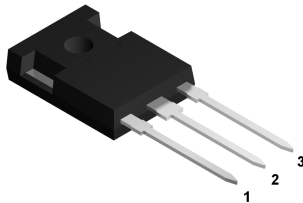
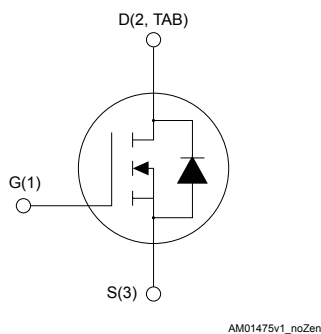


### Silicon carbide Power MOSFET 1200 V, 52 mΩ typ., 65 A in an HiP247 long leads package



HiP247 long leads



### Features

- Very low  $R_{DS(on)}$  over the entire temperature range
- Very high operating junction temperature capability ( $T_J = 200\text{ °C}$ )
- Very fast and robust intrinsic body diode
- Low capacitance

### Applications

- AC-DC converters
- DC-DC converters
- Motor drives
- Solar inverters (string and central)
- Uninterruptable power supplies (UPS)

### Description

This silicon carbide Power MOSFET is produced exploiting the advanced, innovative properties of wide bandgap materials. This results in unsurpassed on-resistance per unit area and very good switching performance almost independent of temperature. The outstanding thermal properties of the SiC material allow designers to use an industry-standard outline with significantly improved thermal capability. These features render the device perfectly suitable for high-efficiency and high power density applications.

#### Product status link

[SCTWA50N120](#)

#### Product summary

|            |                   |
|------------|-------------------|
| Order code | SCTWA50N120       |
| Marking    | SCT50N120         |
| Package    | HiP247 long leads |
| Packing    | Tube              |

## 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol         | Parameter                                           | Value      | Unit |
|----------------|-----------------------------------------------------|------------|------|
| $V_{DS}$       | Drain-source voltage                                | 1200       | V    |
| $V_{GS}$       | Gate-source voltage                                 | -10 to 25  | V    |
| $I_D$          | Drain current (continuous) at $T_C = 25\text{ °C}$  | 65         | A    |
| $I_D$          | Drain current (continuous) at $T_C = 100\text{ °C}$ | 50         | A    |
| $I_{DM}^{(1)}$ | Drain current (pulsed)                              | 130        | A    |
| $P_{TOT}$      | Total power dissipation at $T_C = 25\text{ °C}$     | 318        | W    |
| $T_{stg}$      | Storage temperature range                           | -55 to 200 | °C   |
| $T_j$          | Operating junction temperature range                |            | °C   |

1. Pulse width limited by safe operating area.

**Table 2. Thermal data**

| Symbol     | Parameter                               | Value | Unit |
|------------|-----------------------------------------|-------|------|
| $R_{thJC}$ | Thermal resistance, junction-to-case    | 0.55  | °C/W |
| $R_{thJA}$ | Thermal resistance, junction-to-ambient | 40    | °C/W |

## 2 Electrical characteristics

( $T_C = 25\text{ °C}$  unless otherwise specified).

**Table 3. On/off states**

| Symbol       | Parameter                         | Test conditions                                                    | Min. | Typ. | Max.      | Unit          |
|--------------|-----------------------------------|--------------------------------------------------------------------|------|------|-----------|---------------|
| $I_{DSS}$    | Zero gate voltage drain current   | $V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$                      |      | 1    | 100       | $\mu\text{A}$ |
|              |                                   | $V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}, T_J = 200\text{ °C}$ |      | 10   |           | $\mu\text{A}$ |
| $I_{GSS}$    | Gate-body leakage current         | $V_{DS} = 0\text{ V}, V_{GS} = -10\text{ to }22\text{ V}$          |      |      | $\pm 100$ | nA            |
| $V_{GS(th)}$ | Gate threshold voltage            | $V_{DS} = V_{GS}, I_D = 1\text{ mA}$                               | 1.8  | 3.0  |           | V             |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS} = 20\text{ V}, I_D = 40\text{ A}$                          |      | 52   | 69        | m $\Omega$    |
|              |                                   | $V_{GS} = 20\text{ V}, I_D = 40\text{ A}, T_J = 150\text{ °C}$     |      | 59   |           | m $\Omega$    |
|              |                                   | $V_{GS} = 20\text{ V}, I_D = 40\text{ A}, T_J = 200\text{ °C}$     |      | 70   |           | m $\Omega$    |

**Table 4. Dynamic**

| Symbol    | Parameter                    | Test conditions                                                                   | Min. | Typ. | Max. | Unit     |
|-----------|------------------------------|-----------------------------------------------------------------------------------|------|------|------|----------|
| $C_{iss}$ | Input capacitance            | $V_{DS} = 400\text{ V}, f = 1\text{ MHz}, V_{GS} = 0\text{ V}$                    | -    | 1900 | -    | pF       |
| $C_{oss}$ | Output capacitance           |                                                                                   | -    | 170  | -    | pF       |
| $C_{rss}$ | Reverse transfer capacitance |                                                                                   | -    | 30   | -    | pF       |
| $Q_g$     | Total gate charge            | $V_{DD} = 800\text{ V}, I_D = 40\text{ A},$<br>$V_{GS} = 0\text{ to }20\text{ V}$ | -    | 122  | -    | nC       |
| $Q_{gs}$  | Gate-source charge           |                                                                                   | -    | 19   | -    | nC       |
| $Q_{gd}$  | Gate-drain charge            |                                                                                   | -    | 35   | -    | nC       |
| $R_g$     | Gate input resistance        | $f = 1\text{ MHz open drain}$                                                     | -    | 1.9  | -    | $\Omega$ |

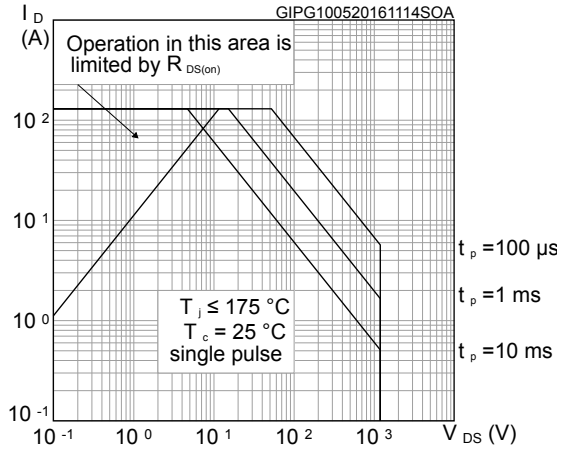
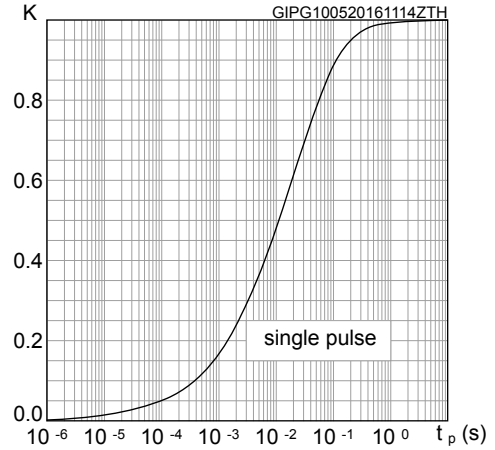
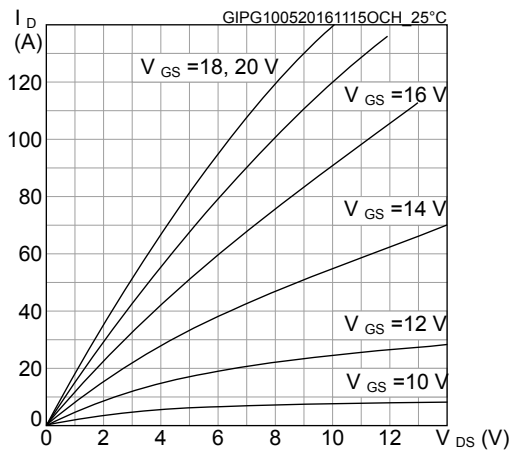
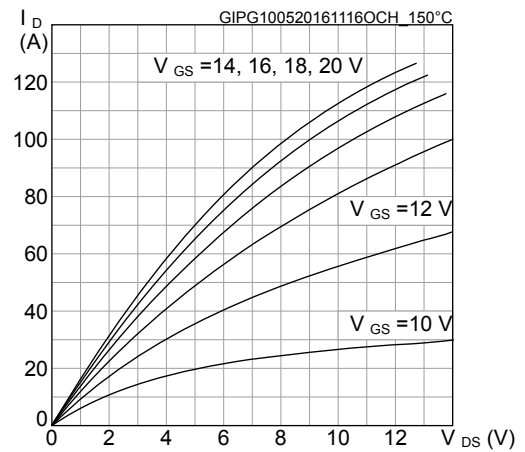
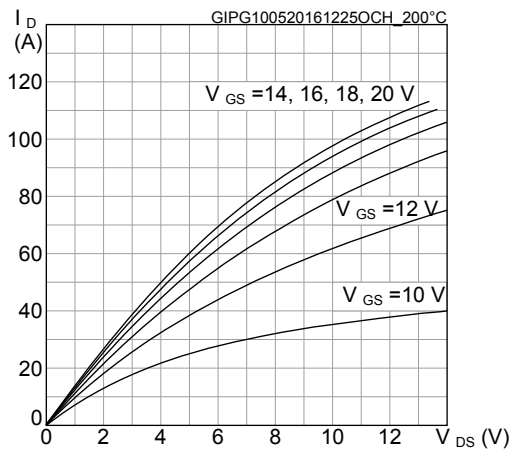
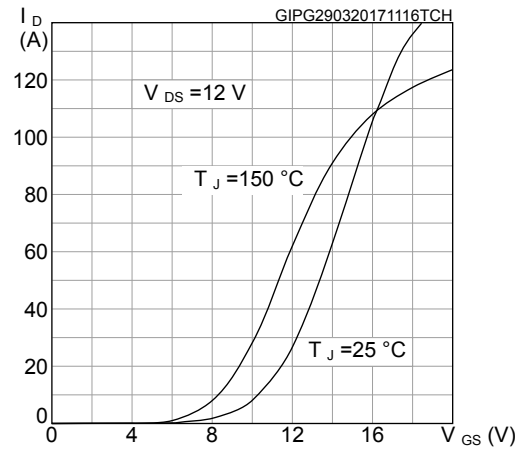
**Table 5. Switching energy (inductive load)**

| Symbol    | Parameter                 | Test conditions                                                                       | Min. | Typ. | Max. | Unit          |
|-----------|---------------------------|---------------------------------------------------------------------------------------|------|------|------|---------------|
| $E_{on}$  | Turn-on switching energy  | $V_{DD} = 800\text{ V}, I_D = 40\text{ A}$                                            | -    | 530  | -    | $\mu\text{J}$ |
| $E_{off}$ | Turn-off switching energy | $R_G = 2.2\text{ }\Omega, V_{GS} = -5\text{ to }20\text{ V}$                          | -    | 310  | -    | $\mu\text{J}$ |
| $E_{on}$  | Turn-on switching energy  | $V_{DD} = 800\text{ V}, I_D = 40\text{ A}$                                            | -    | 670  | -    | $\mu\text{J}$ |
| $E_{off}$ | Turn-off switching energy | $R_G = 2.2\text{ }\Omega, V_{GS} = -5\text{ to }20\text{ V}$<br>$T_J = 150\text{ °C}$ | -    | 334  | -    | $\mu\text{J}$ |

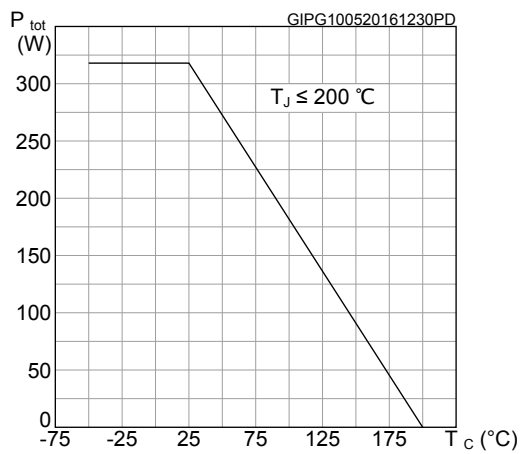
**Table 6. Reverse SiC diode characteristics**

| Symbol    | Parameter                | Test conditions                                                        | Min | Typ. | Max | Unit |
|-----------|--------------------------|------------------------------------------------------------------------|-----|------|-----|------|
| $V_{SD}$  | Diode forward voltage    | $I_F = 20\text{ A}, V_{GS} = 0\text{ V}$                               | -   | 3.5  | -   | V    |
| $t_{rr}$  | Reverse recovery time    | $I_F = 40\text{ A}, di/dt = 2000/\text{ns}$<br>$V_{DD} = 800\text{ V}$ | -   | 55   |     | ns   |
| $Q_{rr}$  | Reverse recovery charge  |                                                                        | -   | 230  | -   | nC   |
| $I_{RRM}$ | Reverse recovery current |                                                                        | -   | 14   | -   | A    |

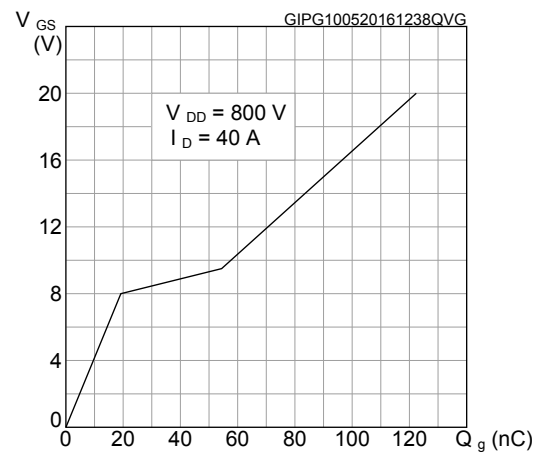
## 2.1 Electrical characteristics (curves)

**Figure 1. Safe operating area**

**Figure 2. Normalized transient thermal impedance**

**Figure 3. Output characteristics (T<sub>J</sub> = 25 °C)**

**Figure 4. Output characteristics (T<sub>J</sub> = 150 °C)**

**Figure 5. Output characteristics (T<sub>J</sub> = 200 °C)**

**Figure 6. Transfer characteristics**


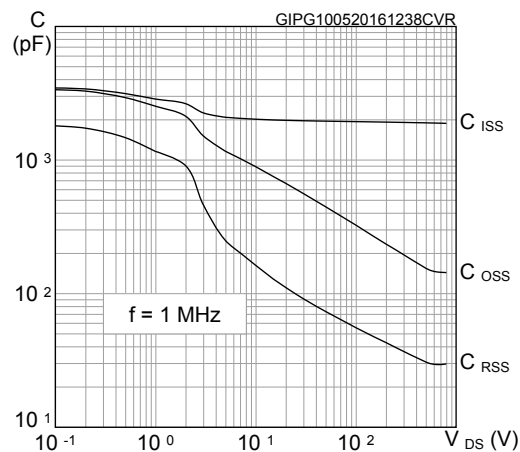
**Figure 7. Power dissipation**



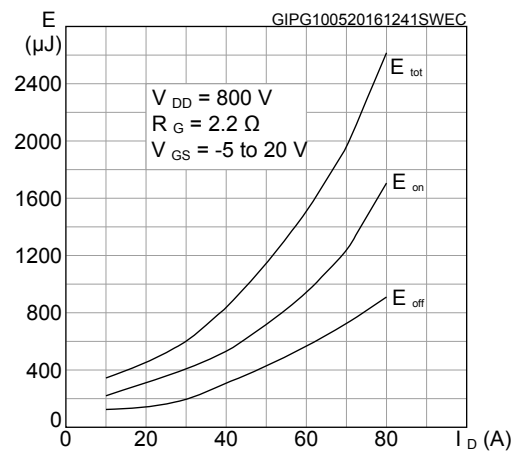
**Figure 8. Gate charge vs gate-source voltage**



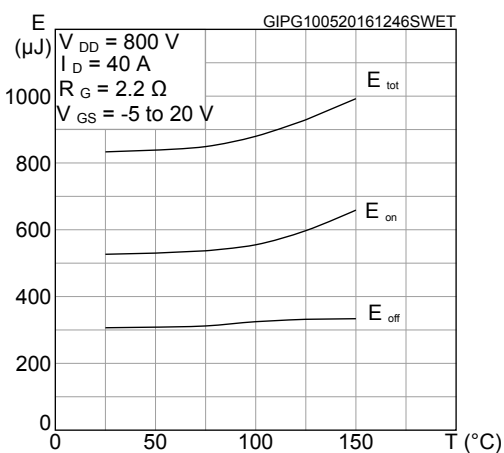
**Figure 9. Capacitance variations**



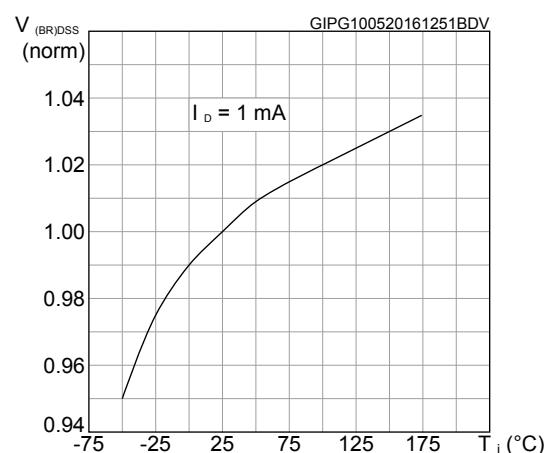
**Figure 10. Switching energy vs. drain current**



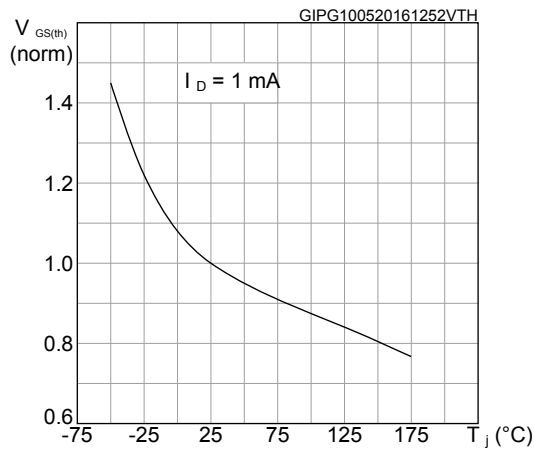
**Figure 11. Switching energy vs. junction temperature**



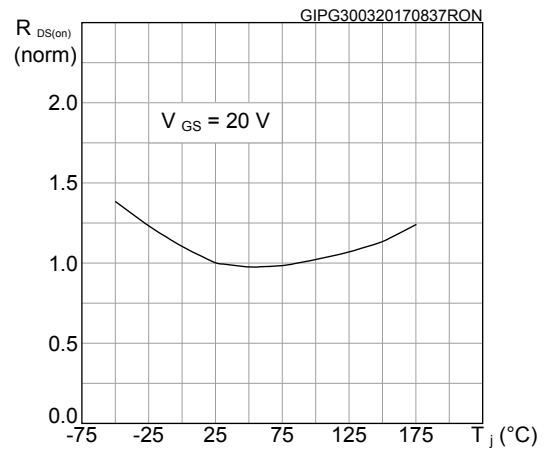
**Figure 12. Normalized  $V_{(BR)DSS}$  vs. temperature**



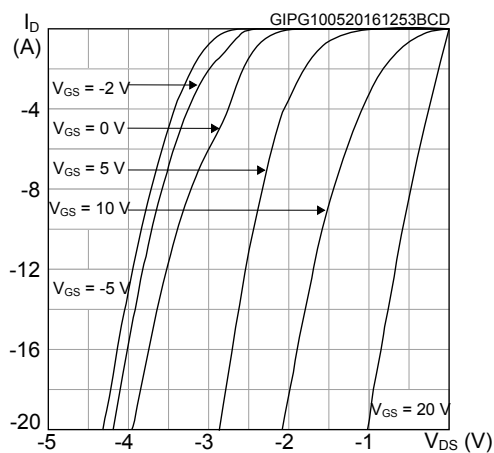
**Figure 13. Normalized gate threshold voltage vs. temperature**



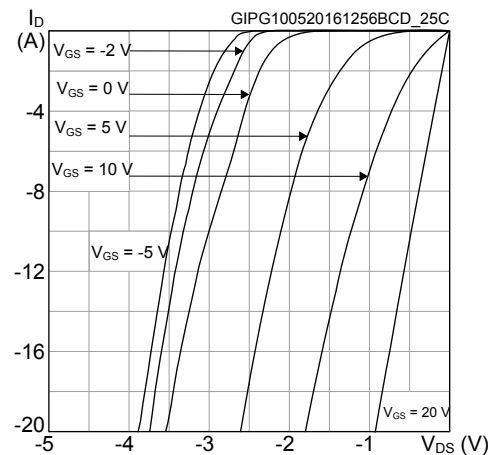
**Figure 14. Normalized on-resistance vs. temperature**



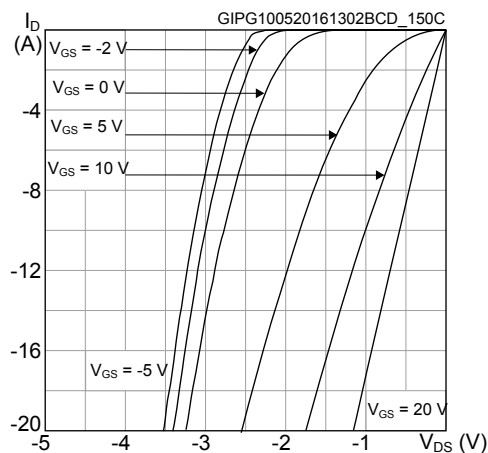
**Figure 15. Reverse conduction characteristics (T\_J = -50 °C)**



**Figure 16. Reverse conduction characteristics (T\_J = +25 °C)**



**Figure 17. Reverse conduction characteristics (T\_J = 150 °C)**

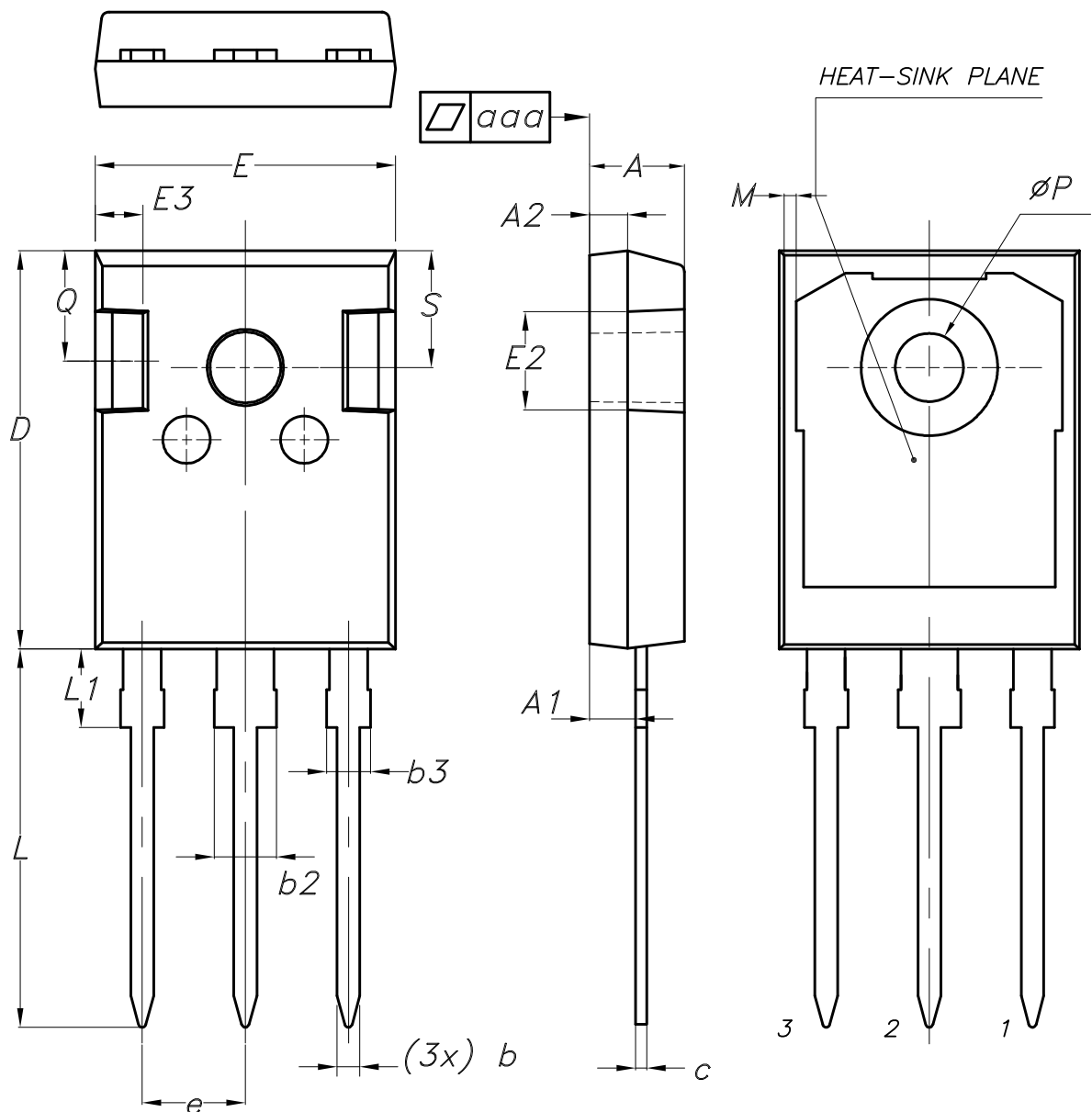


### 3 Package information

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](http://www.st.com). ECOPACK is an ST trademark.

#### 3.1 HiP247 long leads package information

**Figure 18. HiP247 long leads package outline**



*BACK VIEW*

8463846\_5

**Table 7. HiP247 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 8. Document revision history**

| Date        | Revision | Changes                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 07-Jun-2016 | 1        | First release                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 14-Sep-2016 | 2        | Document status changed from preliminary to production data.                                                                                                                                                                                                                                                                                                                                                                     |
| 30-Mar-2017 | 3        | Modified <i>Table 7: "Reverse SiC diode characteristics"</i><br>Modified <i>Figure 7: "Transfer characteristics"</i> , <i>Figure 15: "Normalized on-resistance vs. temperature"</i> , <i>Figure 16: "Reverse conduction characteristics (TJ = -50 °C)"</i> , <i>Figure 17: "Reverse conduction characteristics (TJ = 25 °C)"</i> and <i>Figure 18: "Reverse conduction characteristics (TJ = 150 °C)"</i><br>Minor text changes. |
| 18-Feb-2025 | 4        | Updated title on cover page.<br>Updated <a href="#">Section 3.1: HiP247 long leads package information</a> .<br>Minor text changes.                                                                                                                                                                                                                                                                                              |

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