

Features

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

Applications

- Welding
- Induction heating
- Resonant converters

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. The suffix "W" denotes a subset of products tailored to high switching frequency operation (over 100 kHz).

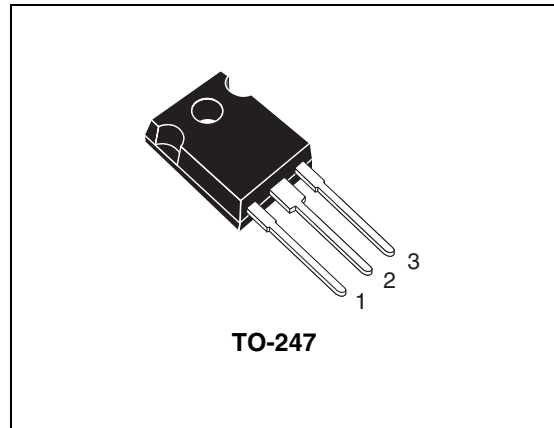


Figure 1. Internal schematic diagram

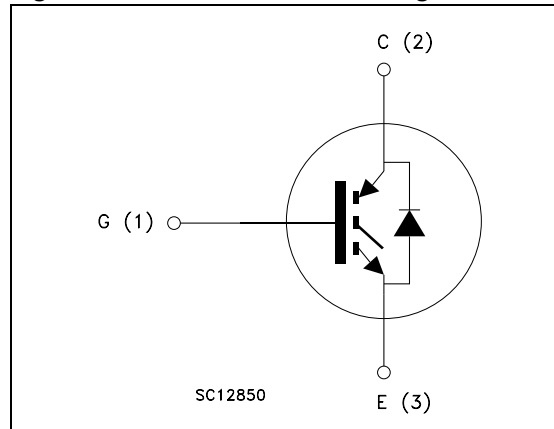


Table 1. Device summary

Order code	Marking	Package	Packaging
STGW35HF60WDI	GW35HF60WDI	TO-247	Tube
STGWA35HF60WDI	35HF60WDI	TO-247 long leads	

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-247	TO-247 long leads	
V_{CES}	Collector-emitter voltage ($V_{GE} = 0$)	600		V
$I_C^{(1)}$	Continuous collector current at $T_C = 25\text{ °C}$	60	70	A
$I_C^{(1)}$	Continuous collector current at $T_C = 100\text{ °C}$	35	40	A
$I_{CL}^{(2)}$	Turn-off latching current	80		A
$I_{CP}^{(3)}$	Pulsed collector current	150		A
V_{GE}	Gate-emitter voltage	± 20		V
I_F	Diode RMS forward current at $T_C = 25\text{ °C}$	30		A
I_{FSM}	Surge non repetitive forward current $t_p = 10\text{ ms}$ sinusoidal	130		A
P_{TOT}	Total dissipation at $T_C = 25\text{ °C}$	200	260	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. $V_{CLAMP} = 80\% (V_{CES})$, $V_{GE} = 15\text{ V}$, $R_G = 10\ \Omega$, $T_J = 150\text{ °C}$

Table 3. Thermal data

Symbol	Parameter	Value		Unit
		TO-247	TO-247 long leads	
$R_{thj-case}$	Thermal resistance junction-case IGBT	0.63	0.48	°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	$V_{GE} = 15\text{ V}$, $I_C = 20\text{ A}$ $V_{GE} = 15\text{ V}$, $I_C = 20\text{ A}$, $T_J = 125\text{ °C}$		1.9 1.65	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 ($V_{GE} = 0$)	$V_{CE} = 600\text{ V}$ $V_{CE} = 600\text{ V}$, $T_J = 125\text{ °C}$			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	$V_{CE} = 15\text{ V}$, $I_C = 20\text{ A}$		15		S

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0$	-	2400	-	pF
C_{oes}	Output capacitance			235		pF
C_{res}	Reverse transfer capacitance			50		pF
Q_g	Total gate charge	$V_{CE} = 390\text{ V}$, $I_C = 20\text{ A}$,	-	140	-	nC
Q_{ge}	Gate-emitter charge	$V_{GE} = 15\text{ V}$,		13		nC
Q_{gc}	Gate-collector charge	(see Figure 3)		52		nC

Table 6. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 390\text{ V}$, $I_C = 20\text{ A}$	-	30	-	ns
t_r	Current rise time	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$,	-	15	-	ns
$(di/dt)_{on}$	Turn-on current slope	(see Figure 2)	-	1650	-	A/ μ s
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 390\text{ V}$, $I_C = 20\text{ A}$	-	30	-	ns
t_r	Current rise time	$R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$,	-	15	-	ns
$(di/dt)_{on}$	Turn-on current slope	$T_J = 125\text{ }^\circ\text{C}$ (see Figure 2)	-	1600	-	A/ μ s
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 390\text{ V}$, $I_C = 20\text{ A}$,	-	30	-	ns
$t_{d(off)}$	Turn-off delay time	$R_{GE} = 10\ \Omega$, $V_{GE} = 15\text{ V}$	-	175	-	ns
t_f	Current fall time	(see Figure 2)	-	40	-	ns
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 390\text{ V}$, $I_C = 20\text{ A}$,	-	50	-	ns
$t_{d(off)}$	Turn-off delay time	$R_{GE} = 10\ \Omega$, $V_{GE} = 15\text{ V}$,	-	225	-	ns
t_f	Current fall time	$T_J = 125\text{ }^\circ\text{C}$ (see Figure 2)	-	70	-	ns

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{off}	Turn-off switching losses	$V_{CC} = 390\text{ V}$, $I_C = 20\text{ A}$ $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, (see Figure 4)	-	185	-	μ J
E_{off}	Turn-off switching losses	$V_{CC} = 390\text{ V}$, $I_C = 20\text{ A}$ $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$, (see Figure 4)	-	350	530	μ J

Table 8. Collector-emitter diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_F	Forward on-voltage	$I_F = 20\text{ A}$ $I_F = 20\text{ A}$, $T_J = 125\text{ }^\circ\text{C}$	-	1.3 1.1	1.7	V V
t_{rr}	Reverse recovery time	$I_F = 20\text{ A}$, $V_R = 50\text{ V}$,	-	85	-	ns
Q_{rr}	Reverse recovery charge	$di/dt = 100\text{ A}/\mu\text{s}$	-	240	-	nC
I_{rrm}	Reverse recovery current	(see Figure 5)	-	5.2	-	A
t_{rr}	Reverse recovery time	$I_F = 20\text{ A}$, $V_R = 50\text{ V}$,	-	230	-	ns
Q_{rr}	Reverse recovery charge	$T_J = 125\text{ }^\circ\text{C}$, $di/dt = 100\text{ A}/\mu\text{s}$	-	930	-	nC
I_{rrm}	Reverse recovery current	(see Figure 5)	-	8.7	-	A

3 Test circuits

Figure 2. Test circuit for inductive load switching

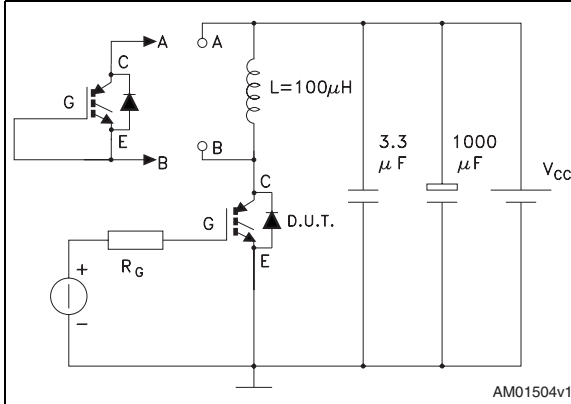


Figure 3. Gate charge test circuit

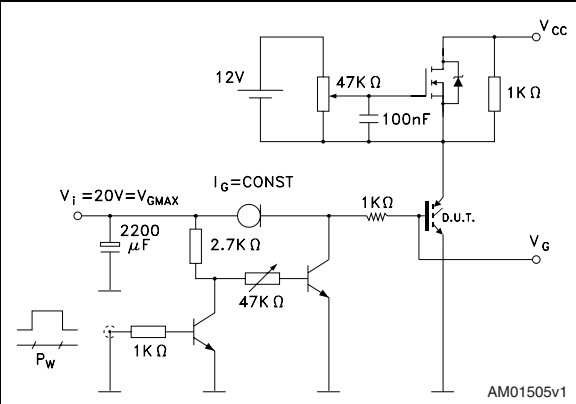


Figure 4. Switching waveform

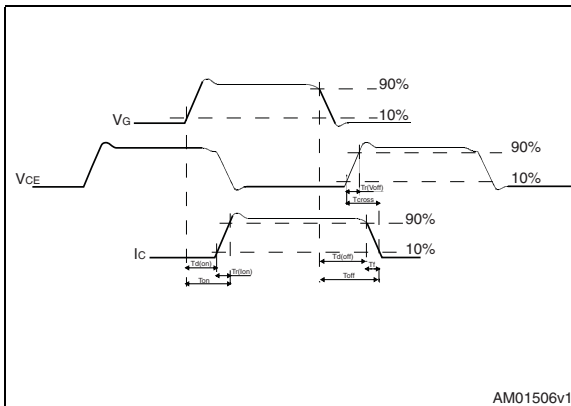
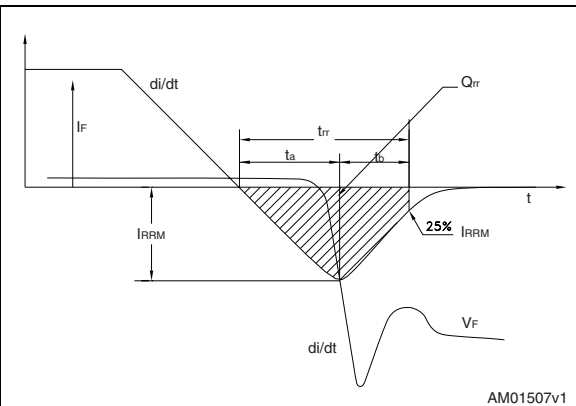


Figure 5. Diode recovery time waveform

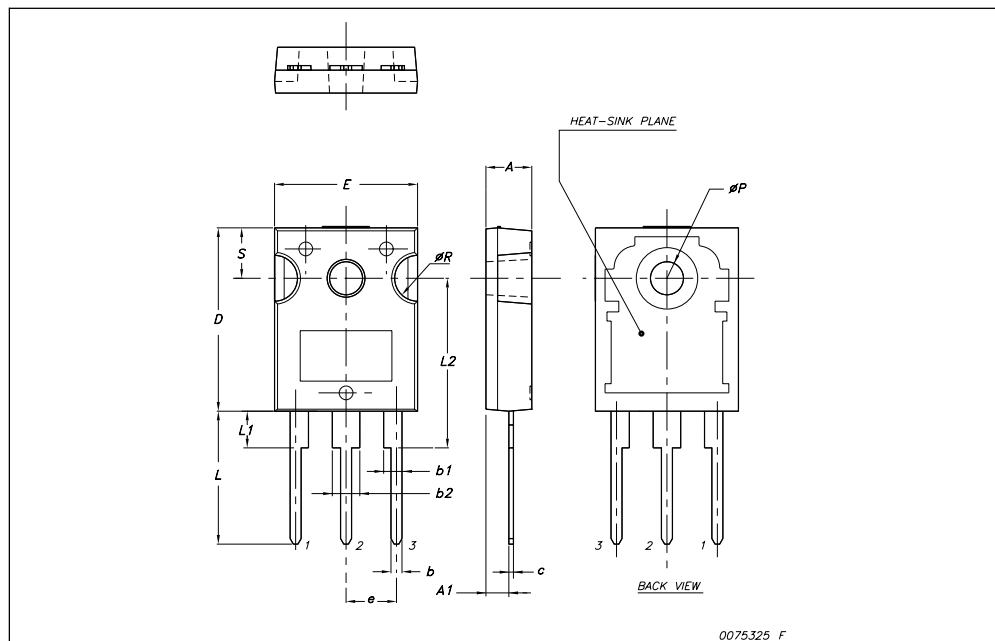


4 Package mechanical data

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.

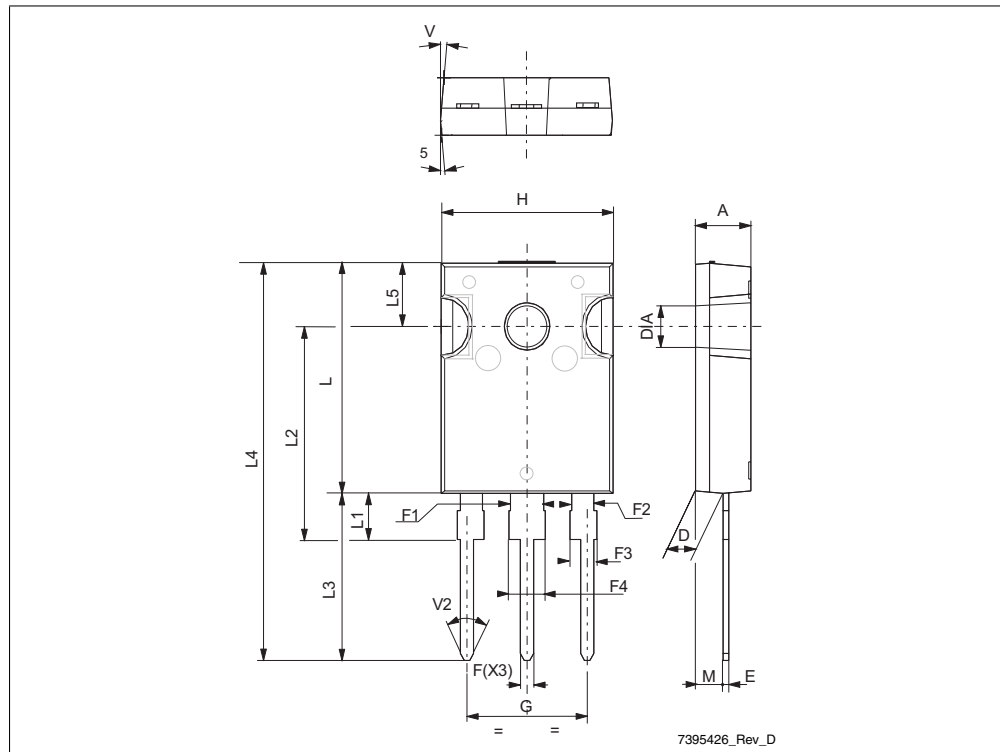
TO-247 Mechanical data

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	



TO-247 long leads mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.85		5.16
D	2.2		2.6
E	0.4		0.8
F	1		1.4
F1		3	
F2		2	
F3	1.9		2.4
F4	3		3.4
G		10.9	
H	15.45		16.03
L	19.85		21.09
L1	3.7		4.3
L2	18.3		19.13
L3	14.2		20.3
L4	34.05		41.38
L5	5.35		6.3
M	2		3
V		5°	
V2		60°	
DIAM	3.55		3.65



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
03-Aug-2009	1	Initial release.
02-Sep-2009	2	Minor text changes throughout the document Removed watermark

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