STFI7LN80K5

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

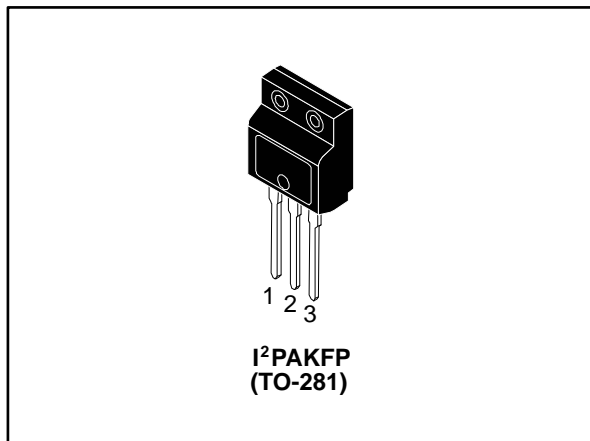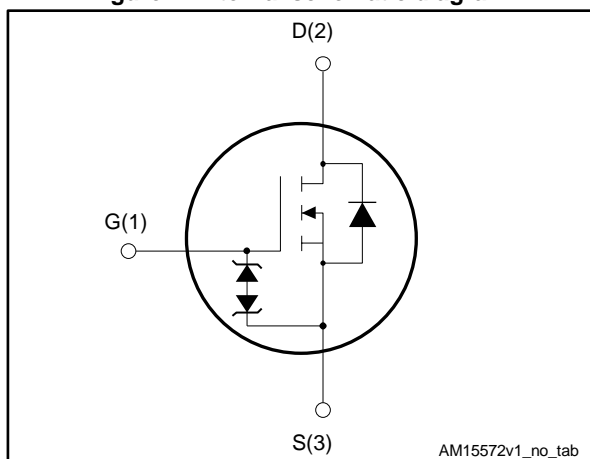Datasheet - production data

I²PAKFP (TO-281)

Figure 1: 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	I²PAKFP (TO-281)	Tube

This is information on a product in full production.

Contents

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 °C	5	A
I_D[1]	Drain current (continuous) at T_C = 100 °C	3.4	A
I_D[2]	Drain current (pulsed)	20	A
P_{TOT}	Total dissipation at T_C = 25 °C	25	W
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t=1 s; T_C=25 °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	°C
T_J	Operating junction temperature		

Notes:

[1]Limited by maximum junction temperature.

[2]Pulse width limited by safe operating area.

[3]I_{SD} ≤ 5 A, di/dt 100 A/µs; V_{DS} peak < $V_{(BR)DSS}$, V_{DD}= 640 V

[4]V_{DS} ≤ 640 V

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	5	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	62.5	°C/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 °C, I_D = I_{AR}, V_{DD} = 50 V)	200	mJ

2   Electrical characteristics

T_C = 25 °C unless otherwise specified

Table 5: On/off-state

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

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 100 V, f = 1 MHz, V_{GS} = 0 V	-	270	-	pF
C_{oss}	Output capacitance		-	22	-	pF
C_{rss}	Reverse transfer capacitance		-	0.5	-	pF
$C_{o(er)}$[1]	Equivalent capacitance energy related	V_{DS} = 0 to 640 V, V_{GS} = 0 V	-	17	-	nC
$C_{o(tr)}$[2]	Equivalent capacitance time related		-	48	-	nC
R_g	Intrinsic gate resistance	f = 1 MHz, I_D=0 A	-	7.5	-	Ω
Q_g	Total gate charge	V_{DD} = 640 V, I_D = 5 A V_{GS}= 10 V	-	12	-	nC
Q_{gs}	Gate-source charge		-	2.6	-	nC
Q_{gd}	Gate-drain charge	See (*Figure 15: "Test circuit for gate charge behavior"*)	-	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
$t_{d(on)}$	Turn-on delay time	V_{DD}= 400 V, I_D =2.5 A, R_G = 4.7 Ω V_{GS} = 10 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
$t_{d(off)}$	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 A, V_{GS} = 0 V	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 5 A, di/dt = 100 A/µs, V_{DD} = 60 V See *Figure 16: "Test circuit for inductive load switching and diode recovery times"*	-	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 A, di/dt = 100 A/µs V_{DD} = 60 V, T_j = 150 °C See *Figure 16: "Test circuit for inductive load switching and diode recovery times"*	-	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}= ± 1mA, I_D= 0 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.

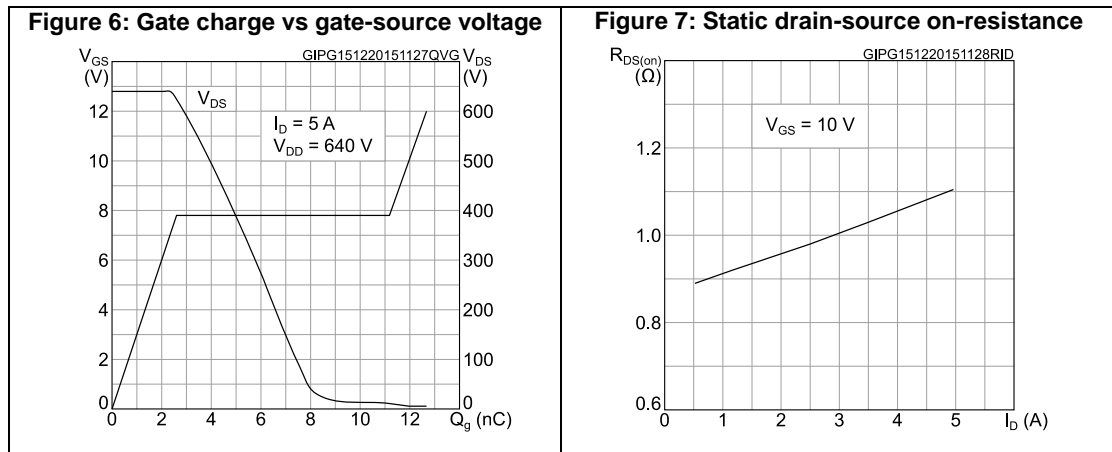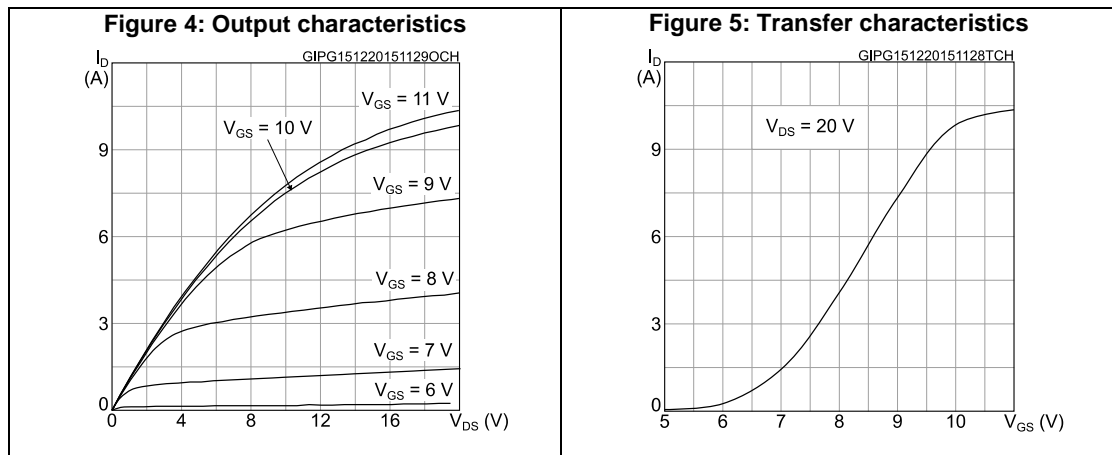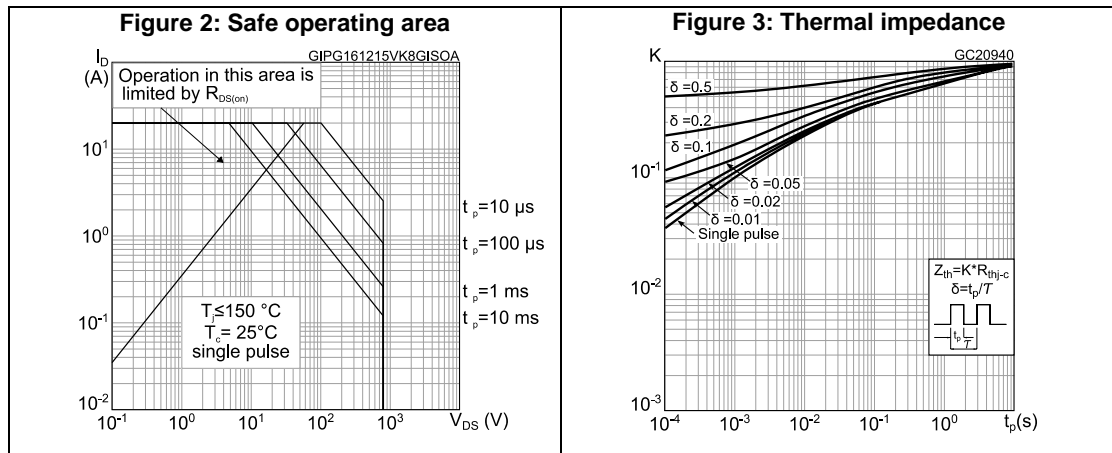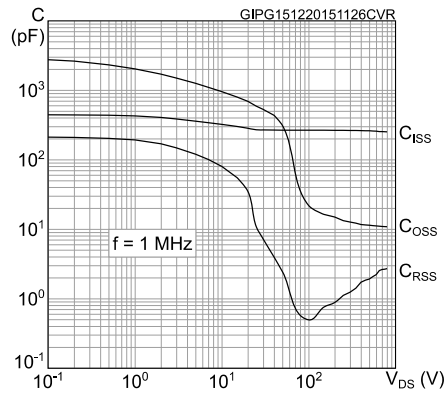## 2.2 Electrical characteristics (curves)

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

GIPG151220151126CVR

C (pF)

C_{ISS}
C_{OSS}
C_{RSS}

f = 1 MHz

V_{DS} (V)

Figure 9: Normalized gate threshold voltage vs temperature

GIPG151220151134VTH

$V_{GS(th)}$ (norm.)

I_D = 100 µA

T_j (°C)
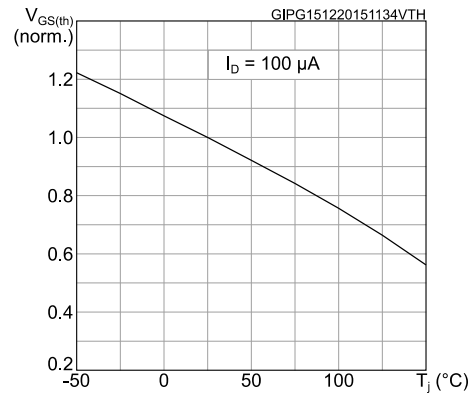
Figure 10: Normalized V(BR)DSS vs temperature

GIPG151220151133BDV

$V_{(BR)DSS}$ (norm.)

I_D = 1 mA

T_j (°C)
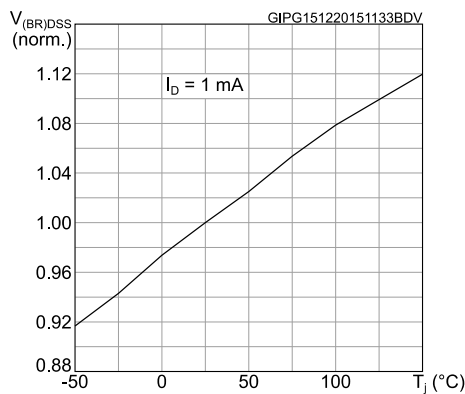
Figure 11: Normalized on-resistance vs temperature

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$R_{DS(on)}$ (norm.)

V_{GS} = 10 V

T_j (°C)
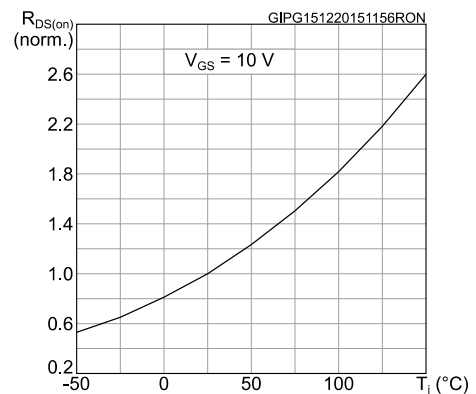
Figure 12: Source-drain diode forward characteristics

GIPG151220151156SDF

V_{SD} (V)

T_j = -50 °C
T_j = 25 °C
T_j = 150 °C

I_{SD} (A)
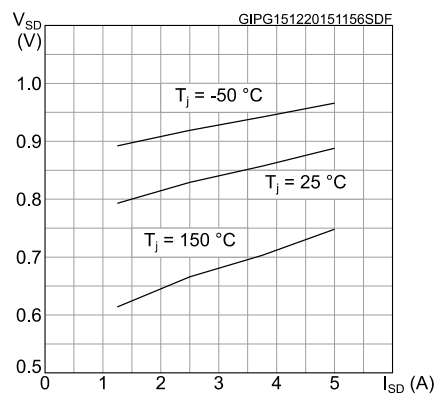
Figure 13: Maximum avalanche energy vs starting TJ

GIPG151220151157EAS

E_{AS} (mJ)

Single pulse
V_{DD}= 50 V
I_D= 1.5 A

T_J(°C)
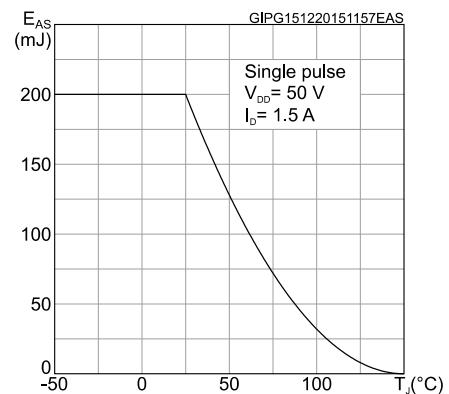
3 Test circuits

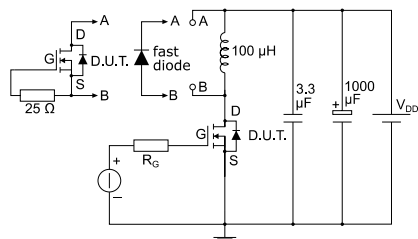**Figure 14: Test circuit for resistive load switching times**
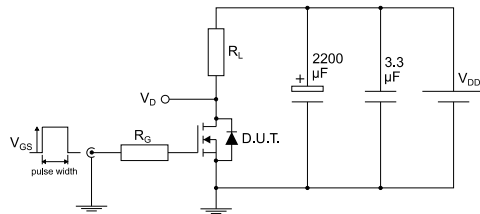
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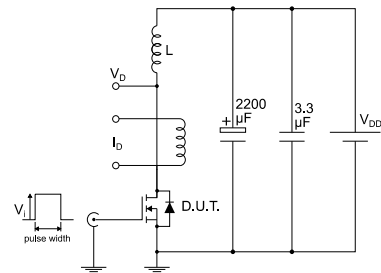**Figure 15: Test circuit for gate charge behavior**
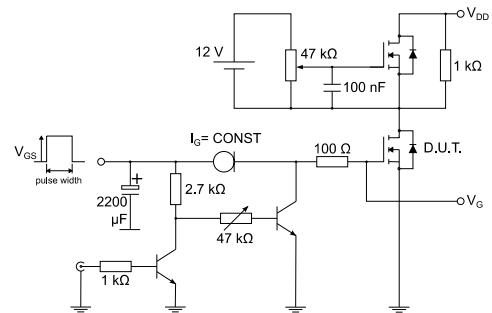
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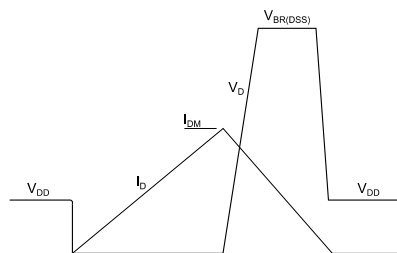**Figure 16: Test circuit for inductive load switching and diode recovery times**

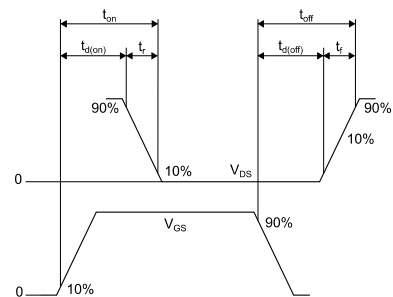AM01470v1

Figure 17: Unclamped inductive load test circuit

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Figure 18: Unclamped inductive waveform

AM01472v1

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 I²PAKFP (TO-281) package information

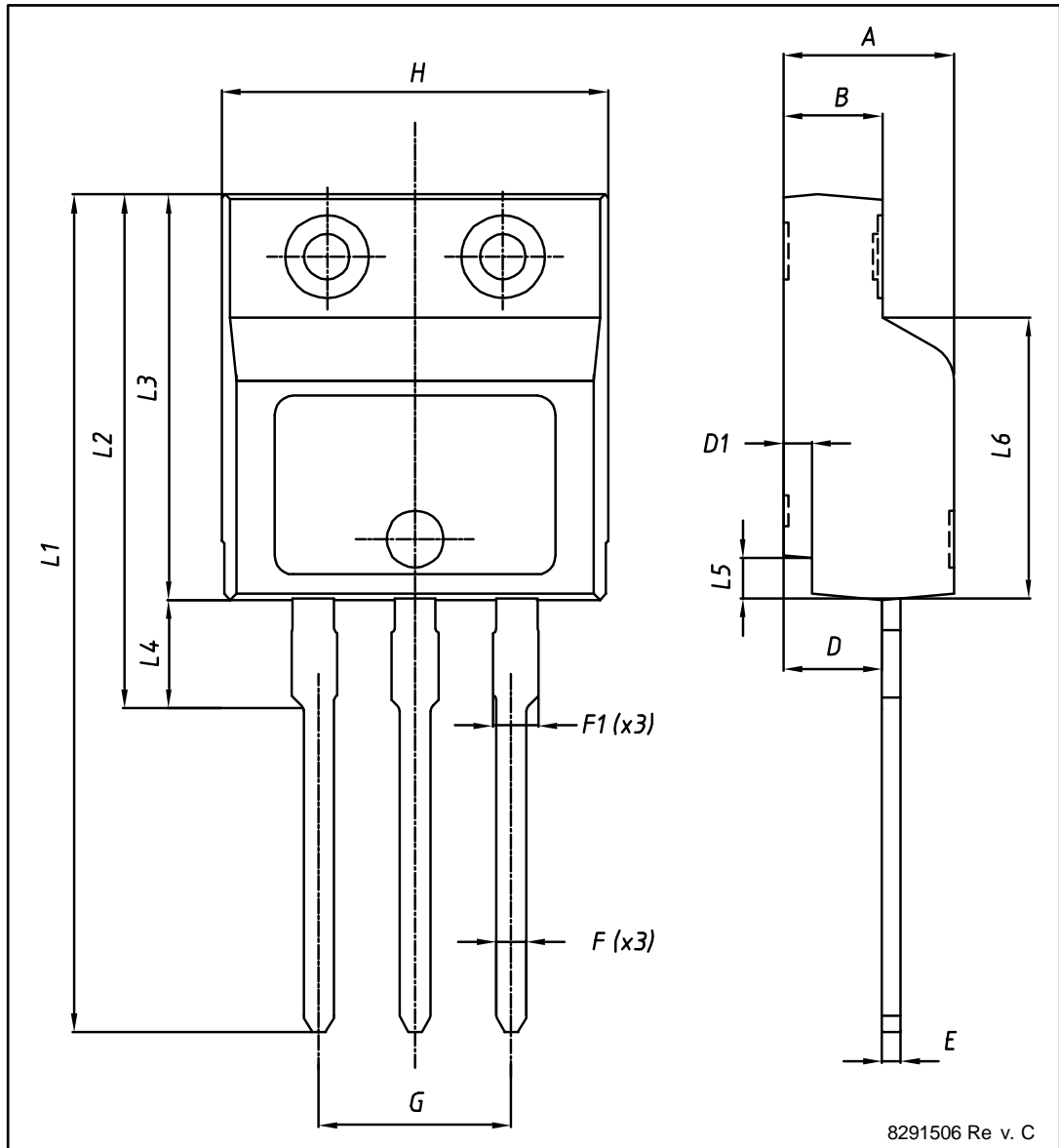**Figure 20: I²PAKFP (TO-281) package outline**

8291506 Re v. C

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.

IMPORTANT NOTICE – PLEASE READ CAREFULLY