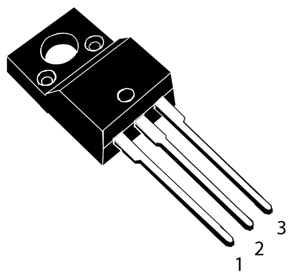
STF18N60DM2

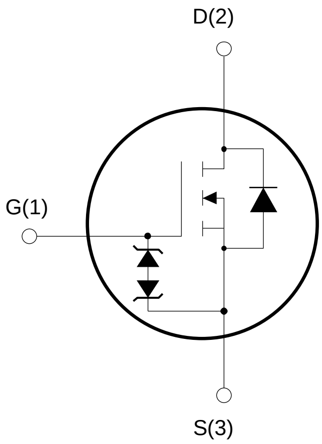
N-channel 600 V, 0.260 Ω typ., 13 A MDmesh™ DM2 Power MOSFET in a TO-220FP package

Datasheet - production data



TO-220FP

Figure 1: Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STF18N60DM2	600 V	0.295 Ω	13 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
STF18N60DM2	18N60DM2	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_{case} = 25 °C	13	A
	Drain current (continuous) at T_{case} = 100 °C	7.6	
I_{DM} (2)	Drain current (pulsed)	48	A
P_{TOT}	Total dissipation at T_{case} = 25 °C	25	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	Operating junction temperature range		

Notes:

(1) Limited by maximum junction temperature.

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

(3) I_{SD} ≤ 12 A, di/dt ≤ 400 A/µs, $V_{DS(peak)} < V_{(BR)DSS}$, V_{DD} = 80% $V_{(BR)DSS}$.

(4) V_{DS} ≤ 480 V.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	5	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient	62.5	

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR} (1)	Avalanche current, repetitive or not repetitive	2.5	A
E_{AR} (2)	Single pulse avalanche energy	380	mJ

Notes:

(1) Pulse width is limited by T_{jmax}.

(2) starting T_j = 25 °C, I_D = I_{AR}, V_{DD} = 50 V.

2 Electrical characteristics

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

Table 5: Static

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_{case} = 125 °C			100	
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 = 6 A		0.260	0.295	Ω

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	-	800	-	pF
C_{oss}	Output capacitance		-	40	-	
C_{rss}	Reverse transfer capacitance		-	1.33	-	
$C_{oss\ eq.}$ [(1)]	Equivalent output capacitance	V_{DS} = 0 to 480 V, f = 1 MHz, V_{GS} = 0 V	-	80	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz, I_D = 0 A	-	5.6	-	Ω
Q_g	Total gate charge	V_{DD} = 480 V, I_D = 12 A, V_{GS} = 10 V (see *Figure 15: "Test circuit for gate charge behavior"*)	-	20	-	nC
Q_{gs}	Gate-source charge		-	5.2	-	
Q_{gd}	Gate-drain charge		-	8.5	-	

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 = 6 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"*)	-	13.5	-	ns
t_r	Rise time		-	8	-	
$t_{d(off)}$	Turn-off-delay time		-	9.5	-	
t_f	Fall time		-	32.5	-	

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		12	A
I_{SDM}(1)	Source-drain current (pulsed)		-		48	A
V_{SD} (2)	Forward on voltage	V_{GS} = 0 V, I_{SD} = 12 A	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 12 A, di/dt = 100 A/µs, V_{DD} = 60 V (see *Figure 16: "Test circuit for inductive load switching and diode recovery times"*)	-	125		ns
Q_{rr}	Reverse recovery charge		-	675		nC
I_{RRM}	Reverse recovery current		-	11		A
t_{rr}	Reverse recovery time	I_{SD} = 12 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"*)	-	190		ns
Q_{rr}	Reverse recovery charge		-	1200		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

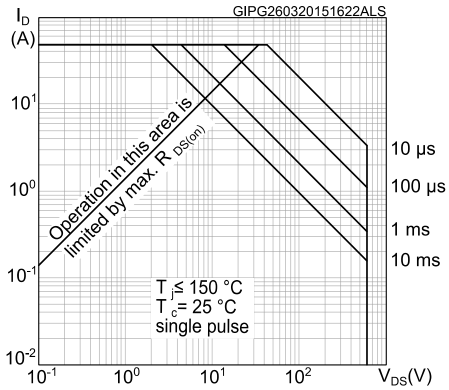


Figure 3: Thermal impedance

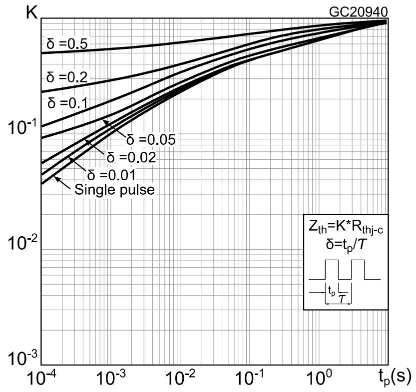


Figure 4: Output characteristics

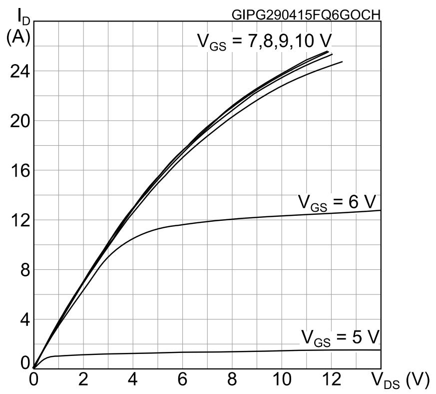


Figure 5: Transfer characteristics

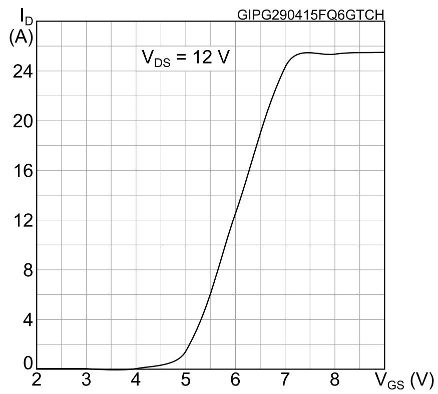


Figure 6: Gate charge vs gate-source voltage

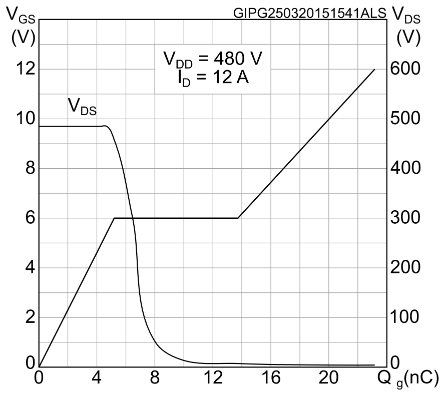


Figure 7: Static drain-source on-resistance

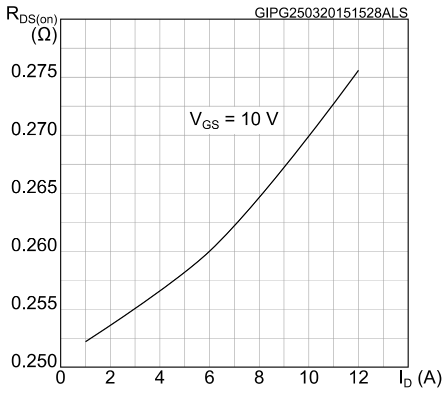


Figure 8: Capacitance variations

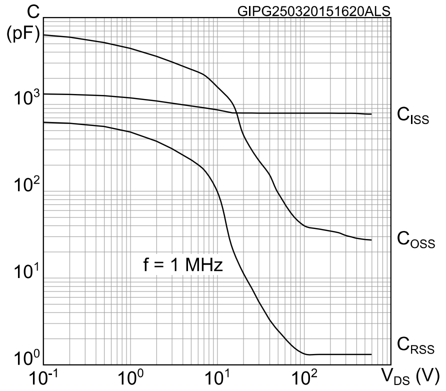


Figure 9: Normalized gate threshold voltage vs temperature

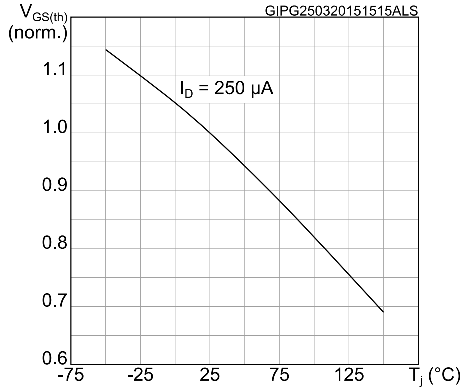


Figure 10: Normalized on-resistance vs temperature

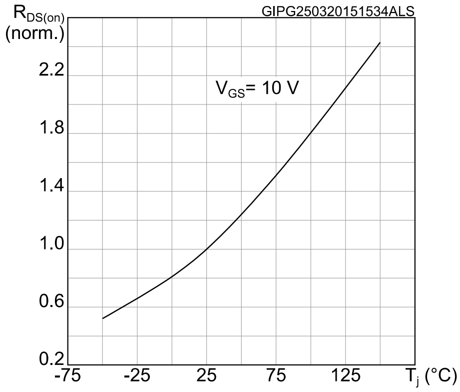


Figure 11: Normalized V(BR)DSS vs temperature

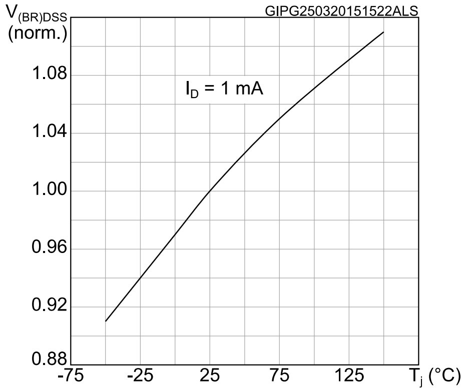


Figure 12: Source-drain diode forward characteristics

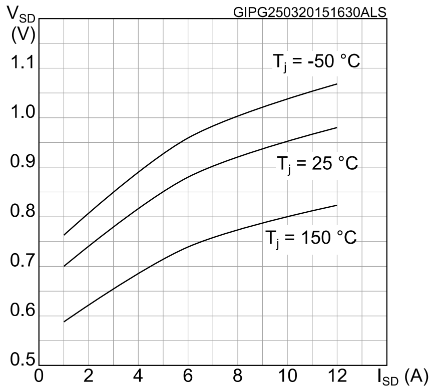
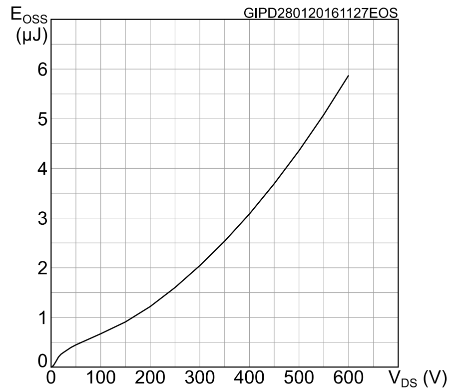


Figure 13: Output capacitance stored energy



3 Test circuits

Figure 14: Test circuit for resistive load switching times

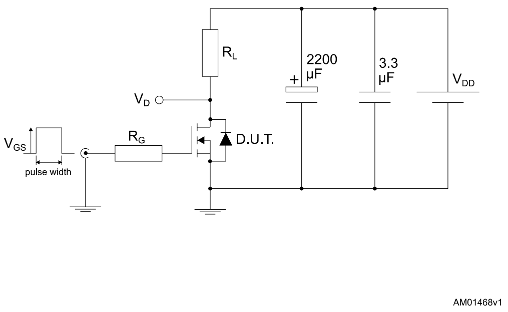


Figure 15: Test circuit for gate charge behavior

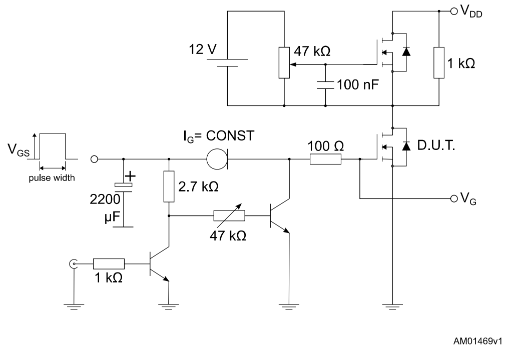


Figure 16: Test circuit for inductive load switching and diode recovery times

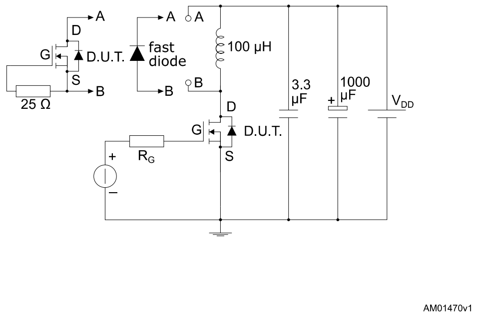


Figure 17: Unclamped inductive load test circuit

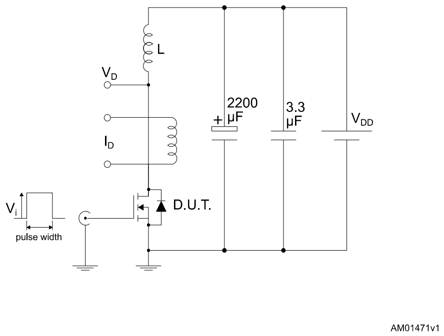


Figure 18: Unclamped inductive waveform

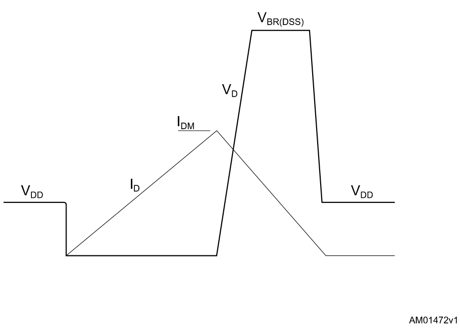
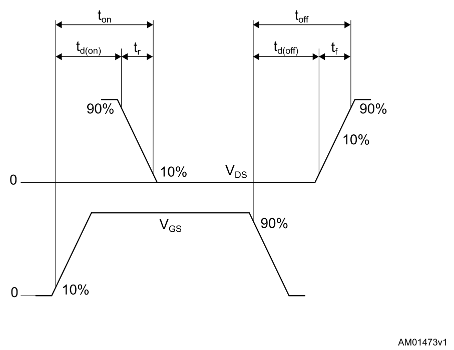


Figure 19: Switching time waveform



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

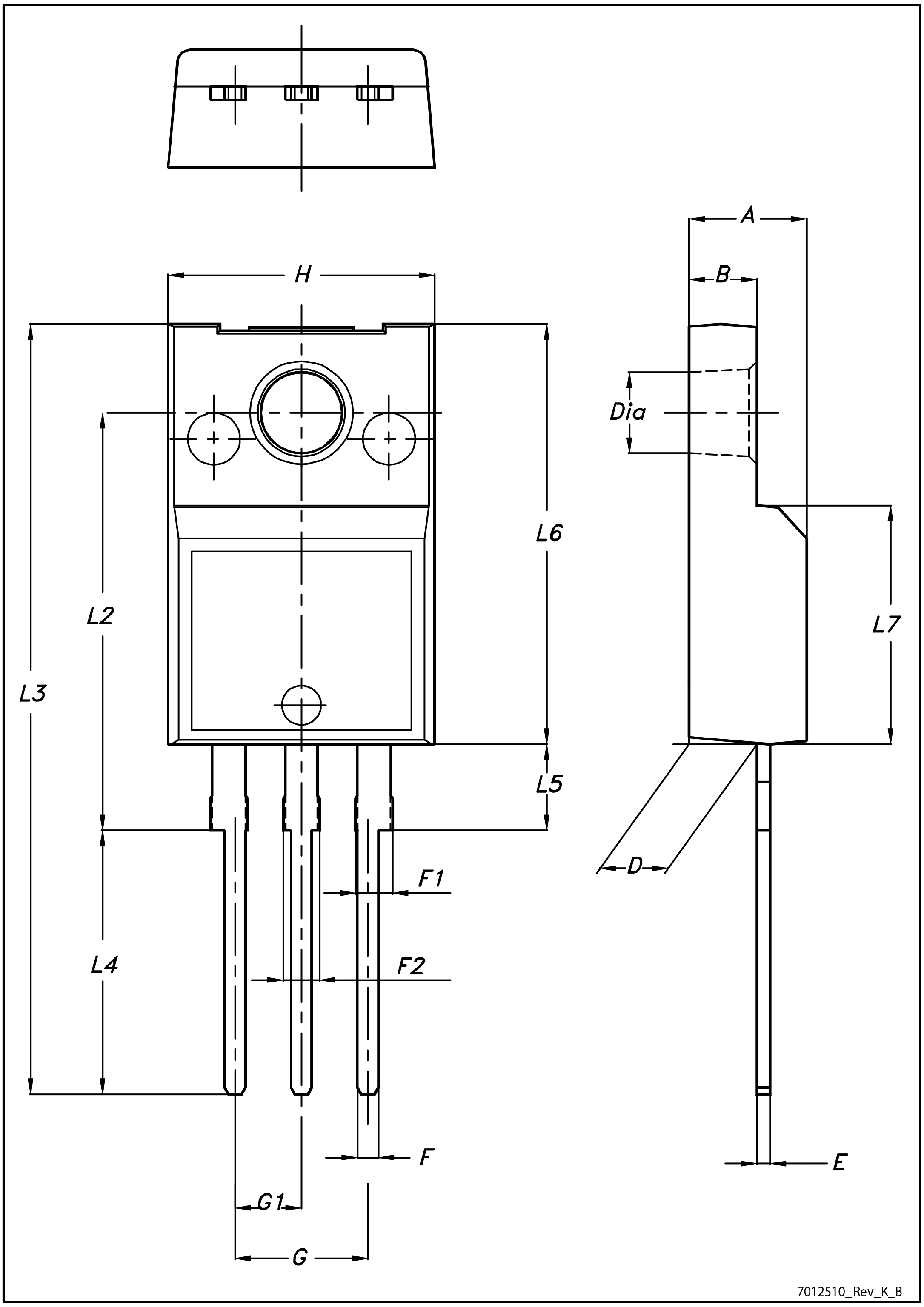


Table 9: TO-220FP package mechanical data

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
01-Apr-2015	1	First release.
21-May-2015	2	Text edits throughout document In Section 2.1 Electrical characteristics (curves): - updated Figure 4: Output characteristics - updated Figure 5: Transfer characteristics
02-Jul-2015	3	Updated title and I_D values in features and Table 1
28-Jan-2016	4	Updated *Section 2.1: "Electrical characteristics (curves)"*.