



STP165N10F4

N-channel 100 V, 4.4 mΩ, 120 A TO-220
STripFET™ DeepGATE™ Power MOSFET

Features

Order code	V _{DSS}	R _{DS(on)} max	I _D
STP165N10F4	100 V	< 5.5 mΩ	120 A

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

Application

Switching applications

Description

The STP165N10F4 is an N-channel enhancement mode Power MOSFET built with STripFET™ DeepGATE™ technology with a new gate structure. The product is tailored to minimize on-resistance.

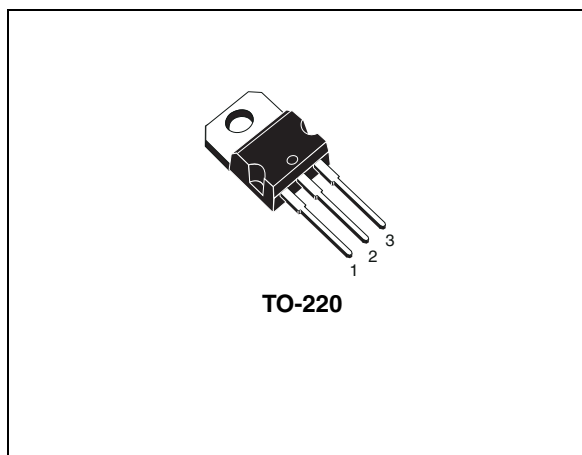


Figure 1. Internal schematic diagram

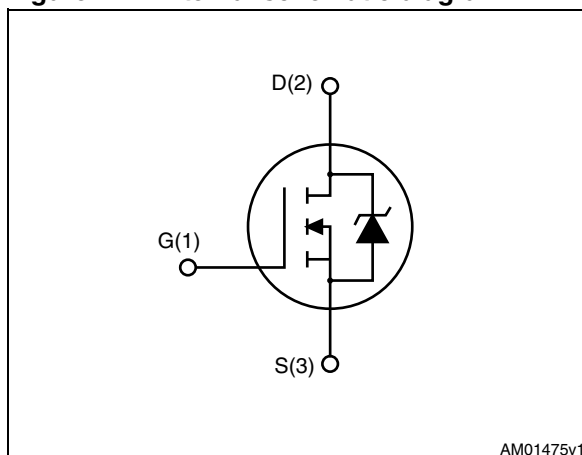


Table 1. Device summary

Order code	Marking	Package	Packaging
STP165N10F4	165N10F4	TO-220	Tube

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	100	V
V_{GS}	Gate- source voltage	± 20	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	120	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	110	A
$I_{DM}^{(1)}$	Drain current (pulsed)	480	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	315	W
	Derating factor	2.1	W/ $^\circ\text{C}$
$E_{AS}^{(2)}$	Single pulse avalanche energy	500	mJ
T_{stg}	Storage temperature	- 55 to 150	$^\circ\text{C}$
T_j	Max. operating junction temperature	150	

1. Pulse width limited by safe operating area

2. Starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = 58\text{ A}$, $V_{DD} = 50\text{ V}$

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.48	$^\circ\text{C}/\text{W}$
R_{thj-a}	Thermal resistance junction-ambient max	62.5	$^\circ\text{C}/\text{W}$
T_l	Maximum lead temperature for soldering purpose	315	$^\circ\text{C}$

2 Electrical characteristics

($T_{CASE}=25^{\circ}\text{C}$ unless otherwise specified)

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown voltage	$I_D = 250 \mu\text{A}$, $V_{GS} = 0$	100			V
I_{DSS}	Zero gate voltage Drain current ($V_{GS} = 0$)	$V_{DS} = \text{max rating}$ $V_{DS} = \text{max rating}$, $T_C = 125^{\circ}\text{C}$			1 100	μA 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	$V_{GS} = 10 \text{ V}$, $I_D = 60 \text{ A}$		4.4	5.5	$\text{m}\Omega$

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance			10750		pF
C_{oss}	Output capacitance	$V_{DS} = 25 \text{ V}$, $f = 1 \text{ MHz}$, $V_{GS} = 0$	-	939	-	pF
C_{rss}	Reverse transfer capacitance			603		pF
Q_g	Total gate charge	$V_{DD} = 50 \text{ V}$, $I_D = 120 \text{ A}$, $V_{GS} = 10 \text{ V}$ <i>(see Figure 14)</i>		192		nC
Q_{gs}	Gate-source charge		-	48	-	nC
Q_{gd}	Gate-drain charge			62		nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on delay time Rise time	$V_{DD} = 50\text{ V}$, $I_D = 60\text{ A}$ $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 13)	-	29.6 62	-	ns ns
$t_{d(off)}$ t_f	Turn-off-delay time Fall time	$V_{DD} = 50\text{ V}$, $I_D = 60\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 13)	-	154 106	-	ns ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		120	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		480	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 120\text{ A}$, $V_{GS} = 0$	-		1.4	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD} = 120\text{ A}$, $V_{DD} = 80\text{ V}$ $di/dt = 100\text{ A}/\mu\text{s}$, $T_j = 150\text{ }^\circ\text{C}$ (see Figure 15)	-	86.8 313 7.2		ns nC 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

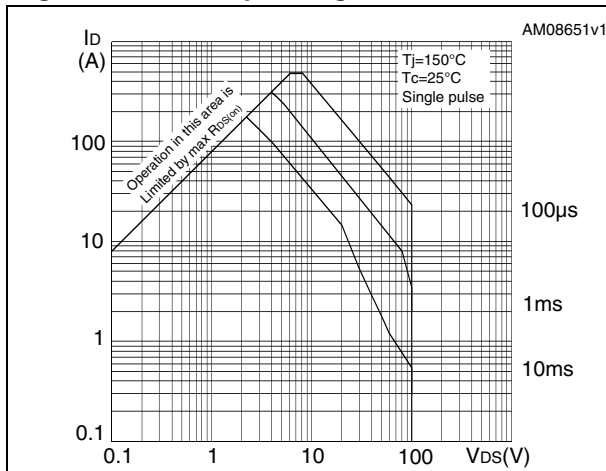


Figure 3. Thermal impedance

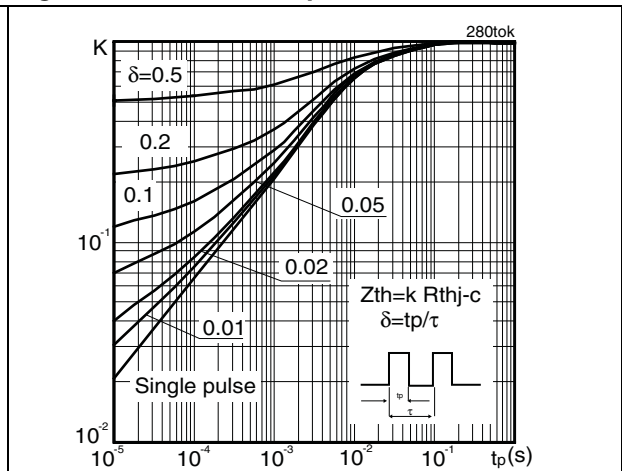


Figure 4. Output characteristics

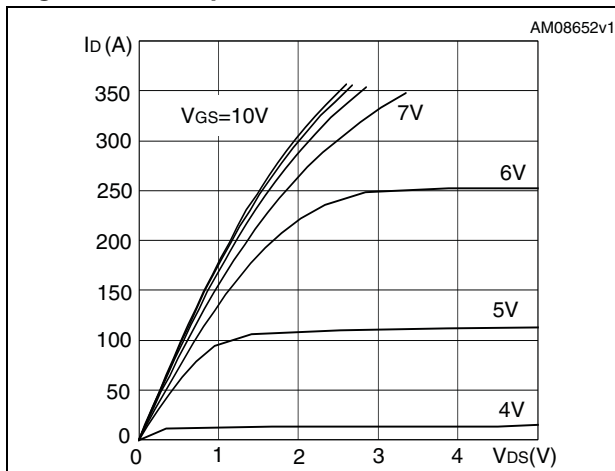


Figure 5. Transfer characteristics

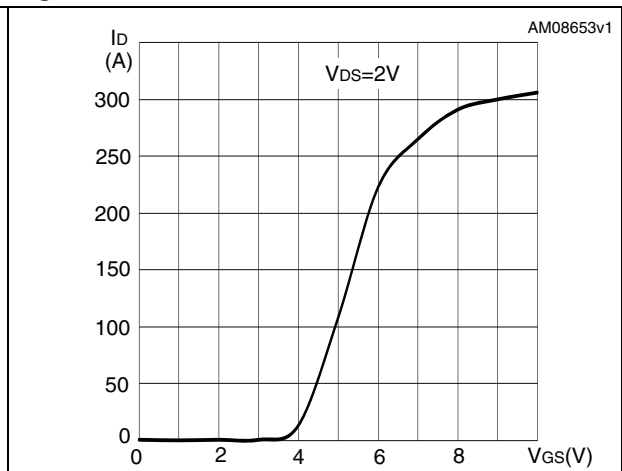


Figure 6. Normalized $B_{V_{DS}}$ vs temperature

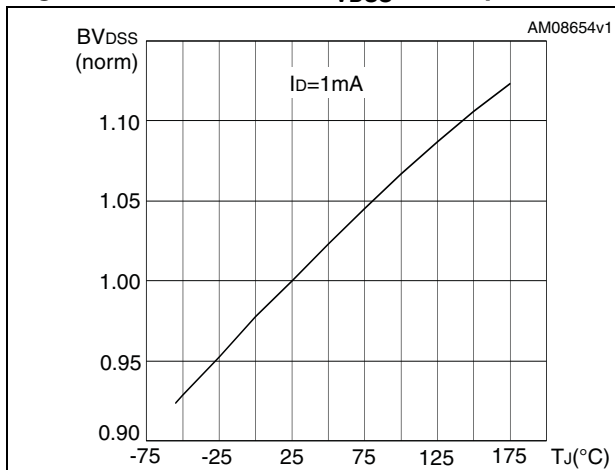


Figure 7. Static drain-source on resistance

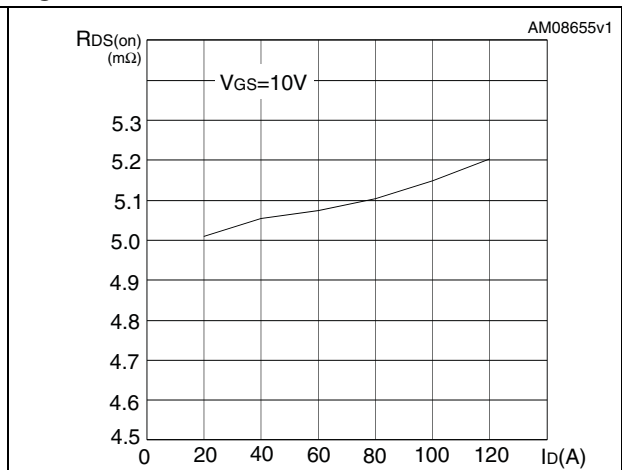


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

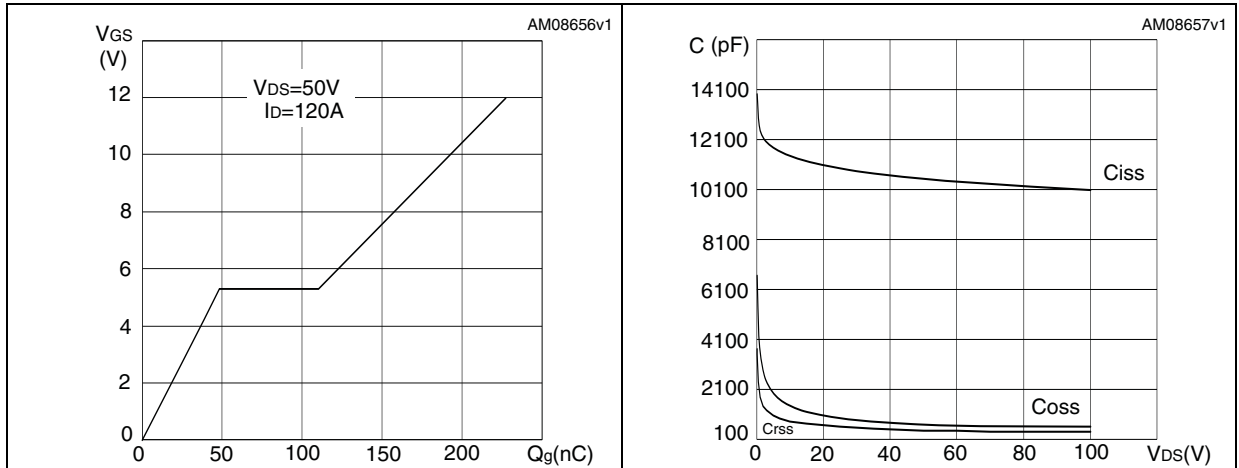


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

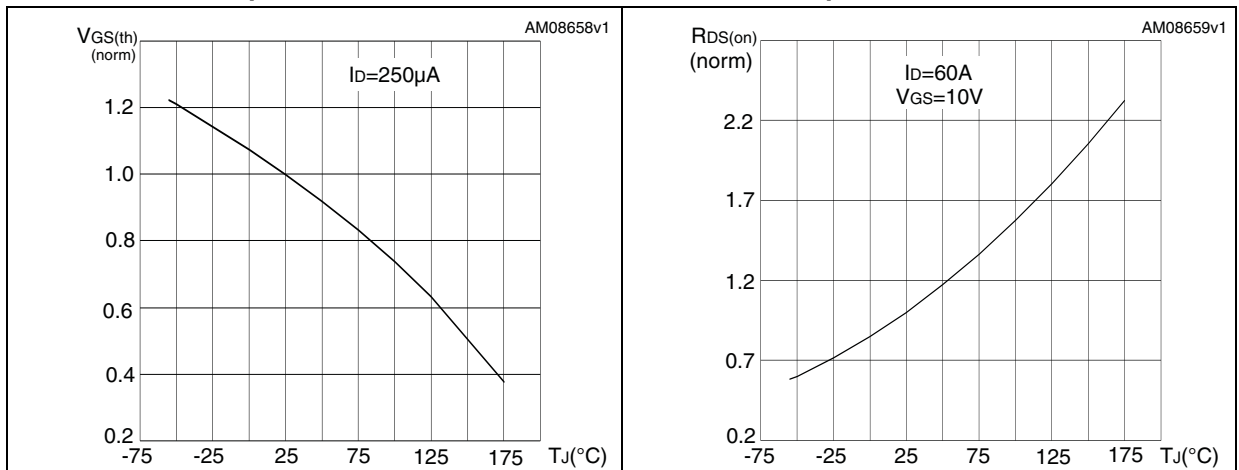
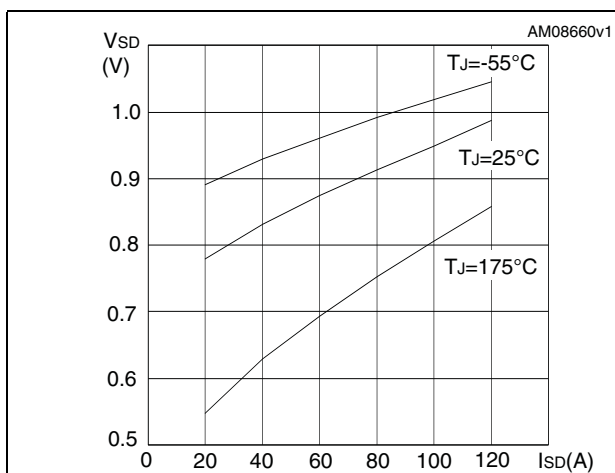


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load



Figure 14. Gate charge test circuit

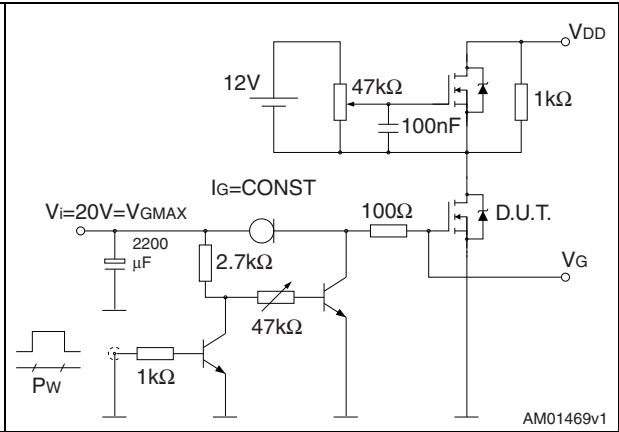


Figure 15. Test circuit for inductive load switching and diode recovery times

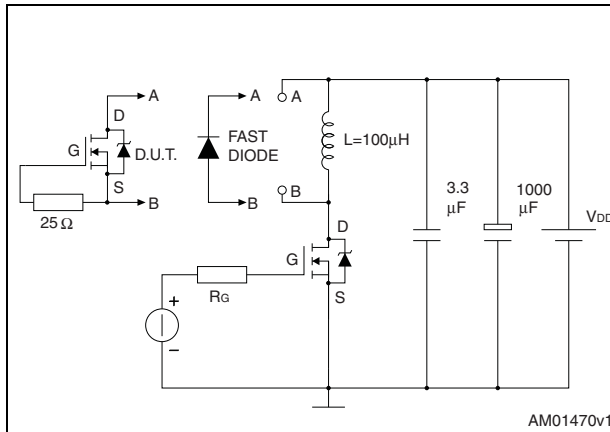


Figure 16. Unclamped inductive load test circuit

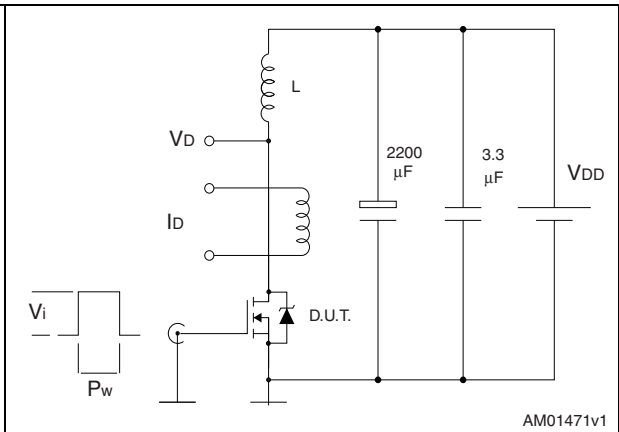


Figure 17. Unclamped inductive waveform

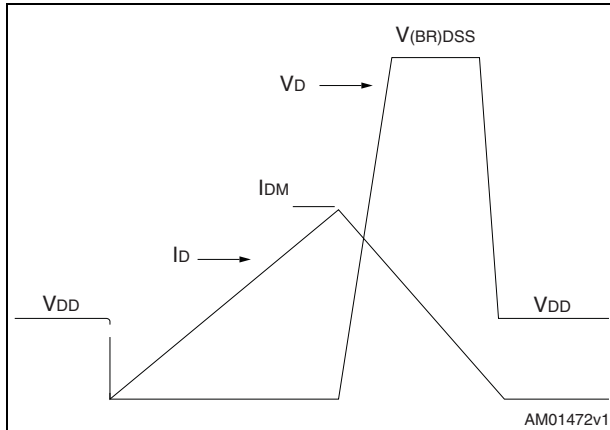
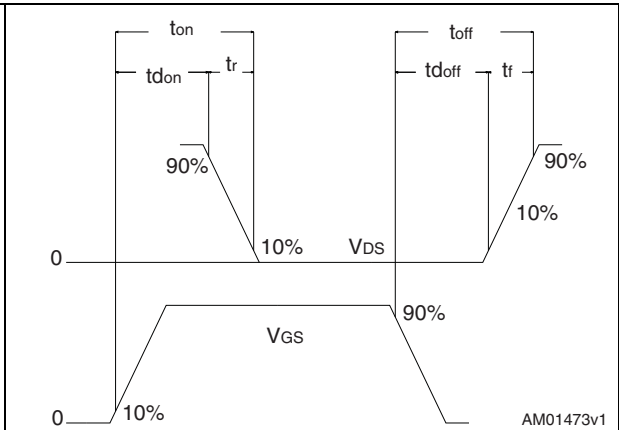


Figure 18. Switching time waveform

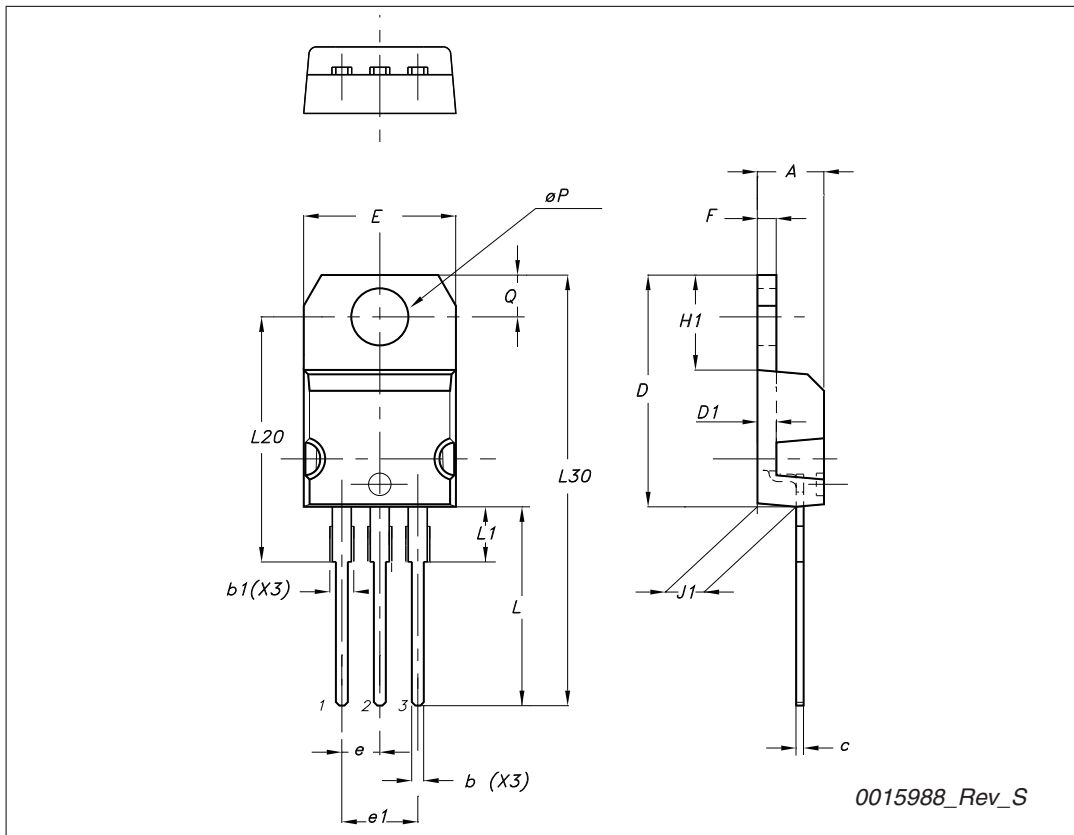


4 Package mechanical data

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.

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	
∅P	3.75		3.85
Q	2.65		2.95



5 Revision history

Table 8. Document revision history

Date	Revision	Changes
19-May-2009	1	First release
12-Nov-2010	2	– Removed package H ² PAK. – Document status promoted from preliminary data to datasheet.

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