

## Automotive-grade N-channel 24 V, 0.95 mΩ typ., 180 A STripFET™ III Power MOSFET in a H<sup>2</sup>PAK-6 package

Datasheet – production data

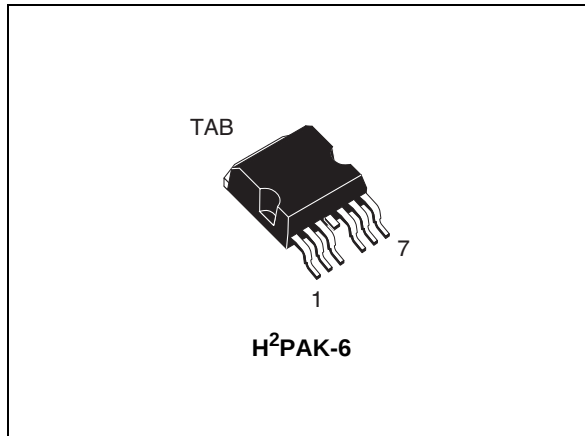
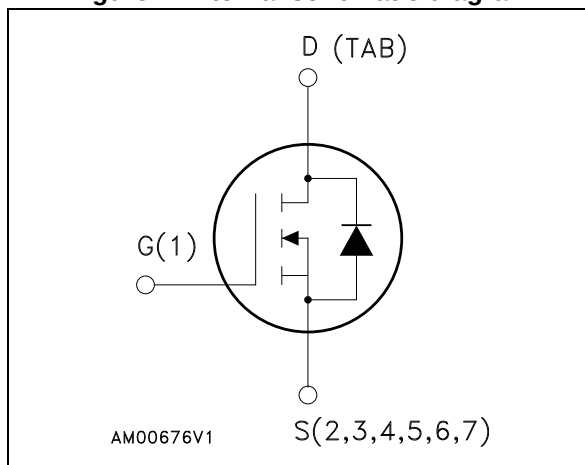


Figure 1. Internal schematic diagram



### Features

| Order code    | V <sub>DSS</sub> | R <sub>DS(on)</sub> max. | I <sub>D</sub> <sup>(1)</sup> |
|---------------|------------------|--------------------------|-------------------------------|
| STH300NH02L-6 | 24 V             | < 1.2 mΩ                 | 180 A                         |

1. Current limited by package.

- Designed for automotive applications and AEC-Q101 qualified
- Conduction losses reduced
- Low profile, very low parasitic inductance, high current package

### Applications

- Switching applications

### Description

This device is an N-channel enhancement mode Power MOSFET produced using STMicroelectronics' STripFET™ III technology, which is specifically designed to minimize on-resistance and gate charge to provide superior switching performance.

Table 1. Device summary

| Order code    | Marking  | Package              | Packaging     |
|---------------|----------|----------------------|---------------|
| STH300NH02L-6 | 300NH02L | H <sup>2</sup> PAK-6 | Tape and reel |

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol          | Parameter                                                         | Value      | Unit                  |
|-----------------|-------------------------------------------------------------------|------------|-----------------------|
| $V_{DS}$        | Drain-source voltage                                              | 24         | 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                     |
| $P_{TOT}^{(3)}$ | Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$           | 300        | W                     |
|                 | Derating factor                                                   | 2          | W/ $^{\circ}\text{C}$ |
| $E_{AS}^{(4)}$  | Single pulse avalanche energy                                     | 1.6        | J                     |
| $T_{stg}$       | Storage temperature                                               | -55 to 175 | $^{\circ}\text{C}$    |
| $T_j$           | Operating junction temperature                                    |            |                       |

1. Current limited by package
2. Pulse width limited by safe operating area
3. This value is rated according to  $R_{thj-c}$
4. Starting  $T_j = 25\text{ }^{\circ}\text{C}$ ,  $I_D = 60\text{ A}$ ,  $V_{DD} = 20\text{ V}$

**Table 3. Thermal data**

| Symbol              | Parameter                            | Value | Unit                        |
|---------------------|--------------------------------------|-------|-----------------------------|
| $R_{thj-case}$      | Thermal resistance junction-case max | 0.5   | $^{\circ}\text{C}/\text{W}$ |
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb max  | 35    | $^{\circ}\text{C}/\text{W}$ |

1. When mounted on 1 inch<sup>2</sup> FR-4 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               |
|---------------|--------------------------------------------------|-----------------------------------------------------------------|------|--------------|------------|--------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage ( $V_{GS} = 0$ )  | $I_D = 250 \mu A$                                               | 24   |              |            | V                  |
| $I_{DSS}$     | Zero gate voltage drain current ( $V_{GS} = 0$ ) | $V_{DS} = 24 V$ ,<br>$V_{DS} = 24 V$ , $T_C = 125^\circ C$      |      |              | 1<br>10    | $\mu A$<br>$\mu A$ |
| $I_{GSS}$     | Gate body leakage current ( $V_{DS} = 0$ )       | $V_{GS} = \pm 20 V$                                             |      |              | $\pm 100$  | nA                 |
| $V_{GS(th)}$  | Gate threshold voltage                           | $V_{DS} = V_{GS}$ , $I_D = 250 \mu A$                           | 1    |              |            | V                  |
| $R_{DS(on)}$  | Static drain-source on-resistance                | $V_{GS} = 10 V$ , $I_D = 80 A$<br>$V_{GS} = 5 V$ , $I_D = 40 A$ |      | 0.95<br>1.15 | 1.2<br>1.5 | m $\Omega$         |

**Table 5. Dynamic**

| Symbol    | Parameter                    | Test conditions                                                         | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|-------------------------------------------------------------------------|------|------|------|------|
| $C_{iss}$ | Input capacitance            | $V_{DS} = 15 V$ , $f = 1 MHz$ , $V_{GS} = 0$                            | -    | 7050 | -    | pF   |
| $C_{oss}$ | Output capacitance           |                                                                         | -    | 3250 | -    | pF   |
| $C_{rss}$ | Reverse transfer capacitance |                                                                         | -    | 307  | -    | pF   |
| $Q_g$     | Total gate charge            | $V_{DD} = 20 V$ , $I_D = 120 A$ ,<br>$V_{GS} = 10 V$<br>(see Figure 14) | -    | 109  | -    | nC   |
| $Q_{gs}$  | Gate-source charge           |                                                                         | -    | 30   | -    | nC   |
| $Q_{gd}$  | Gate-drain charge            |                                                                         | -    | 26   | -    | nC   |

**Table 6. Switching times**

| Symbol       | Parameter           | Test conditions                                                                             | Min. | Typ. | Max. | Unit |
|--------------|---------------------|---------------------------------------------------------------------------------------------|------|------|------|------|
| $t_{d(on)}$  | Turn-on delay time  | $V_{DD} = 20 V$ , $I_D = 80 A$<br>$R_G = 4.7 \Omega$ , $V_{GS} = 10 V$ ,<br>(see Figure 13) | -    | 18   | -    | ns   |
| $t_r$        | Rise time           |                                                                                             | -    | 275  | -    | ns   |
| $t_{d(off)}$ | Turn-off delay time | $V_{DD} = 20 V$ , $I_D = 80 A$<br>$R_G = 4.7 \Omega$ , $V_{GS} = 10 V$ ,<br>(see Figure 13) | -    | 138  | -    | ns   |
| $t_f$        | Fall time           |                                                                                             | -    | 94.4 | -    | ns   |

Table 7. Source drain diode

| Symbol         | Parameter                     | Test conditions                                                                                                                               | Min. | Typ. | Max. | Unit |
|----------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $I_{SD}^{(1)}$ | Source-drain current          |                                                                                                                                               | -    |      | 180  | A    |
| $I_{SD}^{(2)}$ | Source-drain current (pulsed) |                                                                                                                                               |      |      | 720  | A    |
| $V_{SD}^{(3)}$ | Forward on voltage            | $I_{SD} = 180\text{ A}$ , $V_{GS} = 0$                                                                                                        | -    |      | 1.3  | V    |
| $t_{rr}$       | Reverse recovery time         | $I_{SD} = 120\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$<br>$V_{DD} = 20\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$<br>(see Figure 15) | -    | 65   |      | ns   |
| $Q_{rr}$       | Reverse recovery charge       |                                                                                                                                               | -    | 90   |      | nC   |
| $I_{RRM}$      | Reverse recovery current      |                                                                                                                                               | -    | 2.8  |      | A    |

1. Current limited by package
2. Pulse width limited by safe operating area
3. Pulsed: Pulse duration =  $300\text{ }\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

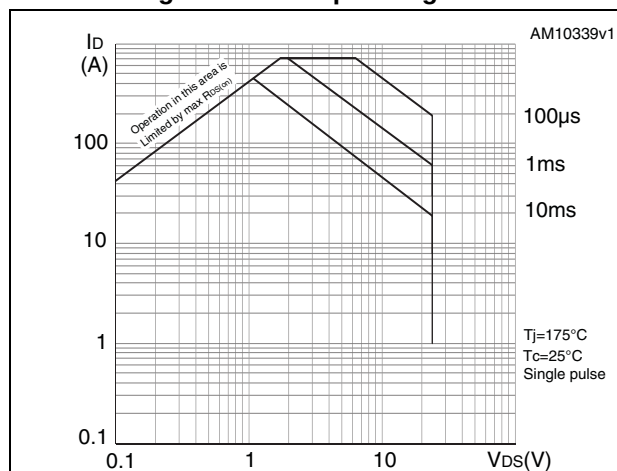


Figure 3. Thermal impedance

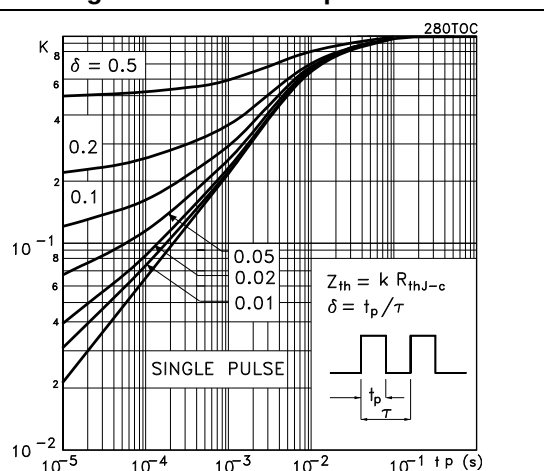


Figure 4. Output characteristics

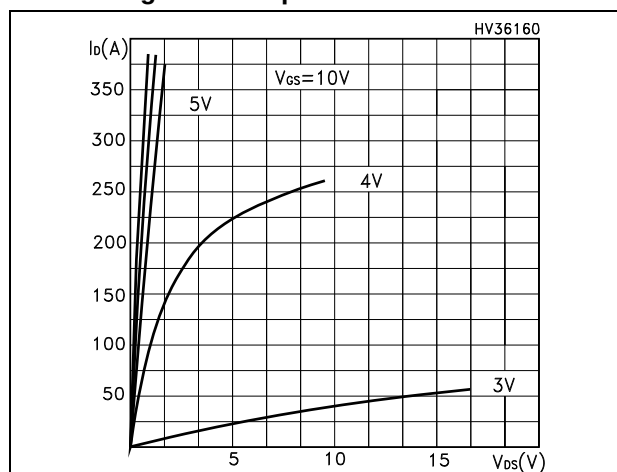


Figure 5. Transfer characteristics

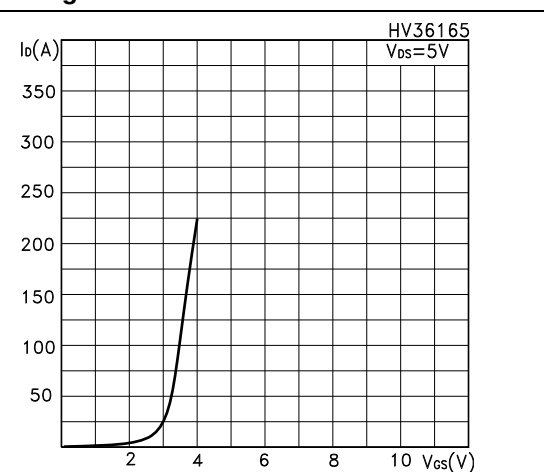
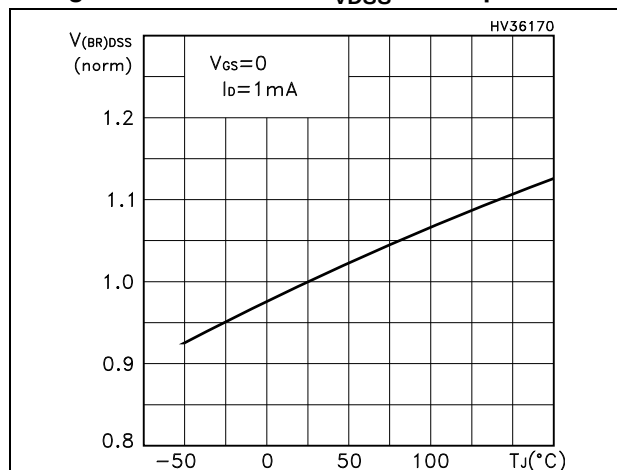
Figure 6. Normalized  $B_{VDS}$  vs temperature

Figure 7. Static drain-source on-resistance

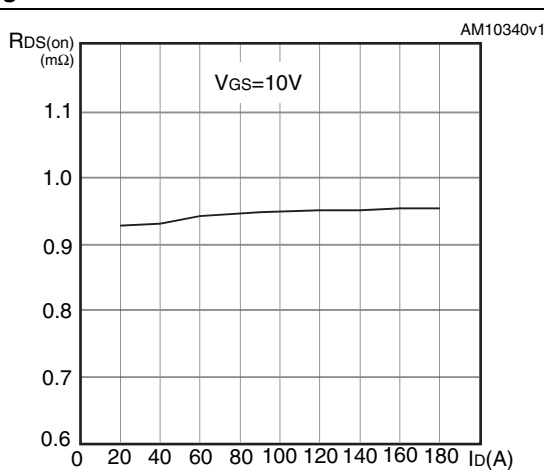


Figure 8. Gate charge vs gate-source voltage

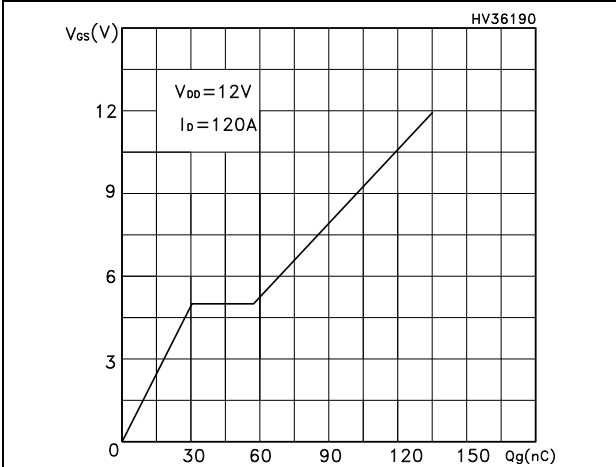


Figure 9. Capacitance variations

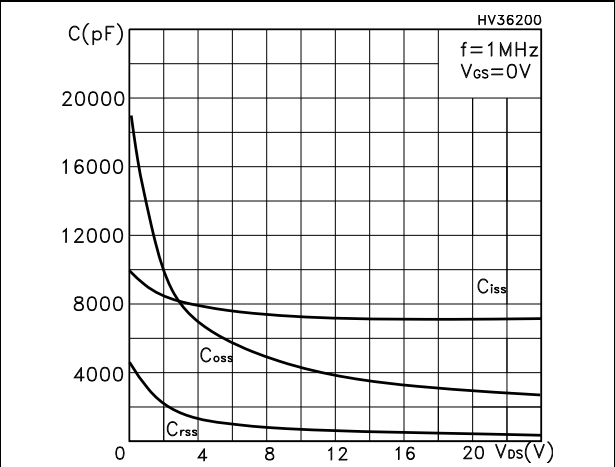


Figure 10. Normalized gate threshold voltage vs temperature

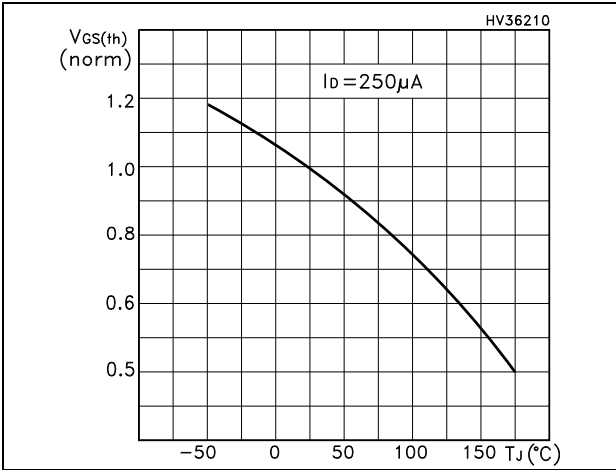


Figure 11. Normalized on resistance vs temperature

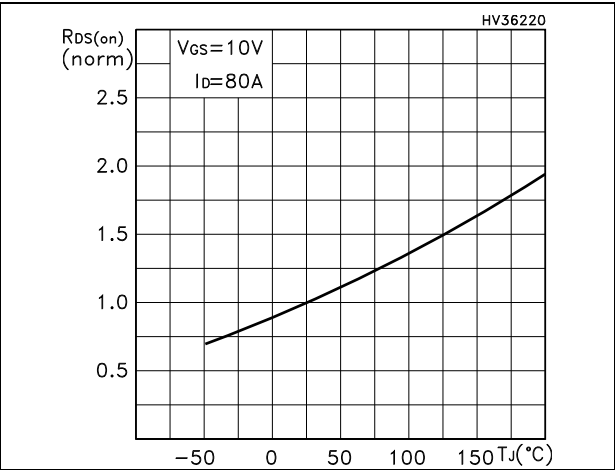
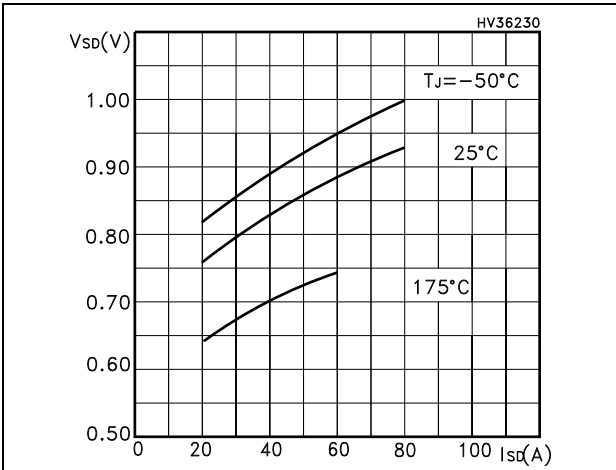


Figure 12. Source-drain diode forward characteristics





## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

Table 8. 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 19. H<sup>2</sup>PAK-6 drawing

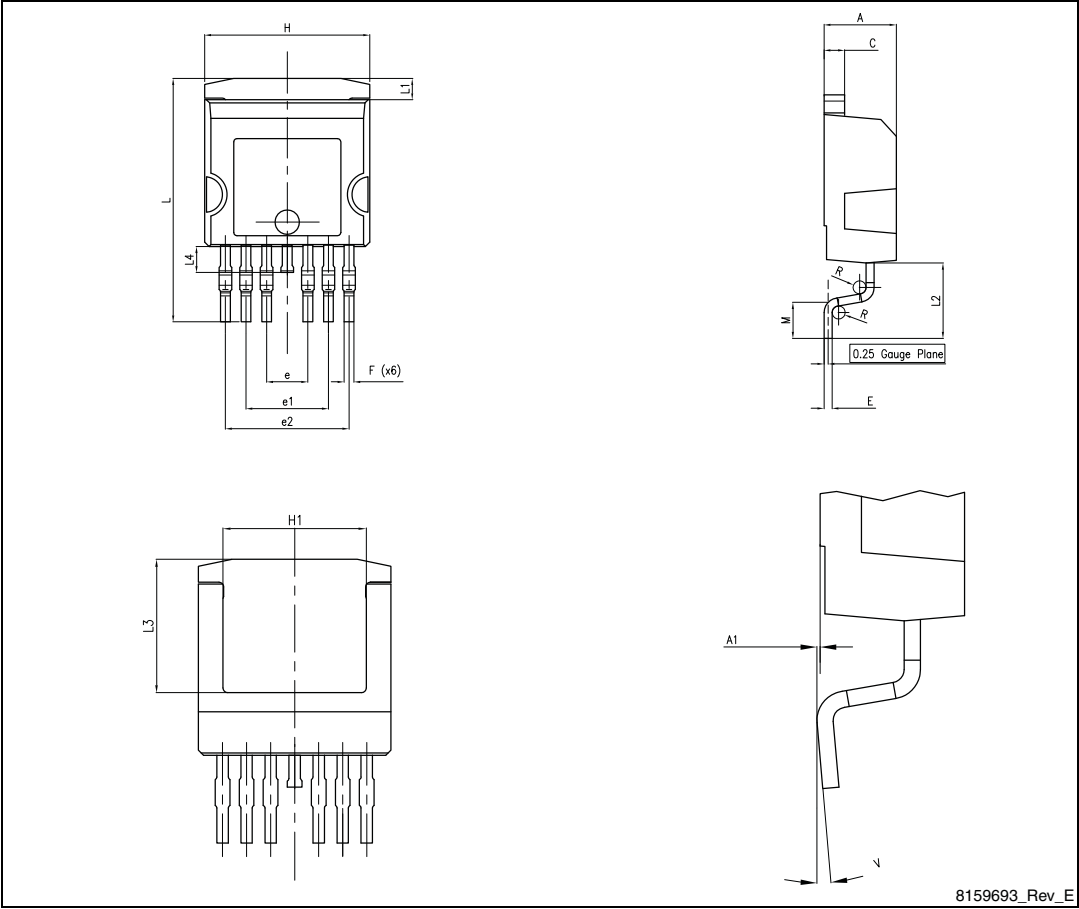
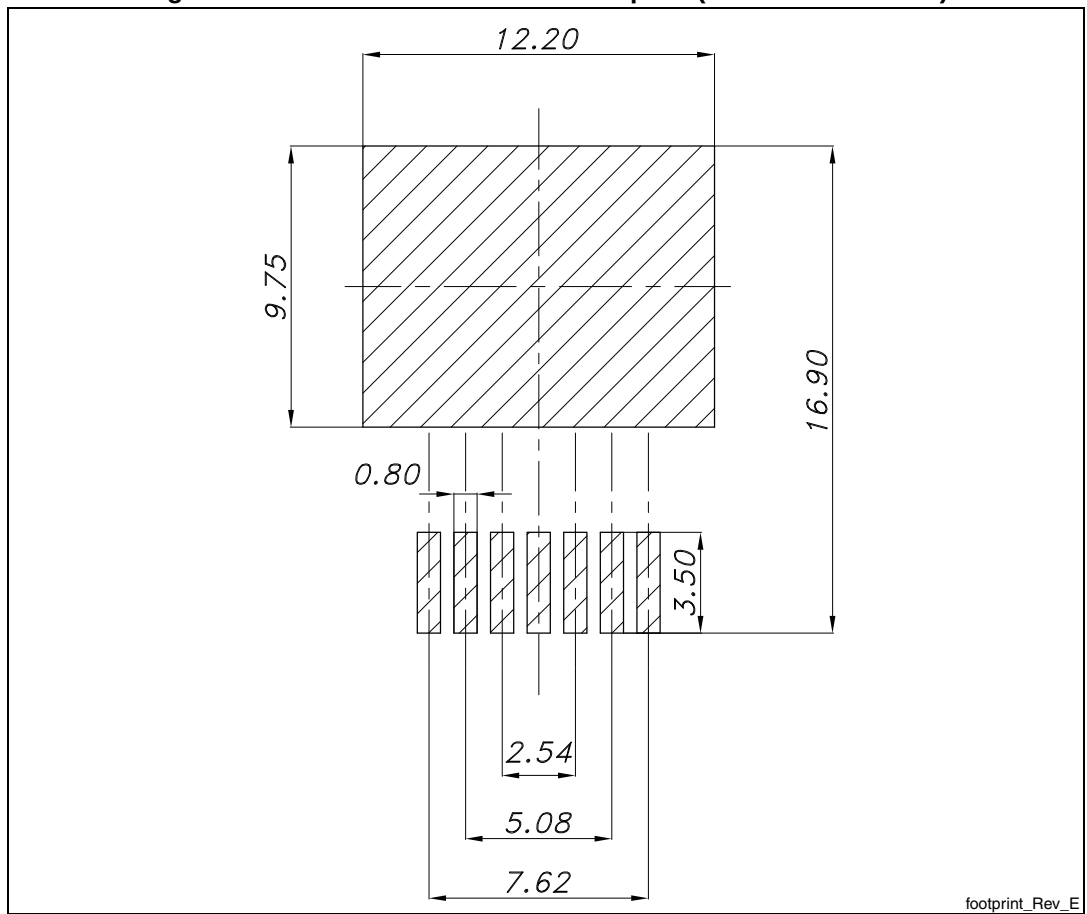


Figure 20. H<sup>2</sup>PAK-6 recommended footprint (dimensions in mm)



## 5 Packaging mechanical data

Table 9. 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 qty |      | 1000 |
| P2   | 1.9  | 2.1  | Bulk qty |      | 1000 |
| R    | 50   |      |          |      |      |
| T    | 0.25 | 0.35 |          |      |      |
| W    | 23.7 | 24.3 |          |      |      |

Figure 21. Tape

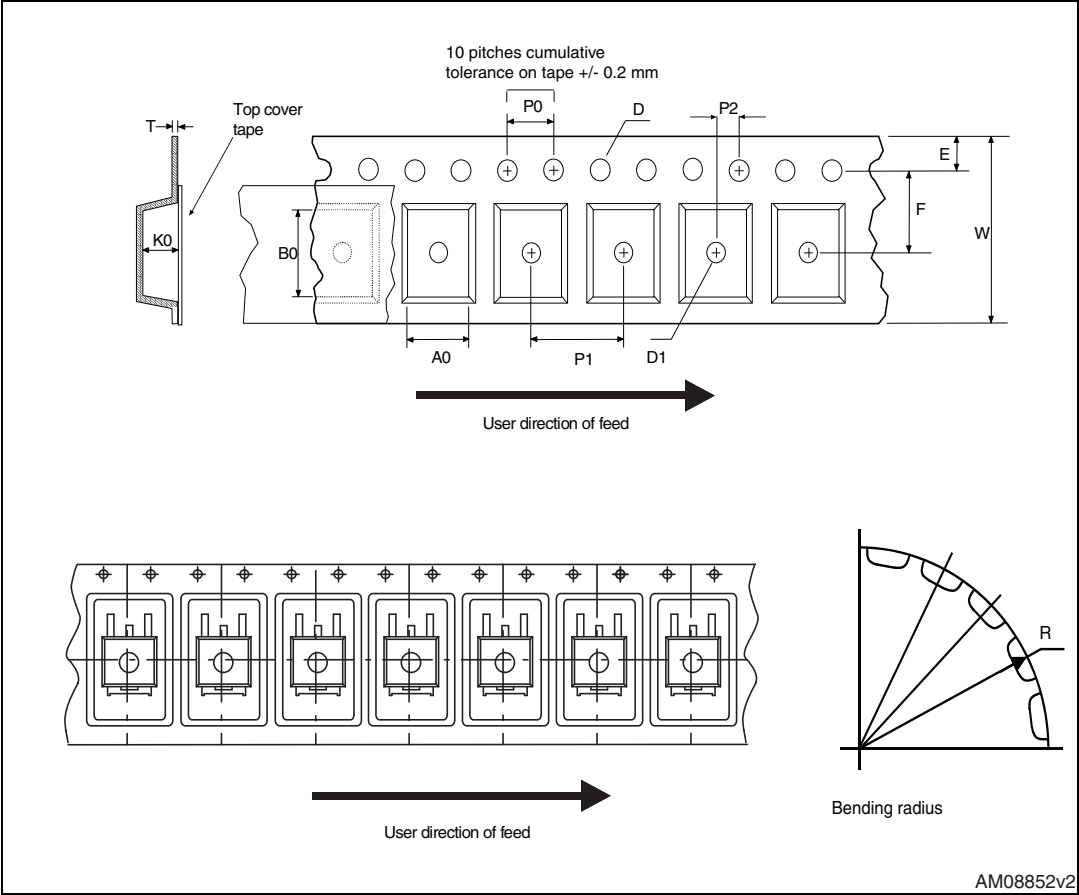
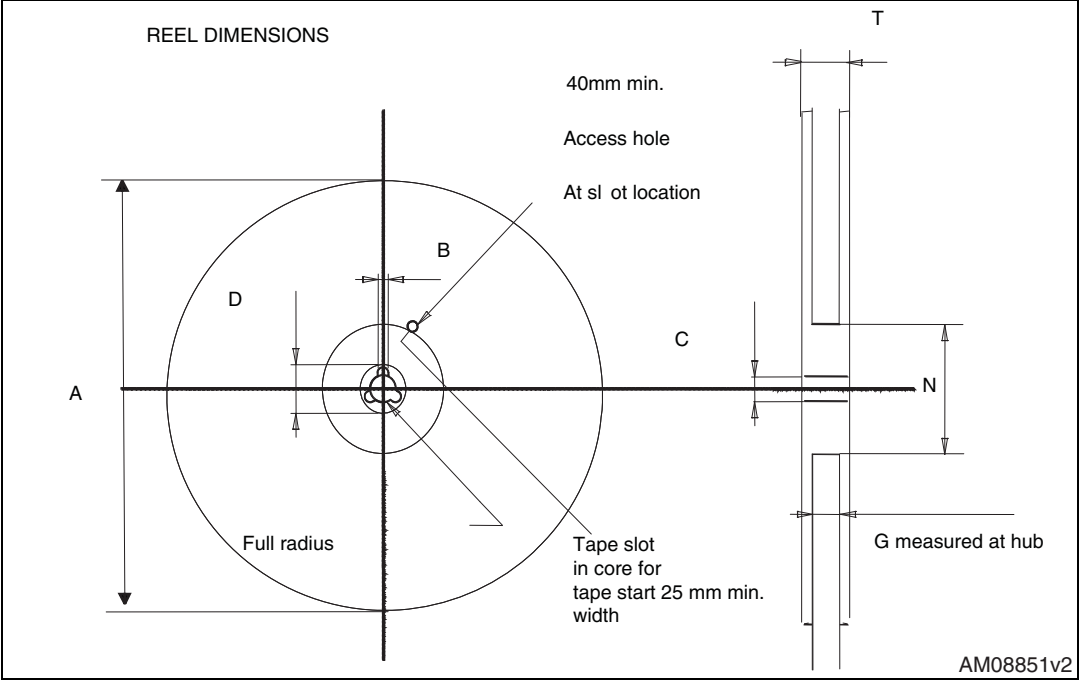


Figure 22. Reel



## 6 Revision history

Table 10. Document revision history

| Date        | Revision | Changes                                                                                                                                                                   |
|-------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12-Jul-2011 | 1        | initial release                                                                                                                                                           |
| 24-Oct-2011 | 2        | Updated test conditions in <a href="#">Section Table 5.: Dynamic</a> and <a href="#">Section Table 7.: Source drain diode</a> .                                           |
| 15-May-2013 | 3        | <ul style="list-style-type: none"><li>– Updated: title, <a href="#">Applications</a> and <a href="#">Description</a> in cover page</li><li>– Minor text changes</li></ul> |
| 22-Jul-2013 | 4        | <ul style="list-style-type: none"><li>– Updated title in cover page.</li></ul>                                                                                            |

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