STGD3HF60WD

3 A, 600 V ultra fast IGBT

Preliminary data

Features

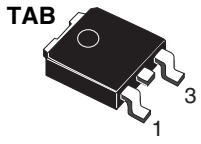
- Minimal tail current
- Low conduction and switching losses
- Ultra fast soft recovery antiparallel diode

Applications

- High frequency inverters
- Motor drives

Description

The "HF" family is based on a new advanced planar technology concept to yield an IGBT with more stable switching performance (E_{off}) versus temperature, as well as lower conduction losses. The STGD3HF60WD is tailored to cost effective solution for motor drive.



DPAK

Figure 1. Internal schematic diagram

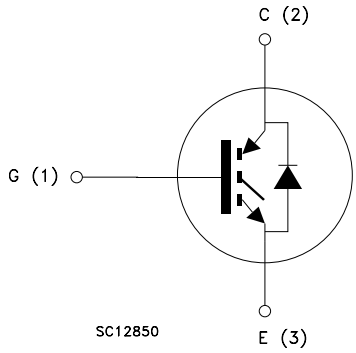


Table 1. Device summary

Order codes	Marking	Package	Packaging
STGD3HF60WDT4	GD3HF60WD	DPAK	Tape and reel

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	TBD	A
I_C(1)	Continuous collector current at T_C = 100 °C	TBD	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=10ms sinusoidal	25	A
P_{TOT}	Total dissipation at T_C = 25 °C	TBD	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. Vclamp = 80%,(V_{CES}), Tj =150°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
$R_{thj\text{-}case}$	Thermal resistance junction-case IGBT	TBD	°C/W
	Thermal resistance junction-case diode	TBD	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	100	°C/W

2 Electrical characteristics

(T_j=25 °C unless otherwise specified)

Table 4. Static electrical characteristics

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= 0.5 A, T_j=125°C V_{GE} = 15 V, I_C= 1.5 A V_{GE}= 15 V, I_C= 1.5 A, T_j=125°C		1.3 2.3 1.8		V
$V_{GE(th)}$	Gate threshold voltage	V_{CE}= V_{GE}, I_C= 250 µA	3.75		5.75	V
I_{CES}	Collector cut-off current (V_{GE} = 0)	V_{CE} = 600 V V_{CE} = 600 V, T_j= 125 °C			250 1	µA mA
I_{GES}	Gate-emitter leakage current (V_{CE} = 0)	V_{GE} = ±20 V			±100	nA
g_{fs}	Forward transconductance	V_{CE} = 15 V, I_C= 1.5 A		TBD		S

Table 5. Dynamic electrical characteristics

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 = 1.5 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 = 1.5 A R_G= 10 Ω, V_{GE} = 15 V *(see Figure 4)*	-	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 = 1.5 A R_G = 10 Ω, V_{GE} = 15 V, T_j =125 °C *(see Figure 4)*	-	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 = 1.5 A, R_{GE} = 10 Ω, V_{GE} = 15 V *(see Figure 4)*	-	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 = 1.5 A, R_{GE} = 10 Ω, V_{GE} =15 V, T_j = 125 °C *(see Figure 4)*	-	TBD TBD TBD	-	ns ns ns

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on} (1) E_{off}(2) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 390 V, I_C = 1.5 A R_G = 10 Ω, V_{GE}=15 V *(see Figure 4)*	-	12 30 42	-	µJ µJ µJ
E_{on} (1) E_{off}(2) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 390 V, I_C = 1.5 A R_G = 10 Ω, V_{GE} = 15 V, T_j = 125 °C *(see Figure 4)*	-	20 40 60	-	µJ µJ µJ

1. Eon is the turn-on losses when a typical diode is used in the test circuit in *(see Figure 5)*. If the IGBT is offered in a package with a co-pak 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 = 1.5 A I_F = 1.5 A, Tj=125 °C	-	1.4 1.15	1.8	V
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_F = 1.5 A, V_R = 40 V, di/dt = 100 A/µs *(see Figure 5)*	-	TBD TBD TBD		ns nC A
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_F = 1.5 A,V_R = 40 V, T_j =125 °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

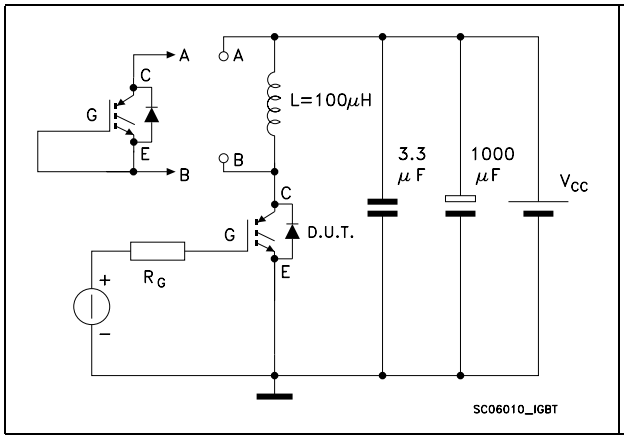


Figure 3. Gate charge test circuit

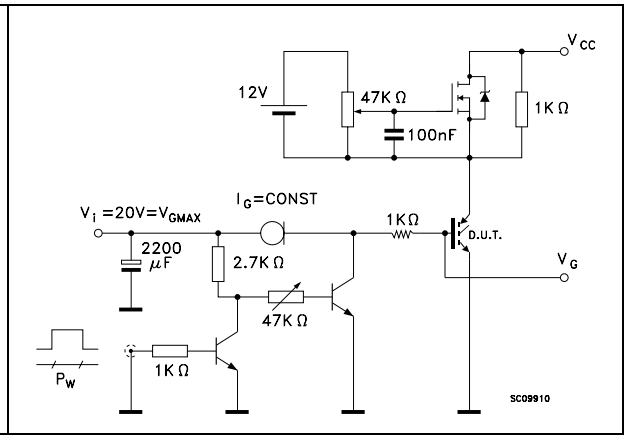


Figure 4. Switching waveform

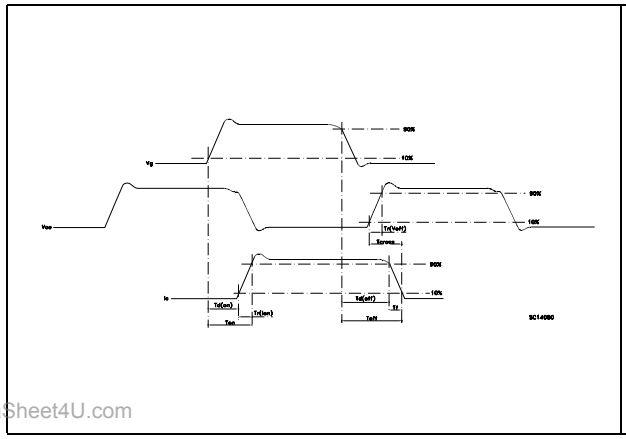
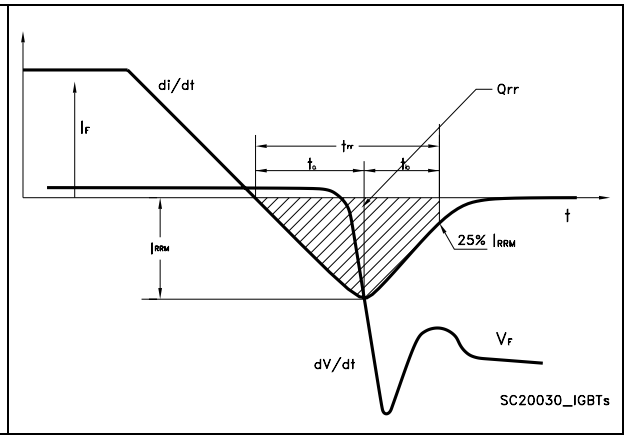


Figure 5. Diode recovery time waveform

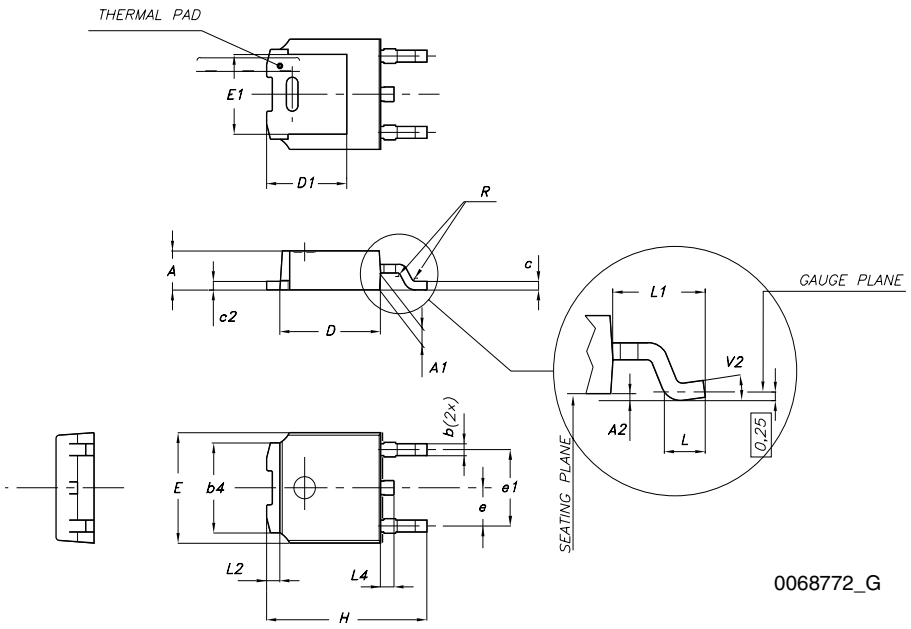


4 Package mechanical data

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.

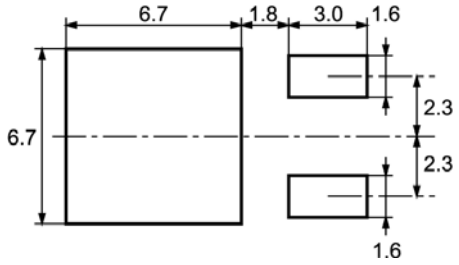
TO-252 (DPAK) mechanical data

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1		
L1		2.80	
L2		0.80	
L4	0.60		1
R		0.20	
V2	0 °		8 °



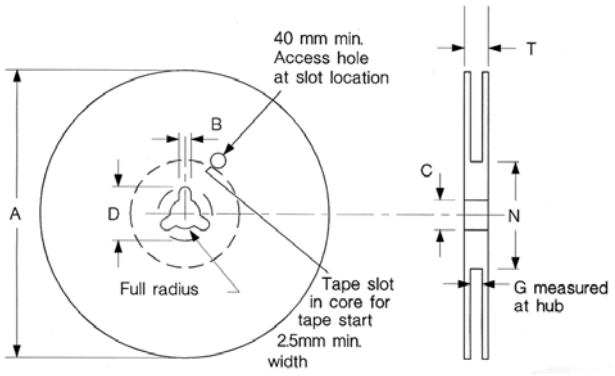
5 Packaging mechanical data

DPAK FOOTPRINT



All dimensions are in millimeters

TAPE AND REEL SHIPMENT



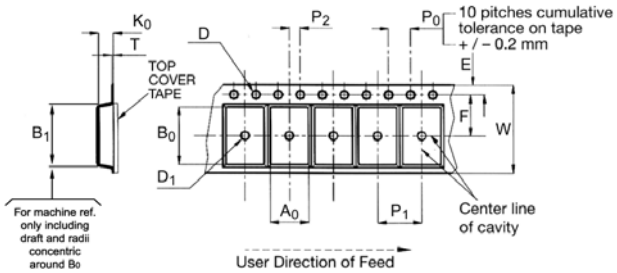
REEL MECHANICAL DATA

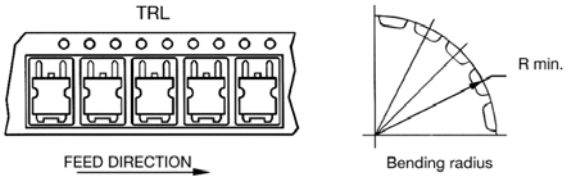
DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	16.4	18.4	0.645	0.724
N	50		1.968	
T		22.4		0.881

BASE QTY	BULK QTY
2500	2500

TAPE MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	6.8	7	0.267	0.275
B0	10.4	10.6	0.409	0.417
B1		12.1		0.476
D	1.5	1.6	0.059	0.063
D1	1.5		0.059	
E	1.65	1.85	0.065	0.073
F	7.4	7.6	0.291	0.299
K0	2.55	2.75	0.100	0.108
P0	3.9	4.1	0.153	0.161
P1	7.9	8.1	0.311	0.319
P2	1.9	2.1	0.075	0.082
R	40		1.574	
W	15.7	16.3	0.618	0.641





6 Revision history

Table 9. Document revision history

Date	Revision	Changes
29-Oct-2009	1	First release

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