

STW12NK90Z

N-CHANNEL 900V - 0.72Ω - 11A TO-247

Zener-Protected SuperMESH™ Power MOSFET

TYPE	V _{DSS}	R _{DS(on)}	I _D	P _w
STW12NK90Z	900 V	< 0.88 Ω	11 A	230 W

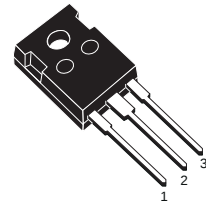
- TYPICAL R_{DS(on)} = 0.72 Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- GATE CHARGE MINIMIZED
- VERY LOW INTRINSIC CAPACITANCES
- VERY GOOD MANUFACTURING REPEATABILITY

DESCRIPTION

The SuperMESH™ series is obtained through an extreme optimization of ST's well established strip-based PowerMESH™ layout. In addition to pushing on-resistance significantly down, special care is taken to ensure a very good dv/dt capability for the most demanding applications. Such series complements ST full range of high voltage MOSFETs including revolutionary MDmesh™ products.

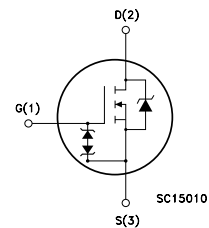
APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- IDEAL FOR OFF-LINE POWER SUPPLIES



TO-247

INTERNAL SCHEMATIC DIAGRAM



ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STW12NK90Z	W12NK90Z	TO-247	TUBE

STW12NK90Z

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source Voltage ($V_{GS} = 0$)	900	V
V_{DGR}	Drain-gate Voltage ($R_{GS} = 20\text{ k}\Omega$)	900	V
V_{GS}	Gate- source Voltage	± 30	V
I_D	Drain Current (continuous) at $T_C = 25^\circ\text{C}$	11	A
I_D	Drain Current (continuous) at $T_C = 100^\circ\text{C}$	7	A
$I_{DM}(\bullet)$	Drain Current (pulsed)	44	A
P_{TOT}	Total Dissipation at $T_C = 25^\circ\text{C}$	230	W
	Derating Factor	1.85	W/ $^\circ\text{C}$
$V_{ESD(G-S)}$	Gate source ESD(HBM-C=100pF, R=1.5K Ω)	6000	V
$dv/dt(1)$	Peak Diode Recovery voltage slope	4.5	V/ns
T_j T_{stg}	Operating Junction Temperature Storage Temperature	-55 to 150	$^\circ\text{C}$

(●) Pulse width limited by safe operating area

(1) $I_{SD} \leq 11\text{A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$, $T_j \leq T_{JMAX}$.

(*) Limited only by maximum temperature allowed

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case Max	0.54	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$ T_I	Thermal Resistance Junction-ambient Max Maximum Lead Temperature For Soldering Purpose	50 300	$^\circ\text{C}/\text{W}$ $^\circ\text{C}$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max)	11	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	500	mJ

GATE-SOURCE ZENER DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
BV_{GSO}	Gate-Source Breakdown Voltage	$I_{GS} = \pm 1\text{mA}$ (Open Drain)	30			V

ELECTRICAL CHARACTERISTICS ($T_{CASE} = 25^{\circ}C$ UNLESS OTHERWISE SPECIFIED)
 ON/OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1\text{ mA}$, $V_{GS} = 0$	900			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating}$, $T_C = 125^{\circ}C$			1 50	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20V$			± 10	μA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 100\text{ }\mu A$	3	3.75	4.5	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10V$, $I_D = 5.5\text{ A}$		0.72	0.88	Ω

DYNAMIC

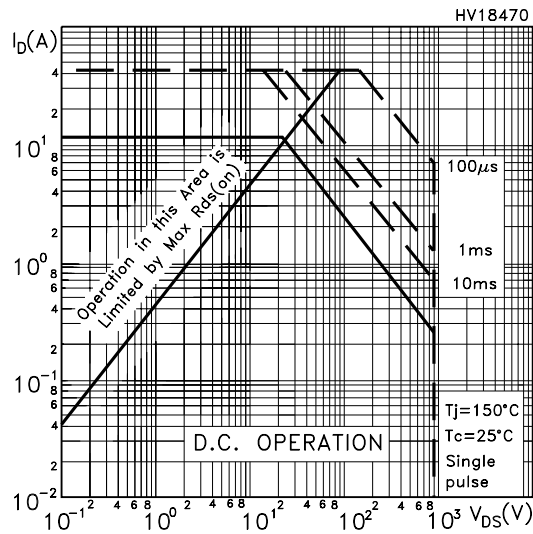
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (1)$	Forward Transconductance	$V_{DS} = 15\text{ V}$, $I_D = 5.5\text{ A}$		11		S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25V$, $f = 1\text{ MHz}$, $V_{GS} = 0$		3500 280 58		pF pF pF
$C_{oss\text{ eq. (3)}}$	Equivalent Output Capacitance	$V_{GS} = 0V$, $V_{DS} = 0V\text{ to }800V$		117		pF
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on Delay Time Rise Time Turn-off Delay Time Fall Time	$V_{DD} = 450\text{ V}$, $I_D = 5\text{ A}$ $R_G = 4.7\Omega$, $V_{GS} = 10\text{ V}$ (Resistive Load see, Figure 3)		31 20 88 55		ns ns ns ns
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 720V$, $I_D = 10\text{ A}$, $V_{GS} = 10V$		113 19 60	152	nC nC nC

SOURCE DRAIN DIODE

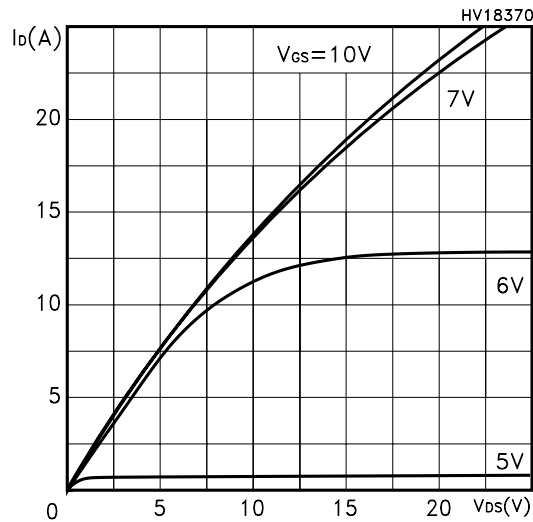
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM} (2)$	Source-drain Current Source-drain Current (pulsed)				11 44	A A
$V_{SD} (1)$	Forward On Voltage	$I_{SD} = 11\text{ A}$, $V_{GS} = 0$			1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 10\text{ A}$, $di/dt = 100A/\mu s$ $V_{DD} = 50\text{ V}$ (see test circuit, Figure 5)		728 7.8 21.6		ns μC A
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 10\text{ A}$, $di/dt = 100A/\mu s$ $V_{DD} = 50\text{ V}$, $T_j = 150^{\circ}C$ (see test circuit, Figure 5)		964 11 23		ns μC A

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

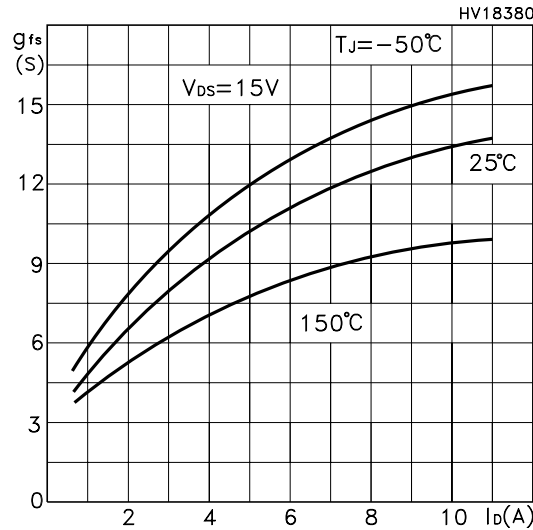
Safe Operating Area



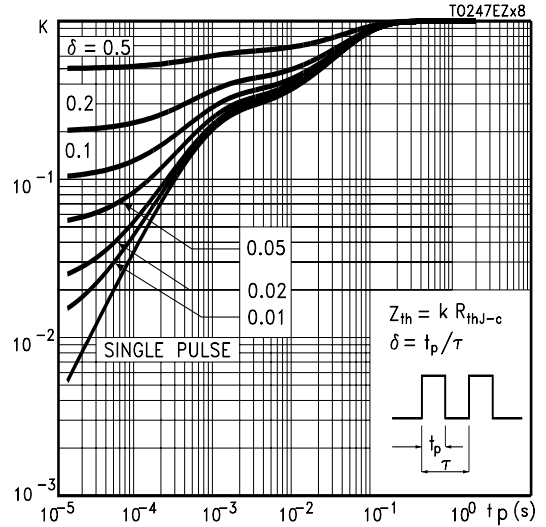
Output Characteristics



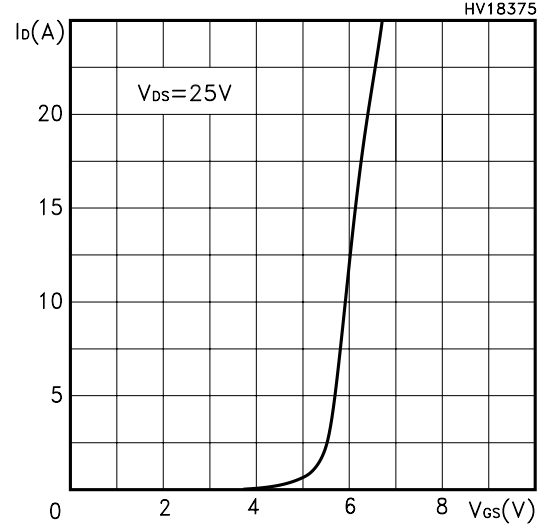
Transconductance



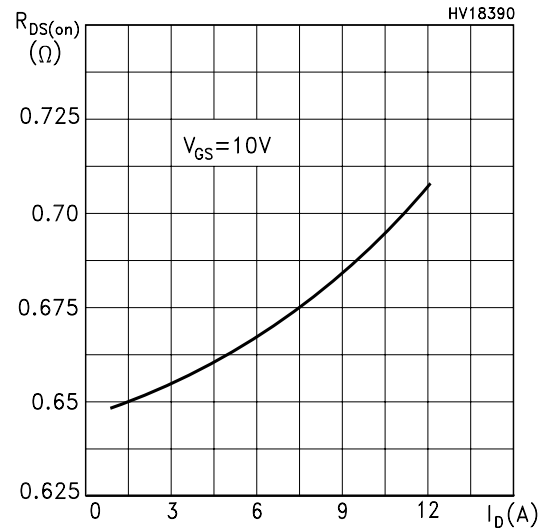
Thermal Impedance

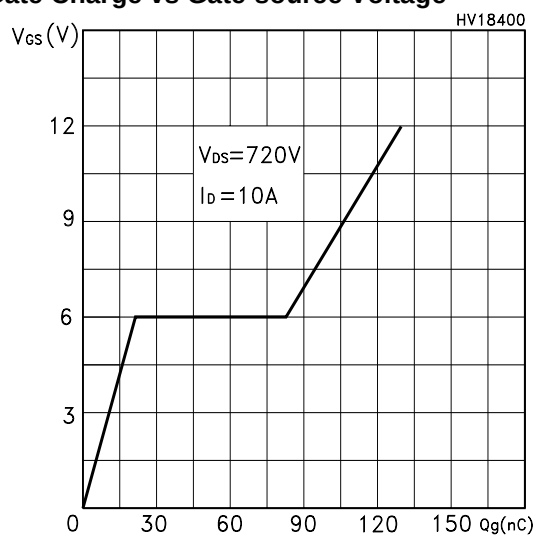
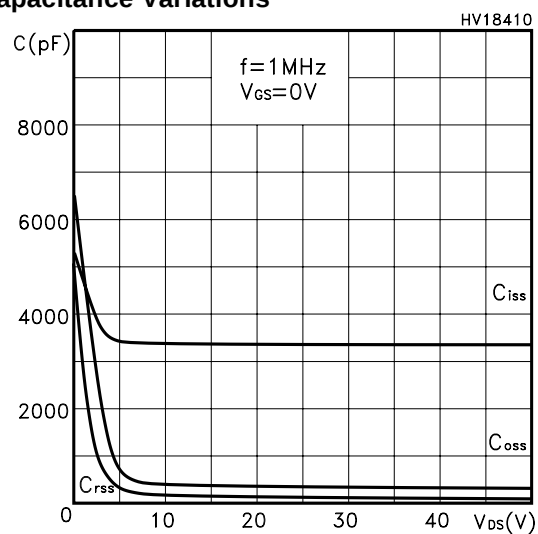
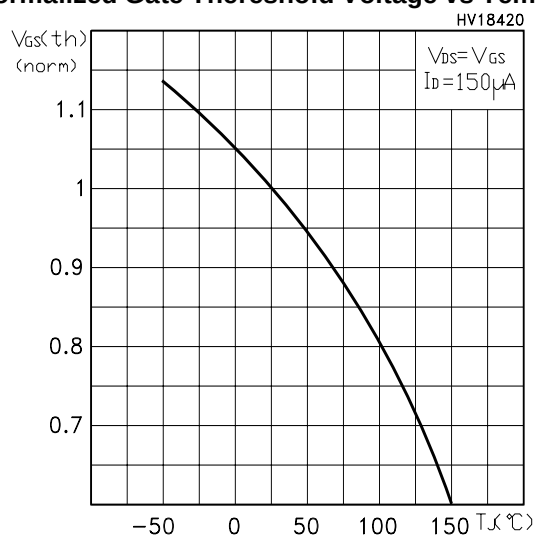
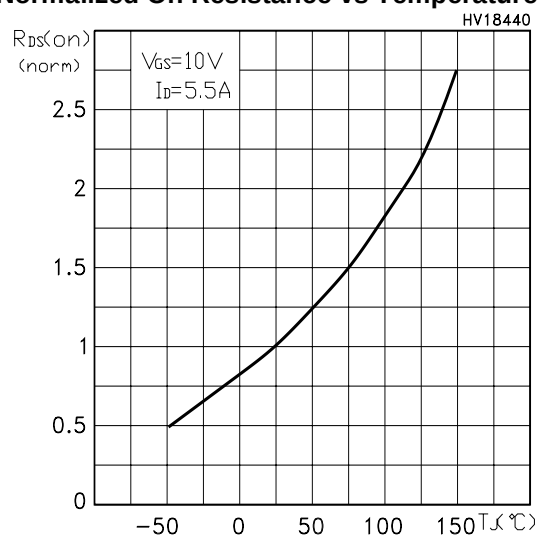
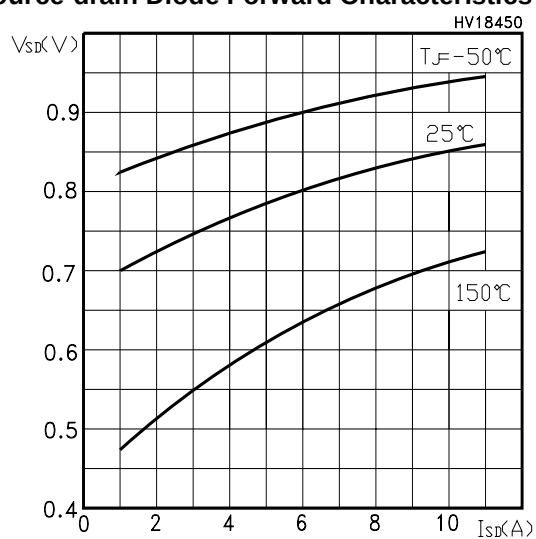
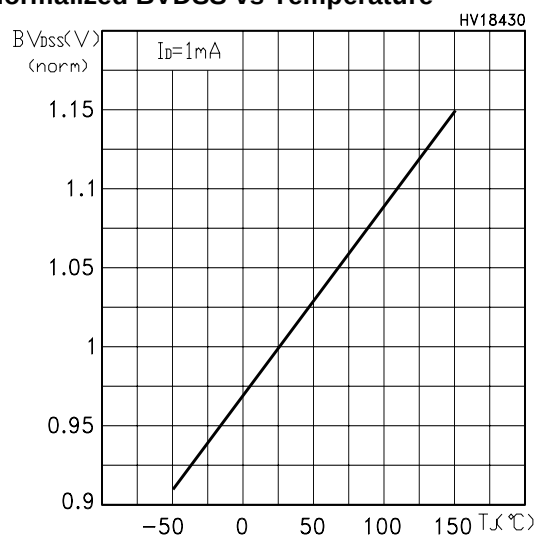


Transfer Characteristics



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****Normalized BVDSS vs Temperature**

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Maximum Avalanche Energy vs Temperature

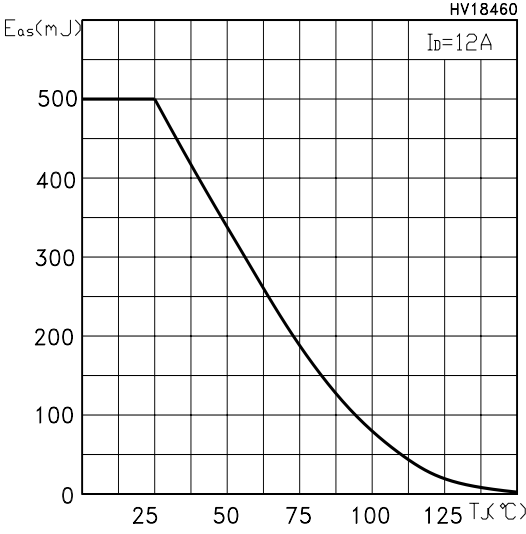


Fig. 1: Unclamped Inductive Load Test Circuit

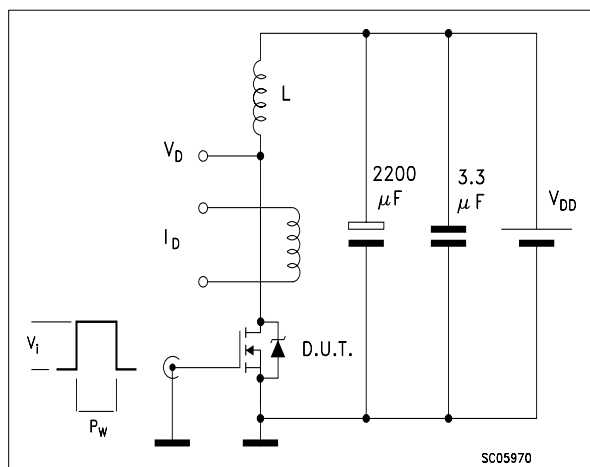


Fig. 2: Unclamped Inductive Waveform

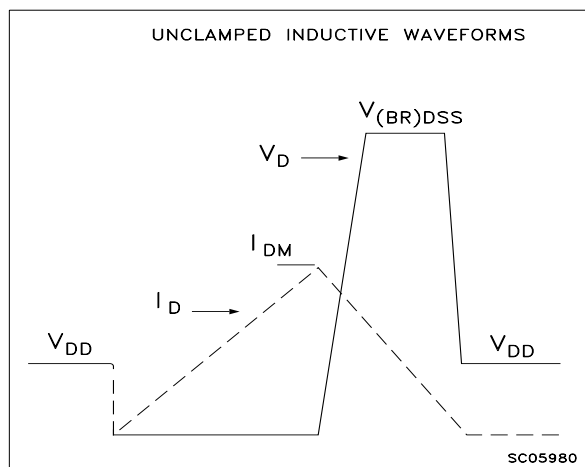


Fig. 3: Switching Times Test Circuit For Resistive Load

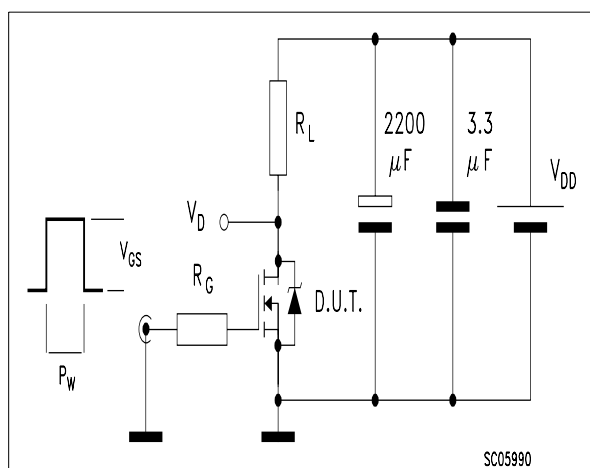


Fig. 4: Gate Charge test Circuit

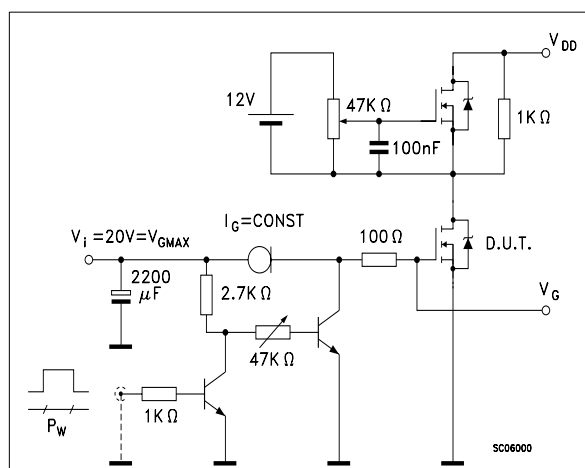
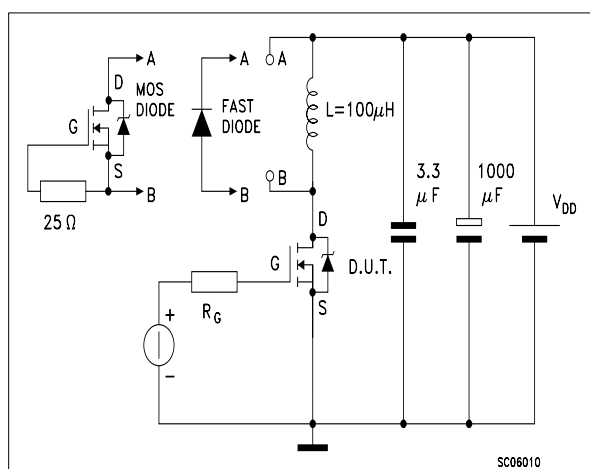


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



TO-247 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.85		5.15	0.19		0.20
A1	2.20		2.60	0.086		0.102
b	1.0		1.40	0.039		0.055
b1	2.0		2.40	0.079		0.094
b2	3.0		3.40	0.118		0.134
c	0.40		0.80	0.015		0.03
D	19.85		20.15	0.781		0.793
E	15.45		15.75	0.608		0.620
e		5.45			0.214	
L	14.20		14.80	0.560		0.582
L1	3.70		4.30	0.14		0.17
L2		18.50			0.728	
øP	3.55		3.65	0.140		0.143
øR	4.50		5.50	0.177		0.216
S		5.50			0.216	

