



STE53NC50

N-CHANNEL 500V - 0.070Ω - 53A ISOTOP PowerMesh™II MOSFET

TYPE	V _{DS}	R _{DS(on)}	I _D
STE53NC50	500V	< 0.08Ω	53 A

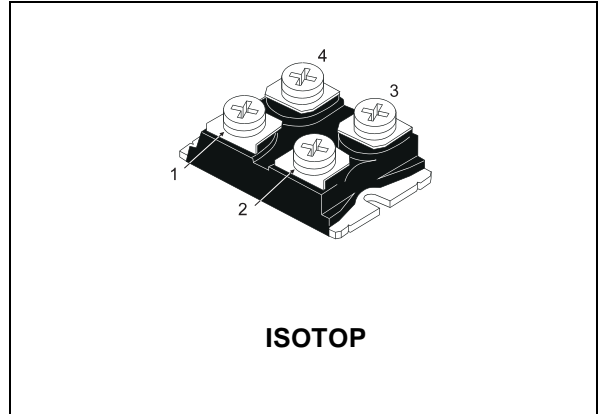
- TYPICAL R_{DS(on)} = 0.07 Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- NEW HIGH VOLTAGE BENCHMARK
- GATE CHARGE MINIMIZED

DESCRIPTION

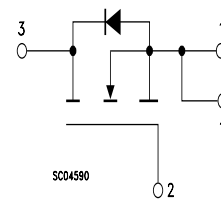
The PowerMESH™II is the evolution of the first generation of MESH OVERLAY™. The layout refinements introduced greatly improve the Ron*area figure of merit while keeping the device at the leading edge for what concerns switching speed, gate charge and ruggedness.

APPLICATIONS

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



INTERNAL SCHEMATIC DIAGRAM



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 kΩ)	500	V
V _{GS}	Gate- source Voltage	±30	V
I _D	Drain Current (continuous) at T _C = 25°C	53	A
I _D	Drain Current (continuous) at T _C = 100°C	33	A
I _{DM} (•)	Drain Current (pulsed)	212	A
P _{TOT}	Total Dissipation at T _C = 25°C	460	W
	Derating Factor	3.68	W/°C
dv/dt (1)	Peak Diode Recovery voltage slope	3	V/ns
V _{ISO}	Insulation Withstand Voltage (AC-RMS)	2500	V
T _{stg}	Storage Temperature	- 65 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C

(•) Pulse width limited by safe operating area

(1) I_{SD} ≤ 53A, di/dt ≤ 100 A/μs, V_{DD} ≤ 24V, T_J ≤ T_{JMAX}

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1/8

STE53NC50

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THERMAL DATA

Rthj-case	Thermal Resistance Junction-case	Max	0.272	°C/W
Rthc-h	Thermal Resistance Case-heatsink with Conductive Grease Applied		0.05	°C/W

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I _{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max)	53	A
E _{AS}	Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V)	1043	mJ

ELECTRICAL CHARACTERISTICS (TCASE = 25 °C 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	500			V
I _{DSS}	Zero Gate Voltage Drain Current (V _{GS} = 0)	V _{DS} = Max Rating V _{DS} = Max Rating, T _C = 125 °C			10 100	μA μA
I _{GSS}	Gate-body Leakage Current (V _{DS} = 0)	V _{GS} = ± 30V			±100	nA

ON (1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250μA	2	3	4	V
R _{DS(on)}	Static Drain-source On Resistance	V _{GS} = 10V, I _D = 27A		0.07	0.08	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs} (1)	Forward Transconductance	V _{DS} > I _{D(on)} × R _{DS(on)max} , I _D = 15 A		42		S
C _{iss}	Input Capacitance	V _{DS} = 25V, f = 1 MHz, V _{GS} = 0		11.2		nF
C _{oss}	Output Capacitance			1350		pF
C _{rss}	Reverse Transfer Capacitance			115		pF

Note: 1. Pulsed: Pulse duration = 300 μs, duty cycle 1.5 %.

ELECTRICAL CHARACTERISTICS (CONTINUED)
SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Delay Time	$V_{DD} = 250V, I_D = 26.5A$		46		ns
t_r	Rise Time	$R_G = 4.7\Omega, V_{GS} = 10V$ (see test circuit, Figure 3)		70		ns
Q_g	Total Gate Charge	$V_{DD} = 400V, I_D = 53A,$ $V_{GS} = 10V$		310	434	nC
Q_{gs}	Gate-Source Charge			46		nC
Q_{gd}	Gate-Drain Charge			150		nC

SWITCHING OFF

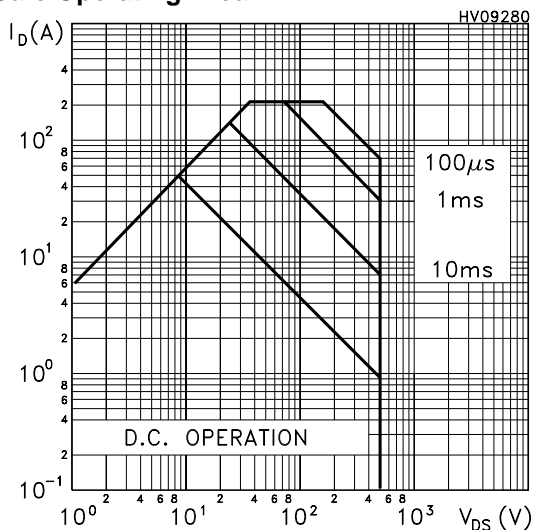
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 400V, I_D = 53A,$		45		ns
t_f	Fall Time	$R_G = 4.7\Omega, V_{GS} = 10V$ (see test circuit, Figure 5)		38		ns
t_c	Cross-over Time			85		ns

SOURCE DRAIN DIODE

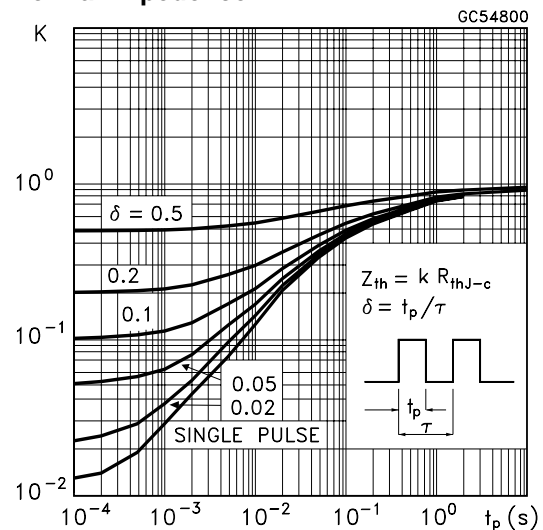
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				53	A
$I_{SDM(2)}$	Source-drain Current (pulsed)				212	A
$V_{SD(1)}$	Forward On Voltage	$I_{SD} = 53A, V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 53A, di/dt = 100A/\mu s,$		760		ns
Q_{rr}	Reverse Recovery Charge	$V_{DD} = 70V, T_j = 150^\circ C$ (see test circuit, Figure 5)		17.86		μC
I_{RRM}	Reverse Recovery Current			47		A

Note: 1. Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %.
2. Pulse width limited by safe operating area.

Safe Operating Area



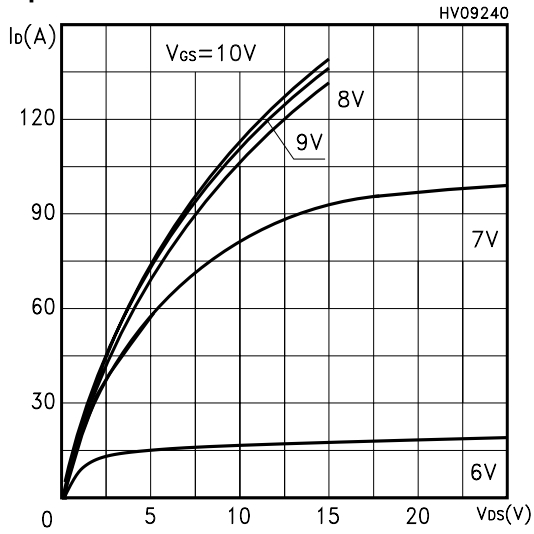
Thermal Impedance



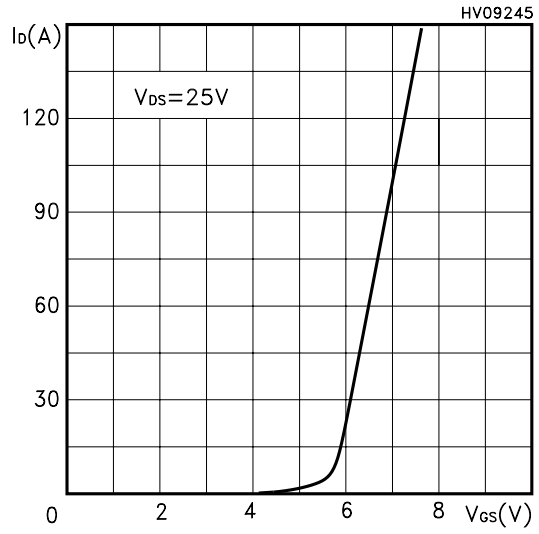
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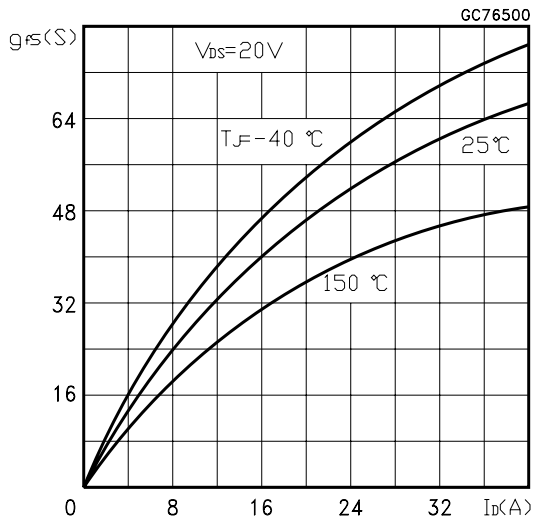
Output Characteristics



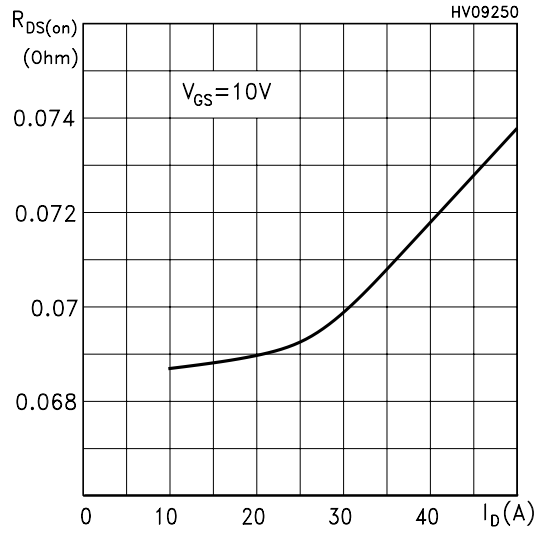
Transfer Characteristics



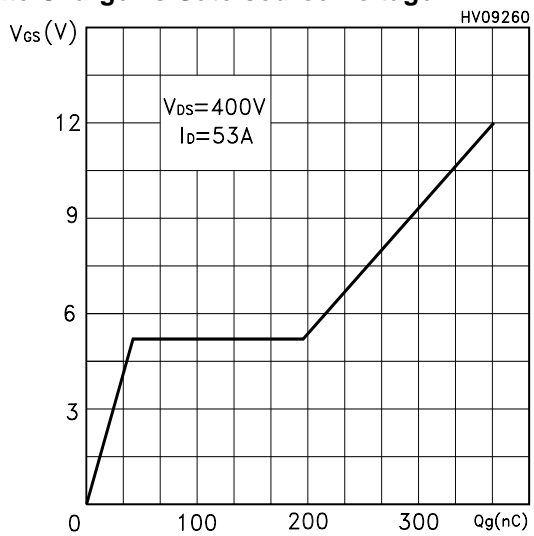
Transconductance



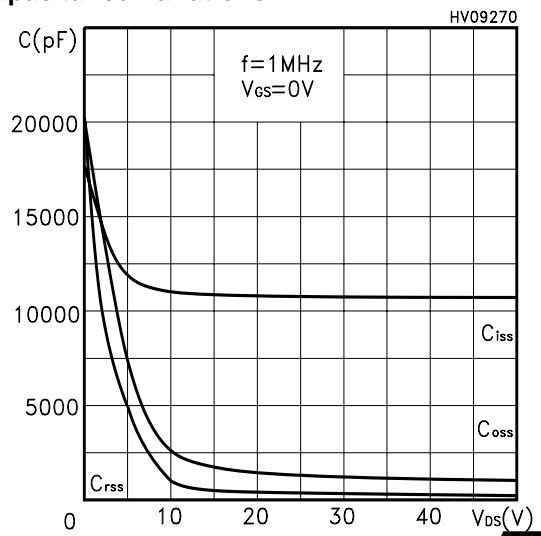
Static Drain-source On Resistance



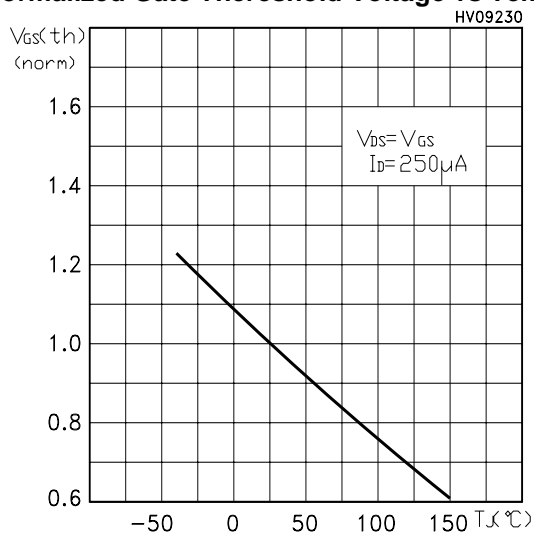
Gate Charge vs Gate-source Voltage



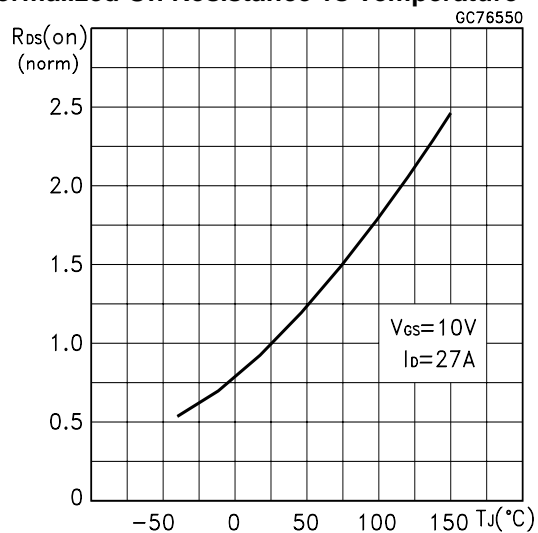
Capacitance Variations



Normalized Gate Threshold Voltage vs Temp.



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics

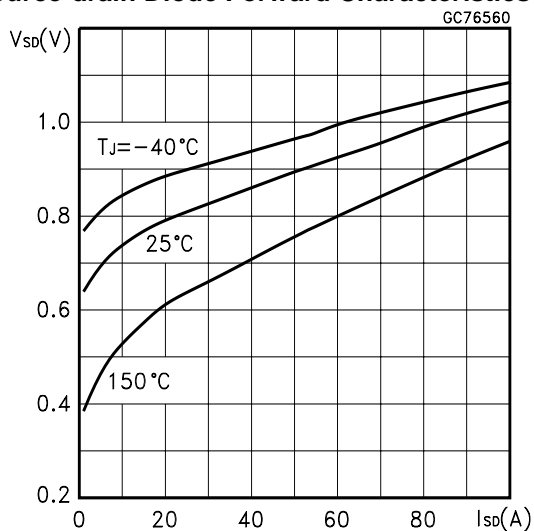


Fig. 1: Unclamped Inductive Load Test Circuit

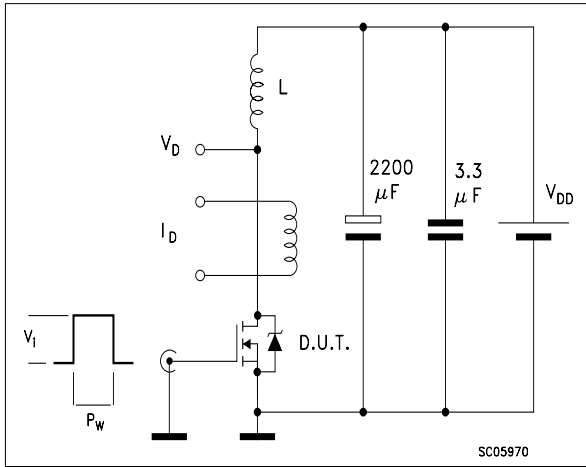


Fig. 2: Unclamped Inductive Waveform

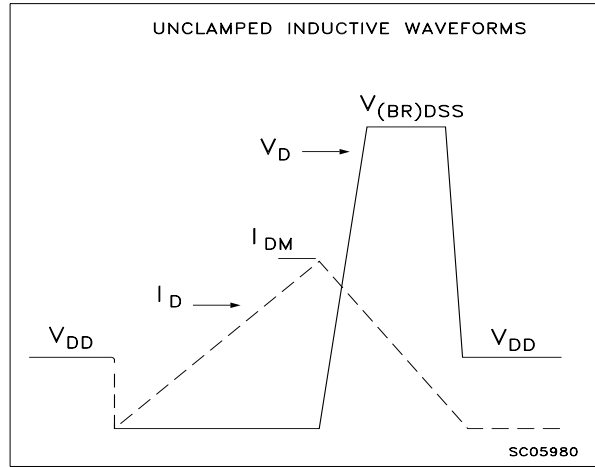


Fig. 3: Switching Times Test Circuit For Resistive Load

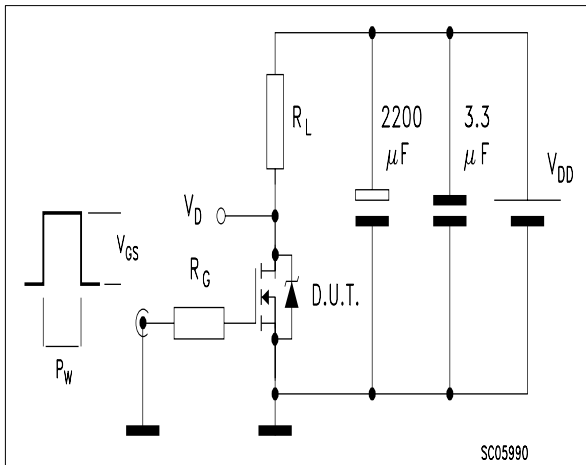


Fig. 4: Gate Charge test Circuit

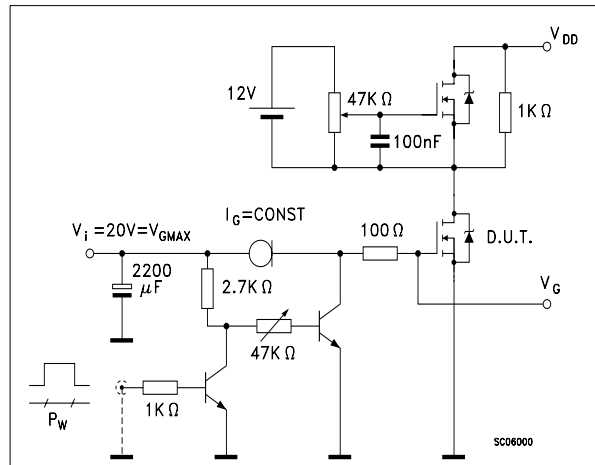
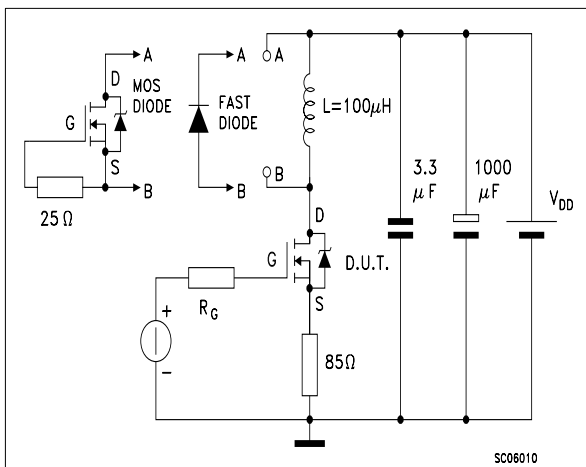
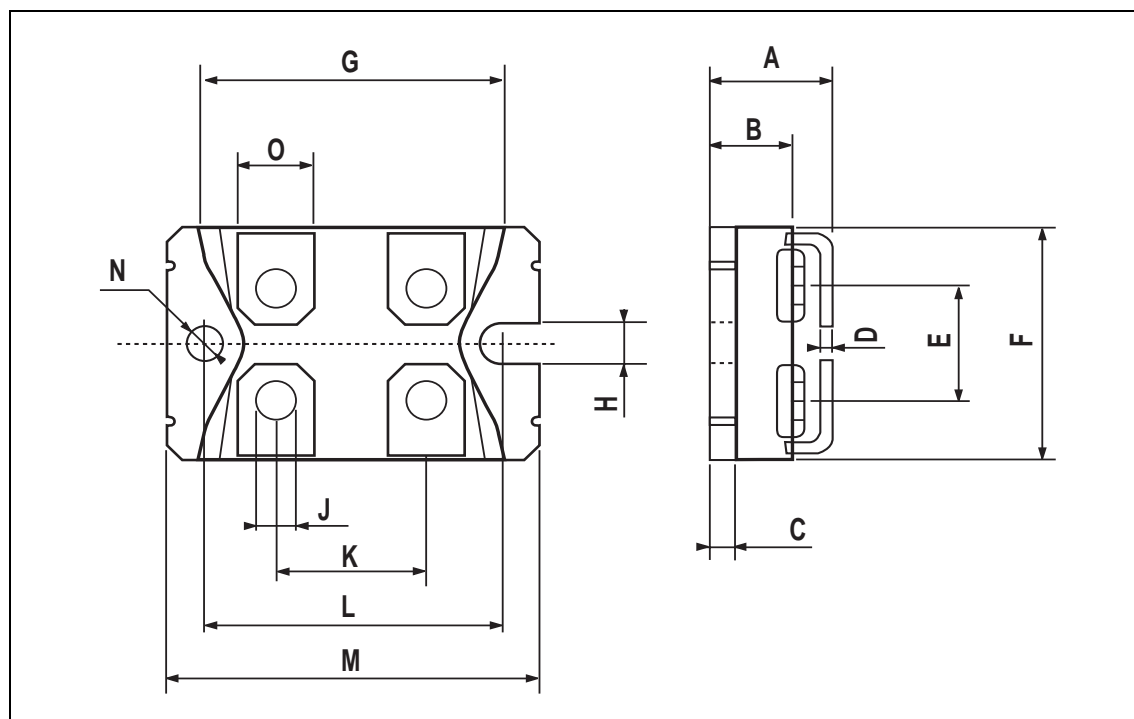


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



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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