

## Automotive N-channel 60 V, 1.6 mΩ typ., 180 A STripFET™ F6 Power MOSFET in H<sup>2</sup>PAK-2 and H<sup>2</sup>PAK-6 packages

Datasheet - production data

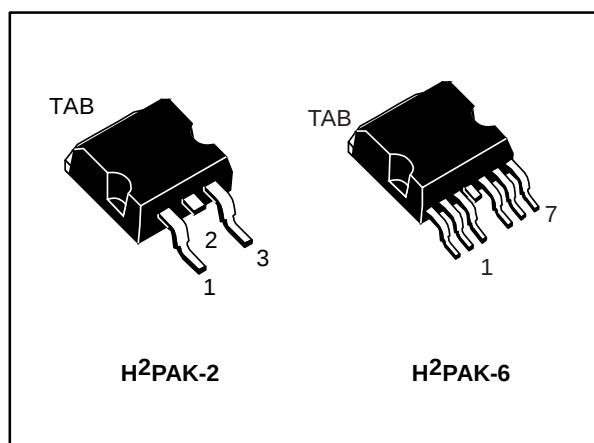
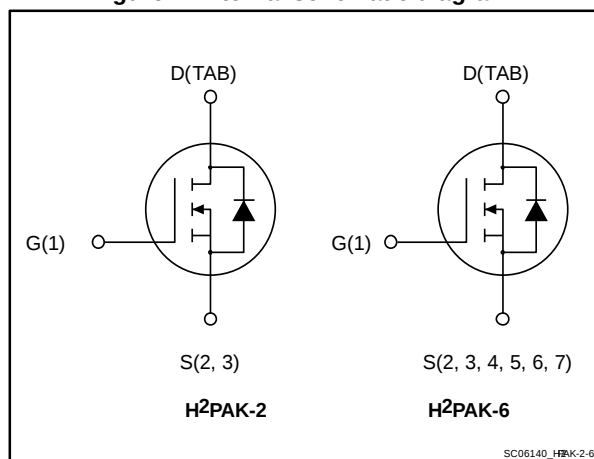


Figure 1: Internal schematic diagram



### Features

| Order code     | V <sub>DS</sub> | R <sub>DS(on)</sub> max | I <sub>D</sub> |
|----------------|-----------------|-------------------------|----------------|
| STH265N6F6-2AG | 60 V            | 2.1 mΩ                  | 180 A          |
| STH265N6F6-6AG | 60 V            | 2.1 mΩ                  | 180 A          |

- Designed for automotive applications
- Very low on-resistance
- Very low gate charge
- High avalanche ruggedness
- Low gate drive power loss

### Applications

- Switching applications

### Description

This device is an N-channel Power MOSFET developed using the STripFET™ F6 technology with a new trench gate structure. The resulting Power MOSFET exhibits very low R<sub>DS(on)</sub> in all packages.

Table 1: Device summary

| Order code     | Marking | Package              | Packaging     |
|----------------|---------|----------------------|---------------|
| STH265N6F6-2AG | 265N6F6 | H <sup>2</sup> PAK-2 | Tape and reel |
| STH265N6F6-6AG | 265N6F6 | H <sup>2</sup> PAK-6 | Tape and reel |

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## Contents

|          |                                                   |           |
|----------|---------------------------------------------------|-----------|
| <b>1</b> | <b>Electrical ratings .....</b>                   | <b>3</b>  |
| <b>2</b> | <b>Electrical characteristics .....</b>           | <b>4</b>  |
|          | 2.1 Electrical characteristics (curves).....      | 6         |
| <b>3</b> | <b>Package mechanical data .....</b>              | <b>8</b>  |
|          | 3.1 H2PAK-2 mechanical data .....                 | 9         |
|          | 3.2 H <sup>2</sup> PAK-6 package information..... | 12        |
| <b>4</b> | <b>Packaging information.....</b>                 | <b>15</b> |
| <b>5</b> | <b>Revision history .....</b>                     | <b>17</b> |

# 1 Electrical ratings

Table 2: Absolute maximum ratings

| Symbol         | Parameter                                                                                        | Value       | Unit                |
|----------------|--------------------------------------------------------------------------------------------------|-------------|---------------------|
| $V_{DS}$       | Drain-source voltage                                                                             | 60          | 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                   |
| $I_D^{(1)}$    | Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$                                  | 180         | A                   |
| $I_{DM}^{(2)}$ | Drain current (pulsed)                                                                           | 720         | A                   |
| $P_{TOT}$      | Total dissipation at $T_C = 25\text{ }^\circ\text{C}$                                            | 300         | W                   |
| $E_{AS}$       | Single pulse avalanche energy (Starting $T_J = 25\text{ }^\circ\text{C}$ , $I_D = 80\text{ A}$ ) | 720         | mJ                  |
|                | Derating factor                                                                                  | 2           | W/ $^\circ\text{C}$ |
| $T_{stg}$      | Storage temperature                                                                              | - 55 to 175 | $^\circ\text{C}$    |
| $T_J$          | Operating junction temperature                                                                   |             |                     |

**Notes:**

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

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

Table 3: Thermal data

| Symbol              | Parameter                            | Value | Unit               |
|---------------------|--------------------------------------|-------|--------------------|
| $R_{thj-case}$      | Thermal resistance junction-case max | 0.5   | $^\circ\text{C/W}$ |
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb max  | 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 states

| 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                                     | 60   |      |       | V    |
| I <sub>DSS</sub>     | Zero gate voltage drain current (V <sub>GS</sub> = 0) | V <sub>DS</sub> = 60 V                                      |      |      | 1     | μA   |
|                      |                                                       | V <sub>DS</sub> = 60 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    |      | 4     | V    |
| R <sub>DS(on)</sub>  | Static drain-source on-resistance                     | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 60 A               |      | 1.6  | 2.1   | 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, V <sub>GS</sub> = 0                 | -    | 11800 | -    | pF   |
| C <sub>oss</sub> | Output capacitance           |                                                                        | -    | 1235  | -    | pF   |
| C <sub>rss</sub> | Reverse transfer capacitance |                                                                        | -    | 488   | -    | pF   |
| Q <sub>g</sub>   | Total gate charge            | V <sub>DD</sub> = 30 V, I <sub>D</sub> = 120 A, V <sub>GS</sub> = 10 V | -    | 183   | -    | nC   |
| Q <sub>gs</sub>  | Gate-source charge           |                                                                        | -    | 53    | -    | nC   |
| Q <sub>gd</sub>  | Gate-drain charge            |                                                                        | -    | 41    | -    | 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> = 30 V, I <sub>D</sub> = 60 A R <sub>G</sub> = 4.7 Ω, V <sub>GS</sub> = 10 V | -    | 31   | -    | ns   |
| t <sub>r</sub>      | Rise time           |                                                                                              | -    | 165  | -    | ns   |
| t <sub>d(off)</sub> | Turn-off-delay time |                                                                                              | -    | 144  | -    | ns   |
| t <sub>f</sub>      | Fall time           |                                                                                              | -    | 63   | -    | ns   |

Table 7: 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    |
| $V_{SD}^{(2)}$  | Forward on voltage            | $I_{SD} = 180 \text{ A}$ , $V_{GS} = 0$                                                                                           |      |      | 1.1  | V    |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 120 \text{ A}$ , $V_{DD} = 48 \text{ V}$<br>$di/dt = 100 \text{ A}/\mu\text{s}$ ,<br>$T_j = 150 \text{ }^\circ\text{C}$ | -    | 56   | -    | ns   |
| $Q_{rr}$        | Reverse recovery charge       |                                                                                                                                   | -    | 116  | -    | nC   |
| $I_{RRM}$       | Reverse recovery current      |                                                                                                                                   | -    | 3.8  | -    | 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%

## 2.2 Electrical characteristics (curves)

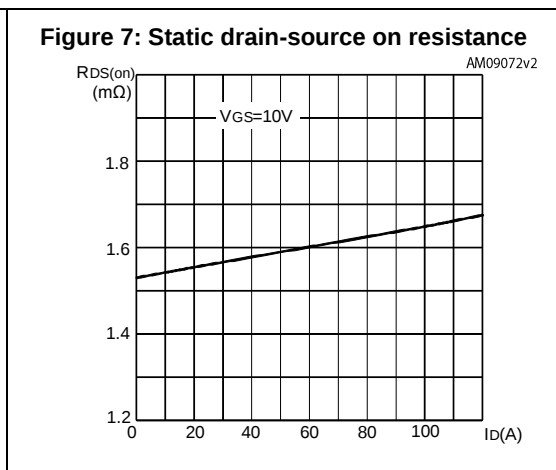
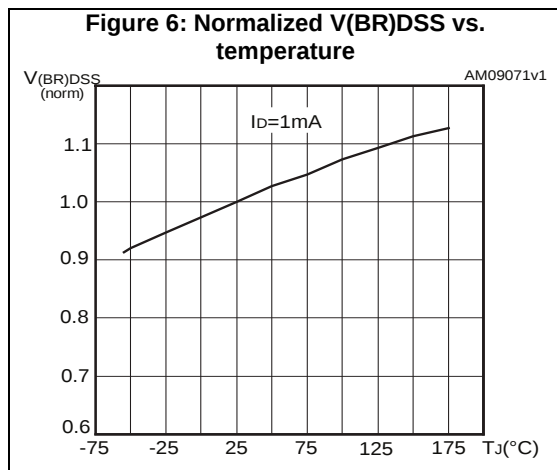
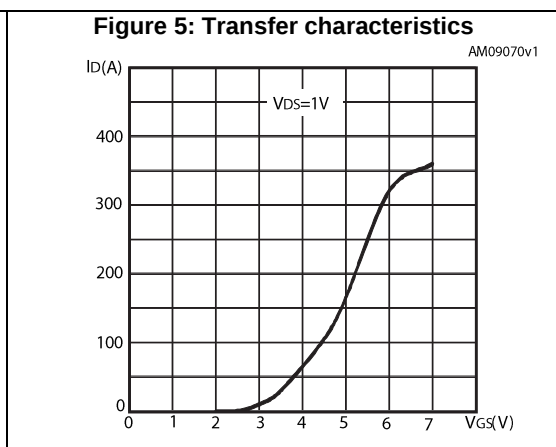
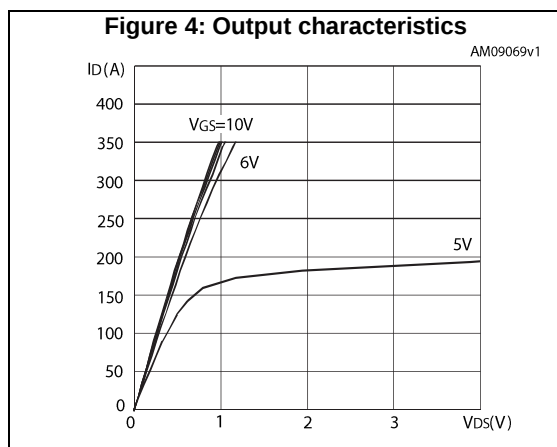
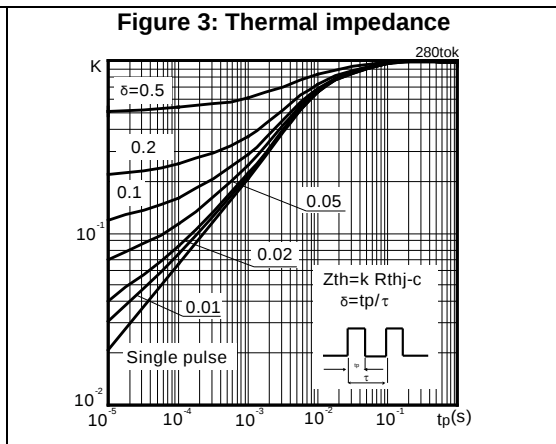
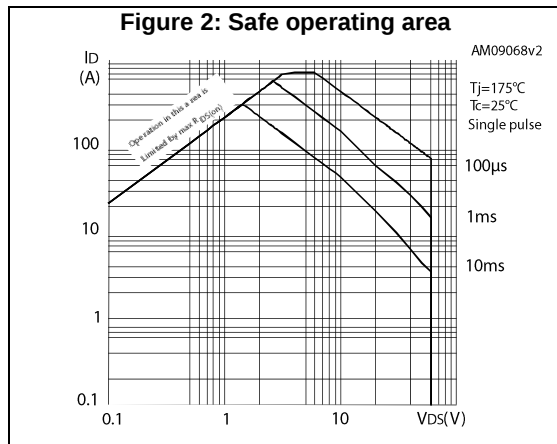


Figure 8: Gate charge vs. gate-source voltage

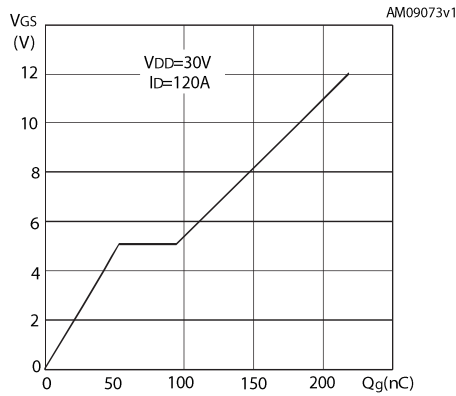


Figure 9: Capacitance variations

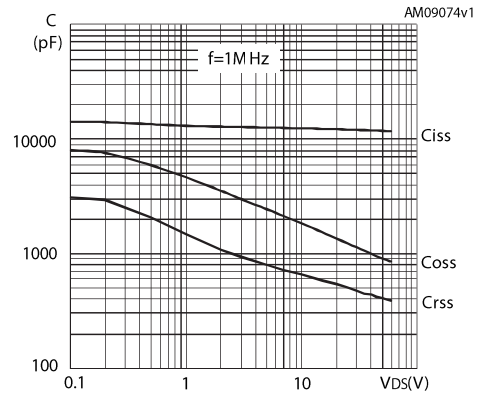


Figure 10: Normalized gate threshold voltage vs. temperature

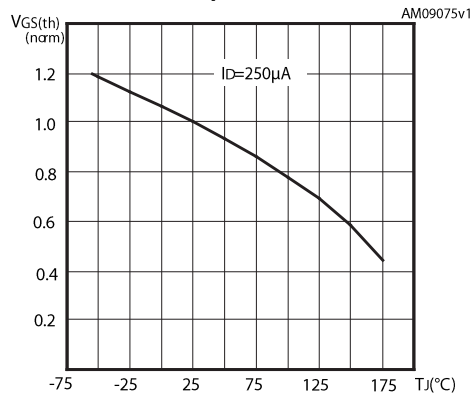


Figure 11: Normalized on resistance vs. temperature

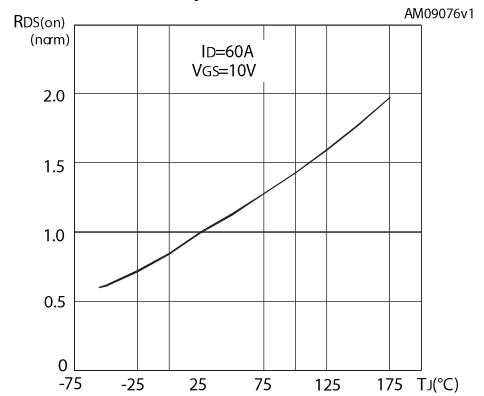
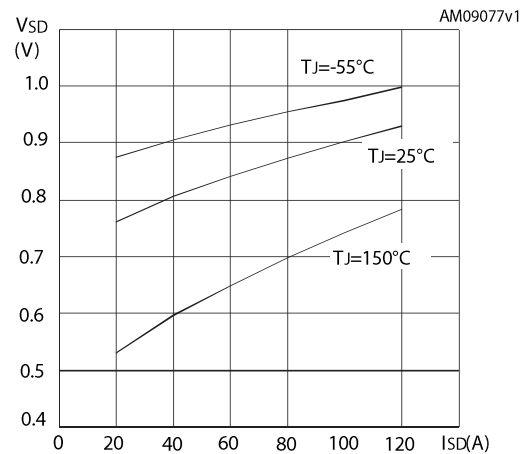


Figure 12: Source-drain diode forward characteristics



### 3      **Package mechanical data**

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.

### 3.1 H2PAK-2 mechanical data

Figure 13: H<sup>2</sup>PAK-2 outline

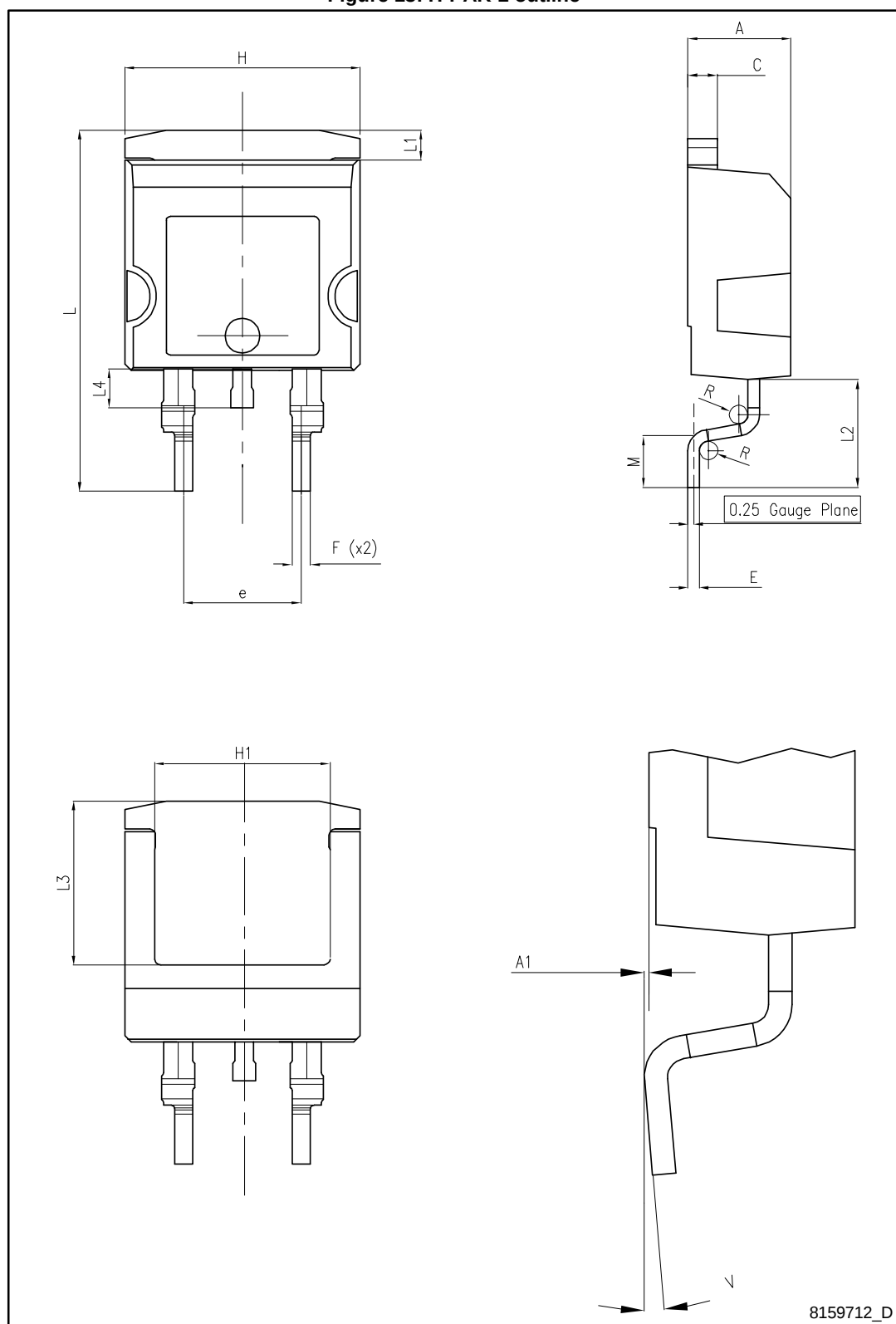
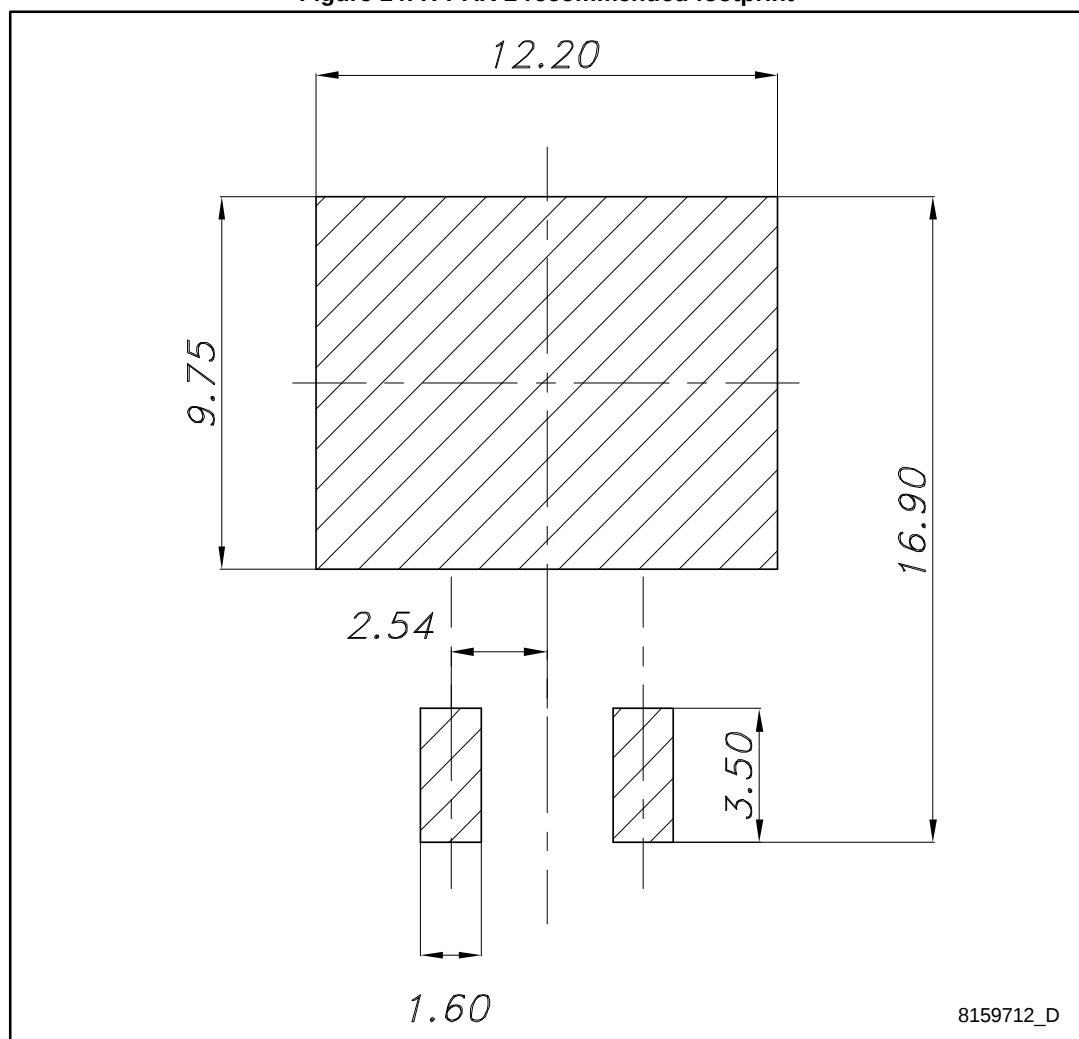


Table 8: H<sup>2</sup>PAK-2 mechanical data

| 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 14: H<sup>2</sup>PAK-2 recommended footprint



### 3.2 H<sup>2</sup>PAK-6 package information

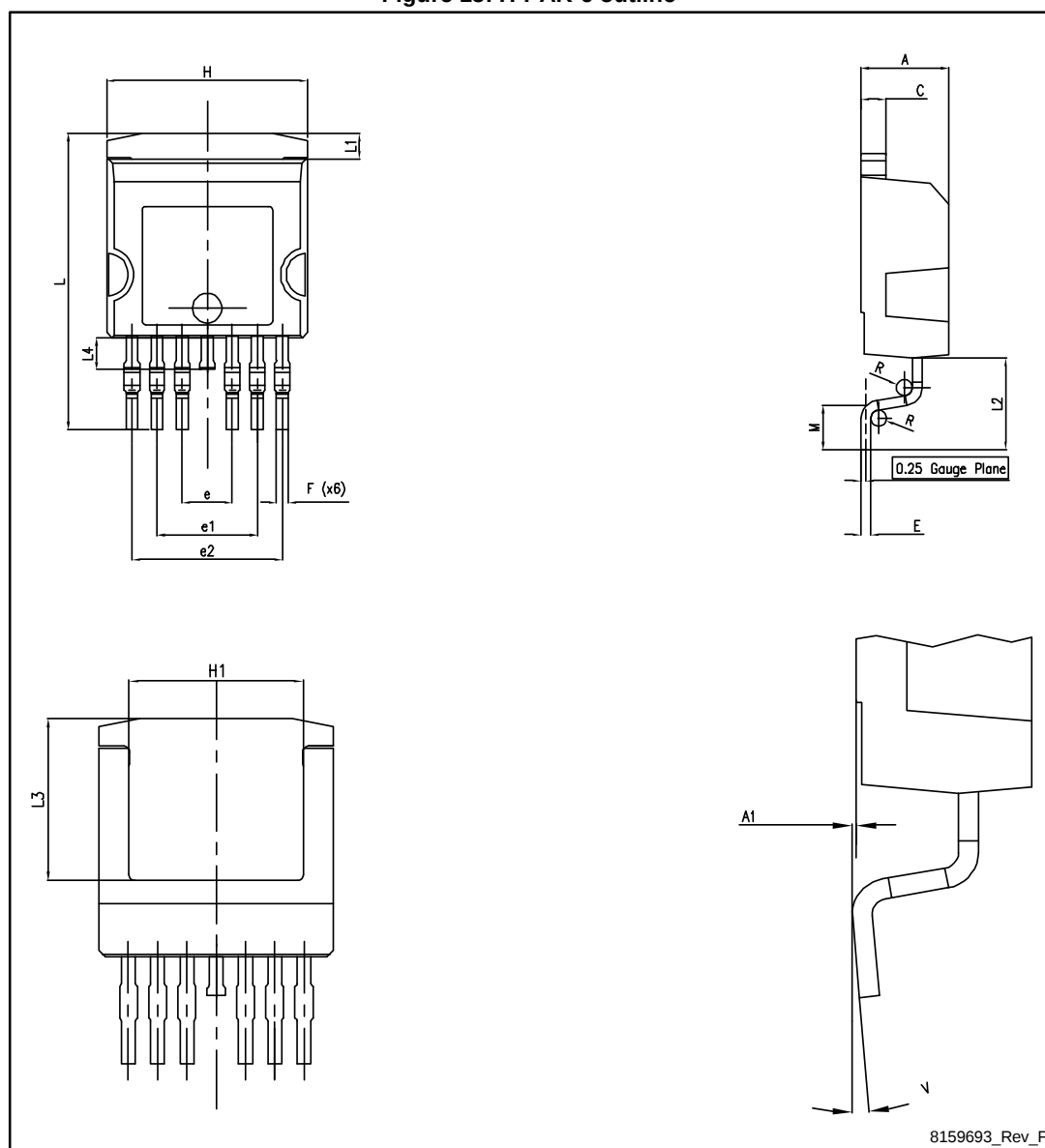
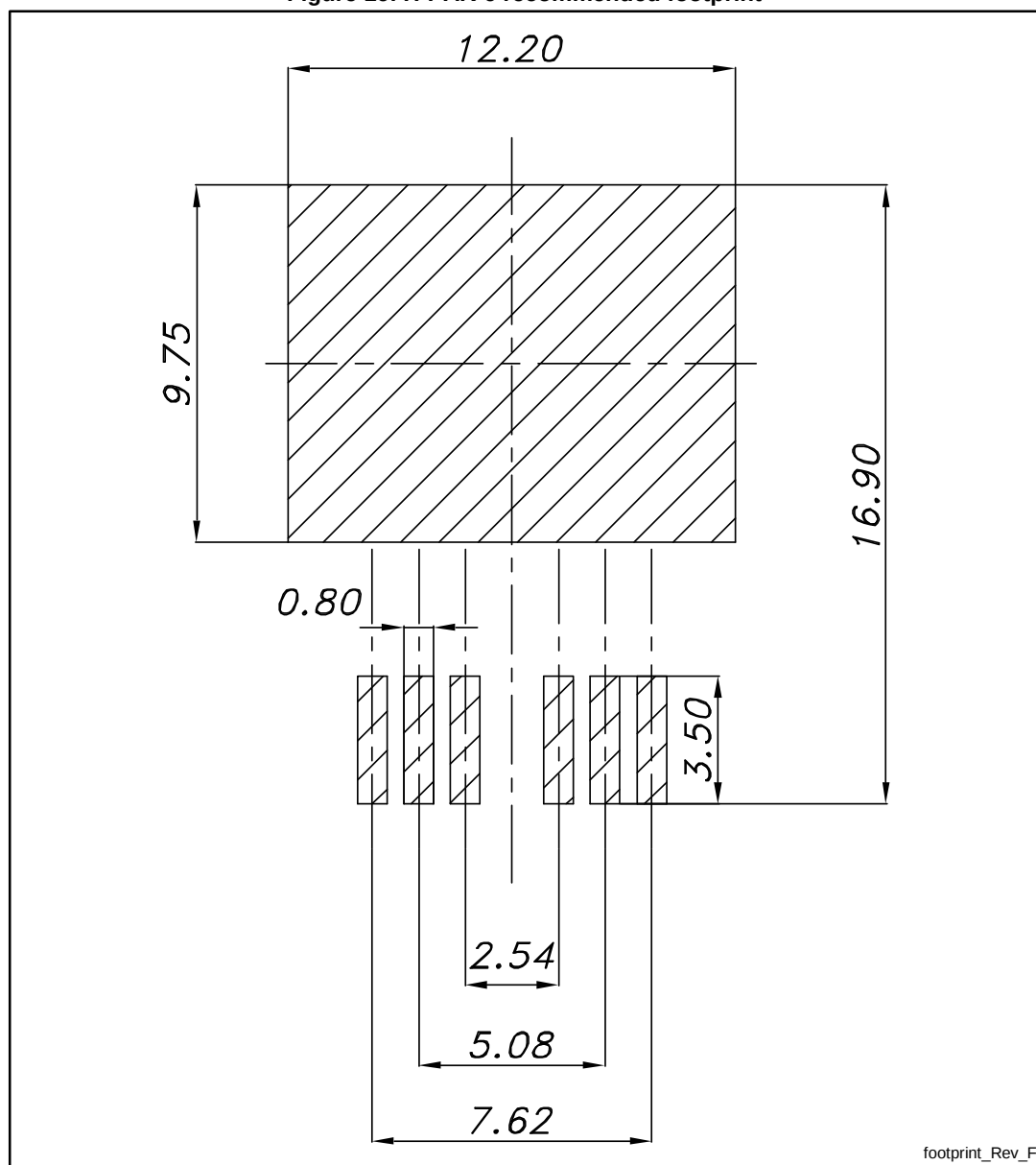
Figure 15: H<sup>2</sup>PAK-6 outline

Table 9: H<sup>2</sup>PAK-6 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 16: H<sup>2</sup>PAK-6 recommended footprint

Dimensions are in mm.

## 4 Packaging information

Figure 17: Tape outline

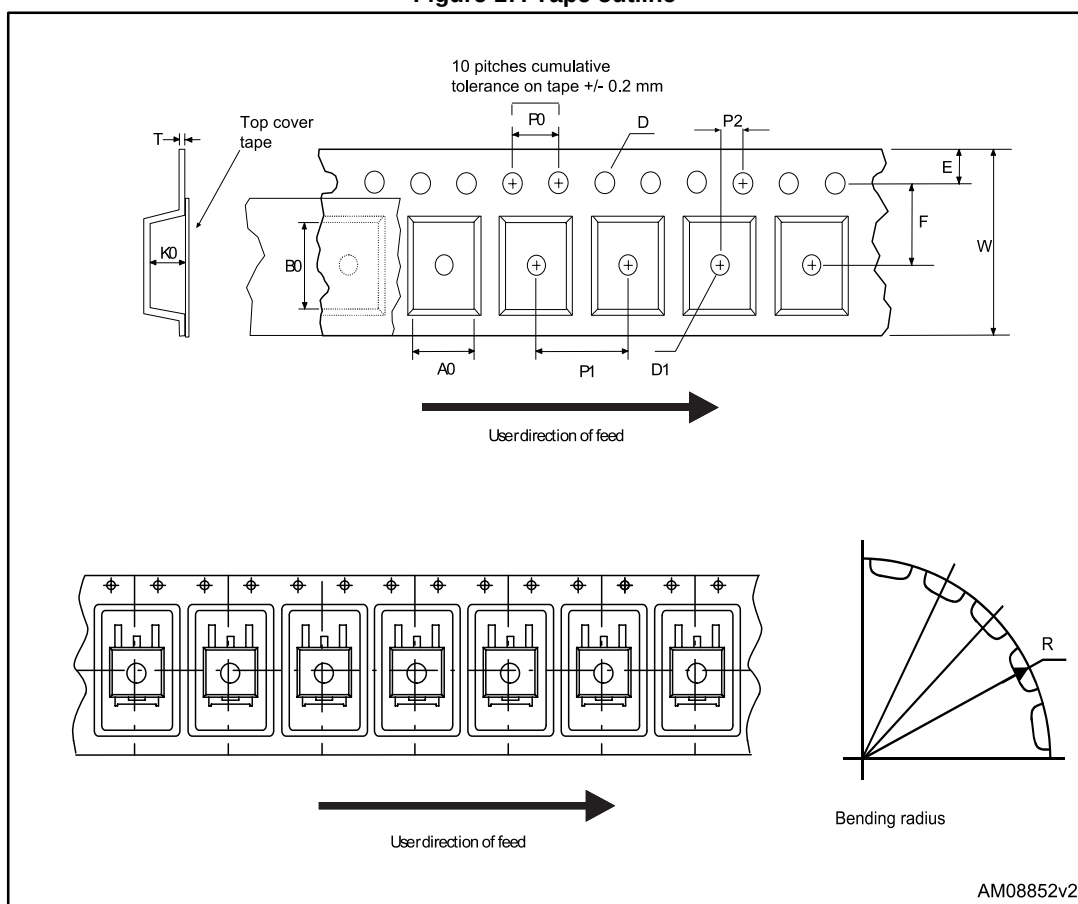


Figure 18: Reel outline

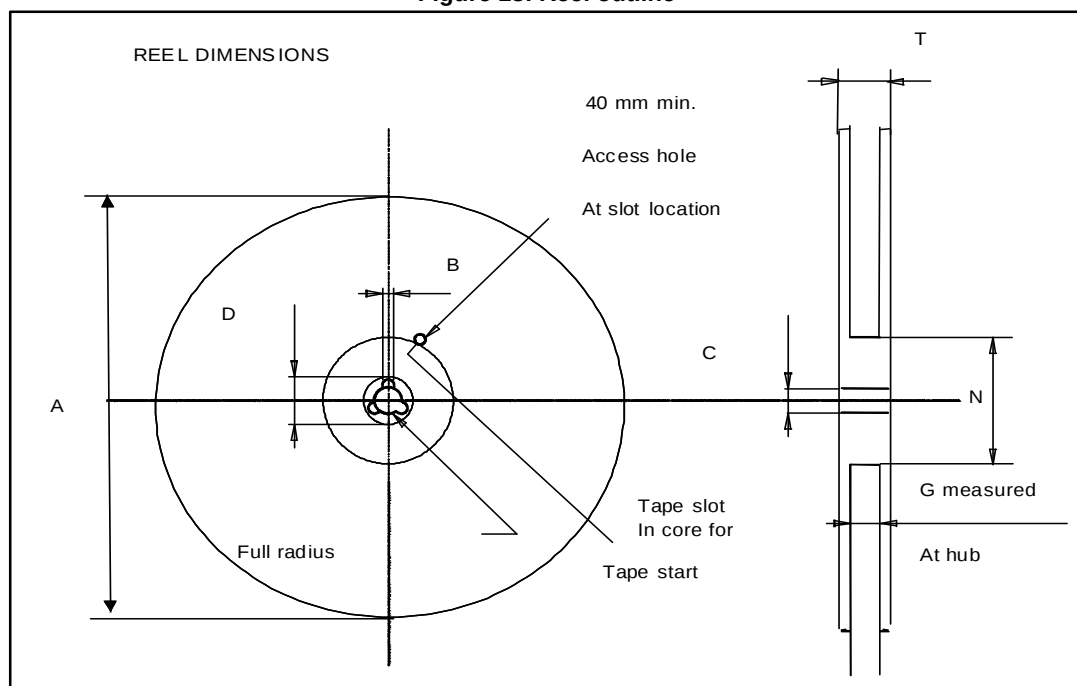


Table 10: Tape and reel mechanical data

| 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                                                       |
|-------------|----------|---------------------------------------------------------------|
| 13-Oct-2014 | 1        | First release.                                                |
| 18-Dec-2014 | 2        | Document status promoted from preliminary to production data. |

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