



STP78N75F4

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

Datasheet — production data

Features

Type	V _{DSS}	R _{DS(on)} max	I _D
STP78N75F4	75 V	< 0.011 Ω	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.

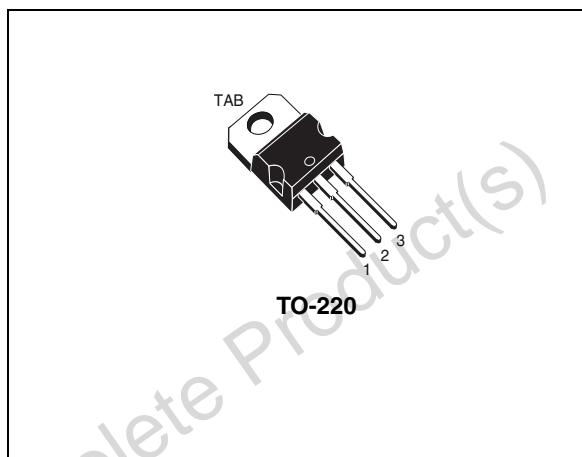


Figure 1. Internal schematic diagram

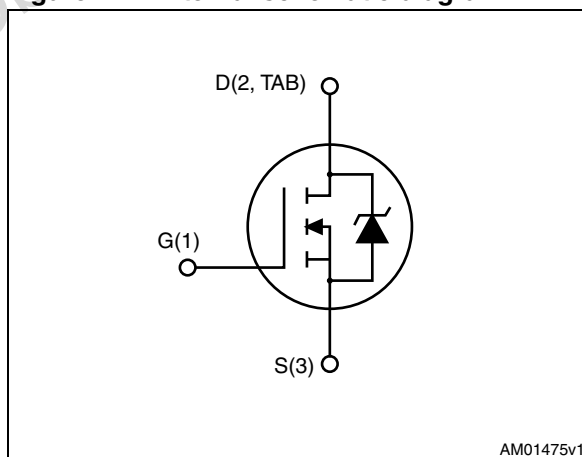


Table 1. Device summary

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

Contents

1	Electrical ratings	3
2	Electrical characteristics	4
	2.1 Electrical characteristics (curves)	6
3	Test circuits	8
4	Package mechanical data	9
5	Revision history	11

Obsolete Product(s) - Obsolete Product(s)

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	75	V
V_{GS}	Gate-source voltage	± 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	$^\circ\text{C/W}$
R_{thj-a}	Thermal resistance junction-ambient max	62.5	$^\circ\text{C/W}$

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	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0$	75			V
I_{DSS}	Zero gate voltage	$V_{DS} = 75\text{ V}$			1	μA
	Drain current ($V_{GS} = 0$)	$V_{DS} = 75\text{ V}$, $T_C = 125\text{ °C}$			100	μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 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	Ω

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 μs , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

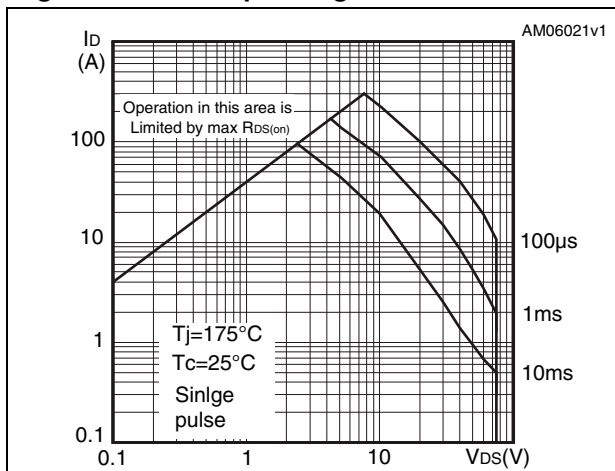


Figure 3. Thermal impedance

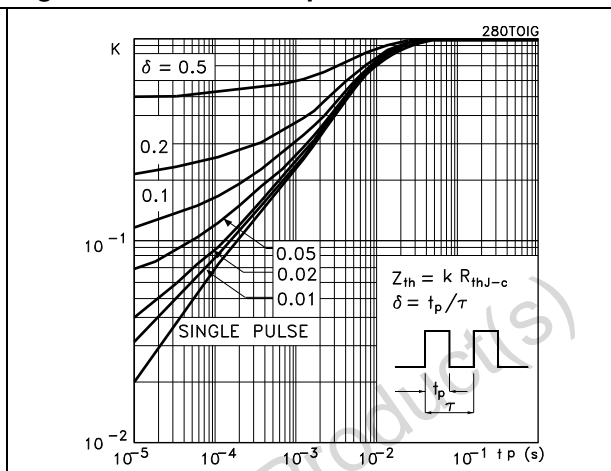


Figure 4. Output characteristics

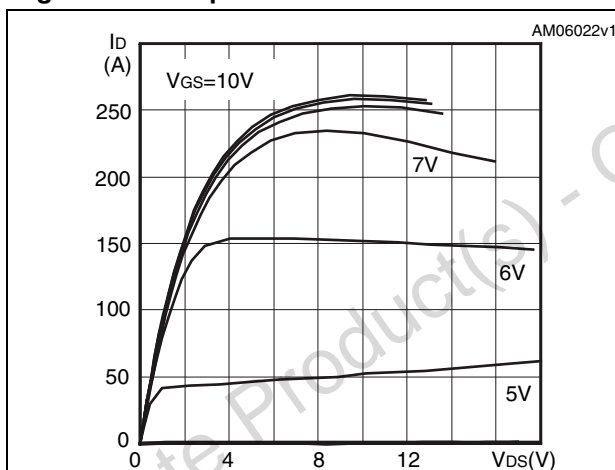


Figure 5. Transfer characteristics

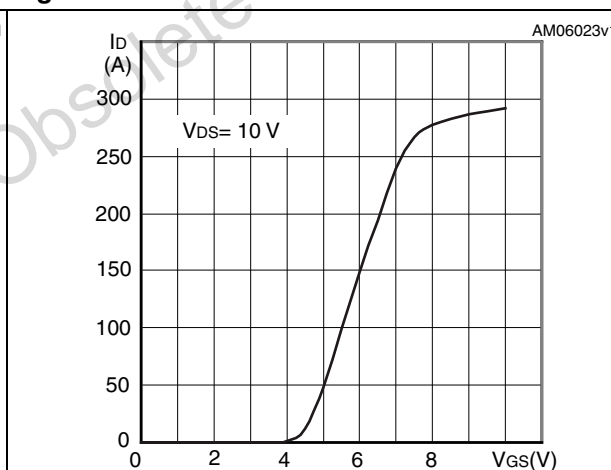


Figure 6. Normalized BV_{DSS} vs temperature

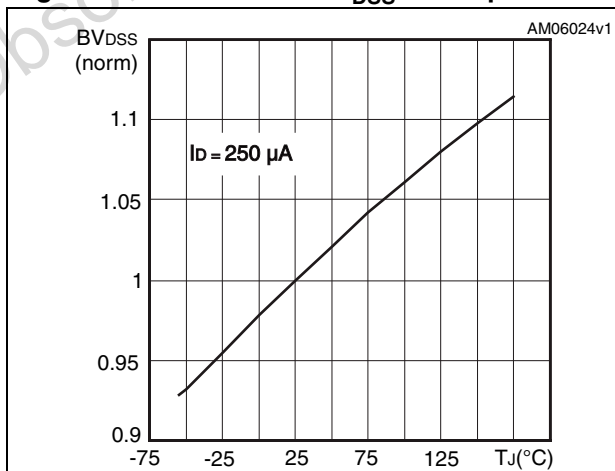


Figure 7. Static drain-source on-resistance

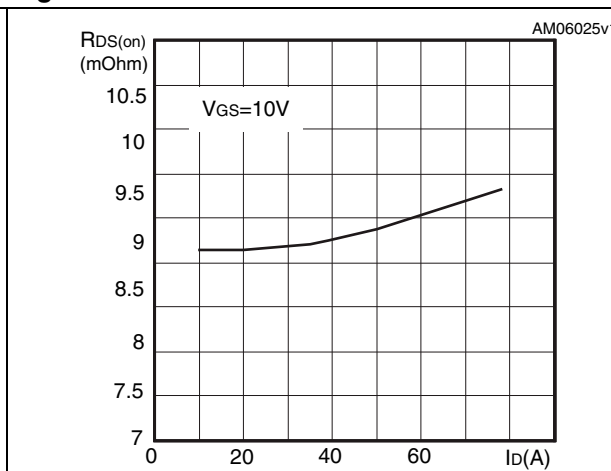


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

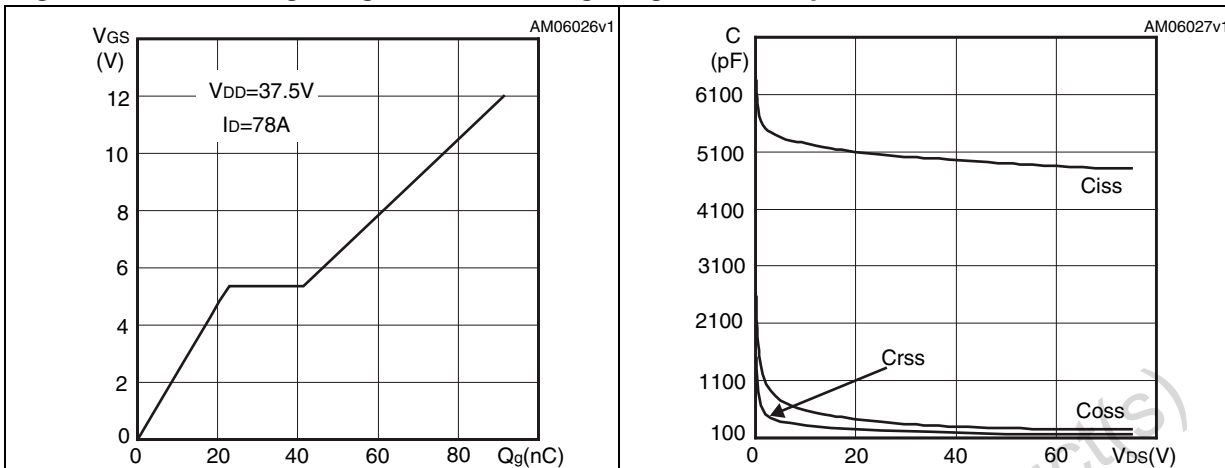


Figure 10. Normalized on-resistance vs temperature

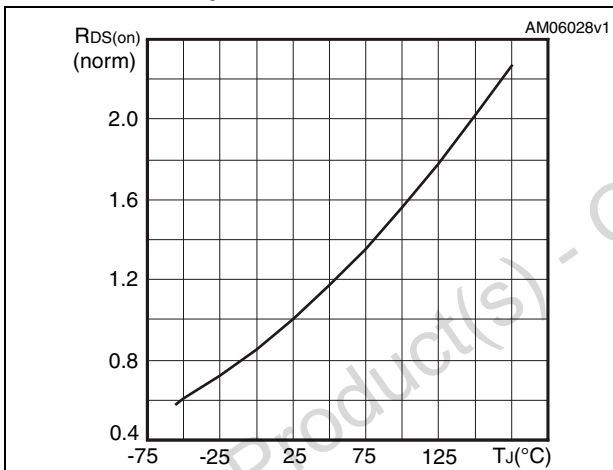


Figure 11. Normalized gate threshold voltage vs temperature

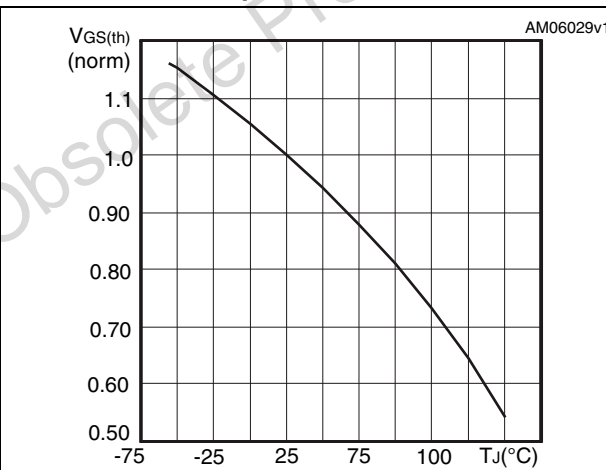
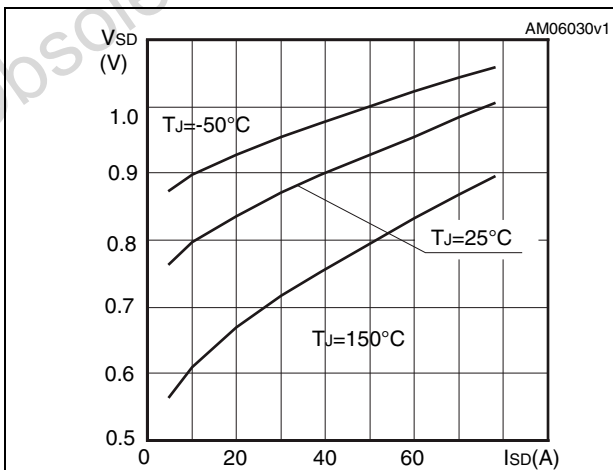


Figure 12. Source-drain diode forward characteristics



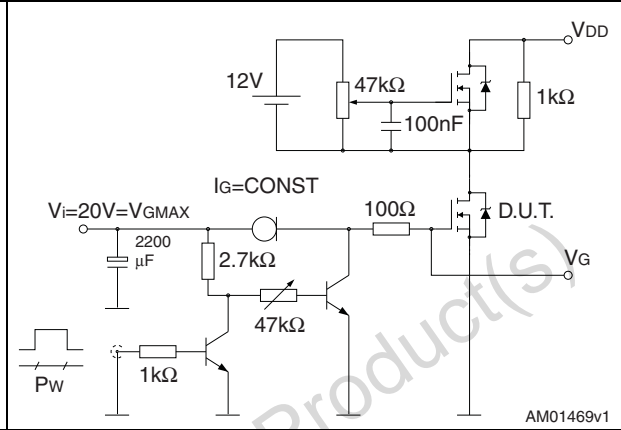
3 Test circuits

Figure 13. Switching times test circuit for resistive load



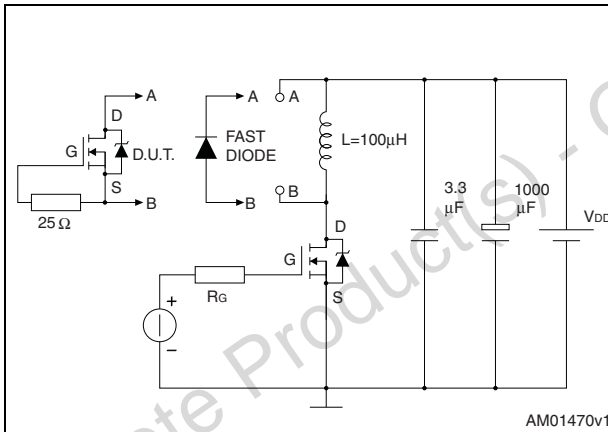
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Figure 14. Gate charge test circuit



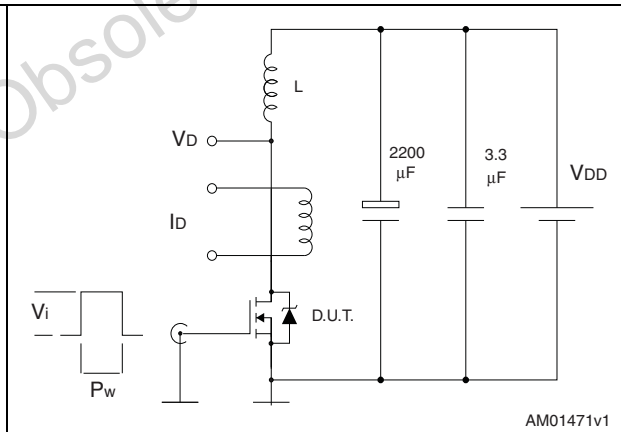
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Figure 15. Test circuit for inductive load switching and diode recovery times



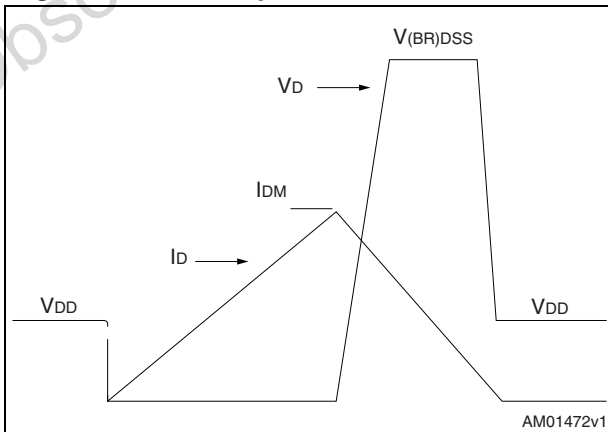
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Figure 16. Unclamped inductive load test circuit



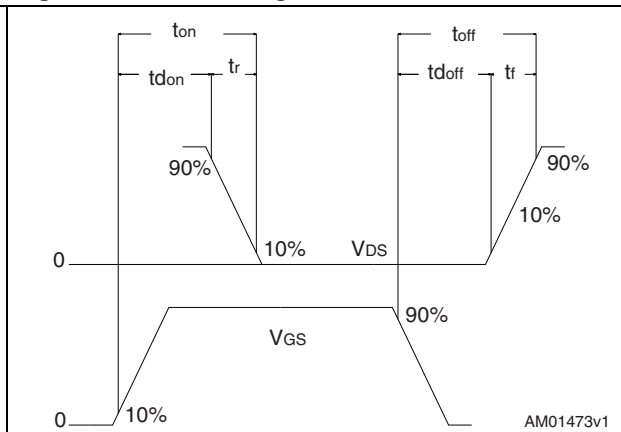
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Figure 17. Unclamped inductive waveform



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Figure 18. Switching time waveform



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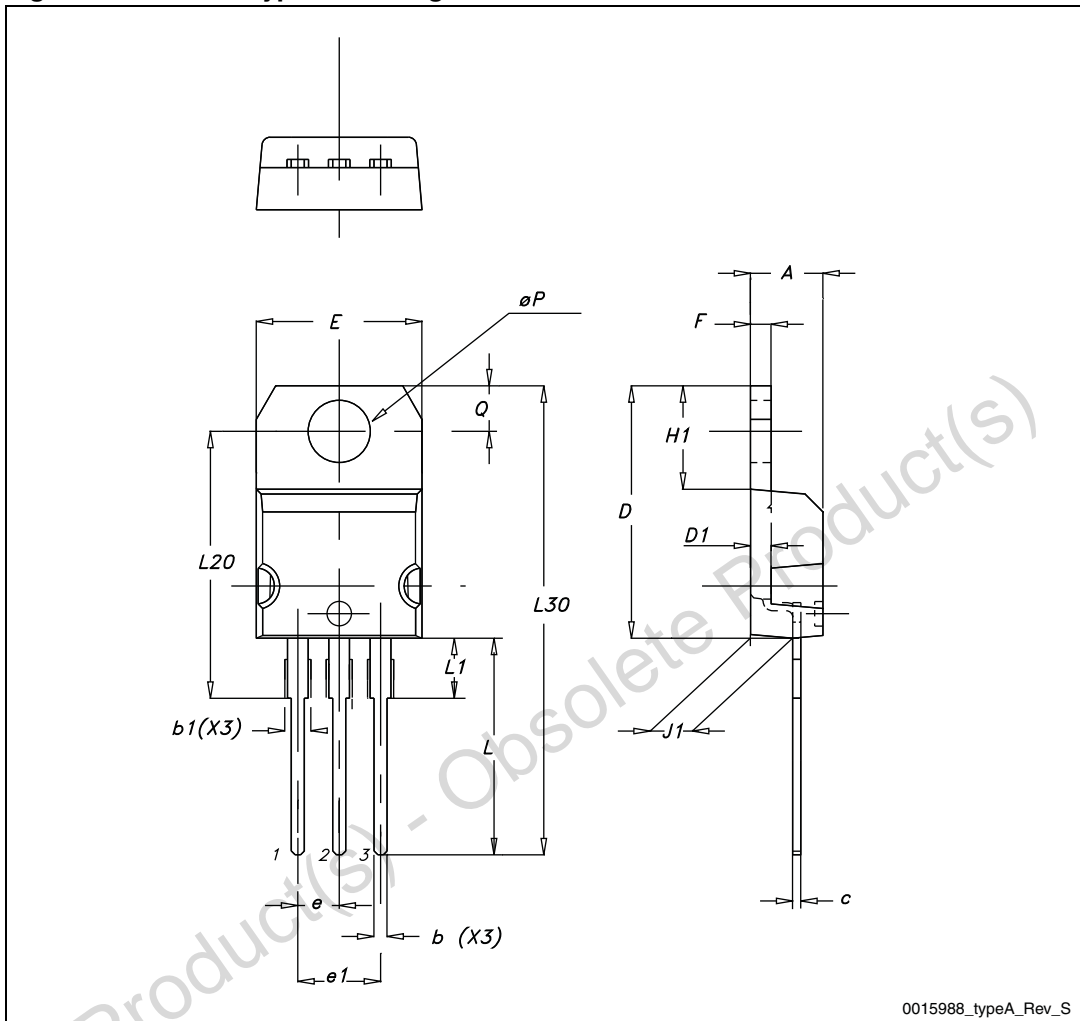
4 Package mechanical data

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



0015988_typeA_Rev_S

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 Section 2.1: Electrical characteristics (curves)).
24-Jul-2012	3	Minor text changes on the cover page. Updated Section 4: Package mechanical data .

Obsolete Product(s) - Obsolete Product(s)

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