



# THE DATASHEET OF STGB3NB60SDT4





# STGB3NB60SD

N-CHANNEL 3A - 600V D<sup>2</sup>PAK

Power MESH™ IGBT

TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub>	I <sub>c</sub>
STGB3NB60SD	600 V	<1.5 V	3 A

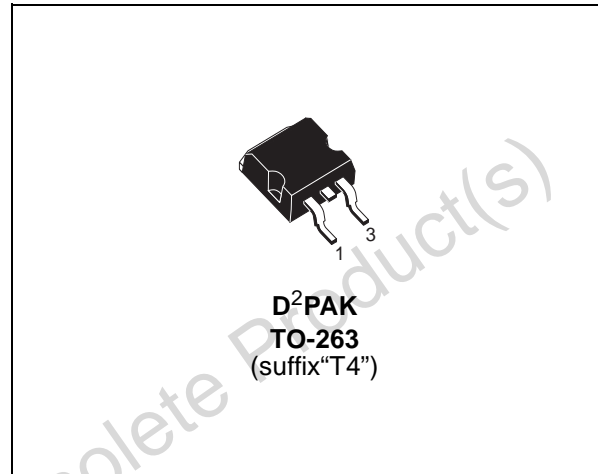
- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- VERY LOW ON-VOLTAGE DROP (V<sub>cesat</sub>)
- HIGH CURRENT CAPABILITY
- OFF LOSSES INCLUDE TAIL CURRENT
- INTEGRATED FREEWHEELING DIODE
- SURFACE-MOUNTING D<sup>2</sup>PAK (TO-263) POWER PACKAGE IN TAPE & REEL (SUFFIX "T4")

## DESCRIPTION

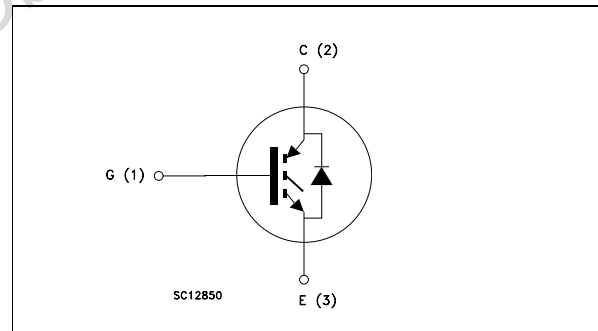
Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The suffix "S" identifies a family optimized to achieve minimum on-voltage drop for low frequency applications (<1kHz).

## APPLICATIONS

- GAS DISCHARGE LAMP
- STATIC RELAYS
- MOTOR CONTROL



## INTERNAL SCHEMATIC DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>CES</sub>	Collector-Emitter Voltage (V <sub>GS</sub> = 0)	600	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)	25	A
P <sub>tot</sub>	Total Dissipation at T <sub>c</sub> = 25°C	70	W
	Derating Factor	0.46	W/°C
T <sub>stg</sub>	Storage Temperature	-60 to 175	°C
T <sub>j</sub>	Max. Operating Junction Temperature	175	°C

(●)Pulse width limited by safe operating area.

## STGB3NB60SD

### THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	2.14	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5	°C/W
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.5	°C/W

### ELECTRICAL CHARACTERISTICS ( $T_{case} = 25\text{ °C}$ unless otherwise specified)

#### OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{BR(CEs)}$	Collector-Emitter Breakdown Voltage	$I_D = 250\ \mu A$ $V_{GE} = 0$	600			V
$I_{CES}$	Collector cut-off ( $V_{GE} = 0$ )	$V_{CE} = \text{Max Rating}$ $T_j = 25\text{ °C}$ $V_{CE} = \text{Max Rating}$ $T_j = 125\text{ °C}$			10 100	$\mu A$ $\mu A$
$I_{GSS}$	Gate-body Leakage Current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20V$ $V_{CE} = 0$			$\pm 100$	nA

#### ON (\*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate Threshold Voltage	$V_{CE} = V_{GE}$ $I_C = 250\ \mu A$	2.5		5	V
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	$V_{GE} = 15\text{ V}$ $I_C = 1.5\text{ A}$ $V_{GE} = 15\text{ V}$ $I_C = 3\text{ A}$ $V_{GE} = 15\text{ V}$ $I_D = 3\text{ A}$ $T_j = 125\text{ °C}$		1 1.2 1.1	1.5	V V V

#### DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs}$	Forward Transconductance	$V_{CE} = 25\text{ V}$ $I_C = 3\text{ A}$	1.7	2.5		S
$C_{ies}$	Input Capacitance	$V_{CE} = 25V$ $f = 1\text{ MHz}$ $V_{GE} = 0$		255	330	pF
$C_{oes}$	Output Capacitance			30	40	pF
$C_{res}$	Reverse Transfer Capacitances			5.6	7	pF
$Q_G$	Total Gate Charge	$V_{CE} = 480V$ $I_C = 3\text{ A}$ $V_{GE} = 15\text{ V}$		18		nC
$Q_{GE}$	Gate-Emitter Charge			5.4		nC
$Q_{GC}$	Gate-Collector Charge			5.5		nC
$I_{CL}$	Latching Current	$V_{clamp} = 480\text{ V}$ $R_G = 1\text{ k}\Omega$ $T_j = 150\text{ °C}$	12			A

#### SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Delay Time Rise Time	$V_{CC} = 480\text{ V}$ $I_C = 3\text{ A}$ $V_{GE} = 15\text{ V}$ $R_G = 1\text{ k}\Omega$		125 150		ns ns
$(di/dt)_{on}$ $E_{on}$	Turn-on Current Slope Turn-on Switching Losses	$V_{CC} = 480\text{ V}$ $I_C = 3\text{ A}$ $V_{GE} = 15\text{ V}$ $R_G = 1\text{ k}\Omega$ $T_j = 125\text{ °C}$		50 1100		A/ $\mu s$ $\mu J$

**ELECTRICAL CHARACTERISTICS** (continued)

**SWITCHING OFF**

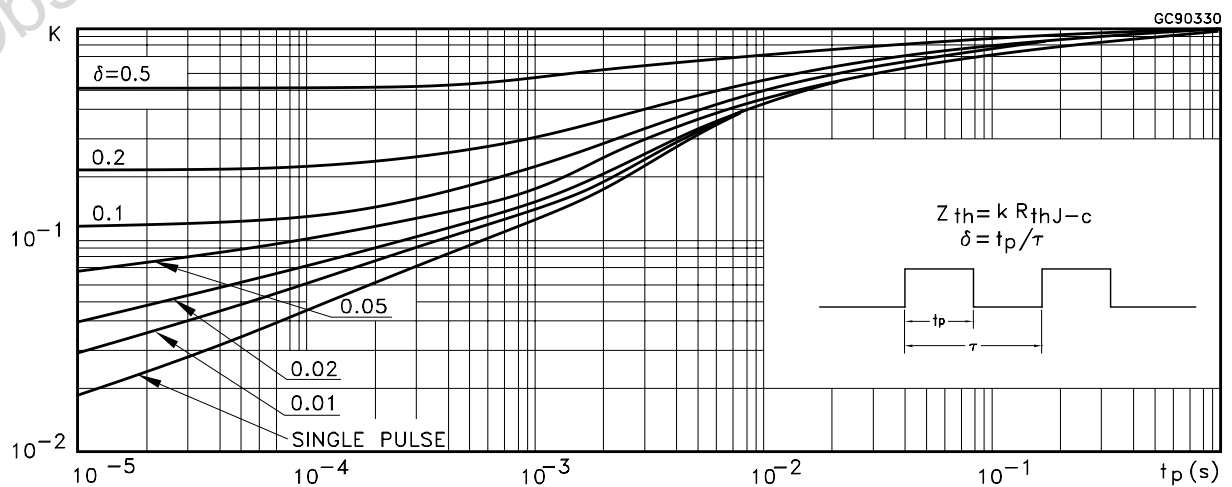
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-Over Time	$V_{CC} = 480\text{ V}$ $I_C = 3\text{ A}$		1.8		$\mu\text{s}$
$t_r(V_{off})$	Off Voltage Rise Time	$R_{GE} = 1\text{ k}\Omega$ $V_{GE} = 15\text{ V}$		1.0		$\mu\text{s}$
$t_d(V_{off})$	Delay Time			3.4		$\mu\text{s}$
$t_f$	Fall Time			0.72		$\mu\text{s}$
$E_{off(**)}$	Turn-off Switching Loss			1.15		mJ
$t_c$	Cross-Over Time	$V_{CC} = 480\text{ V}$ $I_C = 3\text{ A}$		2.8		$\mu\text{s}$
$t_r(V_{off})$	Off Voltage Rise Time	$R_{GE} = 1\text{ k}\Omega$ $V_{GE} = 15\text{ V}$		1.45		$\mu\text{s}$
$t_d(V_{off})$	Delay Time	$T_j = 125\text{ }^\circ\text{C}$		3.6		$\mu\text{s}$
$t_f$	Fall Time			1.2		$\mu\text{s}$
$E_{off(**)}$	Turn-off Switching Loss			1.8		mJ

**COLLECTOR-EMITTER DIODE**

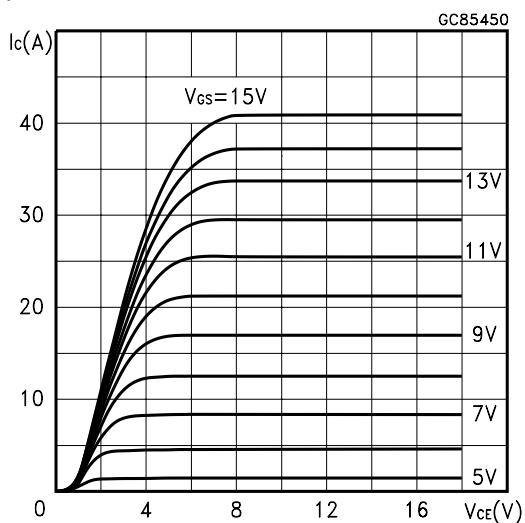
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_f$	Forward Current				3	A
$I_{fm}$	Forward Current pulsed				25	A
$V_f$	Forward On-Voltage	$I_f = 3\text{ A}$ $I_f = 1\text{ A}$		1.55 1.15	1.9	V V
$t_{rr}$	Reverse Recovery Time	$I_f = 3\text{ A}$ $V_R = 200\text{ V}$		1700		ns
$Q_{rr}$	Reverse Recovery Charge	$di/dt = 100\text{ A}/\mu\text{s}$ $T_j = 125\text{ }^\circ\text{C}$		4500		nC
$I_{rrm}$	Reverse Recovery Current			9.5		A

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

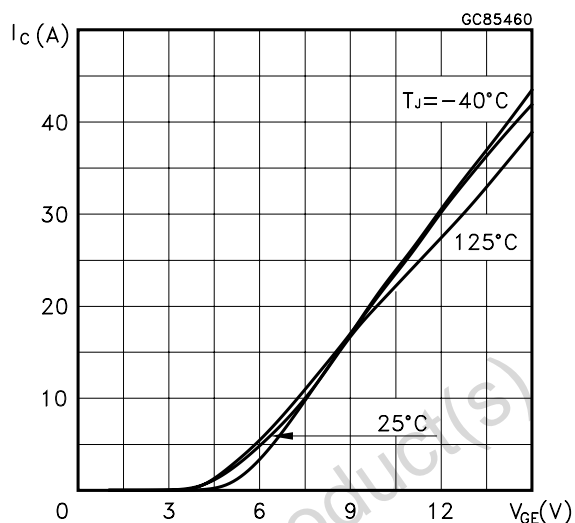
**Thermal Impedance**



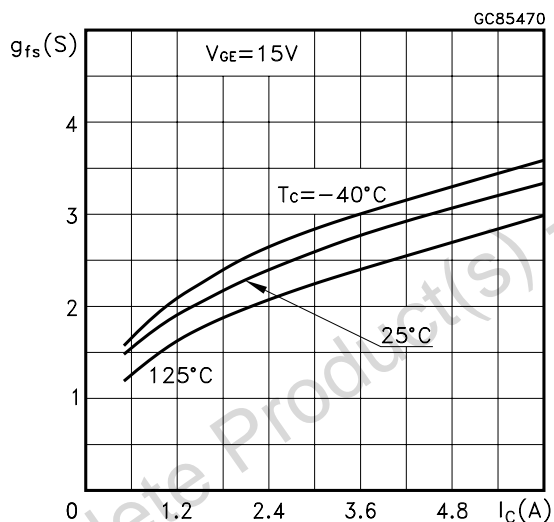
Output Characteristics



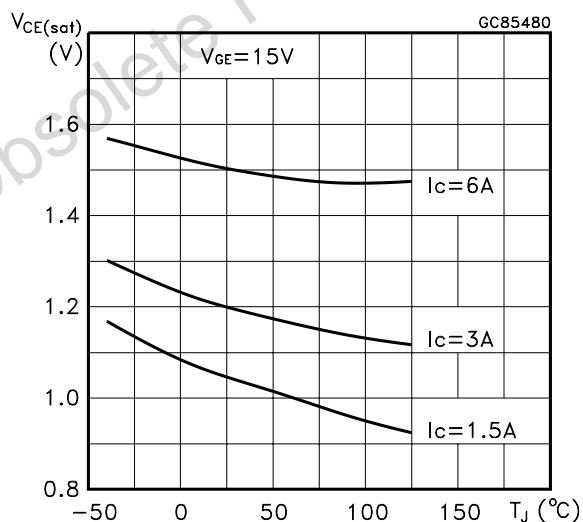
Transfer Characteristics



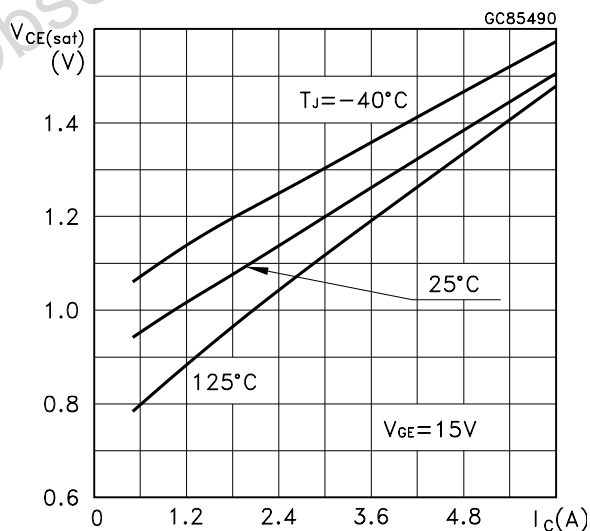
Transconductance



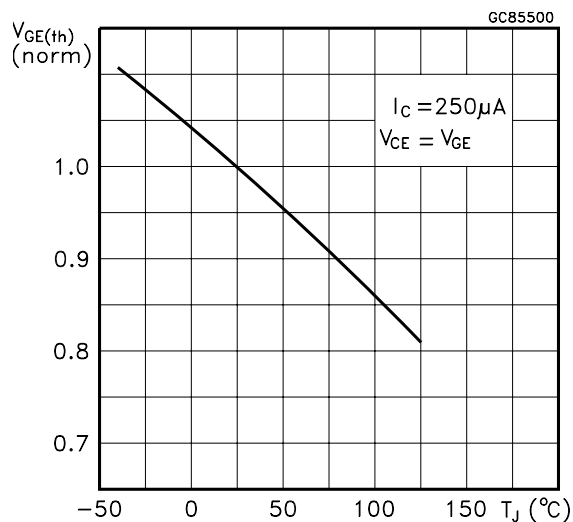
Collector-Emitter on Voltage vs Temperature



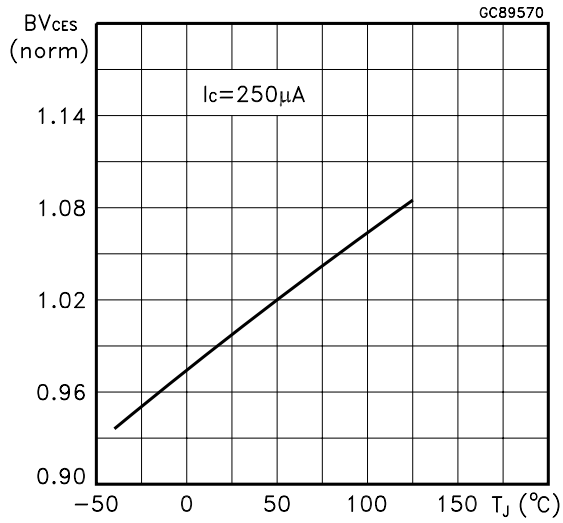
Collector-Emitter on Voltage vs Collector Current



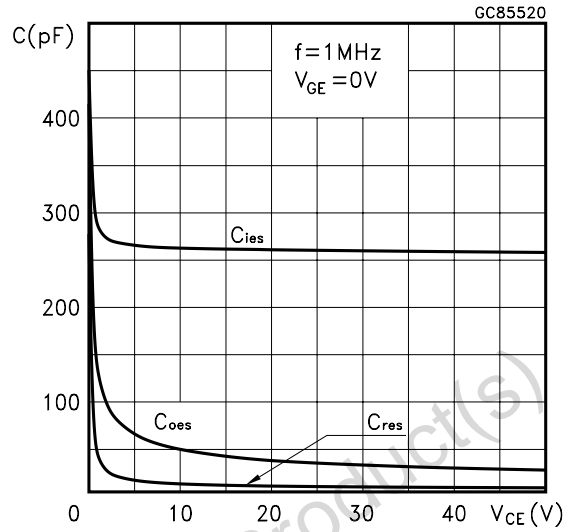
Gate Threshold vs Temperature



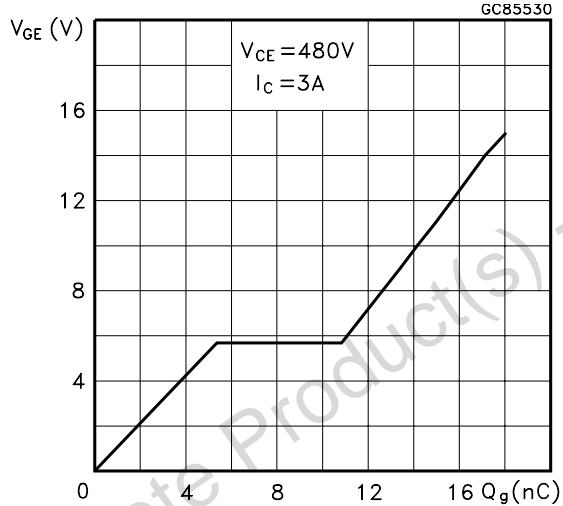
Normalized Breakdown Voltage vs Temperature



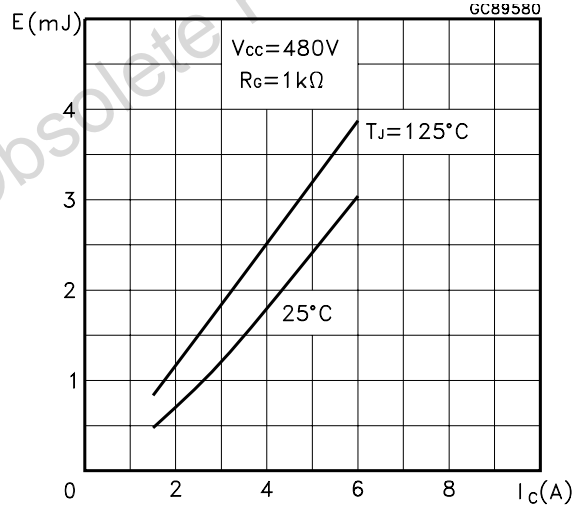
Capacitance Variations



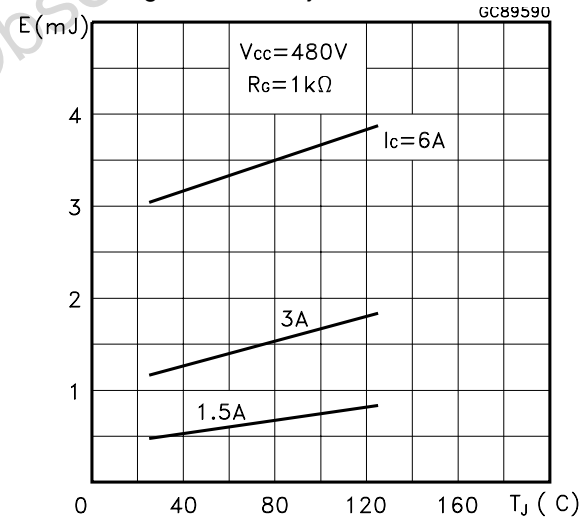
Gate charge Gate-Emitter Voltage



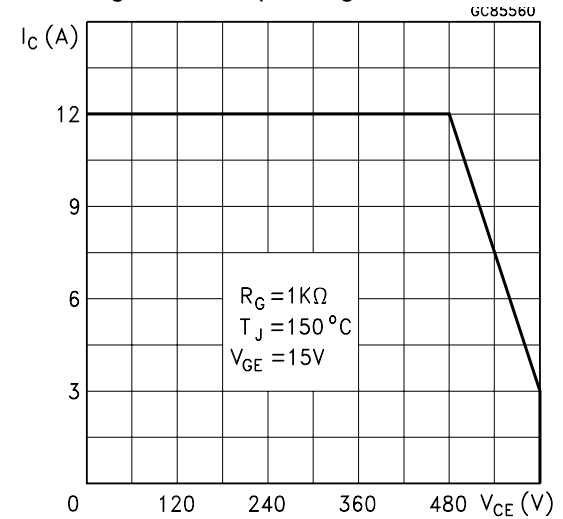
Off Switching Losses vs Ic



Off Switching Losses vs Tj



Switching Off Safe Operating Area



Diode Forward vs Tj

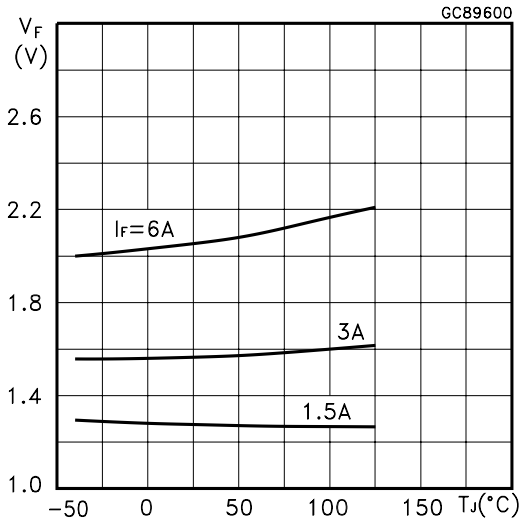
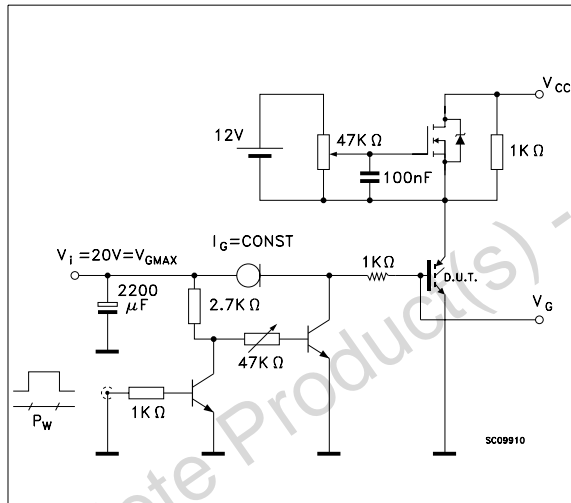


Fig. 1: Gate Charge test Circuit



Diode Forward Voltage

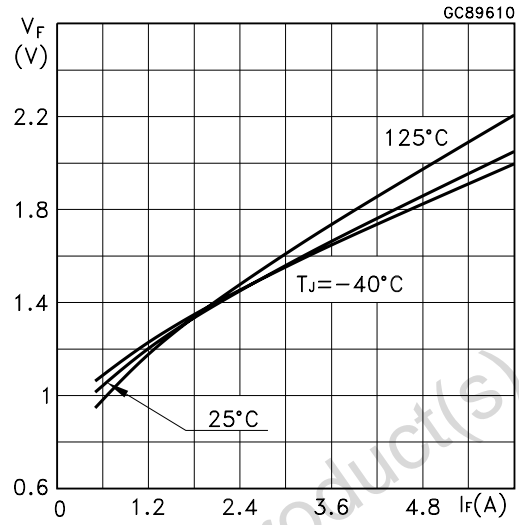


Fig. 2 Test Circuit For Inductive Load Switching

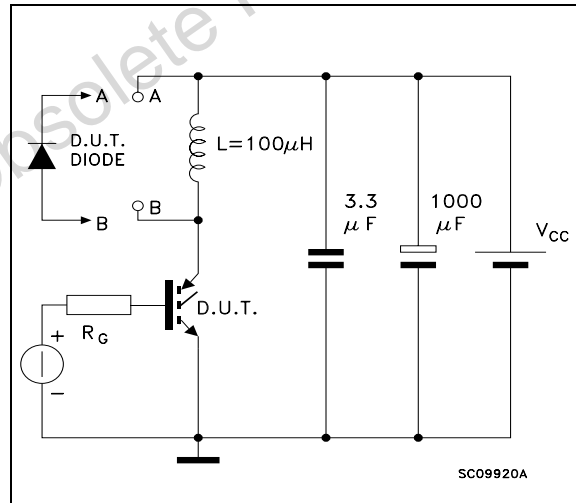
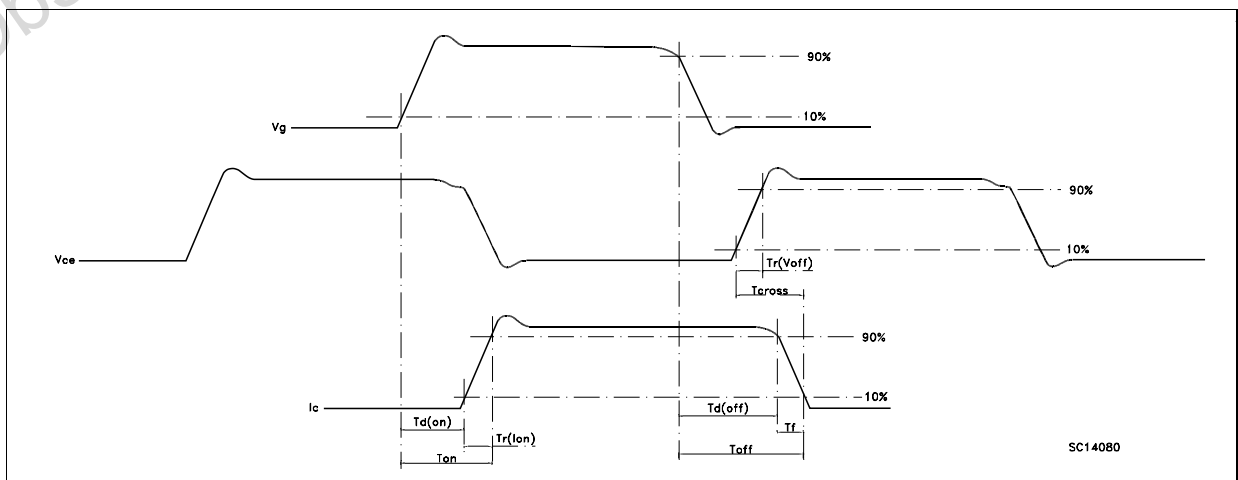
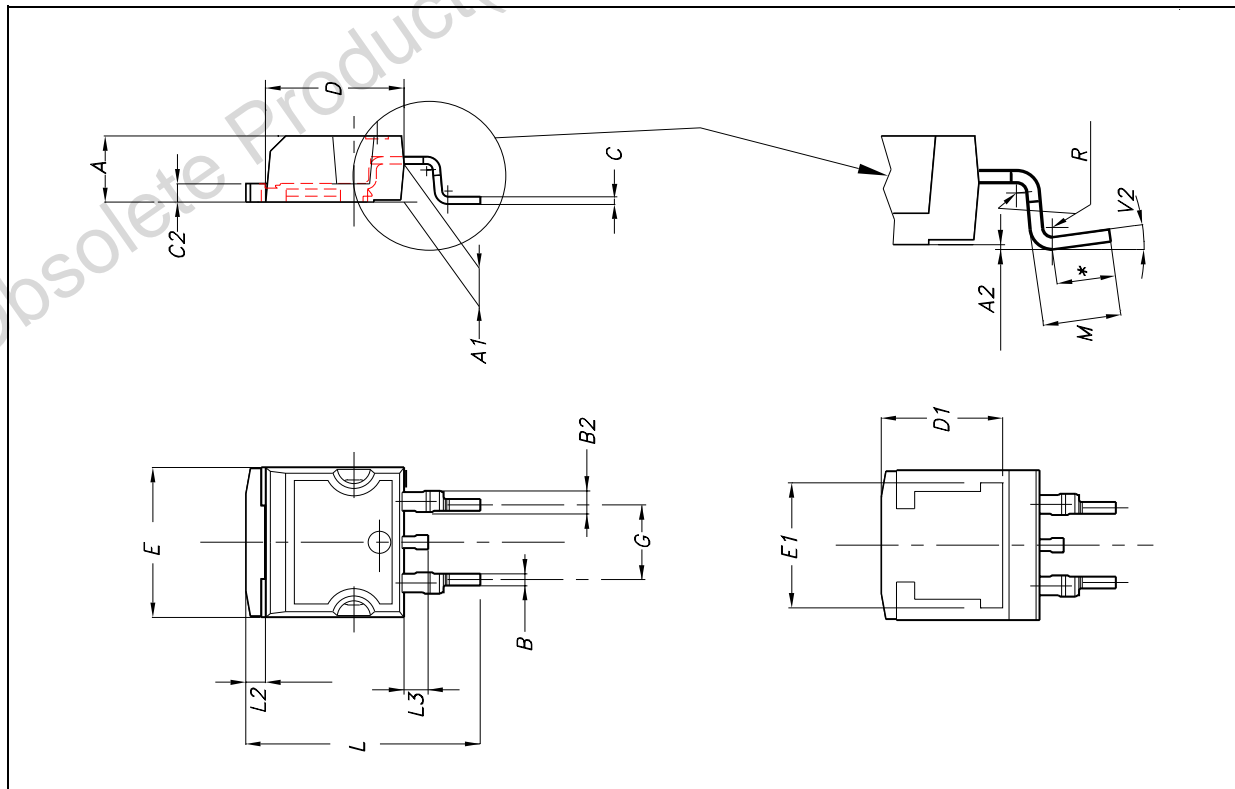


Fig. 3: Switching Waveforms



D<sup>2</sup>PAK MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334	
G	4.88		5.28	0.192		0.208
L	15		15.85	0.590		0.625
L2	1.27		1.4	0.050		0.055
L3	1.4		1.75	0.055		0.068
M	2.4		3.2	0.094		0.126
R		0.4			0.015	
V2	0°		8°			



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