



STGW20NB60HD

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

TYPE	V _{CES}	V _{CE(sat)}	I _C
STGW20NB60HD	600 V	< 2.8 V	20 A

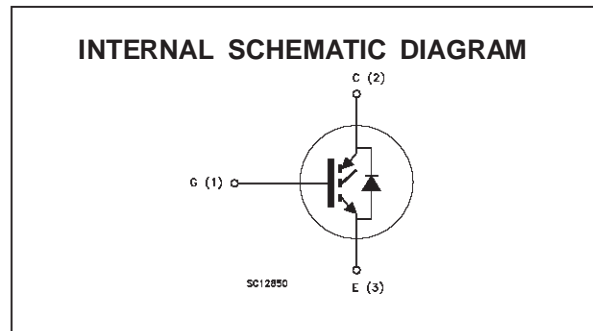
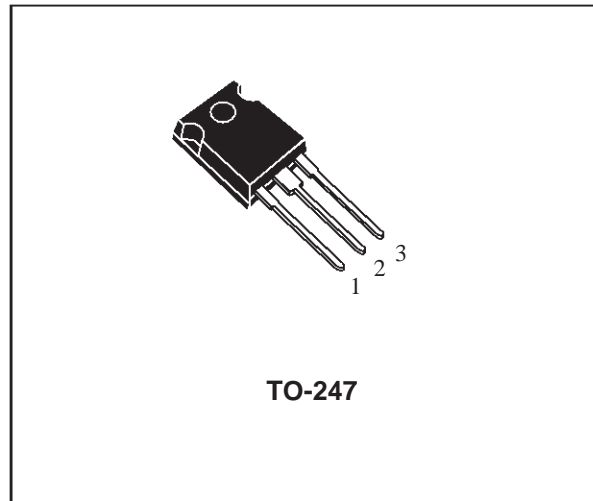
- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- LOW ON-VOLTAGE DROP (V_{CESAT})
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- VERY HIGH FREQUENCY OPERATION
- OFF LOSSES INCLUDE TAIL CURRENT
- CO-PACKAGED WITH TURBOSWITCH™ ANTIPARALLEL DIODE

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 _{CES}	Collector-Emitter Voltage (V _{GS} = 0)	600	V
V _{GE}	Gate-Emitter Voltage	± 20	V
I _C	Collector Current (continuous) at T _c = 25 °C	40	A
I _C	Collector Current (continuous) at T _c = 100 °C	20	A
I _{CM} (•)	Collector Current (pulsed)	160	A
P _{tot}	Total Dissipation at T _c = 25 °C	150	W
	Derating Factor	1.2	W/°C
T _{stg}	Storage Temperature	-65 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C

(•) Pulse width limited by safe operating area

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THERMAL DATA

R _{thj-case}	Thermal Resistance Junction-case	Max	0.83	°C/W
R _{thj-amb}	Thermal Resistance Junction-ambient	Max	30	°C/W
R _{thc-h}	Thermal Resistance Case- heatsink	Typ	0.1	°C/W

ELECTRICAL CHARACTERISTICS (T_j = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{BR(CES)}	Collector-Emitter Breakdown Voltage	I _C = 250 μA V _{GE} = 0	600			V
I _{CES}	Collector cut-off (V _{GE} = 0)	V _{CE} = Max Rating T _j = 25 °C V _{CE} = Max Rating T _j = 125 °C			250 2000	μA μA
I _{GES}	Gate-Emitter Leakage Current (V _{CE} = 0)	V _{GE} = ± 20 V V _{CE} = 0			± 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GE(th)}	Gate Threshold Voltage	V _{CE} = V _{GE} I _C = 250 μA	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 °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 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 Ω T _j = 150 °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 Ω		20 70		ns ns
(di/dt) _{on}	Turn-on Current Slope	V _{CC} = 480 V I _C = 20 A R _G = 10 Ω V _{GE} = 15 V		350		A/μs
E _{on(○)}	Turn-on Switching Losses	T _j = 125 °C		550		μJ

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING OFF

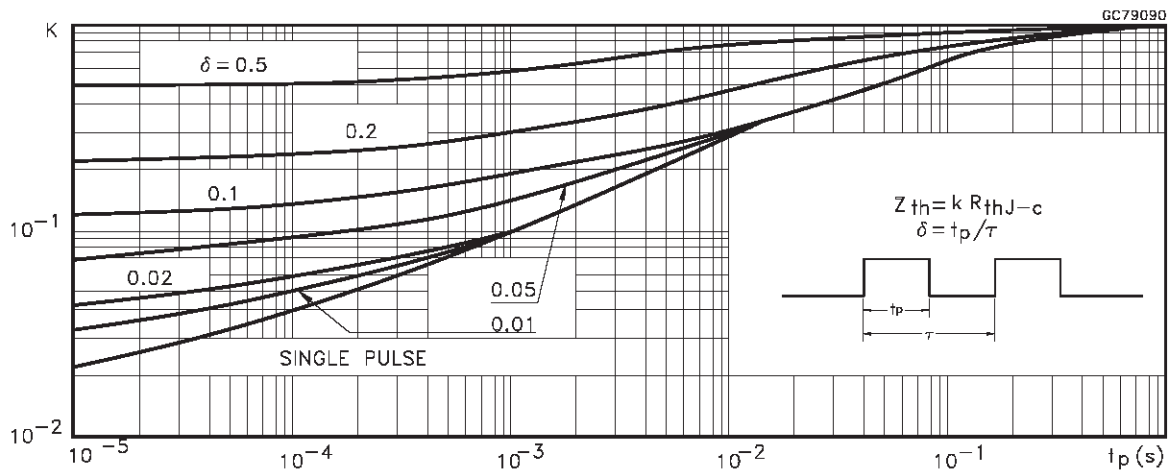
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t_c	Cross-Over Time	$V_{CC} = 480\text{ V}$ $I_C = 20\text{ A}$		115		ns
$t_r(V_{off})$	Off Voltage Rise Time	$R_{GE} = 10\ \Omega$ $V_{GE} = 15\text{ V}$		32		ns
$t_{d(off)}$	Delay Time			170		ns
t_f	Fall Time			75		ns
$E_{off(**)}$	Turn-off Switching Loss			0.4		mJ
$E_{ts(\odot)}$	Total Switching Loss			0.9		mJ
t_c	Cross-Over Time	$V_{CC} = 480\text{ V}$ $I_C = 20\text{ A}$		190		ns
$t_r(V_{off})$	Off Voltage Rise Time	$R_{GE} = 10\ \Omega$ $V_{GE} = 15\text{ V}$		55		ns
$t_{d(off)}$	Delay Time	$T_j = 125\text{ }^\circ\text{C}$		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	$I_f = 20\text{ A}$		1.50	2.0	V
		$I_f = 20\text{ A}$ $T_j = 125\text{ }^\circ\text{C}$		1.25		V
t_{rr}	Reverse Recovery Time	$I_f = 20\text{ A}$ $V_R = 200\text{ V}$		100		nS
Q_{rr}	Reverse Recovery Charge	$di/dt = 100\text{ A}/\mu\text{S}$ $T_j = 125\text{ }^\circ\text{C}$		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)

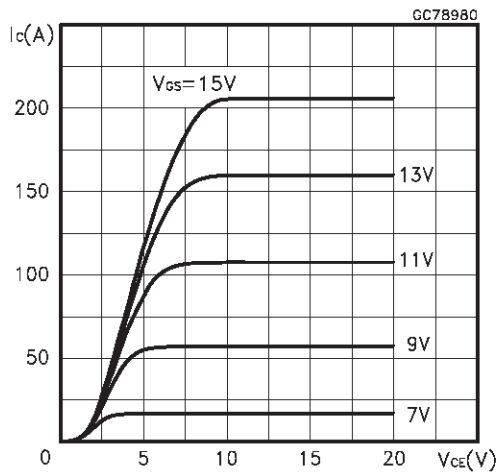
Thermal Impedance



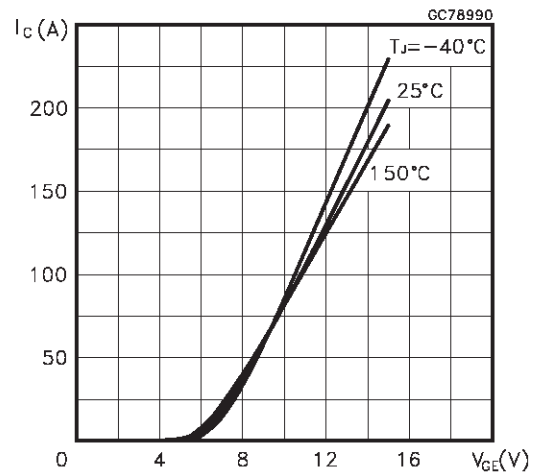
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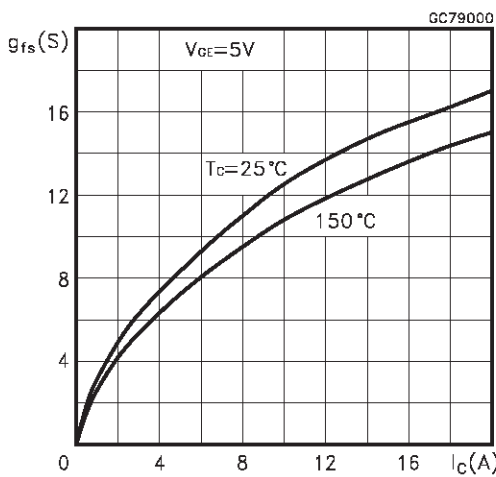
Output Characteristics



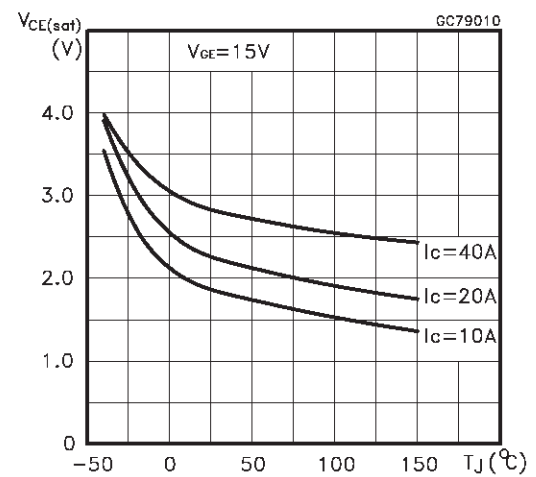
Transfer Characteristics



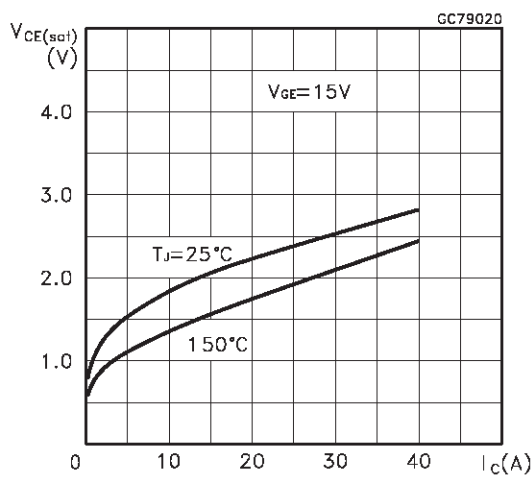
Transconductance



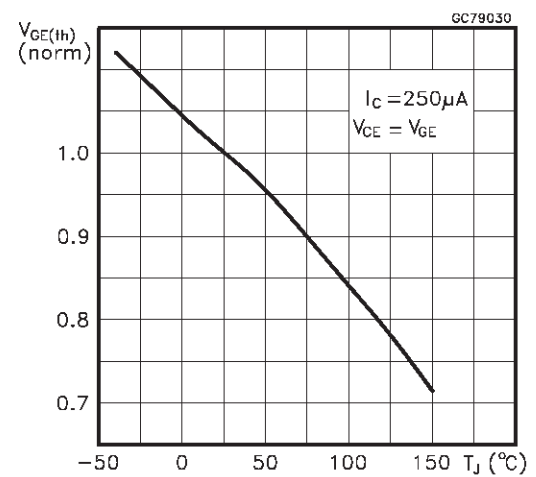
Collector-Emitter On Voltage vs Temperature



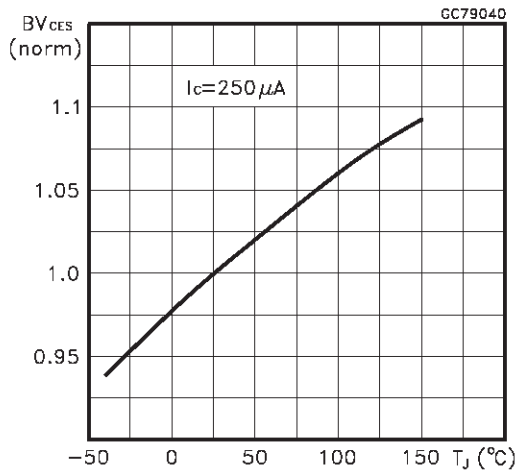
Collector-Emitter On Voltage vs Collector Current



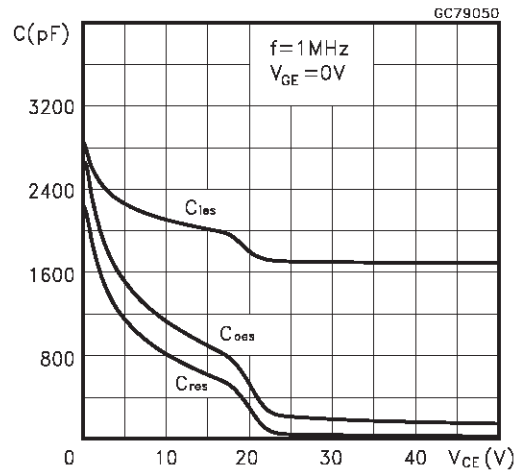
Gate Threshold vs Temperature



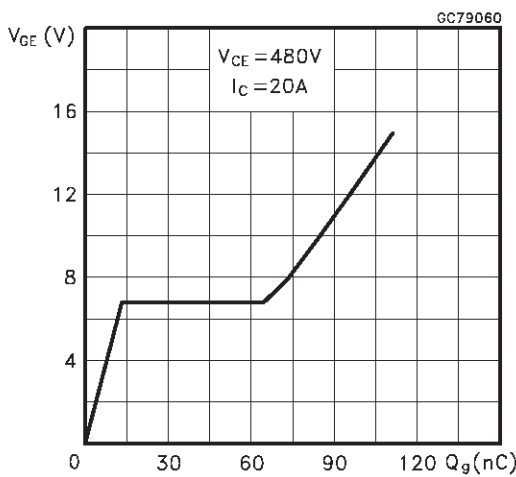
Normalized Breakdown Voltage vs Temperature



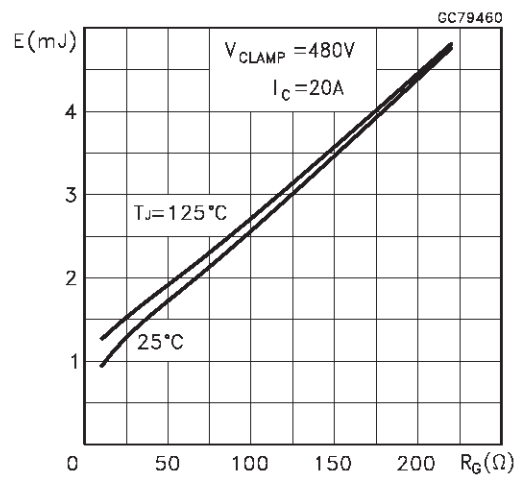
Capacitance Variations



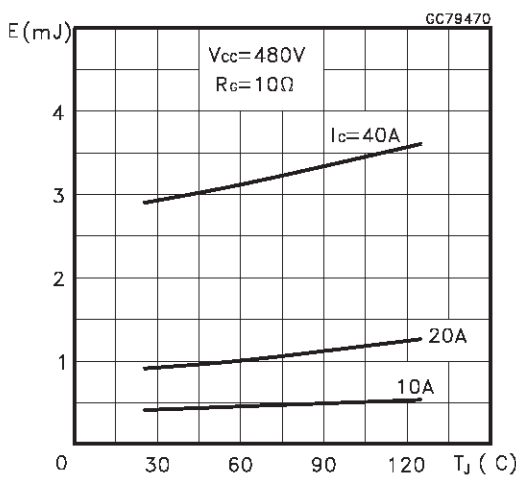
Gate Charge vs Gate-Emitter Voltage



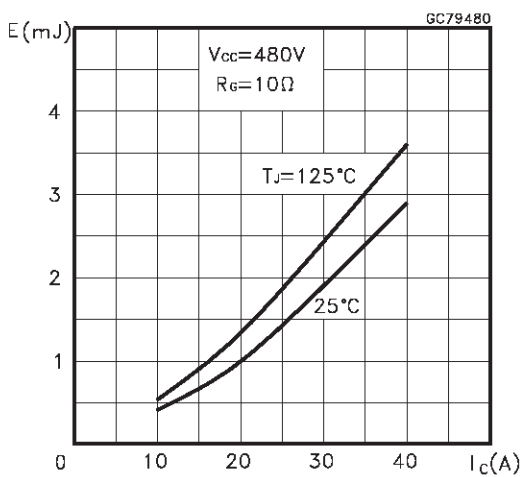
Total Switching Losses vs Gate Resistance



Total Switching Losses vs Temperature



Total Switching Losses vs Collector Current



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Switching Off Safe Operating Area

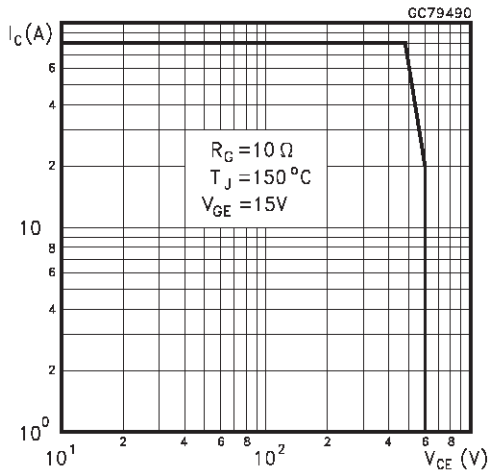


Fig. 1: Gate Charge test Circuit

Diode Forward Voltage

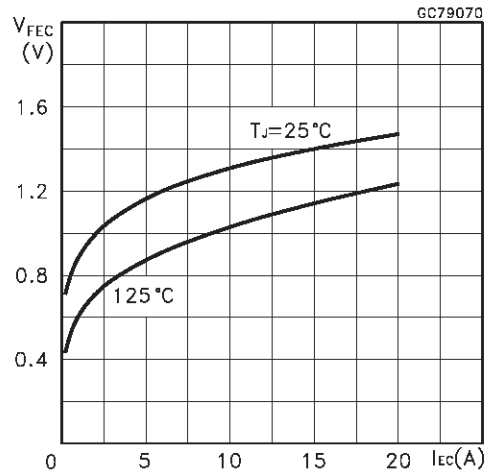


Fig. 2: Test Circuit For Inductive Load Switching

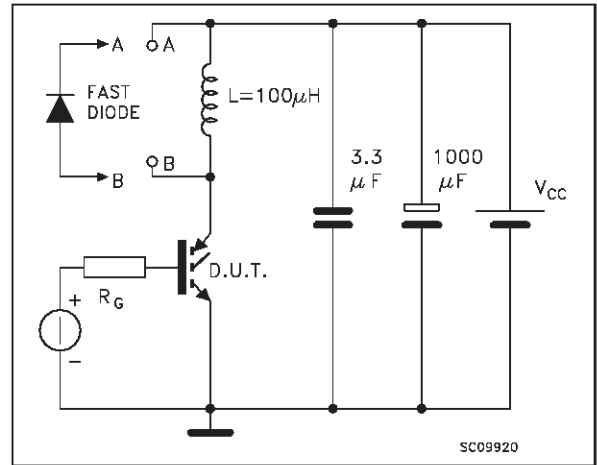
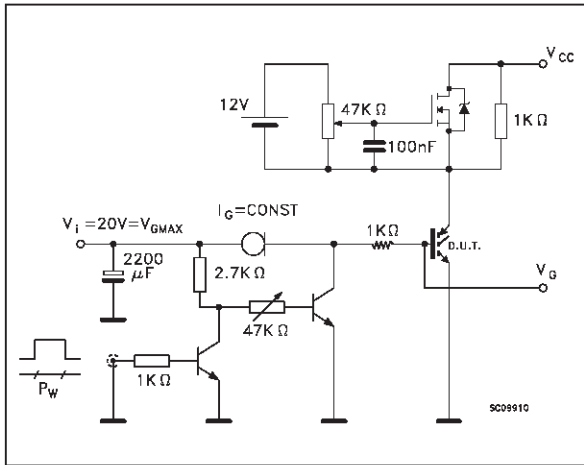
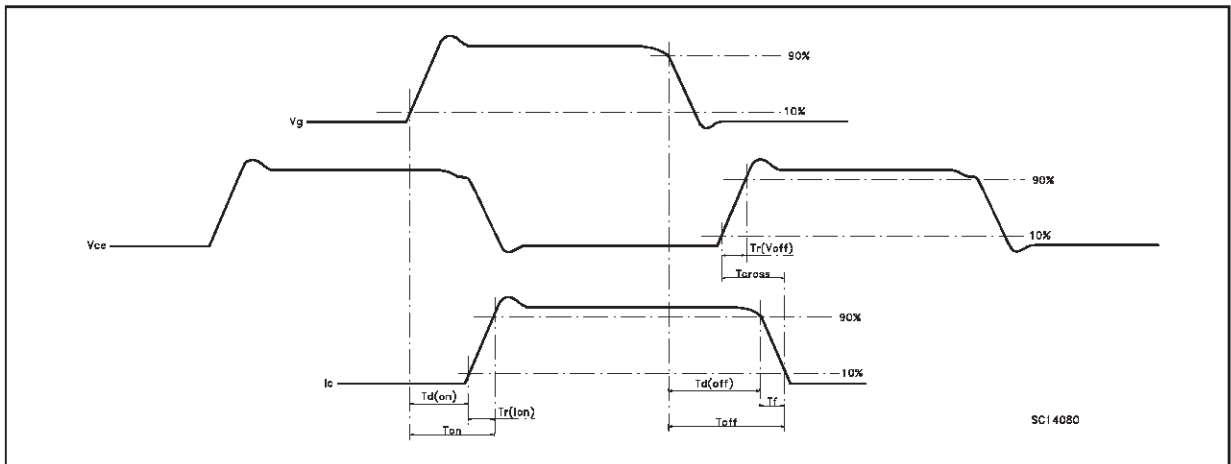
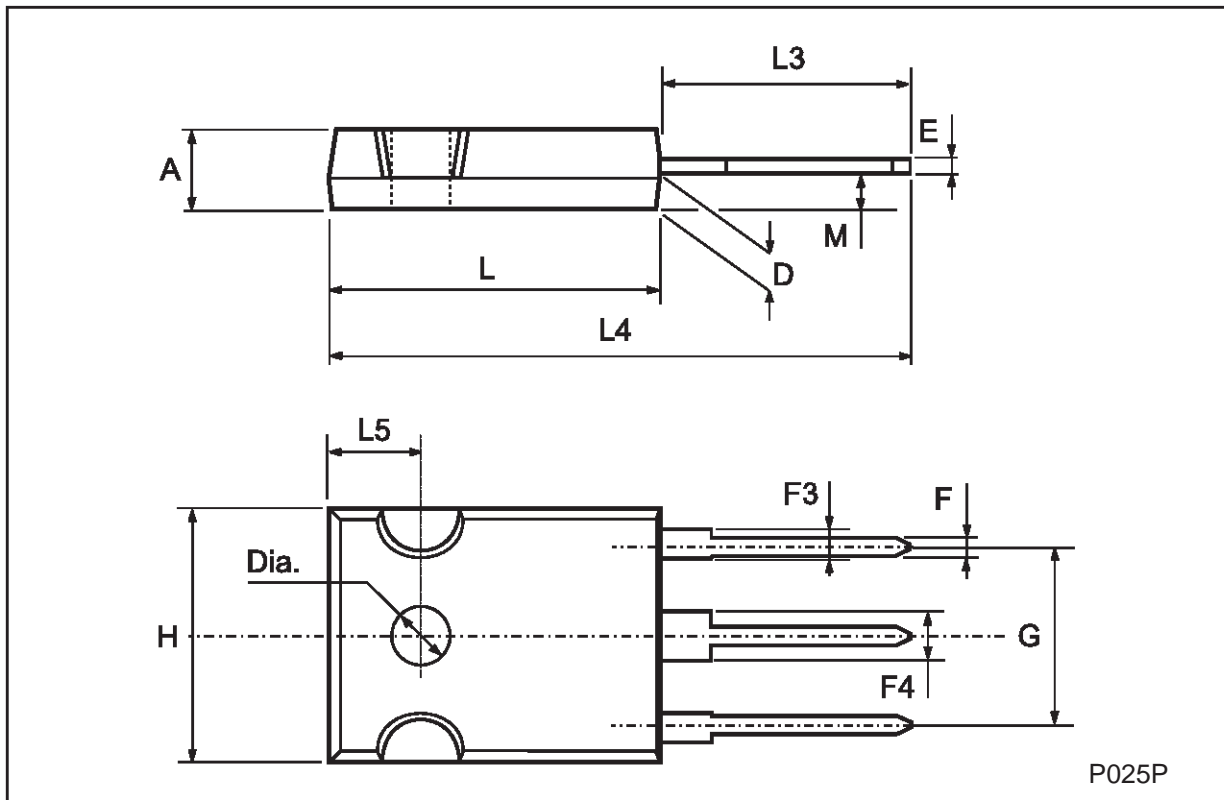


Fig. 3: Switching Waveforms



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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