

N-channel 600 V, 0.14 Ω typ., 20 A MDmesh™ M2 Power MOSFETs in TO-220FP and I²PAKFP packages

Datasheet - production data

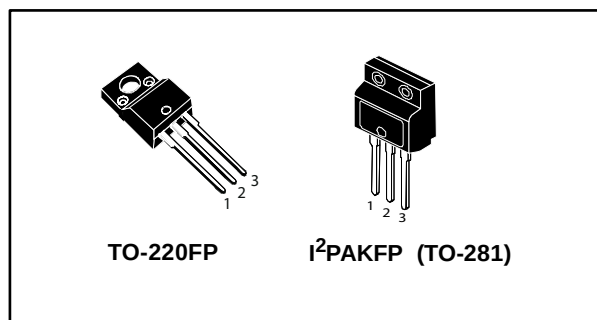
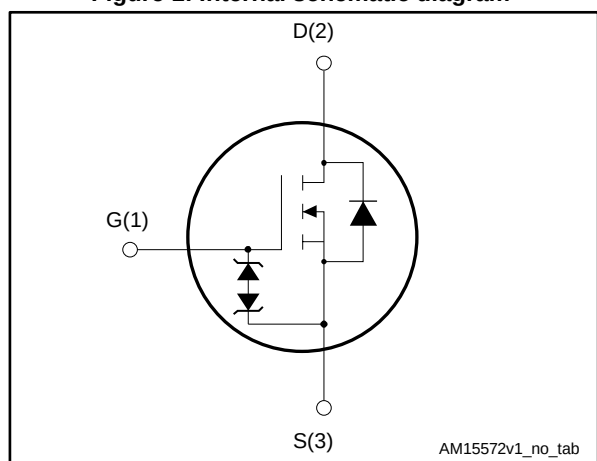


Figure 1: Internal schematic diagram



Features

Order code	V _{DS} @ T _{Jmax}	R _{DS(on)} max.	I _D	P _{TOT}
STF26N60M2	650 V	0.165 Ω	20 A	30 W
STF126N60M2				

- Extremely low gate charge
- Excellent output capacitance (C_{oss}) profile
- 100% avalanche tested
- Zener-protected

Applications

- Switching applications
- LCC converters, resonant converters

Description

These devices are N-channel Power MOSFETs developed using MDmesh™ M2 technology. Thanks to their strip layout and improved vertical structure, these devices exhibit low on-resistance and optimized switching characteristics, rendering them suitable for the most demanding high efficiency converters.

Table 1: Device summary

Order code	Marking	Package	Packing
STF26N60M2	26N60M2	TO-220FP	Tube
STF126N60M2		I ² PAKFP	

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1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	± 25	V
$I_D^{(1)}$	Drain current (continuous) at $T_{case} = 25\text{ }^{\circ}\text{C}$	20	A
	Drain current (continuous) at $T_{case} = 100\text{ }^{\circ}\text{C}$	13	
$I_{DM}^{(2)}$	Drain current (pulsed)	80	A
P_{TOT}	Total dissipation at $T_{case} = 25\text{ }^{\circ}\text{C}$	30	W
$dv/dt^{(3)}$	Peak diode recovery voltage slope	15	V/ns
$dv/dt^{(4)}$	MOSFET dv/dt ruggedness	50	
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink ($t = 1\text{ s}$; $T_C = 25\text{ }^{\circ}\text{C}$)	2.5	kV
T_{stg}	Storage temperature	-55 to 150	$^{\circ}\text{C}$
T_j	Operating junction temperature		

Notes:

- (1) Limited by maximum junction temperature.
 (2) Pulse width is limited by safe operating area.
 (3) $I_{SD} \leq 20\text{ A}$, $di/dt = 400\text{ A}/\mu\text{s}$; $V_{DS(peak)} < V_{(BR)DSS}$, $V_{DD} = 80\% V_{(BR)DSS}$.
 (4) $V_{DS} \leq 480\text{ V}$.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	4.2	$^{\circ}\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient	62.5	

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
$I_{AR}^{(1)}$	Avalanche current, repetitive or not repetitive	3.8	A
$E_{AR}^{(2)}$	Single pulse avalanche energy	250	mJ

Notes:

- (1) Pulse width limited by T_{jmax} .
 (2) starting $T_j = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$.

2 Electrical characteristics

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

Table 5: Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(\text{BR})\text{DSS}}$	Drain-source breakdown voltage	$V_{\text{GS}} = 0\text{ V}$, $I_{\text{D}} = 1\text{ mA}$	600			V
I_{DSS}	Zero gate voltage drain current	$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 600\text{ V}$			1	μA
		$V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 600\text{ V}$, $T_{\text{case}} = 125\text{ }^{\circ}\text{C}$			100	
I_{GSS}	Gate-body leakage current	$V_{\text{DS}} = 0\text{ V}$, $V_{\text{GS}} = \pm 25\text{ V}$			± 10	μA
$V_{\text{GS(th)}}$	Gate threshold voltage	$V_{\text{DS}} = V_{\text{GS}}$, $I_{\text{D}} = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{\text{DS(on)}}$	Static drain-source on-resistance	$V_{\text{GS}} = 10\text{ V}$, $I_{\text{D}} = 10\text{ A}$		0.14	0.165	Ω

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{\text{DS}} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{\text{GS}} = 0\text{ V}$	-	1360	-	pF
C_{oss}	Output capacitance		-	88	-	
C_{rss}	Reverse transfer capacitance		-	2	-	
$C_{\text{oss eq.}}^{(1)}$	Equivalent output capacitance	$V_{\text{DS}} = 0\text{ to }480\text{ V}$, $V_{\text{GS}} = 0\text{ V}$	-	124	-	pF
R_{G}	Intrinsic gate resistance	$f = 1\text{ MHz}$, $I_{\text{D}} = 0\text{ A}$	-	4	-	Ω
Q_{g}	Total gate charge	$V_{\text{DD}} = 480\text{ V}$, $I_{\text{D}} = 20\text{ A}$, $V_{\text{GS}} = 10\text{ V}$ (see Figure 15: "Gate charge test circuit")	-	34	-	nC
Q_{gs}	Gate-source charge		-	5.6	-	
Q_{gd}	Gate-drain charge		-	16.3	-	

Notes:

⁽¹⁾ $C_{\text{oss eq.}}$ 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
$t_{\text{d(on)}}$	Turn-on delay time	$V_{\text{DD}} = 300\text{ V}$, $I_{\text{D}} = 10\text{ A}$ $R_{\text{G}} = 4.7\text{ }\Omega$, $V_{\text{GS}} = 10\text{ V}$ (see Figure 14: "Switching times test circuit for resistive load" and Figure 19: "Switching time waveform")	-	20.2	-	ns
t_{r}	Rise time		-	8	-	
$t_{\text{d(off)}}$	Turn-off delay time		-	66	-	
t_{f}	Fall time		-	10	-	

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		20	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		80	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$, $I_{SD} = 20\text{ A}$	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 20\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$ (see Figure 16 : "Test circuit for inductive load switching and diode recovery times")	-	360		ns
Q_{rr}	Reverse recovery charge		-	5		μC
I_{RRM}	Reverse recovery current		-	27		A
t_{rr}	Reverse recovery time	$I_{SD} = 20\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ (see Figure 16 : "Test circuit for inductive load switching and diode recovery times")	-	556		ns
Q_{rr}	Reverse recovery charge		-	8		μC
I_{RRM}	Reverse recovery current		-	29		A

Notes:

⁽¹⁾ Pulse width is limited by safe operating area.

⁽²⁾ Pulse test: pulse duration = 300 μs , duty cycle 1.5%.

2.1 Electrical characteristics (curves)

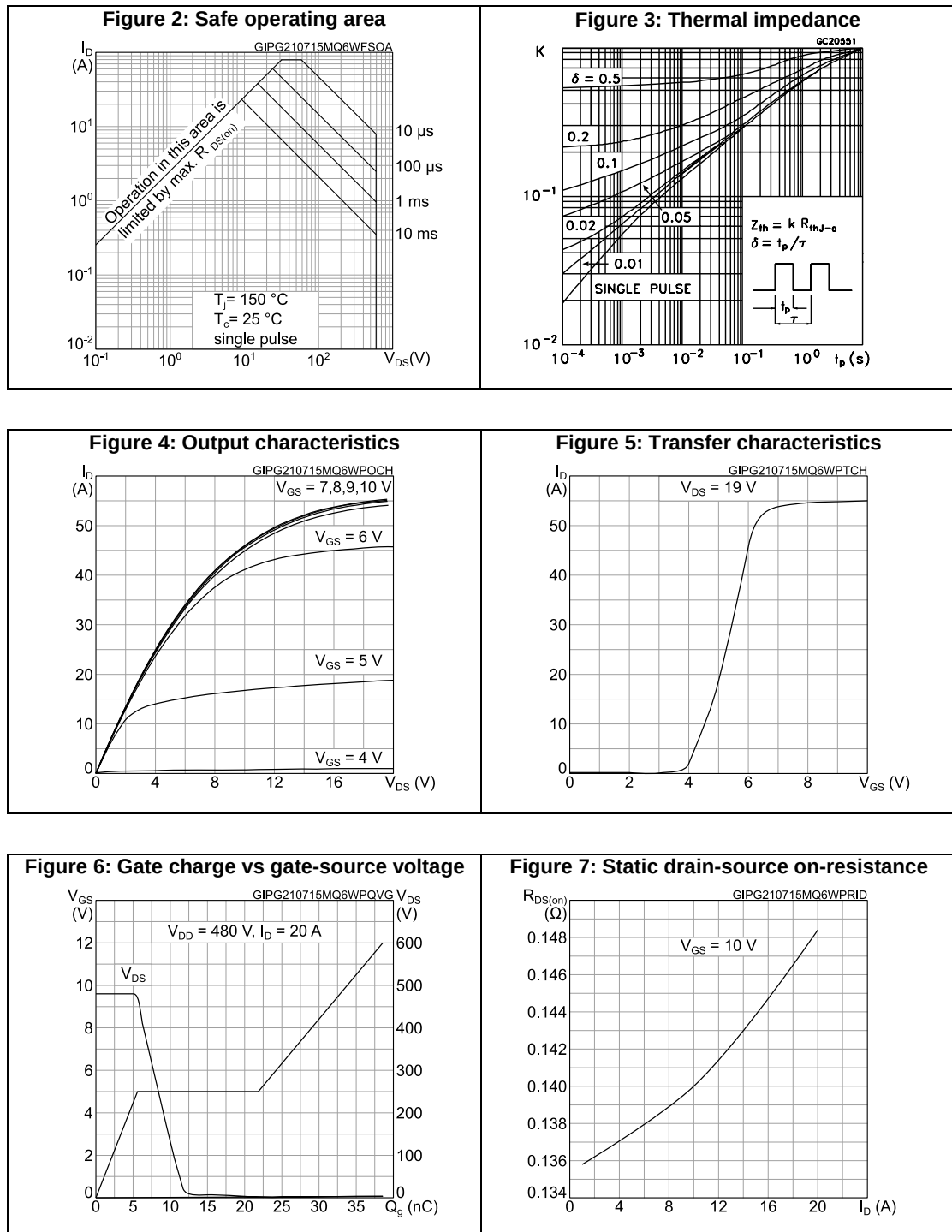


Figure 8: Capacitance variations

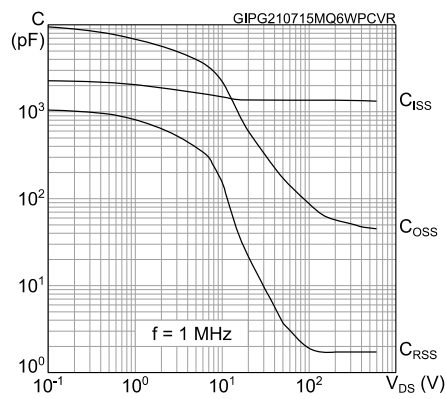


Figure 9: Normalized gate threshold voltage vs temperature

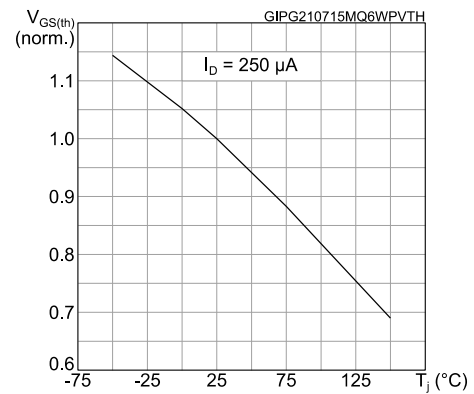


Figure 10: Normalized on-resistance vs temperature

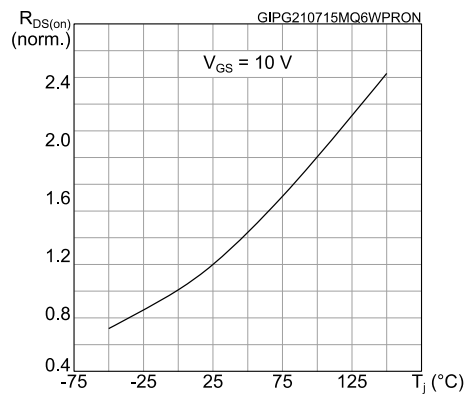


Figure 11: Normalized V(BR)DSS vs temperature

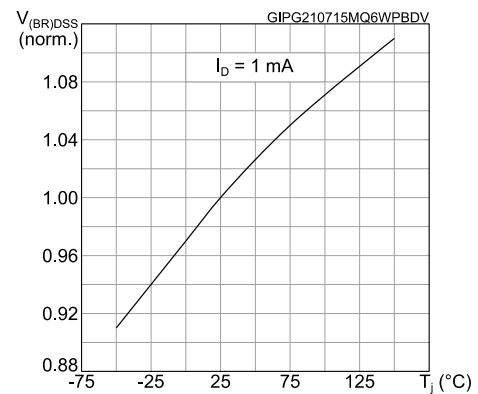


Figure 12: Output capacitance stored energy

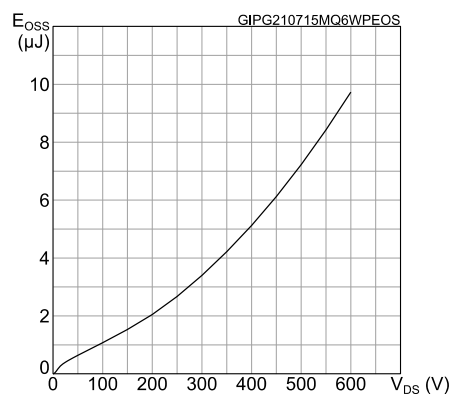
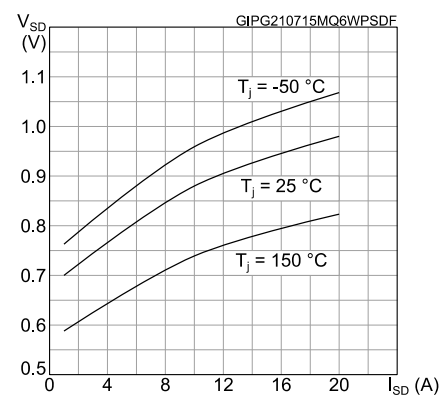
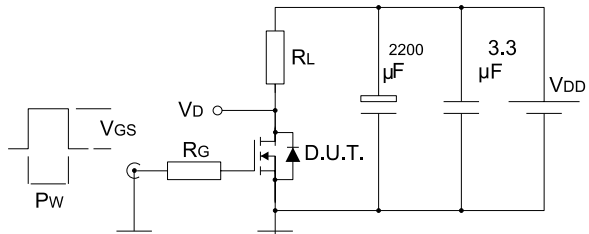


Figure 13: Source-drain diode forward characteristics



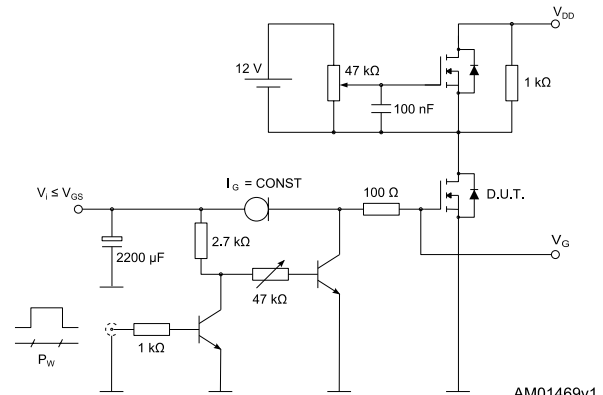
3 Test circuits

Figure 14: Switching times test circuit for resistive load



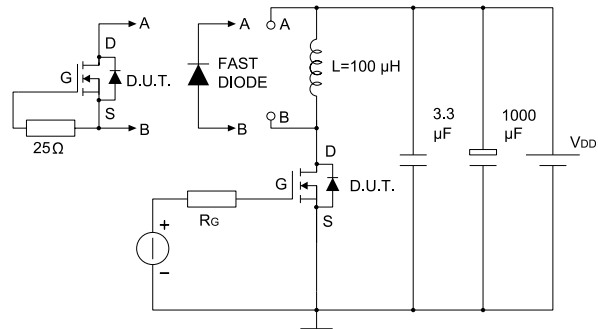
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Figure 15: Gate charge test circuit



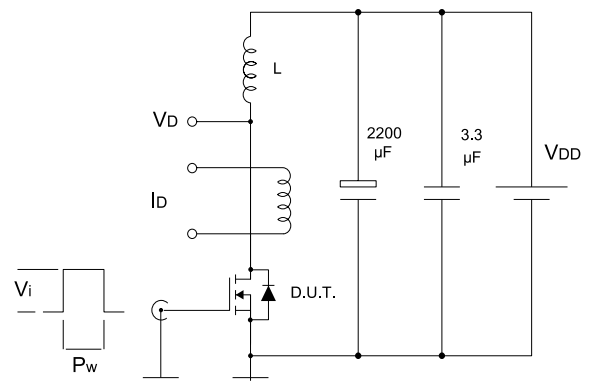
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Figure 16: Test circuit for inductive load switching and diode recovery times



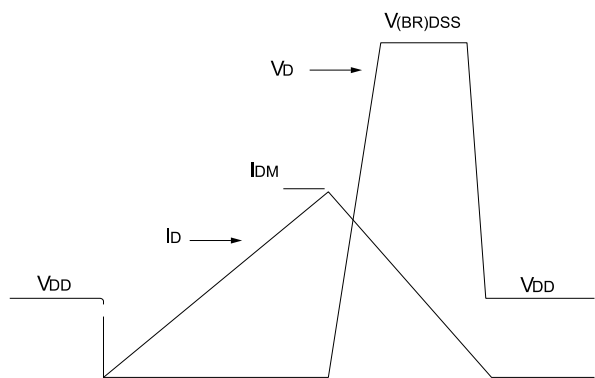
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Figure 17: Unclamped inductive load test circuit



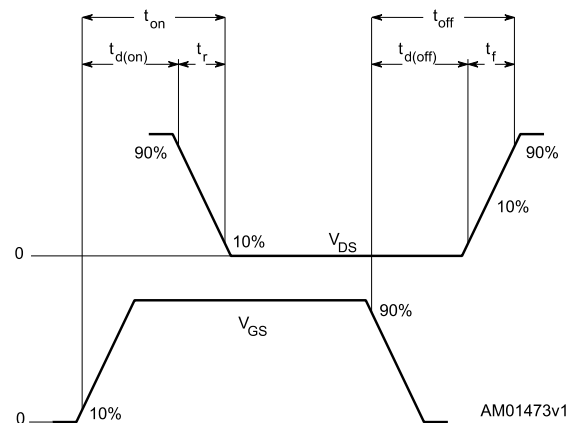
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Figure 18: Unclamped inductive waveform



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Figure 19: 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**. ECOPACK[®] is an ST trademark.

4.1 TO-220FP package information

Figure 20: TO-220FP package outline

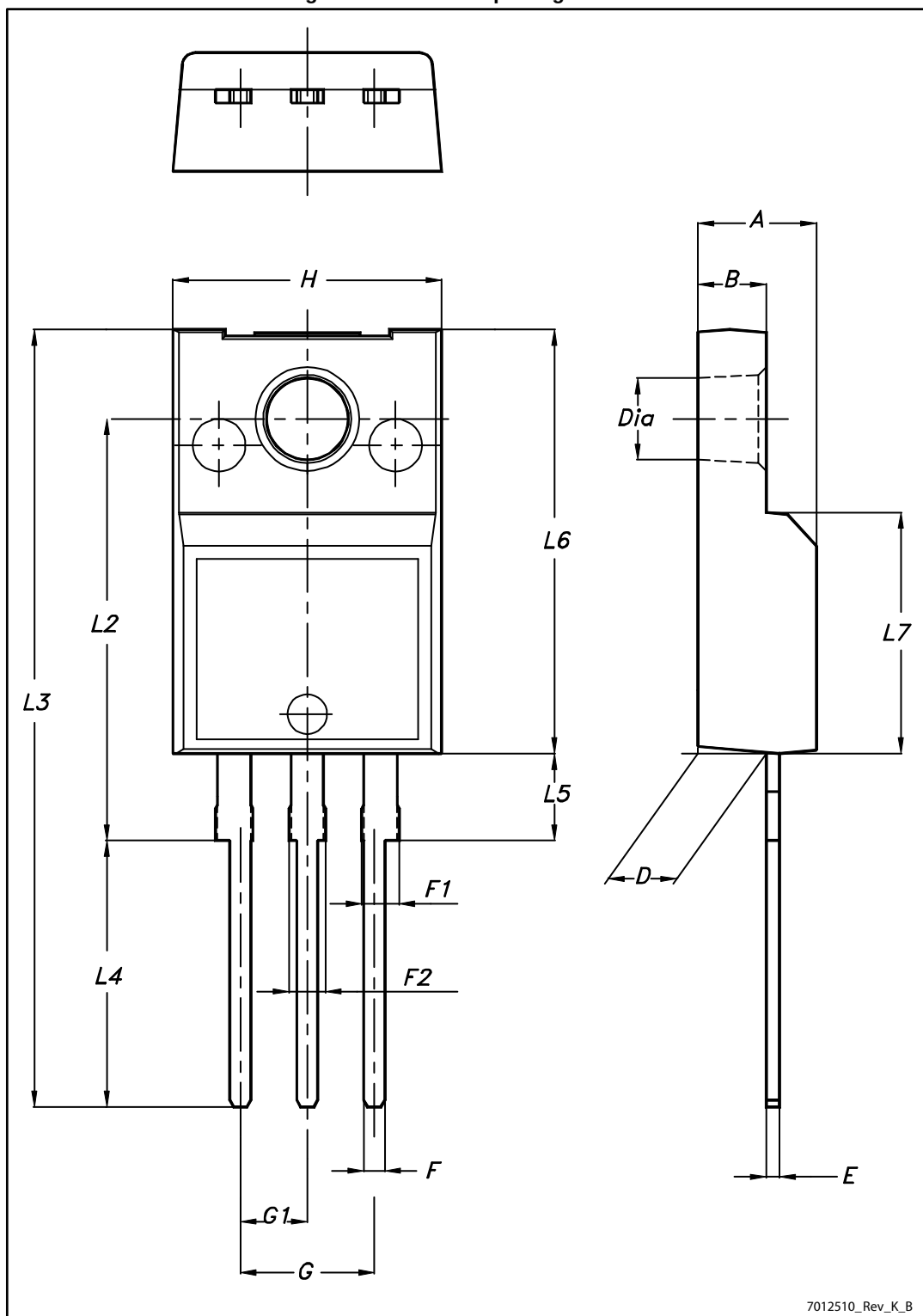


Table 9: TO-220FP package mechanical data

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

4.2 I²PAKFP (TO-281) package information

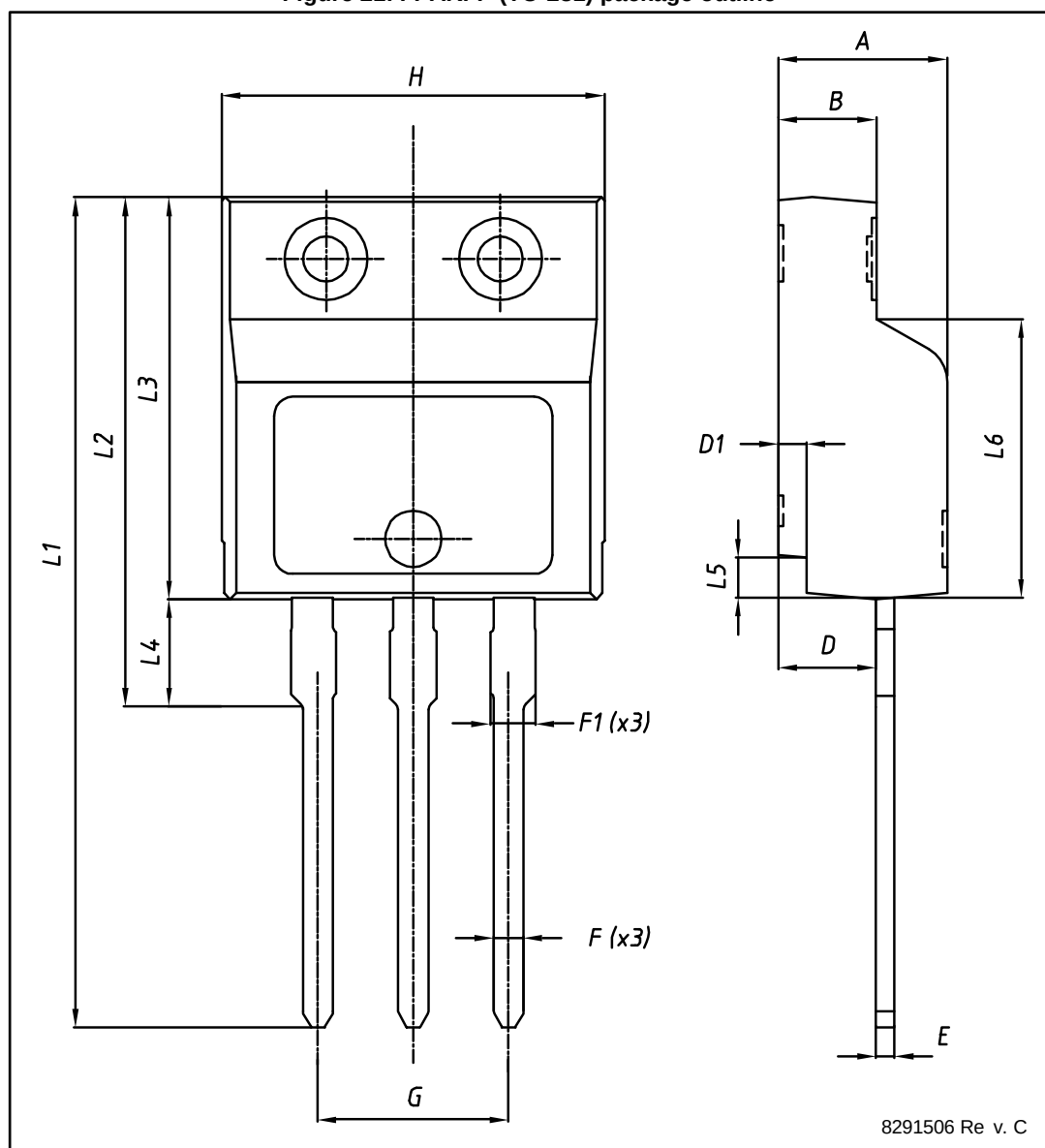
Figure 21: I²PAKFP (TO-281) package outline

Table 10: I²PAKFP (TO-281) mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40	-	4.60
B	2.50		2.70
D	2.50		2.75
D1	0.65		0.85
E	0.45		0.70
F	0.75		1.00
F1			1.20
G	4.95		5.20
H	10.00		10.40
L1	21.00		23.00
L2	13.20		14.10
L3	10.55		10.85
L4	2.70		3.20
L5	0.85		1.25
L6	7.50	7.60	7.70

5 Revision history

Table 11: Document revision history

Date	Revision	Changes
05-Mar-2015	1	First release.
30-July-2015	2	Text and formatting changes throughout document Datasheet promoted from preliminary data to production data In Section <i>Electrical characteristics</i> : - updated and renamed table <i>Static</i> (was On/off states) - updated table <i>Dynamic</i>, <i>Switching times</i> and <i>Source-drain diode</i> - added section <i>Electrical characteristics (curves)</i>

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