VIPower Products housed in TO-220 / D2PAK: Aluminum Soft Wires Implementation

WHAT:

We are going to implement Aluminum (Al) "soft" wires on VIPower products housed in TO-220, D2PAK replacing the current "hard" versions (15,10 and 5 mils diameters).

Difference between the current and new wire is the following:

- Hard wire is composed by Al 99.95% and Mg 0.5%.
- Soft wire is composed by Al 100% (pure Aluminum).

New wires do not affect neither resistivity nor the electrical behavior of the impacted devices. Change is considered negligible vs the AEC-Q100 and ZVEI requirements in case of wire change.

WHY:

To improve quality, workability and optimization of assembly process.

WHO:

All the Customers that are using VIPower products housed in TO220 and D2PAK.

WHEN:

Tentative date of change is from August 2015 onward.
Samples are available on request
Qualification report is included to this communication (RR000815CT2235)

WHERE:

ST Shenzhen (China) assembly Plant.

Aluminum 15-10-5 mils
Soft Wires usage
Package TO220 and D2PAK

Revision history			
Rev.	**Date of Release**	**Author**	**Changes description**
1	April 20th 2015	A.Marmoni - APG Q&R Catania	Creation

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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 some test vehicles to qualify the Aluminum 15, 10 and 5 mils soft wires usage for the VIPower products designed in M02 and M03 technologies assembled in packages TO220 and D2PAK.

The so called hard wire is a composition of Al 99.95% and Mg 0.5%. The soft wire is now composed by pure Aluminum without affecting neither the resistivity's wire nor the electrical behavior of the impacted devices. The change is considered negligible vs the AEC-Q100 and ZVEI requirements in case of wire change, the applied qualification plan was addressed to investigate about failure mechanisms related to the thermo mechanical and humidity stress.

The qualification was done according to **Grade 1** of the **AEC_Q100 Rev.H** specification following the path described here below:

Test group as per **AEC-Q100 Rev.H**		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	To be implemented starting from first production lot
G	Cavity Package Integrity	N	Not applicable

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 before and after stress test.

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

- 2. Traceability

General Information					
Commercial Product	VNP35N07-E	VNB10N07-E	VN1160T-E	VNB14NV04-E	VNP14NV04-E
Product Line	VN19	VN39	VN58	VN78	VN78
Silicon process technology	VIPower M02	VIPower M02	VIPower M03	VIPower M03	VIPower M03
Package	TO220	D2PAK	TO220	D2PAK	TO220

Wafer Fab information					
Wafer diameter (inches)	6				
Die finishing back side	Ti-Ni-Au				
Die size (micron)	4290 x 5560	3100 x 3100	2190 x 2520	2540 x 3540	2540 x 3540
Metal levels / materials	1 / AlSi				
Die finishing front side	SiN				
Diffusion Lots #	3214756	3350803	3401770	3201173	6213X01

Assembly Information					
Assembly plant location	ST Shenzhen (China)				
Package	TO220	D2PAK	TO220	D2PAK	TO220
Molding compound	RESIN SAMSUNG SI-7200DXC	RESIN SUMITOMO EME7026	RESIN SAMSUNG SI-7200DXC	RESIN SUMITOMO EME7026	RESIN SAMSUNG SI-7200DXC
Die attach material	PREFORM Pb/Ag/Sn 95.5/2.5/2				
Wires bonding Materials/diameters	Al 5 and 15 mils	Al 5 and 10 mils			
Assembly Lot #	GK224072ZY	GK4230VT01	GK42516GRJ	GK22611CZZ	GK2250KYZR

Reliability Information	
Reliability test execution location	ST Catania (Italy)

- 3. 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)	77/5	0/77/5	All lots mentioned in the traceability section of this report
A4	**TC** Temp. Cycling	Ta=-65ºC / +150ºC for 500 cycles	77/5	0/77/5	All lots mentioned in the traceability section of this report
A5	**PTC** Power Temp. Cycling	Ta=-40ºC / +125ºC for 1000 cycles.	-	-	Not Applicable
A6	**HTSL** High Temp. Storage Life	Ta=150ºC for 1000 hours.	45/5	0/45/5	All lots mentioned in the traceability section of this report

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)	-	-	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		-	-	Not Applicable Only for memory devices

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		15/3	All measurement within spec limits	
C4	**PD** Physical Dimensions		10/3	All measurement within spec limits	
C5	**SBS** Solder Ball Shear		-	-	Not Applicable Only for BGA package
C6	**LI** Lead Integrity		-	-	Not Applicable Not required for Surface Mount Devices

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		-	-	Not Applicable
E3	**ESD** CDM		-	-	Not Applicable
E4	**LU** Latch-Up		-	-	Not Applicable
E5	**ED** Electrical Distributions		-	-	Not Applicable
E7	**CHAR** Characterization		-	-	Not Applicable
E9	**EMC** Electromagnetic Compatibility		-	-	Not Applicable
E10	**SC** Short Circuit Characterization	According to **AEC-Q100-012**	-	Not Applicable	
E11	**SER** Soft Error Rate		-	Not Applicable Only for devices with memory sizes ≥1Mbit SRAM or DRAM based cells	
E12	**LF** Lead (Pb) free		-	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				

Public Products List

PCN Title : VIPower Products Housed in TO-220 / D2PAK: Aluminum Soft Wire Implementation

PCN Reference : APG/15/9215

PCN Created on : 22-Apr-2015

Subject : Public Product List

Dear Customer,

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

VNP20N07-E	VNB20N07-E	VNB14NV04TR-E
VNP10N06-E	VNB20N07TR-E	VNP10N07-E
VNB35NV04-E	VNB10N07-E	VNP35NV04-E
VNB10N07TR-E	VNB35NV04TR-E	VNP5N07-E
VNB14NV04-E	VNP35N07-E	RVNB35NV04
RVNB35NV04TR	VNP7N04-E	VNP28N04-E

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