PRODUCT / PROCESS CHANGE NOTIFICATION

1. PCN basic data	
1.1 Company	STMicroelectronics International N.V
1.2 PCN No.	APG/14/9004
1.3 Title of PCN	VIPower housed in PowerSO-30: Wire Sagging Improvement
1.4 Product Category	VIPower products housed in PowerSSO-36 (VH01/VH02/VH21 lines)
1.5 Issue date	2014-12-03

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, ?)	MU1A---ST MUAR - MALAYSIA

4. Description of change		
	Old	New
4.1 Description	Lead frame design: Floating die attach paddle - Corner leads not fused together	Lead frame design: Corner leads fused together
4.2 Anticipated Impact on form,fit, function, quality, reliability or processability?	No Impact in Functionand Realiability	

5. Reason / motivation for change	
5.1 Motivation	In ordert o improve quality a modification of lead frame has been implemented. Corner leads are fused toghether in order to improve wire sagging and to avoid pad tilt/movement during handling
5.2 Customer Benefit	QUALITY IMPROVEMENT

6. Marking of parts / traceability of change	
6.1 Description	Dedicated Finished-Good codes

7. Timing / schedule	
7.1 Date of qualification results	2014-11-13
7.2 Intended start of delivery	2015-05-13
7.3 Qualification sample available?	Upon Request

8. Qualification / Validation			
8.1 Description	RR002714CT2235_01_VH01_MPSO30_Frame change for sagging wires.pdf		
8.2 Qualification report and qualification results	Available (see attachment)	Issue Date	2014-12-03

9. Attachments (additional documentations)
9004PpPrdtLst.pdf RR002714CT2235_01_VH01_MPSO30_Frame change for sagging wires.pdf description.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
	VND5E004A30-E	
	VNH2SP30-E	
	VNH2SP30TR-E	
	VNH3ASP30-E	
	VNH3SP30-E	
	VNH3SP30TR-E	
	VNH5019A-E	
	VNH5019ATR-E	

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VIPower housed in PowerSO-30: Wire Sagging Improvement

WHAT:
In order to improve quality a modification of lead frame has been implemented. Corner leads are fused together in order to improve wire sagging and to avoid pad tilt/movement during handling

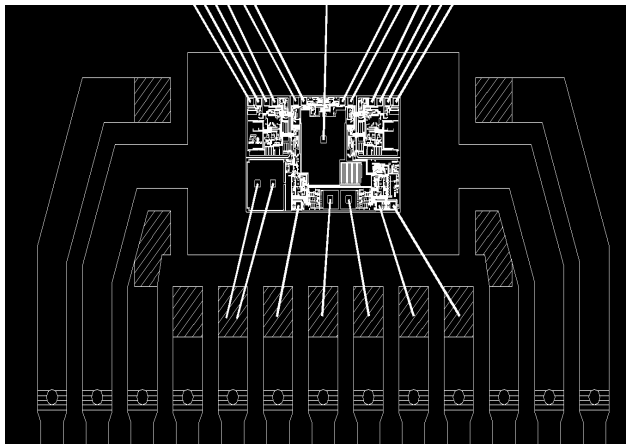
WHY:
Quality Improvement

HOW:
See enclosed description of the change and qualification report RR002714CT2235

HOW:
Change will be implemented according the following schedule
Samples: Available on demand
Qualification results: enclosed to this communication
Implementation: May 2015, but we are ready to implement the change prior this date upon Customer agreement

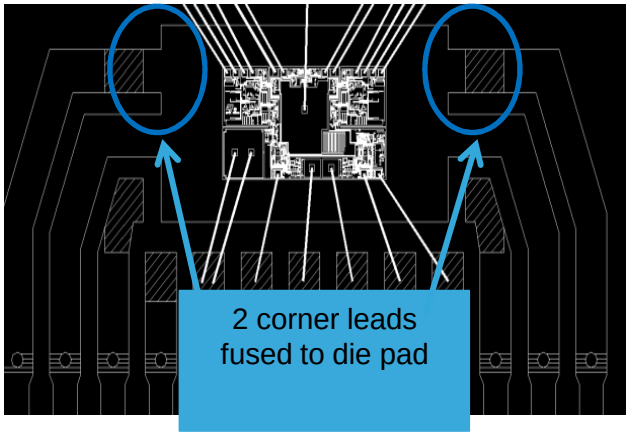
VIPower housed in PowerSO-30: Wire Sagging Improvement

Current



No corner leads are fused together in

New



Corner leads are fused together in order to improve wire sagging and to avoid pad tilt/movement during handling

life.augmented

VND5004ASP30-E (VH01)

Package MultiPowerSO30
New frame for sagging wire improvement

Revision history			
Rev.	**Date of Release**	**Author**	**Changes description**
0.1	September 4th 2014	F. Ceraulo - APG Q&R Catania	Creation

Table of contents

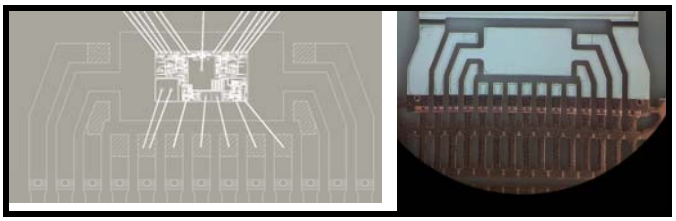
- 1. Reliability evaluations overview

1.1 Objectives

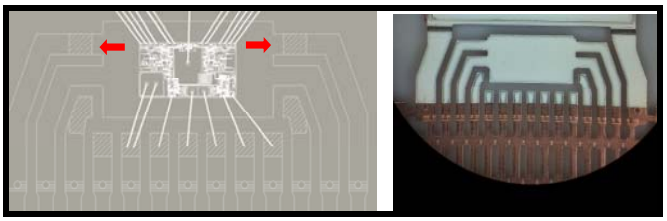
Aim of this report is to present the results of the reliability evaluations performed on **VND5004ASP30-E** (VH01 as ST internal code) chosen as test vehicle to release in production a new frame for package MultiPowerSO30.

This product is a 4mohm Dual Channel High Side Driver with analog current sense for Automotive Applications designed in VIPower M05 technology, composed by two power dice (VNI4 as ST internal silicon line) and one signal die (VNG4 as ST internal silicon line) both diffused in ST AMK6 Ang Mo Kio (Singapore) 6" wafer fab.

The new frame is introduced for sagging wire improvement and was designed to make the floating paddle more rigid reducing the vertical vibration during handling.



Current frame



New frame

Change between the current and the new frames occurs only in a geometry dimension (see red arrows for details) but not in the material or in the assembly configuration.

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	N	Not applicable
F	Defect Screening	N	Not applicable
G	Cavity Package Integrity	N	N/A: not for plastic packaged devices

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

In the below table a comparison between the AEC-Q100 and ZVEI requirements for this kind of change (lead frame dimension) 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		x	x	x						x	x												x
ZVEI		x	x	x						x	x												x
ST		x	x					x	x	x	x												

The applied qualification plan was addressed to investigate about failure mechanisms related to the thermo mechanical and humidity stress while the impact of the change is considered negligible vs the failure mechanism related to PTC and SC (no change in wires/assembly configuration/die attach).

1.2 Results

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

The 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 AMK6 Ang Mo Kio (Singapore)
Wafer diameter (inches)	6
Silicon process technology	VIPower M05
Die finishing back side	Ti-Ni-Au
Die size (micron)	VNG4 (signal): 2800 x 1560 VNI4 (power) : 7990 x 4000
Metal levels / materials	VNG4 (signal): 2 levels / Ti/TiN/Ti/AlSiCu (3.2 µm last level) VNI4 (power) : 1 level / Ti/AlSiCu (4.5 µm)
Die finishing front side	SiN/POLYIMIDE
Diffusion Lots #	VNG4 (signal): 61431X3, VNI4 (power): 63245T5

Assembly Information	
Assembly plant location	ST Muar (Malaysia)
Package description	Multi PowerSO_30
Molding compound	RESIN SUMITOMO EME-G600C
Wires bonding materials/diameters	Au 1.2mils (on signal) / Al 15mils (on power)
Die attach material	GLUE QMI9507 PREFORM Pb/Ag/Sn 97.5/1.5/1
Assembly Lots #	993360NR01 (old frame), 993360NR02 (new frame)

Reliability Information	
Reliability test execution location	ST Catania (Italy)

- 3. Device characteristics

3.1 Generalities

VND5004A-E
VND5004ASP30-E

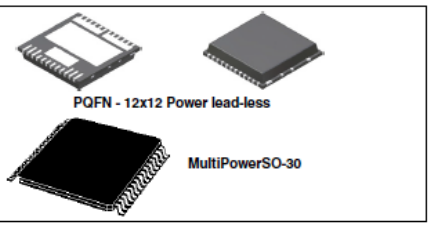
Double 4mΩ high side driver with analog current sense for automotive applications

Features

Max transient supply voltage	V_{CC}	41V
Operating voltage range	V_{CC}	4.5 to 27V
Max On-State resistance (per ch.)	R_{ON}	4 mΩ
Current limitation (typ)	I_{LIMH}	100A
Off state supply current	I_S	2 µA(1)

1. Typical value with all loads connected

- General
  - Inrush current active management by power limitation
  - Very low stand-by current
  - 3.0V CMOS compatible input
  - Optimized electromagnetic emission
  - Very low electromagnetic susceptibility
  - In compliance with the 2002/95/EC European directive
- Diagnostic functions
  - Proportional load current sense
  - Current sense disable
  - Thermal shutdown indication
- Protection
  - Undervoltage shut-down
  - Overvoltage clamp
  - Load current limitation
  - Thermal shut down
  - Self limiting of fast thermal transients
  - Protection against loss of ground and loss of V_{CC}
  - Reverse battery protection with self switch on of the PowerMOS (see *Application schematic on page 18*)
  - Electrostatic discharge protection



Application

- All types of resistive, inductive and capacitive loads
- Suitable for power management applications

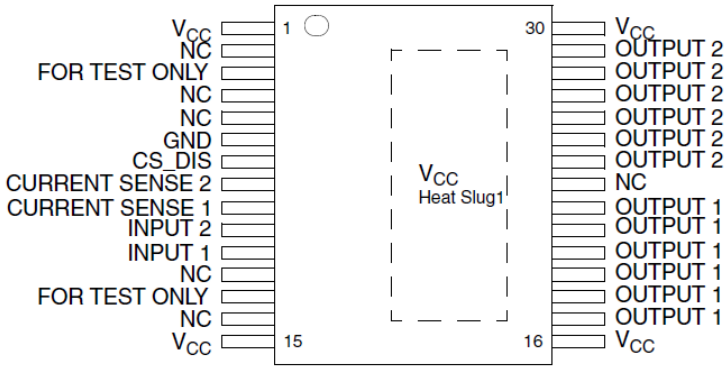
Description

The VND5004ATR-E and VND5004ASP30-E are devices made using STMicroelectronics VIPower technology. They are intended for driving resistive or inductive loads with one side connected to ground. Active V_{CC} pin voltage clamp and load dump protection circuit protect the devices against transients on the Vcc pin (see ISO7637 transient compatibility table). These devices integrate an analog current sense which delivers a current proportional to the load current (according to a known ratio) when CS_DIS is driven low or left open. When CS_DIS is driven high, the CURRENT SENSE pin is high impedance. Output current limitation protects the devices in overload condition. In case of long duration overload, the devicesa limit the dissipated power to a safe level up to thermal shut-down intervention. Thermal shut-down with automatic restart allows the device to recover normal operation as soon as a fault condition disappears.

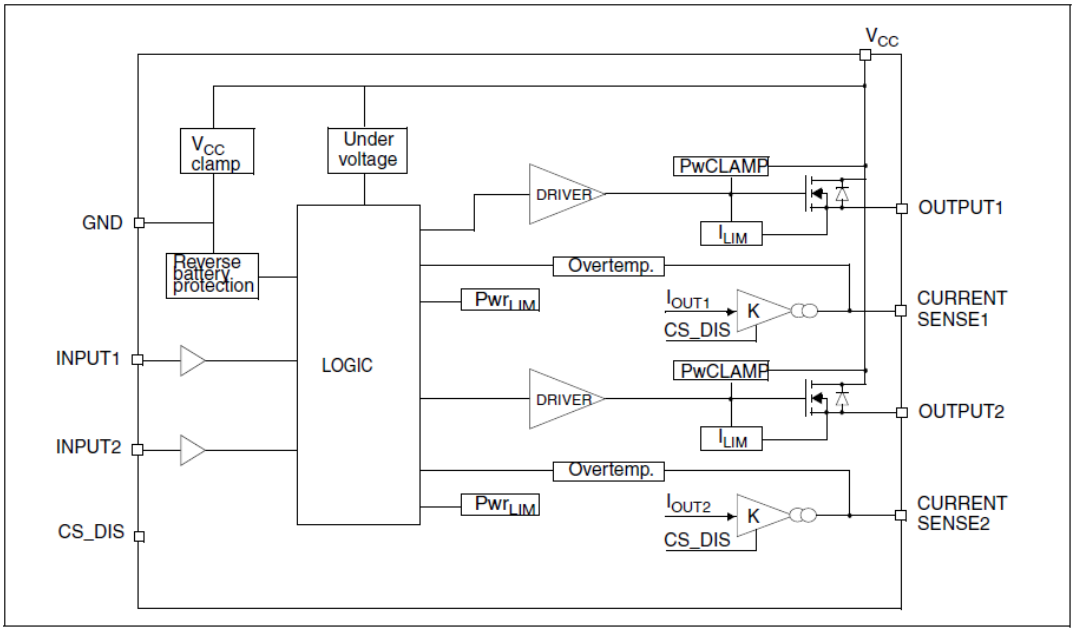
Table 1. Devices summary

Package	Order codes		
	Tube	Tape and Reel	Tray
PQFN-12x12 Power lead-less	-	VND5004ATR-E	VND5004A-E
MultiPowerSO-30	VND5004ASP30-E	VND5004ASP30TR-E	-

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=-40ºC/+60ºC - Reflow according to level 3 Jedec JSTD020D-1 - 100 Temperature Cycling Ta=-50ºC/+150ºC	Before AC, TC		
A2	**THB** Temp Humidity Bias	Ta=85ºC, RH=85%, Vcc=24V for 1000 hours	-	-	Not Applicable
A3	**AC** Autoclave	**ENV. SEQ.** Enviromental Sequence **TC** (Ta=-65ºC / +150ºC for 100 cycles) + **AC** (Ta=121ºC, Pa=2atm for 96 hours)	77/2	0/77/2	1 Lot old frame 1 Lot new frame
A4	**TC** Temp. Cycling	Ta=-65ºC / +150ºC for 500 cycles	77/2	0/77/2	1 Lot old frame 1 Lot new frame
A5	**PTC** Power Temp. Cycling	Ta=-40ºC / +125ºC for 1000 cycles.	-	-	Not Applicable
A6	**HTSL** High Temp. Storage Life	Ta=150ºC for 1000 hours.	-	-	Not Applicable

Test group A: Accelerated Environment Stress Robustness activity					
AEC #	Test Name	STM Test Conditions	Sample Size/ Lots	Results Fails/SS/Lots	Comments
A4	**TC** Temp. Cycling	Ta=-50ºC / +150ºC **for 1000 cycles**	77/2	0/77/2	1 Lot old frame 1 Lot new frame

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 Static stress (JESD22-A108): **HTB** Tamb=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	1 Lot old frame 1 Lot new frame
C2	**WBP** Wire Bond Pull		30 bonds /minimum 5 units/1 lot	All measurement within spec limits	1 Lot old frame 1 Lot new frame
C3	**SD** Solderability		15/4	Passed	1 Lot old frame 1 Lot new frame
C4	**PD** Physical Dimensions		10/4	Passed	1 Lot old frame 1 Lot new frame
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		-	-	Not Applicable
E7	**CHAR** Characterization		-	-	Not Applicable
E8	**GL** Gate Leakage		-	-	Not Applicable
E9	**EMC** Electromagnetic Compatibility		-	-	Not Applicable

E10	**SC** Short Circuit Characterization	According to **AEC-Q100-012**	-	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 Applicable		
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				