



# STP78N75F4

N-channel 75 V, 0.0092  $\Omega$  typ., 78 A STripFET™ DeepGATE™ Power MOSFET in TO-220 package

Datasheet — production data

## Features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
STP78N75F4	75 V	< 0.011 $\Omega$	78 A

- N-channel enhancement mode
- 100% avalanche rated
- Low gate charge
- Very low on-resistance

## Application

- Switching applications

## Description

This device is an N-channel Power MOSFET developed using ST's STripFET™ DeepGATE™ technology. The device has a new gate structure and is specially designed to minimize on-state resistance to provide superior switching performance.

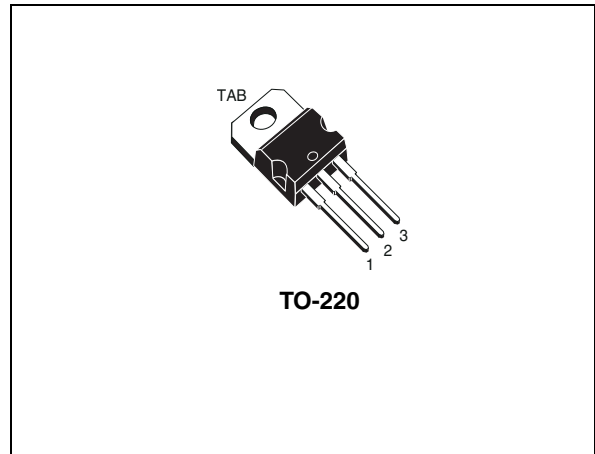


Figure 1. Internal schematic diagram

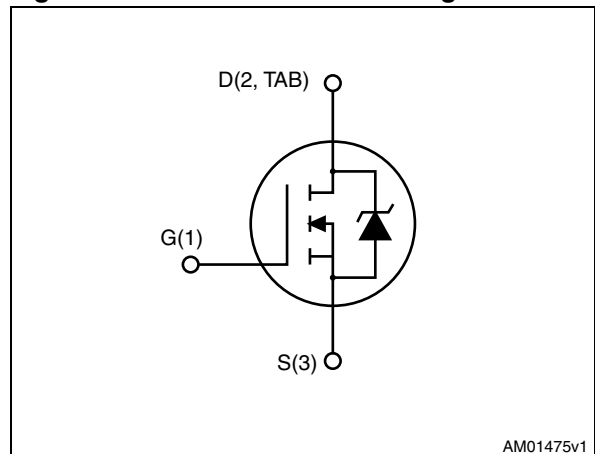


Table 1. Device summary

Order codes	Marking	Package	Packaging
STP78N75F4	78N75F4	TO-220	Tube

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	75	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	78	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	55	A
$I_{DM}^{(1)}$	Drain current (pulsed)	312	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	150	W
	Derating factor	1	W/ $^\circ\text{C}$
$E_{AS}^{(2)}$	Single pulse avalanche energy	185	mJ
$T_{stg}$	Storage temperature	- 55 to 175	$^\circ\text{C}$
$T_j$	Operating junction temperature		

1. Pulse width limited by safe operating area

2. Starting  $T_j = 25\text{ }^\circ\text{C}$ ,  $I_D = 35\text{ A}$ ,  $V_{DD} = 50\text{ V}$

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	1	$^\circ\text{C}/\text{W}$
$R_{thj-a}$	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	$I_D = 250\ \mu\text{A}$ , $V_{GS} = 0$	75			V
$I_{DSS}$	Zero gate voltage	$V_{DS} = 75\text{ V}$			1	$\mu\text{A}$
	Drain current ( $V_{GS} = 0$ )	$V_{DS} = 75\text{ V}$ , $T_C = 125\text{ °C}$			100	$\mu\text{A}$
$I_{GSS}$	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	$V_{GS} = 10\text{ V}$ , $I_D = 39\text{ A}$		0.0092	0.011	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	
$C_{iss}$	Input capacitance			5015		pF	
$C_{oss}$	Output capacitance	$V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$	-	382	-	pF	
$C_{rss}$	Reverse transfer capacitance				218		pF
$Q_g$	Total gate charge	$V_{DD} = 37.5\text{ V}$ , $I_D = 78\text{ A}$ , $V_{GS} = 10\text{ V}$ <i>(see Figure 14)</i>	-	76		nC	
$Q_{gs}$	Gate-source charge				23		nC
$Q_{gd}$	Gate-drain charge				18.5		nC

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 37.5\text{ V}$ , $I_D = 39\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ <i>(see Figure 13)</i>	-	25	-	ns	
$t_r$	Rise time				33		ns
$t_{d(off)}$	Turn-off-delay time			-	61	-	ns
$t_f$	Fall time			14		ns	

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$I_{SD}$	Source-drain current		-		78	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		312	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 78 \text{ A}, V_{GS} = 0$	-		1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 78 \text{ A}, V_{DD} = 60 \text{ V}$ $di/dt = 100 \text{ A}/\mu\text{s},$ $T_j = 150 \text{ }^\circ\text{C}$ <i>(see Figure 15)</i>	-	67		ns
$Q_{rr}$	Reverse recovery charge			183		nC
$I_{RRM}$	Reverse recovery current			5.5		A

1. Pulse width 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

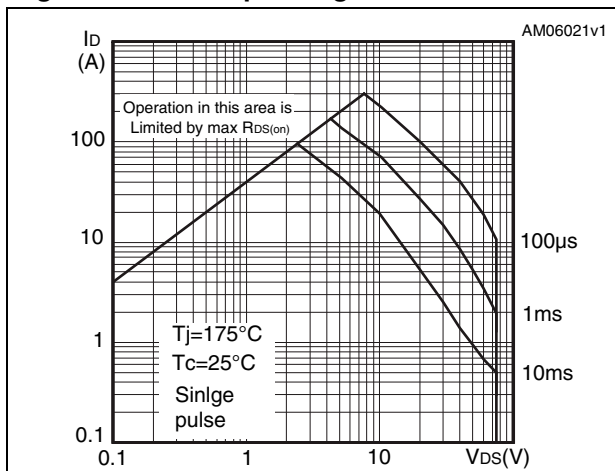


Figure 3. Thermal impedance

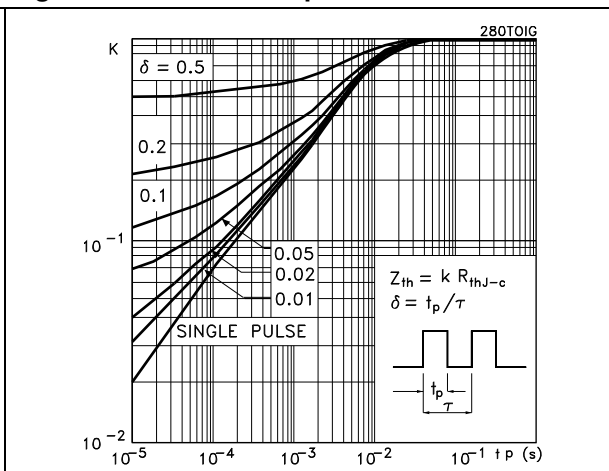


Figure 4. Output characteristics

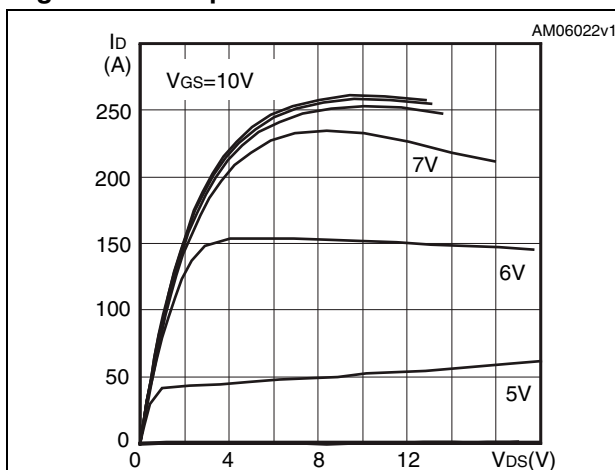


Figure 5. Transfer characteristics

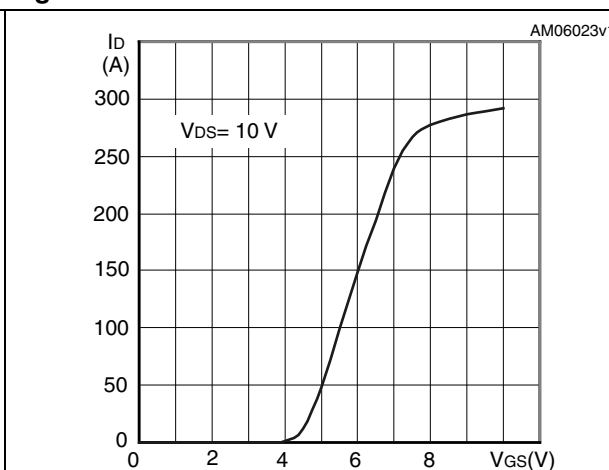


Figure 6. Normalized BV<sub>DSS</sub> vs temperature

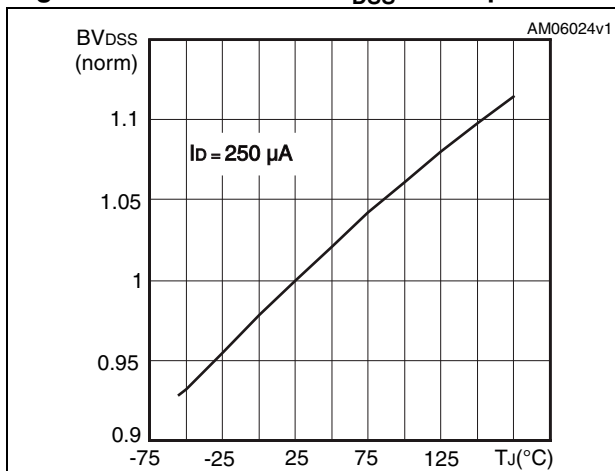


Figure 7. Static drain-source on-resistance

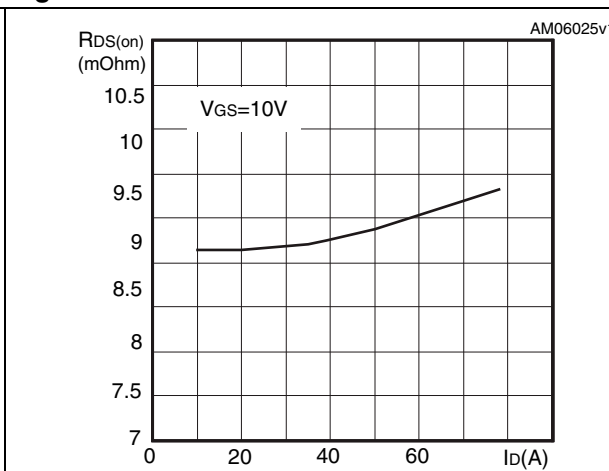


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

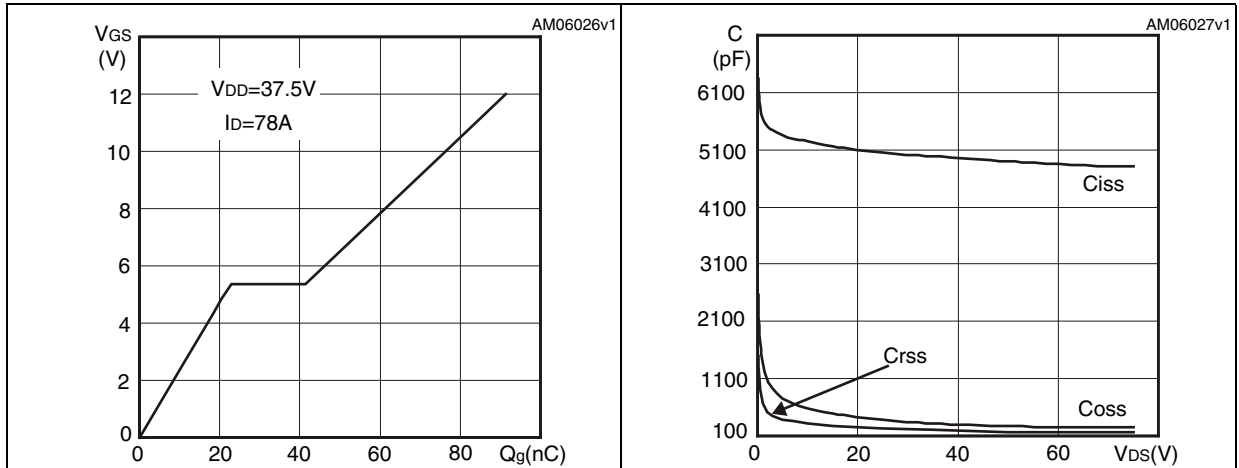


Figure 10. Normalized on-resistance vs temperature

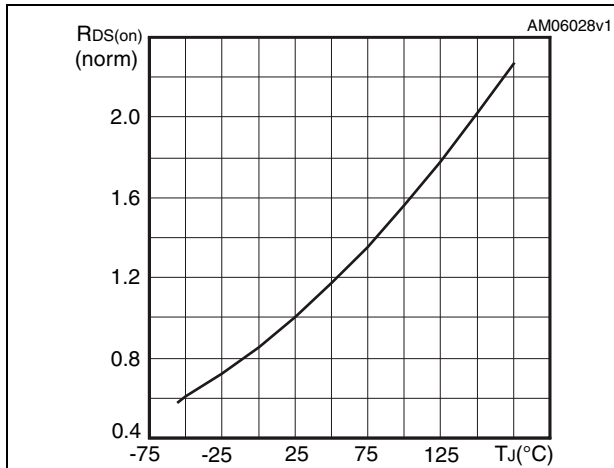


Figure 11. Normalized gate threshold voltage vs temperature

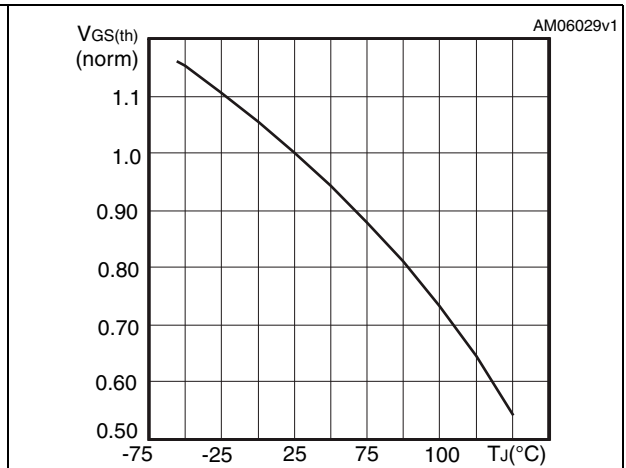
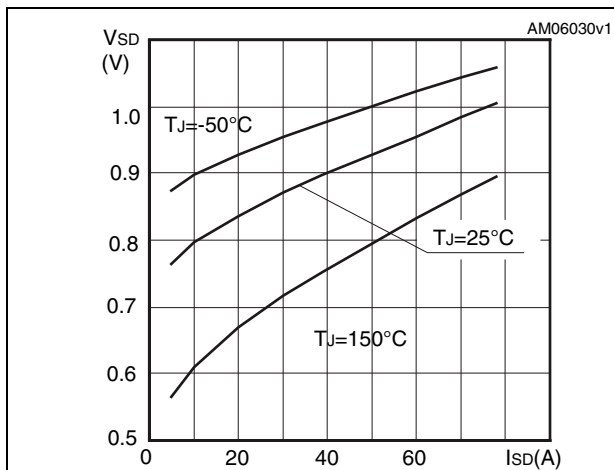
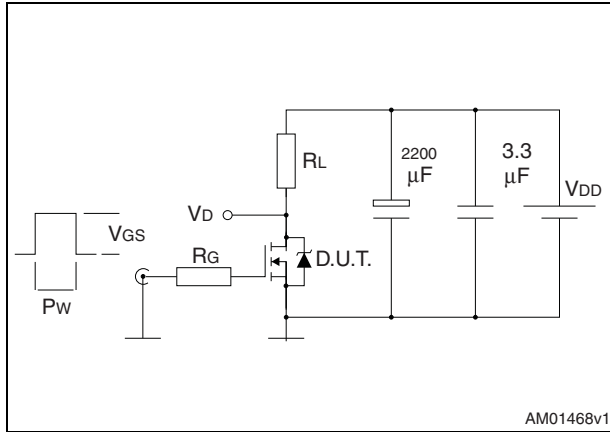


Figure 12. Source-drain diode forward characteristics

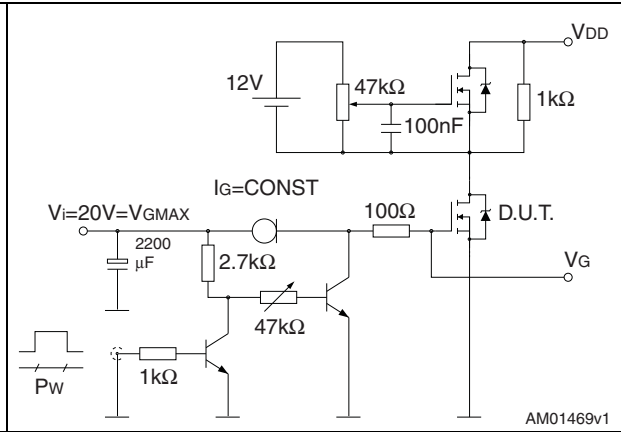


### 3 Test circuits

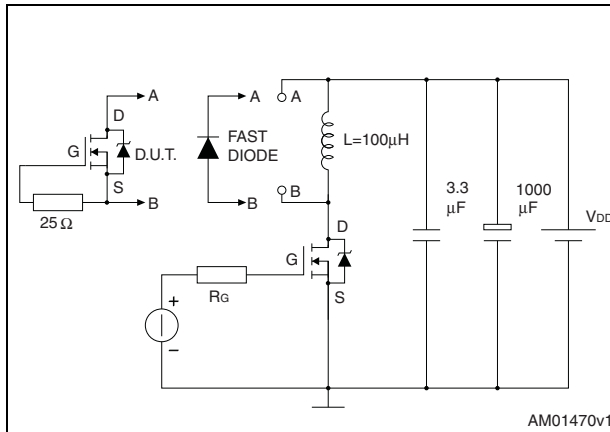
**Figure 13. Switching times test circuit for resistive load**



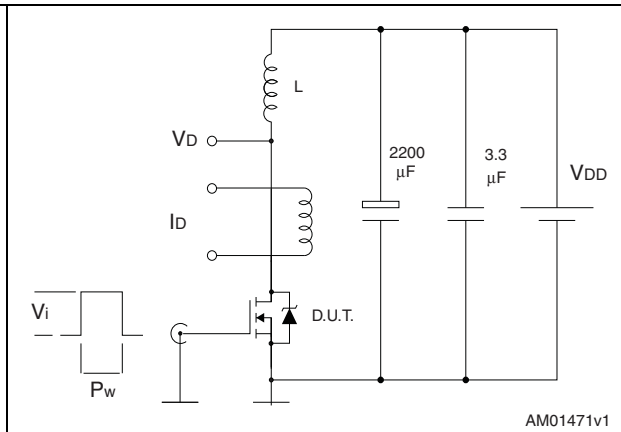
**Figure 14. Gate charge test circuit**



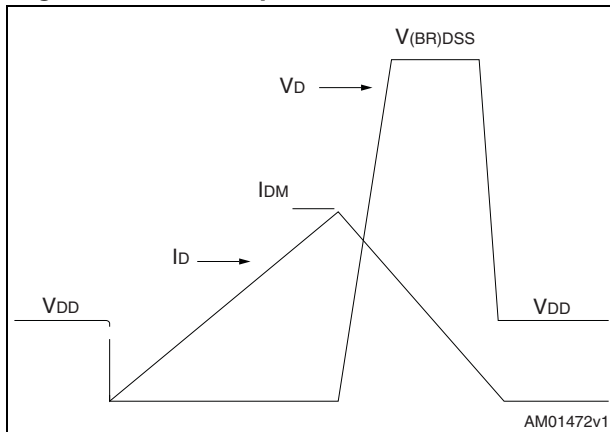
**Figure 15. Test circuit for inductive load switching and diode recovery times**



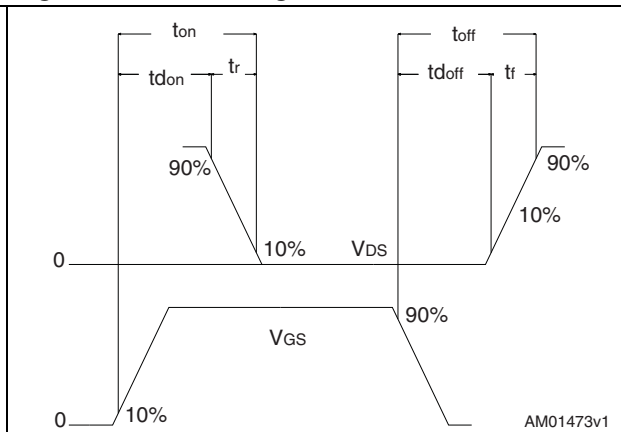
**Figure 16. Unclamped inductive load test circuit**



**Figure 17. Unclamped inductive waveform**



**Figure 18. Switching time waveform**





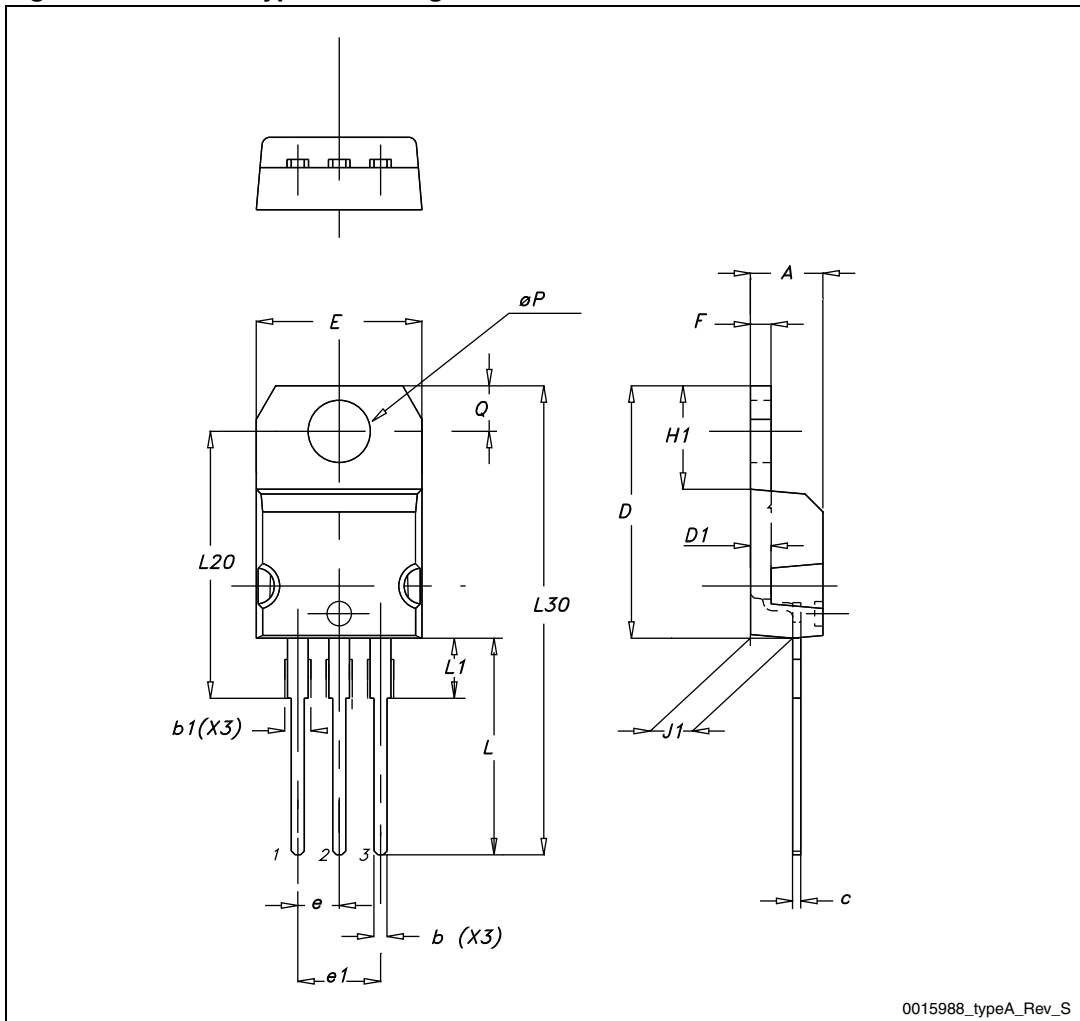
## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<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 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
12-May-2009	1	First release.
26-Nov-2009	2	Document status promoted from preliminary data to datasheet (see <a href="#">Section 2.1: Electrical characteristics (curves)</a> ).
24-Jul-2012	3	Minor text changes on the cover page. Updated <a href="#">Section 4: Package mechanical data</a> .

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