STGP10NB60SFP

16 A, 600 V, low drop IGBT

Features

- Low on-voltage drop ($V_{CE(sat)}$)
- High current capability

Applications

- Light dimmer
- Static relays
- Motor drive

Description

This IGBT utilizes the advanced PowerMESH™ process featuring extremely low on-state voltage drop in low-frequency working conditions (up to 1 kHz).

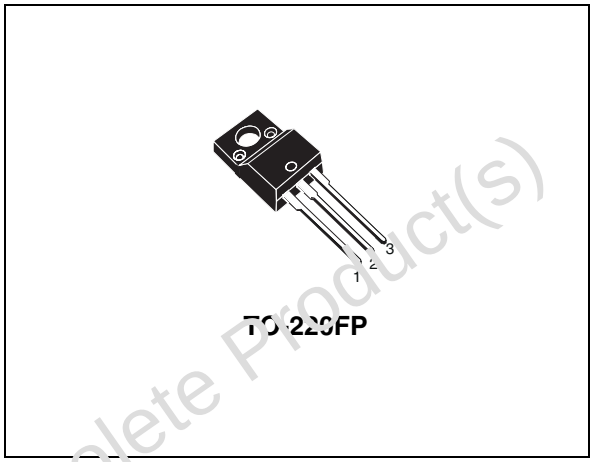
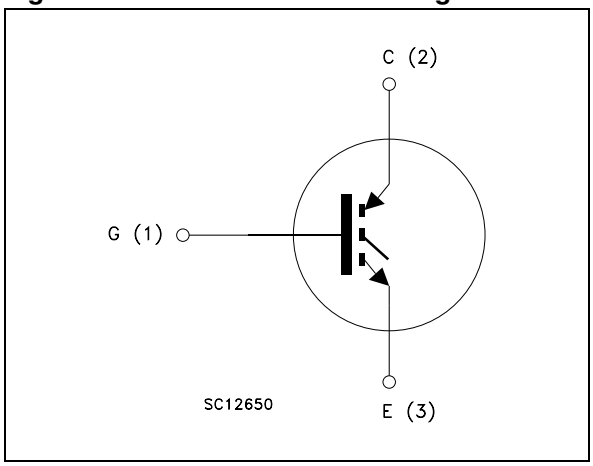


Figure 1. Internal schematic diagram



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Table 1. Device summary

Order codes	Marking	Package	Packaging
STGP10NB60SFP	GP10NB60SFP	TO-220-FP	Tube

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GE} = 0)	600	V
I_C (1)	Continuous collector current at T_C = 25 °C	23	A
I_C (1)	Continuous collector current at T_C = 100 °C	12	A
I_{CL} (2)	Turn-off latching current	20	A
I_{CP} (3)	Pulsed collector current	80	A
V_{GE}	Gate-emitter voltage	±20	V
V_{ISO}	Isolation withstand voltage (RMS) from all three leads to external hea sink (t=1 s; T_C = 25 °C)	2500	V
P_{TOT}	Total dissipation at T_C = 25 °C	25	W
T_j	Operating junction temperature	– 55 to 150	°C

1. Calculated according to the iterative formula

$$I_C(T_C) = \frac{T_{j(max)} - T_C}{R_{thj-c} \times V_{CE(sat)(max)}(T_{j(max)}, I_C(T_C))}$$

2. Vclamp = 80% of V_{CES}, T_j = 150 °C, R_G=1kΩ, V_{GE}=15 V
3. Pulse width limited by maximum junction temperature and turn-off within RBSOA

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	5	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	62.5	°C/W

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2 Electrical characteristics

(T_j =25 °C unless otherwise specified)

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage (V_{GE}= 0)	I_C= 250 µA	600			V
$V_{(BR)ECS}$	Emitter-collector breakdown voltage (V_{GE}= 0)	I_C= 1 mA	20			V
I_{GES}	Gate-emitter leakage current (V_{CE} = 0)	V_{GE}= ±20 V			±100	nA
I_{CES}	Collector cut-off current (V_{GE} = 0)	V_{CE}= 600 V V_{CE}= 600 V, T_j= 125 °C			10 100	µA µA
$V_{GE(th)}$	Gate threshold voltage	V_{CE}= V_{GE}, I_C= 250 µA	2.5		5	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE}= 15 V, I_C= 5 A V_{GE}= 15 V, I_C= 10 A V_{GE}= 15 V, I_C= 10 A, T_j= 125 °C		1.15 1.35 1.25	1.75	V
g_{fs} (1)	Forward transconductance	V_{CE} = 15 V , I_C = 10 A	5			S

1. Pulsed: Pulse duration = 300 µs, duty cycle 1.5%

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies} C_{oes} C_{res}	Input capacitance Output capacitance Reverse transfer capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE}= 0	-	610 65 12	-	pF pF pF
Q_g	Total gate charge	V_{CE} = 400 V, I_C = 10 A, V_{GE} = 15 V *(see Figure 17)*	-	33	-	nC

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Table 6. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r $(di/dt)_{on}$	Turn-on delay time Current rise time Turn-on current slope	V_{CC} = 480 V, I_C = 10 A R_G= 1 kΩ, V_{GE}= 15 V *(see Figure 16)*	-	0.7 0.46 8	-	µs µs A/µs
$t_r(V_{off})$ $t_{d(off)}$ t_f	Off voltage rise time Turn-off delay time Current fall time	V_{CC} = 480 V, I_C = 10 A R_G= 1 kΩ, V_{GE}= 15 V *(see Figure 16)*	-	2.2 1.2 1.2	-	µs
$t_r(V_{off})$ $t_{d(off)}$ t_f	Off voltage rise time Turn-off delay time Current fall time	V_{CC} = 480 V, I_C = 10 A R_G= 1 kΩ, V_{GE}= 15 V, T_j= 125 °C *(see Figure 16)*	-	3.8 1.2 1.9	-	µs

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
Eon (1) E_{off} (2) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 480 V, I_C = 10 A R_G= 1 kΩ, V_{GE}= 15 V *(see Figure 16)*	-	0.6 5 5.6	-	µJ µJ µJ
E_{off} (2)	Turn-off switching losses	V_{CC} = 480 V, I_C = 10 A R_G= 1 kΩ, V_{GE}= 15 V, T_j= 125 °C *(see Figure 16)*	-	8	-	µJ

1. Eon is the turn-on losses when a typical diode is used in the test circuit. If the IGBT is offered in a package with a co-pack diode, the co-pack diode is used as external diode. IGBTs and diode are at the same temperature (25 °C and 125°C).
2. Turn-off losses include also the tail of the collector current.

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2.1 Electrical characteristics (curves)

Figure 2. Output characteristics

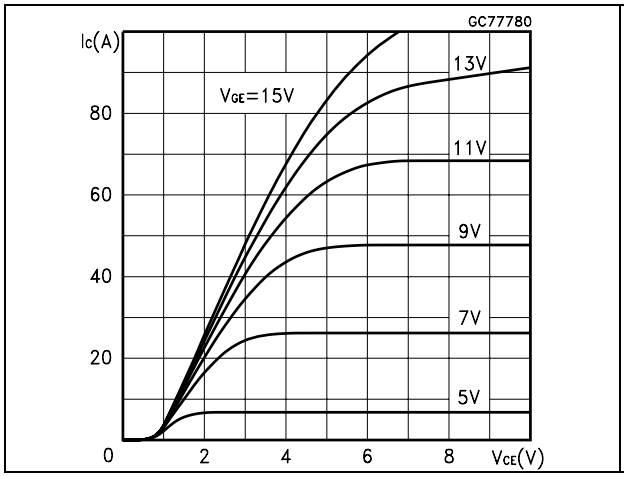


Figure 3. Transfer characteristics

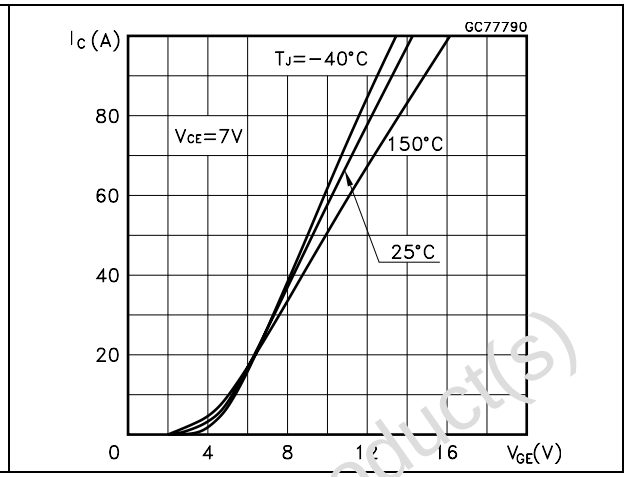


Figure 4. Transconductance

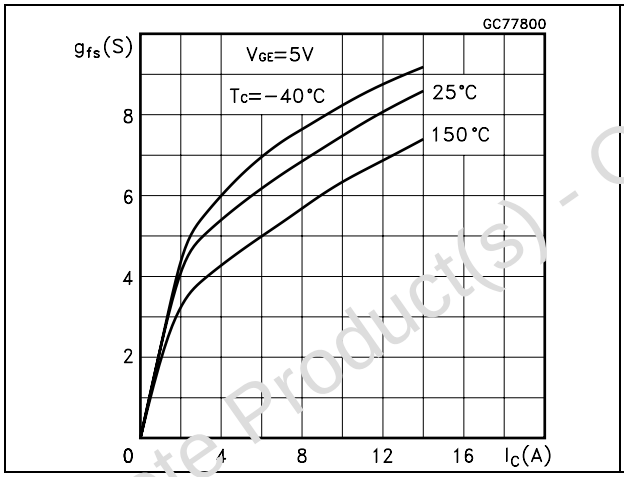


Figure 5. Collector-emitter on voltage vs temperature

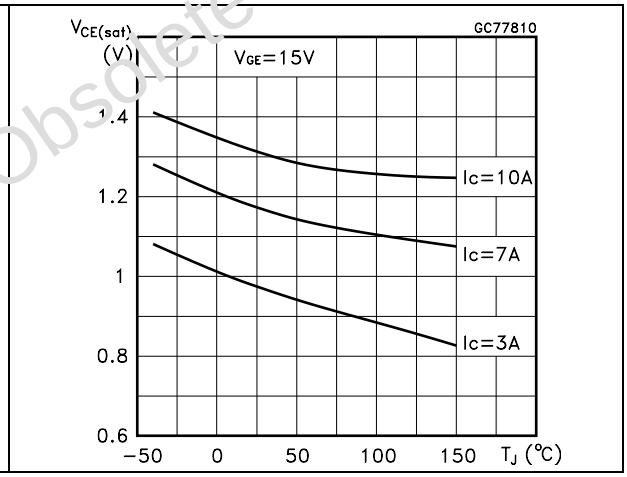


Figure 6. Collector-emitter on voltage vs collector current

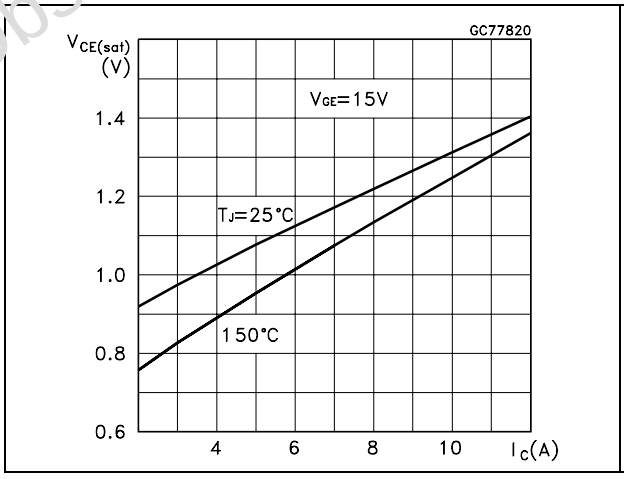
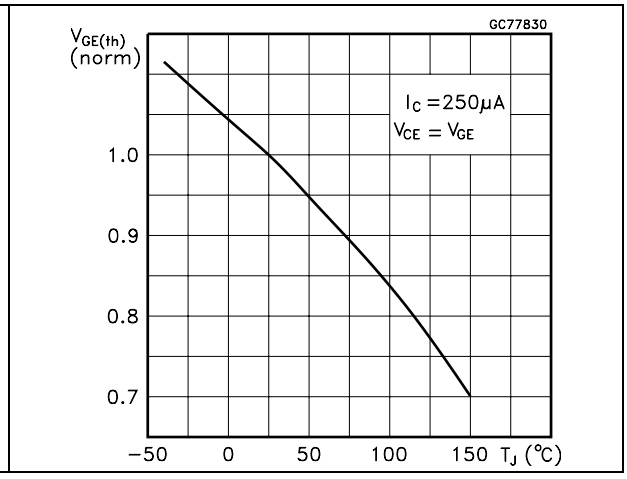


Figure 7. Normalized gate threshold vs temperature



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Figure 8. Normalized breakdown voltage vs temperature

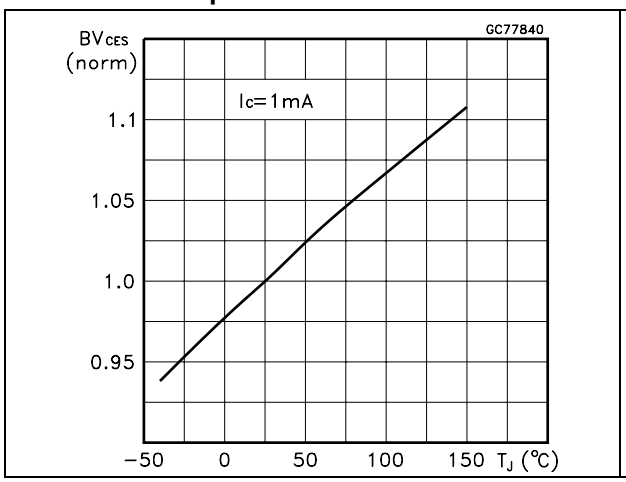


Figure 9. Gate charge vs gate-emitter voltage

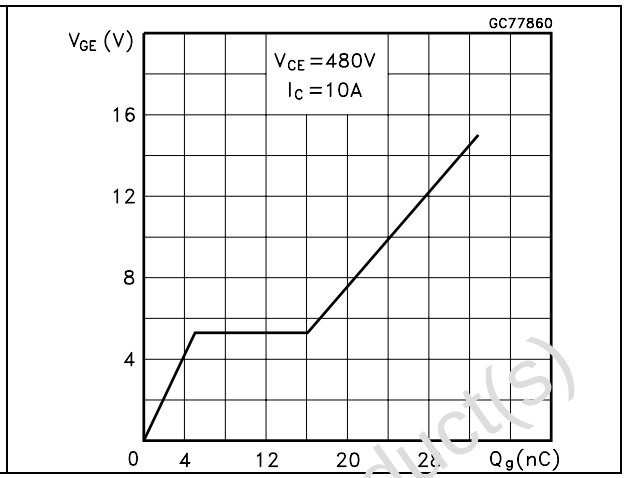


Figure 10. Capacitance variations

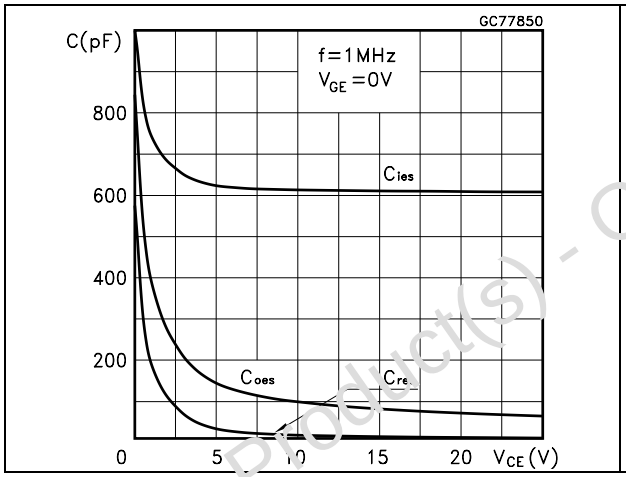


Figure 11. Switching losses vs temperature

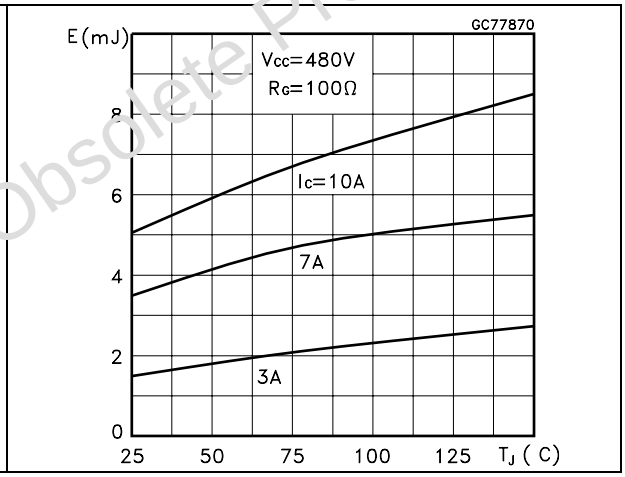


Figure 12. Switching losses vs gate resistance

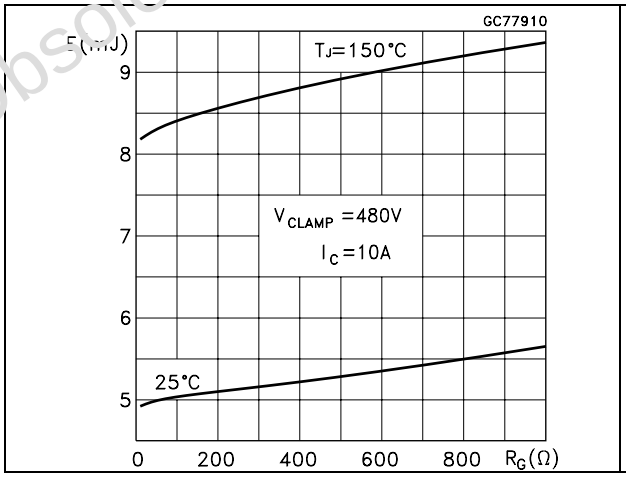
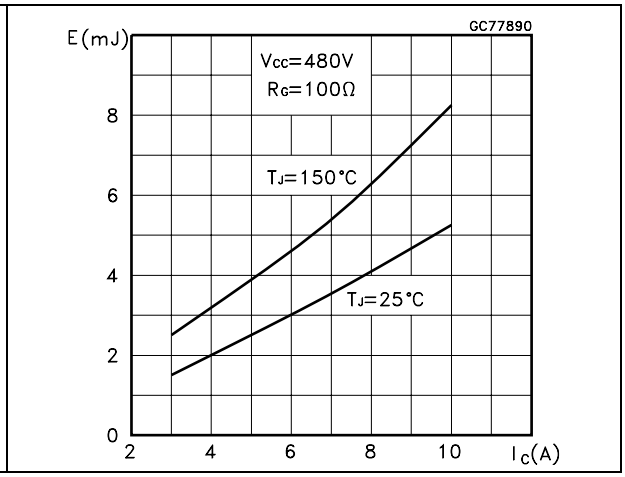


Figure 13. Switching losses vs collector current



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Figure 14. Thermal impedance

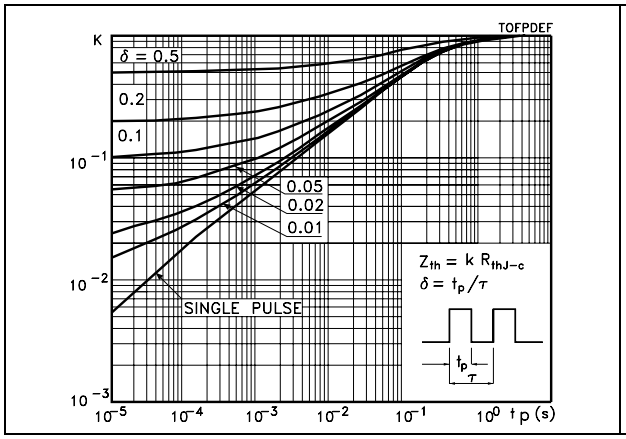
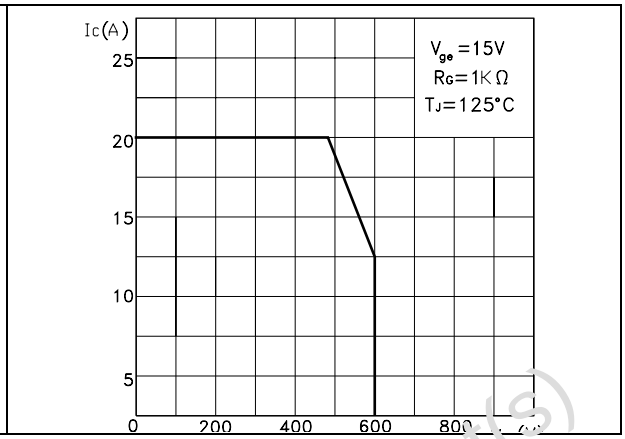


Figure 15. Turn-off SOA



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3 Test circuits

Figure 16. Test circuit for inductive load switching

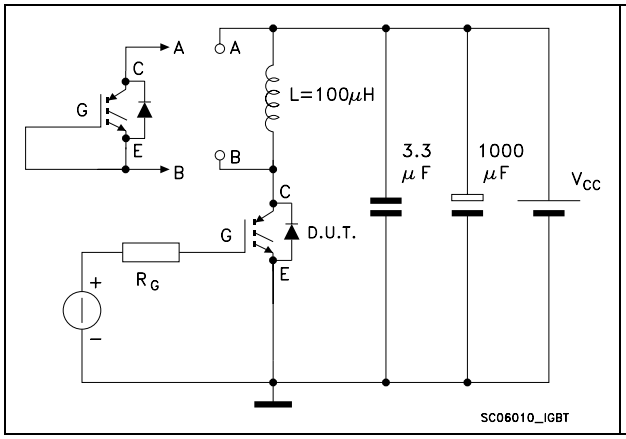


Figure 17. Gate charge test circuit

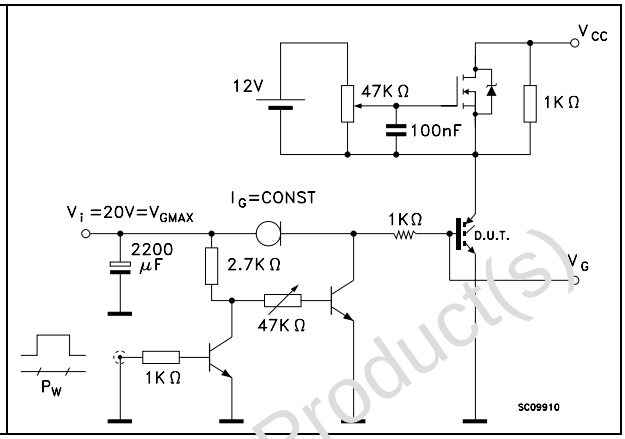
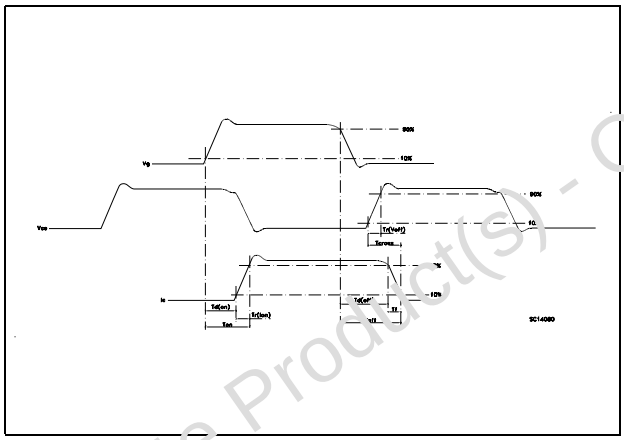


Figure 18. Switching waveforms



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4 Package mechanical data

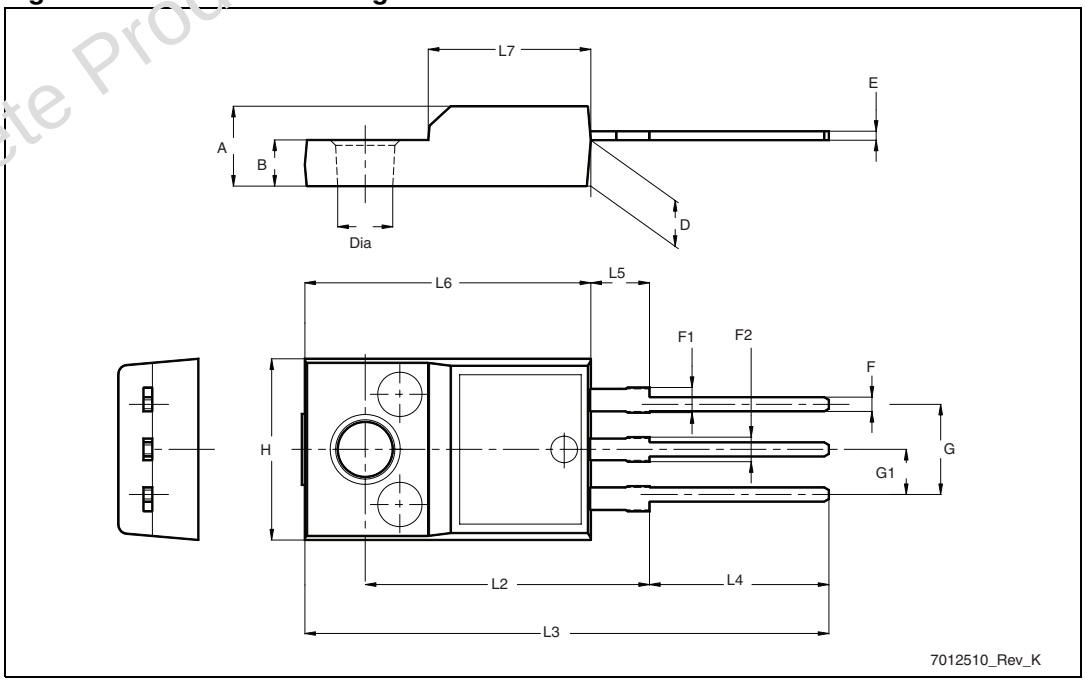
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Table 8. TO-220FP mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.4		4.6
B	2.5		2.7
D	2.5		2.75
E	0.45		0.7
F	0.75		1
F1	1.15		1.70
F2	1.15		1.70
G	4.95		5.2
G1	2.4		2.7
H	10		10.4
L2		16	
L3	28.6		30.6
L4	9.8		10.6
L5	2.9		3.6
L6	15.9		16.4
L7	9		9.3
Dia	3		3.2

Figure 19. TO-220FP drawing



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5 Revision history

Table 9. Document revision history

Date	Revision	Changes
03-Oct-2011	1	New release.

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