

Automotive-grade N-channel 80 V, 1.7 mΩ typ., 180 A,  
STripFET™ F7 Power MOSFETs in H<sup>2</sup>PAK-2 and H<sup>2</sup>PAK-6

Datasheet - production data

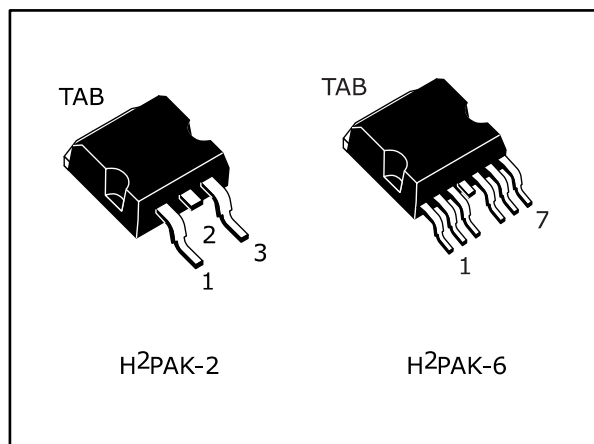
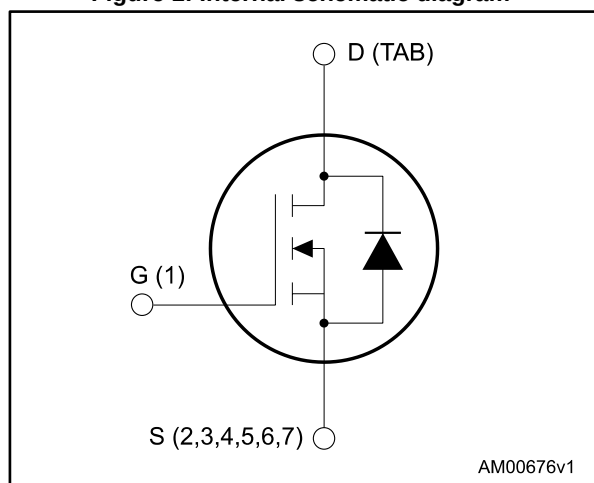


Figure 1: Internal schematic diagram



## Features

| Order code     | V <sub>DS</sub> | R <sub>DS(on)</sub> max. | I <sub>D</sub> |
|----------------|-----------------|--------------------------|----------------|
| STH275N8F7-2AG | 80 V            | 2.1 mΩ                   | 180 A          |
| STH275N8F7-6AG |                 |                          |                |

- AEC-Q101 qualified
- Among the lowest R<sub>DS(on)</sub> on the market
- Excellent FoM (figure of merit)
- 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-state resistance, while also reducing internal capacitance and gate charge for faster and more efficient switching.

Table 1: Device summary

| Order code     | Marking | Package              | Packing       |
|----------------|---------|----------------------|---------------|
| STH275N8F7-2AG | 275N8F7 | H <sup>2</sup> PAK-2 | Tape and reel |
| STH275N8F7-6AG |         | H <sup>2</sup> PAK-6 |               |

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## Contents

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# 1 Electrical ratings

Table 2: Absolute maximum ratings

| Symbol         | Parameter                                                       | Value      | Unit             |
|----------------|-----------------------------------------------------------------|------------|------------------|
| $V_{DS}$       | Drain-source voltage                                            | 80         | 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        |                  |
| $I_{DM}^{(2)}$ | 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                                   | 0.775      | J                |
| $T_{stg}$      | Storage temperature range                                       | -55 to 175 | $^\circ\text{C}$ |
| $T_j$          | Operating junction temperature range                            |            |                  |

**Notes:**

<sup>(1)</sup> Limited by package.

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

<sup>(3)</sup> Starting  $T_j = 25\text{ }^\circ\text{C}$ ,  $I_d = 65\text{ A}$ ,  $V_{dd} = 50\text{ V}$ ,  $T_j < T_{j-max}$ .

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    |                    |

**Notes:**

<sup>(1)</sup> When mounted on FR-4 board of 1 inch<sup>2</sup>, 2oz 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 V, I <sub>D</sub> = 1 mA                                          | 80   |      |      | V    |
| I <sub>DSS</sub>     | Zero gate voltage drain current   | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 80 V                                         |      |      | 1    | μA   |
|                      |                                   | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 80 V, T <sub>C</sub> = 125 °C <sup>(1)</sup> |      |      | 100  |      |
| I <sub>GSS</sub>     | Gate-body leakage current         | V <sub>DS</sub> = 0 V, 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  |      | 4.5  | V    |
| R <sub>DS(on)</sub>  | Static drain-source on-resistance | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 90 A                                         |      | 1.7  | 2.1  | mΩ   |

**Notes:**

<sup>(1)</sup> Defined by design, not subject to production test.

**Table 5: Dynamic**

| Symbol           | Parameter                    | Test conditions                                                                                                                                     | Min. | Typ.  | Max. | Unit |
|------------------|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|------|------|
| C <sub>iss</sub> | Input capacitance            | V <sub>DS</sub> = 50 V, f = 1 MHz, V <sub>GS</sub> = 0 V                                                                                            | -    | 13600 | -    | pF   |
| C <sub>oss</sub> | Output capacitance           |                                                                                                                                                     | -    | 2050  | -    |      |
| C <sub>rss</sub> | Reverse transfer capacitance |                                                                                                                                                     | -    | 236   | -    |      |
| Q <sub>g</sub>   | Total gate charge            | V <sub>DD</sub> = 40 V, I <sub>D</sub> = 180 A, V <sub>GS</sub> = 10 V<br>(see <a href="#">Figure 14: "Test circuit for gate charge behavior"</a> ) | -    | 193   | -    | nC   |
| Q <sub>gs</sub>  | Gate-source charge           |                                                                                                                                                     | -    | 96    | -    |      |
| Q <sub>gd</sub>  | Gate-drain charge            |                                                                                                                                                     | -    | 46    | -    |      |

**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> = 40 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 18: "Switching time waveform"</a> ) | -    | 56   | -    | ns   |
| t <sub>r</sub>      | Rise time           |                                                                                                                                                                | -    | 180  | -    |      |
| t <sub>d(off)</sub> | Turn-off delay time |                                                                                                                                                                | -    | 98   | -    |      |
| t <sub>f</sub>      | Fall time           |                                                                                                                                                                | -    | 42   | -    |      |

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            | $V_{GS} = 0 \text{ V}$ , $I_{SD} = 90 \text{ A}$                                                                                 | -    |      | 1.2  | V    |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 180 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ ,<br>$V_{DD} = 64 \text{ V}$ , $T_j = 150 \text{ }^\circ\text{C}$ | -    | 78   |      | ns   |
| $Q_{rr}$        | Reverse recovery charge       |                                                                                                                                  | -    | 182  |      | nC   |
| $I_{RRM}$       | 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

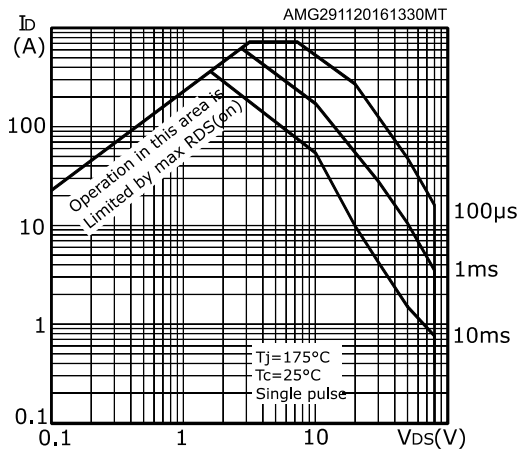


Figure 3: Thermal impedance

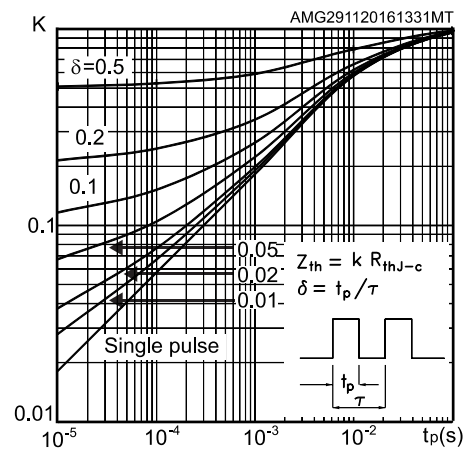


Figure 4: Gate charge vs gate-source voltage

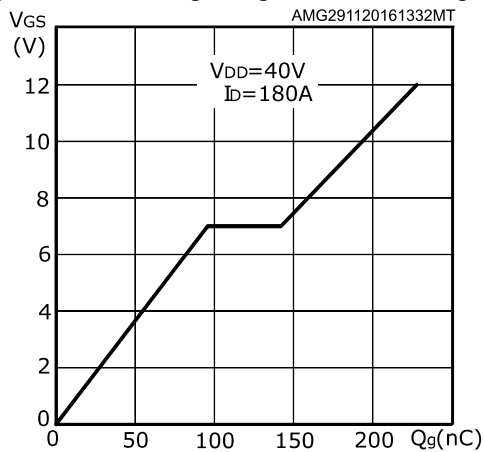


Figure 5: Output characteristics

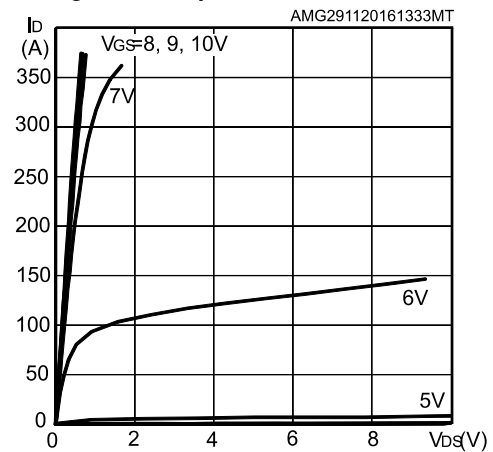


Figure 6: Transfer characteristics

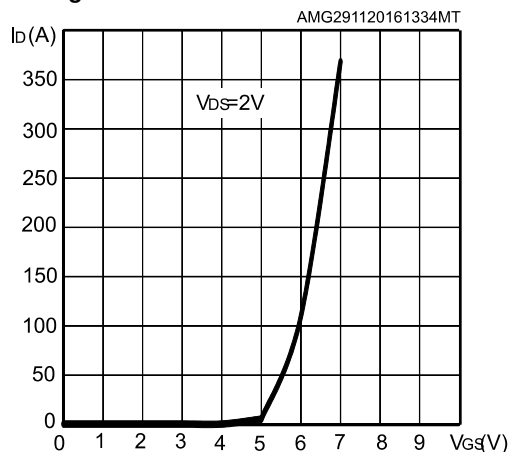
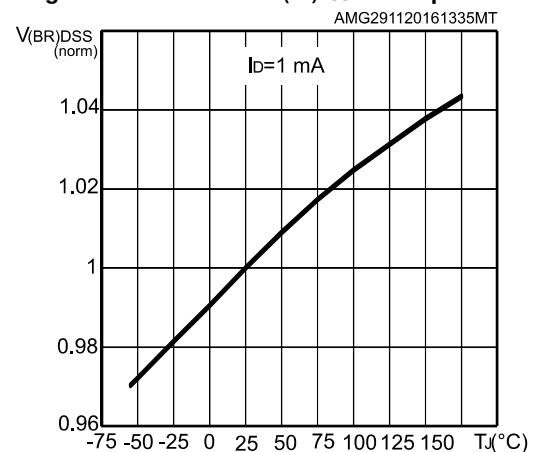
Figure 7: Normalized  $V_{(BR)DSS}$  vs temperature

Figure 8: Static drain-source on-resistance

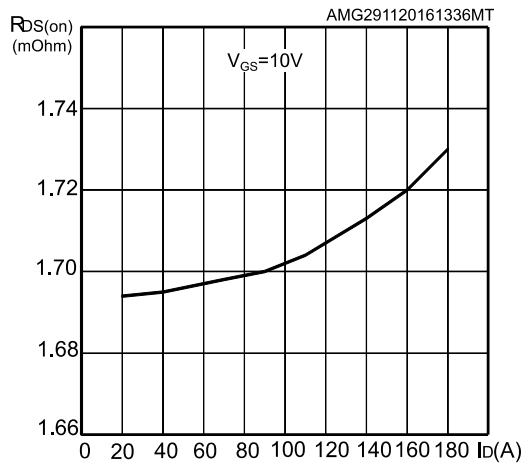


Figure 9: Capacitance variations

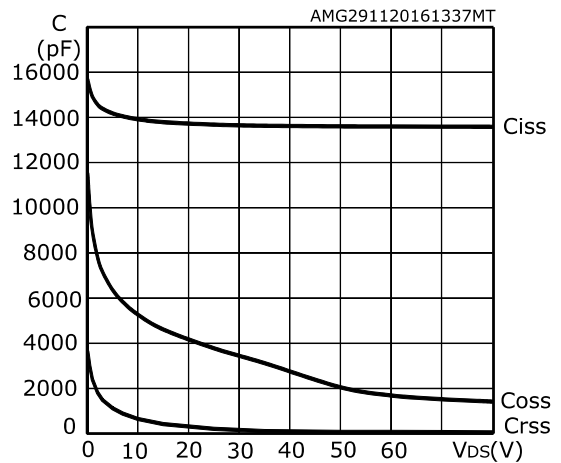


Figure 10: Source-drain diode forward characteristics

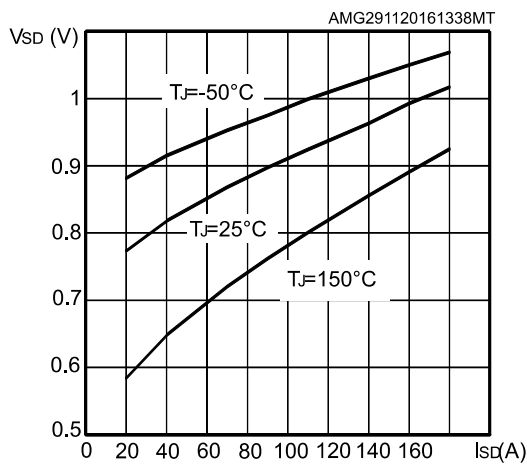


Figure 11: Normalized gate threshold voltage vs temperature

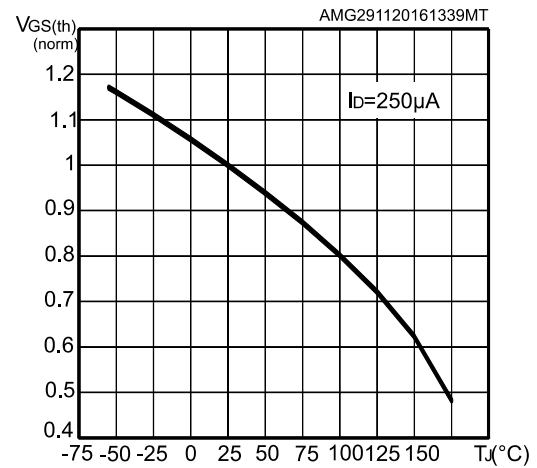
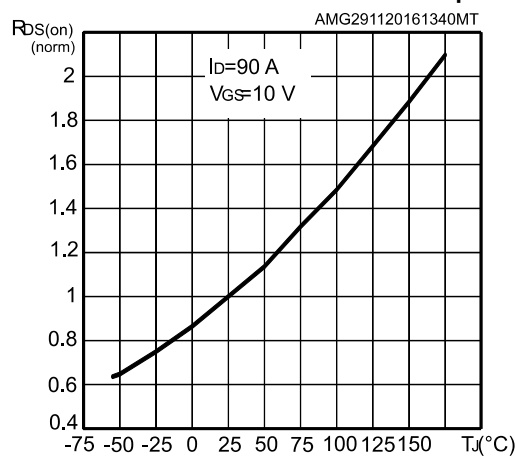
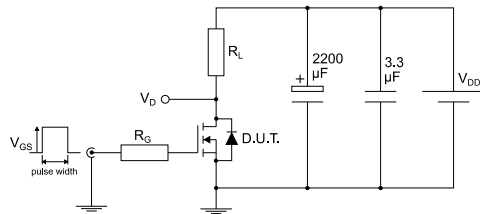


Figure 12: Normalized on-resistance vs temperature



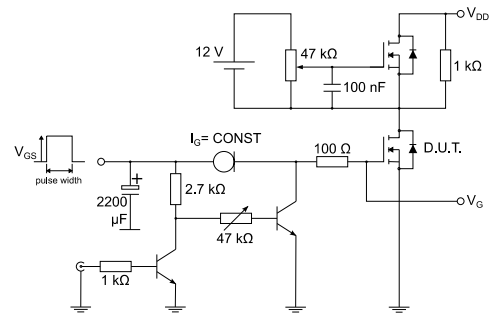
### 3 Test circuits

**Figure 13: Test circuit for resistive load switching times**



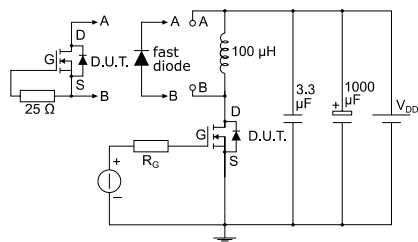
AM01468v1

**Figure 14: Test circuit for gate charge behavior**



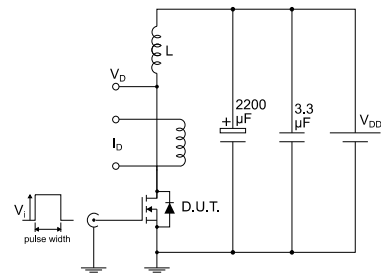
AM01469v1

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



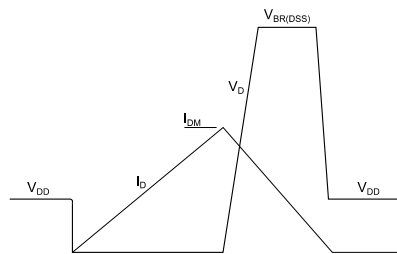
AM01470v1

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



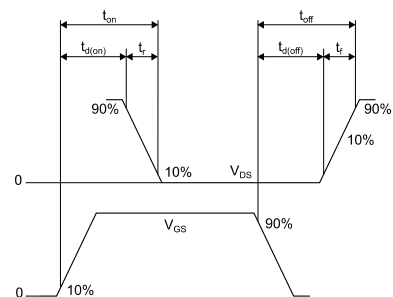
AM01471v1

**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 H<sup>2</sup>PAK-2 package information

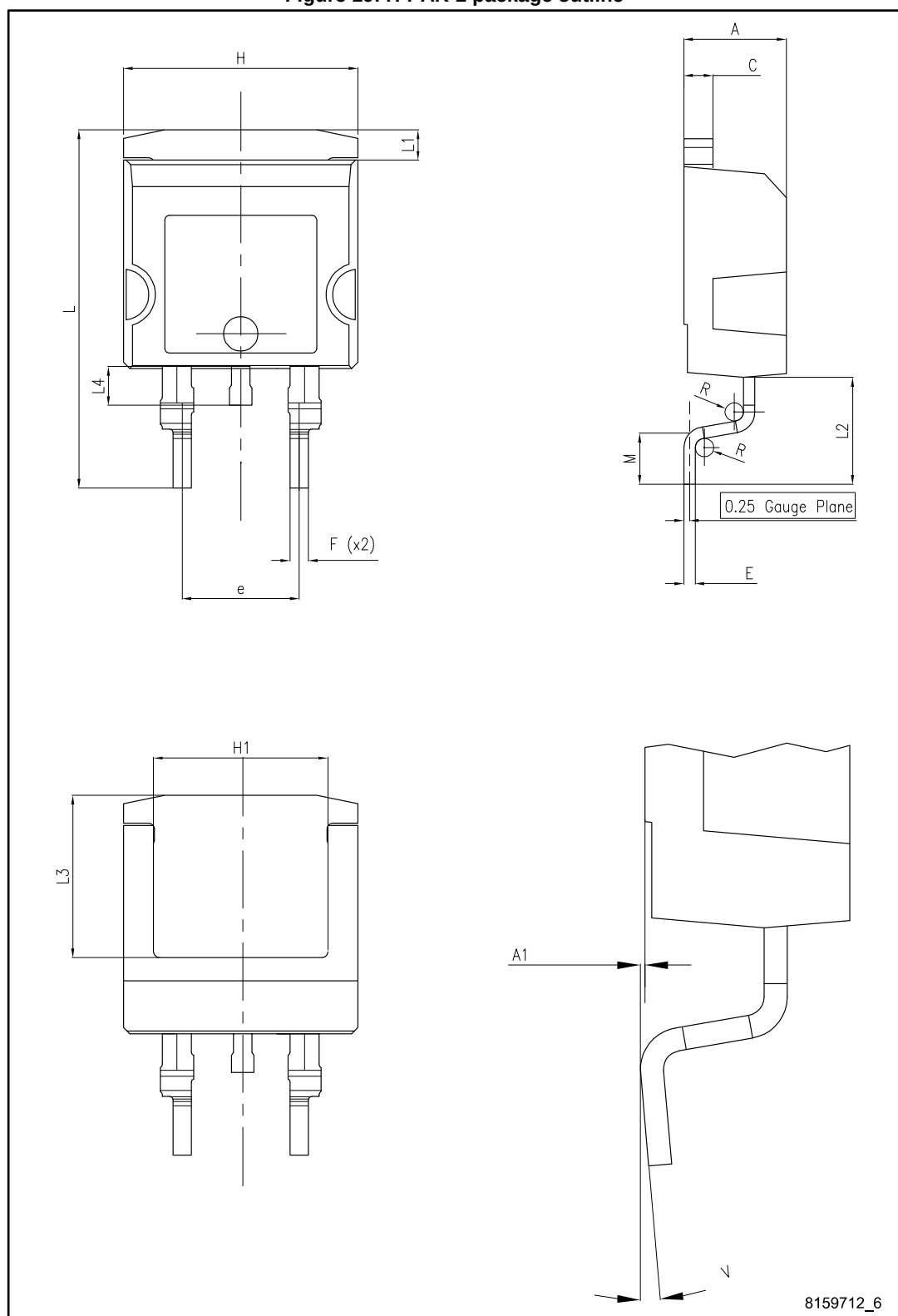
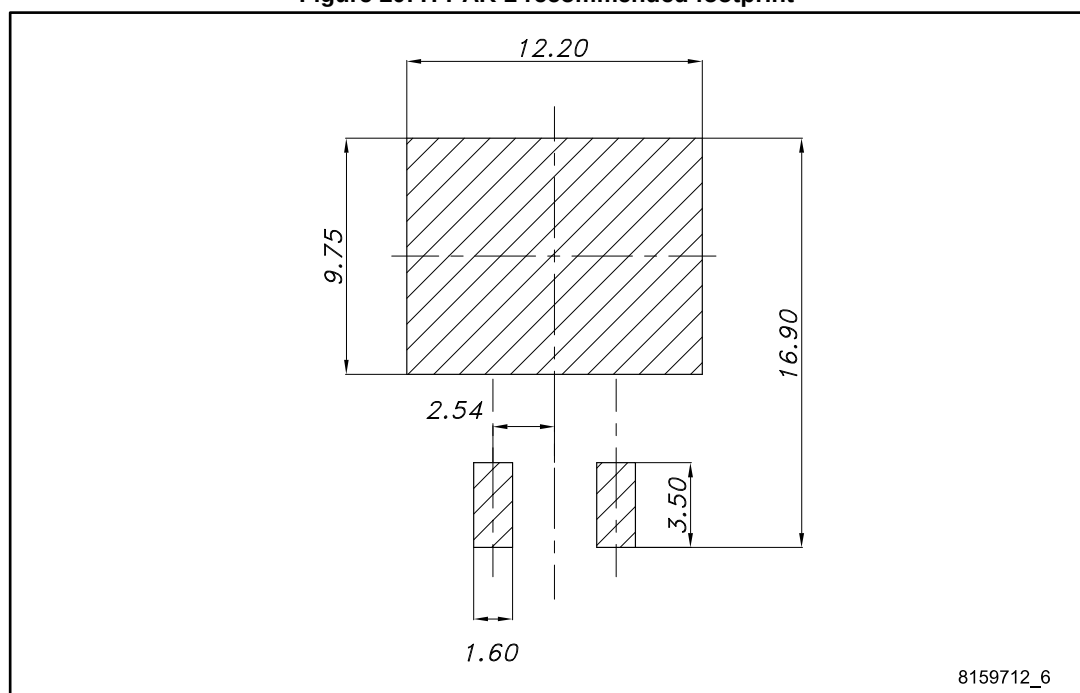
Figure 19: H<sup>2</sup>PAK-2 package outline

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

| Dim. | mm    |      |       |
|------|-------|------|-------|
|      | Min.  | Typ. | Max.  |
| A    | 4.30  | -    | 4.70  |
| 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 H<sup>2</sup>PAK-6 package information

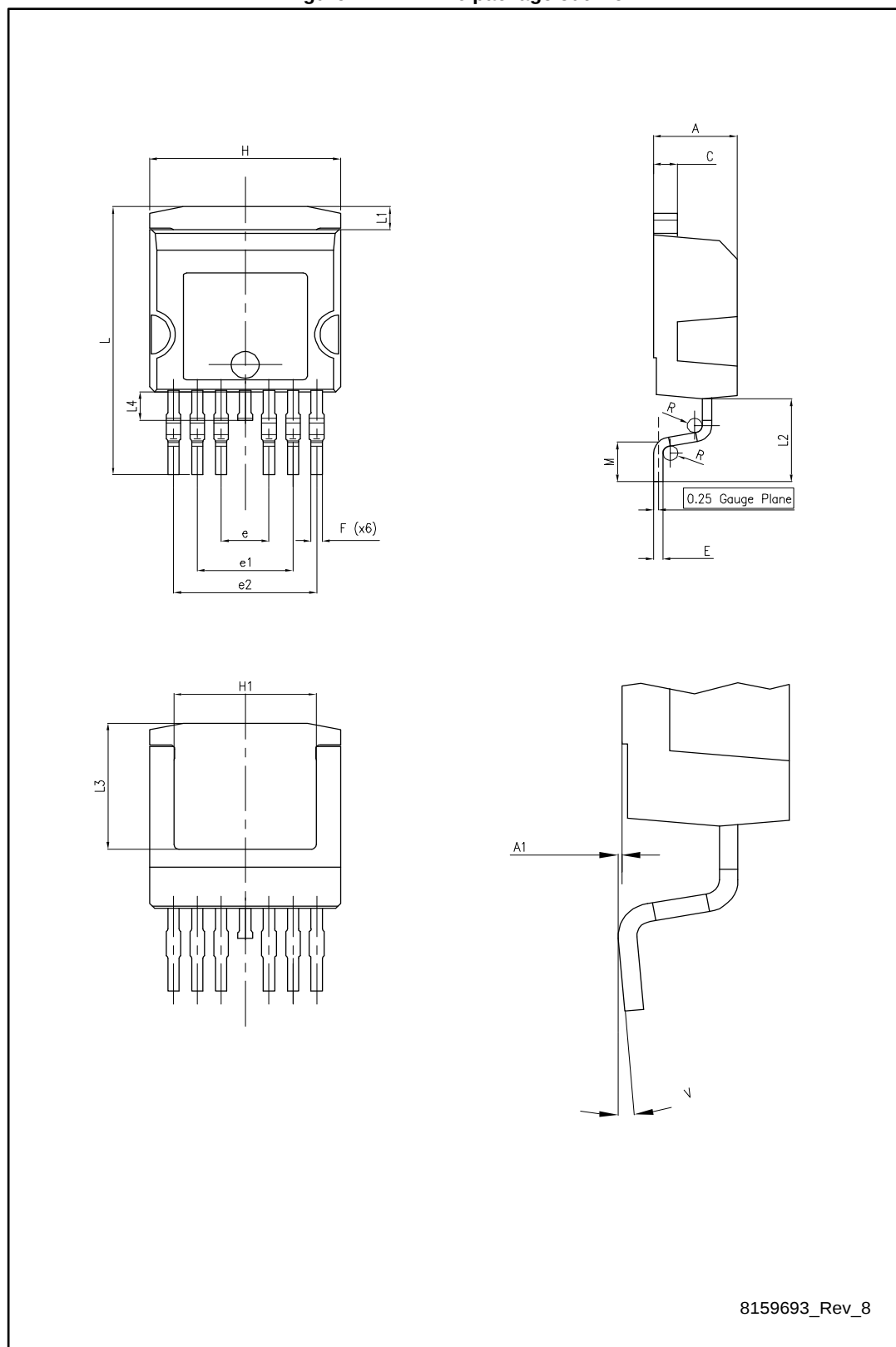
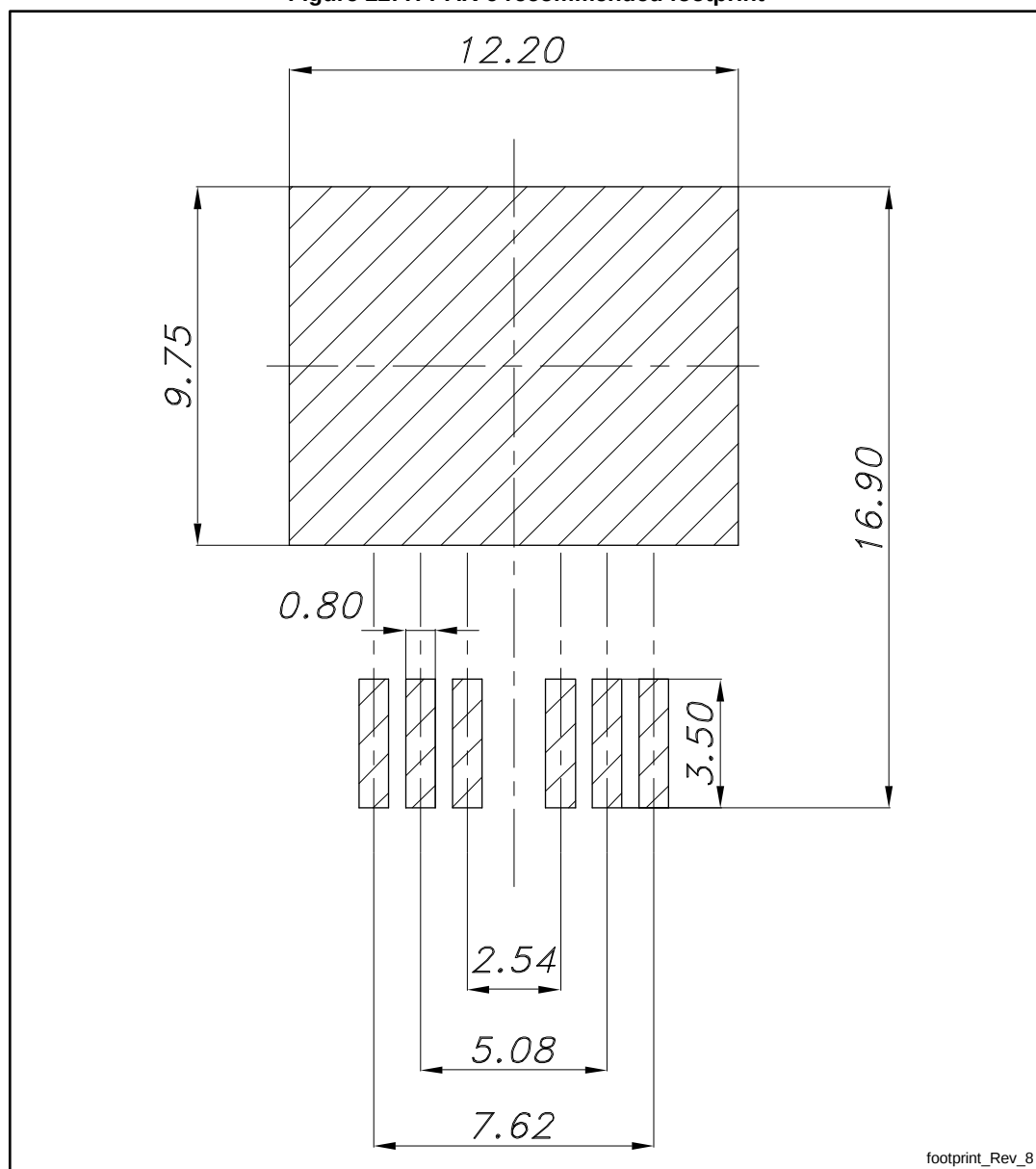
Figure 21: H<sup>2</sup>PAK-6 package outline

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

| Dim. | mm    |      |       |
|------|-------|------|-------|
|      | Min.  | Typ. | Max.  |
| A    | 4.30  |      | 4.70  |
| 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 22: H<sup>2</sup>PAK-6 recommended footprint

Dimensions are in mm.

### 4.3 H<sup>2</sup>PAK packing information

Figure 23: Tape outline

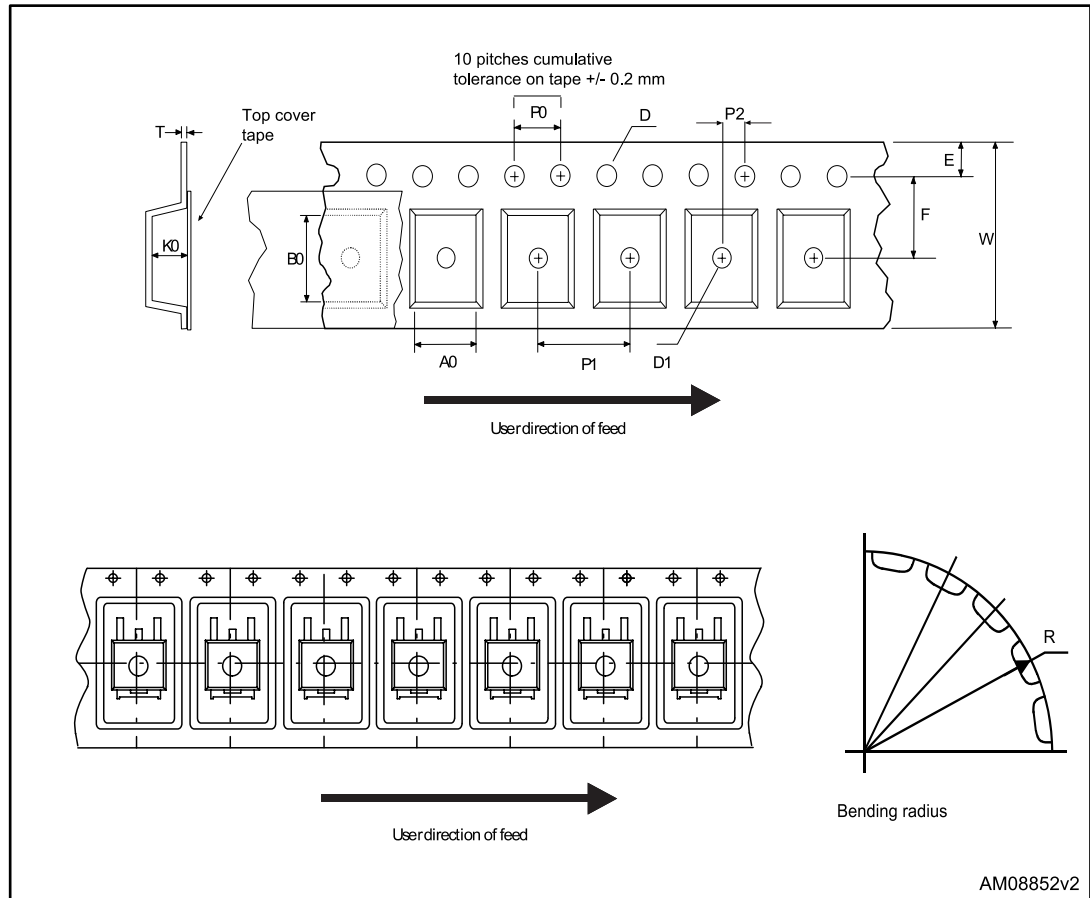


Figure 24: Reel outline

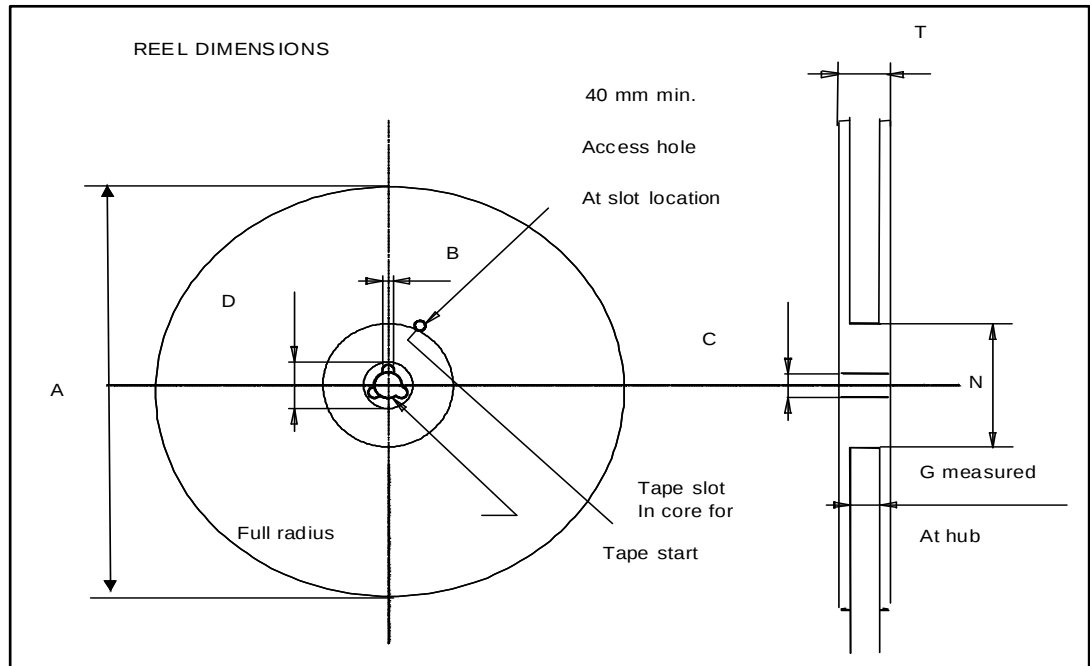


Table 10: Tape and reel mechanical data

| 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                                                                                                                                                                                                                     |
|-------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 27-Nov-2014 | 1        | First release.                                                                                                                                                                                                              |
| 05-Mar-2015 | 2        | Document status promoted from preliminary to production data.<br>Updated title and feature in cover page.                                                                                                                   |
| 10-Mar-2016 | 3        | Updated Table 4. Minor text changes.                                                                                                                                                                                        |
| 10-Jan-2017 | 4        | Updated title and features in cover page.<br>Updated <a href="#">Table 2: "Absolute maximum ratings"</a> , <a href="#">Table 4: "On/off states"</a> and <a href="#">Table 6: "Switching times"</a> .<br>Minor text changes. |

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- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



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