

VIPower M0L7 devices

Ang Mo Kio SG8 (Singapore) second source qualification

Revision history

Rev.	Date of Release	Author	Changes description
1.0	October 12, 2017	A. Vilaro - APG Q&R Catania	Creation

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- 1. Reliability evaluations overview

1.1 Objectives

The VIPower M0L7 Technology was fully AEC-Q100 qualified in ST SG8 Ang Mo Kio (Singapore) 8" Wafer Fab as second source by means selected test vehicles reported here below:

Test vehicles general information			
Commercial Product	VN7040AS	VND7050AJ	VND7020AJ
Product Line	XV14	XV17	VNY6
Package	SO8	PSSO16	PSSO16

Aim of this report is to present the results of the reliability evaluation to activate ST SG8 Ang Mo Kio (Singapore) 8" Wafer Fab as second source for all the others M0L7 devices available in the present portfolio:

Commercial Product	Product Line	Package
VN7010AJ	XV18	PSSO16
VN7016AJ	XV08	PSSO16
VN7020AJ	XV15	PSSO16
VN7040AJ	XV14	PSSO16
VN7050AJ/S	XV10	PSSO16/SO8
VN7140AJ/S	XV16	PSSO16/SO8
VND7030AJ	XV13	PSSO16
VND7040AJ	XV09	PSSO16
VND7140AJ	XV01	PSSO16
VNQ7050AJ	XV20	PSSO16
VNQ7140AJ	XV02	PSSO16

All products are High-side drivers with Multi Sense analog feedback for Automotive Applications assembled in SO8 or PSSO16 packages having single, double or quad channels configuration.

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The qualification has been performed 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	N	Family approach
B	Accelerated Lifetime Simulation	N	Family approach
C	Package Assembly Integrity	Y	
D	Die Fabrication Reliability	N	Family approach
E	Electrical Verification	Y	
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.

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 AEC-Q100 Grade 1 qualified from a reliability point of view.

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- 2. Construction note

Wafer Fab Information			
Silicon process technology	VIPower MOL7		
Wafer fab manufacturing location	ST SG8 Ang Mo Kio (Singapore)		
Wafer diameter (inches)	8		
Die finishing back side	Ti-NiV-Au		
Metal levels / materials	2 Ti/TiN/Ti/AlCu/TiN (3.18 last)		
Die finishing front side	Teos + PTeos + SiOn + PIX		
Assembly Information			
Package description	SO8	PSSO16	
Assembly plant location	ST SHENZHEN (China)	ST SHENZHEN (China)	ST BOUSKOURA (Morocco)
Wires bonding material/diameter	CU 1mils, Cu 2 mils	CU 1mils, CU 2.5 mils	
Molding compound	SUMITOMO EME-G700KC	SUMITOMO EME-G700LS	
Die attach material	GLUE LOCTITE ABLESTIK QMI9507	PREFORM Pb/Ag/Sn 95.5/2.5/2	
Reliability Information			
Reliability test execution location	ST Catania (Italy)		

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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 JSTD020E - 100 Temperature Cycling Ta=-50°C/+150°C			Family approach with M0L7 Technology in SG8 test vehicle (ST reference report # RR002716CT2235)
A2	THB Temp Humidity Bias	Ta=85°C, RH=85%, Vcc=24V for 1000 hours			
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)			
A4	TC Temp. Cycling	Ta=-65°C / +150°C for 500 cycles			
A5	PTC Power Temp. Cycling	Ta=-40°C / +125°C for 1000 cycles Incandescent lamps loads 2xP27W+R5W each channel, ton=10ms, toff=30s, 120K activations within 1000cy			
A6	HTSL High Temp. Storage Life	Ta=150°C for 1000 hours.			

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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 OLT (JESD22-A108) Tj=150°C, PWM=100Hz, D.C.=68%, 1000 hours. Duration according to Mission Profile based on Ea=0.7eV			Family approach with MOL7 Technology in SG8 test vehicle (ST reference report # RR002716CT2235)
B1	HTOL High Temp. Op. Life	Bias Static stress HTRB (JESD22-A108) Ta=125°C for 1000 hours			
B2	ELFR Early Life Failure Rate	Parts submitted to HTOL per JESD22-A108 requirements; GRADE 1: 24 hours at 150°C			
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/3 lots	All measurement within spec limits	1 Lot/product
C2	WBP Wire Bond Pull		30 bonds /minimum 5 units/3 lots	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

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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				Family approach with M0L7 Technology in SG8 test vehicle (ST reference report # RR002716CT2235)
D2	TDDB Time Dependent Dielectric Breakdown				
D3	HCI Hot Carrier Injection				
D4	NBTI Negative Bias Temperature Instability				
D5	SM Stress Migration				

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Test group E: Electrical Verification AEC # E2 – ESD HBM 100pF, 1.5kΩ						
AEC #	Commercial Product	Product Line	Package	Sample Size/Lots	Results Fails/SS/Lots	Comments
E2	VN7010AJ	XV18	PSSO16	1 lot	Done: results aligned with each product datasheet	1 Lot/product
	VN7016AJ	XV08	PSSO16	1 lot	Done: results aligned with each product datasheet	
	VN7020AJ	XV15	PSSO16	1 lot	To be done	
	VN7040AJ	XV14	PSSO16	1 lot	Done: results aligned with each product datasheet	
	VN7050AJ	XV10	PSSO16	1 lot	To be done	
	VN7050AS	XV10	SO8	1 lot	To be done	
	VN7140AJ	XV16	PSSO16	1 lot	To be done	
	VN7140AS	XV16	SO8	1 lot	To be done	
	VND7030AJ	XV13	PSSO16	1 lot	To be done	
	VND7040AJ	XV09	PSSO16	1 lot	To be done	
	VND7140AJ	XV01	PSSO16	1 lot	Done: results aligned with each product datasheet	
	VNQ7050AJ	XV20	PSSO16	1 lot	To be done	
	VNQ7140AJ	XV02	PSSO16	1 lot	To be done	

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Test group E: Electrical Verification AEC # E3 – ESD CDM						
AEC #	Commercial Product	Product Line	Package	Sample Size/Lots	Results Fails/SS/Lots	Comments
E3	VN7010AJ	XV18	PSSO16	1 lot	±750V	1 Lot/product
	VN7016AJ	XV08	PSSO16	1 lot	±750V	
	VN7020AJ	XV15	PSSO16	1 lot	To be done	
	VN7040AJ	XV14	PSSO16	1 lot	±750V	
	VN7050AJ	XV10	PSSO16	1 lot	To be done	
	VN7050AS	XV10	SO8	1 lot	To be done	
	VN7140AJ	XV16	PSSO16	1 lot	To be done	
	VN7140AS	XV16	SO8	1 lot	To be done	
	VND7030AJ	XV13	PSSO16	1 lot	To be done	
	VND7040AJ	XV09	PSSO16	1 lot	To be done	
	VND7140AJ	XV01	PSSO16	1 lot	±750V	
	VNQ7050AJ	XV20	PSSO16	1 lot	To be done	
	VNQ7140AJ	XV02	PSSO16	1 lot	To be done	

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Test group E: Electrical Verification AEC # E4 – LU Latch-up						
AEC #	Commercial Product	Product Line	Package	Sample Size/ Lots	Results Fails/SS/Lots	Comments
E4	VN7010AJ	XV18	PSSO16	1 lot	Inj-Low/Inj-High @125°C: ±50mA all pins Inj+Low/Inj+High @125°C: ±100mA all pins Inj-Low/Inj-High @25°C: ±100mA all pins Inj+Low/Inj+High @25°C: ±100mA all pins Overvoltage: passed	1 Lot/product
	VN7016AJ	XV08	PSSO16	1 lot	Inj-Low/Inj-High @125°C: ±50mA all pins Inj+Low/Inj+High @125°C: ±100mA all pins Inj-Low/Inj-High @25°C: ±100mA all pins Inj+Low/Inj+High @25°C: ±100mA all pins Overvoltage: passed	
	VN7020AJ	XV15	PSSO16	1 lot	To be done	
	VN7040AJ	XV14	PSSO16	1 lot	Inj-Low/Inj-High @125°C: ±50mA all pins Inj+Low/Inj+High @125°C: ±100mA all pins Inj-Low/Inj-High @25°C: ±100mA all pins Inj+Low/Inj+High @25°C: ±100mA all pins Overvoltage: passed	
	VN7050AJ	XV10	PSSO16	1 lot	To be done	
	VN7050AS	XV10	SO8	1 lot	To be done	
	VN7140AJ	XV16	PSSO16	1 lot	To be done	
	VN7140AS	XV16	SO8	1 lot	To be done	
	VND7030AJ	XV13	PSSO16	1 lot	To be done	
	VND7040AJ	XV09	PSSO16	1 lot	To be done	
VND7140AJ	XV01	PSSO16	1 lot	Inj-Low/Inj-High @125°C: ±50mA all pins Inj+Low/Inj+High @125°C: ±100mA all pins Inj-Low/Inj-High @25°C: ±100mA all pins Inj+Low/Inj+High @25°C: ±100mA all pins Overvoltage: passed		
VNQ7050AJ	XV20	PSSO16	1 lot	To be done		
VNQ7140AJ	XV02	PSSO16	1 lot	To be done		

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Test group E: Electrical Verification AEC # E5 – ED Electrical Distribution						
AEC #	Commercial Product	Product Line	Package	Sample Size/ Lots	Results Fails/SS/Lots	Comments
E5	VN7010AJ	XV18	PSSO16	1 lot	Done	1 Lot/product
	VN7016AJ	XV08	PSSO16	1 lot	Done	
	VN7020AJ	XV15	PSSO16	1 lot	To be done	
	VN7040AJ	XV14	PSSO16	1 lot	Done	
	VN7050AJ	XV10	PSSO16	1 lot	To be done	
	VN7050AS	XV10	SO8	1 lot	To be done	
	VN7140AJ	XV16	PSSO16	1 lot	To be done	
	VN7140AS	XV16	SO8	1 lot	To be done	
	VND7030AJ	XV13	PSSO16	1 lot	To be done	
	VND7040AJ	XV09	PSSO16	1 lot	To be done	
	VND7140AJ	XV01	PSSO16	1 lot	Done	
	VNQ7050AJ	XV20	PSSO16	1 lot	To be done	
	VNQ7140AJ	XV02	PSSO16	1 lot	To be done	

Test group E: Electrical Verification					
AEC #	Test Name	STM Test Conditions	Sample Size/ Lots	Results Fails/SS/Lots	Comments
E9	EMC Electromagnetic Compatibility		-	-	Not Applicable
E10	SC Short Circuit Characterization	According to AEC-Q100-012	-	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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VIPower MOL7 (additional products): Activation of Singapore 8" (AMK8) as additional location beside Catania 8" (CT8)

WHAT:

Please be informed that we have completed the activities to qualify AMK8 as additional location beside Catania 8" (CT8) for additional VIPower MOL7 products. Electrical Wafer Sort is included in this activation

WHY:

Double Source, Capacity increase and service Improvement

WHO:

See list of products involved

WHEN:

Change will be implemented upon Customer Agreement

Samples will be available from end of January 2018

Qualification report included in this communication (RR002817CT2235)

WHERE:

ST Singapore