



# STGP12NB60H

N-CHANNEL 12A - 600V – TO-220

PowerMESH™ IGBT

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

- HIGH INPUT IMPEDANCE
- LOW ON-VOLTAGE DROP (V<sub>cesat</sub>)
- OFF LOSSES INCLUDE TAIL CURRENT
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- VERY HIGH FREQUENCY OPERATION
- CO-PACKAGED WITH TURBOSWITCHT
- TYPICAL SHORT CIRCUIT WITHSTAND TIME  
5MICROS S-family, 4 micro H family
- ANTIPARALLEL DIODE

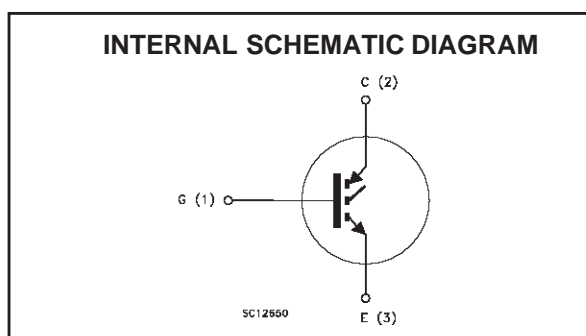
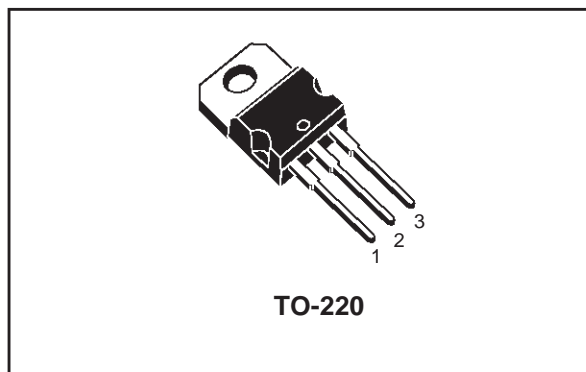
## DESCRIPTION

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 tfall) maintaining a low voltage drop.

## APPLICATIONS

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



## ABSOLUTE MAXIMUM RATINGS

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

## STGP12NB60H

### 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
$V_{BR(CEs)}$	Collectro-Emitter Breakdown Voltage	$I_C = 250 \mu A, V_{GE} = 0$	600			V
$I_{CES}$	Collector cut-off ( $V_{GE} = 0$ )	$V_{CE} = \text{Max Rating}, T_C = 25 \text{ }^\circ\text{C}$ $V_{CE} = \text{Max Rating}, T_C = 125 \text{ }^\circ\text{C}$			10 100	$\mu A$ $\mu A$
$I_{GES}$	Gate-Emitter Leakage Current ( $V_{CE} = 0$ )	$V_{GE} = \pm 20V, V_{CE} = 0$			$\pm 100$	nA

ON (1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate Threshold Voltage	$V_{CE} = V_{GE}, I_C = 250\mu A$	3		5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE} = 15V, I_C = 12 A$ $V_{GE} = 15V, I_C = 12 A, T_J = 125^\circ C$		2.0 1.7	2.8	V V

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs}$	Forward Transconductance	$V_{CE} = 25 V, I_C = 12 A$		9.5		S
$C_{ies}$	Input Capacitance	$V_{CE} = 25V, f = 1 \text{ MHz}, V_{GE} = 0$		950		pF
$C_{oes}$	Output Capacitance			120		pF
$C_{res}$	Reverse Transfer Capacitance			27		pF
$Q_g$	Total Gate Charge	$V_{CE} = 480V, I_C = 12 A,$ $V_{GE} = 15V$		68		nC
$Q_{ge}$	Gate-Emitter Charge			10		nC
$Q_{gc}$	Gate-Collector Charge			30		nC
$I_{CL}$	Latching Current	$V_{clamp} = 480 V, T_J = 150^\circ C$ $R_G = 10 \Omega$	48			A

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Delay Time	$V_{CC} = 480 V, I_C = 12 A$ $R_G = 10\Omega, V_{GE} = 15 V$		5		ns
$t_r$	Rise Time			46		ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{CC} = 480 V, I_C = 12 A$ $R_G = 10\Omega, V_{GE} = 15 V,$ $T_J = 125^\circ C$		1000		A/ $\mu s$
$E_{on}$	Turn-on Switching Losses			290		$\mu J$

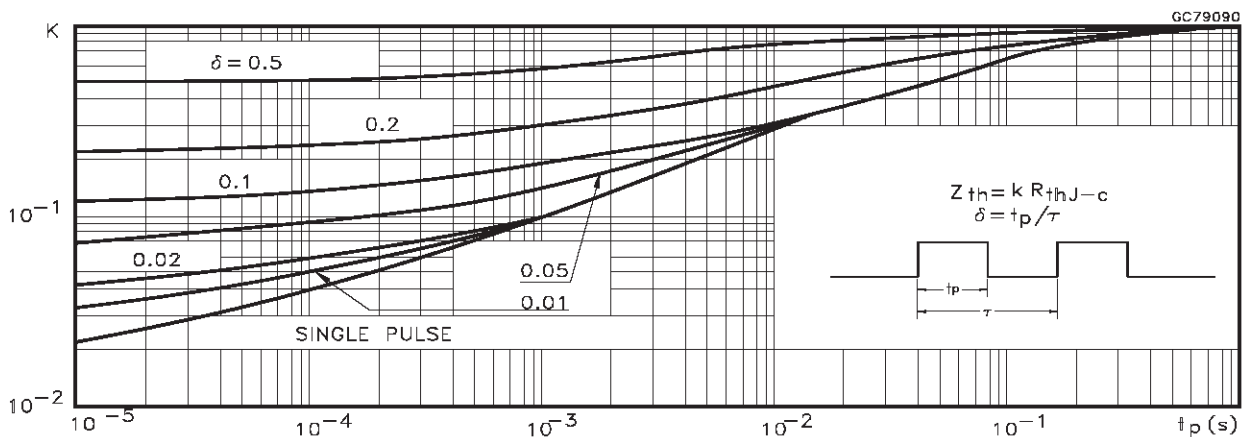
**ELECTRICAL CHARACTERISTICS (CONTINUED)**

**SWITCHING OFF**

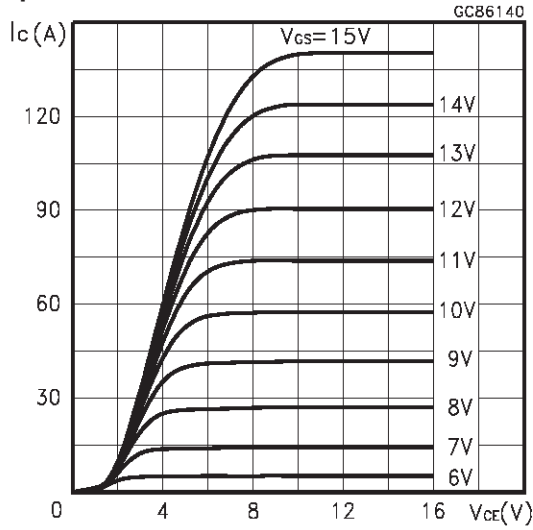
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-over Time	$V_{CC} = 480\text{ V}, I_C = 12\text{ A},$ $R_{GE} = 10\ \Omega, V_{GE} = 15\text{ V}$		150		ns
$t_r(V_{off})$	Off Voltage Rise Time			27		ns
$t_{d(off)}$	Delay Time			76		ns
$t_f$	Fall Time			92		ns
$E_{off(**)}$	Turn-off Switching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

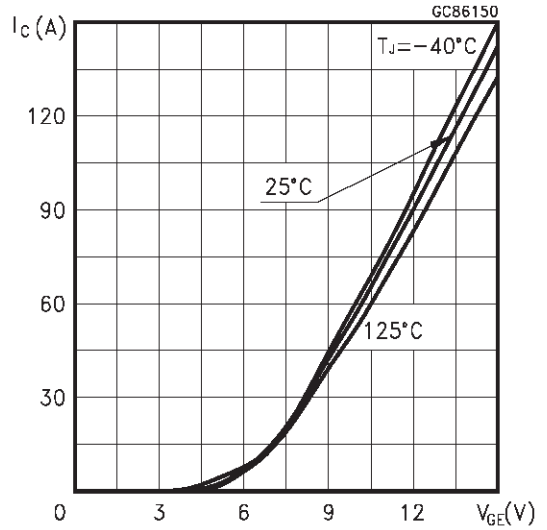
**Thermal Impedance**



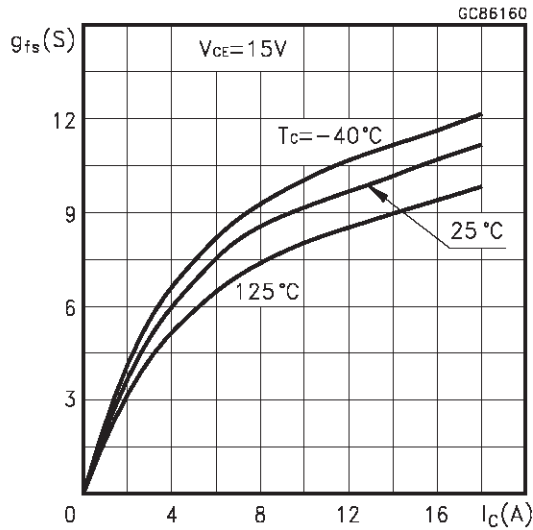
Output Characteristics



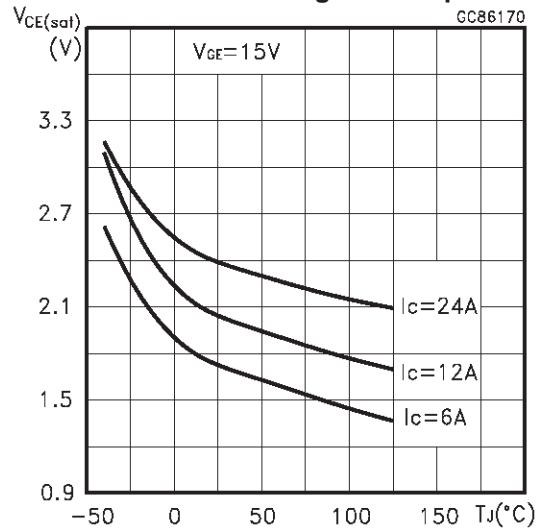
Transfer Characteristics



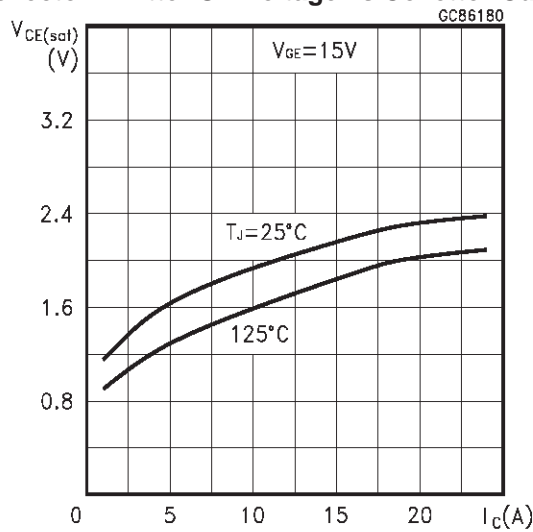
Transconductance



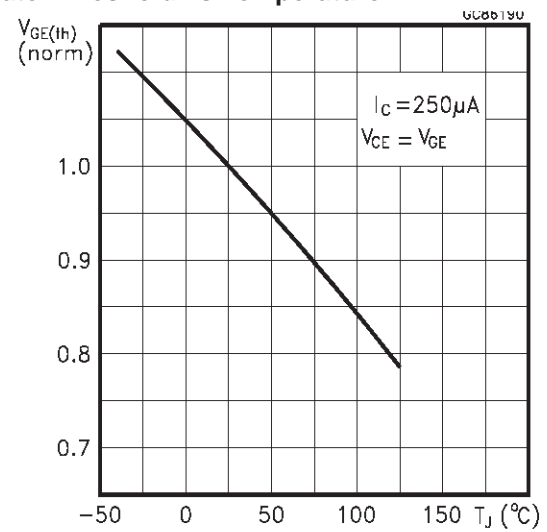
Collector-Emitter On Voltage vs Temperature



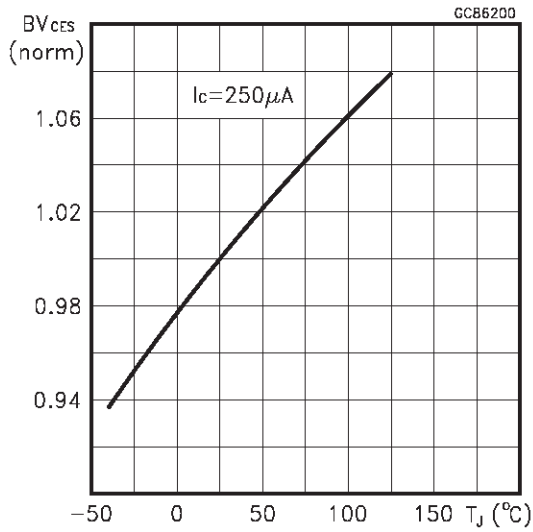
Collector-Emitter On Voltage vs Collector Current



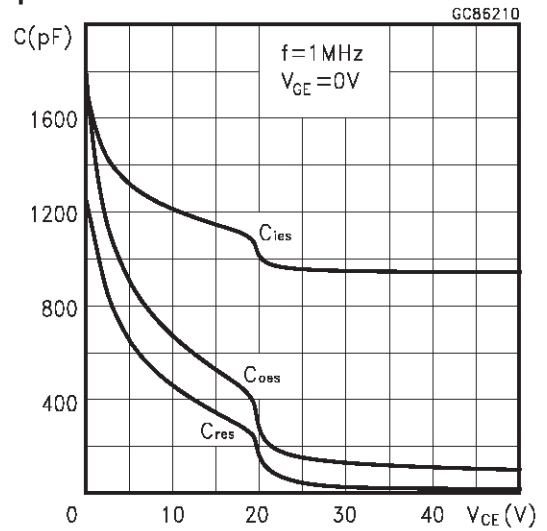
Gate Threshold vs Temperature



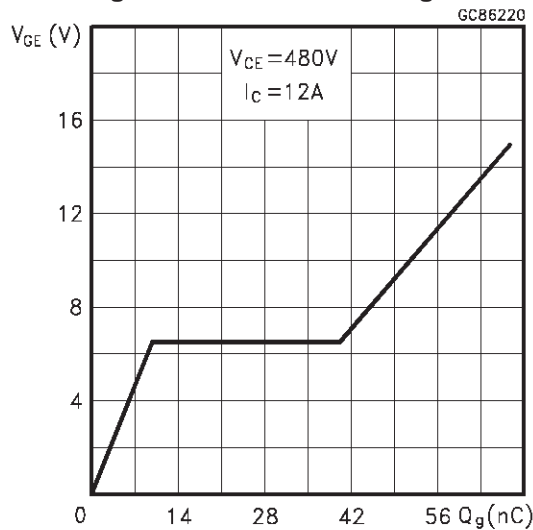
Normalized Breakdown Voltage vs Temperature



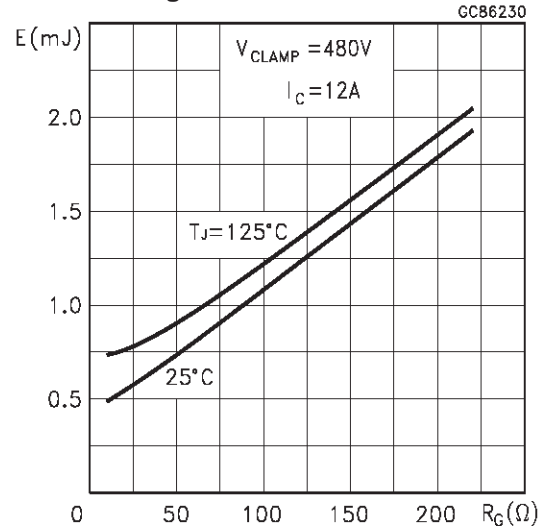
Capacitance Variations



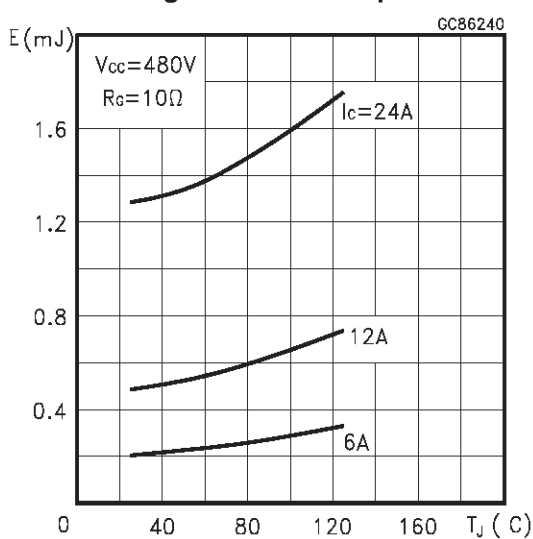
Gate Charge vs Gate-Emitter Voltage



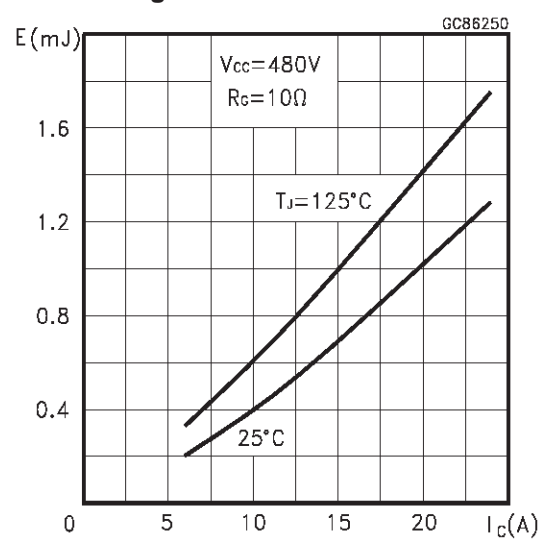
Total Switching Losses vs Gate Resistance



Total Switching Losses vs Temperature



Total Switching Losses vs Collector Current



Switching Off Safe Operating Area

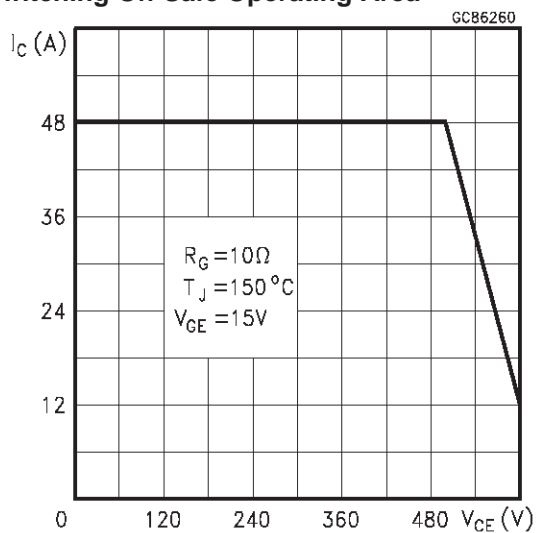


Fig. 1: Gate Charge test Circuit

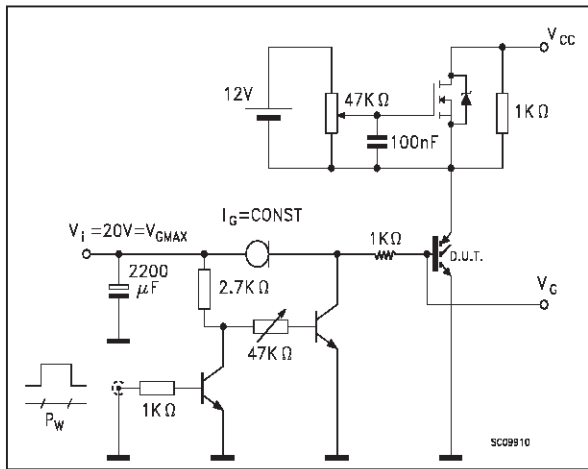
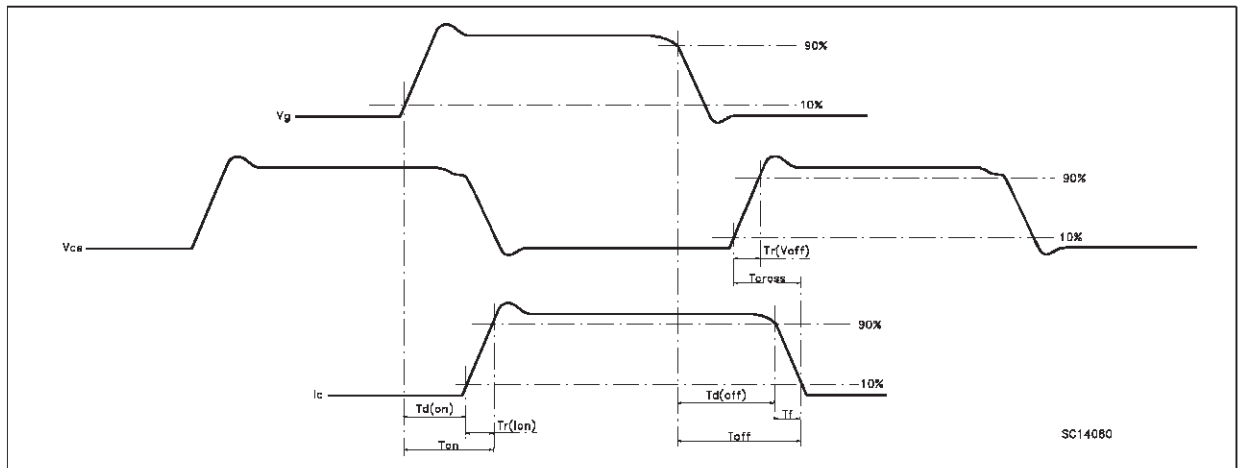
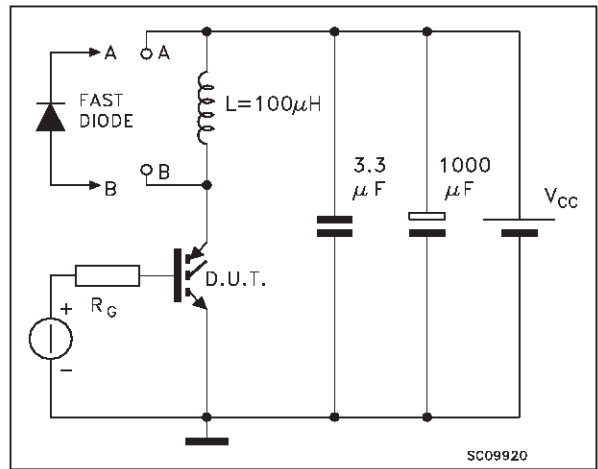
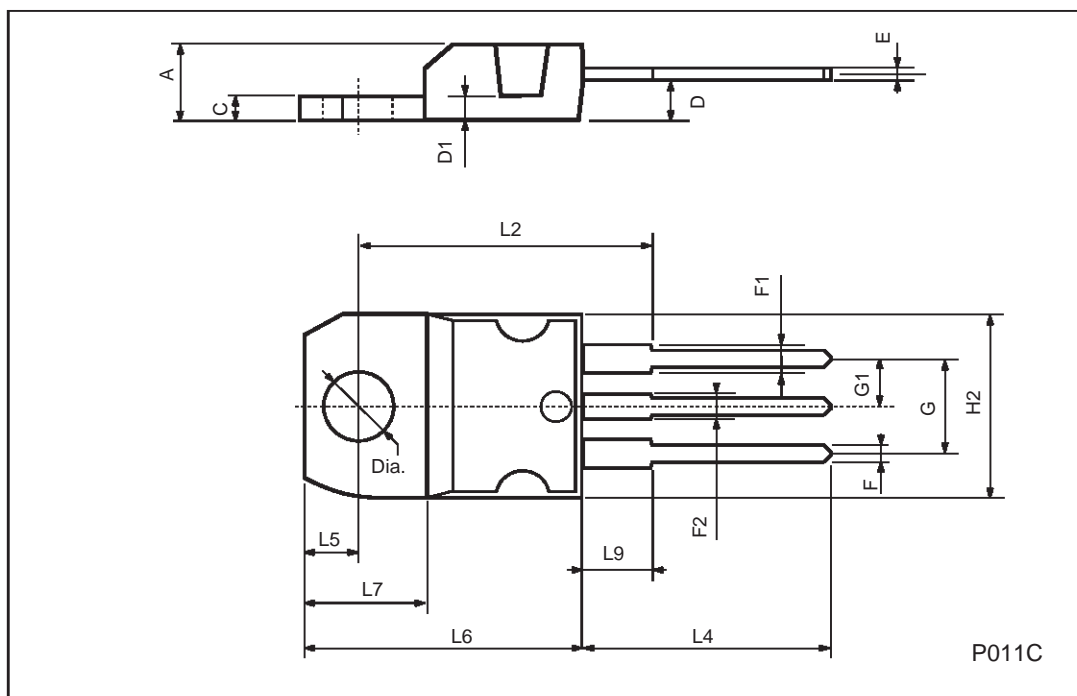


Fig. 2: Test Circuit For Inductive Load Switching



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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