



# STW9NA80 STH9NA80FI

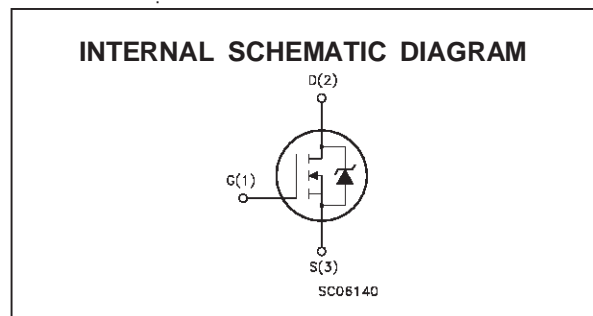
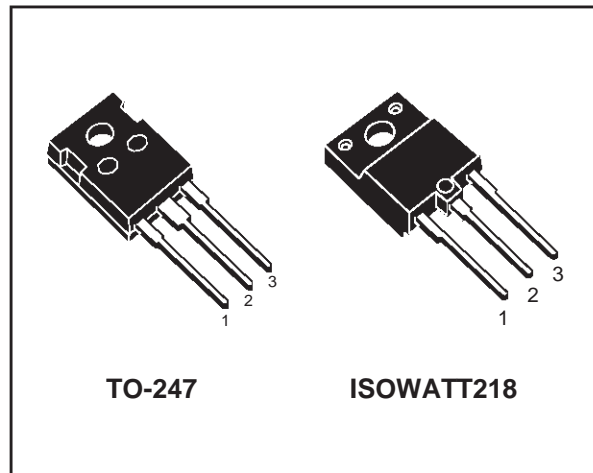
## N - CHANNEL 800V - 0.85Ω - 9.1A - TO-247/ISOWATT218 FAST POWER MOS TRANSISTOR

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STW9NA80	800 V	< 1.0 Ω	9.1 A
STH9NA80FI	800 V	< 1.0 Ω	5.9 A

- TYPICAL R<sub>DS(on)</sub> = 0.85 Ω
- ± 30V GATE TO SOURCE VOLTAGE RATING
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INTRINSIC CAPACITANCES
- GATE CHARGE MINIMIZED
- REDUCED THRESHOLD VOLTAGE SPREAD

### APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- DC-AC CONVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLIES AND MOTOR DRIVE



### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STW9NA80	STH9NA80FI	
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	800		V
V <sub>DGR</sub>	Drain- gate Voltage (R <sub>GS</sub> = 20 kΩ)	800		V
V <sub>GS</sub>	Gate-source Voltage	± 30		V
I <sub>D</sub>	Drain Current (continuous) at T <sub>c</sub> = 25 °C	9.1	5.9	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>c</sub> = 100 °C	6	3.9	A
I <sub>DM</sub> (●)	Drain Current (pulsed)	36.4	36.4	A
P <sub>tot</sub>	Total Dissipation at T <sub>c</sub> = 25 °C	190	80	W
	Derating Factor	1.52	0.64	W/°C
V <sub>ISO</sub>	Insulation Withstand Voltage (DC)	—	4000	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

## STW9NA80-STH9NA80FI

### THERMAL DATA

		TO-247	ISOWATT218		
R <sub>thj-case</sub>	Thermal Resistance Junction-case	Max	0.65	1.56	°C/W
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient	Max	30		°C/W
R <sub>thc-sink</sub>	Thermal Resistance Case-sink	Typ	0.1		°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)	9.1	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)	415	mJ

### 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	800			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 T <sub>c</sub> = 100 °C			50 500	μA μA
I <sub>GSS</sub>	Gate-body Leakage Current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ± 30 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> = 250 μA	2.25	3	3.75	V
R <sub>DS(on)</sub>	Static Drain-source On Resistance	V <sub>GS</sub> = 10V I <sub>D</sub> = 4.5 A		0.85	1	Ω
I <sub>D(on)</sub>	On State Drain Current	V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)max</sub> V <sub>GS</sub> = 10 V	9.1			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> × R <sub>DS(on)max</sub> I <sub>D</sub> = 4.5A	7.5	10		S
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25 V f = 1 MHz V <sub>GS</sub> = 0		2900	3800	pF
C <sub>oss</sub>	Output Capacitance			290	380	pF
C <sub>rss</sub>	Reverse Transfer Capacitance			80	105	pF

**ELECTRICAL CHARACTERISTICS** (continued)

**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 400\text{ V}$ $I_D = 4.5\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		37	50	ns
$t_r$	Rise Time			45	60	ns
$Q_g$	Total Gate Charge	$V_{DD} = 640\text{ V}$ $I_D = 9\text{ A}$ $V_{GS} = 10\text{ V}$		115	150	nC
$Q_{gs}$	Gate-Source Charge			15		nC
$Q_{gd}$	Gate-Drain Charge			55		nC

**SWITCHING OFF**

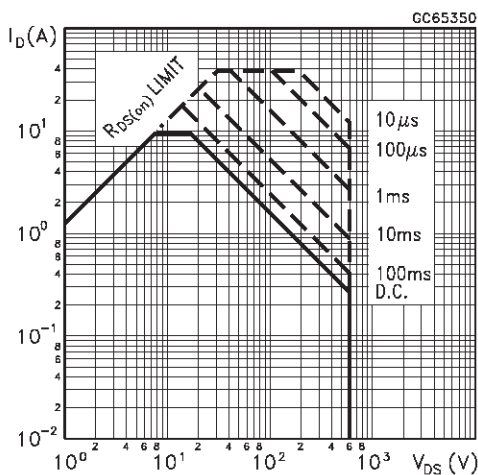
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 640\text{ V}$ $I_D = 9\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		45	60	ns
$t_f$	Fall Time			15	20	ns
$t_c$	Cross-over Time			70	91	ns

**SOURCE DRAIN DIODE**

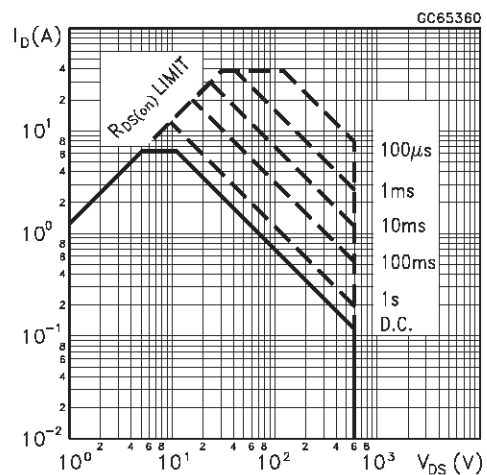
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain Current				9.1	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				36.4	A
$V_{SD}(\ast)$	Forward On Voltage	$I_{SD} = 9.1\text{ A}$ $V_{GS} = 0$			1.6	V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 9\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		765		ns
$Q_{rr}$	Reverse Recovery Charge			113.4		$\mu\text{C}$
$I_{RRM}$	Reverse Recovery Current			35		A

(\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %  
 (•) Pulse width limited by safe operating area

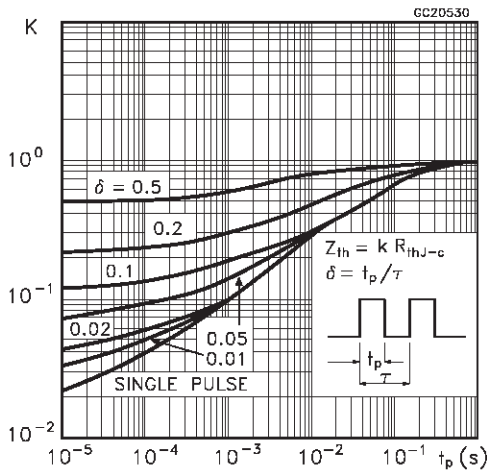
Safe Operating Area for TO-247



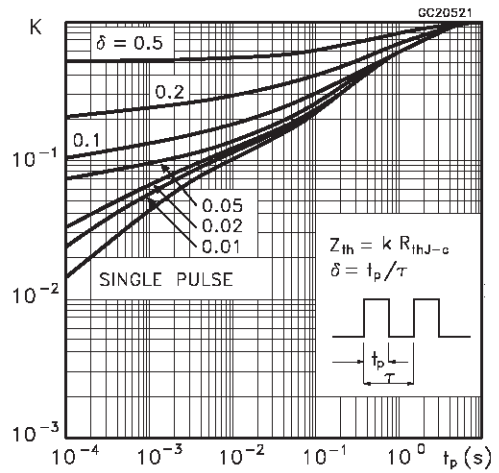
Safe Operating Area for ISOWATT218



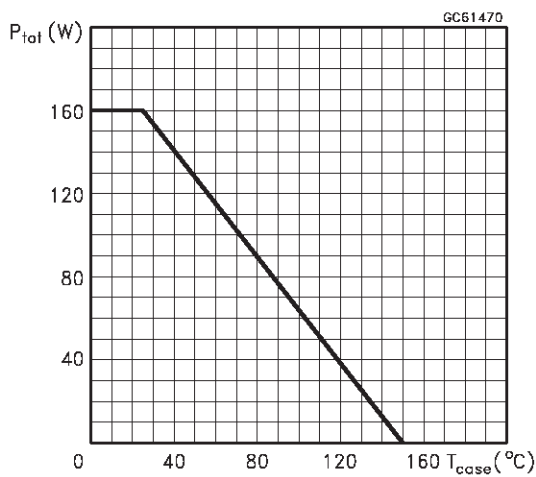
Thermal Impedance for TO-247



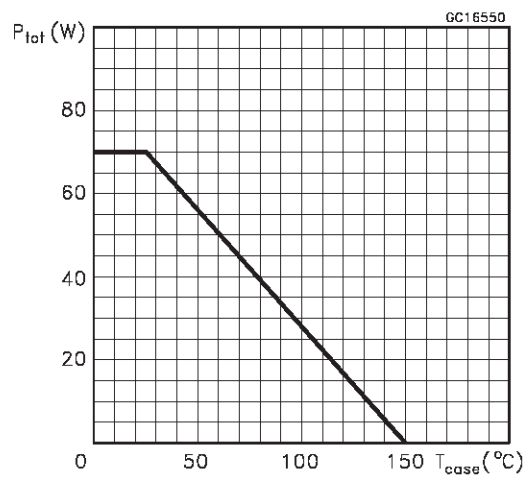
Thermal Impedance for ISOWATT218



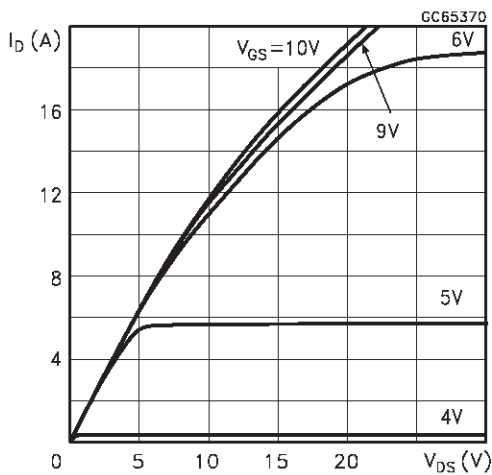
Derating Curve for TO-247



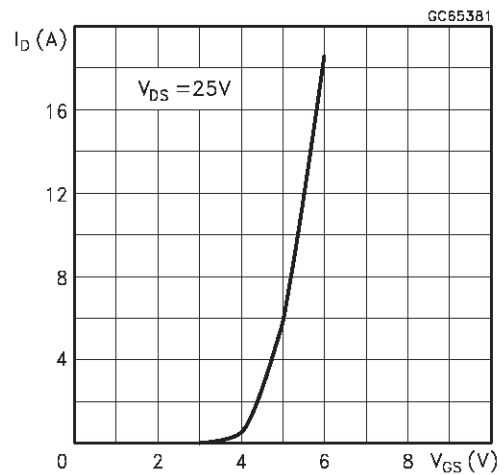
Derating Curve for ISOWATT218



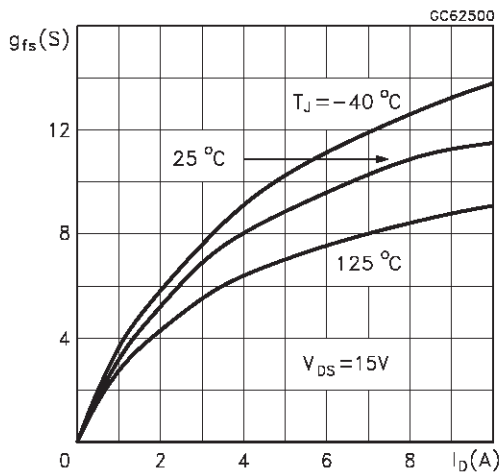
Output Characteristics



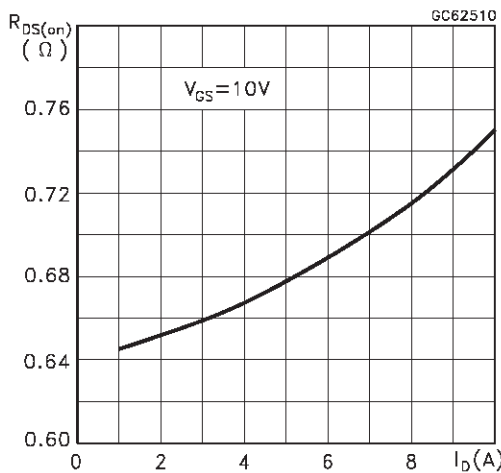
Transfer Characteristics



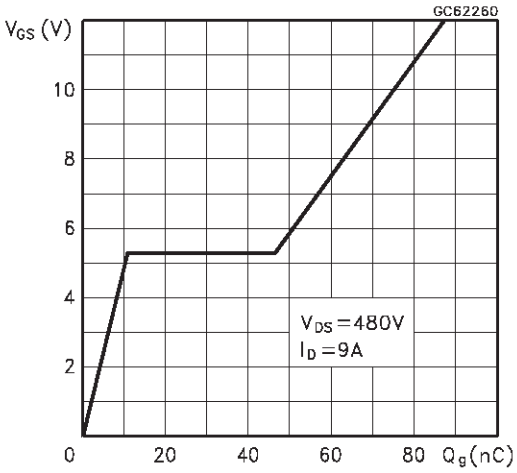
Transconductance



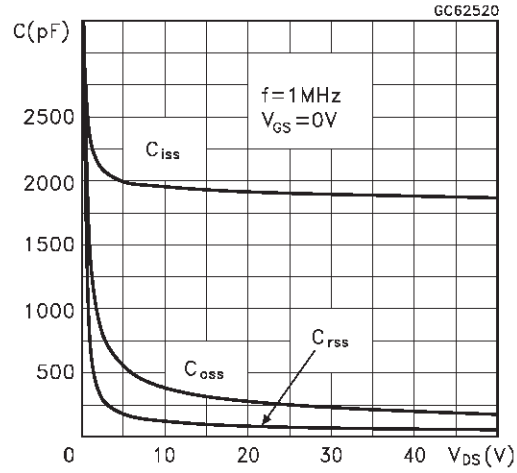
Static Drain-source On Resistance



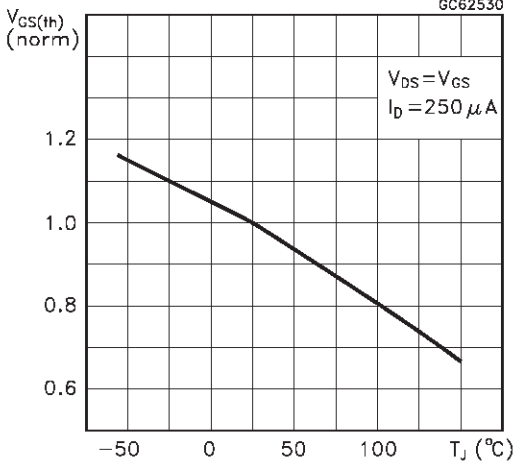
Gate Charge vs Gate-source Voltage



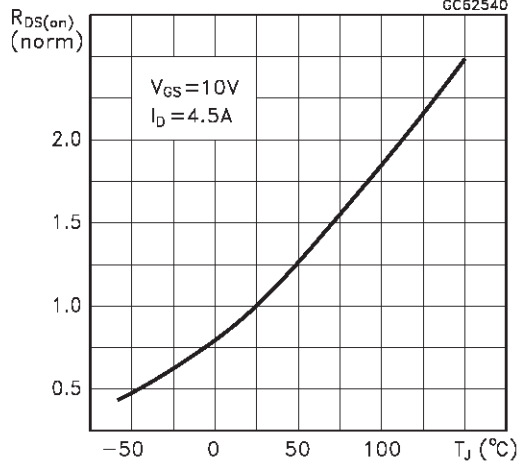
Capacitance Variations



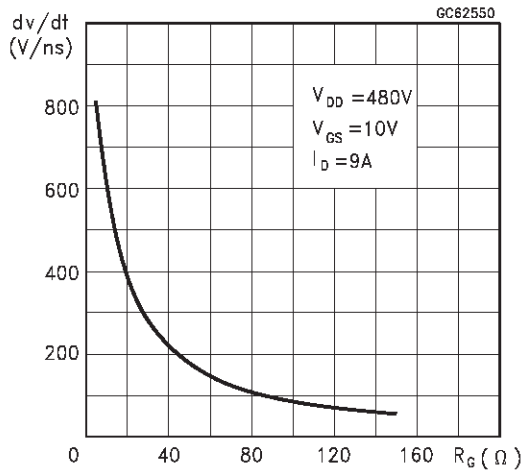
Normalized Gate Threshold Voltage vs Temperature



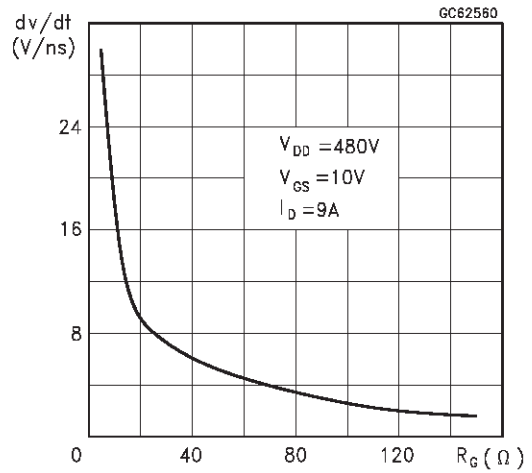
Normalized On Resistance vs Temperature



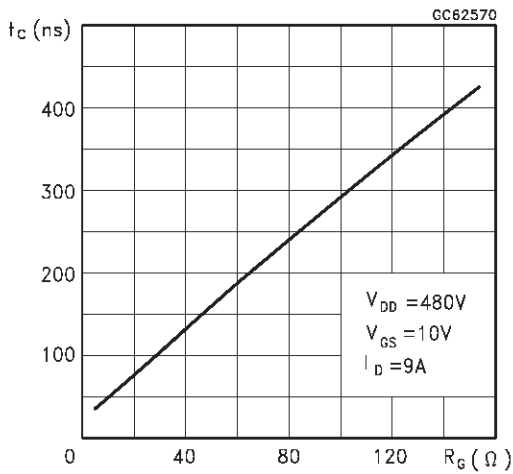
Turn-on Current Slope



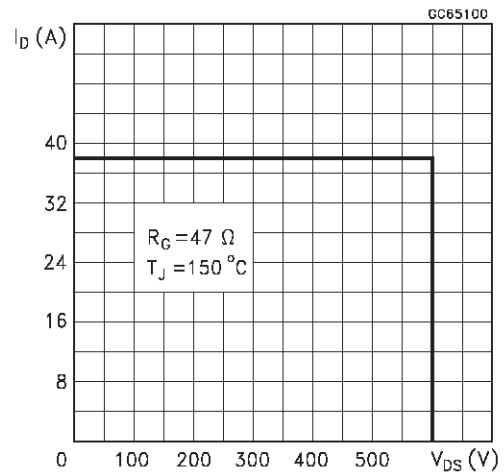
Turn-off Drain-source Voltage Slope



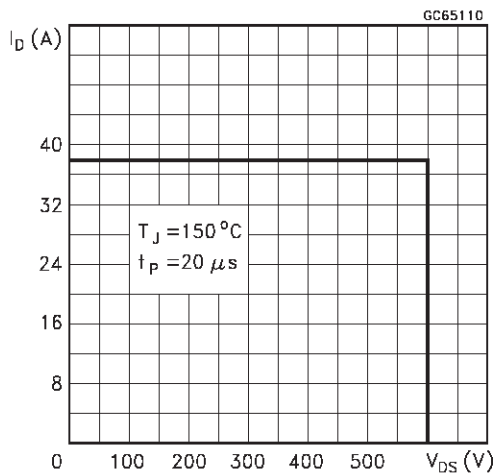
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

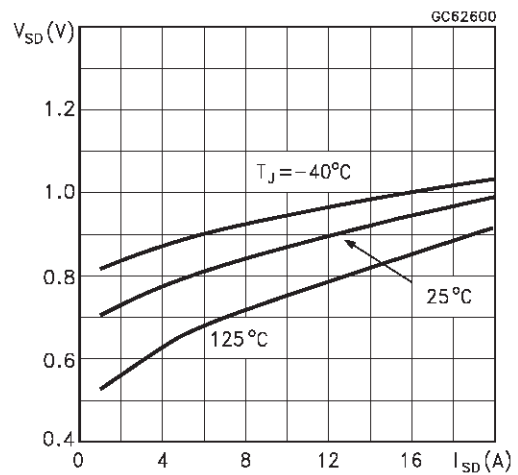


Fig. 1: Unclamped Inductive Load Test Circuit

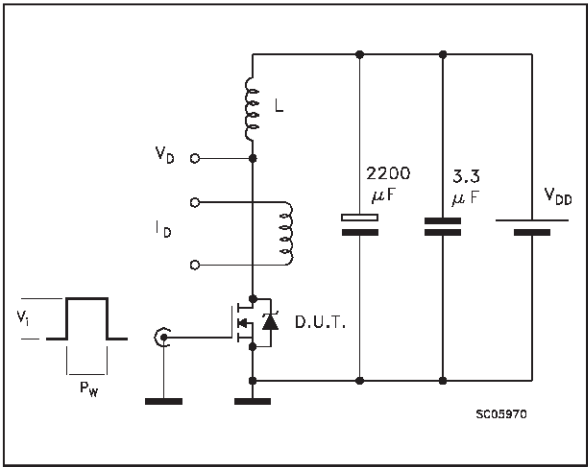


Fig. 2: Unclamped Inductive Waveform

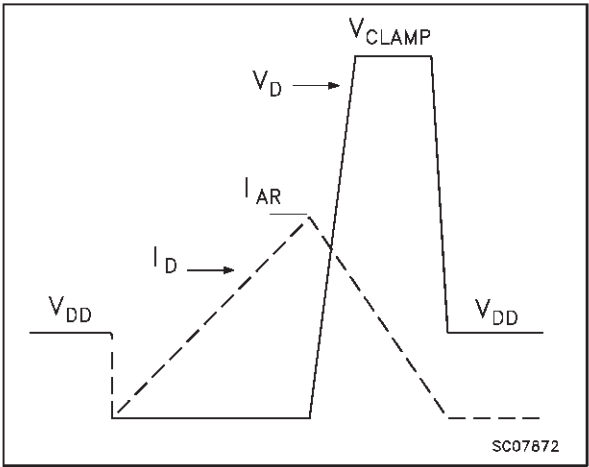


Fig. 3: Switching Times Test Circuits For Resistive Load

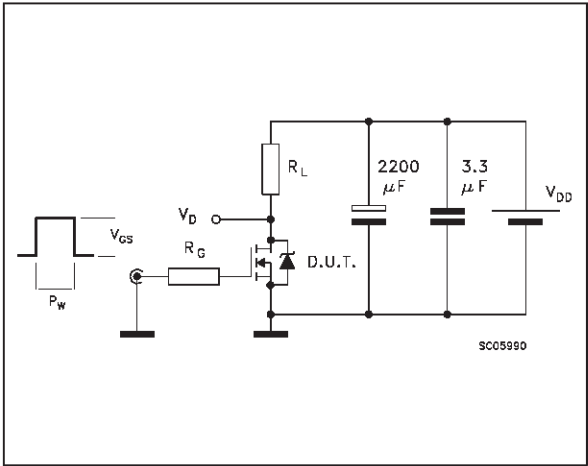


Fig. 4: Gate Charge test Circuit

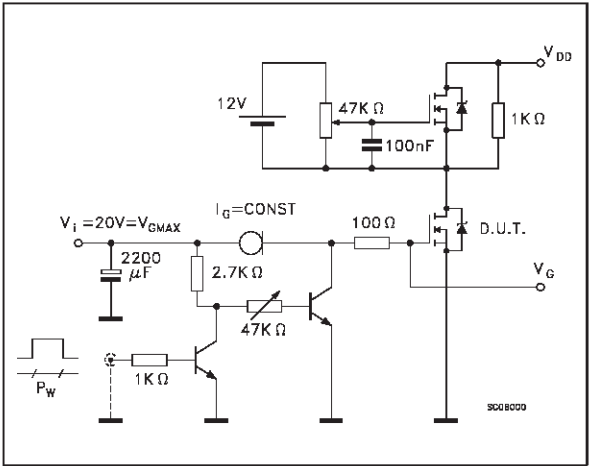
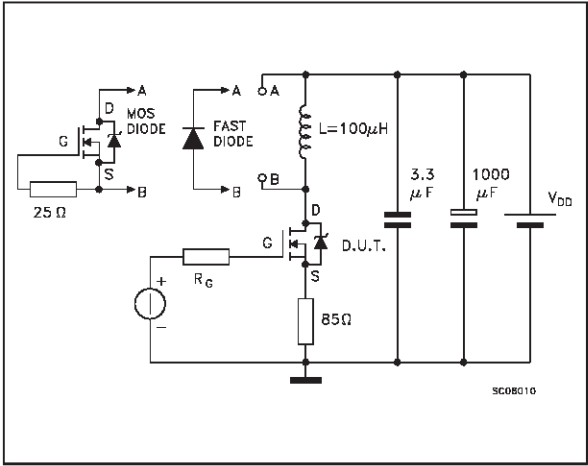
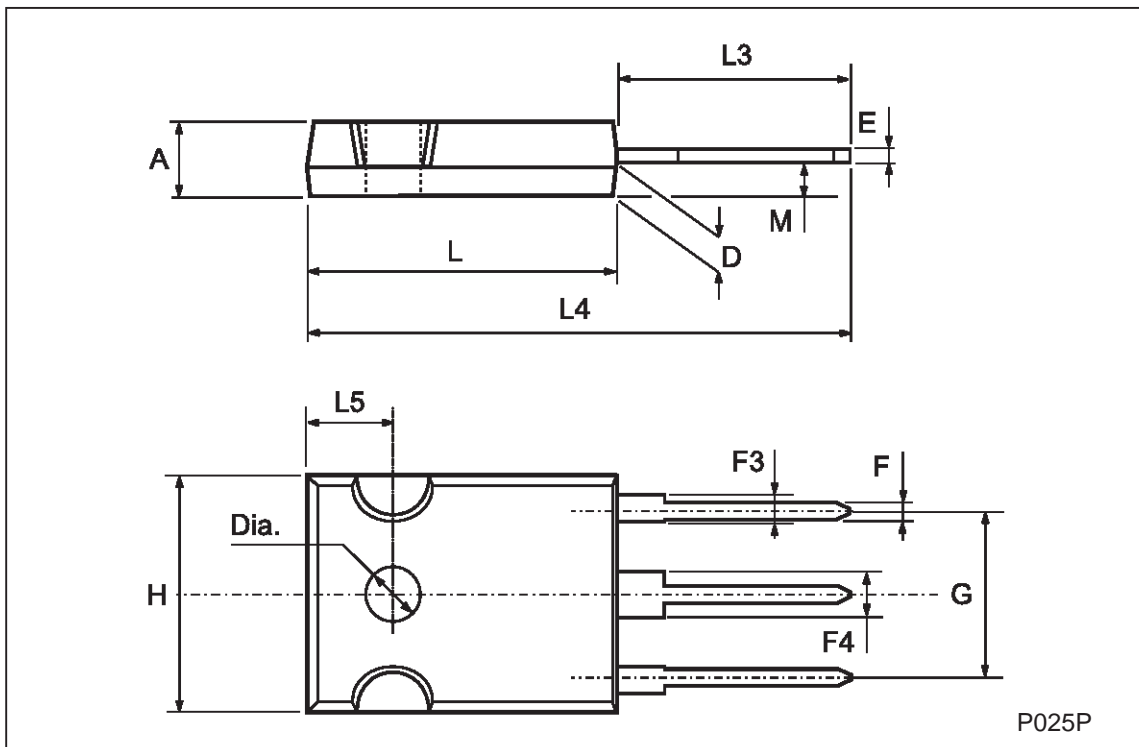


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



TO-247 MECHANICAL DATA

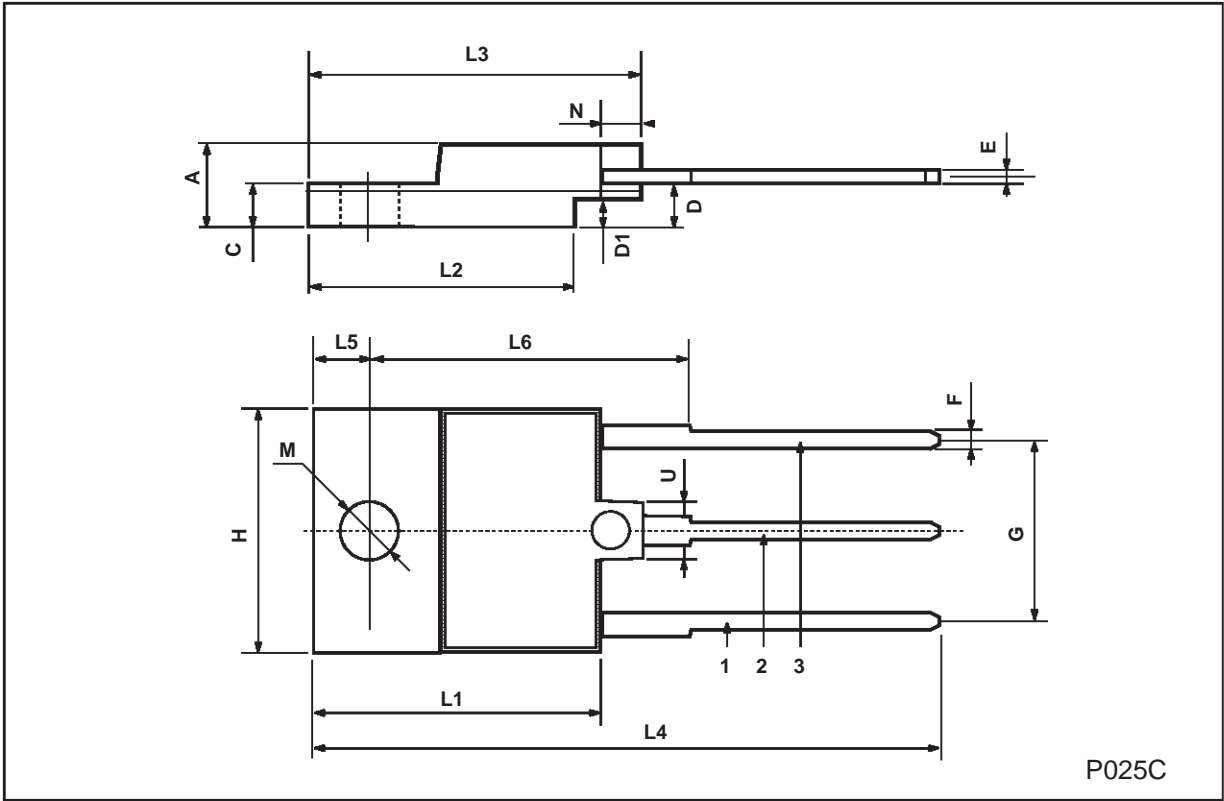
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.7		5.3	0.185		0.209
D	2.2		2.6	0.087		0.102
E	0.4		0.8	0.016		0.031
F	1		1.4	0.039		0.055
F3	2		2.4	0.079		0.094
F4	3		3.4	0.118		0.134
G		10.9			0.429	
H	15.3		15.9	0.602		0.626
L	19.7		20.3	0.776		0.779
L3	14.2		14.8	0.559	0.413	0.582
L4		34.6			1.362	
L5		5.5			0.217	
M	2		3	0.079		0.118
Dia	3.55		3.65	0.140		0.144





**ISOWATT218 MECHANICAL DATA**

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	5.35		5.65	0.210		0.222
C	3.3		3.8	0.130		0.149
D	2.9		3.1	0.114		0.122
D1	1.88		2.08	0.074		0.081
E	0.75		1	0.029		0.039
F	1.05		1.25	0.041		0.049
G	10.8		11.2	0.425		0.441
H	15.8		16.2	0.622		0.637
L1	20.8		21.2	0.818		0.834
L2	19.1		19.9	0.752		0.783
L3	22.8		23.6	0.897		0.929
L4	40.5		42.5	1.594		1.673
L5	4.85		5.25	0.190		0.206
L6	20.25		20.75	0.797		0.817
M	3.5		3.7	0.137		0.145
N	2.1		2.3	0.082		0.090
U		4.6			0.181	



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