STGW45HF60WD

45 A, 600 V ultra fast IGBT

Preliminary data

Features

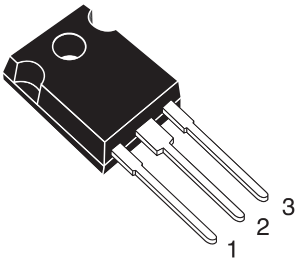
- Improved E_{off} at elevated temperature
- Low C_{RES} / C_{IES} ratio (no cross-conduction susceptibility)
- Ultra fast soft recovery antiparallel diode

Applications

- Welding
- High frequency converters
- Power factor correction

Description

The "HF" series is based on a new planar technology concept to yield an IGBT with tighter variation of switching energy (E_{off}) versus temperature. Suffix "W" denotes a subset of products tailored to high switching frequency operation over 100 kHz.



TO-247

Figure 1. Internal schematic diagram

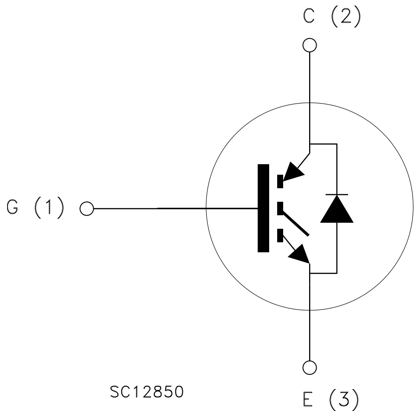


Table 1. Device summary

Order code	Marking	Package	Packaging
STGW45HF60WD	GW45HF60WD	TO-247	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	70	A
I_C (1)	Continuous collector current at T_C = 100 °C	45	A
I_{CP}(2)	Collector current (pulsed)	TBD	A
I_{CL} (3)	Turn-off latching current	TBD	A
V_{GE}	Gate-emitter voltage	± 20	V
I_F	Diode RMS forward current at T_C = 25 °C	30	A
I_{FSM}	Surge not repetitive forward current t_p= 10 ms sinusoidal	120	A
P_{TOT}	Total dissipation at T_C = 25 °C	250	W
T_{stg}	Storage temperature	– 55 to 150	°C
T_j	Operating junction temperature		

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. V_{CLAMP} = 80% (V_{CES}), V_{GE} = 15 V, R_G = 10 Ω, T_J = 150 °C

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case IGBT	0.5	°C/W
	Thermal resistance junction-case diode	1.5	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	50	°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= 30 A V_{GE} = 15V, I_C = 30 A,T_J= 125 °C		1.9 TBD	2.5	V V
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 1 mA	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			500 5	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 = 30 A		TBD		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	-	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 = 30 A, V_{GE} = 15 V, *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 = 30 A R_G = 4.7 Ω, V_{GE} = 15 V, *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 = 30 A R_G = 4.7 Ω, V_{GE} = 15 V, T_J = 125 °C *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 = 30 A, R_{GE} = 4.7 Ω, V_{GE} = 15 V *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 = 30 A, R_{GE} = 4.7 Ω, V_{GE} =15 V, T_J = 125 °C *Figure 2*	-	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} E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 390 V, I_C = 30 A R_G = 4.7 Ω, V_{GE} = 15 V, *Figure 4*	-	300 330 630		µJ µJ µJ
E_{on}(1) E_{off} E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 390 V, I_C = 30 A R_G = 4.7 Ω, V_{GE} = 15 V, T_J = 125 °C *Figure 4*	-	550 550 1100	 800 	µJ µJ µJ

1. Eon is the tun-on losses when a typical diode is used in the test circuit in *Figure 4*. If the IGBT is offered in a package with a co-pak diode, the co-pack diode is used as external diode. IGBTs & Diode are at the same temperature (25 °C and 125 °C). Eon include diode recovery energy.

Table 8. Collector-emitter diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_F	Forward on-voltage	I_F = 30 A I_F = 30 A, T_J = 125 °C	-	1.6 1.4	-	V V
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_F = 30 A,V_R = 50 V, di/dt = 100 A/µs *(see Figure 5)*	-	45 56 2.55	-	ns nC A
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_F = 30 A,V_R = 50 V, di/dt = 100 A/µs T_J =125 °C, *(see Figure 5)*	-	100 290 5.8	-	ns nC A

3 Test circuits

Figure 2. Test circuit for inductive load switching

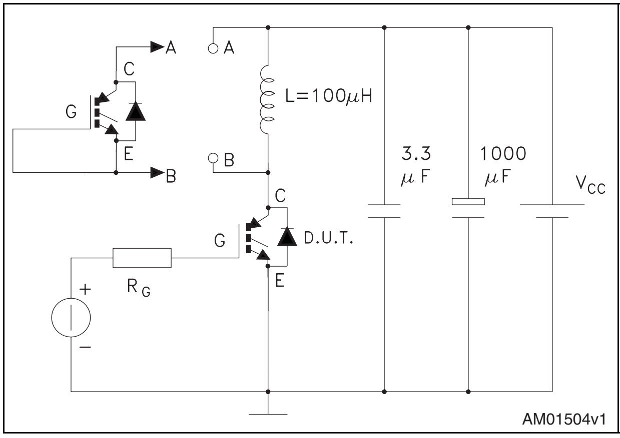


Figure 3. Gate charge test circuit

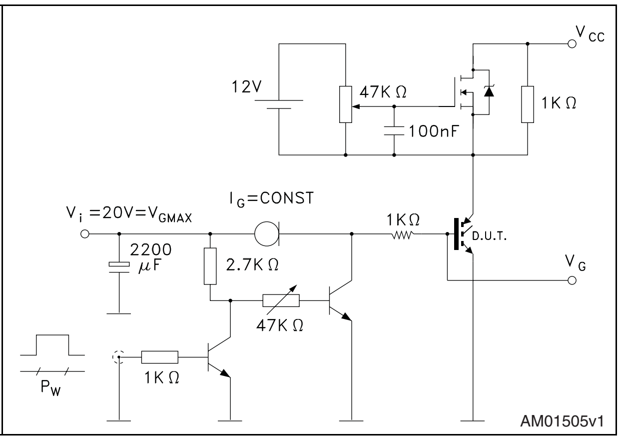


Figure 4. Switching waveform

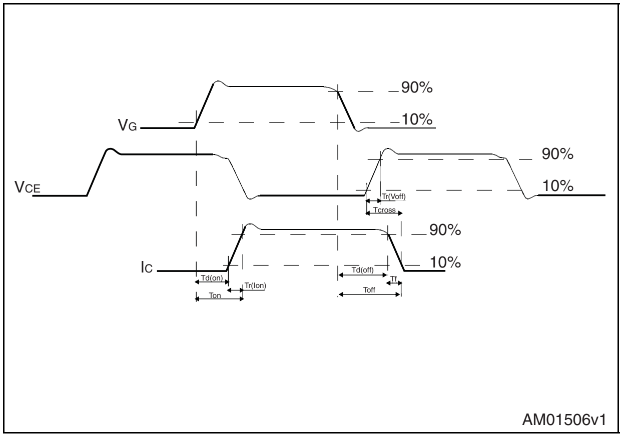
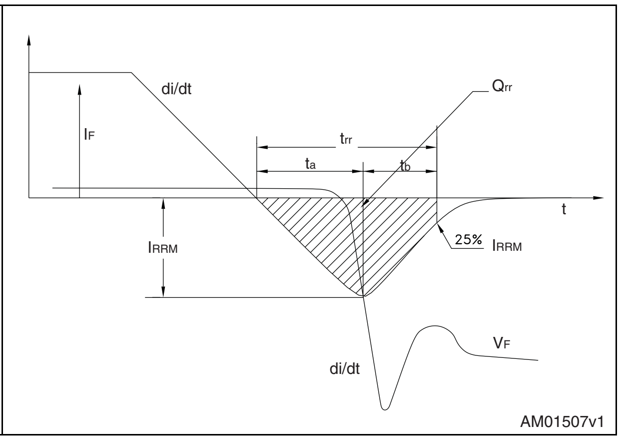


Figure 5. Diode recovery time waveform

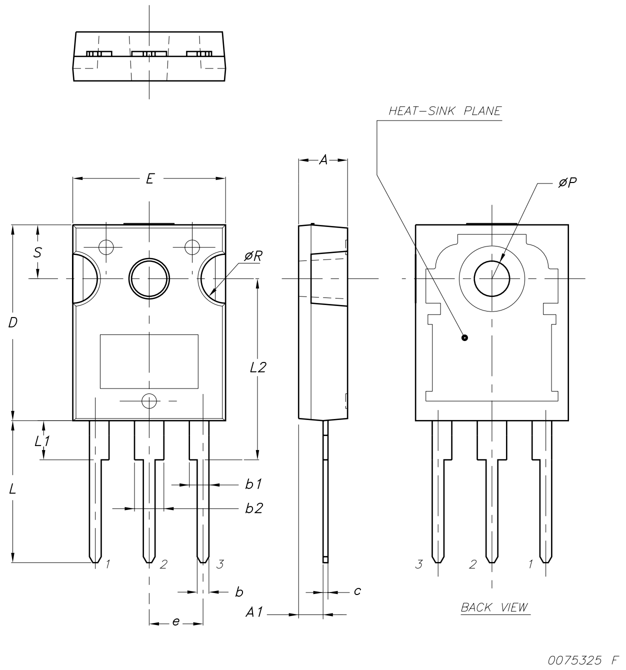


4 Package mechanical data

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-247 Mechanical data

Dim.	mm.		
	Min.	Typ	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e		5.45	
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
øP	3.55		3.65
øR	4.50		5.50
S		5.50	



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
16-Apr-2009	1	Initial release.
04-Aug-2009	2	– Modified I_C value on Test conditions *Table 4* – Modified R_G value on Test conditions *Table 6* and *Table 7*

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