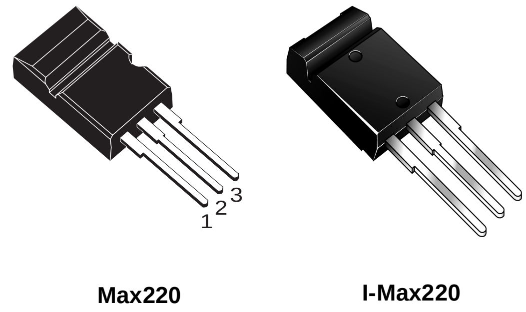
STU8NC90Z
STU8NC90ZI

N-CHANNEL 900V - 1.1Ω - 7.6A Max220/I-Max220
Zener-Protected PowerMESH™III MOSFET

TYPE	V_{DSS}	$R_{DS(on)}$	I_D
STU8NC90Z STU9NC90ZI	900 V 900 V	< 1.38Ω < 1.38Ω	7 A 7 A

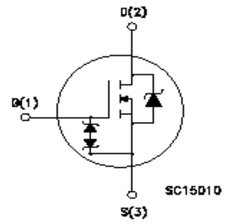
- TYPICAL R_{DS}(on) = 1.1Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- GATE-TO-SOURCE ZENER DIODES
- 100% AVALANCHE TESTED
- VERY LOW INTRINSIC CAPACITANCES
- GATE CHARGE MINIMIZED



DESCRIPTION
The third generation of MESH OVERLAY™ Power MOSFETs for very high voltage exhibits unsurpassed on-resistance per unit area while integrating back-to-back Zener diodes between gate and source. Such arrangement gives extra ESD capability with higher ruggedness performance as requested by a large variety of single-switch applications.

APPLICATIONS
- SINGLE-ENDED SMPS IN MONITORS, COMPUTER AND INDUSTRIAL APPLICATION
- WELDING EQUIPMENT

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STU8NC90Z	STU8NC90ZI	
V_{DS}	Drain-source Voltage (V_{GS} = 0)	900		V
V_{DGR}	Drain-gate Voltage (R_{GS} = 20 kΩ)	900		V
V_{GS}	Gate- source Voltage	±25		V
I_D	Drain Current (continuos) at T_C = 25°C	7	7(*)	A
I_D	Drain Current (continuos) at T_C = 100°C	4.4	4.4(*)	A
I_{DM} (1)	Drain Current (pulsed)	28	28(*)	A
P_{TOT}	Total Dissipation at T_C = 25°C	160	55	W
	Derating Factor	1.28	0.44	W/°C
I_{GS}	Gate-source Current	±50		mA
$V_{ESD(G-S)}$	Gate source ESD(HBM-C=100pF, R=15KΩ)	4		KV
dv/dt(•)	Peak Diode Recovery voltage slope	3		V/ns
V_{ISO}	Insulation Winthstand Voltage (DC)	--	2000	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} ≤ 7A, di/dt ≤100A/µs, V_{DD} ≤ $V_{(BR)DSS}$, T_j ≤ T_{JMAX}
(*)Limited only by maximum temperature allowed

THERMAL DATA

		Max220	I-Max220	
Rthj-case	Thermal Resistance Junction-case Max	0.78	2.27	°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	30		°C/W
Rthc-sink	Thermal Resistance Case-sink Typ	0.1		°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)	7	A
E_{AS}	Single Pulse Avalanche Energy (starting T_j = 25 °C, $I_D = I_{AR}$, V_{DD} = 50 V)	430	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	900			V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	I_D = 1 mA, V_{GS} = 0		1		V/°C
I_{DSS}	Zero Gate Voltage Drain Current (V_{GS} = 0)	V_{DS} = Max Rating			1	µA
		V_{DS} = Max Rating, T_C = 125 °C			50	µA
I_{GSS}	Gate-body Leakage Current (V_{DS} = 0)	V_{GS} = ±20V			±10	µA

ON (1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, I_D = 250µA	3	4	5	V
$R_{DS(on)}$	Static Drain-source On Resistance	V_{GS} = 10V, I_D = 3.8A		1.1	1.38	Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$, V_{GS} = 10V	7			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 = 3.8A		9		S
C_{iss}	Input Capacitance	V_{DS} = 25V, f = 1 MHz, V_{GS} = 0		3550		pF
C_{oss}	Output Capacitance			205		pF
C_{rss}	Reverse Transfer Capacitance			25		pF

ELECTRICAL CHARACTERISTICS (CONTINUED)

SWITCHING ON (RESISTIVE LOAD)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Delay Time Rise Time	V_{DD} = 400V, I_D = 4A R_G = 4.7Ω V_{GS} = 10V (see test circuit, Figure 3)		36 12		ns ns
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	V_{DD} = 720V, I_D = 8 A, V_{GS} = 10V		73 18 27	102	nC nC nC

SWITCHING OFF (INDUCTIVE LOAD)

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} = 720V, I_D = 8 A, R_G = 4.7Ω, V_{GS} = 10V (see test circuit, Figure 5)		36 45 77		ns ns ns

SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (2)	Source-drain Current Source-drain Current (pulsed)				7 28	A A
V_{SD} (1)	Forward On Voltage	I_{SD} = 7 A, V_{GS} = 0			1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_{SD} = 8 A, di/dt = 100A/µs, V_{DD} = 50V, T_j = 150°C (see test circuit, Figure 5)		860 10 24		ns µC A

GATE-SOURCE ZENER DIODE

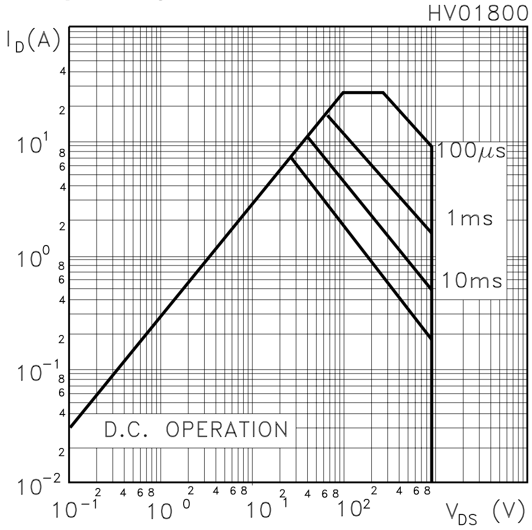
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
BV_{GSO}	Gate-Source Breakdown Voltage	Igs=± 1mA (Open Drain)	25			V
αT	Voltage Thermal Coefficient	T=25°C Note(3)		1.3		10^{-4}/°C
Rz	Dynamic Resistance	I_{GS} = 50 mA, V_{GS} = 0		90		Ω

Note: 1. Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %.
2. Pulse width limited by safe operating area.
3. $\Delta V_{BV} = \alpha T\ (25°\text{-}T)\ BV_{GSO}(25°)$

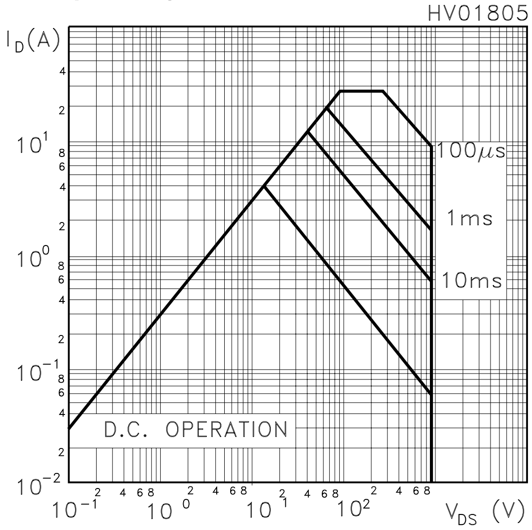
PROTECTION FEATURES OF GATE-TO-SOURCE ZENER DIODES

The built-in back-to-back Zener diodes have specifically been designed to enhance not only the device's ESD capability, but also to make them safely absorb possible voltage transients that may occasionally be applied from gate to souce. In this respect the 25V Zener voltage is appropiate to achieve an efficient and cost-effective intervention to protect the device's integrity. These integrated Zener diodes thus avoid the usage of external components.

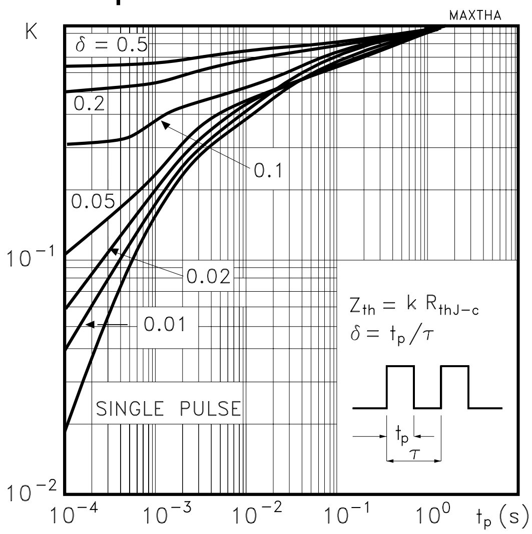
Safe Operating Area For Max220



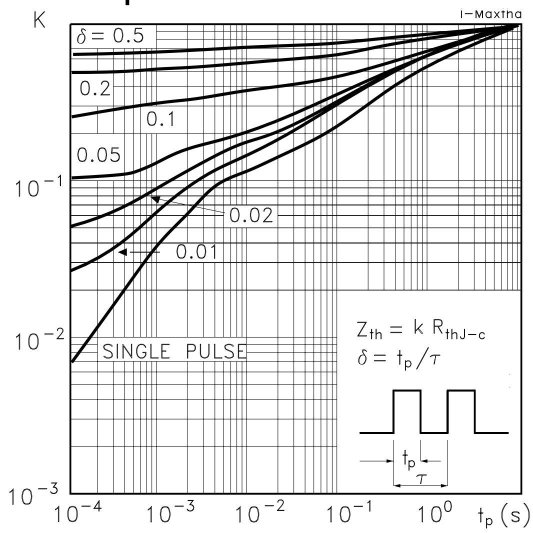
Safe Operating Area For I-Max220



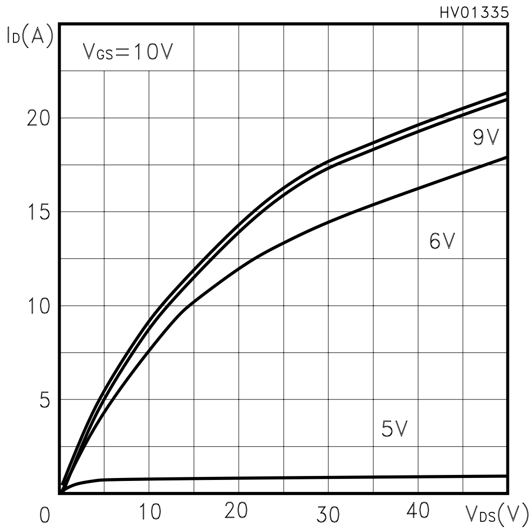
Thermal Impedance For Max220



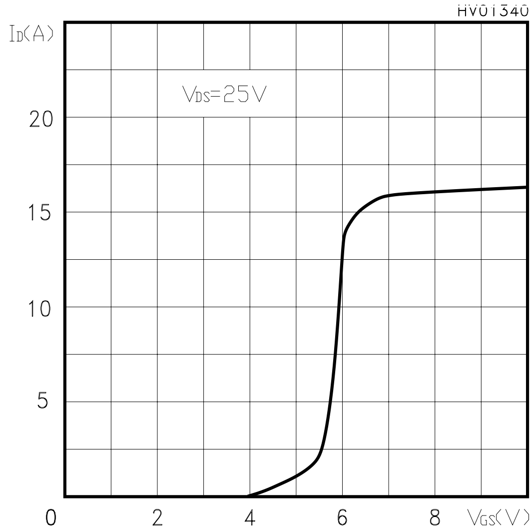
Thermal Impedance For I-Max220



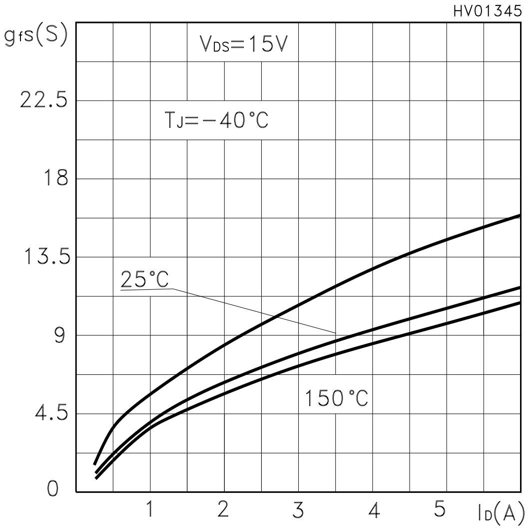
Output Characteristics



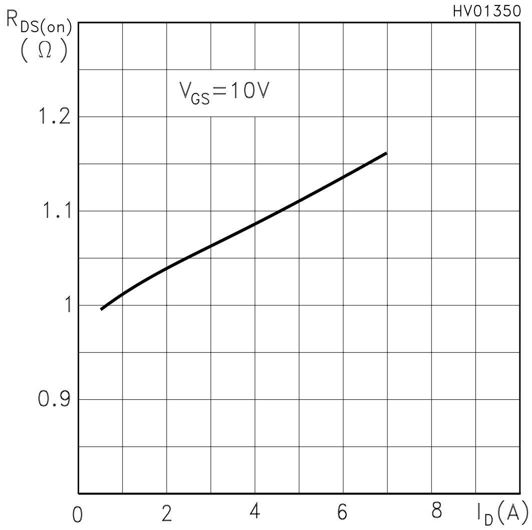
Transfer Characteristics



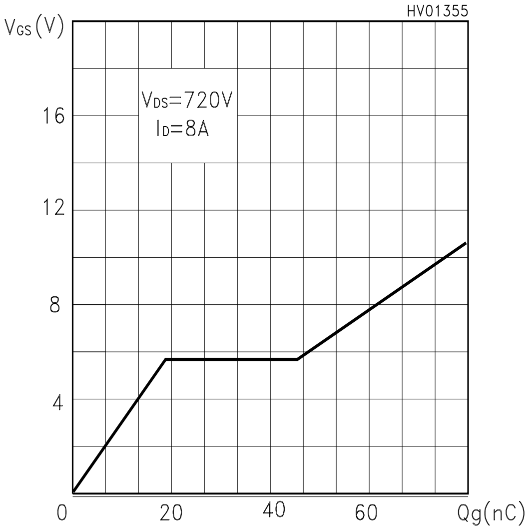
Transconductance



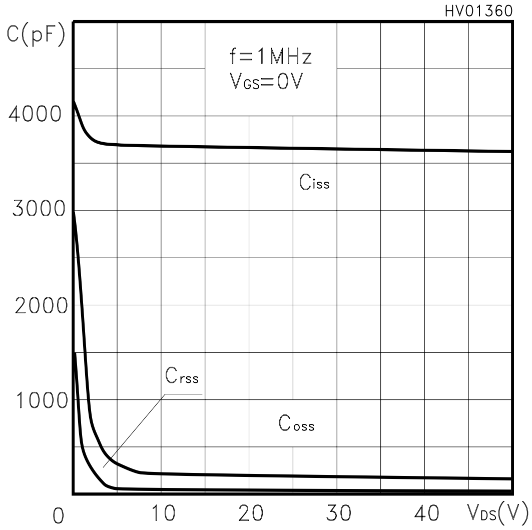
Static Drain-source On Resistance



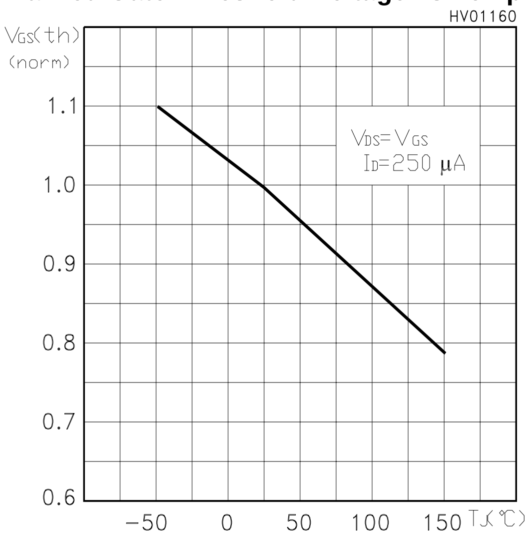
Gate Charge vs Gate-source Voltage



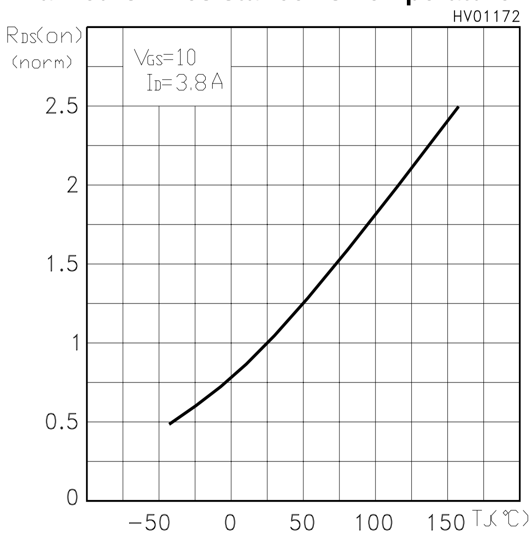
Capacitance Variations



Normalized Gate Threshold Voltage vs Temp.



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics

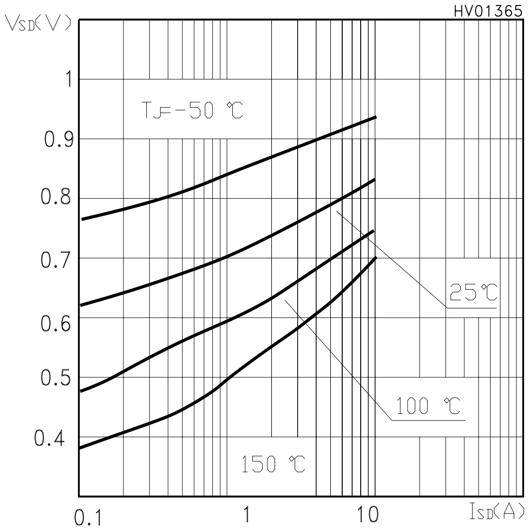


Fig. 1: Unclamped Inductive Load Test Circuit

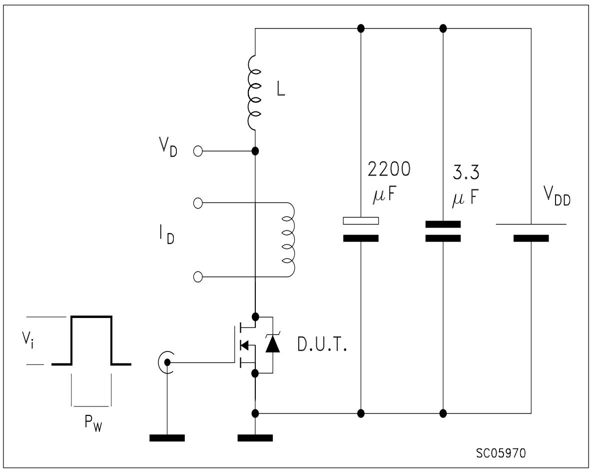


Fig. 2: Unclamped Inductive Waveform

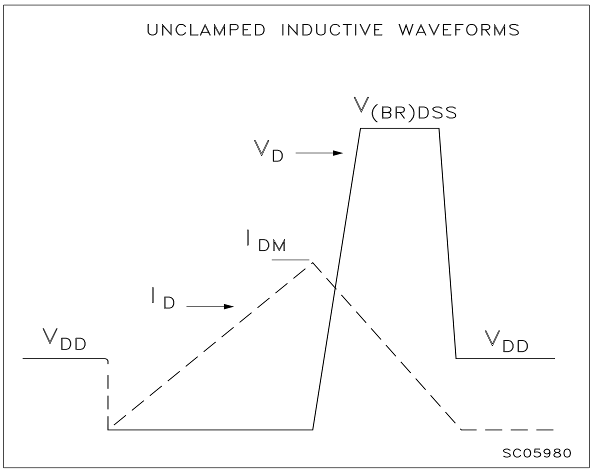


Fig. 3: Switching Times Test Circuit For Resistive Load

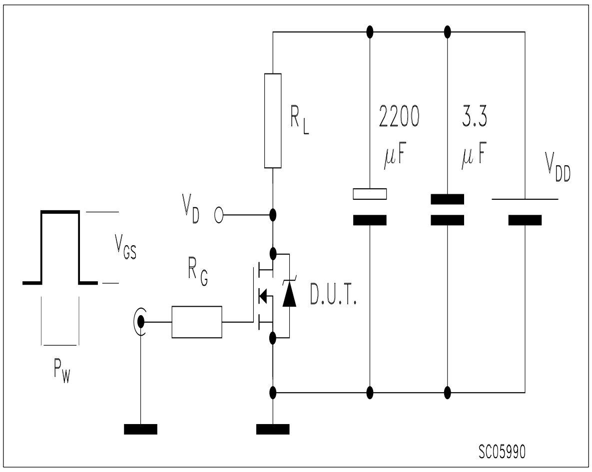


Fig. 4: Gate Charge test Circuit

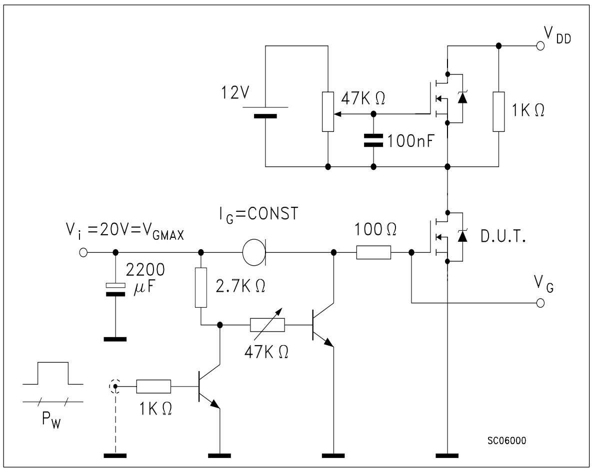
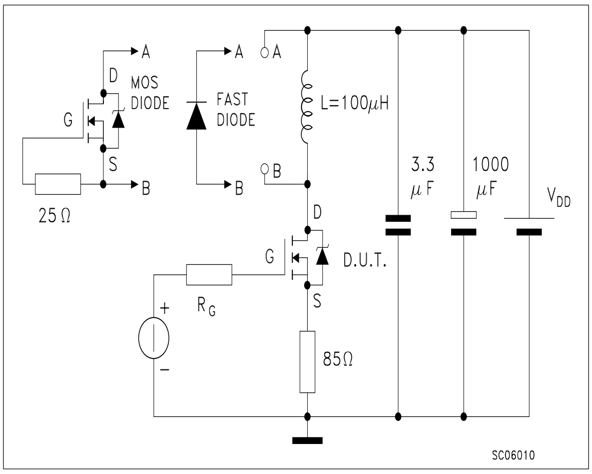
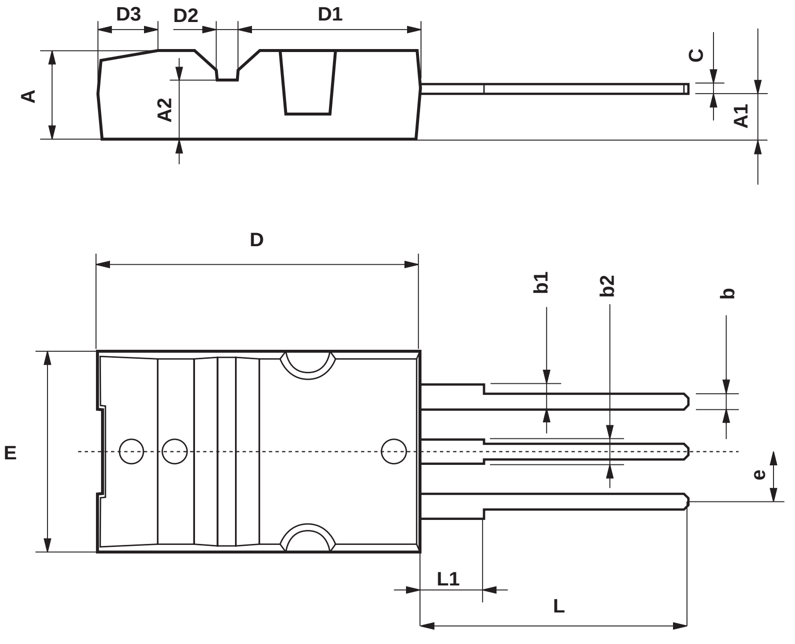


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



Max220 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.3		4.6	0.169		0.181
A1	2.2		2.4	0.087		0.094
A2	2.9		3.1	0.114		0.122
b	0.7		0.93	0.027		0.036
b1	1.25		1.4	0.049		0.055
b2	1.2		1.38	0.047		0.054
c	0.45		0.6		0.18	0.023
D	15.9		16.3		0.626	0.641
D1	9		9.35	0.354		0.368
D2	0.8		1.2	0.031		0.047
D3	2.8		3.2	0.110		0.126
e	2.44		2.64	0.096		0.104
E	10.05		10.35	0.396		0.407
L	13.2		13.6	0.520		0.535
L1	3		3.4	0.118		0.133



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I-Max220 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.3		4.6	0.169		0.181
A1	2.6		2.75	0.102		0.108
A2	1.95		2.15	0.077		0.084
b	0.7		0.93	0.027		0.036
b1	1.25		1.4	0.049		0.055
b2	1.2		1.38	0.047		0.054
c	0.45		0.6	0.017		0.023
D	15.9		16.3	0.626		0.641
D1	12.5		12.9	0.492		0.508
D2	0.6		1	0.023		0.039
D3	1.75		2.15	0.069		0.084
e	2.44		2.64	0.096		0.104
E	10.05		10.35	0.396		0.407
L	13.2		13.6	0.520		0.535
L1	3		3.4	0.118		0.133