PRODUCT / PROCESS CHANGE NOTIFICATION

1. PCN basic data	
1.1 Company	STMicroelectronics International N.V
1.2 PCN No.	POWER AND DISCRETE PRODUCTS/24/14882
1.3 Title of PCN	TO-220 line transfer from Shenzhen to TFME Tongke (China).
1.4 Product Category	Pls refer to the Products list
1.5 Issue date	2024-07-17

2. PCN Team	
2.1 Contact supplier	
2.1.1 Name	ROBERTSON HEATHER
2.1.2 Phone	+1 8475853058
2.1.3 Email	heather.robertson@st.com
2.2 Change responsibility	
2.2.1 Product Manager	Maurizio GIUDICE
2.1.2 Marketing Manager	Antonino PELLEGRINO
2.1.3 Quality Manager	Vincenzo MILITANO

3. Change		
3.1 Category	3.2 Type of change	3.3 Manufacturing Location
Transfer	Line transfer for a full process or process brick (process step, control plan, recipes) from one site to another site: Assembly site (SOP 2617)	TFME Tongke (China) as Assy Plant

4. Description of change		
	Old	New
4.1 Description	TO-220 products manufactured in Shenzhen (China).	TO-220 products manufactured in TFME Tongke (China).
4.2 Anticipated Impact on form,fit, function, quality, reliability or processability?	Impact on processability	

5. Reason / motivation for change	
5.1 Motivation	TO-220 Shenzhen line closure and equipment transfer to TFME Tongke.
5.2 Customer Benefit	SERVICE CONTINUITY

6. Marking of parts / traceability of change	
6.1 Description	by the first two digits of the traceability code ("GS"), by internal code (Finished Good) and Q.A. number.

7. Timing / schedule	
7.1 Date of qualification results	2024-07-11
7.2 Intended start of delivery	2025-01-12
7.3 Qualification sample available?	Upon Request

8. Qualification / Validation			
8.1 Description	14882 RERPTD24071_1.0_STP45N60DM2AG_SUNRISE PROJECT by package TO220 -Auto.pdf		
8.2 Qualification report and qualification results	Available (see attachment)	Issue Date	2024-07-17

9. Attachments (additional documentations)
14882 Public product.pdf 14882 TO-220 Line transfer from Shenzhen to Tongke - AUT.pdf 14882 RERPTD24071_1.0_STP45N60DM2AG_SUNRISE PROJECT by package TO220 -Auto.pdf

10. Affected parts		
10. 1 Current		10.2 New (if applicable)
10.1.1 Customer Part No	10.1.2 Supplier Part No	10.1.2 Supplier Part No
	STP45N40DM2AG	
	STP45N60DM2AG	
	STP46NF30	

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Public Products List

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PCN Title : TO-220 line transfer from Shenzhen to TFME Tongke (China).

PCN Reference : POWER AND DISCRETE PRODUCTS/24/14882

Subject : Public Products List

Dear Customer,

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

STP46NF30	STP45N60DM2AG	STP30N65DM6AG
STP45N40DM2AG		

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STP45N60DM2AG product
TO220 Assembling & testing line relocation from ST Shenzhen to Tongke (China) plant of TFME for HV MOSFET products
Automotive domain
Reliability Evaluation Report

General Information on selected Test Vehicle	
Commercial Product	**STP45N60DM2AG**
Product Line	**FQ6LA1**
Package	**TO220**

Note: *this report is a summary of the reliability trials performed in good faith by STMicroelectronics in order to evaluate the electronic device conformance to its specific mission profile for Automotive Application. This report and its contents shall not be disclosed to a third party without previous written agreement from STMicroelectronics or under the approval of the author (see below).*

Revision history

Rev.	Changes description	Author	Date
1.0	First release	A. Settinieri	11th July 2024

Approved by

Function	Location	Name	Date
Division Reliability Manager	ST Castelletto (Italy)	M. De Tomasi	11th July 2024

Contents

1. Reliability Evaluation Overview

1.1. Objective and Reliability strategy

Aim of this document is to present the reliability evaluation report performed to Assembling & testing line relocation from ST Shenzhen to TFME Tongke (China) plant of TFME for HV Power MOSFET products designed for Automotive application domain and assembled in TO220 in TFME Tongke (China) plant of TFME Subcon Assembly Plant.

Starting from current test vehicle, here below a table summarizing the features and the classification for reliability evaluations of products belonging to the mentioned family.

1.1.1. Classification table

Commercial Product	Silicon line	BVDss (V)	Die size (mm^2)	Gate wires	Source wires	WF Die Finish Back	WF Die Finish Front	Classification for reliability evaluation
STP45N60DM2AG	FQ6LA1	600	34.54	5 mils Al/Mg	15 mils Al	Ti-Ni-Ag	TEOS + SiN	Test Vehicle for automotive domain requiring full reliability evaluation on 3 lots

Basing on technical features the product **STP45N60DM2AG,** (FQ6LA1 as ST internal silicon line) was classified Master Test Vehicles because it is representative of all products diffused in MDmesh DM2 Technology and assembled in TO220 package for Automotive application domain.

Reliability activity will be performed in agreement with **AEC-Q101 Rev. E** and **ST 0061692** specification as listed in below Test Plan. For details on test conditions, generic data used and specifications references, refer to test results summary in section 2.

1.2. Test Plan

AEC-Q101 Test Plan Table

TEST GROUP	#	Data Type	TEST NAME	DESCRIPTION / COMMENTS	TEST FLAG
A ACCELERATED ENVIRONMENT STRESS TESTS	A1	1	PC	Preconditioning	No
	A2	1	HAST	Highly Accelerated Stress Test	No
	A2 alt	1	H3TRB	High Humidity High Temp. Reverse Bias	Yes
	A3	1	UHAST	Unbiased Highly Accelerated Stress Test	No
	A3 alt	1	AC	Autoclave	Yes
	A4	1	TC	Temperature Cycling	Yes
	A4a	1	TCHT	Temperature Cycling Hot Test	Yes
	A4a alt	1	TCDT	Temperature Cycling Delamination Test	Yes
	A5	1	IOL	Intermittent Operational Life	Yes
	A5alt	1	PTC	Power Temperature Cycling	No
B ACCELERATED LIFETIME SIMULATION TESTS	B1	1	HTRB	High Temperature Reverse Bias	Yes
	B1a	1	ACBV	AC blocking voltage	Not Applicable
	B1b	1	SSOP	Steady State Operational	Not Applicable
	B2	1	HTGB	High Temperature Gate Bias	Yes
C PACKAGE ASSEMBLY INTEGRITY TESTS	C1	1	DPA	Destructive Physical Analysis	Yes
	C2	2	PD	Physical Dimension	Yes
	C3	3	WBP	Wire Bond Pull Strength	Yes
	C4	3	WBS	Wire Bond Shear Strength	Yes
	C5	3	DS	Die Shear	Yes
	C6	2	TS	Terminal Strength	Yes
	C7	2	RTS	Resistance to Solvents	No
	C8	2	RSH	Resistance to Solder Heat	Yes
	C9	3	TR	Thermal Resistance	No
	C10	2	SD	Solderability	Yes
	C11	3	WG	Whisker Growth Evaluation	No
	C12	2	CA	Constant Acceleration	Not Applicable
	C13	2	VVF	Vibration Variable Frequency	Not Applicable
	C14	2	MS	Mechanical Shock	Not Applicable
	C15	2	HER	Hermeticity	Not Applicable
D DIE FABRICATION RELIABILITY TESTS	D1	3	DI	Dielectric Integrity	No
E ELECTRICAL VERIFICATION TESTS	E0	1	EV	External Visual	Yes
	E1	1	TEST	Pre- and Post-Stress Electrical Test	Yes
	E2	1	PV	Parametric Verification	Yes
	E3	1	ESDH	ESD HBM Characterization	No
	E4	2	ESDC	ESD CDM Characterization	No
	E5	3	UIS	Unclamped Inductive Switching	No
	E6	3	SC	Short Circuit Characterization	No

1.3. Conclusion

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 obtained from reliability evaluation performed in agreement with AEC-Q101 Rev. E and ST 0061692 specification on the test vehicle STP45N60DM2AG, (FQ6LA1 as ST internal silicon line), we can release the production of the mentioned product designed in Power MOSFET MDmesh DM2, diffused in ST SG8 Ang Mo Kio (Singapore) 8" Wafer Fab and assembled in TO220 in TFME Tongke (China) plant of TFME Subcon Assembly Plant.

2. Product Characteristics

2.1. Generalities

2.1.1. Test vehicle.

life.augmented

STP45N60DM2AG

Automotive-grade N-channel 600 V, 0.085 Ω typ., 34 A MDmesh™ DM2 Power MOSFET in a TO-220 package

Datasheet - production data

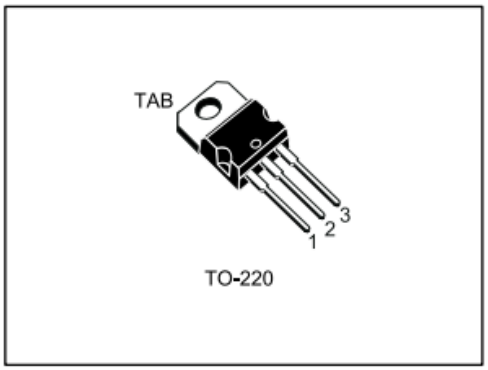
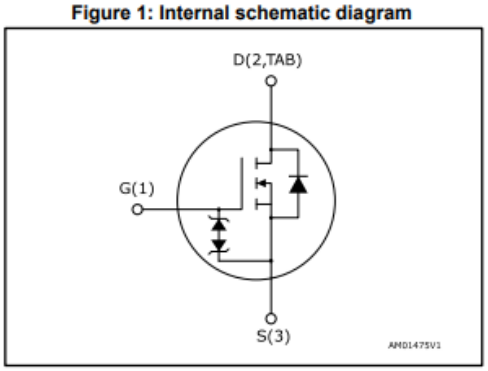


Figure 1: Internal schematic diagram



Features

Order code	V_{DS} @ $T_{Jmax.}$	$R_{DS(on)}$ max.	I_D	P_{TOT}
STP45N60DM2AG	650 V	0.093 Ω	34 A	250 W

- Designed for automotive applications and AEC-Q101 qualified
- Fast-recovery body diode
- Extremely low gate charge and input capacitance
- Low on-resistance
- 100% avalanche tested
- Extremely high dv/dt ruggedness
- Zener-protected

Applications

- Switching applications

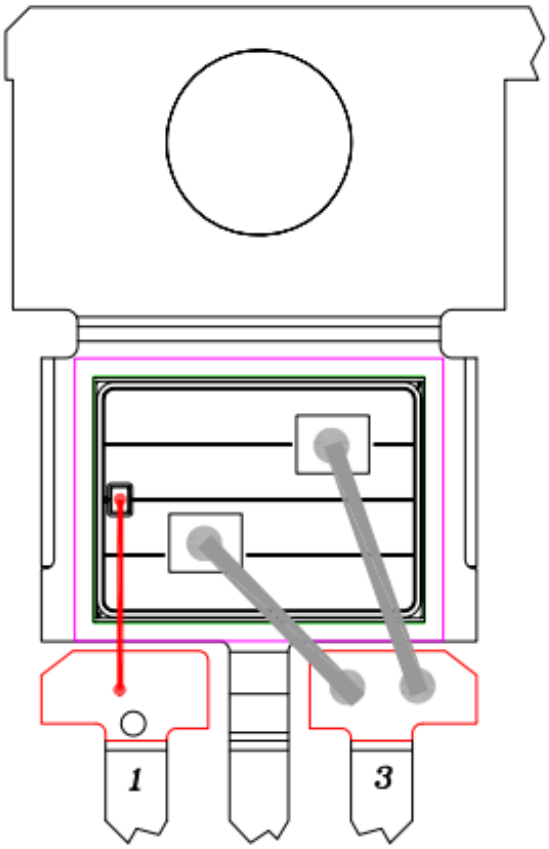
Description

This high voltage N-channel Power MOSFET is part of the MDmesh™ DM2 fast recovery diode series. It offers very low recovery charge (Q_{rr}) and time (t_{rr}) combined with low $R_{DS(on)}$, rendering it suitable for the most demanding high efficiency converters and ideal for bridge topologies and ZVS phase-shift converters.

Table 1: Device summary

Order code	Marking	Package	Packing
STP45N60DM2AG	45N60DM2	TO-220	Tube

2.2. Pin connection/bonding diagram



2.3. Traceability

2.3.1. Wafer Fab information

Wafer fab name / location	ST SG8 Ang Mo Kio (Singapore)
Wafer diameter (inches)	8”
Silicon process technology	MDmesh DM2
Die finishing front side	TEOS+SiN
Die finishing back side	Ti-Ni-Ag
Die size (micron)	6840 x 5050 um
Metal levels/ materials/ thicknesses	Ti/TiN/TiAlCu (4.5 um)

2.3.2. Assembly information

Assembly plant name / location	TFME Tongke (China)
Package description	To220
Lead frame/Substrate	FRAME TO220 Mon Ve1 OpD/M/N PlNi/NiP
Die attach material	PREFORM Pb/Ag/Sn 95.5/2.5/2 D.76mm SSD
Wire bonding material/diameter	Al-Mg 5 mils Al 10 mils
Molding compound material	GR30 Green
Package Moisture Sensitivity Level (JEDEC J-STD020D)	Not available

2.3.3. Reliability Testing information

Reliability laboratory location	STM Catania (Italy)

3. Test summary details

3.1. Test Summary table

Test method revision reference is the one active at the date of reliability trial execution.

Test	#	Reference	**AEC-Q101 (Group A – ACCELERATED ENVIRONMENT STRESS TESTS)** STM Test Conditions	Lots	S.S.	Total	Results Fail/SS/lots	Comments
PC	A1	JESD22-A113 J-STD-020	- 24h bake@125°C - MSL1: 168h moisture soak @ TA=85°C RH=85% - 3x Reflow simulation with Peak Reflow Temp= 260°C	-	-	-		No because the package is not MSL classifies
HAST	A2	-	-	-	-	-		NO, covered by H3TRB
H3TRB	A2 alt	JESD22A-101	Ta=85°C, RH=85% Vds= 100V, 1000h	3	77	231	0/77/3	
UHAST	A3	-	-	-	-	-		NO, covered by AC
AC	A3 alt	JESD22 A-102	AC (Ta=121°C, Pa=2atm, RH=100%, 96 hours)	3	77	231	0/77/3	
TC	A4	JESD22A-104 Appendix 6 J-STD-035	Ta=-55°C /+150°C Duration= 1000cy	3	77	231	0/77/3	
TCHT	A4a		125°C TEST after TC					
TCDT	A4a alt		100% AM inspection after TC					
IOL	A5	MIL-STD-750 Method 1037	ΔTj ≥ 100°C, 15Kcy	3	77	231		
PTC	A5alt	-	-	-	-	-		NO, covered by IOL

Test	#	Reference	**AEC-Q101 (Group B – ACCELERATED LIFETIME SIMULATION TESTS)** STM Test Conditions	Lots	S.S.	Total	Results Fail/SS/lots	Comments
HTRB	B1	JESD22 A-108	Tj=150°C, Vds= 600V, 1000h	3	77	231	0/77/3	
ACBV	B1a	-	-	-	-	-		Not Applicable Thyristors only
SSOP	B1b	-	-	-	-	-		Not Applicable Voltage Regulator only
HTGB	B2	JESD22 A-108	HTGB + Tj=150°C Vgs= +25V, 1000h	3	77	231	0/77/3	
			HTGB - Tj=150°C Vgs= -25V, 1000h	3	77	231	0/77/3	

Test	#	Reference	AEC-Q101 (Group C – PACKAGE ASSEMBLY INTEGRITY TESTS) STM Test Conditions	Lots	S.S.	Total	Results Fail/SS/lots	Comments
DPA	C1	AECQ101-004 Section 4	–	1	4	4	Done	Devices after TC and H3TRB
PD	C2	JEDEC JESD22-B-100	–	1	30	30	Done	From assembly data
WBP	C3	MIL-STD-750-2 Method 2037	–	1	5	5	Done	From assembly data
WBS	C4	AEC Q101-003 JESD22 B116	–	1	5	5	Done	From assembly data
DS	C5	.		1	5	5	Done	From assembly data
TS	C6			1	30	30	Done	From assembly data
RTS	C7							Not included in Rel Plan
RSH	C8			1	30	30	Done	From assembly data
TR	C9	JESD24-3, 24-4, 24-6	–	–	–	–		
SD	C10	JEDEC J-STD-002	–	1	10	10	Done	From assembly data
WG	C11	Not applicable: only for new package.		–	–	–		–
CA	C12	Not applicable: only for new package. Items C12 through C15 are sequential tests for hermetic packages.		–	–	–		–
VVF	C13			–	–	–		–
MS	C14			–	–	–		–
HER	C15			–	–	–		–

Test	#	Reference	AEC-Q101 (Group D – DIE FABRICATION RELIABILITY TESTS) STM Test Conditions	Lots	S.S.	Total	Results Fail/SS/lots	Comments
DI	D1	AEC Q101-004 Section 3	–	–	–	–		

Test	#	Reference	**AEC-Q101 (Group E – ELECTRICAL VERIFICATION TESTS)** STM Test Conditions	Lots	S.S.	Total	Results Fail/SS/lots	Comments
EV	E0	JEDEC JESD22-B101	All qualification parts submitted for testing	3	539	1617	Done	
TEST	E1		User specification or supplier's standard specification	3	539	1617	Done	
PV	E2		All parameters according to user specification	1	25	25	Passed	
ESDH	E3	AEC-Q101-001	ESD HBM Characterization	-	-	-		
ESDC	E4	AEC-Q101-005	ESD CDM Characterization	-	-	-		
UIS	E5	AEC-Q101-004 Section 2		-	-	-		Not applicable
SC	E6	AEC Q101-006		-	-	-		Not applicable

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Product/process change notification:

TO-220 production line transfer from Shenzhen to TFME Tongke (China)

POWER AND DISCRETE PRODUCTS/24/14882

Description of the change

Analog, Power & Discrete, MEMS & Sensors (APMS)
Power Transistor Sub-Group
High Voltage Division

Automotive

Dear Customer,

Following the continuous improvement of our service and with the aim of ensuring service continuity, this document announces the transfer of the TO-220 assembly equipment and test line to TFME Tongke (China). Tongke is a plant of Tongfu Microelectronics (China) also named TFME.
TO-220 products, manufactured in TFME Tongke, guarantee the same equipment, process, BOM (bill of materials), POA, quality and electrical characteristics as the current Shenzhen production.

Involved Products	Package	Test Vehicle	Samples Availability	End of Qualification
HV Power MOSFET	TO-220	STP45N60DM2AG	Upon request	30-Jun-24

Yours faithfully

July 12, 2024

Reason

TO-220 Shenzhen line closure and equipment transfer to TFME Tongke

Date of implementation

January 12, 2025

Impact of the change	
Form	
Fit	
Function	
Reliability	
Processibility	X

Qualification of the change
See attached Qualification report plan and results.

Marking and traceability:

Unless otherwise stated by customer specific requirement, traceability of products in TO-220, manufactured in TFME Tongke (China), will be ensured by the first two digits of the traceability code ("GS"), by internal code (Finished Good) and Q.A. number.

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