



# THERMAL NOTE

## EP5368QI DC-DC Converter

### Thermal Characteristics

The Enpirion EP5368QI DC-DC converter is packaged in a 3x3x1.1 mm 16-pin QFN package. The recommended maximum junction temperature for continuous operation is 125°C. Continuous operation above 125°C can reduce long-term reliability. The device has a thermal overload protection circuit designed to trip at an approximate junction temperature value of 150°C.

The junction temperature,  $T_J$ , is calculated from the ambient temperature,  $T_A$ , the device power dissipation,  $P_D$ , and the device junction-to-ambient thermal resistance,  $\theta_{JA}$  in °C/W, as follows:

$$T_J = T_A + (P_D)(\theta_{JA})$$

The device junction-to-ambient thermal resistance,  $\theta_{JA}$ , is given in Table 1. The  $\theta_{JA}$  is a function of user's system design parameters that include the thermal effectiveness of the customer PCB and airflow. The

$\theta_{JA}$  value in Table 1 is for free convection with the device mounted to a heavy copper plated PC board. Because of the strong dependence on the thermal effectiveness of the PCB and the system design parameters the actual  $\theta_{JA}$  value will be a function of the specific application.

Figure 1 gives the power dissipation values for this device as a function of the output current. The power dissipation at a given current value is primarily a function of the input voltage. The plots show two use conditions 3.3Vin 1.2Vout and 5Vin 2.5Vout. The data for all other use conditions is bound within the two plots. Figure 2 gives the junction temperature rise as a function of the output current for the same two use conditions.

The Figure 2 data shows that the devices do not require current de-rating up to an ambient operating temperature of 85°C.

**Table 1: Thermal Parameters**

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS
Operating Ambient Temperature Range	$T_{MAX}$	-40		85	°C
Storage Temperature Range	$T_{STG}$	-65		150	°C
Operating Junction Temperature	$T_J$	-40		125	°C
Thermal Overload Trip Point	$T_{J-TP}$		150		°C
Thermal Overload Trip Point Hysteresis			15		°C
Thermal Resistance: Junction to Ambient (0 LFM)	$\theta_{JA}$		100 <sup>1</sup>		°C/W
Reflow Temp, 10 Sec, MSL3 JEDEC J-STD-020C			260		°C

Note 1: Follows JEDEC EIJ/JESD 51 Standards, the device mounted to a heavy copper plated PC board.

## Recommendations

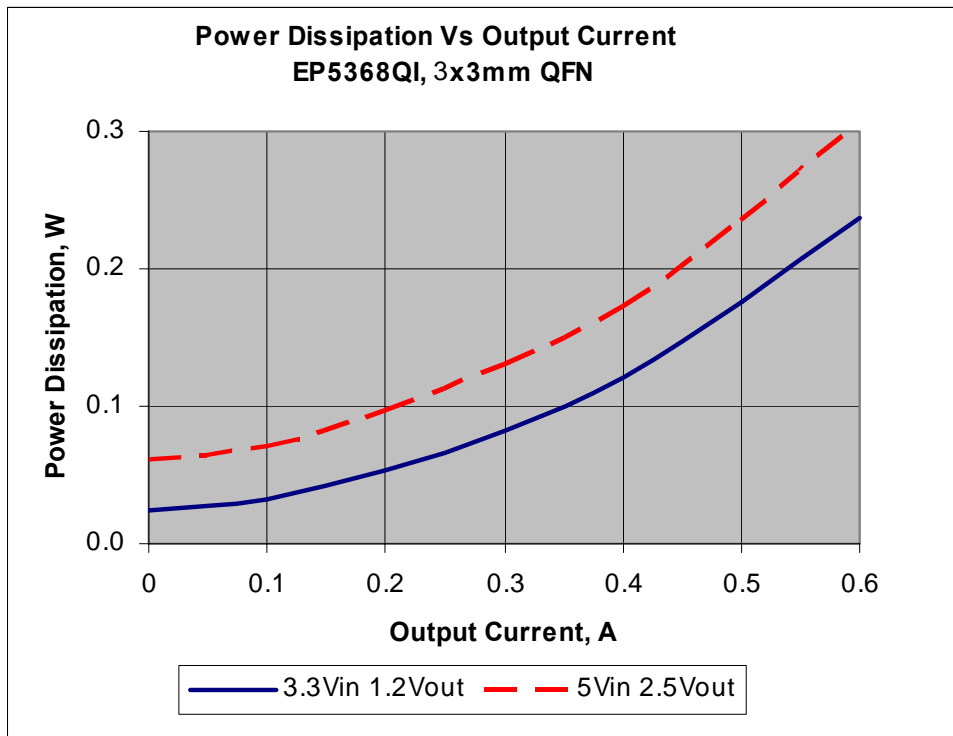
The device conducts the internal heat generated on the IC through the copper leads to the printed circuit board (PCB). The PCB acts as a heat sink to the device by spreading the heat over the PCB surface and convecting it to the ambient air. In order for the PCB to be an effective heat sink the copper coverage must be maximized.

Given below are recommended features for a thermally effective PCB:

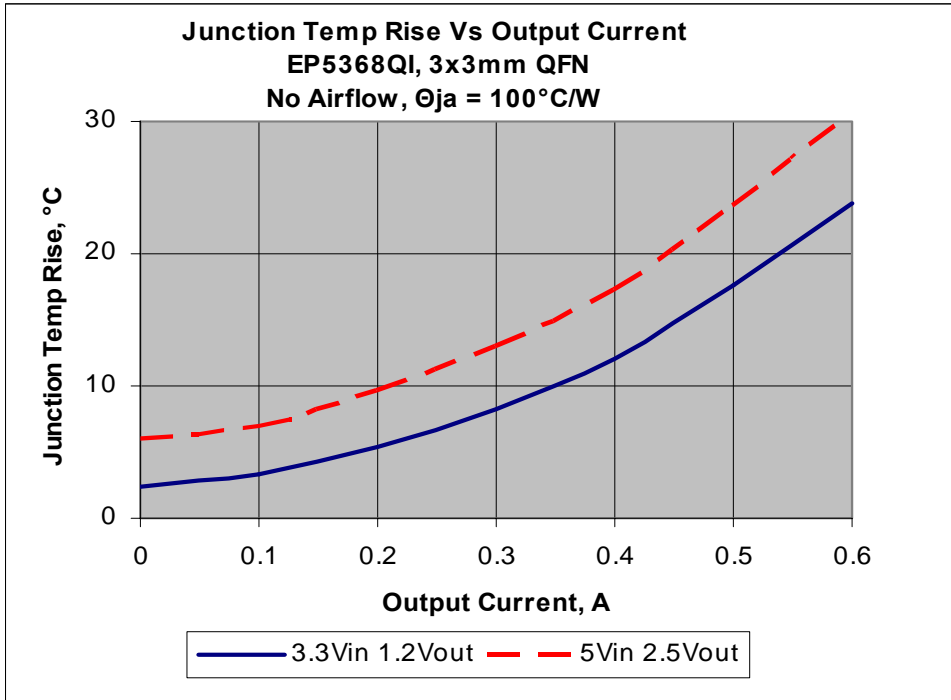
1. Fill all unused areas on every layer of the PCB with copper.
2. Use the thickest possible copper plating on every layer.
3. Use the thinnest possible PCB board.
4. Use wide traces and multiple vias as interconnect between layers for high current nodes. This will reduce  $i^2R$  heating and increase surface area for convective cooling.
5. If possible, the PCB should have full copper plated power & ground planes.

Refer to the EP5368QI Data Sheets for the description of the 3x3x1.1mm 16-pin QFN package.

**Figure 1: Power Dissipation vs Output Current**



**Figure 2: Junction Temperature Rise vs Output Current, No Airflow**



## Contact Information

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