Since the Look Up Table provided by Vishay is used for the calculation in the AMS Software, the following calculation is also based on it.

As the characteristic curve is not linear, it is relatively trivial to find the absolute maximum measurement error, therefore, the maximum error at 60 °C is calculated here.

Our Voltage measurement system is based on a NTC (NTCLE413E2103F102L from Vishay) and a 10k 0.1% resistor (named R_1 here) froming a voltage divider, and the output voltage is then feed to an ADC after passing through a RC-filter.

To calculate the error, the highest possible measured voltage at 60 °C is worked out here, since according to the design of our voltage divider, the lower the temperature, the higher the voltage. As shown in Fig. 2, the supply voltage V_{REF2} of the voltage divider can have a maximum value of 3.006 V, while the total measurement error of the GPIO is ± 2.8 mV. (Fig. 1) In addition, the maximum resistance from the NTC can be 3086.8 Ω according to the LUT (Tab. 1). the maximum possible voltage recorded is therefore:

$$V_{worstcase} = V_{REF2} \cdot \frac{R_{NTC}}{R_{NTC} + R_1} + V_{err} \tag{1}$$

$$= 3.006\,\mathrm{V} \cdot \frac{3086.8}{3086.8 + 9990} + 0.0028V \tag{2}$$

$$\approx 712.4mV \tag{3}$$

to find the largest possible error, the lowest possible matching temperature should be calculated, that theoretically can produce the same voltage output. The calculation is as below:

$$V_{worstcase} = V_{REF2} \cdot \frac{R_{NTC}}{R_{NTC} + R_1} + V_{err} \tag{4}$$

$$712.4V = 2.994V \cdot \frac{R_{NTC}}{R_{NTC} + 10010} - 0.0028V \tag{5}$$

$$R_{NTC} \approx 3141.6 \tag{6}$$

since the LUT is used to match the voltage to the temperature, and the nominal resistance from the LUT is used for the calculation, the closest matching temperature is 58.7 °C.

Table 3. Auxiliary (AUX) ADC DC Specifications

Parameter	Test Conditions/Comments	Min	Typ	Max	Unit
MEASUREMENT RESOLUTION			0.15		mV/bit
INPUT RANGE	GPIOx to V−	−0.3		V_{REG}	V
ADC OFFSET VOLTAGE[1]			−0.2		mV
ADC GAIN ERROR[1]			±0.01		%
ADC UPDATE RATE		0.9	1	1.1	kHz
ADC TRANSITION NOISE			50		µV rms
GPIOx TOTAL MEASUREMENT ERROR					
	0 V < GPIOx to V− ≤ 3.3 V			±2.8	mV
	3.3 V < GPIOx to V− ≤ 5 V			±4.2	mV
DIAGNOSTIC MEASUREMENTS	Internal temperature, T = maximum specified temperature		±5		°C
	V_{REG} pin		±0.1	±0.25	%
	V_{REF2}, VRES		±0.02	±0.2	%
	Digital supply voltage, V_{REGD}		±0.1	±1.6	%
	V+ to V−, V+ > 20 V	−1	±0.05	+0.5	%
	−0.1 V ≤ S1N to V− ≤ 0.1 V		±0.02	0.2	%
INPUT LEAKAGE CURRENT	AUX ADC off, GPIOx = 5 V		10	±250	nA
INPUT RESISTANCE	AUX ADC on	1.5	2.7	3.5	MΩ
INPUT CURRENT DURING OPEN WIRE DETECTION	Pull-down current: GPIOx > 1.5 V	−140	−200	−260	µA
	Pull-up current: GPIOx < V_{REG} − 1.5 V	140	200	260	µA
ADC SAMPLING FREQUENCY		3.7	4.1	4.5	MHz

Figure 1: AUX-ADC Specifications

Table 5. Voltage Reference Specifications

Parameter	Test Conditions/Comments	Min	Typ	Max	Unit
FIRST REFERENCE VOLTAGE	V_{REF1} pin, no load	3	3.2	3.3	V
FIRST REFERENCE VOLTAGE TEMPERATURE COEFFICIENT (TC)	V_{REF1} pin, no load		3		ppm/°C
FIRST REFERENCE VOLTAGE HYSTERESIS	V_{REF1} pin, no load		20		ppm
FIRST REFERENCE VOLTAGE LONG-TERM DRIFT	V_{REF1} pin, no load		20		ppm/√kHr
SECOND REFERENCE VOLTAGE	V_{REF2} pin, no load	2.994	3	3.006	V
	V_{REF2} pin, 1 kΩ load to V−	2.994	3	3.006	V
OUTPUT CURRENT	$\Delta V_{REF2} < \pm 2$ mV	−0.2		+5	mA
SECOND REFERENCE VOLTAGE TC	V_{REF2} pin, no load		10		ppm/°C
SECOND REFERENCE VOLTAGE HYSTERESIS	V_{REF2} pin, no load		100		ppm
SECOND REFERENCE VOLTAGE LONG-TERM DRIFT	V_{REF2} pin, no load		60		ppm/√kHr

Figure 2: V_{REF2} Specifications

Table 1: NTC Look Up Table

Temp. [°C]	$R_{nom}[\Omega]$	$R_{min}[\Omega]$	$R_{max}[\Omega]$	$\Delta R/R[\%]$	$\Delta T[°C]$
58	3214.99	3145.6	3284.4	2.16	0.69
58.1	3204.88	3135.6	3274.2	2.16	0.69
58.2	3194.81	3125.6	3264.0	2.17	0.69
58.3	3184.78	3115.7	3253.9	2.17	0.69
58.4	3174.78	3105.8	3243.7	2.17	0.69
58.5	3164.81	3096.0	3233.7	2.18	0.69
58.6	3154.89	3086.2	3223.6	2.18	0.69
58.7	3145.00	3076.4	3213.6	2.18	0.69
58.8	3135.15	3066.7	3203.6	2.18	0.70
58.9	3125.33	3056.9	3193.7	2.19	0.70
59	3115.55	3047.3	3183.8	2.19	0.70
59.1	3105.80	3037.7	3173.9	2.19	0.70
59.2	3096.09	3028.1	3164.1	2.20	0.70
59.3	3086.41	3018.5	3154.3	2.20	0.70
59.4	3076.77	3009.0	3144.6	2.20	0.70
59.5	3067.17	2999.5	3134.9	2.21	0.71
59.6	3057.60	2990.0	3125.2	2.21	0.71
59.7	3048.06	2980.6	3115.5	2.21	0.71
59.8	3038.56	2971.2	3105.9	2.22	0.71
59.9	3029.09	2961.9	3096.3	2.22	0.71
60	3019.66	2952.5	3086.8	2.22	0.71
60.1	3010.26	2943.3	3077.3	2.23	0.71

Reference

[1] *Data Sheet ADBMS6830B Rev.0 page 5.* analog.com, 01.2024.