



STP150NF04

N-channel 40 V, 0.005 Ω typ., 80 A STripFET™II Power MOSFET
in a TO-220 package

Datasheet — production data

Features

Type	V _{DSS}	R _{DS(on)} max	I _D
STP150NF04	40 V	< 0.007 Ω	80 A

- 100% avalanche tested
- Standard level gate drive

Applications

- Switching applications

Description

This Power MOSFET has been developed using STMicroelectronics' unique STripFET process, which is specifically designed to minimize input capacitance and gate charge. This renders the device suitable for use as primary switch in advanced high-efficiency isolated DC-DC converters for telecom and computer applications, and applications with low gate charge driving requirements.

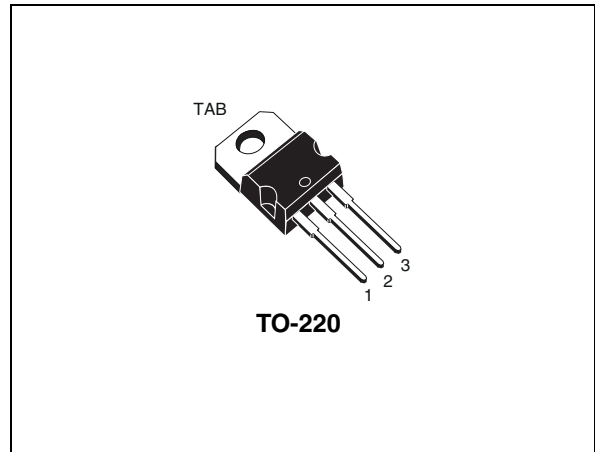


Figure 1. Internal schematic diagram

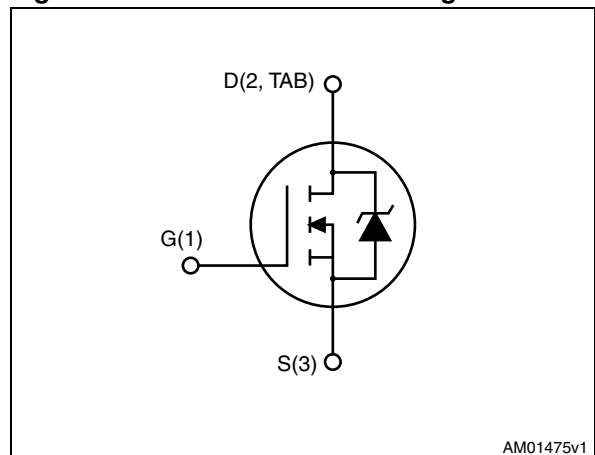


Table 1. Device summary

Order code	Marking	Package	Packaging
STP150NF04	P150NF04	TO-220	Tube

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	40	V
V_{GS}	Gate- source voltage	± 20	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	80	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	80	A
$I_{DM}^{(2)}$	Drain current (pulsed)	320	A
P_{tot}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	300	W
	Derating factor	2	W/ $^\circ\text{C}$
$dv/dt^{(3)}$	Peak diode recovery voltage slope	2	V/ns
$E_{AS}^{(4)}$	Single pulse avalanche energy	0.6	J
T_{stg}	Storage temperature	-55 to 175	$^\circ\text{C}$
T_j	Max. operating junction temperature		

1. Current limited by package
2. Pulse width limited by safe operating area
3. $I_{SD} \leq 80\text{ A}$, $di/dt \leq 300\text{ A}/\mu\text{s}$, $V_{DD} = 80\%V_{(BR)DSS}$
4. Starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = 40\text{ A}$, $V_{DD} = 30\text{ V}$

Table 3. Thermal resistance

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.5	$^\circ\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb max	35	$^\circ\text{C}/\text{W}$

1. When mounted on 1inch² FR-4 board, 2 oz of Cu

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	$I_D = 250 \mu\text{A}$, $V_{GS} = 0$	40			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 40 \text{ V}$ $V_{DS} = 40 \text{ V} @ T_j = 125^{\circ}\text{C}$			1 10	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	$V_{GS} = 10 \text{ V}$, $I_D = 40 \text{ A}$		0.005	0.007	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 15 \text{ V}$, $I_D = 15 \text{ A}$	-	90	-	S
C_{iss}	Input capacitance	$V_{DS} = 25 \text{ V}$, $f = 1 \text{ MHz}$ $V_{GS} = 0$	-	3650	-	pF
C_{oss}	Output capacitance			1145		pF
C_{rss}	Reverse transfer capacitance			400		pF
Q_g	Total gate charge	$V_{DD} = 32 \text{ V}$, $I_D = 80 \text{ A}$, $V_{GS} = 10 \text{ V}$ (see Figure 14)	-	118	150	nC
Q_{gs}	Gate-source charge			20	nC	
Q_{gd}	Gate-drain charge			45	nC	

1. Pulsed: Pulse duration = 300 μs , duty cycle 1.5%

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 25 \text{ V}$, $I_D = 40 \text{ A}$ $R_G = 4.7 \Omega$, $V_{GS} = 10 \text{ V}$ (see Figure 13)	-	15	-	ns
t_r	Rise time			150		ns
$t_{d(off)}$	Turn-off delay time			70		ns
t_f	Fall time			45		ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		80	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)	$I_{SD} = 80 \text{ A}, V_{GS} = 0$	-		320	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 80 \text{ A}, V_{GS} = 0$	-		1.3	ns nC A
t_{rr}	Reverse recovery time	$I_{SD} = 80 \text{ A},$ $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 25 \text{ V}, T_j = 150 \text{ }^\circ\text{C}$ (see Figure 15)	-	73		ns
Q_{rr}	Reverse recovery charge			170		nC
I_{RRM}	Reverse recovery current			4.6		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

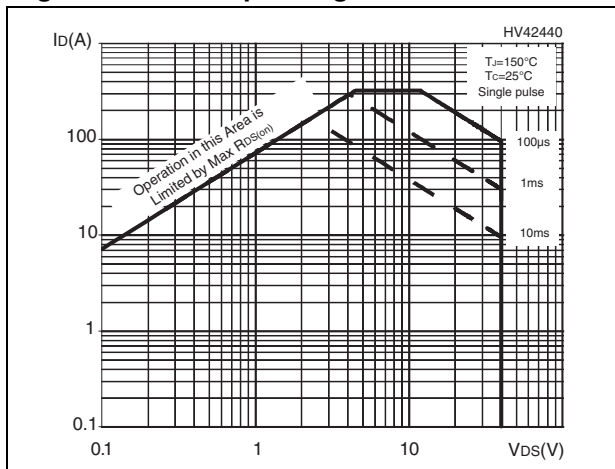


Figure 3. Thermal impedance

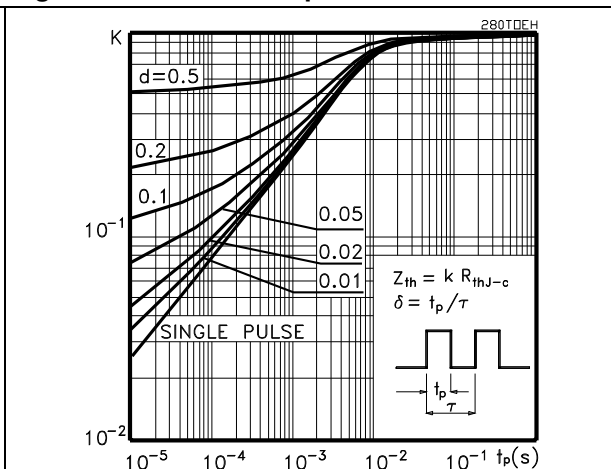


Figure 4. Output characteristics

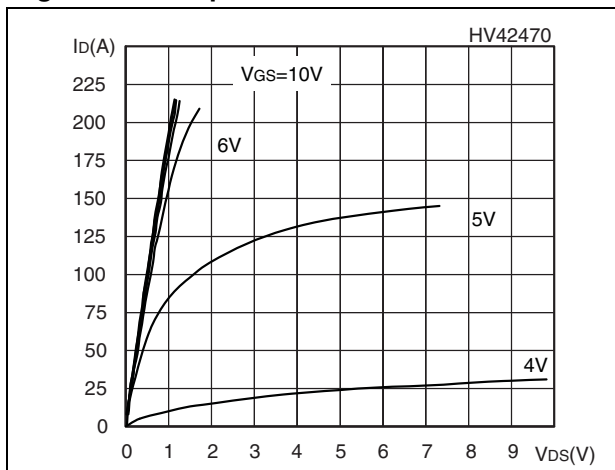


Figure 5. Transfer characteristics

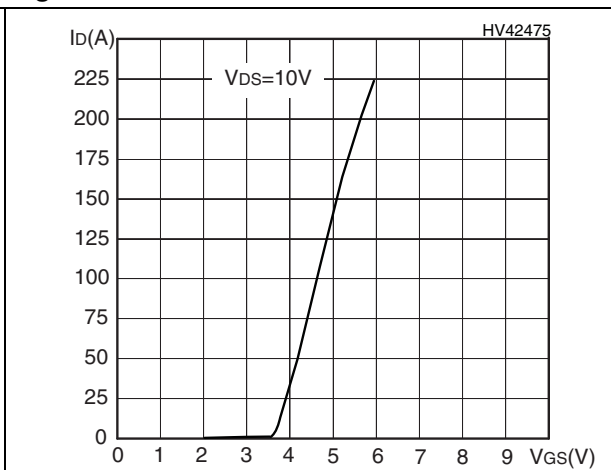


Figure 6. Normalized BV_{DSS} vs temperature

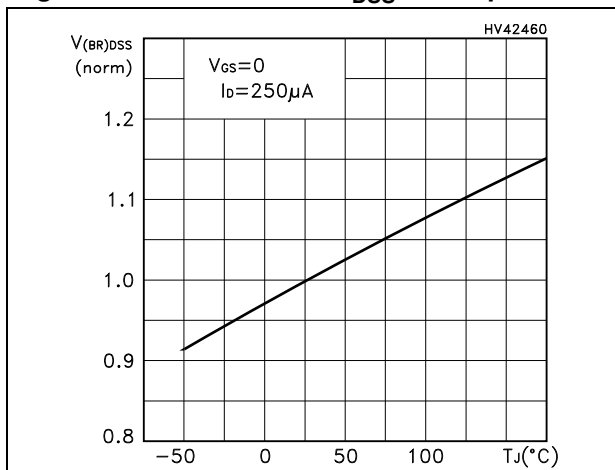


Figure 7. Static drain-source on-resistance

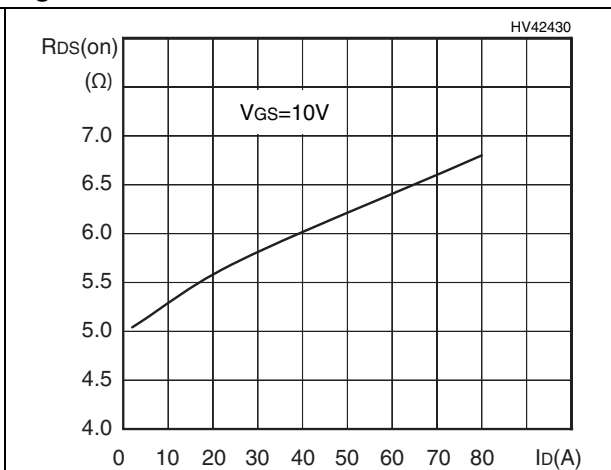


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

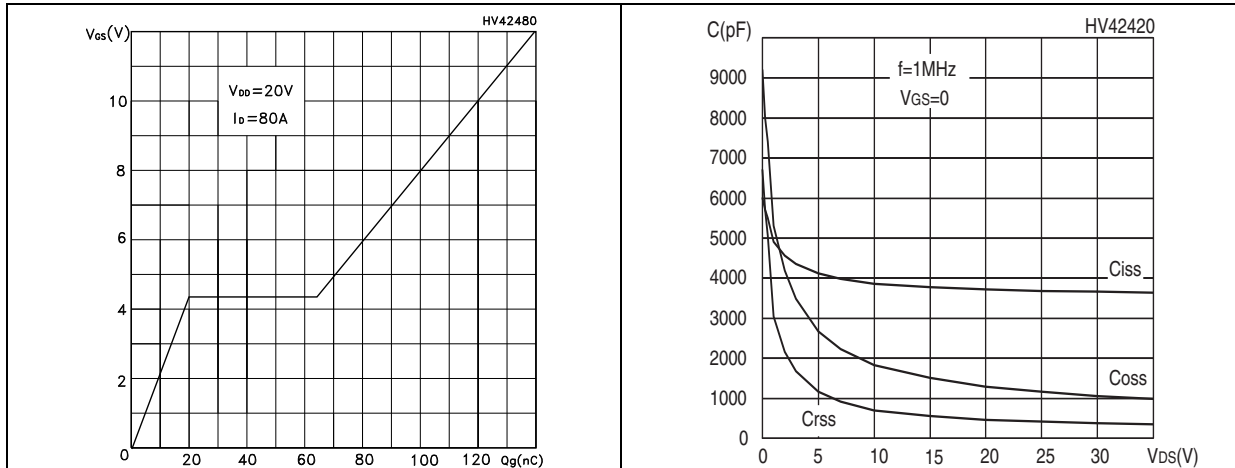


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on-resistance vs temperature

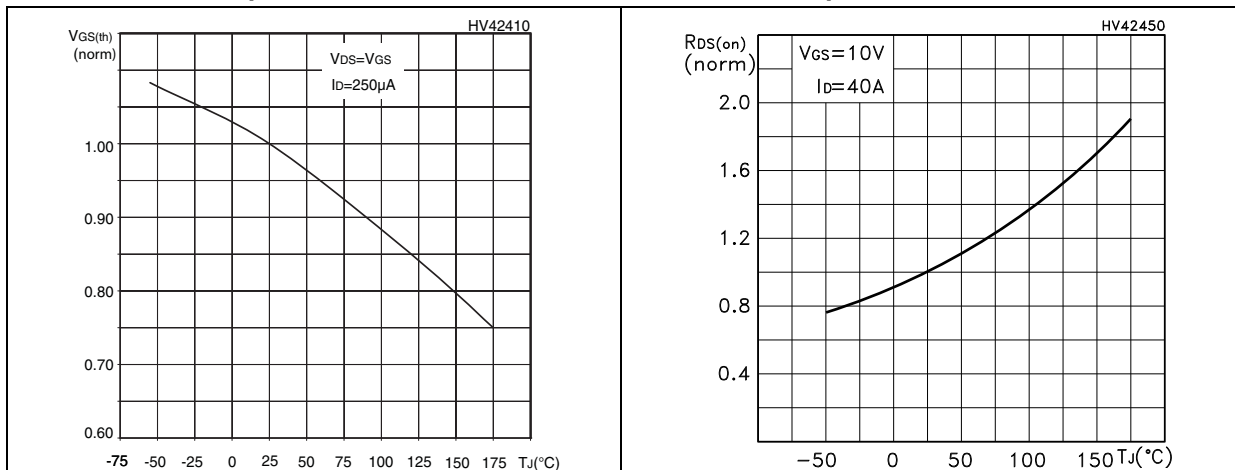
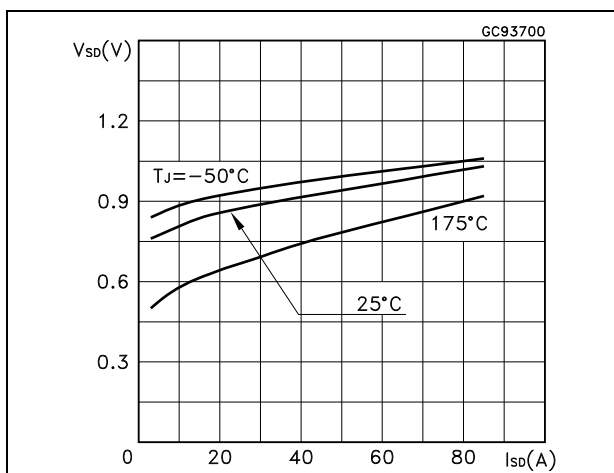


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

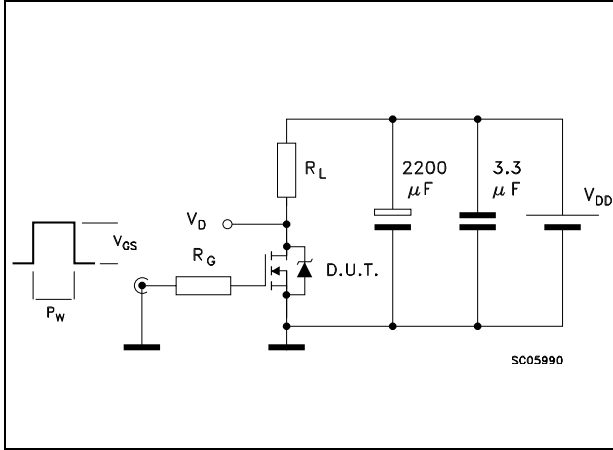


Figure 14. Gate charge test circuit

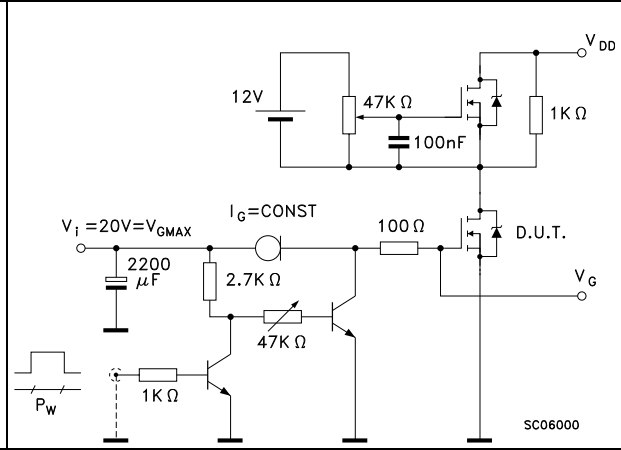


Figure 15. Test circuit for inductive load switching and diode recovery times

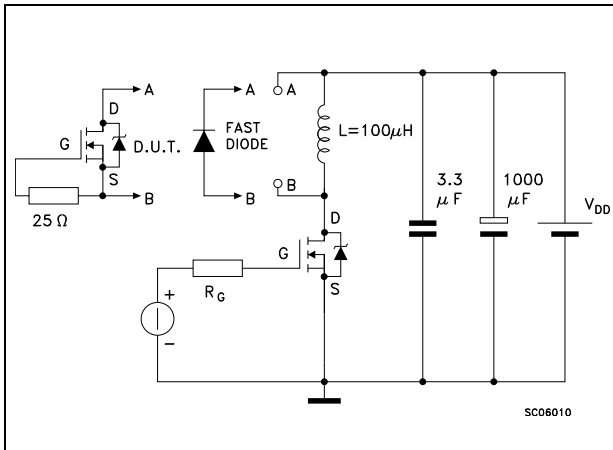


Figure 16. Unclamped inductive load test circuit

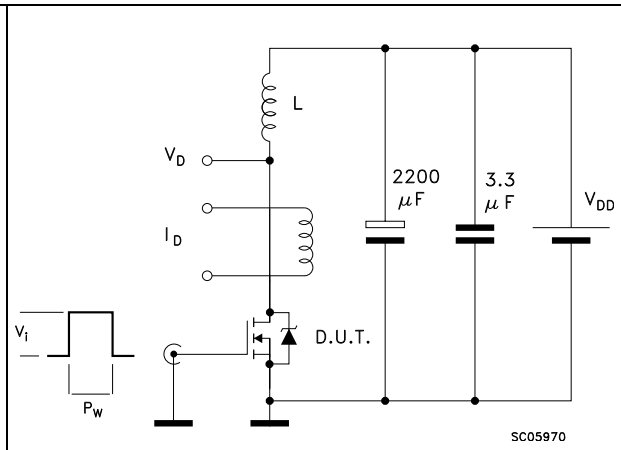
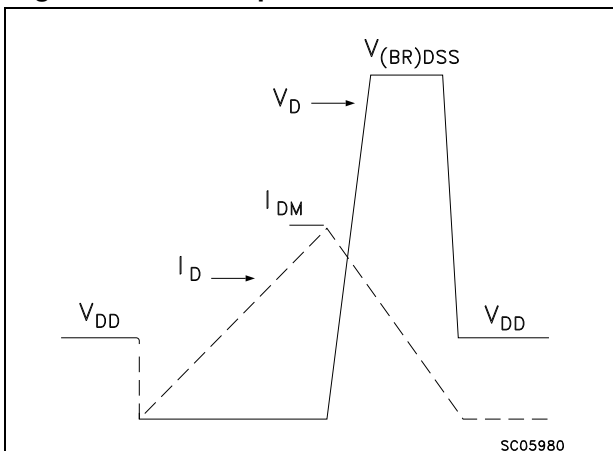


Figure 17. Unclamped inductive waveform



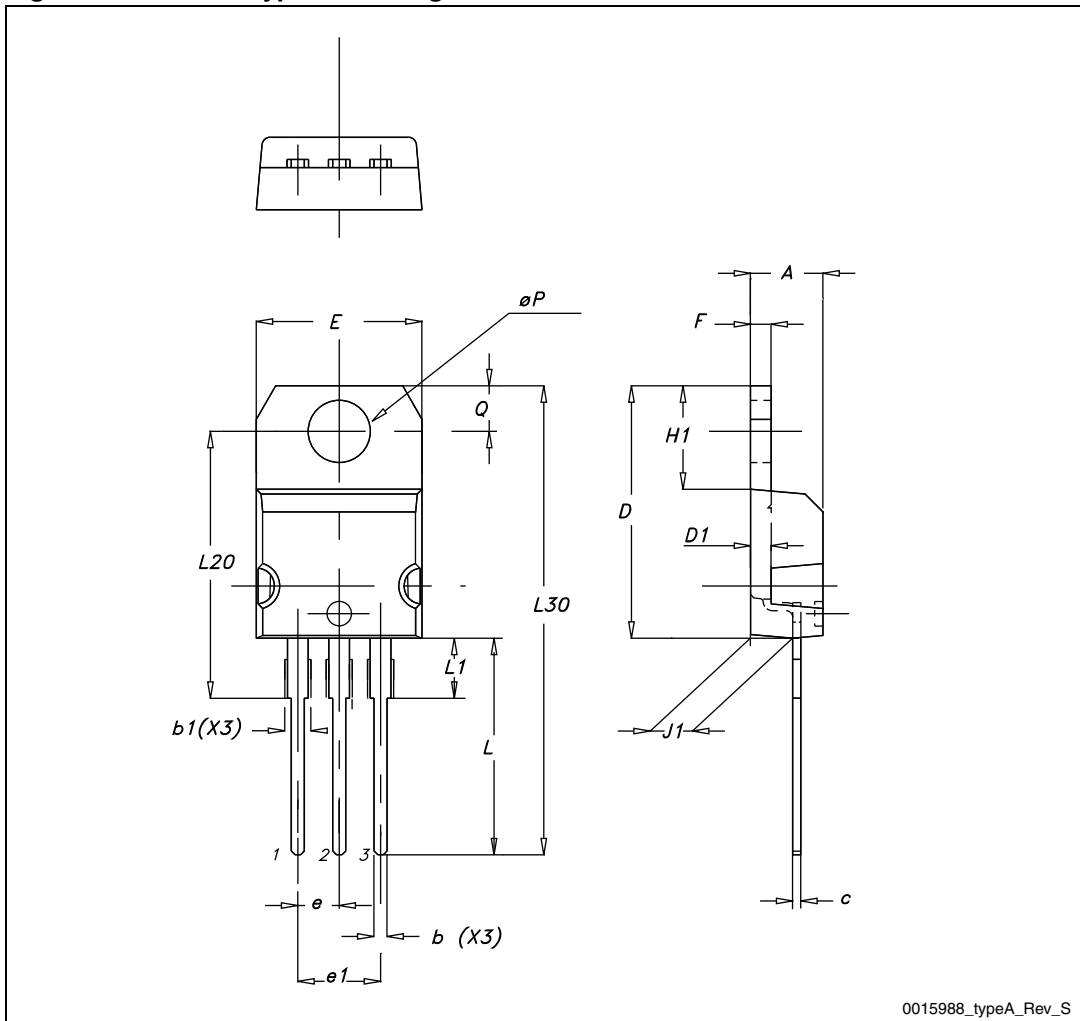
4 Package mechanical data

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 18. TO-220 type A drawing



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
01-Jul-2008	1	First release
25-Sep-2009	2	Inserted device in TO-220.
04-Oct-2012	3	Updated title and description on the cover page. Updated mechanical data.

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