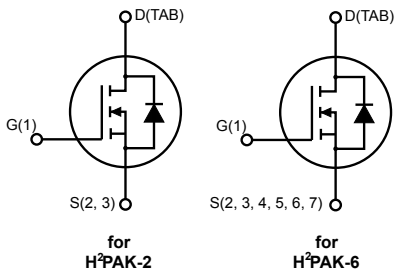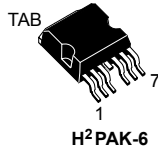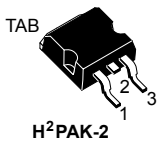# Automotive-grade N-channel 100 V, 2.1 mΩ typ., 180 A STripFET F7 Power MOSFETs in an H²PAK-2 and H²PAK-6 packages



TAB

H²PAK-2

TAB

7

H²PAK-6



D(TAB)

G(1)

S(2, 3)

**for
H²PAK-2**

D(TAB)

G(1)

S(2, 3, 4, 5, 6, 7)

**for
H²PAK-6**

N-CHG1DTABS23_2_6

## Features

| Order code | $V_{DS}$ | $R_{DS(on)}$ max. | $I_D$ |
|---|---|---|---|
| STH315N10F7-2 | 100 V | 2.3 mΩ | 180 A |
| STH315N10F7-6 | | | |

- AEC-Q101 qualified
- Among the lowest $R_{DS(on)}$ on the market
- Excellent FoM (figure of merit)
- Low $C_{rss}/C_{iss}$ ratio for EMI immunity
- High avalanche ruggedness

## Applications

- Switching applications

## Description

These N-channel Power MOSFETs utilize STripFET F7 technology with an enhanced trench gate structure that results in very low on-state resistance, while also reducing internal capacitance and gate charge for faster and more efficient switching.

| Product status | |
|---|---|
| STH315N10F7-2 | |
| STH315N10F7-6 | |

| Product summary | |
|---|---|
| **Order code** | **STH315N10F7-2** |
| **Marking** | 315N10F7 |
| **Package** | H²PAK-2 |
| **Packing** | Tape and reel |
| **Order code** | **STH315N10F7-6** |
| **Marking** | 315N10F7 |
| **Package** | H²PAK-6 |
| **Packing** | Tape and reel |

**DS9870 - Rev 5 - May 2021**
For further information contact your local STMicroelectronics sales office.

www.st.com

# 1 Electrical ratings

**Table 1.** **Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|--------|-----------|-------|------|
| $V_{DS}$ | Drain-source voltage | 100 | V |
| $V_{GS}$ | Gate-source voltage | ±20 | V |
| $I_D$ [1] | Drain current (continuous) at $T_C$ = 25 °C | 180 | A |
| $I_D$ [1] | Drain current (continuous) at $T_c$ = 100 °C | 180 | A |
| $I_{DM}$ [2] | Drain current (pulsed) | 720 | A |
| $P_{TOT}$ | Total dissipation at $T_C$ = 25 °C | 315 | W |
| | Derating factor | 2.1 | W/°C |
| $E_{AS}$ [3] | Single pulse avalanche energy | 1 | J |
| $T_j$ | Operating junction temperature range | -55 to 175 | °C |
| $T_{stg}$ | Storage temperature range | | |

1. *Current limited by package.*
2. *Pulse width limited by safe operating area.*
3. *Starting $T_j$=25 °C, $I_D$=60 A, $V_{DD}$=50 V*

**Table 2.** **Thermal data**

| Symbol | Parameter | Value | Unit |
|--------|-----------|-------|------|
| $R_{thJC}$ | Thermal resistance, junction-to-case | 0.48 | °C/W |
| $R_{thJB}$ [1] | Thermal resistance, junction-to-board | 35 | °C/W |

1. *When mounted on 1 inch² FR-4, 2 Oz copper board.*

# 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 | $I_D$ = 250 µA, $V_{GS}$ = 0 V | 100 | | | V |
| $I_{DSS}$ | Zero gate voltage drain current | $V_{GS}$ = 0 V, $V_{DS}$ = 100 V | | | 1 | µA |
| | | $V_{GS}$ = 0 V, $V_{DS}$ = 100 V, $T_C$=125 °C [1] | | | 100 | µA |
| $I_{GSS}$ | Gate-body leakage current | $V_{GS}$ = ±20 V, $V_{DS}$ = 0 V | | | 100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS}$ = $V_{GS}$ , $I_D$ = 250 µA | 2.5 | 3.5 | 4.5 | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS}$ = 10 V, $I_D$= 60 A | | 2.1 | 2.3 | mΩ |

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

**Table 4. Dynamic**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input capacitance | $V_{DS}$ = 25 V, f = 1 MHz, $V_{GS}$ = 0 V | - | 12800 | - | pF |
| $C_{oss}$ | Output capacitance | | - | 3500 | - | pF |
| $C_{rss}$ | Reverse transfer capacitance | | - | 170 | - | pF |
| $Q_g$ | Total gate charge | $V_{DD}$ = 50 V, $I_D$ = 180 A, $V_{GS}$ = 0 to 10 V | - | 180 | - | nC |
| $Q_{gs}$ | Gate-source charge | | - | 78 | - | nC |
| $Q_{gd}$ | Gate-drain charge | (see Figure 15. Test circuit for gate charge behavior) | - | 34 | - | nC |

**Table 5. Switching times**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD}$ = 50 V, $I_D$ = 90 A, $R_G$ = 4.7 Ω, $V_{GS}$ = 10 V (see Figure 14. Test circuit for resistive load switching times and Figure 19. Switching time waveform) | - | 62 | - | ns |
| $t_r$ | Rise time | | - | 108 | - | ns |
| $t_{d(off)}$ | Turn-off delay time | | - | 148 | - | ns |
| $t_f$ | Fall time | | - | 40 | - | ns |

**Table 6. Source-drain diode**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$ | Source-drain current | | - | | 180 | A |
| $I_{SDM}$ [1] | Source-drain current (pulsed) | | - | | 720 | A |
| $V_{SD}$[2] | Source-drain curren | $I_{SD}$ = 60 A, $V_{GS}$ = 0 V | - | | 1.5 | V |

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------|-----------|-----------------|------|------|------|------|
| $t_{rr}$ | Reverse recovery time | $I_{SD}$ = 180 A, di/dt = 100 A/µs | - | 85 | | ns |
| $Q_{rr}$ | Reverse recovery charge | $V_{DD}$ = 80 V, $T_J$ = 150 °C (see Figure 16. Test circuit for inductive load switching and diode recovery times) | - | 200 | | nC |
| $I_{RRM}$ | Reverse recovery current | | - | 4.7 | | A |

1. *Pulse width limited by safe operating area.*

2. *Pulsed: pulse duration=300 µs, duty cycle 1.5%.*

## 2.1 Electrical characteristics (curves)

**Figure 1. Safe operating area**



**Figure 2. Thermal impedance**



**Figure 3. Output characteristics**



**Figure 4. Transfer characteristics**



**Figure 5. Gate charge vs gate-source voltage**



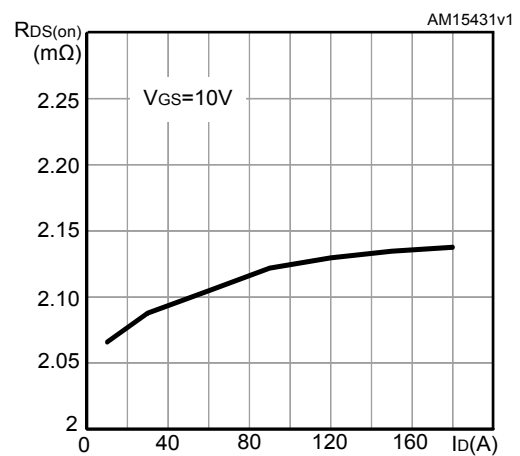**Figure 6. Static drain-source on-resistance**
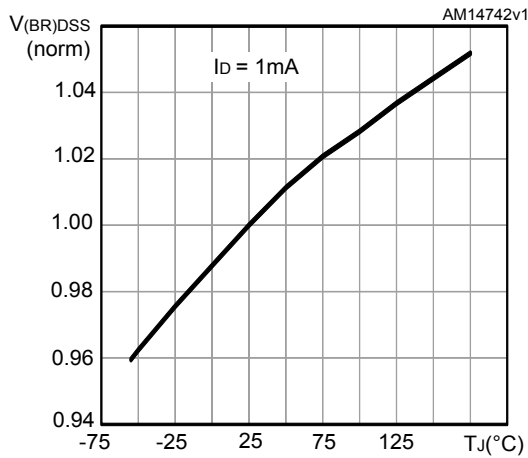
**Figure 7. Normalized V$_{(BR)DSS}$ vs temperature**



**Figure 8. Capacitance variations**



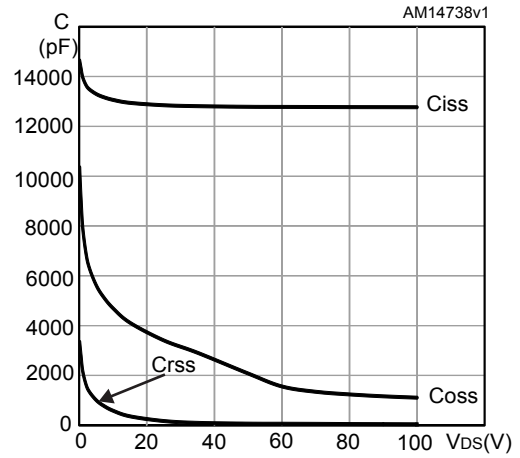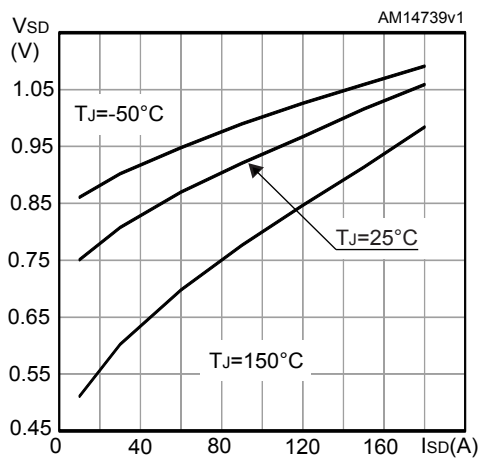**Figure 9. Source-drain diode forward characteristics**
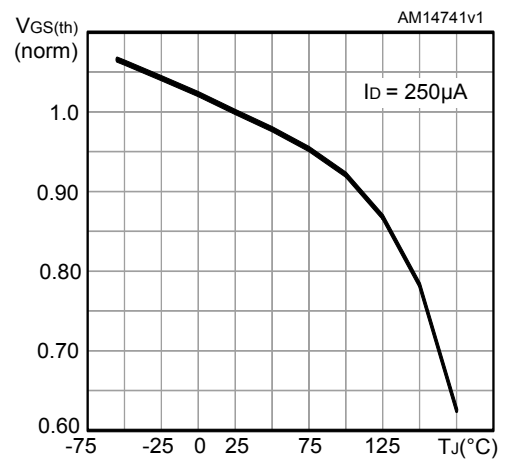


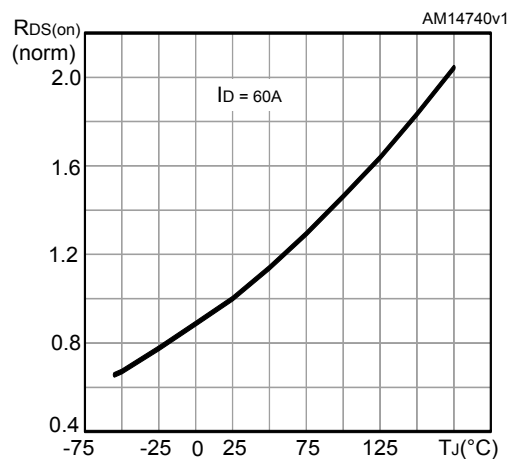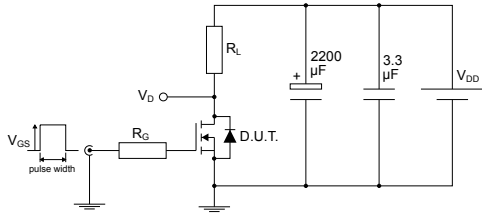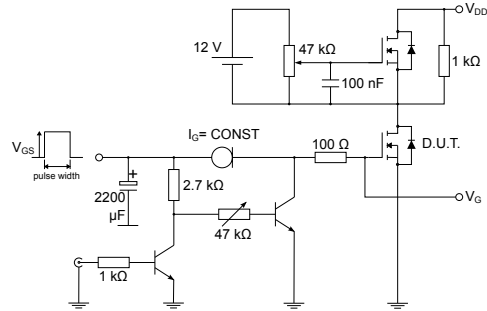**Figure 10. Normalized gate threshold voltage vs temperature**
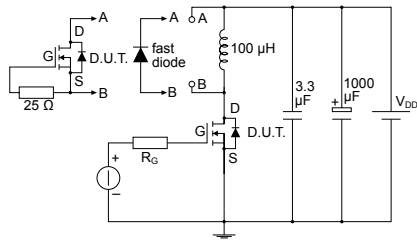


**Figure 11. Normalized on-resistance vs temperature**

# 3 Test circuits

Figure 12. **Test circuit for resistive load switching times**
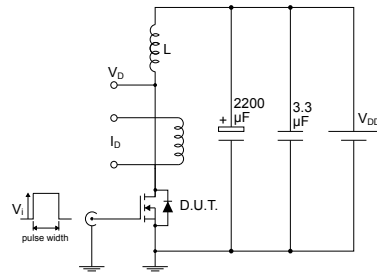


AM01468v1

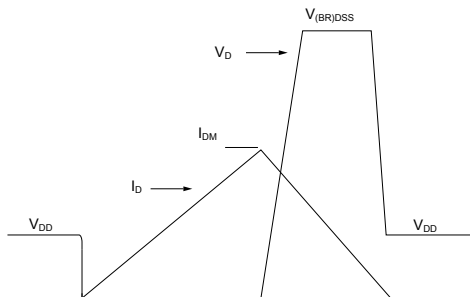Figure 13. **Test circuit for gate charge behavior**



AM01469v1

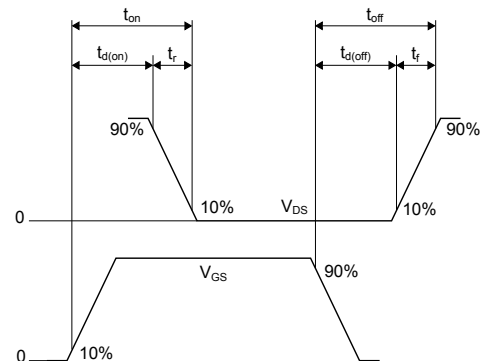Figure 14. **Test circuit for inductive load switching and diode recovery times**



AM01470v1

Figure 15. **Unclamped inductive load test circuit**



AM01471v1

Figure 16. **Unclamped inductive waveform**



AM01472v1

Figure 17. **Switching time waveform**



AM01473v1
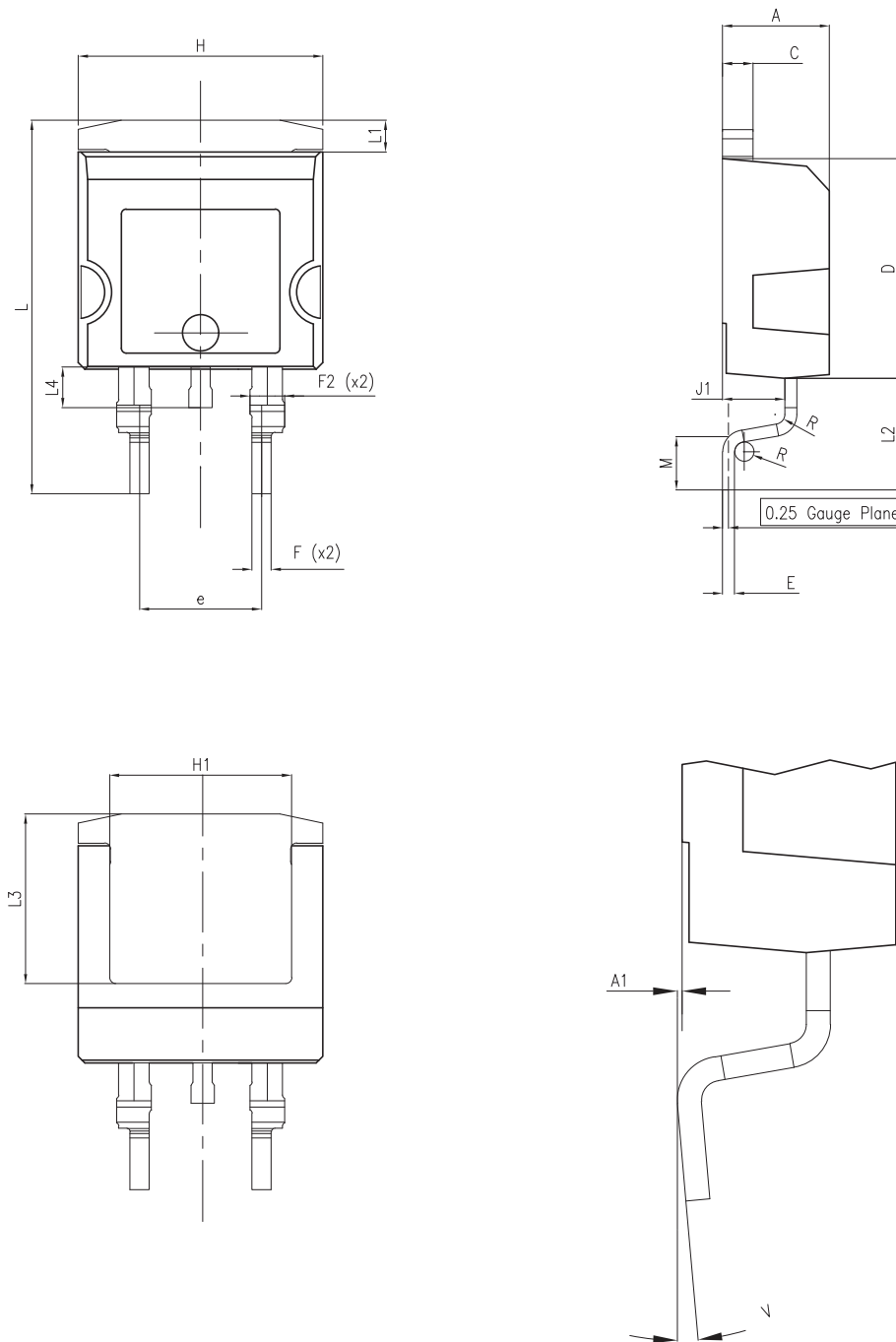
# 4 Package information

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.

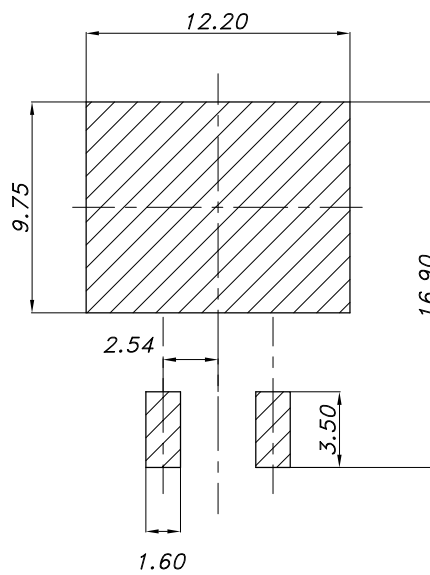## 4.1 H²PAK-2 package information

**Figure 18. H²PAK-2 package outline**



8159712_9

Table 7. **H²PAK-2 package mechanical data**

| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 4.30 | | 4.70 |
| A1 | 0.03 | | 0.20 |
| C | 1.17 | | 1.37 |
| D | 8.95 | | 9.35 |
| e | 4.98 | | 5.18 |
| E | 0.50 | | 0.90 |
| F | 0.78 | | 0.85 |
| F2 | 1.14 | | 1.70 |
| H | 10.00 | - | 10.40 |
| H1 | 7.40 | | 7.80 |
| J1 | 2.49 | | 2.69 |
| L | 15.30 | | 15.80 |
| L1 | 1.27 | | 1.40 |
| L2 | 4.93 | | 5.23 |
| L3 | 6.85 | | 7.25 |
| L4 | 1.50 | | 1.70 |
| M | 2.60 | | 2.90 |
| R | 0.20 | | 0.60 |
| V | 0° | | 8° |

Figure 19. **H²PAK-2 recommended footprint**



8159712_9

Note:        Dimensions are in mm.

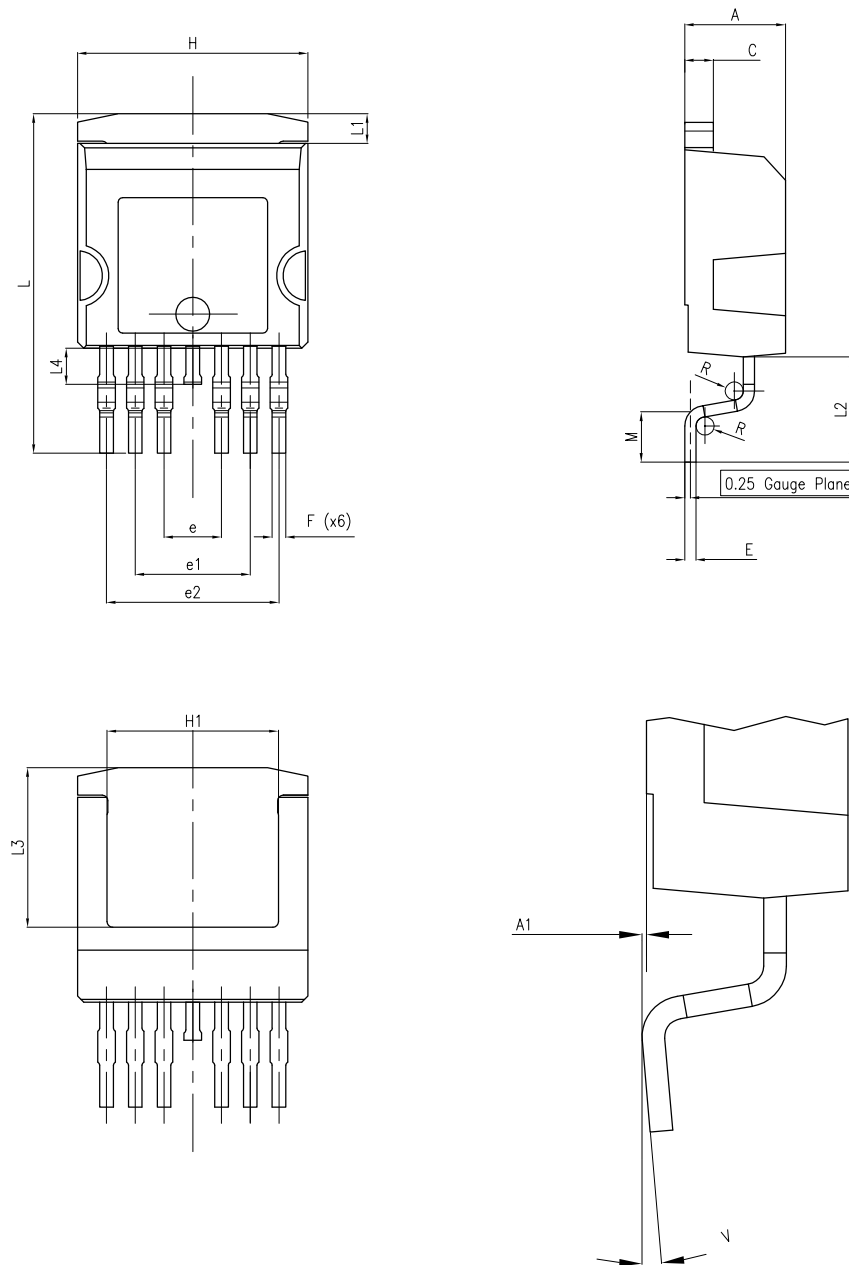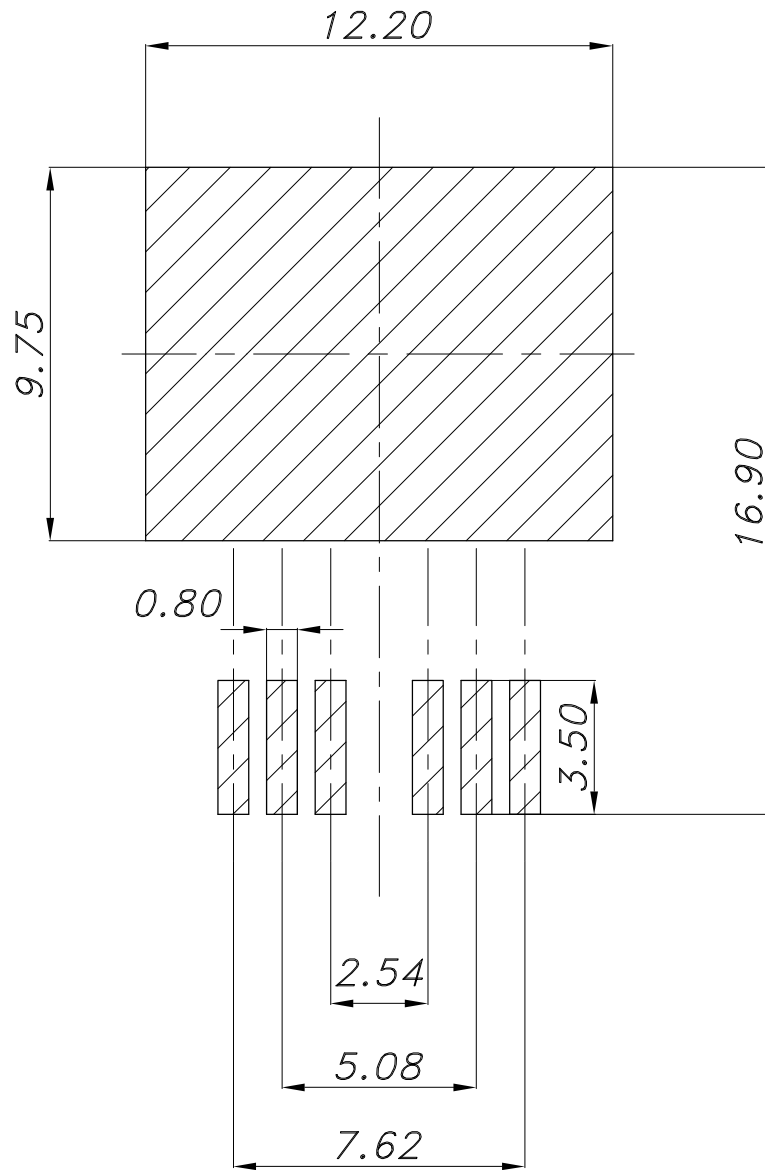## 4.2 H²PAK-6 package information

**Figure 20. H²PAK-6 package outline**



8159693_Rev_8

**Table 8.** **H²PAK-6 package mechanical data**

| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 4.30 | | 4.70 |
| A1 | 0.03 | | 0.20 |
| C | 1.17 | | 1.37 |
| e | 2.34 | 2.54 | 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 | | 7.80 |
| L | 14.75 | | 15.25 |
| L1 | 1.27 | | 1.40 |
| L2 | 4.35 | | 4.95 |
| L3 | 6.85 | | 7.25 |
| L4 | 1.50 | | 1.75 |
| M | 1.90 | | 2.50 |
| R | 0.20 | | 0.60 |
| V | 0° | | 8° |

**Figure 21. H²PAK-6 recommended footprint**



12.20

9.75

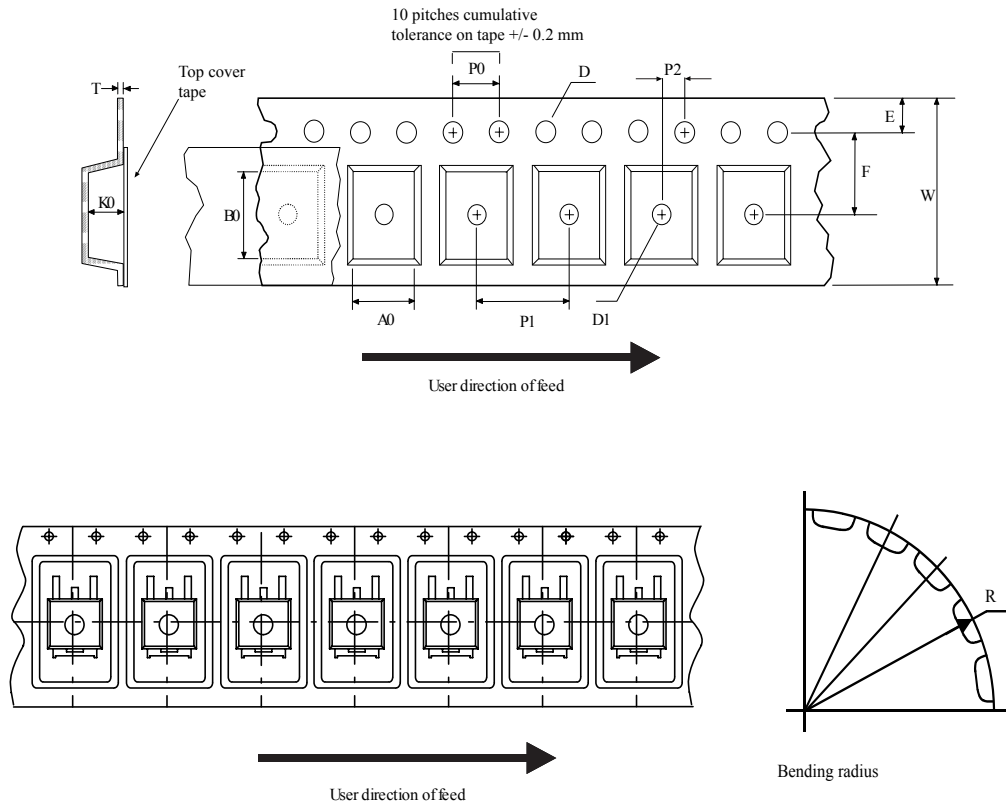16.90

0.80

3.50

2.54

5.08

7.62

footprint_Rev_8

*Note:*      *Dimensions are in mm.*

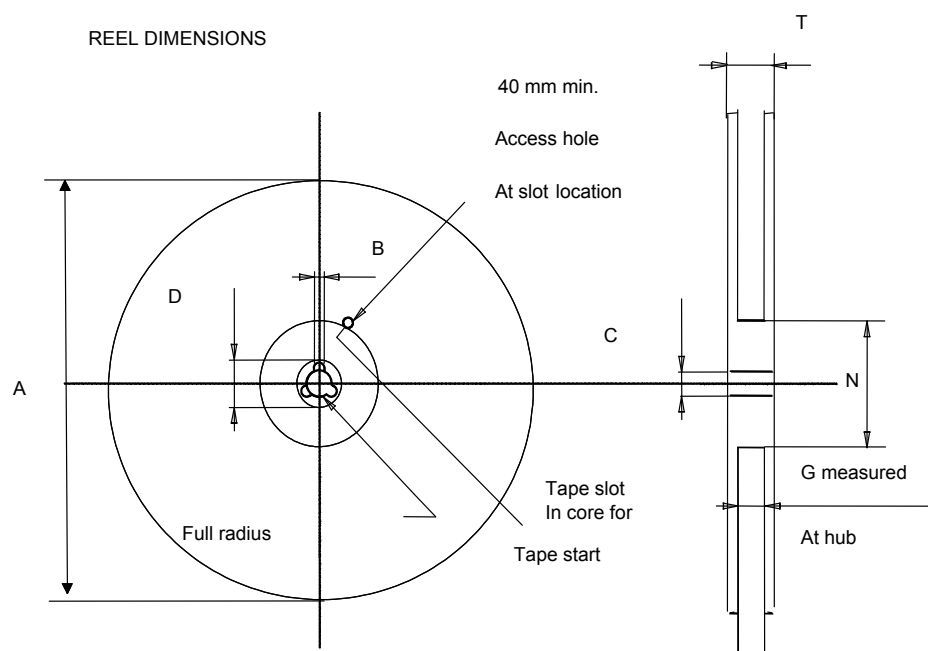## 4.3 Packing information

**Figure 22. Tape outline**



AM08852v2

**Figure 23. Reel outline**

**Table 9. Tape and reel mechanical data**

| Tape | | | Reel | | | page 14/17 |
|---|---|---|---|---|---|---|
| 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 10. Document revision history**

| Date | Version | Changes |
|------|---------|---------|
| 02-Aug-2013 | 1 | Initial release. |
| 03-Sep-2013 | 2 | – Modified: *Table 1*, RDS(on) typical value in *Table 4*<br>– Minor text changes |
| 27-May-2014 | 3 | – Modified: title and *Features* in cover page<br>– Updated: *Section 4: Package mechanical data*<br>– Minor text changes |
| 12-Sep-2014 | 4 | – Modified: title, features and description in cover page. |
| 03-May-2021 | 5 | Updated Table 1. Absolute maximum ratings.<br>Minor text changes. |

# Contents

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