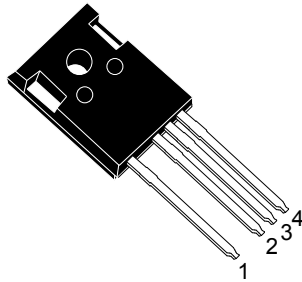
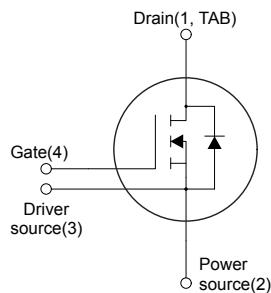


Automotive-grade silicon carbide Power MOSFET 1200 V, 63 mΩ typ., 30 A in an HiP247-4 package



HiP247-4




ND1TPS2DS3G4



Features

| Order code | V _{DS} | R _{DS(on)} typ. | I _D |
|------------------|-----------------|--------------------------|----------------|
| SCT070W120G3-4AG | 1200 V | 63 mΩ | 30 A |

- AEC-Q101 qualified 
- Very fast and robust intrinsic body diode
- Extremely low gate charge and input capacitance
- Very high operating junction temperature capability (T_J = 200 °C)
- Source sensing pin for increased efficiency

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.

Product status link

[SCT070W120G3-4AG](#)

Product summary

| | |
|------------|------------------|
| Order code | SCT070W120G3-4AG |
| Marking | 070W120G3AG |
| Package | HiP247-4 |
| 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 22 | V |
| | Gate-source voltage (recommended operating values) | -5 to 18 | |
| | Gate-source transient voltage, $t_p < 1 \mu s$, $t \leq 10$ hours over lifetime | -11 to 25 | |
| $I_D^{(1)}$ | Drain current (continuous) at $T_C = 25 \text{ }^\circ\text{C}$ | 30 | A |
| | Drain current (continuous) at $T_C = 100 \text{ }^\circ\text{C}$ | 29 | |
| $I_{DM}^{(2)}$ | Drain current (pulsed) | 116 | A |
| P_{TOT} | Total power dissipation at $T_C = 25 \text{ }^\circ\text{C}$ | 236 | W |
| T_{stg} | Storage temperature range | -55 to 200 | $^\circ\text{C}$ |
| T_J | Operating junction temperature range | | $^\circ\text{C}$ |

- I_D is limited by package.
- Pulse width is limited by safe operating area.

Table 2. Thermal data

| Symbol | Parameter | Value | Unit |
|------------|---|-------|---------------------------|
| R_{thJC} | Thermal resistance, junction-to-case | 0.74 | $^\circ\text{C}/\text{W}$ |
| R_{thJA} | Thermal resistance, junction-to-ambient | 40 | $^\circ\text{C}/\text{W}$ |

2 Electrical characteristics

$T_C = 25\text{ °C}$ unless otherwise specified.

Table 3. On/off states

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|-----------------------------------|--|------|------|-----------|---------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$ | 1200 | | | V |
| I_{DSS} | Zero gate voltage drain current | $V_{GS} = 0\text{ V}$, $V_{DS} = 1200\text{ V}$ | | | 10 | μA |
| 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 | $V_{DS} = V_{GS}$, $I_D = 1\text{ mA}$ | 1.8 | 3.0 | 4.2 | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS} = 15\text{ V}$, $I_D = 15\text{ A}$ | | 78 | | m Ω |
| | | $V_{GS} = 18\text{ V}$, $I_D = 15\text{ A}$ | | 63 | 87 | |
| | | $V_{GS} = 18\text{ V}$, $I_D = 15\text{ A}$, $T_J = 200\text{ °C}$ | | 138 | | |

Table 4. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|------------|------------------------------|---|------|------|------|----------|
| C_{iss} | Input capacitance | $V_{DS} = 850\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$ | - | 900 | - | pF |
| C_{oss} | Output capacitance | | - | 40 | - | pF |
| C_{riss} | Reverse transfer capacitance | | - | 5 | - | pF |
| Q_g | Total gate charge | $V_{DD} = 850\text{ V}$, $V_{GS} = -5\text{ to }18\text{ V}$, $I_D = 15\text{ A}$ | - | 41 | - | nC |
| Q_{gs} | Gate-source charge | | - | 11 | - | nC |
| Q_{gd} | Gate-drain charge | | - | 17 | - | nC |
| R_g | Gate input resistance | $f = 1\text{ MHz}$, $I_D = 0\text{ A}$ | - | 1.5 | - | Ω |

Table 5. Switching energy (inductive load)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|---------------------------|--|------|------|------|---------------|
| E_{on} | Turn-on switching energy | $V_{DD} = 850\text{ V}$, $I_D = 15\text{ A}$, | - | 237 | - | μJ |
| E_{off} | Turn-off switching energy | $R_G = 10\text{ }\Omega$, $V_{GS} = -5\text{ V to }18\text{ V}$ | - | 67 | - | μJ |

Table 6. Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------------|---------------------|---|------|------|------|------|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD} = 850\text{ V}$, $I_D = 15\text{ A}$, $R_G = 10\text{ }\Omega$, $V_{GS} = -5\text{ to }18\text{ V}$ | - | 9.5 | - | ns |
| t_r | Rise time | | - | 4.8 | - | ns |
| $t_{d(off)}$ | Turn-off delay time | | - | 23 | - | ns |
| t_f | Fall time | | - | 17 | - | ns |

Table 7. Reverse SiC diode characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|----------------|----------------------------------|---|------|------|------|------|
| $I_{SD}^{(1)}$ | Continuous diode forward current | $T_C = 25\text{ }^\circ\text{C}$ | - | | 30 | A |
| | | $T_C = 100\text{ }^\circ\text{C}$ | - | | 22 | |
| V_{SD} | Diode forward voltage | $I_{SD} = 15\text{ A}$, $V_{GS} = 0\text{ V}$ | - | 3 | 3.9 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 15\text{ A}$, $di/dt = 1000\text{ A}/\mu\text{s}$, $V_{DD} = 850\text{ V}$ | - | 15 | | ns |
| Q_{rr} | Reverse recovery charge | | - | 75 | | nC |
| I_{RRM} | Reverse recovery current | | - | 8.4 | | A |

1. I_{SD} is limited by package.

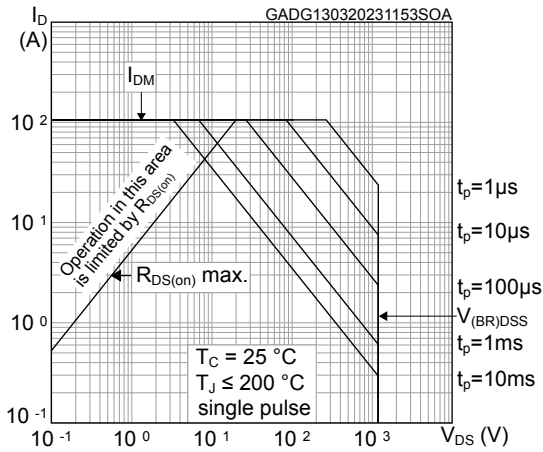
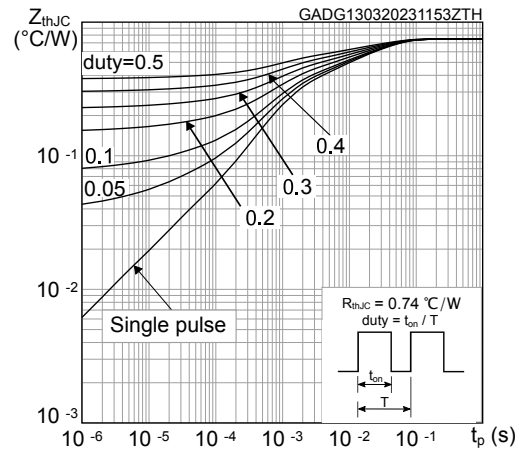
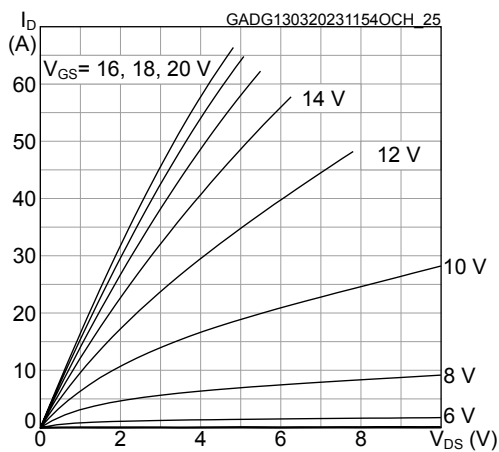
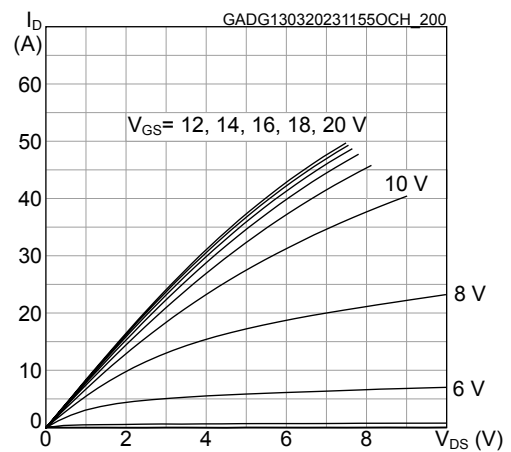
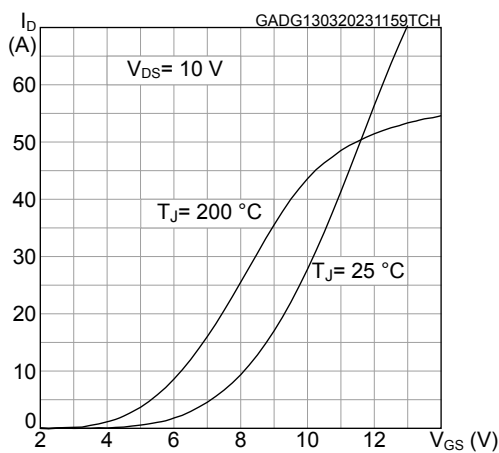
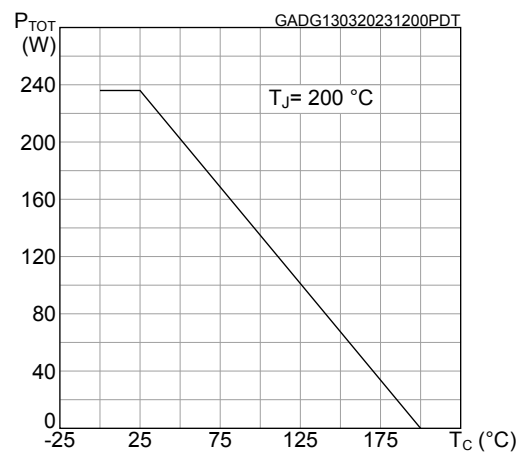
2.1 Electrical characteristics (curves)
Figure 1. Safe operating area

Figure 2. Maximum transient thermal impedance

Figure 3. Typical output characteristics ($T_J = 25\text{ °C}$)

Figure 4. Typical output characteristics ($T_J = 200\text{ °C}$)

Figure 5. Typical transfer characteristics

Figure 6. Total power dissipation


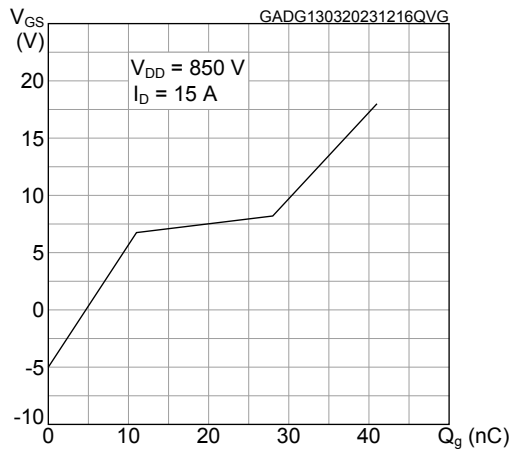
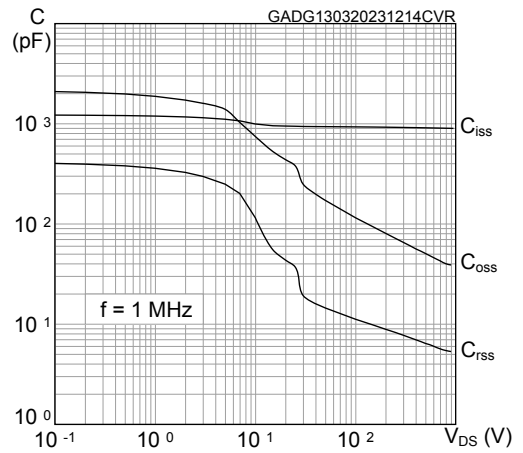
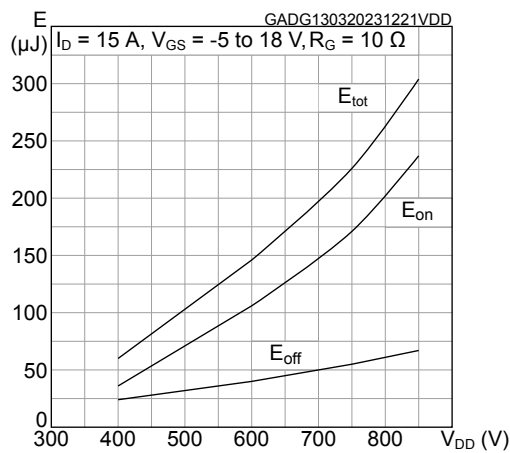
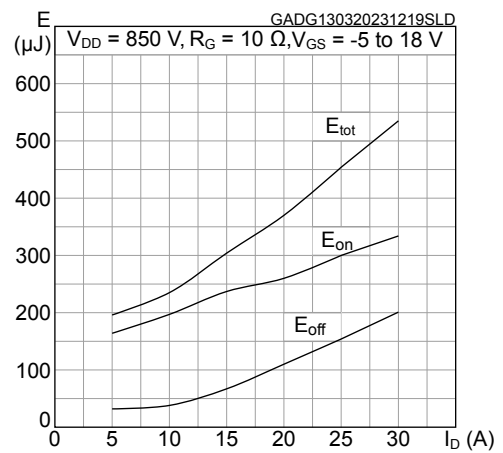
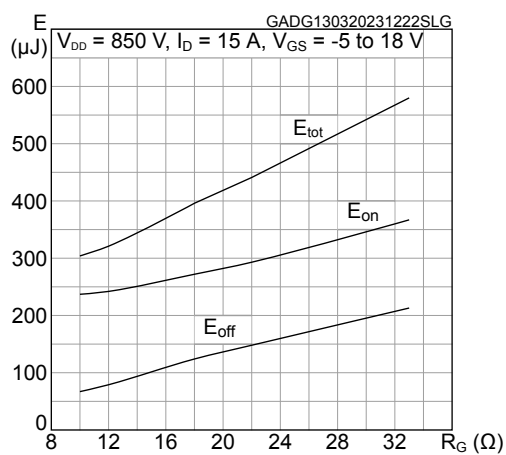
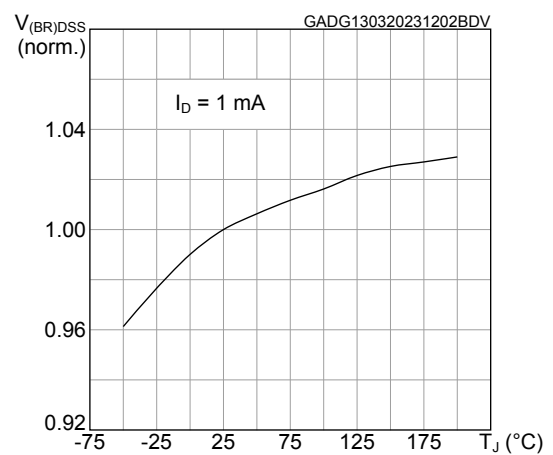
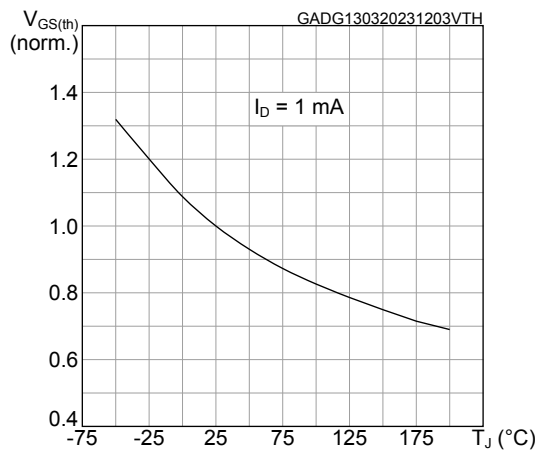
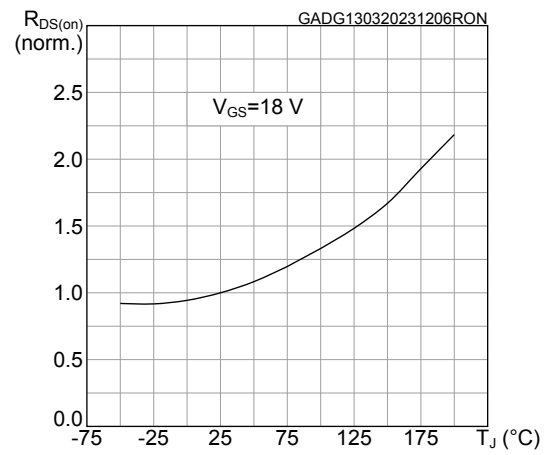
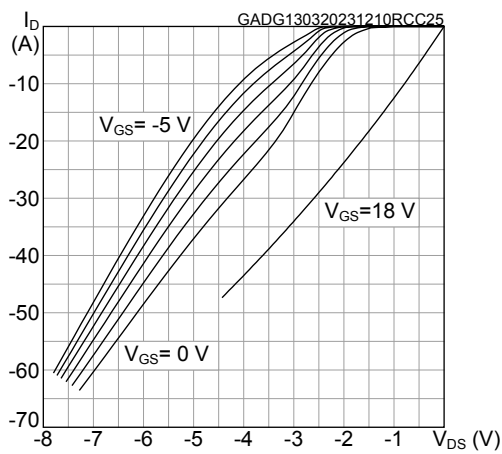
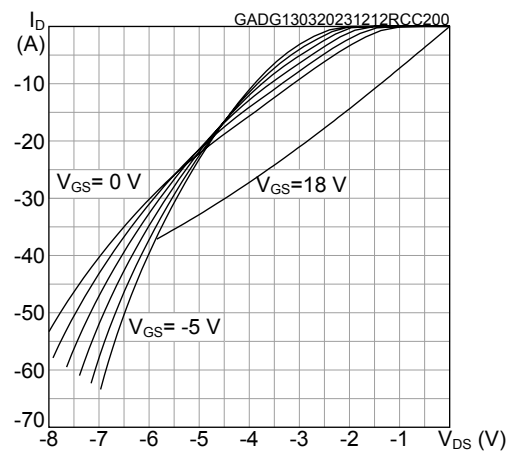
Figure 7. Typical gate charge characteristics

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. Normalized breakdown voltage vs temperature


Figure 13. Normalized gate threshold vs temperature

Figure 14. Normalized on-resistance vs temperature

Figure 15. Typical reverse conduction characteristics ($T_J = 25 \text{ }^\circ\text{C}$)

Figure 16. Typical reverse conduction characteristics ($T_J = 200 \text{ }^\circ\text{C}$)


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 HiP247-4 package information

Figure 17. HiP247-4 package outline

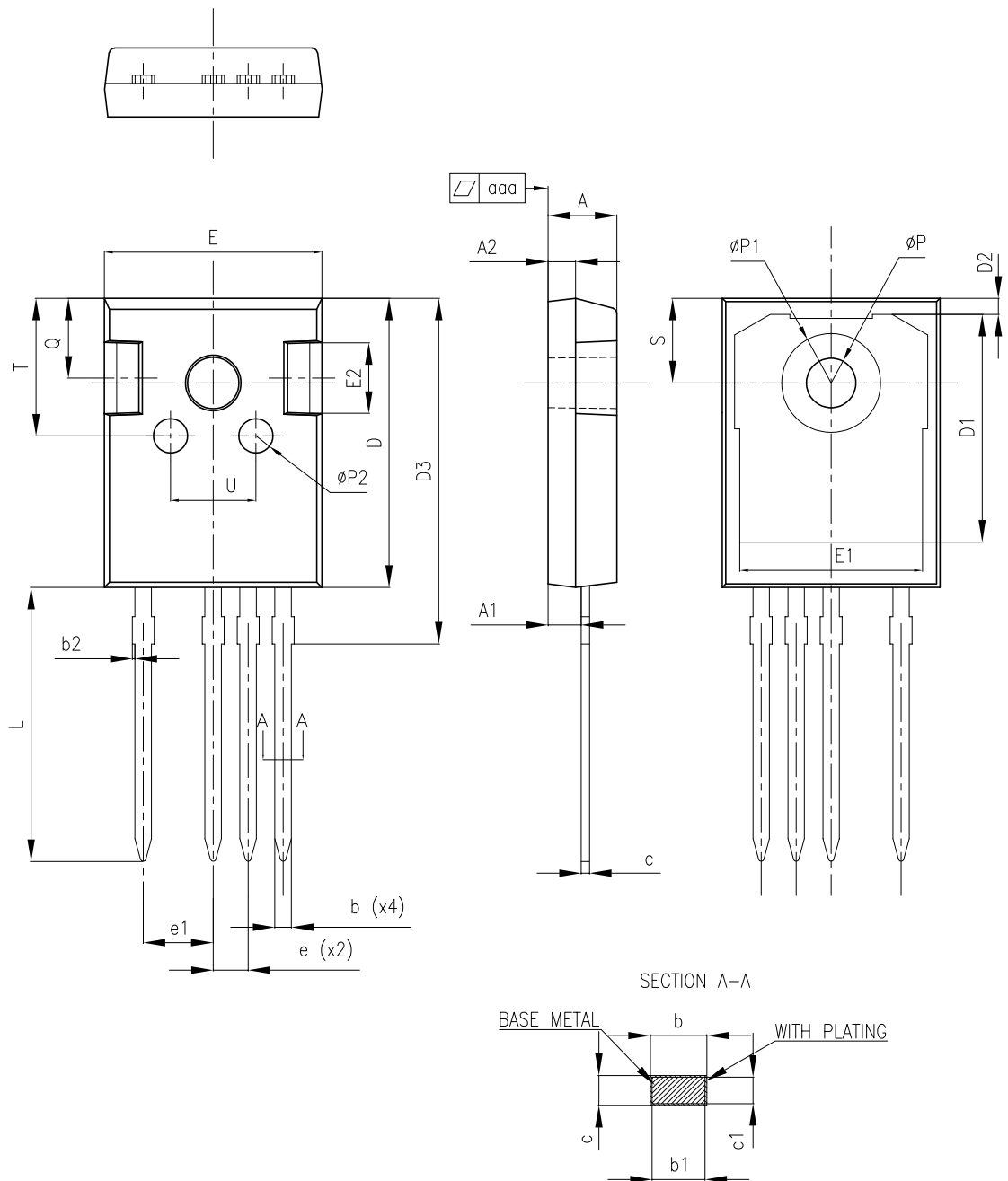


Table 8. HiP247-4 mechanical data

| Dim. | mm | | |
|------|-------|-------|-------|
| | Min. | Typ. | Max. |
| A | 4.90 | 5.00 | 5.10 |
| A1 | 2.31 | 2.41 | 2.51 |
| A2 | 1.90 | 2.00 | 2.10 |
| b | 1.16 | | 1.29 |
| b1 | 1.15 | 1.20 | 1.25 |
| b2 | 0 | | 0.20 |
| c | 0.59 | | 0.66 |
| c1 | 0.58 | 0.60 | 0.62 |
| D | 20.90 | 21.00 | 21.10 |
| D1 | 16.25 | 16.55 | 16.85 |
| D2 | 1.05 | 1.20 | 1.35 |
| D3 | 24.97 | 25.12 | 25.27 |
| E | 15.70 | 15.80 | 15.90 |
| E1 | 13.10 | 13.30 | 13.50 |
| E2 | 4.90 | 5.00 | 5.10 |
| E3 | 2.40 | 2.50 | 2.60 |
| e | 2.44 | 2.54 | 2.64 |
| e1 | 4.98 | 5.08 | 5.18 |
| L | 19.80 | 19.92 | 20.10 |
| P | 3.50 | 3.60 | 3.70 |
| P1 | | | 7.40 |
| P2 | 2.40 | 2.50 | 2.60 |
| Q | 5.60 | | 6.00 |
| S | | 6.15 | |
| T | 9.80 | | 10.20 |
| U | 6.00 | | 6.40 |
| aaa | | 0.04 | 0.10 |

Revision history

Table 9. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 14-Mar-2023 | 1 | First release. |
| 19-Dec-2023 | 2 | Updated Table 7 . Reverse SiC diode characteristics. |

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