

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).

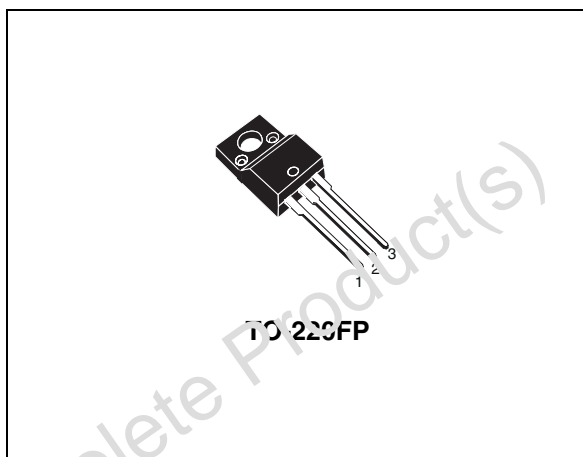


Figure 1. Internal schematic diagram

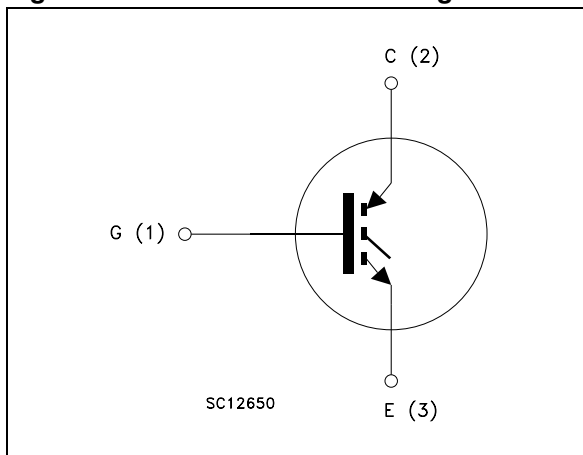


Table 1. Device summary

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 $T_C = 25\text{ °C}$	23	A
$I_C^{(1)}$	Continuous collector current at $T_C = 100\text{ °C}$	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 heat sink ($t=1\text{ s}$; $T_C = 25\text{ °C}$)	2500	V
P_{TOT}	Total dissipation at $T_C = 25\text{ °C}$	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. $V_{clamp} = 80\%$ of V_{CES} , $T_j = 150\text{ °C}$, $R_G = 1k\Omega$, $V_{GE} = 15\text{ V}$

3. Pulse width limited by maximum junction temperature and turn-off within RBSOA

Table 3. Thermal data

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

2 Electrical characteristics

($T_j = 25\text{ °C}$ unless otherwise specified)

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage ($V_{GE} = 0$)	$I_C = 250\ \mu\text{A}$	600			V
$V_{(BR)ECS}$	Emitter-collector breakdown voltage ($V_{GE} = 0$)	$I_C = 1\ \text{mA}$	20			V
I_{GES}	Gate-emitter leakage current ($V_{CE} = 0$)	$V_{GE} = \pm 20\ \text{V}$			± 100	nA
I_{CES}	Collector cut-off current ($V_{GE} = 0$)	$V_{CE} = 600\ \text{V}$ $V_{CE} = 600\ \text{V}, T_j = 125\text{ °C}$			10 100	μA μA
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}, I_C = 250\ \mu\text{A}$	2.5		5	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\ \text{V}, I_C = 5\ \text{A}$ $V_{GE} = 15\ \text{V}, I_C = 10\ \text{A}$ $V_{GE} = 15\ \text{V}, I_C = 10\ \text{A},$ $T_j = 125\text{ °C}$		1.15 1.35 1.25	1.75	V
$g_{fs}^{(1)}$	Forward transconductance	$V_{CE} = 15\ \text{V}, I_C = 10\ \text{A}$	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}	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	
Q_g	Total gate charge	$V_{CE} = 400\ \text{V}, I_C = 10\ \text{A},$ $V_{GE} = 15\ \text{V}$ (see Figure 17)	-	33	-	nC

Table 6. Switching on/off (inductive load)

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

Table 7. Switching energy (inductive load)

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

1. E_{on} 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.

2.1 Electrical characteristics (curves)

Figure 2. Output characteristics

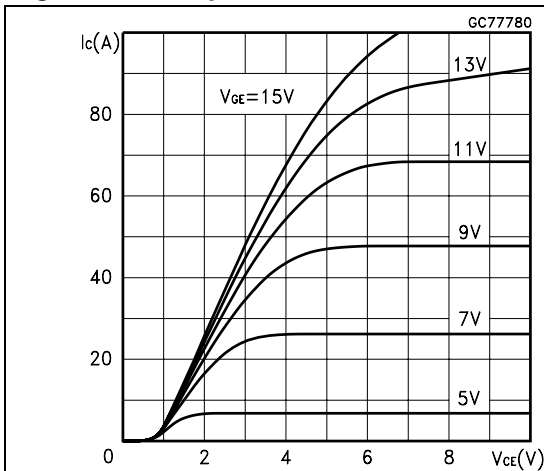


Figure 3. Transfer characteristics

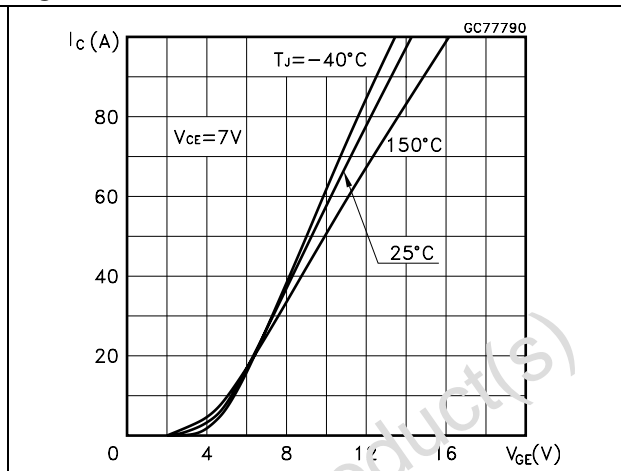


Figure 4. Transconductance

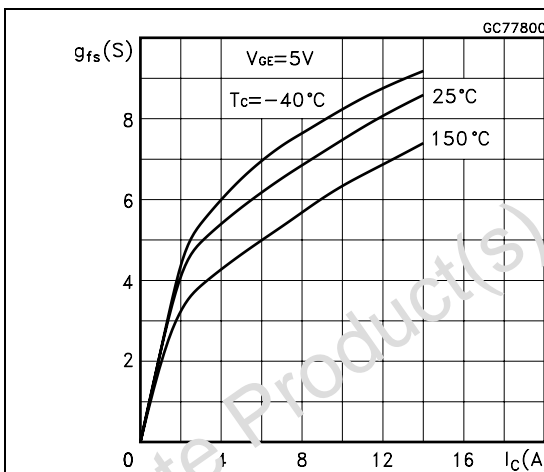


Figure 5. Collector-emitter on voltage vs temperature

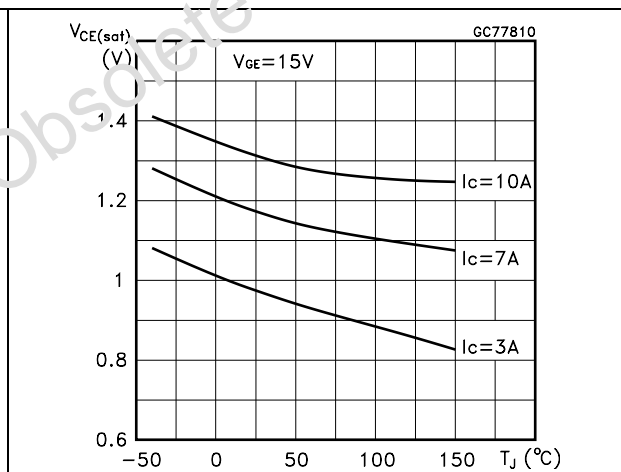


Figure 6. Collector-emitter on voltage vs collector current

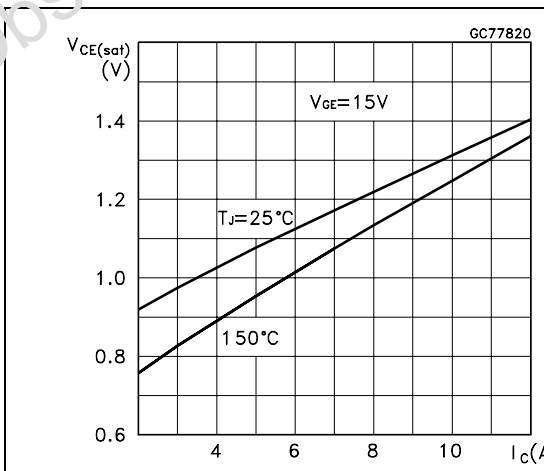


Figure 7. Normalized gate threshold vs temperature

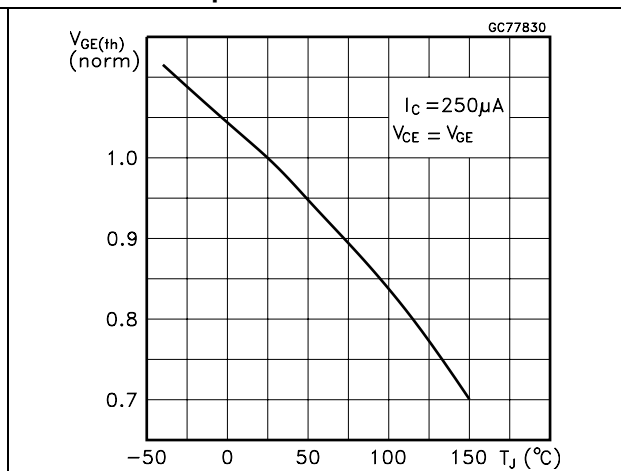


Figure 8. Normalized breakdown voltage vs temperature

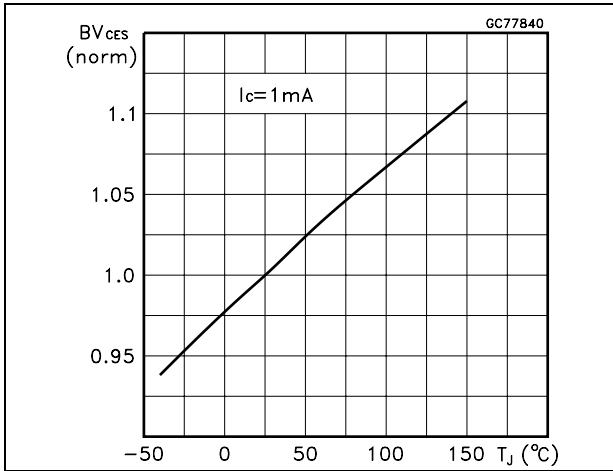


Figure 9. Gate charge vs gate-emitter voltage

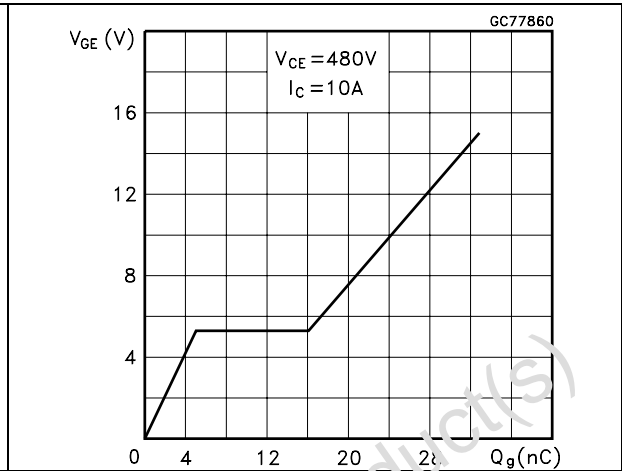


Figure 10. Capacitance variations

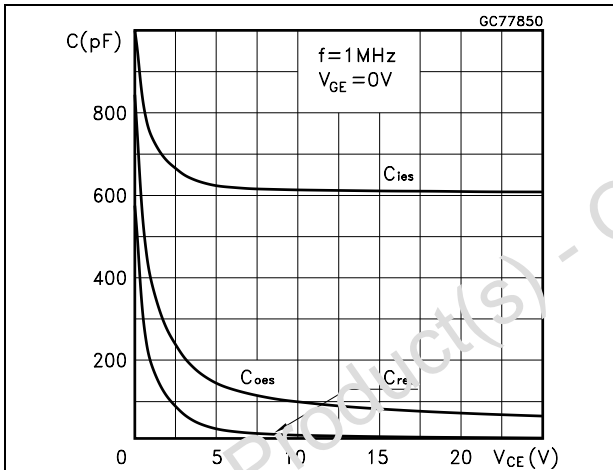


Figure 11. Switching losses vs temperature

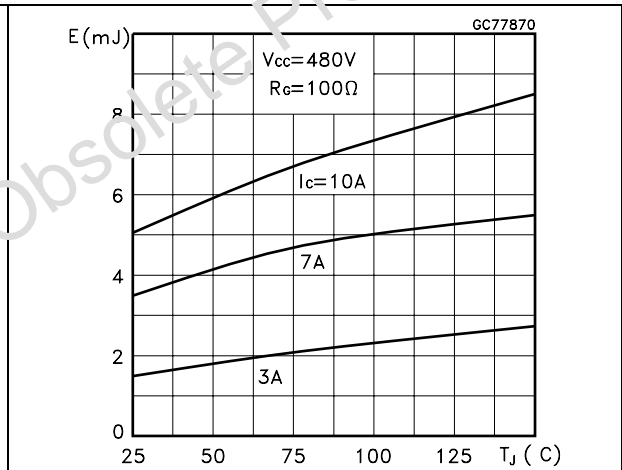


Figure 12. Switching losses vs gate resistance

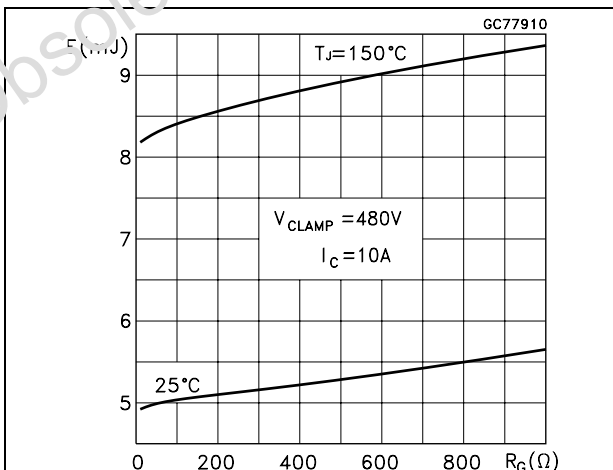


Figure 13. Switching losses vs collector current

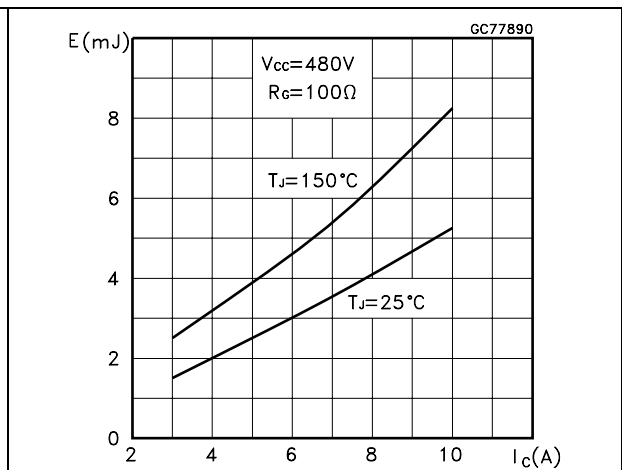


Figure 14. Thermal impedance

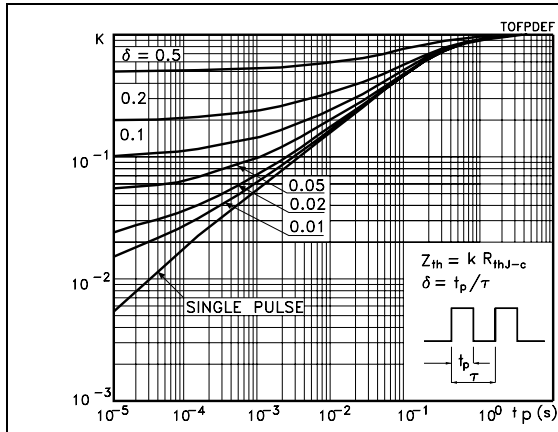
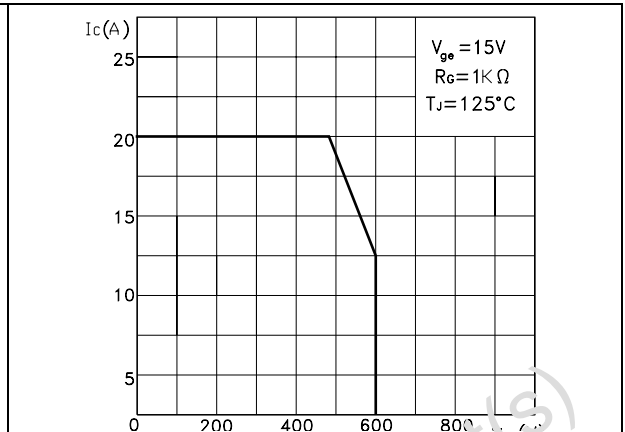


Figure 15. Turn-off SOA



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3 Test circuits

Figure 16. Test circuit for inductive load switching

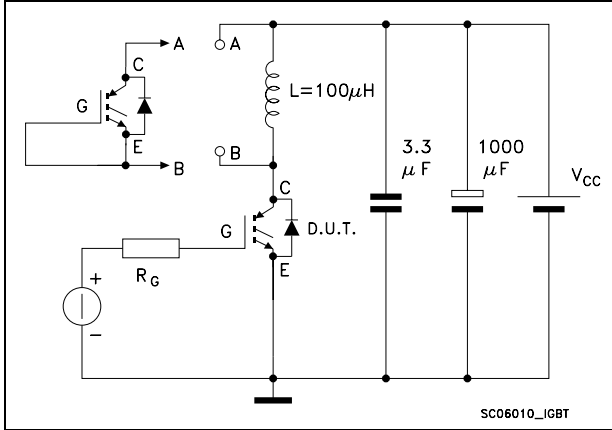


Figure 17. Gate charge test circuit

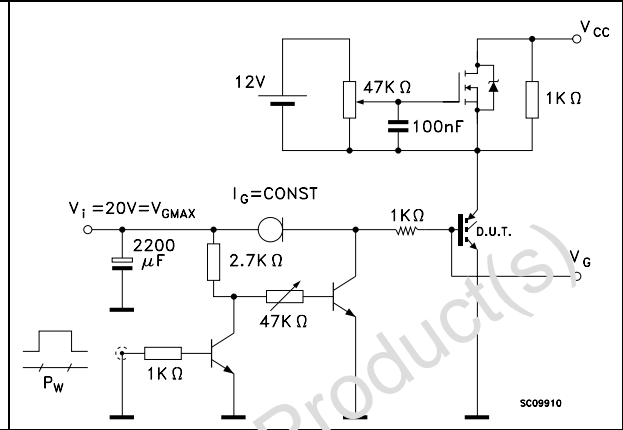
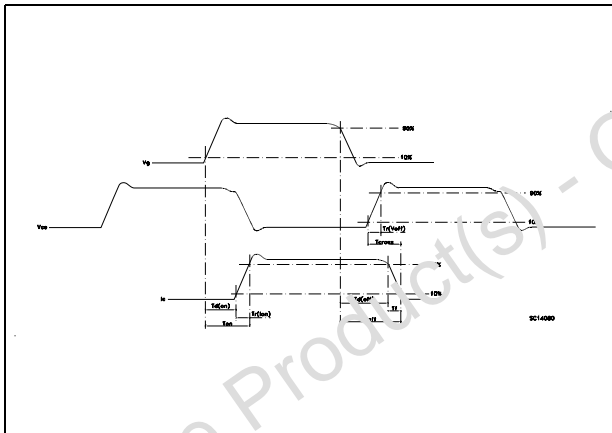


Figure 18. Switching waveforms



4 Package mechanical data

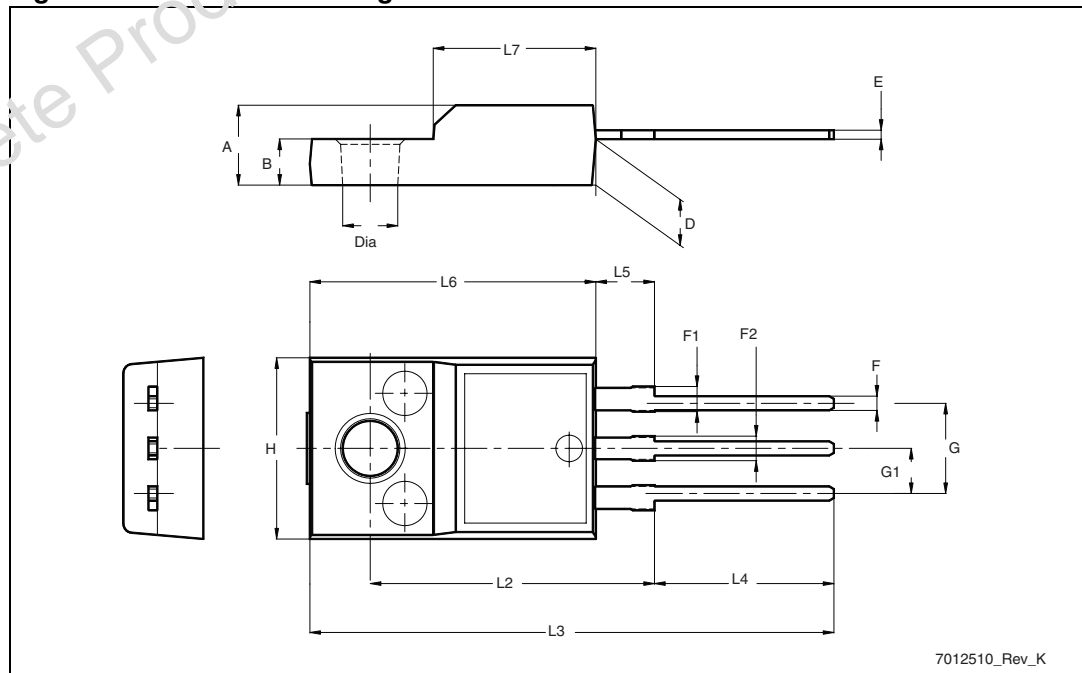
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Table 8. TO-220FP mechanical data

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



7012510_Rev_K

5 Revision history

Table 9. Document revision history

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

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