PRODUCT / PROCESS CHANGE NOTIFICATION

1. PCN basic data	
1.1 Company	STMicroelectronics International N.V
1.2 PCN No.	POWER AND DISCRETE PRODUCTS/25/15161
1.3 Title of PCN	Qualification of the new Lead Frame and soft solder dispenser tool for selected MOSFET LV products in TO252 (DPAK) in TFME plant.
1.4 Product Category	Pls Refer to the Products List (MOSFET LV)
1.5 Issue date	2025-01-14

2. PCN Team
2.1 Contact supplier

3. Change		
3.1 Category	3.2 Type of change	3.3 Manufacturing Location
Materials	New direct material part number r (same supplier, different supplier or new supplier),(Lead frame dimensions)	998G (TFME)

4. Description of change		
	Old	New
4.1 Description	Standard DPAK Leadframe TO252-3H + Soft Solder dispenser PUM.	New DPAK Leadframe TO252-3U + Soft Solder dispenser SPANKER.
4.2 Anticipated Impact on form,fit, function, quality, reliability or processability?	No Impact	

5. Reason / motivation for change	
5.1 Motivation	To continuously improve our service and to rationalize and optimize Power MOSFET Transistors productivity.
5.2 Customer Benefit	SERVICE IMPROVEMENT

6. Marking of parts / traceability of change	
6.1 Description	Dedicated FGs

7. Timing / schedule	
7.1 Date of qualification results	2024-12-20
7.2 Intended start of delivery	2025-04-01
7.3 Qualification sample available?	Upon Request

8. Qualification / Validation			
8.1 Description	15161 RERLVIP24034_1.0_New_LF_TO252-3U_Die_attached_Spanker_DPAK_TFME.pdf		
8.2 Qualification report and qualification results	Available (see attachment)	Issue Date	2025-01-14

9. Attachments (additional documentations)

15161 Public product.pdf
15161 New Lead Frame and soft solder tool for LV in TO252 (DPAK) in TFME plant_.pdf
15161 RERLVIP24034_1.0_New_LF_TO252-3U_Die_attached_Spanker_DPAK_TFME.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
	STD20NF20	
	STD60NF06T4	

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PCN Title : Qualification of the new Lead Frame and soft solder dispenser tool for selected MOSFET LV products in TO252 (DPAK) in TFME plant.
PCN Reference : POWER AND DISCRETE PRODUCTS/25/15161

Subject : Public Products List

Dear Customer,

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

STD60NF06T4	STD40NF10	STD20NF20

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Qualification of the new Lead Frame and soft solder dispenser tool for the Mosfet products in TO252 (DPAK) package in TFME plant : STD60NF06T4, STD40NF10 and STD20NF20

Agenda

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Change description

- Aim of this document is to describe following qualification activity performed for the STD60NF06T4, STD40NF10 and STD20NF20 Mosfet products in TO252 (DPAK) package in TFME plant :
  - new Lead Frame with large die pad → from current TO252-3H to new TO252-3U lead frame
  - New soft solder dispenser tool → from current PUM to new SPANKER

- This report shows the qualification plan that ensures the same quality and electrical characteristics of these 3 product lines currently in production in the TO252 (DPAK) in the TFME plant.
- All reliability tests have been completed with positive results.

Lead Frame comparison current TO252-3H vs new TO252-3U

Comparing the actual standard lead frame TO252-3H (Shinwon supplier) with new the TO252-3U (SDI and Jielin suppliers):

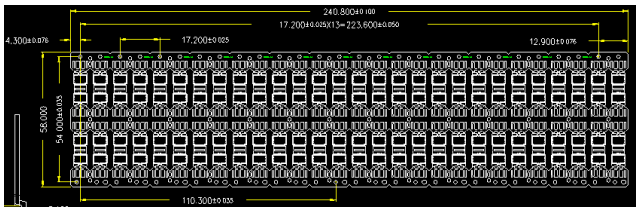
- Both SDI and Jielin supplier were qualified for ST product;
- The strip level drawing of TO252-3U from Jielin is same as SDI;

Lead frame (strip level):

Item	TO252-3H (current)	TO252-3U from SDI (New)	TO252-3U from Jielin (New)
Supplier	Shinwon	SDI	Jielin
Copper type	HCL-12SN	TAMAC4	HCL-12SN
Manufacture Method	Stamping	Stamping	Stamping
LF SIZE L×W×T	240.8*58*0.5(0.8)	240.8*58*0.5(0.8)	240.8*58*0.5(0.8)
Matrix	112units(4*28)	112units(4*28)	112units(4*28)
Location hole spacing	17.2+/-0.025mm	17.2+/-0.025mm	17.2+/-0.025mm

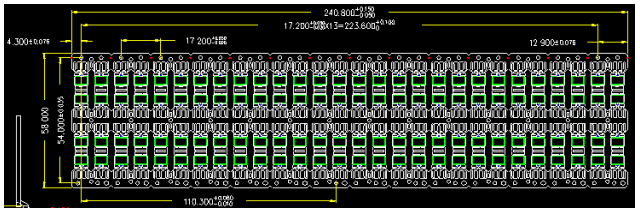
Current

TO252-3H



New

TO252-3U



Lead Frame comparison current TO252-3H vs new TO252-3U

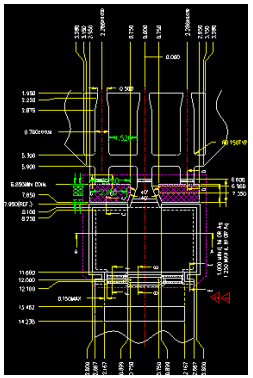
Comparing the actual standard lead frame TO252-3H (Shinwon supplier) with new the TO252-3U (SDI and Jielin suppliers):

Lead frame (unit level):

Item		TO252-3 (current)	TO252-3U from SDI (new)	TO252-3U from Jielin (new)	note
Plating Method		Spot Ni, plating on inner lead	Spot Ni, plating on inner lead	Spot Ni, plating on inner lead	
Plating thickness		1.3um~3.5um	1.3um~3.5um	1.3um~3.5um	
Die pad	Size	Size :5.6*3.5mmmm	Size ::5.5*3.81mm(inner v-groove: 5.04*3.29mm)	Size :5.5*3.81mm(inner v-groove: 5.04*3.29mm)	TO252-3U can meet the max single die size of mass production. Increased Y-direction size in order to follow the design rule of big die attached with spanker.
	Design	No V-groove	V-groove on each sides	V-groove on each sides	Add V-groove can improve overflow.
Inner lead Design		1.Size:2.2*1.0mm 2.No Mold-lock	1.Size:2.2*1.0mm 2.Mold-lock on Pin1	1.Size:2.2*1.0mm 2.Mold-lock on Pin1	Add mold lock can improve the Delam on inner lead.
Outside lead pitch		2.286±0.03mm	2.286±0.03mm	2.286±0.03mm	
Outside lead width		0.76±0.03mm	0.76±0.03mm	0.76±0.03mm	

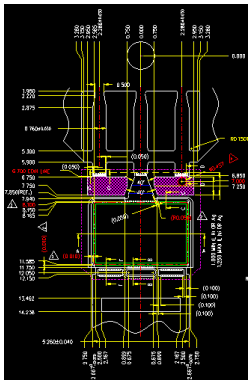
Current

TO252-3H



New

TO252-3U



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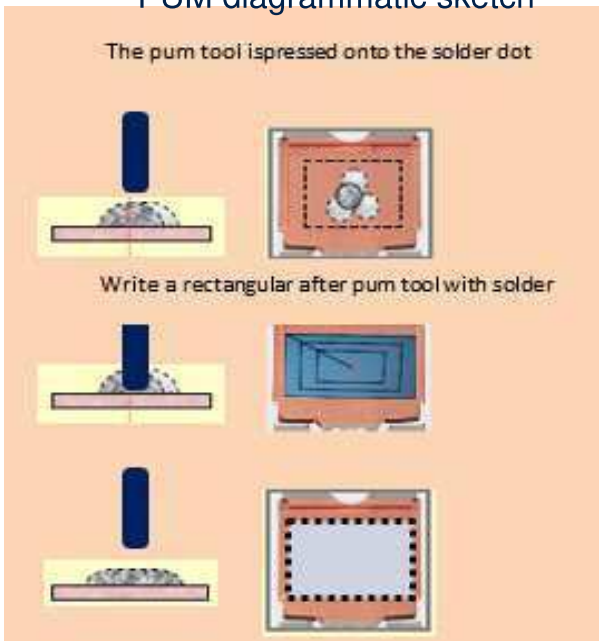
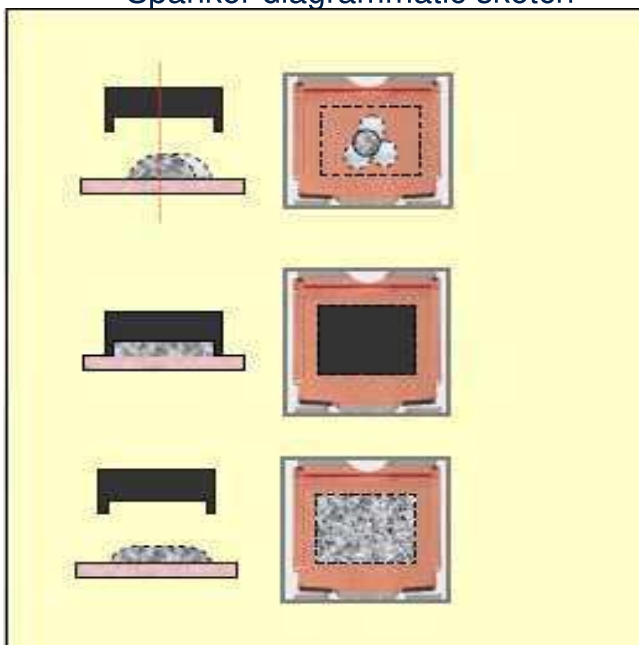
Soft Solder dispenser tool comparison current PUM vs new SPANKER

Comparing the actual **PUM and spanker**

PUM diagrammatic sketch



Spanker diagrammatic sketch



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Product lines impacted

The products lines impacted&qualified in TFME subcontractor plant

MOSFET Products lines in DPACK (DP package codes)

Commercial Product :	STD60NF06T4	(Silicon Line ED6F01)
Commercial Product :	STD40NF10	(Silicon Line MM0G01)
Commercial Product :	STD20NF20	(Silicon Line MM2G01)

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Bill Of Material Comparison

Actual Bill of Material in TFME	
ITEM	**MATERIAL**
FRAME	TO-252-3H(IL Ni) - DWG#: TO-LFM-SW005
DIE ATTACH	SOFT SOLDER Pb/Ag/Sn 95.5/2.5/2
MOLD COMPOUND	RESIN EME-G620A
WIRE	Al 10 mils
WIRE	Al 5 mils

New Bill of Material in TFME	
ITEM	**MATERIAL**
FRAME	TO-LFM-HI015 and SD079 Rev4
DIE ATTACH	SOFT SOLDER Pb/Ag/Sn 95.5/2.5/2
MOLD COMPOUND	RESIN EME-G620A
WIRE	Al 10 mils
WIRE	Al 5 mils

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Conclusions

- Detailed activity has been performed in order to qualify the new Lead Frame with large die pad and new soft solder dispenser tool for the STD60NF06T4, STD40NF10 and STD20NF20 Mosfet products in TO252 (DPAK) package in TFME plant.
- All reliability tests have been completed with positive results.
- This report shows the positive results achieved, ensuring the same quality and electrical characteristics as the current production in TFME plant.

Reliability Evaluation Report
RERLVIP24034
New lead frame TO252-3U / Die attached method Spanker
DPAK - Tongfu TFME (China) subcon
PowerMOSFET Planar and EHD2 Technology

Release	Date	Author	Function
1.0	September 24th, 2024	A. Giuffrida	APMS – Q&R - Catania

This report is a summary of the reliability trials performed in good faith by STMicroelectronics. This report does not imply for STMicroelectronics expressly or implicitly any contractual obligations other than as set forth in STMicroelectronics General Terms and Conditions of Sale.

RELIABILITY EVALUATION OVERVIEW

- **OBJECTIVE**

Aim of this report is to present the reliability evaluations performed on **STD60NF06T4, STD40NF10, STD20NF20** (respectively ED6F, MM0G and MM2G as ST internal silicon line) chosen as test vehicles to qualify the new lead frame TO252-3U and the new die attached method Spanker for PowerMOSFET Low Voltage products designed in EHD2 and Planar Technology, assembled in package DPAK in Tongfu TFME (China) subcon Assembly Plant.

- **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 results obtained, the new lead frame TO252-3U and the new die attached method Spanker for PowerMOSFET Low Voltage products designed in EHD2 and Planar Technology, assembled in package DPAK in Tongfu TFME (China) subcon Assembly Plant, have positively passed reliability evaluation performed in agreement with **ST 0061692** specification.

TABLE OF CONTENTS

1. RELIABILITY STRATEGY

1.1. Reliability strategy

To evaluate the introduction of the new frame TO252-3U and the new die attached method Spanker for PowerMOSFET Low Voltage products designed in EHD2 and Planar Technology, assembled in package DPAK in Tongfu TFME (China) subcon Assembly Plant, the qualification plan was based to address the specific failure mechanism on 3 different chosen test vehicles.

Reliability trials performed as part of this reliability evaluation are in agreement with **ST 0061692** specification and are listed in below Test Plan. For details on test conditions, generic data used and specifications references, refer to test results summary in section 3.

1.2. Test Plan

Table 1 – TEST PLAN

TEST	TEST NAME	DESCRIPTION / COMMENTS	TEST FLAG
ACCELERATED ENVIRONMENT STRESS	PC	Preconditioning	Yes
	H^3TRB	High Humidity High Temp. Reverse Bias	Yes
	AC	Autoclave	Yes
	TC	Temperature Cycling	Yes
	IOL	Intermittent Operational Life	Yes
ACCELERATED LIFETIME SIMULATION	HTRB	High Temperature Reverse Bias	No
	HTGB	High Temperature Gate Bias	No
ELECTRICAL VERIFICATION	TEST	Pre- and Post-Stress Electrical Test	Yes
	PV	Parametric Verification	No
	EV	External Visual	Yes
	ESDH (HBM)	ESD HBM Characterization	No
	ESDC (CDM)	ESD CDM Characterization	No

2. PRODUCT OR TEST VEHICLE CHARACTERISTICS

2.1. Generalities

STD20NF20
STF20NF20, STP20NF20

N-channel 200 V, 0.10 Ω, 18 A DPAK, TO-220, TO-220FP low gate charge STripFET™ Power MOSFET

Features

Type	V_{DSS}	$R_{DS(on)}$	I_D	P_W
STD20NF20	200 V	< 0.125 Ω	18 A	110 W
STF20NF20	200 V	< 0.125 Ω	18 A	30 W
STP20NF20	200 V	< 0.125 Ω	18 A	110 W

- Exceptional dv/dt capability
- Low gate charge
- 100% avalanche tested

Application

- Switching applications

Description

This Power MOSFET series realized with STMicroelectronics unique STripFET™ process has specifically been designed to minimize input capacitance and gate charge. It is therefore suitable as primary switch in advanced high-efficiency isolated DC-DC converters.

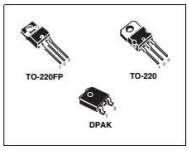


Figure 1. Internal schematic diagram

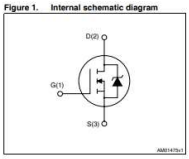


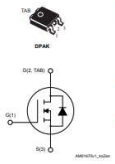
Table 1. Device summary

Order codes	Marking	Package	Packaging
STD20NF20	20NF20	DPAK	Tape and reel
STF20NF20	20NF20	TO-220FP	Tube
STP20NF20	20NF20	TO-220	Tube

STD40NF10

Datasheet

N-channel 100 V, 25 mΩ typ., 50 A, STripFET™ II Power MOSFET in a DPAK package



Features

Type	V_{DS}	$R_{DS(on)}$ max.	I_D
STD40NF10	100 V	28 mΩ	50 A

- Exceptional dv/dt capability
- 100% avalanche tested
- Low gate charge

Applications

- Switching applications

Description

This Power MOSFET series has been developed using STMicroelectronics' unique STripFET™ process, which is specifically designed to minimize input capacitance and gate charge. This renders the device suitable for use as primary switch in advanced high-efficiency isolated DC-DC converters for telecom and computer applications, and applications with low gate charge driving requirements.

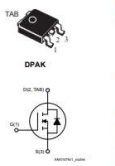
Product status link
STD40NF10

Product summary	
Order code	STD40NF10
Marking	D40NF10
Package	DPAK
Packing	Tape and reel

STD60NF06T4

Datasheet

N-channel 60 V, 0.014 Ω typ., 60 A STripFET II Power MOSFET in a DPAK package



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STD60NF06T4	60 V	0.016 Ω	60 A

- Exceptional dv/dt capability
- 100% avalanche tested
- Low gate charge

Applications

- Switching applications

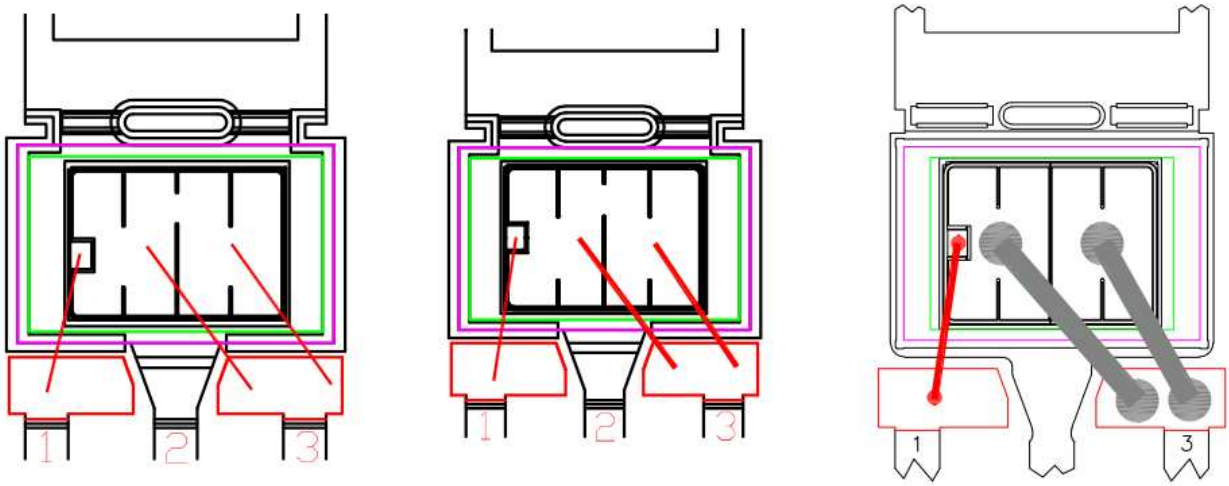
Description

This Power MOSFET series has been developed using STMicroelectronics' unique STripFET™ process, which is specifically designed to minimize input capacitance and gate charge. This renders the device suitable for use as primary switch in advanced high-efficiency isolated DC-DC converters for telecom and computer applications, and applications with low gate charge driving requirements.

Product status link
STD60NF06T4

Product summary	
Order code	STD60NF06T4
Marking	D60NF06
Package	DPAK
Packing	Tape and reel

2.2. Pin connection / Bonding diagram



2.3. Traceability

2.3.1. Wafer Fab information

Wafer fab information	
Wafer Fab name / location	Ang Mo Kio SG6 (Singapore)
Wafer diameter (inches)	6”
Wafer thickness (µm)	280 um
Silicon process technology	EHD2 PLANAR
Die finishing front side	(ED6F/MM0G) No Passivation (MM2G) SiN (nitride)
Die finishing back side	(ED6F/MM0G) Ti-Ni-Au (MM2G) Ti-Ni_Ag
Die size	(ED6F) 2900 x 3780 um (MM0G) 2920 x 3960 um (MM2G) 2920 x 3980 um
Metal levels/Materials/Thicknesses	(ED6F) AlSi 4.5 um (MM0G/MM2G) AlSiCu 4.5 um

2.3.2. Assembly Plant information

Assembly Information	
Assembly Plant name / location	Tongfu – TFME (China) subcon
Package description	DPAK
Lead frame	TO252-3U
Die attach	SOFT SOLDER Pb/Ag/Sn 95.5/2.5/2
Wire bonding	Al 5 mils Al 10 mils
Molding compound	RESIN EME-G620A
Package Moisture Sensitivity Level (J-STD020D)	MSL1

2.3.3.Reliability testing information

Reliability Testing Information	
Reliability laboratory location	ST Catania

Note: ST is ISO 9001 certified. This induces certification of all internal and subcontractor labs.
ST certification document can be downloaded under the following link:
http://www.st.com/content/st_com/en/support/quality-and-reliability/certifications.html

3. TEST RESULTS SUMMARY

3.1. Lot Information

Lot #	Commercial Product	Diffusion Lot	Assy lot	comment
1	STD60NF06T4 (ED6F)	V6320JK3	GF328476	EHD2 Technology
2	STD40NF10 (MM0G)	V6310H93	GF328474	Planar Technology
3	STD20NF20 (MM2G)	V632112L	GF328475	Planar Technology

3.2. ACCELERATED ENVIRONMENT STRESS TESTS

Test	Reference	STM Test Conditions	Lots	S.S.	Total	Results FAIL/SS/Lots	Comments
PC	JEDEC/IPC J-STD-020 JESD22-A-113	MSL1 (168h@85C/85%RH) 3x Reflow simulation Peak Reflow Temp= 260°C	3	308	924	0/308/3	All parts before H^3TRB, AC, TC, IOL
H^3TRB	JESD22A-101	1000h @ Ta=85°C, RH=85% Vds=100V and 60V	3	77	231	0/77/3	1 lot / vehicle 100V for Planar 60V for EHD2
AC	JESD22 A-102	ES (Environmental Sequence) 100cy @ T= -55°C/+150°C 96h @ T= 121°C, 2atm, 100%RH	3	77	231	0/77/3	1 lot / vehicle
TC	JESD22A-104	1000cy @ Ta=-55°C /+150°C	3	77	231	0/77/3	1 lot / vehicle
IOL	MIL-STD-750 Method 1037	15Kcy / ΔTj ≥ 100°C	3	77	231	0/77/3	1 lot / vehicle

3.3. ACCELERATED LIFETIME SIMULATION TESTS

Test	Reference	STM Test Conditions	Lots	S.S.	Total	Results FAIL/SS/Lots	Comments
HTRB	JESD22A-108	1000h @ Tj= 175°C	-	-	-	-	Not applicable
HTGB	JESD22A-108	1000h @ Tj= 175°C	-	-	-	-	Not applicable

3.4. ELECTRICAL VERIFICATION TESTS

Test	Reference	STM Test Conditions	Lots	S.S.	Total	Results FAIL/SS/Lots	Comments
TEST	User specification or supplier's standard specification		3	308	924	0/308/3	
PV	All parameters according to user specification		-	-	-	-	Not applicable
External Visual	JESD22B-101	All devices submitted for testing	3	308	924	0/308/3	
ESDH	AEC-Q101-001	ESD HBM Characterization	-	-	-	-	Not applicable
ESDM	AEC-Q101-001	ESD CDM Characterization	-	-	-	-	Not applicable

4. REVISION HISTORY

Release	Date	Description
1.0	December 5th, 2024	Full plan covered

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