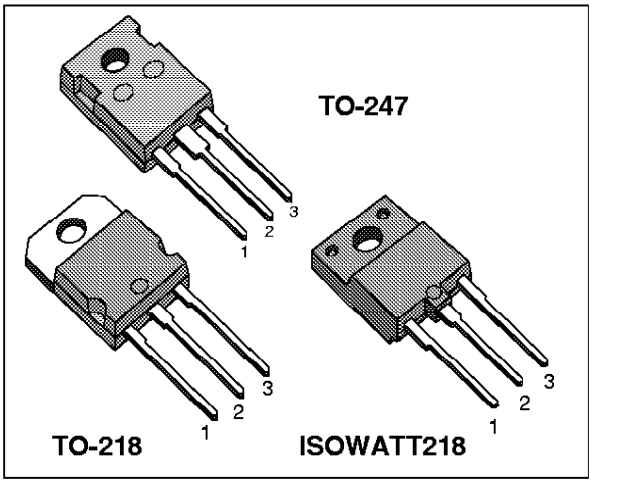
SGS-THOMSON MICROELECTRONICS

STH60N10/FI
STW60N10

N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

TYPE	V_{DSS}	$R_{DS(on)}$	I_D
STH60N10	100 V	< 0.025 Ω	60 A
STH60N10FI	100 V	< 0.025 Ω	36 A
STW60N10	100 V	< 0.025 Ω	60 A

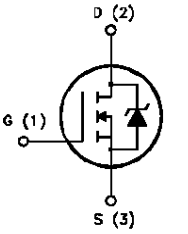


- TYPICAL $R_{DS(on)}$ = 0.02 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- VERY HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- APPLICATION ORIENTED CHARACTERIZATION

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.)

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STH/STW60N10	STH60N10FI	
V_{DS}	Drain-source Voltage (V_{GS} = 0)	100		V
V_{DGR}	Drain- gate Voltage (R_{GS} = 20 kΩ)	100		V
V_{GS}	Gate-source Voltage	± 20		V
I_D	Drain Current (continuous) at T_c = 25 °C	60	36	A
I_D	Drain Current (continuous) at T_c = 100 °C	42	22	A
I_{DM}(•)	Drain Current (pulsed)	240	240	A
P_{tot}	Total Dissipation at T_c = 25 °C	200	70	W
	Derating Factor	1.33	0.56	W/°C
V_{ISO}	Insulation Withstand Voltage (DC)	—	4000	V
T_{stg}	Storage Temperature	-65 to 175	-65 to 150	°C
T_j	Max. Operating Junction Temperature	175	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	0.75	1.79	°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, $\delta < 1\%$)	60	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\ ^oC$, $I_D = I_{AR}$, $V_{DD} = 25$ V)	720	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	180	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\ ^oC$, pulse width limited by T_j max, $\delta < 1\%$)	37	A

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

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\ \mu A$ $V_{GS} = 0$	100			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	V_{DS} = Max Rating V_{DS} = Max Rating x 0.8 $T_c = 125\ ^oC$			250 1000	µA µA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20$ 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	2.9	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10$ V $I_D = 30$ A $V_{GS} = 10$ V $I_D = 30$ A $T_c = 100^oC$		0.02	0.025 0.05	Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10$ V	60			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 30$ A	25	35		S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25$ V $f = 1$ MHz $V_{GS} = 0$		4000 1100 250	5000 1400 350	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} = 80 V I_D = 30 A R_G = 50 Ω V_{GS} = 10 V (see test circuit, figure 3)		90 270	130 380	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	V_{DD} = 80 V I_D = 60 A R_G = 50 Ω V_{GS} = 10 V (see test circuit, figure 5)		270		A/µs
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	V_{DD} = 80 V I_D = 30 A V_{GS} = 10 V		120 16 60	170	nC nC nC

SWITCHING OFF

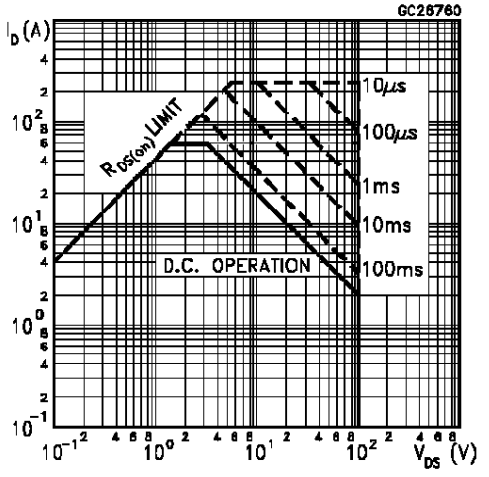
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	V_{DD} = 80 V I_D = 60 A R_G = 50 Ω V_{GS} = 10 V (see test circuit, figure 5)		200 210 410	280 290 570	ns ns ns

SOURCE DRAIN DIODE

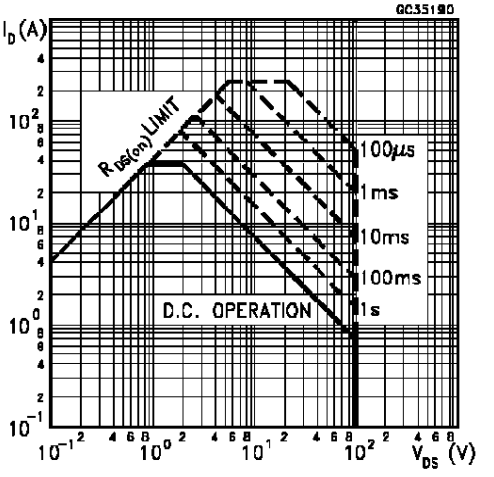
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM}(•)	Source-drain Current Source-drain Current (pulsed)				60 240	A A
V_{SD} (*)	Forward On Voltage	I_{SD} = 60 A V_{GS} = 0			1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_{SD} = 60 A di/dt = 100 A/µs V_{DD} = 30 V T_j = 150 °C (see test circuit, figure 5)		180 1 11		ns µC A

(*) Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %
(•) Pulse width limited by safe operating area

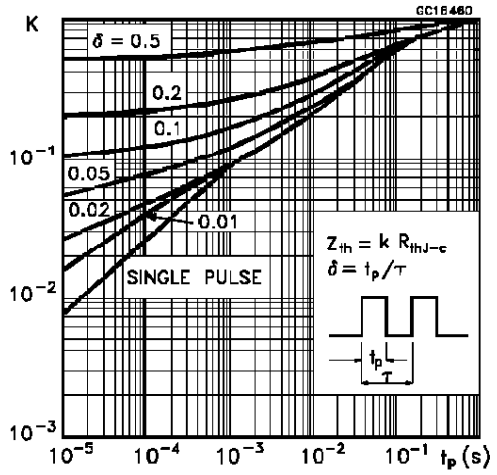
Safe Operating Areas For TO-218 and TO-247



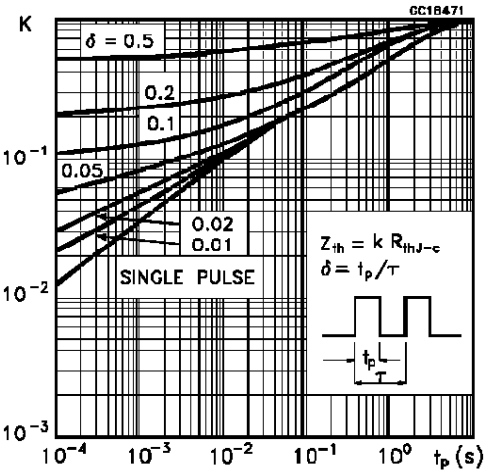
Safe Operating Areas For ISOWATT218



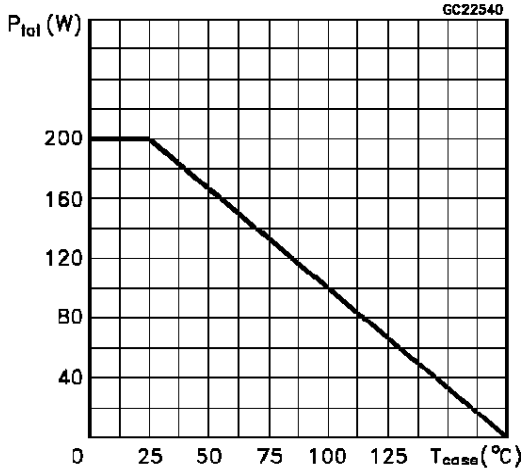
Thermal Impedeance For TO-218 and TO-247



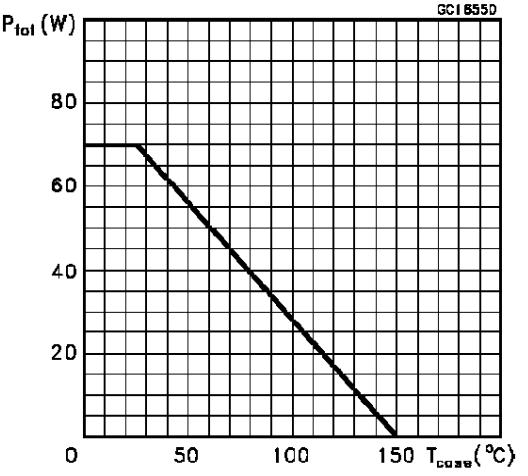
Thermal Impedance For ISOWATT218



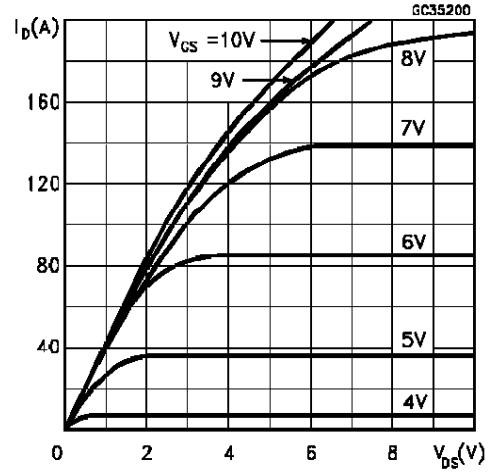
Derating Curve For TO-218 and TO-247



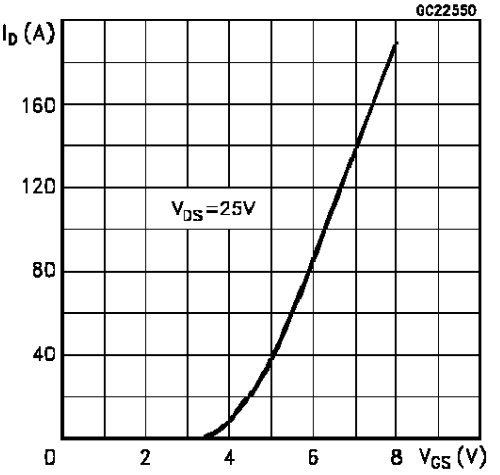
Derating Curve For ISOWATT218



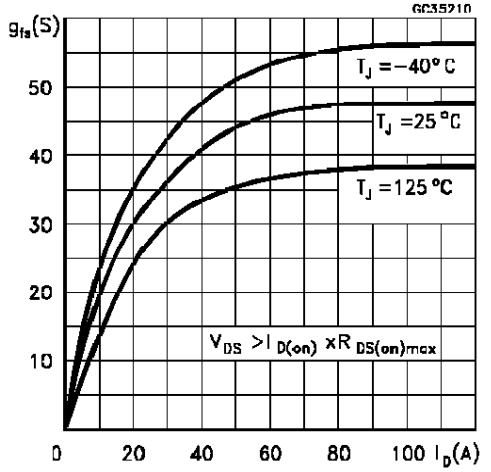
Output Characteristics



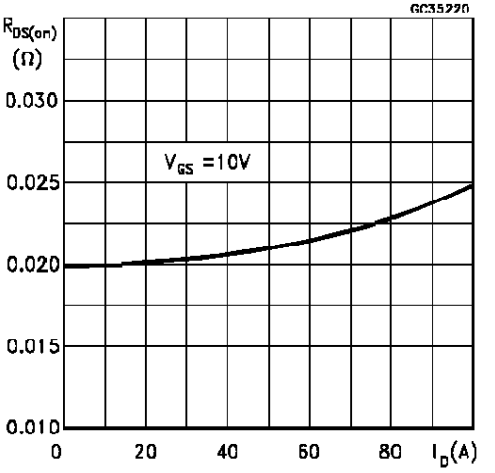
Transfer Characteristics



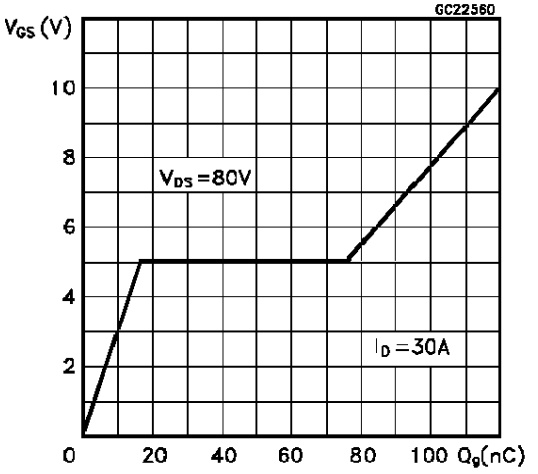
Transconductance



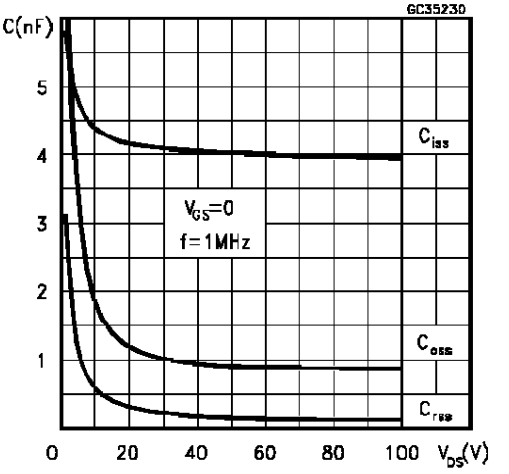
Static Drain-source On Resistance



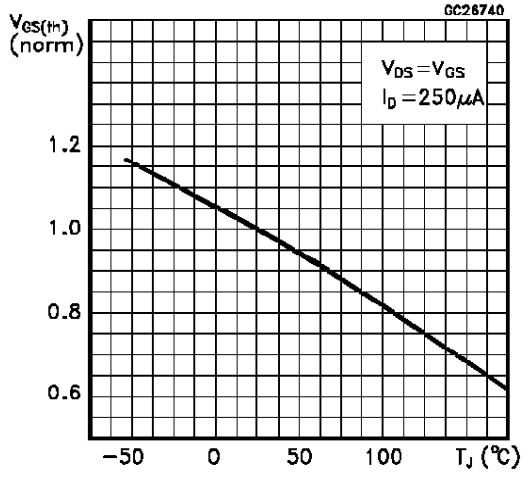
Gate Charge vs Gate-source Voltage



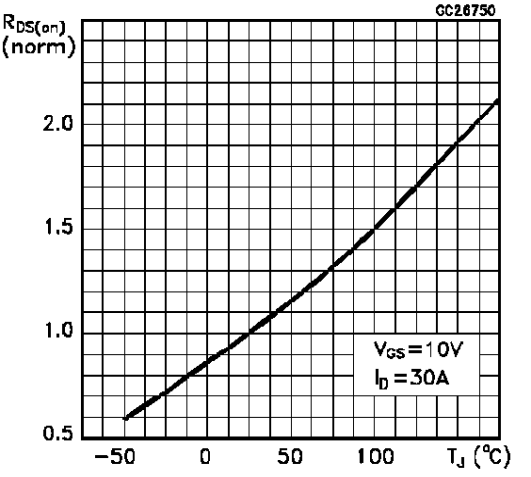
Capacitance Variations



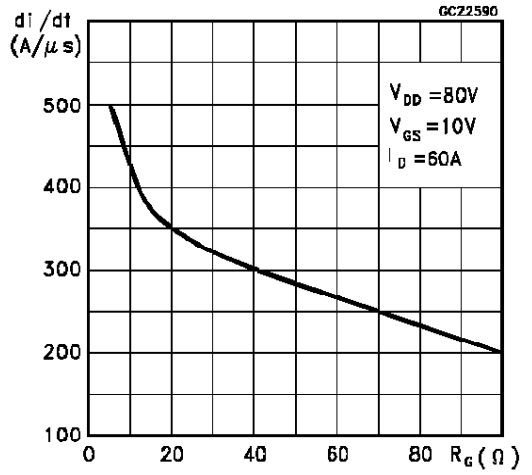
Normalized Gate Threshold Voltage vs Temperature



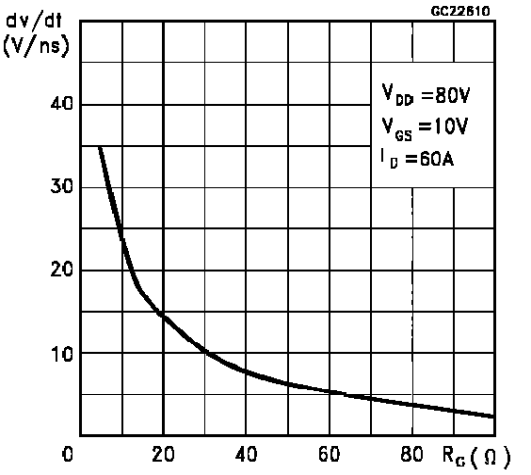
Normalized On Resistance vs Temperature



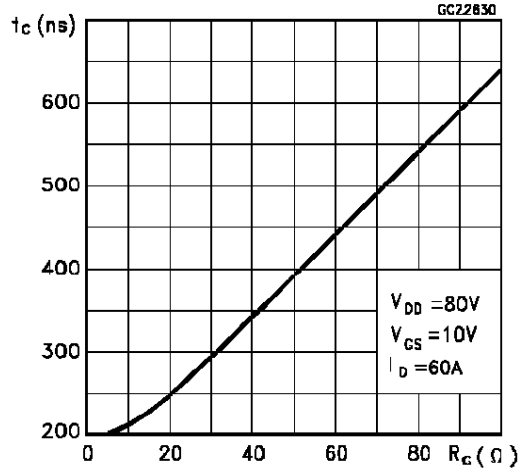
Turn-on Current Slope



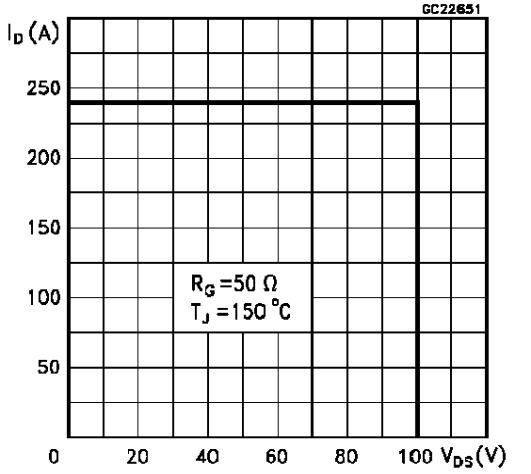
Turn-off Drain-source Voltage Slope



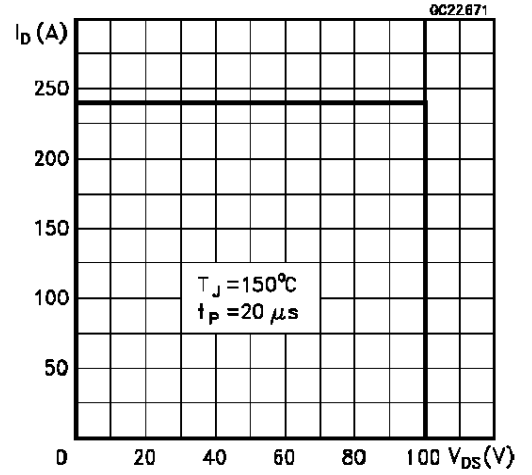
Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

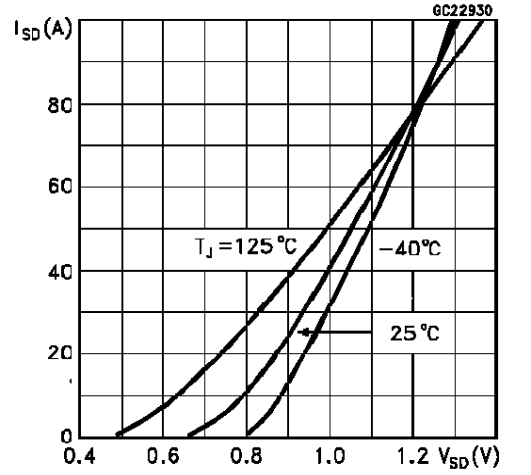


Fig. 1: Unclamped Inductive Load Test Circuits

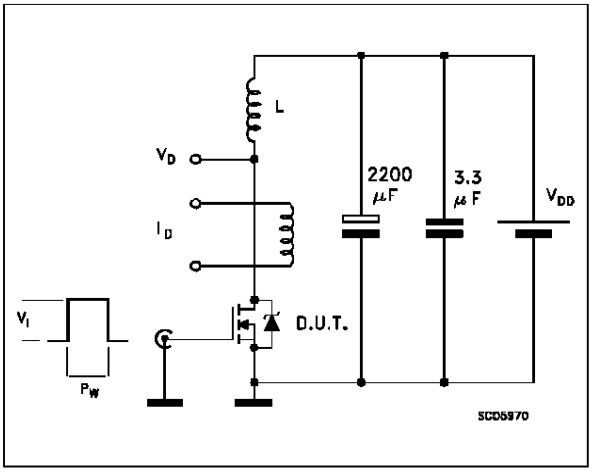


Fig. 2: Unclamped Inductive Waveforms

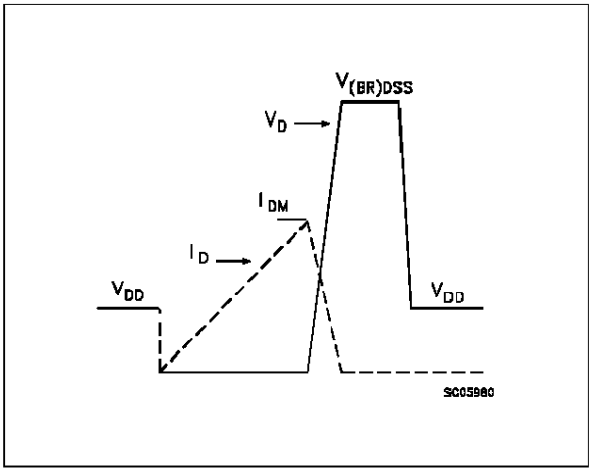


Fig. 3: Switching Times Test Circuits For Resistive Load

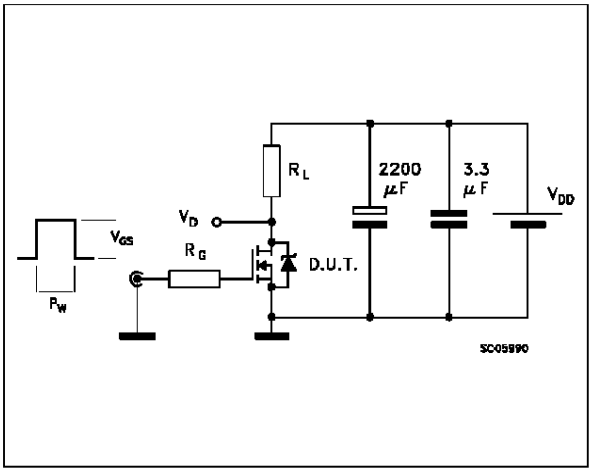


Fig. 4: Gate Charge Test Circuit

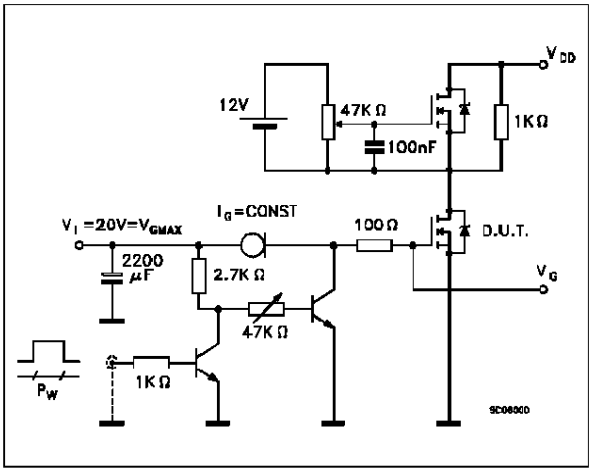
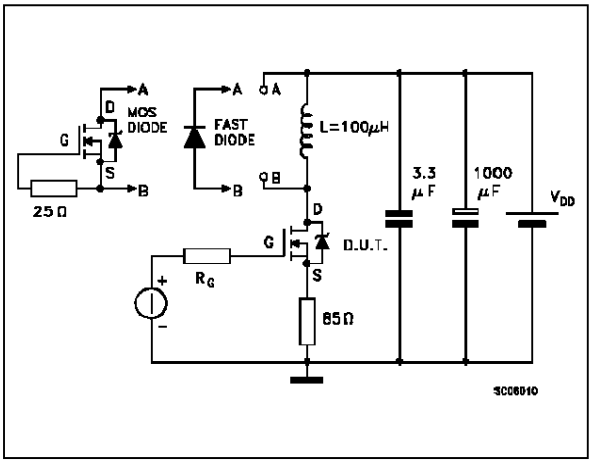
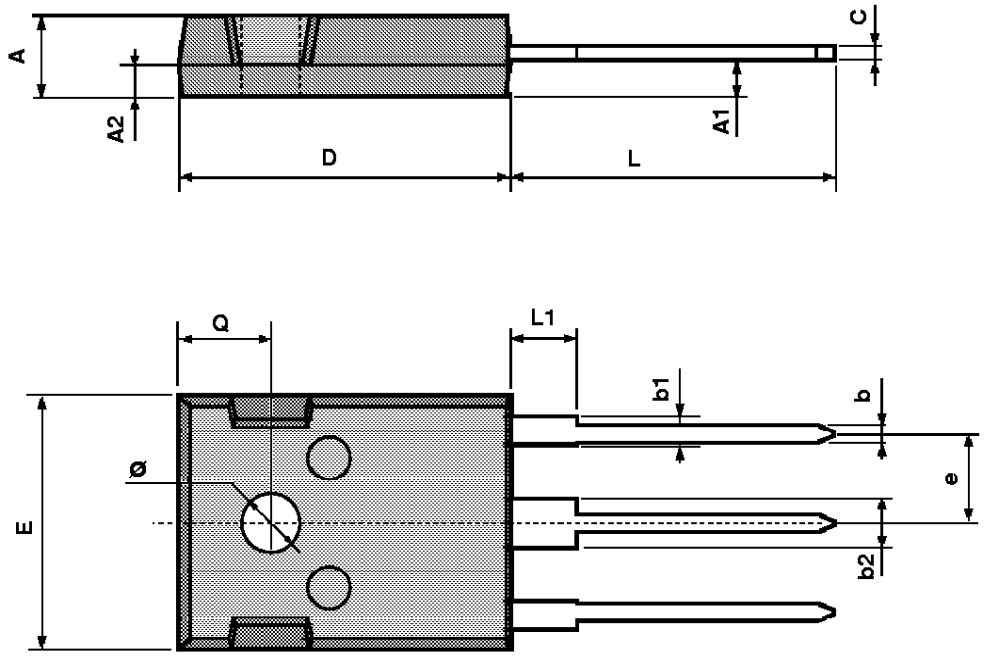


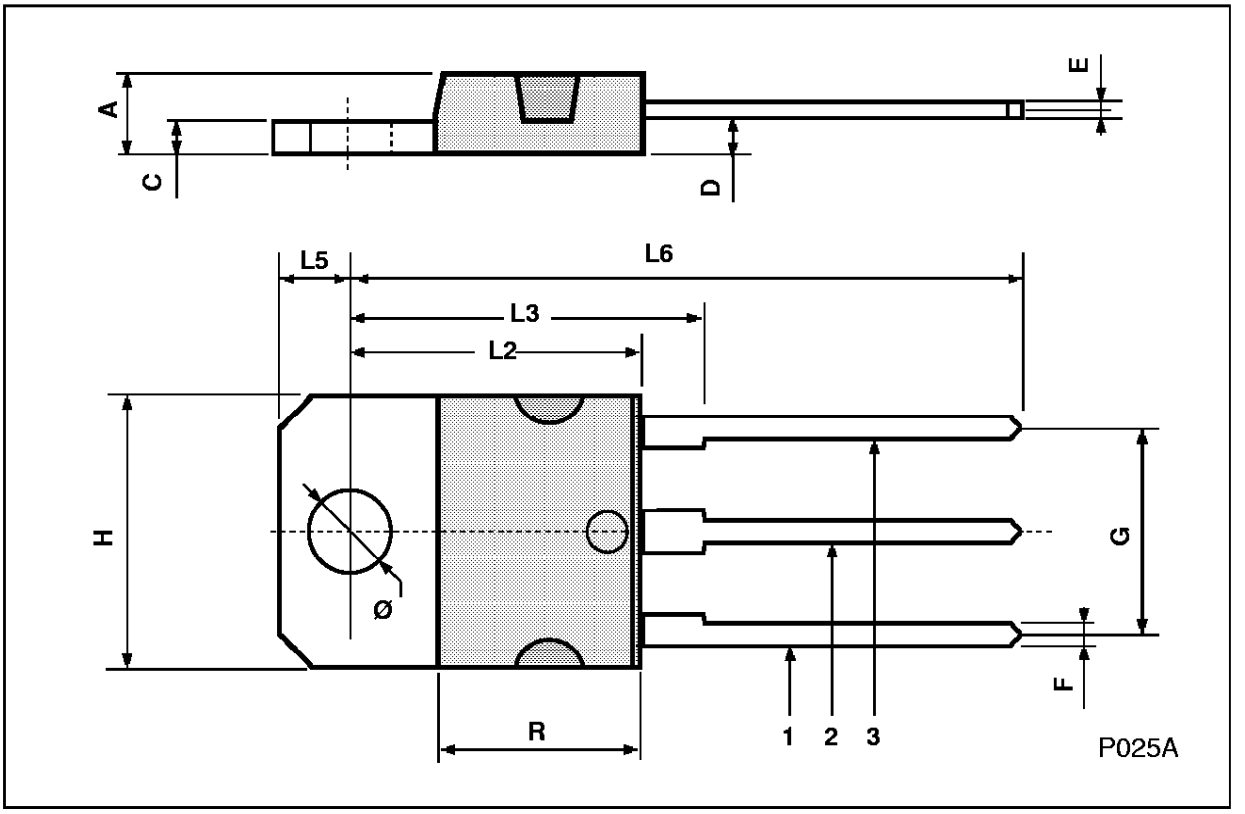
Fig. 5: Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



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