

Features

- Very low on-voltage drop ($V_{CE(sat)}$)
- Minimum power losses at 5 kHz in hard switching
- Optimized performance for medium operating frequencies
- IGBT co-packaged with Ultrafast freewheeling diode

Application

Electronic light dimmer

Description

This high voltage and fast IGBT shows an excellent compromise between low conduction loss and fast switching performance. It is designed in PowerMESH™ technology combined with Ultrafast diode.

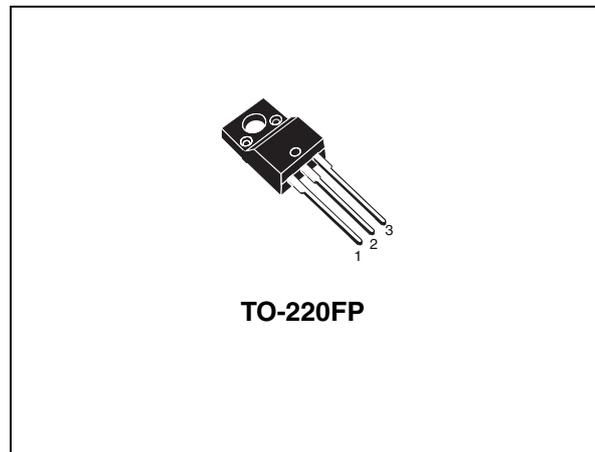


Figure 1. Internal schematic diagram

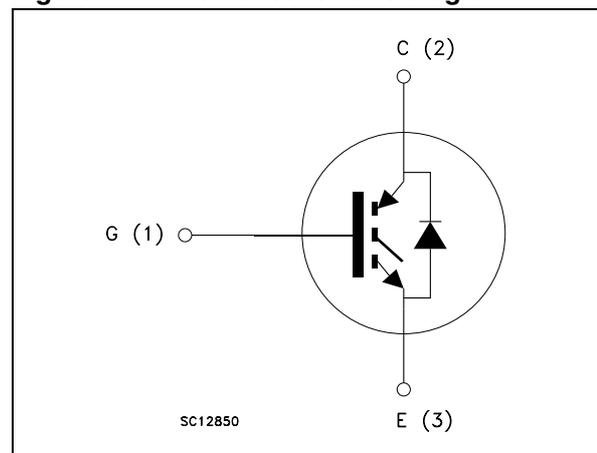


Table 1. Device summary

Order code	Marking	Package	Packaging
STGF17NC60SD	GF17NC60SD	TO-220FP	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	17	A
I _C ⁽¹⁾	Continuous collector current at T _C = 100°C	11	A
I _{CP} ⁽²⁾	Pulsed collector current	80	A
I _{CL} ⁽³⁾	Turn-off latching current	80	A
I _F	Diode RMS forward current at T _C = 25°C	20	A
I _{FSM}	Surge non repetitive forward current t _p = 10 ms sinusoidal	50	A
V _{GE}	Gate-emitter voltage	±20	V
V _{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s; T _C = 25°C)	2500	V
P _{TOT}	Total dissipation at T _C = 25°C	32	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. Pulse width limited by maximum junction temperature and turn-off within RBSOA
- 3. V_{clamp} = 80% of V_{CES}, T_j = 150 °C, R_G = 10 Ω, V_{GE} = 15 V

Table 3. Thermal data

Symbol	Parameter	Value	Unit
R _{thj-c}	Thermal resistance junction-case IGBT	3.9	°C/W
	Thermal resistance junction-case diode	5.5	°C/W
R _{thj-a}	Thermal resistance junction-ambient	62.5	°C/W

2 Electrical characteristics

$T_j = 25^\circ\text{C}$ unless otherwise specified.

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage ($V_{GE} = 0$)	$I_C = 1 \text{ mA}$	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15 \text{ V}, I_C = 12 \text{ A}$ $V_{GE} = 15 \text{ V}, I_C = 12 \text{ A}, T_j = 125^\circ\text{C}$		1.55 1.35	1.9	V V
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}, I_C = 250 \mu\text{A}$	4.2		6.2	V
I_{CES}	Collector cut-off current ($V_{GE} = 0$)	$V_{CE} = 600 \text{ V}$ $V_{CE} = 600 \text{ V}, T_j = 125^\circ\text{C}$			150 1	μA mA
I_{GES}	Gate-emitter leakage current ($V_{CE} = 0$)	$V_{GE} = \pm 20 \text{ V}, V_{CE} = 0$			± 100	nA
g_{fs}	Forward transconductance	$V_{CE} = 15 \text{ V}, I_C = 12 \text{ A}$		10		S

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	$V_{CE} = 25 \text{ V}, f = 1 \text{ MHz}, V_{GE} = 0$	-	1190	-	pF
C_{oes}	Output capacitance			135		pF
C_{res}	Reverse transfer capacitance			28.5		pF
Q_g	Total gate charge	$V_{CE} = 480 \text{ V}, I_C = 12 \text{ A}, V_{GE} = 15 \text{ V}, \text{Figure 3}$	-	54.5	-	nC
Q_{ge}	Gate-emitter charge			8.7		nC
Q_{gc}	Gate-collector charge			25.8		nC

Table 6. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 480 \text{ V}, I_C = 12 \text{ A}, R_G = 10 \Omega, V_{GE} = 15 \text{ V}, \text{Figure 4}$	-	17.5	-	ns
t_r	Current rise time			6.2		ns
$(di/dt)_{on}$	Turn-on current slope			1870		A/ μs
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 480 \text{ V}, I_C = 12 \text{ A}, R_G = 10 \Omega, V_{GE} = 15 \text{ V}, T_j = 125^\circ\text{C}, \text{Figure 4}$	-	17	-	ns
t_r	Current rise time			6.5		ns
$(di/dt)_{on}$	Turn-on current slope			1700		A/ μs
$t_{r(Voff)}$	Off voltage rise time	$V_{CC} = 480 \text{ V}, I_C = 12 \text{ A}, R_G = 10 \Omega, V_{GE} = 15 \text{ V}, \text{Figure 4}$	-	90	-	ns
$t_{d(Voff)}$	Turn-off delay time			175		ns
t_f	Current fall time			215		ns
$t_{r(Voff)}$	Off voltage rise time	$V_{CC} = 480 \text{ V}, I_C = 12 \text{ A}, R_G = 10 \Omega, V_{GE} = 15 \text{ V}, T_j = 125^\circ\text{C}, \text{Figure 4}$	-	155	-	ns
$t_{d(Voff)}$	Turn-off delay time			245		ns
t_f	Current fall time			290		ns

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}	Turn-on switching losses	$V_{CC} = 480\text{ V}, I_C = 12\text{ A}$		135		μJ
$E_{off}^{(1)}$	Turn-off switching losses	$R_G = 10\ \Omega, V_{GE} = 15\text{ V},$ <i>Figure 2</i>	-	815	-	μJ
E_{ts}	Total switching losses			995		μJ
E_{on}	Turn-on switching losses	$V_{CC} = 480\text{ V}, I_C = 12\text{ A}$		200		μJ
$E_{off}^{(1)}$	Turn-off switching losses	$R_G = 10\ \Omega, V_{GE} = 15\text{ V},$ $T_j = 125\text{ }^\circ\text{C},$ <i>Figure 2</i>	-	1175	-	μJ
E_{ts}	Total switching losses			1375		μJ

1. Turn-off losses include also the tail of the collector current

Table 8. Collector-emitter diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_F	Forward on-voltage	$I_F = 12\text{ A}$ $I_F = 12\text{ A}, T_j = 125\text{ }^\circ\text{C}$		2.3 2.0		V V
t_{rr}	Reverse recovery time	$I_F = 12\text{ A}, V_R = 40\text{ V},$ $di/dt = 100\text{ A}/\mu\text{s},$ <i>Figure 5</i>		31		ns
Q_{rr}	Reverse recovery charge			29.5		nC
I_{rrm}	Reverse recovery current			1.9		A
t_{rr}	Reverse recovery time	$I_F = 12\text{ A}, V_R = 40\text{ V},$ $di/dt = 100\text{ A}/\mu\text{s}, T_j = 125\text{ }^\circ\text{C}$ <i>Figure 5</i>		48.5		ns
Q_{rr}	Reverse recovery charge			70.5		nC
I_{rrm}	Reverse recovery current			3		A

3 Test circuits

Figure 2. Test circuit for inductive load switching

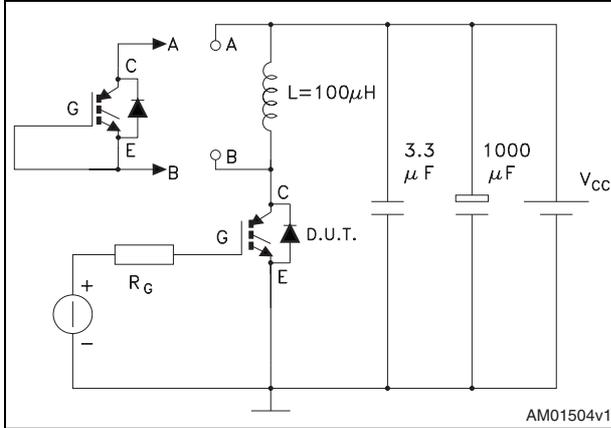


Figure 3. Gate charge test circuit

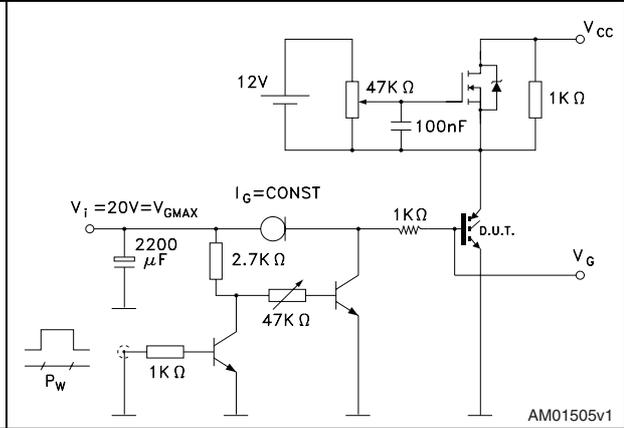


Figure 4. Switching waveform

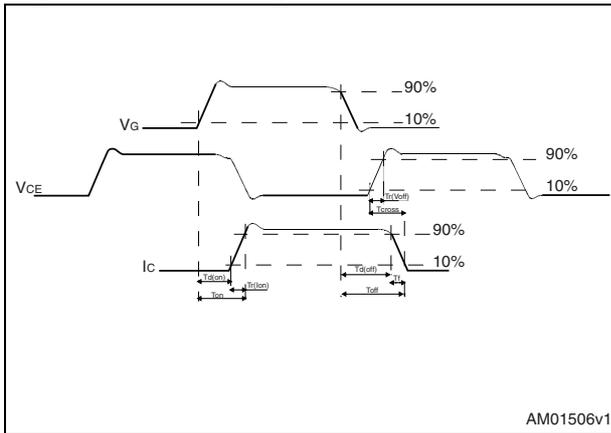
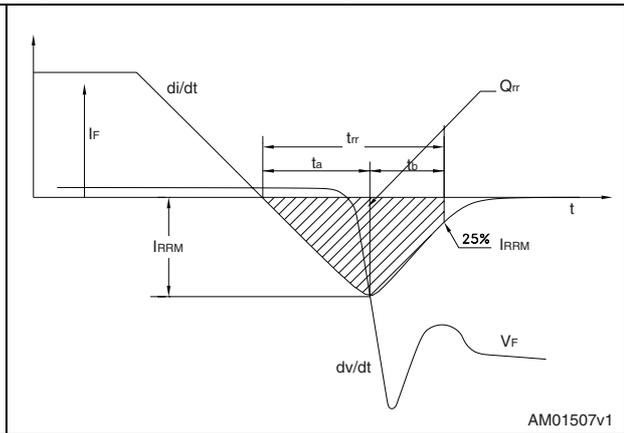


Figure 5. Diode recovery time waveform



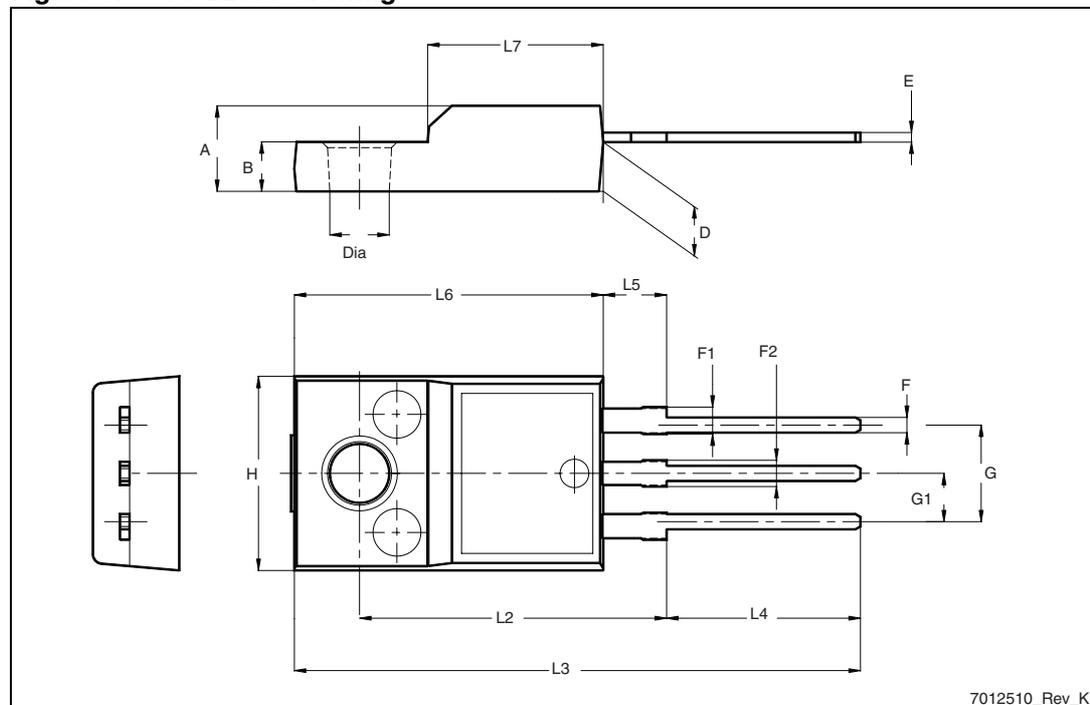
4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK[®] packages, depending on their level of environmental compliance. ECOPACK[®] specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

Table 9. 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 6. TO-220FP drawing



5 Revision history

Table 10. Document revision history

Date	Revision	Changes
14-Nov-2012	1	First release

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