

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

Datasheet - production data

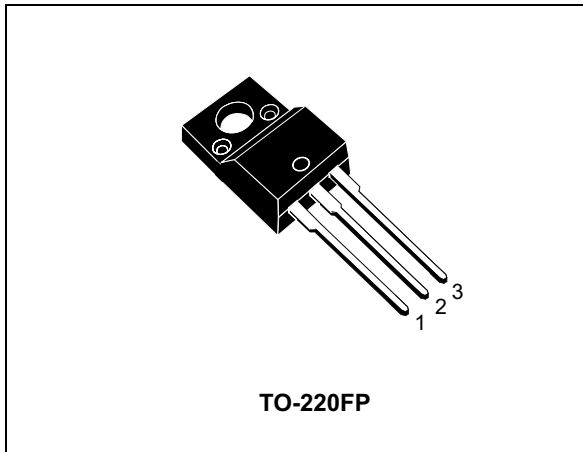
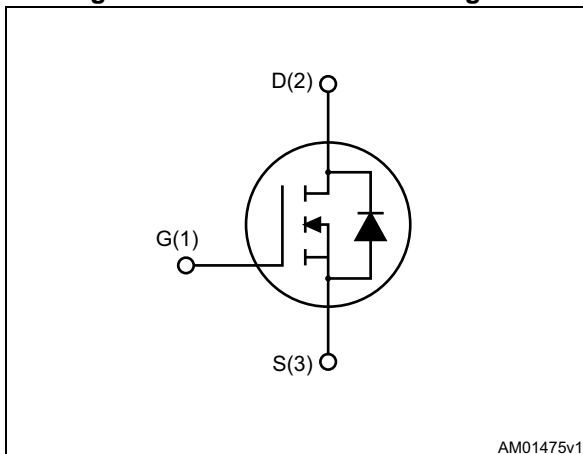


Figure 1. Internal schematic diagram



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		

- 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	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

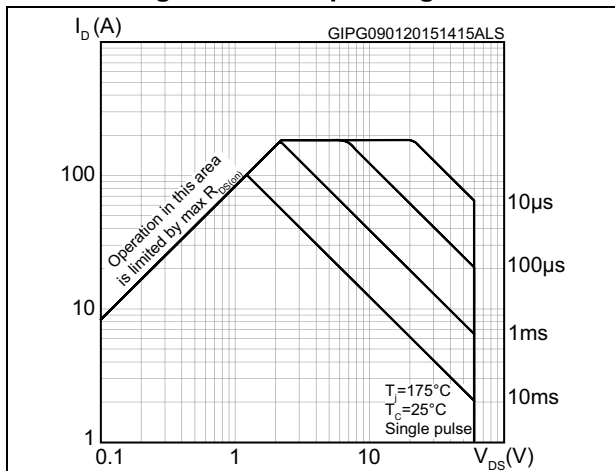


Figure 3. Thermal impedance

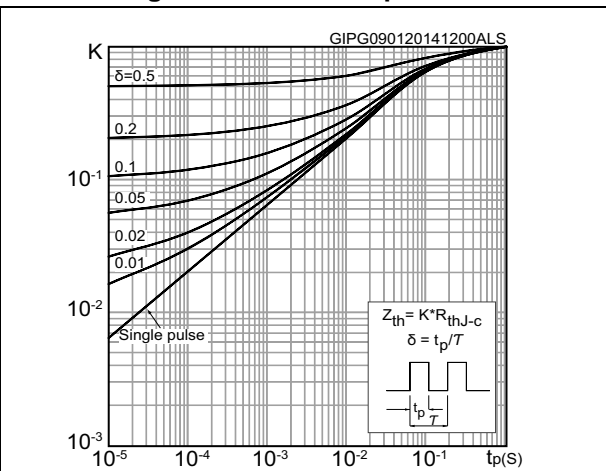


Figure 4. Output characteristics

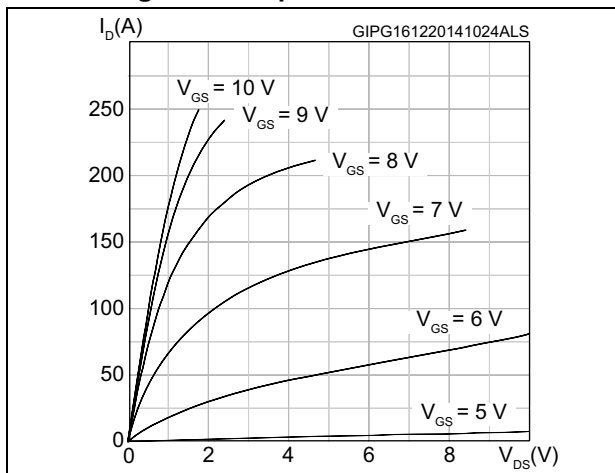


Figure 5. Transfer characteristics

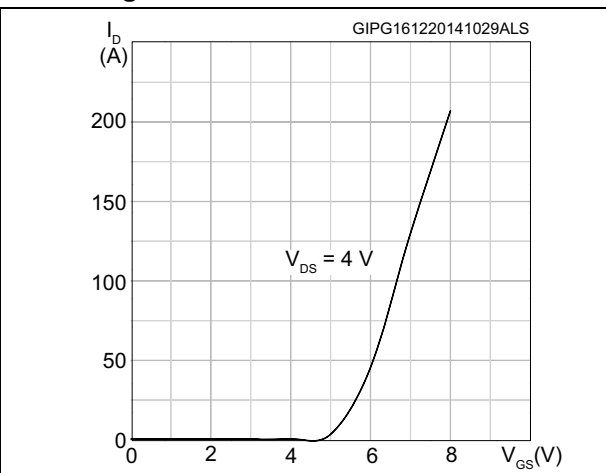


Figure 6. Gate charge vs gate-source voltage

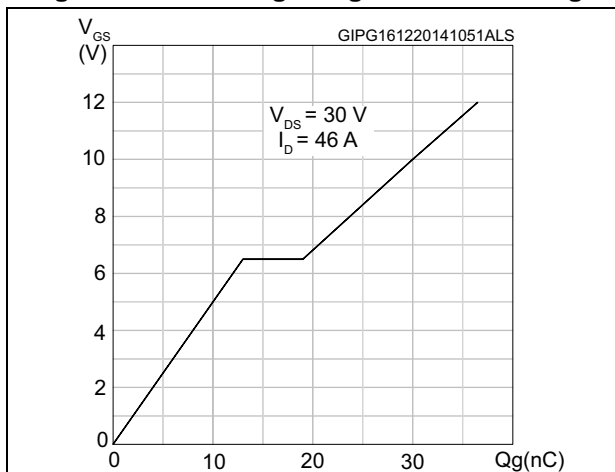


Figure 7. Static drain-source on-resistance

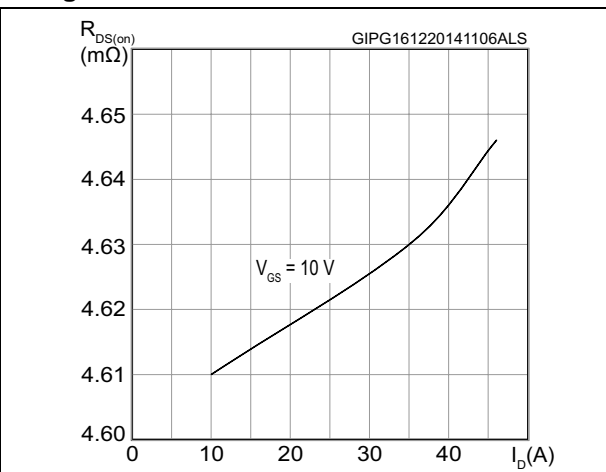


Figure 8. Capacitance variations

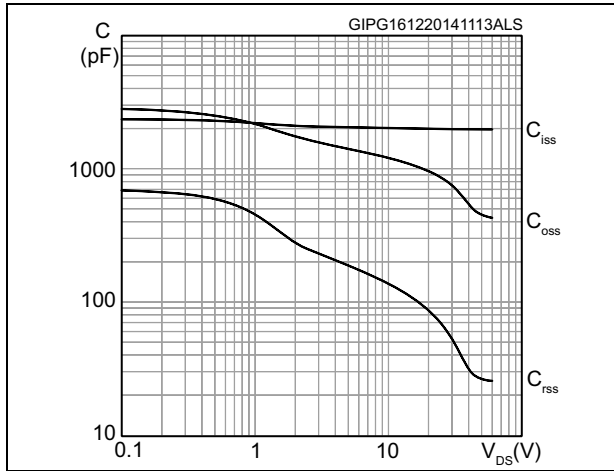


Figure 9. Normalized gate threshold voltage vs temperature

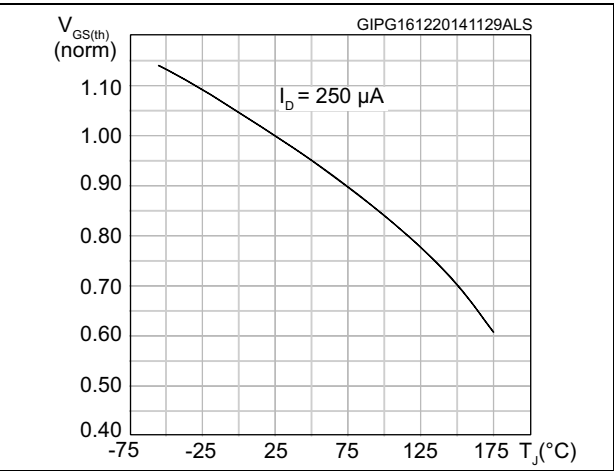


Figure 10. Normalized on-resistance vs temperature

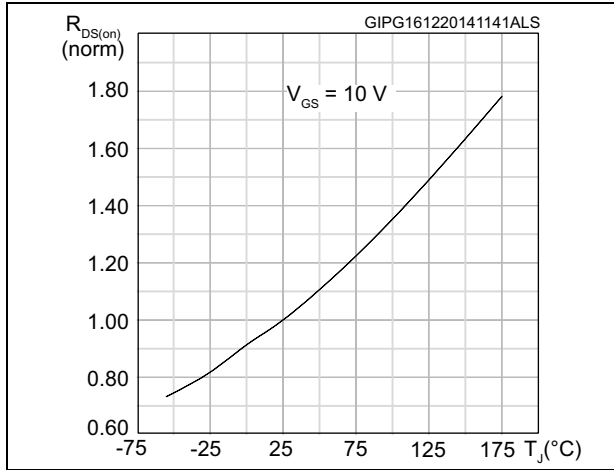


Figure 11. Source-drain diode forward characteristics

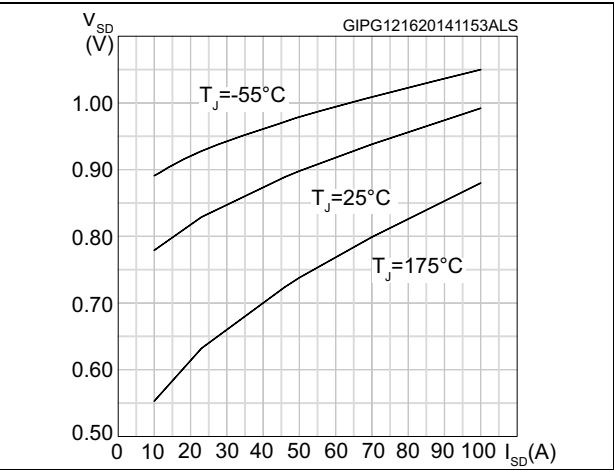
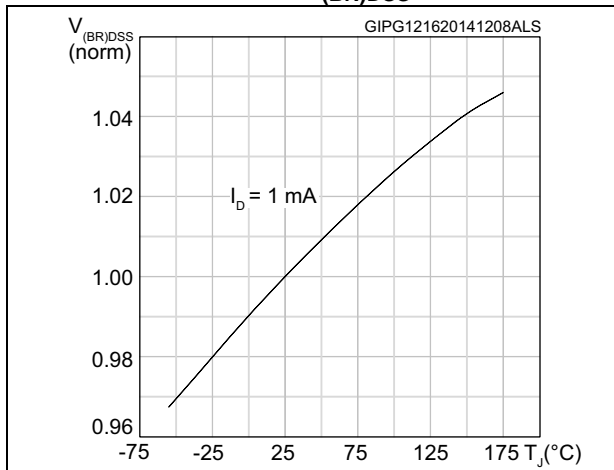


Figure 12. Normalized $V_{(BR)DSS}$ vs temperature



3 Test circuits

Figure 13. Switching times test circuit for resistive load



Figure 14. Gate charge test circuit

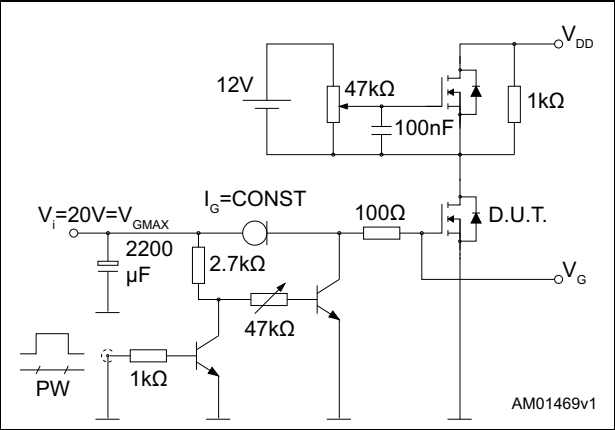


Figure 15. Test circuit for inductive load switching and diode recovery times



Figure 16. Unclamped inductive load test circuit

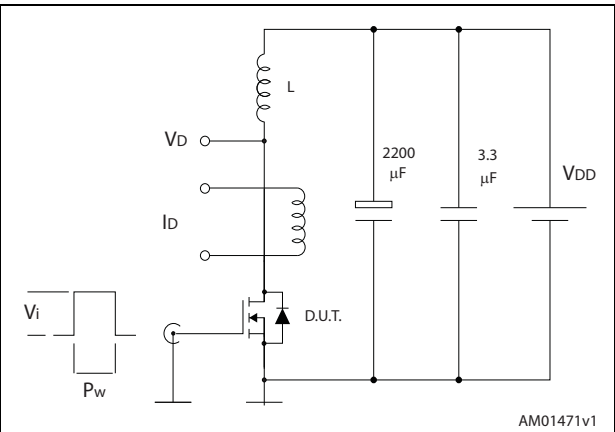


Figure 17. Unclamped inductive waveform

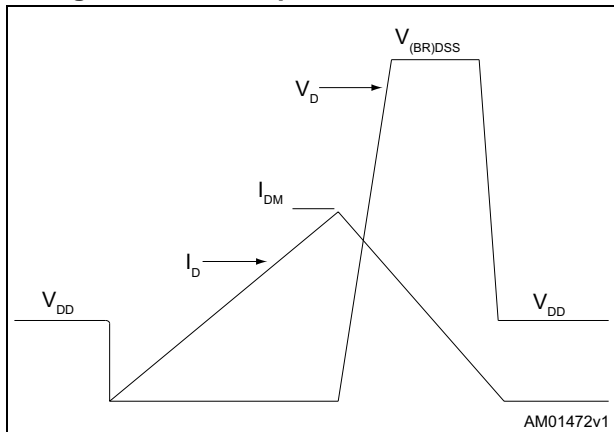
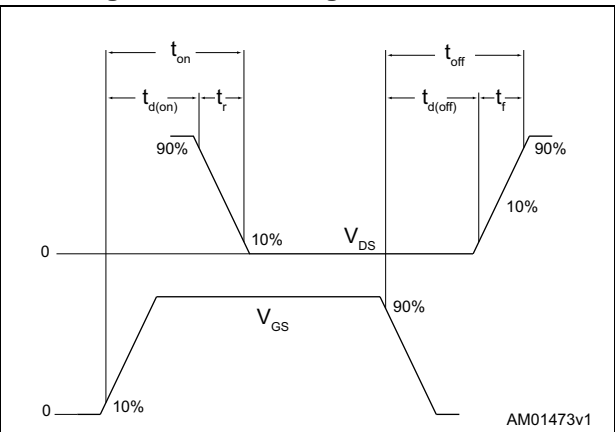


Figure 18. Switching time waveform



4 Package 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

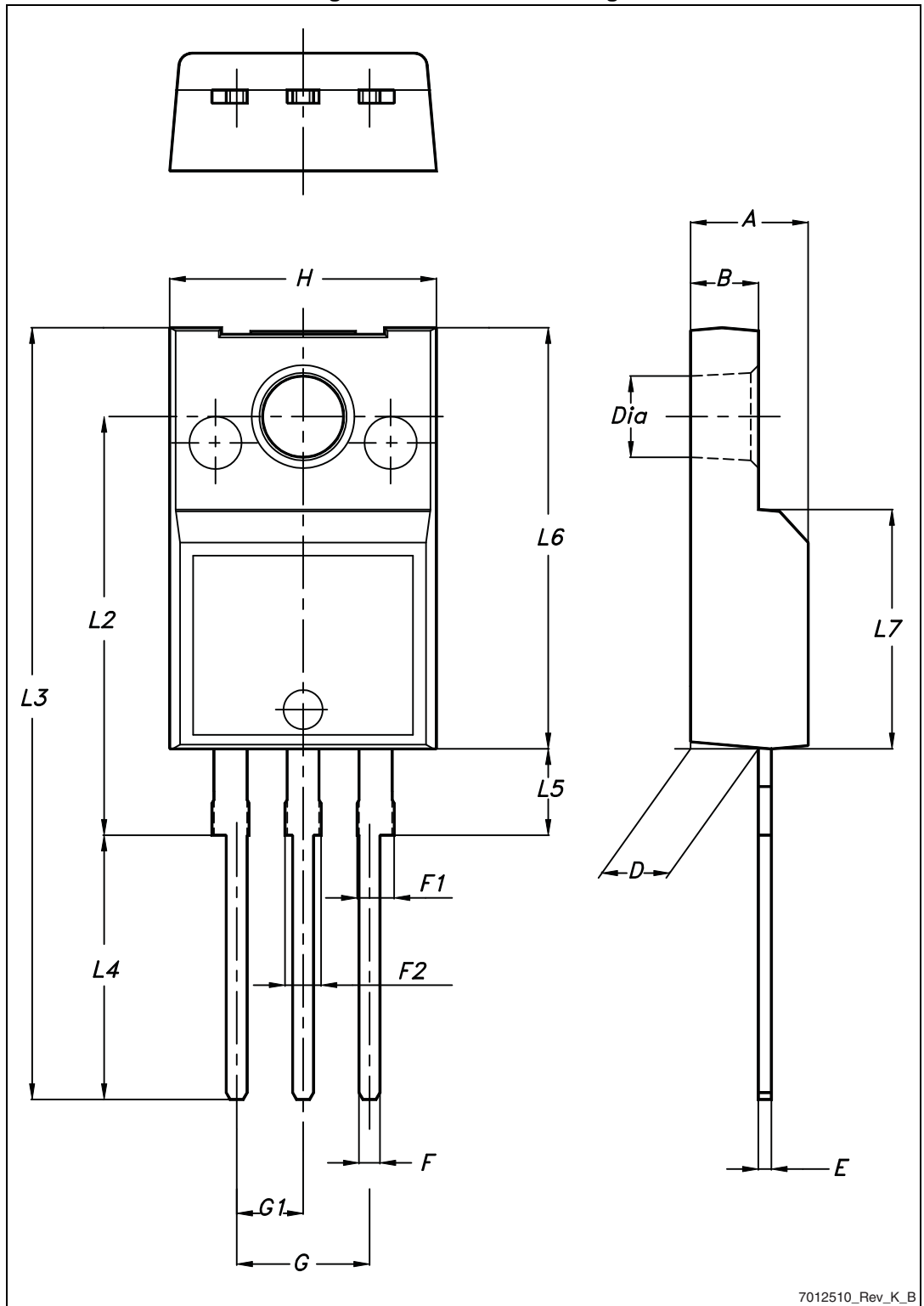


Table 8. TO-220FP mechanical data

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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