



STW9NA60 STH9NA60FI

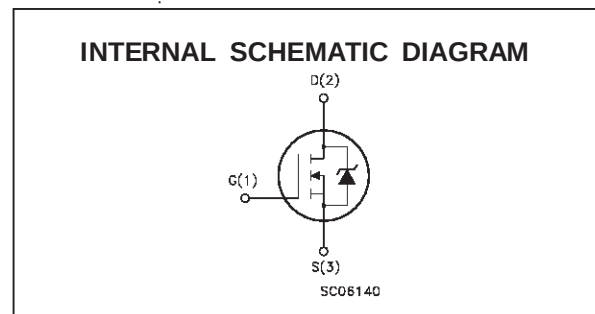
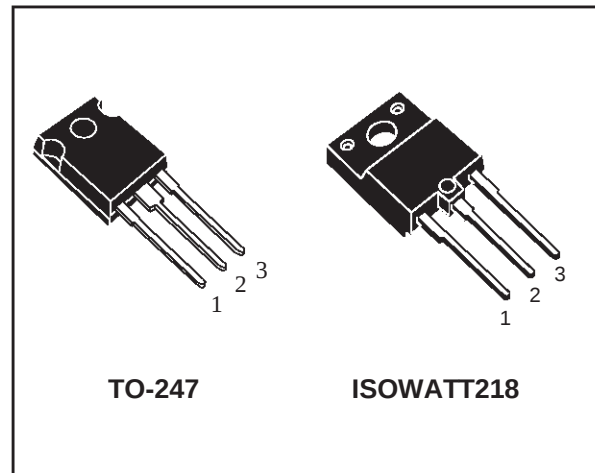
N - CHANNEL ENHANCEMENT MODE FAST POWER MOS TRANSISTOR

TYPE	V _{DSS}	R _{DS(on)}	I _D
STW9NA60	600 V	< 0.8 Ω	9.5 A
STH9NA60FI	600 V	< 0.8 Ω	6.4 A

- TYPICAL R_{DS(on)} = 0.69 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
		STW9NA60	STH9NA60FI	
V _{DS}	Drain-source Voltage (V _{GS} = 0)	600		V
V _{DGR}	Drain- gate Voltage (R _{GS} = 20 kΩ)	600		V
V _{GS}	Gate-source Voltage	± 30		V
I _D	Drain Current (continuous) at T _c = 25 °C	6.4	9.5	A
I _D	Drain Current (continuous) at T _c = 100 °C	4	6	A
I _{DM} (•)	Drain Current (pulsed)	38	38	A
P _{tot}	Total Dissipation at T _c = 25 °C	70	160	W
	Derating Factor	0.56	1.28	W/°C
V _{ISO}	Insulation Withstand Voltage (DC)	—	4000	V
T _{stg}	Storage Temperature	-65 to 150		°C
T _j	Max. Operating Junction Temperature	150		°C

(•) Pulse width limited by safe operating area

THERMAL DATA

				TO-247	ISOWATT218	
R _{thj-case}	Thermal Resistance Junction-case	Max		0.78	1.78	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max		30		°C/W
R _{thc-sink}	Thermal Resistance Case-sink	Typ		0.1		°C/W
T _I	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, $\delta < 1\%$)	9.5	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}C$, $I_D = I_{AR}$, $V_{DD} = 50 V$)	450	mJ

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^{\circ}C$ unless otherwise specified)

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 ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating}$ $T_c = 100^{\circ}C$			25 250	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 30 V$			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250 \mu A$	2.25	3	3.75	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10V$ $I_D = 4.5 A$		0.69	0.8	Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10 V$	9			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (*)$	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 4.5A$	5	8.3		S
C_{iss}	Input Capacitance	$V_{DS} = 25 V$ $f = 1 MHz$ $V_{GS} = 0$		1800	2350	pF
C_{oss}	Output Capacitance			230	300	pF
C_{rss}	Reverse Transfer Capacitance			65	85	pF

ELECTRICAL CHARACTERISTICS (continued)**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Time	$V_{DD} = 300\text{ V}$ $I_D = 4.5\text{ A}$		21	30	ns
t_r	Rise Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 3)		32	45	ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{DD} = 480\text{ V}$ $I_D = 9\text{ A}$ $R_G = 47\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		180		A/ μ s
Q_g	Total Gate Charge	$V_{DD} = 480\text{ V}$ $I_D = 9\text{ A}$ $V_{GS} = 10\text{ V}$		75	100	nC
Q_{gs}	Gate-Source Charge			11		nC
Q_{gd}	Gate-Drain Charge			36		nC

SWITCHING OFF

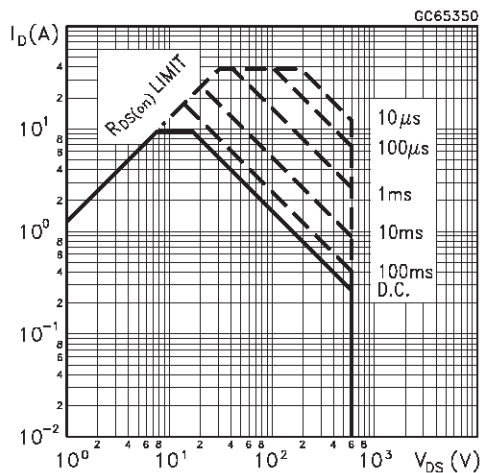
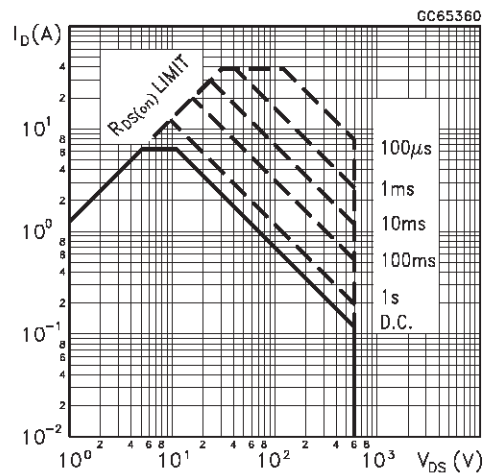
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off-voltage Rise Time	$V_{DD} = 480\text{ V}$ $I_D = 9\text{ A}$		16	23	ns
t_f	Fall Time	$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (see test circuit, figure 5)		18	25	ns
t_c	Cross-over Time			26	35	ns

SOURCE DRAIN DIODE

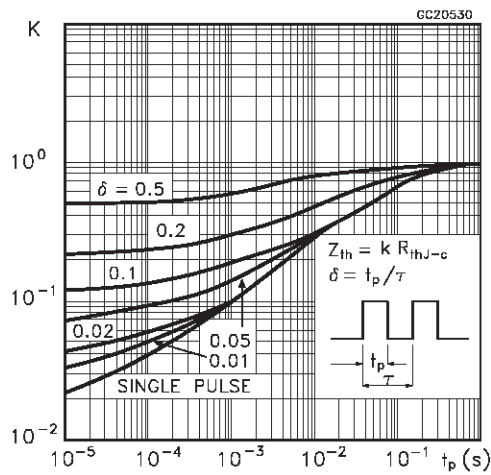
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				9.5	A
$I_{SDM}(\bullet)$	Source-drain Current (pulsed)				38	A
$V_{SD} (*)$	Forward On Voltage	$I_{SD} = 9.5\text{ A}$ $V_{GS} = 0$			1.6	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 9.5\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ (see test circuit, figure 5)		660		ns
Q_{rr}	Reverse Recovery Charge			12		μC
I_{RRM}	Reverse Recovery Current			36		A

(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

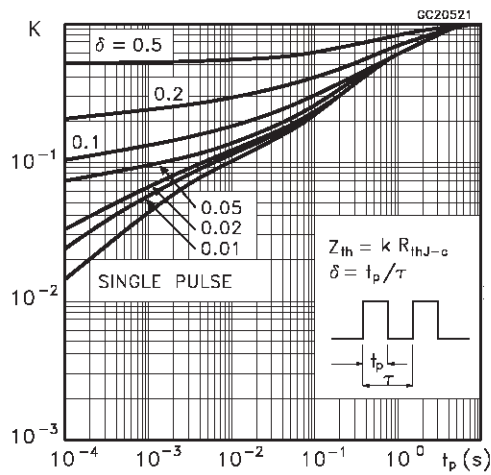
(\bullet) Pulse width limited by safe operating area

Safe Operating Area for TO-247**Safe Operating Area for ISOWATT218**

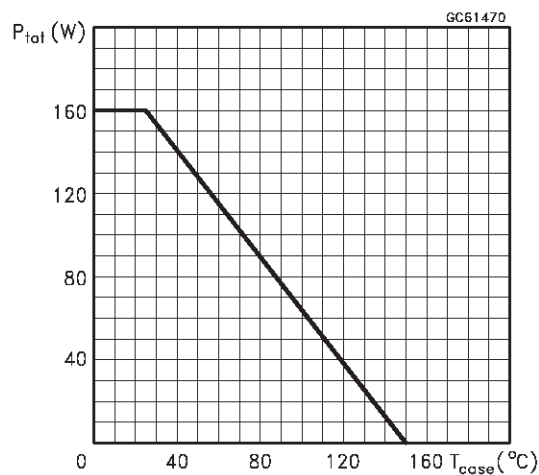
Thermal Impedance for TO-247



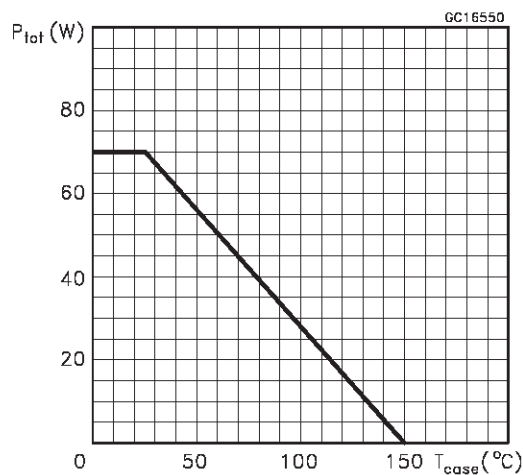
Thermal Impedance for ISOWATT218



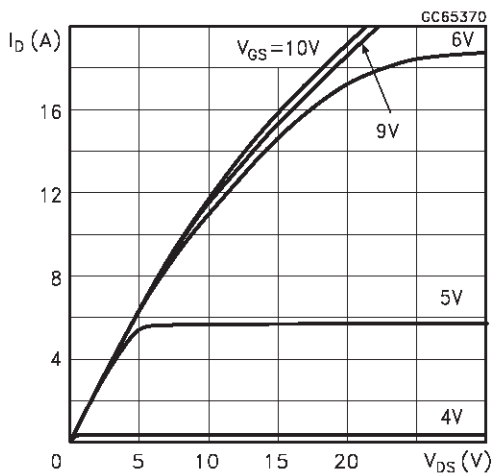
Derating Curve for TO-247



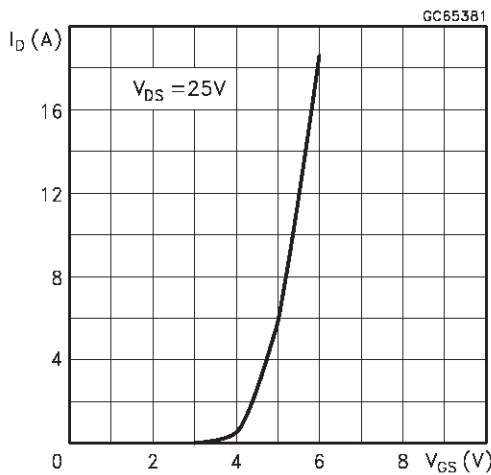
Derating Curve for ISOWATT218



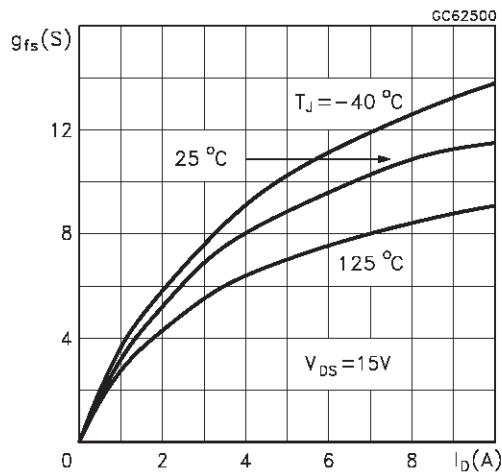
Output Characteristics



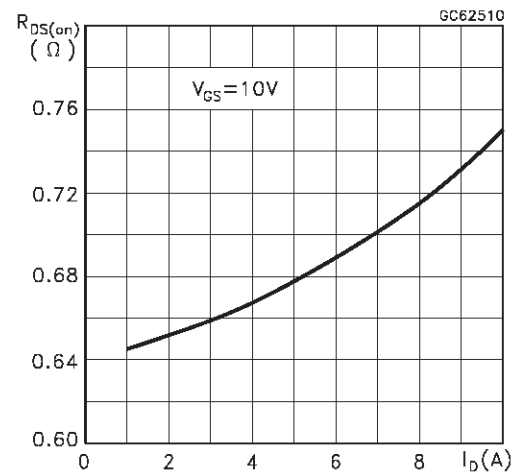
Transfer Characteristics



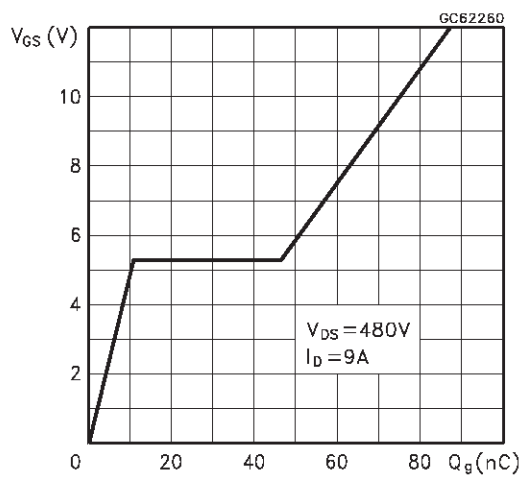
Transconductance



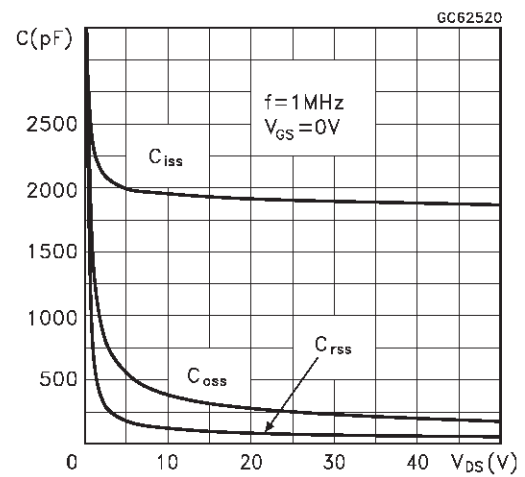
Static Drain-source On Resistance



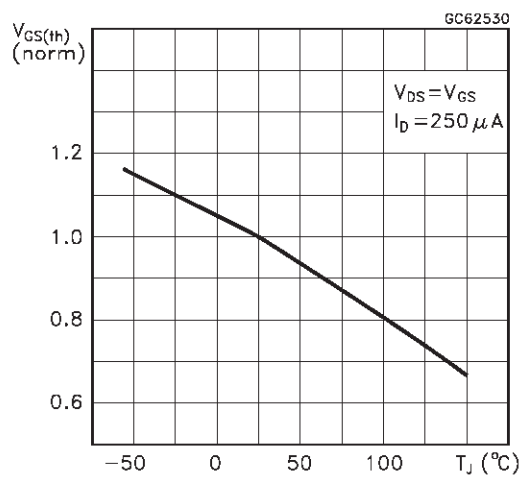
Gate Charge vs Gate-source Voltage



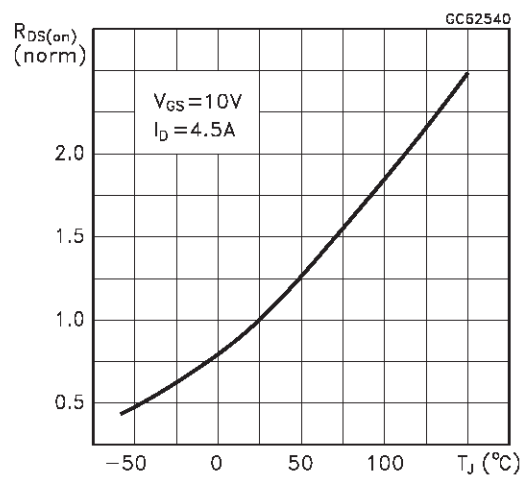
Capacitance Variations



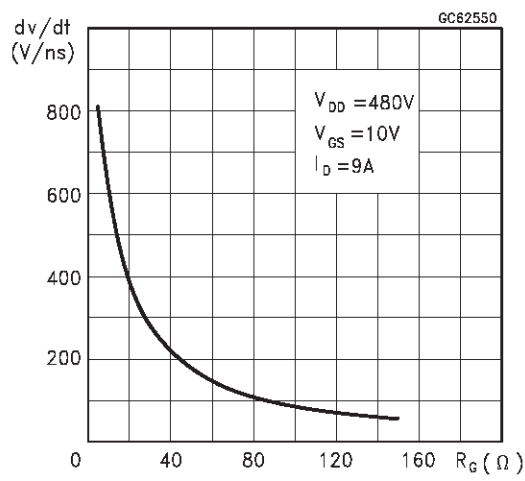
Normalized Gate Threshold Voltage vs Temperature



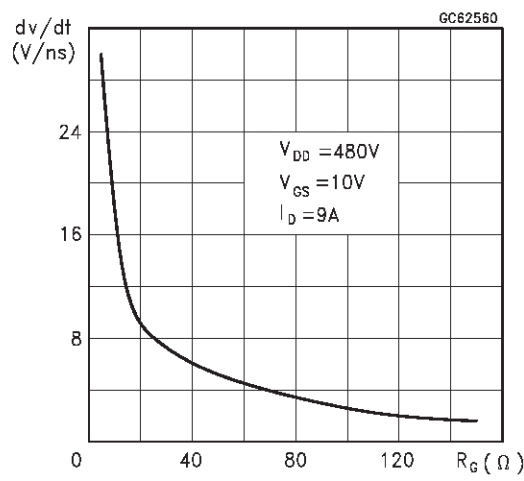
Normalized On Resistance vs Temperature



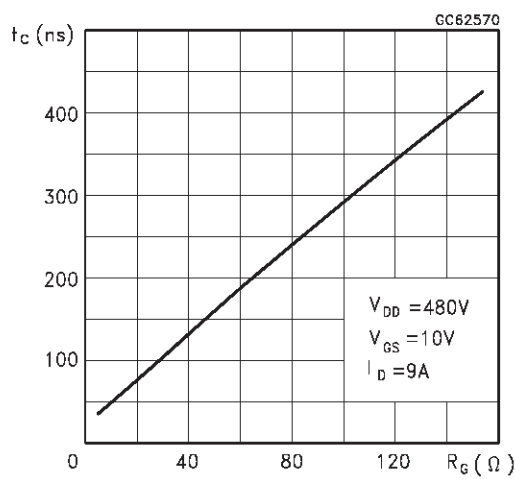
Turn-on Current Slope



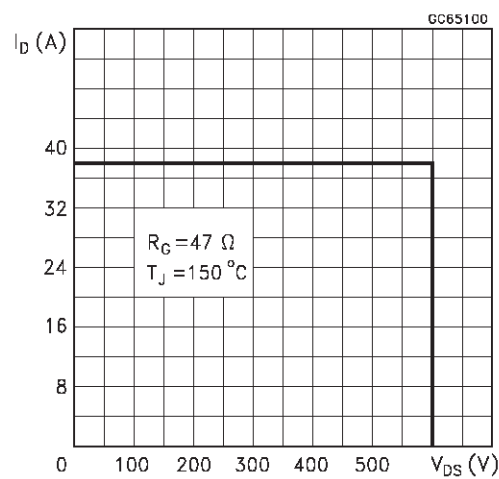
Turn-off Drain-source Voltage Slope



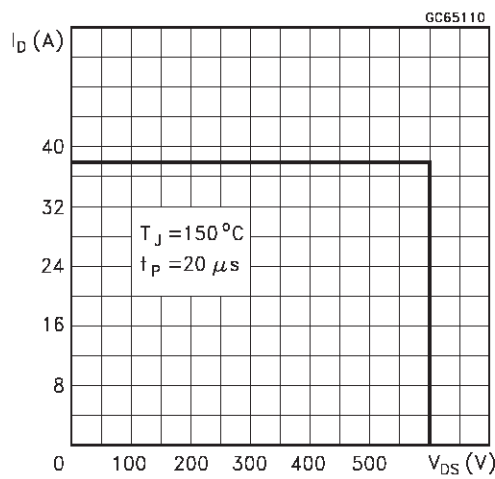
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

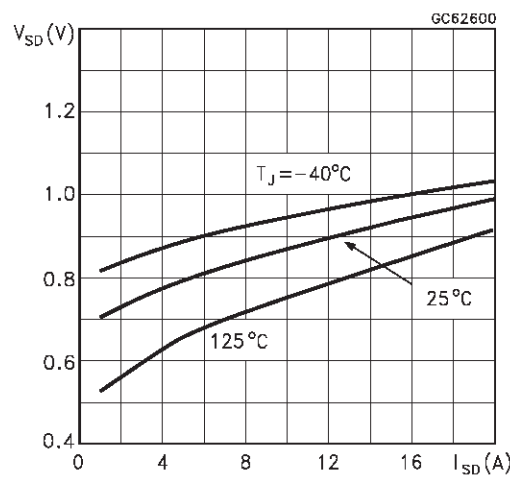


Fig. 1: Unclamped Inductive Load Test Circuit

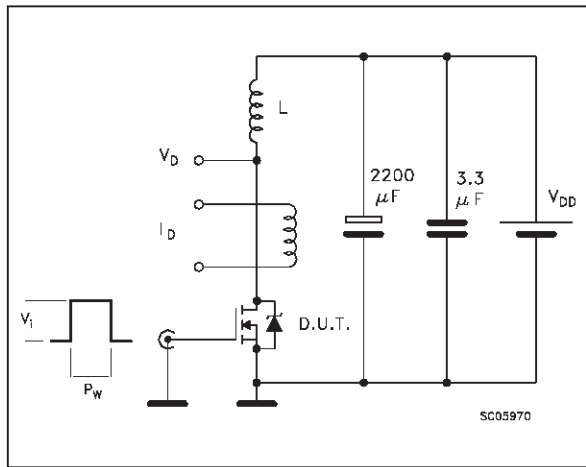


Fig. 2: Unclamped Inductive Waveform

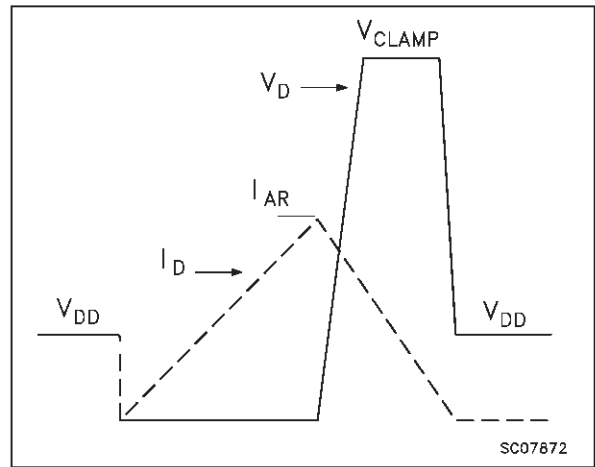


Fig. 3: Switching Times Test Circuits For Resistive Load

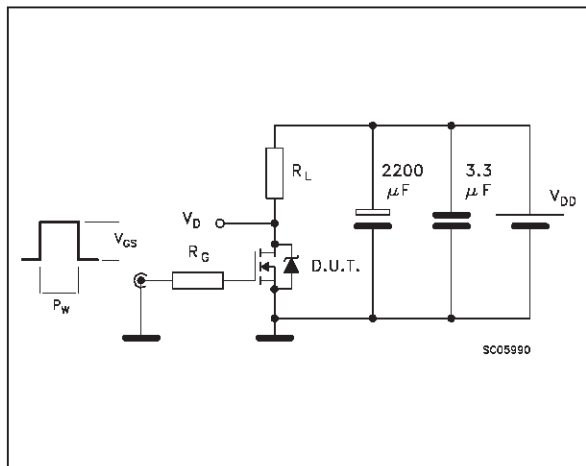


Fig. 4: Gate Charge test Circuit

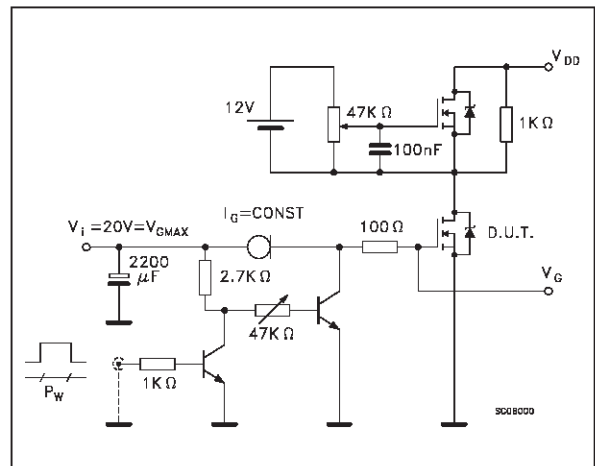
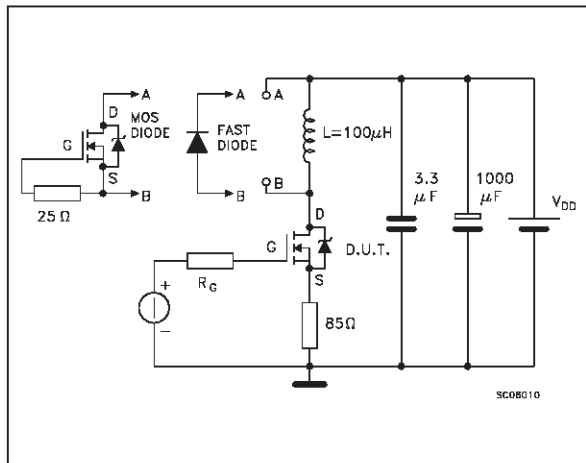
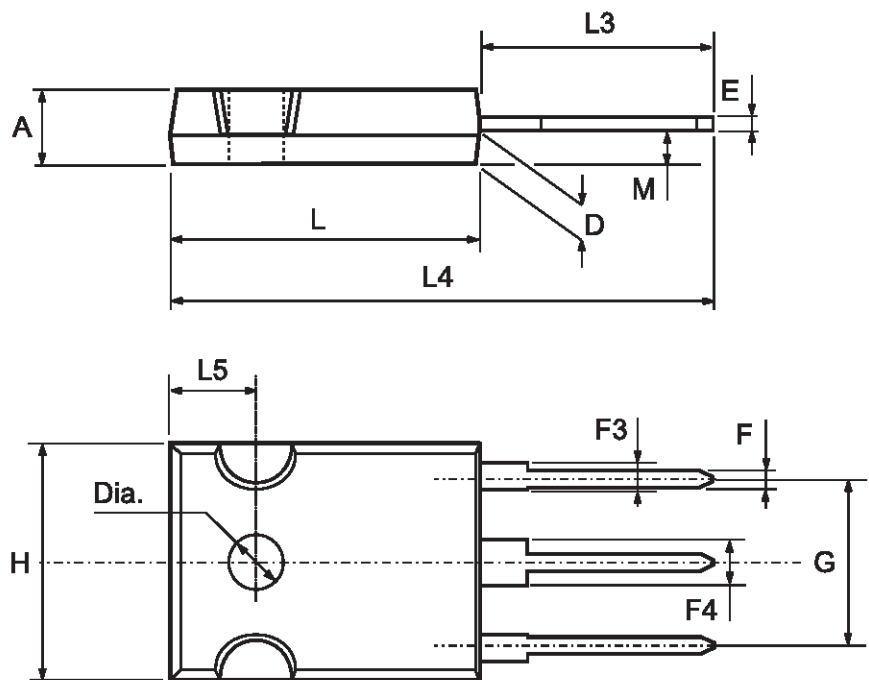


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



TO-247 MECHANICAL DATA

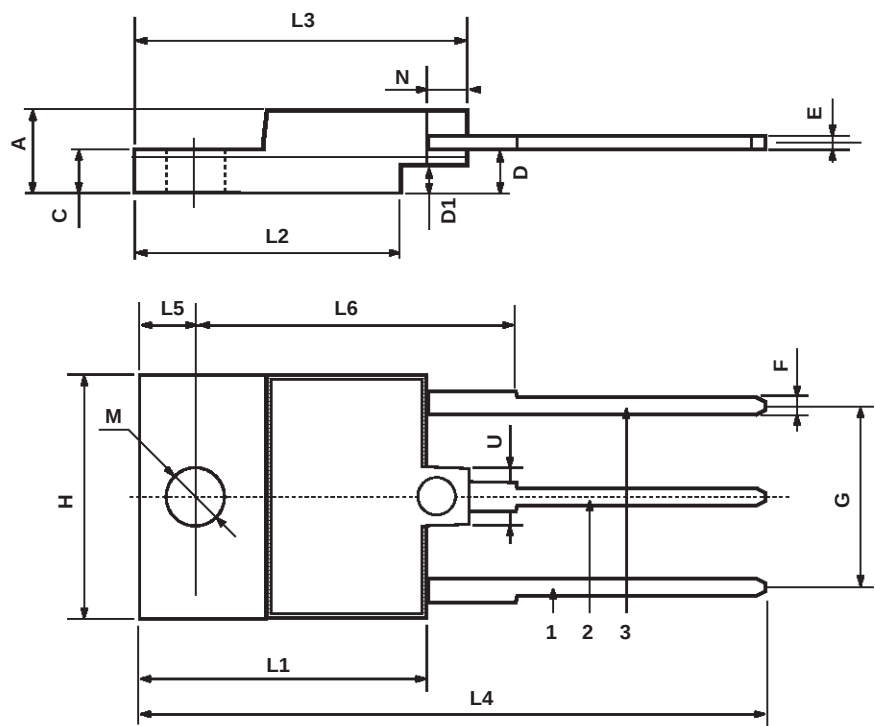
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.7		5.3	0.185		0.209
D	2.2		2.6	0.087		0.102
E	0.4		0.8	0.016		0.031
F	1		1.4	0.039		0.055
F3	2		2.4	0.079		0.094
F4	3		3.4	0.118		0.134
G		10.9			0.429	
H	15.3		15.9	0.602		0.626
L	19.7		20.3	0.776		0.779
L3	14.2		14.8	0.559	0.413	0.582
L4		34.6			1.362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



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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	



P025C

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