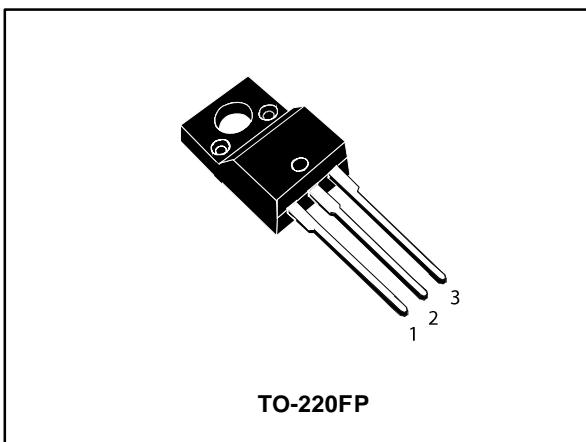
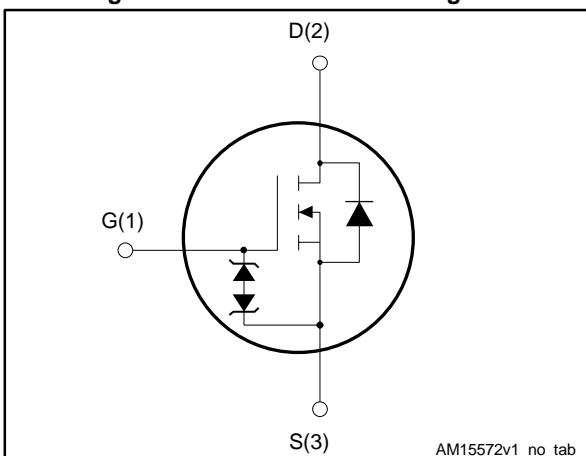


## N-channel 600 V, 0.260 $\Omega$ typ., 13 A MDmesh™ DM2 Power MOSFET in a TO-220FP package

Datasheet - production data



**Figure 1: Internal schematic diagram**



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>
STF18N60DM2	600 V	0.295 $\Omega$	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

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# 1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
$V_{GS}$	Gate-source voltage	$\pm 25$	V
$I_D^{(1)}$	Drain current (continuous) at $T_{case} = 25^\circ\text{C}$	13	A
	Drain current (continuous) at $T_{case} = 100^\circ\text{C}$	7.6	
$I_{DM}^{(2)}$	Drain current (pulsed)	48	A
$P_{TOT}$	Total dissipation at $T_{case} = 25^\circ\text{C}$	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 ( $t = 1\text{ s}$ ; $T_C = 25^\circ\text{C}$ )	2500	V
$T_{stg}$	Storage temperature range	−55 to 150	$^\circ\text{C}$
$T_j$	Operating junction temperature range		

**Notes:**

(<sup>1</sup>) Limited by maximum junction temperature.

(<sup>2</sup>) Pulse width is limited by safe operating area.

(<sup>3</sup>)  $I_{SD} \leq 12\text{ A}$ ,  $di/dt \leq 400\text{ A}/\mu\text{s}$ ,  $V_{DS}(\text{peak}) < V_{(\text{BR})DSS}$ ,  $V_{DD} = 80\%$   $V_{(\text{BR})DSS}$ .

(<sup>4</sup>)  $V_{DS} \leq 480\text{ V}$ .

Table 3: Thermal data

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

(<sup>1</sup>) Pulse width is limited by  $T_{jmax}$ .

(<sup>2</sup>) starting  $T_j = 25^\circ\text{C}$ ,  $I_D = I_{AR}$ ,  $V_{DD} = 50\text{ V}$ .

## 2 Electrical characteristics

( $T_{case} = 25^\circ\text{C}$  unless otherwise specified)

**Table 5: Static**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0 \text{ V}, I_D = 1 \text{ mA}$	600			V
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0 \text{ V}, V_{DS} = 600 \text{ V}$			1.5	$\mu\text{A}$
		$V_{GS} = 0 \text{ V}, V_{DS} = 600 \text{ V}, T_{case} = 125^\circ\text{C}$			100	
$I_{GSS}$	Gate-body leakage current	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 25 \text{ V}$			$\pm 10$	$\mu\text{A}$
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10 \text{ V}, I_D = 6 \text{ A}$		0.260	0.295	$\Omega$

**Table 6: Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 100 \text{ V}, f = 1 \text{ MHz}, V_{GS} = 0 \text{ V}$	-	800	-	$\text{pF}$
$C_{oss}$	Output capacitance		-	40	-	
$C_{rss}$	Reverse transfer capacitance		-	1.33	-	
$C_{oss \text{ eq.}}^{(1)}$	Equivalent output capacitance	$V_{DS} = 0 \text{ to } 480 \text{ V}, f = 1 \text{ MHz}, V_{GS} = 0 \text{ V}$	-	80	-	$\text{pF}$
$R_G$	Intrinsic gate resistance	$f = 1 \text{ MHz}, I_D = 0 \text{ A}$	-	5.6	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 480 \text{ V}, I_D = 12 \text{ A}, V_{GS} = 10 \text{ V}$ (see <i>Figure 15: "Test circuit for gate charge behavior"</i> )	-	20	-	$\text{nC}$
$Q_{gs}$	Gate-source charge		-	5.2	-	
$Q_{gd}$	Gate-drain charge		-	8.5	-	

**Notes:**

<sup>(1)</sup>  $C_{oss \text{ eq.}}$  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	$V_{DD} = 300 \text{ V}, I_D = 6 \text{ A}, R_G = 4.7 \Omega, V_{GS} = 10 \text{ V}$ (see <i>Figure 14: "Test circuit for resistive load switching times"</i> and <i>Figure 19: "Switching time waveform"</i> )	-	13.5	-	$\text{ns}$
$t_r$	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	$V_{GS} = 0 \text{ V}$ , $I_{SD} = 12 \text{ A}$	-		1.6	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 12 \text{ A}$ , $dI/dt = 100 \text{ A}/\mu\text{s}$ , $V_{DD} = 60 \text{ V}$ (see <i>Figure 16: "Test circuit for inductive load switching and diode recovery times"</i> )	-	125		ns
$Q_{rr}$	Reverse recovery charge		-	675		nC
$I_{RRM}$	Reverse recovery current		-	11		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 12 \text{ A}$ , $dI/dt = 100 \text{ A}/\mu\text{s}$ , $V_{DD} = 60 \text{ V}$ , $T_j = 150^\circ\text{C}$ (see <i>Figure 16: "Test circuit for inductive load switching and diode recovery times"</i> )	-	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  $\mu\text{s}$ , duty cycle 1.5%.

## 2.1

## Electrical characteristics (curves)

Figure 2: Safe operating area

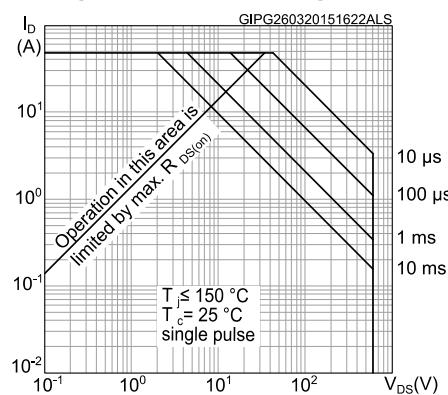


Figure 3: Thermal impedance

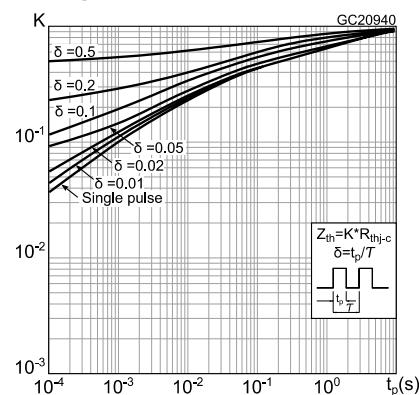


Figure 4: Output characteristics

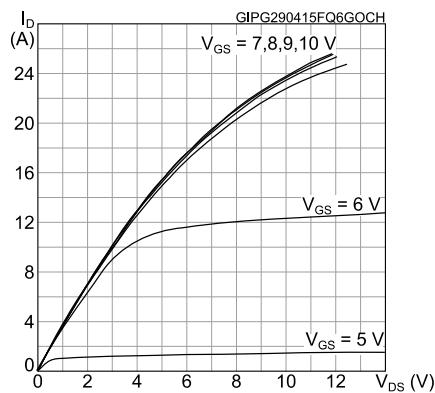


Figure 5: Transfer characteristics

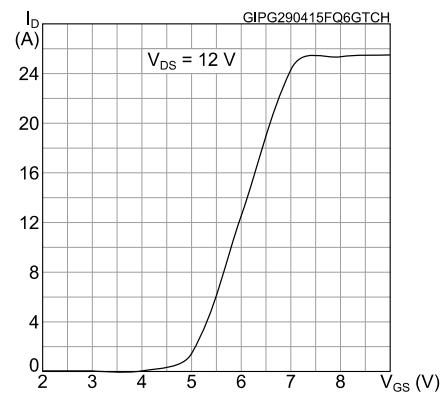


Figure 6: Gate charge vs gate-source voltage

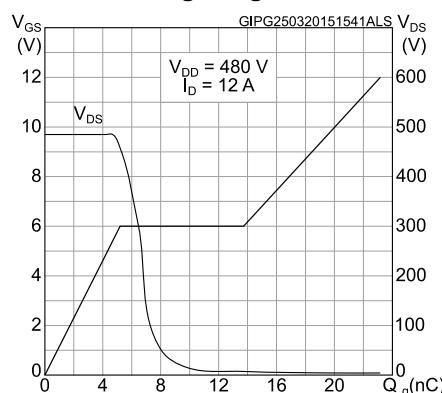
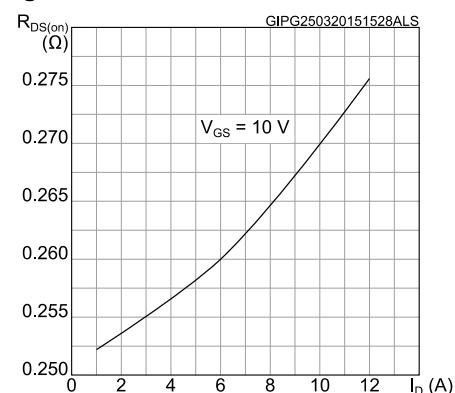
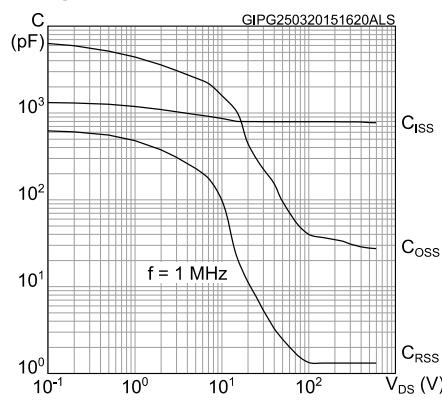
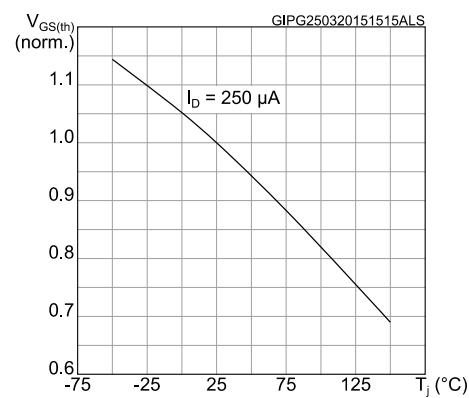
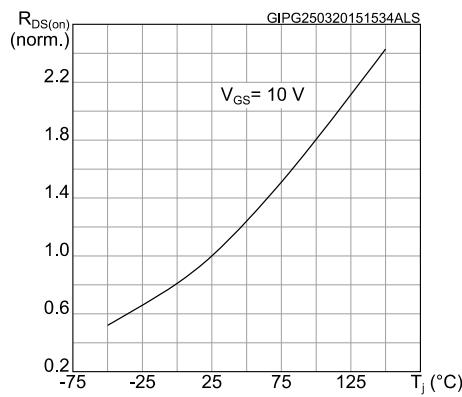
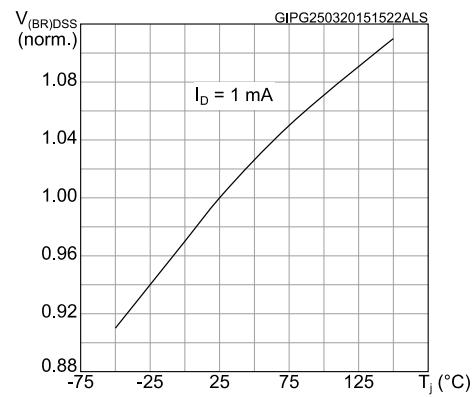
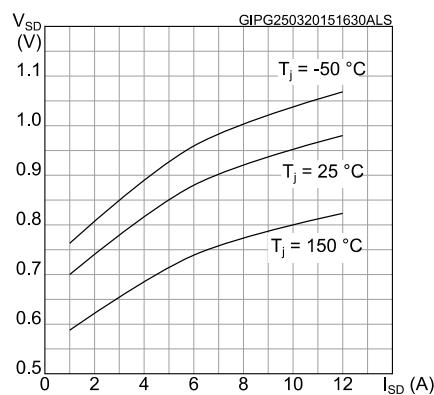
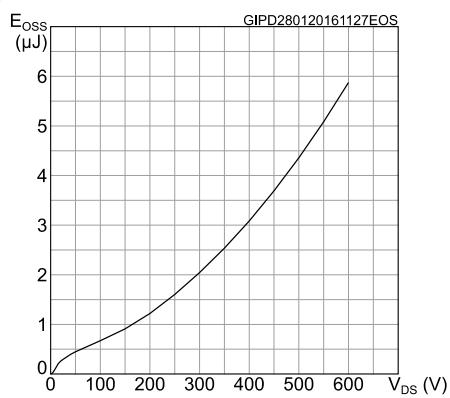


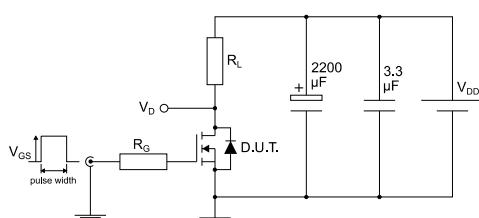
Figure 7: Static drain-source on-resistance



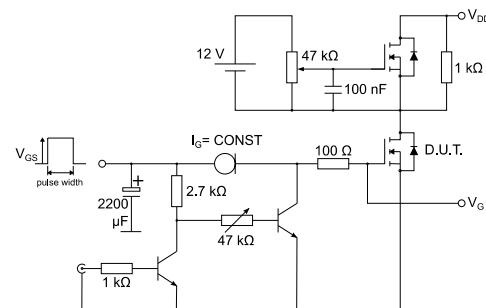
**Figure 8: Capacitance variations****Figure 9: Normalized gate threshold voltage vs temperature****Figure 10: Normalized on-resistance vs temperature****Figure 11: Normalized V(BR)DSS vs temperature****Figure 12: Source-drain diode forward characteristics****Figure 13: Output capacitance stored energy**

### 3 Test circuits

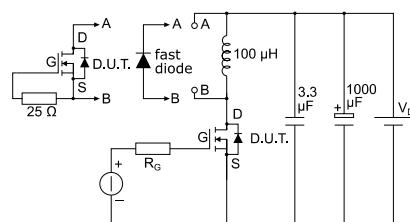
**Figure 14: Test circuit for resistive load switching times**



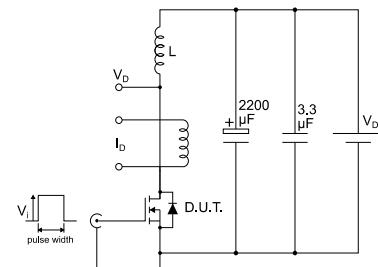
**Figure 15: Test circuit for gate charge behavior**



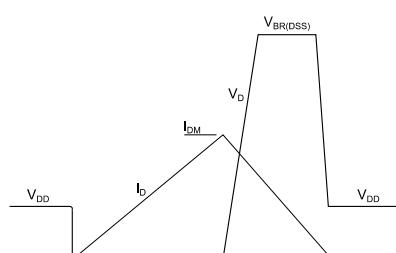
**Figure 16: Test circuit for inductive load switching and diode recovery times**



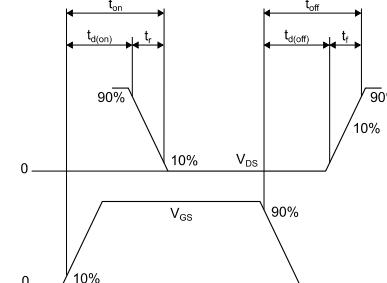
**Figure 17: Unclamped inductive load test circuit**



**Figure 18: Unclamped inductive waveform**



**Figure 19: Switching time waveform**

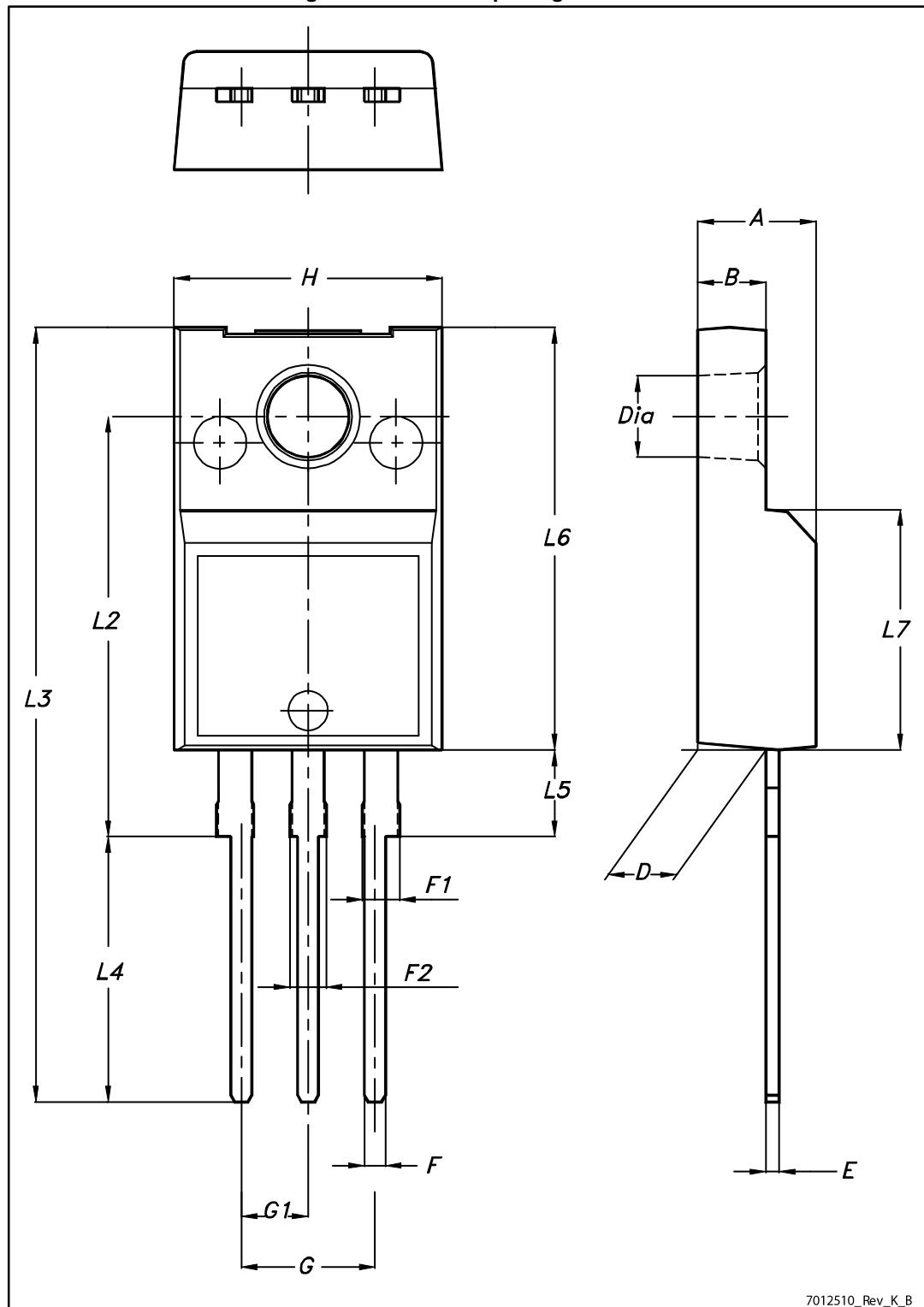


## 4 Package information

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](http://www.st.com).  
ECOPACK® is an ST trademark.

## 4.1 TO-220FP package information

Figure 20: TO-220FP package outline



7012510\_Rev\_K\_B

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 <a href="#">Section 2.1: "Electrical characteristics (curves)"</a> .

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