



# IRFP460

## N - CHANNEL 500V - 0.22 $\Omega$ - 20 A - TO-247 PowerMESH™ MOSFET

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
IRFP460	500 V	< 0.27 $\Omega$	20 A

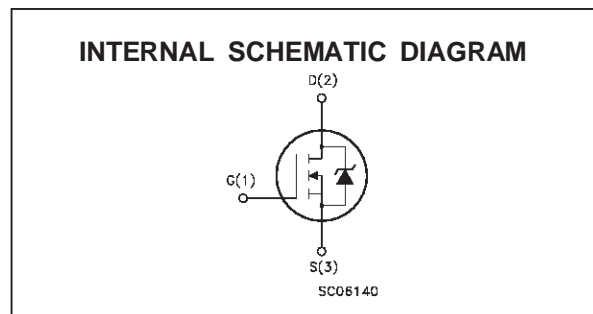
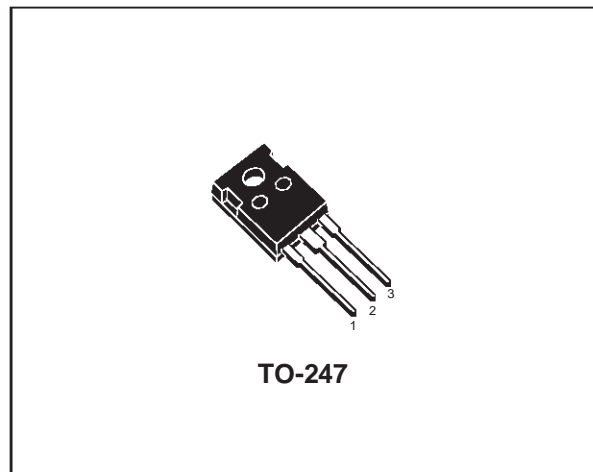
- TYPICAL R<sub>DS(on)</sub> = 0.22  $\Omega$
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- VERY LOW INTRINSIC CAPACITANCES
- GATE CHARGE MINIMIZED

### DESCRIPTION

This power MOSFET is designed using the company's consolidated strip layout-based MESH OVERLAY™ process. This technology matches and improves the performances compared with standard parts from various sources.

### APPLICATIONS

- HIGH CURRENT SWITCHING
- UNINTERRUPTIBLE POWER SUPPLY (UPS)
- DC/DC CONVERTERS FOR TELECOM, INDUSTRIAL, AND LIGHTING EQUIPMENT.



### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
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 k $\Omega$ )	500	V
V <sub>GS</sub>	Gate-source Voltage	$\pm$ 20	V
I <sub>D</sub>	Drain Current (continuous) at T <sub>c</sub> = 25 °C	20	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>c</sub> = 100 °C	13	A
I <sub>DM</sub> (•)	Drain Current (pulsed)	80	A
P <sub>tot</sub>	Total Dissipation at T <sub>c</sub> = 25 °C	250	W
	Derating Factor	2	W/°C
dv/dt(1)	Peak Diode Recovery voltage slope	3.5	V/ns
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>  $\leq$  20 A, di/dt  $\leq$  160 A/ $\mu$ s, V<sub>DD</sub>  $\leq$  V<sub>(BR)DSS</sub>, T<sub>j</sub>  $\leq$  T<sub>JMAX</sub>

# IRFP460

## THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	0.5	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	30	$^{\circ}C/W$
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.1	$^{\circ}C/W$
$T_I$	Maximum Lead Temperature For Soldering Purpose		300	$^{\circ}C$

## AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
$I_{AR}$	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by $T_j$ max)	20	A
$E_{AS}$	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}C$ , $I_D = I_{AR}$ , $V_{DD} = 50 V$ )	1000	mJ

## ELECTRICAL CHARACTERISTICS ( $T_{case} = 25^{\circ}C$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250 \mu A$ $V_{GS} = 0$	500			V
$I_{DSS}$	Zero Gate Voltage Drain Current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating}$ $T_c = 125^{\circ}C$			10 100	$\mu A$ $\mu A$
$I_{GSS}$	Gate-body Leakage Current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20 V$			$\pm 100$	nA

ON (\*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250 \mu A$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10V$ $I_D = 12 A$		0.22	0.27	$\Omega$
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10 V$	20			A

## DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs}$ (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 12 A$	13			S
$C_{iss}$	Input Capacitance	$V_{DS} = 25 V$ $f = 1 MHz$ $V_{GS} = 0$		4200		pF
$C_{oss}$	Output Capacitance			500		pF
$C_{rss}$	Reverse Transfer Capacitance			50		pF

**ELECTRICAL CHARACTERISTICS** (continued)

**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 250\text{ V}$ $I_D = 10\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 1)		32		ns
$t_r$	Rise Time			15		ns
$Q_g$	Total Gate Charge	$V_{DD} = 400\text{ V}$ $I_D = 20\text{ A}$ $V_{GS} = 10\text{ V}$		100	130	nC
$Q_{gs}$	Gate-Source Charge			21		nC
$Q_{gd}$	Gate-Drain Charge			37		nC

**SWITCHING OFF**

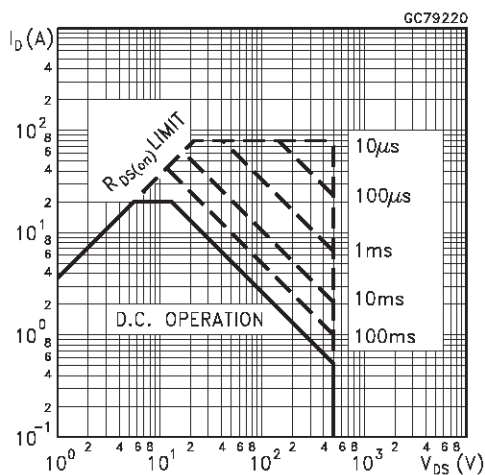
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 400\text{ V}$ $I_D = 20\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		20		ns
$t_f$	Fall Time			25		ns
$t_c$	Cross-over Time			47		ns

**SOURCE DRAIN DIODE**

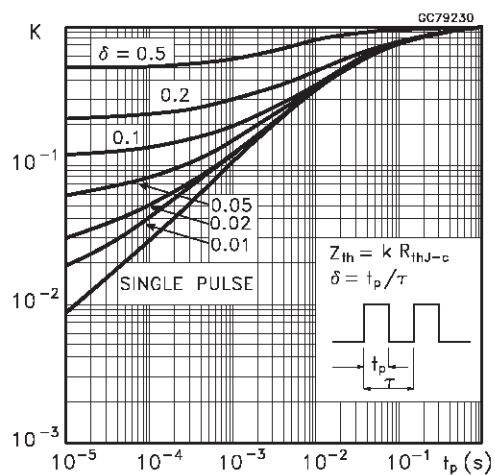
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain Current				20	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				80	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 20\text{ A}$ $V_{GS} = 0$			1.6	V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 20\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 3)		700		ns
$Q_{rr}$	Reverse Recovery Charge			9		$\mu\text{C}$
$I_{RRM}$	Reverse Recovery Current			25		A

(\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %  
 (•) Pulse width limited by safe operating area

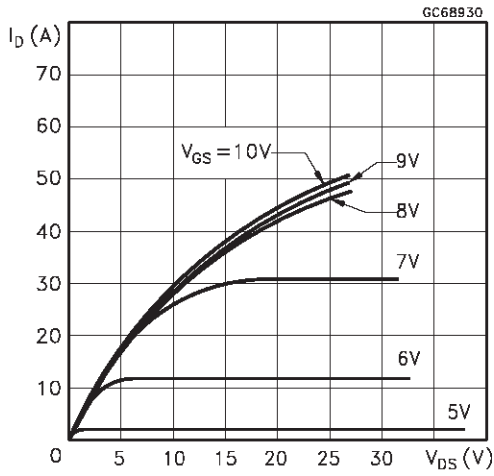
**Safe Operating Area**



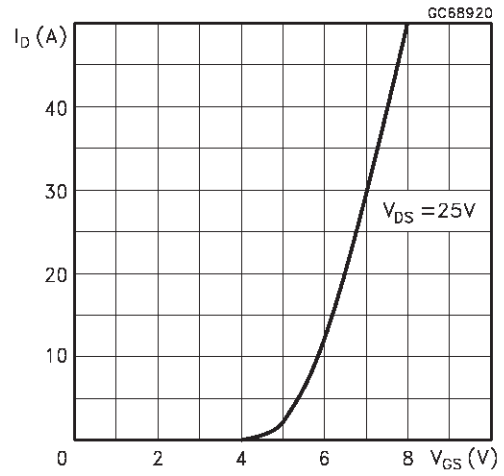
**Thermal Impedance**



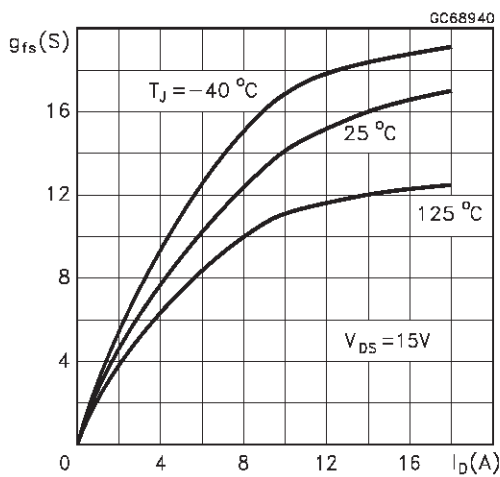
Output Characteristics



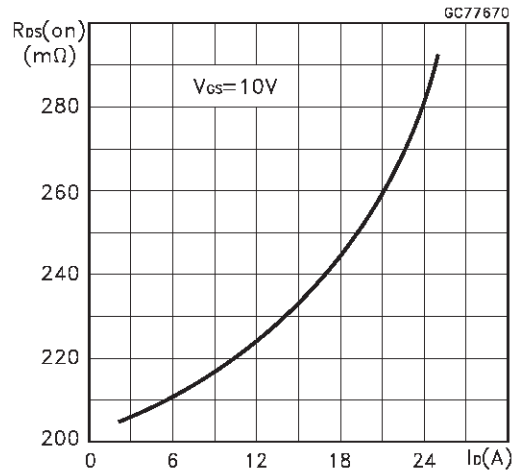
Transfer Characteristics



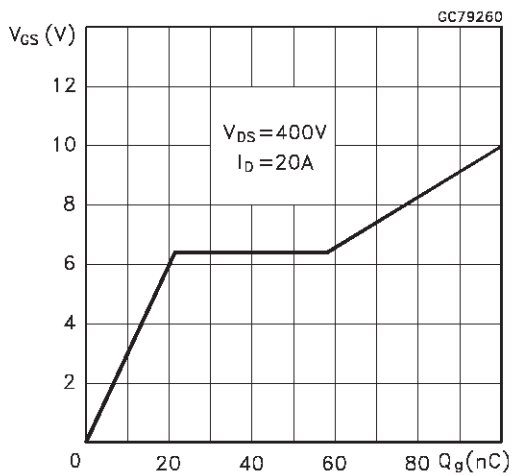
Transconductance



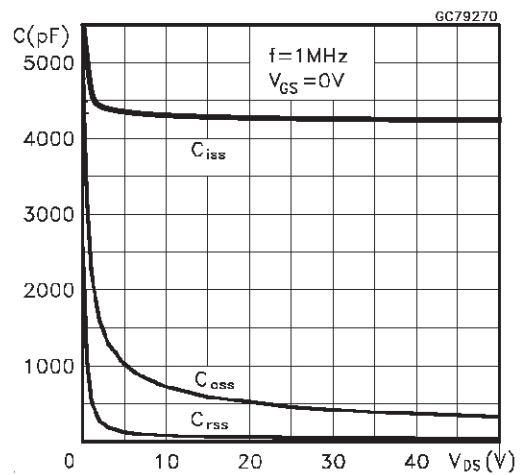
Static Drain-source On Resistance



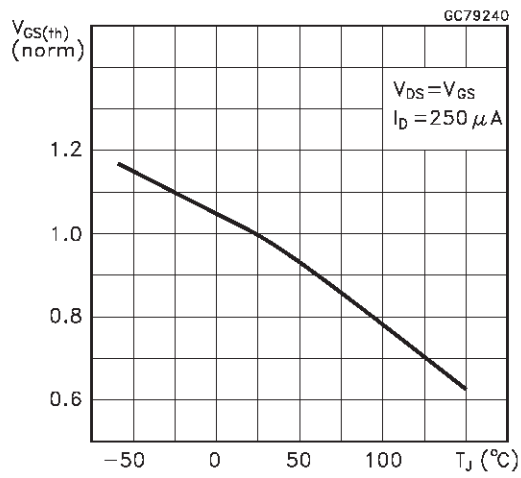
Gate Charge vs Gate-source Voltage



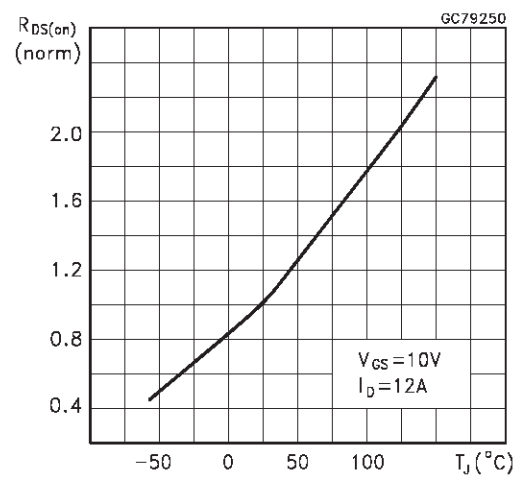
Capacitance Variations



Normalized Gate Threshold Voltage vs



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics

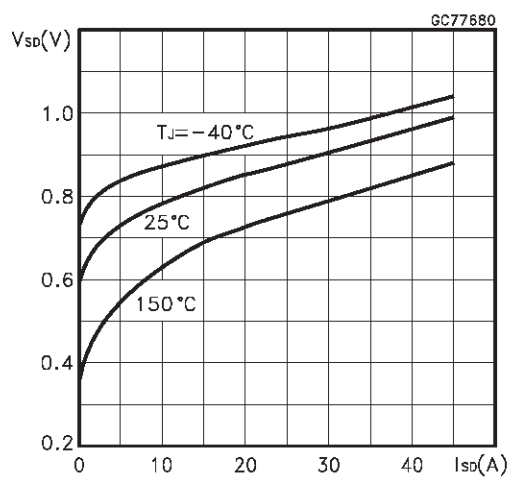


Fig. 1: Unclamped Inductive Load Test Circuit

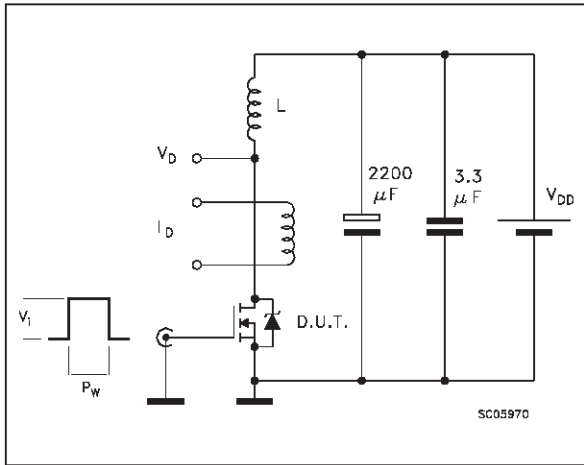


Fig. 1: Unclamped Inductive Waveform

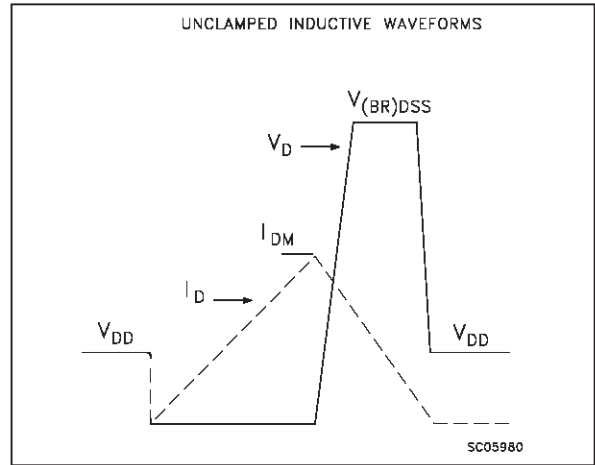


Fig. 3: Switching Times Test Circuits For Resistive Load

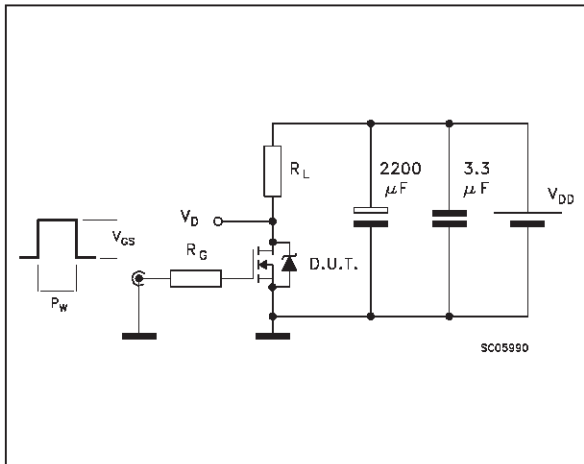


Fig. 4: Gate Charge test Circuit

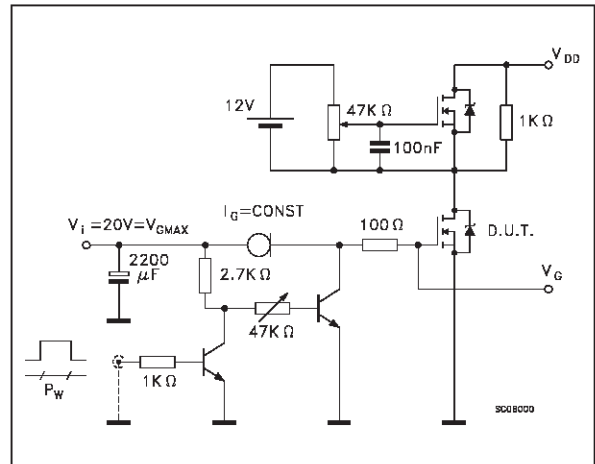
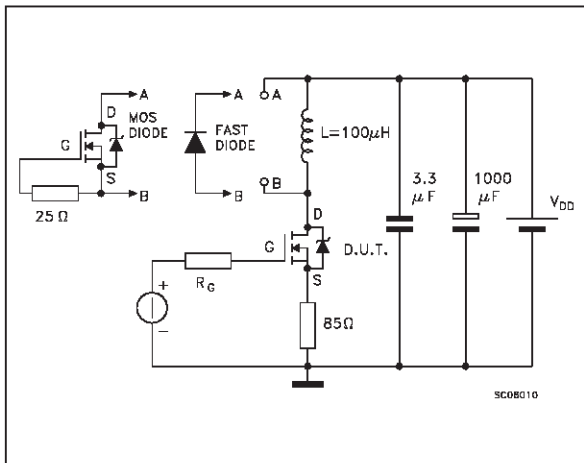
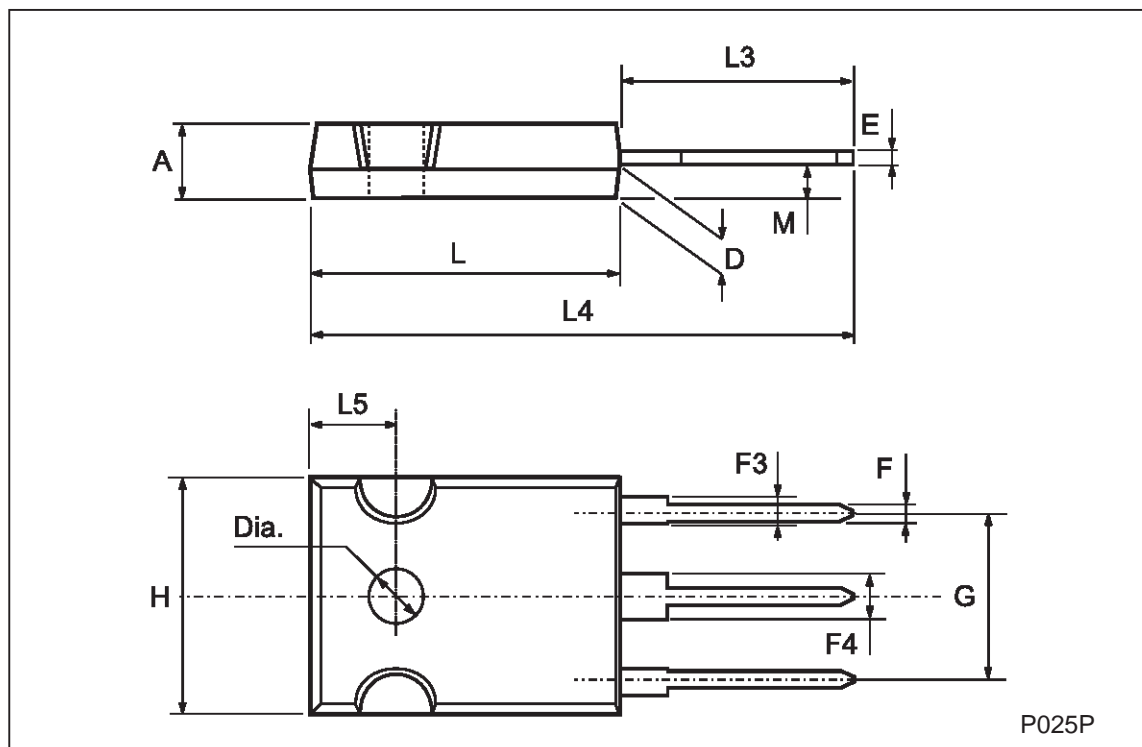


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



## TO-247 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.7		5.3	0.185		0.209
D	2.2		2.6	0.087		0.102
E	0.4		0.8	0.016		0.031
F	1		1.4	0.039		0.055
F3	2		2.4	0.079		0.094
F4	3		3.4	0.118		0.134
G		10.9			0.429	
H	15.3		15.9	0.602		0.626
L	19.7		20.3	0.776		0.779
L3	14.2		14.8	0.559	0.413	0.582
L4		34.6			1.362	
L5		5.5			0.217	
M	2		3	0.079		0.118
Dia	3.55		3.65	0.140		0.144



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