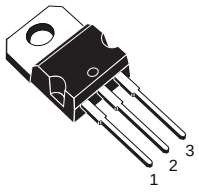
STP60NS04Z

N-CHANNEL CLAMPED 10mΩ - 60A TO-220
FULLY PROTECTED MESH OVERLAY™ MOSFET

TYPE	V_{DSS}	$R_{DS(on)}$	I_D
STP60NS04Z	CLAMPED	<0.015 Ω	60 A

- TYPICAL $R_{DS}(on)$ = 0.010 Ω
- 100% AVALANCHE TESTED
- LOW CAPACITANCE AND GATE CHARGE
- 175 ^{o}C MAXIMUM JUNCTION TEMPERATURE



TO-220

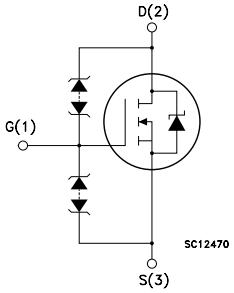
DESCRIPTION

This fully clamped Mosfet is produced by using the latest advanced Company's Mesh Overlay process which is based on a novel strip layout.
The inherent benefits of the new technology coupled with the extra clamping capabilities make this product particularly suitable for the harshest operation conditions such as those encountered in the automotive environment. Any other application requiring extra ruggedness is also recommended.

APPLICATIONS

- ABS, SOLENOID DRIVERS
- MOTOR CONTROL
- DC-DC CONVERTERS

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source Voltage (V_{GS} = 0)	CLAMPED	V
V_{DG}	Drain-gate Voltage	CLAMPED	V
V_{GS}	Gate- source Voltage	CLAMPED	V
I_D	Drain Current (continuous) at T_C = 25°C	60	A
I_D	Drain Current (continuous) at T_C = 100°C	42	A
I_{DG}	Drain Gate Current (continuous)	± 50	mA
I_{GS}	Gate SourceCurrent (continuous)	± 50	mA
I_{DM}(•)	Drain Current (pulsed)	240	A
P_{tot}	Total Dissipation at T_C = 25°C	140	W
	Derating Factor	0.93	W/°C
$V_{ESD(G-S)}$	Gate-Source ESD (HBM - C = 100pF, R=1.5 kΩ)	2	kV
$V_{ESD(G-D)}$	Gate-Drain ESD (HBM - C = 100pF, R=1.5 kΩ)	4	kV
$V_{ESD(D-S)}$	Drain-source ESD (HBM - C = 100pF, R=1.5 kΩ)	4	kV
T_{stg}	Storage Temperature	-65 to 175	°C
T_j	Max. Operating Junction Temperature	-40 to 175	°C

(•) Pulse width limited by safe operating area.

THERMAL DATA

Rthj-case	Thermal Resistance Junction-case	Max	1.07	°C/W
Rthj-case	Thermal Resistance Junction-case	Typ	0.85	°C/W
Rthj-amb	Thermal Resistance Junction-ambient	Max	62.5	°C/W
Rthc-sink	Thermal Resistance Case-sink	Typ	0.5	°C/W
T_l	Maximum Lead Temperature For Soldering Purpose		300	°C

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 °C, $I_D = I_{AR}$, V_{DD} = 30 V)	550	mJ

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Clamped Voltage	I_D = 1 mA, V_{GS} = 0 -40 < T_J < 175 °C	33			V
I_{DSS}	Zero Gate Voltage Drain Current (V_{GS} = 0)	V_{DS} = 16 V T_J =150 °C V_{DS} = 16 V T_J =175 °C			50 100	µA µA
I_{GSS}	Gate-body Leakage Current (V_{DS} = 0)	V_{GS} = ± 10 V T_J =175 °C V_{GS} = ± 16 V T_J =175 °C			50 150	µA µA
V_{GSS}	Gate-Source Breakdown Voltage	I_{GS} = 100 µA	18			V

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ I_D = 1 mA -40 < T_J < 150 °C	1.7	3	4.2	V
$R_{DS(on)}$	Static Drain-source On Resistance	V_{GS} = 10 V I_D = 30 A V_{GS} = 16 V I_D = 30 A		11 10	15 14	mΩ mΩ
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$, V_{GS} = 10V	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=30A	20	30		S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V_{DS} = 25V, f = 1 MHz, V_{GS} = 0		2500 800 150	3400 1100 200	pF pF pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	V_{DD}= 16 V I_D= 60 A V_{GS}= 10V		68 15 19	100	nC nC nC

SWITCHING OFF

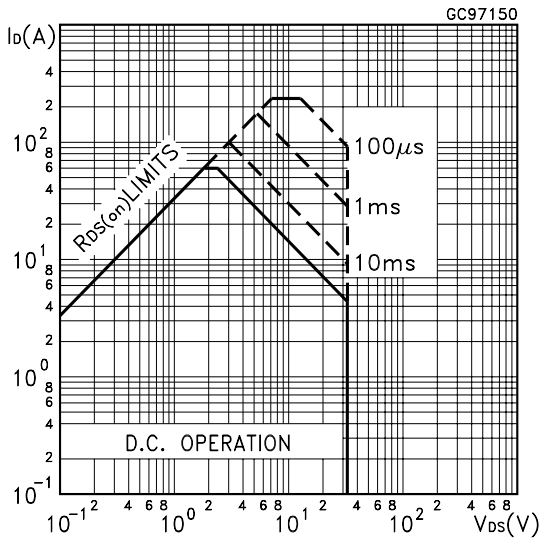
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	V_{clamp} = 30 V I_D = 60 A R_G = 4.7Ω, V_{GS} = 10 V (Inductive Load, Figure 5)		85 145 90	110 180 120	ns ns ns

SOURCE DRAIN DIODE

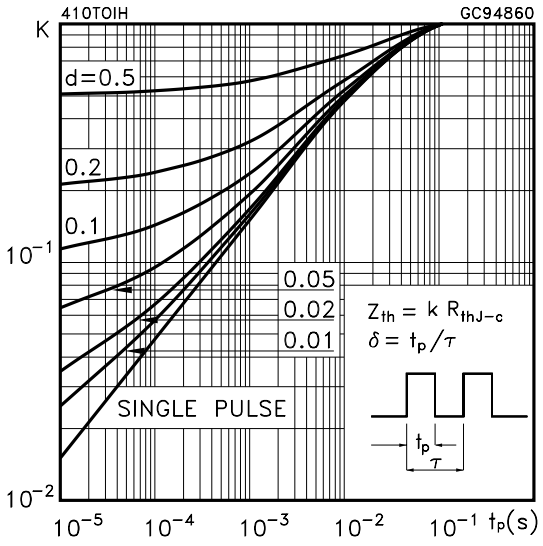
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (•)	Source-drain Current Source-drain Current (pulsed)				60 240	A A
V_{SD} (*)	Forward On Voltage	I_{SD} = 60 A V_{GS} = 0			1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_{SD} = 60 A di/dt = 100A/µs V_{DD} = 25 V T_j = 150°C (see test circuit, Figure 5)		65 0.15 4.5		ns µC A

(*)Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %.
(•)Pulse width limited by safe operating area.

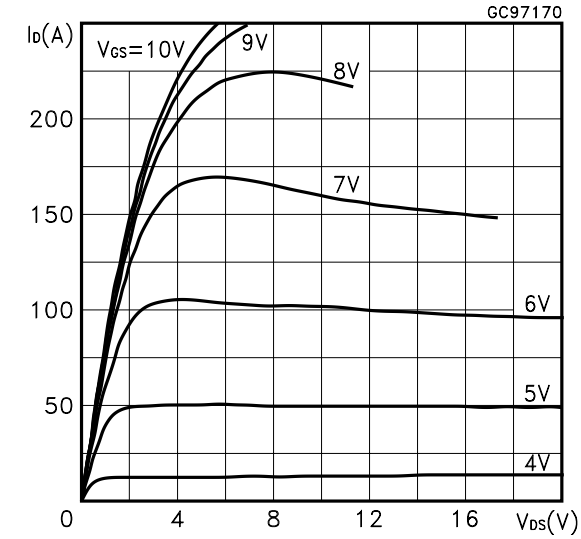
Safe Operating Area



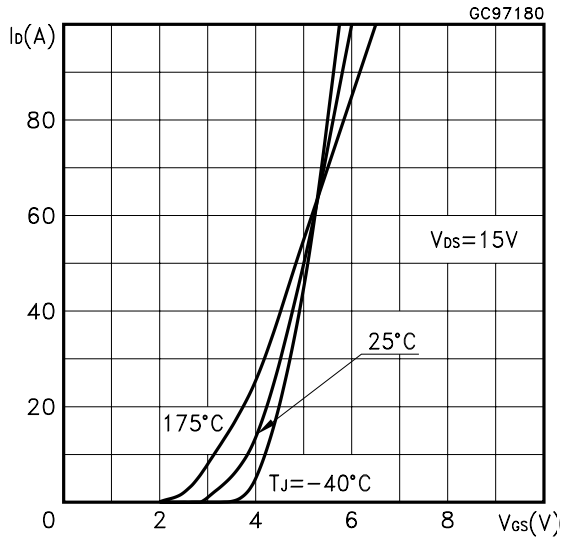
Thermal Impedance



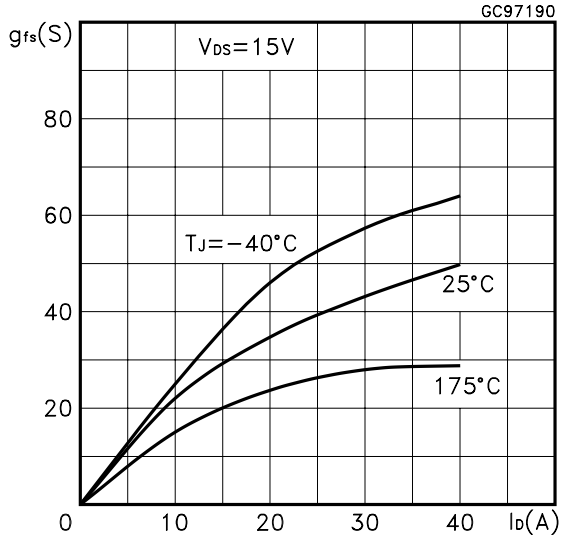
Output Characteristics



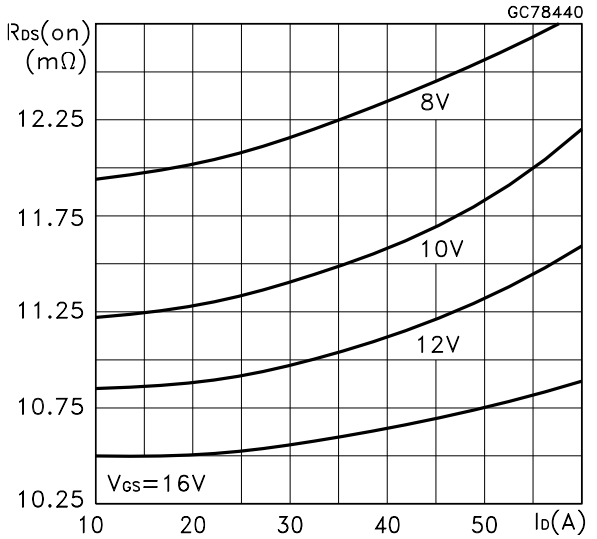
Transfer Characteristics



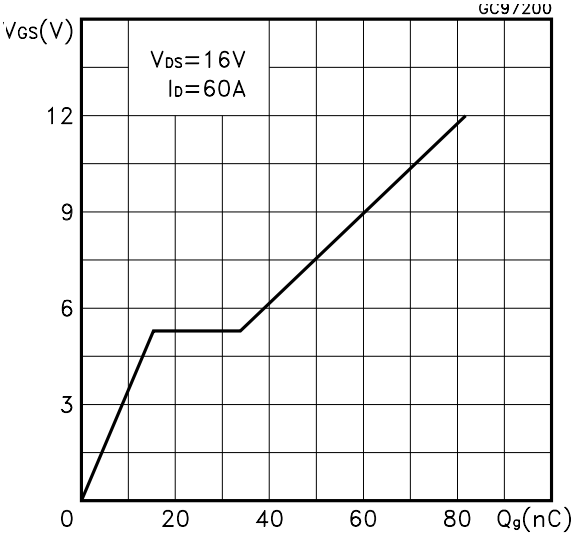
Transconductance



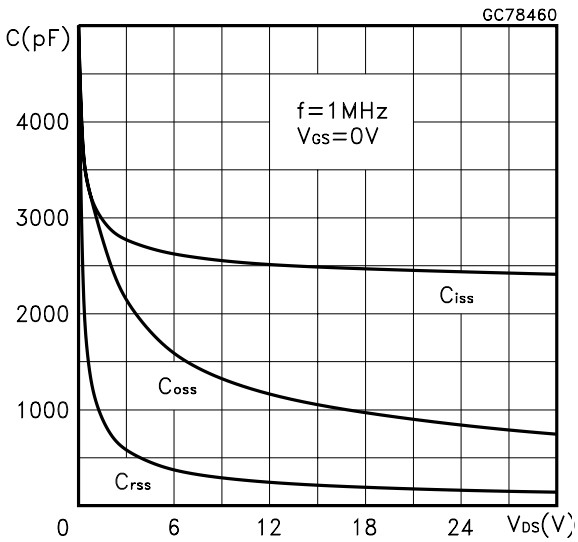
Static Drain-source On Resistance



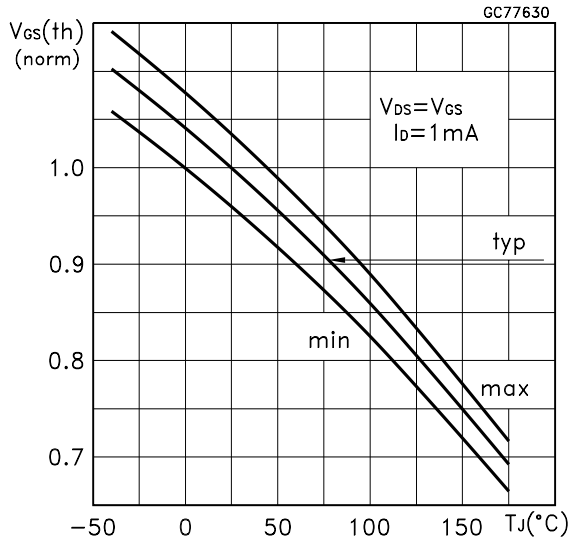
Gate Charge vs Gate-source Voltage



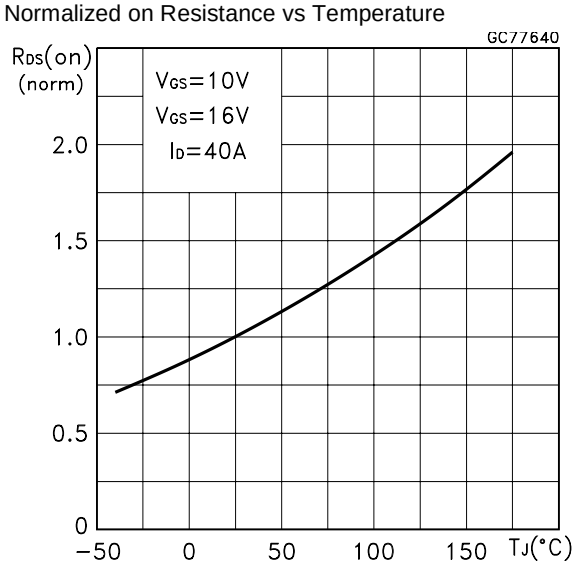
Capacitance Variations



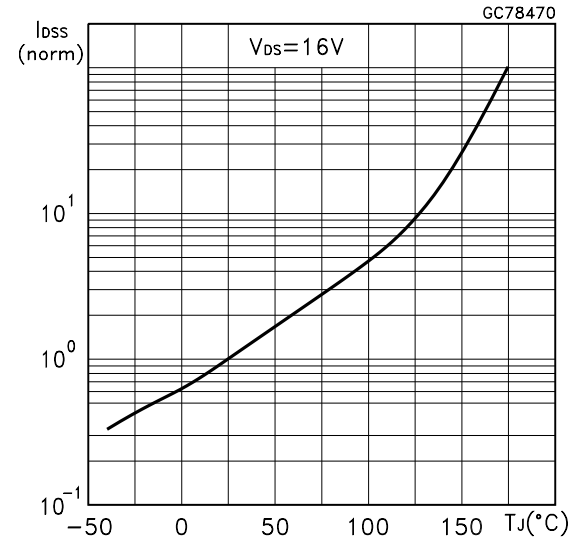
Normalized Gate Threshold Voltage vs Temperature



Normalized on Resistance vs Temperature



Zero Gate Voltage Drain Current vs Temperature



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Source-drain Diode Forward Characteristics.

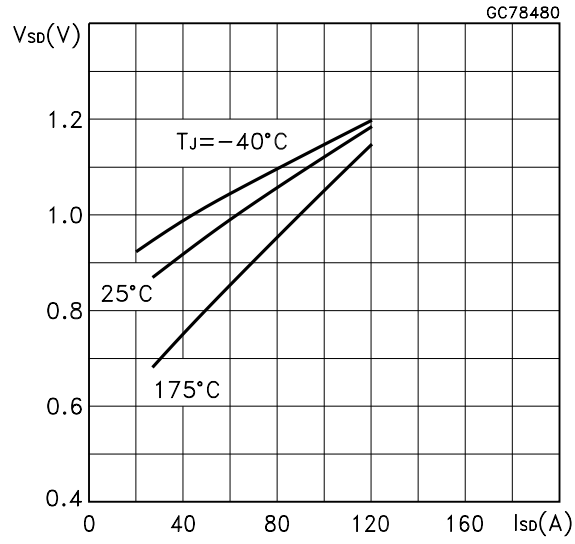

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Fig. 1: Unclamped Inductive Load Test Circuit

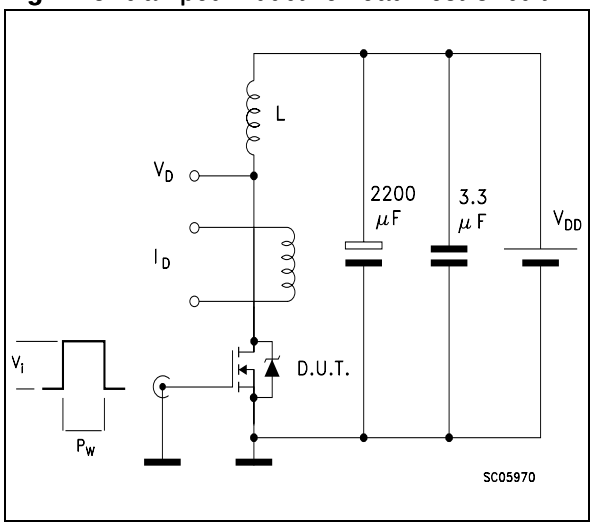


Fig. 2: Unclamped Inductive Waveform

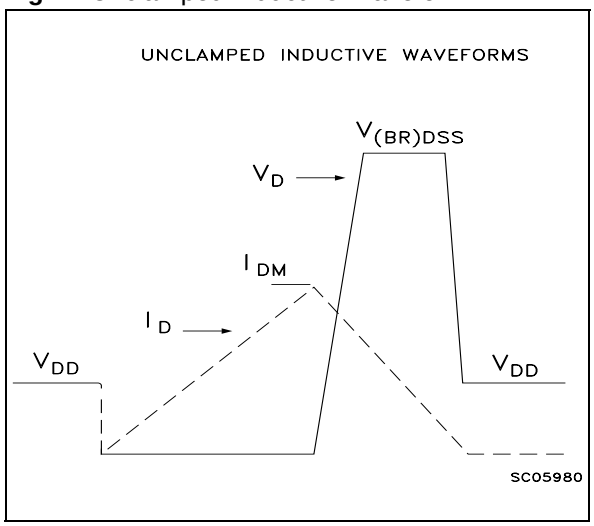


Fig. 3: Switching Times Test Circuits For Resistive Load

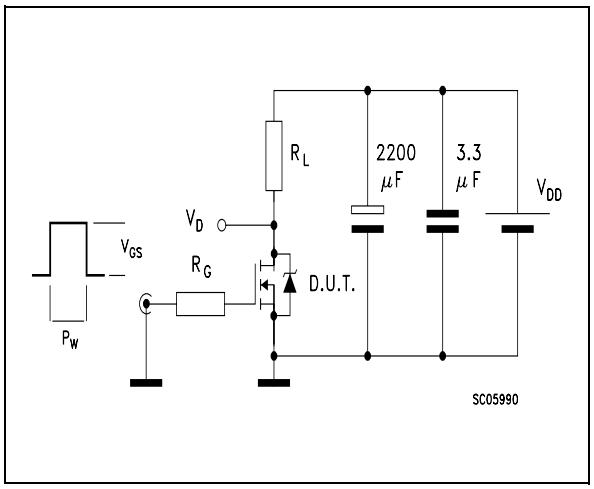


Fig. 4: Gate Charge test Circuit

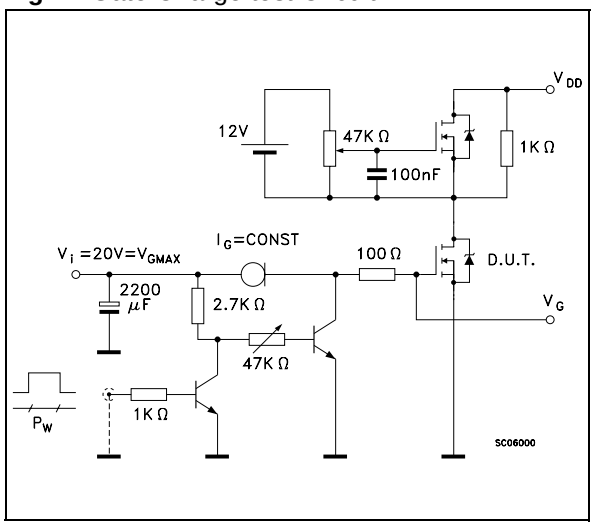
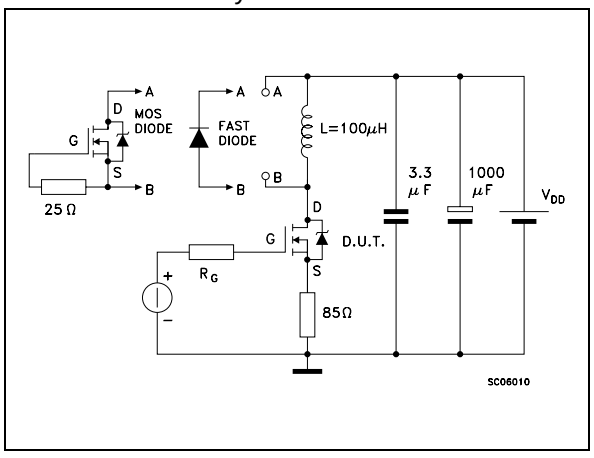
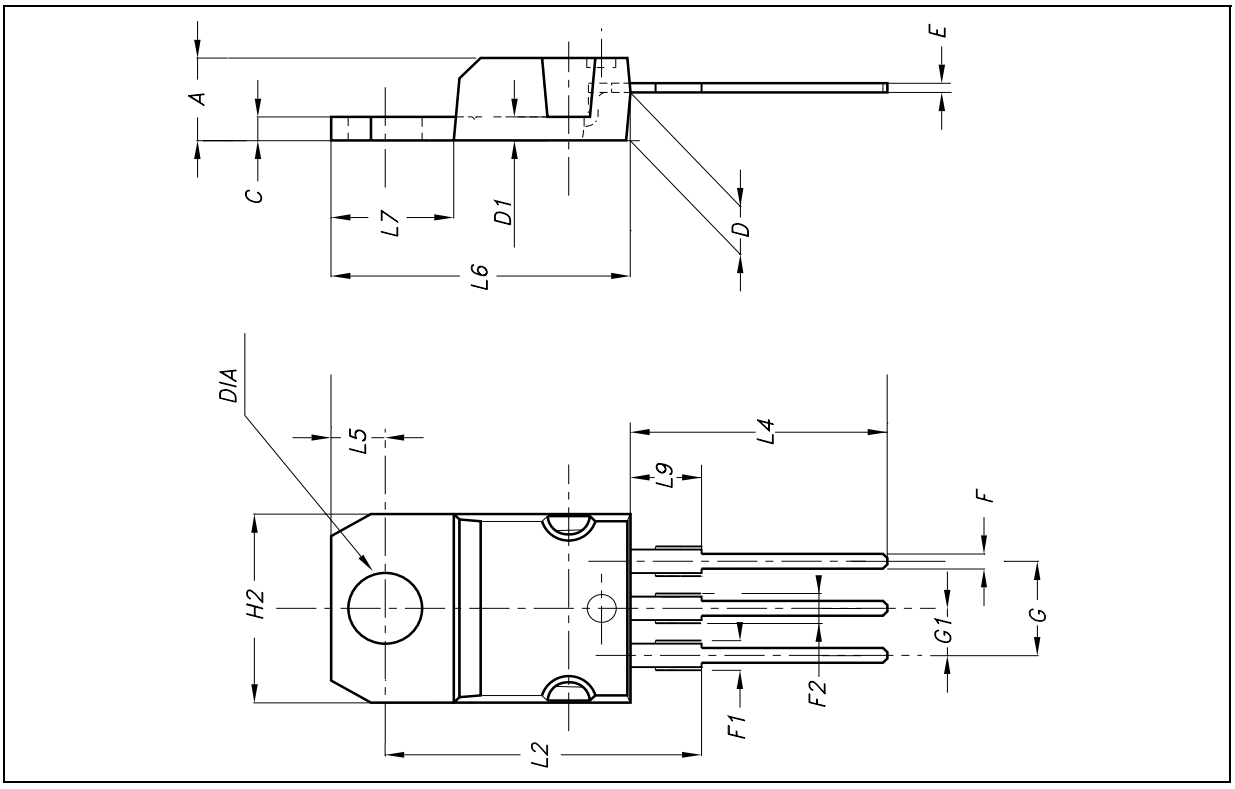


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



TO-220 MECHANICAL DATA

DIM.	mm.			inch.		
	MIN.	TYP.	MAX.	MIN.	TYP.	TYP.
A	4.4		4.6	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	2.40		2.70	0.094		0.106
H2	10		10.40	0.393		0.409
L2	16.10	16.40	16.73	0.633	0.645	0.658
L4	13		14	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.25		15.75	0.600		0.620
L7	6.20		6.60	0.244		0.260
L9	3.50		3.93	0.137		0.154
DIA	3.75		3.85	0.147		0.151



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