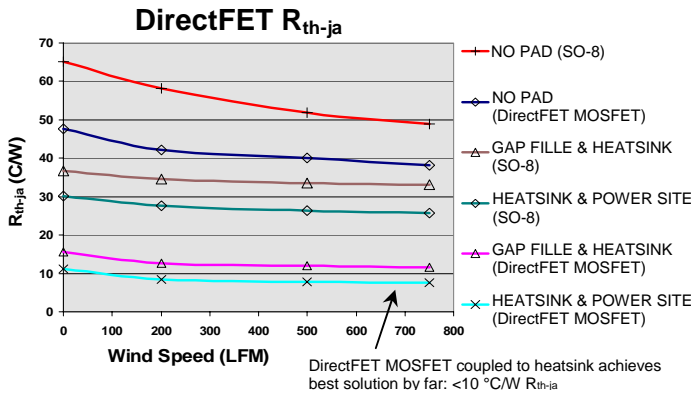
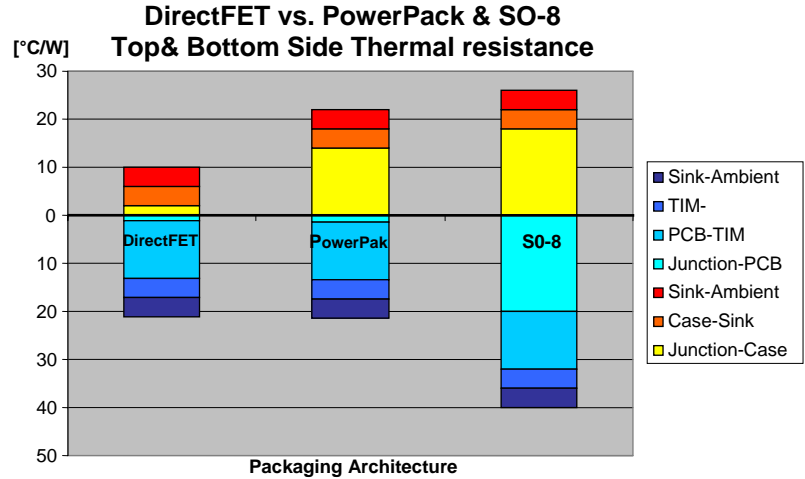
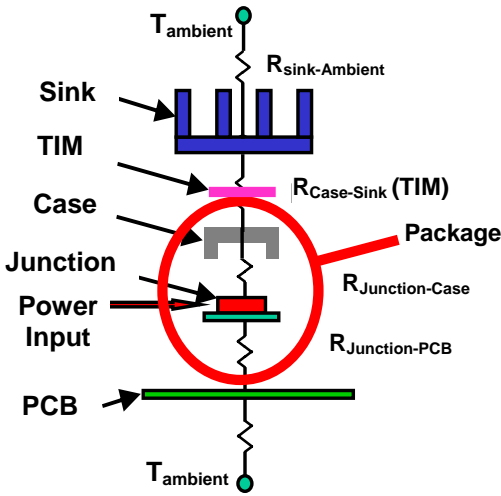


Thermal Engineer



TIM Interfaces

Interface Material	Features	Thermal	Thickness (mil)	I _{max} (Amp)
		Conductivity (W/m-K)		
GPA3000	highly conductive gap filler	3	20	105.9
	polymer laminate		15	104.9
SPA2000	Sil-Pad, thermally conductive silicon elastomer	3.5	15	96.9
GPVO, Ultra Soft	highly conformable, used for uneven surface	1	20	97.9
			40	95.9
Bond Ply 100	double sided tape with high bond strength	0.8	8	92.9

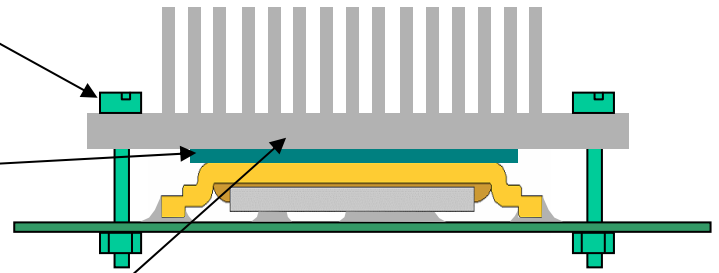
<http://www.irf.com/product-info/hexfet/dfheatsinking.html>

TIM's and Heatsinking

Board attachment: in the majority of cases the method of attachment is a compression fit of the heatsink onto the top of the device. This is achieved either by the screw mounting of the heatsink (shown) or through the use of a clip to affix the heatsink to the board. In both cases the DirectFET and the interface material is sandwiched between the heatsink and the board.

Interface material: interface material should be used and provides two functions:

- Improves the intimacy on thermal contact between the top of the DirectFET and the heatsink.
- Provides electrical isolation between the drain clip which is at drain potential and the heatsink (not required if only one device is to be heatsunk or all devices are running at the same potential and phase).



Heatsink: the size/shape of the heatsink will depend on the customer's requirement for R_{th(c-amb)} and required thermal capacity. The heatsink can be designed to sink single or multiple devices

Thermal Interface Materials - Classifications

Material Class	Description	Benefits	Drawbacks	Bulk K (W/mK)	Surface Wetting	Surface Conforming	Vendors
Grease	These are the traditional TIM's filled with conductive particles of Al ₂ O ₃ , BeO, Al, Ag, etc.	Can achieve very thin bondlines <0.005"	Difficult to preapply to assemblies Messy Typically pumps out affecting long term reliability Requires controlled dispensing No electrical isolation	0.3-2 Al Filled 6+	Very Good	Very Good	Hi-K Grease - Shinetsu Bergquist
Gel	Grease replacement that cross links during cure to form a gel-like substance.	Can achieve very thin bondlines <0.005" Does not pump out	Cannot be preapplied to assemblies Requires cure which can be from burn-in Messy Requires controlled dispensing No electrical isolation	0.3-2	Very Good	Very Good	Thermoset-Lord MG Series
Adhesive	Heat cured adhesives filled with conductive particles similar to grease.	Can achieve very thin bondlines <0.005" Mechanical and thermal attach	Cannot be preapplied Typically requires process oven curing Messy Requires controlled dispensing Typically no electrical isolation	0.3-1.3	Very Good	Very Good	Dow Corning 3M
Tape	Usually pressure sensitive adhesive filled with conductive particles on a fiberglass or plastic carrier.	Mechanical and thermal attach Can be die cut and preapplied Clean, simple processing Typically electrical isolating	Typically thick bondlines with low thermal conductivity	0.7-1.5	Moderate	Poor	Bergquist 3M Dow Corning
Phase Change	A waxy type material that changes to a gel at approximately 50 C allowing it to conform to surface irregularities. Can be preapplied or supplied on a carrier.	Can achieve very thin bondlines <0.005" when preapplied Fairly clean process With carrier has electrical isolation	Typically low thermal conductivity The phase change material itself is usually very thin and does not conform to large irregularities	0.8-1.5	Very Good	Very Good for irregularities <0.002" Very Poor for large irregularities or bowing	Bergquist 3M Dow Corning
Pads	Typically thick materials 0.010"-0.250" thick. Some are very compliant with a low K and others are not very compliant with a reasonably high K.	Simple to use Can typically be re-used Can be die cut and preapplied Clean process	Typically requires moderate to high pressures to achieve reasonable performance - can be tricky to use effectively Typically do not conform well to small surface irregularities Thick bondlines	0.8-4	Poor	Very Good for large irregularities Very Poor for small irregularities	Bergquist 3M Dow Corning