

### Features

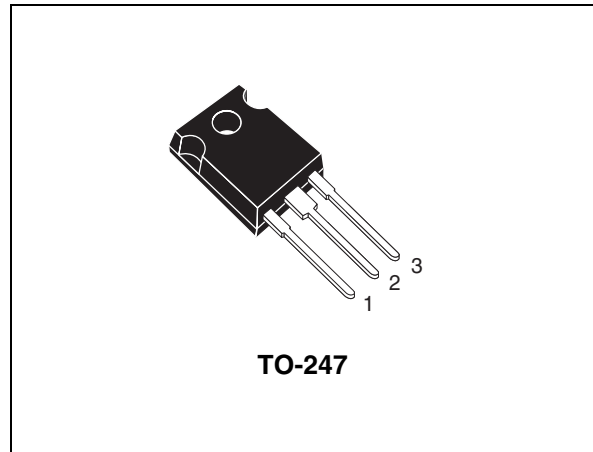
- Very high speed switching
- Tight parameters distribution
- Tail-less switching off
- Ultrafast free-wheeling diode co-packaged
- Low thermal resistance

### Applications

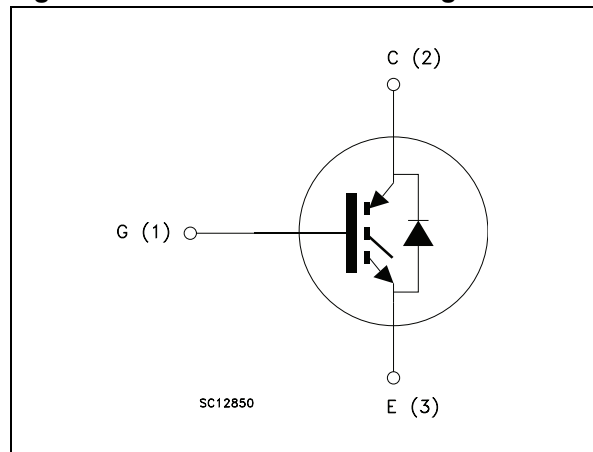
- Uninterruptible power supply
- Welding machines
- Photovoltaic inverters
- Power factor correction
- High switching frequency converters

### Description

This device is an IGBT developed using an advanced proprietary trench gate and field stop structure. The device is part of the "H" series of IGBTs, which represent an optimum compromise between conduction and switching losses to maximize the efficiency of high switching frequency converters. Moreover, a slightly positive  $V_{CE(sat)}$  temperature coefficient and very tight parameter distribution result in safer paralleling operation.



**Figure 1. Internal schematic diagram**



**Table 1. Device summary**

Order code	Marking	Package	Packaging
STGW25H120DF	GW25H120DF	TO-247	Tube

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-emitter voltage ( $V_{GE} = 0$ )	1200	V
$I_C$	Continuous collector current at $T_C = 25\text{ °C}$	50	A
$I_C$	Continuous collector current at $T_C = 100\text{ °C}$	25	A
$I_{CP}^{(1)}$	Pulsed collector current	75	A
$I_F$	Continuous collector current at $T_C = 25\text{ °C}$	25	A
	Continuous collector current at $T_C = 100\text{ °C}$	50	A
$I_F^{(1)}$	Pulsed forward current	100	A
$V_{GE}$	Gate-emitter voltage	$\pm 20$	V
$P_{TOT}$	Total dissipation at $T_C = 25\text{ °C}$	330	W
$T_J$	Operating junction temperature	- 55 to 150	$^{\circ}\text{C}$

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

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance junction-case IGBT	0.38	$^{\circ}\text{C/W}$
$R_{thJC}$	Thermal resistance junction-case diode	1.6	$^{\circ}\text{C/W}$
$R_{thJA}$	Thermal resistance junction-ambient	50	$^{\circ}\text{C/W}$

## 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 ( $V_{GE} = 0$ )	$I_C = 1\text{ mA}$	1200			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$ , $I_C = 25\text{ A}$ $V_{GE} = 15\text{ V}$ , $I_C = 25\text{ A}$ , $T_J = 150\text{ °C}$		2.15 2.25		V V
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}$ , $I_C = 1\text{ mA}$		6		V
$I_{CES}$	Collector cut-off current ( $V_{GE} = 0$ )	$V_{CE} = 1200\text{ V}$ $V_{CE} = 1200\text{ V}$ , $T_J = 150\text{ °C}$			100 1	$\mu\text{A}$ mA
$I_{GES}$	Gate-emitter leakage current ( $V_{CE} = 0$ )	$V_{GE} = \pm 20\text{ V}$			250	nA

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{ies}$	Input capacitance	$V_{CE} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GE} = 0$		4880		pF
$C_{oes}$	Output capacitance		-	125	-	pF
$C_{res}$	Reverse transfer capacitance				65	
$Q_g$	Total gate charge	$V_{CE} = 600\text{ V}$ , $I_C = 25\text{ A}$ , $V_{GE} = 15\text{ V}$		144		nC
$Q_{ge}$	Gate-emitter charge		-	36	-	nC
$Q_{gc}$	Gate-collector charge				64	

**Table 6. Switching on/off (inductive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 600\text{ V}, I_C = 25\text{ A}$	-	75	-	ns
$t_r$	Current rise time	$R_G = 22\ \Omega, V_{GE} = 15\text{ V}$	-	24	-	ns
$(di/dt)_{on}$	Turn-on current slope	(see Figure 2)	-	1100	-	A/ $\mu$ s
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 600\text{ V}, I_C = 25\text{ A}$	-	70	-	ns
$t_r$	Current rise time	$R_G = 22\ \Omega, V_{GE} = 15\text{ V},$ $T_J = 150\text{ }^\circ\text{C}$	-	32	-	ns
$(di/dt)_{on}$	Turn-on current slope	(see Figure 2)	-	950	-	A/ $\mu$ s
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 600\text{ V}, I_C = 25\text{ A}$	-	50	-	ns
$t_{d(off)}$	Turn-off delay time	$R_G = 22\ \Omega, V_{GE} = 15\text{ V}$	-	285	-	ns
$t_f$	Current fall time	(see Figure 2)	-	46	-	ns
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 600\text{ V}, I_C = 25\text{ A}$	-	72	-	ns
$t_{d(off)}$	Turn-off delay time	$R_G = 22\ \Omega, V_{GE} = 15\text{ V},$ $T_J = 150\text{ }^\circ\text{C}$	-	335	-	ns
$t_f$	Current fall time	(see Figure 2)	-	125	-	ns

**Table 7. Switching energy (inductive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{on}^{(1)}$	Turn-on switching losses	$V_{CC} = 600\text{ V}, I_C = 25\text{ A}$	-	1.48	-	mJ
$E_{off}^{(2)}$	Turn-off switching losses	$R_G = 22\ \Omega, V_{GE} = 15\text{ V}$	-	0.78	-	mJ
$E_{ts}$	Total switching losses	(see Figure 2)	-	2.26	-	mJ
$E_{on}^{(1)}$	Turn-on switching losses	$V_{CC} = 600\text{ V}, I_C = 25\text{ A}$	-	2.5	-	mJ
$E_{off}^{(2)}$	Turn-off switching losses	$R_G = 22\ \Omega, V_{GE} = 15\text{ V}$	-	1.36	-	mJ
$E_{ts}$	Total switching losses	$T_J = 150\text{ }^\circ\text{C}$ (see Figure 2)	-	3.86	-	mJ

1. Energy losses include reverse recovery of the diode
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	$I_F = 25\text{ A}$ $I_F = 25\text{ A}, T_J = 150\text{ }^\circ\text{C}$	-	1.6	2.6	V V
$t_{rr}$	Reverse recovery time	$I_F = 25\text{ A}, V_R = 600\text{ V},$ $di/dt = 1050\text{ A}/\mu\text{s}$	-	88	-	ns
$Q_{rr}$	Reverse recovery charge	(see Figure 5)	-	1.52	-	$\mu\text{C}$
$I_{rrm}$	Reverse recovery current	(see Figure 5)	-	30	-	A
$t_{rr}$	Reverse recovery time	$I_F = 25\text{ A}, V_R = 600\text{ V},$ $T_J = 150\text{ }^\circ\text{C},$ $di/dt = 900\text{ A}/\mu\text{s}$	-	185	-	ns
$Q_{rr}$	Reverse recovery charge	(see Figure 5)	-	4.46	-	$\mu\text{C}$
$I_{rrm}$	Reverse recovery current	(see Figure 5)	-	44	-	A

### 3 Test circuits

Figure 2. Test circuit for inductive load switching

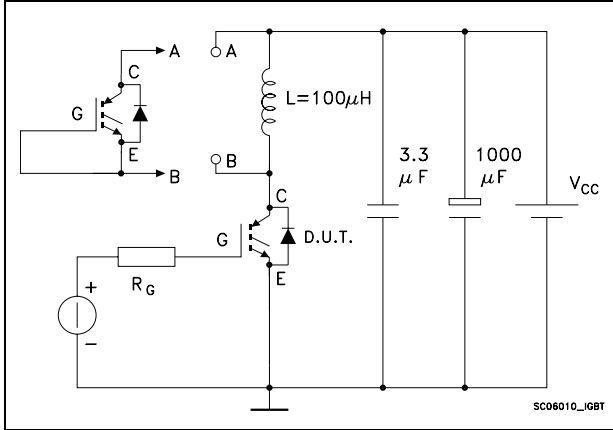


Figure 3. Gate charge test circuit

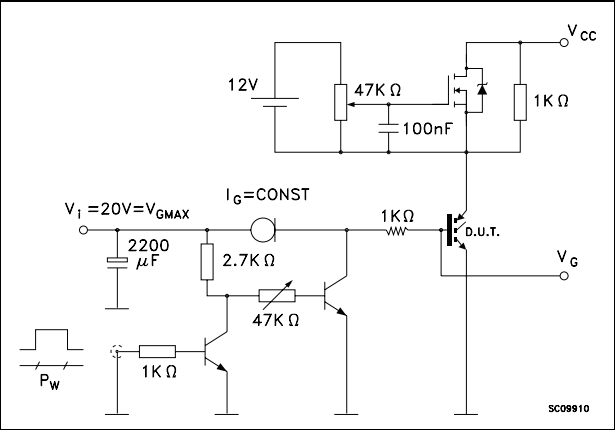


Figure 4. Switching waveform

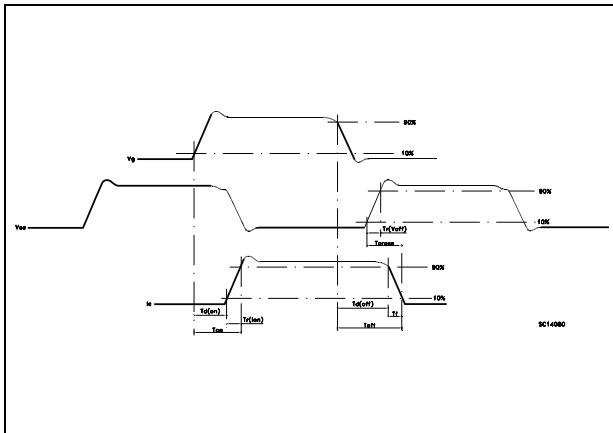
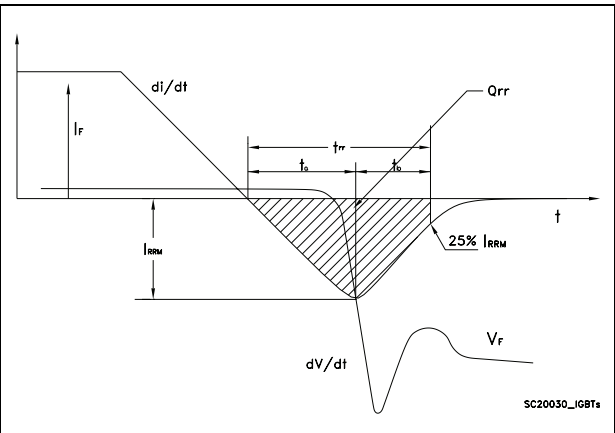


Figure 5. Diode recovery time waveform



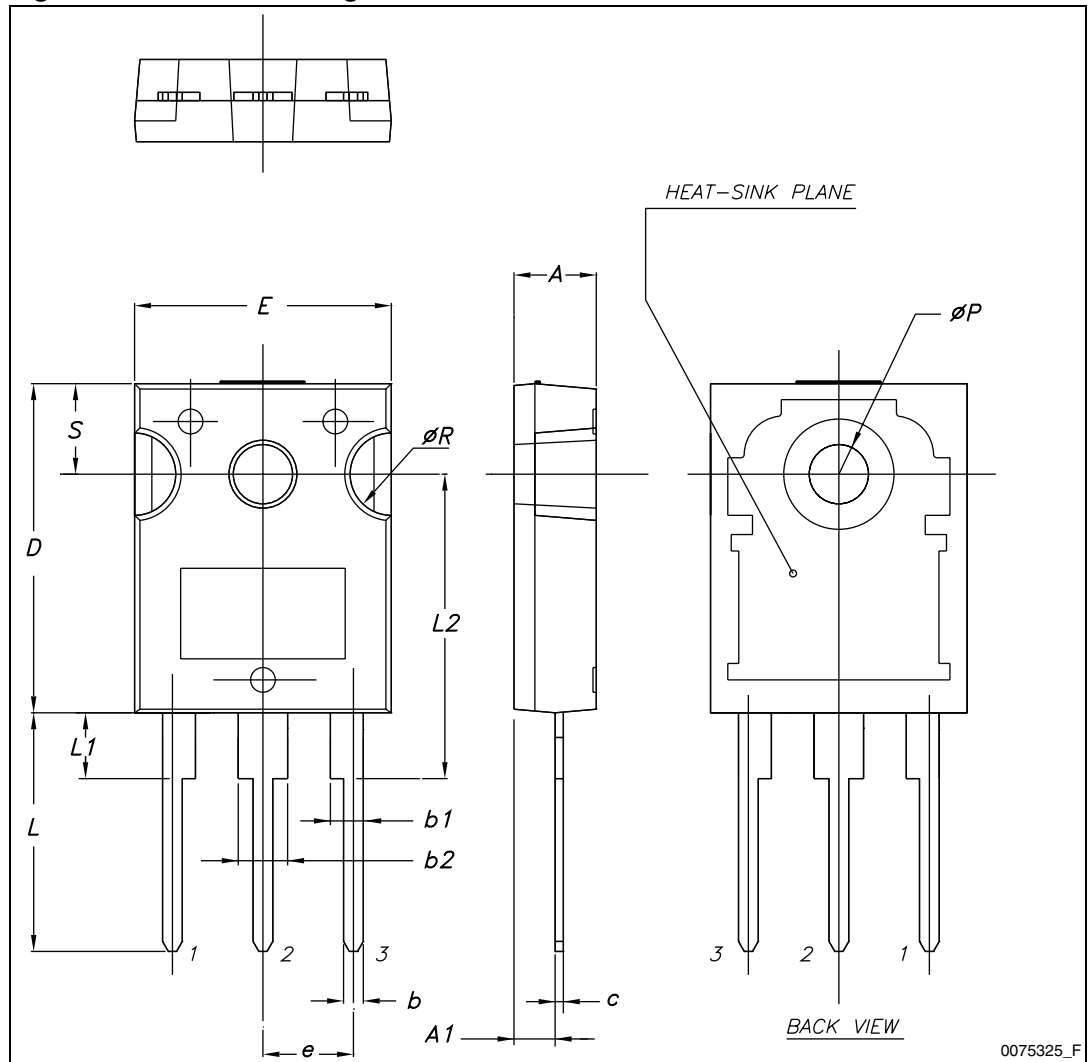
## 4 Package mechanical data

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](http://www.st.com). ECOPACK® is an ST trademark.

**Table 9. 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	

Figure 6. TO-247 drawing



0075325\_F

## 5 Revision history

**Table 10. Document revision history**

Date	Revision	Changes
07-May-2010	1	Initial release.
05-Apr-2011	2	Document status promoted from target specification to preliminary data.
23-Jul-2012	3	Modified: Title in cover page, <i>Description on page 1</i> , typical values <i>Table 4 on page 3</i> , <i>Table 5 on page 3</i> , <i>Table 6 on page 4</i> , <i>Table 7 on page 4</i> and <i>Table 8 on page 4</i> .



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