



STP40NF10

N-channel 100 V, 0.025 Ω , 50 A TO-220
low gate charge STripFET™ II Power MOSFET

Features

Order code	V _{DSS}	R _{DS(on)} max.	I _D
STP40NF10	100 V	< 0.028 Ω	50 A

- Exceptional dv/dt capability
- Low gate charge
- 100% avalanche tested

Application

Switching applications

Description

This N-channel 100 V Power MOSFET is the latest development of STMicroelectronics unique "single feature size" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps allowing remarkable manufacturing reproducibility.

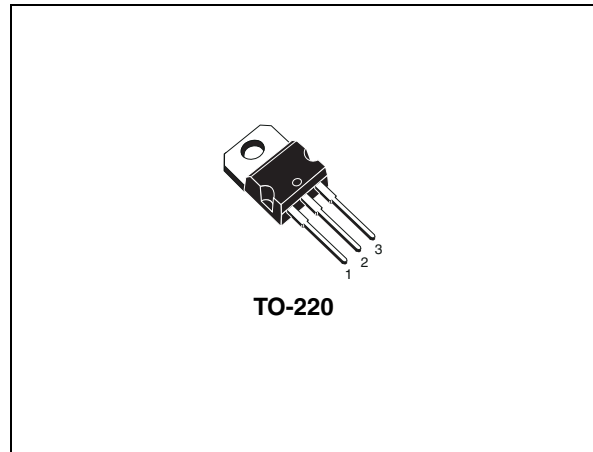


Figure 1. Internal schematic diagram

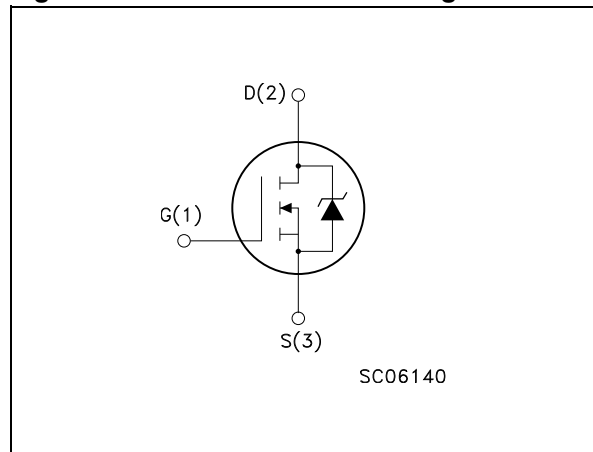


Table 1. Device summary

Order code	Marking	Package	Packaging
STP40NF10	P40NF10@	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
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	50	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	35	A
$I_{DM}^{(2)}$	Drain current (pulsed)	200	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	150	W
	Derating factor	1	W/ $^\circ\text{C}$
$dv/dt^{(3)}$	Peak diode recovery voltage slope	27	V/ns
$E_{AS}^{(4)}$	Single pulse avalanche energy	385	mJ
T_{stg}	Storage temperature	- 55 to 175	$^\circ\text{C}$
T_j	Max. operating junction temperature		

1. Limited by wire bonding
2. Pulse width limited by safe operating area
3. $I_{SD} \leq 50\text{ A}$, $di/dt \leq 600\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$, $T_j \leq T_{JMAX}$.
4. Starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = 50\text{ A}$, $V_{DD} = 25\text{ V}$

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	$^\circ\text{C}/\text{W}$
T_l	Maximum lead temperature for soldering purpose	300	$^\circ\text{C}$

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	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0$	100			V
I_{DSS}	Zero gate voltage Drain current ($V_{GS} = 0$)	$V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating}$, $T_C = 125\text{ °C}$			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	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\ \text{V}$, $I_D = 25\ \text{A}$		0.025	0.028	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 15\ \text{V}$, $I_D = 28\ \text{A}$	-	22		S
C_{iss}	Input capacitance	$V_{DS} = 25\ \text{V}$, $f = 1\ \text{MHz}$, $V_{GS} = 0$	-	2180		pF
C_{oss}	Output capacitance			298		pF
C_{rss}	Reverse transfer capacitance			83.7		pF
Q_g	Total gate charge	$V_{DD} = 50\ \text{V}$, $I_D = 40\ \text{A}$, $V_{GS} = 10\ \text{V}$ <i>(see Figure 15)</i>	-	46.5	62	nC
Q_{gs}	Gate-source charge			13.3		nC
Q_{gd}	Gate-drain charge			17.5	22.5	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	$V_{DD} = 50\ \text{V}$, $I_D = 25\ \text{A}$ $R_G = 4.7\ \Omega$, $V_{GS} = 10\ \text{V}$ <i>(see Figure 14)</i>	-	21	-	ns
t_r	Rise time			46		
$t_{d(off)}$	Turn-off-delay time			54		
t_f	Fall time			13		

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)		-		320	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 50A, V_{GS} = 0$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 50A, V_{DD} = 25V$ $di/dt = 100A/\mu s,$ $T_j = 150^\circ C$ <i>(see Figure 16)</i>	-	80		ns
Q_{rr}	Reverse recovery charge			250		nC
I_{RRM}	Reverse recovery current			6.4		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 for TO-220

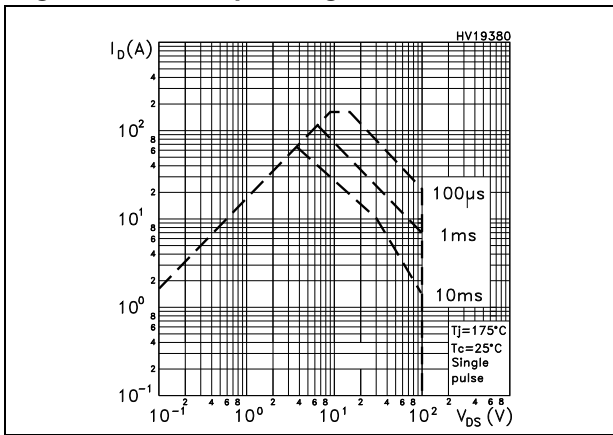


Figure 3. Thermal impedance for TO-220

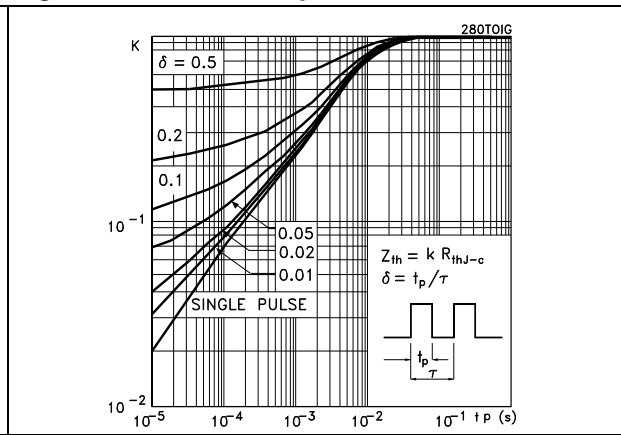


Figure 4. Output characteristics

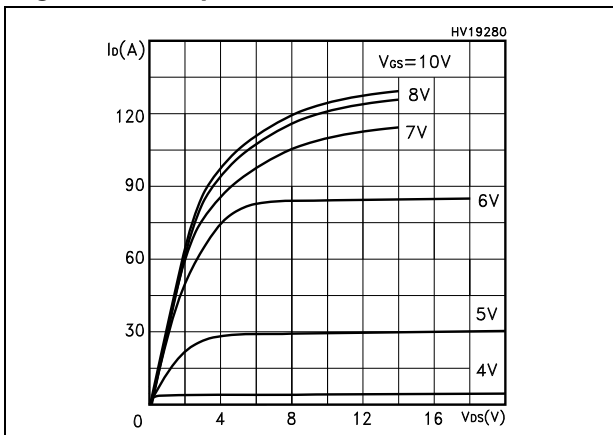


Figure 5. Transfer characteristics

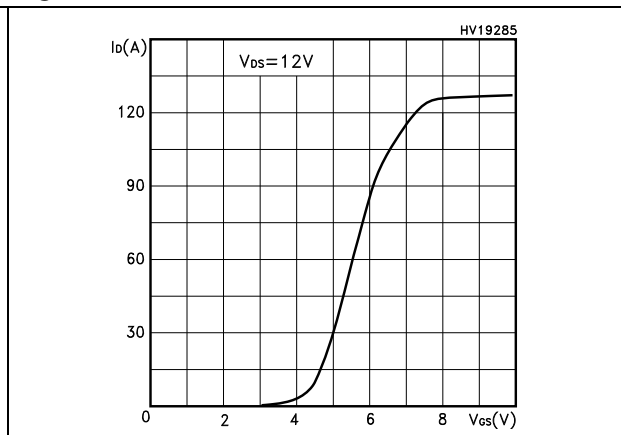


Figure 6. Transconductance

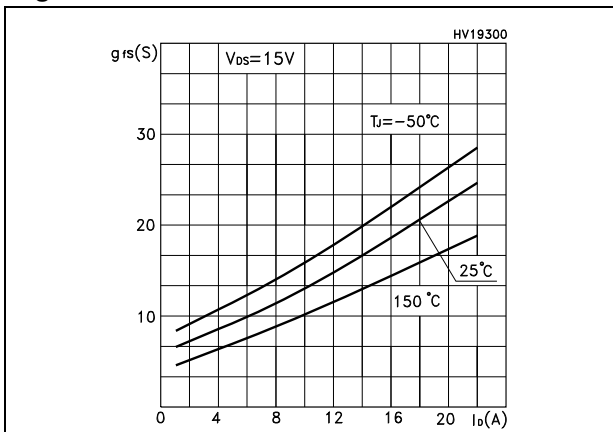


Figure 7. Static drain-source on resistance

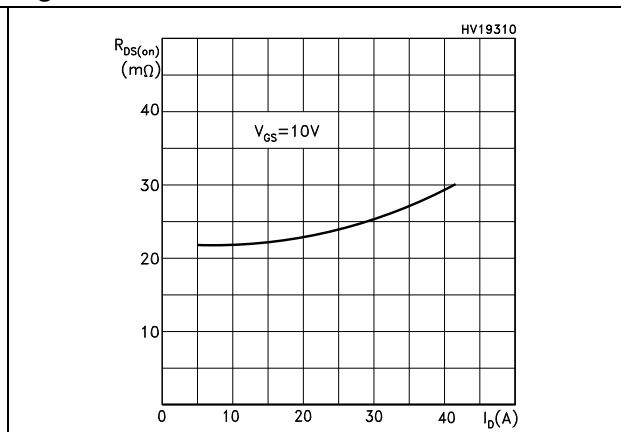


Figure 8. Gate charge vs. gate-source voltage Figure 9. Capacitance variations

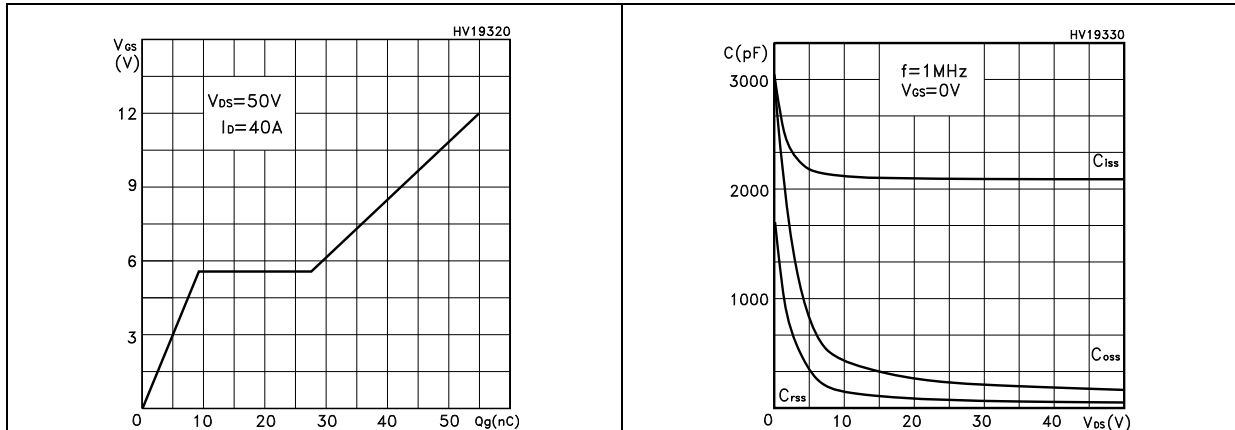


Figure 10. Normalized gate threshold voltage vs. temperature Figure 11. Normalized on resistance vs. temperature

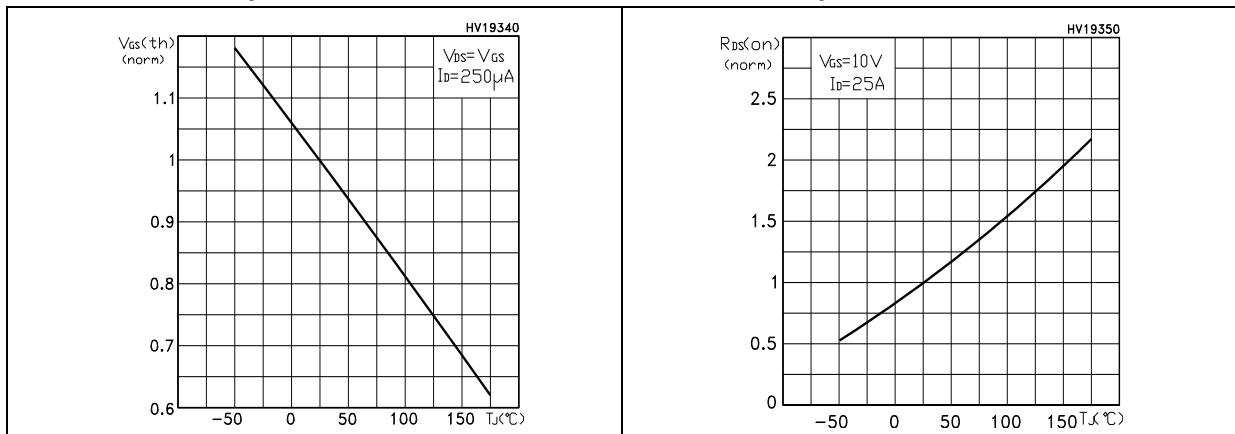
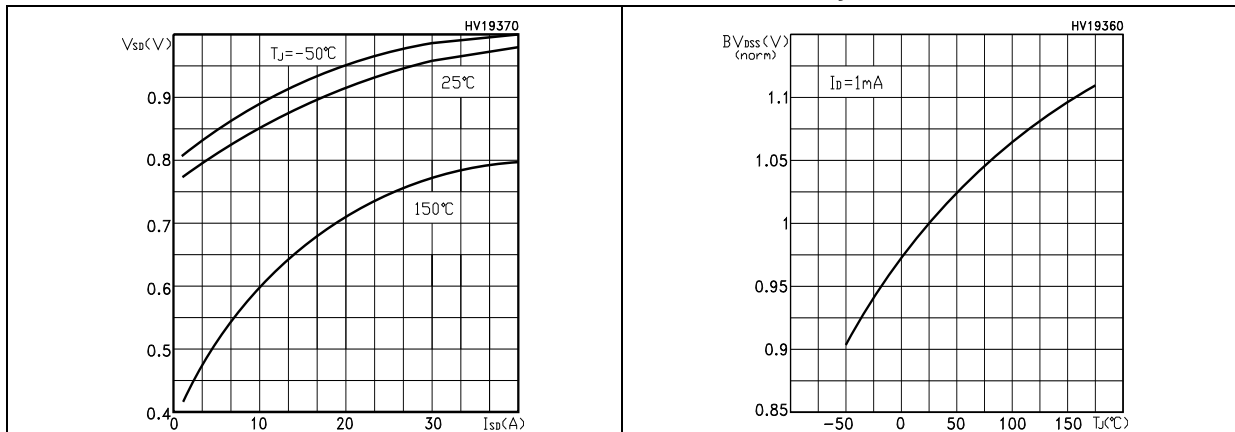


Figure 12. Source-drain diode forward characteristics Figure 13. Normalized breakdown voltage vs. T_j



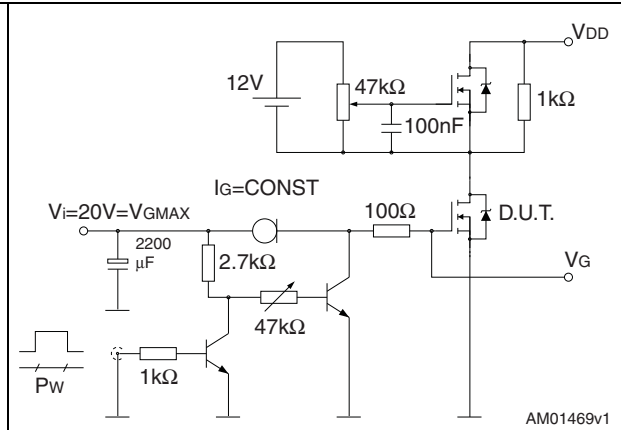
3 Test circuit

Figure 14. Switching times test circuit for resistive load



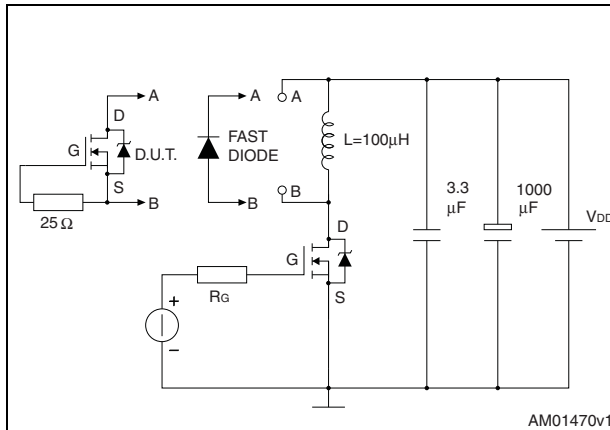
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Figure 15. Gate charge test circuit



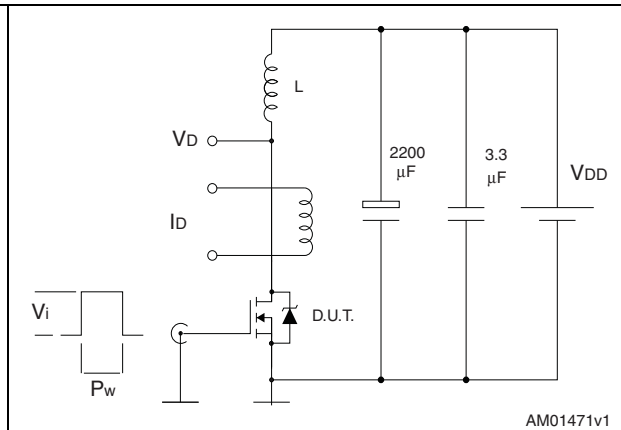
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Figure 16. Test circuit for inductive load switching and diode recovery times



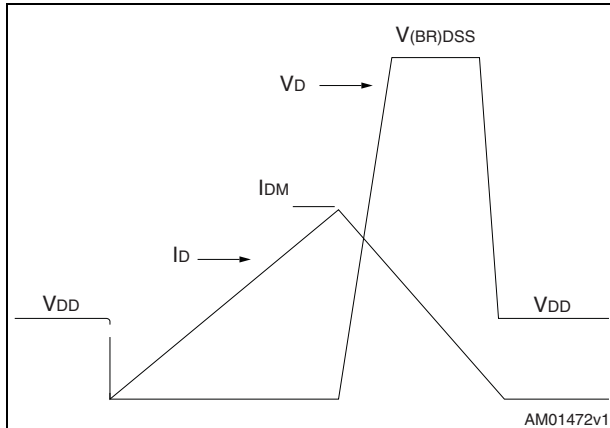
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Figure 17. Unclamped Inductive load test circuit



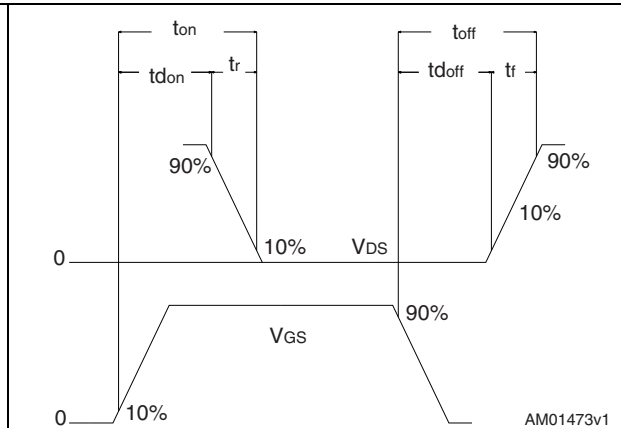
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Figure 18. Unclamped inductive waveform



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Figure 19. Switching time waveform



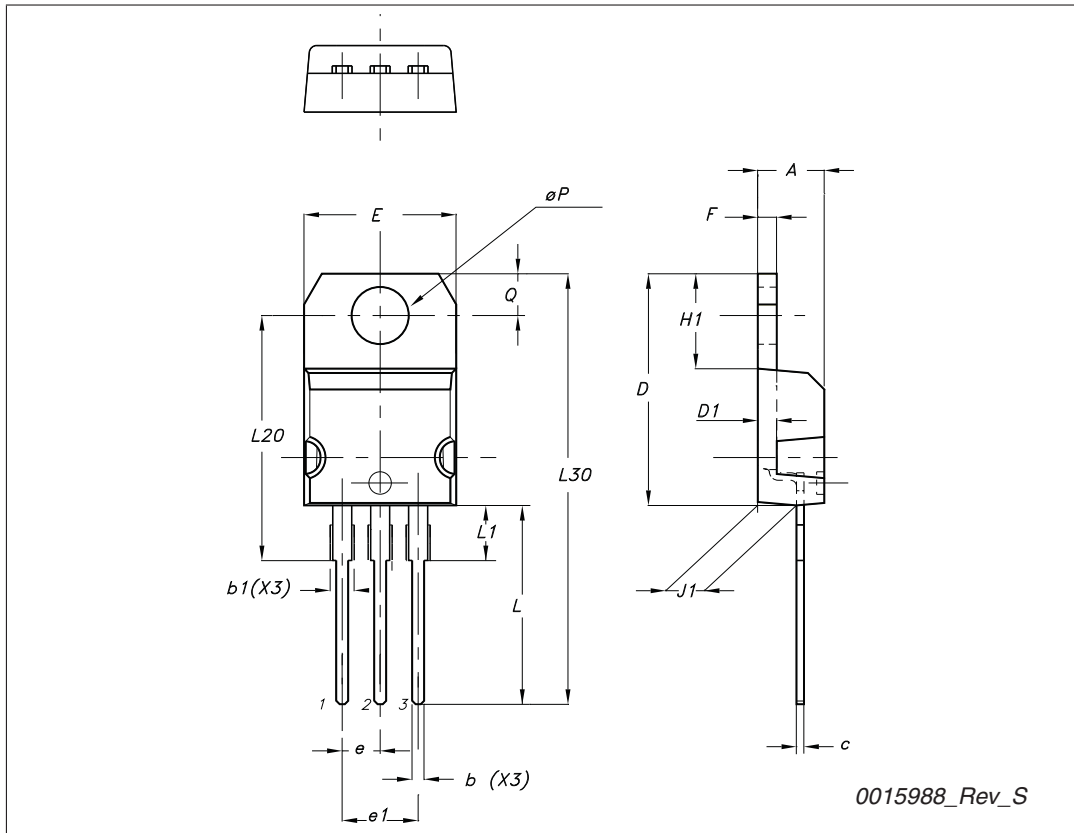
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4 Package mechanical data

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.

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
16-Dec-2004	1	First version.
17-Aug-2006	2	The document has been reformatted.
31-Jan-2007	3	Typo mistake on Table 2 .
19-Sep-2007	4	Added DPAK.
10-Nov-2010	5	Removed DPAK.

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