

## N-channel 950 V, 0.41 $\Omega$ typ., 12 A MDmesh™ K5 Power MOSFET in a I<sup>2</sup>PAKFP package

Datasheet - production data

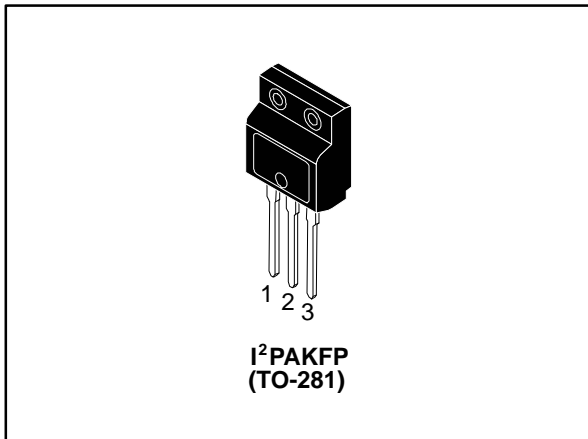
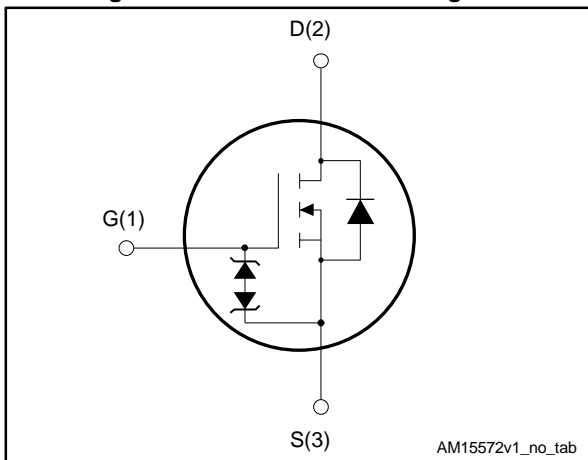


Figure 1: Internal schematic diagram



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>	P <sub>tot</sub>
STFI15N95K5	950 V	0.50 $\Omega$	12 A	30 W

- Fully insulated and low profile package with increased creepage path from pin to heatsink plate
- Industry's lowest R<sub>DS(on)</sub> x area
- Industry's best FoM (figure of merit)
- 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
STFI15N95K5	15N95K5	I <sup>2</sup> PAKFP (TO-281)	Tube

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# 1 Electrical ratings

**Table 2: Absolute maximum ratings**

Symbol	Parameter	Value	Unit
V <sub>GS</sub>	Gate-source voltage	± 30	V
I <sub>D</sub> <sup>(1)</sup>	Drain current (continuous) at T <sub>C</sub> = 25 °C	12	A
I <sub>D</sub> <sup>(1)</sup>	Drain current (continuous) at T <sub>C</sub> = 100 °C	7.6	A
I <sub>DM</sub> <sup>(2)</sup>	Drain current pulsed	48	A
P <sub>TOT</sub>	Total dissipation at T <sub>C</sub> = 25 °C	30	W
ESD	Gate-source human body model (R= 1,5 kΩ, C = 100 pF)	2	kV
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
dv/dt <sup>(3)</sup>	Peak diode recovery voltage slope	4.5	V/ns
dv/dt <sup>(4)</sup>	MOSFET dv/dt ruggedness	50	
T <sub>j</sub>	Operating junction temperature range	- 55 to 150	°C
T <sub>stg</sub>	Storage temperature range		

**Notes:**

(1)Limited by maximum junction temperature.

(2)Pulse width limited by safe operating area.

(3) $I_{SD} \leq 12$  A,  $di/dt \leq 100$  A/ $\mu$ s,  $V_{DS}$  (peak)  $\leq V_{(BR)DSS}$

(4) $V_{DS} \leq 760$  V

**Table 3: Thermal data**

Symbol	Parameter	Value	Unit
R <sub>thj-case</sub>	Thermal resistance junction-case	4.2	°C/W
R <sub>thj-amb</sub>	Thermal resistance junction-ambient	62.5	°C/W

**Table 4: Avalanche characteristics**

Symbol	Parameter	Value	Unit
I <sub>AR</sub>	Avalanche current, repetitive or not repetitive (pulse width limited by T <sub>jmax</sub> )	4	A
E <sub>AS</sub>	Single pulse avalanche energy (starting T <sub>j</sub> = 25 °C, I <sub>D</sub> = I <sub>AR</sub> , V <sub>DD</sub> = 50 V)	124	mJ

## 2 Electrical characteristics

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

**Table 5: On/off-state**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$ , $I_D = 1\text{ mA}$	950			V
$I_{DSS}$	Zero gate voltage drain current	$V_{DS} = 950\text{ V}$ , $V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
		$V_{DS} = 950\text{ V}$ , $V_{GS} = 0\text{ V}$ $T_C = 125\text{ °C}^{(1)}$			50	$\mu\text{A}$
$I_{GSS}$	Gate body leakage current	$V_{GS} = \pm 20\text{ V}$ , $V_{DS} = 0\text{ V}$			$\pm 10$	$\mu\text{A}$
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 100\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$ , $I_D = 6\text{ A}$		0.41	0.50	$\Omega$

**Notes:**

<sup>(1)</sup>Defined by design, not subject to production test.

**Table 6: Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 100\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0\text{ V}$	-	855	-	pF
$C_{oss}$	Output capacitance		-	65	-	pF
$C_{rss}$	Reverse transfer capacitance		-	1	-	pF
$C_{o(tr)}^{(1)}$	Equivalent capacitance time related	$V_{GS} = 0\text{ V}$ , $V_{DS} = 0\text{ to }760\text{ V}$	-	104	-	pF
$C_{o(er)}^{(2)}$	Equivalent capacitance energy related				38	-
$R_g$	Intrinsic gate resistance	$f = 1\text{ MHz}$ open drain	-	6	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 760\text{ V}$ , $I_D = 12\text{ A}$ $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 16: "Test circuit for gate charge behavior"</a> )	-	30	-	nC
$Q_{gs}$	Gate-source charge		-	5	-	nC
$Q_{gd}$	Gate-drain charge		-	22	-	nC

**Notes:**

<sup>(1)</sup>Time related is defined as a constant equivalent capacitance giving the same charging time as  $C_{oss}$  when  $V_{DS}$  increases from 0 to 80%  $V_{DSS}$

<sup>(2)</sup>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%  $V_{DSS}$

**Table 7: Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 475\text{ V}$ , $I_D = 6\text{ A}$ , $R_G = 4.7\text{ }\Omega$ $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 15: "Test circuit for resistive load switching times"</a> and <a href="#">Figure 18: "Unclamped inductive load test circuit"</a> )	-	23	-	ns
$t_r$	Rise time		-	20	-	ns
$t_{d(off)}$	Turn-off delay time		-	62	-	ns
$t_f$	Fall time		-	11	-	ns

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		12	A
$I_{SDM}$	Source-drain current (pulsed)		-		48	A
$V_{SD}^{(1)}$	Forward on voltage	$I_{SD} = 12\text{ A}$ , $V_{GS} = 0\text{ V}$	-		1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 12\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ ,	-	444		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 60\text{ V}$	-	7		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current	(see <a href="#">Figure 17: "Test circuit for inductive load switching and diode recovery times"</a> )	-	32		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 12\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ ,	-	630		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 60\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$	-	9.2		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current	(see <a href="#">Figure 17: "Test circuit for inductive load switching and diode recovery times"</a> )	-	29		A

**Notes:**

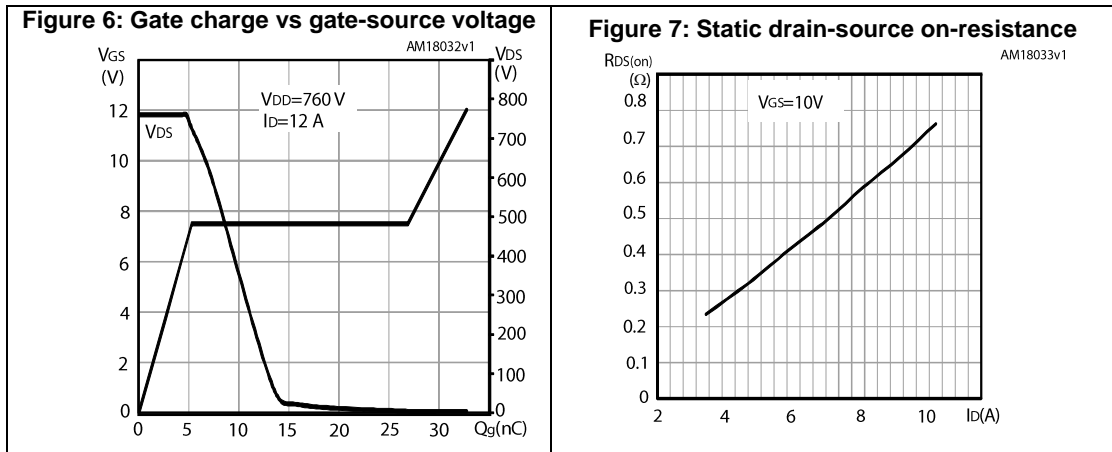
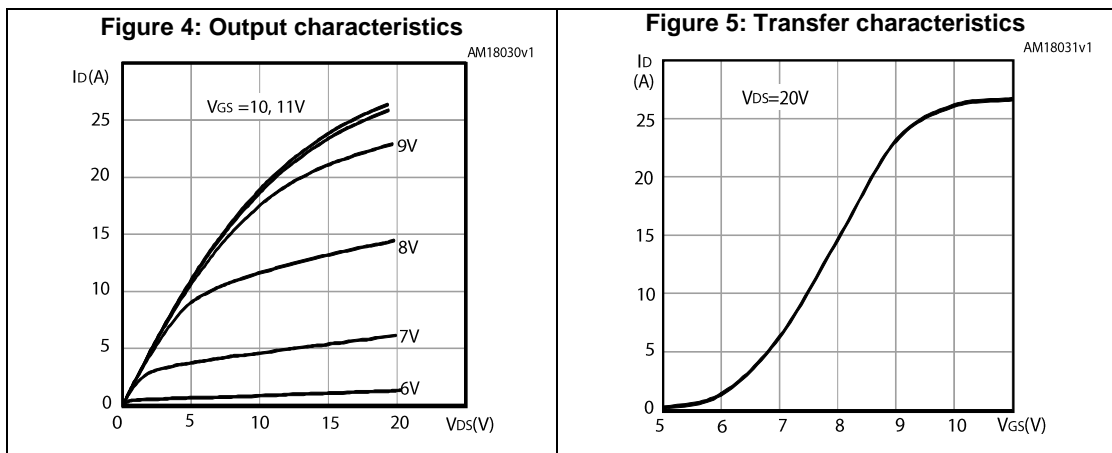
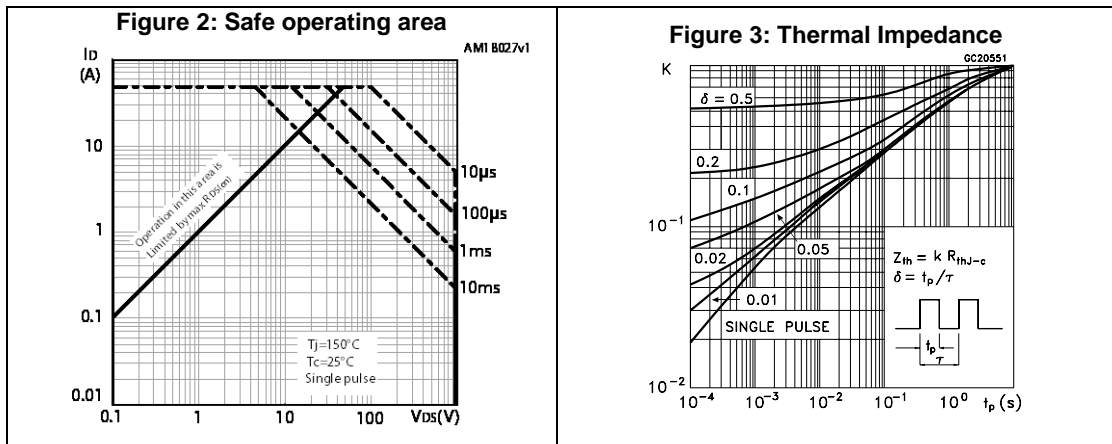
<sup>(1)</sup>Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

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.

## 2.1 Electrical characteristics (curves)



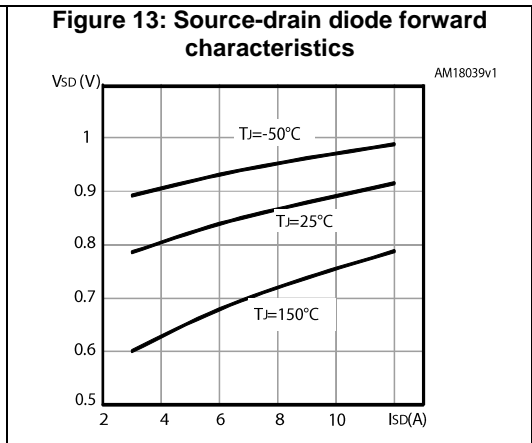
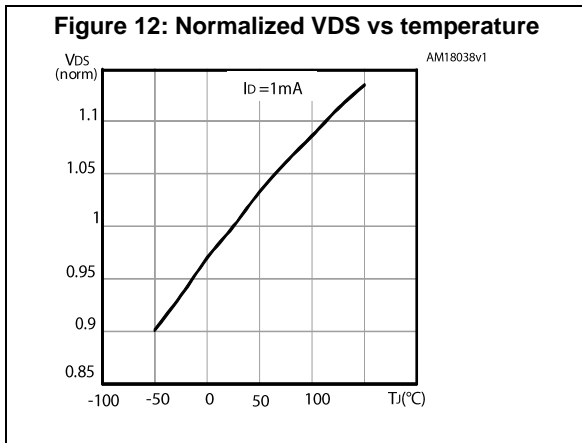
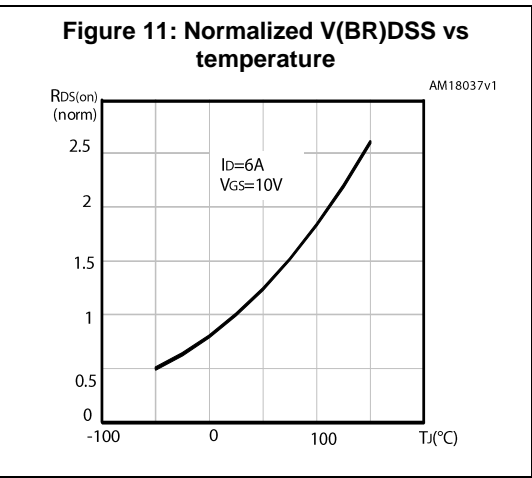
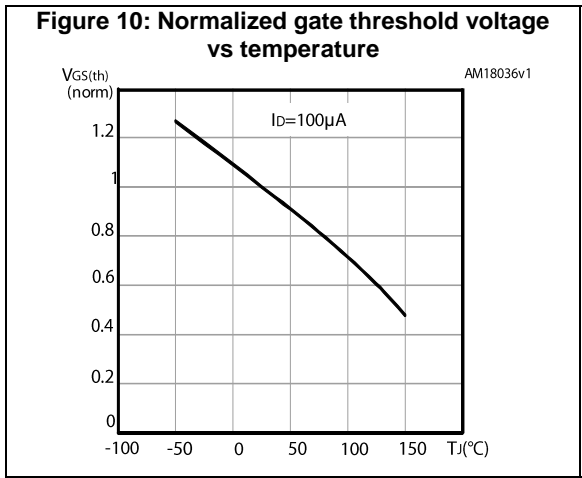
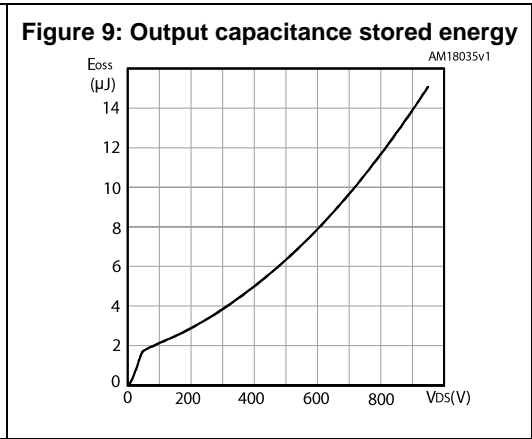
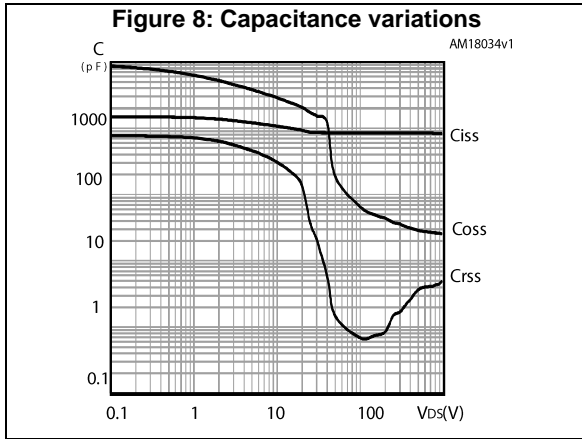
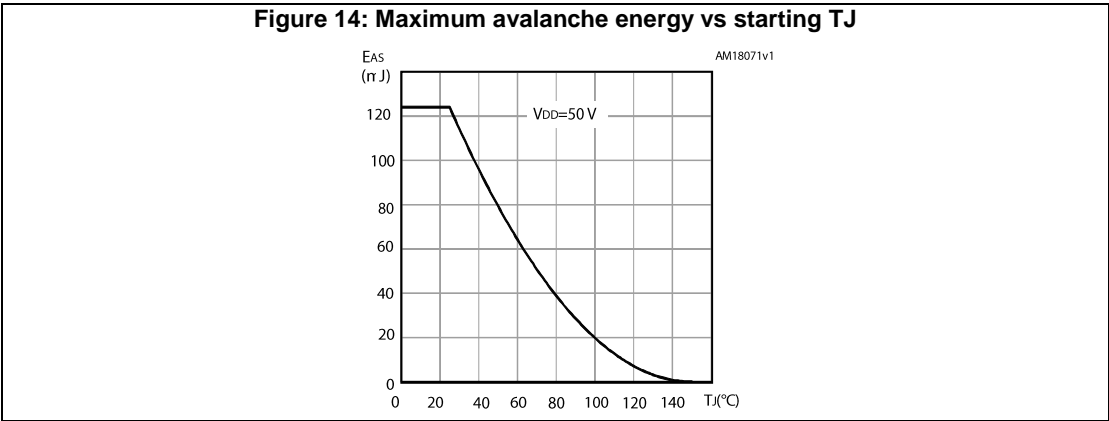


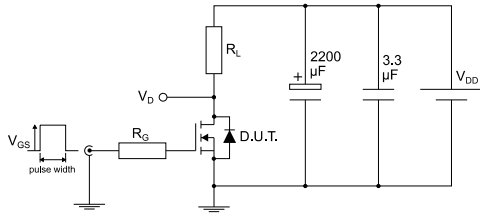
Figure 14: Maximum avalanche energy vs starting TJ





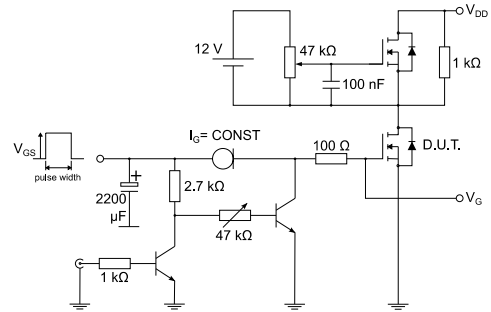
### 3 Test circuits

**Figure 15: Test circuit for resistive load switching times**



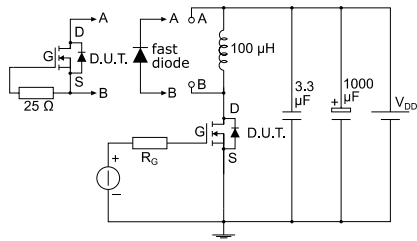
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**Figure 16: Test circuit for gate charge behavior**



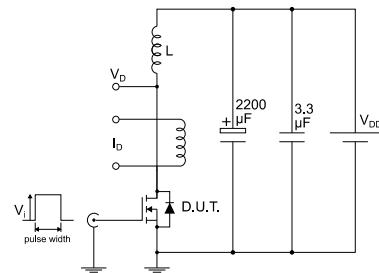
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**Figure 17: Test circuit for inductive load switching and diode recovery times**



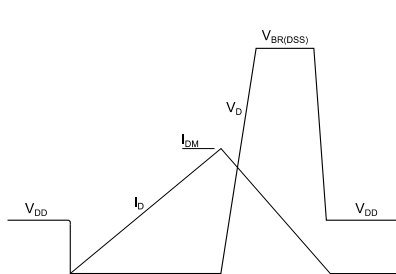
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**Figure 18: Unclamped inductive load test circuit**



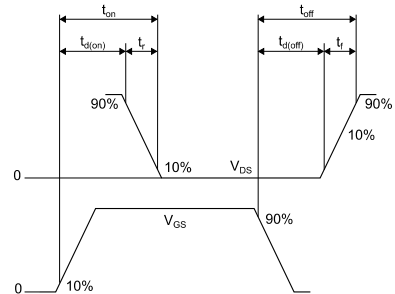
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**Figure 19: Unclamped inductive waveform**



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**Figure 20: Switching time waveform**



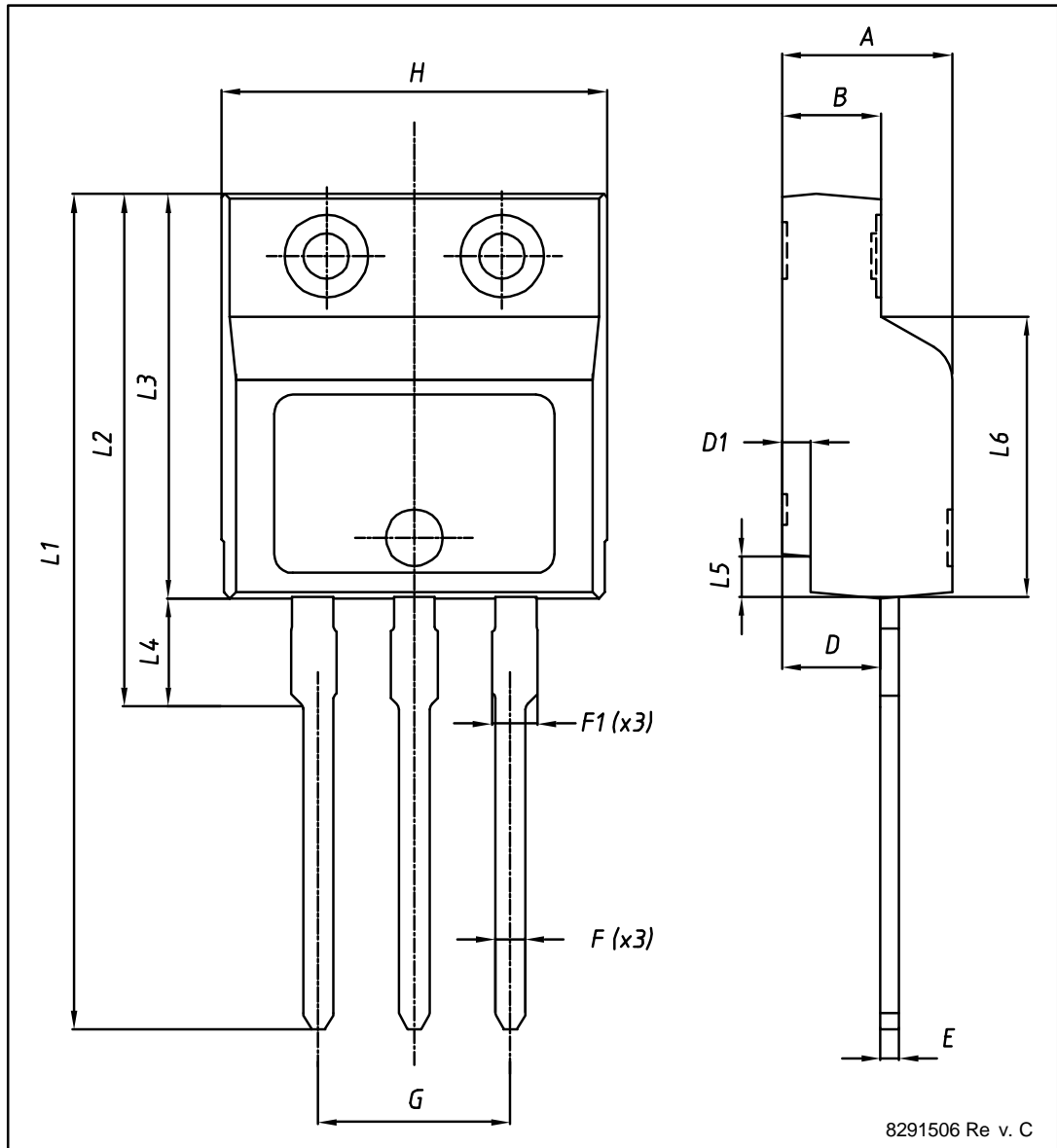
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## 4 Package information

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 I2PAKFP (TO-281) package information

Figure 21: I2PAKFP (TO-281) package outline



8291506 Re v. C

Table 10: I<sup>2</sup>PAKFP (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
29-Jul-2016	1	First release.

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