

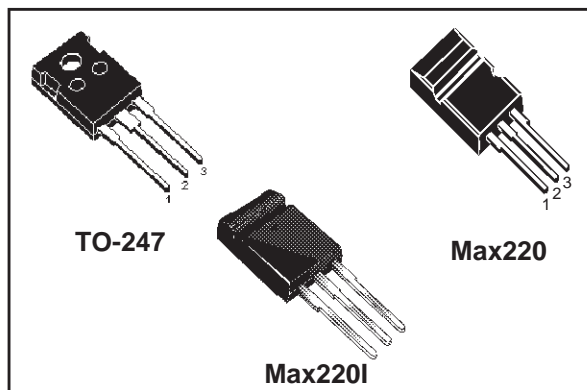


# STW26NM60 STU26NM60, STU26NM60I

N-CHANNEL 600V - 0.125Ω - 26A TO-247,Max220,Max220I  
Zener-Protected MDmesh™ Power MOSFET

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STW26NM60	600 V	< 0.135 Ω	30 A
STU26NM60	600 V	< 0.135 Ω	26 A
STU26NM60I	600 V	< 0.135 Ω	26 A

- n TYPICAL R<sub>DS(on)</sub> = 0.125Ω
- n HIGH dv/dt AND AVALANCHE CAPABILITIES
- n IMPROVED ESD CAPABILITY
- n LOW INPUT CAPACITANCE AND GATE CHARGE
- n LOW GATE INPUT RESISTANCE



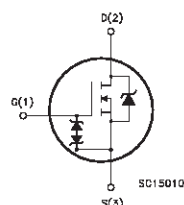
## DESCRIPTION

The MDmesh™ is a new revolutionary MOSFET technology that associates the Multiple Drain process with the Company's PowerMESH™ horizontal layout. The resulting product has an outstanding low on-resistance, impressively high dv/dt and excellent avalanche characteristics. The adoption of the Company's proprietary strip technique yields overall dynamic performance that is significantly better than that of similar competition's products.

## APPLICATIONS

The MDmesh™ family is very suitable for increasing power density of high voltage converters allowing system miniaturization and higher efficiencies.

## INTERNAL SCHEMATIC DIAGRAM



## ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STW26NM60	W26NM60	TO-247	TUBE
STU26NM60	U26NM60	Max220	TUBE
STU26NM60I	U26NM60I	Max220I	TUBE

## STW26NM60, STU26NM60, STU26NM60I

### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value			Unit
		STW26NM60	STU26NM60	STU26NM60I	
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	600			V
V <sub>DGR</sub>	Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)	600			V
V <sub>GS</sub>	Gate- source Voltage	± 30			V
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 25°C	30	26	26 (*)	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 100°C	18.9	16.38	16.38 (*)	A
I <sub>DM</sub> (1)	Drain Current (pulsed)	120	104	104 (*)	A
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	313	192	73	W
	Derating Factor	2.5	1.54	0.58	W/°C
V <sub>ESD(G-S)</sub>	Gate source ESD(HBM-C=100pF, R=1.5KΩ)	6000			V
dv/dt (1)	Peak Diode Recovery voltage slope	15			V/ns
T <sub>j</sub>	Operating Junction Temperature	-55 to 150			°C
T <sub>stg</sub>	Storage Temperature	-55 to 150			°C

(1) Pulse width limited by safe operating area

(1) I<sub>SD</sub> ≤ 26A, di/dt ≤ 200A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>j</sub> ≤ T<sub>JMAX</sub>.

(\*) Limited only by maximum temperature allowed

### THERMAL DATA

		TO-247	Max220	Max220I	
R <sub>thj-case</sub>	Thermal Resistance Junction-case Max	0.4	0.65	1.7	°C/W
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient Max	62.5			°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)	13	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)	740	mJ

### GATE-SOURCE ZENER DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
BV <sub>GSO</sub>	Gate-Source Breakdown Voltage	I <sub>gss</sub> =± 1mA (Open Drain)	30			V

### 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 source. In this respect the Zener voltage is appropriate 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.

**ELECTRICAL CHARACTERISTICS** (TCASE = 25°C UNLESS OTHERWISE SPECIFIED)  
ON/OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250 \mu A$ , $V_{GS} = 0$	600			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 ( $V_{DS} = 0$ )	$V_{GS} = \pm 20V$			$\pm 10$	$\mu A$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ , $I_D = 250 \mu A$	3	4	5	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10V$ , $I_D = 13 A$		0.125	0.135	$\Omega$

**DYNAMIC**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (1)$	Forward Transconductance	$V_{DS} = 15 V$ , $I_D = 13 A$		20		S
$C_{iss}$ $C_{oss}$ $C_{rss}$	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25V$ , $f = 1 \text{ MHz}$ , $V_{GS} = 0$		2900 900 40		pF pF pF

**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on Delay Time Rise Time	$V_{DD} = 300V$ , $I_D = 13 A$ $R_G = 4.7\Omega$ , $V_{GS} = 10 V$ (Resistive Load see, Figure 3)		35 22		ns ns
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 480V$ , $I_D = 26 A$ , $V_{GS} = 10V$		73 20 37	102	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	$V_{DD} = 480V$ , $I_D = 26 A$ , $R_G = 4.7\Omega$ , $V_{GS} = 10V$ (Inductive Load see, Figure 5)		14 20 40		ns ns ns

**SOURCE DRAIN DIODE**

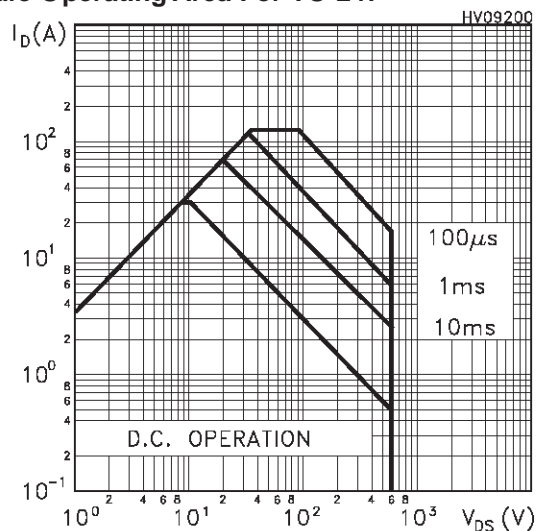
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$ $I_{SDM} (2)$	Source-drain Current Source-drain Current (pulsed)				26 104	A A
$V_{SD} (1)$	Forward On Voltage	$I_{SD} = 26 A$ , $V_{GS} = 0$			1.5	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 26 A$ , $di/dt = 100A/\mu s$ $V_{DD} = 60V$ , $T_J = 150^\circ C$ (see test circuit, Figure 5)		560 9 32.5		ns $\mu C$ A

Note: 1. Pulsed: Pulse duration = 300  $\mu s$ , duty cycle 1.5 %.

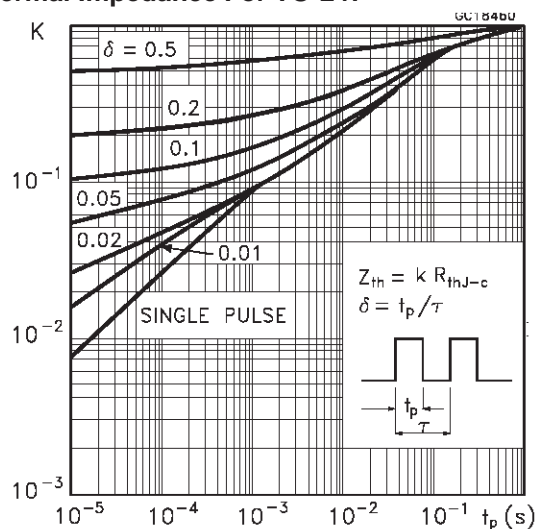
2. Pulse width limited by safe operating area.

3.  $C_{oss eq.}$  is defined as a constant equivalent capacitance giving the same charging time as  $C_{oss}$  when  $V_{DS}$  increases from 0 to 80%  $V_{DSS}$ .

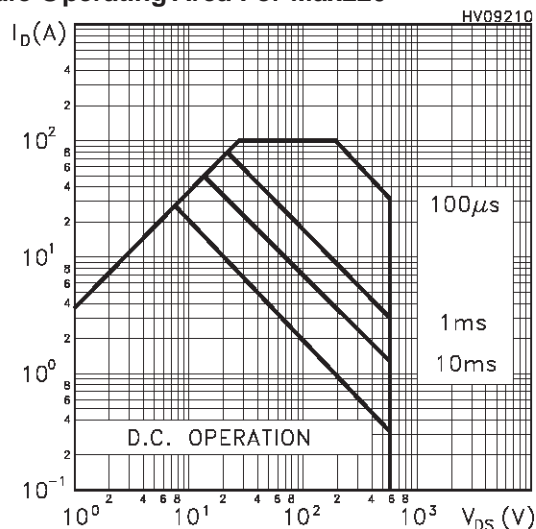
Safe Operating Area For TO-247



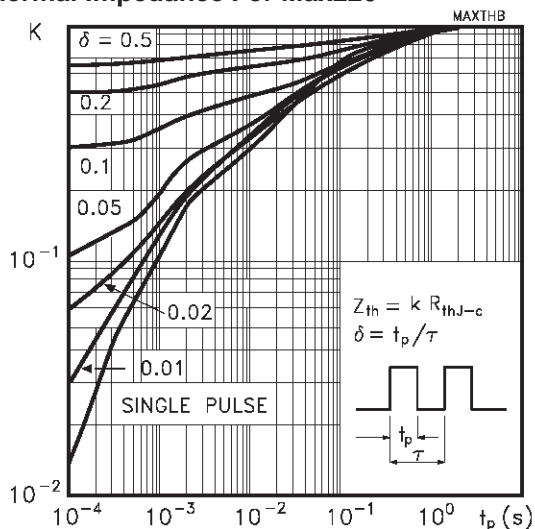
Thermal Impedance For TO-247



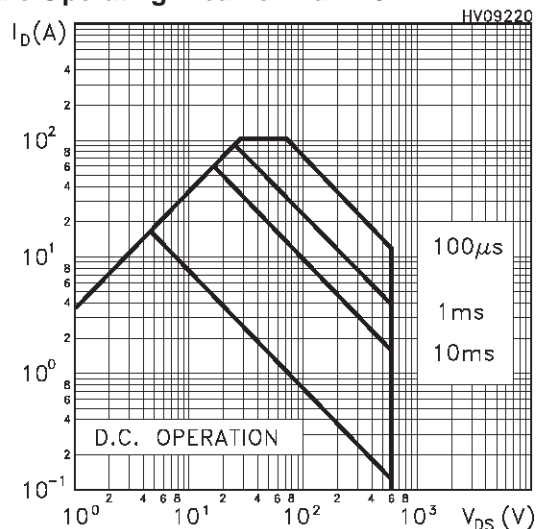
Safe Operating Area For Max220



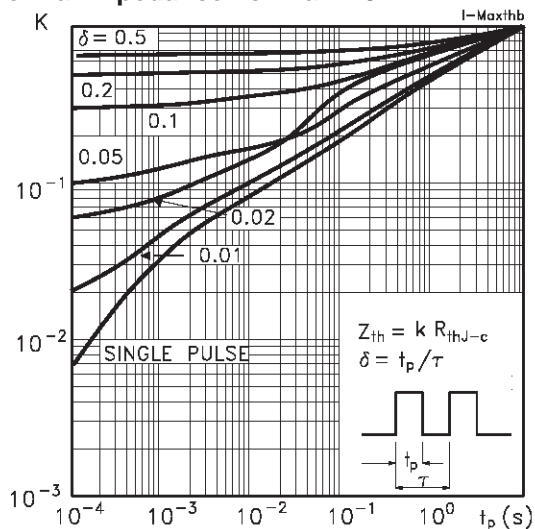
Thermal Impedance For Max220



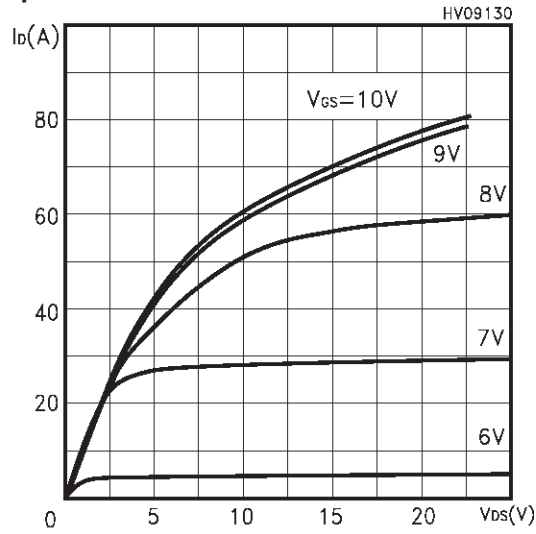
Safe Operating Area For Max220I



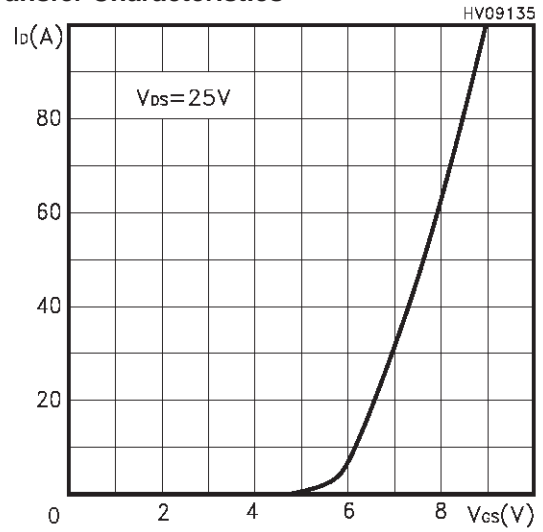
Thermal Impedance For Max220I



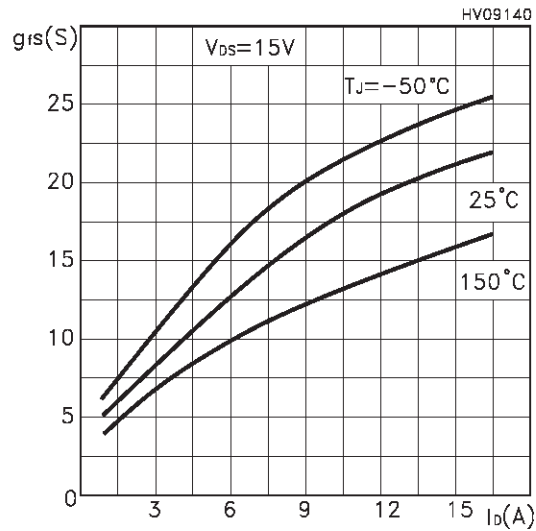
### Output Characteristics



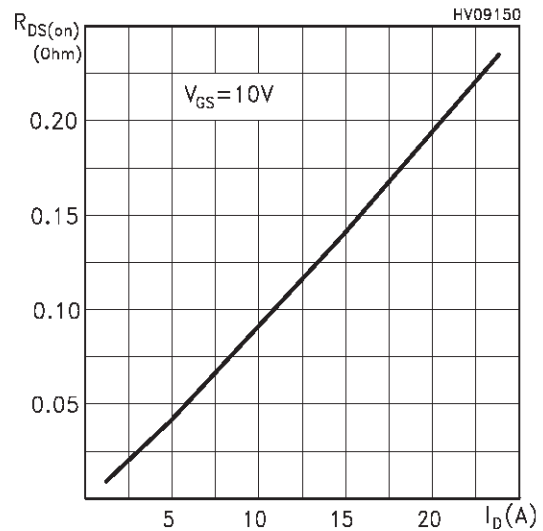
### Transfer Characteristics



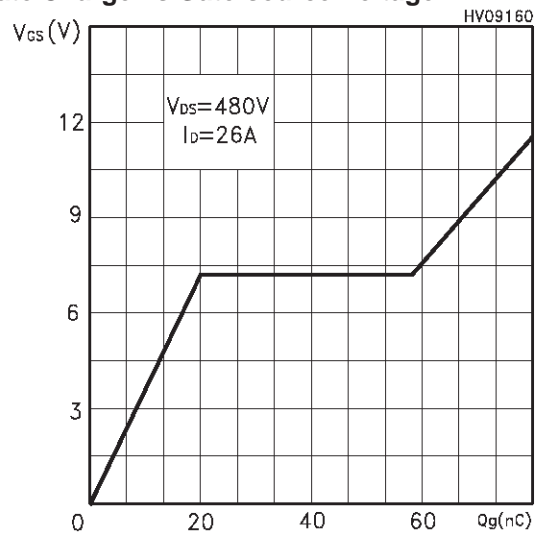
### Transconductance



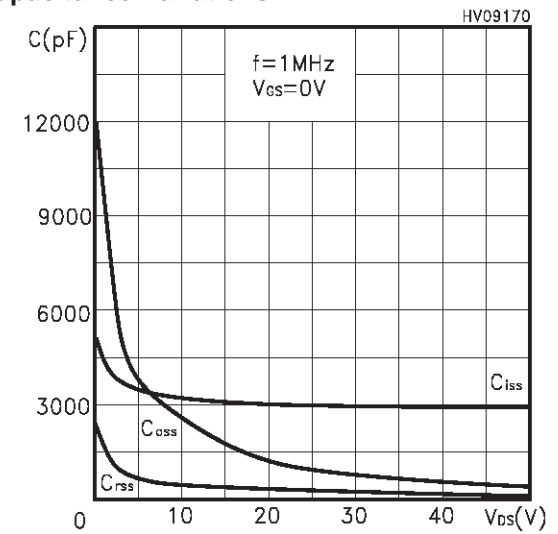
### Static Drain-source On Resistance



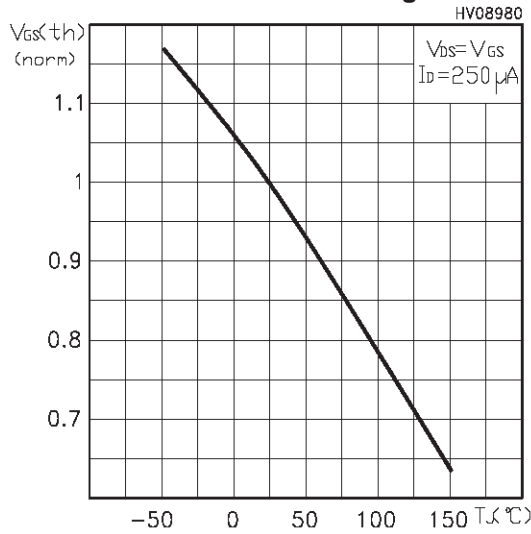
### Gate Charge vs Gate-source Voltage



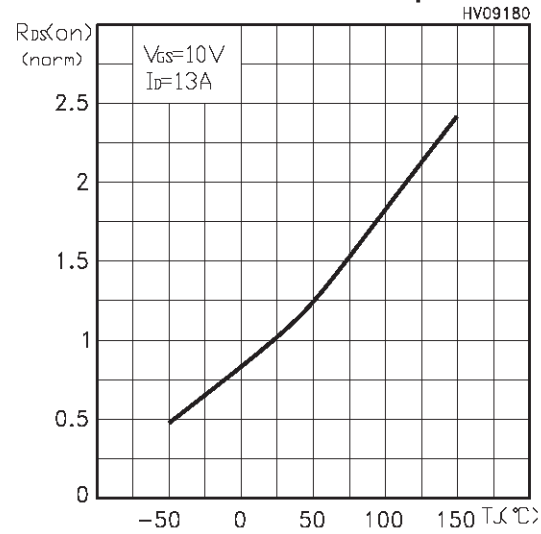
### Capacitance Variations



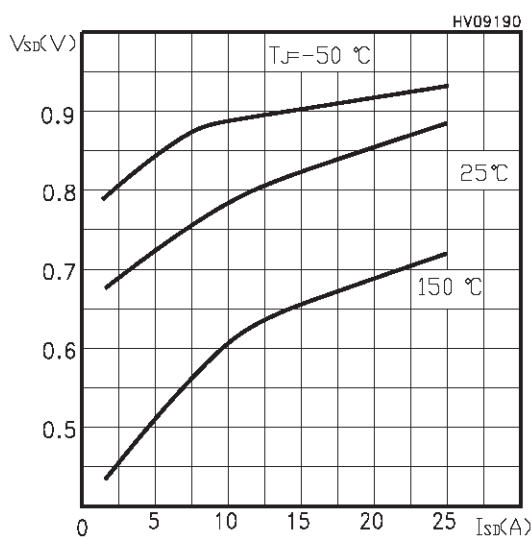
Normalized Gate Threshold Voltage vs Temp.



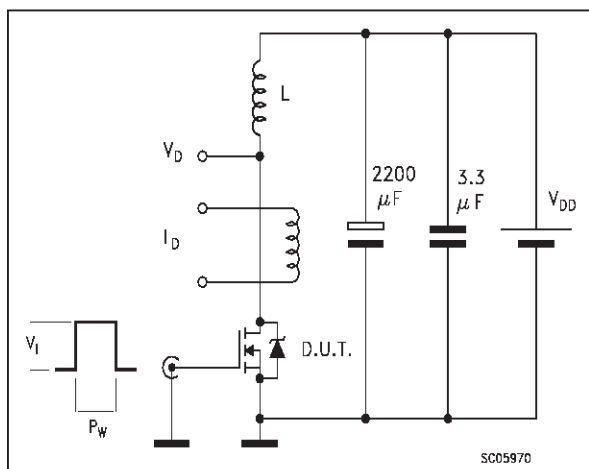
Normalized On Resistance vs Temperature



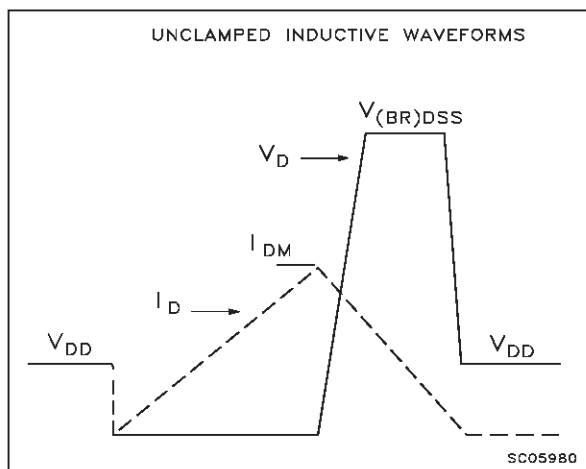
Source-drain Diode Forward Characteristics



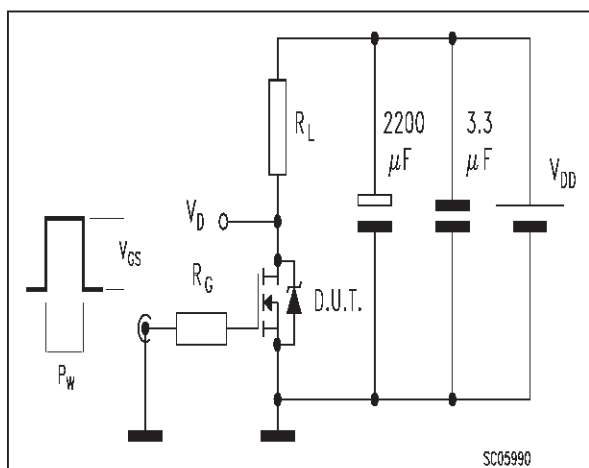
**Fig. 1: Unclamped Inductive Load Test Circuit**



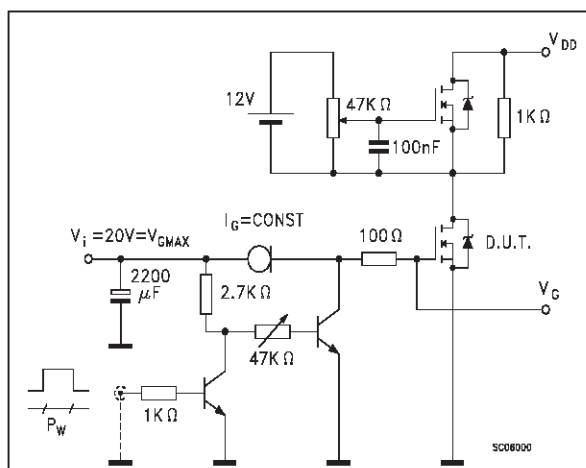
**Fig. 2: Unclamped Inductive Waveform**



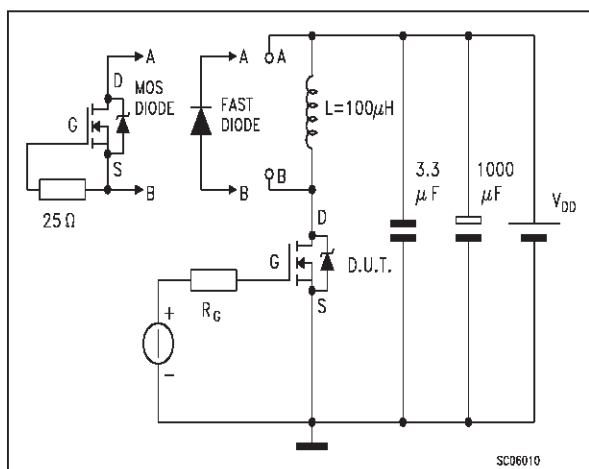
**Fig. 3: Switching Times Test Circuit For Resistive Load**



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

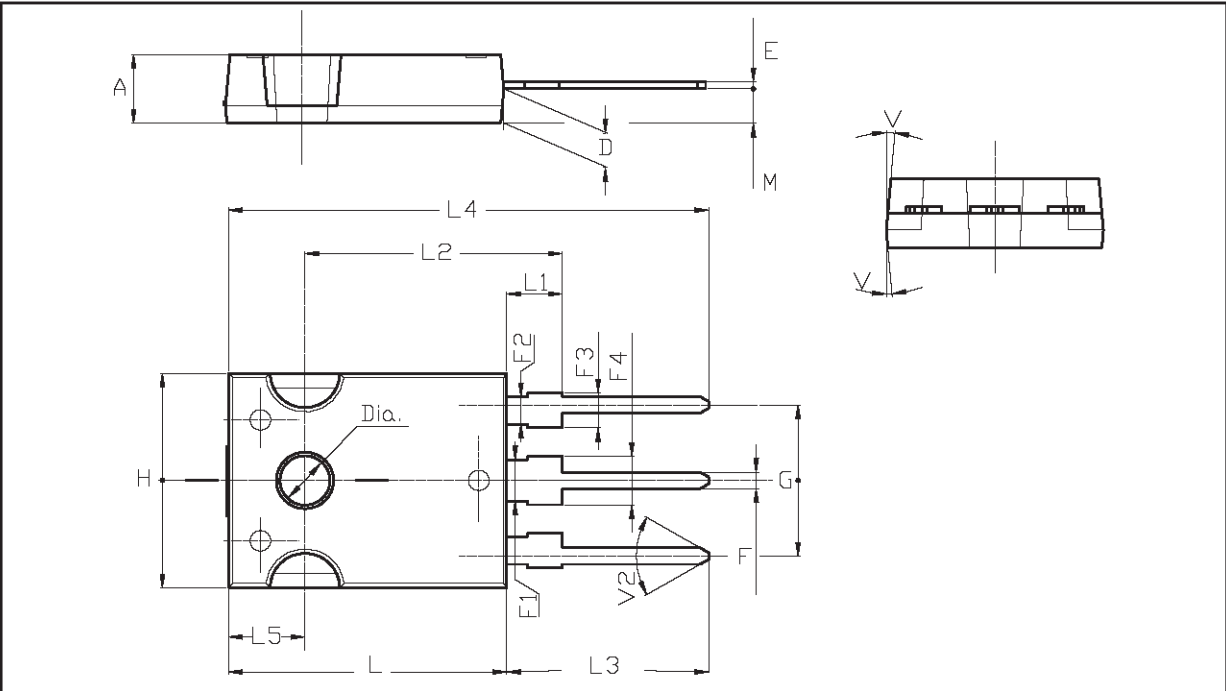


**Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times**



TO-247 MECHANICAL DATA

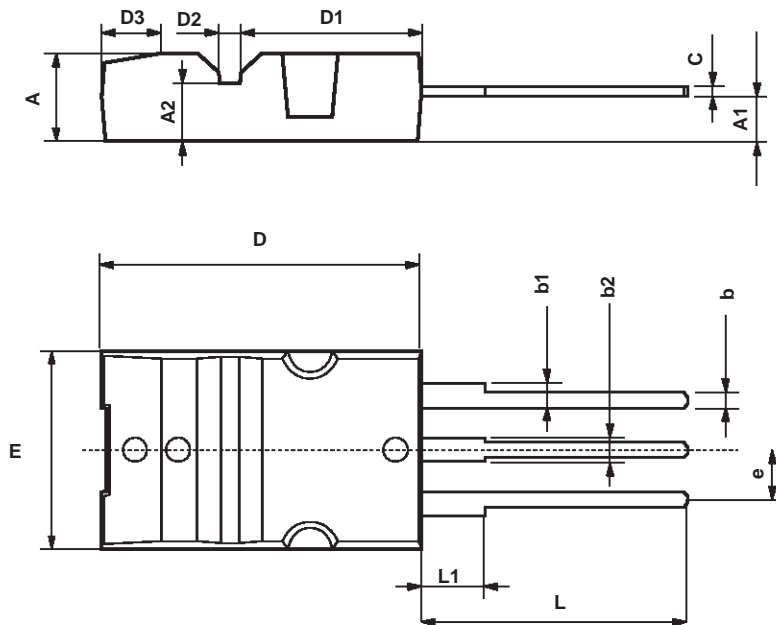
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.85		5.15	0.19		0.20
D	2.20		2.60	0.08		0.10
E	0.40		0.80	0.015		0.03
F	1		1.40	0.04		0.05
F1		3			0.11	
F2		2			0.07	
F3	2		2.40	0.07		0.09
F4	3		3.40	0.11		0.13
G		10.90			0.43	
H	15.45		15.75	0.60		0.62
L	19.85		20.15	0.78		0.79
L1	3.70		4.30	0.14		0.17
L2		18.50			0.72	
L3	14.20		14.80	0.56		0.58
L4		34.60			1.36	
L5		5.50			0.21	
M	2		3	0.07		0.11
V		5°			5°	
V2		60°			60°	
Dia	3.55		3.65	0.14		0.143





Max220 MECHANICAL DATA

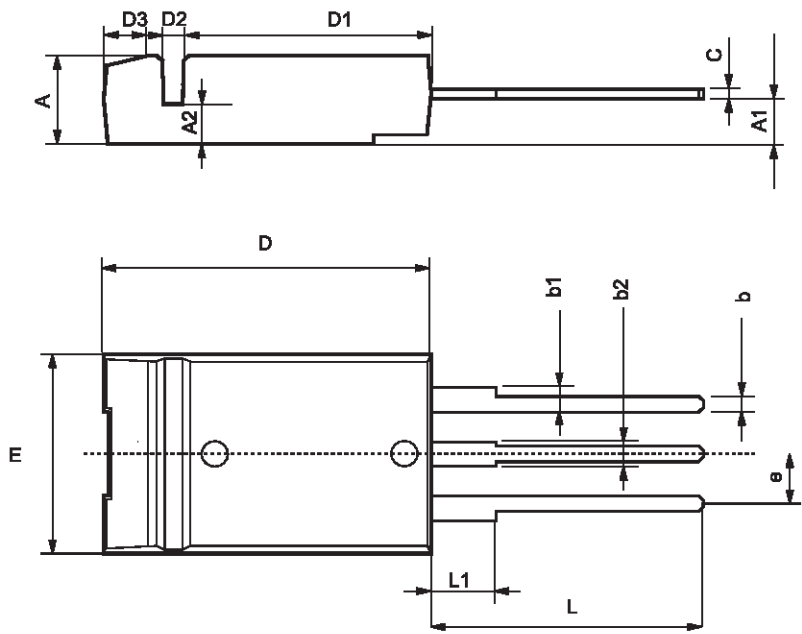
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.3		4.6	0.169		0.181
A1	2.2		2.4	0.087		0.094
A2	2.9		3.1	0.114		0.122
b	0.7		0.93	0.027		0.036
b1	1.25		1.4	0.049		0.055
b2	1.2		1.38	0.047		0.054
c	0.45		0.6		0.18	0.023
D	15.9		16.3		0.626	0.641
D1	9		9.35	0.354		0.368
D2	0.8		1.2	0.031		0.047
D3	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



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