



# STGP7NB60HD STGP7NB60HDFP

## N-CHANNEL 7A - 600V TO-220/FP PowerMESH™ IGBT

TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub>	I <sub>C</sub>
STGP7NB60HD	600 V	< 2.8 V	7 A
STGP7NB60HDFP	600 V	< 2.8 V	7 A

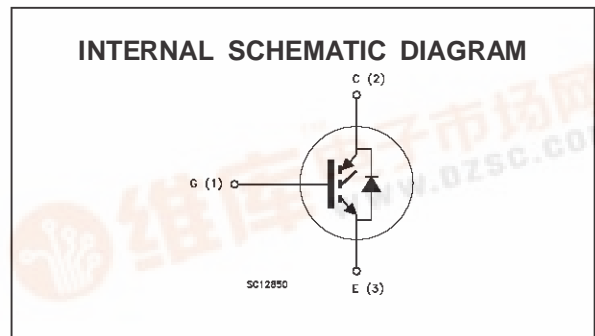
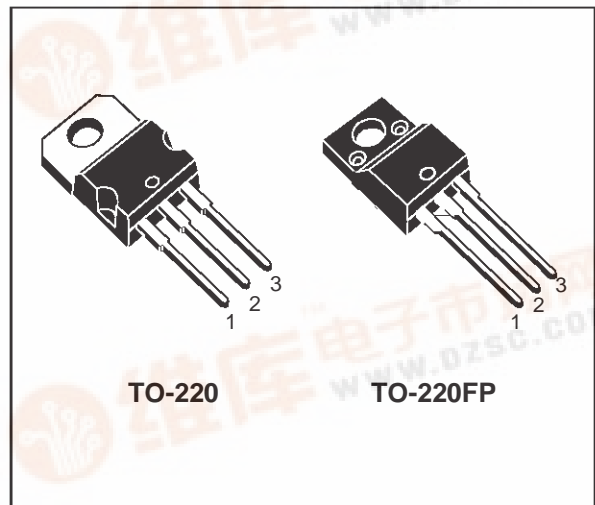
- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- LOW ON-VOLTAGE DROP (V<sub>cesat</sub>)
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- VERY HIGH FREQUENCY OPERATION
- OFF LOSSES INCLUDE TAIL CURRENT
- CO-PACKAGED WITH TURBOSWITCH™ ANTIPARALLEL DIODE

### 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
- SMPS AND PFC IN BOTH HARD SWITCH AND RESONANT TOPOLOGIES



### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STGP7NB60HD	STGP7NB60HDFP	
V <sub>CES</sub>	Collector-Emitter Voltage (V <sub>GS</sub> = 0)	600	600	V
V <sub>GE</sub>	Gate-Emitter Voltage	± 20	± 20	V
I <sub>C</sub>	Collector Current (continuous) at T <sub>c</sub> = 25 °C	14	13	A
I <sub>C</sub>	Collector Current (continuous) at T <sub>c</sub> = 100 °C	7	6	A
I <sub>CM</sub> (●)	Collector Current (pulsed)	56	56	A
P <sub>tot</sub>	Total Dissipation at T <sub>c</sub> = 25 °C	80	35	W
	Derating Factor	0.64	0.28	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

## STGP7NB60HD/FP

### THERMAL DATA

			TO-220	TO-220FP	
R <sub>thj-case</sub>	Thermal Resistance Junction-case	Max	1.56	3.57	°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			250 2000	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		185		μJ

**ELECTRICAL CHARACTERISTICS** (continued)

**SWITCHING OFF**

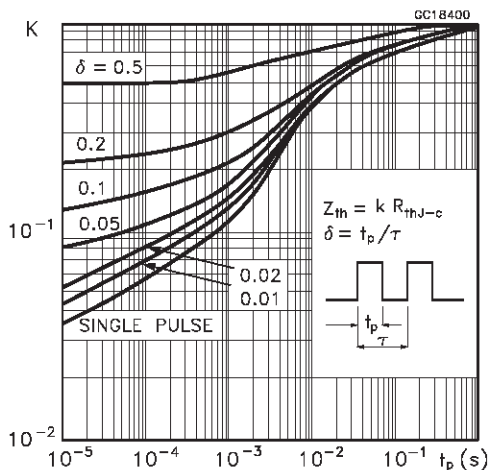
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-Over Time	$V_{CC} = 480\text{ V}$		85		ns
$t_r(V_{off})$	Off Voltage Rise Time	$I_C = 7\text{ A}$		20		ns
$t_{d(off)}$	Delay Time	$R_{GE} = 10\ \Omega$		75		ns
$t_f$	Fall Time	$V_{GE} = 15\text{ V}$		70		ns
$E_{off(**)}$	Turn-off Switching Loss			85		$\mu\text{J}$
$E_{ts(\circ)}$	Total Switching Loss			235		$\mu\text{J}$
$t_c$	Cross-Over Time	$V_{CC} = 480\text{ V}$		150		ns
$t_r(V_{off})$	Off Voltage Rise Time	$I_C = 7\text{ A}$		50		ns
$t_{d(off)}$	Delay Time	$R_{GE} = 10\ \Omega$		110		ns
$t_f$	Fall Time	$T_j = 125\text{ }^\circ\text{C}$		110		ns
$E_{off(**)}$	Turn-off Switching Loss			220		$\mu\text{J}$
$E_{ts(\circ)}$	Total Switching Loss			405		$\mu\text{J}$

**COLLECTOR-EMITTER DIODE**

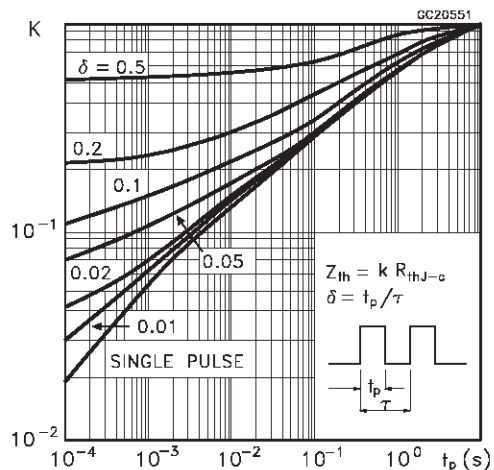
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_f$	Forward Current				7	A
$I_{fm}$	Forward Current pulsed				56	A
$V_f$	Forward On-Voltage	$I_f = 7\text{ A}$		1.6	2.0	V
		$I_f = 7\text{ A}$		1.4		V
		$T_j = 125\text{ }^\circ\text{C}$				
$t_{rr}$	Reverse Recovery Time	$I_f = 7\text{ A}$		100		ns
$Q_{rr}$	Reverse Recovery Charge	$di/dt = 100\text{ A}/\mu\text{S}$		180		nC
$I_{rrm}$	Reverse Recovery Current	$V_R = 200\text{ V}$		3.6		A
		$T_j = 125\text{ }^\circ\text{C}$				

- (●) Pulse width limited by max. junction temperature
- (○) Include recovery losses on the STTA506 freewheeling diode
- (\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %
- (\*\*) Losses Include Also The Tail (Jedec Standardization)

Thermal Impedance For TO-220

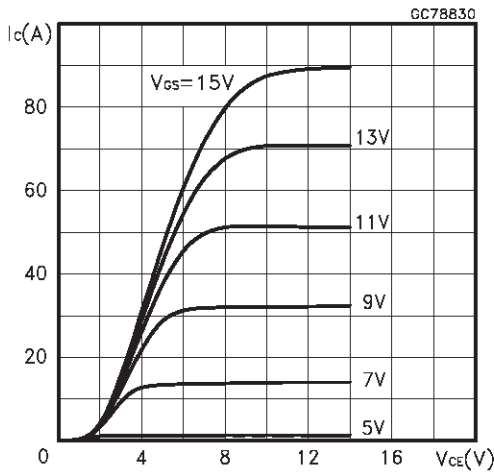


Thermal Impedance For TO-220FP

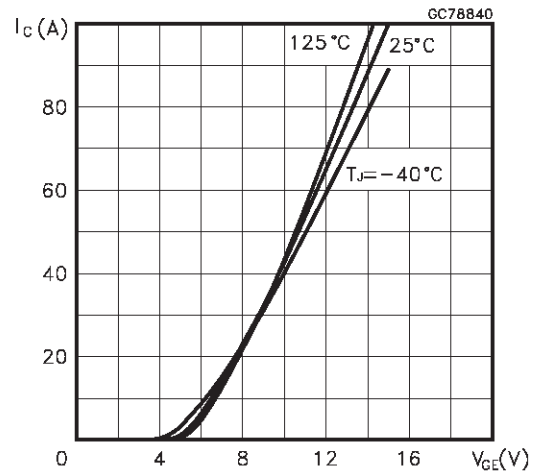


# STGP7NB60HD/FP

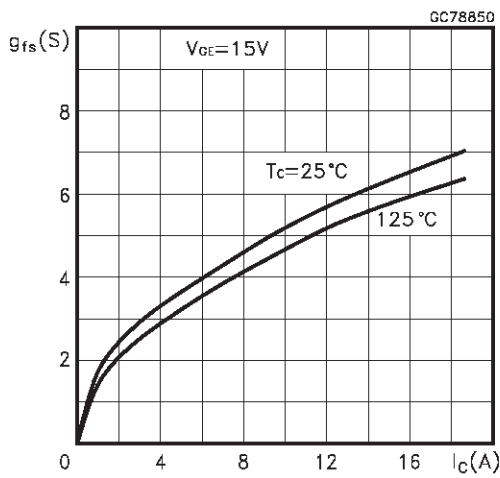
Output Characteristics



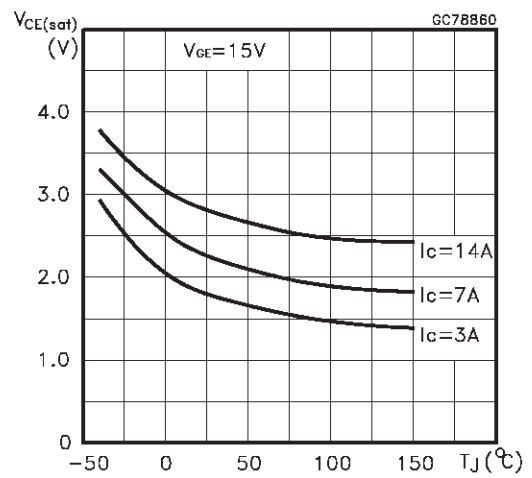
Transfer Characteristics



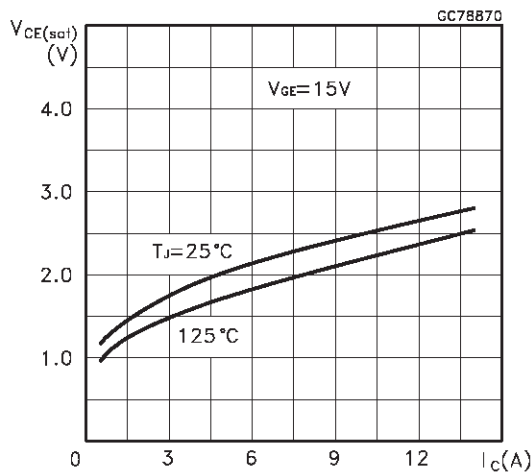
Transconductance



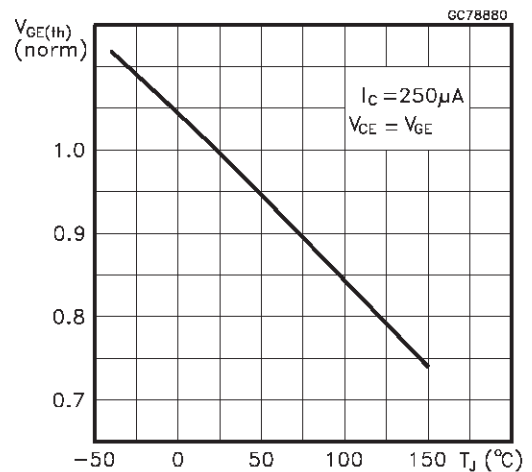
Collector-Emitter On Voltage vs Temperature



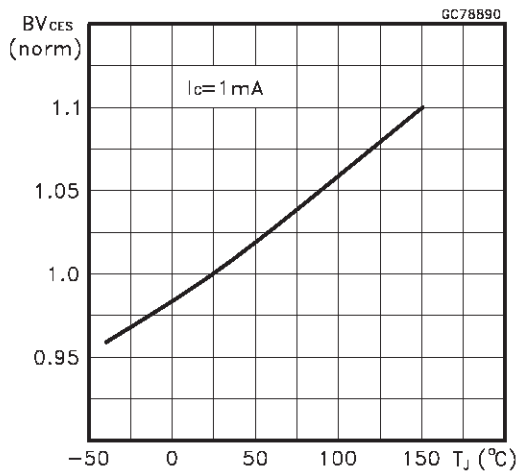
Collector-Emitter On Voltage vs Collector Current



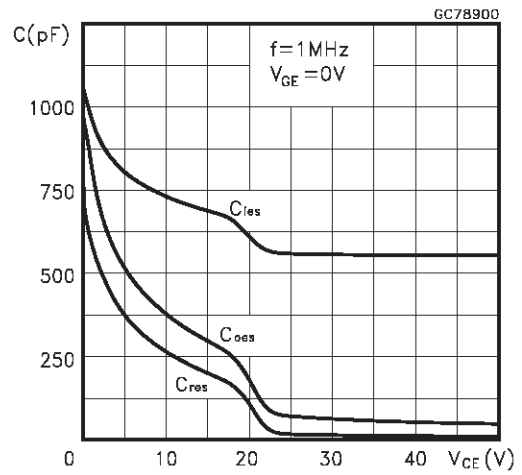
Gate Threshold vs Temperature



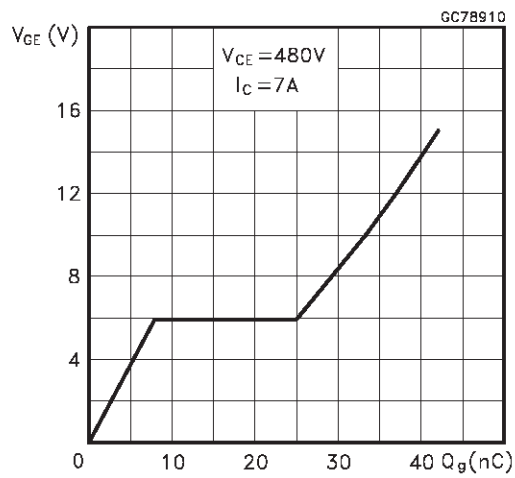
Normalized Breakdown Voltage vs Temperature



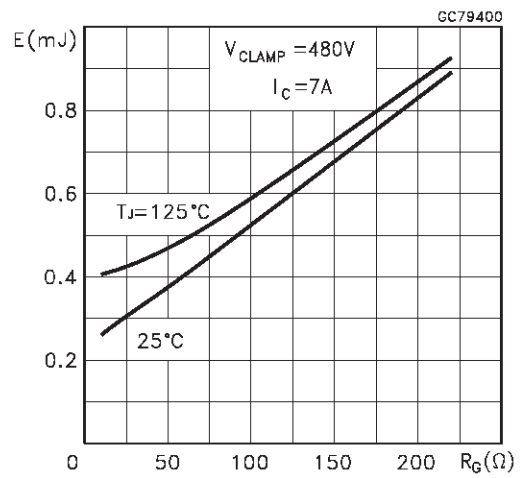
Capacitance Variations



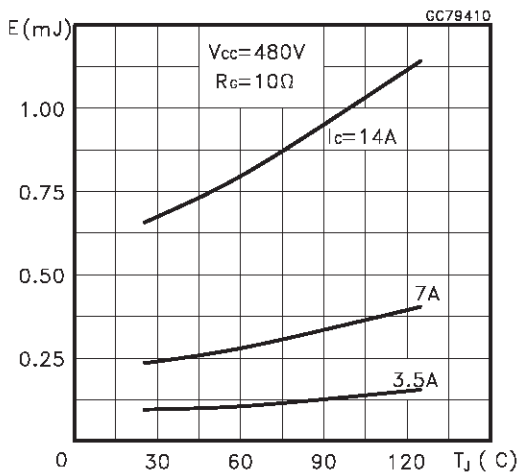
Gate Charge vs Gate-Emitter Voltage



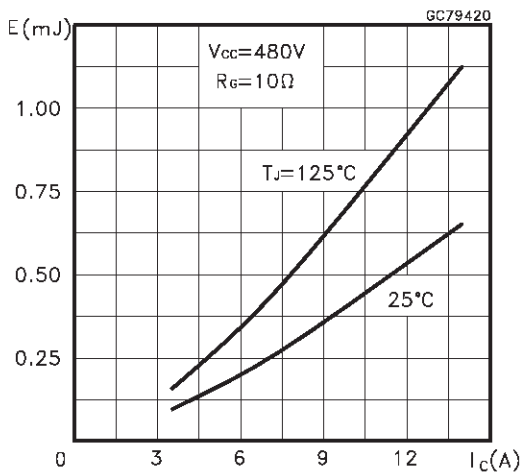
Total Switching Losses vs Gate Resistance



Total Switching Losses vs Temperature



Total Switching Losses vs Collector Current



# STGP7NB60HD/FP

## Switching Off Safe Operating Area

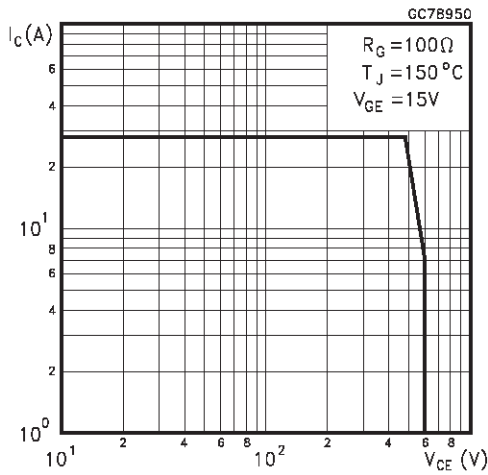


Fig. 1: Gate Charge test Circuit

## Diode Forward Voltage

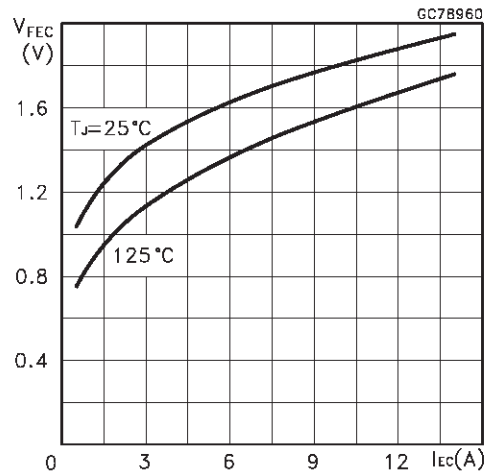


Fig. 2: Test Circuit For Inductive Load Switching

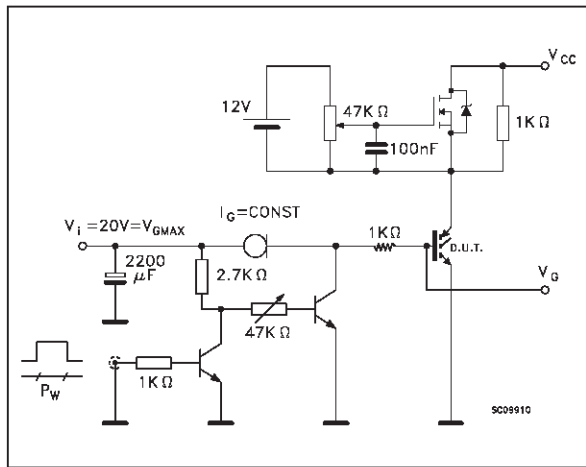
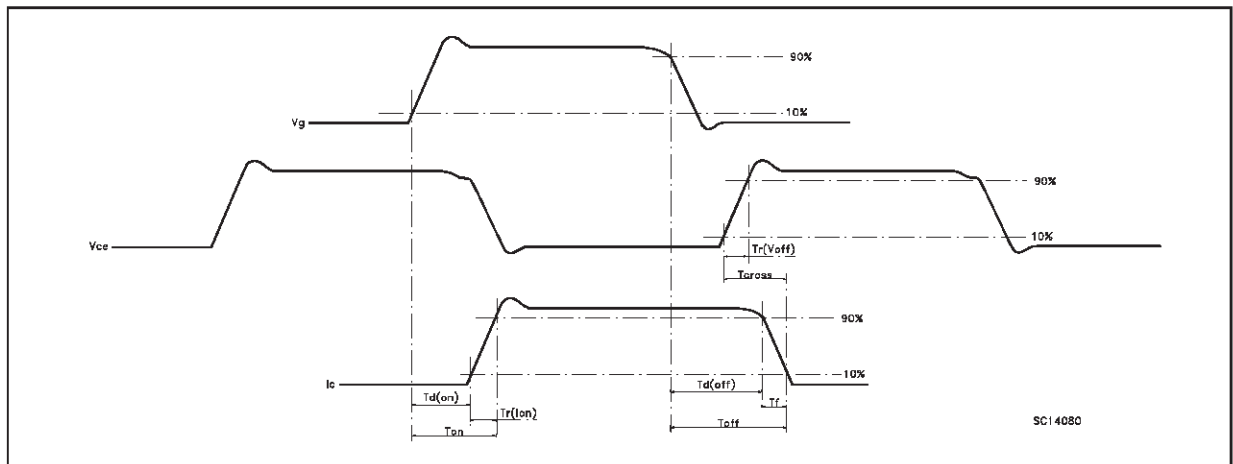
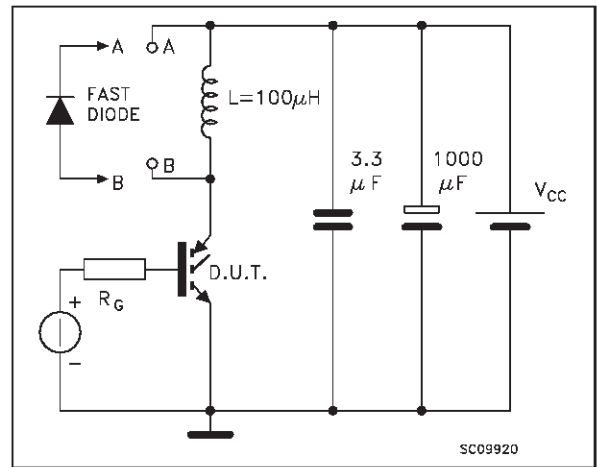
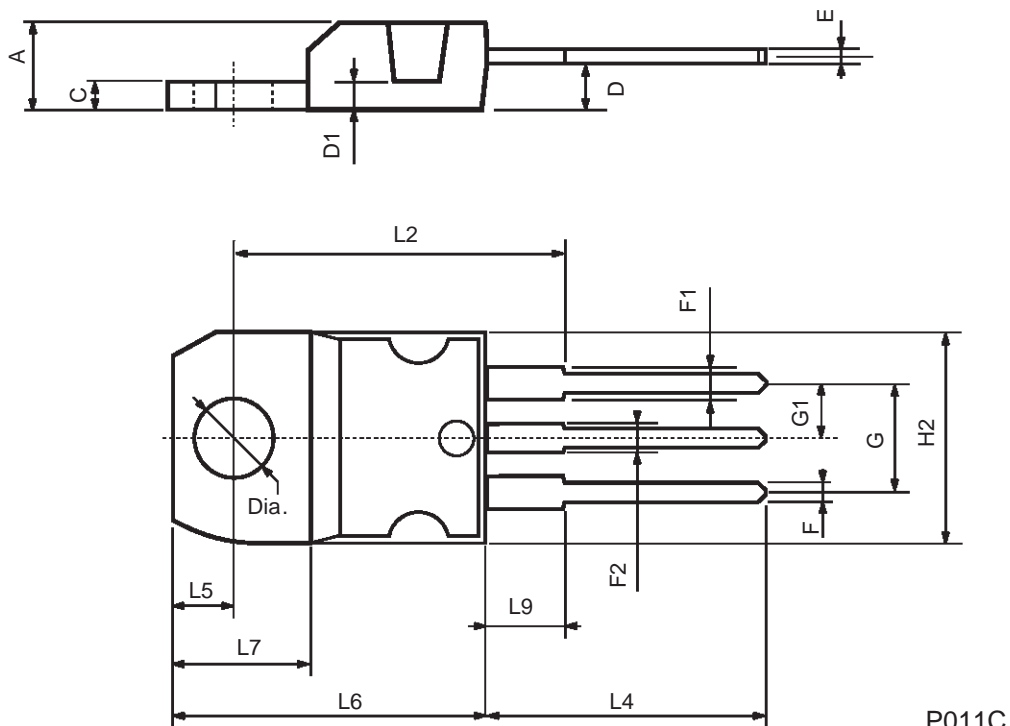


Fig. 3: Switching Waveforms



## TO-220 MECHANICAL DATA

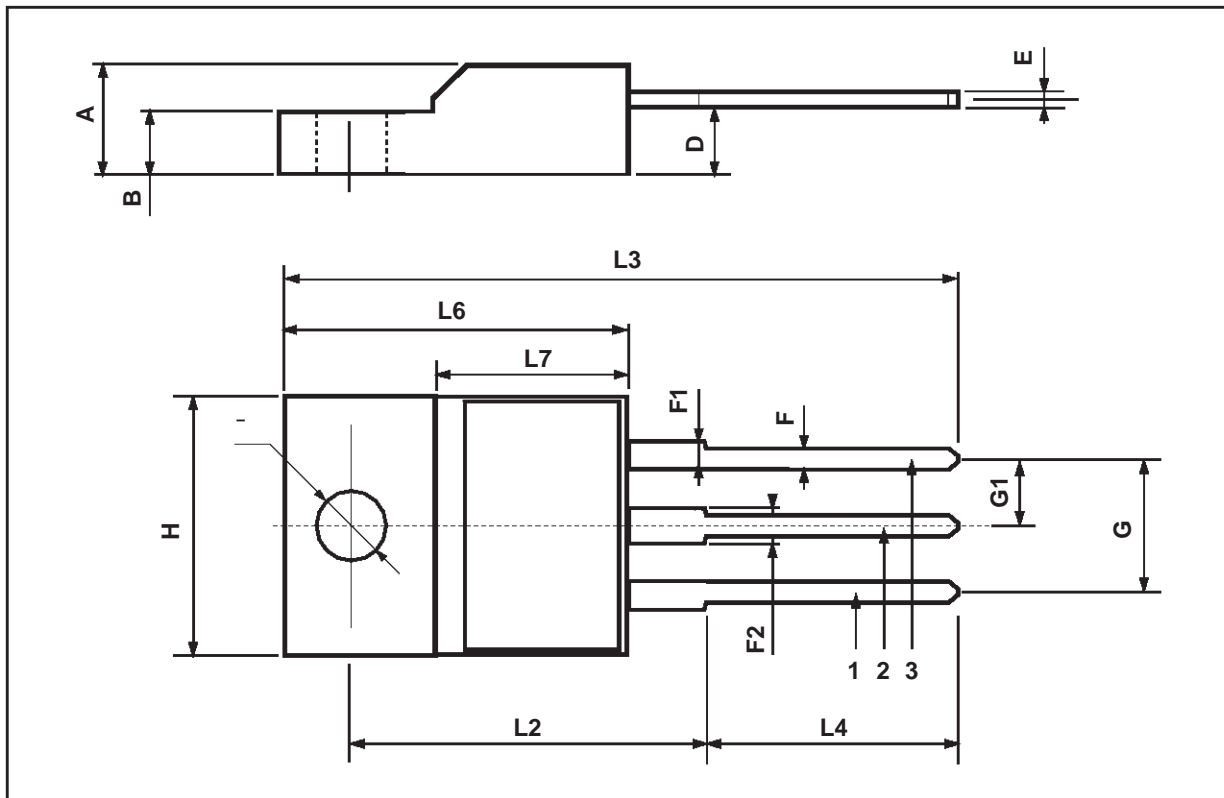
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
C	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
D1		1.27			0.050	
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
G1	2.4		2.7	0.094		0.106
H2	10.0		10.40	0.393		0.409
L2		16.4			0.645	
L4	13.0		14.0	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.25		15.75	0.600		0.620
L7	6.2		6.6	0.244		0.260
L9	3.5		3.93	0.137		0.154
DIA.	3.75		3.85	0.147		0.151



P011C

TO-220FP MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.7	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.7	0.045		0.067
F2	1.15		1.7	0.045		0.067
G	4.95		5.2	0.195		0.204
G1	2.4		2.7	0.094		0.106
H	10		10.4	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	0.385		0.417
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
∅	3		3.2	0.118		0.126





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