
Recommended Handling and Attachment Techniques for ATC Microcap[®] Capacitors

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A M E R I C A N T E C H N I C A L C E R A M I C S

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1.0. SCOPE. This document describes the attachment techniques recommended by ATC for unleaded MICROCAP® capacitors. Customers with specific attachment requirements, or attachment scenarios that are not covered by this document, should contact ATC.

2.0. MICROCAP® DESIGN. ATC 111 Series MICROCAPS® have a unique truncated pyramid shape. See Figure 1.



Figure 1. Microcap® shape.

The capacitance value will remain approximately the same regardless of which side is attached to the circuit board. With the base on the circuit board, the sloped sides and reduced top electrode area aid in preventing shorts while epoxying or soldering. By choosing either top or base electrode, you can more closely match the width of your circuit conductors.

ATC offers a standard line of terminations and sizes for general use. We are always available to discuss development of new and unique terminations and sizes to fit your specific need. Technical assistance is available by calling us directly.

3.0. MICROCAP® HANDLING. The simplest and safest tool for handling MICROCAPS® is the vacuum pencil. A variety of different size tips may be used for different size parts. ATC recommends that non-metallic tips be used. The most common tip is a metal tip with a Tygon tubing insert.

A basic vacuum parts handling system (Part #50) is available from TECHNI-TOOL CO., 1547 N. Trooper Road, P.O. Box 1117, Worcester, PA 19490-1117. Equivalent systems are available from other manufacturers.

3.1. Chip Tray Package Handling. Care must be taken when opening and closing the chip tray package. First remove the interlocking clips. These hold the cover and base together. Place the chip trays on a table when removing the cover. Open chip trays on a clean, light colored table or sheet of paper to help locate fallen pieces. There is an anti-static insert and paper filler between cover and parts. MICROCAPS® can sometimes stick to the inserts, so care must be taken not to lose them. Close the chip trays by carefully replacing the inserts and sealing the cover. Taking a few minutes of care will insure a minimal loss of capacitors.

4.0. SURFACE PREPARATION PRIOR TO BONDING. For any bonding operation, the parts and substrate involved must be clean. In microelectronics, the small areas involved dictate that this cleanliness be scrupulous. The most prevalent forms of contamination are common finger oils and surface oxides. These can cause poor solder wetting and poor bonding.

MICROCAP® capacitors have been extensively cleaned and carefully packaged. If an extra cleaning is desired, this should be done ultrasonically with a standard microelectric solvent. Acetone, alcohol and trichloroethylene are the most common solvents.

Burnishing of MICROCAPS® is not usually required. If a surface film presents a problem, it is possible to lightly burnish a part to expose a

cleaner surface of the termination. Exercise caution to insure that metallization is not removed as a result of excessive or rough burnishing.

5.0. EPOXY BONDING. All MICROCAPS® may be epoxy bonded. Epoxy bonding can be done with a fine needle on automatic dispensers. Screen printing is also another effective way to apply epoxy. One advantage of epoxy bonding over soldering is the greater ease in repairs. Epoxy bonding is also effective for frequencies up to 60 GHz.

When epoxying ATC MICROCAPS®, the unique truncated pyramid shape allows for an easier, more effective visual inspection of the bond joint than conventional straight sided capacitors. There is also a longer path between electrodes to help prevent shorts.

5.1. Epoxy Selection. Epoxies suitable for use in fabricating microwave hybrid circuits should meet the following specifications:

1. Low volume resistivity (0.0001 to 0.0003 ohm-cm).
2. Good thermal conductivity (11.5 BTU/ft. 2°F).
3. Lap shear strength of approximately 1000 to 2000 PSI.
4. Minimum resin bleed. Resin bleed may cause shorts or render nearby bonding areas useless.
5. Minimum outgassing in hermetically sealed packages.
6. No byproducts that break down into corrosive agents.
7. Acceptable shelf life. Depending on demand and use, shelf life should be from 6 months to 2 years.
8. Proper viscosity for the use intended.
9. Ability to tolerate the wire bonding temperature without weakening or softening.
10. Pot life stability, to maintain uniformity in batch.
11. A curing temperature compatible with the substrate (that is, requires no higher temperature to cure than that which the substrate can tolerate). Conductive epoxies are available in compositions of silver and gold. Insulating epoxies are available which offer mechanical protection to the devices without noticeably affecting their electrical performance at higher microwave frequencies.

5.2. Epoxy Curing. Epoxies need not be cured right away once applied. Therefore, hundreds of substrates may be printed with epoxy and made ready for assembly at any time. However, take precautions when storing uncured, printed epoxies.

We have found several conditions that cause possible problems in epoxy curing and wire bonding after cure. Solvent vapors such as benzene, MEK, acetone, or alcohol will degrade epoxy cure properties and other critical parameters. Storage in closed plastic containers, especially vacuform plastics, should be avoided. Affected epoxies usually appear very granular, lack resin and are spongy after cure.

We recommend storage in open metal trays inside nitrogen desiccator boxes with adequate nitrogen flow. Storage for uncured epoxies should be separate from all other parts storage.

After the capacitors are attached, cure the epoxy as soon as possible. Assure that epoxy cure time and temperatures are adequate for the epoxy being used. It is better to cure for a longer time than the manufacturer recommends than to risk an incomplete cure cycle.

6.0. SOLDER BONDING. All MICROCAPS® may be soldered. The preferred termination for single layer devices is ATC’s TT Termination (Titanium Tungsten/Nickel/Gold). TT has universal attachment compatibility and excellent solderability. The thick film termination AP (Platinum Gold) also offers compatibility over a wide range of acceptable solders.

When soldering ATC MICROCAPS®, the unique truncated pyramid shape allows for an easier, more effective visual inspection of the bond joint than conventional straight sided capacitors. There is also a longer path between electrodes, to help prevent shorts.

6.1. Solder Compatibility. Table I lists the more commonly used solders, and their compatibility with ATC termination styles. Additional technical assistance is readily available by consulting the factory.

6.2. Solder Forms. The solder form chosen will not have an impact on compatibility with ATC MICROCAPS®. This choice is made solely as a concern of the user’s assembly requirements. Solder paste, reflow soldered is the most common solder combination. Solder paste has the added advantage of holding the part in place during soldering.

TABLE I: SOLDER COMPATIBILITY

Solder Type	Composition	Liquidous Temp. °C	Solderability ATC Termination Style	
			TT	AP
#1	50In / 50Sn	125°	↑	F
#2	80In / 15Pb / 5Ag	150°		F
#204	70In / 30Pb	174°		F
Sn 62	62Sn / 36Pb / 2Ag	179°		VG
Sn 60	60Sn / 40Pb	183°	VG	G
#205	60In / 40Pb	185°	↓	G
#7	50Pb / 50In	210°		G
#206	60Pb / 40Ag	225°		G
Sn 96	96Sn / 4Ag	221°		F
Sn 10	10Sn / 88Pb / 2Ag	268°		F
#150	81Pb / 19In	280°		P
	80Au / 20Sn	280°		P
	88Au / 12Ge	356°		P

VG = Very Good **G** = Good **F** = Fair **P** = Poor

7.0. FLUXES. Flux selection involves compatibility with the solder and the surfaces to be soldered. Generally only non-corrosive, non-conductive rosin fluxes should be used. Parts and surfaces which have aged due to time and/or exposure may need a more activated type of flux. The rule of thumb is to use the least activated, most easily cleaned flux which provides a suitable solder joint. Solder flux manufacturers are very able to specify the right combination with any assembly requirement.

8.0. THERMOCOMPRESSION BONDING. All ATC MICROCAP® terminations may be wire bonded with gold wire and meet MIL. STD. 883.

However, (AP) platinum gold terminations may require extra bond energy to achieve satisfactory bond results.

8.1. Surface Preparation. Generally speaking no surface preparation is required. It may be advantageous to briefly clean MICROCAPS® with any standard microelectronic cleaning solvent to remove dust, etc.

8.2. Pull Strengths. Pull strengths for 1 mil gold wire, thermocompression ball bonded are typically 3 – 7 grams.

9.0. REFERENCES

Flux products, refer to:

Kester Solder Company, 88 Ferguson St., Newark, NJ and
Alpha Metals, Inc., 52 Water St., Jersey City, NJ 07304

Epoxy, refer to:

Hardman, Inc., Dept. G, Belleville, NJ 07019 and
Dow Chemical Company, 2020 G Dow Center, Midland, MI 48640

Epoxy Techniques for Hybrid Microwave Integrated Circuits,
Louis Hernandez, ALL, a division of Cutler-Hammer, Melville, NY

Epoxy Device Bonding and Die Handling Techniques
for Hybrid Microcircuits,
Jay Kimball

The Significance of Glass Transition Temperature on Electrically Conduc-
tive Resins in Hybrid Microelectronics,
Frank W. Kelesza and Thomas Saunders

For more information about manual and automatic epoxy dispensing devices, refer to:

Electron Fusion Products, 977 G Watermelon Ave. East, Providence, RI
02861 and
Hardman, Inc., Dept. G, Belleville, NJ 07019

For more information about wirebonding and reflow soldering tech- niques, refer to:

"Handbook of Thick Film Hybrid Microelectronics",
Harper, Charles A., McGraw-Hill, Inc., 1974

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