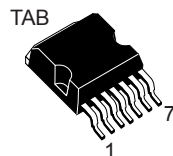
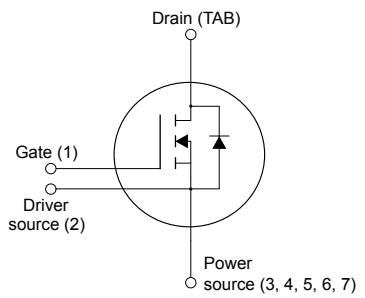


Automotive-grade silicon carbide Power MOSFET, 650 V, 45 A, 55 mΩ (typ., T_J = 25 °C) in an H²PAK-7 package


H²PAK-7



N-chG1DS2PS34567DTAB


Product status link
[SCTH35N65G2V-7AG](#)
Product summary

| | |
|-------------------|----------------------|
| Order code | SCTH35N65G2V-7AG |
| Marking | 35N65AG |
| Package | H ² PAK-7 |
| Packing | Tape and reel |

Features

| Order code | V _{DS} | R _{DS(on)} typ. | I _D |
|------------------|-----------------|--------------------------|----------------|
| SCTH35N65G2V-7AG | 650 V | 55 mΩ | 45 A |

- AEC-Q101 qualified 
- Very fast and robust intrinsic body diode
- Low capacitance

Applications

- Switching mode power supply
- EV chargers
- DC-DC converters

Description

This silicon carbide Power MOSFET device has been developed using ST's advanced and innovative 2nd generation SiC MOSFET technology. The device features remarkably low on-resistance per unit area and very good switching performance.

1 Electrical ratings

Table 1. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|----------------|--|------------|------|
| V_{GS} | Gate-source voltage | -10 to 22 | V |
| | Gate-source voltage (recommended operational values) | -5 to 20 | |
| V_{DS} | Drain-source voltage | 650 | V |
| I_D | Drain current (continuous) at $T_C = 25\text{ °C}$ | 45 | A |
| | Drain current (continuous) at $T_C = 100\text{ °C}$ | 35 | |
| $I_{DM}^{(1)}$ | Drain current (pulsed) | 90 | A |
| P_{TOT} | Total power dissipation at $T_C = 25\text{ °C}$ | 208 | 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 |
|----------------|-------------------------------------|-------|------|
| $R_{thj-case}$ | Thermal resistance junction-case | 0.72 | °C/W |
| $R_{thj-amb}$ | Thermal resistance junction-ambient | 62.5 | °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 |
|---------------|-----------------------------------|--|------|------|-----------|---------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$ | 650 | | | V |
| I_{DSS} | Zero gate voltage drain current | $V_{GS} = 0\text{ V}, V_{DS} = 650\text{ V}$ | | | 50 | μA |
| | | $V_{GS} = 0\text{ V}, V_{DS} = 650\text{ V},$ $T_J = 175\text{ °C}$ (1) | | | 100 | |
| I_{GSS} | Gate-body leakage current | $V_{DS} = 0\text{ V}, V_{GS} = -10\text{ to }22\text{ V}$ | | | ± 250 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS} = V_{GS}, I_D = 1\text{ mA}$ | 1.8 | 3.2 | | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS} = 20\text{ V}, I_D = 20\text{ A}$ | | 45 | 67 | m Ω |
| | | $V_{GS} = 18\text{ V}, I_D = 20\text{ A}$ | | 55 | | |
| | | $V_{GS} = 20\text{ V}, I_D = 20\text{ A},$ $T_J = 175\text{ °C}$ | | 65 | | |

1. Defined by design, not subject to production test.

Table 4. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|--|------|------|------|----------|
| C_{iss} | Input capacitance | $V_{DS} = 400\text{ V}, f = 1\text{ MHz}, V_{GS} = 0\text{ V}$ | - | 1370 | - | pF |
| C_{oss} | Output capacitance | | - | 125 | - | pF |
| C_{rss} | Reverse transfer capacitance | | - | 30 | - | pF |
| Q_g | Total gate charge | $V_{DD} = 400\text{ V}, V_{GS} = 0\text{ to }20\text{ V}, I_D = 20\text{ A}$ | - | 73 | - | nC |
| Q_{gs} | Gate-source charge | | - | 14 | - | nC |
| Q_{gd} | Gate-drain charge | | - | 27 | - | nC |
| R_g | Gate input resistance | $f = 1\text{ MHz}, I_D = 0\text{ A}$ | - | 2 | - | Ω |

Table 5. Switching energy (inductive load)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|---------------------------|---|------|------|------|---------------|
| E_{on} | Turn-on switching energy | $V_{DD} = 400\text{ V}, I_D = 20\text{ A}$ | - | 100 | - | μJ |
| E_{off} | Turn-off switching energy | $R_G = 10\text{ }\Omega, V_{GS} = -5\text{ to }20\text{ V}$ | - | 35 | - | μJ |

Table 6. Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------------|---------------------|--|------|------|------|------|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD} = 400\text{ V}$, $I_D = 20\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = -5\text{ to }20\text{ V}$ | - | 16 | - | ns |
| t_f | Fall time | | - | 14 | - | |
| $t_{d(off)}$ | Turn-off delay time | | - | 35 | - | |
| t_r | Rise time | | - | 9 | - | |

Table 7. Reverse SiC diode characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|--------------------------|---|------|------|------|------|
| V_{SD} | Diode forward voltage | $I_F = 20\text{ A}$, $V_{GS} = 0\text{ V}$ | - | 4.5 | - | V |
| t_{rr} | Reverse recovery time | $V_{DD} = 400\text{ V}$, $I_F = 20\text{ A}$, $di/dt = 1000\text{ A}/\mu\text{s}$ | - | 18 | - | ns |
| Q_{rr} | Reverse recovery charge | | - | 85 | - | nC |
| I_{RRM} | Reverse recovery current | | - | 7 | - | A |

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

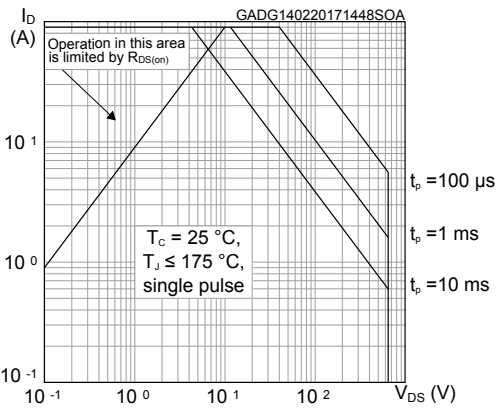


Figure 2. Thermal impedance

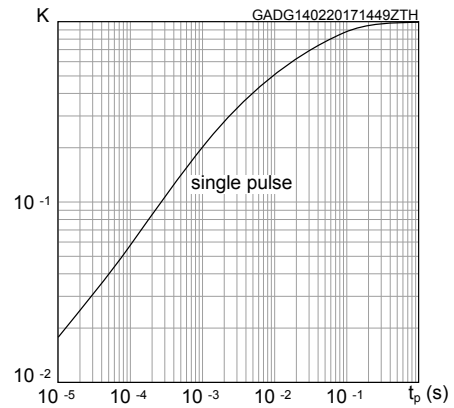


Figure 3. Output characteristics ($T_J = 25\text{ °C}$)

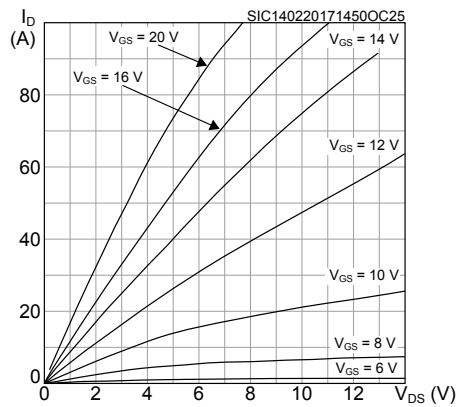


Figure 4. Output characteristics ($T_J = 175\text{ °C}$)

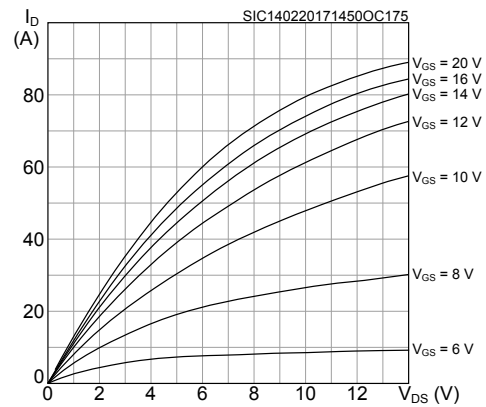


Figure 5. Transfer characteristics

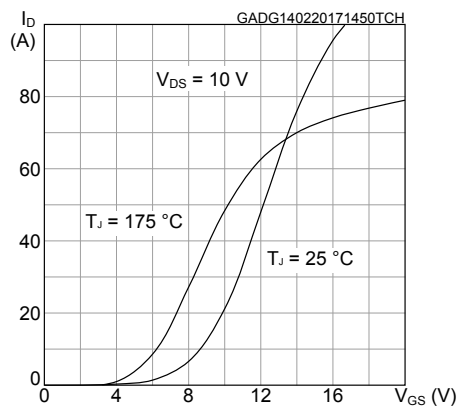


Figure 6. Power total dissipation

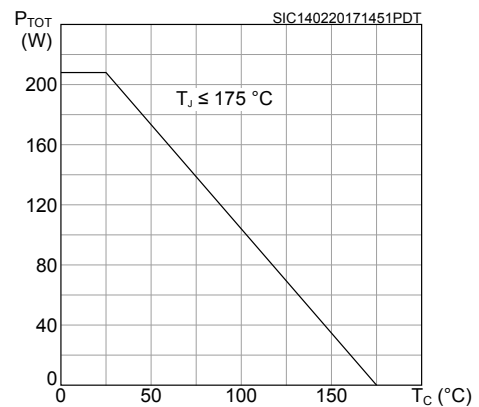


Figure 7. Gate charge vs gate-source voltage

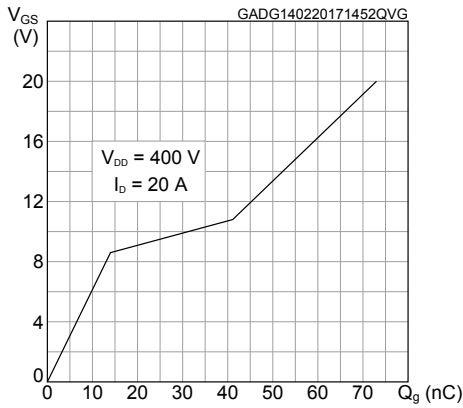


Figure 8. Capacitance variations

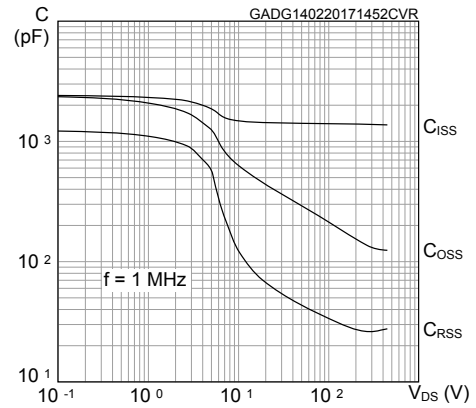


Figure 9. Switching energy vs. drain current

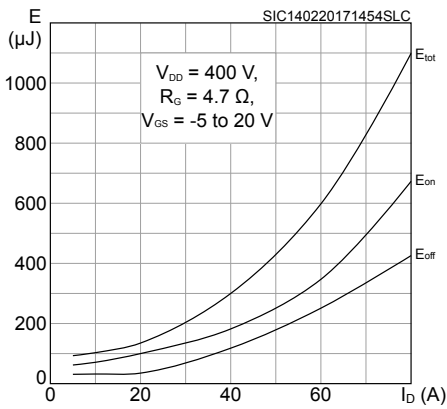


Figure 10. Switching energy vs. junction temperature

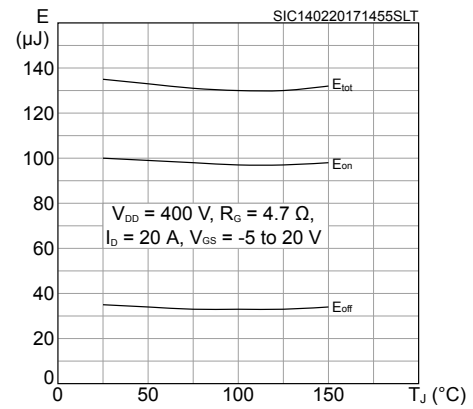


Figure 11. Normalized $V_{(BR)DSS}$ vs. temperature

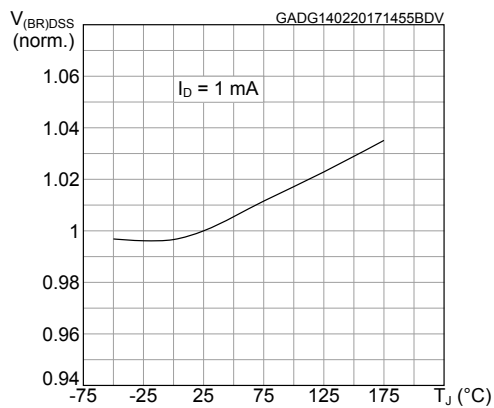


Figure 12. Normalized gate threshold voltage vs. temperature

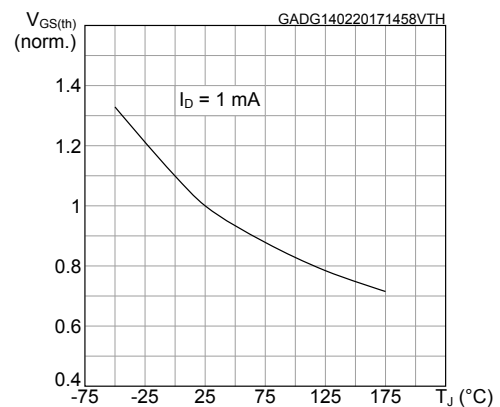


Figure 13. Normalized on-resistance vs. temperature

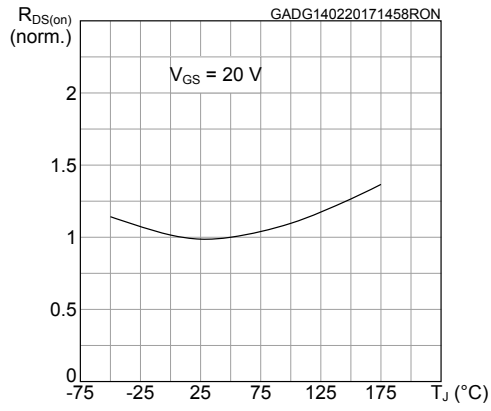


Figure 14. Reverse conduction characteristics ($T_J = 25\text{ °C}$)

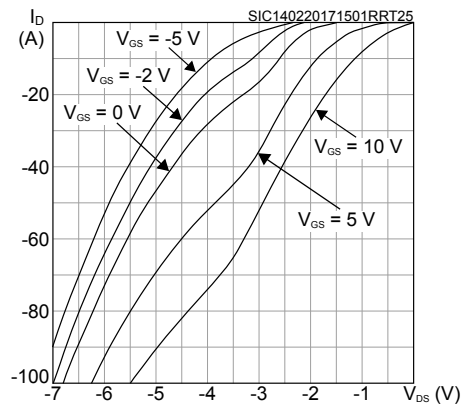
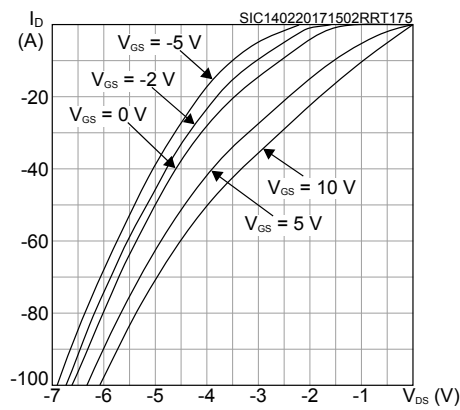
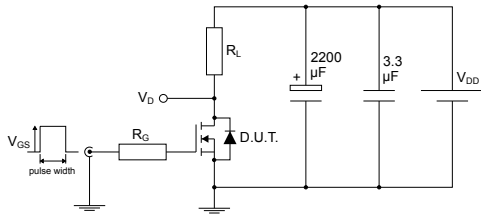


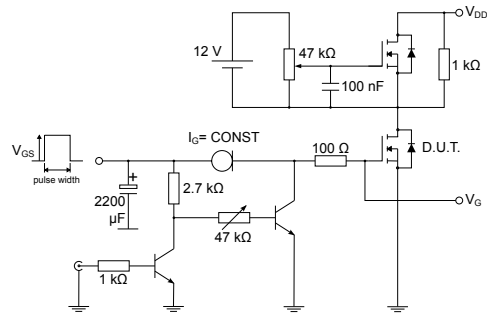
Figure 15. Reverse conduction characteristics ($T_J = 175\text{ °C}$)



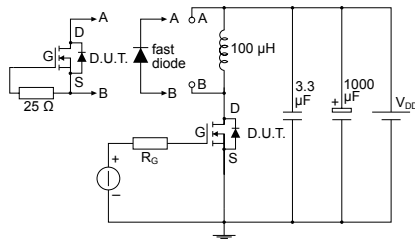
3 Test circuits

Figure 16. Test circuit for resistive load switching times


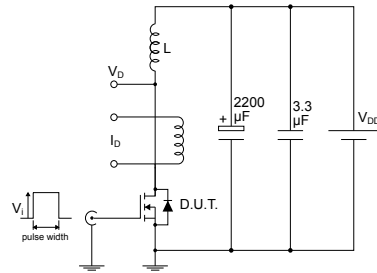
AM01468v1

Figure 17. Test circuit for gate charge behavior


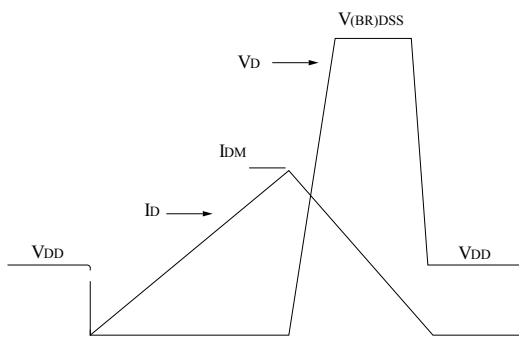
AM01469v1

Figure 18. Test circuit for inductive load switching and diode recovery times


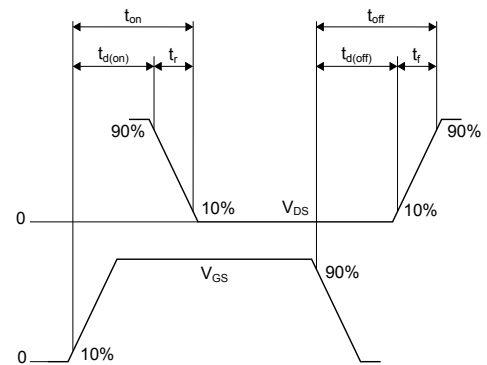
AM01470v1

Figure 19. Unclamped inductive load test circuit


AM01471v1

Figure 20. Unclamped inductive waveform


AM01472v1

Figure 21. Switching time waveform


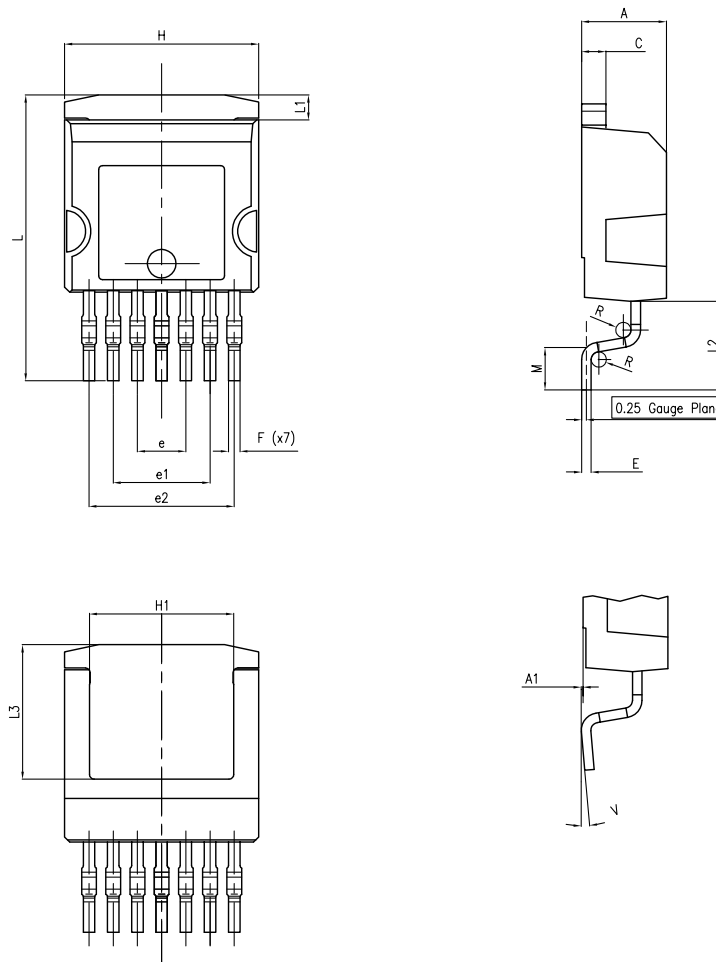
AM01473v1

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. ECOPACK® is an ST trademark.

4.1 H²PAK-7 package information

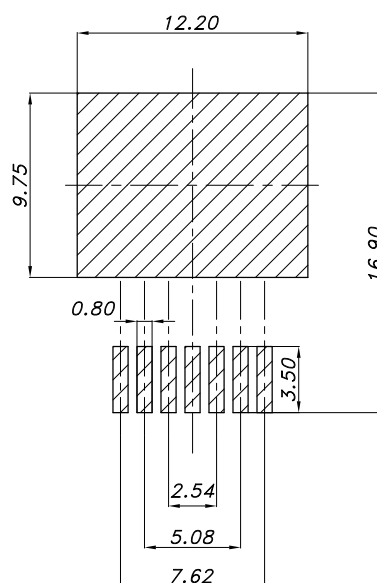
Figure 22. H²PAK-7 package outline



DM00249216_4

Table 8. H²PAK-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° |

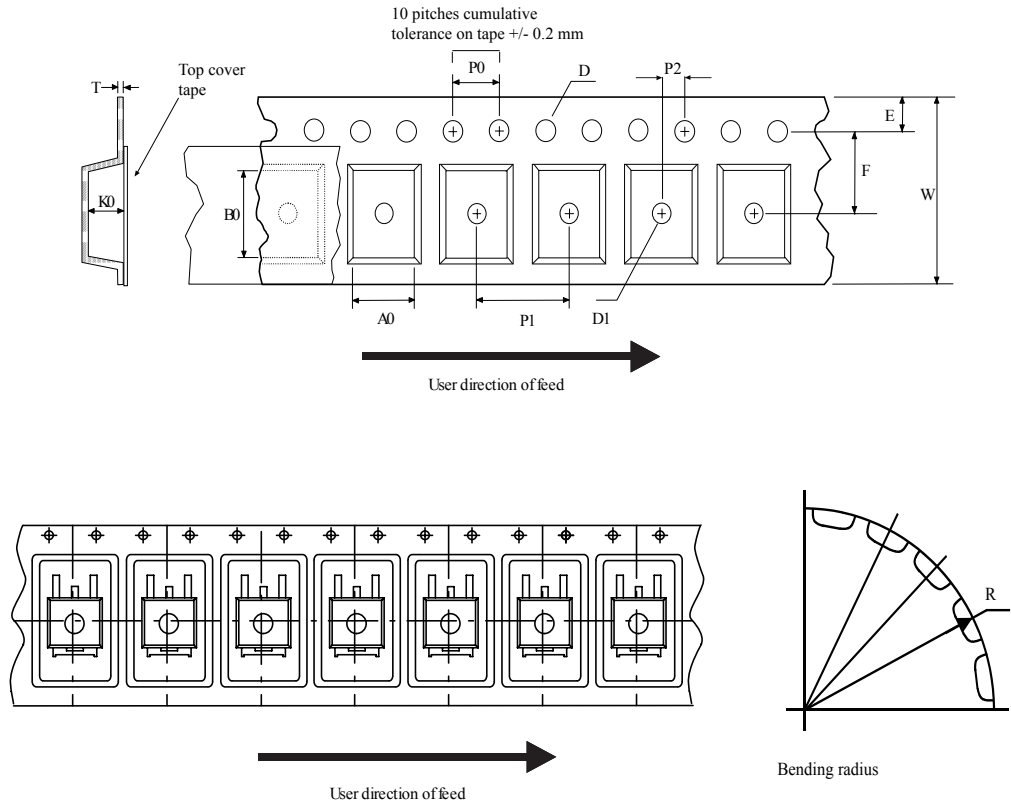
Figure 23. H²PAK-7 recommended footprint


footprint_DM00249216_4

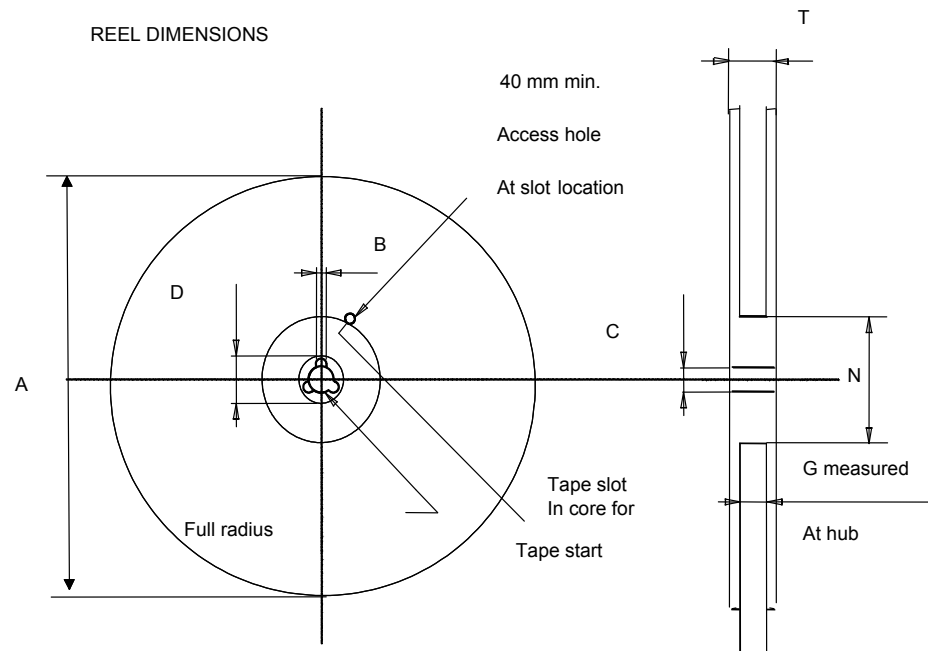
Note: Dimensions are in mm.

4.2 Packing information

Figure 24. Tape outline



AM08852v2

Figure 25. Reel outline

Table 9. Tape and reel mechanical data

| Dim. | Tape | | Dim. | Reel | |
|------|------|------|---------------|------|------|
| | mm | | | 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 10. Document revision history

| Date | Version | Changes |
|-------------|---------|---|
| 17-Feb-2017 | 1 | First release. |
| 13-Dec-2017 | 2 | Updated document title. Updated <i>Table 4: "On/off states"</i> . Minor text changes. |
| 13-Dec-2018 | 3 | Datasheet promoted from preliminary data to production data. Modified title and features on cover page. Minor text changes. |

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