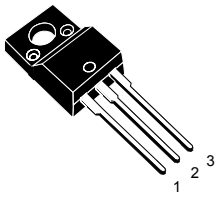
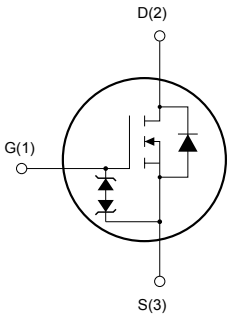
STF43N60DM2

Datasheet

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



TO-220FP



Features

Order code	V_{DS} @ T_J max.	$R_{DS(on)}$ max.	I_D	P_{TOT}
STF43N60DM2	650 V	0.093 Ω	34 A	40 W

- 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.

Product status links
STF43N60DM2

Product summary	
Order code	STF43N60DM2
Marking	43N60DM2
Package	TO-220FP
Packing	Tube

1 Electrical ratings

Table 1. 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	34	A
	Drain current (continuous) at T_{case}= 100 °C	21	
I_{DM} (2)	Drain current (pulsed)	136	
P_{TOT}	Total power dissipation at T_{case} = 25 °C	40	W
dv/dt (3)	Peak diode recovery voltage slope	50	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)	2.5	kV
T_{stg}	Storage temperature range	–55 to 150	°C
T_j	Operating junction temperature range		°C

1. *Limited by maximum junction temperature.*
2. *Pulse width is limited by safe operating area.*
3. *I_{SD} ≤ 34, di/dt ≤ 900 A/µs, $V_{DS(peak)}$ < $V_{(BR)DSS}$, V_{DD} = 400 V*
4. *V_{DS} ≤ 480 V*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	3.13	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	62.5	

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by T_{jmax})	6	A
E_{AR}	Single pulse avalanche energy (starting T_j = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	800	mJ

2 Electrical characteristics

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

Table 4. 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	µA
		V_{GS} = 0 V, V_{DS} = 600 V, T_{case} = 125 °C (1)			100	µA
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, V_{GS} = ±25 V			±5	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 = 17 A		0.085	0.093	Ω

1. *Defined by design, not subject to production test.*

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 100 V, f = 1 MHz, V_{GS} = 0 V	-	2500	-	pF
C_{oss}	Output capacitance		-	120	-	pF
C_{rss}	Reverse transfer capacitance		-	3	-	pF
$C_{oss\ eq.}$ (1)	Equivalent output capacitance	V_{DS} = 0 to 480 V, f = 1 MHz, V_{GS} = 0 V	-	200	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz, I_D=0 A	-	4	-	Ω
Q_g	Total gate charge	V_{DD} = 480 V, I_D = 34 A, V_{GS} = 0 to 10 V (see Figure 14. Test circuit for gate charge behavior)	-	56	-	nC
Q_{gs}	Gate-source charge		-	13	-	nC
Q_{gd}	Gate-drain charge		-	30	-	nC

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 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 300 V, I_D = 25 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 13. Test circuit for resistive load switching times and Figure 18. Switching time waveform)	-	29	-	ns
t_r	Rise time		-	27	-	ns
$t_{d(off)}$	Turn-off delay time		-	85	-	ns
t_f	Fall time		-	6	-	ns

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} (1)	Source-drain current		-		34	A
I_{SDM} (2)	Source-drain current (pulsed)		-		136	A
V_{SD} (3)	Forward on voltage	V_{GS} = 0 V, I_{SD} = 34 A	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 34 A, di/dt = 100 A/µs, V_{DD} = 60 V (see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	120		ns
Q_{rr}	Reverse recovery charge		-	0.6		µC
I_{RRM}	Reverse recovery current		-	10.4		A
t_{rr}	Reverse recovery time	I_{SD} = 34 A, di/dt = 100 A/µs, V_{DD} = 60 V, T_j = 150 °C (see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	240		ns
Q_{rr}	Reverse recovery charge		-	2.4		µC
I_{RRM}	Reverse recovery current		-	20.5		A

1. *Limited by maximum junction temperature.*
2. *Pulse width is limited by safe operating area.*
3. *Pulse test: pulse duration = 300 µs, duty cycle 1.5%.*

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

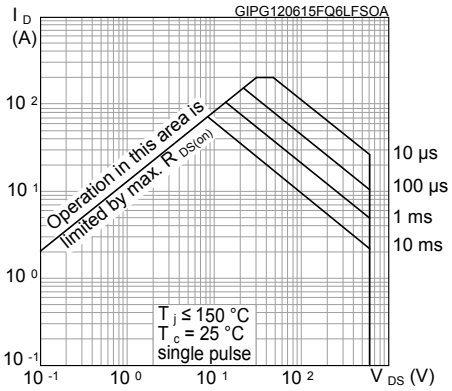


Figure 2. Thermal impedance

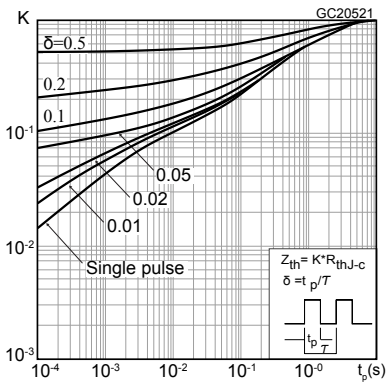


Figure 3. Output characteristics

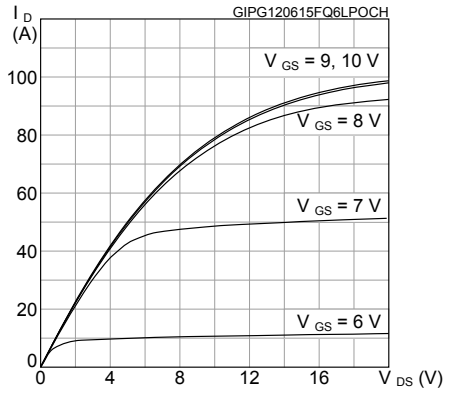


Figure 4. Transfer characteristics

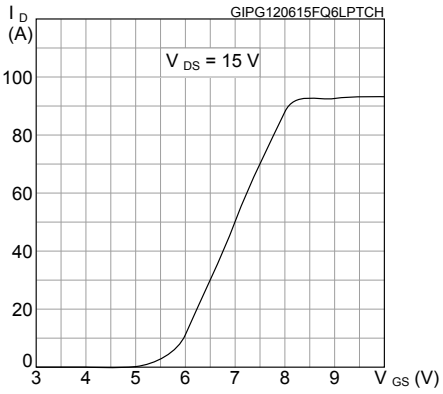


Figure 5. Gate charge vs gate-source voltage

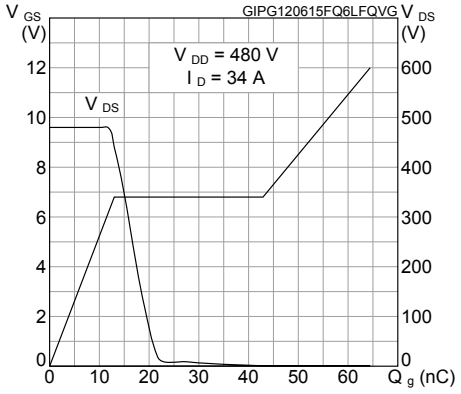


Figure 6. Static drain-source on-resistance

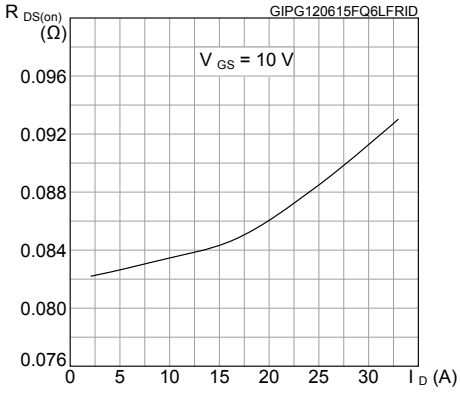


Figure 7. Capacitance variations

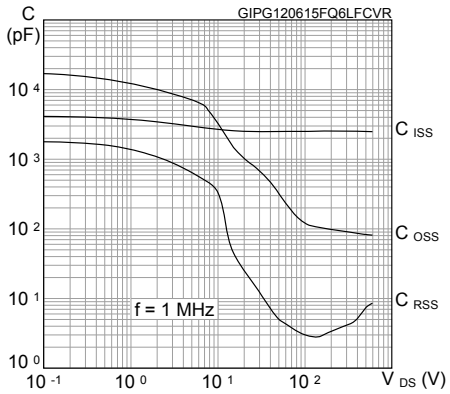


Figure 8. Normalized gate threshold voltage vs temperature

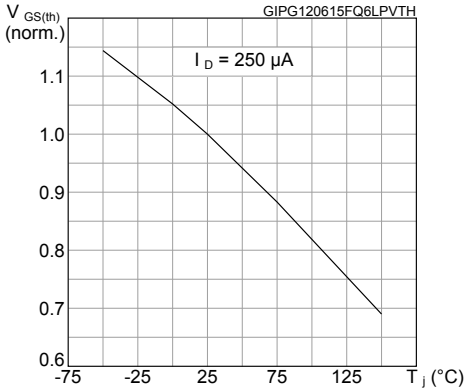


Figure 9. Normalized on-resistance vs temperature

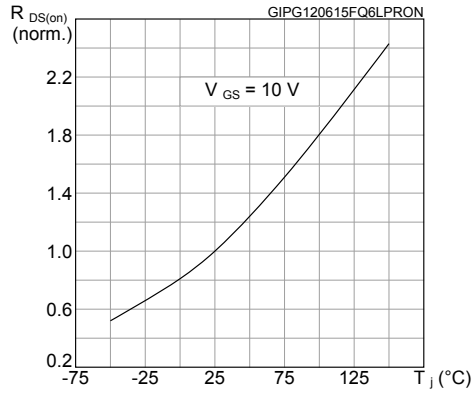


Figure 10. Normalized $V_{(BR)DSS}$ vs temperature

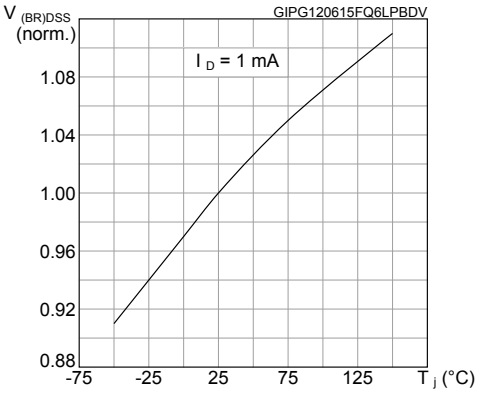


Figure 11. Output capacitance stored energy

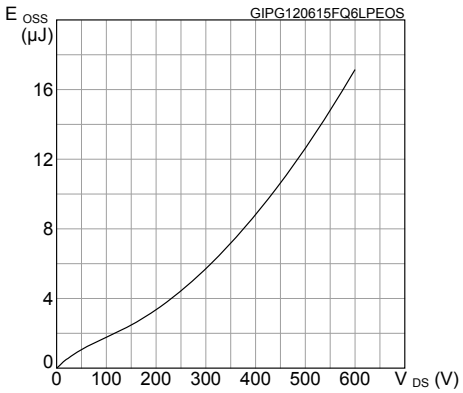
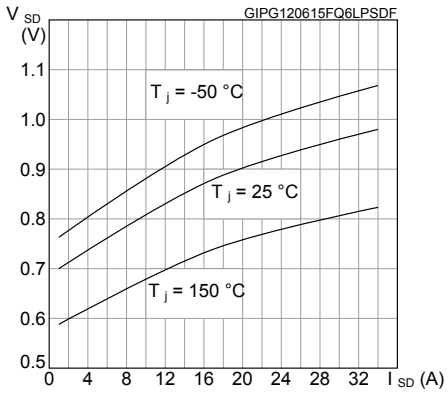


Figure 12. Source- drain diode forward characteristics



3 Test circuits

Figure 13. Test circuit for resistive load switching times

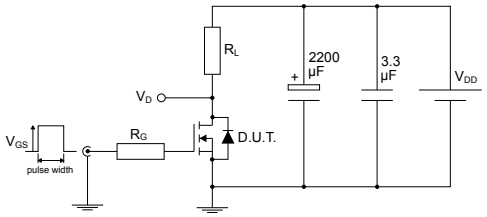


Figure 14. Test circuit for gate charge behavior

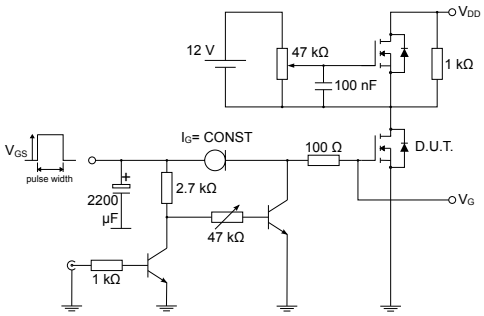


Figure 15. Test circuit for inductive load switching and diode recovery times

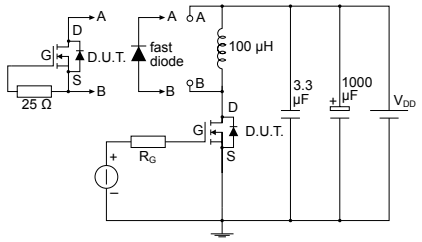


Figure 16. Unclamped inductive load test circuit

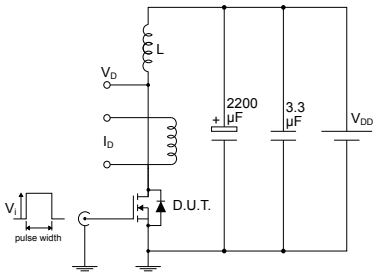


Figure 17. Unclamped inductive waveform

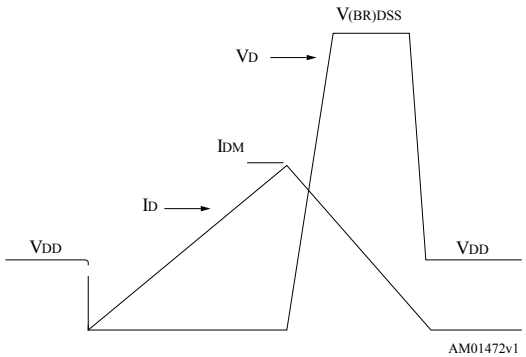
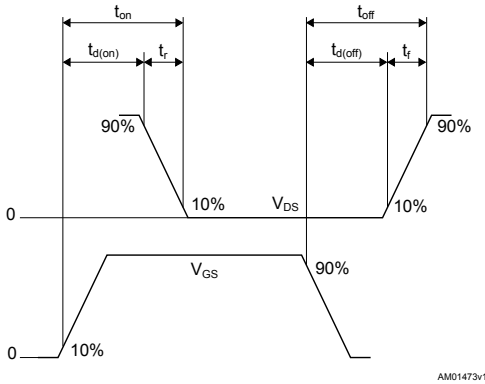


Figure 18. Switching time waveform



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 19. **TO-220FP package outline**

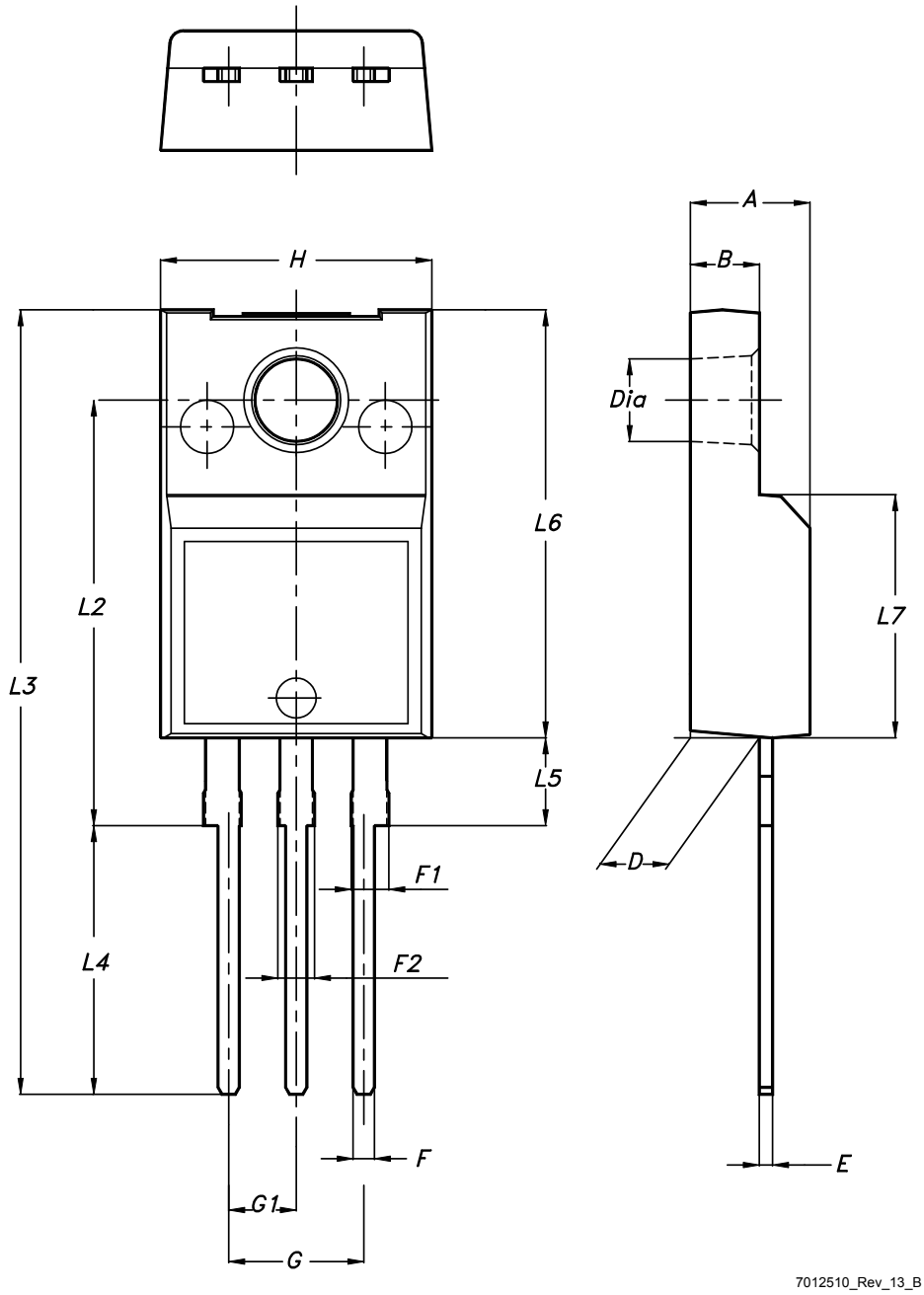


Table 8. **TO-220FP package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
B	2.50		2.70
D	2.50		2.75
E	0.45		0.70
F	0.75		1.00
F1	1.15		1.70
F2	1.15		1.70
G	4.95		5.20
G1	2.40		2.70
H	10.00		10.40
L2		16.00	
L3	28.60		30.60
L4	9.80		10.60
L5	2.90		3.60
L6	15.90		16.40
L7	9.00		9.30
Dia	3.00		3.20

Revision history

Table 9. **Document revision history**

Date	Revision	Changes
06-Aug-2014	1	First release.
01-Jul-2015	2	Text and formatting changes throughout document Datasheet promoted from preliminary data to production data On cover page: - updated *title description* - updated *features table* In Section Electrical ratings: - updated *Table Absolute maximum ratings* - updated *Table Thermal data* - updated *Table Avalanche characteristics* In *Section Electrical characteristics*: - updated and renamed *Table Static (was On/off states)* - updated *Table Dynamic* - updated *Table Switching times* - updated *Table Source-drain diode* Added *Section 2.1 Electrical characteristics (curves)*
22-Aug-2019	3	Modified Table 2. Thermal data. Minor text changes.

Contents