

STGW35NB60SD

N-CHANNEL 35A - 600V - TO-247 Low Drop PowerMESH™ IGBT

General features

Туре	V _{CES}	V _{CE(sat)} (Max)@ 25°C	I _C @100°C
STGW35NB60SD	600V	< 1.7V	35A

- LOW ON-VOLTAGE DROP (V_{CEsat})
- LOW INPUT CAPACITANCE
- HIGH CURRENT CAPABILITY

Description

Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH $^{\text{TM}}$ IGBTs, with outstanding performances.

Applications

- LIGHT DIMMER
- HID
- WELDING
- MOTOR CONTROL
- STATIC RELAYS

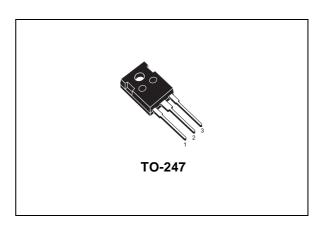
Order codes

STGW35NB60SD

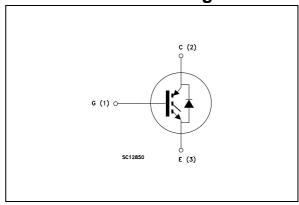


TO-247

GW35NB60SD



Internal schematic diagram



TUBE

1 Electrical ratings STGW35NB60SD

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V _{CES}	Collector-Emitter Voltage (V _{GS} = 0)	600	V
I _C Note 4	Collector Current (continuous) at 25°C	70	Α
I _C Note 4	Collector Current (continuous) at 100°C	35	Α
I _{CM} Note 1	Collector Current (pulsed)	250	Α
V _{GE}	Gate-Emitter Voltage	± 20	V
I _f	Diode RMS Forward Current at T _C = 25°C	30	Α
P _{TOT}	Total Dissipation at T _C = 25°C	200	W
T _j	Operating Junction Temperature	EE to 150	
T _{stg}	Storage Temperature	- 55 to 150	
TL	Maximum Lead Temperature for Soldering Purpose (1.6mm from case, for 10sec.)	300	°C

Table 2. Thermal resistance

		Min.	Тур.	Max.	Unit
Rthj-case	Thermal Resistance Junction-case (IGBT)			0.625	°C/W
Rthj-case	Thermal Resistance Junction-case (DIODE)			1.5	°C/W
Rthj-amb	Thermal Resistance Junction-ambient			50	°C/W

STGW35NB60SD 2 Electrical characteristics

2 Electrical characteristics

 $(T_{CASE} = 25 \, ^{\circ}C \text{ unless otherwise specified})$

Table 3. Static

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
V _{BR(CES)}	Collectro-Emitter Breakdown Voltage	$I_C = 1$ mA, $V_{GE} = 0$	600			V
V _{CE(SAT)}	Collector-Emitter Saturation Voltage	V _{GE} = 15V, I _C = 20A, Tj= 25°C V _{GE} = 15V, I _C = 20A, Tj= 125°C		1.25 1.2	1.7	V V
V _{GE(th)}	Gate Threshold Voltage	$V_{CE} = V_{GE}$, $I_{C} = 250\mu A$	2.5		5	V
I _{CES}	Collector-Emitter Leakage Current (V _{GE} = 0)	V _{CE} = Max Rating,Tc=25°C V _{CE} = Max Rating, Tc=125°C			10 100	μA μA
I _{GES}	Gate-Emitter Leakage Current (V _{CE} = 0)	V _{GE} = ± 20V , V _{CE} = 0			± 100	nA
9 _{fs}	Forward Transconductance	$V_{CE} = 10V, I_{C} = 18A$		20		S

Table 4. Dynamic

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
C _{ies} C _{oes} C _{res}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{CE} = 25V, f = 1 \text{ MHz}, V_{GE} = 0$		1820 167 27		pF pF pF
Q _g Q _{ge} Q _{gc}	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	V_{CE} = 480V, I_{C} = 20A, V_{GE} = 15V, (see Figure 17)		83 10 27	115	nC nC nC
I _{CL}	Turn-Off SOA Minimum Current	$V_{clamp} = 480V$, $Tj = 125$ °C $R_G = 100\Omega$	80			А

2 Electrical characteristics STGW35NB60SD

Table 5. Switching on/off (inductive load)

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
t _{d(on)} t _r (di/dt) _{on}	Turn-on Delay Time Current Rise Time Turn-on Current Slope	V_{CC} = 480V, I_{C} = 20A R_{G} = 100 Ω , V_{GE} = 15V, T_{J} = 25°C (see Figure 3)		92 70 340		ns ns A/µs
t _{d(on)} t _r (di/dt) _{on}	Turn-on Delay Time Current Rise Time Turn-on Current Slope	$V_{CC} = 480V, I_{C} = 20A$ $R_{G} = 100\Omega, V_{GE} = 15V, Tj = 125^{\circ}C$ (see Figure 3)		80 73 320		ns ns A/µs
$t_{\rm r}({ m V}_{ m off}) \ t_{ m d}({ m off}) \ t_{ m f}$	Off Voltage Rise Time Turn-off Delay Time Current Fall Time	V_{cc} = 480V, I_{C} = 20A, R_{GE} = 100 Ω , V_{GE} = 5V, T_{J} =25°C (see Figure 18)		0.78 1.1 0.79		µs µs µs
$\begin{array}{c} t_{\rm r}({\rm V}_{\rm off}) \\ t_{\rm d}(_{\rm off}) \\ t_{\rm f} \end{array}$	Off Voltage Rise Time Turn-off Delay Time Current Fall Time	$V_{cc} = 480 \text{V}, I_{C} = 20 \text{A},$ $R_{GE} = 100 \Omega, V_{GE} = 15 \text{V}, Tj = 125 ^{\circ}\text{C}$ (see Figure 18)		1.1 2.4 1.2		µs µs µs

Table 6. Switching energy (inductive load)

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Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit	
Eon Note 2 E _{off} Note 3 E _{ts}	Turn-on Switching Losses Turn-off Switching Losses Total Switching Losses	V_{CC} = 480V, I_{C} = 20A R_{G} =100 Ω , V_{GE} = 15V, Tj= 25°C (see Figure 18)		0.84 7.4 8.24		mJ mJ	
Eon Note 2 E _{off} Note 3 E _{ts}	Turn-on Switching Losses Turn-off Switching Losses Total Switching Losses	V_{CC} = 480V, I_{C} = 20A R_{G} =100 Ω , V_{GE} = 15V, Tj= 125°C (see Figure 18)		0.86 11.5 12.4		mJ mJ mJ	

STGW35NB60SD 2 Electrical characteristics

Table 7. Collector-emitter diode

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
V _f	Forward On-Voltage	If = 10A If = 10A, Tj = 125°C		1.3 1	2	V V
t _{rr} t _a Q _{rr} I _{rrm} S	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current Softness factor of the diode	If = 20A, $V_R = 40V$, $T_j = 25$ °C, di/dt = 100A/ μ s (see Figure 19)		44 32 66 3 0.375		ns ns nC A
t _{rr} t _a Q _{rr} I _{rrm} S	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current Softness factor of the diode	If = 20A, $V_R = 40V$, $T_j = 125$ °C, di/dt = 100A/ μ s (see Figure 19)		88 56 237 5.4 0.57		ns ns nC A

⁽¹⁾Pulse width limited by max. junction temperature

(4) Calculated according to the iterative formula:

$$I_{C}(T_{C}) = \frac{T_{JMAX} - T_{C}}{R_{THJ-C} \times V_{CESAT(MAX)}(T_{C}, I_{C})}$$

⁽²⁾ Eon is the tun-on losses when a typical diode is used in the test circuit in figure 2 Eon include diode recovery energy. 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)

⁽³⁾ Turn-off losses include also the tail of the collector current

2 Electrical characteristics STGW35NB60SD

2.1 Electrical characteristics (curves)

Figure 1. Output Characteristics

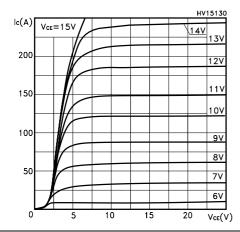


Figure 2. Transfer Characteristics

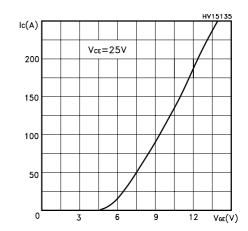


Figure 3. Transconductance

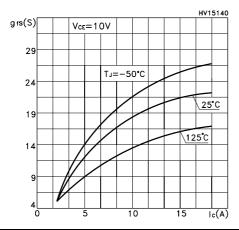


Figure 4. Normalized Collector-Emitter On Voltage vs Temperature

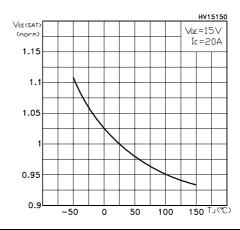


Figure 5. Collector-Emitter on Voltage vs Collector Current

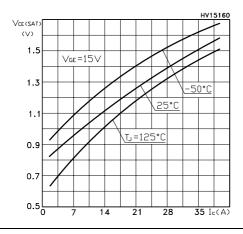
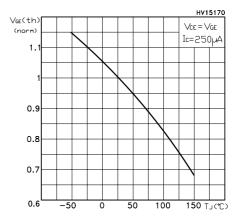


Figure 6. Gate Threshold vs Temperature



STGW35NB60SD 2 Electrical characteristics

Figure 7. Normalized Breakdown Voltage vs Temperature

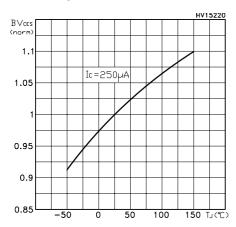


Figure 8. Gate Charge vs Gate-Emitter Voltage

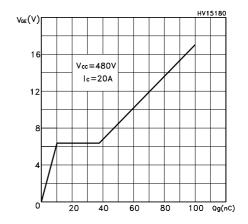
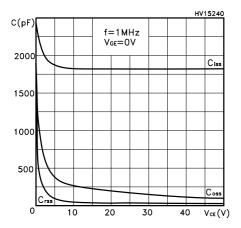


Figure 9. Capacitance Variations

Figure 10. Switching Losses vs Gate Charge



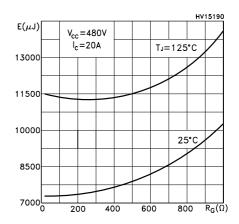


Figure 11. Switching Losses vs Temperature

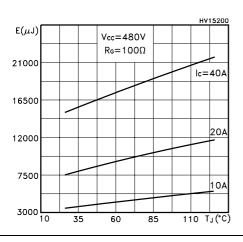
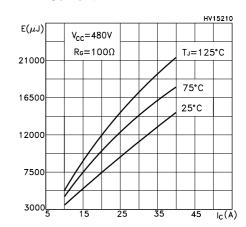


Figure 12. Switching Losses vs Collector Current



2 Electrical characteristics STGW35NB60SD

Figure 13. Thermal Impedance

K 6=0.5 0.2 0.1 10-1

Figure 14. Turn-Off SOA

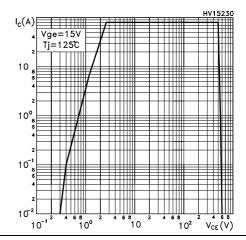
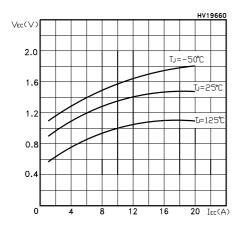


Figure 15. Emitter-Collector Diode Characteristics



STGW35NB60SD 3 Test Circuits

3 Test Circuits

Figure 16. Test Circuit for Inductive Load Switching

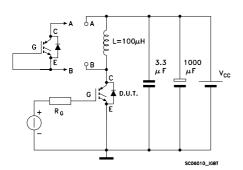


Figure 17. Gate Charge Test Circuit

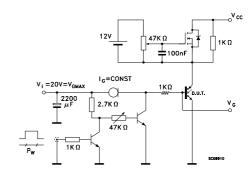
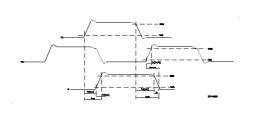
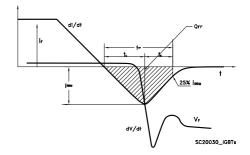


Figure 18. Switching Waveform

Figure 19. Diode Recovery Time Waveform



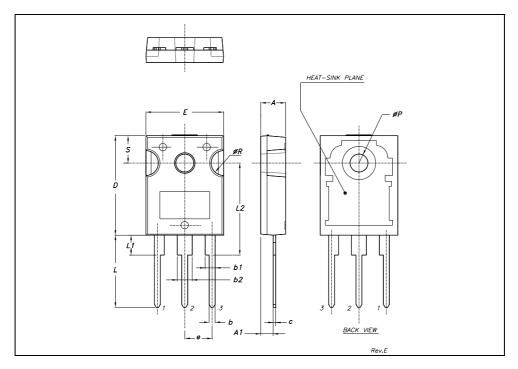


4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com

TO-247 MECHANICAL DATA

DIM		mm.			inch	
DIM.	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
Α	4.85		5.15	0.19		0.20
A1	2.20		2.60	0.086		0.102
b	1.0		1.40	0.039		0.055
b1	2.0		2.40	0.079		0.094
b2	3.0		3.40	0.118		0.134
С	0.40		0.80	0.015		0.03
D	19.85		20.15	0.781		0.793
Е	15.45		15.75	0.608		0.620
е		5.45			0.214	
L	14.20		14.80	0.560		0.582
L1	3.70		4.30	0.14		0.17
L2		18.50			0.728	
øΡ	3.55		3.65	0.140		0.143
øR	4.50		5.50	0.177		0.216
S		5.50			0.216	



5 Revision History STGW35NB60SD

5 Revision History

Date	Revision	Changes
16-Nov-2005	1	Initial release.

STGW35NB60SD 5 Revision History

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