PRODUCT/PROCESS CHANGE NOTIFICATION

PCN APG-BAD/12/7546
Dated 05 Nov 2012

VIPower Products Housed in

DPAK/D2PAK,PACK/P2PAK,PENTAWATT: Migration to Leadfree

Table 1. Change Implementation Schedule

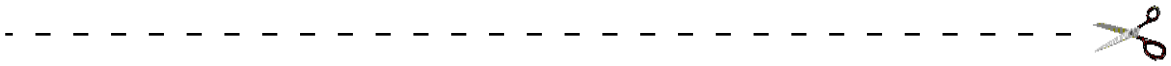
Forecasted implementation date for change	01-Jan-2013
Forecasted availability date of samples for customer	29-Oct-2012
Forecasted date for **STMicroelectronics** change Qualification Plan results availability	29-Oct-2012
Estimated date of changed product first shipment	04-Feb-2013

Table 2. Change Identification

Product Identification (Product Family/Commercial Product)	see list
Type of change	Package assembly material change
Reason for change	European Directive 2002/95/E
Description of the change	Due to European Directive 2002/95/EC (RoHS - Restriction of use of certain Hazardous Substances), ST strongly recommend You to start considering the swap of your VIPower orders from the Lead Present devices to the correspondent Lead Free ones.
Change Product Identification	Ecopak logo "E"
Manufacturing Location(s)	1]St Bouskoura 2 - Morocco 2]St Shenzhen -China

Table 3. List of Attachments

Customer Part numbers list	
Qualification Plan results	



Customer Acknowledgement of Receipt	**PCN APG-BAD/12/7546**
Please sign and return to STMicroelectronics Sales Office	**Dated 05 Nov 2012**

☐ Qualification Plan Denied	Name:
☐ Qualification Plan Approved	Title:
	Company:
☐ Change Denied	Date:
☐ Change Approved	Signature:

Remark

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DOCUMENT APPROVAL

Name	Function
Liporace, Nicola	Marketing Manager
Nicoloso, Riccardo	Product Manager
Minerva, Francesco	Q.A. Manager

Product Change Notification (PCN)

Dear Customer,
as You know, thanks to the huge capacity investments that ST has afforded over the past years, 2010 and H1 2011 have represented a tremendous growth for VIPower business.

However, despite a certain portion of VIPower production is still on the leaded products, ST has directed all the investments done on the VIPower Back End capacity only to the Lead Free lines.

This choice has been imposed by the European Directive 2002/95/EC (RoHS - Restriction of use of certain Hazardous Substances), which has recommended the dismissal of several hazardous substance, including the lead.

Because of the above-mentioned directive no capacity growth on the existing leaded lines will be ever allowed, meaning that those of You who still buy leaded products will not benefit, in terms of service, from this capacity increase. On top of that difficulties in supply of raw material and spare parts for Lead Present Assembly Lines may create in future delivery issue for all Leaded Parts.

For all these considerations Automotive Electronics Division strongly recommend You to start considering the swap of your VIPower orders from the Lead Present devices to the correspondent Lead Free ones.

Product Change Notification (PCN)

VIPower Products Housed in DPAK/D2PAK, PACK/P2PAK, PENTAWATT: Migration to leadfree

WHAT:
Due to European Directive 2002/95/EC (RoHS - Restriction of use of certain Hazardous Substances), ST strongly recommend You to start considering the swap of your VIPower orders from the Lead Present devices to the correspondent Lead Free ones.

WHY:
European Directive 2002/95/E

WHO:
All Customer using below list of products.

WHEN:
We are ready to ship new parts immediately upon Customer agreement.
Qualification reports enclosed to this PCN.

WHERE:
ST Shenzhen , ST Bouskoura Plants.

List of Product involved

Package	Technology	Silicon line	Lead Present Version	Lead Free version
D2PAK	M0.2	V19Y01	VNB49N04	VNB49N04-E
			VNB49N0413TR	VNB49N04TR-E
		V29Y01	VNB28N04	VNB28N04-E
			VNB28N0413TR	VNB28N04TR-E
		V39Y01	VNB14N04	VNB14N04-E
			VNB14N0413TR	VNB14N04TR-E
		VN1901	VNB35N07	VNB35N07-E
			VNB35N0713TR	VNB35N07TR-E
		VN2901	VNB20N07	VNB20N07-E
			VNB20N07(8957)	VNB20N07-E
			VNB20N07(8957)TR	VNB20N07TR-E
			VNB20N0713TR	VNB20N07TR-E
		VN3901	VNB10N07	VNB10N07-E
			VNB10N0713TR	VNB10N07TR-E
	M0.3	VN7601	VNB35NV04	VNB35NV04-E
			VNB35NV0413TR	VNB35NV04TR-E
		VN7801	VNB14NV04	VNB14NV04-E
			VNB14NV0413TR	VNB14NV04TR-E
P2PAK		VN7501	9382501	VN750B5-E
			4833500AA	VN750B5-E
			VN750-B5	VN750B5-E
			VN750-B513TR	VN750B5TR-E
		VN8201	VN820-B5	VN820B5-E
			VN820-B513TR	VN820B5TR-E
		VN9201	VN920-B5	VN920B5-E
			VN920-B513TR	VN920B5TR-E
			VN920-B5H13TR	VN920B5HTR-E
		VNB601	VN920D-B5	VN920DB5-E
			VN920D-B513TR	VN920DB5TR-E
PENTAWATT		VN9201	VN920	VN920-E
			VN920(012Y)	VN920-12-E

Package	Technology	Silicon line	Lead Present version	Lead Free version
DPAK	M0.2	V49Y01	9353987	VND7N04-E
			VND7N04	VND7N04-E
			VND7N0413TR	VND7N04TR-E
		VN2801	VND10N06	VND10N06-E
			VND10N0613TR	VND10N06TR-E
		VN4901	VND5N07	VND5N07-E
			VND5N0713TR	VND5N07TR-E
	M0.3	VN5801	VN1160	VN1160-E
			VN116013TR	VN1160TR-E
		VN7801	VND14NV04	VND14NV04-E
			VND14NV0413TR	VND14NV04TR-E
		VN7901	9401225	VND7NV04-E
			4833505AA	VND7NV04-E
			VND7NV04	VND7NV04-E
			VND7NV0413TR	VND7NV04TR-E
		VN8401	VND3NV04	VND3NV04-E
			VND3NV0413TR	VND3NV04TR-E
		VN7301	VND1NV04	VND1NV04-E
			VND1NV0413TR	VND1NV04TR-E
PPACK	M03	VN7501	9401436TR	VN750PTTR-E
			VN750PT	VN750PT-E
			VN750PT13TR	VN750PTTR-E
		VN8001	VN800PT	VN800PT-E
			VN800PT13TR	VN800PTTR-E
		VN8201	9399376	VN820PT-E
			VN820PT	VN820PT-E
			VN820PT13TR	VN820PTTR-E

VIPower M0_3.5 Products Qualification assembled in Lead Free finishing configuration

Packages and assembly plants involved

- **ST Muar (Malaysia)**
  - **SO16 narrow**
  - **SO16 wide**
  - **SO28**
  - **PSO10**

- **ST Shenzen (China)**
  - **SO8**
  - **DPAK**
  - **PPAK**
  - **P2PAK**
  - **D2PAK**

- **ST Bouskoura (Morocco)**
  - **PW5**
  - **PSO10**

- **Sub-Con Carsem (Malaysia)**
  - **SOT223**

Author:
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Reliability and electrical test executed by:
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Rel. Eng.
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- 1. Reliability evaluations overview

1.1 Objectives

Aim of this report is to present the results of the reliability evaluations performed on several VIPower products designed in M0_3.5 technology chosen as test vehicles in order to qualify the Lead Free finishing assembly configuration on different package typologies involving three ST Assembly Plants. Here below the products and the relevant packages involved:

Assy plant	Package	Product	Silicon Line
Muar	SO16 narrow	VND810P-E VNQ500P-E	VNE4 VNF6
Muar	SO16 wide	VND830E-E	VNI2
Muar	SO28	VNQ830E-E	VNI2
Muar	PSO10	VN920SP-E	VN92
Shenzen	SO8	VNS7NV04P-E VN750PS-E VNS1NV04P-E	VNS2 VNE7 VNL6
Shenzen	DPAK	VND14NV04-E	VN78
Shenzen	PPAK	VN750PT-E	VN75
Shenzen	P2PAK	VN920B5-E	VN92
Shenzen	D2PAK	VNB14NV04-E	VN78
Bouskoura	PW5	VN820-E	VN82
Bouskoura	PSO10	VND600SP-E	VN60
Sub-Con Carsem	SOT223	VNN1NV04P-E VNN7NV04P-E VNN3NV04P-E	VNL6 VNS2 VNS6

According with the AEC_Q100 Rev.G specification for the reliability evaluations the following tests were performed for each test vehicle: High Temperature Storage (HTS), Thermal Cycling (TC), Autoclave (AC), Temperature Humidity Bias (THB). All the reliability tests as well as the electrical verification were performed in ST Catania (Italy).

1.2 Results

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

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

- 2. ST Muar (Malaysia)

Here below a summary table about the products and the packages involved:

Package	Product	Silicon Line
SO16 narrow	VND810P-E VNQ500P-E	VNE4 VNF6
SO16 wide	VND830E-E	VNI2
SO28	VNQ830E-E	VNI2
PSO10	VN920SP-E VND600SP-E (*)	VN92 VN60

(*) ST Bouskoura (Morocco)

- 2.1 Traceability

2.1.1 - SO16 narrow

The lead free finishing configuration on this package was done qualifying on the same time the new Pre Plated µAdvPPF LeadFrame and for this reason the qualification was based on three lots: two two lots of VND810P-E and one of VNQ500P-E that were the products chosen as test vehicles.
The new Pre Plated Frame is composed by Nickel (Ni)/ Palladium (Pd)/ Silver (Ag)/ Gold (Au) instead of the old one that is composed of Nickel (Ni)/ Palladium (Pd)/ Gold (Au).

VND810P-E

General Informations test vehicle 1	
Product Line	VNE4
Commercial Product	**VND810P-E**
Silicon process technology	M03.5
Package	**SO16 Narrow**

Locations	
Diffusion fab location	ST CT6 Catania (Italy)
Assembly plant location	ST Muar (Malaysia)
Test plant location	ST Muar (Malaysia)
Reliability lab location	ST Catania (Italy)

Wafer fab information	
Wafer fab manufacturing location	ST CT 6” CATANIA (Italy)
Wafer diameter	6
Silicon process technology	VIPOWER M03.5
Die finishing back side	Ti-Ni-Au
Die size	3820 x 2150 micron
Metal materials/levels	AlSi (3 micron) / 1
Passivation	SiN / Polyimide
Diffusion Lot #	**3538213E**

Assembly Information	
Assembly plant location	ST Muar (Malaysia)
Package description	SO16 narrow
Lead Frame	SO16L 94x172 Ni/Pd/Ag/Au - Advanced µPPF
Molding compound	RESIN NITTO MP8000CH4-2A D11mm W2.73g
Wires bonding materials/diameters	Au 2.0 mils
Die attach material	LOCTITE - QMI9507-2A1
Assy Lots #	**998350FM01, 998341PG01**

Final Testing Information	
Electrical testing manufacturing location	ST Muar (Malaysia)

VNQ500P-E

General Informations test vehicle 2	
Product Line	VNF6
Commercial Product	**VNQ500P-E**
Silicon process technology	M03.5
Package	**SO16 Narrow**

Locations	
Diffusion fab location	ST CT6 Catania (Italy)
Assembly plant location	ST Muar (Malaysia)
Test plant location	ST Muar (Malaysia)
Reliability lab location	ST Catania (Italy)

Wafer fab information	
Wafer fab manufacturing location	ST CT 6” CATANIA (Italy)
Wafer diameter	6
Silicon process technology	VIPOWER M03.5
Die finishing back side	Ti-Ni-Au
Die size	3070 x 2230 micron
Metal materials/levels	AlSi (3 micron) / 1
Passivation	SiN / Polyimide
Diffusion Lot #	**3812286E**

Assembly Information	
Assembly plant location	ST Muar (Malaysia)
Package description	SO16 narrow
Lead Frame	SO16L 94x172 Ni/Pd/Ag/Au - Advanced µPPF
Molding compound	RESIN NITTO MP8000CH4-2A D11mm W2.73g
Wires bonding materials/diameters	Au 1.3 / 2.0 mils
Die attach material	LOCTITE - QMI9507-2A1
Assy Lots #	**998341PN01**

Final Testing Information	
Electrical testing manufacturing location	ST Muar (Malaysia)

2.1.2 - SO16 large

VND830E-E

General Informations	
Product Line	**VNI2**
Commercial Product	VND830E-E
Silicon process technology	VIPower M0_3.5
Package	**SO16 large**

Locations	
Diffusion fab location	CT6 Catania (Italy)
Assembly plant location	ST Muar (Malaysia)
Test plant location	ST Muar (Malaysia)
Reliability lab location	ST Catania (Italy)

Wafer fab information	
Wafer fab manufacturing location	ST CT 6” CATANIA (Italy)
Wafer diameter	6
Silicon process technology	VIPOWER M0_3.5
Die finishing back side	Ti-Ni-Au
Die size	3400 x 3590 micron
Metal materials/levels	AlSi (3 micron) / 1
Passivation	SiN / Polyimide
Diffusion Lot #	**3529396E**

Assembly Information	
Assembly plant location	ST Muar (Malaysia)
Package description	SO16 large
Lead Frame	SO16L 200x263 SpAg
Molding compound	SUMITOMO EME7026
Wires bonding materials/diameters	Au 2.0mils
Die attach material	PREFORM Pb/Ag/Sn 97.5/1.5/1
Assy Lots #	**9984515601**

Final Testing Information	
Electrical testing manufacturing location	ST Muar (Malaysia)

2.1.3 - SO28

VNQ830E-E

General Informations	
Product Line	**VNI2**
Commercial Product	VNQ830E-E
Silicon process technology	VIPower M0_3.5
Package	**SO28**

Locations	
Diffusion fab location	ST CT6 Catania (Italy)
Assembly plant location	ST Muar (Malaysia)
Test plant location	ST Muar (Malaysia)
Reliability lab location	ST Catania (Italy)

Wafer fab information	
Wafer fab manufacturing location	ST CT 6” CATANIA (Italy)
Wafer diameter	6
Silicon process technology	VIPower M0_3.5
Die finishing back side	Ti-Ni-Au
Die size	3400 x 3590 micron
Metal materials/levels	AlSi (3 micron) / 1
Die finishing front side	SiN / Polyimide
Diffusion Lots #	**3529396E**

Assembly Information	
Assembly plant location	ST Muar (Malaysia)
Package description	SO28
Lead Frame	SO28L 190x563 SpAg
Molding compound	SUMITOMO EME7026
Wires bonding materials/diameters	Au 2.0mils
Die attach material	PREFORM Pb/Ag/Sn 97.5/1.5/1
Assy Lots #	**998410QN01**

Final Testing Information	
Electrical testing manufacturing location	ST Muar (Malaysia)

2.1.4 - PowerSO10

On this package a double goal was reached qualifying on the same time the Lead Free finishing configuration and the Passive Pad on Ground. For this reason the qualification was based on three lots, two of VN920SP-E and one of VND600SP-E that were the products chosen as test vehicles assembled respectively in ST Muar (Malaysia) and in ST Bouskoura (Morocco) in order to qualify two different assembly plants. Here below a traceability for both product is reported although later will be a section dedicated just to Bouskoura.

VN920SP-E

General Informations	
Product Line	**VN92**
Commercial Product	VN920SP-E
Silicon process technology	VIPower M0_3.5
Package	**PowerSO_10**

Locations	
Diffusion fab location	ST CT6 Catania (Italy)
Assembly plant location	ST Muar (Malaysia)
Test plant location	ST Muar (Malaysia)
Reliability lab location	ST Catania (Italy)

Wafer fab information	
Wafer fab manufacturing location	ST CT 6” CATANIA (Italy)
Wafer diameter	6
Silicon process technology	VIPower M0_3.5
Die finishing back side	Ti-Ni-Au
Die size	4420 x 3860 micron
Metal materials/levels	AlSi (3.2 micron) / 1
Die finishing front side	SiN
Diffusion Lots #	**3912186**

Assembly Information	
Assembly plant location	ST Muar (Malaysia)
Package description	PowerSO_10
Lead Frame	PSO-10 4riv 1-2/4-5Fus PlNi/NiP-Ag
Molding compound	HYSOL MG47F-ES
Wires bonding materials/diameters	Au 1.3mils, Al 10mils
Die attach material	PREFORM Pb/Ag/Sn 97.5/1.5/1
Assy Lots #	**9992403T01, 999250TN01**

Final Testing Information	
Electrical testing manufacturing location	ST Muar (Malaysia)

VND600SP-E

General Informations	
Product Line	**VN60**
Commercial Product	VND600SP-E
Silicon process technology	VIPower M0_3.5
Package	**PowerSO_10**

Locations	
Diffusion fab location	ST CT6 Catania (Italy)
Assembly plant location	ST Bouskoura (Morocco)
Test plant location	ST Bouskoura (Morocco)
Reliability lab location	ST Catania (Italy)

Wafer fab information	
Wafer fab manufacturing location	ST CT 6" CATANIA (Italy)
Wafer diameter	6
Silicon process technology	VIPower M0_3.5
Die finishing back side	Ti-Ni-Au
Die size	5450 x 3590 micron
Metal materials/levels	AlSi (3.2 micron) / 1
Die finishing front side	SiN
Diffusion Lots #	**3912184**

Assembly Information	
Assembly plant location	ST Bouskoura (Morocco)
Package description	PowerSO_10
Lead Frame	PSO-10 Mon Ve3 OpB/G 16u PlNi/NiP
Molding compound	SUMITOMO 6650RL1L D14mm W4.4g
Wires bonding materials/diameters	Au 1.3mils, Al 10mils
Die attach material	PREFORM Pb/Ag/Sn 95.5/2.5/2
Assy Lots #	**CZ91908A01**

Final Testing Information	
Electrical testing manufacturing location	ST Bouskoura (Morocco)

- 2.2 Reliability qualification plan and results

AEC #	Test Name	STM Test Conditions	Sample Size	Results Fails/SS	Comments
A1	**PC** Pre Cond	Preconditioning at Jedec Level 3, store 192 hours at Ta=30ºC, RH=60%, reflow (3 times)	Before THB, AC, TC - Tpeak=260ºC for SO16 wide and narrow, SO28 - Tpeak=250ºC for PSO10		
A2	**THB** Temp Humidity Bias	Ta=85ºC, RH=85%, Vcc=24V for 1000 hours	77	0/77	- 3 lots for SO16 narrow - 1 lot for SO16 large - 1 lot for SO28 - 3 lots for PSO10
A3	**AC** Autoclave	Ta=121ºC, Pa=2atm, RH=100% for 96 hours	77	0/77	
A4	**TC** Temp. Cycling	Ta=-65ºC / +150ºC for 500 cycles	77	0/77	
A6	**HTSL** High Temp. Storage Life	Ta=150ºC for 1000 hours. TST before and after at room and hot temperatures.	45	0/45	

- 3. ST Shenzen (China)

Here below a summary table about the products and the packages involved:

Package	Product	Silicon Line
SO8	VNS7NV04P-E VN750PS-E VNS1NV04P-E	VNS2 VNE7 VNL6
DPAK	VND14NV04-E	VN78
PPAK	VN750PT-E	VN75
P2PAK	VN920B5-E	VN92
D2PAK	VNB14NV04-E	VN78

- 3.1 Traceability

3.1.1 - SO8

The lead free finishing configuration on this package was done qualifying on the same time the new Pre Plated µAdvPPF LeadFrame and three products were chosen as test vehicles:, one lot per each test vehicle that are VNS7NV04P-E (VNS2) single island, VN750PS-E (VNE7) single island and VNS1NV04P-E (VNL6) double island.
The new Pre Plated Frame is composed by Nickel (Ni)/ Palladium (Pd)/ Silver (Ag)/ Gold (Au) instead of the old one that is composed of Nickel (Ni)/ Palladium (Pd)/ Gold (Au).

VNS7NV04P-E

General Informations test vehicle 1	
Product Line	**VNS2**
Commercial Product	VNS7NV04P-E
Silicon process technology	M03.5
Package	**SO8**

Locations	
Diffusion fab location	ST CT6 Catania (Italy)
Assembly plant location	ST Shenzen (China)
Test plant location	ST Shenzen (China)
Reliability lab location	ST Catania (Italy)

Wafer fab information	
Wafer fab manufacturing location	ST CT 6” CATANIA (Italy)
Wafer diameter	6
Silicon process technology	VIPOWER M03.5
Die finishing back side	Ti-Ni-Au
Die size	2130 x 2540 micron
Metal materials/levels	AlSi (3.2 micron) / 1
Passivation	SiN / Polyimide
Diffusion Lot #	**3728110**

Assembly Information	
Assembly plant location	ST Shenzen (China)
Package description	**SO 08 STRIP SINGLE ISLAND**
Molding compound	RESIN NITTO MP8000CH4-2A D14mm W3.9g
Wires bonding materials/diameters	Au 2.0 mils
Die attach material	LOCTITE - QMI9507-2A1
Assy Lots #	**GK8391Y501**

Final Testing Information	
Electrical testing manufacturing location	*ST Shenzen (China)*

VN750PS-E

General Informations test vehicle 2	
Product Line	**VNE7**
Commercial Product	VN750PS-E
Silicon process technology	M03.5
Package	**SO8**

Locations	
Diffusion fab location	ST CT6 Catania (Italy)
Assembly plant location	ST Shenzen (China)
Test plant location	ST Shenzen (China)
Reliability lab location	ST Catania (Italy)

Wafer fab information	
Wafer fab manufacturing location	ST CT 6” CATANIA (Italy)
Wafer diameter	6
Silicon process technology	VIPOWER M03.5
Die finishing back side	Ti-Ni-Au
Die size	3540 x 2040 micron
Metal materials/levels	AlSi (3 micron) / 1
Passivation	SiN / Polyimide
Diffusion Lot #	**3811685**

Assembly Information	
Assembly plant location	ST Shenzen (China)
Package description	**SO 08 STRIP SINGLE ISLAND**
Molding compound	RESIN NITTO MP8000CH4-2A D14mm W3.9g
Wires bonding materials/diameters	Au 2.0 mils
Die attach material	LOCTITE - QMI9507-2A1
Assy Lots #	**GK8420KU01**

Final Testing Information	
Electrical testing manufacturing location	ST Shenzen (China)

VNS1NV04P-E

General Informations test vehicle 3	
Product Line	**VNL6**
Commercial Product	VNS1NV04P-E
Silicon process technology	M03.5
Package	**SO8**

Locations	
Diffusion fab location	ST CT6 Catania (Italy)
Assembly plant location	ST Shenzen (China)
Test plant location	ST Shenzen (China)
Reliability lab location	ST Catania (Italy)

Wafer fab information	
Wafer fab manufacturing location	ST CT 6” CATANIA (Italy)
Wafer diameter	6
Silicon process technology	VIPOWER M03.5
Die finishing back side	Ti-Ni-Au
Die size	1710 x 1520 micron
Metal materials/levels	AlSi (3.2 micron) / 1
Passivation	SiN / Polyimide
Diffusion Lot #	**3824020**

Assembly Information	
Assembly plant location	ST Shenzen (China)
Package description	**SO 08 STRIP DOUBLE ISLAND**
Molding compound	RESIN NITTO MP8000CH4-2A D14mm W3.9g
Wires bonding materials/diameters	Au 2.0 mils
Die attach material	LOCTITE - QMI9507-2A1
Assy Lots #	**GK8391Y602**

Final Testing Information	
Electrical testing manufacturing location	ST Shenzen (China)

3.1.2 - DPAK – PPAK – P2PAK_D2PAK

On these packages a double goal was reached qualifying on the same time the Lead Free finishing configuration and the Passive Pad on Ground. For this reason the qualification was based on three lots, one lot per each package. Here below the details for the chosen test vehicle:

VND14NV04-E

General Informations	
Product Line	**VN78**
Commercial Product	VND14NV04-E
Silicon process technology	VIPower M0_3.5
Package	**DPAK**

Locations	
Diffusion fab location	ST AMK6 Ang Mo Kio (Singapore)
Assembly plant location	ST Shenzen (China)
Test plant location	ST Shenzen (China)
Reliability lab location	ST Catania (Italy)

Wafer fab information	
Wafer fab manufacturing location	ST AMK6 Ang Mo Kio (Singapore)
Wafer diameter	6
Silicon process technology	VIPower M0_3.5
Die finishing back side	Ti-Ni-Au
Die size	3540 x 2540 micron
Metal materials/levels	AlSi (3 micron) / 1
Die finishing front side	SiN
Diffusion Lots #	**6836350**

Assembly Information	
Assembly plant location	ST Shenzen (China)
Package description	**DPAK**
Molding compound	SUMITOMO EME7026
Wires bonding materials/diameters	Al 10mils, Al-Mg 7mils
Die attach material	PREFORM Pb/Ag/Sn
Assembly Lots #	**GK8421YT01**

Final Testing Information	
Electrical testing manufacturing location	ST Shenzen (China)

VN750PT-E

General Informations	
Product Line	**VN75**
Commercial Product	VN750PT-E
Silicon process technology	VIPower M0_3.5
Package	**PPAK**

Locations	
Diffusion fab location	ST CT6 Catania (Italy)
Assembly plant location	ST Shenzen (China)
Test plant location	ST Shenzen (China)
Reliability lab location	ST Catania (Italy)

Wafer fab information	
Wafer fab manufacturing location	ST CT6 Catania (Italy)
Wafer diameter	6
Silicon process technology	VIPower M0_3.5
Die finishing back side	Ti-Ni-Au
Die size	*3360 x 2130 micron*
Metal materials/levels	AlSi (3.2 micron) / 1
Die finishing front side	SiN
Diffusion Lots #	**3903129**

Assembly Information	
Assembly plant location	ST Shenzen (China)
Package description	**PPAK**
Molding compound	*SUMITOMO EME7026*
Wires bonding materials/diameters	*Au 2.0mils, Al 10mils*
Die attach material	PREFORM Pb/Ag/Sn 95.5/2.5/2 D.76mm SSD
Assembly Lots #	**GK9270YQ01**

Final Testing Information	
Electrical testing manufacturing location	ST Shenzen (China)

VN920B5-E

General Informations	
Product Line	**VN92**
Commercial Product	VN920B5-E
Silicon process technology	VIPower M0_3.5
Package	**P2PAK**

Locations	
Diffusion fab location	ST CT6 Catania (Italy)
Assembly plant location	ST Shenzen (China)
Test plant location	ST Shenzen (China)
Reliability lab location	ST Catania (Italy)

Wafer fab information	
Wafer fab manufacturing location	ST CT6 Catania (Italy)
Wafer diameter	6
Silicon process technology	VIPower M0_3.5
Die finishing back side	Ti-Ni-Au
Die size	*4420 x 3860 micron*
Metal materials/levels	AlSi (3 micron) / 1
Die finishing front side	SiN
Diffusion Lots #	**3912186A**

Assembly Information	
Assembly plant location	ST Shenzen (China)
Package description	**P2PAK**
Molding compound	*SUMITOMO EME7026*
Wires bonding materials/diameters	*Au 2.0mils, Al 10mils*
Die attach material	PREFORM Pb/Ag/Sn 95.5/2.5/2 D.76mm SSD
Assembly Lots #	**GK9270YP01**

Final Testing Information	
Electrical testing manufacturing location	ST Shenzen (China)

VNB14NV04-E

General Informations	
Product Line	**VN78**
Commercial Product	VNB14NV04-E
Silicon process technology	VIPower M0_3.5
Package	**D2PAK**

Locations	
Diffusion fab location	ST AMK6 Ang Mo Kio (Singapore)
Assembly plant location	ST Shenzen (China)
Test plant location	ST Shenzen (China)
Reliability lab location	ST Catania (Italy)

Wafer fab information	
Wafer fab manufacturing location	ST AMK6 Ang Mo Kio (Singapore)
Wafer diameter	6
Silicon process technology	VIPower M0_3.5
Die finishing back side	Ti-Ni-Au
Die size	3540 x 2540 micron
Metal materials/levels	AlSi (3 micron) / 1
Die finishing front side	SiN

Assembly Information	
Assembly plant location	ST Shenzen (China)
Package description	**D2PAK**
Molding compound	SUMITOMO EME7026
Wires bonding materials/diameters	Al 10mils, Al-Mg 7mils
Die attach material	PREFORM Pb/Ag/Sn

Final Testing Information	
Electrical testing manufacturing location	ST Shenzen (China)

- 3.2 Reliability qualification plan and results

AEC #	Test Name	STM Test Conditions	Sample Size	Results Fails/SS	Comments
A1	**PC** Pre Cond	Preconditioning at Jedec Level 3, store 192 hours at Ta=30ºC, RH=60%, reflow (3 times)	Before THB, AC, TC - Tpeak=260ºC for SO8, DPAK, PPAK - Tpeak=245ºC for P2PAK		
A2	**THB** Temp Humidity Bias	Ta=85ºC, RH=85%, Vcc=24V for 1000 hours	77	0/77	- 3 lots for SO8 - 1 lot for DPAK - 1 lot for PPAK - 1 lot for P2PAK - 1 lot for D2PAK
A3	**AC** Autoclave	Ta=121ºC, Pa=2atm, RH=100% for 96 hours	77	0/77	
A4	**TC** Temp. Cycling	Ta=-65ºC / +150ºC for 500 cycles	77	0/77	
A6	**HTSL** High Temp. Storage Life	Ta=150ºC for 1000 hours. TST before and after at room and hot temperatures.	45	0/45	

- 4. ST Bouskoura (Morocco)

Here below a summary table about the products and the packages involved:

Package	Product	Silicon Line
PentaWatt 5	VN820-E	VN82
PSO10	VND600SP-E (*)	VN60

(*) See section dedicated to ST Muar assembly plant

- 4.1 Traceability

4.1.1 - Pentawatt (PW) 5

On this package a double goal was reached qualifying on the same time the Lead Free finishing configuration and the Passive Pad on Ground.

VN820-E_VN82

General Informations	
Product Line	**VN82**
Commercial Product	VN820-E
Silicon process technology	VIPower M0_3.5
Package	**PW5**

Locations	
Diffusion fab location	ST CT6 Catania (Italy)
Assembly plant location	ST Bouskoura (Morocco)
Test plant location	ST Bouskoura (Morocco)
Reliability lab location	ST Catania (Italy)

Wafer fab information	
Wafer fab manufacturing location	ST CT6 Catania (Italy)
Wafer diameter	6
Silicon process technology	VIPower M0_3.5
Die finishing back side	Ti-Ni-Au
Die size	*3210 x 2640 micron*
Metal materials/levels	AlSi (3 micron) / 1
Die finishing front side	SiN
Diffusion Lots #	**3912187**

Assembly Information	
Assembly plant location	ST Bouskoura (Morocco)
Package description	**PW5**
Molding compound	*SUMITOMO 6300HR1L D11mm W3.1g*
Wires bonding materials/diameters	*Au 2.0mils, Al 10mils*
Die attach material	PREFORM Pb/Ag/Sn 95.5/2.5/2 D.76mm SSD
Assembly Lots #	**CZ9360NSZZ**

Final Testing Information	
Electrical testing manufacturing location	ST Bouskoura (Morocco)

- 4.2 Reliability qualification plan and results

AEC #	Test Name	STM Test Conditions	Sample Size	Results Fails/SS	Comments
A2	**THB** Temp Humidity Bias	Ta=85ºC, RH=85%, Vcc=24V for 1000 hours	77	0/77	- 1 lot for PW5
A3	**AC** Autoclave	Ta=121ºC, Pa=2atm, RH=100% for 96 hours	77	0/77	
A4	**TC** Temp. Cycling	Ta=-65ºC / +150ºC for 500 cycles	77	0/77	
A6	**HTSL** High Temp. Storage Life	Ta=150ºC for 1000 hours. TST before and after at room and hot temperatures.	45	0/45	

- 5. Sub-Contractor Carsem (Malaysia)

Here below a summary table about the products and the packages involved:

Package	Product	Silicon Line
SOT223	VNN1NV04P-E VNN7NV04P-E VNN3NV04P-E	VNL6 VNS2 VNS6

- 5.1 Traceability

5.1.1 – SOT223

On this package a double goal was reached qualifying on the same time the Lead Free finishing configuration and the Passive Pad on Ground.

VNN1NV04P-E

General Informations	
Product Line	**VNL6**
Commercial Product	VNN1NV04P-E
Silicon process technology	VIPower M0_3.5
Package	**SOT223**

Locations	
Diffusion fab location	ST CT6 Catania (Italy)
Assembly plant location	SC Carsem (Malaysia)
Test plant location	ST Shenzhen (China)
Reliability lab location	ST Catania (Italy)

Wafer fab information	
Wafer fab manufacturing location	ST CT6 Catania (Italy)
Wafer diameter	6
Silicon process technology	VIPower M0_3.5
Die finishing back side	Ti-Ni-Au
Die size	1710 x 1520 micron
Metal materials/levels	AlSi (3.2 micron) / 1
Die finishing front side	SiN/POLYIMIDE
Diffusion Lots #	**3110200**

Assembly Information	
Assembly plant location	SC Carsem (Malaysia)
Package description	**SOT223**
Molding compound	SPL 18 / CEL9240HF10CT
Wires bonding materials/diameters	BALL BONDING 2 MILS Au WIRES
Die attach material	SOFT SOLDER PB/SN 95/5
Assembly Lots #	**GK1230BR01**

Final Testing Information	
Electrical testing manufacturing location	ST Shenzhen (China)

VNN7NV04P-E

General Informations	
Product Line	**VNS2**
Commercial Product	VNN7NV04P-E
Silicon process technology	VIPower M0_3.5
Package	**SOT223**

Locations	
Diffusion fab location	ST CT6 Catania (Italy)
Assembly plant location	SC Carsem (Malaysia)
Test plant location	ST Shenzhen (China)
Reliability lab location	ST Catania (Italy)

Wafer fab information	
Wafer fab manufacturing location	ST CT6 Catania (Italy)
Wafer diameter	6
Silicon process technology	VIPower M0_3.5
Die finishing back side	Ti-Ni-Au
Die size	2130 x 2540 micron
Metal materials/levels	AlSi (3.2 micron) / 1
Die finishing front side	SiN/POLYIMIDE
Diffusion Lots #	**3045272**

Assembly Information	
Assembly plant location	SC Carsem (Malaysia)
Package description	**SOT223**
Molding compound	SPL 18 / CEL9240HF10CT
Wires bonding materials/diameters	BALL BONDING 2 MILS Au WIRES
Die attach material	SOFT SOLDER PB/SN 95/5
Assembly Lots #	**GK14506HZX**

Final Testing Information	
Electrical testing manufacturing location	ST Shenzhen (China)

VNN3NV04P-E

General Informations	
Product Line	**VNS6**
Commercial Product	VNN3NV04P-E
Silicon process technology	VIPower M0_3.5
Package	**SOT223**

Locations	
Diffusion fab location	ST CT6 Catania (Italy)
Assembly plant location	SC Carsem (Malaysia)
Test plant location	ST Shenzhen (China)
Reliability lab location	ST Catania (Italy)

Wafer fab information	
Wafer fab manufacturing location	ST CT6 Catania (Italy)
Wafer diameter	6
Silicon process technology	VIPower M0_3.5
Die finishing back side	Ti-Ni-Au
Die size	2350 x 1720 micron
Metal materials/levels	AlSi (3.2 micron) / 1
Die finishing front side	SiN/POLYIMIDE
Diffusion Lots #	**3111452**

Assembly Information	
Assembly plant location	SC Carsem (Malaysia)
Package description	**SOT223**
Molding compound	SPL 18 / CEL9240HF10CT
Wires bonding materials/diameters	BALL BONDING 2 MILS Au WIRES
Die attach material	SOFT SOLDER PB/SN 95/5
Assembly Lots #	**GK1270UK01**

Final Testing Information	
Electrical testing manufacturing location	ST Shenzhen (China)

- 5.2 Reliability qualification plan and results

AEC #	Test Name	STM Test Conditions	Sample Size	Results Fails/SS	Comments
A1	**PC** Pre Cond	Preconditioning at Jedec Level 3, store 192 hours at Ta=30ºC, RH=60%, reflow (3 times) at 260ºC	Before THB, AC, TC		- 3 lots for SOT223
A2	**THB** Temp Humidity Bias	Ta=85ºC, RH=85%, Vcc=24V for 1000 hours	77	0/77	
A3	**AC** Autoclave	Ta=121ºC, Pa=2atm, RH=100% for 96 hours	77	0/77	
A4	**TC** Temp. Cycling	Ta=-65ºC / +150ºC for 500 cycles	77	0/77	
A6	**HTSL** High Temp. Storage Life	Ta=150ºC for 1000 hours. TST before and after at room and hot temperatures.	45	0/45	

VIPower M02 products lead free qualification
Package D2PAK, DPAK

General Informations	
Commercial Product	**VNB35N07-E**
Product Line	VN19
Silicon process technology	VIPower M02
Package	D2PAK

Locations	
Diffusion fab location	ST CT6 Catania (Italy)
Assembly plant location	ST Shenzhen (China)
Test plant location	ST Shenzhen (China)
Reliability lab location	ST Catania (Italy)

General Informations	
Commercial Product	**VNB10N07-E**
Product Line	VN39
Silicon process technology	VIPower M02
Package	D2PAK

Locations	
Diffusion fab location	ST CT6 Catania (Italy)
Assembly plant location	ST Shenzhen (China)
Test plant location	ST Shenzhen (China)
Reliability lab location	ST Catania (Italy)

General Informations	
Commercial Product	**VND5N07-E**
Product Line	VN49
Silicon process technology	VIPower M02
Package	DPAK

Locations	
Diffusion fab location	ST CT6 Catania (Italy)
Assembly plant location	ST Shenzhen (China)
Test plant location	ST Shenzhen (China)
Reliability lab location	ST Catania (Italy)

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Table of contents

- 1. Reliability evaluations overview

1.1 Objectives

Aim of this report is to present the results of the reliability evaluations performed on several VIPower products designed in M02 technology chosen as test vehicles in order to qualify the Lead Free finishing assembly configuration on D2PAK and DPAK packages. Here below the chosen test vehicles:

1) D2PAK
    a. VNB35N07-E (VN19 as ST internal silicon line) as max die size
    b. VNB10N07-E (VN39 as ST internal silicon line) as min die size

2) DPAK
    a. VND5N07-E (VN49 as ST internal silicon line) as max die size

The reliability evaluation was based on 3 lots per each vehicle and according with the **AEC_Q100 Rev.G** specification for the Accelerated Environment Stress (test Group A) the following tests were performed: Preconditioning (PC), Temperature Humidity Bias (THB), Autoclave (AC), Thermal Cycling (TC), High Temperature Storage (HTS).

1.2 Results

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

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

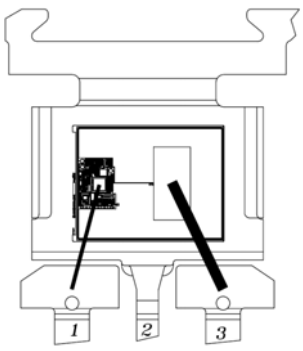
- 2. Traceability

Wafer fab information	
Wafer fab manufacturing location	ST CT6 CATANIA (Italy)
Wafer diameter (inches)	6
Silicon process technology	VIPower M02
Die finishing back side	Ti-Ni-Au
Die size (micron)	**VN19:** 4290x5560, **VN39:** 3100x3100, **VN49:** 2960x2260
Metal levels / materials	1 level / AlSi 3 µm
Die finishing front side	SiN

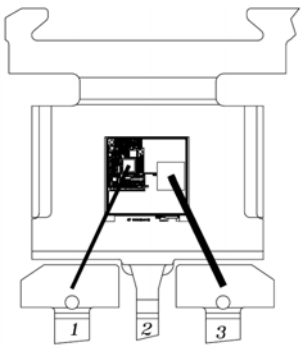
Assembly Information	
Assembly plant location	ST Shenzhen (China)
Package description	D2PAK, DPAK
Molding compound	Resin SUMITOMO EME7026
Die finishing back	Ti-Ni-Au
Wires bonding materials/diameters	**VN19:** Al 5 and 15 mils **VN39:** Al 5 and 10 mils **VN49:** Al 7 mils
Die attach material	Preform Pb/Ag/Sn 95.5/2.5/2

Final Testing Information	
Electrical testing manufacturing location	ST Shenzhen (China)

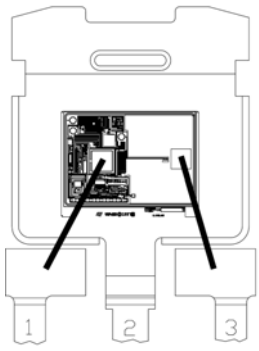
Reliability Information	
Reliability test execution location	ST Catania (Italy)



VNB35N07-E (VN19)



VNB10N07-E (VN39)



VND5N07-E (VN49)

- 3. Reliability qualification plan and results

AEC #	Test Name	STM Test Conditions	Sample Size/ Lots	Results Fails/SS/Lots	Comments
A1	**PC** Pre Cond	- Preconditioning according to level 3 Jedec JESD22-A113F - Reflow according to Jedec JSTD020D-1	Before THB, AC, TC		
A2	**THB** Temp Humidity Bias	Ta=85ºC, RH=85% for 1000 hours	77/3	0/77/3	3 lots/ test vehicle
A3	**AC** Autoclave	Ta=121ºC, Pa=2atm, RH=100% for 96 hours	77/3	0/77/3	3 lots/ test vehicle
A4	**TC** Temp. Cycling	Ta=-65ºC / +150ºC for 500 cycles	77/3	0/77/3	3 lots/ test vehicle
A6	**HTSL** High Temp. Storage Life	Ta=150ºC for 1000 hours	45/3	0/45/3	3 lots/ test vehicle

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