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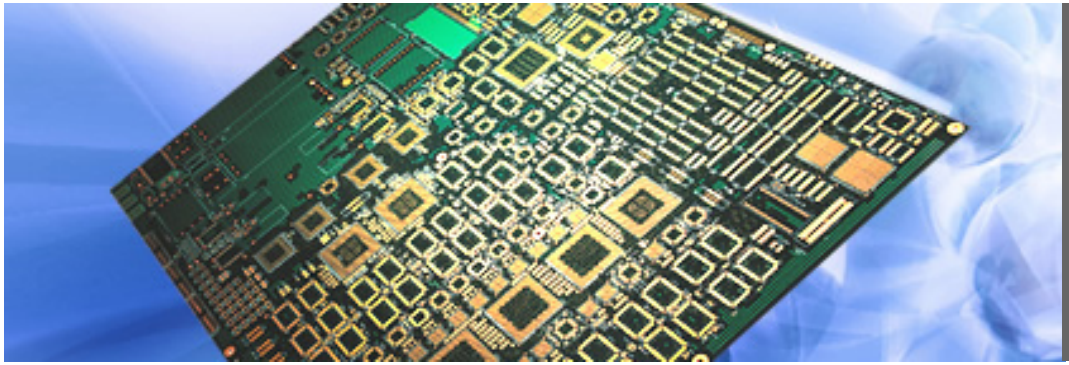
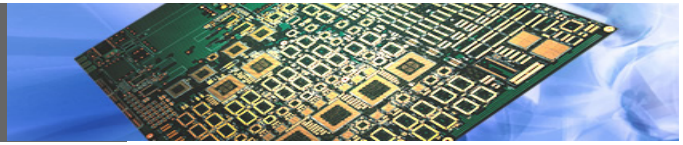
PCB RoHS Update

OCT08



ELECTRONICS
MANUFACTURING
SERVICES

What is RoHS, WEEE & Lead-free?



RoHS: Restrictions on the Use of Hazardous Substances

- **Requires EU Member States to Legislate limits on restricted substances in Electrical /Electronic Equipment sold after July, 2006.**
- **Maximum allowable impurity levels at the component level:**
  - **Mercury 0.1% by weight 1000 ppm**
  - **Cadmium 0.01% by weight 100 ppm**
  - **Lead 0.1 % by weight 1000 ppm**
  - **Cr^{6+} 0.1% by weight 1000 ppm**
  - **PBB, PBDE 0.1% by weight 1000 ppm**
- **Compliance date: 7/1/06**

- **Common component and systems classifications are:**
  - **RoHS 6 (6/6): This implies that the PCB meets the above limits**
  - **RoHS 5 (5/6): The PCB meets the above limits except that it exceeds the lead limit & customer is taking lead exemption**

Legislation is dynamic and subject to geographic and sector variations

- **More than 130 countries have laws in place or pending**
- **More than 20 US states have laws in place or pending**
- **China has approved their RoHS legislation**

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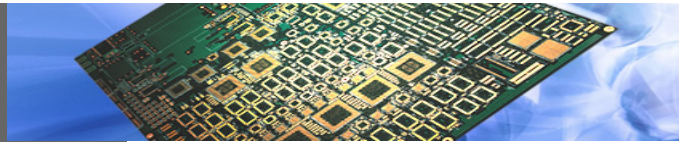
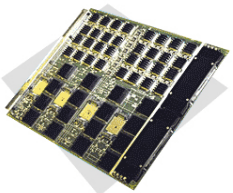
How RoHS affects Sanmina-SCI

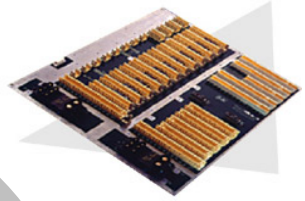


PCB Assembly
- Lead-free Soldering
- Equipment upgrade
- Material Risk/MSL



Modular Solutions

Cables
- Lead-free Soldering
- Cadmium free

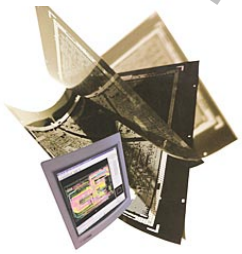


Backplanes
- Lead-free process
- Press-fit compatibility

A Complete End-to-End Solution

PCB Fabrication
- High Temp Laminates
- PBB, PBDE free
- Surface Finishes

Enclosures
- Hexavalent Chromium free (metal & plastics)



Design and Engineering
- Pb Free BOM/AVL
- Design for Disassembly

End-of-Life Management
- Repair and Refurbishment
- WEEE Disassembly

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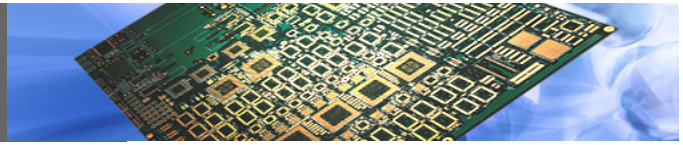
PCB RoHS Compliancy



- PCB laminate materials used by SSCI are compliant
  - The PCB fire retardant is TBBPA. This has bromine in it, but is allowed by all RoHS regulations.
- SnPb solder (HASL or reflow SnPb) is not 6/6 compliant
  - It is 5/6 compliant if the OEM takes the lead exemption
- Some yellow and orange legend inks contain lead and cadmium
- Applies to homogenous materials
  - EU Definition: The lowest level that the PCB can be mechanically disjoined
  - SSCI Definition:
    - Precious metal surface finish
    - Copper
    - Polymers (laminate, prepreg, soldermask, legend ink, etc.)

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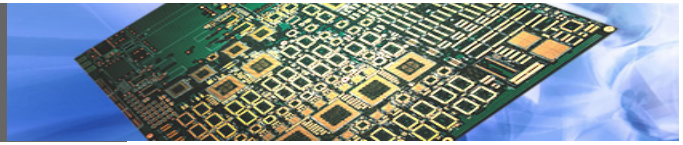
China RoHS



- **If PCB is RoHS Compliant as of March, 1st, 2007**
  - **Marking on the PCB is not required if it is not sold to an end user**
  - **The shipping packaging material content must be on box labels**

- **If PCB is not RoHS Compliant as of March, 1st, 2007**
  - **Marking on the PCB is not required if it is not sold to an end user**
  - **The shipping packaging material content must be on box labels**
    - **Materials must be listed in Chinese**
  - **PCB material content must be reported to customer**
  - **"Valid Period for Environmental Production Use" life time must be reported to customer**

Homogenous Material	Chemical substance symbol					
	Pb	Hg	Cd	Cr(VI)	PBE	PBDE
Copper	O	O	O	O	O	O
Surface Finish	XXX	O	O	O	O	O
Polymers	O	O	O	O	O	O
Note 1	O: Indicates that this toxic or hazardous substance contained in the homogenous materials for this part(s) is below the limit requirement of SJ/T11363-2006.					
Note 2	X: Indicates that this toxic or hazardous substance contained in the homogenous materials for this part(s) is above the limit requirement of SJ/T11363-2006.					

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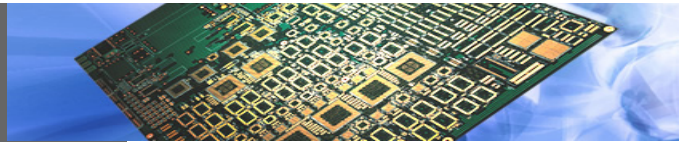
RoHS does not mean lead-free



RoHS

COMPLIANT

And/or

Lead-free Assembly

COMPATIBLE

- RoHS Compliant means:
  - Restricted materials are below the Directive limits
  - But, it does NOT mean that the PCB will work in a lead-free process
- Lead-free Compatible means:
  - The PCB will survive a higher temperature **assembly** process
  - The PCB will survive a higher temperature **rework** process
- Both must be specified on the print and/or PO

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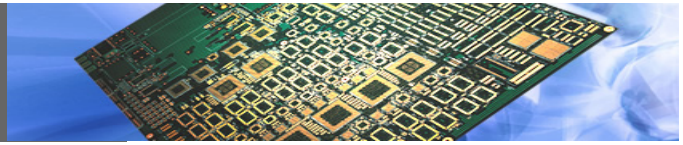
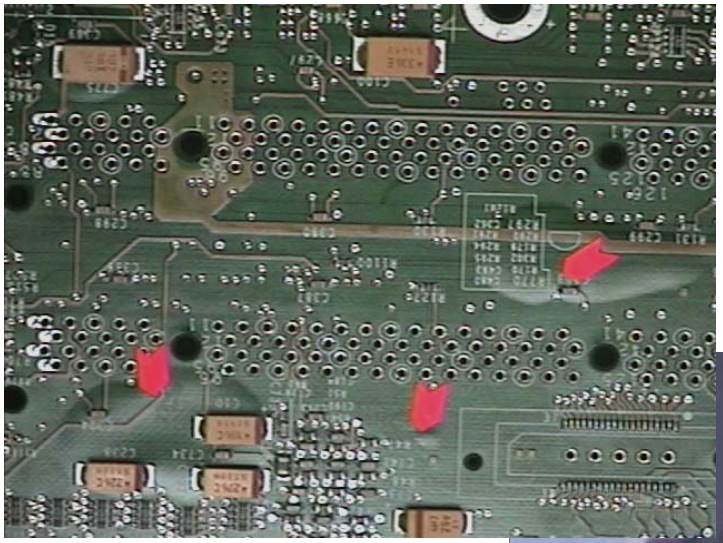
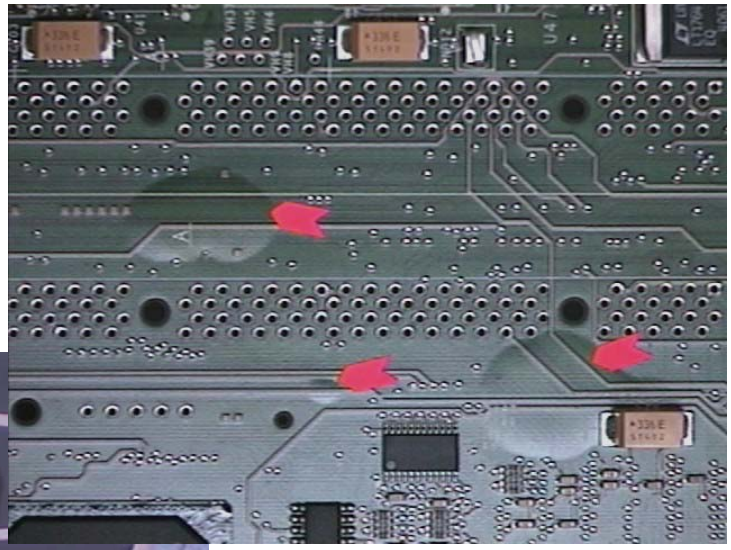
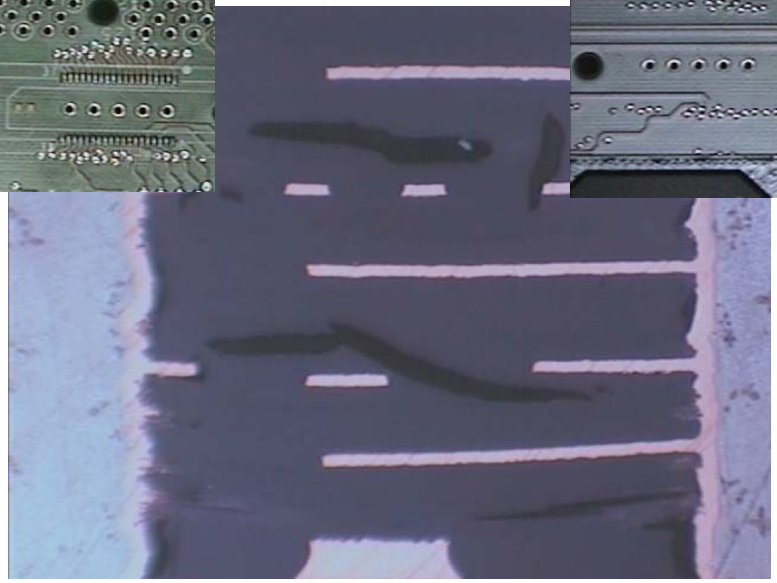
Lead-free assembly failures









Some materials do not survive lead-free assembly and rework temperatures

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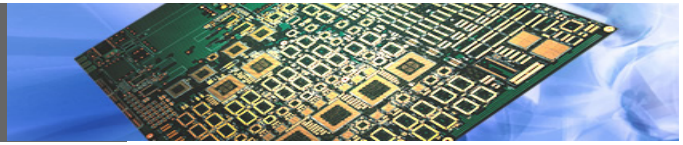
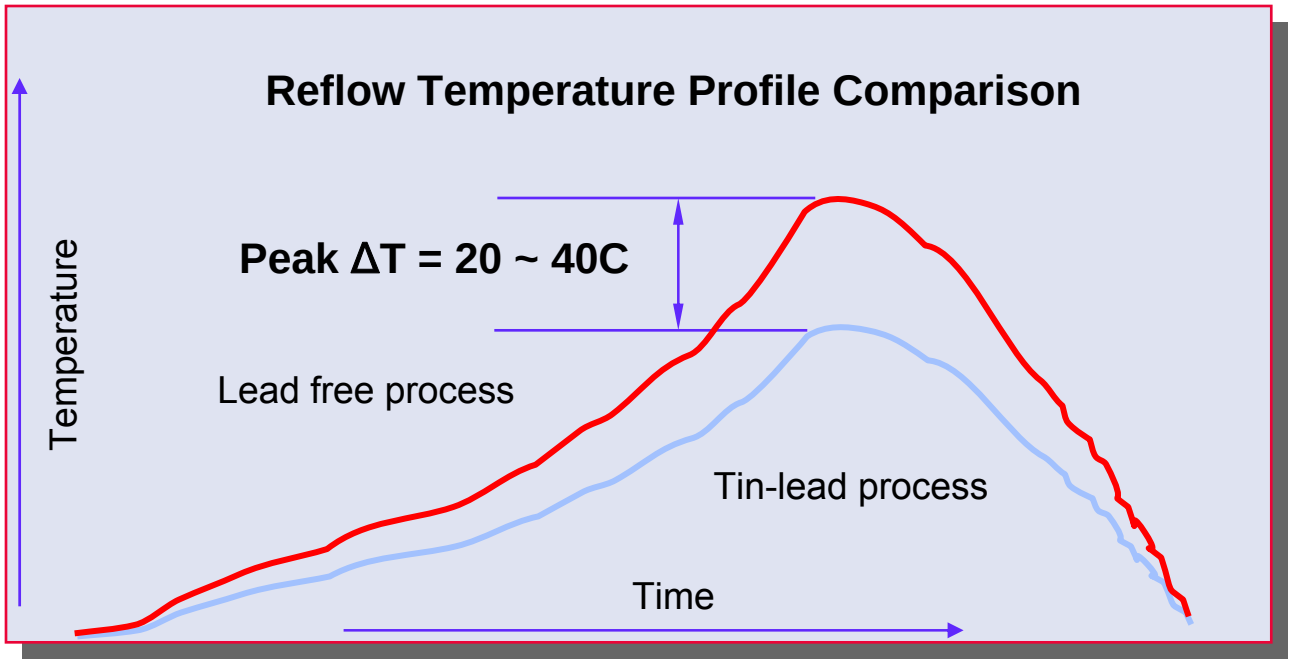
Higher Lead-free Assembly Temperature





- Low thermal mass assembly reflow @ 240 – 245C
- Higher thermal mass assembly reflow @ 260C
- Lead-free PCB temperature is 30C higher than SnPb process
- Up to 6 soldering/rework cycles may be required

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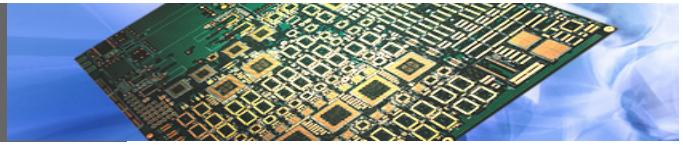
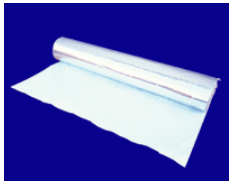
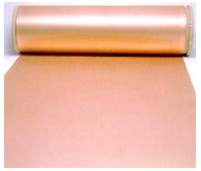
What Are FR-4 Constituents?



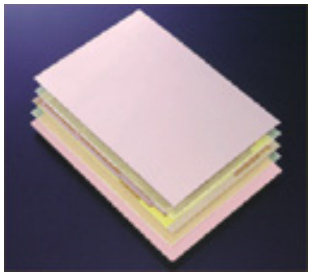


Glass Cloth

Resin

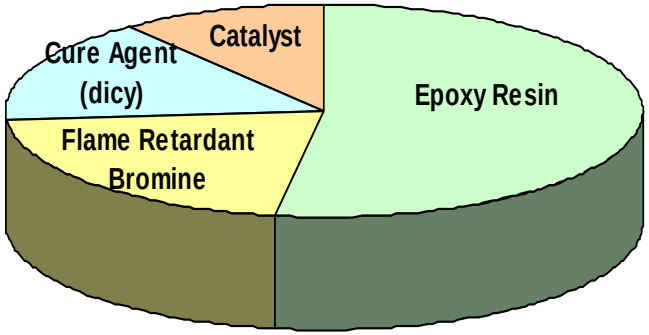


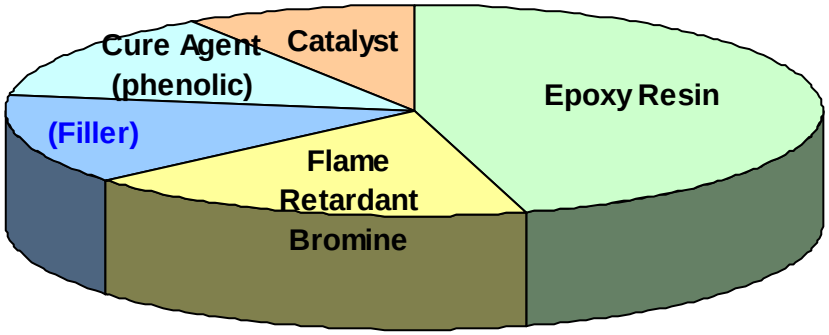
Copper Foil



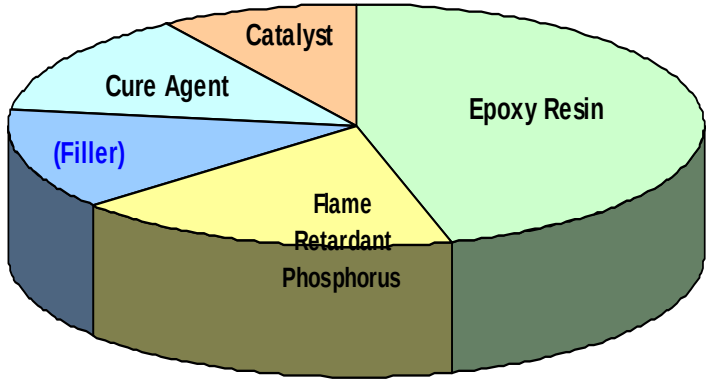
Laminate (FR4)

Dicy FR4





RoHS Lead-Free FR4



Halogen Free FR4

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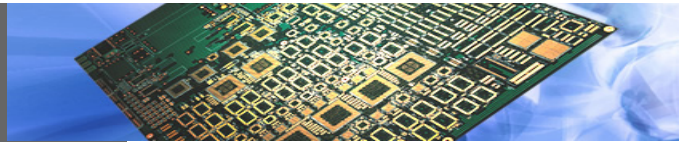
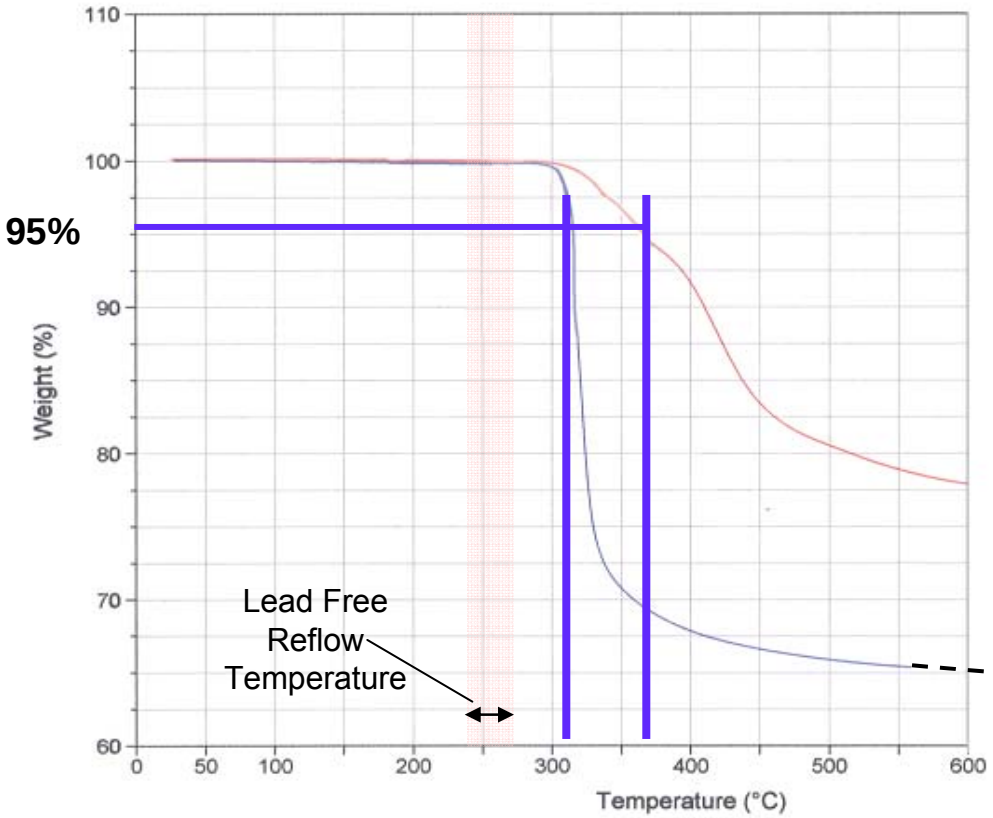
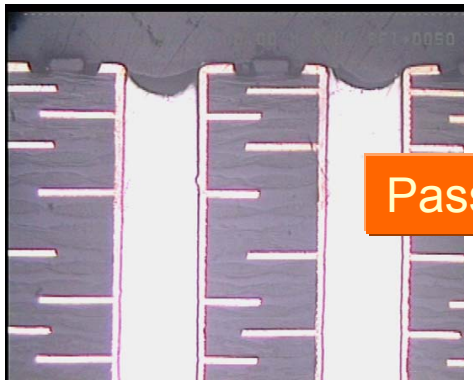
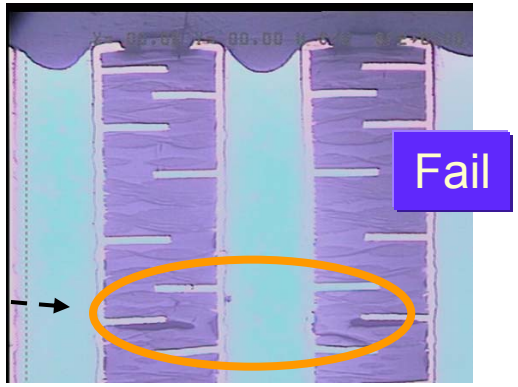
Decomposition Temperature (T_D)



Thermal Gravity Analysis (TGA)







- Higher Assembly Temperature = Increased Decomposition
- Replaces T_G as the key specification

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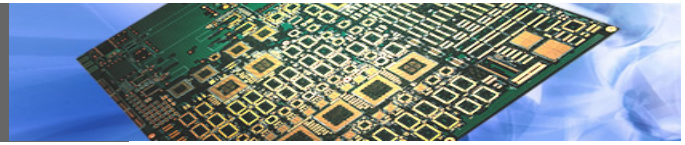
Lead-free Assembly Compatible Material Selection Process: Steps 1 & 2



Step 1: Determine the Assembly Process Attributes

Assembly Attributes	Low Mass	High Mass	Other
Solder Shock	3X (30 sec)	6X (60 sec)	
Max. ASSY Temperature	240C	260C	

Step 2: Determine the PCB Physical Attributes

PCB Attributes			
Thickness	< 0.062” [1.5mm]	0.062” – 0.125” [3.1mm]	> 0.125” [3.1mm]
Layer Quantity	1 – 2	4 – 16	18+
Max. Copper Weight	1 oz.	2 oz.	3+ oz.
Standard or High Reliability	Standard	High	
CAF Resistant?	No	Yes	Yes

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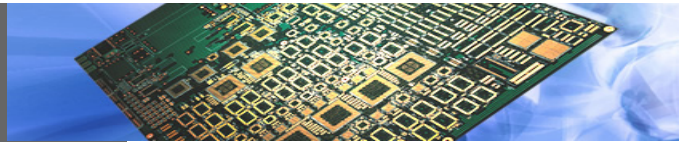
Lead-free Assembly Compatible Material Selection Process: Step 3



FR-4 Type	Dicy	Phenolic, Unfilled	Phenolic, Filled
Solder Shock	2X (20 sec)	6X (60 sec)	6X (60 sec)
Max. ASSY Temperature	≤ 240C	260C	260C
Thickness	< 0.062" [1.5mm]	0.062" – 0.125" [3.1mm]	> 0.125" [3.1mm]
Layer Quantity	1 – 2	4 – 16	18+
Max. Copper Weight	1 oz.	2 oz.	3+ oz.
Standard or High Reliability	Standard	Standard	High
CAF Resistant?	No	Yes	Yes
Material Attributes			
CTE, Z-axis (TMA @ 50%RC)	4.0%	3.5%	3.0%
T260 (minutes)	1	10	30
T_d (C) (@ 10C/min ramp rate)	290	330	330

Step 3: Select Material Type

- Use material with selections furthest to the right
- (These are recommendations. We strongly suggest that testing be performed)

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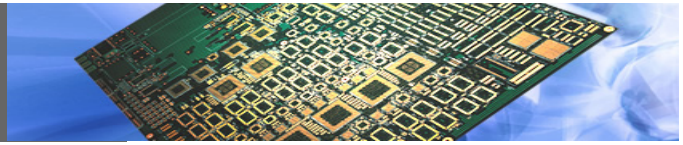
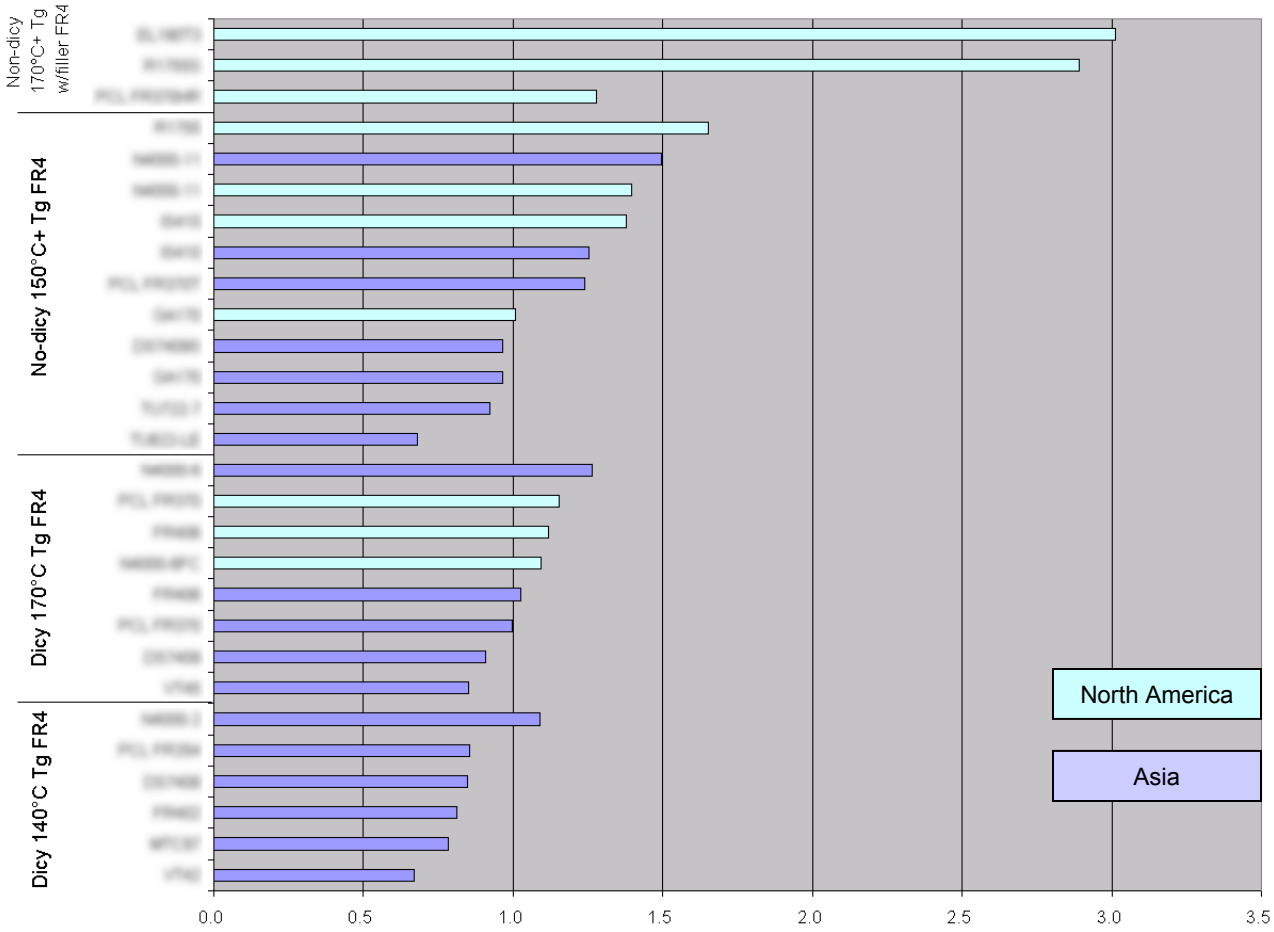
FR-4 Material Cost





- Material cost varies by resin supplier
- Material cost varies by manufacturing region (US versus Asia)

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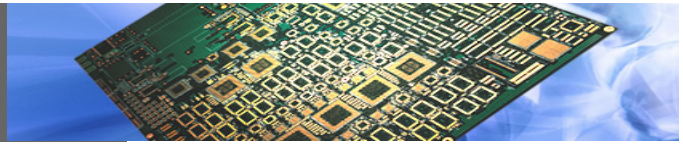
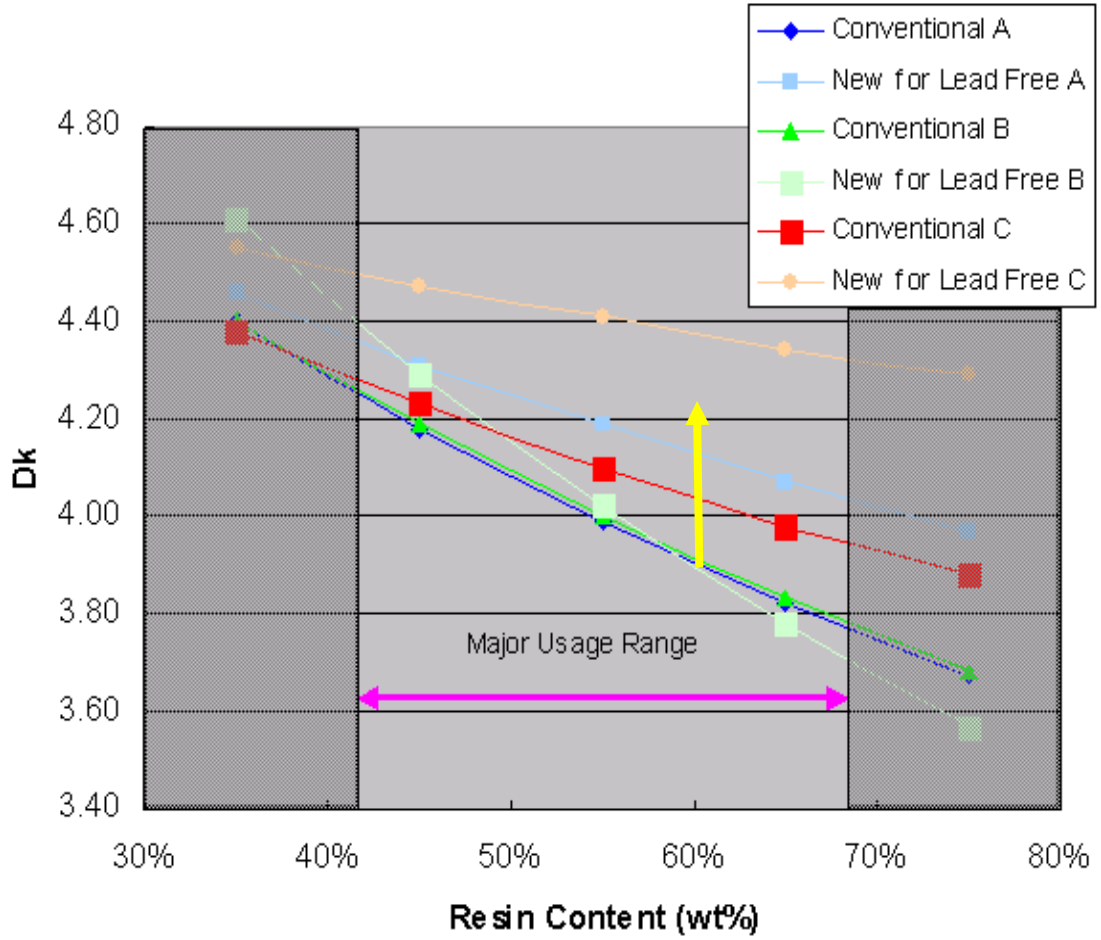
FR-4 Electrical Impact





- **Most phenolic Dk's are higher than dicy cured materials**
- **Converted PCB's should be re-characterized**

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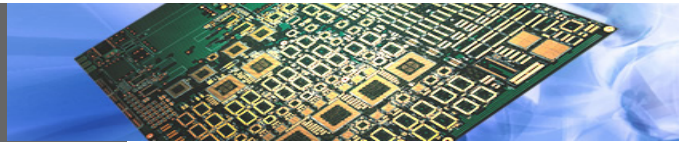
RoHS & Lead-Free Drawing Notes



1) HOMOGENOUS MATERIALS IN THIS PCB SHALL BE COMPLIANT TO THE EU RoHS DIRECTIVE 2002/95/EC.
2) MATERIAL SHALL BE COMPATIBLE WITH (X) YYY C @ 10 SEC. LEAD-FREE ASSEMBLY AND REWORK CYCLES.
3) MATERIAL SPECIFICATION:
   a) BASE LAMINATE – COPPER CLAD GLASS BASE EPOXY RESIN SHALL BE IN ACCORDANCE WITH IPC-4101/XX.
   b) BONDING AGENT – PREIMPREGNATED B STAGE EPOXY G CLOTH SHALL BE IN ACCORDANCE WITH IPC-4101/XX.

Optional Notes:

4) THIS PCB IS EXEMPT FROM THE MAXIMUM LEAD REQUIREMENT OF EU DIRECTIVE 2002/95/EC.
5) THIS PCB DOES NOT REQUIRE THE USE OF LEAD-FREE PROCESS COMPATIBLE MATERIALS.
6) PCB SHALL BE MARKED ACCORDING TO CHINA MII ORDER #39

/121	**Standard Tg, Un-filled**	**/101**	**Standard Tg, Filled**
/124	**Mid Tg, Un-filled**	**/99**	**Mid Tg, Filled**
/129	**High Tg, Un-filled**	**/126**	**High Tg, Filled**

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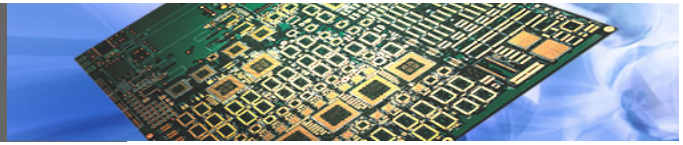
Soldermask and Legend Impact



- Solder Mask & Via Plug
  - Existing masks are lead-free compatible
  - Existing via plug materials appear to be are lead-free compatible
  - Compatible with 260C assembly temperature
- Legend
  - Existing legend inks are lead-free compatible
  - Some yellow and orange inks are not RoHS compliant due to Pb and Cd content
  - Compatible with 260C assembly temperature

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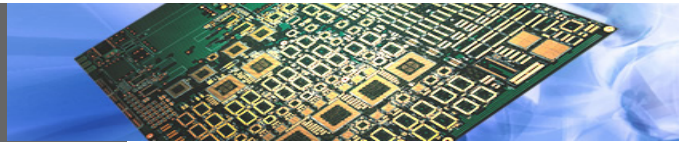
RoHS Compliant Surface Finishes



OSP

Entek 106AX-HT

Immersion Silver

ENIG

Immersion Tin

ENEPIG

Electrolytic Gold

- Multiple surface finishes are available
- Application specific selection process
- Combination finishes are being utilized, some added cost
- Retesting certain finishes for lead-free assembly
- *Note: Sanmina-SCI is UL rated above UL LVLE to 250V for Immersion Silver.*

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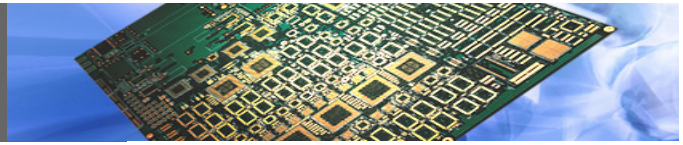
Conversion Process



- Indicate RoHS and lead-free requirements on the PCB fab print and purchase orders
- Switch to a RoHS compliant surface finish
- Change to a lead-free compatible material
- Build and test prototypes
  - Establish that the surface finish is compatible with the assembly process
  - Verify that the material is compatible with the lead-free assembly process
- Convert components/BOM

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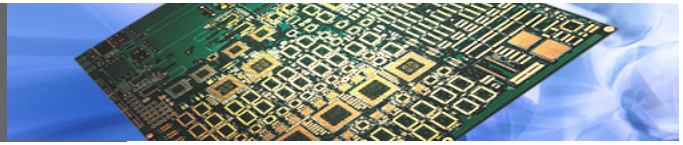
Halogen-free Materials



- What are Halogen-free requirements?
  - Bromine must be below 900 PPM by weight
  - Chlorine must be below 900 PPM by weight
  - Combined Bromine + Chlorine must be below 1200 PPM by weight
- Laminate
  - The TBPPA based fire retardant material must be replaced
  - We do offer Halogen-free materials
- Soldermask
  - Most soldermasks contain chlorine
  - We do have a limited offering of halogen-free masks
  - Several are in the UL approval process (1Q07 approval anticipated)

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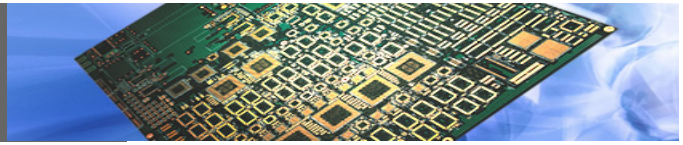
RoHS & Lead Free Summary



- PCB's manufactured by SSCI w/o SnPb are RoHS 6/6 compliant
- PCB's which have a SnPb surface finish can be 5/6 compliant if the OEM takes an exemption
- Lead-free assembly requires that materials are selected that are compatible with the lead-free higher temperature assembly process
- SSCI will work with you to evaluate and recommend materials

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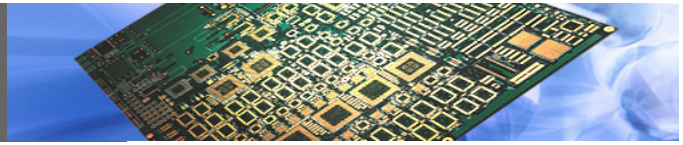

Thank you!!

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