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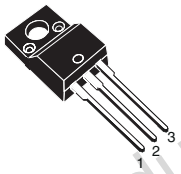
STGF17NC60SD

17 A, 600 V fast IGBT with Ultrafast diode

Datasheet – production data

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



TO-220FP

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

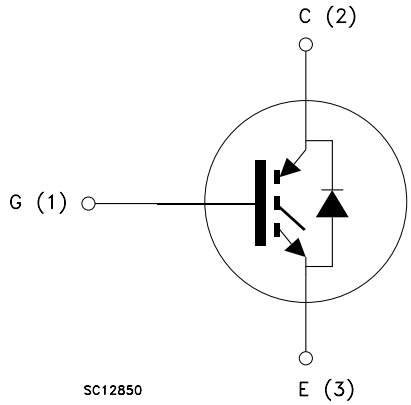


Table 1. Device summary

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. Vclamp = 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°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 mA	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 12 A V_{GE} = 15 V, I_C = 12 A, T_j =125°C		1.55 1.35	1.9	V V
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 250 µA	4.2		6.2	V
I_{CES}	Collector cut-off current (V_{GE} = 0)	V_{CE} = 600 V V_{CE} = 600 V, T_j =125°C			150 1	µA mA
I_{GES}	Gate-emitter leakage current (V_{CE} = 0)	V_{GE} = ±20 V, V_{CE} = 0			±100	nA
g_{fs}	Forward transconductance	V_{CE} = 15 V, I_C = 12 A		10		S

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	-	1190 135 28.5	-	pF pF pF
Q_g Q_{ge} Q_{gc}	Total gate charge Gate-emitter charge Gate-collector charge	V_{CE} = 480 V, I_C = 12 A, V_{GE} = 15 V, *Figure 3*	-	54.5 8.7 25.8	-	nC nC nC

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 = 12 A R_G = 10 Ω, V_{GE} = 15 V, *Figure 4*	-	17.5 6.2 1870	-	ns ns A/µs
$t_{d(on)}$ t_r (di/dt)on	Turn-on delay time Current rise time Turn-on current slope	V_{CC} = 480 V, I_C = 12 A R_G = 10 Ω, V_{GE}= 15 V, T_j = 125°C, *Figure 4*	-	17 6.5 1700	-	ns ns A/µs
$t_{r(Voff)}$ $t_{d(Voff)}$ t_f	Off voltage rise time Turn-off delay time Current fall time	V_{CC} = 480 V, I_C = 12 A R_G = 10 Ω, V_{GE} = 15 V, *Figure 4*	-	90 175 215	-	ns ns ns
$t_{r(Voff)}$ $t_{d(Voff)}$ t_f	Off voltage rise time Turn-off delay time Current fall time	V_{CC} = 480 V, I_C = 12 A R_G = 10 Ω, V_{GE} = 15 V, T_j = 125°C, *Figure 4*	-	155 245 290	-	ns ns ns

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on} E_{off}(1) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 480 V, I_C = 12 A R_G= 10 Ω, V_{GE}= 15 V, *Figure 2*	-	135 815 995	-	µJ µJ µJ
E_{on} E_{off}(1) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 480 V, I_C = 12 A R_G= 10 Ω, V_{GE}= 15 V, T_j = 125 °C, *Figure 2*	-	200 1175 1375	-	µJ µJ 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 A I_F = 12 A, T_j = 125 °C		2.3 2.0		V V
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_F = 12 A, V_R =40 V, di/dt=100 A/µs, *Figure 5*		31 29.5 1.9		ns nC A
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_F = 12 A, V_R =40 V, di/dt=100 A/µs, T_j = 125 °C *Figure 5*		48.5 70.5 3		ns nC A

3 Test circuits

Figure 2. Test circuit for inductive load switching

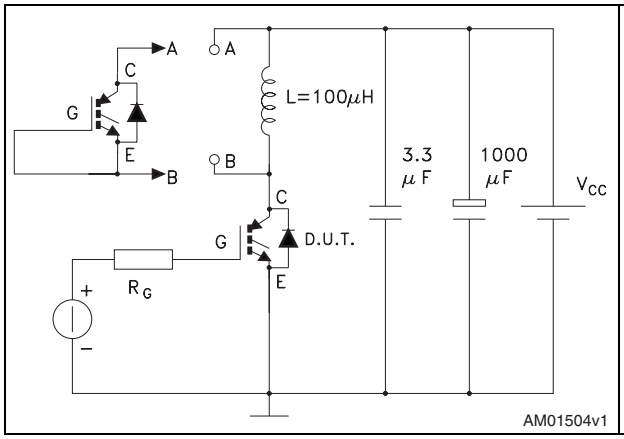


Figure 3. Gate charge test circuit

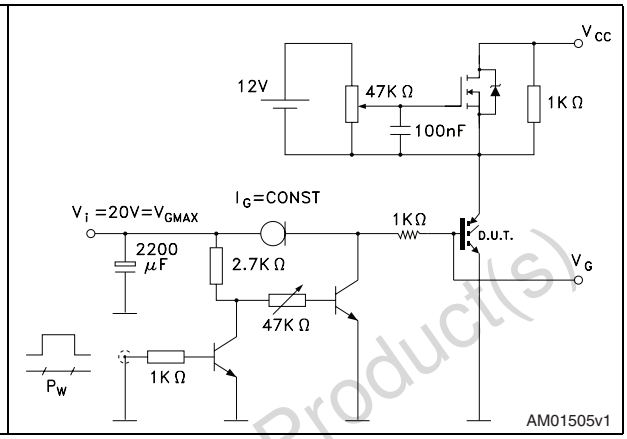


Figure 4. Switching waveform

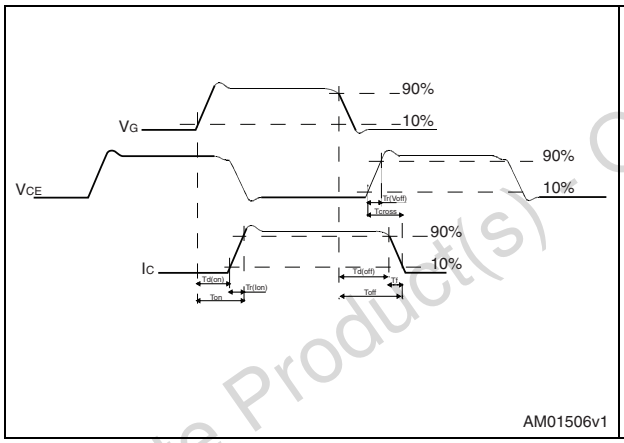
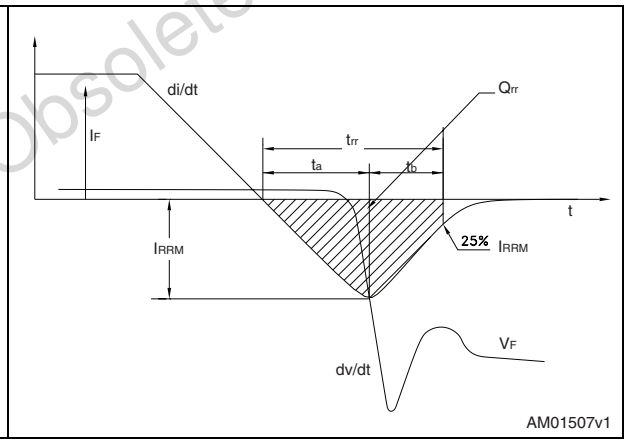


Figure 5. Diode recovery time waveform



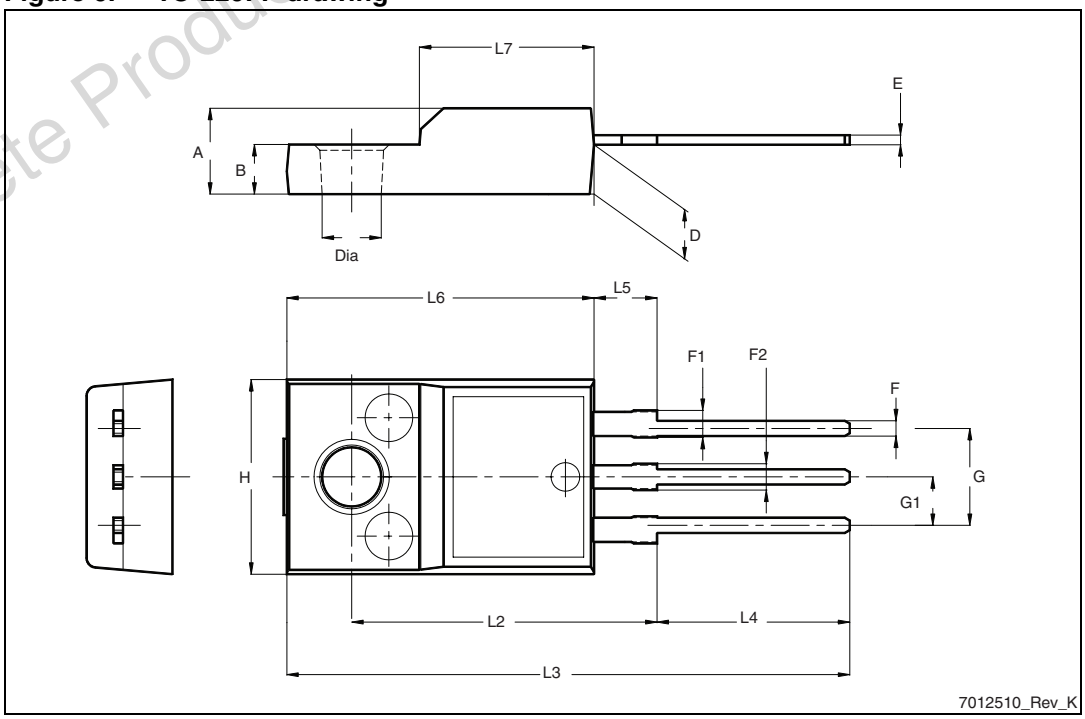
4 Package mechanical data

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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