STP90NF03L
STB90NF03L-1

N-channel 30V - 0.0056Ω -90A TO-220/I^{2}PAK
Low gate charge STripFET™ Power MOSFET

General features

| Type	V$_{DSS}$ (@Tjmax)	R$_{DS(on)}$	I$_D$
STP90NF03L	30V	<0.0065Ω	90A
STP90NF03L-1	30V	<0.0065Ω	90A

■ Optimal R$_{DS}$(on) x Q$_g$ 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

TO-220   **I^{2}PAK**
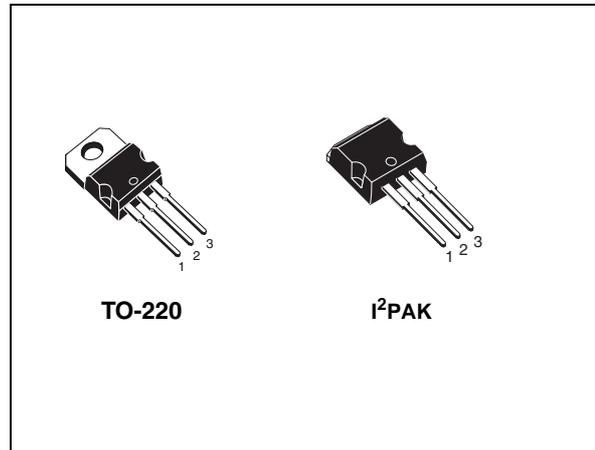
Internal schematic diagram

SC06140
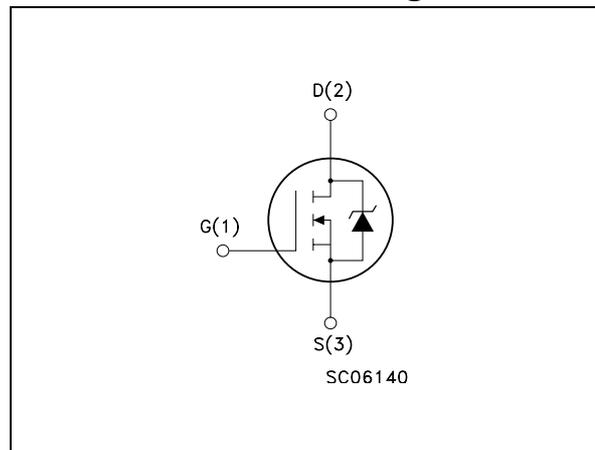
Order codes

Part number	Marking	Package	Packaging
STP90NF03L	P90NF03L	TO-220	Tube
STB90NF03L-1	B90NF03L	I^{2}PAK	Tube

Contents

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	± 20	V
I_D	Drain current (continuous) at T_C = 25°C	90	A
I_D	Drain current (continuous) at T_C=100°C	65	A
I_{DM}[(1)]	Drain current (pulsed)	360	A
P_{TOT}	Total dissipation at T_C = 25°C	150	W
	Derating factor	0.73	W/°C
T_J T_{stg}	Operating junction temperature Storage temperature	-65 to 175 175	°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°C unless otherwise specified)

Table 3.   On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250$ μA, $V_{GS}= 0$	30			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	V_{DS} = Max rating, V_{DS} = Max rating @125°C			1 10	μA μA
I_{GSS}	Gate body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20V$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS}= V_{GS}$, $I_D = 250$μA	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	Ω Ω

Table 4.   Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs} [1]	Forward transconductance	$V_{DS} >$ ID(on) x RDS(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 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=300μs, 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	$V_{DD} = 15V$, $I_D = 45A$, $R_G = 4.7Ω$, $V_{GS} = 4.5V$ (see Figure 12)		30 200		ns ns
$t_{d(off)}$ t_f	Turn-off-delay time fall time	$V_{DD} = 15V$, $I_D = 45A$, $R_G = 4.7Ω$, $V_{GS} = 4.5V$ (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} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD}=90A, di/dt = 100A/μs, V_{DD}=15V, Tj=150°C (see Figure 14)		80 90 2.5		ns μC A

1. Pulse width limited by safe operating area

2. Pulsed: pulse duration=300μs, duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 1.   Safe operating area
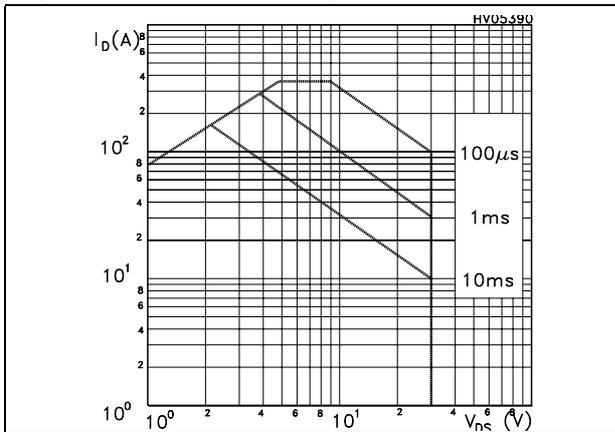
Figure 2.   Thermal impedance
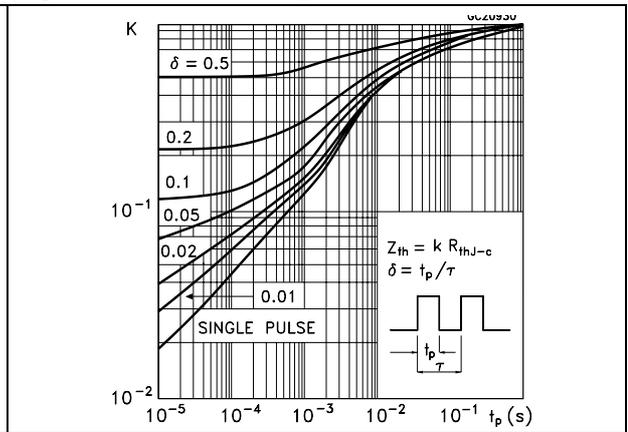
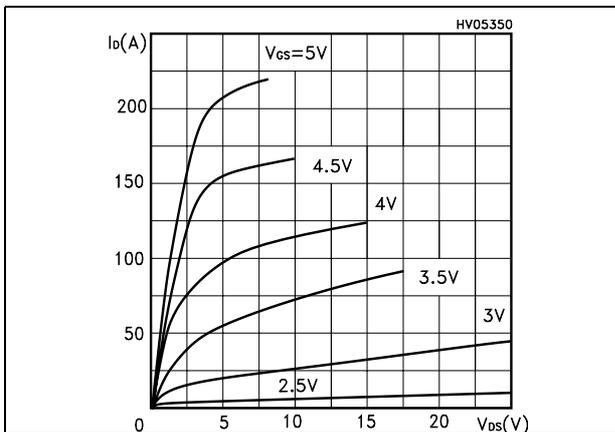**Figure 3.   Output characterisics**

Figure 4.   Transfer characteristics
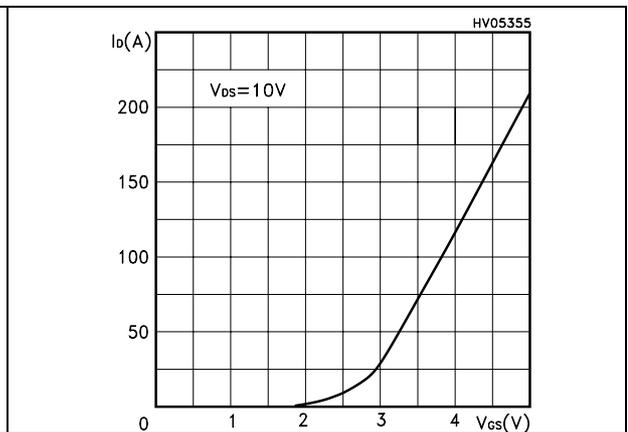

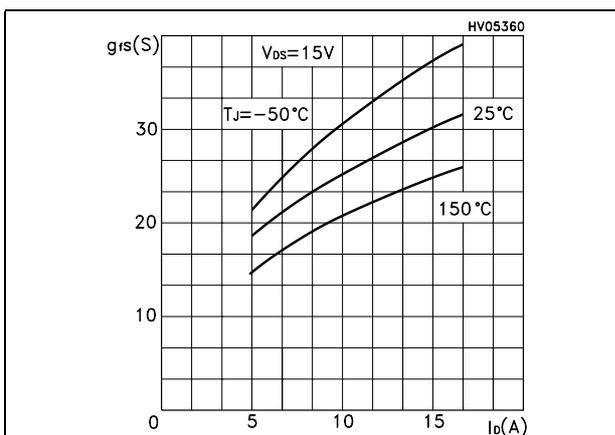**Figure 5.   Transconductance**

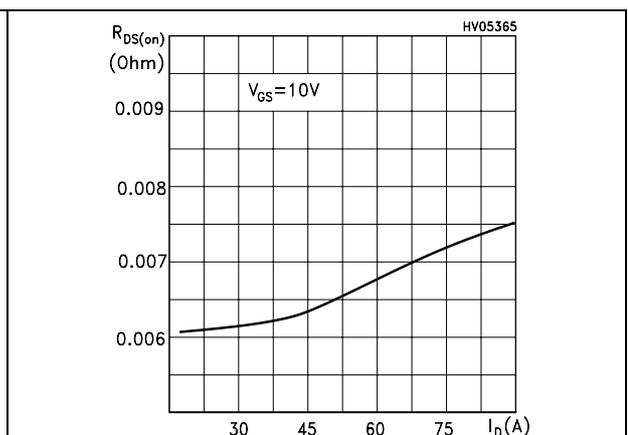**Figure 6.   Static drain-source on resistance**

Figure 7.   Gate charge vs gate-source voltage

Figure 8.   Capacitance variations
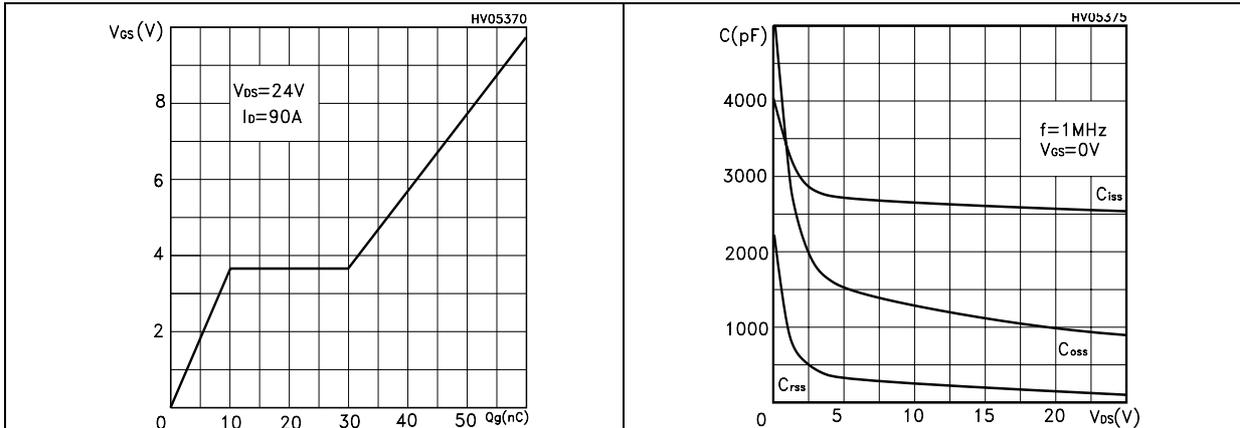

Figure 9.   Normalized gate threshold voltage vs temperature

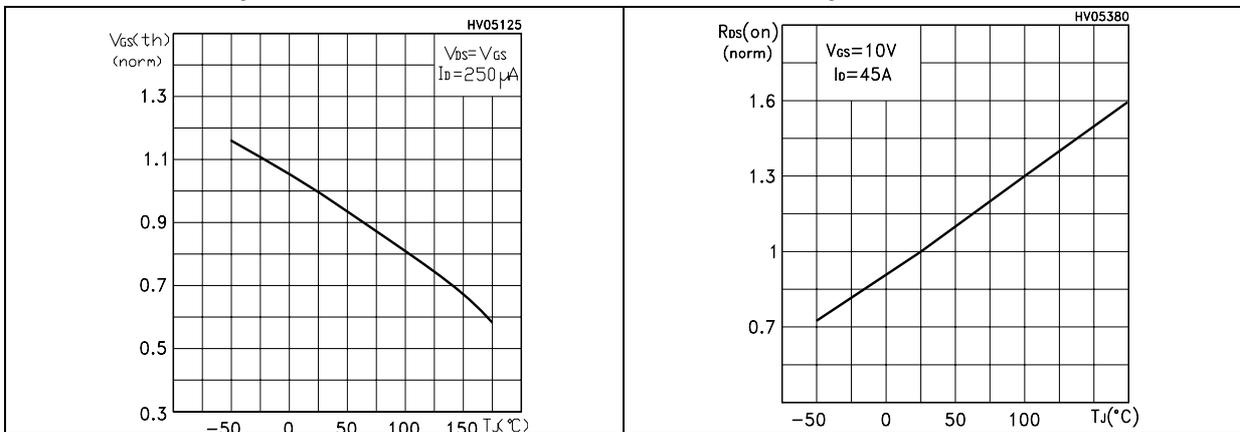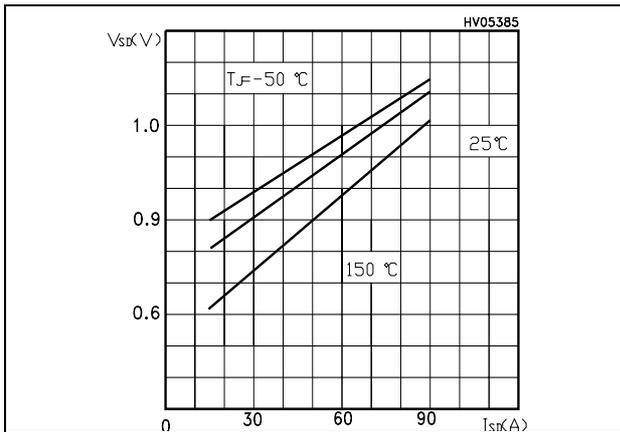**Figure 10.   Normalized on resistance vs temperature**

Figure 11.   Source-drain diode forward characteristics

3   Test circuit

Figure 12.   Switching times test circuit for resistive load
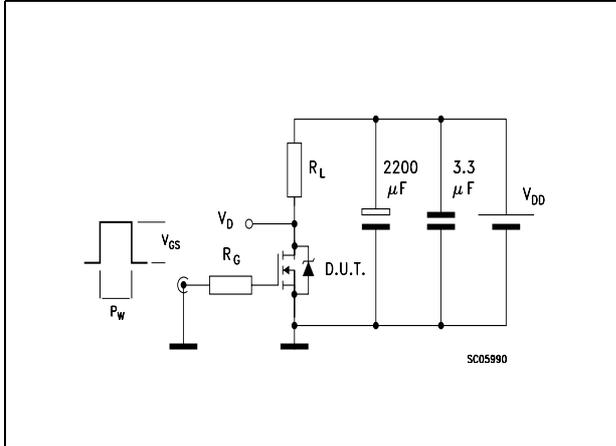

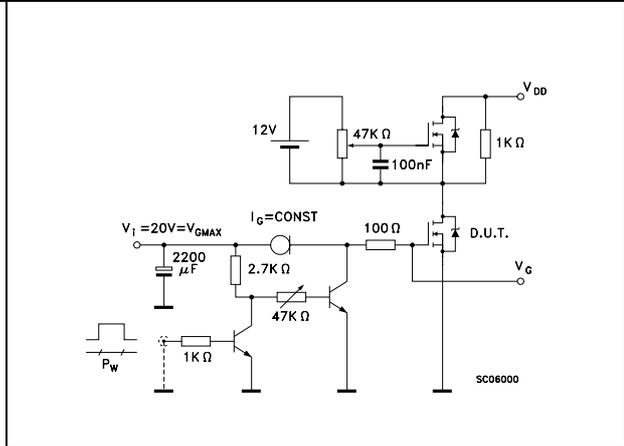**Figure 13.   Gate charge test circuit**

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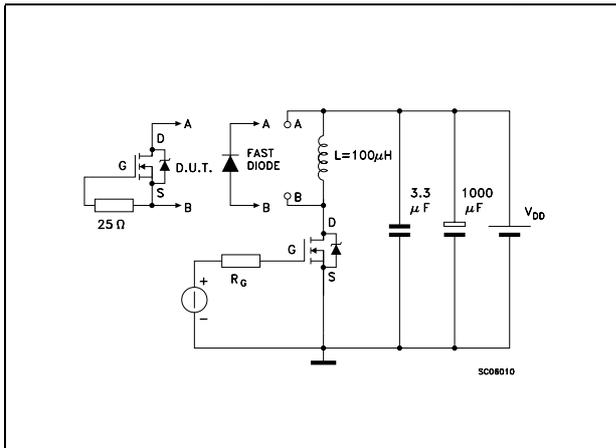

Figure 15.   Unclamped Inductive load test circuit
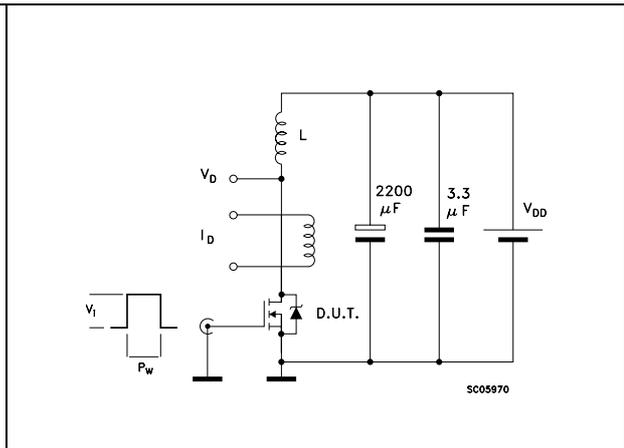
Figure 16.   Unclamped inductive waveform
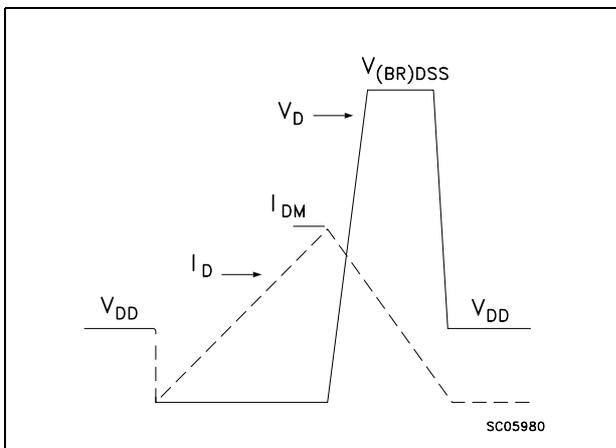
Figure 17.   Switching time waveform
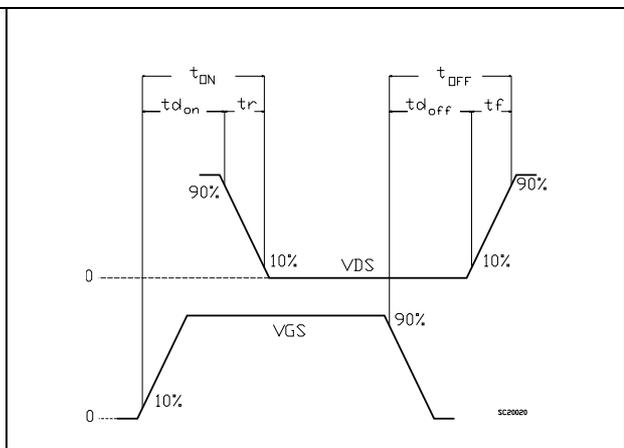
4   Package mechanical data

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

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

POA0015988_M
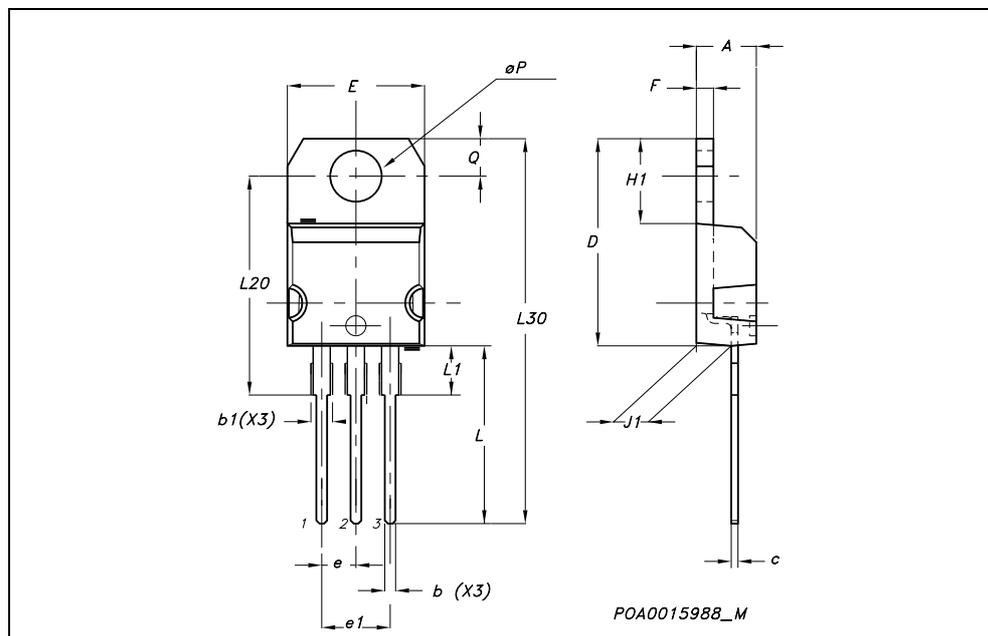
| TO-262 (I²PAK) MECHANICAL DATA |

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

(0004982_Rev_G.)
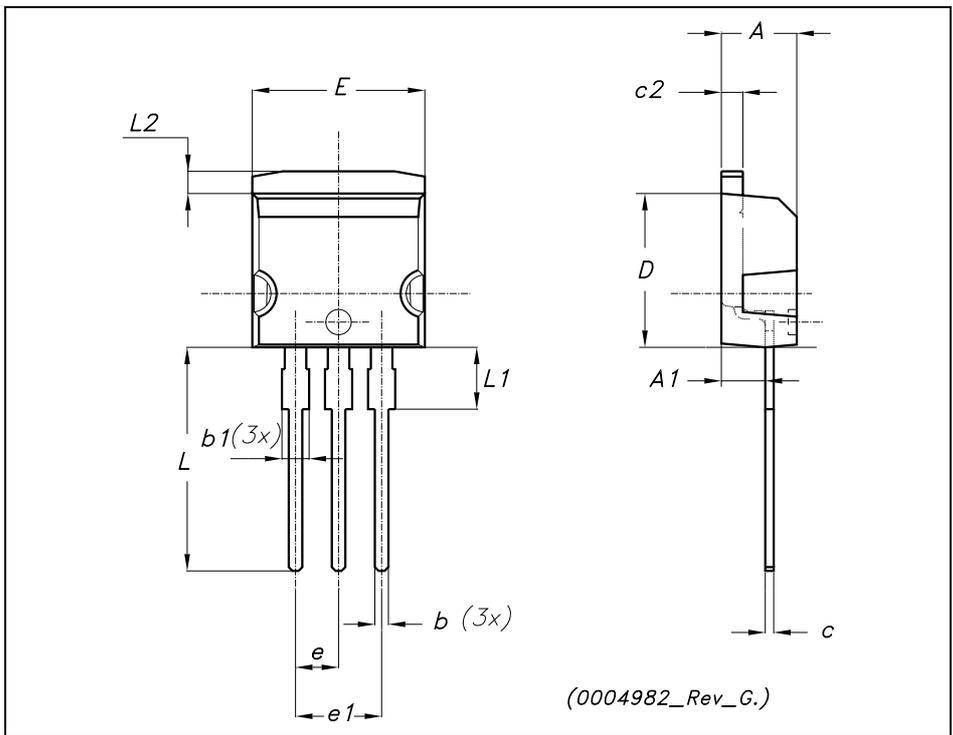
5   Revision history

Table 7.   Revision history

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

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