

N-channel 80 V, 0.0017  $\Omega$  typ., 180 A, STripFET™ F7  
Power MOSFETs in H<sup>2</sup>PAK-2, H<sup>2</sup>PAK-6 and TO-220 packages

Datasheet – production data

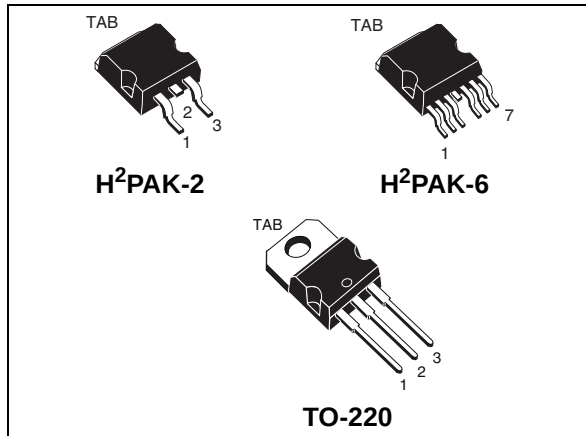
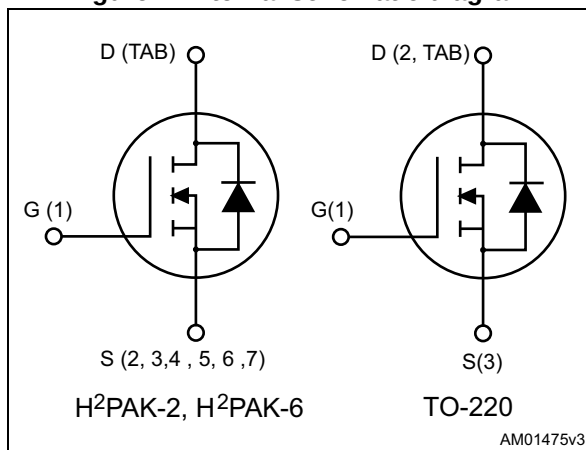


Figure 1. Internal schematic diagram



## Features

| Order codes  | V <sub>DS</sub> | R <sub>DS(on)</sub> max | I <sub>D</sub> |
|--------------|-----------------|-------------------------|----------------|
| STH270N8F7-2 | 80 V            | 0.0021 $\Omega$         | 180 A          |
| STH270N8F7-6 |                 |                         |                |
| STP270N8F7   |                 | 0.0025 $\Omega$         |                |

- 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-state resistance, while also reducing internal capacitance and gate charge for faster and more efficient switching.

Table 1. Device summary

| Order codes  | Marking | Package              | Packaging     |
|--------------|---------|----------------------|---------------|
| STH270N8F7-2 | 270N8F7 | H <sup>2</sup> PAK-2 | Tape and reel |
| STH270N8F7-6 |         | H <sup>2</sup> PAK-6 |               |
| STP270N8F7   |         | TO-220               | Tube          |

## 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)                                      | 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 $T_C = 25\text{ }^\circ\text{C}$           | 315        | W                |
| $E_{AS}^{(4)}$  | Single pulse avalanche energy                                   | 1.16       | J                |
| $T_J$           | Operating junction temperature                                  | -55 to 175 | $^\circ\text{C}$ |
| $T_{stg}$       | Storage temperature                                             |            | $^\circ\text{C}$ |

1. Limited by package
2. Pulse width limited by safe operating area
3. This value is rated according to  $R_{thj-c}$
4. Starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $I_d = 65\text{ A}$ ,  $V_{dd} = 50\text{ V}$

**Table 3. Thermal resistance**

| Symbol              | Parameter                               | Value                                         |        | Unit               |
|---------------------|-----------------------------------------|-----------------------------------------------|--------|--------------------|
|                     |                                         | H <sup>2</sup> PAK-2,<br>H <sup>2</sup> PAK-6 | TO-220 |                    |
| $R_{thj-case}$      | Thermal resistance junction-case        | 0.48                                          |        | $^\circ\text{C/W}$ |
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb         | 35                                            |        | $^\circ\text{C/W}$ |
| $R_{thj-amb}$       | Thermal resistance junction-ambient max |                                               | 62.5   | $^\circ\text{C/W}$ |

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

## 2 Electrical characteristics

( $T_{CASE}=25\text{ }^{\circ}\text{C}$  unless otherwise specified)

**Table 4. On/off states**

| Symbol        | Parameter                                      | Test conditions                                                                              | Min. | Typ.   | Max.      | Unit                           |
|---------------|------------------------------------------------|----------------------------------------------------------------------------------------------|------|--------|-----------|--------------------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage ( $V_{GS}=0$ )  | $I_D = 250\text{ }\mu\text{A}$                                                               | 80   |        |           | V                              |
| $I_{DSS}$     | Zero gate voltage drain current ( $V_{GS}=0$ ) | $V_{DS} = 80\text{ V}$<br>$V_{DS} = 80\text{ V}; T_C=125\text{ }^{\circ}\text{C}$            |      |        | 10<br>100 | $\mu\text{A}$<br>$\mu\text{A}$ |
| $I_{GSS}$     | Gate body leakage current ( $V_{DS}=0$ )       | $V_{GS} = +20\text{ V}$                                                                      |      |        | 100       | nA                             |
| $V_{GS(th)}$  | Gate threshold voltage                         | $V_{DS}=V_{GS}, I_D = 250\text{ }\mu\text{A}$                                                | 2    |        | 4         | V                              |
| $R_{DS(on)}$  | Static drain-source on-resistance              | For H <sup>2</sup> PAK-2, H <sup>2</sup> PAK-6:<br>$V_{GS} = 10\text{ V}, I_D = 90\text{ A}$ |      | 0.0017 | 0.0021    | $\Omega$                       |
|               |                                                | For TO-220:<br>$V_{GS} = 10\text{ V}, I_D = 90\text{ A}$                                     |      | 0.0021 | 0.0025    |                                |

**Table 5. Dynamic**

| Symbol    | Parameter                    | Test conditions                                                                      | Min. | Typ.  | Max. | Unit |
|-----------|------------------------------|--------------------------------------------------------------------------------------|------|-------|------|------|
| $C_{iss}$ | Input capacitance            | $V_{DS}=50\text{ V}, f=1\text{ MHz}, V_{GS}=0$                                       | -    | 13600 | -    | pF   |
| $C_{oss}$ | Output capacitance           |                                                                                      | -    | 2050  | -    | pF   |
| $C_{rss}$ | Reverse transfer capacitance |                                                                                      | -    | 236   | -    | pF   |
| $Q_g$     | Total gate charge            | $V_{DD}=40\text{ V}, I_D = 180\text{ A}$<br>$V_{GS}=10\text{ V}$<br><i>Figure 19</i> | -    | 193   | -    | nC   |
| $Q_{gs}$  | Gate-source charge           |                                                                                      | -    | 96    | -    | nC   |
| $Q_{gd}$  | Gate-drain charge            |                                                                                      | -    | 46    | -    | nC   |

**Table 6. Switching times**

| Symbol       | Parameter           | Test conditions                                                                                             | Min. | Typ. | Max. | Unit |
|--------------|---------------------|-------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $t_{d(on)}$  | Turn-on delay time  | $V_{DD}=40\text{ V}, I_D = 90\text{ A},$<br>$R_G=4.7\text{ }\Omega, V_{GS}=10\text{ V}$<br><i>Figure 18</i> | -    | 56   | -    | ns   |
| $t_r$        | Rise time           |                                                                                                             | -    | 180  | -    | ns   |
| $t_{d(off)}$ | Turn-off delay time |                                                                                                             | -    | 98   | -    | ns   |
| $t_f$        | Fall time           |                                                                                                             | -    | 42   | -    | 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            | $I_{SD} = 90\text{ A}$ , $V_{GS}=0$                                                                                         | -   |      | 1.2 | V    |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 180\text{ A}$ ,<br>$di/dt = 100\text{ A}/\mu\text{s}$ ,<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    |

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

### 3 Electrical characteristics (curves)

Figure 2. Safe operating area for H<sup>2</sup>PAK-2 and H<sup>2</sup>PAK-6

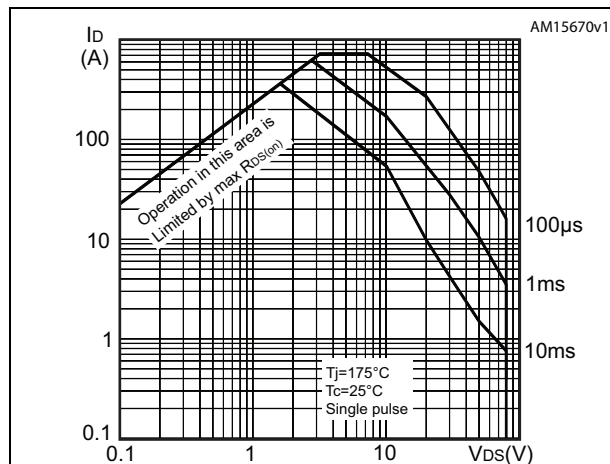


Figure 3. Safe operating area for TO-220

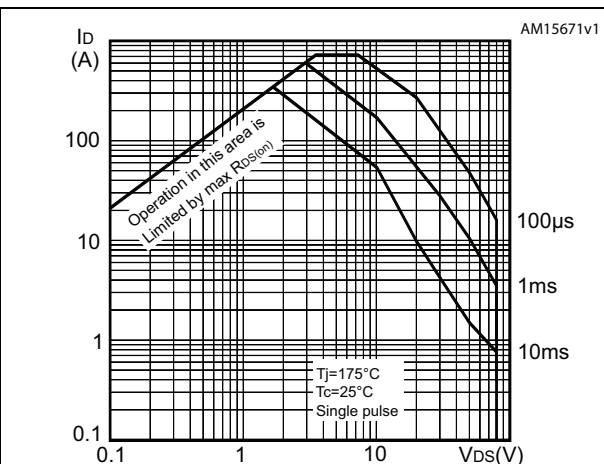


Figure 4. Thermal impedance

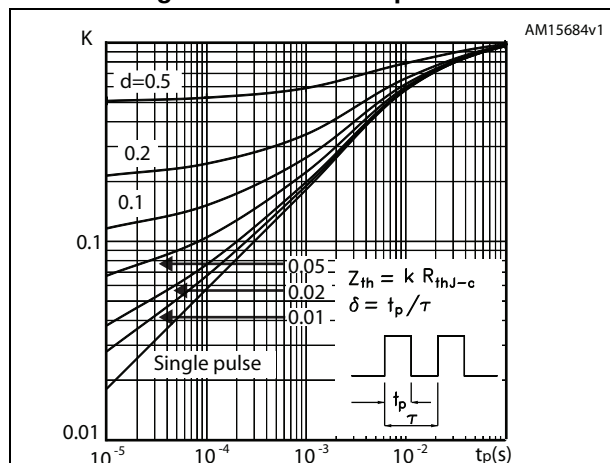


Figure 5. Gate charge vs gate-source voltage

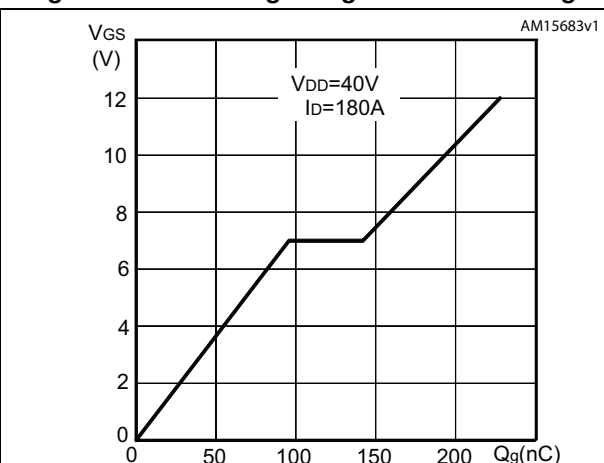


Figure 6. Output characteristics for TO-220

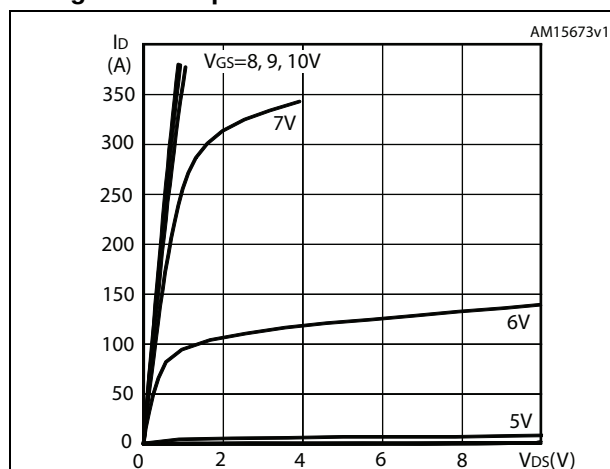


Figure 7. Transfer characteristics for TO-220

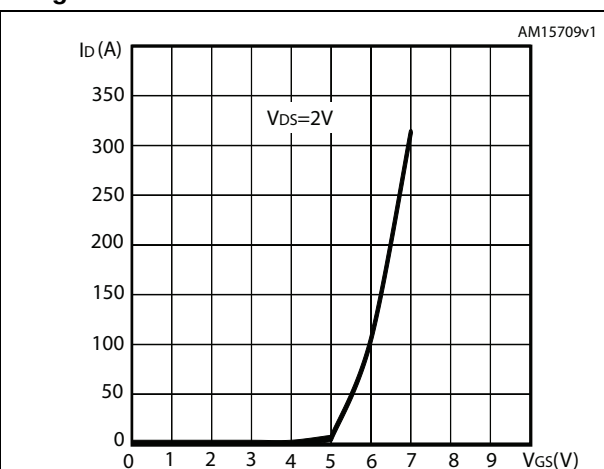


Figure 8. Output characteristics for H<sup>2</sup>PAK-2 and H<sup>2</sup>PAK-6

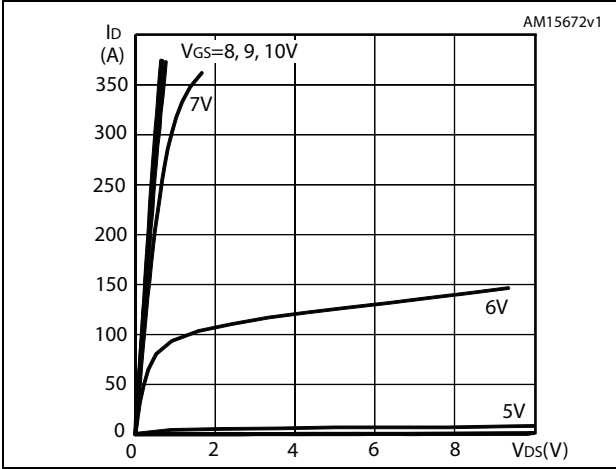


Figure 9. Transfer characteristics for H<sup>2</sup>PAK-2 and H<sup>2</sup>PAK-6

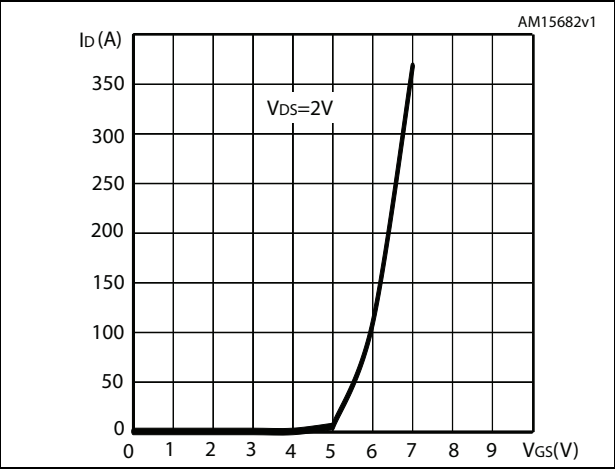


Figure 10. Normalized  $V_{(BR)DSS}$  vs temperature

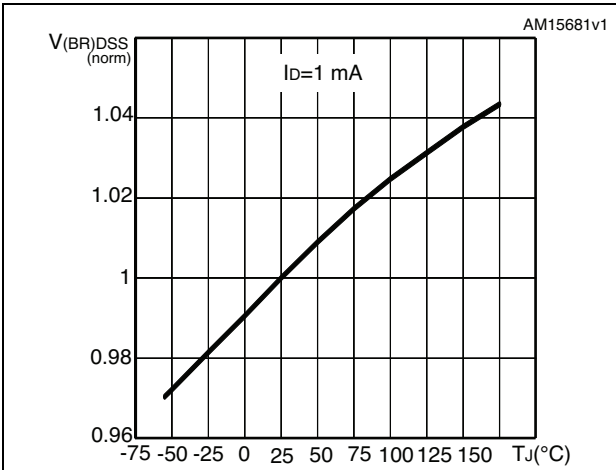


Figure 11. Static drain-source on-resistance for H<sup>2</sup>PAK-2 and H<sup>2</sup>PAK-6

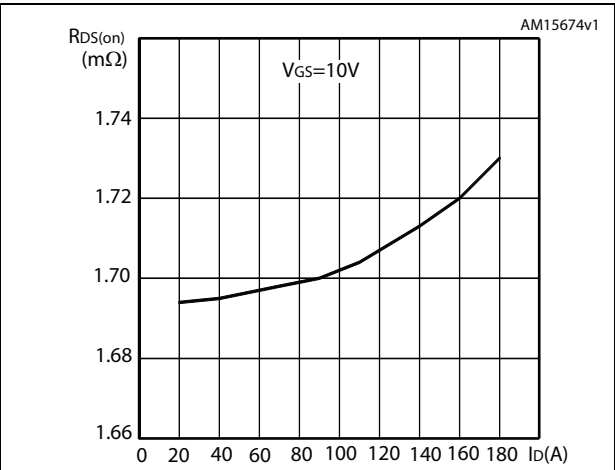


Figure 12. Static drain-source on-resistance for TO-220

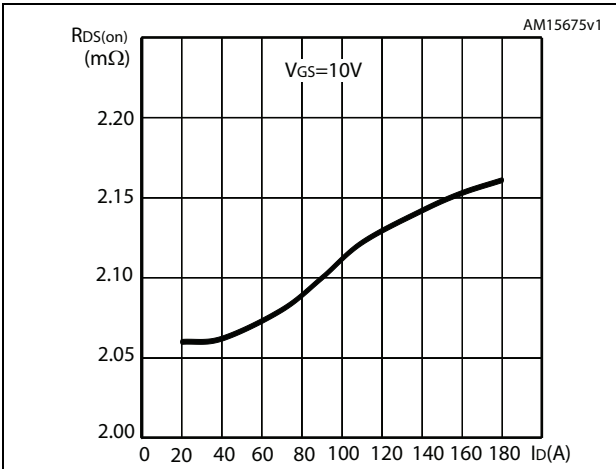


Figure 13. Capacitance variations

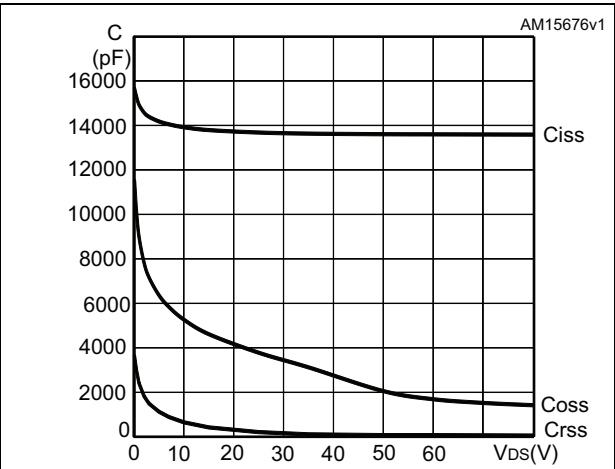


Figure 14. Source-drain diode forward characteristics

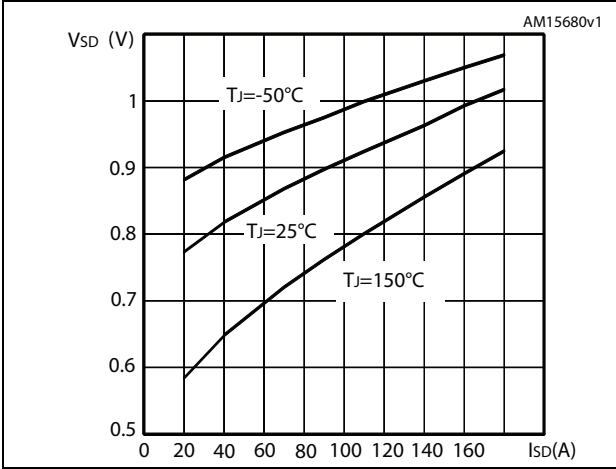


Figure 15. Normalized gate threshold voltage vs temperature

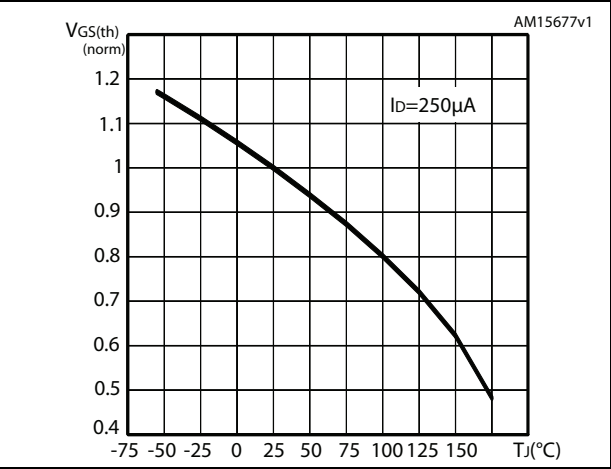


Figure 16. Normalized on-resistance vs temperature for H<sup>2</sup>PAK-2 and H<sup>2</sup>PAK-6

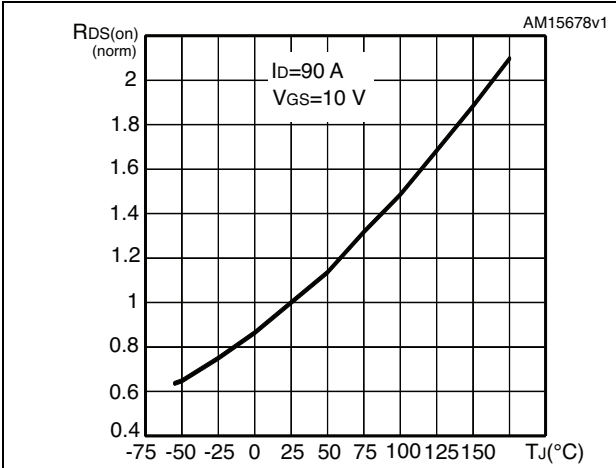
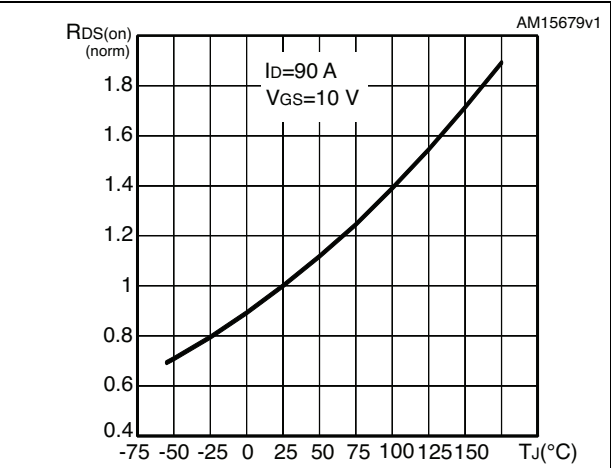


Figure 17. Normalized on-resistance vs temperature for TO-220





## 4 Test circuits

Figure 18. Switching times test circuit for resistive load

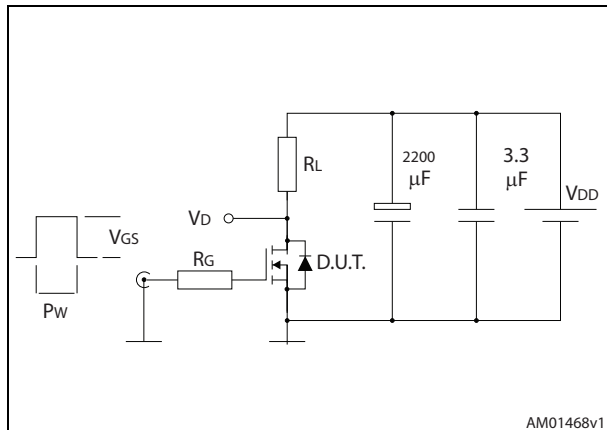


Figure 19. Gate charge test circuit

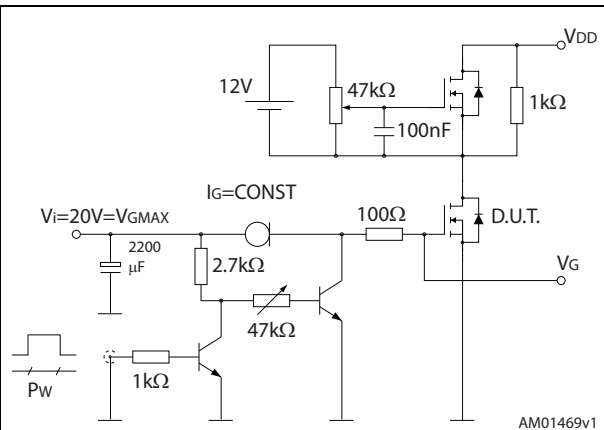


Figure 20. Test circuit for inductive load switching and diode recovery times

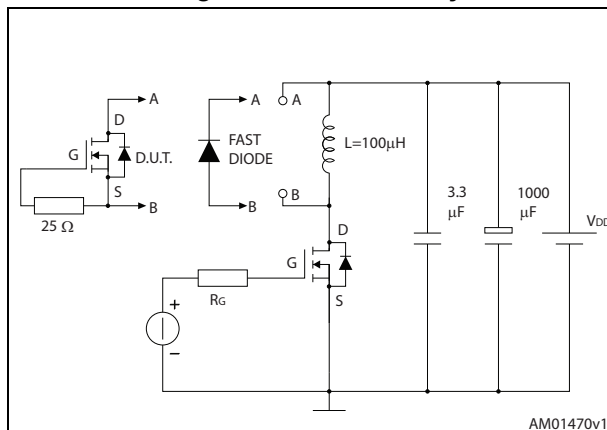


Figure 21. Unclamped inductive load test circuit

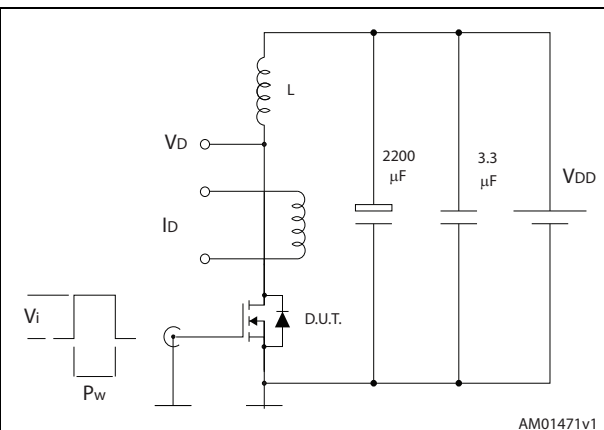


Figure 22. Unclamped inductive waveform

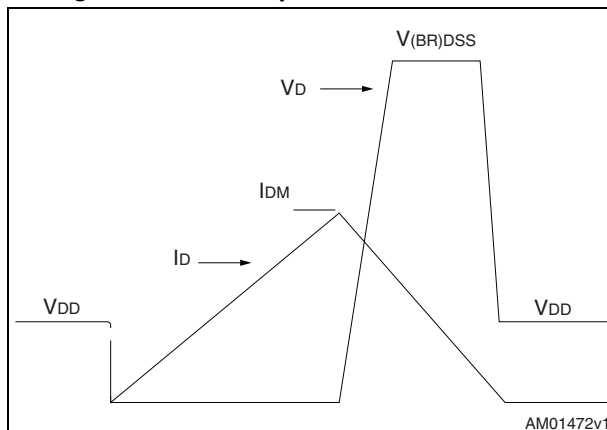
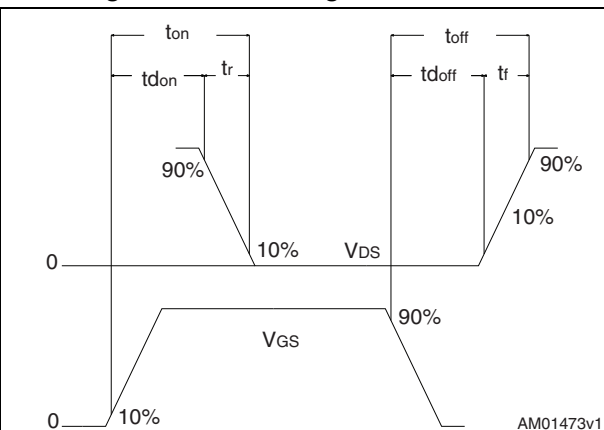


Figure 23. Switching time waveform



## 5 Package information

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.

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

Figure 24. H<sup>2</sup>PAK-2 package information

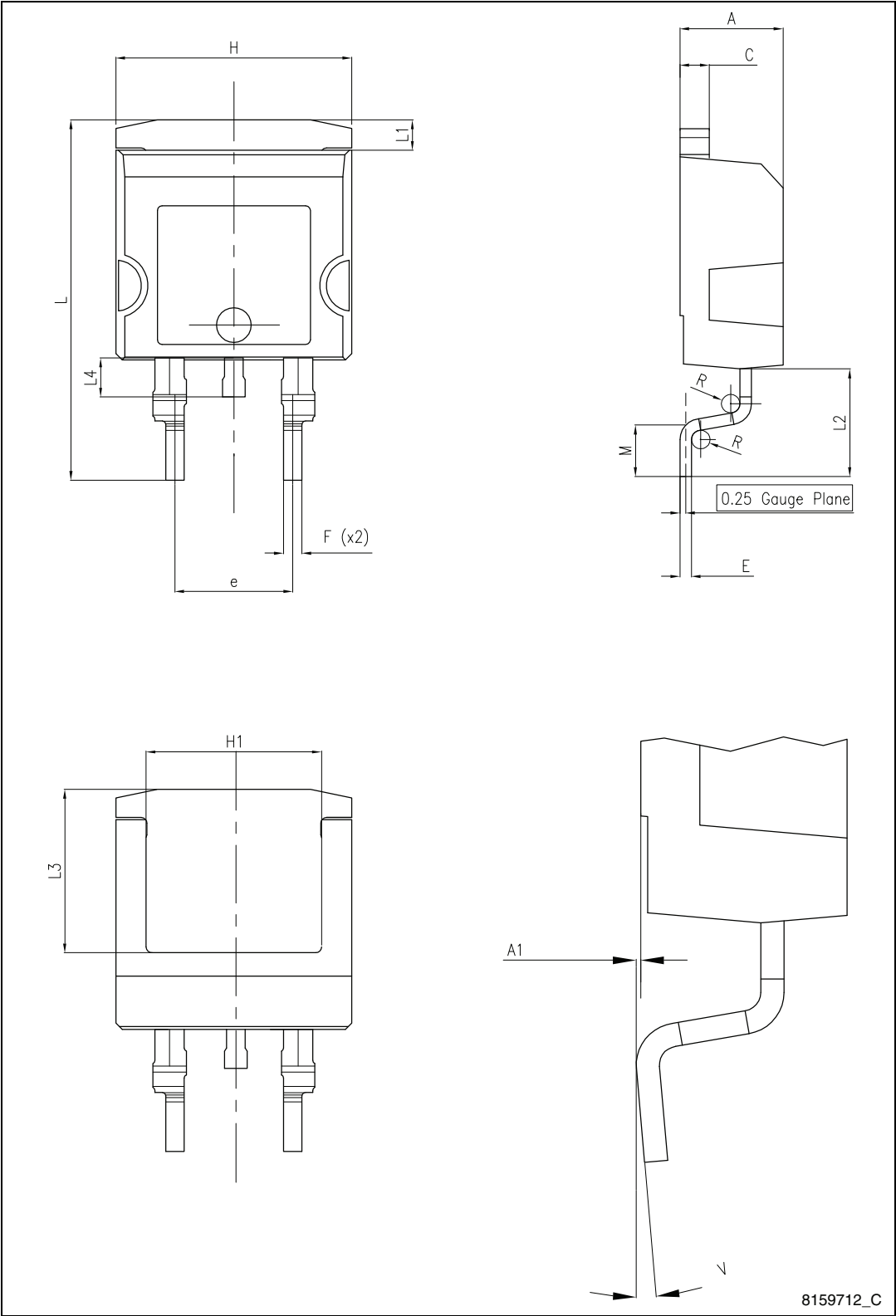
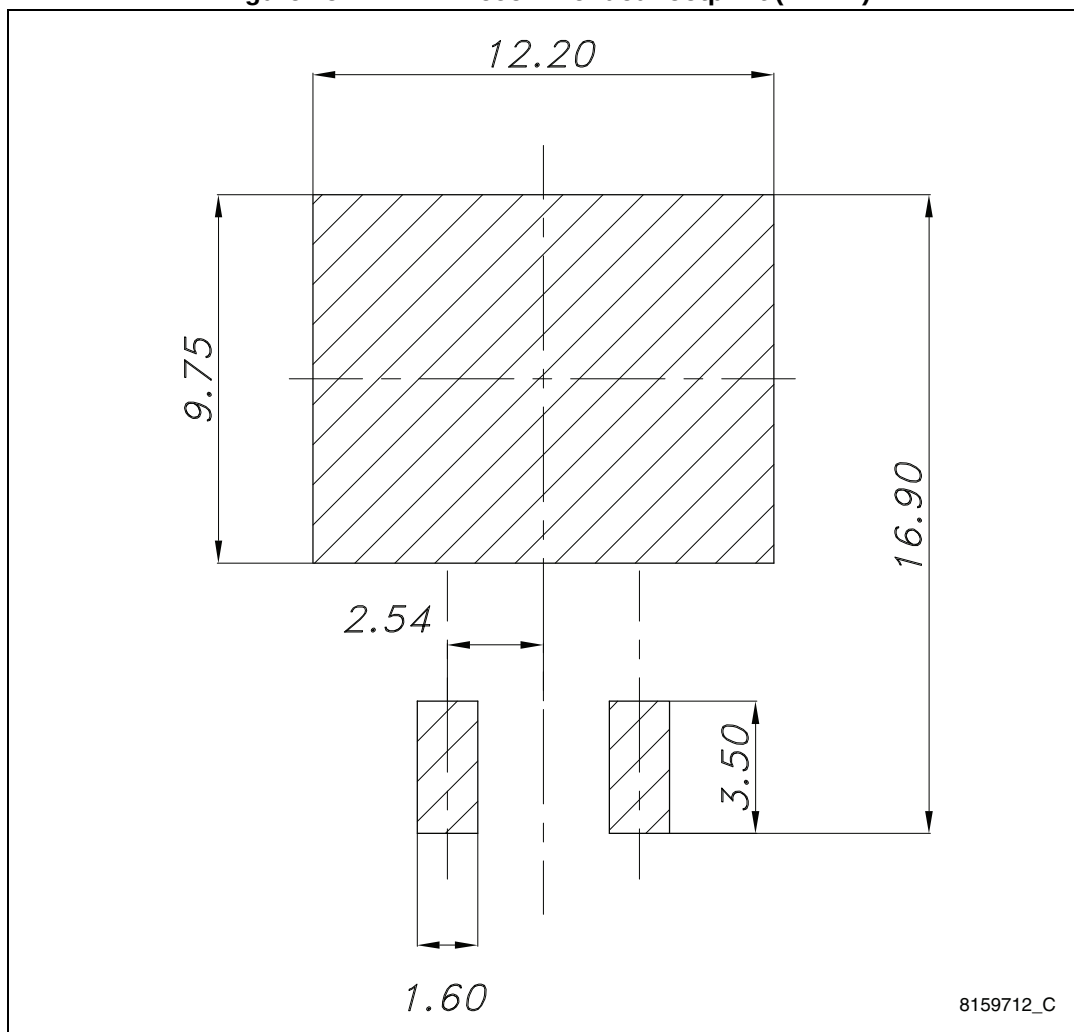


Table 8. H<sup>2</sup>PAK-2 package mechanical data

| 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 25. H<sup>2</sup>PAK-2 recommended footprint (in mm)



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

Figure 26. H<sup>2</sup>PAK-6 package outline

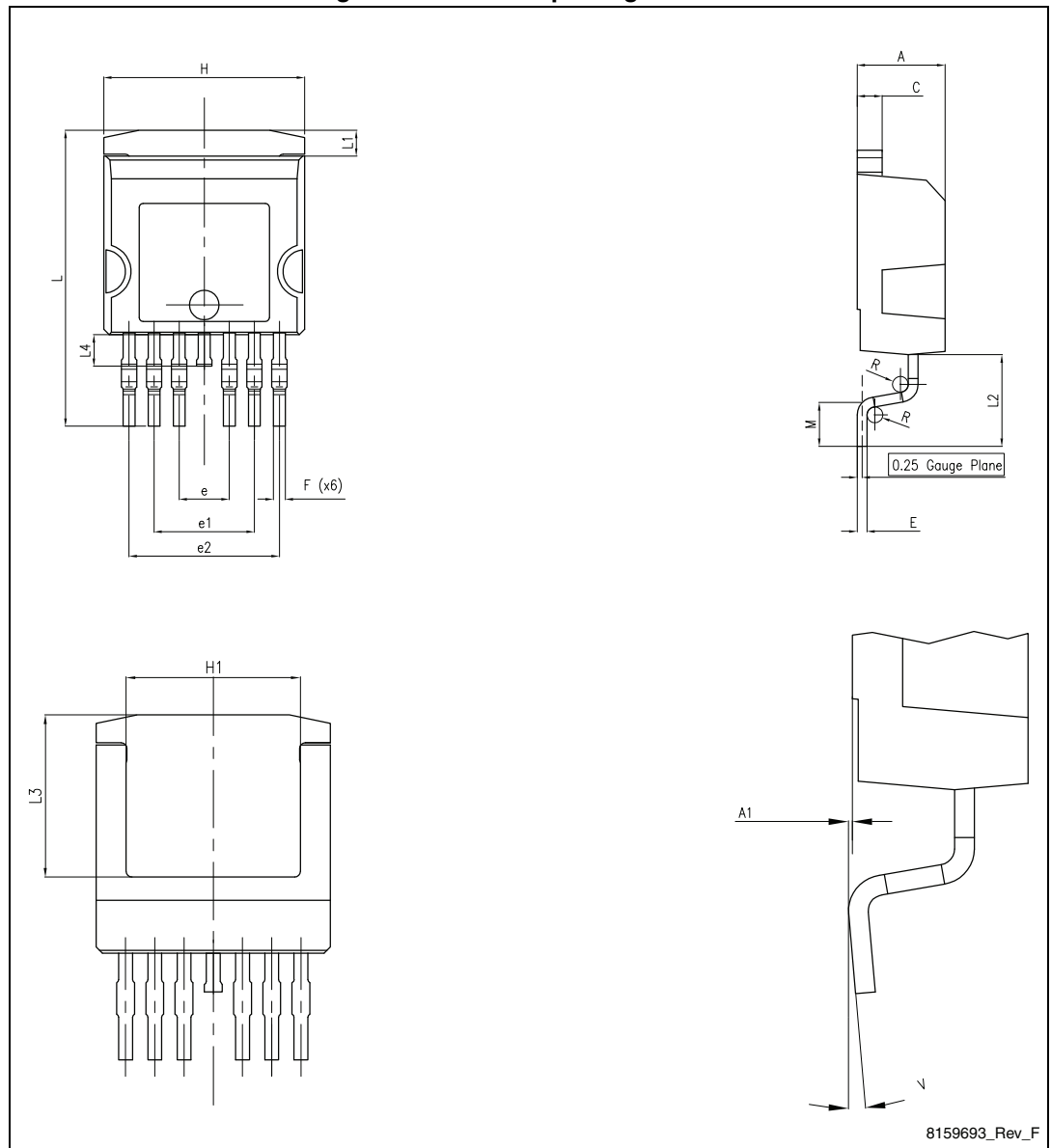
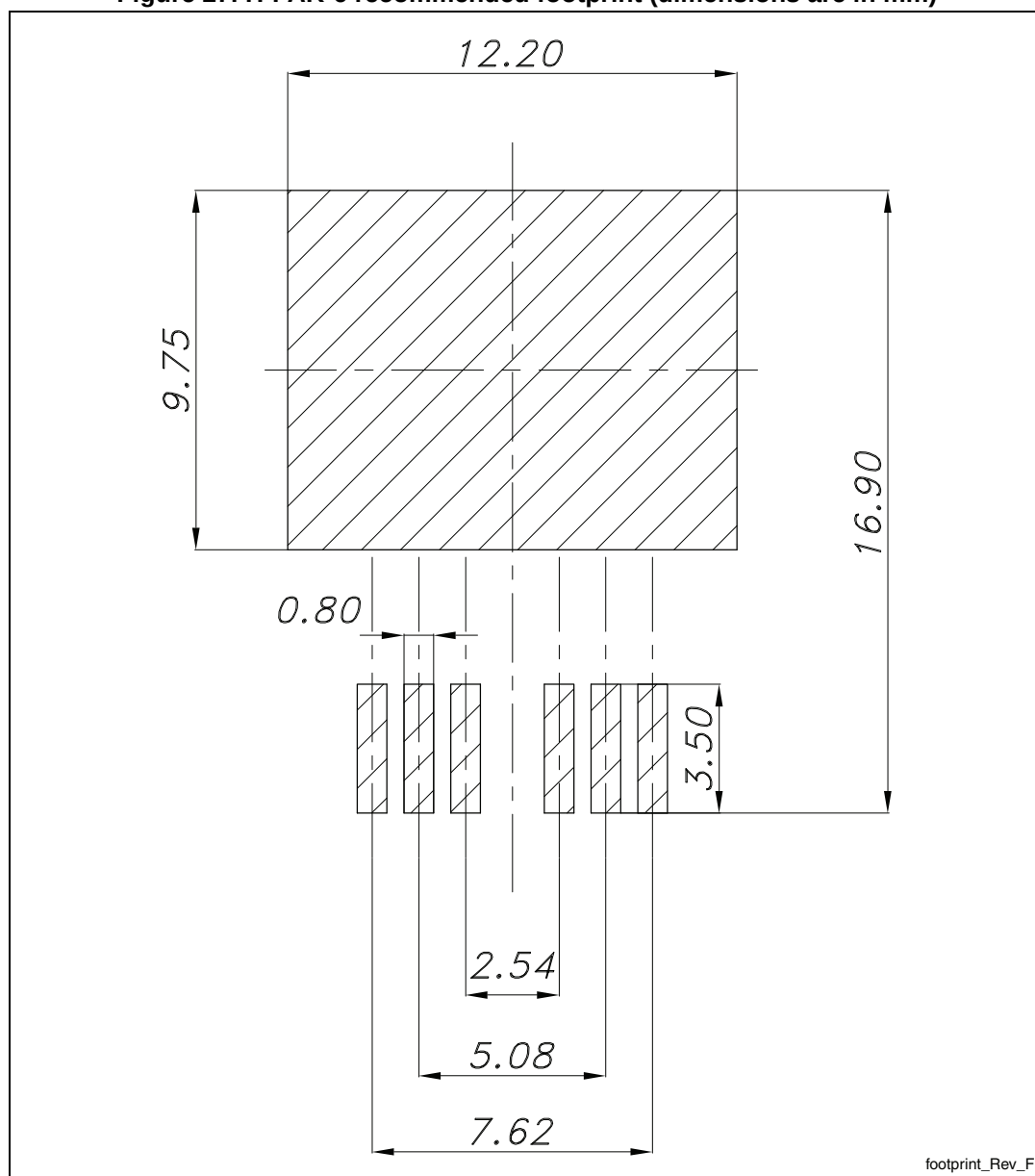


Table 9. H<sup>2</sup>PAK-6 package mechanical data

| 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 27. H<sup>2</sup>PAK-6 recommended footprint (dimensions are in mm)



### 5.3 TO-220 type A package information

Figure 28. TO-220 type A package outline

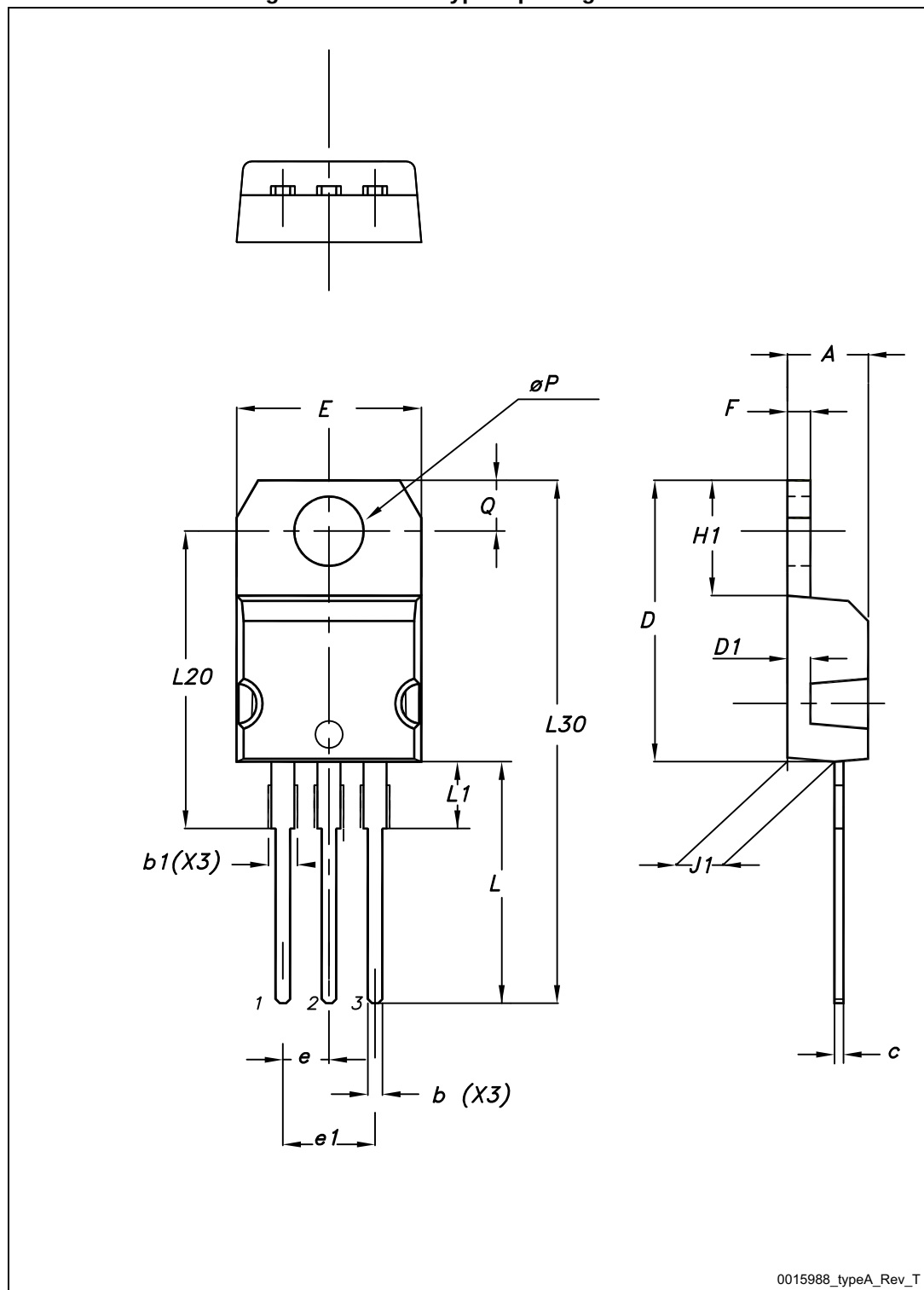


Table 10. TO-220 type A mechanical data

| Dim. | mm    |       |       |
|------|-------|-------|-------|
|      | Min.  | Typ.  | Max.  |
| A    | 4.40  |       | 4.60  |
| b    | 0.61  |       | 0.88  |
| b1   | 1.14  |       | 1.70  |
| c    | 0.48  |       | 0.70  |
| D    | 15.25 |       | 15.75 |
| D1   |       | 1.27  |       |
| E    | 10    |       | 10.40 |
| e    | 2.40  |       | 2.70  |
| e1   | 4.95  |       | 5.15  |
| F    | 1.23  |       | 1.32  |
| H1   | 6.20  |       | 6.60  |
| J1   | 2.40  |       | 2.72  |
| L    | 13    |       | 14    |
| L1   | 3.50  |       | 3.93  |
| L20  |       | 16.40 |       |
| L30  |       | 28.90 |       |
| ØP   | 3.75  |       | 3.85  |
| Q    | 2.65  |       | 2.95  |

6 Packing information

Figure 29. Tape

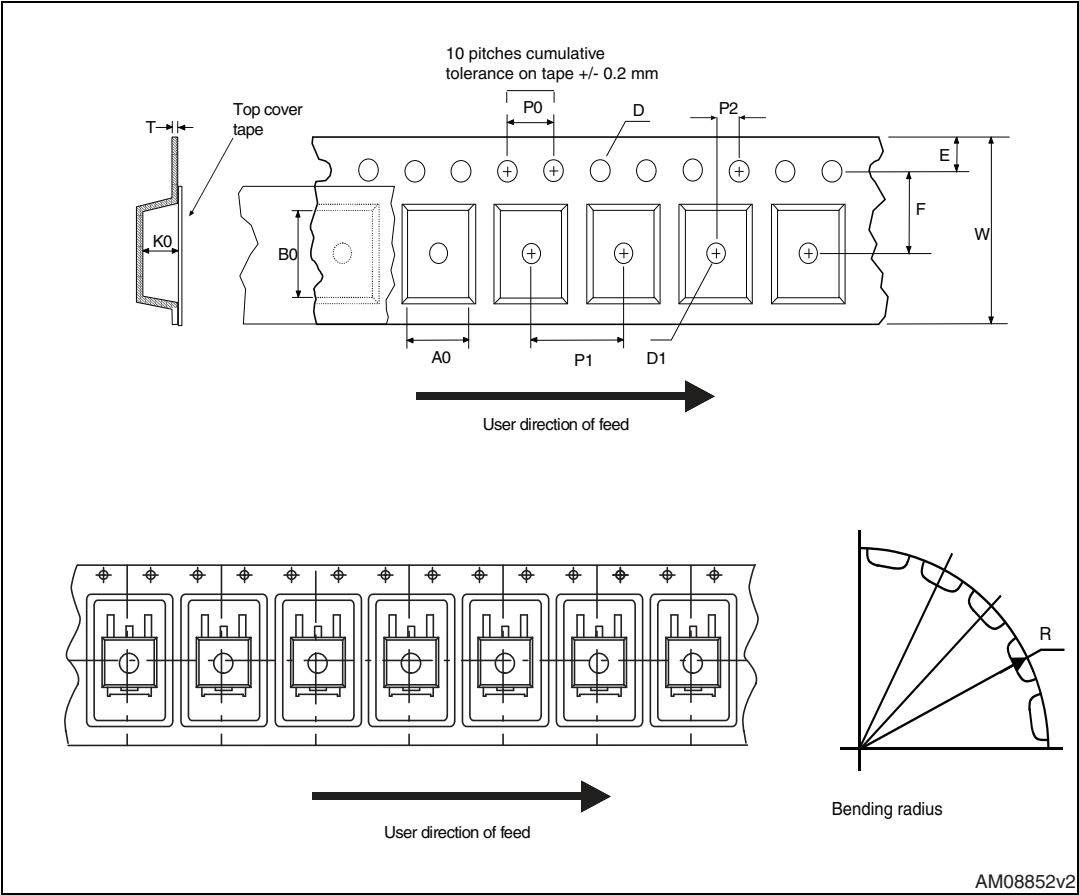
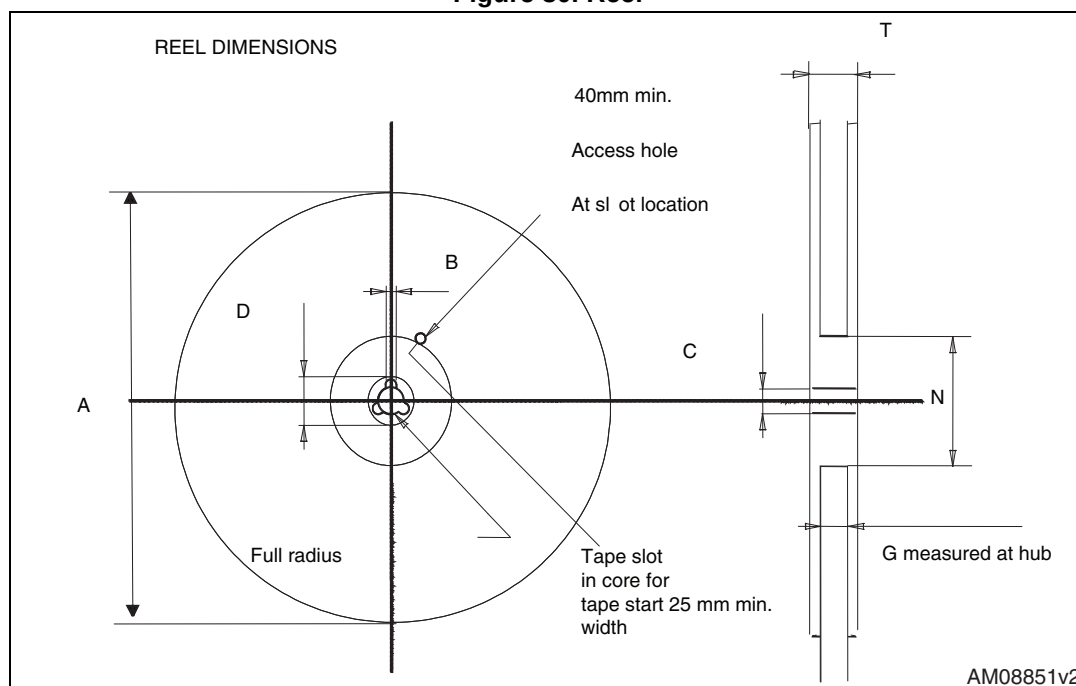


Figure 30. Reel

Table 11. H<sup>2</sup>PAK-2 and H<sup>2</sup>PAK-6 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 |          |      |      |

## 7 Revision history

Table 12. Document revision history

| Date        | Revision | Changes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 03-Dec-2012 | 1        | First release.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 09-Apr-2013 | 2        | <ul style="list-style-type: none"> <li>– Modified: <math>R_{DS(on)}</math> max values on <a href="#">Features</a> table, <math>I_{DSS}</math>, <math>I_{GSS}</math> values on <a href="#">Table 4</a>, <math>R_{DS(on)}</math> value for H<sup>2</sup>PAK-2, the entire typical values on <a href="#">Table 5</a> and <a href="#">6</a>, <math>V_{SD}</math> test conditions and max values, <math>T_{RR}</math>, <math>Q_{RR}</math>, <math>I_{RRM}</math> typical values on <a href="#">Table 7</a></li> <li>– Inserted: <a href="#">Section 3: Electrical characteristics (curves)</a></li> <li>– Document status promoted to preliminary data to production data</li> <li>– Added: H<sup>2</sup>PAK-6 package</li> <li>– Minor text changes</li> </ul> |
| 11-Oct-2013 | 3        | <ul style="list-style-type: none"> <li>– Modified: <math>C_{RSS}</math> typical value in <a href="#">Table 5</a></li> <li>– Updated: <a href="#">Section 5: Package information</a></li> <li>– Updated: <a href="#">Figure 18</a>, <a href="#">19</a>, <a href="#">20</a> and <a href="#">21</a></li> <li>– Minor text changes</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 14-May-2015 | 4        | <ul style="list-style-type: none"> <li>– Updated title, features and description in cover page.</li> <li>– Minor text changes</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

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