

N-channel 800 V, 0.95 Ω typ., 5 A MDmesh™ K5 Power MOSFET in a I²PAKFP package

Datasheet - production data

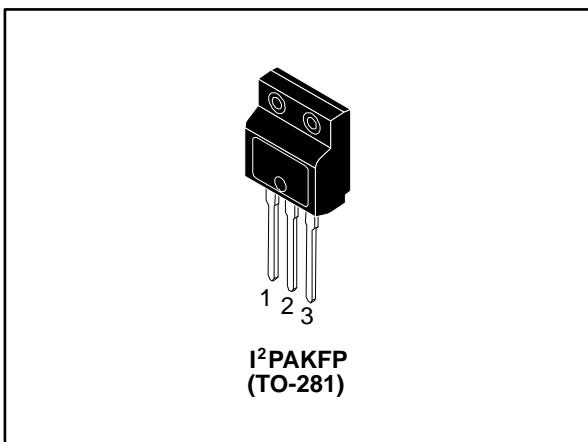


Figure 1: Internal schematic diagram

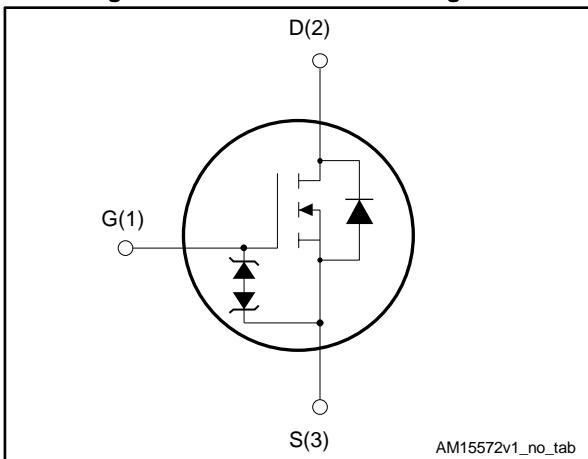


Figure 2: Internal schematic diagram

Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
STFI7LN80K5	800 V	1.15 Ω	5 A

- Industry's lowest R_{DS(on)} x area
- Industry's best figure of merit (FoM)
- Ultra-low gate charge
- 100% avalanche tested
- Zener-protected

Applications

- Switching applications

Description

This very high voltage N-channel Power MOSFET is designed using MDmesh™ K5 technology based on an innovative proprietary vertical structure. The result is a dramatic reduction in on-resistance and ultra-low gate charge for applications requiring superior power density and high efficiency.

Table 1: Device summary

Order code	Marking	Package	Packing
STFI7LN80K5	7LN80K5	I ² PAKFP (TO-281)	Tube

Contents

1	Electrical ratings	3
2	Electrical characteristics	4
2.1	Electrical characteristics (curves)	6
3	Test circuits	8
4	Package information	9
4.1	I ² PAKFP (TO-281) package information	9
5	Revision history	11

1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	± 30	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	5	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	3.4	A
$I_D^{(2)}$	Drain current (pulsed)	20	A
P_{TOT}	Total dissipation at $T_C = 25^\circ\text{C}$	25	W
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink ($t=1\text{ s}$; $T_C=25^\circ\text{C}$)	2500	V
$dv/dt^{(3)}$	Peak diode recovery voltage slope	4.5	V/ns
$dv/dt^{(4)}$	MOSFET dv/dt ruggedness	50	
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 limited by safe operating area.⁽³⁾ $I_{SD} \leq 5\text{ A}$, $di/dt 100\text{ A}/\mu\text{s}$; V_{DS} peak < $V_{(BR)DSS}$, $V_{DD} = 640\text{ V}$ ⁽⁴⁾ $V_{DS} \leq 640\text{ V}$

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	5	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient	62.5	$^\circ\text{C}/\text{W}$

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by T_{jmax})	1.5	A
E_{AS}	Single pulse avalanche energy (starting $T_j = 25^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	200	mJ

2 Electrical characteristics

$T_C = 25^\circ\text{C}$ unless otherwise specified

Table 5: On/off-state

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(\text{BR})\text{DSS}}$	Drain-source breakdown voltage	$V_{\text{GS}} = 0 \text{ V}$, $I_D = 1 \text{ mA}$	800			V
I_{DSS}	Zero gate voltage drain current	$V_{\text{GS}} = 0 \text{ V}$, $V_{\text{DS}} = 800 \text{ V}$			1	μA
		$V_{\text{GS}} = 0 \text{ V}$, $V_{\text{DS}} = 800 \text{ V}$ $T_C = 125^\circ\text{C}$			50	μA
I_{GSS}	Gate body leakage current	$V_{\text{DS}} = 0 \text{ V}$, $V_{\text{GS}} = \pm 20 \text{ V}$			± 10	μA
$V_{\text{GS}(\text{th})}$	Gate threshold voltage	$V_{\text{DS}} = V_{\text{GS}}$, $I_D = 100 \mu\text{A}$	3	4	5	V
$R_{\text{DS}(\text{on})}$	Static drain-source on-resistance	$V_{\text{GS}} = 10 \text{ V}$, $I_D = 2.5 \text{ A}$		0.95	1.15	Ω

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{\text{DS}} = 100 \text{ V}$, $f = 1 \text{ MHz}$, $V_{\text{GS}} = 0 \text{ V}$	-	270	-	pF
C_{oss}	Output capacitance		-	22	-	pF
C_{rss}	Reverse transfer capacitance		-	0.5	-	pF
$C_{\text{o(er)}}^{(1)}$	Equivalent capacitance energy related	$V_{\text{DS}} = 0 \text{ to } 640 \text{ V}$, $V_{\text{GS}} = 0 \text{ V}$	-	17	-	nC
$C_{\text{o(tr)}}^{(2)}$	Equivalent capacitance time related		-	48	-	nC
R_g	Intrinsic gate resistance	$f = 1 \text{ MHz}$, $I_D = 0 \text{ A}$	-	7.5	-	Ω
Q_g	Total gate charge	$V_{\text{DD}} = 640 \text{ V}$, $I_D = 5 \text{ A}$ $V_{\text{GS}} = 10 \text{ V}$ See (Figure 15: "Test circuit for gate charge behavior")	-	12	-	nC
Q_{gs}	Gate-source charge		-	2.6	-	nC
Q_{gd}	Gate-drain charge		-	8.6	-	nC

Notes:

⁽¹⁾Energy related is defined as a constant equivalent capacitance giving the same stored energy as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}

⁽²⁾Time related is defined as a constant equivalent capacitance giving the same stored energy 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	$V_{\text{DD}} = 400 \text{ V}$, $I_D = 2.5 \text{ A}$, $R_G = 4.7 \Omega$ $V_{\text{GS}} = 10 \text{ V}$ See (Figure 14: "Test circuit for resistive load switching times" and Figure 19: "Switching time waveform")	-	9.3	-	ns
t_r	Rise time		-	6.7	-	ns
$t_{\text{d(off)}}$	Turn-off delay time		-	23.6	-	ns
t_f	Fall time		-	17.4	-	ns

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		5	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		20	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 5 \text{ A}, V_{GS} = 0 \text{ V}$	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 5 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}, V_{DD} = 60 \text{ V}$ See <i>Figure 16: "Test circuit for inductive load switching and diode recovery times"</i>	-	276		ns
Q_{rr}	Reverse recovery charge		-	2.13		μC
I_{RRM}	Reverse recovery current		-	15.4		A
t_{rr}	Reverse recovery time	$I_{SD} = 5 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 60 \text{ V}, T_j = 150 \text{ }^\circ\text{C}$ See <i>Figure 16: "Test circuit for inductive load switching and diode recovery times"</i>	-	402		ns
Q_{rr}	Reverse recovery charge		-	2.79		μC
I_{RRM}	Reverse recovery current		-	13.9		A

Notes:

(1) Pulse width limited by safe operating area

(2) Pulsed: pulse duration = 300 μs , duty cycle 1.5%

Table 9: Gate-source Zener diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)GSO}$	Gate-source breakdown voltage	$I_{GS} = \pm 1 \text{ mA}, I_D = 0 \text{ A}$	30	-	-	V

The built-in back-to-back Zener diodes are specifically designed to enhance the ESD performance of the device. The Zener voltage facilitates efficient and cost-effective device integrity protection, thus eliminating the need for additional external componentry.

2.2 Electrical characteristics (curves)

Figure 2: Safe operating area

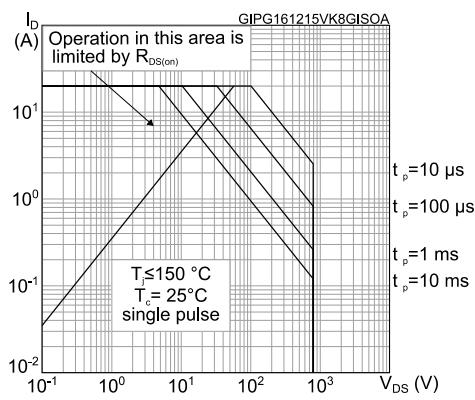


Figure 3: Thermal impedance

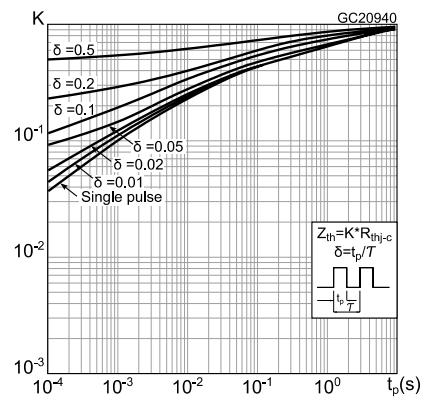


Figure 4: Output characteristics

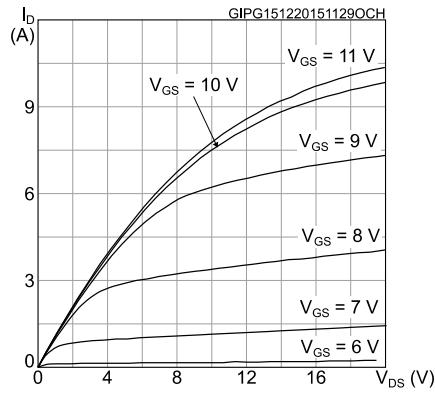


Figure 5: Transfer characteristics

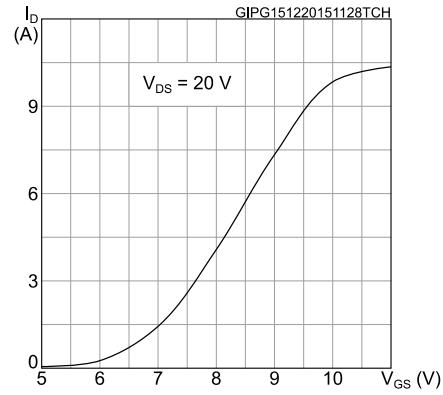


Figure 6: Gate charge vs gate-source voltage

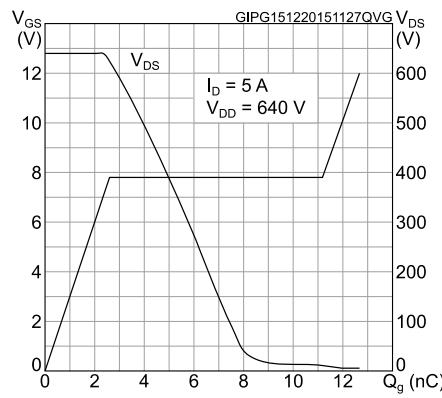


Figure 7: Static drain-source on-resistance

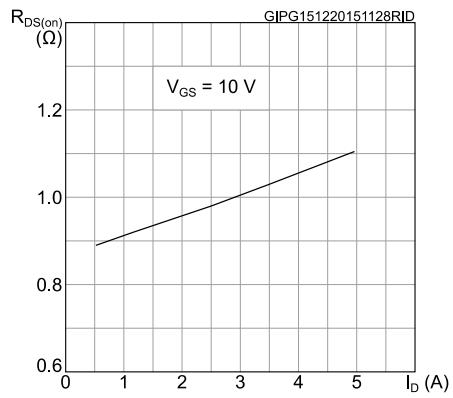


Figure 8: Capacitance variations

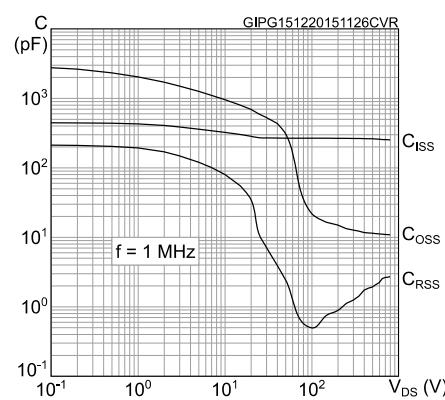


Figure 9: Normalized gate threshold voltage vs temperature

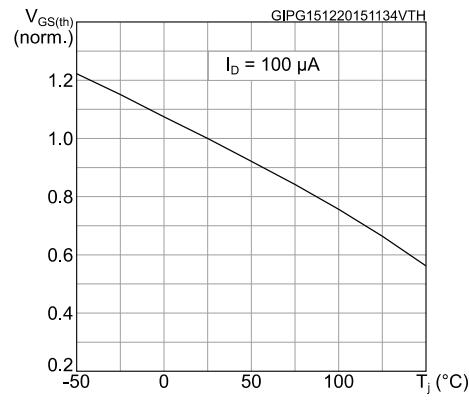
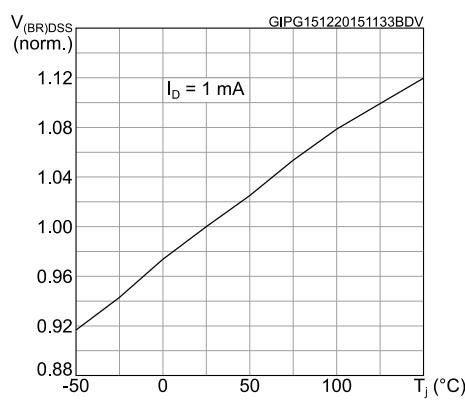
Figure 10: Normalized V_{(BR)DSS} vs temperature

Figure 11: Normalized on-resistance vs temperature

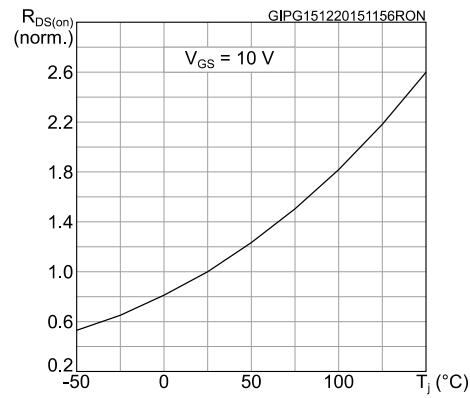


Figure 12: Source-drain diode forward characteristics

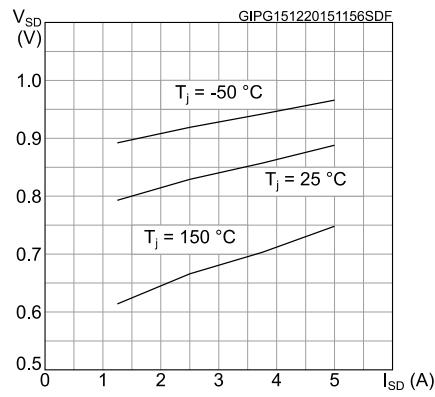
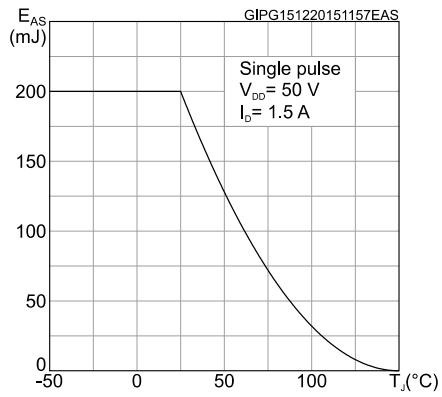


Figure 13: Maximum avalanche energy vs starting T_J



3 Test circuits

Figure 14: Test circuit for resistive load switching times

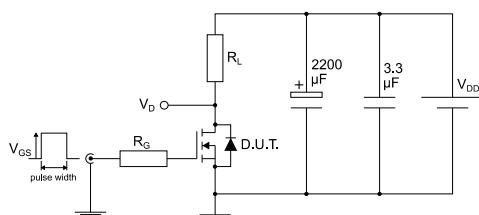


Figure 15: Test circuit for gate charge behavior

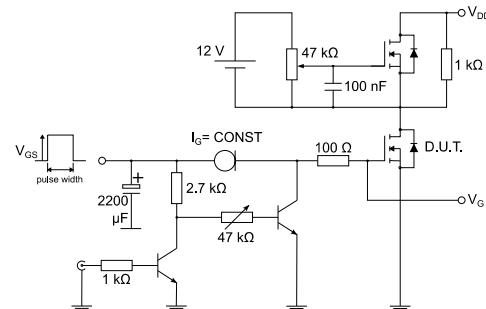


Figure 16: Test circuit for inductive load switching and diode recovery times

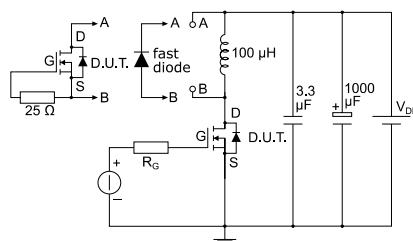


Figure 17: Unclamped inductive load test circuit

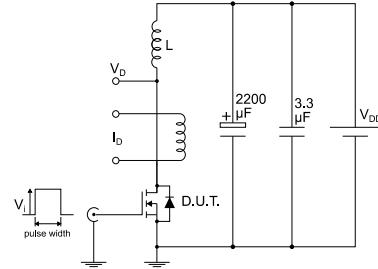


Figure 18: Unclamped inductive waveform

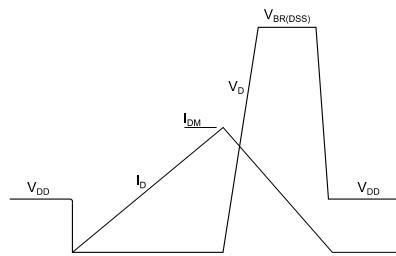
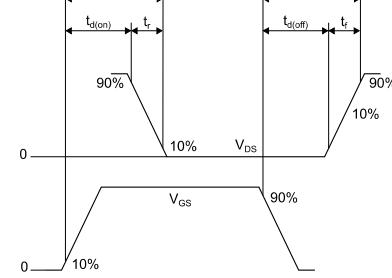


Figure 19: Switching time waveform



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 I²PAKFP (TO-281) package information

Figure 20: I²PAKFP (TO-281) package outline

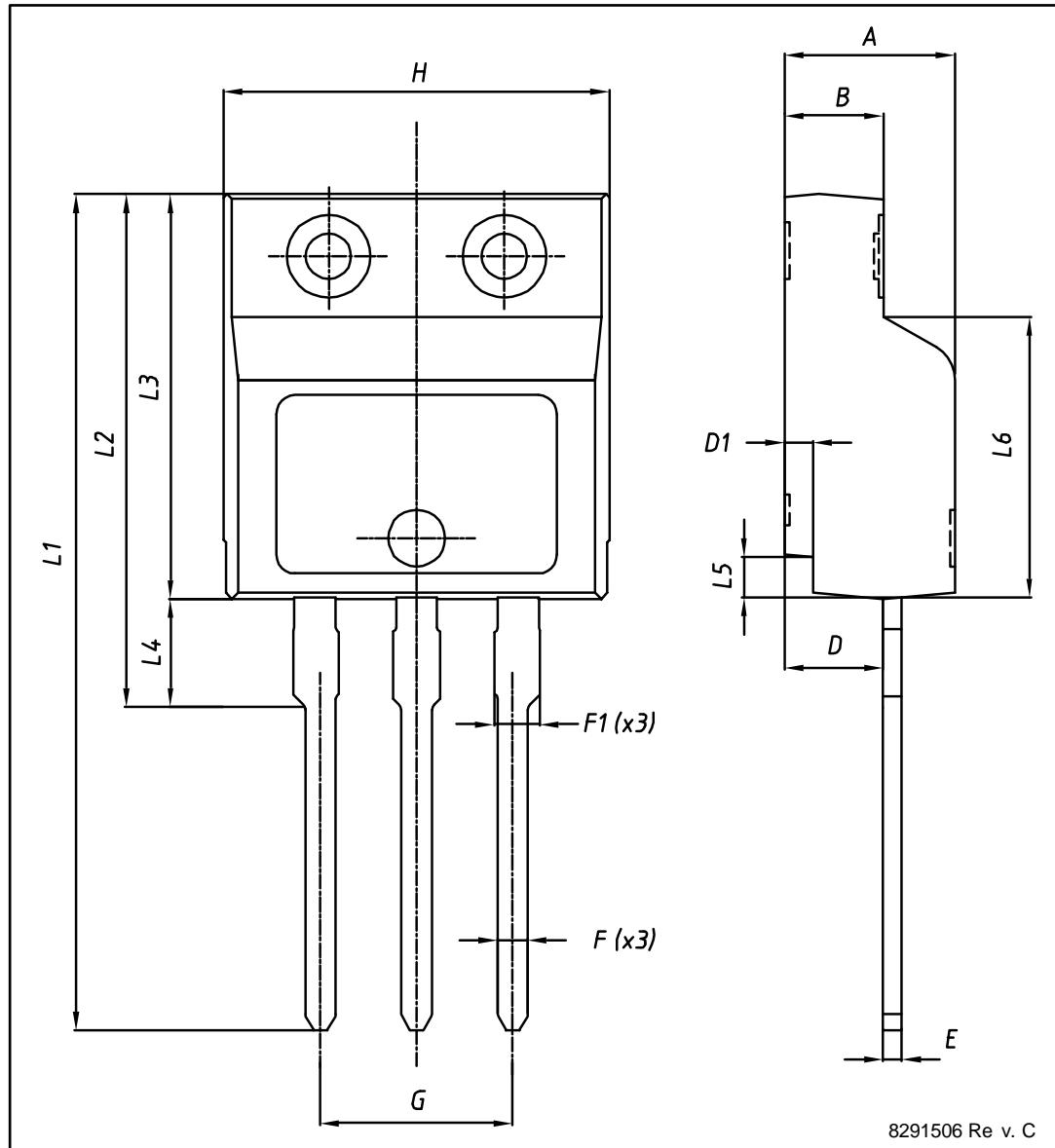


Table 10: I²PAKFP (TO-281) mechanical data

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
15-Dec-2015	1	First release.

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