

PowerPAD™ Made Easy

What is PowerPAD

The PowerPAD package is a thermally enhanced standard size IC package designed to eliminate the use of bulky heatsinks and slugs traditionally used in thermal packages. This package can be easily mounted using standard printed circuit board (PCB) assembly techniques, and can be removed and replaced using standard repair procedures.

The PowerPAD package is designed so that the leadframe die pad (or thermal pad) is exposed on the bottom of the IC. This provides an extremely low thermal resistance (θ_{JC}) path between the die and the exterior of the package. The thermal pad on the bottom of the IC can then be soldered directly to the printed circuit board (PCB), using the PCB as a heatsink. In addition, through the use of thermal vias, the thermal pad can be directly connected to a ground plane or special heat sink structure designed into the PCB.

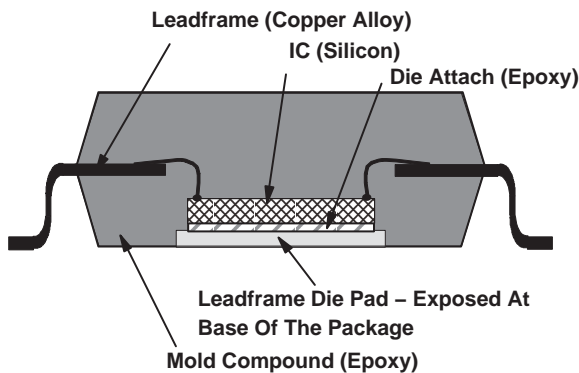


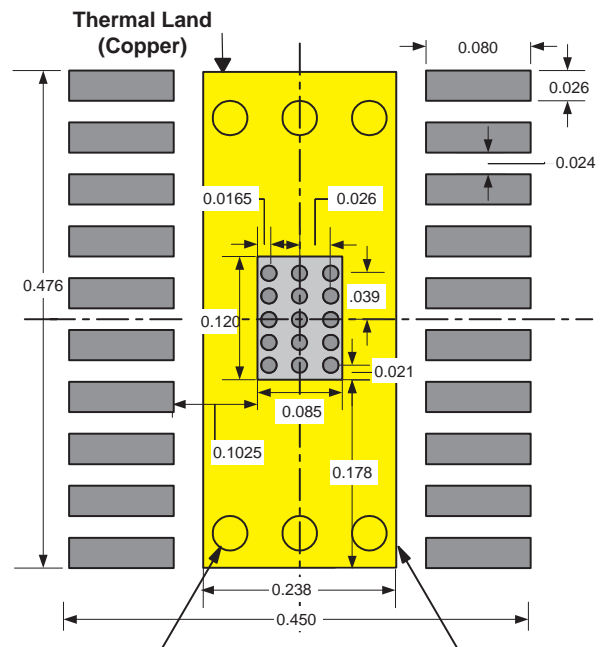
Figure 1. Section View of a PowerPAD Package

PowerPAD Assembly Process

1. Prepare the PCB with a top side etch pattern as shown in Figure 2. There should be etch for the leads as well as etch for the thermal land.
2. Place the recommended number of holes (or thermal vias) in the area of the thermal pad. These holes should be 13 mils in diameter. They are kept small so that solder wicking through the holes is not a problem during reflow. The recommended number of holes for each of the PowerPAD packages can be located in the SLMA002 Technical Brief, *PowerPad Thermally Enhanced Package*.

3. It is recommended, but not required, to place a small number of the holes under the package, but outside the thermal pad area. These holes provide additional heat path between the copper land and ground plane and are 25 mils in diameter. They may be larger because they are not in the area to be soldered, so wicking is not a problem. This is illustrated in Figure 2.

**REQUIRED STANDARD LAYOUT:
PowerPAD size (.085" x .120")
15 Vias with diameter = 0.013"**



**OPTIONAL LAYOUT:
Extended ground plane (0.238" x 0.476")
Addition 6 vias outside of thermal pad area but
under the package (Via diameter = 25 mils)
Solder resist should be used on areas outside
the PowerPAD area.**

All units in inches

Figure 2. 20-Pin DWP PowerPAD PCB Etch and Via Pattern

4. Connect all holes, including those within the thermal pad area and outside the pad area, to the internal ground plane or other internal copper plane.

- When connecting these holes to the ground plane, do **not** use the typical web or spoke via connection methodology. Web connections have a high thermal resistance connection that is useful for slowing the heat transfer during soldering operations. This makes the soldering of vias that have plane connections easier. However, in this application, low thermal resistance is desired for the most efficient heat transfer. Therefore, the holes under the PowerPAD package should make their connection to the internal ground plane with a complete connection around the entire circumference of the plated through hole.

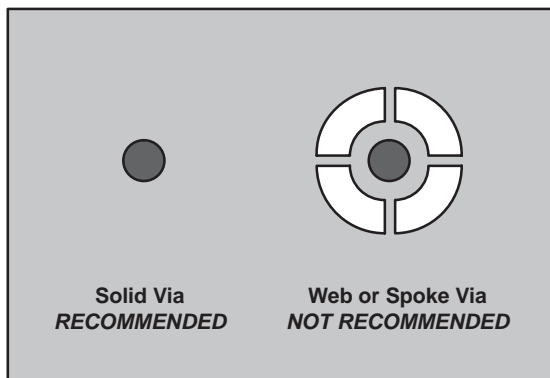


Figure 3. Via Connection

- As illustrated in Figure 2, the top-side solder mask should leave exposed the terminals of the package and the thermal pad area. The thermal pad area should leave the 13 mil holes exposed. The larger 25 mil holes outside the thermal pad area should be covered with solder mask.
- Solder mask should be applied to cover the entire bottom side of the PowerPAD vias to prevent solder wicking. This includes full solder mask coverage over the vias. Many layout programs default to not covering the vias. While this may work, the occurrence of solder wicking is possible. The solution is to make sure the solder mask covers all of the thermal vias.
- Apply solder paste to the exposed thermal pad area and all of the package terminals.
- With these preparatory steps in place, the PowerPAD IC is simply placed in position and run through the solder reflow operation as any standard surface mount component. This results in a part that is properly installed.

For detailed information on the PowerPAD package including thermal modeling considerations and repair procedures, please see SLMA002 Technical Brief *PowerPAD Thermally Enhanced Package*.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265

Copyright © 2004, Texas Instruments Incorporated