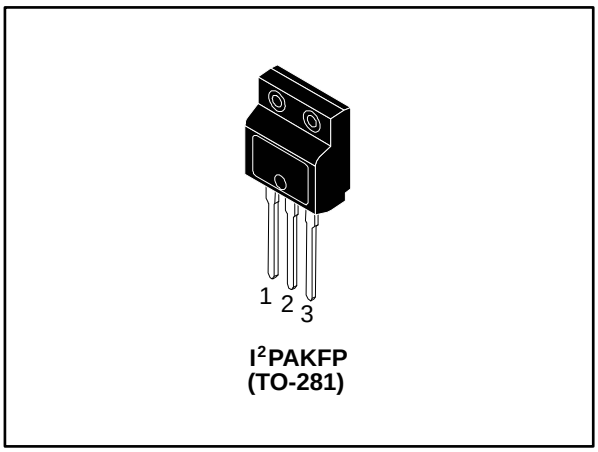
STFI18N65M2

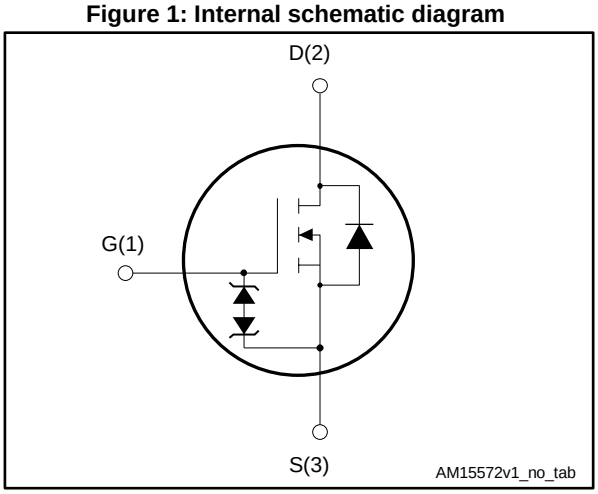
N-channel 650 V, 0.275 Ω typ., 12 A MDmesh™ M2 Power MOSFET in an I²PAKFP package

Datasheet - production data



I²PAKFP (TO-281)

Figure 1: Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D
STFI18N65M2	650 V	0.33 Ω	12 A

- Fully insulated and low profile package with increased creepage path from pin to heatsink plate
- Extremely low gate charge
- Excellent output capacitance (C_{OSS}) profile
- 100% avalanche tested
- Zener-protected

Applications

- Switching applications

Description

This device is an N-channel Power MOSFET developed using MDmesh™ M2 technology. Thanks to its strip layout and an improved vertical structure, the device exhibits low on-resistance and optimized switching characteristics, rendering it suitable for the most demanding high efficiency converters.

Table 1: Device summary

Order code	Marking	Package	Packaging
STFI18N65M2	18N65M2	I²PAKFP (TO-281)	Tube

Contents

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_C = 25 °C	12	A
I_D(1)	Drain current (continuous) at T_C = 100 °C	8	A
I_{DM}(2)	Drain current (pulsed)	48	A
P_{TOT}	Total dissipation at T_C = 25 °C	25	W
dv/dt(3)	Peak diode recovery voltage slope	15	V/ns
dv/dt(4)	MOSFET dv/dt ruggedness	50	V/ns
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s, T_C = 25 °C)	2500	V
T_{stg}	Storage temperature range	-55 to 150	°C
T_j	Operating junction temperature range		

Notes:

(1)Limited by package.

(2)Pulse width limited by safe operating area.

(3)I_{SD} ≤ 12 A, di/dt ≤ 400 A/µs; $V_{DS\ peak}$ < $V_{(BR)DSS}$, V_{DD} = 400 V.

(4)V_{DS} ≤ 520 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, repetetive or not repetetive (pulse width limited by T_{jmax})	2	A
E_{AS}	Single pulse avalanche energy (starting T_j = 25 °C, I_D = I_{AR}; V_{DD} = 50 V)	450	mJ

2 Electrical characteristics

T_C = 25 °C unless otherwise specified

Table 5: On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	V_{GS} = 0 V, I_D = 1 mA	650			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 650 V			1	µA
		V_{GS} = 0 V, V_{DS} = 650 V, T_C = 125 °C (1)			100	µA
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, V_{GS} = ±25 V			±10	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	2	3	4	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 6 A		0.275	0.33	Ω

Notes:

(1)Defined by design, not subject to production test.

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	-	770	-	pF
C_{oss}	Output capacitance		-	35	-	pF
C_{rss}	Reverse transfer capacitance		-	1.2	-	pF
$C_{oss\ eq.}$ (1)	Equivalent output capacitance	V_{DS} = 0 to 520 V, V_{GS} = 0 V	-	175	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz, I_D = 0 A	-	6.1	-	Ω
Q_g	Total gate charge	V_{DD} = 520 V, I_D = 12 A, V_{GS} = 10 V (see *Figure 15: "Test circuit for gate charge behavior"*)	-	20	-	nC
Q_{gs}	Gate-source charge		-	3.6	-	nC
Q_{gd}	Gate-drain charge		-	8.5	-	nC

Notes:

(1)$C_{oss\ eq.}$ 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
$t_{d(on)}$	Turn-on delay time	V_{DD} = 325 V, I_D = 6 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"*)	-	11	-	ns
t_r	Rise time		-	7.5	-	ns
$t_{d(off)}$	Turn-off delay time		-	46	-	ns
t_f	Fall time		-	12.5	-	ns

Table 8: Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		12	A
I_{SDM} (1)	Source-drain current (pulsed)		-		48	A
V_{SD} (2)	Forward on voltage	V_{GS} = 0 V, I_{SD} = 12 A	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 12 A, di/dt = 100 A/µs, V_{DD} = 60 V (see *Figure 16: "Test circuit for inductive load switching and diode recovery times"*)	-	331		ns
Q_{rr}	Reverse recovery charge		-	3.4		µC
I_{RRM}	Reverse recovery current		-	20.5		A
t_{rr}	Reverse recovery time	I_{SD} = 12 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"*)	-	462		ns
Q_{rr}	Reverse recovery charge		-	4.6		µC
I_{RRM}	Reverse recovery current		-	20		A

Notes:

(1)Pulse width is limited by safe operating area

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

2.1 Electrical characteristics (curves)

Figure 2: Safe operating area

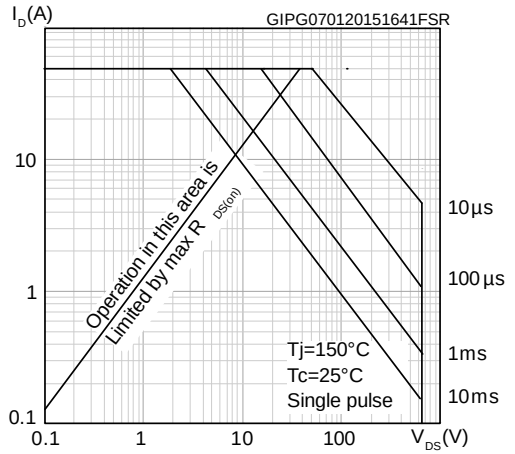


Figure 3: Thermal impedance

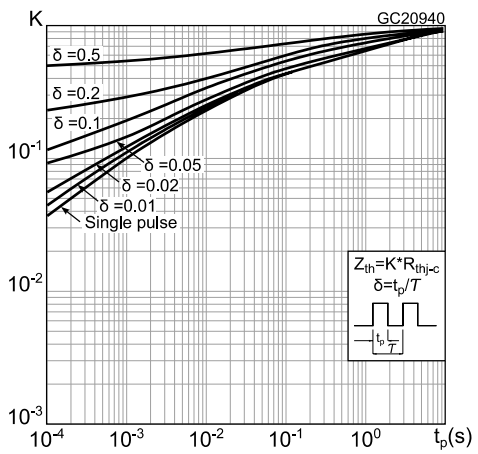


Figure 4: Output characteristics

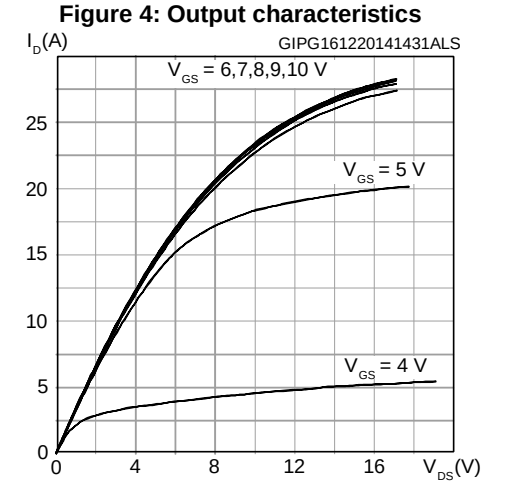


Figure 5: Transfer characteristics

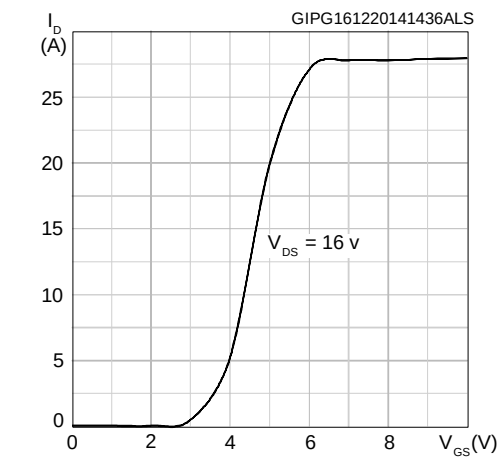


Figure 6: Gate charge vs gate-source voltage

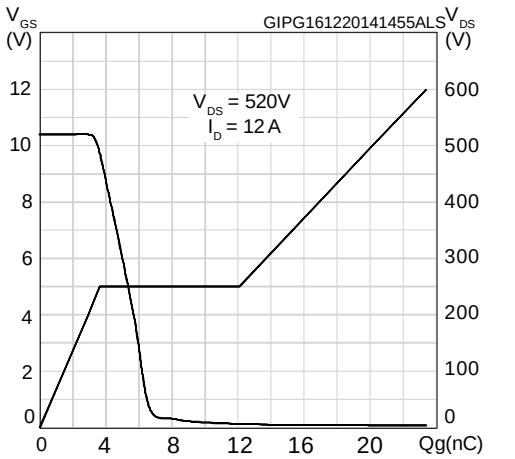


Figure 7: Static drain-source on-resistance

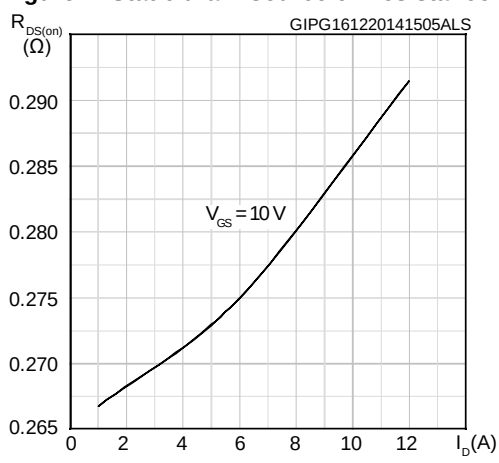


Figure 8: Capacitance variations

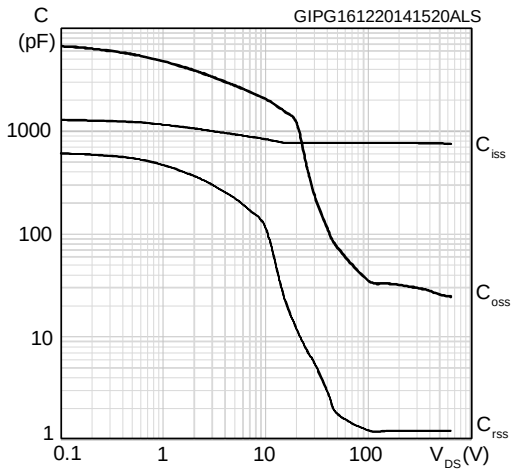


Figure 9: Normalized gate threshold voltage vs temperature

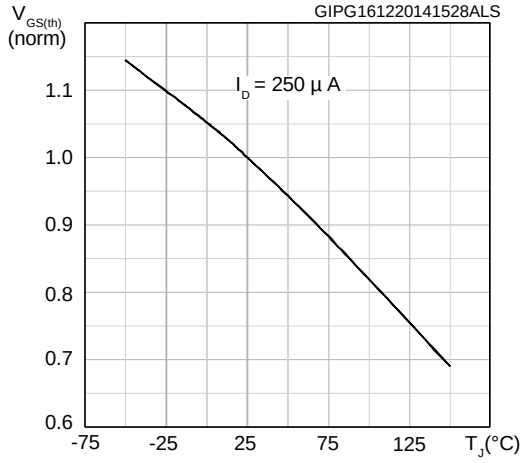


Figure 10: Normalized on-resistance vs temperature

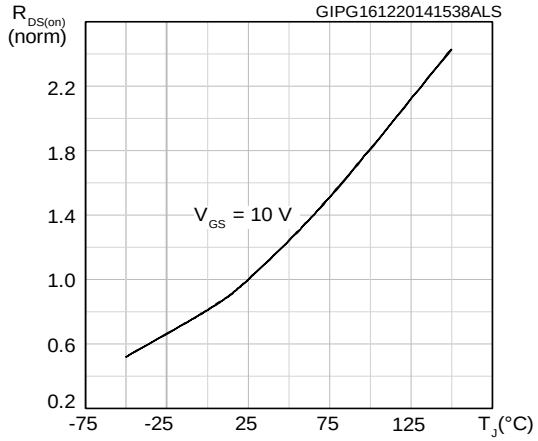


Figure 11: Normalized $V_{(BR)DSS}$ vs temperature

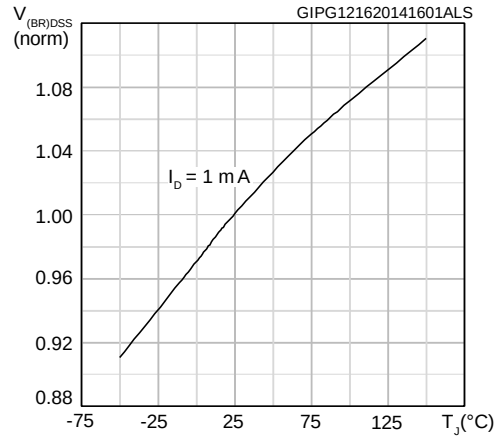


Figure 12: Output capacitance stored energy

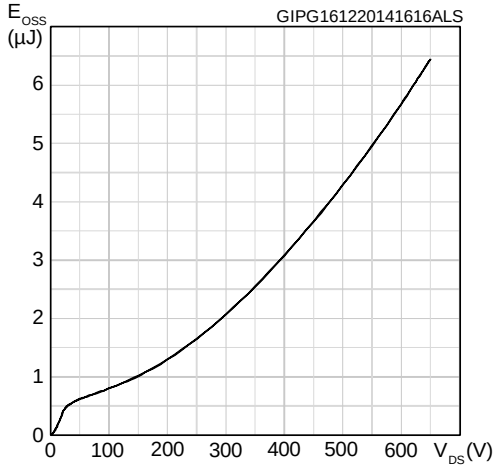
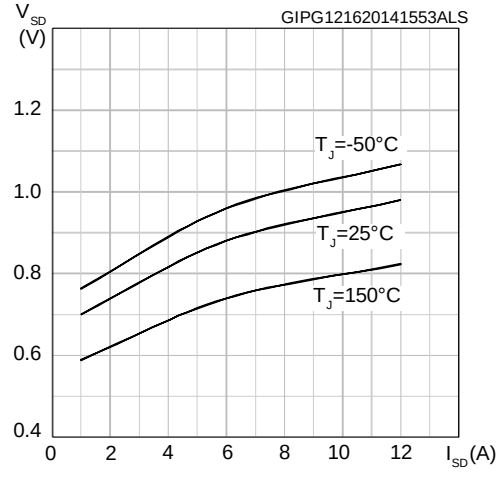


Figure 13: Source-drain diode forward characteristics



3 Test circuits

Figure 14: Test circuit for resistive load switching times

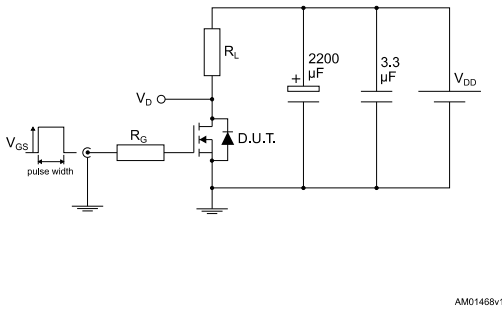


Figure 15: Test circuit for gate charge behavior

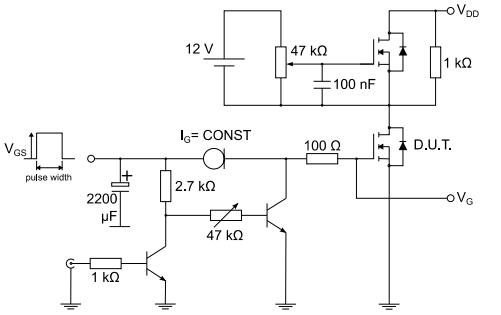


Figure 16: Test circuit for inductive load switching and diode recovery times

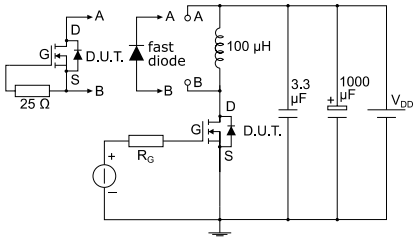


Figure 17: Unclamped inductive load test circuit

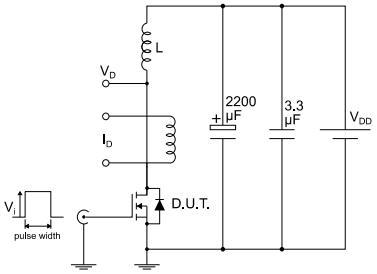


Figure 18: Unclamped inductive waveform

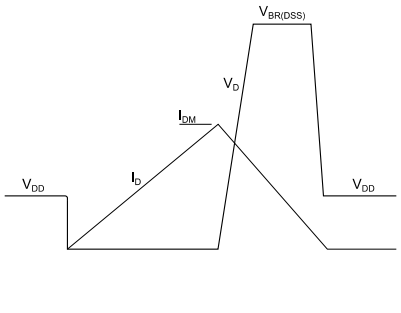
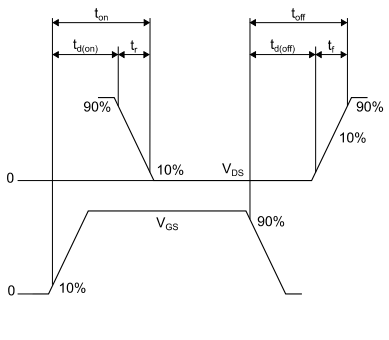


Figure 19: Switching time waveform



4 Package 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.

4.1 I²PAKFP (TO-281) package information

Figure 20: I²PAKFP (TO-281) package outline

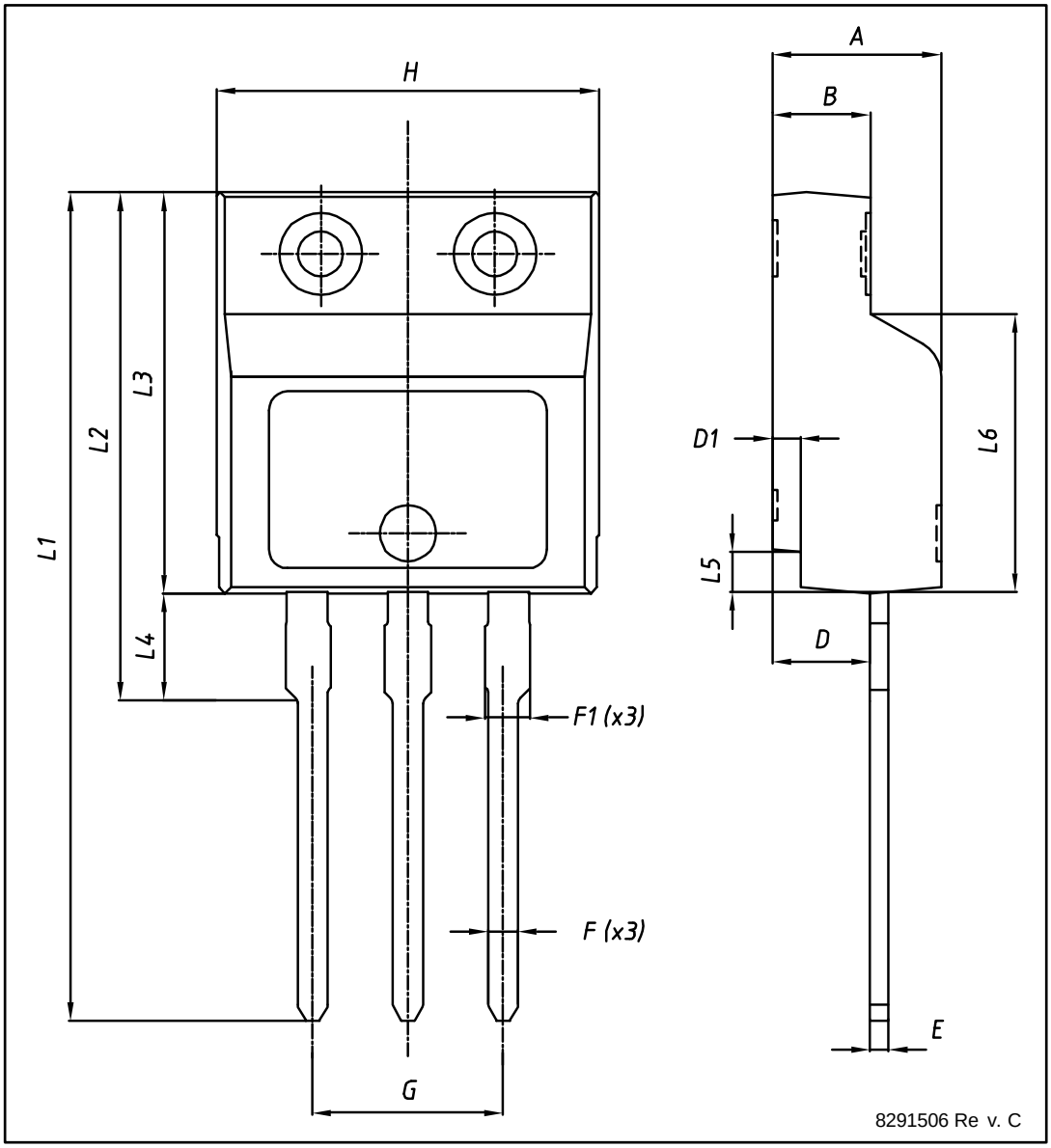


Table 9: I²PAKFP (TO-281) mechanical data

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 10: Document revision history

Date	Revision	Changes
05-Dec-2016	1	First release.

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