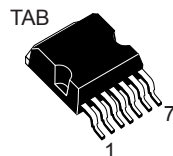
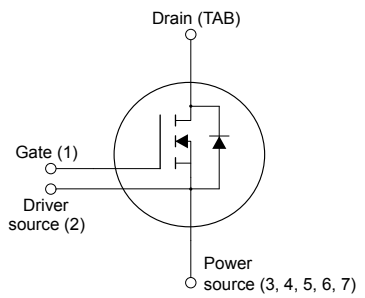


## Automotive-grade silicon carbide Power MOSFET 650 V, 20 mΩ typ., 95 A in an H<sup>2</sup>PAK-7 package



**H<sup>2</sup>PAK-7**


N-chG1DS2PS34567DTAB



### Features

| Order code       | V <sub>DS</sub> | R <sub>DS(on)</sub> max. | I <sub>D</sub> |
|------------------|-----------------|--------------------------|----------------|
| SCTH100N65G2-7AG | 650 V           | 26 mΩ                    | 95 A           |

- AEC-Q101 qualified 
- Very fast and robust intrinsic body diode
- Extremely low gate charge and input capacitance
- 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 2<sup>nd</sup> generation SiC MOSFET technology. The device features remarkably low on-resistance per unit area and very good switching performance. The variation of switching loss is almost independent of junction temperature.

#### Product status link

[SCTH100N65G2-7AG](#)

#### Product summary

|                   |                      |
|-------------------|----------------------|
| <b>Order code</b> | SCTH100N65G2-7AG     |
| <b>Marking</b>    | 100N65AG             |
| <b>Package</b>    | H <sup>2</sup> PAK-7 |
| <b>Packing</b>    | Tape and reel        |

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol         | Parameter  | Value      | Unit |
|----------------|--|------------|------|
| $V_{DS}$       | Drain-source voltage                                 | 650        | V    |
| $V_{GS}$       | Gate-source voltage                                  | -10 to 22  | V    |
|                | Gate-source voltage (recommended operational values) | -5 to 18   |      |
| $I_D$          | Drain current (continuous) at $T_C = 25\text{ °C}$   | 95         | A    |
|                | Drain current (continuous) at $T_C = 100\text{ °C}$  | 65         |      |
| $I_{DM}^{(1)}$ | Drain current (pulsed)                               | 260        | A    |
| $P_{TOT}$      | Total power dissipation at $T_C = 25\text{ °C}$      | 360        | W    |
| $T_{stg}$      | Storage temperature range                            | -55 to 175 | °C   |
| $T_J$          | Operating junction temperature range                 |            | °C   |

1. Pulse width is limited by safe operating area.

**Table 2. Thermal data**

| Symbol     | Parameter                               | Value | Unit |
|------------|---|-------|------|
| $R_{thJC}$ | Thermal resistance, junction-to-case    | 0.42  | °C/W |
| $R_{thJA}$ | Thermal resistance, junction-to-ambient | 50    | °C/W |

## 2 Electrical characteristics

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

**Table 3. On/off states**

| Symbol        | Parameter                         | Test conditions  | Min. | Typ. | Max.      | Unit          |
|---------------|-----------------------------------|--|------|------|-----------|---------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage    | $V_{GS} = 0\text{ V}$ , $I_D = 1\text{ mA}$                                      | 650  |      |           | V             |
| $I_{DSS}$     | Zero gate voltage drain current   | $V_{GS} = 0\text{ V}$ , $V_{DS} = 650\text{ V}$                                  |      |      | 10        | $\mu\text{A}$ |
| $I_{GSS}$     | Gate-body leakage current         | $V_{DS} = 0\text{ V}$ , $V_{GS} = -10\text{ to }22\text{ V}$                     |      |      | $\pm 100$ | nA            |
| $V_{GS(th)}$  | Gate threshold voltage            | $V_{DS} = V_{GS}$ , $I_D = 1\text{ mA}$  | 1.9  | 3.1  | 5.0       | V             |
| $R_{DS(on)}$  | Static drain-source on-resistance | $V_{GS} = 18\text{ V}$ , $I_D = 50\text{ A}$                                     |      | 20   | 26        | m $\Omega$    |
|               |                                   | $V_{GS} = 18\text{ V}$ , $I_D = 50\text{ A}$ , $T_J = 175\text{ }^\circ\text{C}$ |      | 32   |           |               |

**Table 4. Dynamic**

| Symbol     | Parameter                    | Test conditions   | Min. | Typ. | Max. | Unit     |
|------------|------------------------------|---|------|------|------|----------|
| $C_{iss}$  | Input capacitance            | $V_{DS} = 520\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0\text{ V}$                | -    | 3315 | -    | pF       |
| $C_{oss}$  | Output capacitance           |   | -    | 267  | -    | pF       |
| $C_{riss}$ | Reverse transfer capacitance |   | -    | 46   | -    | pF       |
| $Q_g$      | Total gate charge            | $V_{DS} = 520\text{ V}$ , $V_{GS} = -5\text{ to }18\text{ V}$ , $I_D = 50\text{ A}$ | -    | 162  | -    | nC       |
| $Q_{gs}$   | Gate-source charge           |   | -    | 45   | -    | nC       |
| $Q_{gd}$   | Gate-drain charge            |   | -    | 49   | -    | nC       |
| $R_G$      | Gate input resistance        | $f = 1\text{ MHz}$ , $I_D = 0\text{ A}$   | -    | 1    | -    | $\Omega$ |

**Table 5. Switching energy**

| Symbol    | Parameter                 | Test conditions  | Min. | Typ. | Max. | Unit          |
|-----------|---------------------------|--|------|------|------|---------------|
| $E_{on}$  | Turn-on switching energy  | $V_{DD} = 520\text{ V}$ , $I_D = 50\text{ A}$ ,                | -    | 486  | -    | $\mu\text{J}$ |
| $E_{off}$ | Turn-off switching energy | $R_G = 10\text{ }\Omega$ , $V_{GS} = -5\text{ to }18\text{ V}$ | -    | 506  | -    | $\mu\text{J}$ |

**Table 6. Reverse SiC diode characteristics**

| Symbol    | Parameter                | Test conditions   | Min. | Typ. | Max. | Unit |
|-----------|--------------------------|---|------|------|------|------|
| $V_{SD}$  | Diode forward voltage    | $I_F = 50\text{ A}$ , $V_{GS} = 0\text{ V}$   | -    | 2.8  | -    | V    |
| $t_{rr}$  | Reverse recovery time    | $I_F = 50\text{ A}$ , $di/dt = 2140\text{ A}/\mu\text{s}$ ,<br>$V_{DD} = 520\text{ V}$ , $R_G = 10\text{ }\Omega$ , $V_{GS} = -5\text{ to }18\text{ V}$ | -    | 26   | -    | ns   |
| $Q_{rr}$  | Reverse recovery charge  |   | -    | 370  | -    | nC   |
| $I_{RRM}$ | Reverse recovery current |   | -    | 24   | -    | A    |

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

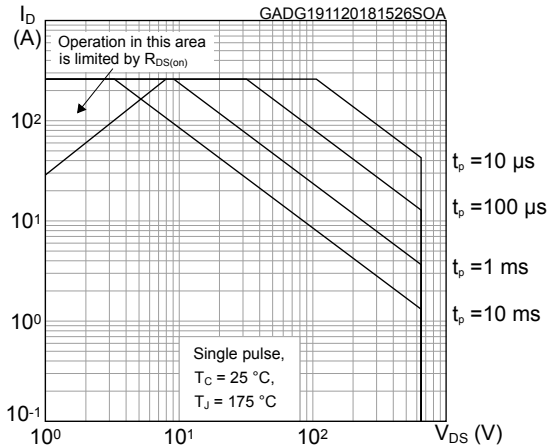


Figure 2. Thermal impedance

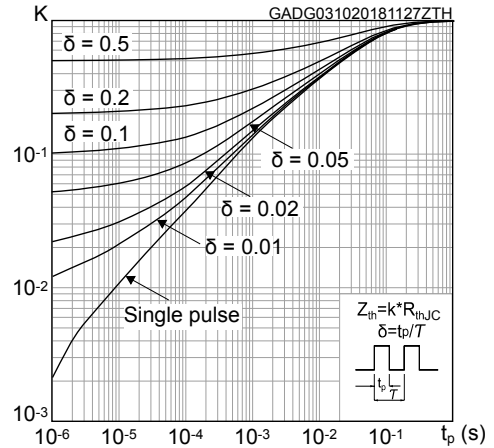


Figure 3. Output characteristics ( $T_J = 25^\circ C$ )

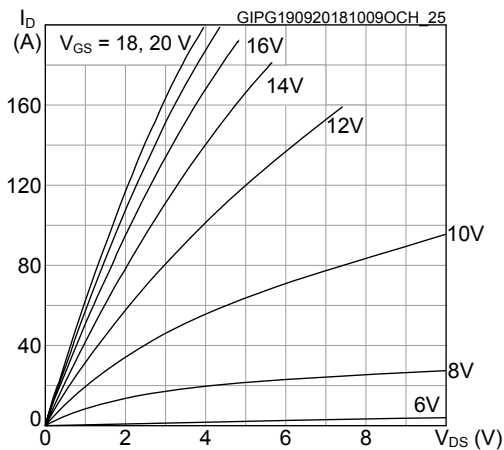


Figure 4. Output characteristics ( $T_J = 175^\circ C$ )

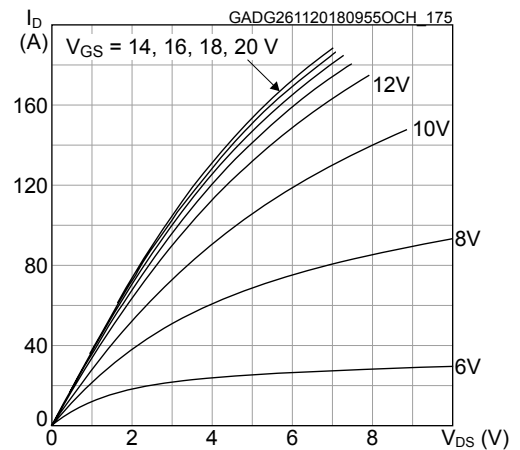


Figure 5. Transfer characteristics

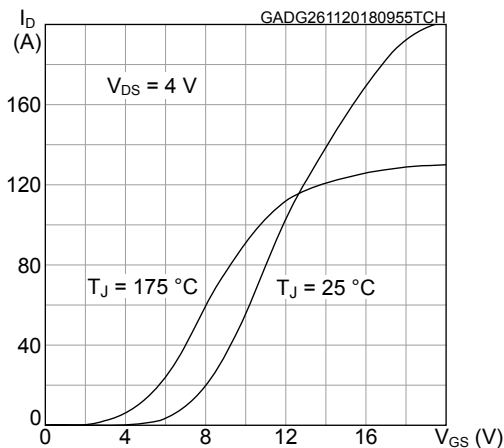
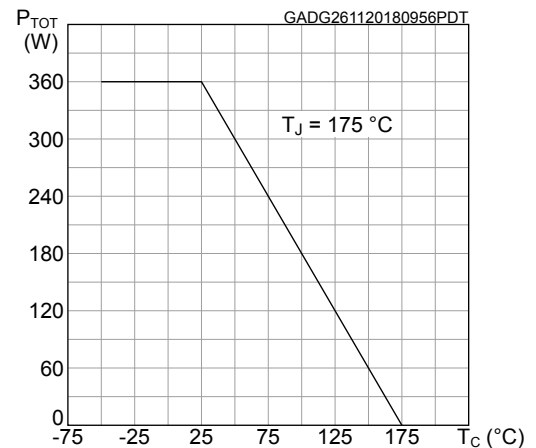
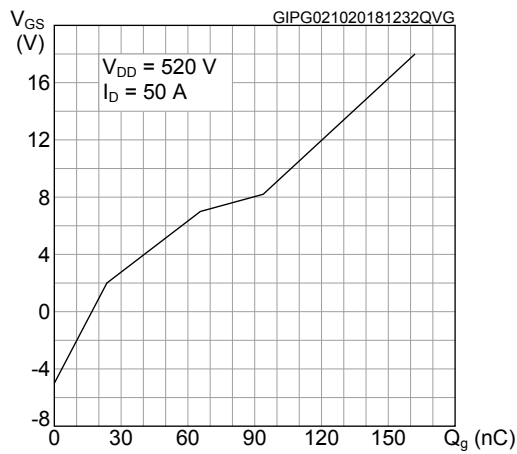


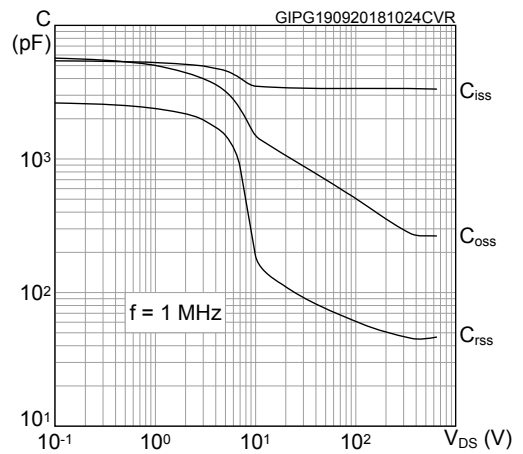
Figure 6. Total power dissipation



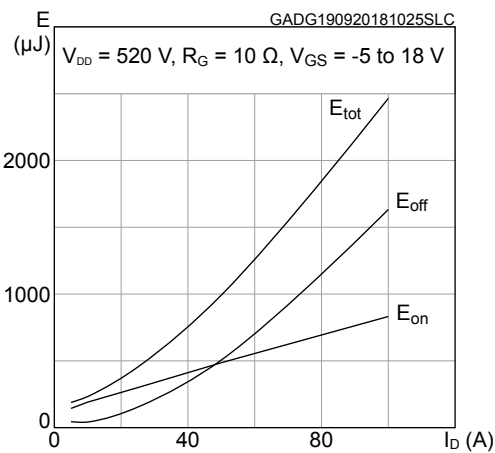
**Figure 7. Gate charge vs gate-source voltage**



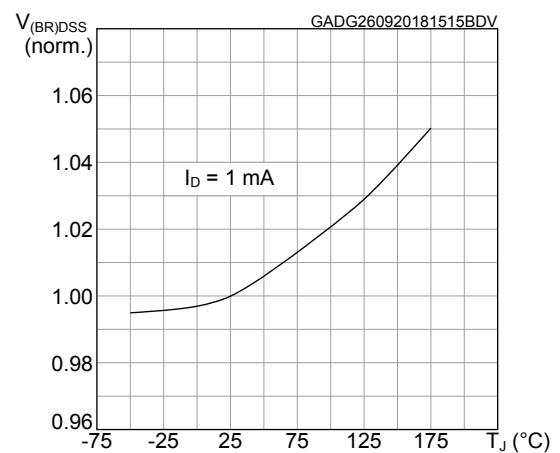
**Figure 8. Capacitance variations**



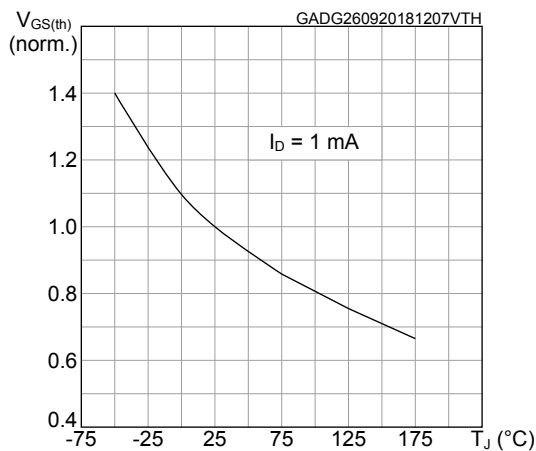
**Figure 9. Switching energy vs drain current**



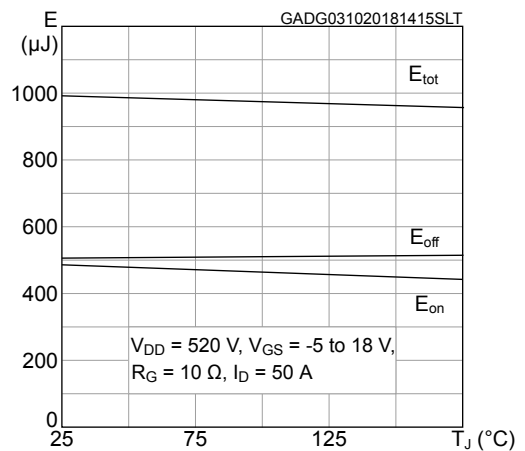
**Figure 10. Normalized  $V_{(BR)DSS}$  vs temperature**



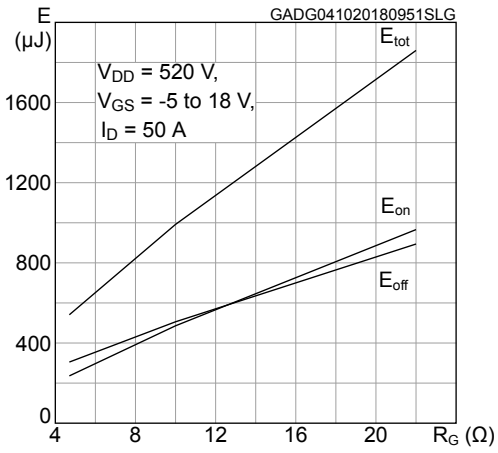
**Figure 11. Normalized gate threshold voltage**



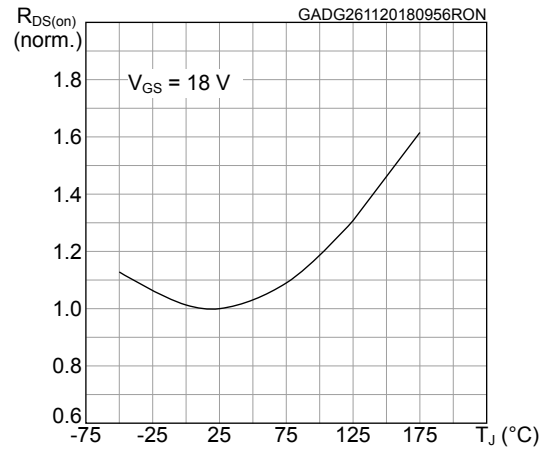
**Figure 12. Switching energy vs junction temperature**



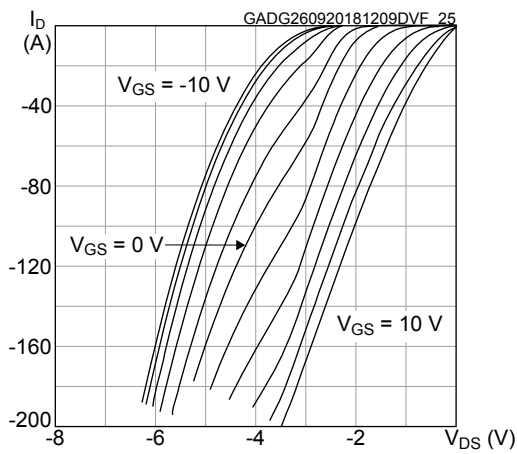
**Figure 13. Switching energy vs gate resistance**



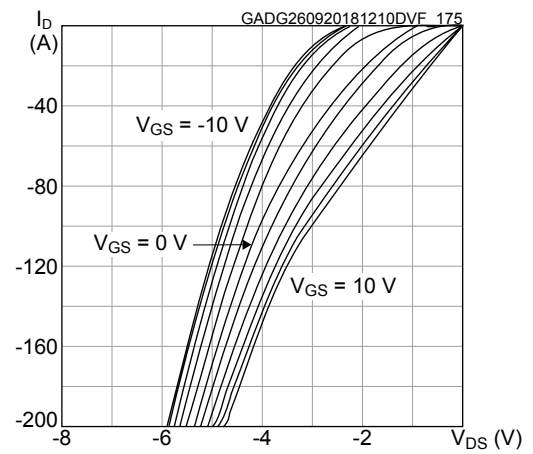
**Figure 14. Normalized on-resistance vs temperature**



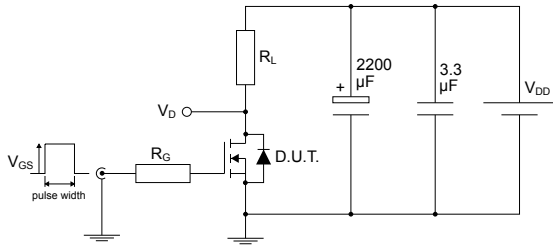
**Figure 15. Body diode characteristics ( $T_J = 25^{\circ}\text{C}$ )**



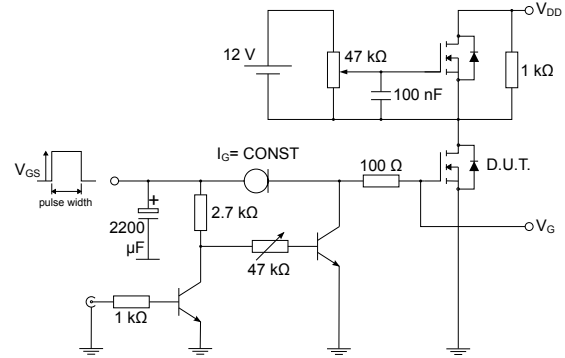
**Figure 16. Body diode characteristics ( $T_J = 175^{\circ}\text{C}$ )**



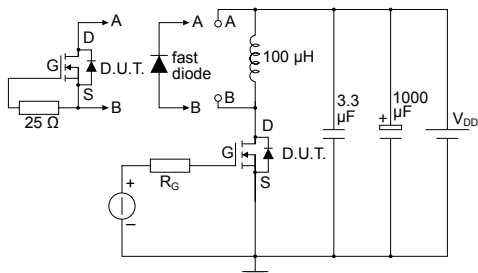
### 3 Test circuits

**Figure 17. Test circuit for resistive load switching times**


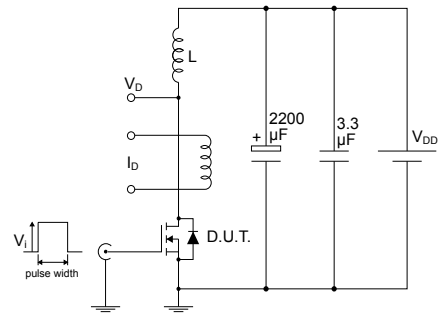
AM01468v1

**Figure 18. Test circuit for gate charge behavior**


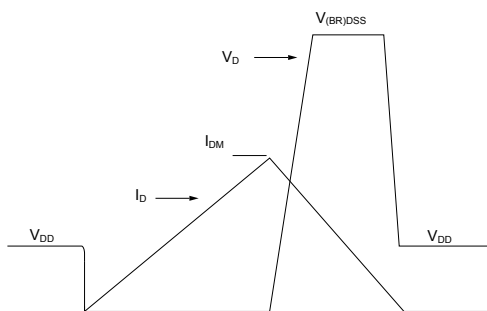
AM01469v1

**Figure 19. Test circuit for inductive load switching and diode recovery times**


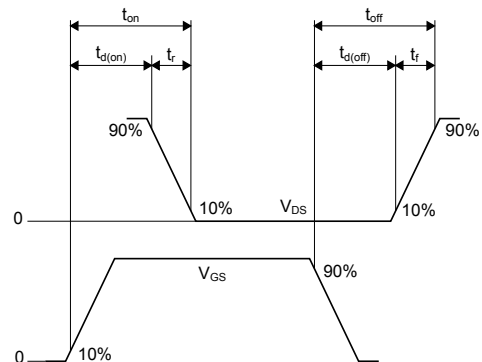
AM01470v1

**Figure 20. Unclamped inductive load test circuit**


AM01471v1

**Figure 21. Unclamped inductive waveform**


AM01472v1

**Figure 22. Switching time waveform**


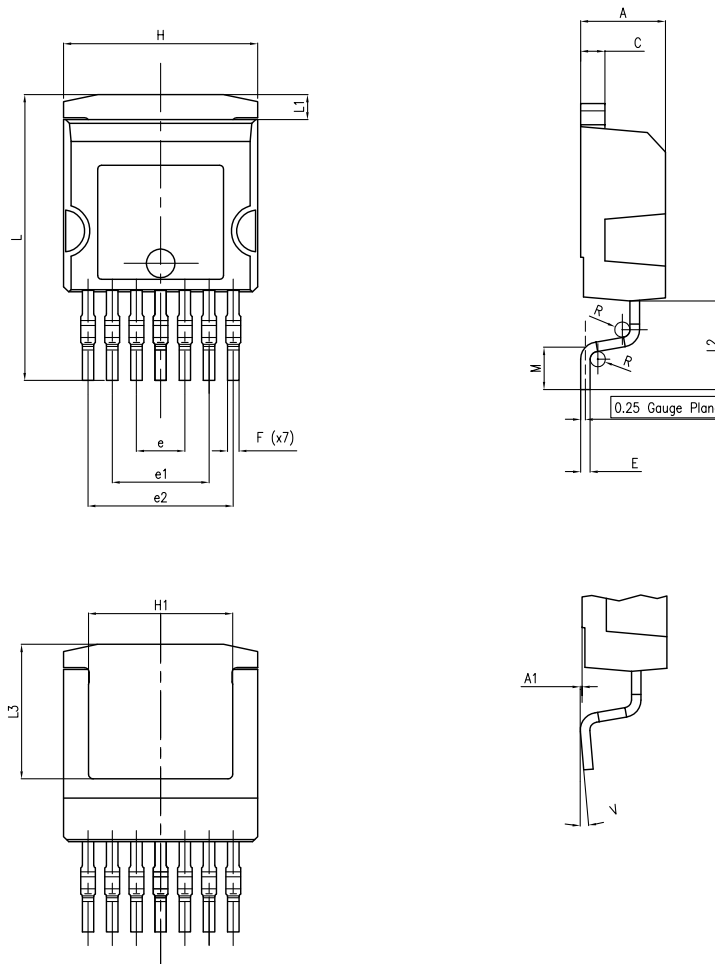
AM01473v1

## 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](http://www.st.com). ECOPACK is an ST trademark.

### 4.1 H<sup>2</sup>PAK-7 package information

Figure 23. H<sup>2</sup>PAK-7 package outline

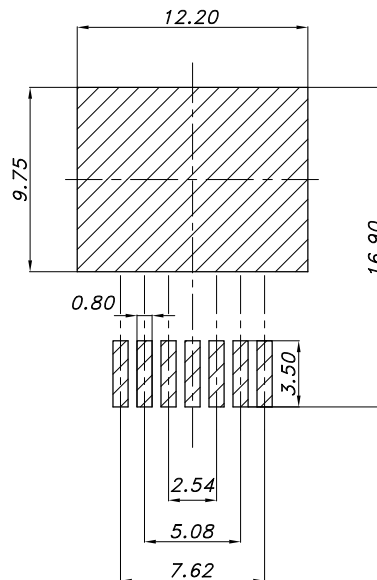




**Table 7. H<sup>2</sup>PAK-7 package mechanical data**

| Dim. | mm    |       |
|------|-------|-------|
|      | Min.  | Max.  |
| A    | 4.30  | 4.80  |
| A1   | 0.03  | 0.20  |
| C    | 1.17  | 1.37  |
| e    | 2.34  | 2.74  |
| e1   | 4.88  | 5.28  |
| e2   | 7.42  | 7.82  |
| E    | 0.45  | 0.60  |
| F    | 0.50  | 0.70  |
| H    | 10.00 | 10.40 |
| H1   | 7.40  | 7.60  |
| L    | 14.75 | 15.25 |
| L1   | 1.27  | 1.40  |
| L2   | 4.35  | 4.95  |
| L3   | 6.85  | 7.25  |
| M    | 1.90  | 2.50  |
| R    | 0.20  | 0.60  |
| V    | 0°    | 8°    |

**Figure 24. H<sup>2</sup>PAK-7 recommended footprint**

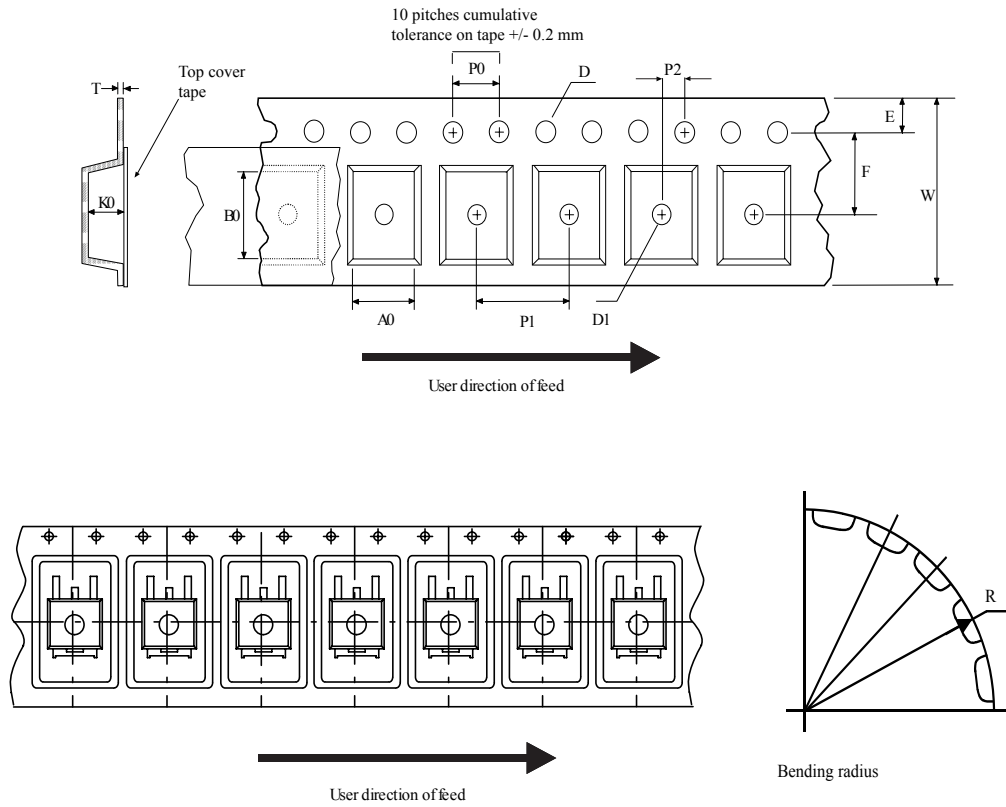


footprint\_DM00249216\_4

*Note: Dimensions are in mm.*

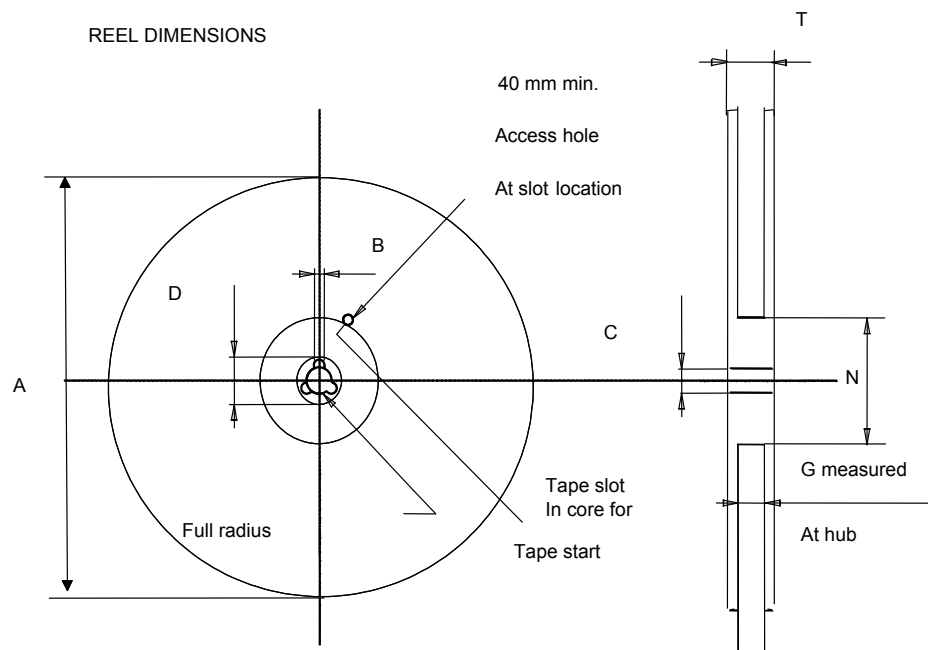
## 4.2 Packing information

Figure 25. Tape outline



AM08852v2

Figure 26. Reel outline



**Table 8. Tape and reel mechanical data**

| Tape |      |      | Reel          |      |      |
|------|------|------|---------------|------|------|
| Dim. | mm   |      | Dim.          | mm   |      |
|      | Min. | Max. |               | Min. | Max. |
| A0   | 10.5 | 10.7 | A             |      | 330  |
| B0   | 15.7 | 15.9 | B             | 1.5  |      |
| D    | 1.5  | 1.6  | C             | 12.8 | 13.2 |
| D1   | 1.59 | 1.61 | D             | 20.2 |      |
| E    | 1.65 | 1.85 | G             | 24.4 | 26.4 |
| F    | 11.4 | 11.6 | N             | 100  |      |
| K0   | 4.8  | 5.0  | T             |      | 30.4 |
| P0   | 3.9  | 4.1  |               |      |      |
| P1   | 11.9 | 12.1 | Base quantity |      | 1000 |
| P2   | 1.9  | 2.1  | Bulk quantity |      | 1000 |
| R    | 50   |      |               |      |      |
| T    | 0.25 | 0.35 |               |      |      |
| W    | 23.7 | 24.3 |               |      |      |

## Revision history

**Table 9. Document revision history**

| Date        | Revision | Changes  |
|-------------|----------|--|
| 27-Nov-2018 | 1        | First release.   |
| 18-Aug-2021 | 2        | Updated Features, Applications and Description.<br>Updated Table 3. On/off states and Table 6. Reverse SiC diode characteristics.<br>Minor text changes. |

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