



# STP80N70F6

N-channel 68 V, 0.0063  $\Omega$  typ., 96 A STripFET™ VI DeepGATE™ Power MOSFET in TO-220 package

Datasheet – production data

## Features

Order code	V <sub>DSS</sub> max.	R <sub>DS(on)</sub> max.	I <sub>D</sub>	P <sub>TOT</sub>
STP80N70F6	68 V	< 0.008 $\Omega$ (V <sub>GS</sub> = 10 V)	96 A	110 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.

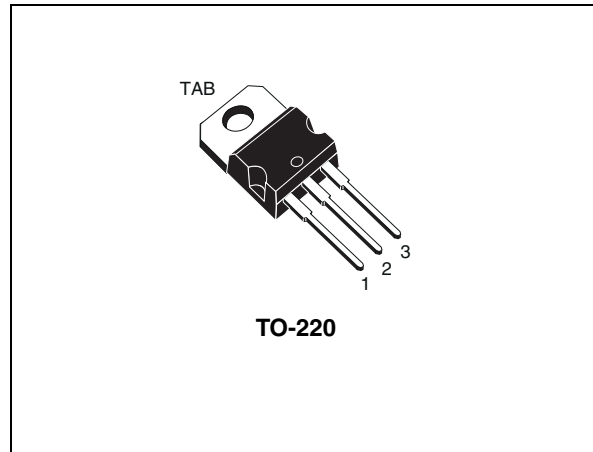


Figure 1. Internal schematic diagram

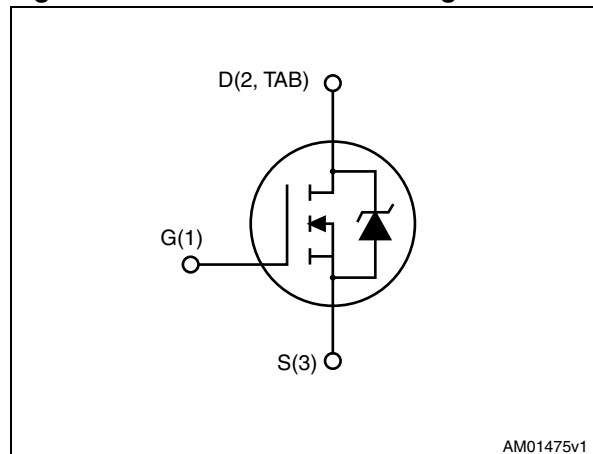


Table 1. Device summary

Order code	Marking	Package	Packaging
STP80N70F6	80N70F6	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	68	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	96	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	60	A
$I_{DM}^{(1)}$	Drain current (pulsed)	384	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	110	W
$T_{stg}$	Storage temperature	- 55 to 175	$^\circ\text{C}$
$T_j$	Operating junction temperature		

1. This value is rated according to  $R_{thj-c}$

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-c}$	Thermal resistance junction-case max	1.36	$^\circ\text{C}/\text{W}$
$R_{thj-a}$	Thermal resistance junction-ambient max	62.5	$^\circ\text{C}/\text{W}$

## 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 ( $V_{GS} = 0$ )	$I_D = 250\ \mu\text{A}$	68			V
$I_{DSS}$	Zero gate voltage Drain current ( $V_{GS} = 0$ )	$V_{DS} = 68\ \text{V}$ $V_{DS} = 68\ \text{V}, T_C = 125\text{ °C}$			1 100	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\ \text{V}$			$\pm 100$	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	$V_{GS} = 10\ \text{V}, I_D = 48\ \text{A}$		0.0063	0.008	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance			5850		pF
$C_{oss}$	Output capacitance	$V_{DS} = 25\ \text{V}, f = 1\ \text{MHz},$ $V_{GS} = 0$	-	341	-	pF
$C_{rss}$	Reverse transfer capacitance			240		pF
$Q_g$	Total gate charge	$V_{DD} = 34\ \text{V}, I_D = 96\ \text{A},$ $V_{GS} = 10\ \text{V}$		99		nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 10\ \text{V}$ <i>(see Figure 14)</i>	-	31	-	nC
$Q_{gd}$	Gate-drain charge			19		nC

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 10\ \text{V}, I_D = 48\ \text{A}$ $R_G = 4.7\ \Omega, V_{GS} = 10\ \text{V}$ <i>(see Figure 13)</i>	-	23	-	ns
$t_r$	Rise time			29		
$t_{d(off)}$	Turn-off-delay time	<i>(see Figure 13)</i>	-	102	-	ns
$t_f$	Fall time			23		

**Table 7. Source drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$I_{SD}$	Source-drain current		-		96	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		384	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 96\text{ A}, V_{GS} = 0$	-		1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 48\text{ A}, V_{DD} = 24\text{ V}$ $di/dt = 100\text{ A}/\mu\text{s},$ $T_j = 150\text{ }^\circ\text{C}$ <i>(see Figure 15)</i>	-	34		ns
$Q_{rr}$	Reverse recovery charge			53		nC
$I_{RRM}$	Reverse recovery current			3		A

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

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

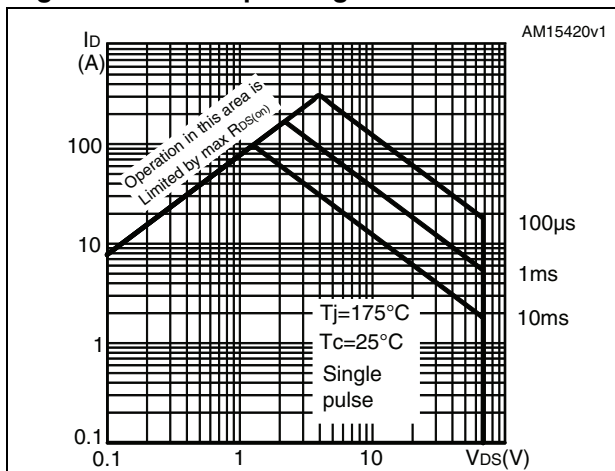


Figure 3. Thermal impedance

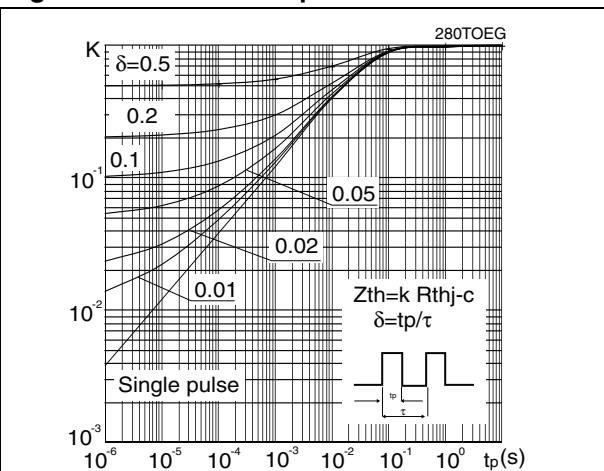


Figure 4. Output characteristics

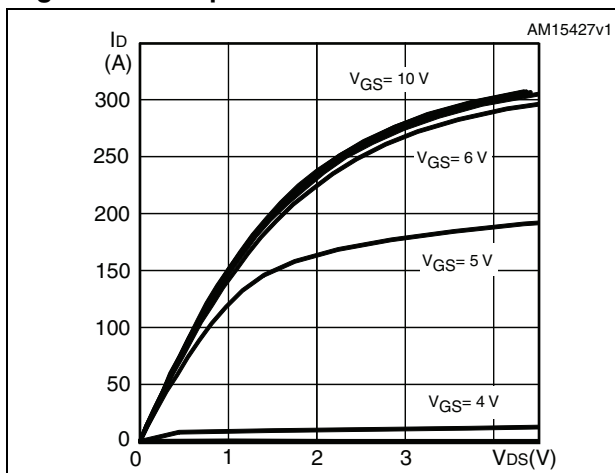


Figure 5. Transfer characteristics

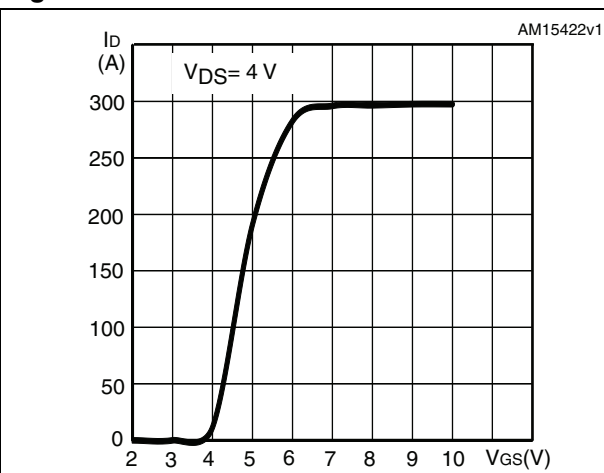


Figure 6. Gate charge vs gate-source voltage

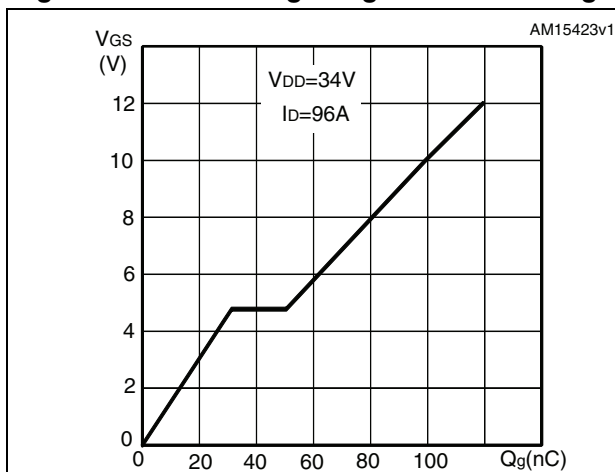


Figure 7. Static drain-source on-resistance

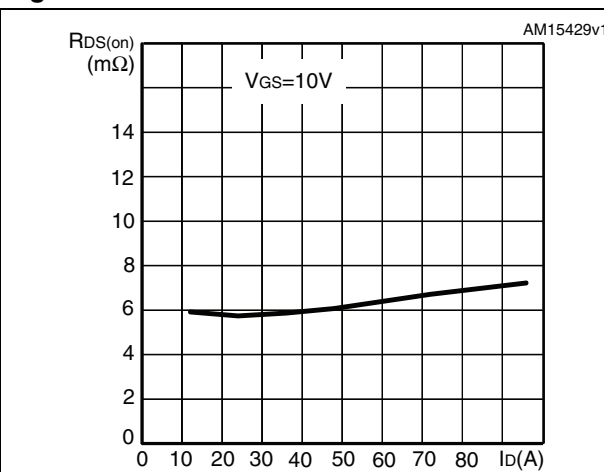


Figure 8. Capacitance variations

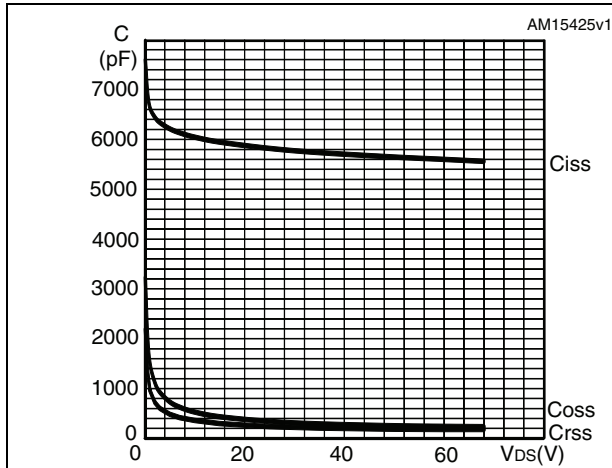


Figure 9. Normalized  $B_{V_{DS}}$  vs temperature

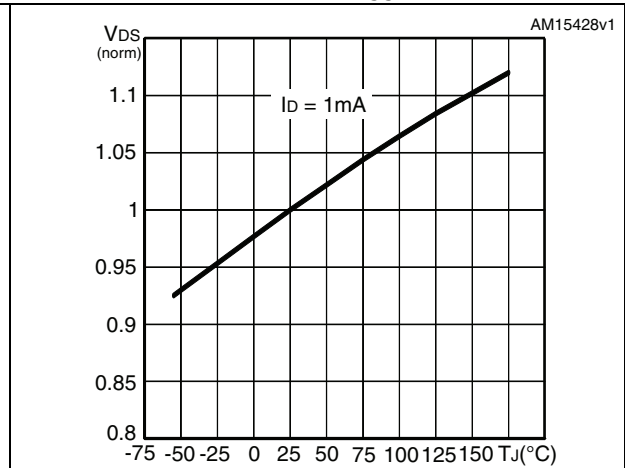


Figure 10. Normalized gate threshold voltage vs temperature

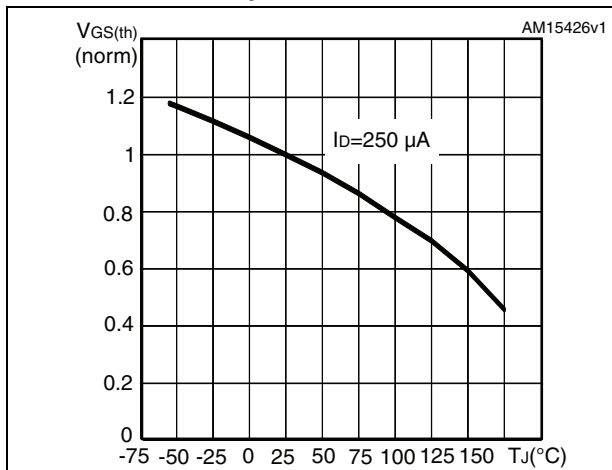


Figure 11. Normalized on-resistance vs temperature

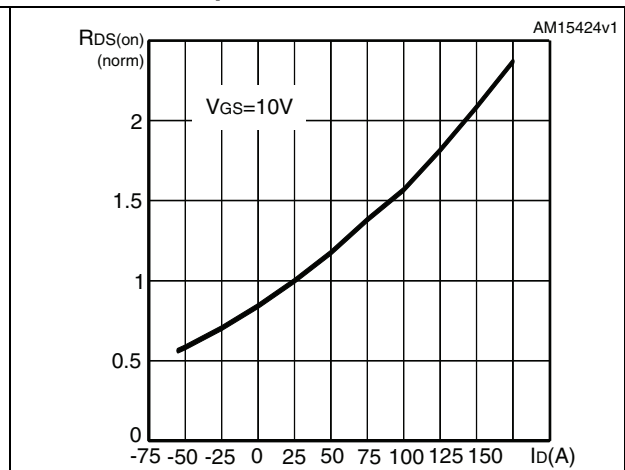
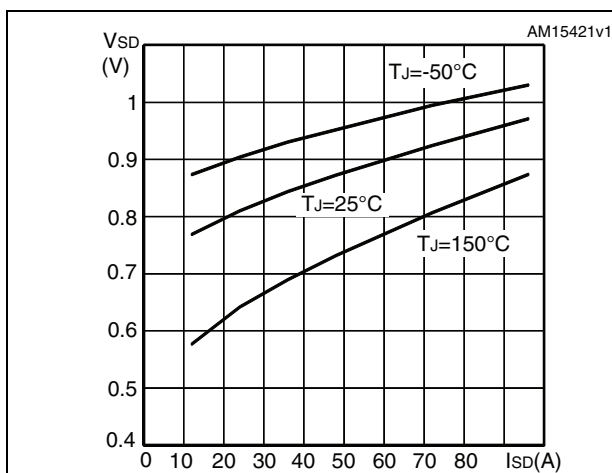


Figure 12. Source-drain diode forward characteristics



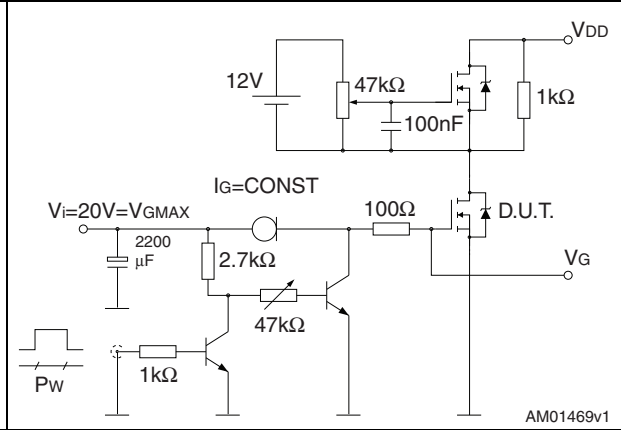
### 3 Test circuits

**Figure 13. Switching times test circuit for resistive load**



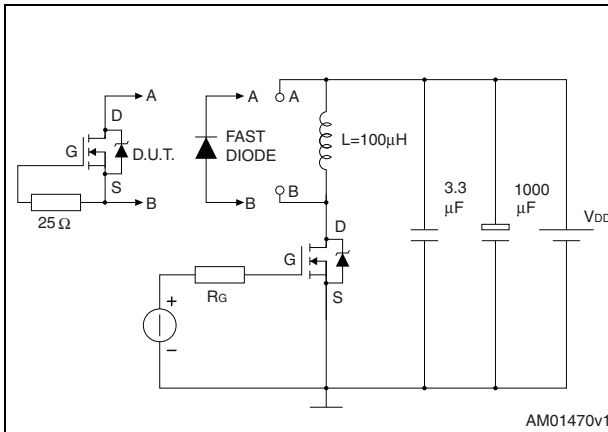
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**Figure 14. Gate charge test circuit**



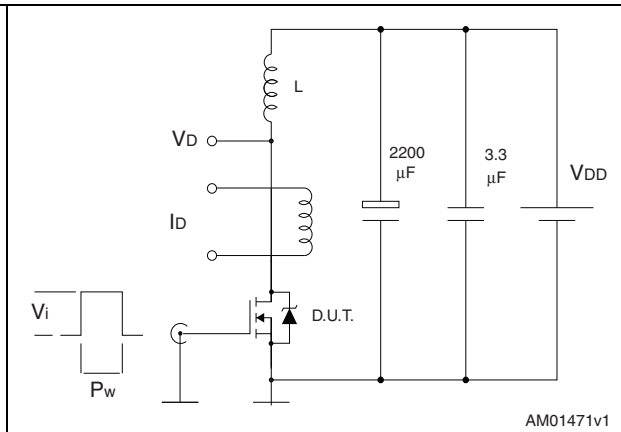
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**Figure 15. Test circuit for inductive load switching and diode recovery times**



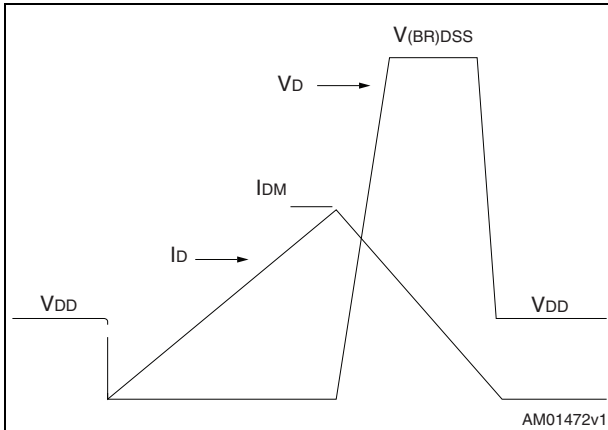
AM01470v1

**Figure 16. Unclamped inductive load test circuit**



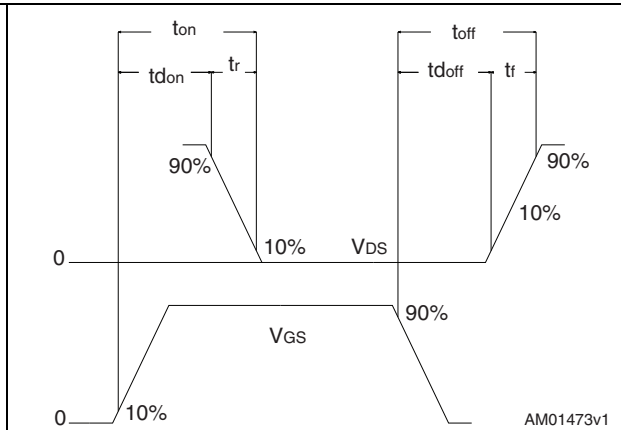
AM01471v1

**Figure 17. Unclamped inductive waveform**



AM01472v1

**Figure 18. Switching time waveform**



AM01473v1



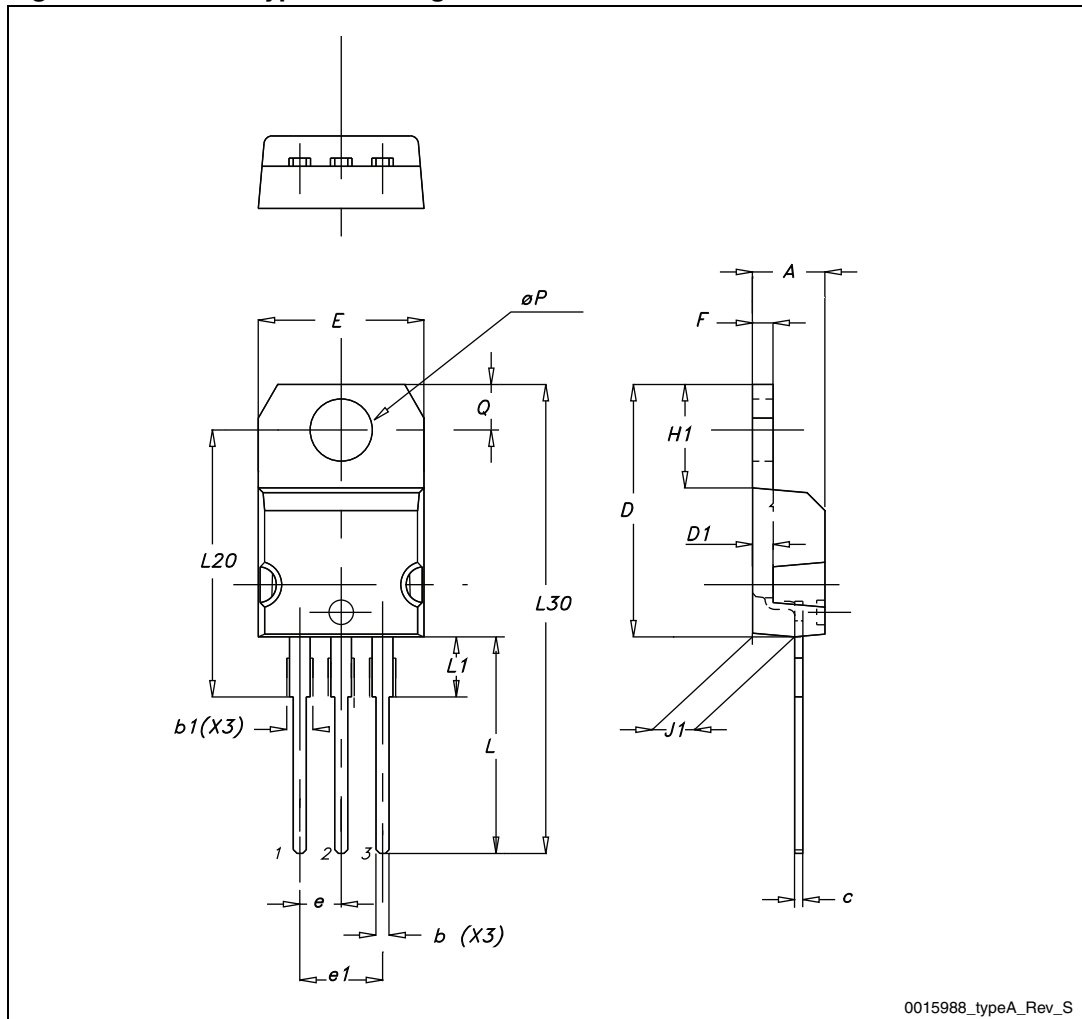
## 4 Package mechanical data

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 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



0015988\_typeA\_Rev\_S

## 5 Revision history

**Table 9. Document revision history**

Date	Revision	Changes
06-Dec-2012	1	First release.

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