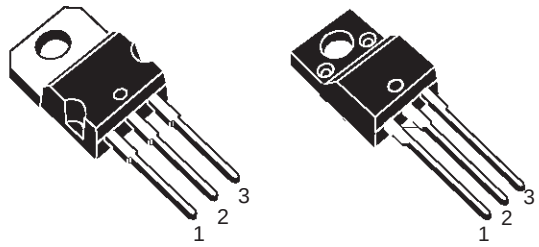
STP60NE10
STP60NE10FP

N - CHANNEL 100V - 0.016Ω - 60A TO-220/TO-220FP
STripFET™ POWER MOSFET

TYPE	V_{DSS}	$R_{DS(on)}$	I_D
STP60NE10	100 V	< 0.022 Ω	60 A
STP60NE10FP	100 V	< 0.022 Ω	30 A

- TYPICAL $R_{DS(on)}$ = 0.016 Ω
- EXCEPTIONAL dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- APPLICATION ORIENTED CHARACTERIZATION



TO-220 **TO-220FP**

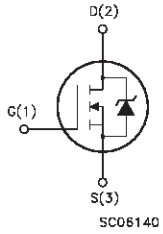
DESCRIPTION

This Power MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based 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.

APPLICATIONS

- SOLENOID AND RELAY DRIVERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- DC-DC CONVERTERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STP60NE10	STP60NE10FP	
V_{DS}	Drain-source Voltage (V_{GS} = 0)	100		V
V_{DGR}	Drain- gate Voltage (R_{GS} = 20 kΩ)	100		V
V_{GS}	Gate-source Voltage	± 20		V
I_D	Drain Current (continuous) at T_c = 25 °C	60	30	A
I_D	Drain Current (continuous) at T_c = 100 °C	42	21	A
I_{DM}(•)	Drain Current (pulsed)	240	120	A
P_{tot}	Total Dissipation at T_c = 25 °C	160	50	W
	Derating Factor	1.06	0.37	W/°C
V_{ISO}	Insulation Withstand Voltage (DC)	—	2000	V
dv/dt	Peak Diode Recovery voltage slope	7		V/ns
T_{stg}	Storage Temperature	-65 to 175		°C
T_j	Max. Operating Junction Temperature	175		°C

(•) Pulse width limited by safe operating area (1) $I_{SD} \leq 60$ A, di/dt ≤ 300 A/µs, $V_{DD} \leq V_{(BR)DSS}$, $T_j \leq T_{JMAX}$

THERMAL DATA

			TO-220	TO-220FP	
$R_{thj\text{-}case}$	Thermal Resistance Junction-case	Max	0.94	2.7	$^oC/W$
$R_{thj\text{-}amb}$	Thermal Resistance Junction-ambient	Max	62.5		$^oC/W$
$R_{thc\text{-}sink}$	Thermal Resistance Case-sink	Typ	0.5		$^oC/W$
T_l	Maximum Lead Temperature For Soldering Purpose		300		^oC

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max)	60	A
E_{AS}	Single Pulse Avalanche Energy (starting T_j = 25 ^oC, $I_D = I_{AR}$, V_{DD} = 35V)	100	mJ

ELECTRICAL CHARACTERISTICS (T_{case} = 25 ^oC unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	I_D = 250 µA V_{GS} = 0	100			V
I_{DSS}	Zero Gate Voltage Drain Current (V_{GS} = 0)	V_{DS} = Max Rating V_{DS} = Max Rating T_c = 125 ^oC			1 10	µA µA
I_{GSS}	Gate-body Leakage Current (V_{DS} = 0)	V_{GS} = ± 20 V			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS} I_D = 250 µA	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	V_{GS} = 10V I_D = 30 A		0.016	0.022	Ω
$I_{D(on)}$	On State Drain Current	V_{DS} > $I_{D(on)}$ x $R_{DS(on)max}$ V_{GS} = 10 V	60			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	V_{DS} > $I_{D(on)}$ x $R_{DS(on)max}$ I_D =18 A		30		S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V_{DS} = 25 V f = 1 MHz V_{GS} = 0		5300 640 215		pF pF pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Delay Time Rise Time	V_{DD} = 50 V I_D = 30 A R_G = 4.7 Ω V_{GS} = 10 V (Resistive Load, see fig. 3)		28 100		ns ns
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	V_{DD} = 80 V I_D = 60 A V_{GS} = 10 V		142 27 59	185	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$ t_f	Turn-off Delay Time Fall Time	V_{DD} = 50 V I_D = 30 A R_G = 4.7 Ω V_{GS} = 10 V (Resistive Load, see fig. 3)		160 45		ns ns
$t_{r(Voff)}$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	V_{clamp} = 80 V I_D = 60 A R_G = 4.7 Ω V_{GS} = 10 V (Inductive Load, see fig. 5)		40 45 85		ns ns ns

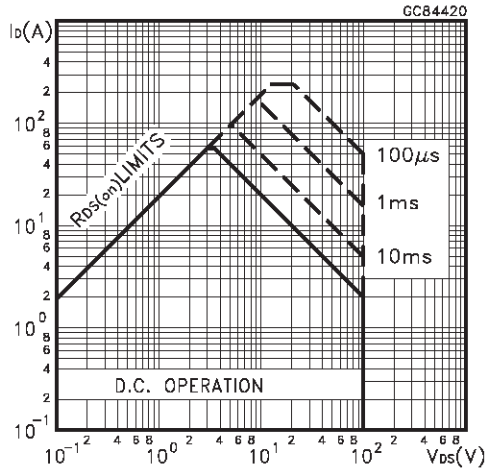
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM}(•)	Source-drain Current Source-drain Current (pulsed)				60 240	A A
V_{SD} (*)	Forward On Voltage	I_{SD} = 60 A V_{GS} = 0			1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_{SD} = 60 A di/dt = 100 A/µs V_{DD} = 50 V T_j = 150 °C (see test circuit, fig. 5)		170 1.02 12		ns µC A

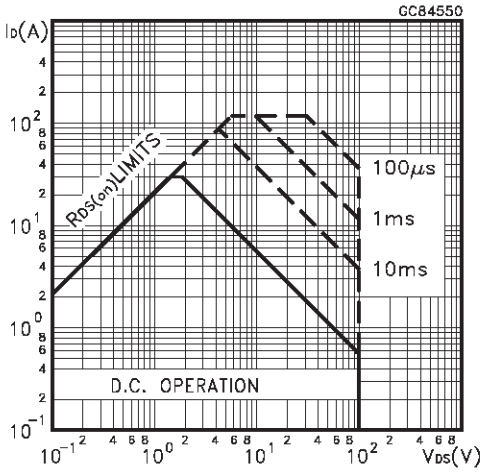
(*) Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %

(•) Pulse width limited by safe operating area

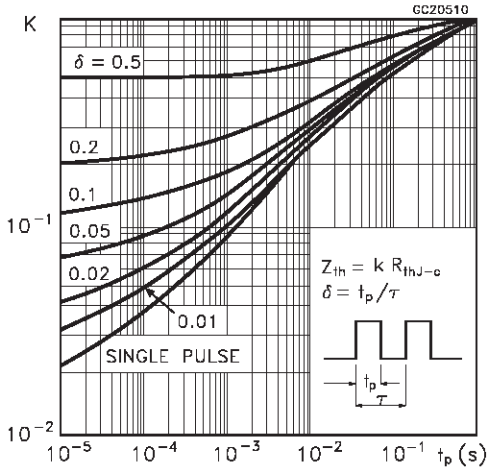
Safe Operating Area for TO-220



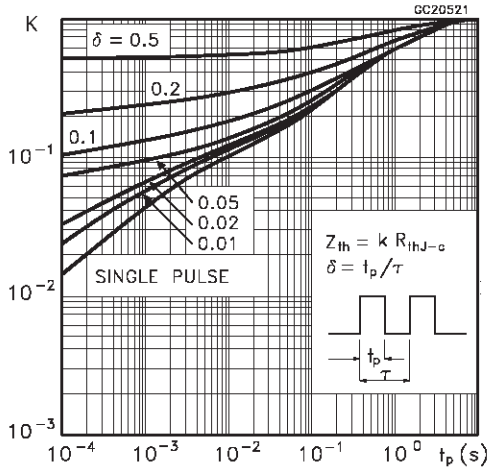
Safe Operating Area for TO-220FP



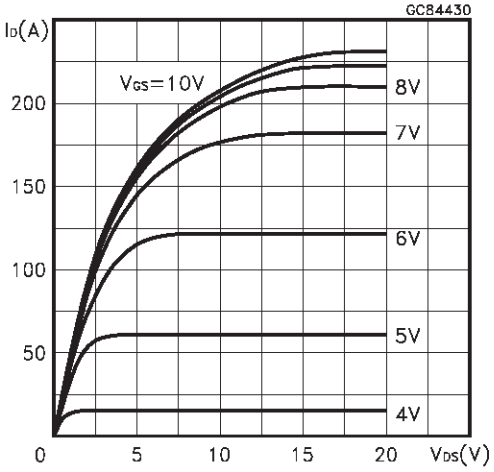
Thermal Impedance for TO-220



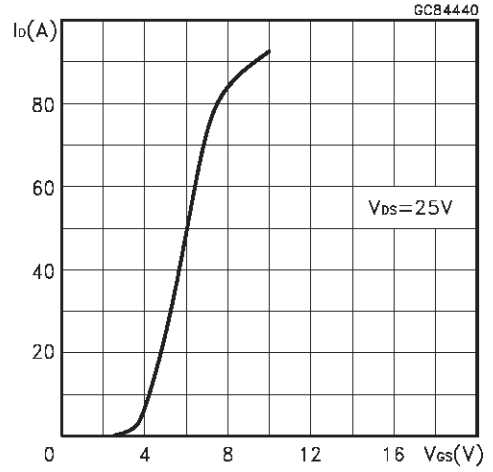
Thermal Impedance forTO-220FP



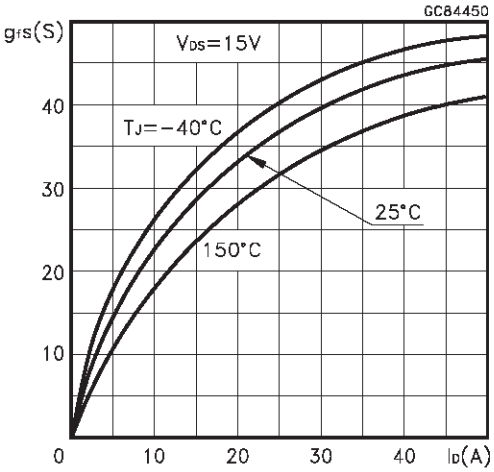
Output Characteristics



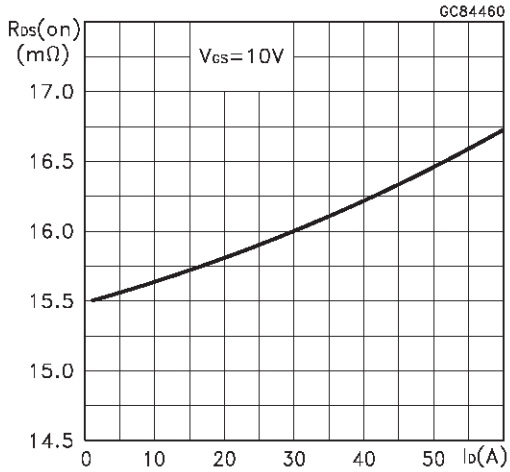
Transfer Characteristics



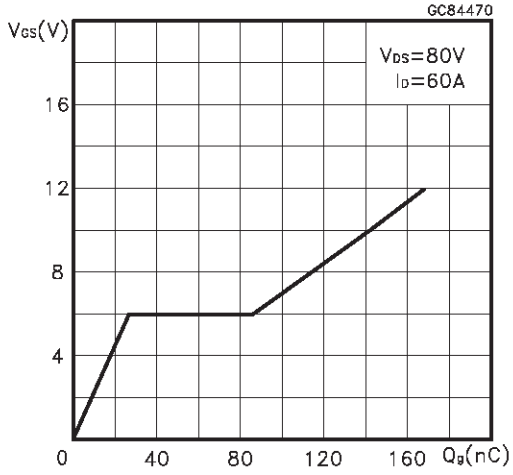
Transconductance



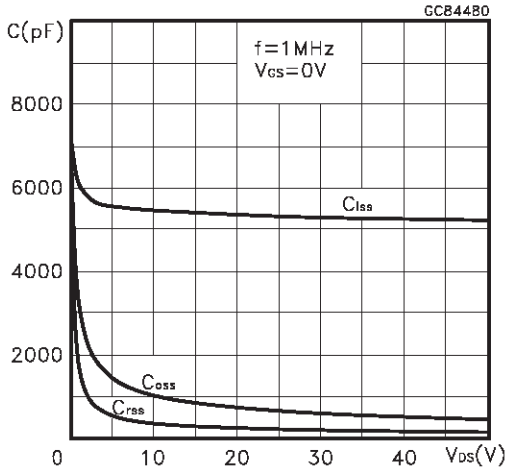
Static Drain-source On Resistance



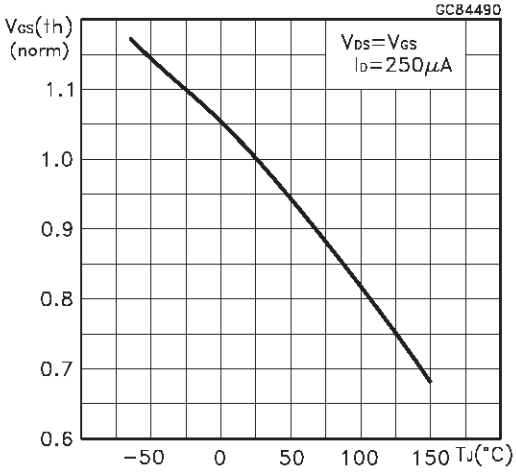
Gate Charge vs Gate-source Voltage



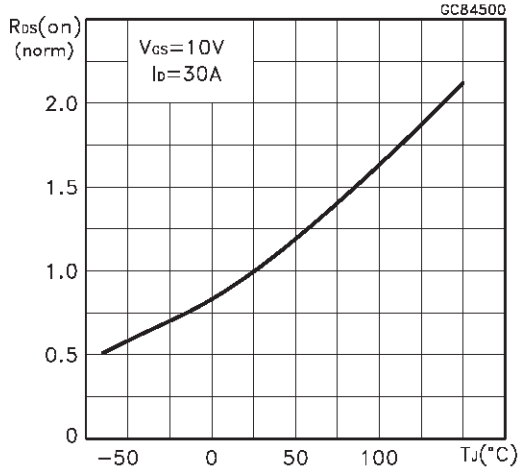
Capacitance Variations



Normalized Gate Threshold Voltage vs Temperature



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics

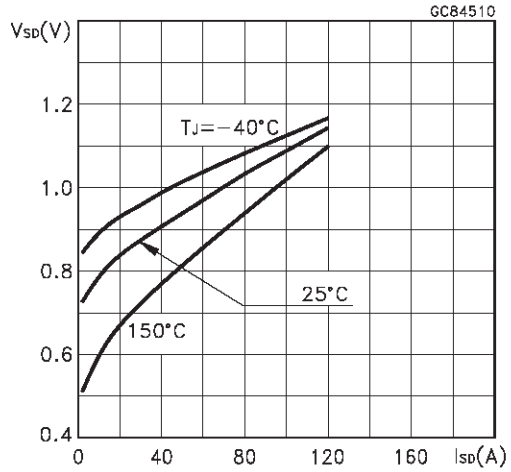


Fig. 1: Unclamped Inductive Load Test Circuit

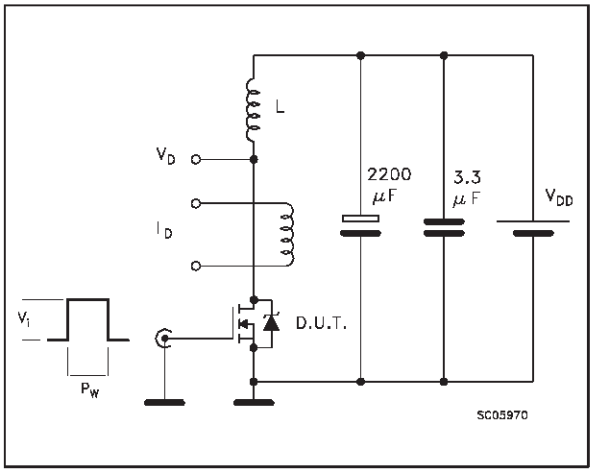


Fig. 2: Unclamped Inductive Waveform

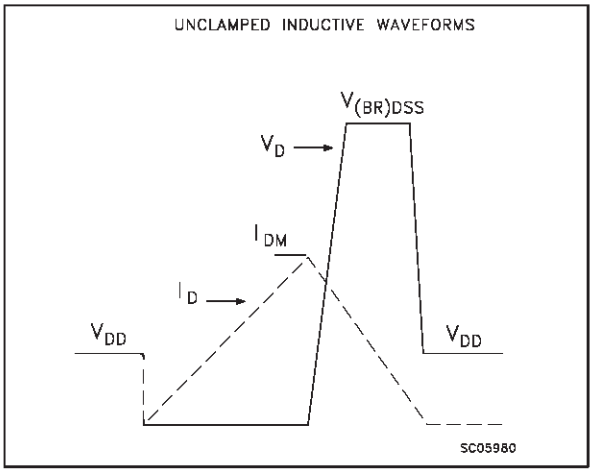


Fig. 3: Switching Times Test Circuits For Resistive Load

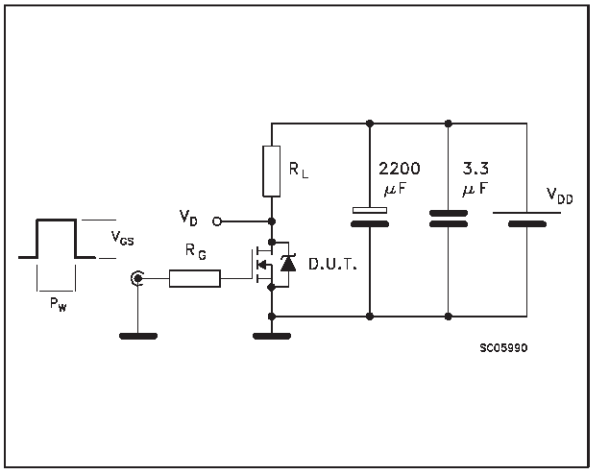


Fig. 4: Gate Charge test Circuit

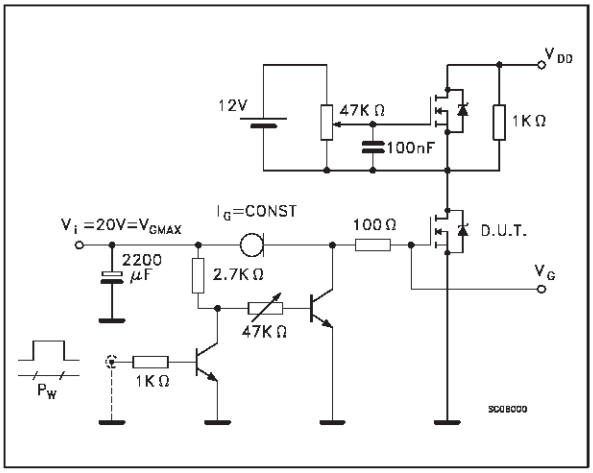
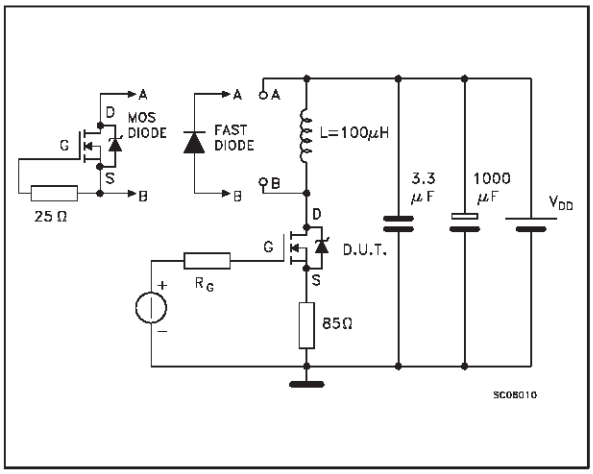
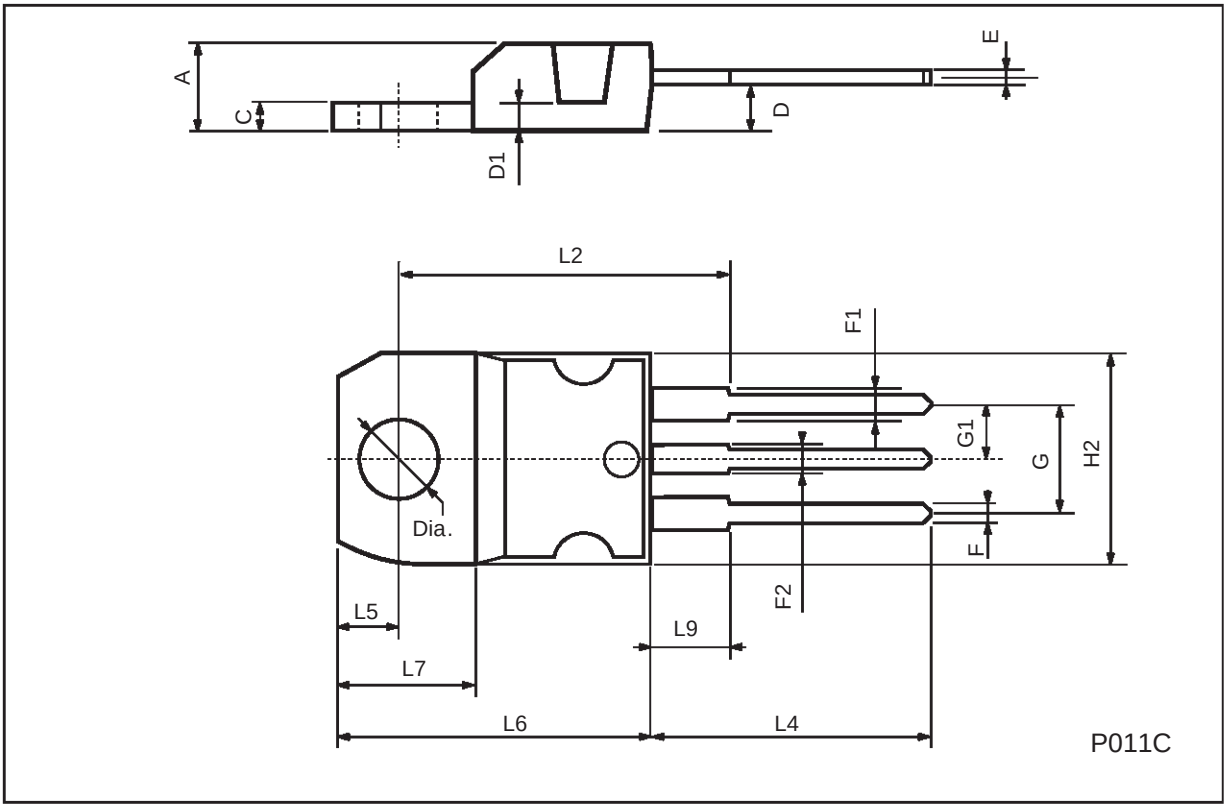


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



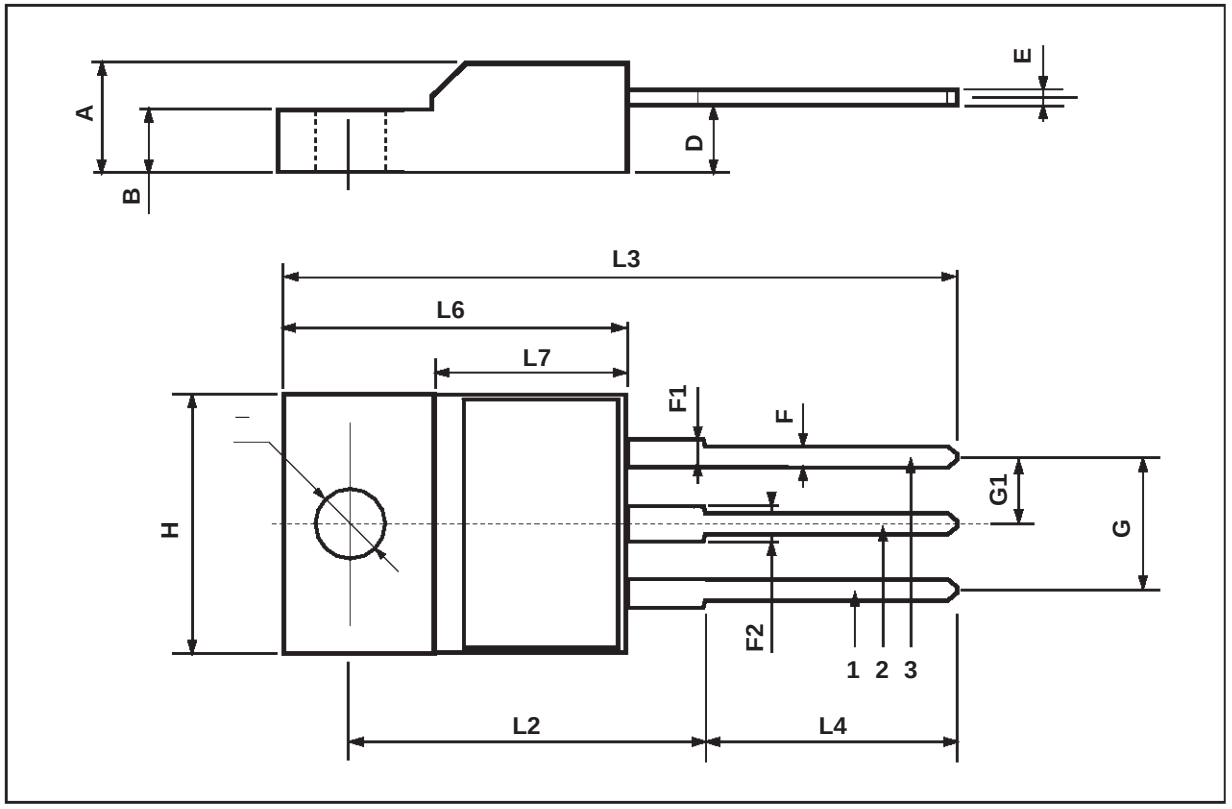
TO-220 MECHANICAL DATA

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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