



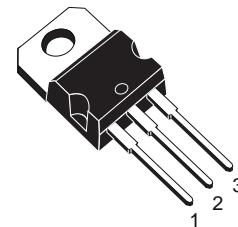
# STGP12NB60H

N-CHANNEL 12A - 600V – TO-220

PowerMESH™ IGBT

TYPE	V <sub>CES</sub>	V <sub>CES(sat)</sub>	I <sub>C</sub>
STGP12NB60H	600 V	< 2.8 V	12 A

- HIGH INPUT IMPEDANCE
- LOW ON-VOLTAGE DROP ( $V_{cesat}$ )
- OFF LOSSES INCLUDE TAIL CURRENT
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- VERY HIGH FREQUENCY OPERATION
- CO-PACKAGED WITH TURBOSWITCH™
- TYPICAL SHORT CIRCUIT WITHSTAND TIME 5MICROS S-family, 4 micro H family
- ANTIPARALLEL DIODE



TO-220

## DESCRIPTION

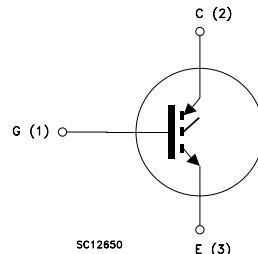
Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances.

The suffix "H" identifies a family optimized for high frequency applications (up to 50kHz) in order to achieve very high switching performances (reduced t<sub>fall</sub>) maintaining a low voltage drop.

## APPLICATIONS

- HIGH FREQUENCY MOTOR CONTROLS
- SMPS and PFC IN BOTH HARD SWITCH AND RESONANT TOPOLOGIES
- UPS

## INTERNAL SCHEMATIC DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>CES</sub>	Collector-Emitter Voltage ( $V_{GS} = 0$ )	600	V
V <sub>ECR</sub>	Emitter-Collector Voltage	20	V
V <sub>GE</sub>	Gate-Emitter Voltage	$\pm 20$	V
I <sub>C</sub>	Collector Current (continuos) at $T_C = 25^\circ\text{C}$	24	A
I <sub>C</sub>	Collector Current (continuos) at $T_C = 100^\circ\text{C}$	12	A
I <sub>CM</sub> (■)	Collector Current (pulsed)	96	A
P <sub>TOT</sub>	Total Dissipation at $T_C = 25^\circ\text{C}$	100	W
	Derating Factor	0.8	W/ $^\circ\text{C}$
T <sub>stg</sub>	Storage Temperature	-65 to 150	$^\circ\text{C}$
T <sub>j</sub>	Max. Operating Junction Temperature	150	$^\circ\text{C}$

## STGP12NB60H

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### THERMAL DATA

Rthj-case	Thermal Resistance Junction-case Max	1.25	°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5	°C/W
Rthc-sink	Thermal Resistance Case-sink Typ	0.5	°C/W

### ELECTRICAL CHARACTERISTICS (TCASE = 25 °C UNLESS OTHERWISE SPECIFIED) OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>BR(CES)</sub>	Collectro-Emitter Breakdown Voltage	I <sub>C</sub> = 250 µA, V <sub>GE</sub> = 0	600			V
I <sub>CES</sub>	Collector cut-off (V <sub>GE</sub> = 0)	V <sub>CE</sub> = Max Rating, T <sub>C</sub> = 25 °C V <sub>CE</sub> = Max Rating, T <sub>C</sub> = 125 °C			10 100	µA µA
I <sub>GES</sub>	Gate-Emitter Leakage Current (V <sub>CE</sub> = 0)	V <sub>GE</sub> = ±20V , V <sub>CE</sub> = 0			±100	nA

### ON (1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>GE(th)</sub>	Gate Threshold Voltage	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250µA	3		5	V
V <sub>CE(sat)</sub>	Collector-Emitter Saturation Voltage	V <sub>GE</sub> = 15V, I <sub>C</sub> = 12 A V <sub>GE</sub> = 15V, I <sub>C</sub> = 12 A, T <sub>j</sub> =125°C		2.0 1.7	2.8	V V

### DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub>	Forward Transconductance	V <sub>CE</sub> = 25 V , I <sub>C</sub> = 12 A		9.5		S
C <sub>ies</sub>	Input Capacitance	V <sub>CE</sub> = 25V, f = 1 MHz, V <sub>GE</sub> = 0		950		pF
C <sub>oes</sub>	Output Capacitance			120		pF
C <sub>res</sub>	Reverse Transfer Capacitance			27		pF
Q <sub>g</sub> Q <sub>ge</sub> Q <sub>gc</sub>	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	V <sub>CE</sub> = 480V, I <sub>C</sub> = 12 A, V <sub>GE</sub> = 15V		68 10 30		nC nC nC
I <sub>CL</sub>	Latching Current	V <sub>clamp</sub> = 480 V , T <sub>j</sub> = 150°C R <sub>G</sub> = 10 Ω	48			A

### SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t <sub>d(on)</sub> t <sub>r</sub>	Turn-on Delay Time Rise Time	V <sub>CC</sub> = 480 V, I <sub>C</sub> = 12 A R <sub>G</sub> = 10Ω , V <sub>GE</sub> = 15 V		5 46		ns ns
(di/dt) <sub>on</sub> Eon	Turn-on Current Slope Turn-on Switching Losses	V <sub>CC</sub> = 480 V, I <sub>C</sub> = 12 A R <sub>G</sub> =10Ω, V <sub>GE</sub> = 15 V, T <sub>j</sub> =125°C		1000 290		A/µs µJ

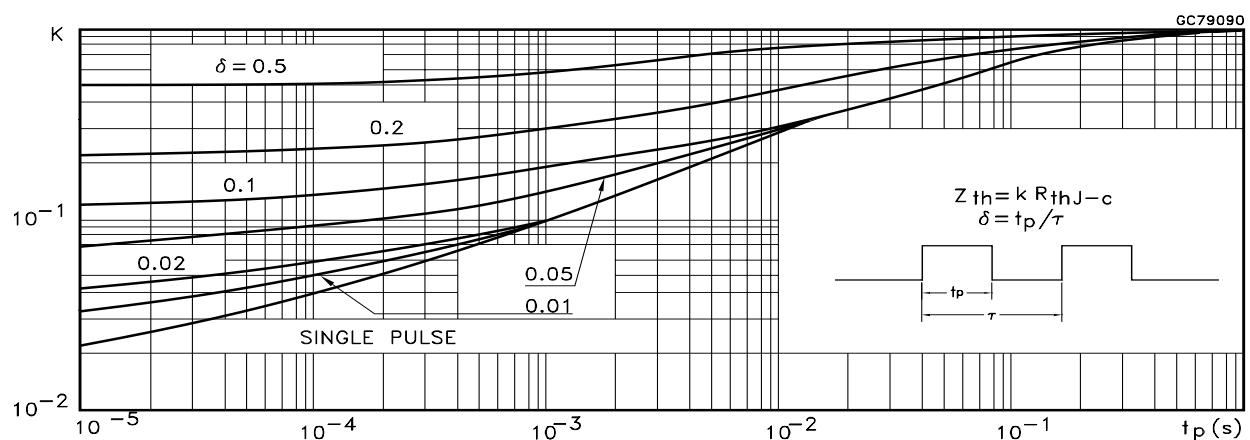
**ELECTRICAL CHARACTERISTICS (CONTINUED)****SWITCHING OFF**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-over Time	$V_{CC} = 480 \text{ V}$ , $I_C = 12 \text{ A}$ ,		150		ns
$t_r(V_{off})$	Off Voltage Rise Time	$R_{GE} = 10 \Omega$ , $V_{GE} = 15 \text{ V}$		27		ns
$t_d(off)$	Delay Time			76		ns
$t_f$	Fall Time			92		ns
$E_{off}(**)$	Turn-off Switching Loss			0.21		mJ
$E_{ts}$	Total Switching Loss			0.49		mJ
$t_c$	Cross-over Time	$V_{CC} = 480 \text{ V}$ , $I_C = 12 \text{ A}$ ,		230		ns
$t_r(V_{off})$	Off Voltage Rise Time	$R_{GE} = 10 \Omega$ , $V_{GE} = 15 \text{ V}$		76		ns
$t_d(off)$	Delay Time	$T_j = 125 \text{ }^\circ\text{C}$		95		ns
$t_f$	Fall Time			200		ns
$E_{off}(**)$	Turn-off Switching Loss			0.45		mJ
$E_{ts}$	Total Switching Loss			0.74		mJ

Note: 1. Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.

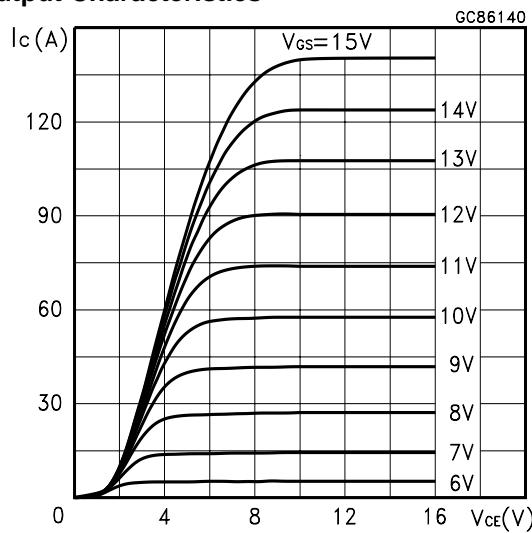
2. Pulse width limited by max. junction temperature.

(\*\*)Losses include Also the Tail (Jedec Standardization)

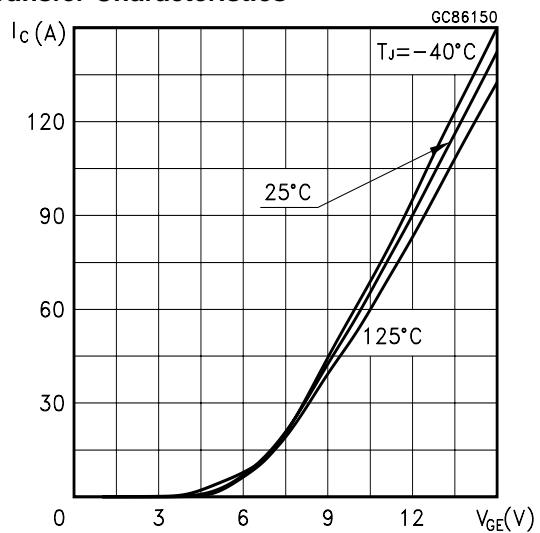
**Thermal Impedance**

# STGP12NB60H

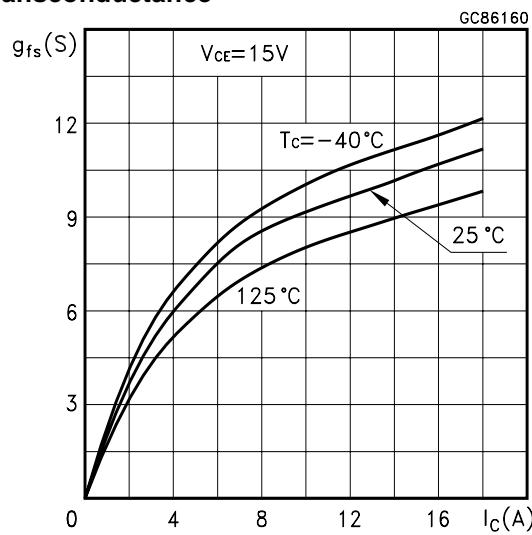
## Output Characteristics



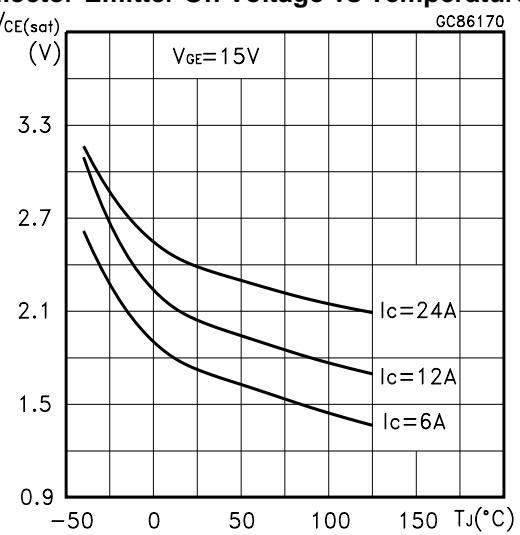
## Transfer Characteristics



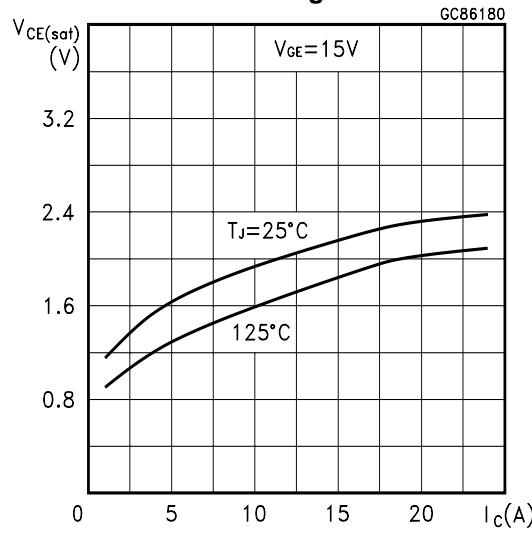
## Transconductance



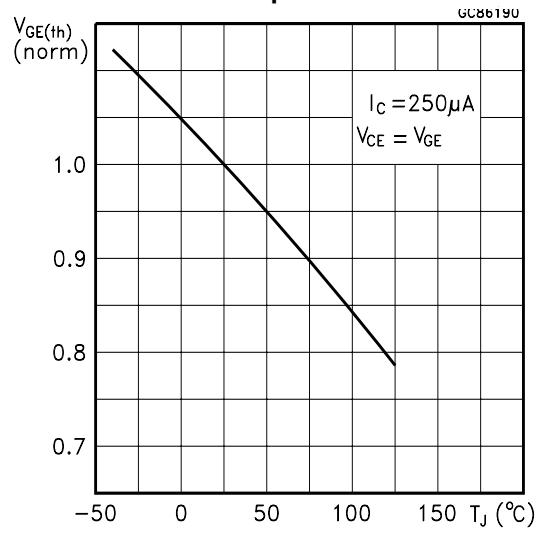
## Collector-Emitter On Voltage vs Temperature



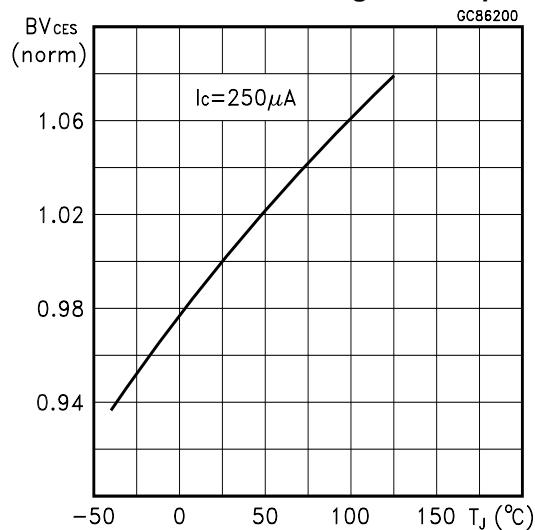
## Collector-Emitter On Voltage vs Collector Current



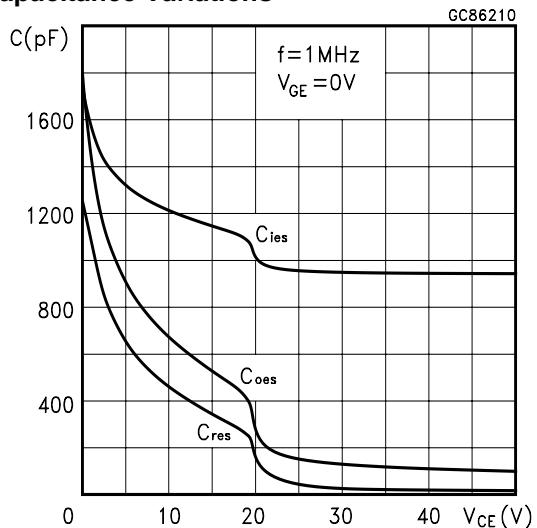
## Gate Threshold vs Temperature



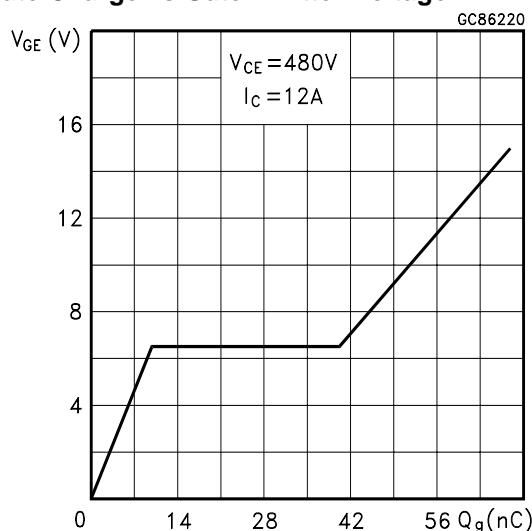
**Normalized Breakdown Voltage vs Temperature**



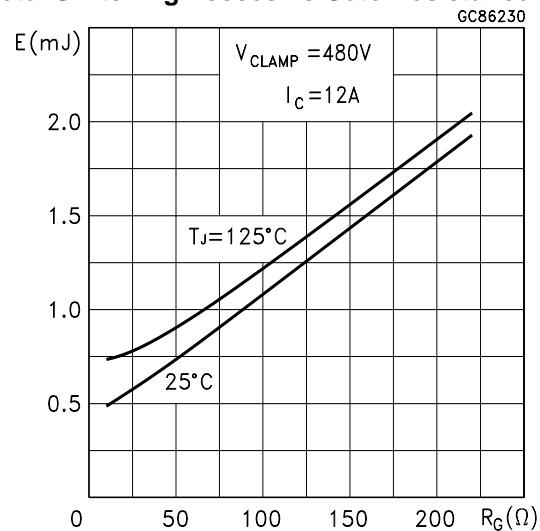
**Capacitance Variations**



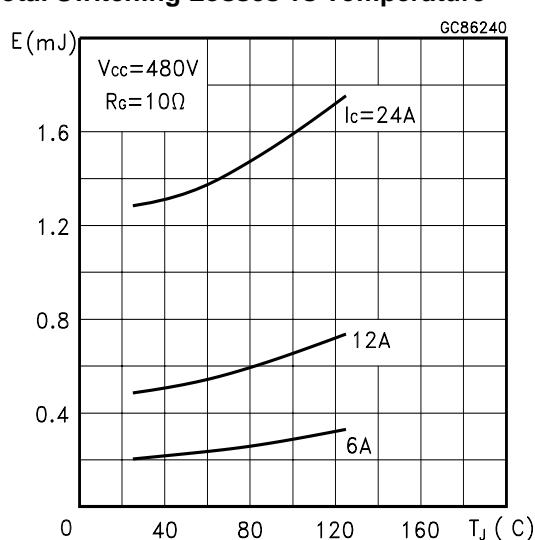
**Gate Charge vs Gate-Emitter Voltage**



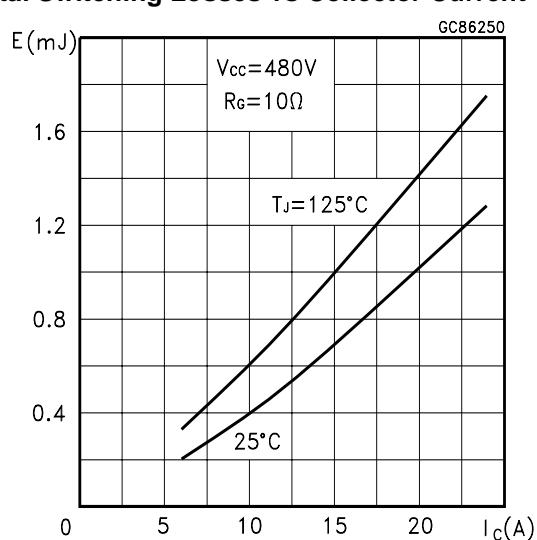
**Total Switching Losses vs Gate Resistance**



**Total Switching Losses vs Temperature**



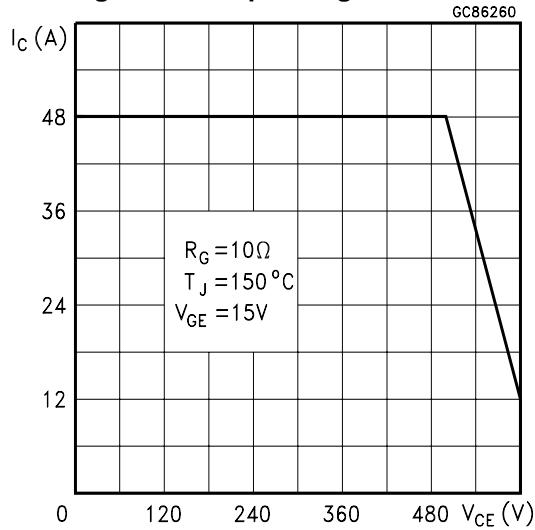
**Total Switching Losses vs Collector Current**



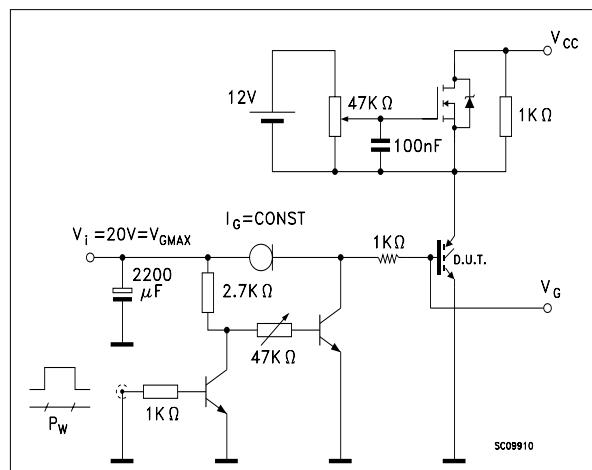
## STGP12NB60H

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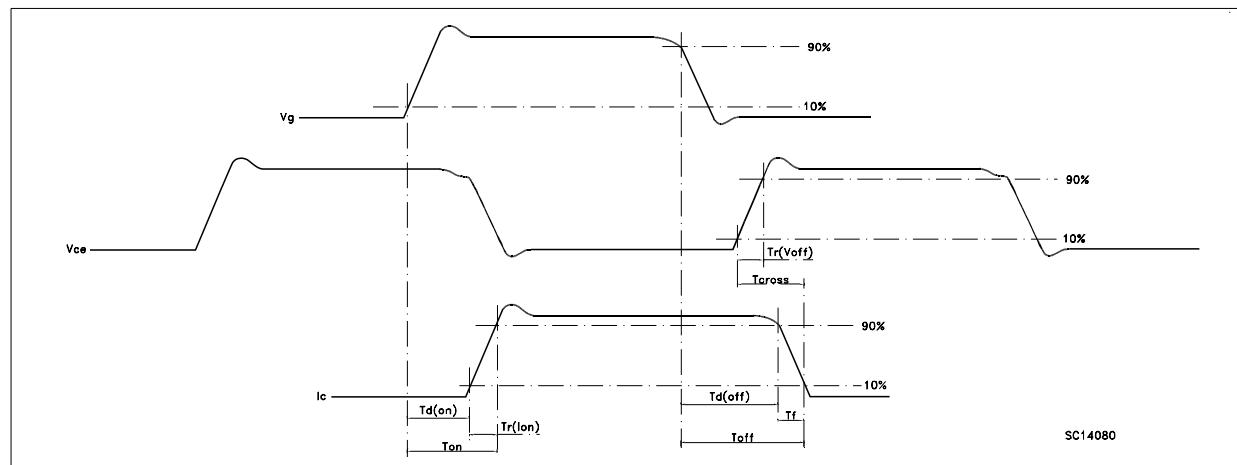
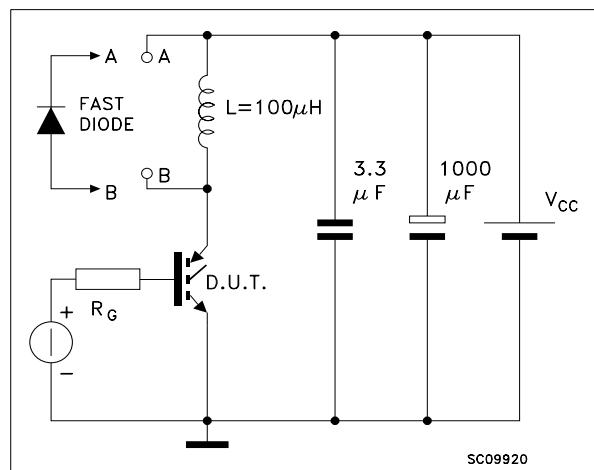
### Switching Off Safe Operating Area



**Fig. 1: Gate Charge test Circuit**

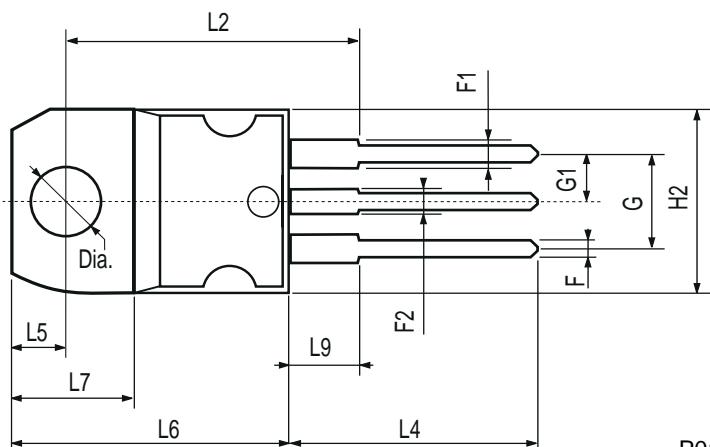
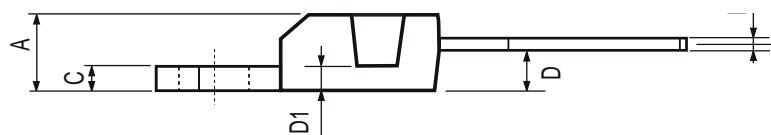


**Fig. 2: Test Circuit For Inductive Load Switching**



**TO-220 MECHANICAL DATA**

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
C	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
D1		1.27			0.050	
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
G1	2.4		2.7	0.094		0.106
H2	10.0		10.40	0.393		0.409
L2		16.4			0.645	
L4	13.0		14.0	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.25		15.75	0.600		0.620
L7	6.2		6.6	0.244		0.260
L9	3.5		3.93	0.137		0.154
DIA.	3.75		3.85	0.147		0.151



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