



# STGB3NB60HD

## N-CHANNEL 3A - 600V TO-263 PowerMESH™ IGBT

TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub>	I <sub>C</sub>
STGB3NB60HD	600 V	< 2.8 V	3 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
- 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 "H" identifies a family optimized to achieve very low switching times for high frequency applications (<120kHz).

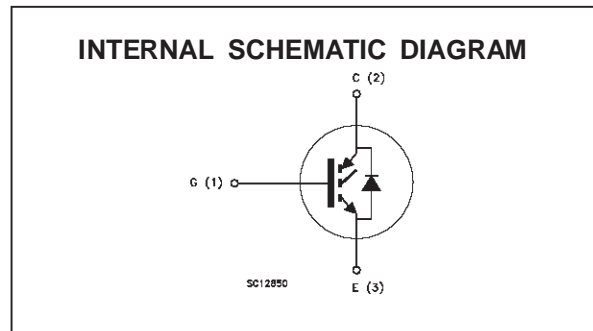
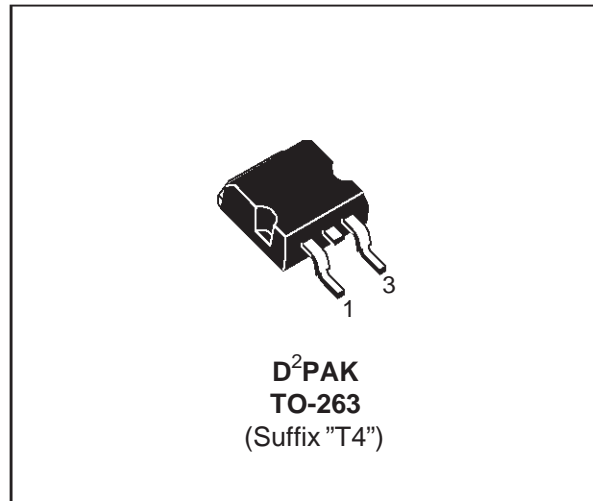
### APPLICATIONS

- HIGH FREQUENCY MOTOR CONTROLS
- 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	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	70	W
	Derating Factor	0.56	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 max. junction temperature



## STGB3NB60HD

### THERMAL DATA

R <sub>thj-case</sub>	Thermal Resistance Junction-case	Max	1.78	°C/W
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient	Max	62.5	°C/W
R <sub>thc-sink</sub>	Thermal Resistance Case-sink	Typ	0.5	°C/W

### ELECTRICAL CHARACTERISTICS (T<sub>j</sub> = 25 °C unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>BR(CES)</sub>	Collector-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>j</sub> = 25 °C V <sub>CE</sub> = Max Rating T <sub>j</sub> = 125 °C			100 1000	μA μA
I <sub>GES</sub>	Gate-Emitter Leakage Current (V <sub>CE</sub> = 0)	V <sub>GE</sub> = ± 20 V V <sub>CE</sub> = 0			± 100	nA

ON (\*)

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> = 250 μA	3		5	V
V <sub>CE(SAT)</sub>	Collector-Emitter Saturation Voltage	V <sub>GE</sub> = 15 V I <sub>C</sub> = 3 A V <sub>GE</sub> = 15 V I <sub>C</sub> = 3 A T <sub>j</sub> = 125 °C		2.4 1.9	2.8	V 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	1.3	2.4		S
C <sub>ies</sub> C <sub>oes</sub> C <sub>res</sub>	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V <sub>CE</sub> = 25 V f = 1 MHz V <sub>GE</sub> = 0	160 23 4.5	235 33 6.6	300 43 8.6	pF pF 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> = 15 V		21 6 7.6	27	nC nC nC
I <sub>CL</sub>	Latching Current	V <sub>clamp</sub> = 480 V R <sub>G</sub> = 10 Ω T <sub>j</sub> = 150 °C	12			A

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t <sub>d(on)</sub> t <sub>r</sub>	Delay Time Rise Time	V <sub>CC</sub> = 480 V I <sub>C</sub> = 3 A V <sub>GE</sub> = 15 V R <sub>G</sub> = 10 Ω		16 30		ns ns
(di/dt) <sub>on</sub>	Turn-on Current Slope	V <sub>CC</sub> = 480 V I <sub>C</sub> = 3 A R <sub>G</sub> = 10 Ω V <sub>GE</sub> = 15 V		400		A/μs
E <sub>on(▷)</sub>	Turn-on Switching Losses	T <sub>j</sub> = 125 °C		77		μJ

**ELECTRICAL CHARACTERISTICS** (continued)

**SWITCHING OFF**

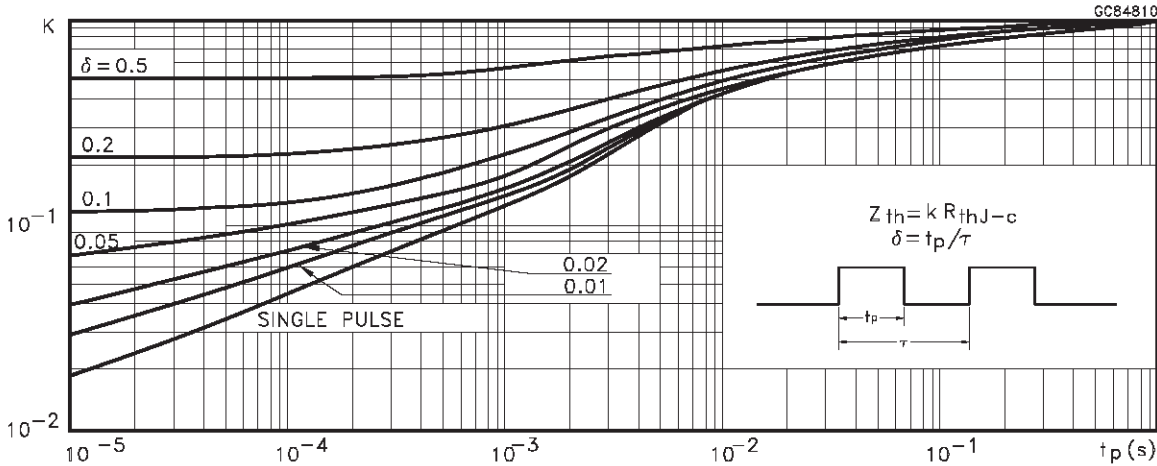
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-Over Time	$V_{CC} = 480\text{ V}$		90		ns
$t_r(V_{off})$	Off Voltage Rise Time	$I_C = 3\text{ A}$ $R_{GE} = 10\ \Omega$		36		ns
$t_d(off)$	Delay Time	$V_{GE} = 15\text{ V}$		53		ns
$t_f$	Fall Time			70		ns
$E_{off(**)}$	Turn-off Switching Loss			33		$\mu\text{J}$
$E_{ts(\circ)}$	Total Switching Loss			100		$\mu\text{J}$
$t_c$	Cross-Over Time	$V_{CC} = 480\text{ V}$		180		ns
$t_r(V_{off})$	Off Voltage Rise Time	$I_C = 3\text{ A}$ $R_{GE} = 10\ \Omega$		82		ns
$t_d(off)$	Delay Time	$V_{GE} = 15\text{ V}$ $T_j = 125\text{ }^\circ\text{C}$		58		ns
$t_f$	Fall Time			110		ns
$E_{off(**)}$	Turn-off Switching Loss			88		$\mu\text{J}$
$E_{ts(\circ)}$	Total Switching Loss			165		$\mu\text{J}$

**COLLECTOR-EMITTER DIODE**

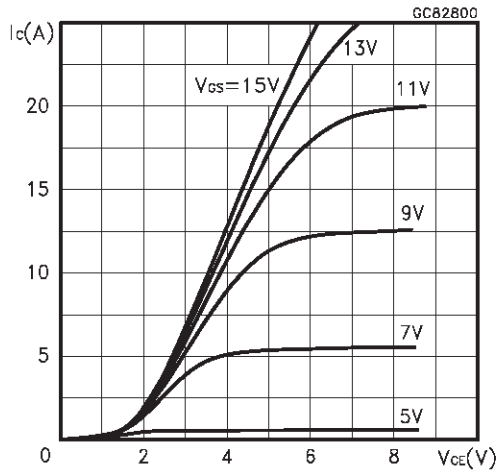
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_f$	Forward Current				3	A
$I_{fm}$	Forward Current pulsed				24	A
$V_f$	Forward On-Voltage	$I_f = 3\text{ A}$ $I_f = 3\text{ A}$		1.6 1.4	2.0	V V
$t_{rr}$	Reverse Recovery Time	$I_f = 3\text{ A}$		87		ns
$Q_{rr}$	Reverse Recovery Charge	$dI/dt = 100\text{ A}/\mu\text{S}$		160		nC
$I_{rrm}$	Reverse Recovery Current	$V_R = 200\text{ V}$ $T_j = 125\text{ }^\circ\text{C}$		3.7		A

- (●) Pulse width limited by max. junction temperature
- (○) Include recovery losses on the STTA306 freewheeling diode
- (\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %
- (\*\*) Losses Include Also The Tail (Jedec Standardization)

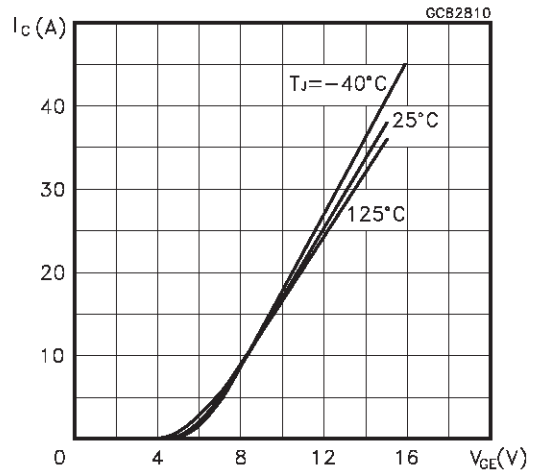
**Thermal Impedance**



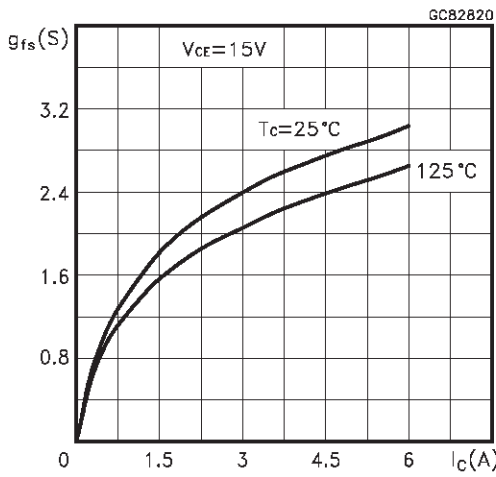
Output Characteristics



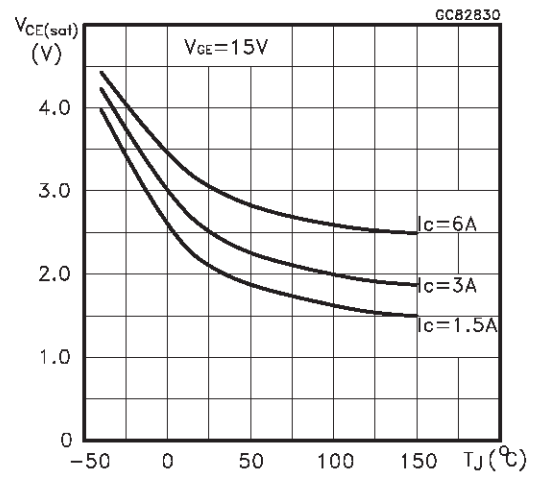
Transfer Characteristics



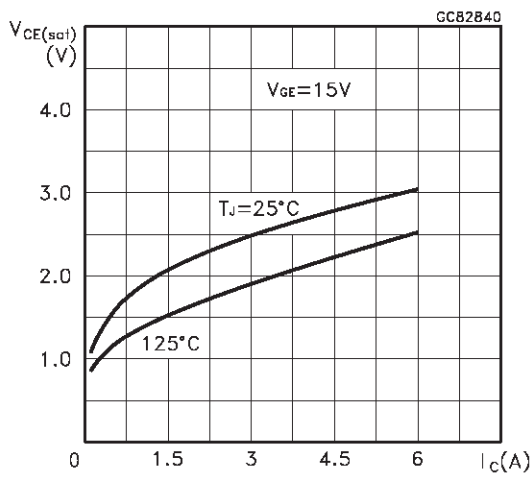
Transconductance



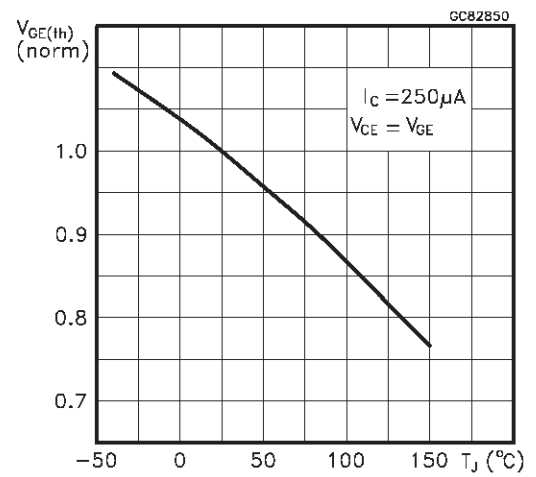
Collector-Emitter On Voltage vs Temperature



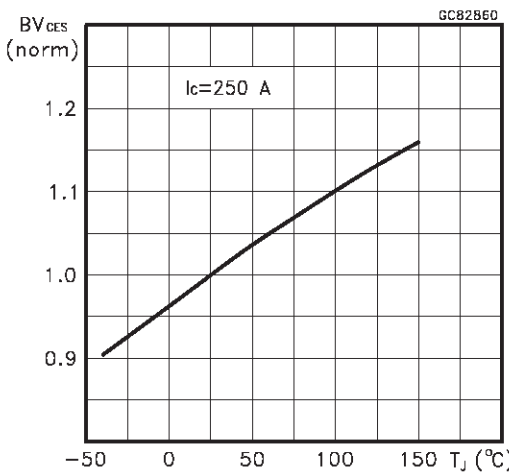
Collector-Emitter On Voltage vs Collector Current



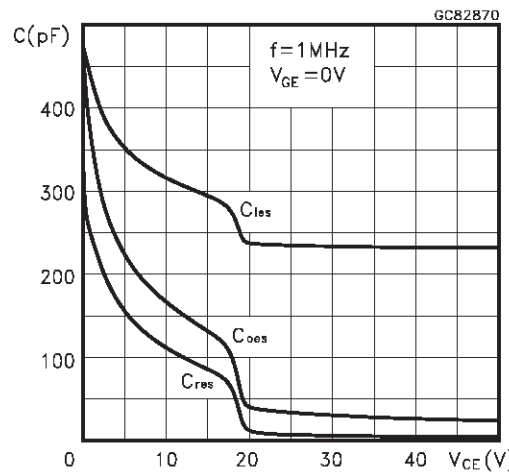
Gate Threshold vs Temperature



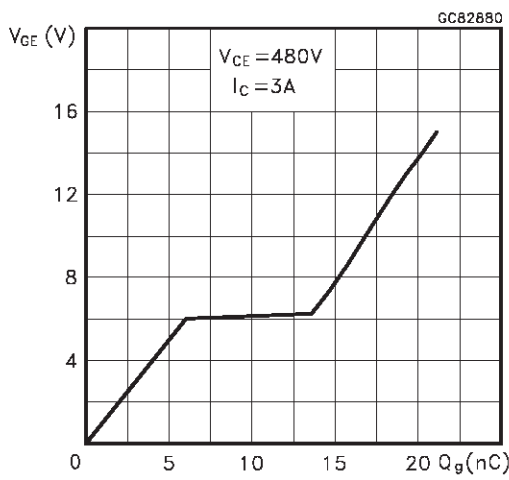
Normalized Breakdown Voltage vs Temperature



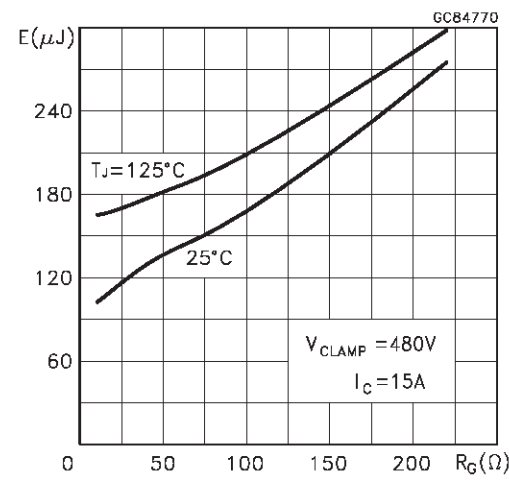
Capacitance Variations



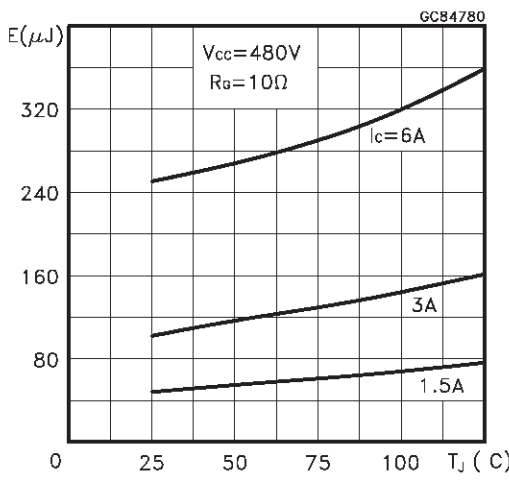
Gate Charge vs Gate-Emitter Voltage



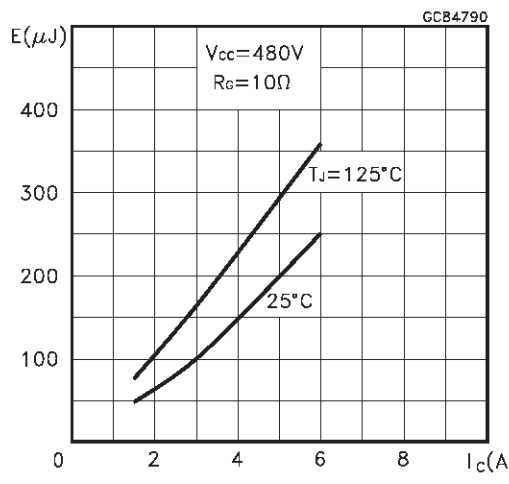
Total Switching Losses vs Gate Resistance



Total Switching Losses vs Temperature



Total Switching Losses vs Collector Current



Switching Off Safe Operating Area

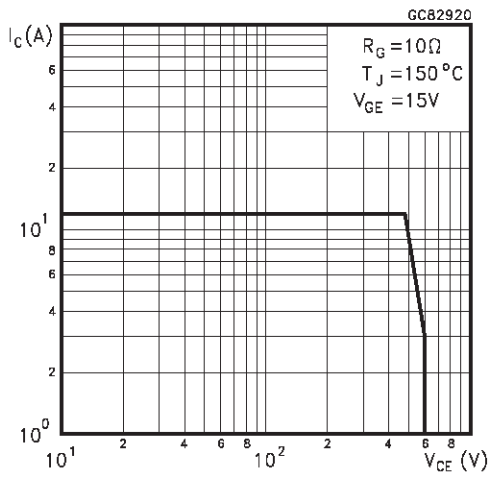


Fig. 1: Gate Charge test Circuit

Diode Forward Voltage

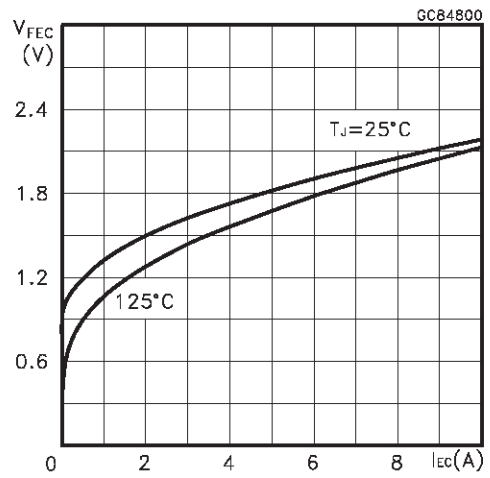


Fig. 2: Test Circuit For Inductive Load Switching

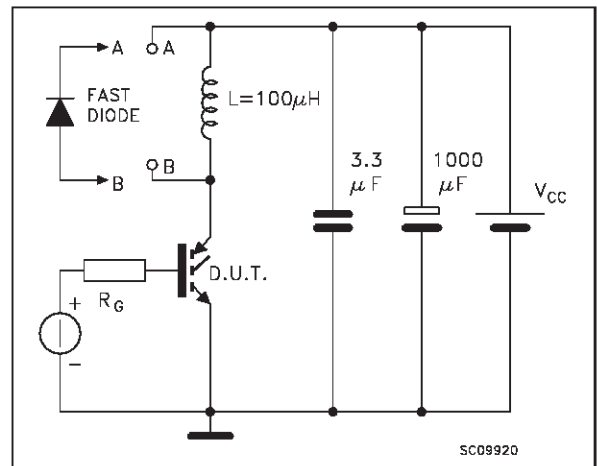
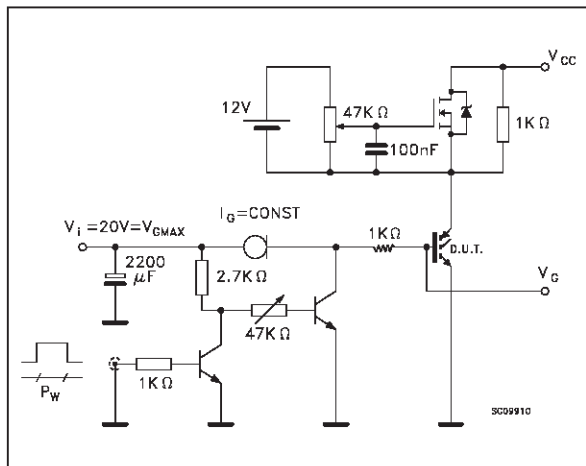
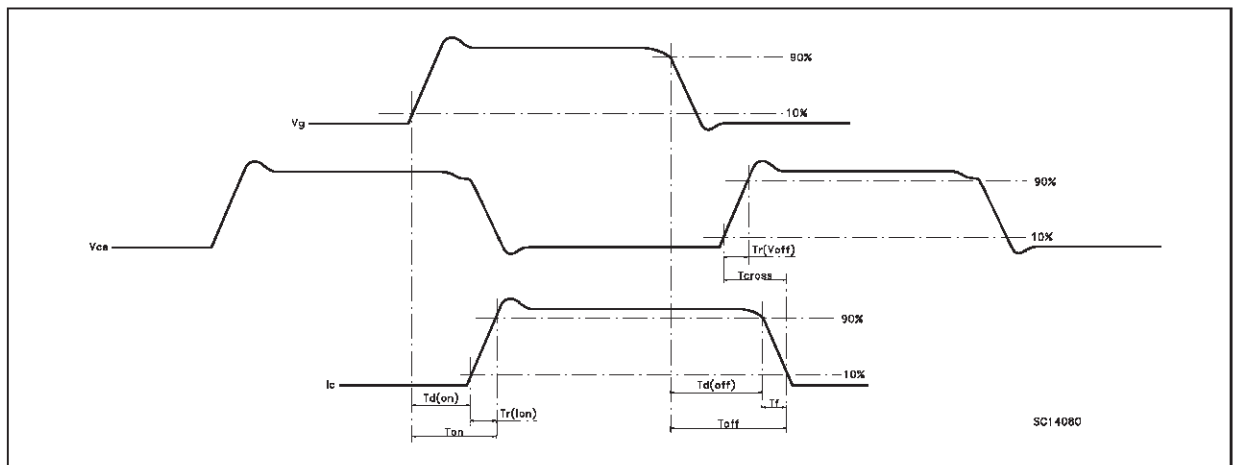
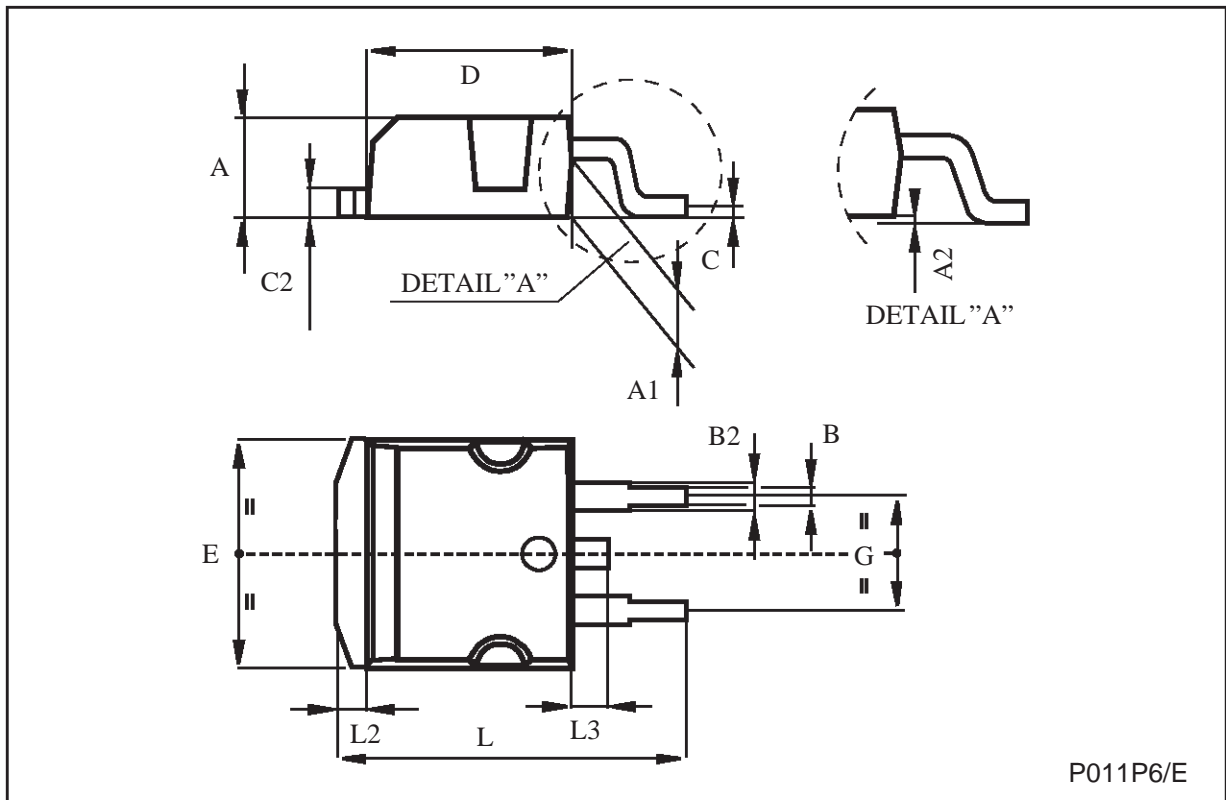


Fig. 3 Switching Waveforms



TO-263 (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
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	1.21		1.36	0.047		0.053
D	8.95		9.35	0.352		0.368
E	10		10.4	0.393		0.409
G	4.88		5.28	0.192		0.208
L	15		15.85	0.590		0.624
L2	1.27		1.4	0.050		0.055
L3	1.4		1.75	0.055		0.068



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