

PRODUCT / PROCESS CHANGE NOTIFICATION

1. PCN basic data

1.1 Company		STMicroelectronics International N.V
1.2 PCN No.	ADG/19/11385	
1.3 Title of PCN	AEC-Q101 Automotive Grade qualification of Protection devices housed in SMA package at assembly and test location in China	
1.4 Product Category	SMA • VBR <= 39 V • SMA6T6V7AY / CAY to SMA6T39AY / CAY • SM4T6V7AY / CAY to SMA4T39AY / CAY	
1.5 Issue date	2019-02-21	

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	Richard RENARD
2.1.2 Marketing Manager	Eric PARIS
2.1.3 Quality Manager	Jean-Paul REBRASSE

3. Change

3.1 Category	3.2 Type of change	3.3 Manufacturing Location
Machines	(Not Defined)	St Morocco assy site and subco in China

4. Description of change

	Old	New
4.1 Description	ST Morocco assy and test site	ST Morocco assy and test site + subco in China
4.2 Anticipated Impact on form,fit, function, quality, reliability or processability?	no	

5. Reason / motivation for change

5.1 Motivation	expand the manufacturing capacity of automotive grade TVS Protection devices housed in SMA package
5.2 Customer Benefit	CAPACITY INCREASE

6. Marking of parts / traceability of change

6.1 Description	internal codification, QA number
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7. Timing / schedule

7.1 Date of qualification results	2019-02-14
7.2 Intended start of delivery	2019-08-19
7.3 Qualification sample available?	Upon Request

8. Qualification / Validation

8.1 Description			
8.2 Qualification report and qualification results	In progress	Issue Date	

9. Attachments (additional documentations)

11385 Public product.pdf
11385 PCN China subco_SMA400W_600W Automotive.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
	SM4T10AY	
	SM4T10CAY	
	SM4T12AY	
	SM4T12CAY	
	SM4T14AY	
	SM4T14CAY	
	SM4T15AY	
	SM4T15CAY	
	SM4T18AY	
	SM4T18CAY	
	SM4T21AY	
	SM4T21CAY	
	SM4T23AY	
	SM4T26AY	
	SM4T26CAY	
	SM4T28AY	
	SM4T28CAY	
	SM4T30AY	
	SM4T33CAY	
	SM4T35AY	
	SM4T35CAY	
	SM4T39AY	
	SM4T39CAY	
	SM4T6V7AY	
	SM4T6V7CAY	
	SM4T7V6AY	
	SM4T7V6CAY	
	SMA6T10AY	
	SMA6T10CAY	
	SMA6T12AY	
	SMA6T14AY	
	SMA6T14CAY	
	SMA6T15CAY	
	SMA6T18AY	
	SMA6T18CAY	
	SMA6T22AY	
	SMA6T22CAY	
	SMA6T24AY	
	SMA6T28AY	
	SMA6T28CAY	
	SMA6T30CAY	
	SMA6T33AY	
	SMA6T33CAY	
	SMA6T39AY	

	SMA6T39CAY	
	SMA6T6V7AY	
	SMA6T7V6CAY	

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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

PCN Title : AEC-Q101 Automotive Grade qualification of Protection devices housed in SMA package at assembly and test location in China

PCN Reference : ADG/19/11385

Subject : Public Products List

Dear Customer,

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

SM4T30AY	SMA6T24AY	SM4T18CAY
SM4T35AY	SMA6T39AY	SMA6T10AY
SM4T30CAY	SMA6T39CAY	SM4T23CAY
SM4T39AY	SMA6T6V7CAY	SMA6T14AY
SMA6T18AY	SM4T33AY	SMA6T7V6AY
SM4T28CAY	SM4T7V6AY	SM4T15AY
SM4T18AY	SMA6T15CAY	SMA6T22AY
SMA6T12AY	SMA6T14CAY	SMA6T6V7AY
SMA6T18CAY	SM4T12CAY	SM4T26CAY
SM4T14AY	SM4T10CAY	SMA6T24CAY
SM4T15CAY	SM4T10AY	SMA6T22CAY
SM4T28AY	SM4T21AY	SM4T26AY
SM4T12AY	SM4T21CAY	SMA6T12CAY
SM4T35CAY	SMA6T15AY	SM4T14CAY
SM4T39CAY	SM4T6V7CAY	SM4T7V6CAY
SM4T6V7AY	SM4T33CAY	SMA6T28CAY
SMA6T10CAY	SMA6T30CAY	SMA6T33CAY
SMA6T33AY	SMA6T30AY	SMA6T28AY
SM4T23AY	SMA6T7V6CAY	



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PCN Product/Process Change Notification			
AEC-Q101 Automotive Grade qualification of Protection devices housed in SMA package at assembly and test location in China			
Notification number:	ADG-DIS/19/11385	Issue Date	14/02/2019
Issued by	Aline AUGIS		
Product series affected by the change		SMA • VBR ≤ 39 V • SMA6T6V7AY / CAY to SMA6T39AY / CAY • SM4T6V7AY / CAY to SMA4T39AY / CAY	
Type of change		Assembly and test line multi-sourcing	
Description of the change STMicroelectronics is qualifying according to automotive grade its SMA package subcontractor in China .			
Reason for change STMicroelectronics has decided to expand the manufacturing capacity of automotive grade TVS Protection devices housed in SMA package . This additional assembly and test plant in China is a subcontractor already qualified and delivering in high volume for ST on industrial SMD package lines.			
Former versus changed product:		The changed products will remain fully compliant with product datasheet in term of electrical, dimensional or thermal parameters. The Moisture Sensitivity Level of the part (according to the IPC/JEDEC JSTD-020D standard) remains unchanged. The footprint recommended by ST remains the same. There is no change in packing modes and standard delivery quantities either. The products remain in full compliance with the ST ECOPACK®2 grade ("halogen-free").	
Disposition of former products As the purpose is a manufacturing multi-sourcing approach, shipments will be done from both automotive qualified sites.			

(1) ADG: Automotive and Discrete Group

Marking and traceability

Parts produced in China are differentiated by their **marking** as indicated below

Assembly location	Assy plant code	Date code marking	
		Assy year	Assy week
Morocco (ST)	CZ (on label) Z (on unit)	Y (1 digit indicating the year)	WW (2 digits indicating the week number)
China (subco)	GP (on label) GP (on unit)		

Traceability for the implemented change will be ensured by an **internal codification** and by the **Q.A. number**.

Qualification complete date

2019 week 07

Forecasted sample availability

Product family	Sub-family	Commercial part Number	Availability date
Protection device	Transil™	SM4T28CAY	W13-2019
Protection device	Transil™	SM4T33CAY	W13-2019
Protection device	Transil™	SM4T35CAY	W13-2019
Protection device	Transil™	SM4T39CAY	W13-2019
Protection device	Transil™	SMA6T18AY	W13-2019
Protection device	Transil™	SMA6T28CAY	W13-2019

Change implementation schedule

Sales types	Estimated production start	Estimated first shipments
All	week 08-2019	week 34-2019

Comments:

With early PCN acceptance, possible shipment starting week 13 on selected part numbers.

Customer's feedback

Please contact your local ST sales representative or quality contact for requests concerning this change notification.

Absence of acknowledgement of this PCN within 30 days of receipt will constitute acceptance of the change

Absence of additional response within 180 days of receipt of this PCN will constitute acceptance of the change

Qualification program and results

19005-Rev2 QRP Attached



Reliability Evaluation Report

SMA6TxxAY/CAY & SM4TxxAY/CAY

Automotive Grade *Transil*TM

xx = VBR from 6.7V to 39V

General Information

Product Description *Transil*TM for automotive applications

SMA6T6V7AY/CAY
SMA6T7V6AY/CAY
SMA6T10AY/CAY
SMA6T12AY/CAY
SMA6T14AY/CAY
SMA6T15AY/CAY
SMA6T18AY/CAY
SMA6T22AY/CAY
SMA6T24AY/CAY
SMA6T28AY/CAY
SMA6T30AY/CAY
SMA6T33AY/CAY
SMA6T39AY/CAY
SM4T6V7AY/CAY
SM4T7V6AY/CAY
SM4T10AY/CAY
SM4T12AY/CAY
SM4T14AY/CAY
SM4T15AY/CAY
SM4T18AY/CAY
SM4T21AY/CAY
SM4T23AY/CAY
SM4T26AY/CAY
SM4T28AY/CAY
SM4T30AY/CAY
SM4T33AY/CAY
SM4T35AY/CAY
SM4T39AY/CAY

Part Numbers

Product Group ADG

Product division DFD

Package SMA

Maturity level step QUALIFIED

Locations

Wafer fab STMicroelectronics Tours (France)

Assembly plant Subcontractor in China

Reliability Lab STMicroelectronics Tours (France)

Reliability Assessment

PASS

DOCUMENT INFORMATION

Version	Date	Pages	Prepared by	Approved by	Comment
1.0	31/01/2019	8	Aude DROMEL	Julien MICHELON	Initial release
2.0	13/02/2019	8	Marine PEREZ	Julien MICHELON	Typo error correction

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.



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1 APPLICABLE AND REFERENCE DOCUMENTS

Document reference	Short description
AEC-Q101 rev D	Stress test qualification for automotive grade discrete semiconductors
JESD 47	Stress-Test-Driven Qualification of Integrated Circuits
JESD 94	Application specific qualification using knowledge based test methodology
JESD 22	Reliability test methods for packaged devices

2 GLOSSARY

SS	Sample Size
PC	Pre-conditioning
HTRB	High Temperature Reverse Bias
TC	Temperature Cycling
PCT / AC	Pressure Pot 2 bars / Autoclave
THB	Thermal Humidity Bias
u-HAST	Unbiased Highly Accelerated Stress Test
DPA	Destructive Physical Analysis
RSH	Resistance to Solder Heat
SD	Solderability
DBT	Dead Bug Test
MSL	Moisture Sensitivity Level

3 RELIABILITY EVALUATION OVERVIEW

3.1 Objectives

The aim of this report is to qualify SMA package at our subcontractor in China for protection devices unidirectional and bidirectional from 6.7V to 39V (VBR) 400W and 600W according to automotive grade AEC-Q101.

3.2 Conclusion

Qualification Plan requirements have been fulfilled without exception. Reliability tests have shown that the devices behave correctly against environmental tests (no failure). Moreover, the stability of electrical parameters during the accelerated tests demonstrates the robustness of the products and safe operation, which is consequently expected during their lifetime.

4 DEVICE CHARACTERISTICS

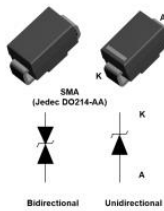
4.1 Device description



SMA6TY

Datasheet

Automotive 600 W TVS in SMA



Features

- AEC-Q101 qualified
- Peak pulse power:
 - 600 W (10/1000 μ s) and 4 kW (8/20 μ s)
- Stand-off voltage range: from 5 V to 70 V
- Unidirectional and bidirectional types
- Low leakage current:
 - 0.2 μ A at 25 °C and 1 μ A at 85 °C
- Operating T_j max: 150 °C
- JEDEC registered package outline
- Lead finishing: matte tin plating

Complies with the following standards

- UL94, V0
- J-STD-020 MSL level 1
- J-STD-002, JESD 22-B102 E3 and MIL-STD-750, method 2026
- JESD-201 class 2 whisker test
- IPC7531 footprint and JEDEC registered package outline
- IEC 61000-4-4 level 4
 - 4 k V
- ISO 10605, IEC 61000-4-2, C = 150 pF, R = 330 Ω exceeds level 4:
 - 30 kV (air discharge)
 - 30 kV (contact discharge)
- ISO 10605, C = 330 pF, R = 330 Ω exceeds level 4:
 - 30 kV (air discharge)
 - 30 kV (contact discharge)
- ISO 7637-2 (not applicable to parts with $V_{S_{AV}}$ lower than battery voltage)
 - Pulse 1: V_S = -150 V
 - Pulse 2a: V_S = +112 V
 - Pulse 3a: V_S = -220 V
 - Pulse3b: V_S = +150 V

Description

The SMA6TY Transil series has been designed to protect sensitive automotive circuits against surges defined in ISO 7637-2 and against electrostatic discharges according to ISO 10605.

The planar technology makes this device compatible with high-end circuits where low leakage current and high junction temperature are required to provide reliability and stability over time. SMA6TY are packaged in SMA.

Transil™ is a trademark of STMicroelectronics.

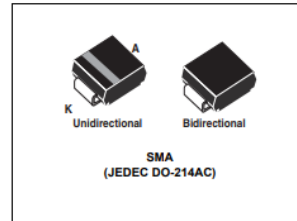
Product status link
SMA6TY



SM4TY

Automotive 400 W Transil™

Datasheet - production data



Complies with the following standards

- ISO 10605, C = 150 pF, R = 330 Ω :
 - 30 kV (air discharge)
 - 30 kV (contact discharge)
- ISO 10605, C = 330 pF, R = 330 Ω :
 - 30 kV (air discharge)
 - 30 kV (contact discharge)
- ISO 7637-2^(a)
 - pulse 1: V_S = -100 V
 - pulse 2a: V_S = +50 V
 - pulse 3a: V_S = -150 V
 - pulse 3b: V_S = +100 V

Description

The SM4TY Transil series has been designed to protect sensitive automotive circuits against surges defined in ISO 7637-2 and against electrostatic discharges according to ISO 10605.

The planar technology makes it compatible with high-end circuits where low leakage current and high junction temperature are required to provide reliability and stability over time. SM4TY devices are packaged in SMA (SMA footprint in accordance with IPC 7531 standard).

TM: Transil is a trademark of STMicroelectronics

a. Not applicable to parts with stand-off voltage lower than the average battery voltage (13.5 V)

4.2 Construction note

SMA6TxxAY/CAY and SM4TxxAY/CAY (xx VBR from 6.7V to 39V)	
Wafer/Die fab. information	
Wafer fab manufacturing location	ST TOURS GLOBAL FRANCE
Technology / Process family	DISCRETE-TRANSIL / TAN
Wafer Testing (EWS) information	
Electrical testing manufacturing location	ST TOURS FRANCE
Assembly information	
Assembly site	SUBCONTRACTOR IN CHINA
Package description	SMA
Final testing information	
Testing location	SUBCONTRACTOR IN CHINA

5 TESTS RESULTS SUMMARY

5.1 Test vehicles

Lot #	Commercial Product	Diffusion Plant	Assembly Plant	Package	Die Size (in μm)	Note
Lot 1	SMAJ5.0CA-TR	ST TOURS	SUBCONTRACTOR IN CHINA	SMA	1250 x 1250 x 300	400W Qualification lot
Lot 2	SMAJ15A-TR			SMA	1250 x 1250 x 300	400W Qualification lot
Lot 3	SMAJ33A-TR			SMA	1250 x 1250 x 300	400W Qualification lot
Lot 4	SMA6J33A-TR			SMA	1500 x 1500 x 300	600W Qualification lot
Lot 5	SMA6J33CA-TR			SMA	1500 x 1500 x 300	600W Qualification lot
Lot 6	SMA6J8.5A-TR			SMA	1500 x 1500 x 300	600W Qualification lot
Lot 7	SMA6J5.0CA-TR			SMA	1500 x 1500 x 300	600W Qualification lot
Lot 8	SMA6T39CAY			SMA	1500 x 1500 x 300	600W Qualification lot
Lot 9	SMA6T6V7CAY			SMA	1500 x 1500 x 300	600W Qualification lot
Lot 10	SMA6T39AY			SMA	1500 x 1500 x 300	600W Qualification lot
Lot 11	SMA6T10AY			SMA	1500 x 1500 x 300	600W Qualification lot

5.2 Test plan and results summary

Test	PC	Std ref.	Conditions	SS	Steps	Failure /SS				
						Lot 5	Lot 8	Lot 9	Lot 10	Lot 11
HTRB	N	JESD22 A-108	Junction Temperature=150°C Temperature=150°C Tension=VRM	231	168h		0/77	0/77		0/77
					504h		0/77	0/77		0/77
					1000h		0/77	0/77		0/77
TC	Y	JESD22 A-104	Frequency (cy/h)=2cy/h Temperature (high)=150°C Temperature (low)=-65°C	231	500cy	0/77		0/77	0/77	
					1000cy	0/77		0/77	0/77	
				2	DPA			0/2		
RSH	N	ST 0060102 JESD22 B-106-A	Temperature=260°C Time (on)=10s	30	Mesure after dip		0/30			
THB	Y	JESD22 A-101	Humidity (HR)=85% Temperature=85°C Tension= VRM	231	168h		0/77	-	-	
					504h		0/77	0/77	0/77	
				2	DPA		0/2			
u-HAST	Y	JESD22-A110-B	Humidity (HR)=85% Pressure=2.3bar Temperature=130°C	231	96h		0/77	0/77	0/77	
Solderability	N	J-STD-002	Steam Ageing SnAgCu bath 245°C	60	Visual inspection		0/15			
			Steam Ageing SnPb 220°C				0/15			
			Dry Ageing SnAgCu 245°C				0/15			
			Dry Ageing SnPb 220°C				0/15			



Test	PC	Std ref.	Conditions	SS	Steps	Failure /SS				
						Lot 5	Lot 8	Lot 9	Lot 10	Lot 11
MSL search	Y	JESD22 A-113	Humidity (HR)=85% Temperature=85°C MSL=1	30	168h		0/30			
DBT	N	DM 00112629	Fluxing followed by IR reflow.	30	Visual inspection		0/30			
Whiskers	Y	AEC-Q005 JESD201	Pb free reflow TC -40°C/85°C 3 cycles/hrs	18	1500cy		0/18			
			Pb free reflow THS 30°C/RH = 60%	18	4000hrs		0/18			
			Pb free reflow THS 60°C / RH = 83%	18	4000hrs		0/18			
			No reflow TC -55°C/85°C 10 min	18	1500cy		0/18			
			No reflow THS 30°C / RH = 60%	18	4000hrs		0/18			
			No reflow THS 55°C / RH = 85%	18	4000hrs		0/18			
			SnPb reflow TC -55°C/85°C 10 min	18	1500cy		0/18			
			SnPb reflow THS 30°C / RH = 60%	18	4000hrs		0/18			
			SnPb reflow THS 55°C / RH = 85%	18	4000hrs		0/18			

Test	PC	Std ref.	Conditions	SS	Steps	Failure /SS						
						Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	Lot 7
Repetitive Surge	Y	ADCS0060282	IPP 10/1000 μ s value from datasheet	140	measure at 50s	0/20	0/20	0/20	0/20	0/20	0/20	0/20

6 ANNEXES

6.1 Tests Description

Test name	Standard Reference	Description	Purpose
Die Oriented			
HTRB High Temperature Reverse Bias	JESD22 A-108	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.
Repetitive surges	ADCS0060282	Devices are submitted to rated Ipp for 1000 surges.	Purpose: This test is intended to verify robustness of device submitted to rated Ipp (as per data sheet) = exploration of reverse characteristic at a calibrated current value followed by the measure of voltage clamping value. Failure mode expected is short circuit of the device due to hot spot creation into silicon bulk at device periphery where the electrical field gradient is the most important. Physical analysis must be done to verify consistency of the failure mode and discriminate from extrinsic causes related to process escapes.
Package Oriented			
u-HAST	JESD22 A-118	The Unbiased HAST is performed for the purpose of evaluating the reliability of non-hermetic packaged solidstate devices in humid environments	Purpose: to investigate corrosion phenomena affecting die or package materials, related to chemical contamination and package hermeticity. To point out critical water entry paths with consequent electrochemical and galvanic corrosion.
RSH Resistance to solder heat	ST 0060102 JESD22 B-106-A	Device is submitted to a dipping in a solder bath at 260°C with a dwell time of 10s. Only for through hole mounted devices.	This test is used to determine whether solid state devices can withstand the effects of the temperature to which they will be subjected during soldering of their leads. The heat is conducted through the leads into the device package from solder heat at the reverse side of the board. This procedure does not simulate wave soldering or reflow heat exposure on the same side of the board as the package body.
PC Preconditioning	JESD22 A-113	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.



Test name	Standard Reference	Description	Purpose
TC Temperature Cycling	JESD22 A-104	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.
THB Temperature Humidity Bias	JESD22 A-101	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.
Solderability	J-STD-002	The purpose of this test method is to provide a referee condition for the evaluation of the solderability of terminations (including leads up to 0.125 inch in diameter) that will be assembled using tin lead eutectic solder.	This evaluation is made on the basis of the ability of these terminations to be wetted and to produce a suitable fillet when coated by tin lead eutectic solder. These procedures will test whether the packaging materials and processes used during the manufacturing operations process produce a component that can be successfully soldered to the next level assembly using tin lead eutectic solder. A preconditioning test is included in this test method, which degrades the termination finish to provide a guard band against marginal finish.
DBT Dead Bug Test	DM00112629	To evaluate the wettability of the SMD. Good indicator to determine the bad solderability behavior	Components are glued up-side down on a substrate. Pins are wetted with a moderately activated flux. Then run once through the reflow oven with leadfree temperature profile. Visual inspection is performed with suitable tool.
DPA Destructive Physical Analysis	AEC Q101-004	Specific construction analysis on random parts that have successfully completed THB or TC.	To investigate on reliability stresses impact on delamination, corrosion and product construction integrity.