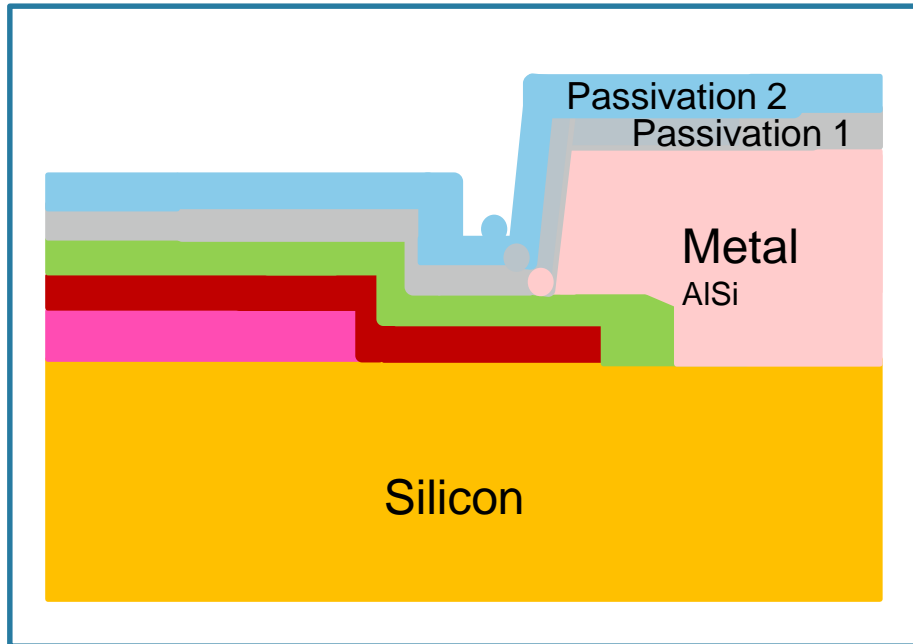


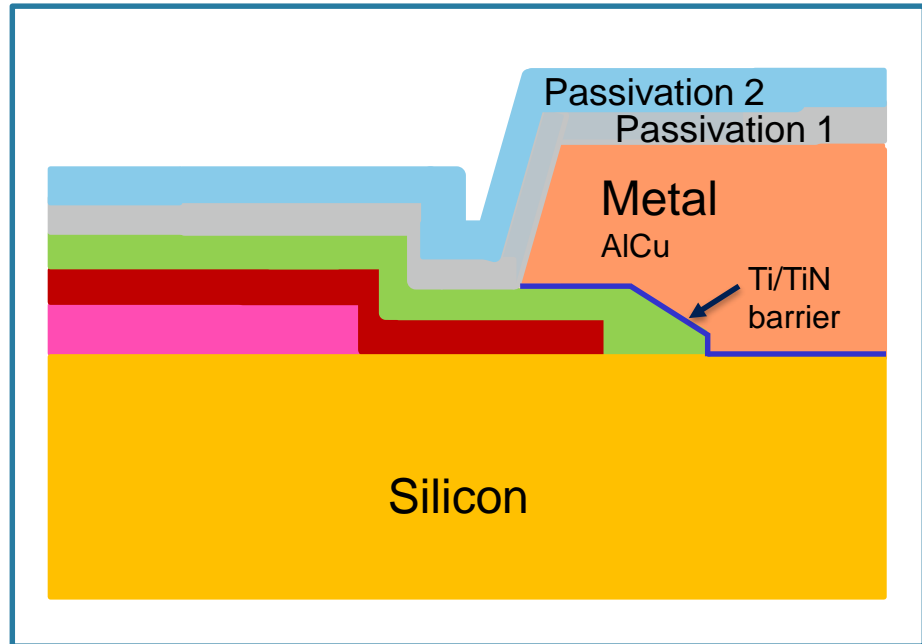
Front Metal Composition

AlCu+Ti/TiN Barrier vs AlSi

Current Structure



New Structure



New Front Metal layer scheme is able to make Metal profile less steep and more regular improving reliability on assembly process.

Automotive Discrete Group (ADG)
Power Transistor Division
HV Business Unit
Process Change Notification

**MDmesh™ DM2 Power MOSFET Top Metal change from AlSi to AlCu+Barrier - Ang Mo Kio
AUTOMOTIVE**

Dear Customer,

Following the continuous improvement of our service and in order to improve MDmesh™ DM2 Technology, for selected Power MOSFET Transistors manufactured in ST's Ang Mo Kio (Singapore) FAB, we are going to change the front top metal from AlSi to AlCu+Ti/TiN barrier.

This new process has been developed first on new MDmesh™ DM6 technology and now we are going to apply it also on MDmesh™ DM2.

MDmesh™ DM2 Technology manufactured in Ang Mo Kio (Singapore) FAB, guarantees the same quality and electrical characteristics as per current production.

The involved products series and affected packages are listed in the table below:

Product Family	Technology	Part Number
Power MOSFET Transistors	MDmesh™ DM2	See involved product list

Any other Product related to the above series, even if not expressly included or partially mentioned in the attached table, is affected by this change.

Qualification program and results availability:

The reliability test report is provided in attachment to this document.

Samples availability:

Samples of the test vehicle devices will be available on request starting from week 49-2018.
Any other sample request will be processed and scheduled by Power Transistor Division upon request.

Product Family	Package	Test Vehicle
Power MOSFET Transistors	D ² PAK TO-247 TO-247 long leads TO-247 long leads	STB45N60DM2AG STW65N65DM2AG STWA50N65DM2AG STWA65N65DM2AG

Change implementation schedule:

The production start and first shipments will be implemented after week 24 of 2019, after customer agreement.

Marking and traceability:

Unless otherwise stated by customer specific requirement, traceability of MDmesh™ DM2, manufactured in ST's Ang Mo Kio (Singapore) FAB with AlCu+Ti/TiN barrier, will be ensured by internal code (Finished Good) and Q.A. number.

Yours faithfully.

Reliability Report
 for
MDmesh™ DM2 Power MOSFET
Top Metal change from AISi to AlCu+Barrier
Ang Mo Kio (Singapore)

Automotive

General Information	
Commercial Product	: STB45N60DM2AG- STW65N65DM2AG- STWA50N65DM2AG-STWA65N65DM2AG
Product Line	: FQ6LA1 – FQF9A1 – FQFIA1
Product Description	: MDmesh™ DM2
Package	: D ² PAK – TO-247- TO247 long lead
Silicon Technology	: Power MOSFET
Division	: Power Transistor Division

Traceability	
Diffusion Plant	: Ang Mo Kio (Singapore)
Assembly Plant	: Shenzhen (China)
Reliability Lab	: Catania (Italy)
Reliability Assessment	
Passed	<input checked="" type="checkbox"/>
Failed	<input type="checkbox"/>

Disclaimer: this report is a summary of the qualification plan results performed in good faith by STMicroelectronics to evaluate the electronic devices conformance to its specific mission profile for Automotive Application. This report and its contents shall not be disclosed to a third party, except in full, without previous written agreement by STMicroelectronics or under the approval of the author (see below)

REVISION HISTORY

Version	Date	Author	Changes description
1.0	22 October 2018	A.SETTINIERI	FINAL REPORT

APPROVED BY:
 Corrado CAPPELLO
 ADG Q&R department - Catania
 STMicroelectronics

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1. RELIABILITY EVALUATION OVERVIEW

1.1 Objective

Reliability evaluation for MDmesh™ DM2 Power MOSFET Top Metal change from AlSi to AlCu+Barrier in Ang Mo Kio (Singapore) - AUTOMOTIVE

1.2 Reliability Test Plan

Reliability tests performed on this device are in agreement with AEC Q101 Rev.D1 and are listed in the Test Plan For details on test conditions, generic data used and spec reference see test results summary at Par.3

#	Stress	Abrv	Reference	Data type	Test flag	Comments
1	Pre and Post-Stress Electrical Test	TEST	User specification or supplier's standard Specification	1	Y	
2	External Visual	EV	JESD22B-101	1	Y	
3	Parametric Verification	PV	User specification	1	Y	
4	High Temperature Reverse Bias	HTRB	MIL-STD-750-1 M1038 Method A	1	Y	
5	High Temperature Gate Bias	HTGB	JESD 22A-108	1	Y	
6	Pre-conditioning	PC	JESD22A-113	1	Y	
7	Temperature Cycling	TC	JESD22A-104	1	Y	
7a	Temperature Cycling Hot Test	TCHT	JESD22A-104	1	Y	
7a alt	TC Delamination Test	TCDT	JESD22A-104	1	Y	
8	Autoclave	AC	JESD22A-102	1	Y	
9	High Humidity High Temperature Reverse Bias	H3TRB	JESD22A-101	1	Y	
10	Intermittent Operational Life / Thermal Fatigue	IOL / TF	MIL-STD-750 Method 1037	1	Y	
11	Destructive Physical Analysis	DPA	AEC-Q101-004 Section 4	1	Y	
12	ESD Characterization	ESD (HBM,CDM)	AEC Q101-001 and 005	1	Y	
13	Thermal Resistance	TR	JESD24-3, 24-4, 24-6 as appropriate	3	Y	
14	Wire Bond Integrity	WBI	MIL-STD-750 Method 2037	3	Y	
15	Wire Bond Strength	WBS	MIL-STD-750 Method 2037	3	Y	
16	Wire Bond Shear	BS	AEC-Q101-003	3	Y	
17	Die Shear	DS	MIL-STD-750 Method 2017	3	Y	
18	Dielectric Integrity	DI	AEC-Q101-004 section 3	3	Y	

1.3 Conclusion

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

Parameter drift analysis performed on samples submitted to die oriented test showed a good stability of the main electrical monitored parameters.

Package oriented tests have not put in evidence any criticality.

ESD is accordance with ST spec.

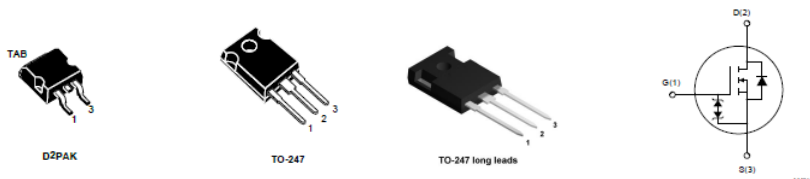
On the basis of the overall results obtained, we can give a positive judgment on the reliability evaluation for MDmesh™ DM2 Power MOSFET Top Metal change from AISi to AlCu+Barrier diffused in Ang Mo Kio (Singapore) and assembled in Shenzhen (China) In agreement with AEC Q101 Rev.D1

2. DEVICE/TEST VEHICLE CHARACTERISTICS

2.1 Generalities

Power MOSFET MDmesh™ DM2

2.2 Pin Connection



2.3 Traceability

Reference “Product Baseline” document if existing, else provide following chapters/information:

D.U.T.: STB45N60DM2AG

PACKAGE: D²PAK

Wafer fab information	
Wafer fab manufacturing location	SG 6” (Singapore)
Wafer diameter (inches)	6”
Silicon process technology	Power MOSFET - MDmesh™ DM2
Die finishing front side (passivation)	TEOS + Nitride
Die finishing back side	Ti/Ni/Ag
Die area (Stepping die size)	6840 x 5050 μm ²
Metal levels/Materials	AlCu+Ti/TiN barrier

Assembly Information	
Assembly plant location	Shenzhen (China)
Package code description	D ² PAK
Lead frame/Substrate	TO263 (Dt 40u Ve5 OpD/G/H) / Selected Ni/NiP
Die attach material	PREFORM PbAgSn
Wires bonding materials/diameters	AlMg 5mils (Gate) – Al 15mils (Source)
Molding compound	Halogen present Molding compound

D.U.T.: STW65N65DM2AG

PACKAGE: TO-247

Wafer fab information	
Wafer fab manufacturing location	SG 6" (Singapore)
Wafer diameter (inches)	6"
Silicon process technology	Power MOSFET - MDmesh™ DM2
Die finishing front side (passivation)	TEOS + Nitride
Die finishing back side	Ti/Ni/Ag
Die area (Stepping die size)	10390 x 6850 μm ²
Metal levels/Materials	AlCu+Ti/TiN barrier

Assembly Information	
Assembly plant location	Shenzhen (China)
Package code description	TO-247
Lead frame/Substrate	TO247 3L (Mon Ve6 OpA/Q) / Selected Ni/NiP
Die attach material	PREFORM PbAgSn
Wires bonding materials/diameters	AlMg 5mils (Gate) – Al 10mils (Source)
Molding compound	Halogen Free Molding compound

D.U.T.: STWA50N65DM2AG

PACKAGE: TO-247 long lead

Wafer fab information	
Wafer fab manufacturing location	SG 6" (Singapore)
Wafer diameter (inches)	6"
Silicon process technology	Power MOSFET - MDmesh™ DM2
Die finishing front side (passivation)	TEOS + Nitride
Die finishing back side	Ti/Ni/Ag
Die area (Stepping die size)	7510 x 5760 μm ²
Metal levels/Materials	AlCu+Ti/TiN barrier

Assembly Information	
Assembly plant location	Tongfu Microelectronics Co Ltd (China)
Package code description	TO-247 long lead
Lead frame/Substrate	TO247-3A(IP CU)LL Full Ni raw Cu on frame pad
Die attach material	PREFORM PbAgSn
Wires bonding materials/diameters	Al 5mils (Gate) – Al 15mils (Source)
Molding compound	Halogen Free Molding compound

D.U.T.: STWA65N65DM2AG

PACKAGE: TO-247 long lead

Wafer fab information	
Wafer fab manufacturing location	SG 6" (Singapore)
Wafer diameter (inches)	6"
Silicon process technology	Power MOSFET - MDmesh™ DM2
Die finishing front side (passivation)	TEOS + Nitride
Die finishing back side	Ti/Ni/Ag
Die area (Stepping die size)	10390 x 6850 μm ²
Metal levels/Materials	AlCu+Ti/TiN barrier

Assembly Information	
Assembly plant location	Tongfu Microelectronics Co Ltd (China)
Package code description	TO-247 long lead
Lead frame/Substrate	TO247-3A(IP CU)LL Full Ni raw Cu on frame pad
Die attach material	PREFORM PbAgSn
Wires bonding materials/diameters	Al 5mils (Gate) – Al 10mils (Source)
Molding compound	Halogen Free Molding compound

Reliability Testing Information	
Reliability laboratory location	Catania (Italy)
Electrical testing location	Catania (Italy)

3. TESTS RESULTS SUMMARY

3.1 Lot Information

Lot #	Commercial Product	Silicon line	Package	Wafer Fab	Assembly plant	Note
1	STB45N60DM2AG	FQ6L	D ² PAK	SG6" (Singapore)	Shenzhen (China)	
2	STW65N65DM2AG	FQF9	TO-247			
3	STWA50N65DM2AG	FQFI	TO-247 long lead		Tongfu Microelectronics Co Ltd (China)	
4	STWA65N65DM2AG	FQF9				

3.2 Test results summary

#	Stress (Abrv)	P C	Std ref.	Conditions	Sample Size (S.S)	Steps	Failure/SS			
							Lot 1	Lot 2	Lot 3	Lot 4
1	TEST		User specification	All qualification parts tested per the requirements of the appropriate device specification.			462	462	462	462
2	External Visual		JESD22 B-101	All devices submitted for testing			462	462	462	462
3	Parametric Verification		User specification	All parameters according to user specification from -55°C to 150°C	75		0/25	0/25	0/25	0/25
4	Pre-conditioning		JESD22 A-113	Dryng 24H @ 125°C Store 168H @ TA=85°C,RH=85% IR Reflow @ 245°C 3 times	All devices to be subjected to H3TRB, TC, AC, IOL	Final	0/77			
5	HTRB	N	MIL-STD-750-1 M1038 Method A	Tj=150°C ; BIAS= 600V	77	1000H	0/77			
				Tj=150°C ; BIAS= 650V	231			0/77	0/77	0/77
6	HTGB	N	JESD22 A-108	TA=150°C ; BIAS= 30V	308	1000H	0/77	0/77	0/77	0/77
7	TC	Y	JESD22 A-104	TA=-55°C TO 150°C	308	1000cy	0/77	0/77	0/77	0/77
7a	TCHT	Y	JESD22 A-104 Appendix 6	125°C TEST after TC	308		0/77	0/77	0/77	0/77
				decap and wire pull for parts with internal bond wire sizes 5 mil diameter and less	20		0/5	0/5	0/5	0/5
7a alt	TCDT	Y		100% C-SAM inspection after TC	308		0/77	0/77	0/77	0/77
8	AC	Y	JESD22 A-102	TA=121°C ; PA=2ATM	308	96H	0/77	0/77	0/77	0/77
9	H3TRB	Y	JESD22 A-101	TA=85°C ; RH=85% BIAS= 100V	308	1000H	0/77	0/77	0/77	0/77
10	IOL	Y	MIL-STD-750 Method 1037	ΔTj ≥ 100°C	308	15Kcy	0/77	0/77	0/77	0/77
11	D.P.A.		AEC-Q101-004 Section 4	Devices after H3TRB - TC	12		0/2 0/2	0/2 0/2		0/2 0/2
12	ESD		AEC Q101-001,002 and 005	CDM / HBM	180		0/30 0/30	0/30 0/30		0/30 0/30
13	Thermal Resistance		JESD24-3, 24-4, 24-6 as appropriate		10 each, pre & post change		0/10	0/10	0/10	0/30
14	Wire Bond Integrity		MIL-STD-750 Method 2037		15		0/10	0/10		0/10

15	Wire Bond Strength	MIL-STD-750 Method 2037		10 bonds from min of 5 devices		0/30	0/30		0/30
16	Wire Bond Shear	AEC-Q101-003		10 bonds from min of 5 devices		0/5	0/5		0/5
17	Die Shear	MIL-STD-750 Method 2017		5		0/5	0/5		0/5
18	Dielectric Integrity	AEC-Q101-004 Section 3		15		0/5	0/5		0/5