



**DSP 691A (Sn/Ag/Cu)  
LEAD FREE  
NO CLEAN SOLDER  
PASTE**

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**Description**

Qualitek has developed a unique flux system designed for both leaded and lead-free alloys. It provides the fluxing activity levels that promote thermal stability and prevents thermal degradation when reflowing under air atmosphere (normal).

In addition, DSP 691A Lead Free version solder paste exhibits superior joint strength with excellent wettability and print definition; and long tack life. The post soldering residues of DSP 691A are non-conductive and non-corrosive.

**Main Features**

- Low residues
- Extended stencil life
- Long tack time
- Excellent wettability
- Hard non-conductive residues

<b>Flux Classification</b>	<b>Specification</b>	<b>Test Method</b>
<b>Copper Mirror</b>	ROL0	J-STD-004
<b>Silver Chromate</b>	No removal of copper film	IPC-TM-650 2.3.32
<b>Corrosion</b>	Pass	IPC-TM-650 2.3.33
<b>SIR</b>	Pass	IPC-TM-650 2.6.15
J-STD-004	8.87 x 10 <sup>11</sup> ohms	IPC-TM-650 2.6.3.3
<b>Electromigration</b>	Pass	Bellcore GR-78-CORE 13.1.4
<b>Post Reflow Flux Residue</b>	55%	TGA Analysis
<b>Acid Value</b>	90	IPC-TM-650 2.3.13
<b>Metal Loading</b>	89%	IPC-TM-650 2.2.20
<b>Viscosity</b>		
Brookfield <sup>(1)</sup> , kcps	950+/-10% kcps	IPC-TM-650 2.4.34 modified
Malcom <sup>(2)</sup> , poise	1600-2600	IPC-TM-650 2.4.34.3 modified
Thixotropic Index	0.50-0.60	
<b>Slump Test</b>		
25 C, 0.63 vertical/horizontal	No bridges all spacings	IPC-TM-650 2.4.35
150 C, 0.63 vertical/horizontal	No bridges all spacings	IPC-TM-650 2.4.35
25 C, 0.33 vertical/horizontal	0.15 /0.15	IPC-TM-650 2.4.35
150 C, 0.33 vertical/horizontal	0.20/0.20	IPC-TM-650 2.4.35
<b>Solder Ball Test</b>	Pass	IPC-TM-650 2.4.43
<b>Tack</b>		
Initial	75.6 gm	JIS Z 3284
Tack retention @ 24 hr	120.2 gm	JIS Z 3284
Tack retention @ 72 hr	96 gm	JIS Z 3284
<b>Stencil Life</b>	>8 hrs	QIT 3.44.5
<b>Abandon Time</b>	30-60 min	QIT 3.44.6

**Physical Properties**

**Solder Composition**

Qualitek Sn/Ag/Cu (Tin/Silver/Copper) alloys are designed as a lead-free alternative for Sn/Pb alloys for electronics assembly operations. Qualitek Sn/Ag/Cu alloys conform and exceed the impurity requirements of J-STD-006 and all other relevant international standards.

<b>Typical Analysis</b>														
	Sn	Ag	Cu	Pb	Sb	Bi	In	As	Fe	Ni	Cd	Al	Zn	Au
<b>LF955-38</b>	Bal	3.6-4.0	0.5-0.9	0.070 Max	0.200 Max	0.100 Max	0.100 Max	0.030 Max	0.020 Max	0.010 Max	0.002 Max	0.005 Max	0.003 Max	0.050 Max
<b>LF958-35</b>	Bal	3.3-3.7	0.5-0.9	0.070 Max	0.200 Max	0.100 Max	0.100 Max	0.030 Max	0.020 Max	0.010 Max	0.002 Max	0.005 Max	0.003 Max	0.050 Max
<b>LF965-30</b>	Bal	2.8-3.2	0.3-0.7	0.070 Max	0.200 Max	0.100 Max	0.100 Max	0.030 Max	0.020 Max	0.010 Max	0.002 Max	0.005 Max	0.003 Max	0.050 Max
<b>LF217</b>	Bal	3.8-4.2	0.3-0.7	0.070 Max	0.200 Max	0.100 Max	0.100 Max	0.030 Max	0.020 Max	0.010 Max	0.002 Max	0.005 Max	0.003 Max	0.050 Max

	Sn/Ag/Cu	Sn63/Pb37
Melting Point, °C	217-221	183 E
Hardness, Brinell	15HB	14HB
Coefficient of Thermal Expansion	Pure Sn= 23.5	24.7
Tensile Strength, psi	4312	4442
Density, g/cc	7.39	8.42
Electrical Resistivity (μohm-cm)	13.0	14.5
Electrical Conductivity, %IACS	16.6	11.9

	Sn/Ag/Cu	Sn63/Pb37
Yield Strength, psi	3724	3950
Total Elongation,%	27	48
Joint Shear Strength, at 0.1mm/min 20 °C	27	23
Joint Shear Strength, at 0.1mm/min 100 °C	17	14
Creep Strength, N/mm <sup>2</sup> at 0.1mm/min 20 °C	13.0	3.3
Creep Strength, N/mm <sup>2</sup> at 0.1mm/min 100 °C	5	1
Thermal Conductivity, W/m.K	58.7	50.9

**Particle Size**

SAC alloys are available in 3(45-25μm), 4(38-20μm) and 5(25-15μm) J-STD-005 powder distribution. Solder powder distribution is measured utilizing laser diffraction, optical analysis and sieve analysis. Careful control of solder powder manufacturing processes ensures the particles' shape are 95% spherical minimum (aspect ratio < 1.5) and that the alloy contains a typical maximum oxide level of 80 ppm.

**Metal Loading**

Typical metal loading for stencil printing application is **88-89%**. Compared to typical Sn63/Sn62 solder pastes manufactured with 90% by weight metal loading, DSP 691A Lead Free provides as much as 10-12% higher metal volume than Sn63/Sn62. This increased in volume of DSP 691A promotes better wetting and spreading of Sn/Ag/Cu lead free alloy.

## **Printing of Solder Paste**

### **Stencil**

Use of chemical etched/electroformed stencil is preferred however DSP 691A has been used successfully with chemical etch, electroformed, and laser cut stencils.

### **Squeegee**

*Blades:* Metal (stainless steel) squeegee blades angled from 45-60° give the best print definition. Metal (nickel) squeegee blades angled from 45-60° give the best performance. 90 durometer polyurethane may also be used.

*Pressure:* Pressure should be adjusted at the point where the paste leaves a relatively clean stencil after each print pass. Typical pressure setting is 0.6-1.5lb per linear inch of blade.

*Speed:* Normal print speeds are 1.0-2.5 (25-50mm) per second. As print speeds increase pressure will need to be increased. Although slower print speeds are desirable, Qualitek 691A solder paste is capable of printing up to 6 inch per second.

### **Print Definition**

DSP 691A provides excellent print definition characterized by brick-like prints. Good release is seen on 12-9 mil apertures with print speeds in the range of 1.0-6.0 inch per second (25mm-150mm).

### **Open & Abandon Time**

Tests have proven that DSP 691A will perform during continuous printing for up to 8 hrs. Field test have shown that an abandon time of at least 1 hr is possible, resulting in a perfect 1st pass print on resumption of printing.

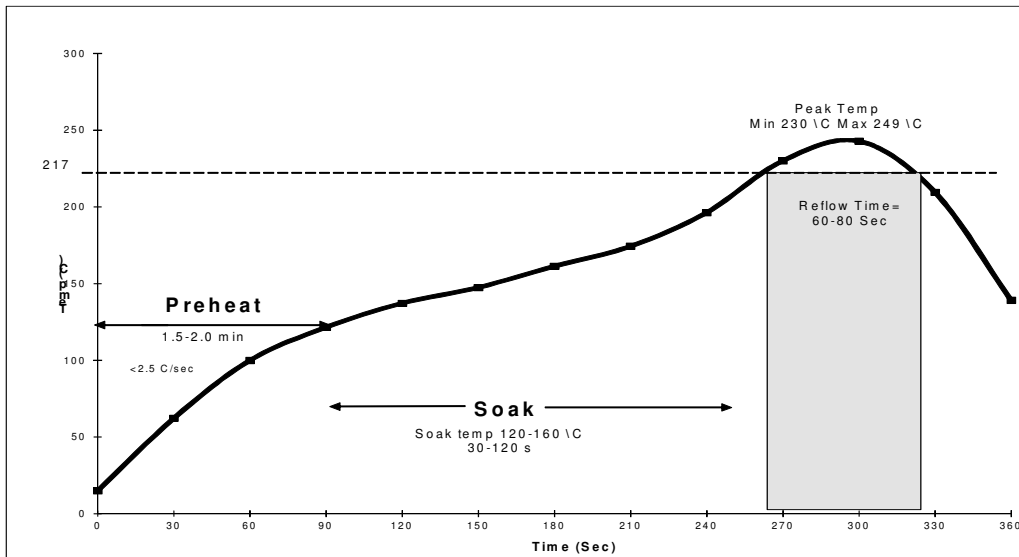
### **Paste Application**

Solder paste should be taken out of the refrigerator at least 3 to 6 hours prior to use. This will give the paste enough time to come to thermal equilibrium with the environment. Also, any fresh jar of solder paste should be gently mixed for at least one minute with a spatula. Be sure not to mix the paste too vigorously, as this will degrade the paste's viscosity characteristics and introduce entrapped air into the paste. The purpose of the mixing is to insure that the paste is smooth and consistent. If solder paste is supplied in cartridges pre-mixing is not necessary due to the shear action produced from the dispensing.

**Reflow**

Best results have been achieved when DSP 691A is reflowed in a **forced air convection** oven with a minimum of 8 zones (top & bottom), however, reflow is possible with a 4 zone oven (top & bottom).

The following is a recommended profile for a forced air convection reflow process. The melting temperature of the solder, the heat resistance of the components, and the characteristics of the PCB (i.e. density, thickness, etc.) determine the actual reflow profile.



**Preheat Zone-** The preheat zone, is also referred to as the ramp zone, and is used to elevate the temperature of the PCB to the desired soak temperature. In the preheat zone the temperature of the PCB is constantly rising, at a rate that should not exceed 2.5 C/sec. The oven's preheat zone should normally occupy 25-33% of the total heated tunnel length.

**The Soak Zone-** normally occupies 33-50% of the total heated tunnel length exposes the PCB to a relatively steady temperature that will allow the components of different mass to be uniform in temperature. The soak zone also allows the flux to concentrate and the volatiles to escape from the paste.

**The Reflow Zone-** or spike zone is to elevate the temperature of the PCB assembly from the activation temperature to the recommended peak temperature. The activation temperature is always somewhat below the melting point of the alloy, while the peak temperature is always above the melting point.

**Flux Residues & Cleaning**

DSP 691A is a no clean formulation therefore the residues do not need to be removed for typical applications. If residue removal is desired, the use of Everkleen 1005 Buffered Saponifier with a 5-15% concentration in hot 60 °C (140 °F) will aid in residue removal.

## **Storage & Shelf Life**

It is recommended that solder paste be stored at a temperature of between 35-50 °F (2-10 °C) to minimize solvent evaporation, flux separation, and chemical activity. If room temperature storage is necessary it should be maintain between 68-77 °F (20-25 °C).

### ***Shelf Life***

Unopened Container (35-50°F/2-10°C) 6 months (from DOM)

Unopened Container (68-77°F/20-25°C) 3 months (from DOM)

## **Working Environment**

Solder paste performs best when used in a controlled environment. Maintaining ambient temperature of between 68-77 °F (20-25 °C) at a relative humidity of 40-65% will ensure consistent performance and maximum life of paste.

## **Cleaning Misprint Boards**

If you should have a misprinted board, the paste may be cleaned off manually with alcohol (IPA) or Qualitek stencil cleaner, SK-11. If you have a more elaborate board cleaner, the paste may be easily removed with use of a 5% saponifier solution in hot DI water. Qualitek SK-45 Stencil Cleaner could be used in this process.

## **Stencil Cleaning**

Periodic cleaning of the stencil during production is recommended to prevent any paste from being deposited in unwanted areas of the board. Without stencil cleaning, solder balling will increase. We recommend a periodic dry wipe (every 5 to 10 boards) with an occasional wet wipe (every 15 to 25 boards). When running fine pitch boards, the cleaning may need to become more frequent. The wet wipes should be performed with either alcohol or a stencil cleaner. Qualitek SK-11 stencil cleaner is designed for this purpose. When cleaning the stencil at the end of a job, the cleaning should be more thorough. If you have stencil cleaning equipment, Qualitek SK- 45 Stencil Cleaner is highly recommended for stencil cleaning purposes.

## **Packaging**

6 oz. Jar	250-500 gm
6 oz. Cartridge	500-700 gm
12 oz. Cartridge	1000-1400gm

## **Disposal**

DSP 691A should be stored in a sealed container and disposed of in accordance with state & local authority requirements.