



VIpower DPAK package: 7 mils Soft wire Implementation

WHAT:

Please be informed that we are going to implement on VIpower products housed in DPAK package the 7 mils soft aluminum wire (pure Al wire), replacing current the hard one (Al 99.5% , Mg 0.5%). Change has no impact neither in resistivity's wire nor the electrical behavior of the impacted devices

WHY:

Capacity Increase and Service Improvement

WHO:

See enclosed list of products impacted

WHEN:

Samples available on demand

Qualification report included in this communication (**RR000717CT2235**)

Start shipment of new parts : upon Customer Agreement from July 2017

WHERE:

ST Shenzhen (China)

DPAK package – VIPower M03 and M02 devices Aluminum 7 mils Soft Wires qualification

Revision history			
Rev.	Date of Release	Author	Changes description
1	March 08, 2017	A.Marmoni - ADG Reliability 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 **VND14NV04-E** chosen as test vehicle to qualify the Aluminum 7 mils soft wires for the VIPower products designed in M03 Technology assembled in package DPAK.

The so called hard wire is a composition of Al 99.5% 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 for this change
C	Package Assembly Integrity	Y	
D	Die Fabrication Reliability	N	Not applicable for this change
E	Electrical Verification	N	Not applicable for this change
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 3 of this report.

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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.

The Scanning Acoustic Microscopy (SAM) analysis after Thermal Cycles (TC) shows no significant delamination through the die-attach layer and its interfaces, nor on die-pad.

An extended reliability (2x AEC-Q100 requirement) has been completed with positive results, neither functional nor parametric rejects were detected at final electrical testing.

Also in this case the delamination check by means the Scanning Acoustic Microscopy (SAM) as well as the wire bonding strength by means Wire Bond Pull/Shear tests (WBP, WBS) have been successfully verified.

Based on the overall positive results we consider the product AEC-Q100 Grade 1 qualified from a reliability point of view.

Note: extension to VIPower M02

This result can be extended also to the VIPower products designed in M02 Technology without additional needs of reliability trials based on this considerations:

- positive workability results were obtained for standard frame with Al 7 mils soft wire by means a dedicated test vehicle designed in M02 Technology
- same wire bonding parameters are used both for M02 and M03 Technology in standard frame with Al 7 mils soft wire
- same wire bonding parameters are used both for M02 and M03 Technology in matrix frame with Al 7 mils soft wire
- same wire bonding parameters are used both for M02 and M03 Technology in matrix and standard frame for Al 7 mils hard wire

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- 2. Traceability

Wafer fab information	
Wafer fab manufacturing location	ST SG6 Ang Mo Kio (Singapore)
Wafer diameter (inches)	6"
Silicon process technology	VIpower M03
Die finishing back side	Ti-Ni-Au
Die size (micron)	2540x3540
Metal levels / materials	1 level / AISi 3µm
Die finishing front side	SiN

Assembly Information	
Assembly plant location	ST Shenzhen (China)
Package description	TO 252 DPAK
Molding compound	RESIN SUMITOMO EME7026
Wires bonding materials/diameters	Al 10mils + Al 7mils
Die attach material	PREFORM Pb/Ag/Sn 95.5/2.5/2

Qualification lots Information	
	Assembly Lots #
Lot 1	GK62414Y01_LL
Lot 2	GK62414YRP_NN
Lot 3	GK62414YRQ_HH

Reliability Information	
Reliability test execution location	ST Shenzhen (China)

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- 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=-40°C/+60°C - Reflow according to level 3 Jedec JSTD020D-1 - 100 Temperature Cycling Ta=-50°C/+150°C	Before AC, TC		
A2	THB Temp Humidity Bias	Ta=85°C, RH=85%, Vcc=24V for 1000 hours	-	-	Not Applicable for this change
A3	AC Autoclave	ENV. SEQ. Enviromental 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=-65°C / +150°C for 500 cycles	77/3	0/77/3	
A5	PTC Power Temp. Cycling	Ta=-40°C / +125°C for 1000 cycles.	-	-	Not Applicable for this change
A6	HTSL High Temp. Storage Life	Ta=150°C for 1000 hours.	45/3	0/45/3	

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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 for this change
B2	ELFR Early Life Failure Rate	Parts submitted to HTOL per JESD22-A108 requirements; GRADE 1: 24 hours at 150°C	-	-	Not Applicable for this change
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		-	-	Not Applicable for this change
C4	PD Physical Dimensions		-	-	Not Applicable for this change
C5	SBS Solder Ball Shear		-	-	Not Applicable Only for BGA package
C6	LI Lead Integrity		-	-	Not Applicable Not required for Surface Mount Devices

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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 for this change
D2	Tddb Time Dependent Dielectric Breakdown		-	-	Not Applicable for this change
D3	HCI Hot Carrier Injection		-	-	Not Applicable for this change
D4	NBTI Negative Bias Temperature Instability		-	-	Not Applicable for this change
D5	SM Stress Migration		-	-	Not Applicable for this change

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Test group E: Electrical Verification					
AEC #	Test Name	STM Test Conditions	Sample Size/ Lots	Results Fails/SS/Lots	Comments
E2	ESD HBM		-	-	Not Applicable for this change
E3	ESD CDM		-	-	Not Applicable for this change
E4	LU Latch-Up		-	-	Not Applicable for this change
E5	ED Electrical Distributions		-	-	Not Applicable for this change
E7	CHAR Characterization		-	-	Not Applicable for this change
E9	EMC Electromagnetic Compatibility		-	-	Not Applicable for this change
E10	SC Short Circuit Characterization	According to AEC-Q100-012	-	-	Not Applicable for this change
E11	SER Soft Error Rate	Only for devices with memory sizes ≥ 1 Mbit SRAM or DRAM based cells	-	-	Not Applicable
E12	LF Lead (Pb) free		-	-	Not Applicable

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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				

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- 4. Extended reliability results (2x AEC-Q100)

AEC #	Test Name	STM Test Conditions	Sample Size/Lots	Results Fails/SS/Lots	Comments
A4	TC Temp. Cycling	Ta=-65°C / +150°C for 1000 cycles	67/3	0/67/3	
A6	HTSL High Temp. Storage Life	Ta=150°C for 2000 hours	35/1	0/35/1	

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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 : VIPower DPAK package: 7 mils Soft Wire Implementation

PCN Reference : ADG/17/10172

Subject : Public Products List

Dear Customer,

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

VND7NV04TR-E	VND7N04TR-E	VND5N07TR-E
VND10N06TR-E	VND10N06-E	VND3NV04TR-E
VND14NV04-E	VND7N04-E	VND3NV04-E
VND5N07-E	VND7NV04-E	VND14NV04TR-E
RVND14NV04TR		



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