

## N-channel 60 V, 4.6 mΩ typ., 46 A STripFET™ F7 Power MOSFET in a TO-220FP package

Datasheet - production data

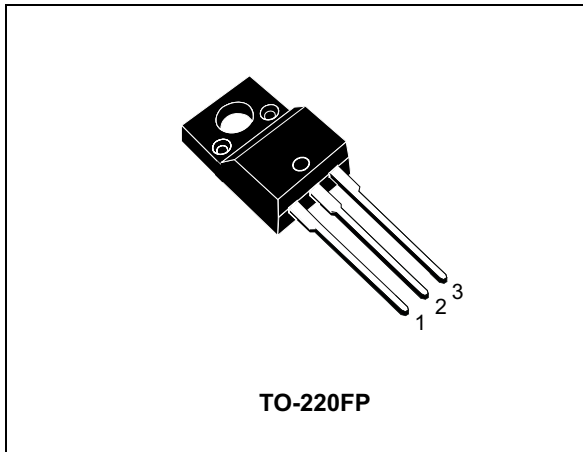
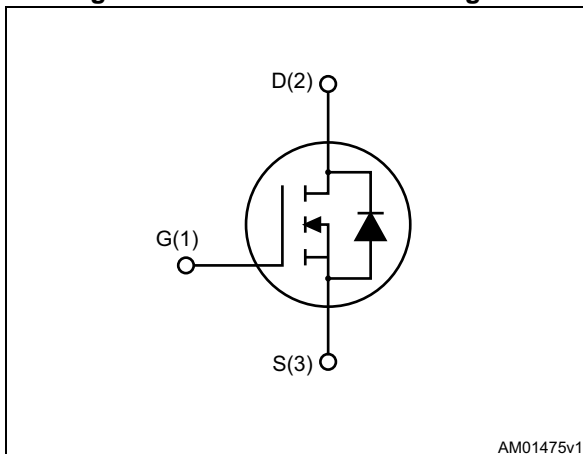


Figure 1. Internal schematic diagram



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>	P <sub>TOT</sub>
STF100N6F7	60 V	5.6 mΩ	46 A	25 W

- Among the lowest R<sub>DS(on)</sub> on the market
- Excellent figure of merit (FoM)
- Low C<sub>rss</sub>/C<sub>iss</sub> ratio for EMI immunity
- High avalanche ruggedness

### Applications

- Switching applications

### Description

This N-channel Power MOSFET utilizes STripFET™ F7 technology with an enhanced trench gate structure that results in very low on-state resistance, while also reducing internal capacitance and gate charge for faster and more efficient switching.

Table 1. Device summary

Order code	Marking	Package	Packaging
STF100N6F7	100N6F7	TO-220FP	Tube

# Contents

<b>1</b>	<b>Electrical ratings</b> .....	<b>3</b>
<b>2</b>	<b>Electrical characteristics</b> .....	<b>4</b>
	2.1 Electrical characteristics (curves) .....	6
<b>3</b>	<b>Test circuits</b> .....	<b>8</b>
<b>4</b>	<b>Package mechanical data</b> .....	<b>9</b>
<b>5</b>	<b>Revision history</b> .....	<b>12</b>

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	60	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	46 <sup>(1)</sup>	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	33 <sup>(1)</sup>	A
$I_{DM}^{(2)}$	Drain current (pulsed)	184	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	25	W
$E_{AS}^{(3)}$	Single pulse avalanche energy	200	mJ
$dV/dt^{(4)}$	Drain-body diode dynamic $dV/dt$ ruggedness	6	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
$T_j$	Operating junction temperature	-55 to 175	$^\circ\text{C}$
$T_{stg}$	Storage temperature		

- Limited by package
- Pulse width is limited by safe operating area
- Starting  $T_j = 25\text{ }^\circ\text{C}$ ,  $I_D = 20\text{ A}$ ,  $V_{DD} = 30\text{ V}$
- $I_{SD} = 46\text{ A}$ ;  $di/dt = 600\text{ A}/\mu\text{s}$ ;  $V_{DD} = 48\text{ V}$ ;  $T_j < T_{jmax}$

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	6	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient	62.5	$^\circ\text{C}/\text{W}$

## 2 Electrical characteristics

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

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	60			V
$I_{DSS}$	Zero gate voltage Drain current	$V_{GS} = 0\text{ V}, V_{DS} = 60\text{ V}$			1	$\mu\text{A}$
		$V_{GS} = 0\text{ V}, V_{DS} = 60\text{ V}, T_J = 125\text{ °C}$			100	$\mu\text{A}$
$I_{GSS}$	Gate-source leakage current	$V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2		4	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}, I_D = 23\text{ A}$		4.6	5.6	m $\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$	-	1980	-	pF
$C_{oss}$	Output capacitance		-	970	-	pF
$C_{riss}$	Reverse transfer capacitance		-	86	-	pF
$Q_g$	Total gate charge	$V_{DD} = 30\text{ V}, I_D = 46\text{ A}, V_{GS} = 10\text{ V}$	-	30	-	nC
$Q_{gs}$	Gate-source charge		-	12.6	-	nC
$Q_{gd}$	Gate-drain charge		-	5.9	-	nC

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 30\text{ V}, I_D = 23\text{ A}, R_G = 4.7\text{ }\Omega, V_{GS} = 10\text{ V}$	-	21.6	-	ns
$t_r$	Rise time		-	55.5	-	ns
$t_{d(off)}$	Turn-off-delay time		-	28.6	-	ns
$t_f$	Fall time		-	15	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{SD}^{(1)}$	Forward on voltage	$V_{GS} = 0 \text{ V}$ , $I_{SD} = 46 \text{ A}$	-		1.2	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 46 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ , $V_{DD} = 48 \text{ V}$	-	48.4		ns
$Q_{rr}$	Reverse recovery charge		-	47		nC
$I_{RRM}$	Reverse recovery current		-	2.0		A

1. Pulse test: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

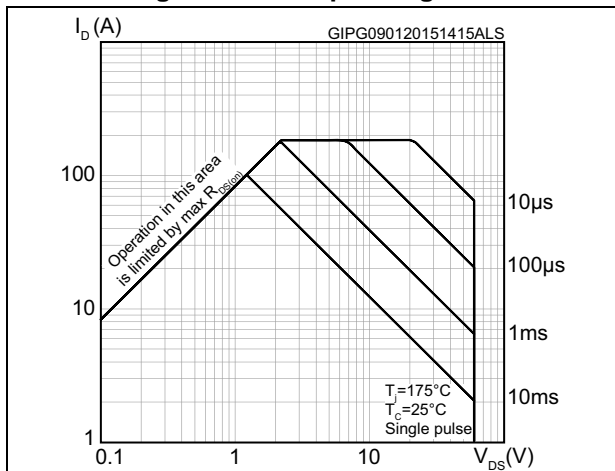


Figure 3. Thermal impedance

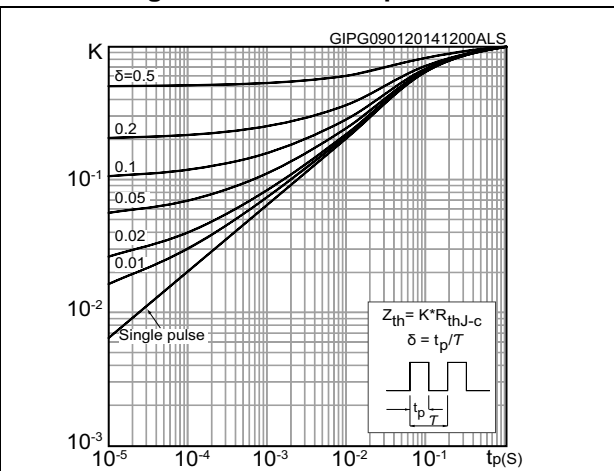


Figure 4. Output characteristics

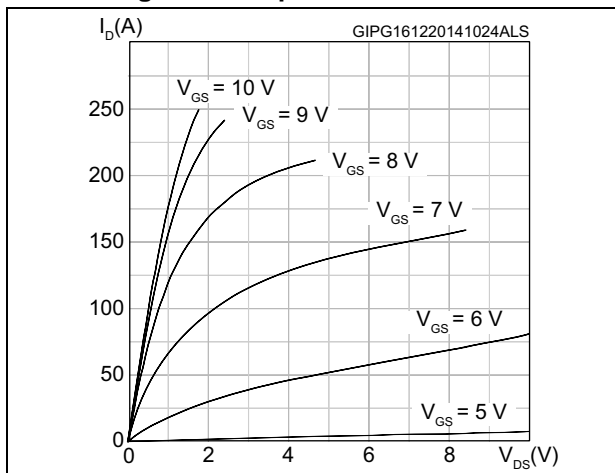


Figure 5. Transfer characteristics

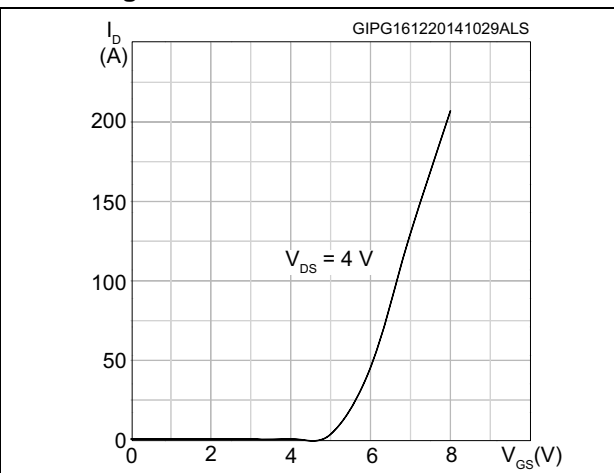


Figure 6. Gate charge vs gate-source voltage

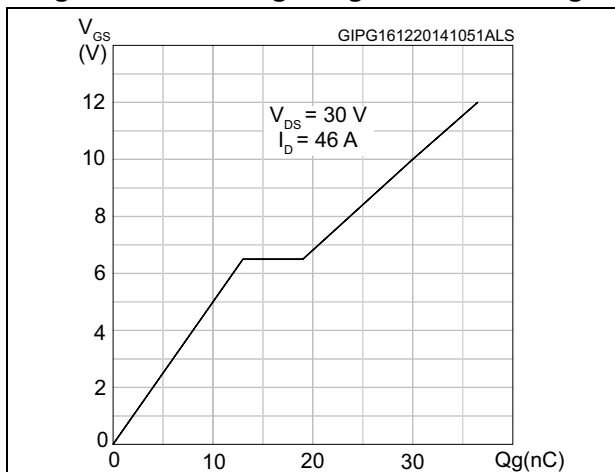


Figure 7. Static drain-source on-resistance

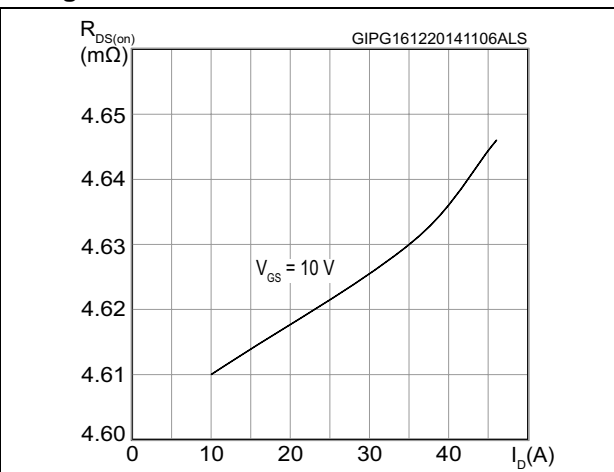


Figure 8. Capacitance variations

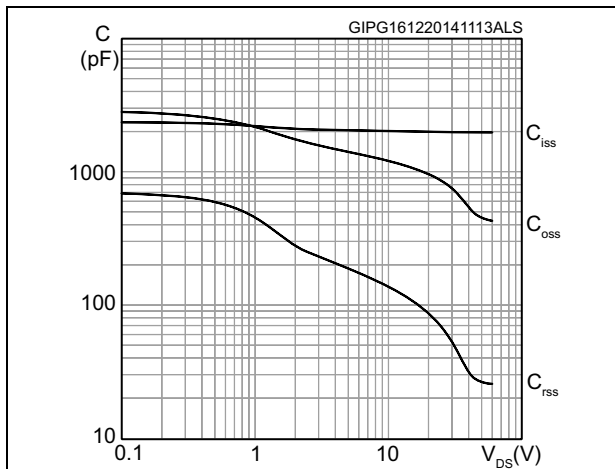


Figure 9. Normalized gate threshold voltage vs temperature

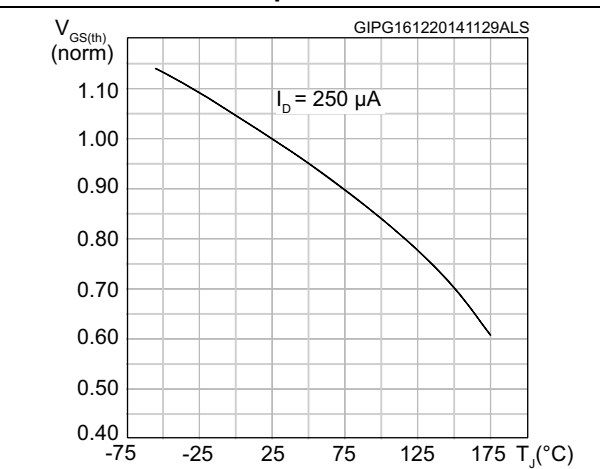


Figure 10. Normalized on-resistance vs temperature

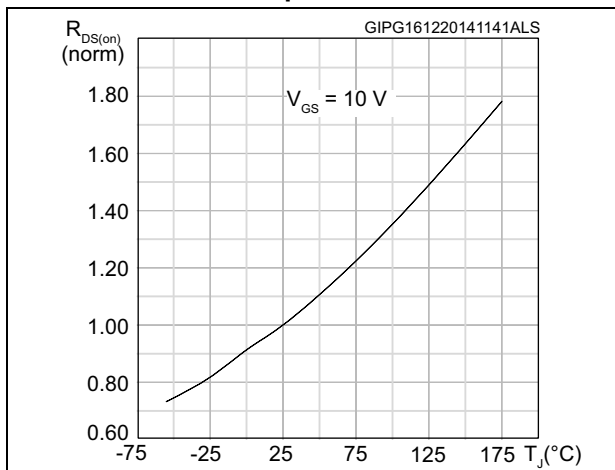


Figure 11. Source-drain diode forward characteristics

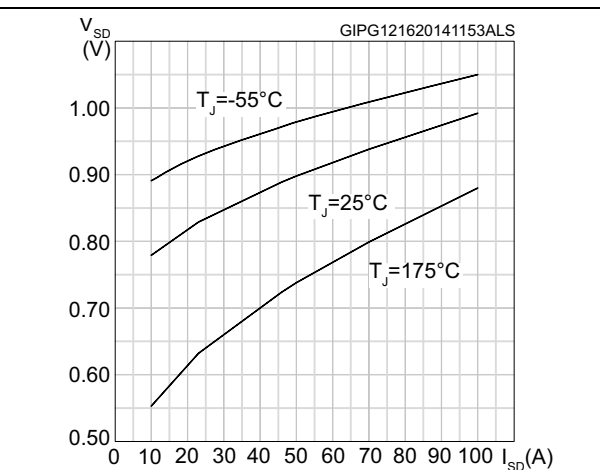
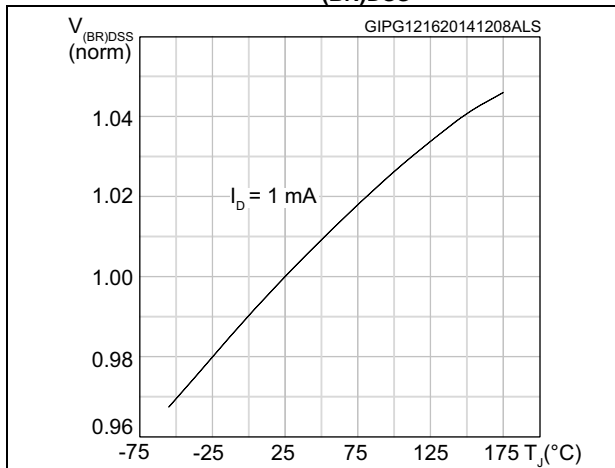
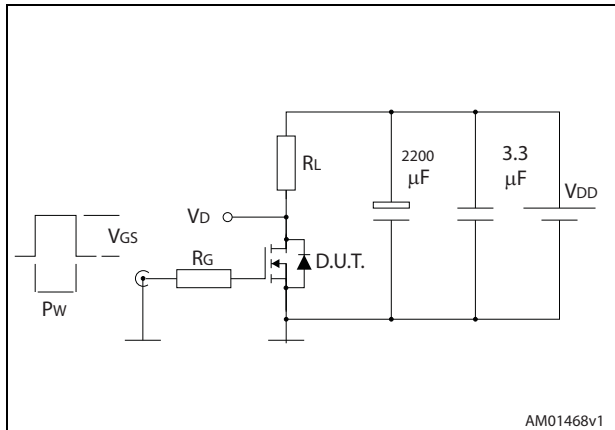


Figure 12. Normalized V\_(BR)DSS vs temperature



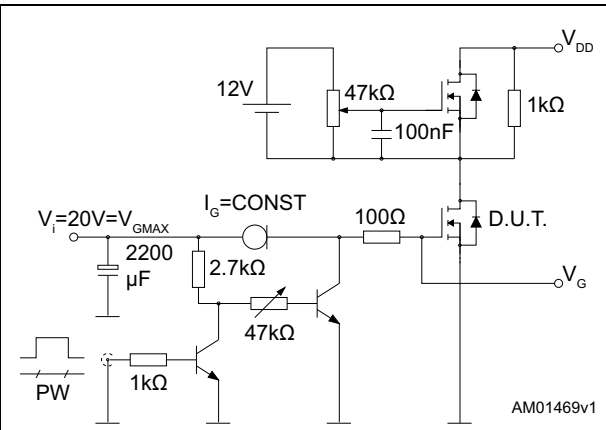
### 3 Test circuits

Figure 13. Switching times test circuit for resistive load



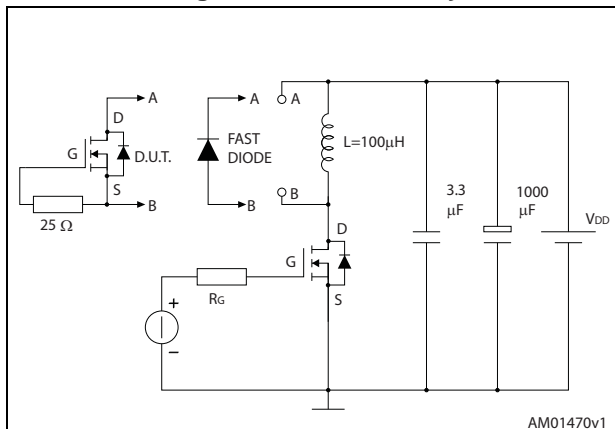
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Figure 14. Gate charge test circuit



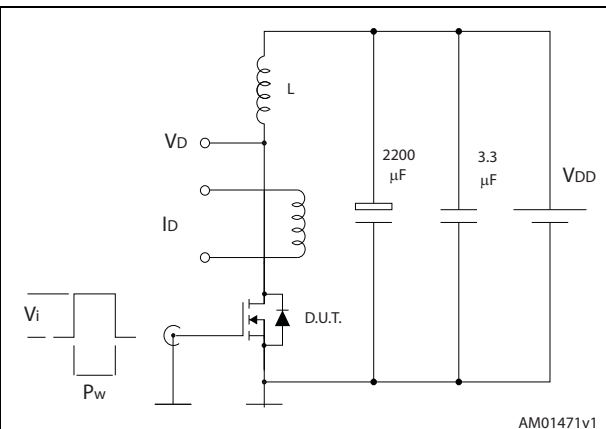
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Figure 15. Test circuit for inductive load switching and diode recovery times



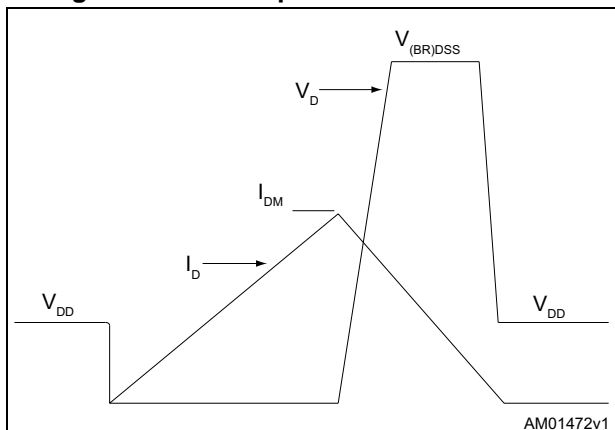
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Figure 16. Unclamped inductive load test circuit



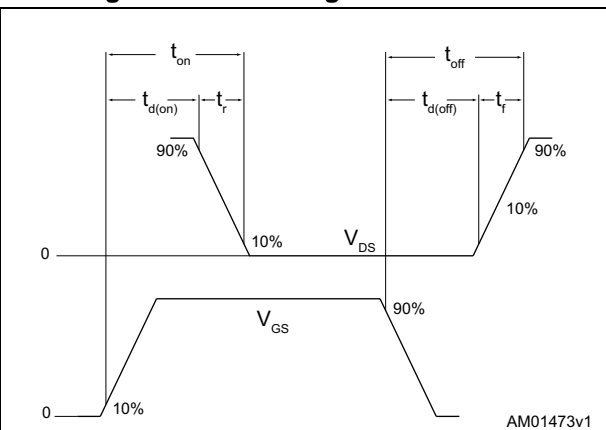
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Figure 17. Unclamped inductive waveform



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Figure 18. Switching time waveform



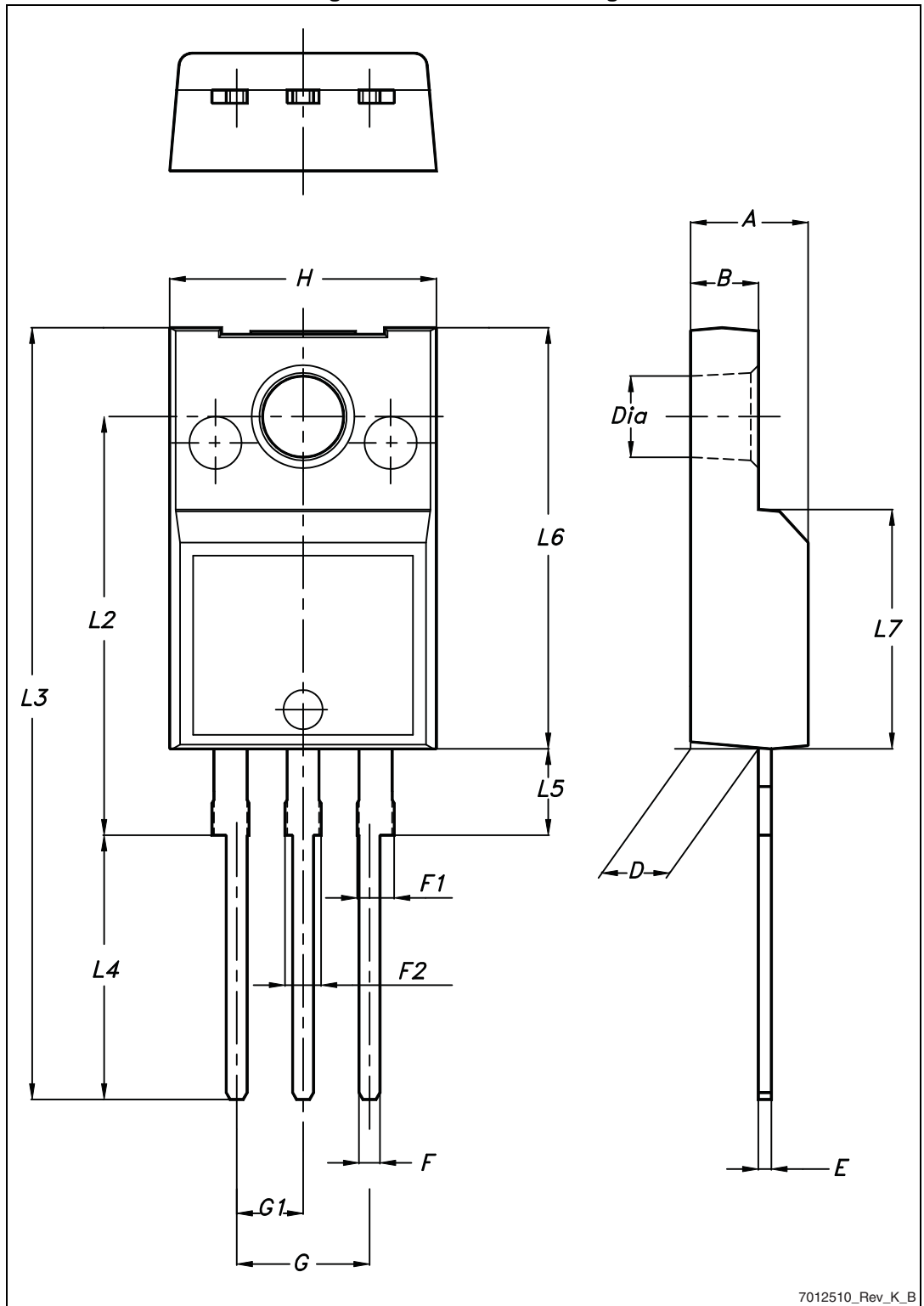
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## 4 Package mechanical data

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

Figure 19. TO-220FP drawing



7012510\_Rev\_K\_B

Table 8. TO-220FP 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
Ø	3		3.2

## 5 Revision history

**Table 9. Document revision history**

Date	Revision	Changes
25-Nov-2014	1	First release.
16-Jan-2015	2	In <a href="#">Section 1</a> , updated <a href="#">Table 2: Absolute maximum ratings</a> In <a href="#">Section 2</a> , – updated <a href="#">Table 4: On/off states</a> – updated <a href="#">Table 5: Dynamic</a> – updated <a href="#">Table 6: Switching times</a> – updated <a href="#">Table 7: Source drain diode</a> Added <a href="#">Section 2.1: Electrical characteristics (curves)</a>
10-Feb-2015	3	Inserted dV/dt value in <a href="#">Table 2: Absolute maximum ratings</a> .

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