## N-channel 40 V, 1.4 mΩ typ., 180 A STripFET™ F3 Power MOSFET in H$^2$PAK-2 package

**Datasheet** − production data



**H$^2$PAK-2**

### Features

| Order codes | $V_{DS}$ | $R_{DS(on)}$ max | $I_D$ |
|---|---|---|---|
| STH270N4F3-2 | 40 V | 1.7 mΩ | 180 A |

- Conduction losses reduced
- Low profile, very low parasitic inductance, high current package

### Applications

- Switching applications

### Description

This device is an N-channel Power MOSFET developed using STripFET™ F3 technology. It is designed to minimize on-resistance and gate charge to provide superior switching performance.

**Figure 1. Internal schematic diagram**



GIPD210520151536FSR

**Table 1. Device summary**

| Order code | Marking | Package | Packaging |
|---|---|---|---|
| STH270N4F3-2 | 270N4F3 | H$^2$PAK-2 | Tape and reel |

# Contents

# 1    Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|:---:|:---:|
| $V_{DS}$ | Drain-source voltage | 40 | |
| $V_{GS}$ | Gate-source voltage | ± 20 | V |
| $I_D$ [1] | Drain current (continuous) at $T_C$ = 25 °C | 180 | A |
| $I_D$ [1] | Drain current (continuous) at $T_C$ = 100 °C | 180 | A |
| $I_{DM}$ [2] | Drain current (pulsed) | 720 | A |
| $P_{TOT}$ | Total dissipation at $T_C$ = 25 °C | 300 | W |
| $E_{AS}$ [3] | Single pulse avalanche energy | 1000 | mJ |
| $T_{stg}$ | Storage temperature | - 55 to 175 | °C |
| $T_j$ | Operating junction temperature | | °C |

1.    Current limited by package.

2.    Pulse width limited by safe operating area

3.    Starting $T_J$=25°C, $I_D$=80 A, $V_{DD}$=32 V

**Table 3. Thermal data**

| Symbol | Parameter | Value | Unit |
|---|---|:---:|:---:|
| $R_{thj-case}$ | Thermal resistance junction-case max | 0.5 | °C/W |
| $R_{thj-pcb}$ [1] | Thermal resistance junction-pcb max | 35 | °C/W |

1.    When mounted on FR-4 board of 1 inch², 2oz Cu.

# 2 Electrical characteristics

($T_C$ = 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 µA | 40 | | | V |
| $I_{DSS}$ | Zero gate voltage drain current | $V_{GS}$ = 0, $V_{DS}$ = 40 V | | | 10 | µA |
| | | $V_{GS}$ = 0, $V_{DS}$ = 40 V, $T_C$=125 °C | | | 100 | µA |
| $I_{GSS}$ | Gate-body leakage current | $V_{DS}$ = 0, $V_{GS}$ = ± 20 V | | | ±200 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | 2 | | 4 | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS}$ = 10 V, $I_D$ = 80 A | | 1.4 | 1.7 | mΩ |

**Table 5. Dynamic**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input capacitance | $V_{DS}$ = 25 V, f = 1 MHz, $V_{GS}$ = 0 | - | 7400 | - | pF |
| $C_{oss}$ | Output capacitance | | - | 1800 | - | pF |
| $C_{rss}$ | Reverse transfer capacitance | | - | 50 | - | pF |
| $Q_g$ | Total gate charge | $V_{DD}$ = 20 V, $I_D$ = 160 A, $V_{GS}$ = 10 V (see *Figure 14*) | - | 110 | 150 | nC |
| $Q_{gs}$ | Gate-source charge | | - | 30 | - | nC |
| $Q_{gd}$ | Gate-drain charge | | - | 25 | - | 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, $R_G$ = 4.7 Ω, $V_{GS}$ = 10 V (see *Figure 2*) | - | 25 | - | ns |
| $t_r$ | Rise time | | - | 180 | - | ns |
| $t_{d(off)}$ | Turn-off delay time | | - | 110 | - | ns |
| $t_f$ | Fall time | | - | 45 | - | ns |

**Table 7. Source drain diode**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------|-----------|-----------------|------|------|------|------|
| $I_{SD}$ [1] | Source-drain current | | - | | 180 | A |
| $I_{SDM}$ [2] | Source-drain current (pulsed) | | - | | 720 | A |
| $V_{SD}$ [3] | Forward on voltage | $I_{SD}$ = 180 A, $V_{GS}$ = 0 | - | | 1.5 | V |
| $t_{rr}$ | Reverse recovery time | $I_{SD}$ = 160 A, di/dt = 100 A/µs $V_{DD}$ = 32 V, $T_J$=150 °C (see *Figure 15*) | - | 70 | | ns |
| $Q_{rr}$ | Reverse recovery charge | | - | 225 | | nC |
| $I_{RRM}$ | Reverse recovery current | | - | 3.2 | | A |

1. Current limited by package

2. Pulse width limited by safe operating area.

3. Pulsed: pulse duration=300 µs, duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

**Figure 2. Safe operating area**
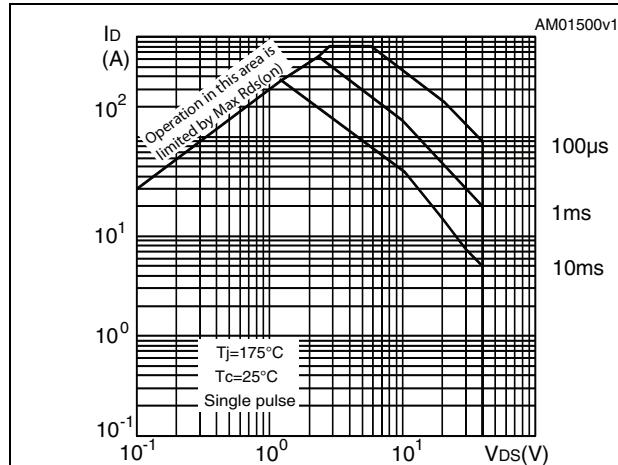


**Figure 3. Thermal impedance**
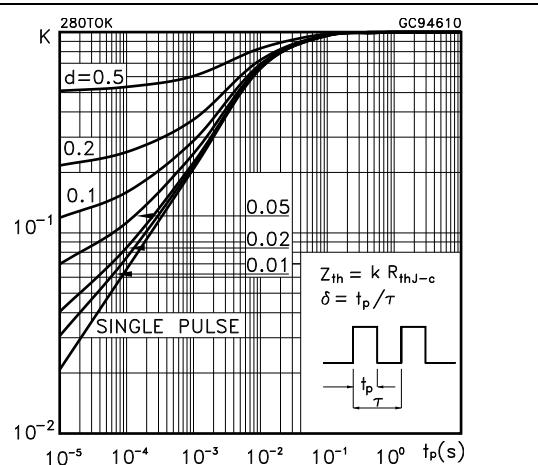


**Figure 4. Output characteristics**
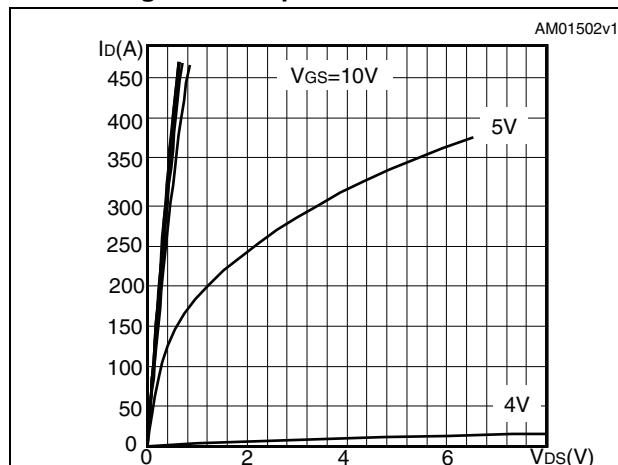


**Figure 5. Transfer characteristics**
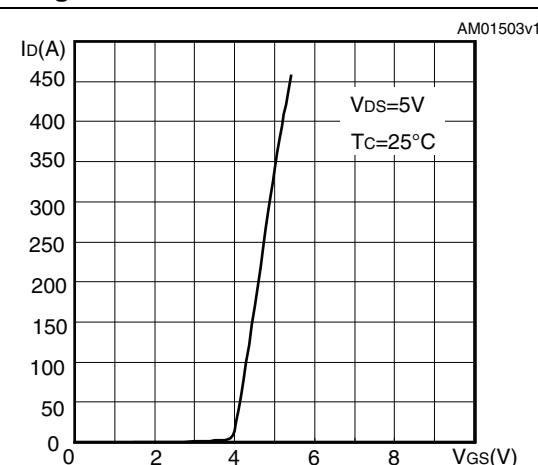


**Figure 6. Gate charge vs gate-source voltage**
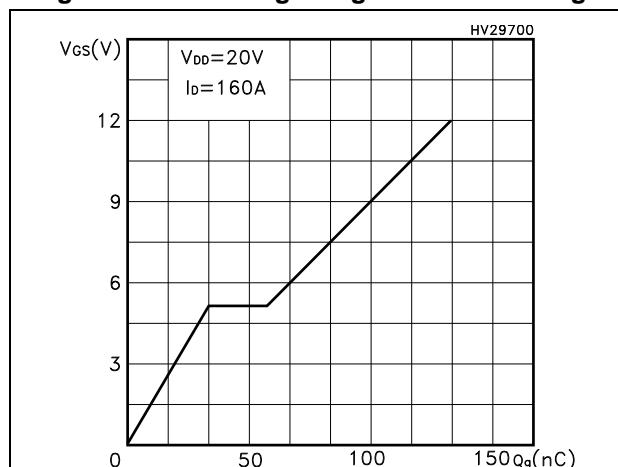


**Figure 7. Static drain-source on-resistance**
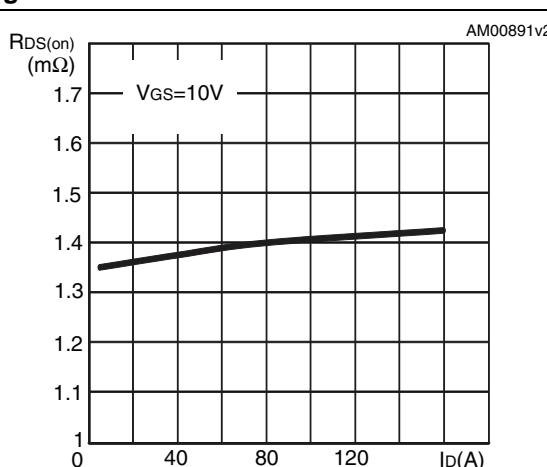
**Figure 8. Capacitance variations**
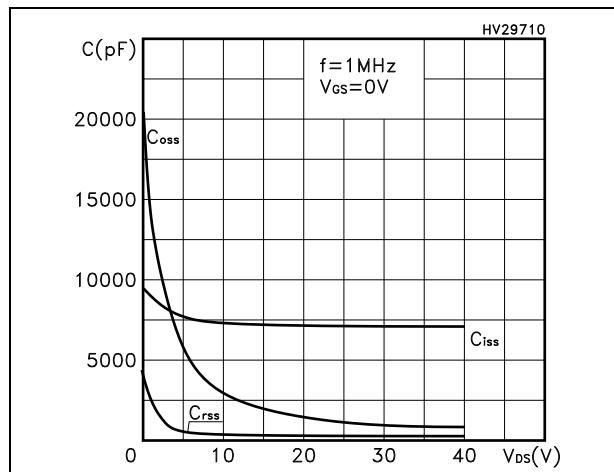


**Figure 9. Normalized gate threshold voltage vs temperature**
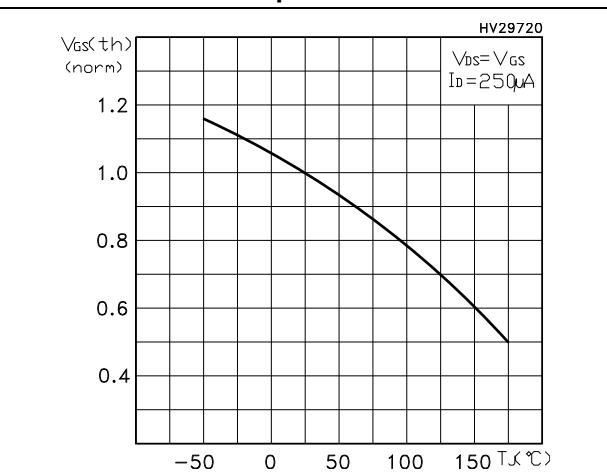


**Figure 10. Normalized on-resistance vs temperature**
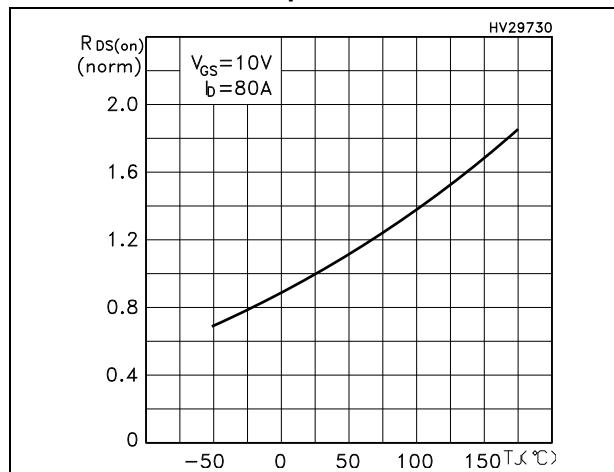


**Figure 11. Normalized $V_{(BR)DSS}$ vs temperature**
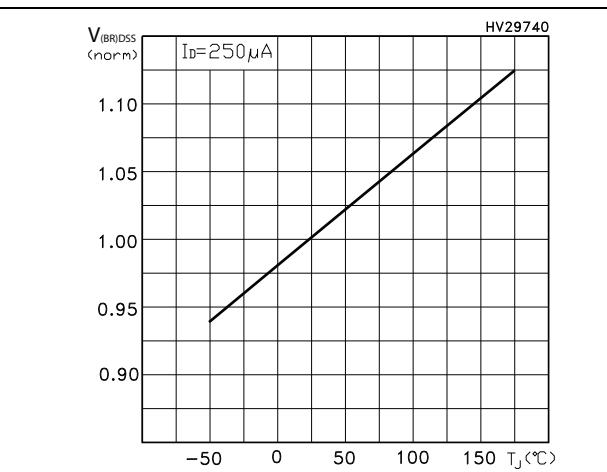


**Figure 12. Drain-source diode forward characteristics**
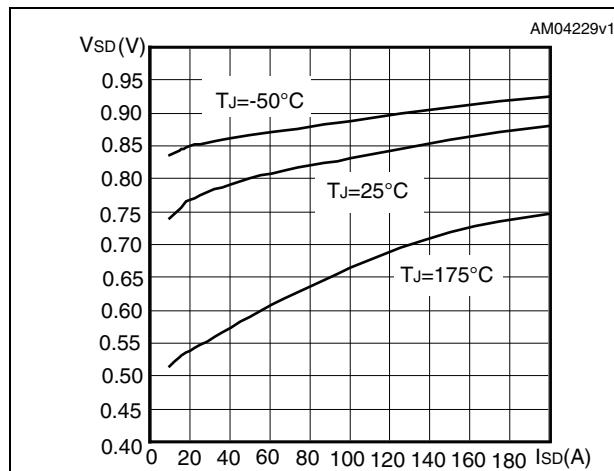
# 3 Test circuits

**Figure 13. Switching times test circuit for resistive load**



AM01468v1

**Figure 14. Gate charge test circuit**



AM01469v1
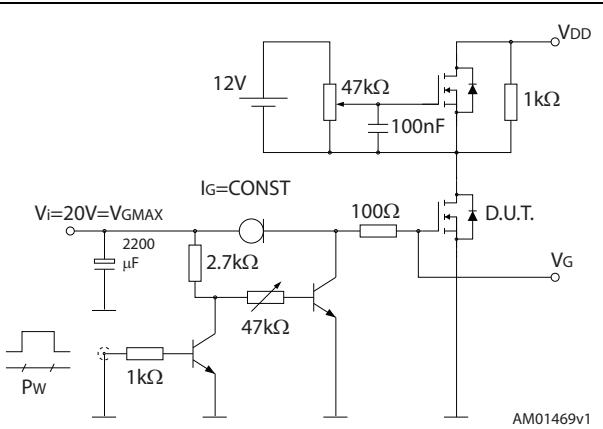
**Figure 15. Test circuit for inductive load switching and diode recovery times**



AM01470v1

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



AM01471v1
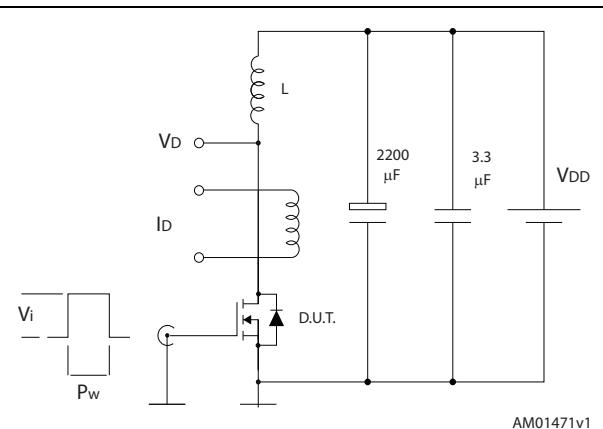
**Figure 17. Unclamped inductive waveform**



AM01472v1

**Figure 18. Switching time waveform**



AM01473v1
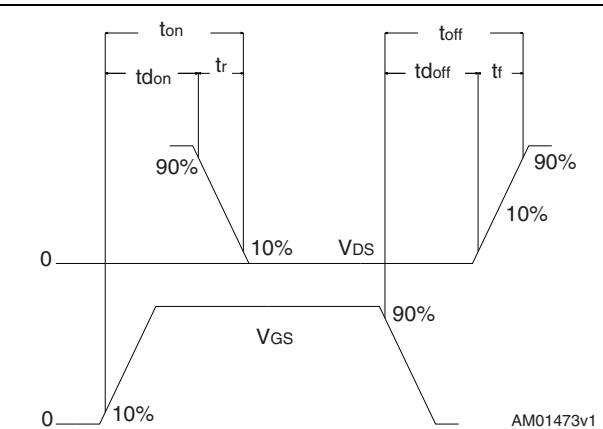
# 4       Package information

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*. ECOPACK® is an ST trademark.

# 4.1 H²PAK-2 package information

**Figure 19. H²PAK-2 package outline**



8159712_D
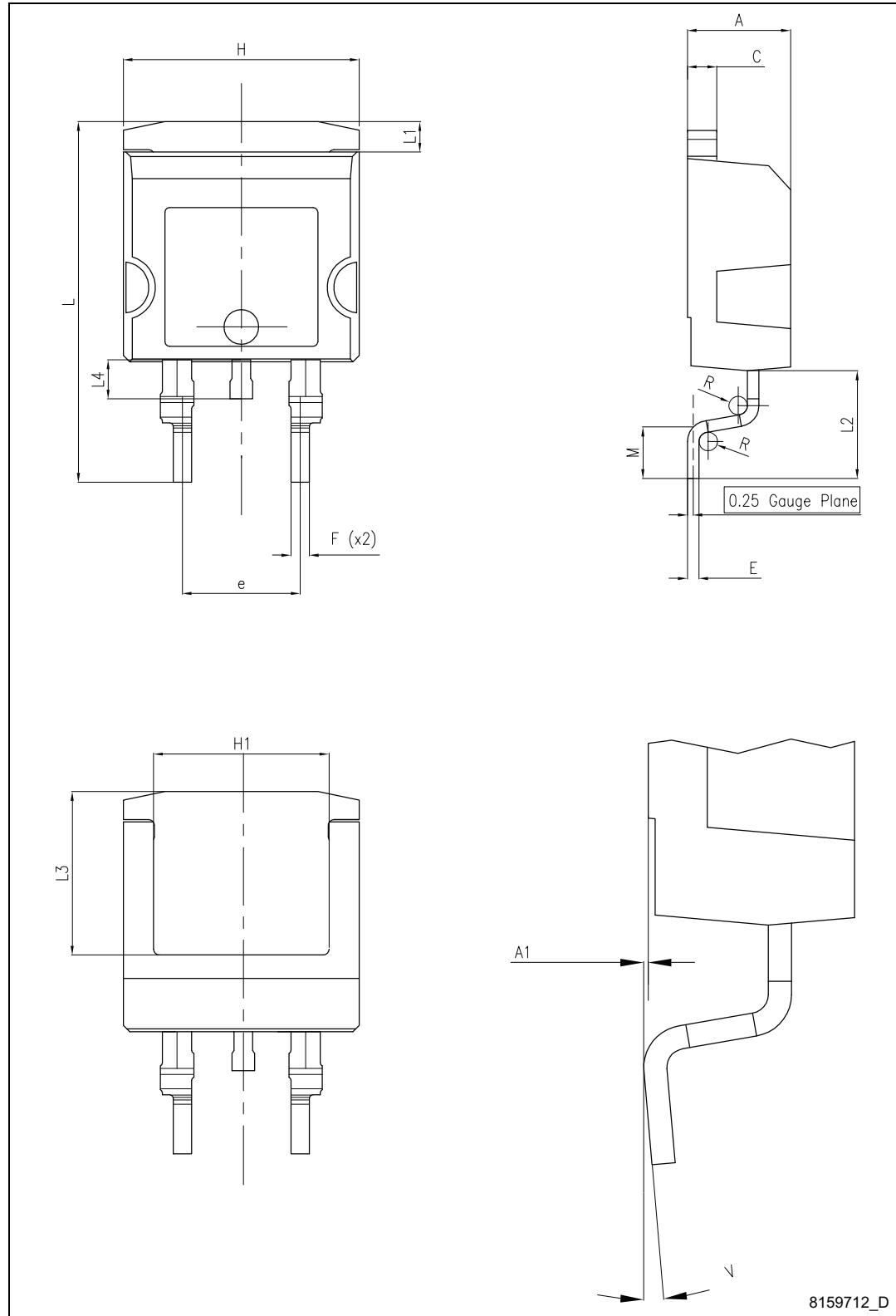
**Table 8. H²PAK-2 mechanical data**

| 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 20. H²PAK-2 recommended footprint (dimensions are in mm)**



8159712_D
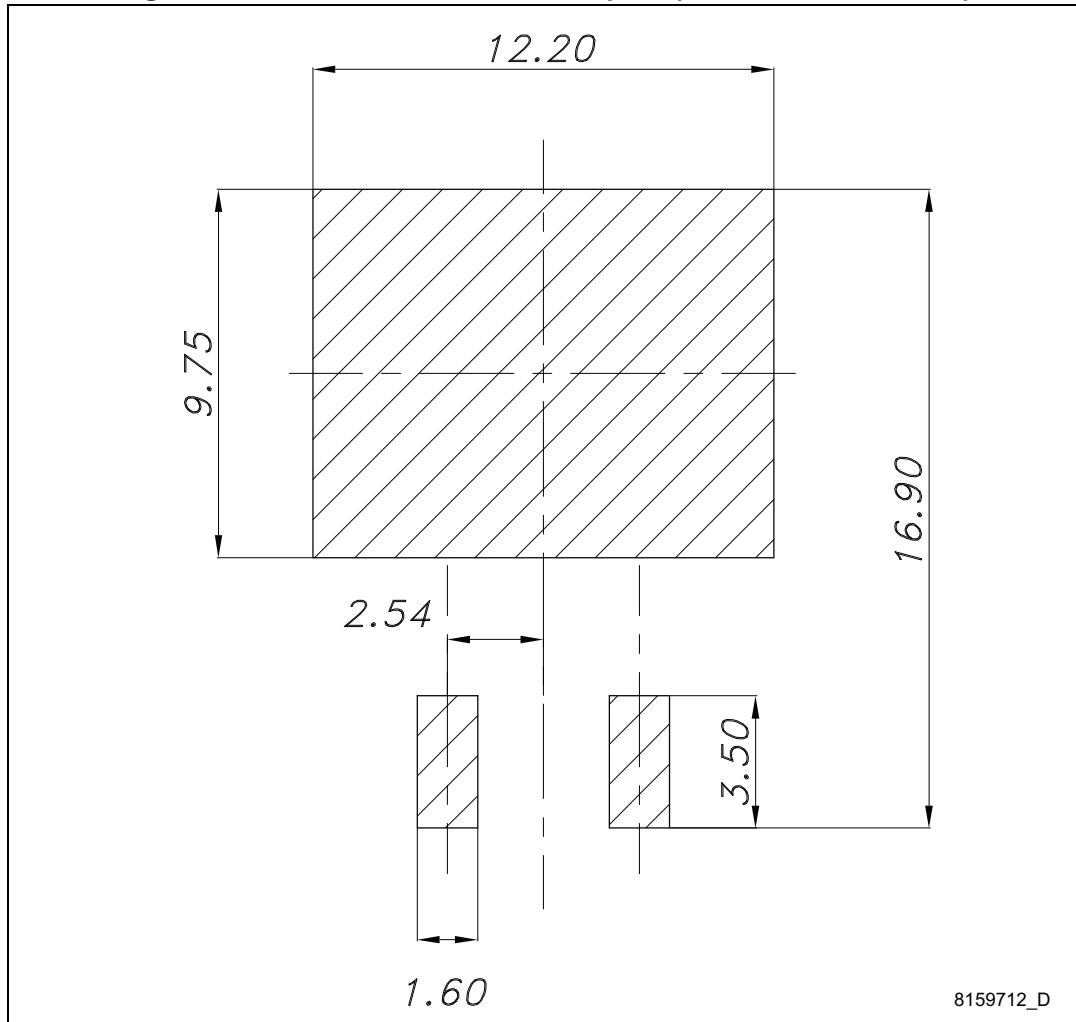
# 5        Packing information

**Figure 21. Tape**
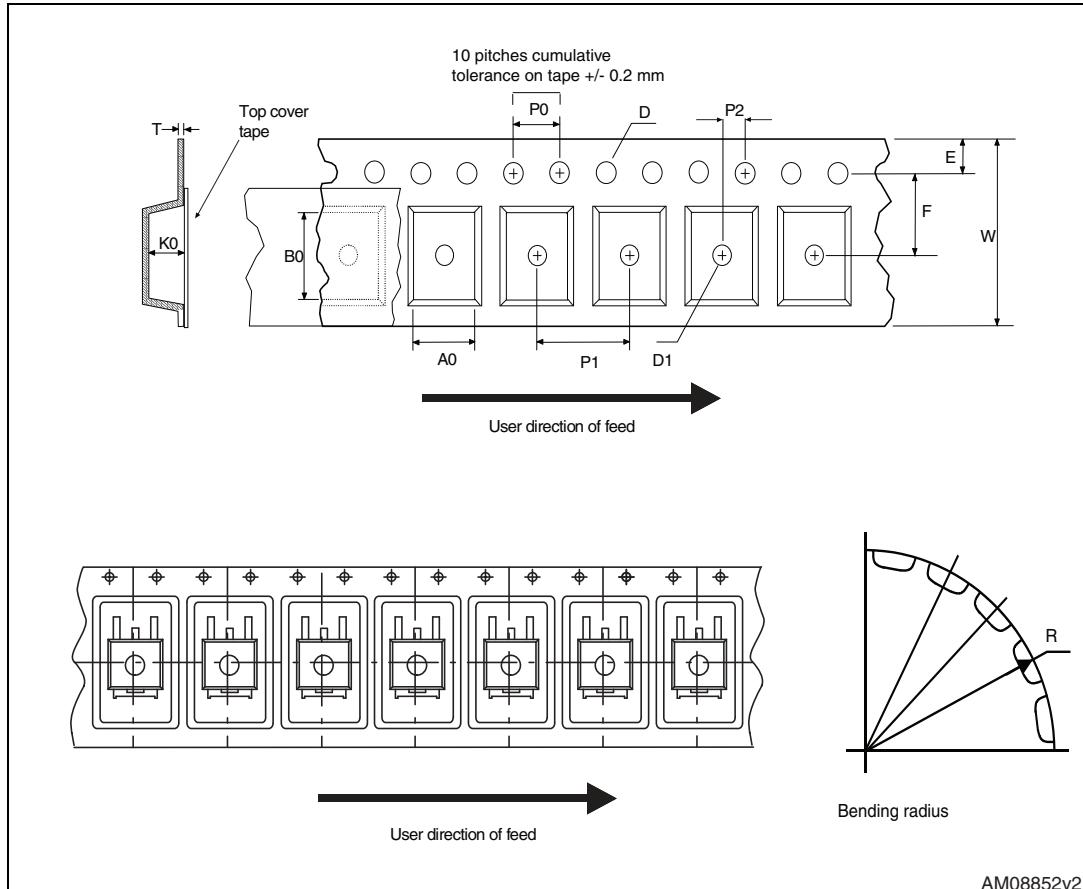
**Figure 22. Reel**
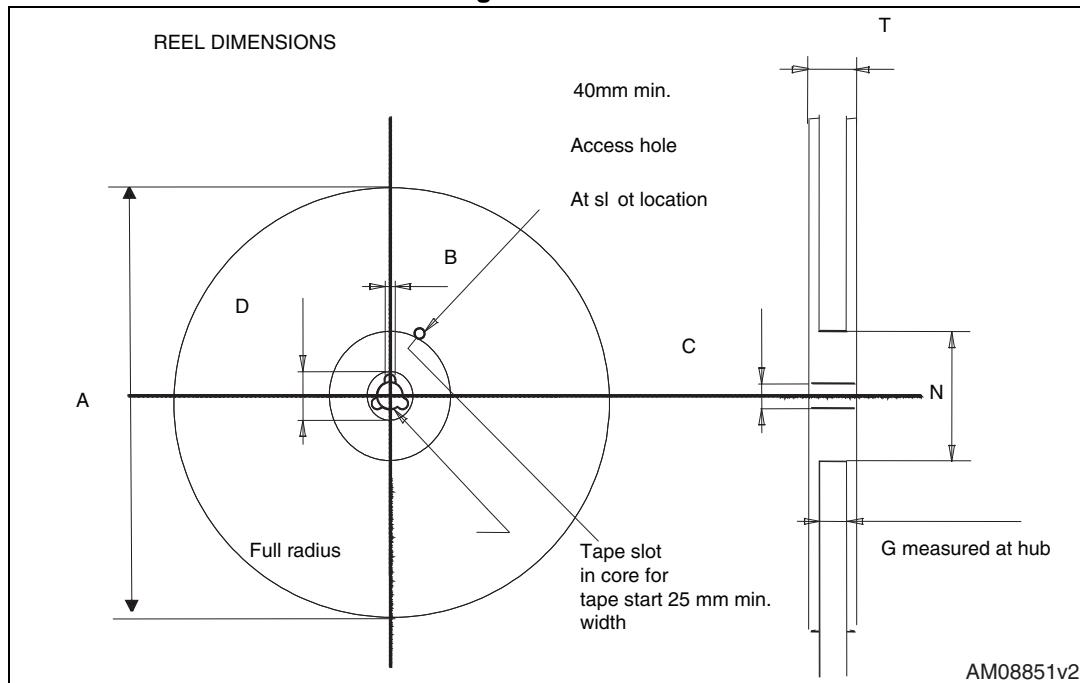


**Table 9. H²PAK-2 and H²PAK-6 tape and reel mechanical data**

| | 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 | | | | |

# 6 Revision history

**Table 10. Document revision history**

| Date | Revision | Changes |
|------|----------|---------|
| 15-Jan-2010 | 1 | First release. |
| 14-Mar-2013 | 2 | – Added: H$^2$PAK-2 package<br>– Updated: *Section 4: Package information* and *Section 5: Packing information*<br>– Minor text changes |
| 21-May-2015 | 3 | – The part number STH270N4F3-6 has been moved to a separate datasheet.<br>– Updated title and description in cover page.<br>– Updated *Section 4: Package information*.<br>– Minor text changes |

**IMPORTANT NOTICE – PLEASE READ CAREFULLY**