

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

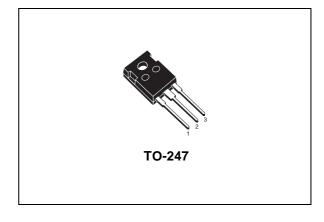
Description

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

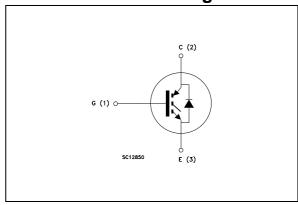
Applications

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

Order codes



Internal schematic diagram



| Sales Type | Marking | Package | Packaging |
|--------------|-------------------------|---------|-----------|
| STGW35NB60SD | STGW35NB60SD GW35NB60SD | | 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 °C unless otherwise specified)

Table 3. Static

| Symbol | Parameter Test Conditions | | Min. | Тур. | Max. | Unit |
|----------------------|--|---|------|-------------|-----------|----------|
| V _{BR(CES)} | Collectro-Emitter Breakdown Voltage | $I_C = 1 \text{mA}, V_{GE} = 0$ | 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 |

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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 |
| $t_{\rm r}({\rm V}_{\rm off}) \\ t_{\rm d}(_{\rm off}) \\ t_{\rm f}$ | 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)

| iable of Officering chargy (maddite load) | | | | | | |
|--|---|--|------|----------------------|------|----------------|
| 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 |

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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

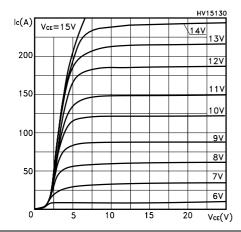


Figure 2. Transfer Characteristics

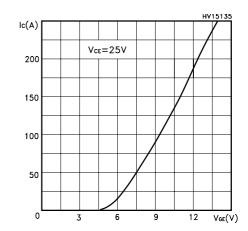


Figure 3. Transconductance

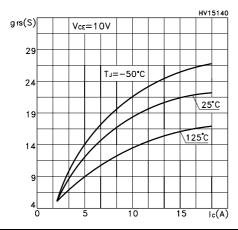


Figure 4. Normalized Collector-Emitter On Voltage vs Temperature

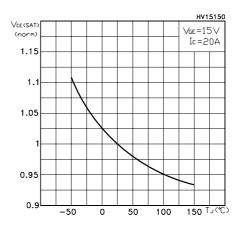


Figure 5. Collector-Emitter on Voltage vs Collector Current

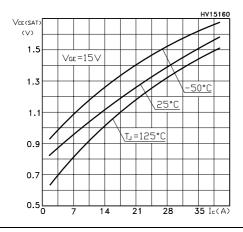
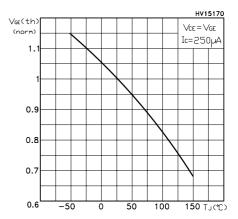


Figure 6. Gate Threshold vs Temperature



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Figure 7. Normalized Breakdown Voltage vs Temperature

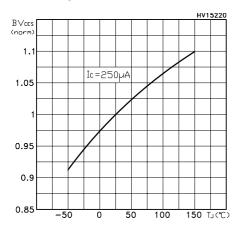


Figure 8. Gate Charge vs Gate-Emitter Voltage

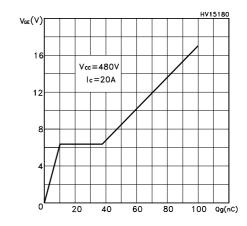
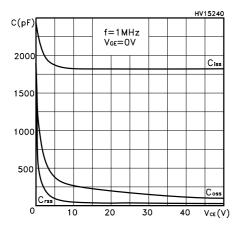


Figure 9. Capacitance Variations

Figure 10. Switching Losses vs Gate Charge



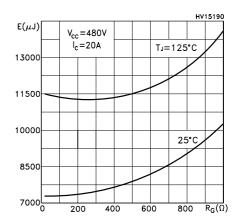


Figure 11. Switching Losses vs Temperature

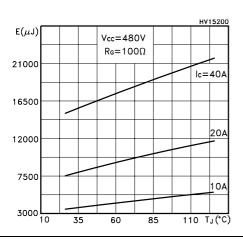
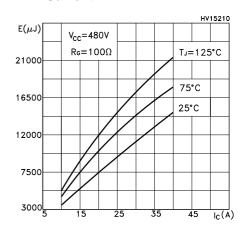


Figure 12. Switching Losses vs Collector Current



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Figure 13. Thermal Impedance

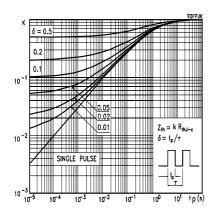


Figure 14. Turn-Off SOA

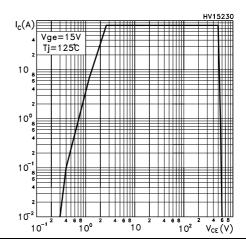
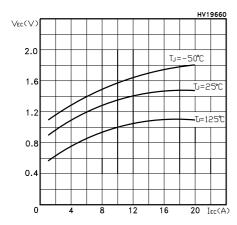


Figure 15. Emitter-Collector Diode **Characteristics**



STGW35NB60SD 3 Test Circuits

3 Test Circuits

Figure 16. Test Circuit for Inductive Load Switching

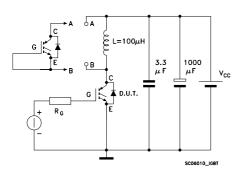


Figure 17. Gate Charge Test Circuit

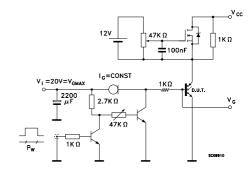
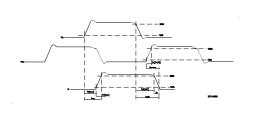
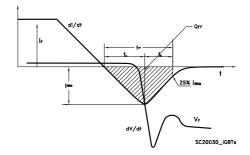


Figure 18. Switching Waveform

Figure 19. Diode Recovery Time Waveform



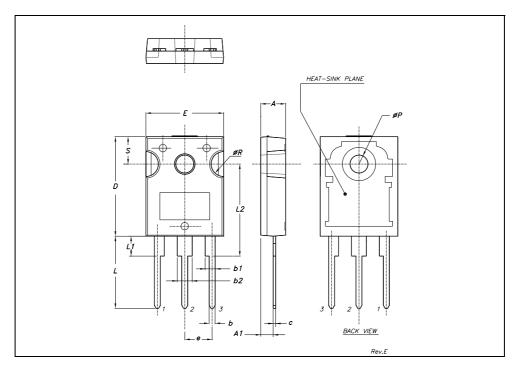


4 Package mechanical data

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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