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## PRODUCT CHANGE NOTICE PCN Form (D4-E000-73)

**PCN#19-049**

**NOTIFICATION DATE: April 22, 2019**

### **MODEL(S) AFFECTED:**

MMIC Devices using Package types:

**MAV, MCLP, MXC, MXP, SOIC, SOT-143, SOT-23, SOT-89** (see attached list for specific models)

### **EXTENT OF CHANGE:**

- Replacement of existing SnAgNi (tin-silver over nickel) plating with industry standard 100% Matte-Tin for RoHS + suffix part numbers

### **EFFECT OF CHANGE:**

- No change to FIT (dimensions) or FUNCTION (electrical or process performance)
- Change to FORM in the surface plating used to interface with customer assembly
- Surface plating for affected models is evaluated and qualified per our standard process for solderability, joint reliability and tin whisker and is already in use with other existing Mini-Circuits MMIC products.

### **REASON FOR CHANGE:**

Existing plating supplier shut-down, SnAgNi is unique to this supplier. Matte tin is a well-established RoHS compliant finish in the industry, and currently used extensively at Mini-Circuits on other MMIC products. Mini-Circuits will offer SnPb plating as a customer special for those with 'No Pure Tin' restrictions. Contact Sales for quoted delivery.

### **EFFECTIVE DATE OF CHANGE:**

- Immediate based on exhaustion of stock or customer request
- For Samples if required, please contact your account manager or click on "[Contact Us](#)" to be contacted by a Mini-Circuits customer service representative

### **LAST TIME BUY OF EXISTING SnAgNi PLATED PARTS:**

Acceptance of Last Time Buy Orders (as defined below) is subject to availability of existing SnAgNi plated parts ("Existing Parts") as determined by Mini-Circuits. All Last Time Buy Orders are non-cancellable and non-returnable. For purposes hereof, the term "Last Time Buy Orders" refers to orders for Existing Parts that are placed with Mini-Circuits on or after the notification date of this product change notice.

### **ATTACHMENTS:**

List of applicable models

[Frequently Asked Questions and Qualification Report for the matte tin finish](#)

**QUESTIONS?**

**[PLEASE CONTACT US.](#)**

AS9100 ISO9001 ISO14001 Certified to QMS and EMS

PCN19-049\_050119-4.doc Rev.: A M135112 (01/16/12) File: PCN19-049\_050119-4.doc

Refer to Procedure: D3-E040

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**Attachment to PCN#19-049**

<b>** List of Affected Models **</b>				
AVA-183+	CY2-143+	ERA-1SM-7	ERA-3SM-22+	ERA-5+
AVA-183A+	D17IA+	ERA-2 99+	ERA-3SM-24+	ERA-50SM+
AVA-24+	D17W+	ERA-2+	ERA-3SM-30+	ERA-50SM-4+
AVA-24-1	D20C+	ERA-21SM+	ERA-3SM-31+	ERA-50SM-6+
AVA-24A+	D20C-3+	ERA-2-3+	ERA-3SM-32+	ERA-51HIREL
AVM-273HP+	EP2C+	ERA-2-5	ERA-3SM-38+	ERA-51SM+
AVM-273HPK+	EP2C-1+	ERA-29SM	ERA-3SM-39+	ERA-51SM-18.2DB
BP2C+	EP2C-2+	ERA-2HIREL	ERA-3SM-40+	ERA-5-2+
BP2C1+	EP2C-6+	ERA-2SM 99+	ERA-3SM-8+	ERA-5-3
BP2G+	EP2K+	ERA-2SM+	ERA-4+	ERA-59SM
BP2G1+	EP2K-1+	ERA-2SM-15	ERA-4-2+	ERA-59SM+
BP2G-6+	EP2K-2+	ERA-2SM-16+	ERA-4SM 99+	ERA-5SM+
BP2P+	EP2W+	ERA-2SM-16DB	ERA-4SM+	ERA-5SM-10
BP2P1+	EP2W1+	ERA-2SM-18+	ERA-4SM-10+	ERA-5SM-13+
BP2U+	ERA-1 99+	ERA-2SM-20+	ERA-4SM-11	ERA-5SM-14
BP2U1+	ERA-1+	ERA-2SM-22+	ERA-4SM-12	ERA-5SM-15+
BP4C+	ERA-1-3	ERA-2SM-24+	ERA-4SM-13	ERA-5SM-16
BP4C-1	ERA-1HIREL	ERA-2SM-25+	ERA-4SM-13.5DB	ERA-5SM-17
BP4C1+	ERA-1SM 99+	ERA-2SM-3+	ERA-4SM-14.4DB	ERA-5SM-19
BP4C-1+	ERA-1SM+	ERA-2SM-5+	ERA-4SM-15	ERA-5SM-2
BP4C1-2+	ERA-1SM-14+	ERA-2SM-7	ERA-4SM-16	ERA-5SM-20DB
BP4C1-3+	ERA-1SM-16+	ERA-3+	ERA-4SM-17+	ERA-5SM-22
BP4C-5	ERA-1SM-17+	ERA-33SM+	ERA-4SM-21+	ERA-5SM-23
BP4P+	ERA-1SM-18+	ERA-33SM-1+	ERA-4SM-6	ERA-5SM-30
BP4P1+	ERA-1SM-19+	ERA-3-4+	ERA-4SM-8	ERA-5SM-32+
BP4U+	ERA-1SM-4	ERA-3HIREL	ERA-4SM-9	ERA-5SM-37+
BP4U1+	ERA-1SM-5+	ERA-3SM 99+	ERA-4XSM+	ERA-5SM-38+
BP4U1-1+	ERA-1SM-6+	ERA-3SM+	ERA-4XSM-2+	ERA-5SM-4

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** List of Affected Models **				
ERA-5SM-40+	GALI-3+	GALI-51+	GALI-6-8+	GAT-12+
ERA-5SM-6+	GALI-3-10+	GALI-5-1+	GALI-6-9+	GAT-15+
ERA-5SM-7	GALI-3-16+	GALI-51-11+	GALI-6F+	GAT-2+
ERA-5SM-9	GALI-3-3	GALI-51-12+	GALI-6F-5+	GAT-20+
ERA-5XSM+	GALI-33+	GALI-51-2+	GALI-6F-7+	GAT-2-1+
ERA-6+	GALI-33-1	GALI-5-12+	GALI-74+	GAT-2-2+
ERA-6SM+	GALI-33-5+	GALI-51-9+	GALI-74-10+	GAT-3+
ERA-6SM-10+	GALI-33-6+	GALI-51F+	GALI-74-11+	GAT-30+
ERA-6SM-12+	GALI-3-6+	GALI-51F-1+	GALI-74-13+	GAT-3-1+
ERA-6SM-14+	GALI-3-7+	GALI-52+	GALI-74-15+	GAT-3-2+
ERA-6SM-15+	GALI-39+	GALI-52-4+	GALI-74-5+	GAT-4+
ERA-6SM-16+	GALI-39-10+	GALI-5-3	GALI-74-6+	GAT-4-2+
ERA-6SM-2+	GALI-39-11+	GALI-5-3+	GALI-74-7+	GAT-5+
ERA-6SM-8+	GALI-39-13+	GALI-55+	GALI-84+	GAT-6+
ERA-8SM+	GALI-39-14+	GALI-55-1+	GALI-84-1+	GAT-6-1+
ERA-8SM-1+	GALI-39-3+	GALI-55-2+	GALI-84-2+	GAT-7+
ERA-8SM-2+	GALI-39-8+	GALI-5-8+	GALI-84-4+	GAT-8+
ERA-9SM+	GALI-4+	GALI-5-9	GALI-84-7+	GAT-9+
GALI-21+	GALI-4-1+	GALI-59+	GALI-REP-1+	GAT-9-1
GALI-2-10+	GALI-4-10+	GALI-59-3+	GALI-S66+	GP2S+
GALI-21-1	GALI-4-11+	GALI-59-5+	GALI-S66-2+	GP2S1+
GALI-21-1+	GALI-4-13+	GALI-5F+	GALI-S66-4+	GP2S1-5+
GALI-21-3+	GALI-4-3	GALI-5F-1+	GALI-S66-5+	GP2S-3+
GALI-21-6+	GALI-4-6	GALI-5F-2+	GAT-0+	GP2S-4+
GALI-21-7+	GALI-4-8+	GALI-6+	GAT-0-1+	GP2S-7+
GALI-24+	GALI-49+	GALI-6-11+	GAT-0-2+	GP2X+
GALI-29+	GALI-4F+	GALI-6-2+	GAT-1+	GP2X1+
GALI-2-9+	GALI-5+	GALI-6-3	GAT-10+	GP2X-1+

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<b>** List of Affected Models **</b>				
GP2X1-11+	GVA-62-2+	K-LAT-1+	LAT-4-6+	LEE-9+
GP2X1-12+	GVA-62-3+	KXMA-1+	LAT-4-7+	LHA-1+
GP2X1-2+	GVA-63+	LAT-0+	LAT-5+	LHA-1H+
GP2X1-3+	GVA-63-1+	LAT-0-1+	LAT-5-8+	LLM-43-1+
GP2X1-5+	GVA-63-2+	LAT-0-2+	LAT-6+	LVA-123+
GP2X1-6+	GVA-63-3+	LAT-0-4+	LAT-6-6+	LVA-84-1+
GP2X-2+	GVA-63-5+	LAT-1+	LAT-6-7+	M3SWA-2-50DR10+
GP2X-3+	GVA-63-6+	LAT-10+	LAT-7+	M3SWA-2-50DR-8+
GP2X-4+	GVA-81+	LAT-10-6+	LAT-7-5+	M3SWA-2-50DRA+
GP2X-5+	GVA-81-2+	LAT-1-10+	LAT-8+	MAR-1+
GP2X-6+	GVA-81-3+	LAT-12+	LAT-8-6+	MAR-1-11
GP2X-7+	GVA-81-5	LAT-15+	LAT-9+	MAR-1-3
GP2Y+	GVA-82+	LAT-15-4+	LEE-19+	MAR-1-7
GP2Y1+	GVA-82-2+	LAT-1-8+	LEE-19-3+	MAR-1-8
GP2Y-1+	GVA-82-3+	LAT-1-9+	LEE2-6+	MAR-1-9
GP2Y1-2+	GVA-83+	LAT-2+	LEE-29+	MAR-1A
GP2Y1-4+	GVA-83-1+	LAT-20+	LEE-29-4-1+	MAR-1A+
GP2Y1-5+	GVA-83-6+	LAT-20-1	LEE-29-7+	MAR-1SM+
GP2Y-3+	GVA-84+	LAT-20-5+	LEE-29-8+	MAR-1SM-10
GVA-123+	GVA-84-1+	LAT-2-6+	LEE-39+	MAR-1SM-11+
GVA-123-1+	GVA-84-2+	LAT-2-8+	LEE-39-10+	MAR-1SM-2
GVA-123-2+	GVA-84-3+	LAT-3+	LEE-39-11	MAR-1SM-5
GVA-123-3+	GVA-84-4+	LAT-30+	LEE-39-12+	MAR-1SM-8
GVA-123-4+	GVA-84-8	LAT-3-10+	LEE-39-3+	MAR-2+
GVA-60+	GVA-84-9+	LAT-3-12+	LEE-39-5+	MAR-2-1
GVA-60-1+	GVA-91+	LAT-3-13+	LEE-39-6+	MAR-2-2
GVA-62+	GVA-92+	LAT-3-8+	LEE-49+	MAR-2-4
GVA-62-1+	GVA-93+	LAT-4+	LEE-59+	MAR-2SM+

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<b>** List of Affected Models **</b>				
MAR-2SM-5	MAR-3SM-3	MAR-4SM-2	MAR-7SM-15+	MAV-11-6
MAR-2SM-6+	MAR-3SM-31+	MAR-4SM-3	MAR-7SM-6	MAV-11A+
MAR-3+	MAR-3SM-33+	MAR-4SM-4	MAR-7SM-8	MAV-11BSM+
MAR-3-10	MAR-3SM-5	MAR-4SM-6	MAR-7SM-9	MAV-11BSM-2+
MAR-3-11	MAR-3SM-6	MAR-4SM-7	MAR-7SM-HIREL	MAV-1A+
MAR-3-12.0DB	MAR-3SM-9	MAR-6+	MAR-8A+	MAV-2A+
MAR-3-16	MAR-4+	MAR-6-2.6DB	MAR-8A-1+	MAV-4SM
MAR-3-3	MAR-4-1	MAR-6-2.6SM	MAR-8ASM+	MAV-4SM+
MAR-3-4	MAR-4-10	MAR-6-8	MAR-8ASM-10+	MDA4-752H+
MAR-3-5	MAR-4-11	MAR-6SM+	MAR-8ASM-5+	MDB-24H+
MAR-3-7	MAR-4-12	MAR-6SM-11	MAR-8ASM-6+	MDB-73H+
MAR-3SM 99+	MAR-4-13	MAR-6SM-17.7DB	MAR-8ASM-7+	MDB-73H-2+
MAR-3SM+	MAR-4-14	MAR-6SM-18.6DB	MAR-8ASM-9+	MDB-73H-3+
MAR-3SM-10	MAR-4-15	MAR-6SM-25+	MAR-8SM-10	MERA-533+
MAR-3SM-11	MAR-4-16+	MAR-6SM-27	MAR-8SM-17+	MERA-556+
MAR-3SM-12	MAR-4-2	MAR-6SM-29+	MAR-8SM-18+	MERA-7433+
MAR-3SM-12DB-1	MAR-4-3	MAR-6SM-30+	MAR-8SM-19+	MERA-7433-1+
MAR-3SM-14	MAR-4-4	MAR-6SM-31+	MAR-8SM-21+	MERA-7456+
MAR-3SM-17	MAR-4-5	MAR-7+	MAR-8SM-3	MGVA-62+
MAR-3SM-19	MAR-4-7	MAR-7-12.8DB	MAR-8SM-6	MGVA-62-1+
MAR-3SM-20	MAR-4-8	MAR-7-4	MAV-11+	MGVA-63+
MAR-3SM-21	MAR-4-9	MAR-7-5	MAV-11-11	MNA-2A+
MAR-3SM-22	MAR-4SM+	MAR-7-6	MAV-11-12	MNA-2W+
MAR-3SM-23	MAR-4SM-11	MAR-7SM+	MAV-11-13	MNA-3A+
MAR-3SM-24+	MAR-4SM-13	MAR-7SM-12	MAV-11-14	MNA-4+TRH
MAR-3SM-25	MAR-4SM-15+	MAR-7SM-13	MAV-11-17	MNA-4-3
MAR-3SM-28	MAR-4SM-16+	MAR-7SM-13+	MAV-11-18	MNA-4A+
MAR-3SM-29+	MAR-4SM-17	MAR-7SM-14+	MAV-11-3	MNA-4A-1+

## PRODUCT CHANGE NOTICE

### PCN Form (D4-E000-73)

**Attachment to PCN#19-049**

<b>** List of Affected Models **</b>				
MNA-4W+	PAT-1+	PAT-15+	PAT-3+	PAT-4-5
MNA-5-1	PAT-10+	PAT-15-1	PAT-30+	PAT-4-8
MNA-5A+	PAT-10-1	PAT-15-2	PAT-30-3+	PAT-5+
MNA-6-1	PAT-10-11+	PAT-15-3	PAT-30-4+	PAT-5-10+
MNA-6-2+	PAT-10-13+	PAT-15-7+	PAT-30-5+	PAT-5-11+
MNA-6-3	PAT-10-14+	PAT-15-8+	PAT-3-10	PAT-5-2
MNA-6-6+ LTB	PAT-10-15+	PAT-15-9+	PAT-3-11	PAT-5-3
MNA-6A+	PAT-10-17+	PAT-1-6	PAT-3-14	PAT-5-4
MNA-6A-1+	PAT-10-2	PAT-1-8	PAT-3-18	PAT-5-5
MNA-6A-2+	PAT-10-5	PAT-2+	PAT-3-2	PAT-5-6
MNA-6W+	PAT-10-6	PAT-20+	PAT-3-20+	PAT-5-9+
MNA-7-11+	PAT-10-7	PAT-20-1	PAT-3-22+	PAT-6+
MNA-7-3	PAT-10-9+	PAT-20-2	PAT-3-23+	PAT-6-1
MNA-7-4	PAT-1-1	PAT-20-3	PAT-3-24+	PAT-6-10
MNA-7-6+	PAT-1-11	PAT-20-6+	PAT-3-4	PAT-6-12
MNA-7A+	PAT-1-14+	PAT-20-7+	PAT-3-5	PAT-6-13+
MNA-7A-1+	PAT-1-16+	PAT-20-8+	PAT-3-7	PAT-6-15+
MPGA-105+	PAT-1-17+	PAT-20-9+	PAT-3-8	PAT-6-16+
MSW-2-20+	PAT-1-18+	PAT-2-10	PAT-3-9	PAT-6-17+
MSW-2-20-7+	PAT-12+	PAT-2-12+	PAT-4+	PAT-6-18+
MSW-2-20-8+	PAT-12-1	PAT-2-13+	PAT-4-10	PAT-6-19
MSWA-2-20+	PAT-12-2	PAT-2-14+	PAT-4-12+	PAT-6-2
MSWA-2-20-6+	PAT-12-4+	PAT-2-15+	PAT-4-13+	PAT-6-5
MTX2-73+	PAT-12-5+	PAT-2-2	PAT-4-14+	PAT-6-6
PAT-0+	PAT-12-6+	PAT-2-3	PAT-4-15+	PAT-6-7
PAT-0-1	PAT-1-3	PAT-2-4	PAT-4-2	PAT-7+
PAT-0-3+	PAT-1-4	PAT-2-5	PAT-4-3	PAT-7-1
PAT-0-4+	PAT-1-5	PAT-2-6	PAT-4-4	PAT-7-2

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**Attachment to PCN#19-049**

<b>** List of Affected Models **</b>				
PAT-7-3	PGA-103-11+	PHA-22-2+	RAM-4+	TAV-541+
PAT-7-6+	PGA-103-12+	PHA-22H+	RAM-4-14+	TAV-551+
PAT-7-7+	PGA-103-2+	PMA2-153LN+	RAM-4-7	TAV-581+
PAT-7-8+	PGA-103-3+	PMA2-33LN+	RAM-6A+	TP2G-1+
PAT-8+	PGA-103-4+	PMA2-43LN+	RAM-6A-1+	TP2G-3+
PAT-8-1	PGA-103-5+	PMA3-83LN+	RAM-7+	TSS-53LNB+
PAT-8-10+	PGA-103-8+	PMA3-83LN-10+	RAM-7-10	TSS-53LNB-2+
PAT-8-2	PGA-103-9+	PMA3-83LN-3+	RAM-7-11+	TSS-53LNB3+
PAT-8-3	PGA-105+	PMA3-83LN-4+	RAM-8A+	TSS-53LNB-4
PAT-8-4	PGA-105-1+	PMA3-83LN-5+	RAM-8A-1+	TSS-53LNB-5+
PAT-8-8+	PGA-105-2+	PMA3-83LN-6+	SP-2C+	VAM-3+
PAT-8-9+	PGA-105-3+	PMA3-83LN-7+	SP-2C1+	VAM-6+
PAT-9+	PGA-105-6+	PMA3-83LN-8+	SP-2C-1+	VAM-7+
PAT-9-1	PGA-105-7+	PMA3-83LN-9+	SP-2C-2+	VAM-7-2+
PAT-9-10+	PGA-106-75+	PMA4-33GLN+	SP-2G+	VAM-77+
PAT-9-11+	PGA-122-75+	PMA-545+	SP-2G1+	VAM-93+
PAT-9-12+	PHA-1+	PMA-5451+	SP-2L+	VNA-28B+
PAT-9-2	PHA-101+	PMA-5452+	SP-2L-1+	WP4A+
PAT-9-4	PHA-1-1+	PMA-5453+	SP-2L-2+	WP4A-1
PAT-9-5	PHA-1-12+	PMA-5454+	SP-2P+	WP4C+
PAT-9-6	PHA-1-15+	PMA-5455+	SP-2P1+	WP4C1+
PAT-9-9+	PHA-1-20+	PMA-5456+	SP-2U+	WP4C1-2+
PGA-102+	PHA-1-22+	PMA-545G1+	SP-2U1+	WP4F+
PGA-102-3+	PHA-1-4+	PMA-545G1-2	SP-2U2+	WP4F1+
PGA-102-4+	PHA-1-6+	PMA-545G1-3+	SP-2U2-1+	WP4G+
PGA-103+	PHA-1H+	RAM-1+	SP-2W+	WP4G1+
PGA-103-1+	PHA-22+	RAM-2+	SP-2W1+	WP4G-1+
PGA-103-10+	PHA-22-1+	RAM-3+	SP-2W1-1+	WP4G1-1+

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Attachment to PCN#19-049

<b>** List of Affected Models **</b>		
WP4L+	XLF-122-1	YSF-162+
WP4M+	XLF-123-2+	YSF-272+
WP4N+	XLF-133+	YSF-322+
WP4P+	XLF-133-1+	YSF-382+
WP4P1+	XLF-14+	
WP4P1-1+	XLF-151+	
WP4R+	XLF-173+	
WP4R-1	XLF-173-1+	
WP4R1+	XLF-173-2+	
WP4S+	XLF-192+	
WP4S-1	XLF-221+	
WP4U+	XLF-252+	
WP4U1+	XLF-252-1+	
WP4W+	XLF-332+	
WP4W1+	XLF-421+	
XBF-282+	XLF-551+	
XBF-282-1	XLF-63+	
XHF2-1162+	XLF-73+	
XHF2-1352+	XLF-73-1+	
XHF2-153+	XLF-732+	
XHF2-1832+	XLF-762+	
XHF-23+	XLF-861+	
XHF-252+	XLF-962+	
XHF2-912+	XLF-962-1+	
XHF-392+	XLF-982+	
XLF-122+	YSF-122+	
XLF-123+	YSF-2151+	
XLF-123-1+	YSF-232+	



PCN#19-049



# FAQ

## Frequently Asked Questions:

### 1.0 Why the change in plating formulation (Tin-Silver over Nickel to Matte Tin)?

This plating was a proprietary formulation from a specific plating house that we have used for many years. The plater will be shutting down as of the end of this month, with very little notification and no last time buy opportunity.

### 2.0 Will we be using a new plater for the matte tin?

**No.** We have used this plater for many years and several of our MMIC product line has been matte tin plated since inception.

### 3.0 Why do we consider this as a change to FORM and not FIT or FUNCTION?

**FORM** is interpreted as the physical appearance of the part, **FIT** is the mechanical dimensions and **FUNCTION** is the performance. The change is to the plating interface of the part only. There is no change to dimensions, layout requirements or performance.

### 4.0 Will this affect the customer soldering or assembly processes?

It will not. The same solder and profiles can be used interchangeably.

### 5.0 If there a concern for Tin Whisker since the plating is now pure tin?

The PCN is accompanied by a qualification report which includes tin whisker test verification.

#### **Whisker Mitigation methods:**

Use of Matte Tin over Copper. Plating thickness 300-800 micro-inch. Annealed at 150°C for 1 hour, 24 hour maximum staging time.

### 6.0 Will there be a change to the part number?

Part numbers will remain unchanged

### 7.0 How will matte tin parts be identified?

Reel labels contain 'e' codes that identify surface plating per JESD97. Matte Tin parts will have an 'e3' code.

### 8.0 Will customers be able to evaluate matte tin parts before acceptance?

Mini-Circuits has stock of many of the affected parts with matte tin plating. Please contact your representative or account manager for samples as needed. However, this does not imply that the transition to Matte Tin will be delayed pending customer approval.

**MINI-CIRCUITS**

**RELIABILITY QUALIFICATION REPORT**

**FOR**

**PURE MATTE TIN**

**PLATING**

**Mini-Circuits Confidential**

**Report Dated: 17-December-2015**

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## **1. BACKGROUND**

Mini-Circuits proposed to adopt Pure Matte Tin plating for lead frame base surface mount packages. The packages selected for qualification are Micro-X Plastic (ERA-3SM+), QFN/DFN (LEE-39+), SOT-89 (Gali-6F+), SOT-143 (LAT-1+), SOT-23 (TP2G-3+), SOIC (BP4C+) and Micro-X Ceramic (PAT-15+). The qualification criteria are based on passing moisture sensitivity level 1, package reliability and whiskers growth test.

## **2. PURE MATTE TIN PLATING – Evolving Trend**

Pure Matte Tin plating is fast becoming the “chosen one” and is most demanded lead free alternative. Its advantages include compatibility with lead-containing solder paste, good solderability and wetting properties. It has excellent control and uniformity of plating thickness, good electrical / heat conductivity, good corrosion resistance and non-toxicity. Pure matte tin plating has gain worldwide acceptance as an alternative in lead free plating and it is RoHS compliant.

## **3. PLATING FEATURE AND SPECIFICATION**

We adopted Pure Matte Tin Plating with post plate annealing to relieve the compressive stresses in the plated deposits. The plating thickness range is 300 ~ 800 micro-inch and annealed at 150°C for 1 hour.

## 4. QUALIFICATION PLAN

In keeping with guidelines established for new plating qualification, representative samples from each package family were selected. A detail qualification test conditions is listed below.

### 4.1 QUALIFICATION TEST CONDITIONS

Test Required		Test Condition	Reference Documents	Sample Size
Moisture Sensitivity Level 1				
MSL 1	Dry Bake	Temperature: 125°C Duration: 24 hours	Jedec Standard, J-Std-020D.01, Level 1	45 units
	Moisture Soak	Temperature: 85°C RH: 85%RH Duration: 168 hours		
	Reflow	Tmax: 260°C Cycles: 3		
Resistance to Heat (Reflow)		Tmax: 260°C Cycles: 3		45 units
Reliability Stress Test				
Temperature Cycle		T <sub>hot</sub> : +150°C T <sub>cold</sub> : -65°C Dwell Time: 15 min Cycles: 500	Jedec Standard, JESD22-A104D, Test Condition C	23 units
Autoclave		Temperature: 121°C RH: 100% Pressure: 15 psig Duration: 96 hours	Jedec Standard, JESD22-A102D, Test Condition C	22 units

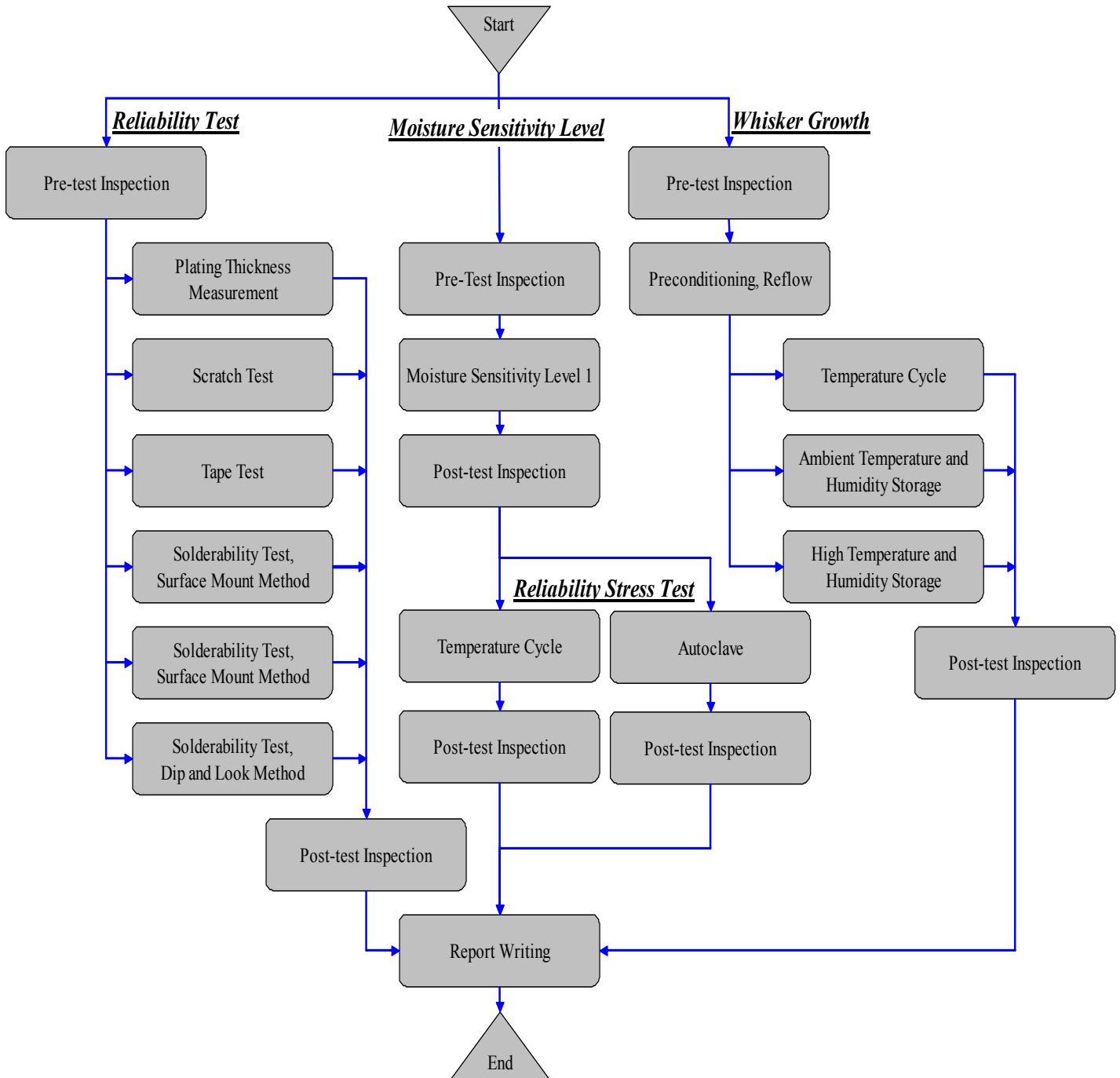
Reliability Test			
Plating Thickness Measurement	X-Ray Fluorescent method Thickness: 300u” to 800u”	Jedec Standard, JESD213	30 units
Scratch Test	Temperature: 150°C Duration: 24 hours	Mini-Circuits, IP-57	30 units
Tape Test	Temperature: 150°C Duration: 24 hours	Mini-Circuits, IP-57	30 units
Solderability Test, Surface Mount Method	Steam Ageing: 8 hours Steam Temperature: 93°C Reflow SnAgCu: 245°C	Jedec Standard, JESD22-B102, Method 2	30 units
Solderability Test, Surface Mount Method	Steam Ageing: 8 hours Steam Temperature: 93°C Reflow SnPb: 225°C	Jedec Standard, JESD22-B102, Method 2	30 units
Solderability Test, Dip and Look Method	Steam Ageing: 8 hours Steam Temperature: 93°C Solder SnAgCu: 245°C	Jedec Standard, JESD22-B102, Method 1	30 units

Whisker Growth			
Preconditioning, Reflow	Peak Temperature: 260°C Cycles: 3	Jedec Standard, JESD22A121 and JESD201	12 units
Temperature Cycle	T <sub>hot</sub> : +85°C T <sub>cold</sub> : -55°C Dwell Time: 10 min Cycles: 1500	Jedec Standard, JESD22A121 and JESD201	4 units
Ambient Temperature and Humidity Storage	Temperature: 30°C RH: 60% Duration: 4000 hours	Jedec Standard, JESD22A121 and JESD201	4 units
High Temperature and Humidity Storage	Temperature: 55°C RH: 85% Duration: 4000 hours	Jedec Standard, JESD22A121 and JESD201	4 units

Note:

- a. T<sub>max</sub> means Maximum Temperature
- b. T<sub>hot</sub> means Hot Temperature
- c. T<sub>cold</sub> means Cold Temperature
- d. RH means Relative Humidity
- e. SnAgCu means Tin Silver Copper
- f. SnPb means Tin Lead

## 4.2 QUALIFICATION FLOW CHART (Note: Jecdec Ref#JESD47)





## 5. QUALIFICATION RESULTS

Test Performed	Test Point	XRF Reading	Post-test (reject/inspected)
Reliability Test – Plating Thickness Measurement			
LAT-1+	Post-test	421u” to 737u”	0/30 units
LEE-39+	Post-test	313u” to 351u”	0/30 units
Gali-6F+	Post-test	320u” to 377u”	0/30 units
ERA-3SM+	Post-test	328u” to 413u”	0/30 units
TP2G-3+	Post-test	494u” to 744u”	0/30 units
BP4C+	Post-test	300u” to 394u”	0/30 units
PAT-15+	Post-test	397u” to 775u”	0/30 units

Test Performed	Test Point	Pre-test (reject/inspected)	Post-test (reject/inspected)
Reliability Test – Scratch Test			
LAT-1+	Pre-test and Post-test	0/30 units	0/30 units
LEE-39+	Pre-test and Post-test	0/30 units	0/30 units
Gali-6F+	Pre-test and Post-test	0/30 units	0/30 units
ERA-3SM+	Pre-test and Post-test	0/30 units	0/30 units
TP2G-3+	Pre-test and Post-test	0/30 units	0/30 units
BP4C+	Pre-test and Post-test	0/30 units	0/30 units
PAT-15+	Pre-test and Post-test	0/30 units	0/30 units

Test Performed	Test Point	Pre-test (reject/inspected)	Post-test (reject/inspected)
Reliability Test – Tape Test			
LAT-1+	Pre-test and Post-test	0/30 units	0/30 units
LEE-39+	Pre-test and Post-test	0/30 units	0/30 units
Gali-6F+	Pre-test and Post-test	0/30 units	0/30 units
ERA-3SM+	Pre-test and Post-test	0/30 units	0/30 units
TP2G-3+	Pre-test and Post-test	0/30 units	0/30 units
BP4C+	Pre-test and Post-test	0/30 units	0/30 units
PAT-15+	Pre-test and Post-test	0/30 units	0/30 units

Test Performed	Test Point	Pre-test (reject/inspected)	Post-test (reject/inspected)
Reliability Test – Solderability Test, surface mount method – SnAgCu solder paste, @245°C			
LAT-1+	Pre-test and Post-test	0/30 units	0/30 units
LEE-39+	Pre-test and Post-test	0/30 units	0/30 units
Gali-6F+	Pre-test and Post-test	0/30 units	0/30 units
ERA-3SM+	Pre-test and Post-test	0/30 units	0/30 units
TP2G-3+	Pre-test and Post-test	0/30 units	0/30 units
BP4C+	Pre-test and Post-test	0/30 units	0/30 units
PAT-15+	Pre-test and Post-test	0/30 units	0/30 units

Test Performed	Test Point	Pre-test (reject/inspected)	Post-test (reject/inspected)
Reliability Test – Solderability Test, surface mount method – SnPb solder paste, @ 225°C			
LAT-1+	Pre-test and Post-test	0/30 units	0/30 units
LEE-39+	Pre-test and Post-test	0/30 units	0/30 units
Gali-6F+	Pre-test and Post-test	0/30 units	0/30 units
ERA-3SM+	Pre-test and Post-test	0/30 units	0/30 units
TP2G-3+	Pre-test and Post-test	0/30 units	0/30 units
BP4C+	Pre-test and Post-test	0/30 units	0/30 units
PAT-15+	Pre-test and Post-test	0/30 units	0/30 units

Test Performed	Test Point	Pre-test (reject/inspected)	Post-test (reject/inspected)
Reliability Test – Solderability Test, dip and look method – SnAgCu solder paste, @ 245°C			
LAT-1+	Pre-test and Post-test	0/30 units	0/30 units
LEE-39+	Pre-test and Post-test	0/30 units	0/30 units
Gali-6F+	Pre-test and Post-test	0/30 units	0/30 units
ERA-3SM+	Pre-test and Post-test	0/30 units	0/30 units
TP2G-3+	Pre-test and Post-test	0/30 units	0/30 units
BP4C+	Pre-test and Post-test	0/30 units	0/30 units
PAT-15+	Pre-test and Post-test	0/30 units	0/30 units

Test Performed		Test Point	Pre-test (reject/inspected)	Post-test (reject/inspected)
Moisture Sensitivity Level 1				
LAT-1+	External Visual	Pre-test and Post-test	0/45 units	0/45 units
	Electrical Test		0/45 units	0/45 units
	SAM Analysis		0/45 units delam	0/45 units delam
LEE-39+	External Visual	Pre-test and Post-test	0/45 units	0/45 units
	Electrical Test		0/45 units	0/45 units
	SAM Analysis		0/45 units delam	0/45 units delam
Gali-6F+	External Visual	Pre-test and Post-test	0/45 units	0/45 units
	Electrical Test		0/45 units	0/45 units
	SAM Analysis		0/45 units delam	0/45 units delam
ERA-3SM+	External Visual	Pre-test and Post-test	0/45 units	0/45 units
	Electrical Test		0/45 units	0/45 units
	SAM Analysis		0/45 units delam	0/45 units delam
TP2G-3+	External Visual	Pre-test and Post-test	0/45 units	0/45 units
	Electrical Test		0/45 units	0/45 units
	SAM Analysis		0/45 units delam	0/45 units delam
BP4C+	External Visual	Pre-test and Post-test	0/45 units	0/45 units
	Electrical Test		0/45 units	0/45 units
	SAM Analysis		0/45 units delam	0/45 units delam

Test Performed		Test Point	Pre-test (reject/inspected)	Post-test (reject/inspected)
Resistance to Heat - Reflow 3 Cycles at 260°C				
PAT-15+	External Visual	Pre-test and Post-test	0/45 units	0/45 units
	Electrical Test		0/45 units	0/45 units

Test Performed		Test Point	Pre-test (reject/inspected)	Post-test (reject/inspected)
Reliability Stress Test – Temperature Cycle, 500 cycles				
LAT-1+	External Visual	Pre-test and Post-test	0/23 units	0/23 units
	Electrical Test		0/23 units	0/23 units
LEE-39+	External Visual	Pre-test and Post-test	0/23 units	0/23 units
	Electrical Test		0/23 units	0/23 units
Gali-6F+	External Visual	Pre-test and Post-test	0/23 units	0/23 units
	Electrical Test		0/23 units	0/23 units
ERA-3SM+	External Visual	Pre-test and Post-test	0/23 units	0/23 units
	Electrical Test		0/23 units	0/23 units
TP2G-3+	External Visual	Pre-test and Post-test	0/23 units	0/23 units
	Electrical Test		0/23 units	0/23 units
BP4C+	External Visual	Pre-test and Post-test	0/23 units	0/23 units
	Electrical Test		0/23 units	0/23 units
PAT-15+	External Visual	Pre-test and Post-test	0/23 units	0/23 units
	Electrical Test		0/23 units	0/23 units

Test Performed		Test Point	Pre-test (reject/inspected)	Post-test (reject/inspected)
Reliability Stress Test – Autoclave, 96 hours				
LAT-1+	External Visual	Pre-test and Post-test	0/22 units	0/22 units
	Electrical Test		0/22 units	0/22 units
LEE-39+	External Visual	Pre-test and Post-test	0/22 units	0/22 units
	Electrical Test		0/22 units	0/22 units
Gali-6F+	External Visual	Pre-test and Post-test	0/22 units	0/22 units
	Electrical Test		0/22 units	0/22 units
ERA-3SM+	External Visual	Pre-test and Post-test	0/22 units	0/22 units
	Electrical Test		0/22 units	0/22 units
TP2G-3+	External Visual	Pre-test and Post-test	0/22 units	0/22 units
	Electrical Test		0/22 units	0/22 units
BP4C+	External Visual	Pre-test and Post-test	0/22 units	0/22 units
	Electrical Test		0/22 units	0/22 units

Test Performed		Test Point	Pre-test (reject/inspected)	Post-test (reject/inspected)
Whisker Growth – Preconditioning Reflow at 260°C				
LAT-1+	External Visual	Pre-test and Post-test	0/12 units	0/12 units
LEE-39+	External Visual	Pre-test and Post-test	0/12 units	0/12 units
Gali-6F+	External Visual	Pre-test and Post-test	0/12 units	0/12 units
ERA-3SM+	External Visual	Pre-test and Post-test	0/12 units	0/12 units
TP2G-3+	External Visual	Pre-test and Post-test	0/12 units	0/12 units
BP4C+	External Visual	Pre-test and Post-test	0/12 units	0/12 units
PAT-15+	External Visual	Pre-test and Post-test	0/12 units	0/12 units

Test Performed		Test Point	Pre-test (reject/inspected)	Post-test (reject/inspected)
Whisker Growth – Temperature Cycle, 1500 cycles				
LAT-1+	External Visual	Pre-test and Post-test	0/4 units	0/4 units
LEE-39+	External Visual	Pre-test and Post-test	0/4 units	0/4 units
Gali-6F+	External Visual	Pre-test and Post-test	0/4 units	0/4 units
ERA-3SM+	External Visual	Pre-test and Post-test	0/4 units	0/4 units
TP2G-3+	External Visual	Pre-test and Post-test	0/4 units	0/4 units
BP4C+	External Visual	Pre-test and Post-test	0/4 units	0/4 units
PAT-15+	External Visual	Pre-test and Post-test	0/4 units	0/4 units

Test Performed		Test Point	Pre-test (reject/inspected)	Post-test (reject/inspected)
Whisker Growth – Ambient Temperature and Humidity Storage, 4000 hours				
LAT-1+	External Visual	Pre-test and Post-test	0/4 units	0/4 units
LEE-39+	External Visual	Pre-test and Post-test	0/4 units	0/4 units
Gali-6F+	External Visual	Pre-test and Post-test	0/4 units	0/4 units
ERA-3SM+	External Visual	Pre-test and Post-test	0/4 units	0/4 units
TP2G-3+	External Visual	Pre-test and Post-test	0/4 units	0/4 units
BP4C+	External Visual	Pre-test and Post-test	0/4 units	0/4 units
PAT-15+	External Visual	Pre-test and Post-test	0/4 units	0/4 units

Test Performed		Test Point	Pre-test (reject/inspected)	Post-test (reject/inspected)
Whisker Growth – High Temperature and Humidity Storage, 4000 hours				
LAT-1+	External Visual	Pre-test and Post-test	0/4 units	0/4 units
LEE-39+	External Visual	Pre-test and Post-test	0/4 units	0/4 units
Gali-6F+	External Visual	Pre-test and Post-test	0/4 units	0/4 units
ERA-3SM+	External Visual	Pre-test and Post-test	0/4 units	0/4 units
TP2G-3+	External Visual	Pre-test and Post-test	0/4 units	0/4 units
BP4C+	External Visual	Pre-test and Post-test	0/4 units	0/4 units
PAT-15+	External Visual	Pre-test and Post-test	0/4 units	0/4 units



## 6. RESULTS SUMMARY

The use of Pure Matte Tin Plating complies with the reliability guidelines documented in the qualification plan

- a. All packages passed Moisture Sensitivity Level 1 and Reliability Stress Test
- b. All packages passed Plating Thickness measurement
- c. There is no plating peeling after Scratch Test and Tape Test for all packages
- d. All packages passed surface mount solderability test using both SnAgCu and SnPb solder paste
- e. All packages passed solderability test for dip and look method using SnAgCu solder paste
- f. All packages passed whisker growth test after ambient temperature / humidity test, high temperature / humidity test, and temperature cycle test

## 7. CONCLUSION

The qualification results demonstrate that pure matte tin plate on Cu and Alloy lead frame complies with the reliability guidelines documented in the qualification plan. Compliance was based on passing moisture sensitivity level 1, package reliability and whisker growth test requirements. Therefore Pure Matte Tin plating is released for production in Mini-Circuits.