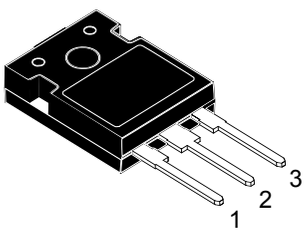
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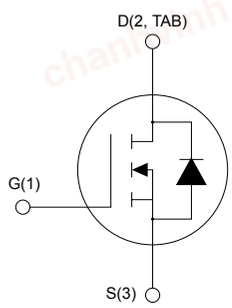
# SCT025W120G3AG

Datasheet

## Automotive-grade silicon carbide Power MOSFET 1200 V, 27 mΩ typ., 56 A in an HiP247 package




**HiP247**




## Features

| Order code | $V_{DS}$ | $R_{DS(on)}$ typ. | $I_D$ |
|---|---|---|---|
| SCT025W120G3AG | 1200 V | 27 mΩ | 56 A |

- AEC-Q101 qualified
- Very low $R_{DS(on)}$ over the entire temperature range
- High speed switching performances
- Very fast and robust intrinsic body diode
- 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 device has been developed using ST's advanced and innovative 3rd generation SiC MOSFET technology. The device features a very low $R_{DS(on)}$ over the entire temperature range combined with low capacitances and very high switching operations, which improve application performance in frequency, energy efficiency, system size and weight reduction.

STPOWER

| Product status link |
|---|
| SCT025W120G3AG |

| Product summary | |
|---|---|
| **Order code** | SCT025W120G3AG |
| **Marking** | 25W120G3AG |
| **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 | |
| | Gate-source transient voltage, $t_p$ < 1 µs, t ≤ 10 hours over lifetime | -11 to 25 | |
| $I_D$(1) | Drain current (continuous) at $T_C$ = 25 °C | 56 | A |
| | Drain current (continuous) at $T_C$ = 100 °C | 56 | |
| $I_{DM}$(2) | Drain current (pulsed) | 240 | A |
| $P_{TOT}$ | Total power dissipation at $T_C$ = 25 °C | 388 | W |
| $T_{stg}$ | Storage temperature range | -55 to 200 | °C |
| $T_J$ | Operating junction temperature range | | °C |

1. *$I_D$ is limited by package.*
2. *Pulse width is limited by safe operating area.*

**Table 2. Thermal data**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{thJC}$ | Thermal resistance, junction-to-case | 0.45 | °C/W |
| $R_{thJA}$ | Thermal resistance, junction-to-ambient | 40 | °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 | $V_{GS}$ = 0 V, $V_{DS}$ = 1200 V | | | 10 | µA |
| $I_{GSS}$ | Gate-body leakage current | $V_{DS}$ = 0 V, $V_{GS}$ = -10 to 22 V | | | ±100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 5 mA | 1.8 | 3.0 | 4.2 | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS}$ = 15 V, $I_D$ = 25 A | | 32 | | mΩ |
| | | $V_{GS}$ = 18 V, $I_D$ = 25 A | | 27 | 37 | |
| | | $V_{GS}$ = 18 V, $I_D$ = 25 A, $T_J$ = 200 °C | | 53 | | |

**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 | - | 1990 | - | pF |
| $C_{oss}$ | Output capacitance | | - | 102 | - | pF |
| $C_{rss}$ | Reverse transfer capacitance | | - | 12 | - | pF |
| $Q_g$ | Total gate charge | $V_{DD}$ = 800 V, $V_{GS}$ = -5 to 18 V, $I_D$ = 25 A | - | 73 | - | nC |
| $Q_{gs}$ | Gate-source charge | | - | 23.5 | - | nC |
| $Q_{gd}$ | Gate-drain charge | | - | 23.5 | - | nC |
| $R_g$ | Gate input resistance | f = 1 MHz, $I_D$ = 0 A | - | 1.3 | - | Ω |

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

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $E_{on}$ | Turn-on switching energy | $V_{DD}$ = 800 V, $I_D$ = 25 A, $R_G$ = 4.7 Ω, $V_{GS}$ = -5 V to 18 V | - | 389 | - | µJ |
| $E_{off}$ | Turn-off switching energy | | - | 125 | - | µJ |

**Table 6. Switching times**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD}$ = 800 V, $I_D$ = 25 A, $R_G$ = 4.7 Ω, $V_{GS}$ = -5 to 18 V | - | 14.4 | - | ns |
| $t_r$ | Rise time | | - | 6.5 | - | ns |
| $t_{d(off)}$ | Turn-off delay time | | - | 29.5 | - | ns |
| $t_f$ | Fall time | | - | 18.4 | - | ns |

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**Table 7. Reverse SiC diode characteristics**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$(1) | Continuous diode forward current | $T_C$ = 25 °C | - | | 56 | A |
| | | $T_C$ = 100 °C | - | | 56 | |
| $V_{SD}$ | Diode forward voltage | $I_{SD}$ = 25 A, $V_{GS}$ = 0 V | - | 2.7 | | V |
| $t_{rr}$ | Reverse recovery time | $I_{SD}$ = 25 A, di/dt = 1000 A/µs, $V_{DD}$ = 800 V | - | 20 | | ns |
| $Q_{rr}$ | Reverse recovery charge | | - | 135 | | nC |
| $I_{RRM}$ | Reverse recovery current | | - | 11.8 | | A |

1. *$I_{SD}$ is limited by package.*

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## 2.1 Electrical characteristics (curves)

**Figure 1. Safe operating area**

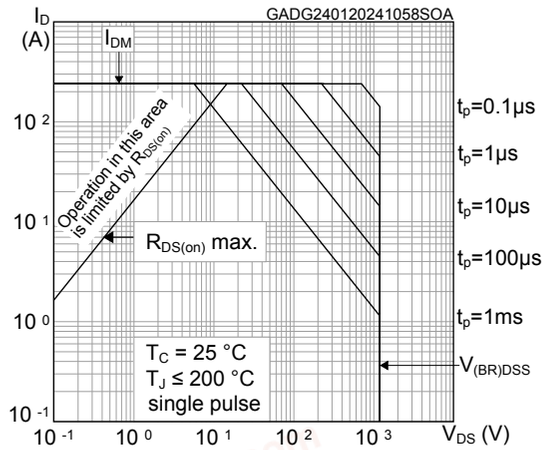



**Figure 2. Maximum transient thermal impedance**

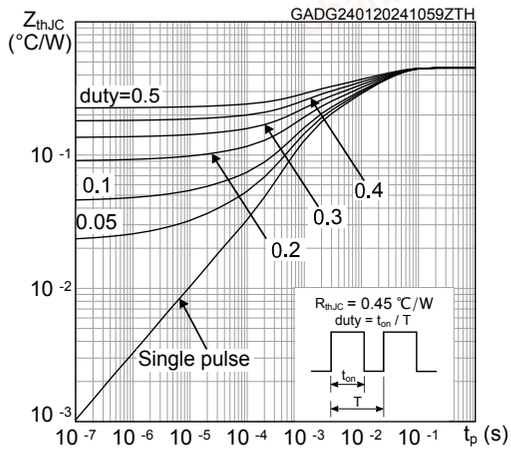



**Figure 3. Typical output characteristics ($T_J$ = 25 °C)**

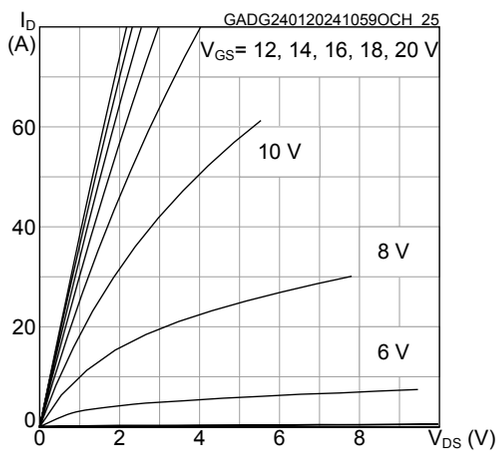



**Figure 4. Typical output characteristics ($T_J$ = 200 °C)**

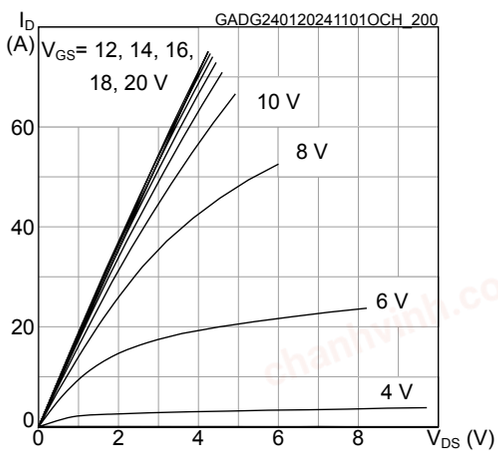



**Figure 5. Typical transfer characteristics**

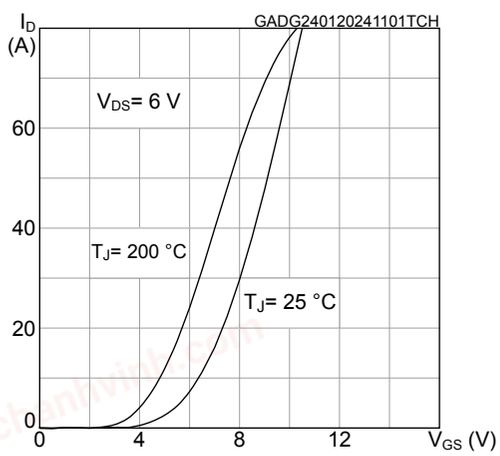
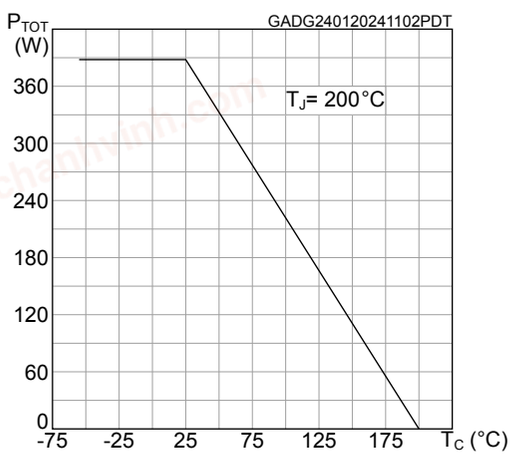



**Figure 6. Total power dissipation**



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**Figure 7. Typical gate charge characteristics**

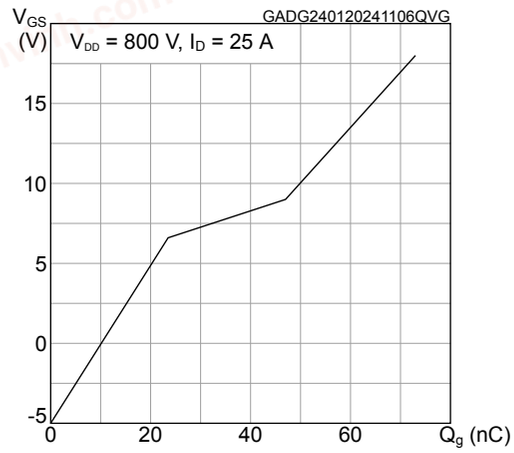



**Figure 8. Typical capacitance characteristics**

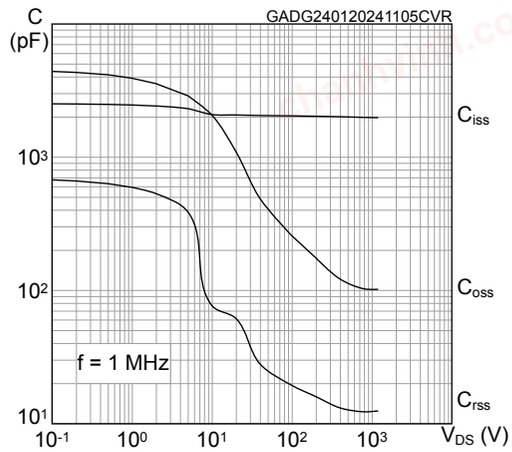



**Figure 9. Typical switching energy vs supply voltage**

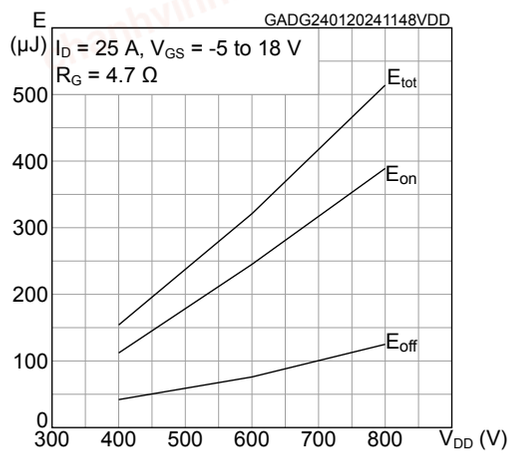



**Figure 10. Typical switching energy vs drain current**

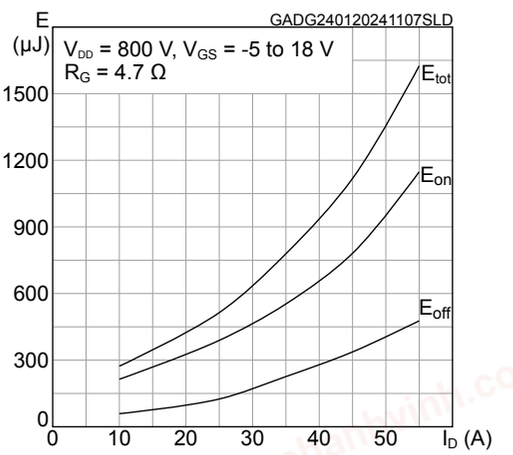



**Figure 11. Typical switching energy vs gate resistance**

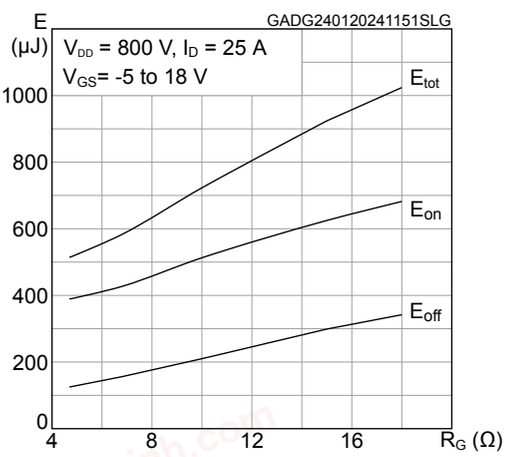
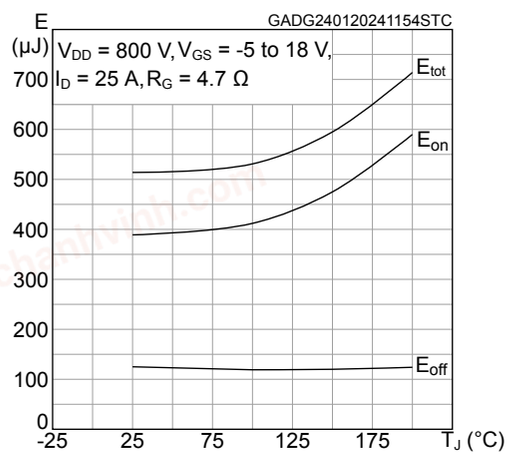



**Figure 12. Typical switching energy vs temperature**



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**Figure 13. Normalized breakdown voltage vs temperature**

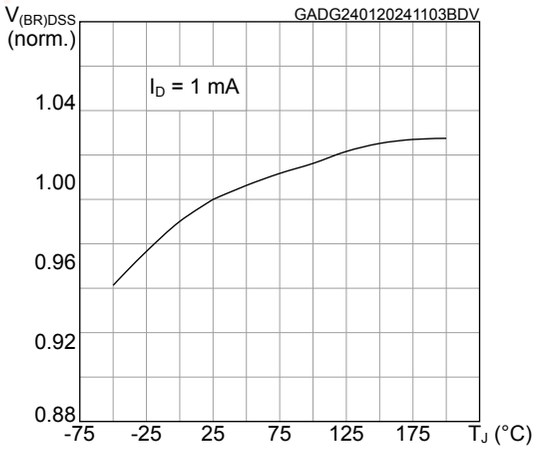



**Figure 14. Normalized gate threshold vs temperature**

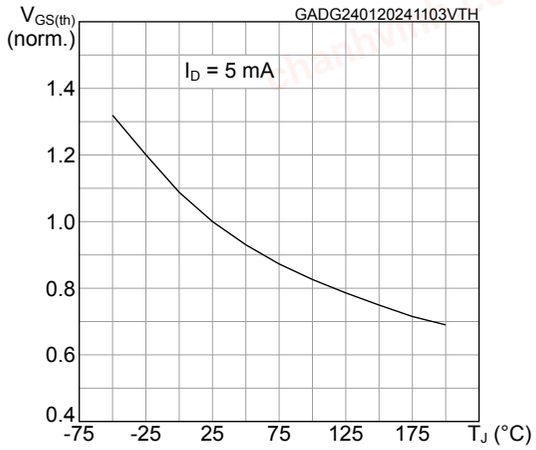



**Figure 15. Normalized on-resistance vs temperature**

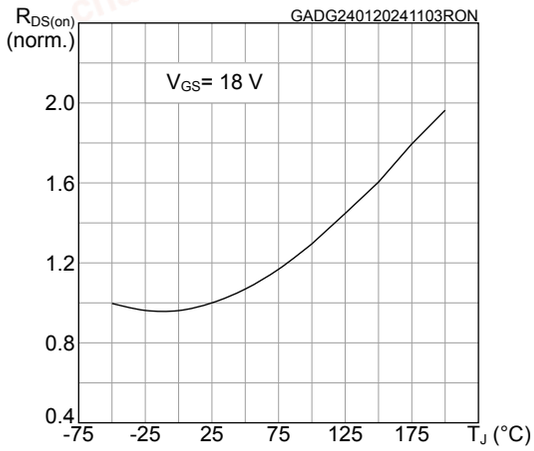



**Figure 16. Typical reverse conduction characteristics ($T_J$ = 25 °C)**

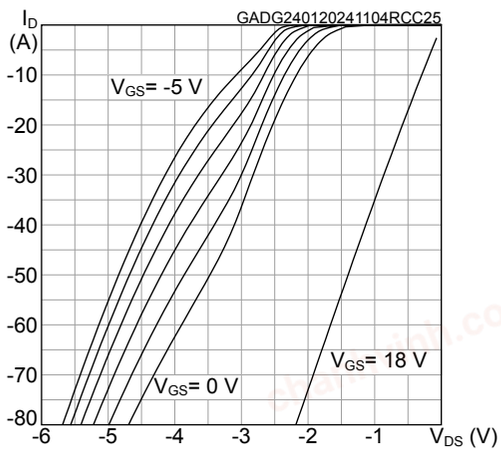
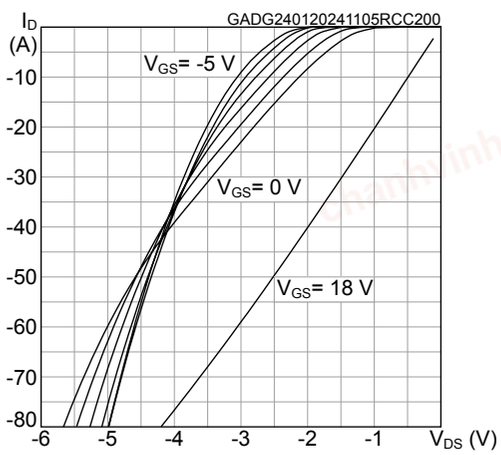



**Figure 17. Typical reverse conduction characteristics ($T_J$ = 200 °C)**



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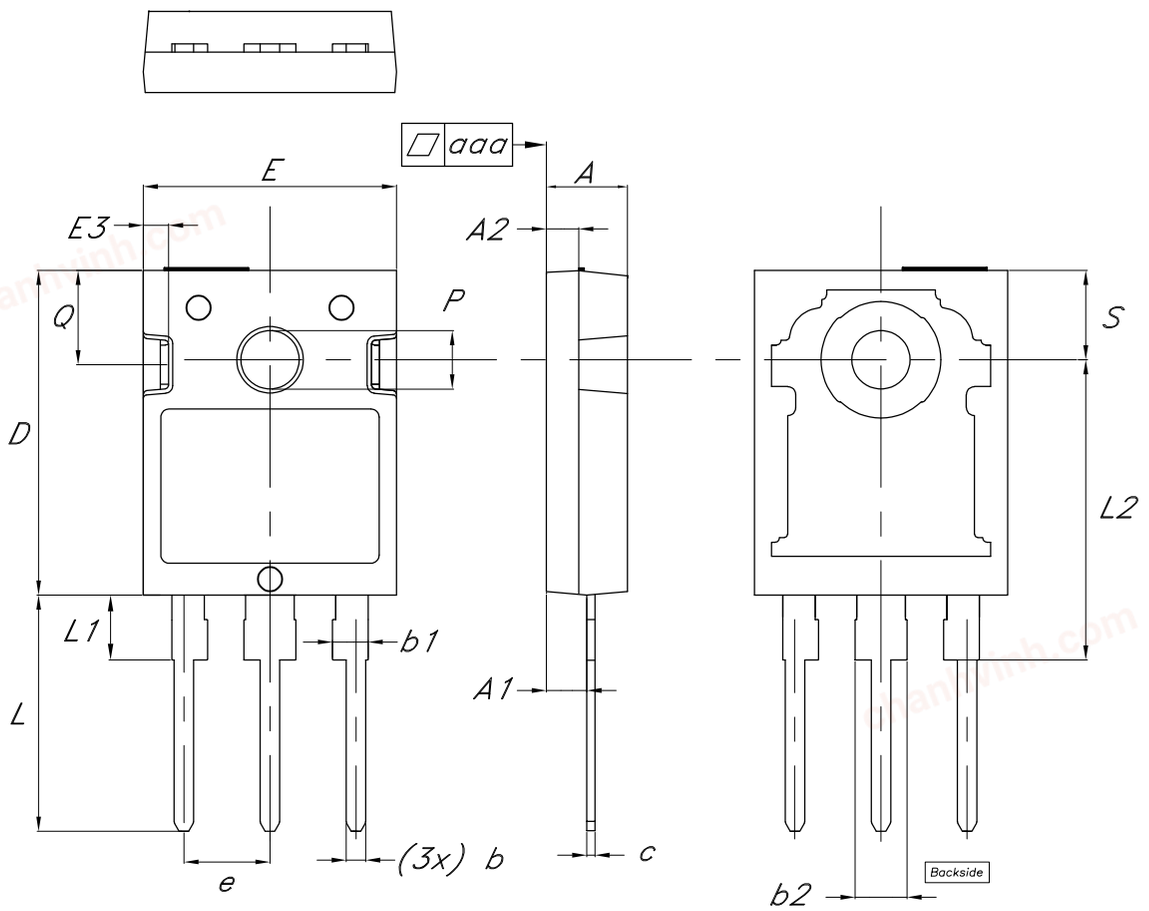


# 3 Package information

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_4

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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 |
| aaa | | 0.04 | 0.10 |

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## Revision history

Table 9. **Document revision history**

| Date | Revision | Changes |
|---|---|---|
| 29-Jan-2024 | 1 | First release. |

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