STGF17NC60SD

17 A, 600 V fast IGBT with Ultrafast diode

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.
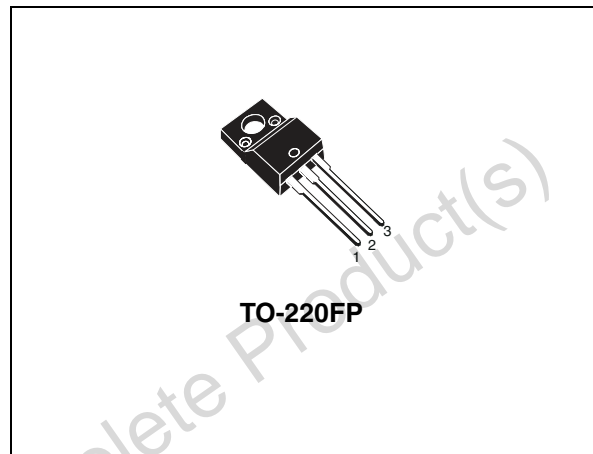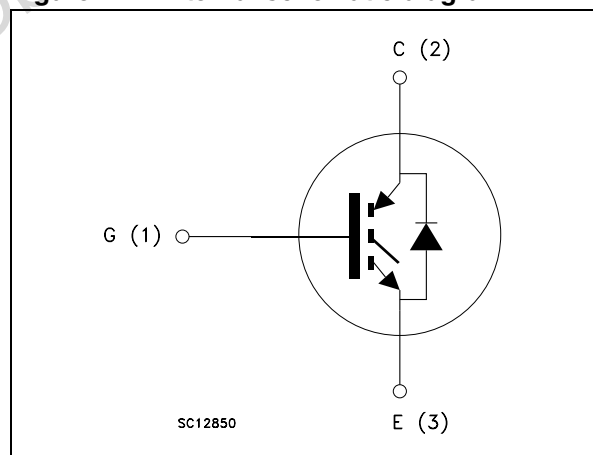
TO-220FP

Figure 1. Internal schematic diagram

SC12850

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 ($V_{CE} = 0$)	$V_{GE} = \pm20$ 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

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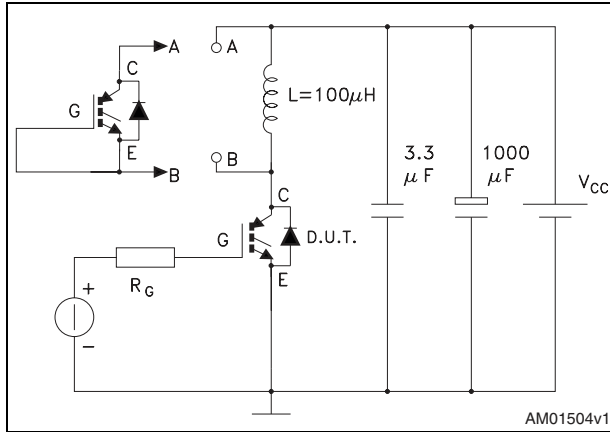
Figure 3.   Gate charge test circuit

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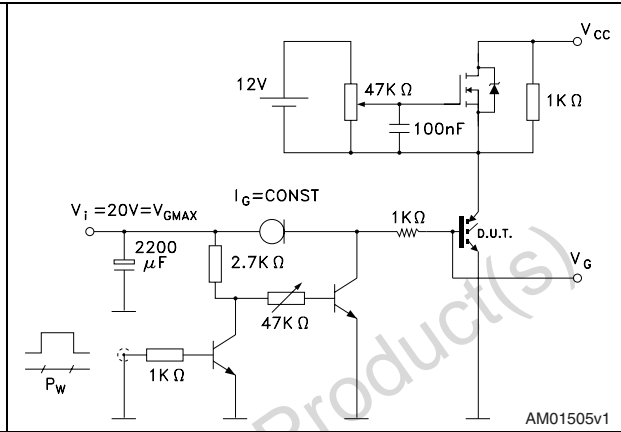
Figure 4.   Switching waveform
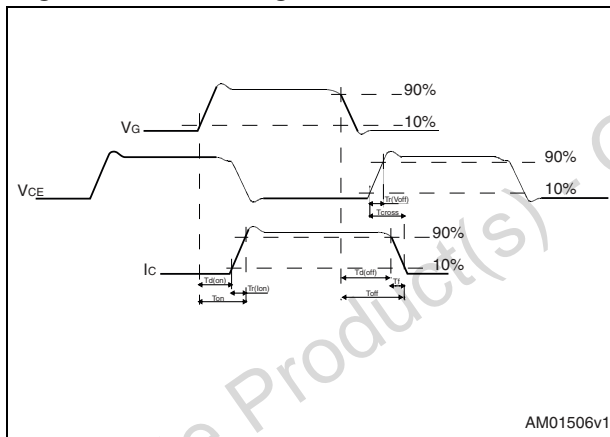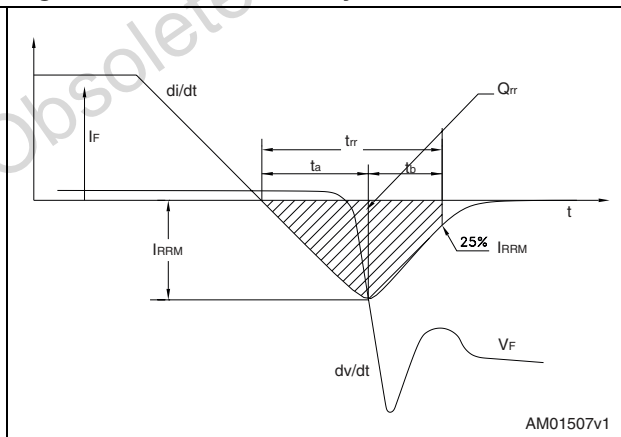

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Figure 5.   Diode recovery time waveform

AM01507v1

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
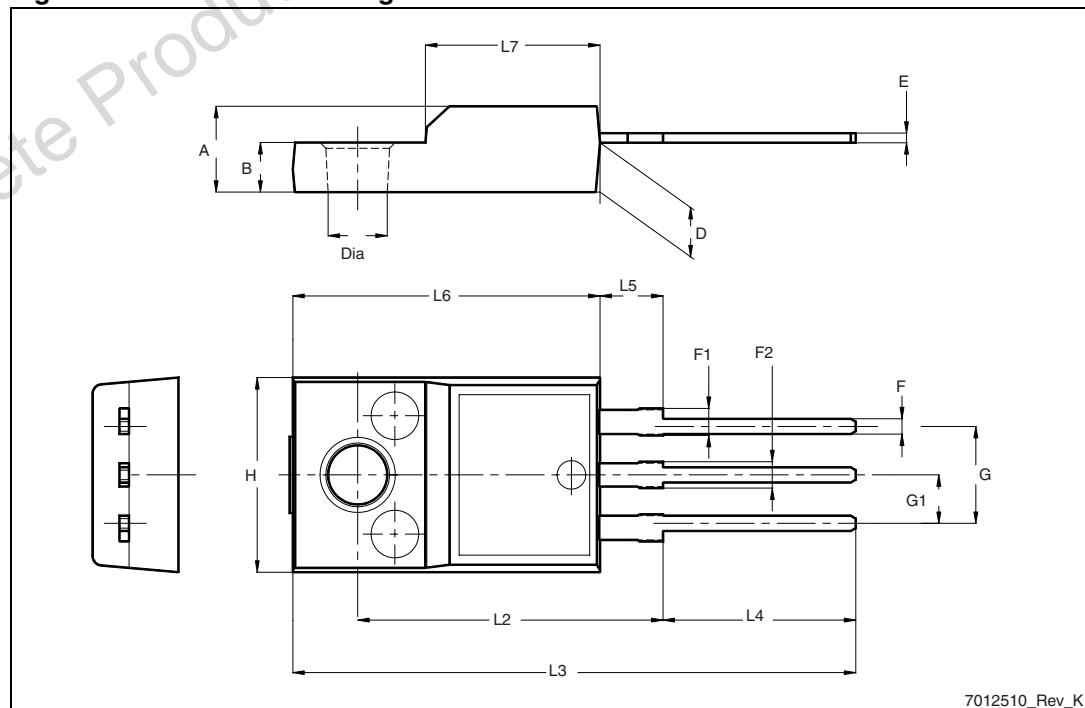
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5 Revision history

Table 10.   Document revision history

Date	Revision	Changes
14-Nov-2012	1	First release

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