

## N - CHANNEL ENHANCEMENT MODE PowerMESH™ MOSFET

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STP6NB50	500 V	< 1.5 Ω	5.8 A
STP6NB50FP	500 V	< 1.5 Ω	3.4 A

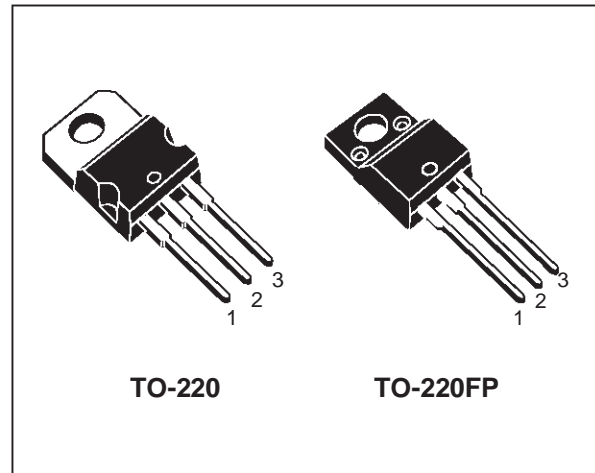
- TYPICAL R<sub>DS(on)</sub> = 1.35 Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- VERY LOW INTRINSIC CAPACITANCES
- GATE CHARGE MINIMIZED

### DESCRIPTION

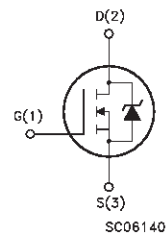
Using the latest high voltage MESH OVERLAY™ process, SGS-Thomson has designed an advanced family of power MOSFETs with outstanding performances. The new patent pending strip layout coupled with the Company's proprietary edge termination structure, gives the lowest R<sub>DS(on)</sub> per area, exceptional avalanche and dv/dt capabilities and unrivalled gate charge and switching characteristics.

### APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- DC-AC CONVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLIES AND MOTOR DRIVE



### INTERNAL SCHEMATIC DIAGRAM



### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP6NB50	STP6NB50FP	
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	500		V
V <sub>DGR</sub>	Drain- gate Voltage (R <sub>GS</sub> = 20 kΩ)	500		V
V <sub>GS</sub>	Gate-source Voltage	± 30		V
I <sub>D</sub>	Drain Current (continuous) at T <sub>c</sub> = 25 °C	5.8	3.4	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>c</sub> = 100 °C	3.7	2.1	A
I <sub>DM</sub> (•)	Drain Current (pulsed)	23.2	23.2	A
P <sub>tot</sub>	Total Dissipation at T <sub>c</sub> = 25 °C	100	35	W
	Derating Factor	0.8	0.28	W/°C
dv/dt(1)	Peak Diode Recovery voltage slope	4.5	4.5	V/ns
V <sub>ISO</sub>	Insulation Withstand Voltage (DC)	--	2000	°C
T <sub>stg</sub>	Storage Temperature	-65 to 150		°C
T <sub>j</sub>	Max. Operating Junction Temperature	150		°C

(•) Pulse width limited by safe operating area

(1) I<sub>SD</sub> ≤ 6A, di/dt ≤ 200 A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>j</sub> ≤ T<sub>JMAX</sub>

## STP6NB50/FP

### THERMAL DATA

		TO-220	TO-220FP	
R <sub>thj-case</sub>	Thermal Resistance Junction-case Max	1.25	3.57	°C/W
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient Max	62.5		°C/W
R <sub>thc-sink</sub>	Thermal Resistance Case-sink Typ	0.5		°C/W
T <sub>I</sub>	Maximum Lead Temperature For Soldering Purpose	300		°C

### AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I <sub>AR</sub>	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T <sub>j</sub> max, $\delta < 1\%$ )	5.8	A
E <sub>AS</sub>	Single Pulse Avalanche Energy (starting T <sub>j</sub> = 25 °C, I <sub>D</sub> = I <sub>AR</sub> , V <sub>DD</sub> = 50 V)	290	mJ

### ELECTRICAL CHARACTERISTICS (T<sub>case</sub> = 25 °C unless otherwise specified)

#### OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source Breakdown Voltage	I <sub>D</sub> = 250 $\mu$ A V <sub>GS</sub> = 0	500			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current (V <sub>GS</sub> = 0)	V <sub>DS</sub> = Max Rating V <sub>DS</sub> = Max Rating T <sub>c</sub> = 125 °C			1 50	$\mu$ A $\mu$ A
I <sub>GSS</sub>	Gate-body Leakage Current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = $\pm 30$ V			$\pm 100$	nA

#### ON (\*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> I <sub>D</sub> = 250 $\mu$ A	3	4	5	V
R <sub>DS(on)</sub>	Static Drain-source On Resistance	V <sub>GS</sub> = 10V I <sub>D</sub> = 2.9 A		1.35	1.5	$\Omega$
I <sub>D(on)</sub>	On State Drain Current	V <sub>DS</sub> > I <sub>D(on)</sub> x R <sub>DS(on)max</sub> V <sub>GS</sub> = 10 V	5.8			A

### DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub> (*)	Forward Transconductance	V <sub>DS</sub> > I <sub>D(on)</sub> x R <sub>DS(on)max</sub> I <sub>D</sub> = 2.9 A	2.5	4		S
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25 V f = 1 MHz V <sub>GS</sub> = 0		680	884	pF
C <sub>oss</sub>	Output Capacitance			110	149	pF
C <sub>rss</sub>	Reverse Transfer Capacitance			12	16	pF

**ELECTRICAL CHARACTERISTICS** (continued)**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 250\text{ V}$ $I_D = 2.9\text{ A}$		11.5	16	ns
$t_r$	Rise Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		8	12	ns
$Q_g$	Total Gate Charge	$V_{DD} = 400\text{ V}$ $I_D = 5.8\text{ A}$ $V_{GS} = 10\text{ V}$		21	30	nC
$Q_{gs}$	Gate-Source Charge			7.2		nC
$Q_{gd}$	Gate-Drain Charge			8		nC

**SWITCHING OFF**

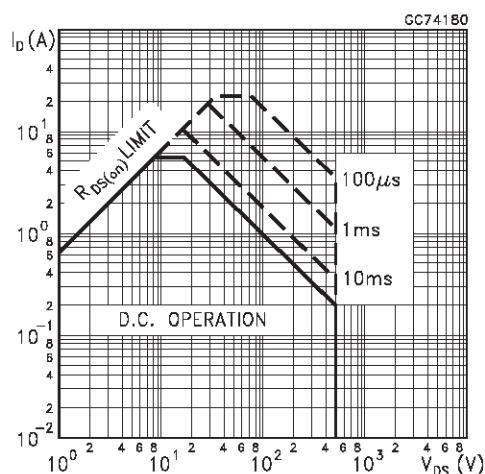
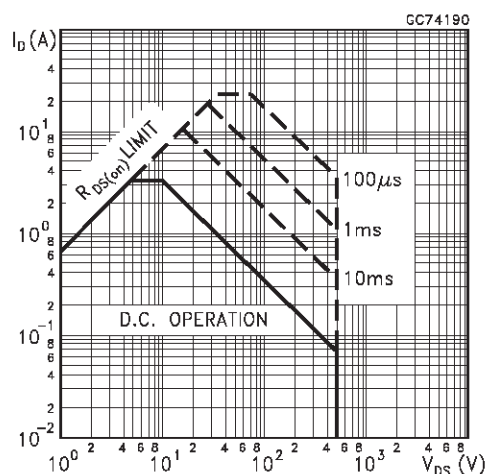
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 400\text{ V}$ $I_D = 5.8\text{ A}$		7	12	ns
$t_f$	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		5	10	ns
$t_c$	Cross-over Time			15	23	ns

**SOURCE DRAIN DIODE**

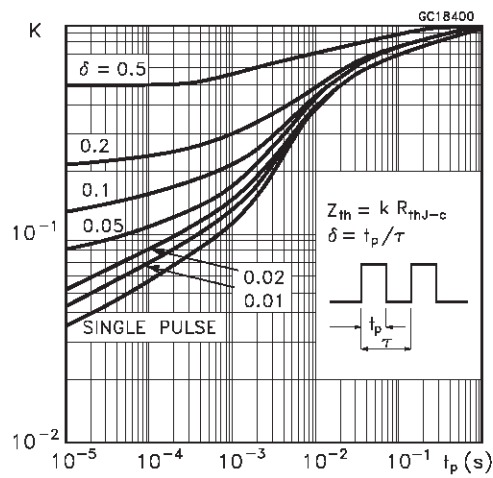
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain Current				5.8	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				23.2	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 5.8\text{ A}$ $V_{GS} = 0$			1.6	V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 5.8\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		435		ns
$Q_{rr}$	Reverse Recovery Charge			3.3		$\mu\text{C}$
$I_{RRM}$	Reverse Recovery Current			15		A

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

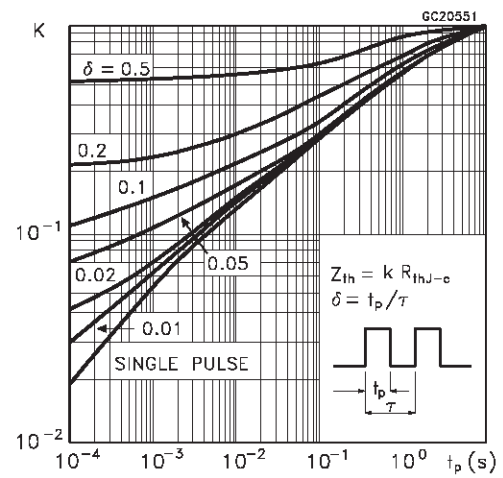
(•) Pulse width limited by safe operating area

**Safe Operating Area for TO-220****Safe Operating Area for TO-220FP**

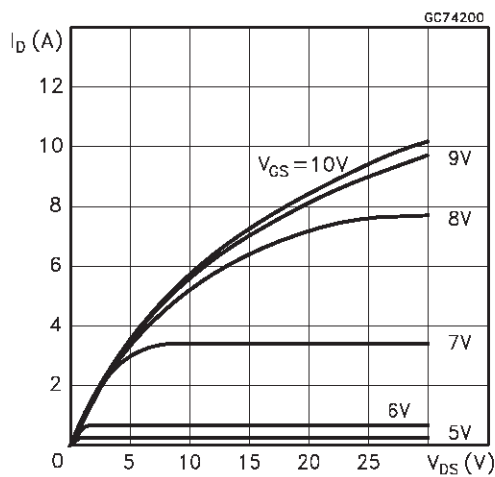
## Thermal Impedance for TO-220



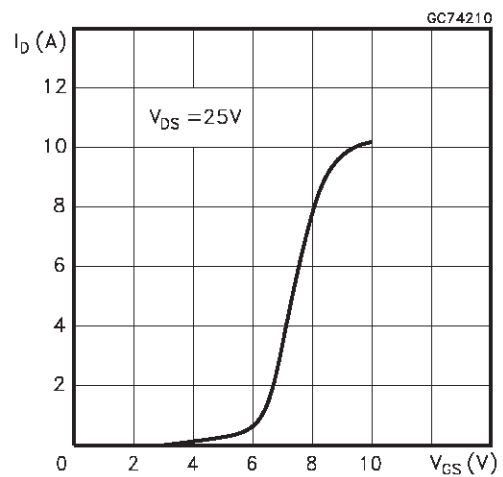
## Thermal Impedance for TO-220FP



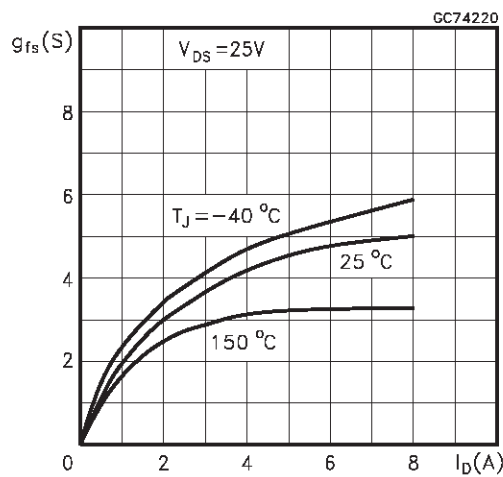
## Output Characteristics



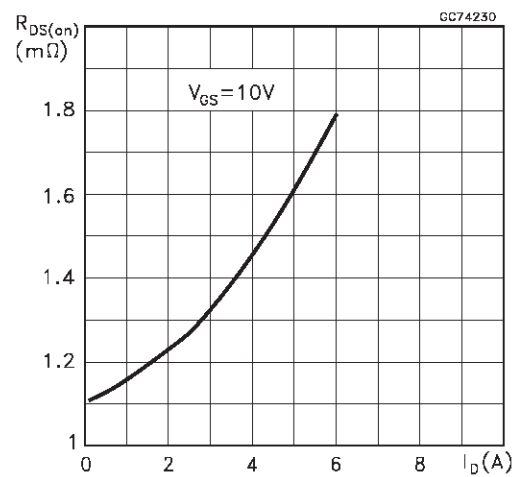
## Transfer Characteristics



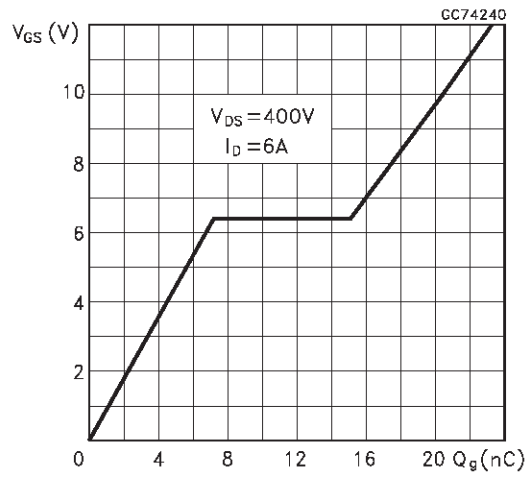
## Transconductance



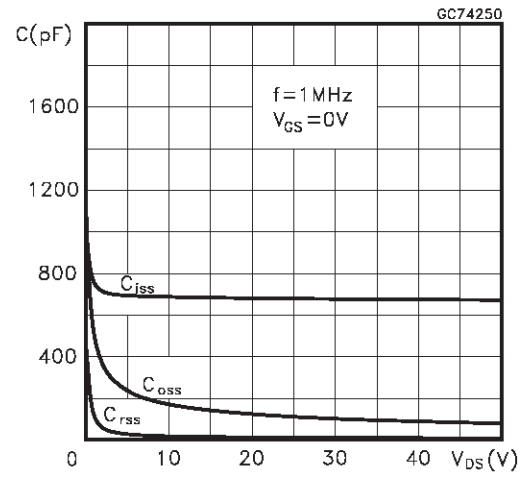
## Static Drain-source On Resistance



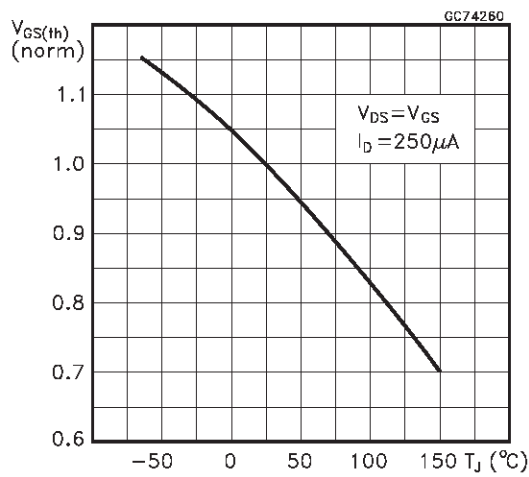
Gate Charge vs Gate-source Voltage



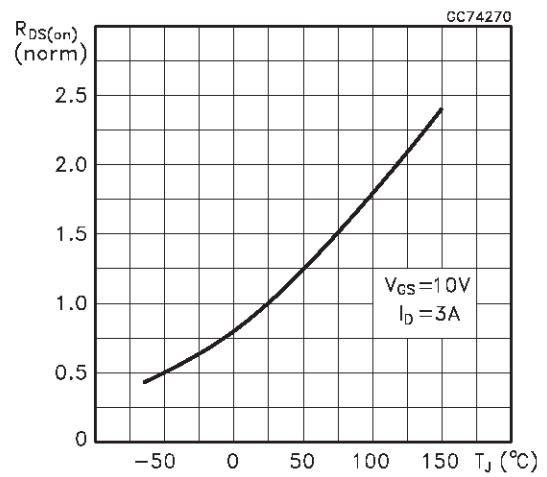
Capacitance Variations



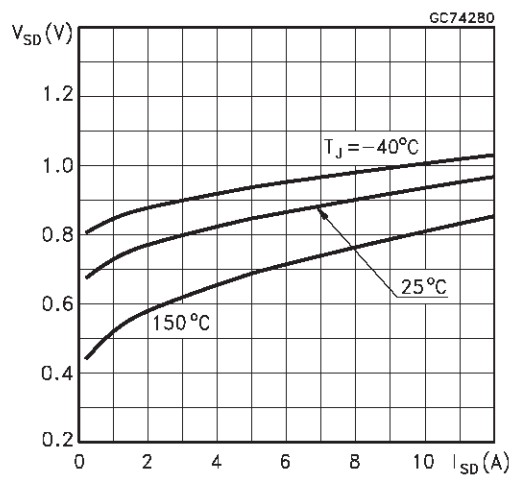
Normalized Gate Threshold Voltage vs Temperature



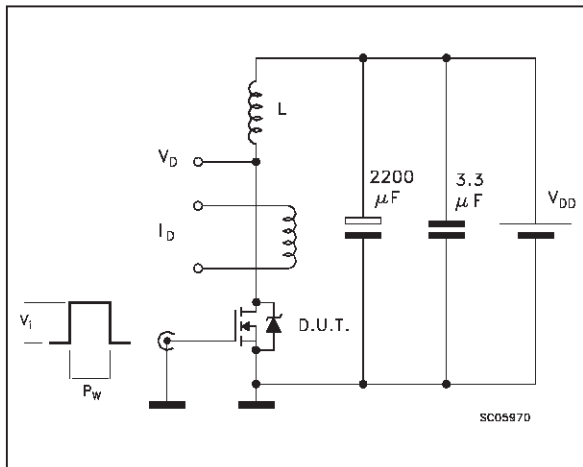
Normalized On Resistance vs Temperature



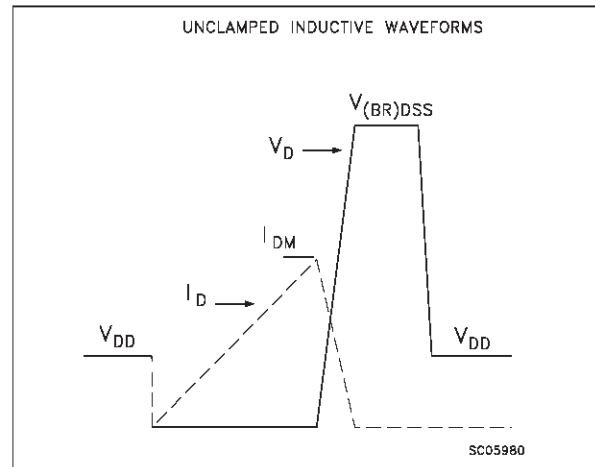
Source-drain Diode Forward Characteristics



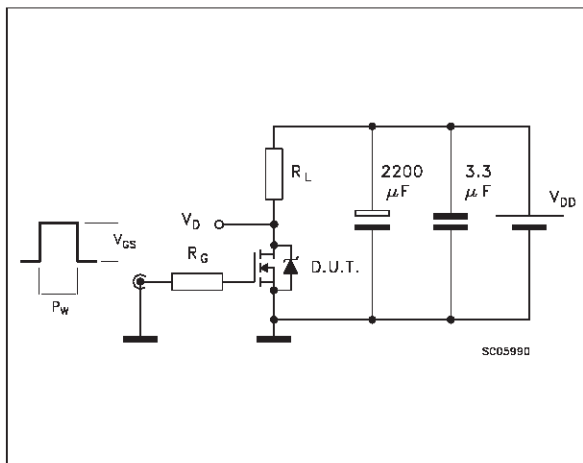
**Fig. 1: Unclamped Inductive Load Test Circuit**



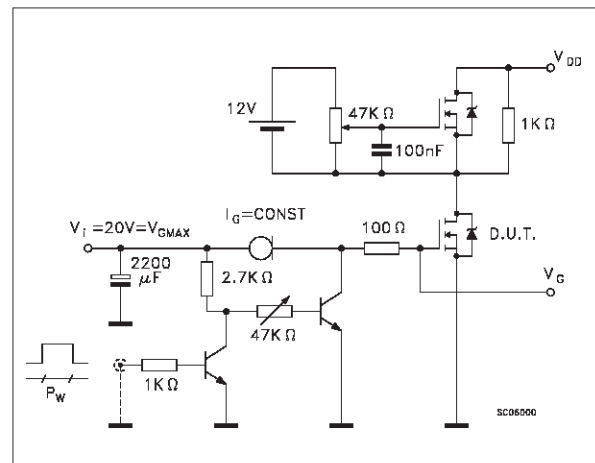
**Fig. 2: Unclamped Inductive Waveform**



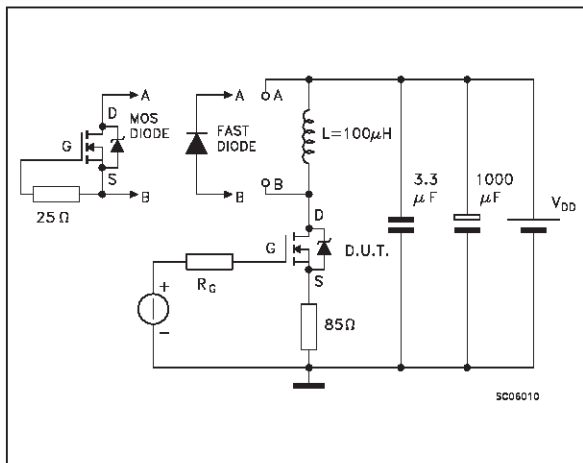
**Fig. 3: Switching Times Test Circuits For Resistive Load**



**Fig. 4: Gate Charge test Circuit**

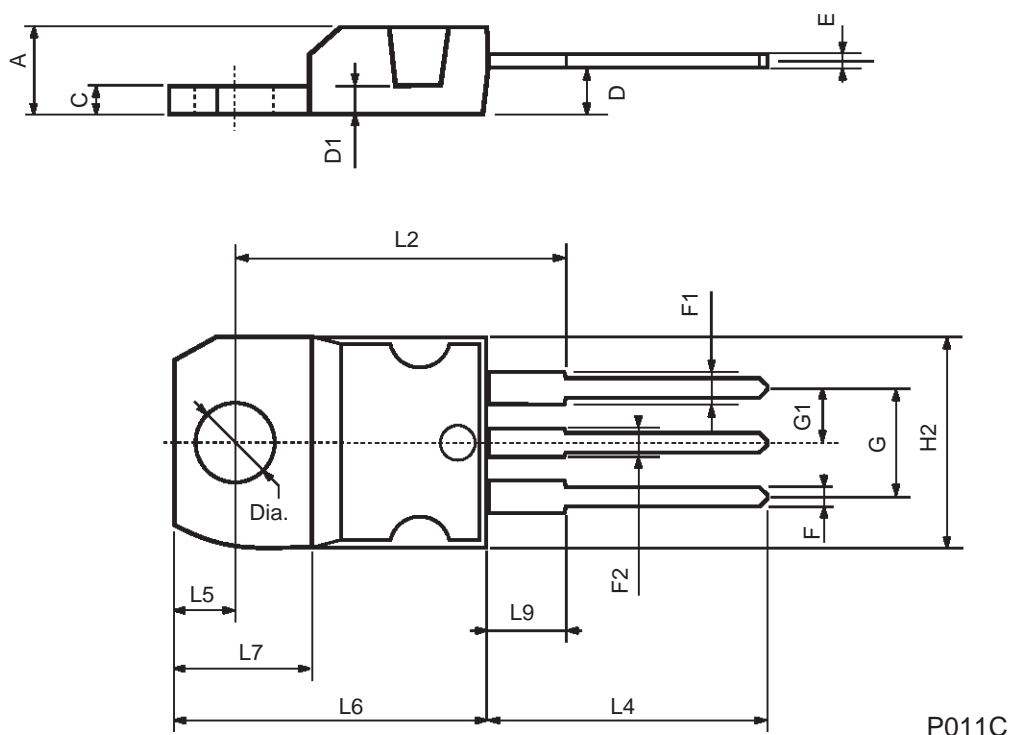


**Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times**



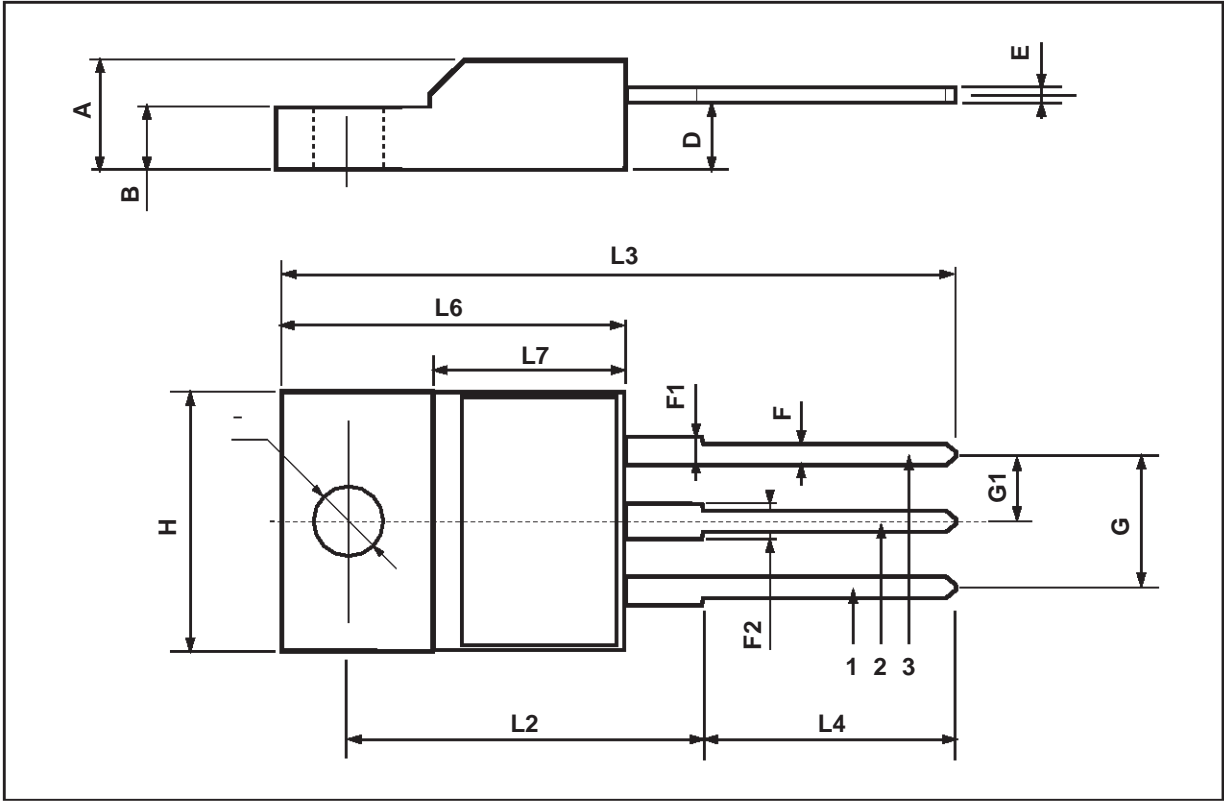
## TO-220 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
C	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
D1		1.27			0.050	
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
G1	2.4		2.7	0.094		0.106
H2	10.0		10.40	0.393		0.409
L2		16.4			0.645	
L4	13.0		14.0	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.25		15.75	0.600		0.620
L7	6.2		6.6	0.244		0.260
L9	3.5		3.93	0.137		0.154
DIA.	3.75		3.85	0.147		0.151



TO-220FP MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.7	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.7	0.045		0.067
F2	1.15		1.7	0.045		0.067
G	4.95		5.2	0.195		0.204
G1	2.4		2.7	0.094		0.106
H	10		10.4	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	0.385		0.417
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
Ø	3		3.2	0.118		0.126





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