Application Note

Chip and Beam Lead Handling

Chip and beam lead devices are packaged for shipment in either waffle packs or Gel-Packs®. Chips in waffle packs are somewhat free to move around their wells, and can be accidently dislodged rather easily when the waffle pack is opened. To prevent this, we recommend the following procedure: The waffle pack top is secured with a locking clip. Place the waffle pack on a smooth, flat surface with the label side up. Hold the waffle pack securely while slowly sliding off the clip. Carefully remove the waffle pack lid by lifting it straight up, then, remove the packing material. Carefully remove chips, one at a time, using tweezers or a grounded vacuum pick-up being careful not to damage the active junction area or metallization. Excessive removal force will cause cracks or chip outs. NOTE: It is at this point that most damage to chips occurs, since they are most fragile at the chip corners and at the mesa edge. Since many devices shipped as chips are sensitive to damage from static discharge, we recommend that all chips be handled in ESD secure areas.

The same procedure holds for Gel-Packs® except that the devices are more securely held in place by the tacky gel surface coat. Since most devices packed this way are beam leads , a vacuum pick-up or a sharpened wooden stick such as a Q-tip dipped in isopropyl alcohol is mandatory. Attempting to handle beam leads with tweezers will result in severe deformation of the beams and probable damage to the devices.

Die Bonding

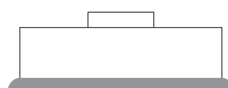
Die bonding is usually done by either solder preform or conductive epoxy die attach methods. For the lowest electrical resistance and highest mechanical strength, we recommend the use of gold/tin or gold/germanium solder preforms to form a bond between the circuit substrate and the gold backing of the chip. Conductive epoxy may be used where general or localized heating of the circuit substrate is impractical. We recommend Ablestik 184 LMI. The recommended bonding temperature for gold/tin is 280 °C and 385°C for gold/germanium. Bonding should be shielded with an inert atmosphere of Nitrogen or forming gas (Nitrogen with 10% hydrogen). Conductive epoxyshould be cured for one hour @ 150°C in a Nitrogen atmosphere.

Lead Bonding

Leads to the top contact of chips may be formed by bonding gold ribbon or wire from the circuit to the contact (usually the anode) by thermo-compression bonding techniques. Here, the combination of heat and pressure causes a gold to gold metallurgical bond to form. Since the bonding process is governed by many factors, including the chip size and geometry, some trial and error will be necessary to find the right combination of heat and pressure to form a secure bond. As a starting point we recommend a bonding tip temperature of 150-165 °C and a substrate temperature of 250 °C. Start with a tip pressure of 40 gm. and reduce it to the minimum necessary to form a good bond.

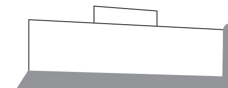
Die Bond Criteria

GOOD BOND



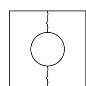
- Solder or Epoxy Thin (Approx. .001" MAX)
- No Meniscus Around Edge
- Solder Surface Shiny
- No Holes, Cracks, etc.
- Minimum 90% Wet

UNACCEPTABLE BOND

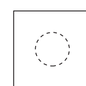


- Tilted Die
- Loose or Foreign Material on Top of Chip
- Solder or Epoxy Carrier on Top of Surface of Die
- No Evidence of Dice to Substraight Melt Around at Least 10% of the Die
- Less than 90% Melting

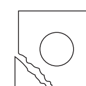
OTHER UNACCEPTABLE BONDS



Cracked Dice



Metallization Missing



Broken Dice

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Die Bonding/Die Attach:

- Ablestik 184 LMI - cured for one hour @ 150°C) in a Nitrogen atmosphere (too hot for Tunnels)
- Conductive silver epoxy - cured at 100 to 125°C - (100 to 110°C recommended for Tunnels)
- Solder perform: Gold (80%)/Tin (20%) 280 °C -320°C - (too hot for Tunnels)
- Solder perform : Gold (90%)/Germanium (10%) 380°C -385°C - (too hot for Tunnels and Schottkys)

Lead Bonding/Wire Bonding:

Use thermo-compression bonding - pads are not designed for thermo-sonic bonding. The best settings for a specific application are determined by experimentation, starting with the typical value shown below. As a starting point we recommend a bonding tip temperature of 150-165 °C and a substrate temperature of 250 °C. Start with a tip pressure of 40 gm. and reduce it to the minimum necessary to form a good bond

For all chips except Tunnels - Wire or Ribbon - base at 210°C, tip at 150°C, tip pressure between 15 and 50 grams

For Tunnels - 0.7 mil wire - base at 150°C, capillary at 150°C, capillary pressure less than 20 grams. A thermo-compression wedge bond is done on the offset bonding pad. Bonding should not be done directly over junction. The Tunnel diode can not be subjected to 150°C for more than 5 sec. Bond to the pad indicated on the waffle pack, which is tested to specification.

For beamleads - Thermal compression bonding with a heated wedge or parallel gap welding can be used to bond beamlead devices to substrates. In either case the devices are positioned face down with the beamleads flat on the substrate's metalization and then the beams are bonded. Care must be taken not to damage the beam - glass interface with too much lateral stress or by bonding too close to the chip. Any cracking caused in the glass can put stress on the diode junction. This stress usually increases the junction resistance. It is not recommended that beamlead devices be mounted on a soft substrates (such as Duroid) as temperature variations can cause excessive expansion or contraction resulting in breakage of the beamlead device. For thermal compression: base at 180°C, tip at 220°C, tip pressure 150 grams.

Flip chip Mounting Techniques:

These chips can be mounted with the junction side down. They can be mounted with conductive epoxy or with a low temperature solder preform. The die can also be assembled with the junction side up, with conductive epoxy or non-conductive epoxy, and wire or ribbon bonds made to the pads.

Solder Die Attachment - Solder which does not scavenge gold, such as Indalloy #2, is recommended. Sn-Pb based solders are not recommended due to solder embrittlement. Do not expose die to a temperature greater than 235°C, or greater than 200°C for longer than 10 seconds. No more than three seconds of scrub should be required for attachment.

Epoxy Die Attachment - Assembly can be preheated to 125 - 150°C. Use a minimum amount of epoxy. Cure epoxy per manufacturer's schedule. For extended cure times, temperatures must be kept below 200°C.

Attaching gold ball to the pads of the device - Attach gold ball to the pads of the device and then flip the chip to attach to the substrate by using a thermal sonic die attach equipment (Special equipment and process needed.)

Flip Chips should be handled in a clean environment. Do not attempt to clean die after installation.

Soldering:

All packaged devices (not chips or beamleads) - 230 °C for 5 seconds. RoHS compliant packaged devices - 260 °C for 3 seconds (use lead free solder only)

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