

N-channel 100 V, 2.5 mΩ typ., 180 A STripFET™ VII DeepGATE™ Power MOSFET in a TO-220 package

Datasheet - preliminary data

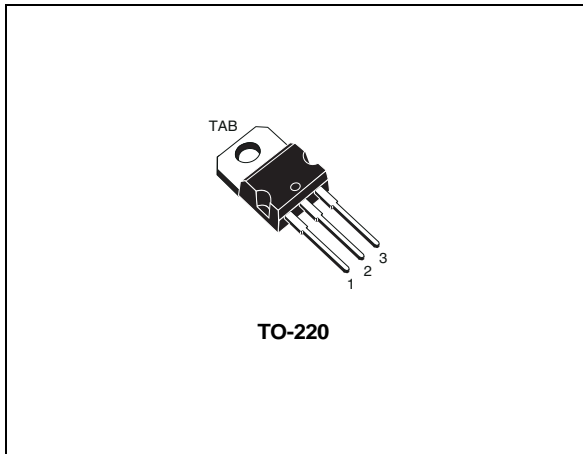
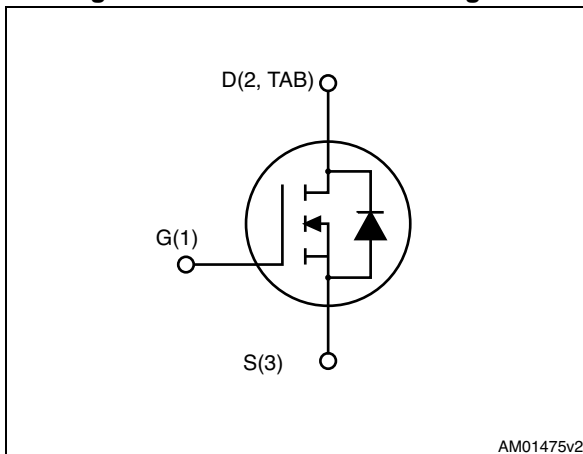


Figure 1. Internal schematic diagram



Features

Order code	V _{DSS}	R _{DS(on)} max.	I _D
STP240N10F7	100 V	3.2 mΩ	180 A

- Ultra low on-resistance
- 100% avalanche tested

Applications

- High current switching applications

Description

This device utilizes the 7th generation of design rules of ST's proprietary STripFET™ technology, with a new gate structure. The resulting Power MOSFET exhibits the lowest R_{DS(on)} in all packages.

Table 1. Device summary

Order code	Marking	Package	Packaging
STP240N10F7	240N10F7	TO-220	Tube

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	100	V
V_{GS}	Gate-source voltage	± 20	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	180	A
$I_D^{(1)}$	Drain current (continuous) at $T_C=100^\circ\text{C}$	120	A
$I_{DM}^{(2)}$	Drain current (pulsed)	720	A
P_{TOT}	Total dissipation at $T_C = 25^\circ\text{C}$	300	W
	Derating factor	2.1	W/°C
T_j T_{stg}	Operating junction temperature storage temperature	- 55 to 175	°C

1. Current limited by package.
2. Pulse width limited by safe operating area.

Table 3. Thermal data

Symbol	Parameter	Value	Unit
Rthj-case	Thermal resistance junction-case	0.5	°C/W
Rthj-amb	Thermal resistance junction-ambient max	62.5	°C/W

2 Electrical characteristics

($T_{CASE} = 25\text{ °C}$ unless otherwise specified).

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage ($V_{GS} = 0$)	$I_D = 250\ \mu A$	100			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 100\text{ V}$ $V_{DS} = 100\text{ V}, T_C = 125\text{ °C}$			10 100	μA μA
I_{GSS}	Gate body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 200	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu A$		3.5	4.5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}, I_D = 60\text{ A}$		2.5	3.2	m Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\text{ V}, f = 1\text{ MHz},$ $V_{GS} = 0$	-	12600	-	pF
C_{oss}	Output capacitance			3450		pF
C_{rss}	Reverse transfer capacitance			160		pF
Q_g	Total gate charge	$V_{DD} = 50\text{ V}, I_D = 180\text{ A},$	-	176	-	nC
Q_{gs}	Gate-source charge	$V_{GS} = 10\text{ V}$		76		nC
Q_{gd}	Gate-drain charge	(see Figure 14)		33		nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 50\text{ V}, I_D = 90\text{ A}$	-	62	-	ns
t_r	Rise time	$R_G = 4.7\ \Omega, V_{GS} = 10\text{ V}$		108		ns
$t_{d(off)}$	Turn-off delay time	(see Figure 13, Figure 18)		148		ns
t_f	Fall time			40		ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}^{(1)}$	Source-drain current Source-drain current (pulsed)		-		180 720	A A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD}=60\text{ A}$, $V_{GS}=0$	-		1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD}=180\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD}=80\text{ V}$, $T_j=150^\circ\text{C}$ (see Figure 15)	-	85 200 4.7		ns nC A

1. Pulse width limited by safe operating area.
2. Pulse duration = $300\mu\text{s}$, duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

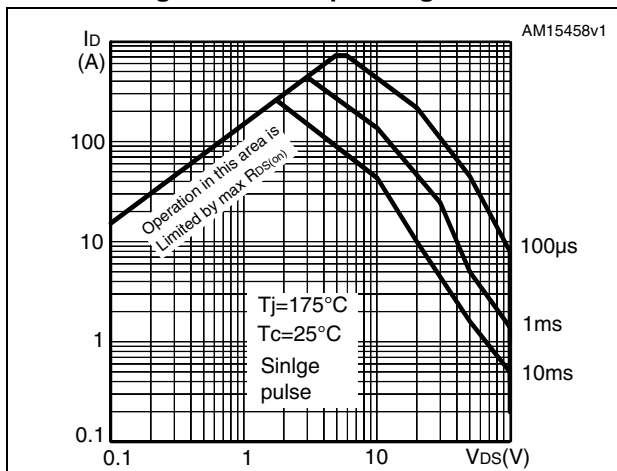


Figure 3. Thermal impedance

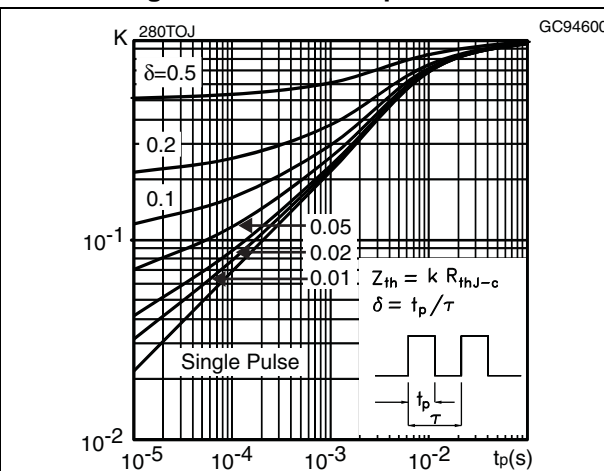


Figure 4. Output characteristics

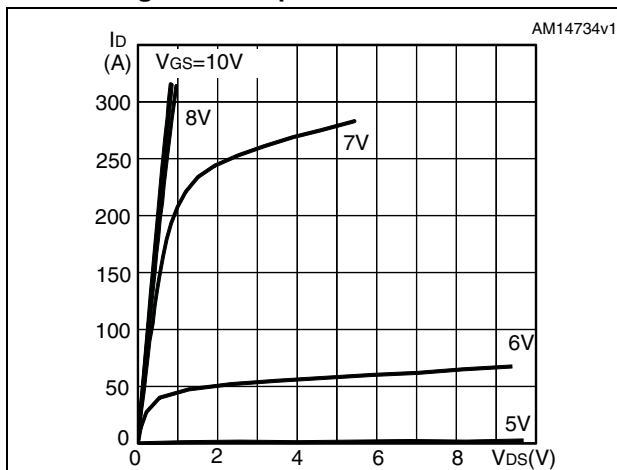


Figure 5. Transfer characteristics

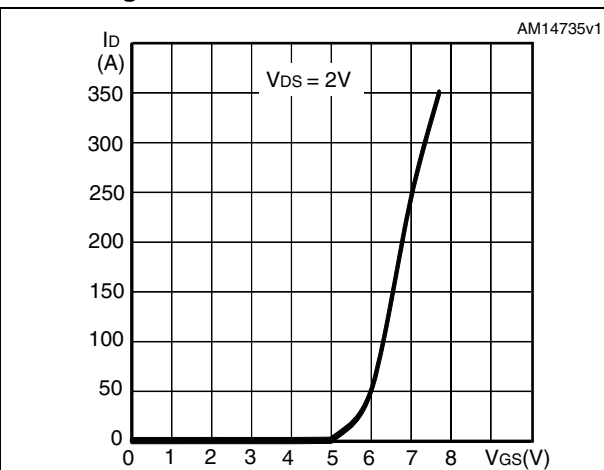


Figure 6. Gate charge vs gate-source voltage

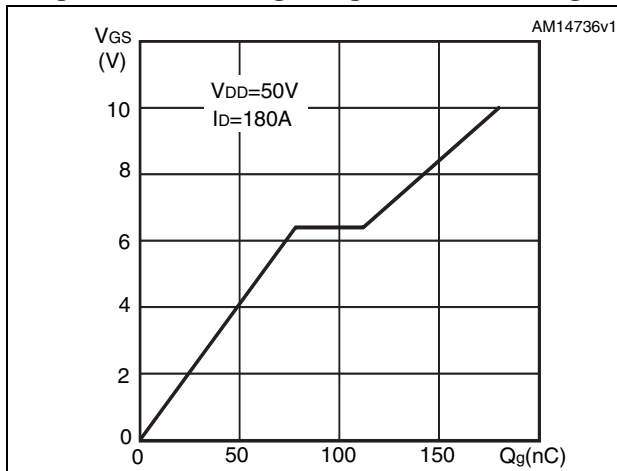


Figure 7. Static drain-source on-resistance

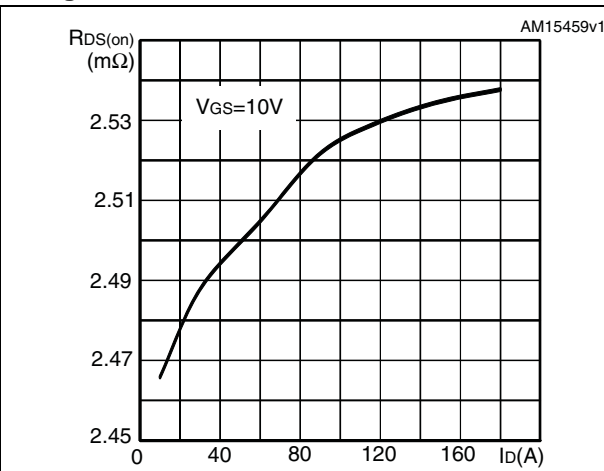


Figure 8. Capacitance variations

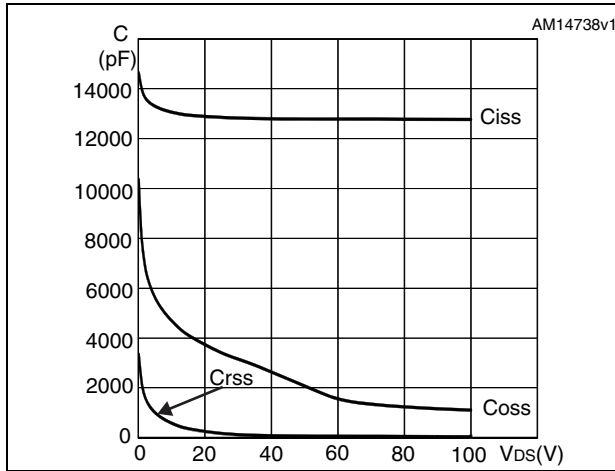


Figure 9. Source-drain diode forward characteristics

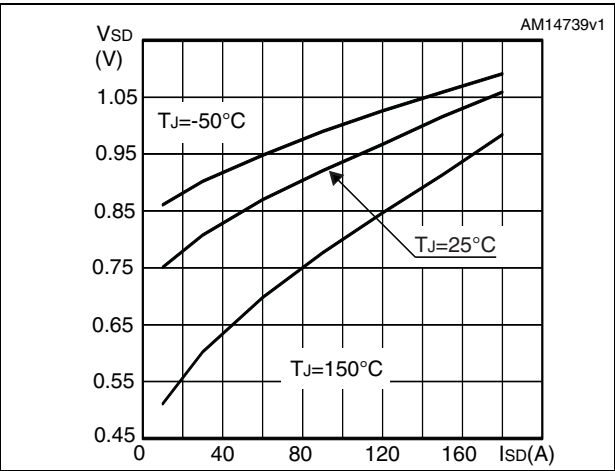


Figure 10. Normalized gate threshold voltage vs temperature

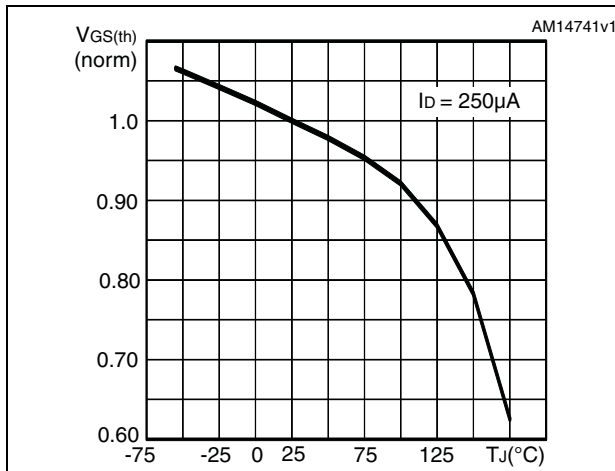


Figure 11. Normalized on-resistance vs temperature

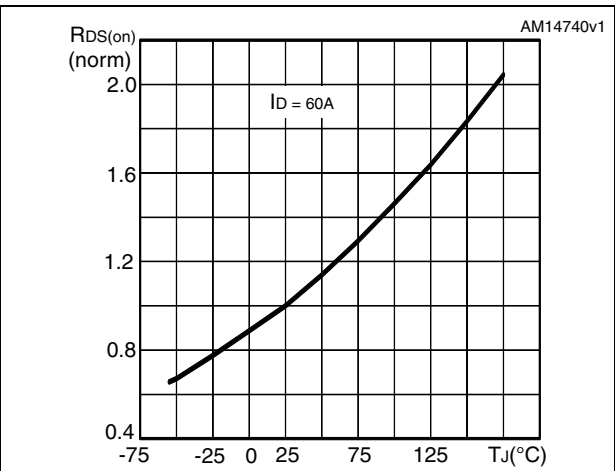
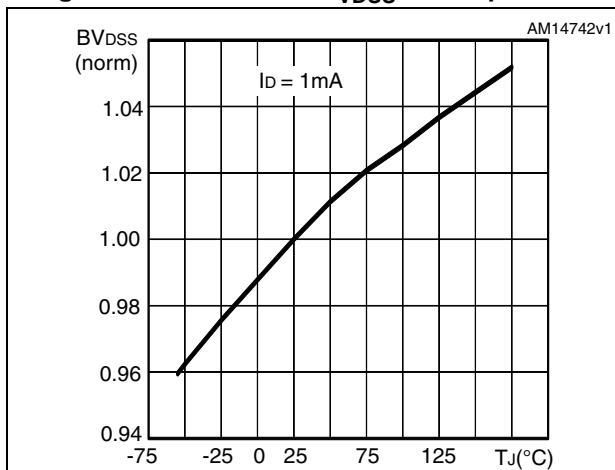


Figure 12. Normalized BV_{DSS} vs temperature



3 Test circuits

Figure 13. Switching times test circuit for resistive load

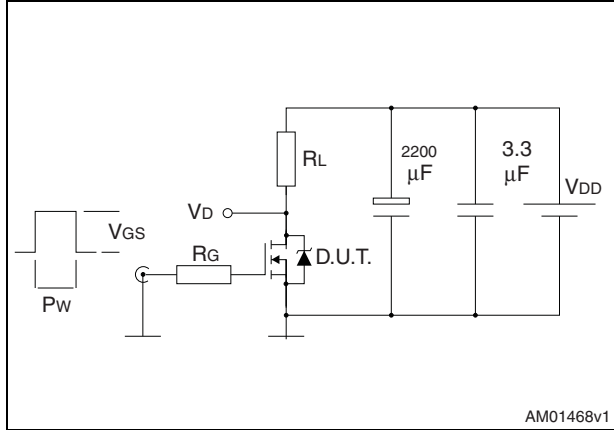


Figure 14. Gate charge test circuit

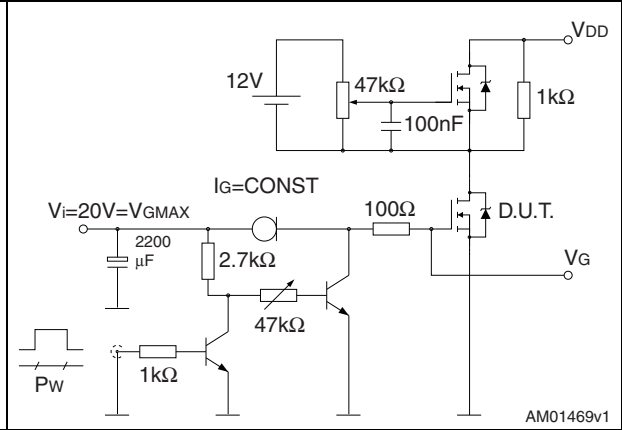


Figure 15. Test circuit for inductive load switching and diode recovery times

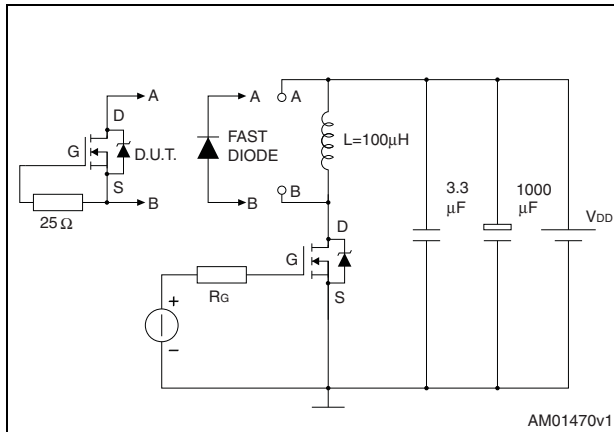


Figure 16. Unclamped inductive load test circuit

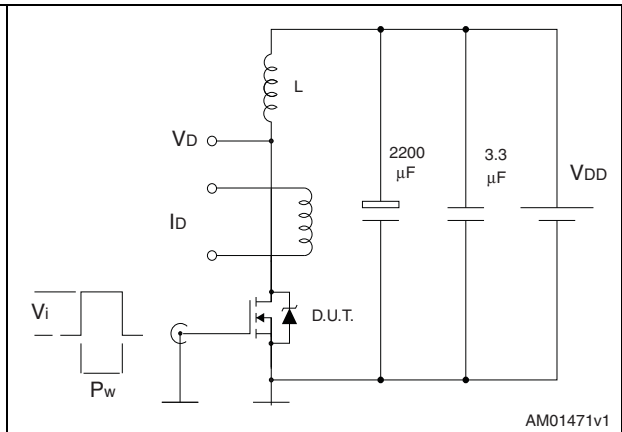


Figure 17. Unclamped inductive waveform

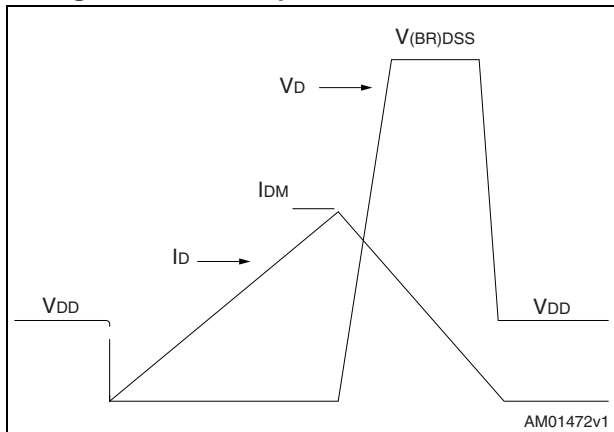
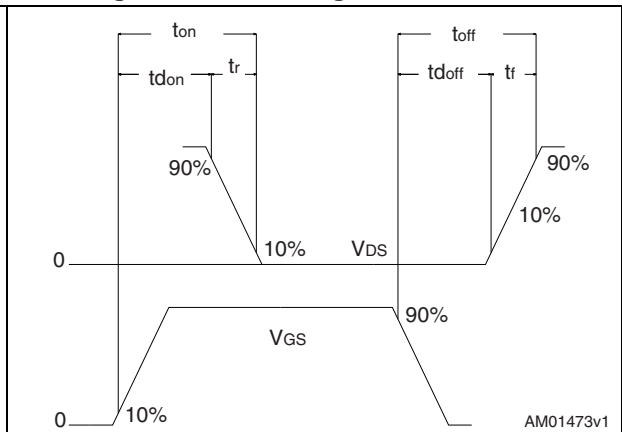


Figure 18. Switching time waveform



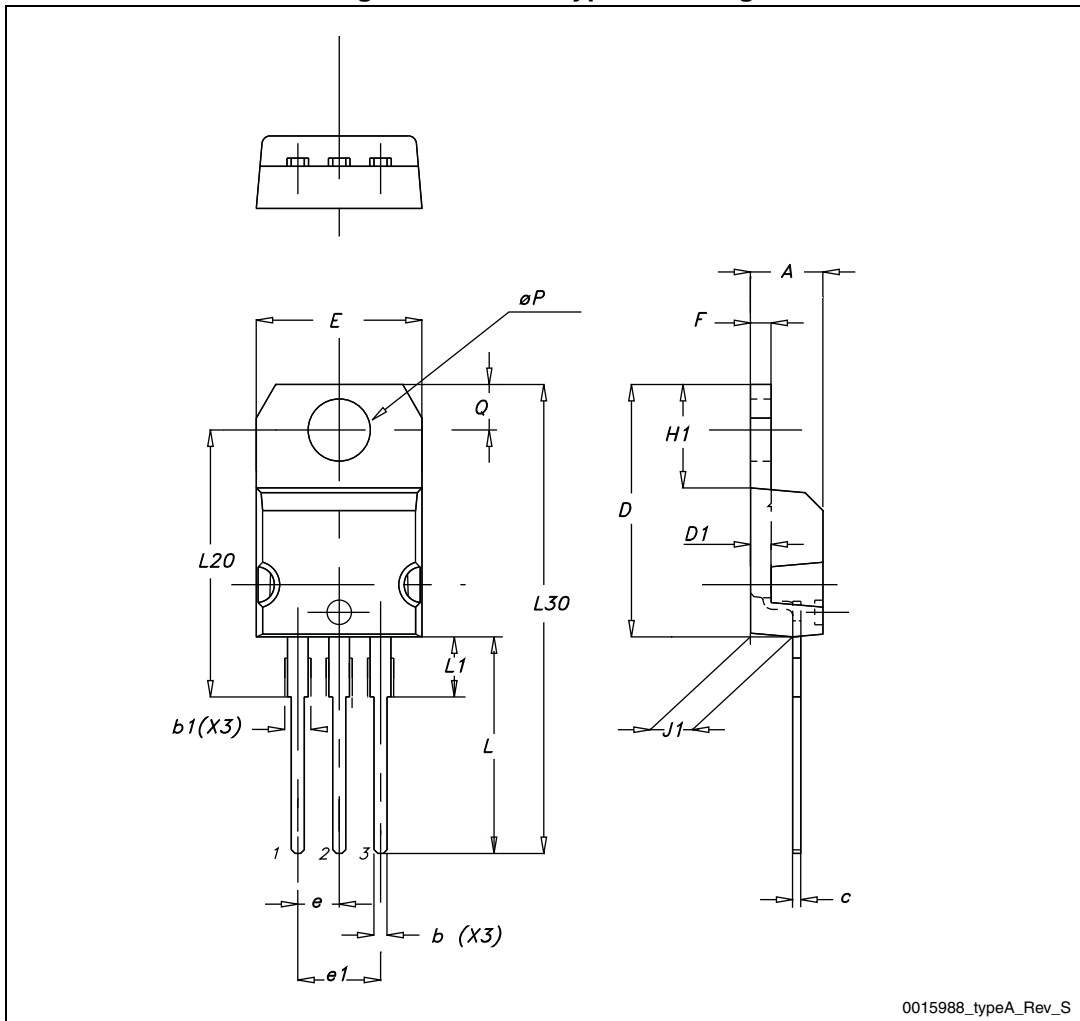
4 Package mechanical data

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 8. TO-220 type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
ØP	3.75		3.85
Q	2.65		2.95

Figure 19. TO-220 type A drawing



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
19-Nov-2012	1	Initial version.
08-Oct-2013	2	Updated $V_{GS(th)}$ typical value in Table 4: On/off states .

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