

PRODUCT / PROCESS CHANGE INFORMATION

1. PCI basic data

1.1 Company		STMicroelectronics International N.V
1.2 PCI No.	AMS/21/12603	
1.3 Title of PCI	Moisture/Reflow Sensitivity Classification for TLxx products	
1.4 Product Category	See product list	
1.5 Issue date	2021-02-25	

2. PCI Team

2.1 Contact supplier	
2.1.1 Name	ROBERTSON HEATHER
2.1.2 Phone	+1 8475853058
2.1.3 Email	heather.robertson@st.com
2.2 Change responsibility	
2.2.1 Product Manager	Marcello SAN BIAGIO
2.1.2 Marketing Manager	Salvatore DI VINCENZO
2.1.3 Quality Manager	Giuseppe LISI

3. Change

3.1 Category	3.2 Type of change	3.3 Manufacturing Location
Methods	Dry pack requirements change	ST Bouskoura

4. Description of change

	Old	New
4.1 Description	TLxx products classification MSL = 3	TLxx products classification MSL = 1
4.2 Anticipated Impact on form,fit, function, quality, reliability or processability?	No impact as MSL will reflect moisture sensitivity class assigned by reliability results.	

5. Reason / motivation for change

5.1 Motivation	To align MSL classification to qualification tests results.
5.2 Customer Benefit	MANUFACTURING FLEXIBILITY

6. Marking of parts / traceability of change

6.1 Description	N/A
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7. Timing / schedule

7.1 Date of qualification results	2021-02-08
7.2 Intended start of delivery	2021-03-30
7.3 Qualification sample available?	Not Applicable

8. Qualification / Validation

8.1 Description	12603 Reliability_report SOSSHD Bouskoura_may2019-Vref case.pdf		
8.2 Qualification report and qualification results	Available (see attachment)	Issue Date	2021-02-25

9. Attachments (additional documentations)

12603 Public product.pdf
12603 Reliability_report SOSSHD Bouskoura_may2019-Vref case.pdf

10. Affected parts		
10. 1 Current		10.2 New (if applicable)
10.1.1 Customer Part No	10.1.2 Supplier Part No	10.1.2 Supplier Part No
	TL1431AIYDT	
	TL1431IYDT	
	TL431AIYDT	
	TL431IYDT	

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Public Products List

Public Products are off the shelf products. They are not dedicated to specific customers, they are available through ST Sales team, or Distributors, and visible on ST.com

PCI Title : Moisture/Reflow Sensitivity Classification for TLxx products

PCI Reference : AMS/21/12603

Subject : Public Products List

Dear Customer,

Please find below the Standard Public Products List impacted by the change.

TL1431IYDT	TL431AIYDT	TL431IYDT
TL1431AIYDT		



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Reliability Report

*Qualification of a new material set for
Automotive grade products assembled in
SO8 package
(Voltage References – General Purpose
Analog Division)*

General Information		Locations	
Product Line	0431, 0912, 0393, V912, 0922, 16VA Voltage reference , Dual CMOS op amp, Dual comparator bipolar, Rail to Rail dual op amp Dual op amp 5V Supervisor, TL431IYDT, TSV912IYDT, LM2903YDT, TSV912HYDT, TS922IYDT, STM706YM7F ,	Wafer fab	ST Singapore UMC Taiwan
Product Description		Assembly plant	ST Bouskoura (Morocco)
P/N		Reliability Lab	ST Grenoble, ST Bouskoura,
Product Group	AMS		
Product division	GPA		
Package	SO8		
Silicon Process technology	Bipolar, HC1PA, Bipolar , HF5CMOS, HF2CMOS, HCMOS4		

Note: This report is a summary of the reliability trials performed in good faith by STMicroelectronics in order to evaluate the potential reliability risks during the product life using a set of defined test methods.

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TABLE OF CONTENTS

1	APPLICABLE AND REFERENCE DOCUMENTS.....	5
2	GLOSSARY	5
3	RELIABILITY EVALUATION OVERVIEW	5
3.1	OBJECTIVES.....	5
3.2	CONCLUSION	5
4	DEVICE CHARACTERISTICS	6
4.1	DEVICE DESCRIPTION	6
4.2	CONSTRUCTION NOTE.....	12
5	TESTS RESULTS SUMMARY	13
5.1	TEST VEHICLE	13
5.2	TEST PLAN AND RESULTS SUMMARY	13
6	ANNEXES	26
6.1	TESTS DESCRIPTION	26

1 APPLICABLE AND REFERENCE DOCUMENTS

Document reference	Short description
AEC-Q100	Stress test qualification for automotive grade integrated circuits
AEC-Q101	Stress test qualification for automotive grade discrete semiconductors
JESD47	Stress-Test-Driven Qualification of Integrated Circuits

2 GLOSSARY

DUT	Device Under Test
PCB	Printed Circuit Board
SS	Sample Size

3 RELIABILITY EVALUATION OVERVIEW

3.1 Objectives

To qualify a new set of material in ST Bouskoura for Voltage Reference devices in Automotive Grade assembled in SO8 package (General Purpose Analog Division.)

3.2 Conclusion

Qualification Plan requirements have been fulfilled without issue. It is stressed that reliability tests have to show that the devices behave correctly against environmental tests (no failure). Moreover, the stability of electrical parameters during the accelerated tests have to demonstrate the ruggedness of the products and safe operation, which is consequently expected during their lifetime.

4 DEVICE CHARACTERISTICS

4.1 Device description

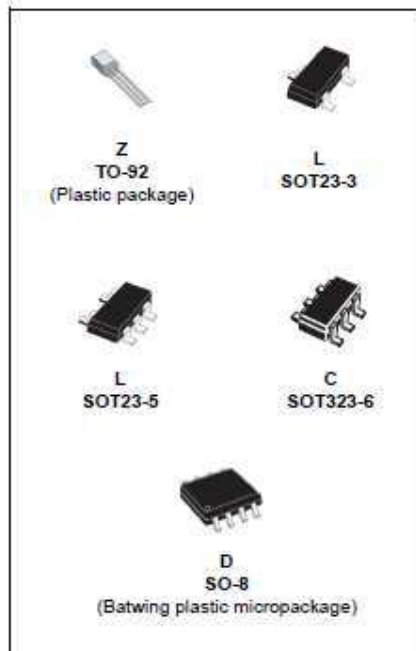
TL431HYDT



TL431
TL432

Automotive adjustable voltage reference

Datasheet - production data



Applications

- Power supply
- Industrial
- Automotive

Description

The TL431 and TL432 are adjustable shunt voltage references with guaranteed temperature stability over the entire operating temperature range. The device temperature range is extended for the automotive version from -40 °C up to +125 °C. The output voltage can be set to any value between 2.5 and 36 V with two external resistors. The TL431 and TL432 operate with a wide current range from 1 to 100 mA with a typical dynamic impedance of 0.22 Ω.

Features

- AEC-Q100 qualified
- Adjustable output voltage: 2.5 to 36 V
- Sink current capability: 1 to 100 mA
- Typical output impedance: 0.22 Ω
- 1% and 2% voltage precision
- Automotive temp. range -40 °C to +125 °C



TS912IYDT



TS912, TS912A, TS912B

Rail-to-rail CMOS dual operational amplifier

Datasheet – production data

Features

- Rail-to-rail input and output voltage ranges
- Single (or dual) supply operation from 2.7 to 16 V
- Extremely low input bias current: 1 pA typ.
- Low input offset voltage: 2 mV max.
- Specified for 600 Ω and 100 Ω loads
- Low supply current: 200 μ A/amplifier ($V_{CC} = 3$ V)
- Latch-up immunity
- ESD tolerance: 3 kV
- Spice macromodel included in this specification

Related products

- See TS56x series for better accuracy and smaller packages

Description

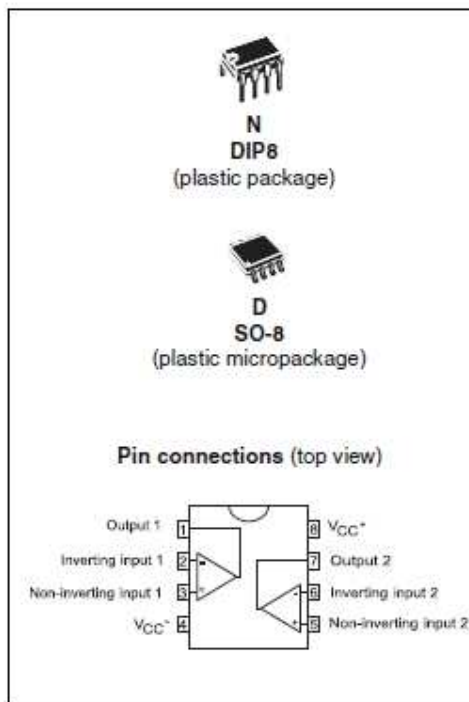
The TS912 device is a rail-to-rail CMOS dual operational amplifier designed to operate with a single or dual supply voltage.

The input voltage range V_{cm} includes the two supply rails V_{CC}^+ and V_{CC}^- .

The output reaches $V_{CC}^- + 30$ mV, $V_{CC}^+ - 40$ mV, with $R_L = 10$ k Ω and $V_{CC}^- + 300$ mV, $V_{CC}^+ - 400$ mV, with $R_L = 600$ Ω .

This product offers a broad supply voltage operating range from 2.7 to 16 V and a supply current of only 200 μ A/amp. ($V_{CC} = 3$ V).

Source and sink output current capability is typically 40 mA (at $V_{CC} = 3$ V), fixed by an internal limitation circuit.



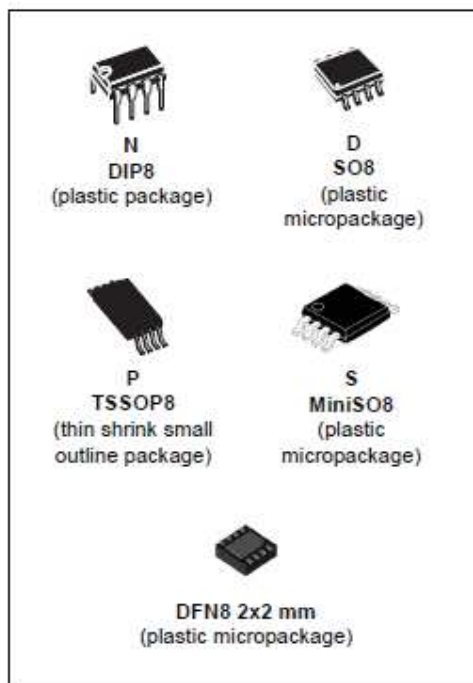
LM2903YDT



LM2903

Low-power dual voltage comparator

Datasheet - production data



- TTL, DTL, ECL, MOS, CMOS compatible outputs
- Automotive qualification

Related products

- See LM2903W for similar device with higher ESD performances
- See LM2903H for similar device with operating temperature up to 150 °C

Description

This device consists of two independent low-power voltage comparators designed specifically to operate from a single supply over a wide range of voltages. Operation from split power supplies is also possible.

In addition, the device has a unique characteristic in that the input common-mode voltage range includes the negative rail even though operated from a single power supply voltage.

Features

- Wide single supply voltage range or dual supplies +2 V to +36 V or ± 1 V to ± 18 V
- Very low supply current (0.4 mA) independent of supply voltage (1 mW/comparator at +5 V)
- Low input bias current: 25 nA typ.
- Low input offset current: ± 5 nA typ.
- Input common-mode voltage range includes negative rail
- Low output saturation voltage: 250 mV typ. ($I_O = 4$ mA)
- Differential input voltage range equal to the supply voltage

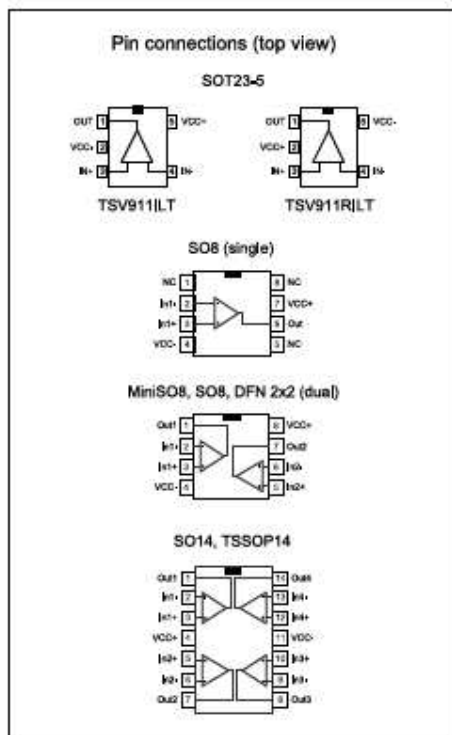
TSV912IYDT



TSV91x, TSV91xA

Single, dual, and quad rail-to-rail input/output 8 MHz operational amplifiers

Datasheet - production data



- Unity gain stability
- High output current: 35 mA
- Operating from 2.5 V to 5.5 V
- Low input bias current, 1 pA typ
- Low input offset voltage: 1.5 mV max (A grade)
- ESD internal protection ≥ 5 kV
- Latch-up immunity

Applications

- Battery-powered applications
- Portable devices
- Signal conditioning
- Active filtering
- Medical instrumentation
- Automotive applications

Description

The TSV91x operational amplifiers (op amps) offer low voltage operation and rail-to-rail input and output, as well as an excellent speed/power consumption ratio, providing an 8 MHz gain-bandwidth product while consuming only 1.1 mA maximum at 5 V. The op amps are unity gain stable and feature an ultra-low input bias current.

The devices are ideal for sensor interfaces, battery-supplied and portable applications, as well as active filtering.

Table 1: Device summary

Reference	Single	Dual	Quad
TSV91x	TSV911	TSV912	TSV914
TSV91xA	TSV911A	TSV912A	TSV914A

Features

- Rail-to-rail input and output
- Wide bandwidth
- Low power consumption: 820 μ A typ

TS922IYDT



TS922, TS922A

Datasheet

Rail-to-rail, high output current, dual operational amplifier



Flip-chip with backcoating



SO8



TSSOP8

Features

- Rail-to-rail input and output
- Low noise: 9 nV/√Hz
- Low distortion
- High output current: 80 mA (able to drive 32 Ω loads)
- High-speed: 4 MHz, 1 V/μs
- Operating from 2.7 to 12 V
- Low input offset voltage: 900 μV max. (TS922A)
- ESD internal protection: 2 kV
- Latch-up immunity

Applications

- Line drivers and actuator drivers
- Portable speakers
- Instrumentation with low noise as key factor
- Multimedia systems and portable equipments

Description

The **TS922** and the **TS922A** devices are rail-to-rail dual BiCMOS operational amplifiers optimized and fully specified for 3 V and 5 V operations. These devices have high output currents which allow low-load impedances to be driven.

Very low noise, low distortion, low offset, and a high output current capability make these devices an excellent choice for high quality, low voltage, or battery operated audio systems.

The devices are stable for capacitive loads up to 500 pF.

Product status link

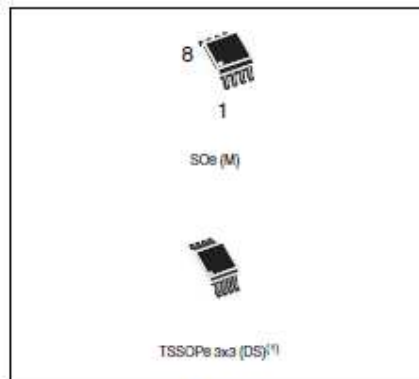
[TS922 and TS922A](#)

STM706YM7F



STM705, STM706 STM707, STM708, STM813L 5 V supervisor

Datasheet – production data



1. Contact local ST sales office for availability.

- 200 ms (typ) t_{rec}
- Watchdog timer - 1.6 s (typ)
- Manual reset input ($\overline{MR}$)
- Power-fail comparator ($PFI/\overline{PFO}$)
- Low supply current - 40 μ A (typ)
- Guaranteed $\overline{RST}$ (RST) assertion down to $V_{CC} = 1.0$ V
- Operating temperature:
 - 40 °C to 85 °C (industrial grade) or
 - 40 °C to 125 °C (automotive grade for the STM706 only)
- RoHS compliance
 - Lead-free components are compliant with the RoHS directive

Features

- 5 V operating voltage
- Precision V_{CC} monitor
 - STM705/707/813L
 - $4.50 \text{ V} \leq V_{RST} \leq 4.75 \text{ V}$
 - STM706/708
 - $4.25 \leq V_{RST} \leq 4.50 \text{ V}$
- RST and $\overline{RST}$ outputs

Table 1. Device summary

	Watchdog input	Watchdog output ⁽¹⁾	Active-low $\overline{RST}$ ⁽¹⁾	Active-high RST ⁽¹⁾	Manual reset input	Power-fail comparator
STM705	✓	✓	✓		✓	✓
STM706 ⁽²⁾	✓	✓	✓		✓	✓
STM707			✓	✓	✓	✓
STM708			✓	✓	✓	✓
STM813L	✓	✓		✓	✓	✓

1. Push-pull output

2. Automotive grade (–40 °C to 125 °C) option for the STM706 only.

4.2 Construction note

	P/N TL431IYDT	P/N TS912IYDT	P/N LM2903YDT	P/N TSV912HYDT	P/N TS922IYDT	P/N STM706YM7F	
Wafer/Die fab. information							
Wafer fab manufacturing location	ST Singapore	ST Singapore	ST Singapore	UMC Taiwan	ST Singapore	ST Singapore	
Technology	Bipolar	HC1PA	Bipolar	HF5CMOS	HF2CMOS	HCMOS4	
Die finishing back side	RAW SILICON	RAW SILICON	RAW SILICON	Lapped Silicon	Raw silicon	RAW SILICON	
Die size (microns)	1380x1120µm²	2600x1950µm²	950 x 870 µm²	1070x1100µm²	1720x1190µm²	1350x1510µm²	
Bond pad metallization layers	AlSiCu	AlSi	AlSiCu	AlCu	AlSiCu	AlSiCu	
Passivation type	Nitride	P-VAPOX/ NITRIDE	Nitride	PSG + NITRIDE	PSG + NITRIDE	PSG+Silicon Nitride+ Polyimide	
Wafer Testing (EWS) information							
Electrical testing manufacturing location	ST Singapore	ST Singapore	ST Singapore	ST Singapore	ST Singapore	ST Singapore	
Assembly information							
Assembly site	ST Bouskoura						
Package description	SO8						
Molding compound	EME G700KC						
Frame material	Copper						
Die attach process	Epoxy Glue						
Die attach material	8601S-25						
Wire bonding process	Thermosonic ball bonding						
Wires bonding materials/ diameters	Cu 1 mil						
Lead finishing process	electroplating						
Lead finishing/bump solder material	Matte tin						
Final testing information							
Testing location	ST Bouskoura						

5 TESTS RESULTS SUMMARY

5.1 Test vehicle

Lot #	Process/ Package	Product Line	Comments
1	Bipolar/SO8	0431	CZ8520BWRR
2	HC1PA/SO8	0912	CZ8150HK01 corner lot wire bonding HH CZ8150HKRQ corner lot wire bonding LL CZ8150HKRR corner lot wire bonding NN
3	Bipolar/SO8	0393	CZ7410EH0G CZ8040FLRE corner lot wire bonding HH CZ8040FLRC corner lot wire bonding LL CZ8040FLRD corner lot wire bonding NN
4	HF5CMOS/SO8	V912	CZ7410F3RP
5	HF2CMOS/SO8	0922	CZ7420D203
6	HCMOS4/SO8	16VA	CZ81701NR0 corner lot wire bonding HH CZ81701NQW corner lot wire bonding NN CZ81701NQY corner lot wire bonding LL

5.2 Test plan and results summary

Test	PC	Std ref.	Conditions	SS	Steps	Failure/SS							Note
						0431	0912	0393	V912	0922	16VA		
Die oriented test													
HTOL	N	JESD22 A-108	Tj = 150°C, BIAS		168 H	0/77		0/77		0/77			
					500 H	0/77		0/77		0/77			
					1000 H	0/77		0/77		0/77			
					2000h			0/77		0/77			
HTSL	N	JESD22 A-103	Ta = 150°C		168 H		3x0/77	4x0/77	0/77	0/77	3x0/77		
					500 H	2x0/45	3x0/77	4x0/77	0/77	0/77	3x0/77		
					1000 H	2x0/45	3x0/77	4x0/77	0/77	0/77	3x0/77		
Package Oriented Tests													
PC		JESD22 A-113	Drying 24 H @ 125°C Store 168 H @ Ta=85°C Rh=85% Over Reflow @ Tpeak=260°C 3 times		Final	PASS	PASS	PASS	PASS	PAS	PASS		
AC	Y	JESD22 A-102	Pa=2Atm / Ta=121°C		96 H	0/77	3x0/77	4x0/77	0/77	0/77	3x0/77		
TC	Y	JESD22 A-104	Ta = -65°C to 150°C		100 cy	0/77	3x0/77	4x0/77	0/77	0/77	3x0/77		*DPA after 500 and 1000cy
					200 cy	0/77	3x0/77	4x0/77	0/77	0/77	3x0/77		
					500 cy	0/77	3x0/77	4x0/77	0/77	0/77	3x0/77		
					1000cy	0/77	3x0/69*	3x0/69 1x0/77	0/69*	0/77	W 852		
					2000cy			0/77		0/77			
THS	Y		Ta = 85°C, RH = 85%,		168h			0/77					
					1000h			0/77					
					2000h			0/77					
THB	Y	JESD22 A-101	Ta = 85°C, RH = 85%, BIAS		168 H	0/77		0/77					
					500 H	0/77		0/77					
					1000 H	0/77		0/77					
Other Tests													
ESD	N	AEC Q101-001, 002 and 005	CDM										
				1500V	Pass		Pass	Pass	Pass				

DPA: destructive physical analysis performed after test with positive results (both value and failure mode)

ELFR results

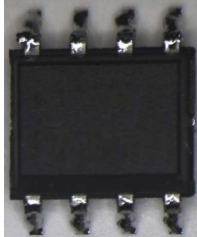
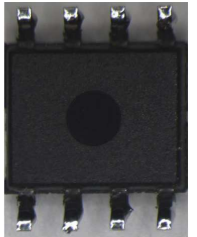
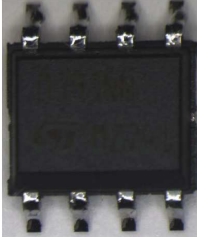
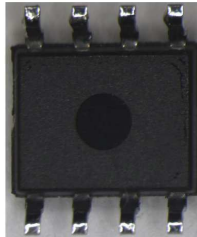
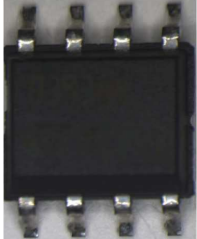
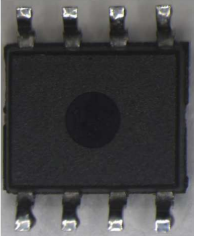
Lot #	Process/ Package	Product Line	Comments
1	Bipolar/SO8	0393	CZ53005LRP
2	HVG8A/SO8	UY18	CZ537088RM
3	HF5CMOS/SO8	V912	CZ544OC1RR
4	HC1PA/SO8	0912	CZ5XX
5	HF2CMOS/SO14	0924	CZ5XX

Test	PC	Std ref.	Conditions	SS	Steps	Failure/SS								
						Lot 1	Lot 2	Lot 3	Lot 4	Lot 5				
Die Oriented Tests														
HTB	N	JESD22 A-108	Tj = 125°C, BIAS	468	168 H	0/78		0/78						
ELFR	N	JESD22 A-008	Tj = 125°C, BIAS	2028	48 H	0/450	0/450	0/450	0/450	0/450				

Solderability:

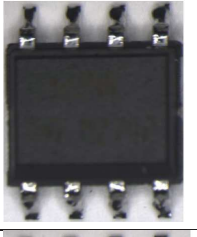
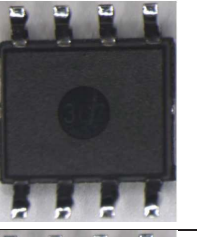
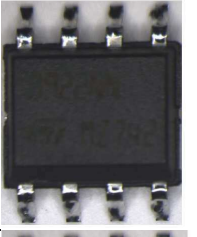
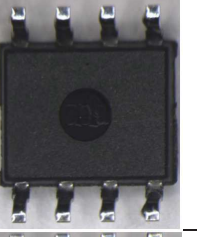
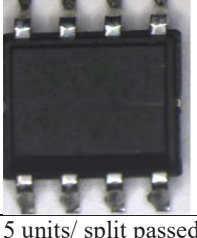
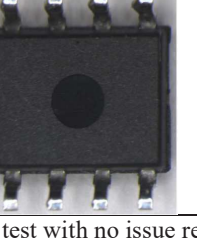
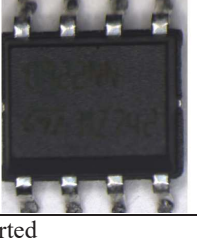
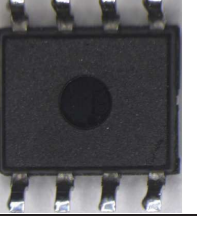
Test vehicle 0393

Lot ref: CZ7410EHQZ

	After 8h at 85°C/85%RH		After 16h dry air 150°C	
SnPb bath				
SnAgCu bath				
Conclusion	5 units/ split passed the test with no issue reported			

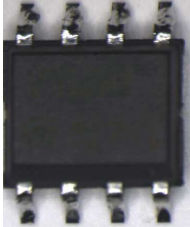
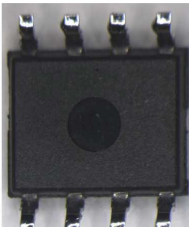
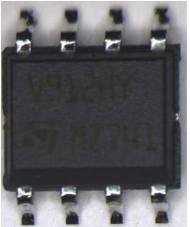
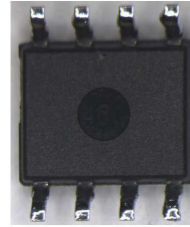
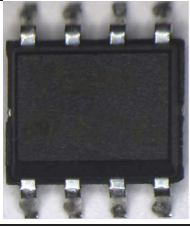
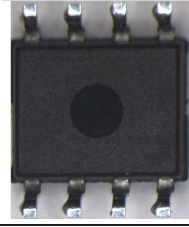
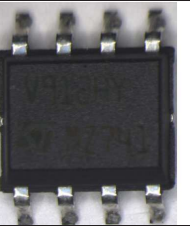
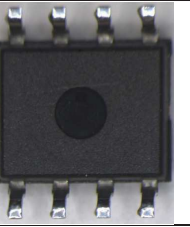
Test vehicle 0922

Lot ref: CZ7420D2RM

	After 8h at 85°C/85%RH		After 16h dry air 150°C	
SnPb bath				
SnAgCu bath				
Conclusion	5 units/ split passed the test with no issue reported			

Test vehicle V912

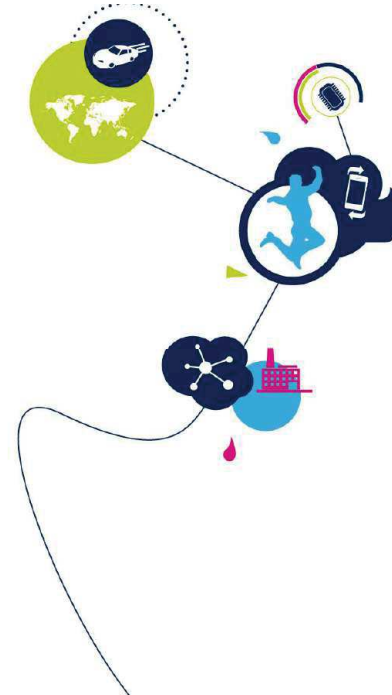
Lot ref: CZ7410F3RN

	After 8h at 85°C/85%RH		After 16h dry air 150°C	
SnPb bath				
SnAgCu bath				
Conclusion	5 units/ split passed the test with no issue reported			

Lead-free Matte tin verification versus whiskers risk

Whiskers Monitoring Report ST BSK LAB: Q1-18

S. CHELLAOUI
K. OULAD BENAÏSSA



Whiskers related tests

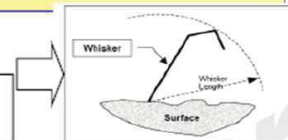
(According to ST BSK Whiskers acceptance criteria referred to DM00485464)

1.	High temp. / high humidity 55 ° C / 85% rel. Hum.	2000h *	max. 20 µm whisker**
2.	Temperature cycle -40° C / +85° C	1000TC	max. 45 µm whisker
3.	Ambient Temp./Humidity 30 ° C / 60 % rel. Hum.	2000h *	max. 20 µm whisker

*In case of whiskers found (even below the Maximum spec. limit) the test must to continue up to 4000 hrs with the interim read out at 3000 hrs .

**In case of corrosion of solder and whiskers associated , this is not considered failure, therefore the lead in object must be discounted .

Whisker length : The straight line distance from the point of emergence of whiskers of the most distant point on the whiskers (i.e. the radius of a sphere containing the whiskers with its center located at the point of emergence).



Monitoring period	Assy Plant	Requestors	Line	Date of aviability	Recieved by	Date of Report
Q1 / 2018	STM BOUSKOURA	A. CHEFFAJ	PLT	10 MARCH 2018	S CHELLAOUI	12/10/2018
		Y. ABOUTOURAB	SMD	15 MARCH 2018		

Line	Products	Lot ID	Devices	Plating Machine	Date process plating	Quantity units recieved	Comment
PLATING CENTRAL	PSO10	CZ8060CKRP	V526	MECO1	W08	50 Units	NO ABNORMALITY ISSUE
	PSO10	CZ8020AKRH	4D4K	MECO2	W07		
	PSSO12	CZ8060P4RM	VNU1	MECO3	W07		
	PSSO12	CZ80803SRQ	UH45	BELT1	W08		
	TO220 BOSCH	CZ8080CWRQ	Z065	MECO2	W08		
	TO220	CZ8070N301	E35H	MECO3	W08		
	TO220	CZ8060MRN	MQ6	BELT3	W07		
	VIP BOSCH	CZ8060SX01	CR665	BELT3	W07		
	SWATT	CZ8050DF01	L200	BELT3	W08		
	MWATT 11L	CZ80506HRR	Q39	MECO1	W07		
	SO-HD	CZ8030NERP	0922	BELT2	W04		NO ABNORMALITY ISSUE
	SO8-HD	CZ804008RG	0111	BELT1	W05		
	SO8-SSHD	CZ8090ADRR	0158	MECO4	W09		
	SO14-HD	CZ8040M0RJ	V324	BELT2	W05		
	SO14-HD	CZ80802FRK	0324	BELT1	W03		
	SMA-SHD	CZ8080D6RJ	TFUV6	MECO4	W09		
	SMB-F	CZ8010FKRN	X020	BELT2	W03		
	SMB-F	CZ8010FKRQ	X020	BELT1	W03		
PLATING SMD	SMA	CZ81101E0J	TRANSIL	TPSL002	W11	40 Units	
	SMA	CZ811011RQ	RECTIFIER	TPSL001	W11		
	SMB	CZ801010RH	TRANSIL	TPSL001	W11		
	SMB	CZ81100WRL	TRANSIL	TPSL002	W11		
	SMC	CZ8100KK01	TRANSIL	TPSL002	W11		
	SMC	CZ8100KK0F	TRANSIL	TPSL001	W11		

Pull test (value in gram)

Unit / TV	431	0393	V912	0922	U494	16VA
1	15.01	13.6	14.672	14.636	14.452	11.664
2	15.36	14.6	15.453	15.453	14.304	16.251
3	15.21	14.2	14.465	14.079	12.545	12.737
4	15.24	14.7	14.426	15.042	15.496	15.761
5	15.42	15.4	14.01	14.903	14.476	11.715
6	14.99	13.8	16.027	15.701	15.011	13.81
7	14.79	14.9	16.432	15.509	17.319	13.608
8	15.21	12.9	14.368	15.425	15.382	12.138
9	13.98	14.8	15.751	14.898	14.678	13.941
10	15.02	13.3	16.432	14.49	14.307	15.261
11	13.51	14.2	14.265	14.823	13.176	14.698
12	15.21	13.1	15.338	14.563	15.617	14.527
13	14.11	14.6	15.551	14.378	16.618	12.306
14	13.44	13.8	15.813	15.265	14.114	11.938
15	14.11	13.8	14.037	14.656	15.627	13.08
16	14.17	14.3	14.008	14.934	15.535	12.499
17	14.35	13.7	16.952	14.941	14.309	15.726
18	14.37	14.0	14.233	15.115	10.447	14.834
19	14.36	14.7	16.103	14.219	13.889	15.188
20	13.69	15.9	15.377	15.173	14.102	11.412
21	15.15	15.4	15.781	16.422	16.117	13.671
22	14.7	13.6	16.52	14.589	16.464	12.423
23	12.97	15.1	16.565	13.446	11.319	13.25
24	13.2	15.2	16.153	16.097	14.759	14.596
25	13.74	12.9	15.985	14.468	16.151	14.806
26	14.02	14.5	13.981	13.235	14.809	16.194
27	15.11	12.4	14.33	15.869	12.718	14.522
28	13.35	12.9	15.985	14.468	16.151	14.806
29	13.25	14.5	13.981	13.235	14.809	16.194
30	14.61	12.4	14.33	15.869	12.718	14.522
31	14.98	13.6	15.079	14.661	16.078	11.821
32	14.6	13.23	15.526	15.999	15.921	13.03
33	16.2	12.09	14.864	14.389	14.046	13.7
mean	14.5	14.0	15.2	14.9	14.7	13.8
stddev	0.77	0.94	0.91	0.76	1.49	1.44
Cpk	4.52	3.56	4.11	4.78	2.38	2.28

All failure mode acceptable

Shear test (value in gram)

Unit / TV	0431	0393	V912	0922	U494	16VA
1	32.35	37.4	33.31	32.73	36.896	32.616
2	32.55	30.4	36.67	36.46	34.027	36.157
3	35.11	37.7	35.22	35.01	37.666	35.672
4	30.25	36.3	36.2	35.55	38.577	33.409
5	30.99	30.3	33.38	34.55	39.49	35.665
6	34.02	33.8	36.16	34.96	43.477	34.332
7	31.31	33.4	35.76	32.62	40.777	37.463
8	31.65	29.1	33.57	32.61	36.792	34.529
9	32.51	31.2	33.69	35.94	39.999	36.368
10	30.51	33.8	32.33	33.07	37.303	35.716
11	32.11	33.2	34.12	32.95	36.429	37.593
12	34.02	30.2	33.26	36.35	41.61	35.997
13	35.02	30.6	33.03	35.42	39.354	35.229
14	33.41	34.7	35.67	36.34	34.663	37.549
15	35.21	34.2	32.38	34.6	39.124	34.581
16	36.21	32.8	35.91	34.74	34.463	38.432
17	36.91	33.9	33.51	34.56	36.495	35.111
18	40.12	33.9	35.96	34.21	37.507	34.353
19	33.38	33.9	36.31	33.56	38.906	34.877
20	31.83	30.6	35.14	35.94	36.378	35.99
21	34.15	38.9	36.35	33.87	38.274	33.866
22	33.74	33.0	36.58	36.57	35.377	32.912
23	36.09	34.3	35.22	35.73	39.367	35.678
24	36.18	37.1	34.89	35.02	41.16	33.921
25	36.36	30.4	33.35	33.65	38.662	34.133
26	36.39	36.2	34.58	33.54	38.292	35.004
27	34.58	34.3	33.31	34.87	41.859	36.838
28	37.57	30.4	33.35	33.65	38.662	34.133
29	35.79	36.2	34.58	33.54	38.292	35.004
30	39.73	34.3	33.31	34.87	41.859	36.838
31	32.3	35.2	33.87	34.98	42.42	37.448
32	36.2	33.3	32.47	34.74	35.713	36.472
33	34.24	33.9	31.48	35.43	39.333	34.733
mean	34.3	33.6	34.4	34.6	38.5	35.4
stddev	2.42	2.45	1.43	1.15	2.34	1.41
Cpk	1.94	1.81	3.30	4.15	2.59	3.58

All failure mode acceptable

Physical dimension

Test vehicle 0393

CZ7410EHR0

Dimensions (mm)	Specifi- cation	Data					
items:	min.	max.	Min.	Max.	Mean	StDev	Cpk
Dambar Protrusion		0.120	0.027	0.071	0.051	0.010	1.68
Lead Width	0.375	0.425	0.395	0.416	0.403	0.004	1.76
Coplanarity		0.040	0.002	0.016	0.006	0.004	3.21
Stand Off	0.120	0.180	0.141	0.160	0.152	0.005	1.99
Foot length	0.567	0.667	0.641	0.654	0.646	0.004	1.88
Lead tip to tip	5.900	6.100	6.020	6.060	6.034	0.008	2.62
K (angle)	3.000	7.000	4.200	5.500	4.723	0.351	1.64

Test vehicle V912

CZ7410F3RN

Dimensions (mm)	Specification					Data	
items:	min.	max.	Min.	Max.	Mean	StDev	Cpk
Side Flash	0.020	0.250	0.132	0.153	0.144	0.006	NA
Dambar Protrusion		0.120	0.027	0.071	0.051	0.010	1.675
Lead Width	0.375	0.425	0.395	0.416	0.403	0.004	1.763
Coplanarity		0.040	0.002	0.016	0.006	0.004	3.210
Stand Off	0.120	0.180	0.141	0.160	0.152	0.005	1.988
Foot length	0.567	0.667	0.641	0.654	0.646	0.004	1.881
Lead tip to tip	5.900	6.100	6.020	6.060	6.034	0.008	2.615
K (angle)	3.000	7.000	4.200	5.500	4.723	0.351	1.636

Test vehicle 0922

Dimensions (mm)	Specification		Data				
items:	min.	max.	Min.	Max.	Mean	StDev	Cpk
Dambar Protrusion		0.120	0.027	0.071	0.051	0.010	1.675
Lead Width	0.375	0.425	0.395	0.416	0.403	0.004	1.763
Coplanarity		0.040	0.002	0.016	0.006	0.004	3.210
Stand Off	0.120	0.180	0.141	0.160	0.152	0.005	1.988
Foot length	0.567	0.667	0.641	0.654	0.646	0.004	1.881
Lead tip to tip	5.900	6.100	6.020	6.060	6.034	0.008	2.615
K (angle)	3.000	7.000	4.200	5.500	4.723	0.351	1.636

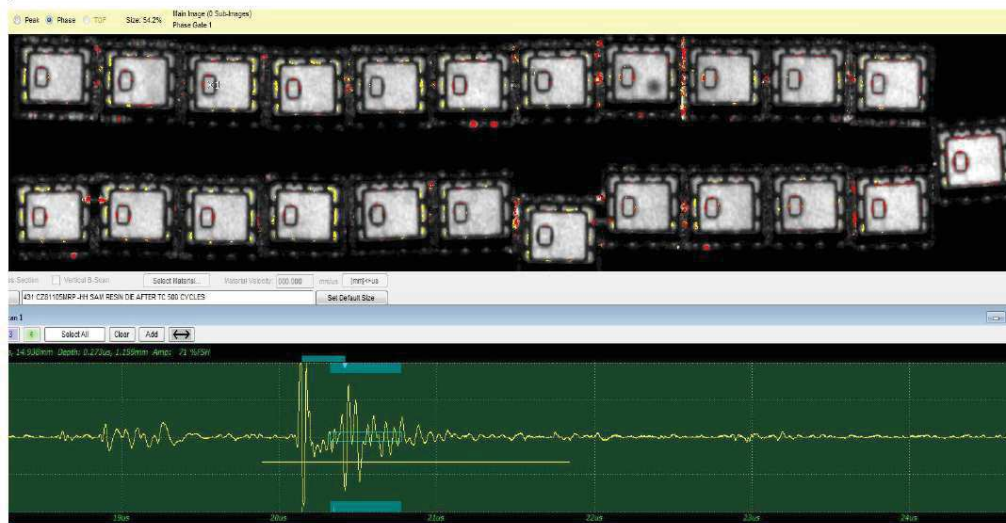
Scanning acoustic microscopy:

Test vehicle 0431

Delamination on die after 500 thermal cycling : no delamination reported neither on die nor on lead

Scanning acoustic analysis resin Die

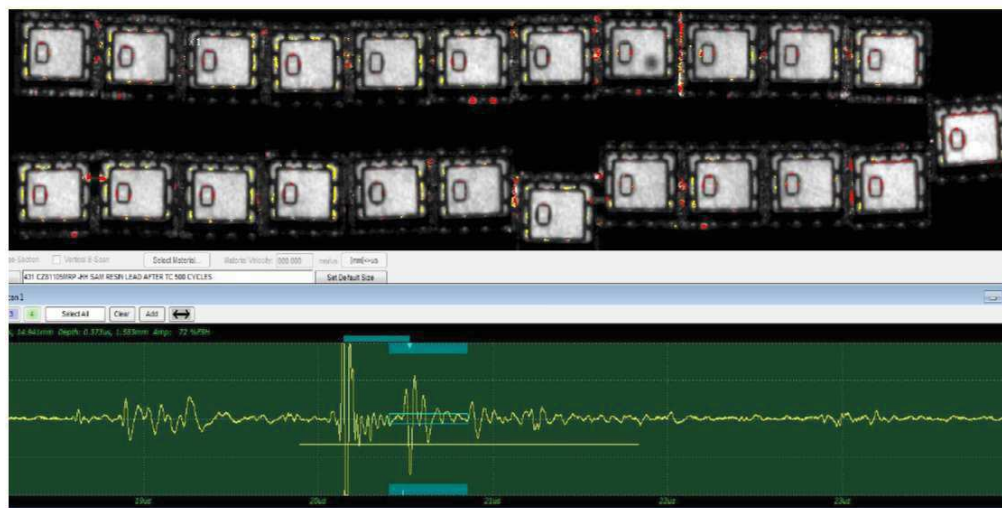
Defect inspected	Spec Number	Equipment	Mainte/Calib	Spec Number
Delamination resin Die	7512807	Sonix	NA	7396821
Delamination resin lead				
Delamination resin Pad				



No delamination issue at all units

Scanning acoustic analysis resin Lead

Defect inspected	Spec Number	Equipment	Mainte/Calib	Spec Number
Delamination resin Die	7512807	Sonix	NA	7396821
Delamination resin lead				
Delamination resin Pad				



No delamination issue at all units

ST Confidential

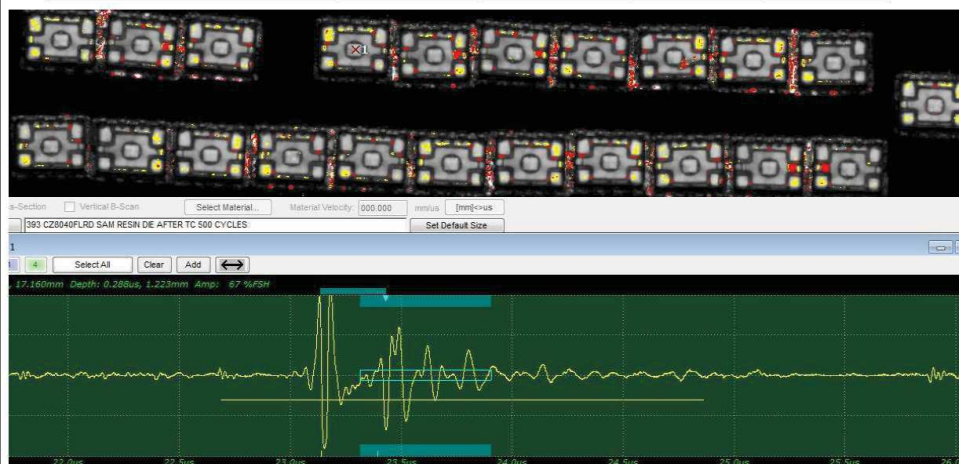
Test vehicle 0393

Delamination on die after 500thermal cycling : no delamination reported neither on die nor on lead

Scanning acoustic analysis resin die

Defect inspected	Spec Number	Equipment	Mainte/Calib	Spec Number
Delamination resin Die	7512807	Sonix	NA	7396821
Delamination resin lead				
Delamination resin Pad				

2

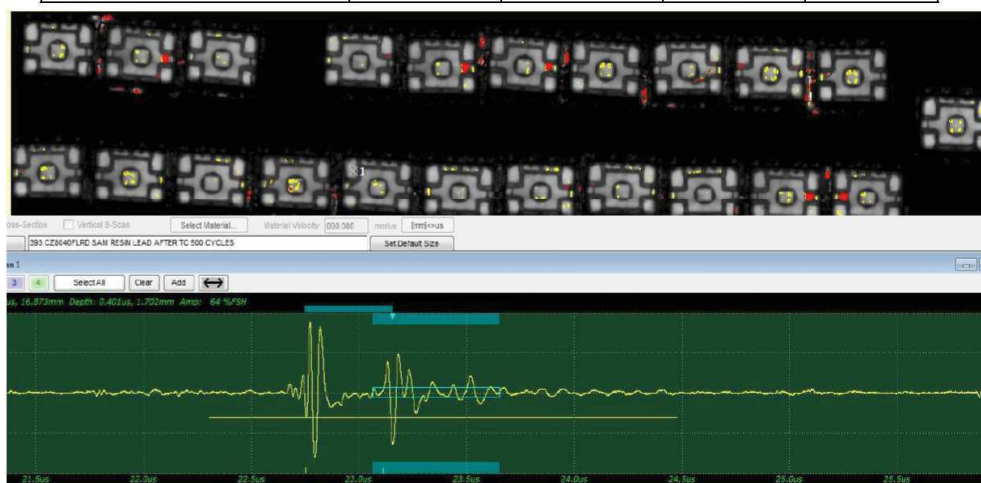


No delamination issue on all units

ST Confidential

Scanning acoustic analysis resin lead

Defect inspected	Spec Number	Equipment	Mainte/Calib	Spec Number
Delamination resin Die	7512807	Sonix	NA	7396821
Delamination resin lead				
Delamination resin Pad				



No delamination issue at all units

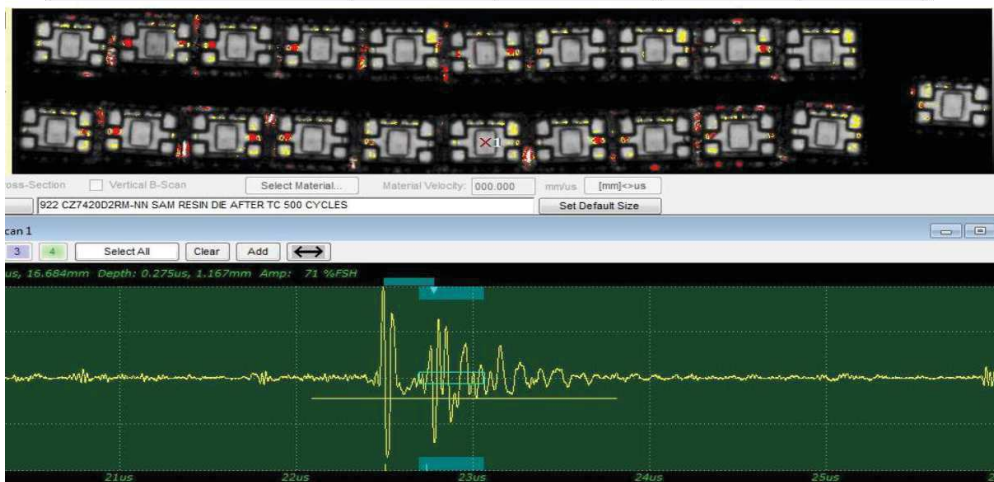
ST Confidential

Test vehicle 0922

Delamination on die after 500thermal cycling : no delamination reported neither on die nor on lead

Scanning acoustic analysis resin die a T0

Defect inspected	Spec Number	Equipment	Mainte/Calib	Spec Number
Delamination resin Die	7512807	Sonix	NA	7396821
Delamination resin lead				
Delamination resin Pad				

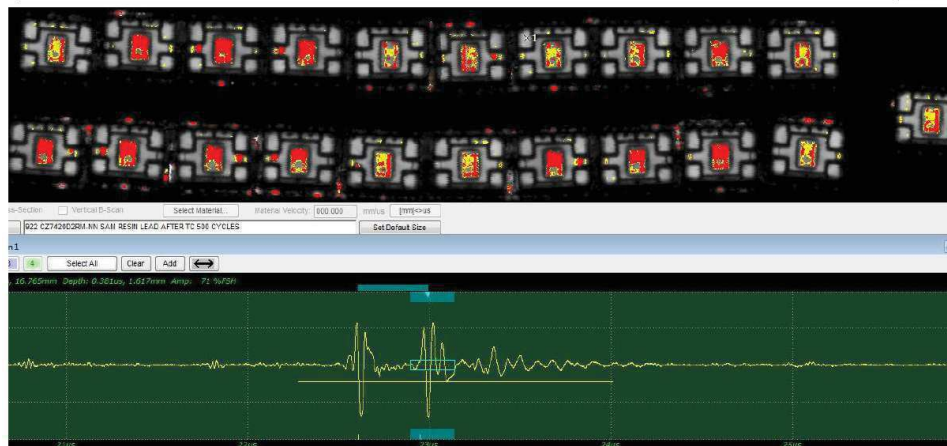


No delamination issue on all units

ST Confidential

Scanning acoustic analysis resin leads a T0

Defect inspected	Spec Number	Equipment	Mainte/Calib	Spec Number
Delamination resin Die	7512807	Sonix	NA	7396821
Delamination resin lead				
Delamination resin Pad				



No delamination issue on all units

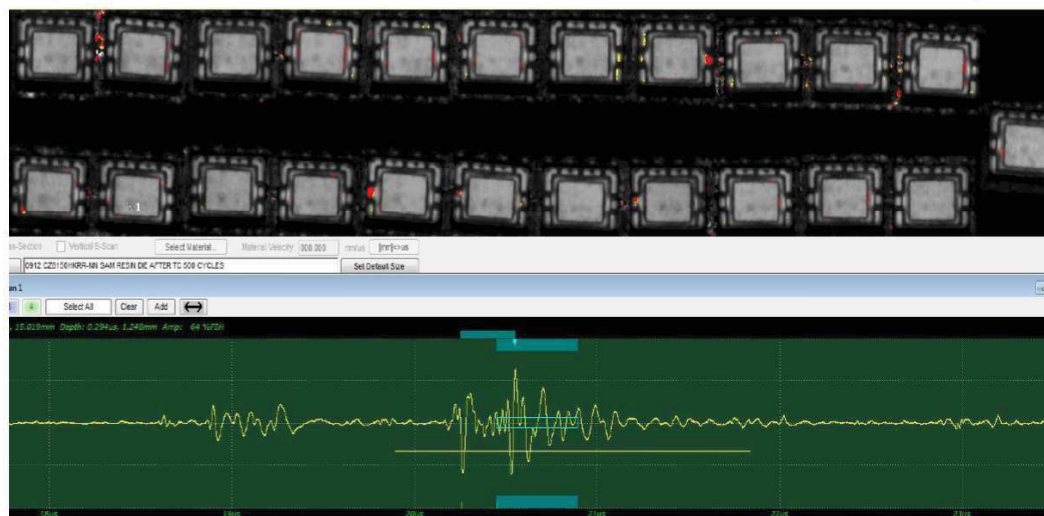
ST Confidential

Test vehicle 0912

Delamination on die after 500thermal cycling : no delamination reported neither on die nor on lead

Scanning acoustic analysis resin Die

Defect inspected	Spec Number	Equipment	Mainte/Calib	Spec Number
Delamination resin Die	7512807	Sonix	NA	7396821
Delamination resin lead				
Delamination resin Pad				

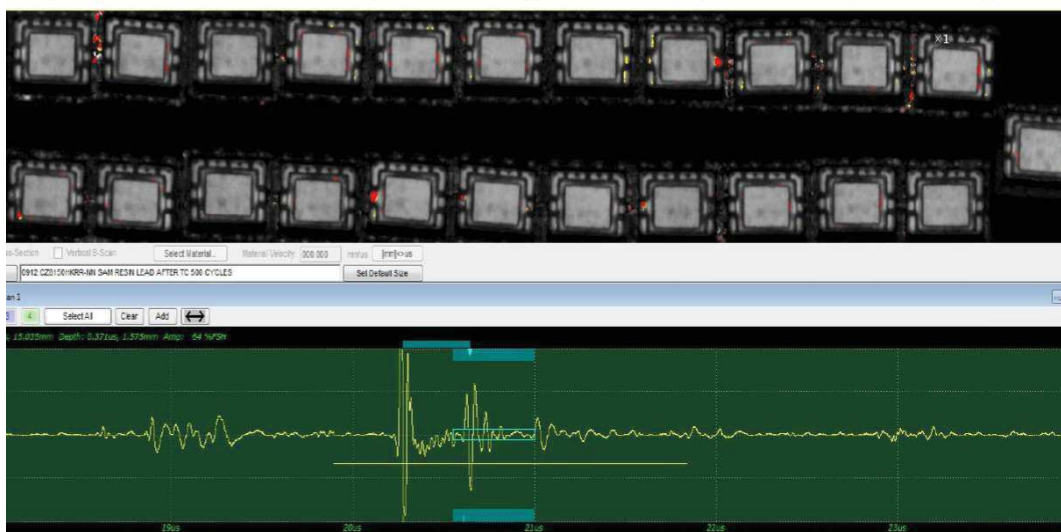


ST Confidential

No delamination issue at all units

Scanning acoustic analysis resin Lead

Defect inspected	Spec Number	Equipment	Mainte/Calib	Spec Number
Delamination resin Die	7512807	Sonix	NA	7396821
Delamination resin lead				
Delamination resin Pad				



ST Confidential

No delamination issue at all units

6 ANNEXES

6.1 Tests Description

Test name	Description	Purpose
Die Oriented		
HTOL High Temperature Operating Life HTB High Temperature Bias	The device is stressed in static or dynamic configuration, approaching the operative max. absolute ratings in terms of junction temperature and bias condition.	To determine the effects of bias conditions and temperature on solid state devices over time. It simulates the devices' operating condition in an accelerated way. The typical failure modes are related to, silicon degradation, wire-bonds degradation, oxide faults.
HTRB High Temperature Reverse Bias HTFB / HTGB High Temperature Forward (Gate) Bias	The device is stressed in static configuration, trying to satisfy as much as possible the following conditions: low power dissipation; max. supply voltage compatible with diffusion process and internal circuitry limitations;	To determine the effects of bias conditions and temperature on solid state devices over time. It simulates the devices' operating condition in an accelerated way. To maximize the electrical field across either reverse-biased junctions or dielectric layers, in order to investigate the failure modes linked to mobile contamination, oxide ageing, layout sensitivity to surface effects.
HTSL High Temperature Storage Life	The device is stored in unbiased condition at the max. temperature allowed by the package materials, sometimes higher than the max. operative temperature.	To investigate the failure mechanisms activated by high temperature, typically wire-bonds solder joint ageing, data retention faults, metal stress-voiding.
ELFR Early Life Failure Rate	The device is stressed in biased conditions at the max junction temperature.	To evaluate the defects inducing failure in early life.
Package Oriented		
PC Preconditioning	The device is submitted to a typical temperature profile used for surface mounting devices, after a controlled moisture absorption.	As stand-alone test: to investigate the moisture sensitivity level. As preconditioning before other reliability tests: to verify that the surface mounting stress does not impact on the subsequent reliability performance. The typical failure modes are "pop corn" effect and delamination.
AC Auto Clave (Pressure Pot)	The device is stored in saturated steam, at fixed and controlled conditions of pressure and temperature.	To investigate corrosion phenomena affecting die or package materials, related to chemical contamination and package hermeticity.
TC Temperature Cycling	The device is submitted to cycled temperature excursions, between a hot and a cold chamber in air atmosphere.	To investigate failure modes related to the thermo-mechanical stress induced by the different thermal expansion of the materials interacting in the die-package system. Typical failure modes are linked to metal displacement, dielectric cracking, molding compound delamination, wire-bonds failure, die-attach layer degradation.

Test name	Description	Purpose
TF / IOL Thermal Fatigue / Intermittent Operating Life	The device is submitted to cycled temperature excursions generated by power cycles (ON/OFF) at T ambient.	To investigate failure modes related to the thermo-mechanical stress induced by the different thermal expansion of the materials interacting in the die-package system. Typical failure modes are linked to metal displacement, dielectric cracking, molding compound delamination, wire-bonds failure, die-attach layer degradation.
THB Temperature Humidity Bias	The device is biased in static configuration minimizing its internal power dissipation, and stored at controlled conditions of ambient temperature and relative humidity.	To evaluate the package moisture resistance with electrical field applied, both electrolytic and galvanic corrosion are put in evidence.
Other		
ESD Electro Static Discharge	The device is submitted to a high voltage peak on all his pins simulating ESD stress according to different simulation models. CBM: Charged Device Model HBM: Human Body Model MM: Machine Model	To classify the device according to his susceptibility to damage or degradation by exposure to electrostatic discharge.
LU Latch-Up	The device is submitted to a direct current forced/sunk into the input/output pins. Removing the direct current no change in the supply current must be observed.	To verify the presence of bulk parasitic effect inducing latch-up.