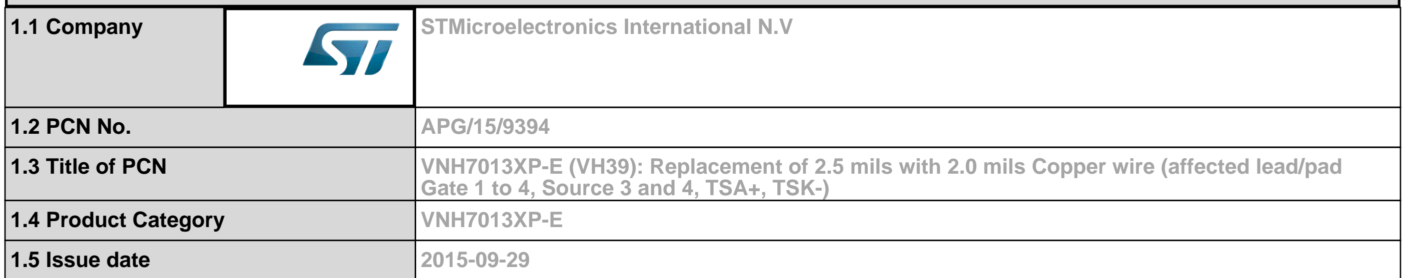
PRODUCT / PROCESS CHANGE NOTIFICATION



1. PCN basic data		
1.1 Company		STMicroelectronics International N.V
1.2 PCN No.		APG/15/9394
1.3 Title of PCN		VNH7013XP-E (VH39): Replacement of 2.5 mils with 2.0 mils Copper wire (affected lead/pad Gate 1 to 4, Source 3 and 4, TSA+, TSK-)
1.4 Product Category		VNH7013XP-E
1.5 Issue date		2015-09-29

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	Riccardo NICOLOSO
2.1.2 Marketing Manager	Nicola LIPORACE
2.1.3 Quality Manager	Francesco MINERVA

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, …)	ST Muar (Malaysia)

4. Description of change		
	Old	New
4.1 Description	Copper 2.5 mils wire on Gate 1 to 4, Source 3 and 4, TSA+, TSK-.	Copper 2.0 mils on Gate 1 to 4, Source 3 and 4, TSA+, TSK-.
4.2 Anticipated Impact on form,fit, function, quality, reliability or processability?	No Impact	

5. Reason / motivation for change	
5.1 Motivation	Product Optimization
5.2 Customer Benefit	QUALITY IMPROVEMENT

6. Marking of parts / traceability of change	
6.1 Description	Dedicted Finished Good code VNH7013XPTR2-DC3

7. Timing / schedule	
7.1 Date of qualification results	2015-09-07
7.2 Intended start of delivery	2016-01-07
7.3 Qualification sample available?	Upon Request

8. Qualification / Validation			
8.1 Description	Qualification Report_RR002514CT2235.pdf		
8.2 Qualification report and qualification results	Available (see attachment)	Issue Date	2015-09-29

9. Attachments (additional documentations)

9394PpPrdtLst.pdf
Qualification Report_RR002514CT2235.pdf
5W and details.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
	VNH7013XPTR-E	

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Public Products List

PCN Title : VNH7013XP-E (VH39): Replacement of 2.5 mils with 2.0 mils Copper wire (affected lead/pad Gate 1 to 4, Source 3 and 4, TSA+, TSK-)
PCN Reference : APG/15/9394
PCN Created on : 07-Sep-2015

Subject : Public Products List

Dear Customer,

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

VNH7013XP-E	VNH7013XPTR-E	

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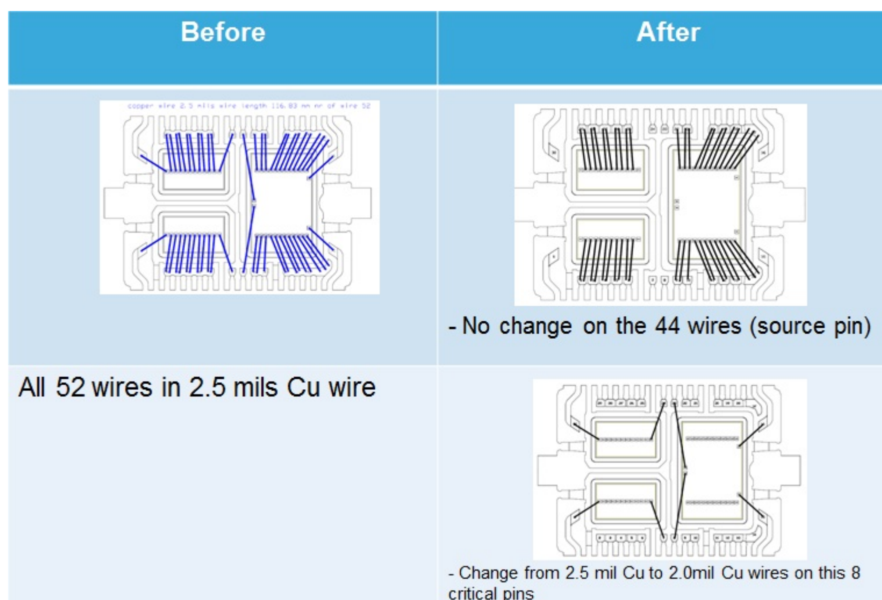
VNH7013XP-E (VH39): Replacement of 2.5 mils with 2.0 mils Copper wire (affected lead/pad Gate 1 to 4, Source 3 and 4, TSA+, TSK-)

WHAT*:* Please be informed that we are going to replace 2.5 mils with 2.0 mils Copper wire on VNH7013XP-E (VH39), affected lead/pad: Gate 1 to 4, Source 3 and 4, TSA+, TSK- (see details below).



Before	After
	- No change on the 44 wires (source pin)
All 52 wires in 2.5 mils Cu wire	- Change from 2.5 mil Cu to 2.0mil Cu wires on this 8 critical pins

WHY:

Product Optimization

HOW:

See enclosed qualification report RR002514CT2235

WHEN:

- Qualification : enclosed to this communication

- Implementation : from January 2016 onward

- Samples: available on demand.

VNH7013XP-E (VH39)
Copper wire diameter change
From 2.5mils to 2.0mils

General Information	
Commercial Product	VNH7013XP-E
Product Line	VH39
Silicon process technology	VIPower M0S7
Package	PowerSSO36 TI

Revision history			
Rev.	**Date of Release**	**Author**	**Changes description**
0.1	October 17th 2014	F.Ceraulo - APG Q&R Catania	Creation
0.2	September 14, 2015	F.Ceraulo - APG Q&R Catania	To update with the right new bonding diagram

Table of contents

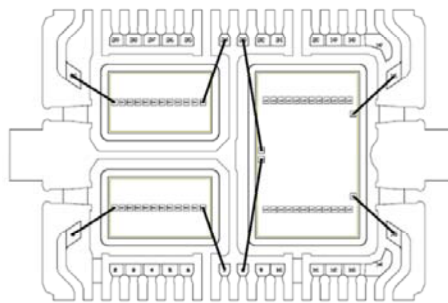
Section	Pag	Content
1	3	Reliability evaluations overview
1.1	3	Objectives
1.2	4	Results
2	5	Traceability
3	6	Devices characteristics
3.1	6	Generalities
3.2	7	Pins connection
3.3	7	Blocks diagram
4	8	Reliability qualification plan and results – Summary table

- 1. Reliability evaluations overview

1.1 Objectives

Aim of this report is to present the results of the reliability evaluations performed on **VNH7013XP-E** (VH39 as ST internal silicon code) to qualify the change on wire diameter from Copper 2.5mils to Copper 2.0mils for lead/pad Gate 1 to 4, Source 3 and 4, TSA+, TSK- and a new capillary for process bonding. The other wires remains 2.5mils Copper wires.

Here below the bonding diagram reporting only the affected wires:



The **VNH7013XP-E** is triple-chips integrated H-bridge for Automotive Applications composed by one high side driver (**VNX5** as ST silicon line) and two low side drivers (**VNY7** as ST silicon line) all designed in VIPower M0S7 technology diffused in CTM8 Catania (Italy) 8” wafer fab and assembled in ST Muar (Malaysia) in package PowerSSO36 triple island.

The reliability evaluation was based on lots assembled in the nominal (NN) condition of Bonding Force and US Power as well as in the higher (HH) and lower (LL) worst case. The qualification was done according to **AEC_Q100 Rev.G** specification following the path described here below:

Test group as per **AEC-Q100 Rev.G**		Performed (Y/N)	Comment
A	Accelerated Environment Stress	Y	
B	Accelerated Lifetime Simulation	N	Not applicable
C	Package Assembly Integrity	Y	
D	Die Fabrication Reliability	N	Not applicable
E	Electrical Verification	Y	
F	Defect Screening	N	To be implemented starting from first production lot
G	Cavity Package Integrity	N	N/A: not for plastic packaged devices

In the below table a comparison between the AEC-Q100 and ZVEI requirements for this kind of change vs the applied ST qualification plan is reported:

	Test Group A					Test Group B		Test Group C				Test Group D					Test Group E						
	THB	AC	TC	PTC	HTSL	HTOL	ELFR	WBS	WBP	SD	PD	EM	TDDB	HCI	NBTI	SM	HBM	CDM	LU	ED	GL	EMC	SC
AEC-Q100 requirement		x	x	x	x			x	x											x	x		x
ZVEI requirement	x	x	x	x	x			x	x											x	X		x
ST qualification plan	x	x	x	x	x			x	x											x	X		

See details per each test group in section 4 of this report.

1.2 Results

All reliability tests have been completed with positive results, neither functional nor parametric rejects were detected at final electrical testing.

The Wire Bond Pull/Shear tests (WBP, WBS) as Package Assembly Integrity (test Group C) pointed out neither abnormal break loads nor forbidden failure modes.

Based on the overall positive results we consider the products qualified from a reliability point of view.

- 2. Traceability

Wafer fab information	
Wafer fab manufacturing location	ST CT8 Catania (Italy)
Wafer diameter (inches)	8
Silicon process technology	VIPower M0_S7
Die finishing back side	Ti-NiV-Au
Die size (micron)	VNY5 (High Side Driver): 2850 x 4600 XV07 (Low Side Driver) : 2850 x 1700
Metal levels / materials	1 level / Ti/TiN/TiAlCu (4.7 µm)
Die finishing front side	Teos-PTeos-SioN
Diffusion Lots #	VNY5 (High Side Driver): 5145269 XV07 (Low Side Driver): 5323625

Assembly Information	
Assembly plant location	ST Muar (Malaysia)
Package description	PSSO36L TRIPLE PAD
Molding compound	HITACHI CEL 9240HF10
Wires bonding materials/diameters	Cu 2.5 mils for sources/drains, Cu 2.0mils for others
Die attach material	PREFORM Pb/Ag/Sn 97.5/1.5/1
Assembly Lots #	Lot1: 993460ASRP (LL assembly parameters) Lot2: 993460AS02 (NN assembly parameters) Lot3: 993460ASRN (HH assembly parameters)

Reliability Information	
Reliability test execution location	ST Catania (Italy)

- 3. Devices characteristics

3.1 Generalities

VNH7013XP-E

Automotive integrated H-bridge

Features

Type	$R_{DS(on)}$	I_{out}	V_{ccmax}
VNH7013XP-E	13 mΩ typ (per leg)	40 A	72 V(1)

1. Per leg: sum of the two BV_{dss} (HSD + LSD); V_{CC} > 36 V whole bridge must be switched off;

- Maximum V_{CC} voltage: 72 V
- 10 V compatible inputs
- $R_{DS(on)}$ per leg: 13 mΩ typical
- Embedded thermal sensor: -8.1 mV/°K
- Very low stray inductance in power line

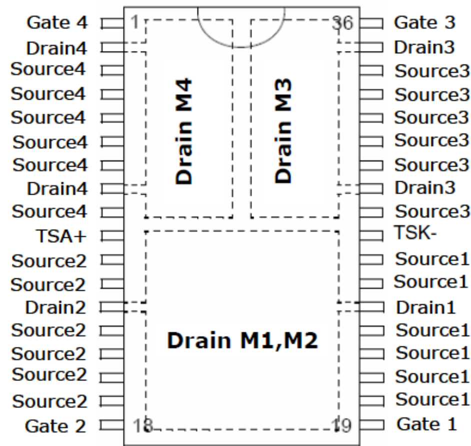
PowerSSO-36 TP

Description

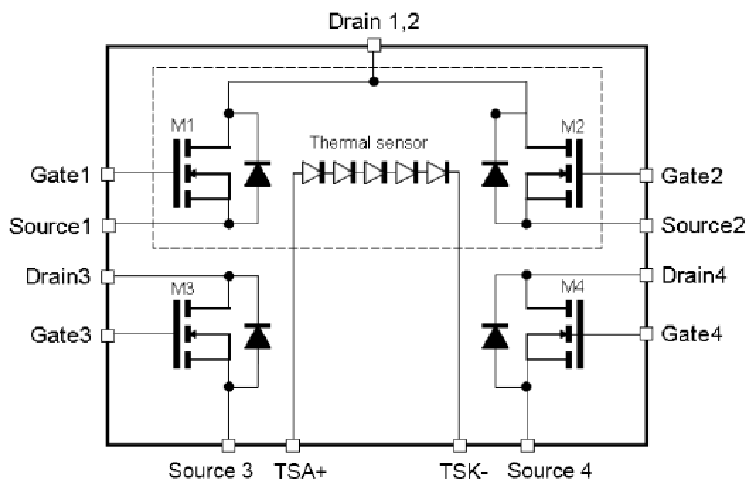
The VNH7013XP-E is an automotive integrated H-bridge intended for a wide range of automotive applications driving DC motors. The device incorporates a dual channel and two single channel MOSFETs. All the devices are designed using STMicroelectronics® well known and proven proprietary VIPower® M0-S7 technology that allows to integrate in a package four different channels in H-bridge topology.

This package, specifically designed for the harsh automotive environment offers improved thermal performance thanks to exposed die pads. Moreover, its fully symmetrical mechanical design allows superior manufacturability at board level.

3.2 Pins connection



3.3 Blocks diagram



- 4. Reliability qualification plan and results

Test group A: Accelerated Environment Stress					
AEC #	**Test Name**	**STM Test Conditions**	**Sample Size/ Lots**	**Results Fails/SS/Lots**	**Comments**
A1	**PC** Pre Cond	- Preconditioning according to Jedec JESD22-A113F including 5 Temperature Cycling Ta=-40°C/+60°C - Reflow according to level 3 Jedec JSTD020D-1 - 100 Temperature Cycling Ta=-50°C/+150°C	Before THB, AC, TC, PTC		
A2	**THB** Temp Humidity Bias	Ta=85°C, RH=85%, Vcc=24V for 1000 hours	77/3	0/77/3	
A3	**AC** Autoclave	**ENV. SEQ.** Environmental Sequence **TC** (Ta=-65°C / +150°C for 100 cycles) + **AC** (Ta=121°C, Pa=2atm for 96 hours)	77/3	0/77/3	
A4	**TC** Temp. Cycling	Ta=-50°C / +150°C for 1000 cycles	77/3	0/77/3	
A5	**PTC** Power Temp. Cycling	Ta=-40°C / +125°C for 1000 cycles.	45/1	0/45/1	
A6	**HTSL** High Temp. Storage Life	Ta=150°C for 1000 hours.	45/3	0/45/3	

Test group A: Accelerated Environment Stress Robustness activity					
AEC #	**Test Name**	**STM Test Conditions**	**Sample Size/ Lots**	**Results Fails/SS/Lots**	**Comments**
A3	**AC** Autoclave	**ENV. SEQ.** Environmental Sequence **TC** (Ta=-65°C / +150°C for 100 cycles) + **AC** (Ta=121°C, Pa=2atm **for 168 hours**)	77/3	0/77/3	
A4	**TC** Temp. Cycling	Ta=-50°C / +150°C **for 2000 cycles**	77/3	0/77/3	
A6	**HTSL** High Temp. Storage Life	Ta=150°C **for 2000 hours**	45/3	0/45/3	

Test group B: Accelerated Lifetime Simulation					
AEC #	**Test Name**	**STM Test Conditions**	**Sample Size/ Lots**	**Results Fails/SS/Lots**	**Comments**
B1	**HTOL** High Temp. Op. Life	Bias Dynamic stress (JESD22-A108): Ta=125ºC, Vcc=28V for 1000 hours	-	-	Not Applicable
B2	**ELFR** Early Life Failure Rate	Parts submitted to **HTOL** per JESD22-A108 requirements; GRADE 1: 24 hours at 150ºC	-	-	Not Applicable
B3	**EDR** Endurance Data Retention	Only for memory devices	-	-	Not Applicable

Test group C: Package Assembly Integrity					
AEC #	**Test Name**	**STM Test Conditions**	**Sample Size/ Lots**	**Results Fails/SS/Lots**	**Comments**
C1	**WBS** Wire Bond Shear		30 bonds /minimum 5 units/1 lot	All measurement within spec limits	
C2	**WBP** Wire Bond Pull		30 bonds /minimum 5 units/1 lot	All measurement within spec limits	
C3	**SD** Solderability		-	-	Not Applicable
C4	**PD** Physical Dimensions		-	-	Not Applicable
C5	**SBS** Solder Ball Shear	Only for BGA package	-	-	Not Applicable
C6	**LI** Lead Integrity	Not required for Surface Mount Devices	-	-	Not Applicable

Test group D: Die Fabrication Reliability					
AEC #	**Test Name**	**STM Test Conditions**	**Sample Size/ Lots**	**Results Fails/SS/Lots**	**Comments**
D1	**EM** Electromigration		-	-	Not Applicable
D2	**TDDB** Time Dependent Dielectric Breakdown		-	-	Not Applicable
D3	**HCI** Hot Carrier Injection		-	-	Not Applicable
D4	**NBTI** Negative Bias Temperature Instability		-	-	Not Applicable
D5	**SM** Stress Migration		-	-	Not Applicable

Test group E: Electrical Verification					
AEC #	**Test Name**	**STM Test Conditions**	**Sample Size/ Lots**	**Results Fails/SS/Lots**	**Comments**
E2	**ESD** HBM / MM		-	-	Not Applicable
E3	**ESD** CDM		-	-	Not Applicable
E4	**LU** Latch-Up		-	-	Not Applicable
E5	**ED** Electrical Distributions		-	Passed	
E7	**CHAR** Characterization		-	-	Not Applicable
E8	**GL** Gate Leakage		-	Passed	
E9	**EMC** Electromagnetic Compatibility		-	-	Not Applicable
E10	**SC** Short Circuit Characterization	According to **AEC-Q100-012**	Not performed because not requested since the product's promotion to commercial maturity. Based on AEC-Q100 this test shall be performed per agreement between user and supplier on a case by case basis		
E11	**SER** Soft Error Rate	Only for devices with memory sizes ≥1Mbit SRAM or DRAM based cells	-	Not Applicable	

Test group F: Defects Screening Tests					
AEC #	**Test Name**	**STM Test Conditions**	**Sample Size/ Lots**	**Results Fails/SS/Lots**	**Comments**
F1	**PAT** Process Average Testing		Not performed on qualification lots listed on traceability section of this report. To be implemented starting from first production lot		
F2	**SBA** Statistical Bin/Yield Analysis				

Test group G: Cavity Package Integrity Tests					
AEC #	**Test Name**	**STM Test Conditions**	**Sample Size/ Lots**	**Results Fails/SS/Lots**	**Comments**
G1	**MS** Mechanical Shock	Not applicable: not for plastic packaged devices			
G2	**VFV** Variable Frequency Vibration				
G3	**CA** Constant Acceleration				
G4	**GFL** Gross/Fine Leak				
G5	**DROP** Package Drop				
G6	**LT** Lid Torque				
G7	**DS** Die Shear				
G8	**IWV** Internal Water Vapor				