STGB10HF60KD
STGF10HF60KD, STGP10HF60KD

10 A - 600 V - short-circuit rugged IGBT

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
- Ultrafast soft-recovery antiparallel diode
- Short-circuit rugged

Applications

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

Description

This device utilizes the advanced PowerMESH™ process for the IGBT and the Turbo 2 Ultrafast high voltage technology for the diode. The combination results in a very good trade-off between conduction losses and switching behavior rendering the product ideal for diverse high voltage applications operating at high frequencies.

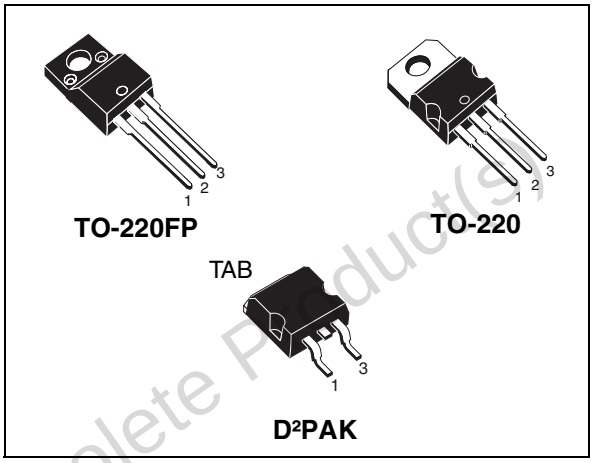


Figure 1. Internal schematic diagram

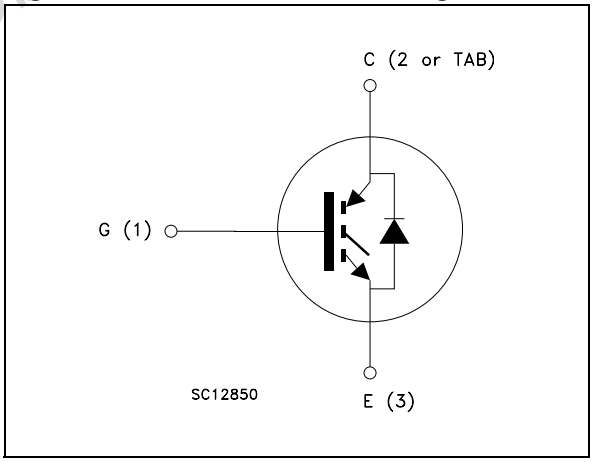


Table 1. Device summary

Order codes	Marking	Package	Packaging
STGB10HF60KDT4	GB10HF60KD	D²PAK	Tape and reel
STGF10HF60KD	GF10HF60KD	TO-220FP	Tube
STGP10HF60KD	GP10HF60KD	TO-220	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		D²PAK, 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	20	9	A
I_C (1)	Collector current (continuous) at T_C = 100 °C	10	6	A
I_{CL} (2)	Turn-off latching current	TBD		A
I_{CP} (3)	Pulsed collector current	TBD		A
V_{GE}	Gate-emitter voltage	±20		V
I_F	Diode RMS forward current at T_C = 25 °C	10		A
I_{FSM}	Surge non repetitive forward current t_p = 10 ms sinusoidal	20		A
V_{ISO}	Isolations 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	80	30	W
t_{scw}	Short-circuit withstand time, V_{CE} = 0.5$V_{(BR)CES}$, T_C = 125 °C, R_G = 10 Ω, V_{GE} = 12 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 maximum junction temperature and turn-off within RBSOA

Table 3. Thermal data

Symbol	Parameter	Value		Unit
		D²PAK TO-220	TO-220FP	
$R_{thj\text{-}case}$	Thermal resistance junction-case IGBT	1.8	5	°C/W
$R_{thj\text{-}case}$	Thermal resistance junction-case diode	4	7	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	62.5	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= 5 A V_{GE}= 15 V, I_C= 5 A, T_j = 150 °C		2 1.6		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_j = 150 °C			±100	nA
I_{CES}	Collector cut-off current (V_{GE} = 0)	V_{CE}= 600 V V_{CE}= 600 V, T_j = 150 °C			150 1	µA mA
g_{fs} (1)	Forward transconductance	V_{CE} = 15 V , I_C = 5 A		3		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 = 5 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 = 5 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 = 5 A R_G= 10 Ω, V_{GE}= 15 V, T_j = 150 °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 = 5 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 = 5 A, R_{GE} = 10 Ω, V_{GE} = 15 V T_j = 150 °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 = 5 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 = 5 A R_G= 10 Ω, V_{GE}= 15 V, T_j = 150 °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 = 5 A I_F = 5 A, T_j = 150 °C	-	2.1 1.8	2.4	V V
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_F = 5 A, V_R = 40 V, di/dt = 100 A/µs *(see Figure 5)*	-	24 17 1.5		ns nC A
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_F = 5 A, V_R = 40 V, T_j = 150 °C, di/dt = 100 A/µs *(see Figure 5)*	-	TBD TBD TBD		ns nC A

3 Test circuits

Figure 2. Test circuit for inductive load switching

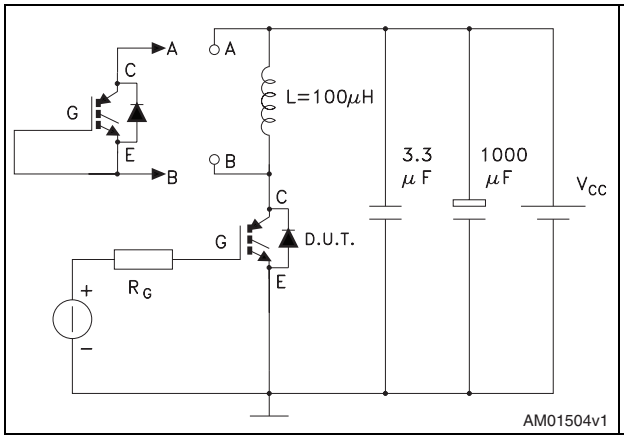


Figure 3. Gate charge test circuit

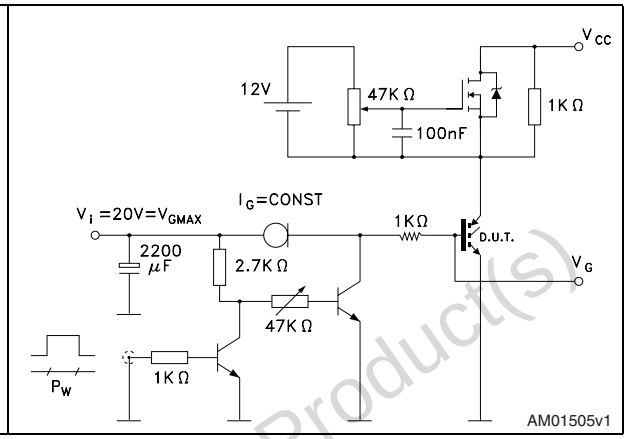


Figure 4. Switching waveforms

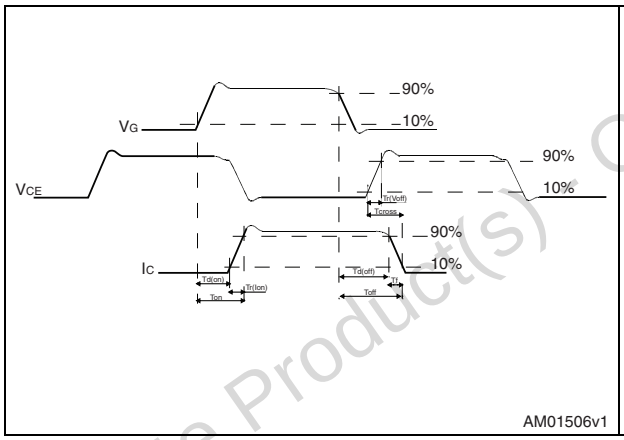
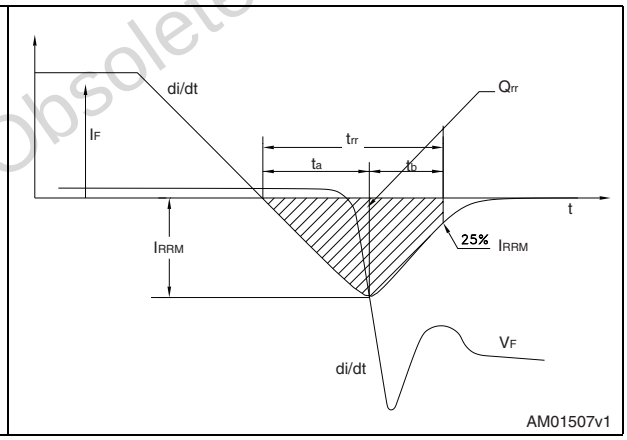


Figure 5. Diode recovery times waveform



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.

Table 9. D²PAK (TO-263) mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50		
E	10		10.40
E1	8.50		
e		2.54	
e1	4.88		5.28
H	15		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.4	
V2	0°		8°

Figure 6. D²PAK (TO-263) drawing

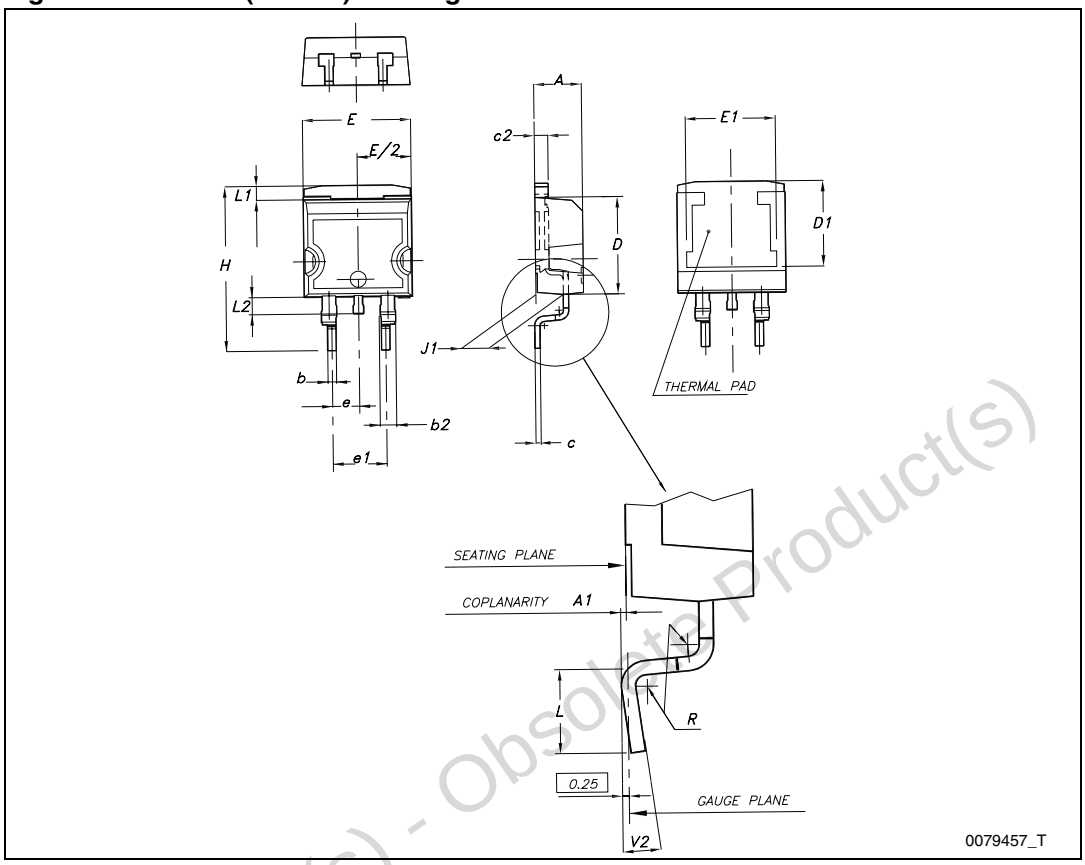


Table 10. TO-220FP mechanical data

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 7. TO-220FP drawing

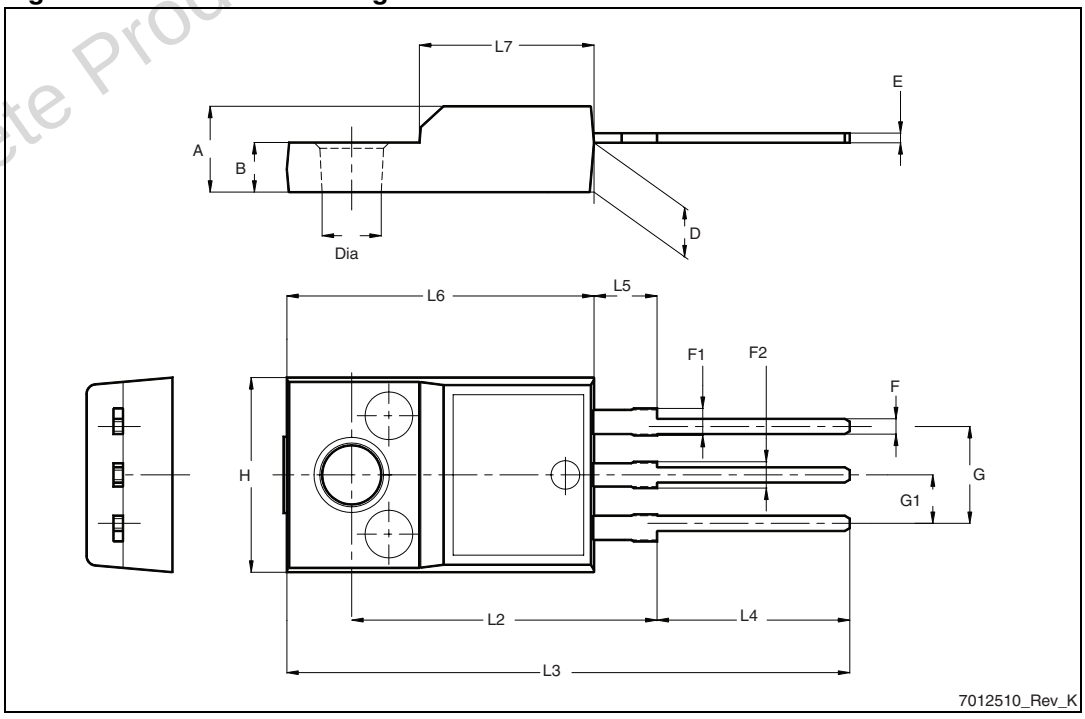
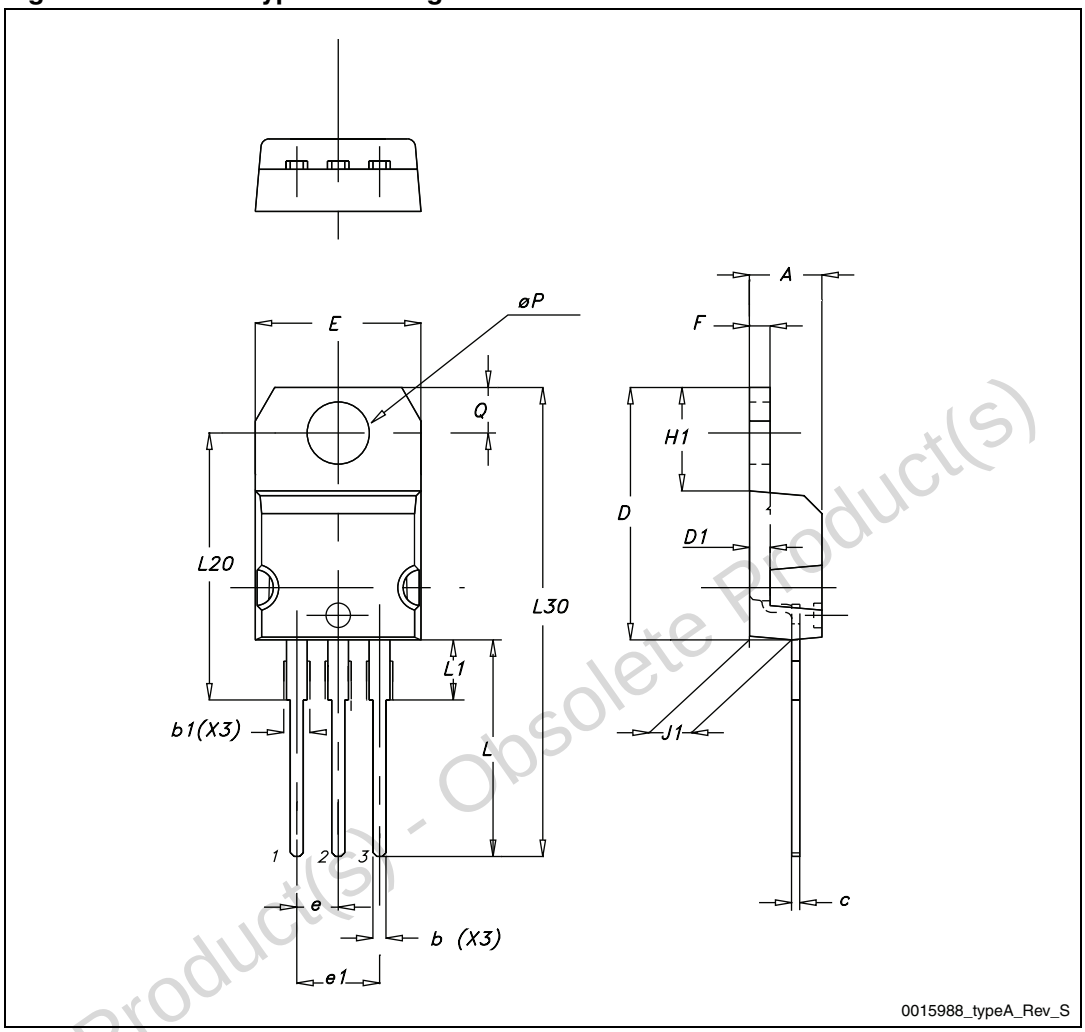


Table 11. TO-220 type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
∅P	3.75		3.85
Q	2.65		2.95

Figure 8. TO-220 type A drawing



5 Revision history

Table 12. Document revision history

Date	Revision	Changes
18-Aug-2009	1	Initial release.
23-Feb-2012	2	The part number STGD10HF60KD has been moved to a separate datasheet. Document promoted from preliminary data to full datasheet - Modified Description text on the coverpage.