



# STGW20NB60HD

## N-CHANNEL 20A - 600V TO-247 PowerMESH™ IGBT

TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub>	I <sub>C</sub>
STGW20NB60HD	600 V	< 2.8 V	20 A

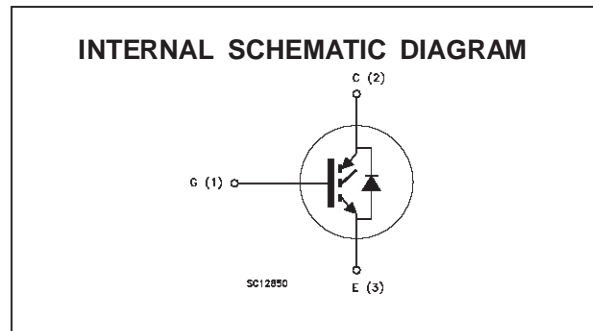
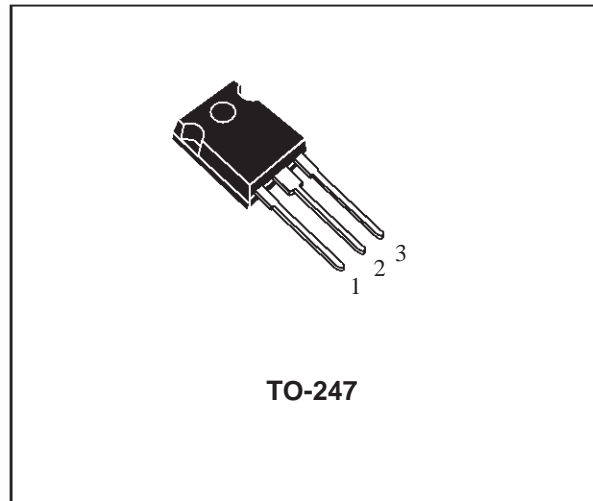
- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- LOW ON-VOLTAGE DROP (V<sub>CESAT</sub>)
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- VERY HIGH FREQUENCY OPERATION
- OFF LOSSES INCLUDE TAIL CURRENT
- CO-PACKAGED WITH TURBOSWITCH™ ANTIPARALLEL DIODE

### 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 to achieve very low switching times for high frequency applications (<120kHz).

### APPLICATIONS

- HIGH FREQUENCY MOTOR CONTROLS
- WELDING EQUIPMENTS
- SMPS AND PFC IN BOTH HARD SWITCH AND RESONANT TOPOLOGIES



### 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	40	A
I <sub>C</sub>	Collector Current (continuous) at T <sub>c</sub> = 100 °C	20	A
I <sub>CM</sub> (•)	Collector Current (pulsed)	160	A
P <sub>tot</sub>	Total Dissipation at T <sub>c</sub> = 25 °C	150	W
	Derating Factor	1.2	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

## STGW20NB60HD

### THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	0.83	$^{\circ}C/W$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	30	$^{\circ}C/W$
$R_{thc-h}$	Thermal Resistance Case- heatsink	Typ	0.1	$^{\circ}C/W$

### ELECTRICAL CHARACTERISTICS ( $T_j = 25^{\circ}C$ unless otherwise specified)

#### OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{BR(CEs)}$	Collector-Emitter Breakdown Voltage	$I_C = 250 \mu A$ $V_{GE} = 0$	600			V
$I_{CES}$	Collector cut-off ( $V_{GE} = 0$ )	$V_{CE} = \text{Max Rating}$ $T_j = 25^{\circ}C$ $V_{CE} = \text{Max Rating}$ $T_j = 125^{\circ}C$			250 2000	$\mu A$ $\mu A$
$I_{GES}$	Gate-Emitter Leakage Current ( $V_{CE} = 0$ )	$V_{GE} = \pm 20 V$ $V_{CE} = 0$			$\pm 100$	nA

#### ON (\*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate Threshold Voltage	$V_{CE} = V_{GE}$ $I_C = 250 \mu A$	3		5	V
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	$V_{GE} = 15 V$ $I_C = 20 A$ $V_{GE} = 15 V$ $I_C = 20 A$ $T_j = 125^{\circ}C$		2.3 1.9	2.8	V V

### DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs}$	Forward Transconductance	$V_{CE} = 25 V$ $I_C = 20 A$	7.0	10		S
$C_{ies}$ $C_{oes}$ $C_{res}$	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{CE} = 25 V$ $f = 1 \text{ MHz}$ $V_{GE} = 0$	1200 140 28	1700 200 40	2200 260 52	pF pF pF
$Q_G$ $Q_{GE}$ $Q_{GC}$	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	$V_{CE} = 480 V$ $I_C = 20 A$ $V_{GE} = 15 V$		110 13 51	145	nC nC nC
$I_{CL}$	Latching Current	$V_{clamp} = 480 V$ $R_G = 10 \Omega$ $T_j = 150^{\circ}C$	80			A

### SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Delay Time Rise Time	$V_{CC} = 480 V$ $I_C = 20 A$ $V_{GE} = 15 V$ $R_G = 10 \Omega$		20 70		ns ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{CC} = 480 V$ $I_C = 20 A$ $R_G = 10 \Omega$ $V_{GE} = 15 V$		350		A/ $\mu s$
$E_{on(\Delta)}$	Turn-on Switching Losses	$T_j = 125^{\circ}C$		550		$\mu J$

**ELECTRICAL CHARACTERISTICS** (continued)

**SWITCHING OFF**

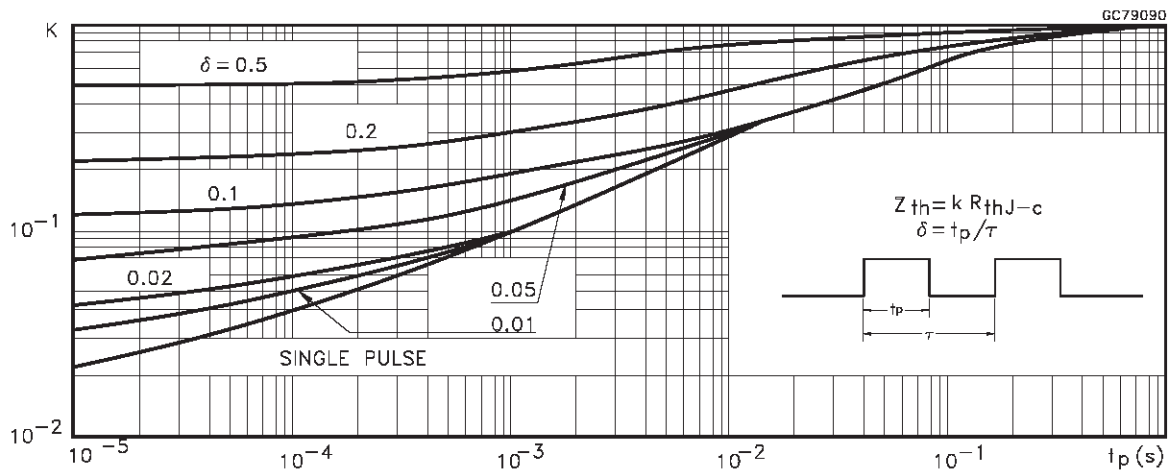
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-Over Time	$V_{CC} = 480\text{ V}$ $I_C = 20\text{ A}$ $R_{GE} = 10\ \Omega$ $V_{GE} = 15\text{ V}$		115		ns
$t_r(V_{off})$	Off Voltage Rise Time			32		ns
$t_{d(off)}$	Delay Time			170		ns
$t_f$	Fall Time			75		ns
$E_{off(**)}$	Turn-off Switching Loss			0.4		mJ
$E_{ts(\odot)}$	Total Switching Loss			0.9		mJ
$t_c$	Cross-Over Time	$V_{CC} = 480\text{ V}$ $I_C = 20\text{ A}$ $R_{GE} = 10\ \Omega$ $V_{GE} = 15\text{ V}$ $T_j = 125\text{ }^\circ\text{C}$		190		ns
$t_r(V_{off})$	Off Voltage Rise Time			55		ns
$t_{d(off)}$	Delay Time			210		ns
$t_f$	Fall Time			140		ns
$E_{off(**)}$	Turn-off Switching Loss			0.7		mJ
$E_{ts(\odot)}$	Total Switching Loss			1.25		mJ

**COLLECTOR-EMITTER DIODE**

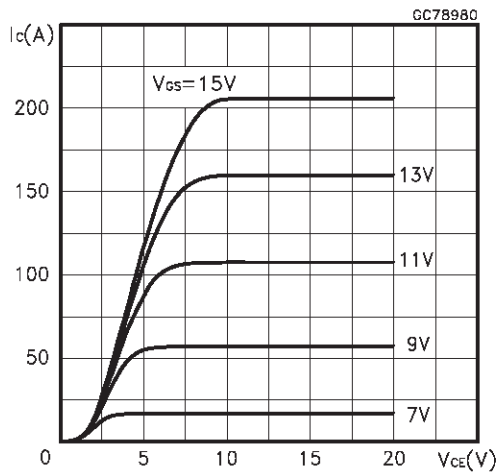
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_f$	Forward Current				20	A
$I_{fm}$	Forward Current pulsed				160	A
$V_f$	Forward On-Voltage	$I_f = 20\text{ A}$ $I_f = 20\text{ A}$ $T_j = 125\text{ }^\circ\text{C}$		1.50	2.0	V
				1.25		V
$t_{rr}$	Reverse Recovery Time	$I_f = 20\text{ A}$ $V_R = 200\text{ V}$ $di/dt = 100\text{ A}/\mu\text{S}$ $T_j = 125\text{ }^\circ\text{C}$		100		nS
$Q_{rr}$	Reverse Recovery Charge			300		nC
$I_{rrm}$	Reverse Recovery Current			5.9		A

- (●) Pulse width limited by max. junction temperature
- (⊙) Include recovery losses on the STTA2006 freewheeling diode
- (\*) Pulsed: Pulse duration = 300 μs, duty cycle 1.5 %
- (\*\*) Losses Include Also The Tail (Jedec Standardization)

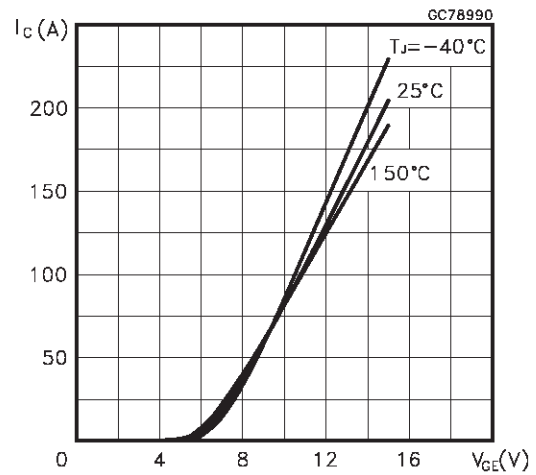
**Thermal Impedance**



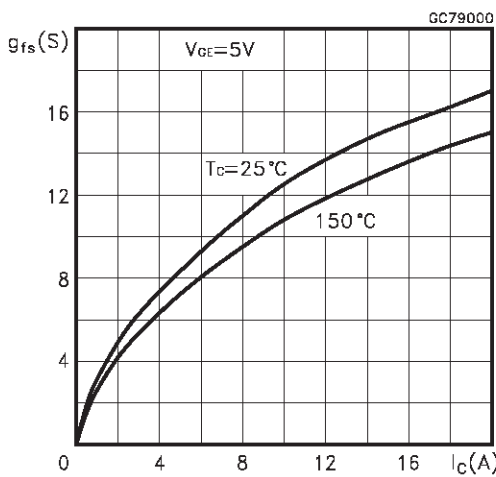
Output Characteristics



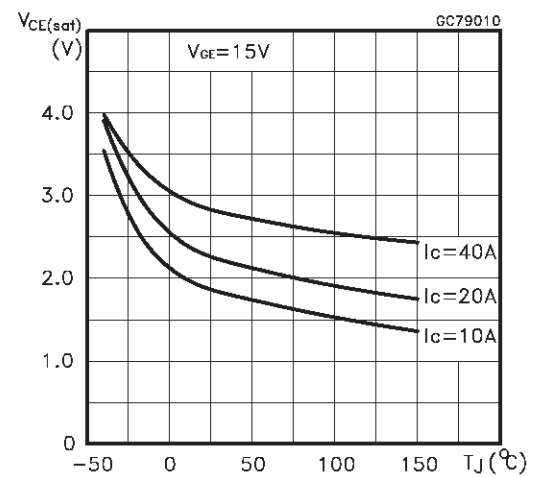
Transfer Characteristics



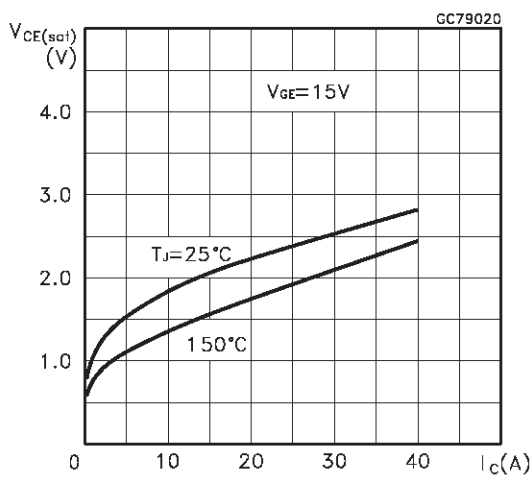
Transconductance



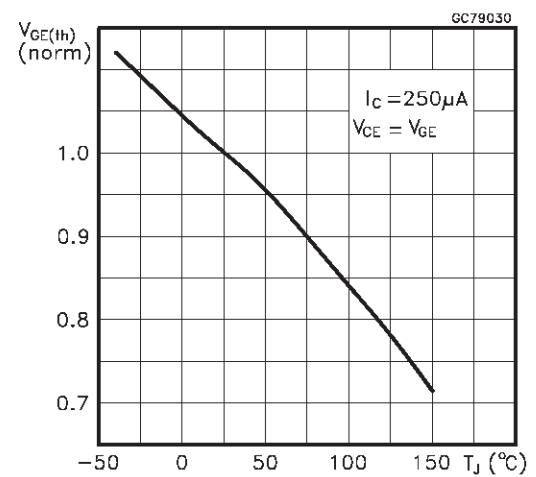
Collector-Emitter On Voltage vs Temperature



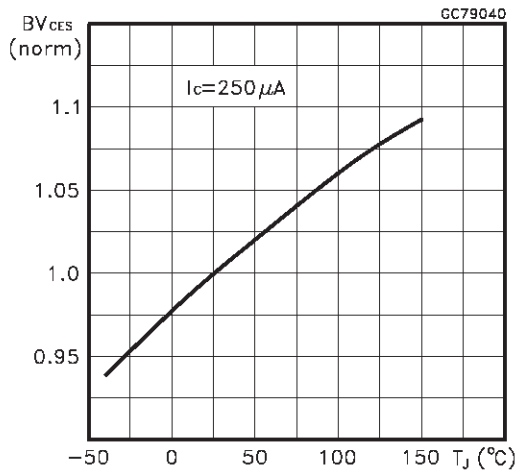
Collector-Emitter On Voltage vs Collector Current



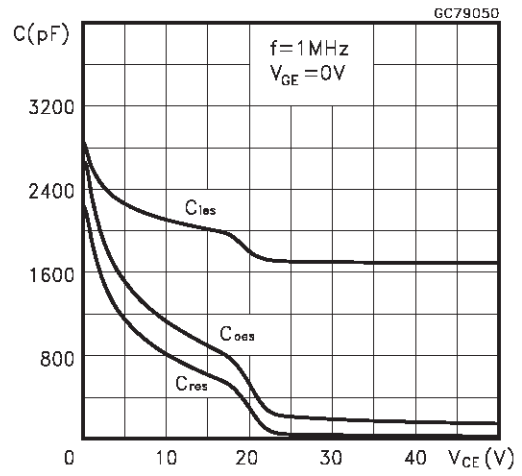
Gate Threshold vs Temperature



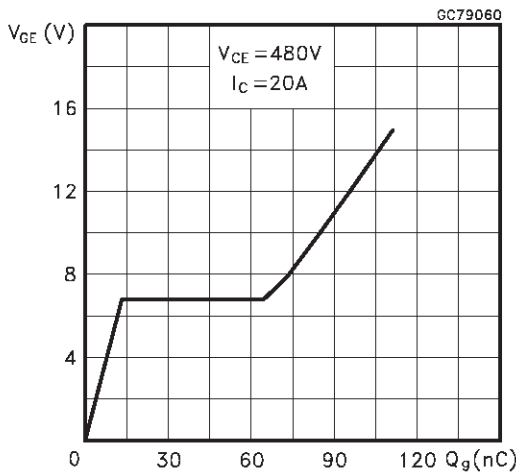
Normalized Breakdown Voltage vs Temperature



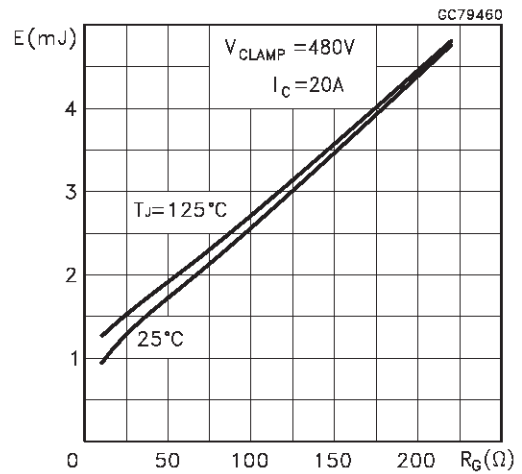
Capacitance Variations



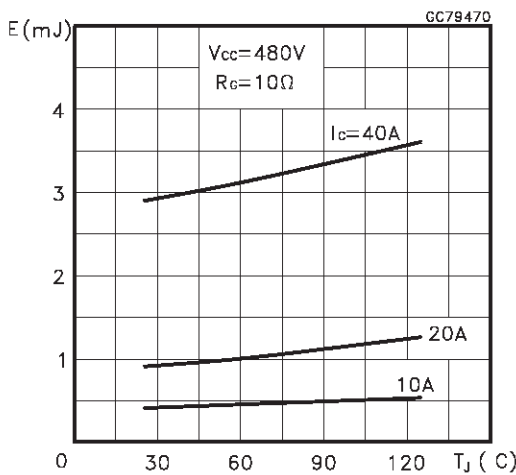
Gate Charge vs Gate-Emitter Voltage



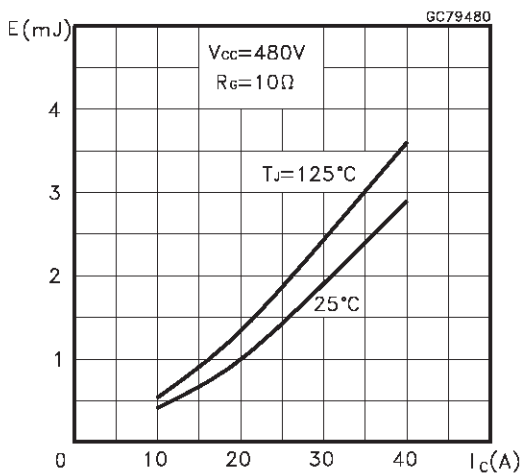
Total Switching Losses vs Gate Resistance



Total Switching Losses vs Temperature



Total Switching Losses vs Collector Current



Switching Off Safe Operating Area

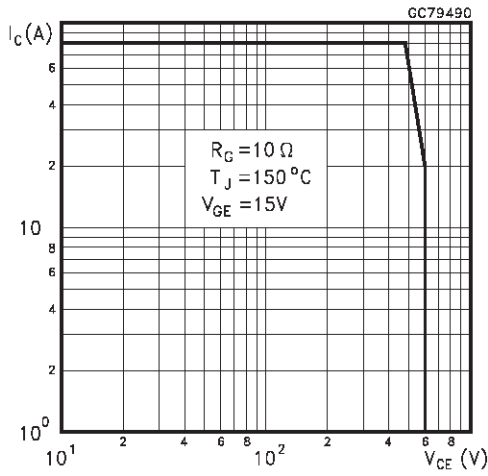


Fig. 1: Gate Charge test Circuit

Diode Forward Voltage

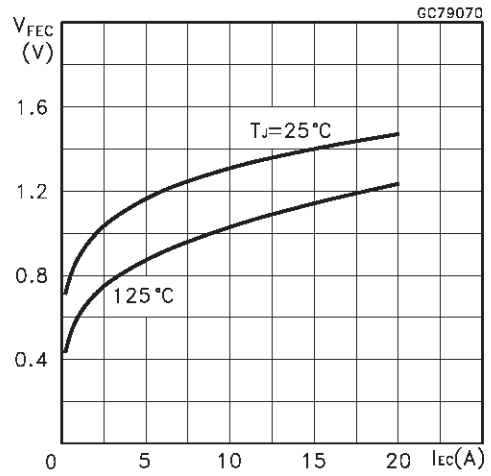


Fig. 2: Test Circuit For Inductive Load Switching

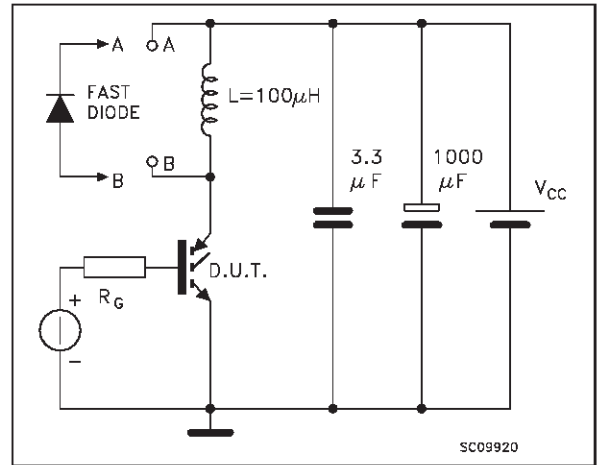
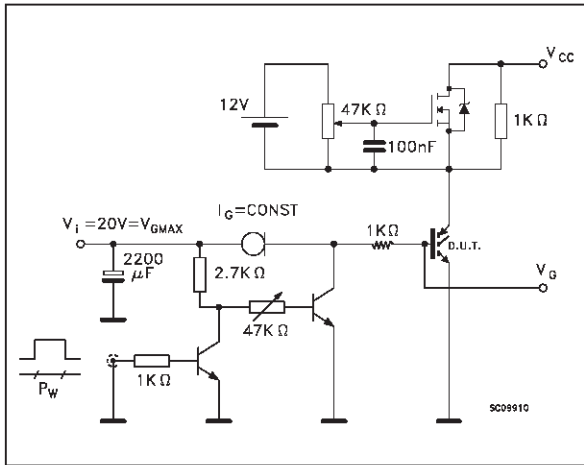
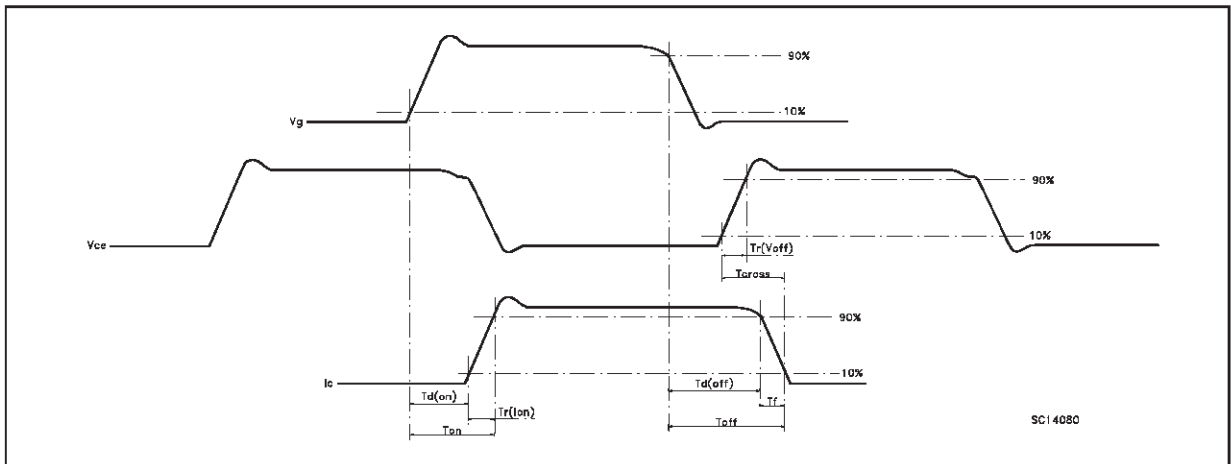
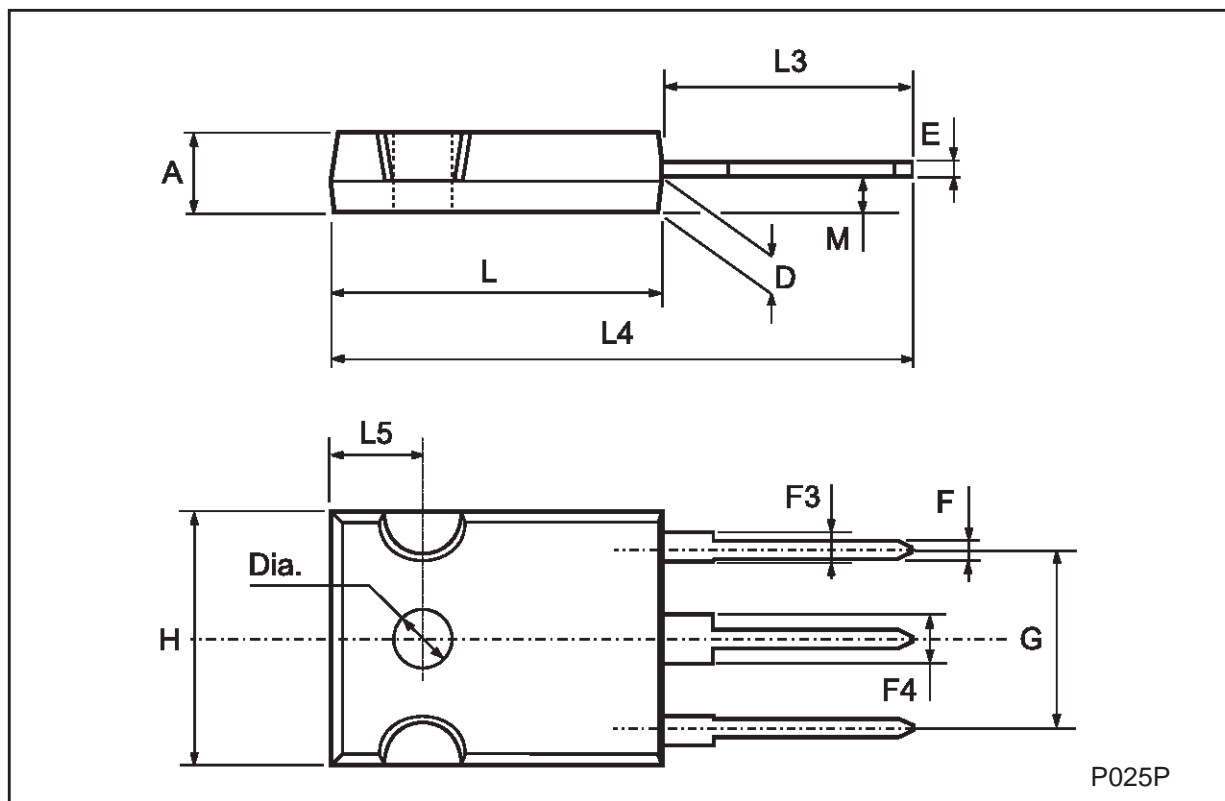


Fig. 3: Switching Waveforms



## 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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