

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

Datasheet - production data

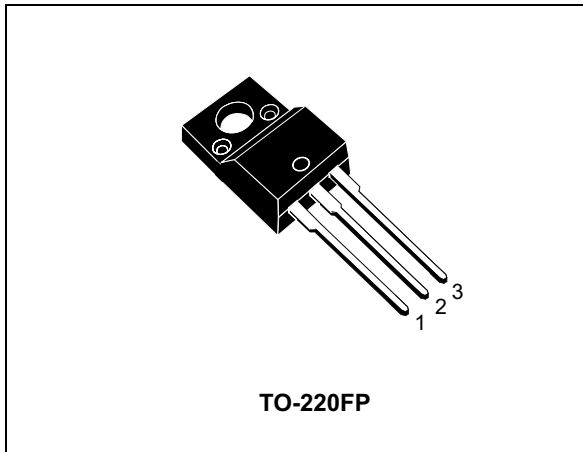
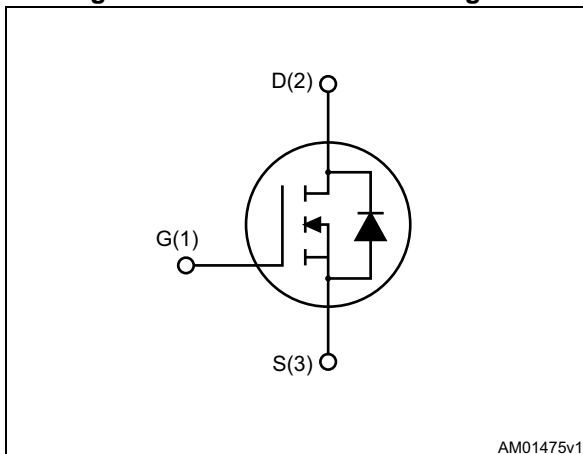


Figure 1. Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D	P _{TOT}
STF100N6F7	60 V	5.6 mΩ	46 A	25 W

- Among the lowest R_{DS(on)} on the market
- Excellent figure of merit (FoM)
- Low C_{rss}/C_{iss} 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

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	60	V
V_{GS}	Gate-source voltage	± 20	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	46 ⁽¹⁾	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	33 ⁽¹⁾	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		

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

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	μA
		$V_{GS} = 0\text{ V}, V_{DS} = 60\text{ V}, T_J = 125\text{ °C}$			100	μA
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 Ω

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_{rss}	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 μs , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

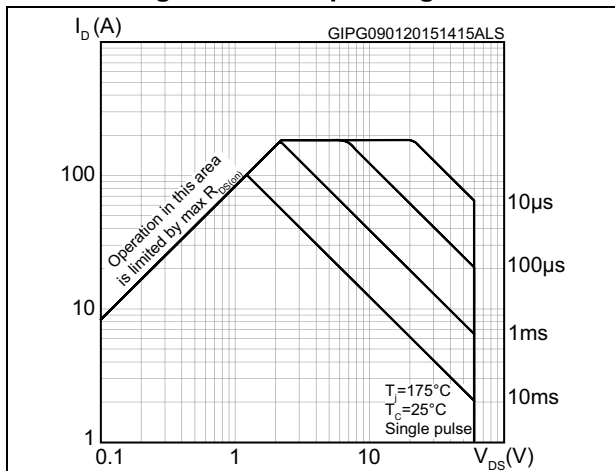


Figure 3. Thermal impedance

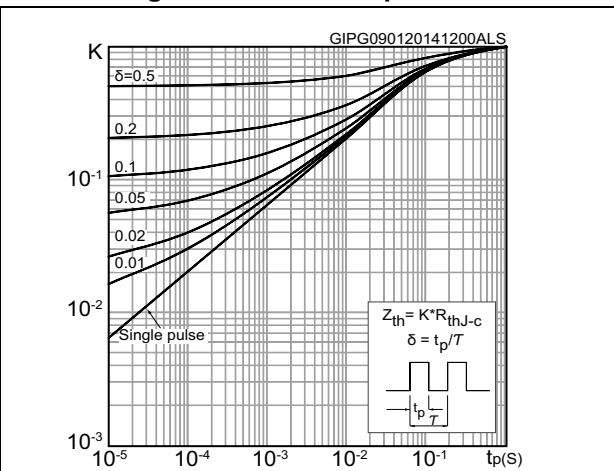


Figure 4. Output characteristics

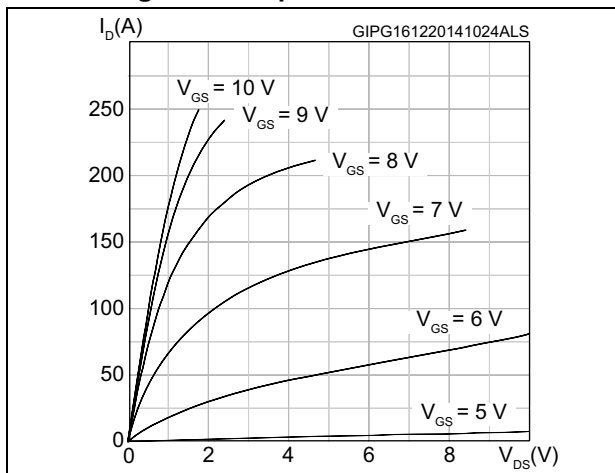


Figure 5. Transfer characteristics

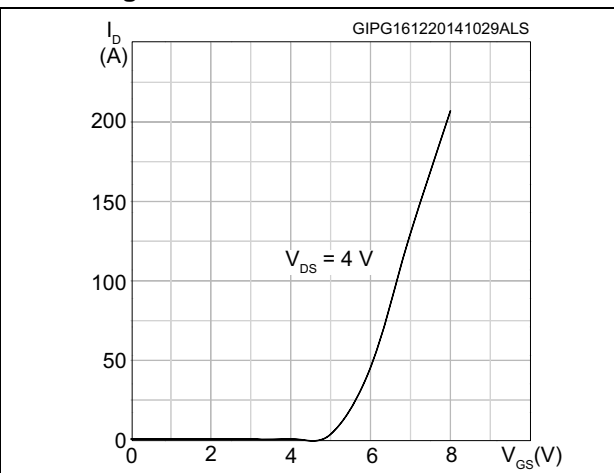


Figure 6. Gate charge vs gate-source voltage

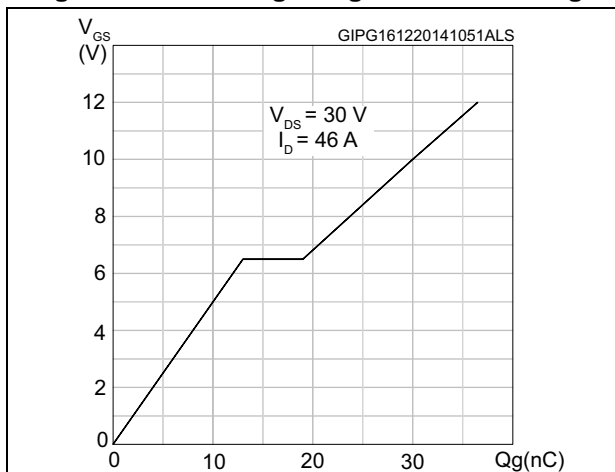


Figure 7. Static drain-source on-resistance

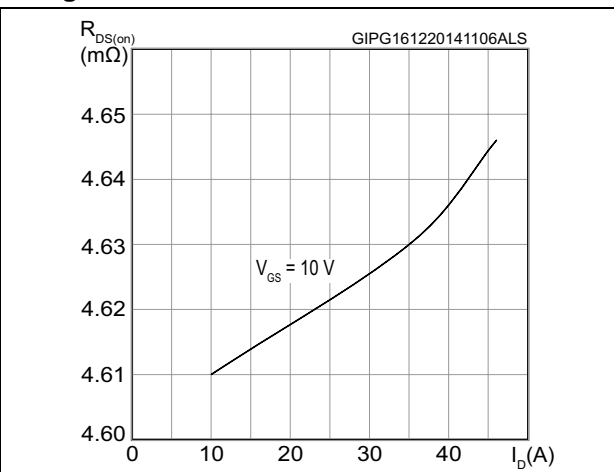


Figure 8. Capacitance variations

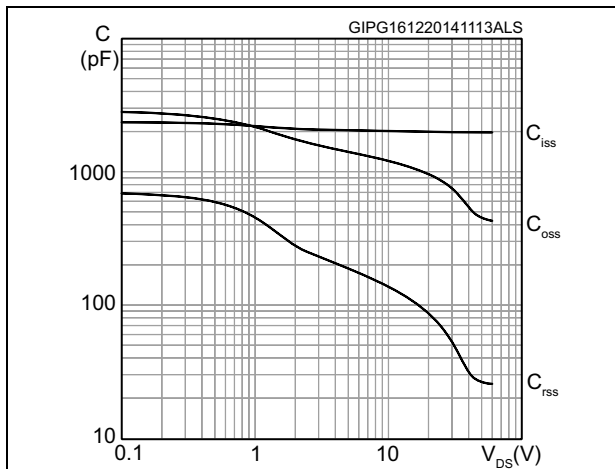


Figure 9. Normalized gate threshold voltage vs temperature

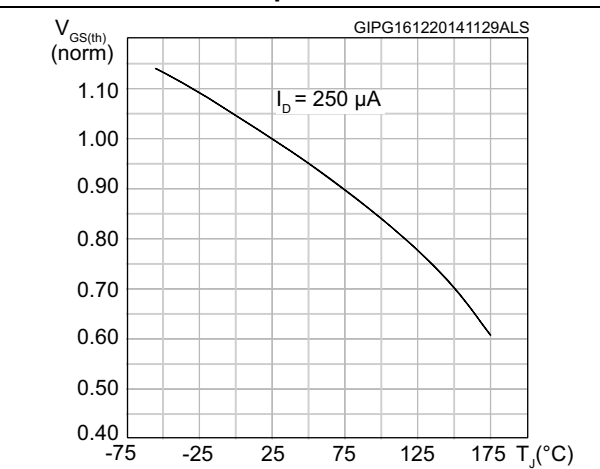


Figure 10. Normalized on-resistance vs temperature

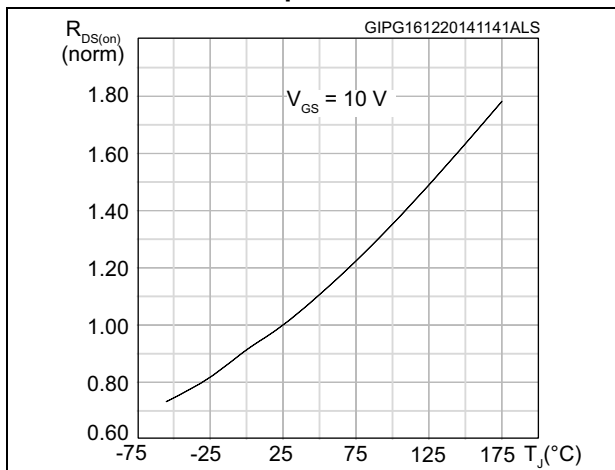


Figure 11. Source-drain diode forward characteristics

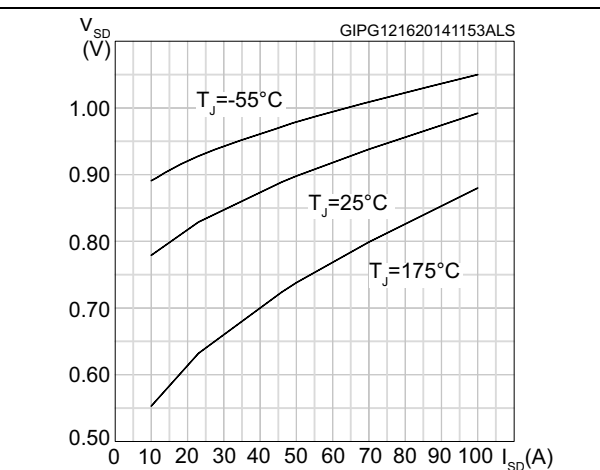
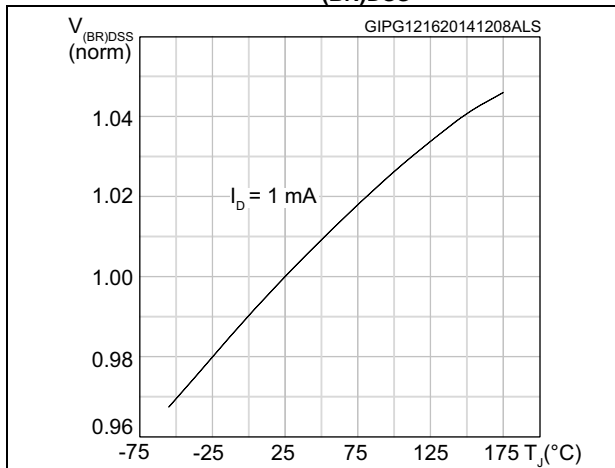


Figure 12. Normalized V_(BR)DSS vs temperature



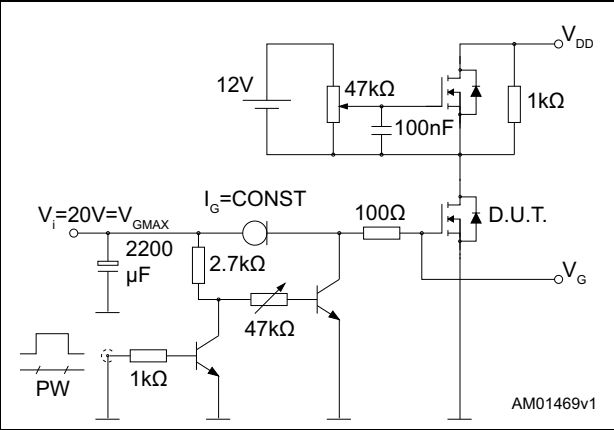
3 Test circuits

Figure 13. Switching times test circuit for resistive load



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Figure 14. Gate charge test circuit



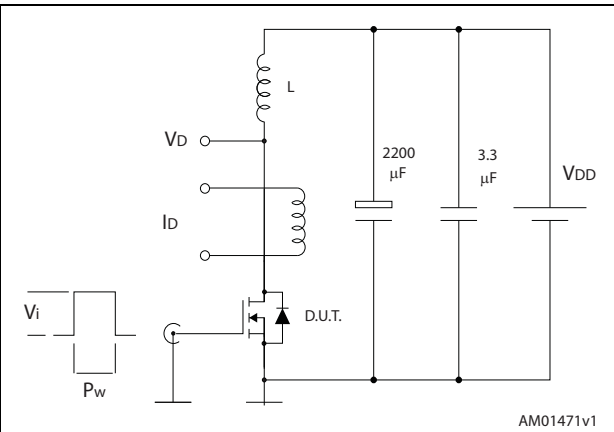
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Figure 15. Test circuit for inductive load switching and diode recovery times



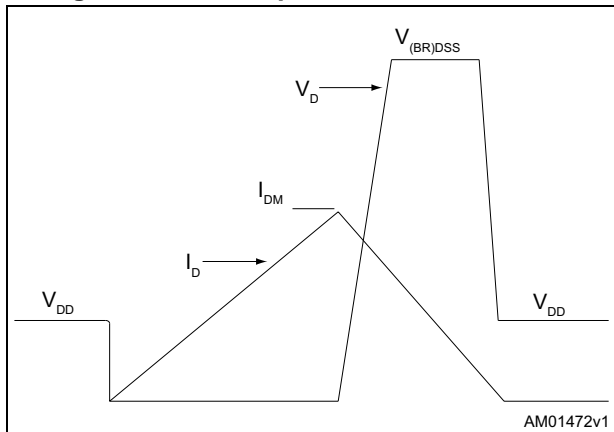
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Figure 16. Unclamped inductive load test circuit



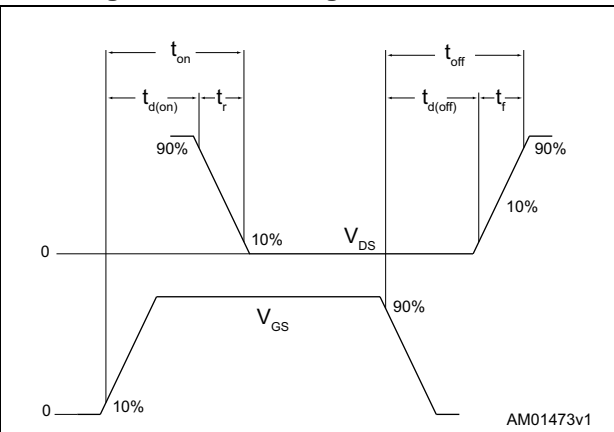
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Figure 17. Unclamped inductive waveform



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Figure 18. Switching time waveform

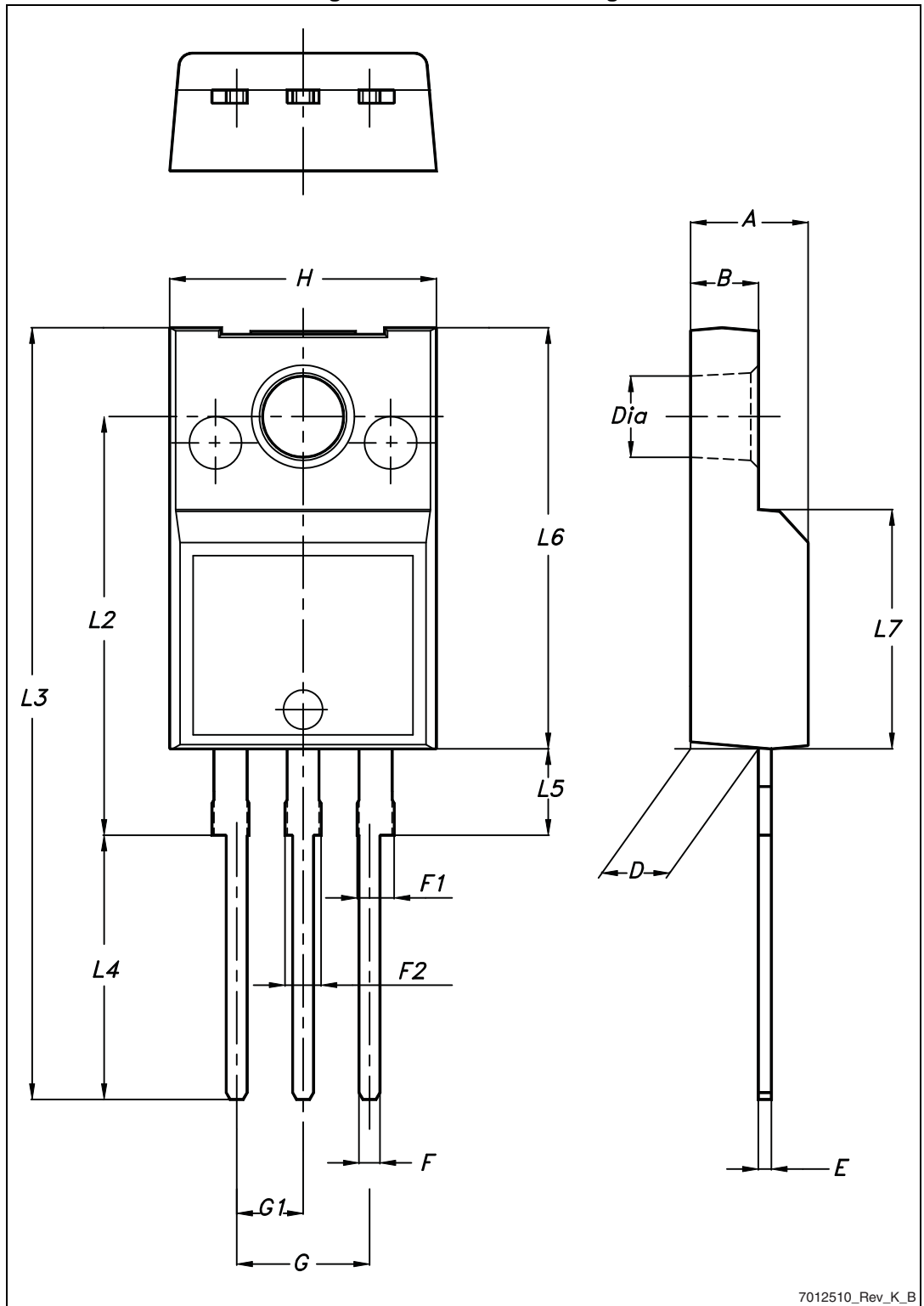


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4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK[®] 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.

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 Section 1 , updated Table 2: Absolute maximum ratings In Section 2 , – updated Table 4: On/off states – updated Table 5: Dynamic – updated Table 6: Switching times – updated Table 7: Source drain diode Added Section 2.1: Electrical characteristics (curves)
10-Feb-2015	3	Inserted dV/dt value in Table 2: Absolute maximum ratings .

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