PRODUCT / PROCESS CHANGE NOTIFICATION

1. PCN basic data	
1.1 Company	STMicroelectronics International N.V
1.2 PCN No.	AMS/21/13170
1.3 Title of PCN	Manufacturing line evolution in Amkor Philippines for General Purpose Analog products in MiniSO8 packages
1.4 Product Category	See product list
1.5 Issue date	2021-12-20

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	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
Materials	New direct material part number r (same supplier, different supplier or new supplier),(Lead frame dimensions)	Back end plant : Amkor Philippines

4. Description of change		
	Old	New
4.1 Description	- Molding compound : Sumitomo G700K - Lead-frame : Copper C7025 preplated NiPdAu - Mold : Manual mold	- Molding compound : Sumitomo G700LS - Lead-frame : Copper C7025 preplated NiPdAu Copper C194 Ag ring (for STC3100IST and TSX562) - Mold : Automold
4.2 Anticipated Impact on form,fit, function, quality, reliability or processability?	No impact	

5. Reason / motivation for change	
5.1 Motivation	This material change will contribute to ST's continuous quality product improvement and ensure a consistent assembly process through MiniSO8 production lines.
5.2 Customer Benefit	QUALITY IMPROVEMENT

6. Marking of parts / traceability of change	
6.1 Description	New Finished good codes

7. Timing / schedule	
7.1 Date of qualification results	2021-12-13
7.2 Intended start of delivery	2022-03-20
7.3 Qualification sample available?	Upon Request

8. Qualification / Validation	
8.1 Description	13170 PCN miniSO AMkor EDLF - S219.pdf

8.2 Qualification report and qualification results	Available (see attachment)	Issue Date	2021-12-20

9. Attachments (additional documentations)
13170 Public product.pdf 13170 PCN miniSO AMkor EDLF - S219.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
	STC3100IST	
	TSX562AIYST	
	TSX562IYST	

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PRODUCT/PROCESS
CHANGE NOTIFICATION

PCN AMS/21/13170

Analog, MEMS & Sensors (AMS)

Manufacturing line evolution in Amkor Philippines for General Purpose Analog products in MiniSO8 packages

WHAT:

Progressing on the activities related to quality continuous improvement, ST is glad to announce a line evolution for General Purpose Analog products in MiniSO8 package produced in Amkor Philippines.
This new set of material was developed to improve our product robustness.

Please find more information related to material change in the table here below

Material	Current process	Modified process	Comment
Diffusion location	ST Crolles/ST Ang Mo Kio (Singapore)/ UMC / ST Agrate	ST Crolles/ST Ang Mo Kio (Singapore)/ UMC / ST Agrate	No change
Assembly location	Amkor ATP1	Amkor ATP1	No change
Molding compound	Sumitomo G700K	Sumitomo G700LS	Same high reliability series, more adapted to higher density
Die attach	Ablestick 8290	Ablestick 8290	No change
Leadframe	Copper C7025 preplated NiPdAu	Copper C194 Ag ring (for STC3100IST and TSX562) Copper C7025 preplated NiPdAu	
Wire	Gold 0.8Mils	Gold 0.8Mils	No change
Mold	Manual mold 	Automold 	To reduce risk of sporadic handling issues

WHY:
This material change will contribute to ST's continuous quality product improvement and ensure a consistent assembly process through MiniSO8 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:
The new material set will be implemented in Q1/2022 in Amkor.

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

Reliability Qualification plan

Quality improvement for MiniSO8 in Amkor for Automotive products

General Information	
Product Line	*0158, 0393, V912, S219 , UY14*
Product Description	Low power Dual op amp bipolar, Low power Dual comparator bipolar, Single, dual, and quad rail-to-rail input/output 8 MHz operational amplifiers, Battery monitor IC, Dual op amp
P/N	*LM2904YST, LM2903YST, TSV912IYST, STC3100IST, TSX562IYST*
Product Group	*AMS*
Product division	*General Purpose Analog &RF*
Package	*MiniSO*
Silicon Process technology	*Bipolar, HF5CMOS, HCMOS7A, HVG8A*

Locations	
Wafer fab	*ST Singapore, UMC Taiwan ST Crolles, ST Agrate*
Assembly plant	*Amkor (Philippines)*
Reliability Lab	*ST Grenoble, Amkor*

TABLE OF CONTENTS

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 improved quality version for products in MiniSO8 package produced in Amkor Philippines.

3.2 Conclusion

Qualification Plan requirements 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

LM2904YST

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LM2904, LM2904A
LM2904W, LM2904AW
Datasheet

Low-power dual operational amplifier

Features

- Frequency compensation implemented internally
- Large DC voltage gain: 100 dB
- Wide bandwidth (unity gain): 1.1 MHz (temperature compensated)
- Very low supply current/amplifier, essentially independent of supply voltage
- Low input bias current: 20 nA (temperature compensated)
- Low input offset current: 2 nA
- Input common-mode voltage range includes negative rail
- Differential input voltage range equal to the power supply voltage
- Large output voltage swing 0 V to [(V_{CC} +) -1.5 V]

Description

This circuit consists of two independent, high gain operational amplifiers (op amps) that have frequency compensation implemented internally. They are designed specifically for automotive and industrial control systems. The circuit operates from a single power supply over a wide range of voltages. The low power supply drain is independent of the magnitude of the power supply voltage.

Application areas include transducer amplifiers, DC gain blocks and all the conventional op amp circuits which can now be more easily implemented in single power supply systems. For example, these circuits can be directly supplied from the standard 5 V which is used in logic systems and easily provides the required electronic interfaces without requiring any additional power supply.

In linear mode, the input common-mode voltage range includes ground and the output voltage can also swing to ground, even though operated from a single power supply.

Maturity status link		
	Enhanced V_{IO}	Enhanced ESD
LM2904		
LM2904A	✓	
LM2904W		✓
LM2904AW	✓	✓

Related products	
TSB572	Dual op-amps for low-power consumption (380 µA with 2.5 MHz GBP)
LM2902 LM2902W	Quad op-amps version
LM2904WH LM2904AH	High temperature version (150 °C)

LM2903YST,

life.augmented

LM2903

Low-power dual voltage comparator

Datasheet - production data

D
SO8
(plastic micropackage)

S
MiniSO8
(plastic micropackage)

P
TSSOP8
(thin shrink small outline package)

DFN8 2x2 mm
(plastic micropackage)

Related products

- See the LM2903W for similar devices with higher ESD performances
- See the LM2903H for similar devices 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
- TTL, DTL, ECL, MOS, CMOS compatible outputs
- Automotive qualification

TSV912IYST

life.augmented

TSV91x, TSV91xA

Datasheet

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

TSV911

TSV912

TSV914

Features

- Rail-to-rail input and output
- Wide bandwidth
- Low power consumption: 820 µA typ.
- 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

Product status link
TSV911, TSV911A, TSV912, TSV912A, TSV914, TSV914A

Related products	
See TSV991, TSV992, TSV994 and TSV991A, TSV992A, TSV994A	for higher speed

Description

The TSV91x and TSV91xA 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.

STC3100IST

STC3100

Battery monitor IC with Coulomb counter/gas gauge

Features

- Battery voltage monitoring
- Internal temperature sensor
- Coulomb counter with 12/14-bit AD converter, +/- 80 mV input voltage range
- Internal or external 32768 Hz time base
- I2C interface for gas gauge monitoring and device control
- 32-RAM bytes
- 8-byte unique device ID
- One general-purpose I/O

Applications

- Cellular phones, PDA, MP3 players, cordless phones
- Digital cameras, USB appliances, Bluetooth devices

Description

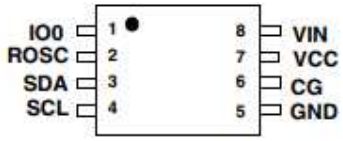
The STC3100 monitors the critical parameters of a single-cell Li-Ion battery (voltage, temperature and current) and includes hardware functions to implement a gas gauge for battery charge monitoring, based on a programmable 12- to 14-bit A/D converter. With a typical 30 milliOhms external sense resistor, the battery current can be up to 2.5 A and the accumulator system provides a capacity up to +/-7000 mAh with a resolution of 0.2 mAh.

The device is programmable through the I2C interface.

MiniSO-8
(Plastic micropackage)

DFN8 3x3
(Plastic micropackage)

Pin connections
(top view)

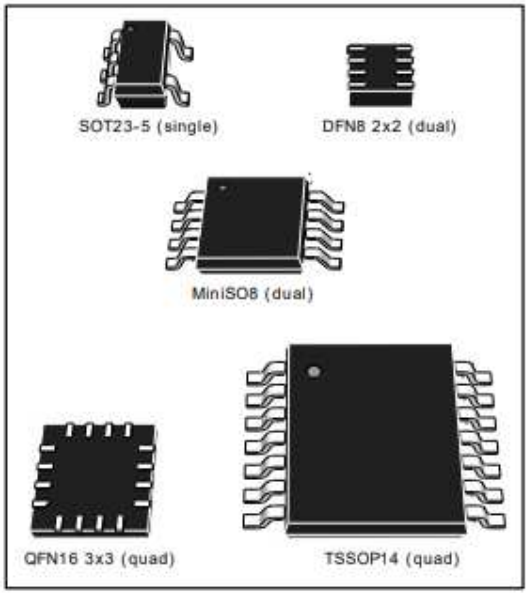


TSX562

TSX56x, TSX56xA

Micropower, wide bandwidth (900 kHz), 16 V CMOS operational amplifiers

Datasheet - production data



Features

- Low power consumption: 235 µA typ. at 5 V
- Supply voltage: 3 V to 16 V
- Gain bandwidth product: 900 kHz typ.
- Low offset voltage
  - "A" version: 600 µV max.
  - Standard version: 1 mV max.
- Low input bias current: 1 pA typ.
- High tolerance to ESD: 4 kV
- Wide temperature range: -40 to 125 °C
- Automotive qualification
- Tiny packages available: SOT23-5, DFN8 2 mm x 2 mm, MiniSO8, QFN16 3 mm x 3 mm, and TSSOP14

Benefits

- Power savings in power-conscious applications
- Easy interfacing with high impedance sensors

Related topics

- See TSX63x series for reduced power consumption (45 mA, 200 kHz)
- See TSX92x series for higher gain bandwidth products (10 MHz)

Applications

- Industrial and automotive signal conditioning
- Active filtering
- Medical instrumentation
- High impedance sensors

Description

The TSX56x, TSX56xA series of operational amplifiers benefit from STMicroelectronics® 16 V CMOS technology to offer state-of-the-art accuracy and performance in the smallest industrial packages. The TSX56x, TSX56xA have pinouts compatible with industrial standards and offer an outstanding speed/power consumption ratio, 900 kHz gain bandwidth product while consuming only 250 µA at 16 V. Such features make the TSX56x, TSX56xA ideal for sensor interfaces and industrial signal conditioning. The wide temperature range and high ESD tolerance ease use in harsh automotive applications.

Table 1: Device summary

Version	Standard V_{IO}	Enhanced V_{IO}
Single	TSX561	TSX561A
Dual	TSX562	TSX562A
Quad	TSX564	TSX564A

4.2 Construction note

	P/N *LM2904YPT*	P/N *LM2903YPT*	P/N TSV912IYST	P/N STC3100IST	P/N TSX562IYST
Wafer/Die fab. Information					
Wafer fab manufacturing location	ST Singapore	ST Singapore	UMC Taiwan	ST Crolles	ST agrate
Technology	Bipolar	Bipolar	HF5CMOS	HCMOS7A	HVG8A
Die finishing back side	RAW SILICON	RAW SILICON	Lapped silicon	Lapped silicon	RAW SILICON
Die size (microns)	1070x1010µm²	950x870µm²	1070x1100µm²	1566,x2032µm²	1498,1326µm²
Bond pad metallization layers	AlSiCu	AlSiCu	AlCu	AlCu	AlCu
Passivation type	Nitride	Nitride	PSG + NITRIDE	PSG + NITRIDE	HDP/TEOS/SiN/Polyimide
Wafer Testing (EWS) information					
Electrical testing manufacturing location	ST Singapore	ST Singapore	ST Singapore	ST Singapore	ST Singapore
Assembly information					
Assembly site	Amkor ATP1	Amkor ATP1	Amkor ATP1	Amkor ATP1	Amkor ATP1
Package description	MiniSO	MiniSO	MiniSO	MiniSO	MiniSO
Molding compound	EME G700LS	EME G700LS	EME G700LS	EME G700LS	EME G700LS
Frame material	Cu	Cu	Cu	Cu	Cu
Die attach process	Epoxy Glue	Epoxy Glue	Epoxy Glue	Epoxy Glue	Epoxy Glue
Die attach material	Ablestick 8290	Ablestick 8290	Ablestick 8290	Ablestick 8290	Ablestick 8290
Wire bonding process	Thermosonic ball bonding	Thermosonic ball bonding	Thermosonic ball bonding	Thermosonic ball bonding	Thermosonic ball bonding
Wires bonding materials/diameters	Gold 0.8Mils	Gold 0.8Mils	Gold 0.8Mils	Gold 0.8Mils	Gold 0.8Mils
Lead finishing process	electroplating	electroplating	electroplating	electroplating	electroplating
Lead finishing/bump solder material	NiPdAu	NiPdAu	NiPdAu	Sn	Sn
Final testing information					
Testing location	Amkor ATP1	Amkor ATP1	Amkor ATP1	Amkor ATP1	Amkor ATP1

Test vehicle on which is based qualification for molding compound sumitomo G700LS

	P/N LM2902YPT
Wafer/Die fab. information	
Wafer fab manufacturing location	ST Singapore
Technology	Bipolar
Die finishing back side	RAW SILICON
Die size (microns)	1430 x 1360 µm
Bond pad metallization layers	AlSiCu
Passivation type	P- VAPOX/NITRIDE
Assembly information	
Assembly site	Amkor Philippines
Package description	TSSOP14
Molding compound	Sumitomo G700LS
Frame material	Cu
Die attach process	Epoxy Glue
Die attach material	ABLEBOND 8290
Wire bonding process	Thermosonic ball bonding
Wires bonding materials/diameters	Au 1 mil
Lead finishing process	electroplating
Lead finishing/bump solder material	Matte tin

5 TESTS PLAN SUMMARY

5.1 Test vehicle

Lot #	Process/ Package	Product Line	Comments
1	Bipolar/MiniSO8	0158	
2	Bipolar/ MiniSO8	0393	
3	HF2CMOS/ MiniSO8	V912	
4	Bipolar/TSSOP14	0124	3 lots
5	HCMOS7A	S219	
6	HVG81A	UY14	

5.2 Test plan and results summary

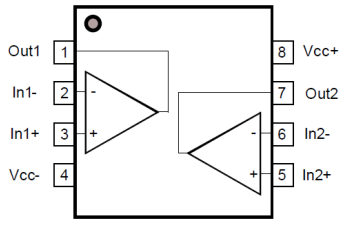
Test	PC	Std ref.	Conditions	SS	Steps	Failure/SS						Note
						Lot 1 0158	Lot 2 0393	Lot3 V912	Lot4 0124	Lot5 S219	Lot5 UY14	
			Die oriented									
HTOL	N	JESD22 A-108	Ta = 125°C		168 H				3x0/77			
					500 H				3x0/77			
					1000 H				3x0/77			
HTSL	N	JESD22 A-103	Ta = 150°C		168 H	0/77	0/77	0/77	3x0/77	0/77	77	
					500 H	0/77	0/77	0/77	3x0/77	0/77	77	
					1000 H	0/77	0/77	0/77	3x0/77	77	77	
ELFR	N	JESD22 A-108	Tj = 125°C, BIAS		48 H				0/800			
			Package oriented									
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			
AC	Y	JESD22 A-102	Pa=2Atm / Ta=121°C		96 H	0/77	0/77	0/77	3x0/77	0/77	0/77	
TC	Y	JESD22 A-104	Ta = -65°C to 150°C		100 cy	0/77	0/77	0/77	3x0/77	0/77	0/77	
					200 cy	0/77	0/77	0/77	3x0/77	0/77	0/77	
					500 cy	0/77	0/77	0/77	3x0/77	0/77	0/77	
					1000cy				3x0/77			
THB	Y	JESD22 A-101	Ta = 85°C, RH = 85%, BIAS		168 H	0/77	0/77	0/77	3x0/77			
					500 H	0/77	0/77	0/77	3x0/77			
					1000 H	0/77	0/77	0/77	3x0/77			

6 ANNEXES

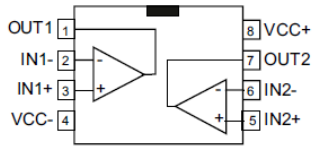
6.1 Device details

6.1.1 Pin connection

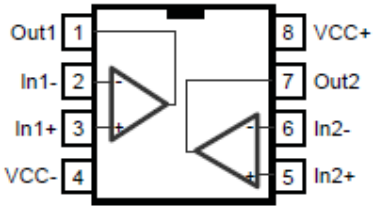
LM2904



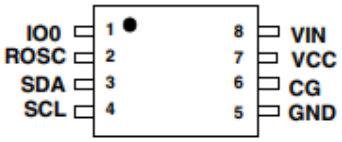
LM2903



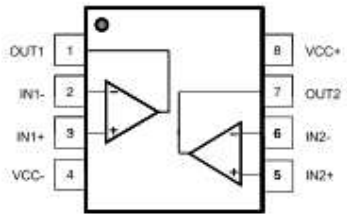
TSV912



STC3100



TSX562



MiniSO8 (TSX562)

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.
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.

Public Products List

Publict 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 : Manufacturing line evolution in Amkor Philippines for General Purpose Analog products in MiniSO8 packages

PCN Reference : AMS/21/13170

Subject : Public Products List

Dear Customer,

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

TSX562AIYST	STC3100IST	TSX562IYST

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