sdiode

November 8, 2022

0.0.1 Thermal Calcs for .....

The spec sheet had no thermal specs.

I found another diode with similar package (SMA).

The calculations will be based on it's specs below.

Specs for SMA Package

THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction–to–Lead (Note 2) MBRA2H100T3G, NRVBA2H100T3G, NRVBA2H100NT3G MBRS2H100T3G, NBRS2H100T3G, NBRS2H100NT3G	Ψ_{JCL}	 14 12	°C/W
Thermal Resistance, Junction–to–Ambient (Note 2) MBRA2H100T3G, NRVBA2H100T3G, NRVBA2H100NT3G MBRS2H100T3G, NBRS2H100T3G, NBRS2H100NT3G	$R_{\theta JA}$	 75 71	°C/W
Thermal Resistance, Junction–to–Ambient (Note 3) MBRA2H100T3G, NRVBA2H100T3G, NRVBA2H100NT3G MBRS2H100T3G, NBRS2H100T3G, NBRS2H100NT3G	$R_{\theta JA}$	 275 230	°C/W

2. Mounted with 700 mm square copper pad size (Approximately 1 inch square) 1 oz FR4 Board.
3. Mounted with minimum recommended pad size 1 oz FR4 Board.

Here are some precalculated values

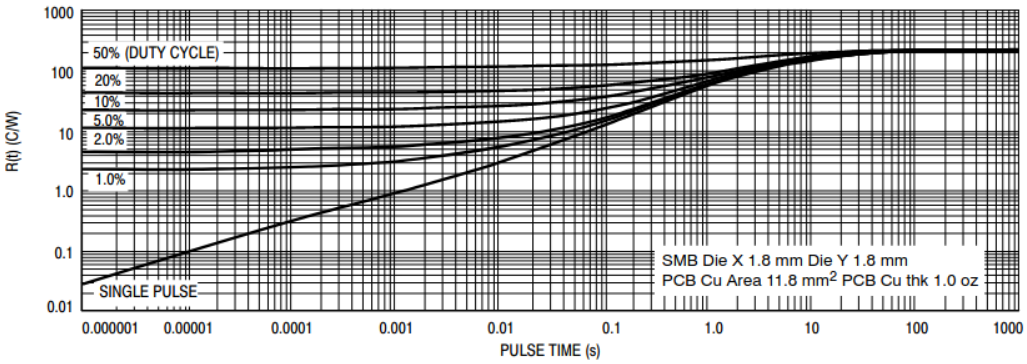


Figure 10. Thermal Response, Junction–to–Ambient (min pad) – MBRS2H100T3G/NBRS2H100T3G/NBRS2H100NT3G

This seems really confusing ..

For,

- Just the minimum pad size

- One ounce copper
- 50% duty cycle

we get $100^{\circ}C$ per watt

If worst case is 100% duty cycle we now get, 200° per watt

Thus at 0.5 watts we get a final temp of $125^{\circ}C$ assuming $25^{\circ}C$ ambient

Let's do the calculations manually,

For the 'leads'

[1]:
```
:opt no-lint
import Text.Printf
degCperWatt = 645*125/11.8

putStrLn $ printf "DegC per Watt for Leads Min Pad Size %8.2f" degCperWatt
```

```
DegC per Watt for Leads Min Pad Size  6832.63
```

Well, they're not doing much .. !

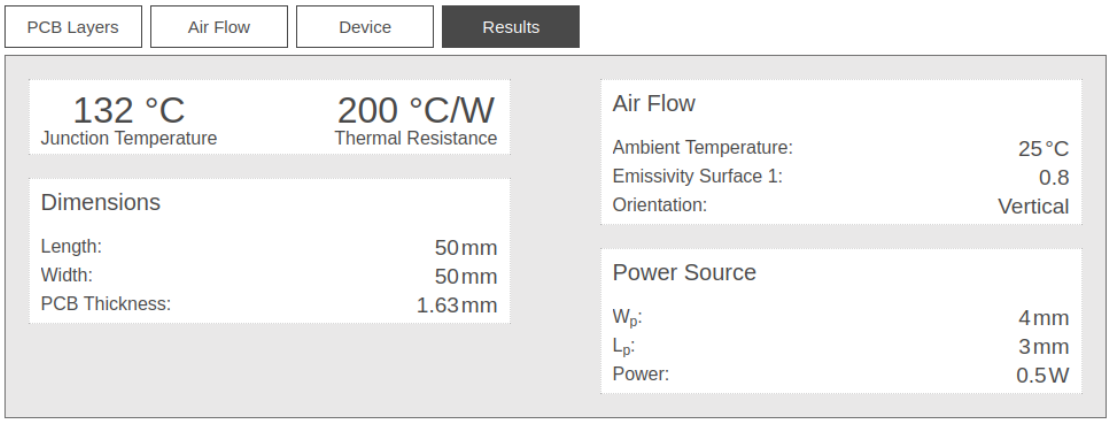
Now let's try junction to ambient ..

Spec says $270^{\circ}C$ per watt,

So at 0.5 watts we get a final temp of $160^{\circ}C$.

Not sure why it's different .. The SMB package is a bit lower -> final temp of $140^{\circ}C$. Maybe that's why.

I tried an online calculator (not completely sure I'm using it properly) and got,



At least we're in the ballpark ..

There are two questions remaining ..

- What is the leakage vs temperature curve
- How big of a copper pad should we use

Notes from Jay ..

ALM Diode - Too Small

Goldilocks Diode - Just Right?

Gigantic Diode - Overkill?

My Favorite Axial Diode

Axial Diode 1N5822RL Datasheet Mouser Link

Uses DO201AD Axial Package .. And it's cheap!

If we mount the diode with one centimeter leads on each side and about 3mm in the air we can achive about 80° C per watt.

At 0.5 Watts,

$40^{\circ}(diode) + 25^{\circ}C(ambient) = 65^{\circ}C$

If we assume absolute worst case is 100° C then the reverse leakage power is about 50mw .. No problem

I consider this a success.

Thermal Runaway App Note from STMicro