

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.

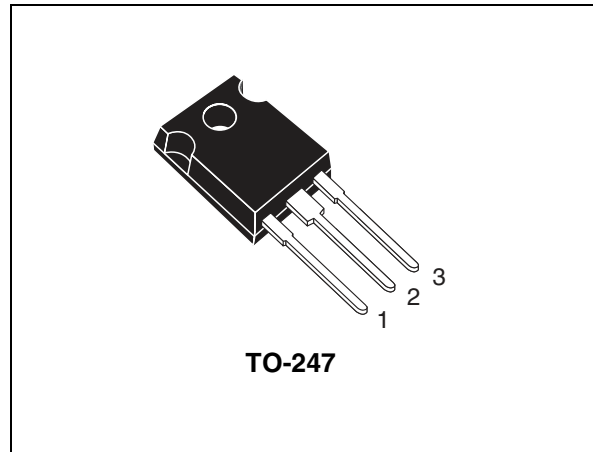


Figure 1. Internal schematic diagram

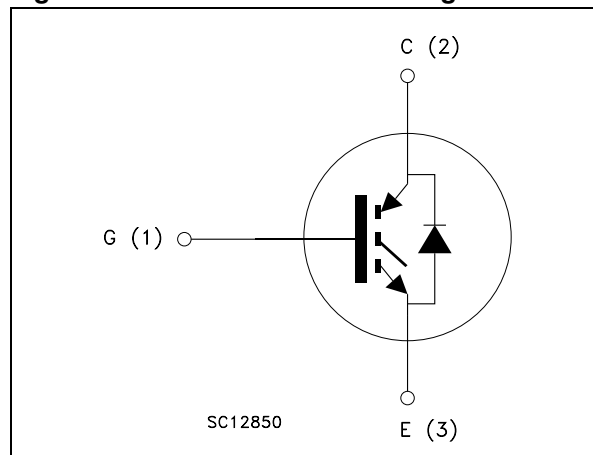


Table 1. Device summary

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:

$$I_C(T_C) = \frac{T_{j(max)} - T_C}{R_{thj-c} \times V_{GE(sat)(max)}(T_{j(max)}, I_C(T_C))}$$

- 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-case}	Thermal resistance junction-case IGBT	0.5	°C/W
	Thermal resistance junction-case diode	1.5	°C/W
R _{thj-amb}	Thermal resistance junction-ambient	50	°C/W

2 Electrical characteristics

($T_J = 25\text{ °C}$ unless otherwise specified)

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage ($V_{GE} = 0$)	$I_C = 1\text{ mA}$	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$, $I_C = 30\text{ A}$ $V_{GE} = 15\text{ V}$, $I_C = 30\text{ A}$, $T_J = 125\text{ °C}$		1.9 TBD	2.5	V V
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}$, $I_C = 1\text{ mA}$	3.75		5.75	V
I_{CES}	Collector cut-off current ($V_{GE} = 0$)	$V_{CE} = 600\text{ V}$ $V_{CE} = 600\text{ V}$, $T_J = 125\text{ °C}$			500 5	μA mA
I_{GES}	Gate-emitter leakage current ($V_{CE} = 0$)	$V_{GE} = \pm 20\text{ V}$			± 100	nA
g_{fs}	Forward transconductance	$V_{CE} = 15\text{ V}$, $I_C = 30\text{ A}$		TBD		S

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0$	-	TBD	-	pF
C_{oes}	Output capacitance			TBD		pF
C_{res}	Reverse transfer capacitance			TBD		pF
Q_g	Total gate charge	$V_{CE} = 390\text{ V}$, $I_C = 30\text{ A}$, $V_{GE} = 15\text{ V}$, <i>Figure 3</i>	-	TBD	-	nC
Q_{ge}	Gate-emitter charge			TBD		nC
Q_{gc}	Gate-collector charge			TBD		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	$V_{CC} = 390\text{ V}$, $I_C = 30\text{ A}$ $R_G = 4.7\ \Omega$, $V_{GE} = 15\text{ V}$, <i>Figure 2</i>	-	TBD TBD TBD	-	ns ns A/ μ s
$t_{d(on)}$ t_r $(di/dt)_{on}$	Turn-on delay time Current rise time Turn-on current slope	$V_{CC} = 390\text{ V}$, $I_C = 30\text{ A}$ $R_G = 4.7\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$ <i>Figure 2</i>	-	TBD TBD TBD	-	ns ns A/ μ s
$t_r(V_{off})$ $t_{d(off)}$ t_f	Off voltage rise time Turn-off delay time Current fall time	$V_{CC} = 390\text{ V}$, $I_C = 30\text{ A}$, $R_{GE} = 4.7\ \Omega$, $V_{GE} = 15\text{ V}$ <i>Figure 2</i>	-	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	$V_{CC} = 390\text{ V}$, $I_C = 30\text{ A}$, $R_{GE} = 4.7\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$ <i>Figure 2</i>	-	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	$V_{CC} = 390\text{ V}$, $I_C = 30\text{ A}$ $R_G = 4.7\ \Omega$, $V_{GE} = 15\text{ V}$, <i>Figure 4</i>	-	300 330 630		μ J μ J μ J
$E_{on}^{(1)}$ E_{off} E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	$V_{CC} = 390\text{ V}$, $I_C = 30\text{ A}$ $R_G = 4.7\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$ <i>Figure 4</i>	-	550 550 1100	800	μ J μ J μ J

1. E_{on} is the turn-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-pak diode is used as external diode. IGBTs & Diode are at the same temperature (25 °C and 125 °C). E_{on} include diode recovery energy.

Table 8. Collector-emitter diode

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

3 Test circuits

Figure 2. Test circuit for inductive load switching

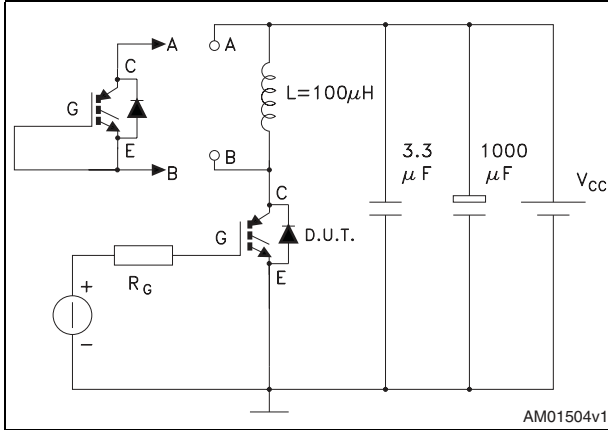


Figure 3. Gate charge test circuit

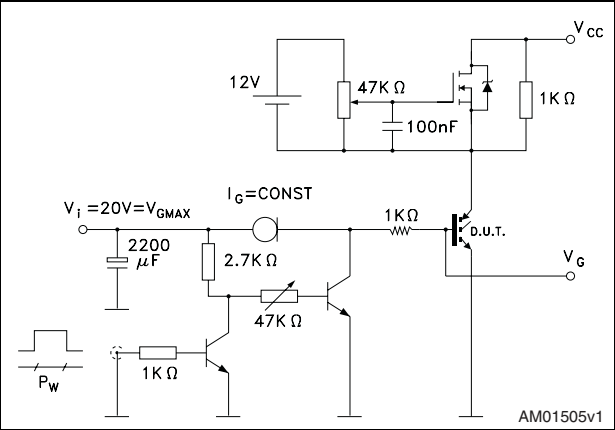


Figure 4. Switching waveform

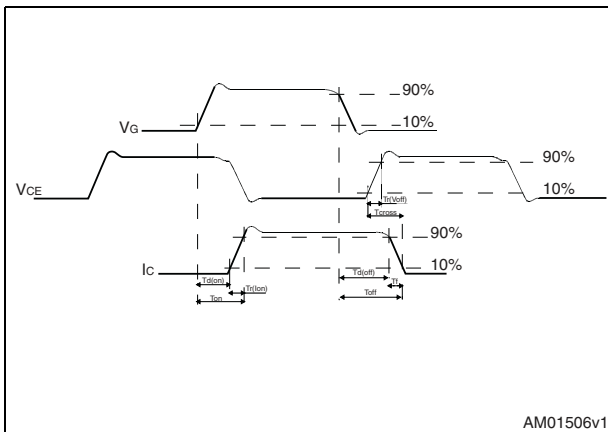
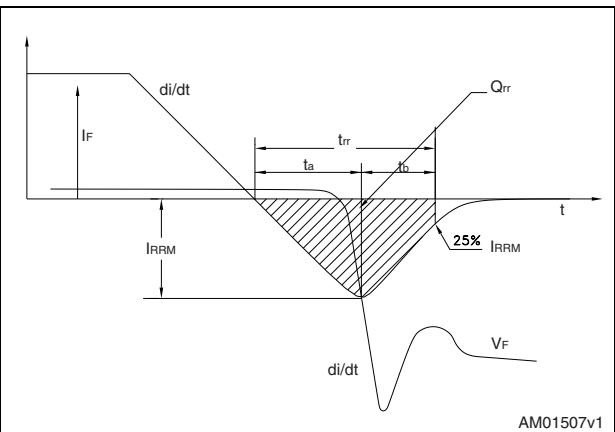


Figure 5. Diode recovery time waveform

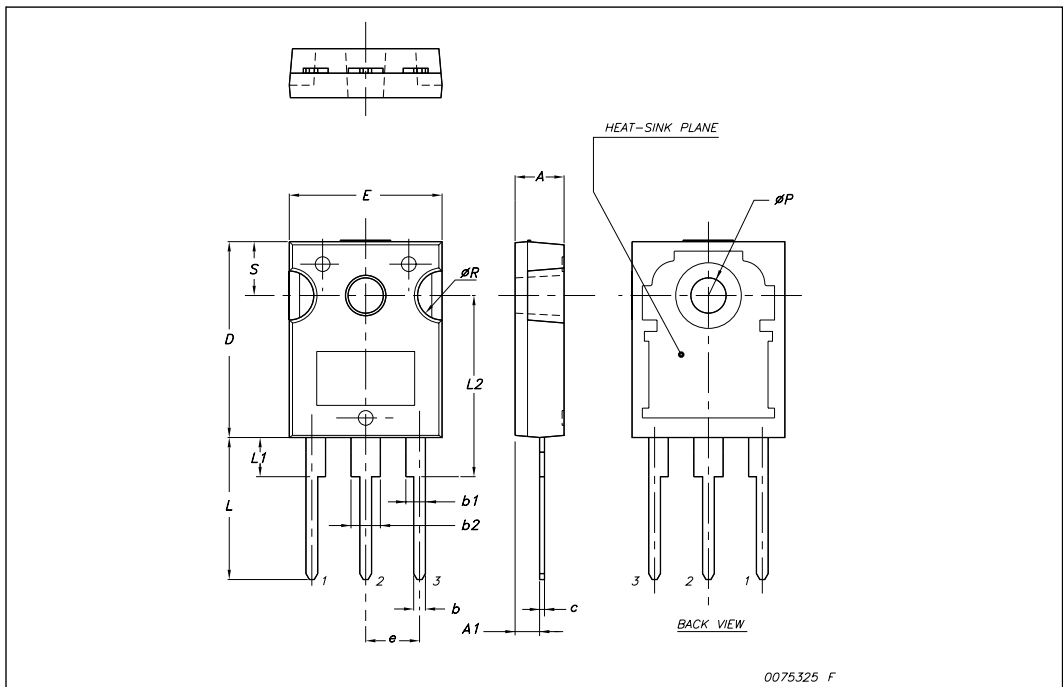


4 Package mechanical data

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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