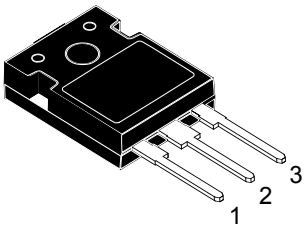
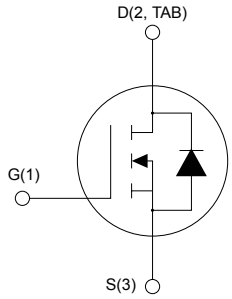
# SCT30N120

Datasheet

## Silicon carbide Power MOSFET 1200 V, 80 mΩ typ., 45 A in an HiP247 package




**HiP247**




## Features

- Very low $R_{DS(on)}$ over the entire temperature range
- Very high operating junction temperature capability ($T_J$ = 200 °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 |
|---|
| SCT30N120 |

| Product summary | |
|---|---|
| **Order code** | SCT30N120 |
| **Marking** | SCT30N120 |
| **Package** | HiP247 |
| **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, limited by silicon) at $T_C$ = 25 °C | 45 | A |
| $I_D$ | Drain current (continuous, limited by bonding wires) at $T_C$ = 25 °C | 40 | A |
| $I_D$ | Drain current (continuous) at $T_C$ = 100 °C | 34 | A |
| $I_{DM}$ (1) | Drain current (pulsed) | 90 | A |
| $P_{TOT}$ | Total power dissipation at $T_C$ = 25 °C | 270 | W |
| $T_{stg}$ | Storage temperature range | -55 to 200 | °C |
| $T_j$ | Operating junction temperature range | | |

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

**Table 2. Thermal data**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{thJC}$ | Thermal resistance, junction-to-case | 0.65 | °C/W |
| $R_{thJA}$ | Thermal resistance, junction-to-ambient | 40 | °C/W |

# 2 Electrical characteristics

($T_C$ = 25 °C unless otherwise specified)

**Table 3. On /off states**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{DSS}$ | Zero gate voltage drain current | $V_{GS}$ = 0 V, $V_{DS}$ = 1200 V | | 1 | 25 | µA |
| | | $V_{GS}$ = 0 V, $V_{DS}$ = 1200 V, $T_J$ = 200 °C | | 50 | | 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 | $V_{DS}$ = $V_{GS}$, $I_D$ = 1 mA | 1.8 | 3.5 | | V |
| $R_{DS(on)}$ | Static drain-source on- resistance | $V_{GS}$ = 20 V, $I_D$ = 20 A | | 80 | 100 | mΩ |
| | | $V_{GS}$ = 20 V, $I_D$ = 20 A, $T_J$ = 150 °C | | 90 | | mΩ |
| | | $V_{GS}$ = 20 V, $I_D$ = 20 A, $T_J$ = 200 °C | | 100 | | mΩ |

**Table 4. Dynamic**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input capacitance | $V_{GS}$ = 0 V, $V_{DS}$ = 400 V, f = 1 MHz | - | 1700 | - | pF |
| $C_{oss}$ | Output capacitance | | - | 130 | - | pF |
| $C_{rss}$ | Reverse transfer capacitance | | - | 25 | - | pF |
| $R_G$ | Intrinsic gate resistance | f = 1 MHz, $I_D$ = 0 A | - | 5 | - | Ω |
| $Q_g$ | Total gate charge | $V_{DD}$ = 800 V, $I_D$ = 20 A<br>$V_{GS}$ = 0 to 20 V | - | 105 | - | nC |
| $Q_{gs}$ | Gate-source charge | | - | 16 | - | nC |
| $Q_{gd}$ | Gate-drain charge | | - | 40 | - | nC |

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

| Symbol | Parameter | Test conditions | Min. | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $E_{on}$ | Turn-on switching energy | $V_{DD}$ = 800 V, $I_D$ = 20 A,<br>$R_G$ = 6.8 Ω, $V_{GS}$ = -2 to 20 V | - | 500 | - | µJ |
| $E_{off}$ | Turn-off switching energy | | - | 350 | - | µJ |
| $E_{on}$ | Turn-on switching energy | $V_{DD}$ = 800 V, $I_D$ = 20 A,<br>$R_G$ = 6.8 Ω, $V_{GS}$ = -2 to 20 V<br>$T_J$ = 150 °C | - | 500 | - | µJ |
| $E_{off}$ | Turn-off switching energy | | - | 400 | - | µJ |

**Table 6. Switching times**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)V}$ | Turn-on delay time | $V_{DD}$ = 800 V, $I_D$ = 20 A,<br>$V_{GS}$ = 0 to 20 V | - | 19 | - | ns |
| $t_{f(V)}$ | Fall time | | - | 28 | - | ns |
| $t_{d(off)V}$ | Turn-off delay time | | - | 45 | - | ns |
| $t_{r(V)}$ | Rise time | | - | 20 | - | ns |

**Table 7. Reverse SiC diode characteristics**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Diode forward voltage | $I_F$ = 10 A, $V_{GS}$ = 0 V | - | 3.5 | - | V |
| $t_{rr}$ | Reverse recovery time | $I_{SD}$ = 20 A, di/dt = 100 A/µs<br>$V_{DD}$ = 800 V | - | 140 | - | ns |
| $Q_{rr}$ | Reverse recovery charge | | - | 140 | | nC |
| $I_{RRM}$ | Reverse recovery current | | - | 2 | | A |

## 2.1 Electrical characteristics (curves)

**Figure 1. Safe operating area**

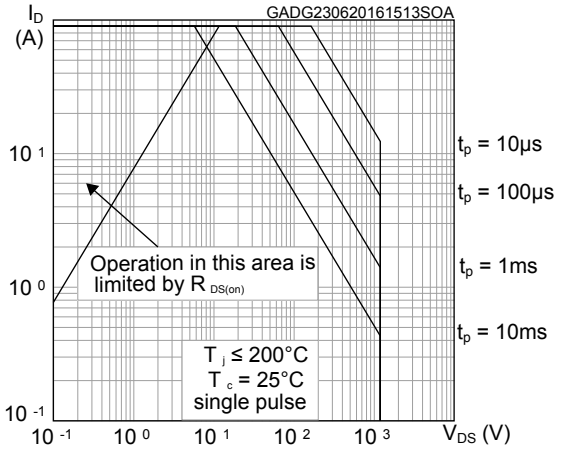



**Figure 2. Nolmalized transient thermal impedance**

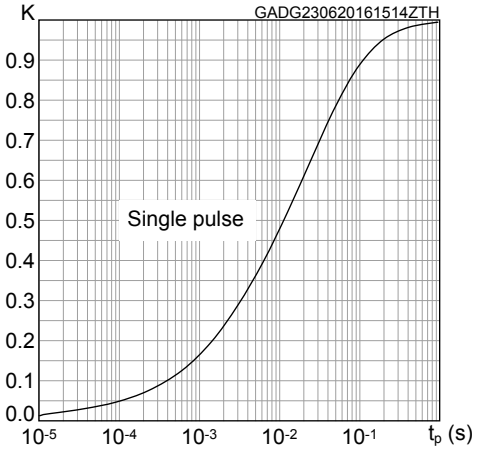



**Figure 3. Output characteristics ($T_J$ = 25 °C)**

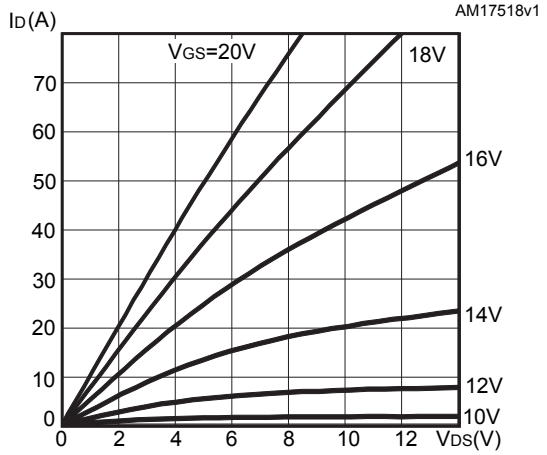



**Figure 4. Output characteristics ($T_J$ = 150 °C)**

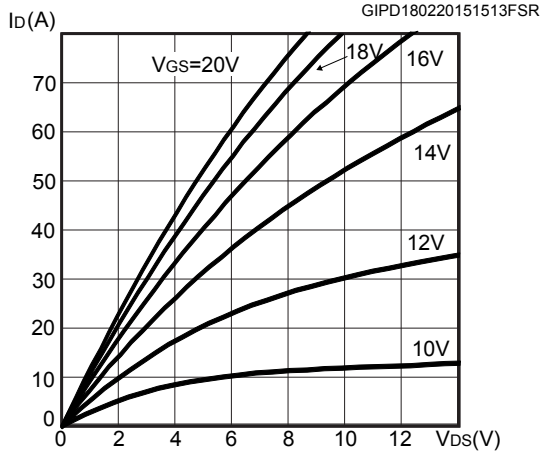



**Figure 5. Output characteristics ($T_J$ = 200 °C)**

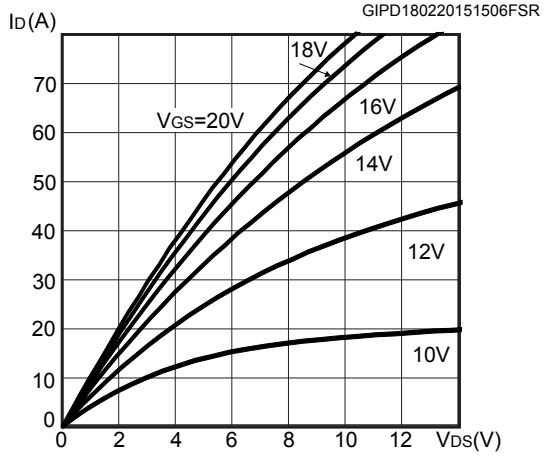



**Figure 6. Transfer characteristics**

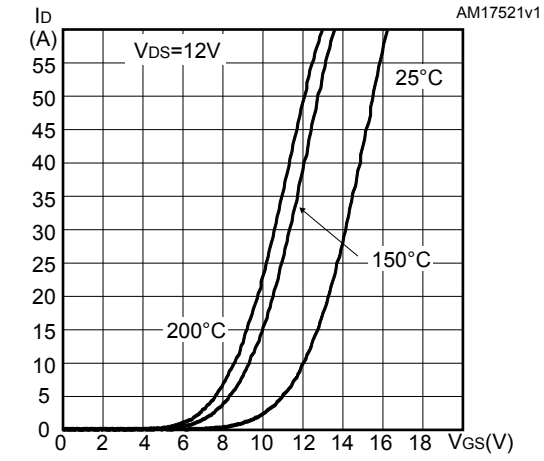


**Figure 7. Total power dissipation**

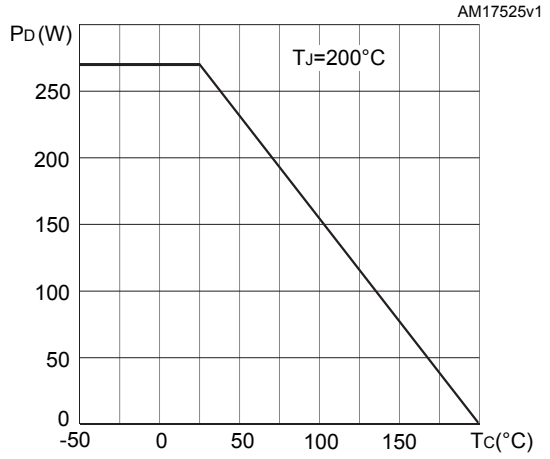



**Figure 8. Maximum continuous drain current vs case temperature**

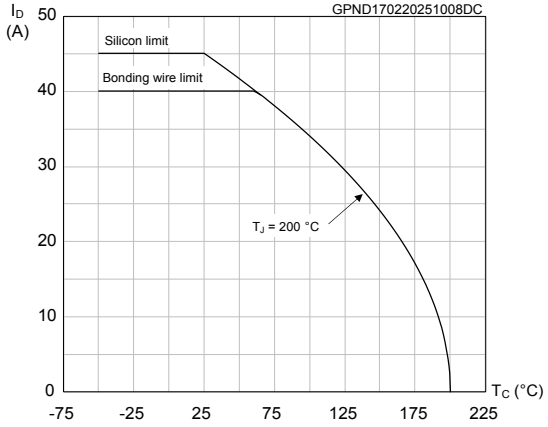



**Figure 9. Gate charge vs gate-source voltage**

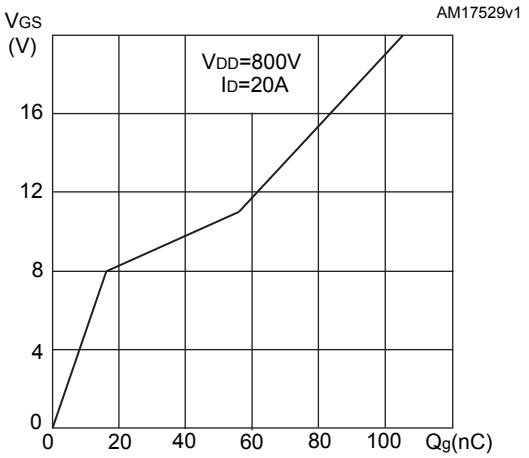



**Figure 10. Capacitance variations**

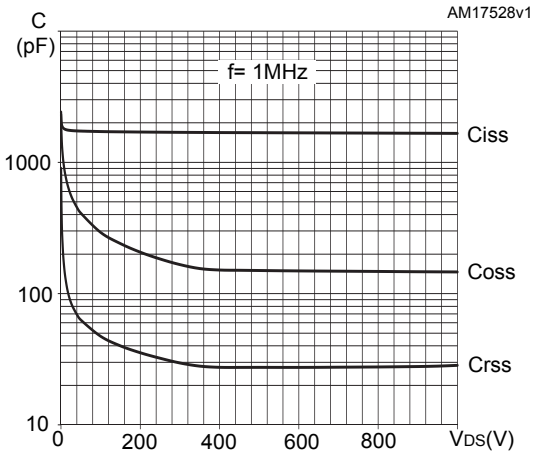



**Figure 11. Switching energy vs. drain current**

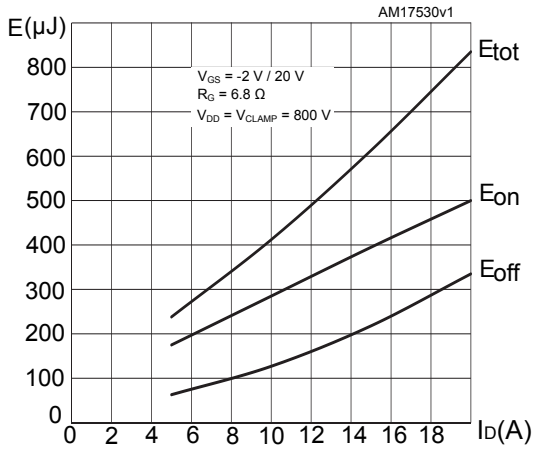



**Figure 12. Switching energy vs. junction temperature**

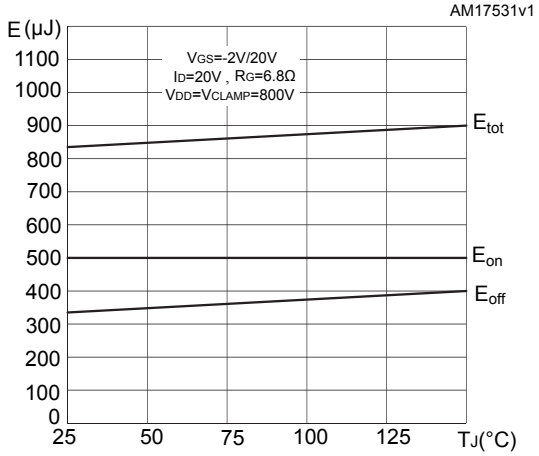


**Figure 13. Normalized $V_{(BR)DSS}$ vs. temperature**

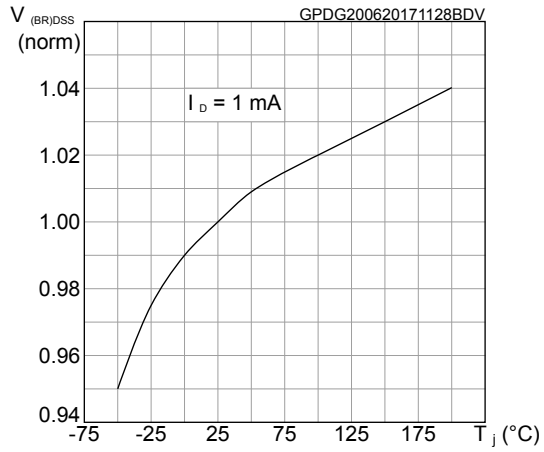



**Figure 14. Normalized gate threshold voltage vs. temperature**

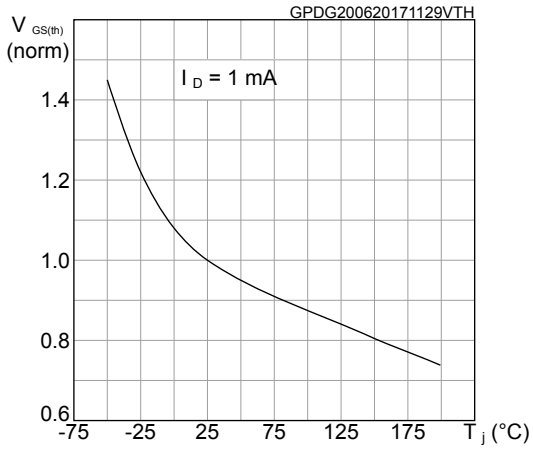



**Figure 15. Normalized on-resistance vs. temperature**

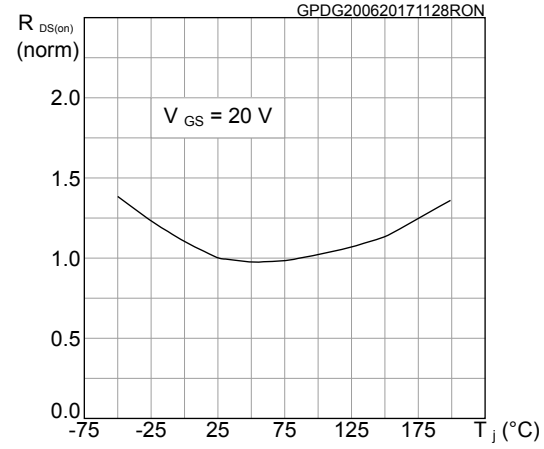



**Figure 16. Body diode characteristics ($T_J$ = -50 °C)**

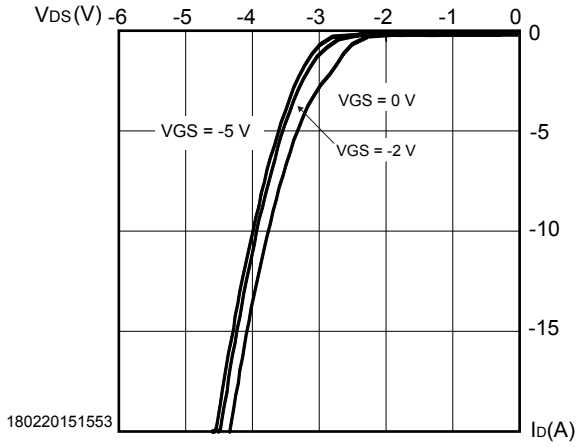



**Figure 17. Body diode characteristics ($T_J$ = 25 °C**

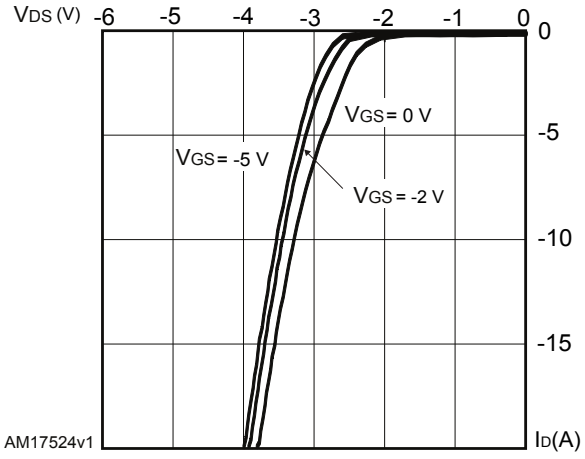



**Figure 18. Body diode characteristics ($T_J$ = 150 °C)**

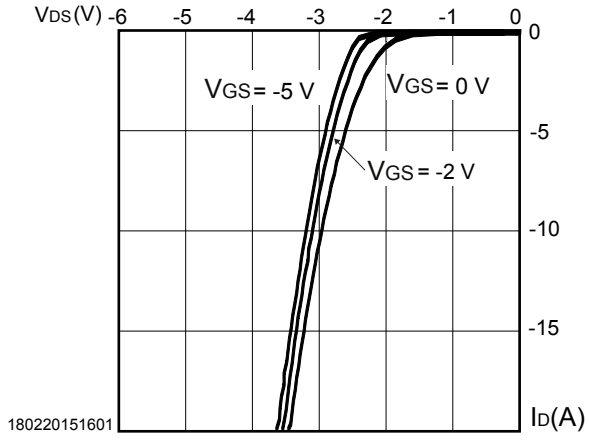


Figure 19. 3rd quadrant characteristics ($T_J$ = -50 °C)

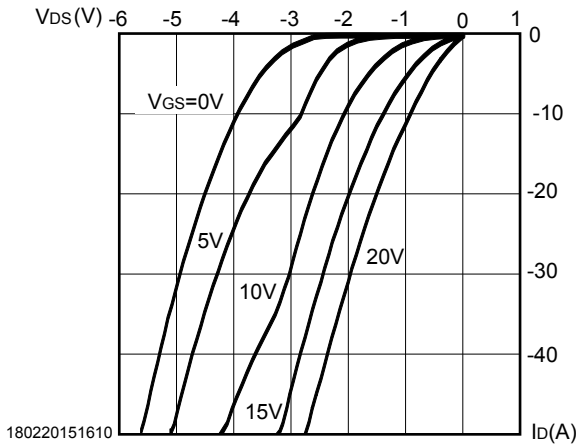



Figure 20. 3rd quadrant characteristics ($T_J$ = 25 °C)

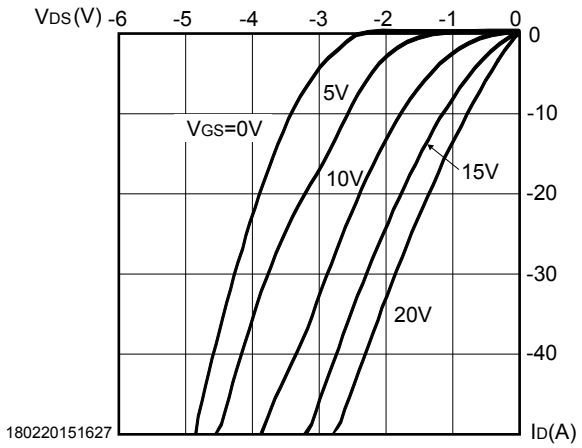
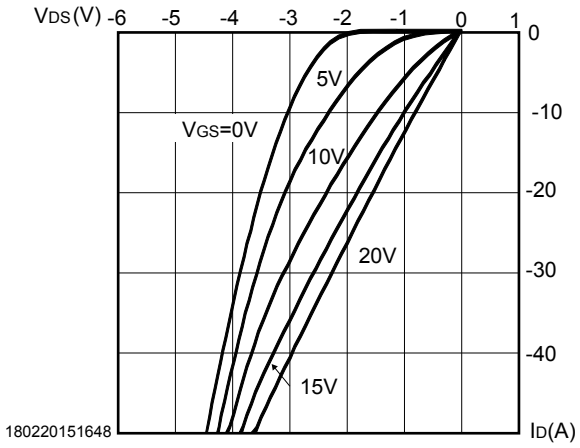



Figure 21. 3rd quadrant characteristics ($T_J$ = 150 °C)

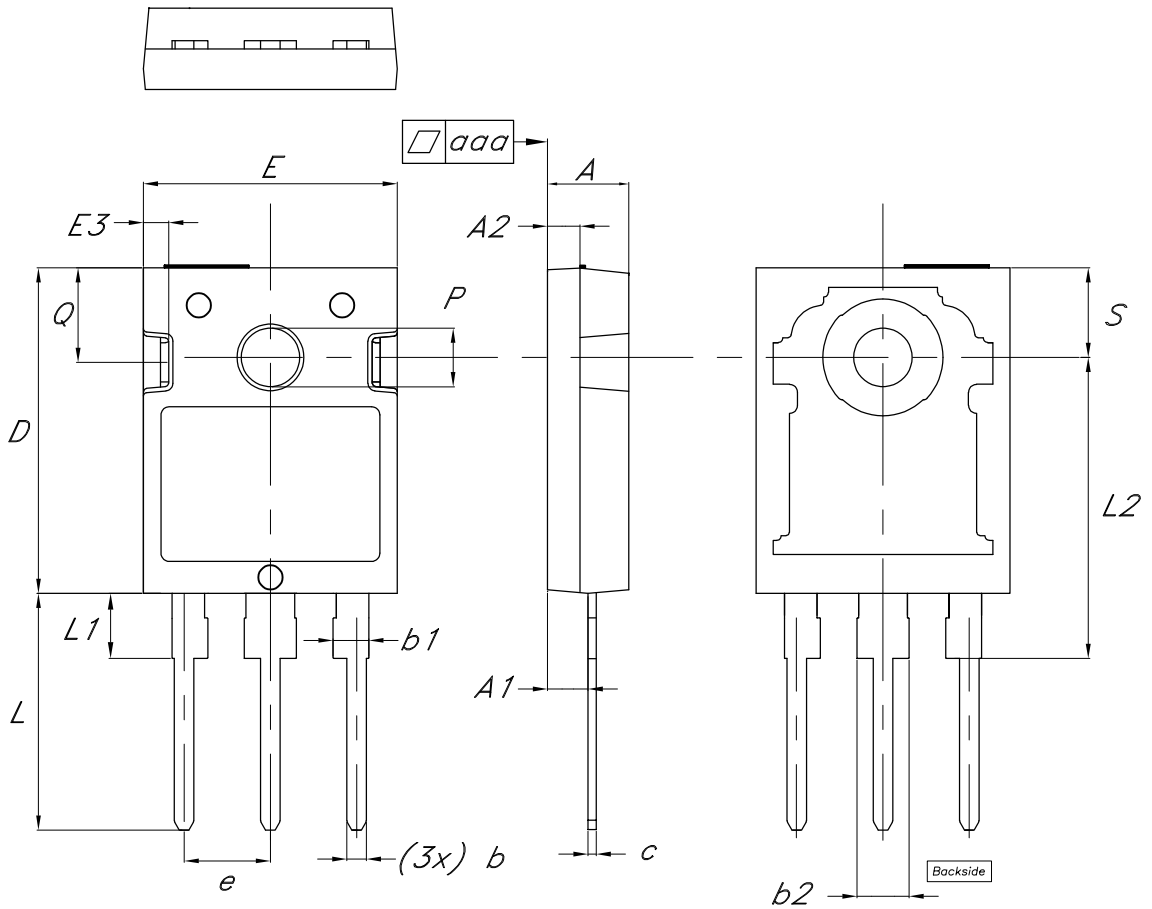


# 3 Package information

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. ECOPACK is an ST trademark.

## 3.1 HiP247 package information

**Figure 22. HiP247 package outline**




8581091_4

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 |

## Revision history

Table 9. **Document revision history**

| Date | Revision | Changes |
|---|---|---|
| 10-May-2012 | 1 | First release |
| 21-May-2013 | 2 | Updated trr value in *Table8*.<br>Updated dynamic parameters in *Table5*, VGS(th) in *Table4* and Eon in *Table6*. |
| 24-Jun-2013 | 3 | Document status promoted from target to preliminary data.<br>Added: *Section2.1: Electrical characteristics (curves)* |
| 11-Jul-2013 | 4 | Updated *Figure6: Output characteristics (TJ = 200 °C)* and *Figure7: Transfer characteristics*. |
| 18-Dec-2013 | 5 | Updated parameters in *Table2: Absolute maximum ratings* and *Table4: On/off states*. |
| 27-May-2014 | 6 | Added *Table7: Switching times*.<br>Updated *Section3: Package mechanical data*.<br>Minor text changes. |
| 25-Sep-2014 | 7 | Document status promoted from preliminary to production data. |
| 17-Feb-2015 | 8 | Updated title in cover page. |
| 20-Feb-2015 | 9 | Updated *Section2.1: Electrical characteristics (curves)*. |
| 24-Jul-2016 | 10 | Updated title and features in cover page.<br>Updated *Figure 2: "Safe operating area" and Figure 3: "Thermal impedance"*.<br>Minor text changes. |
| 11-May-2017 | 11 | Updated *Table 4: "On/off states"* and *Section 2.1: "Electrical characteristics (curves)"*.<br>Minor text changes. |
| 17-Mar-2025 | 12 | Updated Section 3.1: HiP247 package information.<br>Minor text changes. |

# Contents