PRODUCT / PROCESS CHANGE NOTIFICATION

1. PCN basic data	
1.1 Company	STMicroelectronics International N.V
1.2 PCN No.	AMG/17/10447
1.3 Title of PCN	Material set change on TSSOP14 and TSSOP16 packages for General Purpose Analog automotive in Amkor Philippines
1.4 Product Category	See product list
1.5 Issue date	2017-11-10

2. PCN 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	Lorenzo NASO
2.1.2 Marketing Manager	Marcello SAN BIAGIO
2.1.3 Quality Manager	Jean-Marc BUGNARD

3. Change		
3.1 Category	3.2 Type of change	3.3 Manufacturing Location
Materials	New direct material part number (same supplier, different supplier or new supplier), lead frame, resin, wire, ...)	AMKOR ATP1

4. Description of change		
	Old	New
4.1 Description	Assembly in Amkor ATP1 with : - Molding compound : SUMITOMO EME-G700K - HDLF Lead-frame	Assembly in Amkor ATP1 with : - Molding compound : Sumitomo G700LS - XDLF lead-frame
4.2 Anticipated Impact on form,fit, function, quality, reliability or processability?	No impact	

5. Reason / motivation for change	
5.1 Motivation	Progressing on activities related to process modernization and quality improvement, ST is pleased to announce the introduction of a new molding compound (Sumitomo G700LS) for the TSSOP14L and TSSOP16L in Amkor Philippines as well as a new lead-frame strip density. The density (number of lead-frame's unit per strip during production) will be changed from HDLF to XDLF with no impact on internal frame structure.
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	2017-12-15
7.2 Intended start of delivery	2018-02-05
7.3 Qualification sample available?	Upon Request

8. Qualification / Validation			
8.1 Description	10447 10447Qual Report_TSSOP14-16- Auto-f.pdf		
8.2 Qualification report and qualification results	Available (see attachment)	Issue Date	2017-11-10

9. Attachments (additional documentations)
10447 Public product.pdf 10447 10447Qual Report_TSSOP14-16- Auto-f.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
	A6985F	
	A6985F3V3	
	A6985F5VTR	
	A6986	
	A6986F3V3TR	
	A6986F5V	
	A6986TR	
	ALED6001	
	L6985F	
	LM2901YPT	
	LM2902YPT	
	LMV324IYPT	
	TS924IYPT	
	TSV524AIYPT	
	TSV524IYPT	
	TSZ124IYPT	

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PRODUCT/PROCESS
CHANGE NOTIFICATION

PCN AMG/17/10447

Analog & MEMS Group (AMG)

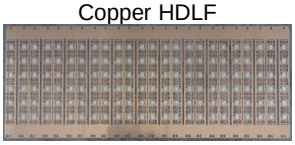
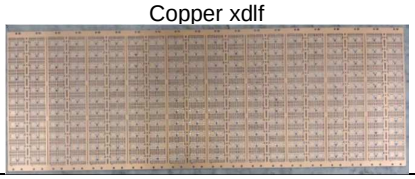
Material set change on TSSOP14 and TSSOP16 for General Purpose Analog automotive in Amkor Philippines

WHAT:

Progressing on activities related to process modernization and quality improvement, ST is pleased to announce the introduction of a new molding compound Sumitomo G700LS for the TSSOP14L and TSSOP16L in Amkor Philippines as well as a new lead-frame strip density. The density (number of lead-frame's unit per strip during production) will be changed from HDLF to XDLF with no impact on internal frame structure.

Phase out of the Old Lead Frame Matrix (OMLF) and High Density Lead Frame (HDLF) will occur in parallel. This change affects our assembly subcontractor Amkor ATP1, Philippines.

This PCN applies to Automotive-grade commercial products.
Please find more information related to transfer for impacted products:

Material	Current process	Modified process	Comment
Diffusion location	No change		No change
Assembly location	Amkor Philippines		No change
Molding compound	SUMITOMO EME-G700K	Sumitomo G700LS	
Die attach	ABLEBOND 8290/Ablestick 84-1LMISR4		No change
Leadframe	Copper HDLF 	Copper xdlf 	Higher number of unit per leadframe during production
Wire	Gold 1 mil/Gold 1.2mils		No change
Plating	Sn		No change
MSL	No change		No change

Samples of vehicle test are available now and other samples will be launched upon customer's requests. Please submit requests for samples within 30 days of this notification.

WHY:

The purpose of the change from Sumitomo G700K to Sumitomo G700LS is to increase quality level and move to higher density frame will allow greater efficiency and productivity.

HOW:

•The change affects molding compound and lead frame strip density. The qualification is based on representative Test vehicles, using internal ST rules for changes.
•To validate the change, dedicated engineering trials have been performed and reliability report is attached.

IMPACTS OF THE CHANGE:

Form/Fit/Fonction : No change

WHEN:

For all impacted products, estimated 1st shipment start date is wk06 2018.

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 -as well- no change in the packing process or in the standard delivery quantities.

Lack of acknowledgement of the PCN within 30 days will constitute acceptance of the change. After acknowledgement, lack of additional response within the 90 day period will constitute acceptance of the change (Jedec Standard No. 46-C).

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

Reliability Report

TSSOP14- 16 material set change
Amkor Philippines
for General Purpose Analog automotive

General Information	
Product Line	*0124, UAF5, UP04, UX54, UP06*
Product Description	Quad op amp, 2 A synchronous step-down switching regulator, Low voltage 8-bit constant current LED sink driver, PWM-dimmable single channel LED driver, DC-DC PWM ctrl+POE Interface
P/N	*LM2902YPT, A6986, STAP08DP5XTTR, ALED6001, PM8800A*
Product Group	*AMG*
Product division	*General Purpose Analog &RF, Industrial Power Conversion*
Package	*TSSOP14, HTSSOP16, TSSOP16*
Silicon Process technology	*Bipolar, BCD8, BCD6RF, BCD6S*

Locations	
Wafer fab	*ST Singapore, ST Agrate, ST Catania*
Assembly plant	*Amkor ATP1*
Reliability Lab	*ST Grenoble, ST Casteletto, ST Catania*

TABLE OF CONTENTS

1 APPLICABLE AND REFERENCE DOCUMENTS

Document reference	Short description
JESD47	Stress-Test-Driven Qualification of Integrated Circuits
0061692	Reliability tests and criteria for qualifications

2 GLOSSARY

DUT	Device Under Test
PCB	Printed Circuit Board
SS	Sample Size

3 RELIABILITY EVALUATION OVERVIEW

3.1 Objectives

To qualify new material set (sumitomo G700LS and xdlf leadframe) for automotive products General Purpose Analog in TSSOP14, HTSSOP16 and TSSOP16 package, from Amkor Philippines.

3.2 Conclusion

Qualification Plan requirements will have to be 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

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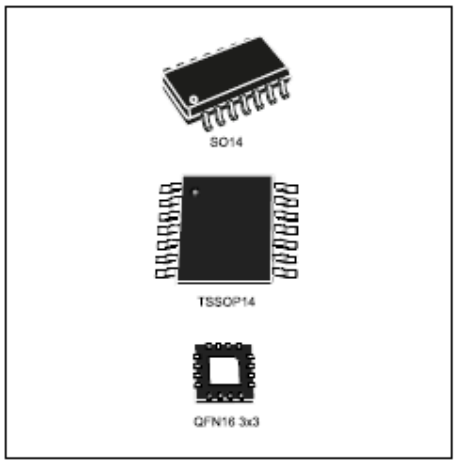
LM2902

Low-power quad operational amplifiers

Datasheet - production data



Description

This circuit consists of four independent, high-gain operational amplifiers (op amps) which employ internal frequency compensation and are specifically designed for automotive and industrial control systems.

The device operates from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low-power supply current drain is independent from the power supply voltage magnitude.

Features

- Wide gain bandwidth: 1.3 MHz
- Input common-mode voltage range includes negative rail
- Large voltage gain: 100 dB
- Supply current per amplifier: 375 µA
- Low input bias current: 20 nA
- Low input offset current: 2 nA
- Wide power supply range:
  - Single supply: 3 V to 30 V
  - Dual supplies: ± 1.5 V to ± 15 V

A6986

38 V, 2 A synchronous step-down switching regulator with 30 µA quiescent current

Datasheet - production data

HTSSOP16 (R_{TH} = 40 °C/W)

Features

- AECQ100 qualification
- 2 A DC output current
- 4 V to 38 V operating input voltage
- Low consumption mode or low noise mode
- 30 µA IQ at light-load (LCM V_{OUT} = 3.3 V)
- 8 µA $I_{Q\text{-}SHTDWN}$
- Adjustable f_{SW} (250 kHz - 2 MHz)
- Output voltage adjustable from 0.85 V to V_{IN}
- Embedded output voltage supervisor
- Synchronization
- Adjustable soft-start time
- Internal current limiting
- Overvoltage protection
- Output voltage sequencing
- Peak current mode architecture
- $R_{DSON\ HS}$ = 180 mΩ, $R_{DSON\ LS}$ = 150 mΩ
- Thermal shutdown

Applications

- Designed for automotive systems
- Battery powered applications
- Car body applications (LCM)
- Car audio and low noise applications (LNM)

Description

The A6986 device is a step-down monolithic switching regulator able to deliver up to 2 A DC. The output voltage adjustability ranges from 0.85 V to VIN. The 100% duty cycle capability to withstand the cold crank event and the wide input voltage range make the A6986 device ideal for battery powered automotive systems. The “Low Consumption Mode” (LCM) is designed for applications active during car parking, so it maximizes the efficiency at the light-load with the controlled output voltage ripple. The “Low Noise Mode” (LNM) makes the switching frequency constant and minimizes the output voltage ripple overload current range, meeting the low noise application specification like car audio. The output voltage supervisor manages the reset phase for any digital load (µC, FPGA). The RST open collector output can also implement output voltage sequencing during the power-up phase. The synchronous rectification, designed for high efficiency at the medium - heavy load, and the high switching frequency capability makes the size of the application compact. Pulse-by-pulse current sensing on both power elements implements effective constant current protection.

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STAP08DP05

Low voltage 8-bit constant current LED sink driver with output error detection for automotive applications

Datasheet - production data

TSSOP16
(Exposed pad)

Features

- AECQ100 qualification
- Low voltage power supply down to 3 V
- 8 constant current output channels
- Adjustable output current through external resistor
- Short and open output error detection
- Serial data IN/parallel data OUT
- Able to drive 3.3 V microcontroller
- Output current: 5-100 mA
- 30 MHz clock frequency
- Available in high thermal efficiency TSSOP exposed pad
- ESD protection 2.5 kV HBM

Applications

- Dashboard and infotainment backlighting
- Exterior/interior lighting
- DTRLs

Description

The STAP08DP05 is a monolithic, low voltage, low current power 8-bit shift register designed for LED panel displays. The STAP08DP05 contains an 8-bit serial-in, parallel-out shift register that feeds an 8-bit D-type storage register. In the output stage, eight regulated current sources are designed to provide 5-100 mA constant current to drive the LEDs.

The detection circuit checks 3 different conditions that can occur on the output line: short to GND, short to V_O or open line. The data detection results are loaded in the shift register and shifted out via the serial line output.

STAP08DP05 detection functionality is implemented without increasing the pin number. Through a secondary function of the output enable and latch pin (DM1 and DM2 respectively), a dedicated logic sequence allows the device to enter or leave detection mode. Through an external resistor, users can adjust the output current of the STAP08DP05, thus controlling the light intensity of the LEDs. In addition, the user can adjust the intensity of the brightness of the LEDs from 0% to 100% through the $\overline{OE}$/DM2 pin.

The STAP08DP05 guarantees a 20 V output driving capability, allowing users to connect more LEDs in series. The high clock frequency, 30 MHz, also satisfies the system requirement of high volume data transmission. The 3.3 V of voltage supply is very useful for applications that interface any microcontroller from 3.3 V. Compared with a standard TSSOP package, the TSSOP exposed pad increases the capability of heat dissipation by a factor of 2.5.

Table 1. Device summary

Order code	Package	Packing
STAP08DP5XTTR	TSSOP16 exposed-pad (Tape and reel)	2500 parts per reel

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ALED6001

Automotive-grade PWM-dimmable single channel LED driver with integrated boost controller

Datasheet - production data

TSSOP-16

Features

- AECQ100 qualification
- Switching controller section
  - 5.5 V to 36 V input voltage range
  - Very low shutdown current: I_{SHDN} < 10 µA
  - Internal +5 V LDO for gate driver supply
  - Internal +3.3 V LDO for device supply
  - Fixed frequency peak current mode control
  - Adjustable (100 kHz to 1 MHz) switching frequency
  - External synchronization for multi-device applications
  - High performance external MOSFET driver
  - Cycle-by-cycle external MOSFET OCP
  - Fixed internal soft-start
  - Programmable output OVP
  - Boost, buck-boost and SEPIC topologies supported
  - Thermal shutdown with autorestart
  - Output short-circuit detection
- LED control section
  - Up to 60 V output voltage
  - Constant current control loop
  - High-side output current sensing circuitry
  - 30 to 300 mV differential sensing voltage
  - ± 4% output current reference accuracy
  - Output overcurrent protection
  - Sensing resistor failure protection
  - PWM dimming with auxiliary series switch
  - Analog dimming

Applications

- Automotive exterior lighting
- Daytime running lights
- High and low beam lights
- Fog lights
- Position lights / blinkers

Description

The ALED6001 is an automotive-grade (AECQ100 compliant) LED driver that combines a boost controller and high-side current sensing circuitry optimized for driving one string of high-brightness LEDs. The device is compatible with multiple topologies such as boost, SEPIC and floating load buck-boost. PWM dimming of the LED brightness is achieved by means of an external MOSFET in series with the LED string and directly driven by a dedicated pin. The pin that manages the LED current setting, usually connected to an external resistor, can also be used as analog control if a microcontroller is located in the LED module. The high-side current sensing, in combination with a P-channel MOSFET, provides effective protection in case the positive terminal of the LED string is shorted to ground. The high precision current sensing circuitry allows an LED current regulation reference within ± 4% accuracy over the entire temperature range and production spread. A fault output (open-drain) informs the host system of faulty conditions: device overtemperature, output overvoltage (disconnected LED string) and LED overcurrent.

Table 1. Device summary

Order code	Package	Packaging
ALED6001	HTSSOP-16 (exposed pad)	Tube
ALED6001TR		Tape and reel

PM8800A

Integrated IEEE 802.3af compliant PoE-PD interface and PWM controller with support of external source

Features

- IEEE 802.3af compliant PD interface
- Works with power supplied from Ethernet LAN cables or from local auxiliary sources
- Integrated 100 V, 0.5 Ω, 800 mA hot-swap MOSFET
- Integrated signature resistor
- Programmable in-rush current limit
- Programmable classification current
- Programmable DC current limit up to 800 mA
- High voltage start-up bias regulator
- Thermal shutdown protection
- Current mode pulse width modulator
- Programmable oscillator frequency
- Programmable soft-start
- Power good indication
- 80 % maximum duty cycle with internal slope compensation
- Supports both isolated and non-isolated Applications.
- HTSSOP16 package

Applications

- VoIP phones, WLAN access points
- Security cameras
- PoE powered device appliances
- High power (>12.95 W) powered devices

HTSSOP16

Description

The PM8800A integrates a standard power over Ethernet (PoE) interface and a current mode PWM controller to simplify the design of the power supply sections of all powered devices.

The PoE interface incorporates all the functions required by the IEEE 802.3af including detection, classification, under-voltage lockout (UVLO) and in-rush current limitation.

PM8800A specifically targets PD with extended power requirement with respect to the limit imposed by the 802.3af standard, embedding a hot-swap MOSFET capable of sustaining twice the current of the 802.3af standard with a programmable DC current limit.

The integrated switching regulator has been designed to work with power either form the Ethernet cable connection or from an external power source such as AC adapter.

The DC-DC section of the PM8800A features a programmable oscillator frequency, soft-start, slope compensation and embeds a voltage output error amplifier allowing use in both isolated and non isolated configuration.

4.2 Construction note

	P/N LM2902YPT	P/N A6986	P/N STAP08DP5XTTR	P/N ALED6001	P/N PM8800A
Wafer/Die fab. information					
Wafer fab manufacturing location	ST Singapore	ST Agrate	ST Catania	ST Agrate	ST Catania
Technology	Bipolar	BCD8	BCD6	BCD6S	BCD6S
Die finishing back side	RAW SILICON	Cr/NiV/Au	Lapped Silicon	Cr/NiV/Au	Cr/Ni/Au
Die size (microns)	1430 x 1360 µm	2191x2209µm	1588 x 1058 micron	2169x2215µm	2346x2116 µm
Bond pad metallization layers	AlSiCu	AlCu	AlCu	AlCu	AlCu
Passivation type	P-VAPOX/NITRIDE	SiN/TEOS/SiN	TEOS/SiN/Polyimide	TEOS/SiN/Polyimide	EOS+SiN+Polyimide
Assembly information					
Assembly site	Amkor Philippines				
Package description	TSSOP14	HTSSOP16			
Molding compound	Sumitomo G700LS				
Frame material	Cu				
Die attach process	Epoxy Glue				
Die attach material	ABLEBOND 8290	Ablestick 84-1 LMIS R4	ABLEBOND 8290		
Wire bonding process	Thermosonic ball bonding				
Wires bonding materials/diameters	Au 1 mil	Au 1.2mils	Au 1 mil	Au 1mil	Au 1.2mils
Lead finishing process	electroplating				
Lead finishing/bump solder material	Matte tin				

5 TESTS RESULTS SUMMARY

5.1 Test vehicle

Lot #	Process/ Package	Product Line	Comments
1	Bipolar / TSSOP14	0124	Assy lots A3L1630MS0474/ A3L1630MS0475/ A3L1630MS0476/ A3L1630MS0477/ A3L1630MS0478/ A3L1630MS0479
2	Bipolar / TSSOP14	0124	
3	Bipolar / TSSOP14	0124	
4	BCD8/HTSSOP16	UAF5	
5	BCD6/HTSSOP16	UP04	7B633659
6	BCD6S/HTSSOP16	UX54	
7	BCD6S/HTSSOP16	UP06	7B617462

5.2 Test plan and results summary

Test	PC	Std ref.	Conditions	SS	Steps	Failure/SS					Note
						Lot1/2/3 0124	Lot 4 UAF5	Lot 5 UP04	Lot6 UX54	Lot 7 UP06	
HTB/ HTOL	N	JESD22 A-108	Ta = 125°C, BIAS		168 H	3x0/77		0/77			
					500 H	3x0/77		0/77			
					1000 H	3x0/77		0/77			
HTSL	N	JESD22 A-103	Ta = 150°C		168 H	3x0/77		0/45			
					500 H	3x0/77		0/45			
					1000 H	3x0/77		0/45			
Package Oriented Tests											
PC		JESD22 A-113	Drying 24 H @ 125°C JL1 (Store 168 H @ Ta=85°C Rh=85%) JL2 (Store 192 H @ Ta=30°C Rh=60%) Over Reflow @ Tpeak=260°C 3 times		Final	PASS JL1	JL3	PASS JL1	JL3	Pass JL3	
AC	Y	JESD22 A-102	Pa=2Atm / Ta=121°C		96 H	3x0/77	77	0/77	77		
					168h			0/77			
PTC	Y		Ta = -40°C to 150°C		100 cy		45				
					500cy		45				
					1000cy		45				
TC	Y	JESD22 A-104	Ta = -65°C to 150°C		300 cy	3x0/77	77	0/77	77	0/77	DPA after test
					500 cy	3x0/77	77	0/77	77	0/77	
					500 cy	3x0/77	77	0/77	77	0/77	
					1000cy	3x0/77					
THB	Y	JESD22 A-101	Ta = 85°C, RH = 85%, BIAS		168 H	3x0/77	77	0/77	77	0/40	
					500 H	3x0/77	77	0/77	77	0/40	
					1000 H	3x0/77	77	0/77	77	0/40	
Other Tests											
ESD	N	AEC Q101-001, 002 and 005	CDM				3		3	0/3	

ELFR / FIT

CMOS (silicon foundry) Technology - Cumulative data

Confid. Level %	60
Sample Size	17788
REJECTS	0
TIME(h)	1000
TEMPERATURE	125
Energy activation	1

Lambda % /1000h	0.00515
F . I. T.	51.51
LAMBDA (1/t)	5.1512E-08
M. T. B. F.	1.9413E+07

(Sample x Hours)
17788000

HRS IN FIELD for ppm evaluation Expected operating lifetime of the device in power-on hours	

TEMPERATURE DERATING (ARRHENIUS)

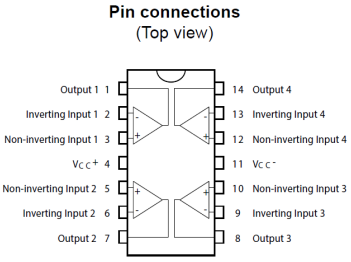
		T °C	T °C	T °C	T °C	T°C
		25	55	70	80	125
HRS IN FIELD for ppm evaluation	0					
Lambda % /1000h		2.9224E-07	1.0264E-05	4.8170E-05	1.2552E-04	5.1512E-03
F . I. T.		0.00	0.10	0.48	1.26	51.51
PPM Expected in field @ xHrs in power on hours		0.00	0.00	0.00	0.00	0.00
LAMBDA (1/t)		2.9224E-12	1.0264E-10	4.8170E-10	1.2552E-09	5.1512E-08
M. T. B. F.		3.4219E+11	9.7426E+09	2.0760E+09	7.9668E+08	1.9413E+07

6 ANNEXES

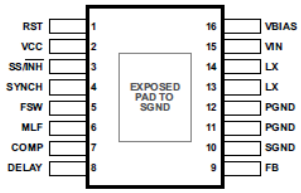
6.1 Device details

6.1.1 Pin connection

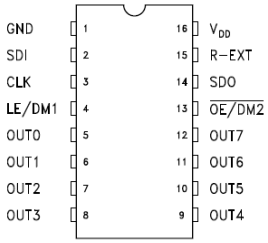
0124



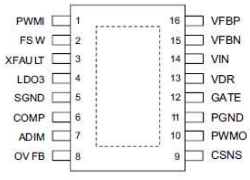
UAF5



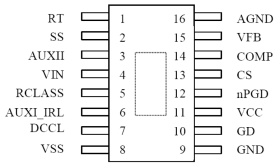
UP04



UX54



UP06



6.2 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.

Test name	Description	Purpose
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.
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.