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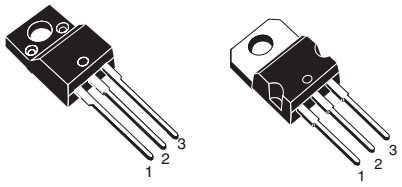
STGF14N60D
STGP14N60D

14 A - 600 V - short circuit rugged IGBT

Preliminary Data

Features

- Low on-voltage drop ($V_{CE(sat)}$)
- Operating junction temperature up to 175 °C
- Low C_{res} / C_{ies} ratio (no cross conduction susceptibility)
- Tight parameter distribution
- Ultra fast soft recovery antiparallel diode
- Short circuit rugged

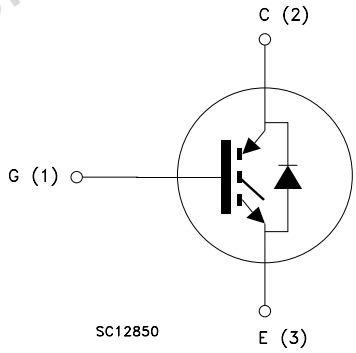


TO-220FP **TO-220**

Applications

- Motor drives
- High frequency inverters
- SMPS and PFC in both hard switch and resonant topologies

Figure 1. Internal schematic diagram



Description

This IGBT utilizes the advanced PowerMESH™ process resulting in an excellent trade-off between switching performance and low on-state behavior.

Table 1. Device summary

Order codes	Marking	Package	Packaging
STGF14N60D	GF14N60D	TO-220FP	Tube
STGP14N60D	GP14N60D	TO-220	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220	TO-220FP	
V_{CES}	Collector-emitter voltage (V_{GE} = 0)	600		V
I_C (1)	Collector current (continuous) at T_C = 25 °C	25	11	A
I_C (1)	Collector current (continuous) at T_C = 100 °C	14	7	A
I_{CL} (2)	Turn-off latching current	50		A
I_{CP} (3)	Pulsed collector current	50		A
V_{GE}	Gate-emitter voltage	±20		V
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	55		A
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external hea sink (t=1 s; T_C = 25 °C)	--	2500	V
P_{TOT}	Total dissipation at T_C = 25 °C	95	33	W
t_{scw}	Short circuit withstand time, V_{CE} = 0.5$V_{(BR)CES}$, T_C = 125 °C, R_G = 10 Ω, V_{GE} = 15 V	5		µs
T_j	Operating junction temperature	– 40 to 175		°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. Vclamp = 80% of V_{CES}, T_j =175 °C, R_G=10 Ω, V_{GE}=15 V
3. Pulse width limited by max. junction temperature allowed

Table 3. Thermal resistance

Symbol	Parameter	Value		Unit
		TO-220	TO-220FP	
$R_{thj\text{-}case}$	Thermal resistance junction-case IGBT max.	1.56	4.5	°C/W
$R_{thj\text{-}case}$	Thermal resistance junction-case diode max.	2.2	5.6	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient max.	62.5		°C/W

2 Electrical characteristics

(T_{CASE}=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= 7 A V_{GE}= 15 V, I_C= 7 A, T_C= 125 °C		2.1 1.8		V V
$V_{GE(th)}$	Gate threshold voltage	V_{CE}= V_{GE}, I_C= 250 µA	4.5		6.5	V
I_{GES}	Gate-emitter leakage current (V_{CE} = 0)	V_{GE}= ±20 V, T_C= 125 °C			±100	nA
I_{CES}	Collector cut-off current (V_{GE} = 0)	V_{CE}= 600 V V_{CE}= 600 V, T_C= 125 °C			150 1	µA mA
g_{fs} (1)	Forward transconductance	V_{CE} = 15 V , I_C = 7 A		3.2		S

1. Pulsed: Pulse duration = 300 µs, duty cycle 1.5%

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		TBD TBD TBD		pF pF pF
Q_g Q_{ge} Q_{gc}	Total gate charge Gate-emitter charge Gate-collector charge	V_{CE} = 390 V, I_C = 7 A, V_{GE} = 15 V *(see Figure 3)*		TBD TBD TBD		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} = 390 V, I_C = 7 A R_G= 10 Ω, V_{GE}= 15 V, *(see Figure 2)*		TBD TBD TBD		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} = 390 V, I_C = 7 A R_G= 10 Ω, V_{GE}= 15 V, T_C= 125 °C *(see Figure 2)*		TBD TBD TBD		ns ns A/µs
$t_r(V_{off})$ $t_{d(off)}$ t_f	Off voltage rise time Turn-off delay time Current fall time	V_{CC} = 390 V, I_C = 7 A, R_{GE} = 10 Ω, V_{GE} = 15 V *(see Figure 2)*		TBD TBD TBD		ns ns ns
$t_r(V_{off})$ $t_{d(off)}$ t_f	Off voltage rise time Turn-off delay time Current fall time	V_{CC} = 390 V, I_C = 7 A, R_{GE} = 10 Ω, V_{GE} = 15 V T_C= 125 °C *(see Figure 2)*		TBD TBD TBD		ns ns ns

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
Eon (1) E_{off} (2) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 390 V, I_C = 7 A R_G= 10 Ω, V_{GE}= 15 V, *(see Figure 2)*		TBD TBD TBD		µJ µJ µJ
Eon (1) E_{off} (2) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 390 V, I_C = 7 A R_G= 10 Ω, V_{GE}= 15 V, T_C= 125 °C *(see Figure 2)*		TBD TBD TBD		µJ µJ µJ

1. Eon 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.

Table 8. Collector-emitter diode

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
V_F	Forward on-voltage	I_F = 7 A I_F = 7 A, T_C= 125 °C		1.8 1.3	2.1	V V
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_F = 7 A, V_R = 40 V, di/dt = 100 A/µs *(see Figure 5)*		37 40 2.1		ns nC A
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_F = 7 A, V_R = 40 V, T_C= 125 °C, di/dt = 100 A/µs *(see Figure 5)*		61 98 3.2		ns nC A

3 Test circuit

Figure 2. Test circuit for inductive load switching

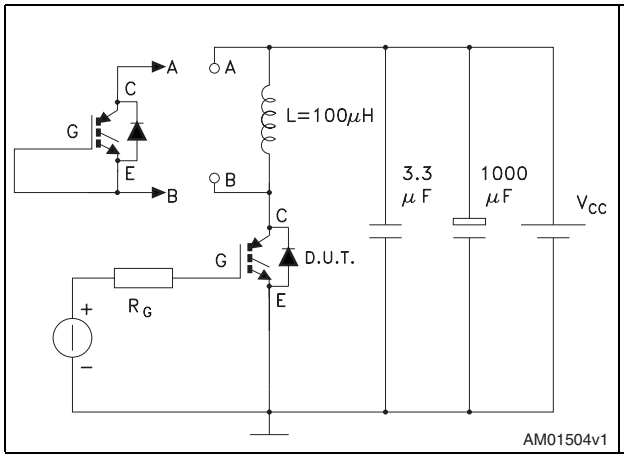


Figure 3. Gate charge test circuit

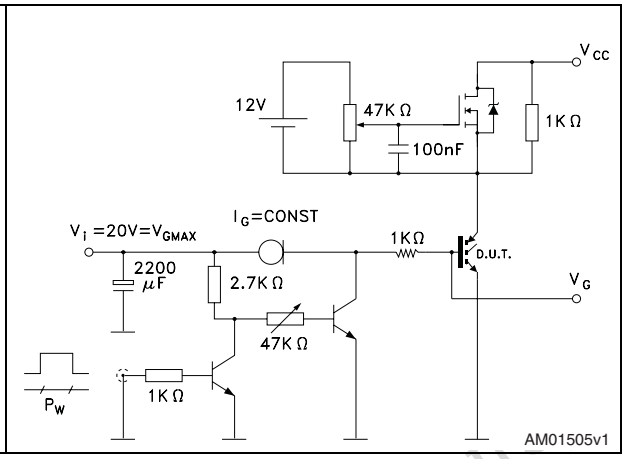


Figure 4. Switching waveforms

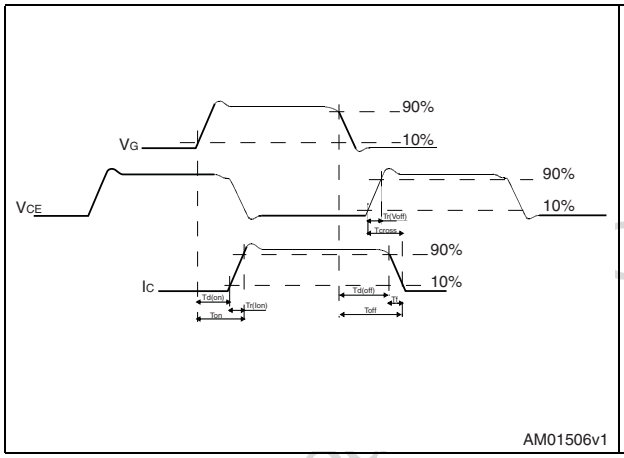
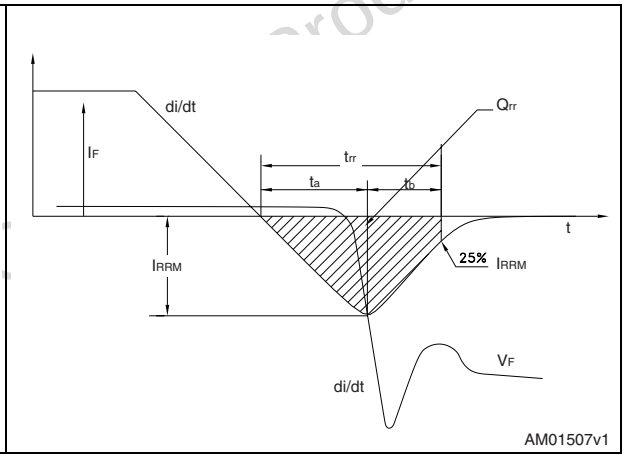


Figure 5. Diode recovery times waveform

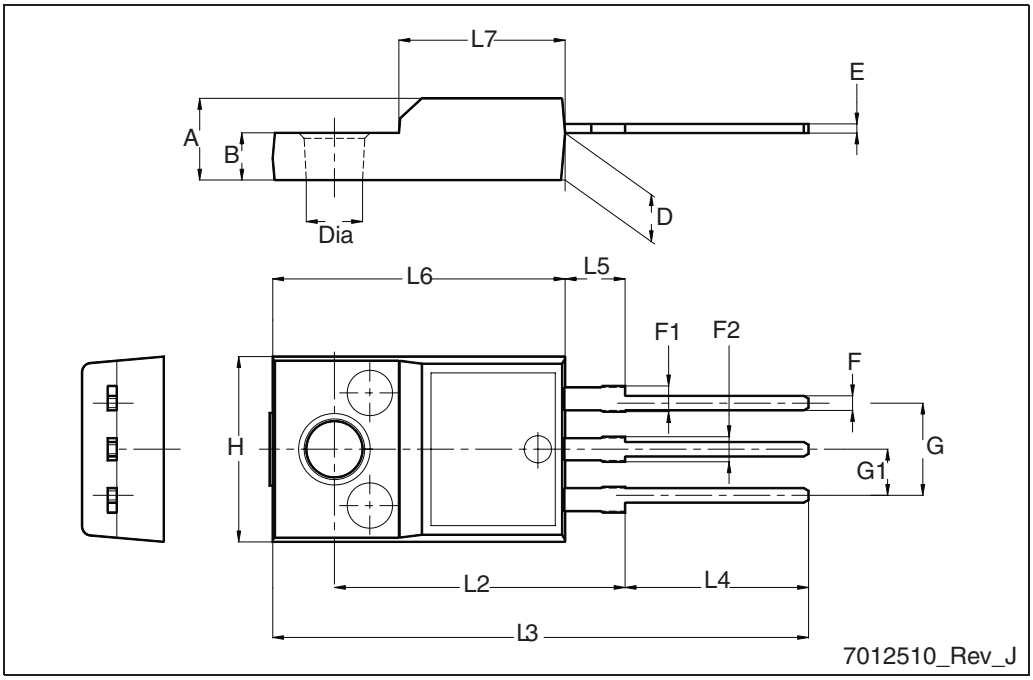


4 Package mechanical data

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.

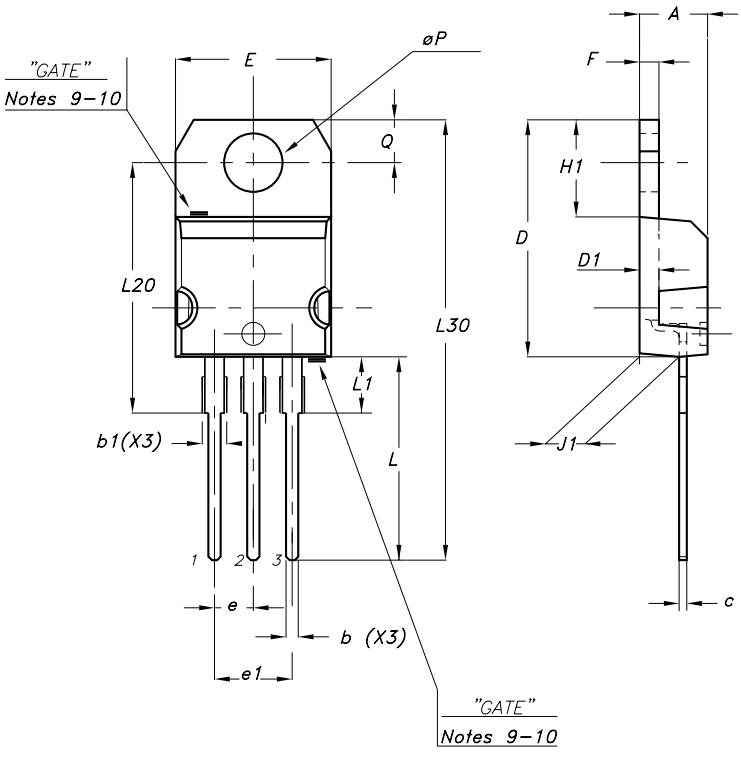
TO-220FP mechanical data

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		1.5
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



TO-220 mechanical data

Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.48		0.70	0.019		0.027
D	15.25		15.75	0.6		0.62
D1		1.27			0.050	
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.051
H1	6.20		6.60	0.244		0.256
J1	2.40		2.72	0.094		0.107
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L20		16.40			0.645	
L30		28.90			1.137	
∅P	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
20-Feb-2009	1	Initial release.