



# STP90NF03L STB90NF03L-1

N-channel 30V - 0.0056Ω -90A TO-220/I<sup>2</sup>PAK  
Low gate charge STripFET™ Power MOSFET

## General features

Type	V <sub>DSS</sub> (@T <sub>jmax</sub> )	R <sub>DS(on)</sub>	I <sub>D</sub>
STP90NF03L	30V	<0.0065Ω	90A
STB90NF03L-1	30V	<0.0065Ω	90A

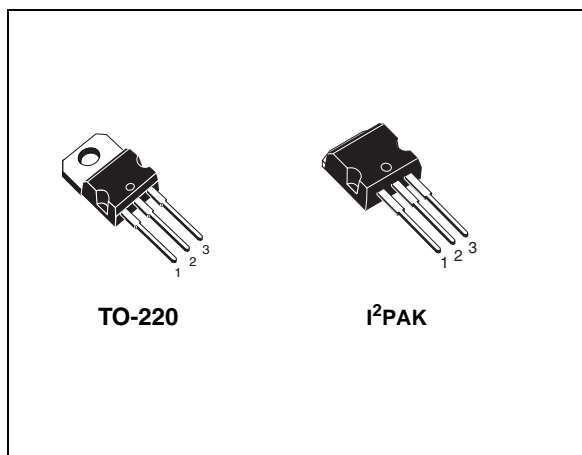
- Optimal R<sub>DS(on)</sub> x Q<sub>g</sub> trade-off
- Conduction losses reduced
- Switching losses reduced

## Description

This application specific Power Mosfet is the third generation of STMicroelectronics unique “Single Feature Size™” strip-based process. The resulting transistor shows the best trade-off between on-resistance and gate charge. When used as high and low side in buck regulators, it gives the best performance in terms of both conduction and switching losses. This is extremely important for motherboards where fast switching and high efficiency are of paramount importance.

## Applications

- Switching application



## Internal schematic diagram



## Order codes

Part number	Marking	Package	Packaging
STP90NF03L	P90NF03L	TO-220	Tube
STB90NF03L-1	B90NF03L	I <sup>2</sup> PAK	Tube

# Contents

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# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	30	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	90	A
$I_D$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	65	A
$I_{DM}^{(1)}$	Drain current (pulsed)	360	A
$P_{TOT}$	Total dissipation at $T_C = 25^\circ\text{C}$	150	W
	Derating factor	0.73	W/°C
$T_J$	Operating junction temperature	-65 to 175	°C
$T_{stg}$	Storage temperature	175	°C

1. Pulse width limited by safe operating area

**Table 2. Thermal data**

$R_{thj-case}$	Thermal resistance junction-case Max	1	°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

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

**Table 3. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250 \mu A, V_{GS} = 0$	30			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max rating},$ $V_{DS} = \text{Max rating} @ 125^{\circ}C$			1 10	$\mu A$ $\mu A$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20V$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250 \mu A$	1		2.5	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10V, I_D = 45A$ $V_{GS} = 5V, I_D = 45A$		0.0056 0.007	0.0065 0.012	$\Omega$ $\Omega$

**Table 4. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max},$ $I_D = 45A$		40		S
$C_{iss}$ $C_{oss}$ $C_{rss}$	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 25V, f = 1 \text{ MHz}, V_{GS} = 0$		2700 860 170		pF pF pF
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 24V, I_D = 90A$ $V_{GS} = 5V$		35 10 18	47	nC nC nC

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

**Table 5. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on delay time rise time	$V_{DD} = 15V, I_D = 45A,$ $R_G = 4.7\Omega, V_{GS} = 4.5V$ (see Figure 12)		30 200		ns ns
$t_{d(off)}$ $t_f$	Turn-off-delay time fall time	$V_{DD} = 15V, I_D = 45A,$ $R_G = 4.7\Omega, V_{GS} = 4.5V$ (see Figure 12)		50 105		ns ns

**Table 6. Source drain diode**

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$I_{SD}$	Source-drain current				90	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				360	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD}=90A, V_{GS}=0$			1.3	V
$t_{rr}$	Reverse recovery time	$I_{SD}=90A,$ $di/dt = 100A/\mu s,$ $V_{DD}=15V, T_j=150^\circ C$ (see Figure 14)		80		ns
$Q_{rr}$	Reverse recovery charge			90		$\mu C$
$I_{RRM}$	Reverse recovery current			2.5		A

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

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

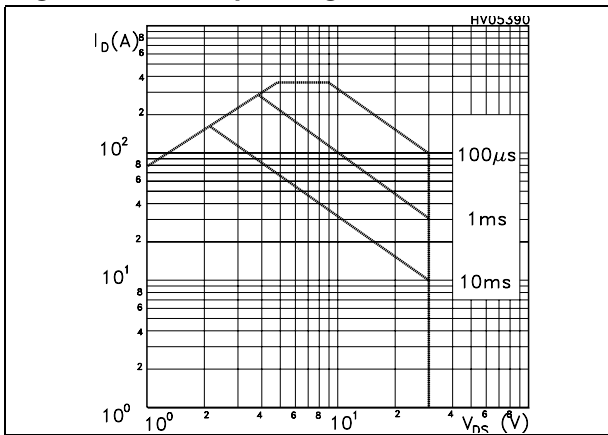


Figure 2. Thermal impedance

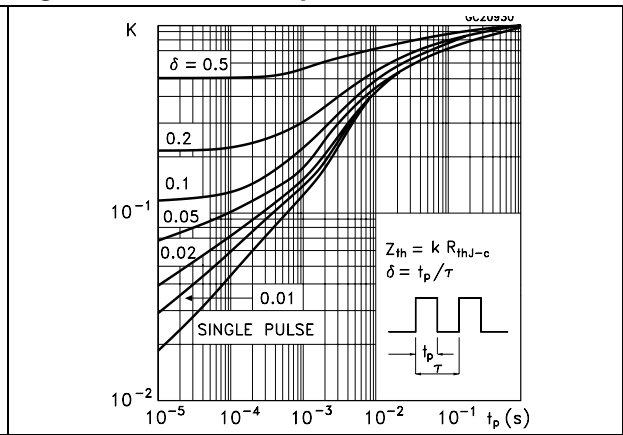


Figure 3. Output characteristics

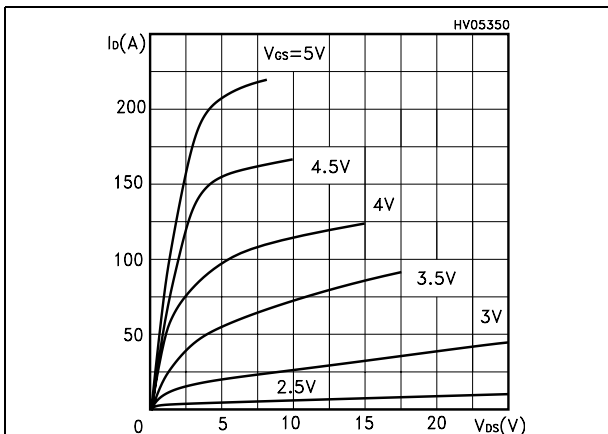


Figure 4. Transfer characteristics

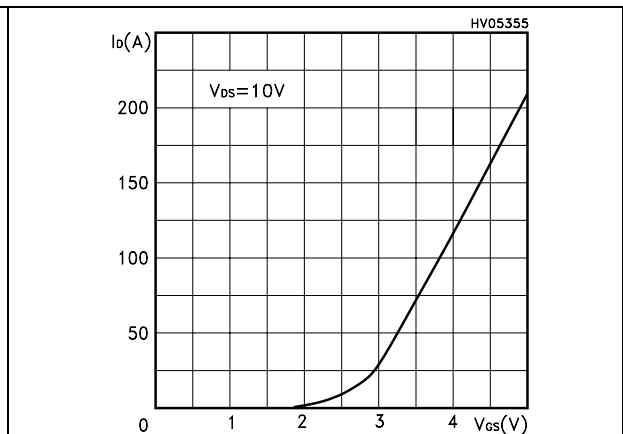


Figure 5. Transconductance

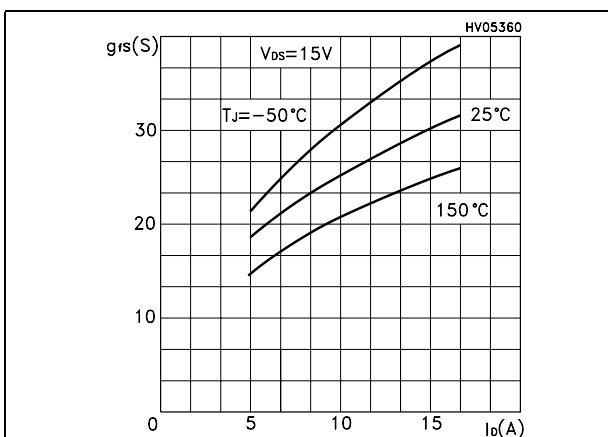


Figure 6. Static drain-source on resistance

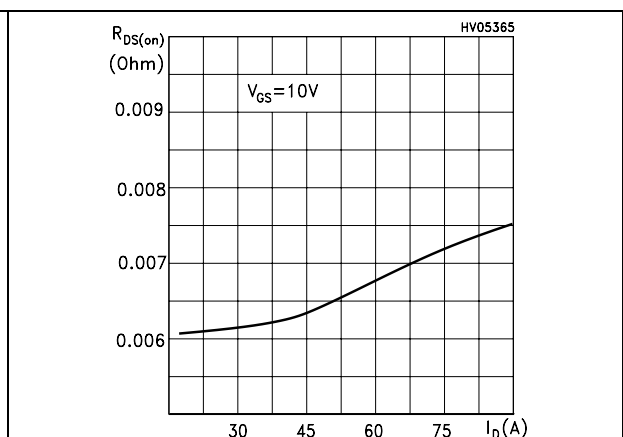


Figure 7. Gate charge vs gate-source voltage Figure 8. Capacitance variations

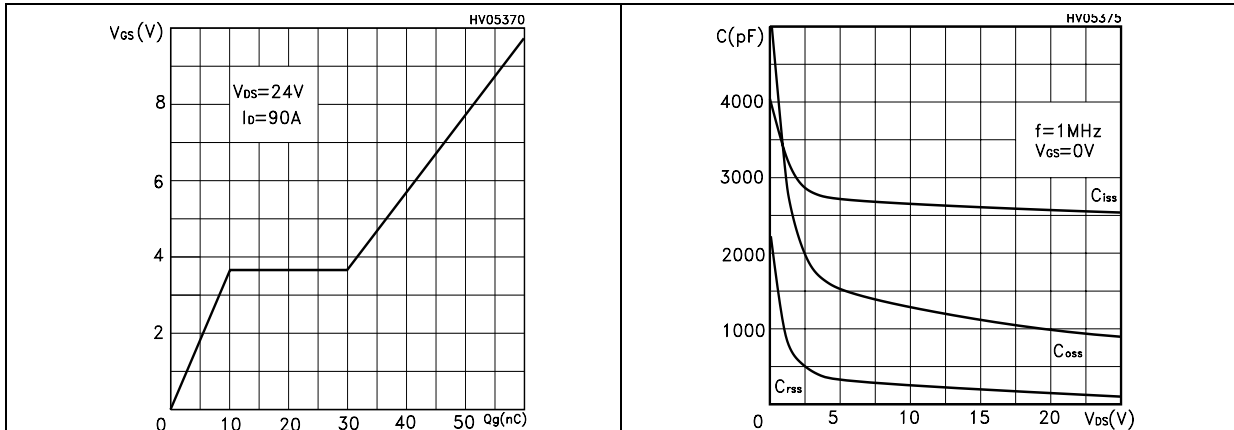


Figure 9. Normalized gate threshold voltage vs temperature Figure 10. Normalized on resistance vs temperature

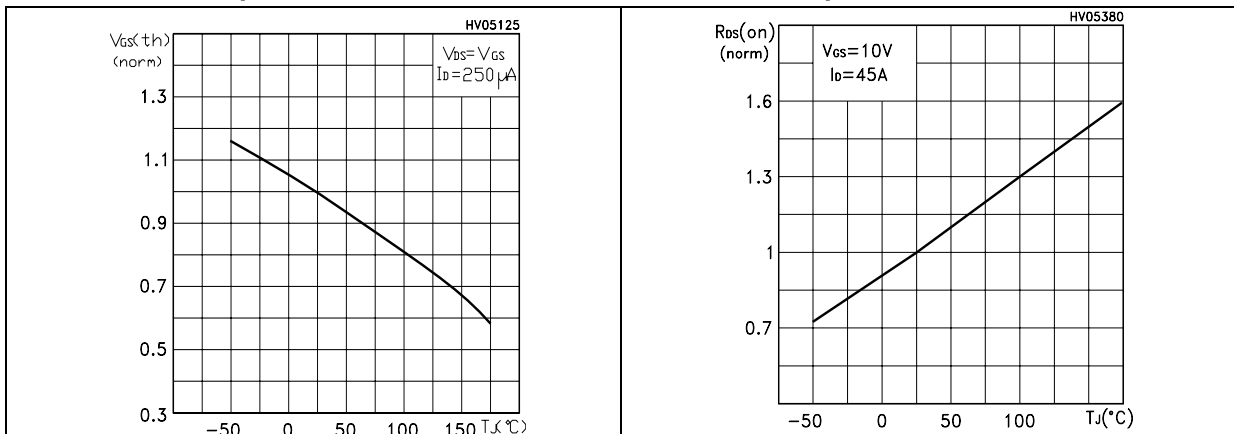
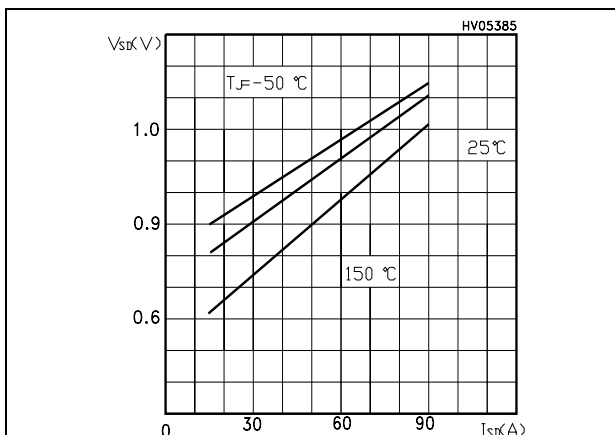


Figure 11. Source-drain diode forward characteristics



### 3 Test circuit

Figure 12. Switching times test circuit for resistive load

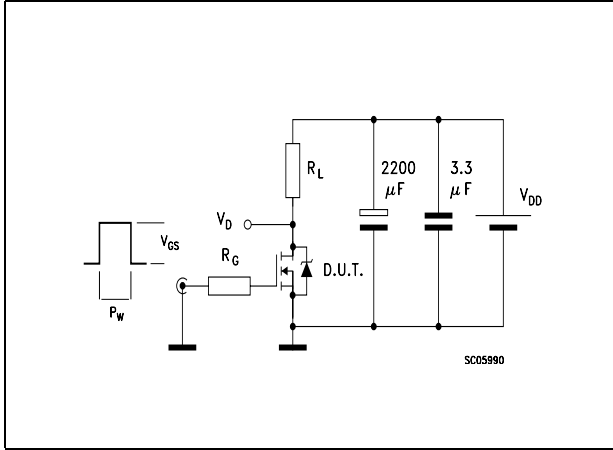


Figure 13. Gate charge test circuit

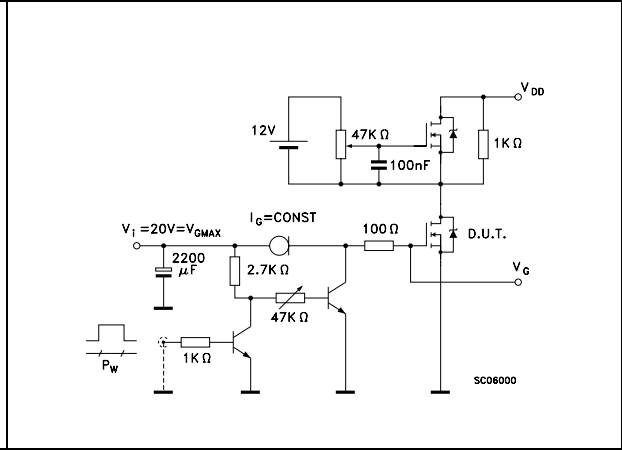


Figure 14. Test circuit for inductive load switching and diode recovery times



Figure 15. Unclamped Inductive load test circuit

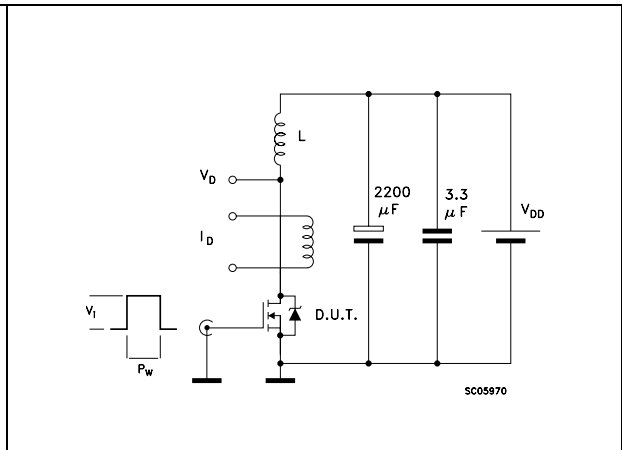


Figure 16. Unclamped inductive waveform

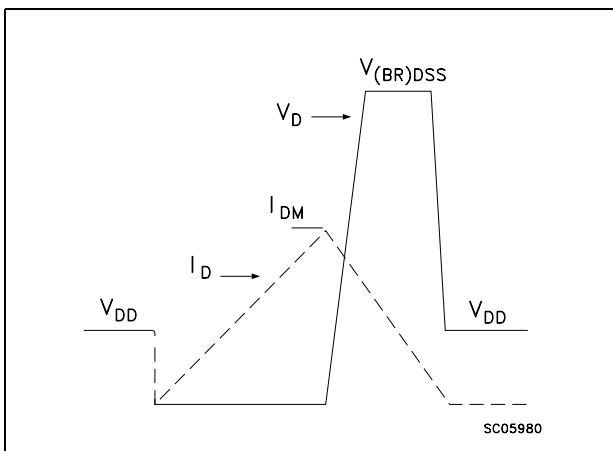
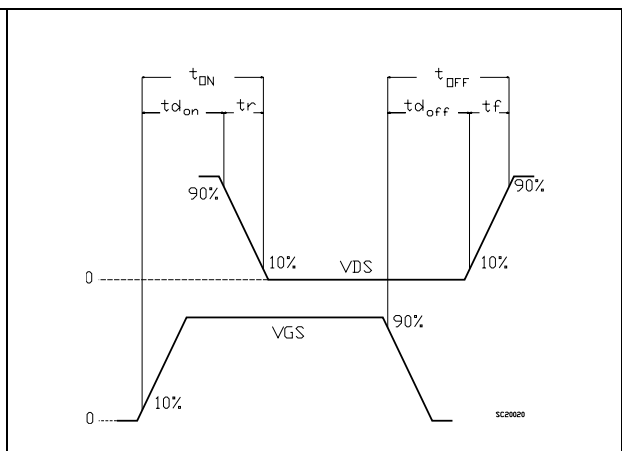


Figure 17. Switching time waveform



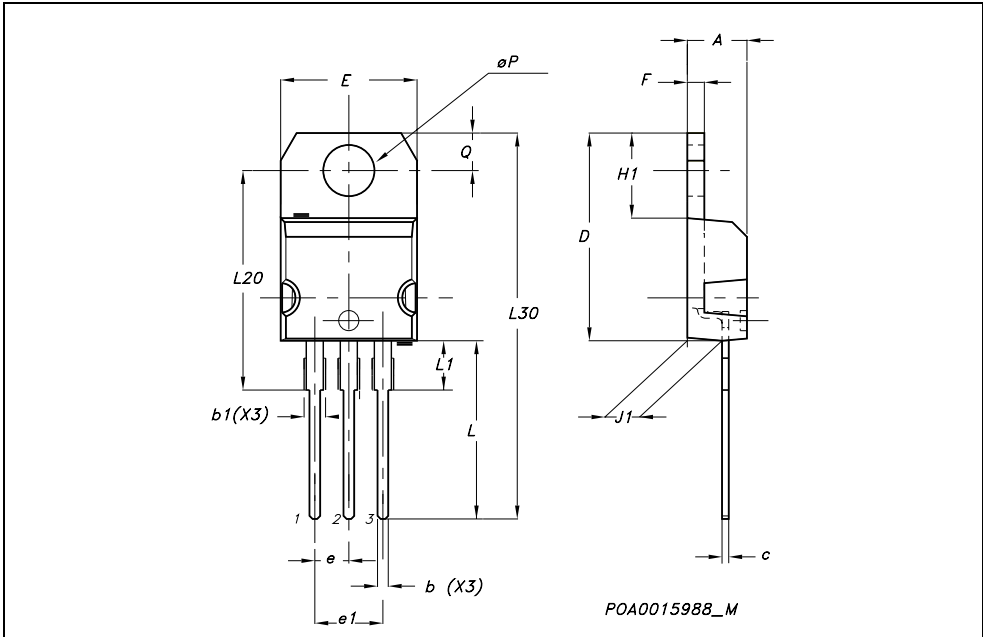


## 4 Package mechanical data

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](http://www.st.com)

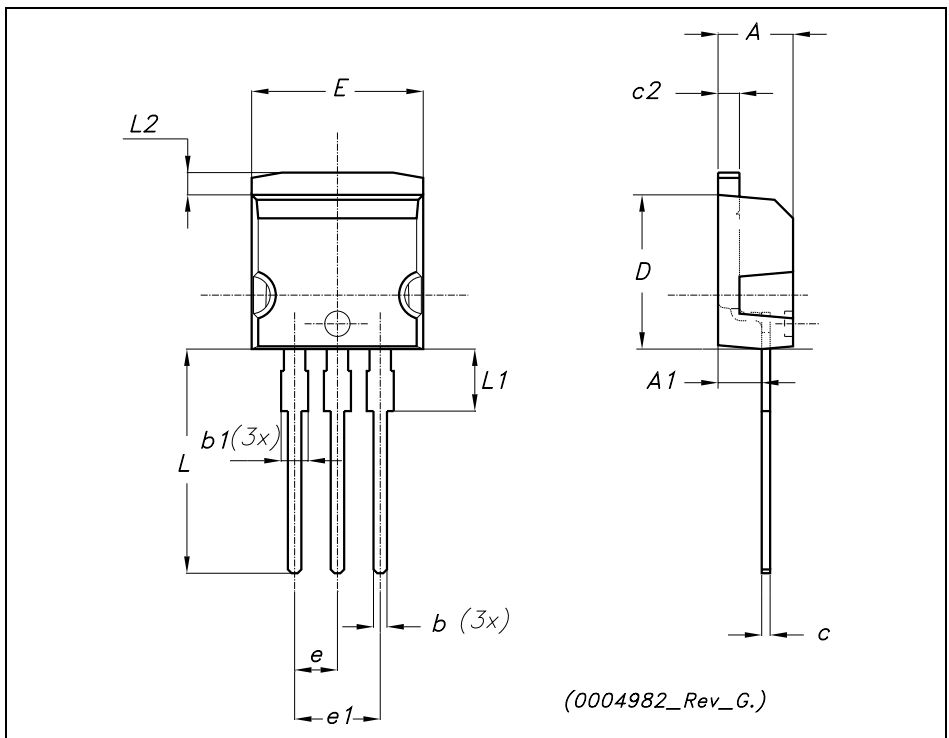
**TO-220 MECHANICAL DATA**

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	1.15		1.70	0.045		0.066
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.60		0.620
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		0.052
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	
øP	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



**TO-262 (I<sup>2</sup>PAK) MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
A1	2.40		2.72	0.094		0.107
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.49		0.70	0.019		0.027
c2	1.23		1.32	0.048		0.052
D	8.95		9.35	0.352		0.368
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
E	10		10.40	0.393		0.410
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L2	1.27		1.40	0.050		0.055



## 5 Revision history

**Table 7. Revision history**

<b>Date</b>	<b>Revision</b>	<b>Changes</b>
09-Sep-2004	4	Complete version
17-Aug-2006	5	New template, no content change

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