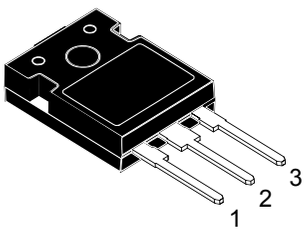
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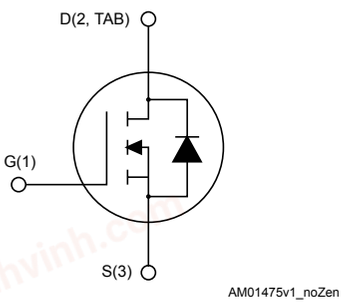
# SCTW70N120G2V

Datasheet

## Silicon carbide Power MOSFET 1200 V, 91 A, 21 mΩ (typ., $T_J$ = 25 °C) in an HiP247 package




**HiP247**




## Features

| Order code | $V_{DS}$ | $R_{DS(on)}$ typ. | $I_D$ |
|---|---|---|---|
| SCTW70N120G2V | 1200 V | 21 mΩ | 91 A |

- Very high operating junction temperature capability ($T_J$ = 200 °C)
- Very fast and robust intrinsic body diode
- Extremely low gate charge and input capacitances

## Applications

- Charger
- Power supply for renewable energy systems
- High frequency DC-DC converters

## 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.

STPOWER

| Product status link |
|---|
| SCTW70N120G2V |

| Product summary | |
|---|---|
| **Order code** | SCTW70N120G2V |
| **Marking** | SCT70N120G2 |
| **Package** | HiP247 |
| **Packing** | Tube |

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# 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 +22 | V |
| | Gate-source voltage (recommended operating values) | -5 to +18 | |
| $I_D$ | Drain current (continuous) at $T_C$ = 25 °C | 91 | A |
| | Drain current (continuous) at $T_C$ = 100 °C | 69 | |
| $I_{DM}$(1) | Drain current (pulsed) | 274 | A |
| $P_{TOT}$ | Total power dissipation at $T_C$ = 25 °C | 547 | W |
| $T_{stg}$ | Storage temperature range | -55 to 200 | °C |
| $T_J$ | Operating junction temperature range | | |

1. *Pulse width is limited by safe operating area.*

**Table 2. Thermal data**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{thj\text{-}case}$ | Thermal resistance junction-case | 0.32 | °C/W |
| $R_{thj\text{-}amb}$ | Thermal resistance junction-ambient | 50 | °C/W |

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## 2 Electrical characteristics

($T_C$ = 25 °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 V, $I_D$ = 1 mA | 1200 | | | V |
| $I_{DSS}$ | Zero-gate voltage drain current | $V_{DS}$ = 1200 V, $V_{GS}$ = 0 V | | | 10 | µA |
| | | $V_{DS}$ = 1200 V, $V_{GS}$ = 0 V, $T_J$ = 150 °C | | 100 | | |
| $I_{GSS}$ | Gate-body leakage current | $V_{DS}$ = 0 V, $V_{GS}$ = -10 to +22 V | | ±10 | | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 1 mA | 1.9 | 2.45 | 4.9 | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS}$ = 18 V, $I_D$ = 50 A | | 21 | 30 | mΩ |
| | | $V_{GS}$ = 18 V, $I_D$ = 50 A, $T_J$ = 200 °C | | 46 | | |

**Table 4. Dynamic**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input capacitance | $V_{DS}$ = 800 V, f = 1 MHz, $V_{GS}$ = 0 V | - | 3540 | - | pF |
| $C_{oss}$ | Output capacitance | | - | 176 | - | pF |
| $C_{rss}$ | Reverse transfer capacitance | | - | 28 | - | pF |
| $R_G$ | Intrinsic gate resistance | f = 1 MHz, $I_D$ = 0 A | - | 1 | - | Ω |
| $Q_g$ | Total gate charge | $V_{DD}$ = 800 V, $I_D$ = 50 A, $V_{GS}$ = -5 to +18 V | - | 150 | - | nC |
| $Q_{gs}$ | Gate-source charge | | - | 28 | - | nC |
| $Q_{gd}$ | Gate-drain charge | | - | 63 | - | nC |

**Table 5. Switching energy**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $E_{on}$ | Turn-on switching energy | $V_{DD}$ = 800 V, $I_D$ = 50 A | - | 1019 | - | µJ |
| $E_{off}$ | Turn-off switching energy | $R_G$= 3.4 Ω, $V_{GS}$ = -5 to +18 V | - | 378 | - | µJ |

**Table 6. Switching times**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD}$ = 800 V, $I_D$ = 50 A, $R_G$= 3.4 Ω, $V_{GS}$ = -5 to +18 V | - | 16 | - | ns |
| $t_r$ | Rise time | | - | 9.5 | - | ns |
| $t_{d(off)}$ | Turn-off delay time | | - | 37 | - | ns |
| $t_f$ | Fall time | | - | 22 | - | ns |

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**Table 7. Reverse SiC diode characteristics**

| Symbol | Parameter | Test conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Forward on voltage | $I_{SD}$ = 50 A, $V_{GS}$ = 0 V | - | 2.7 | - | V |
| $t_{rr}$ | Reverse recovery time | $I_{SD}$ = 50 A, $V_{DD}$ = 800 V, $V_{GS}$ = -5 to +18 V | - | 11.16 | - | ns |
| $Q_{rr}$ | Reverse recovery charge | | - | 276 | - | nC |
| $I_{RRM}$ | Reverse recovery current | | - | 40 | - | A |

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## 2.1 Electrical characteristics (curves)

**Figure 1. Safe operating area**

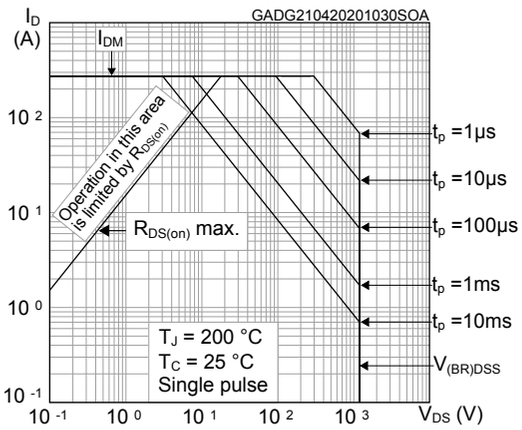



**Figure 2. Maximum transient thermal impedance**

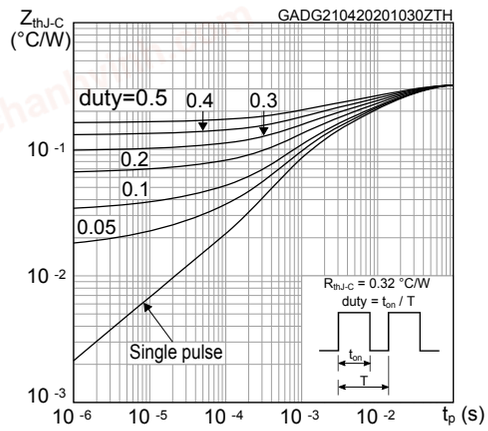



**Figure 3. Typical output characteristics ($T_J$ = 25 °C)**

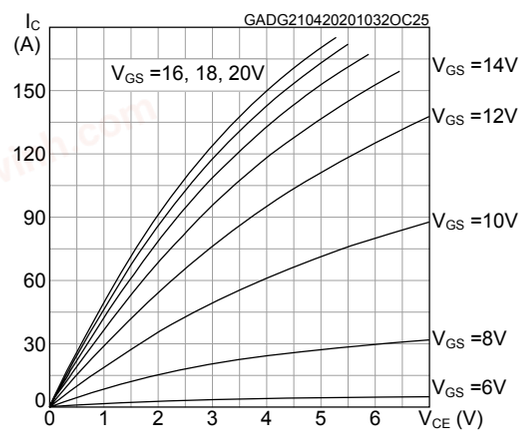



**Figure 4. Typical output characteristics ($T_J$ = 200 °C)**

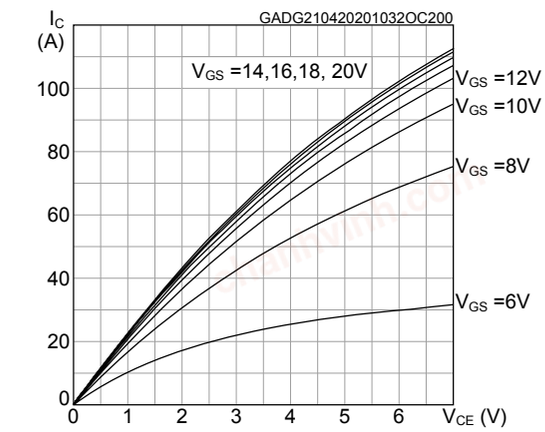



**Figure 5. Typical transfer characteristics**

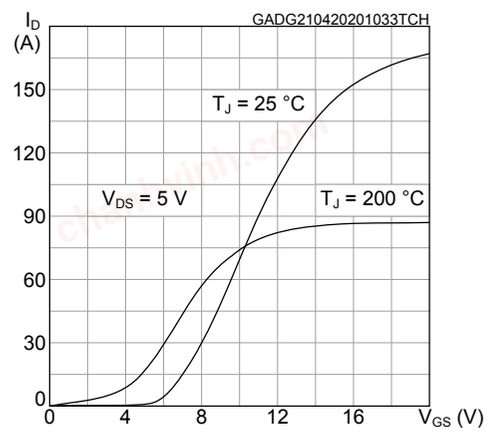
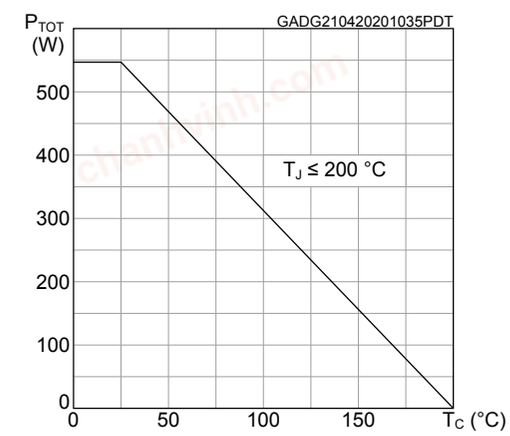



**Figure 6. Total power dissipation**



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**Figure 7. Typical gate charge characteristics**

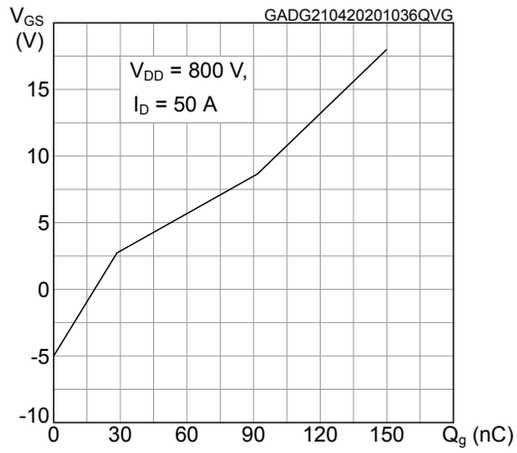



**Figure 8. Typical capacitance characteristics**

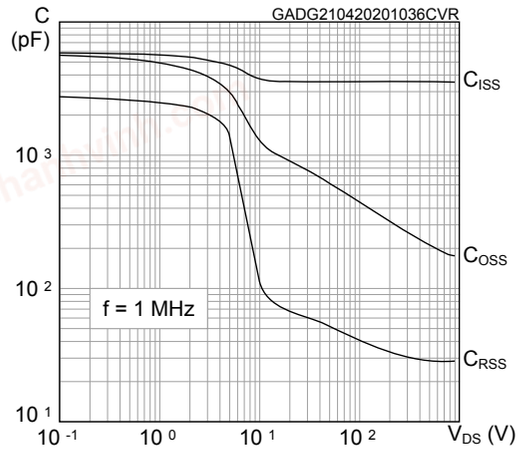



**Figure 9. Typical switching energy vs drain current**

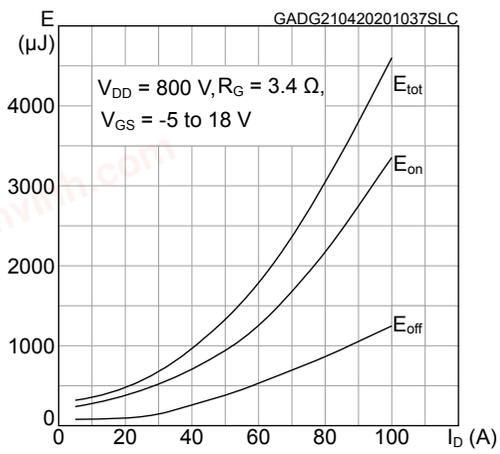



**Figure 10. Typical switching energy vs temperature**

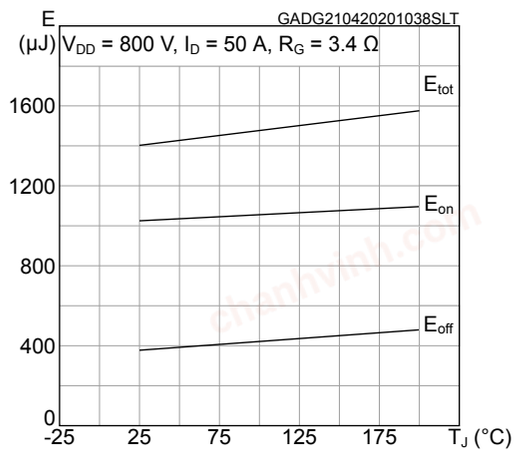



**Figure 11. Normalized breakdown voltage vs temperature**

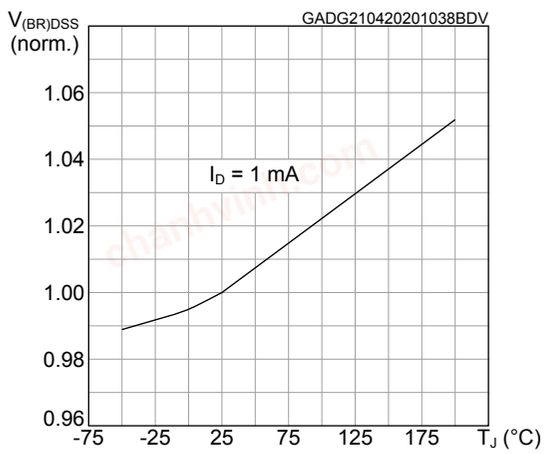
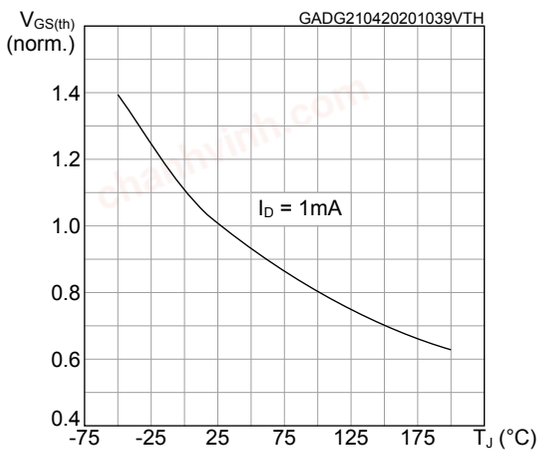



**Figure 12. Normalized gate threshold vs temperature**



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

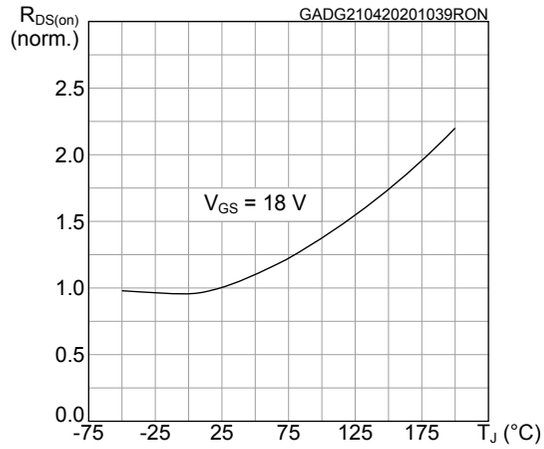



**Figure 14. Typical drain-source on-resistance**

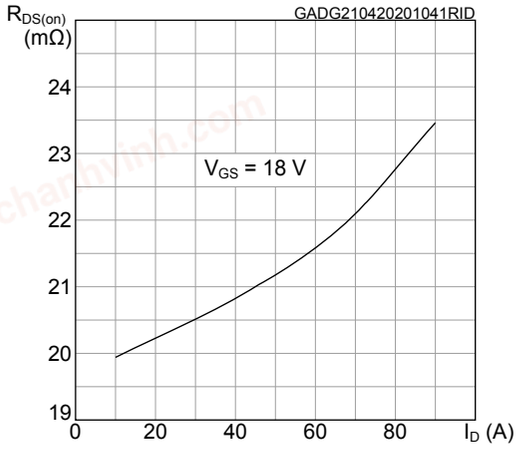



**Figure 15. Typical reverse conduction characteristics ($T_J$ = 25 °C)**

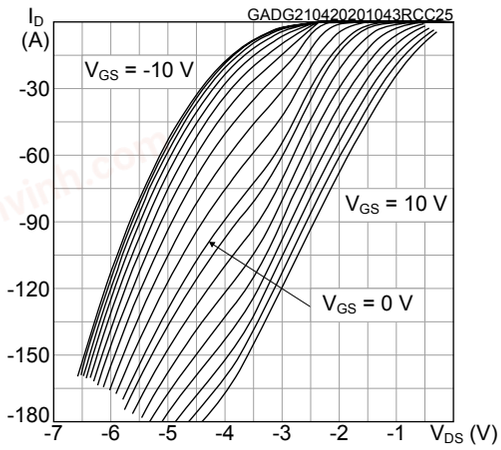



**Figure 16. Typical reverse conduction characteristics ($T_J$ = 200 °C)**

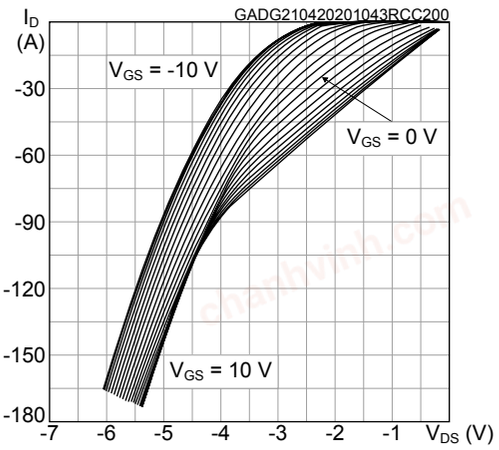
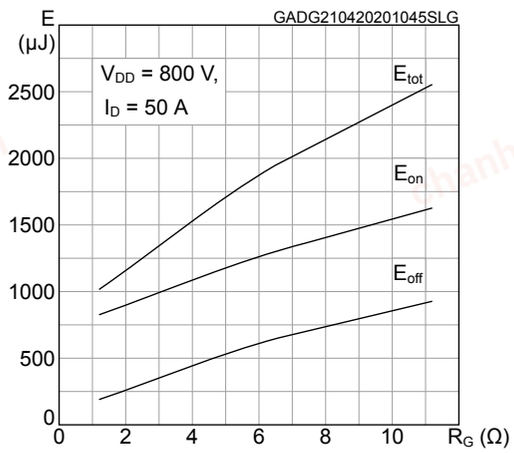



**Figure 17. Typical switching energy vs gate resistance**



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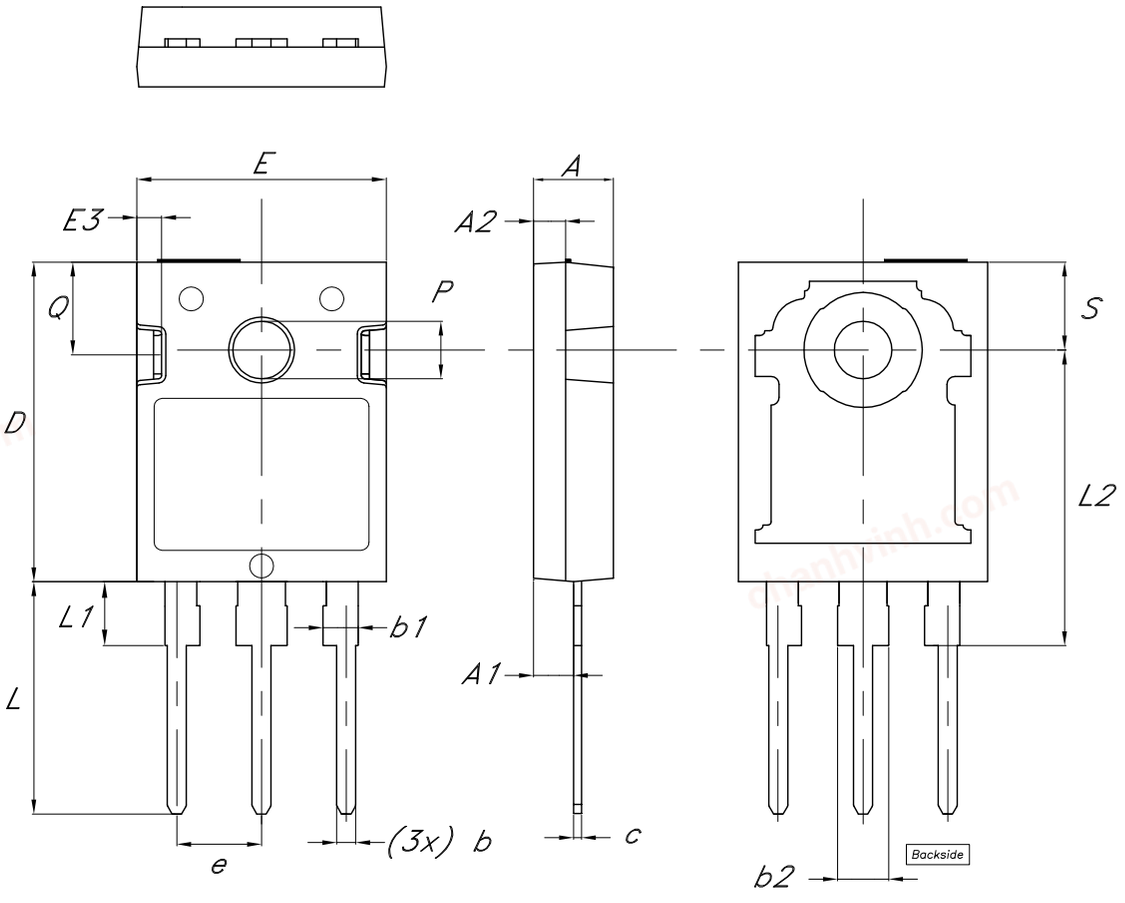


# 3 Package information

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_3_fig2

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Table 8. **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 |

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## Revision history

Table 9. **Document revision history**

| Date | Revision | Changes |
|---|---|---|
| 26-Jan-2017 | 1 | First release |
| 22-May-2020 | 2 | Updated T*itle, Internal schematic, Features, Description* and *Device summary* in cover page.<br>Updated *Section 1 Electrical ratings*.<br>Updated *Section 2 Electrical characteristics*.<br>Updated *Section 2.1 Electrical characteristics (curves)*.<br>Updated *Section 3 Package information*. |
| 31-Aug-2020 | 3 | Modified Table 7. Reverse SiC diode characteristics.<br>Modified Figure 9. Typical switching energy vs drain current. |

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