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Reliability Qualification Report
ST Qualification of New green mold compound Sumitomo EME-G633CA
PDIP 18L

General Information	
Finished Good	L6506$9BA601
Product Line	XW037BA6
Product From	B5C7*W037BA6
Process Plan	T95-F5C20TM1-PG
Package Technology	PDIP 18 .3 Cu .25

Locations	
Wafer Fab Location	AM6F-Singapore SG6 6"
Assembly Plant Location	BE MU1T ST MUAR - MALAYSIA
Testing Plant	MU1T ST MUAR - MALAYSIA
Reliability Assessment	QA RELIABILITY LAB ST MUAR

Issued By: Uhatta Uahmad

Approved By: Francesco VENTURA

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1 APPLICABLE AND REFERENCE DOCUMENTS

Document Reference	Short Description
AEC-Q100	Stress test qualification for integrated circuits
SOP 2.6.11	Project management for product development
SOP 2.6.19	Front-end technology platform development & qualification
SOP 2.6.2	Internals change management
SOP 2.6.7	Product maturity level
SOP 2.6.9	Package and process maturity management in Back End
SOP 2.7.5	Automotive products definition and status
0061692	Reliability tests and criteria for product qualification
7512807	Delamination Analysis for Plastic Packages in Reliability Test
8160601	Internal reliability evaluation report template
8161393	General specifications for product development

2 TEST GLOSSARY

TEST NAME	DESCRIPTION
PC (JL3) + Solder Simulation	Preconditioning (3X Reflow)
TC	Temperature Cycling
PPT	Pressure Pot Test
THS	Temperature Humidity Storage
HTS	High Temperature Storage

3 RELIABILITY EVALUATION OVERVIEW

3.1 Objectives

The aim of this report is to present the results of the reliability assessment evaluation performed on W037 (B5C7*W037BA6) – ST Qualification Plan for Pdip18L (with reference to New green mold compound Sumitomo EME-G633CA).

The main purpose is to qualify existing devices of ST (W037) Pdip 18L using W037 Device as vehicle to continue support customer demand of new green mold compound Sumitomo EME-G633CA

W037 is processed in CD - BI20II / U2 – I2L100DM-D, diffused in AM6F-Singapore SG6 6" and assembled in BE MU1T ST MUAR - MALAYSIA.

For the reliability assessment evaluation, the following test were carried out:

- Temperature Cycling (TC)
- Pressure Pot Test (PPT)
- Temperature Humidity Storage (THS)
- High Temperature Storage Life (HTSL)

3.2 Conclusions

All reliability tests have been completed with positive results (no any electrical failure that can be link to Pdip 18L changed to New green mold compound Sumitomo EME-G633CA). Package oriented test and SAM + Physical Analysis (Wire/Stitch Pull & Ball Shear) also have not put in evidence any criticality to package robustness.

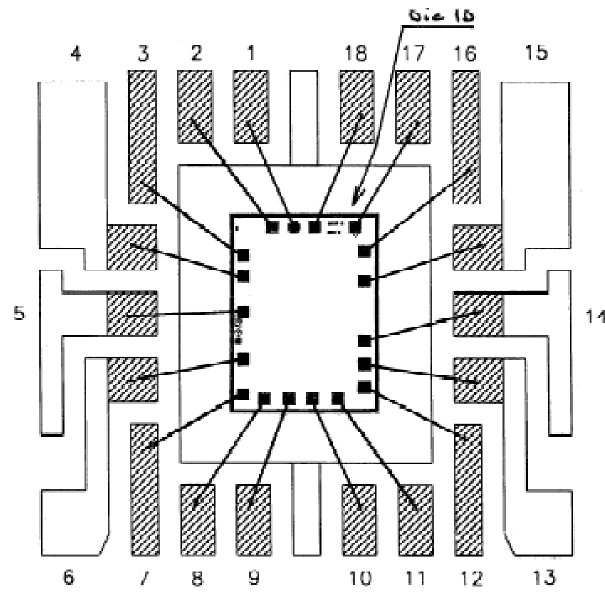
4 DEVICE CHARACTERISTICS

4.1 Bond Diagram

BONDING DIAGRAM FOR LINE : W037 PACKAGE : C7

FRAME PAD : .112 x .135 inch / 2,845 x 3,429 mm

SCALE 1mm



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4.2 Traceability

Wafer Fab Information	
Wafer fab manufacturing location	AM6F-Singapore SG6 6"
Wafer diameter	6 inch
Wafer thickness	275+/-25 UM
Silicon process technology	CD - BI20II / U2 – I2L100DM-D
Die finishing back side	Cr/Ni/Au
Die finishing front side	SiN (nitride)
Stepping Die Size(X,Y)	1680,2240 UM
Sawing Street Width(X,Y)	60,60 UM
Min Bond Pad Pitch	150 UM
No of Metal Layer	2

Assembly Information	
Assembly plant location	BE MU1T ST MUAR - MALAYSIA
Package description	Pdip 18L
Molding compound	Sumitomo EME-G633CA
Wire bonding materials/diameters	Au 1.0 MILS
Die attach material	GLUE LOCTITE ABLESTIK 8390
Lead frame material	FRAME PDIP 18L 112x135 IDF Cu T10 Flo Sp

Final Testing Information	
Electrical testing location	MU1T ST MUAR - MALAYSIA
Tester	TESTER A360

5. TEST RESULTS SUMMARY

5.1 Lot Information

Lot #	Diffusion Lot	Lot Details / Trace Code	Assy Lot Id	Testing Lot Id
1	V69169LL	9993517401 - Control	9993517401	9993517401
2	V69169LL	99935174RN – Qual 1	99935174RN	99935174RN
3	V69169LL	99935174RP – Qual 2	99935174RP	99935174RP
4	V69169LL	99935174RQ – Qual 3	99935174RQ	99935174RQ

5.2 Test Plan and Results Summary (Electrical Test)

	Reliability Test Status								
No	Test Name	Prec.	Condition/ Method	Steps	Fails/SS				Notes
					9993517401	99935174RN	99935174RP	99935174RQ	
1	TC	No	Test Conditions = -65°C / +150°C	200cyc	0 / 45	0 / 45	0 / 45	0 / 45	Pass
				500cyc	0 / 45	0 / 45	0 / 45	0 / 45	Pass
2	PPT	No	Test Conditions = Ta = 121°C/ 2 atm	96 hrs	0 / 45	0 / 45	0 / 45	0 / 45	Pass
				168 hrs	0 / 45	0 / 45	0 / 45	0 / 45	Pass
3	THS	No	Test Conditions = Ta = 85°C/85% RH	500 hrs	0 / 45	0 / 45	0 / 45	0 / 45	Pass
4	HTSL	No	Test Conditions = Ta = +150°C	500 hrs	0 / 45	0 / 45	0 / 45	0 / 45	Pass
				1000hrs	0 / 45	0 / 45	0 / 45	0 / 45	Pass

NOTES

All units electrically tested good (all Pass) after each reliability test readout. No any electrical failure found that can be link to the weakness of the assembly process or due to new green mold compound Sumitomo EME-G633CA Muar Assembly Plant.

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5.3 Test Plan and Results Summary (SAM Analysis)

	Reliability Test Status								
No	Test Name	Prec.	Condition/ Method	Steps	Fails/SS				Notes
					9993517401	99935174RN	99935174RP	99935174RQ	
1	TC	No	Test Conditions = -65°C / +150°C	200 cyc	0 / 20	0 / 20	0 / 20	0 / 20	No Delam
				500 cyc	0 / 20	0 / 20	0 / 20	0 / 20	No delam
2	PPT	No	Test Conditions = Ta = 121°C/ 2 atm	96 hrs	0 / 20	0 / 20	0 / 20	0 / 20	No Delam
				168 hrs	0 / 20	0 / 20	0 / 20	0 / 20	No Delam
3	THS	No	Test Conditions = Ta = 85°C/85% RH	500 hrs	0 / 20	0 / 20	0 / 20	0 / 20	No Delam
4	HTSL	No	Test Conditions = Ta = +150°C	168hrs	0 / 20	0 / 20	0 / 20	0 / 20	No Delam
				1000hrs	0 / 20	0 / 20	0 / 20	0 / 20	No Delam

NOTES

SAM analysis did not reveal any delamination issue at all interface - Die / Molding Compound (Die Top), Die Pad front-side / molding compound & Die Pad backside / molding compound on sampling basis 20 pcs after each reliability readout.

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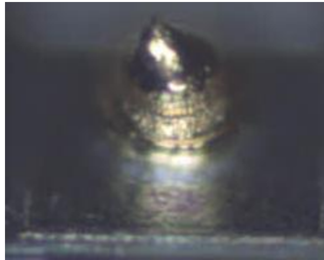
5.4 Test Plan and Results Summary (Physical Analysis – Wire Pull & Ball Shear Test)

Reliability Test Status						
No	Test Name	Condition/ Method	Fails/SS			Notes
			99935174RP			
1	Wire Pull	After TC 500 cycle	Pass			No any failure detected.
	Ball Shear		Pass			

NOTES

Wire bonding strength has been verified through Wire & Ball Shear Test: neither abnormal break loads, nor forbidden failure modes have been found on sampling basis 5 pcs after each reliability readout.



Ball Neck Break @ 1st Bond

Ball Shear @ 1st Bond

6. TESTS DESCRIPTION

6.1 Package tests description

TEST NAME	DESCRIPTION	PURPOSE
THS **Temperature Humidity Storage**	**The device is stored in saturated steam, at fixed and controlled conditions**	**Evaluating the reliability of assembly package in humid environment**
TC **Temperature Cycling**	**The device is submitted to cycled temperature excursions, between a hot and a cold chamber in air atmosphere.**	**To investigate failure modes related to the thermo-mechanical stress induced by the different thermal expansion of the materials interacting in the die-package system. Typical failure modes are link to metal displacement, dielectric cracking, molding compound delamination, wire bonds failure, die crack.**
PPT **Pressure Pot Test**	**The device is stored in saturated steam, at fixed and controlled conditions of pressure and temperature**	**To investigate corrosion phenomena affecting die or package materials, related to chemical contamination and package hermeticity.**
HTSL **High Temperature Storage Life**	**The device is stored in unbiased condition at the max temperature allowed by the package materials, sometimes higher than the max operative temperature.**	**To investigate the failure mechanisms activated by high temperature, typically wire-bonds solder joint ageing, data retention faults, metal stress-voiding**

Reliability Evaluation Report

QUALIFICATION of NEW RESIN on PDIP 28L
ST MUAR - MALAYSIA

General Information	
Product Lines	*K6AA*
P/N Positive voltage regulators	*M48T35Y-70PC1*
Product Group	*AMG*
Product division	*General Purpose Analog & RF Division*
Package	*PDIP 28*
Silicon Process technology	*HCMOS4PZ*

Locations	
Wafer fab	*Singapore 6*
Assembly plant	*ST MUAR - MALAYSIA*
Reliability Lab	*Catania Reliability LAB*

DOCUMENT INFORMATION

Version	Date	Pages	Prepared by	Approved by	Comment
1.0	January 2020	6	Antonio Russo	Sergio Spampinato	Final Report

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1 APPLICABLE AND REFERENCE DOCUMENTS

Document reference	Short description
JESD47	Stress-Test-Driven Qualification of Integrated Circuits

2 GLOSSARY

DUT	Device Under Test
SS	Sample Size

3 RELIABILITY EVALUATION OVERVIEW OBJECTIVES

To qualify new molding compound SUMITOMO EME-G633CA for PDIP 28 assembled in ST MUAR - MALAYSIA.
Qualification activity have been performed on three different assy lots as requested by JEDEC JESD47 for this change.

4 CONCLUSION

Qualification plan has been fulfilled without exception. Reliability tests have shown that those devices behave correctly against environmental tests (no failure). Moreover, the stability of electrical parameters during the accelerated tests demonstrates the robustness of those products and safe operation, which is consequently expected during their lifetime.

5 DEVICE CHARACTERISTIC

5.1 Change description

Qualification of new molding compound SUMITOMO EME-G633CA for PDIP 28 assembled in ST MUAR – MALAYSIA in replacement of current HITACHI MP180.

5.2 Construction note

	48T35
Wafer/Die fab. information	
Wafer fab manufacturing location	Ang Mo Kio 6”
Technology	HCMOS4PZ
Die finishing back side	POLISHED SILICON
Die size	4.030 X 4.180
Passivation type	PSG+Silicon Nitride+Polyimide
Assembly information	
Assemby Site	ST MUAR - MALAYSIA
Package description	PDIP 28
Molding compound	SUMITOMO EME-G633CA
Die attach material	Epoxy
Wires bonding materials/diameters	Au 1mil

6 TEST VEHICLE & TEST RESULTS SUMMARY

6.1 Test vehicle

Lot #	T.V.	Process/ Package	Commercial product
1	K6AA	PDIP 28	M48T35Y-70PC
2			
3			

6.2 Test results summary

Test	PC	Std ref.	Conditions	ss	Steps	SS Lot 1	SS Lot 2	SS Lot 3	Note
Die Oriented Reliability trials									
HTSL	N	JESD22 A-103	Ta = 150°C	225	168 H	0/75	0/75	0/75	
					500 H	0/75	0/75	0/75	
					1000 H	0/75	0/75	0/75	
Package Oriented Reliability trials									
AC	Y	JESD22 A-102	Pa=2Atm / Ta=121°C	225	96 H	0/75	0/75	0/75	
					168 H	0/75	0/75	0/75	Eng. evaluation
TC	Y	JESD22 A-104	Ta = -65°C to 150°C	225	100cy	0/75	0/75	0/75	
					500 cy	0/75	0/75	0/75	
					1000cy	0/75	0/75	0/75	Eng. evaluation
Package Assembly Integrity trials									
WBP	-	M2011	30 wires, characterization	15	Final	Pass CPK>1.66	Pass CPK>1.66	Pass CPK>1.66	
WBS	-	JESD22-B116	30 balls, characterization	15	Final	Pass CPK>1.66	Pass CPK>1.66	Pass CPK>1.66	

7 ANNEXES

7.1 Devices details

7.1.1 Pin connections

Refer to products datasheet

7.1.2 Package Mechanical data

Refer to products datasheet

8 TEST DESCRIPTION

Test name	Description	Purpose
Die Oriented		
HTSL High Temperature Storage Life	The device is stored in unbiased condition at the max. temperature allowed by the package materials, sometimes higher than the max. operative temperature.	To investigate the failure mechanisms activated by high temperature, typically wire-bonds solder joint ageing, data retention faults, metal stress-voiding.
Package Oriented		
AC Auto Clave (Pressure Pot)	The device is stored in saturated steam, at fixed and controlled conditions of pressure and temperature.	To investigate corrosion phenomena affecting die or package materials, related to chemical contamination and package hermeticity.
TC Temperature Cycling	The device is submitted to cycled temperature excursions, between a hot and a cold chamber in air atmosphere.	To investigate failure modes related to the thermo-mechanical stress induced by the different thermal expansion of the materials interacting in the die-package system. Typical failure modes are linked to metal displacement, dielectric cracking, molding compound delamination, wire-bonds failure, die-attach layer degradation.
Other		
WBS Wire Bond Shear	A process in which an instrument uses a chisel shaped tool to shear or push a ball or wedge/stitch bond off the bonding surface. The force required to cause this separation is recorded and is referred to as the bond shear strength. The bond shear strength of a ball bond, when correlated to the diameter of the ball bond, is an indicator of the quality of the metallurgical bond between the ball bond and the die bonding surface metallization.	This test establishes a procedure for determining the strength of the interface between a ball bond and a package bonding surface. This strength measurement is extremely important in determining the integrity of the metallurgical bond which has been formed.
WBP Wire Bond Pull	The apparatus for this test shall consist of suitable equipment for applying the specified stress to lead wire or terminal as required in the specified test condition. A calibrated measurement and indication of the applied stress in grams force (gf) shall be provided by equipment capable of measuring stresses.	The purpose of this test is to measure bond strengths, evaluate bond strength distributions, or determine compliance with specified bond strength requirements of the applicable acquisition document.

AMG (Analog & MEMS Group)
General Purpose Analog & RF Division
Signal Conditioning& Interface

Quality and Reliability

REL.6088-984-W-20

Reliability Evaluation Report

QUALIFICATION of NEW RESIN on PDIP 24L
ST MUAR - MALAYSIA

General Information	
Product Lines	*M6AA*
P/N Positive voltage regulators	*M48Z02-150PC*
Product Group	*AMG*
Product division	*General Purpose Analog & RF Division*
Package	*PDIP 24*
Silicon Process technology	*HCMOS4PZ*

Locations	
Wafer fab	*Singapore 6*
Assembly plant	*ST MUAR - MALAYSIA*
Reliability Lab	*Catania Reliability LAB*

DOCUMENT INFORMATION

Version	Date	Pages	Prepared by	Approved by	Comment
1.0	February 2020	6	Antonio Russo	Sergio Spampinato	Final Report

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1 APPLICABLE AND REFERENCE DOCUMENTS

Document reference	Short description
JESD47	Stress-Test-Driven Qualification of Integrated Circuits

2 GLOSSARY

DUT	Device Under Test
SS	Sample Size

3 RELIABILITY EVALUATION OVERVIEW OBJECTIVES

To qualify new molding compound SUMITOMO EME-G633CA for PDIP 24 assembled in ST MUAR - MALAYSIA.
Qualification activity have been performed on three different assy lots as requested by JEDEC JESD47 for this change.

4 CONCLUSION

Qualification plan has been fulfilled without exception. Reliability tests have shown that those devices behave correctly against environmental tests (no failure). Moreover, the stability of electrical parameters during the accelerated tests demonstrates the robustness of those products and safe operation, which is consequently expected during their lifetime.

5 DEVICE CHARACTERISTIC

5.1 Change description

Qualification of new molding compound SUMITOMO EME-G633CA for PDIP 24 assembled in ST MUAR – MALAYSIA in replacement of current HITACHI MP180.

5.2 Construction note

	48Z02
Wafer/Die fab. information	
Wafer fab manufacturing location	Ang Mo Kio 6”
Technology	HCMOS4PZ
Die finishing back side	LAPPED SILICON
Die size	2.920 X 3.170
Passivation type	PSG+Silicon Nitride+Polyimide
Assembly information	
Assemby Site	ST MUAR - MALAYSIA
Package description	PDIP 24
Molding compound	SUMITOMO EME-G633CA
Die attach material	Epoxy
Wires bonding materials/diameters	Au 1.5 mil

6 TEST VEHICLE & TEST RESULTS SUMMARY

6.1 Test vehicle

Lot #	T.V.	Process/ Package	Commercial product
1	M6AA	PDIP 24	M48Z02-150PC
2			
3			

6.2 Test results summary

Test	PC	Std ref.	Conditions	ss	Steps	SS Lot 1	SS Lot 2	SS Lot 3	Note
Die Oriented Reliability trials									
HTSL	N	JESD22 A-103	Ta = 150°C	225	168 H	0/75	0/75	0/75	
					500 H	0/75	0/75	0/75	
					1000 H	0/75	0/75	0/75	
Package Oriented Reliability trials									
AC	Y	JESD22 A-102	Pa=2Atm / Ta=121°C	225	96 H	0/75	0/75	0/75	
					168 H	0/75	0/75	0/75	Eng. evaluation
TC	Y	JESD22 A-104	Ta = -65°C to 150°C	225	100cy	0/75	0/75	0/75	
					500 cy	0/75	0/75	0/75	
					1000cy	0/75	0/75	0/75	Eng. evaluation
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WBP	-	M2011	30 wires, characterization	15	Final	Pass CPK>1.66	Pass CPK>1.66	Pass CPK>1.66	
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Refer to products datasheet

7.1.2 Package Mechanical data

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WBS Wire Bond Shear	A process in which an instrument uses a chisel shaped tool to shear or push a ball or wedge/stitch bond off the bonding surface. The force required to cause this separation is recorded and is referred to as the bond shear strength. The bond shear strength of a ball bond, when correlated to the diameter of the ball bond, is an indicator of the quality of the metallurgical bond between the ball bond and the die bonding surface metallization.	This test establishes a procedure for determining the strength of the interface between a ball bond and a package bonding surface. This strength measurement is extremely important in determining the integrity of the metallurgical bond which has been formed.
WBP Wire Bond Pull	The apparatus for this test shall consist of suitable equipment for applying the specified stress to lead wire or terminal as required in the specified test condition. A calibrated measurement and indication of the applied stress in grams force (gf) shall be provided by equipment capable of measuring stresses.	The purpose of this test is to measure bond strengths, evaluate bond strength distributions, or determine compliance with specified bond strength requirements of the applicable acquisition document.