Reliability Qualification Report

Interface Product Family

ZT3243LEEA/ZT3243LFEA

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Reliability Life Test Result

<u>Life Test</u>

Life Testing is performed to determine if device has any fundamental reliability related failure mechanisms, which can be divided into 4 main groups:

- Process or die related failures, such as oxide-related defects, metallization-related defects and diffusion-related defects.
- Assembly-related defects such as wire bonding or package-related failures.
- Design-related defects.
- Miscellaneous, undetermined or application-induced failures.

<u>Life Test Result</u>

Product Family: ZT3243E Low Power 3V to 5.5V RS232 Transceiver
Device Type: ZT3241E/ZT3243E
ZT3241F/ZT3243F
Mask Sets: MS101
Process: Zywyn 2µm CMOS SC2 Technology
Package Type: 28L SSOP
Die Attach Adhesive: 84-1LMISR4
Bond Wire: 1.0 mil AU

Test: HTOL 1,000 hrs, 3.3V Dynamic Burn-In at 125°C
Reference Standard: Mil-Std-883

Pass/Fail Criteria: Electrical QA testing to datasheet limits at 25°C before and after stress.

Device Type	HTOL Test	Lot Number	Date Completed	Burn-In Temperature (°C)	Sample Size	No. of Fails
ZT3243LEEA	1,000 hr @ 3.3V	B5A07159	1/20/2010	125	20	0

FIT Rate Calculation

The FIT (failures in time) is the calculated as follows,

$$FR\ (\text{Chi-squared}) = \chi^2_{2n+2} / (2 \times AF \times \text{device-hours}) \times 10^9$$

where AF is the acceleration factor and n is the number of failures. The value is highly dependent on the following:

1. Life test conditions (duration, temperature, sample size and number of failures)
2. Activation energy of the potential failure modes

The weighted activation energy, Ea, of observed failure mechanisms of Zywyn products has been determined to be 0.8eV.

Based on the above criteria, the FIT rates at 25°C, 55°C, and 70°C operation at both 60% and 90% confidence levels for Zywyn's ZT3243E products have been calculated and are listed below.

ZT3243E/

Confidence Level	+25°C	+55°C	+75°C
60%	45.9	792.9	4033.6
90%	18.3	315.6	1605.5

1 FIT = 1 failure per billion device hours

ESD Test Results

Summary:

ZT3243 Series

Device Type	ESD Test	Lot Number	Date Completed	Sample Size	No. of Fails
ZT3243LEEA	±15kV Air Gap Discharge	B3609F52V	06/15/04	14	0
ZT3243LEEA	±8kV Contact Discharge	B3609F52V	06/15/04	14	0

ESD report ZT3243LEEA 1/20/2010 EN61000-4-2 Contact Discharge
LOT B5A07159 DATECODE 0922

CONDITIONS

Vcc= 3.3V, Driver and Receiver enabled.
3 continuous contact discharges on the RS232 I/O (TXOUT and RXIN) pins 4-11 while Transmitter Inputs (TXIN), pins 12-14, are equal to 3.3V (logic 1) and 0V (logic 0). After each ESD test, the functionality is verified and the test will be repeated with an increment of 0.5KV on the ESD voltage.

ESD GUN

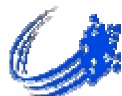
SCHAFFNER NSG-435

UNIT #	Contact Discharge	Pin Name	Status	Signature	Comment
1	±6.0KV	T1OUT (DI=1)	PASS	CL	
	±6.0KV	T2OUT (DI=1)	PASS	CL	
	±6.0KV	T3OUT (DI=1)	PASS	CL	
	±6.0KV	R1IN (DI=1)	PASS	CL	
	±6.0KV	R2IN (DI=1)	PASS	CL	
	±6.0KV	R3IN (DI=1)	PASS	CL	
	±6.0KV	R4IN (DI=1)	PASS	CL	
	±6.0KV	R5IN (DI=1)	PASS	CL	
	±6.0KV	T1OUT (DI=0)	PASS	CL	
	±6.0KV	T2OUT (DI=0)	PASS	CL	
	±6.0KV	T3OUT (DI=0)	PASS	CL	
	±6.0KV	R1IN (DI=0)	PASS	CL	
	±6.0KV	R2IN (DI=0)	PASS	CL	
	±6.0KV	R3IN (DI=0)	PASS	CL	
	±6.0KV	R4IN (DI=0)	PASS	CL	
	±6.0KV	R5IN (DI=0)	PASS	CL	
	±7.0KV	T1OUT (DI=1)	PASS	CL	
	±7.0KV	T2OUT (DI=1)	PASS	CL	
	±7.0KV	T3OUT (DI=1)	PASS	CL	
	±7.0KV	R1IN (DI=1)	PASS	CL	
	±7.0KV	R2IN (DI=1)	PASS	CL	
	±7.0KV	R3IN (DI=1)	PASS	CL	
	±7.0KV	R4IN (DI=1)	PASS	CL	
	±7.0KV	R5IN (DI=1)	PASS	CL	
	±7.0KV	T1OUT (DI=0)	PASS	CL	
	±7.0KV	T2OUT (DI=0)	PASS	CL	
	±7.0KV	T3OUT (DI=0)	PASS	CL	
	±7.0KV	R1IN (DI=0)	PASS	CL	
	±7.0KV	R2IN (DI=0)	PASS	CL	
	±7.0KV	R3IN (DI=0)	PASS	CL	
	±7.0KV	R4IN (DI=0)	PASS	CL	
	±7.0KV	R5IN (DI=0)	PASS	CL	
	±7.5KV	T1OUT (DI=1)	FAIL	CL	FAILED -7.5KV

UNIT #	Contact Discharge	Pin Name	Status	Signature	Comment
2	±7.0KV	T1OUT (DI=1)	PASS	CL	
	±7.0KV	T2OUT (DI=1)	PASS	CL	
	±7.0KV	T3OUT (DI=1)	PASS	CL	
	±7.0KV	R1IN (DI=1)	PASS	CL	
	±7.0KV	R2IN (DI=1)	PASS	CL	
	±7.0KV	R3IN (DI=1)	PASS	CL	
	±7.0KV	R4IN (DI=1)	PASS	CL	
	±7.0KV	R5IN (DI=1)	PASS	CL	
	±7.0KV	T1OUT (DI=0)	PASS	CL	
	±7.0KV	T2OUT (DI=0)	PASS	CL	
	±7.0KV	T3OUT (DI=0)	PASS	CL	
	±7.0KV	R1IN (DI=0)	PASS	CL	
	±7.0KV	R2IN (DI=0)	PASS	CL	
	±7.0KV	R3IN (DI=0)	PASS	CL	
	±7.0KV	R4IN (DI=0)	PASS	CL	
	±7.0KV	R5IN (DI=0)	PASS	CL	
	±7.5KV	T1OUT (DI=1)	PASS	CL	
	±7.5KV	T2OUT (DI=1)	PASS	CL	
	±7.5KV	T3OUT (DI=1)	PASS	CL	
	±7.5KV	R1IN (DI=1)	PASS	CL	
	±7.5KV	R2IN (DI=1)	PASS	CL	
	±7.5KV	R3IN (DI=1)	PASS	CL	
	±7.5KV	R4IN (DI=1)	PASS	CL	
	±7.5KV	R5IN (DI=1)	PASS	CL	
	±7.5KV	T1OUT (DI=0)	PASS	CL	
	±7.5KV	T2OUT (DI=0)	PASS	CL	
	±7.5KV	T3OUT (DI=0)	PASS	CL	
	±7.5KV	R1IN (DI=0)	PASS	CL	
	±7.5KV	R2IN (DI=0)	PASS	CL	
	±7.5KV	R3IN (DI=0)	PASS	CL	
	±7.5KV	R4IN (DI=0)	PASS	CL	
	±7.5KV	R5IN (DI=0)	PASS	CL	
	±8.0KV	T1OUT (DI=1)	PASS	CL	
	±8.0KV	T2OUT (DI=1)	FAIL	CL	FAILED -8.0KV
3	±7.5KV	T1OUT (DI=1)	FAIL	CL	FAILED +7.5KV

UNIT #	Contact Discharge	Pin Name	Status	Signature	Comment
4	±8.0KV	T1OUT (DI=1)	PASS	CL	
	±8.0KV	T2OUT (DI=1)	PASS	CL	
	±8.0KV	T3OUT (DI=1)	PASS	CL	
	±8.0KV	R1IN (DI=1)	PASS	CL	
	±8.0KV	R2IN (DI=1)	PASS	CL	
	±8.0KV	R3IN (DI=1)	PASS	CL	
	±8.0KV	R4IN (DI=1)	PASS	CL	
	±8.0KV	R5IN (DI=1)	PASS	CL	
	±8.0KV	T1OUT (DI=0)	PASS	CL	
	±8.0KV	T2OUT (DI=0)	PASS	CL	
	±8.0KV	T3OUT (DI=0)	PASS	CL	
	±8.0KV	R1IN (DI=0)	PASS	CL	
	±8.0KV	R2IN (DI=0)	PASS	CL	
	±8.0KV	R3IN (DI=0)	PASS	CL	
	±8.0KV	R4IN (DI=0)	PASS	CL	
	±8.0KV	R5IN (DI=0)	PASS	CL	
	±8.5KV	T1OUT (DI=1)	PASS	CL	
	±8.5KV	T2OUT (DI=1)	PASS	CL	
	±8.5KV	T3OUT (DI=1)	PASS	CL	
	±8.5KV	R1IN (DI=1)	PASS	CL	
	±8.5KV	R2IN (DI=1)	PASS	CL	
	±8.5KV	R3IN (DI=1)	PASS	CL	
	±8.5KV	R43IN (DI=1)	FAIL	CL	FAILED +8.5KV
5	±7.0KV	T1OUT (DI=1)	PASS	CL	
	±7.0KV	T2OUT (DI=1)	PASS	CL	
	±7.0KV	T3OUT (DI=1)	PASS	CL	
	±7.0KV	R1IN (DI=1)	PASS	CL	
	±7.0KV	R2IN (DI=1)	PASS	CL	
	±7.0KV	R3IN (DI=1)	PASS	CL	
	±7.0KV	R4IN (DI=1)	PASS	CL	
	±7.0KV	R5IN (DI=1)	PASS	CL	
	±7.0KV	T1OUT (DI=0)	PASS	CL	
	±7.0KV	T2OUT (DI=0)	PASS	CL	
	±7.0KV	T3OUT (DI=0)	FAIL	CL	FAILED +7.0KV
6	±7.0KV	T1OUT (DI=1)	PASS	CL	
	±7.0KV	T2OUT (DI=1)	PASS	CL	
	±7.0KV	T3OUT (DI=1)	PASS	CL	
	±7.0KV	R1IN (DI=1)	PASS	CL	
	±7.0KV	R2IN (DI=1)	PASS	CL	
	±7.0KV	R3IN (DI=1)	PASS	CL	
	±7.0KV	R4IN (DI=1)	PASS	CL	
	±7.0KV	R5IN (DI=1)	PASS	CL	
	±7.0KV	T1OUT (DI=0)	PASS	CL	
	±7.0KV	T2OUT (DI=0)	PASS	CL	
	±7.0KV	T3OUT (DI=0)	PASS	CL	
	±7.0KV	R1IN (DI=0)	PASS	CL	
	±7.0KV	R2IN (DI=0)	PASS	CL	
	±7.0KV	R3IN (DI=0)	PASS	CL	
	±7.0KV	R4IN (DI=0)	PASS	CL	
	±7.0KV	R5IN (DI=0)	PASS	CL	
	±7.5KV	T1OUT (DI=1)	PASS	CL	
	±7.5KV	T2OUT (DI=1)	FAIL	CL	FAILED +7.5KV

UNIT #	Contact Discharge	Pin Name	Status	Signature	Comment
7	±7.0KV	T1OUT (DI=1)	PASS	CL	
	±7.0KV	T2OUT (DI=1)	PASS	CL	
	±7.0KV	T3OUT (DI=1)	PASS	CL	
	±7.0KV	R1IN (DI=1)	PASS	CL	
	±7.0KV	R2IN (DI=1)	PASS	CL	
	±7.0KV	R3IN (DI=1)	PASS	CL	
	±7.0KV	R4IN (DI=1)	PASS	CL	
	±7.0KV	R5IN (DI=1)	PASS	CL	
	±7.0KV	T1OUT (DI=0)	PASS	CL	
	±7.0KV	T2OUT (DI=0)	PASS	CL	
	±7.0KV	T3OUT (DI=0)	PASS	CL	
	±7.0KV	R1IN (DI=0)	PASS	CL	
	±7.0KV	R2IN (DI=0)	PASS	CL	
	±7.0KV	R3IN (DI=0)	PASS	CL	
	±7.0KV	R4IN (DI=0)	PASS	CL	
	±7.0KV	R5IN (DI=0)	PASS	CL	
	±7.5KV	T1OUT (DI=1)	PASS	CL	
	±7.5KV	T2OUT (DI=1)	PASS	CL	
	±7.5KV	T3OUT (DI=1)	PASS	CL	
	±7.5KV	R1IN (DI=1)	PASS	CL	
	±7.5KV	R2IN (DI=1)	PASS	CL	
	±7.5KV	R3IN (DI=1)	PASS	CL	
	±7.5KV	R4IN (DI=1)	PASS	CL	
	±7.5KV	R5IN (DI=1)	PASS	CL	
	±7.5KV	T1OUT (DI=0)	PASS	CL	
	±7.5KV	T2OUT (DI=0)	PASS	CL	
	±7.5KV	T3OUT (DI=0)	PASS	CL	
	±7.5KV	R1IN (DI=0)	PASS	CL	
	±7.5KV	R2IN (DI=0)	PASS	CL	
	±7.5KV	R3IN (DI=0)	PASS	CL	
	±7.5KV	R4IN (DI=0)	PASS	CL	
	±7.5KV	R5IN (DI=0)	PASS	CL	
	±8.0KV	T1OUT (DI=1)	PASS	CL	
	±8.0KV	T2OUT (DI=1)	PASS	CL	
	±8.0KV	T3OUT (DI=1)	PASS	CL	
	±8.0KV	R1IN (DI=1)	PASS	CL	
	±8.0KV	R2IN (DI=1)	PASS	CL	
	±8.0KV	R3IN (DI=1)	PASS	CL	
	±8.0KV	R4IN (DI=1)	PASS	CL	
	±8.0KV	R5IN (DI=1)	PASS	CL	
	±8.0KV	T1OUT (DI=0)	FAIL	CL	FAILED -8.0KV



GREATEK ELECTRONICS INC.
No.136, Gung-Yi Rd., Chunan Cheng, Miaoli Hsien Taiwan R.O.C.
Tel : (037)638-568 Fax : (037)628-323

Reliability Test Report

Customer : ZYW
Purpose : Reliability Test
Package Type : SSOP 28L (209mil)
Report No : B510-RELI-0912021
Report Date :28-JAN-2010
Conclusion : The test results were all passed

Approved By: Steven Su Prepared By : Wanda Wei

Date : 28-JAN-2010 Date : 28-JAN-2010

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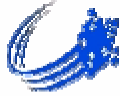
1. Sample Background

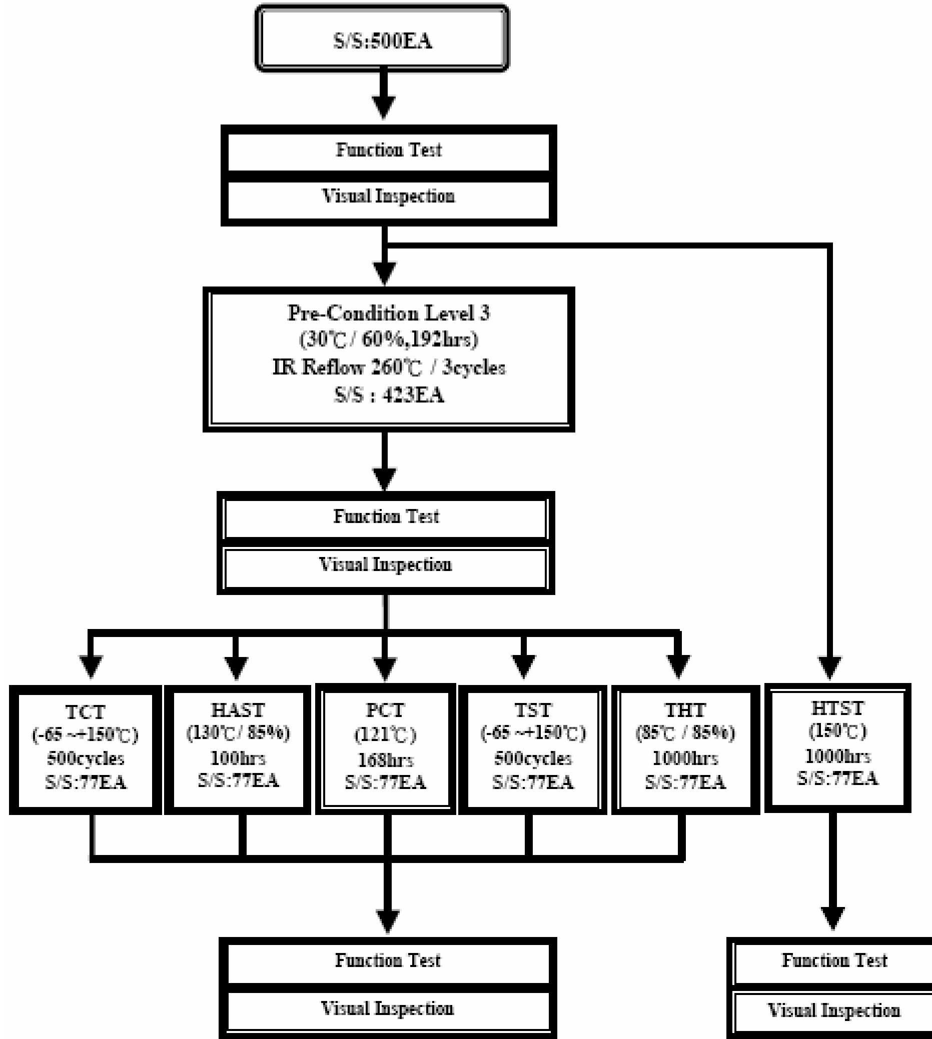
1.1 Sample Background :

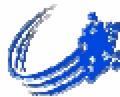
Package Type :	SSOP 28L (209mil)	L/F Material :	A194
Device :	ZT3243LEEA	Lead Frame:	145*158 (mil)
Lot No:	B9904549.1	Silver Epoxy:	83521
Mo No:	SNT28NB92530	Gold Wire:	0.9mil
Coating :	NO	Compound	G600F
Exposed pad :	NO	Lead Finish	Pure Tin
Apply Date:	12-DEC-2009	Sample Size:	423EA
Complete Date:	27-JAN-2010	Report No:	B510-RELI-0912021



2. Test Flow Chart

2.1 Precondition:





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3. Inspection method

3.1 Visual Inspection:

Purpose: In order to check whether the samples have package crack or not before/after reliability test.

Apparatus: Power Scope (7~40x)

3.2 SAT Inspection:

Purpose: Inspecting the delamination of concerned layer.

Apparatus: SONIX FUSION

4. Environment Stress / Mechanical Test

4.1 Precondition:

This test method establishes an industry standard preconditioning flow for plastic SMDs (surface mount device) that is representative of a typical industry multiple solder reflow operation.

Test procedure is as following:

Stept1: TCT 5cycles
Stept2: Bake 125℃ ,24hrs
Stept3: Moisture Soak (30℃/60%/192hrs)
Stept4: IR Reflow 260℃ / 3cycles

4.2 Pressure Cooker Test :

The "Accelerated Moisture Resistance Test" is performed for the purpose of evaluating the moisture resistance of nonhermetic packaged solid state devices. It employs severe conditions of pressure, humidity and temperature that accelerate the penetration of moisture through the external protective material (encapsulant or seal) or along the interface between the external protective material and the metallic conductors that pass through it. This test is destructive; it may* be used for qualification, lot acceptance and as a product monitor.

Test condition: 121℃, 2atm, 168hrs.

4.3 Temperature Cycle Test :

This test is conducted to determine the resistance of a part to extremes of high- and low-temperatures, and to the effect of alternate exposures to these extremes.

Test condition: -65℃ ~ +150℃,500cycles.

4.4 Highly Acceleration Life :

The Highly-Accelerated Temperature and Humidity Stress Test is performed for the purpose of evaluating the reliability of non-hermetic packaged solid-state devices in humid environments. It employs severe conditions of temperature, humidity, and bias which accelerate the penetration of moisture through the external protective material (encapsulant or seal) or along the interface between the external protective material and the metallic conductors which pass through it. The stress usually activates the same failure mechanisms as the "85/85" Steady-State Humidity Life Test . (JEDEC Standard No. 22-A101).

Test condition: 130℃/85% , 100 hrs.

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4.5 High Temperature Storage Life:

The purpose of this test is to determine the effect on solid state electronic devices of storage at elevated temperature without electrical stress applied. This test is considered destructive and, therefore, is applicable for device qualification.

Test condition: 150℃, 1000hrs

4.6 Thermal Shock:

This test is conducted to determine the resistance of a part to sudden exposure to extreme changes in temperature and to the effect of alternate exposures to these extremes.

Test condition: -65 ~ 150℃,500 cycles.

4.7 Temperature Humidity Test(egual to THB without bias):

The Steady-State Temperature Humidity Test is peformed for the purpose of evaluating the reliability of non-hermetic packaged solid-state devices in humid environments. It employs conditions of temperature and humidity which accelerate the penetration of moisture through the external protective material (encapsulant or seal) or along the inteface between the external protective material and the metallic conductors which pass through it.

Test condition: 85℃/85% , 1000hrs

5. Reliability Test Results

5.1 Summary of test results :

Test Procedure	Sample Size	Visual Insp. Rej/s.s	Function Test rej/s.s	SAT insp Rej/s.s	Judgment
Before Pre-condition	423EA	0/423	0/423	0/22	PASS
After Pre-condition	423EA	0/423	0/423	0/22	PASS
PCT 168hrs	77EA	0/77	0/77	N/A	PASS
HAST 100hrs	77EA	0/77	0/77	N/A	PASS
TCT 500cycles	77EA	0/77	0/77	N/A	PASS
HTST 1000hrs	77EA	0/77	0/77	N/A	PASS
TST 500cycles	77EA	0/77	0/77	N/A	PASS
THT 1000hrs	77EA	0/77	0/77	N/A	PASS

5.2 Detail Informations of SAT Inspection：

5.2-1 Before Precondition

Focus	Die Surface (Top)				L/F Surface			
spec	0% acc	0%~10% rej	>10% rej	SAT Photo	0% acc	Partial length on lead	Entire length on lead	SAT Photo
Before Precondition	22	0	0	Fig 1	22	0	0	Fig 1
Focus	Die Pad (Top side) <**No Ground Bond**>				Die Pad (back side)			
spec	0%	0~10%	>10%	SAT Photo	0% acc	0~50% acc	>50% rej	SAT Photo
Before Precondition	22	0	0	Fig 1	22	0	0	Fig 2

5.2-2 After Precondition

Focus	Die Surface (Top)				L/F Surface			
spec	0% acc	0%~10% rej	>10% rej	SAT Photo	0% acc	Partial length on lead	Entire length on lead	SAT Photo
After Precondition	22	0	0	Fig 3	22	0	0	Fig 3
Focus	Die Pad (Top side) <**No Ground Bond**>				Die Pad (back side)			
spec	0%	0~10%	>10%	SAT Photo	0% acc	0~50% acc	>50% rej	SAT Photo
After Precondition	14	8	0	Fig 3	22	0	0	Fig 4

6. Conclusion

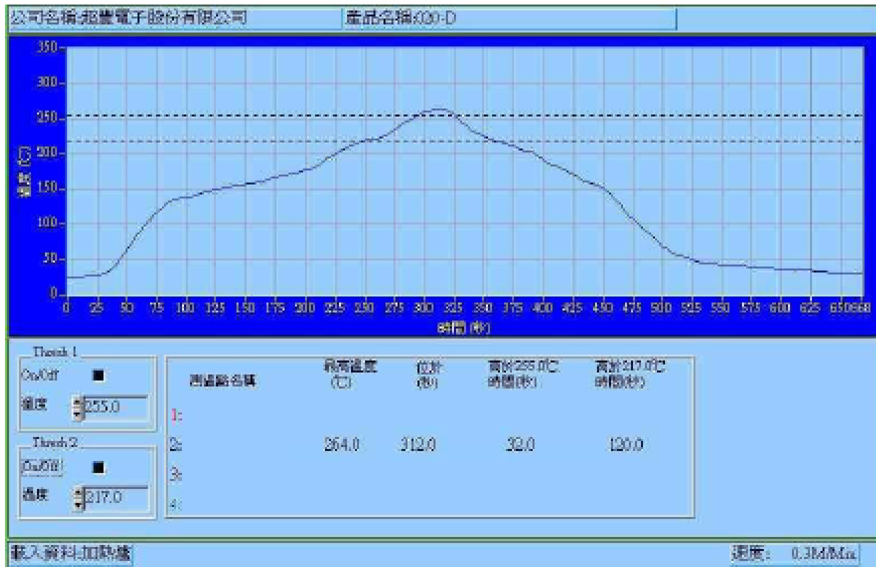
6.1 The test results were all passed.

7. Reference

- **JESD22-A113** Preconditioning of Plastic Surface Mount Devices Prior to Reliability Testing
- **IPC / JEDEC J-STD-020D** IR Reflow
- **Greatek Spec #QA-00-300** Reliability Test Instruction
- **Greatek Spec #QA-00-301** Pressure Cooker Test
- **Greatek Spec #QA-00-302** Temperature/Humidity Chamber Operation Instruction
- **Greatek Spec #QA-00-303** IR Reflow Test System Operation Instruction
- **Greatek Spec #QA-00-305** Temperature cycling
- **Greatek Spec #QA-00-306** Highly Acceleration Life
- **Greatek Spec #QA-00-402** SAT Operation Instruction

8. Attachments:

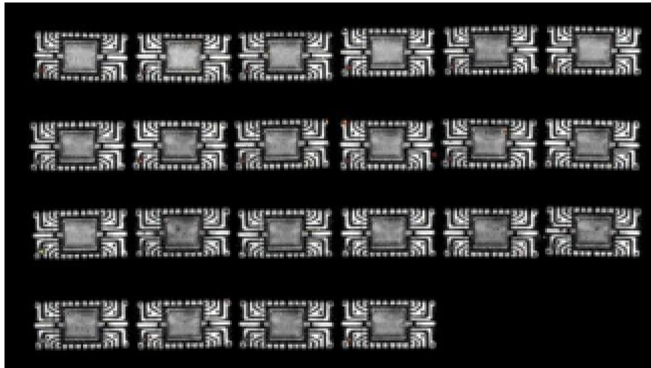
IR PROFILE(Tmax:260℃) for SMD.



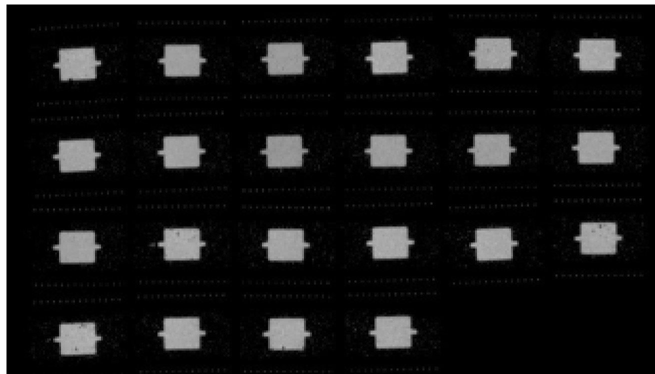
Condition	Spec.	Actual
Time above 217℃	60-150 seconds.	120 seconds.
Peak Temperature	>260℃	264.0℃
Time within 5℃ of actual peak temperature	>30 seconds.	32 seconds.

9. SAT Photo：

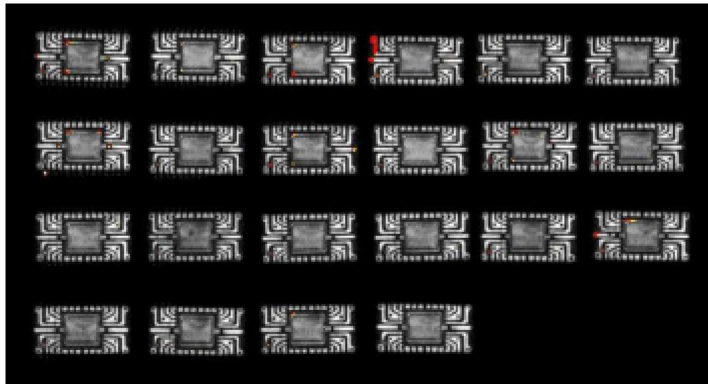
9.1 Before / After Precondition：



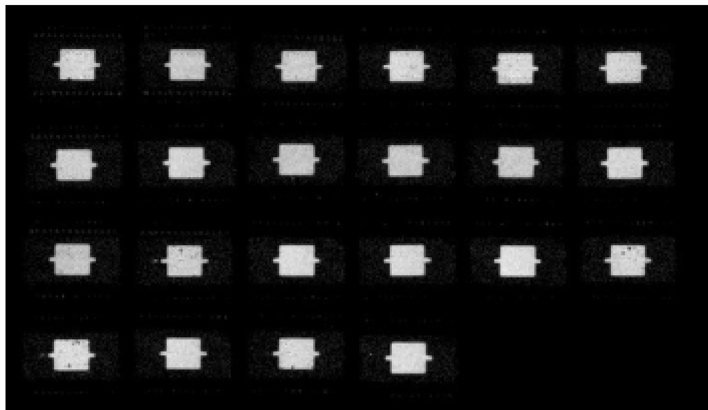
Package Type: SSOP 28L (209mil)
Before Pre-con LEVEL 3
Photo no : Fig 1
Die Surface SAT Result : 0/22ea delam =>PASS
L/F Surface SAT Result : 0/22ea delam =>PASS
Die Pad(Top side) SAT Result : 0/22ea delam =>PASS



Package Type: SSOP 28L (209mil)
Before Pre-con LEVEL 3
Photo no : Fig 2
Die Pad(Back side) SAT Result : 0/22ea delam =>PASS



Package Type: SSOP 28L (209mil)
After Pre-con LEVEL 3
Photo no : Fig 3
Die Surface SAT Result : 0/22ea delam =>PASS
L/F Surface SAT Result : 0/22ea delam =>PASS
Die Pad(Top side) SAT Result : 0/22ea delam =>PASS



Package Type: SSOP 28L (209mil)
After Pre-con LEVEL 3
Photo no : Fig 4
Die Pad(Back side) SAT Result : 0/22ea delam =>PASS

Appendix 1

Burn-in Board and Burn-in Equipment:

Burn-in Board used for Dynamic Life Test

Burn-in oven used for Dynamic Life and Humidity Test

Appendix 2

ESD Tester Equipment:

Front view of the iMCS model#700

Front view of the iMCS model#700
ESD tester with lid open

Back view of the ESD tester with
Machine model/Pulse model being used