



# STGP10NB60S

## STGP10NB60SFP- STGB10NB60S

N-CHANNEL 10A - 600V - TO-220/TO-220FP/D<sup>2</sup>PAK  
PowerMESH™ IGBT

**Table 1: General Features**

TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub> (Max) @25°C	I <sub>C</sub> @100°C
STGP10NB60S	600 V	< 1.7 V	10 A
STGP10NB60SFP	600 V	< 1.7 V	10 A
STGB10NB60S	600 V	< 1.7 V	10 A

- HIGHT INPUT IMPEDANCE (VOLTAGE DRIVEN)
- VERY LOW ON-VOLTAGE DROP ( V<sub>cesat</sub> )
- HIGH CURRENT CAPABILITY
- OFF LOSSES INCLUDE TAIL CURRENT

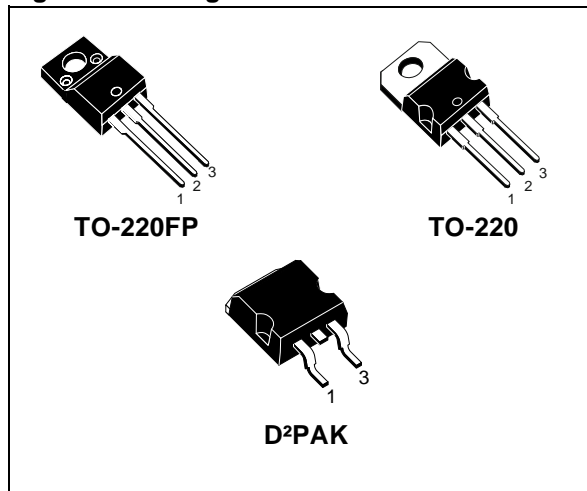
### DESCRIPTION

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 "S" identifies a family optimized achieve minimum on-voltage drop for low frequency applications (<1kHz).

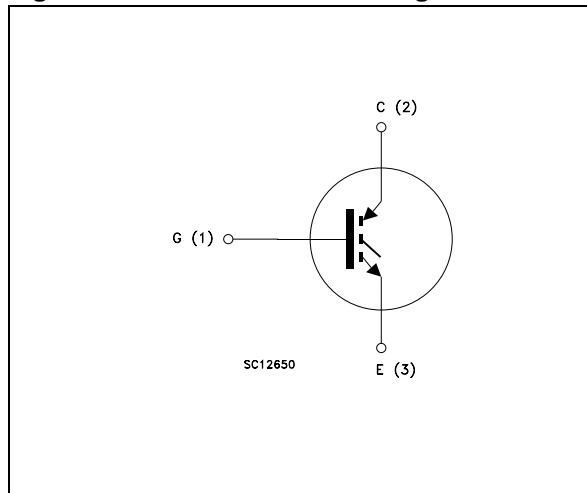
### APPLICATIONS

- LIGHT DIMMER
- STATIC RELAYS
- MOTOR CONTROL

**Figure 1: Package**



**Figure 2: Internal Schematic Diagram**



**Table 2: Order Codes**

SALES TYPE	MARKING	PACKAGE	PACKAGING
STGP10NB60S	GP10NB60S	TO-220	TUBE
STGP10NB60SFP	GP10NB60SFP	TO-220FP	TUBE
STGB10NB60S	GB10NB60S	D <sup>2</sup> PAK	TAPE & REEL

**Table 3: Absolute Maximum ratings**

Symbol	Parameter	Value		Unit
		TO-220/D <sup>2</sup> PAK	TO-220FP	
V <sub>CES</sub>	Collector-Emitter Voltage (V <sub>GS</sub> = 0)	600		V
V <sub>ECR</sub>	Reverse Battery Protection	20		V
V <sub>GE</sub>	Gate-Emitter Voltage	± 20		V
I <sub>C</sub>	Collector Current (continuous) at 25°C	20		A
I <sub>C</sub>	Collector Current (continuous) at 100°C	10		A
I <sub>CM</sub> (1)	Collector Current (pulsed)	80		A
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	80	25	W
	Derating Factor	0.64	0.20	
V <sub>ISO</sub>	Insulation Withstand Voltage A.C.(t=1sec, Tc=25°C)	--	2500	V
T <sub>stg</sub>	Storage Temperature	- 55 to 150		°C
T <sub>j</sub>	Operating Junction Temperature			

(1)Pulse width limited by max. junction temperature.

**Table 4: Thermal Data**

			Min.	Typ.	Max.	Unit
R <sub>thj-case</sub>	Thermal Resistance Junction-case	TO-220 D <sup>2</sup> PAK			1.56	°C/W
		TO-220FP			5.0	°C/W
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient				62.5	°C/W
T <sub>L</sub>	Maximum Lead Temperature for Soldering Purpose (1.6 mm from case, for 10 sec.)			300		°C

**ELECTRICAL CHARACTERISTICS (T<sub>CASE</sub> =25°C UNLESS OTHERWISE SPECIFIED)**

**Table 5: Off**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>BR(CES)</sub>	Collectro-Emitter Breakdown Voltage	I <sub>C</sub> = 250 μA, V <sub>GE</sub> = 0	600			V
V <sub>BR(ECS)</sub>	Emitter-Collector Breakdown Voltage	I <sub>C</sub> = 1mA, V <sub>GE</sub> = 0	20			V
I <sub>CES</sub>	Collector cut-off (V <sub>GE</sub> = 0)	V <sub>GE</sub> = Max Rating, Tc=25°C V <sub>CE</sub> = Max Rating, Tc=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

**Table 6: 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	2.5		5	V
V <sub>CE(SAT)</sub>	Collector-Emitter Saturation Voltage	V <sub>GE</sub> =4.5 V, I <sub>C</sub> = 5 A,		1.15	1.7	V
		V <sub>GE</sub> =4.5 V, I <sub>C</sub> = 10 A,		1.35		V
		V <sub>GE</sub> =4.5 V, I <sub>C</sub> = 10 A, T <sub>j</sub> = 125°C		1.25		V

## ELECTRICAL CHARACTERISTICS (CONTINUED)

Table 7: Dynamic

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs}$ (1)	Forward Transconductance	$V_{CE} = 25 \text{ V}$ , $I_C = 10 \text{ A}$		7		S
$C_{ies}$	Input Capacitance	$V_{CE} = 25 \text{ V}$ , $f = 1 \text{ MHz}$ , $V_{GE} = 0$		610		pF
$C_{oes}$	Output Capacitance			65		pF
$C_{res}$	Reverse Transfer Capacitance			12		pF
$Q_g$	Total Gate Charge	$V_{CE} = 400 \text{ V}$ , $I_C = 10 \text{ A}$ , $V_{GE} = 15 \text{ V}$ (see Figure 20)		33		nC
$I_{CL}$	Latching Current	$V_{clamp} = 480 \text{ V}$ , $T_j = 150^\circ\text{C}$ $R_G = 1 \text{ k}\Omega$	20			A

Table 8: Switching On

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on Delay Time Current Rise Time	$V_{CC} = 480 \text{ V}$ , $I_C = 10 \text{ A}$ $R_G=1\text{K}\Omega$ $V_{GE} = 15 \text{ V}$ (see Figure 18)		0.7 0.46		$\mu\text{s}$ $\mu\text{s}$
$(di/dt)_{on}$ $E_{on}$ (1)	Turn-on Current Slope Turn-on Switching Losses	$V_{CC} = 480 \text{ V}$ , $I_C = 10 \text{ A}$ $R_G=1\text{K}\Omega$ $V_{GE} = 15 \text{ V}$ , $T_j = 125^\circ\text{C}$		8 0.6		$\text{A}/\mu\text{s}$ $\text{mJ}$

Table 9: Switching Off

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-Over Time	$V_{CC} = 480 \text{ V}$ , $I_C = 10 \text{ A}$ , $R_G = 10 \Omega$ , $V_{GE} = 15 \text{ V}$ $T_J = 25^\circ\text{C}$ (see Figure 18)		2.2		$\mu\text{s}$
$t_r(V_{off})$	Off Voltage Rise Time			1.2		$\mu\text{s}$
$t_f$	Current Fall Time			1.2		$\mu\text{s}$
$E_{off}$ (**)	Turn-off Switching Loss			5.0		mJ
$t_c$	Cross-Over Time	$V_{CC} = 480 \text{ V}$ , $I_C = 10 \text{ A}$ , $R_G = 10 \Omega$ , $V_{GE} = 15 \text{ V}$ $T_J = 125^\circ\text{C}$ (see Figure 18)		3.8		$\mu\text{s}$
$t_r(V_{off})$	Off Voltage Rise Time			1.2		$\mu\text{s}$
$t_f$	Current Fall Time			1.9		$\mu\text{s}$
$E_{off}$ (**)	Turn-off Switching Loss			8.0		mJ

(1) Pulse width limited by max. junction temperature.

(\*\*) Losses Include Also the Tail (Jedec Standardization)

Figure 3: Output Characteristics

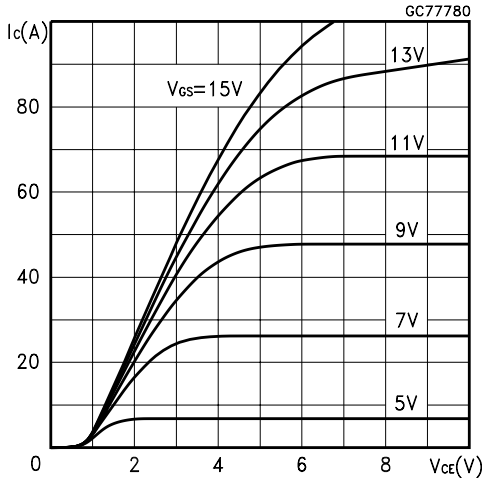


Figure 4: Transconductance

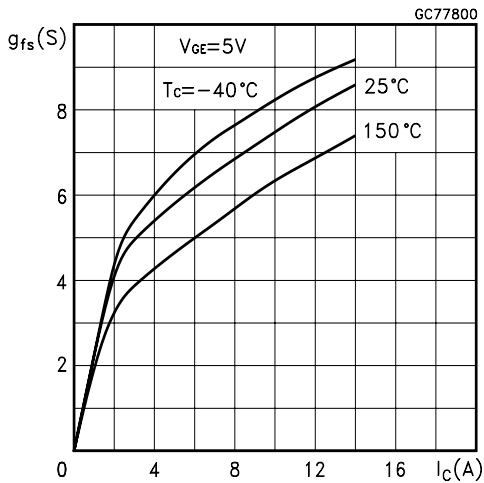


Figure 5: Collector-Emitter On Voltage vs Collector Current

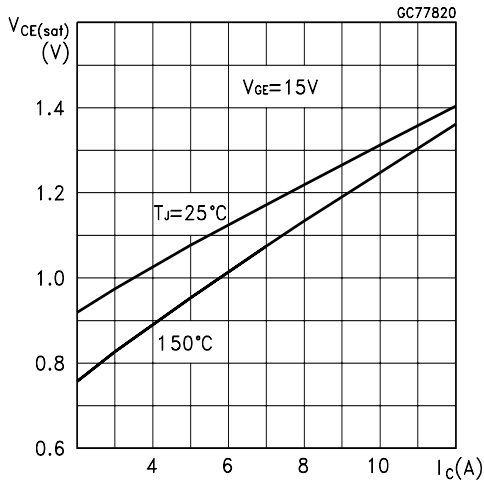


Figure 6: Transfer Characteristics

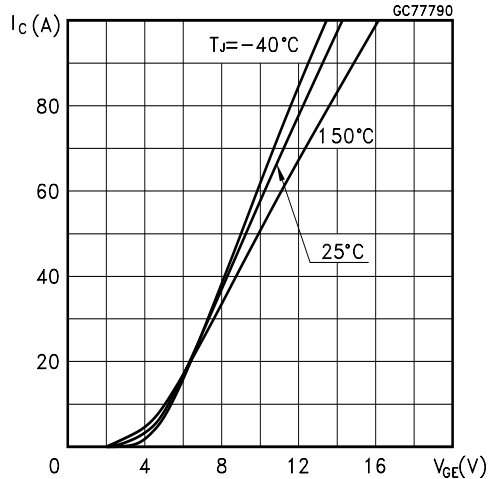


Figure 7: Collector-Emitter On Voltage vs Temperature

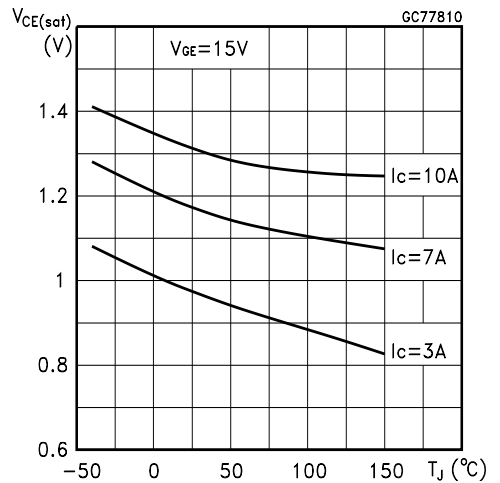


Figure 8: Gate Threshold vs Temperature

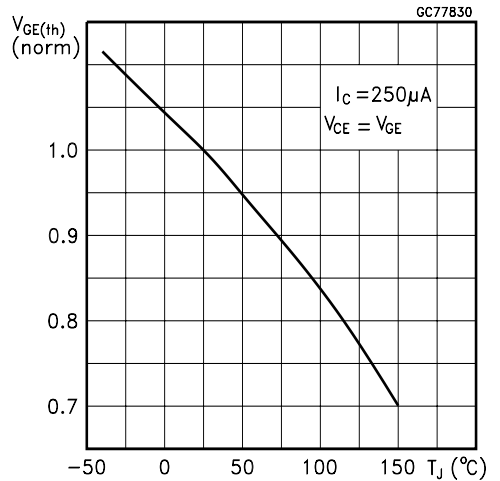


Figure 9: Capacitance Variations

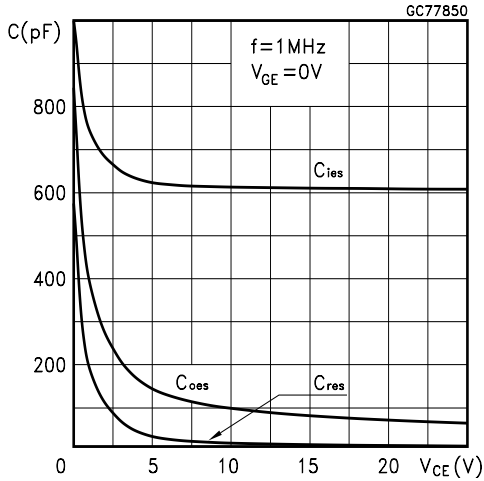


Figure 10: Off Losses vs Gate Resistance

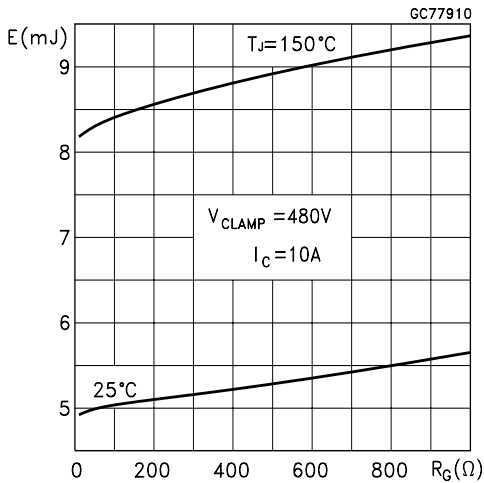


Figure 11: Normalized Breakdown Voltage vs Temperature

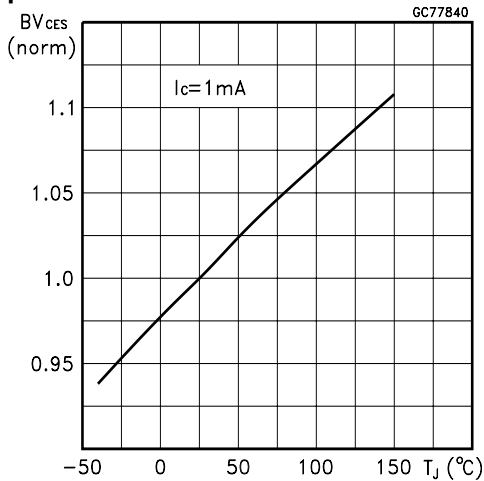


Figure 12: Gate Charge vs Gate-Emitter Voltage

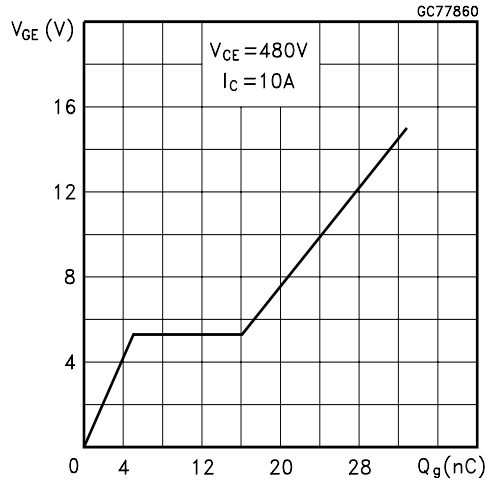


Figure 13: Off Losses vs Temperature

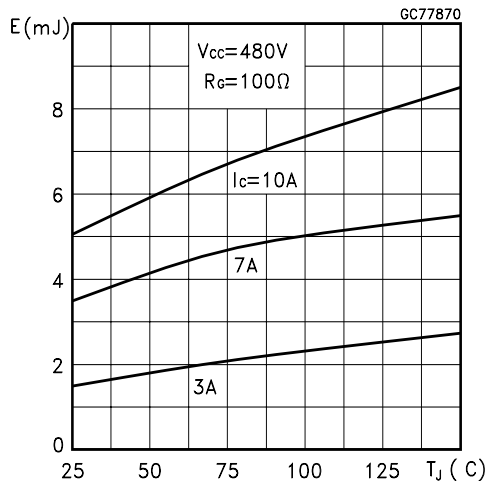


Figure 14: Off Losses vs Collector Current

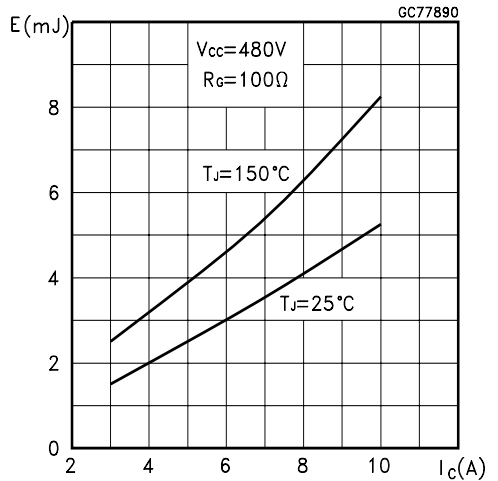
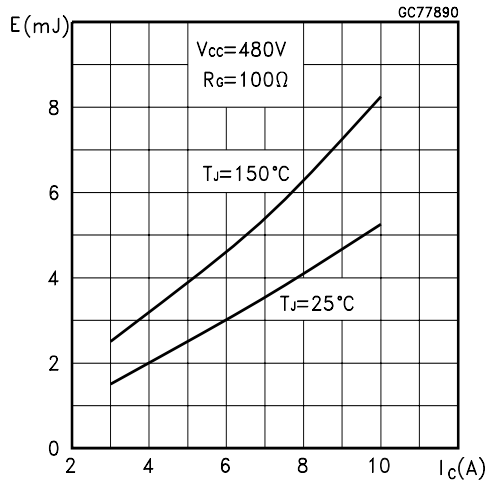
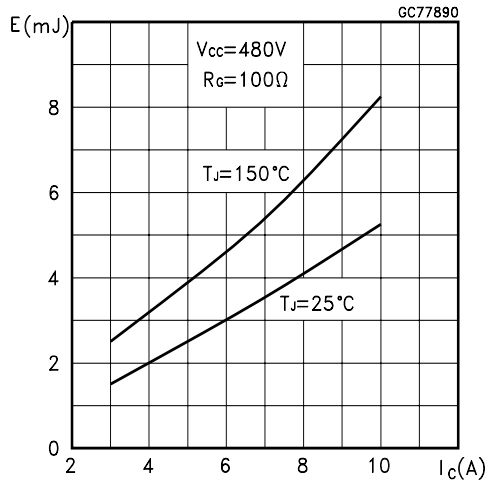


Figure 15: Thermal Impedance For TO-220/ D<sup>2</sup>PAK

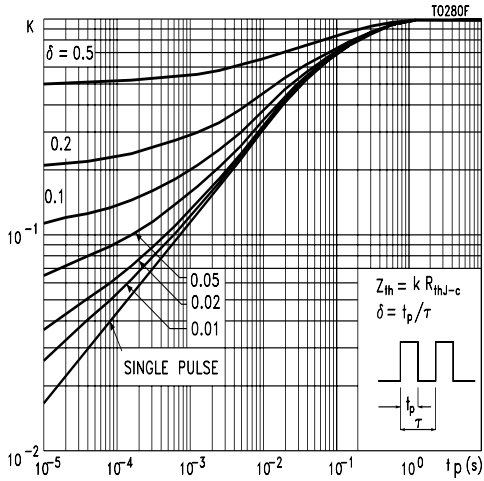


Figure 16: Turn-Off SOA

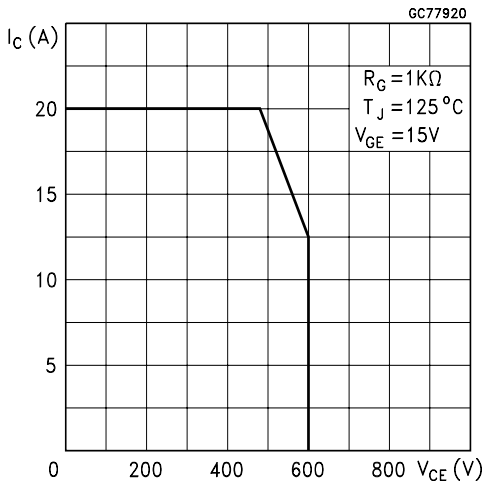


Figure 17: Thermal Impedance For TO-220FP

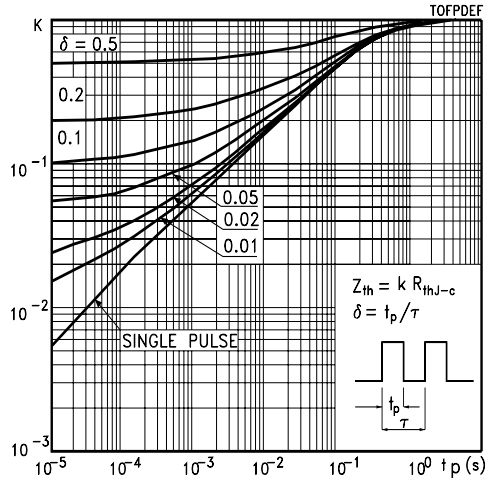


Figure 18: Test Circuit for Inductive Load Switching

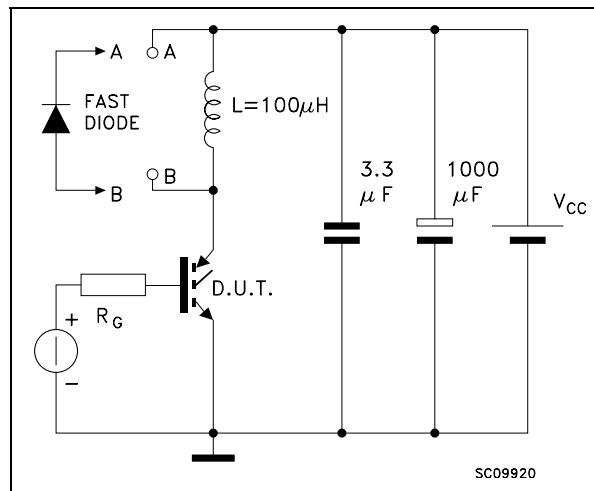


Figure 20: Gate Charge Test Circuit

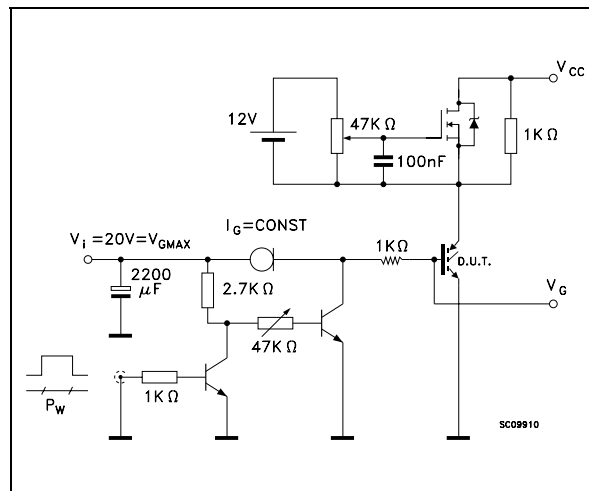
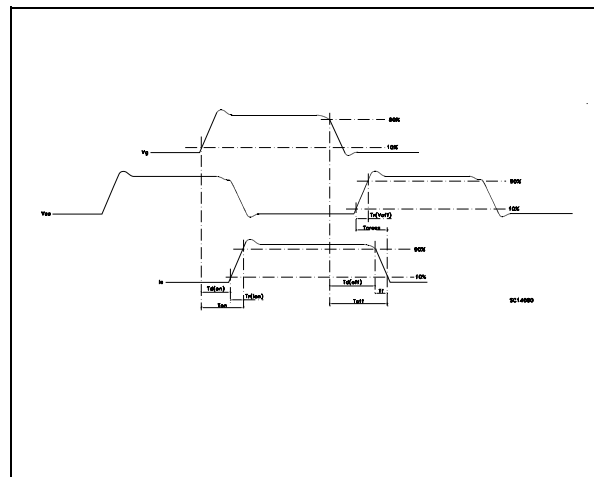
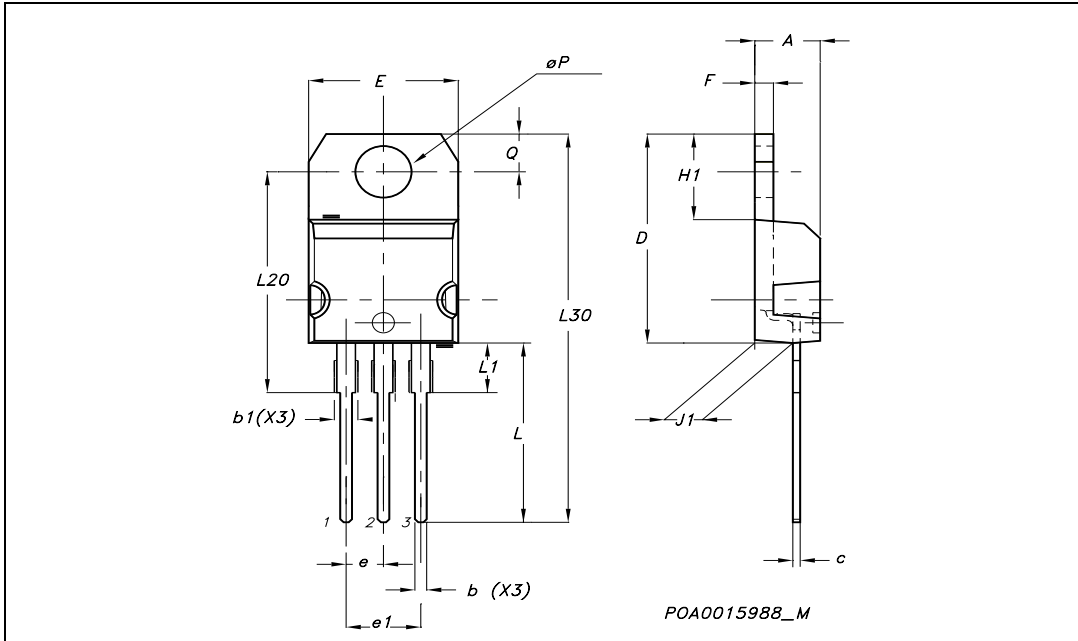


Figure 19: Switching Waveforms



**TO-220 MECHANICAL DATA**

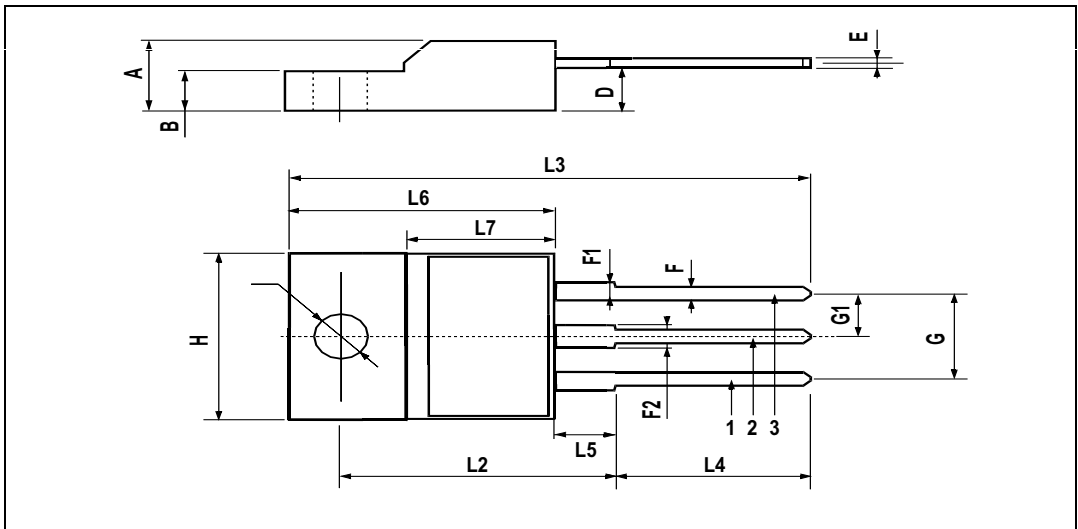
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.15		1.70	0.045		0.066
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.60		0.620
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.052
H1	6.20		6.60	0.244		0.256
J1	2.40		2.72	0.094		0.107
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L20		16.40			0.645	
L30		28.90			1.137	
øP	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116





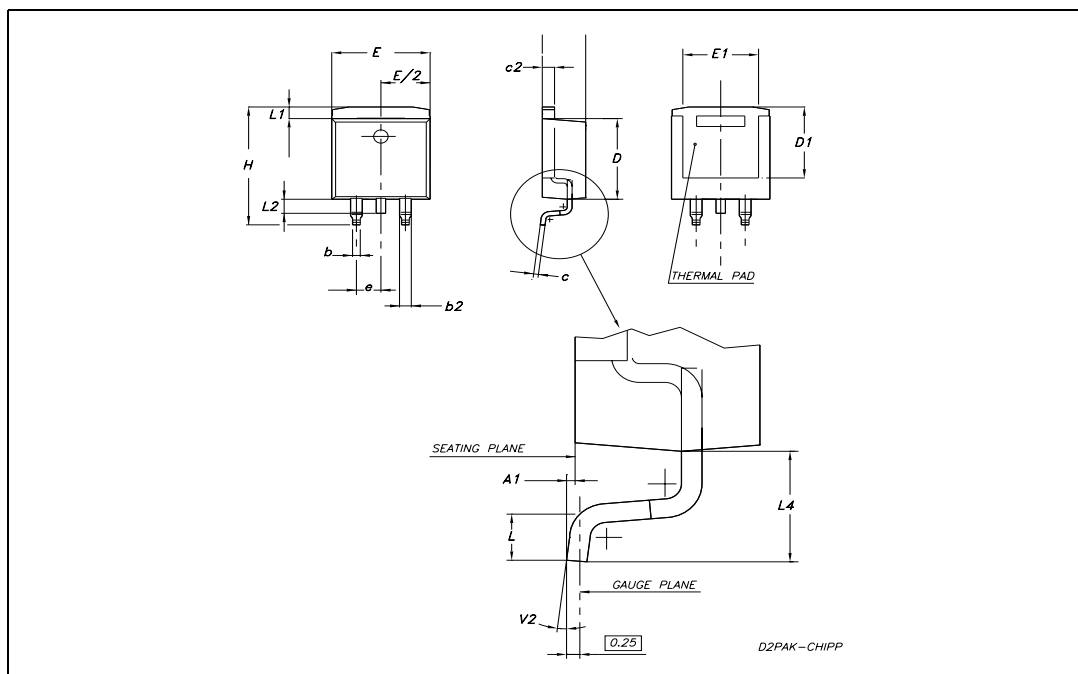
**TO-220FP MECHANICAL DATA**

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	.0385		0.417
L5	2.9		3.6	0.114		0.141
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
∅	3		3.2	0.118		0.126

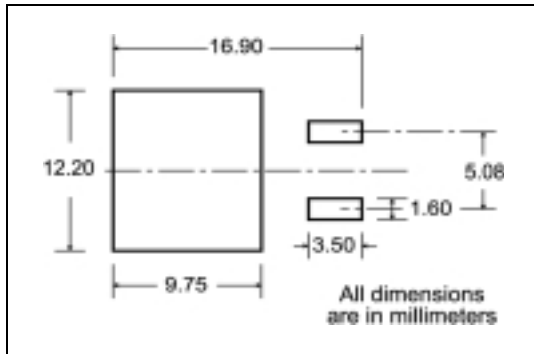


TO-263 (D<sup>2</sup>PAK) MECHANICAL DATA

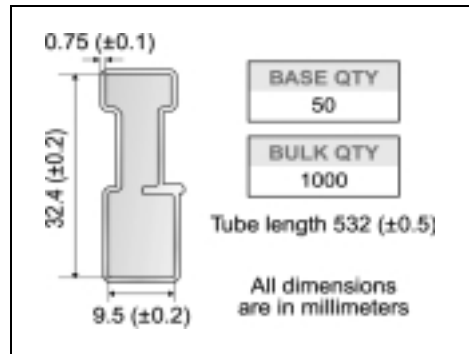
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.32		4.57	0.178		0.180
A1	0.00		0.25	0.00		0.009
b	0.71		0.91	0.028		0.350
b2	1.15		1.40	0.045		0.055
c	0.46		0.61	0.018		0.024
c2	1.22		1.40	0.048		0.055
D	8.89	9.02	9.40	0.350	0.355	0.370
D1	8.01			0.315		
E	10.04		10.28	0.395		0.404
e		2.54			0.010	
H	13.10		13.70	0.515		0.540
L	1.30		1.70	0.051		0.067
L1	1.15		1.39	0.045		0.054
L2	1.27		1.77	0.050		0.069
L4	2.70		3.10	0.106		0.122
V2	0°		8°	0°		8°



**D<sup>2</sup>PAK FOOTPRINT**



**TUBE SHIPMENT (no suffix)\***



**TAPE AND REEL SHIPMENT (suffix "T4")\***

**TAPE MECHANICAL DATA**

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	10.5	10.7	0.413	0.421
B0	15.7	15.9	0.618	0.626
D	1.5	1.6	0.059	0.063
D1	1.59	1.61	0.062	0.063
E	1.65	1.85	0.065	0.073
F	11.4	11.6	0.449	0.456
K0	4.8	5.0	0.189	0.197
P0	3.9	4.1	0.153	0.161
P1	11.9	12.1	0.468	0.476
P2	1.9	2.1	0.075	0.082
R	50		1.574	
T	0.25	0.35	0.0098	0.0137
W	23.7	24.3	0.933	0.956

**REEL MECHANICAL DATA**

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

BASE QTY	BULK QTY
1000	1000

\* on sales type

**Table 10: Revision History**

<b>Date</b>	<b>Revision</b>	<b>Description of Changes</b>
10-Nov-2004	1	First release

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