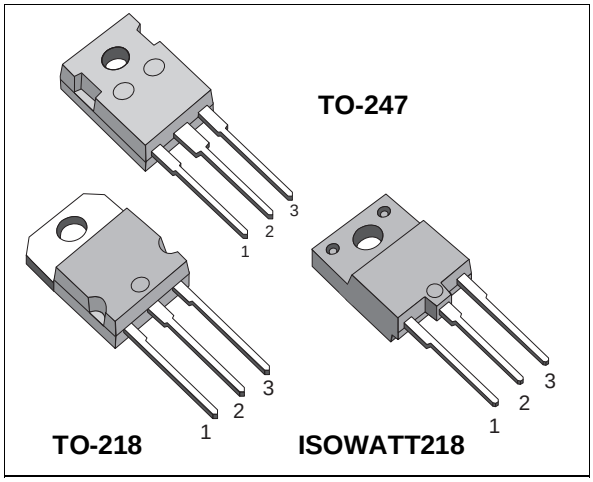
SGS-THOMSON MICROELECTRONICS

STH12NA60/FI
STW12NA60

N - CHANNEL ENHANCEMENT MODE FAST POWER MOS TRANSISTOR

TYPE	V_{DSS}	$R_{DS(on)}$	I_D
STH12NA60	600 V	< 0.6 Ω	12 A
STH12NA60FI	600 V	< 0.6 Ω	7 A
STW12NA60	600 V	< 0.6 Ω	12 A

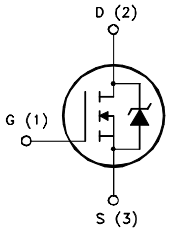
- TYPICAL $R_{DS(on)}$ = 0.44 Ω
- ± 30V GATE TO SOURCE VOLTAGE RATING
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INTRINSIC CAPACITANCES
- GATE GHARGE MINIMIZED
- REDUCED THRESHOLD VOLTAGE SPREAD



DESCRIPTION

This series of POWER MOSFETS represents the most advanced high voltage technology. The optimized cell layout coupled with a new proprietary edge termination concur to give the device low $R_{DS(on)}$ and gate charge, unequalled ruggedness and superior switching performance.

INTERNAL SCHEMATIC DIAGRAM



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
		STH/STW12NA60	STH12NA60FI	
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	12	7	A
I_D	Drain Current (continuous) at T_c = 100 °C	7.6	4.4	A
I_{DM}(•)	Drain Current (pulsed)	48	48	A
P_{tot}	Total Dissipation at T_c = 25 °C	190	80	W
	Derating Factor	1.52	0.64	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-218/TO-247	ISOWATT218	
$R_{thj\text{-}case}$	Thermal Resistance Junction-case	Max	0.66	1.56	°C/W
$R_{thj\text{-}amb}$	Thermal Resistance Junction-ambient	Max	30		°C/W
$R_{thc\text{-}sink}$	Thermal Resistance Case-sink	Typ	0.1		°C/W
T_l	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, $\delta < 1\%$)	12	A
E_{AS}	Single Pulse Avalanche Energy (starting T_j = 25 °C, $I_D = I_{AR}$, V_{DD} = 50 V)	700	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	28	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (T_c = 100 °C, pulse width limited by T_j max, $\delta < 1\%$)	7.6	A

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	I_D = 250 µA V_{GS} = 0	600			V
I_{DSS}	Zero Gate Voltage Drain Current (V_{GS} = 0)	V_{DS} = Max Rating V_{DS} = Max Rating x 0.8 T_c = 125 °C			25 250	µA µA
I_{GSS}	Gate-body Leakage Current (V_{DS} = 0)	V_{GS} = ± 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 µA	2.25	3	3.75	V
$R_{DS(on)}$	Static Drain-source On Resistance	V_{GS} = 10V I_D = 6 A		0.44	0.6	Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ V_{GS} = 10 V	12			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 = 6 A	8	12		S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V_{DS} = 25 V f = 1 MHz V_{GS} = 0		2500 310 85	3250 410 110	pF pF 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} = 300 V I_D = 6 A R_G = 4.7 Ω V_{GS} = 10 V (see test circuit, figure 3)		25 35	35 50	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	V_{DD} = 480 V I_D = 12 A R_G = 47 Ω V_{GS} = 10 V (see test circuit, figure 5)		190		A/µs
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	V_{DD} = 480 V I_D = 12 A V_{GS} = 10 V		110 15 47	150	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 V I_D = 12 A R_G = 4.7 Ω V_{GS} = 10 V (see test circuit, figure 5)		35 20 57	50 30 80	ns ns ns

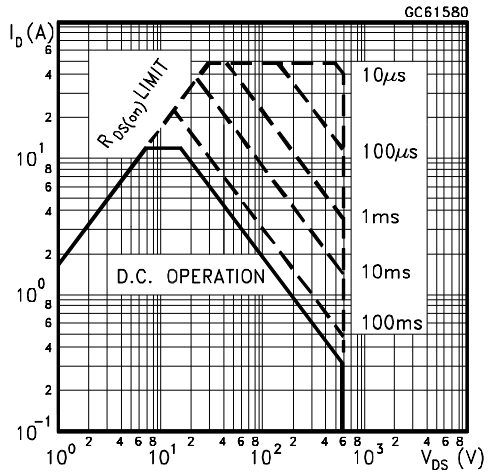
SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM}(•)	Source-drain Current Source-drain Current (pulsed)				12 48	A A
V_{SD} (*)	Forward On Voltage	I_{SD} = 12 A V_{GS} = 0			1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_{SD} = 12 A di/dt = 100 A/µs V_{DD} = 100 V T_j = 150 °C (see test circuit, figure 5)		670 12.7 38		ns µC A

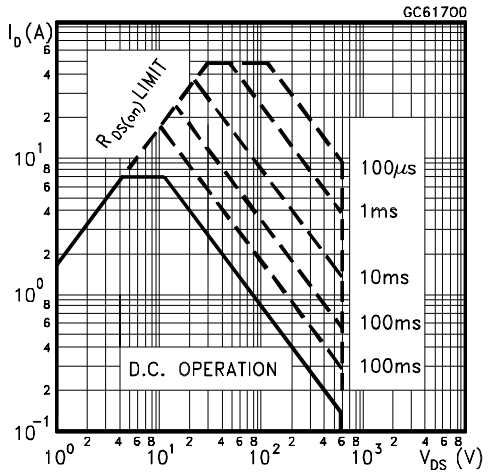
(*) Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %

(•) Pulse width limited by safe operating area

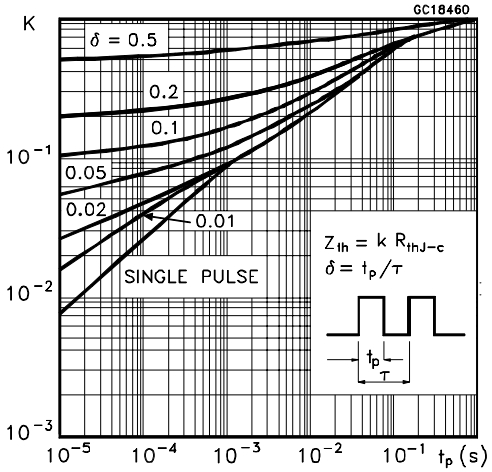
Safe Operating Areas For TO-218 and TO-247



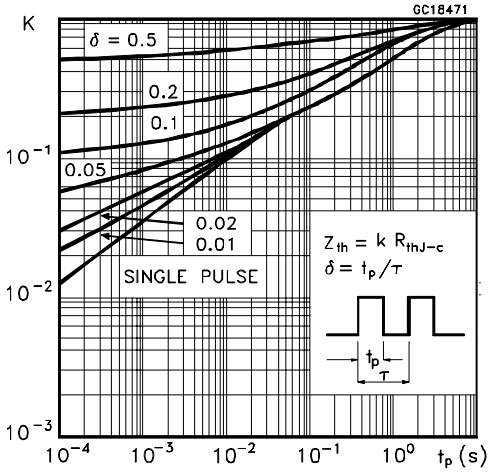
Safe Operating Areas For ISOWATT218



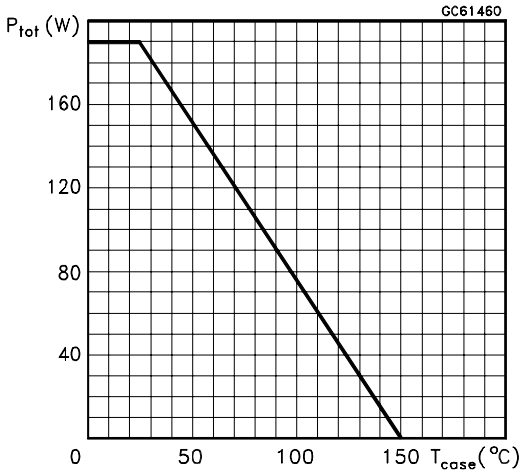
Thermal Impedeance For TO-218 and TO-247



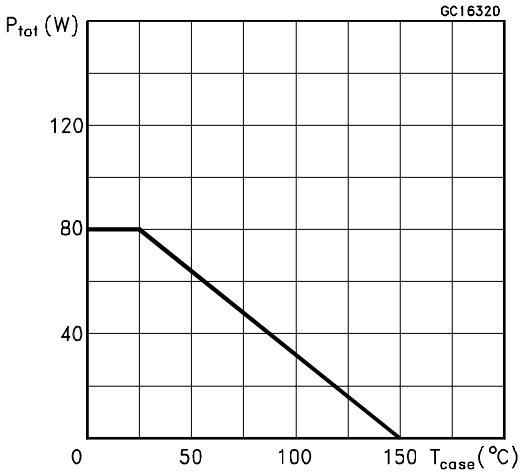
Thermal Impedance For ISOWATT218



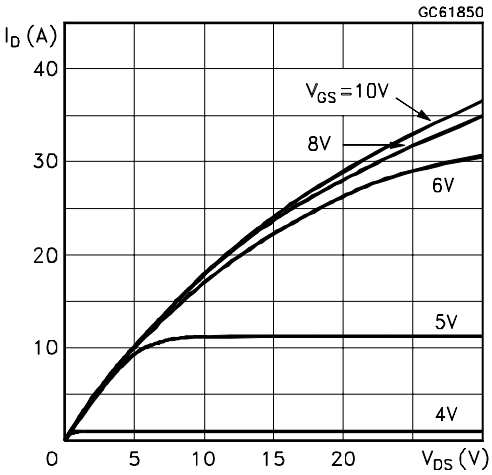
Derating Curve For TO-218 and TO-247



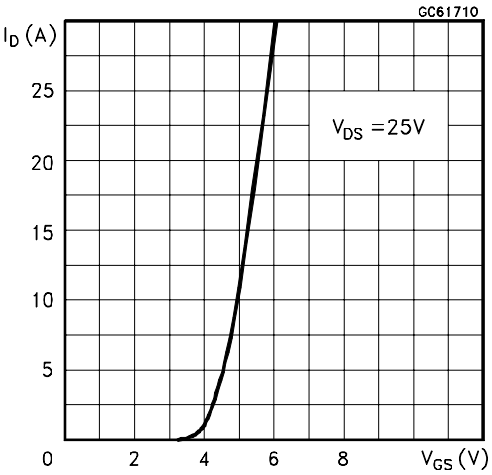
Derating Curve For ISOWATT218



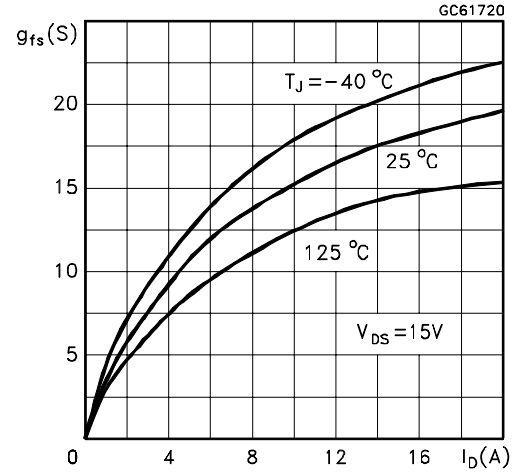
Output Characteristics



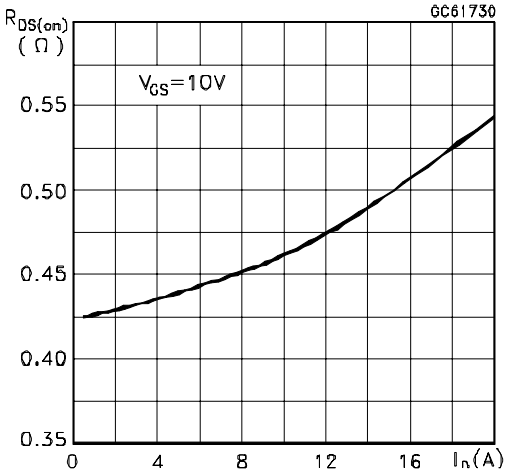
Transfer Characteristics



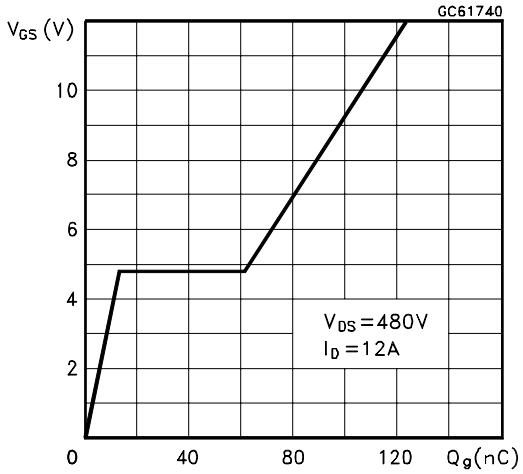
Transconductance



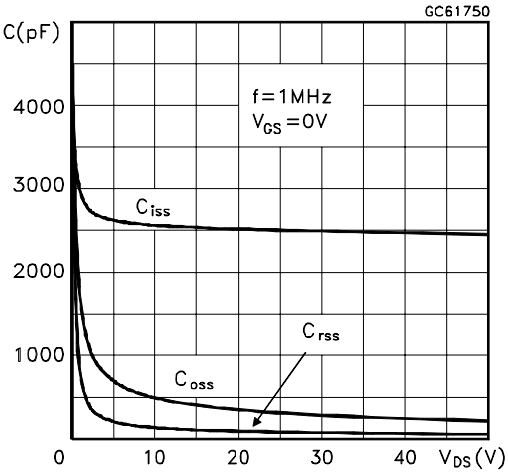
Static Drain-source On Resistance



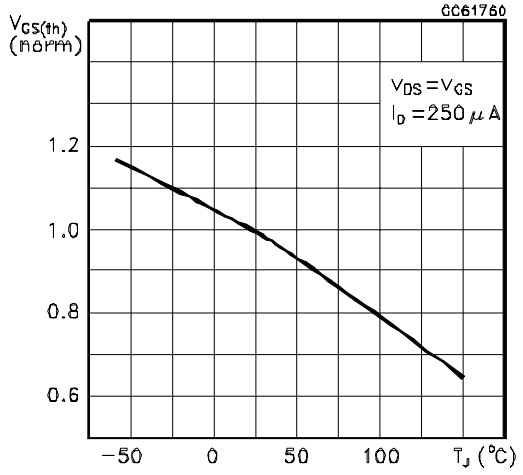
Gate Charge vs Gate-source Voltage



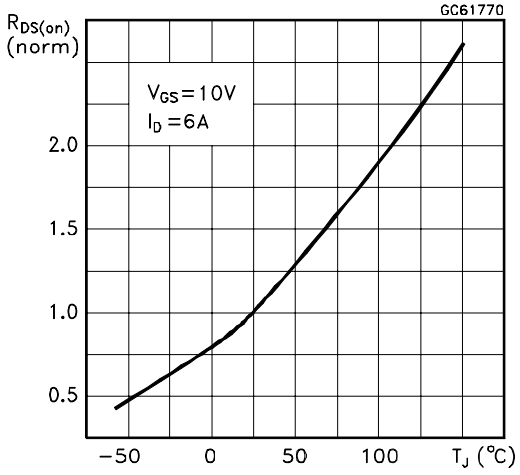
Capacitance Variations



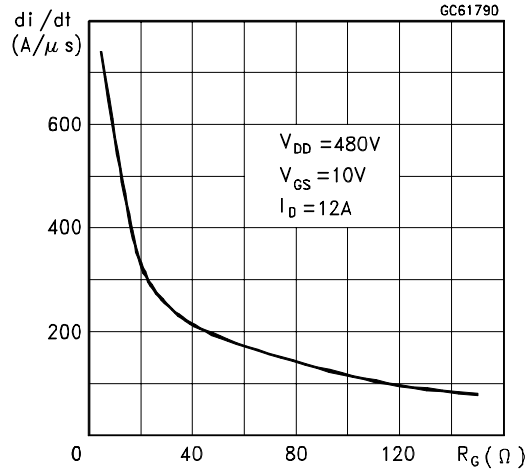
Normalized Gate Threshold Voltage vs Temperature



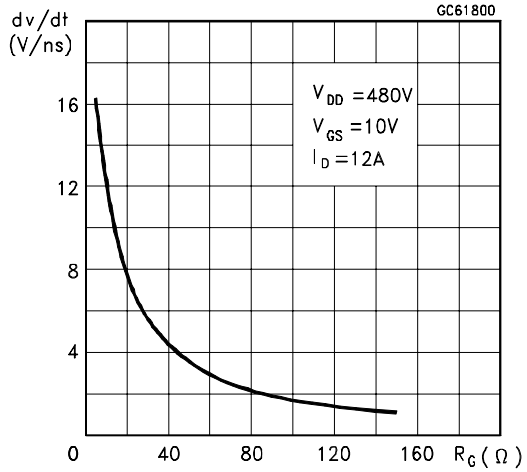
Normalized On Resistance vs Temperature



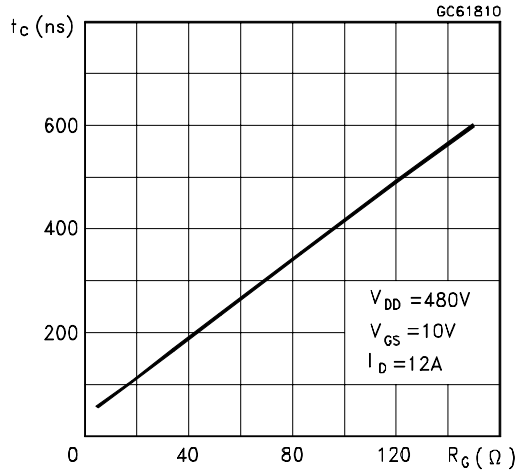
Turn-on Current Slope



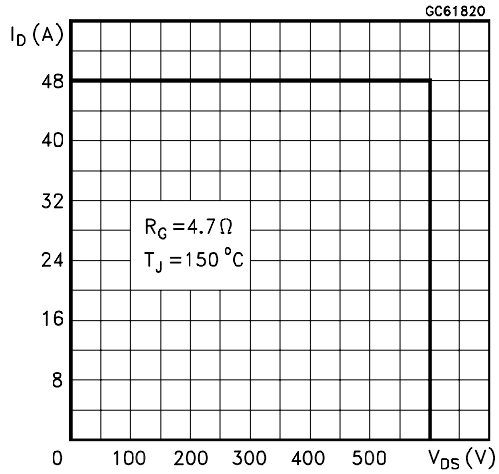
Turn-off Drain-source Voltage Slope



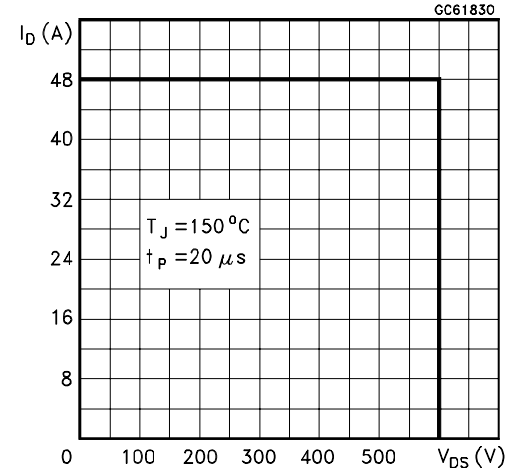
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

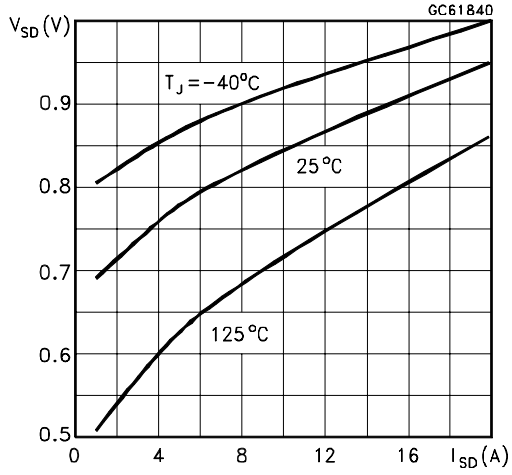


Fig. 1: Unclamped Inductive Load Test Circuits

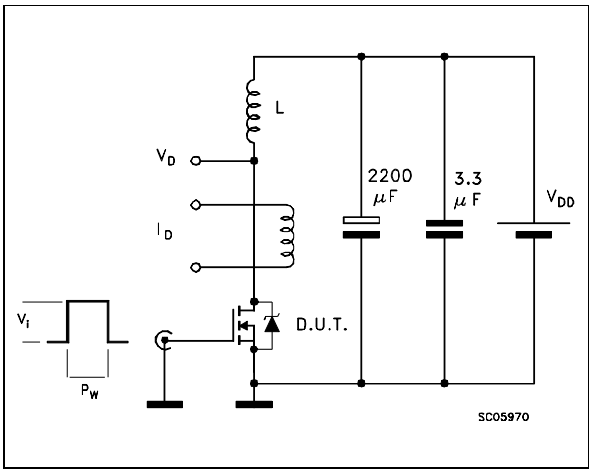


Fig. 2: Unclamped Inductive Waveforms

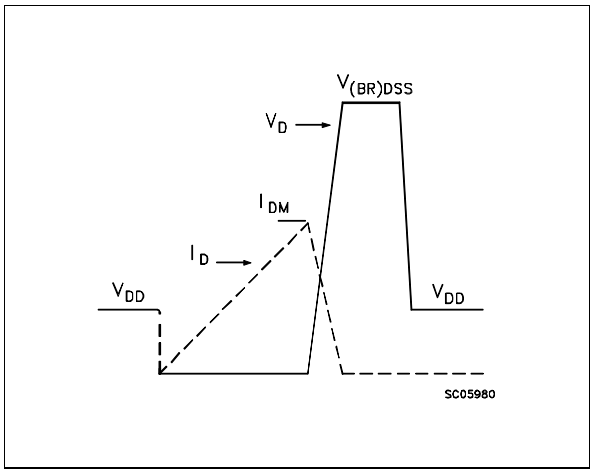


Fig. 3: Switching Times Test Circuits For Resistive Load

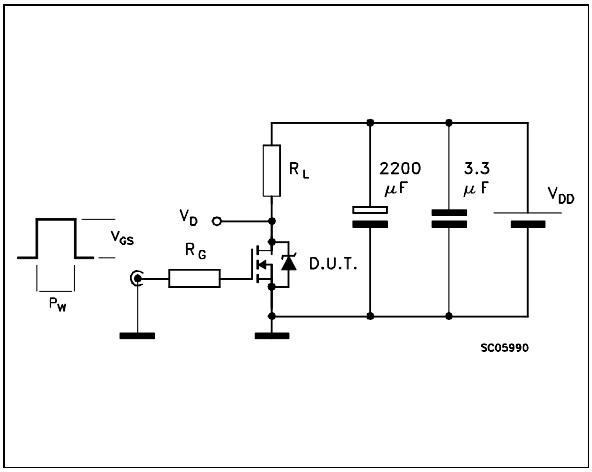


Fig. 4: Gate Charge Test Circuit

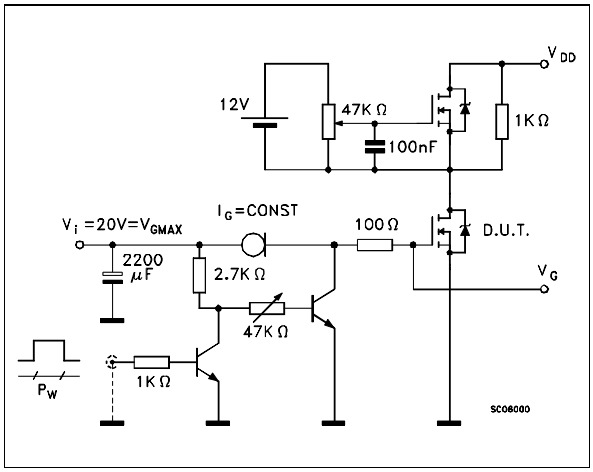
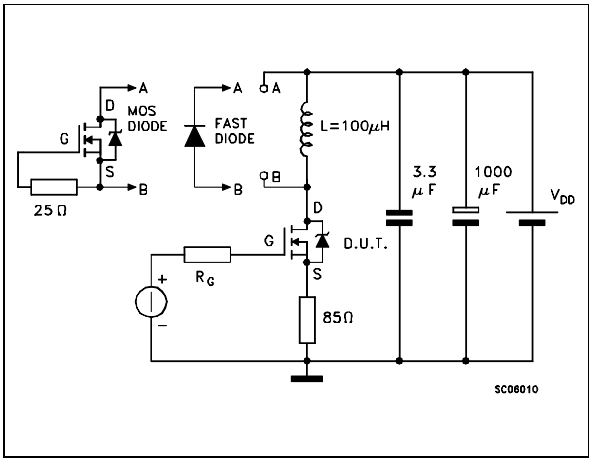
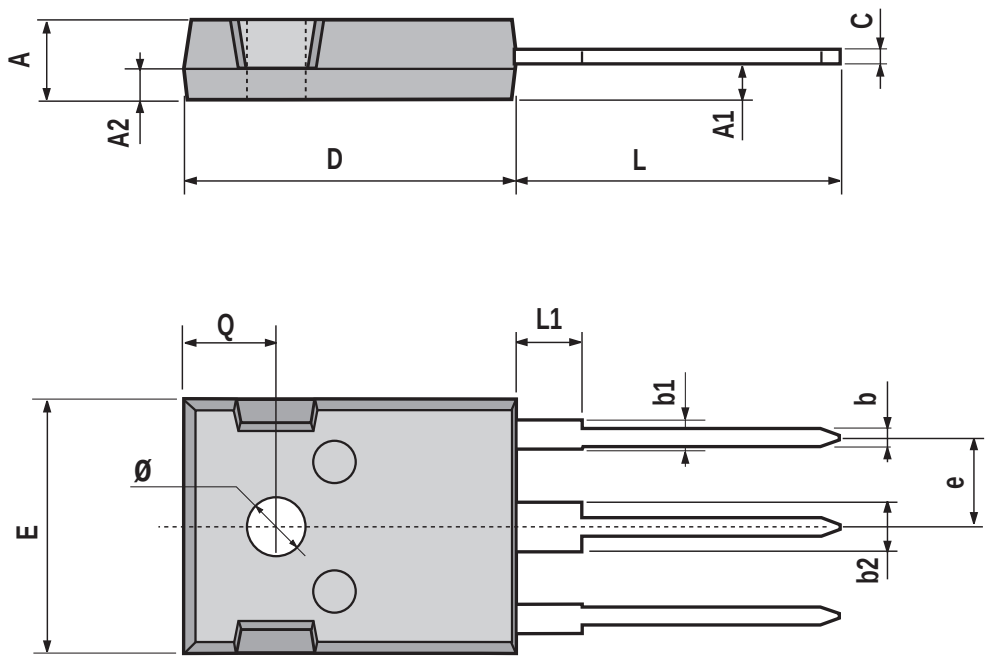


Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



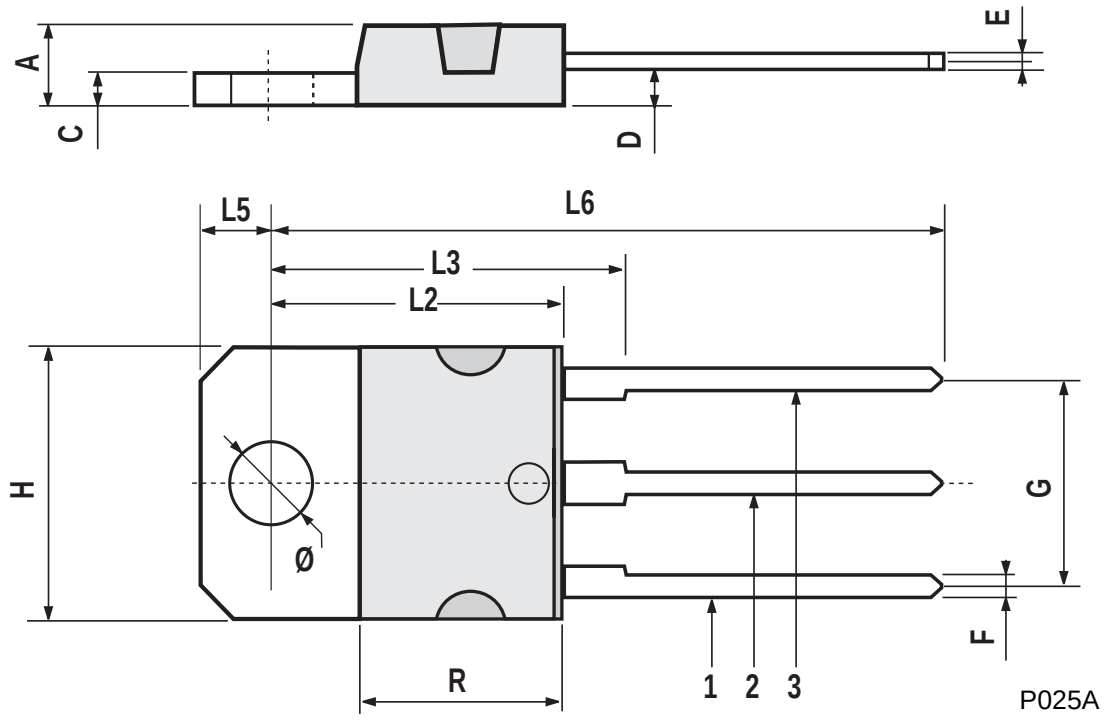
TO-247 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.7		5.3	0.185		0.208
A1			2.87			0.113
A2	1.5		2.5	0.059		0.098
b	1		1.4	0.039		0.055
b1			2.25			0.088
b2	3.05		3.43	0.120		0.135
C	0.4		0.8	0.015		0.031
D	20.4		21.18	0.803		0.833
e	5.43		5.47	0.213		0.215
E	15.3		15.95	0.602		0.628
L	15.57			0.613		
L1	3.7		4.3	0.145		0.169
Q	5.3		5.84	0.208		0.230
ØP	3.5		3.71	0.137		0.146



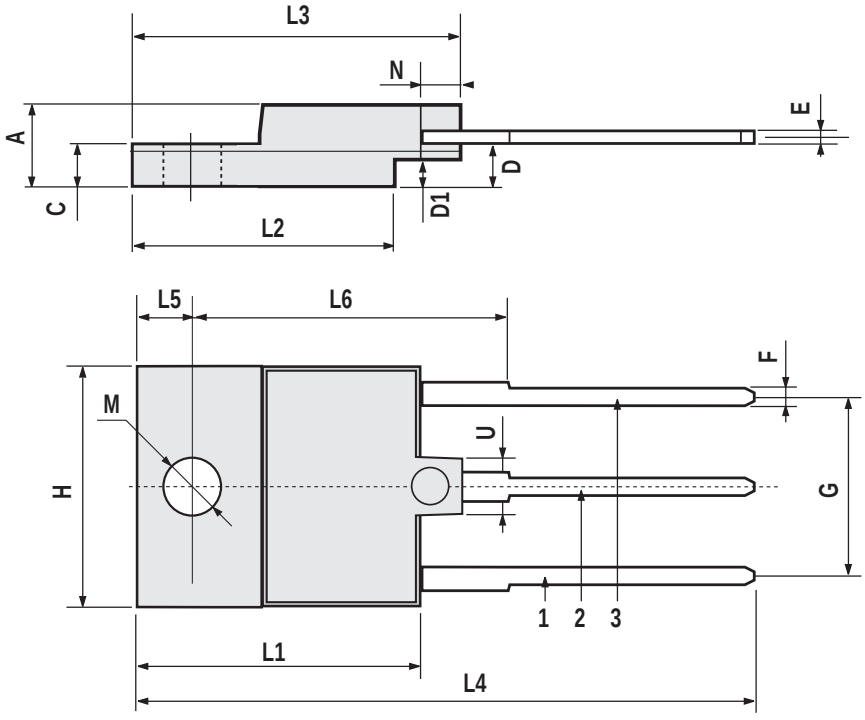
TO-218 (SOT-93) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.7		4.9	0.185		0.193
C	1.17		1.37	0.046		0.054
D		2.5			0.098	
E	0.5		0.78	0.019		0.030
F	1.1		1.3	0.043		0.051
G	10.8		11.1	0.425		0.437
H	14.7		15.2	0.578		0.598
L2	–		16.2	–		0.637
L3		18			0.708	
L5	3.95		4.15	0.155		0.163
L6		31			1.220	
R	–		12.2	–		0.480
Ø	4		4.1	0.157		0.161



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	0.45		1	0.017		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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