

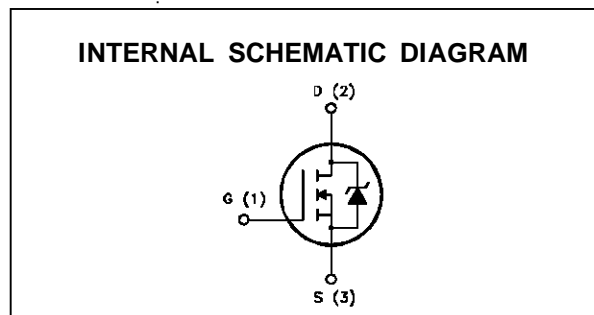
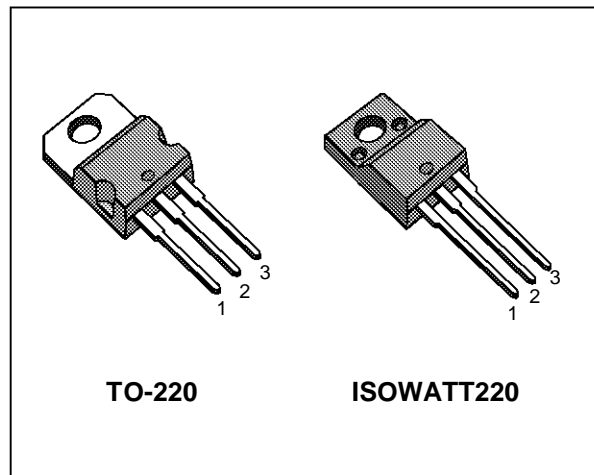
## N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
MTP3N60	600 V	< 2.5 Ω	3.9 A
MTP3N60FI	600 V	< 2.5 Ω	2.5 A

- TYPICAL R<sub>DS(on)</sub> = 2 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION

### APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- CHOPPER REGULATORS, CONVERTERS, MOTOR CONTROL, LIGHTING FOR INDUSTRIAL AND CONSUMER ENVIRONMENT



### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		MTP3N60	MTP3N60FI	
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	± 20		V
I <sub>D</sub>	Drain Current (continuous) at T <sub>c</sub> = 25 °C	3.9	2.5	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>c</sub> = 100 °C	2.4	1.5	A
I <sub>DM(●)</sub>	Drain Current (pulsed)	14	14	A
P <sub>tot</sub>	Total Dissipation at T <sub>c</sub> = 25 °C	100	35	W
	Derating Factor	0.8	0.28	W/°C
V <sub>ISO</sub>	Insulation Withstand Voltage (DC)	—	2000	V
T <sub>stg</sub>	Storage Temperature	-65 to 150		°C
T <sub>j</sub>	Max. Operating Junction Temperature	150		°C

(●) Pulse width limited by safe operating area

## THERMAL DATA

		TO-220	ISOWATT220		
R <sub>thj-case</sub>	Thermal Resistance Junction-case	Max	1.25	3.57	°C/W
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient	Max	62.5		°C/W
R <sub>thc-sink</sub>	Thermal Resistance Case-sink	Typ	0.5		°C/W
T <sub>l</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, δ < 1%)	3.9	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> = 25 V)	300	mJ
E <sub>AR</sub>	Repetitive Avalanche Energy (pulse width limited by T <sub>j</sub> max, δ < 1%)	7.7	mJ
I <sub>AR</sub>	Avalanche Current, Repetitive or Not-Repetitive (T <sub>c</sub> = 100 °C, pulse width limited by T <sub>j</sub> max, δ < 1%)	2.4	A

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	600			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 x 0.8 T <sub>c</sub> = 125 °C			25 250	μA μA
I <sub>GSS</sub>	Gate-body Leakage Current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ± 20 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> = 1 mA	2	3	4.5	V
R <sub>DS(on)</sub>	Static Drain-source On Resistance	V <sub>GS</sub> = 10V I <sub>D</sub> = 1.5 A		2	2.5	Ω
I <sub>D(on)</sub>	On State Drain Current	V <sub>DS</sub> > I <sub>D(on)</sub> x R <sub>DS(on)max</sub> V <sub>GS</sub> = 10 V	3.9			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> x R <sub>DS(on)max</sub> I <sub>D</sub> = 1.5 A	1.5	2.6		S
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25 V f = 1 MHz V <sub>GS</sub> = 0		560	800	pF
C <sub>oss</sub>	Output Capacitance			90	130	pF
C <sub>rss</sub>	Reverse Transfer Capacitance			40	55	pF

**ELECTRICAL CHARACTERISTICS** (continued)

**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on Time Rise Time	$V_{DD} = 225\text{ V}$ $I_D = 2.5\text{ A}$ $R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		45 33	60 42	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 480\text{ V}$ $I_D = 4\text{ A}$ $R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		200		A/ $\mu$ s
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 480\text{ V}$ $I_D = 4\text{ A}$ $V_{GS} = 10\text{ V}$		43 6 21	55	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	$V_{DD} = 480\text{ V}$ $I_D = 4\text{ A}$ $R_G = 15\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		35 40 60	45 55 75	ns ns ns

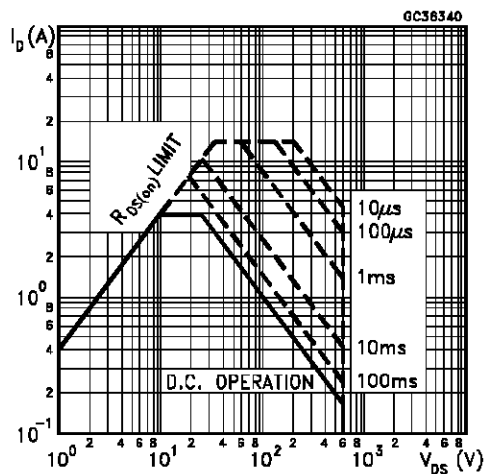
**SOURCE DRAIN DIODE**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$ $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				3.9 14	A A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 3.9\text{ A}$ $V_{GS} = 0$			2	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 4\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		420 3.7 18		ns $\mu$ C A

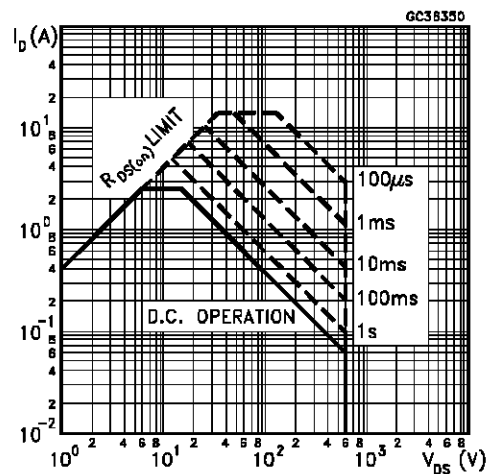
(\*) Pulsed: Pulse duration = 300  $\mu$ s, duty cycle 1.5%

( $\bullet$ ) Pulse width limited by safe operating area

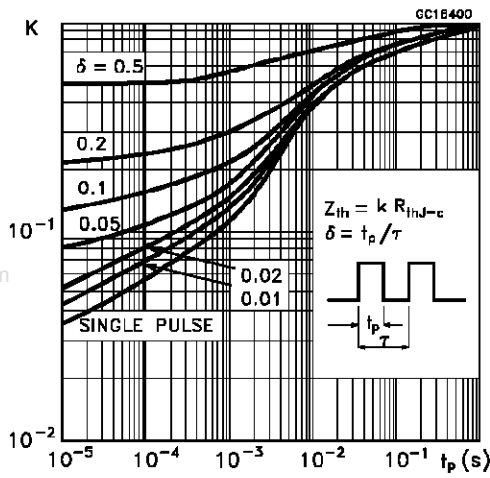
**Safe Operating Areas For TO-220**



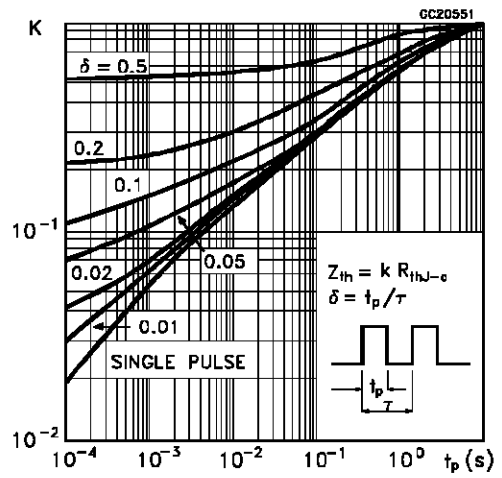
**Safe Operating Areas For ISOWATT220**



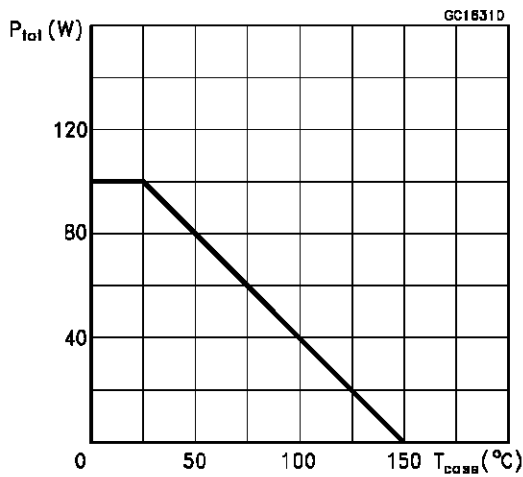
Thermal Impedance For TO-220



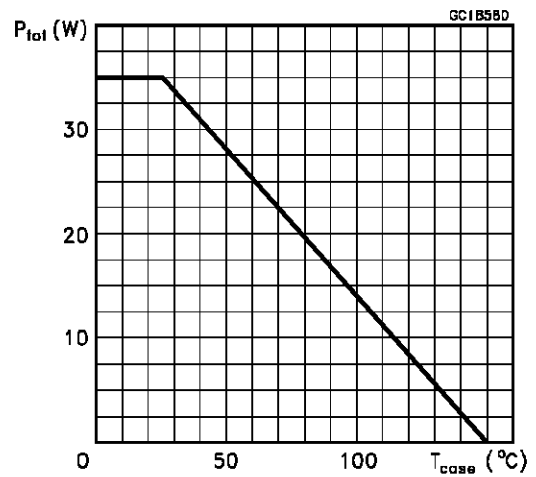
Thermal Impedance For ISOWATT220



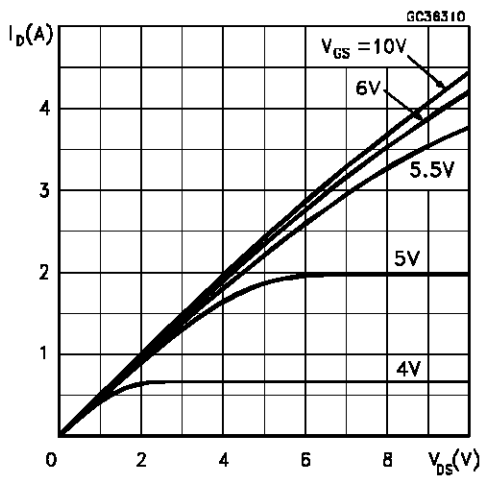
Derating Curve For TO-220



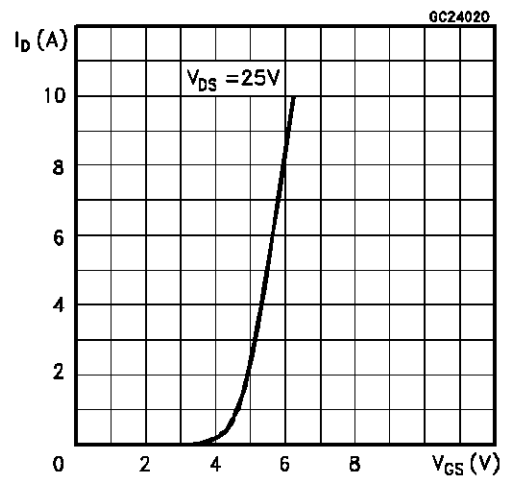
Derating Curve For ISOWATT220



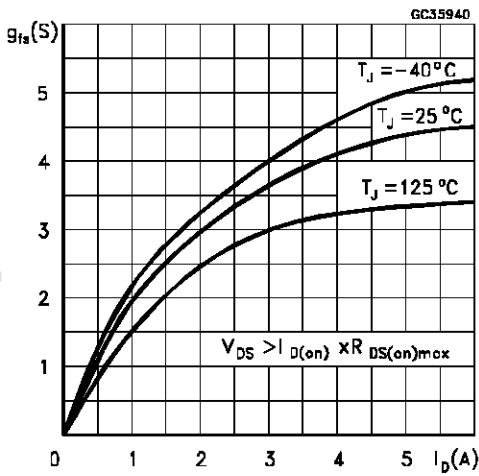
Output Characteristics



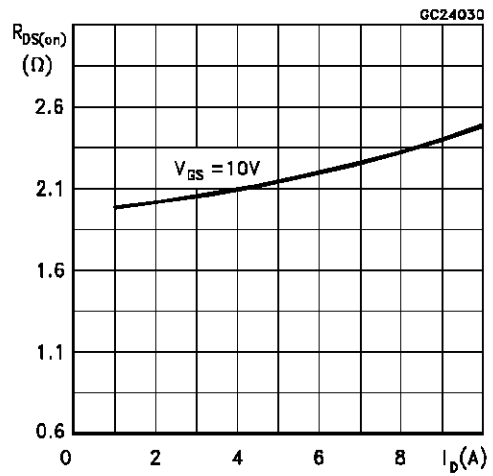
Transfer Characteristics



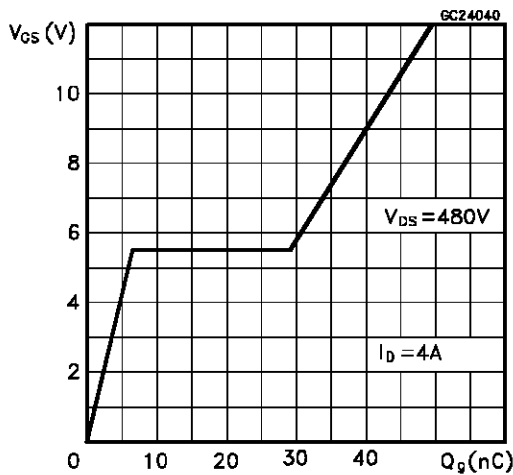
Transconductance



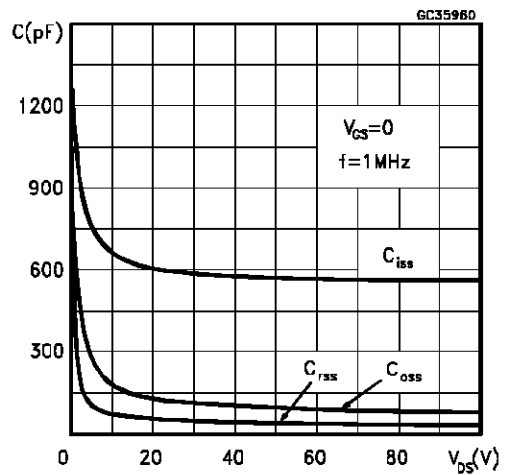
Static Drain-source On Resistance



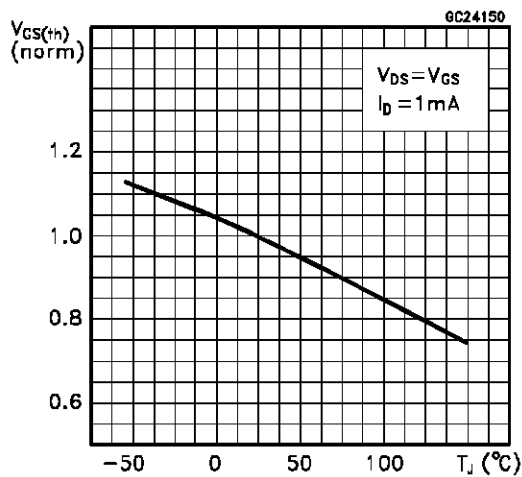
Gate Charge vs Gate-source Voltage



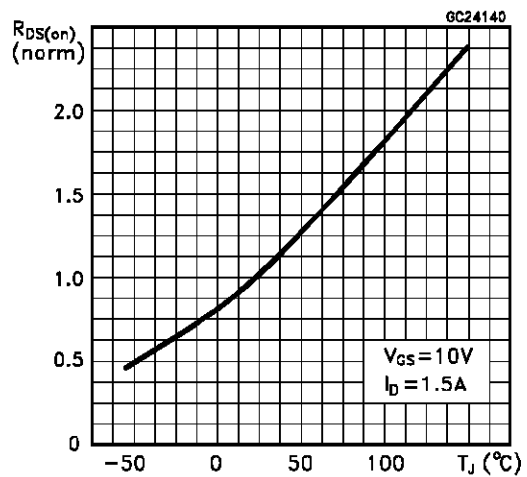
Capacitance Variations



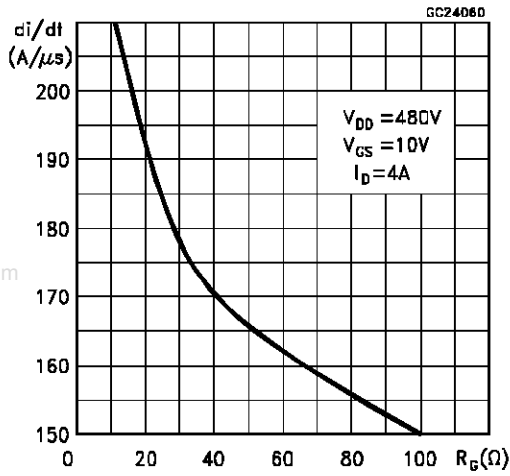
Normalized Gate Threshold Voltage vs Temperature



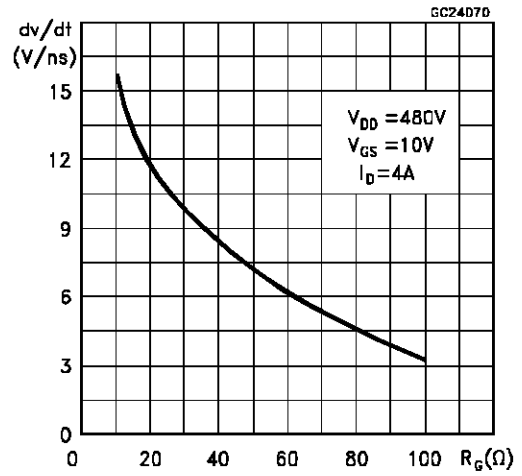
Normalized On Resistance vs Temperature



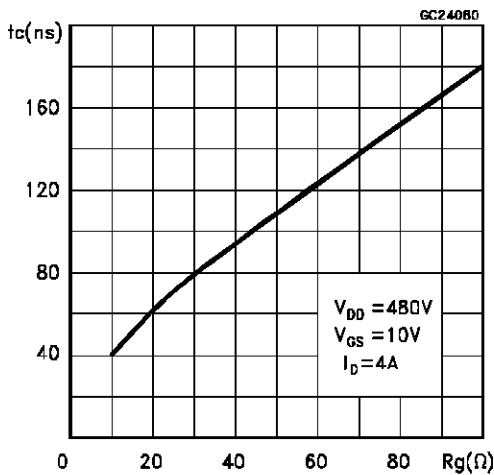
Turn-on Current Slope



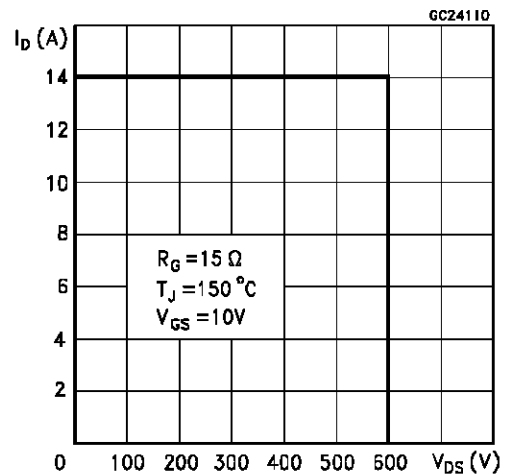
Turn-off Drain-source Voltage Slope



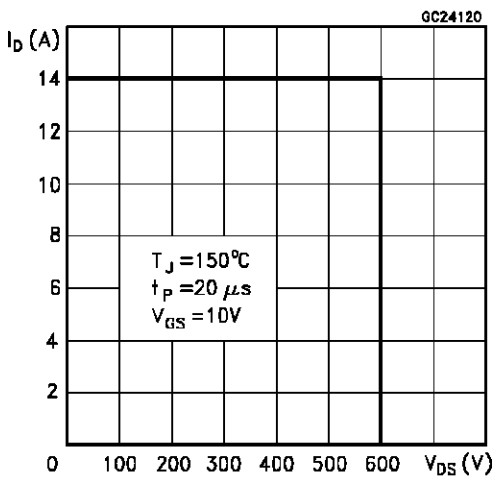
Cross-over Time



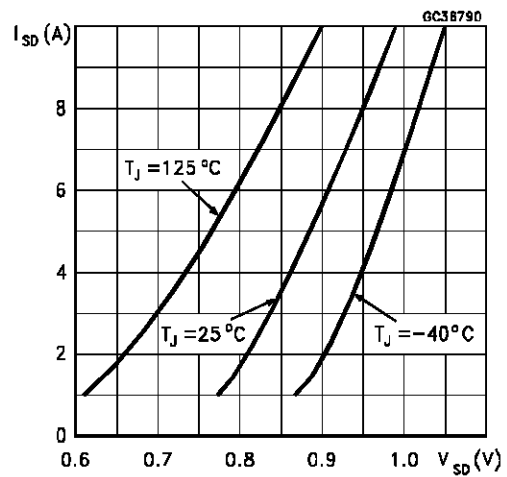
Switching Safe Operating Area



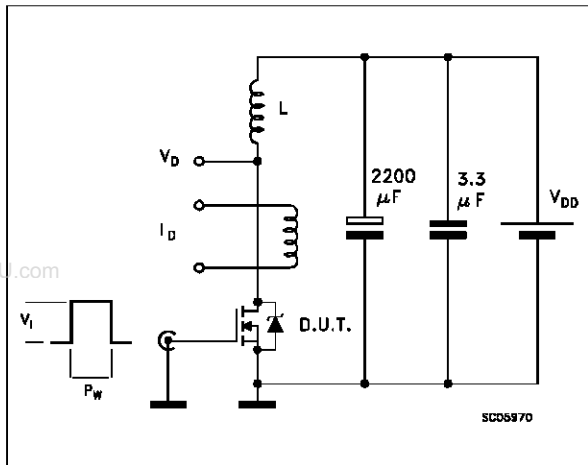
Accidental Overload Area



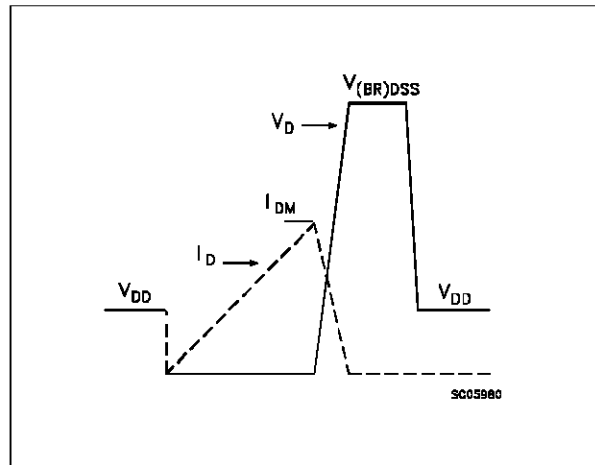
Source-drain Diode Forward Characteristics



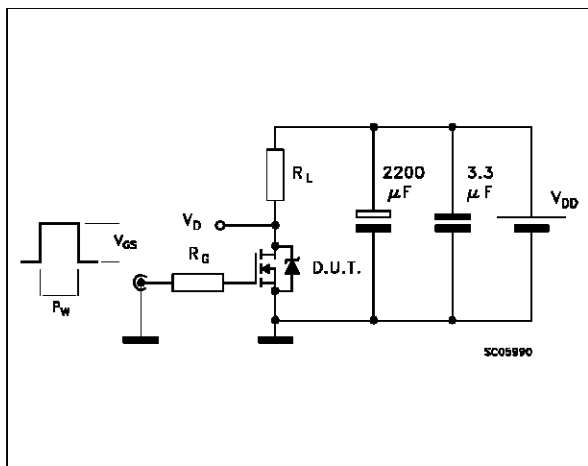
**Fig. 1: Unclamped Inductive Load Test Circuits**



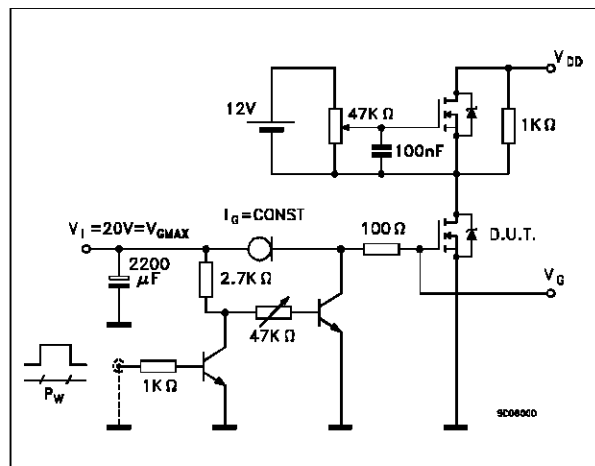
**Fig. 2: Unclamped Inductive Waveforms**



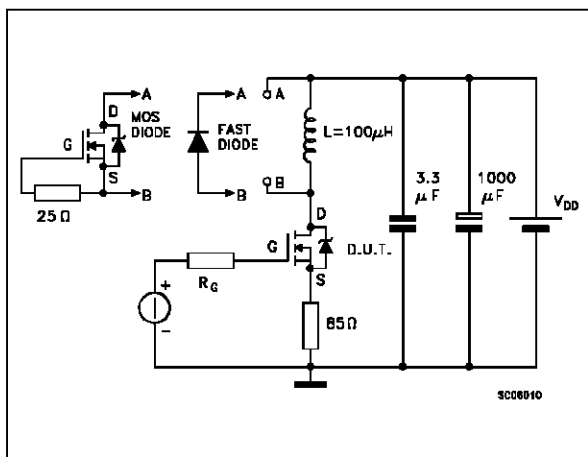
**Fig. 3: Switching Times Test Circuits For Resistive Load**



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

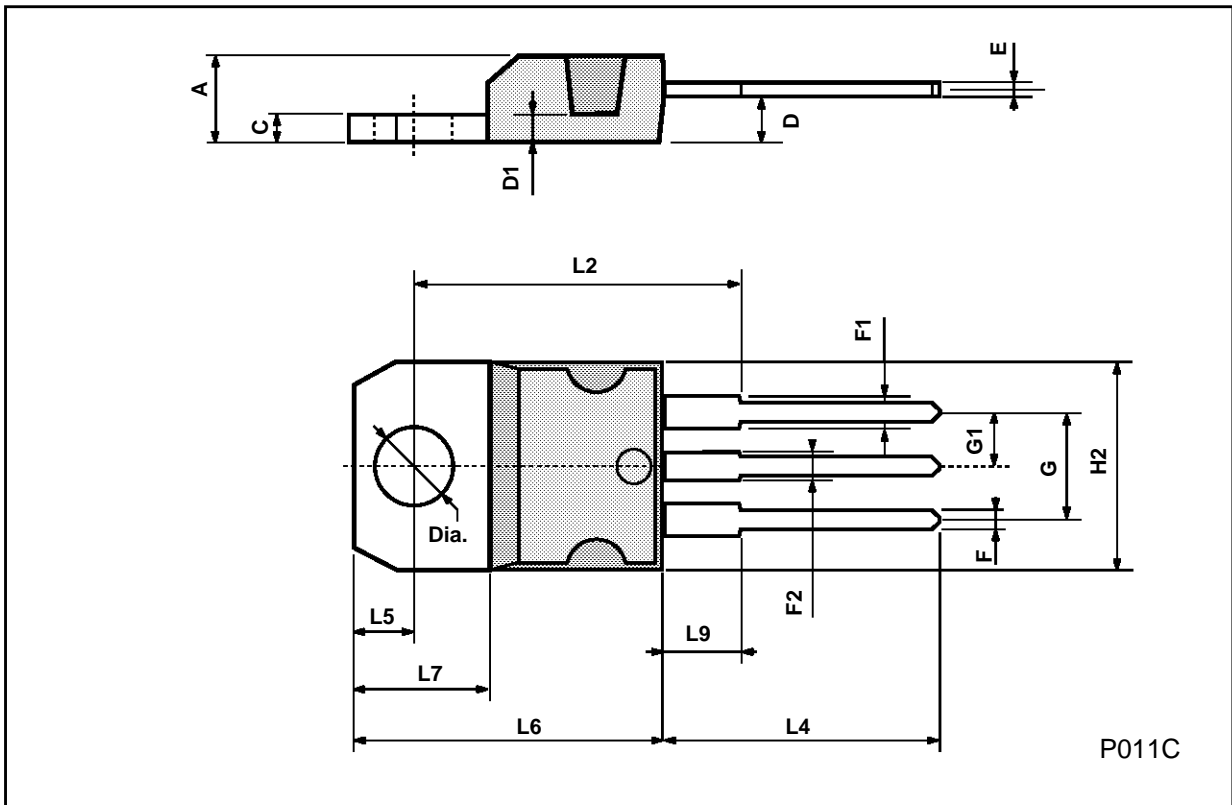


**Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time**



**TO-220 MECHANICAL DATA**

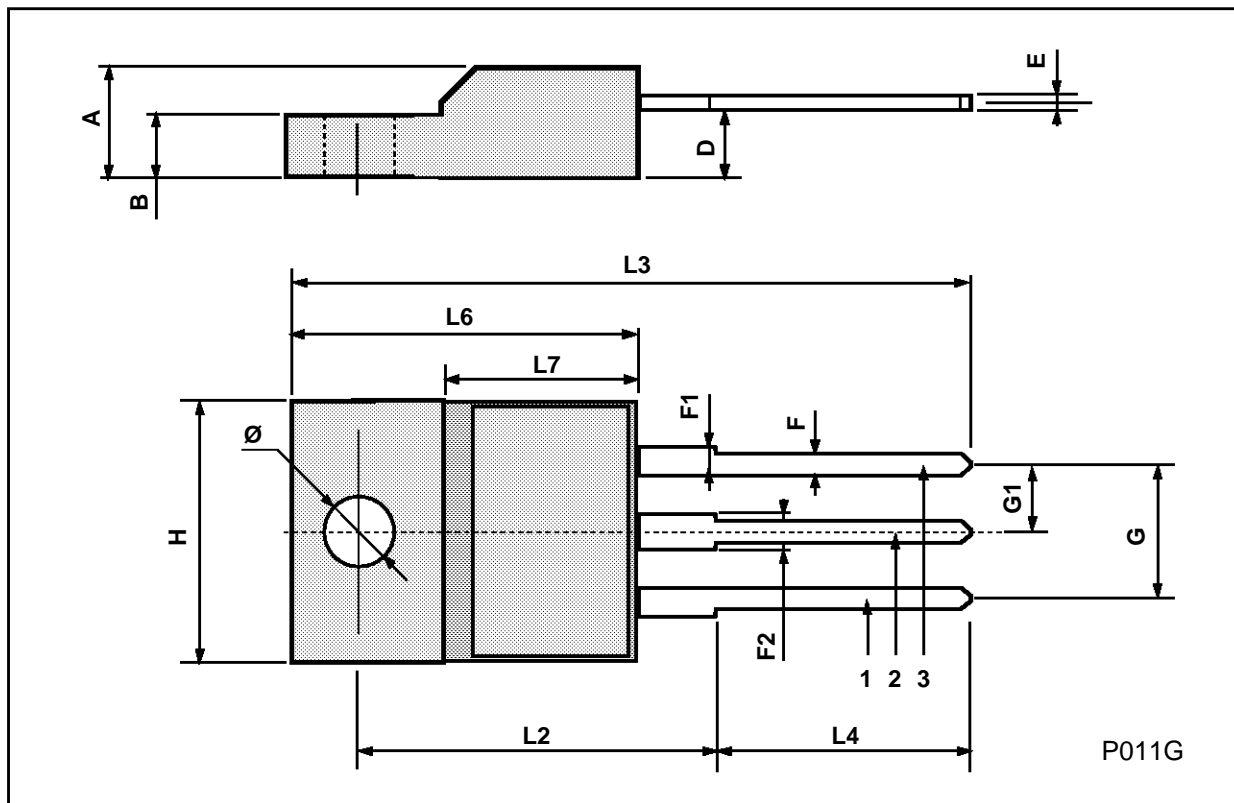
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
C	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
D1		1.27			0.050	
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
G1	2.4		2.7	0.094		0.106
H2	10.0		10.40	0.393		0.409
L2		16.4			0.645	
L4	13.0		14.0	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.25		15.75	0.600		0.620
L7	6.2		6.6	0.244		0.260
L9	3.5		3.93	0.137		0.154
DIA.	3.75		3.85	0.147		0.151





## ISOWATT220 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.4		0.7	0.015		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.7	0.045		0.067
F2	1.15		1.7	0.045		0.067
G	4.95		5.2	0.195		0.204
G1	2.4		2.7	0.094		0.106
H	10		10.4	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	0.385		0.417
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
Ø	3		3.2	0.118		0.126



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