

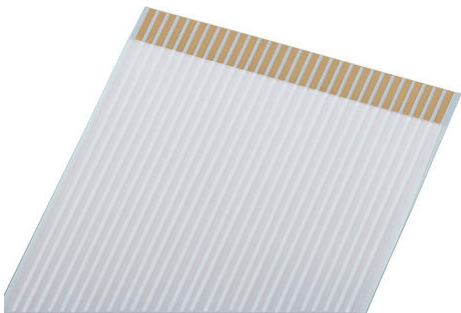
Accumulator Scrutineering

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Part Number : [150390359](#)
Product Description : 1.00mm Pitch Premo-Flex FFC
Jumper, Same Side Contacts (Type A), 76.00mm Cable
Length, Gold (Au) Plating, 20 Circuits
Series Number : 15039
Status : Active
Product Category : Flat-Flexible Cable (FFC)




Documents & Resources

Drawings
[150390359 sd.pdf](#)
Specifications
[PS-15039-001-001.pdf](#)

Product Environment Compliance..

Compliance

GADSL/IMDS	Not Relevant
China RoHS	 per SJ/T 11365-2006
EU ELV	Not Relevant
Low-Halogen Status	Not Low-Halogen per IEC 61249-2-21
REACH SVHC	Not Contained per D(2023)8585-DC (23 Jan 2024)
EU RoHS	Compliant per EU 2015/863

Compliance Statements

- EU RoHS
- REACH SVHC
- Low-Halogen

Industry Documents

- IPC 1752A Class C
- IPC 1752A Class D
- Molex Product Compliance Declaration
- IEC-62474

- chemSHERPA (xml)

Substances of Interest

- PFAS

EU RoHS Certificate of Compliance

Additional Product Compliance Information

Part Details

General

Status	Active
Category	Flat-Flexible Cable (FFC)
Series	15039
Description	1.00mm Pitch Premo-Flex FFC Jumper, Same Side Contacts (Type A), 76.00mm Cable Length, Gold (Au) Plating, 20 Circuits
Comments	Contacts on the same side, Type A
Product Name	Premo-Flex FFC Jumper
UPC	193264175376

Electrical

Current - Maximum per Contact	1.2A
Voltage - Maximum	60V AC

Physical

Cable Length	76.00mm
Circuits (Loaded)	20
Contact Layout Type	A (same side)
Design Feature	Flexible
Material - Plating Mating	Gold
Packaging Type	Bag
Pitch - Mating Interface	1.00mm
Temperature Range - Operating	-40° to +105°C
Termination Style	FFC Connector
Wire/Cable Type	Flat Flex Cable
Wire Size (AWG)	N/A

1 SCOPE

This specification covers the 1.00mm center FFC (Flat Flexible Cable) jumper cable, 105°C, using gold plated copper conductor.

2 PRODUCT DESCRIPTION

2.1 Product name and series number

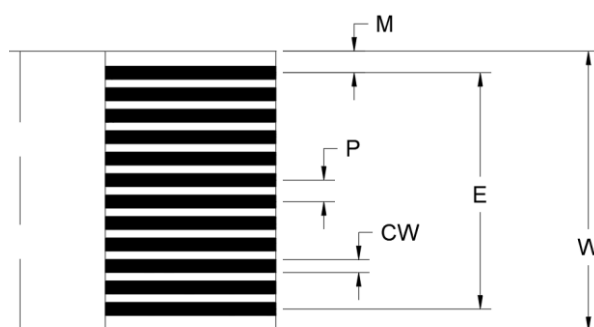
Product name: 1.00MM PITCH FFC JUMPER CABLE (105°C, Au PLATING)

Product material no: 15039-XXXX

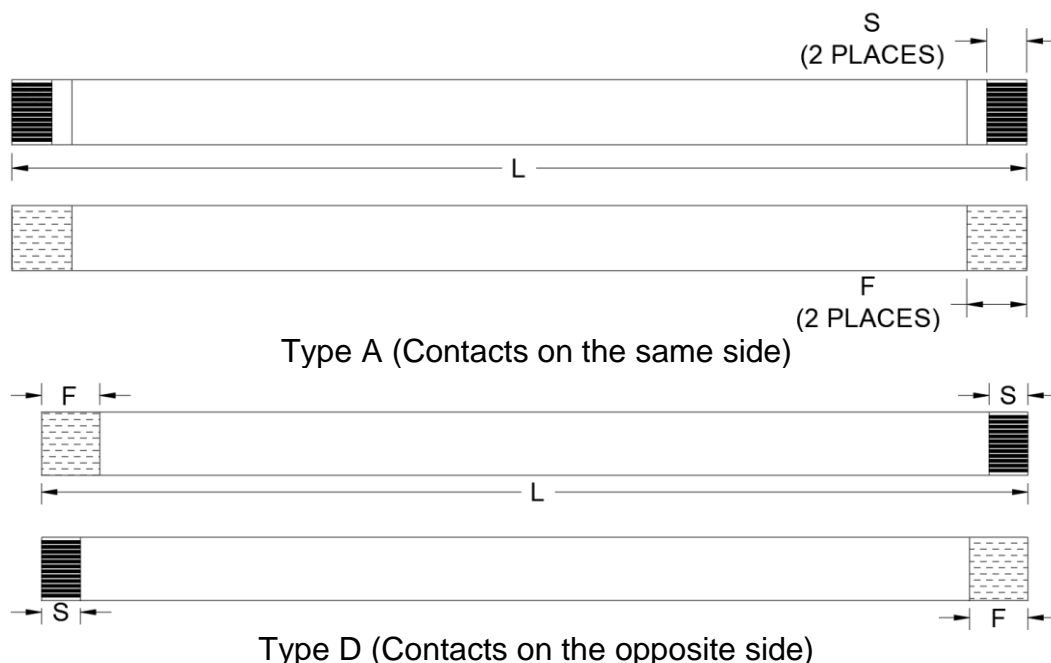
2.2 Dimensions, materials, and markings

Product dimensions (in mm) according to SD-15039-001.

Number of conductors	N	Refer to sales drawing
Pitch	P	1.00 ± 0.08
Span	E	1.00 (N-1) ± 0.15
Total width	W	1.00 (N+1) ± 0.10
Conductor width	CW	0.70 ± 0.03
Margin width	M	1.0 ± 0.20
Strip length	S	4.00 ± 0.80
End thickness of the connection area	Tc	0.30 ± 0.05
End thickness of the insulated area	Ti	0.27 ± 0.05
Insulated length	L	20 to 60 ± 2.00 61 to 100 ± 3.00 101 to 200 ± 4.00 201 to 3999 ± 5.00 4000 to 5999 ± 10.00 6000 to 9999 ± 15.00
Reinforcement length	F	8.00 ± 2.00
End squareness	s-s'	0.40 max.

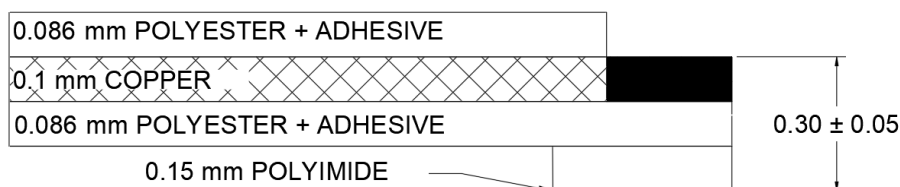


REVISION: E	ECR/ECN INFORMATION: STATUS: RELEASED DATE: 2023/12/06	TITLE: PRODUCT FAMILY SPECIFICATION FOR 1.00 mm PITCH FLAT FLEX CABLE (FFC) (105°C, Au PLATING)	SHEET No. 2 of 5
DOCUMENT NUMBER: PS-15039-001	CREATED / REVISED BY: D. GOMEZ	CHECKED BY: M. IMIG	APPROVED BY: J.SMITH



2.3 COMPOSITION

- Conductor: Material: Copper
Thickness: 0.10 mm nominal
Plating: 0.3 μ m Ni min & 0.05 μ m Au min.
- Insulation tape: Material: Polyester + Flame retardant adhesive
Thickness: 0.086 mm typical
Color: White
- Reinforcement tape: Material: Polyester + Adhesive
Thickness: 0.155 mm nominal



2.4 Current and applicable conductors

Conductor Width	Conductor Thickness	Cross section	Current
0.7 mm	0.1 mm	0.07mm ²	1.25 A


REVISION: E	ECR/ECN INFORMATION: RELEASED DATE: 2023/12/06	TITLE: PRODUCT FAMILY SPECIFICATION FOR 1.00 mm PITCH FLAT FLEX CABLE (FFC) (105°C, Au PLATING)	SHEET No. 3 of 5
DOCUMENT NUMBER: PS-15039-001	CREATED / REVISED BY: D. GOMEZ	CHECKED BY: M. IMIG	APPROVED BY: J.SMITH

3 ELECTRICAL AND PHYSICAL SPECIFICATION

3.1 Electrical requirements

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENT
1	Conductor resistance	ASTM B 193	300 ohms/km MAXIMUM
2	Insulation resistance cond. to cond.	400 V DC	10 Mohms.m MINIMUM
3	Dielectric test	400 V AC for 1 minute	No disruptive discharge
4	Continuity test	3.0 V DC at 0.1mA	passed
5	Voltage rating		60 V AC MAXIMUM
6	Current rating	1.25 A (all conductors under load) at 23°C	40°C heat rise MAX
7	Impedance cond/cond balanced method	FFC at 1 MHz	120 Ω TYP
8	Capacitance cond/cond balanced method	FFC at 1 KHz	50 pF/m

3.2 Physical requirements

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENT
9	Temperature rating		-40°C to +105°C
10	Heat resistance	168 hours at 136°C	Insulation resistance Dielectric test
11	Thermal shock	30 minutes at -55°C 5 minutes at +25°C 30 minutes at +85°C 5 minutes at +25°C	Insulation resistance after 25 cycles
12	Cold coiling	96 hours at -40°C / The sample will be wound on a 3mm dia. Mandrel	Insulation resistance Dielectric test Visual inspection
13	Wear by abrasion	Test following EN3475-503 Weight: 500g Speed: 60 cycles/min Abrasion tool: 0.13mm dia.	10,000 cycles MINIMUM
14	Folding	The specimen shall be folded manually at 180°	Continuity after 20 times
15	Flex Lifecycles	Speed: 100 cycles/min R: 10 mm Temp: 23°C 	50,000 cycles MIN
16	Moisture resistance	96 hours at 60°C, 95% RH	Insulation resistance Dielectric test
17	Flame resistance	UL 758 VW-1	Passed

REVISION:	ECR/ECN INFORMATION:	TITLE:	SHEET No.
E	STATUS: RELEASED DATE: 2023/12/06	PRODUCT FAMILY SPECIFICATION FOR 1.00 mm PITCH FLAT FLEX CABLE (FFC) (105°C, Au PLATING)	4 of 5
DOCUMENT NUMBER:	CREATED / REVISED BY:	CHECKED BY:	APPROVED BY:
PS-15039-001	D. GOMEZ	M. IMIG	J.SMITH



Part Number : [2043130006](#)
Product Description : Sentrality 6.00mm Top-entry,
Knurled Press-fit Socket Assembly with +/-1.00mm
Self-alignment Capability, Tray
Series Number : 204313
Status : Active
Product Category : PCB Headers and Receptacles



Documents & Resources

Drawings

- [2043130006_sd.pdf](#)
- [2043650006-PK-000.pdf](#)

3D Models and Design Files


- [2043130006_stp.zip](#)

Specifications

- [2043130006-PS-000.pdf](#)
- [2043130006-TS-000.pdf](#)
- [2043131234-TS-000.pdf](#)

Product Environment Compliance..

Compliance

GADSL/IMDS	Not Relevant
China RoHS	 per SJ/T 11365-2006
EU ELV	Not Relevant
Low-Halogen Status	Low-Halogen per IEC 61249-2-21
REACH SVHC	Not Contained per D(2024)4144-DC (27 June 2024)
EU RoHS	Compliant per EU 2015/863

Compliance Statements

- EU RoHS
- REACH SVHC

- Low-Halogen

Industry Documents

- IPC 1752A Class C
- IPC 1752A Class D
- Molex Product Compliance Declaration
- IEC-62474
- chemSHERPA (xml)

Substances of Interest

- PFAS

EU RoHS Certificate of Compliance

Additional Product Compliance Information

Part Details

General

Status	Active
Category	PCB Headers and Receptacles
Series	204313
Description	Sentrality 6.00mm Top-entry, Knurled Press-fit Socket Assembly with +/-1.00mm Self-alignment Capability, Tray
Application	Busbar-to-Board, Busbar-to-Busbar, Power
Comments	Current and voltage performances are dependent upon application variables.
Component Type	PCB Receptacle
Product Name	Sentrality
UPC	191130149902

Electrical

Current - Maximum per Contact	140.0A
Voltage - Maximum	600V

Physical

Breakaway	No
Circuits (Loaded)	1

Circuits (maximum)	1
Diameter	6.00mm
Durability (mating cycles max)	200
Glow-Wire Capable	No
Guide to Mating Part	Yes
Height Above Board	3.40mm
Material - Metal	Copper Alloy
Material - Plating Mating	Gold
Material - Plating Termination	Silver
Mating Orientation	Top-entry
Net Weight	10.302/g
Number of Rows	1
Orientation	Vertical
Packaging Type	Tray
PCB Retention	None
Pitch - Mating Interface	N/A
Polarized to Mating Part	No
Polarized to PCB	No
Temperature Range - Operating	-40° to +125°C
Termination Interface Style	Press-Fit

Mates With / Use With

Mates with Part(s)

Description	Part Number
Sentrality Pins	<u>203263</u>



Part Number : [2032630026](#)
Product Description : Sentrality 6.00mm Knurled Press-fit Pin, 14.00mm Engagement Length, Bag
Series Number : 203263
Status : Active
Product Category : PCB Headers and Receptacles



Documents & Resources

Drawings

- [2032630026_sd.pdf](#)
- [2032630006-PK-000.pdf](#)

3D Models and Design Files


- [2032630026_stp.zip](#)

Specifications

- [2043130018-AS-000.pdf](#)
- [2043130006-PS-000.pdf](#)
- [2043131234-TS-000.pdf](#)

Product Environment Compliance..

Compliance

GADSL/IMDS	Not Relevant
China RoHS	 per SJ/T 11365-2006
EU ELV	Not saleable
Low-Halogen Status	Low-Halogen per IEC 61249-2-21
REACH SVHC	Not Contained per D(2024)7663-DC (21 Jan 2025)
EU RoHS	Compliant per EU 2015/863

Compliance Statements

- EU RoHS
- REACH SVHC
- Low-Halogen

Industry Documents

- IPC 1752A Class C
- IPC 1752A Class D
- Molex Product Compliance Declaration
- IEC-62474
- chemSHERPA (xml)

Substances of Interest

- PFAS

EU RoHS Certificate of Compliance

Additional Product Compliance Information

Part Details

General

Status	Active
Category	PCB Headers and Receptacles
Series	203263
Description	Sentrality 6.00mm Knurled Press-fit Pin, 14.00mm Engagement Length, Bag
Application	Board-to-Board, Busbar-to-Board, Busbar-to-Busbar, Power
Component Type	PCB Header
Product Name	Sentrality
UPC	193264044658

Electrical

Current - Maximum per Contact	140.0A
Voltage - Maximum	600V

Physical

Breakaway	No
Circuits (Loaded)	1
Circuits (maximum)	1
Diameter	6.00mm
Durability (mating cycles max)	200
Glow-Wire Capable	No
Guide to Mating Part	No

Height Above Board	14.00mm
Material - Metal	Copper Alloy
Material - Plating Mating	Silver
Material - Plating Termination	Silver
Net Weight	4.464/g
Number of Rows	1
Orientation	Vertical
Packaging Type	Bag
PCB Retention	None
Pitch - Mating Interface	N/A
Polarized to Mating Part	No
Polarized to PCB	No
Temperature Range - Operating	-40° to +125°C
Termination Interface Style	Press-Fit

Mates With / Use With

Mates with Part(s)

Description	Part Number
Sentrality Top-entry Surface Mount Socket Assemblies	<u>204318</u>
Sentrality Top-entry Surface Mount Socket Assemblies with Self-alignment Capability	<u>204365</u>
Sentrality Top-entry Knurled Press-Fit Socket Assemblies with Self-alignment Capability	<u>204313</u>
Sentrality Top-entry Knurled Press-Fit Socket Assemblies	<u>204316</u>
Sentrality 3.40mm Right-Angle Socket Assemblies	<u>205000</u>



Part Number : [2032630006](#)
Product Description : Sentrality 6.00mm Knurled Press-fit Pin, 26.00mm Engagement Length, Bag
Series Number : 203263
Status : Active
Product Category : PCB Headers and Receptacles



Documents & Resources

Drawings

[2032630006_sd.pdf](#)
[2032630006-PK-000.pdf](#)

3D Models and Design Files


[2032630006_stp.zip](#)

Specifications

[2043130006-PS-000.pdf](#)

Product Environment Compliance..

Compliance

GADSL/IMDS	Not Relevant
China RoHS	 per SJ/T 11365-2006
EU ELV	Not Relevant
Low-Halogen Status	Low-Halogen per IEC 61249-2-21
REACH SVHC	Not Contained per D(2024)4144-DC (27 June 2024)
EU RoHS	Compliant per EU 2015/863

Compliance Statements

- EU RoHS
- REACH SVHC
- Low-Halogen

Industry Documents

- IPC 1752A Class C
- IPC 1752A Class D

- Molex Product Compliance Declaration
- IEC-62474
- chemSHERPA (xml)

Substances of Interest

- PFAS

EU RoHS Certificate of Compliance

Additional Product Compliance Information

Part Details

General

Status	Active
Category	PCB Headers and Receptacles
Series	203263
Description	Sentrality 6.00mm Knurled Press-fit Pin, 26.00mm Engagement Length, Bag
Application	Board-to-Board, Busbar-to-Board, Busbar-to-Busbar, Power
Component Type	PCB Header
Product Name	Sentrality
UPC	191130149858

Electrical

Current - Maximum per Contact	140.0A
Voltage - Maximum	600V

Physical

Breakaway	No
Circuits (Loaded)	1
Circuits (maximum)	1
Diameter	6.00mm
Durability (mating cycles max)	200
Glow-Wire Capable	No
Guide to Mating Part	No
Height Above Board	26.00mm
Material - Metal	Copper Alloy

Material - Plating Mating	Silver
Material - Plating Termination	Silver
Net Weight	7.527/g
Number of Rows	1
Orientation	Vertical
Packaging Type	Bag
PCB Retention	None
Pitch - Mating Interface	N/A
Polarized to Mating Part	No
Polarized to PCB	No
Temperature Range - Operating	-40° to +125°C
Termination Interface Style	Press-Fit

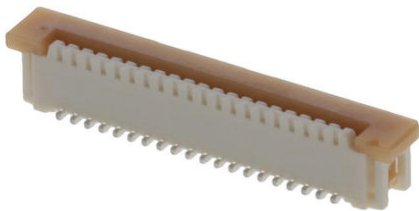
Mates With / Use With

Mates with Part(s)

Description	Part Number
Sentrality Top-entry Surface Mount Socket Assemblies	<u>204318</u>
Sentrality Top-entry Surface Mount Socket Assemblies with Self-alignment Capability	<u>204365</u>
Sentrality Top-entry Knurled Press-Fit Socket Assemblies with Self-alignment Capability	<u>204313</u>
Sentrality Top-entry Knurled Press-Fit Socket Assemblies	<u>204316</u>
Sentrality 3.40mm Right-Angle Socket Assemblies	<u>205000</u>



Part Number : [526102072](#)
Product Description : Easy-On FFC/FPC Connector,
1.00mm Pitch, Slider Series, Vertical, 5.75mm Height,
20 Circuits, Gold Plating
Series Number : 52610
Status : Active
Product Category : FFC / FPC Connectors



Documents & Resources

Drawings

[526102072_sd.pdf](#)

3D Models and Design Files

[526102072.dxf](#)

[526102072_stp.zip](#)

Specifications


[526100003-A00.pdf](#)

[SPK-52610-003-001.pdf](#)

[PS-52610-007-001.pdf](#)

Product Environment Compliance..

Compliance

GADSL/IMDS	Compliant with Exemption 44; 33
China RoHS	 per SJ/T 11365-2006
EU ELV	Not Relevant
Low-Halogen Status	Not Low-Halogen per IEC 61249-2-21
REACH SVHC	Not Contained per D(2024)6225-DC (07 Nov 2024)
EU RoHS	Compliant per EU 2015/863

Compliance Statements

- EU RoHS

- REACH SVHC
- Low-Halogen

Industry Documents

- IPC 1752A Class C
- IPC 1752A Class D
- Molex Product Compliance Declaration
- IEC-62474
- chemSHERPA (xml)

Substances of Interest

- PFAS

EU RoHS Certificate of Compliance

Additional Product Compliance Information

Part Details

General

Status	Active
Category	FFC / FPC Connectors
Series	Slider
Description	Easy-On FFC/FPC Connector, 1.00mm Pitch, Slider Series, Vertical, 5.75mm Height, 20 Circuits, Gold Plating
Product Name	Easy-On
UPC	822350243704

Agency

CSA	LR19980
UL	E29179

Electrical

Current - Maximum per Contact	1.0A
Voltage - Maximum	125V

Physical

Actuator Type	Slider
Circuits (Loaded)	20
Circuits (maximum)	20

Color - Resin	Natural
Contact Position	N/A
Durability (mating cycles max)	30
Flammability	94V-0
Mated Height	5.75mm
Material - Metal	Phosphor Bronze
Material - Plating Mating	Gold
Material - Plating Termination	Tin
Material - Resin	Nylon
Net Weight	929.900/mg
Orientation	Vertical
Packaging Type	Embossed Tape on Reel
PCB Locator	No
PCB Mounting	Surface Mount
PCB Retention	None
PC Tail Length	2.00mm
Pitch - Mating Interface	1.00mm
Pitch - Termination Interface	1.00mm
Polarized to PCB	No
Stackable	No
Temperature Range - Operating	-40° to +85°C
Wire/Cable Type	FFC/FPC

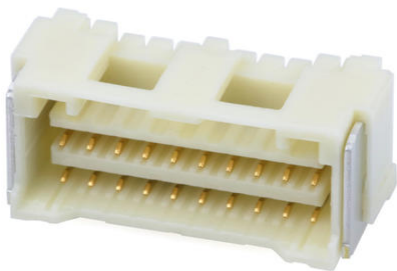
Mates With / Use With

Mates with Part(s)

Description	Part Number
1.00mm Pitch Premo-Flex FFC Jumpers	<u>15039</u>



Part Number : [2132282010](#)
Product Description : 1.50mm Pitch CLIK-Mate Wire-to-Board PCB Receptacle, Dual Row, Surface Mount, Right-Angle, 0.10µm Gold (Au) Plating, 20 Circuits, Natural
Series Number : 213228
Status : Active
Product Category : PCB Headers and Receptacles



Documents & Resources

Drawings

[2132282010 sd.pdf](#)

3D Models and Design Files

[2132282010.dxf](#)

[2132282010 stp.zip](#)

Specifications


[2132289200-SPK-200.pdf](#)

[5031491002-PS-000.pdf](#)

[5031490002-PS-000.pdf](#)

Product Environment Compliance..

Compliance

GADSL/IMDS	Compliant with Exemption 44; 34; 33
China RoHS	 per SJ/T 11365-2006
EU ELV	Not Relevant
Low-Halogen Status	Not Low-Halogen per IEC 61249-2-21
REACH SVHC	Not Contained per D(2024)6225-DC (07 Nov 2024)
EU RoHS	Compliant per EU 2015/863

Compliance Statements

- EU RoHS
- REACH SVHC
- Low-Halogen

Industry Documents

- IPC 1752A Class C
- IPC 1752A Class D
- Molex Product Compliance Declaration
- IEC-62474
- chemSHERPA (xml)

Substances of Interest

- PFAS

EU RoHS Certificate of Compliance

Additional Product Compliance Information

Part Details

General

Status	Active
Category	PCB Headers and Receptacles
Series	213228
Description	1.50mm Pitch CLIK-Mate Wire-to-Board PCB Receptacle, Dual Row, Surface Mount, Right-Angle, 0.10µm Gold (Au) Plating, 20 Circuits, Natural
Application	Signal, Wire-to-Board
Component Type	PCB Receptacle
Product Name	CLIK-Mate
UPC	193264244966

Agency

UL	E29179
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Electrical

Current - Maximum per Contact	2.0A
Voltage - Maximum	100V AC (RMS)/DC

Physical

Circuits (Loaded)	20
Circuits (maximum)	20
Color - Resin	Natural
Durability (mating cycles max)	30
Glow-Wire Capable	No
Guide to Mating Part	Yes
Keying to Mating Part	Yes
Lock to Mating Part	Yes
Material - Metal	Copper Alloy
Material - Plating Mating	Gold
Material - Resin	Polyamide
Number of Rows	2
Orientation	Right Angle
Packaging Type	Embossed Tape on Reel
PCB Locator	No
PCB Retention	Yes
Pitch - Mating Interface	1.50mm
Pitch - Termination Interface	1.50mm
Plating min - Mating	0.102µm
Plating min - Termination	0.102µm
Polarized to Mating Part	Yes
Polarized to PCB	No
Stackable	No
Temperature Range - Operating	-40° to +105°C
Termination Interface Style	Surface Mount

Mates With / Use With

Mates with Part(s)

Description	Part Number
1.50mm Pitch CLIK-Mate Dual Row Plug Housings	<u>503149</u>



NTC Thermistors, Mini Epoxy PVC Twin Insulated Leads



LINKS TO ADDITIONAL RESOURCES



QUICK REFERENCE DATA		
PARAMETER	VALUE	UNIT
Resistance value at 25 °C	4.7K to 100K	Ω
Tolerance on R_{25} -value	± 1.0 to ± 5.0	%
$B_{25/85}$ -value	3435 to 4190	K
Tolerance on $B_{25/85}$	± 0.5 to ± 1.5	%
Operating temperature range at zero dissipation	-40 to 105	°C
Maximum power dissipation at 55 °C	100	mW
Accuracy of temperature measurement (for 1 % types)	± 0.5 between 0 and 40 ± 1.0 between -40 and 80	°C
Dissipation factor δ (in still air)	≈ 3	mW/K
Response time (in oil)	≈ 2.5	s
Climatic category (LCT / UCT / days)	40 / 105 / 28	
Minimum dielectric withstanding voltage between leads and coated body	500	V _{RMS}
Weight (40 mm length)	0.2	g

FEATURES

- High adhesive strength between the PVC wire and the encapsulating lacquer
- Accurate down to ± 0.3 °C
- Small body of max. 3 mm for easy installation
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS COMPLIANT

APPLICATIONS

- Temperature measurement, sensing, and control
- On battery packs, heat-sinks, tubing, enclosures, etc.

DESCRIPTION

These sensors consist of small NTC chip soldered between stranded AWG #30, 105 °C resistant, PVC (UL2651). The conductors are overall tinned. They are lacquered and insulated with a black epoxy coating.

MARKING

Black lacquered body without additional mark

PACKAGING

SPQ: 125 items (for standard 40 mm lead wire length)

MOUNTING

Important mounting and handling instructions: see www.vishay.com/doc?29222

By soldering the wire end, or crimping connector. The body can be inserted in a tube, free in air, tape attached or glued. Not intended for fluid immersed applications or continuous contact with water. Not for potting in hard material or over-molding applications. Consult Vishay for specific application or mounting.

DESIGN-IN SUPPORT

- NTC curve computation: www.vishay.com/thermistors/ntc-rt-calculator/
- Other R/T curves available on request
- The lead length can be customized
- Connectors can be added to the wire end
- Consult Vishay for multistranded conductors for connector crimping

DIMENSIONS in millimeters	
Electronic components of assessed quality measured in accordance with IEC 60539-1	
Outline	NTCLE413E2
$\varnothing D$ max.	3.0
L	Refer to the "Electrical Data and Ordering Information" table
L_1 max.	10
L_2	3 ± 1
W	2 (for information)
$\varnothing d_1$	0.3 ± 0.03
$\varnothing d_2$	1 (for information)



Table 3

PART IDENTIFICATION	R_{25}		$B_{25/85}$	
	k Ω	\pm %	K	\pm %
NTCLE413 10K 1 % B3435 K	10	1	3435	1.0

RESISTANCE VALUES AT INTERMEDIATE TEMPERATURES							
TEMPERATURE (°C)	R_T (Ω)	R_T/R_{25}	R -TOL. (\pm %)	α (%/K)	T-TOL. (\pm °C)	$R_{MIN.}$ (Ω)	$R_{MAX.}$ (Ω)
-40.0	190 953	19.095	4.24	-5.46	0.78	182 848	199 057
-35.0	145 953	14.595	3.93	-5.30	0.74	140 213	151 693
-30.0	112 440	11.244	3.63	-5.14	0.71	108 354	116 526
-25.0	87 285	8.7285	3.35	-4.99	0.67	84 364	90 206
-20.0	68 260	6.8260	3.07	-4.85	0.63	66 164	70 355
-15.0	53 762	5.3762	2.80	-4.71	0.60	52 254	55 270
-10.0	42 636	4.2636	2.55	-4.57	0.56	41 549	43 723
-5.0	34 038	3.4038	2.30	-4.44	0.52	33 254	34 822
0.0	27 348	2.7348	2.07	-4.31	0.48	26 783	27 913
5.0	22 108	2.2108	1.84	-4.19	0.44	21 702	22 515
10.0	17 979	1.7979	1.62	-4.08	0.40	17 689	18 270
15.0	14 706	1.4706	1.40	-3.96	0.35	14 499	14 912
20.0	12 094	1.2094	1.20	-3.86	0.31	11 949	12 239
25.0	10 000	1.0000	1.00	-3.75	0.27	9900.0	10 100
30.0	8310.8	0.83108	1.19	-3.65	0.33	8211.7	8409.8
35.0	6941.1	0.69411	1.38	-3.55	0.39	6845.5	7036.7
40.0	5824.9	0.58249	1.56	-3.46	0.45	5734.1	5915.6
45.0	4910.6	0.49106	1.73	-3.37	0.51	4825.6	4995.7
50.0	4158.3	0.41583	1.90	-3.28	0.58	4079.2	4237.3
55.0	3536.2	0.35362	2.06	-3.20	0.65	3463.2	3609.2
60.0	3019.7	0.30197	2.22	-3.12	0.71	2952.5	3086.8
65.0	2588.8	0.25888	2.38	-3.04	0.78	2527.3	2650.4
70.0	2228.0	0.22280	2.53	-2.96	0.85	2171.7	2284.3
75.0	1924.6	0.19246	2.67	-2.89	0.92	1873.1	1976.0
80.0	1668.4	0.16684	2.81	-2.82	1.00	1621.5	1715.3
85.0	1451.3	0.14513	2.95	-2.75	1.07	1408.5	1494.2
90.0	1266.7	0.12667	3.08	-2.69	1.15	1227.7	1305.8
95.0	1109.2	0.11092	3.21	-2.62	1.22	1073.6	1144.8
100.0	974.26	0.097426	3.34	-2.56	1.30	941.74	1006.8
105.0	858.33	0.085833	3.46	-2.50	1.38	828.62	888.04

Type C2Q

Surface Mount Very Fast-Acting Chip Fuse

HF  C2Q Series – 0603 Size

RoHS Compliant

Features



- Fast-acting
- Small size, 0603 SMD
- Current rating from 250mA to 5A
- Wide operating temperature range from -55°C to 125°C
- Tape and Reel for automatic SMD placement
- Compatible with 260°C IR Pb-free and wave soldering process
- Full compliance with EU Directive 2011/65/EU and amending directive 2015/863 (MSL = 1)
- Halogen Free and Lead Free
- AEC-Q Compliant
- Meets Bel automotive qualification*
- * - Largely based on internal AEC-Q test plan



Applications

- Notebook
- LCD monitor
- PC computer
- Office electronic equipment
- Industrial equipment
- Medical equipment
- POE, POE+
- LCD / LED monitor
- Power supply
- LCD / LED TV
- DC-DC Converter


UK
CA c  US CE
AEC-Q Compliant

LEAD FREE = 
HALOGEN FREE = 



Electrical Characteristics (UL STD.248-14)

Testing Current	Blow Time	
	Minimum	Maximum
100%	4 Hrs.	N/A
200%	N/A	5 Sec
300%	N/A	0.2 Sec

Safety Agency Approvals

Safety Agency	Safety Agency Certificate	Ampere Rating/ Voltage Rating	Ampere Range / Volt @ I.R. ability*
	E506667	250mA-4A/32V AC 63V DC	250mA-4A/32V AC @ 35A 63V DC @ 50A
		5A / 32V AC & DC	5A / 32V AC & DC @ 50A
*I.R.= Interrupting Rating = Short Circuit Rating(Amps)			

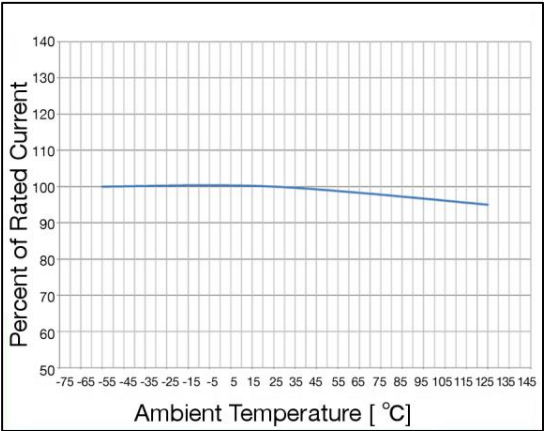
Physical Specifications

Materials	Body : Ceramic Substrate
	Terminations : Ag / Ni / Sn (100% Lead-free)
	Element Cover Coating : Lead-free Glass
Marking	On Fuse :
	None
	On Label :
	"bel", "C2Q", "Current Rating", "Voltage Rating", "Interrupting Rating", "Appropriate Safety Logos" and   (China RoHS compliant).

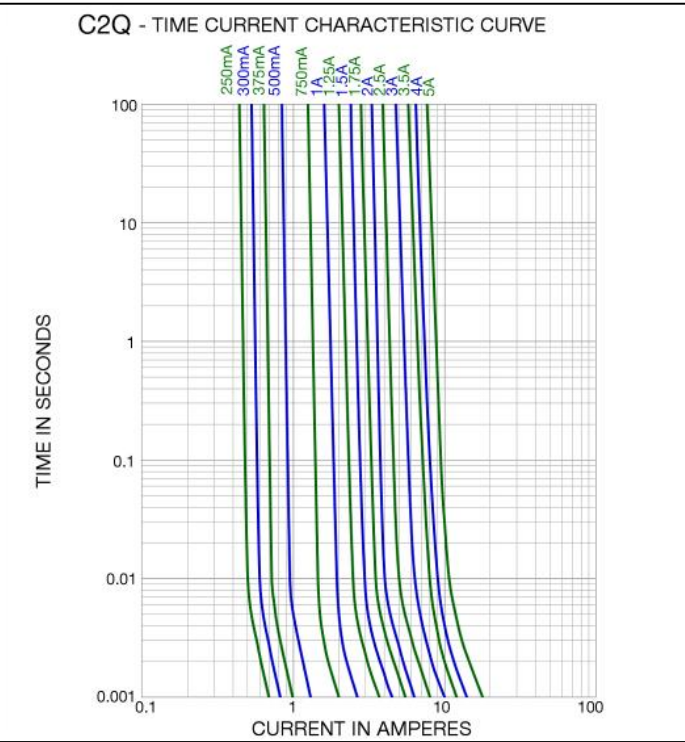
Type C2Q

2 / 4


Temperature Derating Curve



Average Time Current Curve



Electrical Specifications

Catalog Number	Ampere Rating (A)	Nominal Cold Resistance (ohms)	Nominal Volt-drop @ 100% In (Volt)	Voltage and Interrupting Ratings	Nominal Melting I ² T @ 10 In (A ² Sec)	Nominal Power Dissipation @ 100% In (W)	Agency Approvals
							
C2Q 250	250mA	0.77	0.243	See Table of Safety Approvals on Page 1 for Voltage and associated Interrupting Ratings	0.00001	0.06	Y
C2Q 300	300mA	0.54	0.217		0.00003	0.07	Y
C2Q 375	375mA	0.42	0.196		0.00004	0.07	Y
C2Q 500	500mA	0.28	0.171		0.00015	0.09	Y
C2Q 750	750mA	0.17	0.159		0.0005	0.12	Y
C2Q 1	1A	0.122	0.154		0.0010	0.15	Y
C2Q 1.25	1.25A	0.092	0.152		0.0018	0.19	Y
C2Q 1.5	1.5A	0.073	0.146		0.0025	0.22	Y
C2Q 1.75	1.75A	0.063	0.144		0.0044	0.25	Y
C2Q 2	2A	0.053	0.133		0.0063	0.27	Y
C2Q 2.5	2.5A	0.042	0.130		0.0074	0.33	Y
C2Q 3	3A	0.034	0.130		0.018	0.39	Y
C2Q 3.5	3.5A	0.028	0.131		0.021	0.46	Y
C2Q 4	4A	0.023	0.131		0.042	0.52	Y
C2Q 5	5A	0.019	0.131		0.055	0.66	Y

Consult manufacturer for other ratings

Environmental Specifications



Specifications subject to change without notice

Bel Fuse Inc.
300 Executive Drive, Suite 300
West Orange, NJ 07052 USA

+1 201.432.0463
Bel.US.CS@belf.com
belfuse.com/circuit-protection

HIGH VOLTAGE DC CONTACTOR ECK100B SERIES

UP TO 150AMP, BI-DIRECTIONAL

INTRODUCTION

TE Connectivity (TE)'s ECK100B series high-voltage DC contactor is designed for control in high voltage applications like battery energy storage system, solar inverters, and EV charging applications. It can be used in 1000 VDC voltage systems and the enhanced contacts design provides for higher electrical endurance. The contacts provided in this series allows bi-directional load and are hermetically sealed with ceramic sealing technology, making it safer and reliable.

FEATURES

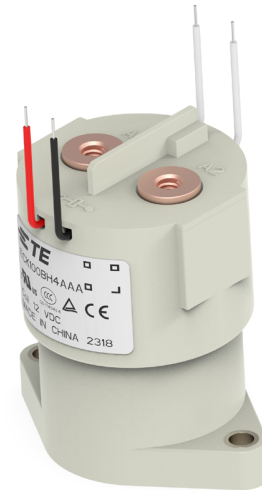
- Hermetically sealed with ceramic technology
- Allow bi-directional load for main contacts
- Continuous current carrying capacity of up to 150 A
- Enhanced breaking capacity up to 1000 VDC
- Auxiliary contact version available
- Compatibility with DC-1 utilization category in IEC60947-4-1

APPLICATIONS

- DC charging station
- Electric vehicle
- Automated Guided Vehicles (AGV)
- Electric forklift
- Battery energy storage systems
- Photovoltaic inverter

APPROVALS

- UL: E82292
- TUV: R50616669
- CE: 724_00007
- CCC approved



High Voltage DC Contactor ECK100B Series

CONTACT DATA

Contact current	150 A (at 40 °C) 100 A (at 85 °C)
Maximum switching voltage	1000 VDC
Contact arrangement	1 Form X (SPST-NO-DM)
Initial contact voltage drop	≤80 mV (100 A, after 1 minute)
Maximum short circuit current	1500 A, 30 ms 1000 A, 50 ms
Operate time, maximum (at 23 °C)	30 ms
Release time, maximum (at 23°C)	10 ms
Mechanical life	300,000 cycles

Note:

For contact current of 150 A (at 40 °C), recommended connection conductor size is AWG 2 (33.6 mm²). For contact current 100 A (at 85 °C), recommended connection conductor size AWG 4 (21.2 mm²). Smaller conductor size are also applicable but end users are requested to verify with application requirements and take active cooling actions to support long term performance.

CONTACT RATINGS

Load	Cycles
100A, 450 VDC, make/break, resistive	6,000
100A, 800VDC, make/break, resistive	1,000
100A, 1000VDC, make/break, resistive	1,000
150A, 1000VDC, make/break, resistive	100
300A, 500VDC, make/break, resistive	5

CE DECLARATION (IEC60947-4-1)

Rated Operational Current	Utilization Category	Switching Cycles
50A	DC-1	6,050

AUXILIARY CONTACT DATA

Contact form	1 Form A (SPST-NO)
Contact current, maximum	2 A, 30 VDC
Contact current, minimum	10 mA, 24 VDC
Contact resistance, maximum	0.4 Ω at 30 VDC / 0.15 Ω at 125 VAC

COIL VERSIONS, DC COIL

Coil code	Nominal voltage	Nominal operating current	Operate voltage	Maximum operating voltage	Release voltage	Coil power
4	12 VDC	0.462 A	≤9 VDC	13.2 VDC	≥1.2 VDC	5.5 W
5	24 VDC	0.249 A	≤18 VDC	26.4 VDC	≥2.4 VDC	6 W
6	48 VDC	0.122 A	≤36 VDC	52.8 VDC	≥4.8 VDC	6 W

All figures are given for coil without pre-energization, at ambient temperature +23°C.

INSULATION DATA

Dielectric withstand voltage (leakage current <1mA)	
between open main contacts	4,300 Vrms
between main contact and coil	4,300 Vrms
between main contacts and auxiliary contacts	4,300 Vrms
between open auxiliary contacts	750 Vrms
Initial insulation resistance at 1000VDC	
between insulated elements	> 1x10 ⁹ Ω

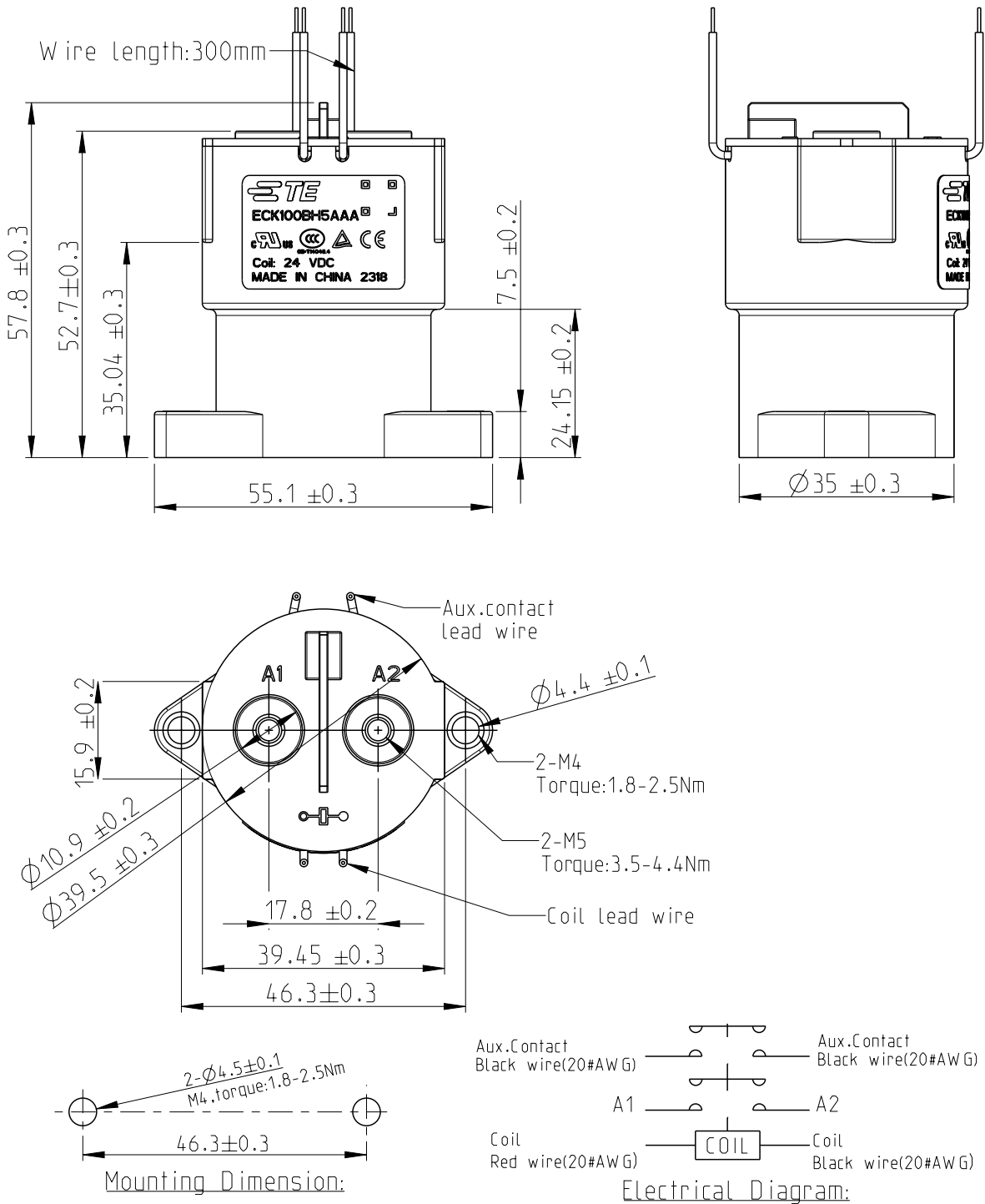
Note: End of life is reached when insulation resistance is <50 MΩ @ 1,000 V.

OTHER DATA

Material compliance: EU RoHS/ELV, China RoHS, REACH, and for halogen content refer to the product Compliance Support Center at www.te.com/customer-support/rohssupportcenter	
Protection category	IP67
Ambient temperature	-40 °C to 85 °C
Shock 11ms ½ sine (functional)	20G peak
Vibration sine, peak (functional)	6G, 10 Hz - 2000 Hz
Terminal type	Screw for main load contact, wire for coil and auxiliary contact
Weight	0.18 kg

High Voltage DC Contactor ECK100B Series

DIMENSIONS (Unit: mm)

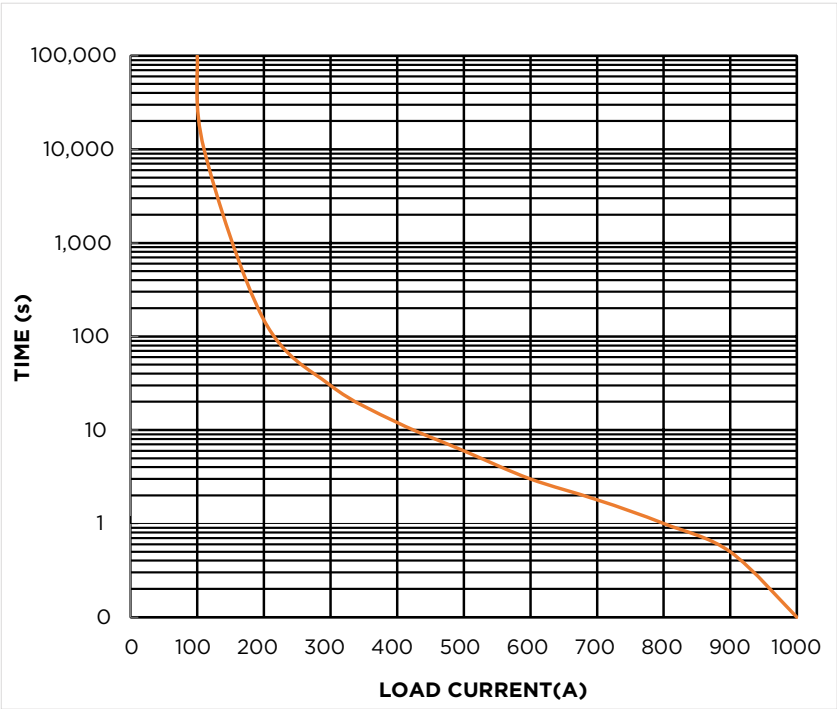


Notes:

1. ECK100B series, non-polarized, 1 form A of main contact, gas-filled and ceramic seal contactor.
2. Lead wire: UL3266, 20AWG, 300 V, -40 °C to 125 °C. Customized length of lead wire is available.
3. Product require label marking.
4. Coil voltage 12 VDC and 24 VDC are available.

High Voltage DC Contactor ECK100B Series

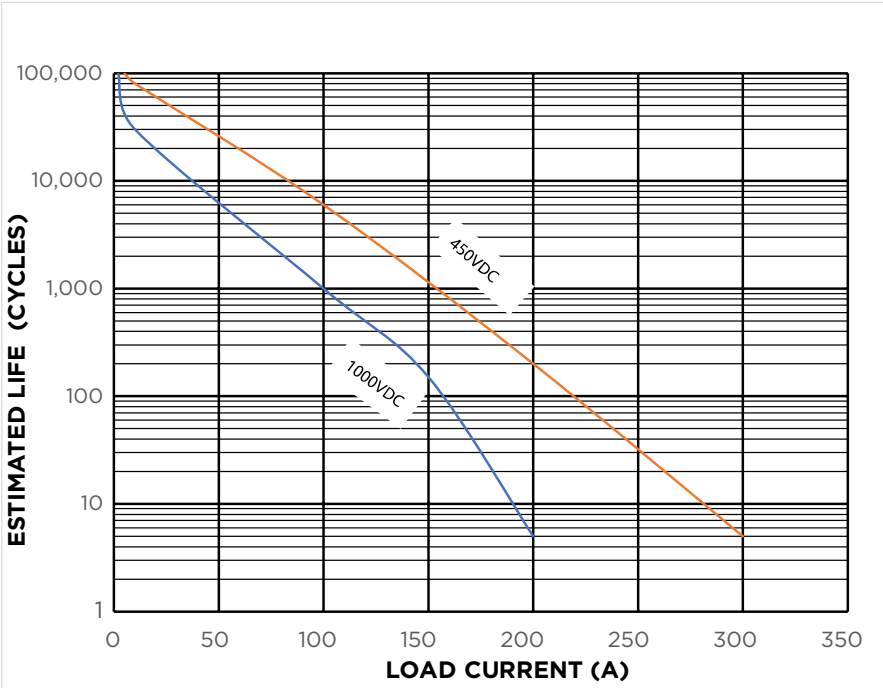
CURRENT CARRYING CAPABILITY CURVE



Note:

- 1. The data is measured at the environment temperature 85 °C with cross section area of wire 35 mm² min.

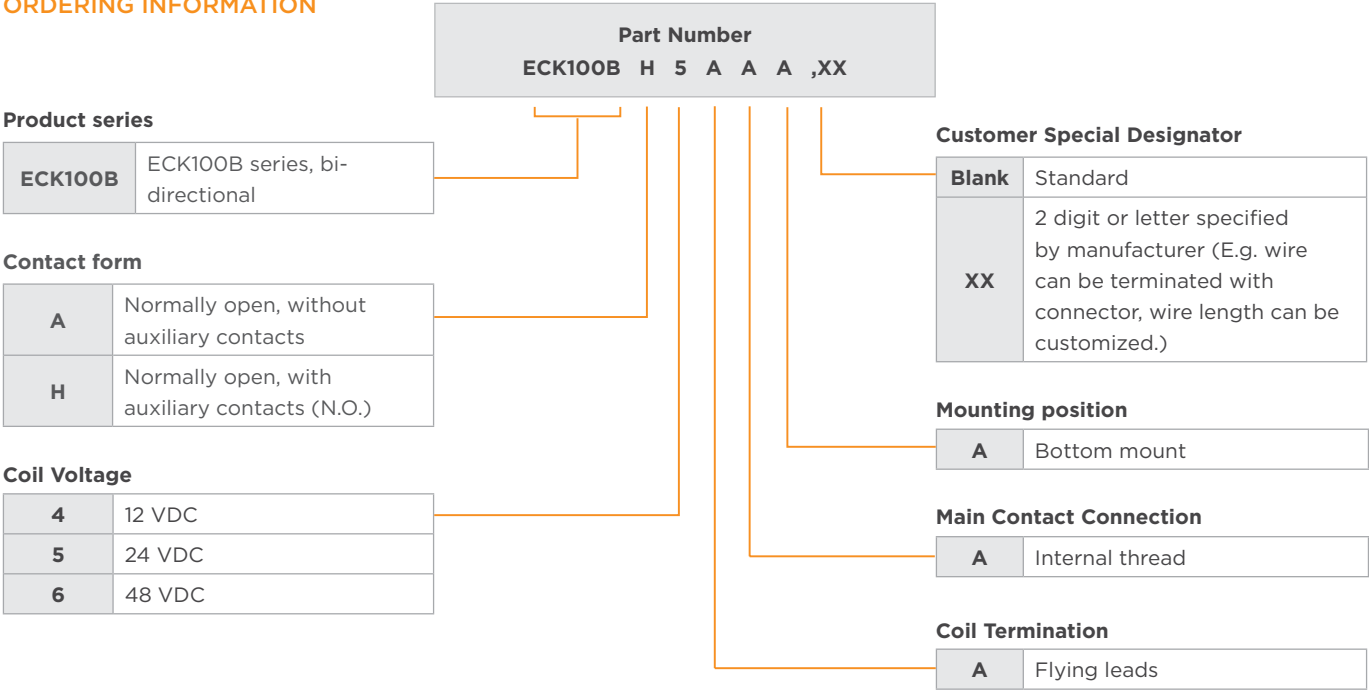
ESTIMATED MAKE AND BREAK POWER SWITCHING RATINGS



Notes:

- 1. The curve was created based on extrapolated data with few typical points, users are recommended to confirm performance in actual application.
- 2. The typical data were estimated with resistive load at room temperature.

ORDERING INFORMATION



PRODUCT PART NUMBER TABLE

Product Code	Contact Form	Mounting Position	Main Contact Connection	Coil	Part Number		
ECK100BH4AAA	Normally open + Auxiliary contact (N.O)	Bottom	Internal thread	12 VDC	2071583-1		
ECK100BH5AAA				24 VDC	2071583-2		
ECK100BH6AAA				48 VDC	2071583-3		
ECK100BA4AAA	Normally open			12 VDC	2071583-4		
ECK100BA5AAA				24 VDC	2071583-5		
ECK100BA6AAA				48 VDC	2071583-6		

Note: Only typical part numbers are listed above, other types please contact TE engineer.

CAUTIONS

- Do not use the contactor when contactor is dropped or broken.
- Avoid mounting the contactor with the main contact screw terminals in downward direction, otherwise the contactor performance will not be achieved.
- Please drive the contactor coil through the fast rising (step type power supply mode), otherwise the contactors will not operate.
- If using with diodes for coil, it may lead to a decline in product switching performance.
- Please consider electromagnetic interference when using the product.
- Screw locking torque of main contact terminals should be 3.5 N·m - 4.4 N·m for M5 screw. Screw locking torque of contactor bottom mounting should be 1.8 N·m - 2.5 N·m for M4 screw.

te.com

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PANEL REAR MOUNTED CABLE RECEPTACLE



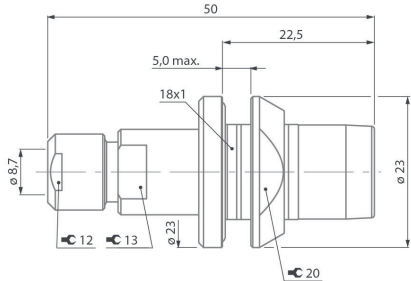
GENERAL INFORMATIONS

Part number	135211
Designation	DKBE 104 A087-80E+
Product line	Core Series Brass
Series size	104
Connector type	Receptacle
Body style design	Cable mounted
Housing material	Brass
Housing color	Grey
Contact termination	Solder
Contact gender	Female
Contact configuration	Mixed low voltage
Locking system	Plug-related
Mounting type	Panel Rear Mounted
Cable diameter (min - max) [mm]	-
Panel cut-out diameter [mm]	18.1
Data protocol compliance	USB 2.0 up to 480Mbit/s



Picture for illustration purpose only.
Contact configuration may vary- refer to pin layout.

DIMENSIONS



KEYING CODE



PIN LAYOUT



All dimensions and images shown are in millimeters and are for reference only.

ELECTRICAL & CONTACT CONFIGURATION

Number of contacts	Contact type	Insulator material	Contact Ø [mm]	Pin Ø [mm]	Ground pin Ø [mm]	Wire size min [AWG]	Wire size max [AWG]	Test voltage AC r.m.s [kV] in mated position		Test voltage DC [kV] in mated position		Current per contact [A]
								Contact to body	Contact to contact	Contact to body	Contact to contact	
2	Low voltage	PEEK	2.3	-	-	-	11	1.5	1.6	2.2	2.5	28
2	Low voltage	PEEK	0.9	-	-	-	21	2	1.6	2.8	2.5	3

PANEL REAR MOUNTED CABLE RECEPTACLE



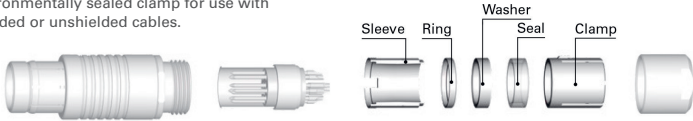
ENVIRONMENTAL & MECHANICAL DATA

Characteristic	Value	Standard
Corrosion resistance	Salt mist, 1000 hours ; 5% salt solution, 35°C	IEC 60068-2-11 Test Ka // MIL-STD-202 Method 101 Condition A // EIA-364-26
Endurance	10'000	IEC 60512-2-1, Test 2a // IEC 60512-2-2, Test 2b
Vibration resistance	10 to 2000 Hz, 1,5 mm or 15 g, 12 sweep cycles per axis, 20 minutes per 10-2000-10 Hz sweep cycle, no discontinuity > 1us	MIL-STD-202 Method 204 Condition B
Shock resistance	On request	On request

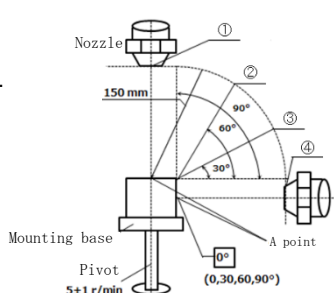
For this connector, you need to select from the following clamp sets

E ENVIRONMENTAL CLAMP SET

Environmentally sealed clamp for use with shielded or unshielded cables.



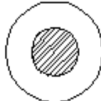
Characteristic	Value	Standard
Sealing performance	IP68 / IP69K	IEC 60529
Operation temperature	From -50 °C to 130 °C	IEC 60512-6-11 i+j // IEC 60068-2-14-Nb

APPLICABLE STANDARD					
RATING	OPERATING TEMPERATURE RANGE	-40 °C TO +125 °C	STORAGE TEMPERATURE RANGE	-10 °C TO +60 °C ⁽¹⁾	
	VOLTAGE	\triangle 60 V AC/DC	STORAGE HUMIDITY RANGE	RELATIVE HUMIDITY 85% MAX	
	CURRENT	2 A		(NOT DEWED)	
SPECIFICATIONS					
ITEM		TEST METHOD	REQUIREMENTS	QT	AT
CONSTRUCTION					
GENERAL EXAMINATION		VISUALLY AND BY MEASURING INSTRUMENT.	ACCORDING TO DRAWING.	x	x
MARKING		CONFIRMED VISUALLY.		x	x
ELECTRIC CHARACTERISTICS					
CONTACT RESISTANCE		1A DC.	8 m Ω MAX.	—	—
CONTACT RESISTANCE		20 mV AC MAX, 0.1 mA(DC OR 1000Hz)	8 m Ω MAX.	—	—
MILLIVOLT LEVEL METHOD					
INSULATION RESISTANCE		500V DC.	100 M Ω MIN.	x	—
VOLTAGE PROOF		1000 V AC FOR 1 min.	\triangle NO BREAKDOWN.	—	—
MECHANICAL CHARACTERISTICS					
MECHANICAL OPERATION		30 TIMES INSERTIONS AND EXTRACTIONS.	① CONTACT RESISTANCE: 16 m Ω MAX. ② NO DAMAGE, CRACK AND LOOSENESS OF PARTS.	—	—
VIBRATION		FREQUENCY 20 TO 200Hz (88m/s ²) SWEEP TIME 3min.(ROUND TRIP) AT 3h FOR 3 DIRECTIONS.	① NO ELECTRICAL DISCONTINUITY OF 7 Ω MIN, 1 μ s MIN. ② CONTACT RESISTANCE: 16 m Ω MAX. ③ NO DAMAGE, CRACK AND LOOSENESS OF PARTS.	—	—
SHOCK		981m/s ² DURATION OF PULSE 6ms AT 3 TIMES FOR 6 DIRECTIONS.	① NO ELECTRICAL DISCONTINUITY OF 7 Ω MIN, 1 μ s MIN. ② NO DAMAGE, CRACK AND LOOSENESS OF PARTS.	—	—
LOCK STRENGTH		MEASURE BREAK STRENGTH OF THE LOCK BY PULLING THE CONNECTOR IN THE MATING DIRECTION.	100N MIN.	x	—
ENVIRONMENTAL CHARACTERISTICS					
DAMP HEAT (STEADY STATE)		EXPOSED AT 60 °C, 90 ~ 95 %, 96 h.	① CONTACT RESISTANCE: 16 m Ω MAX. ② INSULATION RESISTANCE:100 M Ω MIN. ③ NO DAMAGE, CRACK AND LOOSENESS OF PARTS.	—	—
RAPID CHANGE OF TEMPERATURE		TEMPERATURE- 40 →ROOM TEMP →125°C→ ROOM TEMP TIME 30 → 5 → 30 → 5 min UNDER 1000 CYCLES.	① CONTACT RESISTANCE: 16 m Ω MAX. ② NO DAMAGE, CRACK AND LOOSENESS OF PARTS.	—	—
DRY HEAT		EXPOSED AT 140°C, 120 h.	① CONTACT RESISTANCE: 16 m Ω MAX. ② NO DAMAGE, CRACK AND LOOSENESS OF PARTS.	—	—
COLD		EXPOSED AT -40°C, 120 h.	① CONTACT RESISTANCE: 16 m Ω MAX. ② NO DAMAGE, CRACK AND LOOSENESS OF PARTS.	—	—
RESISTANCE TO SO ₂ GAS		EXPOSED IN 25 PPM AT 75% MIN FOR 96h.	CONTACT RESISTANCE: 16 m Ω MAX.	—	—
RESISTANCE TO HIGH-PRESSURE WASHING \triangle		AFTER HEATING AT 120°C FOR 120 h, WATER AT 80°C, 10 MPa, FOR 30 sec AT THE POSITIONS OF ① TO ④. ROTATE THE MOUNTING BASE AT 5 r/min. 	① NO WATER PENETRATION PERMITTED. ② INSULATION RESISTANCE:100 M Ω MIN.	x	—
COUNT	DESCRIPTION OF REVISIONS		DESIGNED	CHECKED	DATE
\triangle 3	DIS-T-00005917		AN. SAIKI	HH. TSUKUMO	20200312
REMARK			APPROVED	HK. UMEHARA	20190207
(NOTE1) "STORAGE" means a long-term storage state for the unused product.			CHECKED	HH. TSUKUMO	20190207
			DESIGNED	AS. SHIBAHARA	20190207
			DRAWN	GYEONGMIN LEE	20190207
Note QT:Qualification Test AT:Assurance Test X:Applicable Test			DRAWING NO.		ELC-378448-00-00
HRS	SPECIFICATION SHEET		PART NO.	ZE064W-14DP-HU/R(A)	
	HIROSE ELECTRIC CO., LTD.		CODE NO.	CL753-2008-0-00	\triangle 1/1



Datasheet

Product Name:	UL11028 26AWG
Product Discription:	UL11028 26AWG
Specification No.:	SPEC-UL11028-26AWG
Customer's Name:	

Description					Construction						
Rated Voltage:		600V			Conductor		Stranded Tinned Copper				
Rated Temperature:		105℃			Size(AWG)		26				
Reference Standard:		UL758,UL1581			Construction(±0.008mm)		7/0.16				
Cross Section					Stranded Dia.(mm)Ref.		0.48				
					Insulation Material		mPPE				
					Insulation Color		ANY COLOR				
					Ave Thickness(mm)		0.20				
					Min Thickness(mm)		0.18				
					Insulation Dia.(±0.05mm)		1.00				
Marking					Remark:						
E254881 AWM STYLE 11028 26AWG 105℃ 600V VW-1 AWM I A 105℃ 600V FT1 -LF- -HF- ELETECK					8724458 Black		8724467 Brown		8724476 Green	8724489 Orange	
					8724460 Red		8724470 Yellow		8724482 Grey		
					8724464 Blue		8724473 White		8724486 Violet		
Applications					Characteristics					Customer Approve	
For internal wiring of electrical equipment					Test Item			Standard Value		Seal & Stamp	
					Test Material			mPPE(RoHS)			
					Before Aging	Tensile Strength(Mpa)		≥21. 37			
						Elongation(%)		≥175			
					Aging Conduction			136±2℃*168hrs			
Revisions					After Aging	Tensile Strength(Mpa)		≥85% of original		Signature:	
						Elongation(%)		≥50% of original			
					Deformation(121±1℃*250g)			≤50%			
					Cold Bend(-10±1℃*4hrs)			No crack			
					Heat Shock(121±1℃*1hr)			No crack			
					Max.DC Resistance(20℃ Ω/km)			150		Date:	
					Flammability Test			VW-1			
Version	Description	Drawn by	Approved by	Date							
0	New document issue	YanBin	David Lin	#####							

RS, Professionally Approved Products, gives you professional quality parts across all products categories. Our range has been testified by engineers as giving comparable quality to that of the leading brands without paying a premium price.

4

3

2

GENERAL TOLERANCE

DIM. RANGE	0.5 - 3	>3-6	>6-30	>30-120	>120-400
TOLERANCE	±0.1	±0.1	±0.2	±0.3	±0.5

CUSTOMER DRAWING

REVISION

REV.	DESCRIPTION	DATE
C	MODIFY DESIGN	2016-11-29
D	UPDATE RoHS LABEL	2017-03-11
E	UPDATE CODE NUMBER AND MFG NUMBER	2018-06-28
F	UPDATE CONNECTOR LENGTH	2019-01-16
G	UPDATE CODE NUMBER	2019-02-21

SPECIFICATION

CONTACT SIZE	5.7 MM (RADSOK CONTACT) / #20 (HVIL CONTACT)
CONTACT TEST CURRENT	120 Amps Max / 5 Amps
OPERATING VOLTAGE	600V AC
OPERATING TEMPERATURE	-40°C TO 125 °C
DIELECTRIC WITHSTANDING VOLTAGE	2500V AC
NUMBER OF CONTACT	2&2
DURABILITY	100 (MIN)
WATER PROOF	IP67 (MATED)
FINGER PROOF	YES
HVIL	OPTION
SALT SPRAY	96 H

RECOMMENDED CABLE OD RANGE:
25MM² CABLE SIZE 13.9±0.3MM
16MM² CABLE SIZE 11.2±0.3MM



3. FOR ORDERING INFORMATION, PLEASE SEE CODE NUMBER REFERENCE. TO COMPLETE IT, ADD APPLICABLE CHARACTERS FOR DESIRED REQUIREMENT. SEE PAGE 2 FOR DETAIL INFORMATION.

2. THE DRAWING ILLUSTRATE FINAL ASSEMBLY. FOR STORAGE AND SHIPPING, THE POWER & HVIL CONTACTS ARE SHIPPED UNASSEMBLED.

1. THE REFERENCED PRODUCT SHALL BE COMPLIANT TO RoHS DIRECTIVE.

NOTES:

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UNLESS OTHERWISE SPECIFIED

LINEAR DIMENSIONS ARE IN:
MILLIMETERS
TOLERANCES:
ANGLES: ±1°
DEFAULT LINEAR TOLERANCES SEE TABLE
DIM. & TOL. PER ASME Y14.5M-1994;
DIM. PER MIL-DTL-31000;
OTHER AMPHENOL STANDARDS: 9-3800

LEGEND:

=FLAG NOTE CALL OUT REFERENCE

THIRD ANGLE PROJECTION



APPROVALS

DATE

PREPARED BY: THOR YAN
ENGINEER IN CHARGE: SEVEN XIE
DESIGN MANAGER: ROB WENG
PRODUCT GROUP: C&3
A/P DIVISION:

2018-06-28

MATERIAL SPEC

N/A

PROCESS SPEC

N/A

AMPHENOL INDUSTRIAL OPERATIONS

Amphenol Technology (Zhuhai) Co., Ltd.
No.63, Xingnan Road, Sanzao Town, Jinwan, Zhuhai, PRC

**ELECTRICAL PLUG CONNECTOR
WITH HVIL & SHIELDING
2PORTS, Epower-lite SERIES**

SIZE	CAGE CODE	DOCUMENT NUMBER	REV
C	77820	C ()-738986-2 () S ()	G

SCALE: 1:2

REF:

SHEET 1 OF 2

4

3

2

1

G CODE NUMBER REFERENCE: ELPA2() () ()

KEYWAY MARKING
SEE TABLE 1

WIRE SIZE
SEE TABLE 1

HVIL&EMI OPTION
SEE TABLE 1

TABLE 1			
ITEM NO.	DESCRIPTION	CODE NUMBER	DIMENSION A
KEYWAY MARKING	KEYWAY A	A	4
	KEYWAY Y	Y	8
	KEYWAY Z	Z	0
	KEYWAY U	U	-8
	KEYWAY W	W	-4
WIRE SIZE	25 MM^2	25	
	16 MM^2	16	
HVIL & EMI OPTION	YES EMI & YES HVIL	--	
	YES EMI & NO HVIL	01	
	NO EMI & YES HVIL	10	
	NO EMI & NO HVIL	11	

MFG NUMBER REFERENCE: C() -738986-2()S()

HVIL&EMI OPTION
SEE TABLE 2

KEYWAY MARKING
SEE TABLE 2

WIRE SIZE
SEE TABLE 2

TABLE 2			
ITEM NO.	DESCRIPTION	MFG NUMBER	DIMENSION A
KEYWAY MARKING	KEYWAY A	A	4
	KEYWAY Y	Y	8
	KEYWAY Z	Z	0
	KEYWAY U	U	-8
	KEYWAY W	W	-4
WIRE SIZE	25 MM^2	2	
	16 MM^2	1	
HVIL & EMI OPTION	YES EMI & YES HVIL	10	
	YES EMI & NO HVIL	20	
	NO EMI & YES HVIL	30	
	NO EMI & NO HVIL	40	

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SIZE	CAGE CODE	DOCUMENT NUMBER	REV
C	77820	C()-738986-2()S()	G
SCALE: 2:1		REF:	SHEET 2 OF 2

4

3

2

1

CODE NUMBER REFERENCE: ELRA2() () () () G

KEYWAY MARKING
SEE TABLE 1

PIN TYPE
SEE TABLE 1

HVIL&EMI OPTION
SEE TABLE 1

MFG NUMBER REFERENCE: C () -738985-2 () P ()

HVIL&EMI OPTION
SEE TABLE 2

KEYWAY MARKING
SEE TABLE 2

PIN TYPE
SEE TABLE 2

SEPCIFICATION	
CONTACT SIZE	5.7 MM (RADSOK CONTACT) / #20 (HVIL CONTACT)
CONTACT TEST CURRENT	POWER 120 Amps Max HVIL 5 Amps
OPERATING VOLTAGE	600V AC
OPERATING TEMPERATRUE	-40°C TO 125°C
DIELECTRIC WITHATANDING VOLTAGE	2500V AC
NUMBER OF CANTACT	2&2
DURABILITY	100 (MIN)
WATER PROOF	IP67 (MATED)
FINGER PROOF	YES
HVIL	OPTION
SALT SPRAY	96 H

NOTES:

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TABLE 1			
ITEM NO.	DESCRIPTION	CODE NUMBER	DIMENSION A
KEYWAY MARKING	KEYWAY A	A	-4
	KEYWAY Y	Y	-8
	KEYWAY Z	Z	0
	KEYWAY U	U	8
	KEYWAY W	W	4
PIN TYPE	25 MM^2 CRIMP	25	
	16 MM^2 CRIMP	16	
	BUSBAR	03	
HVIL & EMI OPTION	YES EMI & YES HVIL	--	
	YES EMI & NO HVIL	01	
	NO EMI & YES HVIL	10	
	NO EMI & NO HVIL	11	

TABLE 2			
ITEM NO.	DESCRIPTION	MFG NUMBER	DIMENSION A
KEYWAY MARKING	KEYWAY A	A	-4
	KEYWAY Y	Y	-8
	KEYWAY Z	Z	0
	KEYWAY U	U	8
	KEYWAY W	W	4
PIN TYPE	BUSBAR	3	
	25 MM^2	2	
	16 MM^2	1	
HVIL & EMI OPTION	YES EMI & YES HVIL	10	
	YES EMI & NO HVIL	20	
	NO EMI & YES HVIL	30	
	NO EMI & NO HVIL	40	

SIZE	CAGE CODE	DOCUMENT NUMBER	REV
C	77820	C () -738985-2 () P ()	G
SCALE: 2:1		REF: N/A	SHEET 2 OF 2

ISOMETER® IR155-3203/IR155-3204

Insulation monitoring device (IMD) for unearthed DC drive systems (IT systems) in electric vehicles

Version V004



ISOMETER® IR155-3203/IR155-3204

Insulation monitoring device (IMD) for unearthed DC drive systems (IT systems) in electric vehicles



Device features

- Suitable for 12 V and 24 V systems
- Automatic device self test
- Continuous measurement of the insulation resistance 0...10 MΩ
 - Response time for the first measurement of the system state (SST) is < 2 s after switching the supply voltage on
 - Response time < 20 s for insulation resistance measurement (DCP)
- Automatic adaptation to the existing system leakage capacitance ($\leq 1 \mu\text{F}$)
- Detection of earth faults and interruption of the earth connection
- Insulation monitoring of AC and DC insulation faults for unearthed systems (IT systems) 0...1000 V
- Undervoltage detection for voltages below 500 V (adjustable at factory by Bender)
- Short-circuit proof outputs for:
 - Fault detection (high-side output)
 - Measured value (PWM 5...95 %) and status ($f=10...50 \text{ Hz}$) at high or inverted low-side driver (M_{HS}/M_{LS} output)
- Protective coating (SL 1307 FLZ)

Approvals



ATTENTION



Observe precautions for handling electrostatic sensitive devices.
Handle only at safe work stations.

ATTENTION



The device is monitoring HIGH VOLTAGE.
Be aware of HIGH VOLTAGE near to the device.

Product description

The ISOMETER® IR155-3203/-3204 monitors the insulation resistance between the insulated and active HV-conductors of an electrical drive system ($U_n = \text{DC } 0 \text{ V} \dots 1000 \text{ V}$) and the reference earth (chassis ground ▶ Kl.31). The patented measurement technology is used to monitor the condition of the insulation on the DC side as well as on the AC motor side of the electrical drive system. Existing insulation faults will be signalled reliably, even under high system interferences, which can be caused by motor control processes, accelerating, energy recovering etc.

Due to its space-saving design and optimised measurement technology, the device is optimised for use in hybrid or fully electric vehicles. The device meets the increased automotive requirements with regard to the environmental conditions (e.g. temperatures and vibration, EMC...).

The fault messages (insulation fault at the HV-system, connection or device error of the IMD) will be provided at the integrated and galvanic isolated interface (high- or low-side driver). The interface consists of a status output (OK_{HS} output) and a measurement output (M_{HS}/M_{LS} output). The status output signalises errors or that the system is error free, i.e. the "good" condition as shown by the "Operating principle PWM driver" diagram on page 5. The measurement output signalises the actual insulation resistance. Furthermore, it is possible to distinguish between different fault messages and device conditions, which are base frequency encoded.

Function

The ISOMETER® IR155-3203/-3204 generates a pulsed measuring voltage, which is superimposed on the IT system via terminals L+/L- and E/KE. The latest measured insulation condition is available as a pulse-width-modulated (PWM) signal at terminals M_{HS} (for IR155-3204) or M_{LS} (for IR155-3203). The connection between the terminals E/KE and the chassis ground (▶ Kl.31) is continuously monitored. Therefore it is necessary to install two separated conductors from the terminals E or KE to chassis ground.



Connection monitoring of the earth terminals E/KE is specified for $R_F \leq 4 \text{ M}\Omega$ if the ISOMETER® is connected as shown in the application diagram on page 3.

Once power is switched on, the device performs an initialisation and starts the system state (SST) measurement. The ISOMETER® provides the first estimated insulation resistance during a maximum time of 2 seconds. The DCP measurement (▶ continuous measurement method) starts subsequently. Faults in the connecting wires or functional faults will be automatically recognised and signalled.

During operation, a self test is carried out automatically every five minutes. The interfaces will not be influenced by these self tests.



Connection monitoring of the earth terminals E/KE may not work as intended when $R_F > 4 \text{ M}\Omega$ if the supply terminals (Kl.15/Kl.31) are not galvanically isolated from the chassis earth (Kl.31).

Standards

Corresponding standards and regulations*

IEC 61557-8	2014-12
IEC 61010-1	2010-06
IEC 60664-1	2004-04
ISO 6469-3	2011-12
ISO 23273-3	2006-11
ISO 16750-1	2006-08
ISO 16750-2	2010-03
ISO 16750-4	2010-04
E1 (ECE regulation No. 10 revision 5)	
acc. 72/245/EWG/EEC	2009/19/EG/EC
DIN EN 60068-2-38	Z/AD:2010
DIN EN 60068-2-30	Db:2006
DIN EN 60068-2-14	Nb:2010
DIN EN 60068-2-64	Fh:2009
DIN EN 60068-2-27	Ea:2010

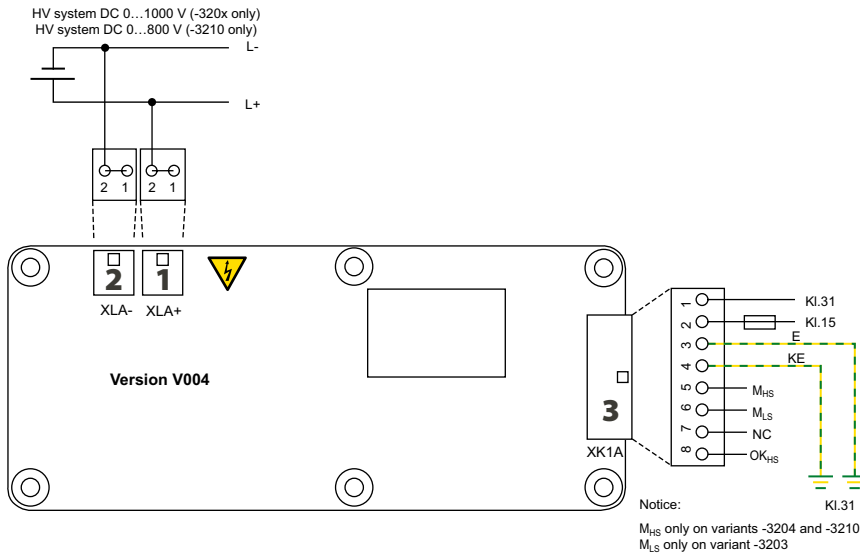
* Normative exclusion

The device went through an automotive test procedure in combination with multi customer requirements reg. ISO16750-x.
The standard IEC61557-8 will be fulfilled by creating the function for LED warning and test button at the customer site if necessary.
The device includes no surge and load dump protection above 50 V. An additional central protection is necessary.

Abbreviations

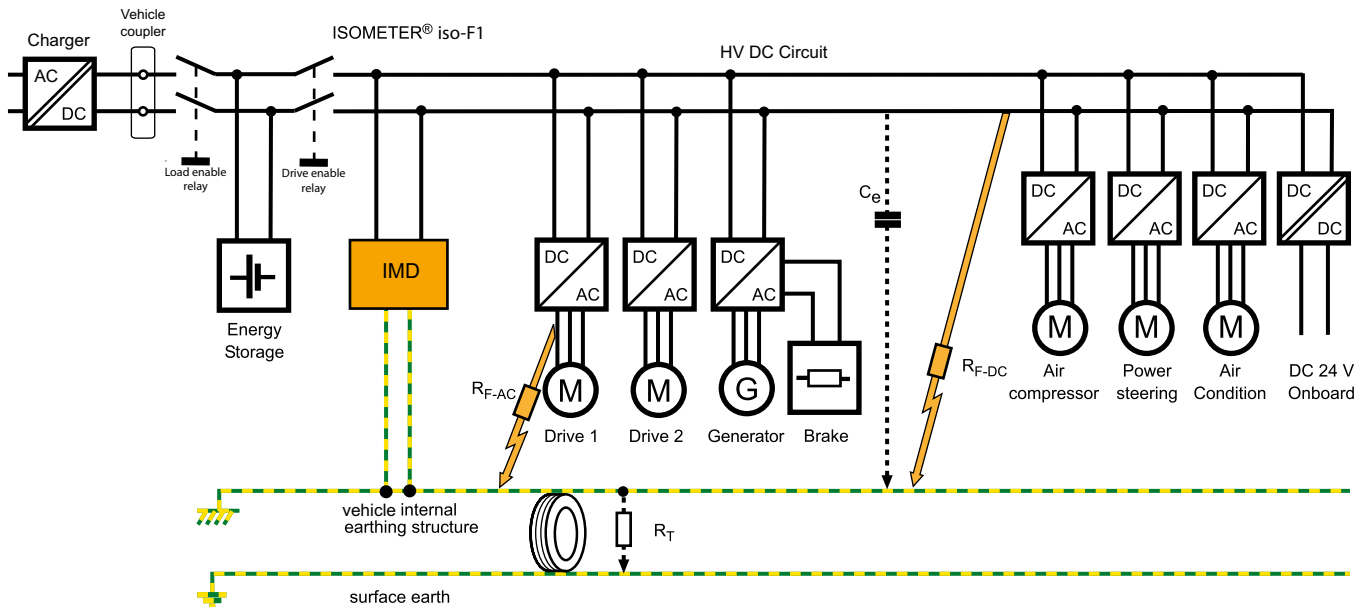
DCP	Direct Current Pulse
SST	Speed Start Measuring

Wiring diagrams



1	Connector XLA+		
	Pin 1+2	L+	Line Voltage
2	Connector XLA-		
	Pin 1+2	L-	Line Voltage
3	Connector XK1A		
	Pin 1	KI. 31	Chassis ground/electronic ground
	Pin 2	KI. 15	Supply voltage
	Pin 3	KI. 31	Chassis ground
	Pin 4	KI. 31	Chassis ground (separate line)
	Pin 5	M _{HS}	Data Out, PWM (high side)
	Pin 6	M _{LS}	Data Out, PWM (low side)
	Pin 7	n.c.	
	Pin 8	OK _{HS}	Status Output (high side)

Typical application



Technical data

Insulation coordination acc. to IEC 60664-1

Protective separation (reinforced insulation)	between (L+/L-) – (Kl. 31, Kl. 15, E, KE, M _{HS} , M _{LS} , OK _{HS})
Voltage test	AC 3500 V/1 min
Supply/IT system being monitored	
Supply voltage U_S	DC 10...36 V
Max. operating current I_S	150 mA
Max. current I_k	2 A
	6 A/2 ms inrush current
HV voltage range (L+/L-) U_n	AC 0...1000 V (peak value) 0...660 V RMS (10 Hz...1 kHz) DC 0...1000 V
Power consumption	< 2 W

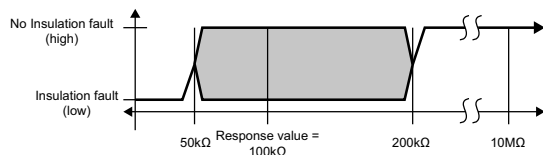
Response values

Response value hysteresis (DCP)	25 %
Response value R_{an}	100 kΩ...1 MΩ
Undervoltage detection	0...500 V

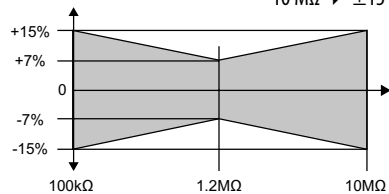
Measuring range

Measuring range	0...10 MΩ
Undervoltage detection	0...500 V default setting: 0 V (inactive)
Relative uncertainty	
SST (≤ 2 s)	good $> 2 * R_{an}$; bad $< 0.5 * R_{an}$
Relative uncertainty DCP	0...85 kΩ $\triangleright \pm 20$ kΩ
(default setting 100 kΩ)	100 kΩ...10 MΩ $\triangleright \pm 15$ %
Relative uncertainty output M (fundamental frequency)	± 5 % at each frequency (10 Hz; 20 Hz; 30 Hz; 40 Hz; 50 Hz)

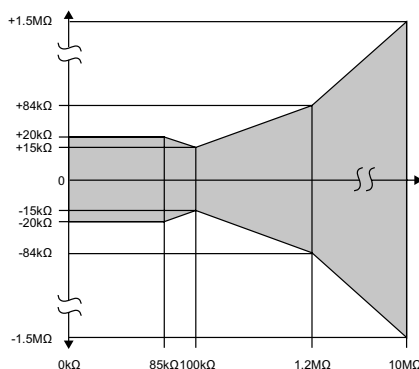
Relative uncertainty undervoltage detection	$U_n \geq 100$ V $\triangleright \pm 10$ %; at $U_n \geq 300$ V $\triangleright \pm 5$ %
Relative uncertainty (SST)	"Good condition" $\geq 2 * R_{an}$ "Bad condition" $\leq 0.5 * R_{an}$



Relative uncertainty DCP	100 kΩ...10 MΩ ± 15 % 100 kΩ...1.2 MΩ $\triangleright \pm 15$ % to ± 7 % 1.2 MΩ $\triangleright \pm 7$ % 1.2...10 MΩ $\triangleright \pm 7$ % to ± 15 % 10 MΩ $\triangleright \pm 15$ %
--------------------------	---



Absolute uncertainty	0...85 kΩ $\triangleright \pm 20$ kΩ
----------------------	--------------------------------------



Time response

Response time t_{an} (OK _{HS} ; SST)	$t_{an} \leq 2$ s (typ. < 1 s at $U_n > 100$ V)
Response time t_{an} (OK _{HS} ; DCP)	(when changing over from $R_F = 10$ MΩ to $R_{an}/2$; at $C_e = 1$ μF; $U_n = DC 1000$ V)
	$t_{an} \leq 20$ s (at $F_{ave} = 10^*$) $t_{an} \leq 17.5$ s (at $F_{ave} = 9$) $t_{an} \leq 17.5$ s (at $F_{ave} = 8$) $t_{an} \leq 15$ s (at $F_{ave} = 7$) $t_{an} \leq 12.5$ s (at $F_{ave} = 6$) $t_{an} \leq 12.5$ s (at $F_{ave} = 5$) $t_{an} \leq 10$ s (at $F_{ave} = 4$) $t_{an} \leq 7.5$ s (at $F_{ave} = 3$) $t_{an} \leq 7.5$ s (at $F_{ave} = 2$) $t_{an} \leq 5$ s (at $F_{ave} = 1$) during the self test $t_{an} + 10$ s

Switch-off time t_{ab} (OK_{HS}; DCP)

(when changing over from $R_{an}/2$ to $R_F = 10$ MΩ; at $C_e = 1$ μF; $U_n = DC 1000$ V)	$t_{ab} \leq 40$ s (at $F_{ave} = 10$) $t_{ab} \leq 40$ s (at $F_{ave} = 9$) $t_{ab} \leq 33$ s (at $F_{ave} = 8$) $t_{ab} \leq 33$ s (at $F_{ave} = 7$) $t_{ab} \leq 33$ s (at $F_{ave} = 6$) $t_{ab} \leq 26$ s (at $F_{ave} = 5$) $t_{ab} \leq 26$ s (at $F_{ave} = 4$) $t_{ab} \leq 26$ s (at $F_{ave} = 3$) $t_{ab} \leq 20$ s (at $F_{ave} = 2$) $t_{ab} \leq 20$ s (at $F_{ave} = 1$) during a self test $t_{ab} + 10$ s
---	---

Duration of the self test

	10 s (every five minutes; should be added to t_{an}/t_{ab})
--	---

Measuring circuit

System leakage capacitance C_e	≤ 1 μF
Smaller measurement range and increased measuring time at C_e	> 1 μF (e.g. max. range 1 MΩ @ 3 μF, $t_{an} = 68$ s when changing over from R_F 1 MΩ to $R_{an}/2$)
Measuring voltage U_M	± 40 V
Measuring current I_M at $R_F = 0$	± 33 μA
Impedance Z_i at 50 Hz	≥ 1.2 MΩ
Internal DC resistance R_i	≥ 1.2 MΩ

* $F_{ave} = 10$ is recommended for electric and hybrid vehicles

Output

Measurement output (M)

M_{HS} switches to $U_S - 2\text{ V}$ (3204)

(external pull-down resistor to Kl. 31 necessary 2.2 k Ω)

M_{LS} switches to Kl. 31 + 2 V (3203)

(external pull-up resistor to Kl. 15 required 2.2 k Ω)

0 Hz ▶ Hi > short-circuit to $U_b + (\text{Kl. 15})$; Low > IMD off or short-circuit to Kl. 31

10 Hz ▶ Normal condition
Insulation measurement DCP;
starts two seconds after power on;
First successful insulation measurement at $\leq 17.5\text{ s}$
PWM active 5...95 %

20 Hz ▶ undervoltage condition
Insulation measurement DCP (continuous measurement);
starts two seconds after power on;
PWM active 5...95 %
First successful insulation measurement at $\leq 17.5\text{ s}$
Undervoltage detection 0...500 V
(Bender configurable)

30 Hz ▶ Speed start measurement
Insulation measurement (only good/bad evaluation)
starts directly after power on $\leq 2\text{ s}$;
PWM 5...10 % (good) and 90...95 % (bad)

40 Hz ▶ Device error
Device error detected; PWM 47.5...52.5 %

50 Hz ▶ Connection fault earth
Fault detected on the earth connection (Kl. 31)
PWM 47.5...52.5 %

Status output (OK_{HS})

OK_{HS} switches to $U_S - 2\text{ V}$

(external pull-down resistor to Kl. 31 required 2.2 k Ω)

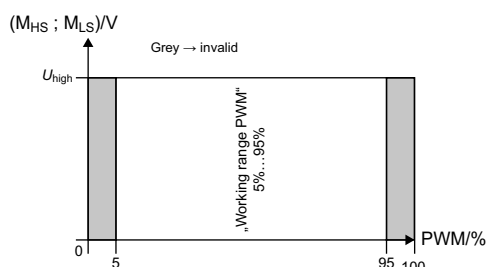
High ▶ No fault; $R_F >$ response value
Low ▶ Insulation resistance \leq response value detected;
Device error; Fault in the earth connection
Undervoltage detected or device switched off

Operating principle PWM driver

- Condition "Normal" and "Undervoltage detected" (10 Hz; 20 Hz)
Duty cycle 5 % => 50 M Ω (∞)
Duty cycle 50 % = 1200 k Ω
Duty cycle 95 % = 0 k Ω

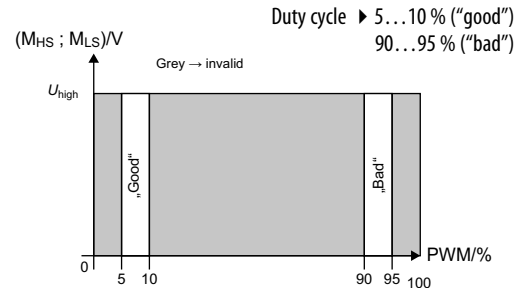
$$R_F = \frac{90\% \times 1200\text{ k}\Omega}{d_{C_{\text{meas}}} - 5\%} - 1200\text{ k}\Omega$$

$d_{C_{\text{meas}}} = \text{measured duty cycle (5\%...95\%)}$



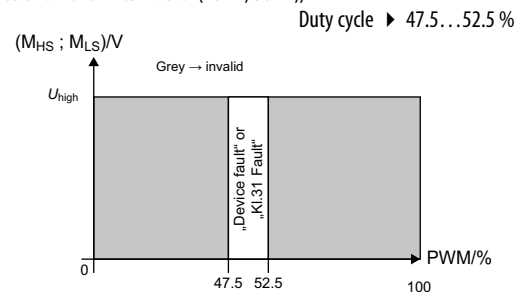
Operating principle PWM driver

- Condition "SST" (30 Hz)

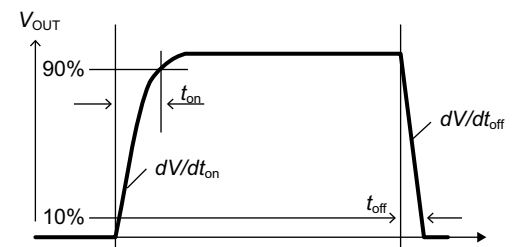


Operating principle PWM driver

- Condition "Device error" and "Kl.31 fault" (40 Hz; 50 Hz)



Load current I_L	80 mA
Turn-on time ▶ to 90 % V_{out}	max. 125 μs
Turn-off time ▶ to 10 % V_{out}	max. 175 μs
Slew rate on ▶ 10...30 % V_{out}	max. 6 V/ μs
Slew rate off ▶ 70...40 % V_{out}	max. 8 V/ μs
Timing 3204 (inverse to 3203)	



EMC

Load dump protection	< 50 V
Measurement method	Bender-DCP technology
Factor averaging	
F_{ave} (output M)	1...10 (factory set: 10)

ESD protection

Contact discharge – directly to terminals	$\leq 10\text{ kV}$
Contact discharge – indirectly to environment	$\leq 25\text{ kV}$
Air discharge – handling of the PCB	$\leq 6\text{ kV}$

Connection

On-board connectors	TYCO-MICRO MATE-N-LOK 1 x 2-1445088-8 (Kl. 31, Kl.15, E, KE, M_{HS} , M_{LS} , OK_{HS} 2 x 2-1445088-2 (L+, L-); The connection between the respective connecting pins at L+ or L- may only be used as redundancy. Cannot be used for looping through!
Crimp contacts	TYCO-MICRO MATE-N-LOK Gold 14 x 1-794606-1 Conductor cross section: AWG 20...24
Enclosure for crimp contacts	TYCO-MICRO MATE-N-LOK receptor HSG single R-1445022-8 TYCO-MICRO MATE-N-LOK receptor HSG single R-1445022-2

General data

Necessary crimp tongs (TYCO)	91501-1
Operating mode/mounting	continuous operation/any position
Temperature range	-40...+105 °C
Voltage failure	≤ 2 ms
Flammability class acc. to	UL 94 V-0

Mounting

M4 metal screws with locking washers between screw head and PCB. Torx, T20 with a maximum tightening torque of 4 Nm for the screws. Furthermore, a maximum of 10 Nm tightening torque to the PCB at the mounting points.

Mounting and connector kits are not included in delivery, but are available as accessories. The maximum diameter of the mounting points is 10 mm.

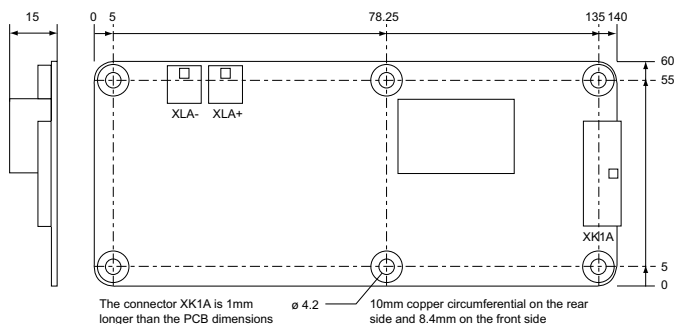
Before mounting the device, ensure sufficient insulation between the device and the vehicle or the mounting points (min. 11.4 mm to other parts). If the device is mounted on a metal or conductive subsurface, this subsurface has to be at earth potential (Kl.31; vehicle mass).

Deflection	max. 1 % of the length or width of the PCB
Coating	thick-film lacquer
Weight	52 g ±2 g

Dimension diagram

Dimensions in mm

PCB dimensions (L x W x H) 140 mm x 60 mm x 15 mm



Ordering information

Parameters	Response value R_{an}	F_{ave}	Undervoltage detection	Measured value output	Type	Art. No.
Continuously set value	100 kΩ	10	300 V	Low side	IR155-3203	B91068138V4
			0 V (inactive)	High side	IR155-3204	B91068139V4
Customer-specific setting	100 kΩ...1 MΩ	1...10	0...500 V	Low side	IR155-3203	B91068138CV4
				High side	IR155-3204	B91068139CV4

Accessories

Type designation	Art. No.
Fastening set	B91068500
Connector set IR155-32xx	B91068501

Example for ordering

IR155-3204-100kΩ-0V + B 9106 8139V4

IR155-3204-200kΩ-100V + B 9106 8139CV4

The parameters, i.e. the response value and undervoltage protection value must be included in the order.



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info@bender.de
www.bender.de



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Subject to change!

The specified standards take into account the edition valid until 06.2024 unless otherwise indicated.

1249500	DATA SHEET	
valid from: 15.03.2022	ÖLFLEX® HEAT 180 SiF A	

Application

ÖLFLEX® HEAT SiF A are UL/cRU certified, heat resistant silicone single cores for the European and North American market, for fixed installation under low mechanical stress. They are halogen-free and feature low toxicity of gases and corrosivity in case of fire. They are characterized by good ozone and UV resistances and suitable for use under high ambient temperatures provided adequate ventilation.

Application range:

Control cabinets, wiring and connecting in devices and apparatus engineering, heating elements, air-conditioning, sauna and solarium construction as well as in other operating ranges.

Use acc. to UL: Internal wiring of appliances where totally enclosed.

Use acc. to cRU: CSA AWM I A/B, internal wiring of equipment with or without mechanical abuse.

Design

Design	based on EN 50525-2-41 acc. to UL 758, Style 3644 CSA AWM C22.2 No. 210-15
Certification	UL AWM Style 3644, UL 758 cRU AWM I A/B, C22.2 No. 210-15
Conductor	fine wire strands of non-porous tinned copper acc. to IEC 60228 resp. EN 60228, class 5
Insulation	Silicone compound acc. to UL 1581, table 50.210 (150°C) and EI2 acc. to EN 50363-1
Core identification code	Available core colours: GN-YE / BK / BN / BU / GY / WH / OG / GN / YE / VT / RD / DBU

Electrical properties at 20 °C

Nominal voltage	U ₀ / U:	600/1000 V
	UL/cRU:	1000 V
Test voltage		3000 V AC

Mechanical and thermal properties

Minimum bending radius	fixed installation: 6 x outer diameter One bend at end of core: 3 x outer diameter
Temperature range	fixed installation: (UL/CSA) up to +150°C (EN) -50°C up to +180°C (adequate ventilation required)
Flammability	flame retardant acc. to IEC 60332-1-2 resp. EN 60332-1-2 UL: Horizontal Flame Test
Halogen free	acc. to IEC 60754-1 resp. EN 60754-1
Corrosivity of gases	acc. to IEC 60754-2 resp. EN 60754-2
Toxicity	acc. to EN 50305
UV resistance	acc. to EN ISO 4892-2, method A (change of color allowed)
Ozone resistance	acc. to EN 50396, method B

General requirements

These cables conform to the EU-Directive 2014/35/EU (Low Voltage Directive)

Environmental information

These cables meet the substance-specific requirements of the EU Directive 2011/65/EU (RoHS).

Creator: LABU / PDC	Document: DB1249500EN	Page 1 of 1
Released: ALTE / PDC	Version: 04	



By CRC Industries 

TECHNICAL DATA SHEET 1/3

PLASTIK 70 SUPER

PLASTIK 70 SUPER

Effective protection for electronic circuits and assemblies.

1. GENERAL DESCRIPTION

Quick drying, colorless transparent insulating and protective coating based on novel acrylic resins.

2. FEATURES

- PLASTIK 70 SUPER is a low viscosity, solvent drying acrylic based conformal coating with excellent insulating properties. The lacquer is colorless transparent and elastic. It resists to extreme temperatures in the range from – 40°C to + 125°C.

Perfect protection and insulation in hot/humid environment.

PLASTIK 70 SUPER is colorless-transparent and as such is not visual on the printed circuit board surface.

Contains a pigment that gives a fluorescent blue glow when exposed to UV light.

Without silicones.

For repair works PLASTIK 70 SUPER can be soldered through or be totally removed with Kontakt Chemie THINNER 70

3. APPLICATIONS

PLASTIK 70 SUPER can be used in applications such as aeronautics, marine, aerospace, telecommunications, electronic materials, automotive electricity etc.

PLASTIK 70 SUPER is used as a durable protection on all electronic assemblies which have to resist extreme climatic conditions.

4. DIRECTIONS

For small runs and service applications, the easiest way to apply PLASTIK 70 SUPER is from an aerosol can. Spray from a distance of 20 to 30 cm on the dry and degreased surface.

As pre-cleaning of PCB's, we do recommend the use of KONTAKT PCC to remove greases, dirt and flux residues. When finished spraying, clean the aerosol valve by turning the can upside down and pressing the button until only propellant escapes.

For serial production runs, PLASTIK 70 SUPER in bulk can be applied by brush or by dipping. For spraying, two parts per volume PLASTIK 70 SUPER is diluted with up to one part of Kontakt Chemie THINNER 70. The exact mixing ratio must be determined by trials with the equipment concerned.



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TECHNICAL DATA SHEET 2/3

PLASTIK 70 SUPER

For dip coating it is also necessary to fix the immersion time and the withdrawal speed. The faster the removal from the bulk, then thicker the film will be. Dipping baths have to be carefully protected to ensure no entrapment of conductive stuck-on residues.

PLASTIK 70 SUPER contains solvents like butyl acetate. Printed circuit board materials and electronic components generally have a good compatibility with these solvents. In case of plastic surfaces (e.g. housings) a compatibility test is always recommend. It is necessary in particular, to test its suitability for plastics susceptible to stress cracking (e.g. polycarbonate).

PLASTIK 70 SUPER contains flammable solvents and hence when working with the product, make sure there is good ventilation in the workplace. Remove all possible ignition sources.

A safety data sheet (SDS) according to EU directive 91/155/EEC and amendments is available for all CRC products.

5. TYPICAL PRODUCT DATA

Aspect	:	liquid.
Density	:	0.85 – 0.91 g/cm ³
Viscosity bulk	:	15 – 20 mPa.s
Solid content (bulk)	:	16 – 20 %
Flashpoint (bulk)	:	< 0°C
Coat thickness	:	20 to 40 microns
Coverage (bulk)	:	approx. 4.5 m ² /litre
Drying time at ambient temperature (HR 50%)	:	dust-free : 20 à 30 min dry to touch : 20 à 30 min fully dried : 1 day

Electrical characteristics:

Dielectric strength	:	value > 85 kV/mm
Surface resistivity	:	value > 1 x 10 ¹² Ω
Volume resistivity	:	value > 1 x 10 ¹³ Ω cm
Resistance to thermal choc	:	excellent (7 cycles in 24 h / temperatures from – 40 °C to + 85 °C).
Resistance to humid heat	:	excellent (24 h at + 55°C and 95% HR plus 24 h at +25°C and 95% HR).

Temperature resistance (tested at ambient temperature):

After exposure at – 40°C during 6h	:	excellent
After exposure at +125°C during 6h	:	excellent
Fungal growth (test method D850)	:	none



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TECHNICAL DATA SHEET 3/3

PLASTIK 70 SUPER

6. APPROVALS:

UL 94 Flammability test rating : V-0

7. PACKAGING

Aerosol : 400 ml
Canister : 5L

PLASTIK 70 THINNER

Canister: 1L
5L

All statements in this publication are based on service experience and/or laboratory testing. Because of the wide variety of equipment and conditions and the unpredictable human factors involved, we recommend that our products be tested on-the-job prior to use. All information is given in good faith but without warranty neither expressed nor implied.

This Technical Data Sheet may already have been revised at this moment for reason such as legislation, availability of components and newly acquired experiences. The latest and only valid version of this Technical Data Sheet will be sent to you upon simple request or can be found on our website: www.crcind.com.

We recommend you to register on this website for this product so you will be able to receive any future updated version automatically.

Version : 4.2

Date: 12 August 2022

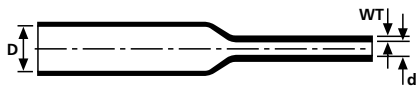


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Technical data sheet

Article number:
308-30300

HIS-3-3/1



Product Group	Heat shrinkable tubing 3:1 on a reel
Product Family	HIS-3
Material	Polyolefin, cross-linked (PO-X)
Colour	Black (BK)
Behaviour at Heat Shock	not fluid, not dripping, not cracking
Behaviour at Low Temperature [Test method]	not cracking [UL 224]
Dielectric Strength [Test method]	32 kV/mm [IEC 60243]
Elongation at break [Test method]	800 [ASTM D2671]
Elongation At Heat Aging	400 %
Flammability	UL 224 VW-1
Heat Aging Test [Test method]	168h/175°C [UL 224]
Heat Shock Test	4h/250°C
Insulation Class	B (VDE 0530)
Longitudinal Change After Shrinkage	+/-5%
Min. Shrink Temperature - °C	+100 °C
Minimum Tensile Strength At Heat Aging	13 MPa
Operating Temperature	-55 °C to +135 °C
Package Content packed in	pcs.
Pack Cont.	10 m
Recov. Ø d max.	1.0 mm
Shrink Ratio	3:1
Specifications	ANSI/UL 224, C22.2 no. 198.1-06
Supplied Ø D min.	3.2 mm
Tensile Strength [Test method]	14 MPa [ASTM D2671]
UL-File Number	E143529
Wall (WT)	0.55 mm





Part Number : [2043130006](#)
Product Description : Sentrality 6.00mm Top-entry,
Knurled Press-fit Socket Assembly with +/-1.00mm
Self-alignment Capability, Tray
Series Number : 204313
Status : Active
Product Category : PCB Headers and Receptacles



Documents & Resources

Drawings

[2043130006_sd.pdf](#)
[2043650006-PK-000.pdf](#)

3D Models and Design Files


[2043130006_stp.zip](#)

Specifications

[2043130006-PS-000.pdf](#)
[2043130006-TS-000.pdf](#)
[2043131234-TS-000.pdf](#)

Product Environment Compliance..

Compliance

GADSL/IMDS	Not Relevant
China RoHS	 per SJ/T 11365-2006
EU ELV	Not Relevant
Low-Halogen Status	Low-Halogen per IEC 61249-2-21
REACH SVHC	Not Contained per D(2024)4144-DC (27 June 2024)
EU RoHS	Compliant per EU 2015/863

Compliance Statements

- EU RoHS
- REACH SVHC

- Low-Halogen

Industry Documents

- IPC 1752A Class C
- IPC 1752A Class D
- Molex Product Compliance Declaration
- IEC-62474
- chemSHERPA (xml)

Substances of Interest

- PFAS

EU RoHS Certificate of Compliance

Additional Product Compliance Information

Part Details

General

Status	Active
Category	PCB Headers and Receptacles
Series	204313
Description	Sentrality 6.00mm Top-entry, Knurled Press-fit Socket Assembly with +/-1.00mm Self-alignment Capability, Tray
Application	Busbar-to-Board, Busbar-to-Busbar, Power
Comments	Current and voltage performances are dependent upon application variables.
Component Type	PCB Receptacle
Product Name	Sentrality
UPC	191130149902

Electrical

Current - Maximum per Contact	140.0A
Voltage - Maximum	600V

Physical

Breakaway	No
Circuits (Loaded)	1

Circuits (maximum)	1
Diameter	6.00mm
Durability (mating cycles max)	200
Glow-Wire Capable	No
Guide to Mating Part	Yes
Height Above Board	3.40mm
Material - Metal	Copper Alloy
Material - Plating Mating	Gold
Material - Plating Termination	Silver
Mating Orientation	Top-entry
Net Weight	10.302/g
Number of Rows	1
Orientation	Vertical
Packaging Type	Tray
PCB Retention	None
Pitch - Mating Interface	N/A
Polarized to Mating Part	No
Polarized to PCB	No
Temperature Range - Operating	-40° to +125°C
Termination Interface Style	Press-Fit

Mates With / Use With

Mates with Part(s)

Description	Part Number
Sentrality Pins	<u>203263</u>



Part Number : [2032630006](#)
Product Description : Sentrality 6.00mm Knurled Press-fit Pin, 26.00mm Engagement Length, Bag
Series Number : 203263
Status : Active
Product Category : PCB Headers and Receptacles



Documents & Resources

Drawings

- [2032630006_sd.pdf](#)
- [2032630006-PK-000.pdf](#)

3D Models and Design Files


- [2032630006_stp.zip](#)

Specifications

- [2043130006-PS-000.pdf](#)

Product Environment Compliance..

Compliance

GADSL/IMDS	Not Relevant
China RoHS	 per SJ/T 11365-2006
EU ELV	Not Relevant
Low-Halogen Status	Low-Halogen per IEC 61249-2-21
REACH SVHC	Not Contained per D(2024)4144-DC (27 June 2024)
EU RoHS	Compliant per EU 2015/863

Compliance Statements

- EU RoHS
- REACH SVHC
- Low-Halogen

Industry Documents

- IPC 1752A Class C
- IPC 1752A Class D

- Molex Product Compliance Declaration
- IEC-62474
- chemSHERPA (xml)

Substances of Interest

- PFAS

EU RoHS Certificate of Compliance

Additional Product Compliance Information

Part Details

General

Status	Active
Category	PCB Headers and Receptacles
Series	203263
Description	Sentrality 6.00mm Knurled Press-fit Pin, 26.00mm Engagement Length, Bag
Application	Board-to-Board, Busbar-to-Board, Busbar-to-Busbar, Power
Component Type	PCB Header
Product Name	Sentrality
UPC	191130149858

Electrical

Current - Maximum per Contact	140.0A
Voltage - Maximum	600V

Physical

Breakaway	No
Circuits (Loaded)	1
Circuits (maximum)	1
Diameter	6.00mm
Durability (mating cycles max)	200
Glow-Wire Capable	No
Guide to Mating Part	No
Height Above Board	26.00mm
Material - Metal	Copper Alloy

Material - Plating Mating	Silver
Material - Plating Termination	Silver
Net Weight	7.527/g
Number of Rows	1
Orientation	Vertical
Packaging Type	Bag
PCB Retention	None
Pitch - Mating Interface	N/A
Polarized to Mating Part	No
Polarized to PCB	No
Temperature Range - Operating	-40° to +125°C
Termination Interface Style	Press-Fit

Mates With / Use With

Mates with Part(s)

Description	Part Number
Sentrality Top-entry Surface Mount Socket Assemblies	<u>204318</u>
Sentrality Top-entry Surface Mount Socket Assemblies with Self-alignment Capability	<u>204365</u>
Sentrality Top-entry Knurled Press-Fit Socket Assemblies with Self-alignment Capability	<u>204313</u>
Sentrality Top-entry Knurled Press-Fit Socket Assemblies	<u>204316</u>
Sentrality 3.40mm Right-Angle Socket Assemblies	<u>205000</u>

IVT-S // HIGH PRECISION CURRENT MEASUREMENT

1.	Introduction	1
2.	Application	1
3.	Functionality description	2
4.	Measurement description	5
5.	Technical Data	11
6.	Mechanical data	13
7.	Part description / Ordering	18
8.	CANbus protocol	19
9.	Startup	41
10.	Qualification	42
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1. Introduction

The IVT-S is a high precision current measurement system, designed for DC applications, especially for automotive application. The product is based on a modular design and provides flexibility for fast adaptations to meet customer requirements in the automotive and the industrial area. The continuous current measurement has a range up to ± 2500 A. At higher currents (i.e. peaks) the measurement range will extend automatically.

The shunt-based measurement method uses a 16-bit analog-digital-converter to transform the voltage drop into a digital signal. The communication is based on a CAN bus 2.0a interface. A CAN description file (CAN-dbc) is available and supports fast system integration.



2. Application

The IVT-S is designed for a wide range of DC applications.

For example:

- Hybrid and full electric drives
- Uninterruptible Power Supply (UPS) systems
- Stationary energy storage systems
- Fuel cells
- All battery and storage based applications

No	Item	Unit	Min	Max
23	U1 measurement minimum	V	- 32.000	+ 32.000
24	U2 measurement maximum	V	- 32.000	+ 32.000
25	U2 measurement minimum	V	- 32.000	+ 32.000
26	U3 measurement maximum	V	- 32.000	+ 32.000
27	U3 measurement minimum	V	- 32.000	+ 32.000
28	Temperature measurement maximum	1/10 °C	- 500	+ 2000
29	Temperature measurement minimum	1/10 °C	- 500	+ 2000

3.5. Firmware update

To update the firmware, the IVT has an implemented bootloader. Firmware update can only be done by Isabellenhütte.

3.6. Galvanic isolation

This functionality is designed for high voltage applications. With the isolation module the sensor can be used with different potential levels on power supply (low voltage side) and shunt (high voltage side).

Isolation voltage according DIN EN 60664-1:2008-01

Declarations are valid at the following condition:
Sea level under 2000m

Max Working Isolation Voltage	1000V RMS CATI 600V RMS CATI-II 300V RMS CATI-III
Basis Isolation DC Voltage	1000 V
Reinforced Isolation DC Voltage	600 V
Highest allowed transient overvoltage	6000V (for 1s)
Minimum External Clearance distance	> 40 mm
Minimum External Creepage distance	> 50 mm
Minimum Internal Clearance	8 mm
Material Group housing	IIIa
Material Group connectors	II



Note: For high voltages, it is recommended to use an insulation monitor.

3.7. Flammability

We confirm, that the IVT-S uses exclusively UL94-V0 materials. This applies to the following components:

- Housing
- Connectors
- PCB

3.8. Communication interface

The IVT-S uses the standard CAN 2.0 a protocol.

The complete protocol description is listed in chapter 8.

5. Technical Data

5.1. Operation conditions

Parameter	Min	Typical	Max	Unit
Ambient Temperature	-40		+105	°C
Operating Temperature Shunt ¹	-40		+125	°C
Supply Voltage (V _{cc})	5.5	12	40	V
Current Consumption		30	80	mA
Re-/ Startup Time		350	400	ms
Waiting Time Power On/Off	2			ms
Isolation	According to chapter 3.6			

5.2. Maximum ratings

Parameter	Min	Max	Unit
Storage Temperature	-40	+125	°C
Storage Humidity		95	%
Supply Voltage	-42	42	V

Parameter Shunt	Value					Unit
Nominal Measurement Range (depending on shunt)	±100	±300	±500	±1000	±2500	A
Extended Load (max. time)						
5min	±120	±320	±730	±1100	±2700	A
30s	±200	±430	±860	±1400	±3200	A
10s	±300	±600	±1000	±2000	±4300	A
1s	±900	±1600	±2700	±5500	±11300	A
200ms	±2000	±3600	±6000	±12000	±24000	A

5.3. Current measurement

Parameter	Value					Unit
Nominal Measurement Range	±100	±300	±500	±1000	±2500	A
Typical Shunt Resistance	285	95	35	20	5	μΩ
Power Loss	< 3	< 9	< 9	< 20	< 32	W
Overcurrent Measurement Range	±800	±2500	±6900	±12200	±48000	A
Initial Accuracy ²	±0.1					%rdg ³
Total Accuracy ²	±0.4					%rdg ³
Offset	8	25	75	125	500	mA
Linearity	0.01					% of range
Noise	5	15	40	70	280	mA (RMS)
Resolution	3	10	27	47	186	mA
Accuracy Overcurrent Range	± 3					%rdg
Offset Overcurrent Range	60	200	540	940	3720	mA
Linearity Overcurrent Range	0.1					% of range
Noise Overcurrent Range	40	120	320	560	2240	mA (RMS)
Resolution Overcurrent Range	24	80	216	376	1488	mA

¹ Results from 105°C ambient temperature + 20°C self-heating at hotspot (resistance material)

² In nominal measurement range

³ Failure of reading

5.4. Voltage measurement

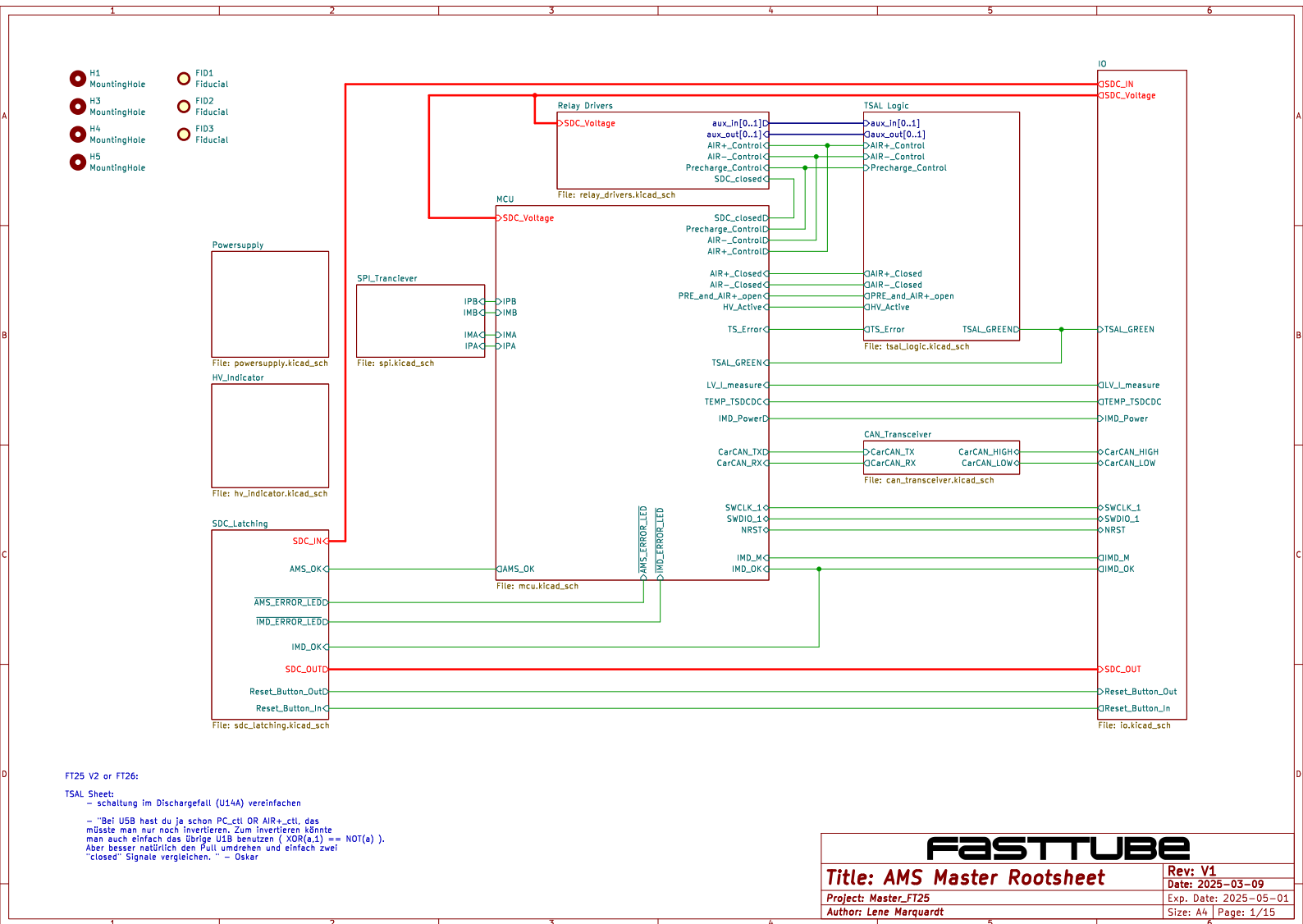
Parameter	Value	Unit
Nominal Measurement Range	±1000	V
Extended Range (nonlinear)	±1200	V
Typical Input Resistance	4	MΩ
Initial Accuracy	0.1	% of reading
Total Accuracy	0.5	% of reading
Offset	100	mV
Linearity	0.01	% of range
Noise ⁴	60	mV (RMS)
Resolution	30	mV

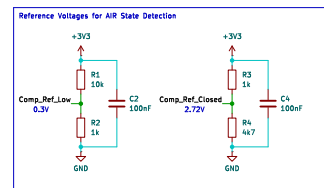
5.5. Communication

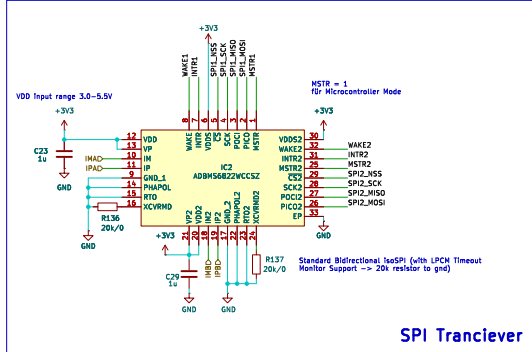
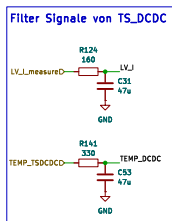
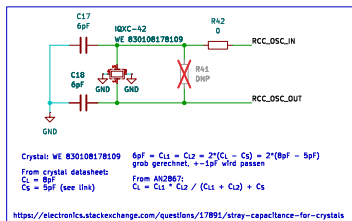
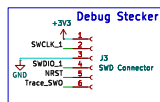
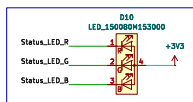
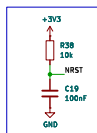
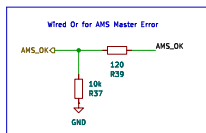
Interface	Specification	Speed	Termination	Max Number of Unit
CAN	2.0 a	250 kbit/s; 500 kbits/s; 1 Mbit/s	120 Ω	6

	Direction		Min	Max	Unit
V _{IH}	High-Level Input Voltage	TXD,S	2	5.25	V
V _{IL}	Low-Level Input Voltage	TXD,S	0	0.8	V
V _{ID}	Differential Input Voltage		-6	6	V
I _{OH}	High-Level Output Current	Driver	-70		mA
		Receiver	2		mA
I _{OL}	Low-Level Output Current	Driver	70		mA
		Receiver	2		mA

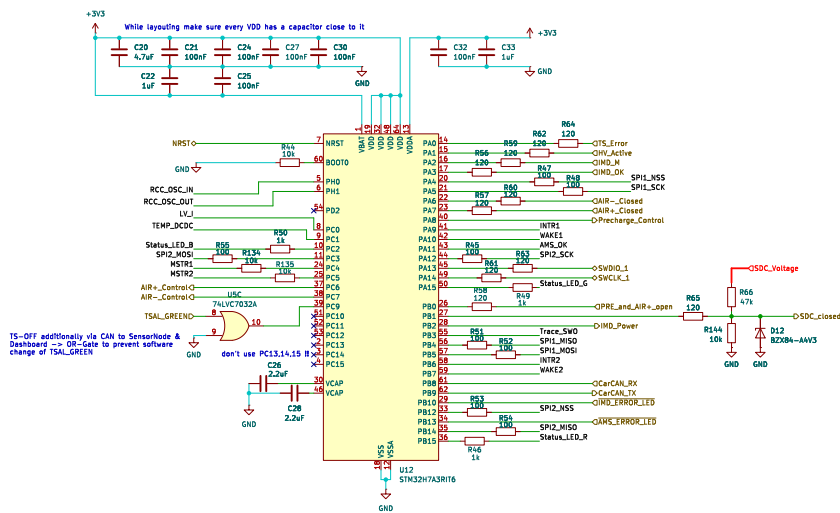
⁴ Without averaging

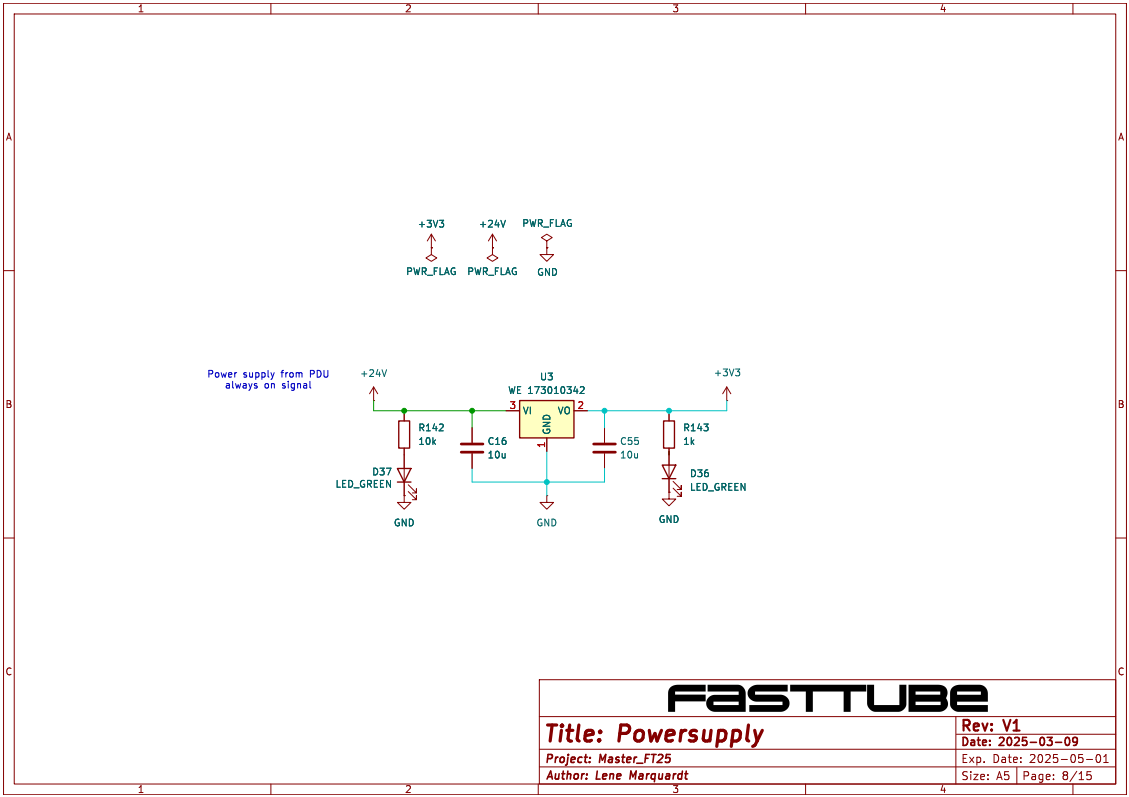


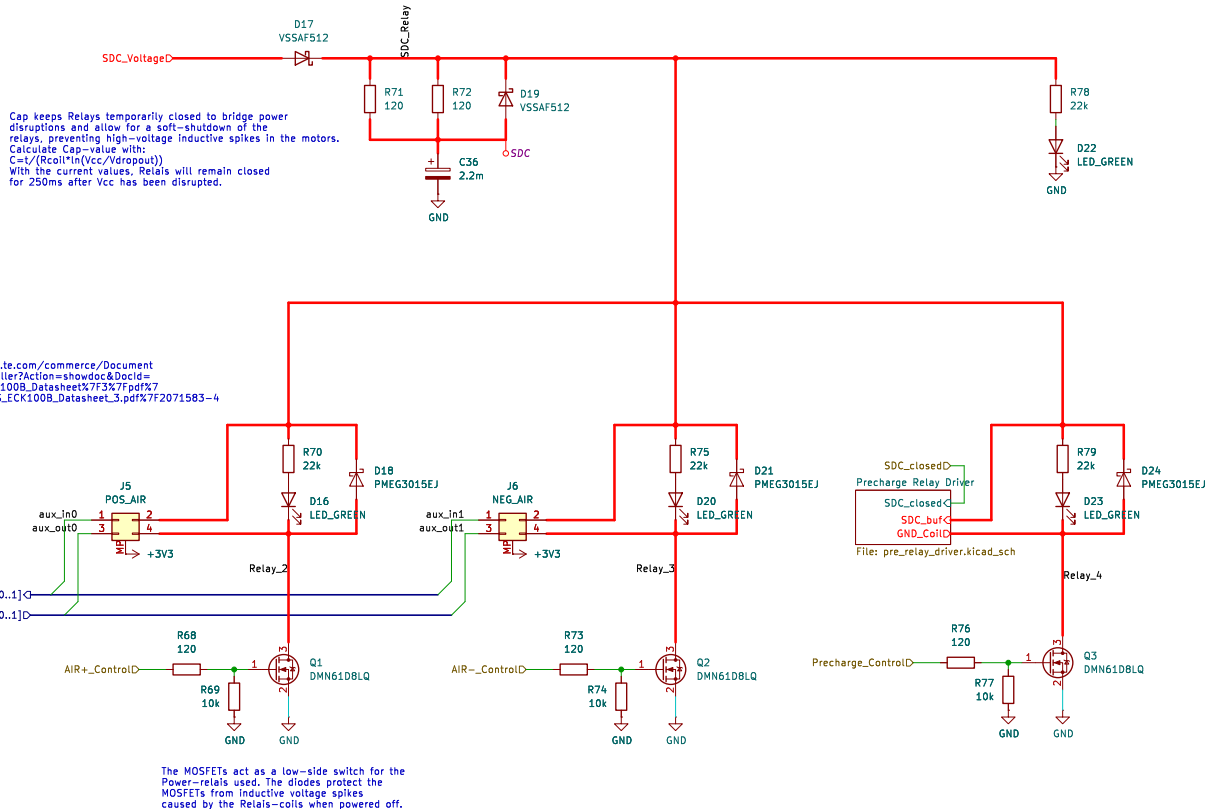




SPI Tranciever

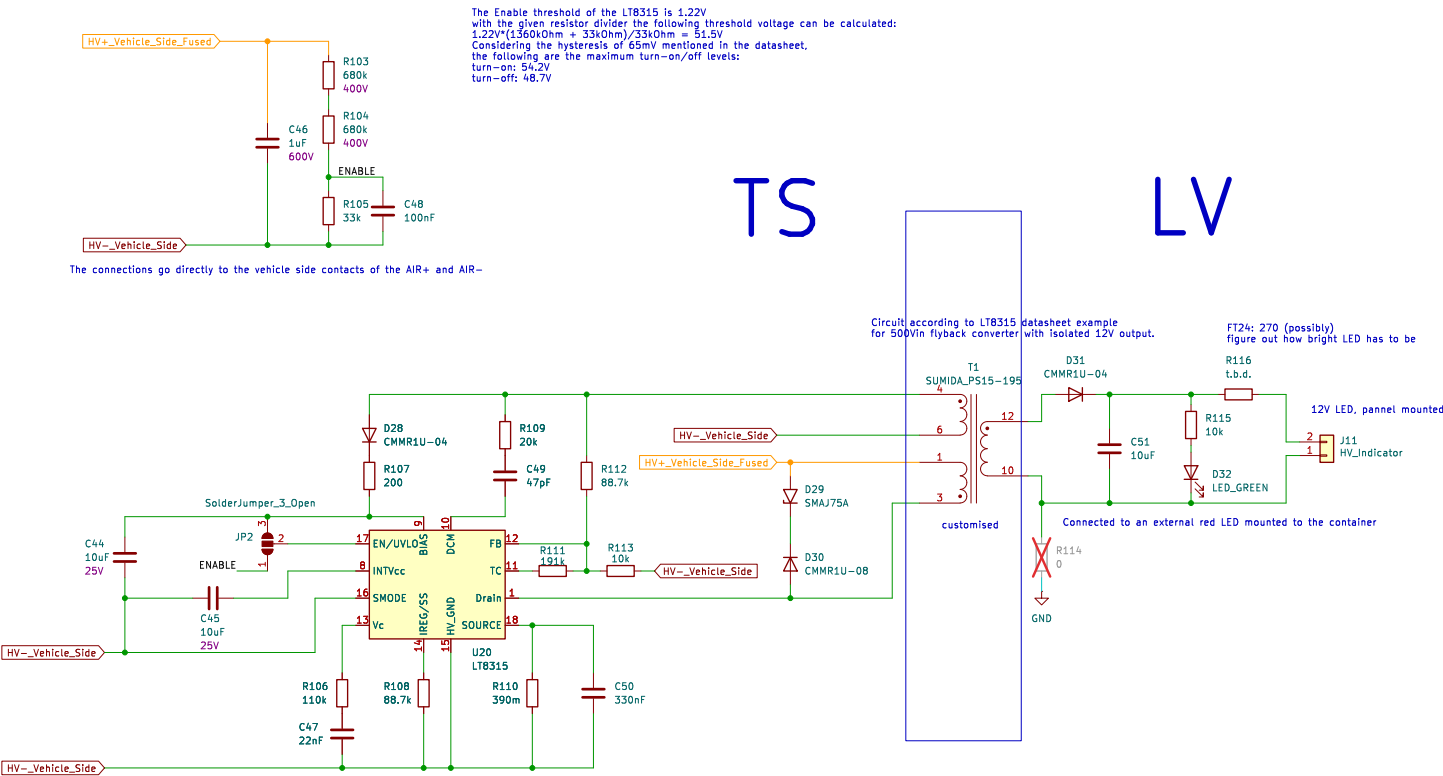






FASTTUBE	
Title: Relay Drivers	Rev: V1
Project: Master_FT25	Date: 2025-03-09
Author: Lene Marquardt	Exp. Date: 2025-05-01
	Size: A4 Page: 9/15

HV Indicator nicht verändert, wie FT24



FASTTUBE

Title: HV Indicator Driver

Project: Master_FT25

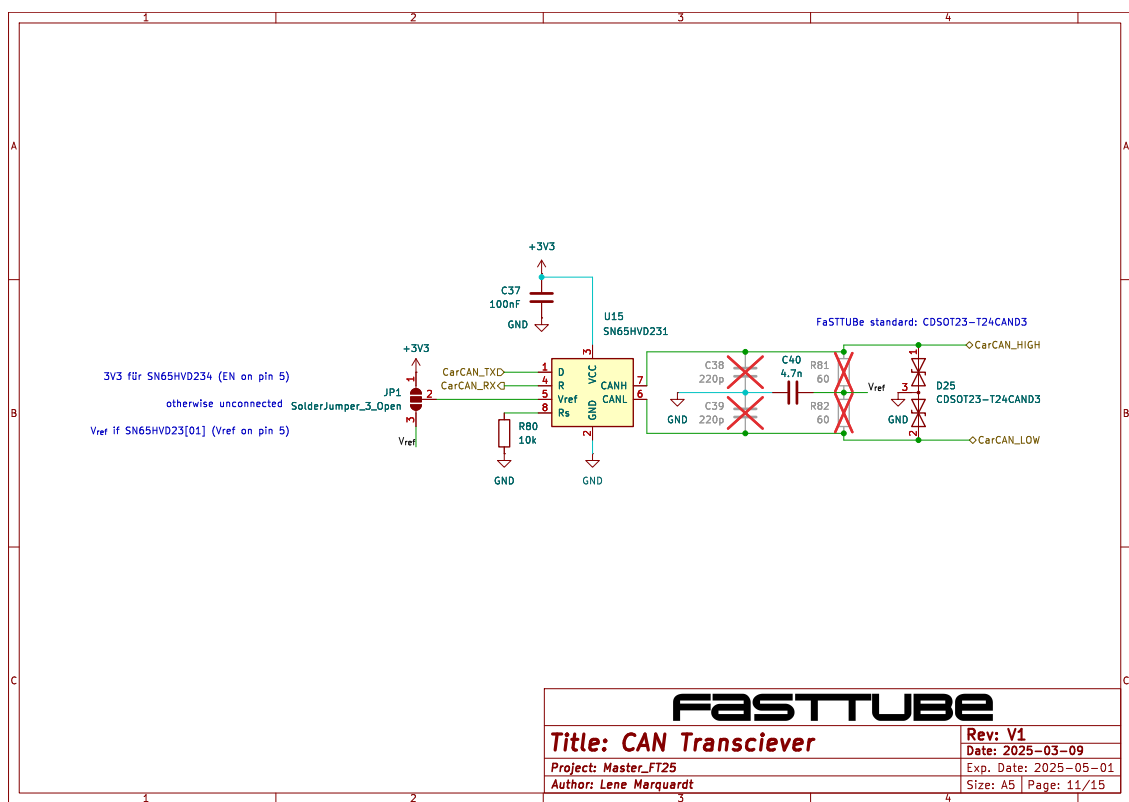
Author: Lene Marquardt

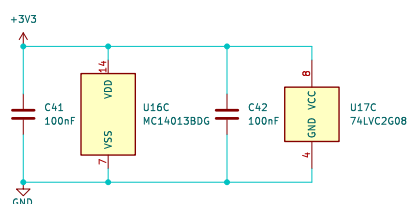
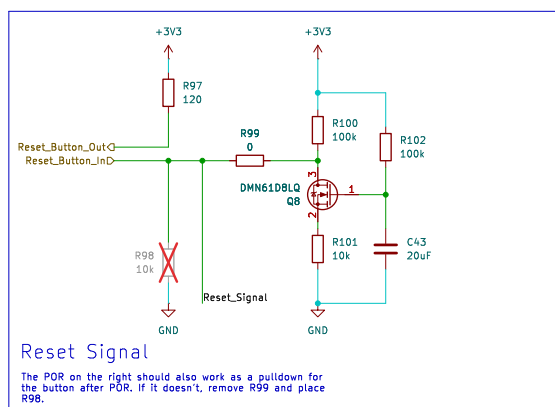
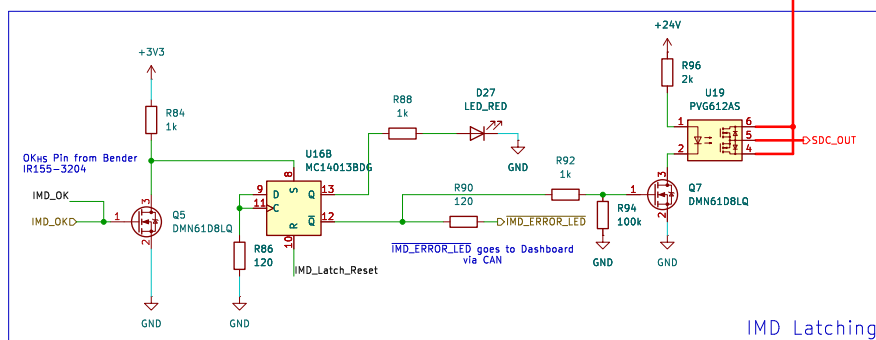
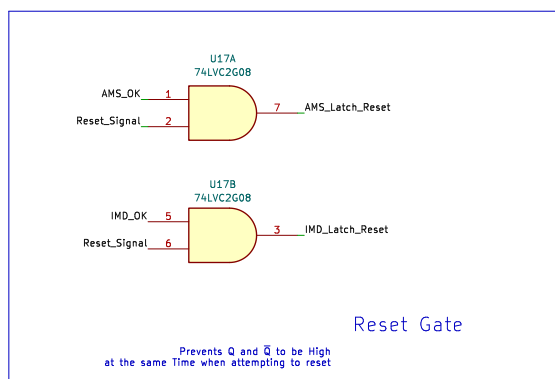
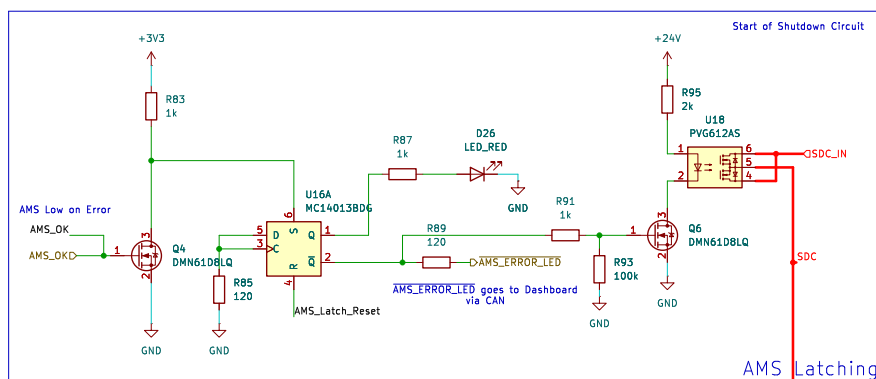
Rev: V1

Date: 2025-03-09

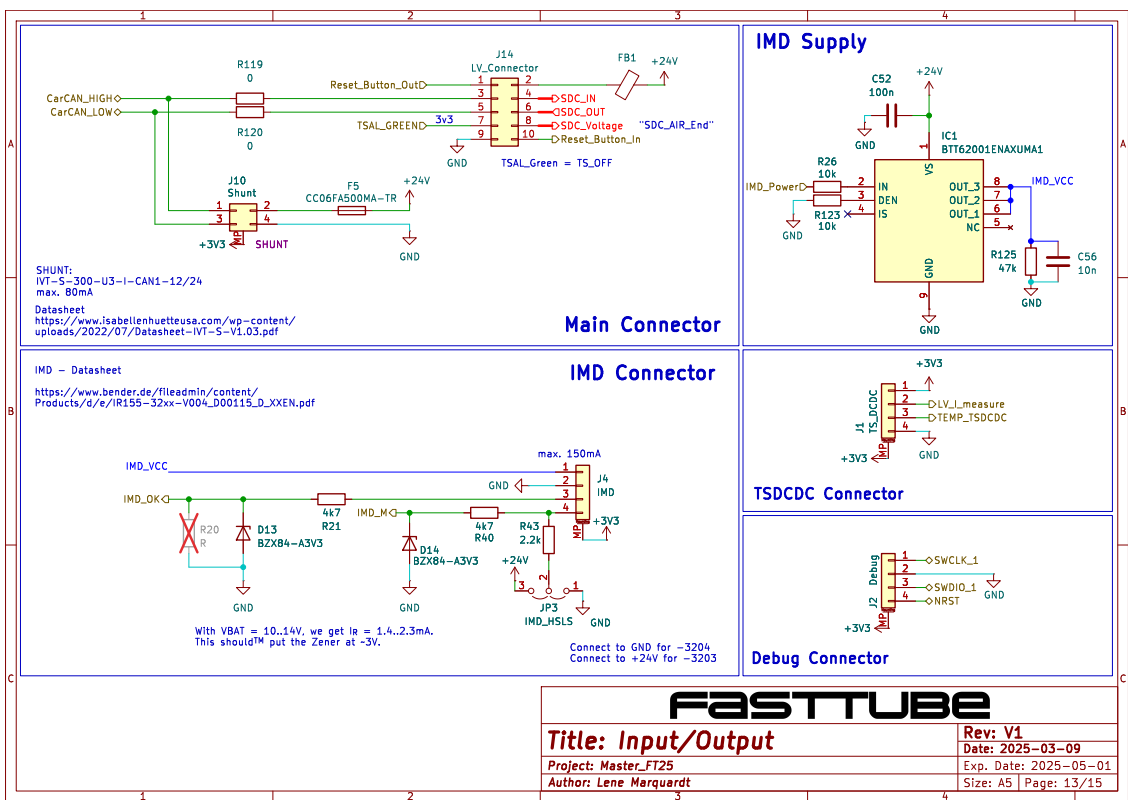
Exp. Date: 2025-05-01

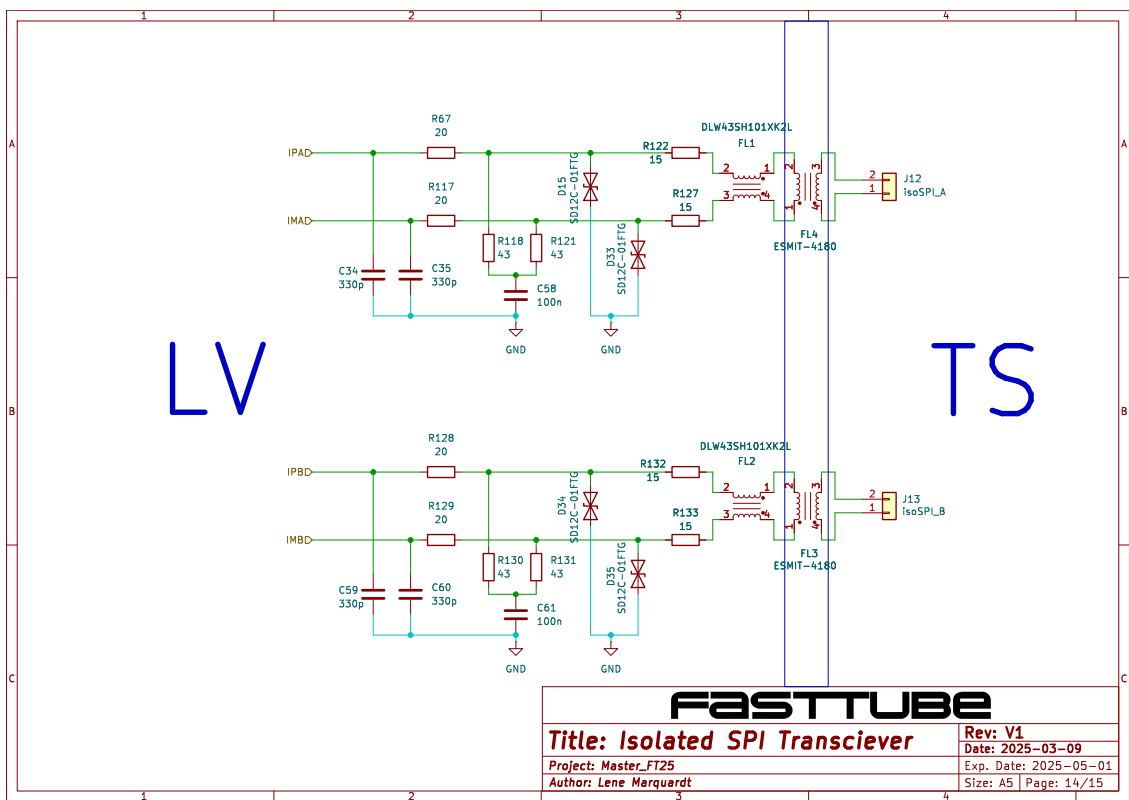
Size: A4 | Page: 11/15

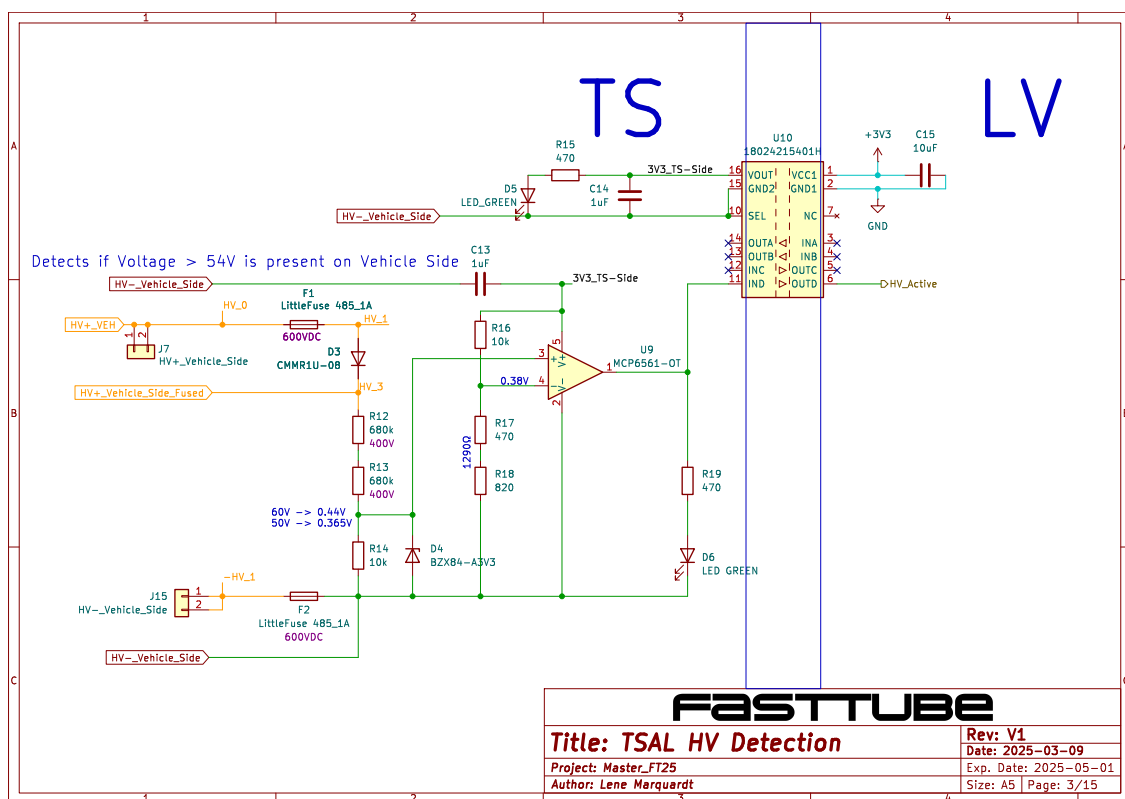




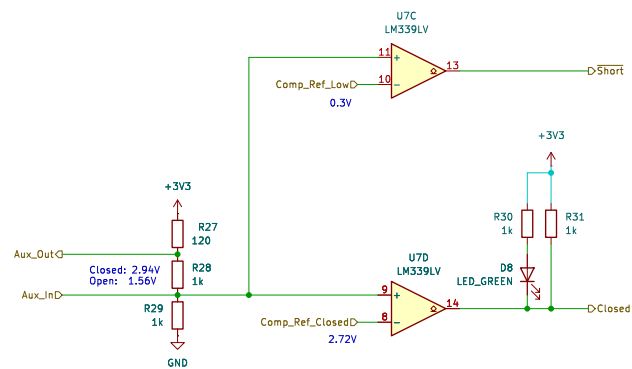
FASTTUBE			
Title: SDC Latching		Rev: V1	
Project: Master_FT25		Date: 2025-03-09	
Author: Lene Marquardt		Exp. Date: 2025-05-01	
		Size: A4 Page: 12/15	







Accumulator TSAL – Relay state detection



FASTTUBE

Title: AIR Relay State Detection

Rev: V1

Date: 2025-03-09

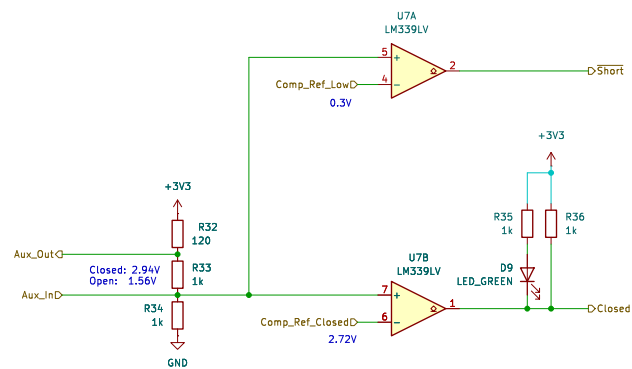
Project: Master_FT25

Exp. Date: 2025-05-01

Author: Lene Marquardt

Size: A5 | Page: 4/15

Accumulator TSAL – Relay state detection



FASTTUBE

Title: AIR Relay State Detection

Rev: V1

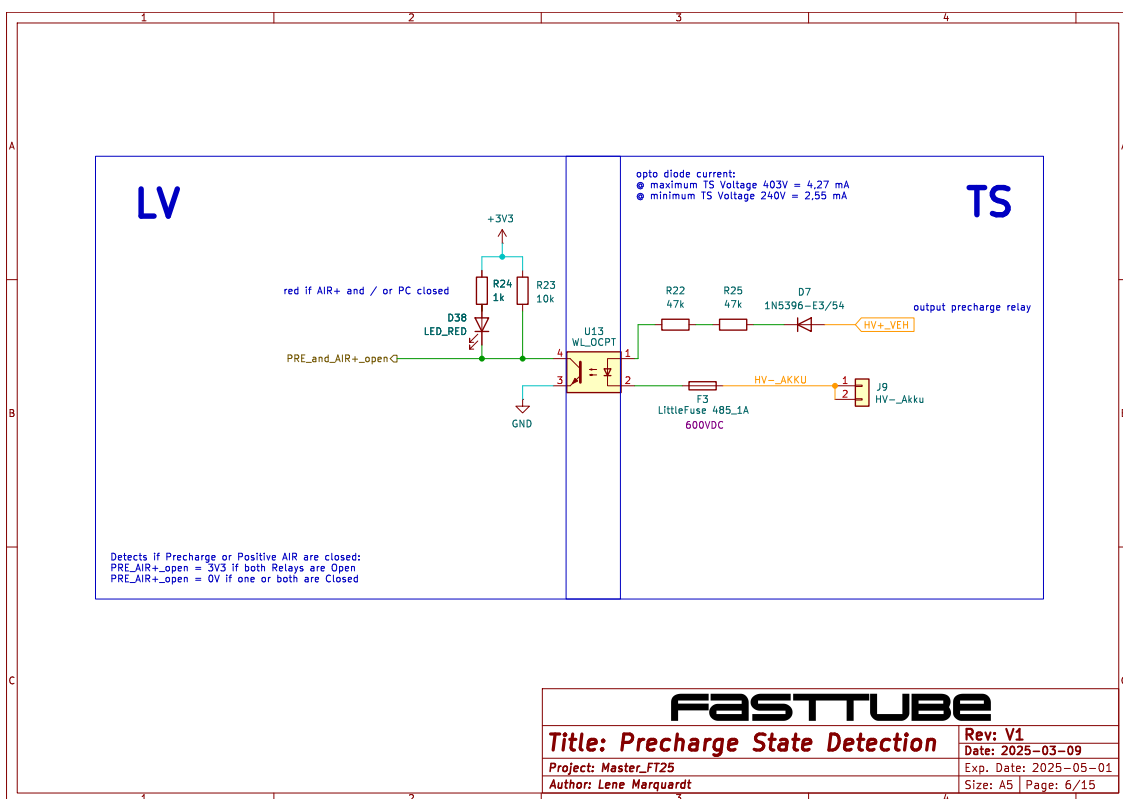
Date: 2025-03-09

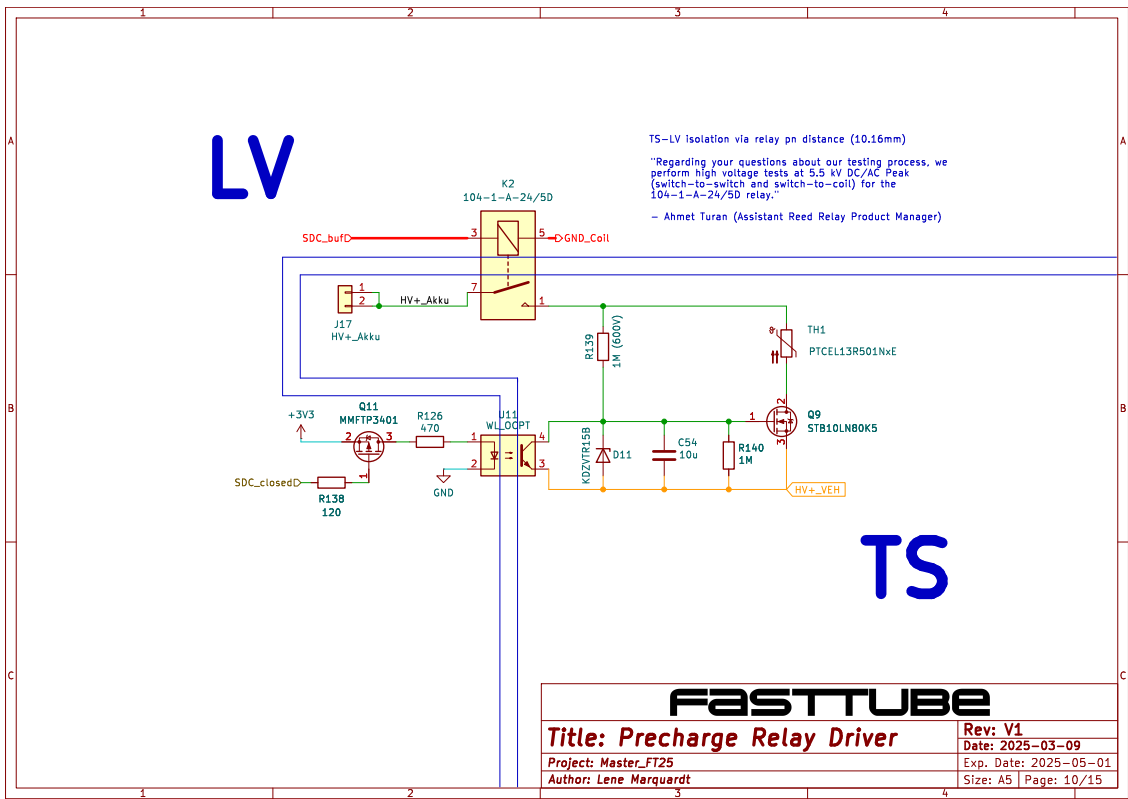
Project: Master_FT25

Exp. Date: 2025-05-01

Author: Lene Marquardt

Size: A5 | Page: 5/15





Type 0ACJ

High Voltage DC, SMD Fuse

0ACJ Series

RoHS Compliant

Features

- Surface mount design to save space
- Ceramic tube, silver plated cap construction
- Compatible with 260°C, IR Pb-free solder process
- Wide operating temperature range, -40°C to 125°C
- Tape & Reel for auto-insert SMD process
- MSL = 1
- RoHS compliant with exemption 7(a)
Fully compliance with EU Directive 2011/65/EU and amending directive 2015/863
- AEC-Q Compliant
- Meets Bel automotive qualification*
- * - Largely based on internal AEC-Q test plan



AEC-Q Compliant

Applications

- Battery Management Systems, (BMS)
- Li-ion Battery Packs
- DC-DC Converters
- Uninterruptible Power Supply (UPS) - Single phase and 3-Phase
- 380VDC server / lighting in data center

Physical Specifications

Materials	Body : Ceramic
	Cap : Silver plated copper
Marking	On Fuse :
	"Current Rating"
	On Label :
	"bel", "0ACJ", "Current Rating", "Voltage Rating", "Interrupting Rating", and "RoHS", "50" (China RoHS compliant).

Electrical Characteristics

% of Ampere Rating (A)	Opening Time	
	Min	Max
100%	4 hour	-
200%	-	120 sec

Safety Agency Approvals

Safety Agency	Ampere Rating / Voltage Rating	Ampere Range / Volt @ I.R. ability**
	1-3.15A/600V DC /400V DC /350V AC 4-5A/500V DC /400V DC /350V AC 6-7.5A/400V DC /350V AC	1-3.15A/600V @ 100A DC /400V @ 200A DC /350V @ 100A AC 4-5A/500V @ 100A DC /400V @ 200A DC /350V @ 100A AC 6-7.5A/400V @ 200A DC /350V @ 100A AC
** AC Interrupting Rating (measured at designated voltage, 100% power factor); DC Interrupting Rating (measured at designated voltage, time constant of less than 50 microseconds, battery source)		

Type 0ACJ

2 / 4

Electrical Specifications

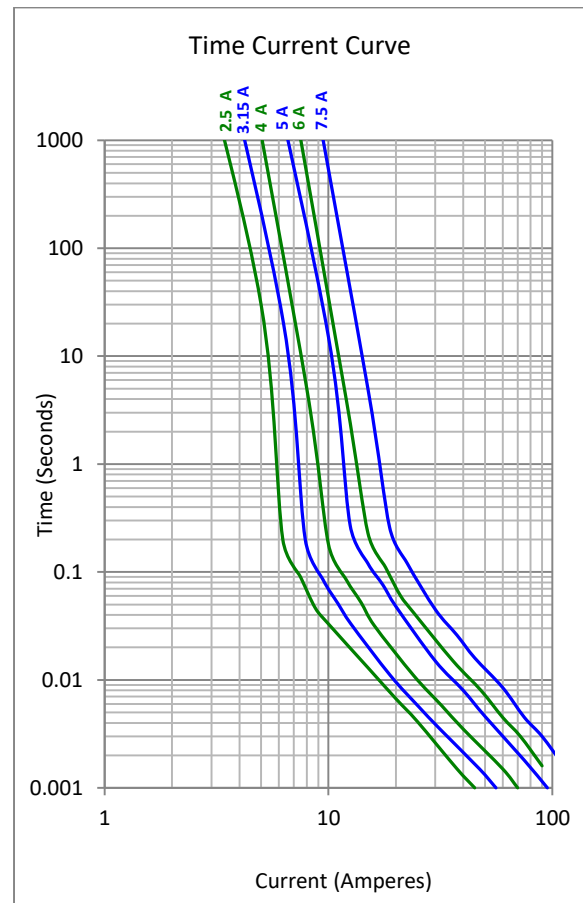
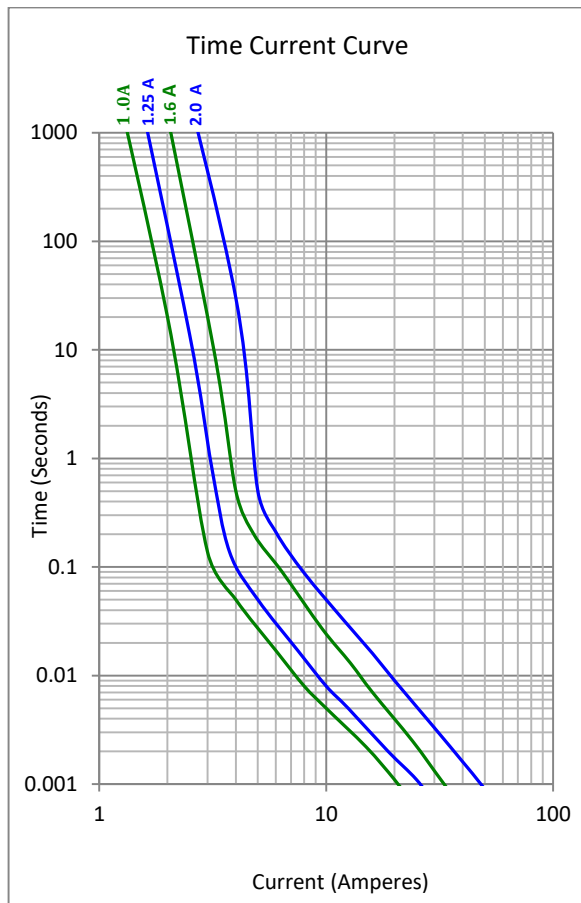
Part Number	Ampere Rating	Alpha Mark	Voltage and Interrupting Ratings	Typical Cold. Resistance (mohms)**	Typical Voltage Drop (mV)	Typical Pre-Arcing I ² t (A ² Sec)***
0ACJ-1000-XX	1A	1	See Table of Ratings on Page 1 for Voltage and associated Interrupting Ratings	252	335	0.50
0ACJ-1250-XX	1.25A	1.25		192	325	0.95
0ACJ-1600-XX	1.6A	1.6		116	230	2.3
0ACJ-2000-XX	2A	2		93	255	4.1
0ACJ-2500-XX	2.5A	2.5		51	174	2.6
0ACJ-3150-XX	3.15A	3.15		39	165	3.0
0ACJ-4000-XX	4A	4		31	175	5.5
0ACJ-5000-XX	5A	5		20	155	11.5
0ACJ-6000-XX	6A	6		16.3	155	15
0ACJ-7500-XX	7.5A	7.5		13.5	165	25

Consult manufacturer for other ratings

** DC Cold Resistance are measured at <10% of rated current in ambient temperature of 25°C

*** Typical Pre-arcing I²t are measured at 10In Current, DC battery bank.

Time Current Curve



Type 0ACJ

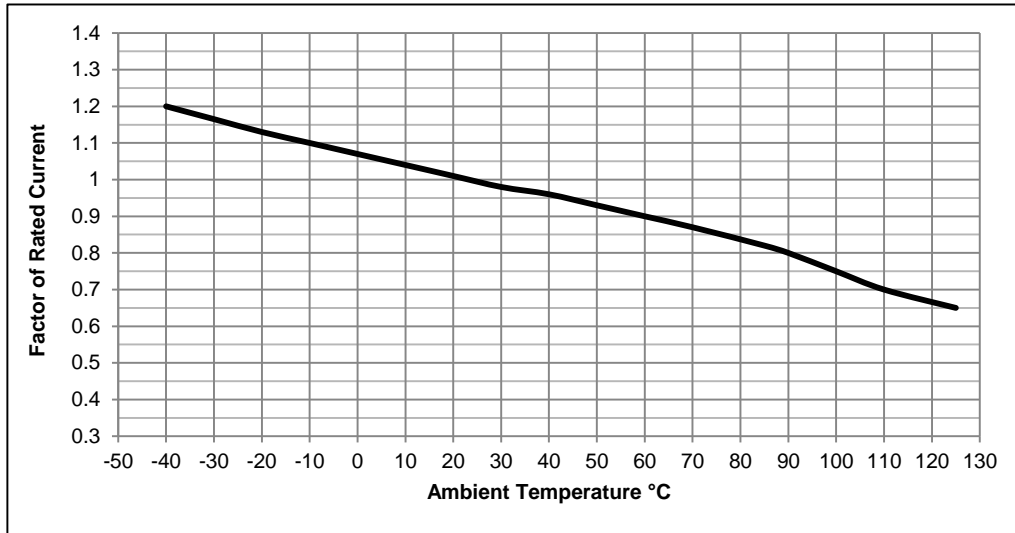
3 / 4

Temperature derating curve

Normal Operating Temperature: $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$

Operating Temperature: -40°C to 125°C with proper correction factor applied.

Chart of correction factor



Soldering Characteristics

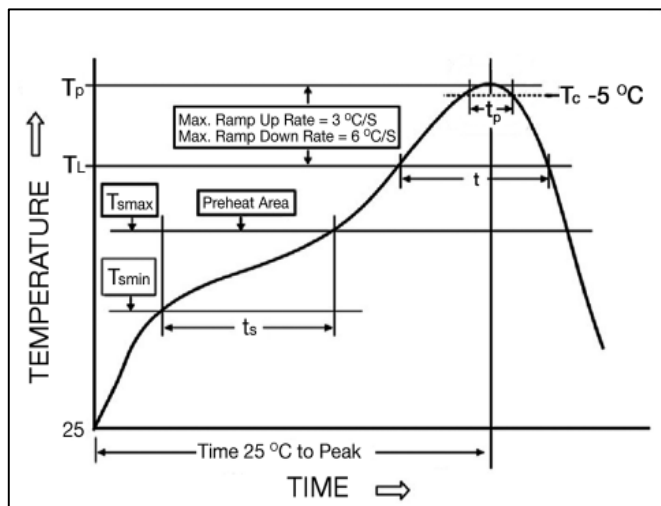
Reflow Soldering

- Temperature: 260°C
- Time: 30 Seconds Maximum

Manual Soldering (not recommended)

- Temperature: 350°C
- Time: 5 Seconds Maximum

Profile Feature	
Preheat & Soak	
Temperature min (T_{smin})	Lead(Pb) free solder 150°C
Temperature max (T_{smax})	200°C
Time (T_{smin} to T_{smax}) (t_s)	60-120 seconds
Average ramp-up rate(T_{smax} to T_p)	$3^{\circ}\text{C} / \text{second max.}$
Liquidous temperature(T_L)	217°C
Time at liquidous (t_L)	60 – 150 seconds
Peak package body temperature (T_p)	260°C
Time (t_p) within 5°C of the specified classification temperature (T_c)	30 seconds
Average ramp-down rate(T_p to T_{smax})	$6^{\circ}\text{C} / \text{second max.}$
Time 25°C to peak temperature	8 minutes max.



Type 0ACJ

4 / 4

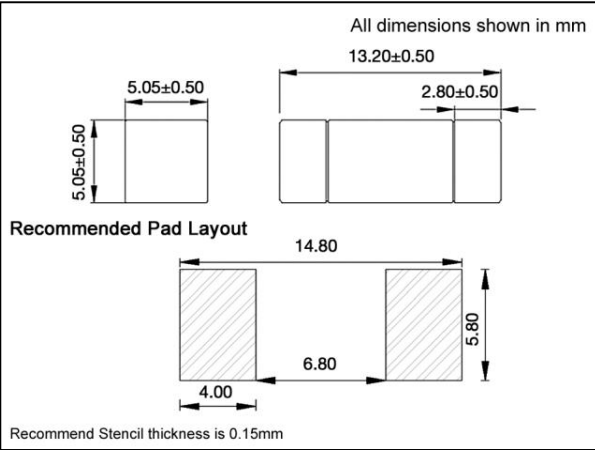
Fuse FGNO Explanation

0ACJ - [XXXX] -XX

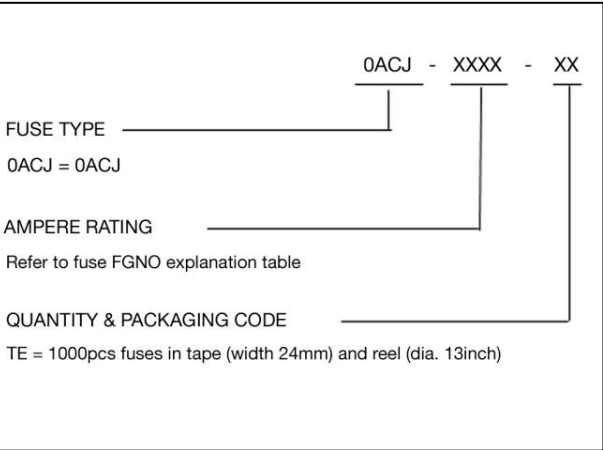
0ACJ=0ACJ; [XXXX]=Ampere Rating; XX=See Ordering Information as below

Fraction	Decimal	Amps	Bel FGNO[XXXX]
	1.0	1	1000
1-1/4	1.25	1.25	1250
	1.6	1.6	1600
	2.0	2	2000
2-1/2	2.5	2.5	2500
	3.15	3.15	3150
	4.0	4	4000
	5.0	5	5000
	6.0	6	6000
	7.5	7.5	7500

Mechanical Dimensions



Ordering Information



Packaging

Packaging Option	Quantity	Packaging Code
Tape (width 24mm) and reel (dia. 13inch)	1000	TE

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Bel:

[0ACJ-1000-TE](#) [0ACJ-1250-TE](#) [0ACJ-1600-TE](#) [0ACJ-2000-TE](#) [0ACJ-2500-TE](#) [0ACJ-3150-TE](#) [0ACJ-4000-TE](#)
[0ACJ-5000-TE](#) [0ACJ-6000-TE](#) [0ACJ-7500-TE](#)

4 Channel Digital Isolator with Integrated 0.65W Isolated DC/DC Power Module

DESCRIPTION

The CDIP 18024x15401x is a 4 channel digital isolator that includes an integrated isolated DC/DC converter.

A single supply voltage is necessary to power both the primary side channels and the integrated isolated power supply. The integrated power supply generates the required isolated secondary supply voltage.

The integrated power module has integrated protection systems that guard against thermal overstress with thermal shutdown and protect against electrical damage using overcurrent, short-circuit and undervoltage circuitry.

The CDIP digital isolator ensures fast time to market and low development costs.

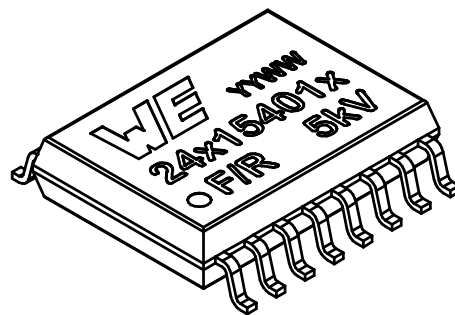
The digital isolator is available in an SOIC-16WB package (10.3 x 10.3 x 2.65)mm.

TYPICAL APPLICATIONS

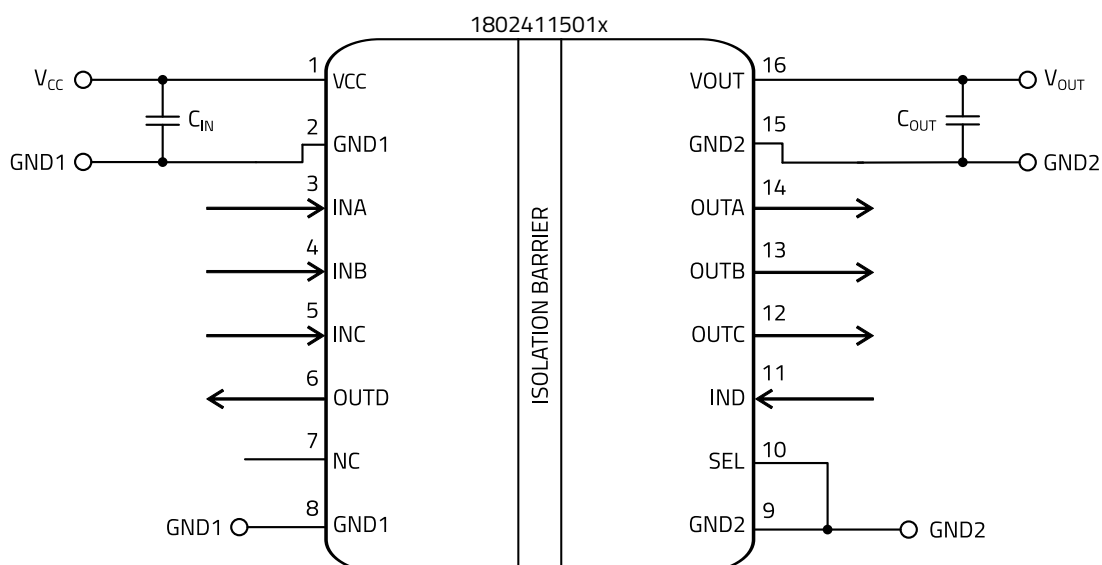
- Isolated communication interfaces (SPI, CAN, RS-232, RS-485)
- Motor control
- Battery management systems
- Solar inverters
- Test and measurement systems
- Programmable logic controller (PLC) interfaces

FEATURES

- Reinforced isolation: 5kV_{RMS} for 60s
- Input voltage range: 3.15V to 5.5V
- User-selectable output voltage: 5V or 3.3V
- Data rate up to 100Mbps
- $\pm 150\text{kV}/\mu\text{s}$ typ. CMTI
- Available channel configurations: 4/0, 3/1 and 2/2
- Default channel output status: high or low
- Low propagation delay: 10ns typ.
- Ambient temperature range: -40°C to 125°C
- RoHS and REACH compliant
- Complies with EN55032 (CISPR-32) class B conducted and radiated emissions standard
- UL1577 recognized
- DIN EN IEC 60747-17 (VDE 0884-17):2021-10 certified



TYPICAL CIRCUIT DIAGRAM



The above diagram indicates only one of the possible channel configurations available.

4 ABSOLUTE MAXIMUM RATINGS

Caution:

Exceeding the listed absolute maximum ratings may affect the device negatively and may cause permanent damage.

Table 4: Absolute maximum ratings.

SYMBOL	PARAMETER	LIMIT		UNIT
		MIN ⁽¹⁾	MAX ⁽¹⁾	
V _{CC}	Supply pin voltage	-0.5	6	V
V _{OUT}	Isolated supply output voltage pin	-0.5	6	V
INX, OUTX	Voltage at INX, OUTX, SEL pins	-0.5	V _{CC} + 0.5 ⁽²⁾	V
I _{OUTX}	Channel output current	-20	20	mA
T _{storage}	Assembled, non-operating storage temperature	-65	150	°C
V _{ESD}	ESD voltage (HBM) ⁽⁴⁾	-6	6	kV
V _{ESD}	ESD voltage (CDM) ⁽⁴⁾	-2	2	kV

5 OPERATING CONDITIONS

Operating conditions are conditions under which the device is intended to be functional. All values are either referenced to GND1 or GND2.

MIN and MAX limits are valid for the recommended ambient temperature range of -40°C to 125°C.

Table 5: Operating conditions.

SYMBOL	PARAMETER	MIN ⁽¹⁾	TYP ⁽³⁾	MAX ⁽¹⁾	UNIT
V _{CC}	Supply voltage ⁽⁹⁾	3.15	—	5.5	V
V _{INX_H}	Logic input high threshold	2.0	—	—	V
V _{INX_L}	Logic input low threshold	—	—	0.8	V
I _{OH}	High-level channel output current V _{OUT} = 5V	-4	—	—	mA
	High-level channel output current V _{OUT} = 3.3V	-2	—	—	mA
I _{OL}	Low-level channel output current V _{OUT} = 5V	—	—	4	mA
	Low-level channel output current V _{OUT} = 3.3V	—	—	2	mA
DR	Data rate	0	—	100	Mbps
PW	Signal pulse width	5	—	—	ns
T _a	Ambient temperature range	-40	—	125	°C

6 THERMAL SPECIFICATIONS

Caution:

Exceeding the listed absolute maximum ratings may affect the device negatively and may cause permanent damage.

Table 6: Thermal specifications.

SYMBOL	PARAMETER	TEST CONDITIONS	MIN ⁽¹⁾	TYP ⁽³⁾	MAX ⁽¹⁾	UNIT
Θ _{JA}	Junction-to-ambient thermal resistance ⁽⁵⁾		—	68.5	—	°C/W
P _D	Maximum power dissipation	V _{CC} =5.5V, V _{OUT} =5V, I _{OUT} =0.13A, 50% duty cycle square signal on all channels with C _L =15pF	—	—	1	W

8 ISOLATION SPECIFICATIONS

Table 11: Isolation specification table.

SYMBOL	PARAMETER	TEST CONDITIONS	VALUE	UNIT
CLR	External clearance	Shortest distance through air between terminals	8	mm
CPG	External creepage	Shortest distance across package surface between terminals	8	mm
C _{IO}	Barrier capacitance, input to output	V _{IO} = 0.4 x sin (2πft), f = 1MHz	3.5	pF
R _{IO}	Isolation resistance	V _{IO} = 500V, T _A = 25 °C	>10 ¹²	Ω
		V _{IO} = 500V, 100 °C ≤ T _A ≤ 125 °C	>10 ¹¹	Ω
		V _{IO} = 500V at T _A = 150 °C	>10 ⁹	Ω
DTI	Distance through the insulation	Minimum internal clearance	19	μm
CTI	Comparative tracking index	DIN EN 60112 (VDE 0303-11); IEC 60112	>600	V
	IEC 60664-1 material group		I	
	IEC 60664-1 overvoltage category	Rated mains voltage ≤300 V _{RMS}	I-IV	
		Rated mains voltage ≤600 V _{RMS}	I-IV	
		Rated mains voltage ≤1000 V _{RMS}	I-III	
DIN EN IEC 60747-17 (VDE 0884-17):2021-10				
V _{IORM}	Max. repetitive peak isolation voltage	AC voltage (bipolar)	1414	V _{PK}
V _{IOWM}	Max. working isolation voltage	AC voltage; Time-dependent dielectric breakdown (TDDB) test	1000	V _{RMS}
		DC voltage	1414	V _{DC}
V _{IOTM}	Max. transient isolation voltage	V _{TEST} = V _{IOTM} , t = 60s (qualification); V _{TEST} = 1.2 x V _{IOTM} , t = 1s (100% production)	7070	V _{PK}
V _{IOSM}	Max. surge isolation voltage	Test method per IEC 60065, 1.2/50 μs waveform, V _{TEST} = 1.6 x V _{IOSM} (qualification)	7070	V _{PK}
q _{pd}	Apparent charge	Method a, after input/output safety test subgroup 2/3, V _{ini} = V _{IOTM} , t _{ini} = 60s; V _{pd(m)} = 1.2 x V _{IORM} , t _m = 10s	≤5	pC
		Method a, after environmental tests subgroup 1, V _{ini} = V _{IOTM} , t _{ini} = 60s; V _{pd(m)} = 1.6 x V _{IORM} , t _m = 10s	≤5	pC
		Method b1, at routine test (100% production) and preconditioning (type test), V _{ini} = 1.2 x V _{IOTM} , t _{ini} = 1s; V _{pd(m)} = 1.875 x V _{IORM} , t _m = 1s	≤5	pC
	Pollution degree		2	
UL1577				
V _{ISO(max)}	Max. withstanding isolation voltage	V _{TEST} = V _{ISO} , t = 60s (qualification), V _{TEST} = 1.2 x V _{ISO} , t = 1s (100% production)	5000	V _{RMS}


9 APPROVALS

Table 12: Approvals.

STANDARD	DESCRIPTION
UL 1577	UL File No: E535458
DIN EN IEC 60747-17 (VDE 0884-17):2021-10	VDE certification number: 40058069

10 RoHS, REACH

Table 13: RoHS, REACH.

RoHS directive		Directive 2011/65/EU of the European Parliament and the Council of June 8th, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.
REACH directive		Directive 1907/2006/EU of the European Parliament and the Council of June 1st, 2007 regarding the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH).

11 PACKAGE SPECIFICATIONS

Table 14: Package specifications.

ITEM	PARAMETER	TYP ⁽³⁾	UNIT
Lead finish	Matte Sn	—	—
Weight	—	0.42	g

12 NOTES

- (1) Min and Max limits are 100% production tested at 25°C. Limits over the operating temperature range are guaranteed through correlation using Statistical Quality Control (SQC) methods.
- (2) This value must never exceed 6V.
- (3) Typical numbers are valid at 25°C ambient temperature and represent statistically the utmost probability assuming the Gaussian distribution.
- (4) The human body model is a 100pF capacitor discharged through a 1.5 kΩ resistor into each pin. Test method is per JESD-22-114. The charged device model test method is per JESD22-C101.
- (5) Measured without heatsink, still air. (0 - 20LFM / 0 - 0.1m/s) Test PCB 80mm x 80mm horizontal orientation 35μm copper on top and bottom.
- (6) 100% final production tested value. The qualified isolation voltage value is 5kV_{RMS}. For detailed isolation characteristics see the isolation specification table ([Isolation specification table](#)).
- (7) Depending on ambient temperature, see thermal derating diagram ([Thermal Derating](#)).
- (8) Supply current measurements are made with no external load connected to the integrated isolated power supply. The indicated values only describe the current required to supply the internal circuitry and external capacitive loads on the channel outputs based on the signal described in the test conditions.
- (9) The supply voltage must always be equal to or greater than the selected output voltage. The device is incapable of boost operation (e.g. V_{CC} = 3.3V and V_{OUT} = 5V) and should never be used in such a configuration.



MICRO MATE-N-LOK CONNECTOR SYSTEM

Quick Reference Guide

The Micro MATE-N-LOK 3 mm connector system offers wire-to-wire and wire-to-board connections with contacts on a 3 mm (0.118) centerline and current ratings up to 5 Amps max. per line. Both single-row and dual-row configurations are available. Crimp, snap-in pin and receptacle contacts are used to terminate 30-18 (0.05-0.9 mm²) AWG wire with insulation diameters up to 1.52 mm. Plug and receptacle housings allow wire-to-wire and wire-to-panel configurations and header assemblies offer wire-to-board connections in vertical and right angle configurations. These IR reflow process compatible headers are available in through-hole and surface mount configurations with multiple board mount options.

FEATURES AND BENEFITS

- Wire-to-wire and wire-to-board pin and receptacle connector system
- Contacts are on 3 mm centerline spacing and are available in strip form or loose piece
- Panel mount or free-hanging versions
- Dual beam receptacle contact design for improved reliability
- PCB mount pin header assemblies available in both vertical and right angle styles and surface mount or through hole versions
- Available in low profile design (<4.7 mm)
- Discrete wire interconnect available in 2-12 position single row and 2-24 position dual row
- Housings available to accommodate 18 AWG wire in select circuits up to 6 position
- UL, CSA and VDE approved
- Multiple flammability options, including UL 94 V-0, UL 94 V-2, and glow wire tested (GWT*)

PRODUCT APPLICATIONS

- Household appliances
- Lighting
- Factory automation
- Data storage
- Gaming
- Vending
- Garage door openers
- Security systems

ADDITIONAL INFORMATION

For more information about the TE Connectivity Micro MATE-N LOK connector offerings, please refer to these resources:

- [Micro MATE-N-LOK connector product landing page](#)
- [Product Specification 108-1836](#)
- [Application Specification 114-13000](#)

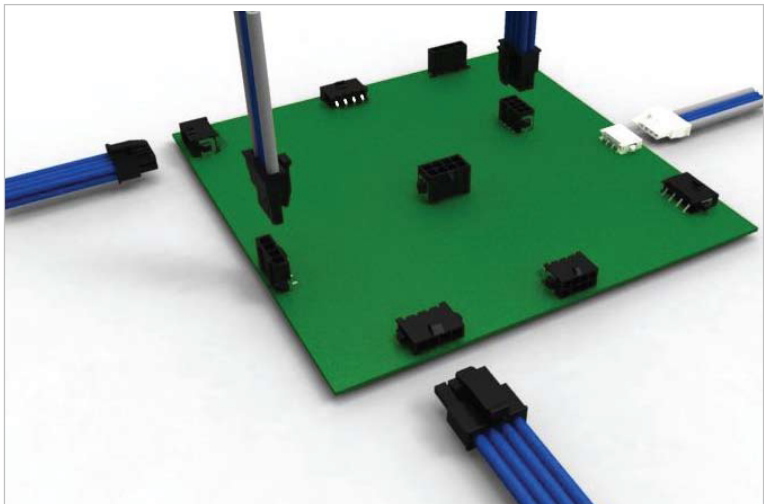
*For more information on glow wire testing please review the [white paper Glow Wire Testing for the Appliance Industry](#) or visit the [Glow Wire Capable Connectors product page](#).

CONTACTS

Wire Size Range AWG (mm²)	Insulation Diameter Range	Receptacle	Pin	Contact Base Part No. (PN)		Plating			Application Tooling*	Hand Tool
				Strip Form	Loose Piece	Tin	15µ Gold	30µ Gold		
26-30 0.12-0.05	.035-.060 0.89-1.52	x	-	794607	794611	PN-1	1-PN-1	1-PN-2	2151142-1	91502-1
20-24 0.50-0.20	.035-.060 0.89-1.52	x	-	794606	794610	PN-1	1-PN-1	1-PN-2	2151022-1	91501-1
22-18 0.3-0.9	.059-.110 1.50-2.79	x	-	2008625	-	PN-1	PN-2	PN-3	2266495-1	2217299-1 (18AWG)
26-30 0.12-0.05	.035-.060 0.89-1.52	-	x	794609	794613	1-PN-0	1-PN-1	1-PN-2	2836146-1	91502-1
20-24 0.50-0.20	.035-.060 0.89-1.52	-	x	94608	794612	1-PN-0	1-PN-1	1-PN-2	2151616-1	91501-1

* For application tooling, see 114-13000 for AMPOMATOR CLS machine, AMP-O-LECTRICC Model K terminator and AMP-O-LECTRIC Model G terminator.

Note: To select a contact and plating, first select the contact base part number and add appropriate plating prefi and suffix. For example, for a loose piece receptacle with 30µ gold plating, select base part number 794610 and add the plating prefix and suffix for 30µ gold to obtain part number 1-794610-2.



SINGLE ROW HEADERS

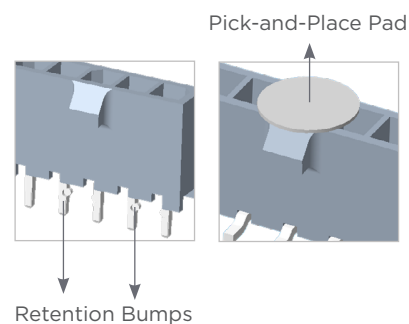
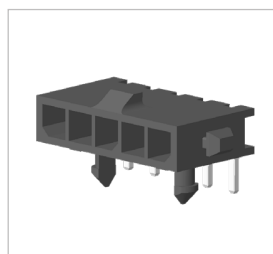
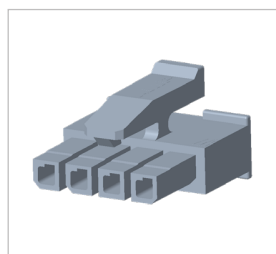
Part No. (PN)	Position	Single Row	Plating Style			Vertical	Right Angle	SMT	Thruhole	SMT Hold Down	Thru-hole Metal Hold Down	Plastic Hold Down	Pick-and-Place Pad	Retention feature on Solder Tail	Packing Type		Mating Half
			Tin	15µ gold	30µ gold										Tray	Tape and Reel	
x-1445050-x	2-12	x	x			x			x			x		x	x		x-1445022-x
x-1445051-x	2-12	x	x			x			x		x				x		x-1445022-x
x-1445052-x	2-12	x	x			x		x			x		x			x	x-1445022-x
x-1445053-x	2-12	x	x			x		x		x			x			x	x-1445022-x
x-1445054-x	2-12	x	x				x		x		x				x		x-1445022-x
x-1445055-x	2-12	x	x				x		x			x			x		x-1445022-x
x-1445056-x	2-12	x	x				x	x			x					x	x-1445022-x
x-1445057-x	2-12	x	x				x	x		x						x	x-1445022-x
x-1445084-x	2-12	x		x		x			x			x		x	x		x-1445022-x
x-1445085-x	2-12	x		x		x			x		x				x		x-1445022-x
x-1445086-x	2-12	x		x		x		x			x		x			x	x-1445022-x
x-1445087-x	2-12	x		x		x		x		x			x			x	x-1445022-x
x-1445088-x	2-12	x		x			x		x		x				x		x-1445022-x
x-1445089-x	2-12	x		x			x		x			x			x		x-1445022-x
x-1445090-x	2-12	x		x			x	x			x					x	x-1445022-x
x-1445091-x	2-12	x		x			x	x		x						x	x-1445022-x
x-1445093-x	2-12	x			x	x			x			x		x	x		x-1445022-x
x-1445094-x	2-12	x			x	x			x		x				x		x-1445022-x
x-1445095-x	2-12	x			x	x		x			x		x			x	x-1445022-x
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x-1445097-x	2-12	x			x		x		x		x				x		x-1445022-x
x-1445098-x	2-12	x			x		x		x			x			x		x-1445022-x
x-1445099-x	2-12	x			x		x	x			x					x	x-1445022-x
x-1445100-x	2-12	x			x		x	x		x						x	x-1445022-x

PART NUMBER EXPLANATION

2-PN-2	2 Position Header
2-PN-3	3 Position Header
2-PN-4	4 Position Header
2-PN-5	5 Position Header
2-PN-6	6 Position Header
2-PN-7	7 Position Header
2-PN-8	8 Position Header
2-PN-9	9 Position Header
3-PN-0	10 Position Header
3-PN-1	11 Position Header
3-PN-2	12 Position Header

Note: To select the complete part number,

- Use 2- prefix for single row headers up to 9 positions
- Use 3- prefix for single row headers from 10 to 12 positions
- The -X suffix indicates number of positions
(Example: 2-1445050-5 would be a 5 position header.
3-1445050-1 would be an 11 position header)



DOUBLE ROW HEADERS

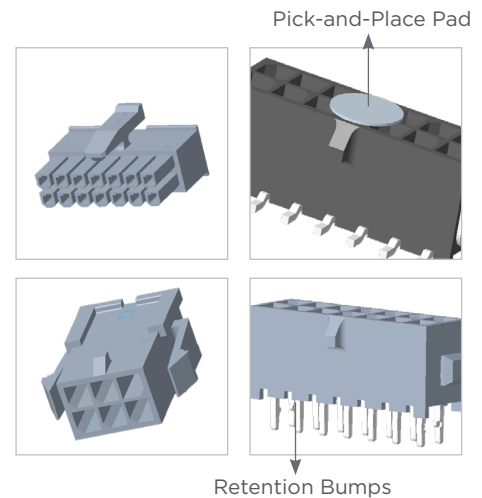
Part No. (PN)	Position	Double Row	Plating Style			Vertical	Right Angle	SMT	Thruhole	SMT Hold Down	Metal Hold Down	Plastic Hold Down	Pick-and-Place Pad	Retention feature on Solder Tail	Packing Type		Mating Half
			Tin	15µ gold	30µ gold										Tray	Tape and Reel	
x-794618-x	2-24	x	x				x		x			x			x		x-794617-x
x-794619-x	2-24	x		x			x		x			x			x		x-794617-x
x-794620-x	2-24	x			x		x		x			x			x		x-794617-x
x-794621-x	2-24	x	x				x	x				x				x	x-794617-x
x-794622-x	2-24	x		x			x	x				x				x	x-794617-x
x-794623-x	2-24	x			x		x	x				x				x	x-794617-x
x-794624-x	2-24	x	x				x	x			x					x	x-794617-x
x-794625-x	2-24	x		x			x	x			x					x	x-794617-x
x-794626-x	2-24	x			x		x	x			x					x	x-794617-x
x-794627-x	2-24	x	x				x	x		x						x	x-794617-x
x-794628-x	2-24	x		x			x	x		x						x	x-794617-x
x-794629-x	2-24	x			x		x	x		x						x	x-794617-x
x-794630-x	2-24	x	x			x			x					x	x		x-794617-x
x-794631-x	2-24	x		x		x			x					x	x		x-794617-x
x-794632-x	2-24	x			x	x			x					x	x		x-794617-x
x-794633-x	2-24	x	x			x		x			x		x			x	x-794617-x
x-794634-x	2-24	x		x		x		x			x		x			x	x-794617-x
x-794635-x	2-24	x			x	x		x			x		x			x	x-794617-x
x-794636-x	2-24	x	x			x		x		x			x			x	x-794617-x
x-794637-x	2-24	x		x		x		x		x			x			x	x-794617-x
x-794638-x	2-24	x			x	x		x		x			x			x	x-794617-x
x-794677-x	2-24	x	x				x		x		x				x		x-794617-x
x-794678-x	2-24	x		x			x		x		x				x		x-794617-x
x-794679-x	2-24	x			x		x		x		x				x		x-794617-x
x-794680-x	2-24	x	x			x			x		x			x	x		x-794617-x
x-794681-x	2-24	x		x		x			x		x			x	x		x-794617-x
x-794682-x	2-24	x			x	x			x		x			x	x		x-794617-x

PART NUMBER EXPLANATION

3-PN-2	2 Position Header
3-PN-4	4 Position Header
3-PN-6	6 Position Header
3-PN-8	8 Position Header
4-PN-0	10 Position Header
4-PN-2	12 Position Header
4-PN-4	14 Position Header
4-PN-6	16 Position Header
4-PN-8	18 Position Header
5-PN-0	20 Position Header
5-PN-2	22 Position Header
5-PN-4	24 Position Header

Note: To select the complete part number,

- Use 3- prefix for dual row headers up to 8 positions
- Use 4- prefix for dual row headers from 10 to 18 positions
- Use 5- prefix for dual row headers from 20 to 24 positions
- The -X suffix indicates number of positions (Example: 3-794630-4 would be a 4 position header. 4-794630-4 would be a 14 position header. 5-794630-4 would be a 24 position header.)



HOUSINGS

No. of Circuits*	Part No.	Plug	Receptacle	Single Row	Double Row	Free Hanging	Panel Mount	Mating Half	Terminals	Color	Remarks
2-12	x-1445049-x	x		x		x		x-1445022-x	x-794608-x	Black	
2-12	x-1445048-x	x		x			x		x-794609-x x-794612-x x-794613-x		
2-12	x-1445022-x		x	x					x-794606-x x-794607-x x-794610-x x-794611-x		
2-4	2029047-x		x	x					x-794606-x x-794607-x x-794610-x x-794611-x	Black	Low profile housing
2-4	2029102-x		x	x				low profile headers		Natural	
2-6	2008570-X		x		x			single row headers	2008625-x** x-794606-x x-794607-x x-794610-x x-794611-x	Black	Low profile housing, Accepts 18AWG wire
2-6	2008571-X		x		x			low profile headers			

Note:

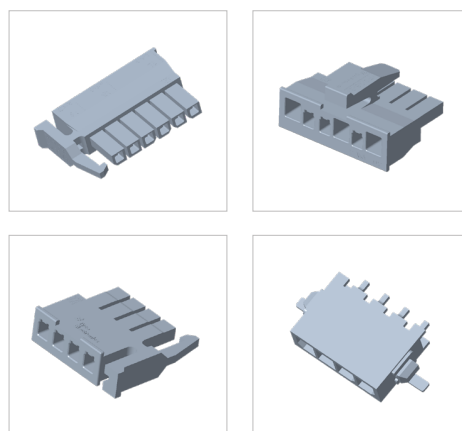
- (*) Use the prefix and suffix to indicate position size.
(Example: 794617-2 would be a 2 position housing and 2-794617-4 would be a 24 position housing)
- (**) Terminal can be used in the other receptacle housings, but not with 18AWG cables. This size needs to be used only in the specific positions designed for that.
- Receptacle terminals mate in the receptacle housings and pin terminals mate in the Plug housings

SELECT 18 AWG RECEPTACLE HOUSINGS

No. of Position	Part No.	18 AWG Circuits	Black	Top Latch	Side Latch
2	2008570-2	1, 2	x		x
3	2008570-3	1, 3	x		x
4	2008570-4	1, 4	x		x
5	2008570-5	1, 3, 5	x		x
6	2008570-6	1, 3, 6	x		x
2	2008571-2	1, 2	x	x	
3	2008571-3	1, 3	x	x	
4	2008571-4	1, 4	x	x	
5	2008571-5	1, 3, 5	x	x	
6	2008571-6	1, 3, 6	x	x	

Notes:

- For natural color add 1- prefix to base part number
- Remaining circuits accommodate 20 AWG wire or smaller using standard contacts



LOW PROFILE RECEPTACLE HOUSINGS AND HEADERS

Part Number	Position	Single Row	Plating			Vertical	Right Angle	SMT	Thru-hole	SMT Hold Down	Metal Hold Down	Plastic Hold Down	Pick-and-Place Pad	Retention feature on Solder Tail	Packaging Type		Mating Half	Color
			Tin	15µ Gold	30µ Gold										Tray	Tape & Reel		
2029030-x	2-4	x	x				x	x		x						x	2029047-x	Black
2029104-x	2-4	x	x				x	x		x						x	2029102-x	Natural
2029266-x	2-4	x			x		x	x		x						x	2029047-x	Black

VDE APPROVED CONNECTORS

No. of Circuits	Part Number	Plug	Receptacle	Single Row	Double Row	Free Hanging	Panel Mount	Mating Half	Terminals
2 to 4	2315758-x	x			x		x	2315744-x	x-794608-x, x-794609-x, x-794612-x, x-794613-x
2 to 4	2315759-x	x			x	x		2315744-x	x-794608-x, x-794609-x, x-794612-x, x-794613-x
6 to 10	3-794615-x	x			x		x	3-794617-x	x-794608-x, x-794609-x, x-794612-x, x-794613-x
6 to 10	3-794616-x	x			x	x		3-794617-x	x-794608-x, x-794609-x, x-794612-x, x-794613-x
2, 3 and 4	2315785-x	x		x		x		2315752-x	x-794608-x, x-794609-x, x-794612-x, x-794613-x
2, 3 and 4	2315786-x	x		x			x	2315752-x	x-794608-x, x-794609-x, x-794612-x, x-794613-x
2 to 4	2315744-x		x		x			2315758-x, 2315759-x	x-794606-x, x-794607-x, x-794610-x, x-794611-x, 2008625-x
6 to 10	3-794617-x		x		x			3-794615-x, 3-794616-x	x-794606-x, x-794607-x, x-794610-x, x-794611-x, 2008625-x
2, 3 and 4	2315752-x		x	x				2315785-x, 2315786-x	x-794606-x, x-794607-x, x-794610-x, x-794611-x, 2008625-x

Note:

- Use the suffix -6 (6 position housing), -8 (8 position housing) or -0 (10 position housing)
- These connectors have keying by position size - different from the standard receptacle and plug connectors

Additional headers with alternative packaging, colors, and materials are available upon request.

QUESTIONS THAT WILL HELP YOU BETTER SELECT THE PRODUCT THAT YOU NEED:

What are the current and voltage requirements for your application?

The Micro MATE-N-LOK 3 mm connector system has a maximum current rating of 5 Amps per line and is rated for 250 Volts AC/DC.

What are the wire type and size requirements?

The Micro MATE-N-LOK 3 mm connector system contacts are approved for use with 22-18 (0.3-0.9), 24-20 (0.2-0.6) and 30-26 (0.05-0.15) AWG wire with a maximum insulation diameter of 0.110 (2.79).

What are the number of positions?

The Micro MATE-N-LOK 3 mm connector system is available in 2-12 position single row and 2-24 position dual row configurations on a 3.0 mm pitch.

What are the operating temperature requirements?

The Micro-MATE-N-LOK 3 mm connector system has a maximum operating temperature of 105°C. For more information regarding operating temperatures refer to Product Specification 108-1836.

What packaging types are offered for headers and housings?

The Micro MATE-N-LOK 3 mm connector system offers tape and reel packaging for surface mount headers, tray packaging for thru-board headers and bulk packaging for all receptacle and plug housings.

What is the benefit of choosing low-profile receptacle housings?

The Micro MATE-N-LOK 3 mm connector system offers a low profile receptacle housing for applications that need to meet minimal height requirements. This low profile design offers a mated height of only 4.7 mm and is available in 2, 3 and 4 positions, in black or natural color.

What is the benefit of using an 18 AWG select circuit receptacle housing?

The Micro MATE-N-LOK 3 mm connector system offers a special 18 AWG wire-to-board select circuit housing for low voltage lighting applications. Designed to accommodate 18 AWG UL1007 wire in select circuits of the 2, 3, 4, 5 and 6 position housings, this product is ideal to minimize millivolt drops on long wire runs sometimes required by low voltage conventional and solid state lighting.

What flame resistant material options are available?

The Micro MATE-N-LOK 3 mm connector system is available with multiple flammability options, including UL 94 V-0, UL 94 V-2, and glow wire tested (GWT).

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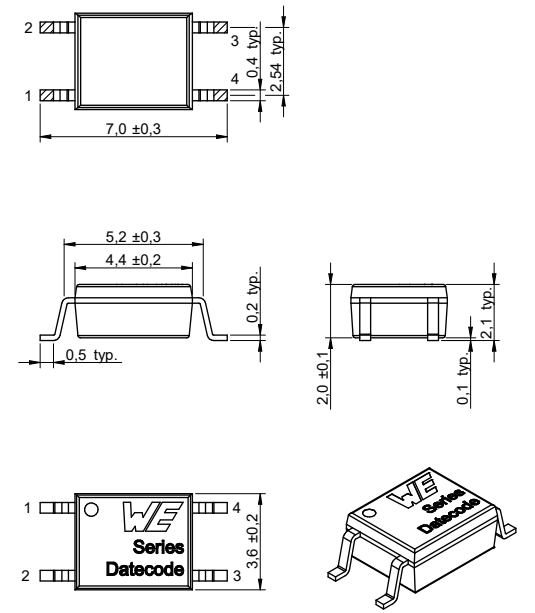
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12/22 Original

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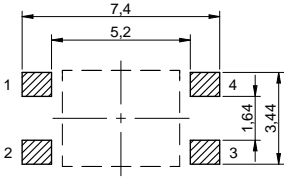
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Product Marking:

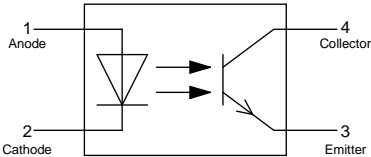
Pin 1 Anode	0
Marking	356B (Series 356, Binning B)
Marking - Date Code	YWW

Recommended Land Pattern: [mm]



Scale - 5:1

Schematic:



Scale - 5:1

General Properties:









Type	Optocoupler Phototransistor
Input	DC
Package	SOP 4
Plastic Housing Color	White

Certification:

RoHS Approval	Compliant [2011/65/EU&2015/863]
REACH Approval	Conform or declared [(EC)1907/2006]
Halogen Free	Conform [JEDEC JS709B]
Halogen Free	Conform [IEC 61249-2-21]
VDE Approval	40051484 [DIN EN 60747-5-5 (VDE0884-5); EN 60747-5-5:2011; A1:2015]
cULus Approval	E513104 [UL 1577]
CQC Approval	CQC20001274583 [GB4943.1-2001; GB8898-2011]

General Information:

Operating Temperature	-55 up to +110 °C
Storage Conditions (for single parts)	-55 up to +125 °C
Storage Conditions (in original packaging)	< 40 °C; < 75 % RH
Moisture Sensitivity Level (MSL)	1

     	CHECKED SalVo	REVISION 001.004	DATE (YYYY-MM-DD) 2023-08-22	GENERAL TOLERANCE DIN ISO 2768-1m	PROJECTION METHOD 
 WÜRTH ELEKTRONIK MORE THAN YOU EXPECT	DESCRIPTION WL-OCPT Optocoupler Phototransistor			ORDER CODE 140356145200	
	SIZE/TYPE SOP4			BUSINESS UNIT ePal	STATUS Valid

This electronic component has been designed and developed for usage in general electronic equipment only. This product is not authorized for use in equipment where a higher safety standard and reliability standard is especially required or where a failure of the product is reasonably expected to cause severe personal injury or death, unless the parties have executed an agreement specifically governing such use. Moreover Würth Elektronik eSas GmbH & Co KG products are neither designed nor intended for use in areas such as military, aerospace, aviation, nuclear control, submarine, transportation, transportation signal, disaster prevention, medical, public information network etc.. Würth Elektronik eSas GmbH & Co KG must be informed about the intent of such usage before the design-in stage. In addition, sufficient reliability evaluation checks for safety must be performed on every electronic component which is used in electrical circuits that require high safety and reliability functions or performance.

Absolute Maximum Ratings Input Properties (Ambient Temperature 25 °C unless otherwise specified):

Properties		Test conditions	Value	Unit
Forward Current	$I_{F\ max.}$		60	mA
Peak Forward Current	$I_{F\ Peak}$	duty/ 100 @ 100 Hz	1	A
Input Power Dissipation	P_I		100	mW
Reverse Voltage	V_{REV}		6	V

Absolute Maximum Ratings Output Properties: (Ambient Temperature 25 °C unless otherwise specified):

Properties		Value	Unit
Collector Emitter Voltage	V_{CE}	80	V
Emitter Collector Voltage	V_{EC}	7	V
Collector Current	I_{CEP}	50	mA
Output Power Dissipation	P_O	150	mW

Absolute Maximum Ratings Common Properties:

Properties		Test conditions	Value	Unit
Power Dissipation ¹⁾	P_{Diss}		200	mW
Isolation Voltage	V_{ISO}	AC for 1 Minute, RH 40~60 %	3750	V (RMS)

¹⁾ Total power dissipation of the whole component

Electrical & Optical Input Properties:









Properties		Test conditions	Value		Unit
			typ.	max.	
Forward Voltage	V_F	$I_C = 10\ mA$	1.24	1.4	V
Reverse Current	I_{REV}	$V_{REV} = 6\ V$		10	µA
Input Capacitance	C_{in}	$V = 0\ V$ $f = 1\ kHz$	10		pF

Electrical & Optical Output Properties:

Properties		Test conditions	Value		Unit
			min.	max.	
Collector-Emitter Dark Current	$I_{CEO\ Dark}$	$V_{CE} = 20\ V$ $I_F = 0$		100	nA
Collector-Emitter Breakdown Voltage	$V_{(BR)CE}$	$I_C = 100\ \mu A$ $I_F = 0$	80		V
Emitter-Collector Breakdown Voltage	$V_{(BR)EC}$	$I_E = 100\ \mu A$ $I_F = 0$	7		V

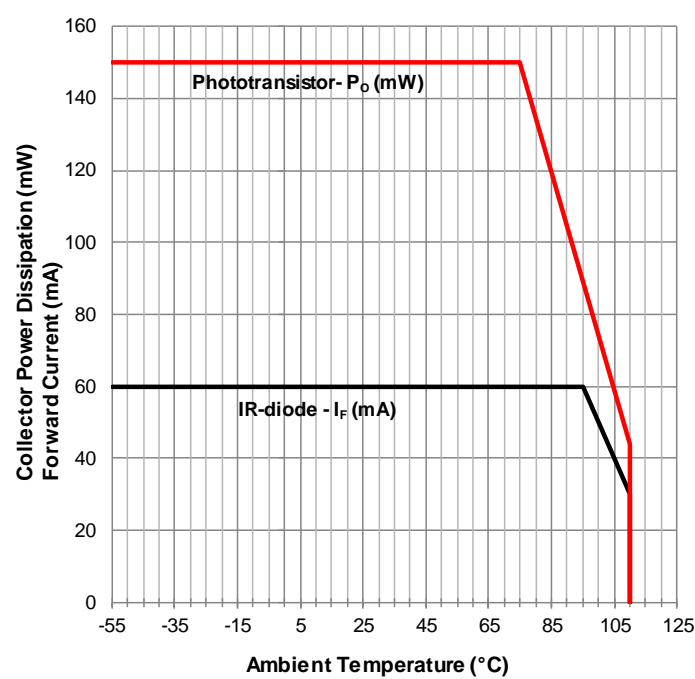
Electrical & Optical Transfer Properties:

Properties		Test conditions	Value			Unit
			min.	typ.	max.	
Current Transfer Ratio	CTR	$I_C = 5\ mA$ $V_{CE} = 5\ V$	130		260	%
Collector-Emitter Saturation Voltage	V_{CEsat}	$I_C = 20\ mA$ $I_E = 1\ mA$		0.06	0.2	V
Rise Time	t_r	$V_{CE} = 2\ V$ $I_C = 2\ mA$ $R_L = 100\ \Omega$		3	18	µs
Fall Time	t_f	$V_{CE} = 2\ V$ $I_C = 2\ mA$ $R_L = 100\ \Omega$		4	18	µs
Cut-Off Frequency	f_c	$V_{CE} = 2\ V$ $I_C = 2\ mA$ $R_L = 100\ \Omega$ -3 dB		80		kHz
Floating Capacitance	C_{fO}	$V = 0\ V$ $f = 1\ MHz$		0.4		pF
Isolation Resistance	R_{ISO}	DC = 500 V 40~60 % R.H.	1	100		TΩ

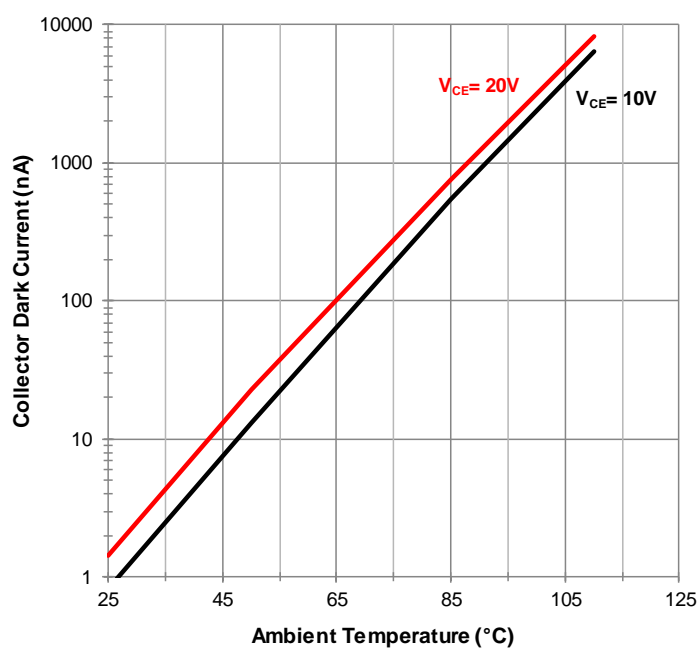
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<div><div></div><div><div>WÜRTH ELEKTRONIK MORE THAN YOU EXPECT</div><div>Würth Elektronik eiSos GmbH & Co. KG EMC & Inductive Solutions Max-Eyth-Str. 1 74638 Waldenburg Germany Tel. +49 (0) 79 42 945 - 0 www.w-e-online.com eiSos@we-online.com</div></div></div>		DESCRIPTION WL-OCPT Optocoupler Phototransistor		ORDER CODE 140356145200		
		SIZES/TYPE SOP4	BUSINESS UNIT ePal	STATUS Valid	PAGE 2/12	









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Total Power Dissipation vs. Ambient Temperature:



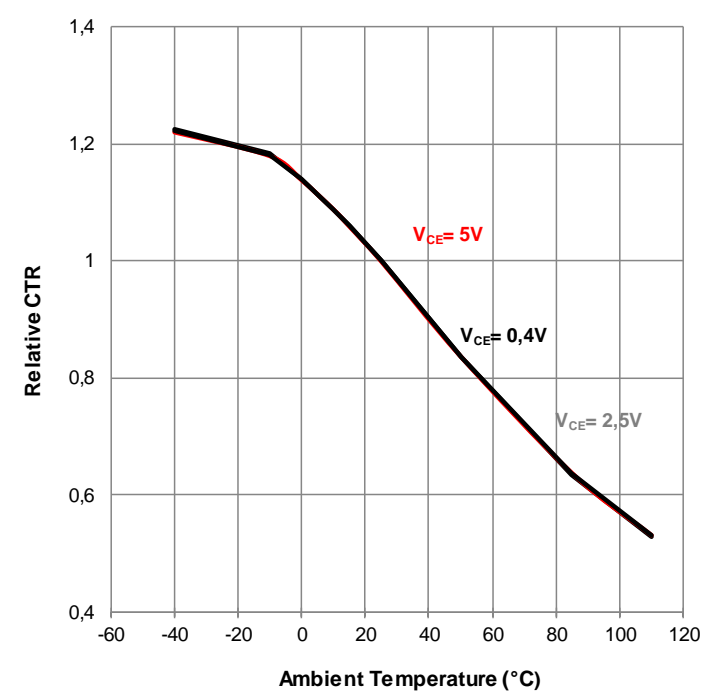
Collector Dark Current vs. Ambient Temperature:



     		CHECKED SalVo	REVISION 001.004	DATE (YYYY-MM-DD) 2023-08-22	GENERAL TOLERANCE DIN ISO 2768-1m	PROJECTION METHOD 
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		SIZES/TYPES SOP4	BUSINESS UNIT ePal	STATUS Valid	PAGE 3/12	

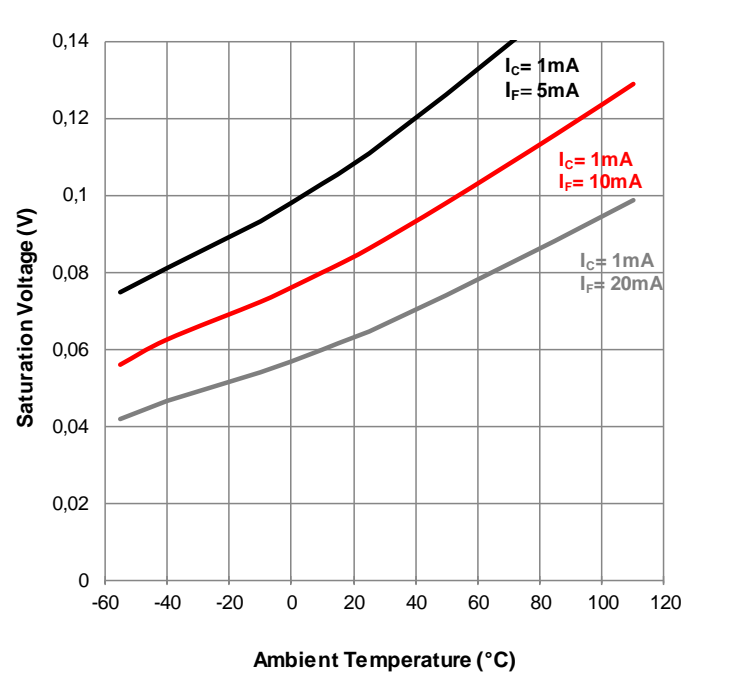
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Relative CTR vs. Ambient Temperature:



Testcondition: $I_F = 5mA$; Normalized to $T_A = 25^{\circ}C$

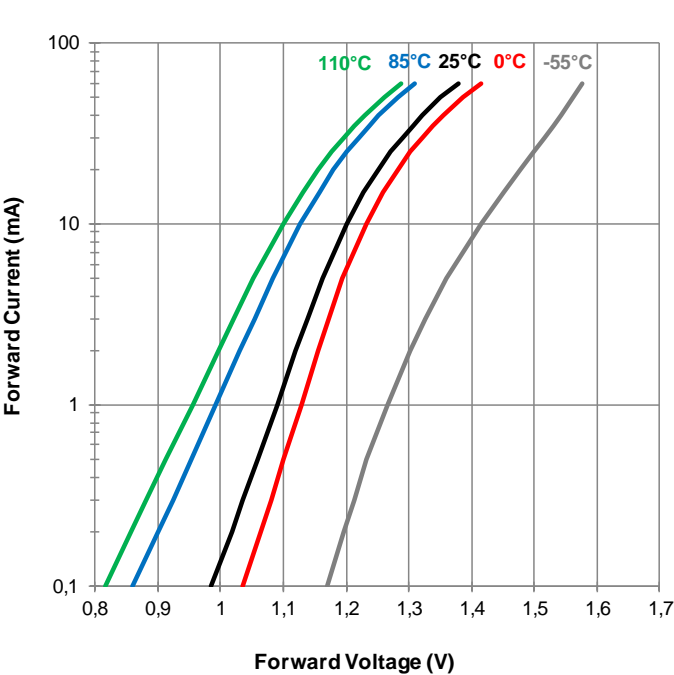
Collector-Emitter Saturation Voltage vs. Ambient Temperature:



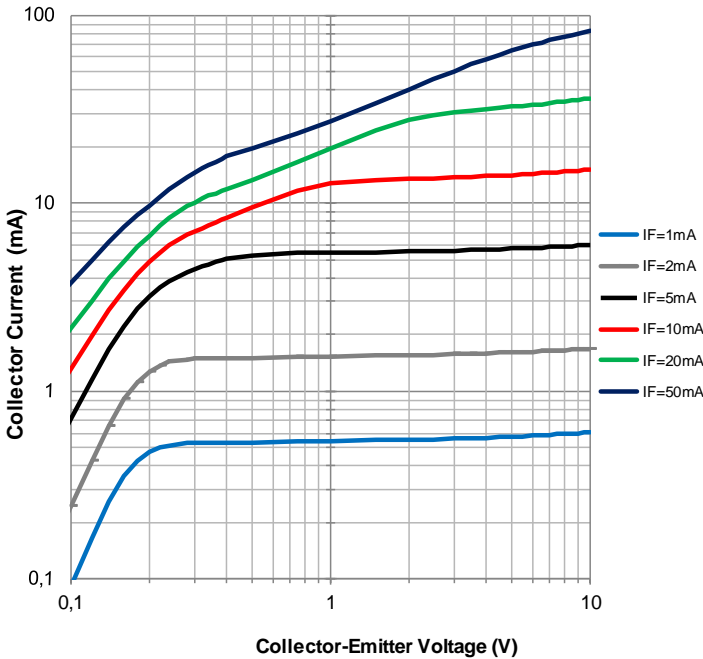
<div><div></div><div></div><div></div><div></div><div></div><div></div></div>		CHECKED SalVo	REVISION 001.004	DATE (YYYY-MM-DD) 2023-08-22	GENERAL TOLERANCE DIN ISO 2768-1m	PROJECTION METHOD 
<div><div></div><div>Würth Elektronik eiSos GmbH & Co. KG EMC & Inductive Solutions Max-Eyth-Str. 1 74638 Waldenburg Germany Tel. +49 (0) 79 42 945 - 0 www.we-online.com eiSos@we-online.com</div></div>		DESCRIPTION WL-OCPT Optocoupler Phototransistor			ORDER CODE 140356145200	
		SUBTYPE SOP4	BUSINESS UNIT ePal	STATUS Valid	PAGE 4/12	

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Forward Current vs. Forward Voltage:



Collector Current vs. Collector-Emitter Voltage:

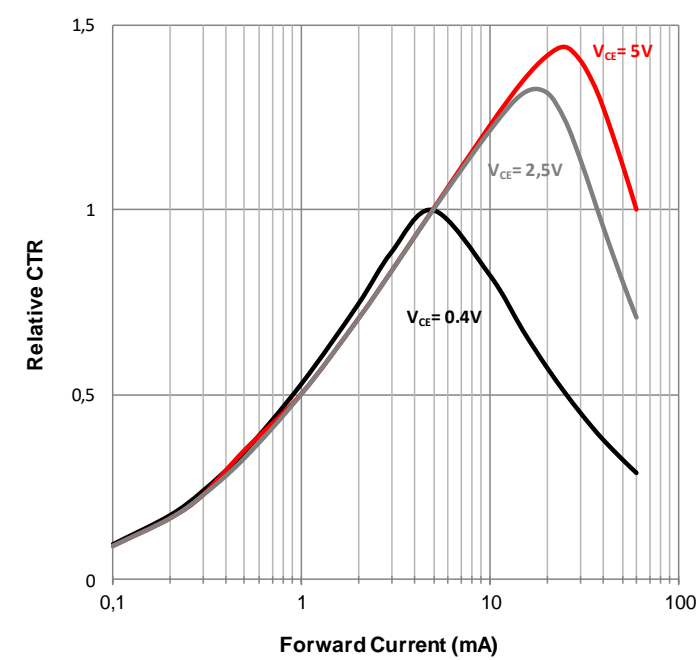


Testcondition: TA= 25°C

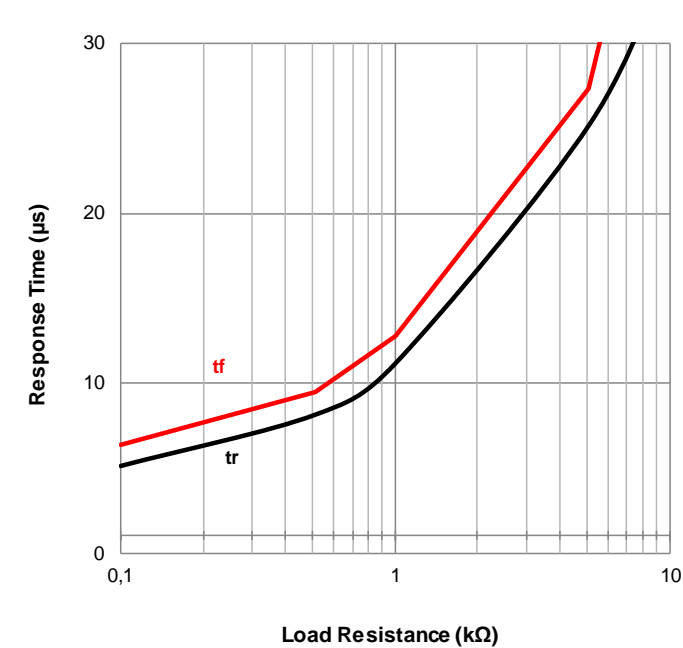
      		CHECKED SaVo	REVISION 001.004	DATE (YYYY-MM-DD) 2023-08-22	GENERAL TOLERANCE DIN ISO 2768-1m	PROJECTION METHOD: 	
 <div>Würth Elektronik eiSos GmbH & Co. KG EMC & Inductive Solutions Max-Eyth-Str. 1 74638 Waldenburg Germany Tel. +49 (0) 79 42 945 - 0 www.wue-online.com eiSos@wue-online.com</div>		DESCRIPTION WL-OCPT Optocoupler Phototransistor				ORDER CODE 140356145200	
		SIZES/TYPES SOP4	BUSINESS UNIT ePal		STATUS Valid	PAGE 5/12	

This electronic component has been designed and developed for usage in general electronic equipment only. This product is not authorized for use in equipment where a higher safety standard and reliability standard is especially required or where a failure of the product is reasonably expected to cause severe personal injury or death, unless the parties have executed an agreement specifically governing such use. Moreover Würth Elektronik eiSos GmbH & Co KG products are neither designed nor intended for use in areas such as military, aerospace, aviation, nuclear control, submarine, transportation, transportation signal, disaster prevention, medical, public information network etc.. Würth Elektronik eiSos GmbH & Co KG must be informed about the intent of such usage before the design-in stage. In addition, sufficient reliability evaluation checks for safety must be performed on every electronic component which is used in electrical circuits that require high safety and reliability functions or performance.

Relative CTR vs. Forward Current:











Switching time vs. Load Resistance:



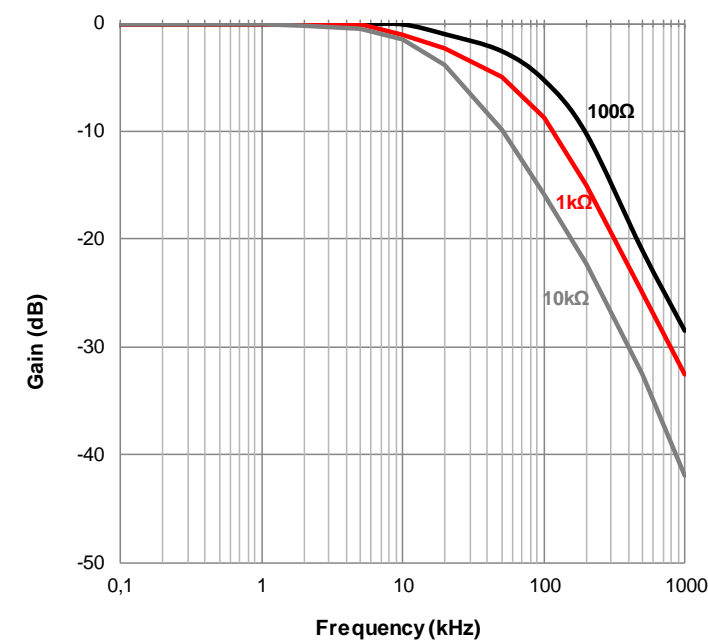
Testcondition: $I_F = 5mA$; $T_A = 25^{\circ}C$

Testcondition: $I_C = 2mA$; $V_{CE} = 2V$; $T_A = 25^{\circ}C$

     		CHECKED SalVo	REVISION 001.004	DATE (YYYY-MM-DD) 2023-08-22	GENERAL TOLERANCE DIN ISO 2768-1m	PROJECTION METHOD 
 <div>Würth Elektronik eiSos GmbH & Co. KG EMC & Inductive Solutions Max-Eyth-Str. 1 74638 Waldenburg Germany Tel. +49 (0) 79 42 945 - 0 www.wue-online.com eiSos@wue-online.com</div>		DESCRIPTION WL-OCPT Optocoupler Phototransistor			ORDER CODE 140356145200	
		SIZES/TYPE SOP4	BUSINESS UNIT ePal	STATUS Valid	PAGE 6/12	

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Gain vs. Frequency:

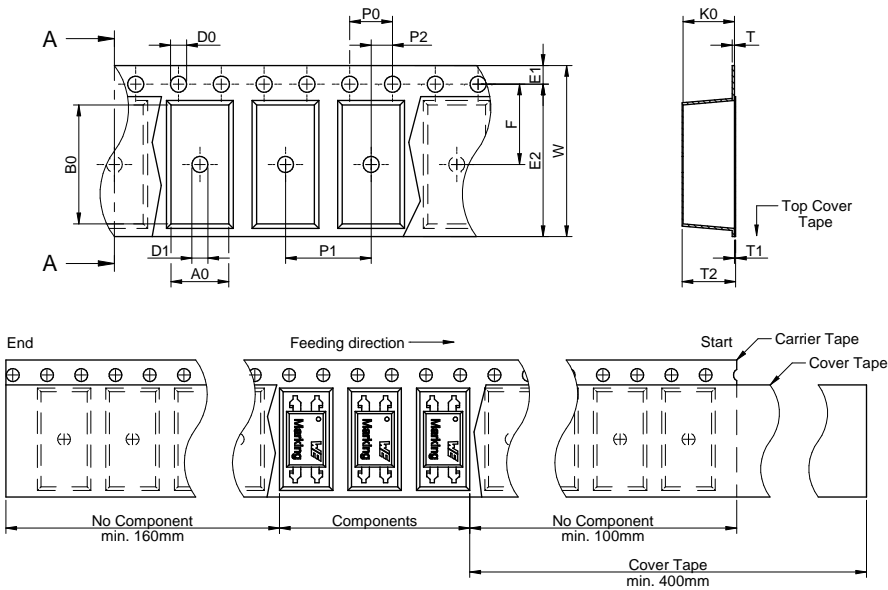


Testcondition: $I_C=2\text{mA}$; $V_{CE}=2\text{V}$; $T_A=25^\circ\text{C}$

<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div>		CHECKED SalVo	REVISION 001.004	DATE (YYYY-MM-DD) 2023-08-22	GENERAL TOLERANCE DIN ISO 2768-1m	PROJECTION METHOD
<div><div></div><div><div>WÜRTH ELEKTRONIK MORE THAN YOU EXPECT</div><div>Würth Elektronik eiSos GmbH & Co. KG EMC & Inductive Solutions Max-Eyth-Str. 1 74638 Waldenburg Germany Tel. +49 (0) 79 42 945 - 0 www.wue-online.com eiSos@wue-online.com</div></div></div>		DESCRIPTION WL-OCPT Optocoupler Phototransistor			ORDER CODE 140356145200	
		SUBTYPE SOP4	BUSINESS UNIT eiPal	STATUS Valid	PAGE 7/12	

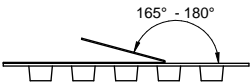
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Packaging Specification - Tape: [mm]



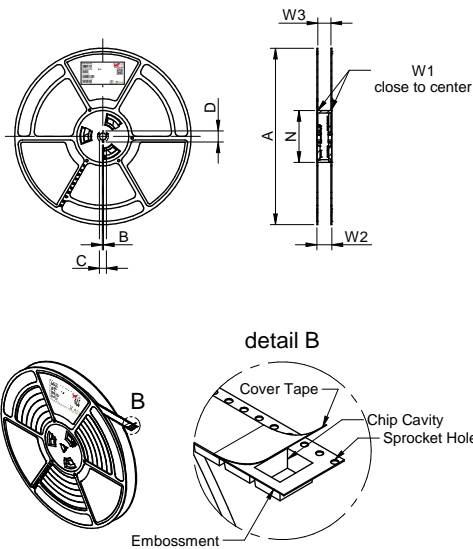
Packaging is referred to the international standard IEC 60286-3:2019

Tape Type	A0 (mm)	B0 (mm)	W (mm)	T (mm)	T1 (mm)	T2 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	D0 (mm)	D1 (mm)	E1 (mm)	E2 (mm)	F (mm)	Material	Qty. (pcs.)
	typ.	typ.	+0.3/-0.1	ref.	ref.	typ.	typ.	±0.1	±0.1	±0.1	+0.1/-0.0	min.	±0.1	min.	±0.1	Polystyrene	3000
Za	4,70	10,50	16,00	0,40	0,10	4,60	4,20	4,00	8,00	2,00	1,50	1,50	1,75	14,25	7,90		











Tape width	16 mm	Pull-off force
		0,1 N - 1,3 N

Packaging Specification - Reel: [mm]

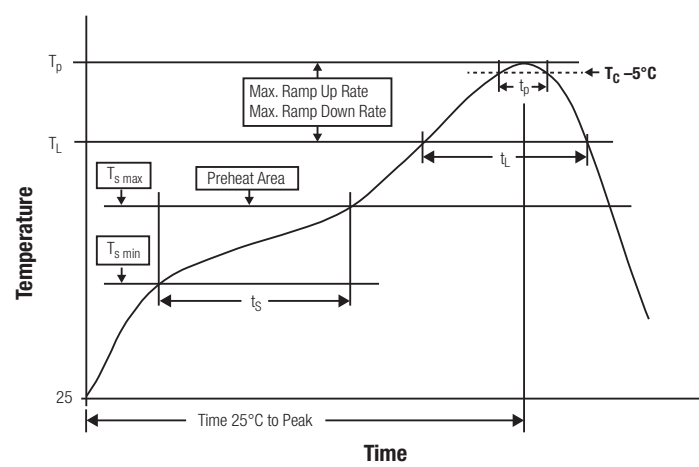


	A (mm)	B (mm)	C (mm)	D (mm)	N (mm)	W1 (mm)	W2 (mm)	W3 (mm)	W3 (mm)	Material
Tolerance	± 2.0	typ.	typ.	typ.	typ.	typ.	typ.	min.	max.	
Value	330,00	2,20	13,00	20,90	97,20	16,70	20,70	15,90	19,40	Polystyrene

     	Checked SaVo	Revision 001.004	Date (YYYY-MM-DD) 2023-08-22	General Tolerance DIN ISO 2768-1m	Projection Method 
 WÜRTH ELEKTRONIK MORE THAN YOU EXPECT	Description WL-OCPT Optocoupler Phototransistor				Order Code 140356145200
	Size/Type SOP4		Business Unit ePal	Status Valid	Page 8/12

This electronic component has been designed and developed for usage in general electronic equipment only. This product is not authorized for use in equipment where a higher safety standard and reliability standard is especially required or where a failure of the product is reasonably expected to cause severe personal injury or death, unless the parties have executed an agreement specifically governing such use. Moreover Würth Elektronik eSos GmbH & Co KG products are neither designed nor intended for use in areas such as military, aerospace, aviation, nuclear control, submarine, transportation, transportation signal, disaster prevention, medical, public information network etc.. Würth Elektronik eSos GmbH & Co KG must be informed about the intent of such usage before the design-in stage. In addition, sufficient reliability evaluation checks for safety must be performed on every electronic component which is used in electrical circuits that require high safety and reliability functions or performance.

Classification Reflow Profile for SMT components:



Classification Reflow Soldering Profile:










Profile Feature		Value
Preheat Temperature Min	T _{s min}	150 °C
Preheat Temperature Max	T _{s max}	200 °C
Preheat Time t _s from T _{s min} to T _{s max}	t _s	max. 60 - 120 seconds
Ramp-up Rate (T _L to T _p)		3 °C/ second max.
Liquidous Temperature	T _L	217 °C
Time t _L maintained above T _L	t _L	max. 60 seconds
Peak package body temperature	T _p	T _p ≤ T _c , see Table below
Time within 5°C of actual peak temperature	t _p	max. 10 seconds
Ramp-down Rate (T _p to T _L)		6 °C/ second max.
Time 25°C to peak temperature		max. 220 seconds

refer to IPC/ JEDEC J-STD-020E

Package Classification Reflow Temperature (T_c):

Properties	Volume mm³ <350	Volume mm³ 350-2000	Volume mm³ >2000
PB-Free Assembly I Package Thickness < 1.6 mm	260 °C	260 °C	260 °C
PB-Free Assembly I Package Thickness 1.6 mm - 2.5 mm	260 °C	250 °C	245 °C
PB-Free Assembly I Package Thickness > 2.5 mm	250 °C	245 °C	245 °C
Applied cycles	2 cycles max.		

refer to IPC/ JEDEC J-STD-020E

<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div>		CHECKED SaVo	REVISION 001.004	DATE (YYYY-MM-DD) 2023-08-22	GENERAL TOLERANCE DIN ISO 2768-1m	PROJECTION METHOD 
<div><div></div><div>Würth Elektronik eSas GmbH & Co. KG EMC & Inductive Solutions Max-Eyth-Str. 1 74638 Waldenburg Germany Tel. +49 (0) 79 42 945 - 0 www.we-online.com eSas@we-online.com</div></div>		DESCRIPTION WL-OCPT Optocoupler Phototransistor				ORDER CODE 140356145200
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Cautions and Warnings:

The following conditions apply to all goods within the product series of Optoelectronic Components of Würth Elektronik eiSos GmbH & Co. KG:

General:

- This optoelectronic component is designed and manufactured for use in general electronic equipment.
- Würth Elektronik must be asked for written approval (following the PPAP procedure) before incorporating the components into any equipment in fields such as military, aerospace, aviation, nuclear control, submarine, transportation (automotive control, train control, ship control), transportation signal, disaster prevention, medical, public information network, etc. where higher safety and reliability are especially required and/or if there is the possibility of direct damage or human injury.
- Optoelectronic components that will be used in safety-critical or high-reliability applications, should be pre-evaluated by the customer.
- The optoelectronic component is designed and manufactured to be used within the datasheet specified values. If the usage and operation conditions specified in the datasheet are not met, the wire insulation may be damaged or dissolved.
- Do not drop or impact the components, the component may be damaged
- Würth Elektronik products are qualified according to international standards, which are listed in each product reliability report. Würth Elektronik does not warrant any customer qualified product characteristics beyond Würth Elektronik's specifications, for its validity and sustainability over time.
- The responsibility for the applicability of the customer specific products and use in a particular customer design is always within the authority of the customer. All technical specifications for standard products also apply to customer specific products.
- Unless Würth Elektronik has given its express consent, the customer is under no circumstances entitled to reverse engineer, disassemble or otherwise attempt to extract knowledge or design information from the optoelectronic component.

Product specific:

Soldering:

- The solder profile must comply with the technical product specifications. All other profiles will void the warranty.
- All other soldering methods are at the customers' own risk
- The soldering pad pattern shown above is a general recommendation for the easy assembly of optoelectronic components. If a high degree of precision is required for the selected application (i.e. high density assembly), the customer must ensure that the soldering pad pattern is optimized accordingly.

Cleaning and Washing:

- Washing agents used during the production to clean the customer application might damage or change the characteristics of the optoelectronic component body, marking or plating. Washing agents may have a negative effect on the long-term functionality of the product.

- Using a brush during the cleaning process may break the optoelectronic component body. Therefore, we do not recommend using a brush during the PCB cleaning process.

Potting:

- If the product is potted in the customer application, the potting material might shrink or expand during and after hardening. Shrinking could lead to an incomplete seal, allowing contaminants into the optoelectronic component body, pins or termination. Expansion could damage the components. We recommend a manual inspection after potting to avoid these effects.

Storage Conditions:

- A storage of Würth Elektronik products for longer than 12 months is not recommended. Within other effects, the terminals may suffer degradation, resulting in bad solderability. Therefore, all products shall be used within the period of 12 months based on the day of shipment.
- Do not expose the optoelectronic component to direct sunlight.
- The storage conditions in the original packaging are defined according to DIN EN 61760-2.
- For a moisture sensitive component, the storage condition in the original packaging is defined according to IPC/JEDEC-J-STD-033. It is also recommended to return the optoelectronic component to the original moisture proof bag and reseal the moisture proof bag again.
- The storage conditions stated in the original packaging apply to the storage time and not to the transportation time of the components.

Packaging:

- The packaging specifications apply only to purchase orders comprising whole packaging units. If the ordered quantity exceeds or is lower than the specified packaging unit, packaging in accordance with the packaging specifications cannot be ensured.

Handling:

- Violation of the technical product specifications such as exceeding the nominal rated current, will void the warranty.
- The product design may influence the automatic optical inspection.
- Certain optoelectronic component surfaces consist of soft material. Pressure on the top surface has to be handled carefully to prevent negative influence to the function and reliability of the optoelectronic components.
- ESD prevention methods need to be applied for manual handling and processing by machinery.
- Resistors for protection are obligatory.
- In addition to optoelectronic components testing, products incorporating these devices have to comply with the safety precautions given in IEC 60825-1, IEC 62471 and IEC 62778.










Technical specification:

- The typical and/or calculated values and graphics of technical parameters can only reflect statistical figures. The actual parameters of each single product, may differ from the typical and/or calculated values or the typical characteristic line.

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- In the characteristics curves, all values given in dotted lines may show a higher deviation than the paramters mentioned above.
- On each reel, only one bin is sorted and taped. The bin is defined on the current transfer ratio.
- In order to ensure highest availability, the reel binning of standard deliveries can vary. A single bin cannot be ordered. Please contact us in advance, if you need a particular bin sorting before placing your order.
- These cautions and warnings comply with the state of the scientific and technical knowledge and are believed to be accurate and reliable. However, no responsibility is assumed for inaccuracies or incompleteness.

The customer has the sole responsibility to ensure that he uses the latest version of this datasheet, which is available on Würth Elektronik's homepage. Unless otherwise agreed in writing (i.e. customer specific specification), changes to the content of this datasheet may occur without notice, provided that the changes do not have a significant effect on the usability of the optoelectronic components.

<div><div></div></div>	CHECKED SaVo	REVISION 001.004	DATE (YYYY-MM-DD) 2023-08-22	GENERAL TOLERANCE DIN ISO 2768-1m	PROJECTION METHOD 
<div><div><div><div>WÜRTH ELEKTRONIK</div><div>MORE THAN YOU EXPECT</div></div></div><div><div>Würth Elektronik eiSos GmbH & Co. KG</div><div>EMC & Inductive Solutions</div><div>Max-Eyth-Str. 1</div><div>74638 Waldenburg</div><div>Germany</div><div>Tel. +49 (0) 79 42 945 - 0</div><div>www.wue-online.com</div><div>eiSos@wue-online.com</div></div></div>	DESCRIPTION WL-OCPT Optocoupler Phototransistor			ORDER CODE 140356145200	
	SIZES/TYPE SOP4	BUSINESS UNIT ePal	STATUS Valid	PAGE 11/12	

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Important Notes

The following conditions apply to all goods within the product range of Würth Elektronik eiSos GmbH & Co. KG:

1. General Customer Responsibility

Some goods within the product range of Würth Elektronik eiSos GmbH & Co. KG contain statements regarding general suitability for certain application areas. These statements about suitability are based on our knowledge and experience of typical requirements concerning the areas, serve as general guidance and cannot be estimated as binding statements about the suitability for a customer application. The responsibility for the applicability and use in a particular customer design is always solely within the authority of the customer. Due to this fact it is up to the customer to evaluate, where appropriate to investigate and decide whether the device with the specific product characteristics described in the product specification is valid and suitable for the respective customer application or not.

2. Customer Responsibility related to Specific, in particular Safety-Relevant Applications

It has to be clearly pointed out that the possibility of a malfunction of electronic components or failure before the end of the usual lifetime cannot be completely eliminated in the current state of the art, even if the products are operated within the range of the specifications. In certain customer applications requiring a very high level of safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health it must be ensured by most advanced technological aid of suitable design of the customer application that no injury or damage is caused to third parties in the event of malfunction or failure of an electronic component. Therefore, customer is cautioned to verify that data sheets are current before placing orders. The current data sheets can be downloaded at www.we-online.com.

3. Best Care and Attention

Any product-specific notes, cautions and warnings must be strictly observed. Any disregard will result in the loss of warranty.

4. Customer Support for Product Specifications

Some products within the product range may contain substances which are subject to restrictions in certain jurisdictions in order to serve specific technical requirements. Necessary information is available on request. In this case the field sales engineer or the internal sales person in charge should be contacted who will be happy to support in this matter.

5. Product R&D

Due to constant product improvement product specifications may change from time to time. As a standard reporting procedure of the Product Change Notification (PCN) according to the JEDEC-Standard inform about minor and major changes. In case of further queries regarding the PCN, the field sales engineer or the internal sales person in charge should be contacted. The basic responsibility of the customer as per Section 1 and 2 remains unaffected.

6. Product Life Cycle

Due to technical progress and economical evaluation we also reserve the right to discontinue production and delivery of products. As a standard reporting procedure of the Product Termination Notification (PTN) according to the JEDEC-Standard we will inform at an early stage about inevitable product discontinuance. According to this we cannot guarantee that all products within our product range will always be available. Therefore it needs to be verified with the field sales engineer or the internal sales person in charge about the current product availability expectancy before or when the product for application design-in disposal is considered. The approach named above does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.










7. Property Rights

All the rights for contractual products produced by Würth Elektronik eiSos GmbH & Co. KG on the basis of ideas, development contracts as well as models or templates that are subject to copyright, patent or commercial protection supplied to the customer will remain with Würth Elektronik eiSos GmbH & Co. KG. Würth Elektronik eiSos GmbH & Co. KG does not warrant or represent that any license, either expressed or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, application, or process in which Würth Elektronik eiSos GmbH & Co. KG components or services are used.

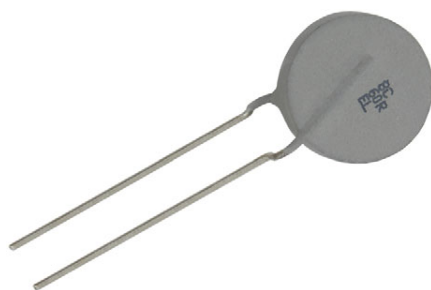
8. General Terms and Conditions

Unless otherwise agreed in individual contracts, all orders are subject to the current version of the "General Terms and Conditions of Würth Elektronik eiSos Group", last version available at www.we-online.com.

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DESCRIPTION WL-OCPT Optocoupler Phototransistor						ORDER CODE 140356145200	
SIZE/TYPE SOP4			BUSINESS UNIT ePal		STATUS Valid	PAGE 12/12	

PTC Thermistors, Inrush Current Limiter



LINKS TO ADDITIONAL RESOURCES



QUICK REFERENCE DATA		
PARAMETER ⁽¹⁾	VALUE	UNIT
Resistance at 25 °C (R_{25}) ⁽²⁾	60 to 1000	Ω
Switching temperature	130 to 140	°C
Maximum inrush current	10 to 40	A
Maximum AC voltage ⁽²⁾	350 to 800	V _{RMS}
Maximum DC voltage ⁽²⁾	500 to 1200	V _{DC}
Maximum peak voltage ⁽³⁾	4000	V _P
Maximum energy at 25 °C ⁽¹⁾	150 to 240	J
Operating temperature range	-40 to 105	°C
Storage temperature range	-55 to 165	°C
Dissipation factor	14.5 to 19.5	mW/K
Thermal time constant (τ_c) (still air cooling)	130 to 155	s
Weight	3.5 to 5.7	g

Notes

- ⁽¹⁾ Definitions, measurements, and tests are made in accordance with standard IEC 60738-1 "Thermistors - Directly heated positive temperature coefficient" and AEC-Q200 stress test qualification for passive components
- ⁽²⁾ Other resistance values and maximum operating voltages available on request.
Matched resistance values available on request
- ⁽³⁾ Maximum peak voltages are based on 8/20 μ s pulses that can be applied with limited non-switching energy

AGENCY APPROVALS

Agency approval documents, please see:

www.vishay.com/ppg?29165&documents

UL recognition standard for safety is UL 1434: "Thermistor-Type Devices". UL file E148885

FEATURES

- High energy absorption levels up to 150 J and 240 J
- High number of inrush-power cycles: > 100 000 cycles
- Highly resistant against non-switching peak-powers of up to 25 kW
- Can handle high direct voltage up to 1200 V
- Self protecting in case of overload with no risk of over-heating
- AEC-Q200 qualified
- C-UL-US recognized under file E148885 for AC and DC use
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT

APPLICATIONS

Inrush current limiting and load-dump resistor in:

- AC/DC and DC/DC converters
- Load dump and DC-Link circuits
- Emergency discharge circuits
- OBC, battery charging equipment
- Motor drives
- Welding equipment

PTCEL thermistors have resistance values that can change instantly based on the applied voltage levels and varying body temperatures.

DESCRIPTION

These directly heated ceramic-based doped barium titanate thermistors have a positive temperature coefficient and are primarily intended for inrush current limiting and overload protection. They consist of a ceramic pellet soldered between two tinned CCS wires and coated with a UL 94 V-0 compliant high temperature silicone lacquer. The body is marked with the logo, cold resistance value, EL on one side and date code on the opposite side.

MOUNTING

Important mounting and handling instructions, see:

www.vishay.com/doc?29223

By soldering in any position.


Not intended for potting or sealing.

Maximum surface temperature in case of overload can reach 200 °C.

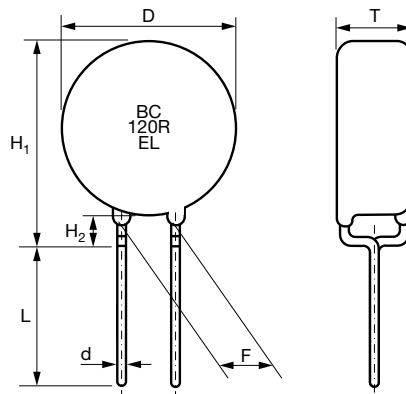
PACKAGING

PTC thermistors are available in 200 pieces individually packed in layered PET trays or tape on reel 500 pieces.

ELECTRICAL DATA AND ORDERING INFORMATION

PART NUMBER ⁽¹⁾	R_{25} (Ω)	R_{25} TOL. (%)	$V_{MAX.}$ (V_{RMS})	$V_{LINK MAX.}$ (V_{DC})	$R_{MIN.}$ < 1.5 V_{DC} (Ω)	I_{HOLD} AT 25°C (mA)	C_{th} (J/K)	$E_{MAX.}$ 1 CYCLE AT 25°C (J)	τ_{th} (s)	LEAD PITCH F (mm)	UL RECOG. 
PTCEL13R600LxE	60	30	350	500	32	120	1.45	150	130	5.0	✓
PTCEL13R121MxE	120	30	440	625	64	85	1.45	150	130	5.0	✓
PTCEL13R251NxE	250	30	480	680	130	60	1.45	150	130	5.0	✓
PTCEL13R501RxE	500	30	560	800	260	42	1.45	150	130	5.0	✓
PTCEL13R102SxE	1000	30	600	850	520	30	1.45	140	130	5.0	✓
PTCEL17R600MxE	60	30	440	625	32	140	2.3	240	155	5.0	✓
PTCEL17R600MxE303	60	30	440	625	32	140	2.3	240	155	7.5	✓
PTCEL17R121NxE	120	30	460	650	64	100	2.3	240	155	5.0	✓
PTCEL17R251SxE	250	30	600	850	130	70	2.3	240	155	5.0	✓
PTCEL17R501TxE	500	30	700	1000	260	50	2.3	230	155	5.0	✓
PTCEL17R501TxE302	500	30	700	1000	260	50	2.3	230	155	7.5	✓
PTCEL17R501TxE401	500	30	700	1000	260	50	2.3	230	155	10.0	✓
PTCEL17R102UxE404	1000	30	800	1200	500	35	2.3	230	155	10.0	

Note
⁽¹⁾ Replace the x by B for bulk or T for tape and reel

OUTLINE AND DIMENSIONS

COMPONENT DIMENSIONS in millimeters

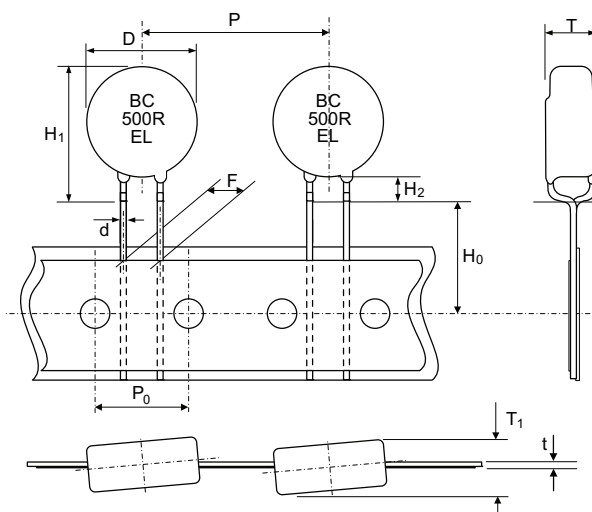
SYMBOL	PTCEL13		PTCEL17		
D	13.5 max.		16.5 max.		
d	0.6 ± 0.05		0.8 ± 0.05		
H ₁	17 max.		20 max.		
H ₂	3 ± 1		3 ± 1		
T	7.0 max.		7.5 max.		
F ⁽¹⁾	5.0 ± 0.8	7.5 ± 0.8	5.0 ± 0.8	7.5 ± 0.8	10.0 ± 0.8
L ⁽²⁾	20 min.	18 min.	20 min.	18 min.	16 min.

Notes
⁽¹⁾ F pitch = see "Electrical Data and Ordering Information" table for available wire pitch part numbers

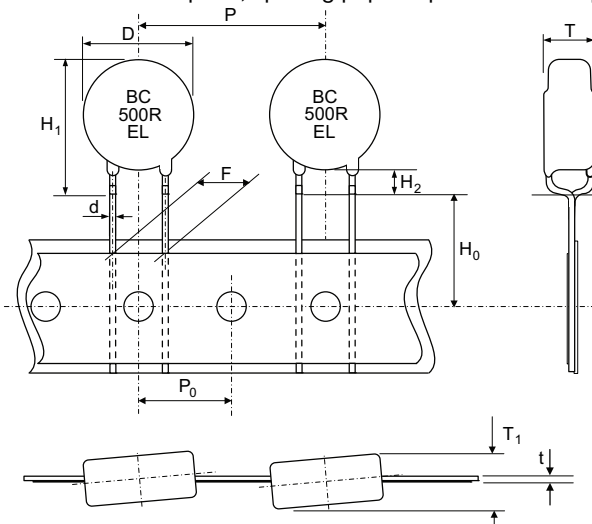
⁽²⁾ L lead length corresponds to available wire pitch part numbers

TAPE AND REEL DIMENSIONS

Taping on reel with $F = 5.0$ mm wire pitch, spacing paper tape and foam separator tape used on reel.



Taping on reel with $F = 7.5$ mm and 10.0 mm wire pitch, spacing paper tape and foam separator tape used on reel.



DIMENSIONS in millimeters (standard cardboard tape W 18 mm according IEC 60286-2)		
SYMBOL	PARAMETER	VALUE
D	Body diameter	See bulk dimensions
d	Lead diameter	See bulk dimensions
P	Component pitch	25.4 ± 1.0
P ₀	Feedhole pitch	12.7 ± 0.3
F	Lead center to lead center distance (between component and tape)	
	13R and 17R type *TE (leads between feedholes)	$5.0 +0.5/-0.2$
	13R and 17R type *TE3xx (feedhole between leads)	$7.5 +0.5/-0.2$
	17R type *TE4xx (feedhole between leads)	$10.0 +0.5/-0.2$
H ₀	Lead wire clinch height	16.0 ± 0.5
H ₂	Component bottom to seating plane	3.0 ± 1.0
H ₁	Component top to seating plane	See bulk dimensions
T	Body thickness	See bulk dimensions
t	Total tape thickness	1.7 max.
T ₁	Total thickness	T + 1.0 max.

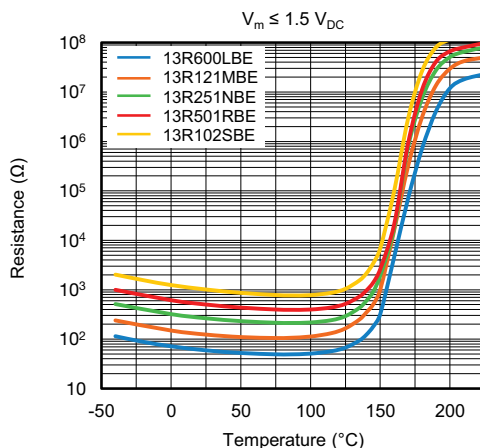
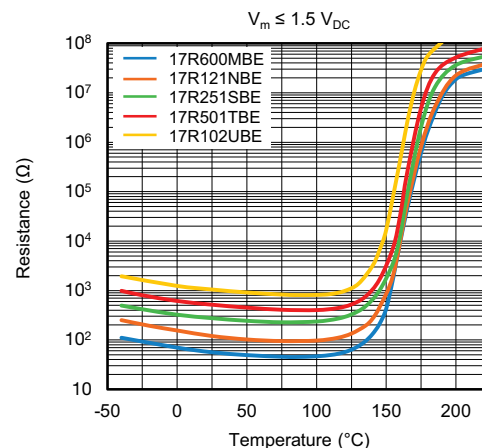
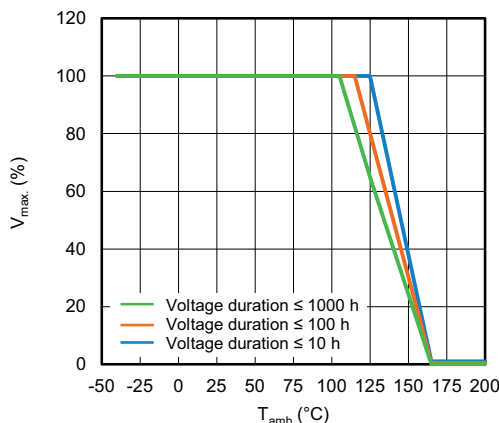
**REQUIRED NUMBER OF PTC THERMISTORS TO LIMIT CURRENT AND ABSORB ENERGY**

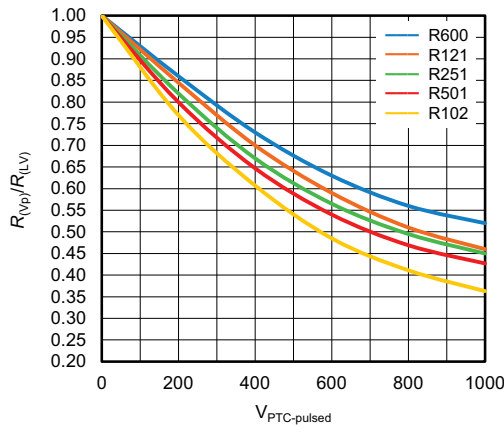
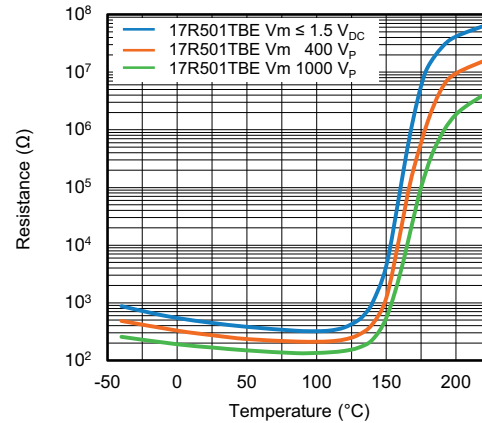
By using several PTC's in a series / parallel network, the maximum current limitation and absorbed energy levels can be further optimized. For homogeneous current and energy distribution it is recommended to combine only PTCEL of the same size and matched resistance value. Energy absorption per PTC in a network depends on current distribution in the network and as such on the individual PTC resistance value. PTCEL thermistors might be used in a series connection to further lower the inrush current, but not to increase the maximum allowed voltage levels. Following formula may be used to calculate the minimum number of PTCEL thermistors of the same size and matched resistance value that are required in a DC link or other capacitor bank application to properly charge or discharge a given amount of non-repetitive energy without follow current. The formula is valid for one charge or discharge operation within cool down period of at least 5 times the thermal time constant and for which the T_{PTC} equals the T_{amb} before a consecutive operation.

$$N \geq \frac{K \times C \times V^2}{2 \times C_{th} \times (T_{sw} - T_{amb})}$$

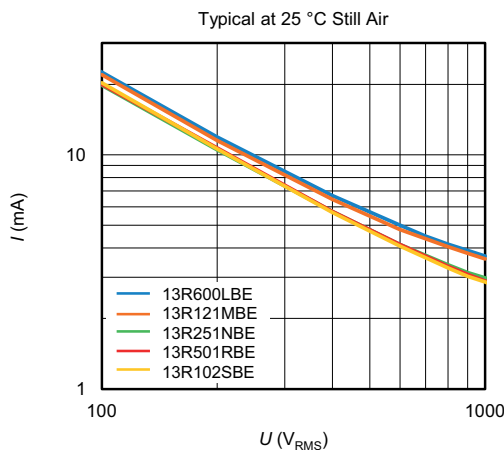
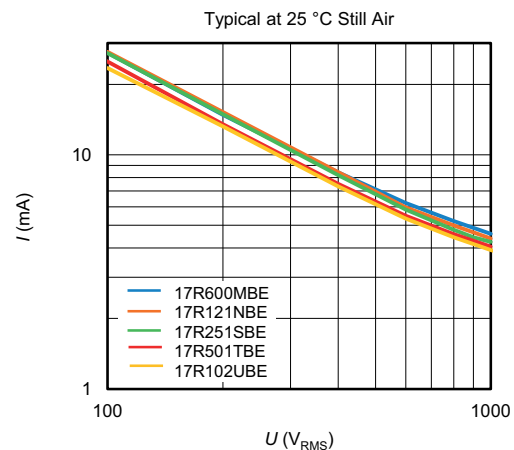
Notes

- N is the number of PTCEL required in the network
- C is the total capacitor value to charge or discharge in F
- V is the maximum DC voltage on the capacitor C
- C_{th} is the thermal capacity of one PTC in [J/K] (see table)
- T_{sw} is the minimum switching temperature of the PTCEL (130 °C)
- T_{amb} is the maximum ambient temperature at which the PTC needs to operate
- K is the factor that determines the charging operation mode
 - K = 1 for DC charging or discharging
 - K = 0.96 for 3-phase rectified charging
 - K = 0.76 for single phase rectified charging

RESISTANCE VS. TEMPERATURE FOR PTCEL13 (Typical)**RESISTANCE VS. TEMPERATURE FOR PTCEL17 (Typical)** **V_{max} . DERATING VS. T_{amb}** 

PTC RESISTANCE UNDER PULSED VOLTAGE

RESISTANCE VS. TEMPERATURE PULSED
(Typical)

Notes

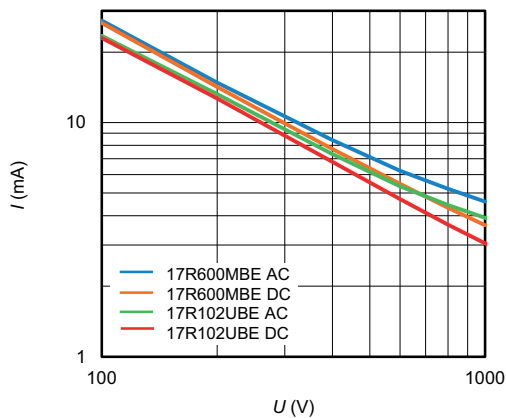
- The minimum PTC resistance values under (pulsed) voltage are depending on actual minimum resistance value in the temperature range of 70 °C to 100 °C. The actual voltage dependency effect or $R_{(Vp)}/R_{(LV)}$ ratio of ceramic PTC is depending on its resistance values at low voltage ($R_{(LV)}$). The different curves represent the influence of (pulsed) voltage related to the PTCEL value types in the minimum resistance temperature range of 70 °C to 100 °C. A PTC resistance value $R_{(LV)}$ can be taken from the "Resistance vs Temperature" graphs and multiplied by a corresponding ratio to estimate the (minimum) resistance value and determine a maximum peak current at a defined voltage. Example: a PTCEL17R501TBE type has a $R_{min.}$ (see Electrical Data table) of 260 Ω at around 90 °C, and at a 1000 V peak-voltage the resistance will drop to $260 \Omega \times 0.43$ (red curve) = 112 Ω, which will give rise to a peak-current of around 9 Ap. Actual peak currents that could be reached at certain voltage levels can be more precisely evaluated by using the available SPICE models
- Also check the graph "Resistance vs. Temperature Pulsed" to see the typical resistance to voltage dependency effect on a PTCEL17R501TBE

RESIDUAL CURRENT VS. VOLTAGE FOR PTCEL13

RESIDUAL CURRENT VS. VOLTAGE FOR PTCEL17


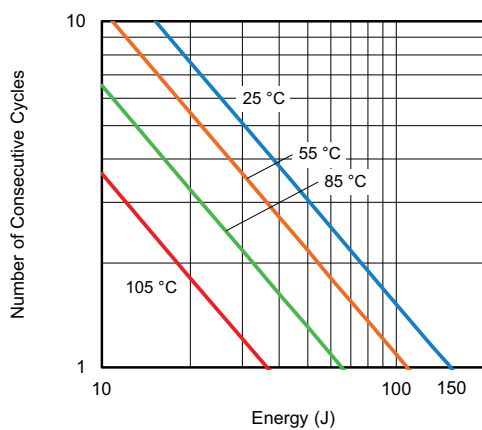


RESIDUAL CURRENT VS. VOLTAGE AC / DC

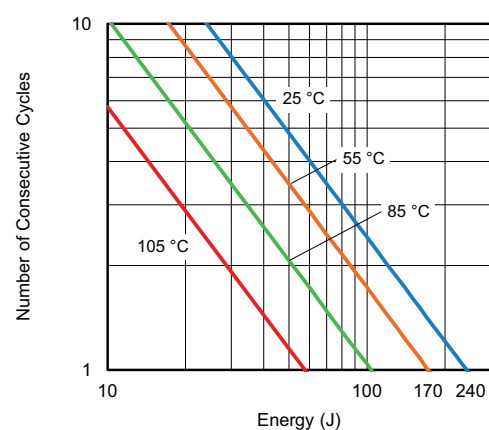
Typical at 25 °C Still Air



CONSECUTIVE ENERGY AT DIFFERENT T_{amb} FOR PTCEL13



CONSECUTIVE ENERGY AT DIFFERENT T_{amb} FOR PTCEL17





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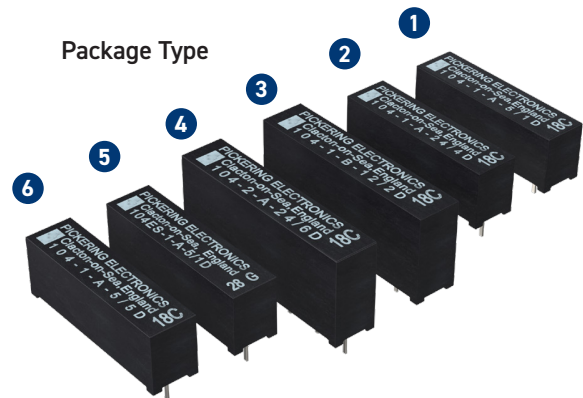
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- Up to **5 kV** stand-off **NEW**
- Switching Voltage up to **1500 VDC** **NEW**
- Small size. Stacking on **0.25 Inches** pitch
- Internal mu-metal magnetic screen
- Optional electrostatic screen **NEW**
- **104HT** High temperature versions available **NEW**
- One or two switches in a single package
- **1 Form A, 2 Form A & 1 Form B** configurations
- Dry switches
- **5 V, 12 V or 24 V** Coils with optional internal diode
- Ideal for mixed semiconductor testers, renewable energies and much more (see below)
- **Additional build options are available including many pin configurations**
- **Many benefits compared to industry standard relays (see last page)**



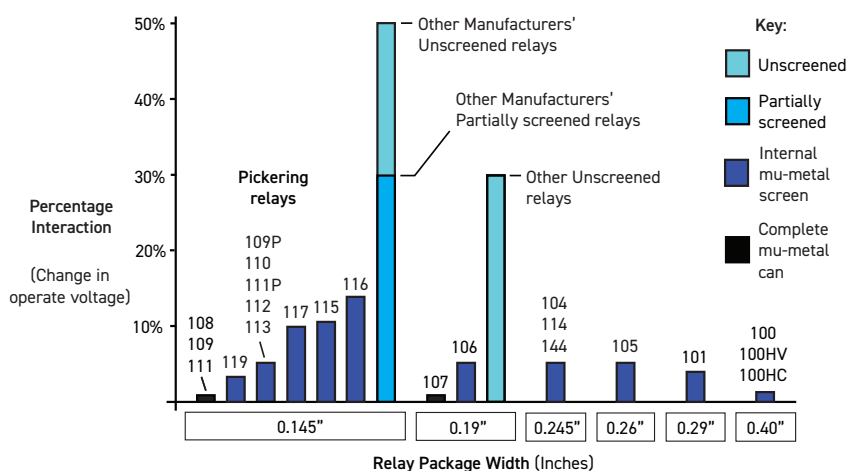
The Series 104 reed relays are ideal for mixed signal semiconductor testers, cable testing, monitoring photovoltaic efficiency, EVs & charge point testing, mining gas analysis, medical electronics, in-circuit test equipment, high voltage instrumentation, and much more.

The range features an internal mu-metal screen to eliminate problems that would otherwise be experienced due to magnetic interaction when they are closely stacked.

There is an option for an electrostatic shield between the switch and the coil to help minimise noise between the coil drive and high voltage circuits.

Where extended operating temperature ranges are required, options are designed to work from -40 °C to +125 °C, or custom versions up to +150 °C.

Five types of dry switches are available, capable of standing-off 1.5, 2, 3, 4 or 5 kV DC. The 1.5 kV and 2 kV versions are rated to switch up to 1000 VDC, for 3 kV, 4 kV and 5 kV versions, under certain conditions, this can be extended to 1500 VDC. The 3, 4 & 5 kV versions also have an increased clearance between the switch and coil pins to accommodate the higher voltage. For information on the recommended spacing between high voltage parts, please see [page 3](#).



Magnetic Interaction

This chart demonstrates the percentage changes in operate voltage due to magnetic interaction depending on the level of magnetic screening offered from the relay package. For more information on magnetic interaction [click here](#).

Switch Ratings - Dry Switches

1 Form A (energize to make)	1 Form B (energize to break)	2 Form A (energize to make)
1500 VDC min stand-off 1000 VDC switching at 25 W	1500 VDC min stand-off 1000 VDC switching at 25 W	1500 VDC min stand-off 1000 VDC switching at 25 W
2000 VDC min stand-off 1000 VDC switching at 25 W	2000 VDC min stand-off 1000 VDC switching at 25 W	2000 VDC min stand-off 1000 VDC switching at 25 W
3000 VDC min stand-off 1000* VDC switching at 25 W	-	-
4000 VDC min stand-off 1000* VDC switching at 25 W	-	-
5000 VDC min stand-off 1000* VDC switching at 25 W	-	-

* For higher standoff versions, switching voltages greater than 1000 VDC are possible at reduced current and power, see the Extending Switching Voltages table below.

Dry Reed: Series 104 switch ratings - contact ratings for each switch type

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Min. stand-off volts	Life expectancy ops typical (see Note ¹)	Operate time inc bounce (max)	Release time	Special features
1	A or B	25 W	1.0 A	1.5 A	1000	1500	10 ⁸	1.0 ms	0.3 ms	High voltage
2	A or B	25 W	1.0 A	1.5 A	1000	2000	10 ⁸	1.0 ms	0.3 ms	High voltage
3	A	25 W	1.0 A	1.5 A	1000*	3000	10 ⁸	1.0 ms	0.3 ms	High voltage
4	A	25 W	1.0 A	1.5 A	1000*	4000	10 ⁸	1.0 ms	0.3 ms	High voltage
5	A	25 W	1.0 A	1.5 A	1000*	5000	10 ⁸	1.0 ms	0.3 ms	High voltage

* For higher standoff versions, switching voltages greater than 1000 VDC are possible at reduced current and power, see the Extending Switching Voltages table below.

Note¹: Life Expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1Ω, switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 1 x 10⁹ ops. At the maximum load (resistive), typical life is 1 x 10⁷ ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

Dry Reed: Series 104 switch ratings - Extended Switching Voltages

Switch No	Switch form	Max. switch current	Max. switching volts	Switched power	Typical life expectancy
3, 4 or 5	A	1 mA	1250	1.25 W	10 ⁷
3, 4 or 5	A	4 mA	1250	5 W	5 x 10 ⁶
3, 4 or 5	A	8 mA	1250	10 W	10 ⁶
3, 4 or 5	A	1 mA	1500	1.5 W	10 ⁶
3, 4 or 5	A	2 mA	1500	3 W	5 x 10 ⁵

For more detailed information on switching voltages greater than 1000 VDC please see our application note [extending switching voltages](#) or contact our technical team techsales@pickeringrelay.com

Operating Voltages - Standard

Coil voltage - nominal	Must operate voltage - maximum at 25 °C	Must release voltage - minimum at 25 °C
5 V	3.75 V	0.5 V
12 V	9 V	1.2 V
24 V	18 V	2.4 V

Operating Voltages - HT (High Temperature) Versions

Coil voltage - nominal	Must operate voltage		Must release voltage	
	maximum at 25 °C	maximum at 125 °C	minimum at 25 °C	minimum at 125 °C
5 V	2.75 V	3.75 V	0.5 V	0.5 V
12 V	6 V	9 V	1.2 V	1.2 V
24 V	12 V	18 V	2.4 V	2.4 V

Environmental Specification/Mechanical Characteristics

In applications where a higher or lower operating temperature range is required, the 104HT range has been designed to maintain optimum performance from -40 °C to +125 °C.

Standard Operating Temperature Range	-20 °C to +85 °C
Standard Storage Temperature Range	-35 °C to +100 °C
104HT Operating Temperature Range	-40 °C to +125 °C
104HT Storage Temperature Range	-40 °C to +150 °C
Shock Resistance	50 g
Vibration Resistance (10 - 2000 Hz)	20 g
Soldering Temperature (max) (10 s max)	270 °C
Washability (Proper drying process is recommended)	Fully Sealed

Washing Guidelines

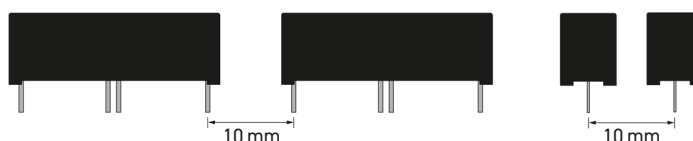
Pickering do not make any specific recommendations on washing reed relays, due to the large number of factors in cleaning processes, however we do have suggestions on best practices. Click [here](#) for more information.

Extended Operating Temperature Range

With the copper coil winding wire having a resistance/temperature coefficient of approximately 0.4% per °C, changes in temperature will result in changes in operating voltage. A standard reed relay is designed to have optimum performance up to the maximum operating temperature of +85 °C, the 104HT range has increased coil drive to ensure the same performance up to 125 °C, and with certain considerations, up to +150 °C. For more information, see our [Temperature guide](#) or contact techsales@pickeringrelay.com

Recommended Spacing for High Voltage Parts

When working with high voltages, the recommended space between pins is 2 mm per 1kV stand-off voltage. For example, the 5 kV version of the 104 should have a gap of 10 mm between the pins.



Dry Relay: Series 104 Coil Data and Type Numbers

Device Type	Type Number	Coil (V)	Coil resistance	Max. contact resistance (initial)	Insulation resistance (minimum at 25 °C) (see Note ⁴)		Capacitance (typical) (see Note ²)	
					Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A Switch No. 1 (1.5 kV) Package Type 1 *	104-1-A-5/1D	5	375 Ω	0.15 Ω	10 ¹² Ω	10 ¹² Ω	2.5 pF	0.1 pF
	104-1-A-12/1D	12	1000 Ω					
	104-1-A-24/1D	24	3000 Ω					
1 Form A Switch No. 2 (2 kV) Package Type 1 *	104-1-A-5/2D	5	375 Ω	0.15 Ω	10 ¹² Ω	10 ¹² Ω	2.5 pF	0.1 pF
	104-1-A-12/2D	12	1000 Ω					
	104-1-A-24/2D	24	3000 Ω					
1 Form A Switch No. 3 (3 kV) Package Type 2	104-1-A-5/3D	5	220 Ω	0.15 Ω	10 ¹² Ω	10 ¹² Ω	2.5 pF	0.1 pF
	104-1-A-12/3D	12	500 Ω					
	104-1-A-24/3D	24	3000 Ω					
1 Form A Switch No. 4 (4 kV) Package Type 2	104-1-A-5/4D	5	220 Ω	0.15 Ω	10 ¹² Ω	10 ¹² Ω	2.5 pF	0.1 pF
	104-1-A-12/4D	12	500 Ω					
	104-1-A-24/4D	24	3000 Ω					
1 Form A Switch No. 5 (5 kV) Package Type 6 *	104-1-A-5/5D	5	220 Ω	0.15 Ω	10 ¹² Ω	10 ¹² Ω	2.5 pF	0.1 pF
	104-1-A-12/5D	12	500 Ω					
	104-1-A-24/5D	24	3000 Ω					
1 Form B Switch No. 1 (1.5 kV) Package Type 3	104-1-B-5/1D	5	750 Ω	0.20 Ω	10 ¹² Ω	10 ¹² Ω	2.5 pF	0.1 pF
	104-1-B-12/1D	12	2000 Ω					
	104-1-B-24/1D	24	3000 Ω					
1 Form B Switch No. 2 (2 kV) Package Type 3	104-1-B-5/2D	5	750 Ω	0.20 Ω	10 ¹² Ω	10 ¹² Ω	2.5 pF	0.1 pF
	104-1-B-12/2D	12	2000 Ω					
	104-1-B-24/2D	24	3000 Ω					
2 Form A Switch No. 1 (1.5 kV) Package Type 4	104-2-A-5/1D	5	250 Ω	0.20 Ω	10 ¹² Ω	10 ¹² Ω	See Note ³	See Note ³
	104-2-A-12/1D	12	750 Ω					
	104-2-A-24/1D	24	2000 Ω					
2 Form A Switch No. 2 (2 kV) Package Type 4	104-2-A-5/2D	5	250 Ω	0.20 Ω	10 ¹² Ω	10 ¹² Ω	See Note ³	See Note ³
	104-2-A-12/2D	12	750 Ω					
	104-2-A-24/2D	24	2000 Ω					

When an internal diode is required, the suffix D is added to the part number as shown in the table.

* Package Type 2 available, contact Pickering for more details.

Note²: Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

Note³: Capacitance values

The value will depend upon on the mode of connection/guarding of unused terminals. Please contact technical sales for details.

Note⁴: Insulation resistance

Insulation resistance will reduce at higher temperatures. For more information on temperature effects [click here](#), or **contact Pickering** for more in depth guidance.

Dry Relay: Series 104 (Electrostatic Shield) Coil Data and Type Numbers

Device Type	Type Number	Coil (V)	Coil resistance	Max. contact resistance (initial)	Insulation resistance (minimum at 25 °C) (see Note ³)		Capacitance (typical) (see Note ²)	
					Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (ES Shielded) Switch No. 1 (1.5 kV) Package Type 5	104ES-1-A-5/1D	5	150 Ω	0.15 Ω	10 ¹² Ω	10 ¹² Ω	2.5 pF	0.1 pF
	104ES-1-A-12/1D	12	600 Ω					
	104ES-1-A-24/1D	24	2000 Ω					
1 Form A (ES Shielded) Switch No. 2 (2 kV) Package Type 5	104ES-1-A-5/2D	5	150 Ω	0.15 Ω	10 ¹² Ω	10 ¹² Ω	2.5 pF	0.1 pF
	104ES-1-A-12/2D	12	600 Ω					
	104ES-1-A-24/2D	24	2000 Ω					
1 Form A (ES Shielded) Switch No. 3 (3 kV) Package Type 5	104ES-1-A-5/3D	5	50 Ω	0.15 Ω	10 ¹² Ω	10 ¹² Ω	2.5 pF	0.1 pF
	104ES-1-A-12/3D	12	400 Ω					
	104ES-1-A-24/3D	24	1200 Ω					

When an internal diode is required, the suffix D is added to the part number as shown in the table.

Dry Relay: Series 104 (High Temperature) Coil Data and Type Numbers

Device Type	Type Number	Coil (V)	Coil resistance	Max. contact resistance (initial)	Insulation resistance (minimum at 25 °C) (see Note ³)		Capacitance (typical) (see Note ²)	
					Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (HT High Temp) Switch No. 1 (1.5 kV) Package Type 1	104HT-1-A-5/1D	5	300 Ω	0.15 Ω	10 ¹² Ω	10 ¹² Ω	2.5 pF	0.1 pF
	104HT-1-A-12/1D	12	750 Ω					
	104HT-1-A-24/1D	24	3000 Ω					
1 Form A (HT High Temp) Switch No. 2 (2 kV) Package Type 1	104HT-1-A-5/2D	5	300 Ω	0.15 Ω	10 ¹² Ω	10 ¹² Ω	2.5 pF	0.1 pF
	104HT-1-A-12/2D	12	750 Ω					
	104HT-1-A-24/2D	24	3000 Ω					
1 Form A (HT High Temp) Switch No. 3 (3 kV) Package Type 2	104HT-1-A-5/3D	5	125 Ω	0.15 Ω	10 ¹² Ω	10 ¹² Ω	2.5 pF	0.1 pF
	104HT-1-A-12/3D	12	500 Ω					
	104HT-1-A-24/3D	24	2500 Ω					
1 Form A (HT High Temp) Switch No. 4 (4 kV) Package Type 2	104HT-1-A-5/4D	5	125 Ω	0.15 Ω	10 ¹² Ω	10 ¹² Ω	2.5 pF	0.1 pF
	104HT-1-A-12/4D	12	500 Ω					
	104HT-1-A-24/4D	24	2500 Ω					
1 Form A (HT High Temp) Switch No. 5 (5 kV) Package Type 6	104HT-1-A-5/5D	5	125 Ω	0.15 Ω	10 ¹² Ω	10 ¹² Ω	2.5 pF	0.1 pF
	104HT-1-A-12/5D	12	500 Ω					
	104HT-1-A-24/5D	24	2500 Ω					

When an internal diode is required, the suffix D is added to the part number as shown in the table.

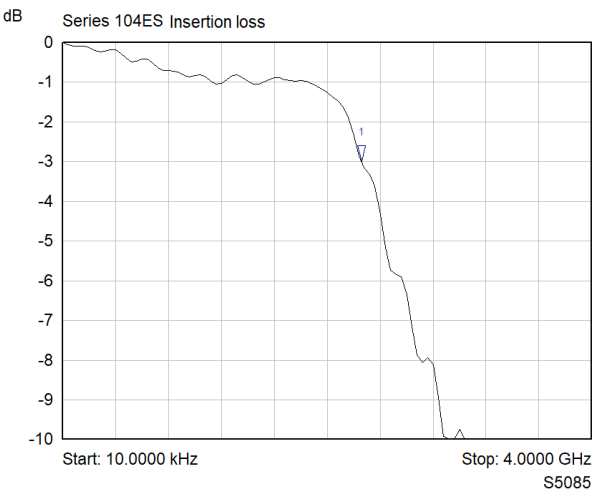
Note²: Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

Note³: Insulation resistance

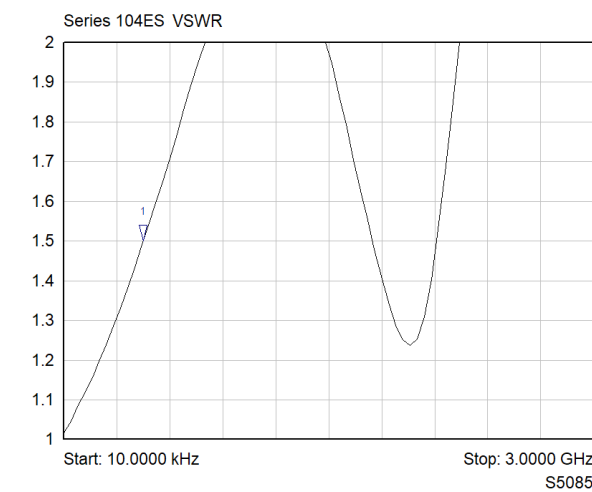
Insulation resistance will reduce at higher temperatures. For more information on temperature effects [click here](#), or [contact Pickering](#) for more in depth guidance.

RF Plots for the 104ES Reed Relay



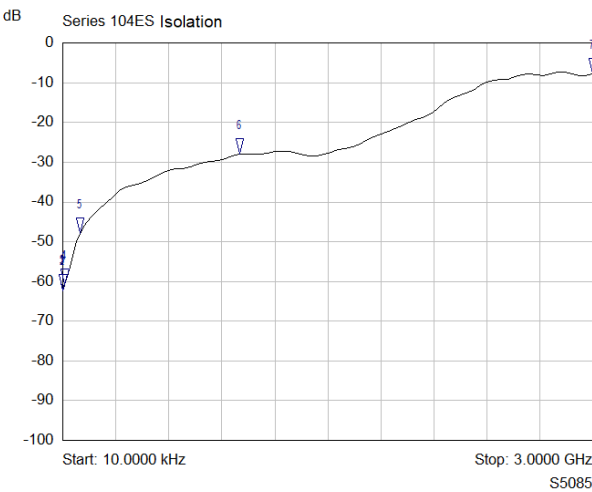
Mkr	Trace	X-Axis	Value
1 ▾	Series 104ES	2.2594 GHz	-3.00 dB

104ES Typical Insertion Loss Plot



Mkr	Trace	X-Axis	Value
1 ▾	Series 104ES	450.1271 MHz	1.50

104ES Typical VSWR Plot



Mkr	Trace	X-Axis	Value
1 ▾	Series 104ES	10.0000 kHz	-62.29 dB
2 ▾	Series 104ES	100.0000 kHz	-62.28 dB
3 ▾	Series 104ES	1.0000 MHz	-62.15 dB
4 ▾	Series 104ES	10.0000 MHz	-60.86 dB
5 ▾	Series 104ES	100.0000 MHz	-47.95 dB
6 ▾	Series 104ES	1.0000 GHz	-28.04 dB
7 ▾	Series 104ES	3.0000 GHz	-7.83 dB

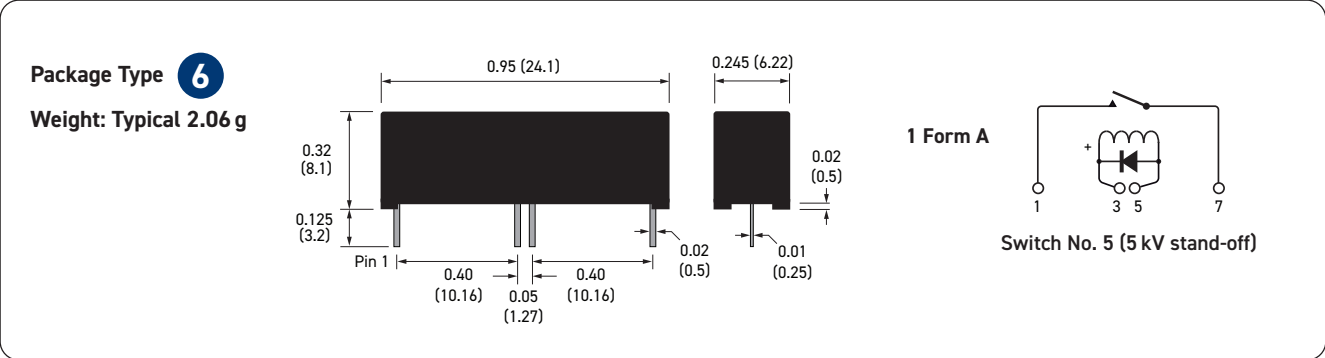
104ES Typical Isolation Plot

Pin Configuration, Weights and Dimensional Data (dimensions in inches, millimeters in brackets)

Package Type 1 Weight: Typical 2.06 g		1 Form A <p>Switch No. 1 (1.5 kV stand-off) Switch No. 2 (2 kV stand-off)</p>
Package Type 2 Weight: Typical 2.06 g		1 Form A <p>Switch No. 3 (3 kV stand-off) Switch No. 4 (4 kV stand-off) Additional Build Options: Switch No. 1 (1.5 kV stand-off) Switch No. 2 (2 kV stand-off) Switch No. 5 (5 kV stand-off)</p>
Package Type 3 Weight: Typical 3.75 g		1 Form B (see Note) <p>Switch No. 1 (1.5 kV stand-off) Switch No. 2 (2 kV stand-off)</p>
Package Type 4 Weight: Typical 3.70 g		2 Form A <p>Switch No. 1 (1.5 kV stand-off) Switch No. 2 (2 kV stand-off)</p>
Package Type 5 Weight: Typical 1.94 g		1 Form A Coaxial <p>Switch No. 1 (1.5 kV stand-off) Switch No. 2 (2 kV stand-off) Switch No. 3 (3 kV stand-off)</p>

Important: Where the optional internal diode is fitted or for all Form B types, the correct coil polarity must be observed, as shown by the + symbol on the schematics.

Pin Configuration, Weights and Dimensional Data Continued (dimensions in inches, millimeters in brackets)



Important: Where the optional internal diode is fitted, the correct coil polarity must be observed, as shown by the + symbol on the schematic.

The technical information shown in this data sheet could contain inaccuracies or typographical errors. This information may be periodically changed or updated and these changes will be included in future versions of this data sheet.

For different values, latest specifications and product details, please contact your local Pickering sales office.






For **FREE** evaluation samples go to: [pickeringrelay.com/samples](https://www.pickeringrelay.com/samples)

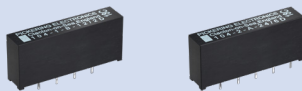
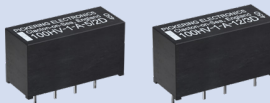
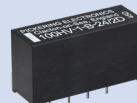
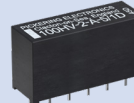
Mercury Relays


Mercury relays no longer form part of our standard range due to ROHS guidelines, although some exceptions may apply. For more information please visit [pickeringrelay.com/mercuryreedrelays](https://www.pickeringrelay.com/mercuryreedrelays), email techsales@pickeringrelay.com, or call +44 (0) 1255 428141.

Similar Relays Comparison

If the Series 104 is unsuitable for your application, Pickering also manufactures four other series of reed relays with similar characteristics, but in different package sizes.

Series Name		131-1-A	119-1-A			119-2-A	119-1-B		104-1-A & 104HT-1-A					104ES-1-A			
Physical Outline																	
Depth	mm (inches)	3.7 (0.145)	3.7 (0.145)					6.3 (0.245)									
Width		12.5 (0.49)	15.1 (0.595)		20.1 (0.79)		15.1 (0.595)		24.1 (0.95)								
Height		6.6 (0.26)	6.6 (0.26)		8.9 (0.35)		8.9 (0.35)		8.2 (0.32)								
Package Volume (mm³)		306	369		491	662		498		❶ & ❷ 1245		❷ 1245		❹ 1245		❺ 1245	
Typical Weights (g)		0.58	0.67		0.74	1.06		0.89		2.06		2.06		2.06		1.94	
Contact Configuration		1-A (SPST)	1-A (SPST)			2-A (DPST)		1-B (SPNC)		1-A (SPST)					1-A (SPST)		
Reed Switch Type		Dry	Dry	Dry	Dry	Dry		Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Stand-off Voltage (V)		1500	1500	2000	3000	1500		1500	2000	1500	2000	3000	4000	5000	1500	2000	3000
Switching Voltage (V)		1000	1000					1000			1000 (1500)			1000	1000	1000	
Switching Current (A)		0.7	0.7					1			1			1	1	1	
Carry Current (A)		1.25	1.25					1.5			1.5			1.5	1.5	1.5	
Switch Power (W)		10	10					25			25 (3)			25	25	25	

Series Name		104-1-B		104-2-A		100HV-1-A			100HV-1-B		100HV-2-A	
Physical Outline												
Depth	mm (inches)	6.3 (0.245)				10.2 (0.40)			10.2 (0.40)		10.2 (0.40)	
Width		29 (1.14)				24.1 (0.95)			29 (1.14)		29 (1.14)	
Height		12.5 (0.49)				12.7 (0.50)			15.2 (0.60)		15.2 (0.60)	
Package Volume (mm³)		3 2284		4 2284		3122		3122	4496		4496	
Typical Weights (g)		3.75		3.7		6.99			8.75		8.75	
Contact Configuration		1-B (SPNC)		2-A (DPST)		1-A (SPST)			1-B (SPNC)		2-A (DPST)	
Reed Switch Type		Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Stand-off Voltage (V)		1500	2000	1500	2000	1500	2000	3000	1500	2000	1500	2000
Switching Voltage (V)		1000		1000		1000			1000		1000	
Switching Current (A)		1		1		1			1		1	
Carry Current (A)		1.5		1.5		1.5			1.5		1.5	
Switch Power (W)		25		25		25			25		25	

Series Name		219-1-A			219-2-A		219-1-B	
Physical Outline								
Depth	mm (inches)	10.5 (0.42) Body, 13.8 (0.55) Across Legs						
Width		17.2 (0.677)						
Height		8.5 (0.34)						
Package Volume (mm³)		1535			1535		1535	
Typical Weights (g)		2.12			2.39		2.19	
Contact Configuration		1-A (SPST)			2-A (DPST)		1-B (SPNC)	
Reed Switch Type		Dry	Dry	Dry	Dry		Dry	Dry
Stand-off Voltage (V)		1500	2000	3000	1500		1500	2000
Switching Voltage (V)		1000						
Switching Current (A)		0.7						
Carry Current (A)		1.25						
Switch Power (W)		10						

Reed Relay Selection Tool

Because Pickering offer the largest range of high-quality reed relays, sometimes it can be difficult to find the right reed relay you require. That is why we created the Reed Relay Selector, this tool will help you narrow down our offering to get you the correct reed relay for your application. To try the tool today go to: pickeringrelay.com/reed-relay-selector-tool

Standard Build Options

The Series 104 Reed Relays are available with a number of standard build options to tailor them to your specific application. These options are detailed in the table below. If you decide to go ahead and specify one, or more, of these options you will be allocated a unique part number suffix.

Mechanical Build Options	Electrical Build Options
Special pin configurations or pin lengths	Different coil resistance
Special print with customer's own part number or logo	Different stand-off or switching voltage
Custom packaging possibility	Operate or de-operate time
Equivalents to competitors discontinued parts	Pulse capability
	Enhanced specifications
	Equivalents to competitors discontinued parts
	Non-standard coil voltages and resistance figures
	Special Life testing under customer's specific load conditions
	Specific environmental requirements
	Controlled thermal EMF possibility

Customization

If your specific requirements are not met by standard relay, or any of the standard build options, please speak to us to discuss producing a customized reed relay to service your specific application: pickeringrelay.com/contact

3D Models

Interactive 3D models of the complete range of Pickering relay products in STEP, IGS and SLDPRT formats can be downloaded from the website: pickeringrelay.com/3d-models

Part Number Description: 104 ES - 1 - A - 5 / 2 D - xxx

Series _____
 ES Shielded or HT (High Temp) _____
 (omit if not required)
 Number of reeds _____
 Switch form _____
 Coil voltage _____
 Switch number (see table on page 2) _____
 Diode if fitted (omit if not required) _____
 Unique suffix (if standard build option selected) _____

Help

If you need any technical advice or other help, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

Contact Us

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Nordic - email: ndsales@pickeringtest.com | Tel. +46 340 69 06 69


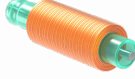
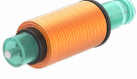
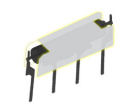
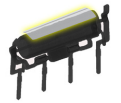


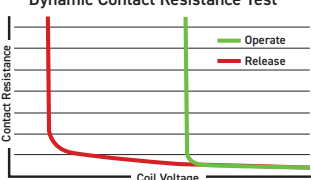

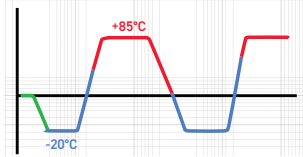



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For a full list of agents, distributors and representatives visit: pickeringrelay.com/agents



10 Key Benefits of Pickering Reed Relays

Key Benefit	Pickering Reed Relays	Typical Industry Reed Relays	
1 Instrumentation Grade Reed Switches	Instrumentation Grade Reed Switches with vacuum sputtered Ruthenium plating to ensure stable, long life up to 5x10E9 operations.	Often low grade Reed Switches with electroplated Rhodium plating resulting in higher, less stable contact resistance.	
2 Formerless Coil Construction	Formerless coil construction increases the coil winding volume, maximizing magnetic efficiency, allowing the use of less sensitive reed switches resulting in optimal switching action and extended lifetime at operational extremes.	Use of bobbins decreases the coil winding volume, resulting in having less magnetic drive and a need to use more sensitive reed switches which are inherently less stable with greatly reduced restoring forces.	  Pickering former-less coil Typical industry coil wound on bobbin
3 Magnetic Screening	Mu-metal magnetic screening (either external or internal), enables ultra-high PCB side-by-side packing densities with minimal magnetic interaction, saving significant cost and space. Pickering Mu-Metal magnetic screen - interaction approx. 5%	Lower cost reed relays have minimal or no magnetic screening, resulting in magnetic interaction issues causing changes in operating and release voltages, timing and contact resistance, causing switches to not operate at their nominal voltages. Typical industry screen - interaction approx. 30%	  X-Ray of Pickering mu-metal magnetic screen X-Ray of typical industry magnetic screen
4 SoftCenter™ Technology	SoftCenter™ technology, provides maximum cushioned protection of the reed switch, minimising internal lifetime stresses and extending the working life and contact stability.	Transfer moulded reed relays (produced using high temperature/pressure), result in significant stresses to the glass reed switch which can cause the switch blades to deflect or misalign leading to changes in the operating characteristics, contact resistance stability and operating lifetime.	  Pickering soft center protection of the reed switch Typical industry thermo-setting hard moulded protection of the reed switch
5 100% Dynamic Testing	100% testing for all operating parameters including dynamic contact wave-shape analysis with full data scrutiny to maintain consistency.	Simple dc testing or just batch testing which may result in non-operational devices being supplied.	Dynamic Contact Resistance Test 
6 100% Inspection at Every Stage of Manufacturing	Inspection at every stage of manufacturing maintaining high levels of quality.	Often limited batch inspection.	
7 100% Thermal Cycling	Stress testing of the manufacturing processes, from -20 °C to +85 °C to -20 °C, repeated 3 times.	Rarely included resulting in field failures.	
8 Flexible Manufacturing Process	Flexible manufacturing processes allow quick-turn manufacturing of small batches.	Mass production: Usually large batch sizes and with no quick-turn manufacturing.	
9 Custom Reed Relays	Our reed relays can be customized easily, e.g. special pin configurations, enhanced specifications, non-standard coil or resistance figures, special life testing, low capacitance, and more.	Limited ability to customize.	
10 Product Longevity	Pickering are committed to product longevity; our reed relays are manufactured and supported for more than 25 years from introduction, typically much longer.	Most other manufacturers discontinue parts when they reach a low sales threshold; costing purchasing and R&D a great deal of unnecessary time and money to redesign and maintain supply.	

For more information go to: pickeringrelay.com/10-key-benefits

N-channel 800 V, 0.55 Ω typ., 8 A MDmesh™ K5 Power MOSFET in a D²PAK package

Datasheet - production data

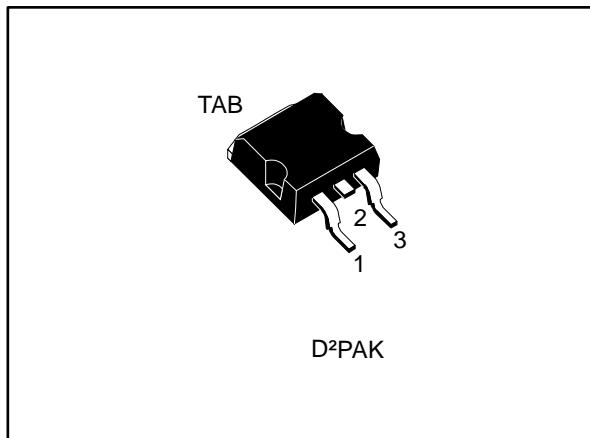
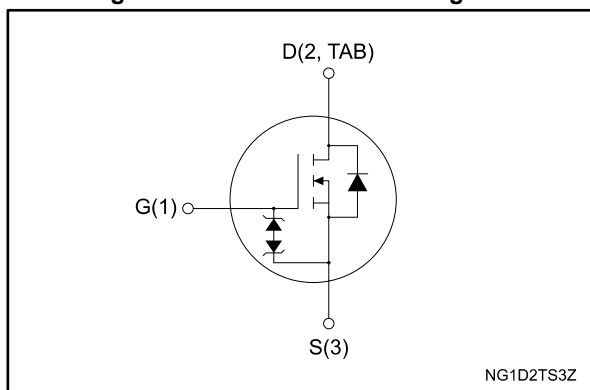


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
STB10LN80K5	800 V	0.63 Ω	8 A

- Industry's lowest R_{DS(on)} x area
- Industry's best figure of merit (FoM)
- Ultra-low gate charge
- 100% avalanche tested
- Zener-protected

Applications

- Switching applications

Description

This very high voltage N-channel Power MOSFET is designed using MDmesh™ K5 technology based on an innovative proprietary vertical structure. The result is a dramatic reduction in on-resistance and ultra-low gate charge for applications requiring superior power density and high efficiency.

Table 1: Device summary

Order code	Marking	Package	Packing
STB10LN80K5	10LN80K5	D ² PAK	Tape and reel

Contents

1	Electrical ratings	3
2	Electrical characteristics	4
	2.2 Electrical characteristics (curves)	6
3	Test circuits	9
4	Package information	10
	4.1 D2PAK package information	10
	4.2 Packing information.....	13
5	Revision history	15

1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	± 30	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$	8	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	5	A
$I_D^{(1)}$	Drain current (pulsed)	32	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	110	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	4.5	V/ns
$dv/dt^{(3)}$	MOSFET dv/dt ruggedness	50	
T_j	Operating junction temperature range	- 55 to 150	$^{\circ}\text{C}$
T_{stg}	Storage temperature range		

Notes:

⁽¹⁾ Pulse width limited by safe operating area.

⁽²⁾ $I_{SD} \leq 8\text{ A}$, $di/dt \leq 100\text{ A}/\mu\text{s}$; $V_{DS\text{ peak}} < V_{(BR)DSS}$

⁽³⁾ $V_{DS} \leq 640\text{ V}$

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	1.14	$^{\circ}\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	35	$^{\circ}\text{C}/\text{W}$

Notes:

⁽¹⁾ When mounted on FR-4 board of 1 inch², 2 oz Cu

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by T_{jmax})	2.7	A
E_{AS}	Single pulse avalanche energy (starting $T_j = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	240	mJ

2 Electrical characteristics

$T_C = 25^\circ\text{C}$ unless otherwise specified

Table 5: On/off-state

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$	800			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 800\text{ V}$			1	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 800\text{ V}$ $T_C = 125^\circ\text{C}$			50	μA
I_{GSS}	Gate body leakage current	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 20\text{ V}$			± 10	μA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 100\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 4\text{ A}$		0.55	0.63	Ω

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	427	-	pF
C_{oss}	Output capacitance		-	43	-	pF
C_{rss}	Reverse transfer capacitance		-	0.25	-	pF
$C_{o(tr)}^{(1)}$	Equivalent capacitance time related	$V_{DS} = 0\text{ to }640\text{ V}$, $V_{GS} = 0\text{ V}$	-	72	-	pF
$C_{o(er)}^{(2)}$	Equivalent capacitance energy related			27	-	pF
R_g	Intrinsic gate resistance	$f = 1\text{ MHz}$, $I_D = 0\text{ A}$	-	7	-	Ω
Q_g	Total gate charge	$V_{DD} = 640\text{ V}$, $I_D = 8\text{ A}$ $V_{GS} = 10\text{ V}$ See Figure 16: "Test circuit for gate charge behavior"	-	15	-	nC
Q_{gs}	Gate-source charge		-	4.2	-	nC
Q_{gd}	Gate-drain charge		-	9	-	nC

Notes:

⁽¹⁾Time related is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}

⁽²⁾Energy related is defined as a constant equivalent capacitance giving the same stored energy as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}

Table 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 400\text{ V}$, $I_D = 4\text{ A}$, $R_G = 4.7\text{ }\Omega$ $V_{GS} = 10\text{ V}$	-	11.8	-	ns
t_r	Rise time		-	10	-	ns
$t_{d(off)}$	Turn-off delay time	See Figure 15: "Test circuit for resistive load switching times" and Figure 20: "Switching time waveform"	-	28	-	ns
t_f	Fall time		-	13	-	ns

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		8	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		32	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 8 \text{ A}$, $V_{GS} = 0 \text{ V}$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 8 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$, $V_{DD} = 60 \text{ V}$ See Figure 17: "Test circuit for inductive load switching and diode recovery times"	-	350		ns
Q_{rr}	Reverse recovery charge		-	3.9		μC
I_{RRM}	Reverse recovery current		-	22.5		A
t_{rr}	Reverse recovery time	$I_{SD} = 8 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$, $V_{DD} = 60 \text{ V}$, $T_j = 150 \text{ }^\circ\text{C}$ See Figure 17: "Test circuit for inductive load switching and diode recovery times"	-	505		ns
Q_{rr}	Reverse recovery charge		-	5		μC
I_{RRM}	Reverse recovery current		-	20		A

Notes:⁽¹⁾ Pulse width limited by safe operating area⁽²⁾ Pulsed: pulse duration = 300 μs , duty cycle 1.5%

Table 9: Gate-source Zener diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)GSO}$	Gate-source breakdown voltage	$I_{GS} = \pm 1 \text{ mA}$, $I_D = 0 \text{ A}$	30	-	-	V

The built-in back-to-back Zener diodes are specifically designed to enhance the ESD performance of the device. The Zener voltage facilitates efficient and cost-effective device integrity protection, thus eliminating the need for additional external componentry.

2.2 Electrical characteristics (curves)

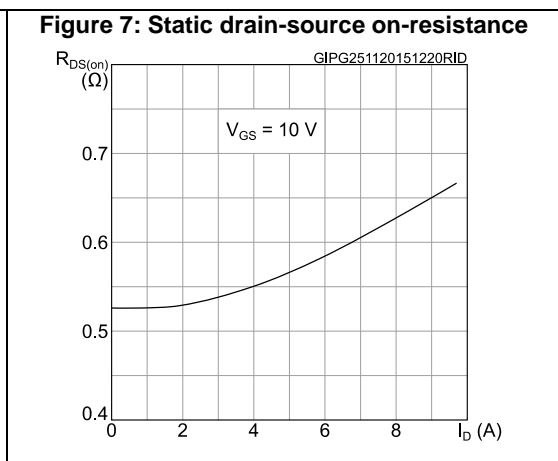
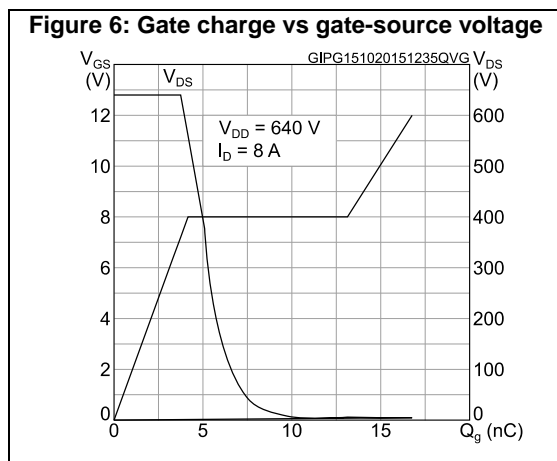
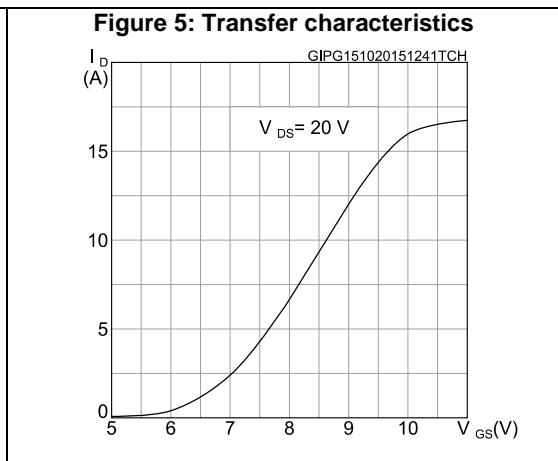
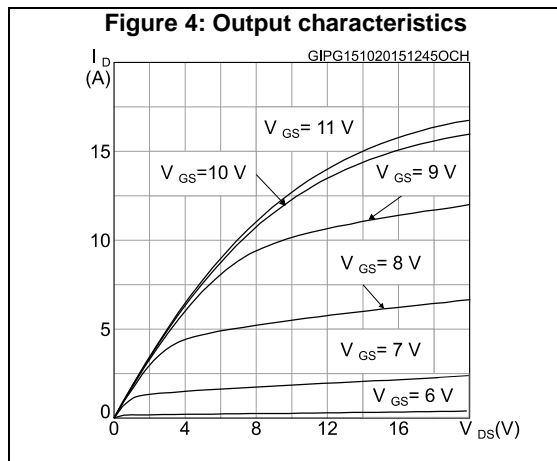
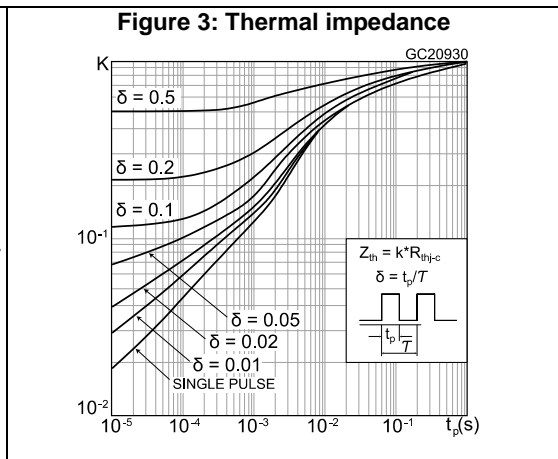
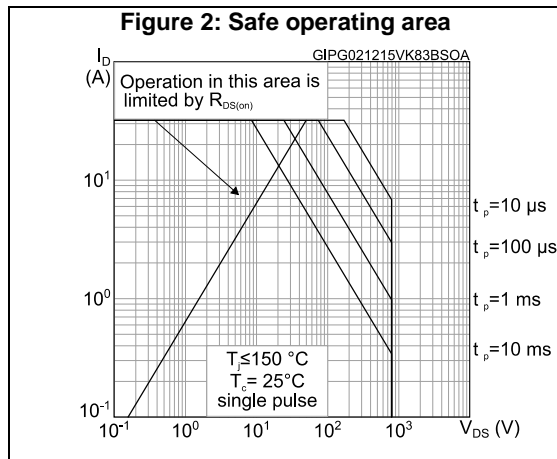


Figure 8: Capacitance variations

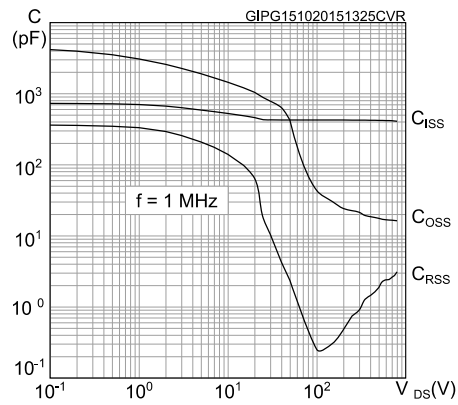


Figure 9: Normalized gate threshold voltage vs temperature

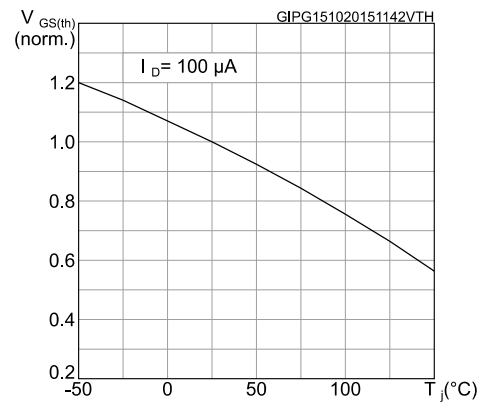


Figure 10: Normalized on-resistance vs temperature

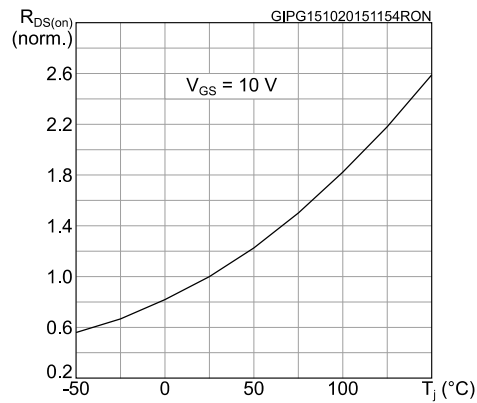
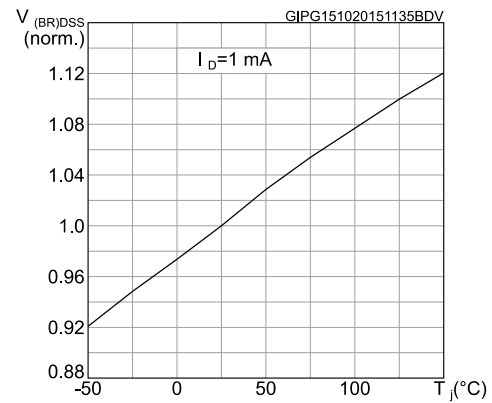
Figure 11: Normalized $V_{(BR)DSS}$ vs temperature

Figure 12: Output capacitance stored energy

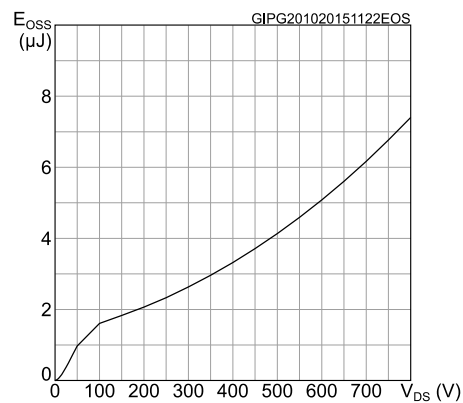


Figure 13: Source-drain diode forward characteristics

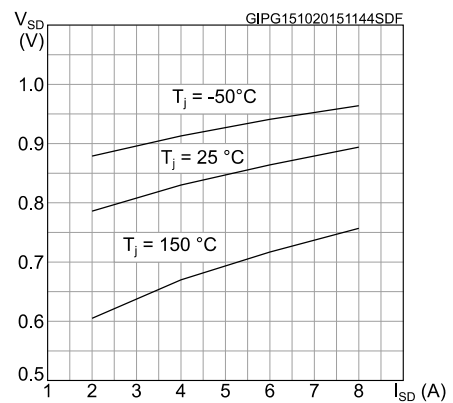
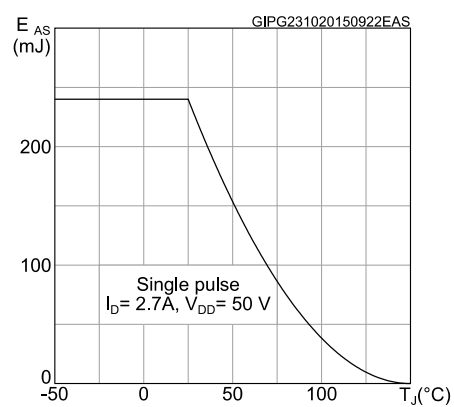
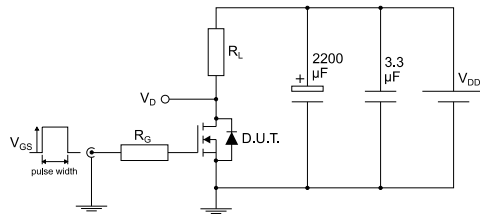


Figure 14: Maximum avalanche energy vs starting T_J 

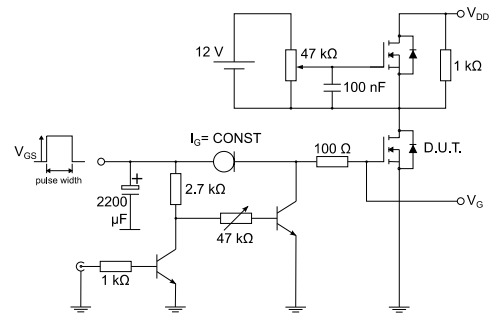
3 Test circuits

Figure 15: Test circuit for resistive load switching times



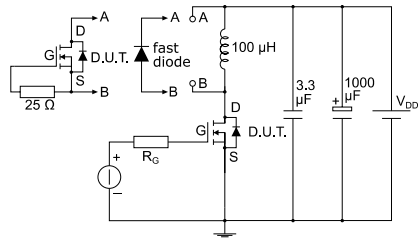
AM01468v1

Figure 16: Test circuit for gate charge behavior



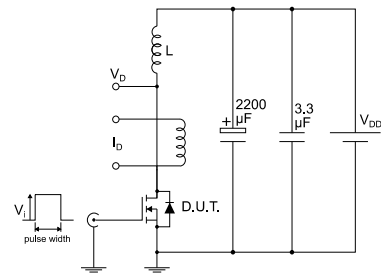
AM01469v1

Figure 17: Test circuit for inductive load switching and diode recovery times



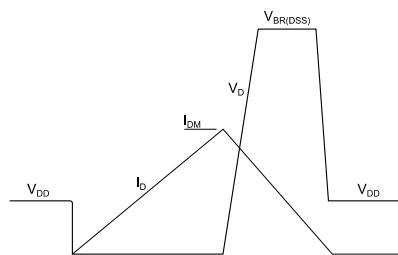
AM01470v1

Figure 18: Unclamped inductive load test circuit



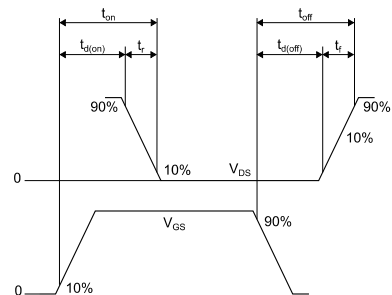
AM01471v1

Figure 19: Unclamped inductive waveform



AM01472v1

Figure 20: Switching time waveform



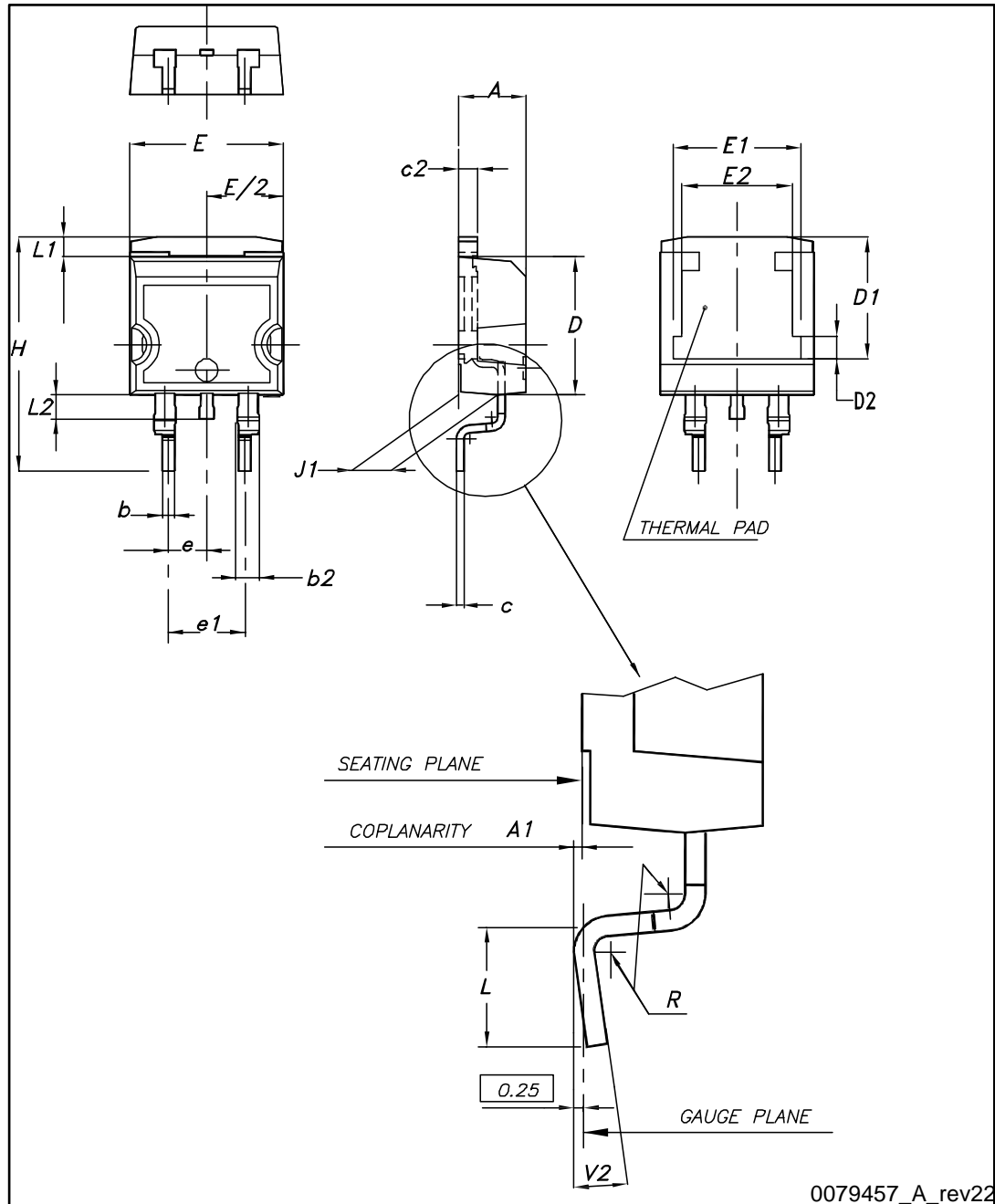
AM01473v1

4 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

4.1 D²PAK package information

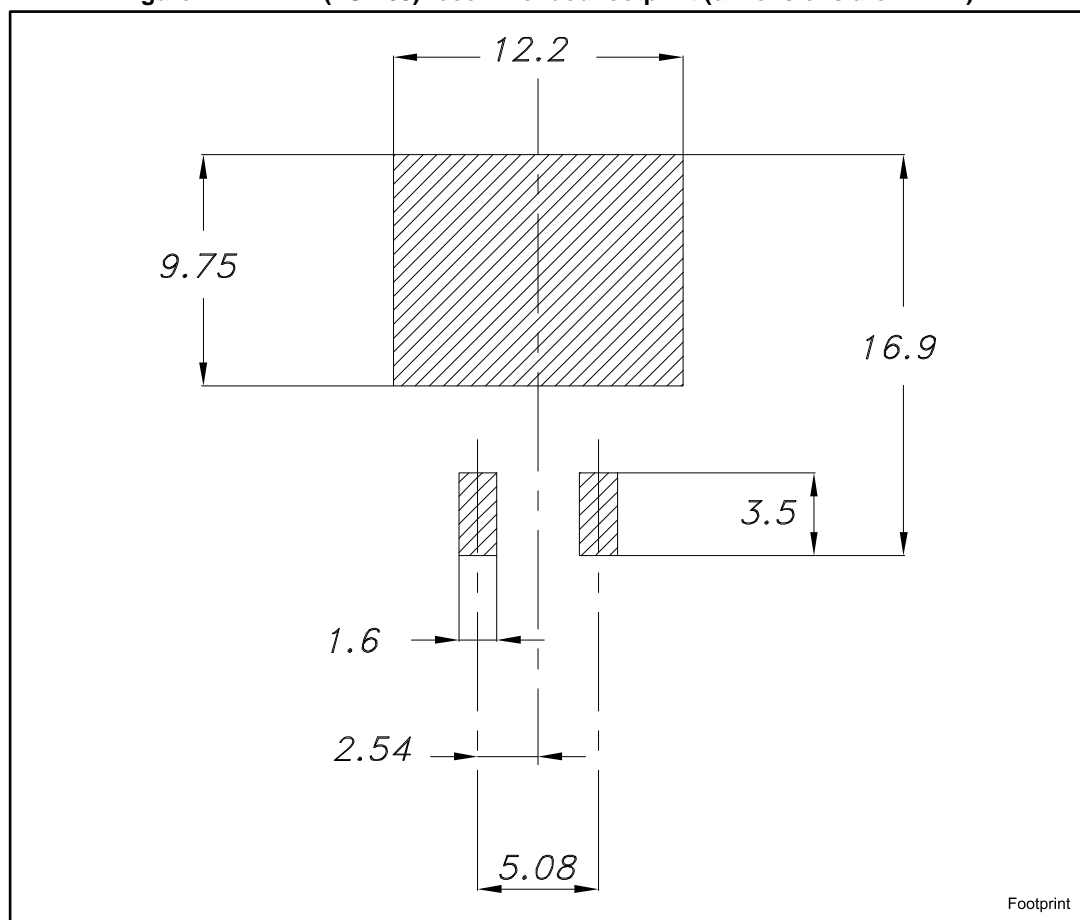
Figure 21: D²PAK (TO-263) type A package outline



0079457_A_rev22

Table 10: D²PAK (TO-263) type A package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50	7.75	8.00
D2	1.10	1.30	1.50
E	10		10.40
E1	8.50	8.70	8.90
E2	6.85	7.05	7.25
e		2.54	
e1	4.88		5.28
H	15		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.4	
V2	0°		8°

Figure 22: D²PAK (TO-263) recommended footprint (dimensions are in mm)

4.2 Packing information

Figure 23: Tape outline

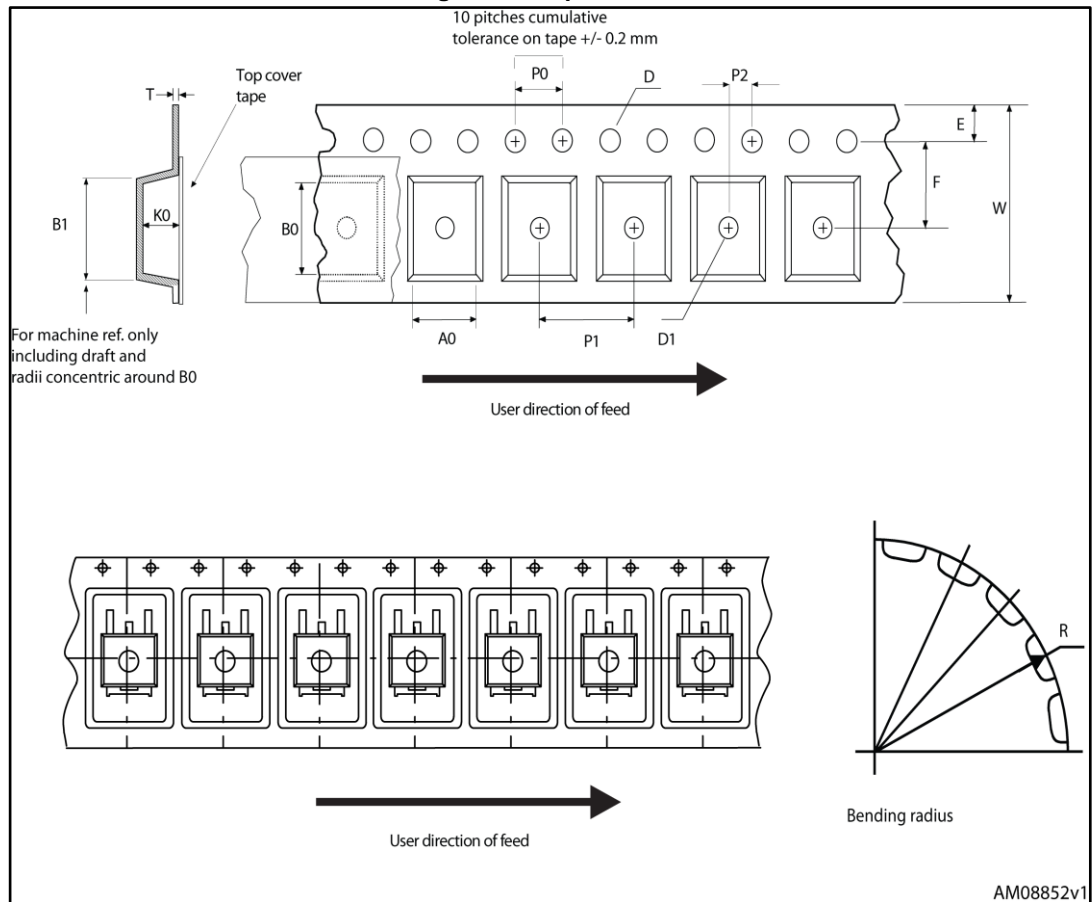
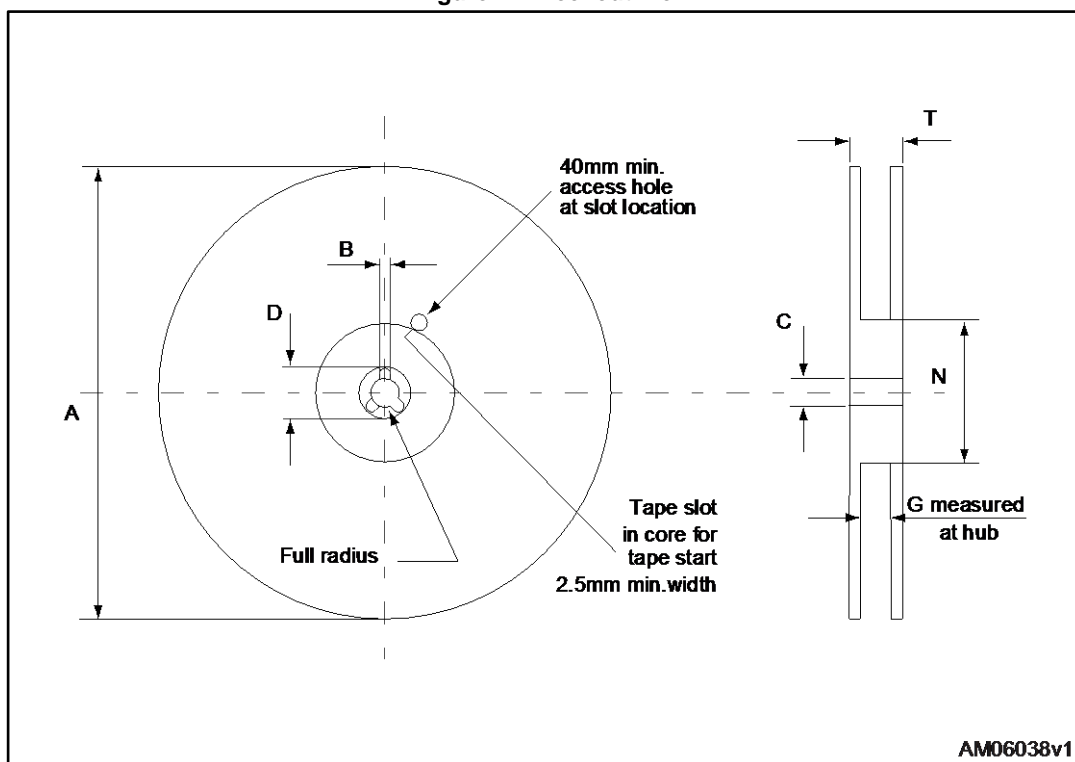


Figure 24: Reel outline

Table 11: D²PAK tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	10.5	10.7	A		330
B0	15.7	15.9	B	1.5	
D	1.5	1.6	C	12.8	13.2
D1	1.59	1.61	D	20.2	
E	1.65	1.85	G	24.4	26.4
F	11.4	11.6	N	100	
K0	4.8	5.0	T		30.4
P0	3.9	4.1			
P1	11.9	12.1	Base quantity		1000
P2	1.9	2.1	Bulk quantity		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

5 Revision history

Table 12: Document revision history

Date	Revision	Changes
04-May-2015	1	First release.
08-Feb-2016	2	Modified: Table 2: "Absolute maximum ratings" , Table 3: "Thermal data" , Table 4: "Avalanche characteristics" , Table 5: "On/off-state" , Table 7: "Switching times" and Table 8: "Source-drain diode" Added: Section 3.1: "Electrical characteristics (curves)" Datasheet promoted from preliminary data to production data Minor text changes

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Microelectronic Power IC

HEXFET® Power MOSFET Photovoltaic Relay
Single-Pole, Normally-Open, 0-60V, 2.0A AC / 4.0A DC

General Description

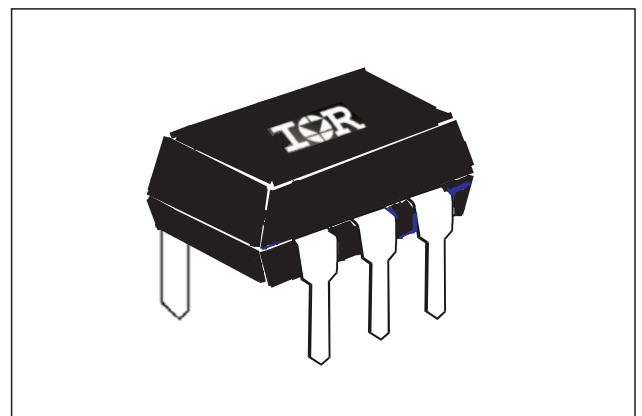
The PVG612A Series Photovoltaic Relay is a single-pole, normally open solid-state relay that can replace electromechanical relays in many applications. It utilizes International Rectifier's proprietary HEXFET power MOSFET as the output switch, driven by an integrated circuit photovoltaic generator of novel construction. The output switch is controlled by radiation from a GaAlAs light emitting diode (LED) which is optically isolated from the photovoltaic generator.

These units exceed the performance capabilities of electromechanical relays in operating life, sensitivity, stability of on-resistance, miniaturization, insensitivity to magnetic fields and ruggedness. The compact PVG612A is particularly suited for isolated switching of high currents from 12 to 48 Volt AC or DC power sources.

Series PVG612A Relays are packaged in a 6-pin, molded DIP package with either thru-hole or surface mount (gull-wing) terminals. It is available in standard plastic shipping tubes or on tape-and-reel. Please refer to Part Identification information opposite.

Features

- Bounce-free operation
- High load current capacity
- High off-state resistance
- Linear AC/DC operation
- 4,000 V_{RMS} I/O Isolation
- Solid-State reliability
- UL recognized
- ESD Tolerance:
 - 4000V Human Body Model
 - 500V Machine Model



Applications

- Programmable Logic Controllers
- Computers and Peripheral Devices
- Audio Equipment
- Power Supplies and Power Distribution
- Control of Displays and Indicators
- Industrial Automation

Part Identification

PVG612APbF	thru-hole
PVG612ASPbF	surface-mount
PVG612AS-TPbF	surface-mount, tape and reel

(HEXFET is the registered trademark for International Rectifier Power MOSFETs)

Electrical Specifications ($-40^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$ unless otherwise specified)

INPUT CHARACTERISTICS	Limits	Units
Minimum Control Current (see figure 1)	5.0	mA
Maximum Control Current for Off-State Resistance @ $T_A = +25^{\circ}\text{C}$	0.4	mA
Control Current Range (Caution: current limit input LED, see figure 6)	5.0 - 25	mA
Maximum Reverse Voltage (1mA max.)	6.0	V

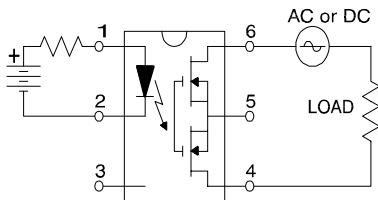
OUTPUT CHARACTERISTICS	Limits	Units
Operating Voltage Range	0 to ± 60	$V_{(\text{DC or AC peak})}$
Maximum Continuous Load Current @ $T_A = +40^{\circ}\text{C}$, 10mA Control (see figure 1)		
A Connection	2.0	A (AC or DC)
B Connection	2.5	A (DC)
C Connection	4.0	A (DC)
Maximum Pulsed Load Current @ $T_A = +25^{\circ}\text{C}$ (100 ms @ 10% Duty Cycle)		
A Connection	7.5	A (AC or DC)
B Connection	8.5	A (DC)
C Connection	15.5	A (DC)
Typical Thermal Resistance (R_{thja} , Junction-to-Ambient)		
A Connection	79.1	$(^{\circ}\text{C/W})$
B Connection	112.2	$(^{\circ}\text{C/W})$
C Connection	81.0	$(^{\circ}\text{C/W})$
Maximum On-State Resistance @ $T_A = +25^{\circ}\text{C}$ For 1A pulsed load, 10mA Control (see figure 4)		
A Connection	100	$\text{m}\Omega$
B Connection	50	$\text{m}\Omega$
C Connection	35	$\text{m}\Omega$
Maximum Off-State Leakage @ 60V, $T_A = +25^{\circ}\text{C}$	1.0	μA
Maximum Turn-On Time @ $T_A = +25^{\circ}\text{C}$ (see figures 7 & 8) For 500mA, 50V _{DC} load, 10mA Control, 10mS pulse width	3.5	ms
Maximum Turn-Off Time @ $T_A = +25^{\circ}\text{C}$ (see figures 7 & 8) For 500mA, 50V _{DC} load, 10mA Control, 10mS pulse width	0.5	ms
Typical Output Capacitance @ V _{dd} =50V, f=1MHz (see figure 2)	105	pF

GENERAL CHARACTERISTICS	Limits	Units
Minimum Dielectric Strength, Input-Output	4000	V_{RMS}
Minimum Insulation Resistance, Input-Output, @ $T_A = +25^{\circ}\text{C}$, 50%RH, 100V _{DC}	10^{12}	Ω
Maximum Capacitance, Input-Output	1.0	pF
Maximum Pin Soldering Temperature (10 seconds maximum)	+260	
Ambient Temperature Range:		$^{\circ}\text{C}$
Operating	-40 to +85	
Storage	-40 to +100	

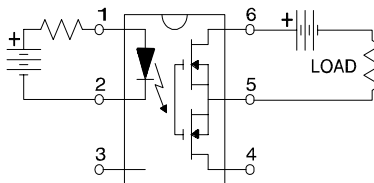
International Rectifier does not recommend the use of this product in aerospace, avionics, military or life support applications. Users of this International Rectifier product in such applications assume all risks of such use and indemnify International Rectifier against all damages resulting from such use.

Connection Diagrams

"A" Connection



"B" Connection



"C" Connection

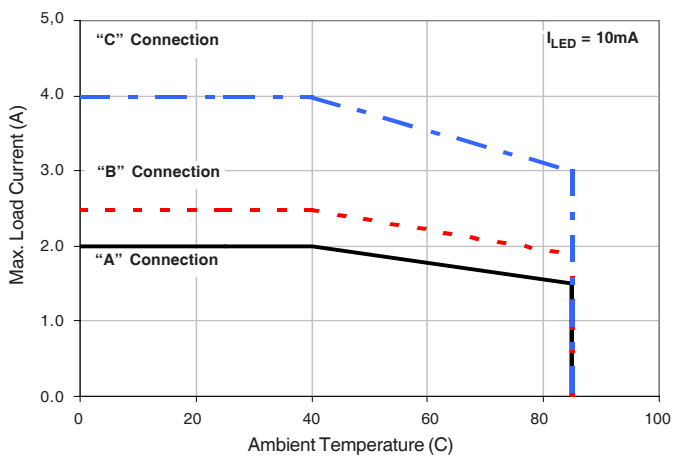
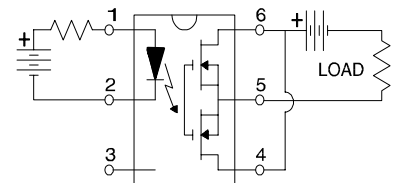


Figure 1. Current Derating Curves

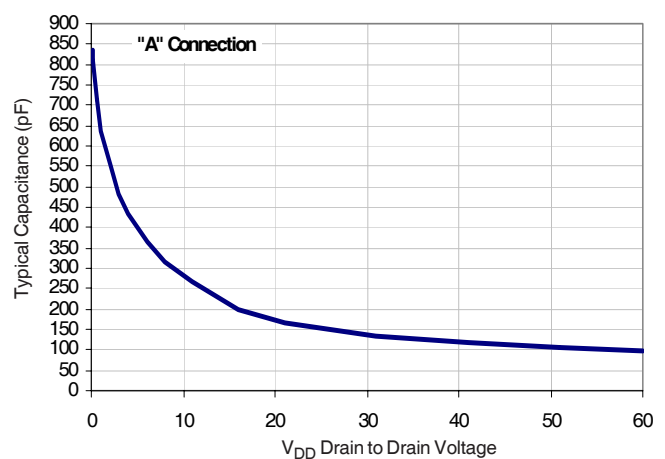


Figure 2. Typical Output Capacitance

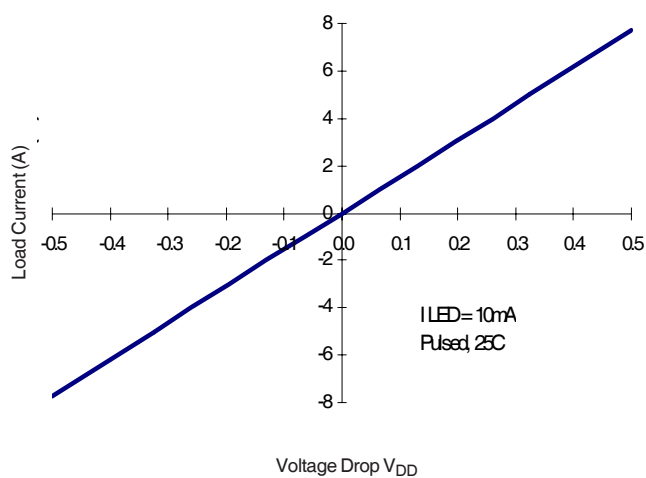


Figure 3. Typical Linearity Characteristics

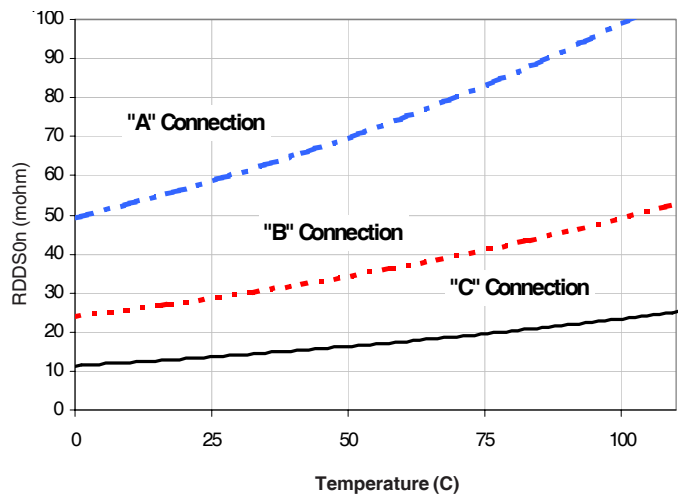


Figure 4. Typical Normalized On-Resistance

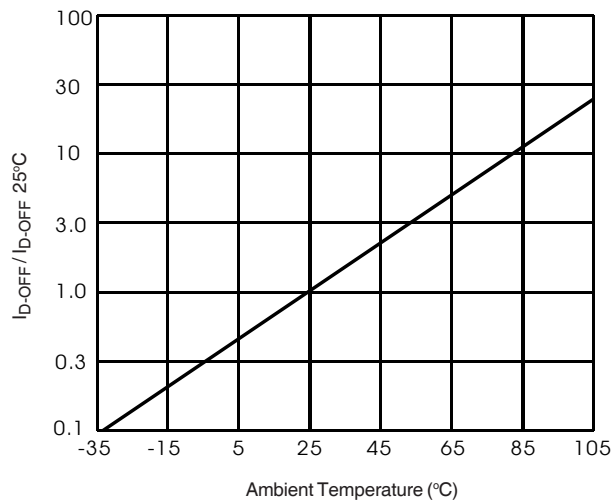


Figure 5. Typical Normalized Off-State Leakage

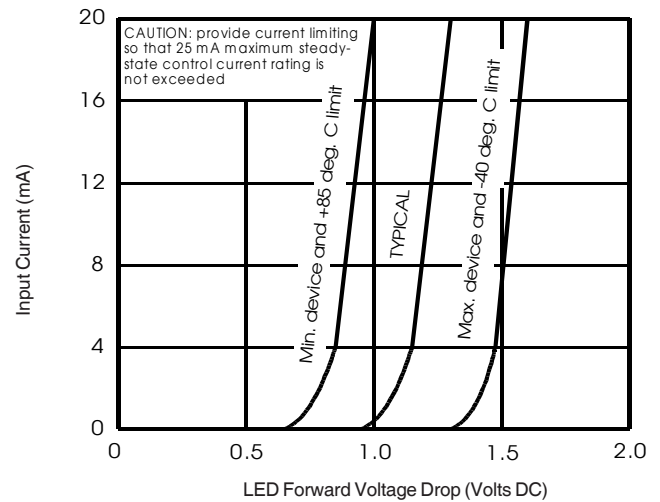


Figure 6. Input Characteristics (Current Controlled)

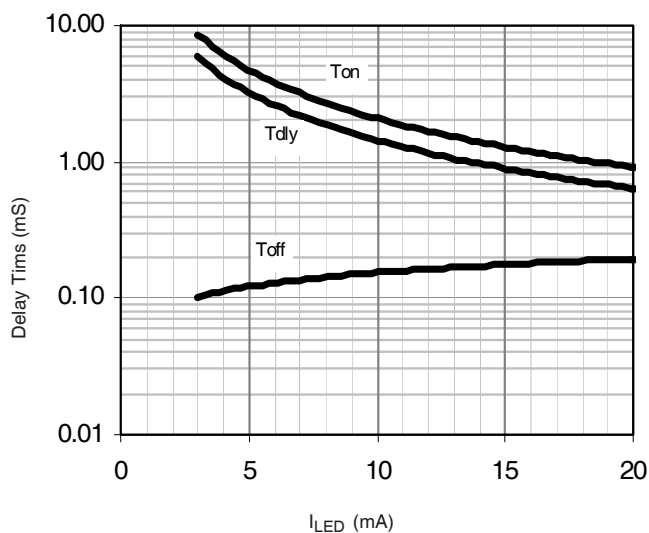


Figure 7. Typical Delay Times

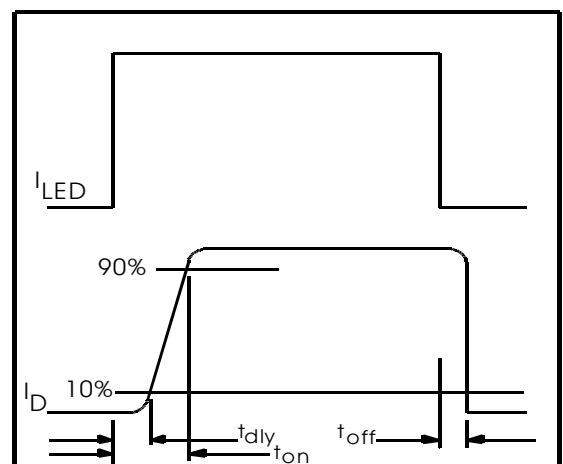
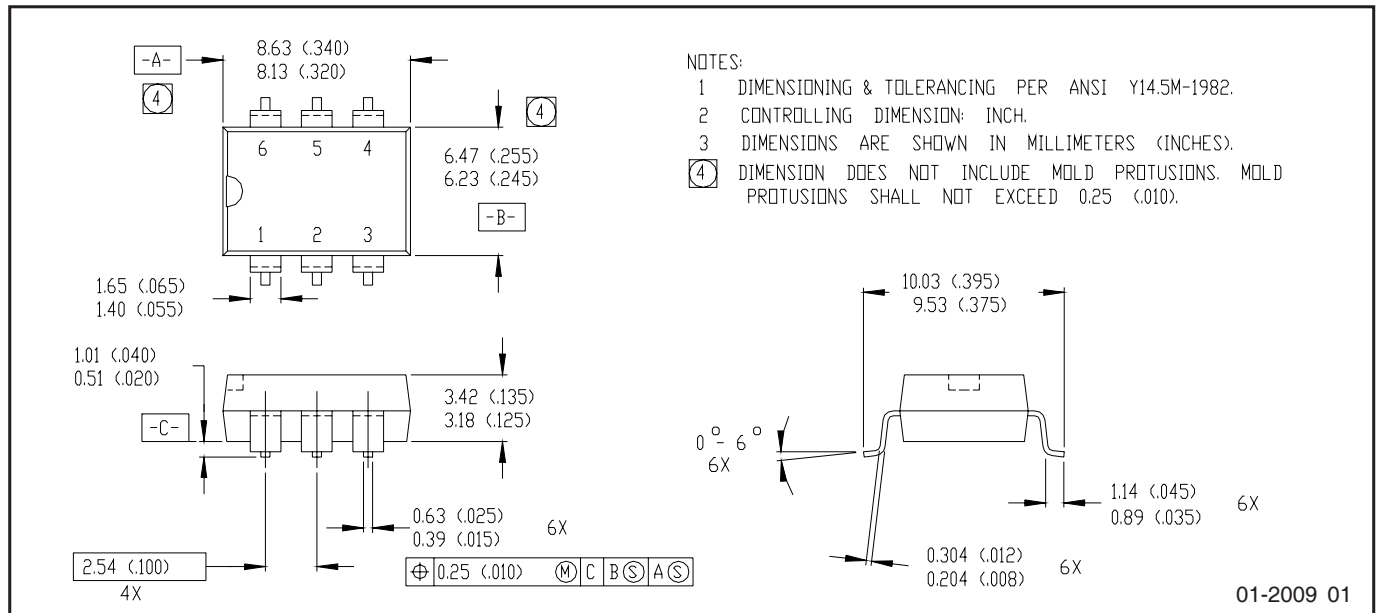
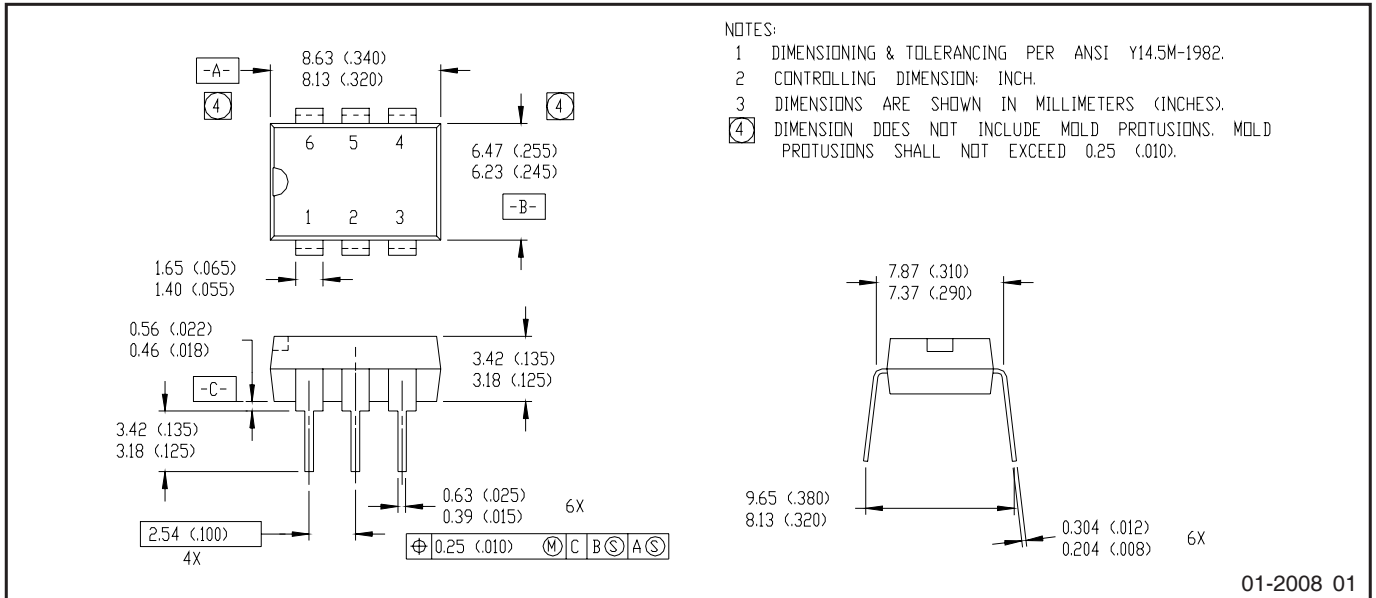


Figure 8. Delay Time Definitions

Case Outlines



Note: For the most current drawing please refer to IR website at: <http://www.irf.com/package/>

Qualification information[†]

Qualification level	Industrial (per JEDEC JESD47I ^{††} guidelines)	
Moisture Sensitivity Level	PVG612APbF	N/A
	PVG612ASPbF	MSL4
	PVG612AS-TPbF	(per JEDEC J-STD-020E & JEDEC J-STD-033C ^{††})
RoHS compliant	Yes	

[†] Qualification standards can be found at International Rectifier's web site: <http://www.irf.com/product-info/reliability>

^{††} Applicable version of JEDEC standard at the time of product release

Revision History

Date	Comments
5/4/2015	<ul style="list-style-type: none"> Added Qualification Information Table on page 6 Updated data sheet with new IR corporate template

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IR WORLD HEADQUARTERS: 101 N. Sepulveda Blvd., El Segundo, California 90245, USA

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ESMIT-4180/C CBM5D33



Description

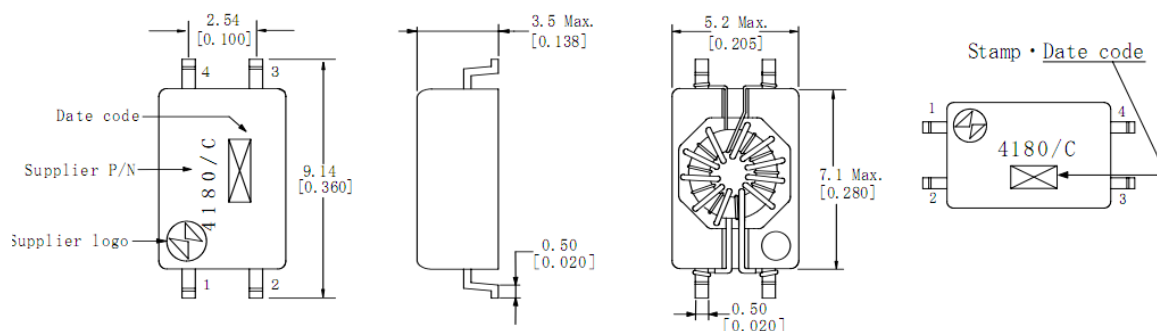
- Reference Design in Freescale HV/EV Battery Management
- Low Profile
- Qualified to AEC-Q200
- High Voltage Isolation 3750Vrms
- Operating Temperature: -40°C to +105°C
- Optimize Core Material for low temperature operation
- For BMS – low voltage applications <less than 100v of working voltage>



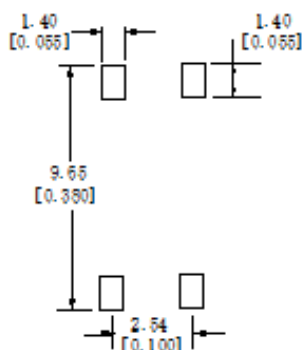
Applications

- Automotive applications (AEC-Q200 only of reliability test)
※There is a difficult case to cope with your request for the use of automotive application.
- Industrial applications

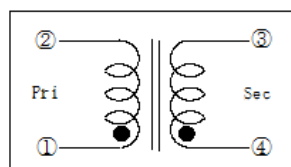
Dimension – mm [inch]



Recommended land pattern - mm [inch]



Schematics (Bottom)



Note : This specification is subject to change without notice. Please contact your nearest sales office for updated information when placing an order.

ESMIT-4180/C

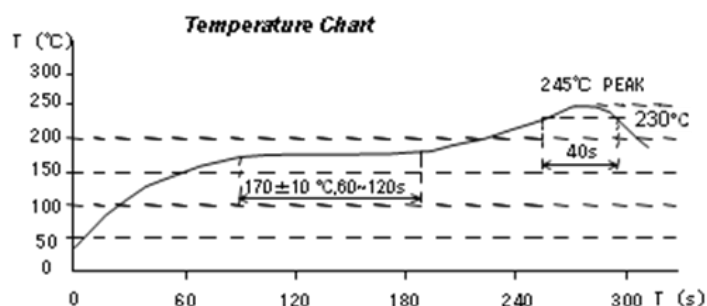
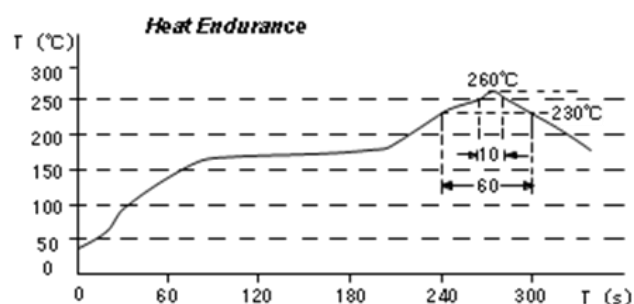
CBM5D33



Electrical Characteristics @ 25°C

PARAMETER	CONDITIONS	VALUE	UNITS	TOLERANCE
Inductance (OCL)	100 kHz, 0.01 V, (1-2)	125	μH	Min.
Inductance (OCL)	100 kHz, 0.01v , (1.2), -40°C	120	μH	Nom.
DC Resistance (DCR)	(1-2)	0.25	Ω	Max.
	(4-3)	0.25	Ω	Ma.
Dielectric Breakdown Isolation (equivalent to 1 min, 3000 Vrms)	1 sec, (1-4) Max Leakage current 0.5mA	3750	Vrms	Min.
Operating Temperature		-40 to +105	°C	Nom.

Soldering Reflow Profile



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Spec. No. : S - 0 2 2 7 - 6 4 2 7

To: ADI LT8315

Date of application

2019 03 13
(year) (month) (day)

Approval Sheet

■ Part number : P S 1 5 - 1 9 5

■ Document attached ☐ No ☒ Yes(See Below)



* Scope and Precautions S-074-1511	*
*	*
*	*
*	*

■ Tick the relevant box “ ☒ ” .

- ☒ New product / New specification
- ☐ New part(s) is added to approved specification
- ☐ Revision of approved specification

■ Note

This specification will be considered accepted upon receipt of your order.

Approved by	Sales
	Sumida America Components Inc.
	Approval: _____ Salesman: _____
	<div style="display: flex; justify-content: space-around;"><div style="text-align: center;"> Check: _____</div><div style="text-align: center;"> Design: _____</div></div>

Customer : ADI LT8315		Specification (Change History)		Type RM6 B
Change Mark	Change Date	Request No.	Change content	Requested by

Note:					
Creation Date : 12th. Mar., 2019		ADI Part Name (Customer Part Name)		P S 1 5 – 1 9 5	
Approved by	Checked by	R&D	Type Code	1 5 3 6 4	
WEI SHAOHONG	ZENG YUNXIA	JIANG ZHIMING QN	Trial Drawing No.	1 5 3 6 4 – T 0 0 2	Spec. No. S – 0 2 2 7 – 6 4 2 7 1 / 3

Specification

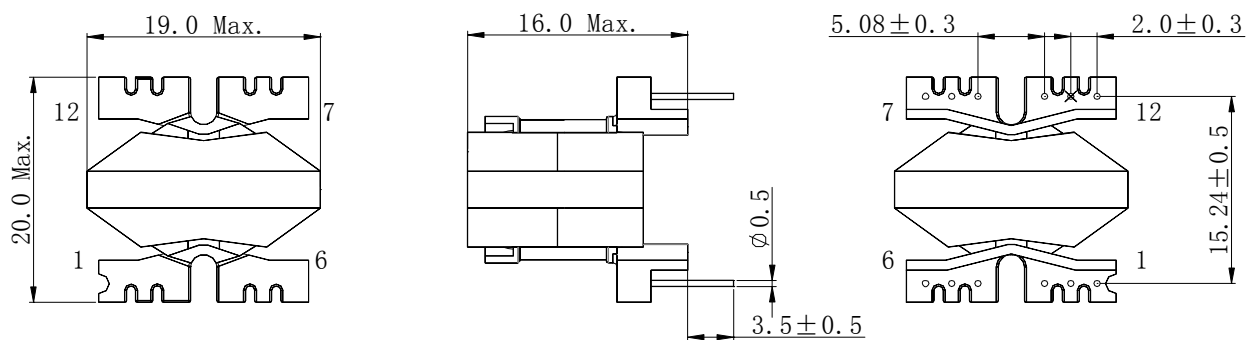
Type	RM 6 B
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1. Scope & Precautions

Refer to S-074-1511.

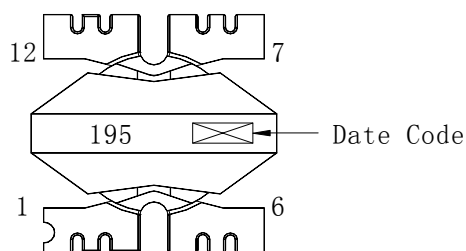
2. Appearance

2-1. Dimensions (mm)

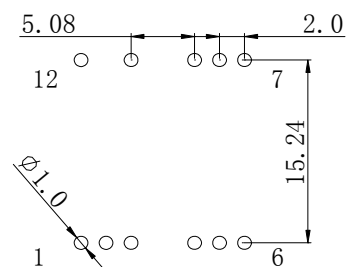


- * The dimension of terminals don't include the solder icicle.
- * Dimension without tolerance is reference value.
- * "X" indicates no terminal.
- * Pin pitch shall be measured at the root of terminal.

2-2. Stamp

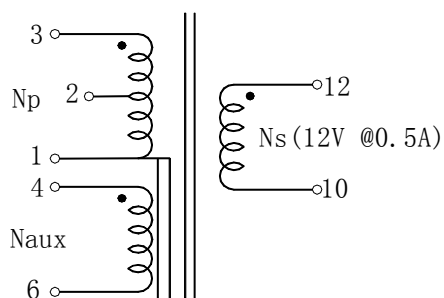


2-3. Recommended land pattern (mm)



3. Coil specification

3-1. Schematic



RoHS
compliance
Cd:Max. 0.01wt%
others:Max. 0.1wt%

“●” Indicates the same polarity.

Note:	Spec. No. S-0227-6427 2/3
-------	---------------------------------

Specification

Type	RM 6 B
------	--------

3-2. Electrical characteristics(at25°C)

Item	Pin	Specification	Measuring conditions
Inductance	(1-3)	4500 μ H \pm 10% within	10kHz/0.1V
Leakage inductance	(1-3)	70 μ H Max.	100kHz/0.1V Tie 4+6+10+12
D. C. R.	(1-3)	14.5 Ω Max.	
	(12-10)	4.8 Ω Max.	
	(4-6)	5.3 Ω Max.	
Turns ratio	Np/Ns/Naux	3:1:1	
Withstanding voltage	(Np, Naux) -Ns	DC 3000V, 1Second	1.0mA
Rated current	(1-3)	0.4A DC	

* The rated current applied on this coil causing its initial inductance roll off 20%.

4. General characteristics

4-1.Storage temperature range : -40°C ~ +125°C

4-2.Operating temperature range : -40°C ~ +125°C(Including coil' s temperature rise)

Note:	Spec. No. S - 0 2 2 7 - 6 4 2 7 3 / 3
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SUMIDA製品の適用範囲と注意事項

Scope and notes of SUMIDA products

1. 当納入仕様書の記載内容は、部品単体での特性、品質を保証するものです。使用に際しては、使用される製品に実装した状態で必ず評価、確認を行ってください。設計に際しては、絶対最大定格、動作保証条件(動作電源電圧、動作環境など)の範囲内でご使用いただきますようお願いいたします。
The specification expresses the quality and characteristic of the part as individual product.
When designing, please make sure the using condition is within the maximum rated current and operation guarantee conditions (working voltage, working environment etc.). Before use, please be sure to evaluate and check their operations after assembled.
2. 当部品は各種電子機器に使用可能ですが、使用に際しては、弊社保証仕様を超えないように十分なご検討をお願いいたします。保証値を超えてご使用された場合、その後に発生した機器の故障、欠陥については弊社として責任を負いません。
The part can be used for various electronic devices, When use, please make sure not to exceed the guarantee specifications. Sumida shall not be liable for any defect of equipment due to your improper use.
3. 人命や財産に影響を与える可能性のある車載機器、航空宇宙機器、輸送機器、医療機器又は同等と思われる機器にご使用される場合は、必ず弊社営業部門にお問い合わせ下さい。
また、使用条件を満たさない、または使用条件を超えて使用された場合、搭載機器に何らかの事故、損害が発生しても弊社は一切その責を負いませんので、予めご了承下さい。
In the event the part is used in vehicle equipment, aerospace equipment, transportation equipment, medical equipment or an equivalent which may affect human life and property, please be sure to consult with Sumida sales or business office.
When the usage conditions are not satisfied or exceeded, Sumida shall not be liable for any accident & damage due to your improper use.
4. 当納入仕様書に記載の製品及び技術情報を輸出又は非居住者に提供する場合は当該国における法令、特に安全保障貿易管理に関する法令を遵守してください。
When exporting or offering the products and technical information described in this specification to exporters or nonresidents, please comply with the laws and regulations concerning the relevant country, especially security export control.
5. 保証値内のご使用であっても、他の部品との組み合わせによる誤動作防止、安全保護対策などのシステム上の設計対策を講じて頂きますようお願いいたします。
Even the part is used within the guaranteed value, please also overall consider prevention of malfunction by combining with other parts and security protection measures when design.

6. 御使用上の注意事項

Attention for use

- 6-1、部品は高温、多湿、水滴落下、塵埃、腐食性ガス、外部からの衝撃の無い環境で保管して下さい。
Do not keep the part in the environment such as high temperature, high humidity, water drop falling, dust, corrosive gas, external shock.
- 6-2、部品の落下や乱雑な取り扱い、バラ積みは、破損の恐れがありますので注意して下さい。
Always handle the part with care to avoid dropping or messy handling or bulk stacking which may cause damage.
- 6-3、手脂によりはんだ付け性が劣化しますので、端子に直接手を触れないで下さい。
Do not touch terminals/electrodes directly with bare hands as hand secretion may inhibit soldering.
Always ensure optimum conditions for soldering.

	仕様書番号 Spec. No. S-074-1511 1 / 2
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共通仕様書

COMMON SPECIFICATION

- 6-4、端子への過度なストレスは断線の原因になりますので、端子に触れないようにして下さい。
Excessive stress to the terminals/electrodes may cause disconnection, so do not touch the terminals/electrodes.
- 6-5、端子及びケースのラグ部は、全てプリント基板にはんだ付けをして下さい。
Please ensure that all terminals/electrodes and case lugs of the part are completely soldered onto PCB.
- 6-6、調整コアがはんだ付けフラックスにより固定されないよう、生産工程に注意して下さい。
Ensure the tuning core (slug or cap) of the part is not fixed by the solder flux during your production process.
- 6-7、部品の洗浄はしないで下さい。もし、洗浄が必要な場合は連絡下さい。
Refrain from rinsing the part. If necessary, please consult with Sumida sales or business office.
- 6-8、プリント基板設計の際は、部品はプリント基板端面部への配置を避けて下さい。
When designing a printed circuit board, avoid arranging the part near the edge of the PCB.
- 6-9、SMD部品を基板上に搭載される場合、弊社製品外形寸法を確認頂き、マウンタメーカーが推奨されているピック&プレイス用最適なノズル先端径タイプを選択してください。ノズル先端径と弊社製品外形寸法がマウンタメーカーの推奨吸引条件と合致していない場合、適切に製品吸引できないことが発生いたします。
When SMD parts are mounted on the board, please confirm the external dimensions of the part and select the optimum nozzle (tip diameter) for picking & placing. If the nozzle (tip diameter) and the part's external dimensions do not match the recommended adsorption condition of the mounter maker, the part adsorption cannot be performed properly.
- 6-10、弊社SMDコイルは自動実装を基準に設計されていますので、手はんだの場合は取り扱いに注意して下さい。
Sumida SMD coils are designed for automatic mounting. Please be careful if soldering by hand.
- 6-11、コイルを自動実装される場合は、巻線露出部分への接触を避けて下さい。
また、端子をガイドとして使用しないで下さい。
Do not touch any exposed winding part (enameled wire) and avoid using terminals/electrodes as a conductor guide in automatic mounting.
- 6-12、高電圧を発生させるインバータトランスでは、導体はトランスから2mm以上離す設計をして下さい。
When using Sumida high voltage inverter transformer, please design the conductor 2mm or more away from the transformer.
- 6-13、結露する環境での使用はお避けください。
Do not use the part in dew condensation environment.
- 6-14、密閉状態の環境で使用する場合は温度変化により結露する恐れがありますので注意をお願いします。
Please note that dew condensation may occur due to temperature change, when the part is used in a sealed condition.
- 6-15、当部品は直射日光の当たらない常温(温度 15℃～35℃)常湿(湿度 25%～85%)の室内環境で保管し、納入後 6 ヶ月以内にご使用いただけるようお願いいたします。納入後 6 ヶ月を超えてのご使用に際しては、事前に弊社営業部門までお問い合わせ下さい。
Please keep the part in an indoor environment with normal temperature (15℃ to 35℃) and normal humidity (25% to 85%) not exposed to direct sunlight, and use it within 6 months after delivery. Please contact Sumida sales in advance for using the parts which stored beyond 6 months after delivery.

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Flyback Transformer for LT8316



PQ2620 (11328-T060 /11328-T061 /11328-T073 /11328-T074 /11328-T078 /11328-T086)

RM6B (15364-T008)

CEEH178 (11338-T195)

CEFD2010 (00399-T239)

Descriptions

- Transformer associates LT8316 reference design which is a 600VIN Micropower No-Opto Isolated Flyback Controller
- Environmental RoHS compliant without exemption, REACH compliance
- PQ2620: size 31 x 28.5 x 23.5 (H) mm max. PIN type
- RM6B: size: 20 x 19 x 16 (H) mm max. PIN type
- CEEH178: size 19±0.5 x 17.4±0.6 x 8.6±0.5 (H) mm SMD type
- CEFD2010: size 21 x 21.5 x 11.8 mm max. SMD type
- Terminal platings: Matte Tin and thickness ≥ 8μm
- Moisture Sensitivity Level (MSL) 1
- Unlimited floor life at < 30°C /85% relative humidity
- Operating temprature range: -40°C to 125°C (ambient + Temp rise)
- Storage temperature range: -40°C to 125°C
- Recommended reflow condition as max temperature 245°C withstand no longer than 40 seconds

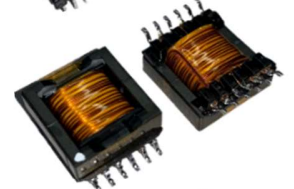
PQ2620



RM6B



CEEH178



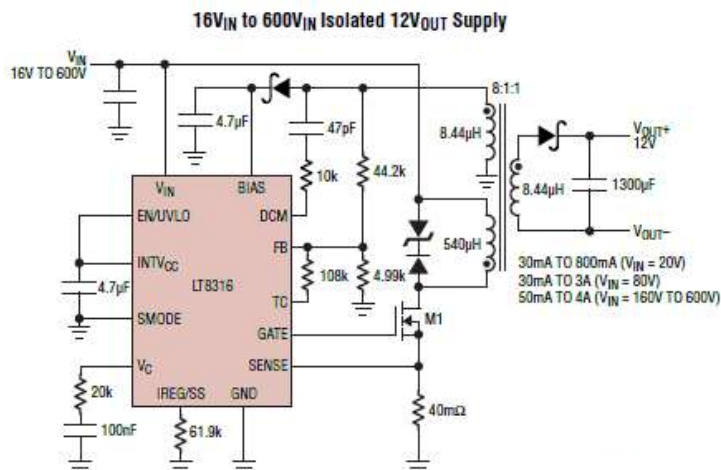
CEFD2010



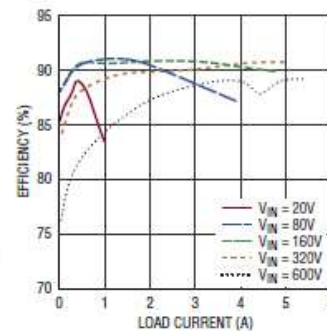
Applications

- Isolated Telecom, Automotive, Industrial, Medical Power Supplies
- Isolated Off-Line Housekeeping Power Supplies
- Electric Vehicles and Battery Stacks
- Multioutput Isolated Power Supplies for Inverter Gate Drives

Typical Application



Efficiency



Note: This specification is subject to change without notice. Please contact your nearest sales office for updated information when placing an order.

Flyback Transformer for LT8316



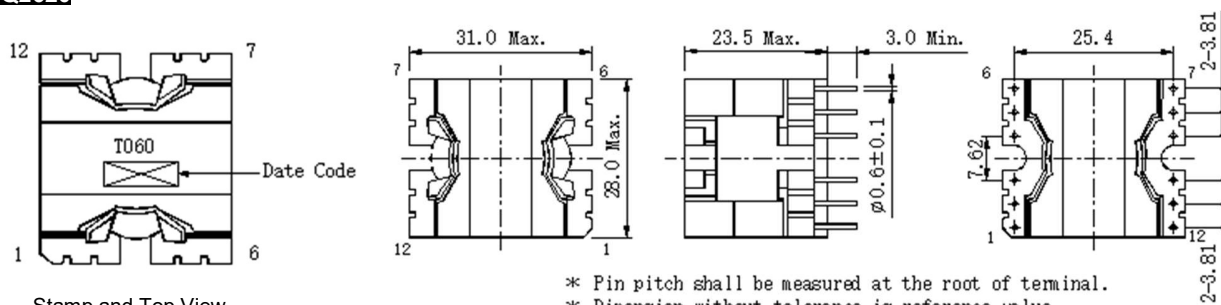
PQ2620 (11328-T060 /11328-T061 /11328-T073 /11328-T074 /11328-T078 /11328-T086)

RM6B (15364-T008)

CEEH178 (11338-T195)

CEFD2010 (00399-T239)

PQ2620



Stamp and Top View

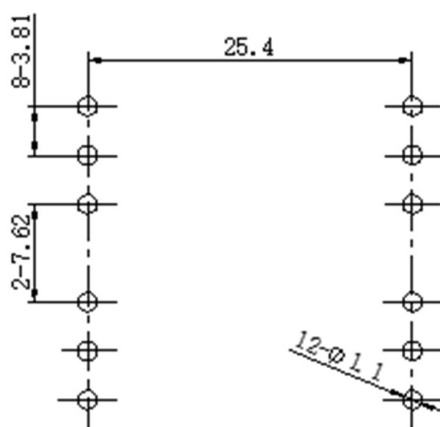
Stamp with last 4 digits of PN

Such as T060 or T078, T080...

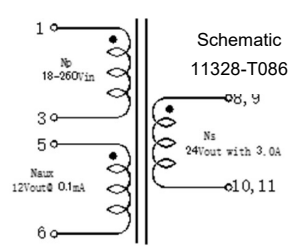
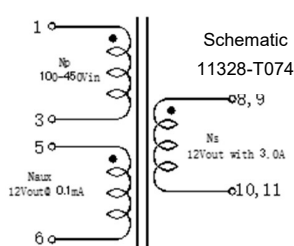
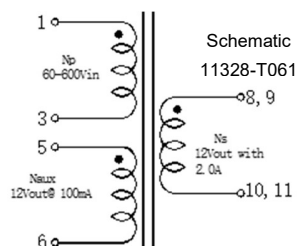
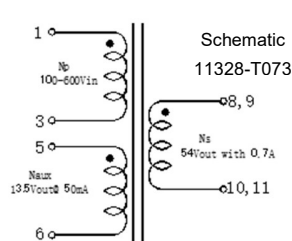
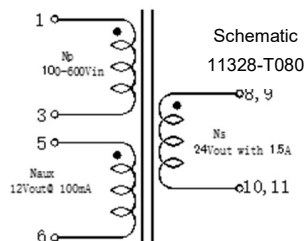
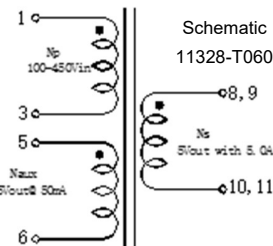
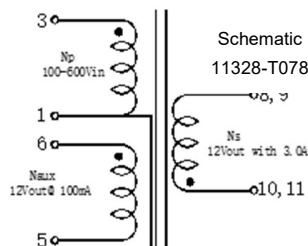
* Pin pitch shall be measured at the root of terminal.
* Dimension without tolerance is reference value.

Dimension - [mm]

All "●" Indicates the same polarity



Land Pattern - [mm]



Note: This specification is subject to change without notice. Please contact your nearest sales office for updated information when placing an order.



Flyback Transformer for LT8316

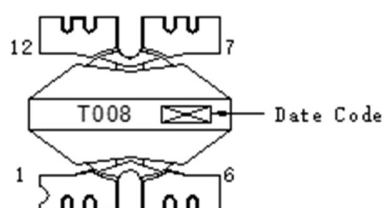
PQ2620 (11328-T060 /11328-T061 /11328-T073 /11328-T074 /11328-T078 /11328-T086)

RM6B (15364-T008)

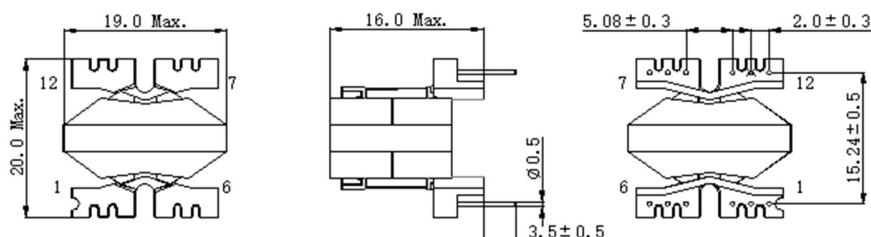
CEEH178 (11338-T195)

CEFD2010 (00399-T239)

RM6B

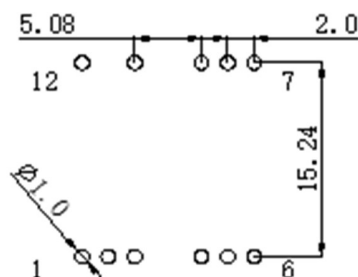


Stamp and Top View of 15364-T008

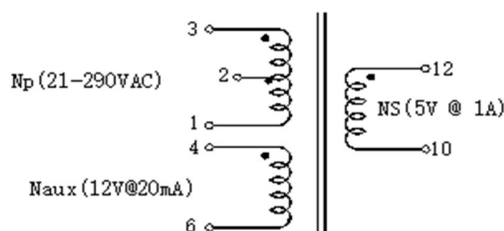


- * The dimension of terminals don't include the solder icicle.
- * Dimension without tolerance is reference value.
- * "x" indicates no terminal.
- * Pin pitch shall be measured at the root of terminal.

Dimension - [mm]

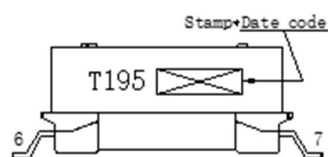


Land Pattern - [mm]

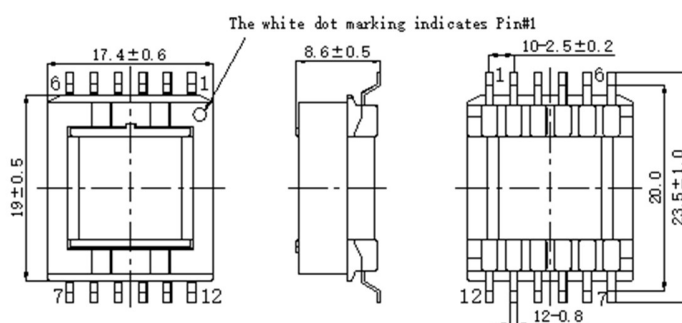


Schematic 15364-T008 -- All "●" Indicates the same polarity

CEEH178



Stamp and Side View of 11338-195



- * The dimension of terminals don't include the solder icicle.
- * Dimension without tolerance is reference value.
- * Terminals coplanarity:

Dimension - [mm]



Note: This specification is subject to change without notice. Please contact your nearest sales office for updated information when placing an order.

Flyback Transformer for LT8316

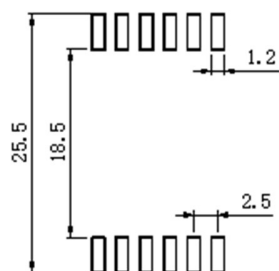


PQ2620 (11328-T060 /11328-T061 /11328-T073 /11328-T074 /11328-T078 /11328-T086)

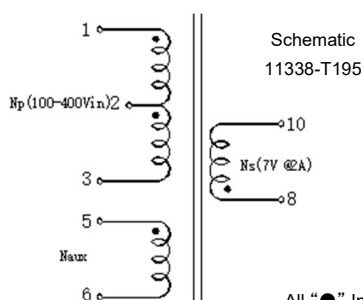
RM6B (15364-T008)

CEEH178 (11338-T195)

CEFD2010 (00399-T239)

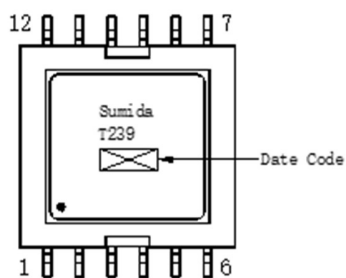


Land Pattern – [mm]

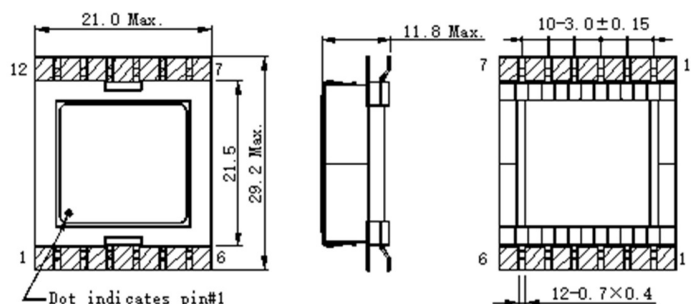


All "●" Indicates the same polarity

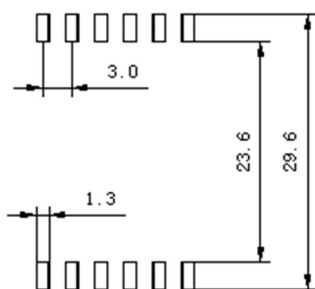
CEFD2010



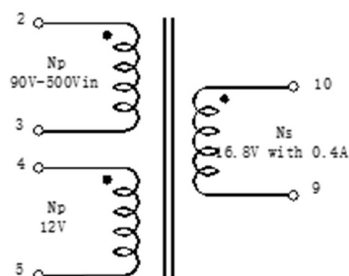
Stamp and Top View of 00399-T239



- * The dimension of terminals don't include the solder icicle.
- * Dimension without tolerance is reference value.
- * Terminals coplanarity:



Land Pattern – [mm]



Schematic 00399-T239 All "●" Indicates the same polarity

Note: This specification is subject to change without notice. Please contact your nearest sales office for updated information when placing an order.

Flyback Transformer for LT8316



PQ2620 (11328-T060 /11328-T061 /11328-T073 /11328-T074 /11328-T078 /11328-T086)

RM6B (15364-T008)

CEEH178 (11338-T195)

CEFD2010 (00399-T239)

Electrical Characteristics (at 25°C unless otherwise specified)

Core Type	Sumida PN	Primary Lpri (μH)			Leakage Inductance (μH)			DCR (mΩ)		
		PIN	Spec (μH)	Measuring Conditions	PIN	Spec (μH)	Measuring Conditions	PIN	Spec (mΩ)	Measuring Conditions
PQ2620	11328-T078	(3-1)	670 ±10% within	100kHz /1V	(3-1)	8.0 max (4.0 Typ)	100kHz /1V Tie (5+6+8+9+10+11)	(1-3)	470 Max/380 Typ	
								(8,9 - 10,11)	11 Max/9 Typ	Tie (8+9 , 10+11)
								(5-6)	150 Max/125 Typ	
	11328-T080	(1-3)	670 ±10% within	100kHz /0.1V	(1-3)	6.0 max (3.0 Typ)	100kHz /0.1V Tie (5+6+8+9+10+11)	(1-3)	470 Max/380 Typ	
								(8,9 - 10,11)	62.5 Max/50 Typ	Tie (8+9 , 10+11)
								(5-6)	156 Max /120 Typ	
	11328-T073	(1-3)	670 ±10% within	100kHz /0.1V	(1-3)	7.0 max (3.5 Typ)	100kHz /0.1V Tie (5+6+8+9+10+11)	(1-3)	675 Max/585 Typ	Tie (2+3 , 4+5)
								(8,9 - 10,11)	186 Max/155 Typ	Tie (8+9 , 10+11)
								(5-6)	225 Max/195 Typ	
	11328-T060	(1-3)	800 ±10% within	100kHz /1V	(1-3)	10 max (4.8 Typ)	100kHz /1V Tie (5+6+8+9+10+11)	(1-3)	660 Max/550 Typ	
								(8,9 - 10,11)	10 Max/8 Typ	Tie (8+9 , 10+11)
								(5-6)	530 Max/440 Typ	
	11328-T061	(1-3)	600 ±10% within	100kHz /0.1V	(1-3)	5.2 max (3.4 Typ)	100kHz /0.1V Tie (5+6+8+9+10+11)	(1-3)	265 Max/220 Typ	
								(8,9 - 10,11)	53 Max/43 Typ	Tie (8+9 , 10+11)
								(5-6)	140 Max/115 Typ	
	11328-T074	(1-3)	500 ±10% within	100kHz /0.1V	(1-3)	7.0 max (3.5 Typ)	100kHz /0.1V Tie (5+6+8+9+10+11)	(1-3)	114 Max/95 Typ	
								(8,9 - 10,11)	12.5 Max/9.0 Typ	Tie (8+9 , 10+11)
								(5-6)	200 Max/160 Typ	
	11328-T086	(1-3)	70 ±10% within	100kHz /0.1V	(1-3)	3.0 max (1.5 Typ)	100kHz /0.1V Tie (5+6+8+9+10+11)	(1-3)	96 Max/80 Typ	Tie (2+3 , 4+5)
								(8,9 - 10,11)	20 Max/16 Typ	Tie (8+9 , 10+11)
								(5-6)	240 Max/200 Typ	
RM6B	15364-T008	(1-3)	1500 ±10% within	10kHz /0.1V	(1-3)	68 max (34 Typ)	100kHz /0.1V Tie (4+6+10+12)	(1-3)	4600 Max/3800 Typ	
								(12 - 10)	43 Max/36 Typ	
								(4 - 6)	600 Max/500 Typ	
CEEH178	11338-T195	(1-3)	1000 ±10% within	100kHz /1V	(1-3)	34 max (17 Typ)	100kHz /1V Tie (5+6+8+10)	(1-3)	3000 Max/2500 Typ	
								(8 - 10)	60 Max/51 Typ	
								(5 - 6)	420 Max/350 Typ	
CEFD2010	00399-T239	(2-3)	2800 ±10% within	100kHz /1V at 25°C	(2-3)	26 max (13 Typ)	100kHz /1V at 25°C Tie (4+5+9+10)	(2-3)	5760 Max/4600 Typ	at 25°C
								(9 - 10)	195 Max/165 Typ	at 25°C
								(4 - 5)	1560 Max/1300 Typ	at 25°C

Note: This specification is subject to change without notice. Please contact your nearest sales office for updated information when placing an order.

Flyback Transformer for LT8316



PQ2620 (11328-T060 /11328-T061 /11328-T073 /11328-T074 /11328-T078 /11328-T086)

RM6B (15364-T008)

CEEH178 (11338-T195)

CEFD2010 (00399-T239)

Continue...

Core Type	Sumida PN	Turns Ratio	Rate Current	Withstanding Voltage (V)			Isolation	Target Application	Stamping
				PIN	Spec	Measuring Conditions			
PQ2620	11328-T078	Np : Ns :Naux 8 : 1 : 1	3.0ADC (3-1)		AC 1000Vrms, 1S	1.0mA 50/60Hz	Reinforced	100V~600V to 12V/3A DC2817A	T078
				Coil-Core					
				Np,Naux - Ns	AC 3000Vrms, 1S				
	11328-T080	Np : Ns :Naux 4 : 1 : 0.5	2.0ADC (1-3)		AC 1000Vrms, 1S	1.0mA 50/60Hz	Reinforced	100V~600V to 24V/1.5A	T080
				Coil-Core					
				Np,Naux - Ns	AC 3000Vrms, 1S				
	11328-T073	Np : Ns :Naux 2 : 1 : 0.25	1.9ADC (1-3)		AC 1000Vrms, 1S	1.0mA 50/60Hz	Reinforced	100V~600V to 54V/0.7A	T073
				Coil-Core					
				Np,Naux - Ns	AC 3000Vrms, 1S				
	11328-T060	Np : Ns :Naux 18 : 1 : 3	1.7ADC (1-3)		AC 1000Vrms, 1S	1.0mA 50/60Hz	Reinforced	140V~450V to 5V/7A DC2593A	T060
				Coil-Core					
				Np,Naux - Ns	AC 3000Vrms, 1S				
	11328-T061	Np : Ns :Naux 5 : 1 : 1	2.5ADC (1-3)		AC 1000Vrms, 1S	1.0mA 50/60Hz	Basic	200V~450V to 15V/2A	T061
				Coil-Core					
				Np,Naux - Ns	AC 3000Vrms, 1S				
	11328-T074	Np : Ns :Naux 8 : 1 : 1	2.0ADC (1-3)		AC 1000Vrms, 1S	1.0mA 50/60Hz	Reinforced	100V~450V to 12V/3A	T074
				Coil-Core					
				Np,Naux - Ns	AC 3000Vrms, 1S				
	11328-T086	Np : Ns :Naux 4 : 1 : 1.5	8.5ADC (1-3)		AC 1000Vrms, 1S	1.0mA 50/60Hz	Reinforced	30V~260V to 24V/3A	T086
				Coil-Core					
				Np,Naux - Ns	AC 3000Vrms, 1S				
RM6B	15364-T008	Np : Ns :Naux 20 : 1 : 2.4	0.75ADC (1-3)		AC 1000Vrms, 1S	1.0mA 50/60Hz	Reinforced	25V~450V to 5V/1A	T008
				Coil-Core					
				Np,Naux - Ns	AC 3000Vrms, 1S				
CEEH178	11338-T195	Np : Ns :Naux 14 : 1 : 1.7	0.9ADC (1-3)		AC 1500Vrms, 2S	1.0mA 50/60Hz	Basic	100V~400V to 7V/2A	T195
				Coil-Core					
				Np,Naux - Ns	AC 3000Vrms, 2S				
CEFD2010	00399-T239	Np : Ns :Naux 6 : 1 : 0.7	0.39ADC (2-3)		AC 500Vrms, 1S	1.0mA 50/60Hz	Reinforced	90V~500V to 16.8V/0.4A	T239
				Coil-Core					
				Np,Naux - Ns	AC 2500Vrms, 1S				

Note: This specification is subject to change without notice. Please contact your nearest sales office for updated information when placing an order.

Flyback Transformer for LT8316

PQ2620 (11328-T060 /11328-T061 /11328-T073 /11328-T074 /11328-T078 /11328-T086)

RM6B (15364-T008)

CEEH178 (11338-T195)

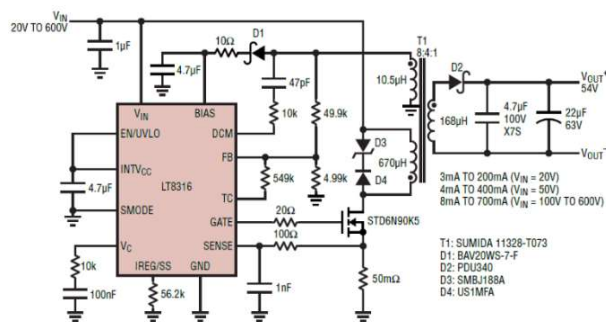
CEFD2010 (00399-T239)



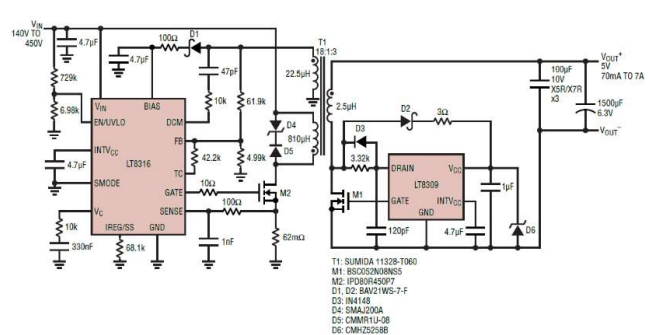
Typical Application Circuits

The LT®8316 is a micropower, high voltage flyback controller. No opto-isolator is needed for regulation. The device samples the output voltage from the isolated flyback waveform appearing across a third winding on the transformer. Quasi-resonant boundary mode operation improves load regulation, reduces transformer size, and maintains high efficiency.

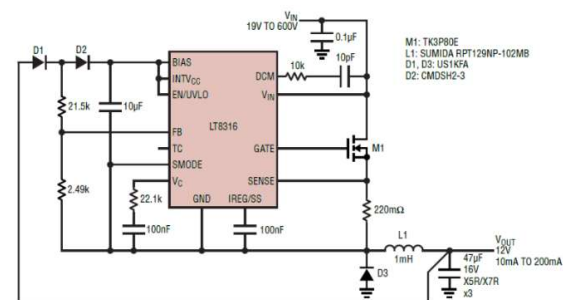
94% Efficient Isolated 54V supply



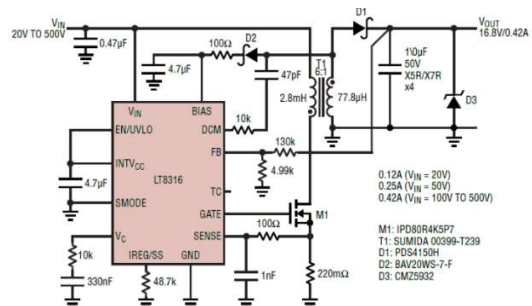
91% Efficient Isolated 5V/7A Synchronous Flyback Converter



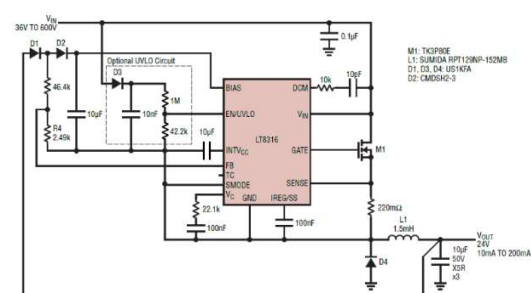
Ultra-Wide Input Range Non-Isolated 12V Buck Converter (Sumida Inductor type RPT129 designed into this reference)



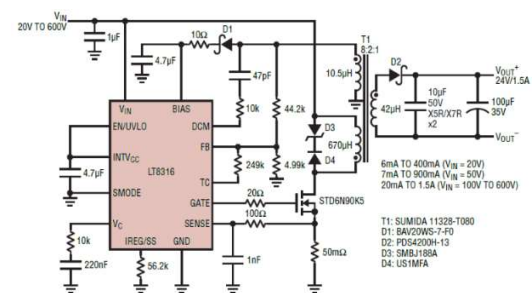
Non-isolated 16.8V Gate Drive Supply



Non-isolate 24V Buck Converter with Optional Undervoltage Lockout

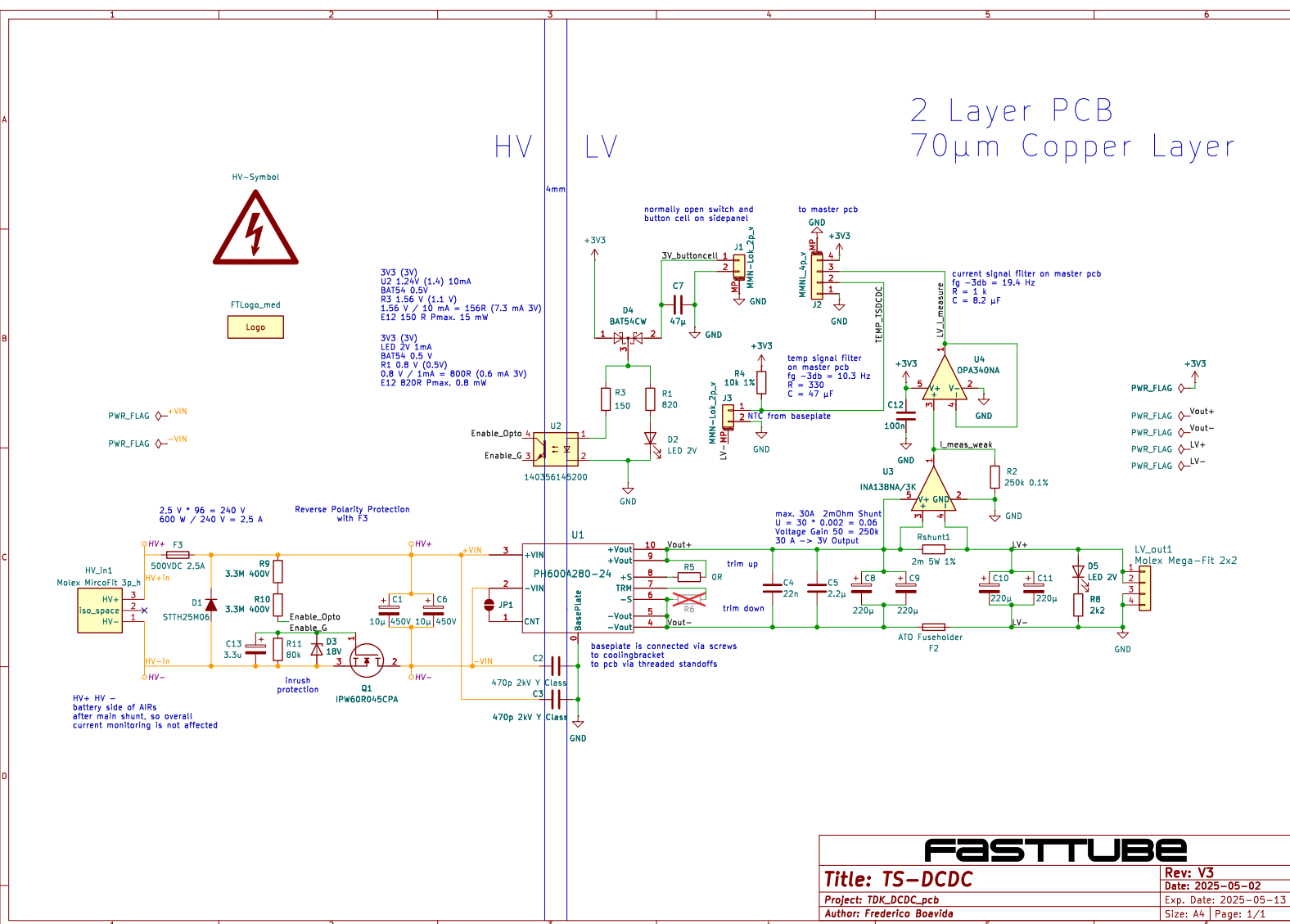


Wide Input Range 24V Flyback Converter



For sales office information, please [click here](#) to visit our website.

Note: This specification is subject to change without notice. Please contact your nearest sales office for updated information when placing an order.



50W to 600W, 200 to 425VDC Input DC-DC Converters

<https://product.tdk.com/en/power/ph-a>
www.emea.lambda.tdk.com/ph-a



The PH-A series of isolated DC-DC converters operate from a wide range 200 to 425Vdc input and are available in multiple power levels from 50 to 600W. Output voltages cover 3.3V to 48V and can be adjusted using the trim terminal by up to -60% to +20%. All models feature remote sense and remote on/off and can be conduction cooled to a cold plate or mounted with an optional heatsink. The 300 and 600W models are certified to EN 62477-1 (OVC III) for use in industrial robots connected to an incoming distribution panel, avoiding the requirement for an isolation transformer. These efficient converters are also well suited for HVDC (High Voltage Direct Current) power transmission systems and renewable energy applications.

Features	Benefits
• Wide Range 200 to 425Vdc Input	• Suitable for HVDC Applications
• Baseplate Cooled	• Can be Conduction or Convection Cooled (With an Optional Heatsink)
• -40 to 100°C Baseplate Temperature	• Operates in Harsh Environments
• Certified to IEC/EN62477-1 (OVC III)	• No External Transformer Needed
• Up to 93% Efficient	• Easier To Cool In the End System

Model Selector							
Model	Output Voltage (V)	Adjustment Range (V)	Maximum Current (A)	Maximum Power (W)	Input Current (A) 280V input, 100% load	Efficiency (%) 280V input, 100% load	Overvoltage Protection (%) ⁽²⁾
PH75A280-3.3	3.3	2.97 - 3.96	15	49.5	0.22	83	130 - 200
PH100A280-3.3	3.3	2.97 - 3.96	20	66	0.29	83	130 - 200
PH50A280-5	5	4 - 6	10	50.0	0.21	86	125 - 150
PH75A280-5	5	4 - 6	15	75.0	0.32	86	125 - 150
PH100A280-5	5	4 - 6	20	100.0	0.42	86	125 - 150
PH300A280-5	5	2.5 - 6	60	300.0	1.22	89	125 - 145
PH50A280-12	12	9.6 - 13.2	4.2	50.4	0.2	89	115 - 145
PH75A280-12	12	9.6 - 13.2	6.3	75.6	0.31	89	115 - 145
PH100A280-12	12	9.6 - 13.2	8.4	100.8	0.41	89	115 - 145
PH150A280-12	12	9.6 - 13.2	12.5	150.0	0.62	88	115 - 145
PH300A280-12	12	4.8 - 14.4	25	300.0	1.22	89	125 - 145
PH75A280-15	15	12 - 16.5	5	75.0	0.3	90	115 - 145
PH150A280-15	15	12 - 16.5	10	150.0	0.6	90	115 - 145
PH50A280-24	24	19.2 - 26.4	2.1	50.4	0.2	89	115 - 145
PH75A280-24	24	19.2 - 26.4	3.2	76.8	0.31	90	115 - 145
PH100A280-24	24	19.2 - 26.4	4.2	100.8	0.4	90	115 - 145
PH150A280-24	24	19.2 - 26.4	6.3	151.2	0.61	89	115 - 145
PH300A280-24	24	9.6 - 28.8	12.5	300.0	1.2	90.5	125 - 145
PH600A280-24	24	14.4 - 28.8	25	600.0	2.33	93	125 - 145
PH75A280-28	28	22.4 - 30.8	2.7	75.6	0.3	90	115 - 145
PH150A280-28	28	22.4 - 30.8	5.4	151.2	0.61	90	115 - 145
PH300A280-28	28	11.2 - 33.6	10.8	302.4	1.2	91	125 - 145
PH50A280-48	48	38.4 - 52.8	1.1	52.8	0.21	89	115 - 145
PH75A280-48	48	38.4 - 52.8	1.6	76.8	0.31	90	115 - 145
PH100A280-48	48	38.4 - 52.8	2.1	100.8	0.4	90	115 - 145
PH150A280-48	48	38.4 - 52.8	3.2	153.6	0.6	90	115 - 145
PH300A280-48	48	19.2 - 57.6	6.3	302.4	1.19	92	125 - 145

Options	
Suffix	Description
Blank	M3 tapped mounting inserts
/T	3.3mm non-threaded inserts

Heat Sink Accessories	
Suffix	Description
HAQ-10T	PH50A to 150A 25mm transverse fins
HAH-10T	PH300A and 600A 25mm transverse fins
HAH-15L	PH300A and 600A 38mm longitudinal fins

Related Products		
Type	Part Number	Description
DC-DC Converters	PH-A series	1200W, 200 to 425V Input DC-DC Converters
DC-DC Converters	CN200B110 to CN300B110	200 to 300W, 43 to 160V Input DC-DC Converters

Specifications			
Model		PH50A to PH150A	PH300A to PH600A
Input			
Input Voltage range	Vdc	200 - 425	
Input Current (280Vdc)	A	See model selector	
No Load Power Consumption	W	See evaluation data on website	
Efficiency (280Vdc)	-	See model selector	
Safety Certifications and Markings	-	IEC/UL/CSA/EN62368-1, 60950-1, EN62477-1 OVC III (PH300A and 600A only), CE Mark and UKCA Mark	
Output			
Line Regulation	mV	3.3V - 5V: 10; 12V: 24; 15V: 30, 24V: 48, 28V: 56, 48V: 96	
Load Regulation	mV	3.3V - 5V: 10; 12V: 24; 15V: 30, 24V: 48, 28V: 56, 48V: 96	
Ripple & Noise	mV	3.3V - 5V: 100; 12V - 15V: 150; 24V: 240, 28V: 280, 48V: 400 (1)	
Temperature Coefficient	%/°C	0.02	
Minimum Load	-	No minimum load required	
Overcurrent Protection	%	102 - 150 Constant current style. (PH600A constant current and hiccup)	
Overvoltage Protection	V	Yes, see model selector	
Remote Sense	-	Yes	
Remote On/Off	-	Yes; Low = ON, High = OFF	
Parallel Operation	-	Not possible	
Series Operation	-	Possible, see installation manual	
Environmental			
Operating Temperature	°C	-40 to +100 Base-plate, -40 to +85 Ambient (See derating section)	
Storage Temperature	°C	-40 to +100	
Humidity (non condensing)	%RH	5 - 95 Operating and Non Operating	
Cooling	-	Conduction, convection or forced air (See Installation Manual for heatsink selection)	
Altitude	m	3,000	
Withstand Voltage (For 1 minute)	Vac	Input to Base-plate: 2,500; Input to Output 3,000; Output to Base-plate: 500	
Isolation Resistance	MΩ	>100 at 25°C, 70%RH & 500Vdc	
Vibration	-	Non Operating, 10-55Hz (sweep for 1 min.) Amplitude 0.825mm constant (Max 49 m/s²) X,Y,Z 1 hour each	
Shock	-	196.1m/s²	
Other			
Weight (Typ)	g	55	100
Size (WxHxD)	mm	37.2 x 12.7 x 58.3	61.0 x 12.7 x 57.9
Size (WxHxD)	Inches	1.46 x 0.5 x 2.30	2.4 x 0.5 x 2.28
MTBF - Telcordia SR-332 issue 3 (3)	Hours	2 128,235	1,174,511
Warranty	yrs	5 years	

Notes

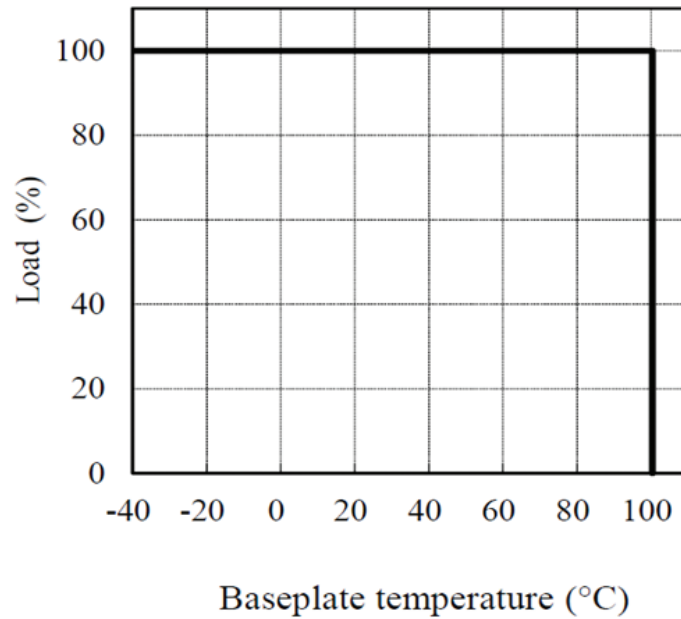
See website for detailed specifications, test methods and installation manual

(1) PH300A280-48 480mV

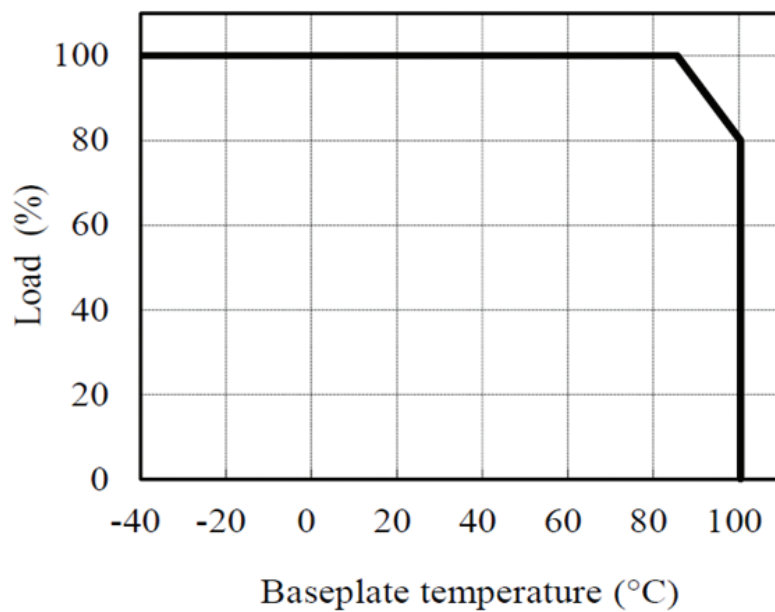
(2) Cycle input or remote on/off to reset

(3) PH100A280-48 model, 40°C baseplate, full load, 280Vdc input. PH300A280-24 model, 40°C baseplate, full load, 280Vdc input, ground benign (See full reliability data on website)

Derating Curve (PH50A to PH300A)



Derating Curve (PH600A)



Technical drawing of the PH150A280-48 DC-DC converter, showing top, side, and front views with dimensions and labels.

Top View Dimensions:

- Overall Width: 49.7 ± 0.25
- Overall Height: 28 ± 0.25
- Pin 1 to Pin 4 Spacing: 3.175
- Pin 1 to Pin 5 Spacing: 6.35
- Pin 5 to Pin 6 Spacing: 3.81

Front View Dimensions:

- Overall Width: 58.3 ± 0.5
- Overall Height: 12.7 ± 0.5
- Mounting Flange Height: 5 ± 0.5

Side View Dimensions:

- Overall Width: 37.2 ± 0.5
- Pin 1 to Pin 4 Spacing: 15.24
- Pin 5 to Pin 6 Spacing: 7.62

Labels and Notes:

- NOTE A:** Points to the bottom edge of the top view.
- NOTE B:** Points to the top edge of the top view.
- NOTE C:** Points to the side view.
- NOTE D:** Points to the front view.
- Lot No. seal:** Points to the bottom edge of the front view.
- Top View Label:**

PH150A280-48
INPUT: 200-425V \approx 1.2A
OUTPUT: 48V \approx 3.2A
DC-DC
BAR CODE
TDK-Lambda
MADE IN CHINA

Technical drawing of the TDK-Lambda PH300A280-48 power supply unit, showing dimensions and labels.

Top View Dimensions:

- Width: 57.9 ± 0.5
- Height: 61 ± 0.5

Front View Dimensions:

- Width: 48.3 ± 0.3
- Height: 50.8 ± 0.3

Side View Dimensions:

- Height: 12.7 ± 0.5

Labels and Markings:

- Model: **PH300A280-48**
- Input: **INPUT : 200-250V ~ 1.6A**
- Output: **OUTPUT : 48V ~ 6.3A**
- Brand: **TDK-Lambda**
- Certifications: **CE**, **RoHS**
- Type: **DC-DC**
- Barcode: **BAR CODE**
- Origin: **MADE IN CHINA**
- Manufacturer: **EU Rep. TDK-Lambda UK Ltd. Kingsley Avenue, ECK4 8ES, UK tdk-lambda.com**

Terminal Connections:

- Input: **-Vin**, **+Vin**
- Output: **-V**, **-V**, **-S**, **TRM**, **+S**, **+V**, **+V**

Notes:

- See note A
- See note B
- See note D
- See note E



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CoolMOS® Power Transistor

Product Summary

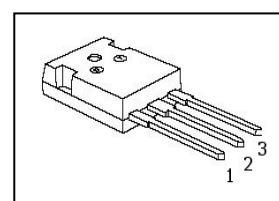
V_{DS}	600	V
$R_{DS(on),max}$	0.045	Ω
$Q_{g,typ}$	150	nC

Features

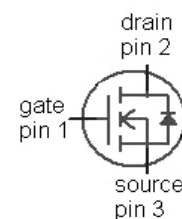
- Worldwide best $R_{DS(on)}$ in TO247
- Ultra low gate charge
- Extreme dv/dt rated
- High peak current capability
- Automotive AEC Q101 qualified
- Green package (RoHS compliant)

CoolMOS CPA is specially designed for:

- DC/DC converters for Automotive Applications

PG-TO247-3


Type	Package	Marking
IPW60R045CPA	PG-TO247-3	6R045A


Maximum ratings, at $T_j=25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	$T_C=25\text{ °C}$	60	A
		$T_C=100\text{ °C}$	38	
Pulsed drain current ¹⁾	$I_{D,pulse}$	$T_C=25\text{ °C}$	230	
Avalanche energy, single pulse	E_{AS}	$I_D=11\text{ A}$, $V_{DD}=50\text{ V}$	1950	mJ
Avalanche energy, repetitive $t_{AR}^{1),2)}$	E_{AR}	$I_D=11\text{ A}$, $V_{DD}=50\text{ V}$	3	
Avalanche current, repetitive $t_{AR}^{1),2)}$	I_{AR}		11	A
MOSFET dv/dt ruggedness	dv/dt	$V_{DS}=0\ldots480\text{ V}$	50	V/ns
Gate source voltage	V_{GS}	static	± 20	V
Power dissipation	P_{tot}	$T_C=25\text{ °C}$	431	W
Operating temperature	T_j		-40 ... 150	°C
Storage temperature	T_{stg}		-40 ... 150	
Mounting torque		M3 and M3.5 screws	60	Ncm

Maximum ratings, at $T_j=25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Continuous diode forward current	I_S	$T_C=25\text{ °C}$	44	A
Diode pulse current ¹⁾	$I_{S,pulse}$		230	
Reverse diode dv/dt ³⁾	dv/dt		15	V/ns

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Thermal characteristics

Thermal resistance, junction - case	R_{thJC}		-	-	0.29	K/W
Thermal resistance, junction - ambient	R_{thJA}	leaded	-	-	62	
Soldering temperature, wavesoldering only allowed at leads	T_{solder}	1.6 mm (0.063 in.) from case for 10 s	-	-	260	°C

Electrical characteristics, at $T_j=25\text{ °C}$, unless otherwise specified

Static characteristics

Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS}=0\text{ V}$, $I_D=250\text{ }\mu\text{A}$	600	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}$, $I_D=3\text{ mA}$	2.5	3	3.5	
Zero gate voltage drain current	I_{DSS}	$V_{DS}=600\text{ V}$, $V_{GS}=0\text{ V}$, $T_j=25\text{ °C}$	-	-	10	μA
Gate-source leakage current	I_{GSS}	$V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$	-	-	100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}$, $I_D=44\text{ A}$, $T_j=25\text{ °C}$	-	0.04	0.045	Ω
		$V_{GS}=10\text{ V}$, $I_D=44\text{ A}$, $T_j=150\text{ °C}$	-	0.11	-	
Gate resistance	R_G	$f=1\text{ MHz}$, open drain	-	1.3	-	Ω

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Dynamic characteristics

Input capacitance	C_{iss}	$V_{GS}=0\text{ V}, V_{DS}=100\text{ V},$ $f=1\text{ MHz}$	-	6800	-	pF
Output capacitance	C_{oss}		-	320	-	
Effective output capacitance, energy related ⁴⁾	$C_{o(er)}$	$V_{GS}=0\text{ V}, V_{DS}=0\text{ V}$ to 480 V	-	310	-	
Effective output capacitance, time related ⁵⁾	$C_{o(tr)}$		-	820	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=400\text{ V},$ $V_{GS}=10\text{ V}, I_D=44\text{ A},$ $R_G=3.3\ \Omega$	-	30	-	ns
Rise time	t_r		-	20	-	
Turn-off delay time	$t_{d(off)}$		-	100	-	
Fall time	t_f		-	10	-	

Gate Charge Characteristics

Gate to source charge	Q_{gs}	$V_{DD}=400\text{ V}, I_D=44\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	34	-	nC
Gate to drain charge	Q_{gd}		-	51	-	
Gate charge total	Q_g		-	150	190	
Gate plateau voltage	$V_{plateau}$		-	5.0	-	V

Reverse Diode

Diode forward voltage	V_{SD}	$V_{GS}=0\text{ V}, I_F=44\text{ A},$ $T_J=25\text{ }^\circ\text{C}$	-	0.9	1.2	V
Reverse recovery time	t_{rr}	$V_R=400\text{ V}, I_F=I_S,$ $di_F/dt=100\text{ A}/\mu\text{s}$	-	600	-	ns
Reverse recovery charge	Q_{rr}		-	17	-	μC
Peak reverse recovery current	I_{rrm}		-	60	-	A

¹⁾ Pulse width t_p limited by $T_{j,max}$

²⁾ Repetitive avalanche causes additional power losses that can be calculated as $P_{AV}=E_{AR}*f$.

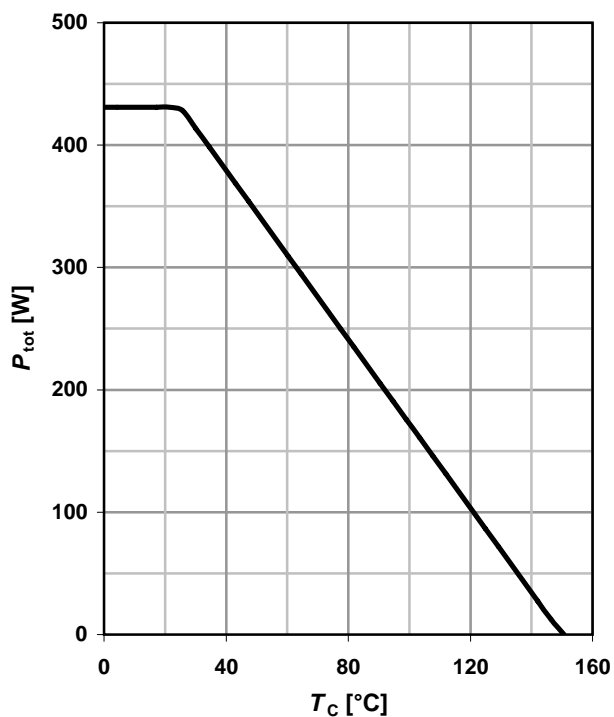
³⁾ $I_{SD}\leq I_D, di/dt\leq 100\text{ A}/\mu\text{s}, V_{DClink}=400\text{ V}, V_{peak}<V_{(BR)DSS}, T_J<T_{j,max}$, identical low side and high side switch

⁴⁾ $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

⁵⁾ $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

1 Power dissipation

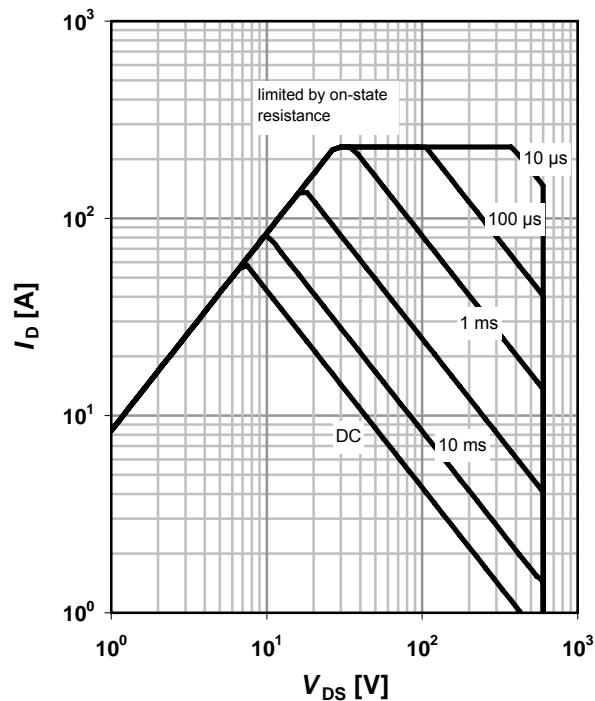
$$P_{\text{tot}} = f(T_C)$$



2 Safe operating area

$$I_D = f(V_{DS}); T_C = 25^\circ\text{C}; D = 0$$

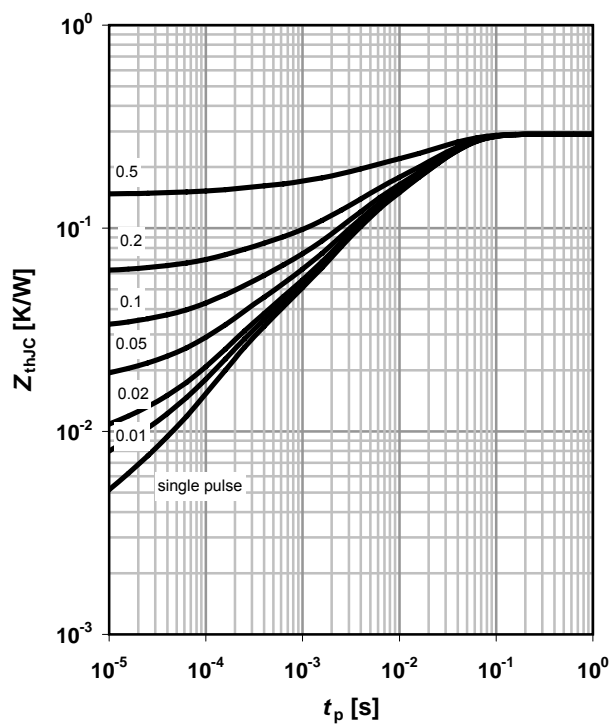
parameter: t_p



3 Max. transient thermal impedance

$$Z_{\text{thJC}} = f(t_p)$$

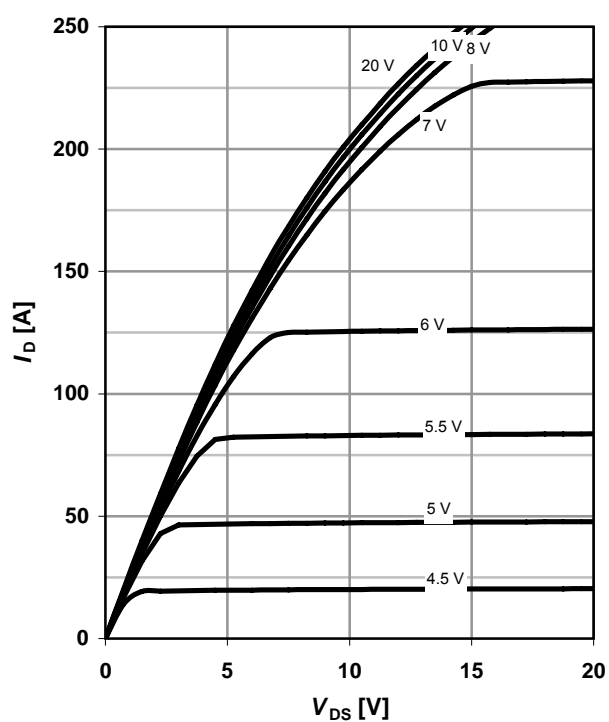
parameter: $D = t_p / T$



4 Typ. output characteristics

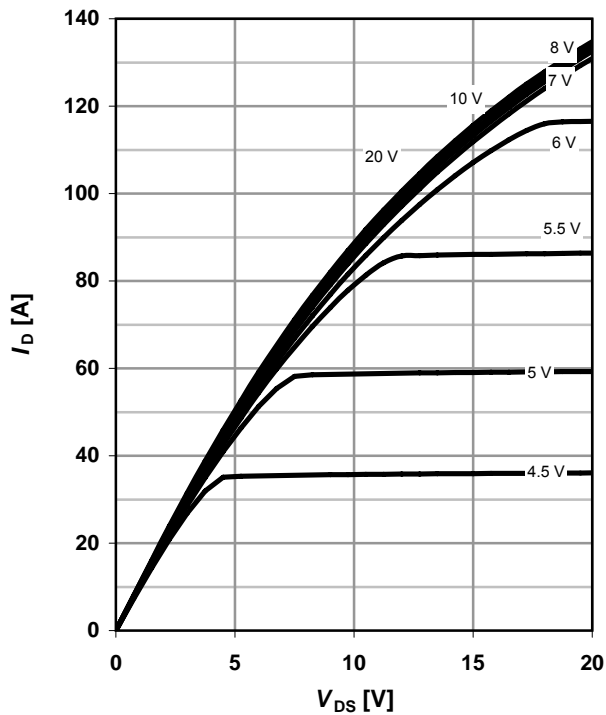
$$I_D = f(V_{DS}); T_J = 25^\circ\text{C}$$

parameter: V_{GS}



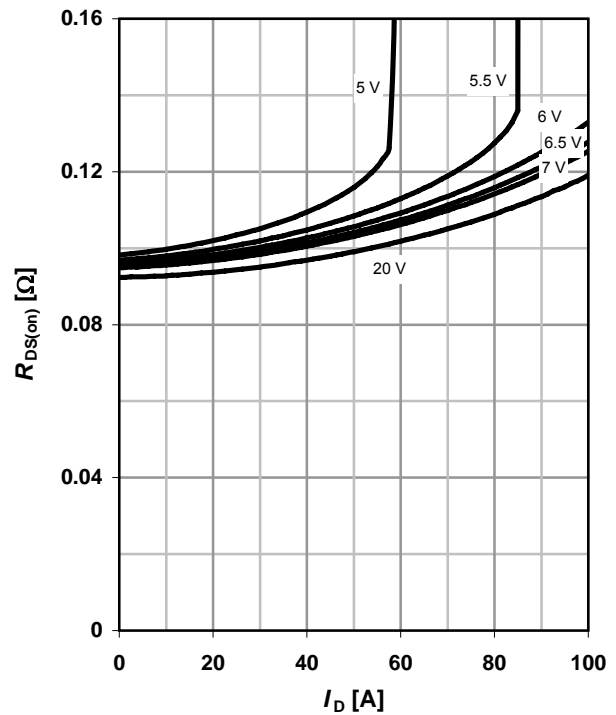
5 Typ. output characteristics

 $I_D = f(V_{DS}); T_j = 150^\circ\text{C}$

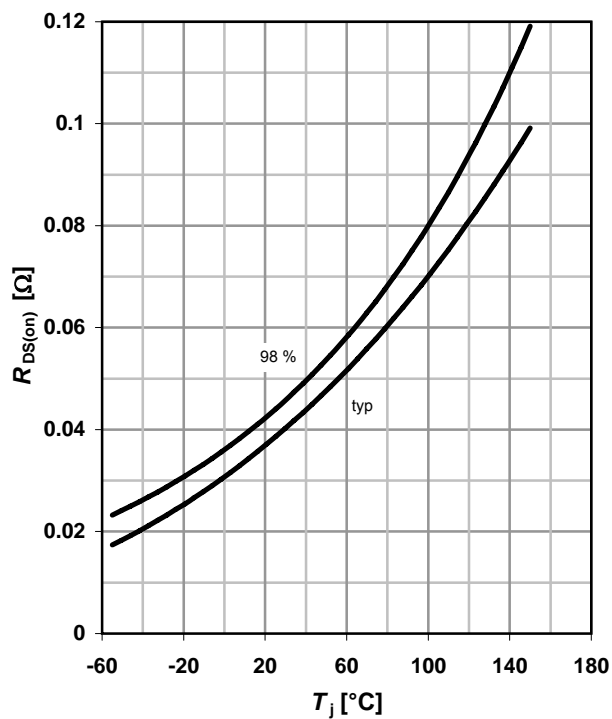
parameter: V_{GS}


6 Typ. drain-source on-state resistance

 $R_{DS(on)} = f(I_D); T_j = 150^\circ\text{C}$

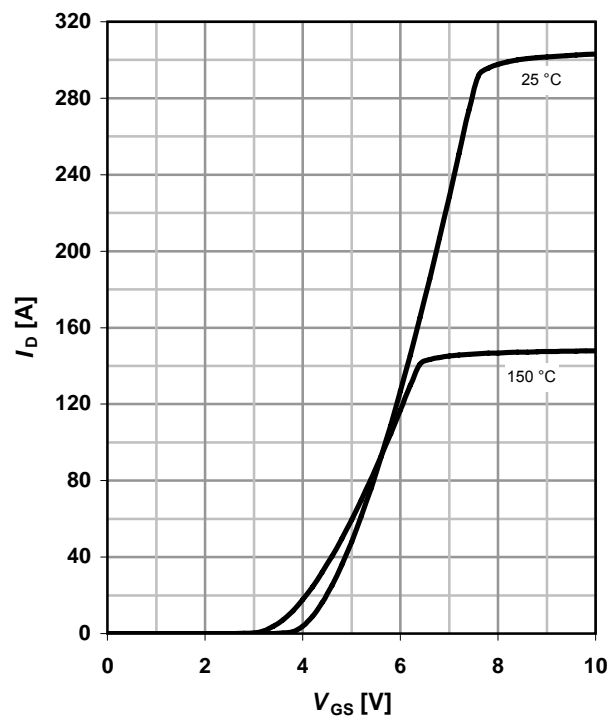
parameter: V_{GS}


7 Drain-source on-state resistance

 $R_{DS(on)} = f(T_j); I_D = 44\text{ A}; V_{GS} = 10\text{ V}$


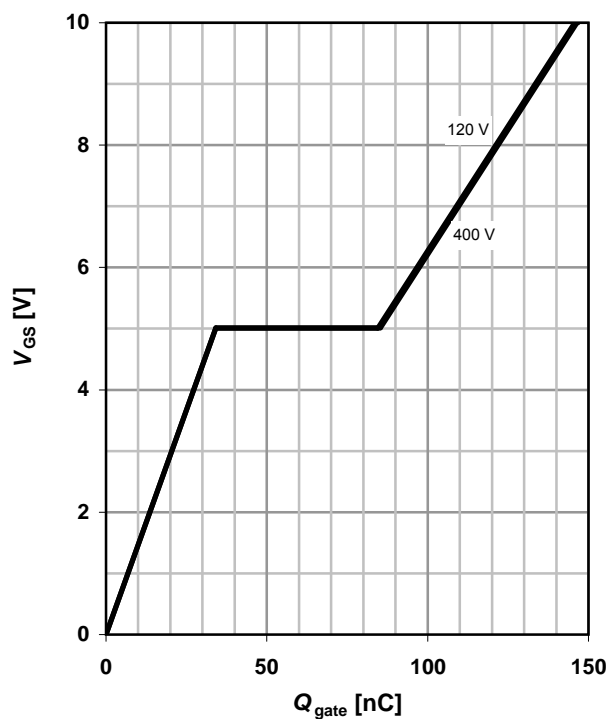
8 Typ. transfer characteristics

 $I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}$

parameter: T_j


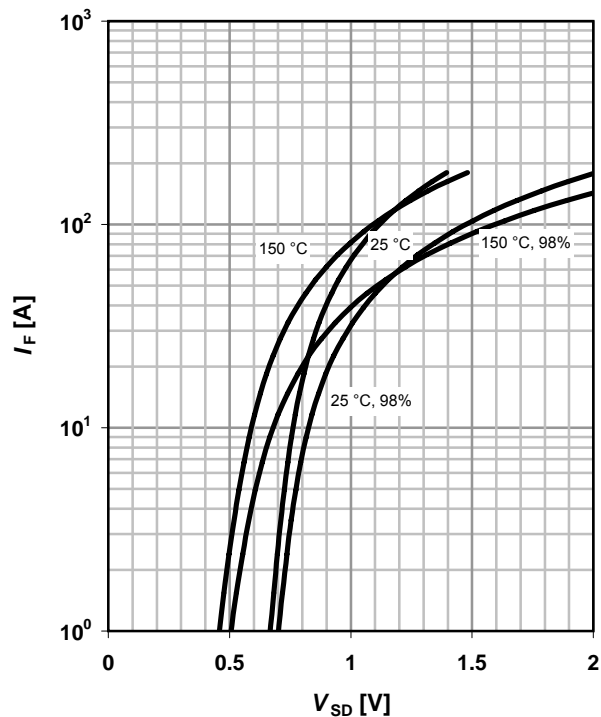
9 Typ. gate charge

 $V_{GS}=f(Q_{gate}); I_D=44\text{ A pulsed}$

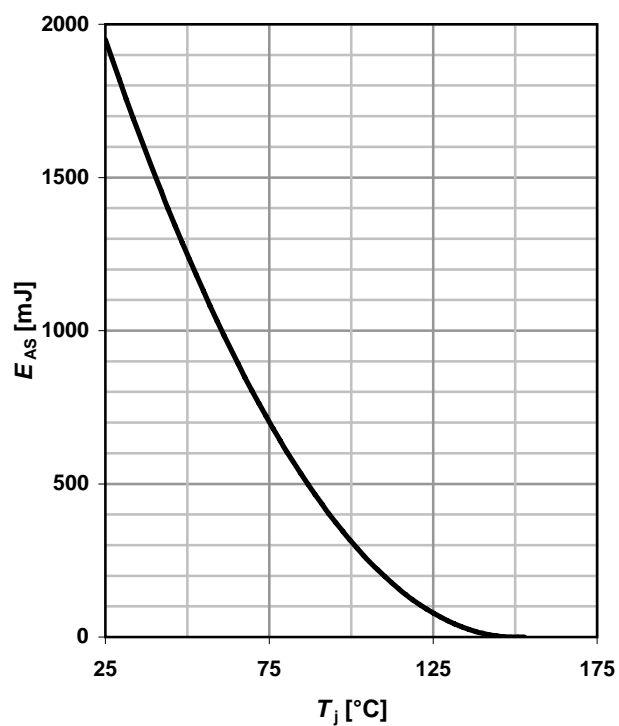
parameter: V_{DD}


10 Forward characteristics of reverse diode

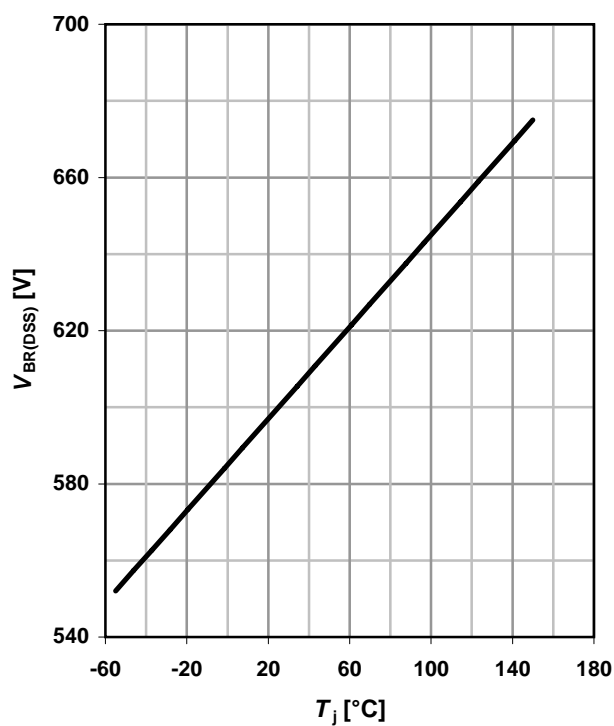
 $I_F=f(V_{SD})$

parameter: T_j


11 Avalanche energy

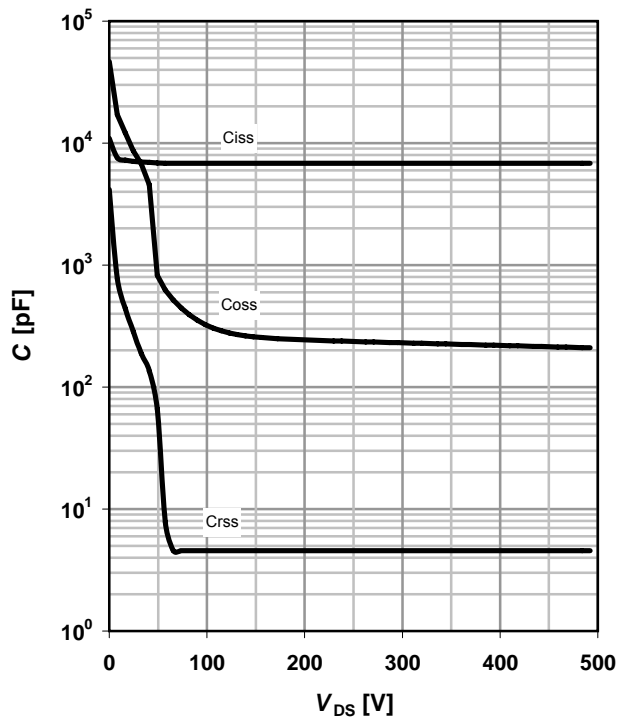
 $E_{AS}=f(T_j); I_D=11\text{ A}; V_{DD}=50\text{ V}$


12 Drain-source breakdown voltage

 $V_{BR(DSS)}=f(T_j); I_D=0.25\text{ mA}$


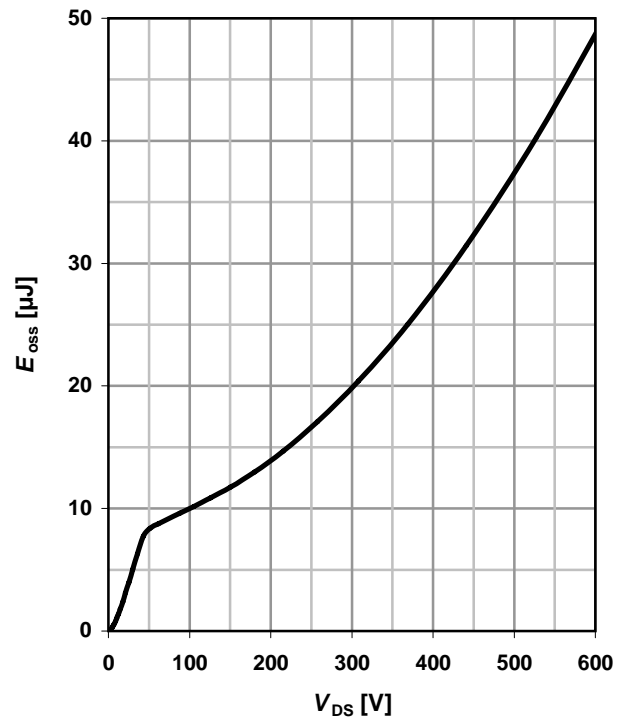
13 Typ. capacitances

$C=f(V_{DS}); V_{GS}=0\text{ V}; f=1\text{ MHz}$

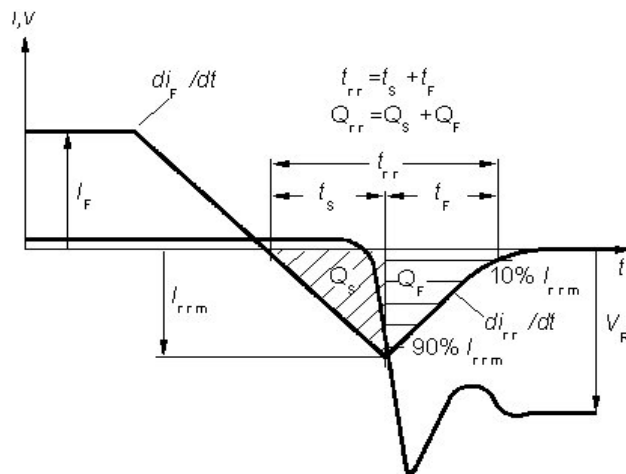


14 Typ. Coss stored energy

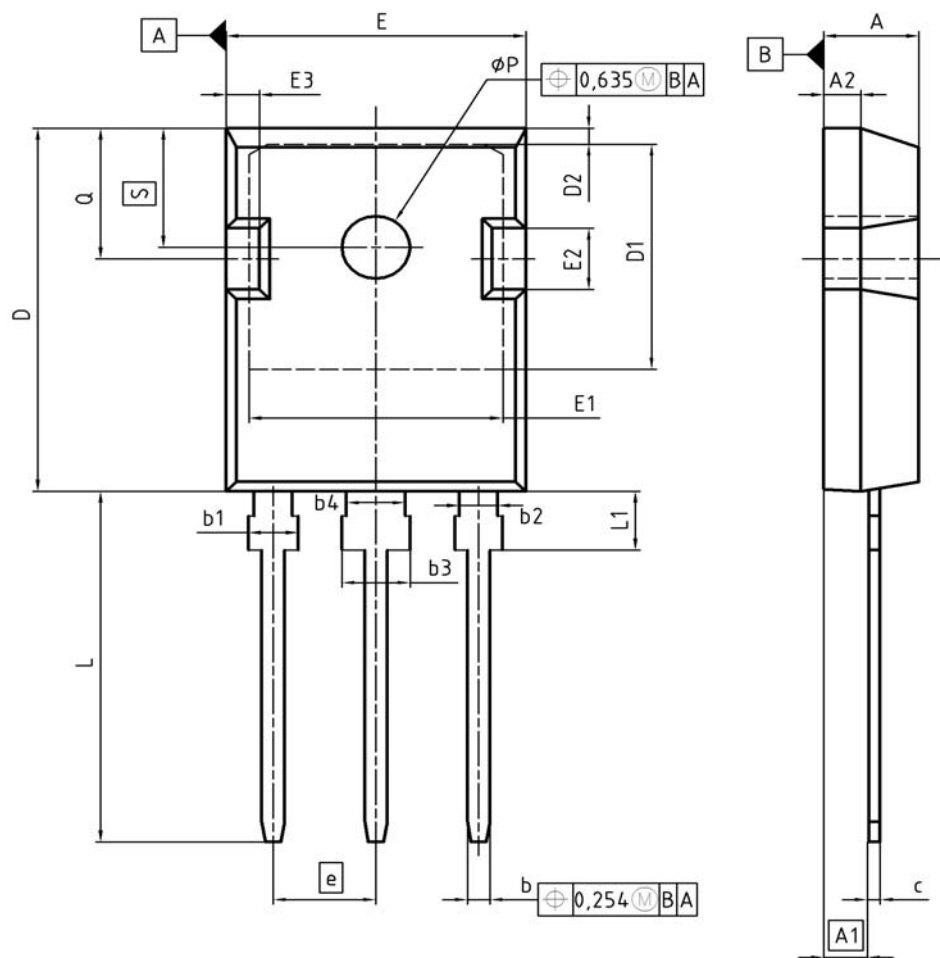
$E_{oss}=f(V_{DS})$



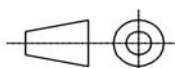
Definition of diode switching characteristics



PG-TO-247-3: Outlines



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.90	5.16	0.193	0.203
A1	2.27	2.53	0.089	0.099
A2	1.85	2.11	0.073	0.083
b	1.07	1.33	0.042	0.052
b1	1.90	2.41	0.075	0.095
b2	1.90	2.16	0.075	0.085
b3	2.87	3.38	0.113	0.133
b4	2.87	3.13	0.113	0.123
c	0.55	0.68	0.022	0.027
D	20.82	21.10	0.820	0.831
D1	16.25	17.65	0.640	0.695
D2	1.05	1.35	0.041	0.053
E	15.70	16.03	0.618	0.631
E1	13.10	14.15	0.516	0.557
E2	3.68	5.10	0.145	0.201
E3	1.68	2.60	0.066	0.102
e	5.44		0.214	
N	3		3	
L	19.80	20.31	0.780	0.799
L1	4.17	4.47	0.164	0.176
ϕP	3.50	3.70	0.138	0.146
Q	5.49	6.00	0.216	0.236
S	6.04	6.30	0.238	0.248

DOCUMENT NO. Z8B00003327
SCALE 0 5 5 7.5mm
EUROPEAN PROJECTION 
ISSUE DATE 17-12-2007
REVISION 03

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NOTIFICATION



N° 040/10

Information on N-Channel MOSFET products designed for automotive applications

Products affected:

SalesName	Package
IPB60R099CPA	PG-TO263-3-2
IPB60R199CPA	PG-TO263-3-2
IPB60R299CPA	PG-TO263-3-2
IPC60R075CPA	Bare Die
IPI60R099CPA	PG-TO262-3-1
IPP60R099CPA	PG-TO220-3-1
IPW60R045CPA	PG-TO247-3-41
IPW60R075CPA	PG-TO247-3-41
IPW60R099CPA	PG-TO247-3-41

Dear Customer,

The devices listed for this notification are sensitive to hard commutation of the conducting body diode. This operating condition can occur in half-bridge configurations used in ZVS phase shift and resonant switching PWM converters. Using the device under such conditions may result in violation of the datasheet specification limits and may lead to permanent damage of the device.

Please take care that in the context of the application described above the datasheet limits are not exceeded.

Best Regards

Michael Paulu

If you have any questions, please do not hesitate to contact your local Sales office.

Type 0ACG

500VDC, SMD Fuse

HF 0ACG Series

RoHS Compliant

Features

- Surface mount design to save space
- Ceramic tube, silver plated cap construction
- Compatible with 260°C, IR Pb-free solder process
- Wide operating temperature range, -40°C to 125°C
- Tape & Reel for auto-insert SMD process
- MSL = 1
- Complies with IEC 60127-7 standard
- RoHS compliant with exemption 7(a)
- Full compliance with EU Directive 2011/65/EU and amending directive 2015/863
- AEC-Q Compliant
- Meets Bel automotive qualification*
- * - Largely based on internal AEC-Q test plan



AEC-Q Compliant

Applications

- Battery Management Systems, (BMS)
- Li-ion Battery Packs
- DC-DC Converters

HALOGEN FREE = **HF**

Physical Specifications

Materials	Body : Ceramic
	Cap : Silver plated copper
Marking	On Fuse :
	"Current Rating"
	On Label :
	"bel", "0ACG", "Current Rating", "Voltage Rating", "Interrupting Rating", "Appropriate Safety Logos" and "RoHS", "50" (China RoHS compliant).

Electrical Characteristics

% of Ampere Rating (A)	Operating Time	
	Min	Max
125%	1 hour	-
200%	-	120 sec
1000%		1 sec

Safety Agency Approvals

Safety Agency	Ampere Rating / Voltage Rating	Ampere Range / Volt @ I.R. ability**
cULus	1-3.15A/500V DC /350V DC /350V AC 4-5A/450V DC /125V DC /350V AC	1-3.15A/500V @ 100A DC /350V @ 1500A DC /350V @ 100A AC 4-5A/450V @ 100A DC /125V @ 1500A DC /350V @ 100A AC
** AC Interrupting Rating (measured at designated voltage, 100% power factor); DC Interrupting Rating (measured at designated voltage, time constant of less than 50 microseconds, battery source)		

Type 0ACG

Electrical Specifications

Part Number	Ampere Rating	Alpha Mark	Voltage and Interrupting Ratings	Typical Cold. Resistance (mohms)**	Typical Voltage Drop (mV)	Typical Pre-Arcing I ² t (A ² Sec)***
0ACG-1000-XX	1A	1	See Table of Ratings on Page 1 for Voltage and associated Interrupting Ratings	220	220	0.50
0ACG-1250-XX	1.25A	1.25		140	210	0.95
0ACG-1600-XX	1.6A	1.6		90	190	2.3
0ACG-2000-XX	2A	2		70	185	4.1
0ACG-2500-XX	2.5A	2.5		40	120	2.6
0ACG-3150-XX	3.15A	3.15		31.5	140	3.3
0ACG-4000-XX	4A	4		24.5	140	5.5
0ACG-5000-XX	5A	5		17.5	130	11.5

Consult manufacturer for other ratings

** DC Cold Resistance are measured at <10% of rated current in ambient temperature of 25 °C

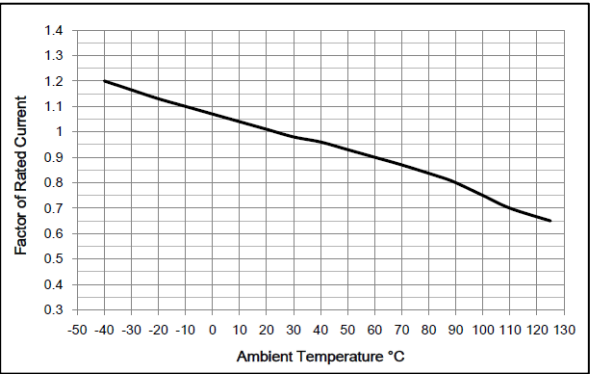
*** Typical Pre-arcing I²t are measured at 10In Current, DC battery bank.

Temperature derating curve

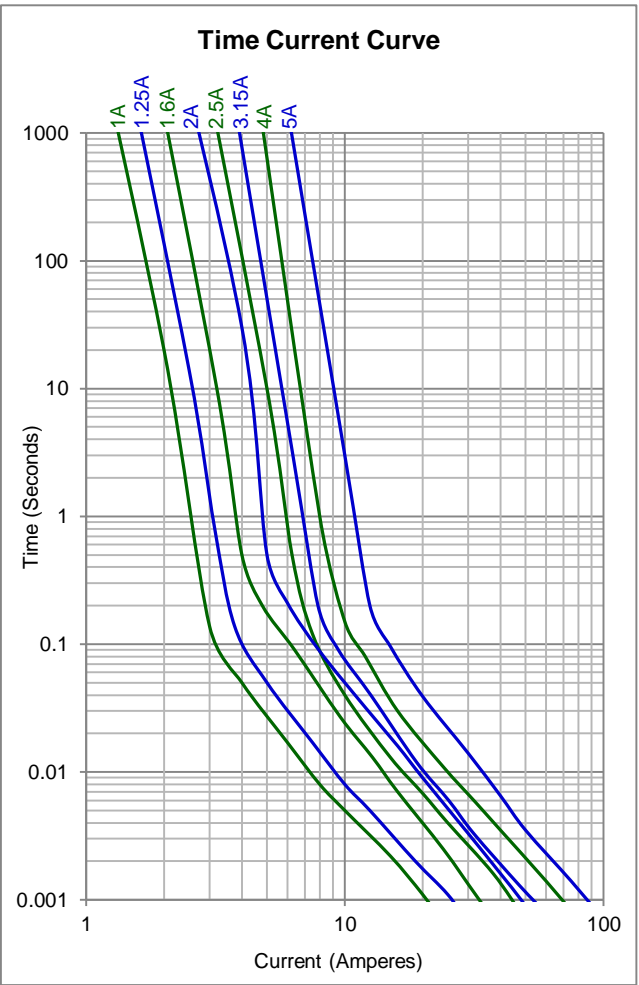
Normal Operating Temperature: 25 °C ± 2 °C

Operating Temperature: -40 °C to 125 °C with proper correction factor applied.

Chart of correction factor



Time Current Curve



Type 0ACG

3 / 4

Soldering Characteristics

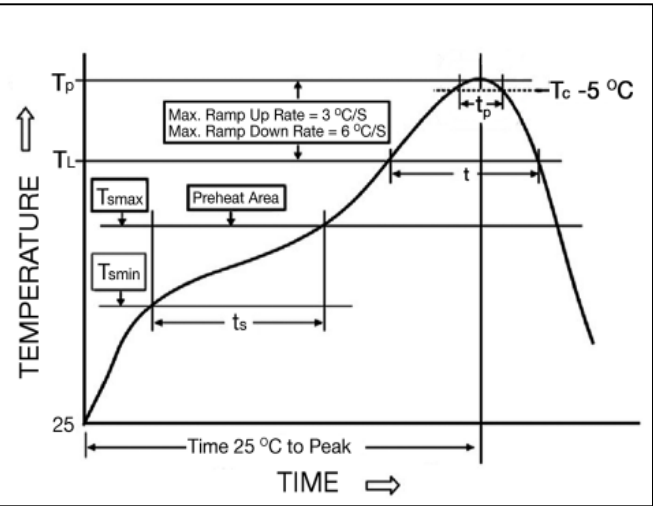
Reflow Soldering

- Temperature: 260° C
- Time: 30 Seconds Maximum

Manual Soldering (not recommended)

- Temperature: 350° C
- Time: 5 Seconds Maximum

Profile Feature	
Preheat & Soak	
Temperature min (T_{smin})	150°C
Temperature max (T_{smax})	200°C
Time (T_{smin} to T_{smax}) (t_s)	60-120 seconds
Average ramp-up rate(T_{smax} to T_p)	3°C / second max.
Liquidous temperature(T_L)	217°C
Time at liquidous (t_L)	60 – 150 seconds
Peak package body temperature (T_p)	260°C max
Time (t_p) within 5°C of the specified classification temperature (T_c)	30 seconds
Average ramp-down rate(T_p to T_{smax})	6°C / second max.
Time 25°C to peak temperature	8 minutes max.



Type 0ACG

4 / 4

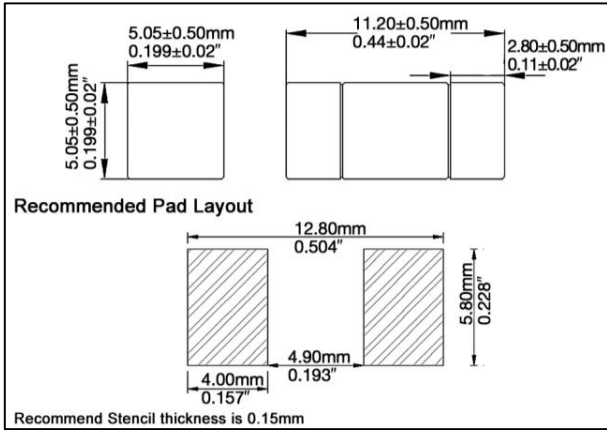
Fuse FGNO Explanation

0ACG - [XXXX] -XX

0ACG=0ACG; [XXXX]=Ampere Rating; XX=See Ordering Information as below

Fraction	Decimal	Amps	Bel FGNO[XXXX]
	1.0	1	1000
1-1/4	1.25	1.25	1250
	1.6	1.6	1600
	2.0	2	2000
2-1/2	2.5	2.5	2500
	3.15	3.15	3150
	4.0	4	4000
	5.0	5	5000

Mechanical Dimensions



Ordering Information

0ACG - XXXX - XX

FUSE TYPE _____

0ACG = 0ACG

AMPERE RATING _____

Refer to fuse FGNO explanation table

QUANTITY & PACKAGING CODE _____

TE = 1000pcs fuses in tape (width 24mm) and reel (dia. 13inch)

Packaging

Packaging Option	Quantity	Packaging Code
Tape (width 24mm) and reel (dia. 13inch)	1000	TE



EMI Suppression Safety Capacitor, Ceramic Disc, Class X1, 760 V_{AC}, Class Y1, 500 V_{AC}



LINKS TO ADDITIONAL RESOURCES



QUICK REFERENCE DATA				
DESCRIPTION	VALUE			
Ceramic Class	1		2	
Ceramic Dielectric	U2J	U2J	Y5S, Y5U, Y5V	Y5S, Y5U, Y5V
Voltage (V _{AC})	500	760	500	760
Min. Capacitance (pF)	10		33	
Max. Capacitance (pF)	22		4700	
Mounting	Radial			

OPERATING TEMPERATURE RANGE

-40 °C to +125 °C

TEMPERATURE CHARACTERISTICS

Class 1: U2J

Class 2: Y5S, Y5U, Y5V

SECTIONAL SPECIFICATIONS

Climatic category (according to EN 60058-1)

Class 1 and class 2: 40 / 125 / 21

COATING

According to UL 94 V-0

Epoxy resin, isolating, flame retardant

Halogen-free available

Reinforced insulation

APPROVALS

IEC 60384-14

UL 60384-14

DIN EN 60384-14

CSA E60384-1:03, CSA E60384-14:09

CQC11-471112-2009

PACKAGING

Bulk, tape and reel, taped ammpack

FEATURES

- Complying with IEC 60384-14
- High reliability
- Vertical (inline) kinked or straight leads
- Singlelayer AC disc safety capacitors
- Material categorization:
for definitions of compliance please see
www.vishay.com/doc?99912

APPLICATIONS

- X1, Y1 according to IEC 60384-14
- Line-to-line filtering (Class X)
- Line-to-ground filtering (Class Y)
- Primary and secondary coupling (SMPS)
- EMI / RFI suppression and filtering

DESIGN

The capacitor consists of a ceramic disc which is silver plated on both sides. Connection leads are made of tinned copper clad steel having a diameter of 0.6 mm.

The capacitors may be supplied with vertical (inline) kinked leads having a lead spacing of 10.0 mm, or 12.5 mm. Encapsulation is made of flame retardant epoxy resin in accordance with UL 94 V-0.

CAPACITANCE RANGE

10 pF to 4700 pF

RATED VOLTAGE U_R

IEC 60384-14:

(X1): 760 V_{AC}, 50 Hz

(Y1): 500 V_{AC}, 50 Hz

1500 V_{DC}

TEST VOLTAGE

Component test (100 %):

4000 V_{AC}, 50 Hz, 2 s

Random sampling test (destructive test):

4000 V_{AC}, 50 Hz, 60 s

Voltage proof of coating (destructive test):

4000 V_{AC}, 50 Hz, 60 s

INSULATION RESISTANCE

≥ 10 000 MΩ

CAPACITANCE TOLERANCE

± 20 % (code M); ± 10 % (code K)

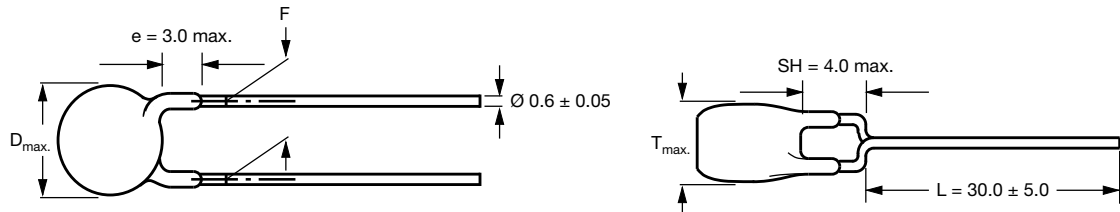
DISSIPATION FACTOR

Class 1: max. 0.5 % (1 MHz)

Class 2: max. 2.5 % (1 kHz)



RoHS
COMPLIANT
HALOGEN
FREE
GREEN
(5-2008)

DIMENSIONS in millimeters


Capacitors with 10.0 mm or 12.5 mm lead spacing

TECHNICAL DATA

CAPACITANCE C (pF)	CAPACITANCE TOLERANCE (%)	BODY DIAMETER D _{max.} (mm)	BODY THICKNESS T _{max.} (mm)	LEAD SPACING F (mm) ± 1 mm	PART NUMBER
					MISSING DIGITS SEE ORDERING CODE BELOW
U2J					
10	± 10	8.0	5.0	10.0 or 12.5	VY1100K31U2JQ6###
15					VY1150K31U2JQ6###
22					VY1220K31U2JQ6###
Y5S					
33	± 10	8.0	5.0	10.0 or 12.5	VY1330K31Y5SQ6###
47					VY1470K31Y5SQ6###
68					VY1680K31Y5SQ6###
100					VY1101K31Y5SQ6###
150					VY1151K31Y5SQ6###
220					VY1221K31Y5SQ6###
330					VY1331K31Y5SQ6###
Y5U					
470	± 20 ⁽¹⁾	8.0	5.0	10.0 or 12.5	VY1471#31Y5UQ6###
680					VY1681#31Y5UQ6###
1000		9.0			VY1102#35Y5UQ6###
1500		10.5			VY1152#41Y5UQ6###
2200		12.0			VY1222#47Y5UQ6###
3300		15.0			VY1332#59Y5UQ6###
3900		15.5			VY1392#61Y5UQ6###
4700		16.0			VY1472#63Y5UQ6###
Y5V MINI SIZE SERIES					
1000	± 20	7.5	5.5	10.0 or 12.5	VY1102M29Y5VQ6###
1500		8.5			VY1152M33Y5VQ6###
2200		9.5			VY1222M37Y5VQ6###
3300		11.0			VY1332M43Y5VQ6###
3900		12.0			VY1392M47Y5VQ6###
4700		13.0			VY1472M51Y5VQ6###

Notes

- Straight leads available on request
- Coating extension DR valid for straight leads only

⁽¹⁾ ± 10 % available on request



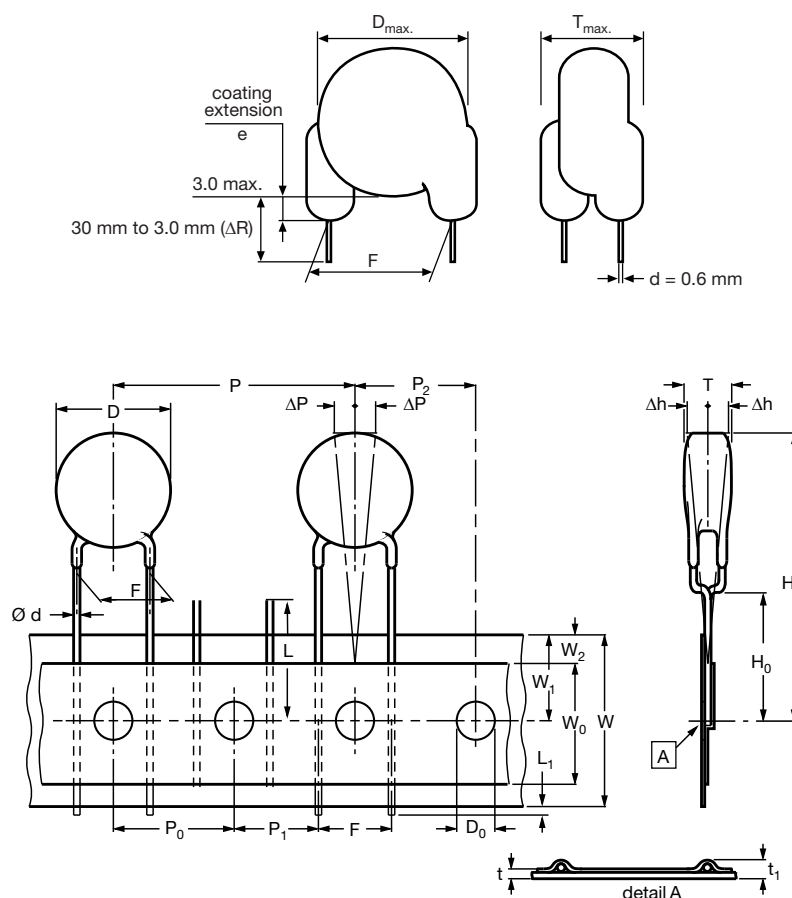
ORDERING CODE										
#	7 th digit		Capacitance tolerance			$\pm 10\% = K, \pm 20\% = M$				
###	15 th to 17 th digit		Lead configuration			Available configurations see below				
Example	VY1	101	K	31	Y5S	Q	6	T	V	0
	Series	Capacitance value	Tolerance code	Size code	Temperature coefficient	Rated voltage	Lead wire diameter	Packaging / lead length	Lead style	Lead spacing
						Q = X1/Y1 500 V (AC)		3 = bulk T = tape and reel U = ammpack	L = straight V = inline kinked	0 = 10.0 X = 12.5

PACKAGING				
SIZE CODE	BODY DIAMETER D _{max.} (mm)	PACKAGING QUANTITIES		
		BULK	REEL	AMMO
31 to 47	12.0	1000	500	750
51 to 63	16.0	500	500	750

Note

- The capacitors are supplied in bulk packaging (cardboard boxes), in tape on reel or in ammpack

STRAIGHT LEADS

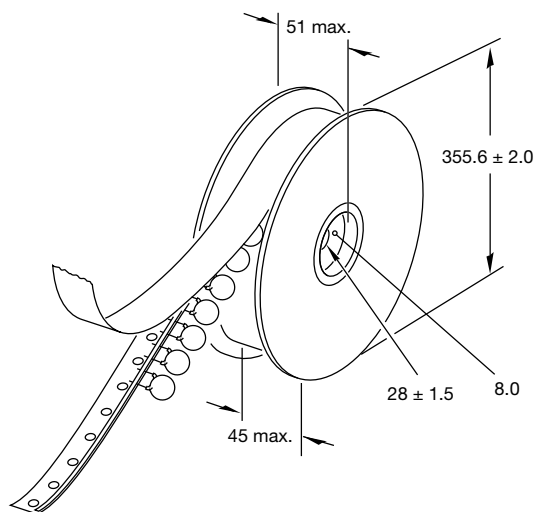


The sprocket hole pitch (P₀) is 12.7 mm for lead spacing 10.0 mm and 12.5 mm

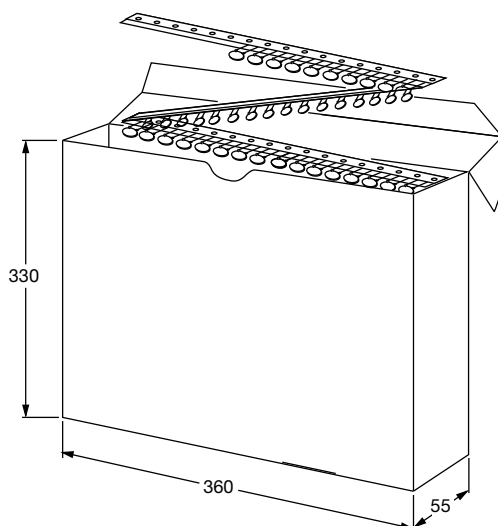
DIMENSIONS OF TAPE		
SYMBOL	PARAMETER	DIMENSIONS (mm)
D ⁽¹⁾	Body diameter	16.0 max.
d	Lead diameter	0.6 ± 0.05
P	Pitch of component	25.4 ± 1
P ₀ ⁽²⁾	Pitch of sprocket hole	12.7 ± 0.3
P ₁ ⁽³⁾	Distance, hole center to lead	7.7 or 6.4 ± 1.0
P ₂ ⁽³⁾	Distance, hole to center of component	12.7 ± 1.5
F	Lead spacing	10.0 or 12.5 + 0.6/- 0.4
Δh	Average deviation across tape	± 1.0 max.
ΔP	Average deviation in direction of reeling	± 1.0 max.
W	Carrier tape width	18.0 + 1/- 0.5
W ₀	Hold-down tape width	5.0 min.
W ₁	Position of sprocket hole	9.0 + 0.75/- 0.5
W ₂	Distance of hold-down tape	3.0 max.
H ₁	Maximum component height	40.0
H ₀	Height to seating plane (for kinked leads)	16.0 ± 0.5
H ₀	Height to seating plane (for straight leads)	20.0 ± 0.5
L	Length of cut leads	11.0 max.
L ₁	Length of lead protrusion	1.0 max.
D ₀	Diameter of sprocket hole	4.0 ± 0.2
t	Total tape thickness	0.9 max.
t ₁	Total tape thickness with lead wire	t + d

Notes

- (1) See "Technical Data" table
(2) Cumulative pitch error: ± 1 mm/20 pitches
(3) Obliquity maximum 3°

REEL AND TAPE DATA in millimeters


Reel with capacitors on tape



Ampopack with capacitors on tape



APPROVALS

IEC 60384-14 - Safety tests

This approval together with CB test certificate substitutes all national approvals.

CB Certificate

Y1-capacitor: CB test certificate:	US-26561-UL	10 pF to 4.7 nF	500 V _{AC}
X1-capacitor: CB test certificate:	US-26561-UL	10 pF to 4.7 nF	760 V _{AC}



VDE

Y1-capacitor: VDE marks approval:	40012673	10 pF to 4.7 nF	500 V _{AC}
X1-capacitor: VDE marks approval:	40012673	10 pF to 4.7 nF	760 V _{AC}



DIN EN 60384-14 VDE 0565-1-1:2006-04 - Safety tests

Underwriters Laboratories Inc./Canadian Standards Association

Y1-capacitor: CSA test certificate:	E183844	10 pF to 4.7 nF	500 V _{AC}
X1-capacitor: CSA test certificate:	E183844	10 pF to 4.7 nF	760 V _{AC}



UL 60384-14, CSA E60384-1:03, CSA E60384-14:09

Fixed capacitors for electromagnetic interference suppression and connection to the supply mains.

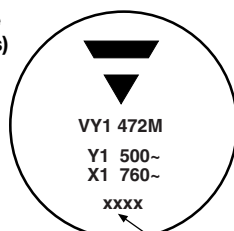
CQC

Y1-capacitor: CQC test certificate:	CQC05001015032	10 pF to 4.7 nF	500 V _{AC}
X1-capacitor: CQC test certificate:	CQC05001015032	10 pF to 4.7 nF	760 V _{AC}



MARKING

Sample
(2 sides)



4 digit date code
(year/week; add suffix "V" for mini size series)

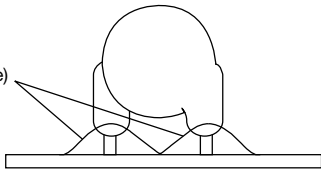


PN: VY1471M31Y5UQ6XT0 Lot1: 14Z551S12 DC1: 0601
QTY: 225 Lot2: DC2:
PO: Batch: 200601CN
SO: Region: 9520 SL: 0010
Ser.No: 0601H69340



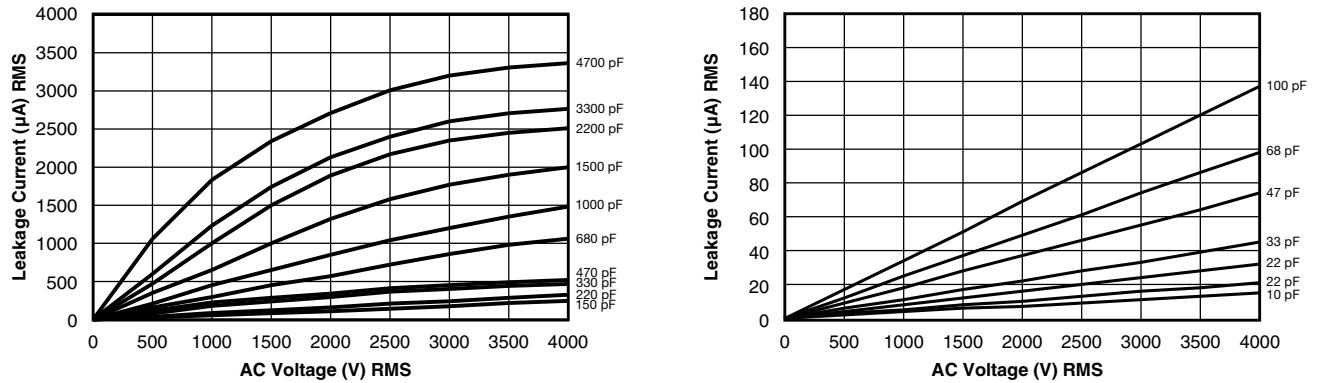
1/1



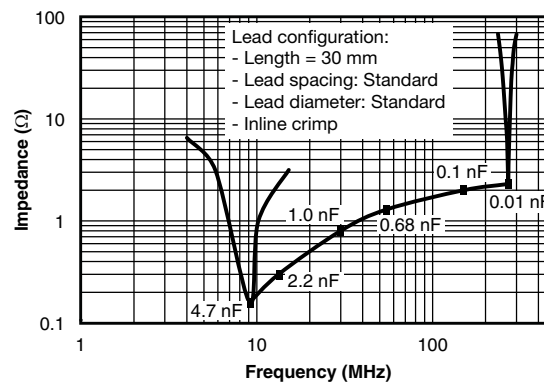
PERFORMANCE		
TEST	TEST CONDITION	TEST LIMITS
Visual and mechanical inspection	Optical inspection, dimensions measured with caliper	No visible damage, marking legible
Capacitance (C)	25 °C ± 3 °C, relative humidity (RH) ≤ 75 %, 1.0 V _{RMS} ± 0.2 V _{RMS} at 1 kHz for Y5U and Y5S, and 1 MHz for U2J	Capacitance within specified tolerance
Dissipation factor (DF)		DF ≤ 0.3 % for U2J and DF ≤ 2.5 % for Y5S and Y5U
Insulation resistance (IR)	Measured within 60 s ± 5 s after charging at 500 V _{DC}	10 000 MΩ min.
Dielectric strength	4000 V _{AC} at 50 Hz/60 Hz for 1 min, 50 mA max.	No failure
Temperature characteristic	RH ≤ 75 %, 1.0 V _{RMS} ± 0.2 V _{RMS} at 1 kHz for Y5U and Y5S, and 1 MHz for U2J	U2J: -750 ppm ± 120 ppm Y5S: ± 22 % Y5U: +22 %/-56 %
Impulse voltage	3 pulses of 8 kV	No failure
Life test	1000 h at 125 °C ± 2 °C, 850 V _{AC} /50 Hz; once every hour 1000 V _{AC} for 0.1 s	External appearance: no visible damage ΔC/C ≤ ± 15 % DF ≤ 0.5 % for U2J and ≤ 5 % for Y5S and Y5U IR ≥ 3000 MΩ Dielectric strength: no failure
Humidity test	500 h at 500 V _{AC} , 50 Hz and 500 h unloaded 40 °C, RH = 90 % to 95%	External appearance: no visible damage ΔC/C ≤ ± 10 % for U2J and ≤ ± 15 % for Y5S and Y5U DF ≤ 0.5 % for U2J and ≤ 5 % for Y5S and Y5U IR ≥ 3000 MΩ Dielectric strength: no failure
Robustness of termination	Pull test: 0.5 kg tensile weight in radial direction for 10 s ± 1 s Bending strength: capacitor body rotated by 90° in both directions	No damage to capacitor body and lead wire
Soldering effect	Immersion of lead wires into 260 °C ± 5 °C solder for 10 s ± 2 s; min. distance from body: 1.5 mm Hand soldering at 400 °C ± 10 °C for 3 s to 4 s; min. distance from body: 1.5 mm	External appearance: no visible damage ΔC/C ≤ ± 5 % for U2J and ≤ ± 10 % for Y5S and Y5U Dielectric strength: no failure
Vibration test	 <p>Solder the capacitor onto test jig (glass epoxy body) and use resin (adhesive) to stick the body to the test jig. The capacitor must be soldered firmly to the supporting lead wire. Vibration change from 10 Hz to 2000 Hz and back to 10 Hz; Total amplitude: 1.5 mm; Acceleration: 100 m/s²; Sweep rate: 1 oct/min, each axis 2 h (6 h in total)</p>	External appearance: no visible damage Capacitance within specified tolerance DF ≤ 0.3 % for U2J and ≤ 2.5 % for Y5S and Y5U IR ≥ 10 000 GΩ



LEAKAGE CURRENT VS. VOLTAGE (Typical)



IMPEDANCE VS. FREQUENCY (Typical)



Note

- The capacitors meet the essential requirements of "EIA 198". Unless stated otherwise all electrical values apply at an ambient temperature of 25 °C ± 3 °C, at normal atmospheric conditions

RELATED DOCUMENTS	
General Information	www.vishay.com/doc?28536
CB Test Certificate	www.vishay.com/doc?22249
VDE Marks Approval	www.vishay.com/doc?22251
UL Test Certificate	www.vishay.com/doc?22250
CQC Test Certificate	www.vishay.com/doc?22248
LTspice® Models	www.vishay.com/doc?28568

SAMPLE KITS	
Part Number (VY1 Sample Kit)	VY11-KIT-HF
Link (VY1 Sample Kit)	www.vishay.com/doc?28552
Part Number (VY1...Y5V Sample Kit)	VY1-KIT-MS
Link (VY1...Y5V Sample Kit)	www.vishay.com/doc?28561



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Part Number : [768250004](#)
Product Description : Mega-Fit Right-Angle Header,
4 Circuits, Tin (Sn) Plating, UL 94 V-0, Glow-Wire
Capable, Tray
Series Number : 76825
Status : Active
Product Category : PCB Headers and Receptacles



Documents & Resources

Drawings

- [768250004 sd.pdf](#)
- [768250001-PK-000.pdf](#)

3D Models and Design Files


- [768250004 stp.zip](#)
- [SYM-76825-0004-001.zip](#)

Specifications

- [AS-76823-100-001.pdf](#)
- [1720631000-PS-000.pdf](#)
- [PS-76823-100-001.pdf](#)
- [1720631000-TS-000.pdf](#)
- [TS-76823-100-001.pdf](#)
- [TS-76825-001-001.pdf](#)

Product Environment Compliance..

Compliance

GADSL/IMDS	Compliant with Exemption 44; 33
China RoHS	 per SJ/T 11365-2006
EU ELV	Not Relevant
Low-Halogen Status	Low-Halogen per IEC 61249-2-21
REACH SVHC	Not Contained per D(2024)7663-DC (21 Jan 2025)

EU RoHS	Compliant per EU 2015/863
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Compliance Statements

- EU RoHS
- REACH SVHC
- Low-Halogen

Industry Documents

- IPC 1752A Class C
- IPC 1752A Class D
- Molex Product Compliance Declaration
- IEC-62474
- chemSHERPA (xml)

Substances of Interest

- PFAS

EU RoHS Certificate of Compliance

Additional Product Compliance Information

Part Details

General

Status	Active
Category	PCB Headers and Receptacles
Series	76825
Description	Mega-Fit Right-Angle Header, 4 Circuits, Tin (Sn) Plating, UL 94 V-0, Glow-Wire Capable, Tray
Application	Power, Wire-to-Board
Component Type	PCB Header
Product Name	Mega-Fit
UPC	887191453842

Agency

CSA	LR19980
UL	E29179

Electrical

Current - Maximum per Contact	23.5A
Voltage - Maximum	600V

Physical

Breakaway	No
Circuits (Loaded)	4
Circuits (maximum)	4
Color - Resin	Black
First Mate / Last Break	No
Flammability	94V-0
Glow-Wire Capable	Yes
Keying to Mating Part	Yes
Lock to Mating Part	Yes
Mated Height	16.78mm
Material - Metal	Copper
Material - Plating Mating	Matte Tin
Material - Plating Termination	Matte Tin
Material - Resin	High Temperature Thermoplastic
Net Weight	2.836/g
Number of Rows	2
Orientation	Right Angle
Packaging Type	Tray
PCB Locator	Yes
PCB Retention	Yes
PCB Thickness - Recommended	1.57mm, 2.36mm
Pitch - Mating Interface	5.70mm
Pitch - Termination Interface	5.70mm
Plating min - Mating	1.524µm
Plating min - Termination	1.270µm
Polarized to Mating Part	Yes
Polarized to PCB	Yes
Shrouded	Yes
Temperature Range - Operating	-40° to +105°C
Termination Interface Style	Through Hole
Unmated Height	14.53mm

Solder Process Data

Max-Duration	30
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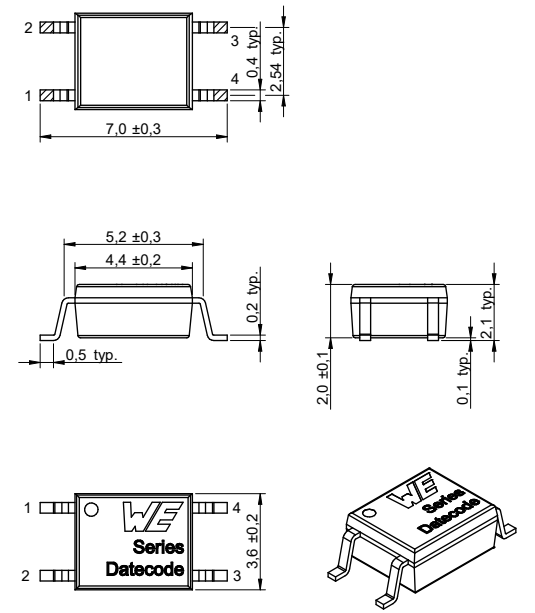
Lead-Free Process Capability	SMC&WAVE
Max-Cycle	1
Max-Temp	260

Mates With / Use With

Mates with Part(s)

Description	Part Number
Mega-Fit Dual Row Receptacle Housings	<u>170001</u>
Mega-Fit Dual Row Receptacle Housings	<u>171692</u>
Mega-Fit-to-Mega-Fit Off-the-Shelf (OTS) Cable Assemblies	<u>45136</u>

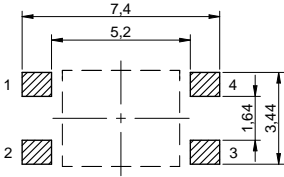
Dimensions: [mm]



Product Marking:

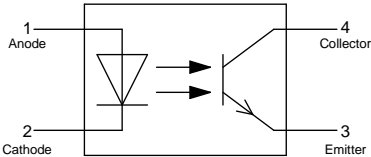
Pin 1 Anode	0
Marking	356B (Series 356, Binning B)
Marking - Date Code	YWW

Recommended Land Pattern: [mm]



Scale - 5:1

Schematic:



Scale - 5:1

General Properties:









Type	Optocoupler Phototransistor
Input	DC
Package	SOP 4
Plastic Housing Color	White

Certification:

RoHS Approval	Compliant [2011/65/EU&2015/863]
REACH Approval	Conform or declared [(EC)1907/2006]
Halogen Free	Conform [JEDEC JS709B]
Halogen Free	Conform [IEC 61249-2-21]
VDE Approval	40051484 [DIN EN 60747-5-5 (VDE0884-5); EN 60747-5-5:2011; A1:2015]
cULus Approval	E513104 [UL 1577]
CQC Approval	CQC20001274583 [GB4943.1-2001; GB8898-2011]

General Information:

Operating Temperature	-55 up to +110 °C
Storage Conditions (for single parts)	-55 up to +125 °C
Storage Conditions (in original packaging)	< 40 °C; < 75 % RH
Moisture Sensitivity Level (MSL)	1

     	CHECKED SalVo	REVISION 001.004	DATE (YYYY-MM-DD) 2023-08-22	GENERAL TOLERANCE DIN ISO 2768-1m	PROJECTION METHOD 
 WÜRTH ELEKTRONIK MORE THAN YOU EXPECT	DESCRIPTION WL-OCPT Optocoupler Phototransistor			ORDER CODE 140356145200	
	SIZE/TYPE SOP4			BUSINESS UNIT ePal	STATUS Valid

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Absolute Maximum Ratings Input Properties (Ambient Temperature 25 °C unless otherwise specified):

Properties		Test conditions	Value	Unit
Forward Current	$I_{F\ max.}$		60	mA
Peak Forward Current	$I_{F\ Peak}$	duty/ 100 @ 100 Hz	1	A
Input Power Dissipation	P_I		100	mW
Reverse Voltage	V_{REV}		6	V

Absolute Maximum Ratings Output Properties: (Ambient Temperature 25 °C unless otherwise specified):

Properties		Value	Unit
Collector Emitter Voltage	V_{CE}	80	V
Emitter Collector Voltage	V_{EC}	7	V
Collector Current	I_{CEP}	50	mA
Output Power Dissipation	P_O	150	mW

Absolute Maximum Ratings Common Properties:

Properties		Test conditions	Value	Unit
Power Dissipation ¹⁾	P_{Diss}		200	mW
Isolation Voltage	V_{ISO}	AC for 1 Minute, RH 40~60 %	3750	V (RMS)

¹⁾ Total power dissipation of the whole component

Electrical & Optical Input Properties:









Properties		Test conditions	Value		Unit
			typ.	max.	
Forward Voltage	V_F	$I_C = 10\ mA$	1.24	1.4	V
Reverse Current	I_{REV}	$V_{REV} = 6\ V$		10	µA
Input Capacitance	C_{in}	$V = 0\ V$ $f = 1\ kHz$	10		pF

Electrical & Optical Output Properties:

Properties		Test conditions	Value		Unit
			min.	max.	
Collector-Emitter Dark Current	$I_{CEO\ Dark}$	$V_{CE} = 20\ V$ $I_F = 0$		100	nA
Collector-Emitter Breakdown Voltage	$V_{(BR)CE}$	$I_C = 100\ \mu A$ $I_F = 0$	80		V
Emitter-Collector Breakdown Voltage	$V_{(BR)EC}$	$I_E = 100\ \mu A$ $I_F = 0$	7		V

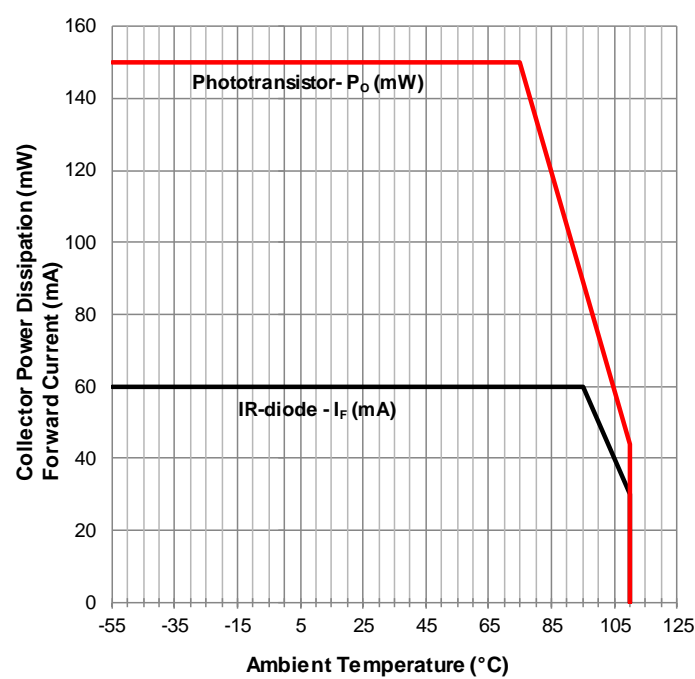
Electrical & Optical Transfer Properties:

Properties		Test conditions	Value			Unit
			min.	typ.	max.	
Current Transfer Ratio	CTR	$I_C = 5\ mA$ $V_{CE} = 5\ V$	130		260	%
Collector-Emitter Saturation Voltage	V_{CEsat}	$I_C = 20\ mA$ $I_E = 1\ mA$		0.06	0.2	V
Rise Time	t_r	$V_{CE} = 2\ V$ $I_C = 2\ mA$ $R_L = 100\ \Omega$		3	18	µs
Fall Time	t_f	$V_{CE} = 2\ V$ $I_C = 2\ mA$ $R_L = 100\ \Omega$		4	18	µs
Cut-Off Frequency	f_c	$V_{CE} = 2\ V$ $I_C = 2\ mA$ $R_L = 100\ \Omega$ -3 dB		80		kHz
Floating Capacitance	C_{fO}	$V = 0\ V$ $f = 1\ MHz$		0.4		pF
Isolation Resistance	R_{ISO}	DC = 500 V 40~60 % R.H.	1	100		TΩ

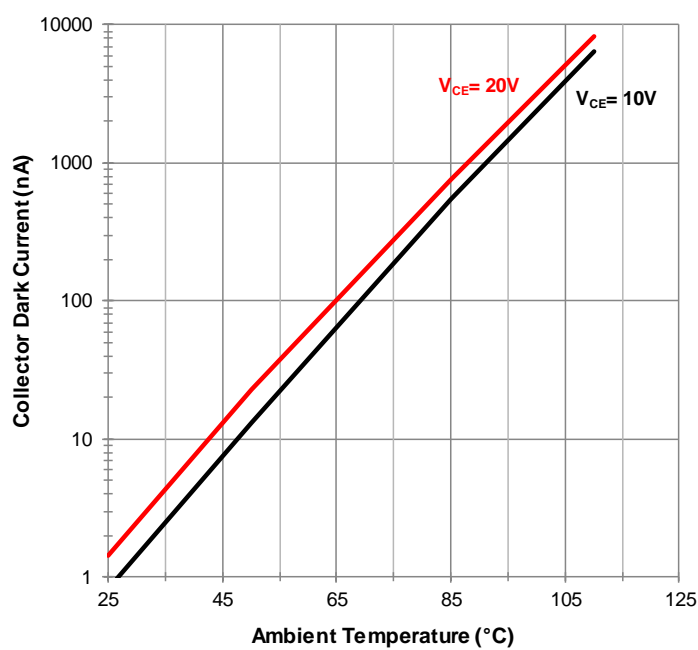
<div><div></div></div>		CHECKED SaVo	REVISION 001.004	DATE (YYYY-MM-DD) 2023-08-22	GENERAL TOLERANCE DIN ISO 2768-1m	PROJECTION METHOD 
<div><div></div><div><div>Würth Elektronik eiSos GmbH & Co. KG</div><div>EMC & Inductive Solutions</div><div>Max-Eyth-Str. 1</div><div>74638 Waldenburg</div><div>Germany</div><div>Tel. +49 (0) 79 42 945 - 0</div><div>www.w-e-online.com</div><div>eiSos@we-online.com</div></div></div>		DESCRIPTION WL-OCPT Optocoupler Phototransistor		ORDER CODE 140356145200		
		SIZES/TYPE SOP4	BUSINESS UNIT ePal	STATUS Valid	PAGE 2/12	

This electronic component has been designed and developed for usage in general electronic equipment only. This product is not authorized for use in equipment where a higher safety standard and reliability standard is especially required or where a failure of the product is reasonably expected to cause severe personal injury or death, unless the parties have executed an agreement specifically governing such use. Moreover Würth Elektronik eiSos GmbH & Co KG products are neither designed nor intended for use in areas such as military, aerospace, aviation, nuclear control, submarine, transportation, transportation signal, disaster prevention, medical, public information network etc.. Würth Elektronik eiSos GmbH & Co KG must be informed about the intent of such usage before the design-in stage. In addition, sufficient reliability evaluation checks for safety must be performed on every electronic component which is used in electrical circuits that require high safety and reliability functions or performance.

Total Power Dissipation vs. Ambient Temperature:



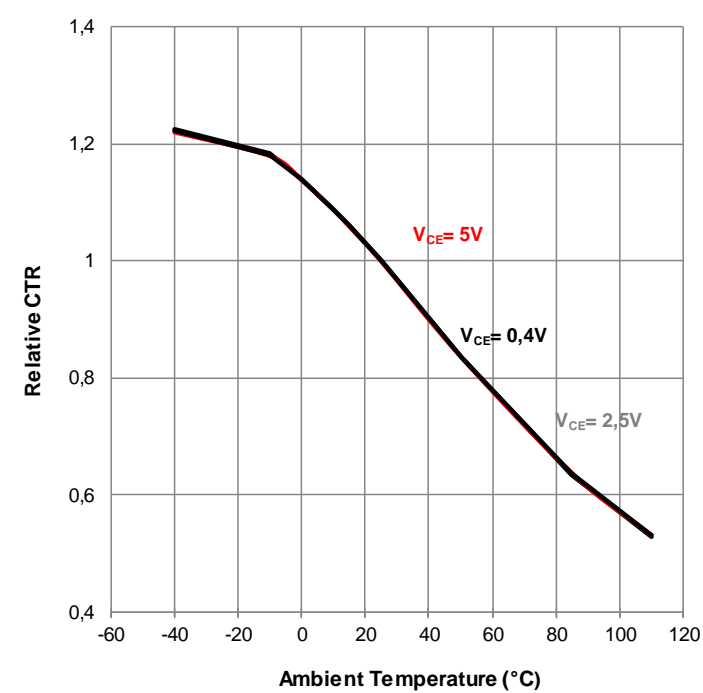
Collector Dark Current vs. Ambient Temperature:



<div><div></div><div></div><div></div><div></div><div></div><div></div></div>		CHECKED SalVo	REVISION 001.004	DATE (YYYY-MM-DD) 2023-08-22	GENERAL TOLERANCE DIN ISO 2768-1m	PROJECTION METHOD
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		SUBTYPE SOP4	BUSINESS UNIT ePal	STATUS Valid	PAGE 3/12	

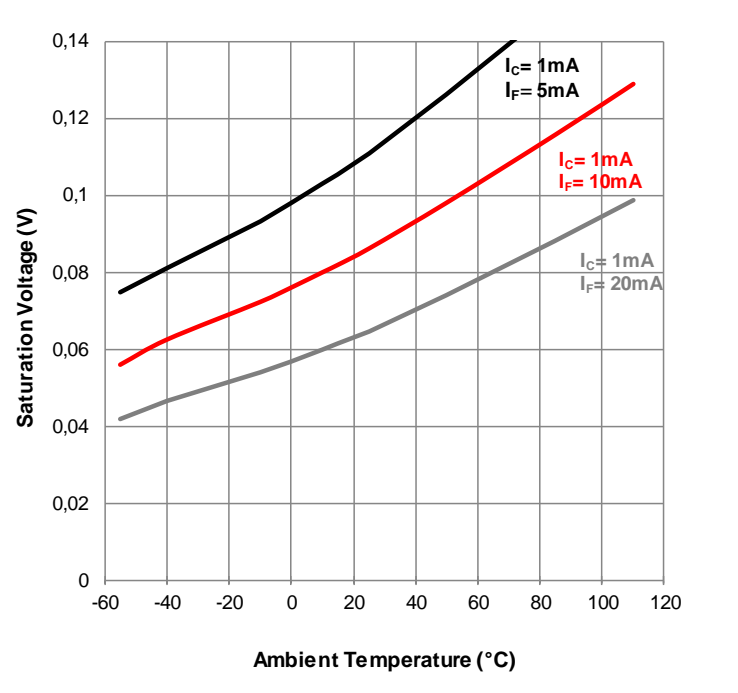
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Relative CTR vs. Ambient Temperature:



Testcondition: IF= 5mA; Normalized to TA= 25°C

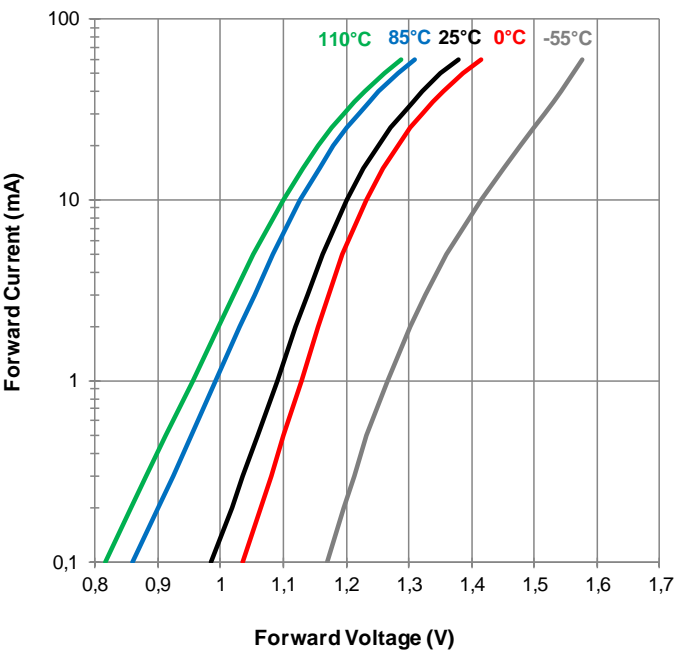
Collector-Emitter Saturation Voltage vs. Ambient Temperature:



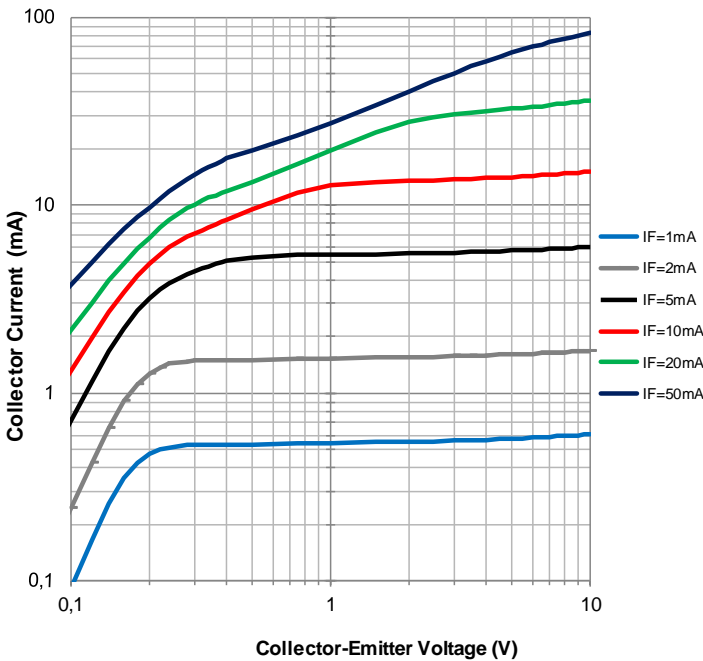
     		CHECKED SalVo	REVISION 001.004	DATE (YYYY-MM-DD) 2023-08-22	GENERAL TOLERANCE DIN ISO 2768-1m	PROJECTION METHOD 	
 <div>Würth Elektronik eiSos GmbH & Co. KG EMC & Inductive Solutions Max-Eyth-Str. 1 74638 Waldenburg Germany Tel. +49 (0) 79 42 945 - 0 www.we-online.com eiSos@we-online.com</div>		DESCRIPTION WL-OCPT Optocoupler Phototransistor				ORDER CODE 140356145200	
		SIZES/TYPE SOP4	BUSINESS UNIT ePal	STATUS Valid	PAGE 4/12		

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Forward Current vs. Forward Voltage:



Collector Current vs. Collector-Emitter Voltage:

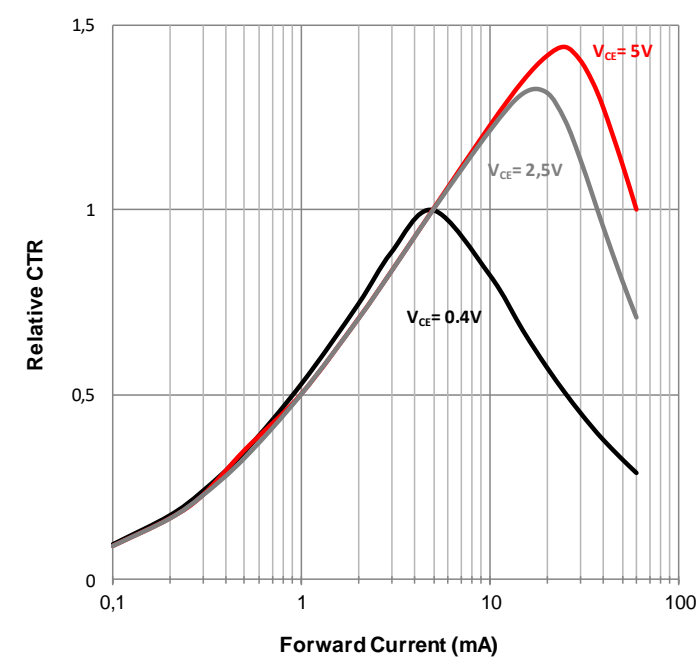


Testcondition: TA= 25°C

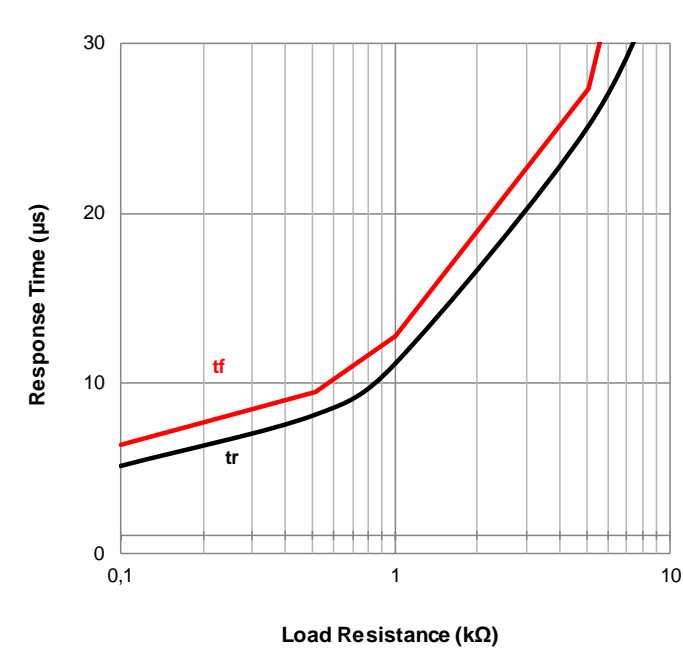
<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div>		CHECKED SaVo	REVISION 001.004	DATE (YYYY-MM-DD) 2023-08-22	GENERAL TOLERANCE DIN ISO 2768-1m	PROJECTION METHOD
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		SIZES/TYPES SOP4	BUSINESS UNIT ePal	STATUS Valid	PAGE 5/12	

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Relative CTR vs. Forward Current:











Switching time vs. Load Resistance:



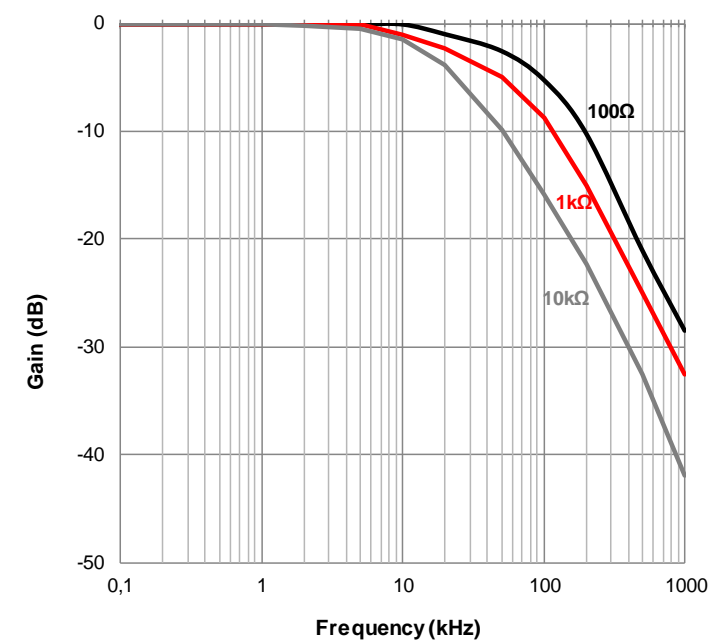
Testcondition: $I_F = 5mA$; $T_A = 25^{\circ}C$

Testcondition: $I_C = 2mA$; $V_{CE} = 2V$; $T_A = 25^{\circ}C$

<div></div>		CHECKED SalVo	REVISION 001.004	DATE (YYYY-MM-DD) 2023-08-22	GENERAL TOLERANCE DIN ISO 2768-1m	PROJECTION METHOD 
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Gain vs. Frequency:

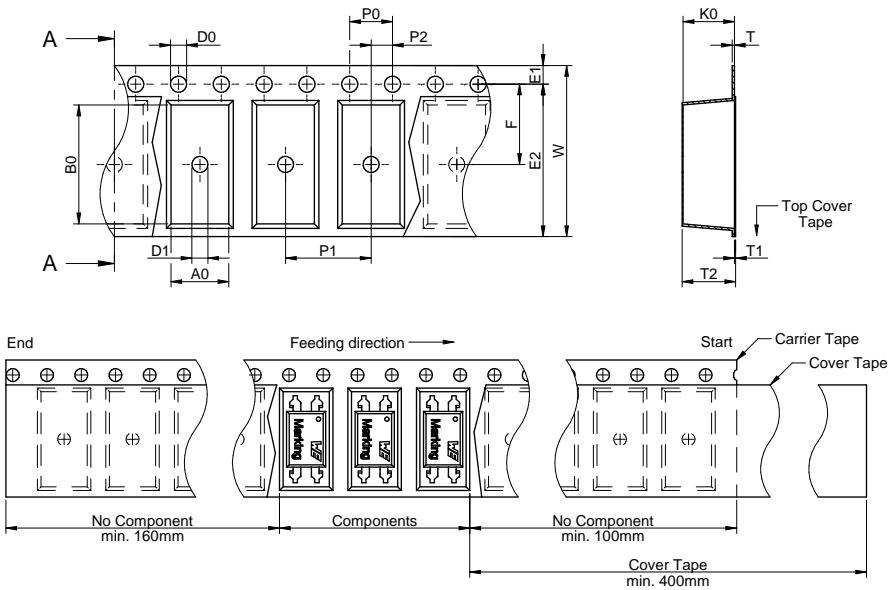


Testcondition: $I_C=2\text{mA}$; $V_{CE}=2\text{V}$; $T_A=25^\circ\text{C}$

<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div>		CHECKED SalVo	REVISION 001.004	DATE (YYYY-MM-DD) 2023-08-22	GENERAL TOLERANCE DIN ISO 2768-1m	PROJECTION METHOD
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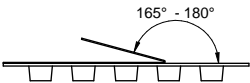
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Packaging Specification - Tape: [mm]



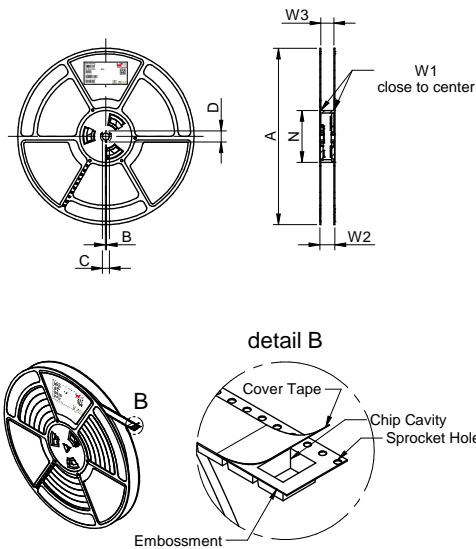
Packaging is referred to the international standard IEC 60286-3:2019

Tape Type	A0 (mm)	B0 (mm)	W (mm)	T (mm)	T1 (mm)	T2 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	D0 (mm)	D1 (mm)	E1 (mm)	E2 (mm)	F (mm)	Material	Qty. (pcs.)
	typ.	typ.	+0.3/-0.1	ref.	ref.	typ.	typ.	±0.1	±0.1	±0.1	+0.1/-0.0	min.	±0.1	min.	±0.1	Polystyrene	3000
Za	4,70	10,50	16,00	0,40	0,10	4,60	4,20	4,00	8,00	2,00	1,50	1,50	1,75	14,25	7,90		











Tape width	16 mm	Pull-off force
		0,1 N - 1,3 N

Packaging Specification - Reel: [mm]

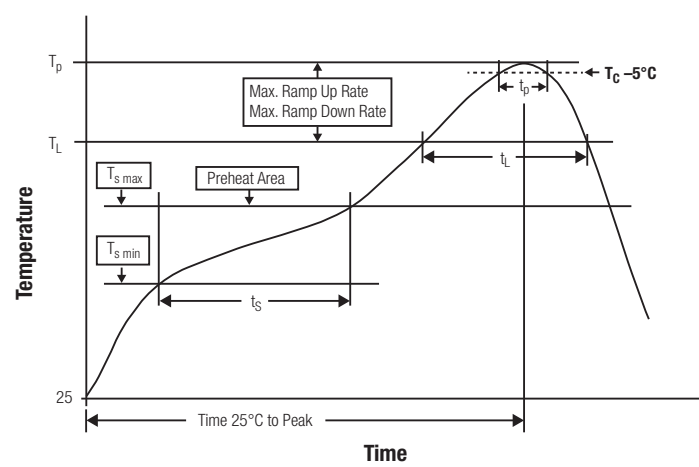


	A (mm)	B (mm)	C (mm)	D (mm)	N (mm)	W1 (mm)	W2 (mm)	W3 (mm)	W3 (mm)	Material
Tolerance	± 2.0	typ.	typ.	typ.	typ.	typ.	typ.	min.	max.	
Value	330,00	2,20	13,00	20,90	97,20	16,70	20,70	15,90	19,40	Polystyrene

     	Checked SaVo	Revision 001.004	Date (YYYY-MM-DD) 2023-08-22	General Tolerance DIN ISO 2768-1m	Projection Method 
 WÜRTH ELEKTRONIK MORE THAN YOU EXPECT	Description WL-OCPT Optocoupler Phototransistor				Order Code 140356145200
	Size/Type SOP4		Business Unit ePal	Status Valid	Page 8/12

This electronic component has been designed and developed for usage in general electronic equipment only. This product is not authorized for use in equipment where a higher safety standard and reliability standard is especially required or where a failure of the product is reasonably expected to cause severe personal injury or death, unless the parties have executed an agreement specifically governing such use. Moreover Würth Elektronik eSas GmbH & Co KG products are neither designed nor intended for use in areas such as military, aerospace, aviation, nuclear control, submarine, transportation, transportation signal, disaster prevention, medical, public information network etc.. Würth Elektronik eSas GmbH & Co KG must be informed about the intent of such usage before the design-in stage. In addition, sufficient reliability evaluation checks for safety must be performed on every electronic component which is used in electrical circuits that require high safety and reliability functions or performance.

Classification Reflow Profile for SMT components:



Classification Reflow Soldering Profile:









Profile Feature		Value
Preheat Temperature Min	$T_{s\ min}$	150 °C
Preheat Temperature Max	$T_{s\ max}$	200 °C
Preheat Time t_s from $T_{s\ min}$ to $T_{s\ max}$	t_s	max. 60 - 120 seconds
Ramp-up Rate (T_L to T_p)		3 °C/ second max.
Liquidous Temperature	T_L	217 °C
Time t_L maintained above T_L	t_L	max. 60 seconds
Peak package body temperature	T_p	$T_p \leq T_c$, see Table below
Time within 5°C of actual peak temperature	t_p	max. 10 seconds
Ramp-down Rate (T_p to T_L)		6 °C/ second max.
Time 25°C to peak temperature		max. 220 seconds

refer to IPC/ JEDEC J-STD-020E

Package Classification Reflow Temperature (T_c):

Properties	Volume mm³ <350	Volume mm³ 350-2000	Volume mm³ >2000
PB-Free Assembly I Package Thickness < 1.6 mm	260 °C	260 °C	260 °C
PB-Free Assembly I Package Thickness 1.6 mm - 2.5 mm	260 °C	250 °C	245 °C
PB-Free Assembly I Package Thickness > 2.5 mm	250 °C	245 °C	245 °C
Applied cycles	2 cycles max.		

refer to IPC/ JEDEC J-STD-020E

<div></div>	CHECKED SaVo	REVISION 001.004	DATE (YYYY-MM-DD) 2023-08-22	GENERAL TOLERANCE DIN ISO 2768-1m	PROJECTION METHOD 
<div><div>Würth Elektronik eSas GmbH & Co. KG EMC & Inductive Solutions Max-Eyth-Str. 1 74638 Waldenburg Germany Tel. +49 (0) 79 42 945 - 0 www.we-online.com eSas@we-online.com</div></div>	DESCRIPTION WL-OCPT Optocoupler Phototransistor			ORDER CODE 140356145200	
	SIZES/TYPE SOP4	BUSINESS UNIT ePal	STATUS Valid	PAGE 9/12	

This electronic component has been designed and developed for usage in general electronic equipment only. This product is not authorized for use in equipment where a higher safety standard and reliability standard is especially required or where a failure of the product is reasonably expected to cause severe personal injury or death, unless the parties have executed an agreement specifically governing such use. Moreover Würth Elektronik eSas GmbH & Co KG products are neither designed nor intended for use in areas such as military, aerospace, aviation, nuclear control, submarine, transportation, transportation signal, disaster prevention, medical, public information network etc.. Würth Elektronik eSas GmbH & Co KG must be informed about the intent of such usage before the design-in stage. In addition, sufficient reliability evaluation checks for safety must be performed on every electronic component which is used in electrical circuits that require high safety and reliability functions or performance.

Cautions and Warnings:

The following conditions apply to all goods within the product series of Optoelectronic Components of Würth Elektronik eiSos GmbH & Co. KG:

General:

- This optoelectronic component is designed and manufactured for use in general electronic equipment.
- Würth Elektronik must be asked for written approval (following the PPAP procedure) before incorporating the components into any equipment in fields such as military, aerospace, aviation, nuclear control, submarine, transportation (automotive control, train control, ship control), transportation signal, disaster prevention, medical, public information network, etc. where higher safety and reliability are especially required and/or if there is the possibility of direct damage or human injury.
- Optoelectronic components that will be used in safety-critical or high-reliability applications, should be pre-evaluated by the customer.
- The optoelectronic component is designed and manufactured to be used within the datasheet specified values. If the usage and operation conditions specified in the datasheet are not met, the wire insulation may be damaged or dissolved.
- Do not drop or impact the components, the component may be damaged
- Würth Elektronik products are qualified according to international standards, which are listed in each product reliability report. Würth Elektronik does not warrant any customer qualified product characteristics beyond Würth Elektronik's specifications, for its validity and sustainability over time.
- The responsibility for the applicability of the customer specific products and use in a particular customer design is always within the authority of the customer. All technical specifications for standard products also apply to customer specific products.
- Unless Würth Elektronik has given its express consent, the customer is under no circumstances entitled to reverse engineer, disassemble or otherwise attempt to extract knowledge or design information from the optoelectronic component.

Product specific:

Soldering:

- The solder profile must comply with the technical product specifications. All other profiles will void the warranty.
- All other soldering methods are at the customers' own risk
- The soldering pad pattern shown above is a general recommendation for the easy assembly of optoelectronic components. If a high degree of precision is required for the selected application (i.e. high density assembly), the customer must ensure that the soldering pad pattern is optimized accordingly.

Cleaning and Washing:

- Washing agents used during the production to clean the customer application might damage or change the characteristics of the optoelectronic component body, marking or plating. Washing agents may have a negative effect on the long-term functionality of the product.

- Using a brush during the cleaning process may break the optoelectronic component body. Therefore, we do not recommend using a brush during the PCB cleaning process.

Potting:

- If the product is potted in the customer application, the potting material might shrink or expand during and after hardening. Shrinking could lead to an incomplete seal, allowing contaminants into the optoelectronic component body, pins or termination. Expansion could damage the components. We recommend a manual inspection after potting to avoid these effects.

Storage Conditions:

- A storage of Würth Elektronik products for longer than 12 months is not recommended. Within other effects, the terminals may suffer degradation, resulting in bad solderability. Therefore, all products shall be used within the period of 12 months based on the day of shipment.
- Do not expose the optoelectronic component to direct sunlight.
- The storage conditions in the original packaging are defined according to DIN EN 61760-2.
- For a moisture sensitive component, the storage condition in the original packaging is defined according to IPC/JEDEC-J-STD-033. It is also recommended to return the optoelectronic component to the original moisture proof bag and reseal the moisture proof bag again.
- The storage conditions stated in the original packaging apply to the storage time and not to the transportation time of the components.

Packaging:

- The packaging specifications apply only to purchase orders comprising whole packaging units. If the ordered quantity exceeds or is lower than the specified packaging unit, packaging in accordance with the packaging specifications cannot be ensured.

Handling:

- Violation of the technical product specifications such as exceeding the nominal rated current, will void the warranty.
- The product design may influence the automatic optical inspection.
- Certain optoelectronic component surfaces consist of soft material. Pressure on the top surface has to be handled carefully to prevent negative influence to the function and reliability of the optoelectronic components.
- ESD prevention methods need to be applied for manual handling and processing by machinery.
- Resistors for protection are obligatory.
- In addition to optoelectronic components testing, products incorporating these devices have to comply with the safety precautions given in IEC 60825-1, IEC 62471 and IEC 62778.

Technical specification:

- The typical and/or calculated values and graphics of technical parameters can only reflect statistical figures. The actual parameters of each single product, may differ from the typical and/or calculated values or the typical characteristic line.

This electronic component has been designed and developed for usage in general electronic equipment only. This product is not authorized for use in equipment where a higher safety standard and reliability standard is especially required or where a failure of the product is reasonably expected to cause severe personal injury or death, unless the parties have executed an agreement specifically governing such use. Moreover Würth Elektronik eiSos GmbH & Co KG products are neither designed nor intended for use in areas such as military, aerospace, aviation, nuclear control, submarine, transportation, transportation signal, disaster prevention, medical, public information network etc.. Würth Elektronik eiSos GmbH & Co KG must be informed about the intent of such usage before the design-in stage. In addition, sufficient reliability evaluation checks for safety must be performed on every electronic component which is used in electrical circuits that require high safety and reliability functions or performance.

- In the characteristics curves, all values given in dotted lines may show a higher deviation than the paramters mentioned above.
- On each reel, only one bin is sorted and taped. The bin is defined on the current transfer ratio.
- In order to ensure highest availability, the reel binning of standard deliveries can vary. A single bin cannot be ordered. Please contact us in advance, if you need a particular bin sorting before placing your order.
- These cautions and warnings comply with the state of the scientific and technical knowledge and are believed to be accurate and reliable. However, no responsibility is assumed for inaccuracies or incompleteness.

The customer has the sole responsibility to ensure that he uses the latest version of this datasheet, which is available on Würth Elektronik's homepage. Unless otherwise agreed in writing (i.e. customer specific specification), changes to the content of this datasheet may occur without notice, provided that the changes do not have a significant effect on the usability of the optoelectronic components.

<div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div></div>		CHECKED SaVo	REVISION 001.004	DATE (YYYY-MM-DD) 2023-08-22	GENERAL TOLERANCE DIN ISO 2768-1m	PROJECTION METHOD
<div><div></div><div><div>WÜRTH ELEKTRONIK MORE THAN YOU EXPECT</div><div><div>Würth Elektronik eiSos GmbH & Co. KG</div><div>EMC & Inductive Solutions</div><div>Max-Eyth-Str. 1</div><div>74638 Waldenburg</div><div>Germany</div><div>Tel. +49 (0) 79 42 945 - 0</div><div>www.wue-online.com</div><div>eiSos@wue-online.com</div></div></div></div>		DESCRIPTION WL-OCPT Optocoupler Phototransistor			ORDER CODE 140356145200	
		SIZES/TYPE SOP4	BUSINESS UNIT ePal	STATUS Valid	PAGE 11/12	

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Important Notes

The following conditions apply to all goods within the product range of Würth Elektronik eiSos GmbH & Co. KG:

1. General Customer Responsibility

Some goods within the product range of Würth Elektronik eiSos GmbH & Co. KG contain statements regarding general suitability for certain application areas. These statements about suitability are based on our knowledge and experience of typical requirements concerning the areas, serve as general guidance and cannot be estimated as binding statements about the suitability for a customer application. The responsibility for the applicability and use in a particular customer design is always solely within the authority of the customer. Due to this fact it is up to the customer to evaluate, where appropriate to investigate and decide whether the device with the specific product characteristics described in the product specification is valid and suitable for the respective customer application or not.

2. Customer Responsibility related to Specific, in particular Safety-Relevant Applications

It has to be clearly pointed out that the possibility of a malfunction of electronic components or failure before the end of the usual lifetime cannot be completely eliminated in the current state of the art, even if the products are operated within the range of the specifications. In certain customer applications requiring a very high level of safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health it must be ensured by most advanced technological aid of suitable design of the customer application that no injury or damage is caused to third parties in the event of malfunction or failure of an electronic component. Therefore, customer is cautioned to verify that data sheets are current before placing orders. The current data sheets can be downloaded at www.we-online.com.

3. Best Care and Attention

Any product-specific notes, cautions and warnings must be strictly observed. Any disregard will result in the loss of warranty.

4. Customer Support for Product Specifications

Some products within the product range may contain substances which are subject to restrictions in certain jurisdictions in order to serve specific technical requirements. Necessary information is available on request. In this case the field sales engineer or the internal sales person in charge should be contacted who will be happy to support in this matter.

5. Product R&D

Due to constant product improvement product specifications may change from time to time. As a standard reporting procedure of the Product Change Notification (PCN) according to the JEDEC-Standard inform about minor and major changes. In case of further queries regarding the PCN, the field sales engineer or the internal sales person in charge should be contacted. The basic responsibility of the customer as per Section 1 and 2 remains unaffected.

6. Product Life Cycle

Due to technical progress and economical evaluation we also reserve the right to discontinue production and delivery of products. As a standard reporting procedure of the Product Termination Notification (PTN) according to the JEDEC-Standard we will inform at an early stage about inevitable product discontinuance. According to this we cannot guarantee that all products within our product range will always be available. Therefore it needs to be verified with the field sales engineer or the internal sales person in charge about the current product availability expectancy before or when the product for application design-in disposal is considered. The approach named above does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.










7. Property Rights

All the rights for contractual products produced by Würth Elektronik eiSos GmbH & Co. KG on the basis of ideas, development contracts as well as models or templates that are subject to copyright, patent or commercial protection supplied to the customer will remain with Würth Elektronik eiSos GmbH & Co. KG. Würth Elektronik eiSos GmbH & Co. KG does not warrant or represent that any license, either expressed or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, application, or process in which Würth Elektronik eiSos GmbH & Co. KG components or services are used.

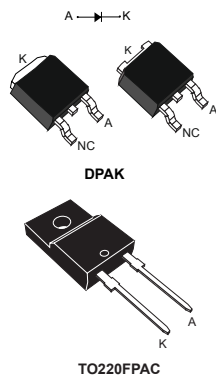
8. General Terms and Conditions

Unless otherwise agreed in individual contracts, all orders are subject to the current version of the "General Terms and Conditions of Würth Elektronik eiSos Group", last version available at www.we-online.com.

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DESCRIPTION WL-OCPT Optocoupler Phototransistor							ORDER CODE 140356145200	
SIZE/TYPE SOP4				BUSINESS UNIT ePal		STATUS Valid	PAGE 12/12	

600 V, 25 A ultrafast high voltage diode



Features

- Ultrafast recovery, soft recovery
- Low power losses at high switching frequency operations
- Low leakage current
- High junction temperature
- High overcurrent capability
- ECOPACK2 compliant

Applications

- PFC
- Boost diode
- LLC clamping diode

Description

The **STTH25M06** is an ultrafast recovery power rectifier especially suited for boost or LLC clamping circuits working at high switching frequencies in heavy duty applications such as air conditioning equipment or telecom power supplies.

Designed with the latest ST's ultrafast technology, this 600 V 25 A diode in DPAK and TO-220FPAC has a robust behavior against electrostatic discharge and high overcurrent capability.

Product status	
STTH25M06	
Product summary	
Symbol	Value
$I_{F(AV)}$	25 A
V_{RRM}	600 V
$t_{rr(typ.)}$	25 ns
$T_{j(max.)}$	175 °C
$V_{F(typ.)}$	1.6 V

1 Characteristics

Table 1. Absolute ratings (limiting values at 25 °C, unless otherwise specified)

Symbol	Parameter		Value	Unit
V_{RRM}	Repetitive peak reverse voltage		600	V
$I_{F(AV)}$	Average forward current		25	A
I_{FSM}	Surge non repetitive forward current	$t_p = 10$ ms sinusoidal	170	A
T_{stg}	Storage temperature range		-65 to +175	°C
T_j	Maximum operating junction temperature		+175	°C

Table 2. Thermal resistance parameter

Symbol	Parameter		Typ. value	Unit
$R_{th(j-c)}$	Junction to case	DPAK	0.5	°C/W
		TO-220FPAC	2.45	

For more information, please refer to the following application note :

- AN5088 : Rectifiers thermal management, handling and mounting recommendations

Table 3. Static electrical characteristics

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
$I_R^{(1)}$	Reverse leakage current	$T_j = 25$ °C	$V_R = 600$ V	-		60	μ A
		$T_j = 125$ °C		-	70	800	
$V_F^{(2)}$	Forward voltage drop	$T_j = 25$ °C	$I_F = 15$ A	-	2.1		V
		$T_j = 150$ °C		-	1.3		
		$T_j = 25$ °C	$I_F = 25$ A	-	2.5	3.4	
		$T_j = 150$ °C		-	1.6	2.0	

1. Pulse test: $t_p = 5$ ms, $\delta < 2\%$

2. Pulse test: $t_p = 380$ μ s, $\delta < 2\%$

To evaluate the conduction losses, use the following equation:

$$P = 1.04 \times I_{F(AV)} + 0.0385 \times I_F^2(RMS)$$

For more information, please refer to the following application notes related to the power losses :

- AN604: Calculation of conduction losses in a power rectifier
- AN4058: Calculation of turn-off power losses generated by an ultrafast diode

Table 4. Dynamic electrical characteristics

Symbol	Parameters	Test conditions		Min.	Typ.	Max.	Unit
t_{rr}	Reverse recovery time	$T_j = 25\text{ }^{\circ}\text{C}$	$I_F = 1\text{ A}$ $di_F/dt = -50\text{ A}/\mu\text{s}$ $V_R = 30\text{ V}$	-		50	ns
			$I_F = 1\text{ A}$ $di_F/dt = -100\text{ A}/\mu\text{s}$ $V_R = 30\text{ V}$	-	25	35	
		$T_j = 125\text{ }^{\circ}\text{C}$	$I_F = 15\text{ A}$ $di_F/dt = -200\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}$	-	55		
			$I_F = 25\text{ A}$ $di_F/dt = -200\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}$	-	60		
I_{RM}	Reverse recovery current	$T_j = 125\text{ }^{\circ}\text{C}$	$I_F = 25\text{ A}$	-	7		A
Q_{rr}	Reverse recovery charge		$di_F/dt = -200\text{ A}/\mu\text{s}$ $V_R = 400\text{ V}$	-	250		nC

1.1 Characteristics (curves)

Figure 1. Average forward power dissipation versus average forward current (square waveform)

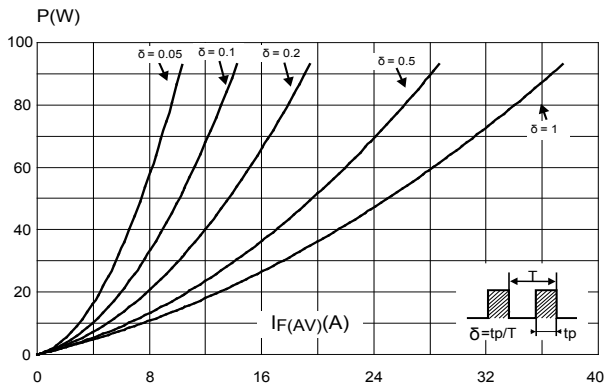


Figure 2. Forward voltage drop versus forward current (typical values)

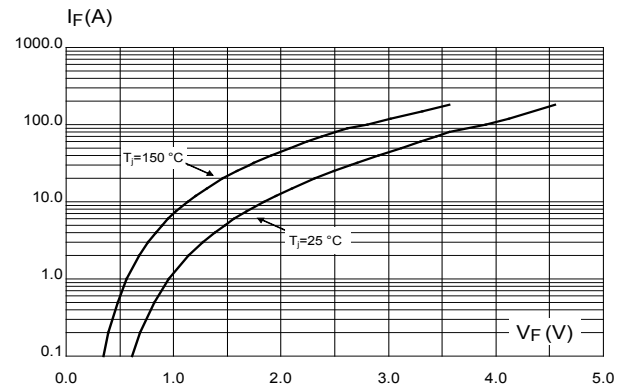


Figure 3. Forward voltage drop versus forward current (maximum values)

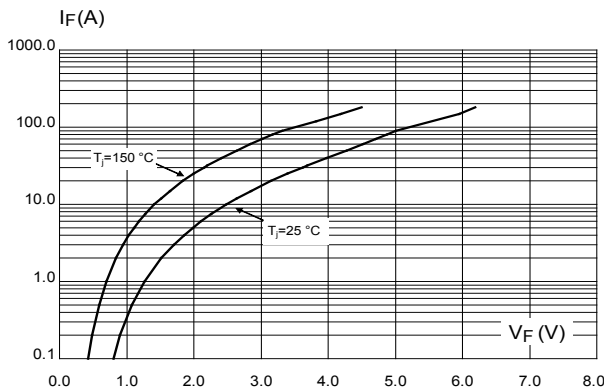


Figure 4. Relative variation of thermal impedance, junction to case versus pulse duration (DPAK)

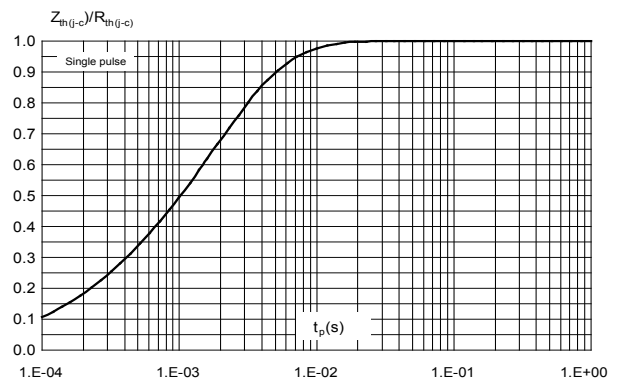


Figure 5. Relative variation of thermal impedance, junction to case versus pulse duration (TO-220FPAC)

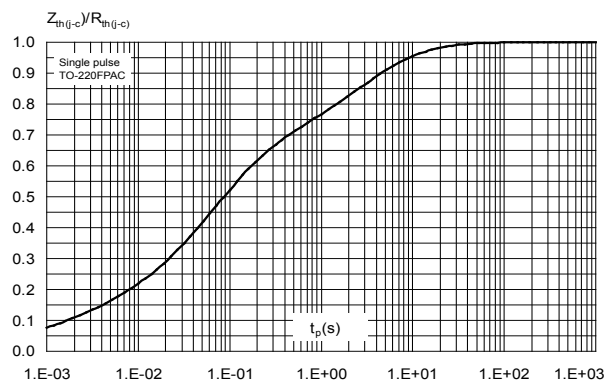


Figure 6. Peak reverse recovery current versus di_F/dt (typical values)

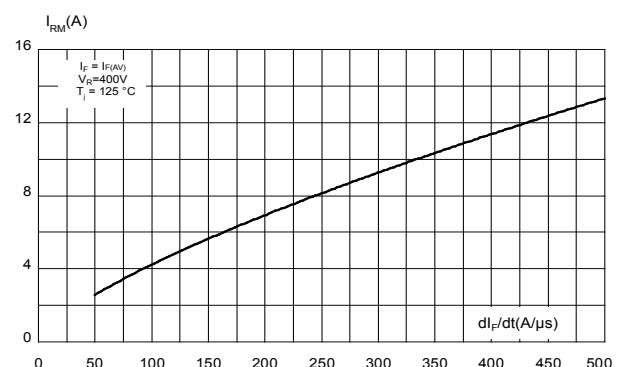


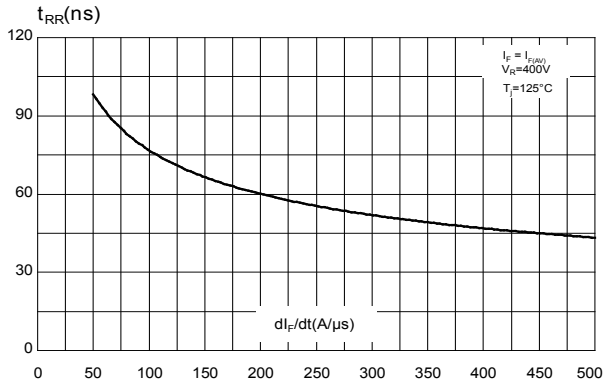
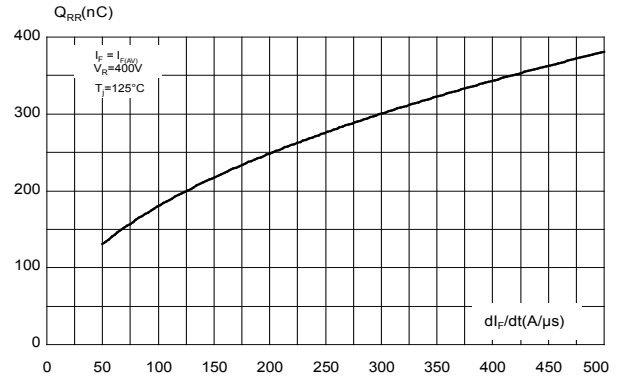
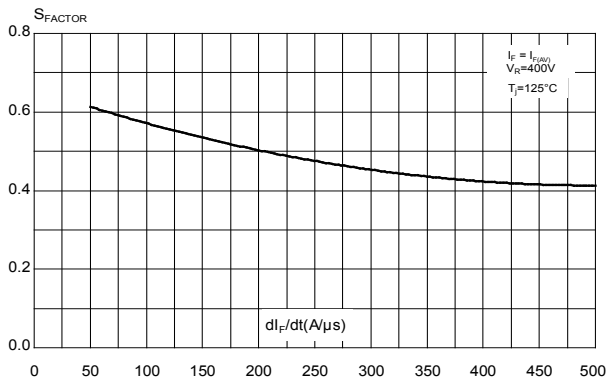
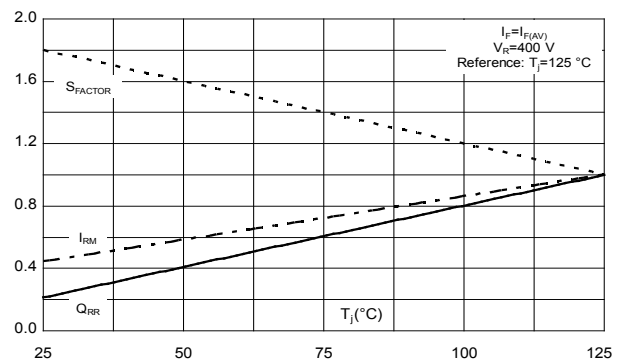
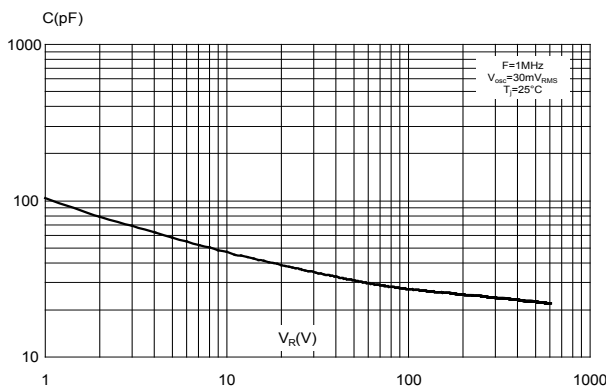
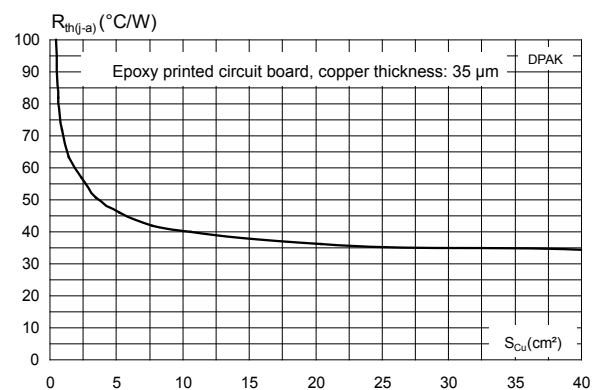
Figure 7. Reverse recovery time versus dl_F/dt (typical values)

Figure 8. Reverse recovery charges versus dl_F/dt (typical values)

Figure 9. Reverse recovery softness factor versus dl_F/dt (typical values)

Figure 10. Relative variations of dynamic parameters versus junction temperature

Figure 11. Junction capacitance versus reverse voltage applied (typical values)

Figure 12. Thermal resistance junction to ambient versus copper surface under tab (typical values, epoxy printed board FR4, $e_{Cu} = 70 \mu m$)


Figure 13. Relative variation of non-repetitive peak surge forward current versus pulse duration (sinusoidal waveform)

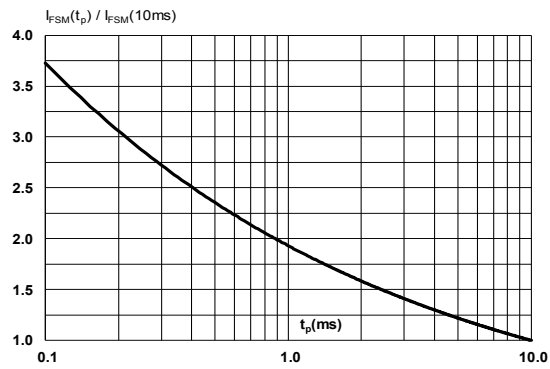
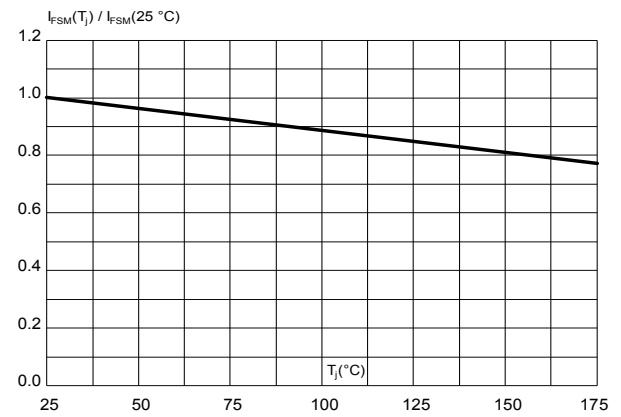


Figure 14. Relative variation of non-repetitive peak surge forward current versus initial junction temperature (sinusoidal waveform)



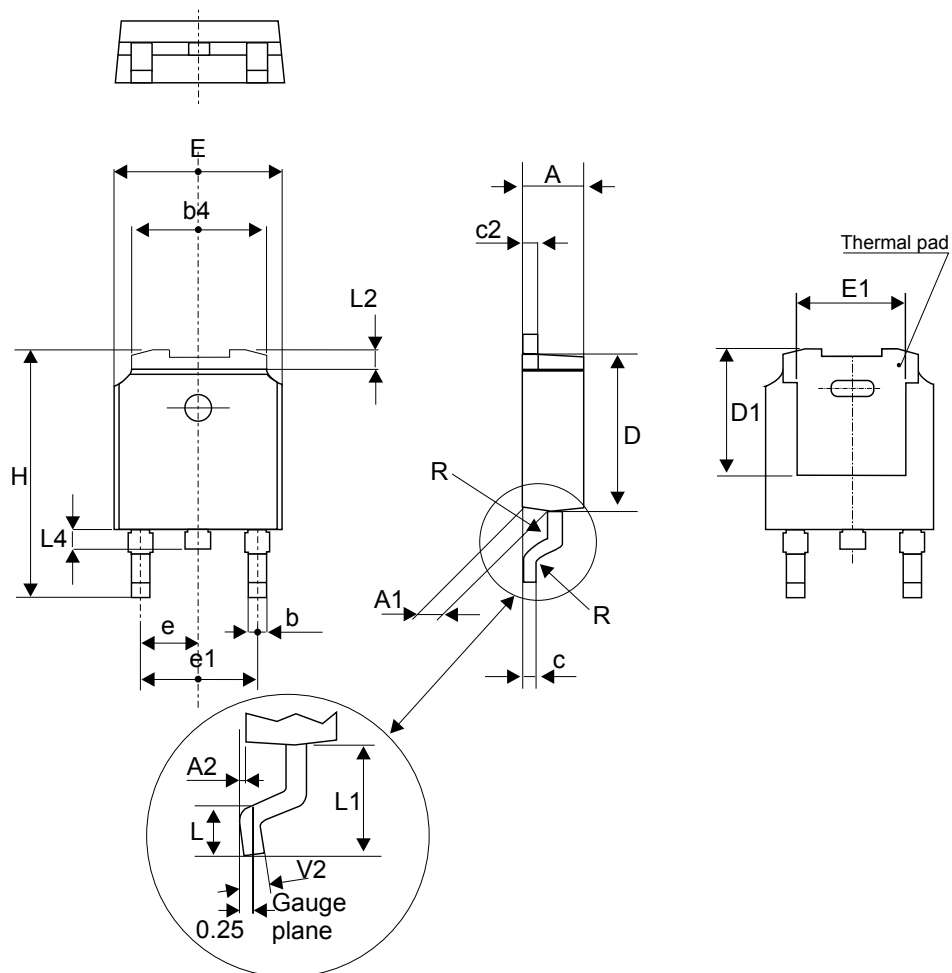
2 Package information

In order to meet environmental requirements, ST offers these devices in different grades of **ECOPACK** packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

2.1 DPAK package information

- Epoxy meets UL 94,V0
- Cooling method: by conduction (C)

Figure 15. DPAK package outline

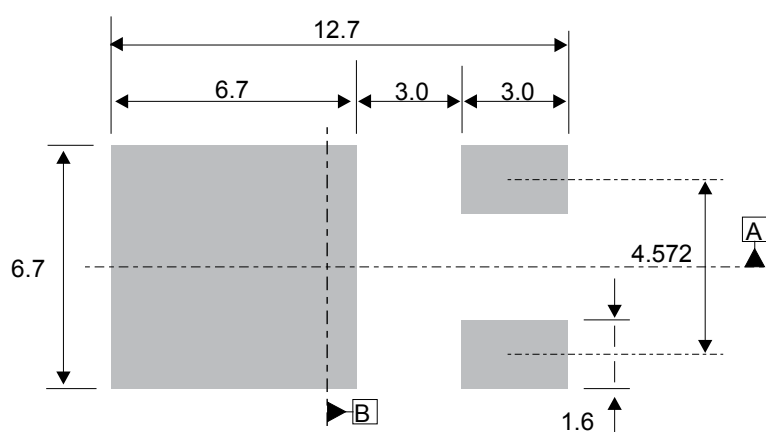


Note: This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.

Table 5. DPAK package mechanical data

Ref.	Dimensions			
	Millimeters		Inches (for reference only)	
	Min.	Max.	Min.	Max.
A	2.18	2.40	0.085	0.094
A1	0.90	1.10	0.035	0.043
A2	0.03	0.23	0.001	0.009
b	0.64	0.90	0.025	0.035
b4	4.95	5.46	0.194	0.215
c	0.46	0.61	0.018	0.024
c2	0.46	0.60	0.018	0.023
D	5.97	6.22	0.235	0.244
D1	4.95	5.60	0.194	0.220
E	6.35	6.73	0.250	0.265
E1	4.32	5.50	0.170	0.216
e	2.286 typ.		0.090 typ.	
e1	4.40	4.70	0.173	0.185
H	9.35	10.40	0.368	0.409
L	1.0	1.78	0.039	0.070
L2		1.27		0.050
L4	0.60	1.02	0.023	0.040
V2	-8°	+8°	-8°	+8°

Figure 16. DPAK recommended footprint (dimensions in mm)



The device must be positioned within $\oplus 0.05$ AB

2.2 TO-220FPAC package information

- Epoxy meets UL 94,V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.55 N·m
- Maximum torque value: 0.70 N·m

Figure 17. TO-220FPAC package outline

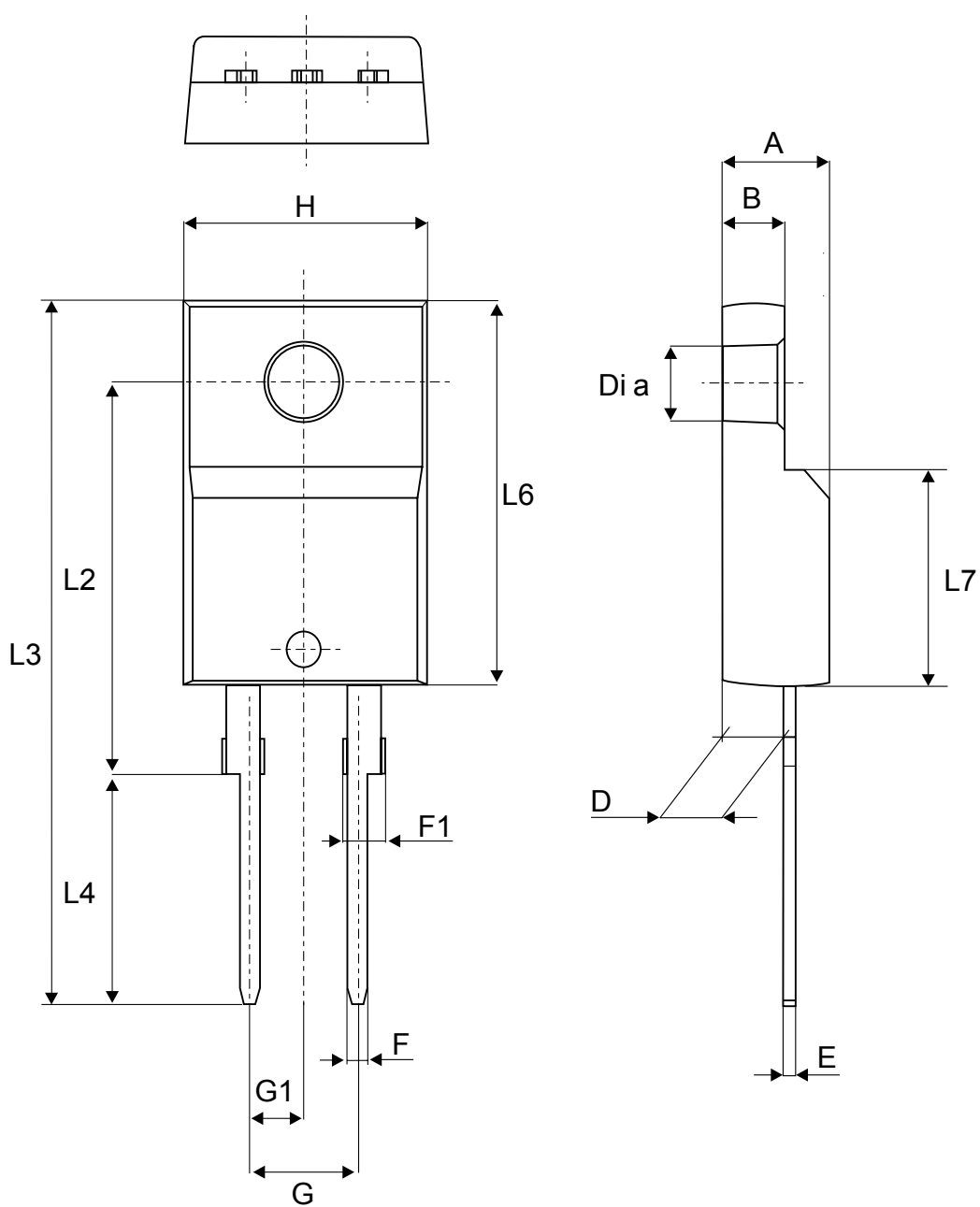


Table 6. TO-220FPAC package mechanical data

Ref.	Dimensions			
	Millimeters		Inches (for reference only)	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
B	2.5	2.7	0.098	0.106
D	2.5	2.75	0.098	0.108
E	0.45	0.70	0.018	0.027
F	0.75	1	0.030	0.039
F1	1.15	1.70	0.045	0.067
G	4.95	5.20	0.195	0.205
G1	2.4	2.7	0.094	0.106
H	10	10.4	0.393	0.409
L2	16 typ.		0.63 typ.	
L3	28.6	30.6	1.126	1.205
L4	9.8	10.6	0.386	0.417
L6	15.9	16.4	0.626	0.646
L7	9.00	9.30	0.354	0.366
Diam	3.00	3.20	0.118	0.126

3 Ordering information

Table 7. Ordering information

Order code	Marking	Package	Weight	Base qty.	Delivery mode
STTH25M06B-TR	TH25 M06B	DPAK	0.32 g	2500	Tape and reel
STTH25M06FP	STTH25M06FP	TO-220FPAC	1.90 g	50	Tube

Revision history

Table 8. Document revision history

Date	Revision	Changes
09-Dec-2019	1	Initial release.
10-Feb-2020	2	Added TO-220FPAC package information.

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Reference

- [1] *TE ECK100BH5AAA Datasheet*. www.te.com, 11.2024