



# STGP3NB60S STGD3NB60S

N-CHANNEL 3A - 600V - TO-220 / DPAK

PowerMESH™ IGBT

TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub>	I <sub>C</sub>
STGP3NB60S	600 V	< 1.5 V	3 A
STGD3NB60S	600 V	< 1.5 V	3 A

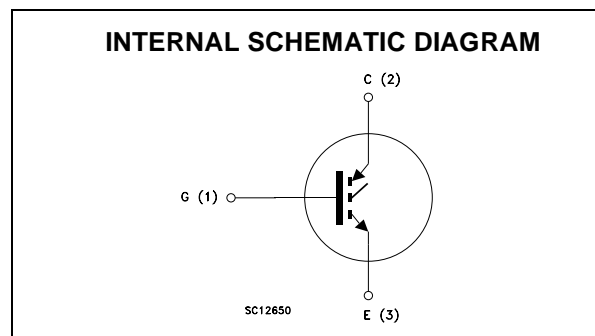
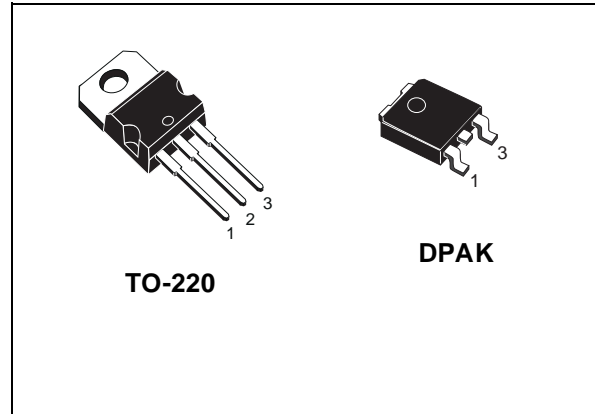
- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- VERY LOW ON-VOLTAGE DROP (V<sub>cesat</sub>)
- OFF LOSSES INCLUDE TAIL CURRENT
- ADD SUFFIX "T4" FOR ORDERING IN TAPE & REEL (SMD VERSION)

## 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 "S" identifies a family optimized achieve minimum on-voltage drop for low frequency applications (<1kHz).

## APPLICATIONS

- MOTOR CONTROL
- LIGHT DIMMER
- STATIC RELAYS



## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STGP3NB60S	STGD3NB60S	
V <sub>CES</sub>	Collector-Emitter Voltage (V <sub>GS</sub> = 0)	600		V
V <sub>ECR</sub>	Reverse Battery Protection	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	6		A
I <sub>C</sub>	Collector Current (continuous) at T <sub>C</sub> = 100°C	3		A
I <sub>CM</sub> (■)	Collector Current (pulsed)	24		A
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	65	45	W
	Derating Factor	0.32		W/°C
T <sub>stg</sub>	Storage Temperature	-65 to 150		°C
T <sub>j</sub>	Max. Operating Junction Temperature	150		°C

(●) Pulse width limited by safe operating area

## STGP3NB60S - STGD3NB60S

### THERMAL DATA

		TO-220	DPAK	
Rthj-case	Thermal Resistance Junction-case Max	1.92	2.75	°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5	100	°C/W
Rthc-h	Thermal Resistance Case-heatsink 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	2.5		5	V
V <sub>CE(sat)</sub>	Collector-Emitter Saturation Voltage	V <sub>GE</sub> = 15V, I <sub>C</sub> = 3 A V <sub>GE</sub> = 15V, I <sub>C</sub> = 1 A		1.2 1	1.5	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> = 3 A	1.7	2.5		S
C <sub>ies</sub>	Input Capacitance	V <sub>CE</sub> = 25V, f = 1 MHz, V <sub>GE</sub> = 0		255		pF
C <sub>oes</sub>	Output Capacitance			30		pF
C <sub>res</sub>	Reverse Transfer Capacitance			5.6		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> = 480 V, I <sub>C</sub> = 3 A, V <sub>GE</sub> = 15V		18 5.4 5.5		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> = 1KΩ	12			A

### SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>CC</sub> = 480 V, I <sub>C</sub> = 3 A R <sub>G</sub> = 1KΩ, V <sub>GE</sub> = 15 V		170		ns
t <sub>r</sub>	Rise Time			540		ns
(di/dt) <sub>on</sub> E <sub>on</sub>	Turn-on Current Slope Turn-on Switching Losses	V <sub>CC</sub> = 480 V, I <sub>C</sub> = 3 A, R <sub>G</sub> = 1KΩ V <sub>GE</sub> = 15 V, T <sub>j</sub> = 125°C		300		A/μs μJ

**ELECTRICAL CHARACTERISTICS (CONTINUED)**

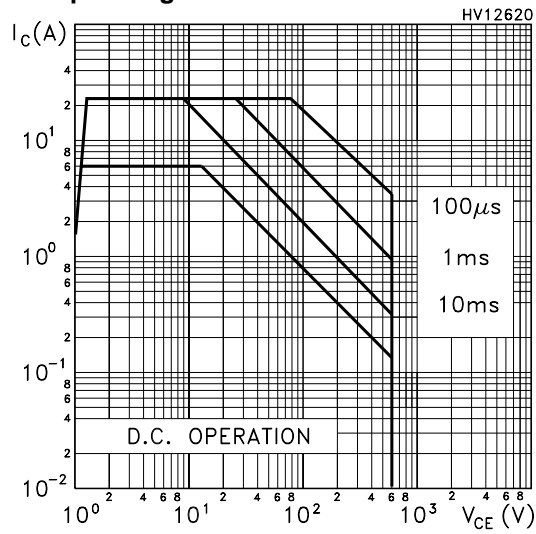
**SWITCHING OFF**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-over Time	$V_{cc} = 480\text{ V}$ , $I_C = 3\text{ A}$ , $R_{GE} = 1\text{ K}\Omega$ , $V_{GE} = 15\text{ V}$		1.8		$\mu\text{s}$
$t_r(V_{off})$	Off Voltage Rise Time			1.0		$\mu\text{s}$
$t_d(O_{ff})$	Delay Time			3.4		$\mu\text{s}$
$t_f$	Fall Time			0.72		$\mu\text{s}$
$E_{off(**)}$	Turn-off Switching Loss			1.15		mJ
$t_c$	Cross-over Time	$V_{cc} = 480\text{ V}$ , $I_C = 3\text{ A}$ , $R_{GE} = 1\text{ K}\Omega$ , $V_{GE} = 15\text{ V}$ , $T_j = 150^\circ\text{C}$		2.8		$\mu\text{s}$
$t_r(V_{off})$	Off Voltage Rise Time			1.45		$\mu\text{s}$
$t_d(O_{ff})$	Delay Time			3.6		$\mu\text{s}$
$t_f$	Fall Time			1.2		$\mu\text{s}$
$E_{off(**)}$	Turn-off Switching Loss			1.8		mJ

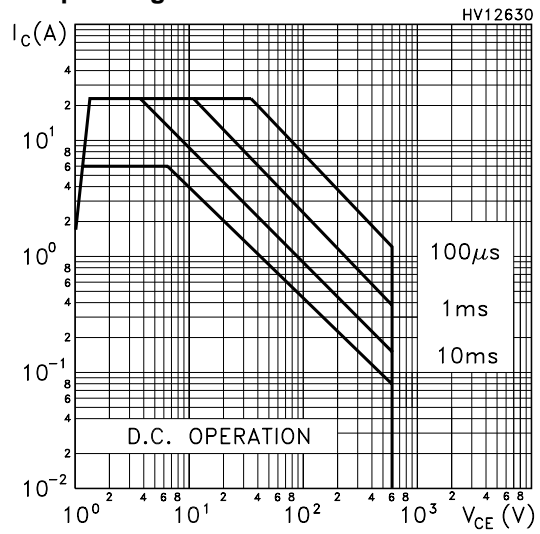
Note: 1. Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.  
 2. Pulse width limited by max. junction temperature.  
 (\*\*)Losses include Also the Tail (Jedec Standardization)

# STGP3NB60S - STGD3NB60S

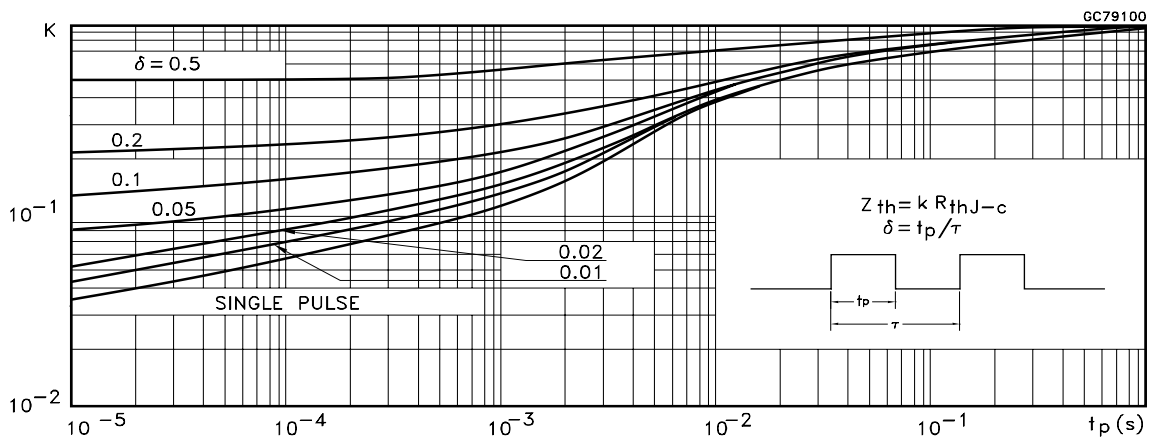
### Safe Operating Area for TO-220



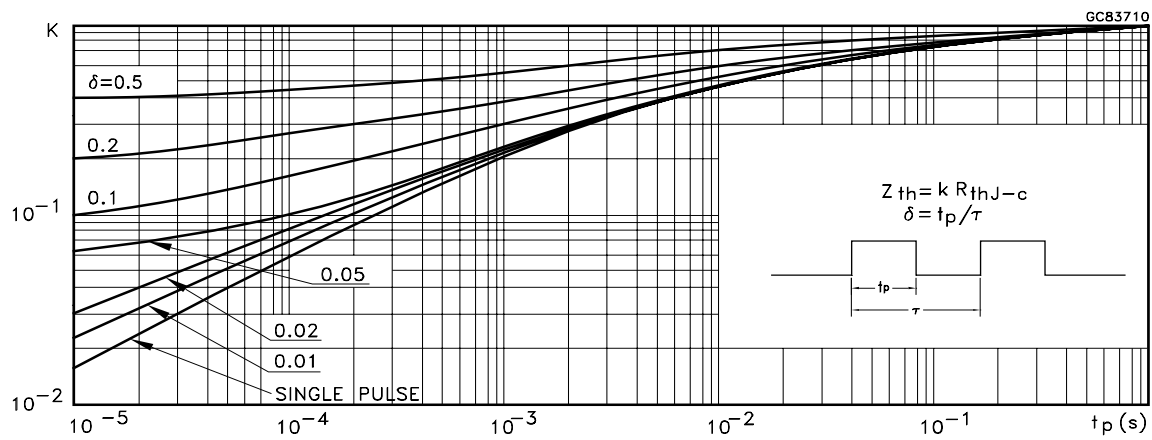
### Safe Operating Area for DPAK



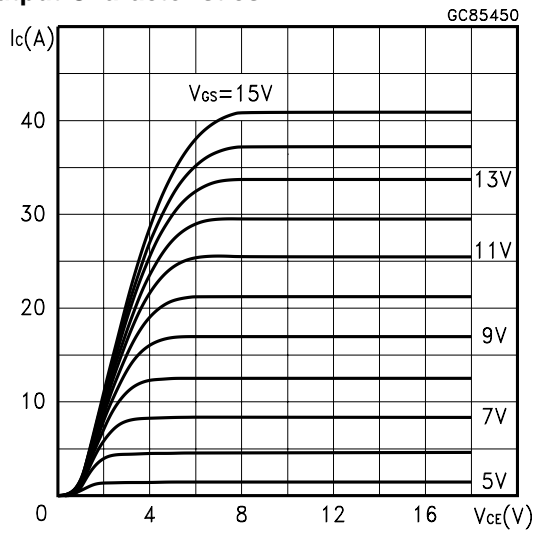
### Thermal Impedance for TO-220



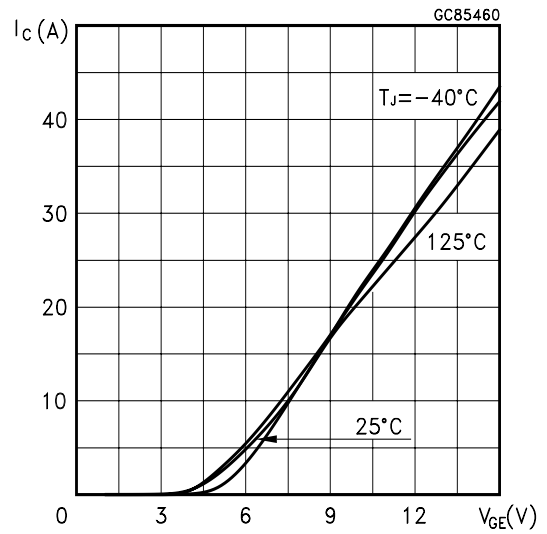
### Thermal Impedance for DPAK



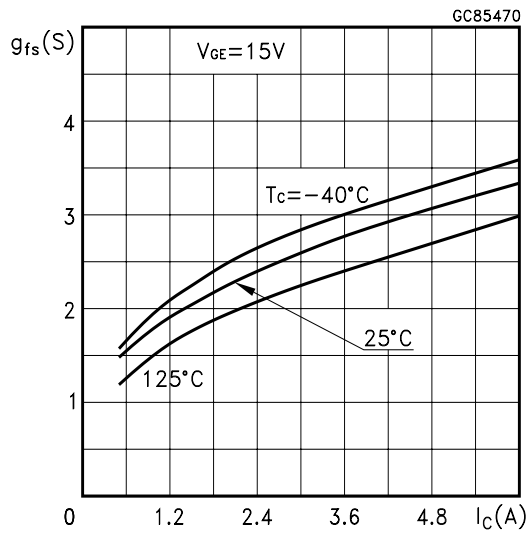
**Output Characteristics**



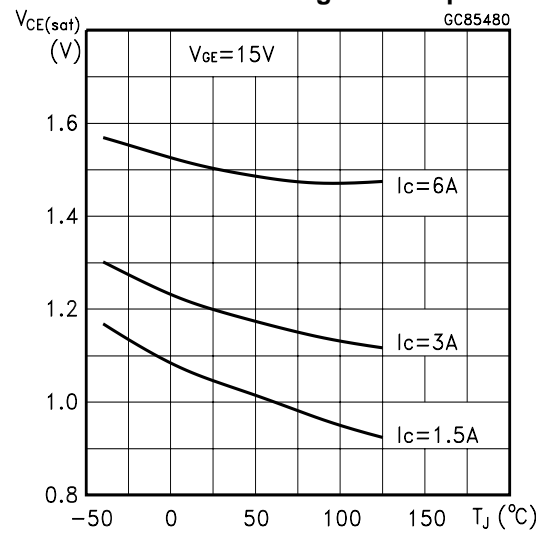
**Transfer Characteristics**



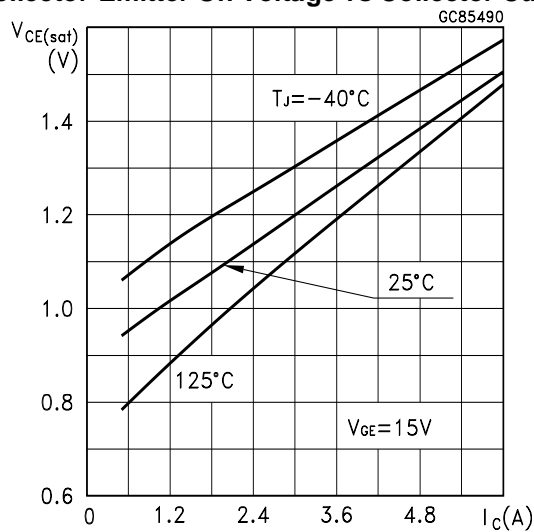
**Transconductance**



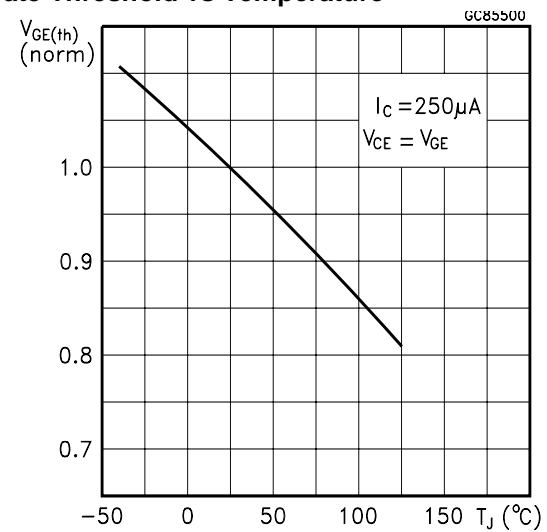
**Collector-Emitter On Voltage vs Temperature**



**Collector-Emitter On Voltage vs Collector Current**

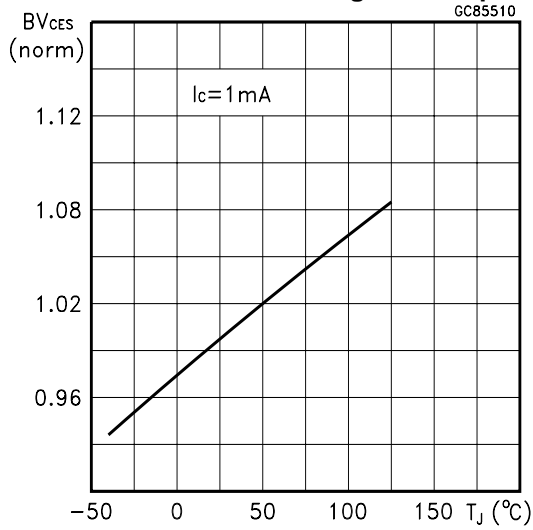


**Gate Threshold vs Temperature**

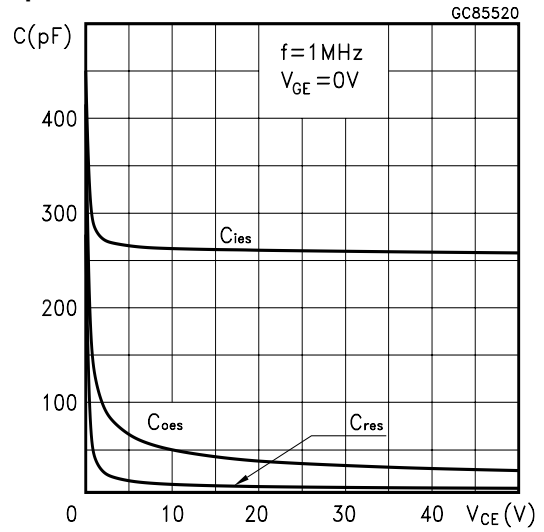


# STGP3NB60S - STGD3NB60S

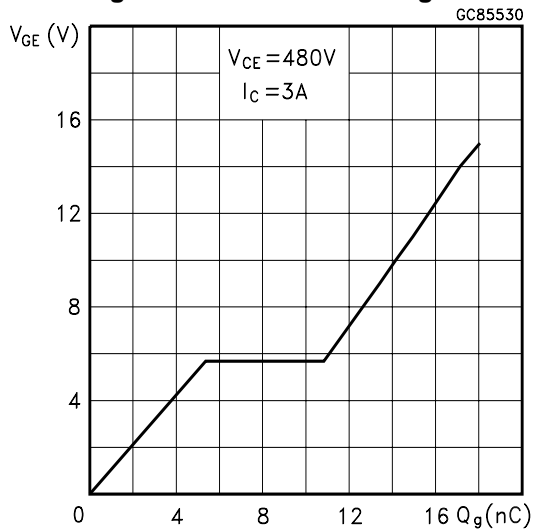
**Normalized Breakdown Voltage vs Temperature**



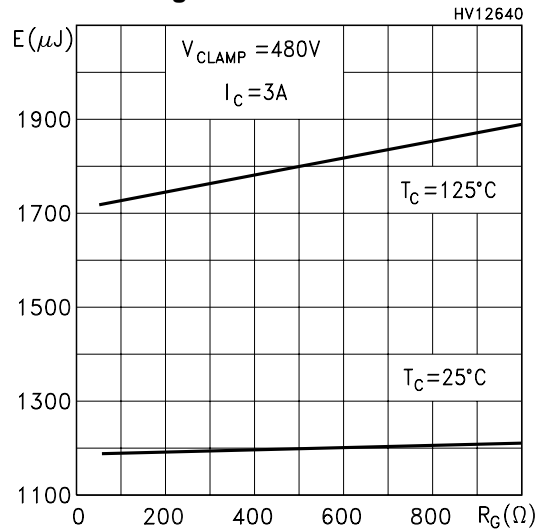
**Capacitance Variations**



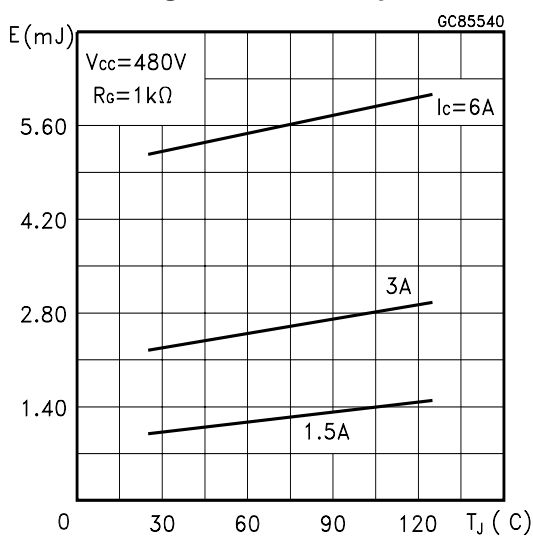
**Gate Charge vs Gate-Emitter Voltage**



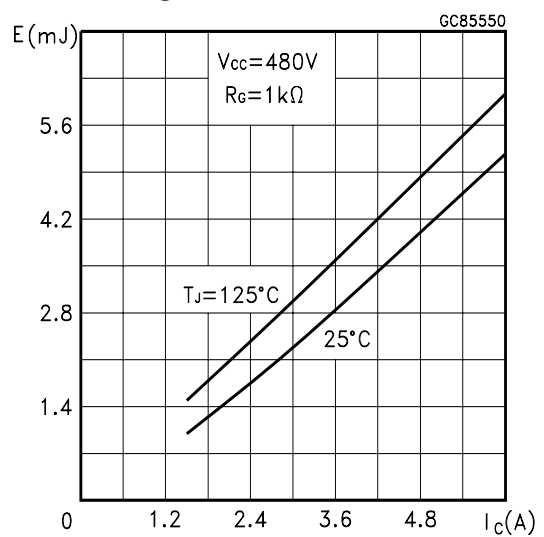
**Total Switching Losses vs Gate Resistance**



**Total Switching Losses vs Temperature**



**Total Switching Losses vs Collector Current**



Switching Off Safe Operating Area

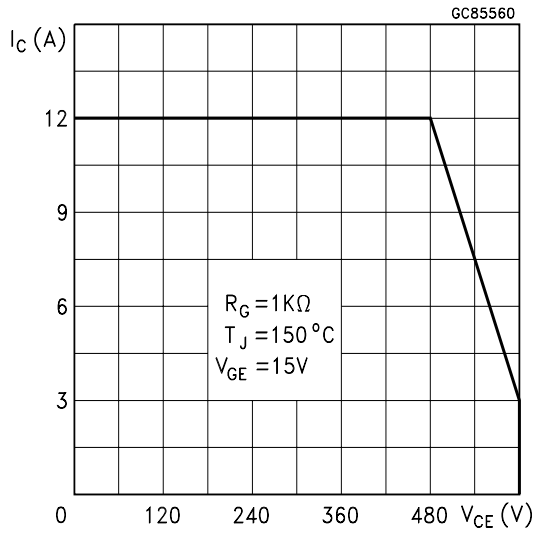


Fig. 1: Gate Charge test Circuit

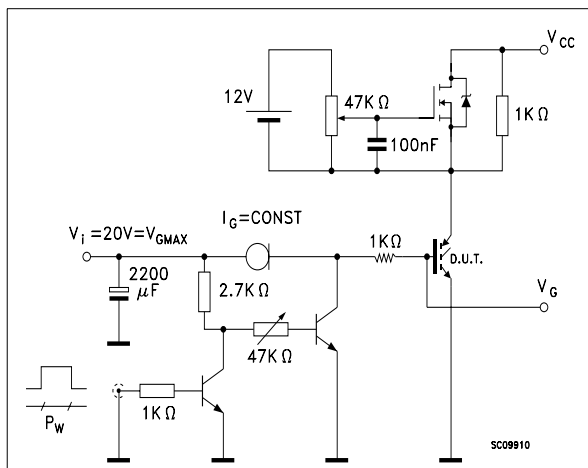
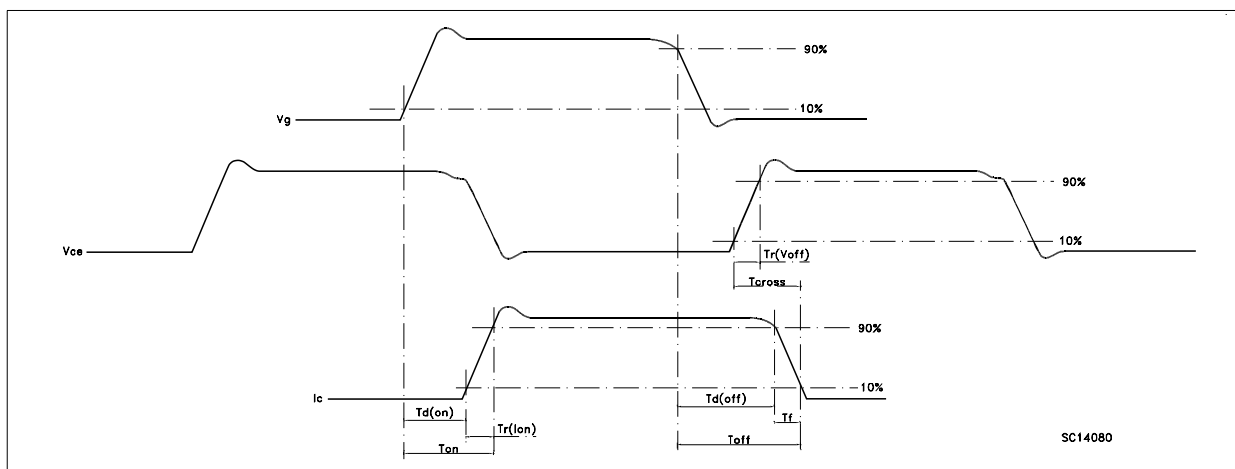
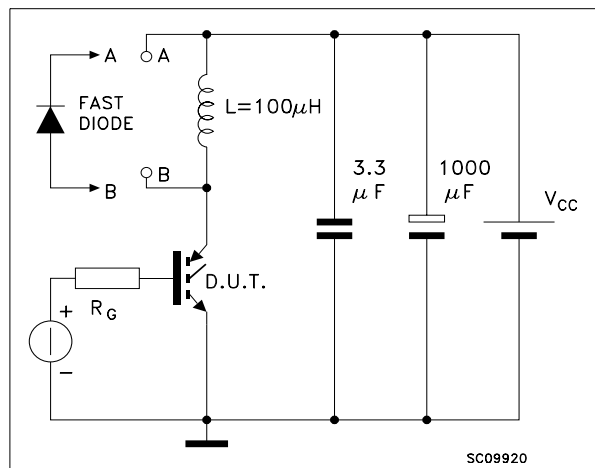
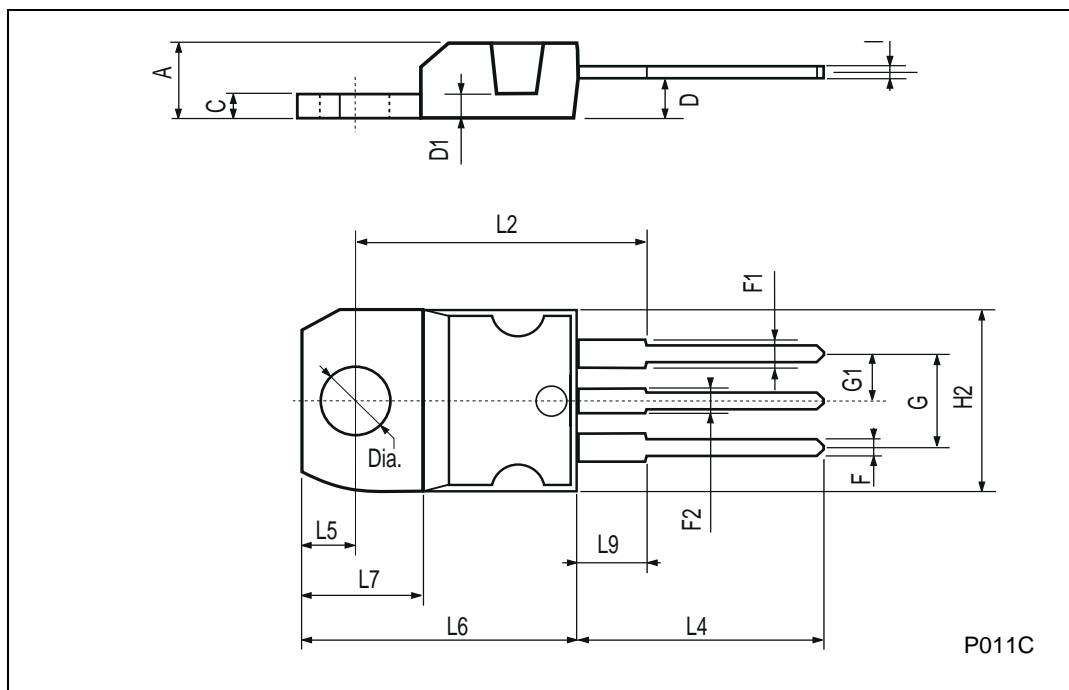


Fig. 2: Test Circuit For Inductive Load Switching



TO-220 MECHANICAL DATA

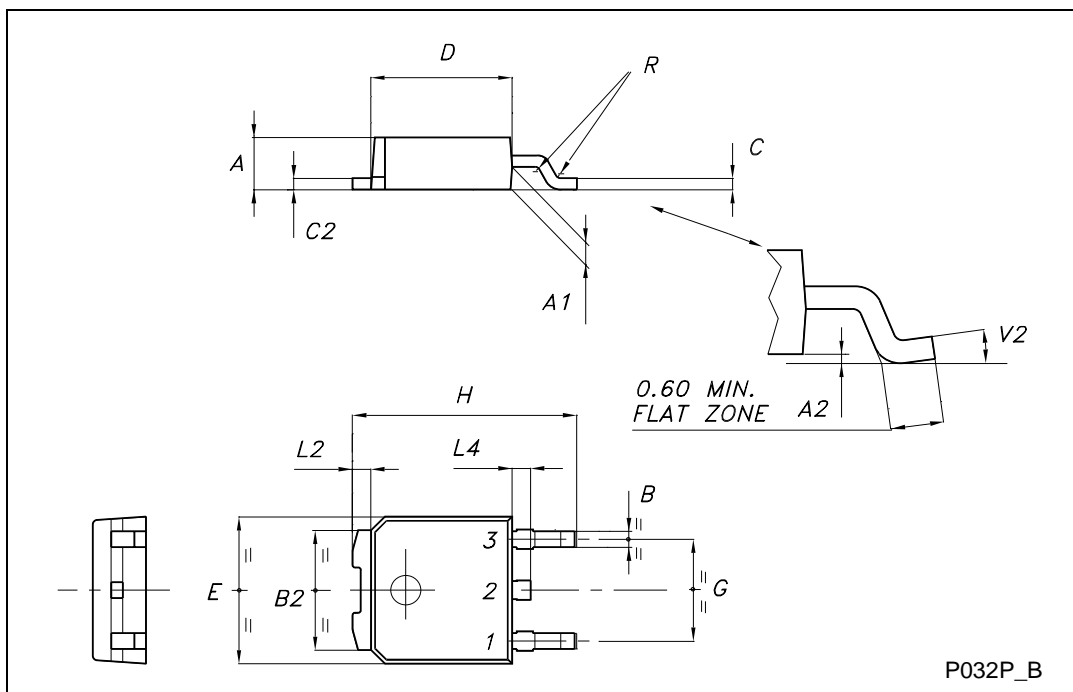
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
C	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
D1		1.27			0.050	
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
G1	2.4		2.7	0.094		0.106
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





TO-252 (DPAK) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.20		2.40	0.087		0.094
A1	0.90		1.10	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.90	0.025		0.035
B2	5.20		5.40	0.204		0.213
C	0.45		0.60	0.018		0.024
C2	0.48		0.60	0.019		0.024
D	6.00		6.20	0.236		0.244
E	6.40		6.60	0.252		0.260
G	4.40		4.60	0.173		0.181
H	9.35		10.10	0.368		0.398
L2		0.8			0.031	
L4	0.60		1.00	0.024		0.039
V2	0°		8°	0°		0°



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