SMT Assembly Considerations for LGA Package

Solder paste

- **The screen printing quantity of solder paste is an key factor in producing high yield assemblies.**
- **Solder Paste**
  - Alloys: 63Sn/37Pb or 62Sn/36Pb/2Ag
    Sn/Ag/Cu family for lead-free application
  - Low residue,no clean flux
  - Particle size:
    Type III (25 ~ 45 μm) or Type IV (25 ~ 38 μm)
    Type IV is preferred to improved printing performance.

Solder stencils (1)

- The contrast between large thermal pad and small terminal pads of the LGA can present a challenge in production an even solder line thickness.
- The precise volume of solder paste deposited onto the device land pattern is controlled by the stencil thickness and the opening geometry.
- Stencil alignment accuracy and consistent solder volume transfer is critical for uniform reflow-solder processing.
- The solder joint thickness for LGA terminal pads should be 50 - 75 μm.

Solder stencils (2)

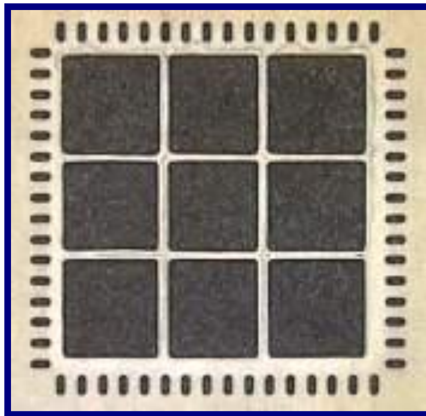
- **Stencil**
  - Stencil Type & Thickness
    - Laser cutting
    - stainless steel
    - Thickness : 100 ~ 150 μm
      (125 μm as a guide)
    - The actual thickness of a stencil is depend on other SMD on the PCB.
  - Squeegee
    - Metal blade
    - Polymer with 90 deg hardness

Solder stencils (3)

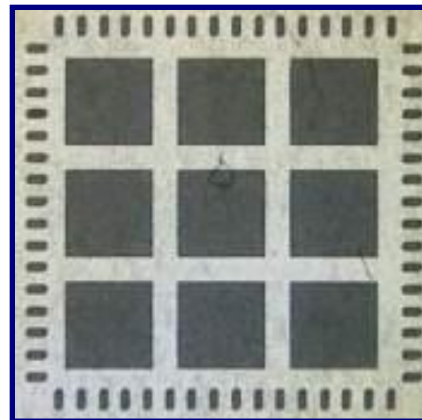
- Aperture size and Shape for terminal pad
  - Aspect ratio (width / thickness) > 1.5
  - Area ratio > 0.66
    (Area of aperture opening / aperture wall area)
  - Aperture shape
    - The stencil aperture is typically designed to match the pad size on the PCB 1 to 1.
    - For fine pitch components of 0.5mm and below it may be necessary to reduce the stencil aperture length by 20%.
    - Oval-shaped opening should be used to get the optimum paste release.
    - Rounded corners to minimize clogging
    - Positive taper walls (5° tapering) with bottom opening larger than the top

Solder stencils (4)

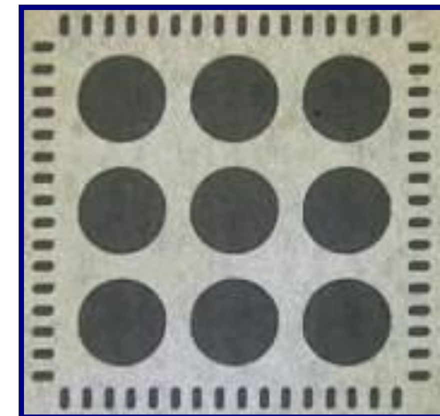
- **Stencil**
  - Aperture design for thermal pad
    - The small multiple openings should be used in steady of one big opening.
    - 60 ~ 85% solder paste coverage
    - Rounded corners to minimize clogging
    - Positive taper with bottom opening larger than the top



Don’t recommend
Coverage 91%



Recommend
Coverage 77%

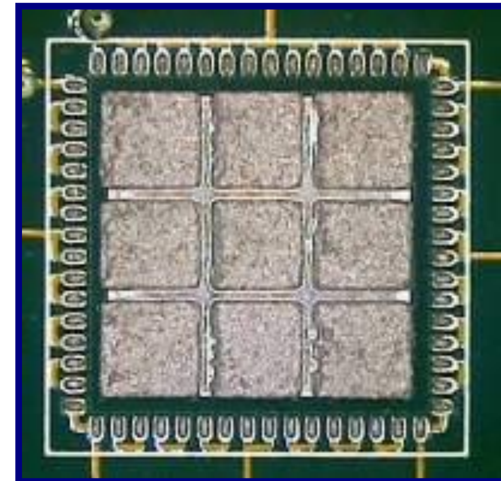


Recommend
Coverage 65%

Package to board assembly (1)

- **Printing Parameters**
  - Metal squeegee with $45^o \sim 60^o$ printing angle
  - Speed : start with 20 mm/sec,increasing with experience
  - Printing pressure : 10 N/mm^2
  - Snap-off distance : 0 mm

For the pitch ≤ 0.5 mm, 3D post-printing inspection is highly recommended.



Package to board assembly (2)

- **LGA Placement**
  - Using standard pick and place machine with ± 0.05 mm accuracy
  - Mounting with slower speed and higher force
  - Place the package 1 ~ 2 mils into the paste
  - LGAs has excellent self-alignment during solder reflow if a minimum of 75% of the lead diameter intersect with the pad.

Package to board assembly (3)

- **Reflow Oven**
  - Forced convection reflow with nitrogen
  - Temperature uniformity $\leq \pm 5^{o}C$
- **Profile**
  - Follow datasheet of solder paste
  - Other concerns: other parts,board density,board thickness….
  - For the PPF leadframe, the palladium will be dissolved into the solder and the joint is formed with the underlying nickel layer. Higher reflow temperature is required to foam a good solder joint.

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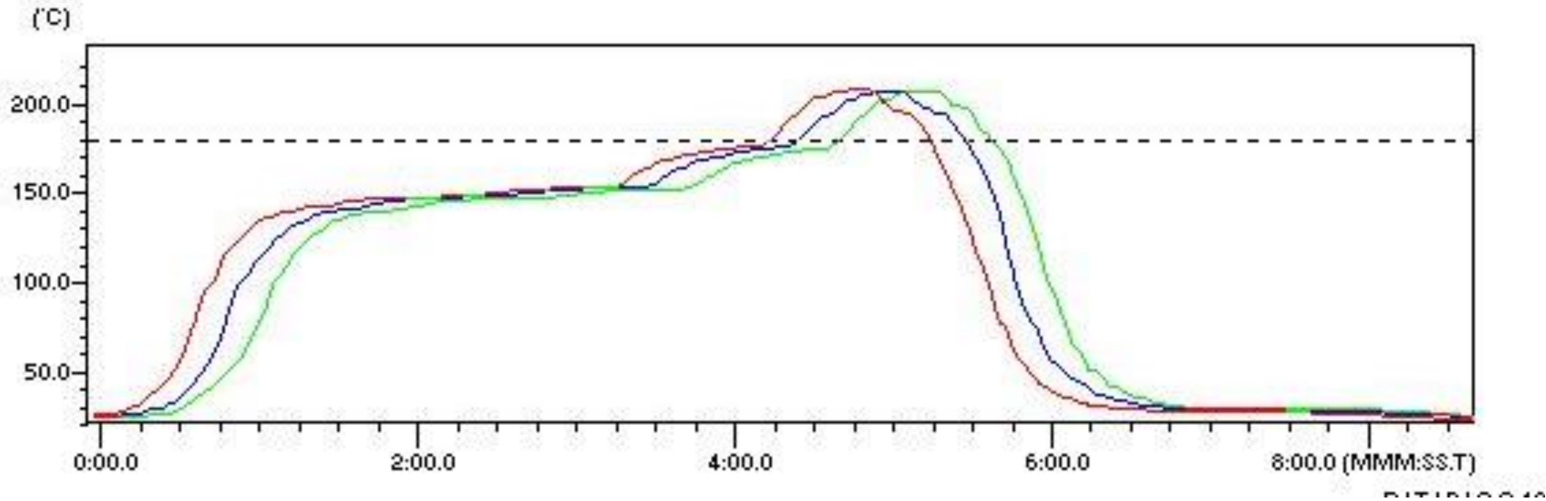
Package to board assembly (4)

Recommended Reflow Profile for 63/37 Solder Paste or Cu lead frame



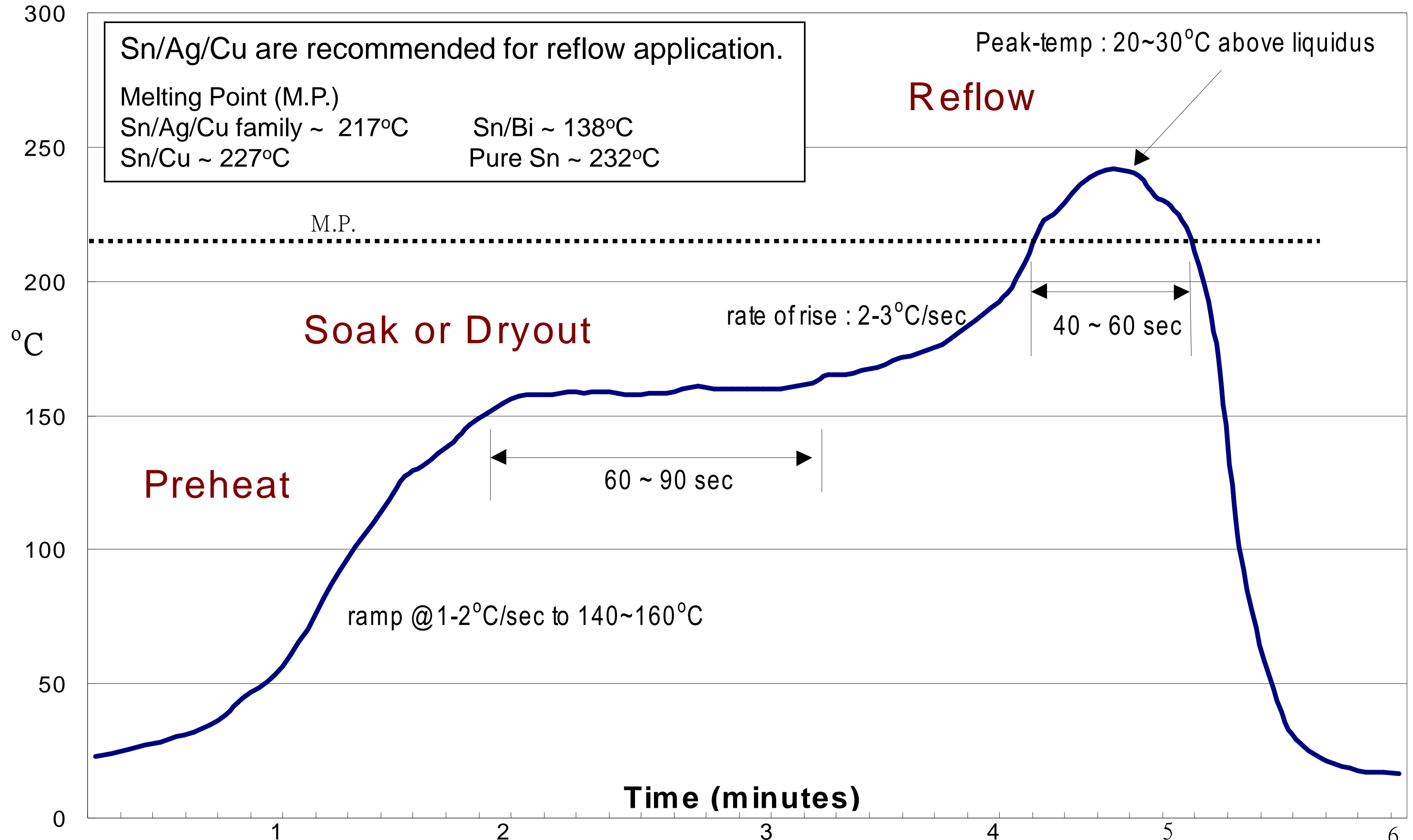
This profile is designed for use with Sn63 or Sn62 and can serve as a general guideline in establishing a reflow profile.

Reflow Profile:

- Heating-up @1~3°C/sec to 140°C
- Preheat @ 140-150°C for 120 ~ 160 sec
- Ramp @ 2~3 °C/sec to peak temperature (220 ~ 225 °C),
  Temperature over 183°C for 45~ 75 sec
- Cooling down to room temperature @4~2°C/sec to avoid undesired intermatalic compound layer.

Package to board assembly (5)

Recommended Reflow Profile for Lead-free Solder Paste or PPF lead frame



Package to board assembly (6)

- **Inspections**
  - Using transmission X-ray to sample monitoring of the solder joint.
  - Side-view inspector is also recommended.