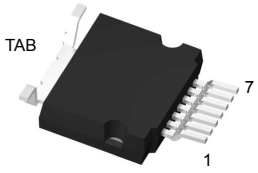
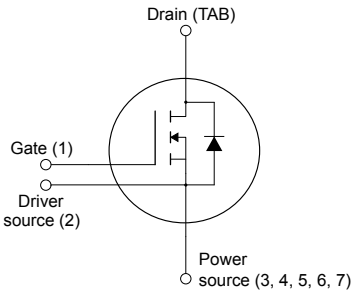
# SCT011HU75G3AG

Datasheet

## Automotive-grade silicon carbide Power MOSFET 750 V, 11.4 mΩ typ., 110 A in an HU3PAK package




HU3PAK




N-chG1DS2PS34567DTAB

## Features

| Order code | $V_{DS}$ | $R_{DS(on)}$ typ. | $I_D$ |
|---|---|---|---|
| SCT011HU75G3AG | 750 V | 11.4 mΩ | 110 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
- Source sensing pin for increased efficiency

## Applications

- DC/DC converter for EV/HEV
- Main inverter (electric traction)
- 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 |
|---|
| SCT011HU75G3AG |

| Product summary | |
|---|---|
| **Order code** | SCT011HU75G3AG |
| **Top-side marking** | 11HU75G3AG |
| **Back-side marking** | SCT11HU75G3A |
| **Package** | HU3PAK |
| **Packing** | Tape and reel |

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DS}$ | Drain-source voltage | 750 | 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 | 110 | A |
| | Drain current (continuous) at $T_C$ = 100 °C | 110 | |
| $I_{DM}$(2) | Drain current (pulsed) | 532 | A |
| $P_{TOT}$ | Total power dissipation at $T_C$ = 25 °C | 652 | W |
| $T_{stg}$ | Storage temperature range | -55 to 175 | °C |
| $T_J$ | Operating junction temperature range | | °C |

1. *Limited by bonding wires.*
2. *Pulse width is limited by safe operating area.*

**Table 2. Thermal data**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{thJC}$ | Thermal resistance, junction-to-case | 0.23 | °C/W |
| $R_{thJA}$ | Thermal resistance, junction-to-ambient | 50 | °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 |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $V_{GS}$ = 0 V, $I_D$ = 1 mA | 750 | | | V |
| $I_{DSS}$ | Zero gate voltage drain current | $V_{GS}$ = 0 V, $V_{DS}$ = 750 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 | $V_{DS}$ = $V_{GS}$, $I_D$ = 1 mA | 1.8 | 3.2 | 4.2 | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS}$ = 18 V, $I_D$ = 80 A | | 11.4 | 15 | mΩ |
| | | $V_{GS}$ = 15 V, $I_D$ = 80 A | | 14.2 | | |
| | | $V_{GS}$ = 18 V, $I_D$ = 80 A, $T_J$ = 175 °C | | 17.1 | | |
| | | $V_{GS}$ = 15 V, $I_D$ = 80 A, $T_J$ = 175 °C | | 18.9 | | |

**Table 4. Dynamic**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input capacitance | $V_{DS}$ = 400 V, f = 1 MHz, $V_{GS}$ = 0 V | - | 3860 | - | pF |
| $C_{oss}$ | Output capacitance | | - | 300 | - | pF |
| $C_{rss}$ | Reverse transfer capacitance | | - | 31 | - | pF |
| $Q_g$ | Total gate charge | $V_{DD}$ = 400 V, $V_{GS}$ = -5 to 18 V, $I_D$ = 50 A | - | 154 | - | nC |
| $Q_{gs}$ | Gate-source charge | | - | 53.5 | - | nC |
| $Q_{gd}$ | Gate-drain charge | | - | 38 | - | nC |
| $R_g$ | Gate input resistance | f = 1 MHz, $I_D$ = 0 A | - | 1.2 | - | Ω |

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

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $E_{on}$ | Turn-on switching energy | $V_{DD}$ = 400 V, $I_D$ = 50 A, $R_G$ = 2.2 Ω, $V_{GS}$ = -5 to 18 V | - | 184 | - | µJ |
| $E_{off}$ | Turn-off switching energy | | - | 114 | - | µJ |

**Table 6. Switching times**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD}$ = 400 V, $I_D$ = 50 A, $R_G$ = 2.2 Ω, $V_{GS}$ = -5 to 18 V | - | 23 | - | ns |
| $t_r$ | Rise time | | - | 11 | - | ns |
| $t_{d(off)}$ | Turn-off delay time | | - | 42 | - | ns |
| $t_f$ | Fall time | | - | 9 | - | 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 °C | - | | 110 | A |
| | | $T_C$ = 100 °C | - | | 110 | |
| $V_{SD}$ | Diode forward voltage | $I_{SD}$ = 50 A, $V_{GS}$ = 0 V | - | 2.6 | | V |
| $t_{rr}$ | Reverse recovery time | $I_{SD}$ = 50 A, di/dt = 1 kA/µs, $V_{DD}$ = 400 V, $V_{GS}$ = -5 V | - | 22 | | ns |
| $Q_{rr}$ | Reverse recovery charge | | - | 186 | | nC |
| $I_{RRM}$ | Reverse recovery current | | - | 14 | | A |

1. *Limited by bonding wires.*

## 2.1 Electrical characteristics (curves)

**Figure 1. Safe operating area**

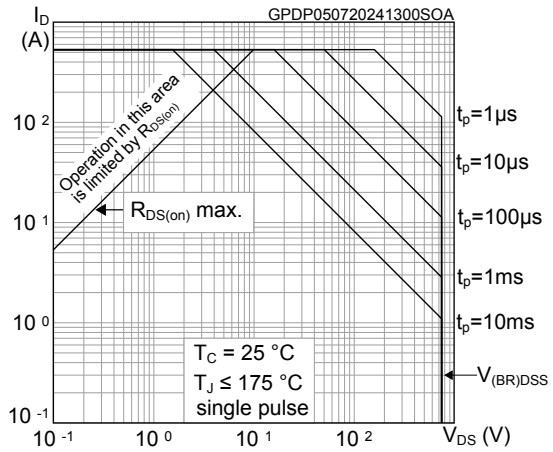



**Figure 2. Maximum transient thermal impedance**

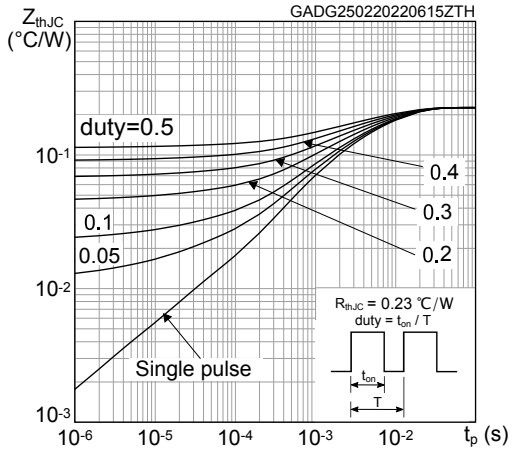



**Figure 3. Typical output characteristics ($T_J$ = 25 °C)**

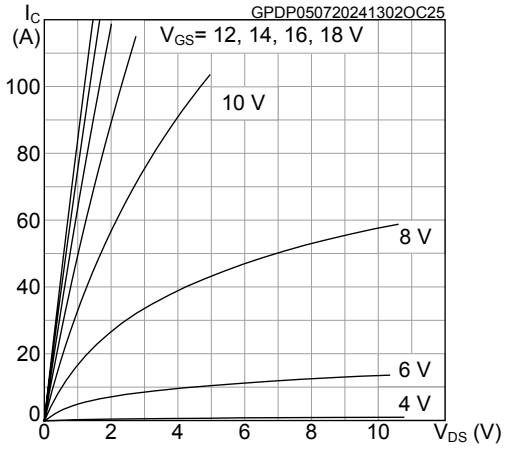



**Figure 4. Typical output characteristics ($T_J$ = 175 °C)**

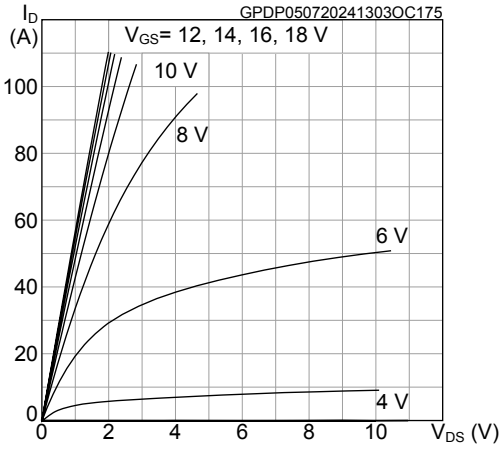



**Figure 5. Typical transfer characteristics**

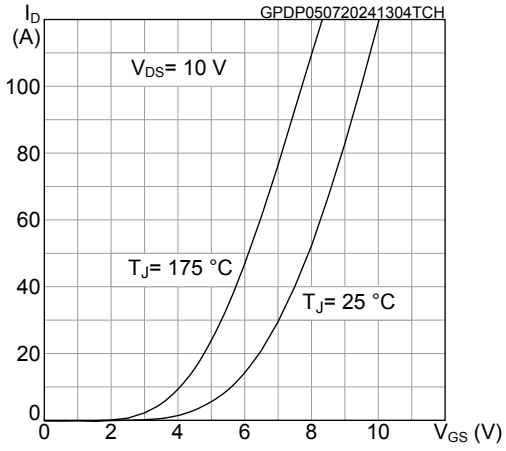



**Figure 6. Total power dissipation**

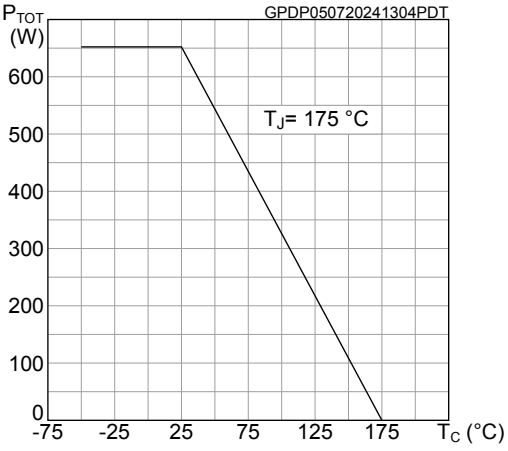


**Figure 7. Maximum continuous drain current vs case temperature**

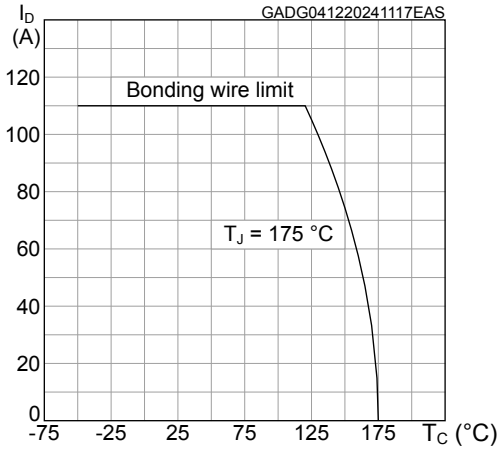



**Figure 8. Normalized breakdown voltage vs temperature**

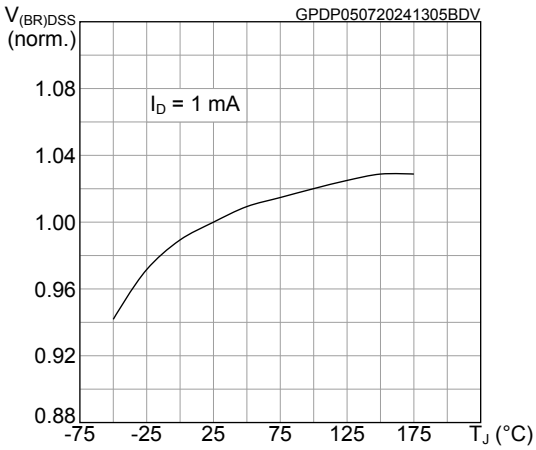



**Figure 9. Normalized gate threshold vs temperature**

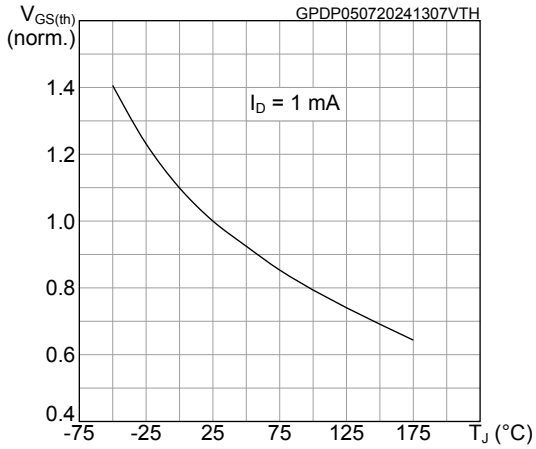



**Figure 10. Normalized on-resistance vs temperature**

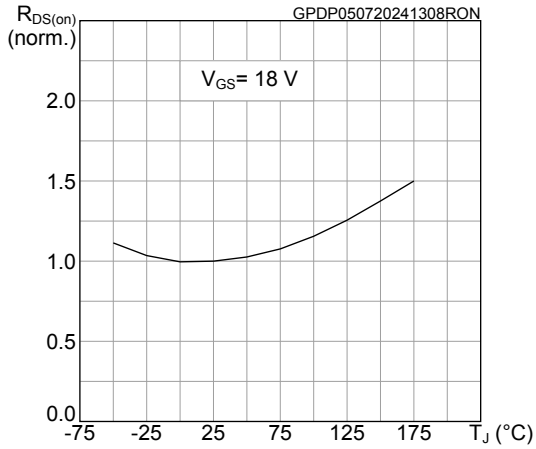



**Figure 11. Typical reverse diode characteristics ($T_J$ = 25 °C)**

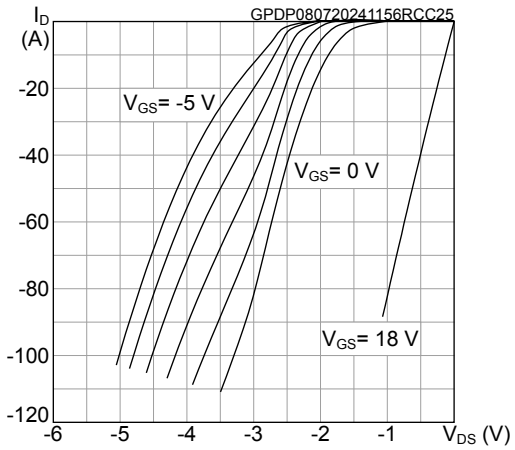



**Figure 12. Typical reverse diode characteristics ($T_J$ = 175 °C)**

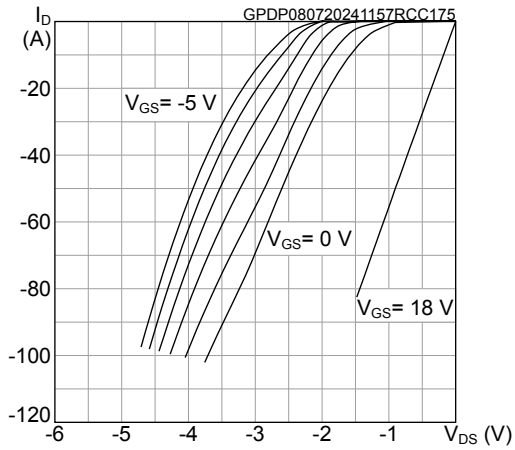


**Figure 13. Typical capacitance characteristics**

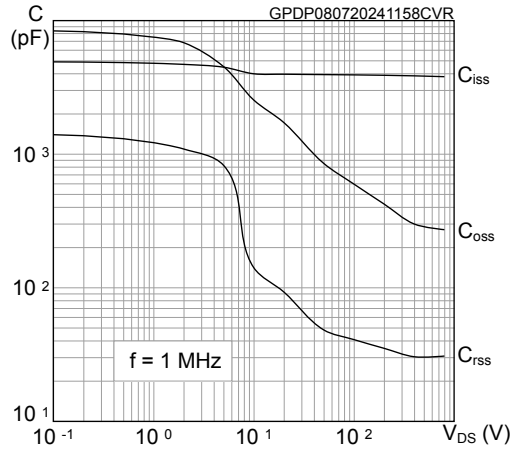



**Figure 14. Typical gate charge characteristics**

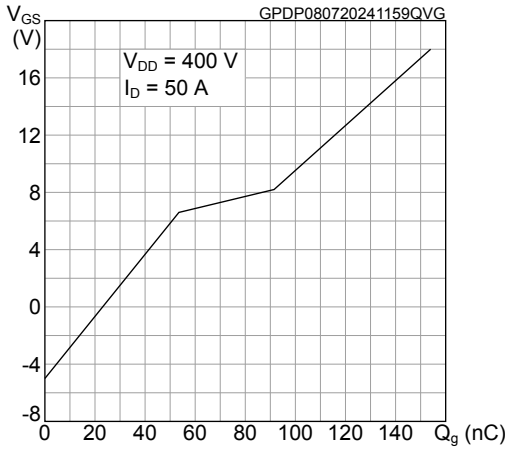



**Figure 15. Typical switching energy vs drain current**

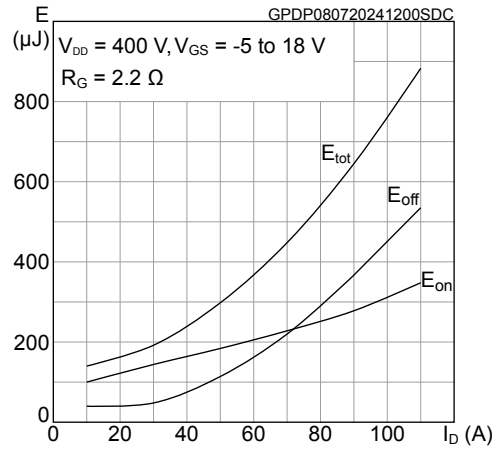



**Figure 16. Typical switching energy vs supply voltage**

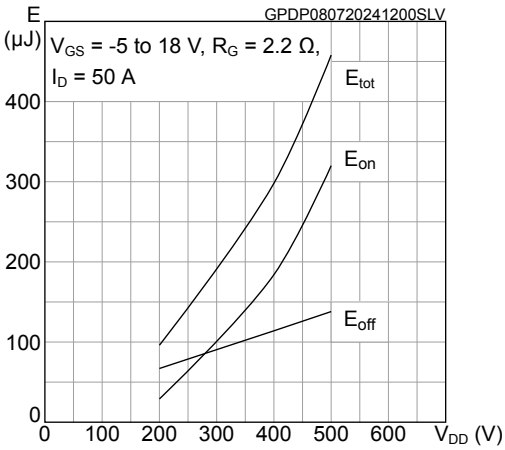



**Figure 17. Typical switching energy vs gate resistance**

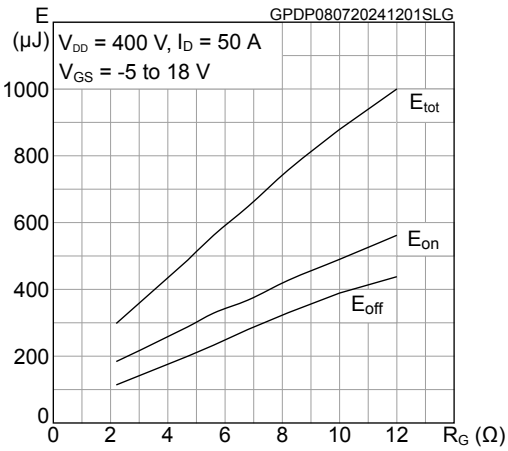
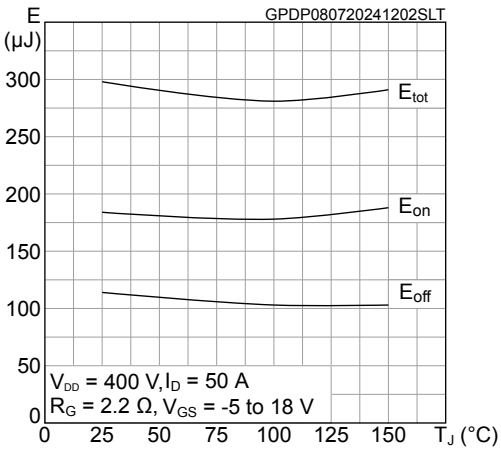



**Figure 18. Typical switching energy vs temperature**



# 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 HU3PAK package information

**Figure 19. HU3PAK package outline**

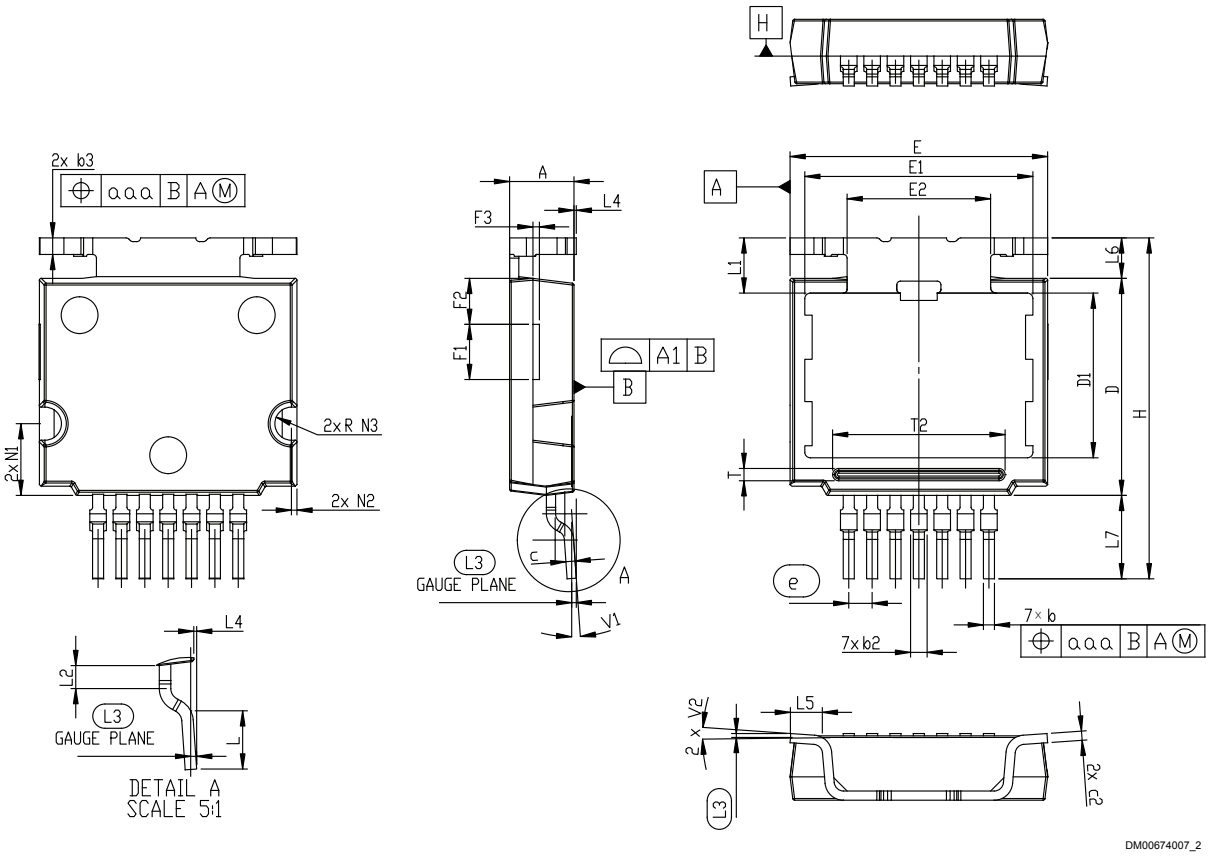
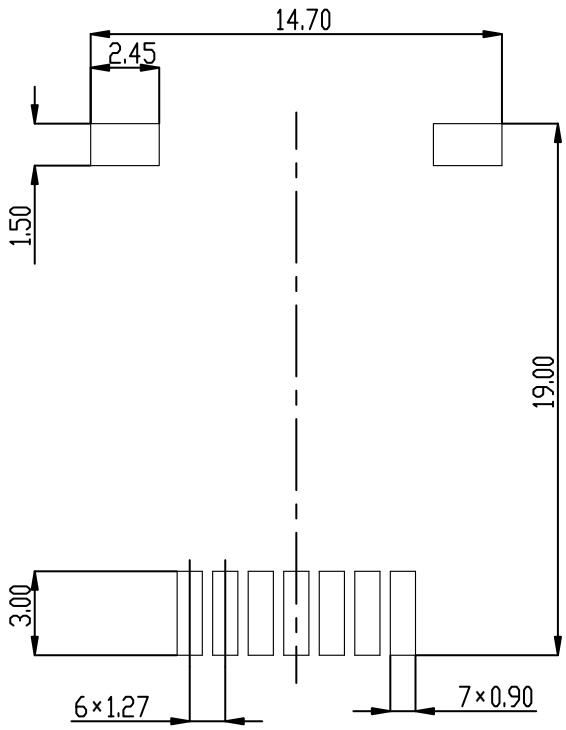


Table 8. **HU3PAK package mechanical data**

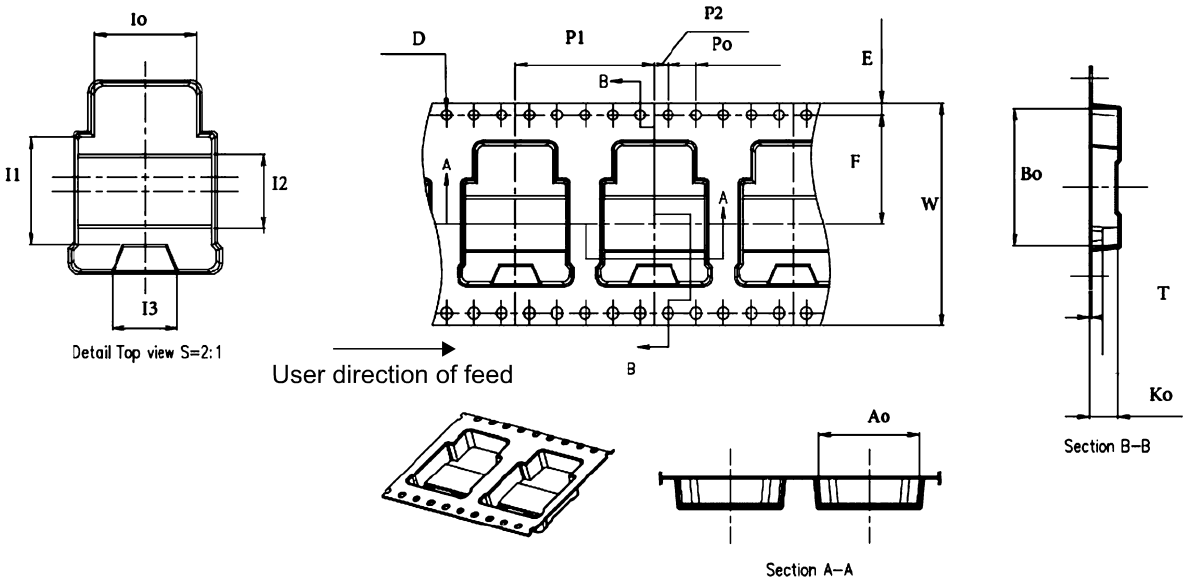
| Ref. | Dimensions | | |
|---|---|---|---|
| | mm | | |
| | Min. | Typ. | Max. |
| A | 3.40 | 3.50 | 3.60 |
| A1 | | 0.05 | |
| b | 0.50 | 0.60 | 0.70 |
| b2 | 0.50 | 0.70 | 1.00 |
| b3 | 0.80 | 0.90 | 1.00 |
| c | 0.40 | 0.50 | 0.60 |
| c2 | 0.40 | 0.50 | 0.60 |
| D | 11.70 | 11.80 | 11.90 |
| D1 | 8.80 | 8.955 | 9.10 |
| E | 13.90 | 14.00 | 14.10 |
| E1 | 12.30 | 12.40 | 12.50 |
| E2 | 7.75 | 7.80 | 7.85 |
| e | | 1.27 | |
| H | 18.00 | 18.58 | 19.00 |
| aaa | | 0.10 | |
| L | 2.40 | 2.52 | 2.60 |
| L1 | | 3.05 | |
| L2 | 0.90 | 1.00 | 1.10 |
| L3 | | 0.26 | |
| L4 | 0.075 | 0.125 | 0.175 |
| L5 | 1.83 | 1.93 | 2.03 |
| L6 | 2.14 | 2.24 | 2.34 |
| L7 | 4.44 | 4.54 | 4.64 |
| F1 | 2.90 | 3.00 | 3.10 |
| F2 | 2.40 | 2.50 | 2.60 |
| F3 | 0.25 | 0.35 | 0.45 |
| N1 | 3.80 | 3.90 | 4.00 |
| N2 | 0.25 | 0.30 | 0.45 |
| N3 | 0.80 | 0.90 | 1.00 |
| T | 0.50 | 0.67 | 0.70 |
| T2 | 9.18 | 9.38 | 9.43 |
| V1 | | 0 ° | 8 ° |
| V2 | | 0 ° | 8 ° |

Figure 20. **HU3PAK recommended footprint (dimensions in mm)**



## 3.2 HU3PAK packing information

Figure 21. **HU3PAK carrier tape outline**

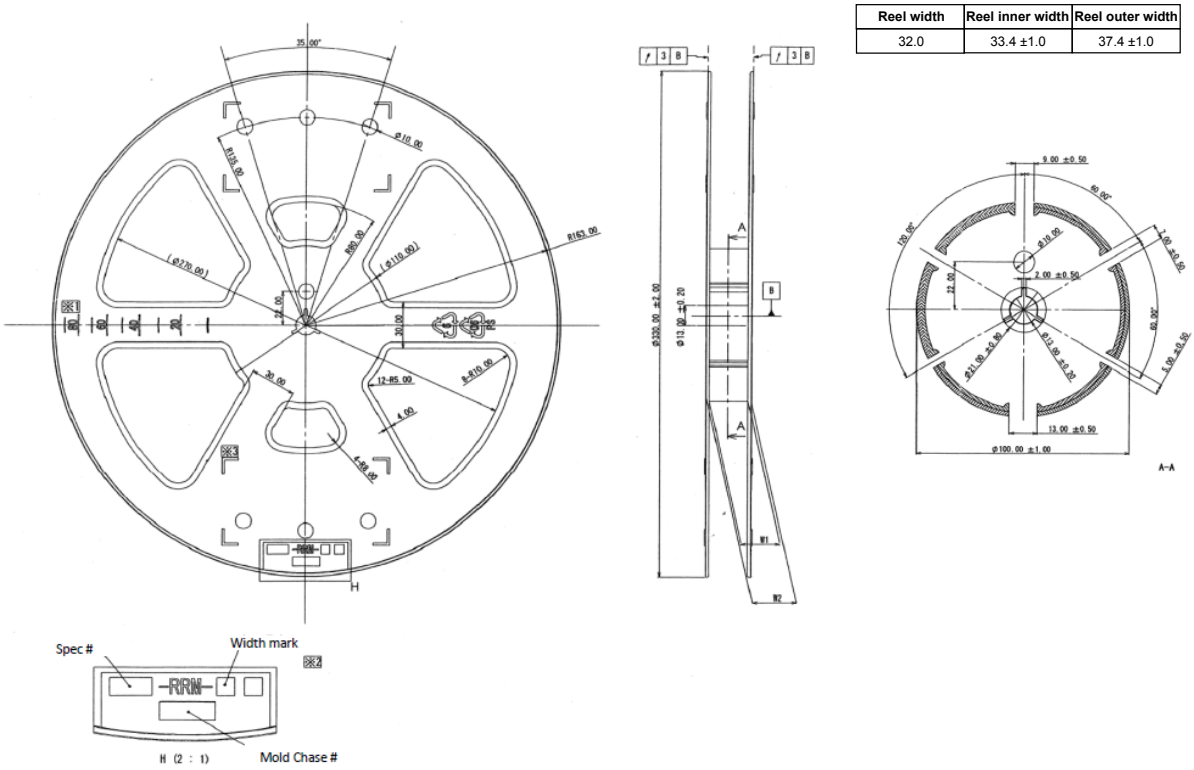



DM00345054_3

Table 9. **HU3PAK tape mechanical data**

| Dimension | Value |
|---|---|
| | mm |
| A0 | 14.40 ±0.10 |
| B0 | 19.70 |
| D | 1.50 ±0.10 |
| E | 1.75 ±0.10 |
| F | 15.65 ±0.10 |
| I0 | 11.00 |
| I1 | 11.60 ±0.10 |
| I2 | 8.00 |
| I3 | 7.00 |
| K0 | 4.20 |
| P0 | 4.00 ±0.10 |
| P1 | 20.00 ±0.10 |
| P2 | 2.00 ±0.10 |
| T | 0.40 ±0.50 |
| W | 32.00 ±0.30 |

Figure 22. **HU3PAK reel outline (dimensions are in mm)**




| Reel width | Reel inner width | Reel outer width |
|---|---|---|
| 32.0 | 33.4 ±1.0 | 37.4 ±1.0 |

DM00345054_3_reel

## Revision history

Table 10. **Document revision history**

| Date | Revision | Changes |
|---|---|---|
| 19-Apr-2022 | 1 | First release. |
| 12-Jul-2024 | 2 | Modified *Table 1. Absolute maximum ratings*, *Table 3. On/off states*, *Table 4. Dynamic*, *Table 5. Switching energy (inductive load)*, *Table 6. Switching times* and *Table 7. Reverse SiC diode characteristics*.<br>Updated *Section 2.1: Electrical characteristics (curves)*.<br>Minor text changes. |
| 11-Dec-2024 | 3 | Updated Section Device summary on cover page.<br>Added Figure 7. Maximum continuous drain current vs case temperature.<br>Minor text changes. |

# Contents