

# N - CHANNEL 500V - 0.11 Ω - 38A - ISOTOP PowerMESH™ MOSFET

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STE38NB50	500 V	< 0.13 Ω	38 A

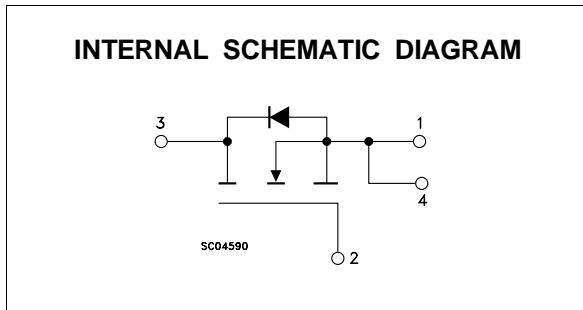
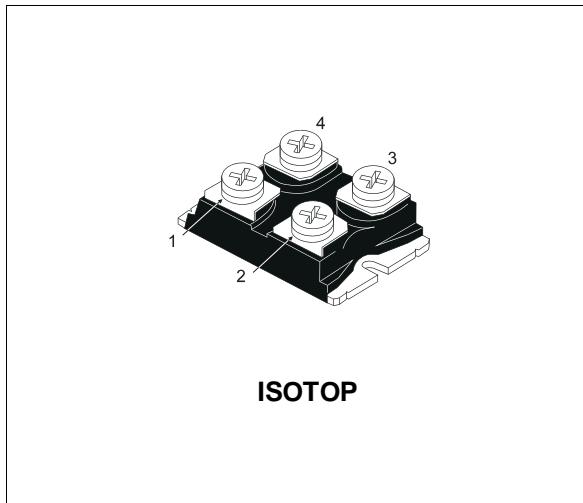
- TYPICAL  $R_{DS(on)}$  = 0.11 Ω
  - EXTREMELY HIGH dv/dt CAPABILITY
  - ± 30V GATE TO SOURCE VOLTAGE RATING
  - 100% AVALANCHE TESTED
  - LOW INTRINSIC CAPACITANCE
  - GATE CHARGE MINIMIZED
  - REDUCED VOLTAGE SPREAD

## **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 RDS(on) per area, exceptional avalanche and dv/dt capabilities and unrivalled gate charge and switching characteristics.

## APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
  - SWITCH MODE POWER SUPPLY (SMPS)
  - DC-AC CONVERTER FOR WELDING EQUIPMENT AND UNINTERRUPTABLE POWER SUPPLY AND MOTOR DRIVE



## **ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source Voltage ( $V_{GS} = 0$ )	500	V
$V_{DGR}$	Drain- gate Voltage ( $R_{GS} = 20 \text{ k}\Omega$ )	500	V
$V_{GS}$	Gate-source Voltage	$\pm 30$	V
$I_D$	Drain Current (continuous) at $T_c = 25 \text{ }^\circ\text{C}$	38	A
$I_D$	Drain Current (continuous) at $T_c = 100 \text{ }^\circ\text{C}$	24	A
$I_{DM(\bullet)}$	Drain Current (pulsed)	152	A
$P_{tot}$	Total Dissipation at $T_c = 25 \text{ }^\circ\text{C}$	400	W
	Derating Factor	3.2	$\text{W}/^\circ\text{C}$
$dv/dt(1)$	Peak Diode Recovery voltage slope	4.5	V/ns
$T_{stg}$	Storage Temperature	-65 to 150	$^\circ\text{C}$
$T_j$	Max. Operating Junction Temperature	150	$^\circ\text{C}$

- (•) Pulse width limited by safe operating area

(1)  $I_{SD} \leq 38$  A,  $di/dt \leq 200$  A/ $\mu$ s,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_j \leq T_{JMAX}$

## STE38NB50

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### THERMAL DATA

R <sub>thj-case</sub>	Thermal Resistance Junction-case	Max	0.31	°C/W
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient	Max	30	°C/W
R <sub>thc-sink</sub>	Thermal Resistance Case-sink	Typ	0.1	°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)	38	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)	1200	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 μA 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			10 100	μA μA
I <sub>GSS</sub>	Gate-body Leakage Current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ± 30 V			± 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 μA	3	4	5	V
R <sub>D(on)</sub>	Static Drain-source On Resistance	V <sub>GS</sub> = 10 V I <sub>D</sub> = 19 A		0.11	0.13	Ω
I <sub>D(on)</sub>	On State Drain Current	V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>D(on)max</sub> V <sub>GS</sub> = 10 V	38			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> × R <sub>D(on)max</sub> I <sub>D</sub> = 19 A	18	20		S
C <sub>iss</sub> C <sub>oss</sub> C <sub>rss</sub>	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V <sub>DS</sub> = 25 V f = 1 MHz V <sub>GS</sub> = 0		7000 950 80	9100 1235 104	pF pF pF

**ELECTRICAL CHARACTERISTICS** (continued)

## SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on Time Rise Time	$V_{DD} = 250 \text{ V}$ $I_D = 19 \text{ A}$ $R_G = 4.7 \Omega$ $V_{GS} = 10 \text{ V}$ (see test circuit, figure 3)		46 32	64 45	ns ns
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400 \text{ V}$ $I_D = 38 \text{ A}$ $V_{GS} = 10 \text{ V}$		159 35 67	223	nC nC nC

## SWITCHING OFF

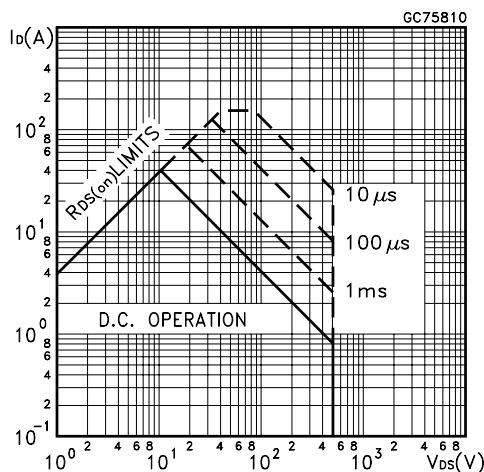
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(voff)}$ $t_f$ $t_c$	Off-voltage Rise Time Fall Time Cross-over Time	$V_{DD} = 400 \text{ V}$ $I_D = 38 \text{ A}$ $R_G = 4.7 \Omega$ $V_{GS} = 10 \text{ V}$ (see test circuit, figure 5)		56 53 120	78 74 168	ns ns ns

## SOURCE DRAIN DIODE

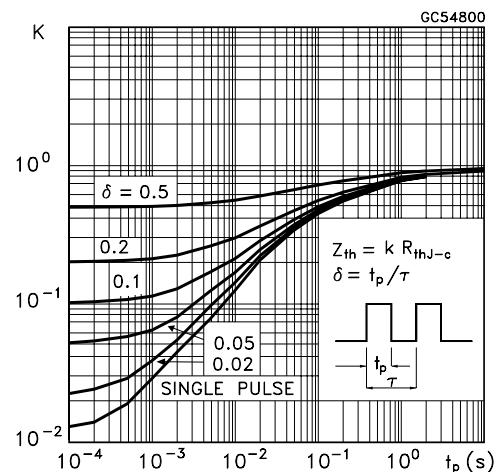
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$ $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				38 152	A A
$V_{SD} (\ast)$	Forward On Voltage	$I_{SD} = 38 \text{ A}$ $V_{GS} = 0$			1.6	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 38 \text{ A}$ $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 100 \text{ V}$ $T_j = 150^\circ\text{C}$ (see test circuit, figure 5)		950 12 25		ns $\mu\text{C}$ A

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

## Safe Operating Area

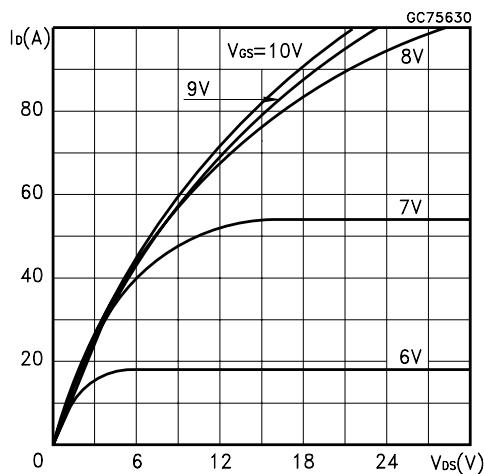


## Thermal Impedance

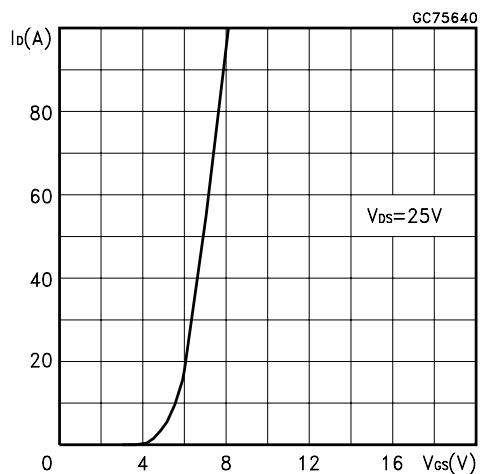


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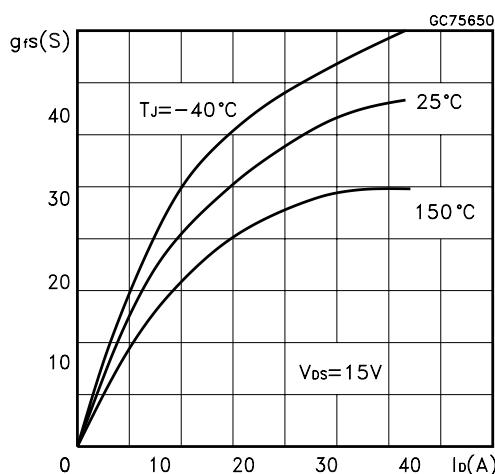
### Output Characteristics



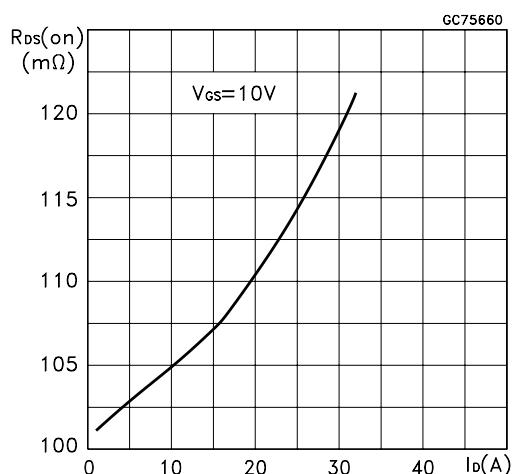
### Transfer Characteristics



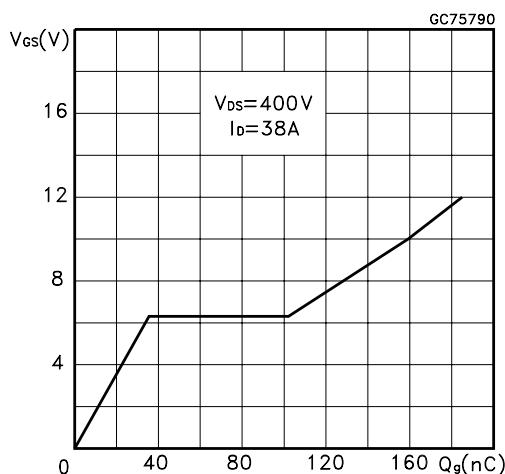
### Transconductance



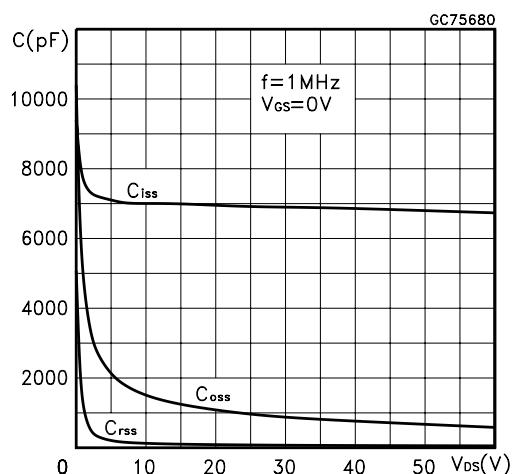
### Static Drain-source On Resistance



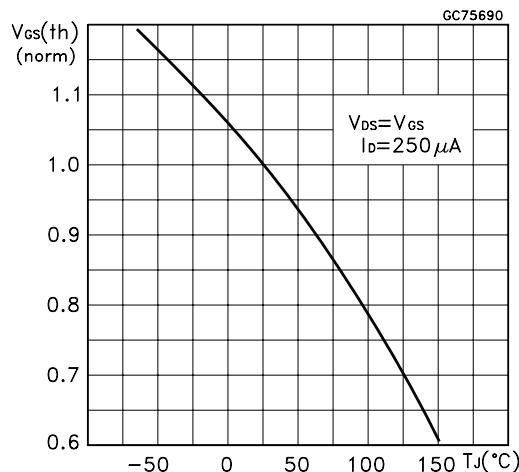
### Gate Charge vs Gate-source Voltage



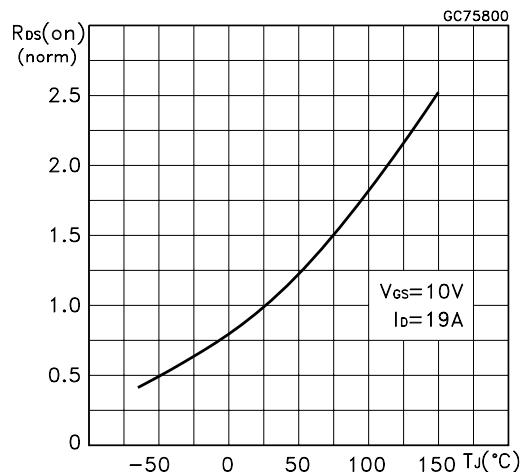
### Capacitance Variations



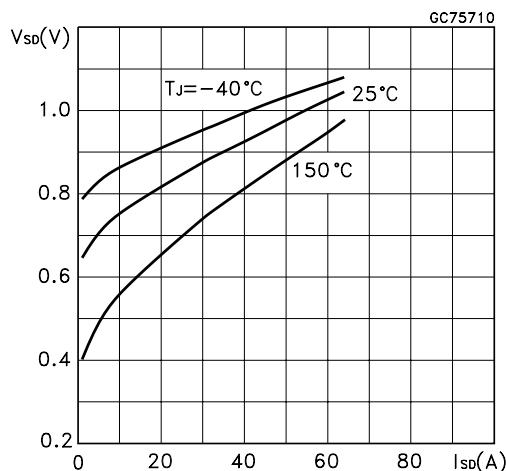
Normalized Gate Threshold Voltage vs Temperature



Normalized On Resistance vs Temperature

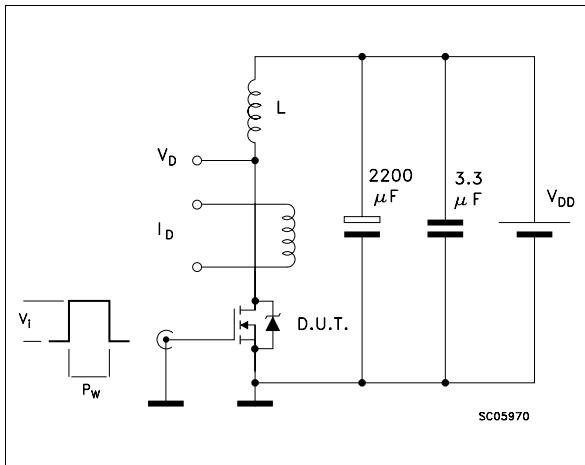


Source-drain Diode Forward Characteristics

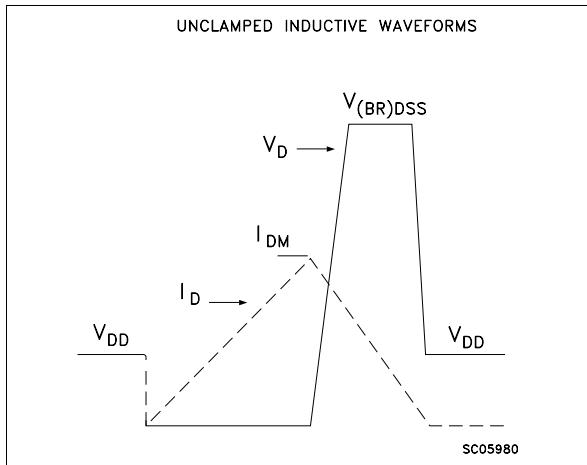


## STE38NB50

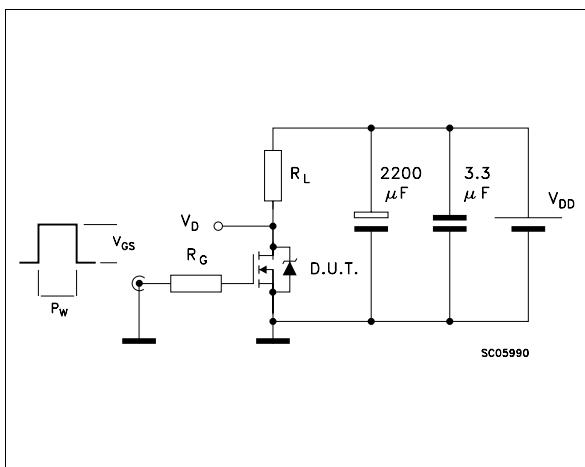
**Fig. 1:** Unclamped Inductive Load Test Circuit



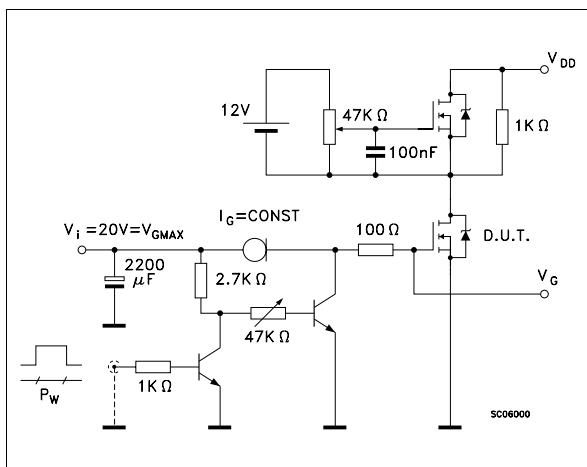
**Fig. 2:** Unclamped Inductive Waveform



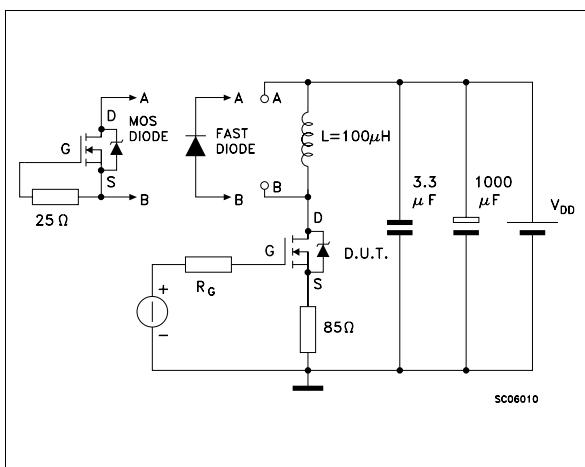
**Fig. 3:** Switching Times Test Circuits For Resistive Load



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

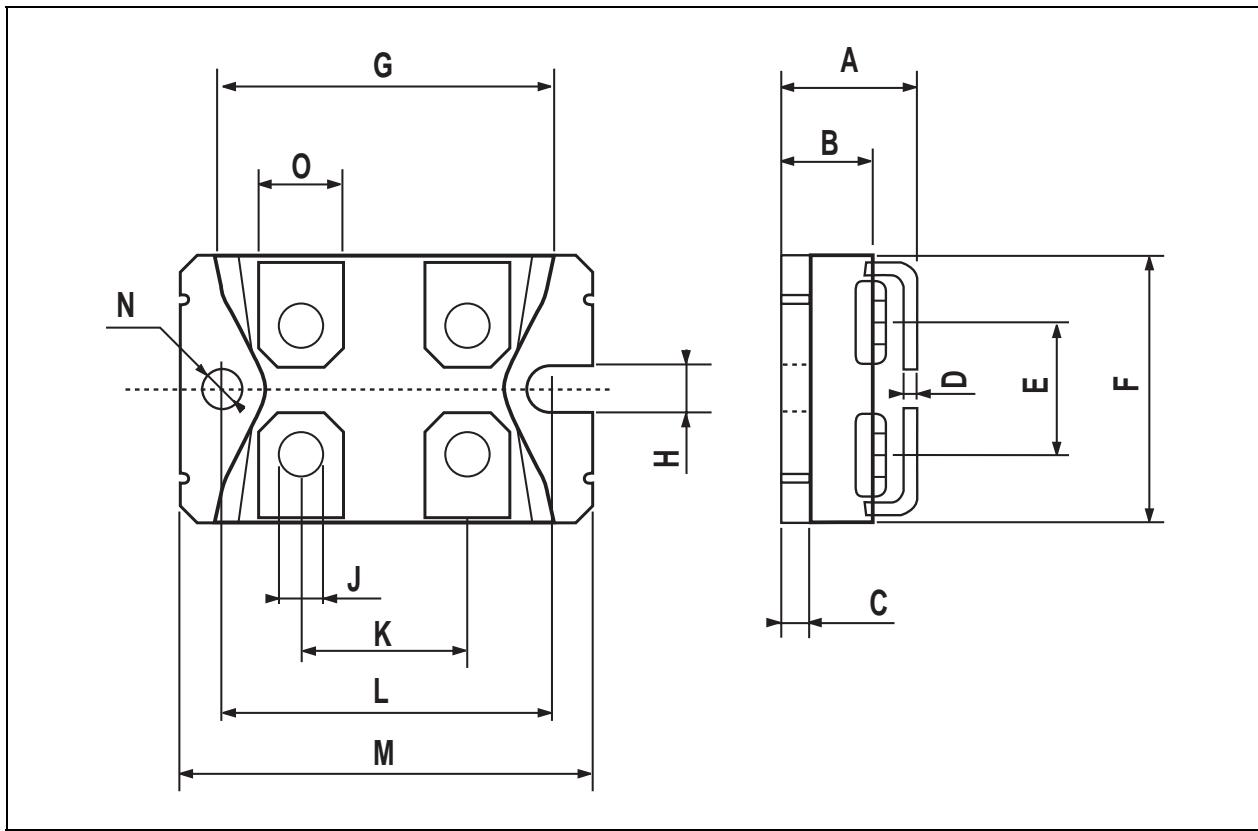


**Fig. 5:** Test Circuit For Inductive Load Switching And Diode Recovery Times



## ISOTOP MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	11.8		12.2	0.466		0.480
B	8.9		9.1	0.350		0.358
C	1.95		2.05	0.076		0.080
D	0.75		0.85	0.029		0.033
E	12.6		12.8	0.496		0.503
F	25.15		25.5	0.990		1.003
G	31.5		31.7	1.240		1.248
H	4			0.157		
J	4.1		4.3	0.161		0.169
K	14.9		15.1	0.586		0.594
L	30.1		30.3	1.185		1.193
M	37.8		38.2	1.488		1.503
N	4			0.157		
O	7.8		8.2	0.307		0.322



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