



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.

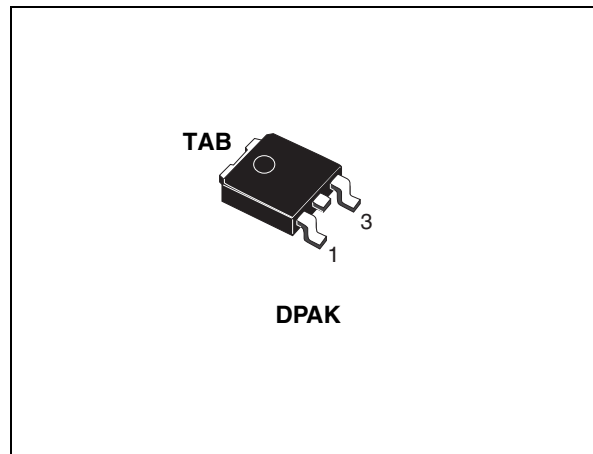
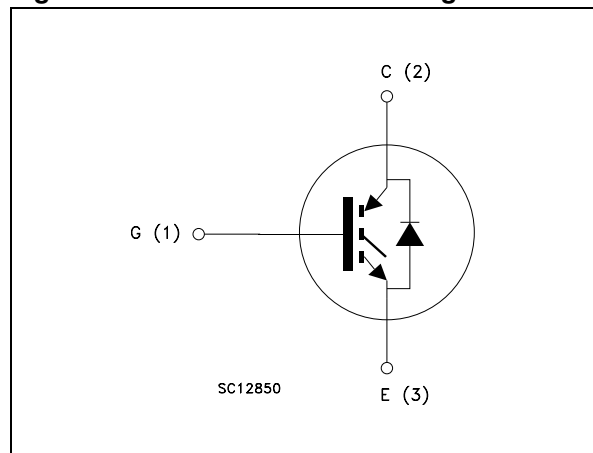


Figure 1. Internal schematic diagram



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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 $T_C = 25\text{ °C}$	TBD	A
$I_C^{(1)}$	Continuous collector current at $T_C = 100\text{ °C}$	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 $T_C = 25\text{ °C}$	10	A
I_{FSM}	Surge non repetitive forward current $t_p=10\text{ms}$ sinusoidal	25	A
P_{TOT}	Total dissipation at $T_C = 25\text{ °C}$	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. $V_{clamp} = 80\%(V_{CES})$, $T_j = 150\text{ °C}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$

3. Pulse width limited by maximum junction temperature and turn-off within RBSOA

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case IGBT	TBD	°C/W
	Thermal resistance junction-case diode	TBD	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient	100	°C/W

2 Electrical characteristics

($T_j=25\text{ }^\circ\text{C}$ unless otherwise specified)

Table 4. Static electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage ($V_{GE} = 0$)	$I_C = 1\text{ mA}$	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$, $I_C = 0.5\text{ A}$, $T_j = 125^\circ\text{C}$ $V_{GE} = 15\text{ V}$, $I_C = 1.5\text{ A}$ $V_{GE} = 15\text{ V}$, $I_C = 1.5\text{ A}$, $T_j = 125^\circ\text{C}$		1.3 2.3 1.8		V
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}$, $I_C = 250\text{ }\mu\text{A}$	3.75		5.75	V
I_{CES}	Collector cut-off current ($V_{GE} = 0$)	$V_{CE} = 600\text{ V}$ $V_{CE} = 600\text{ V}$, $T_j = 125\text{ }^\circ\text{C}$			250 1	μA mA
I_{GES}	Gate-emitter leakage current ($V_{CE} = 0$)	$V_{GE} = \pm 20\text{ V}$			± 100	nA
g_{fs}	Forward transconductance	$V_{CE} = 15\text{ V}$, $I_C = 1.5\text{ A}$		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	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0$	-	TBD TBD TBD	-	pF pF pF
Q_g Q_{ge} Q_{gc}	Total gate charge Gate-emitter charge Gate-collector charge	$V_{CE} = 390\text{ V}$, $I_C = 1.5\text{ A}$, $V_{GE} = 15\text{ V}$ (see Figure 3)	-	TBD TBD TBD	-	nC nC nC

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Electrical characteristics

STGD3HF60WD

Table 6. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 390\text{ V}$, $I_C = 1.5\text{ A}$		TBD		ns
t_r	Current rise time	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$	-	TBD	-	ns
$(di/dt)_{on}$	Turn-on current slope	(see Figure 4)		TBD		A/ μs
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 390\text{ V}$, $I_C = 1.5\text{ A}$		TBD		ns
t_r	Current rise time	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$,	-	TBD	-	ns
$(di/dt)_{on}$	Turn-on current slope	$T_j = 125\text{ }^\circ\text{C}$ (see Figure 4)		TBD		A/ μs
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 390\text{ V}$, $I_C = 1.5\text{ A}$,		TBD		ns
$t_{d(off)}$	Turn-off delay time	$R_{GE} = 10\ \Omega$, $V_{GE} = 15\text{ V}$	-	TBD	-	ns
t_f	Current fall time	(see Figure 4)		TBD		ns
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 390\text{ V}$, $I_C = 1.5\text{ A}$,		TBD		ns
$t_{d(off)}$	Turn-off delay time	$R_{GE} = 10\ \Omega$, $V_{GE} = 15\text{ V}$,	-	TBD	-	ns
t_f	Current fall time	$T_j = 125\text{ }^\circ\text{C}$ (see Figure 4)		TBD		ns

Table 7. Switching energy (inductive load)

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

- E_{on} 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-pak diode is used as external diode. IGBTs and diode are at the same temperature (25°C and 125°C)
- Turn-off losses include also the tail of the collector current

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Table 8. Collector-emitter diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_F	Forward on-voltage	$I_F = 1.5\text{ A}$ $I_F = 1.5\text{ A}$, $T_j = 125\text{ }^\circ\text{C}$	-	1.4 1.15	1.8	V
t_{rr}	Reverse recovery time	$I_F = 1.5\text{ A}$, $V_R = 40\text{ V}$,		TBD		ns
Q_{rr}	Reverse recovery charge	$di/dt = 100\text{ A}/\mu\text{s}$	-	TBD		nC
I_{rrm}	Reverse recovery current	(see Figure 5)		TBD		A
t_{rr}	Reverse recovery time	$I_F = 1.5\text{ A}$, $V_R = 40\text{ V}$,		TBD		ns
Q_{rr}	Reverse recovery charge	$T_j = 125\text{ }^\circ\text{C}$, $di/dt = 100\text{ A}/\mu\text{s}$	-	TBD		nC
I_{rrm}	Reverse recovery current	(see Figure 5)		TBD		A

3 Test circuits

Figure 2. Test circuit for inductive load switching

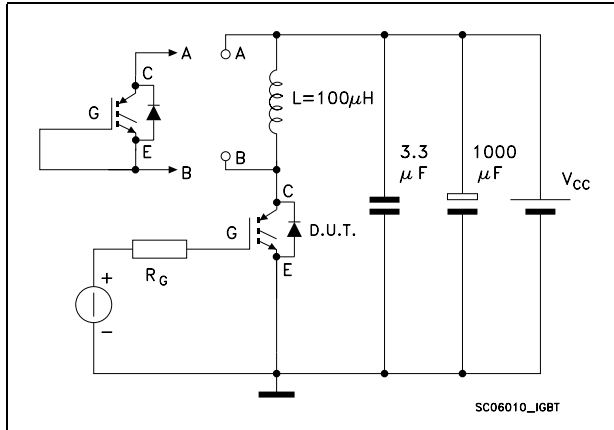


Figure 3. Gate charge test circuit

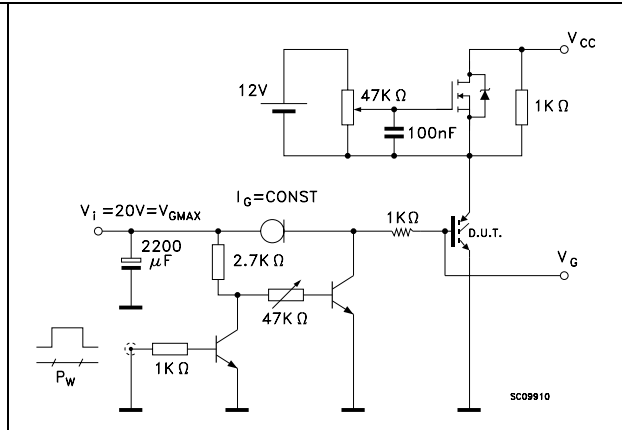


Figure 4. Switching waveform

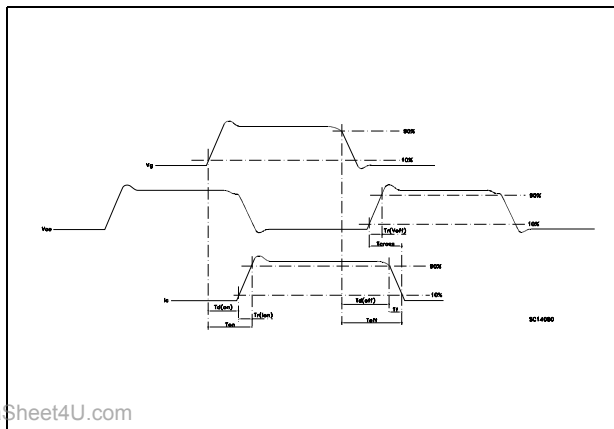
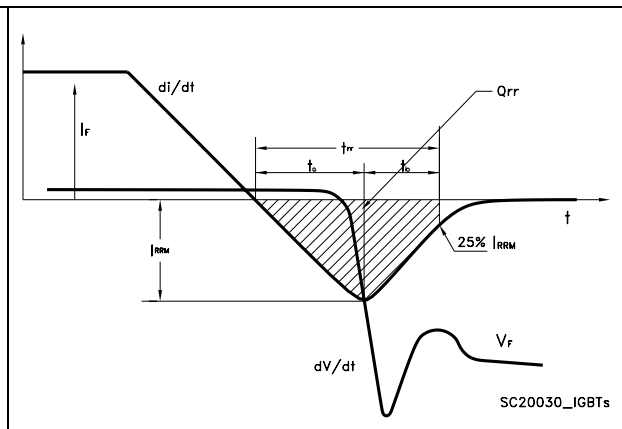


Figure 5. Diode recovery time waveform



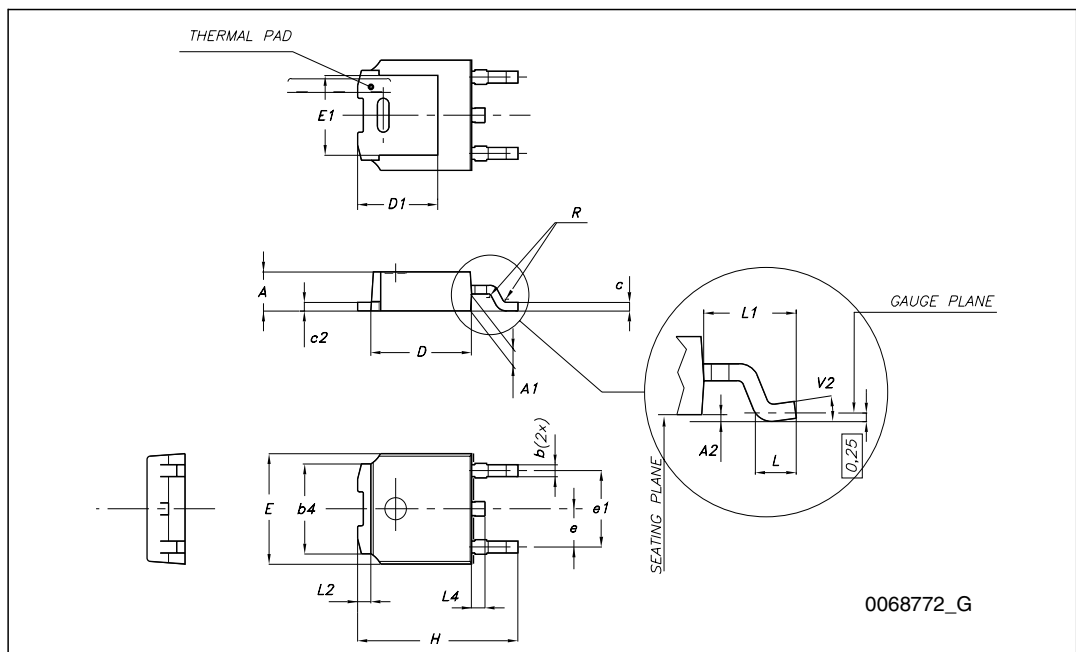
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4 Package mechanical data

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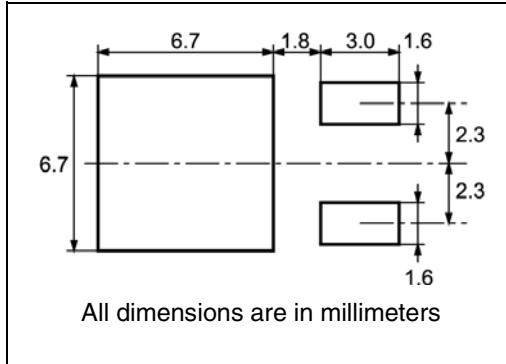
TO-252 (DPAK) mechanical data

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



TAPE AND REEL SHIPMENT

40 mm min. Access hole at slot location

Full radius

Tape slot in core for tape start 2.5mm min. width

G measured at hub

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

TOP COVER TAPE

10 pitches cumulative tolerance on tape +/- 0.2 mm

Center line of cavity

User Direction of Feed

FEED DIRECTION

Bending radius R min.

For machine ref. only including draft and radii concentric around B0

6 Revision history

Table 9. Document revision history

Date	Revision	Changes
29-Oct-2009	1	First release

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