



STGW39NC60VD

N-CHANNEL 40A - 600V - TO-247

Very Fast PowerMESH™ IGBT

TARGET SPECIFICATION

Table 1: General Features

| TYPE | V _{CES} | V _{CE(sat)} (Max) @ 25°C | I _C @ 100°C |
|--------------|------------------|--------------------------------------|---------------------------|
| STGW39NC60VD | 600V | < 2.5 V | 40 A |

- HIGH CURRENT CAPABILITY
- HIGH FREQUENCY OPERATION UP TO 50 KHz
- LOSSES INCLUDE DIODE RECOVERY ENERGY
- OFF LOSSES INCLUDE TAIL CURRENT
- LOWER C_{RES} / C_{IES} RATIO
- NEW GENERATION PRODUCTS WITH TIGHTER PARAMETER DISTRUBUTION

DESCRIPTION

Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The suffix "V" identifies a family optimized for high frequency.

APPLICATIONS

- HIGH FREQUENCY INVERTERS
- SMPS and PFC IN BOTH HARD SWITCH AND RESONANT TOPOLOGIES
- UPS
- MOTOR DRIVERS

Figure 1: Package

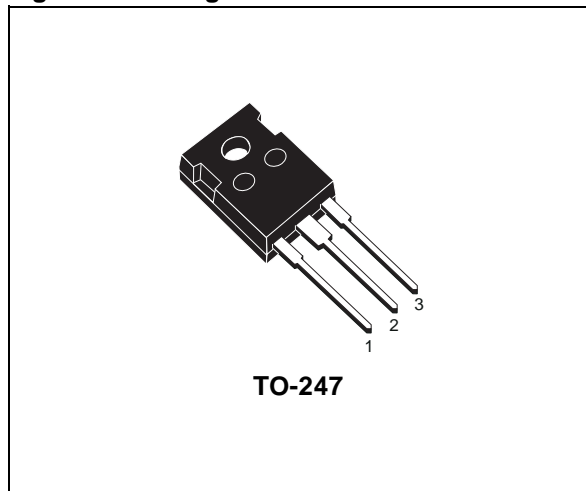


Figure 2: Internal Schematic Diagram

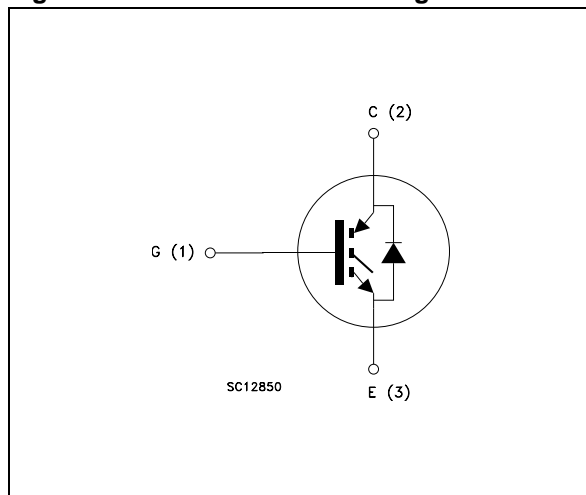


Table 2: Order Codes

| SALES TYPE | MARKING | PACKAGE | PACKAGING |
|--------------|------------|---------|-----------|
| STGW39NC60VD | GW39NC60VD | TO-247 | TUBE |

Rev. 1

Table 3: Absolute Maximum ratings

| Symbol | Parameter | Value | Unit |
|---------------------|--|-------------|------|
| V _{CES} | Collector-Emitter Voltage (V _{GS} = 0) | 600 | V |
| V _{ECR} | Reverse Battery Protection | 20 | V |
| V _{GE} | Gate-Emitter Voltage | ± 20 | V |
| I _C | Collector Current (continuous) at 25°C (#) | 70 | A |
| I _C | Collector Current (continuous) at 100°C (#) | 40 | A |
| I _{CM} (1) | Collector Current (pulsed) | 100 | A |
| I _f | Diode RMS Forward Current at T _C = 25°C | 40 | A |
| P _{TOT} | Total Dissipation at T _C = 25°C | 215 | W |
| | Derating Factor | 1.72 | W/°C |
| T _{stg} | Storage Temperature | – 55 to 150 | °C |
| T _j | Operating Junction Temperature | | |

(1)Pulse width limited by max. junction temperature.

Table 4: Thermal Data

| | | Min. | Typ. | Max. | Unit |
|-----------------------|---|------|------|------|------|
| R _{thj-case} | Thermal Resistance Junction-case | | | 0.58 | °C/W |
| R _{thj-case} | Thermal Resistance Junction-case (Diode) | | | 1.5 | °C/W |
| R _{thj-amb} | Thermal Resistance Junction-ambient | | | 50 | °C/W |
| T _L | Maximum Lead Temperature for Soldering Purpose (1.6 mm from case, for 10 sec.) | | 300 | | °C |

ELECTRICAL CHARACTERISTICS (T_{CASE} =25°C UNLESS OTHERWISE SPECIFIED)
Table 5: Off

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|----------------------|---|---|------|------|---------|----------|
| V _{BR(CES)} | Collectro-Emitter Breakdown Voltage | I _C = 1mA, V _{GE} = 0 | 600 | | | V |
| I _{CES} | Collector-Emitter Leakage Current (V _{CE} = 0) | V _{GE} = Max Rating, T _C =25°C T _C =125°C | | | 10 1 | μA mA |
| I _{GES} | Gate-Emitter Leakage Current (V _{CE} = 0) | V _{GE} = ± 20V , V _{CE} = 0 | | | ± 100 | nA |

Table 6: On

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|----------------------|--------------------------------------|--|------|------------|------|--------|
| V _{GE(th)} | Gate Threshold Voltage | V _{CE} = V _{GE} , I _C = 250μA | 3.75 | | 5.75 | V |
| V _{CE(SAT)} | Collector-Emitter Saturation Voltage | V _{GE} = 15V, I _C = 30A, T _j = 25°C V _{GE} = 15V, I _C = 30A, T _j = 125°C | | 1.8 1.7 | 2.5 | V V |

(#) Calculated according to the iterative formula:

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

ELECTRICAL CHARACTERISTICS (CONTINUED)**Table 7: Dynamic**

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-------------------------------------|---|--|------|-------------------|------|----------------|
| $g_{fs}(1)$ | Forward Transconductance | $V_{CE} = 15V, I_C = 30A$ | | TBD | | S |
| C_{ies} C_{oes} C_{res} | Input Capacitance Output Capacitance Reverse Transfer Capacitance | $V_{CE} = 25V, f = 1MHz, V_{GE} = 0$ | | TBD TBD TBD | | pF pF pF |
| Q_g Q_{ge} Q_{gc} | Total Gate Charge Gate-Emitter Charge Gate-Collector Charge | $V_{CE} = 390V, I_C = 30A,$ $V_{GE} = 15V,$ (see Figure 5) | | TBD TBD TBD | | nC nC nC |
| I_{CL} | Turn-Off SOA Minimum Current | $V_{clamp} = 480V, T_j = 150^\circ C$ $R_G = 100\Omega, V_{GE} = 15V$ | 200 | | | A |

Table 8: Switching On

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|--|--|------|--------------------------|------|-----------------------------------|
| $t_{d(on)}$ t_r $(di/dt)_{on}$ $E_{on}(2)$ | Turn-on Delay Time Current Rise Time Turn-on Current Slope Turn-on Switching Losses | $V_{CC} = 390V, I_C = 30A$ $R_G = 3.3\Omega, V_{GE} = 15V, T_j = 25^\circ C$ (see Figure 3) | | TBD TBD TBD TBD | | ns ns A/ μs μJ |
| $t_{d(on)}$ t_r $(di/dt)_{on}$ $E_{on}(2)$ | Turn-on Delay Time Current Rise Time Turn-on Current Slope Turn-on Switching Losses | $V_{CC} = 390V, I_C = 30A$ $R_G = 3.3\Omega, V_{GE} = 15V, T_j = 125^\circ C$ (see Figure 3) | | TBD TBD TBD TBD | | ns ns A/ μs μJ |

(2) E_{on} 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 ($25^\circ C$ and $125^\circ C$)

Table 9: Switching Off

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|--|--|------|---------------------------------|------|--------------------------------------|
| $t_r(V_{off})$ $t_{d(off)}$ t_f $E_{off}(3)$ E_{ts} | Off Voltage Rise Time Turn-off Delay Time Current Fall Time Turn-off Switching Loss Total Switching Loss | $V_{CC} = 390V, I_C = 30A,$ $R_{GE} = 3.3\Omega, V_{GE} = 15V$ $T_j = 25^\circ C$ (see Figure 3) | | TBD TBD TBD TBD TBD | | ns ns ns μJ μJ |
| $t_r(V_{off})$ $t_{d(off)}$ t_f $E_{off}(3)$ E_{ts} | Off Voltage Rise Time Turn-off Delay Time Current Fall Time Turn-off Switching Loss Total Switching Loss | $V_{CC} = 390V, I_C = 30A,$ $R_{GE} = 3.3\Omega, V_{GE} = 15V$ $T_j = 125^\circ C$ (see Figure 3) | | TBD TBD TBD TBD TBD | | ns ns ns μJ μJ |

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

Table 10: Collector-Emitter Diode

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|--|--|------|--------------------------------|------|---------------------|
| V_f | Forward On-Voltage | $I_f = 30A$ $I_f = 30A, T_j = 125^\circ C$ | | 1.4 1.1 | 2.1 | 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 | $I_f = 30A, V_R = 40V,$ $T_j = 25^\circ C, di/dt = 100A/\mu s$ (see Figure 6) | | 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 | $I_f = 30A, V_R = 40V,$ $T_j = 125^\circ C, di/dt = 100A/\mu s$ (see Figure 6) | | 88 56 237 5.4 0.57 | | ns ns nC A |

Figure 3: Test Circuit for Inductive Load Switching

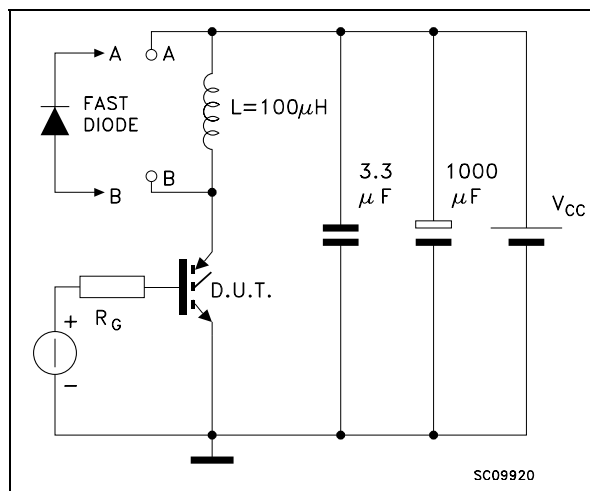


Figure 4: Switching Waveforms

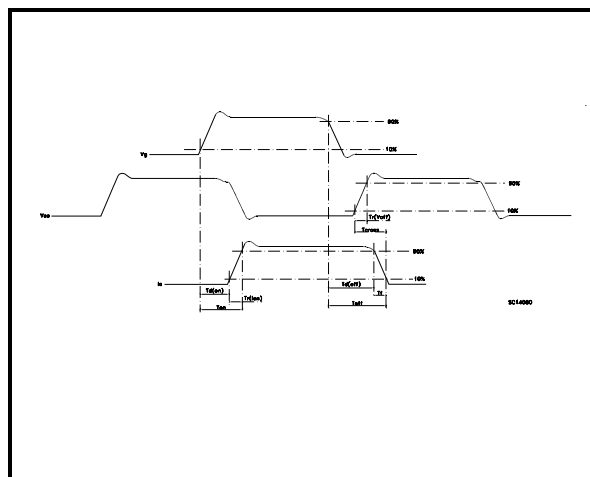


Figure 5: Gate Charge Test Circuit

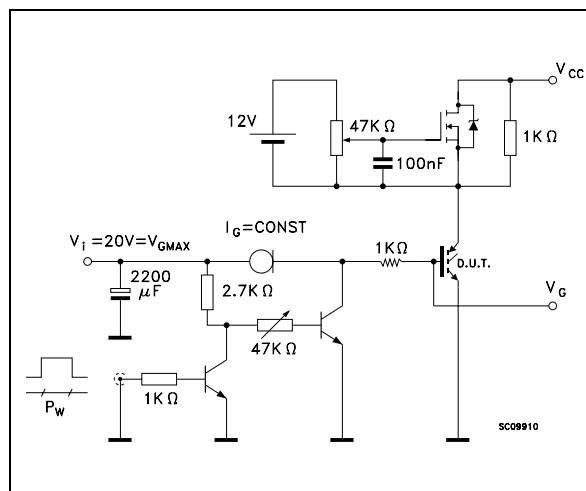
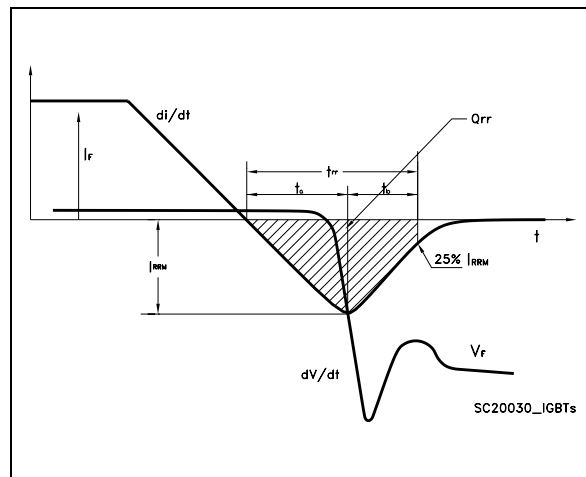


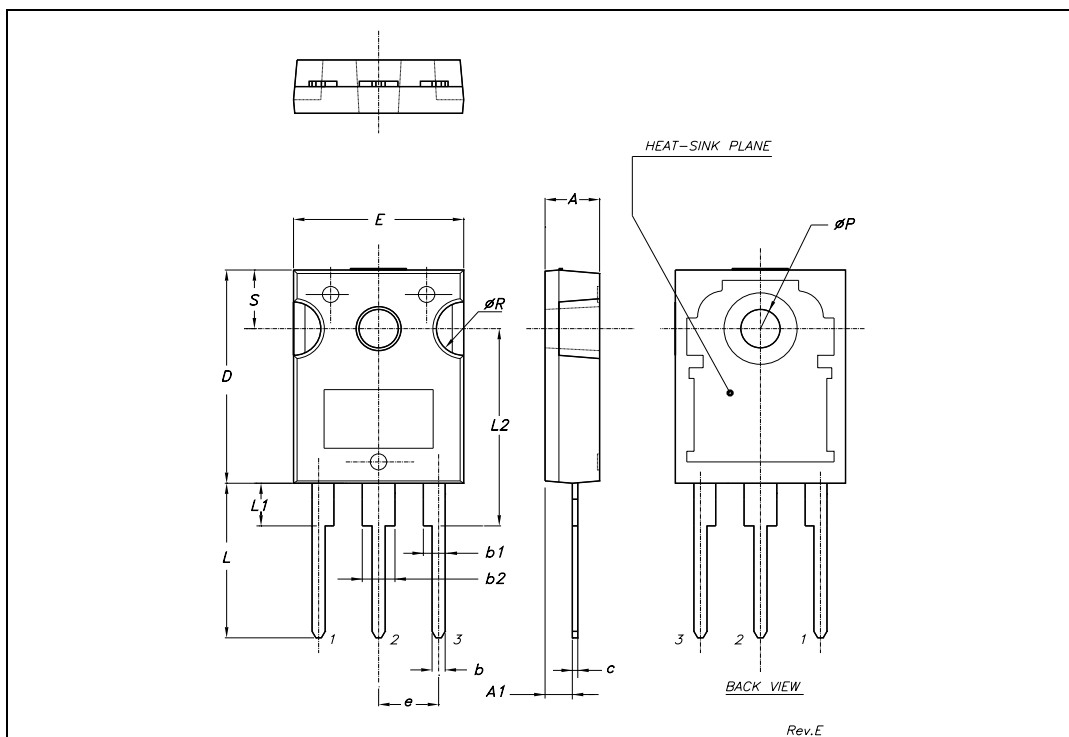
Figure 6: Diode Recovery Times Waveform



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

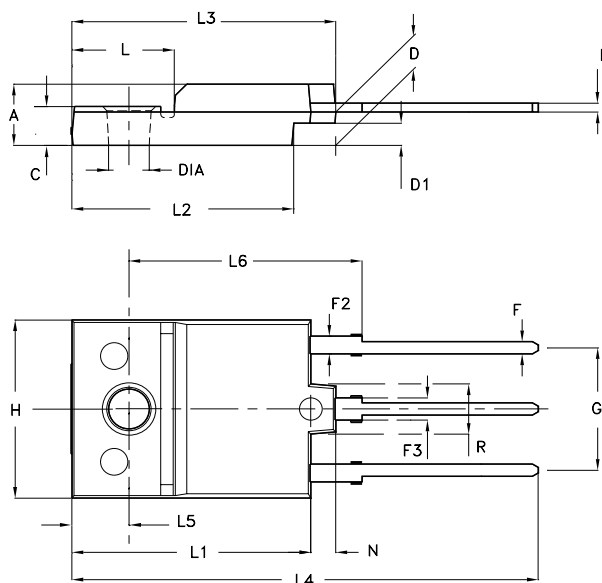
TO-247 MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|-------|-------|-------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | 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 |
| c | 0.40 | | 0.80 | 0.015 | | 0.03 |
| D | 19.85 | | 20.15 | 0.781 | | 0.793 |
| E | 15.45 | | 15.75 | 0.608 | | 0.620 |
| e | | 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 | |
| øP | 3.55 | | 3.65 | 0.140 | | 0.143 |
| øR | 4.50 | | 5.50 | 0.177 | | 0.216 |
| S | | 5.50 | | | 0.216 | |



ISOWATT218 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|-------|------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 5.35 | | 5.65 | 0.211 | | 0.222 |
| C | 3.30 | | 3.80 | 0.130 | | 0.150 |
| D | 2.90 | | 3.10 | 0.114 | | 0.122 |
| D1 | 1.88 | | 2.08 | 0.074 | | 0.082 |
| E | 0.75 | | 0.95 | 0.030 | | 0.037 |
| F | 1.05 | | 1.25 | 0.041 | | 0.049 |
| F2 | 1.50 | | 1.70 | 0.059 | | 0.067 |
| F3 | 1.90 | | 2.10 | 0.075 | | 0.083 |
| G | 10.80 | | 11.20 | 0.425 | | 0.441 |
| H | 15.80 | | 16.20 | 0.622 | | 0.638 |
| L | | 9 | | | 0.354 | |
| L1 | 20.80 | | 21.20 | 0.819 | | 0.835 |
| L2 | 19.10 | | 19.90 | 0.752 | | 0.783 |
| L3 | 22.80 | | 23.60 | 0.898 | | 0.929 |
| L4 | 40.50 | | 42.50 | 1.594 | | 1.673 |
| L5 | 4.85 | | 5.25 | 0.191 | | 0.207 |
| L6 | 20.25 | | 20.75 | 0.797 | | 0.817 |
| N | 2.1 | | 2.3 | 0.083 | | 0.091 |
| R | | 4.6 | | | 0.181 | |
| DIA | 3.5 | | 3.7 | 0.138 | | 0.146 |



- Weight : 4.9 g (typ.)
- Maximum Torque (applied to mounting flange) Recommended: 0.8 Nm; Maximum: 1 Nm
- The side of the dissipator must be flat within 80 μ m

P025C/A

Table 11: Revision History

| Date | Revision | Description of Changes |
|-------------|----------|------------------------|
| 17-Nov-2005 | 1 | First Release |

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