



# STW220NF75

## N-CHANNEL 75V - 0.004 $\Omega$ - 120A TO-247 STripFET™ II POWER MOSFET

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STW220NF75	75V	<0.0044 $\Omega$	120A(**)

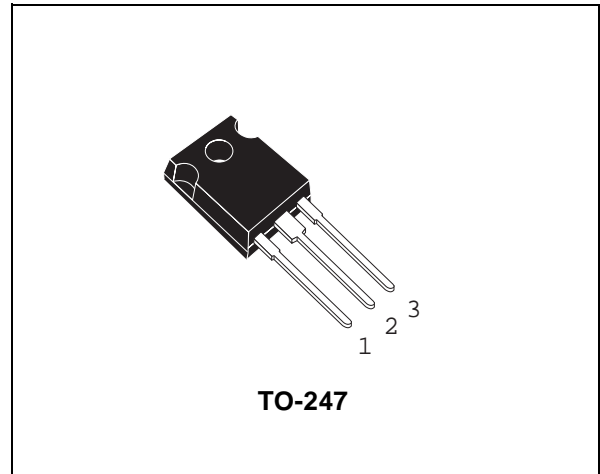
- TYPICAL R<sub>DS(on)</sub> = 0.004 $\Omega$
- STANDARD THRESHOLD DRIVE
- 100% AVALANCHE TESTED

### DESCRIPTION

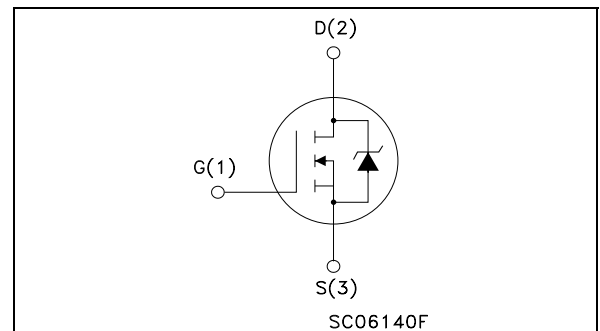
This Power MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

### APPLICATIONS

- HIGH CURRENT, HIGH SWITCHING SPEED
- AUTOMOTIVE 42V BATTERY SYSTEM
- OR-ING FUNCTION



### INTERNAL SCHEMATIC DIAGRAM



### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	75	V
V <sub>DGR</sub>	Drain-gate Voltage (R <sub>GS</sub> = 20 k $\Omega$ )	75	V
V <sub>GS</sub>	Gate- source Voltage	$\pm 20$	V
I <sub>D</sub> (**)	Drain Current (continuous) at T <sub>C</sub> = 25°C	120	A
I <sub>D</sub> (**)	Drain Current (continuous) at T <sub>C</sub> = 100°C	120	A
I <sub>DM</sub> (•)	Drain Current (pulsed)	480	A
P <sub>tot</sub>	Total Dissipation at T <sub>C</sub> = 25°C	500	W
	Derating Factor	3.33	W/°C
dv/dt (1)	Peak Diode Recovery voltage slope	10	V/ns
E <sub>AS</sub> (2)	Single Pulse Avalanche Energy	2500	mJ
T <sub>stg</sub>	Storage Temperature	-55 to 175	°C
T <sub>j</sub>	Operating Junction Temperature		

- ) Pulse width limited by safe operating area.  
(\*\*) Current Limited by Package

- (1) I<sub>SD</sub>  $\leq$  120A, di/dt  $\leq$  100A/ $\mu$ s, V<sub>DD</sub>  $\leq$  V(BR)<sub>DSS</sub>, T<sub>j</sub>  $\leq$  T<sub>JMAX</sub>  
(2) Starting T<sub>j</sub> = 25 °C, I<sub>D</sub> = 60 A, V<sub>DD</sub> = 30V

**THERMAL DATA**

R <sub>thj-case</sub>	Thermal Resistance Junction-case	Max	0.30	°C/W
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient	Max	50	°C/W
T <sub>j</sub>	Maximum Lead Temperature For Soldering Purpose (1.6 mm from case, for 10 sec)	Typ	300	°C

**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	75			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> = 125°C			1 10	µA µA
I <sub>GSS</sub>	Gate-body Leakage Current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ± 20V			±100	nA

**ON (1)**

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		4	V
R <sub>DS(on)</sub>	Static Drain-source On Resistance	V <sub>GS</sub> = 10 V I <sub>D</sub> = 60 A		0.004	0.0044	Ω

**DYNAMIC**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub> (*)	Forward Transconductance	V <sub>DS</sub> = 25 V I <sub>D</sub> = 60 A		200		S
C <sub>iss</sub> C <sub>oss</sub> C <sub>rss</sub>	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V <sub>DS</sub> = 25V, f = 1 MHz, V <sub>GS</sub> = 0		12500 2150 600		pF pF pF

**ELECTRICAL CHARACTERISTICS** (continued)**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on Delay Time Rise Time	$V_{DD} = 38\text{ V}$ $I_D = 60\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ (Resistive Load, Figure 3)		50 215		ns ns
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD}=38\text{V}$ $I_D=120\text{A}$ $V_{GS}=10\text{V}$		350 60 135	430	nC nC nC

**SWITCHING OFF**

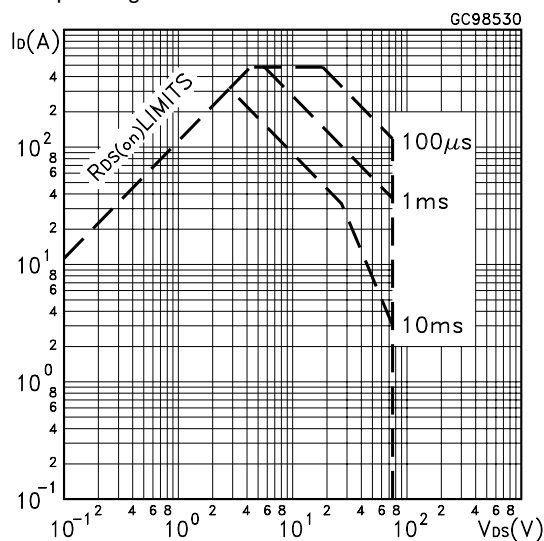
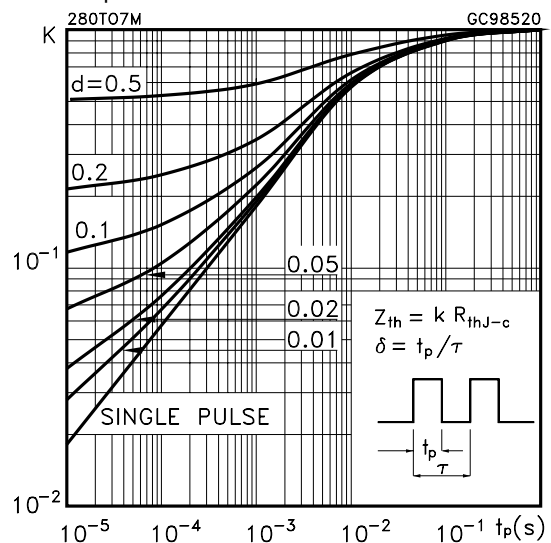
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$ $t_f$	Turn-off Delay Time Fall Time	$V_{DD} = 38\text{ V}$ $I_D = 60\text{ A}$ $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ (Resistive Load, Figure 3)		250 130		ns ns

**SOURCE DRAIN DIODE**

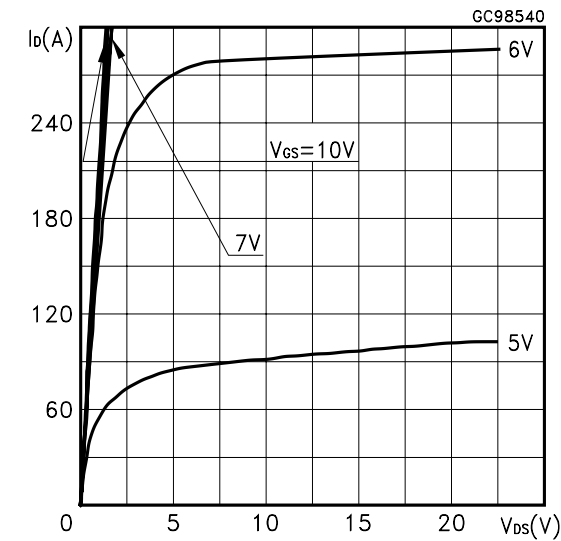
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$ $I_{SDM}(\bullet)$	Source-drain Current Source-drain Current (pulsed)				120 480	A A
$V_{SD}^(*)$	Forward On Voltage	$I_{SD} = 120\text{ A}$ $V_{GS} = 0$			1.5	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 120\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 32\text{ V}$ $T_J = 150^\circ\text{C}$ (see test circuit, Figure 5)		140 770 11		ns nC A

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

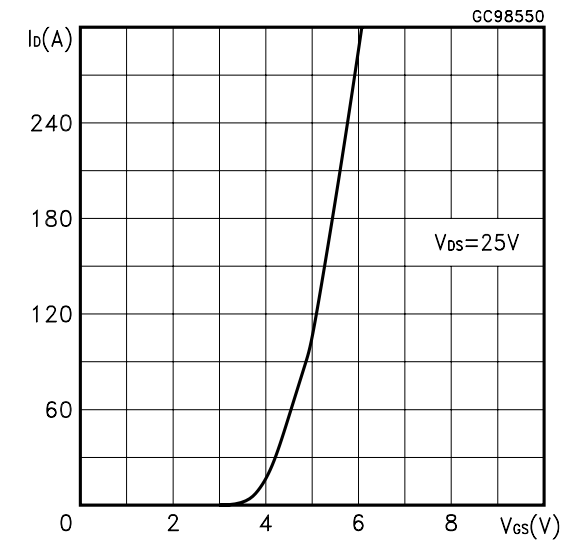
(•) Pulse width limited by safe operating area.

**Safe Operating Area****Thermal Impedance**

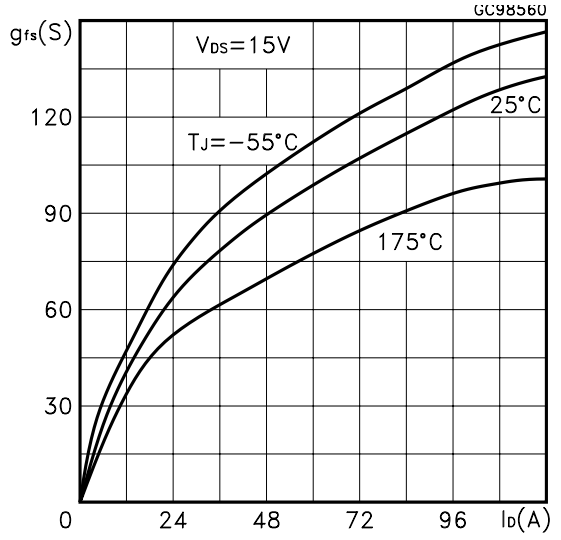
Output Characteristics



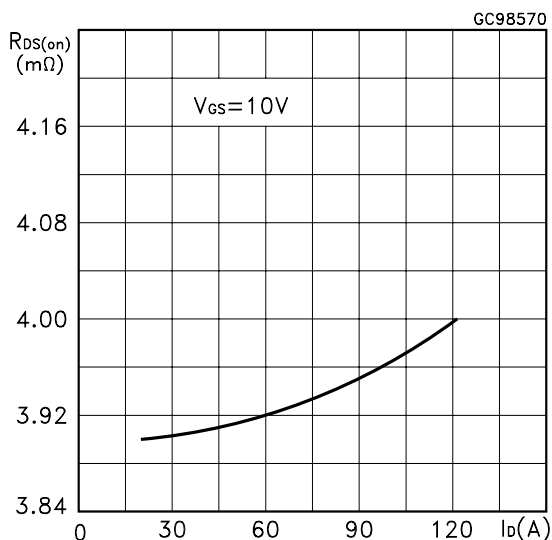
Transfer Characteristics



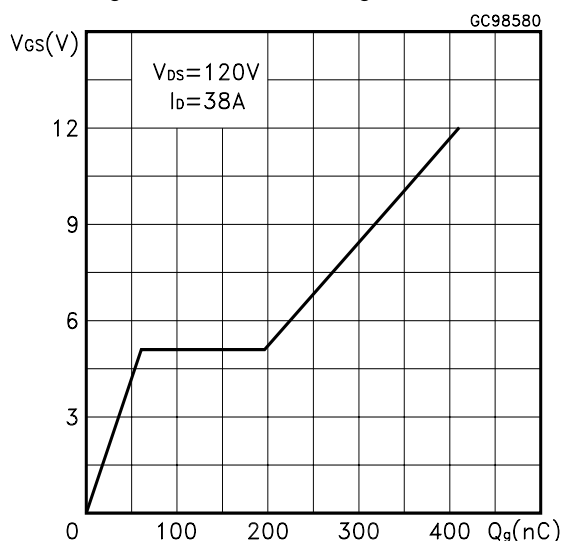
Transconductance



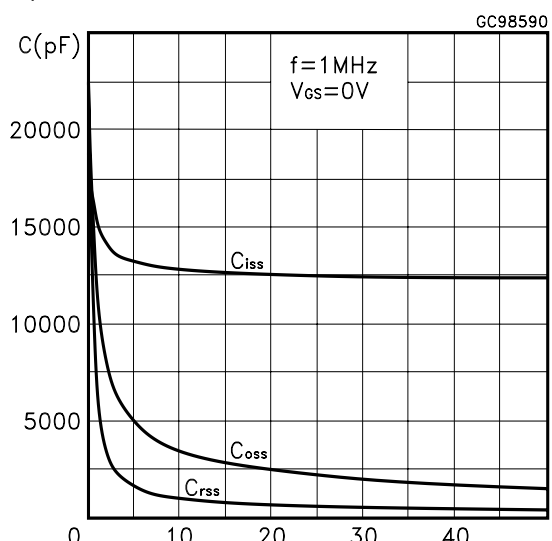
Static Drain-source On Resistance



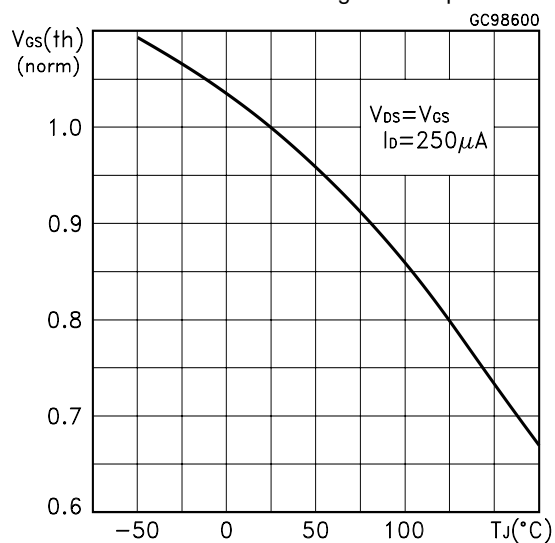
Gate Charge vs Gate-source Voltage



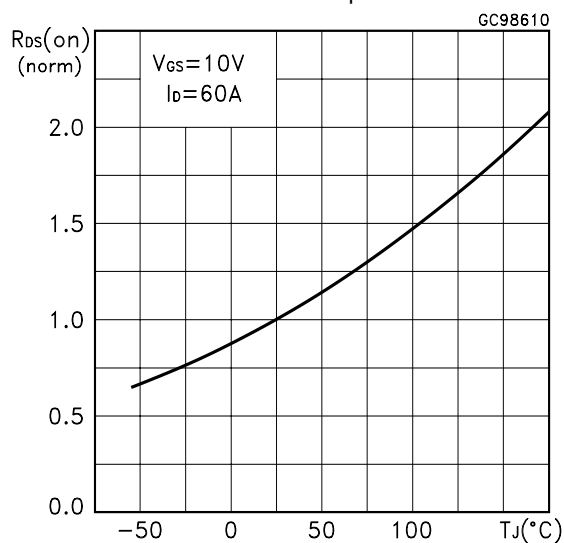
Capacitance Variations



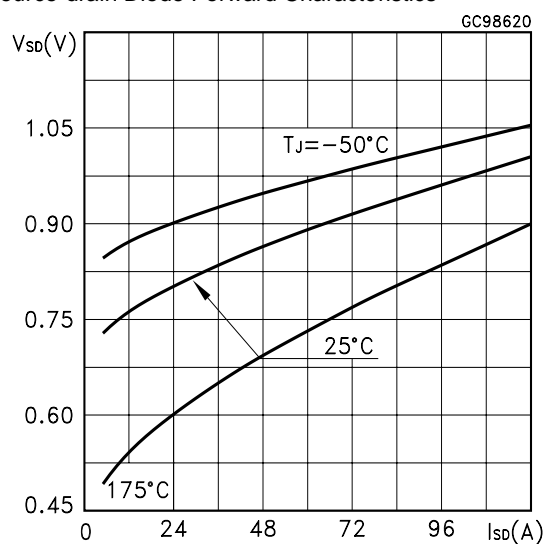
Normalized Gate Threshold Voltage vs Temperature



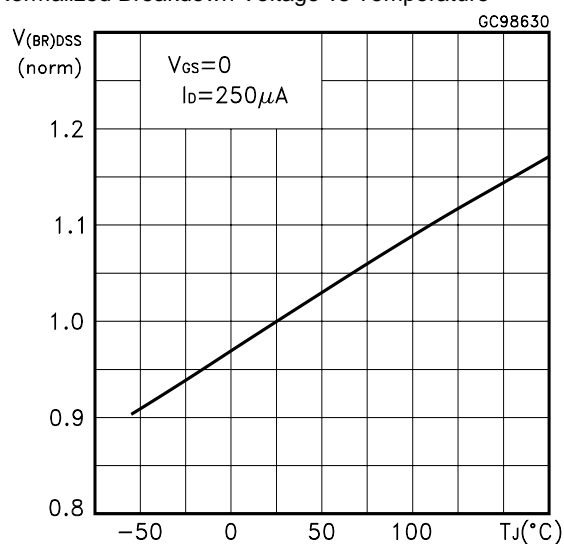
Normalized on Resistance vs Temperature



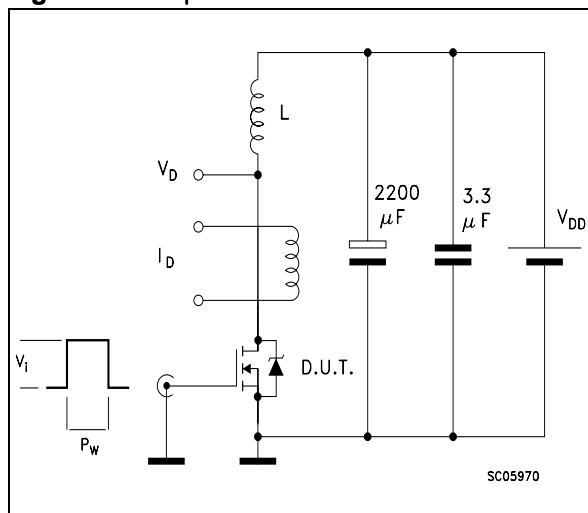
Source-drain Diode Forward Characteristics



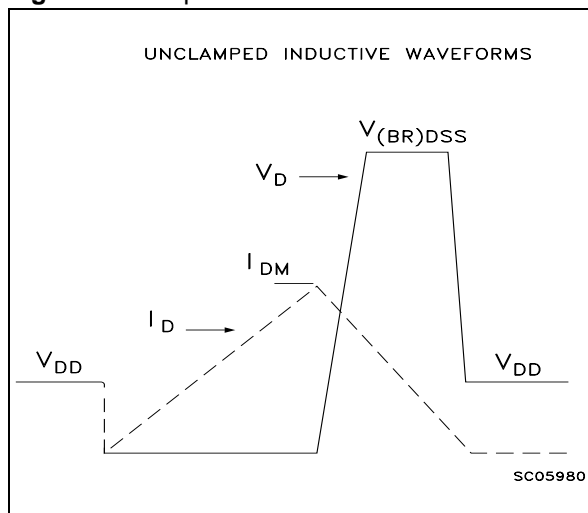
Normalized Breakdown Voltage vs Temperature



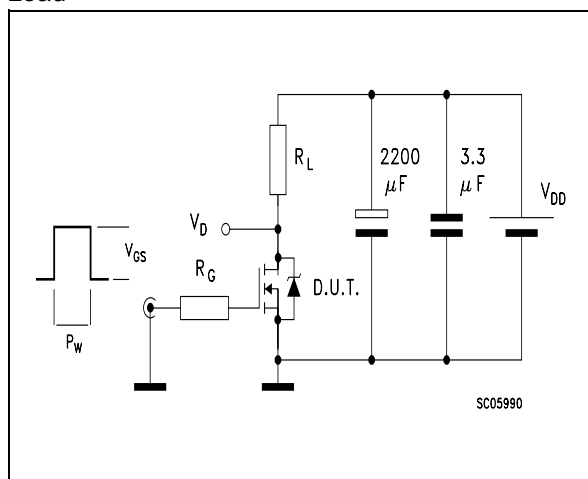
**Fig. 1: Unclamped Inductive Load Test Circuit**



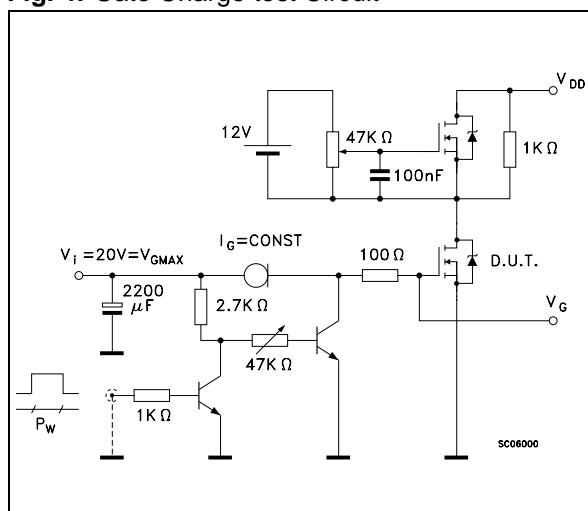
**Fig. 2: Unclamped Inductive Waveform**



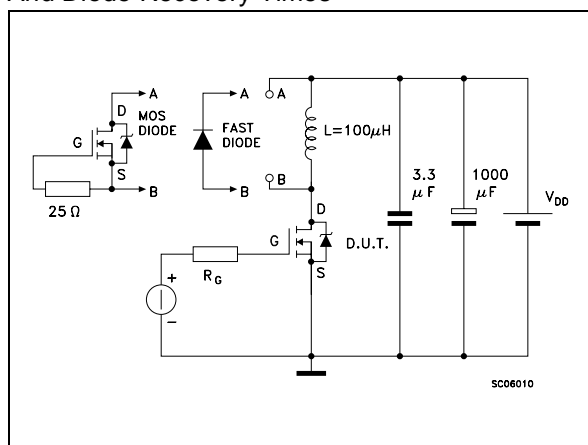
**Fig. 3: Switching Times Test Circuits For Resistive Load**



**Fig. 4: Gate Charge test Circuit**

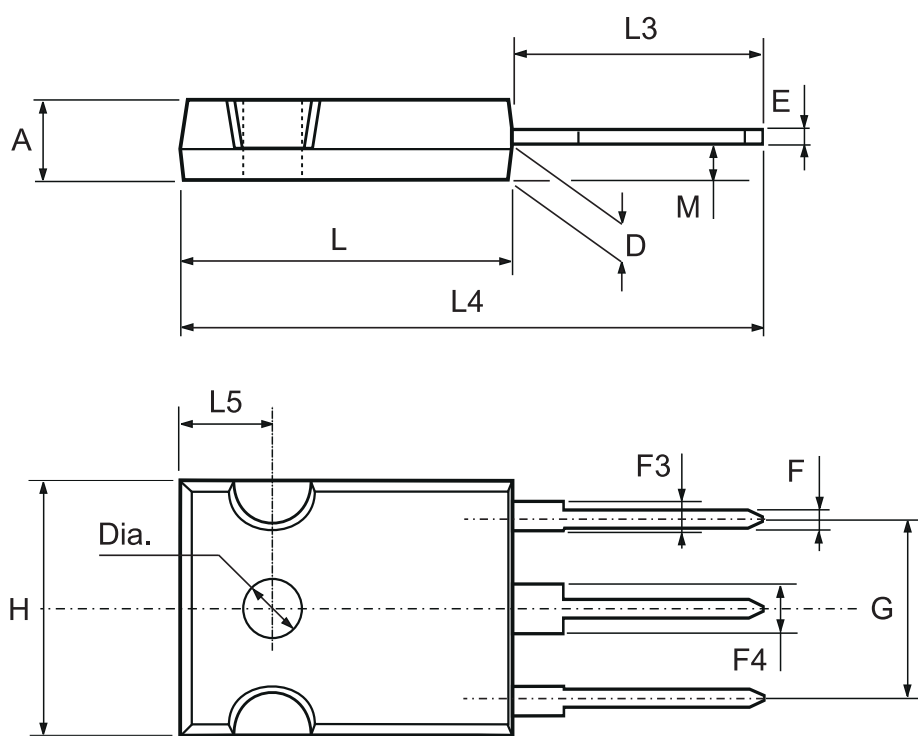


**Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times**



## 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		0.582
L4		34.6			1.362	
L5		5.5			0.217	
M	2		3	0.079		0.118



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