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Efficient Thermal Transfer for Lead-free Hand Soldering

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Common Misconception

- Lead-free solder processes require higher temperature settings

Truth

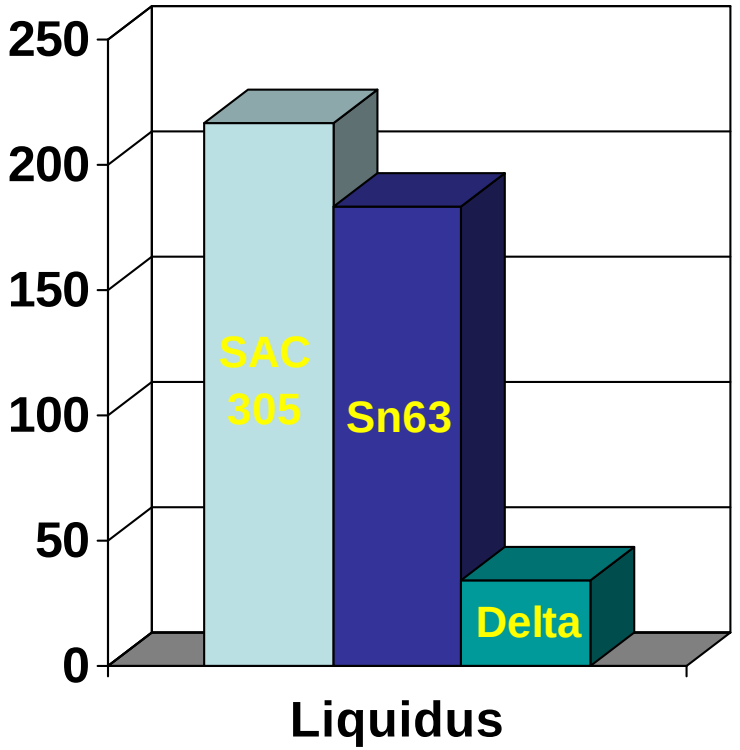
- Automated processes (reflow, wave, etc.) do require higher temperature settings
- Hand soldering processes may not need increased temperature settings

Problem

- People are used to tin-lead solder
  - Good wetting
- When lead-free does not wet as well
  - They want to increase the heat

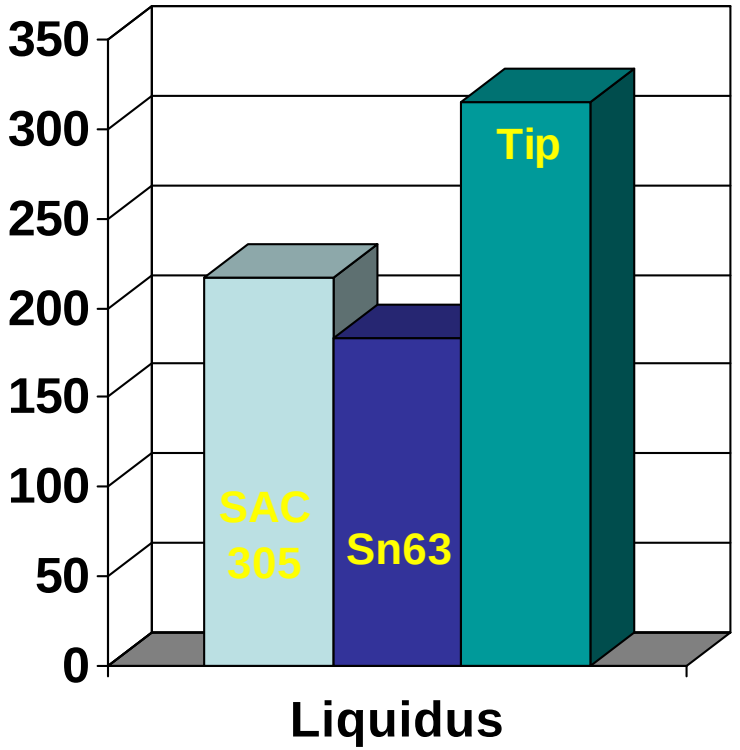
Solder Differences

- Lead-free (SAC305)
  - 217° C liquidus
- Tin lead (Sn63Pb37)
  - 183° C liquidus
- 34° C difference



Tip Temperatures

- Typical tip temperature
  - 315° C (600° F)
- 98° C difference
- Typical peak reflow temperature
  - 245° C to 260° C



Thermal Transfer

- Temperature
- Mass (reservoir/wattage)
- Contact area
- Time

Thermal Transfer

- Similar dynamics to a reflow oven
  - Increase in one parameter
  - Affects other parameters

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Temperature

- Already hot enough
- Increased temperature will speed up the process
- Increased temperature has risks

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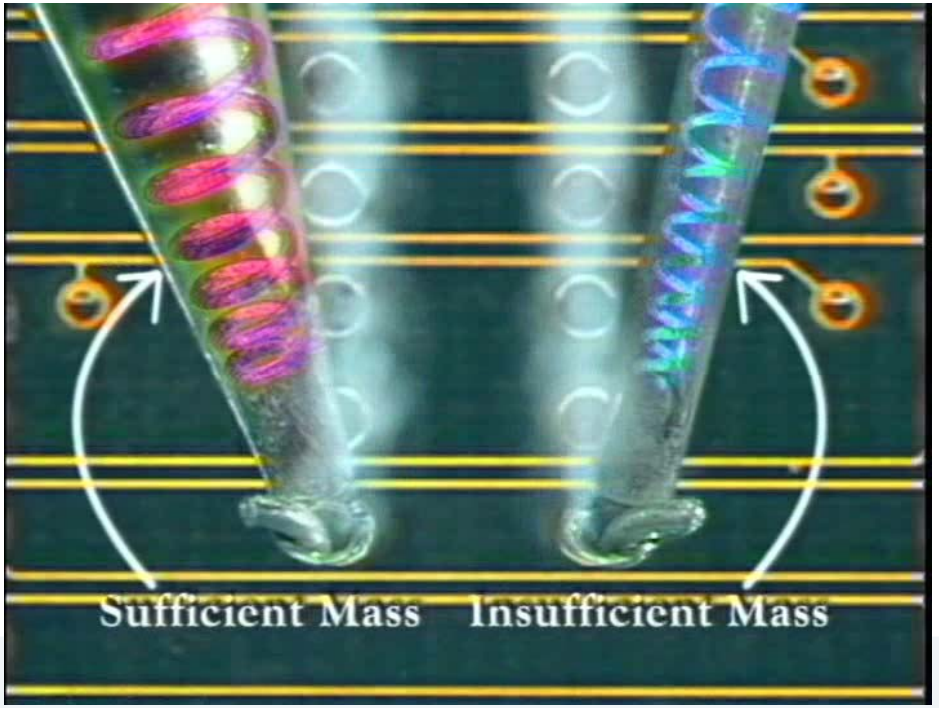
Thermal Mass

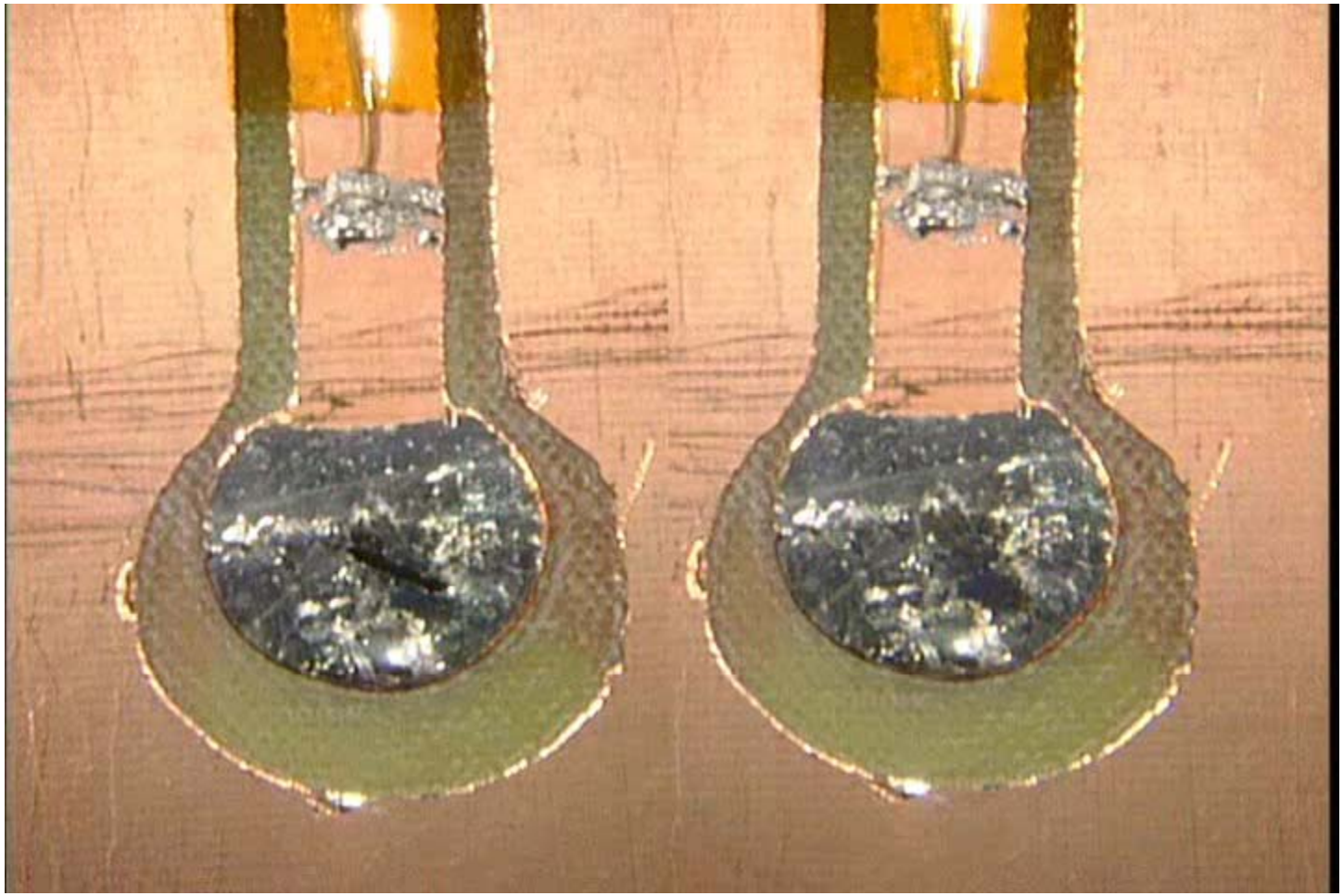
- Power/wattage
- Physical size



Thermal Mass

- Power/wattage
- Physical size

Thermal Mass

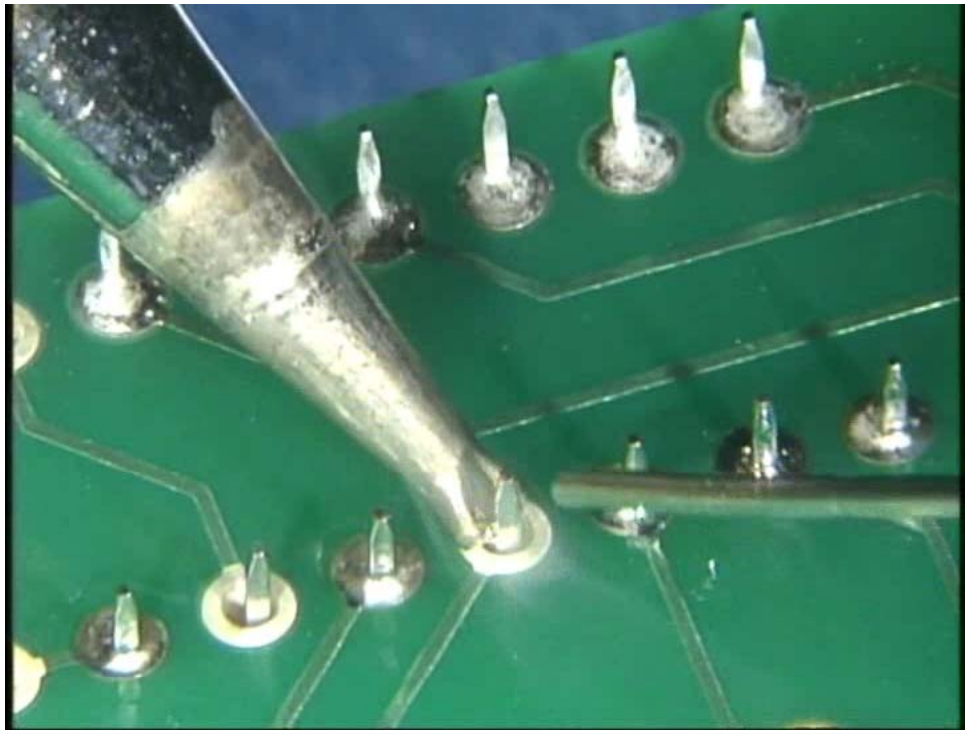


Contact Area

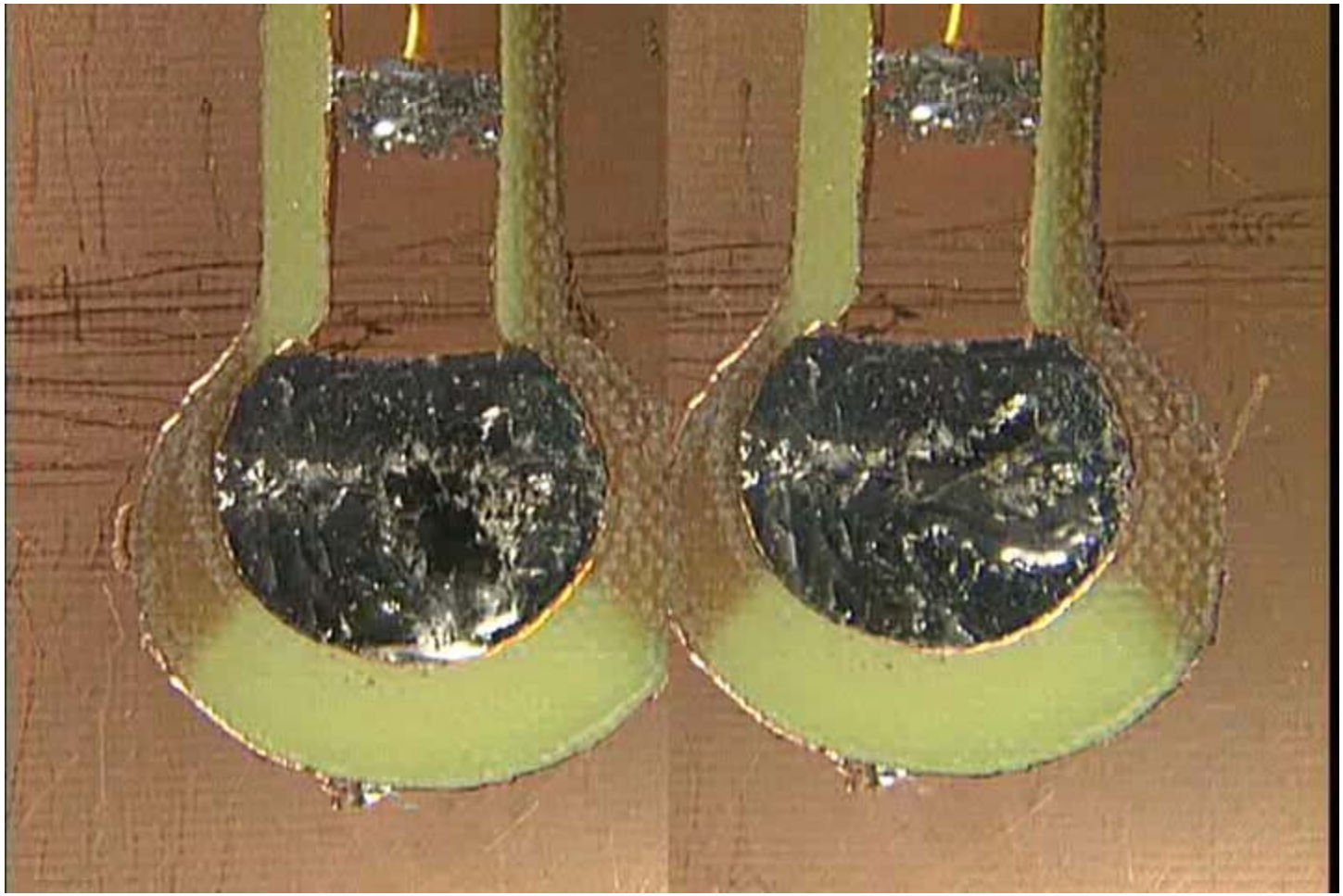
- Bigger is better

Contact Area

- Largest size for the pad



Contact Area



Pre-Heating

- Not needed for most SMT soldering operations
- PTH, ground lugs, etc. need help
- Topside board temperature of ~150° C

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Pre-Heating

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Pre-Heating

Assumptions about flux

- True or False?
  - Flux cleans the metals to be joined
  - The more flux, the better
  - Flux removes light oxidation
  - Flux reduces the surface tension of the solder resulting in better wetting
  - Flux aids in the thermal transfer from the iron tip to the metals being joined

Assumptions about flux

- True or False?
  - Flux cleans the metals to be joined
    - The word clean is subjective
    - Ionic or non-ionic?

Assumptions about flux

- True or False?
  - The more flux, the better
    - Depends
    - Clean or no-clean process?
    - Liquid, paste flux

Assumptions about flux

- True or False?
  - Flux removes light oxidation
    - Absolutely!
    - Most acidic compounds will work

Assumptions about flux

- True or False?
  - Flux reduces the surface tension of the solder resulting in better wetting
    - Still not as nice as tin-lead
    - The right surface finish will help

Assumptions about flux

- True or False?
  - Flux aids in the thermal transfer from the iron tip to the metals being joined
    - Wrong!

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Summary

- More heat
- NOT higher temperature

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Acknowledgements

- Joel Kimmel, IPC Video
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