THERMAL INTERFACE MATERIALS

Type	Part No.	Thermal Conductivity	Thickness	Breakdown Voltage	Calculated $R_{\theta, TIM}$
Gap filling pad	TGARD210	5 W/mK	0.25mm	6 kV	0.89 K/W
	AlN Ceramic	170 W/mK	0.25mm	17kV/mm	0.03 K/W
Adhesive	SA3500	3.5 W/mK	Custom (0.15mm)	10kV/mm	0.77 K/W
	TIA520R	5.2 W/mK	Custom (0.15mm)	20kV/mm	0.52 K/W
Phase Change Materials	HI-FLOW 300P	1.6W/mK	0.1mm	5kV	1.12 K/W

CALCULATING JUNCTION TEMPERATURE

Assuming 2 devices are mounted on the same heatsink:

T_{j1} and T_{j2} = Junction temperatures of Device 1 and Device 2 respectively

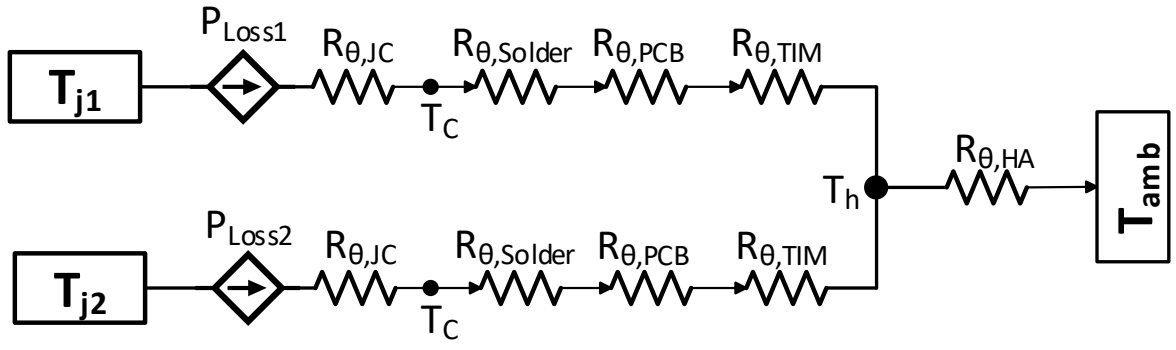
T_h = Heatsink Temperature

P_{Loss1} and P_{Loss2} = Power Loss of Device 1 and Device 2 respectively

$$T_h = (P_{Loss1} + P_{Loss2}) \times R_{\theta,HA} + T_{amb}$$

$$T_{j1} = \left(R_{\theta,JC} + R_{\theta,solder} + R_{\theta,PCB} + R_{\theta,TIM}\right) \times P_{Loss1} + T_h$$

$$T_{j2} = \left(R_{\theta,JC} + R_{\theta,solder} + R_{\theta,PCB} + R_{\theta,TIM}\right) \times P_{Loss2} + T_h$$



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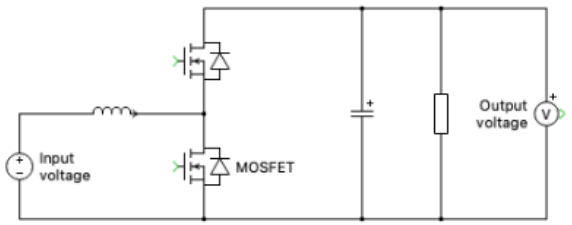
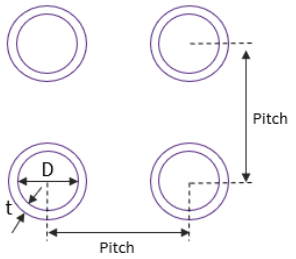
SPEEDFIT DESIGN EXAMPLE

Synchronous Boost Converter





Thermal vias layout

Thermal Impedance	Value	Units	Comments
$R_{\theta,JC}$	1.1	°C/W	Typ. Junction to case thermal impedance of C3M0065090J
$R_{\theta,solder}$	0.015	°C/W	Thermal impedance of 0.06mm thick Tin-Silver Solder
$R_{\theta,PCB}$	1.39	°C/W	For 110 vias with specifications: • D= 12mil • t= 2mil • Pitch (Distance between vias)= 32mil • Height of the vias= 1.7mm (See-through vias)
$R_{\theta,TIM}$	0.52	°C/W	Adhesive TIA520R
$R_{\theta,HA}$	2	°C/W	Aluminum Heatsink: 28 x 28 x 11 mm (Pin-Fin Design) (1000 LFM air-flow)
$R_{\theta,total}$	5.03	°C/W	Total thermal impedance
T_{amb}	25	°C	Cold-plate temperature
P_{loss}	11.3	W	Power loss of one device
Calculated T_j	101	°C	Calculated junction temperature (2 Device per Heatsink)
Calculated T_j	81.8	°C	Calculated junction temperature (1 Device per Heatsink)

$$R_{th,ch} = Thermal\ impedance\ from\ Case - Sink$$
$$= R_{\theta,solder} + R_{\theta,PCB} + R_{\theta,TIM}$$
$$= 0.015 + 1.39 + 0.52 = 1.93\ K/W$$

$$T_h = (P_{oss1} + P_{Loss2}) \times R_{\theta,HA} + T_{amb}$$
$$T_h = (11.3 + 9.57) \times 2 + 25 = 66.74°C$$

$$T_{j1} = (R_{\theta,JC} + R_{\theta,solder} + R_{\theta,PCB} + R_{\theta,TIM}) \times P_{Loss1} + T_h$$
$$T_{j1} = (1.1 + 0.015 + 1.39 + 0.52) \times 11.3 + 66.74 = 100.9\ °C$$

$$T_{j2} = (R_{\theta,JC} + R_{\theta,solder} + R_{\theta,PCB} + R_{\theta,TIM}) \times P_{Loss2} + T_h$$
$$T_{j2} = (1.1 + 0.015 + 1.39 + 0.52) \times 9.57 + 66.74 = 95.7\ °C$$

Device Overview (combined total losses of all devices of a given type)				
	Switching	Conduction	Combined Losses	Peak Junction Temperature
Primary MOSFETs/Modules	2.42 W	8.89 W	11.30 W	100.9 °C
Secondary/Synchronous MOSFETs/Modules	0 W	9.57 W	9.57 W	95.7 °C
Diodes	—	—	—	—
Converter Losses			20.87 W	

Cooling system

◉ Isolated Heatsink

Thermal interface resistance $R_{th,ch}$

1.93 K/W

Heatsink temperature T_h

◉ Variable

○ Fixed

Thermal resistance $R_{th,ha}$

2 K/W

Heatsink time constant τ_{ha}

60 s

Additional heat source on heatsink P_{add}

0 W

Ambient temperature T_{amb}

25 °C

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