QUALITEK Technical Bulletin

Delta DSP 863 SAC305 Solder Paste

DESCRIPTION

Dleta DSP 863 utilises a unique flux system designed specifically for high temperature lead free alloys. It provides the fluxing activity levels that promote thermal stability and prevents thermal degradation when reflowing under air atmosphere (normal). Since use of nitrogen is not required, DSP 863 Lead Free solder paste will provide excellent cost savings.
In addition, DSP 863 Lead Free solder paste exhibits superior joint strength, excellent wettability, and extraordinary print definition and tack life. The post soldering residues of DSP 863 are non-conductive, non-corrosive and highly insulated.

FEATURES AND BENEFITS

- Halogen Free
- Low voiding
- Superior Hot Slump
- Extended Stencil Life
- Long tack time
- Excellent wettability
- Medium soft non-cracking residue

FEATURES AND BENEFITS

	Specification	**Test Method**
Flux Classification	ROL0	JSTD-004
Copper Mirror	No removal of copper film	IPC-TM-650 2.3.32
Silver Chromate	Pass	IPC-TM-650 2.3.33
Corrosion	Pass	IPC-TM-650 2.6.15
SIR		
JSTD-004	1.95×10^{10} ohms	IPC-TM-650 2.6.3.3
Bellcore (Telecordia)	5.35×10^{11} ohms	Bellcore GR-78-CORE 13.1.3
Electromigration	Pass	Bellcore GR-78-CORE 13.1.4
Post Reflow Flux Residue	57%	TGA Analysis
Acid Value	140	IPC-TM-650 2.3.13
Metal Loading	88.5%	IPC-TM-650 2.2.20
Viscosity		
Malcom [2], poise	1800-2100	IPC-TM-650 2.4.34.3 modified
Thixotropic Index	0.50-0.60	
Slump Test		
25 C, 0.63 vertical/horizontal	No Bridges - All Spacing	IPC-TM-650 2.4.35
150 C, 0.63 vertical/horizontal	No Bridges - All Spacing	IPC-TM-650 2.4.35
25 C, 0.33 vertical/horizontal	No Bridges - All Spacing	IPC-TM-650 2.4.35
150 C, 0.33 vertical/horizontal	No Bridges - All Spacing	IPC-TM-650 2.4.35
Solder Ball Test	Pass	IPC-TM-650 2.4.43
Tack		
Initial	130 gm	JIS Z 3284
Tack retention @ 24 hr	170 gm	JIS Z 3284
Tack retention @ 72 hr	65 gm	JIS Z 3284
Stencil Life	>8 hrs	QIT 3.44.5
Abandon Time	60 min	QIT 3.44.6

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.

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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 863 Lead Free provides as much as 10-12% higher metal volume than Sn63/Sn62. This increased in volume of DSP 863 promotes better wetting and spreading of Sn/Ag/Cu lead free alloy.

SOLDER COMPOSITION

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

Typical Analysis

	Sn	Ag	Cu	Pb	Sb	Bi	In	As	Fe	Ni	Cd	Al	Zn	Au
LF955-38	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
LF958-35	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
LF965-30	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
LF217	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, ℃	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 ℃	27	23
Joint Shear Strength, at 0.1mm/min 100 ℃	17	14
Creep Strength, N/mm^2 at 0.1mm/min 20 ℃	13.0	3.3
Creep Strength, N/mm^2 at 0.1mm/min 100 ℃	5	1
Thermal Conductivity, W/m.K	58.7	50.9

PRINTING OF SOLDER PASTE

Stencil:

Use of chemical etched/electroformed stencil is preferred however DSP 863 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 0.6-1.5lb per linear inch of blade.

Speed: Normal print speeds are1.0-2.5 (25-50mm) per second. As print speeds increase pressure will need to be increased.

PRINT DEFINITION

DSP 863 provides excellent print definition characterized by brick-like prints. Good release is seen on 12-9 mil apertures with prints speeds in the range of 1.0-6.0 inch per second (25mm-150mm).

OPEN & ABANDON TIME

Tests have proven that DSP 863 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.

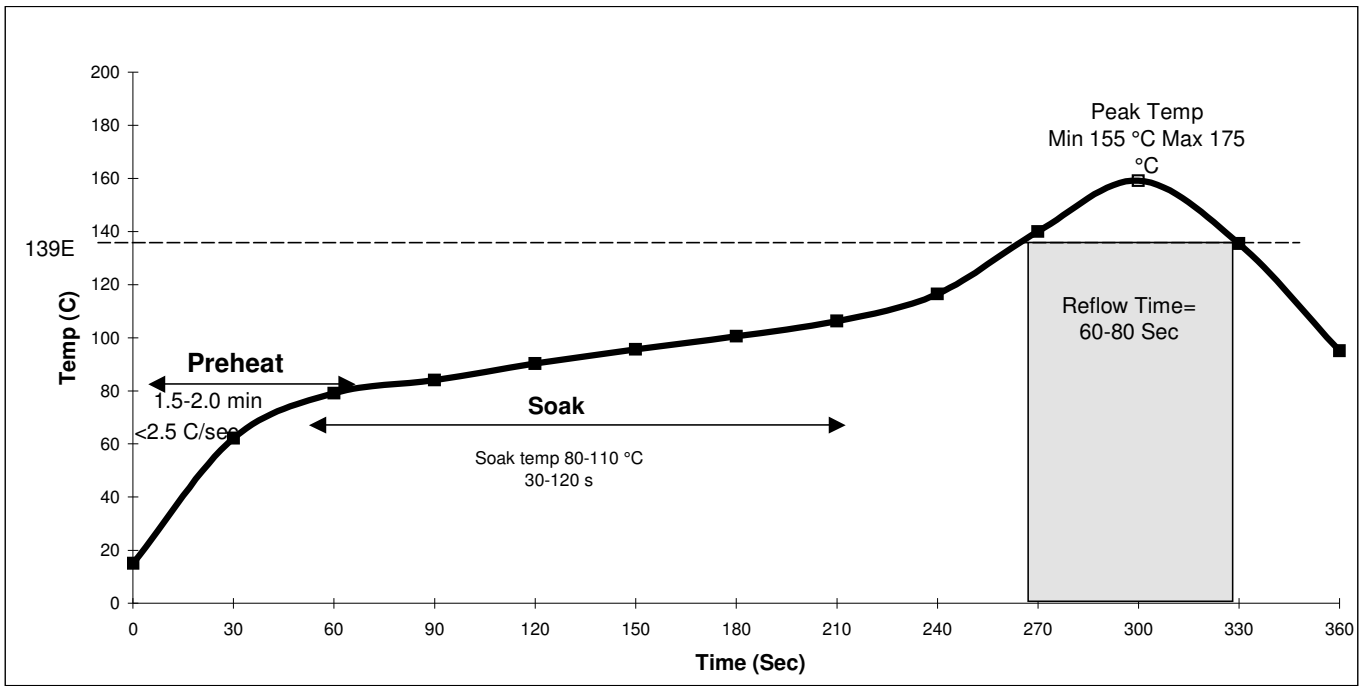
APPLICATION

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 acheived when DSP 863 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.*

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FLUX RESIDUES & CLEANING

DSP 863 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- 25° C) to minimize solvent evaporation, flux separation, and chemical activity. If room temperature storage is necessary it should be maintained between 68-77°F (20-25 °C).

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 stencil cleaner solutions.

STENCIL CLEANING

Periodic cleaning of the stencil during production is recommended to prevent any paste from being deposited in unwanted areas of the board. We recommend a periodic dry wipe (every 5 to 10 boards) with an occasional wet wipe (every 5 to 10 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. Isopropyl Alcohol is designed for this purpose. When cleaning the stencil at the end of a job, the cleaning should be more thorough.

DISPOSAL

DSP 863 should be stored in a sealed container and disposed of in accordance with federal, state and local authority requirements.

PACKAGING

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