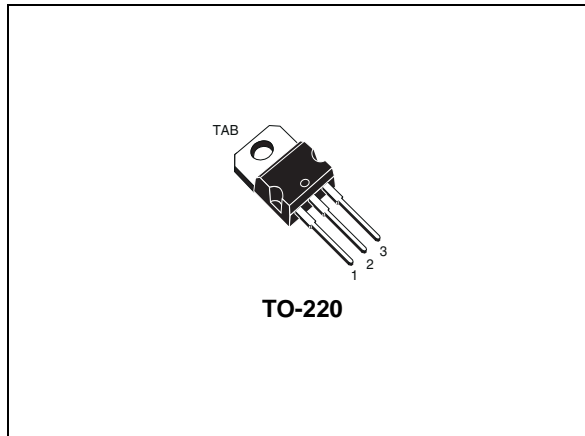
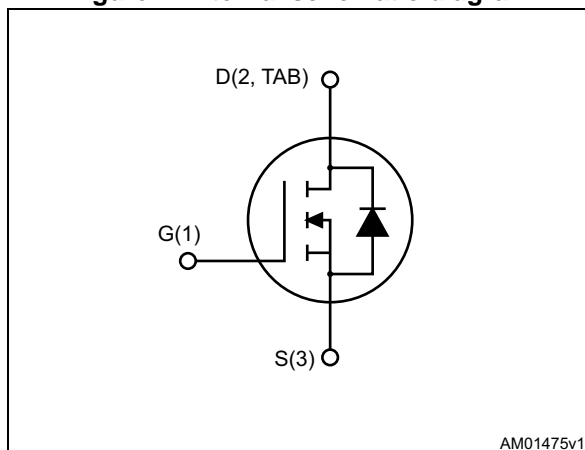


N-channel 60 V, 0.0063  $\Omega$  typ., 77 A STripFET™ VI DeepGATE™  
Power MOSFET in a TO-220 package

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>
STP77N6F6	60 V	0.007 $\Omega$	77 A	80 W

- R<sub>DS(on)</sub> \* Q<sub>g</sub> industry benchmark
- Extremely low on-resistance R<sub>DS(on)</sub>
- High avalanche ruggedness
- Low gate drive power losses
- Very low switching gate charge

**Applications**

- Switching applications

**Description**

This device is an N-channel Power MOSFET developed using the 6<sup>th</sup> generation of STripFET™ DeepGATE™ technology, with a new gate structure. The resulting Power MOSFET exhibits the lowest R<sub>DS(on)</sub> in all packages.

**Table 1. Device summary**

Order code	Marking	Package	Packaging
STP77N6F6	77N6F6	TO-220	Tube

# Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	60	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D^{(1)}$	Drain current (continuous) at $T_c = 25\text{ }^\circ\text{C}$	77	A
$I_D^{(1)}$	Drain current (continuous) at $T_c = 100\text{ }^\circ\text{C}$	55	A
$I_{DM}^{(2)}$	Drain current (pulsed)	308	A
$P_{TOT}^{(1)}$	Total dissipation at $T_c = 25\text{ }^\circ\text{C}$	80	W
$T_{JPstg}$	Operating junction temperature storage temperature	-55 to 175	$^\circ\text{C}$

1. This value is rated according to  $R_{thj-c}$
2. Pulse width is limited by safe operating area

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-c}$	Thermal resistance junction-case	1.88	$^\circ\text{C}/\text{W}$
$R_{thj-a}^{(1)}$	Thermal resistance junction-ambient	62.5	

1. When mounted on FR-4 board of 1 inch<sup>2</sup>, 2 oz Cu,  $t < 10$  sec

**Table 4. Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AV}$	Avalanche current, repetitive or not-repetitive (pulse width limited by maximum junction temperature)	38.5	A
$E_{AS}$	Single pulse avalanche energy ( $T_J = 25\text{ }^\circ\text{C}$ , $I_D = I_{AV}$ , $V_{DD} = 43\text{ V}$ )	152	mJ

## 2 Electrical characteristics

( $T_J = 25\text{ °C}$  unless otherwise specified)

**Table 5. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\ \mu\text{A}$ , $V_{GS} = 0$	60			V
$I_{DSS}$	Zero gate voltage Drain current	$V_{DS} = 60\ \text{V}$ , $V_{GS} = 0$			10	$\mu\text{A}$
		$V_{DS} = 60\ \text{V}$ , $V_{GS} = 0$ , $T_J = 125\text{ °C}$			100	$\mu\text{A}$
$I_{GSS}$	Gate-body leakage current	$V_{GS} = \pm 20\ \text{V}$ , $V_{DS} = 0$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$	2		4	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\ \text{V}$ , $I_D = 38.5\ \text{A}$		0.0063	0.007	$\Omega$

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 25\ \text{V}$ , $f = 1\ \text{MHz}$ , $V_{GS} = 0$	-	4295	-	pF
$C_{oss}$	Output capacitance		-	292	-	pF
$C_{riss}$	Reverse transfer capacitance		-	190	-	pF
$Q_g$	Total gate charge	$V_{DD} = 30\ \text{V}$ , $I_D = 77\ \text{A}$ , $V_{GS} = 10\ \text{V}$	-	70.5	-	nC
$Q_{gs}$	Gate-source charge		-	19.7	-	nC
$Q_{gd}$	Gate-drain charge		-	16.2	-	nC
$R_g$	Intrinsic gate resistance	$f = 1\ \text{MHz}$ open drain	-	2.2	-	$\Omega$

**Table 7. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 30\ \text{V}$ , $I_D = 77\ \text{A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\ \text{V}$	-	22	-	ns
$t_r$	Rise time		-	42	-	ns
$t_{d(off)}$	Turn-off-delay time		-	73	-	ns
$t_f$	Fall time		-	16	-	ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		77	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		308	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 77\text{ A}$ , $V_{GS} = 0$	-		1.3	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 77\text{ A}$ , $V_{DD} = 48\text{ V}$ $di/dt = 100\text{ A}/\mu\text{s}$ , $T_j = 25\text{ }^\circ\text{C}$	-	49		ns
$Q_{rr}$	Reverse recovery charge		-	8.5		nC
$I_{RRM}$	Reverse recovery current		-	0.3		A

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

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

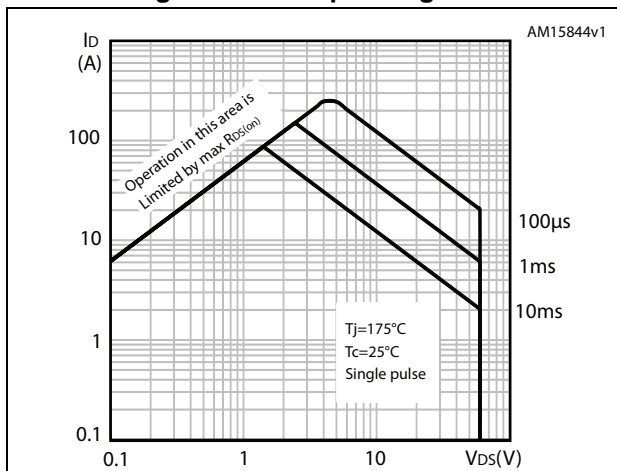


Figure 3. Thermal impedance

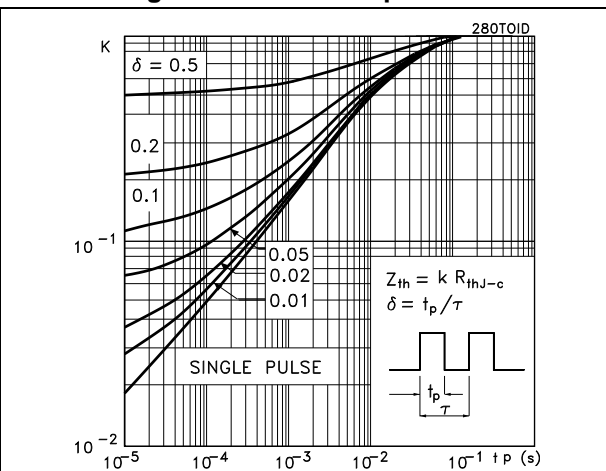


Figure 4. Output characteristics

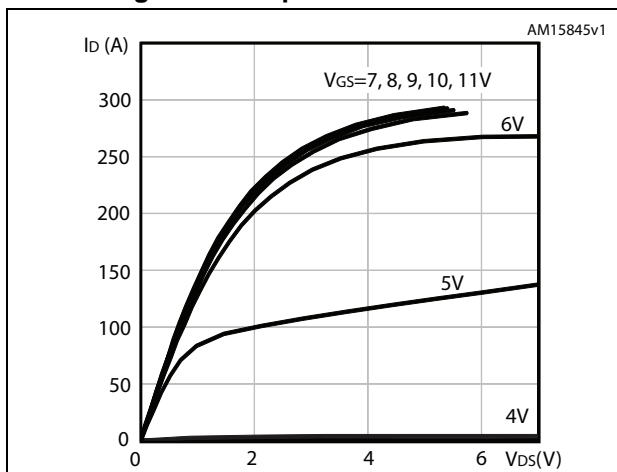


Figure 5. Transfer characteristics

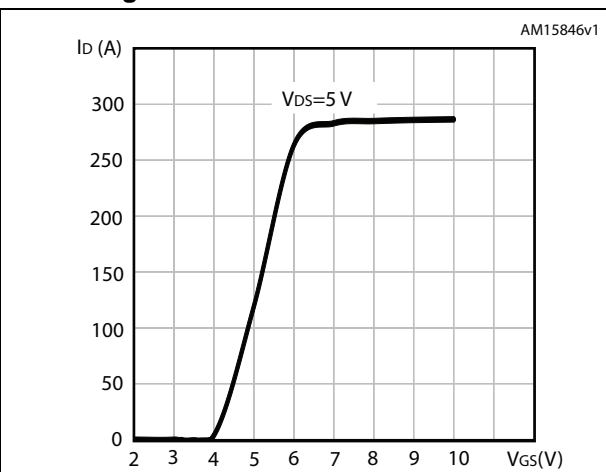


Figure 6. Gate charge vs gate-source voltage

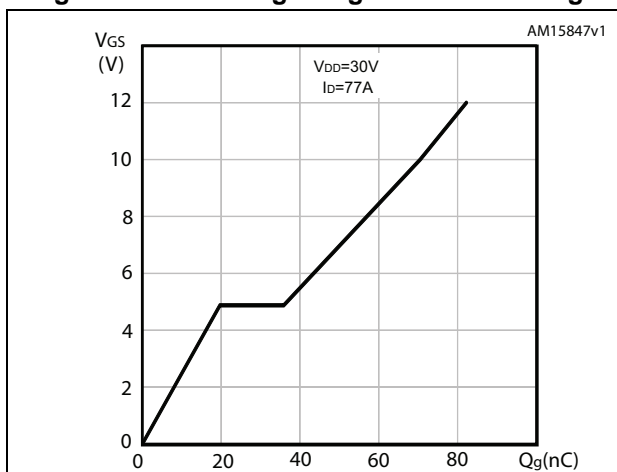


Figure 7. Static drain-source on-resistance

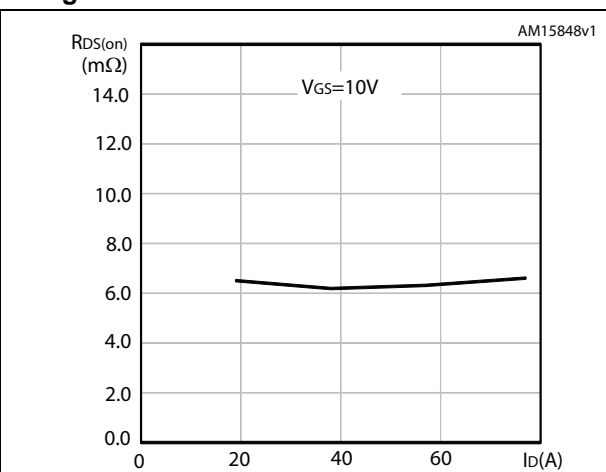


Figure 8. Capacitance variations

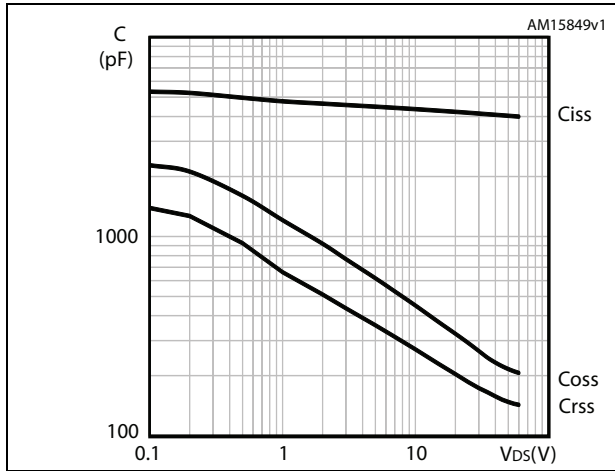


Figure 10. Normalized on-resistance vs. temperature

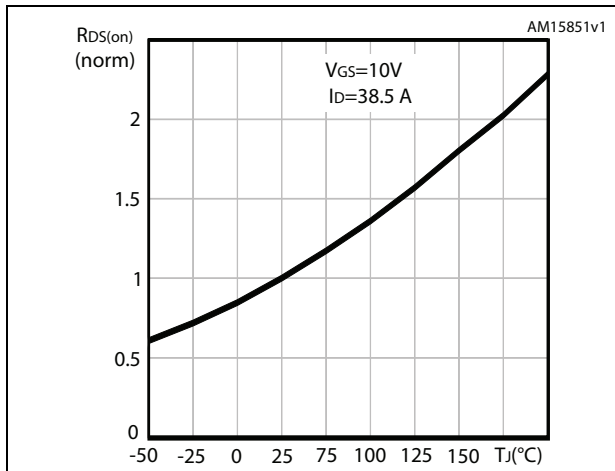


Figure 12. Normalized VDS vs. temperature

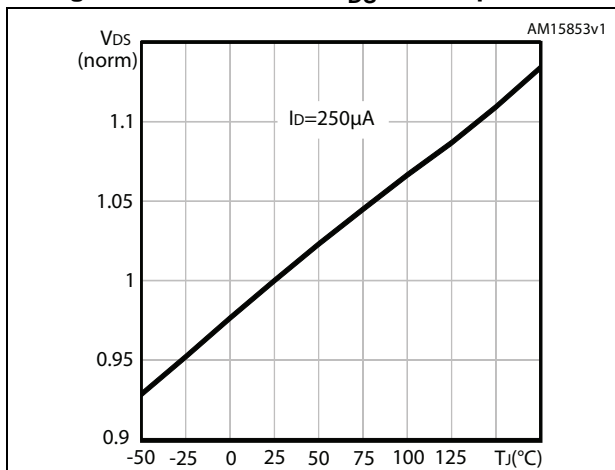


Figure 9. Normalized gate threshold voltage vs. temperature

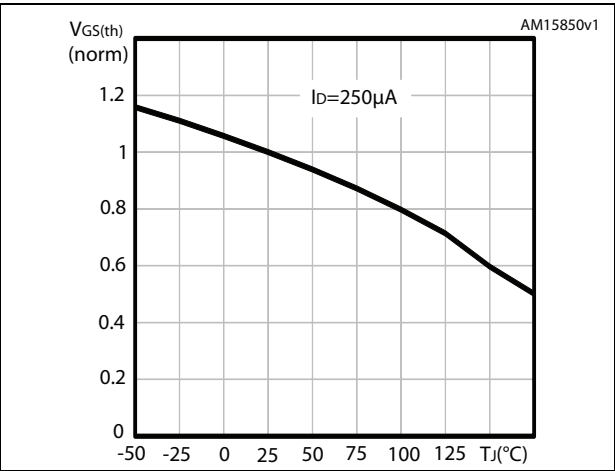
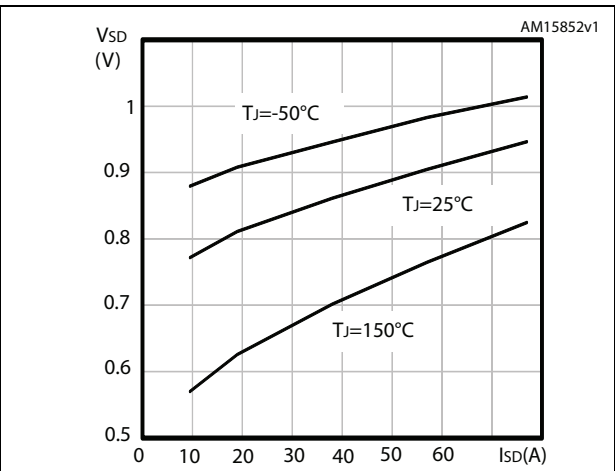


Figure 11. Drain-source diode forward characteristics



### 3 Test circuits

Figure 13. Switching times test circuit for resistive load

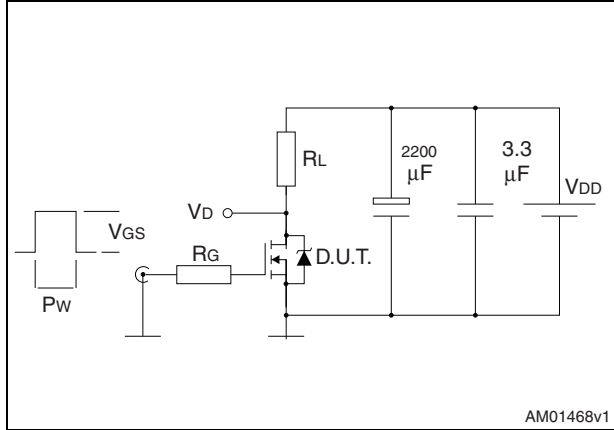


Figure 14. Gate charge test circuit

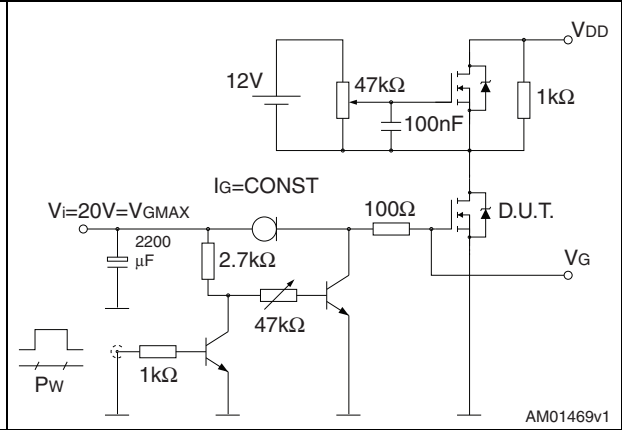


Figure 15. Test circuit for inductive load switching and diode recovery times

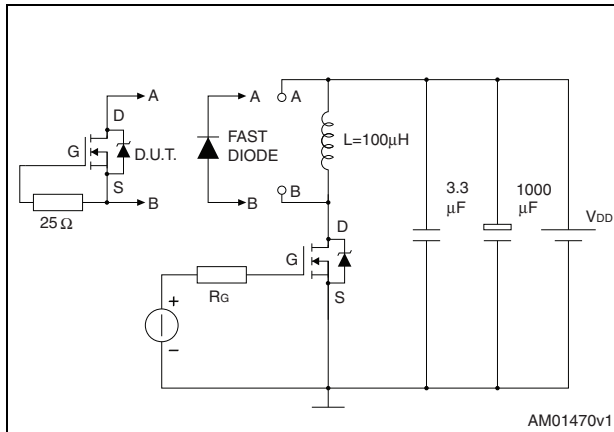


Figure 16. Unclamped inductive load test circuit

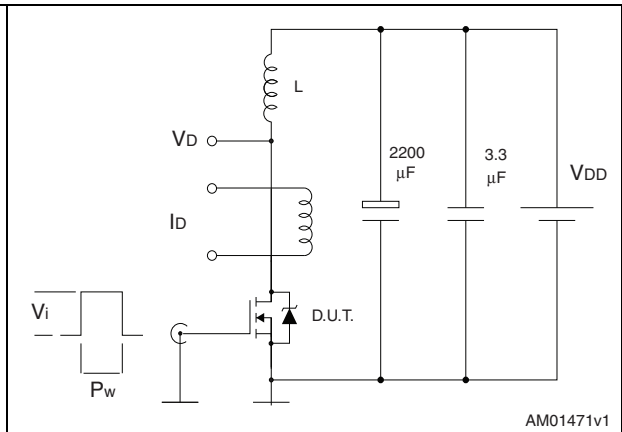


Figure 17. Unclamped inductive waveform

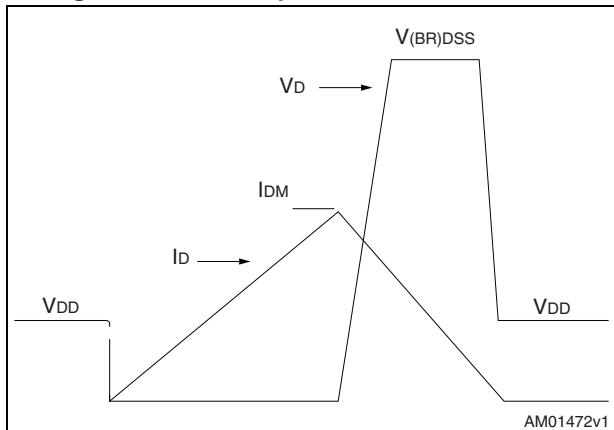
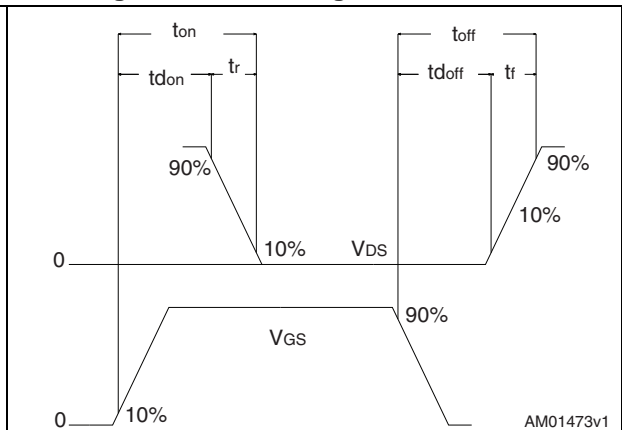


Figure 18. Switching time waveform





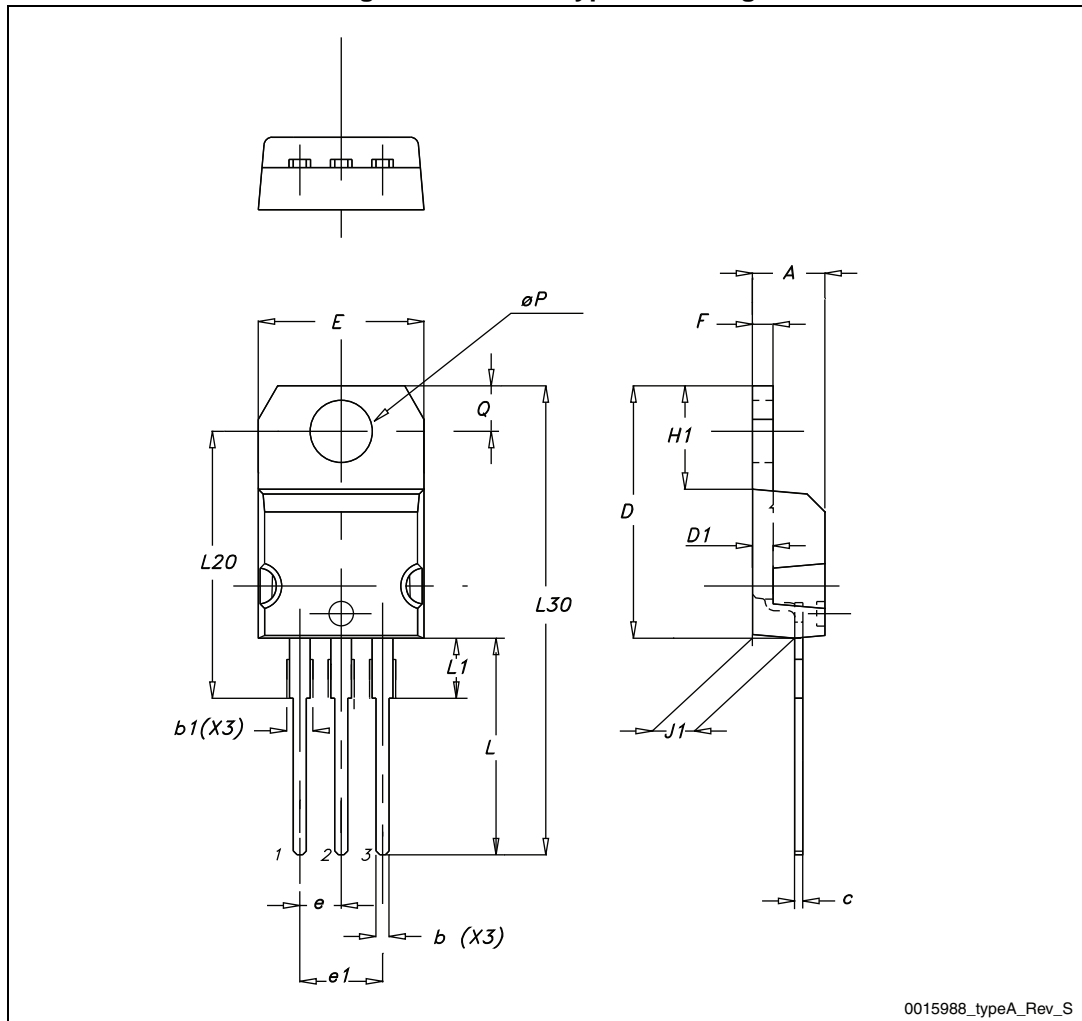
## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

Table 9. 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 10. Document revision history

Date	Revision	Changes
12-Dec-2012	1	First release.
23-May-2013	2	<ul style="list-style-type: none"><li>– Updated: values in <a href="#">Table 4</a>, the entire values in <a href="#">Table 6, 7</a>, <math>V_{DD}</math> and <math>T_J</math> values in <a href="#">Table 8</a>, typical values for <math>t_{rr}</math>, <math>Q_{rr}</math>, <math>I_{RRM}</math> in <a href="#">Table 8</a></li><li>– Added: <math>V_{SD}</math> max value in <a href="#">Table 8</a></li><li>– Added: <a href="#">Section 2.1: Electrical characteristics (curves)</a></li><li>– Minor text changes</li></ul>

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