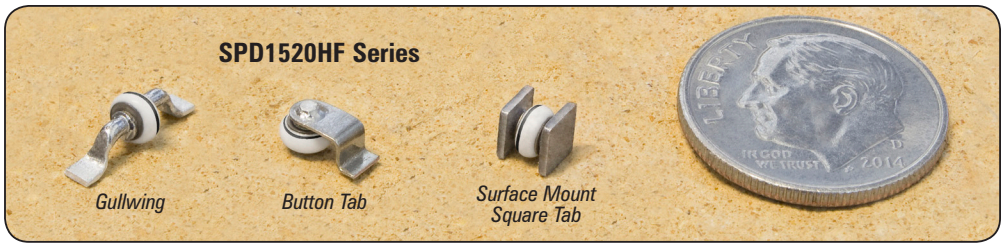
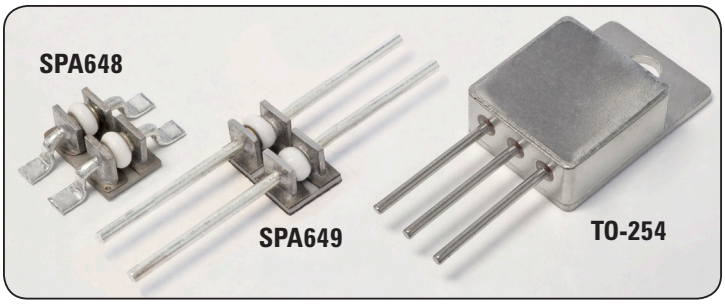
SPA648 and SPA649 Application Note

AN2015-01 Rev. A



SSDI recently introduced a new series of SPD1520 hyperfast diodes that are rated at 15A and available in voltages from 100V to 600V. The SPD1520 diode is designed to be mounted directly to a thermally conductive PCB and is available in 3 configurations: Button for best thermal performance, SMS for classic surface mount with end-tabs, and the new Gullwing lead with a narrow foot-print width (0.10" vs 0.15" for SMS) that is suitable when board space is critical.

SSDI has taken the SPD1520 series a step further by offering it in pairs in an SPA648 and SPA649 isolated assembly. The SPA648 utilizes two SPD1520 with Gullwing leads mounted to an Aluminum Nitride (AlN) substrate using high temp solder (>300°C). The SPA649 is similarly constructed with solid silver round leads for through-hole connection. The diodes are independent from one another and can be configured externally by the user in many ways: parallel applications to boost the total current to 30A, center-tap common anode configuration, center-tap common cathode or doubler configuration. In addition, a full wave or 3 phase bridge can easily be attained by utilizing 2 or 3 subassemblies respectively.



The SPA648 and SPA649 are ideal replacement for larger and heavier TO-254 packages with comparable thermal properties with numerous benefits:

- Small footprint and light weight for easy mounting directly to PCB
- Unlike a TO-254, there are no wire-bonds to fuse or break
- Void-free construction negates Hermeticity, PIND and RGA issues
- Frit glass ceramic body construction provides a very rugged package that has been proven to survive cryogenic temperature cycling
- True high temperature operation at junction and case temperature of 175°C[1/]

As previously mentioned, the SPA648 and SPA649 are designed to be mounted directly to PCB (Figures 1 – 3). The backside of substrate consists of a pre-tinned copper layer that can be soldered, or epoxy attached, directly to PCB. The operating current can be increased by simply attaching a heat-sink directly below the device on the opposite side of the PCB (see Figure 2). The heat-sink can be attached with epoxy, high conductivity double adhesive tape, or, in the case of copper heat-sink, with solder.

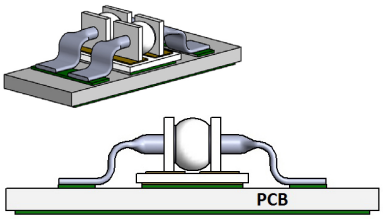


Fig.1 SPA648

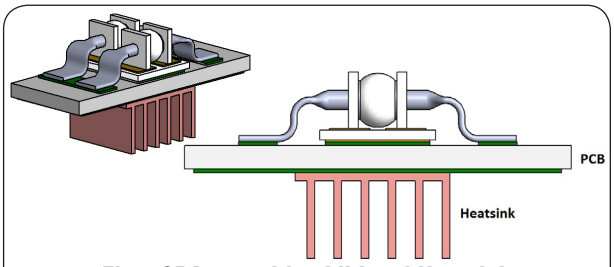


Fig.2 SPA648 with additional Heatsink

The SPA649 is a through hole device with round leads that can be formed as desired similar to an ordinary axial diode. To obtain maximum operating current, the isolated substrate can be attached to a heat-sink as shown in Figure 3 using epoxy, high conductivity double adhesive tape, or, in the case of copper heat-sink, solder.

Please refer to SSDI Application Note AN2010-1 for specifics on soldering guidelines.

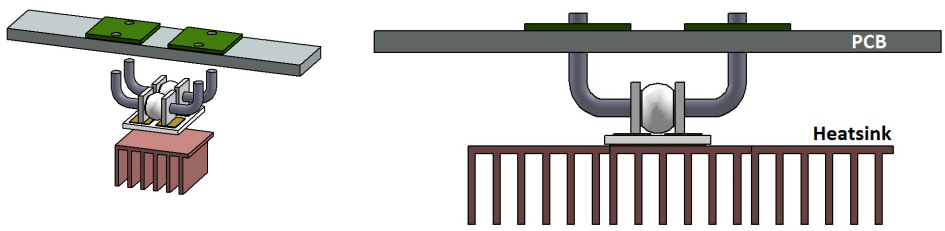


Fig.3 SPA649 with Up-bend Leads

NOTES:

1/ Can be safely operated at or higher than 200°C

2/ 4-layer 2.5" x 3.8" PCB with ~1.25 oz copper on two outer layers & 1 oz copper on two inner layers

3/ Quantitative effect of heatsink is under study and a new application note will be released once it is completed

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Thermal Information

- **Maximum power dissipation may be calculated by the following formula:**

$$P_{DMAX}(T_{REF}) = \frac{T_{JMAX} - T_{REF}}{\theta_{J\text{-}REF}}$$

- T_{JMAX} = Maximum operating junction temperature
- T_{REF} = Worst case operating temperature (ambient or case)
- $\theta_{J\text{-}REF}$ = Junction-to-reference (ambient or case) thermal resistance

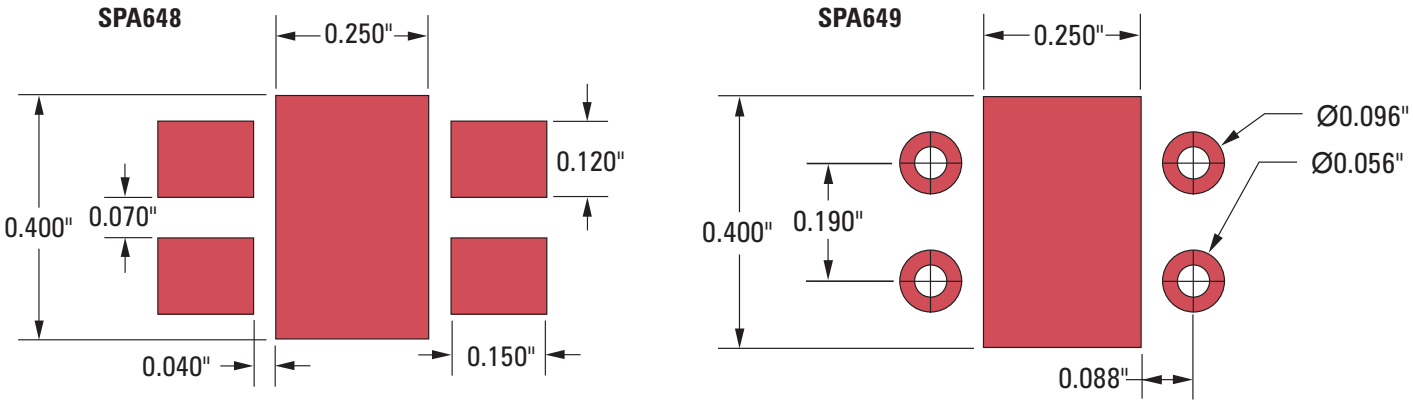
- **Examples of Calculated Power Dissipation**

Device	SPA648 / SPA649	SPA649
Mounting Type	FR-4[2/] per Fig1	FR-4[2/] and heat-sink per Fig3
Calculated Continuous Power Dissipation Allowed	4.3 W	36.8 W
T_{REF}	$T_A = 55^\circ C$	$T_C = 80^\circ C$
$T_{J\ operating}$	150°C	150°C
$\theta_{J\text{-}ref,\ both\ legs}$	max $\theta_{J\text{-}A} = 22$	max $\theta_{J\text{-}C} = 1.9$

In the SPA648 example, the maximum continuous power dissipation (P_D) is 4.3W when both diodes are energized, ambient temperature at 55°C and Tj limited to 150°C. The addition of heat-sink as shown in Figure 2 will increase maximum P_D and/or decrease Tj[3/].

Full potential in terms of power dissipation can be achieved with the substrate fully heat-sunk as shown in the SPA649 example.

Recommended Solder Pad



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