# SCTWA30N120

## Silicon carbide Power MOSFET 1200 V, 45 A, 90 mΩ (typ., $T_J$= 150 °C), in an HiP247™ long leads package

Datasheet - production data

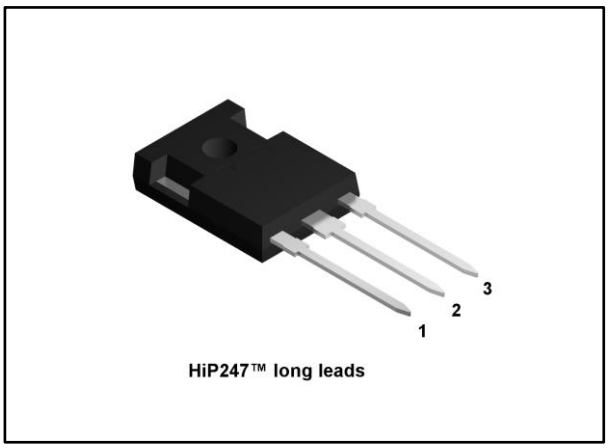
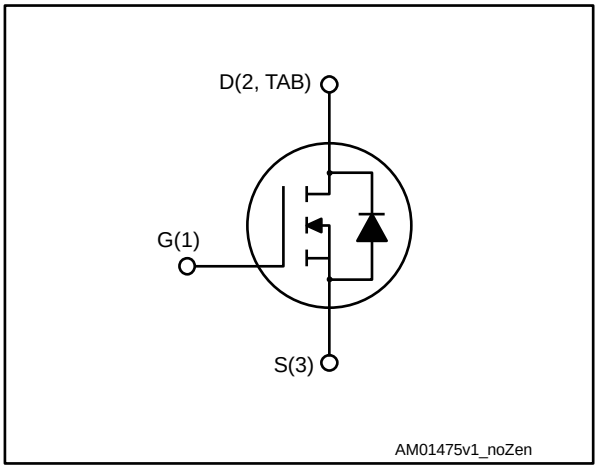



**Figure 1: Internal schematic diagram**




## Features

- Very tight variation of on-resistance vs. temperature
- Very high operating junction temperature capability ($T_J$ = 200 °C)
- Very fast and robust intrinsic body diode
- Low capacitance

## Applications

- Solar inverters, UPS
- Motor drives
- High voltage DC-DC converters
- Switch mode power supply

## 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.

**Table 1: Device summary**

| Order code | Marking | Package | Packaging |
|---|---|---|---|
| SCTWA30N120 | SCT30N120 | HiP247™ long leads | Tube |

# Contents

# 1 Electrical ratings

**Table 2: 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) at $T_C$ = 25 °C (limited by die) | 45 | A |
| $I_D$ | Drain current (continuous) at $T_C$ = 25 °C (limited by package) | 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 dissipation at $T_C$ = 25 °C | 270 | W |
| $T_{stg}$ | Storage temperature range | -55 to 200 | °C |
| $T_j$ | Operating junction temperature range | | |

**Notes:**

(1)Pulse width limited by safe operating area.

**Table 3: Thermal data**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{thj\text{-}case}$ | Thermal resistance junction-case | 0.65 | °C/W |
| $R_{thj\text{-}amb}$ | Thermal resistance junction-amb | 40 | °C/W |

# 2 Electrical characteristics

($T_{case}$ =25 °C unless otherwise specified)

**Table 4: 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 5: 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 $V_{GS}$ =0 to 20 V | - | 105 | - | nC |
| $Q_{gs}$ | Gate-source charge | | - | 16 | - | nC |
| $Q_{gd}$ | Gate-drain charge | | - | 40 | - | nC |

**Table 6: 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, $R_G$ = 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, $R_G$ = 6.8 Ω, $V_{GS}$ = -2 to 20 V $T_J$= 150 °C | - | 500 | - | µJ |
| $E_{off}$ | Turn-off switching energy | | - | 400 | - | µJ |

**Table 7: 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, $R_G$ = 0 Ω, $V_{GS}$ = 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 8: 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 2: Safe operating area**

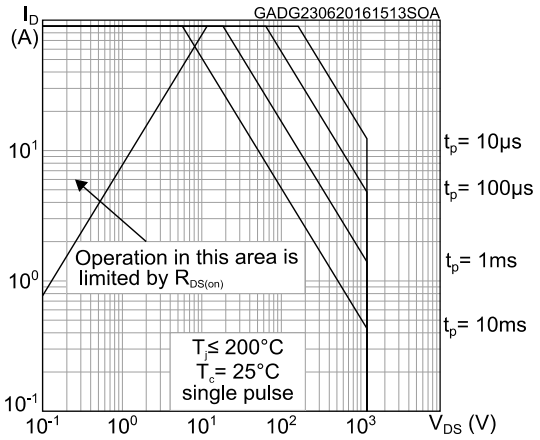



**Figure 3: Thermal impedance**

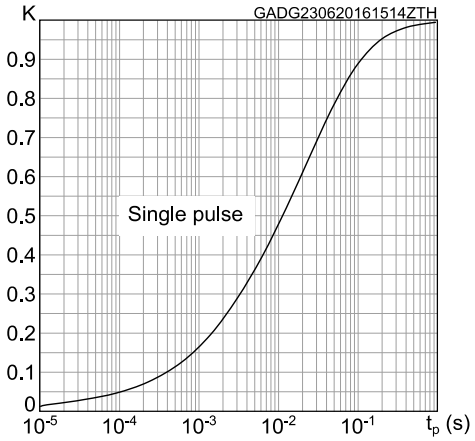



**Figure 4: Output characteristics ($T_J$= 25 °C)**

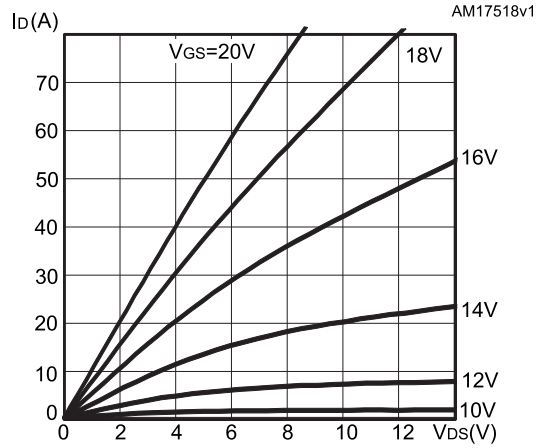



**Figure 5: Output characteristics ($T_J$= 150 °C)**

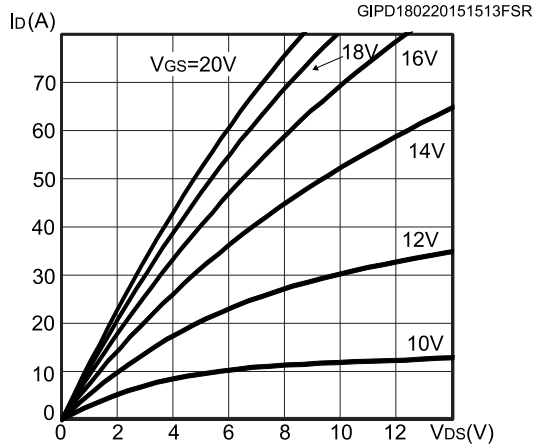



**Figure 6: Output characteristics ($T_J$= 200 °C)**

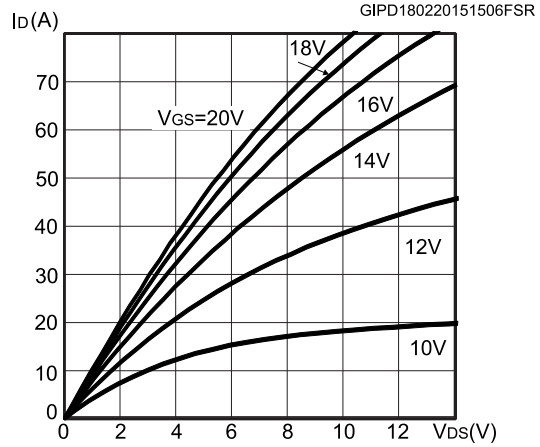



**Figure 7: Transfer characteristics**

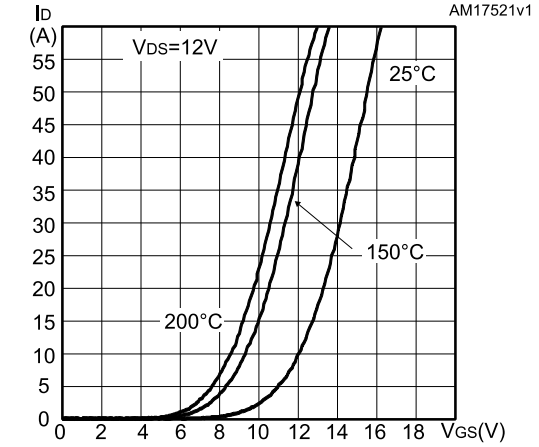


**Figure 8: Power dissipation**

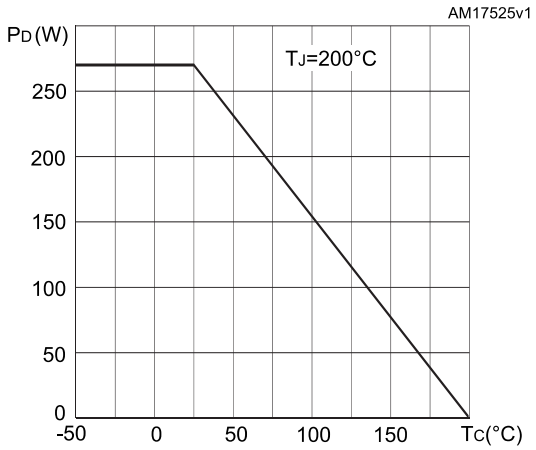



**Figure 9: Gate charge vs gate-source voltage**

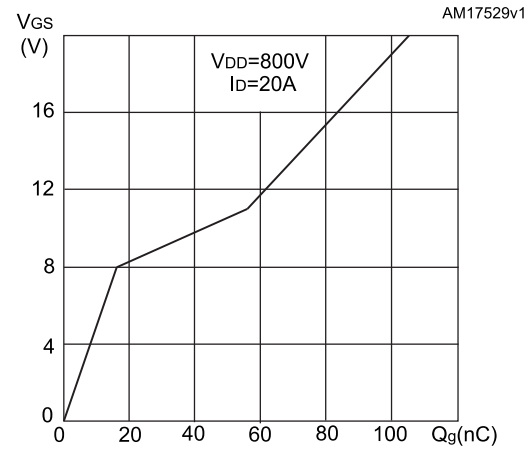



**Figure 10: Capacitance variations**

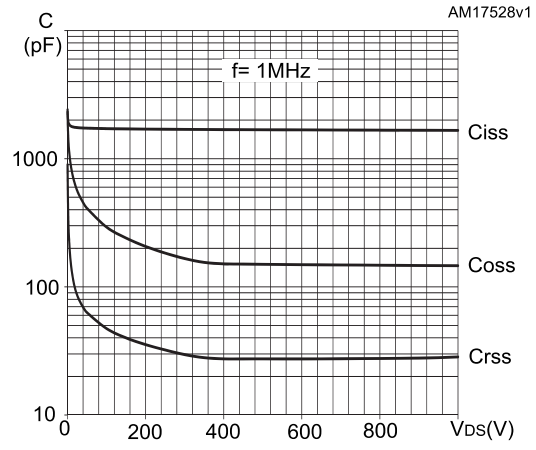



**Figure 11: Switching energy vs. drain current**

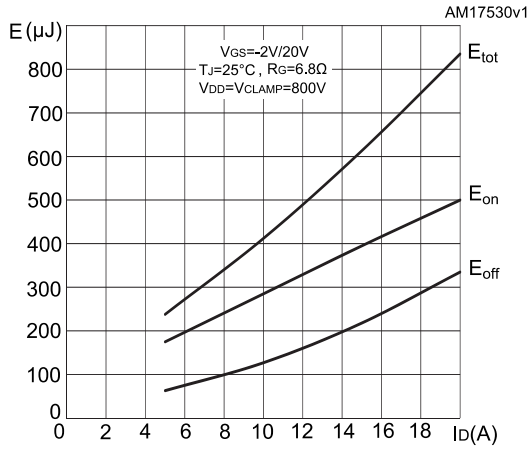



**Figure 12: Switching energy vs. junction temperature**

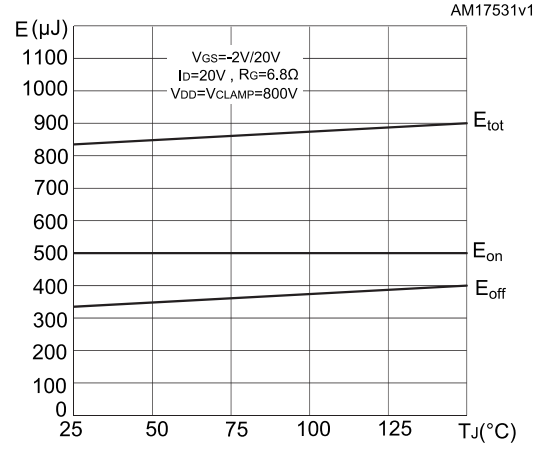



**Figure 13: Normalized $V_{(BR)DSS}$ vs. temperature**

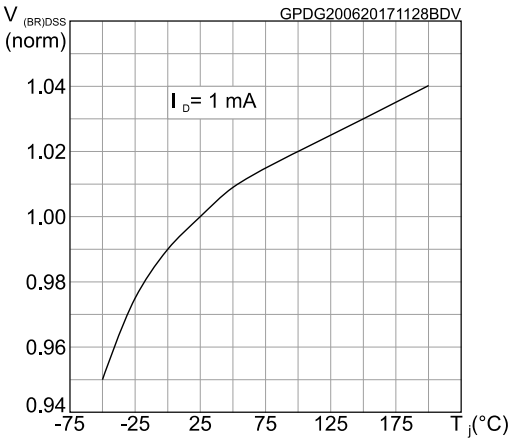


**Figure 14: Normalized gate threshold voltage vs. temperature**

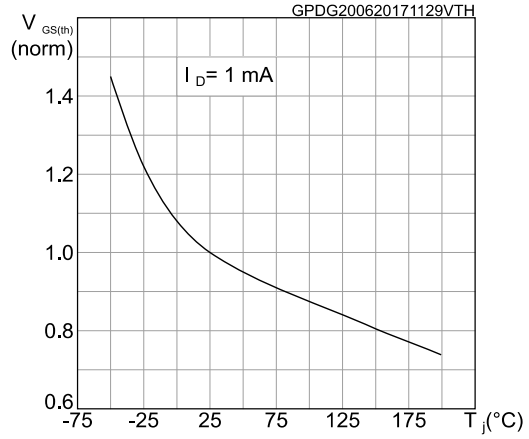



**Figure 15: Normalized on-resistance vs. temperature**

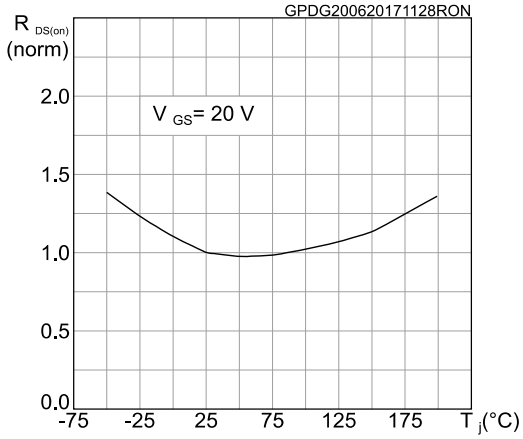



**Figure 16: Body diode characteristics ($T_J$= -50 °C)**

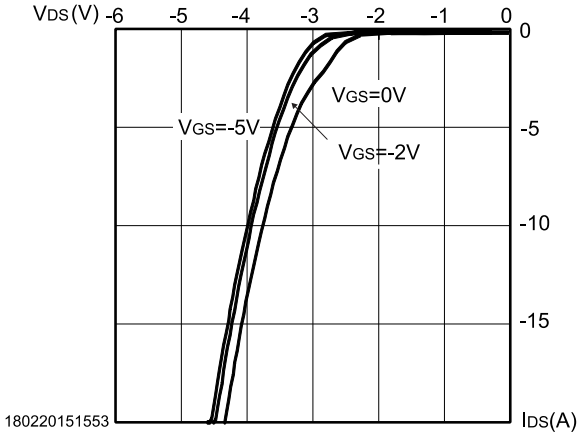



**Figure 17: Body diode characteristics ($T_J$= 25 °C**

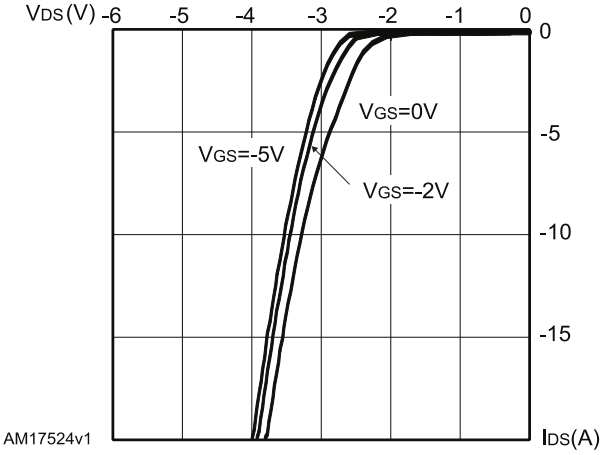



**Figure 18: Body diode characteristics ($T_J$= 150 °C)**

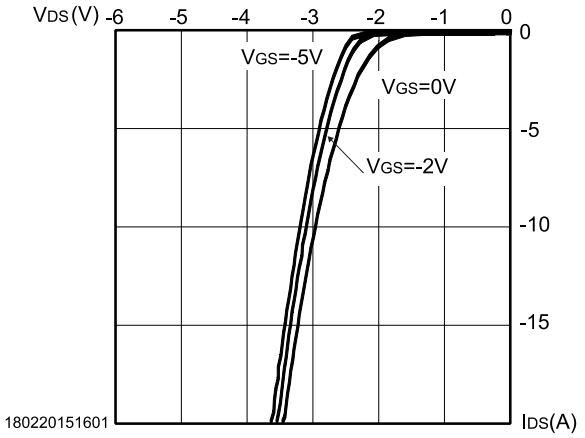



**Figure 19: 3rd quadrant characteristics ($T_J$= -50 °C)**

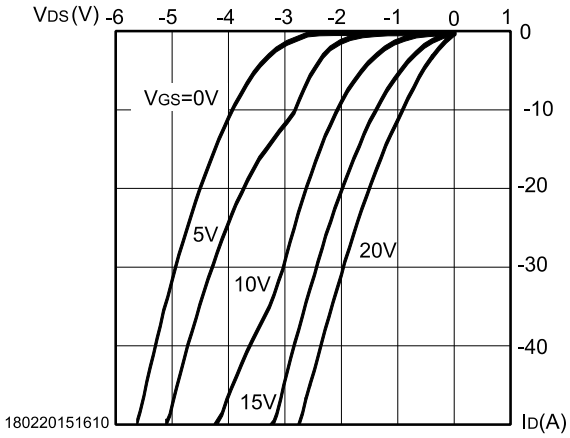


**Figure 20: 3rd quadrant characteristics ($T_J$= 25 °C)**

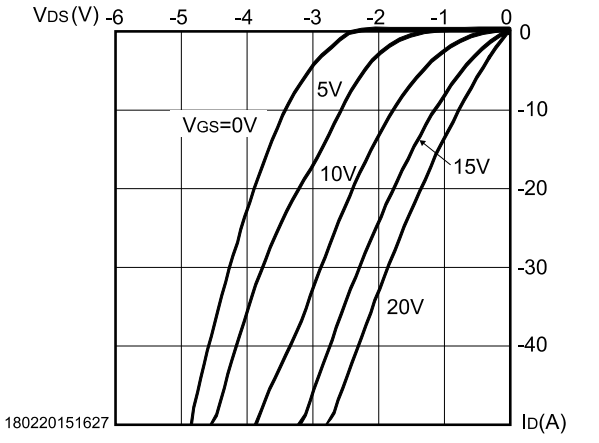
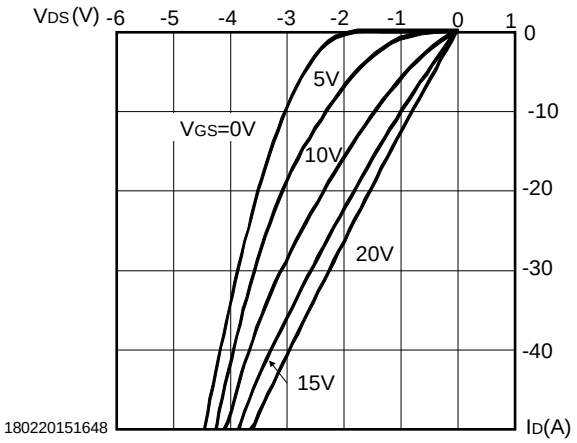



**Figure 21: 3rd quadrant characteristics ($T_J$= 150 °C)**



# 3 Package information

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 long leads package information

**Figure 22: HiP247™ long leads package outline**

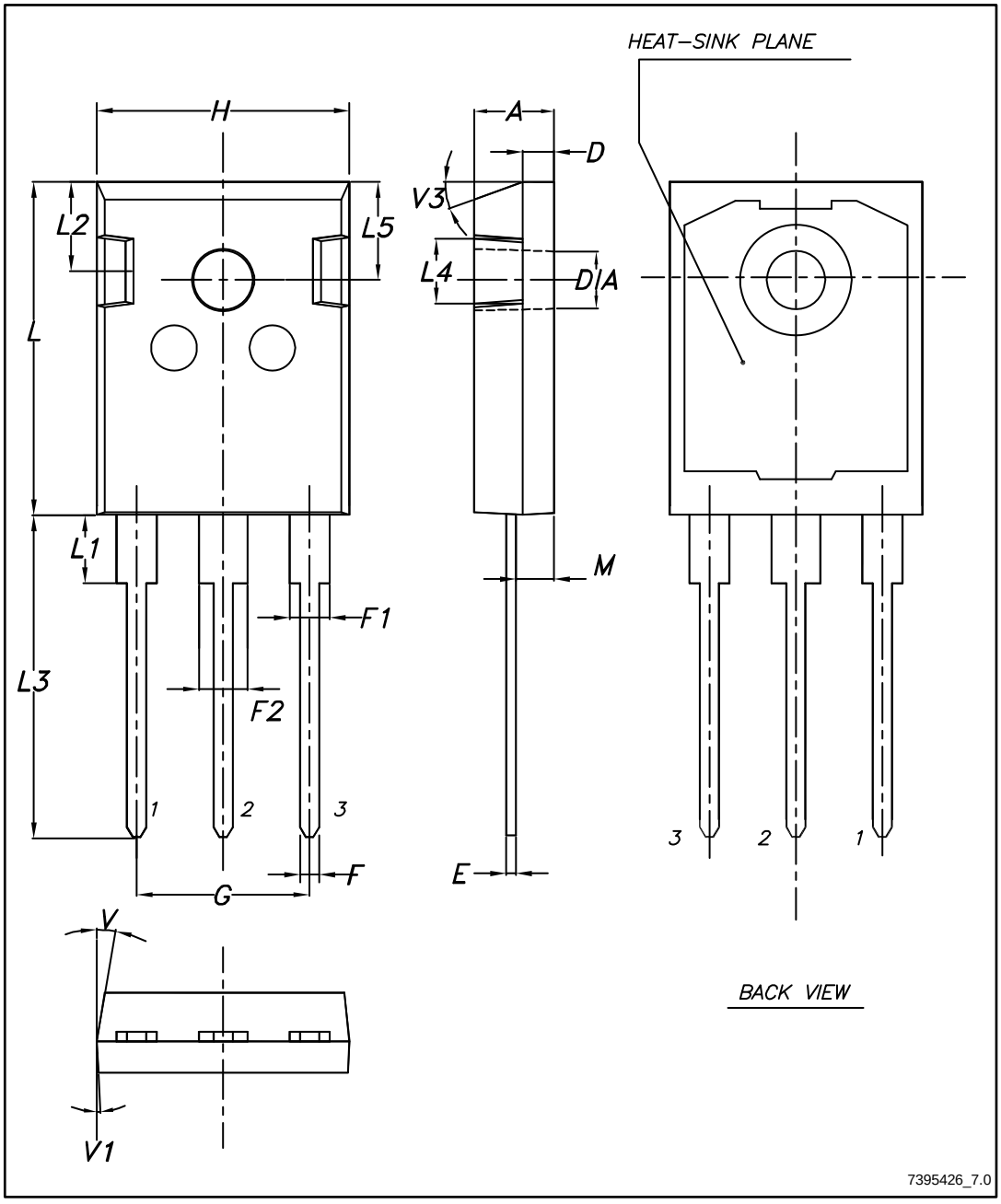


Table 9: HiP247™ long leads package mechanical data

| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 4.90 | | 5.15 |
| D | 1.85 | | 2.10 |
| E | 0.55 | | 0.67 |
| F | 1.07 | | 1.32 |
| F1 | 1.90 | | 2.38 |
| F2 | 2.87 | | 3.38 |
| G | | 10.90 BSC | |
| H | 15.77 | | 16.02 |
| L | 20.82 | | 21.07 |
| L1 | 4.16 | | 4.47 |
| L2 | 5.49 | | 5.74 |
| L3 | 20.05 | | 20.30 |
| L4 | 3.68 | | 3.93 |
| L5 | 6.04 | | 6.29 |
| M | 2.25 | | 2.55 |
| V | | 10° | |
| V1 | | 3° | |
| V3 | | 20° | |
| DIA | 3.55 | | 3.66 |

# 4 Revision history

Table 10: Document revision history

| Date | Revision | Changes |
|---|---|---|
| 11-Jan-2016 | 1 | First release. |
| 19-Jun-2017 | 2 | Updated title, features in cover page.<br>Minor text edit in *Section 1: "Electrical ratings"* and *Section 2: "Electrical characteristics"*.<br>Updated *Figure 2: "Safe operating area"*, *Figure 3: "Thermal impedance"*, *Figure 13: "Normalized V(BR)DSS vs. temperature"*, *Figure 14: "Normalized gate threshold voltage vs. temperature"* and *Figure 15: "Normalized on-resistance vs. temperature"*.<br>Document status promoted from preliminary to production data. |

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