

## N-channel 60 V, 0.0031 $\Omega$ typ., 70 A STripFET™ F7 Power MOSFET in a TO-220FP package

Datasheet - production data

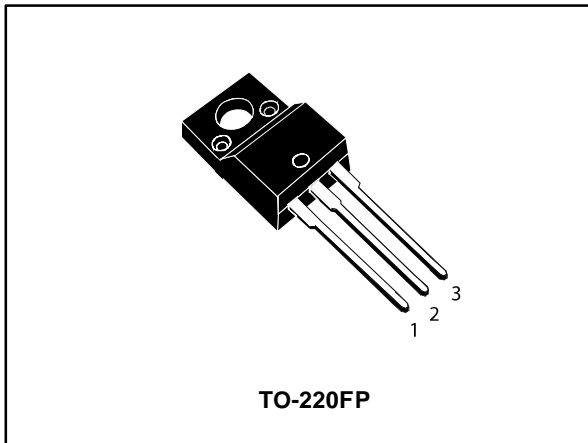
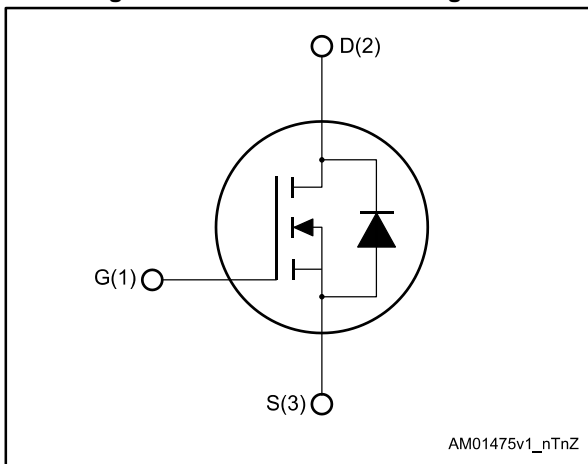


Figure 1: Internal schematic diagram



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>	P <sub>TOT</sub>
STF140N6F7	60 V	0.0035 $\Omega$	70 A	33 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	Packing
STF140N6F7	140N6F7	TO-220FP	Tube

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# 1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V <sub>DS</sub>	Drain-source voltage	60	V
V <sub>GS</sub>	Gate-source voltage	±20	V
I <sub>D</sub> <sup>(1)</sup>	Drain current (continuous) at T <sub>case</sub> = 25 °C	70	A
	Drain current (continuous) at T <sub>case</sub> = 100 °C	50	
I <sub>DM</sub> <sup>(2)</sup>	Drain current (pulsed)	280	A
P <sub>TOT</sub>	Total dissipation at T <sub>case</sub> = 25 °C	33	W
E <sub>AS</sub> <sup>(3)</sup>	Single pulse avalanche energy	250	mJ
dV/dt <sup>(4)</sup>	Drain-body diode dynamic dV/dt ruggedness	7.1	V/ns
V <sub>ISO</sub>	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s; T <sub>c</sub> = 25 °C)	2500	V
T <sub>stg</sub>	Storage temperature	-55 to 175	°C
T <sub>j</sub>	Maximum junction temperature	175	

**Notes:**

- (1) Current is limited by package.
- (2) Pulse width is limited by safe operating area.
- (3) Starting T<sub>j</sub> = 25°C, I<sub>D</sub> = 20 A, V<sub>DD</sub> = 30 V.
- (4) I<sub>SD</sub> = 70 A; di/dt = 600 A/μs; V<sub>DD</sub> = 48 V; T<sub>j</sub> < T<sub>jmax</sub>

Table 3: Thermal data

Symbol	Parameter	Value	Unit
R <sub>thj-case</sub>	Thermal resistance junction-case	4.5	°C/W
R <sub>thj-amb</sub>	Thermal resistance junction-ambient	62.5	

## 2 Electrical characteristics

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

**Table 4: Static**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(\text{BR})\text{DSS}}$	Drain-source breakdown voltage	$V_{\text{GS}} = 0\text{ V}$ , $I_{\text{D}} = 1\text{ mA}$	60			V
$I_{\text{DSS}}$	Zero gate voltage drain current	$V_{\text{GS}} = 0\text{ V}$ , $V_{\text{DS}} = 60\text{ V}$			1	$\mu\text{A}$
		$V_{\text{GS}} = 0\text{ V}$ , $V_{\text{DS}} = 60\text{ V}$ , $T_{\text{j}} = 125\text{ °C}$			100	
$I_{\text{GSS}}$	Gate-body leakage current	$V_{\text{DS}} = 0\text{ V}$ , $V_{\text{GS}} = 20\text{ V}$			100	nA
$V_{\text{GS}(\text{th})}$	Gate threshold voltage	$V_{\text{DS}} = V_{\text{GS}}$ , $I_{\text{D}} = 250\text{ }\mu\text{A}$	2		4	V
$R_{\text{DS}(\text{on})}$	Static drain-source on-resistance	$V_{\text{GS}} = 10\text{ V}$ , $I_{\text{D}} = 35\text{ A}$		0.0031	0.0035	$\Omega$

**Table 5: Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{\text{iSS}}$	Input capacitance	$V_{\text{DS}} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{\text{GS}} = 0\text{ V}$	-	3100	-	$\text{pF}$
$C_{\text{oSS}}$	Output capacitance		-	1520	-	
$C_{\text{rSS}}$	Reverse transfer capacitance		-	193	-	
$Q_{\text{g}}$	Total gate charge	$V_{\text{DD}} = 30\text{ V}$ , $I_{\text{D}} = 70\text{ A}$ , $V_{\text{GS}} = 10\text{ V}$ (see <a href="#">Figure 14: "Test circuit for gate charge behavior"</a> )	-	55	-	nC
$Q_{\text{gs}}$	Gate-source charge		-	19	-	
$Q_{\text{gd}}$	Gate-drain charge		-	18	-	

**Table 6: Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{\text{d}(\text{on})}$	Turn-on delay time	$V_{\text{DD}} = 30\text{ V}$ , $I_{\text{D}} = 35\text{ A}$ , $R_{\text{G}} = 4.7\text{ }\Omega$ , $V_{\text{GS}} = 10\text{ V}$ (see <a href="#">Figure 13: "Test circuit for resistive load switching times"</a> and <a href="#">Figure 18: "Switching time waveform"</a> )	-	24	-	ns
$t_{\text{r}}$	Rise time		-	68	-	
$t_{\text{d}(\text{off})}$	Turn-off delay time		-	39	-	
$t_{\text{f}}$	Fall time		-	20	-	

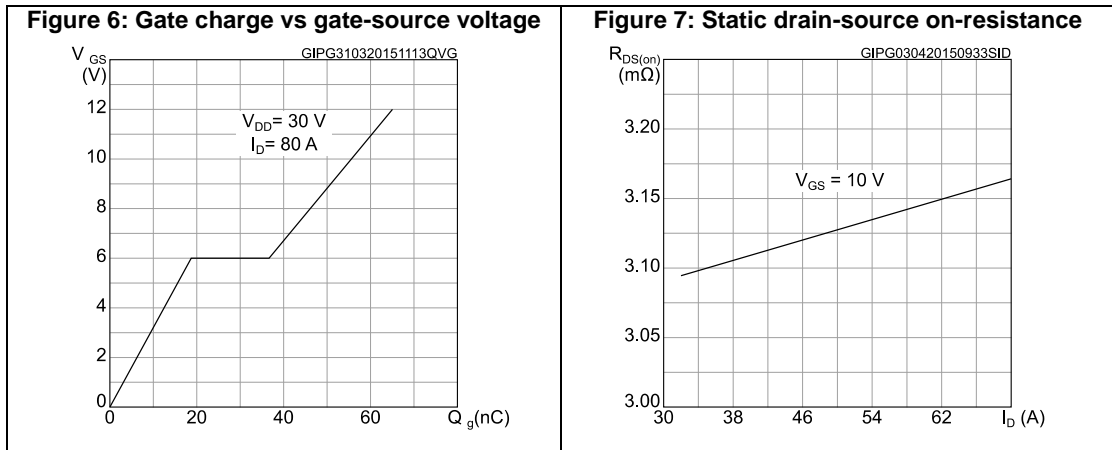
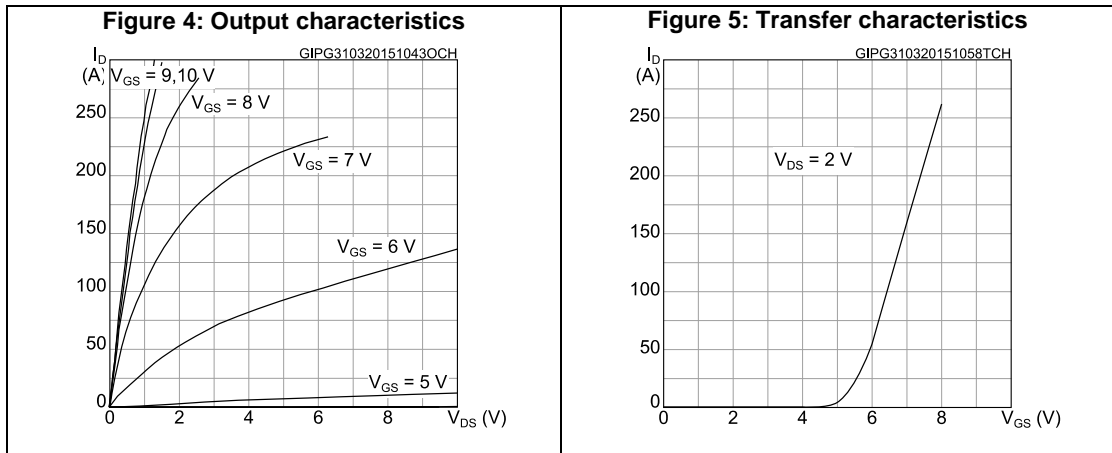
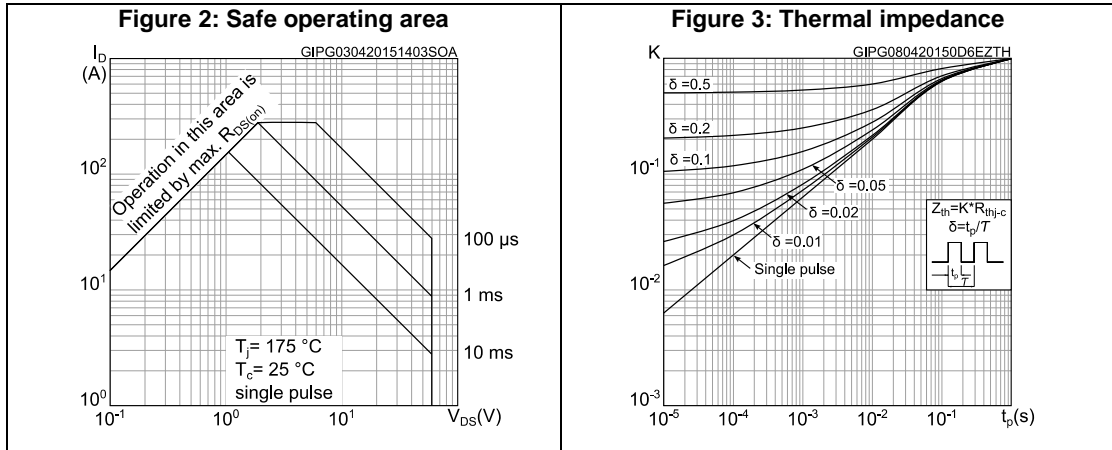
Table 7: Source-drain diode

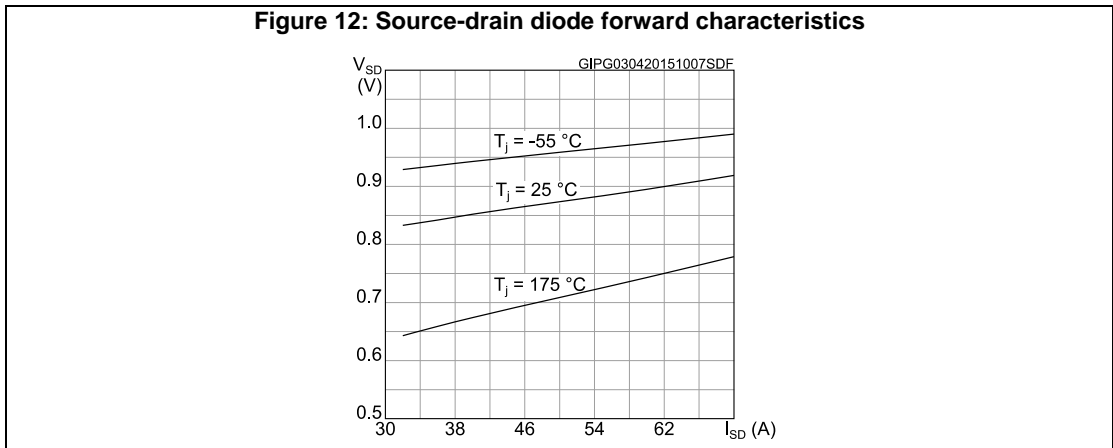
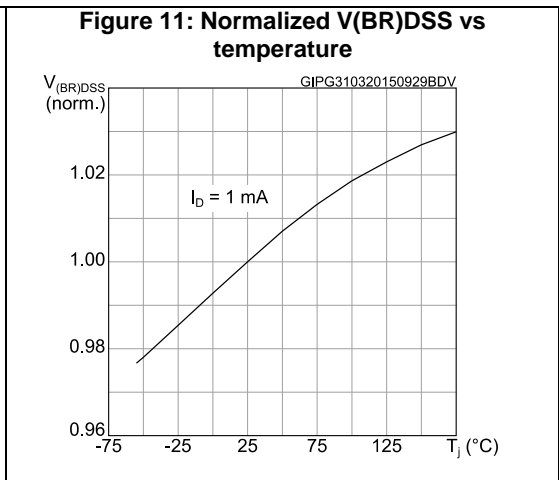
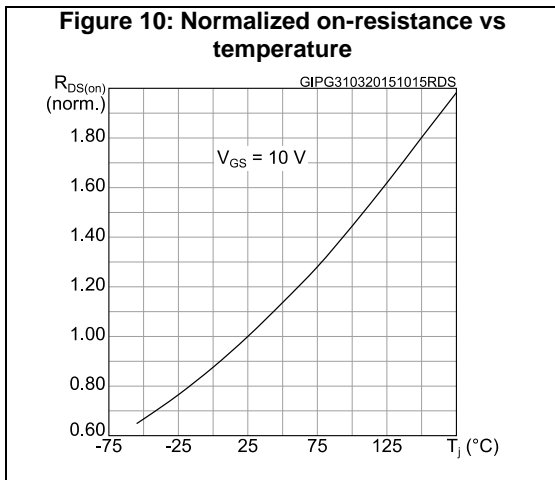
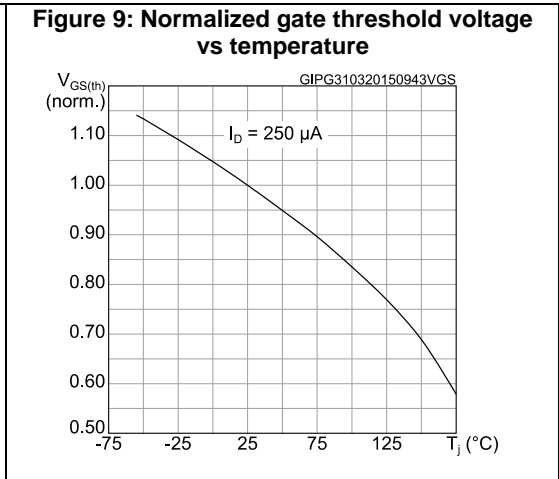
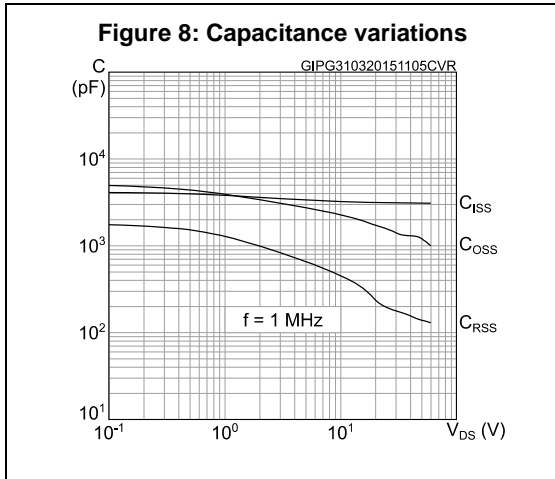
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{SD}^{(1)}$	Forward on voltage	$V_{GS} = 0 \text{ V}$ , $I_{SD} = 70 \text{ A}$	-		1.2	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 70 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ , $V_{DD} = 48 \text{ V}$ (see <a href="#">Figure 15: "Test circuit for inductive load switching and diode recovery times"</a> )	-	42.4		ns
$Q_{rr}$	Reverse recovery charge		-	38.2		nC
$I_{RRM}$	Reverse recovery current		-	1.8		A

**Notes:**

<sup>(1)</sup> Pulse test: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%.

## 2.1 Electrical characteristics (curves)





### 3 Test circuits

**Figure 13: Test circuit for resistive load switching times**



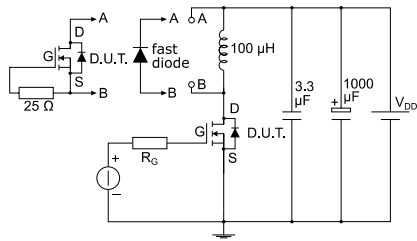
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**Figure 14: Test circuit for gate charge behavior**



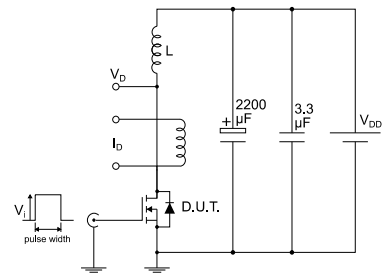
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**Figure 15: Test circuit for inductive load switching and diode recovery times**



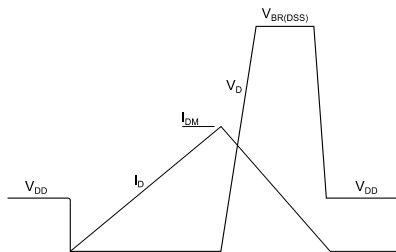
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**Figure 16: Unclamped inductive load test circuit**



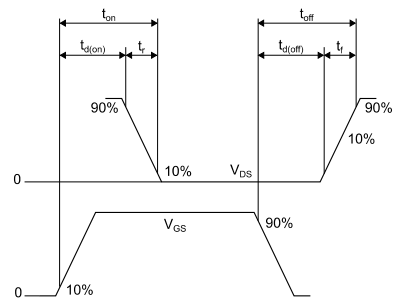
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**Figure 17: Unclamped inductive waveform**



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**Figure 18: Switching time waveform**



AM01473v1



## 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 19: TO-220FP package outline

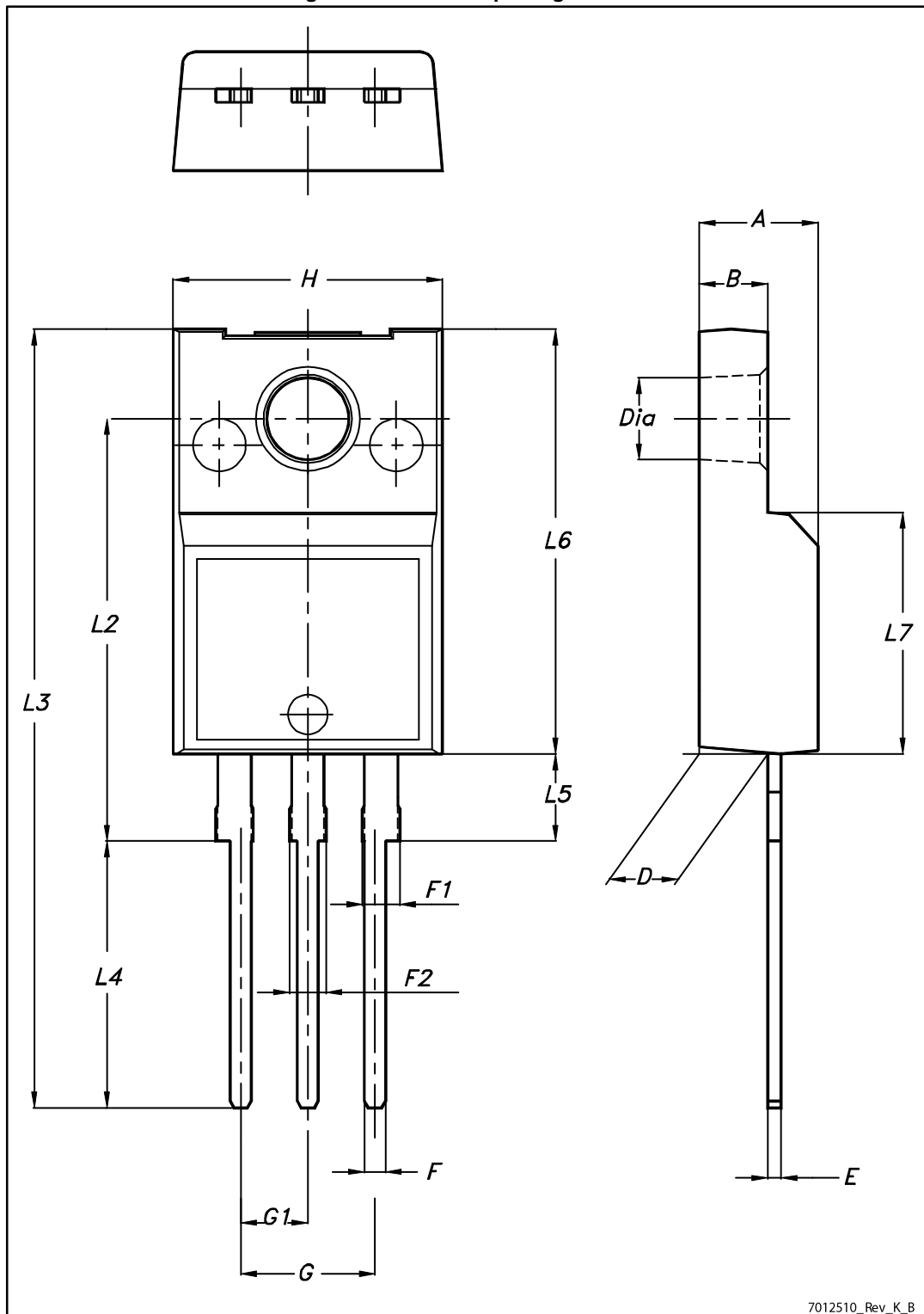


Table 8: TO-220FP package mechanical data

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 9: Document revision history**

Date	Revision	Changes
09-Apr-2015	1	First release.
17-Apr-2015	2	Throughout document: - minor text edits - updated drain-source on-resistance values
14-Jan-2016	3	Updated <a href="#">Table 2: "Absolute maximum ratings"</a> .

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