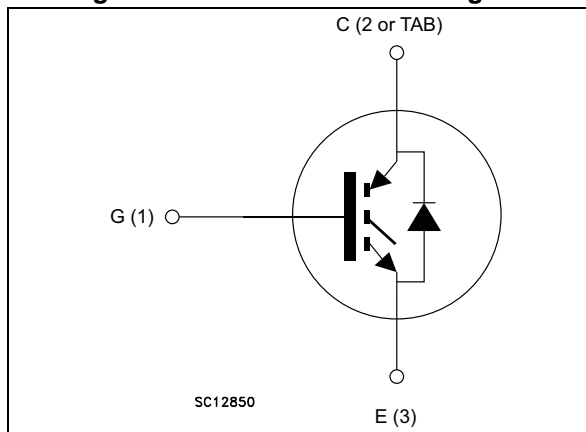


Figure 1. Internal schematic diagram



Features

- Maximum junction temperature: $T_J = 175\text{ }^\circ\text{C}$
- High speed switching series
- Minimized tail current
- $V_{CE(sat)} = 1.6\text{ V (typ.) @ } I_C = 80\text{ A}$
- Tight parameter distribution
- Safe paralleling
- Low thermal resistance
- Very fast soft recovery antiparallel diode

Applications

- Photovoltaic inverters
- High frequency converters

Description

This device is an IGBT developed using an advanced proprietary trench gate and field stop structure. The device is part of the new "HB" series of IGBTs, which represent an optimum compromise between conduction and switching losses to maximize the efficiency of any frequency converter. Furthermore, a slightly positive $V_{CE(sat)}$ temperature coefficient and very tight parameter distribution result in safer paralleling operation.

Table 1. Device summary

| Order code | Marking | Package | Packing |
|---------------|-------------|-------------------|---------|
| STGY80H65DFB | GY80H65DFB | Max247 | Tube |
| STGW80H65DFB | GW80H65DFB | TO-247 | Tube |
| STGWA80H65DFB | GW80H65DFB | TO-247 long leads | Tube |
| STGWT80H65DFB | GWT80H65DFB | TO-3P | Tube |

Contents

| | | |
|----------|---|-----------|
| 1 | Electrical ratings | 3 |
| 2 | Electrical characteristics | 4 |
| 2.1 | Electrical characteristics (curves) | 6 |
| 3 | Test circuits | 11 |
| 4 | Package information | 12 |
| 4.1 | Max247 package information | 13 |
| 4.2 | TO-247 package information | 15 |
| 4.3 | TO-247 long leads package information | 17 |
| 4.4 | TO-3P package information | 19 |
| 5 | Revision history | 21 |

1 Electrical ratings

Table 2. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|-------------------------|---|--------------------|------|
| V_{CES} | Collector-emitter voltage ($V_{GE} = 0$) | 650 | V |
| I_C | Continuous collector current at $T_C = 25\text{ °C}$ | 120 ⁽¹⁾ | A |
| | Continuous collector current at $T_C = 100\text{ °C}$ | 80 | |
| I_{CP} ⁽²⁾ | Pulsed collector current | 240 | A |
| V_{GE} | Gate-emitter voltage | ± 20 | V |
| I_F | Continuous forward current at $T_C = 25\text{ °C}$ | 120 ⁽¹⁾ | A |
| | Continuous forward current at $T_C = 100\text{ °C}$ | 80 | |
| I_{FP} ⁽²⁾ | Pulsed forward current | 240 | A |
| P_{TOT} | Total dissipation at $T_C = 25\text{ °C}$ | 469 | W |
| T_{STG} | Storage temperature range | - 55 to 150 | °C |
| T_J | Operating junction temperature | - 55 to 175 | |

1. Current level is limited by bond wires
2. Pulse width limited by maximum junction temperature

Table 3. Thermal data

| Symbol | Parameter | Value | Unit |
|------------|--|-------|------|
| R_{thJC} | Thermal resistance junction-case IGBT | 0.32 | °C/W |
| R_{thJC} | Thermal resistance junction-case diode | 0.66 | |
| R_{thJA} | Thermal resistance junction-ambient | 50 | |

2 Electrical characteristics

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

Table 4. Static characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|--|--|------|------|------|---------------|
| $V_{(BR)CES}$ | Collector-emitter breakdown voltage ($V_{GE} = 0$) | $I_C = 2\text{ mA}$ | 650 | | | V |
| $V_{CE(sat)}$ | Collector-emitter saturation voltage | $V_{GE} = 15\text{ V}, I_C = 80\text{ A}$ | | 1.6 | 2 | V |
| | | $V_{GE} = 15\text{ V}, I_C = 80\text{ A}$ $T_J = 125\text{ °C}$ | | 1.8 | | |
| | | $V_{GE} = 15\text{ V}, I_C = 80\text{ A}$ $T_J = 175\text{ °C}$ | | 1.9 | | |
| V_F | Forward on-voltage | $I_F = 80\text{ A}$ | | 1.9 | 2.3 | V |
| | | $I_F = 80\text{ A}, T_J = 125\text{ °C}$ | | 1.6 | | |
| | | $I_F = 80\text{ A}, T_J = 175\text{ °C}$ | | 1.5 | | |
| $V_{GE(th)}$ | Gate threshold voltage | $V_{CE} = V_{GE}, I_C = 1\text{ mA}$ | 5 | 6 | 7 | V |
| I_{CES} | Collector cut-off current ($V_{GE} = 0$) | $V_{CE} = 650\text{ V}$ | | | 100 | μA |
| I_{GES} | Gate-emitter leakage current ($V_{CE} = 0$) | $V_{GE} = \pm 20\text{ V}$ | | | 250 | nA |

Table 5. Dynamic characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|--|------|-------|------|------|
| C_{ies} | Input capacitance | $V_{CE} = 25\text{ V}, f = 1\text{ MHz},$ $V_{GE} = 0$ | - | 10524 | - | pF |
| C_{oes} | Output capacitance | | - | 385 | - | |
| C_{res} | Reverse transfer capacitance | | - | 215 | - | |
| Q_g | Total gate charge | $V_{CC} = 520\text{ V}, I_C = 80\text{ A},$ $V_{GE} = 15\text{ V},$ see Figure 29 | - | 414 | - | nC |
| Q_{ge} | Gate-emitter charge | | - | 78 | - | |
| Q_{gc} | Gate-collector charge | | - | 170 | - | |

Table 6. IGBT switching characteristics (inductive load)

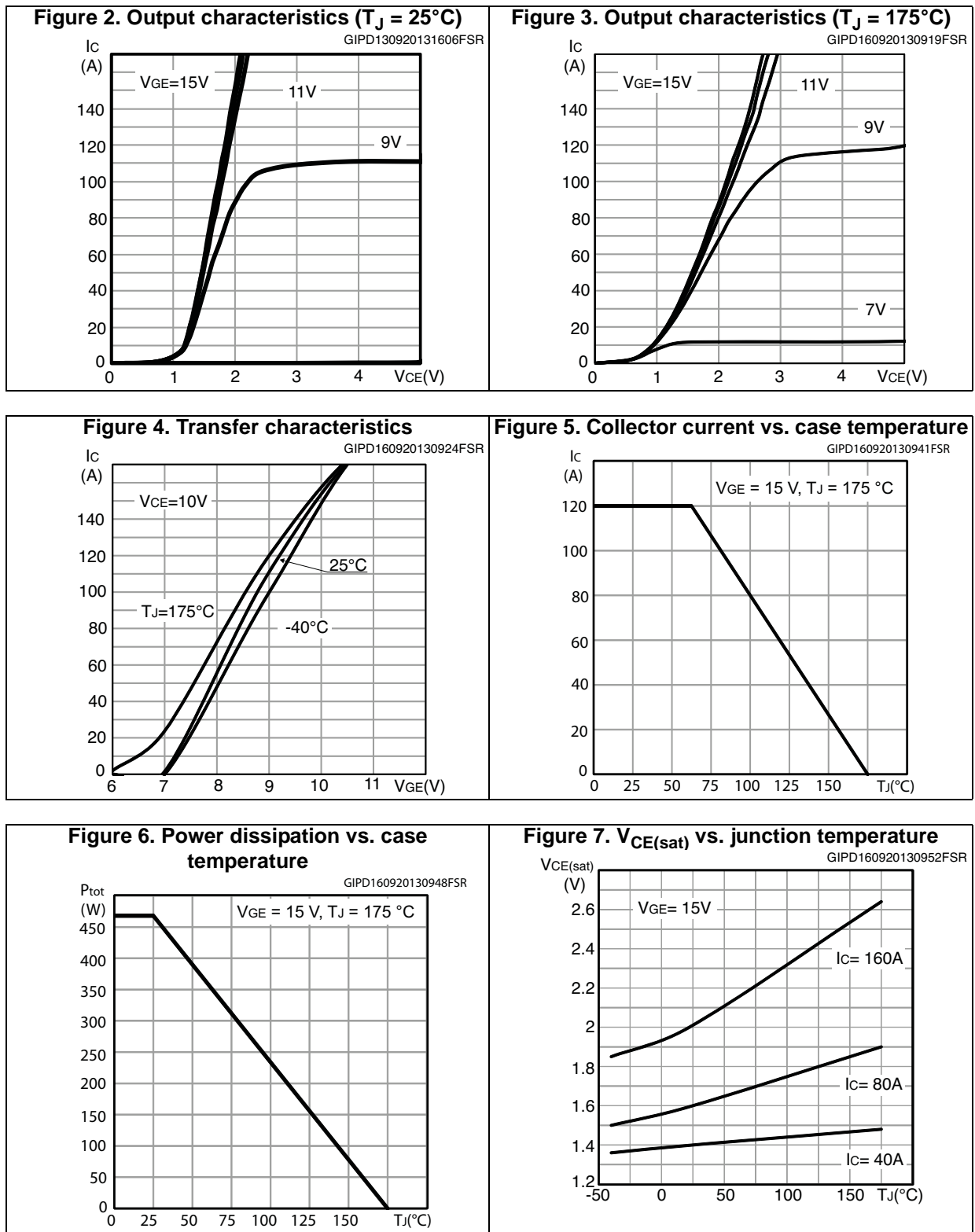
| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|---------------------------|---|------|------|------|------------|
| $t_{d(on)}$ | Turn-on delay time | $V_{CE} = 400\text{ V}$, $I_C = 80\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, see Figure 28 | - | 84 | - | ns |
| t_r | Current rise time | | - | 52 | - | ns |
| $(di/dt)_{on}$ | Turn-on current slope | | - | 1270 | - | A/ μ s |
| $t_{d(off)}$ | Turn-off delay time | | - | 280 | - | ns |
| t_f | Current fall time | | - | 31 | - | ns |
| $E_{on}^{(1)}$ | Turn-on switching losses | | - | 2.1 | - | mJ |
| $E_{off}^{(2)}$ | Turn-off switching losses | | - | 1.5 | - | mJ |
| E_{ts} | Total switching losses | - | 3.6 | - | mJ | |
| $t_{d(on)}$ | Turn-on delay time | $V_{CE} = 400\text{ V}$, $I_C = 80\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 175\text{ }^\circ\text{C}$, see Figure 28 | - | 77 | - | ns |
| t_r | Current rise time | | - | 51 | - | ns |
| $(di/dt)_{on}$ | Turn-on current slope | | - | 1270 | - | A/ μ s |
| $t_{d(off)}$ | Turn-off delay time | | - | 328 | - | ns |
| t_f | Current fall time | | - | 30 | - | ns |
| $E_{on}^{(1)}$ | Turn-on switching losses | | - | 4.4 | - | mJ |
| $E_{off}^{(2)}$ | Turn-off switching losses | | - | 2.1 | - | mJ |
| E_{ts} | Total switching losses | - | 6.5 | - | mJ | |

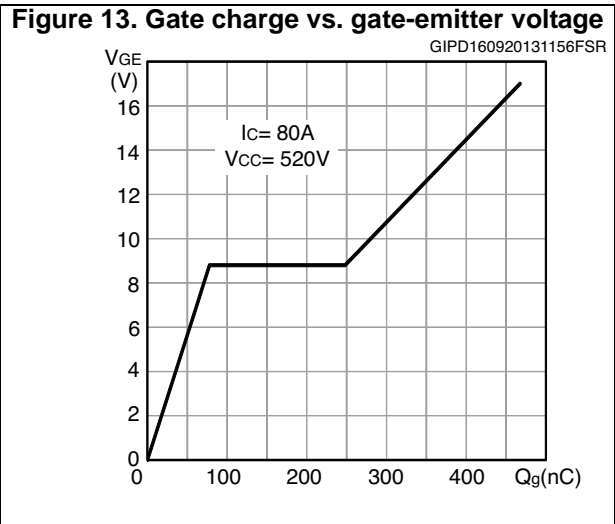
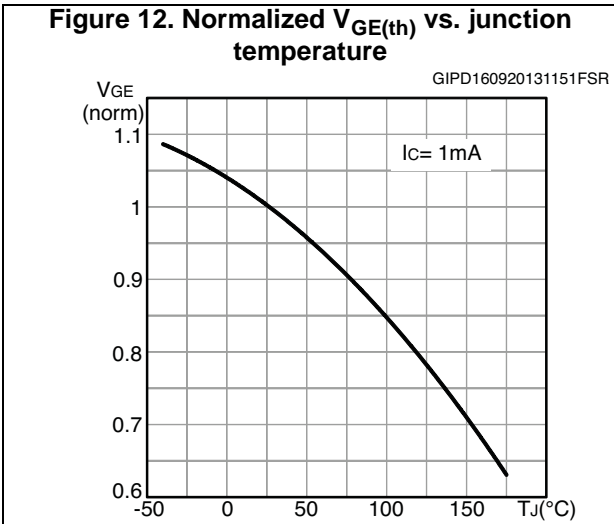
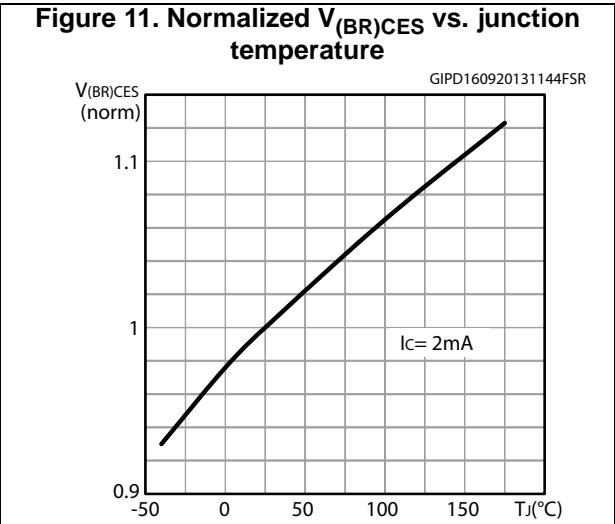
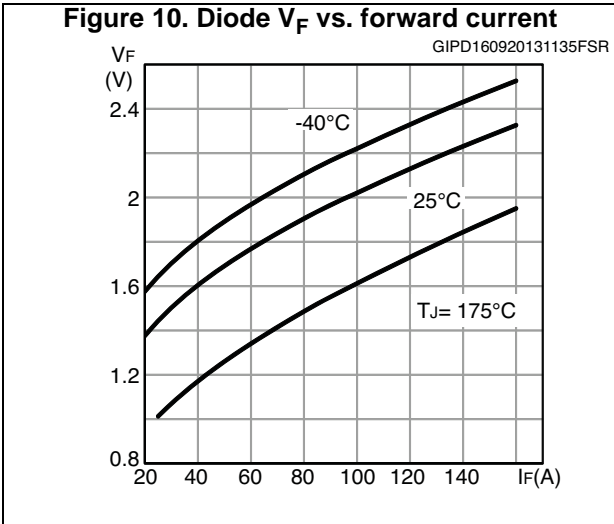
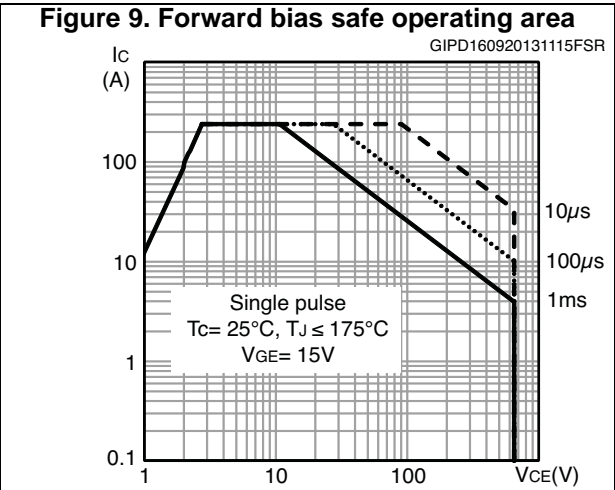
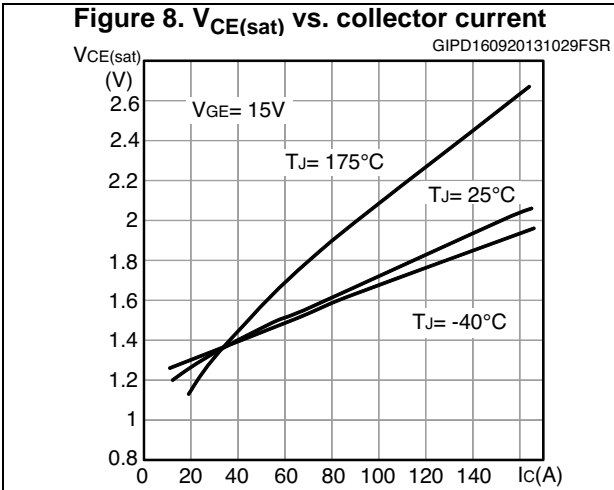
1. Energy losses include reverse recovery of the diode.
2. Turn-off losses include also the tail of the collector current.

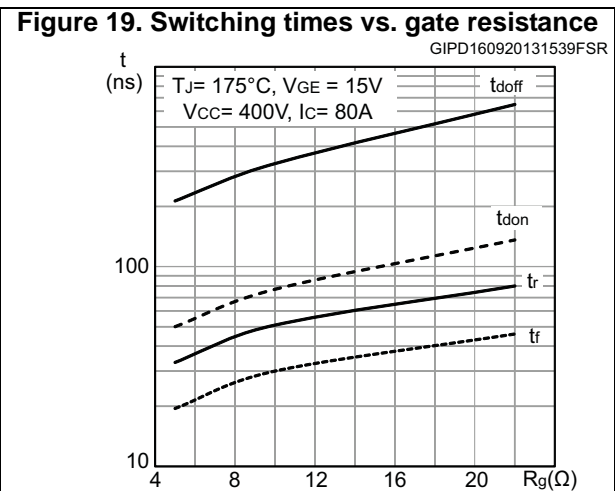
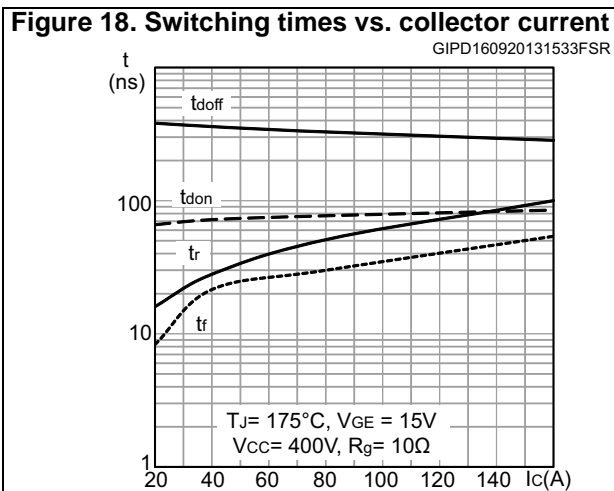
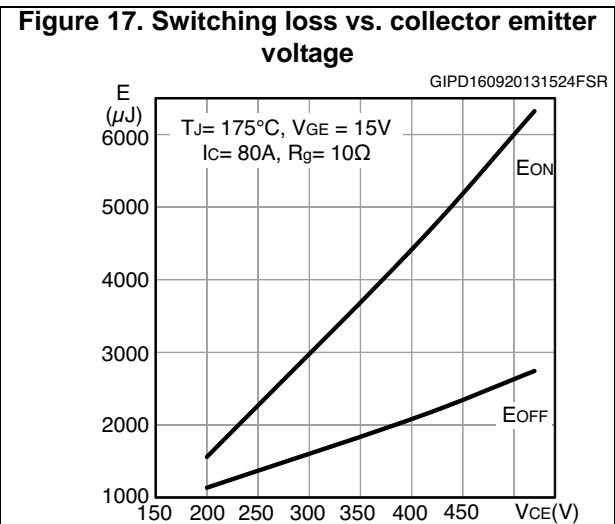
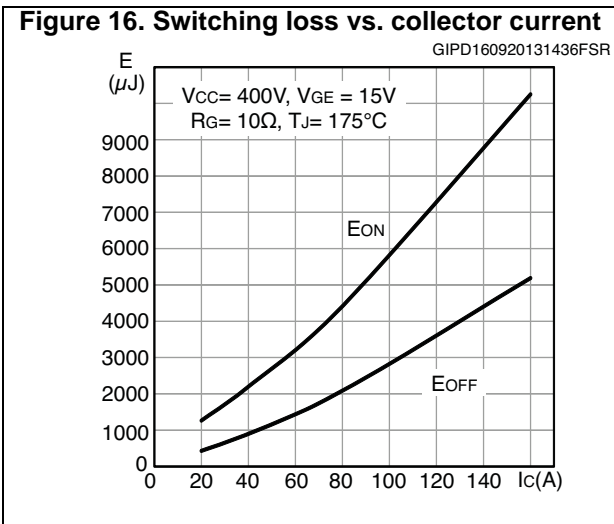
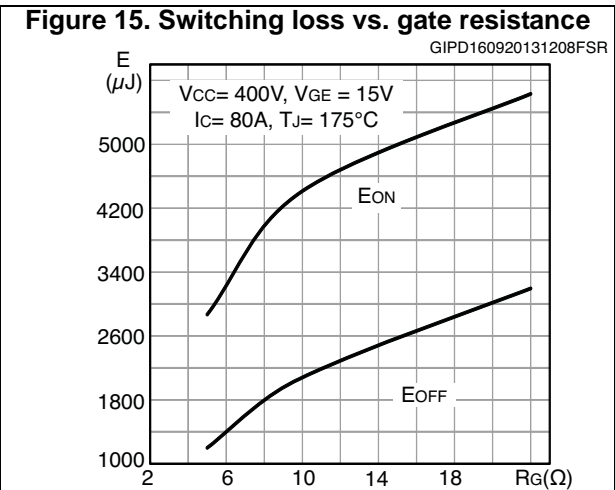
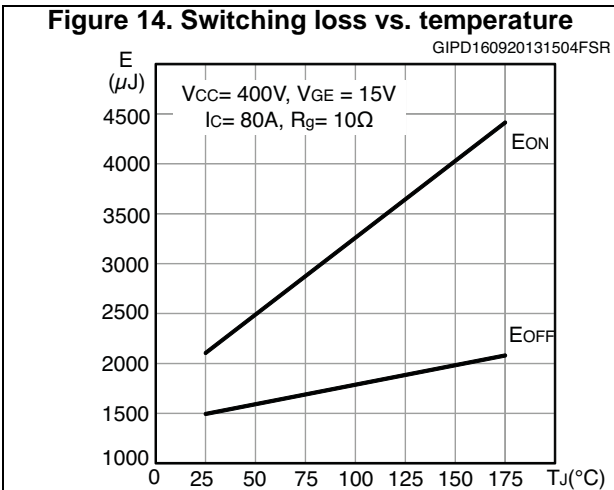
Table 7. Diode switching characteristics (inductive load)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------------|--|--|------|------|------|------------|
| t_{rr} | Reverse recovery time | $I_F = 80\text{ A}$, $V_R = 400\text{ V}$, $di/dt = 1000\text{ A}/\mu\text{s}$, $V_{GE} = 15\text{ V}$, see Figure 28 | - | 85 | - | ns |
| Q_{rr} | Reverse recovery charge | | - | 1105 | - | nC |
| I_{rrm} | Reverse recovery current | | - | 26 | - | A |
| dl_{rr}/dt | Peak rate of fall of reverse recovery current during t_b | | - | 722 | - | A/ μ s |
| E_{rr} | Reverse recovery energy | | - | 267 | - | μ J |
| t_{rr} | Reverse recovery time | $I_F = 80\text{ A}$, $V_R = 400\text{ V}$, $di/dt = 1000\text{ A}/\mu\text{s}$, $V_{GE} = 15\text{ V}$, $T_J = 175\text{ }^\circ\text{C}$, see Figure 28 | - | 149 | - | ns |
| Q_{rr} | Reverse recovery charge | | - | 4920 | - | nC |
| I_{rrm} | Reverse recovery current | | - | 66 | - | A |
| dl_{rr}/dt | Peak rate of fall of reverse recovery current during t_b | | - | 546 | - | A/ μ s |
| E_{rr} | Reverse recovery energy | | - | 1172 | - | μ J |

2.1 Electrical characteristics (curves)







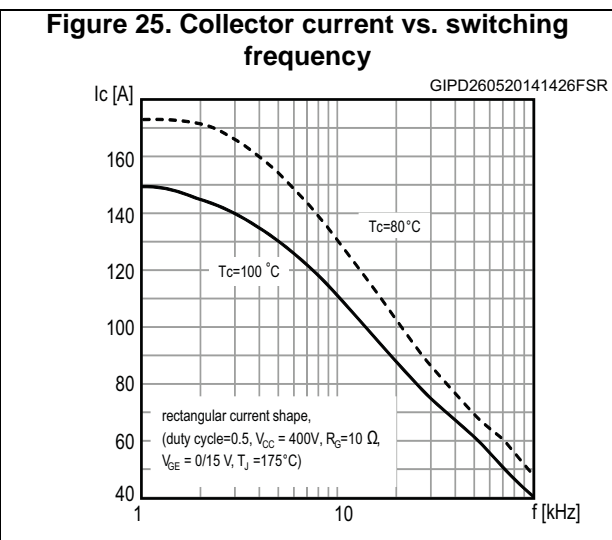
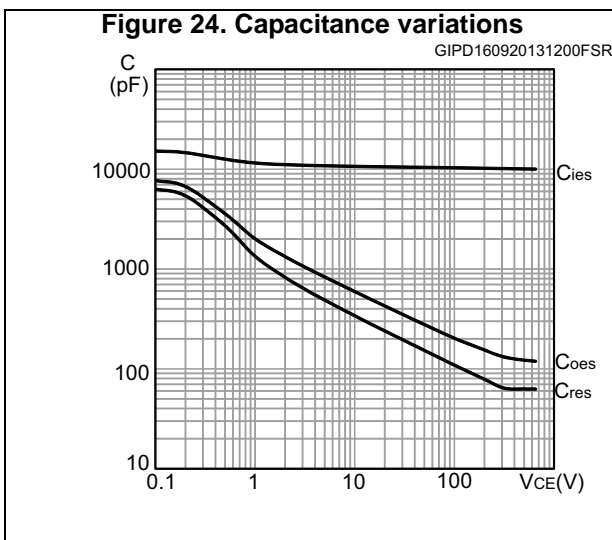
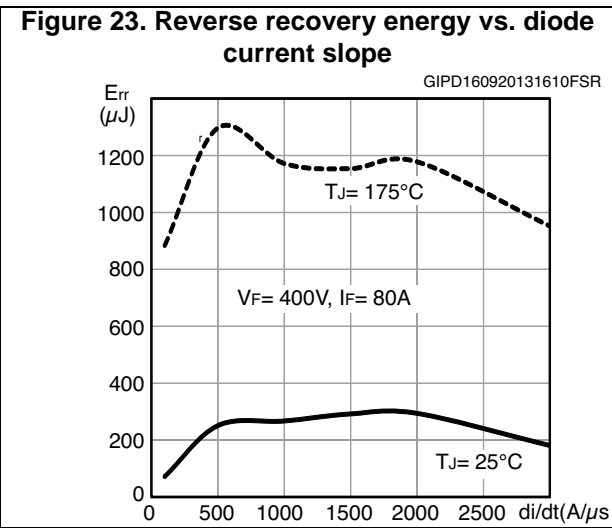
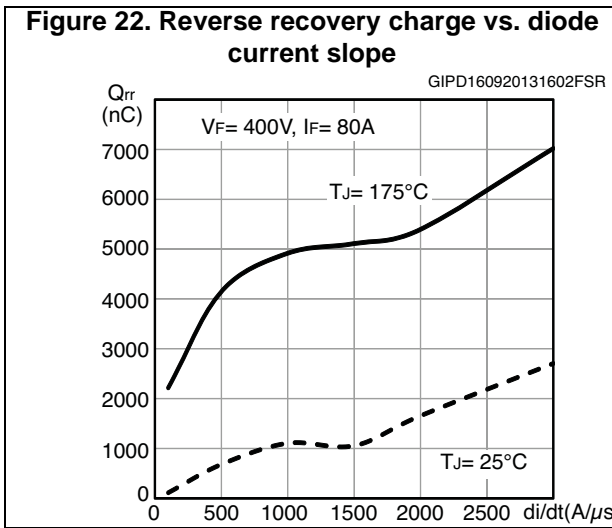
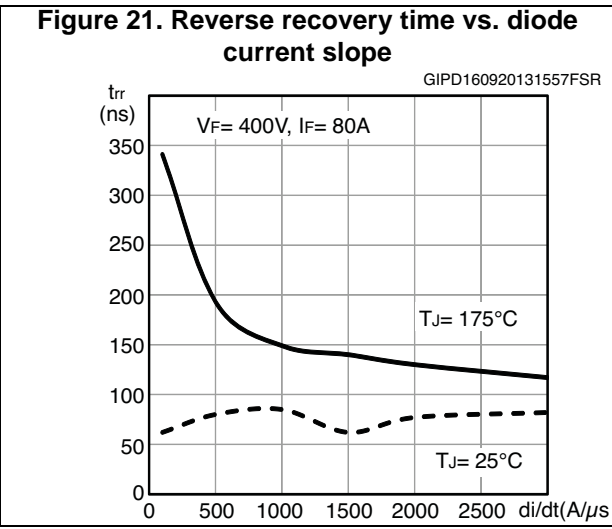
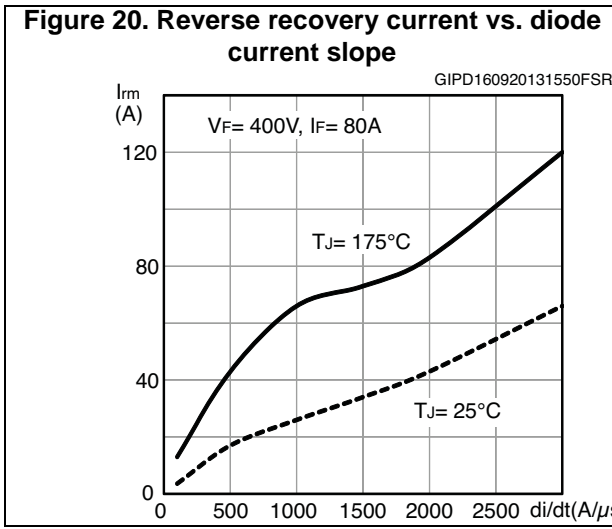


Figure 26. Thermal impedance for IGBT

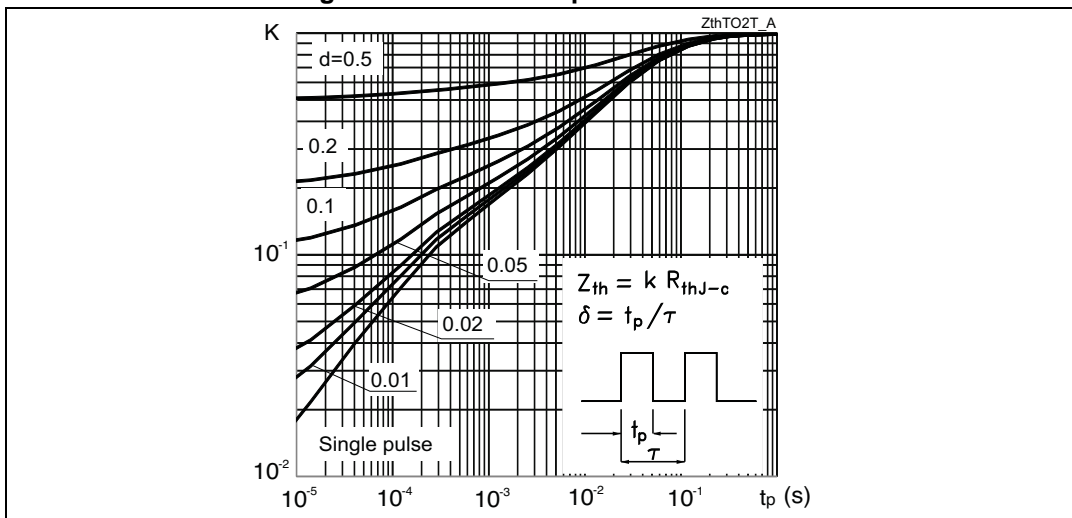
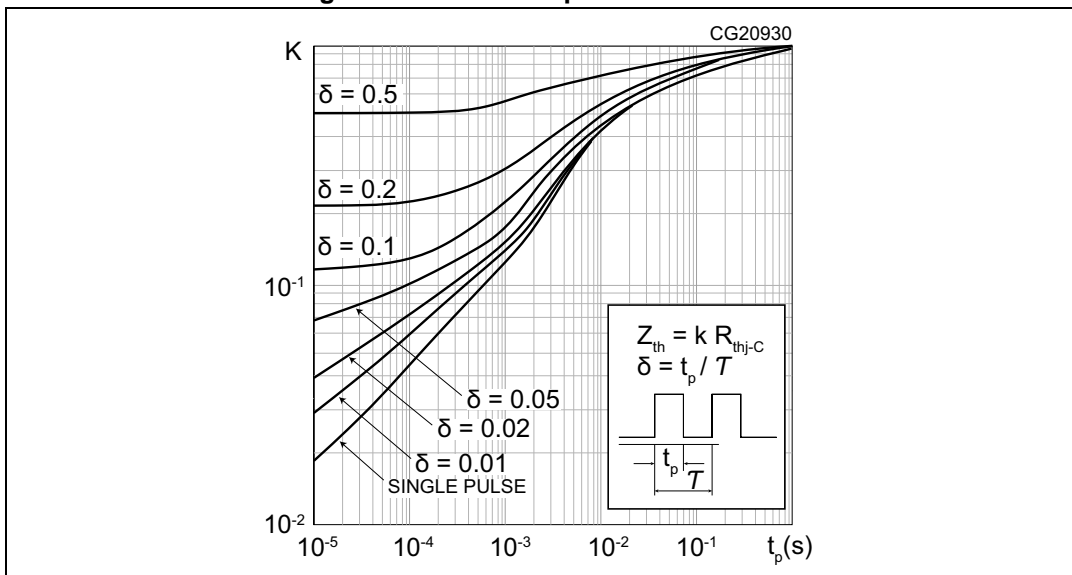


Figure 27. thermal impedance for diode



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 Max247 package information

Figure 32. Max247 package outline

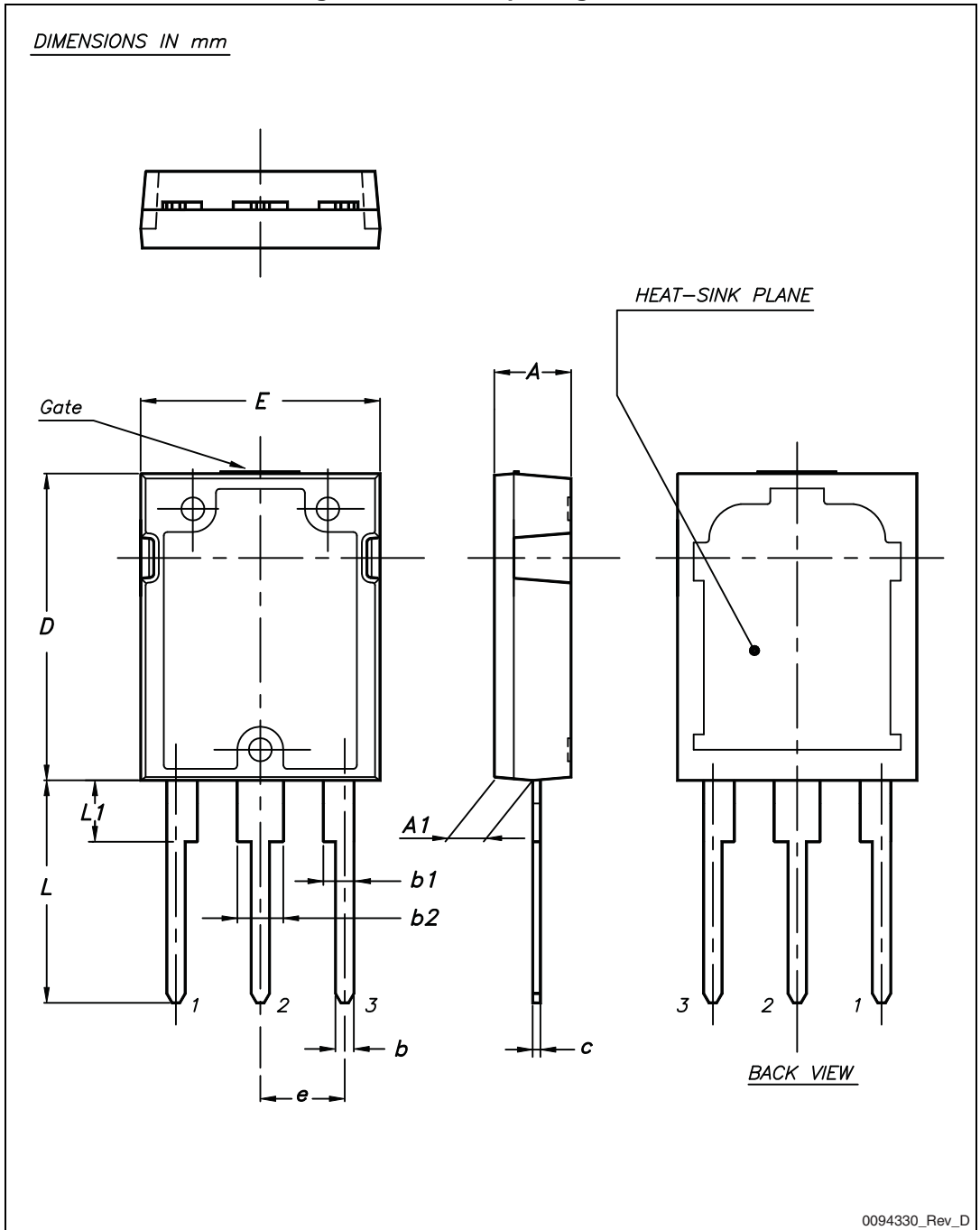
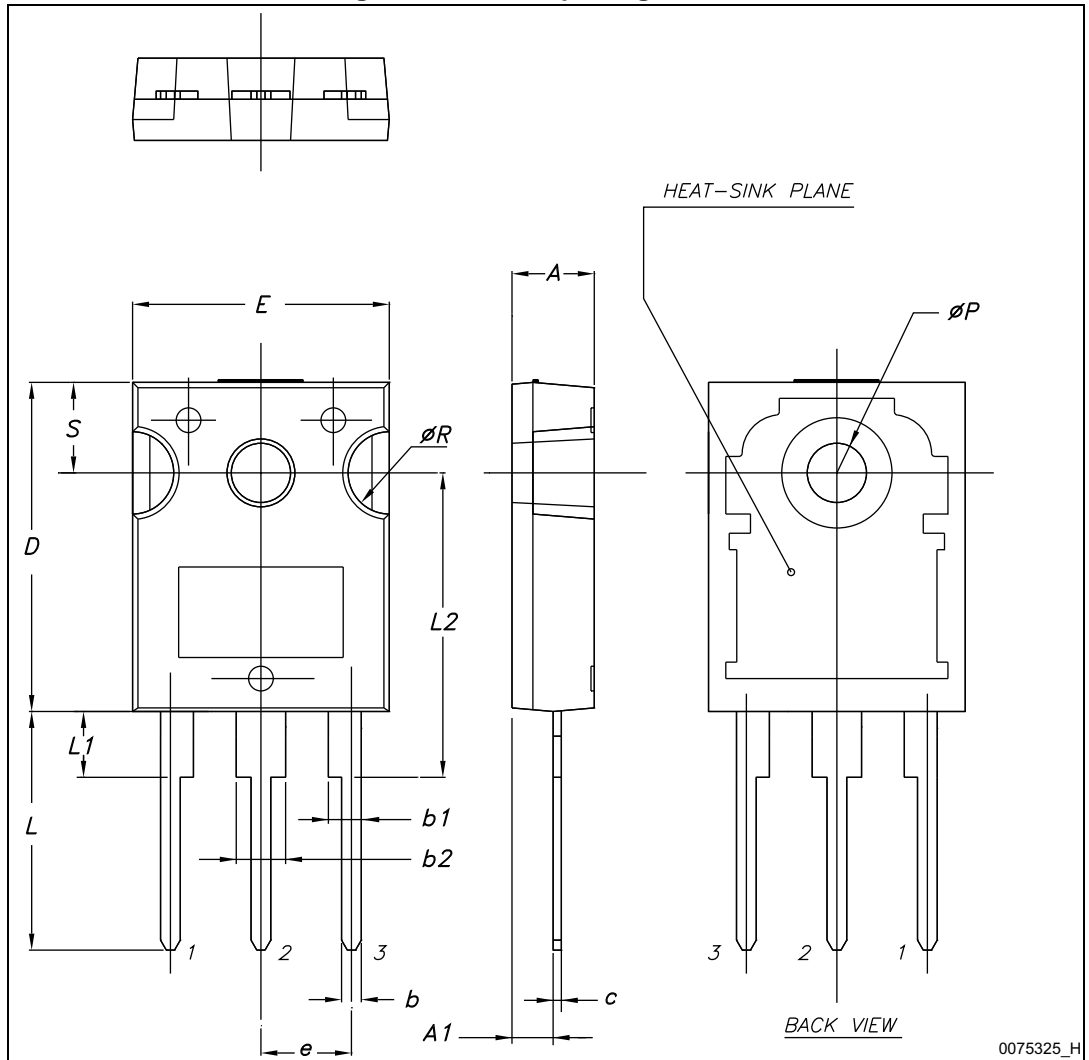


Table 8. Max247 package mechanical data

| Dim. | mm | | |
|------|-------|------|-------|
| | Min. | Typ. | Max. |
| A | 4.70 | | 5.30 |
| A1 | 2.20 | | 2.60 |
| b | 1.00 | | 1.40 |
| b1 | 2.00 | | 2.40 |
| b2 | 3.00 | | 3.40 |
| c | 0.40 | | 0.80 |
| D | 19.70 | | 20.30 |
| e | 5.35 | | 5.55 |
| E | 15.30 | | 15.90 |
| L | 14.20 | | 15.20 |
| L1 | 3.70 | | 4.30 |

4.2 TO-247 package information

Figure 33. TO-247 package outline



0075325_H

Table 9. TO-247 package mechanical data

| Dim. | mm. | | |
|------|-------|-------|-------|
| | Min. | Typ. | Max. |
| A | 4.85 | | 5.15 |
| A1 | 2.20 | | 2.60 |
| b | 1.0 | | 1.40 |
| b1 | 2.0 | | 2.40 |
| b2 | 3.0 | | 3.40 |
| c | 0.40 | | 0.80 |
| D | 19.85 | | 20.15 |
| E | 15.45 | | 15.75 |
| e | 5.30 | 5.45 | 5.60 |
| L | 14.20 | | 14.80 |
| L1 | 3.70 | | 4.30 |
| L2 | | 18.50 | |
| ØP | 3.55 | | 3.65 |
| ØR | 4.50 | | 5.50 |
| S | 5.30 | 5.50 | 5.70 |

4.3 TO-247 long leads package information

Figure 34. TO-247 long leads package outline

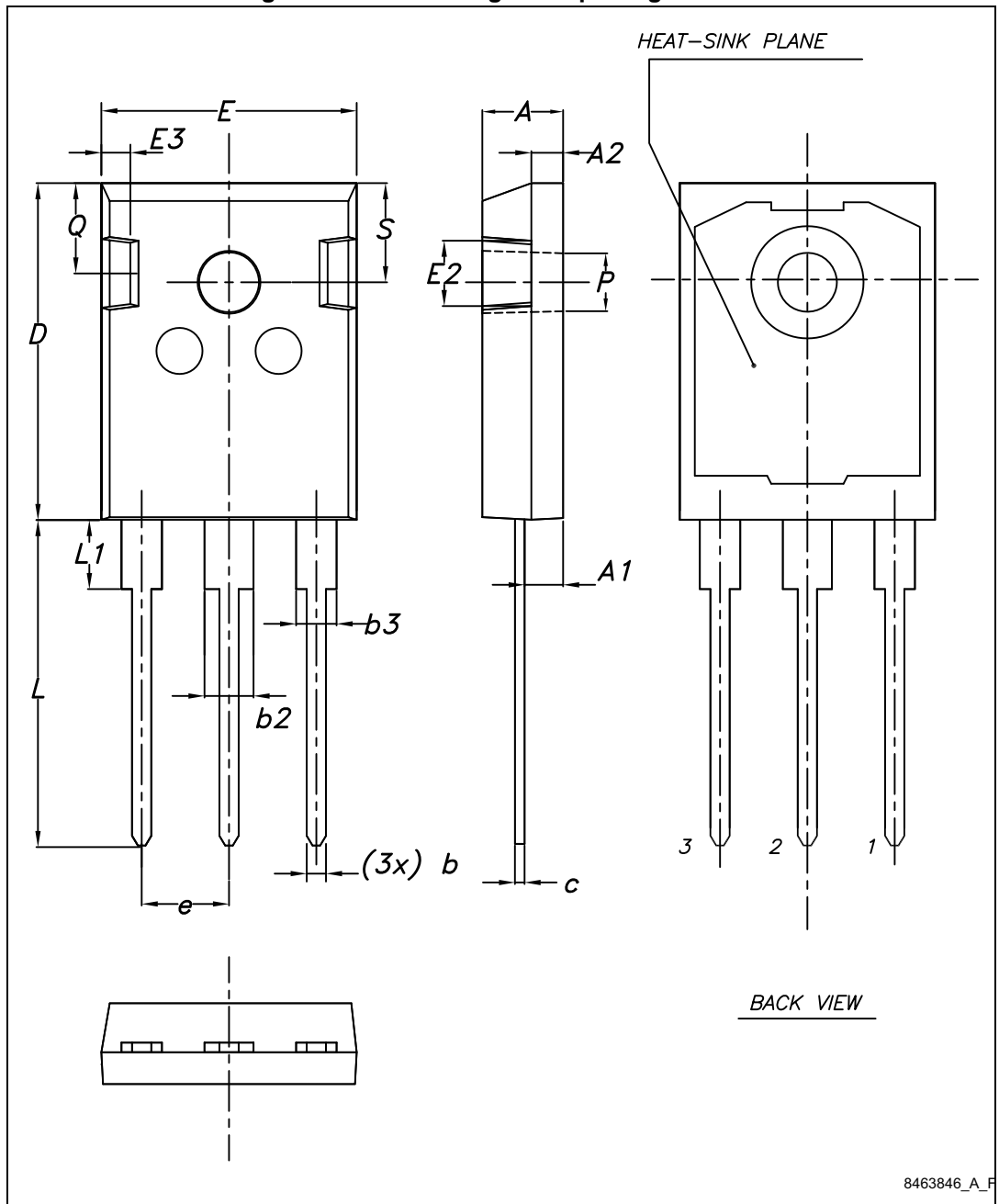
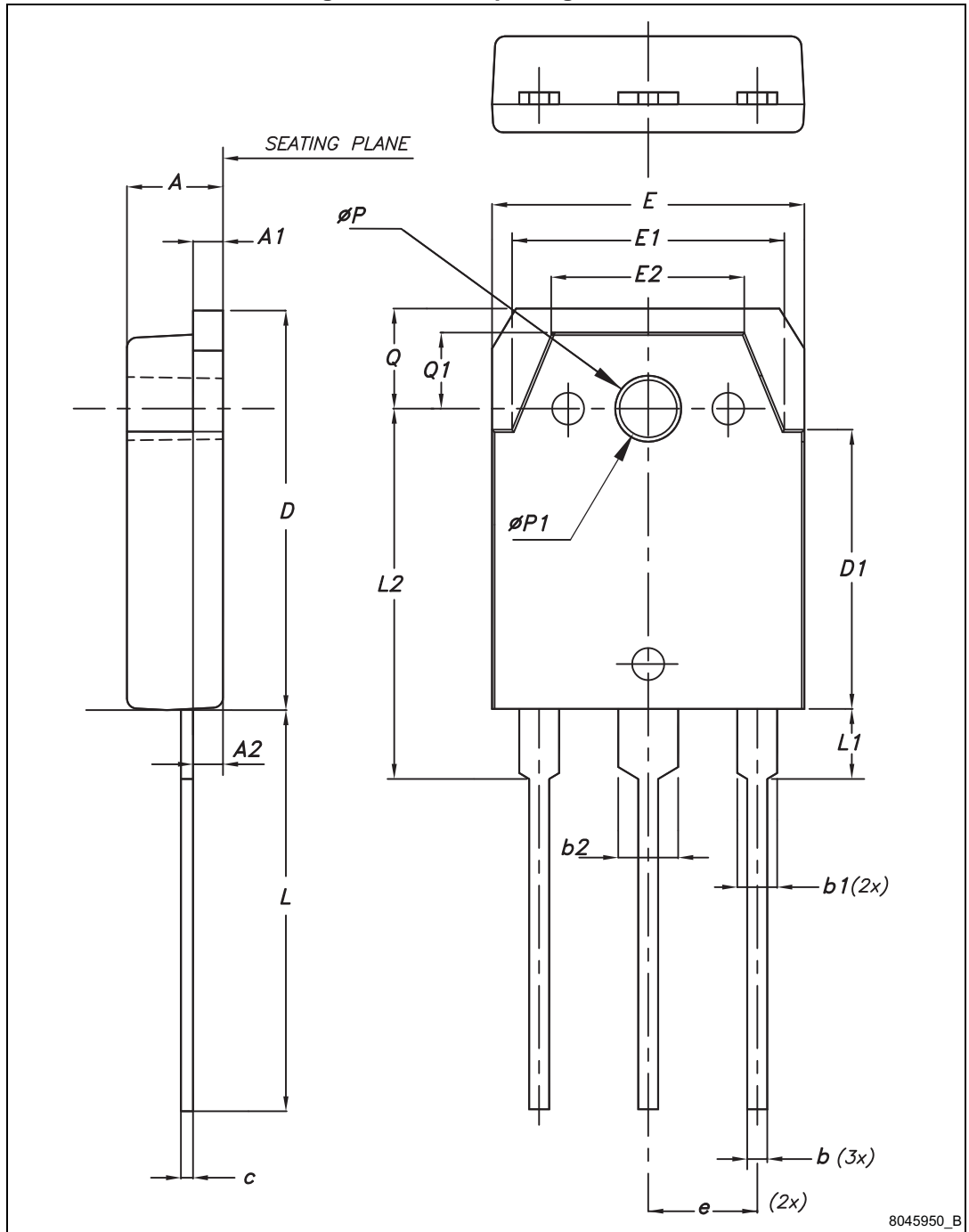


Table 10. TO-247 long leads package mechanical data

| 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 |

4.4 TO-3P package information

Figure 35. TO-3P package outline



8045950_B

Table 11. TO-3P package mechanical data

| Dim. | mm | | |
|------|-------|-------|-------|
| | Min. | Typ. | Max. |
| A | 4.60 | 4.80 | 5 |
| A1 | 1.45 | 1.50 | 1.65 |
| A2 | 1.20 | 1.40 | 1.60 |
| b | 0.80 | 1.00 | 1.20 |
| b1 | 1.80 | 2.00 | 2.20 |
| b2 | 2.80 | 3.00 | 3.20 |
| c | 0.55 | 0.60 | 0.75 |
| D | 19.70 | 19.90 | 20.10 |
| D1 | 13.70 | 13.90 | 14.10 |
| E | 15.40 | 15.60 | 15.80 |
| E1 | 13.40 | 13.60 | 13.80 |
| E2 | 9.40 | 9.60 | 9.90 |
| e | 5.15 | 5.45 | 5.75 |
| L | 19.80 | 20 | 20.20 |
| L1 | 3.30 | 3.50 | 3.70 |
| L2 | 18.20 | 18.40 | 18.60 |
| øP | 3.30 | 3.40 | 3.50 |
| øP1 | 3.10 | 3.20 | 3.30 |
| Q | 4.80 | 5 | 5.20 |
| Q1 | 3.60 | 3.80 | 4 |

5 Revision history

Table 12. Document revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 12-Mar-2013 | 1 | Initial release. |
| 18-Sep-2013 | 2 | Document status promoted from preliminary to production data. Added Section 2.1: Electrical characteristics (curves) |
| 20-Nov-2013 | 3 | Added device in Max247. Modified Table 1 accordingly. Updated Section 4: Package information . Minor text changes in cover page. |
| 24-Jan-2014 | 4 | Updated title and description in cover page. Updated Table 6: IGBT switching characteristics (inductive load) , Table 7: Diode switching characteristics (inductive load) , Figure 9: Forward bias safe operating area and Figure 14: Switching loss vs. temperature . |
| 13-Jun-2014 | 5 | Updated Figure 5: Collector current vs. case temperature , Figure 6: Power dissipation vs. case temperature , Figure 18: Switching times vs. collector current , Figure 19: Switching times vs. gate resistance and Figure 24: Capacitance variations . Added Figure 25: Collector current vs. switching frequency . Updated Section 4: Package information . |
| 07-May-2015 | 6 | Added TO-247 long leads package information |

IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2015 STMicroelectronics – All rights reserved