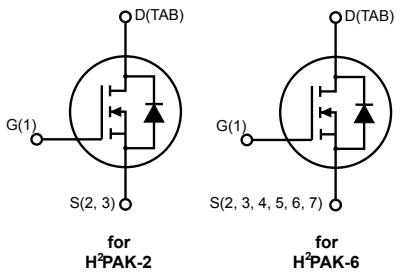
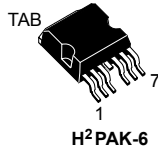
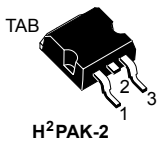



## Automotive-grade N-channel 100 V, 2.1 mΩ typ., 180 A STripFET F7 Power MOSFETs in an H<sup>2</sup>PAK-2 and H<sup>2</sup>PAK-6 packages



N-CHG1DTABS23\_2\_6

### Features

| Order code    | V <sub>DS</sub> | R <sub>DS(on)</sub> max. | I <sub>D</sub> |
|---------------|-----------------|--------------------------|----------------|
| STH315N10F7-2 | 100 V           | 2.3 mΩ                   | 180 A          |
| STH315N10F7-6 |                 |                          |                |

- 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.

| Product status  |                      |
|-----------------|----------------------|
| Order code      | STH315N10F7-2        |
| Order code      | STH315N10F7-6        |
| Product summary |                      |
| Order code      | STH315N10F7-2        |
| Marking         | 315N10F7             |
| Package         | H <sup>2</sup> PAK-2 |
| Packing         | Tape and reel        |
| Order code      | STH315N10F7-6        |
| Marking         | 315N10F7             |
| Package         | H <sup>2</sup> PAK-6 |
| Packing         | Tape and reel        |

# 1 Electrical ratings

**Table 1. 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                   |
| $I_D^{(1)}$    | 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 $T_C = 25\text{ }^\circ\text{C}$           | 315        | W                   |
|                | Derating factor   | 2.1        | W/ $^\circ\text{C}$ |
| $E_{AS}^{(3)}$ | Single pulse avalanche energy                                   | 1          | J                   |
| $T_j$          | Operating junction temperature range                            | -55 to 175 | $^\circ\text{C}$    |
| $T_{stg}$      | Storage temperature range                                       |            |                     |

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

**Table 2. Thermal data**

| Symbol           | Parameter                             | Value | Unit               |
|------------------|---------------------------------------|-------|--------------------|
| $R_{thJC}$       | Thermal resistance, junction-to-case  | 0.48  | $^\circ\text{C/W}$ |
| $R_{thJB}^{(1)}$ | Thermal resistance, junction-to-board | 35    | $^\circ\text{C/W}$ |

1. When mounted on 1 inch<sup>2</sup> FR-4, 2 Oz copper board.

## 2 Electrical characteristics

( $T_C = 25\text{ °C}$  unless otherwise specified)

**Table 3. On/Off states**

| Symbol        | Parameter                         | Test conditions  | Min. | Typ. | Max. | Unit          |
|---------------|-----------------------------------|--|------|------|------|---------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage    | $I_D = 250\text{ }\mu\text{A}$ , $V_{GS} = 0\text{ V}$                                 | 100  |      |      | V             |
| $I_{DSS}$     | Zero gate voltage drain current   | $V_{GS} = 0\text{ V}$ , $V_{DS} = 100\text{ V}$  |      |      | 1    | $\mu\text{A}$ |
|               |                                   | $V_{GS} = 0\text{ V}$ , $V_{DS} = 100\text{ V}$ , $T_C = 125\text{ °C}$ <sup>(1)</sup> |      |      | 100  | $\mu\text{A}$ |
| $I_{GSS}$     | Gate-body leakage current         | $V_{GS} = \pm 20\text{ V}$ , $V_{DS} = 0\text{ V}$                                     |      |      | 100  | nA            |
| $V_{GS(th)}$  | Gate threshold voltage            | $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$                                     | 2.5  | 3.5  | 4.5  | V             |
| $R_{DS(on)}$  | Static drain-source on-resistance | $V_{GS} = 10\text{ V}$ , $I_D = 60\text{ A}$   |      | 2.1  | 2.3  | m $\Omega$    |

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

**Table 4. Dynamic**

| Symbol     | Parameter                    | Test conditions  | Min. | Typ.  | Max. | Unit |
|------------|------------------------------|--|------|-------|------|------|
| $C_{iss}$  | Input capacitance            | $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ ,<br>$V_{GS} = 0\text{ V}$ | -    | 12800 | -    | pF   |
| $C_{oss}$  | Output capacitance           |  | -    | 3500  | -    | pF   |
| $C_{riss}$ | Reverse transfer capacitance |  | -    | 170   | -    | pF   |
| $Q_g$      | Total gate charge            | $V_{DD} = 50\text{ V}$ , $I_D = 180\text{ A}$ ,                        | -    | 180   | -    | nC   |
| $Q_{gs}$   | Gate-source charge           | $V_{GS} = 0$ to $10\text{ V}$  | -    | 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  | $V_{DD} = 50\text{ V}$ , $I_D = 90\text{ A}$ ,<br>$R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$<br>(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    |
| $I_{SDM}$ <sup>(1)</sup> | Source-drain current (pulsed) |  | -    |      | 720  | A    |
| $V_{SD}$ <sup>(2)</sup>  | Source-drain current          | $I_{SD} = 60\text{ A}$ , $V_{GS} = 0\text{ V}$ | -    |      | 1.5  | V    |

| Symbol    | Parameter                | Test conditions   | Min. | Typ. | Max. | Unit |
|-----------|--------------------------|---|------|------|------|------|
| $t_{rr}$  | Reverse recovery time    | $I_{SD} = 180 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$  | -    | 85   |      | ns   |
| $Q_{rr}$  | Reverse recovery charge  | $V_{DD} = 80 \text{ V}$ , $T_J = 150 \text{ }^\circ\text{C}$<br>(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  $\mu\text{s}$ , duty cycle 1.5%.

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

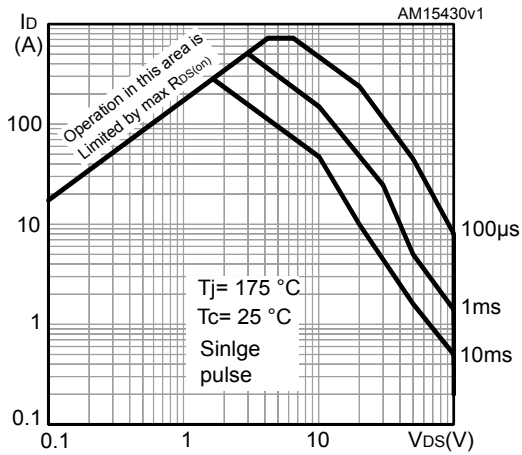


Figure 2. Thermal impedance

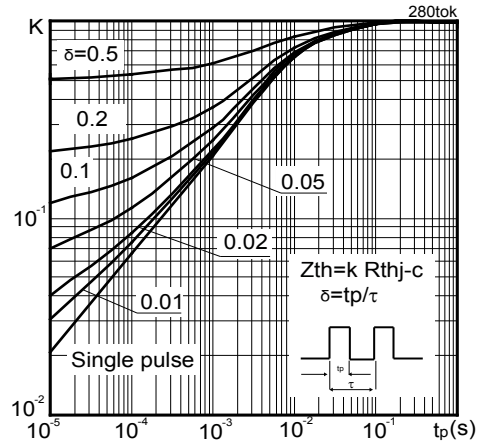


Figure 3. Output characteristics

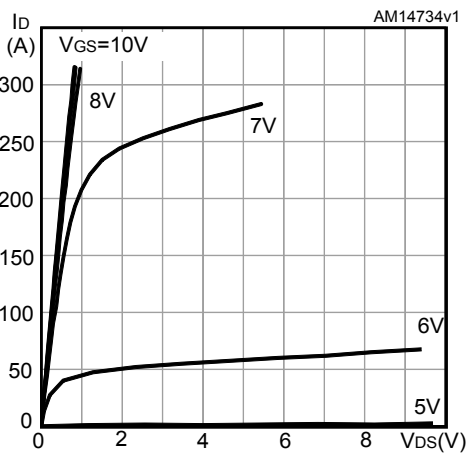


Figure 4. Transfer characteristics

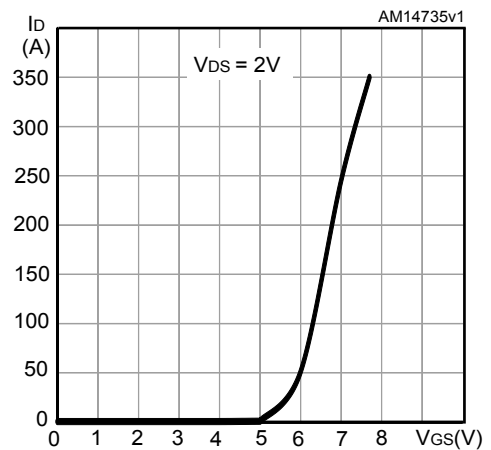


Figure 5. Gate charge vs gate-source voltage

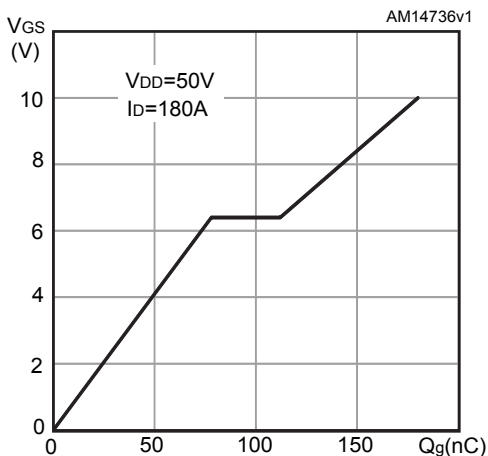


Figure 6. Static drain-source on-resistance

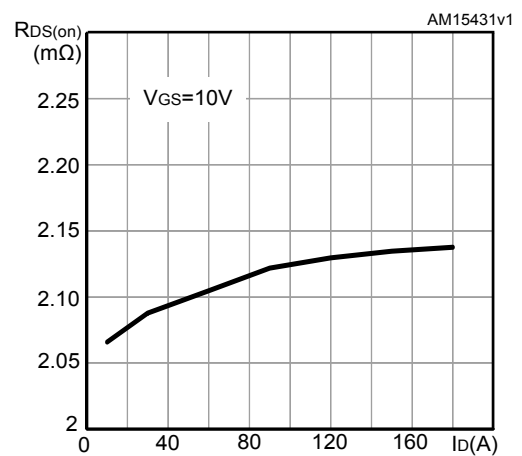


Figure 7. Normalized  $V_{(BR)DSS}$  vs temperature

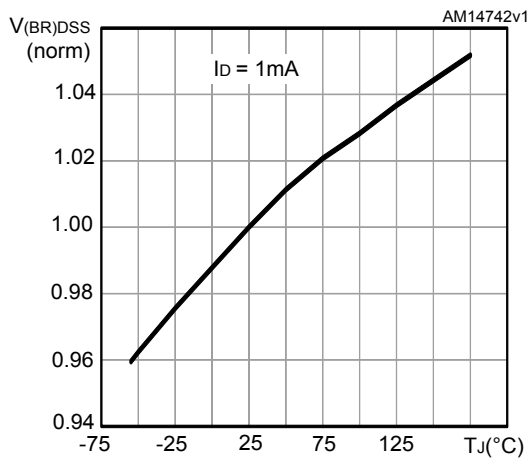


Figure 8. Capacitance variations

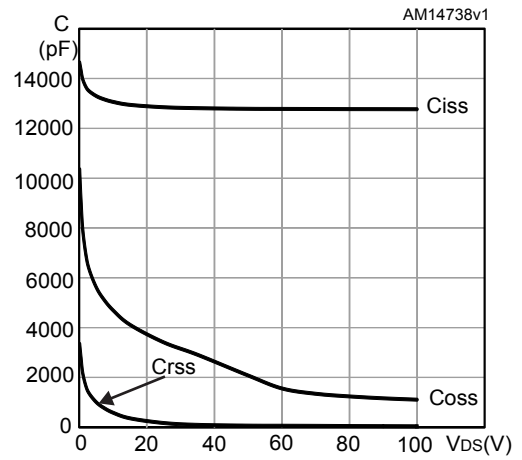


Figure 9. Source-drain diode forward characteristics

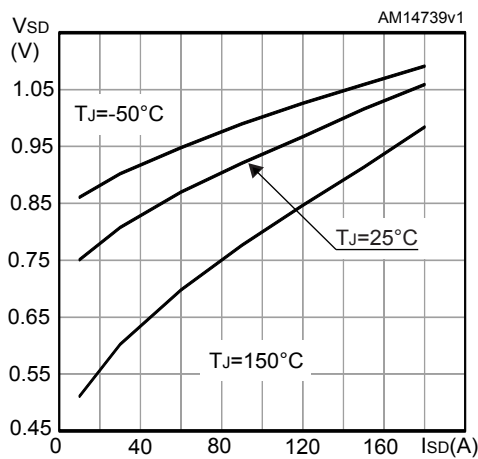


Figure 10. Normalized gate threshold voltage vs temperature

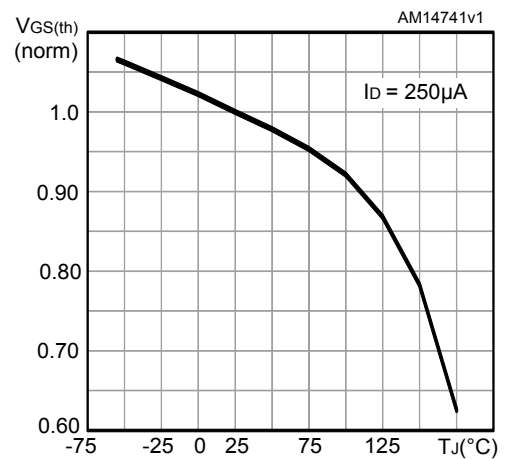
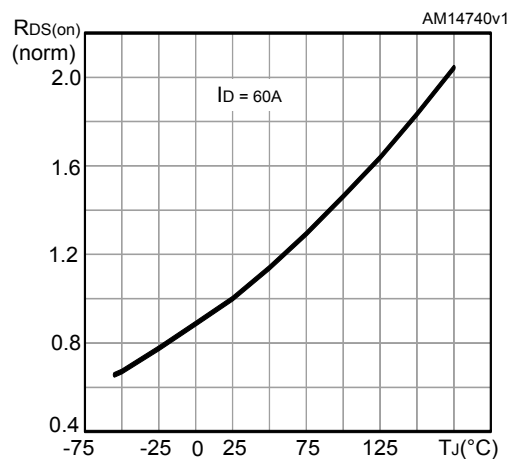
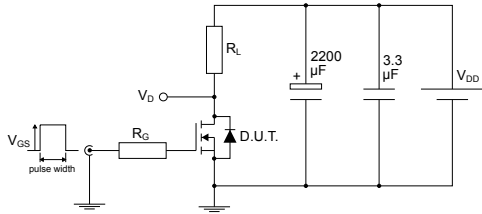


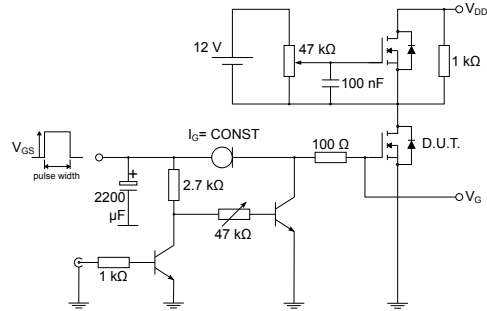
Figure 11. Normalized on-resistance vs temperature



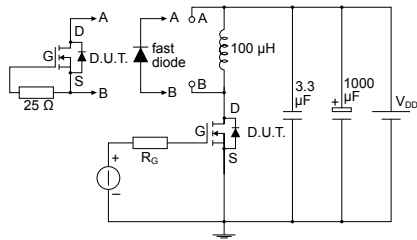
### 3 Test circuits

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


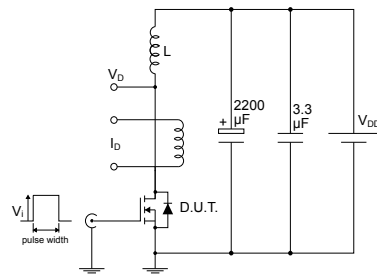
AM01468v1

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


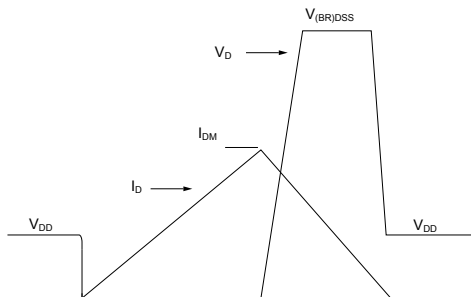
AM01469v1

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


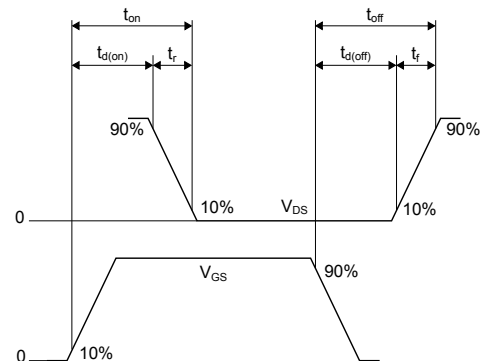
AM01470v1

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


AM01471v1

**Figure 16. Unclamped inductive waveform**


AM01472v1

**Figure 17. Switching time waveform**


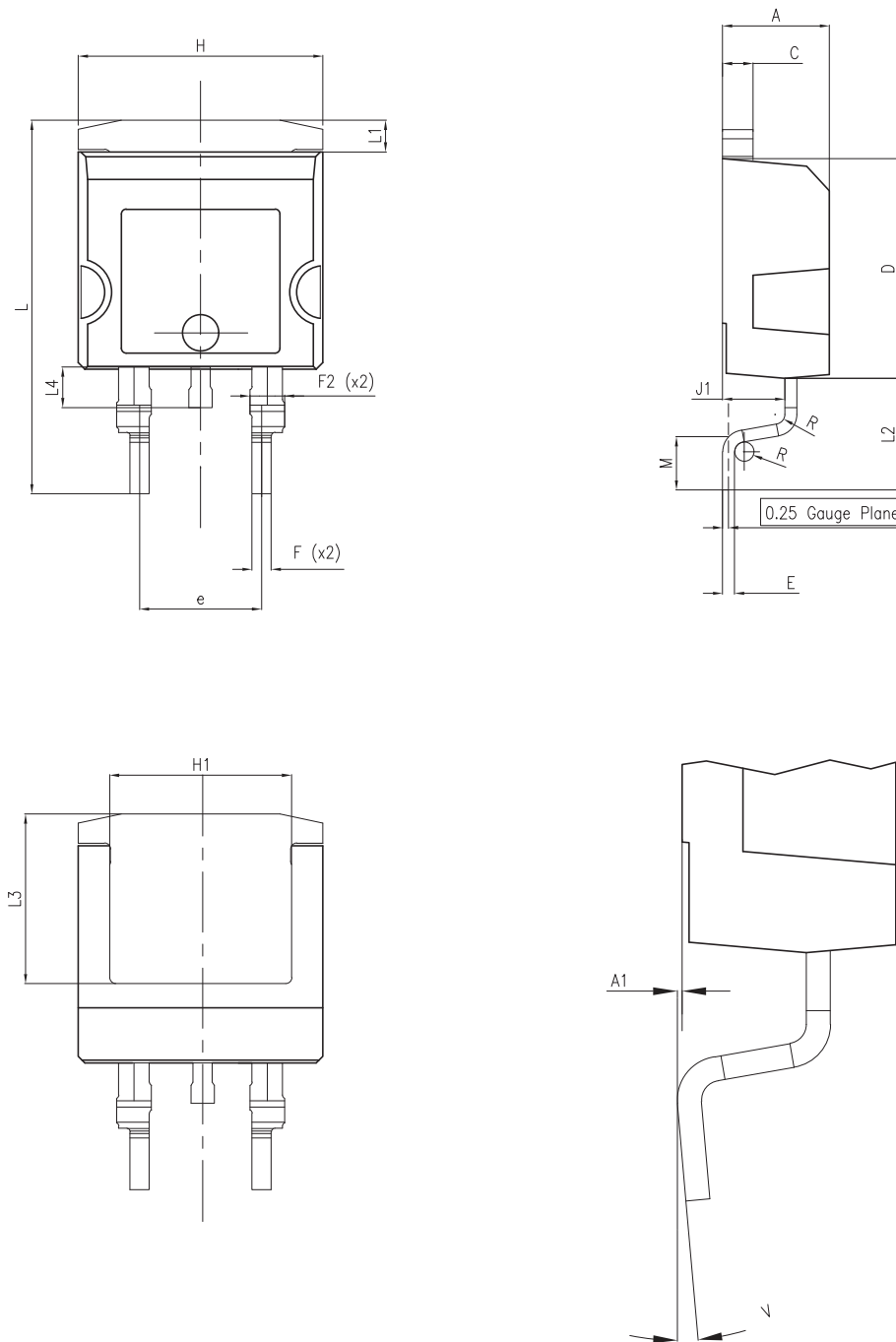
AM01473v1

## 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](http://www.st.com). ECOPACK is an ST trademark.

### 4.1 H<sup>2</sup>PAK-2 package information

Figure 18. H<sup>2</sup>PAK-2 package outline



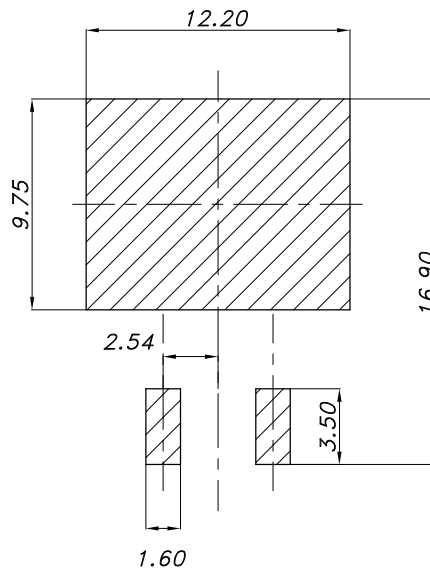
8159712\_9



Table 7. 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  |
| 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. H<sup>2</sup>PAK-2 recommended footprint



8159712\_9

Note: Dimensions are in mm.

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

Figure 20. H<sup>2</sup>PAK-6 package outline

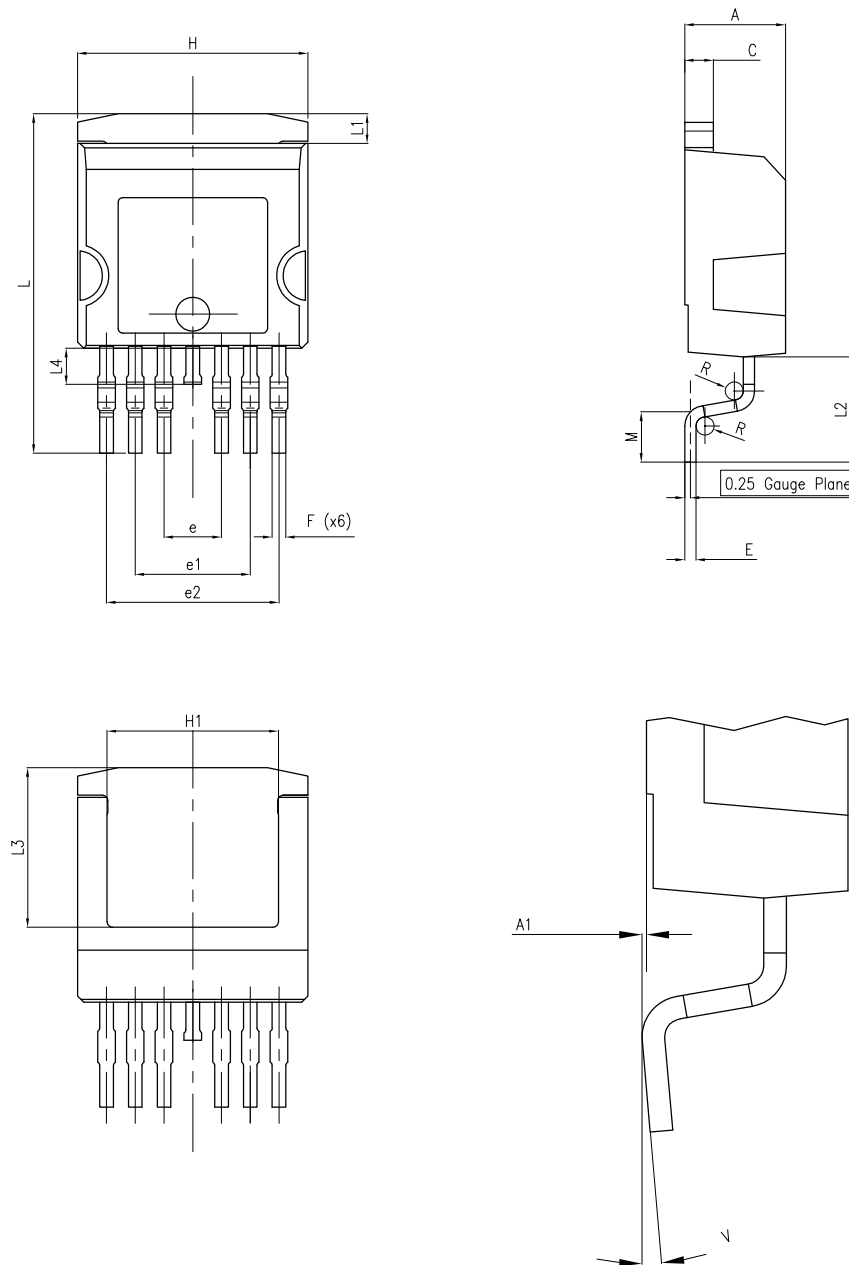
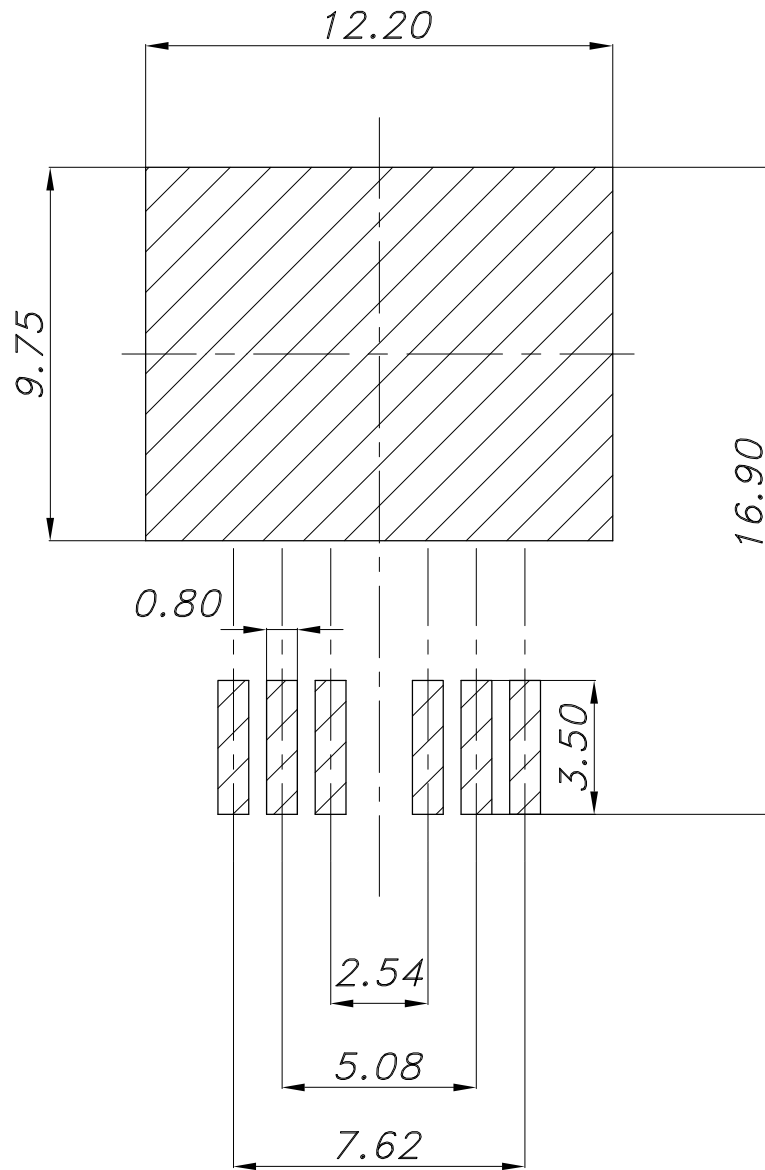


Table 8. H<sup>2</sup>PAK-6 package mechanical data

| 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 21. H<sup>2</sup>PAK-6 recommended footprint

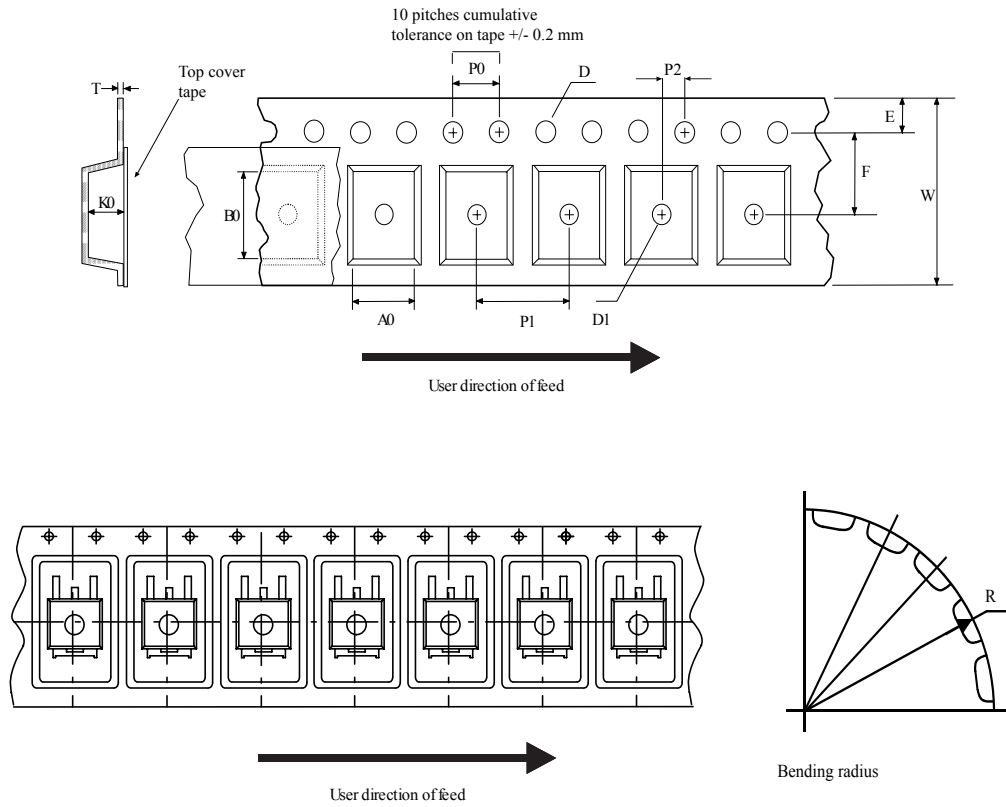


footprint\_Rev\_8

Note: Dimensions are in mm.

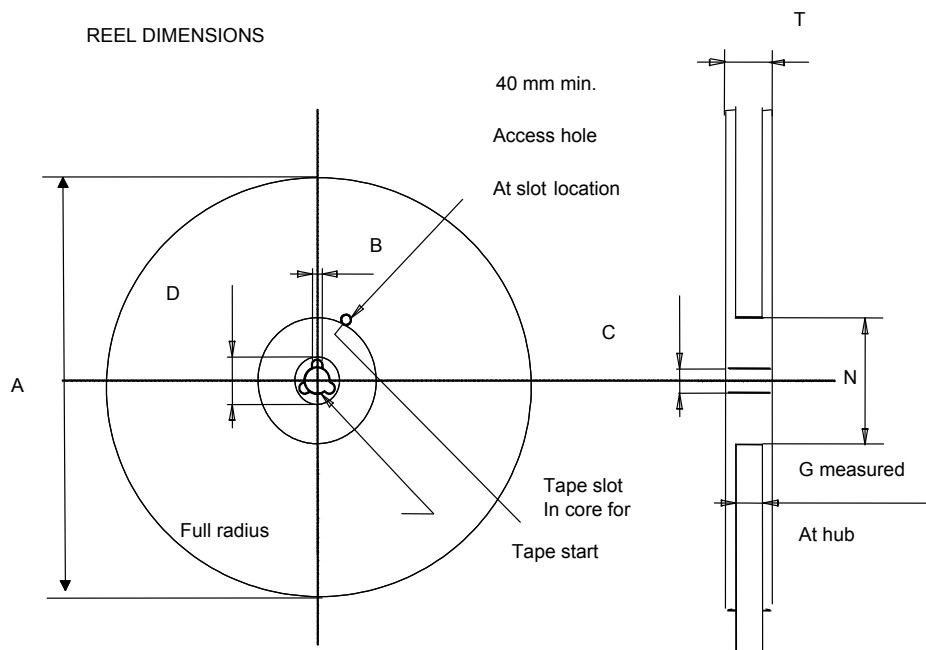
### 4.3 Packing information

Figure 22. Tape outline



AM08852v2

Figure 23. Reel outline



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

| Tape |      |      | Reel          |      |      |
|------|------|------|---------------|------|------|
| 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       | <ul style="list-style-type: none"> <li>– Modified: <i>Table 1</i>, RDS(on) typical value in <i>Table 4</i></li> <li>– Minor text changes</li> </ul>   |
| 27-May-2014 | 3       | <ul style="list-style-type: none"> <li>– Modified: title and <i>Features</i> in cover page</li> <li>– Updated: <i>Section 4: Package mechanical data</i></li> <li>– Minor text changes</li> </ul> |
| 12-Sep-2014 | 4       | – Modified: title, features and description in cover page.  |
| 03-May-2021 | 5       | Updated <i>Table 1. Absolute maximum ratings</i> .<br>Minor text changes.   |

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