



STP22NF03L

N-channel 30 V, 0.0038 Ω , 22 A, TO-220
STripFET™ II Power MOSFET

Features

Type	V _{DSS}	R _{DS(on)} max	I _D
STP22NF03L	30 V	< 0.05 Ω	22 A

- Exceptional dv/dt capability
- Low gate charge at 100°C
- Application oriented characterization
- 100% avalanche tested

Application

- Switching applications

Description

This 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 therefore a remarkable manufacturing reproducibility.

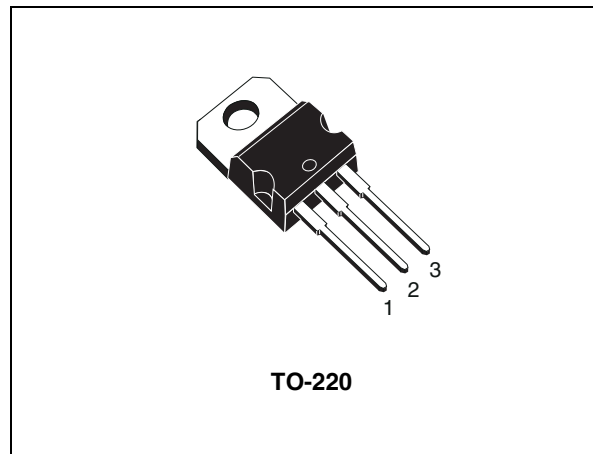


Figure 1. Internal schematic diagram

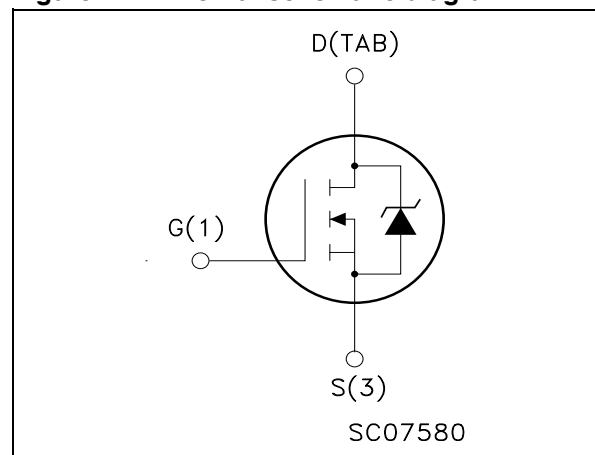


Table 1. Device summary

Order code	Marking	Package	Packaging
STP22NF03L	P22NF03L@	TO-220	Tube

Contents

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

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	30	V
V_{DGR}	Drain-gate voltage ($R_{GS} = 20 \text{ k}\Omega$)	30	V
V_{GS}	Gate- source voltage	± 15	V
I_D	Drain current (continuous) at $T_C = 25 \text{ }^\circ\text{C}$	22	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100 \text{ }^\circ\text{C}$	16	A
$I_{DM}^{(1)}$	Drain current (pulsed)	88	A
P_{tot}	Total dissipation at $T_C = 25 \text{ }^\circ\text{C}$	45	W
	Derating factor	0.3	W/ $^\circ\text{C}$
$dv/dt^{(2)}$	Peak diode recovery voltage slope	6	V/ns
$E_{AS}^{(3)}$	Single pulse avalanche energy	200	mJ
T_{stg}	Storage temperature	-55 to 175	$^\circ\text{C}$
T_j	Max. operating junction temperature		

1. Pulse width limited by safe operating area.

2. $I_{SD} \leq 22 \text{ A}$, $di/dt \leq 300 \text{ A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$, $T_j \leq T_{JMAX}$

3. Starting $T_j = 25 \text{ }^\circ\text{C}$, $I_D = 11 \text{ A}$, $V_{DD} = 15 \text{ V}$

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	3.33	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	62.5	$^\circ\text{C}/\text{W}$
T_J	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	$I_D = 250\text{ }\mu\text{A}$, $V_{GS} = 0$	30			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = \text{max ratings}$ $V_{DS} = \text{max ratings}$, $T_C = 125\text{ °C}$			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	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	1			V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$, $I_D = 11\text{ A}$ $V_{GS} = 5\text{ V}$, $I_D = 11\text{ A}$		0.038 0.045	0.05 0.06	Ω Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 15\text{ V}$, $I_D = 11\text{ A}$		7		S
C_{iss}	Input capacitance	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$		330		pF
C_{oss}	Output capacitance			90		pF
C_{rss}	Reverse transfer capacitance			40		pF
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 15\text{ V}$, $I_D = 11\text{ A}$ $R_G = 4.7\text{ }\Omega$, $V_{GS} = 5\text{ V}$ (see Figure 13)		13		ns
t_r	Rise time			4		ns
$t_{d(off)}$	Turn-off delay time			12		ns
t_f	Fall time			5		ns
Q_g	Total gate charge	$V_{DD} = 24\text{ V}$, $I_D = 22\text{ A}$, $V_{GS} = 5\text{ V}$ (see Figure 14)		6.5	9	nC
Q_{gs}	Gate-source charge			3.6		nC
Q_{gd}	Gate-drain charge			2		nC

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

Table 6. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}^{(1)}$	Source-drain current Source-drain current (pulsed)				22 88	A A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 22\text{ A}$, $V_{GS} = 0$			1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD} = 22\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 15\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ (see Figure 15)		30 18 1.2		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

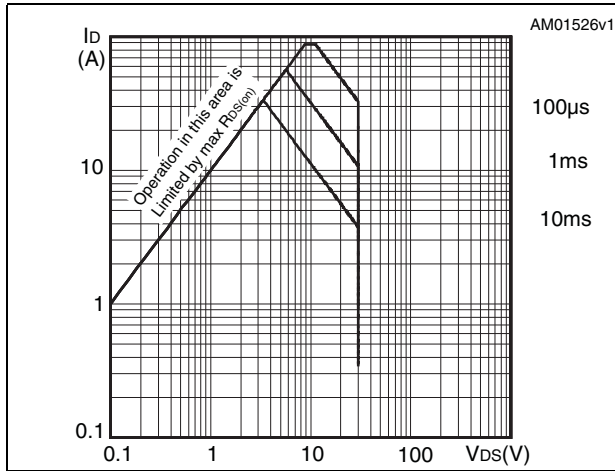


Figure 3. Thermal impedance

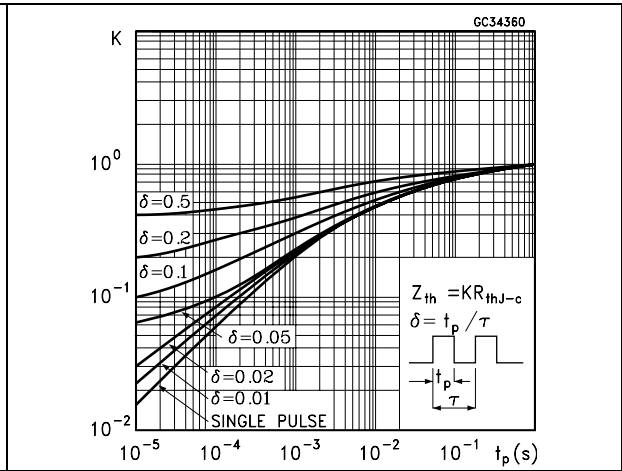


Figure 4. Output characteristics

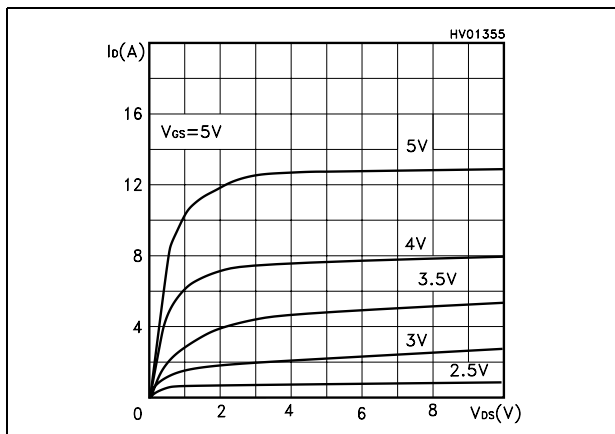


Figure 5. Transfer characteristics

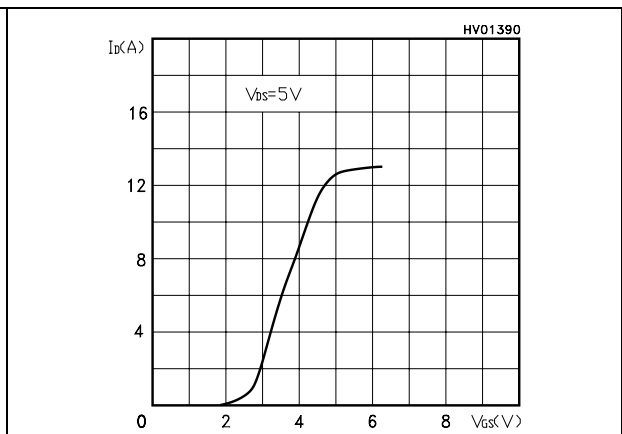


Figure 6. Transconductance

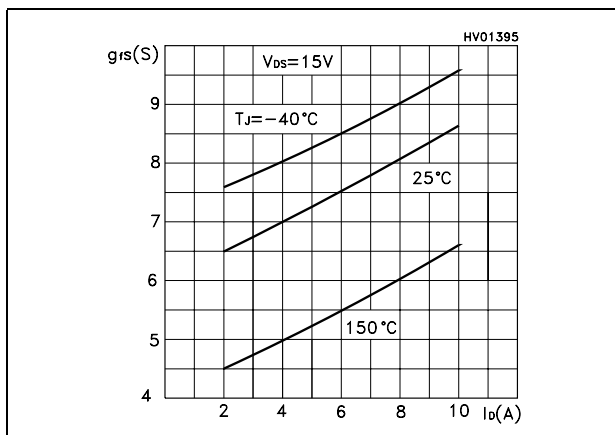


Figure 7. Static drain-source on resistance

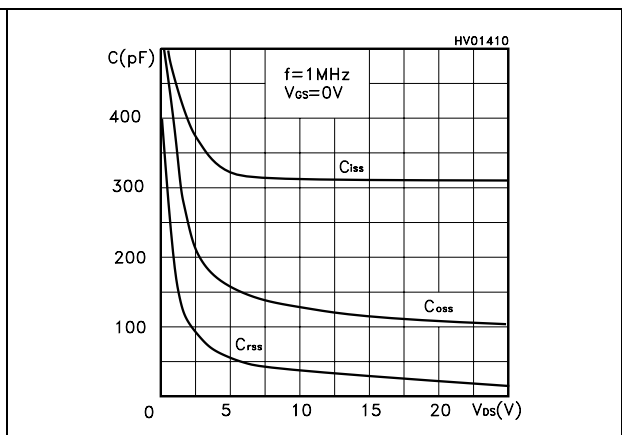


Figure 8. Gate charge vs. gate-source voltage Figure 9. Capacitance variations

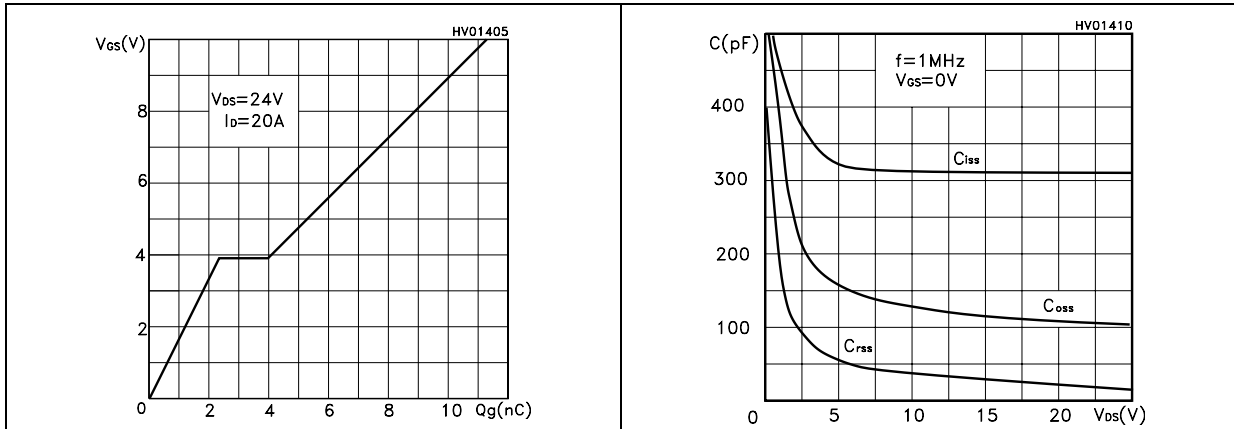


Figure 10. Normalized gate threshold voltage vs. temperature Figure 11. Normalized on resistance vs. temperature

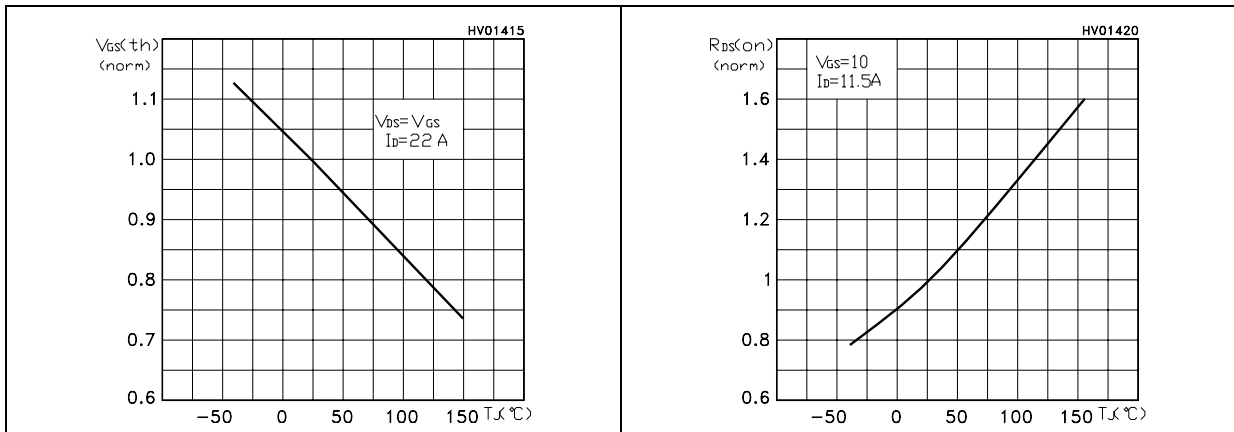
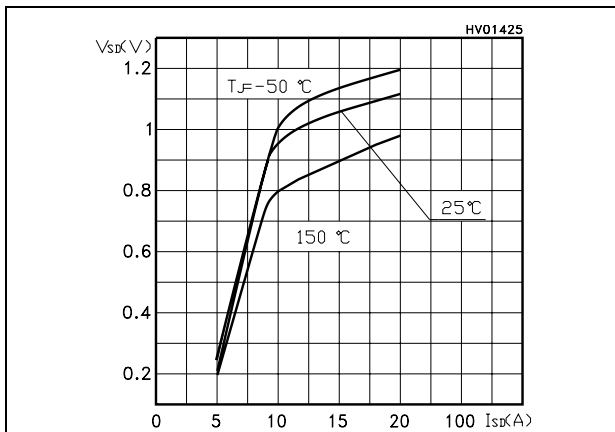


Figure 12. Source-drain diode forward characteristics



3 Test circuit

Figure 13. Switching times test circuit for resistive load



Figure 14. Gate charge test circuit

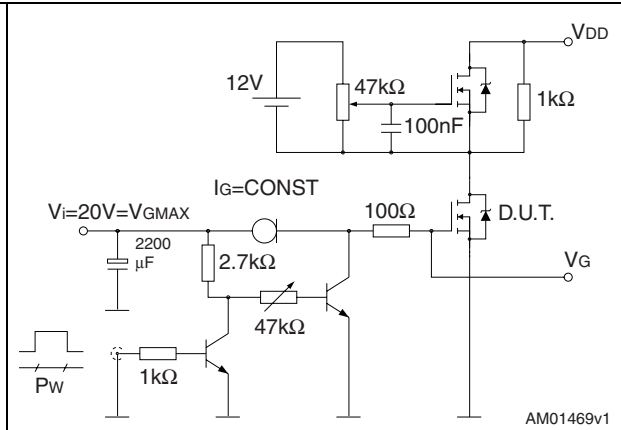


Figure 15. Test circuit for inductive load switching and diode recovery times

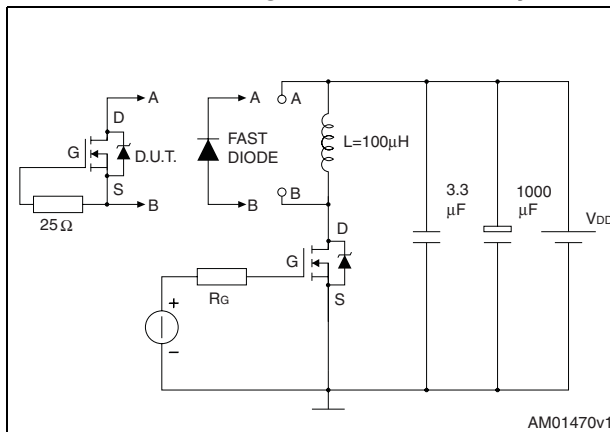


Figure 16. Unclamped Inductive load test circuit

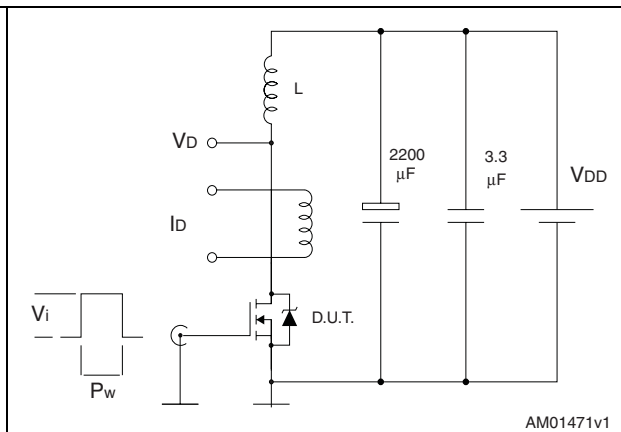


Figure 17. Unclamped inductive waveform

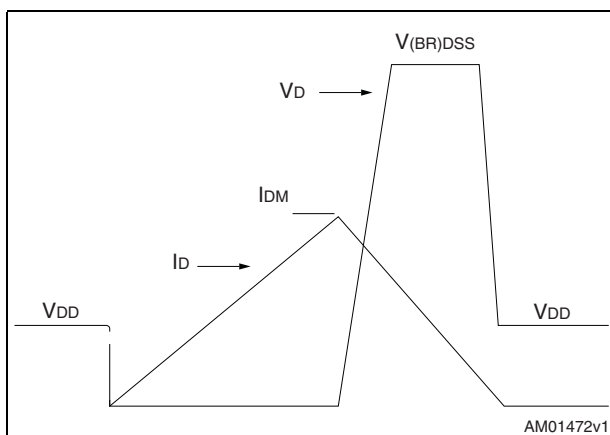
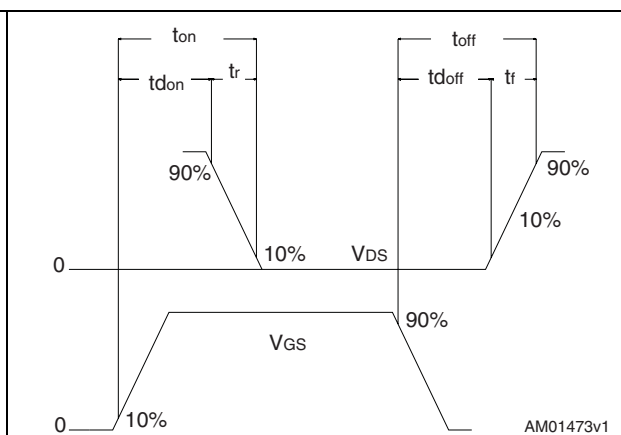


Figure 18. Switching time waveform

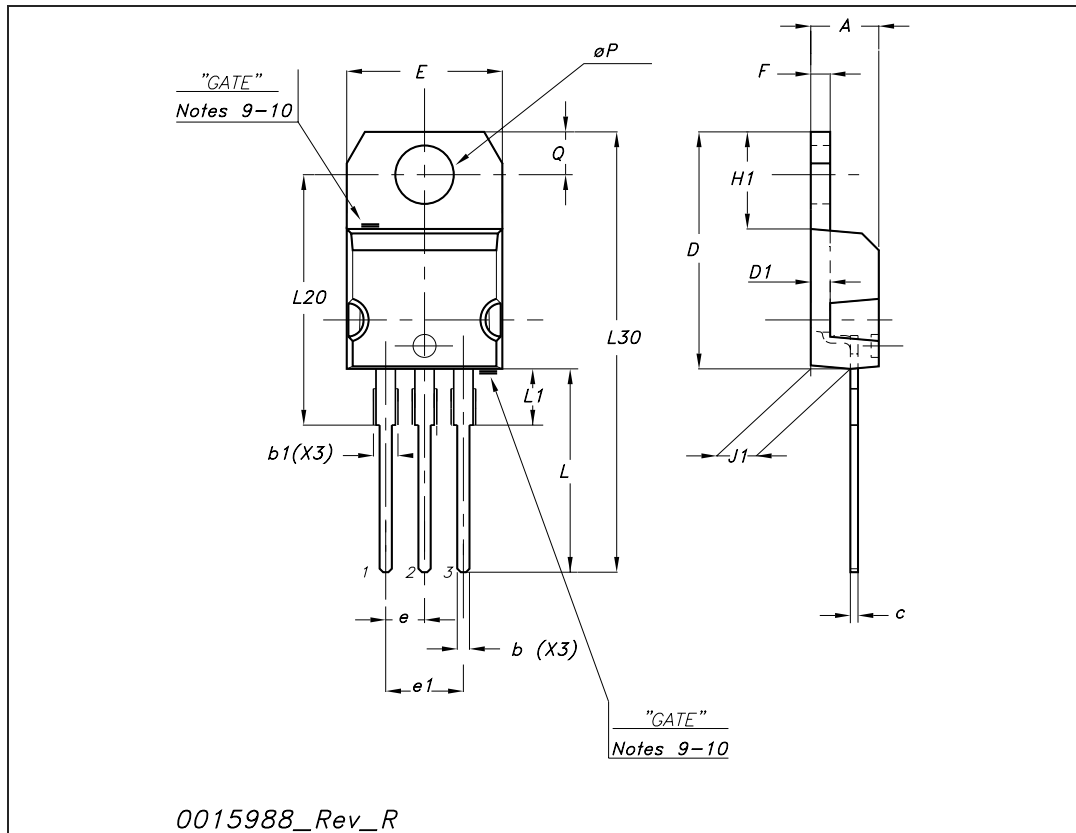


4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com

TO-220 mechanical data

Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.48		0.70	0.019		0.027
D	15.25		15.75	0.6		0.62
D1		1.27			0.050	
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.051
H1	6.20		6.60	0.244		0.256
J1	2.40		2.72	0.094		0.107
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L20		16.40			0.645	
L30		28.90			1.137	
∅P	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



5 Revision history

Table 7. Document revision history

Date	Revision	Changes
09-Sep-2004	1	Datasheet according to PCN DSG-TRA/04/532
09-Aug-2006	2	New template, no content change
20-Feb-2007	3	Typo mistake on page 1
03-Sep-2007	4	<i>Figure 2: Safe operating area</i> has been update.
08-Oct-2008	5	<i>Figure 2: Safe operating area</i> has been update.

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