



# STGD7NB60H-1

## N-CHANNEL 7A - 600V IPAK PowerMESH™ IGBT

TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub>	I <sub>C</sub>
STGD7NB60H-1	600 V	< 2.8 V	7 A

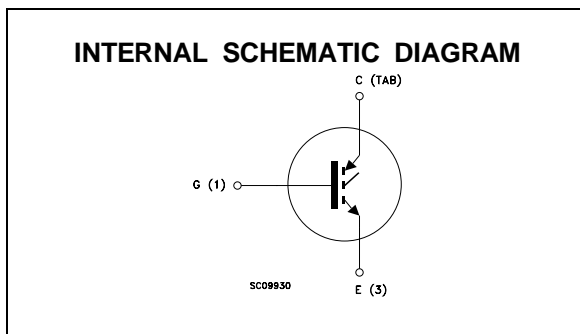
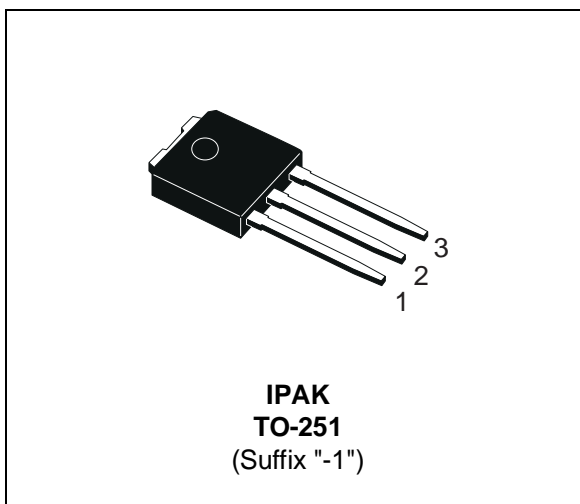
- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- LOW ON-VOLTAGE DROP (V<sub>cesat</sub>)
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- VERY HIGH FREQUENCY OPERATION
- OFF LOSSES INCLUDE TAIL CURRENT
- THROUGH-HOLE IPAK (TO-251) POWER PACKAGE IN TUBE (SUFFIX "-1")

### 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>ECR</sub>	Emitter-Collector Voltage	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	14	A
I <sub>C</sub>	Collector Current (continuous) at T <sub>c</sub> = 100 °C	7	A
I <sub>CM</sub> (•)	Collector Current (pulsed)	56	A
P <sub>tot</sub>	Total Dissipation at T <sub>c</sub> = 25 °C	55	W
	Derating Factor	0.44	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

## STGD7NB60H-1

### THERMAL DATA

R <sub>thj-case</sub>	Thermal Resistance Junction-case	Max	2.27	°C/W
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient	Max	100	°C/W
R <sub>thc-sink</sub>	Thermal Resistance Case-sink	Typ	1.5	°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			10 100	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> = 7 A V <sub>GE</sub> = 15 V I <sub>C</sub> = 7 A T <sub>j</sub> = 125 °C		2.3 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> = 7 A	3.5	5		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	390 45 10	560 68 15	730 90 20	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> = 7 A V <sub>GE</sub> = 15 V		42 7.9 17.6	55	nC nC nC
I <sub>CL</sub>	Latching Current	V <sub>clamp</sub> = 480 V R <sub>G</sub> = 10Ω T <sub>j</sub> = 150 °C	28			A

#### SWITCHING ON

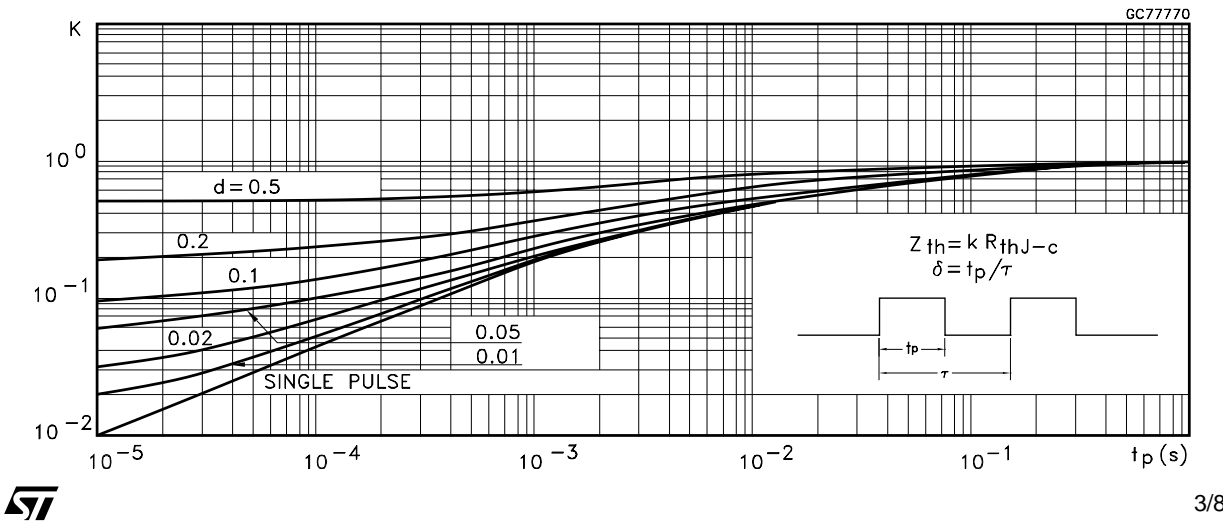
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t <sub>d(on)</sub> t <sub>r</sub>	Delay Time Rise Time	V <sub>CC</sub> = 480 V I <sub>C</sub> = 7 A V <sub>GE</sub> = 15 V R <sub>G</sub> = 10Ω		15 48		ns ns
(di/dt) <sub>on</sub>	Turn-on Current Slope	V <sub>CC</sub> = 480 V I <sub>C</sub> = 7 A R <sub>G</sub> = 10 Ω V <sub>GE</sub> = 15 V		160		A/µs
E <sub>on</sub>	Turn-on Switching Losses	T <sub>j</sub> = 125 °C		70		µJ

ELECTRICAL CHARACTERISTICS (continued)  
SWITCHING OFF

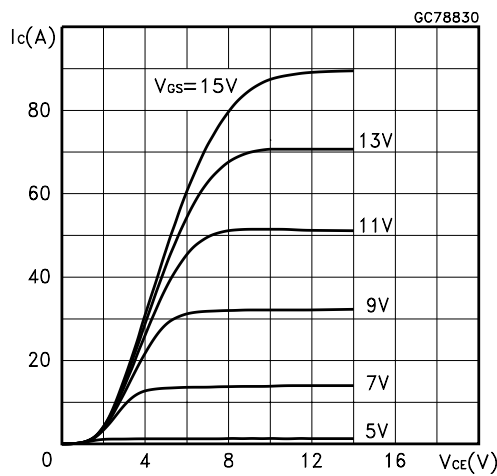
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-Over Time	$V_{CC} = 480\text{ V}$ $R_{GE} = 10\text{ }\Omega$ $I_C = 7\text{ A}$ $V_{GE} = 15\text{ V}$		85		ns
$t_r(v_{off})$	Off Voltage Rise Time			20		ns
$t_d(off)$	Delay Time			75		ns
$t_f$	Fall Time			70		ns
$E_{off(**)}$	Turn-off Switching Loss			85		$\mu\text{J}$
$E_{ts}$	Total Switching Loss			130		$\mu\text{J}$
$t_c$	Cross-Over Time	$V_{CC} = 480\text{ V}$ $R_{GE} = 10\text{ }\Omega$ $T_j = 125\text{ }^\circ\text{C}$ $I_C = 7\text{ A}$ $V_{GE} = 15\text{ V}$		150		ns
$t_r(v_{off})$	Off Voltage Rise Time			50		ns
$t_d(off)$	Delay Time			110		ns
$t_f$	Fall Time			110		ns
$E_{off(**)}$	Turn-off Switching Loss			220		$\mu\text{J}$
$E_{ts}$	Total Switching Loss			290		$\mu\text{J}$

(●) 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)

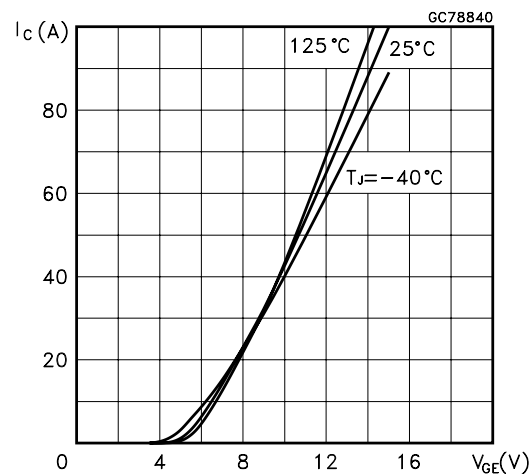
Thermal Impedance



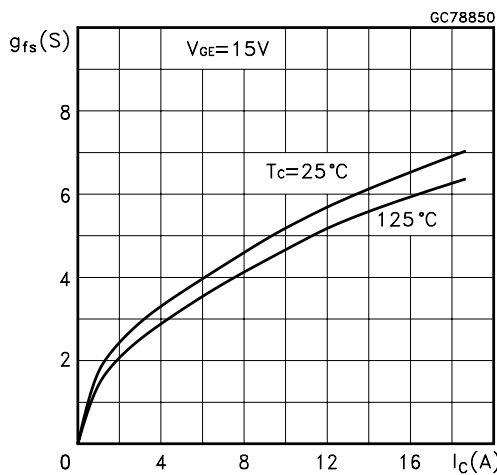
Output Characteristics



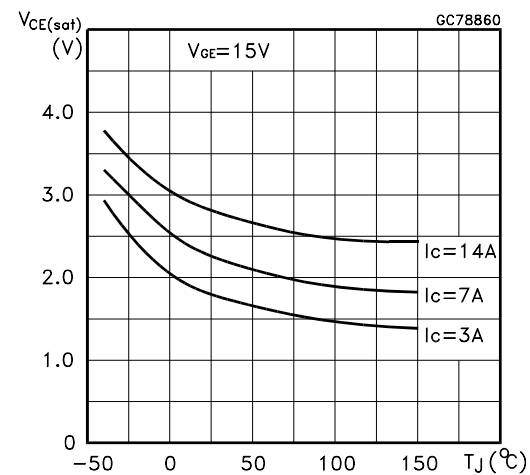
Transfer Characteristics



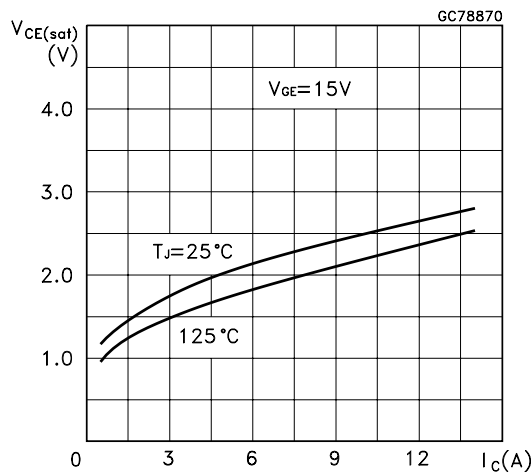
Transconductance



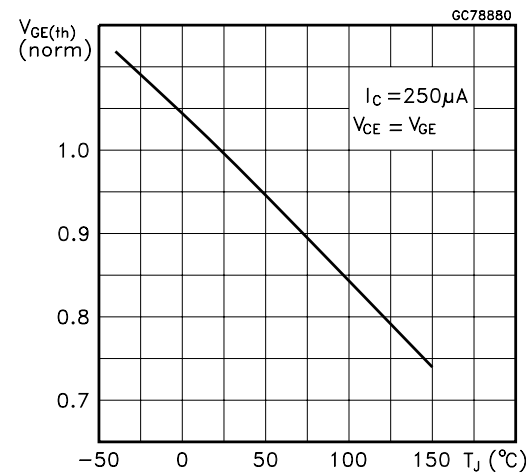
Collector-Emitter On Voltage vs Temperature



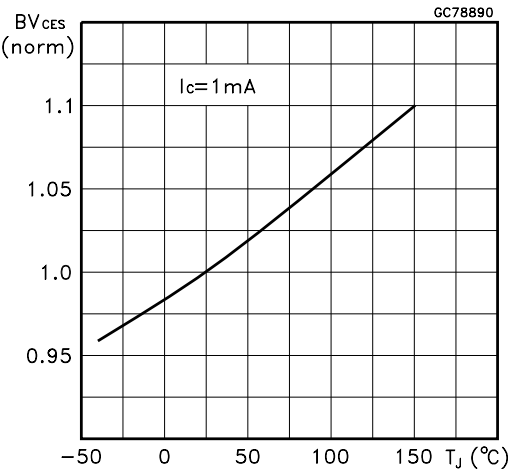
Collector-Emitter On Voltage vs Collector Current



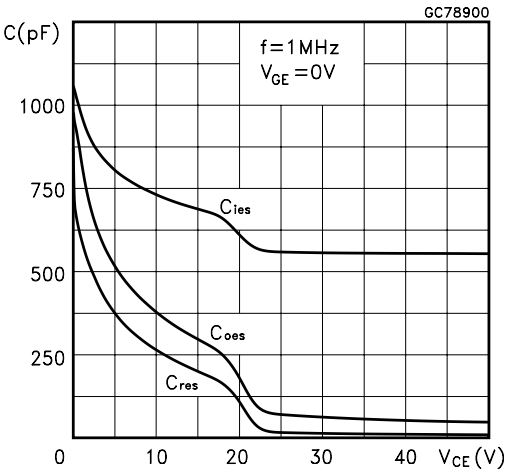
Gate Threshold vs Temperature



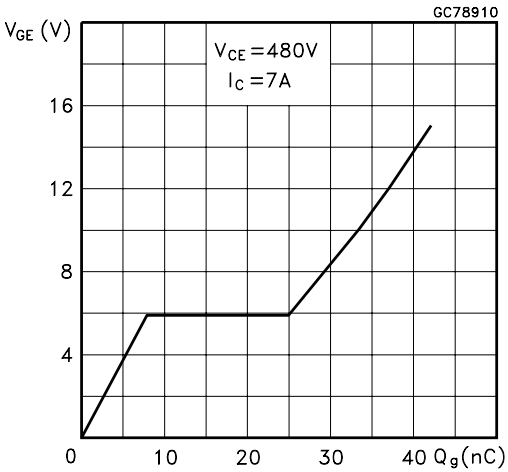
Normalized Breakdown Voltage vs Temperature



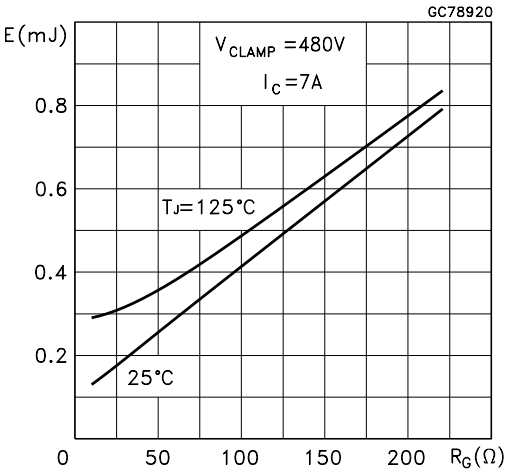
Capacitance Variations



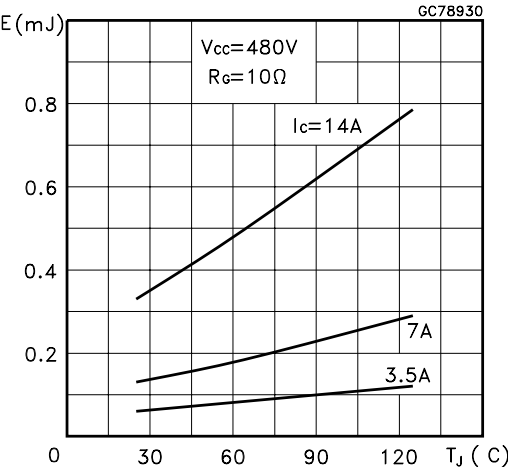
Gate Charge vs Gate-Emitter Voltage



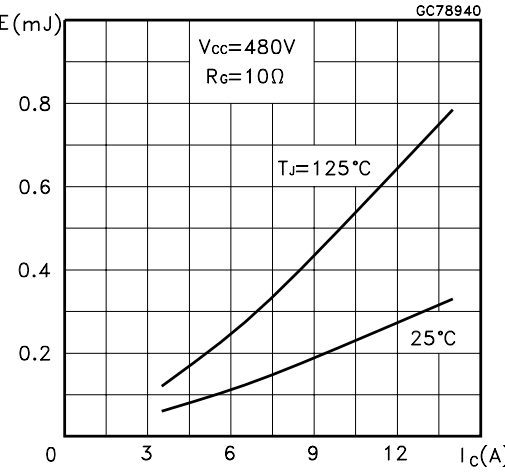
Total Switching Losses vs Gate Resistance



Total Switching Losses vs Temperature



Total Switching Losses vs Collector Current



Switching Off Safe Operating Area

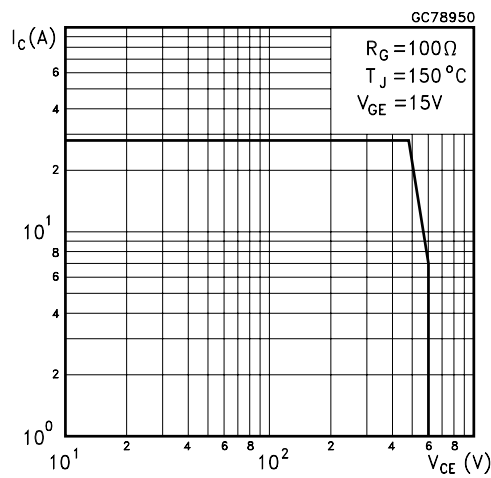


Fig. 1: Gate Charge test Circuit

Fig. 2: Test Circuit For Inductive Load Switching

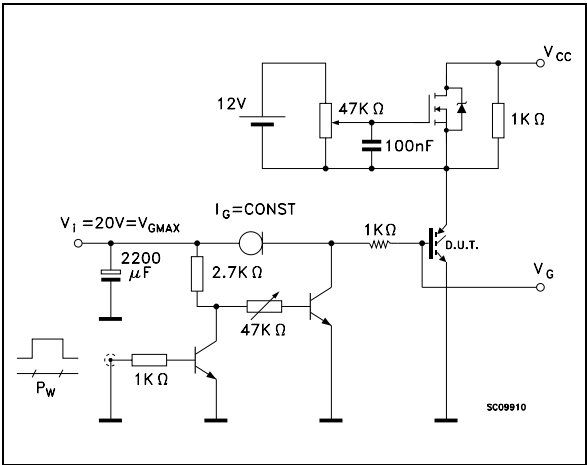
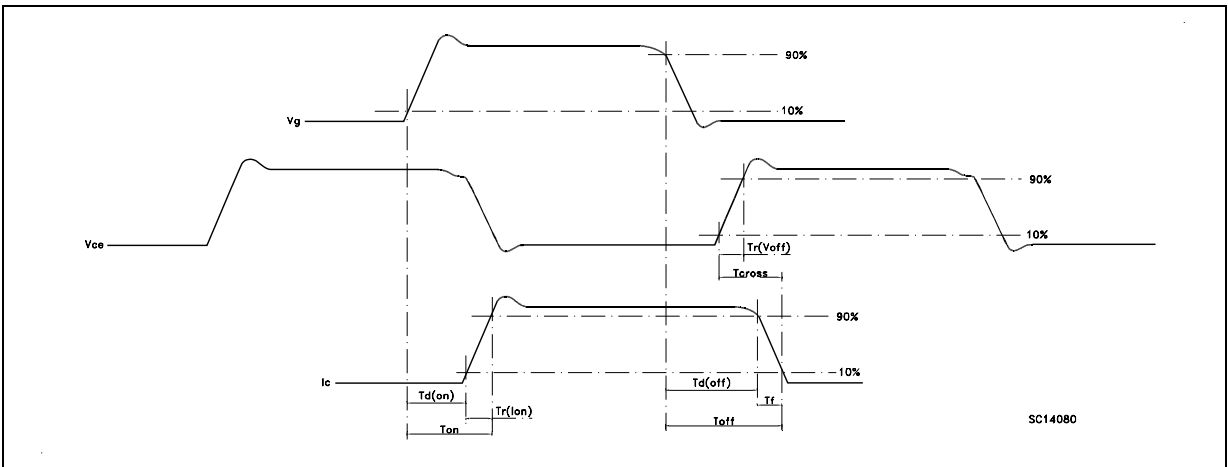
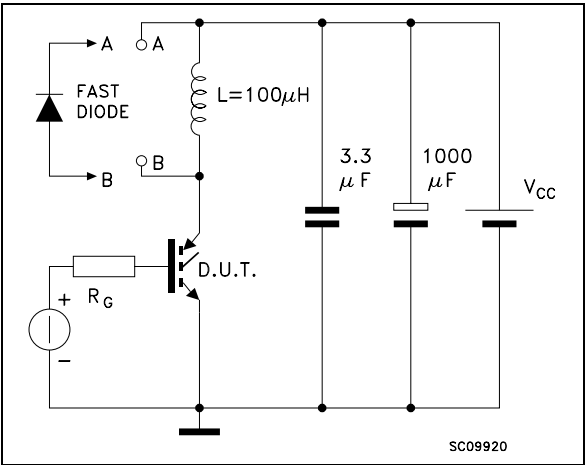
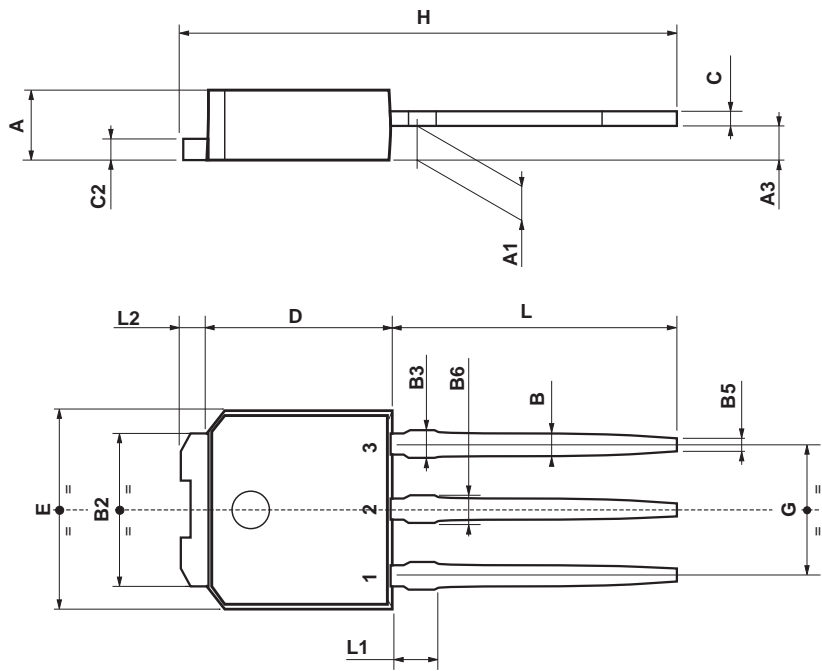


Fig. 3: Switching Waveforms



TO-251 (IPAK) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A3	0.7		1.3	0.027		0.051
B	0.64		0.9	0.025		0.031
B2	5.2		5.4	0.204		0.212
B3			0.85			0.033
B5		0.3			0.012	
B6			0.95			0.037
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
E	6.4		6.6	0.252		0.260
G	4.4		4.6	0.173		0.181
H	15.9		16.3	0.626		0.641
L	9		9.4	0.354		0.370
L1	0.8		1.2	0.031		0.047
L2		0.8	1		0.031	0.039



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