


**PRODUCT / PROCESS CHANGE NOTIFICATION**

**1. PCN basic data**

1.1 Company		STMicroelectronics International N.V
1.2 PCN No.	AMS/21/12964	
1.3 Title of PCN	Introduction of ST Bouskoura for selected Automotive grade products assembled in SO8 (Signal conditioning products)	
1.4 Product Category	See product list	
1.5 Issue date	2021-09-02	

**2. PCN Team**

<b>2.1 Contact supplier</b>	
2.1.1 Name	ROBERTSON HEATHER
2.1.2 Phone	+1 8475853058
2.1.3 Email	heather.robertson@st.com
<b>2.2 Change responsibility</b>	
2.2.1 Product Manager	Marcello SAN BIAGIO
2.1.2 Marketing Manager	Salvatore DI VINCENZO
2.1.3 Quality Manager	Jean-Marc BUGNARD

**3. Change**

3.1 Category	3.2 Type of change	3.3 Manufacturing Location
Transfer	Line transfer for a full process or process brick (process step, control plan, recipes) from one site to another site: Assembly site (SOP 2617)	ST Bouskoura

**4. Description of change**

	Old	New
4.1 Description	Assembly plant : - Subcontractor Amkor	Assembly plant : - Subcontractor Amkor - ST Bouskoura
4.2 Anticipated Impact on form,fit, function, quality, reliability or processability?	No impact	

**5. Reason / motivation for change**

5.1 Motivation	Progressing on the activities related to quality continuous improvement and production rationalization, ST is glad to announce the assembly of selected products in SO8 package in ST Bouskoura.
5.2 Customer Benefit	SERVICE IMPROVEMENT

**6. Marking of parts / traceability of change**

6.1 Description	New Finished good codes
-----------------	-------------------------

**7. Timing / schedule**

7.1 Date of qualification results	2021-08-02
7.2 Intended start of delivery	2021-11-16
7.3 Qualification sample available?	Upon Request

**8. Qualification / Validation**

8.1 Description	12964 RER__Qual report SO Amkor to Bouskoura_1-.pdf		
8.2 Qualification report and qualification results	Available (see attachment)	Issue Date	2021-09-02

9. Attachments (additional documentations)		
12964 Public product.pdf 12964 RER__Qual report SO Amkor to Bouskoura_1-.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
	TSB712AIYDT	
	TSB712IYDT	
	TSB7192AIYDT	
	TSB7192IYDT	
	TSX712IYDT	
	TSX7192IYDT	
	TSZ122IYDT	
	TSZ182IYDT	

## **IMPORTANT NOTICE – PLEASE READ CAREFULLY**

Subject to any contractual arrangement in force with you or to any industry standard implemented by us, STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2018 STMicroelectronics – All rights reserved



## 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

**PCN Title :** Introduction of ST Bouskoura for selected Automotive grade products assembled in SO8 (Signal conditioning products)

**PCN Reference :** AMS/21/12964

**Subject :** Public Products List

Dear Customer,

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

TSZ122IYDT	TSB7192AIYDT	TSX7192IYDT
TSB712AIYDT	TSX712IYDT	TSB7192IYDT
TSB712IYDT	TSZ182IYDT	



### IMPORTANT NOTICE – PLEASE READ CAREFULLY

Subject to any contractual arrangement in force with you or to any industry standard implemented by us, STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

**PRODUCT/PROCESS  
CHANGE NOTIFICATION**

---

PCN AMS/21/12964

---

**Analog, MEMS & Sensors Group (AMS)**

**Introduction of ST Bouskoura for selected Automotive grade  
products assembled in SO8 (Signal conditioning products)**

**WHAT:**

Progressing on the activities related to quality continuous improvement and production rationalization, ST is glad to announce the assembly of selected products in SO8 package in ST Bouskoura.

Material	Current process	Modified process	Comment
Diffusion location	ST Singapore, ST Crolles, ST Agrate	ST Singapore, ST Crolles, ST Agrate	No change
Assembly location	Amkor Philippines	ST Bouskoura	
Molding compound	Sumitomo G600 Sumitomo G700LS	Sumitomo G700KC	Alignment on high reliability compound
Die attach	Ablestick 8290	Ablestick 8601-S25	
Lead-frame	Copper C194	Copper C194	
Wire	Gold 1mil and 0.8mil	Copper 1 mil / Gold 1 Mil	Gold 1 mil for HCMOS7 technology
Plating	Sn and NiPdAu	Sn	
MSL	1	1	

**WHY:**

This change will contribute to ST's continuous service and quality improvement and ensure a consistent assembly process through all the SO production lines.

**HOW:**

The qualification program consists mainly of comparative electrical characterization and reliability tests.

You will find here after the qualification test plan which summarizes the various test methods and conditions that ST uses for this qualification program.

**WHEN:**

This 2<sup>nd</sup> source will be activated in Q4-2021 in ST Bouskoura.

**Marking and traceability:**

Unless otherwise stated by customer's specific requirement, the traceability of the parts assembled with the new material set will be ensured by new internal sales type, date code and lot number.

The changes here reported will not affect the electrical, dimensional and thermal parameters keeping unchanged all the information reported on the relevant datasheets.

There is also no change in the packing process or in the standard delivery quantities.

Shipments may start earlier with the customer's written agreement.

# Reliability Report

*Product transfer SO8 (HCMOS7, BiC-MOS40 and HVG8A technologies) from Amkor to ST Bouskoura*

General Information		Locations	
<b>Product Line :</b>	A256, VB2F, VB2S	<b>Wafer fab</b>	ST Crolles ST Singapore
<b>Product Description</b>	Dual op amps		
<b>P/N</b>	TSB612IYDT, TSV792IYDT, TSV7722IYDT	<b>Assembly plant</b>	ST Bouskoura (Morocco)
<b>Product Group</b>	AMS		
<b>Product division</b>	GPA		
<b>Package</b>	SO8		
<b>Silicon Process technology</b>	HCMOS7, BiCMOS40,	<b>Reliability Lab</b>	ST Grenoble France ST Bouskoura Morocco

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.  
 This report does not imply for STMicroelectronics expressly or implicitly any contractual obligations other than as set forth in STMicroelectronics general terms and conditions of Sale. This report and its contents shall not be disclosed to a third party without previous written agreement from STMicroelectronics.



## TABLE OF CONTENTS

<b>1</b>	<b>APPLICABLE AND REFERENCE DOCUMENTS.....</b>	<b>5</b>
<b>2</b>	<b>GLOSSARY .....</b>	<b>5</b>
<b>3</b>	<b>RELIABILITY EVALUATION OVERVIEW .....</b>	<b>5</b>
3.1	OBJECTIVES.....	5
3.2	CONCLUSION .....	5
<b>4</b>	<b>DEVICE CHARACTERISTICS .....</b>	<b>6</b>
4.1	DEVICE DESCRIPTION .....	6
4.2	CONSTRUCTION NOTE.....	9
<b>5</b>	<b>TESTS RESULTS SUMMARY .....</b>	<b>10</b>
5.1	TEST VEHICLE .....	10
5.2	TEST PLAN AND RESULTS SUMMARY .....	10
<b>6</b>	<b>ANNEXES .....</b>	<b>18</b>
6.1	TESTS DESCRIPTION .....	18

## **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 the second source of signal conditional products in HCMOS7, BiCMOS40 and HVG8A from Amkor to ST Bouskoura for standard and Automotive Grade.

### **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

TSB612IYDT



TSB611, TSB612

Datasheet

Low-power, rail-to-rail output, 36 V operational amplifiers



#### Features

- Low offset voltage: 1 mV max
- Low current consumption: 125  $\mu$ A max. per amplifier at 36 V
- Wide supply voltage: 2.7 to 36 V
- Gain bandwidth product: 560 kHz typ
- Unity gain stable
- Rail-to-rail output
- Input common mode voltage includes ground
- High tolerance to ESD: 4 kV HBM
- Extended temperature range: -40 °C to 125 °C
- Automotive qualification

#### Applications

- Industrial
- Power supplies
- Automotive

#### Description

The TSB611, TSB612 operational amplifiers (op amps) offer an extended supply voltage operating range and rail-to-rail output. They also offer an excellent speed/power consumption ratio with 560 kHz gain bandwidth product while consuming less than 125  $\mu$ A per amplifier at 36 V supply voltage.

The TSB611, TSB612 operate over a wide temperature range from -40 °C to 125°C making this device ideal for industrial and automotive applications.

Thanks to their small package size, the TSB611, TSB612 can be used in applications where space on the board is limited. They can thus reduce the overall cost of the PCB.

Maturity status link

TSB611, TSB612

## TSV792IYDT



## TSV791, TSV792

### Datasheet

High bandwidth (50 MHz) low offset (200  $\mu$ V) rail-to-rail 5 V op-amp



### Features

- Gain bandwidth product 50 MHz, unity gain stable
- Slew rate 30 V/ $\mu$ s
- Low input offset voltage 50  $\mu$ V typ., 200  $\mu$ V max.
- Low input bias current: 2 pA typ.
- Low input voltage noise density 6.5 nV/ $\sqrt{\text{Hz}}$  @ 10 kHz
- Wide supply voltage range: 2.2 V to 5.5 V
- Rail-to-rail input and output
- Extended temperature range: -40 °C to +125 °C
- Automotive grade version available
- Benefits:
  - Accuracy of measurement virtually unaffected by noise or input bias current
  - Signal conditioning for high frequencies

### Applications

- High bandwidth low-side and high-side current sensing
- Photodiode transimpedance amplification
- A/D converters input buffers
- Power management in solar-powered systems
- Power management in automotive applications

### Description

The TSV791 and TSV792 are single and dual 50 MHz-bandwidth unity-gain-stable amplifiers. The rail-to-rail input stage and the slew rate of 30 V/ $\mu$ s make the TSV791 and TSV792 ideal for low-side current measurement. The excellent accuracy provided by maximum input voltage of 200  $\mu$ V allows amplifying accurately small-amplitude input signal. The TSV79x can operate from a 2.2 V to 5.5 V single supply; it can typically handle an output capacitor up to 1 nF and is fully specified on a load of 22 pF, therefore allowing easy usage as A/D converters input buffer.

Maturity status link	
TSV791, TSV792	
Related products	
TSZ181 TSZ182	Zero drift amplifiers with more power savings (3 MHz)
TSB712	36 V high-bandwidth amplifiers (6 MHz)
TSB7192	36 V high-bandwidth amplifiers (20 MHz)

## TSV7722IYDT



## TSV7721, TSV7722, TSV7723

### Datasheet

### High bandwidth (22 MHz) low offset (200 $\mu$ V) 5 V op amp



### Features

- Gain bandwidth product 22 MHz, unity gain stable
- High accuracy input offset voltage: 50  $\mu$ V typ., 200  $\mu$ V max.
- Low input bias current: 2 pA typ.
- Low input voltage noise density: 7 nV/ $\sqrt{\text{Hz}}$
- Wide supply voltage range: 1.8 V to 5.5 V
- Output rail-to-rail
- Input common-mode range includes low rail
- Automotive grade and shutdown versions available
- Benefits:
  - High frequency signal conditioning
  - Optimized accuracy for low-side current sensing

### Applications

- Low-side current measurement
- Photodiode amplifiers
- Automotive current measurement and sensor signal conditioning
- Strain gauges signal conditioning

### Description

The TSV7721, TSV7722 and TSV7723 are single and dual 22 MHz-bandwidth unity-gain-stable amplifiers. The input offset voltage of 200  $\mu$ V max. (50  $\mu$ V typ.) at room temperature, optimized for common-mode close to ground makes the TSV772x ideal for low-side current measurements.

The TSV772x can operate from 1.8 V to 5.5 V single supply and it is fully specified on a load of 47 pF, therefore allowing easy usage as A/D converters input buffer.

The TSV772x series offers rail-to-rail output, excellent speed/power consumption ratio, and 22 MHz gain bandwidth product, while consuming just 1.7 mA at 5 V.

The devices also feature an ultra-low input bias current that enables connection to photodiodes and other sensors where current is the key value to be measured.

These features make the TSV772x series ideal for high-accuracy, high-bandwidth sensor interfaces.

Maturity status link	Channel	Automotive	Package
TSV7721	1		SOT23-5
	1	*	SOT23-5
TSV7722	2		DFN8
	2		MiniSO8
	2		SO8
	2	*	MiniSO8
	2	*	SO8
	2	*	SO8
TSV7723	2		MiniSO10

Related products	
TSV792	Rail-to-rail amplifier with higher GBW 50 MHz
TSB7192	22 MHz amplifier with 36 V supply voltage

## 4.2 Construction note

	P/N TSB612IYDT	P/N TSV792IYDT	P/N TSV7722
Wafer/Die fab. information			
Wafer fab manufacturing location	ST Singapore	ST Crolles	ST Crolles
Technology	BiCMOS40	HCMOS7	HCMOS7
Die finishing back side	RAW SILICON	RAW SILICON	RAW SILICON
Die size (microns)	1518x1656	938x1638	888x1588
Bond pad metallization layers	AlSiCu	AlCu	AlCu
Passivation type	PSG + NITRIDE	PSG + NITRIDE + PIX	PSG + NITRIDE + PIX
Wafer Testing (EWS) information			
Electrical testing manufacturing location	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	Gold 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	BiCMOS40/SO8	A256	
2	HCMOS7/SO8	VB2F	
3	HVG8A/SO8	VB2S	

### 5.2 Test plan and results summary

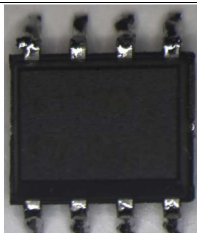
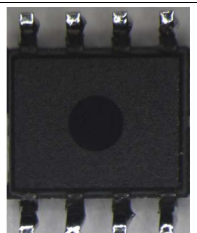
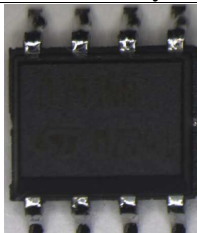
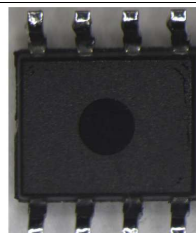




Test	PC	Std ref.	Conditions	SS	Steps	Failure/SS						Note		
						TSB612	TSV792	TSX922						
HTOL	N	JESD22 A-108	Tj = 150°C, BIAS		168 H	2x0/77	2x0/77	0/77						
					500 H	2x0/77	2x0/77	0/77						
					1000 H	2x0/77	2x0/77	0/77						
					2000h	2x0/77	0/77	0/77						
ELFR	N	JESD22 A-008	Ta = 125°C, BIAS		48h	2x0/800	0/800	0/800						
HTSL	N	JESD22 A-103	Ta = 150°C		168 H	2x0/77	2x0/77	0/77						
					500 H	2x0/77	2x0/77	0/77						
					1000 H	2x0/77	2x0/77	0/77						
					2000H	2x0/77	0/77	0/77						
			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						
AC	Y	JESD22 A-102	Pa=2Atm / Ta=121°C		96 H	2x0/77	2x0/77	0/77						
TC	Y	JESD22 A-104	Ta = -65°C to 150°C		100 cy	2x0/77	2x0/77	0/77						
					200 cy	2x0/77	2x0/77	0/77						
					500 cy	2x0/77	2x0/77	0/77						
					1000cy	2x0/77	2x0/77	0/77						
					2000cy	2x0/77	2x0/77	0/77						
THB	Y	JESD22 A-101	Ta = 85°C, RH = 85%, 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						
					1500H	0/77	0/77	0/77						
					2000H	0/77	0/77	0/77						



## Solderability:

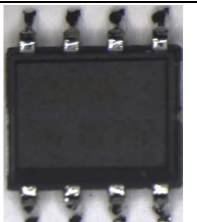
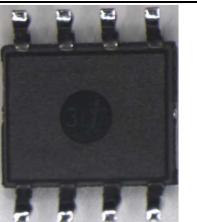
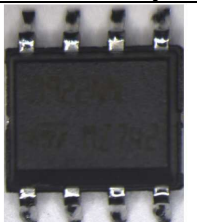
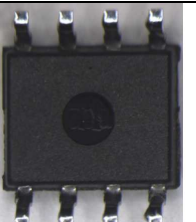
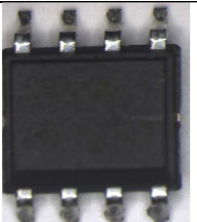
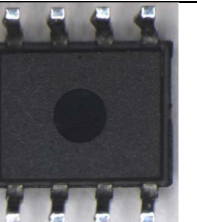
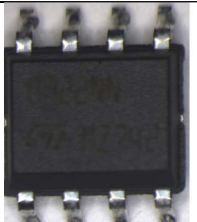
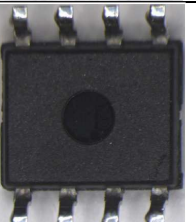
### Test vehicle 0393

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

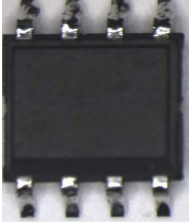
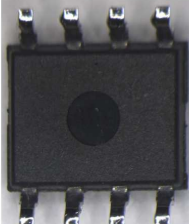
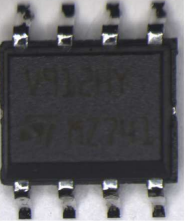
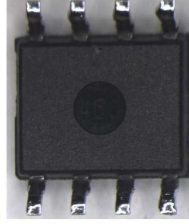
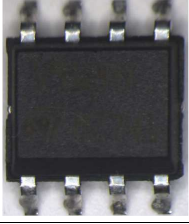
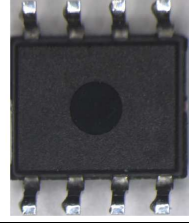
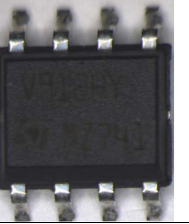
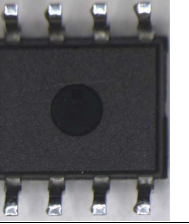
Lot ref: CZ7420D2RM

	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

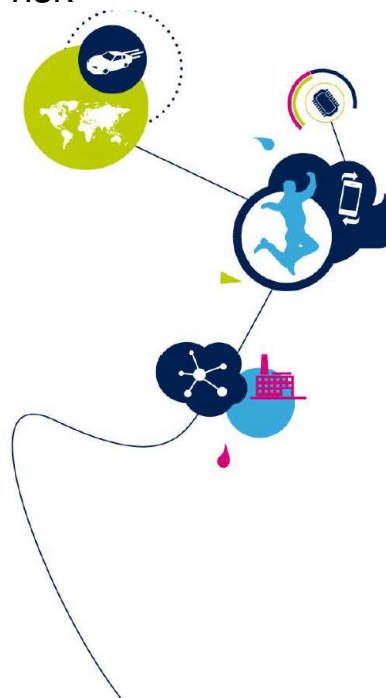
	After 8h at 85°C/85%RH		After 16h dry air 150°C	
SnPb bath				
SnAgCu bath				
Conclusion	5 units/ split passed the test with no issue reported			

## Lead-free Matte tin verification versus whiskers risk

# Whiskers Monitoring Report

## ST BSK LAB: Q1-18

S. CHELLAOU  
K. OULAD BENAÏSSA



## Whiskers related tests

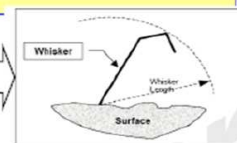
(According to ST BSK Whiskers acceptance criteria referred to DM00485464)

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	0922	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	V524	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)

All failure mode acceptable

Unit / TV	393	V912	922	U494	16VA	0912	0431
1	13.6	14.672	14.636	14.452	11.664	17.587	15.01
2	14.6	15.453	15.453	14.304	16.251	17.609	15.36
3	14.2	14.465	14.079	12.545	12.737	16.638	15.21
4	14.7	14.426	15.042	15.496	15.761	16.381	15.24
5	15.4	14.01	14.903	14.476	11.715	15.957	15.42
6	13.8	16.027	15.701	15.011	13.81	17.179	14.99
7	14.9	16.432	15.509	17.319	13.608	17.377	14.79
8	12.9	14.368	15.425	15.382	12.138	17.856	15.21
9	14.8	15.751	14.898	14.678	13.941	15.283	13.98
10	13.3	16.432	14.49	14.307	15.261	16.984	15.02
11	14.2	14.265	14.823	13.176	14.698	17.817	13.51
12	13.1	15.338	14.563	15.617	14.527	15.021	15.21
13	14.6	15.551	14.378	16.618	12.306	16.867	14.11
14	13.8	15.813	15.265	14.114	11.938	16.542	13.44
15	13.8	14.037	14.656	15.627	13.08	17.162	14.11
16	14.3	14.008	14.934	15.535	12.499	17.26	14.17
17	13.7	16.952	14.941	14.309	15.726	15.135	14.35
18	14	14.233	15.115	10.447	14.834	17.34	14.37
19	14.7	16.103	14.219	13.889	15.188	16.894	14.36
20	15.9	15.377	15.173	14.102	11.412	17.818	13.69
21	15.4	15.781	16.422	16.117	13.671	16.746	15.15
22	13.6	16.52	14.589	16.464	12.423	16.009	14.7
23	15.1	16.565	13.446	11.319	13.25	16.114	12.97
24	15.2	16.153	16.097	14.759	14.596	16.025	13.2
25	12.9	15.985	14.468	16.151	14.806	17.144	13.74
26	14.5	13.981	13.235	14.809	16.194	15.334	14.02
27	12.4	14.33	15.869	12.718	14.522	17.195	15.11
28	12.9	15.985	14.468	16.151	14.806	17.144	13.35
29	14.5	13.981	13.235	14.809	16.194	15.334	13.25
30	12.4	14.33	15.869	12.718	14.522	17.195	14.61
31	13.6	15.079	14.661	16.078	11.821	17.048	14.98
32	13.23	15.526	15.999	15.921	13.03	15.915	14.6
33	12.09	14.864	14.389	14.046	13.7	16.995	16.2
mean	14.0	15.2	14.9	14.7	13.8	16.7	14.5
stddev	0.94	0.91	0.76	1.49	1.44	0.81	0.77
Cpk	3.56	4.11	4.78	2.38	2.28	5.19	4.52

## Shear test (value in gram)

All failure mode acceptable

Unit / TV	393	V912	922	U494	16VA	0431	0912
1	37.4	33.31	32.73	36.896	32.616	32.35	32.35
2	30.4	36.67	36.46	34.027	36.157	32.55	29.17
3	37.7	35.22	35.01	37.666	35.672	35.11	31.8
4	36.3	36.2	35.55	38.577	33.409	30.25	32.34
5	30.3	33.38	34.55	39.49	35.665	30.99	33.03
6	33.8	36.16	34.96	43.477	34.332	34.02	31.53
7	33.4	35.76	32.62	40.777	37.463	31.31	31.4
8	29.1	33.57	32.61	36.792	34.529	31.65	32.94
9	31.2	33.69	35.94	39.999	36.368	32.51	31.02
10	33.8	32.33	33.07	37.303	35.716	30.51	32.88
11	33.2	34.12	32.95	36.429	37.593	32.11	31.79
12	30.2	33.26	36.35	41.61	35.997	34.02	32.66
13	30.6	33.03	35.42	39.354	35.229	35.02	32.62
14	34.7	35.67	36.34	34.663	37.549	33.41	32.86
15	34.2	32.38	34.6	39.124	34.581	35.21	32.7
16	32.8	35.91	34.74	34.463	38.432	36.21	31.46
17	33.9	33.51	34.56	36.495	35.111	36.91	30.12
18	33.9	35.96	34.21	37.507	34.353	40.12	31.47
19	33.9	36.31	33.56	38.906	34.877	33.38	31.86
20	30.6	35.14	35.94	36.378	35.99	31.83	33.01
21	38.9	36.35	33.87	38.274	33.866	34.15	31.61
22	33	36.58	36.57	35.377	32.912	33.74	32.37
23	34.3	35.22	35.73	39.367	35.678	36.09	31.09
24	37.1	34.89	35.02	41.16	33.921	36.18	32.69
25	30.4	33.35	33.65	38.662	34.133	36.36	32.26
26	36.2	34.58	33.54	38.292	35.004	36.39	29.13
27	34.3	33.31	34.87	41.859	36.838	34.58	29.8
28	30.4	33.35	33.65	38.662	34.133	37.57	32.26
29	36.2	34.58	33.54	38.292	35.004	35.79	29.13
30	34.3	33.31	34.87	41.859	36.838	39.73	29.8
31	35.2	33.87	34.98	42.42	37.448	32.3	31.44
32	33.3	32.47	34.74	35.713	36.472	36.2	31.09
33	33.9	31.48	35.43	39.333	34.733	34.24	33.19
mean	33.6	34.4	34.6	38.5	35.4	34.3	31.7
stddev	2.44	1.43	1.15	2.34	1.41	2.42	1.19
Cpk	1.82	3.30	4.15	2.59	3.58	1.94	3.19

## 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 (NN)

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

## 6 ANNEXES

### 6.1 Tests Description

Test name	Description	Purpose
<b>Die Oriented</b>		
<b>HTOL</b> High Temperature Operating Life  <b>HTB</b> 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.
<b>HTRB</b> High Temperature Reverse Bias  <b>HTFB / HTGB</b> 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.
<b>HTSL</b> 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.
<b>ELFR</b> 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.
<b>Package Oriented</b>		
<b>PC</b> 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.
<b>AC</b> 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.
<b>TC</b> 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
<b>TF / IOL</b> 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.
<b>THB</b> 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.
<b>Other</b>		
<b>ESD</b> 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.
<b>LU</b> 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.