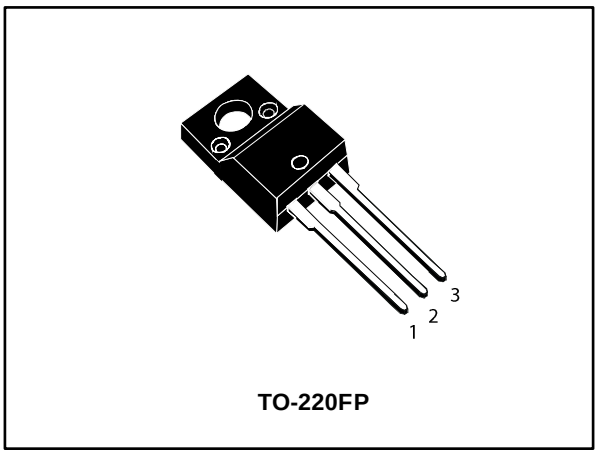
STF24N60DM2

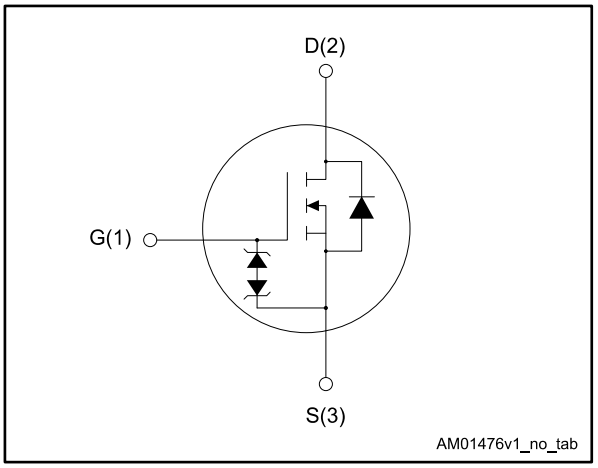
N-channel 600 V, 0.175 Ω typ., 18 A MDmesh™ DM2 Power MOSFET in a TO-220FP package

Datasheet - production data



TO-220FP

Figure 1: Internal schematic diagram



Features

Order code	V_{DS} @ T_{Jmax}	$R_{DS(on)}$ max.	I_D
STF24N60DM2	650 V	0.200 Ω	18 A

- 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
STF24N60DM2	24N60DM2	TO-220FP	Tube

Contents

1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	± 25	V
I_D(1)	Drain current (continuous) at T_C = 25 °C	18	A
	Drain current (continuous) at T_C= 100 °C	11	
I_{DM}(2)(1)	Drain current (pulsed)	72	A
P_{TOT}	Total dissipation at T_C = 25 °C	30	W
dv/dt(3)	Peak diode recovery voltage slope	40	V/ns
dv/dt(4)	MOSFET dv/dt ruggedness	50	
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s; T_C = 25 °C)	2500	V
T_{stg}	Storage temperature range	–55 to 150	°C
T_j	Max. operating junction temperature range		

Notes:

(1) Limited by package.

(2) Pulse width is limited by safe operating area.

(3) I_{SD} ≤ 18 A, di/dt ≤ 400 A/µS, $V_{DS(peak)}$ < $V_{(BR)DSS}$, V_{DD} = 400 V.

(4) V_{DS} ≤ 480 V.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case max.	4.2	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient max.	62.5	

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by T_{Jmax})	3.5	A
E_{AS}	Single pulse avalanche energy (starting T_J =25 °C, I_D = I_{AR}; V_{DD} = 50 V)	180	mJ

2 Electrical characteristics

(T_{case}= 25 °C unless otherwise specified)

Table 5: On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	V_{GS} = 0 V, I_D = 1 mA	600			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 600 V			1.5	µA
		V_{GS} = 0 V, V_{DS} = 600 V, T_C = 125 °C (1)			100	µA
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, V_{GS} = ±25 V			±10	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 9 A		0.175	0.200	Ω

Notes:

(1)Defined by design, not subject to production test.

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 100 V, f = 1 MHz, V_{GS} = 0 V	-	1055	-	pF
C_{oss}	Output capacitance		-	56	-	pF
C_{rss}	Reverse transfer capacitance		-	2.4	-	pF
$C_{oss\ eq.}$ (1)	Equivalent output capacitance	V_{DS} = 0 to 480 V, V_{GS} = 0 V	-	259	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz, I_D = 0 A	-	7	-	Ω
Q_g	Total gate charge	V_{DD} = 480 V, I_D = 18 A, V_{GS} = 10 V (see *Figure 15: "Test circuit for gate charge behavior"*)	-	29	-	nC
Q_{gs}	Gate-source charge		-	6	-	nC
Q_{gd}	Gate-drain charge		-	12	-	nC

Notes:

(1)$C_{oss\ eq.}$ is defined as a constant equivalent capacitance giving the same charging time as C_{OSS} when V_{DS} increases from 0 to 80% V_{DSS}.

Table 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 300 V, I_D = 9 A, R_G = 4.7 Ω, V_{GS} = 10 V (see *Figure 14: "Test circuit for resistive load switching times"* and *Figure 19: "Switching time waveform"*)	-	15	-	ns
t_r	Rise time		-	8.7	-	ns
$t_{d(off)}$	Turn-off-delay time		-	60	-	ns
t_f	Fall time		-	15	-	ns

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		18	A
I_{SDM} (1)	Source-drain current (pulsed)		-		72	A
V_{SD} (2)	Forward on voltage	V_{GS} = 0 V, I_{SD} = 18 A	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 18 A, di/dt = 100 A/µs, V_{DD} = 60 V (see *Figure 16: "Test circuit for inductive load switching and diode recovery times"*)	-	155		ns
Q_{rr}	Reverse recovery charge		-	956		nC
I_{RRM}	Reverse recovery current		-	12.5		A
t_{rr}	Reverse recovery time	I_{SD} = 18 A, di/dt = 100 A/µs, V_{DD} = 60 V, T_j = 150 °C (see *Figure 16: "Test circuit for inductive load switching and diode recovery times"*)	-	200		ns
Q_{rr}	Reverse recovery charge		-	1450		nC
I_{RRM}	Reverse recovery current		-	13		A

Notes:

(1) Pulse width is limited by safe operating area.

(2) Pulse test: pulse duration = 300 µs, duty cycle 1.5%.

2.1 Electrical characteristics (curves)

Figure 2: Safe operating area

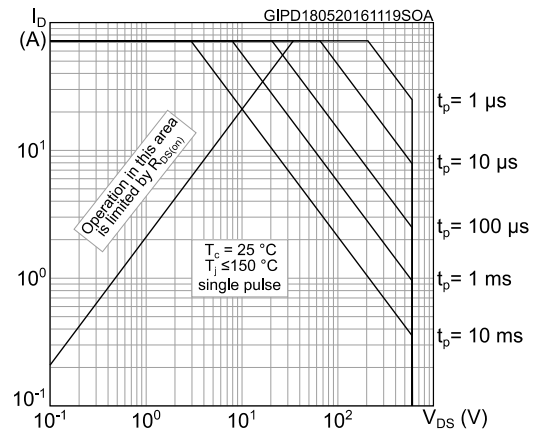


Figure 3: Thermal impedance

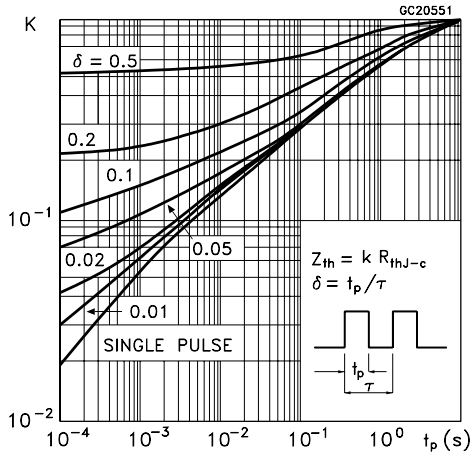


Figure 4: Output characteristics

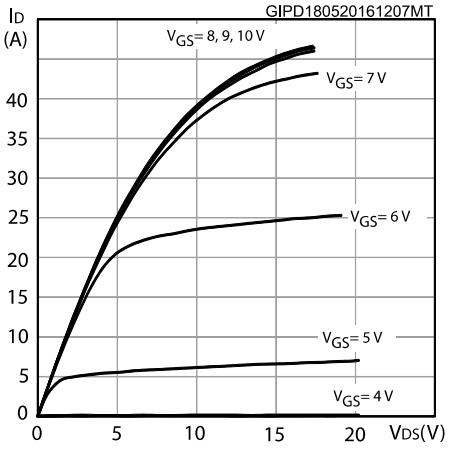


Figure 5: Transfer characteristics

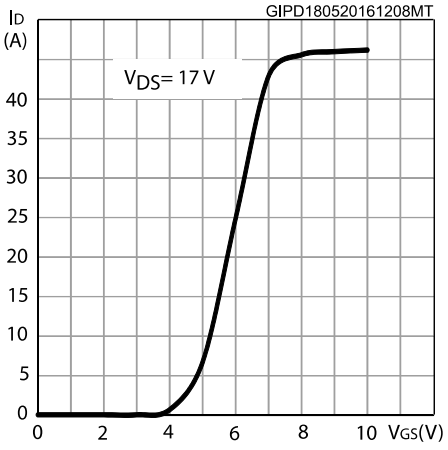


Figure 6: Gate charge vs gate-source voltage

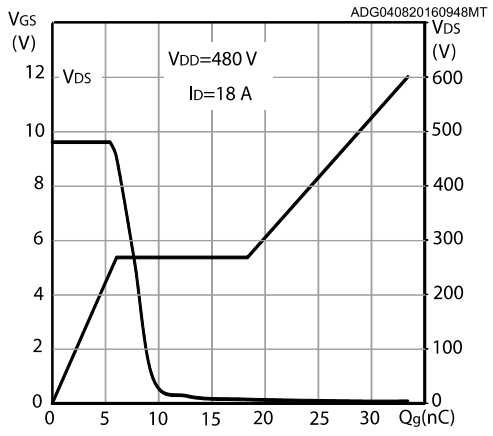


Figure 7: Static drain-source on-resistance

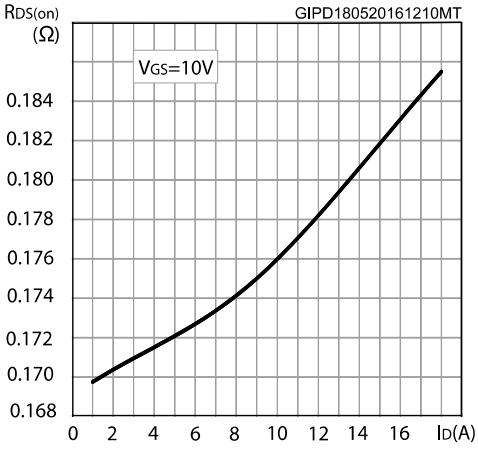


Figure 8: Capacitance variations

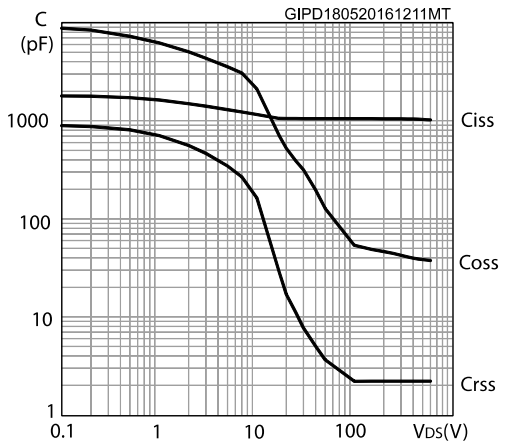


Figure 9: Output capacitance stored energy

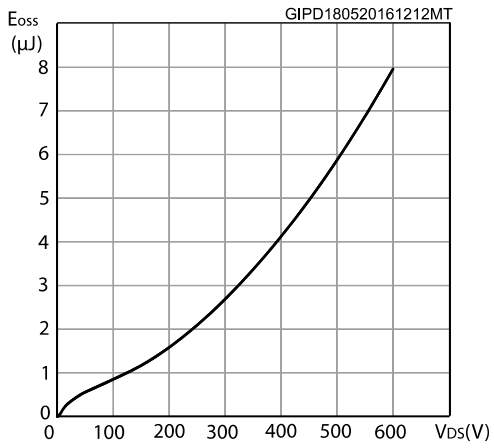


Figure 10: Normalized gate threshold voltage vs temperature

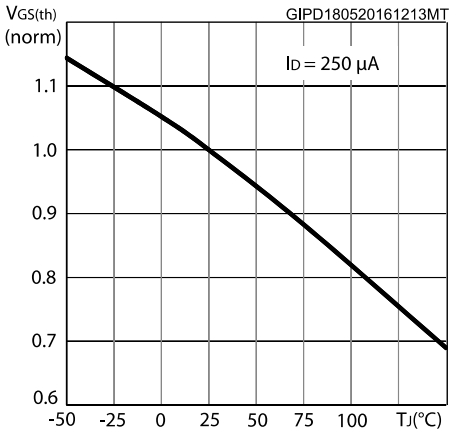


Figure 11: Normalized on-resistance vs temperature

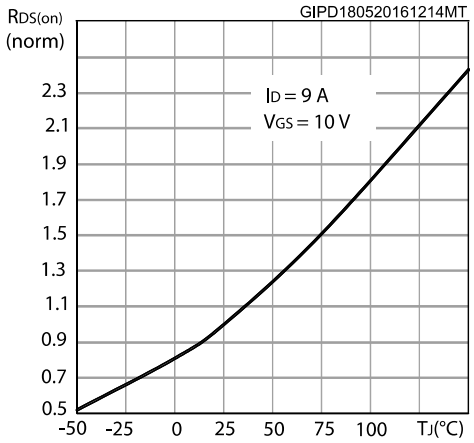


Figure 12: Source-drain diode forward characteristics

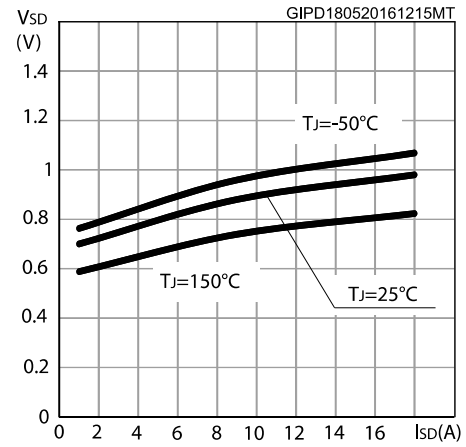
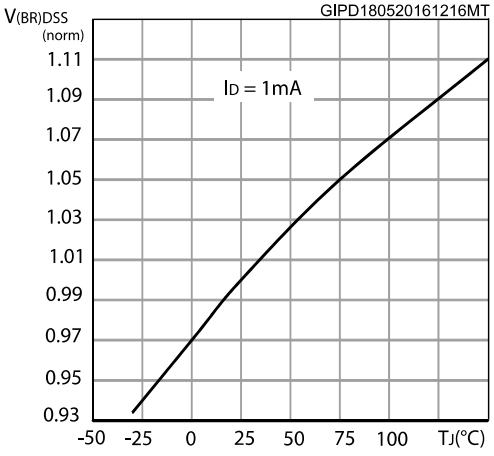


Figure 13: Normalized $V_{(BR)DSS}$ vs temperature



3 Test circuits

Figure 14: Test circuit for resistive load switching times

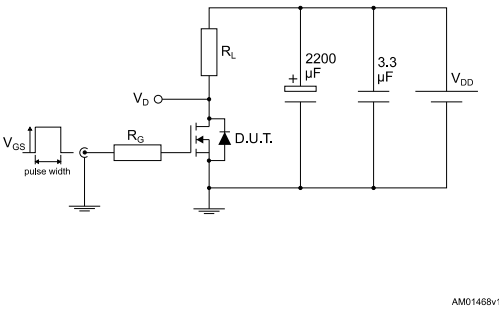


Figure 15: Test circuit for gate charge behavior

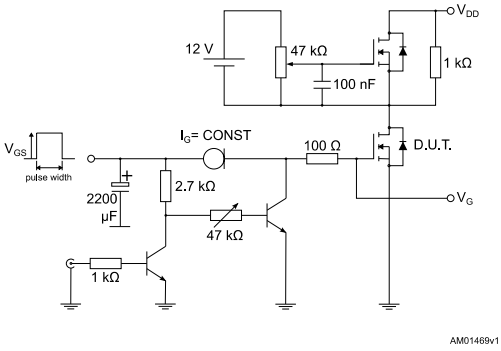


Figure 16: Test circuit for inductive load switching and diode recovery times

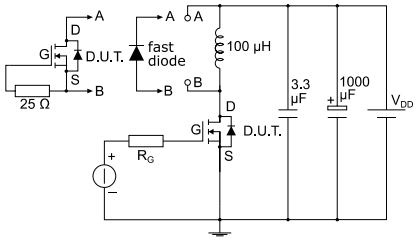


Figure 17: Unclamped inductive load test circuit

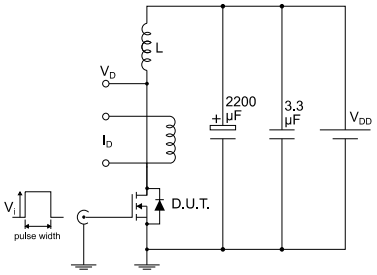


Figure 18: Unclamped inductive waveform

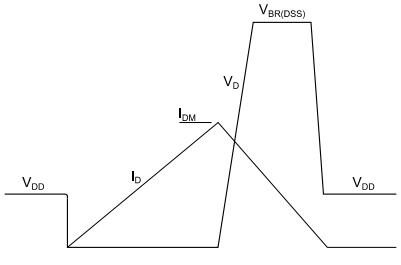
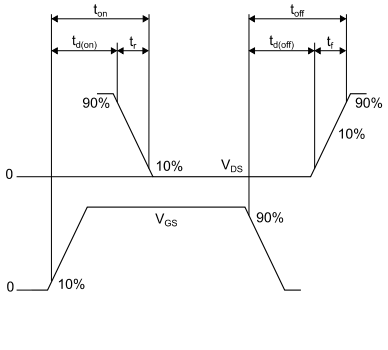


Figure 19: Switching time waveform



4 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: ***www.st.com***. ECOPACK® is an ST trademark.

4.1 TO-220FP package information

Figure 20: TO-220FP package outline

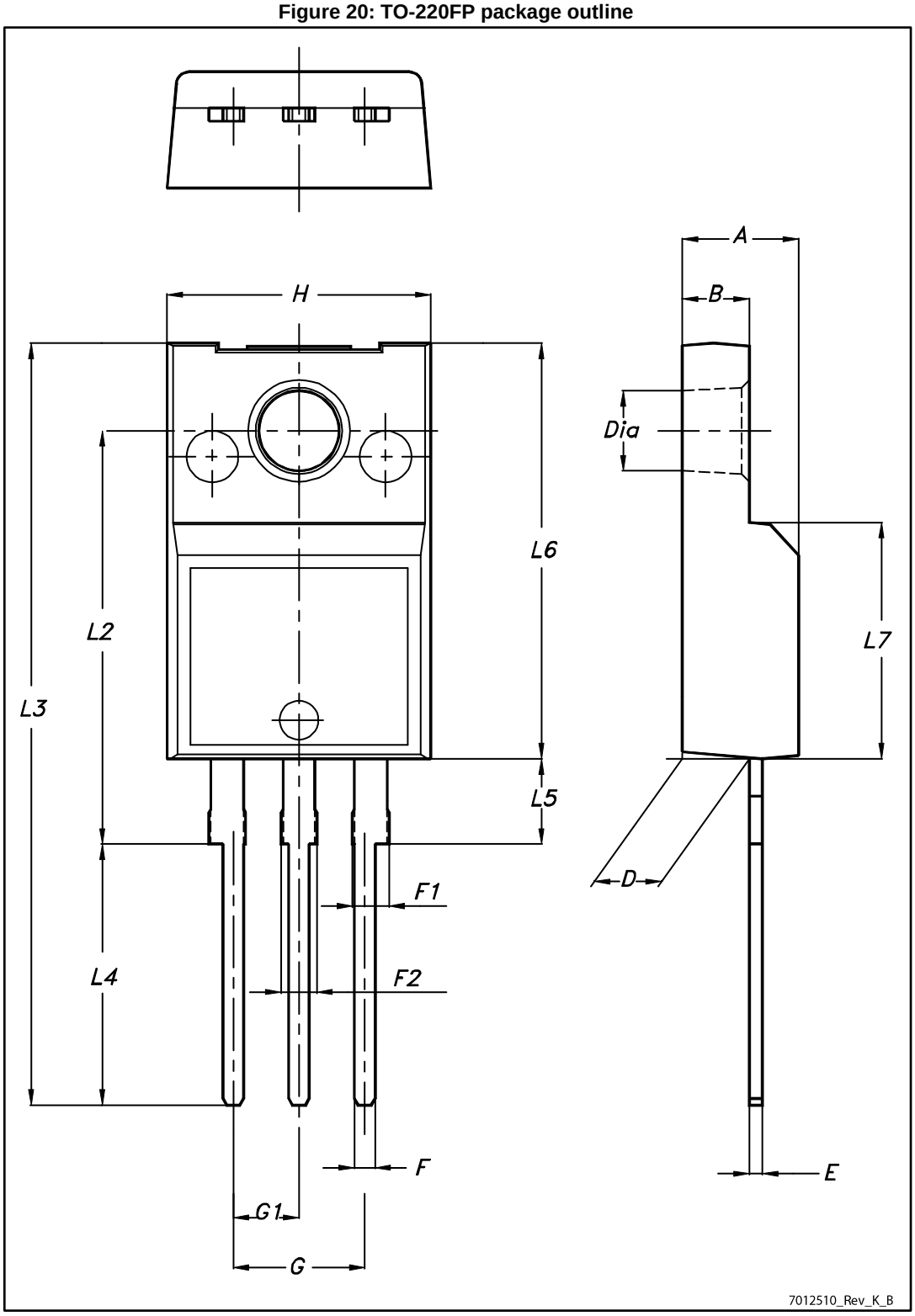


Table 9: TO-220FP package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.4		4.6
B	2.5		2.7
D	2.5		2.75
E	0.45		0.7
F	0.75		1
F1	1.15		1.70
F2	1.15		1.70
G	4.95		5.2
G1	2.4		2.7
H	10		10.4
L2		16	
L3	28.6		30.6
L4	9.8		10.6
L5	2.9		3.6
L6	15.9		16.4
L7	9		9.3
Dia	3		3.2

5 Revision history

Table 10: Document revision history

Date	Revision	Changes
12-Nov-2013	1	First release.
21-Jan-2014	2	– Modified: dv/dt value in Table 2 – Modified: I_{AR} value in Table 4 – Modified: I_{DSS} and $V_{GS(th)}$ in Table 5 – Minor text changes
03-Mar-2014	3	– Modified: Figure 1 – Modified: P_{TOT} value and note 1 in Table 2 – Modified: $R_{thj\text{-}case}$ value in Table 3 – Modified: I_{AR} value in Table 4 – Minor text changes
05-Mar-2015	4	– Document status promoted from preliminary to production data. – Updated title, features and description in cover page.
20-Sep-2016	5	Updated *Figure 2: "Safe operating area"*. Minor text changes

IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

X-ON Electronics

Largest Supplier of Electrical and Electronic Components

Click to view similar products for MOSFET ***category:***

Click to view products by STMicroelectronics ***manufacturer:***

Other Similar products are found below :

614233C 648584F IRFD120 JANTX2N5237 FCA20N60_F109 FDZ595PZ 2SK2545(Q,T) 405094E 423220D TPCC8103,L1Q(CM MIC4420CM-TR VN1206L SBVS138LT1G 614234A 715780A NTNS3166NZT5G SSM6J414TU,LF(T 751625C BUK954R8-60E NTE6400 SQJ402EP-T1-GE3 2SK2614(TE16L1,Q) 2N7002KW-FAI DMN1017UCP3-7 EFC2J004NUZTDG ECH8691-TL-W FCAB21350L1 P85W28HP2F-7071 DMN1053UCP4-7 NTE221 NTE2384 NTE2903 NTE2941 NTE2945 NTE2946 NTE2960 NTE2967 NTE2969 NTE2976 NTE455 NTE6400A NTE2910 NTE2916 NTE2956 NTE2911 DMN2080UCB4-7 TK10A80W,S4X(S SSM6P69NU,LF DMP22D4UFO-7B DMN1006UCA6-7