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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

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.

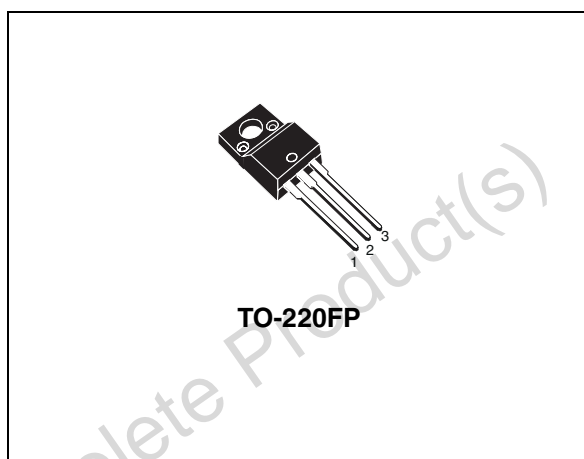


Figure 1. Internal schematic diagram

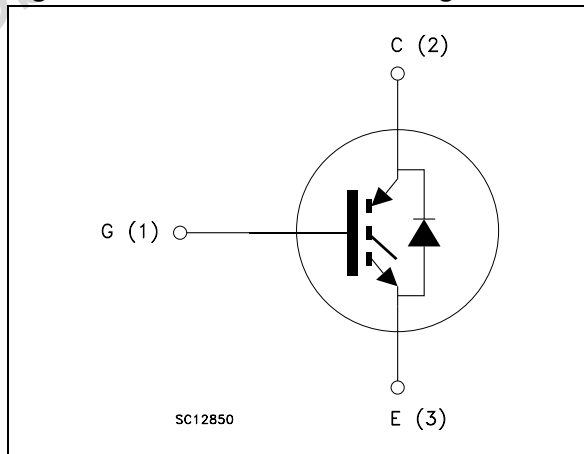


Table 1. Device summary

Order code	Marking	Package	Packaging
STGF17NC60SD	GF17NC60SD	TO-220FP	Tube

Electrical ratings

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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 $T_C = 25^\circ\text{C}$	17	A
$I_C^{(1)}$	Continuous collector current at $T_C = 100^\circ\text{C}$	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 $T_C = 25^\circ\text{C}$	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; $T_C = 25^\circ\text{C}$)	2500	V
P_{TOT}	Total dissipation at $T_C = 25^\circ\text{C}$	32	W
T_j	Operating junction temperature	- 55 to 150	$^\circ\text{C}$

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} , $T_j = 150^\circ\text{C}$, $R_G = 10\ \Omega$, $V_{GE} = 15$ V

Table 3. Thermal data

Symbol	Parameter	Value	Unit
R_{thj-c}	Thermal resistance junction-case IGBT	3.9	$^\circ\text{C/W}$
	Thermal resistance junction-case diode	5.5	$^\circ\text{C/W}$
R_{thj-a}	Thermal resistance junction-ambient	62.5	$^\circ\text{C/W}$

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Electrical characteristics

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	$V_{CE} = V_{GE}$, $I_C = 250\text{ }\mu\text{A}$	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} C_{oes} C_{res}	Input capacitance Output capacitance Reverse transfer capacitance	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0$	-	1190 135 28.5	-	pF pF pF
Q_g Q_{ge} Q_{gc}	Total gate charge Gate-emitter charge Gate-collector charge	$V_{CE} = 480\text{ V}$, $I_C = 12\text{ A}$, $V_{GE} = 15\text{ V}$, 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	$V_{CC} = 480\text{ V}$, $I_C = 12\text{ A}$ $R_G = 10\text{ }\Omega$, $V_{GE} = 15\text{ V}$, 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	$V_{CC} = 480\text{ V}$, $I_C = 12\text{ A}$ $R_G = 10\text{ }\Omega$, $V_{GE} = 15\text{ V}$, $T_j = 125^\circ\text{C}$, 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	$V_{CC} = 480\text{ V}$, $I_C = 12\text{ A}$ $R_G = 10\text{ }\Omega$, $V_{GE} = 15\text{ V}$, 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	$V_{CC} = 480\text{ V}$, $I_C = 12\text{ A}$ $R_G = 10\text{ }\Omega$, $V_{GE} = 15\text{ V}$, $T_j = 125^\circ\text{C}$, Figure 4	-	155 245 290	-	ns ns ns

Electrical characteristics

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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	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$,	-	815	-	μJ
E_{ts}	Total switching losses	<i>Figure 2</i>		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	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$,	-	1175	-	μJ
E_{ts}	Total switching losses	$T_j = 125\text{ }^\circ\text{C}$, <i>Figure 2</i>		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	$I_F = 12\text{ A}$		2.3		V
		$I_F = 12\text{ A}$, $T_j = 125\text{ }^\circ\text{C}$		2.0		V
t_{rr}	Reverse recovery time	$I_F = 12\text{ A}$, $V_R = 40\text{ V}$,		31		ns
Q_{rr}	Reverse recovery charge	$di/dt = 100\text{ A}/\mu\text{s}$, <i>Figure 5</i>		29.5		nC
I_{rrm}	Reverse recovery current			1.9		A
t_{rr}	Reverse recovery time	$I_F = 12\text{ A}$, $V_R = 40\text{ V}$,		48.5		ns
Q_{rr}	Reverse recovery charge	$di/dt = 100\text{ A}/\mu\text{s}$, $T_j = 125\text{ }^\circ\text{C}$		70.5		nC
I_{rrm}	Reverse recovery current	<i>Figure 5</i>		3		A

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Test circuits

3 Test circuits

Figure 2. Test circuit for inductive load switching

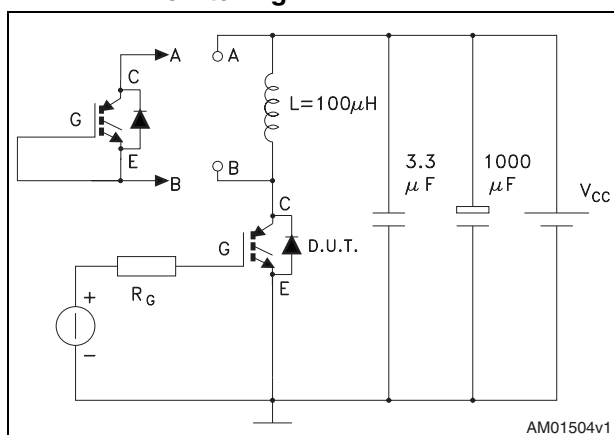


Figure 3. Gate charge test circuit

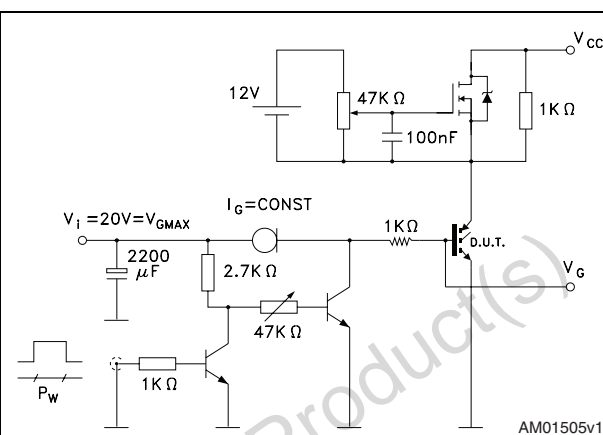


Figure 4. Switching waveform

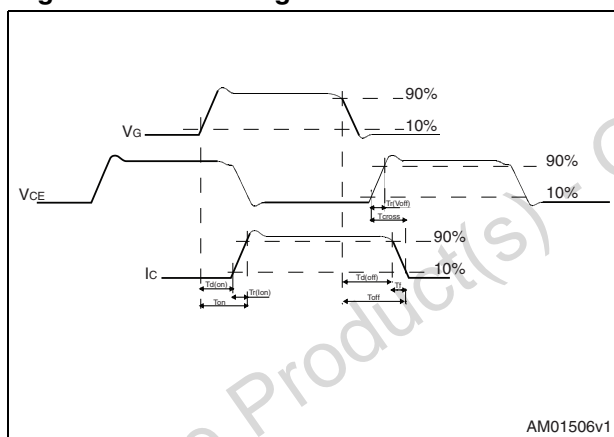
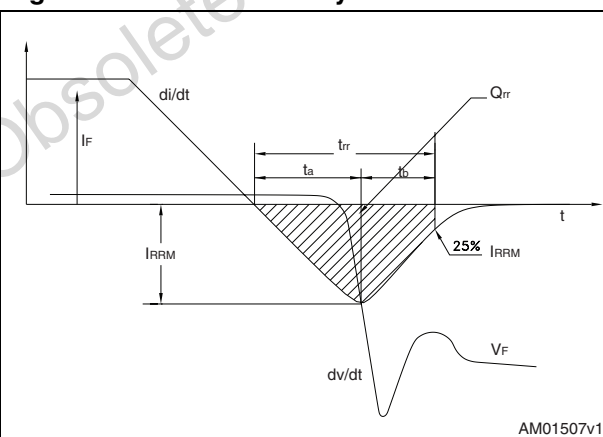


Figure 5. Diode recovery time waveform



4 Package mechanical data

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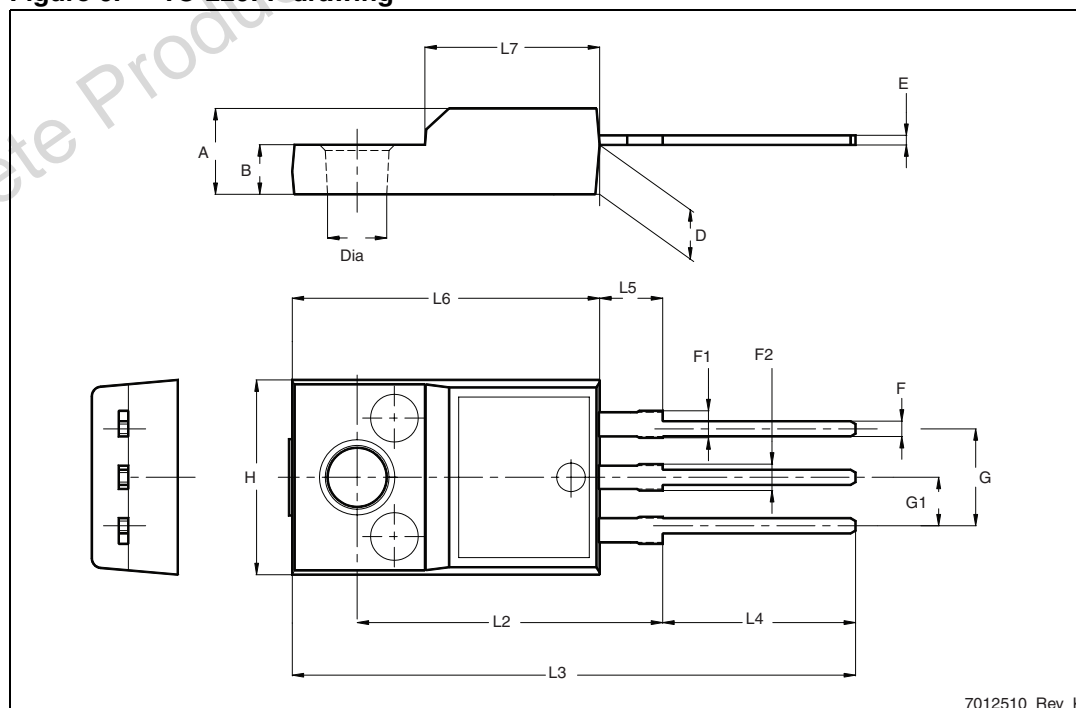
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Package mechanical data

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



7012510_Rev_K

Revision history

STGF17NC60SD

5 Revision history

Table 10. Document revision history

Date	Revision	Changes
14-Nov-2012	1	First release

STGF17NC60SD

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