HIGH EFFICIENCY TEC CONTROLLER

Main features: high efficiency, high precision, high reliability, zero EMI, and surface mount.

Specifications

Target* temp. stability v.s. ambient temp.:	0.002°C/°C
Target temp. offset:	±0.01°C
Target temp. response time:	to ≤0.1°C in less than 5 seconds at 1°C step
Efficiency:	≥90%
Max. output current:	6A
Max. output voltage:	externally adjustable from 0V to Vps − 0.2V
Power supply voltage:	4.75V to 5.25V
Packaging:	DIP through hole
Shielding:	complete metal shielding on all 6 sides
Default set-point temp. range***:	15°C to 35°C
Operating ambient temp. range:	-25°C to 85°C

* Target temperature refers to the actual cold side temperature of the TEC, on where the target is mounted.

** Set-point temperature is the temperature desired to have on the target.

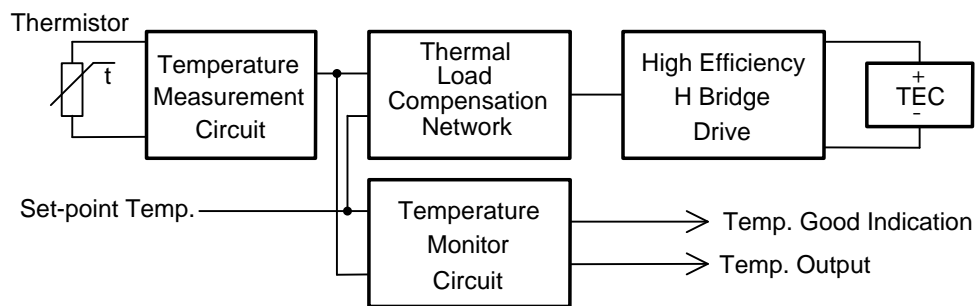*** Can be customized to other range by requirement.

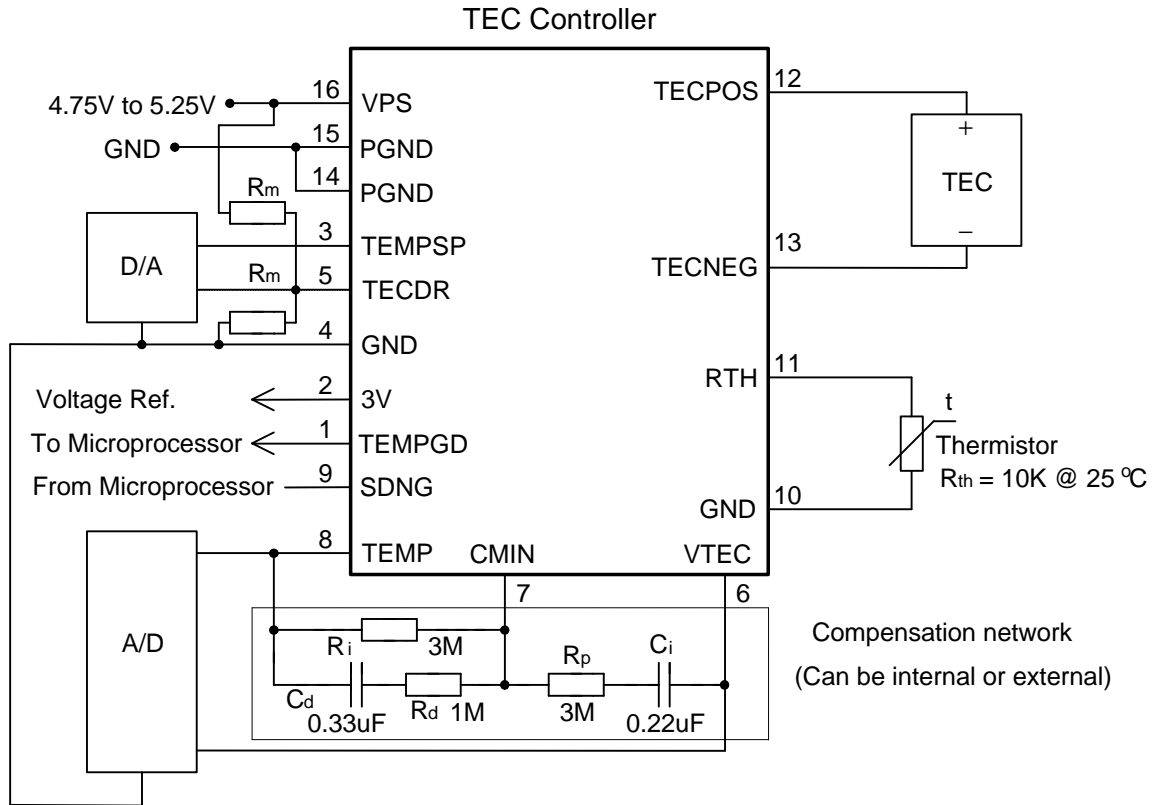Figure 1 TEC Controller Block Diagram

TEC Controller

Figure 2 TEC Controller Connections

Pin Descriptions

Pin 1, TEMPGD, Temperature good indication. It is pulled high when the set-point temperature and the actual target temperature are less than 0.1°C in difference. The internal pull up resistor to Vps is 10K Ohm. The pull down resistance is 250 Ohm @ Vps = 5V.

Pin 2, 3V, reference voltage output, 3V. It can be used for external A/D's and/or D/A's. Maximum output sourcing current 1.5mA and sinking current is 4mA. ΔVo = 50ppm/°C max.

Pin 3, TEMPSP, target temperature set-point value. The open circuit voltage is 1.5V, corresponding to a set-point temperature of 25°C. When Vps = 5V, it can be set from **0.1V** to 5V and the set-point temperature changes from 15°C to 50°C (See the curve in the back). It is recommended to use the 3V reference voltage provided by the this controller for setting the set-point temperature. The set-point temperature at 3V is 35°C by default. The input impedance is 10KΩ. This pin can be set by using a D/A, a POT, or a single resister. When the set-point temp. is fixed at 25°C, leave this pin unconnected.

Pin 4, GND, signal ground for the A/D, D/A and the thermistor.

Pin 5, TECDR, TEC control voltage input. It can be left unconnected or used to control the TEC voltage directly. Set TECDR between 0V to Vps, the voltage across TEC will be:

TEC voltage = Vps − 2*TECDR. It can also be used to configure the maximum voltage cross the TEC: Max. TEC voltage = Vps*Rm/(Rm+10K), where Rm is the resistance of the two resistors one between TECDR to GND and the other between TECDR to Vps, see Figure 2.

Pin 6, VTEC, TEC voltage indication. TEC voltage = [max. TEC voltage]*[Vps − 2*VTEC]/Vps. When TECDR is used to control the TEC voltage directly, measure TECDR to derive the TEC voltage instead, and use this formula: TEC voltage = Vps − 2*TECDR. The maximum driving current of pin **VTEC** is 30mA and the output voltage swing is 0V to Vps.

Pin 7, CMIN, compensation input pin for the thermal control loop. Leave it open in production. When prototyping, use this pin with a tuner on the evaluation board, TTV2.1 (produced by ATI) to tune the compensation network to match the characteristics of the thermal load.

Pin 8, TEMP, actual target temperature. It swings from 0V to Vps, corresponds to 15°C to 50°C when Vps equals 5V, see the curve in the below.

Pin 9, SDNG, shut down control. When pulled low, it shuts down the controller. Leave it open or pull it high to activate the controller. This pin is internal pull up by a resister of 100K to Vps.

Pin 10, GND, signal ground, internally connected to Pin 4 GND, can be used for connecting the thermistor.

Pin 11, RTH, connect to the thermistor for sensing the target temp. Thermistor's other end connects to the signal ground, pin 4 or pin 10. Rth = 10KΩ @ 25°C. Other thermistors or temperature sensors can also be used, Consult with us.

Pin 12, TECPOS, connects to TEC positive terminal.

Pin 13, TECNEG, connects to TEC negative terminal.

Pin 14, PGND, power ground for connecting to the power supply.

Pin 15, PGND, power ground for connecting to the power supply, internally connected with pin 14.

Pin 16, VPS, positive power supply rail of 5V, depending on the module.

Mounting the TEC controller on PCB's

The through hole package can be mounted either by using a socket, or soldered directly on the PCB manually or by wave soldering machine.

Customizations

It is often found that some of the default specifications do not meet our users particular need. We offer customizations on these specifications:

1. Maximum output voltage across TEC. When ordering, the part number will become: TEC6A101-DN-[max. TEC voltage], e.g., TEC6A101-DN-3V.

2. Set-point temperature range. When ordering, specify the lower limit and the upper limit. The part number will become:
TEC6A101-DN-3V-[lower temp. limit]-[upper temp. limit], e.g. for a temperature range from 10°C to 40°C, TEC6A101-DN-3V-10C-40C, by setting **TEMPSP** = 0.1V, the set-point temperature is 10°C; setting **TEMPSP** = 3V, the set-point temperature is 40°C.

3. Compensation network. It is an essential part of the TEC controller and should match the thermal load properly. The default built in network is designed to match the thermal load found in the butter fly packages. When the thermal load is not in the butter fly package, these are the choices:

3

A. Specify the TEC controller without the compensation network: TEC6A101-D, and use external components to build the compensation network on the PCB. The component values of the compensation network can be tuned by using our evaluation kit.

B. Let us find a proper compensation network for you and have it built in, a custom part number will be given for the TEC controller. In this way, the customers need to send the thermal load to us, an NRE fee may apply.

C. Customers find the values of the components in the compensation network by using our evaluation kit, give the values to us and we will build them into our controller modules, a custom part number will be given for the TEC controller.

More Applications

If you want to use this TEC controller for other applications not discussed here, please contact us.
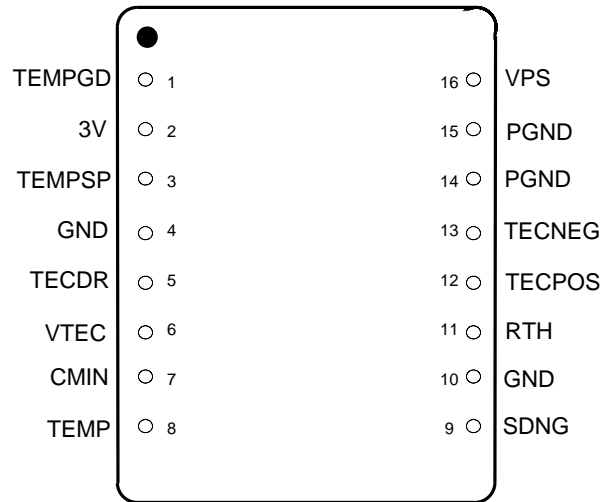
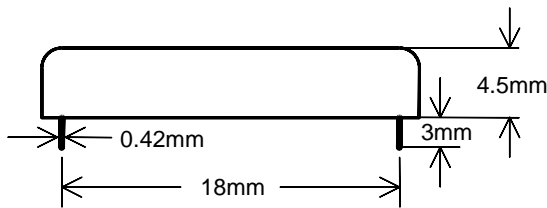## Mechanical Dimensions

Figure 3 Top View of the TEC Controller
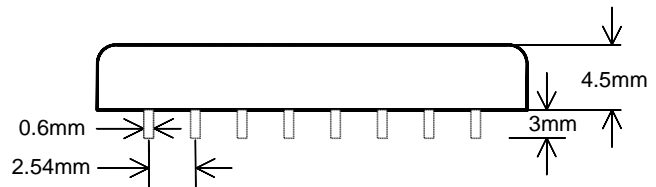

Figure 4 End View of the TEC Controller
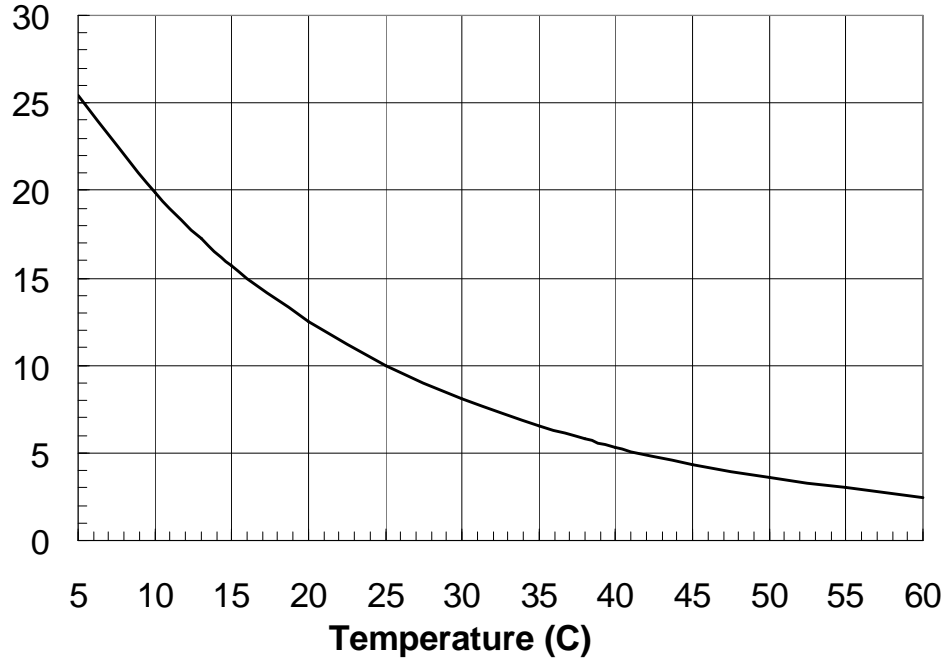

Figure 5 Side View of the TEC Controller

4

Ordering Guide

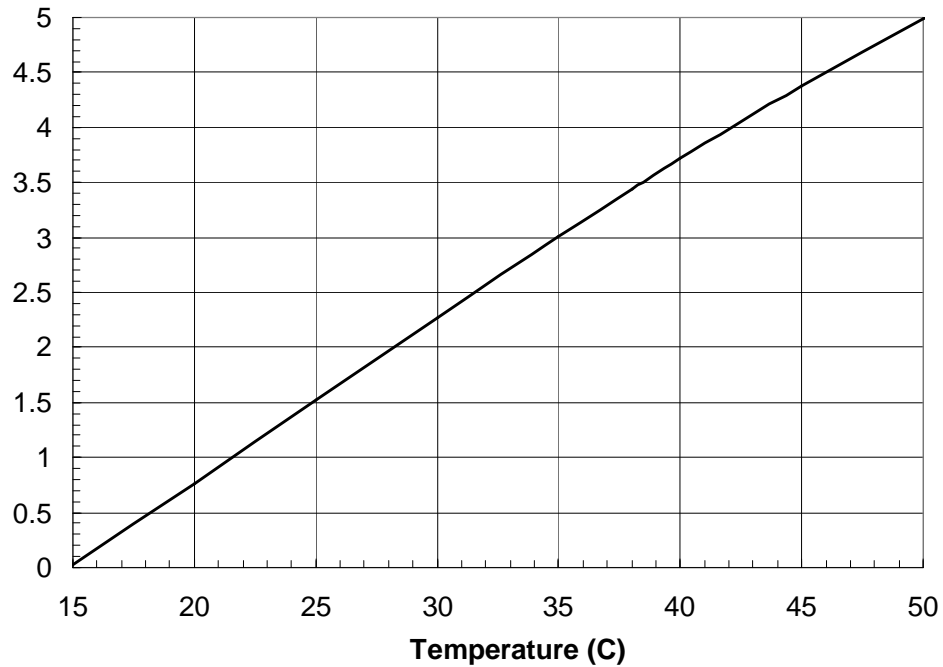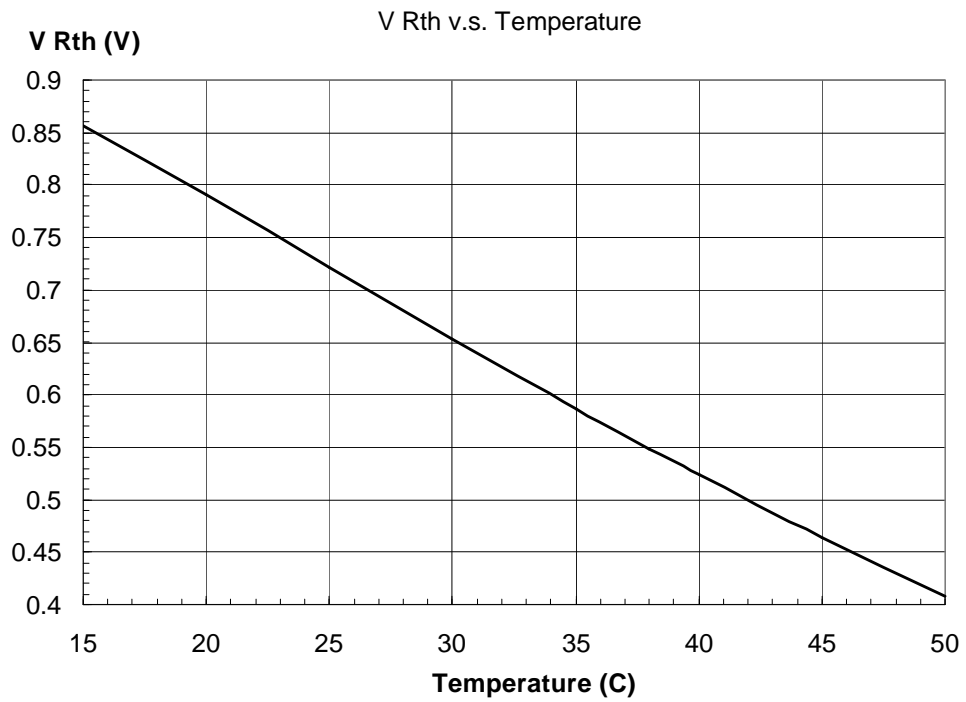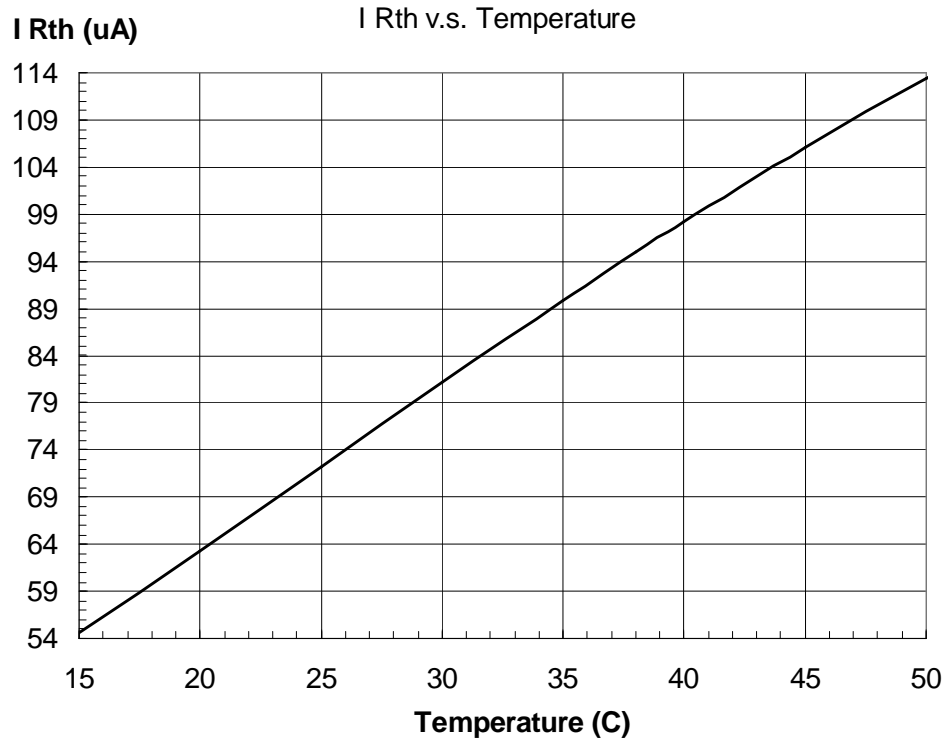| Part Number	Description	Note
TEC6A101-D	5V power supply in DIP package **without** internal compensation network	Maximum output voltage across TEC can be selected from 5V, 4.8V, 4V, 3.5V, 3V, 2.5V and 2V, or specify any value from 0.8V to VPS.
TEC6A101-DN	5V power supply in DIP package **with** internal compensation network	
TEC6A101-DN-X.XV	5V power supply in DIP package **with** internal compensation network, the maximum voltage is X.X volt (with one decimal point).	
TEC6A101-D-YYC-ZZC	YY = lower temperature limit when TEMPSP = 0.1V. ZZ = upper temperature limit when TEMPSP = 3V.	
E.g.: TEC6A101-DN-3.5V-15C-55C	Come with internal compensation network, maximum output voltage is 3.5V, lower end set-point temperature is 15C when TEMPSP = 0.1V and the upper end set-point temperature is 55C.	

Rth v.s. Temperature

Rth (K Ohm)

Temperature (C)

TEMPSP v.s. Temperature

TEMPSP (V)

Temperature (C)

I Rth (uA)

I Rth v.s. Temperature

Temperature (C)

V Rth (V)

V Rth v.s. Temperature

Temperature (C)

P Rth v.s. Temperature

P Rth (uW)

Temperature (C)

Linearity Error in TEMPSP (V)
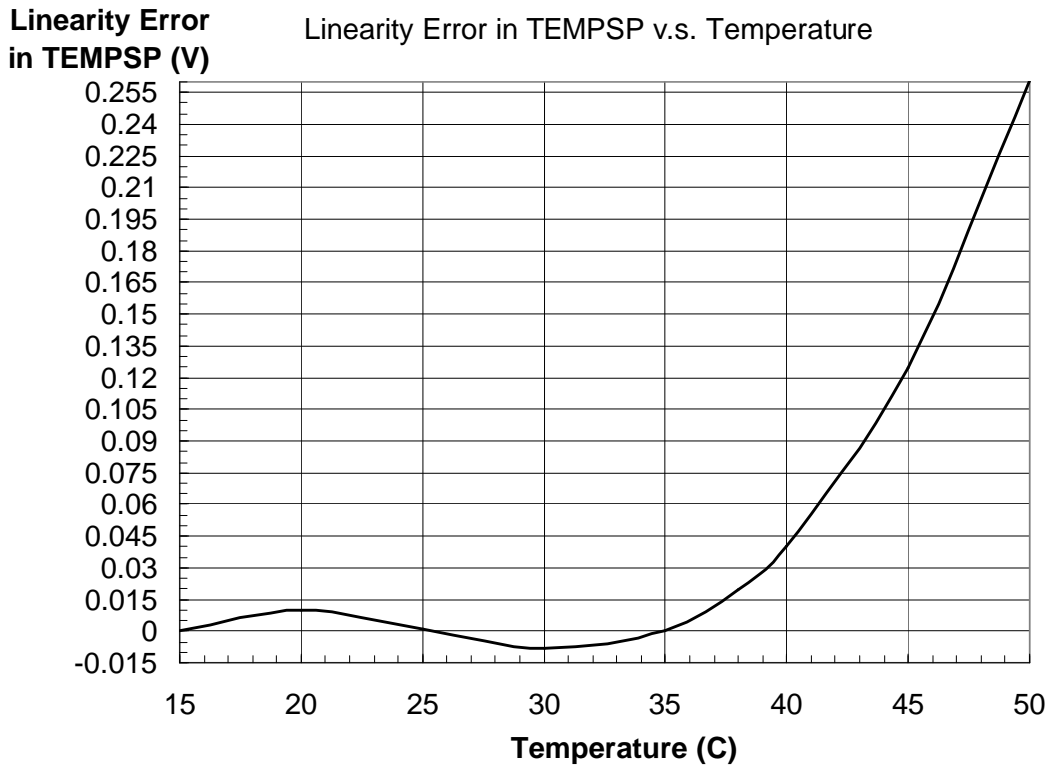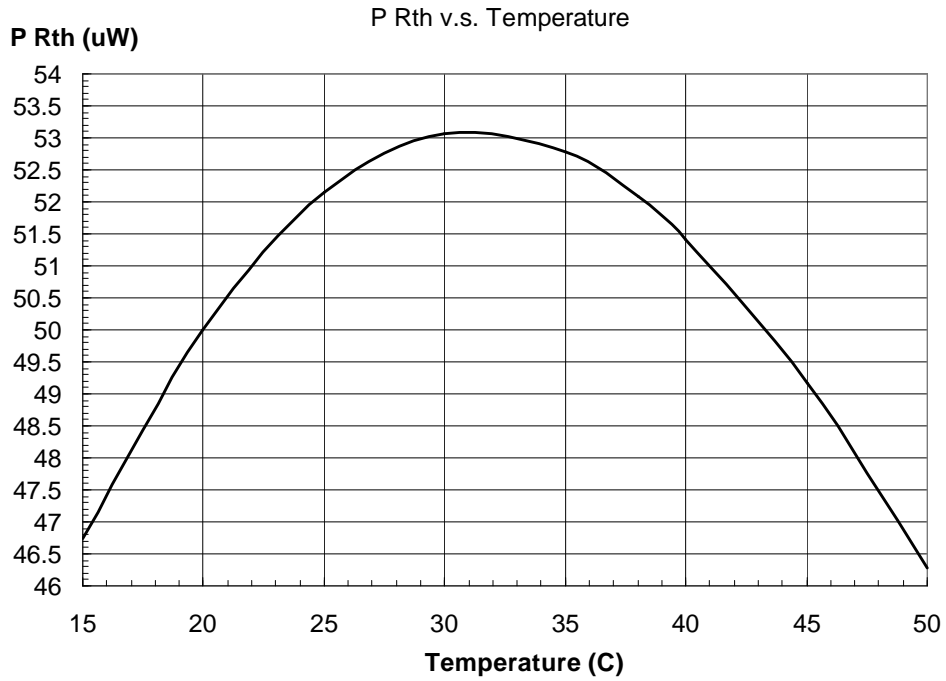
Linearity Error in TEMPSP v.s. Temperature

Temperature (C)

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