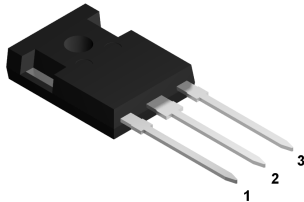
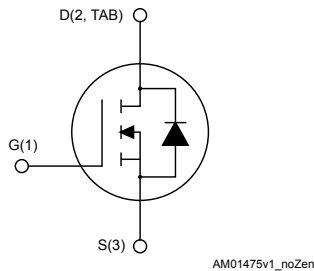


## Silicon carbide Power MOSFET 650 V, 55 mΩ typ., 45 A in an HiP247 long leads package


**HiP247 long leads**


### Features

| Order code    | V <sub>DS</sub> | R <sub>DS(on)</sub> max. | I <sub>D</sub> |
|---------------|-----------------|--------------------------|----------------|
| SCTWA35N65G2V | 650 V           | 67 mΩ                    | 45 A           |

- Very fast and robust intrinsic body diode
- Extremely low gate charge and input capacitance
- Very high operating junction temperature capability (T<sub>J</sub> = 200 °C)

### Applications

- Switching mode power supply
- DC-DC converters
- Industrial motor control

### Description

This silicon carbide Power MOSFET device has been developed using ST's advanced and innovative 2<sup>nd</sup> generation SiC MOSFET technology. The device features remarkably low on-resistance per unit area and very good switching performance. The variation of switching loss is almost independent of junction temperature.

#### Product status link

[SCTWA35N65G2V](#)

#### Product summary

|                   |                   |
|-------------------|-------------------|
| <b>Order code</b> | SCTWA35N65G2V     |
| <b>Marking</b>    | 35N65G2V          |
| <b>Package</b>    | HiP247 long leads |
| <b>Packing</b>    | Tube              |

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol         | Parameter   | Value      | Unit |
|----------------|---|------------|------|
| $V_{DS}$       | Drain-source voltage                                | 650        | V    |
| $V_{GS}$       | Gate-source voltage                                 | -10 to 22  | V    |
|                | Gate-source voltage (recommended operating range)   | -5 to 20   |      |
| $I_D$          | Drain current (continuous) at $T_C = 25\text{ °C}$  | 45         | A    |
|                | Drain current (continuous) at $T_C = 100\text{ °C}$ | 35         |      |
| $I_{DM}^{(1)}$ | Drain current (pulsed)                              | 90         | A    |
| $P_{TOT}$      | Total power dissipation at $T_C = 25\text{ °C}$     | 240        | W    |
| $T_{stg}$      | Storage temperature range                           | -55 to 200 | °C   |
| $T_J$          | Operating junction temperature range                |            | °C   |

1. Pulse width is limited by safe operating area.

**Table 2. Thermal data**

| Symbol     | Parameter                               | Value | Unit |
|------------|---|-------|------|
| $R_{thJC}$ | Thermal resistance, junction-to-case    | 0.72  | °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          |
|---------------|-----------------------------------|--|------|------|-----------|---------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage    | $V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$                       | 650  |      |           | V             |
| $I_{DSS}$     | Zero gate voltage drain current   | $V_{GS} = 0\text{ V}, V_{DS} = 650\text{ V}$                   |      |      | 5         | $\mu\text{A}$ |
| $I_{GSS}$     | 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  | 3.2  | 5.0       | V             |
| $R_{DS(on)}$  | Static drain-source on-resistance | $V_{GS} = 20\text{ V}, I_D = 20\text{ A}$                      |      | 45   | 67        | m $\Omega$    |
|               |                                   | $V_{GS} = 18\text{ V}, I_D = 20\text{ A}$                      |      | 55   |           |               |
|               |                                   | $V_{GS} = 20\text{ V}, I_D = 20\text{ A}, T_J = 200\text{ °C}$ |      | 68   |           |               |

**Table 4. Dynamic**

| Symbol    | Parameter                    | Test conditions  | Min. | Typ. | Max. | Unit     |
|-----------|------------------------------|--|------|------|------|----------|
| $C_{iss}$ | Input capacitance            | $V_{GS} = 0\text{ V}, V_{DS} = 400\text{ V}, f = 1\text{ MHz}$               | -    | 1370 | -    | pF       |
| $C_{oss}$ | Output capacitance           |  | -    | 125  | -    | pF       |
| $C_{rss}$ | Reverse transfer capacitance |  | -    | 30   | -    | pF       |
| $R_g$     | Intrinsic gate resistance    | $f = 1\text{ MHz}$   | -    | 2    | -    | $\Omega$ |
| $Q_g$     | Total gate charge            | $V_{DD} = 400\text{ V}, I_D = 20\text{ A}, V_{GS} = 0\text{ to }20\text{ V}$ | -    | 73   | -    | nC       |
| $Q_{gs}$  | Gate-source charge           |  | -    | 14   | -    | nC       |
| $Q_{gd}$  | Gate-drain charge            |  | -    | 27   | -    | nC       |

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

| Symbol    | Parameter                 | Test conditions  | Min. | Typ. | Max. | Unit          |
|-----------|---------------------------|--|------|------|------|---------------|
| $E_{on}$  | Turn-on switching energy  | $V_{DD} = 400\text{ V}, I_D = 20\text{ A},$                  | -    | 100  | -    | $\mu\text{J}$ |
| $E_{off}$ | Turn-off switching energy | $R_G = 4.7\text{ }\Omega, V_{GS} = -5\text{ to }20\text{ V}$ | -    | 35   | -    | $\mu\text{J}$ |

**Table 6. Switching times**

| Symbol       | Parameter           | Test conditions   | Min. | Typ. | Max. | Unit |
|--------------|---------------------|---|------|------|------|------|
| $t_{d(on)}$  | Turn-on delay time  | $V_{DD} = 400\text{ V}, I_D = 20\text{ A},$<br>$R_G = 4.7\text{ }\Omega, V_{GS} = -5\text{ to }20\text{ V}$ | -    | 16   | -    | ns   |
| $t_f$        | Fall time           |   | -    | 14   | -    | ns   |
| $t_{d(off)}$ | Turn-off delay time |   | -    | 35   | -    | ns   |
| $t_r$        | Rise time           |   | -    | 9    | -    | ns   |

**Table 7. Reverse diode characteristics**

| Symbol    | Parameter                | Test conditions   | Min. | Typ. | Max. | Unit |
|-----------|--------------------------|---|------|------|------|------|
| $V_{SD}$  | Forward on voltage       | $V_{GS} = 0\text{ V}$ , $I_F = 20\text{ A}$ ,                                       | -    | 3.3  | -    | V    |
| $t_{rr}$  | Reverse recovery time    | $V_{DD} = 400\text{ V}$ , $I_F = 20\text{ A}$ , $di/dt = 1000\text{ A}/\mu\text{s}$ | -    | 18   | -    | ns   |
| $Q_{rr}$  | Reverse recovery charge  |   | -    | 85   | -    | nC   |
| $I_{RRM}$ | Reverse recovery current |   | -    | 7    | -    | A    |

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

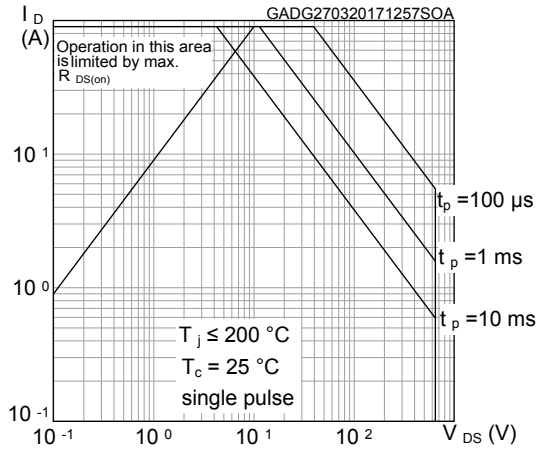


Figure 2. Thermal impedance

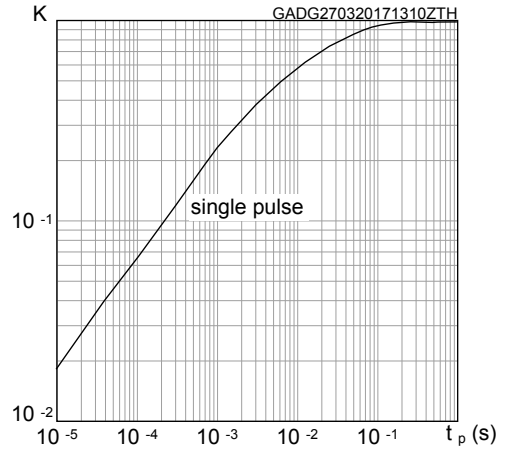


Figure 3. Output characteristics ( $T_J = 25\text{ °C}$ )

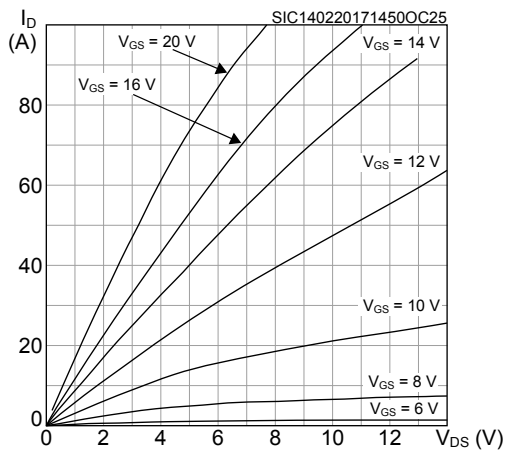


Figure 4. Output characteristics ( $T_J = 175\text{ °C}$ )

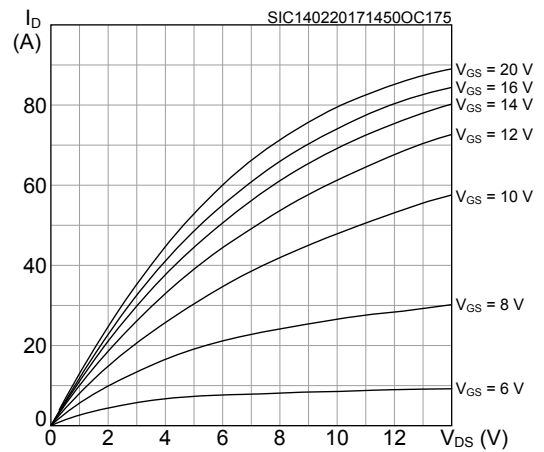


Figure 5. Transfer characteristics

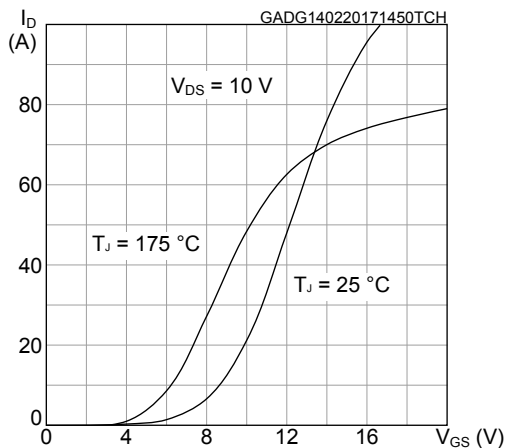


Figure 6. Total power dissipation

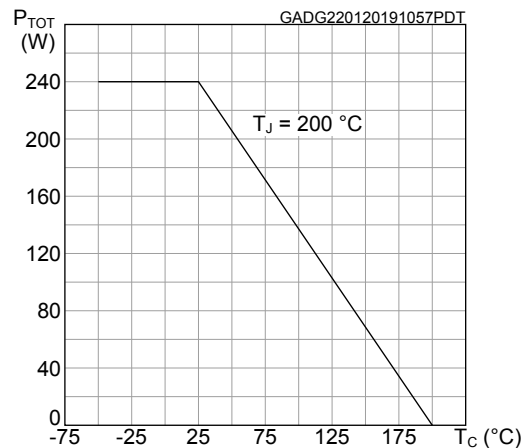


Figure 7. Gate charge vs gate-source voltage

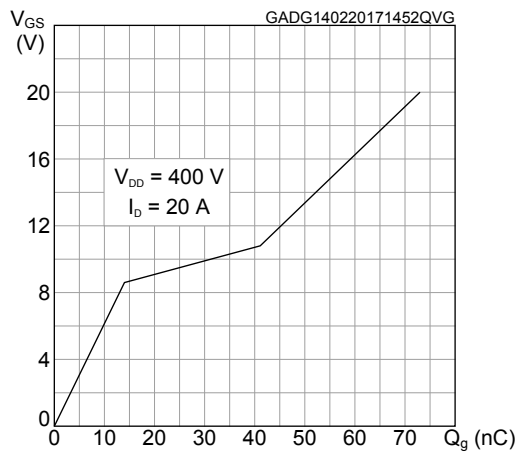


Figure 8. Capacitance variations

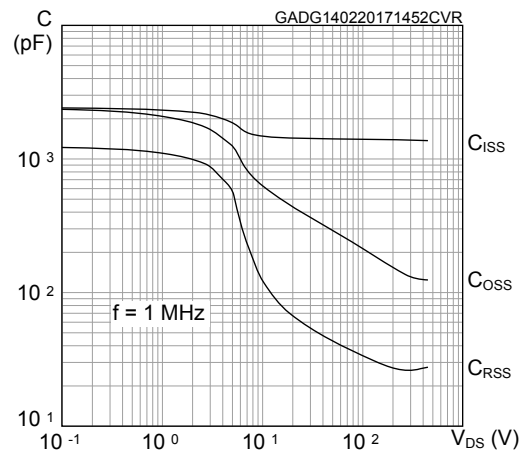


Figure 9. Switching energy vs drain current

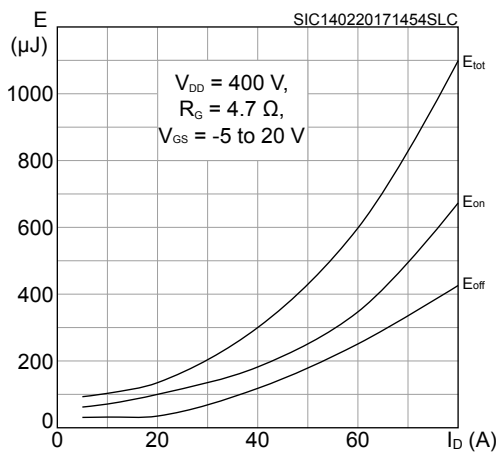


Figure 10. Switching energy vs junction temperature

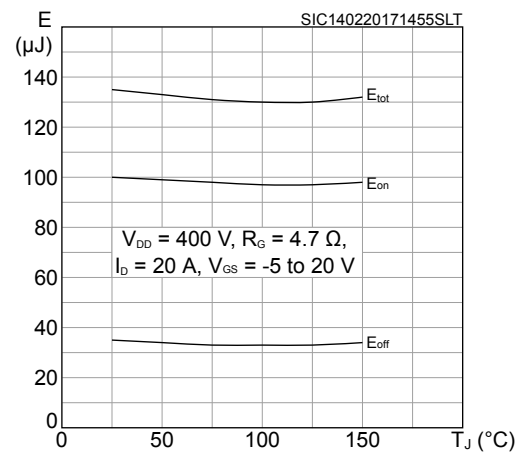


Figure 11. Normalized  $V_{(BR)DSS}$  vs temperature

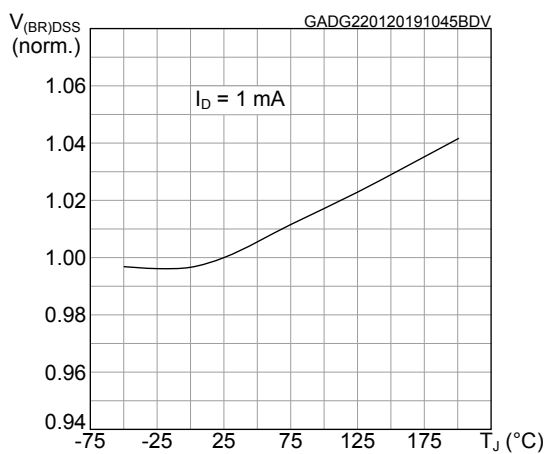
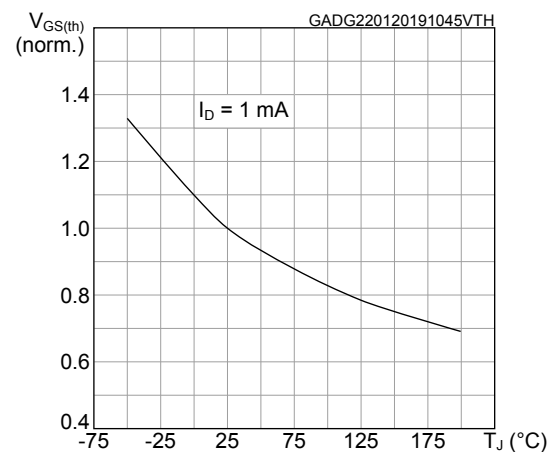
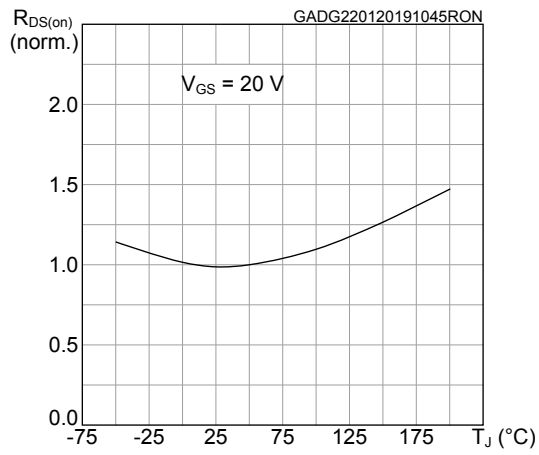


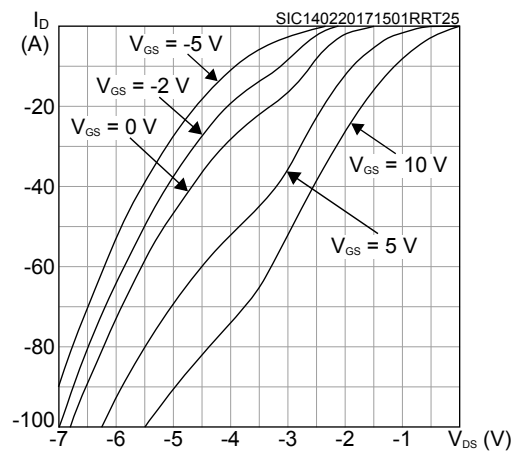
Figure 12. Normalized gate threshold voltage vs temperature



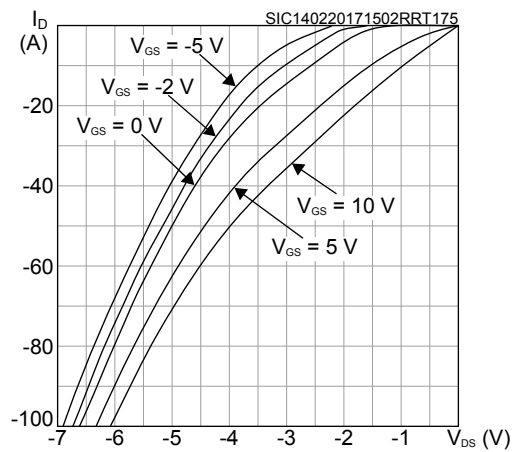
**Figure 13. Normalized on-resistance vs temperature**



**Figure 14. Reverse conduction characteristics ( $T_J = 25$  °C)**



**Figure 15. Reverse conduction characteristics ( $T_J = 175$  °C)**

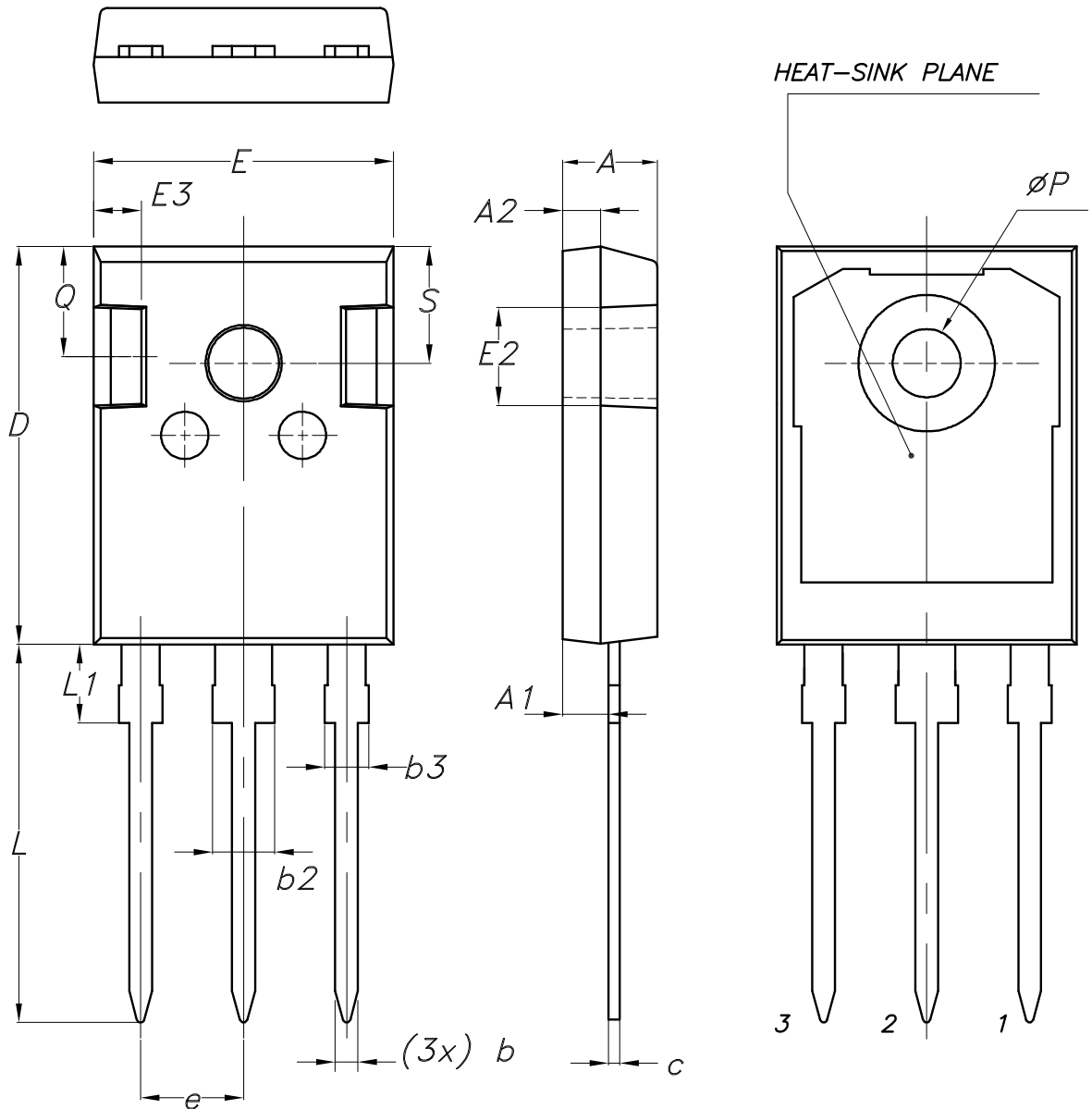


### 3 Package information

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

#### 3.1 HiP247 long leads package information

Figure 16. HiP247 long leads package outline



8463846\_2\_F



**Table 8. 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  |

## Revision history

**Table 9. Document revision history**

| Date        | Version | Changes  |
|-------------|---------|--|
| 04-Apr-2017 | 1       | First release  |
| 21-Dec-2020 | 2       | Updated title, Features and Device summary in cover page.<br>Updated Table 1. Absolute maximum ratings.<br>Updated Table 3. On/off-states and Table 7. Reverse diode characteristics.<br>Updated Section 2.1 Electrical characteristics (curves).<br>Minor text changes. |

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