

# STGW35NC120HD

### 32 A - 1200 V - very fast IGBT

### Features

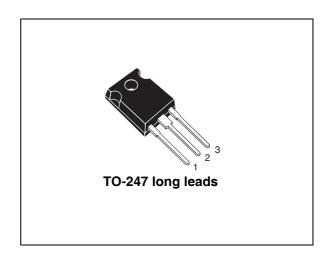
- Low on-losses
- Low on-voltage drop (V<sub>CE(sat)</sub>)
- High current capability
- High input impedance (voltage driven)
- Low gate charge
- Ideal for soft switching application

### Application

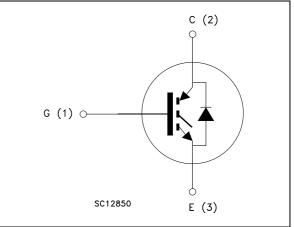
- Induction heating
- High frequency inverters
- UPS

### Description

This IGBT utilizes the advanced PowerMESH<sup>™</sup> process resulting in an excellent trade-off between switching performance and low on-state behavior.



#### Figure 1. Internal schematic diagram



#### Table 1. Device summary

Order code	Marking	Package	Packaging
STGW35NC120HD	GW35NC120HD	TO-247 long leads	Tube

### Contents

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## 1 Electrical ratings

Symbol	Parameter	Value	Unit
V <sub>CES</sub>	Collector-emitter voltage (V <sub>GE</sub> = 0)	1200	V
$I_{C}^{(1)}$	Continuous collector current at $T_C = 25 \text{ °C}$	60	А
$I_{C}^{(1)}$	Continuous collector current at T <sub>C</sub> = 100 °C	32	А
I <sub>CL</sub> <sup>(2)</sup>	Turn-off latching current	135	А
$I_{CP}^{(3)}$	Pulsed collector current	135	А
$V_{GE}$	Gate-emitter voltage	±25	V
P <sub>TOT</sub>	Total dissipation at $T_C = 25 \ ^{\circ}C$	235	W
١ <sub>F</sub>	Diode RMS forward current at $T_C = 25 \text{ °C}$	30	А
I <sub>FSM</sub>	Surge non repetitive forward current t <sub>p</sub> = 10 ms sinusoidal	100	А
Тj	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. Vclamp = 80% of V\_{CES}, T\_j =125 °C, R\_G=10  $\Omega,$  V\_GE=15 V

3. Pulse width limited by max. junction temperature allowed

Symbol	Parameter	Value	Unit
R.	Thermal resistance junction-case IGBT	0.53	°C/W
R <sub>thj-case</sub>	Thermal resistance junction-case diode	1.5	°C/W
R <sub>thj-amb</sub>	Thermal resistance junction-ambient	50	°C/W



## 2 Electrical characteristics

(T<sub>j</sub> =25 °C unless otherwise specified)

Table 4. Stati

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
V <sub>(BR)CES</sub>	Collector-emitter breakdown voltage (V <sub>GE</sub> = 0)	I <sub>C</sub> = 1 mA	1200			V
V <sub>CE(sat)</sub>	Collector-emitter saturation voltage	V <sub>GE</sub> = 15 V, I <sub>C</sub> = 20 A, V <sub>GE</sub> = 15 V, I <sub>C</sub> = 20 A, T <sub>j</sub> =125 °C		2.2 2.0	2.75	V V
V <sub>GE(th)</sub>	Gate threshold voltage	$V_{CE} = V_{GE}$ , $I_C = 250 \mu A$	3.75		5.75	V
I <sub>CES</sub>	Collector cut-off current (V <sub>GE</sub> = 0)	V <sub>CE</sub> =1200 V V <sub>CE</sub> =1200 V, T <sub>j</sub> =125 °C			500 10	μA mA
I <sub>GES</sub>	Gate-emitter leakage current (V <sub>CE</sub> = 0)	V <sub>GE</sub> =± 20 V			± 100	nA
g <sub>fs</sub> <sup>(1)</sup>	Forward transconductance	V <sub>CE</sub> = 25 V <sub>,</sub> I <sub>C</sub> = 20 A		14		S

1. Pulse duration = 300  $\mu$ s, duty cycle 1.5%

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
C <sub>ies</sub> C <sub>oes</sub> C <sub>res</sub>	Input capacitance Output capacitance Reverse transfer capacitance	V <sub>CE</sub> = 25 V, f = 1 MHz, V <sub>GE</sub> =0	-	2510 175 30	-	pF pF pF
Q <sub>g</sub> Q <sub>ge</sub> Q <sub>gc</sub>	Total gate charge Gate-emitter charge Gate-collector charge	V <sub>CE</sub> = 960 V, I <sub>C</sub> = 20 A,V <sub>GE</sub> =15 V	-	110 16 49	-	nC nC nC



Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
t <sub>d(on)</sub> t <sub>r</sub> (di/dt) <sub>on</sub>	Turn-on delay time Current rise time Turn-on current slope	$V_{CC} = 960 \text{ V}, \text{ I}_{C} = 20 \text{ A}$ $R_{G} = 10 \Omega, \text{ V}_{GE} = 15 \text{ V},$ <i>Figure 17</i>	-	29 11 1820	-	ns ns A/µs
t <sub>d(on)</sub> t <sub>r</sub> (di/dt) <sub>on</sub>	Turn-on delay time Current rise time Turn-on current slope	$V_{CC} = 960 \text{ V}, I_C = 20 \text{ A}$ $R_G = 10 \Omega, V_{GE} = 15 \text{ V},$ $T_j = 125 \text{ °C}$ Figure 17	-	27 14 1580	-	ns ns A/µs
t <sub>r</sub> (V <sub>off</sub> ) t <sub>d</sub> ( <sub>off</sub> ) t <sub>f</sub>	Off voltage rise time Turn-off delay time Current fall time	$V_{CC} = 960 \text{ V}, I_{C} = 20 \text{ A}$ $R_{G} = 10 \Omega, V_{GE} = 15 \text{ V},$ <i>Figure 17</i>	-	90 275 312	-	ns ns ns
t <sub>r</sub> (V <sub>off</sub> ) t <sub>d</sub> ( <sub>off</sub> ) t <sub>f</sub>	Off voltage rise time Turn-off delay time Current fall time	$V_{CC} = 960 \text{ V}, I_C = 20 \text{ A}$ $R_G = 10 \Omega, V_{GE} = 15 \text{ V},$ $T_j = 125 \text{ °C} Figure 17$	-	150 336 592	-	ns ns ns

Table 6. Switching on/off (inductive load)

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
Eon <sup>(1)</sup> E <sub>off</sub> <sup>(2)</sup> E <sub>ts</sub>	Turn-on switching losses Turn-off switching losses Total switching losses	$V_{CC}$ = 960 V, I <sub>C</sub> = 20 A R <sub>G</sub> = 10 $\Omega$ , V <sub>GE</sub> = 15 V, <i>Figure 17</i>	-	1660 4438 6098	-	μJ μJ μJ
Eon <sup>(1)</sup> E <sub>off</sub> <sup>(2)</sup> E <sub>ts</sub>	Turn-on switching losses Turn-off switching losses Total switching losses	V <sub>CC</sub> = 960 V, I <sub>C</sub> = 20 A R <sub>G</sub> = 10 Ω, V <sub>GE</sub> = 15 V, T <sub>j</sub> =125 °C <i>Figure 17</i>	-	3015 6900 9915	-	μ Lμ L

 Eon is the turn-on losses when a typical diode is used in the test circuit in figure 2. If the IGBT is offered in a package with a co-pack diode, the co-pack diode is used as external diode. IGBTs & Diode are at the same temperature (25 °C and 125 °C)

2. Turn-off losses include also the tail of the collector current

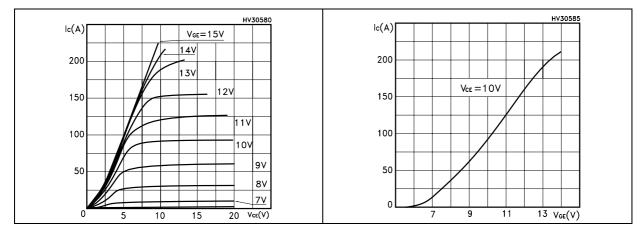
Table 8. Collector-emitter diode

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
V <sub>F</sub>	Forward on-voltage	I <sub>F</sub> = 20 A		1.9	2.5	V
		I <sub>F</sub> = 20 A, T <sub>C</sub> = 125 °C	-	1.7		V
t <sub>rr</sub>	Reverse recovery time	I <sub>F</sub> = 20 A, V <sub>R</sub> = 27 V,		152		ns
Q <sub>rr</sub>	Reverse recovery charge	T <sub>j</sub> =125 °C, di/dt = 100 A/μs	-	722	-	nC
I <sub>rrm</sub>	Reverse recovery current	Figure 20		9		А

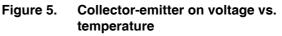
### 2.1 Electrical characteristics (curves)

#### Figure 2. Output characteristics

### Figure 3. Transfer characteristics







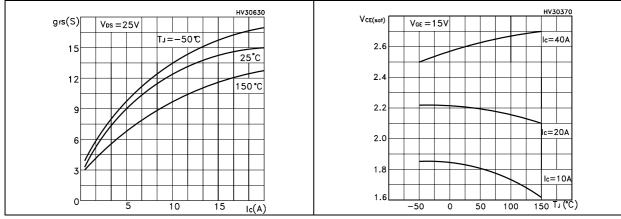
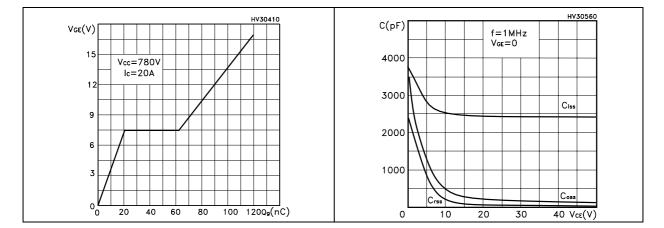
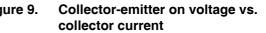


Figure 6. Gate charge vs. gate-source voltage Figure 7. Capacitance variations



## Figure 8. Normalized gate threshold voltage Figure 9. vs. temperature



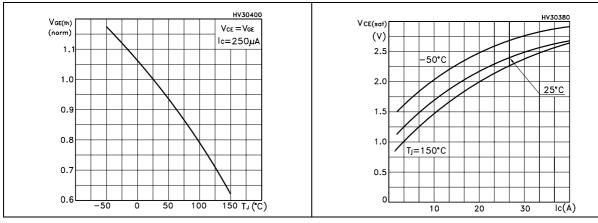


Figure 10. Normalized breakdown voltage vs. Figure 11. Switching losses vs. temperature temperature

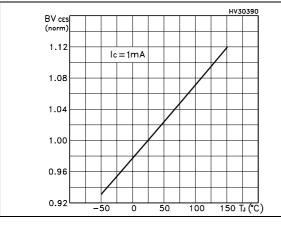


Figure 12. Switching losses vs. gate resistance

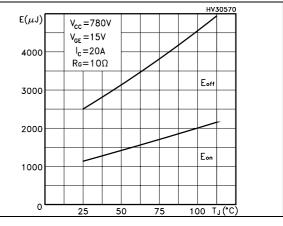
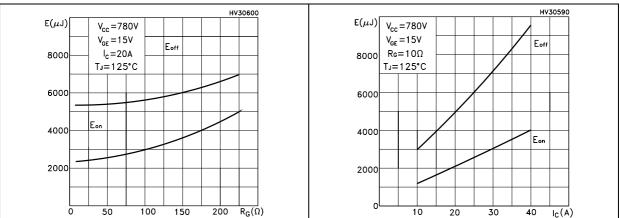
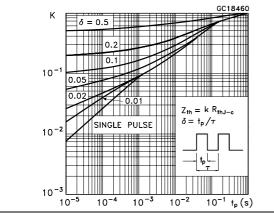


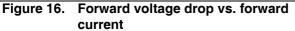
Figure 13. Switching losses vs. collector current

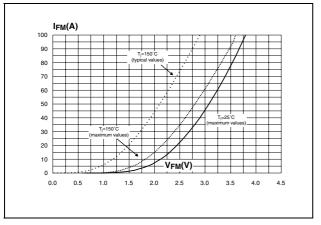




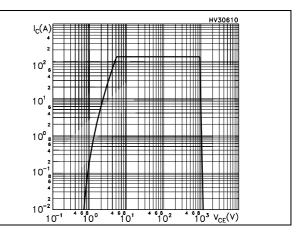
#### Figure 14. Thermal Impedance







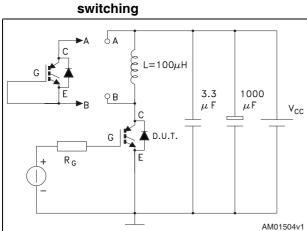
### Figure 15. Reverse biased SOA





## 3 Test circuits

Figure 17. Test circuit for inductive load



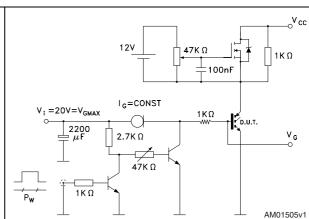
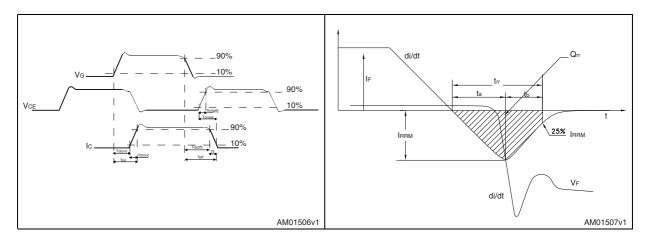




Figure 19. Switching waveform





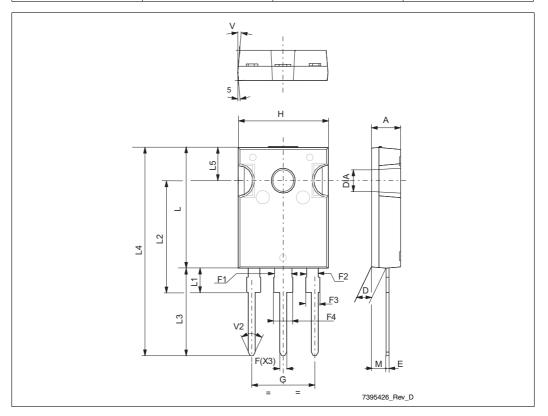


### 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.



TO-247 long leads mechanical data						
Dim	mm					
Dim.	Min.	Тур.	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				
Н	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			
М	2		3			
V		5°				
V2		60°				
DIAM	3.55		3.65			



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## 5 Revision history

#### Table 9.Document revision history

Date	Revision	Changes	
25-Jan-2008	1	First issue.	
07-May-2009	2	Section 4: Package mechanical data has been updated.	



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