

Challenges of Evolving Technology in the Workplace

Weller[®]



Meet our presenter

For almost 3 decades, Bubba Powers has been working in the heart of Weller technical support.

Mr. Powers has authored several papers pertaining to industry standards and applications and served as a committee chairperson on the ESD Associations Standards team for Electrical Soldering and Desoldering Hand Tools.

Bubba Powers

Manager of Technical Services

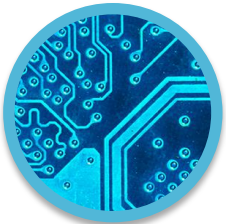
Weller North America



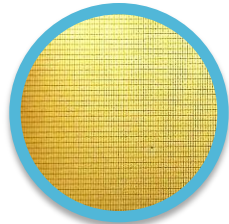
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Challenges of Evolving Technology in the Workplace

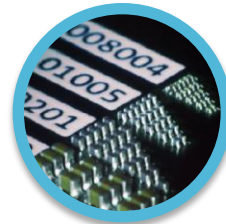
Market challenges



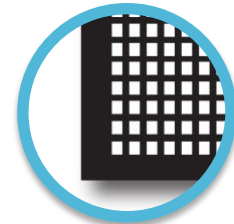
**Board
density**



**Substrate
material**



**Component
size**



**Component
technology**



**Market
challenges**



**Manufacturer's
challenges**



Manufacturer's challenges

- Tip size / geometry
- Tip life
- More power
- Real estate




Board density



2 TO 40 LAYERS



End the madness!



**Thermal
dynamics of
heavy ground
planes or
multi-layer PC**

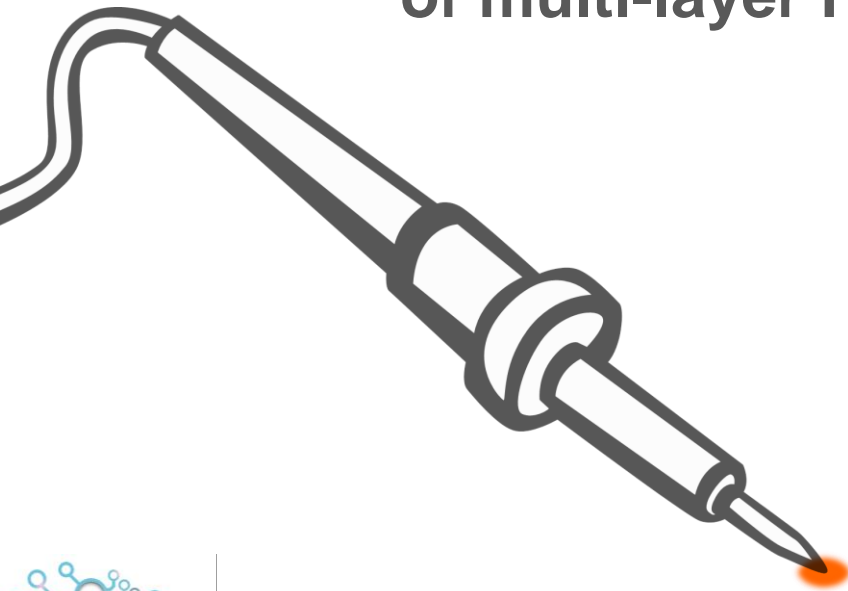


**Thermal
capacity
required from
a soldering or
rework tool**





**Heavier copper layers or ground planes
of multi-layer PC boards...**



**...can quickly deplete the
capacity of a low wattage or
underrated soldering tool.**

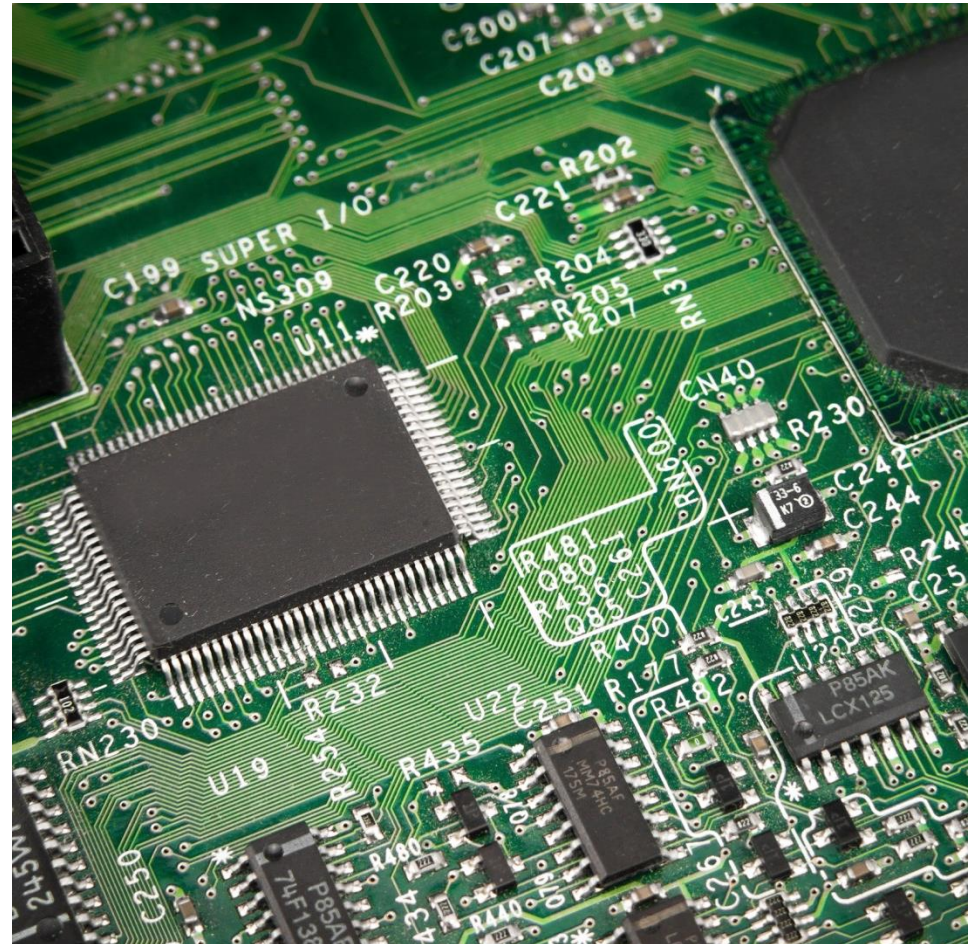
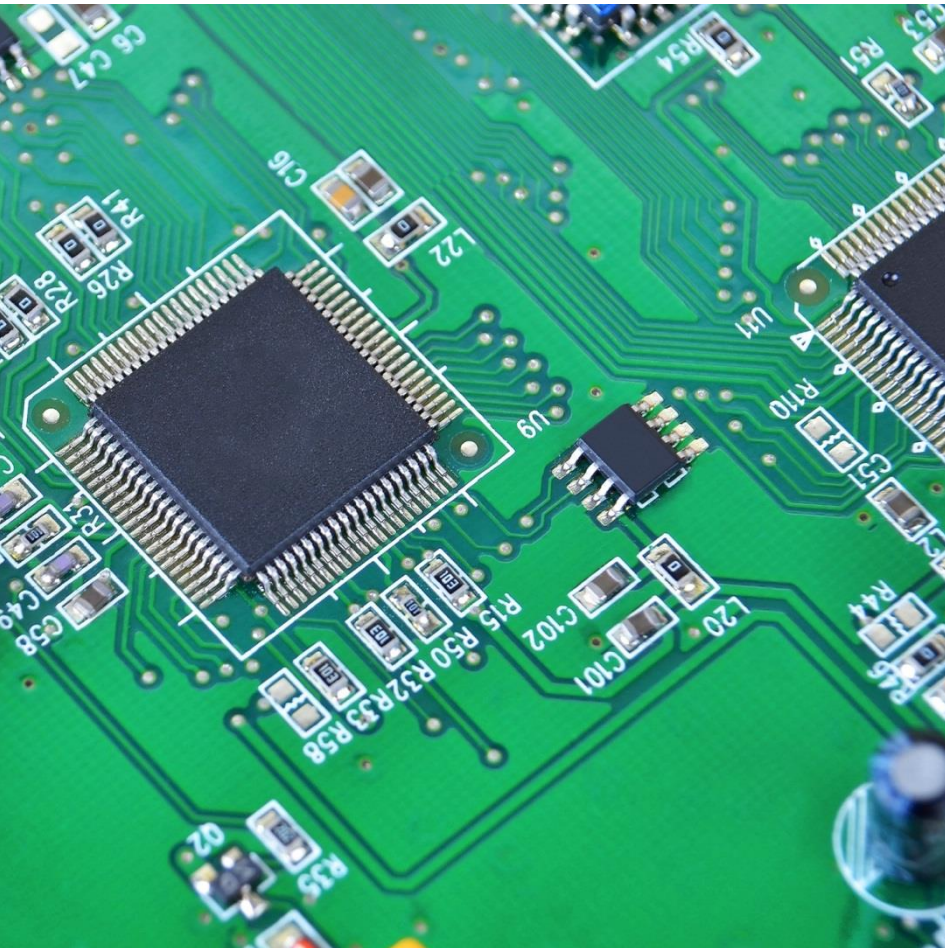


Compensation factors

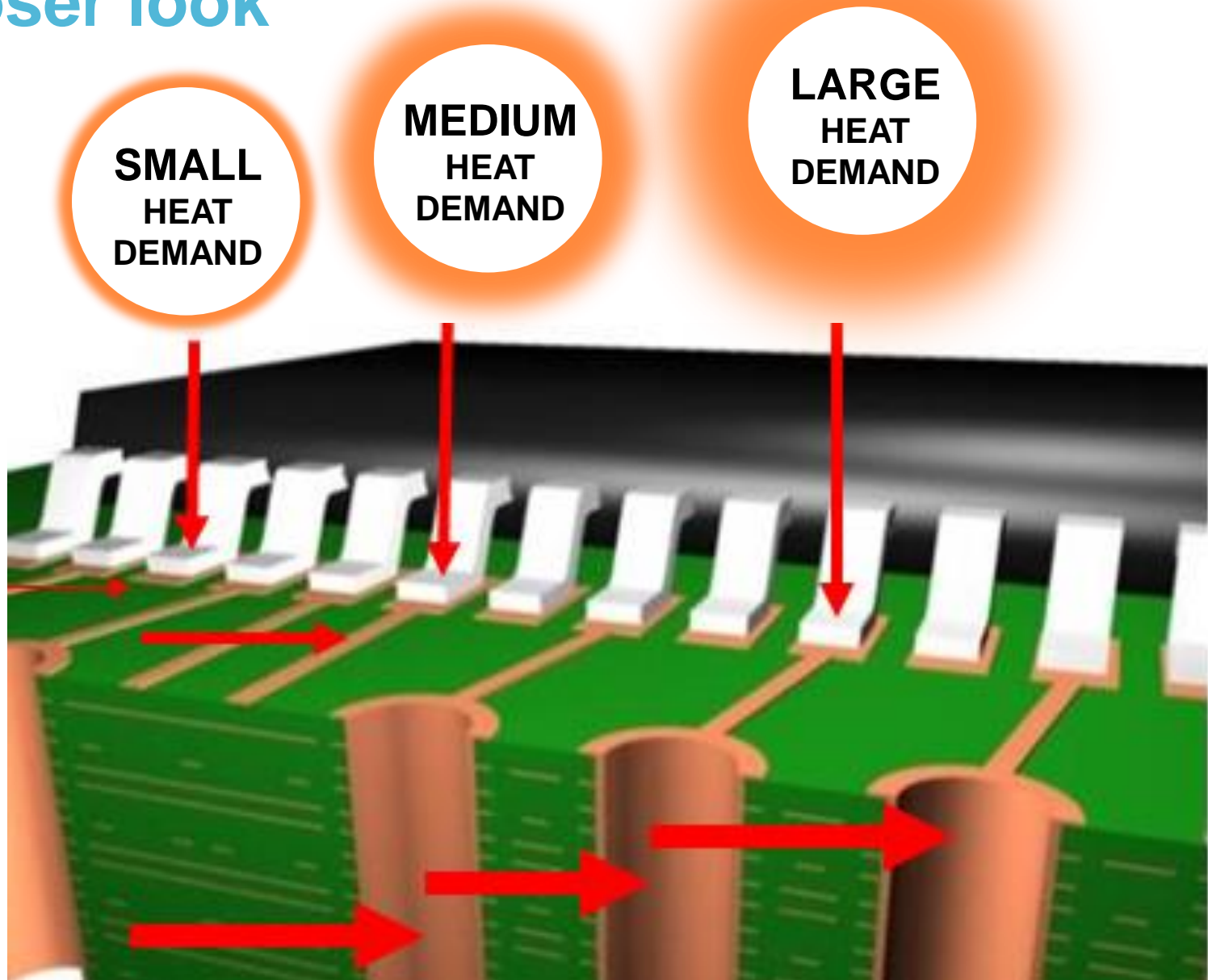


- Increased power / wattage versus temperature
- Power = Thermal energy
- Temperature = Thermal compromise

An aerial view

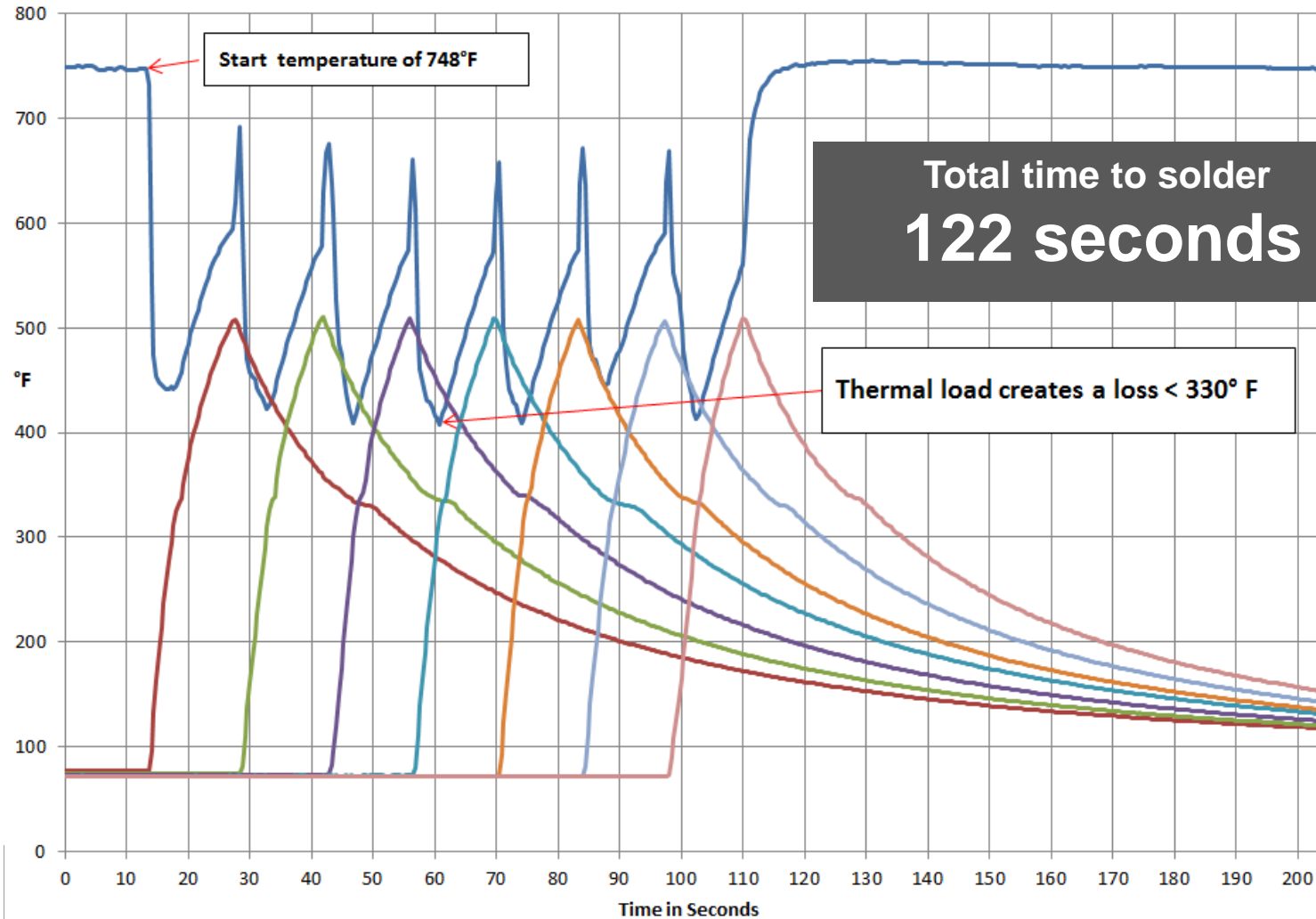


A closer look



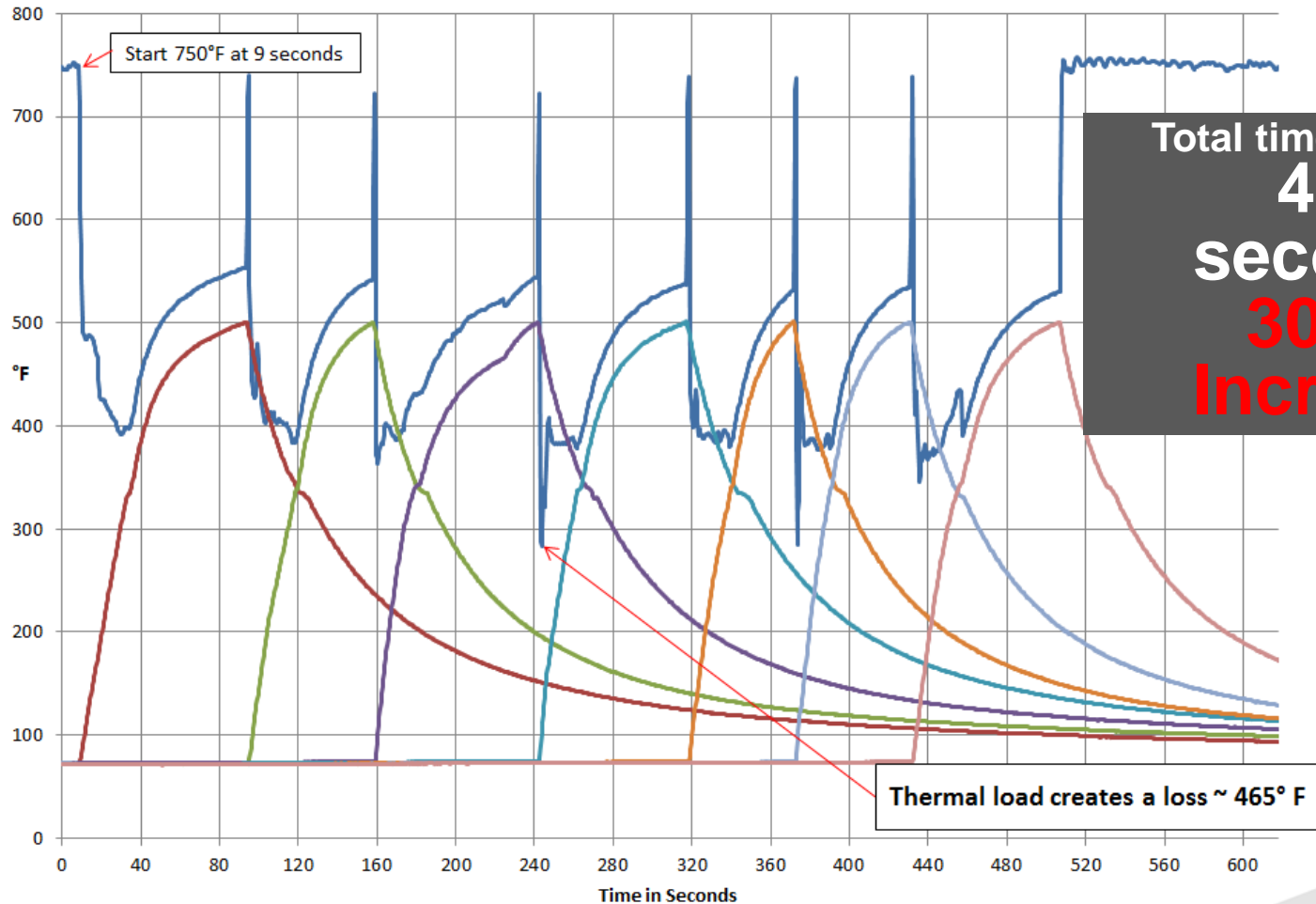
Tips (size matters)

Thermal capacity test with properly matched tip **2.4 mm**



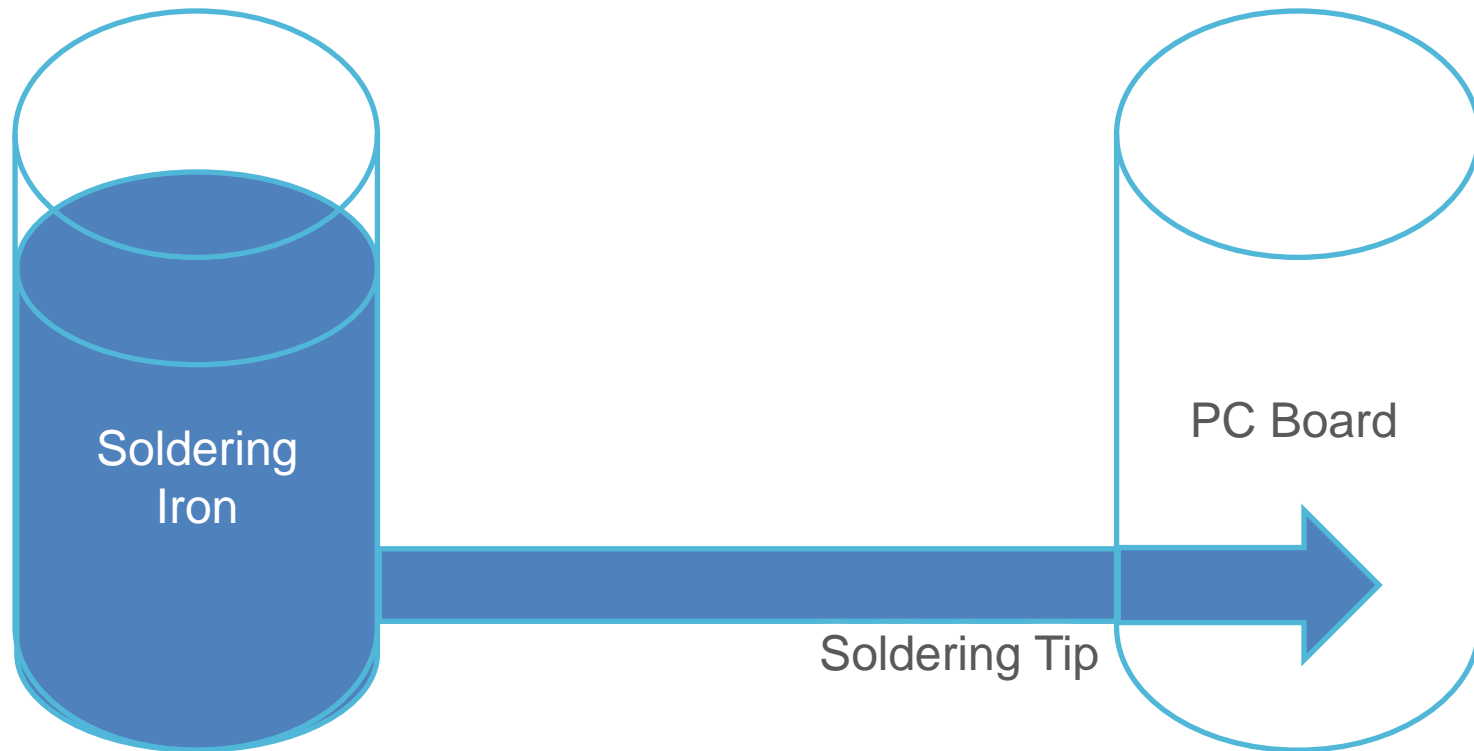
Tips (size matters)

Thermal capacity test with fine-pointed tip 0.4 mm



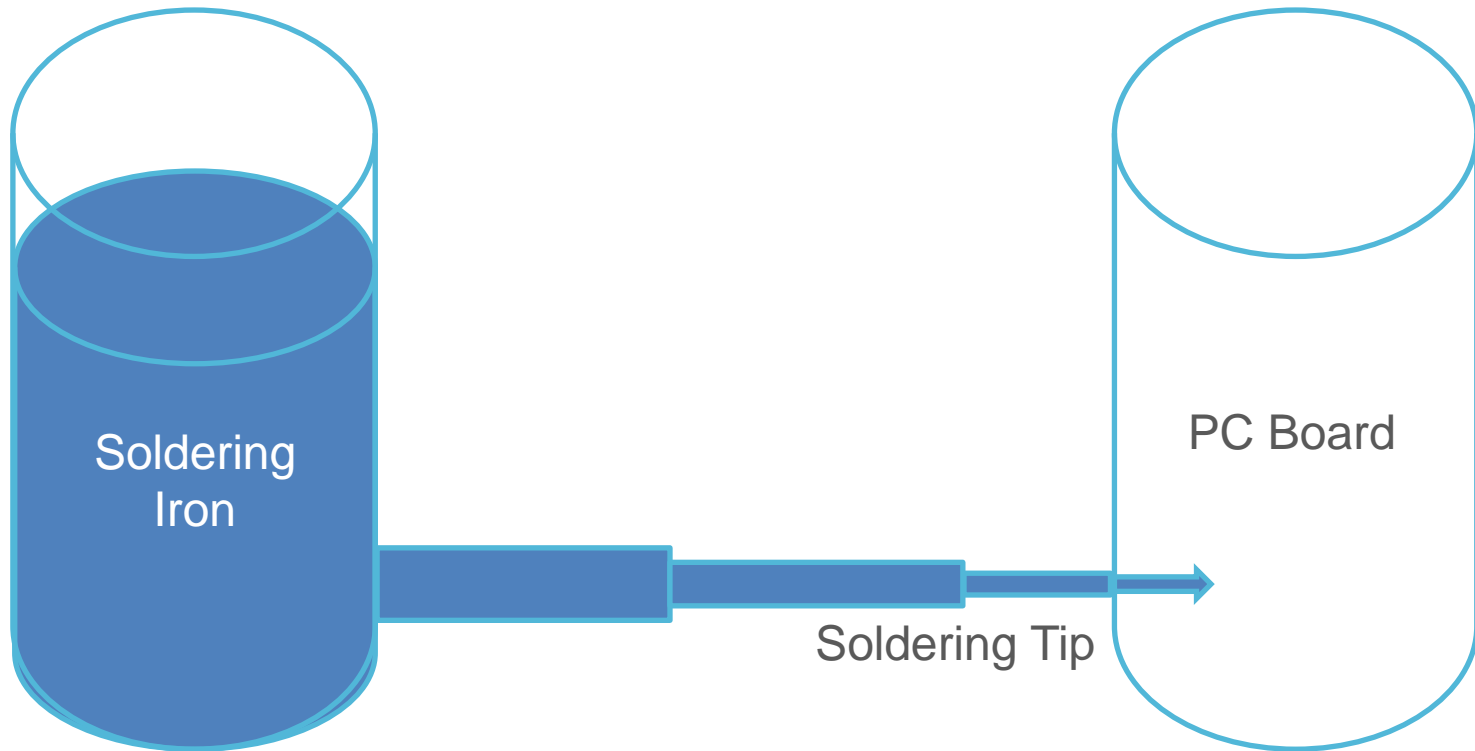
Compensation factor

Increased power, from 40–200 Watts



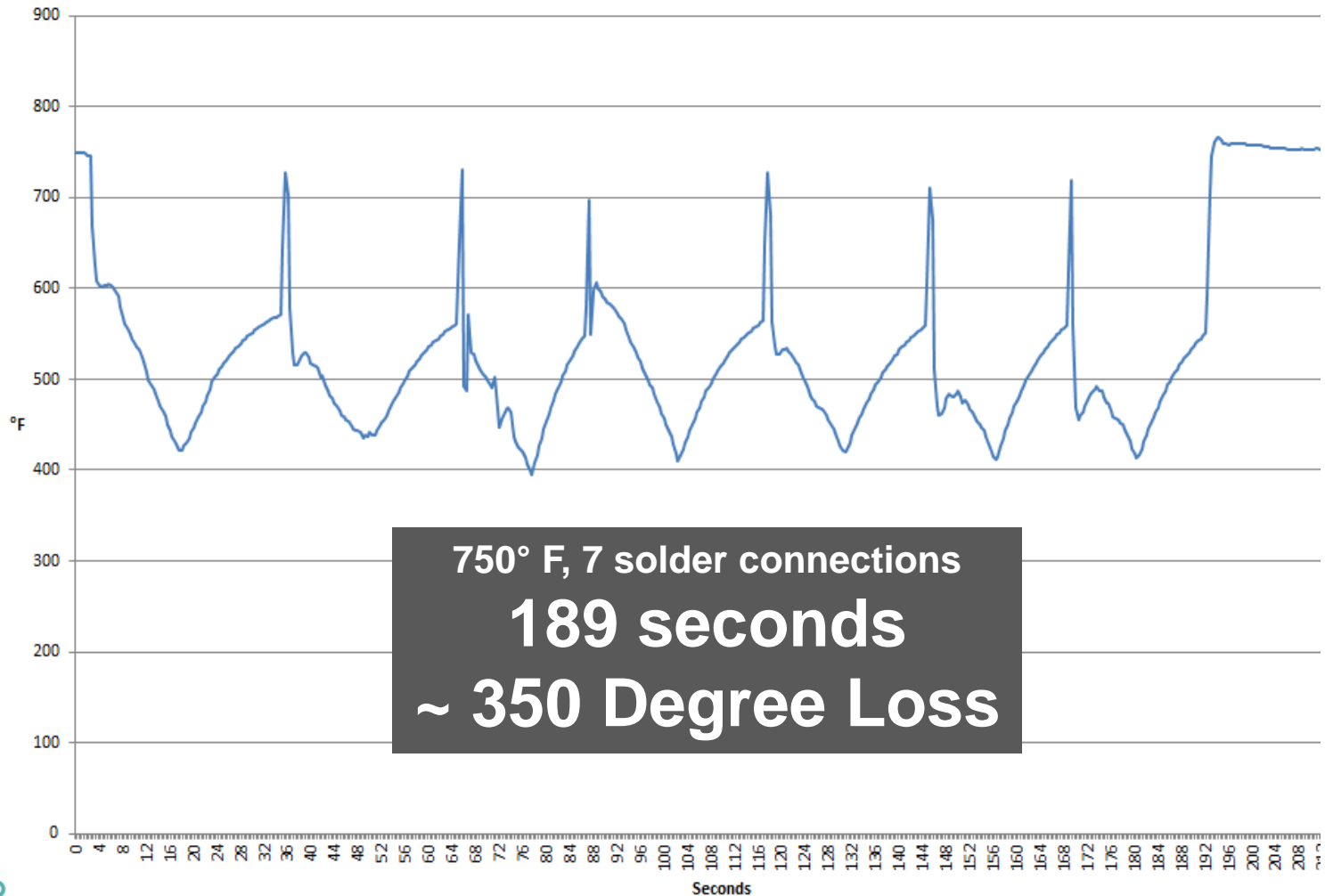
Compensation factor

Increased power, from 40–200 Watts



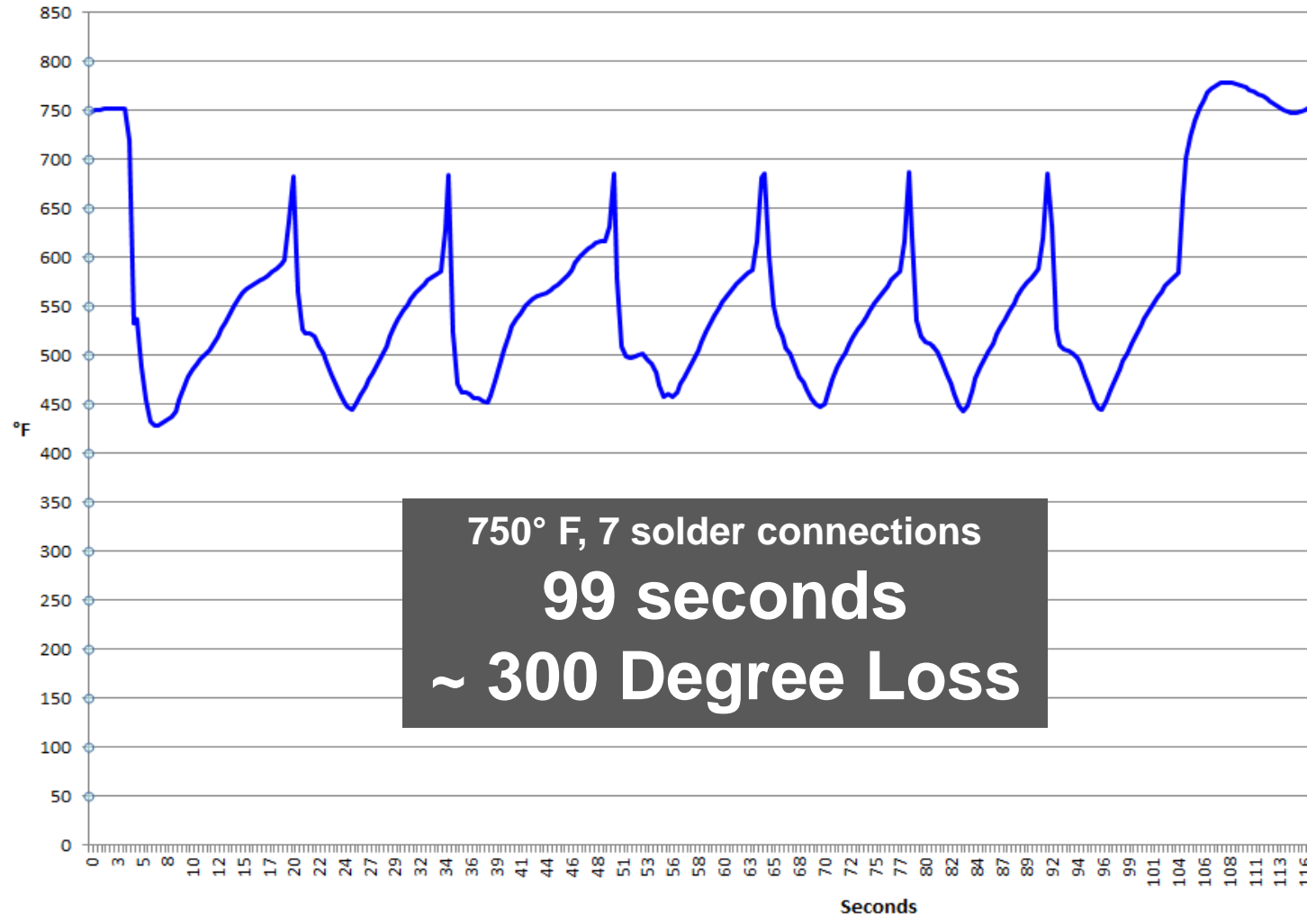
Wattage (performance matters)

Thermal capacity test – light duty iron



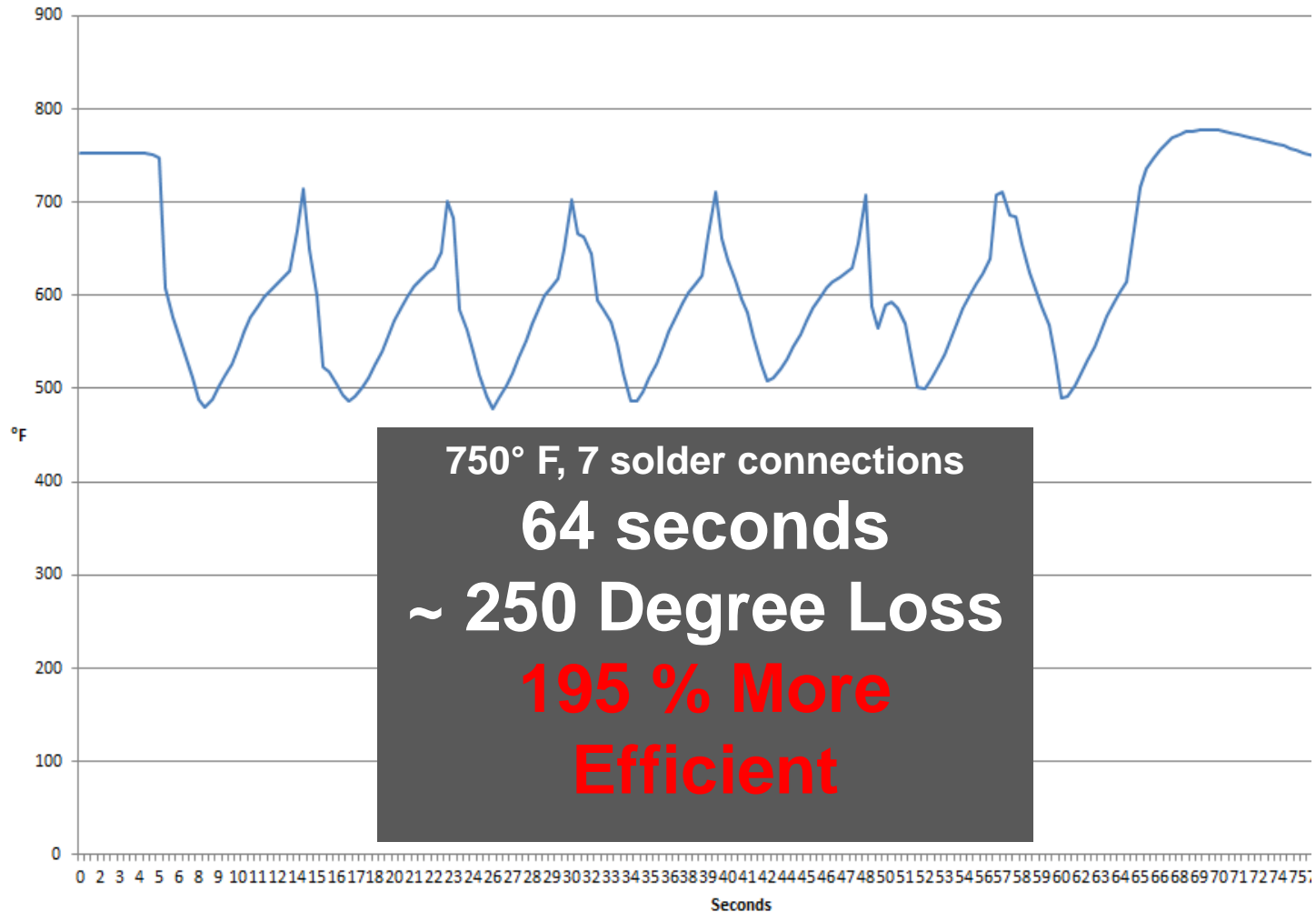
Wattage (performance matters)

Thermal capacity test – medium duty iron



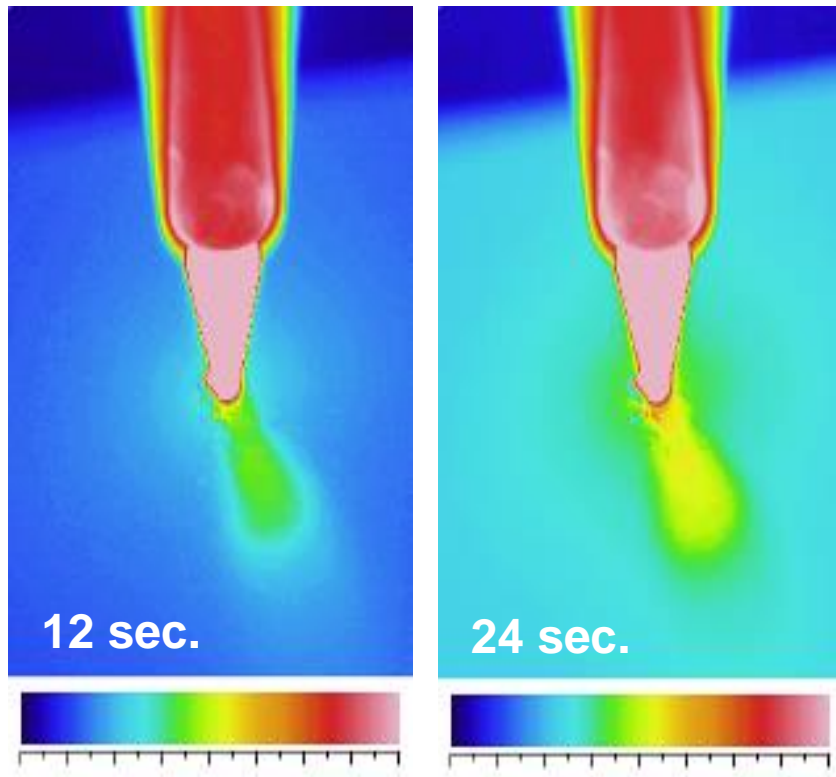
Wattage (performance matters)

Thermal capacity test – high capacity iron

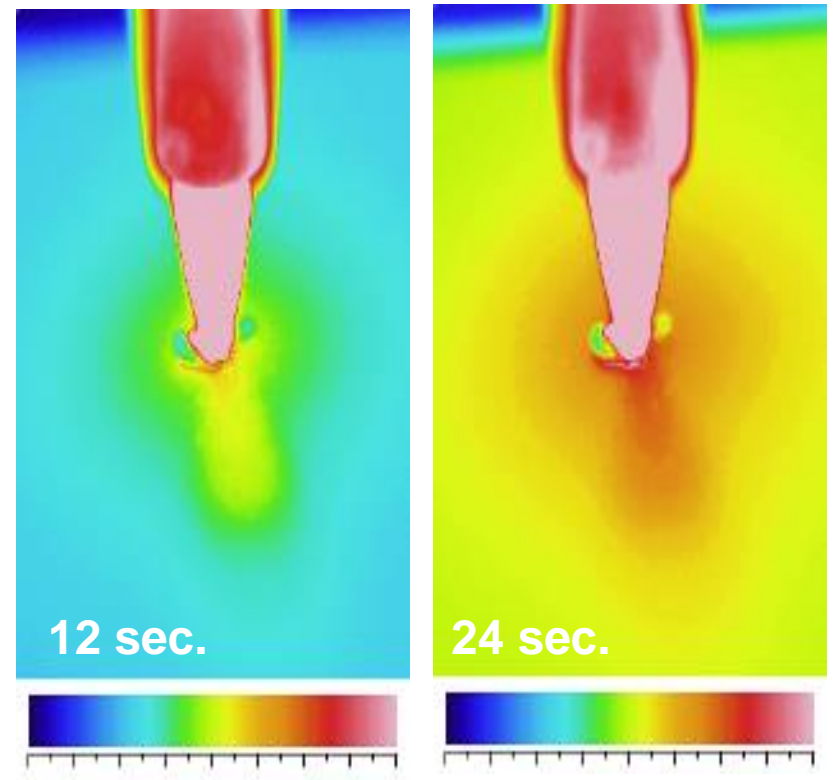


Wattage (performance matters)

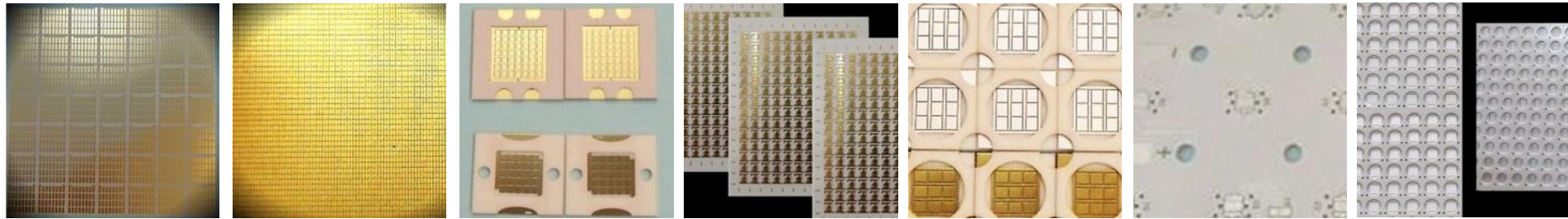
Standard performance iron



High capacity iron



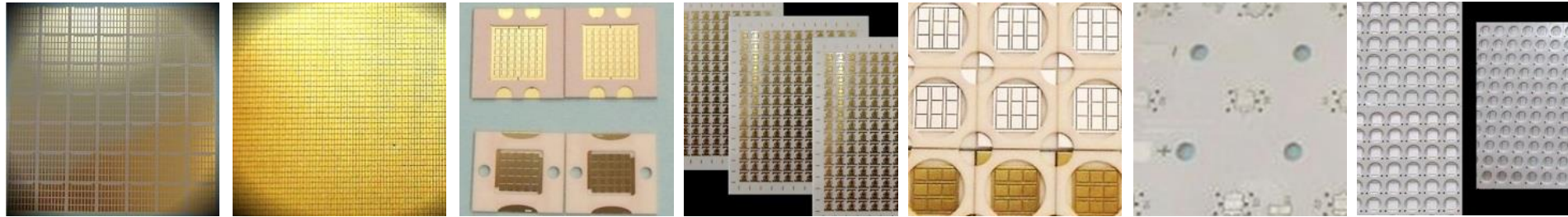
Substrate material



- **FR4 – Fiberglass Reinforced**
- **Ceramic – Alumina / Aluminum Nitride**
- **Flex – Flexible Printed Circuits**
- **Metallized – Ceramic / Porcelain - Aluminum / Copper / Steel**

Substrate images courtesy of Tensky Technology Co., Ltd.

Finishes

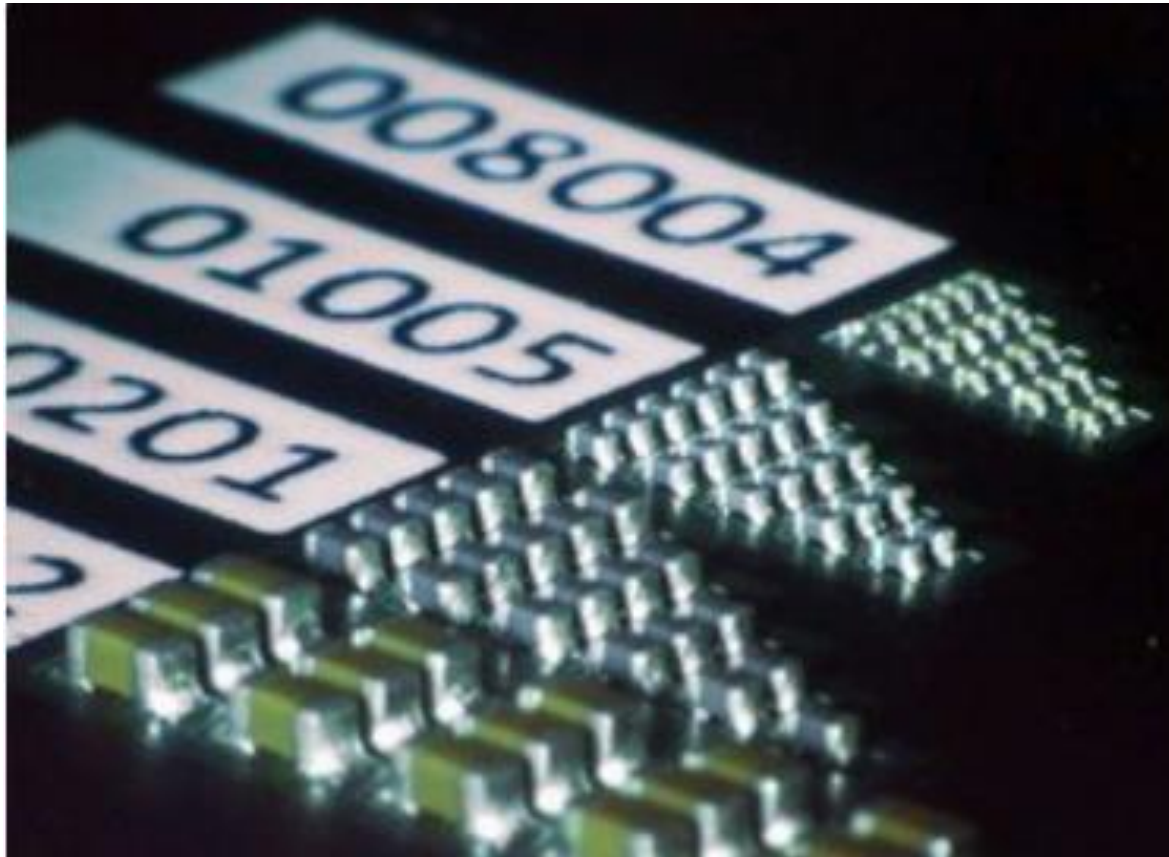


- HAL - Hot Air Levelled - Leaded / Lead-Free
- ENIG – Electroless Nickel / Immersion Gold
- Immersion Silver / Immersion Tin
- OSP – Organic Solder Preservative

Substrate images courtesy of Tensky Technology Co., Ltd.

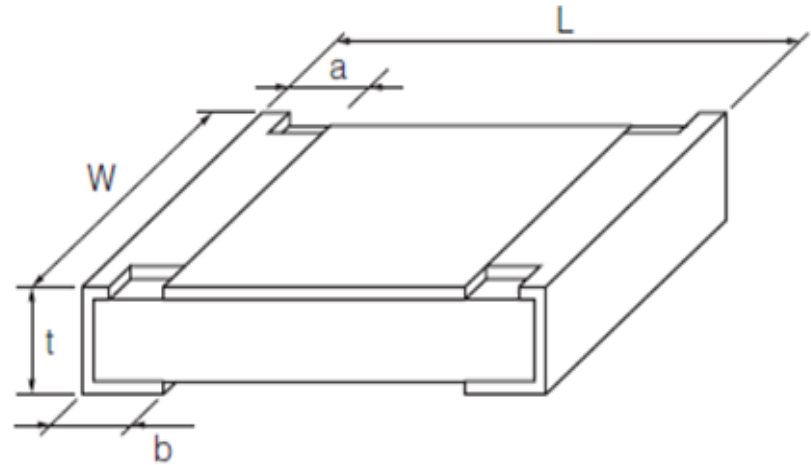
Components (size matters)

0201 / 01005 / 008004



Components (size matters)

0201 / 01005 / 008004

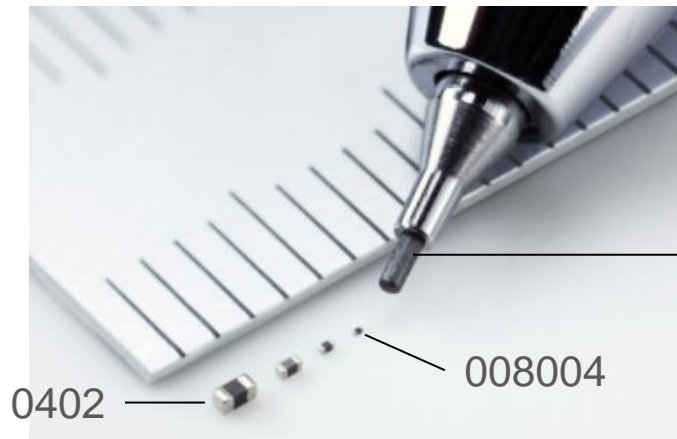
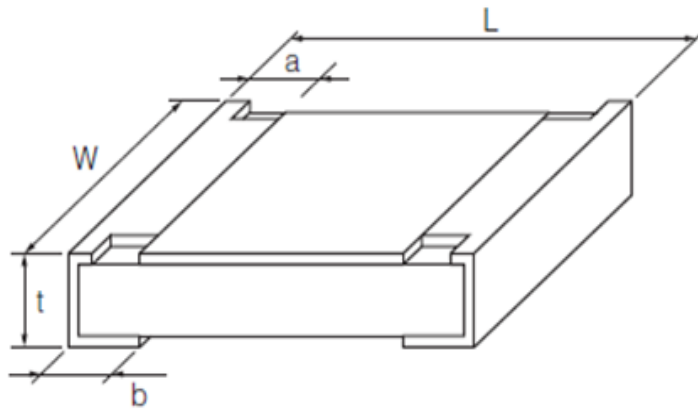


EIA case size	01005	0201	0402	0603	0805
Length (L)	0.4 ± 0.02	0.6 ± 0.03	1.0 ± 0.05	1.6 ± 0.15	2.0 ± 0.2
Width (W)	0.2 ± 0.02	0.3 ± 0.03	0.5 ± 0.05	0.8 ± 0.15	1.25 ± 0.2
Thickness max. (T)	0.22	0.33	0.6	1.0	1.35
Termination width (P)	0.1 ± 0.03	0.15 ± 0.05	0.2 ± 0.1	0.12 ~ 0.51	0.25 ~ 0.71



Components (size matters)

0201 / 01005 / 008004

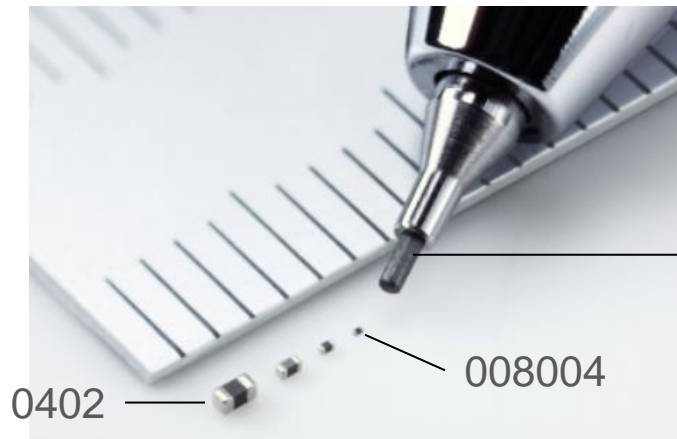
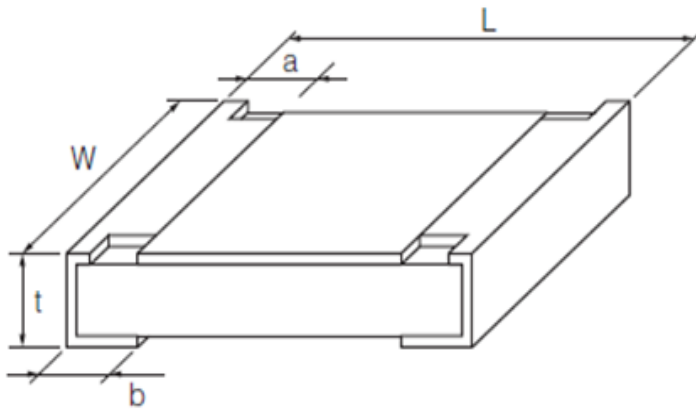


Mechanical pencil lead
0.5 mm

EIA case size	01005	0201	0402	0603	0805
Length (L)	0.4 ± 0.02	0.6 ± 0.03	1.0 ± 0.05	1.6 ± 0.15	2.0 ± 0.2
Width (W)	0.2 ± 0.02	0.3 ± 0.03	0.5 ± 0.05	0.8 ± 0.15	1.25 ± 0.2
Thickness max. (T)	0.22	0.33	0.6	1.0	1.35
Termination width (P)	0.1 ± 0.03	0.15 ± 0.05	0.2 ± 0.1	0.12 ~ 0.51	0.25 ~ 0.71

Components (size matters)

0201 / 01005 / **008004**



008004 - 0.2 x 0.125 mm

	0201	01005	008004	0603	0805
Length (L)	0.8	1.25	1.6	2.0	2.5
Width (W)	0.2 ± 0.02	0.3 ± 0.03	0.5 ± 0.05	0.6 ± 0.08	0.8 ± 0.1
Thickness max. (T)	0.22	0.33	0.6	1.0	1.35
Termination width (P)	0.1 ± 0.03	0.15 ± 0.05	0.2 ± 0.1	0.12 ~ 0.51	0.25 ~ 0.71

Components



56 Ld SSOP
1.35 X
(23.7 x 18 mm)

0.8 mm



56 Ld TSOP
1 X
(20 x 14 mm)

0.5 mm



Easy BGA
.46 X
(13 x 10 mm)

1.0 mm



Stacked-CSP
.29 X
(10 x 8 mm)

0.8 mm



µBGA CSP
.29 X
(10 x 8 mm)

0.8 mm

Leaded or Leadless component types matter

Leaded

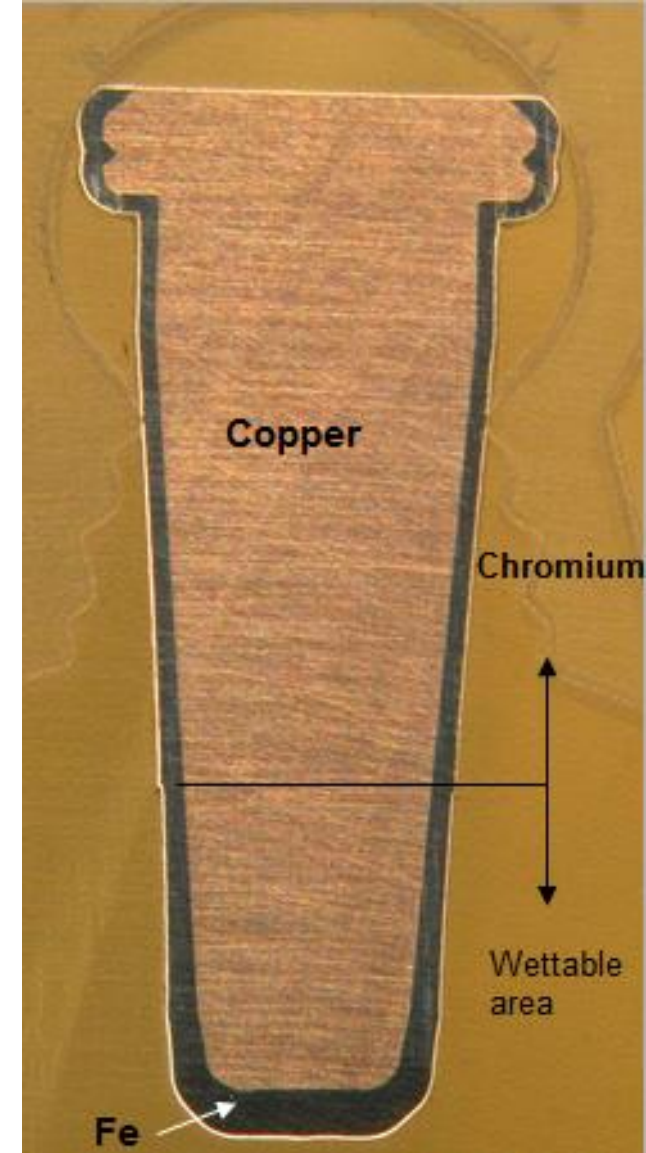
- SSOP - small shrink outline package
- TSOP - thin small outline package

Leadless

- BGA - ball grid array
- CSP - chip scale package
- Micro BGA – micro ball grid array

Anatomy of a soldering tip

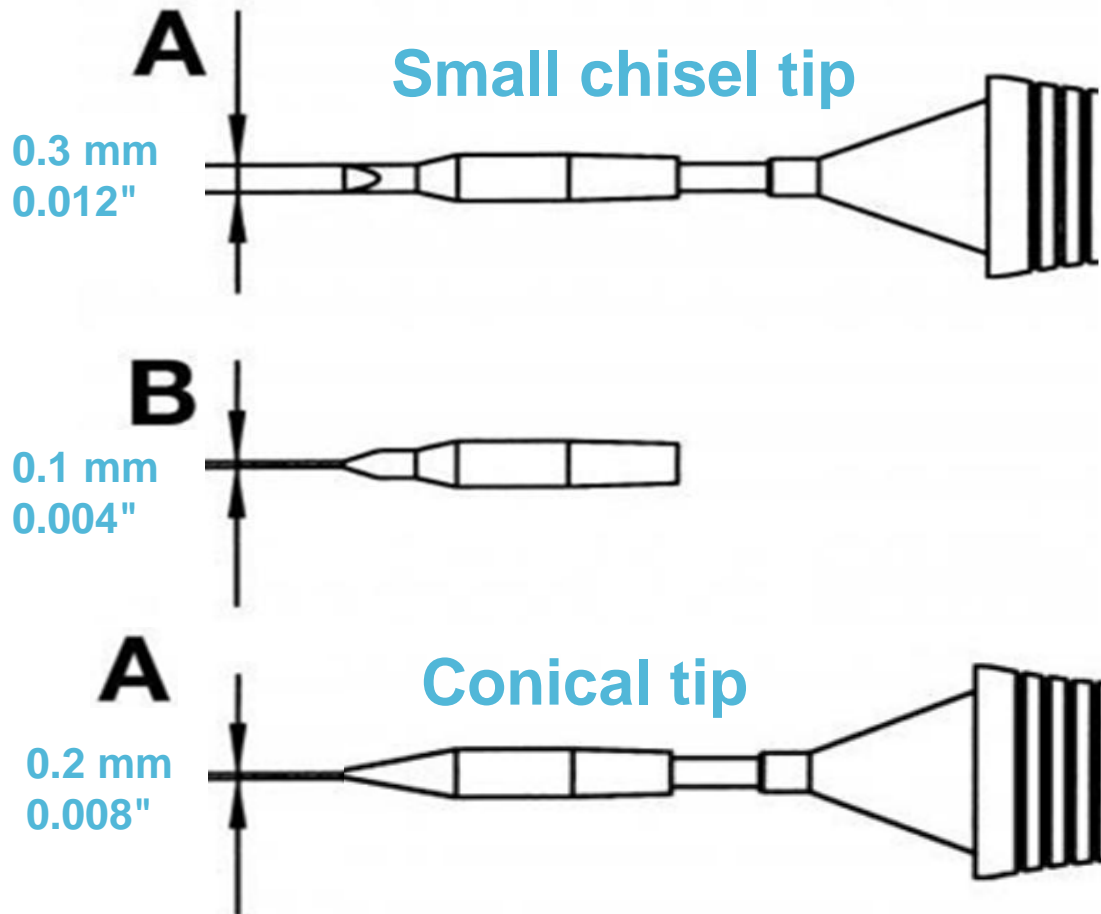
- **Copper core** controls high heat conductivity of the soldering tip
- **Iron layer** controls high wear resistance
- **Chromium (chrome) layer** limits the wettable area
- **Tinned working area** controls wettability of the soldering tip
- **Lead-free tinning** protects the working area of the tip when it is new



Cross section LTC TIP

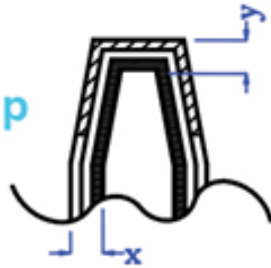


Tip selection (geometry matters)

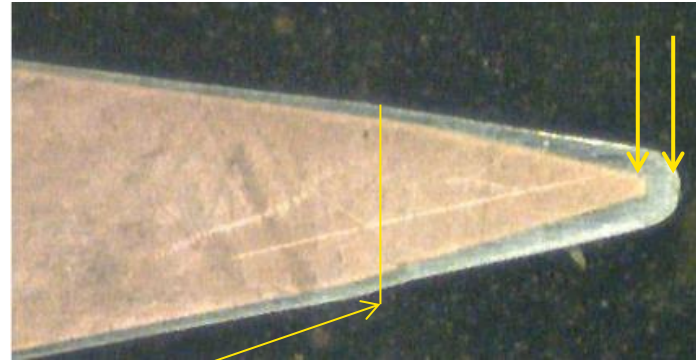


Tip selection (geometry matters)

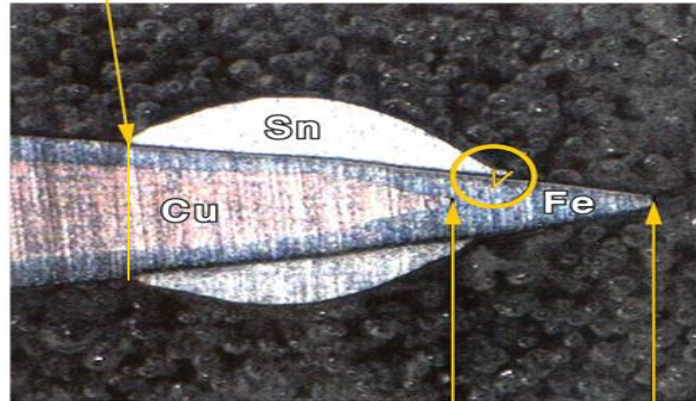
Small chisel tip



Plating is more symmetrical and heat transfer is greater at the point of a chisel tip (cross section – side view)

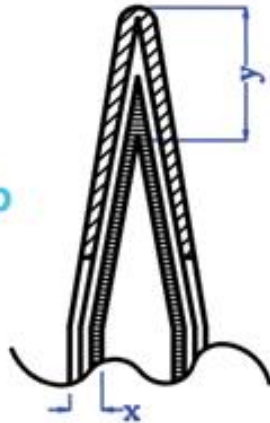


Chrome layer blocks flow of solder

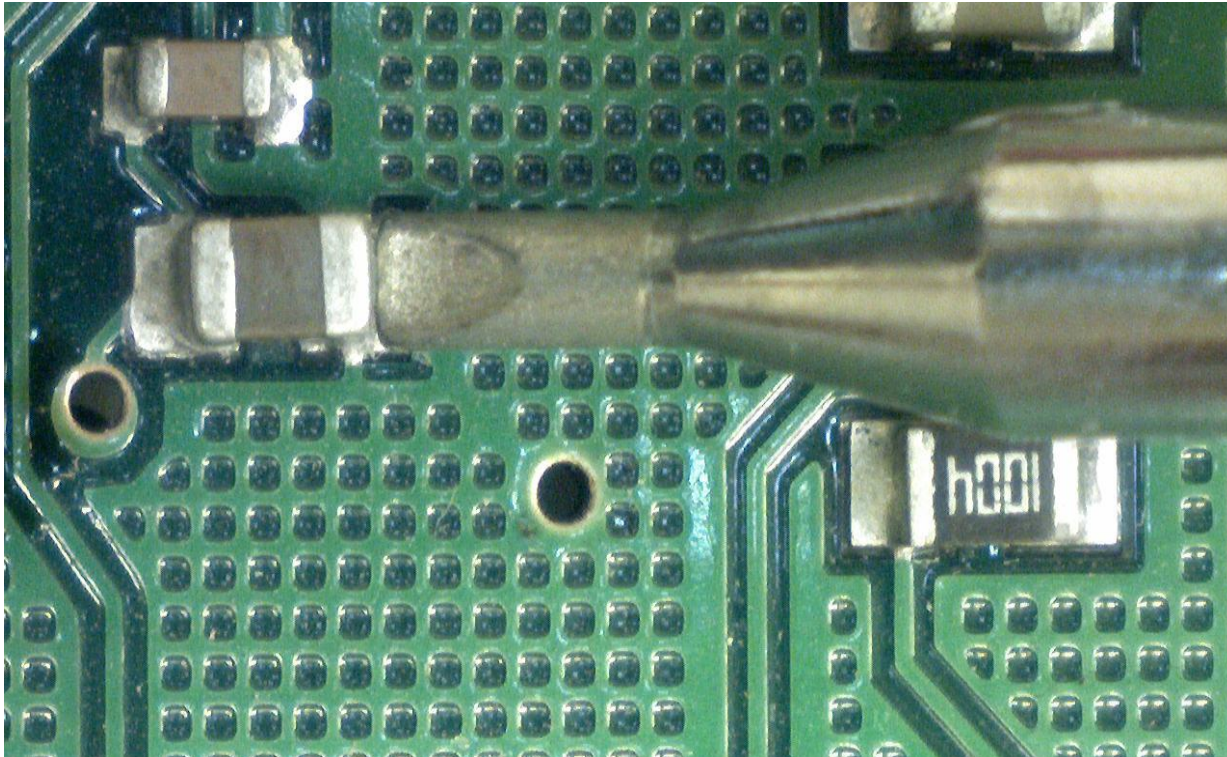


Solder follows the heat source, preventing solder from adhering to the tip point

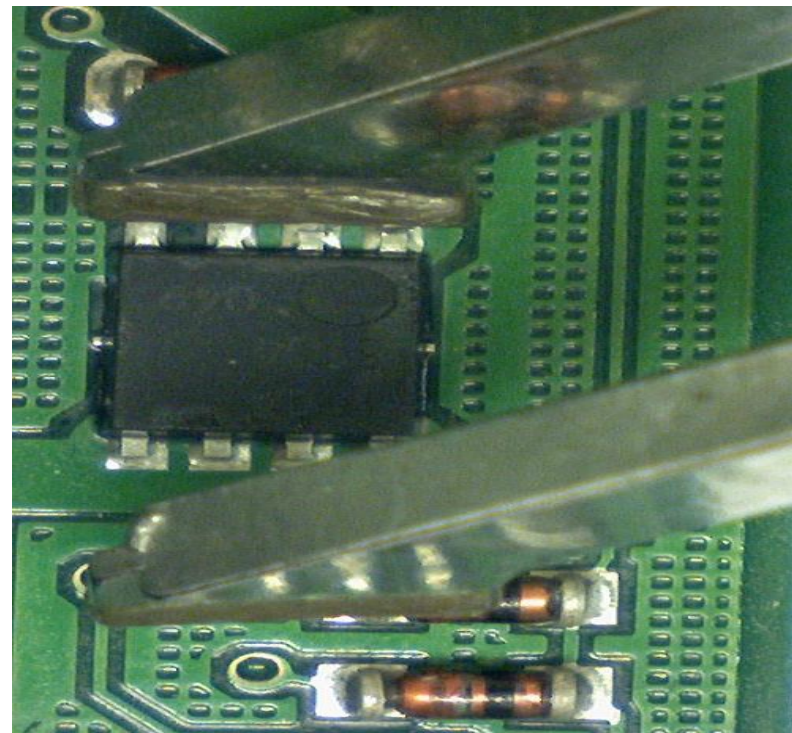
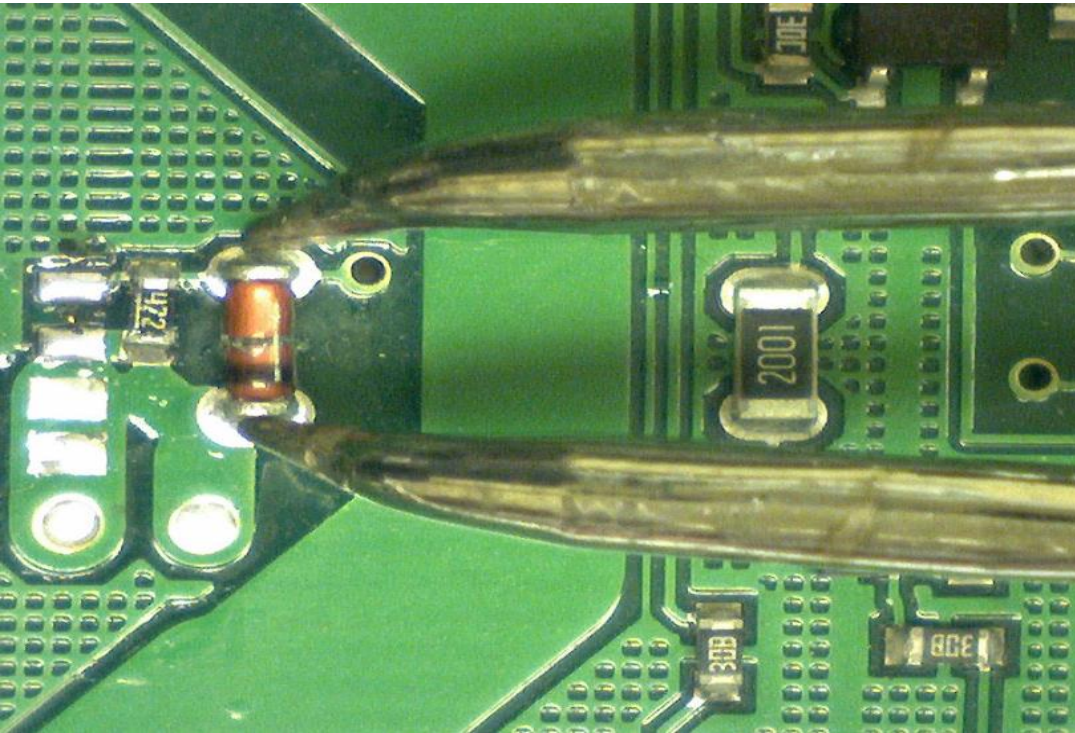
Conical tip



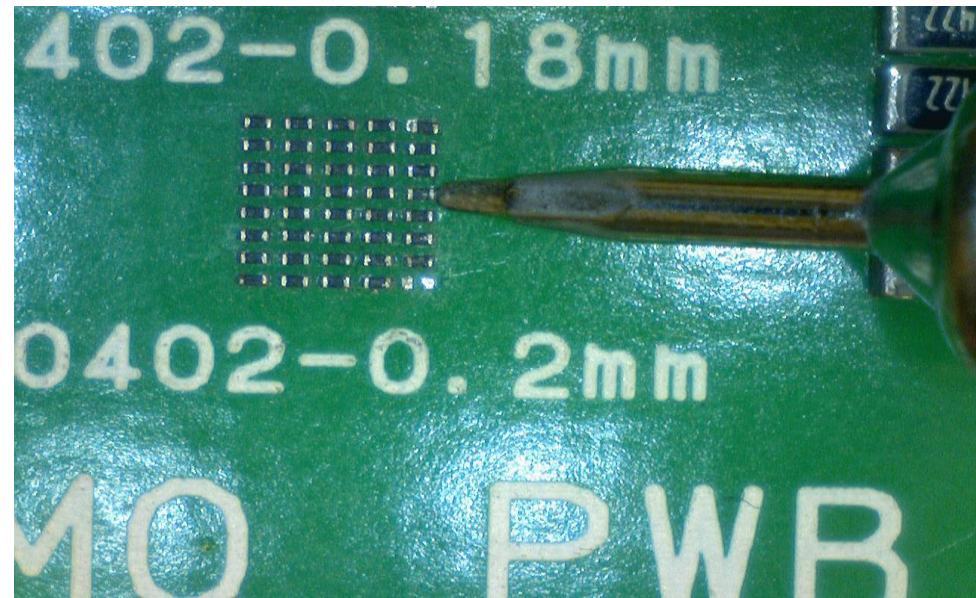
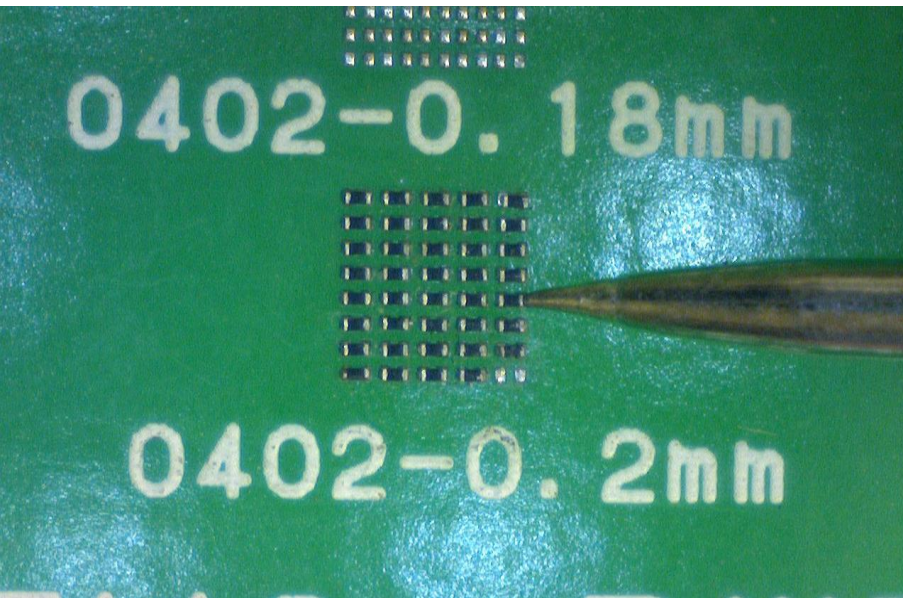
Tip selection (size matters)



Tip selection (size matters)



Tip selection (size matters)



Solder alloy / flux

Suppliers process considerations:

Solder iron tip temperature should be between:

- **350–400°C (650–750°F)** for Sn₆₃, Sn₆₂ and Sn₆₀ alloys
- **370–425°C (700–800°F)** for SN100C[®], SnAg and SnAgCu (SAC₃₀₅, SAC₄₀₅, etc.) alloys.

Hold the solder iron tip at a 45° to 60° angle to the work surface. The solder iron should contact both the component lead and PCB pad surface. Solder and flux should flow onto the lead and pad or lead and barrel to promote optimum flux activity for the joint being worked.

If additional flux is needed, the use of No Clean flux is recommended. Operators should use an applicator capable of dispensing precise amounts of flux to eliminate over-saturation and excessive spread.



Solder alloy / flux

Suppliers process considerations:

Solder iron tip temperature should be between:

- **340–400°C (650–750°F) for Sn₆₃, Sn₆₂ and Sn₆₀ alloys**
- **370–425°C (700–800°F) for SnAg and SnAgCu alloys**
- **340–370°C (650–700°F) for Sn₄₃ Pb₄₃ Bi₁₄**

Hold the solder iron at a 45° to 60° angle to the work surface. The solder iron should contact both the component lead and PCB pad surface. Solder and flux should flow onto both the lead and pad or lead and barrel to promote optimum flux activity to the joint being worked.

If additional flux is needed, the use of RMA flux is recommended. Operators should use an applicator capable of dispensing precise amounts of flux to eliminate over-saturation and excessive spread.



Solder alloy / flux

Suppliers process considerations:

Solder iron tip temperatures are most commonly between:

- **315–371°C (600–700°F)**
for $\text{Sn}_{63}\text{Pb}_{37}$ and $\text{Sn}_{62}\text{Pb}_{36}\text{Ag}_{02}$ alloys
- **371–427°C (700–800°F)**
for lead-free alloys



Solder alloy / flux

Suppliers process considerations:

- Heat both the land area and component lead to be soldered with the iron.
- Apply the solder wire to the land area or component lead.



Solder alloy / flux

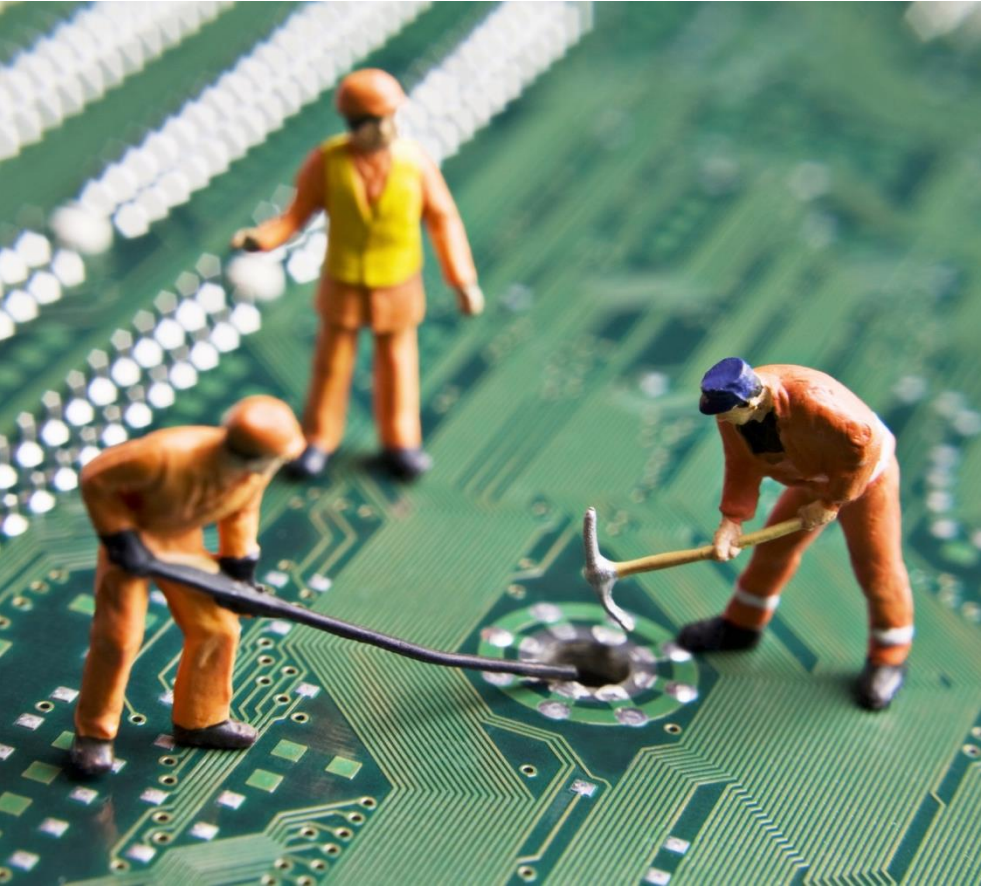
Suppliers process considerations:



Do not apply the solder wire directly to the soldering iron tip.



Equipment Supplier Everyone has a choice!



- Choose your equipment suppliers wisely.
- Equipment should offer versatility and features that suit your current production needs
- Choose equipment suppliers who offer upgrade capabilities

Summary

- **Board density / Material type**
Determines the equipment requirement
- **Equipment power / Thermal performance**
Crucial to the thermal capacity
- **Component size / Pad size**
Crucial to the heat transfer process
- **Tip size / Tip geometry**
Equally important to heat transfer and tip life
- **Flux selection**
Process considerations for now and the future





We're here to help!

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