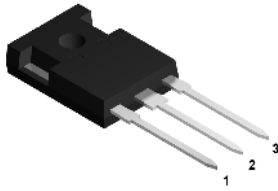
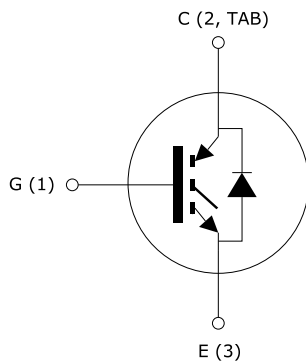


40 A, 600 V, fast IGBT with UltraFAST diode



TO-247 long leads



SC12850_DIODE_IGBT



Features

- High current capability
- High frequency operation up to 50 kHz
- Very soft ultra fast recovery antiparallel diode

Applications

- High frequency inverters, UPS
- Motor drive
- SMPS and PFC in both hard switch and resonant topologies

Description

This device uses the advanced PowerMESH process resulting in an excellent trade-off between switching performance and low on-state behavior.

Product status link

[STGW30NC60VD](#)

Product summary

| | |
|-------------------|-------------------|
| Order code | STGW30NC60VD |
| Marking | GW30NC60VD |
| Package | TO-247 long leads |
| Packing | Tube |

1 Electrical ratings

Table 1. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|--------------------------------|---|------------|------|
| V _{CES} | Collector-emitter voltage (V _{GE} = 0 V) | 600 | V |
| I _C ⁽¹⁾ | Continuous collector current at T _C = 25 °C | 80 | A |
| | Continuous collector current at T _C = 100 °C | 40 | |
| I _{CL} ⁽²⁾ | Turn-off latching current | 100 | A |
| I _{CP} ⁽³⁾ | Pulsed collector current | 150 | A |
| V _{GE} | Gate-emitter voltage | ±20 | V |
| I _F | Diode RMS forward current at T _C = 25 °C | 30 | A |
| I _{FSM} | Surge not repetitive forward current, t _p = 10 ms sinusoidal | 120 | A |
| P _{TOT} | Total power dissipation at T _C = 25 °C | 250 | W |
| T _J | Operating junction temperature range | -55 to 150 | °C |
| T _{STG} | Storage temperature range | | °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. V_{clamp} = 80% V_{CES}, T_J = 150 °C, R_G = 10 Ω, V_{GE} = 15 V.
3. Pulse width limited by maximum junction temperature and turn-off within RBSOA.

Table 2. Thermal data

| Symbol | Parameter | Value | Unit |
|-------------------|--|-------|------|
| R _{thJC} | Thermal resistance, junction-to-case IGBT | 0.5 | °C/W |
| | Thermal resistance, junction-to-case diode | 1.5 | °C/W |
| R _{thJA} | Thermal resistance, junction-to-ambient | 50 | °C/W |

2 Electrical characteristics

$T_J = 25\text{ °C}$ unless otherwise specified

Table 3. Static

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|--------------------------------------|---|------|------|-----------|---------------|
| $V_{(BR)CES}$ | Collector-emitter breakdown voltage | $V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$ | 600 | | | V |
| $V_{CE(sat)}$ | Collector-emitter saturation voltage | $V_{GE} = 15\text{ V}, I_C = 20\text{ A}$ | | 1.8 | 2.5 | V |
| | | $V_{GE} = 15\text{ V}, I_C = 40\text{ A}$ | | 2.1 | | |
| | | $V_{GE} = 15\text{ V}, I_C = 80\text{ A}, T_J = 100\text{ °C}$ | | 2.9 | | |
| | | $V_{GE} = 15\text{ V}, I_C = 20\text{ A}, T_J = 125\text{ °C}$ | | 1.7 | | |
| $V_{GE(th)}$ | Gate threshold voltage | $V_{CE} = V_{GE}, I_C = 250\text{ }\mu\text{A}$ | 3.75 | | 5.75 | V |
| I_{CES} | Collector cut-off current | $V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}$ | | | 10 | μA |
| | | $V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}, T_J = 125\text{ °C}^{(1)}$ | | | 1 | mA |
| I_{GES} | Gate-emitter leakage current | $V_{CE} = 0\text{ V}, V_{GE} = \pm 20\text{ V}$ | | | ± 100 | nA |
| g_{fs} | Forward transconductance | $V_{CE} = 15\text{ V}, I_C = 20\text{ A}$ | | 15 | | S |

1. Specified by design, not tested in production.

Table 4. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|---|------|------|------|------|
| C_{ies} | Input capacitance | $V_{CE} = 25\text{ V}, f = 1\text{ MHz}, V_{GE} = 0\text{ V}$ | - | 2200 | | pF |
| C_{oes} | Output capacitance | | - | 225 | | |
| C_{res} | Reverse transfer capacitance | | - | 50 | | |
| Q_g | Total gate charge | $V_{CE} = 390\text{ V}, I_C = 20\text{ A}, V_{GE} = 15\text{ V}$ (see Figure 17. Gate charge test circuit) | - | 100 | 140 | nC |
| Q_{ge} | Gate-emitter charge | | - | 16 | | |
| Q_{gc} | Gate-collector charge | | - | 45 | | |

Table 5. Switching on/off (inductive load)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|----------------|-----------------------|--|------|------|------|------------|
| $t_{d(on)}$ | Turn-on delay time | $V_{CC} = 390\text{ V}$, $I_C = 20\text{ A}$, | - | 31 | - | ns |
| t_r | Current rise time | $R_G = 3.3\ \Omega$, $V_{GE} = 15\text{ V}$ | - | 11 | - | ns |
| $(di/dt)_{on}$ | Turn-on current slope | (see Figure 16. Test circuit for inductive load switching and Figure 18. Switching waveform) | - | 1600 | - | A/ μ s |
| $t_{d(on)}$ | Turn-on delay time | $V_{CC} = 390\text{ V}$, $I_C = 20\text{ A}$, | - | 31 | - | ns |
| t_r | Current rise time | $R_G = 3.3\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$ | - | 11.5 | - | ns |
| $(di/dt)_{on}$ | Turn-on current slope | (see Figure 16. Test circuit for inductive load switching and Figure 18. Switching waveform) | - | 1500 | - | A/ μ s |
| $t_r(V_{off})$ | Off voltage rise time | $V_{CC} = 390\text{ V}$, $I_C = 20\text{ A}$, | - | 28 | - | ns |
| $t_{d(off)}$ | Turn-off delay time | $R_G = 3.3\ \Omega$, $V_{GE} = 15\text{ V}$ | - | 100 | - | ns |
| t_f | Current fall time | (see Figure 16. Test circuit for inductive load switching and Figure 18. Switching waveform) | - | 75 | - | ns |
| $t_r(V_{off})$ | Off voltage rise time | $V_{CC} = 390\text{ V}$, $I_C = 20\text{ A}$, | - | 66 | - | ns |
| $t_{d(off)}$ | Turn-off delay time | $R_G = 3.3\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$ | - | 150 | - | ns |
| t_f | Current fall time | (see Figure 16. Test circuit for inductive load switching and Figure 18. Switching waveform) | - | 130 | - | ns |

Table 6. Switching energy (inductive load)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|---------------------------|--|------|------|------|---------|
| E_{on} | Turn-on switching energy | $V_{CC} = 390\text{ V}$, $I_C = 20\text{ A}$, | - | 220 | 300 | μ J |
| $E_{off}^{(1)}$ | Turn-off switching energy | $R_G = 3.3\ \Omega$, $V_{GE} = 15\text{ V}$ | - | 330 | 450 | μ J |
| E_{ts} | Total switching energy | (see Figure 16. Test circuit for inductive load switching) | - | 550 | 750 | μ J |
| E_{on} | Turn-on switching energy | $V_{CC} = 390\text{ V}$, $I_C = 20\text{ A}$, | - | 450 | | μ J |
| $E_{off}^{(1)}$ | Turn-off switching energy | $R_G = 3.3\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$ | - | 770 | | μ J |
| E_{ts} | Total switching energy | (see Figure 16. Test circuit for inductive load switching) | - | 1220 | | μ J |

1. Including the tail of the collector current.

Table 7. Collector-emitter diode

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|--------------------------|---|------|------|------|------|
| V_F | Forward on-voltage | $I_F = 20\text{ A}$ | - | 1.8 | 2.3 | V |
| | | $I_F = 20\text{ A}, T_J = 125\text{ °C}$ | - | 1.4 | | V |
| t_{rr} | Reverse recovery time | $I_F = 20\text{ A}, V_R = 40\text{ V}, T_J = 25\text{ °C},$ $di/dt = 100\text{ A}/\mu\text{s}$ (see Figure 19. Diode reverse recovery waveform) | - | 44 | | ns |
| Q_{rr} | Reverse recovery charge | | - | 66 | | nC |
| I_{rrm} | Reverse recovery current | | - | 3 | | A |
| t_{rr} | Reverse recovery time | $I_F = 20\text{ A}, V_R = 40\text{ V}, T_J = 125\text{ °C},$ $di/dt = 100\text{ A}/\mu\text{s}$ (see Figure 19. Diode reverse recovery waveform) | - | 88 | | ns |
| Q_{rr} | Reverse recovery charge | | - | 237 | | nC |
| I_{rrm} | Reverse recovery current | | - | 5.4 | | A |

2.1 Electrical characteristics (curves)

Figure 1. Output characteristics

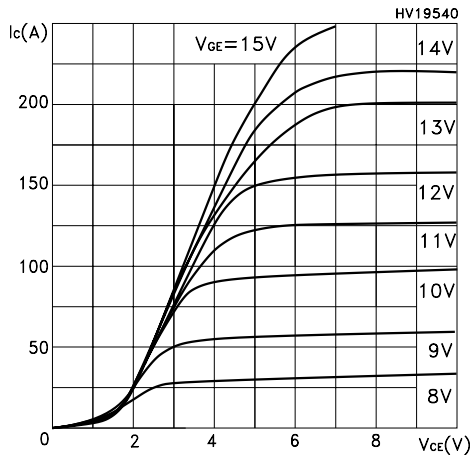


Figure 2. Transfer characteristics

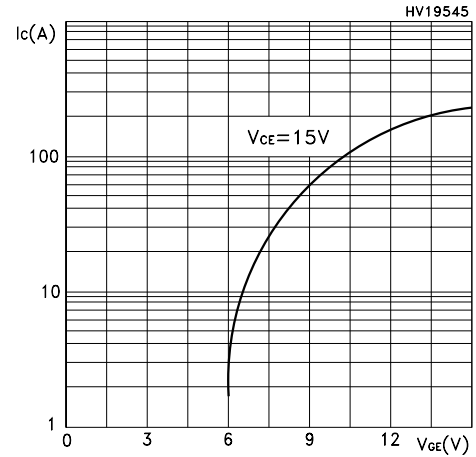


Figure 3. Transconductance

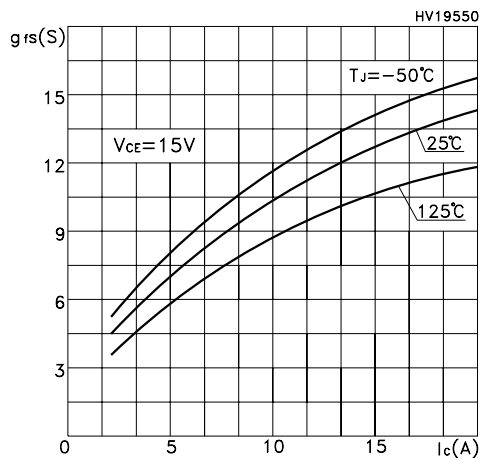


Figure 4. Collector-emitter on voltage vs temperature

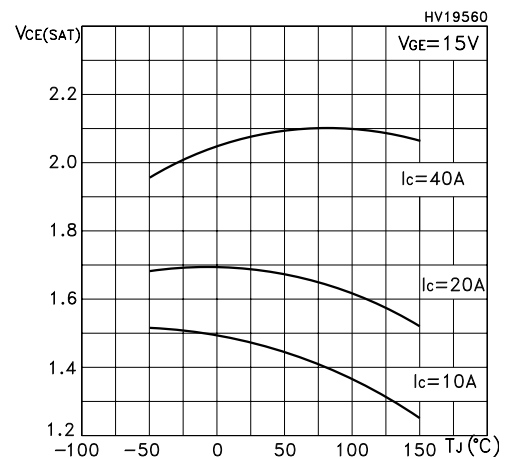


Figure 5. Gate charge vs gate-source voltage

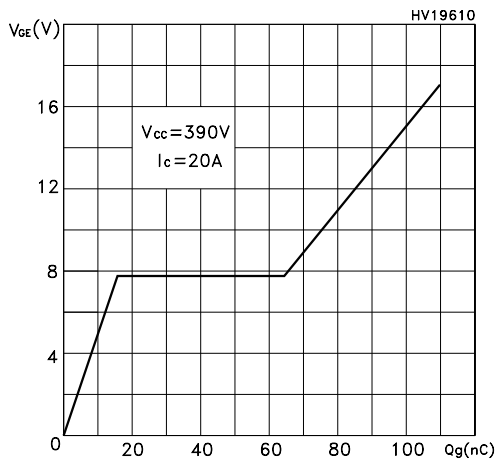


Figure 6. Capacitance variations

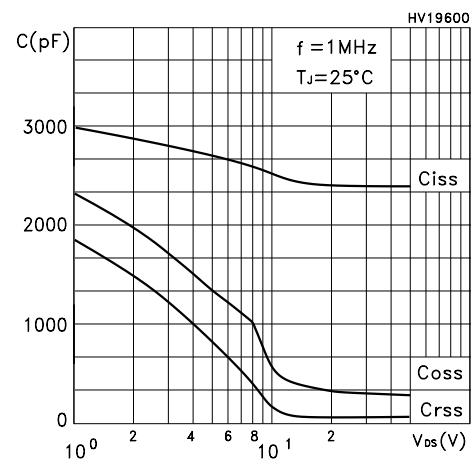


Figure 7. Normalized gate threshold voltage vs temperature

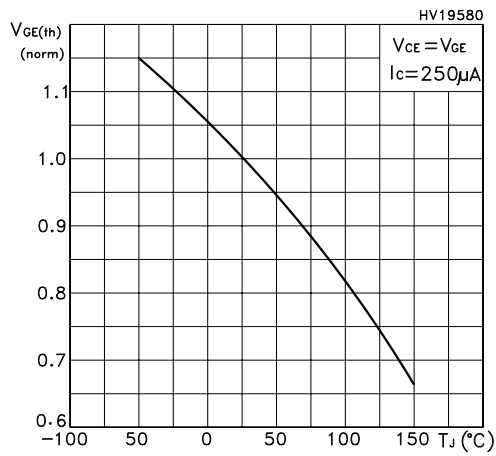


Figure 8. Collector-emitter on voltage vs collector current

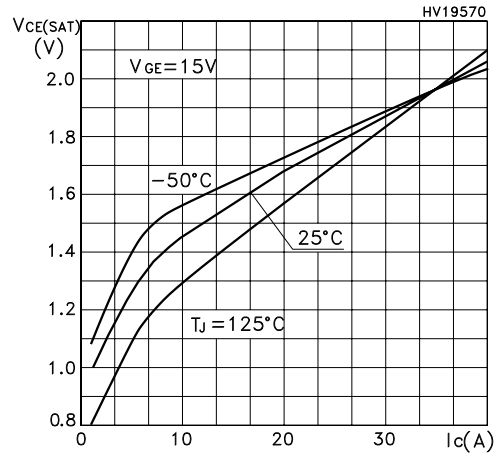


Figure 9. Normalized breakdown voltage vs temperature

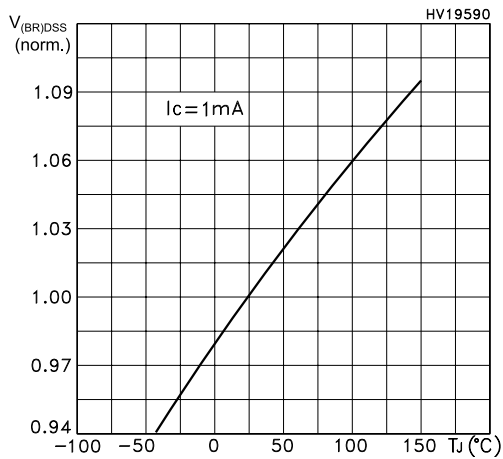


Figure 10. Switching energy vs temperature

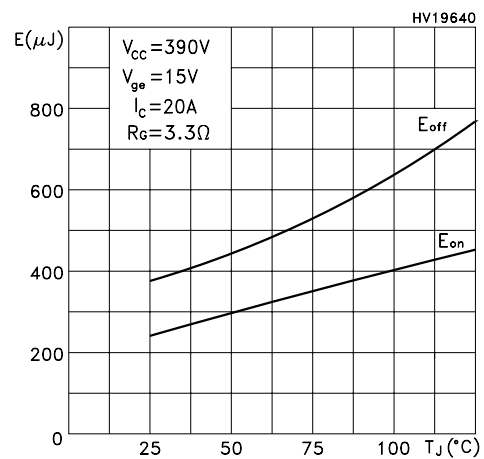


Figure 11. Switching energy vs gate resistance

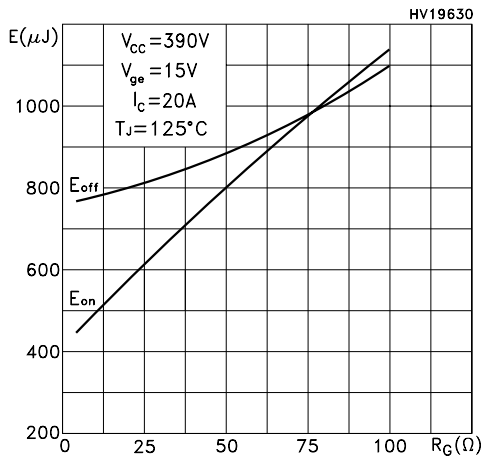


Figure 12. Switching energy vs collector current

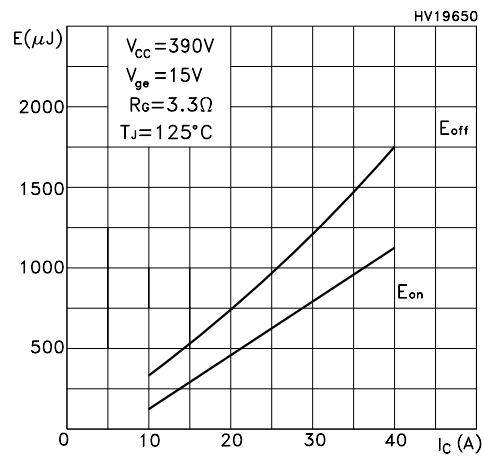


Figure 13. Turn-off SOA

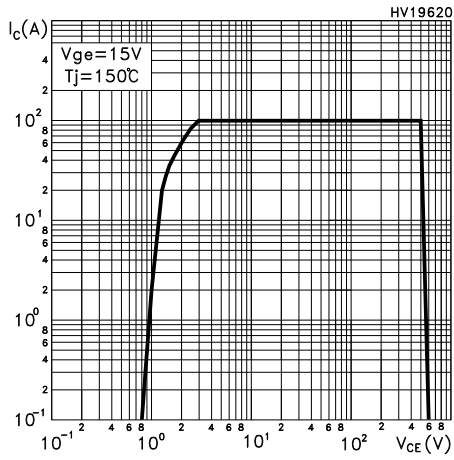


Figure 14. Thermal Impedance

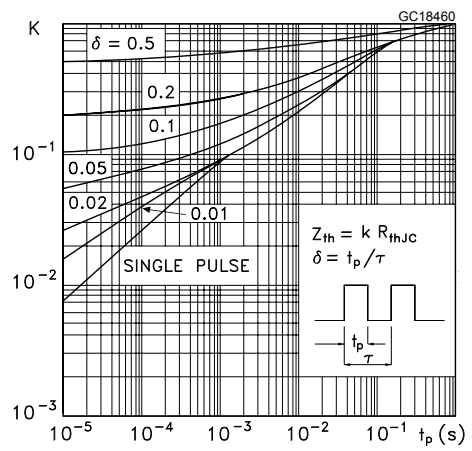
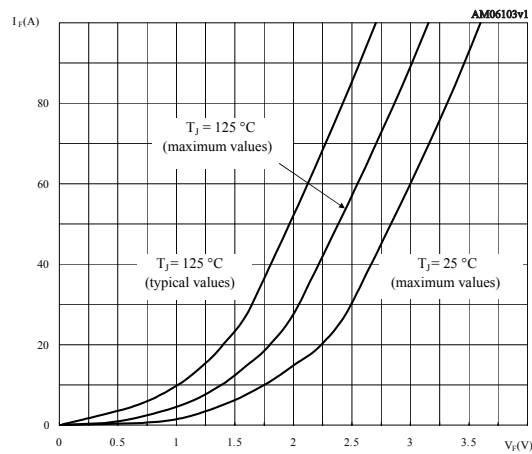


Figure 15. Emitter-collector diode characteristics



3 Test circuits

Figure 16. Test circuit for inductive load switching

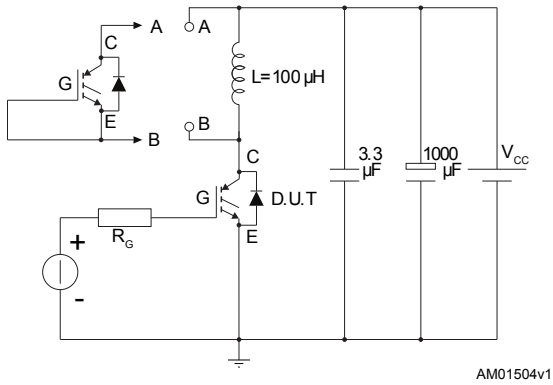


Figure 17. Gate charge test circuit

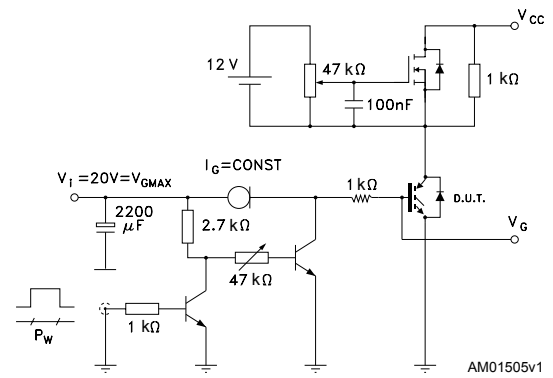


Figure 18. Switching waveform

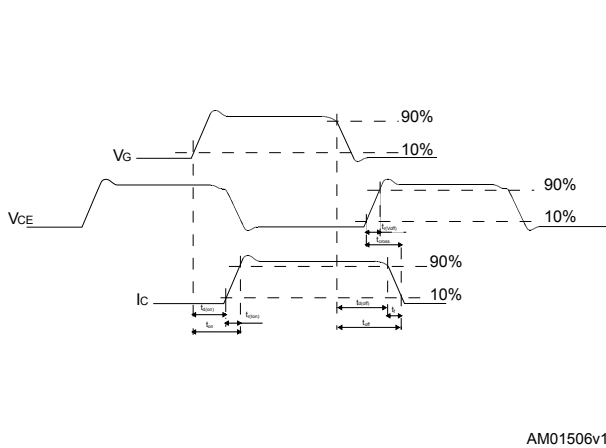
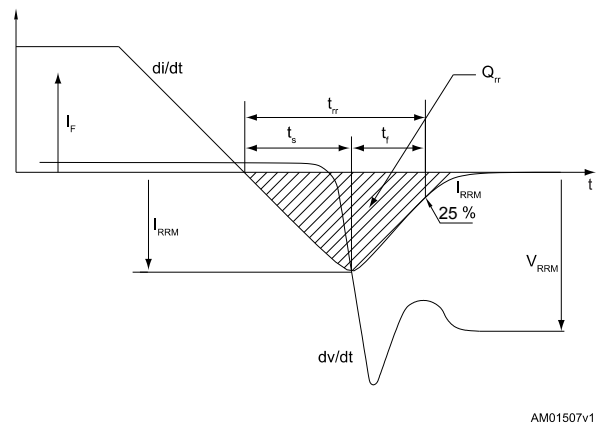


Figure 19. Diode reverse recovery waveform

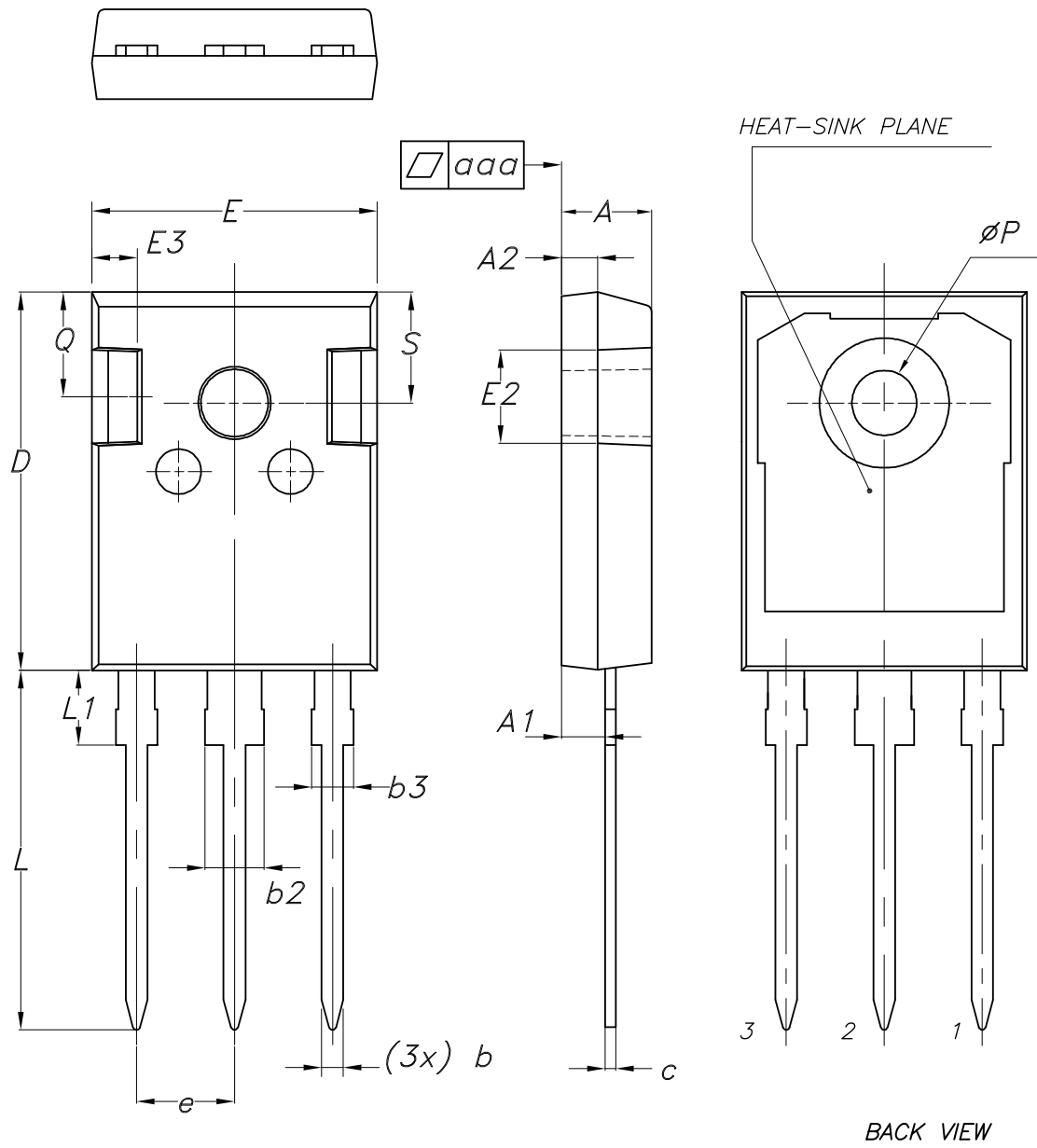


4 Package information

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. ECOPACK is an ST trademark.

4.1 TO-247 long leads package information

Figure 20. TO-247 long leads package outline



8463846_3

Table 8. TO-247 long leads package mechanical data

| Dim. | mm | | |
|------|-------|-------|-------|
| | Min. | Typ. | Max. |
| A | 4.90 | 5.00 | 5.10 |
| A1 | 2.31 | 2.41 | 2.51 |
| A2 | 1.90 | 2.00 | 2.10 |
| b | 1.16 | | 1.26 |
| b2 | | | 3.25 |
| b3 | | | 2.25 |
| c | 0.59 | | 0.66 |
| D | 20.90 | 21.00 | 21.10 |
| E | 15.70 | 15.80 | 15.90 |
| E2 | 4.90 | 5.00 | 5.10 |
| E3 | 2.40 | 2.50 | 2.60 |
| e | 5.34 | 5.44 | 5.54 |
| L | 19.80 | 19.92 | 20.10 |
| L1 | | | 4.30 |
| P | 3.50 | 3.60 | 3.70 |
| Q | 5.60 | | 6.00 |
| S | 6.05 | 6.15 | 6.25 |
| aaa | | 0.04 | 0.10 |

Revision history

Table 9. Document revision history

| Date | Version | Changes |
|-------------|---------|---|
| 12-Feb-2007 | 1 | First release. |
| 19-Feb-2007 | 2 | <i>Figure 6</i> has been updated |
| 12-Mar-2010 | 3 | Inserted IFSM parameter on <i>Table 2: Absolute maximum ratings</i> . Updated <i>Figure 16: Emitter-collector diode characteristics</i> and package mechanical data. |
| 03-Jan-2011 | 4 | Updated <i>Table 4: Static</i> , <i>Table 8: Collector-emitter diode</i> and <i>Figure 14: Thermal impedance</i> . |
| 23-Feb-2011 | 5 | Added T_L row <i>Table 2</i> on page 3. |
| 02-May-2022 | 6 | Updated Section 4.1 TO-247 long leads package information. Minor text changes. |

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