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Welcome to the EPTAC Webinar Series:

Key Tips & Techniques for Manually Reflowing of Solder Paste

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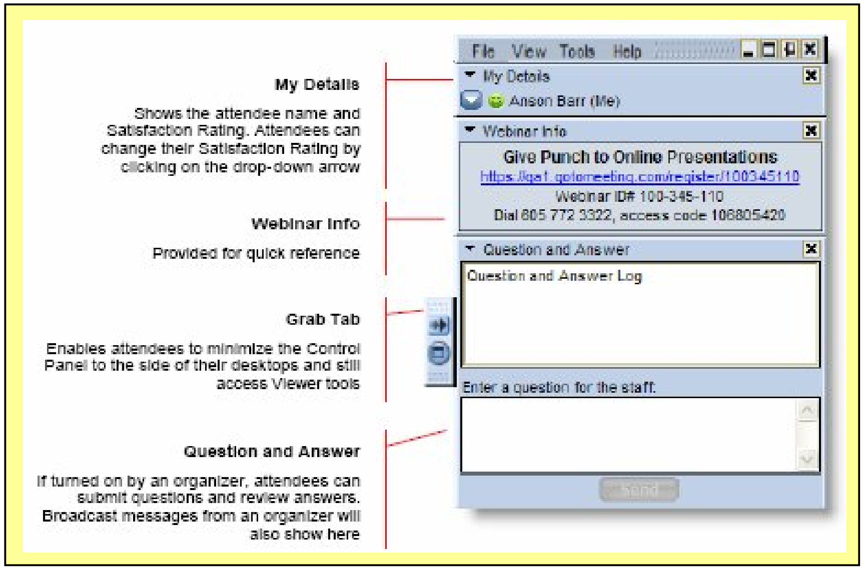

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Anson Barr (Me)

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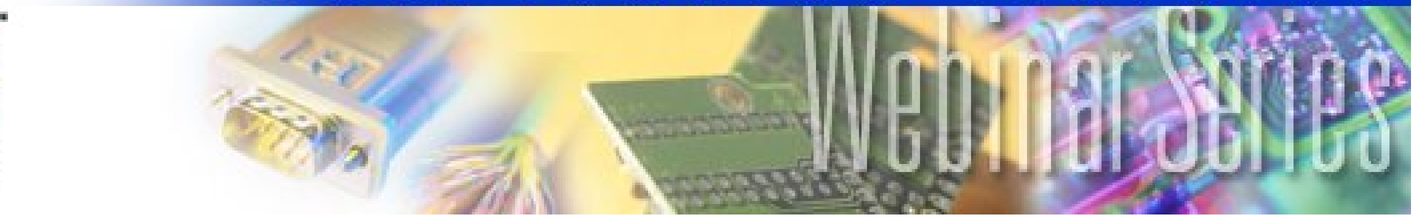

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Solder Paste

- Solder paste by definition is powered solder spheres in a mixture of viscosity agents and flux.

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Solder Paste Selection

- Use J-STD-005 to select your paste.
- Use J-STD-004 to select your flux.
- Test for the following:
  - Powder requirements
  - Alloy requirements
  - Type of solder paste, i.e. size

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Manufacturing Process Profile Requirements

- The profile must be based upon ^{o}C/sec temp rise time typically between 2 and 4^{o}C/sec.
- High temperature for leaded solder is 200 – 225^{o}C (428 – 437^{o}F).
- High temperature for lead-free solder is 240 – 250^{o}C (464 – 482^{o}F).

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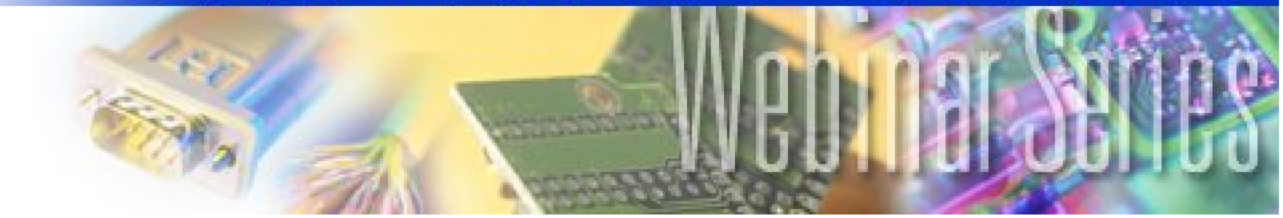
Purpose of Profile

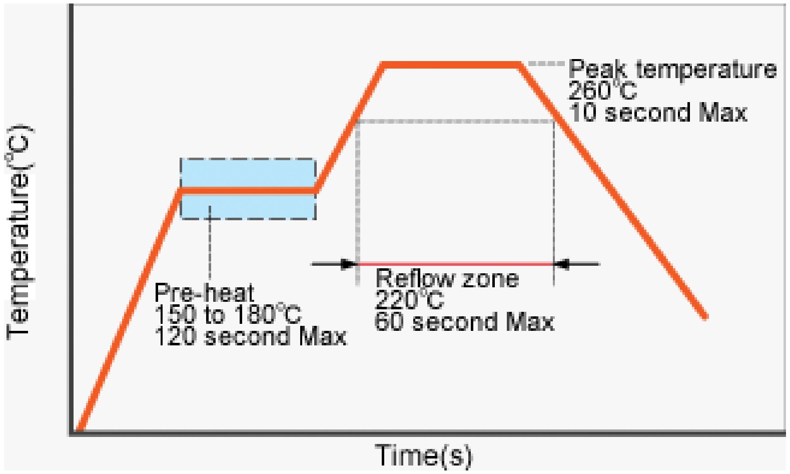
- Dry out the solder paste.
- Activate the fluxes.
- Stabilize the material temperatures prior to reflow to prevent thermal shock.



Component Temperature Profiles

Reflow solder heat resistance:

- Reflow peak temperature of 260°C (500F) for 10 seconds maximum, and reflow zone temperature of 220°C (428F) for 60 seconds.
- Preheat at 150° - 180°C (302F – 356F) for 120 seconds.
- Flow solder heat resistance: 265°C (509F) for 10 seconds.



Standard soldering temperature profile

Adapted from Rohm, Heat Resistance Assured

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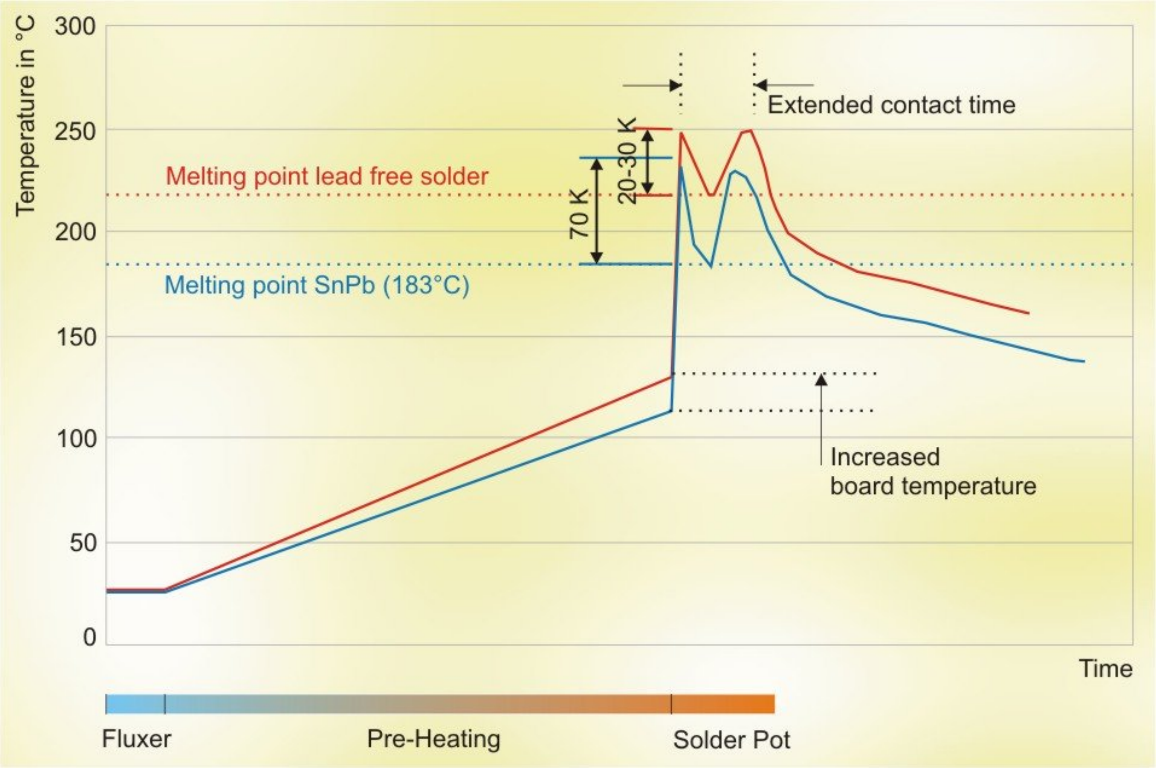
Profile Comparison: Lead-Free and Leaded



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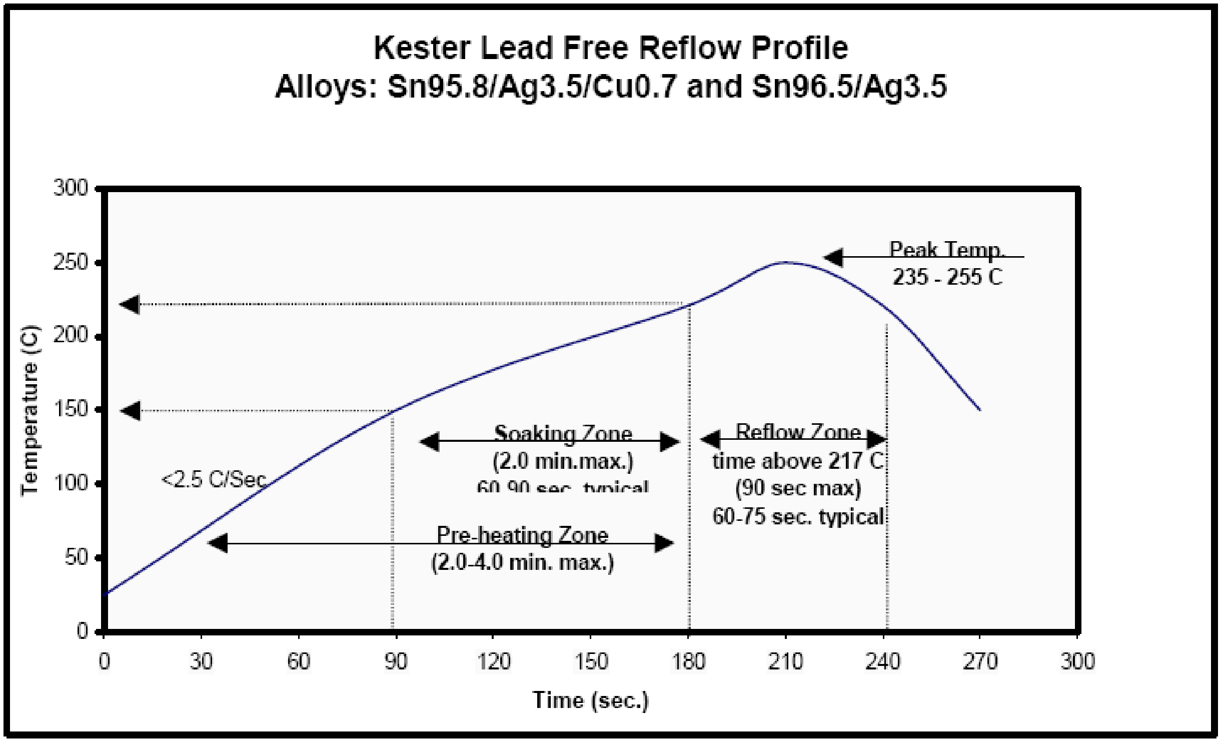
Lead-Free Reflow Profile Example



Kester Lead Free Reflow Profile
Alloys: Sn95.8/Ag3.5/Cu0.7 and Sn96.5/Ag3.5

Adapted from Optimizing Lead-free Reflow Processes by Peter Biocca

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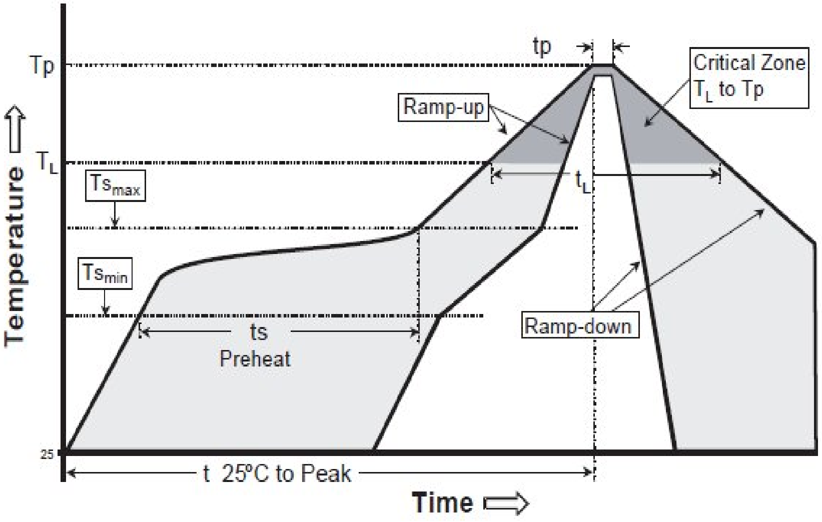
J-STD 020 Sn-Pb Profile

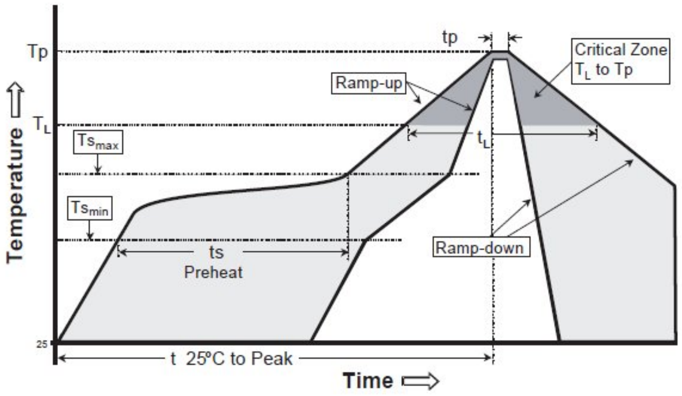


Profile Feature	Sn-Pb Eutectic Assembly
Average Ramp-Up Rate (Ts_{max} to Tp)	3 °C/second max.
Preheat – Temperature Min (Ts_{min}) – Temperature Max (Ts_{max}) – Time (ts_{min} to ts_{max})	 100 °C 150 °C 60-120 seconds
Time maintained above: – Temperature (T_L) – Time (t_L)	 183 °C 60-150 seconds
Peak/Classification Temperature (Tp)	See Table 4.1
Time within 5 °C of actual Peak Temperature (tp)	10-30 seconds
Ramp-Down Rate	6 °C/second max.
Time 25 °C to Peak Temperature	6 minutes max.

Note 1: All temperatures refer to topside of the package, measured on the package body surface.

Adapted from IPC-J-STD-020C

J-STD 020 Lead Free Profile



Profile Feature	Pb-Free Assembly
Average Ramp-Up Rate (Ts_{max} to Tp)	3° C/second max.
Preheat – Temperature Min (Ts_{min}) – Temperature Max (Ts_{max}) – Time (ts_{min} to ts_{max})	150 °C 200 °C 60-180 seconds
Time maintained above: – Temperature (T_L) – Time (t_L)	217 °C 60-150 seconds
Peak/Classification Temperature (Tp)	See Table 4.2
Time within 5 °C of actual Peak Temperature (tp)	20-40 seconds
Ramp-Down Rate	6 °C/second max.
Time 25 °C to Peak Temperature	8 minutes max.

Adapted from IPC-J-STD-020C

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Types of Heat Sources

- Convective – Hot Gas
- Conductive – Solder Irons
- Infra-Red
- Mixed IR/Conductive
- Vapor Phase

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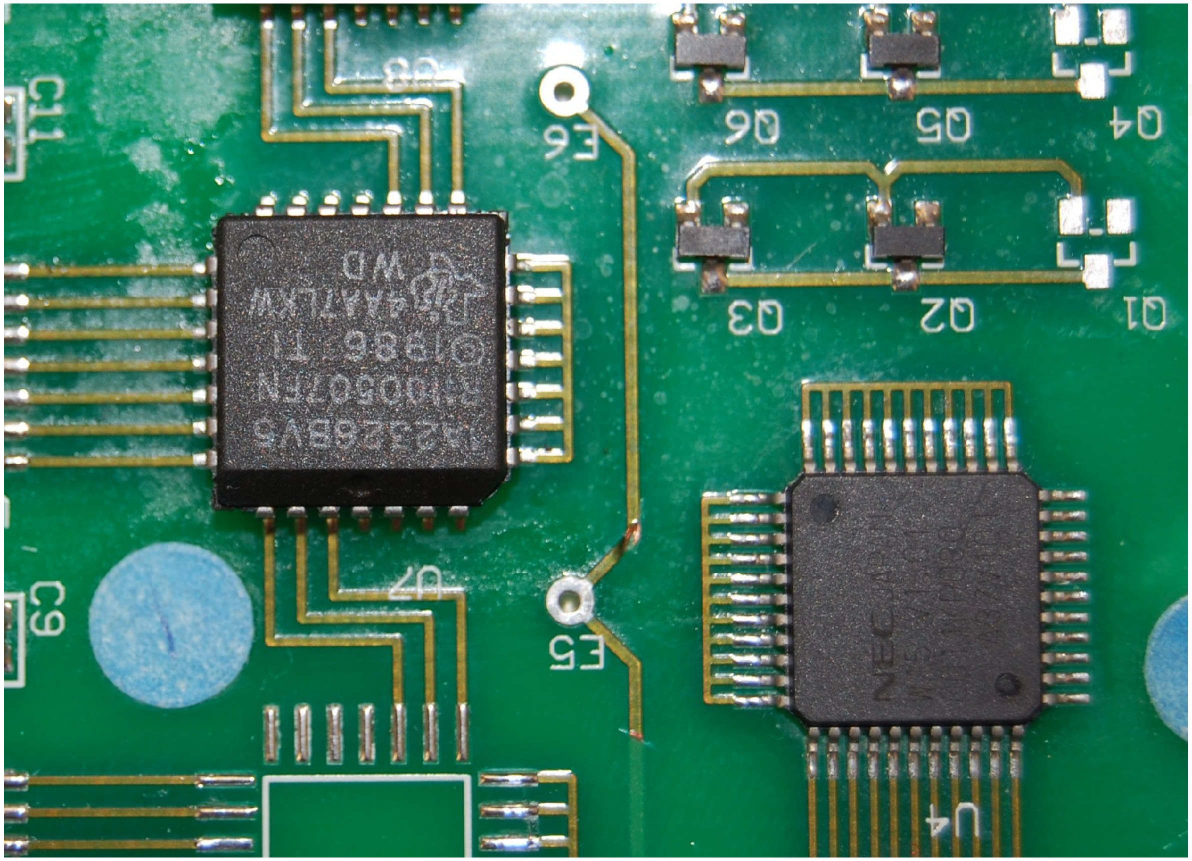
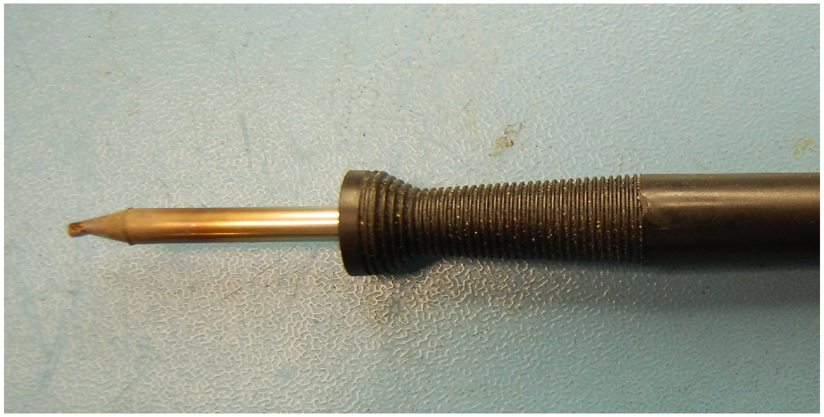


Soldering Irons



Hot Gas Soldering and Desoldering

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Manual Soldering

- The temperature profile is not consistent.
- The tip temperature may be set but is unknown.
- Often the tip is dewetted and not effectively transferring heat to the product.
- Solder volume is not consistent from joint to joint.

Manually Placing and Soldering Component

- Do you paste to prep the pads?
- How do you put it on?
- How do you control quantity?
- How do you control solderability?

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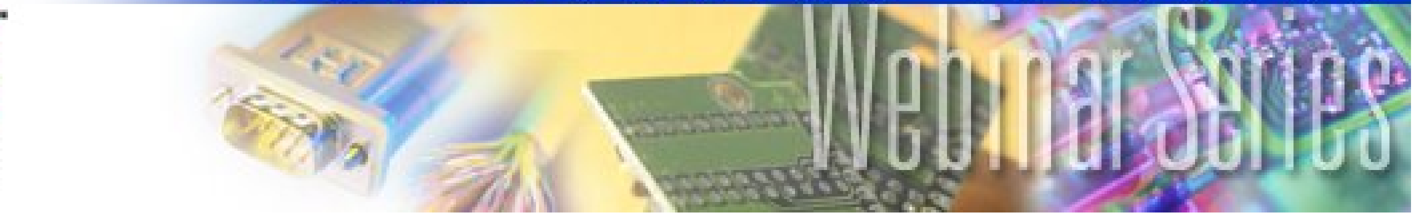
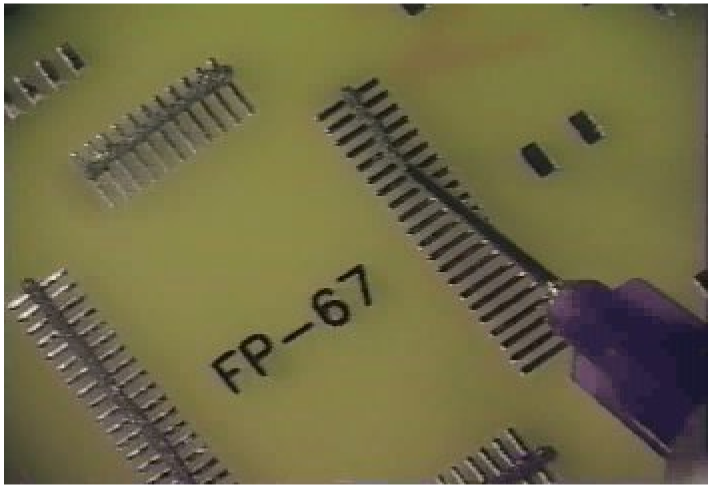


Here are Some Examples of Solder Paste Reflow and Typical Manual Soldering for Surface Mount Components

Hot Gas Process of Solder Paste



QFPTJRI.AVI PACE

- Apply the paste
- Position the component
- Set the air flow and temperature
- Apply the heat and reflow the solder

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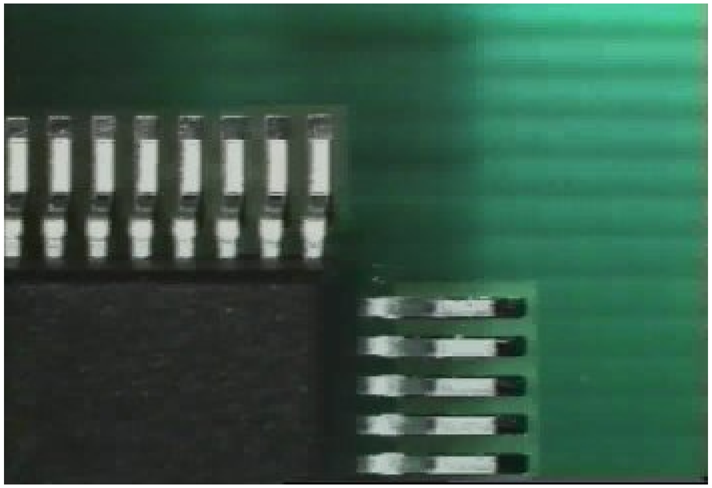
Tip to Lead Soldering Using Cored Solder



QFPPNTI.AVI PACE

- Position component.
- Tack solder one lead to solidify the component in place.
- Flux the leads.
- Clean the tip on the sponge.
- Solder each lead.

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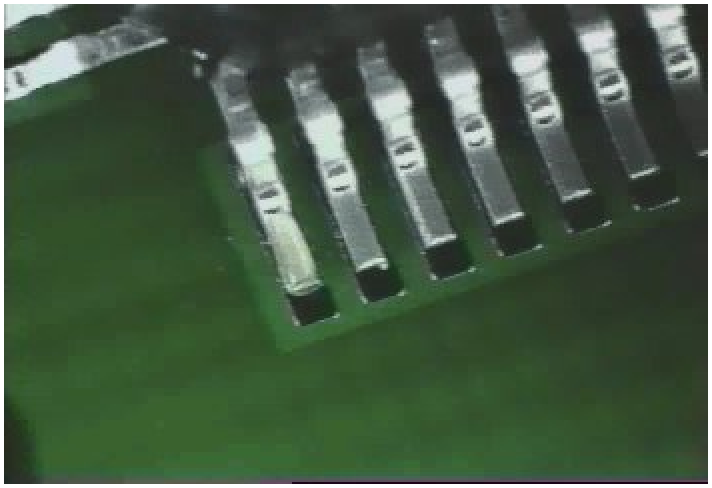
Continuous Lead Soldering Using Solder in Tip



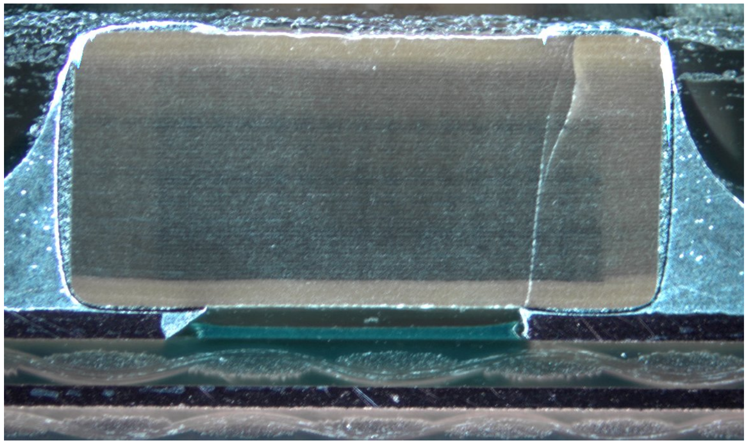
IQFP00A.AVI PACE

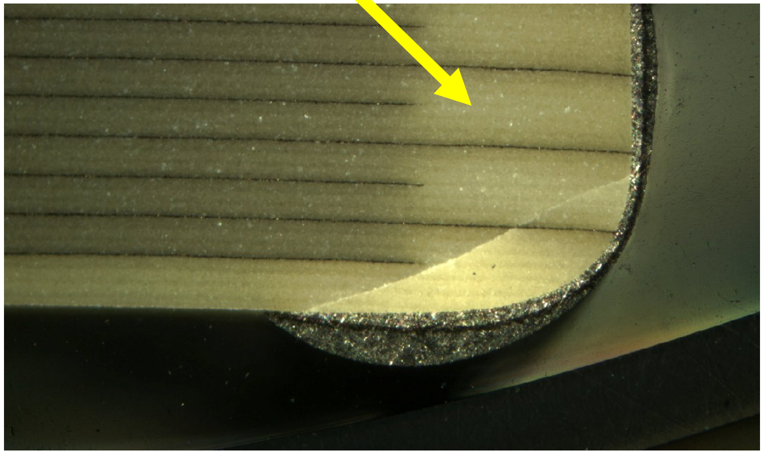
- Tack solder the lead and component in place.
- Flux the leads.
- Prep the solder iron tip.
- Apply the tip to the leads and solder the leads.

Care in the Use of Solder Irons While Soldering Chip Components

- Watch the tip temperature, it should be between 650^{o} to 750^{o} F.
- Keep time to make solder joint as short as possible, 1 to 3 seconds.
- Care should be exercised to make sure pressure is not applied to one side of the device as the other is secure. The mechanical force will crack the capacitor.

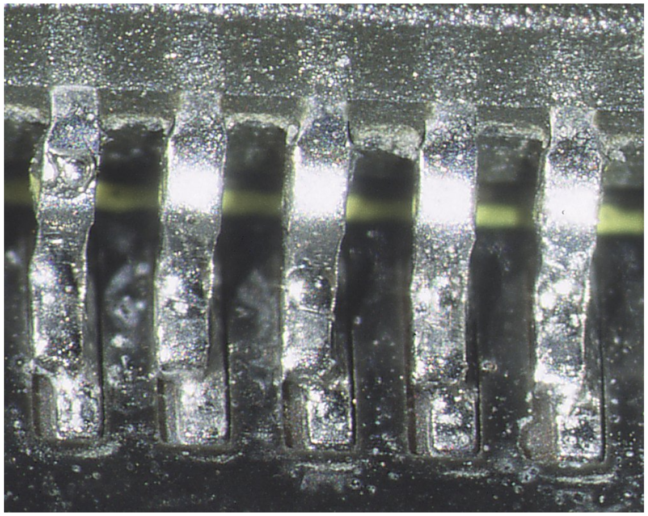
Crack Examples





Dr. Craig Hillman of DfR Solutions
(301) 474-0607 // chillman@dfrsolutions.com // www.dfrsolutions.com
Mike Silverman of Ops A La Carte
(408) 472-3889 // mikes@opsalacarte.com // www.opsalacarte.com

Misaligned Multileaded Component



Courtesy of IPC

- When this condition occurs, hot air can be used to reflow the solder but the re-soldering should be with a soldering iron.

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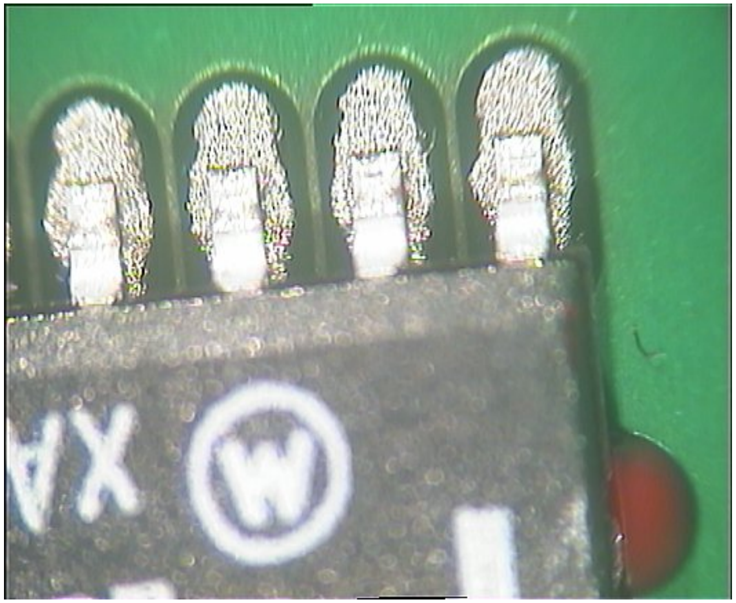
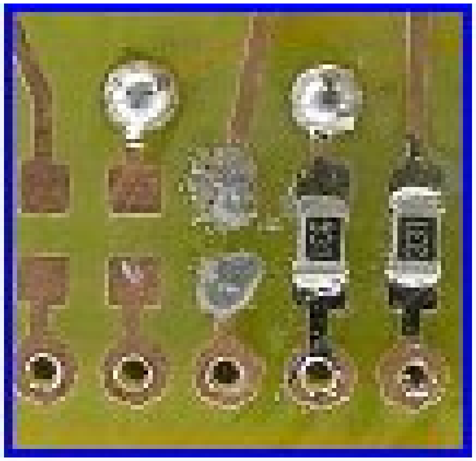
Don’t Reflow Solder Paste with Solder Irons



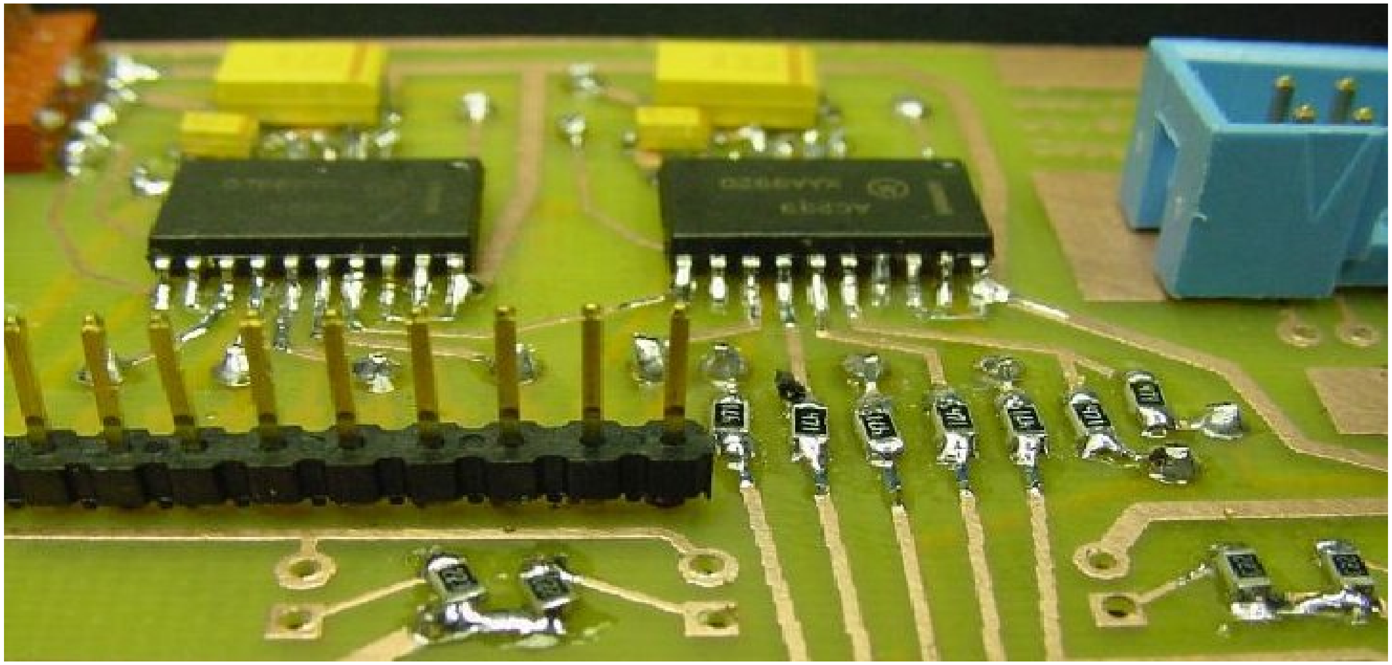
- I don’t recommend soldering irons to reflow these types of solder joints with solder paste.
- The ramp up of temperature will be too quick and the solder paste will go through all kinds of volatization of materials -- the results will be solder balls all over the place.

Inconsistent Solder Paste



- Inconsistent solder paste application.
- When reflowed with a solder iron the solder paste will volatize and create all kinds of problems.

What to Prevent in Cosmetic Appearance



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Upcoming . . .

- February 20th ---
  - Who is EPTAC and What Do We Do
  - Training and the Value of Operator and/or Instructor Certification

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