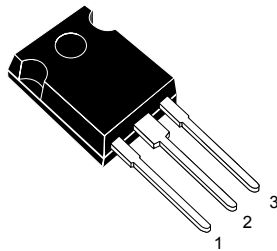
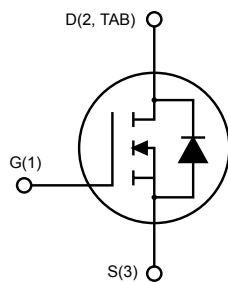


Silicon carbide Power MOSFET 1200 V, 20 A, 189 mΩ (typ., $T_J = 150\text{ °C}$) in an HiP247 package



HiP247



AM01475v1_noZen



Product status link

[SCT20N120](#)

Product summary

| | |
|-------------------|-----------|
| Order code | SCT20N120 |
| Marking | SCT20N120 |
| Package | HiP247 |
| Packing | Tube |

Features

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

Applications

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

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.

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) at $T_C = 25\text{ °C}$ | 20 | A |
| I_D | Drain current (continuous) at $T_C = 100\text{ °C}$ | 16 | A |
| $I_{DM}^{(1)}$ | Drain current (pulsed) | 45 | A |
| P_{TOT} | Total power dissipation at $T_C = 25\text{ °C}$ | 175 | W |
| T_{stg} | Storage temperature range | -55 to 200 | °C |
| T_j | Operating junction temperature range | | °C |

1. Pulse width limited by safe operating area.

Table 2. Thermal data

| Symbol | Parameter | Value | Unit |
|----------------|-------------------------------------|-------|------|
| $R_{thj-case}$ | Thermal resistance junction-case | 1 | °C/W |
| $R_{thj-amb}$ | Thermal resistance junction-ambient | 40 | °C/W |

2 Electrical characteristics

($T_{CASE} = 25\text{ °C}$ unless otherwise specified).

Table 3. On/off states

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------------|-----------------------------------|--|------|------|------|---------------|
| I_{DSS} | Zero gate voltage drain current | $V_{GS} = 0\text{ V}, V_{DS} = 1200\text{ V}$ | | | 100 | μA |
| | | $V_{GS} = 0\text{ V}, V_{DS} = 1200\text{ V}, T_J = 200\text{ °C}$ | | 50 | | |
| I_{GSS} | Gate-body leakage current | $V_{DS} = 0\text{ V}, V_{GS} = -10\text{ to }22\text{ V}$ | | | 100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS} = V_{GS}, I_D = 1\text{ mA}$ | 2 | 3.5 | | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS} = 20\text{ V}, I_D = 10\text{ A}$ | | 169 | 239 | m Ω |
| | | $V_{GS} = 20\text{ V}, I_D = 10\text{ A}, T_J = 150\text{ °C}$ | | 189 | | |
| | | $V_{GS} = 20\text{ V}, I_D = 10\text{ A}, T_J = 200\text{ °C}$ | | 220 | | |

Table 4. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|------------|------------------------------|--|------------------------------------|------|------|------|
| C_{iss} | Input capacitance | $V_{DS} = 400\text{ V}, f = 1\text{ MHz}, V_{GS} = 0\text{ V}$ | - | 650 | - | pF |
| C_{oss} | Output capacitance | | - | 65 | - | pF |
| C_{riss} | Reverse transfer capacitance | | - | 14 | - | pF |
| Q_g | Total gate charge | $V_{DD} = 800\text{ V}, I_D = 10\text{ A}, V_{GS} = 0\text{ to }20\text{ V}$ | - | 45 | - | nC |
| Q_{gs} | Gate-source charge | | - | 7 | - | nC |
| Q_{gd} | Gate-drain charge | | - | 11.7 | - | nC |
| R_g | Gate input resistance | | $f=1\text{ MHz}, I_D = 0\text{ A}$ | - | 7 | - |

Table 5. Switching energy (inductive load)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|---------------------------|---|------|------|------|---------------|
| E_{on} | Turn-on switching energy | $V_{DD} = 800\text{ V}, I_D = 10\text{ A}$ $R_G = 6.8\ \Omega, V_{GS} = -2\text{ to }20\text{ V}$ | - | 160 | - | μJ |
| E_{off} | Turn-off switching energy | | - | 90 | - | μJ |
| E_{on} | Turn-on switching energy | $V_{DD} = 800\text{ V}, I_D = 10\text{ A}$ $R_G = 6.8\ \Omega, V_{GS} = -2\text{ to }20\text{ V}, T_J = 150\text{ °C}$ | - | 165 | - | μJ |
| E_{off} | Turn-off switching energy | | - | 100 | - | μJ |

Table 6. Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|---------------------|---|------|------|------|------|
| $t_{d(on)V}$ | Turn-on delay time | $V_{DD} = 800\text{ V}$, $I_D = 10\text{ A}$, $R_G = 0\ \Omega$, $V_{GS} = 0\text{ to }20\text{ V}$ | - | 10 | - | ns |
| $t_{f(V)}$ | Fall time | | - | 17 | - | ns |
| $t_{d(off)V}$ | Turn-off delay time | | - | 27 | - | ns |
| $t_{r(V)}$ | Rise time | | - | 16 | - | ns |

Table 7. Reverse SiC diode characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|-------------------------------|---|------|------|------|------|
| V_{SD} | Diode forward voltage | $I_F = 5\text{ A}$, $V_{GS} = -5\text{ V}$ | - | 3.6 | - | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 10\text{ A}$, $V_{GS} = -5\text{ V}$, $V_R = 800\text{ V}$, $di/dt = 1650\text{ A}/\mu\text{s}$ | - | 15 | - | ns |
| Q_{rr} | Reverse recovery charge | | - | 75 | - | nC |
| I_{rrm} | Peak reverse recovery current | | - | 8 | - | A |

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

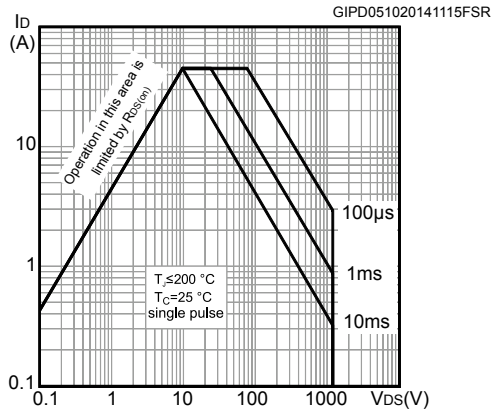


Figure 2. Typical thermal impedance

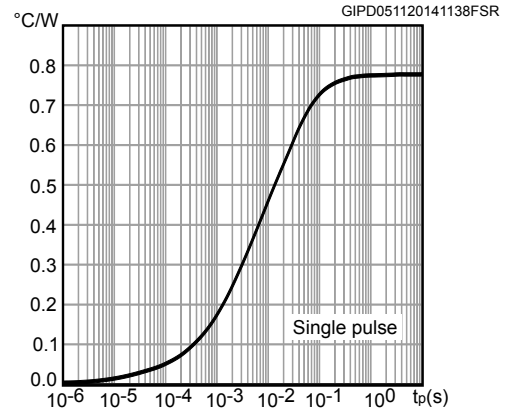


Figure 3. Output characteristics @ $T_J = 25\text{ }^\circ\text{C}$

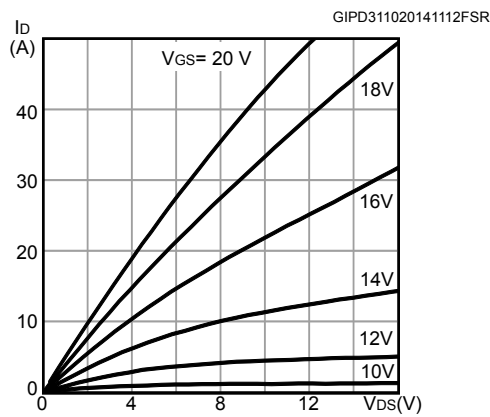


Figure 4. Output characteristics @ $T_J = 200\text{ }^\circ\text{C}$

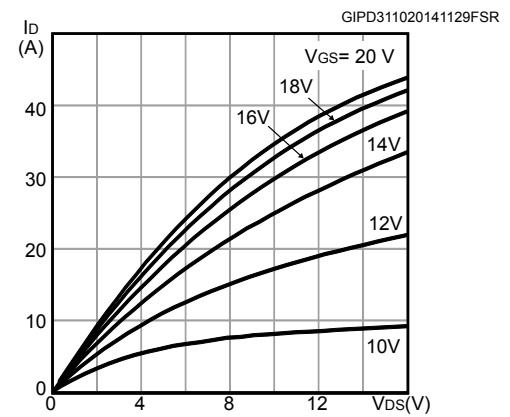


Figure 5. Transfer characteristics

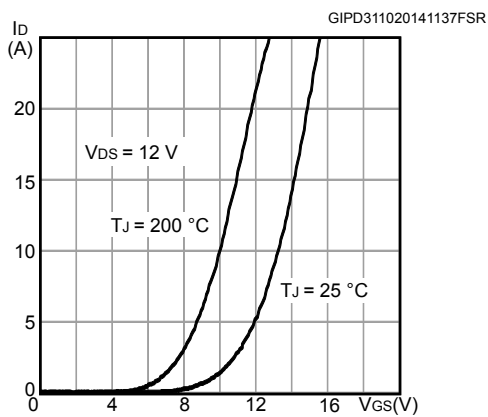


Figure 6. Body diode characteristics @ $T_J = -50\text{ }^\circ\text{C}$

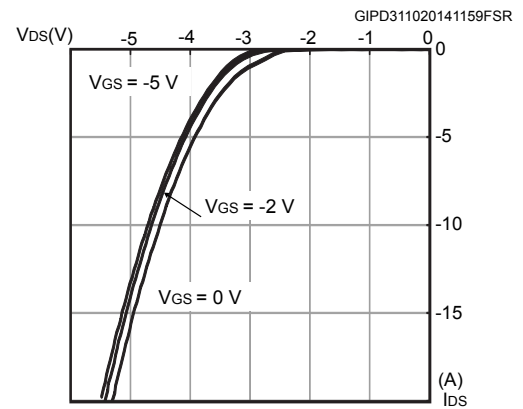


Figure 7. Body diode characteristics @ $T_J = 25\text{ }^\circ\text{C}$

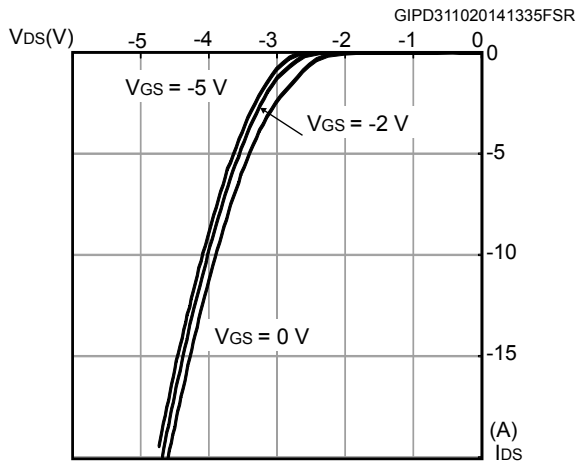


Figure 8. Body diode characteristics @ $T_J = 150\text{ }^\circ\text{C}$

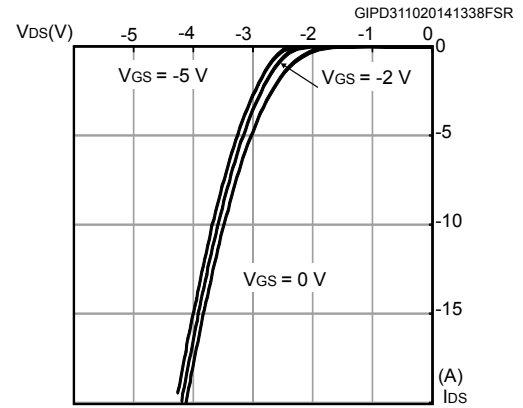


Figure 9. 3rd quadrant characteristics @ $T_J = -50\text{ }^\circ\text{C}$

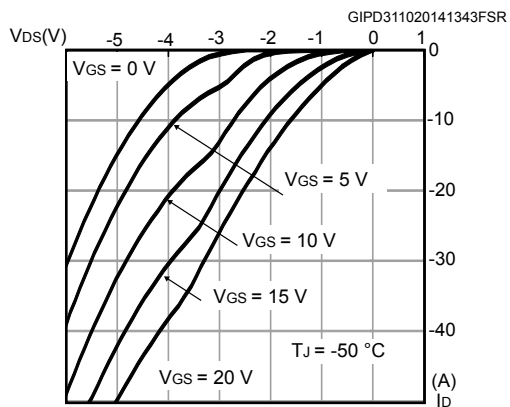


Figure 10. 3rd quadrant characteristics @ $T_J = 25\text{ }^\circ\text{C}$

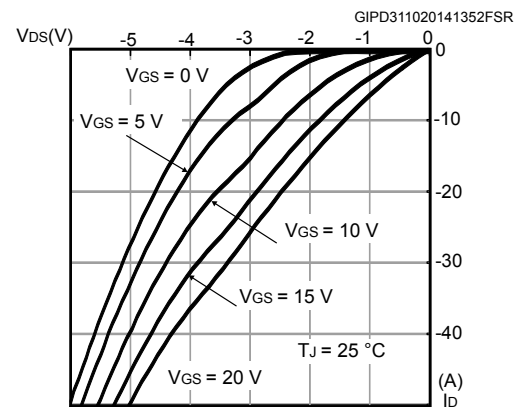


Figure 11. 3rd quadrant characteristics @ $T_J = 150\text{ }^\circ\text{C}$

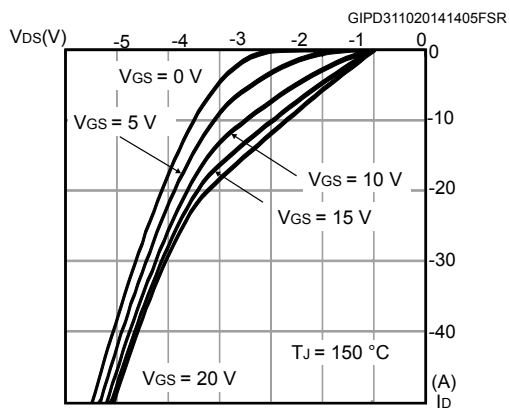


Figure 12. Normalized gate threshold vs. temperature

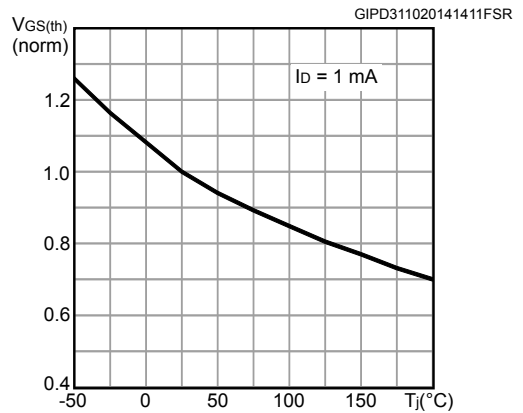


Figure 13. Normalized $R_{DS(on)}$ vs. temperature

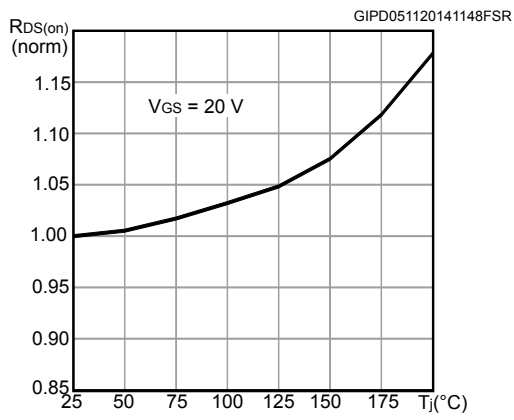
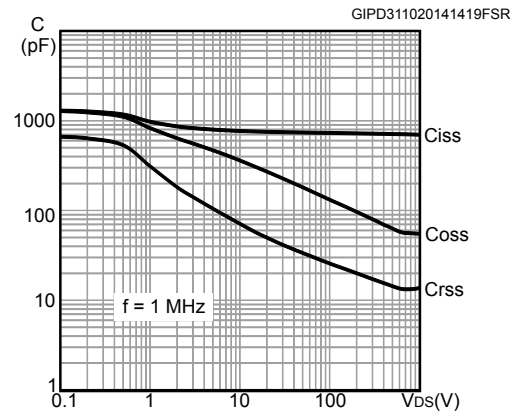
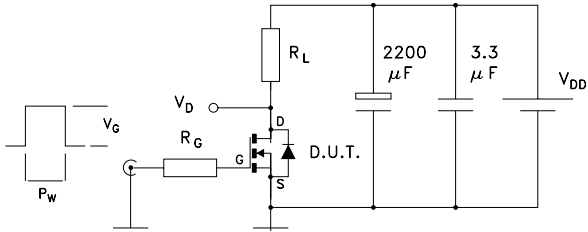


Figure 14. Capacitances variation



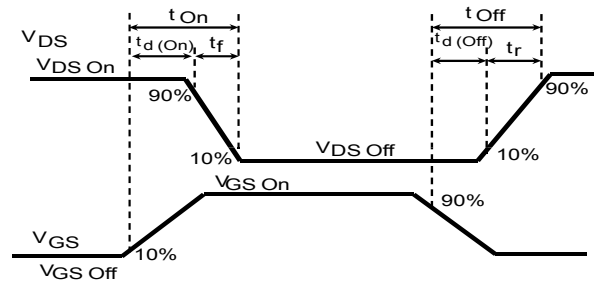
3 Test circuits

Figure 15. Switching test waveforms for transition times



GIPD101020141511FSR

Figure 16. Clamped inductive switching waveform



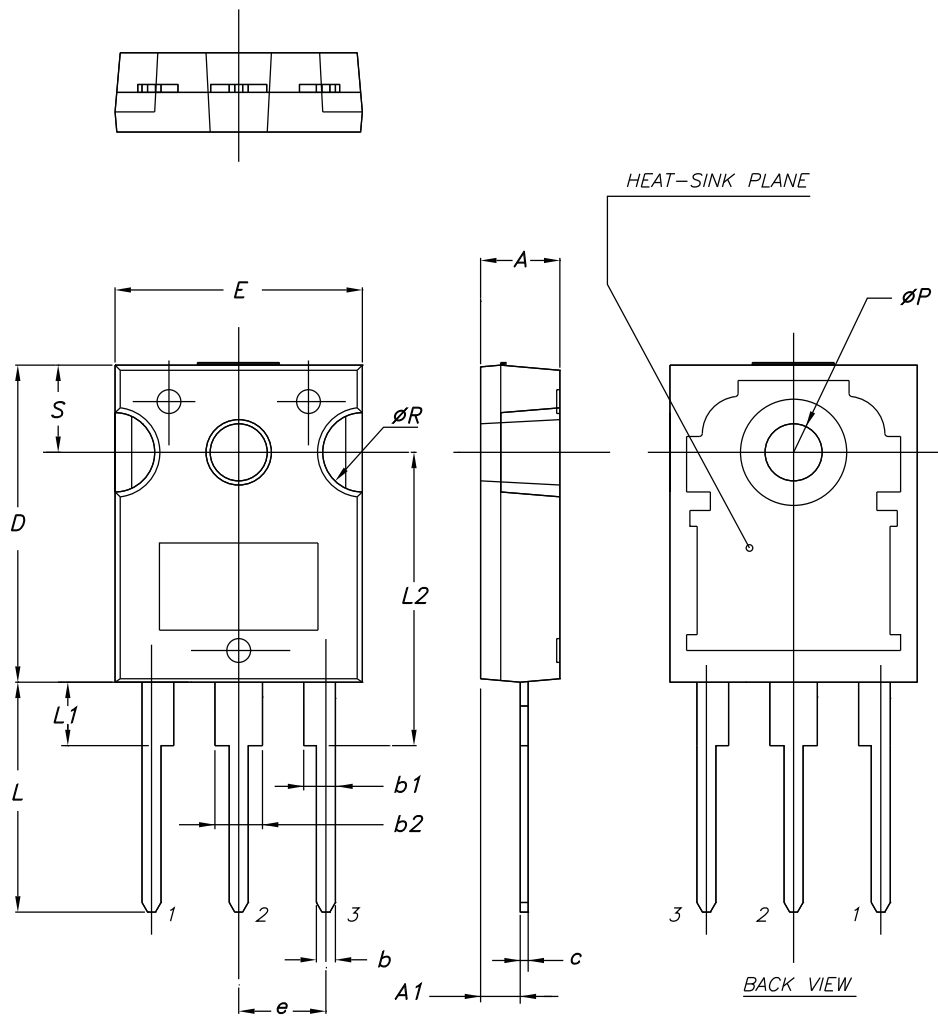
GIPD101020141502FSR

4 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.

4.1 HiP247 package information

Figure 17. HiP247 package outline



8396756_2

Table 8. HiP247 package mechanical data

| Dim. | mm | | |
|------|-------|-------|-------|
| | Min. | Typ. | Max. |
| A | 4.85 | 5.00 | 5.15 |
| A1 | 2.20 | | 2.60 |
| b | 1.0 | | 1.40 |
| b1 | 2.0 | | 2.40 |
| b2 | 3.0 | | 3.40 |
| c | 0.40 | | 0.80 |
| D | 19.85 | | 20.15 |
| E | 15.45 | | 15.75 |
| e | 5.30 | 5.45 | 5.60 |
| L | 14.20 | | 14.80 |
| L1 | 3.70 | | 4.30 |
| L2 | | 18.50 | |
| ∅P | 3.55 | | 3.65 |
| ∅R | 4.50 | | 5.50 |
| S | 5.30 | 5.50 | 5.70 |

Revision history

Table 9. Document revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 07-Nov-2014 | 1 | First release |
| 17-Feb-2015 | 2 | Updated title in cover page. |
| 20-Feb-2015 | 3 | Updated <i>Figure 3: Thermal impedance</i> . Minor text changes. |
| 17-Dec-2015 | 4 | Updated title in cover page and <i>Table 4: On/off states</i> . |
| 17-Sep-2019 | 5 | Updated <i>Figure 1. Safe operating area</i> and <i>Section 4.1 HiP247 package information</i> . Minor text changes. |

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