STFI13NM60N

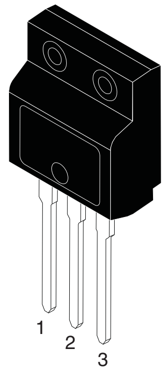
N-channel 600 V, 0.28 Ω, 11 A MDmesh™ II Power MOSFET in I^2PAKFP package

Datasheet — production data

Features

Type	V_{DSS} (@Tjmax)	$R_{DS(on)}$ max	I_D	P_{TOT}
STFI13NM60N	650 V	< 0.36 Ω	11 A	25 W

- Fully insulated and low profile package with increased creepage path from pin to heatsink plate
- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance



I^2PAKFP (TO-281)

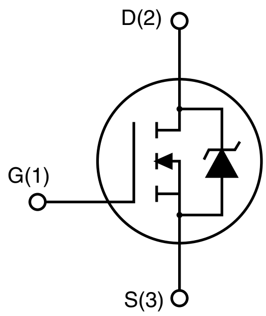
Applications

- Switching applications

Description

This device is an N-channel Power MOSFET developed using the second generation of MDmesh™ technology. This revolutionary Power MOSFET associates a vertical structure to the company's strip layout to yield one of the world's lowest on-resistance and gate charge. It is therefore suitable for the most demanding high efficiency converters.

Figure 1. Internal schematic diagram



SC06140

Table 1. Device summary

Order codes	Marking	Packages	Packaging
STFI13NM60N	13NM60N	I^2PAKFP (TO-281)	Tube

This is information on a product in full production. www.st.com

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	600	V
V_{GS}	Gate-source voltage	± 25	V
I_D	Drain current (continuous) at T_C = 25 °C	11 (1)	A
I_D	Drain current (continuous) at T_C = 100 °C	6.93 (1)	A
I_{DM} (2)	Drain current (pulsed)	44 (1)	A
P_{TOT}	Total dissipation at T_C = 25 °C	25	W
dv/dt (3)	Peak diode recovery voltage slope	15	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	- 55 to 150	°C
T_j	Max. operating junction temperature	150	°C

1. Limited by maximum junction temperature.
2. Pulse width limited by safe operating area.
3. I_{SD} ≤ 11 A, di/dt ≤ 400 A/µs, $V_{DSpeak} \le V_{(BR)DSS}$, V_{DD} = 80% $V_{(BR)DSS}$

Table 3. Thermal data

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

Table 4. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AS}	Repetitive or non repetitive avalanche current	3.5 (1)	A
E_{AS}	Single pulse avalanche energy (starting T_J=25 °C, I_D=I_{AS}, V_{DD}=50 V)	200	mJ

1. Limited by maximum junction temperature.

2 Electrical characteristics

(T_{CASE} = 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)	I_D = 1 mA	600			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 600 V V_{DS} = 600 V, T_c = 125 °C			1 100	µA µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 25 V			±0.1	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 = 5.5 A		0.28	0.36	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 50 V, f = 1 MHz, V_{GS} = 0	-	790 60 3.6	-	pF pF pF
$C_{oss\ eq.}$ (1)	Equivalent output capacitance	V_{GS} = 0, V_{DS} = 0 to 480 V	-	135	-	pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 480 V, I_D = 11 A, V_{GS} = 10 V, *(see Figure 14)*	-	30 4 15	-	nC nC nC
R_G	Gate input resistance	f=1 MHz, I_D = 0	3	4.7	6	Ω

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_{DS}

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on delay time Rise time Turn-off delay time Fall time	V_{DD} = 300 V, I_D = 5.5 A R_G = 4.7 Ω V_{GS} = 10 V *(see Figure 13)*	-	3 8 30 10	-	ns ns ns ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
I_{SD} I_{SDM} (1)	Source-drain current Source-drain current (pulsed)		-		11 44	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 11 A, V_{GS} = 0	-		1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 9 A, di/dt = 100 A/µs V_{DD} = 100 V *(see Figure 15)*	-	230 2 18		ns µC A
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 9 A, di/dt = 100 A/µs V_{DD} = 100 V, T_j = 150 °C *(see Figure 15)*	-	290 190 17		ns µC A

1. Pulse width 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

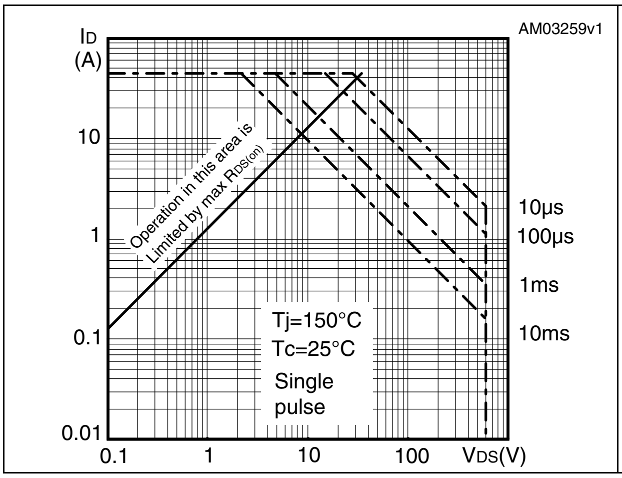


Figure 3. Thermal impedance

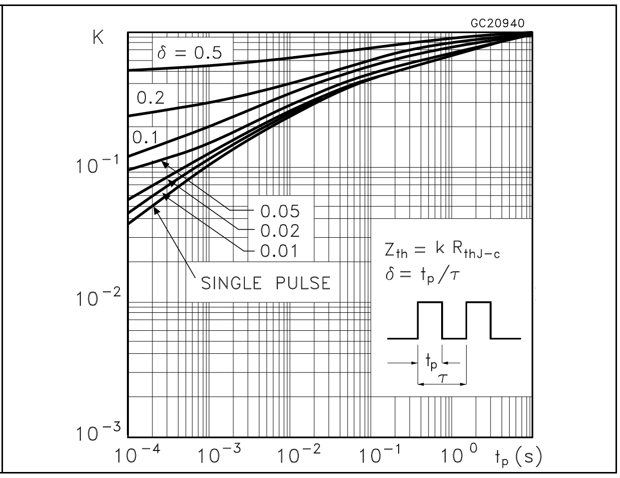


Figure 4. Output characteristics

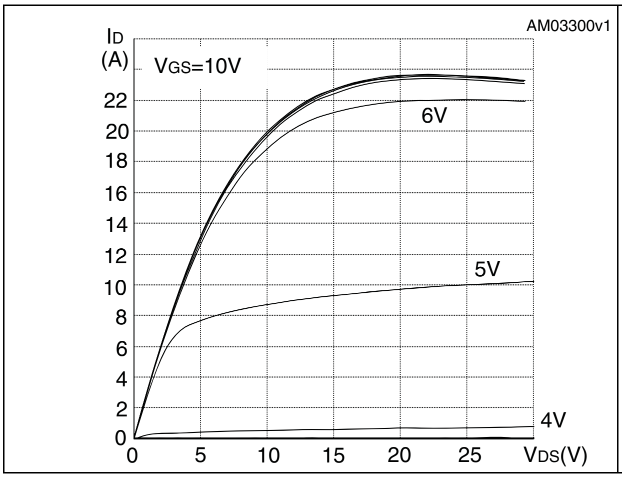


Figure 5. Transfer characteristics

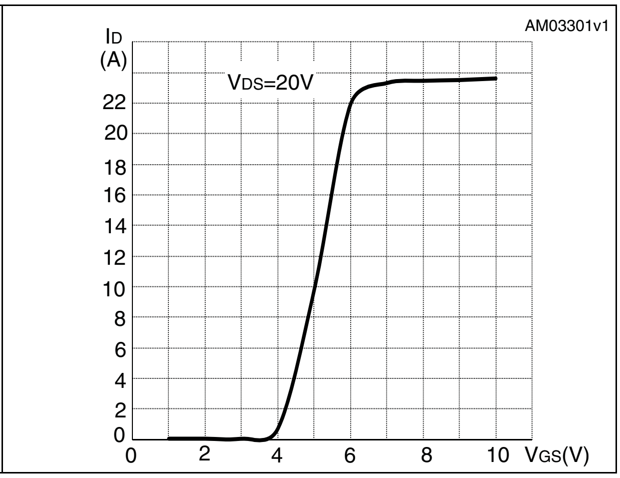


Figure 6. Normalized V_{DS} vs temperature

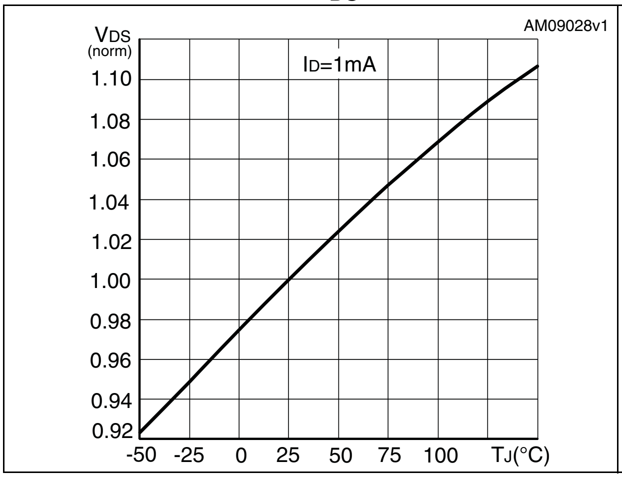


Figure 7. Static drain-source on resistance

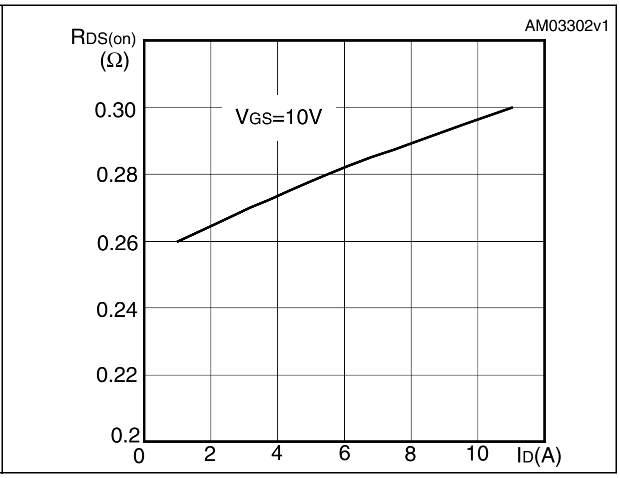


Figure 8. Gate charge vs gate-source voltage

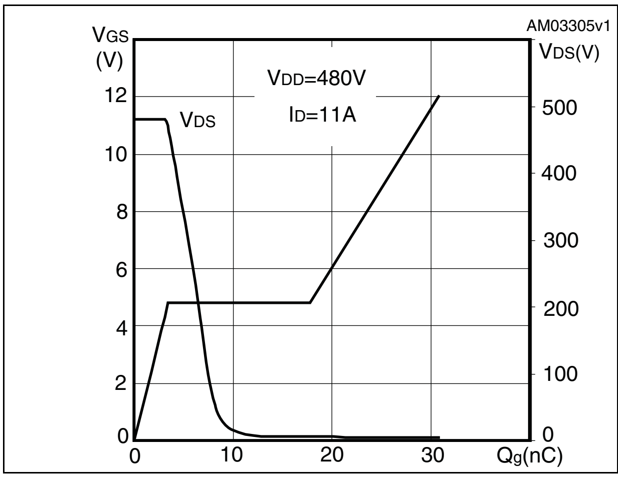


Figure 9. Capacitance variations

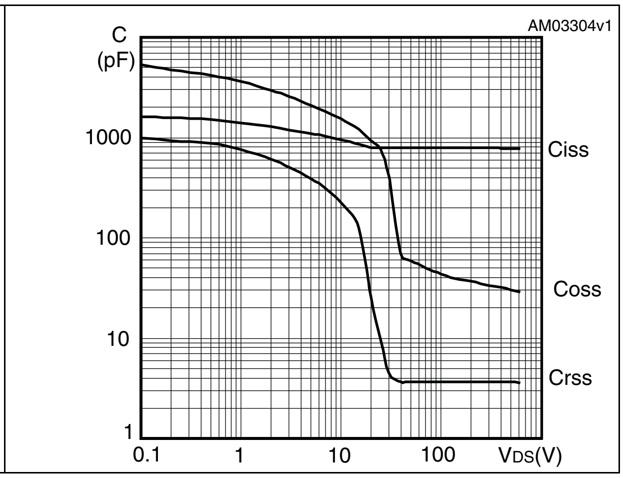


Figure 10. Normalized gate threshold voltage vs temperature

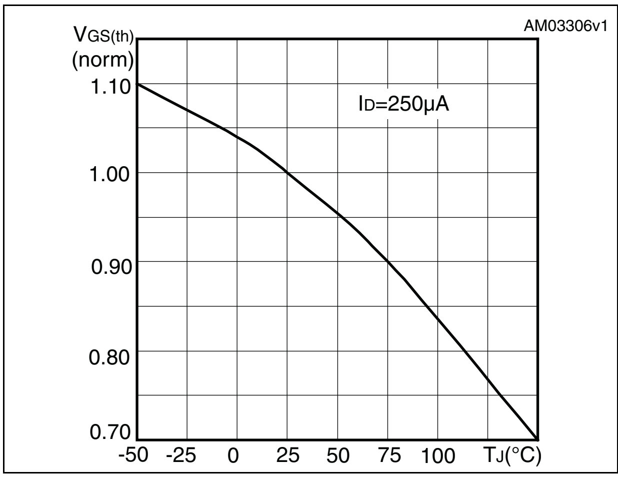


Figure 11. Normalized on resistance vs temperature

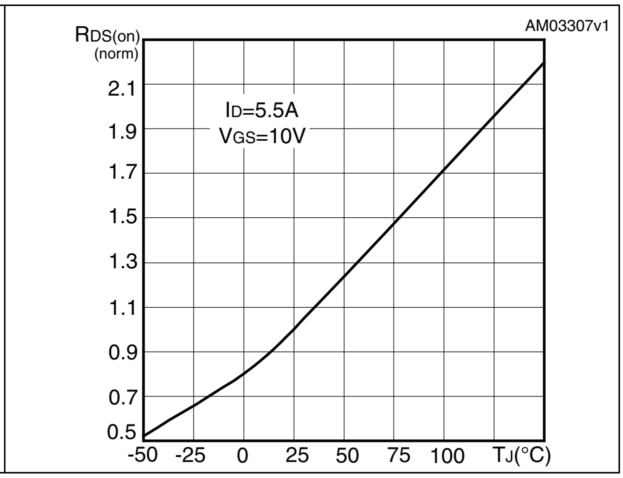
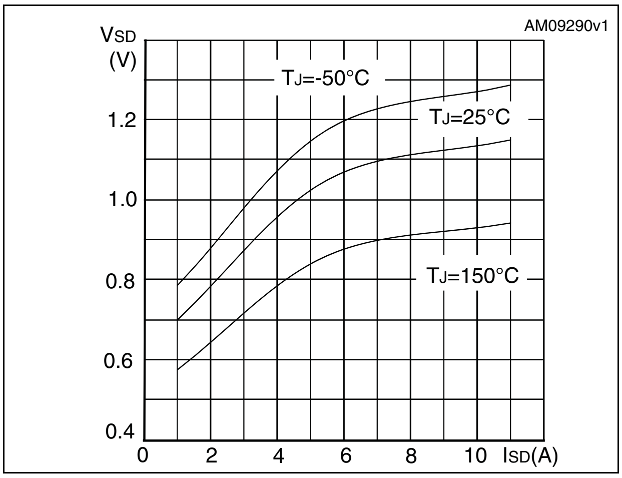


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

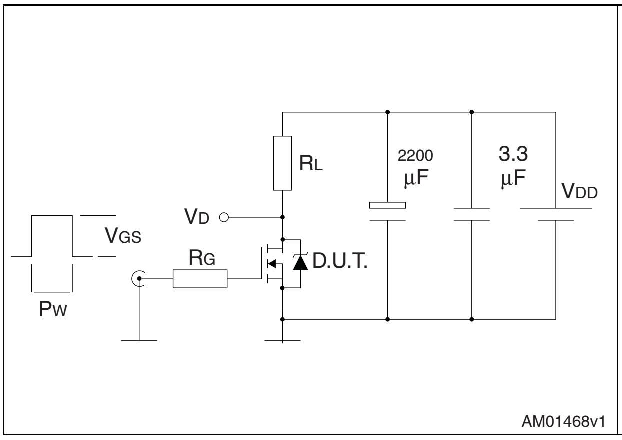


Figure 14. Gate charge test circuit

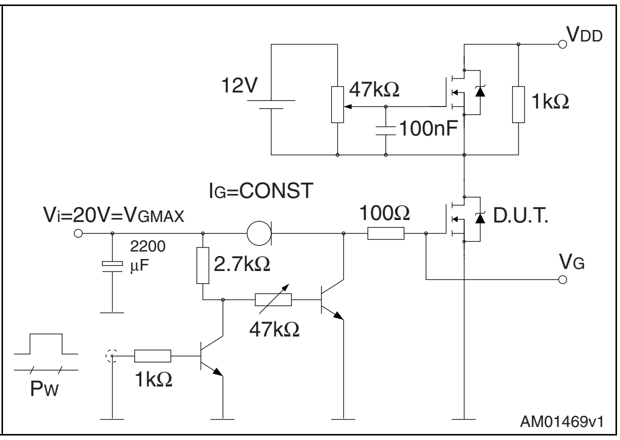


Figure 15. Test circuit for inductive load switching and diode recovery times

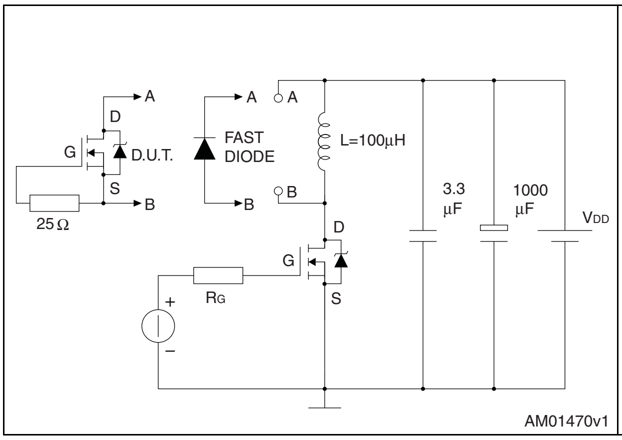


Figure 16. Unclamped inductive load test circuit

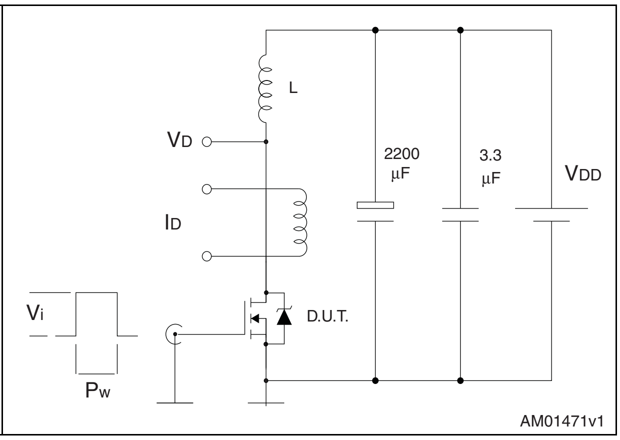


Figure 17. Unclamped inductive waveform

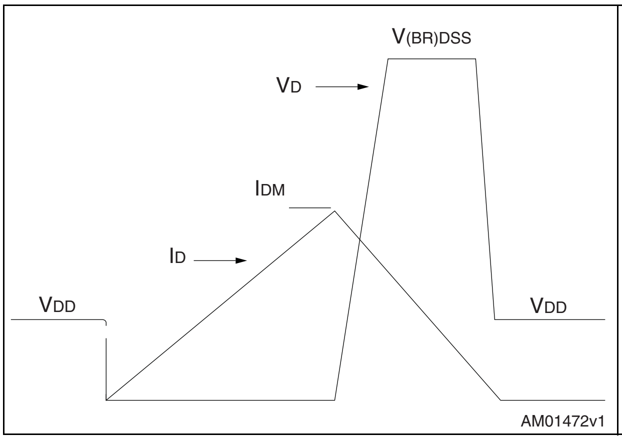
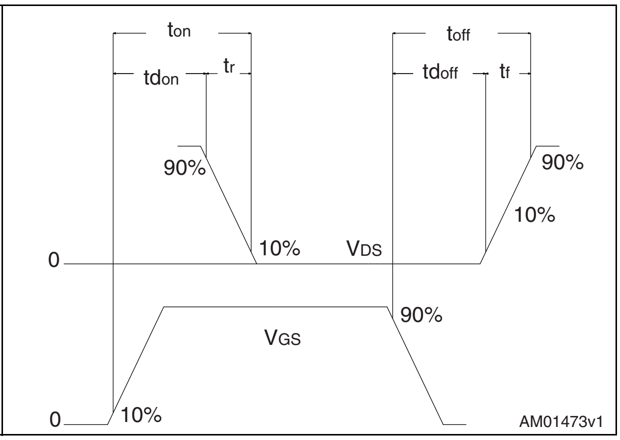


Figure 18. Switching time waveform



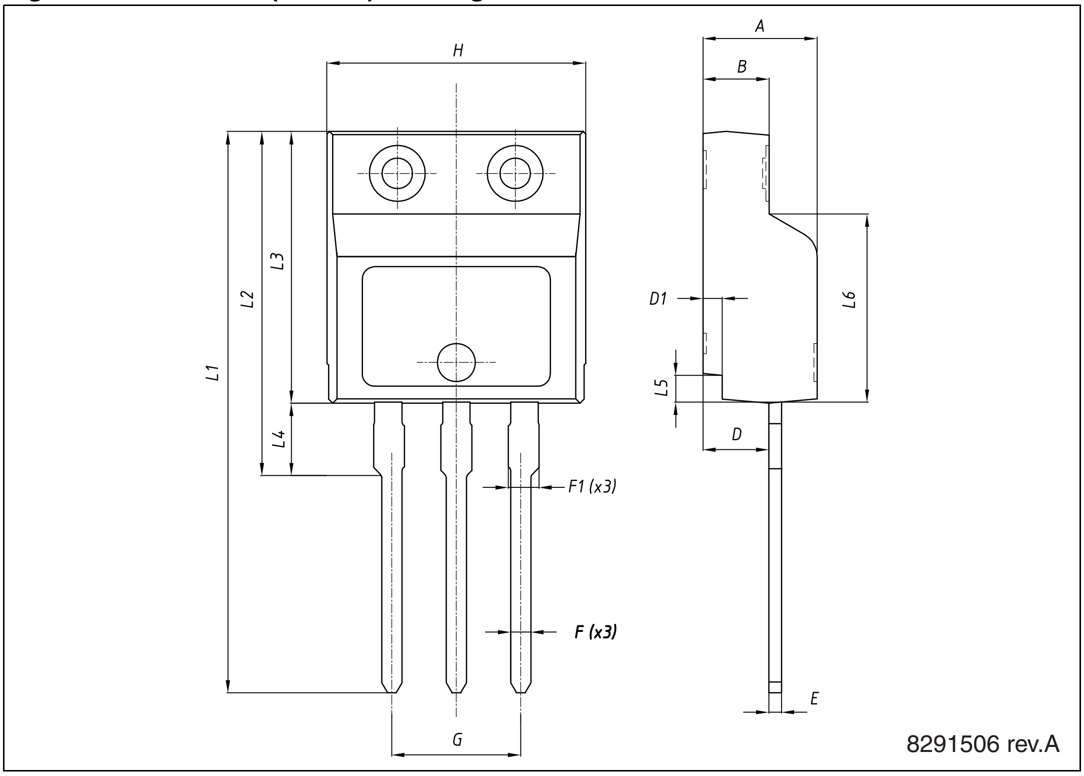
4 Package mechanical data

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.

Table 9. I^2PAKFP (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	7.30		7.50

Figure 19. I^2PAKFP (TO-281) drawing



5 Revision history

Table 10. Document revision history

Date	Revision	Changes
21-Jun-2011	1	First release.
03-Nov-2011	2	*Figure 2: Safe operating area* and *Figure 3: Thermal impedance* have been added.
20-Mar-2012	3	Document status promoted from preliminary data to production data. Package name has been updated.
15-May-2012	4	R_G values have been modified in *Table 6: Dynamic*

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