



# STP62NS04Z

N-channel clamped 12.5 mΩ, 62 A, TO-220  
fully protected MESH OVERLAY™ Power MOSFET

## Features

Type	V <sub>DSS</sub>	R <sub>DS(on) max</sub>	I <sub>D</sub>
STP62NS04Z	Clamped	< 0.015 Ω	62 A

- 100% avalanche tested
- Low capacitance and gate charge
- 175 °C maximum junction temperature

## Application

- Switching applications

## Description

Fully clamped MOSFET is produced by using ST's most advanced MESH OVERLAY™ process based on strip layout. The inherent benefits of this new technology coupled with the extra clamping capabilities make this product particularly suitable for the harshest operating conditions such as those encountered in the automotive environment. It is also recommended for any other application requiring extra ruggedness.

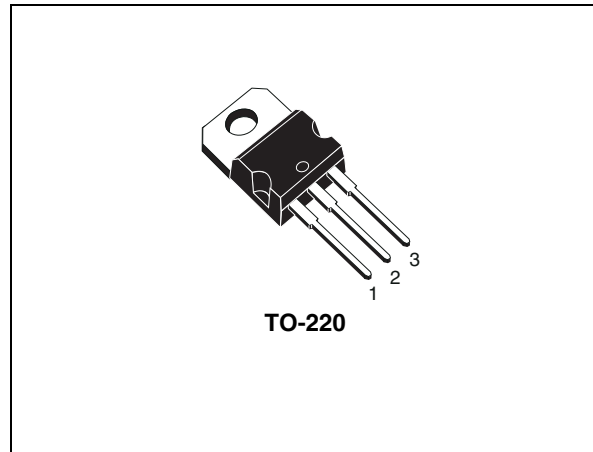


Figure 1. Internal schematic diagram

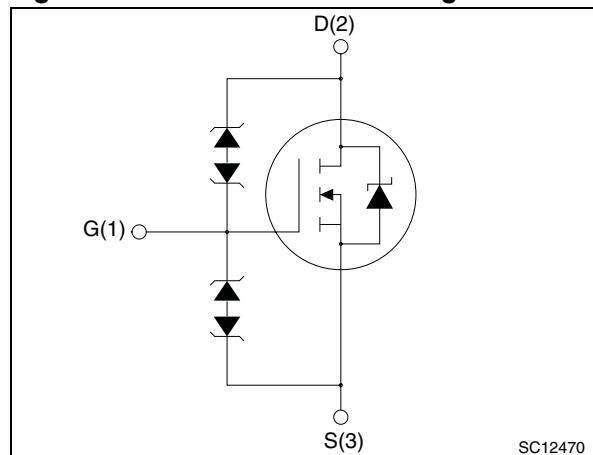


Table 1. Device summary

Order code	Marking	Package	Packaging
STP62NS04Z	P62NS04Z	TO-220	Tube

# Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	Clamped	V
$V_{GS}$	Gate-source voltage	Clamped	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ °C}$	62	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ °C}$	37.5	A
$I_{DG}$	Drain gate current (continuous)	$\pm 50$	mA
$I_{GS}$	Gate sourcecurrent (continuous)	$\pm 50$	mA
$I_{DM}^{(1)}$	Drain current (pulsed)	248	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ °C}$	110	W
	Derating factor	0.74	W/°C
$dv/dt^{(2)}$	Peak diode recovery voltage slope	8	V/ns
$E_{AS}^{(3)}$	Single pulse avalanche energy	500	mJ
$V_{ESD}$	ESD (HBM - C = 100 pF, R = 1.5 k $\Omega$ )	8	V
$T_J$ $T_{stg}$	Operating junction temperature Storage temperature	-55 to 175	°C

1. Pulse width limited by safe operating area
2.  $I_{SD} \leq 40\text{ A}$ ,  $di/dt \leq 100\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq T_{JMAX}$
3. Starting  $T_J = 25\text{ °C}$ ,  $I_D = 20\text{ A}$ ,  $V_{DD} = 20\text{ V}$

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-c}$	Thermal resistance junction-casemax	1.36	°C/W
$R_{thj-a}$	Thermal resistance junction-ambient max	62.5	°C/W
$T_l$	Maximum lead temperature for soldering purpose	300	°C

## 2 Electrical characteristics

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

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}$ , $V_{GS} = 0$	33			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 16\text{ V}$			10	$\mu\text{A}$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 10\text{ V}$			10	$\mu\text{A}$
$V_{GSS}$	Gate-source breakdown voltage	$I_{GS} = 100\text{ }\mu\text{A}$	18			V
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$	2		4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$ , $I_D = 30\text{ A}$		12.5	15	$\text{m}\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 15\text{ V}$ , $I_D = 30\text{ A}$	-	20		S
$C_{iss}$	Input capacitance	$V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$	-	1330		pF
$C_{oss}$	Output capacitance			420		pF
$C_{rss}$	Reverse transfer capacitance			135		pF
$Q_g$	Total gate charge	$V_{DD} = 20\text{ V}$ , $I_D = 40\text{ A}$ $V_{GS} = 10\text{ V}$	-	34	47	nC
$Q_{gs}$	Gate-source charge			10		nC
$Q_{gd}$	Gate-drain charge			11.5		nC

1. Pulsed: pulse duration=300 $\mu\text{s}$ , duty cycle 1.5%

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 20\text{ V}$ , $I_D = 20\text{ A}$ , $R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$ <i>Figure 14 on page 8</i>	-	13		ns
$t_r$	Rise time			104		ns
$t_{d(off)}$	Turn-off delay time			41	-	ns
$t_f$	Fall time			42		ns
$t_{r(Voff)}$	Off-voltage rise time	$V_{clamp} = 30\text{ V}$ , $I_D = 40\text{ A}$ $R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$ <i>Figure 14 on page 8</i>	-	30		ns
$t_f$	Fall time			54		ns
$t_c$	Cross-over time			90		ns

**Table 7. Source drain diode**

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$I_{SD}$	Source-drain current		-		62	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		248	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 62 \text{ A}$ , $V_{GS} = 0$	-		1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 40 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ , $V_{DD} = 20 \text{ V}$ , $T_J = 150 \text{ }^\circ\text{C}$ <a href="#">Figure 16 on page 8</a>	-	45		ns
$Q_{rr}$	Reverse recovery charge			65		nC
$I_{RRM}$	Reverse recovery current			2.9		A

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration=300 $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

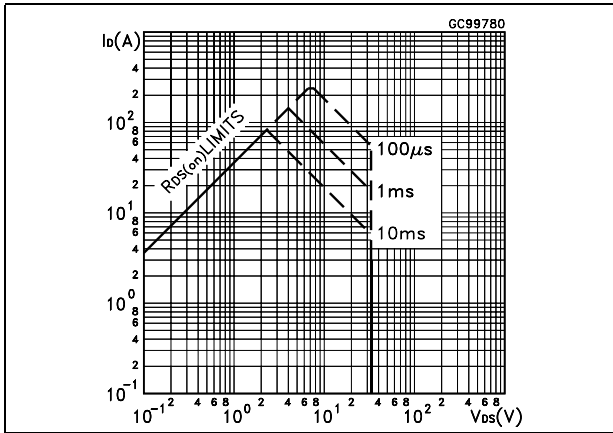


Figure 3. Thermal impedance

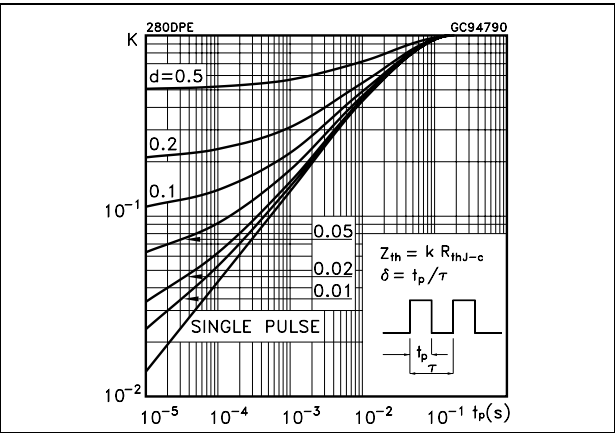


Figure 4. Output characteristics

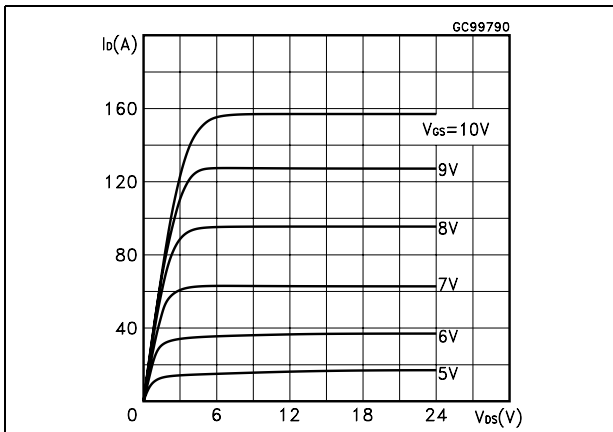


Figure 5. Transfer characteristics

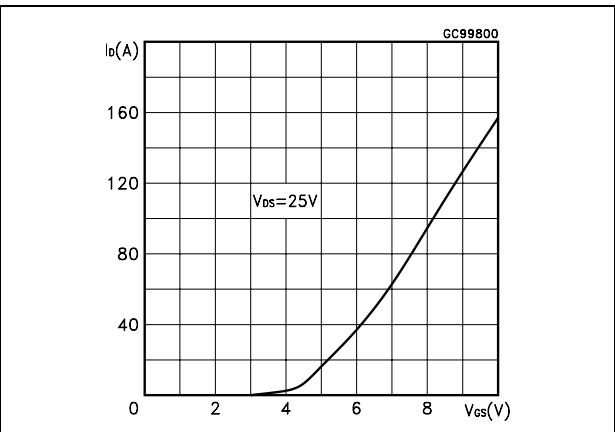


Figure 6. Transconductance

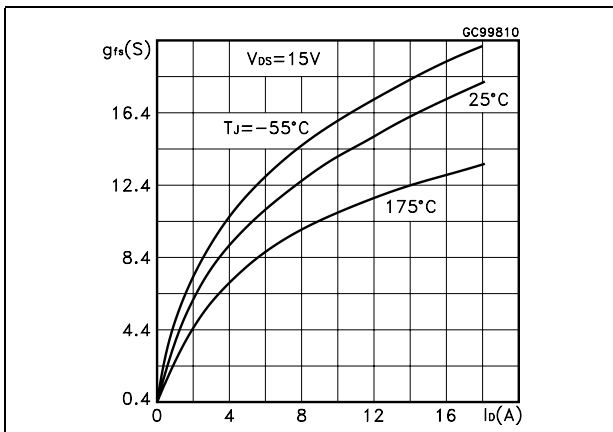


Figure 7. Static drain-source on resistance

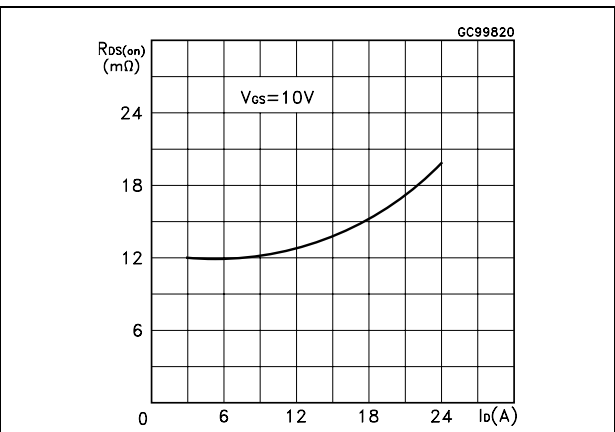


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

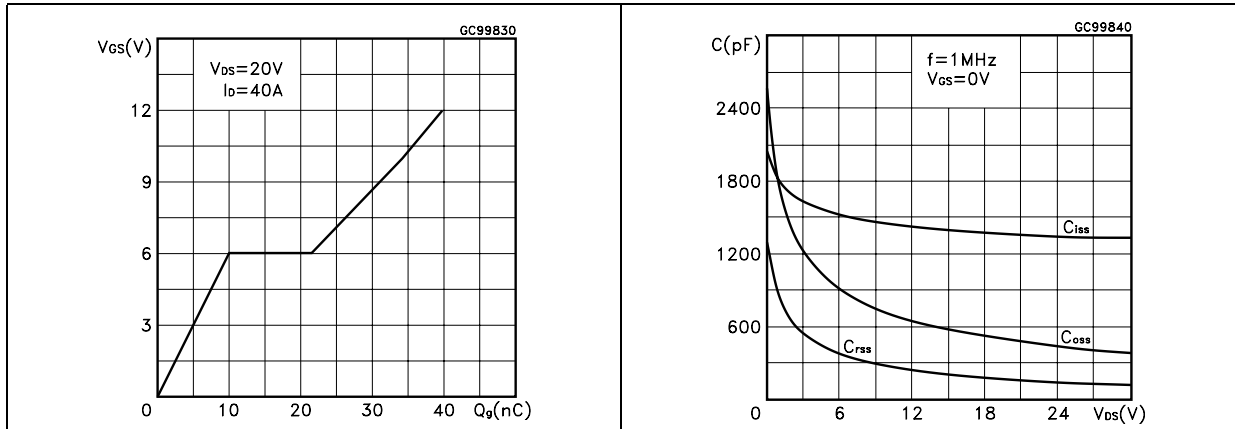


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

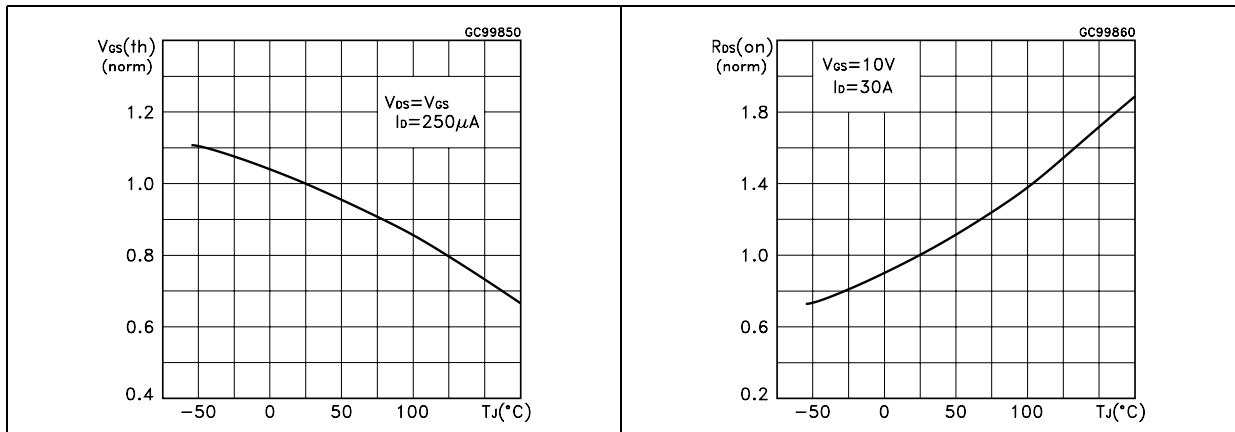
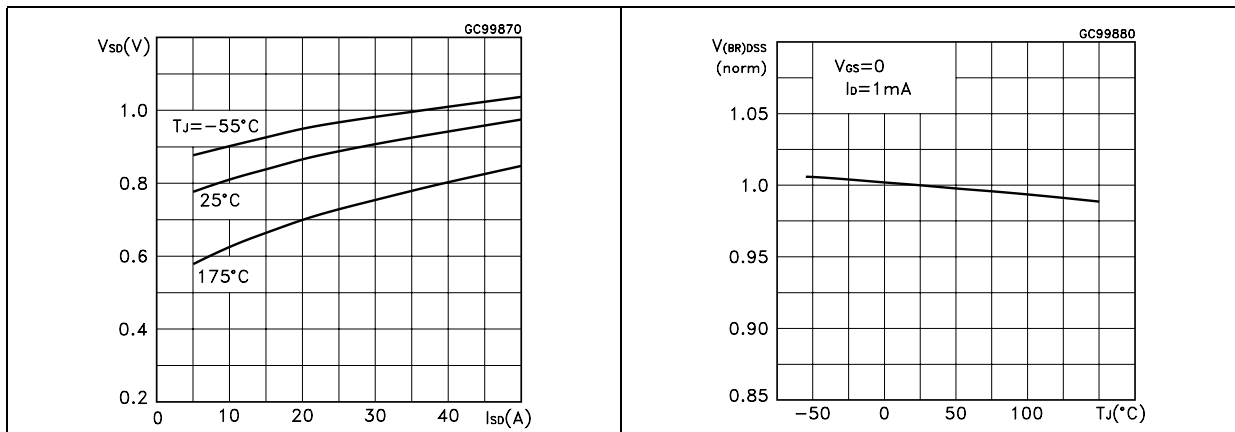
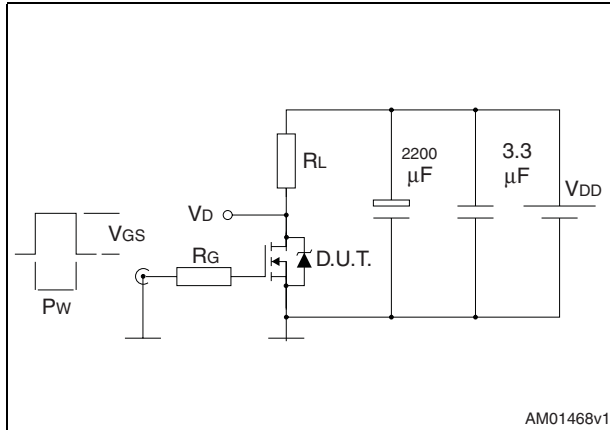


Figure 12. Source-drain diode forward characteristics Figure 13. Normalized  $B_{VDSS}$  vs temperature

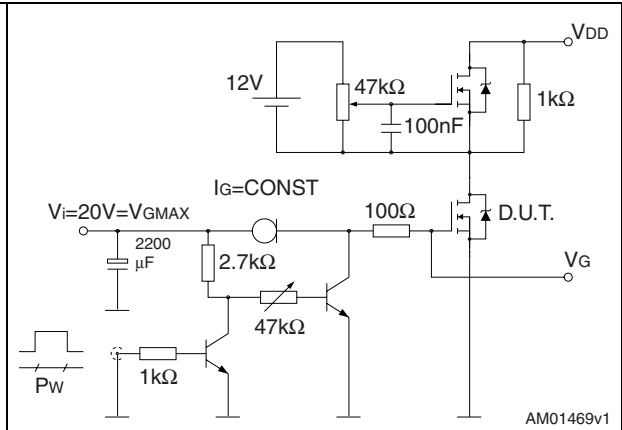


### 3 Test circuits

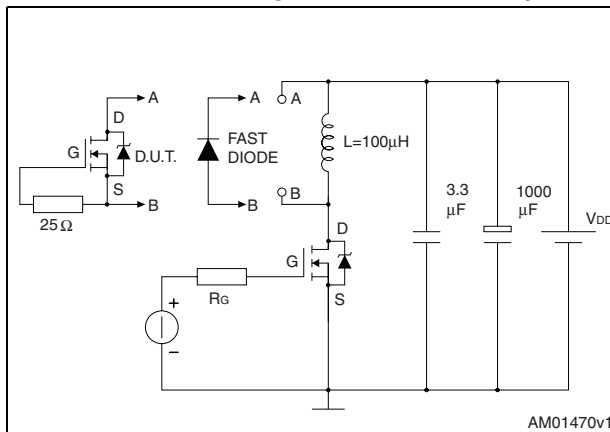
**Figure 14. Switching times test circuit for resistive load**



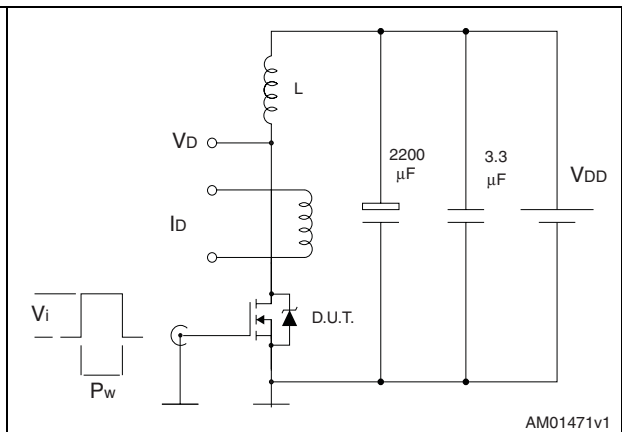
**Figure 15. Gate charge test circuit**



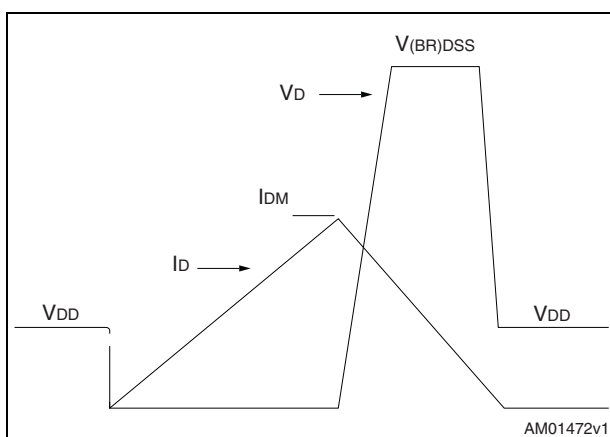
**Figure 16. Test circuit for inductive load switching and diode recovery times**



**Figure 17. Unclamped inductive load test circuit**



**Figure 18. Unclamped inductive waveform**



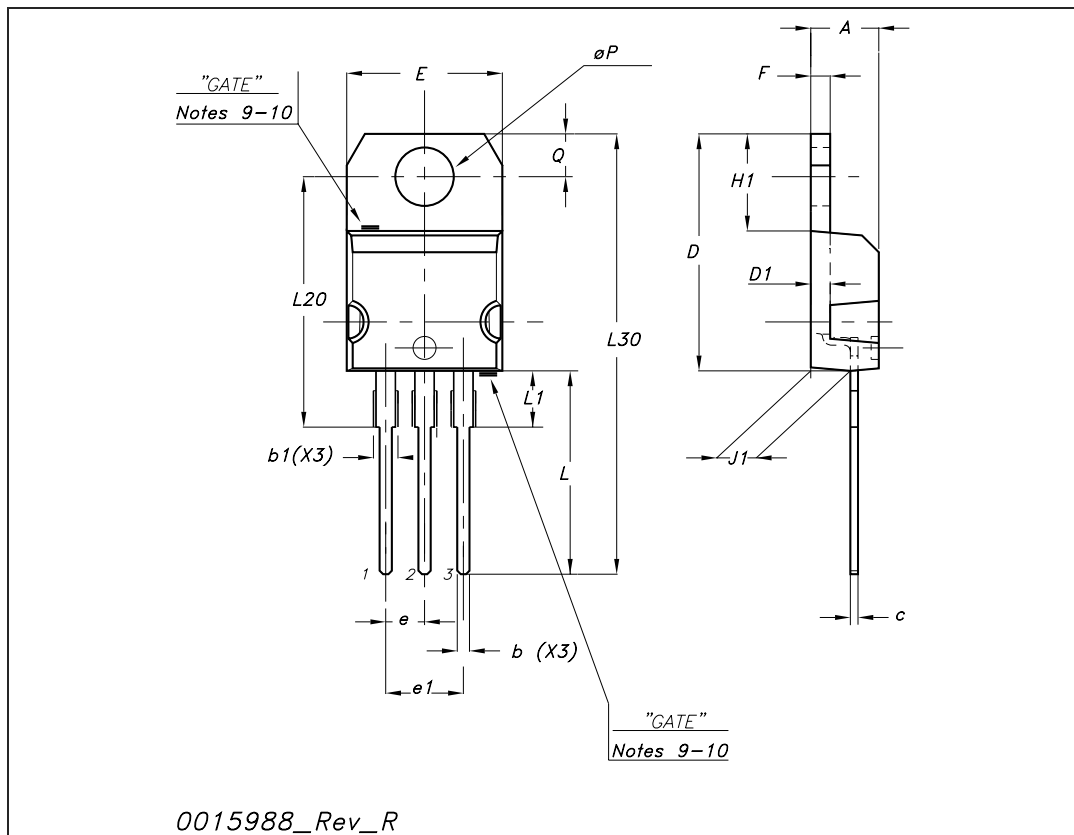


## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

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 8. Document revision history**

Date	Revision	Changes
21-Jun-2004	2	Preliminary datasheet
22-Aug-2005	3	Complete document with curves
21-Jan-2006	4	New ECOPAK label
02-Oct-2006	5	New template, no content change
14-May-2009	6	Updated scheme in <a href="#">Figure 1</a>

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