

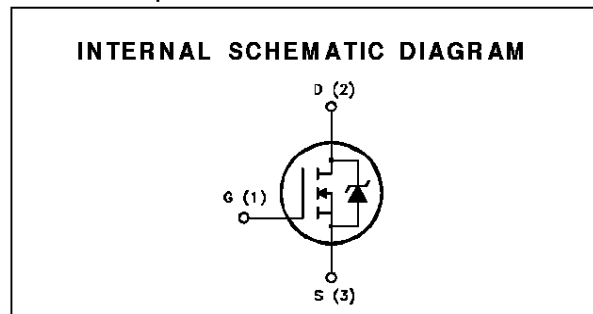
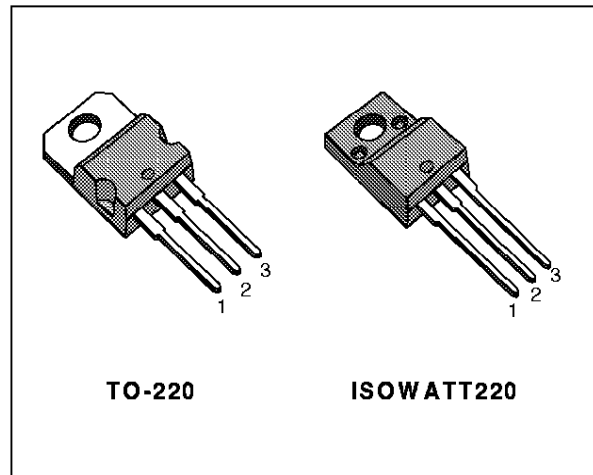
**N - CHANNEL ENHANCEMENT MODE  
LOW THRESHOLD POWER MOS TRANSISTOR**

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STP13N10L	100 V	< 0.2 Ω	13 A
STP13N10LFI	100 V	< 0.2 Ω	9 A

- TYPICAL R<sub>DS(on)</sub> = 0.16 Ω
- AVALANCHE RUGGEDNESS TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- 175 °C OPERATING TEMPERATURE
- LOGIC LEVEL COMPATIBLE INPUT
- APPLICATION ORIENTED CHARACTERIZATION

**APPLICATIONS**

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)



**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value		Unit
		STP13N10L	STP13N10LFI	
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	100		V
V <sub>DCR</sub>	Drain- gate Voltage (R <sub>GS</sub> = 20 kΩ)	100		V
V <sub>GS</sub>	Gate-source Voltage	± 15		V
I <sub>D</sub>	Drain Current (continuous) at T <sub>c</sub> = 25 °C	13	9	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>c</sub> = 100 °C	9	6	A
I <sub>DM</sub> (*)	Drain Current (pulsed)	52	52	A
P <sub>tot</sub>	Total Dissipation at T <sub>c</sub> = 25 °C	80	35	W
	Derating Factor	0.53	0.23	W/°C
V <sub>ISO</sub>	Insulation Withstand Voltage (DC)	—	2000	V
T <sub>stg</sub>	Storage Temperature	-65 to 175		°C
T <sub>j</sub>	Max. Operating Junction Temperature	175		°C

(\*) Pulse width limited by safe operating area

## THERMAL DATA

			TO-220	ISOWATT220	
R <sub>thj-case</sub>	Thermal Resistance Junction-case	Max	1.87	4.3	°C/W
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient	Max	6.25		°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%)	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> = 25 V)	50	mJ
E <sub>AR</sub>	Repetitive Avalanche Energy (pulse width limited by T <sub>j</sub> max, δ < 1%)	10	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%)	9	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	100			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			1 10	μA μA
I <sub>GSS</sub>	Gate-body Leakage Current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ± 15 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	1	1.7	2.5	V
R <sub>DS(on)</sub>	Static Drain-source On Resistance	V <sub>GS</sub> = 5 V I <sub>D</sub> = 6.5 A		0.16	0.2	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> = 5 V	13			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> = 6.5 A	4	6		S
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25 V f = 1 MHz V <sub>GS</sub> = 0		760	1000	pF
C <sub>oss</sub>	Output Capacitance			140	200	pF
C <sub>rss</sub>	Reverse Transfer Capacitance			40	60	pF

**ELECTRICAL CHARACTERISTICS** (continued)  
**SWITCHING RESISTIVE LOAD**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on Time Rise Time	$V_{DD} = 50\text{ V}$ $I_D = 6.5\text{ A}$ $R_{ES} = 4.7\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 3)		15 120	20 160	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 80\text{ V}$ $I_D = 13\text{ A}$ $R_{ES} = 4.7\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		200		A/ $\mu\text{s}$
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total Gate Charge	$V_{DD} = 80\text{ V}$ $I_D = 13\text{ A}$ $V_{GS} = 5\text{ V}$		20 6 8	30	nC

**SWITCHING INDUCTIVE LOAD**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 80\text{ V}$ $I_D = 13\text{ A}$		11	20	ns
$t_f$	Fall Time	$R_{ES} = 4.7\ \Omega$ $V_{GS} = 5\text{ V}$ (see test circuit, figure 5)		17	30	ns
$t_c$	Cross-over Time			32	50	ns

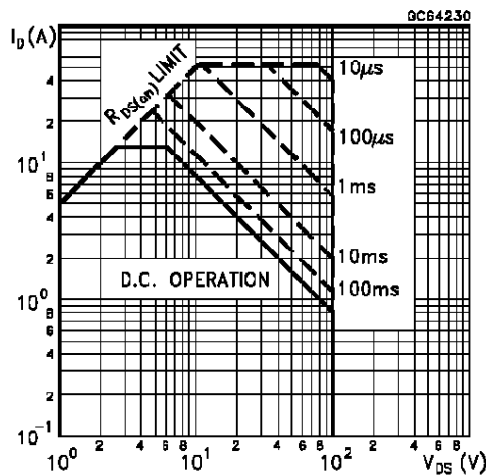
**SOURCE DRAIN DIODE**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$ $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				13 52	A A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 13\text{ A}$ $V_{GS} = 0$			1.5	V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 13\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_R = 30\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		110		ns
$Q_{rr}$	Reverse Recovery Charge			0.4		$\mu\text{C}$
$I_{RRM}$	Reverse Recovery Current			8		A

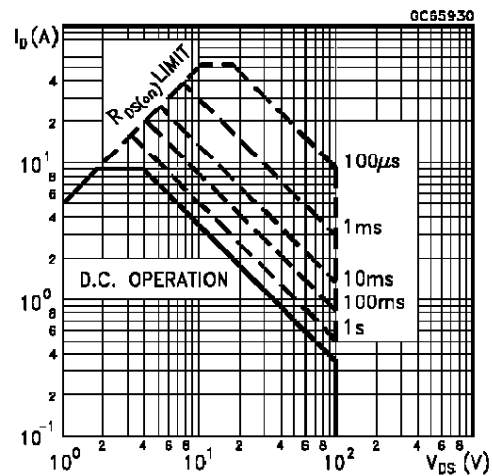
(\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

(•) Pulse width limited by safe operating area

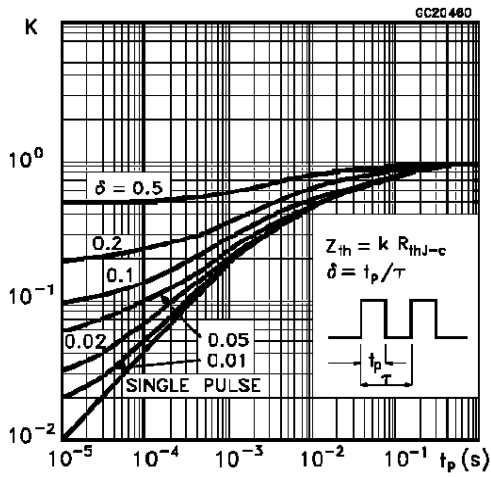
Safe Operating Areas For TO-220



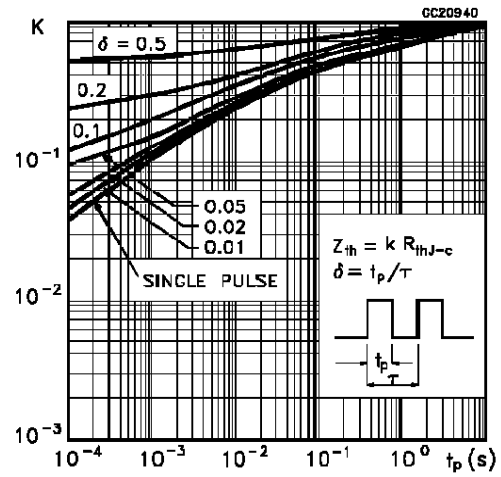
Safe Operating Areas For ISOWATT220



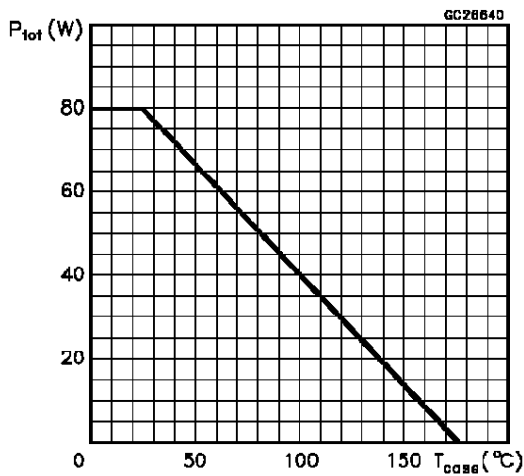
Thermal Impedance For TO-220



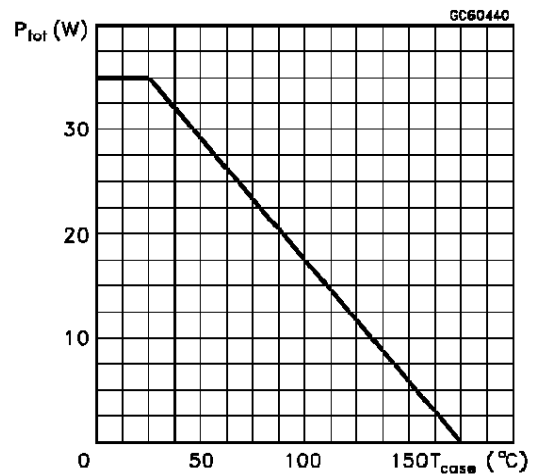
Thermal Impedance For ISOWATT220



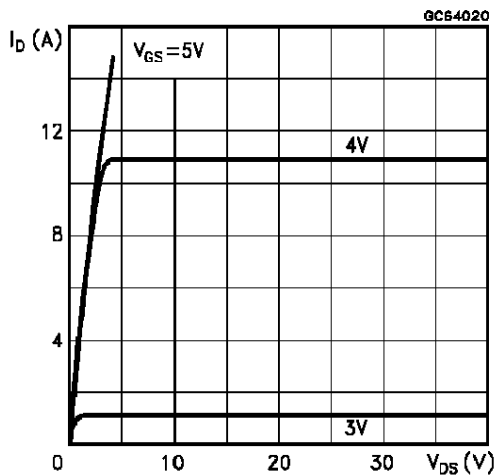
Derating Curve For TO-220



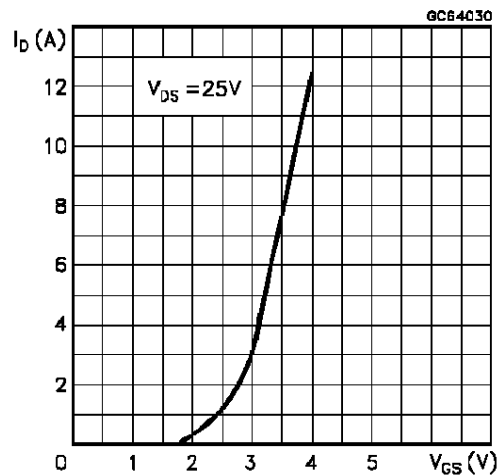
Derating Curve For ISOWATT220



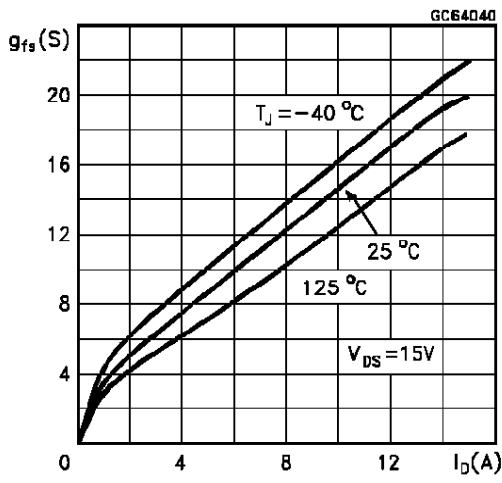
Output Characteristics



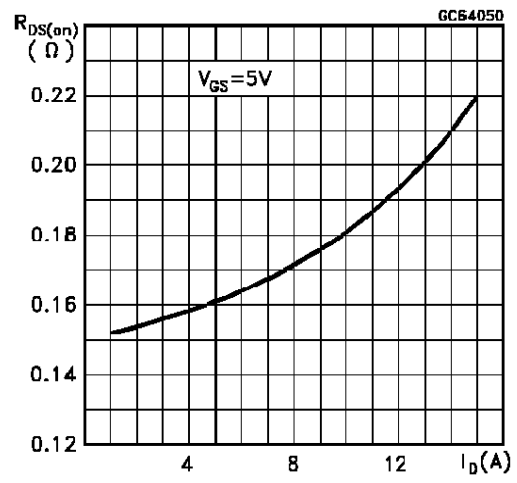
Transfer Characteristics



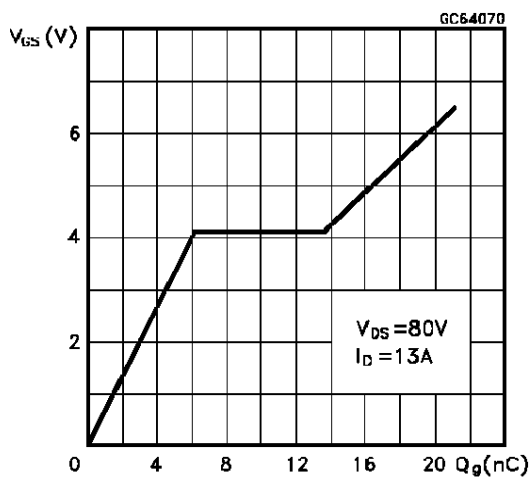
Transconductance



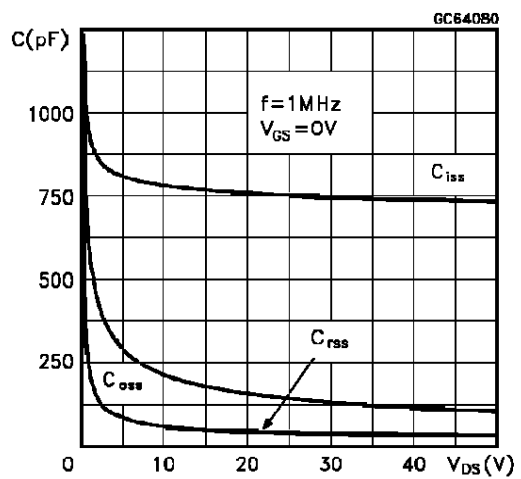
Static Drain-source On Resistance



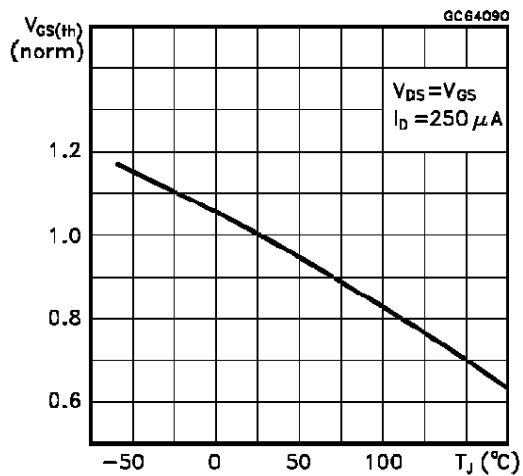
Gate Charge vs Gate-source Voltage



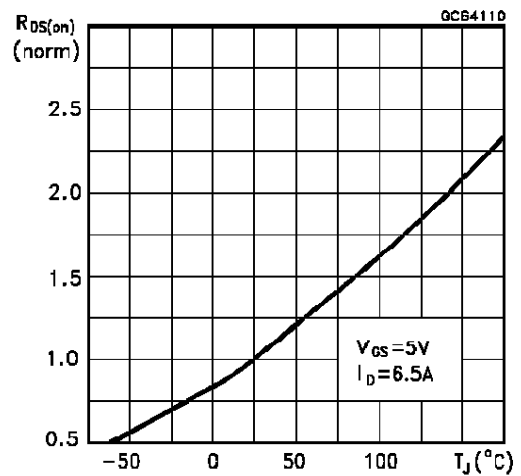
Capacitance Variations



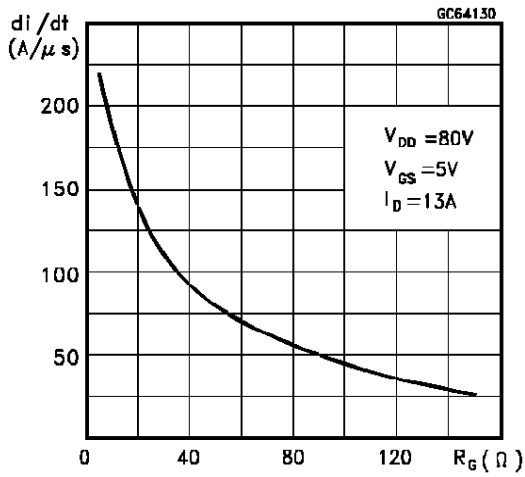
Normalized Gate Threshold Voltage vs Temperature



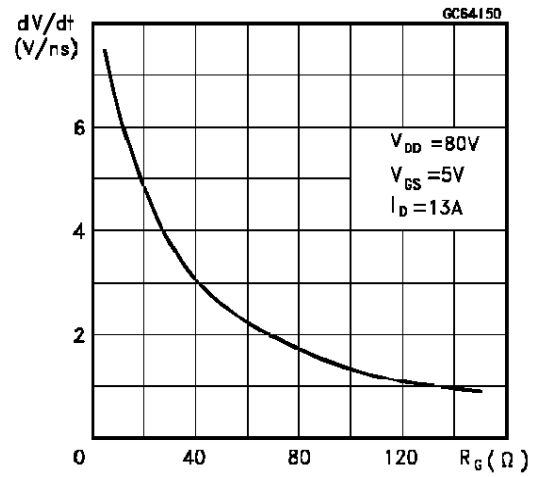
Normalized On Resistance vs Temperature



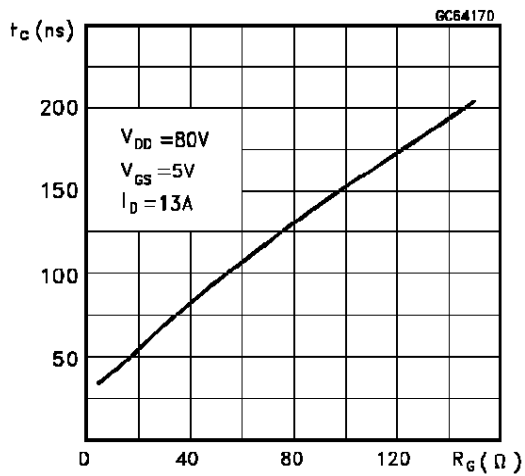
Turn-on Current Slope



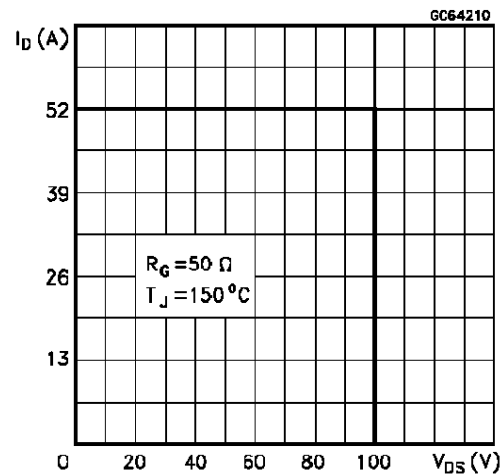
Turn-off Drain-source Voltage Slope



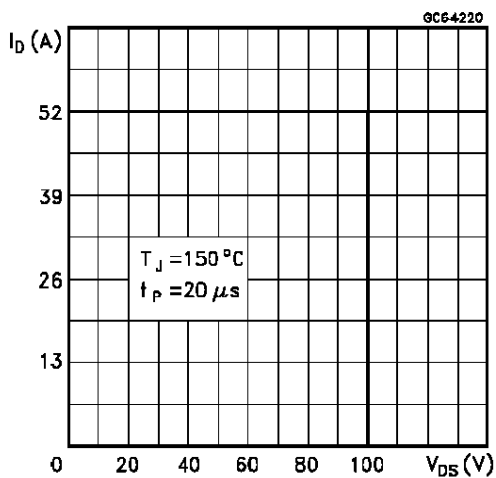
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

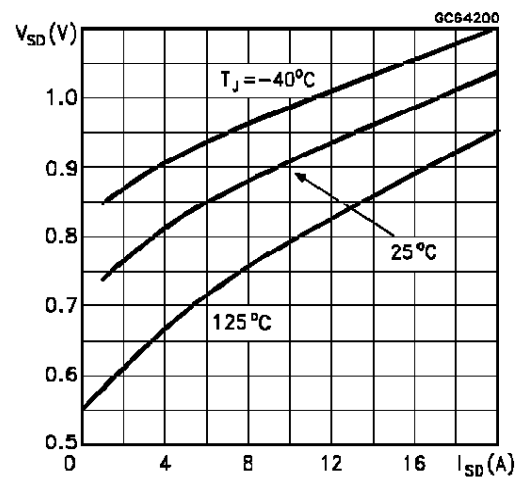


Fig. 1: Unclamped Inductive Load Test Circuits

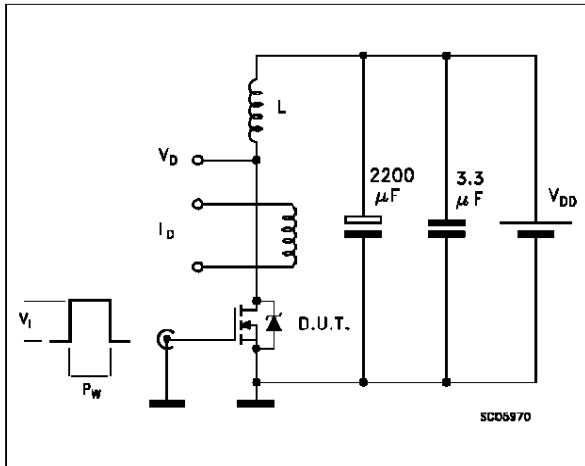


Fig. 2: Unclamped Inductive Waveforms

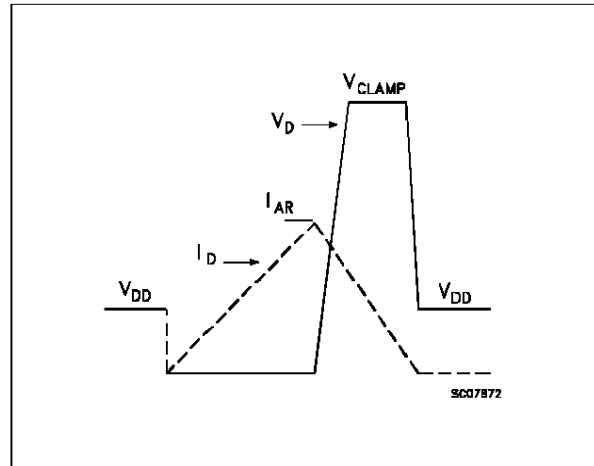


Fig. 3: Switching Times Test Circuits For Resistive Load

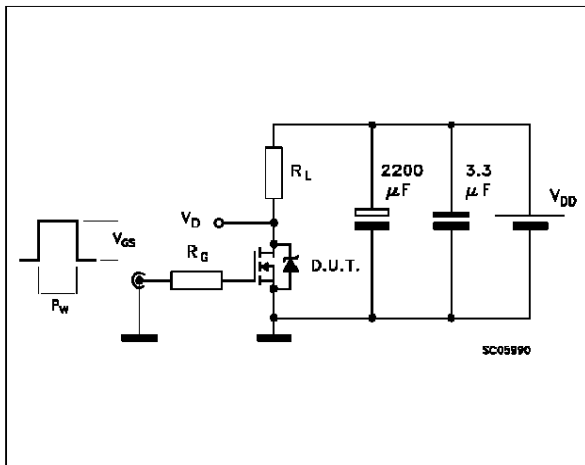


Fig. 4: Gate Charge Test Circuit

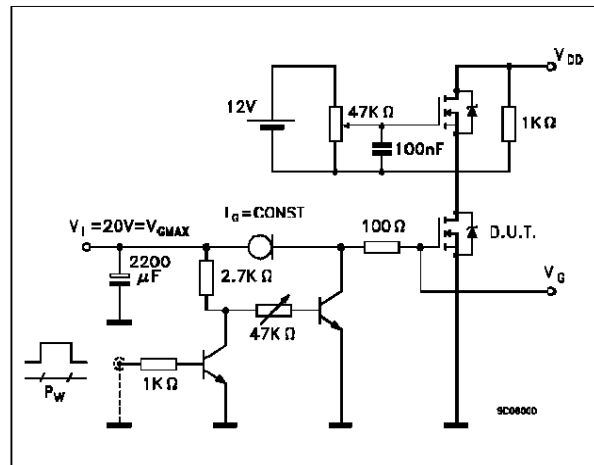
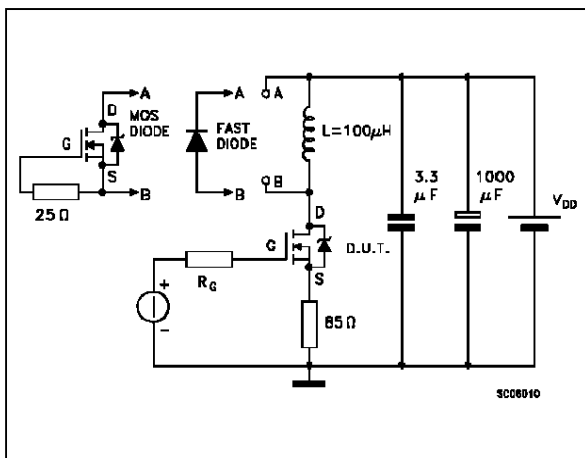
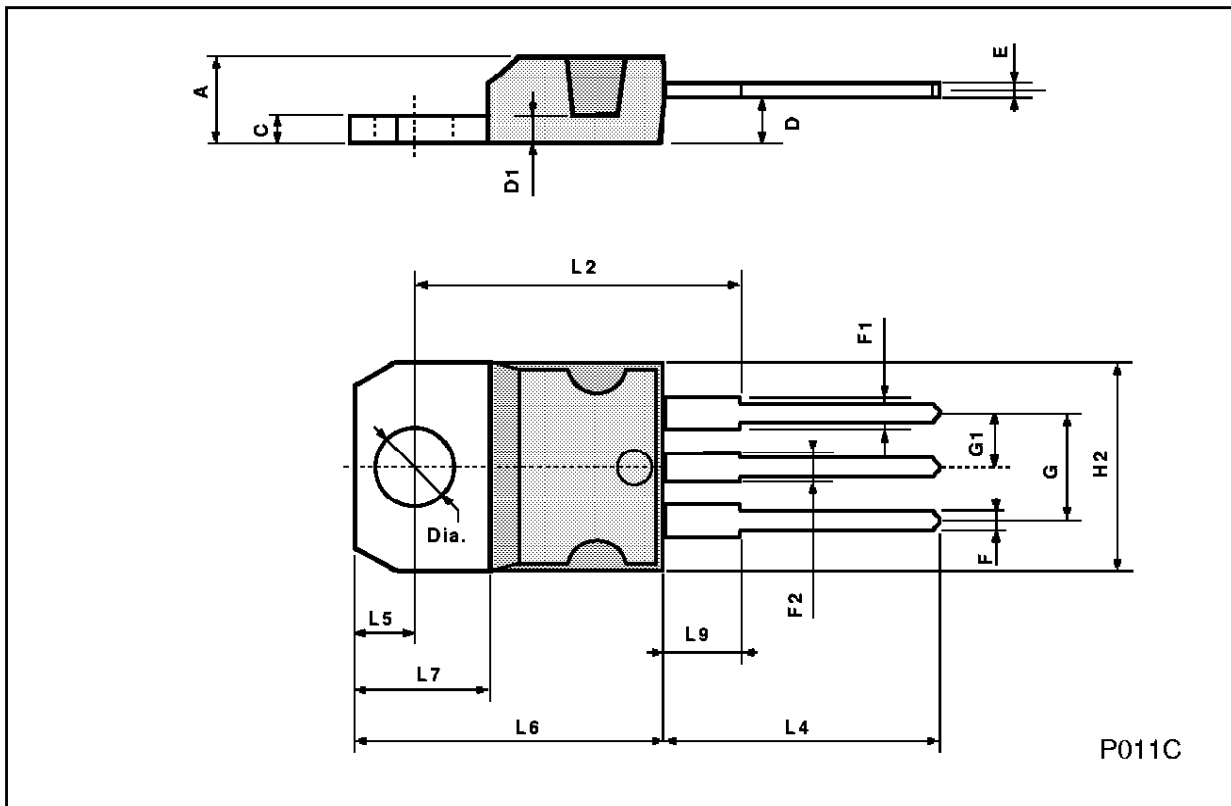


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



**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

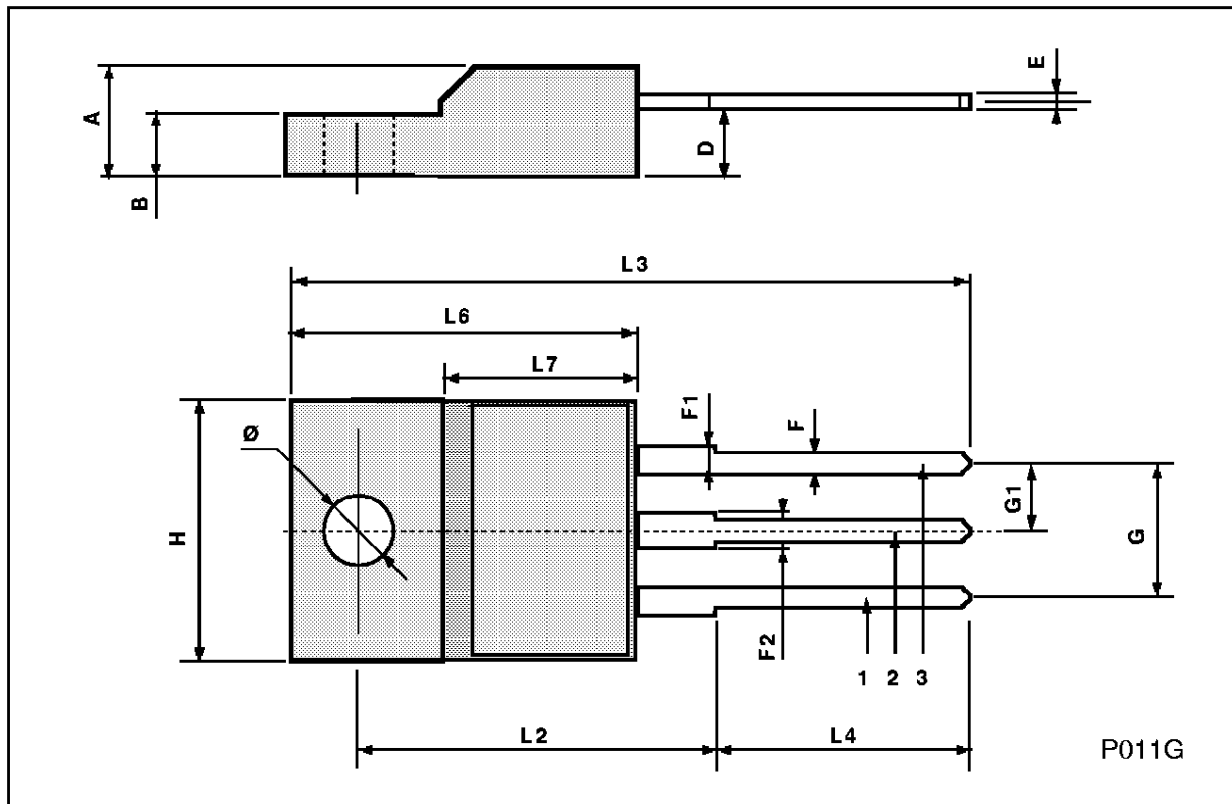


P011C



## 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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