

N-channel 600 V, 0.55 Ω typ., 7.5 A MDmesh™ M2 Power MOSFET in a TO-220FP wide creepage package

Datasheet - production data

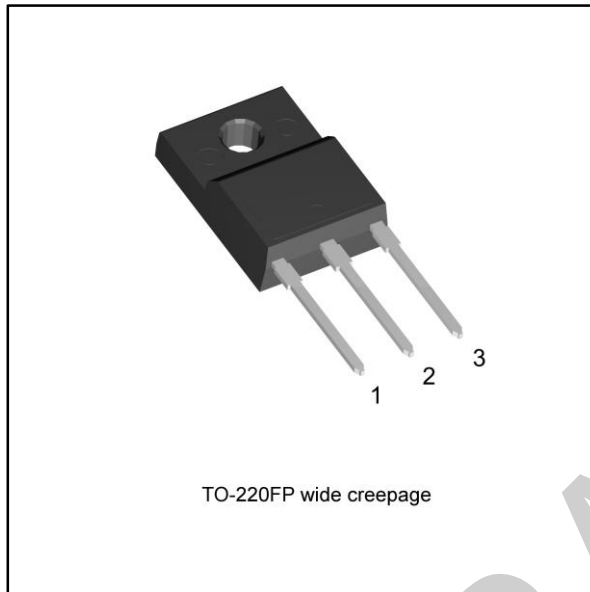
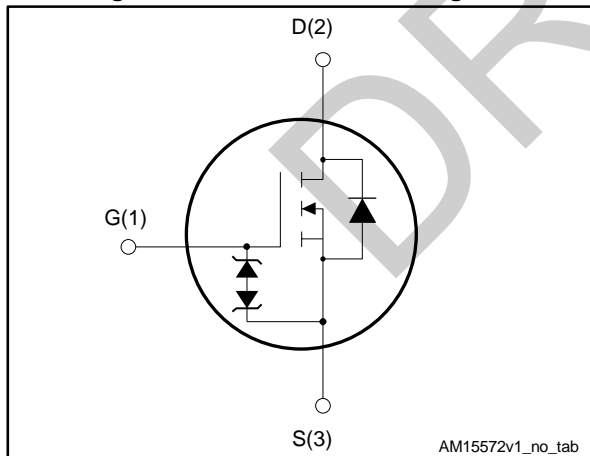


Figure 1: Internal schematic diagram



Features

Order code	V _{DS} @ T _{Jmax}	R _{DS(on)} max	I _D
STFH10N60M2	650 V	0.60 Ω	7.5 A

- Extremely low gate charge
- Excellent output capacitance (C_{oss}) profile
- 100% avalanche tested
- Zener-protected
- Wide creepage distance of 4.25 mm between the pins

Applications

- Switching applications
- LLC converters, resonant converters

Description

This device is an N-channel Power MOSFET developed using MDmesh™ M2 technology. Thanks to its strip layout and an improved vertical structure, the device exhibits low on-resistance and optimized switching characteristics, rendering it suitable for the most demanding high efficiency converters.

The TO-220FP wide creepage package provides increased surface insulation for Power MOSFETs to prevent failure due to arcing, which can occur in polluted environments.

Table 1: Device summary

Order code	Marking	Package	Packing
STFH10N60M2	10N60M2	TO-220FP wide creepage	Tube

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1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	± 25	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	7.5 ⁽¹⁾	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	4.9 ⁽¹⁾	A
I_{DM} ⁽²⁾	Drain current (pulsed)	30 ⁽¹⁾	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	25	W
dv/dt ⁽³⁾	Peak diode recovery voltage slope	15	V/ns
dv/dt ⁽⁴⁾	MOSFET dv/dt ruggedness	50	V/ns
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink ($t = 1\text{ s}$; $T_C = 25\text{ }^\circ\text{C}$)	2500	V
T_{stg}	Storage temperature range	- 55 to 150	$^\circ\text{C}$
T_j	Operating junction temperature range		

Notes:

⁽¹⁾Limited by maximum junction temperature.

⁽²⁾Pulse width limited by safe operating area.

⁽³⁾ $I_{SD} \leq 7.5\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$; $V_{DSpeak} < V_{(BR)DSS}$, $V_{DD} = 400\text{ V}$

⁽⁴⁾ $V_{DS} \leq 480\text{ V}$

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	5	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	62.5	$^\circ\text{C}/\text{W}$

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by T_{jmax})	2.5	A
E_{AS}	Single pulse avalanche energy (starting $T_j=25\text{ }^\circ\text{C}$, $I_D = I_{AR}$; $V_{DD}=50\text{ V}$)	110	mJ

2 Electrical characteristics

($T_C = 25\text{ °C}$ unless otherwise specified)

Table 5: On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0, I_D = 1\text{ mA}$	600			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0, V_{DS} = 600\text{ V}$			1	μA
		$V_{GS} = 0, V_{DS} = 600\text{ V}, T_C = 125\text{ °C}$ ⁽¹⁾			100	μA
I_{GSS}	Gate-body leakage current	$V_{DS} = 0, V_{GS} = \pm 25\text{ V}$			± 10	μA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}, I_D = 3\text{ A}$		0.55	0.60	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	$V_{DS} = 100\text{ V}, f = 1\text{ MHz}, V_{GS} = 0\text{ V}$	-	400	-	pF
C_{oss}	Output capacitance		-	22	-	pF
C_{rss}	Reverse transfer capacitance		-	0.84	-	pF
$C_{oss\text{ eq.}}^{(1)}$	Equivalent output capacitance	$V_{DS} = 0\text{ to }480\text{ V}, V_{GS} = 0\text{ V}$	-	83	-	pF
R_G	Intrinsic gate resistance	$f = 1\text{ MHz}, I_D = 0\text{ A}$	-	6.4	-	Ω
Q_g	Total gate charge	$V_{DD} = 480\text{ V}, I_D = 7.5\text{ A}, V_{GS} = 10\text{ V}$ (see Figure 15: "Test circuit for gate charge behavior")	-	13.5	-	nC
Q_{gs}	Gate-source charge		-	2.1	-	nC
Q_{gd}	Gate-drain charge		-	7.2	-	nC

Notes:

⁽¹⁾ $C_{oss\text{ eq.}}$ 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	$V_{DD} = 300\text{ V}, I_D = 3.75\text{ A}, R_G = 4.7\text{ }\Omega, V_{GS} = 10\text{ V}$ (see Figure 14: "Test circuit for resistive load switching times" and Figure 19: "Switching time waveform")	-	8.8	-	ns
t_r	Rise time		-	8	-	ns
$t_{d(off)}$	Turn-off delay time		-	32.5	-	ns
t_f	Fall time		-	13.2	-	ns

Table 8: Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}^{(1)}$	Source-drain current		-		7.5	A
$I_{SDM}^{(1)(2)}$	Source-drain current (pulsed)		-		30	A
$V_{SD}^{(3)}$	Forward on voltage	$I_{SD} = 7.5 \text{ A}$, $V_{GS} = 0 \text{ V}$	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 7.5 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 60 \text{ V}$ (see Figure 16: "Test circuit for inductive load switching and diode recovery times")	-	270		ns
Q_{rr}	Reverse recovery charge		-	2		μC
I_{RRM}	Reverse recovery current		-	14.4		A
t_{rr}	Reverse recovery time	$I_{SD} = 7.5 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 60 \text{ V}$, $T_j = 150 \text{ }^\circ\text{C}$ (see Figure 16: "Test circuit for inductive load switching and diode recovery times")	-	376		ns
Q_{rr}	Reverse recovery charge		-	2.8		μC
I_{RRM}	Reverse recovery current		-	15		A

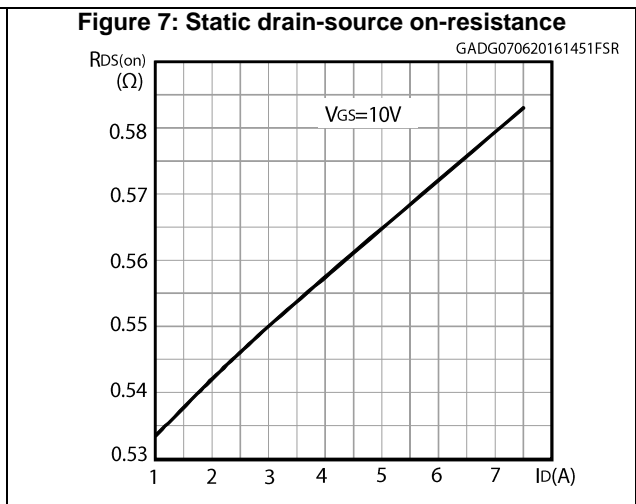
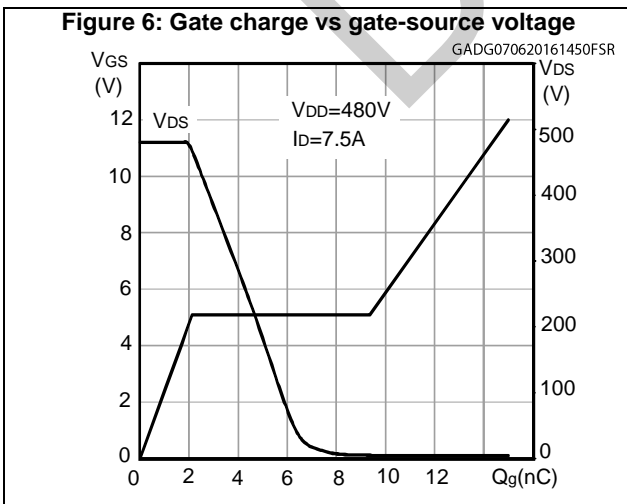
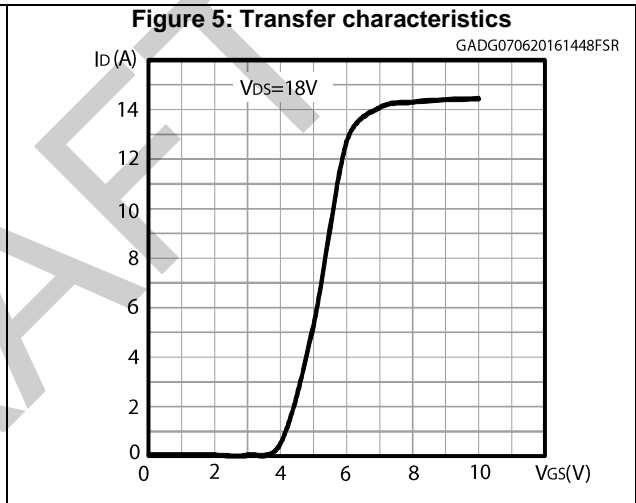
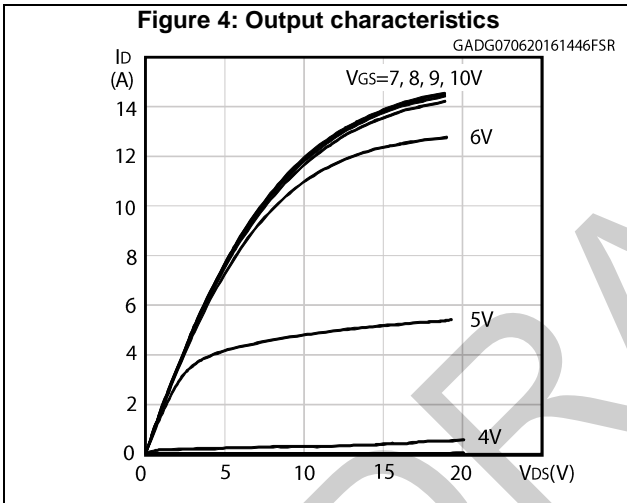
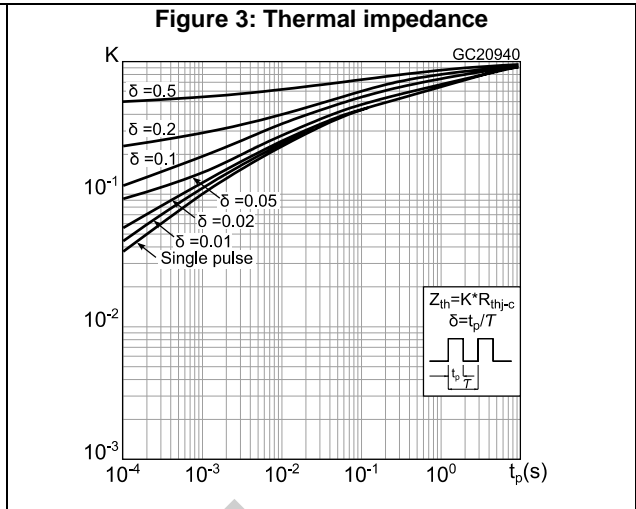
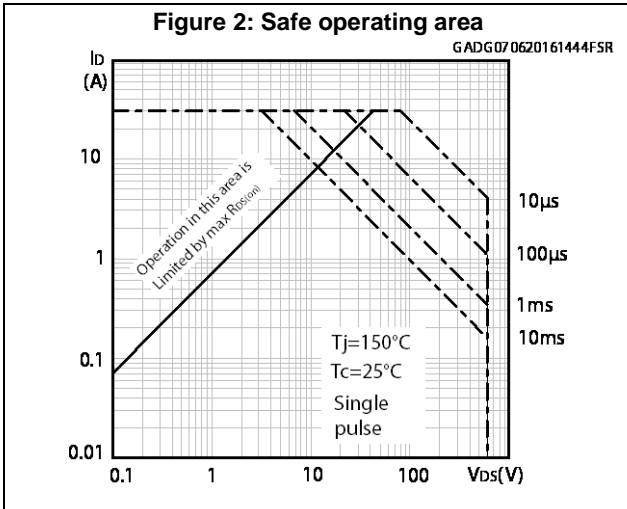
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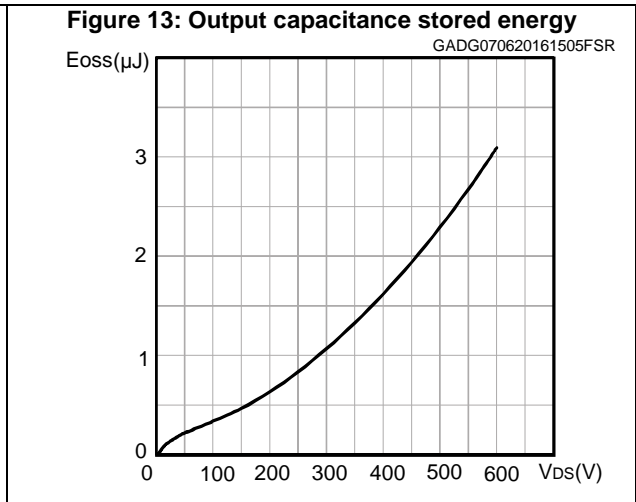
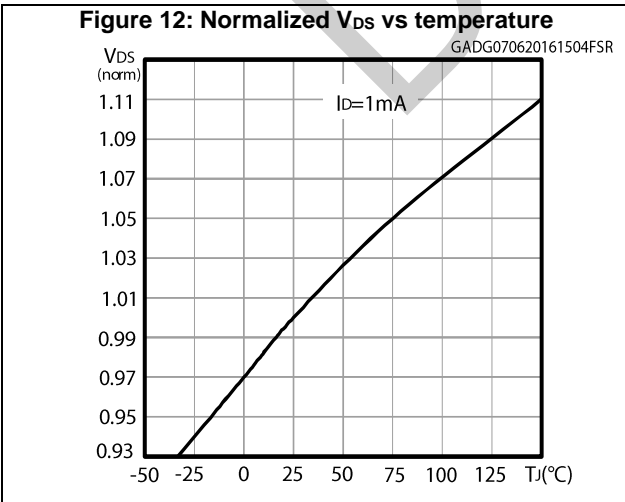
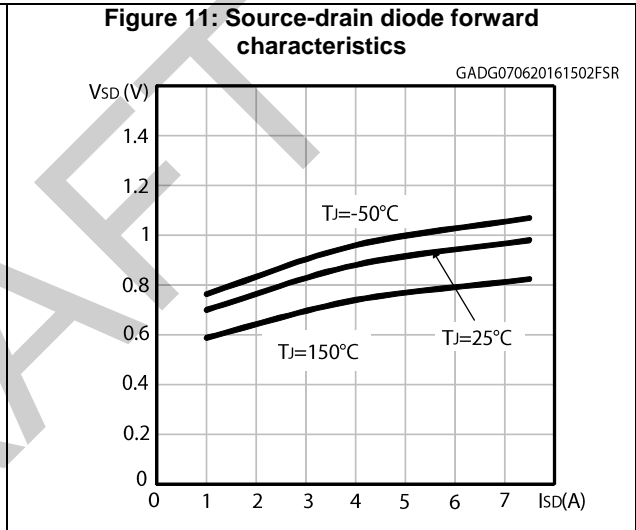
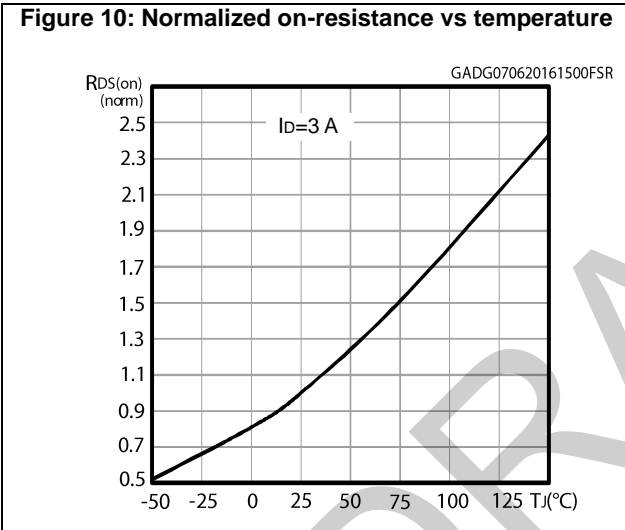
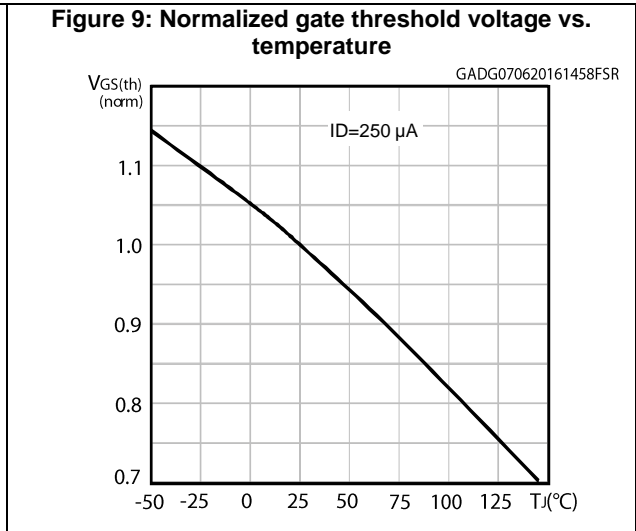
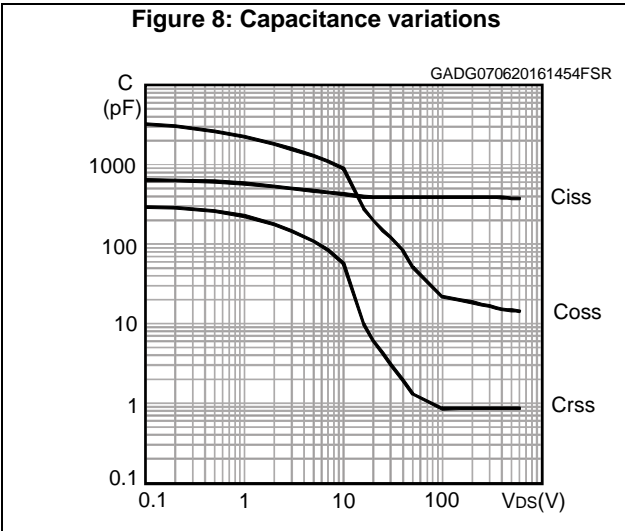
(1)Limited by maximum junction temperature.

(2)Pulse width limited by safe operating area.

(3)Pulsed: pulse duration = 300 μs , duty cycle 1.5%.

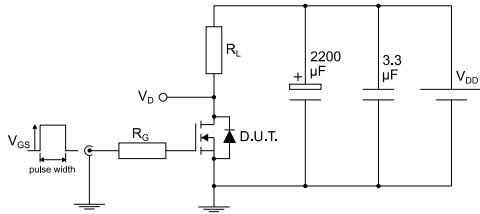
2.2 Electrical characteristics (curves)





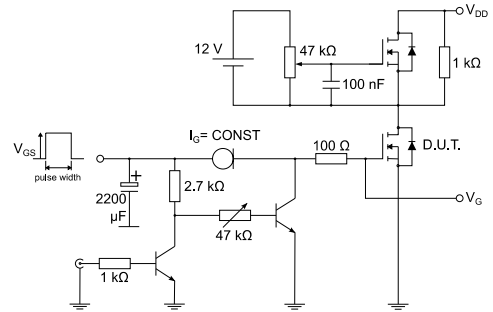
3 Test circuits

Figure 14: Test circuit for resistive load switching times



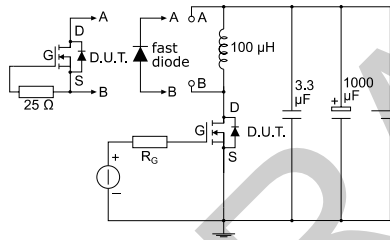
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Figure 15: Test circuit for gate charge behavior



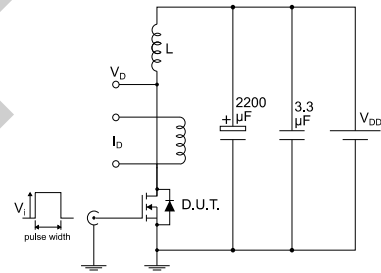
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Figure 16: Test circuit for inductive load switching and diode recovery times



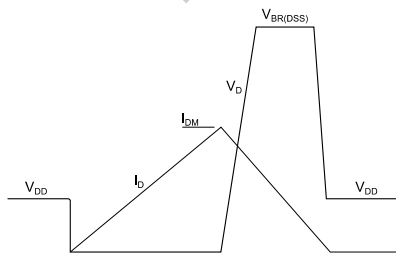
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Figure 17: Unclamped inductive load test circuit



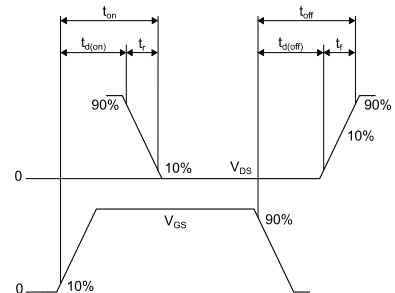
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Figure 18: Unclamped inductive waveform



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Figure 19: Switching time waveform



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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 wide creepage package information

Figure 20: TO-220FP wide creepage package outline

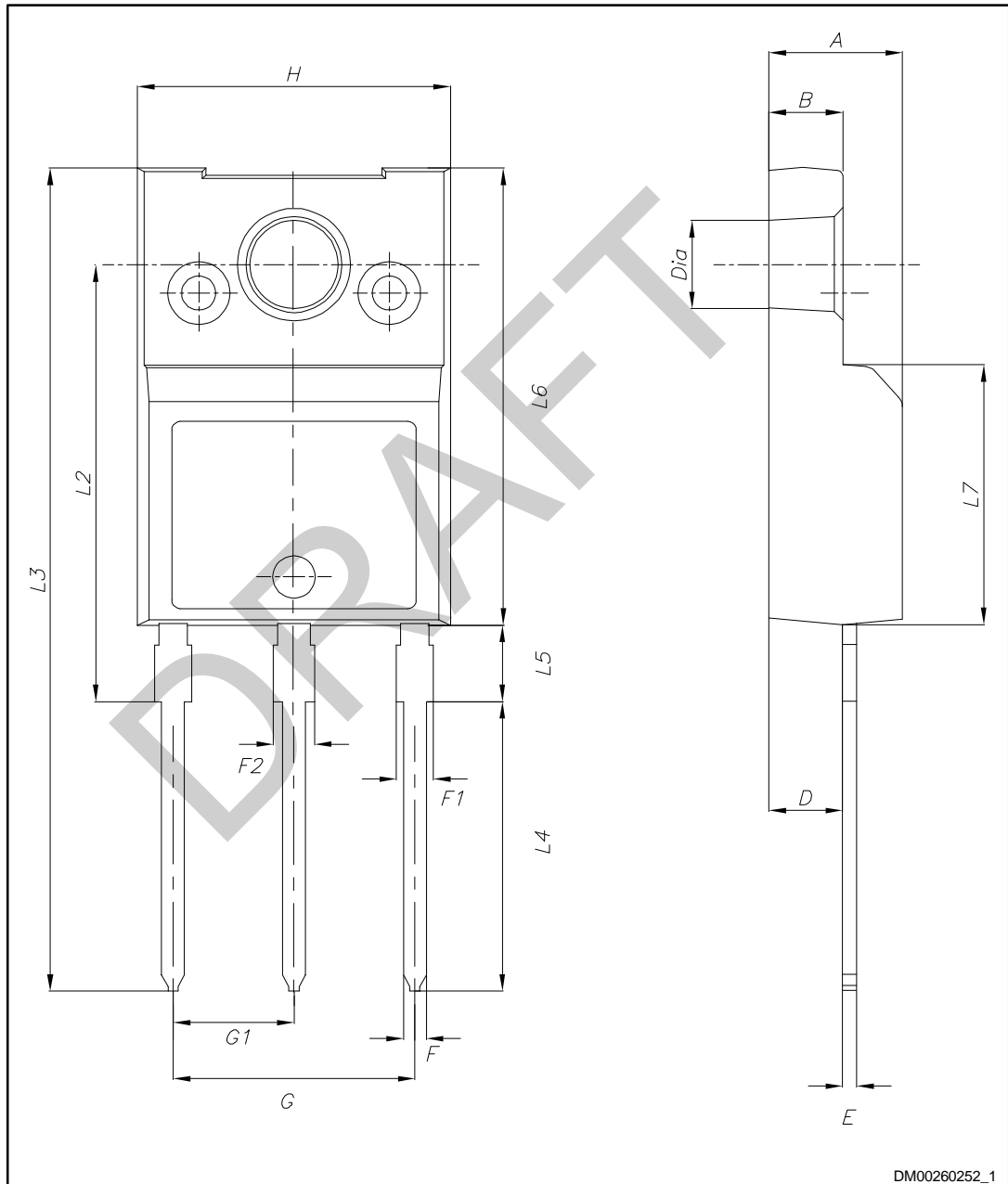


Table 9: TO-220FP wide creepage package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.60	4.70	4.80
B	2.50	2.60	2.70
D	2.49	2.59	2.69
E	0.46		0.59
F	0.76		0.89
F1	0.96		1.25
F2	1.11		1.40
G	8.40	8.50	8.60
G1	4.15	4.25	4.35
H	10.90	11.00	11.10
L2	15.25	15.40	15.55
L3	28.70	29.00	29.30
L4	10.00	10.20	10.40
L5	2.55	2.70	2.85
L6	16.00	16.10	16.20
L7	9.05	9.15	9.25
Dia	3.00	3.10	3.20

5 Revision history

Table 10: Document revision history

Date	Revision	Changes
07-Jun-2016	1	First release.
16-Jun-2016	2	Document status promoted from preliminary data to production data. Minor text changes.
18-Aug-2016	3	Modified: title and $R_{DS(on)}$ in cover page Modified: Table 5: "On /off states" and Table 7: "Switching times" Minor text changes

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