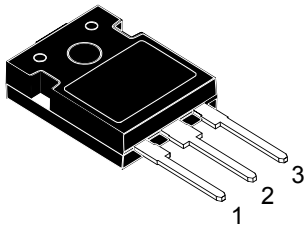
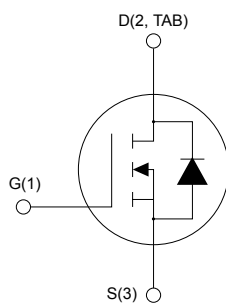


Automotive-grade silicon carbide Power MOSFET 1700 V, 64 mΩ typ., 43 A in an HiP247 package



HiP247


AM01475v1_noZen



Features

| Order code | V _{DS} | R _{DS(on)} max. | I _D |
|-------------|-----------------|--------------------------|----------------|
| SCT20N170AG | 1700 V | 86 mΩ | 43 A |

- AEC-Q101 rev. C qualified 
- Very fast and robust intrinsic body diode
- Low capacitances
- Very high operating junction temperature capability (T_J = 200 °C)

Applications

- Main inverter (electric traction)
- DC/DC converter for EV/HEV
- On board charger (OBC)

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, combined with the device's housing in the proprietary HiP247 package, allows 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

[SCT20N170AG](#)

Product summary

| | |
|-------------------|-------------|
| Order code | SCT20N170AG |
| Marking | SCT20N170AG |
| Package | HiP247 |
| Packing | Tube |

1 Electrical ratings

Table 1. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|----------------|---|------------|------|
| V_{DS} | Drain-source voltage | 1700 | V |
| V_{GS} | Gate-source voltage | -10 to 22 | V |
| I_D | Drain current (continuous) at $T_C = 25\text{ °C}$ | 43 | A |
| | Drain current (continuous) at $T_C = 100\text{ °C}$ | 32 | |
| $I_{DM}^{(1)}$ | Drain current (pulsed) | 129 | A |
| P_{TOT} | Total power dissipation at $T_C = 25\text{ °C}$ | 313 | 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 | 0.56 | °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 | $V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$ | 1700 | | | V |
| I_{DSS} | Zero gate voltage drain current | $V_{GS} = 0\text{ V}$, $V_{DS} = 1700\text{ V}$ | | | 10 | μA |
| I_{GSS} | Gate-body leakage current | $V_{DS} = 0\text{ V}$, $V_{GS} = -10\text{ V to } 22\text{ V}$ | | | ± 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 | $V_{GS} = 20\text{ V}$, $I_D = 20\text{ A}$ | | 64 | 86 | m Ω |
| | | $V_{GS} = 20\text{ V}$, $I_D = 20\text{ A}$, $T_J = 150\text{ °C}$ | | 104 | | |
| | | $V_{GS} = 20\text{ V}$, $I_D = 20\text{ A}$, $T_J = 200\text{ °C}$ | | 134 | | |

Table 4. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|---|------|------|------|----------|
| C_{iss} | Input capacitance | $V_{DS} = 400\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$ | - | 1568 | - | pF |
| C_{oss} | Output capacitance | | - | 141 | - | pF |
| C_{rss} | Reverse transfer capacitance | | - | 21 | - | pF |
| R_G | Gate input resistance | $f = 1\text{ MHz}$, $I_D = 0\text{ A}$ | - | 6.9 | - | Ω |
| Q_g | Total gate charge | $V_{DS} = 1000\text{ V}$, $I_D = 25\text{ A}$, $V_{GS} = -5\text{ to } 20\text{ V}$ | - | 101 | - | nC |
| Q_{gs} | Gate-source charge | | - | 48 | - | nC |
| Q_{gd} | Gate-drain charge | | - | 23 | - | nC |

Table 5. Switching energy (inductive load)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|---------------------------|--|------|------|------|---------------|
| E_{on} | Turn-on switching energy | $V_{DD} = 1000\text{ V}$, $I_D = 25\text{ A}$ | - | 623 | - | μJ |
| E_{off} | Turn-off switching energy | $R_G = 4.7\text{ }\Omega$, $V_{GS} = 0\text{ V to } 20\text{ V}$ | - | 180 | - | μJ |
| E_{+on} | Turn-on switching energy | $V_{DD} = 1000\text{ V}$, $I_D = 25\text{ A}$, $R_G = 4.7\text{ }\Omega$, | - | 1162 | - | μJ |
| E_{off} | Turn-off switching energy | $V_{GS} = 0\text{ V to } 20\text{ V}$, $T_J = 200\text{ °C}$ | - | 183 | - | μJ |

Table 6. Reverse SiC diode characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|--------------------------|---|------|------|------|------|
| V_{SD} | Diode forward voltage | $I_F = 25\text{ A}$, $V_{GS} = 0\text{ V}$ | - | 3.8 | - | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 25\text{ A}$, $V_{GS} = 0\text{ V}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 1000\text{ V}$ | - | 13 | - | ns |
| Q_{rr} | Reverse recovery charge | | - | 280 | - | nC |
| I_{RRM} | Reverse recovery current | | - | 37 | - | A |

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

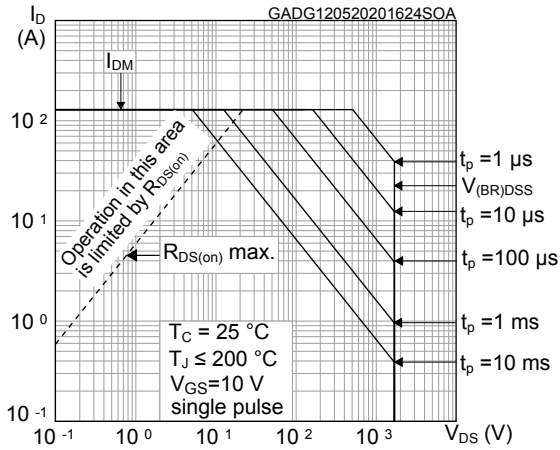


Figure 2. Maximum transient thermal impedance

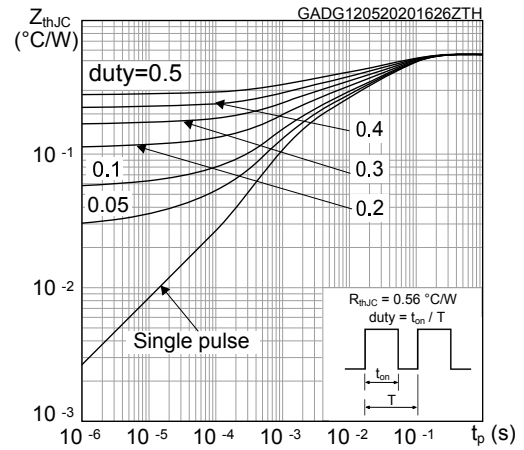


Figure 3. Typical output characteristics ($T_J = 25\text{ °C}$)

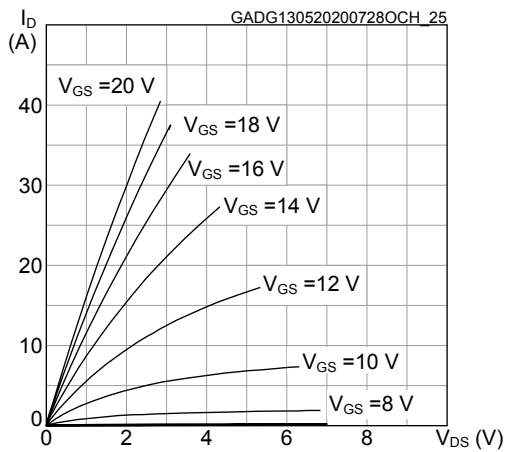


Figure 4. Typical output characteristics ($T_J = 200\text{ °C}$)

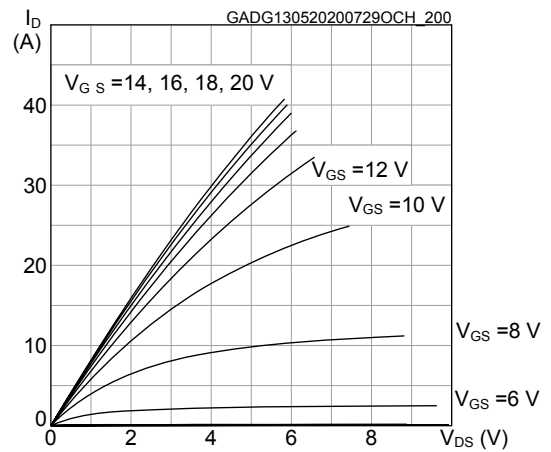


Figure 5. Typical transfer characteristics

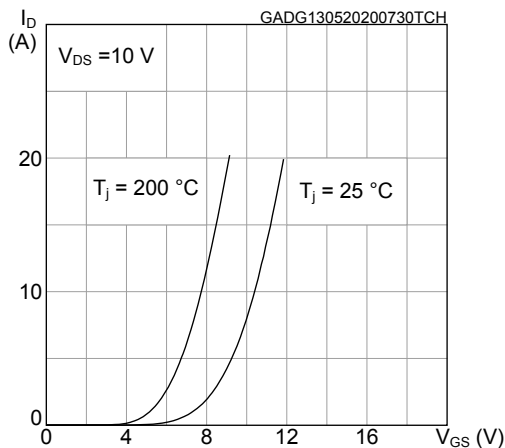


Figure 6. Total power dissipation

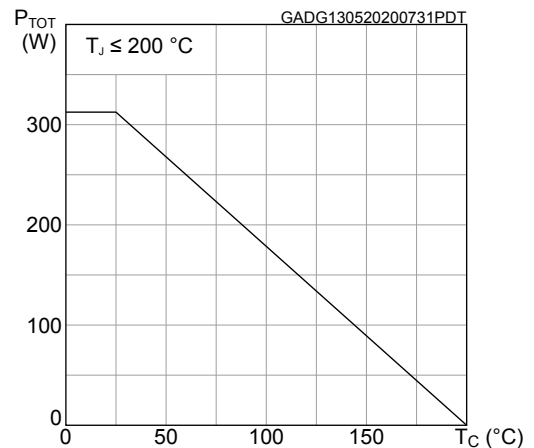


Figure 7. Typical gate charge characteristics

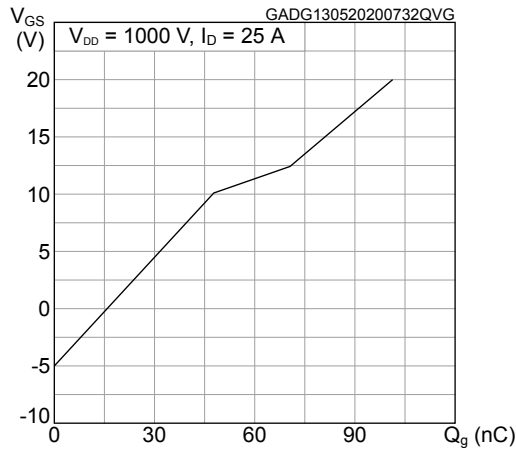


Figure 8. Typical capacitance characteristics

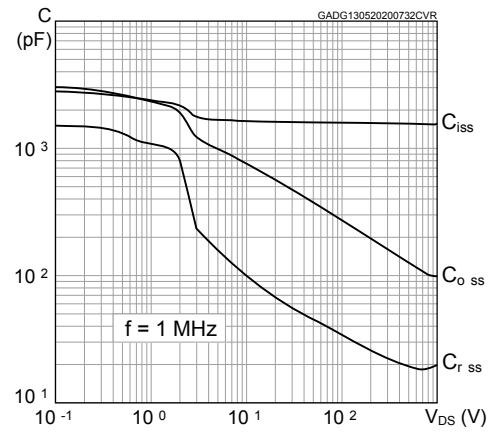


Figure 9. Typical switching energy vs I_D

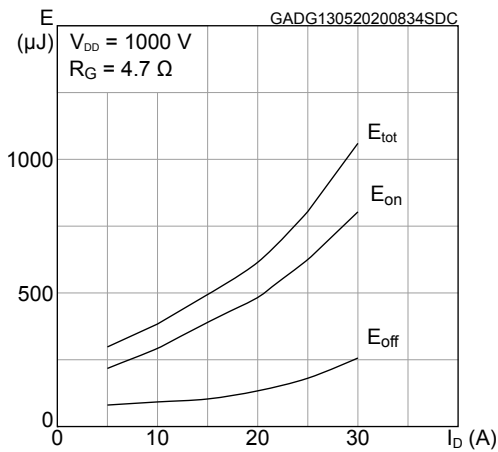


Figure 10. Typical switching energy vs temperature

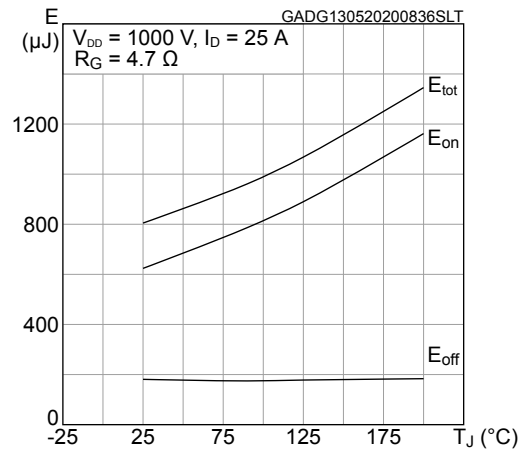


Figure 11. Typical switching energy vs R_G

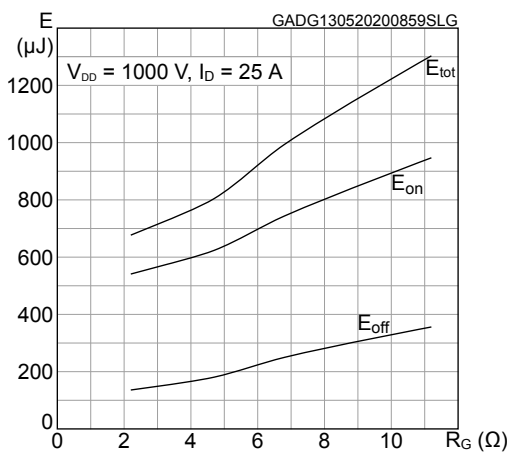


Figure 12. Typical drain-source on-resistance

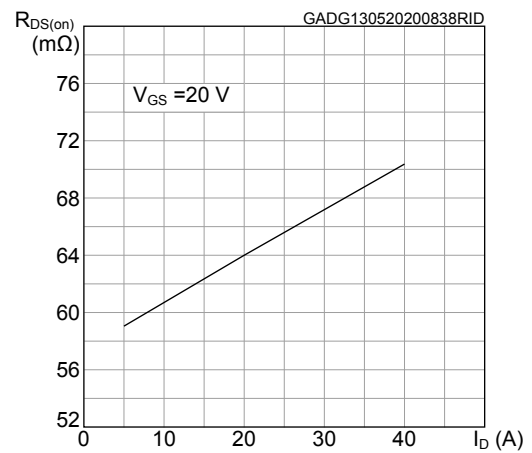


Figure 13. Normalized breakdown voltage vs temperature

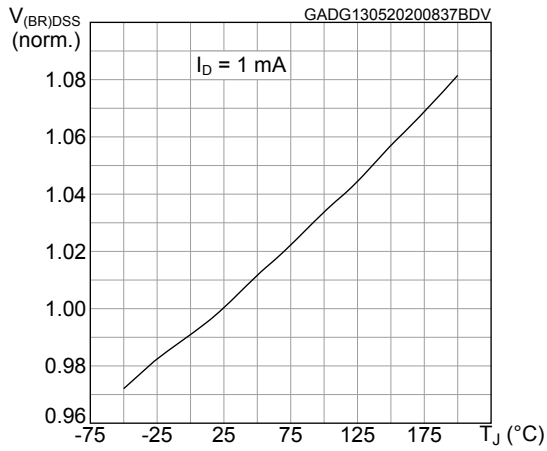


Figure 14. Normalized gate threshold vs temperature

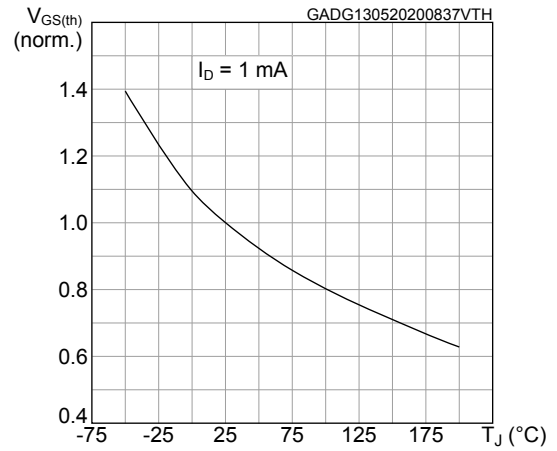


Figure 15. Normalized on-resistance vs temperature

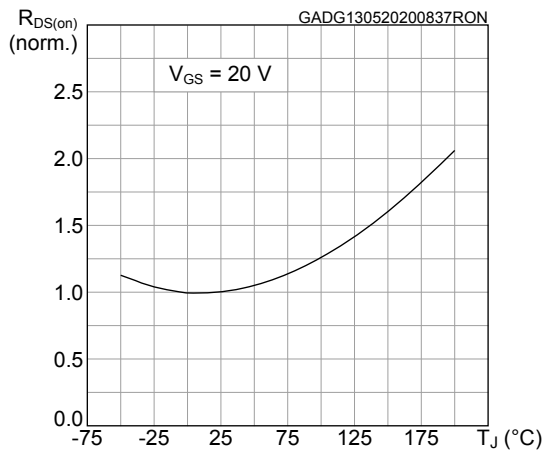


Figure 16. Typical reverse conduction characteristics ($T_J = 25^\circ\text{C}$)

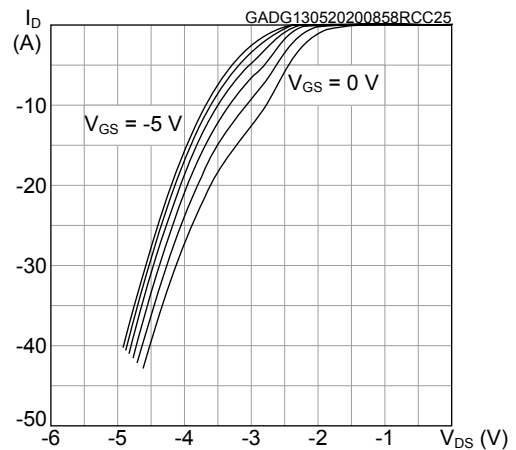
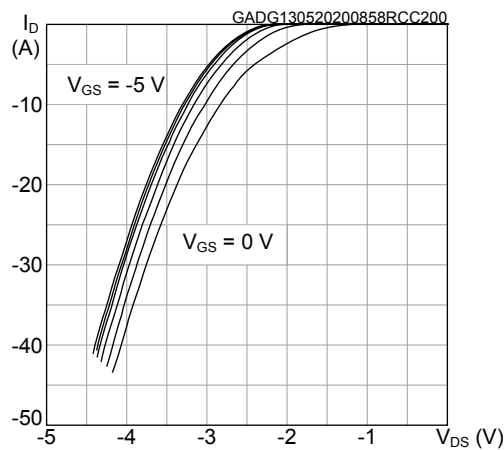


Figure 17. Typical reverse conduction characteristics ($T_J = 200^\circ\text{C}$)

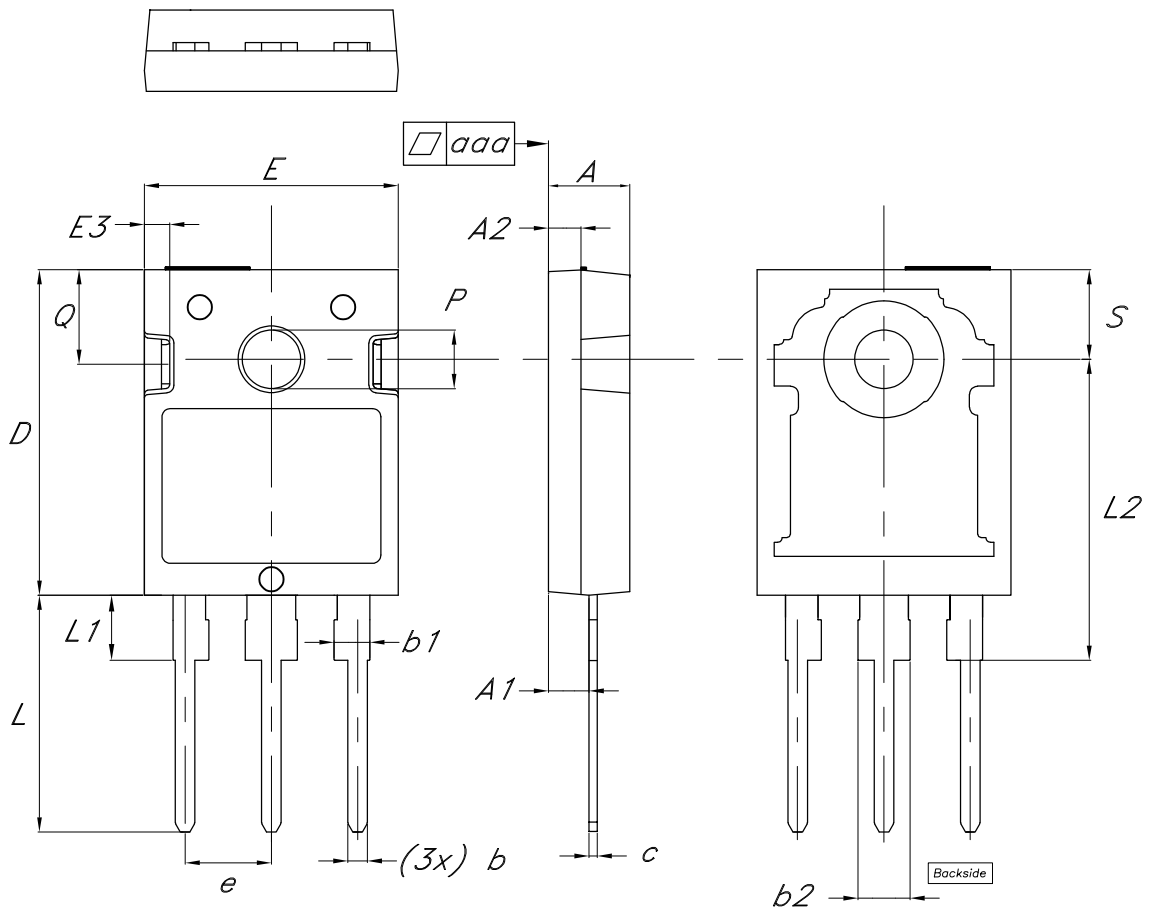


3 Package information

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. ECOPACK is an ST trademark.

3.1 HiP247 package information

Figure 18. HiP247 package outline



8581091_4

Table 7. HiP247 package mechanical data

| Dim. | mm | | |
|------|-------|-------|-------|
| | Min. | Typ. | Max. |
| A | 4.85 | 5.00 | 5.15 |
| A1 | 2.20 | | 2.60 |
| A2 | 1.90 | 2.00 | 2.10 |
| b | 1.00 | | 1.40 |
| b1 | 2.00 | | 2.40 |
| b2 | 3.00 | | 3.40 |
| c | 0.40 | | 0.80 |
| D | 19.85 | 20.00 | 20.15 |
| E | 15.45 | 15.60 | 15.75 |
| E3 | 1.45 | | 1.65 |
| e | 5.30 | 5.45 | 5.60 |
| L | 14.20 | | 14.80 |
| L1 | 3.70 | | 4.30 |
| L2 | 18.30 | 18.50 | 18.70 |
| P | 3.55 | | 3.65 |
| Q | 5.65 | | 5.95 |
| S | 5.30 | 5.50 | 5.70 |
| aaa | | 0.04 | 0.10 |

Revision history

Table 8. Document revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 12-May-2020 | 1 | First release. |
| 8-Jun-2020 | 2 | Modified title. |
| 31-Jul-2020 | 3 | Modified Table 3. On/off states. Minor text changes. |
| 24-Jun-2021 | 4 | Updated Features in cover page. Minor text changes. |

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