

N-channel 100 V, 1.9 mΩ typ., 180 A, STripFET™ F7  
Power MOSFETs in H<sup>2</sup>PAK-2 and H<sup>2</sup>PAK-6 packages

Datasheet - production data

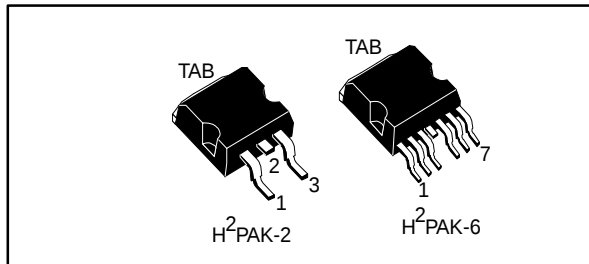
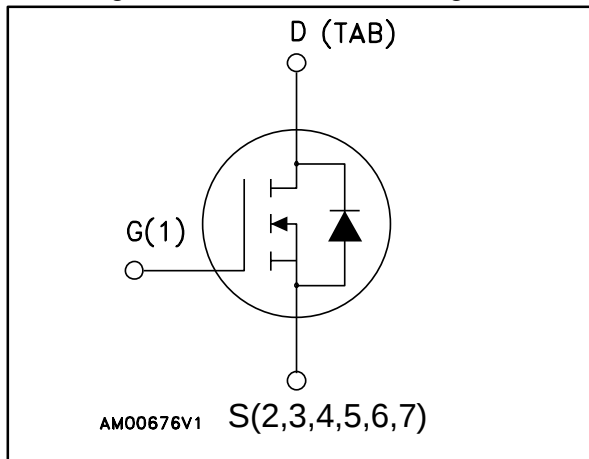


Figure 1: Internal schematic diagram



## Features

| Order code    | V <sub>DS</sub> | R <sub>DS(on)</sub> max. | I <sub>D</sub> |
|---------------|-----------------|--------------------------|----------------|
| STH310N10F7-2 | 100 V           | 2.3 mΩ                   | 180 A          |
| STH310N10F7-6 |                 |                          |                |

- Among the lowest R<sub>DS(on)</sub> on the market
- Excellent figure of merit (FoM)
- Low C<sub>rss</sub>/C<sub>iss</sub> 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-resistance, while also reducing internal capacitance and gate charge for faster and more efficient switching.

Table 1: Device summary

| Order code    | Marking  | Package              | Packing       |
|---------------|----------|----------------------|---------------|
| STH310N10F7-2 | 310N10F7 | H <sup>2</sup> PAK-2 | Tape and reel |
| STH310N10F7-6 |          | H <sup>2</sup> PAK-6 |               |

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# 1 Electrical ratings

Table 2: Absolute maximum ratings

| Symbol         | Parameter                                                                                              | Value      | Unit             |
|----------------|--------------------------------------------------------------------------------------------------------|------------|------------------|
| $V_{DS}$       | Drain-source voltage                                                                                   | 100        | V                |
| $V_{GS}$       | Gate-source voltage                                                                                    | $\pm 20$   | V                |
| $I_D^{(1)}$    | Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$                                         | 180        | A                |
|                | Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$                                        | 180        | A                |
| $I_D^{(2)}$    | Drain current (pulsed)                                                                                 | 720        | A                |
| $P_{TOT}$      | Total dissipation at $T_C = 25\text{ }^\circ\text{C}$                                                  | 315        | W                |
| $E_{AS}^{(3)}$ | Single pulse avalanche energy ( $T_J = 25\text{ }^\circ\text{C}$ L = 0.55 mH, $I_{AS} = 65\text{ A}$ ) | 1          | J                |
| $T_J$          | Operating junction temperature                                                                         | -55 to 175 | $^\circ\text{C}$ |
| $T_{stg}$      | Storage temperature                                                                                    |            | $^\circ\text{C}$ |

**Notes:**

<sup>(1)</sup>Current limited by package

<sup>(2)</sup>Pulse width limited by safe operating area

<sup>(3)</sup>Starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $I_D = 60\text{ A}$ ,  $V_{DD} = 50\text{ V}$

Table 3: Thermal data

| Symbol              | Parameter                        | Value | Unit               |
|---------------------|----------------------------------|-------|--------------------|
| $R_{thj-case}$      | Thermal resistance junction-case | 0.48  | $^\circ\text{C/W}$ |
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb  | 35    | $^\circ\text{C/W}$ |

**Notes:**

<sup>(1)</sup>When mounted on FR-4 board of 1 inch<sup>2</sup>, 2 oz Cu

## 2 Electrical characteristics

(T<sub>CASE</sub> = 25 °C unless otherwise specified)

**Table 4: On/off-state**

| Symbol               | Parameter                                             | Test conditions                                             | Min. | Typ. | Max. | Unit |
|----------------------|-------------------------------------------------------|-------------------------------------------------------------|------|------|------|------|
| V <sub>(BR)DSS</sub> | Drain-source breakdown voltage (V <sub>GS</sub> = 0)  | I <sub>D</sub> = 250 μA                                     | 100  |      |      | V    |
| I <sub>DSS</sub>     | Zero gate voltage drain current (V <sub>GS</sub> = 0) | V <sub>DS</sub> = 100 V                                     |      |      | 1    | μA   |
|                      |                                                       | V <sub>DS</sub> = 100 V; T <sub>C</sub> = 125 °C            |      |      | 100  | μA   |
| I <sub>GSS</sub>     | Gate body leakage current (V <sub>DS</sub> = 0)       | V <sub>GS</sub> = 20 V                                      |      |      | 100  | nA   |
| V <sub>GS(th)</sub>  | Gate threshold voltage                                | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA | 2.5  | 3.5  | 4.5  | V    |
| R <sub>DS(on)</sub>  | Static drain-source on-resistance                     | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 60 A               |      | 1.9  | 2.3  | mΩ   |

**Table 5: Dynamic**

| Symbol           | Parameter                    | Test conditions                                           | Min. | Typ.  | Max. | Unit |
|------------------|------------------------------|-----------------------------------------------------------|------|-------|------|------|
| C <sub>iss</sub> | Input capacitance            | V <sub>DS</sub> = 25 V, f = 1 MHz,<br>V <sub>GS</sub> = 0 | -    | 12800 | -    | pF   |
| C <sub>oss</sub> | Output capacitance           |                                                           |      | 3500  |      | pF   |
| C <sub>rss</sub> | Reverse transfer capacitance |                                                           |      | 170   |      | pF   |
| Q <sub>g</sub>   | Total gate charge            | V <sub>DD</sub> = 50 V, I <sub>D</sub> = 180 A            |      | 180   |      | nC   |
| Q <sub>gs</sub>  | Gate-source charge           | V <sub>GS</sub> = 10 V                                    |      | 78    |      | nC   |
| Q <sub>gd</sub>  | Gate-drain charge            | See <a href="#">Figure 14: "Gate charge test circuit"</a> |      | 34    |      | nC   |

**Table 6: Switching times**

| Symbol              | Parameter           | Test conditions                                                                                                                                                                      | Min. | Typ. | Max. | Unit |
|---------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| t <sub>d(on)</sub>  | Turn-on delay time  | V <sub>DD</sub> = 50 V, I <sub>D</sub> = 90 A,<br>R <sub>G</sub> = 4.7 Ω, V <sub>GS</sub> = 10 V<br>See <a href="#">Figure 13: "Switching times test circuit for resistive load"</a> | -    | 62   | -    | ns   |
| t <sub>r</sub>      | Rise time           |                                                                                                                                                                                      |      | 108  |      | ns   |
| t <sub>d(off)</sub> | Turn-off delay time |                                                                                                                                                                                      |      | 148  |      | ns   |
| t <sub>f</sub>      | Fall time           |                                                                                                                                                                                      |      | 40   |      | ns   |

Table 7: Source-drain diode

| Symbol                          | Parameter                     | Test conditions                                                                                  | Min. | Typ. | Max. | Unit |
|---------------------------------|-------------------------------|--------------------------------------------------------------------------------------------------|------|------|------|------|
| I <sub>SD</sub>                 | Source-drain current          |                                                                                                  | -    |      | 180  | A    |
| I <sub>SDM</sub> <sup>(1)</sup> | Source-drain current (pulsed) |                                                                                                  |      |      | 720  | A    |
| V <sub>SD</sub> <sup>(2)</sup>  | Forward on voltage            | I <sub>SD</sub> = 60 A, V <sub>GS</sub> = 0                                                      |      |      | 1.5  | V    |
| t <sub>rr</sub>                 | Reverse recovery time         | I <sub>SD</sub> = 180 A,<br>di/dt = 100 A/μs,<br>V <sub>DD</sub> = 80 V, T <sub>J</sub> = 150 °C |      | 85   |      | ns   |
| Q <sub>rr</sub>                 | Reverse recovery charge       |                                                                                                  |      | 200  |      | nC   |
| I <sub>RRM</sub>                | Reverse recovery current      |                                                                                                  |      | 4.7  |      | A    |

**Notes:**

<sup>(1)</sup>Pulse width limited by safe operating area

<sup>(2)</sup>Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2: Safe operating area

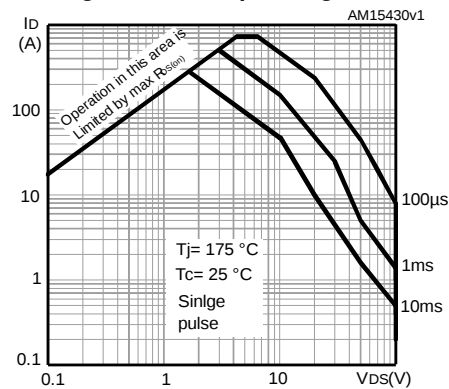


Figure 3: Thermal impedance

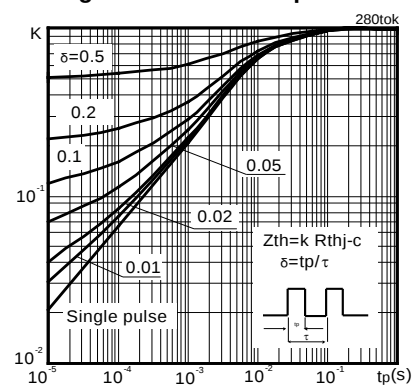


Figure 4: Output characteristics

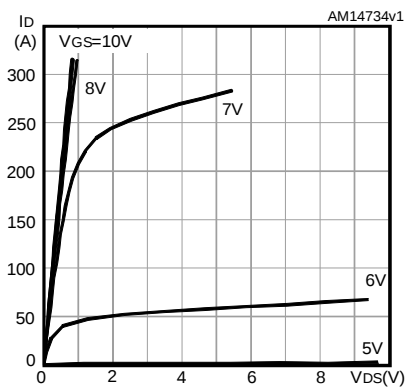


Figure 5: Transfer characteristics

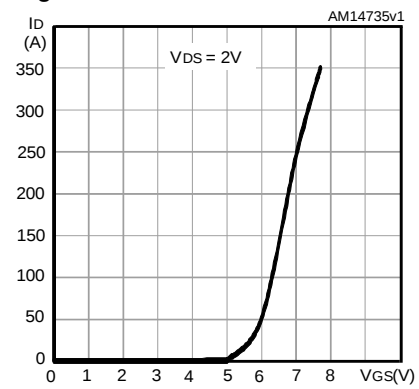


Figure 6: Gate charge vs gate-source voltage

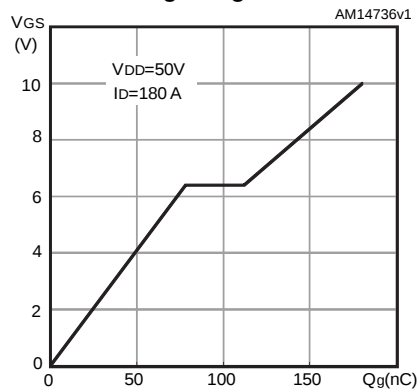
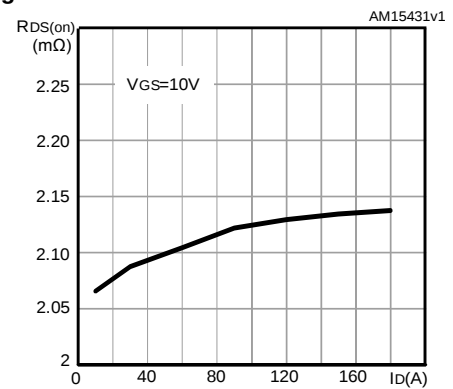
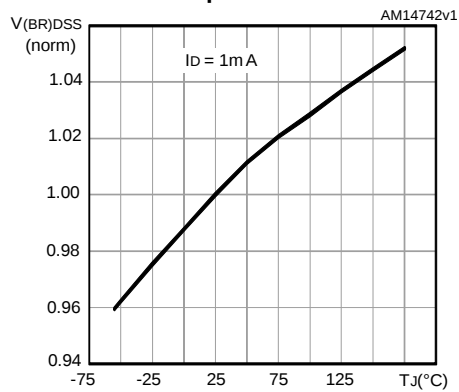


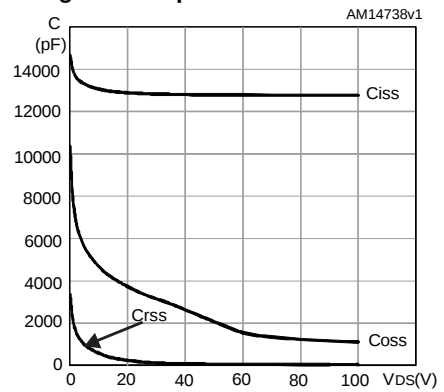
Figure 7: Static drain-source on-resistance



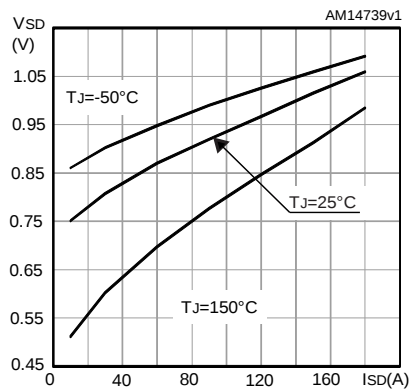
**Figure 8: Normalized  $V_{(BR)DSS}$  vs temperature**



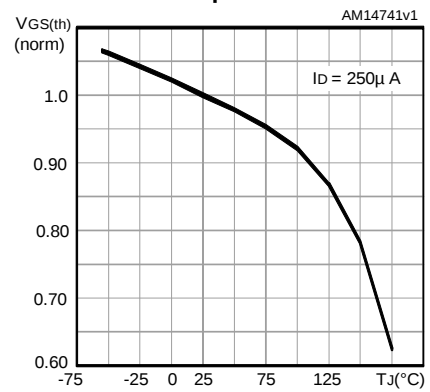
**Figure 9: Capacitance variations**



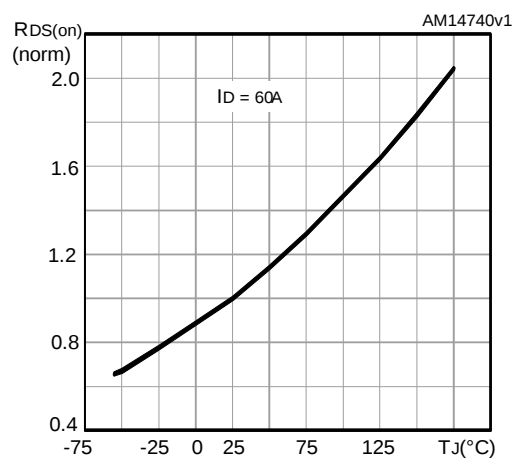
**Figure 10: Source-drain diode forward characteristics**



**Figure 11: Normalized gate threshold voltage vs temperature**

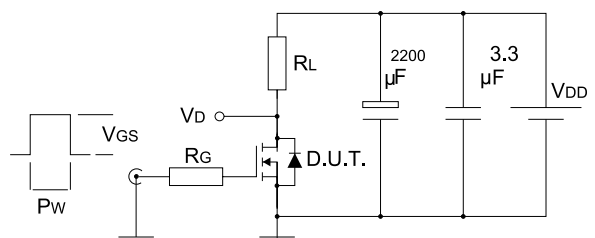


**Figure 12: Normalized on-resistance vs temperature**



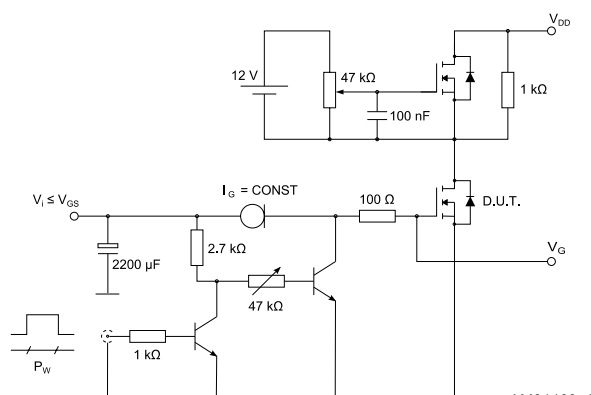
### 3 Test circuits

**Figure 13: Switching times test circuit for resistive load**



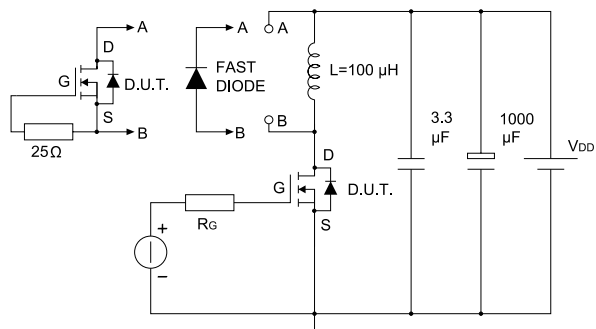
AM01468v1

**Figure 14: Gate charge test circuit**



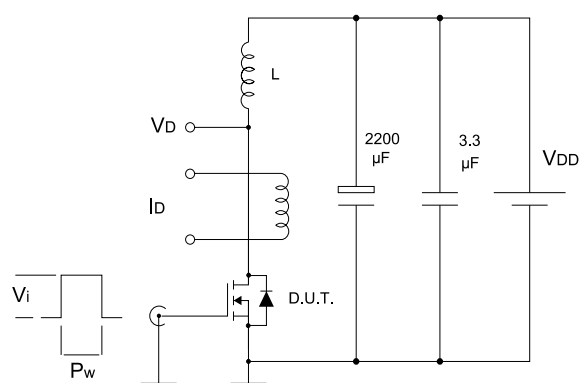
AM01469v1

**Figure 15: Test circuit for inductive load switching and diode recovery times**



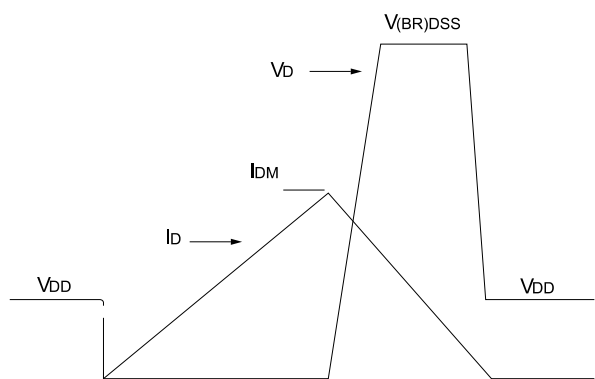
AM01470v1

**Figure 16: Unclamped inductive load test circuit**



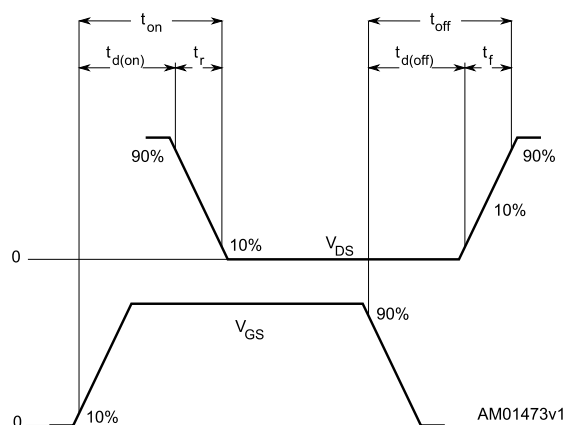
AM01471v1

**Figure 17: Unclamped inductive waveform**



AM01472v1

**Figure 18: 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 H2PAK-2 package information

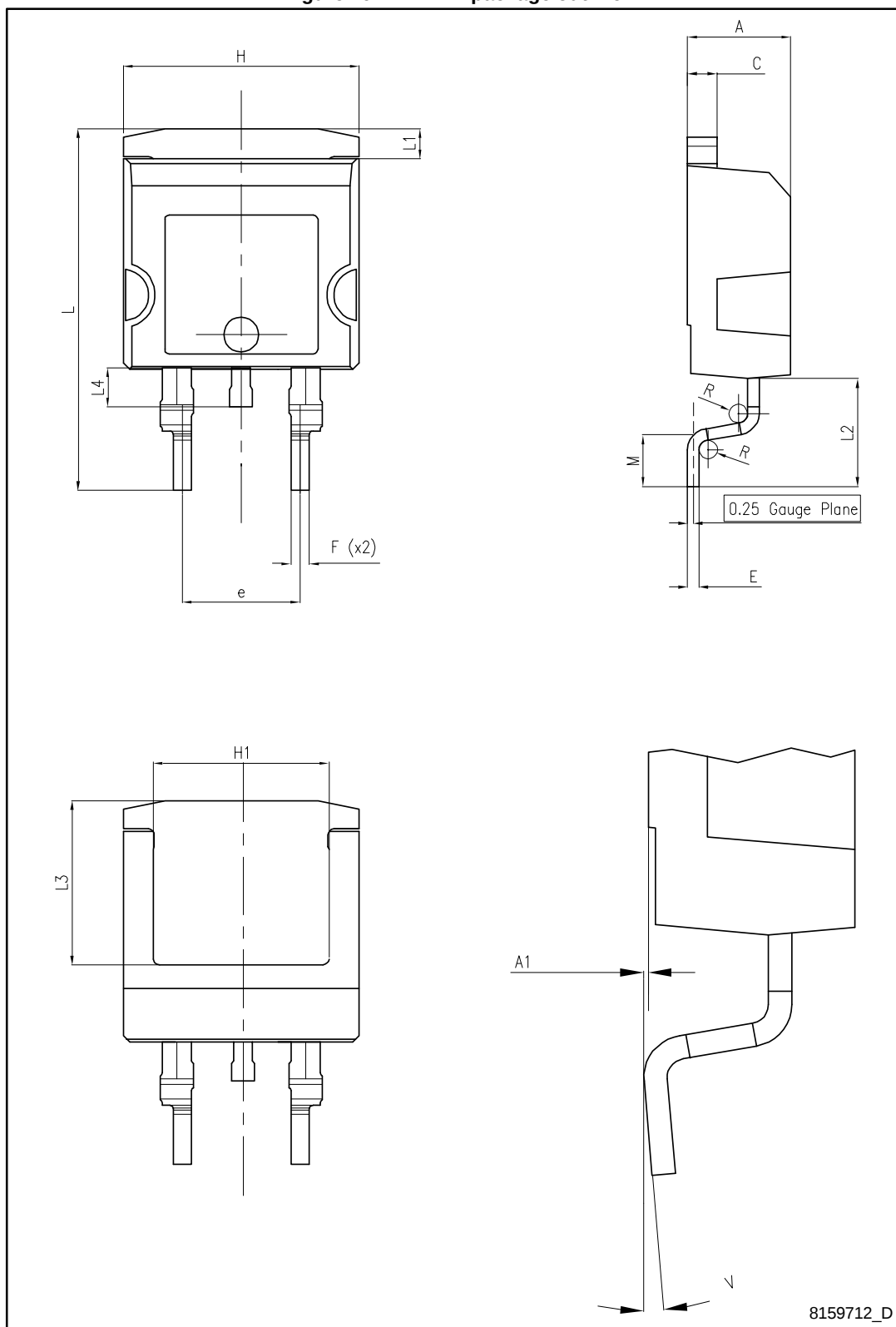
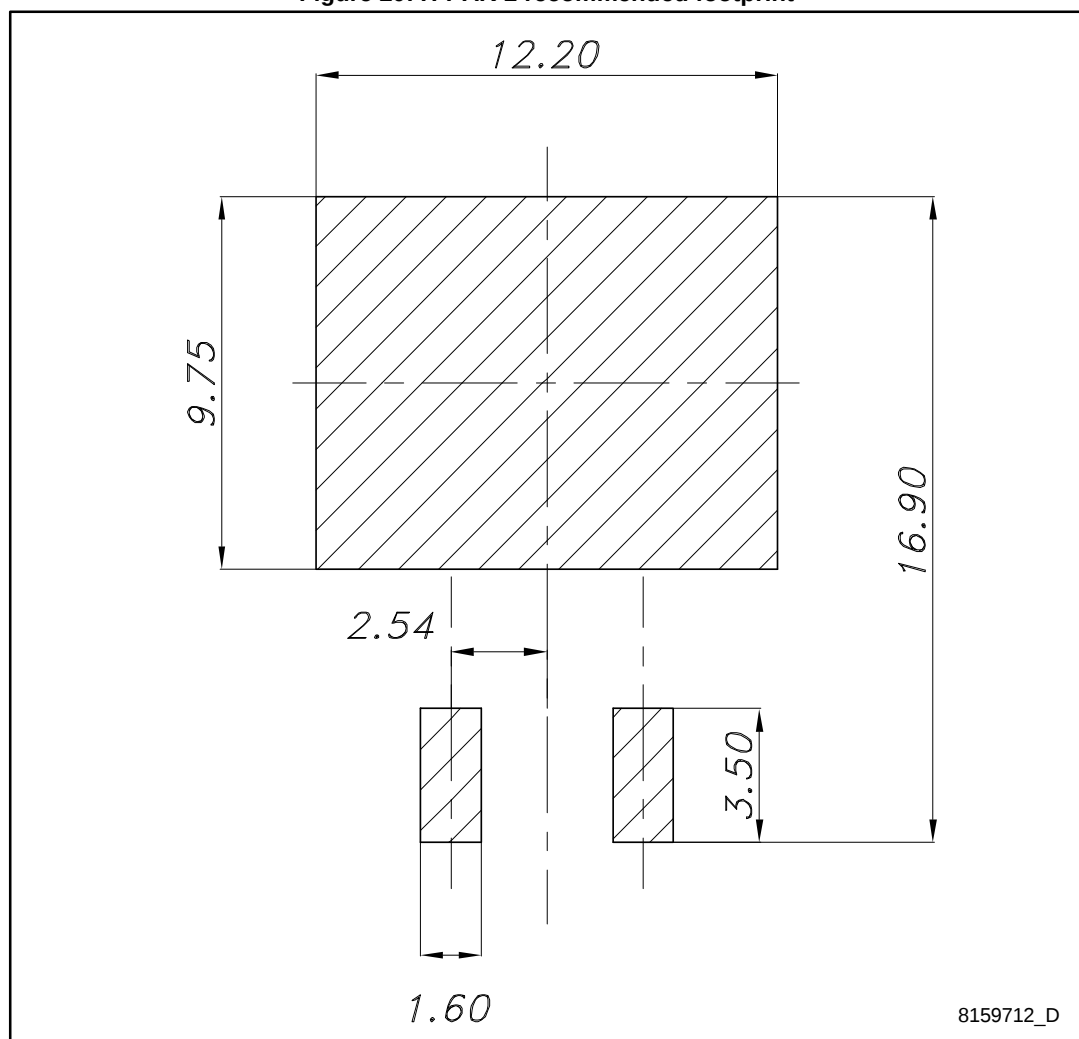
Figure 19: H<sup>2</sup>PAK-2 package outline

Table 8: H<sup>2</sup>PAK-2 package mechanical data

| Dim. | mm    |      |       |
|------|-------|------|-------|
|      | Min.  | Typ. | Max.  |
| A    | 4.30  | -    | 4.80  |
| A1   | 0.03  |      | 0.20  |
| C    | 1.17  |      | 1.37  |
| e    | 4.98  |      | 5.18  |
| E    | 0.50  |      | 0.90  |
| F    | 0.78  |      | 0.85  |
| H    | 10.00 |      | 10.40 |
| H1   | 7.40  |      | 7.80  |
| L    | 15.30 |      | 15.80 |
| L1   | 1.27  |      | 1.40  |
| L2   | 4.93  |      | 5.23  |
| L3   | 6.85  |      | 7.25  |
| L4   | 1.5   |      | 1.7   |
| M    | 2.6   |      | 2.9   |
| R    | 0.20  |      | 0.60  |
| V    | 0°    |      | 8°    |

Figure 20: H<sup>2</sup>PAK-2 recommended footprint

## 4.2 H2PAK-6 package information

Figure 21: H<sup>2</sup>PAK-6 package outline

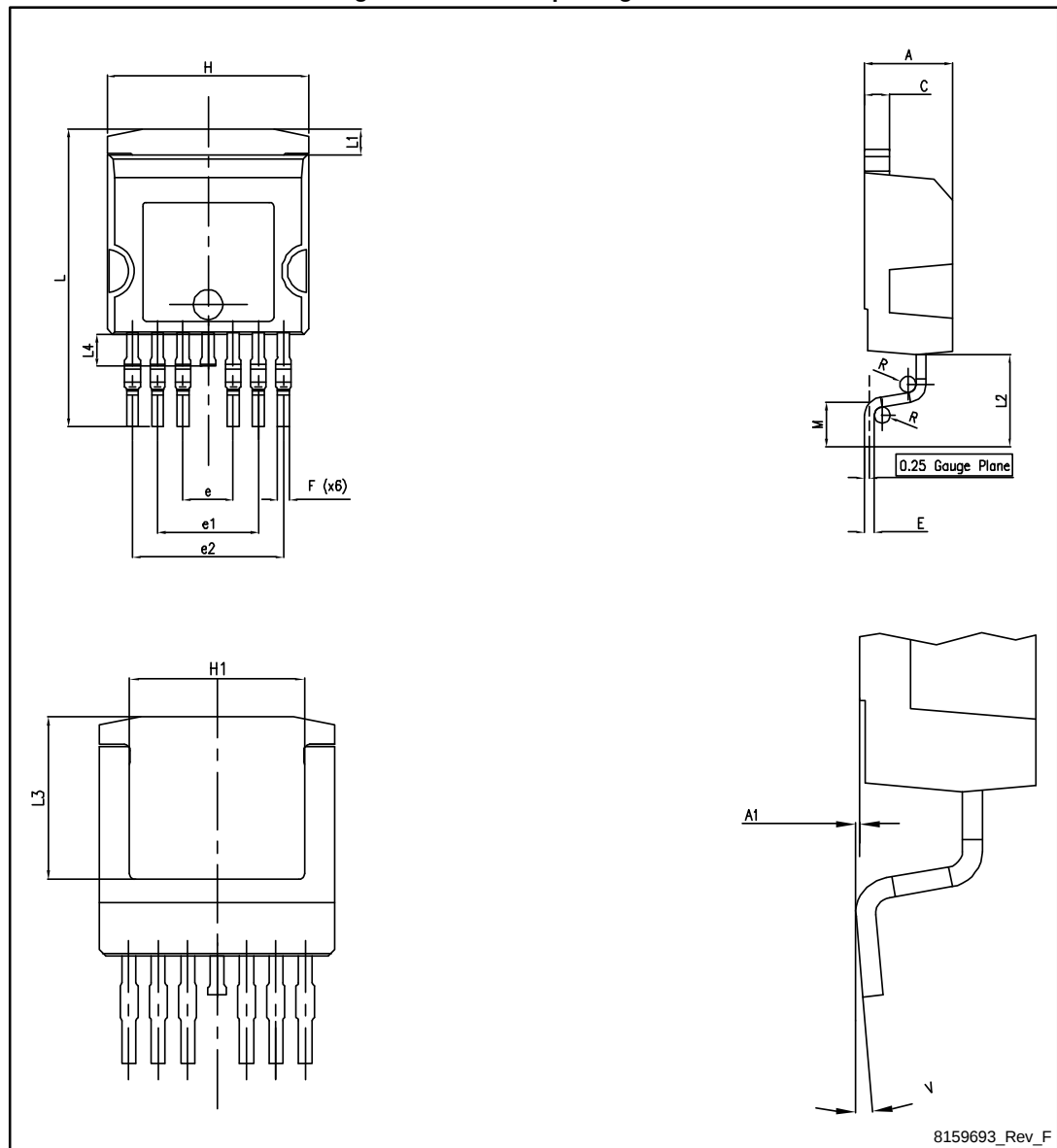
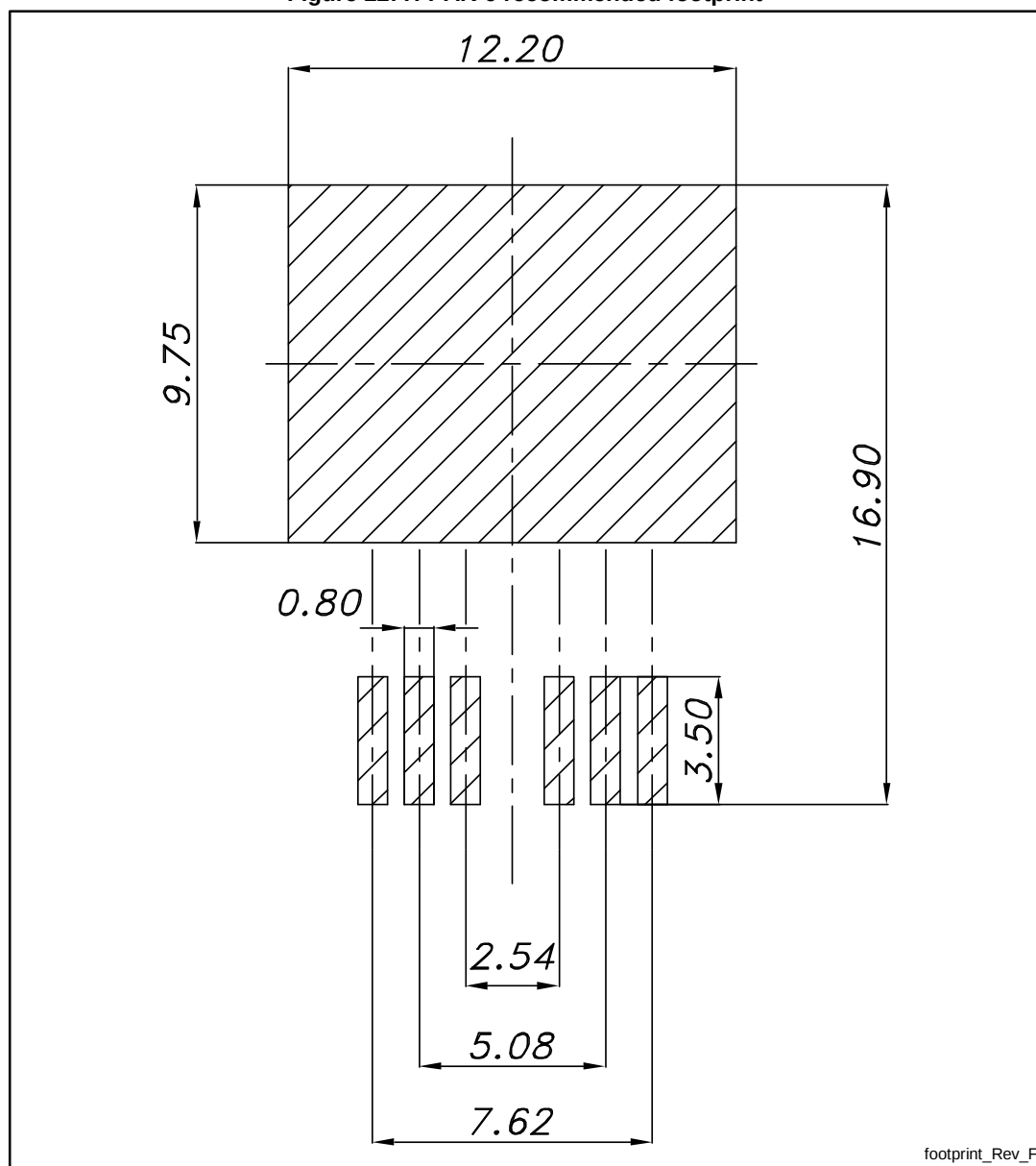


Table 9: H<sup>2</sup>PAK-6 package mechanical data

| Dim. | mm    |      |       |
|------|-------|------|-------|
|      | Min.  | Typ. | 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  |      | 7.80  |
| L    | 14.75 |      | 15.25 |
| L1   | 1.27  |      | 1.40  |
| L2   | 4.35  |      | 4.95  |
| L3   | 6.85  |      | 7.25  |
| L4   | 1.5   |      | 1.75  |
| M    | 1.90  |      | 2.50  |
| R    | 0.20  |      | 0.60  |
| V    | 0°    |      | 8°    |

Figure 22: H<sup>2</sup>PAK-6 recommended footprint



footprint\_Rev\_F



Dimensions are in mm.

### 4.3 Packing information

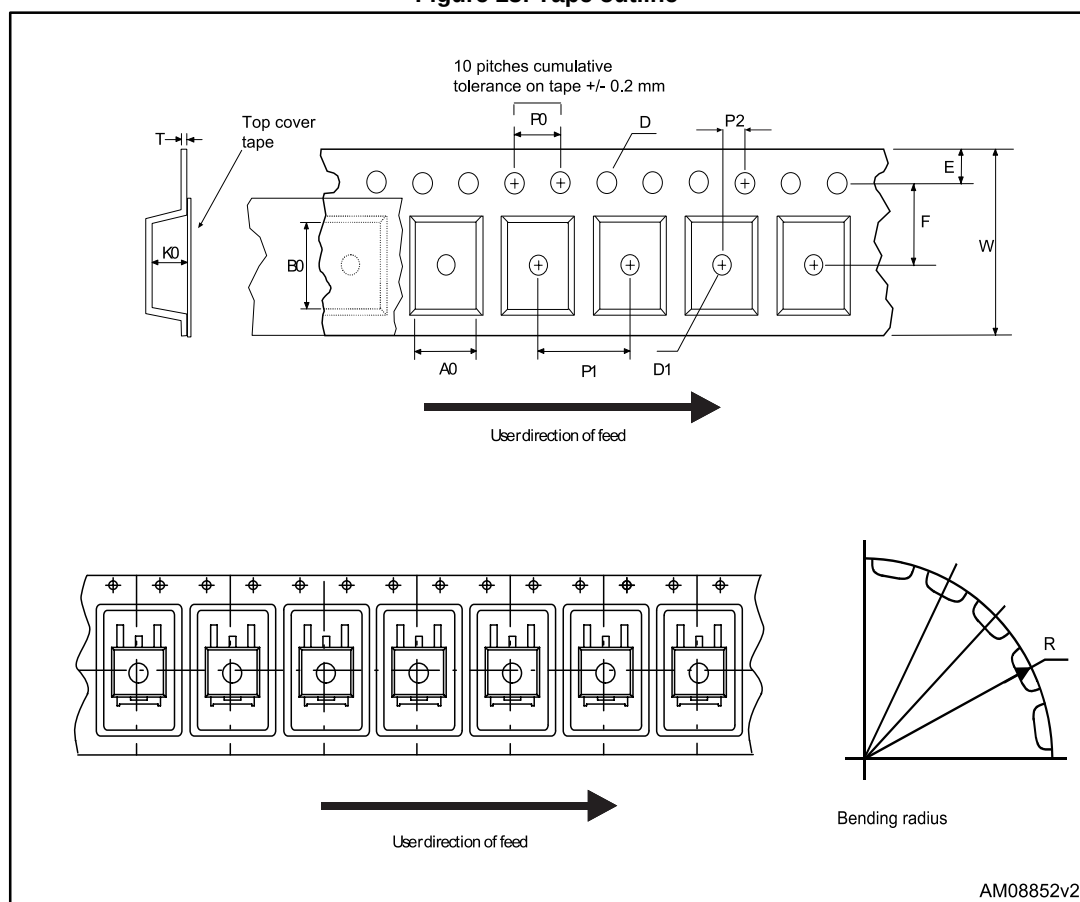
**Figure 23: Tape outline**

Figure 24: Reel outline

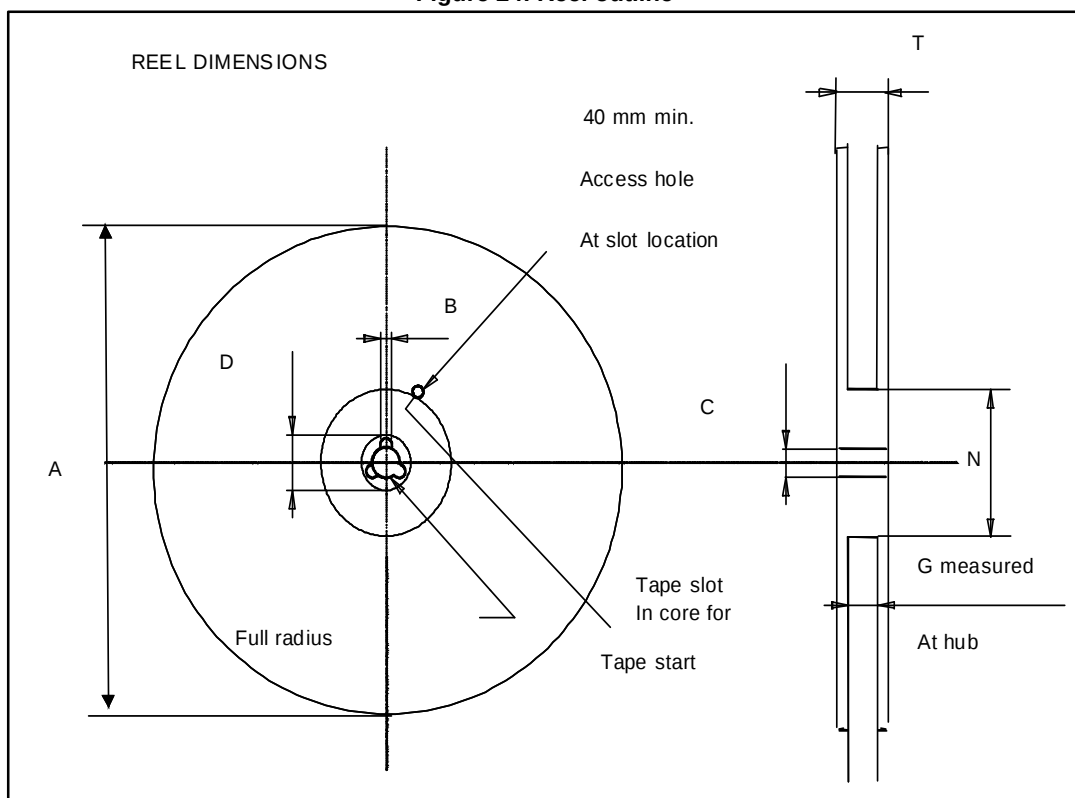


Table 10: Tape and reel mechanical data

| 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 |               |      |      |

## 5 Revision history

**Table 11: Document revision history**

| Date        | Revision | Changes                                                                                                                                                                                                                                                                             |
|-------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 10-Dec-2012 | 1        | Initial release. Part number(s) previously included in datasheet ID02287                                                                                                                                                                                                            |
| 23-Jul-2013 | 2        | <ul style="list-style-type: none"><li>• Document status promoted from preliminary to production data</li><li>• Modified: <math>I_{DSS}</math> and <math>V_{GS}</math> value in table 4</li><li>• Added: <math>E_{AS}</math> value in table 2</li><li>• Minor text changes</li></ul> |
| 27-Nov-2014 | 3        | <ul style="list-style-type: none"><li>• Updated: H<sup>2</sup>PAK-6 package information.</li><li>• Updated the title, features and description.</li><li>• Minor text changes.</li></ul>                                                                                             |
| 29-Jul-2015 | 4        | Updated <a href="#">Table 2: "Absolute maximum ratings"</a> .                                                                                                                                                                                                                       |

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