ALPHA® OM-353 Solder Paste

No-Clean, Low-Silver, Zero-Halogen, ROL0, Solder Paste for PV Applications

DESCRIPTION

ALPHA OM-353 is a low silver and SAC305 capable paste designed for Type 5 (15 to 25µm) powder to meet market segments requiring ultra-fine features application. It has been tested to give excellent printing performance down to 180µm pad size dimension with a 60° angled squeegee on stencil at 50 mm/s speed, 2 mm/s release speed and 0.18 N/m pressure printing parameters. **ALPHA OM-353** is also available in Type 4 (20-38µm) powder size distribution.

ALPHA OM-353 has been shown to work well in PV Module assembly and other Solar Module applications.

READ ENTIRE TECHNICAL DATA SHEET BEFORE USING THIS PRODUCT

FEATURES & BENEFITS

- **Long Stencil Life:** engineered for consistent performance in warm/humid production climates, reducing variations in print performance and paste dry-out
- **High Tack Force Life:** ensures high pick-and-place yields, good self-alignment
- **Wide Reflow Profile Window:** enables quality soldering of complex, high density PWB assemblies in an N_2 environment, using high ramp rates and soak profiles as high as 170 to 180 °C
- **Good Coalescence under the following conditions**

Powder Size	Reflow Profile (Air)	Alloy	
		SAC305	SACX 0307
T5	Low Soak	160 microns	170 microns
	High Soak	160 microns	170 microns

- **Excellent Solder Joint and Flux Residue Cosmetics:** residue does not char or burn after reflow soldering, even when using long/high thermal soaking
- **Excellent Voiding Performance:** Pass IPC7095 Class III requirement for BGA
- **Halogen Content:** Zero Halogen, no halogen intentionally added
- **Reliability:** Pass JIS Copper Corrosion Test and all standard SIR Tests
- **Safe and Environmentally Friendly:** Materials comply with ROHS, TSCA, EINECS and Halogen-free requirements (Zero Halogen, see table below)
- **Low-Silver** alloy availability.

PRODUCT INFORMATION

Alloys:	SAC305, SAC105, Sn96.5Ag3.5, SACX® Plus 0307, Innolot
Powder Size:	Type 4 & Type 5
Packaging Sizes:	500 gram jars, 6” & 12” cartridges
Flux Gel:	Flux gel is available in 10 and 30 cc syringes for rework applications
Lead Free:	RoHS Directive EU/2015/863; amending Annex II of 2011/65/EU

NOTE 1: For other alloys, powder size and packaging sizes, contact your local Alpha Sales Office.

HALOGEN STATUS

Halogen Standards			
Standard	**Requirement**	**Test Method**	**Status**
JEITA ET-7304A Definition of Halogen Free Soldering Materials	< 1000 ppm Br, Cl, I, F in solder material solids	**TM EN 14582**	Pass
IEC 612249-2-21	Post Soldering Residues contain < 900 ppm each or total of < 1500 ppm Br or Cl from flame retardant source		Pass
JEDEC A Guideline for Defining "Low Halogen" Electronics	Post soldering residues contain < 1000 ppm Br or Cl from flame retardant source		Pass
Zero Halogen: No halogenated compounds have been intentionally added to this product			

TECHNICAL DATA

Category	Results	Procedures/Remarks
Chemical Properties		
Activity Level	ROL0	IPC J-STD-004B
Halide Content	Halide free (by I.C.), < 0.05%	IPC J-STD-004B
Fluoride Spot Test	Pass	JIS Z 3197:1999 8.1.4.2.4
Halogen Test	Pass, Zero Halogen - No halogen intentionally added	EN14582, by oxygen bomb combustion, Non-detectable (ND) at < 50 ppm
Ag Chromate Test	Pass	IPC J-STD-004B
	Pass	JIS Z 3197:1999 8.1.4.2.3
Copper Mirror Test	Pass	IPC J-STD-004B
	Pass	JIS Z 3197:1999 8.4.2
Copper Corrosion Test	Pass (No evidence of Corrosion)	IPC J-STD-004B
	Pass (No evidence of Corrosion)	JIS Z 3197:1999 8.4.1
Electrical Properties		
Water Extract Resistivity	11,500 ohm-cm	JIS Z 3197:1999 8.1.1
SIR (7 days, 40°C/90%RH, 12 V bias)	Pass	IPC J-STD-004B TM-650 2.6.3.7 (Pass ≥ 1 x 10^8 ohm)
JIS Electromigration (1000 hrs @ 85°C/85%RH 48V)	Pass	JIS Z 3197:1999 8.5.4 (Pass ≥ 1 x 10^9 ohm)
Bono Test 85°C 85% RH and 50 V bias	Pass	Bono Test
Physical Properties		
Color	Clear, Colorless Flux Residue	
Tack Force vs. Humidity	**Pass,** > 100gf over 24 hours at 25%, 50% and 75% Relative Humidity	JIS Z 3284:1994, Annex 9

Category	Results	Procedures/Remarks
	Pass, Change of <1g/mm2 over 24 hours at 25% and 75% Relative Humidity	IPC J-STD-005 TM-650 2.4.44
Coalescence Test – finest feature	160 µm (SAC305, T5 powder)	Internal Test Method
Solder Ball	Preferred	IPC J-STD-005, TM-650 2.4.43
Spread	>80%	JIS Z 3198 3
Stencil Life	>8 hours	@ 50% RH 23°C (74°C)
Cold/Printing Slump	No bridge for 0.3 mm space	JIS Z 3284:1994 Annex 7
	No bridge for 0.3 mm space	IPC J-STD-005, TM-650 2.4.35
Hot Slump	No bridge for 0.3 mm space	JIS Z 3284:1994 Annex 8
	No bridge for 0.3 mm space	IPC J-STD-005, TM-650 2.4.35
Dryness Test (Talc)	Pass	JIS Z 3197:1999 8.5.1

PROCESSING GUIDELINES

Storage & Handling	Printing	Reflow (see Fig. 1)	Cleaning
1. Refrigerate to guarantee stability @ 0-10 °C (32 to 50 °F). When stored under these conditions, the shelf life of OM-353 is 6 months. 2. Paste can be stored for 2 weeks at room temperature up to 25°C(77°F) prior to use 3. When refrigerated, warm up paste container to room temperature for up to 4 hours. Paste must be 19°C (66°F) before processing. Verify paste temperature with a thermometer to ensure paste is at 19°C (66°F) or greater before set up of printer. 4. Paste can be manually stirred before use. A rotating/Centrifugal force mixing operation is not required. If a rotating/centrifugal force mixing is used, 30 - 60 seconds at 300 RPM is adequate. 5. Do not remove worked paste from stencil and mix with unused paste in jar. This will alter the rheology of unused paste. 6. These are starting recommendations and all process settings should be reviewed independently.	**Stencil:** Recommend ALPHA CUT, ALPHA NICKEL-CUT, ALPHA TETRABOND, or ALPHA FORM stencils @ 0.100 to 0.150 mm (4 to 6 mil) thick for 0.4 to 0.5 mm (0.016" or 0.020") pitch. Stencil design is subject to many process variables. Contact your local Alpha stencil site for advice. **Squeegee:** Metal (recommended) **Pressure:** 0.21 to 0.36 kg/cm of blade (1.25 to 2.0 lbs/inch) **Speed:** 25 to 150 mm per second (1 to 6 inches per second). **Paste Roll:** 1.5 to 2.0 cm diameter and make additions when roll reaches 1-cm (0.4") diameter (min). Max roll size will depend upon blade. **Stencil Release Speed:** 1 to 5 mm/sec. **Lift Height:** 8 to 14mm (0.31 to 0.55")	**Atmosphere:** Clean-dry air or nitrogen atmosphere. **Profile:** Soak: 155 to 175 °C, 60 to 100 sec soak profiles have been determined to give optimal results, please see profile chart, ALPHA OM-353 SAC305/SACX Plus 0307 Typical Reflow Profile. If required, good results are also achievable with high soak temperature profiles of 170 to 180 °C for 60 to120s, especially in N_2. Typical peak temperature is 235 to 245 °C. NOTE 2: Keeping the peak temperature below 241 °C may reduce the number and size of BGA and QFN voids. NOTE 3: Refer to component and board supplier data for thermal properties at elevated temperatures. Lower peak temperatures require longer TAL for improved joint cosmetics.	**ALPHA OM-353** residue is designed to remain on the board after reflow. If reflowed residue cleaning is required, Vigon A201 (in line cleaning), Vigon A 250 (Batch Cleaning) or Vigon US (Ultrasonic Cleaning) are recommended. Vigon is a registered trademark of Zestron. Misprints and stencil cleaning may be done with IPA, ALPHA SM-110E and ALPHA SM-440.

REFLOW PROFILES

Fig 1: ALPHA OM-353 SAC305/SACX Plus 0307
Typical Reflow Profile (High Soak)

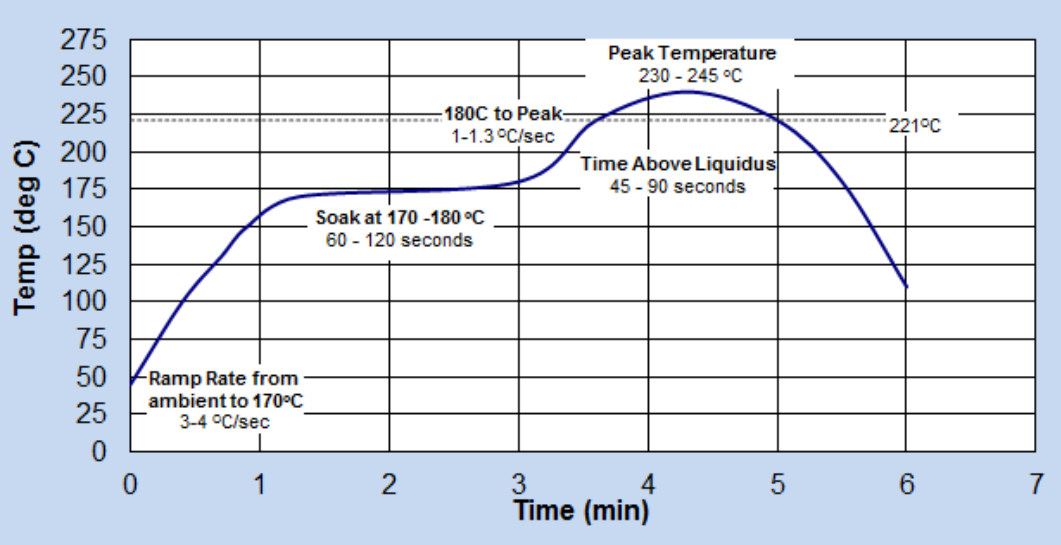
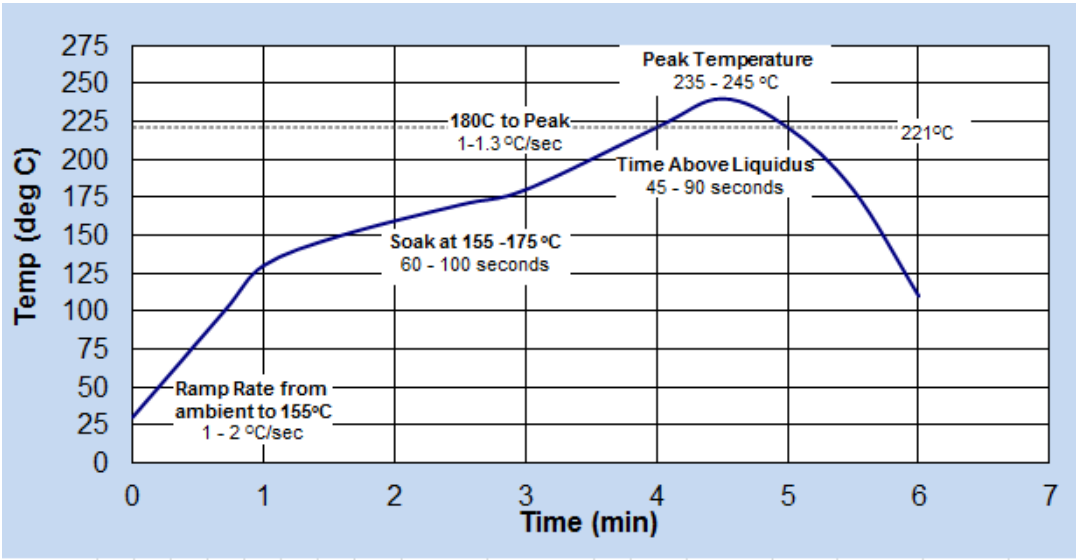


Fig 2: ALPHA OM-353 SAC305/SACX Plus 0307
Typical Reflow Profile (Low Soak - Preferable)



NOTE 4: These are profiles that were tested in the lab with acceptable reflow and coalescence performance. Optimization to each board application should still be carried out by users to ensure best results.

SOLAR APPLICATION

1. **What are the variable parameters affecting dispensing?**
   - 1.1. **Product (paste) Parameters:** Viscosity, flow behavior, wetting behavior, temperature stability, homogeneity, and voids.
   - 1.2. **Machine Parameters:** Nozzle distance to substrate, dwell time between dispenses, "Z" height return, I.D. of needle, dispensed dot diameter, pressure, dispense time.
2. **What parameters affect the volume and shape of dispensed paste?**
   - 2.1. **Surface Tension:** The ability of a material to adhere to a surface. For instance, material and needle nozzle; material and substrate. It should be greater between the material and the substrate (board).
   - 2.2. **Shot Size:** The time a valve or pressure is actuated and as related to the nozzle gap ("Z" height from nozzle tip to substrate).
   - 2.3. **Nozzle Gap:** Dictates shot size. A rule of thumb is that the nozzle or needle gap = ½ needle I.D.
     - 2.3.1. **Footed Nozzles:** A fixed distance "foot" is appended to the needle body and extends a distance below the needle tip, allowing the same gap between tip and substrate when the needle "bottoms out" on the substrate at each dispense.
     - 2.3.2. **Unfooted Nozzles:** Gap is determined manually, with a camera, by touch probe or by laser sensor.
     - 2.3.3. **Consequences of gap too high:** Insufficient shot size, lowers surface tension, results in intermittent dispenses.
     - 2.3.4. **Consequences of gap too low:** Shot size is too large resulting nozzle contamination, tailing of material and dot defects.
   - 2.4. **Nozzle Gauge:** Determines smallest dot (1.5 x Needle I.D.).
   - 2.5. **Dwell Time:** Set in milliseconds on automated equipment or by trial and error on manual equipment. What happens within these milliseconds of the dispense portion of the cycle? The needle remains in the down position after dispensing to allow the material to wet sufficiently for the proper surface tension. When tension between material and substrate is achieved, the needle lifts up, and the tension allows the material to part from the needle tip and material within the needle and stay on the substrate. Manipulating the dwell will affect throughput and the dot profile.
   - 2.6. **Up Height:** The distance the needle moves up after a dispense. Modern dispensers can be adjusted by .001" increments to optimize clean paste snap off from the needle.
3. **Addressing Common Defects:**
   - 3.1. **Tailing** is caused by: Insufficient shot size; Nozzle gap too high; Up-height too low; paste chemistry.
   - 3.2. **Bulging Paste Bump:** Insufficient nozzle gap; Shot size too large.
4. **What about the Nozzles (needles)?**
   - 4.1. **Types:** Plastic, stainless steel, conical walled, straight walled, chamfered tips, footed and non-footed needles, luer lock and set screw locked.

4.2. Nozzle Selection Criteria: Dot size (1.5 x I.D. needle); For larger dots, increase shot size or use a larger needle; Too small a nozzle may result in excessive shot size if pressure is allowed to rule.

5. What are the types of dispensing methods? The 3 most common are: time/pressure, positive displacement piston and positive displacement rotary pump.

5.1. Time/Pressure: Proven technology where you can discard used needles and syringes It is difficult to set up, not suitable for reproducing very small volumes, and is subject to volume variation with changes in temperature and syringe volume (bubble effect).

5.2. Positive Displacement (Piston): Consistent dots, low air pressure, but each piston pump is made for a specific dot size and must be removed and recalibrated for a new size.

5.3. Positive Displacement (Rotary): Consistent dots, infinite dot size flexibility, ambient temperature dispensing, simple setup and process control. Speed is dependent on needle size and requires more cleaning than time/pressure equipment.

6. Does the plunger (follower) in the syringe have an effect on dispensing?

6.1. Plungers are available in rubber, compounds, metal and plastic. They are either straight or concave walled. On PV-300, Orange plastic, straight walled followers (plungers) in the syringes provide best results in the widest range of applications. These plungers work best with high speed, automated equipment and require proper setup on time/pressure systems providing optimum results.

7. Summary:

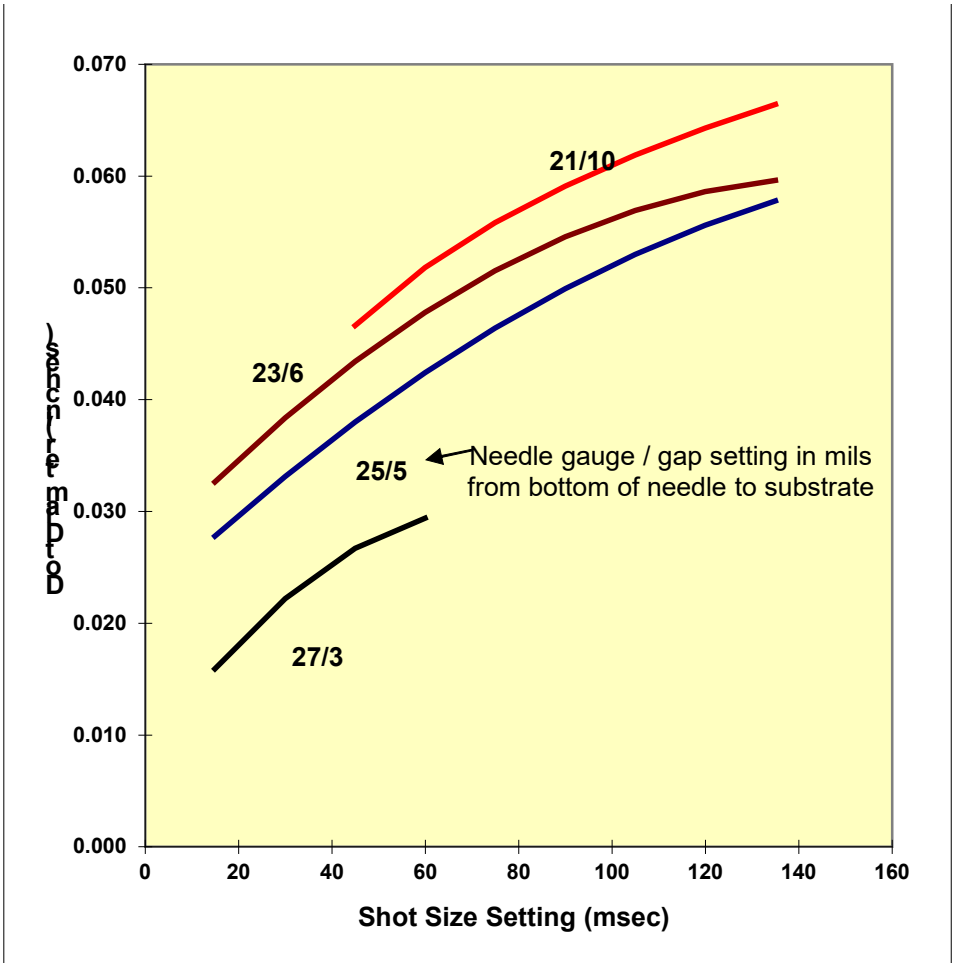
7.1. Surface tension plays a key role in dispensing. Set up to optimize surface tension.

7.2. Nozzle gap must be balanced with shot size and speed.

7.3. Nozzle gauge and shot size control dot profile.

7.4. Investment in correct method and process optimization ensures success.

7.5. A “needle guide” is attached below (Courtesy Speedline CAMALOT)


0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
0
20
40
60
80
100
120
140
160
Shot Size Setting (msec)
21/10
23/6
25/5
27/3
Needle gauge / gap setting in mils
from bottom of needle to substrate

RECYCLING SERVICES

We provide safe and efficient recycling services to help companies meet their environmental and legislative requirements and at the same time, maximize the value of their waste streams.

Our service collects solder dross, solder scrap, and various forms of solder paste waste. Please contact your local sales representative for recycling capabilities in your area or link here.

SAFETY & WARNING

It is recommended that the company/operator read and review the Safety Data Sheets for the appropriate health and safety warnings before use. **Safety Data Sheets are available at MacdermidAlpha.com/assembly-solutions/knowledge-base.**

CONTACT INFORMATION

To confirm this document is the most recent version, please contact Assembly@MacDermidAlpha.com

www.macdermidalpha.com

North America	Europe	Asia
109 Corporate Blvd. South Plainfield, NJ 07080, USA 1.800.367.5460	Unit 2, Genesis Business Park Albert Drive Woking, Surrey, GU21 5RW, UK 44.01483.758400	8/F., Paul Y. Centre 51 Hung To Road Kwun Tong, Kowloon, Hong Kong 852.3190.3100

Also read carefully warning and safety information on the Safety Data Sheet. This data sheet contains technical information required for safe and economical operation of this product. READ IT THOROUGHLY PRIOR TO PRODUCT USE. Emergency safety directory assistance: US 1 202 464 2554, Europe + 44 1235 239 670, Asia + 65 3158 1074, Brazil 0800 707 7022 and 0800 172 020, Mexico 01800 002 1400 and (55) 5559 1588