



# STP200NF04L STB200NF04L - STB200NF04L-1

N-CHANNEL 40V - 3 mΩ - 120 A TO-220/D<sup>2</sup>PAK/I<sup>2</sup>PAK  
STripFET™ II MOSFET

Table 1: General Features

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STB200NF04L	40 V	3.5 mΩ	120 A
STP200NF04L	40 V	3.8 mΩ	120 A
STB200NF04L-1	40 V	3.8 mΩ	120 A

- TYPICAL R<sub>DS(on)</sub> = 3mΩ
- 100% AVALANCHE TESTED
- LOW THRESHOLD DRIVE

## DESCRIPTION

This MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" stripbased 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. This new improved device has been specifically designed for Automotive applications.

## APPLICATIONS

- HIGH CURRENT, HIGH SWITCHING SPEED

Figure 1: Package

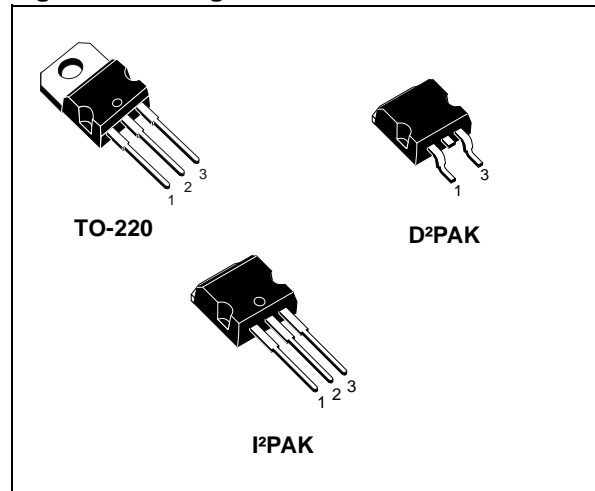


Figure 2: Internal Schematic Diagram

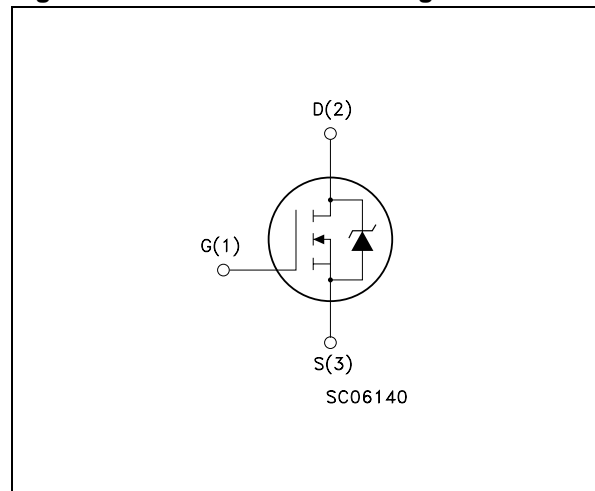


Table 2: Order Codes

PART NUMBER	MARKING	PACKAGE	PACKAGING
STP200NF04L	P200NF04L	TO-220	TUBE
STB200NF04L	B200NF04L	D <sup>2</sup> PAK	TAPE & REEL
STB200NF04L-1	B200NF04L	I <sup>2</sup> PAK	TUBE

Rev. 1

## STP200NF04L - STB200NF04L - STB200NF04L-1

**Table 3: Absolute Maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source Voltage ( $V_{GS} = 0$ )	40	V
$V_{GDR}$	Drain-gate Voltage ( $R_{GS}=20\text{ K}\Omega$ )	40	V
$V_{GS}$	Gate- source Voltage	$\pm 16$	V
$I_D (**)$	Drain Current (continuous) at $T_C = 25^\circ\text{C}$	120	A
$I_D$	Drain Current (continuous) at $T_C = 100^\circ\text{C}$	120	A
$I_{DM} (2)$	Drain Current (pulsed)	480	A
$P_{TOT}$	Total Dissipation at $T_C = 25^\circ\text{C}$	300	W
	Derating Factor	2	W/ $^\circ\text{C}$
dv/dt (1)	Peak Diode Recovery voltage slope	3.6	V/ns
$E_{AS} (3)$	Single Pulse Avalanche Energy	1.4	J
$T_{stg}$	Storage Temperature	-55 to 175	$^\circ\text{C}$
$T_j$	Max. Operating Junction Temperature		

(1)  $I_{SD} \leq 100\text{ A}$ ,  $di/dt \leq 240\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq 32$ ,  $T_j \leq T_{JMAX}$

(2) Pulse width limited by safe operating area.

(3) Starting  $T_j = 25^\circ\text{C}$ ,  $I_{AR} = 50\text{ A}$ ,  $V_{DD} = 30\text{ V}$

(\*\*) Current limited by Package

**Table 4: Thermal Data**

			TO-220/I <sup>2</sup> PAK	D <sup>2</sup> PAK	Unit
Rthj-case	Thermal Resistance Junction-case	Max	0.50		$^\circ\text{C}/\text{W}$
Rthj-pcb (*)	Thermal Resistance Junction-pcb	Max		35	$^\circ\text{C}/\text{W}$
Rthja	Thermal Resistance Junction-ambient	Max	62.5	--	
$T_l$	Maximum Lead Temperature For Soldering Purpose		300	--	$^\circ\text{C}$

(\*)When mounted on 1 inch<sup>2</sup> FR4 2oz Cu

## ELECTRICAL CHARACTERISTICS ( $T_{CASE} = 25^\circ\text{C}$ UNLESS OTHERWISE SPECIFIED)

**Table 5: On/Off**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\ \mu\text{A}$ , $V_{GS} = 0$	40			V	
$I_{DSS}$	Zero Gate Voltage Drain Current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max Rating}$ $V_D = \text{Max Rating}$ , $T_C = 125^\circ\text{C}$			1 10	$\mu\text{A}$ $\mu\text{A}$	
$I_{GSS}$	Gate-body Leakage Current ( $V_{DS} = 0$ )	$V_{GS} = \pm 16\text{ V}$			$\pm 100$	nA	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$	1		4	V	
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ , $I_D = 50\text{ A}$ $V_{GS} = 5\text{ V}$ , $I_D = 50\text{ A}$	<b>TO-220</b> <b>I<sup>2</sup>PAK</b>		3.3 3.8	3.8 4.6	m $\Omega$ m $\Omega$
		$V_{GS} = 10\text{ V}$ , $I_D = 50\text{ A}$ $V_{GS} = 5\text{ V}$ , $I_D = 50\text{ A}$	<b>D<sup>2</sup>PAK</b>		3.0 3.5	3.5 4.3	m $\Omega$ m $\Omega$

## ELECTRICAL CHARACTERISTICS (CONTINUED)

Table 6: Dynamic

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs}$ (4)	Forward Transconductance	$V_{DS} = 15\text{ V}$ , $I_D = 20\text{ A}$		60		S
$C_{iss}$ $C_{oss}$ $C_{rss}$	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$		6400 1300 190		pF pF pF
$t_{d(on)}$ $t_r$ $t_{d(off)}$ $t_f$	Turn-on Delay Time Rise Time Turn-off Delay Time Fall Time	$V_{DD} = 20\text{ V}$ , $I_D = 50\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 4.5\text{ V}$ (see Figure 16)		37 270 90 80		ns ns ns ns
$t_{r(Voff)}$ $t_f$ $t_c$	Turn-off Delay Time Fall Time Cross-over Time	$V_{clamp} = 32\text{ V}$ , $I_D = 100\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 4.5\text{ V}$ (see Figure 17)		85 125 160		ns ns ns
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 32\text{ V}$ , $I_D = 100\text{ A}$ , $V_{GS} = 4.5\text{ V}$ (see Figure 19)		72 20 28.5	90	nC nC nC

Table 7: Source Drain Diode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain Current				100	A
$I_{SDM}$ (1)	Source-drain Current (pulsed)				400	A
$V_{SD}$ (4)	Forward On Voltage	$I_{SD} = 160\text{ A}$ , $V_{GS} = 0$			1.3	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 100\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 20\text{ V}$ , $T_j = 150^\circ\text{C}$ (see Figure 16)		88 240 5.5		ns nC A

(1) Pulse width limited by safe operating area

(4). Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.

Figure 3: Safe Operating Area

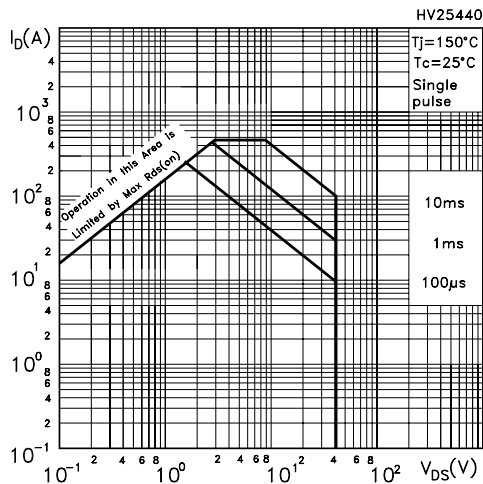


Figure 4: Output Characteristics

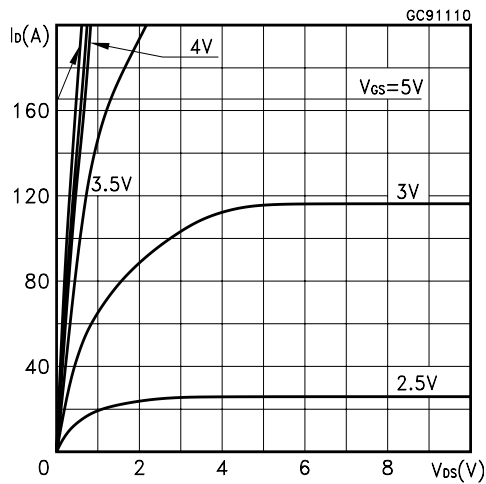


Figure 5: Transconductance

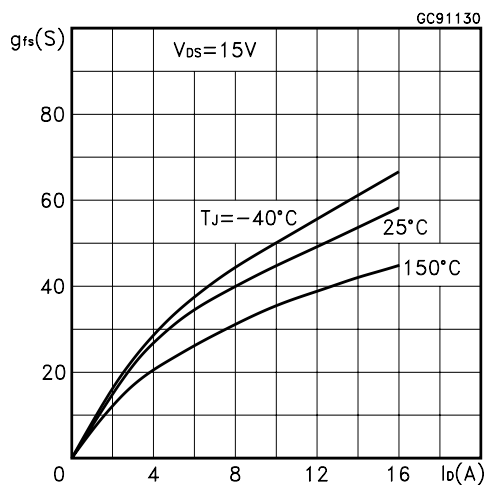


Figure 6: Thermal Impedance

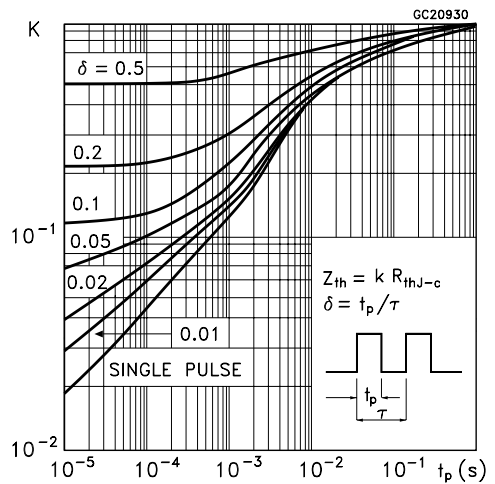


Figure 7: Transfer Characteristics

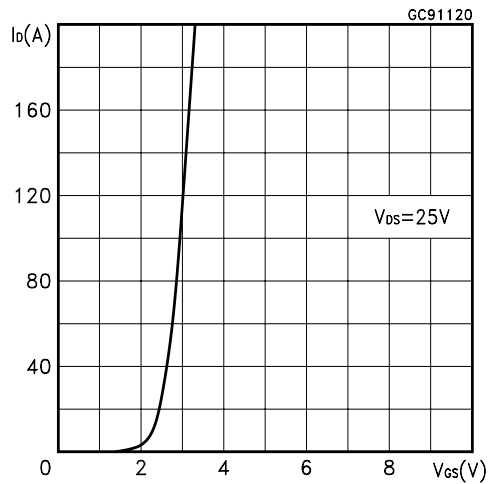


Figure 8: Static Drain-source On Resistance

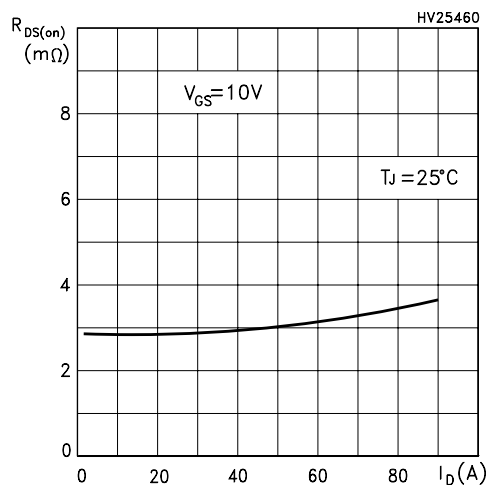


Figure 9: Gate Charge vs Gate-source Voltage

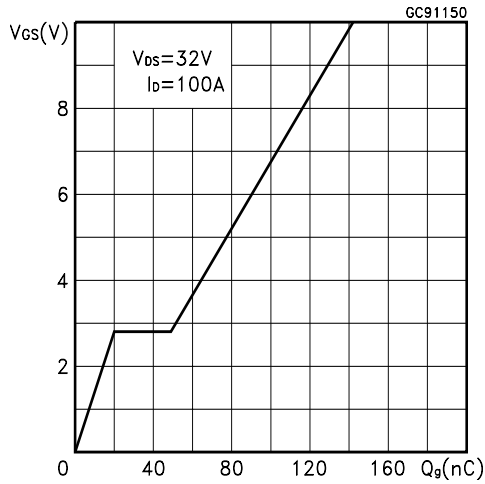


Figure 10: Normalized Gate Threshold Voltage vs Temperature

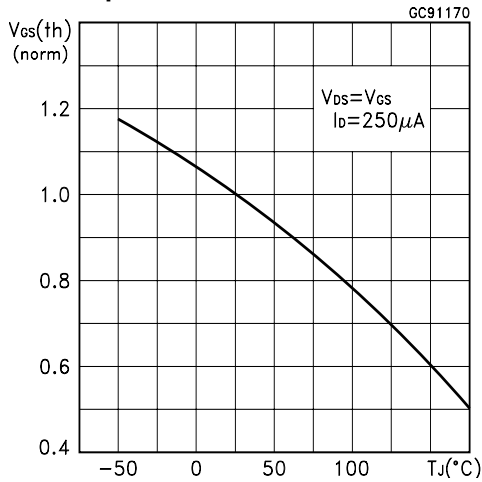


Figure 11: Source-Drain Diode Forward Characteristics

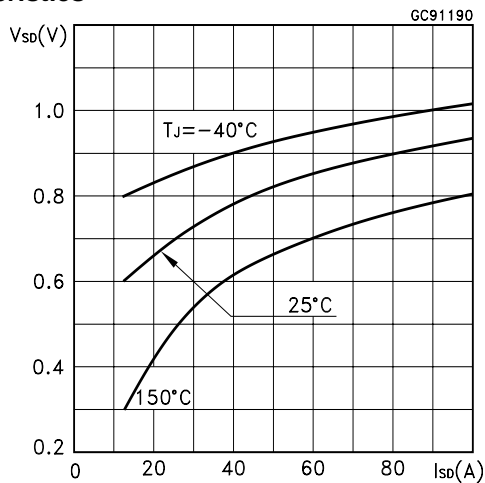


Figure 12: Capacitance Variations

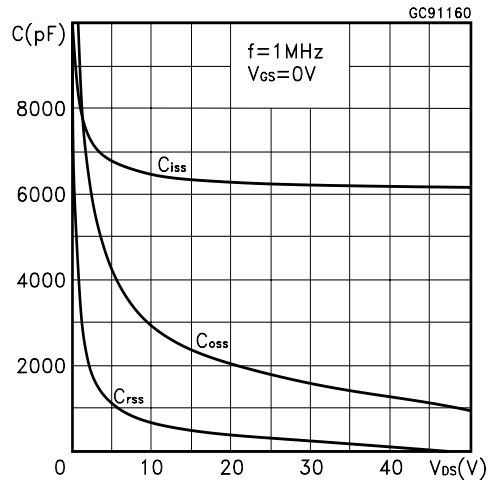


Figure 13: Normalized On Resistance vs Temperature

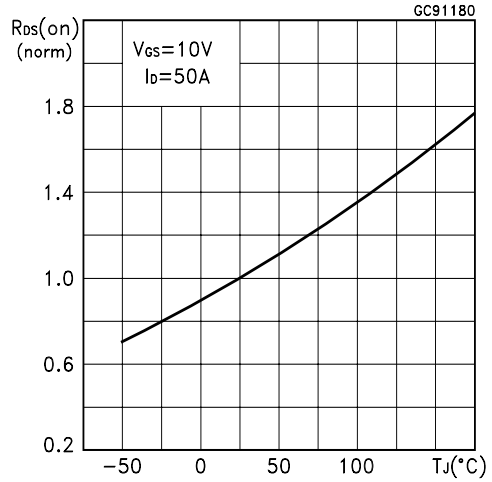


Figure 14: Normalized Breakdown Voltage vs Temperature

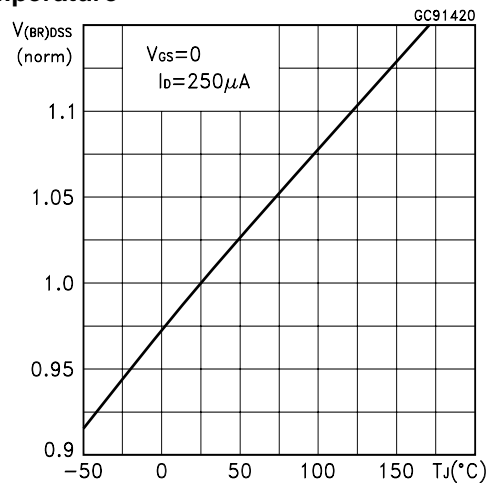


Figure 15: Unclamped Inductive Load Test Circuit

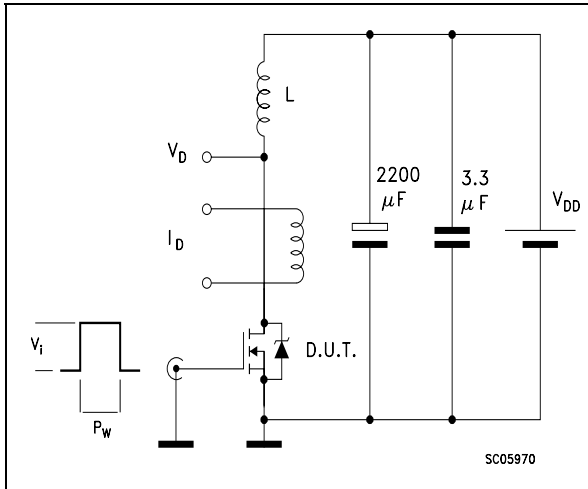


Figure 16: Switching Times Test Circuit For Resistive Load

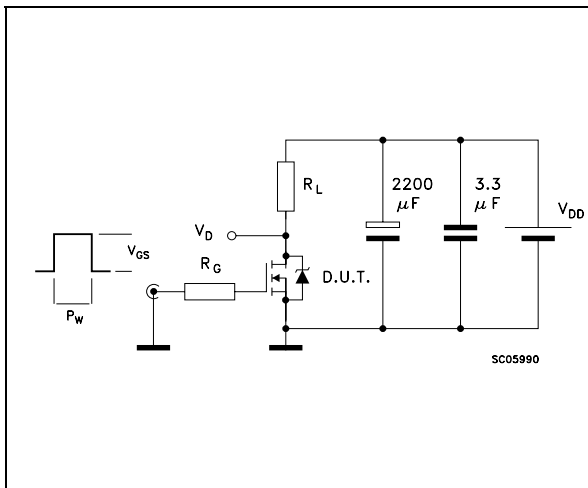


Figure 17: Test Circuit For Inductive Load Switching and Diode Recovery Times

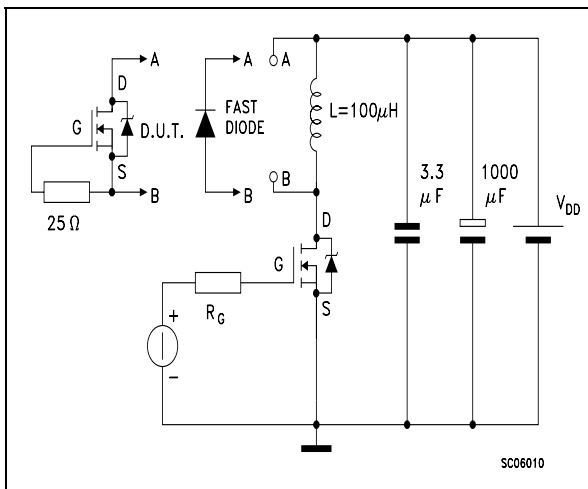


Figure 18: Unclamped Inductive Waferform

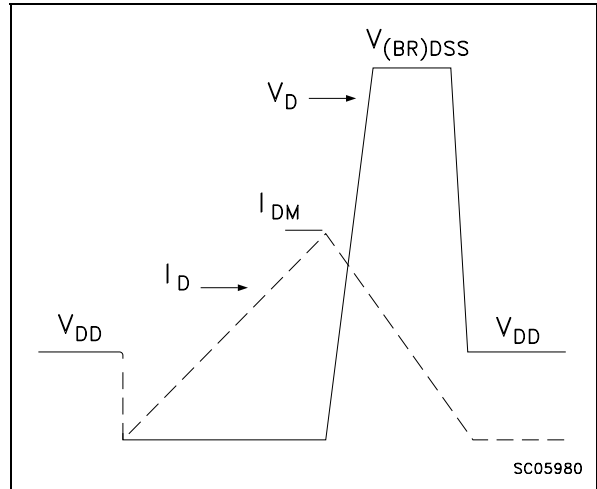
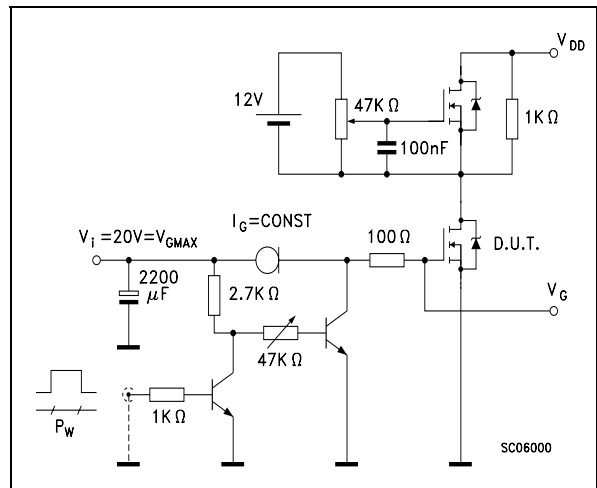
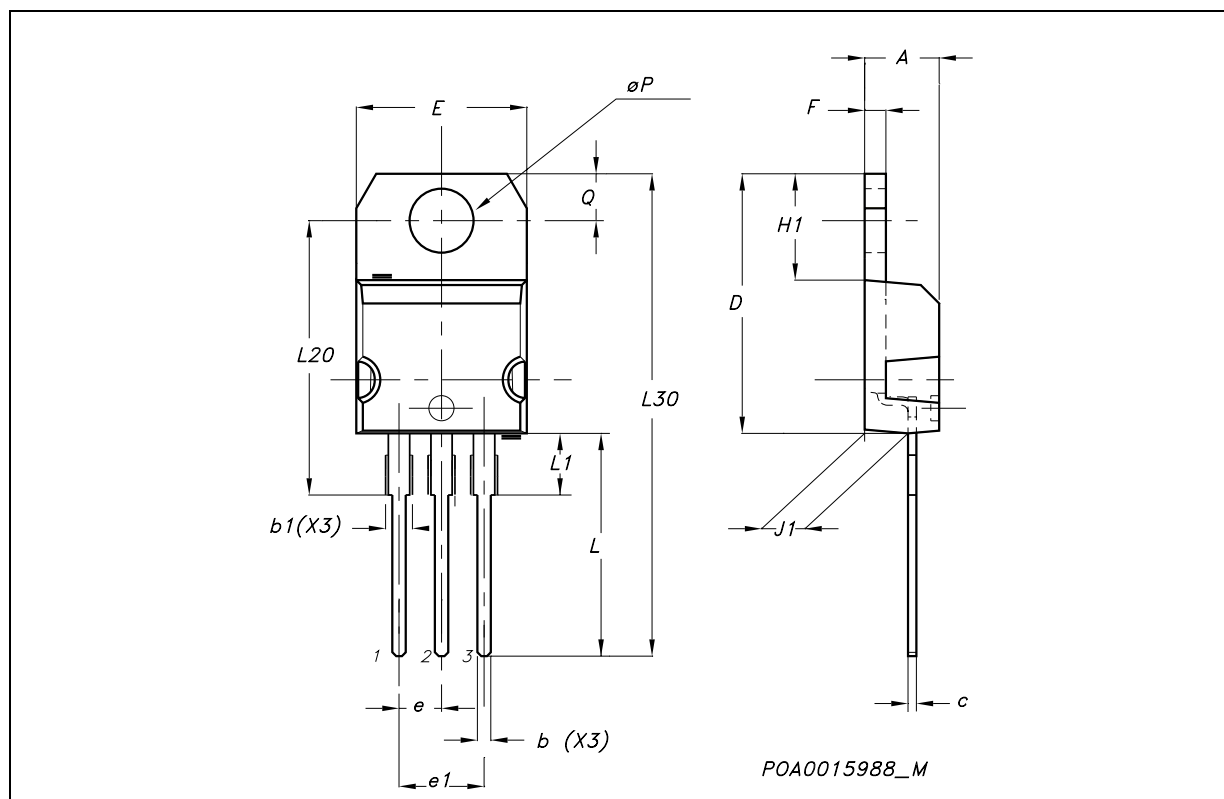


Figure 19: Gate Charge Test Circuit



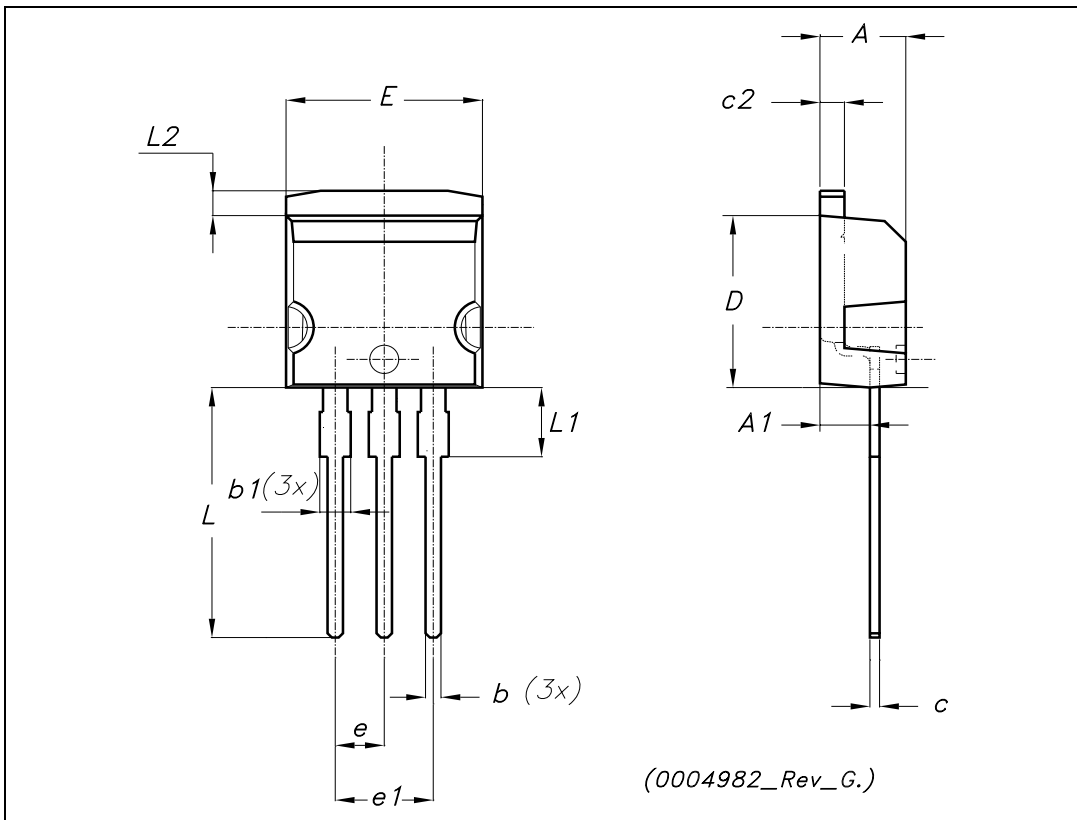
**TO-220 MECHANICAL DATA**

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**

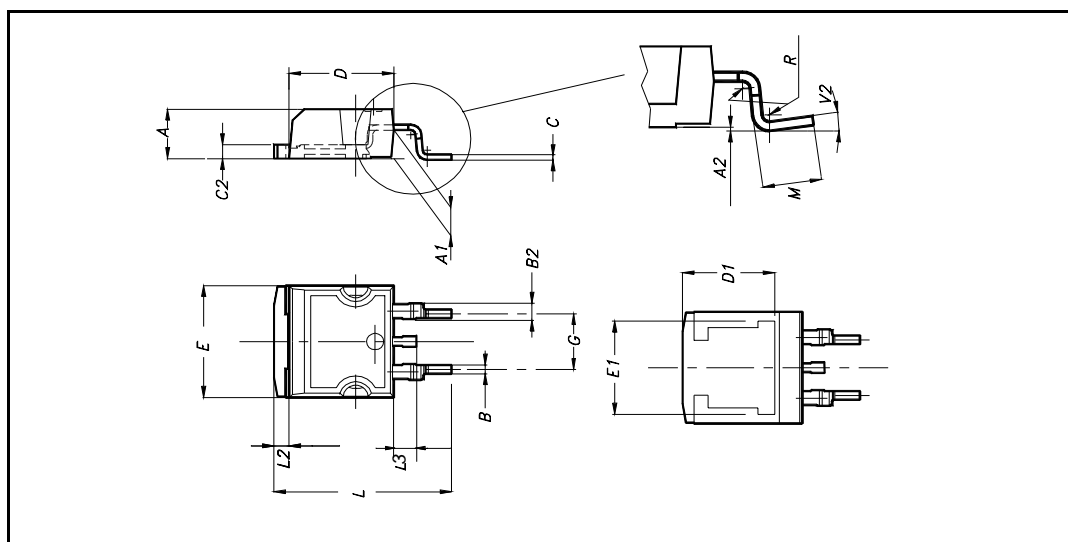
DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
A1	2.40		2.72	0.094		0.107
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.49		0.70	0.019		0.027
c2	1.23		1.32	0.048		0.052
D	8.95		9.35	0.352		0.368
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
E	10		10.40	0.393		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



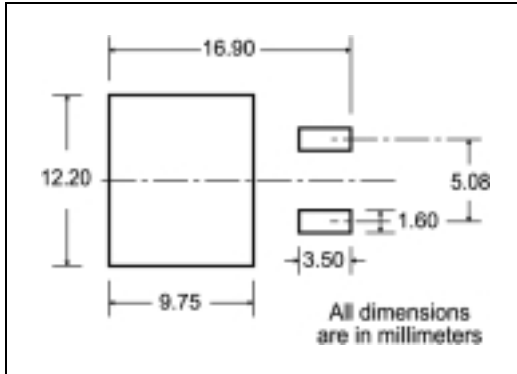


**D<sup>2</sup>PAK MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334	
G	4.88		5.28	0.192		0.208
L	15		15.85	0.590		0.625
L2	1.27		1.4	0.050		0.055
L3	1.4		1.75	0.055		0.068
M	2.4		3.2	0.094		0.126
R		0.4			0.015	
V2	0°		4°			



**D<sup>2</sup>PAK FOOTPRINT**



**TAPE AND REEL SHIPMENT**

**TAPE MECHANICAL DATA**

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	10.5	10.7	0.413	0.421
B0	15.7	15.9	0.618	0.626
D	1.5	1.6	0.059	0.063
D1	1.59	1.61	0.062	0.063
E	1.65	1.85	0.065	0.073
F	11.4	11.6	0.449	0.456
K0	4.8	5.0	0.189	0.197
P0	3.9	4.1	0.153	0.161
P1	11.9	12.1	0.468	0.476
P2	1.9	2.1	0.075	0.082
R	50		1.574	
T	0.25	0.35	0.0098	0.0137
W	23.7	24.3	0.933	0.956

**REEL MECHANICAL DATA**

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

BASE QTY	BULK QTY
1000	1000

\* on sales type

**Table 8: Revision History**

Date	Revision	Description of Changes
11/Apr/2005	1	First Release.

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