# STB80NF55-08AG,
# STP80NF55-08AG

## Automotive-grade N-channel 55 V, 6.5 mΩ typ.,80 A STripFET™ Power MOSFETs in D²PAK and TO-220 packages
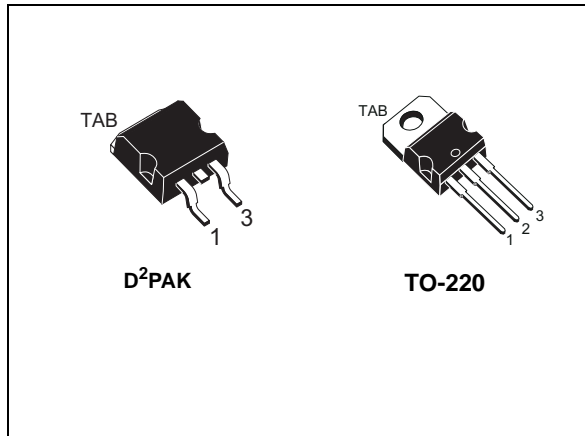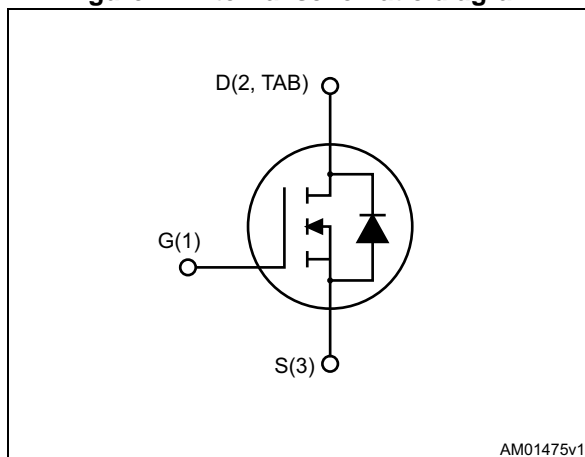
**Datasheet — production data**



**D²PAK**        **TO-220**

**Figure 1. Internal schematic diagram**



AM01475v1

## Features

| Order code | $V_{DSS}$ | $R_{DS(on)}$ max | $I_D$ |
|---|---|---|---|
| STB80NF55-08AG | 55 V | 8 mΩ | 80 A |
| STP80NF55-08AG | | | |

- Designed for automotive applications and AEC-Q101 qualified
- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance

## Applications

- Switching applications

## Description

These Power MOSFETs have been developed using STMicroelectronics' unique STripFET process, which is specifically designed to minimize input capacitance and gate charge. This renders the devices suitable for use as primary switch in advanced high-efficiency isolated DC-DC converters for telecom and computer applications, and applications with low gate charge driving requirements.

**Table 1. Device summary**

| Order code | Marking | Packages | Packing |
|---|---|---|---|
| STB80NF55-08AG | B80NF55-08 | D²PAK | Tape and reel |
| STP80NF55-08AG | P80NF55-08 | TO-220 | Tube |

# Contents

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|--------|-----------|-------|------|
| $V_{DS}$ | Drain-source voltage | 55 | V |
| $V_{GS}$ | Gate-source voltage | ± 20 | V |
| $I_D{}^{(1)}$ | Drain current (continuous) at $T_C$ = 25 °C | 80 | A |
| $I_D{}^{(1)}$ | Drain current (continuous) at $T_C$ = 100 °C | 80 | A |
| $I_{DM}{}^{(2)}$ | Drain current (pulsed) | 320 | A |
| $P_{TOT}$ | Total dissipation at $T_C$ = 25 °C | 300 | W |
| $T_{stg}$ | Operating junction temperature range | - 55 to 175 | °C |
| $T_j$ | Storage temperature range | | |

1. Current limited package

2. Pulse width limited by safe operating area

**Table 3. Thermal data**

| Symbol | Parameter | Value | | Unit |
|--------|-----------|-------|-------|------|
| | | **D²PAK** | **TO-220** | |
| $R_{thj-case}$ | Thermal resistance junction-case | 0.5 | | °C/W |
| $R_{thj-pcb}$ | Thermal resistance junction-pcb | $35^{(1)}$ | | °C/W |
| $R_{thj-amb}$ | Thermal resistance junction-ambient | | 62.5 | °C/W |

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

**Table 4. Avalanche characteristics**

| Symbol | Parameter | Value | Unit |
|--------|-----------|-------|------|
| $I_{AR}$ | Avalanche current, repetitive or not-repetitive (pulse width limited by Tj max) | 40 | A |
| $E_{AS}$ | Single pulse avalanche energy (starting $T_J$ = 25 °C, $I_D$= $I_{AR}$, $V_{DD}$ = 30 V) | 1000 | mJ |

# 2 Electrical characteristics

($T_{CASE}$ = 25 °C unless otherwise specified)

**Table 5. On/off states**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------|-----------|-----------------|------|------|------|------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $V_{GS}$ = 0 V, $I_D$ = 250 µA | 55 | | | V |
| $I_{DSS}$ | Zero gate voltage drain current | $V_{GS}$ = 0 V, $V_{DS}$ = 55 V | | | 1 | µA |
| | | $V_{GS}$ = 0 V, $V_{DS}$ = 55 V, $T_C$ =125 °C [1] | | | 10 | µA |
| $I_{GSS}$ | Gate-body leakage current | $V_{DS}$ = 0 V $V_{GS}$ = ± 20 V | | | ± 100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS}$ = $V_{GS}$ , $I_D$ = 250 µA | 2 | 3 | 4 | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS}$ = 10 V, $I_D$ = 40 A | | 6.5 | 8 | mΩ |

1. Defined by design, not subject to production test

**Table 6. Dynamic**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------|-----------|-----------------|------|------|------|------|
| $g_{fs}$[1] | Forward transconductance | $V_{DS}$ = 15 V, $I_D$ = 18 A | - | 40 | - | S |
| $C_{iss}$ | Input capacitance | | | 3740 | | pF |
| $C_{oss}$ | Output capacitance | $V_{GS}$ = 0 V, $V_{DS}$ = 25 V, f = 1 MHz | - | 830 | - | pF |
| $C_{rss}$ | Reverse transfer capacitance | | - | 265 | - | pF |
| $Q_g$ | Total gate charge | $V_{DD}$ = 27 V, $I_D$ = 80 A, | - | 112 | 155 | nC |
| $Q_{gs}$ | Gate-source charge | $V_{GS}$ = 10 V, (*Figure 14: Gate charge test* | - | 20 | - | nC |
| $Q_{gd}$ | Gate-drain charge | *circuit*) | - | 40 | - | nC |

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

**Table 7. Switching times**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------|-----------|-----------------|------|------|------|------|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD}$ = 27 V, $I_D$ = 40 A $R_G$ = 4.7 Ω, $V_{GS}$ = 10 V (*Figure 13: Switching times test circuit for resistive load* and *Figure 18: Switching time waveform*.) | - | 20 | - | ns |
| $t_r$ | Rise time | | - | 110 | - | ns |
| $t_{d(off)}$ | Turn-off delay time | | - | 75 | - | ns |
| $t_f$ | Fall time | | - | 35 | - | ns |

**Table 8. Source drain diode**

| Symbol | Parameter | Test conditions | Min | Typ. | Max. | Unit |
|--------|-----------|-----------------|-----|------|------|------|
| $I_{SD}$ | Source-drain current | | - | | 80 | A |
| $I_{SDM}$ [1] | Source-drain current (pulsed) | | - | | 320 | A |
| $V_{SD}$ | Forward on voltage | $I_{SD}$ = 80 A, $V_{GS}$ = 0 V | - | | 1.5 | V |
| $t_{rr}$ [2] | Reverse recovery time | $I_{SD}$ = 80 A, $V_{DD}$ = 25 V, di/dt = 100 A/μs $T_j$ = 150 °C (*Figure 15: Test circuit for inductive load switching and diode recovery times*) | - | 80 | | ns |
| $Q_{rr}$ | Reverse recovery charge | | - | 230 | | nC |
| $I_{RRM}$ | Reverse recovery current | | - | 5.7 | | A |

1. Pulse width limited by safe operating area

2. 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 |
|---|---|



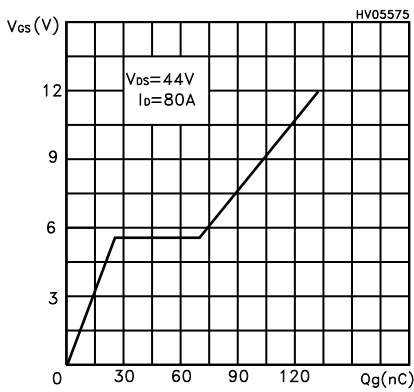| Figure 6. Normalized V$_{(BR)DSS}$ vs temperature | Figure 7. Static drain-source on resistance |
|---|---|
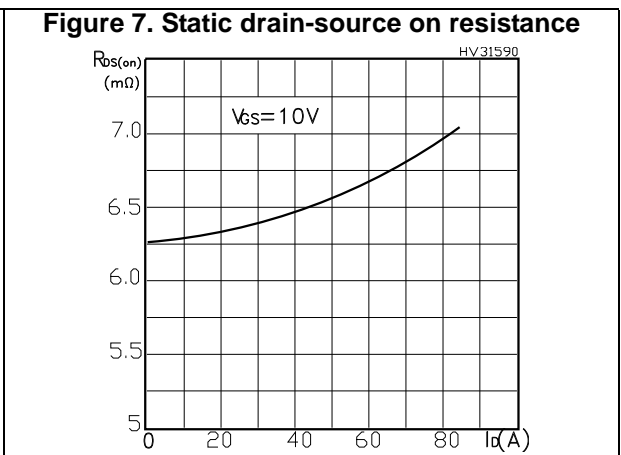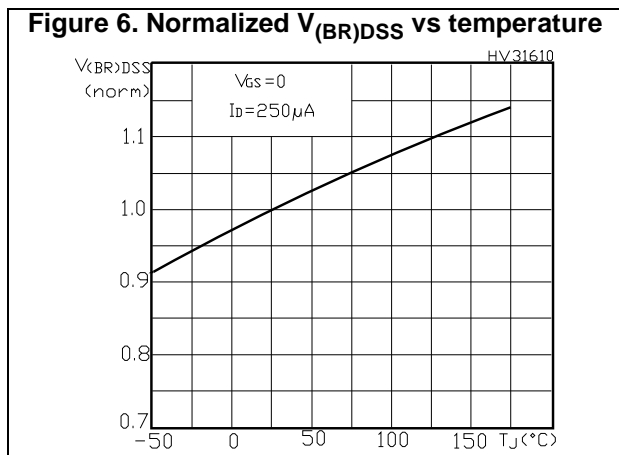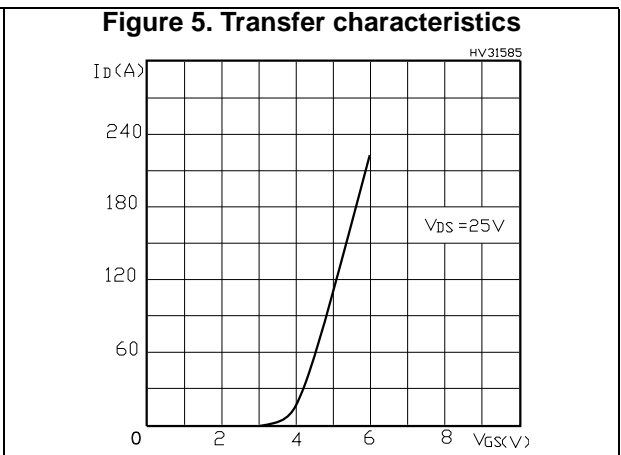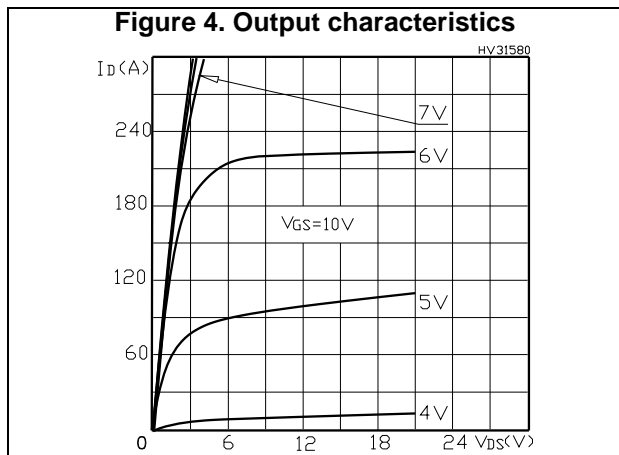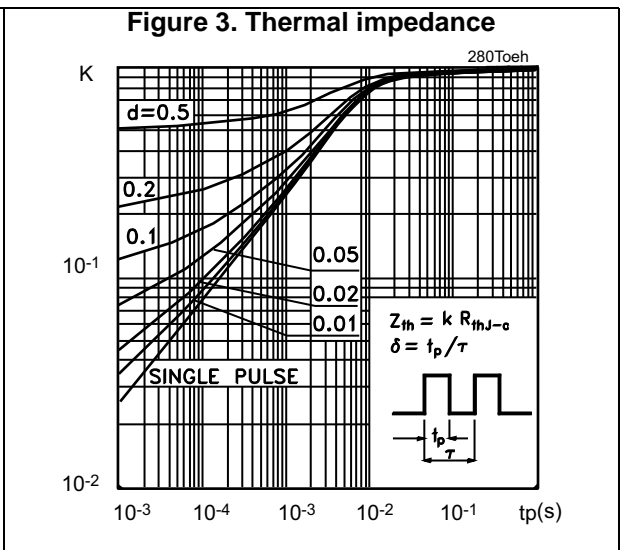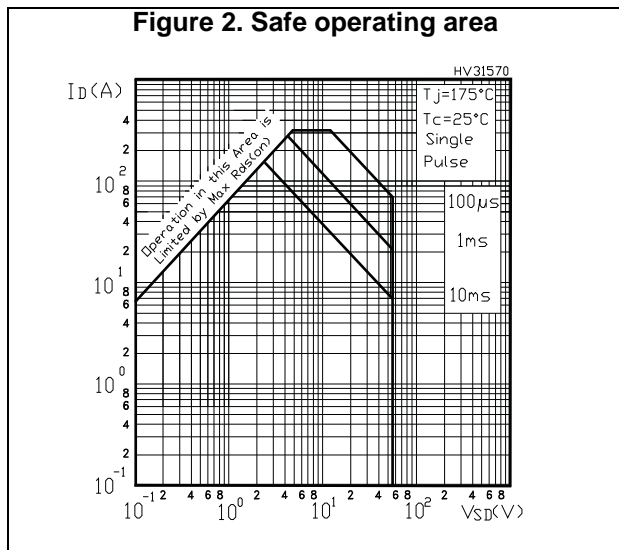
**Figure 8. Gate charge vs gate-source voltage**
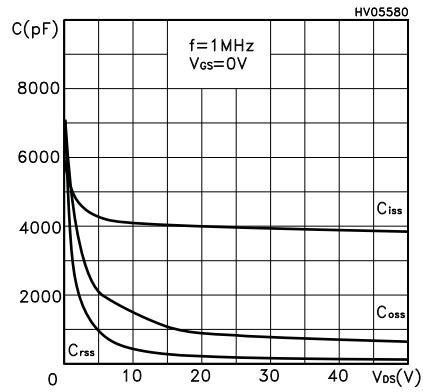


**Figure 9. Capacitance variations**



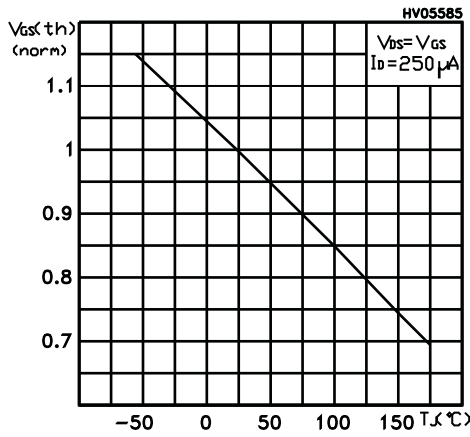**Figure 10. Normalized gate threshold voltage vs temperature**
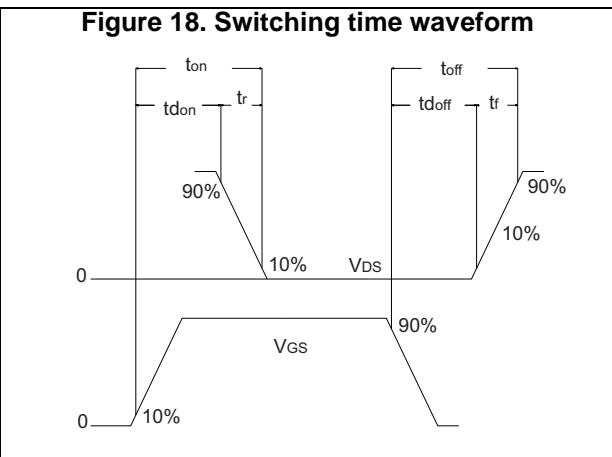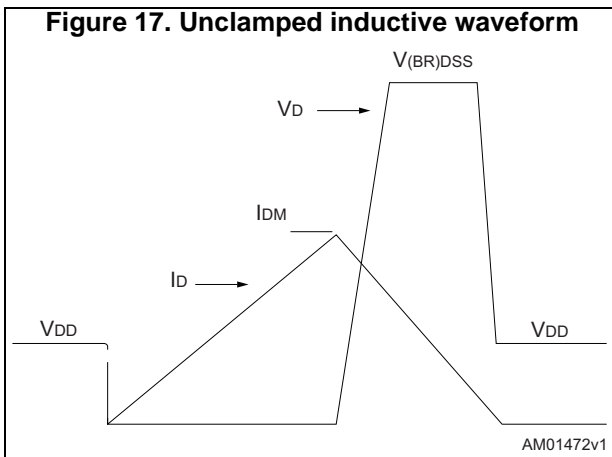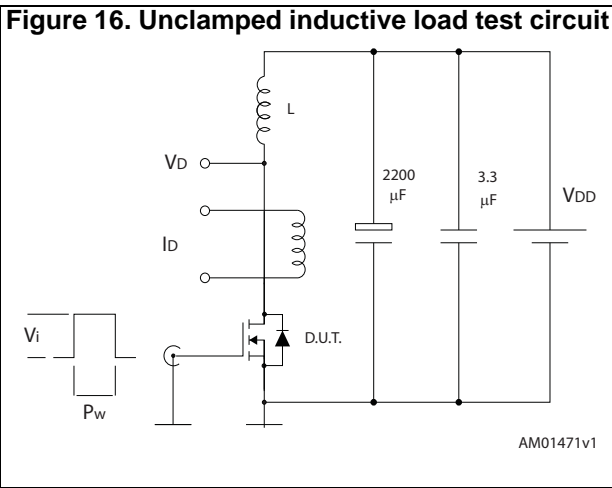


**Figure 11. Normalized on resistance vs temperature**
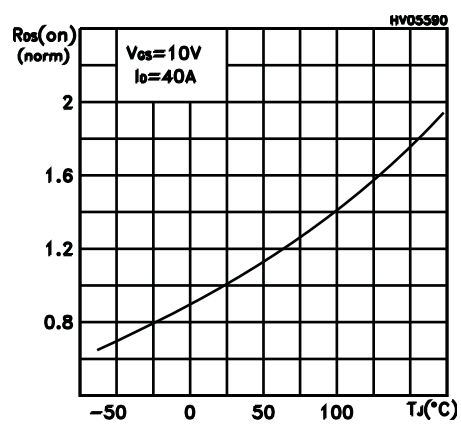


**Figure 12. Source-drain diode forward characteristics**

# 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**
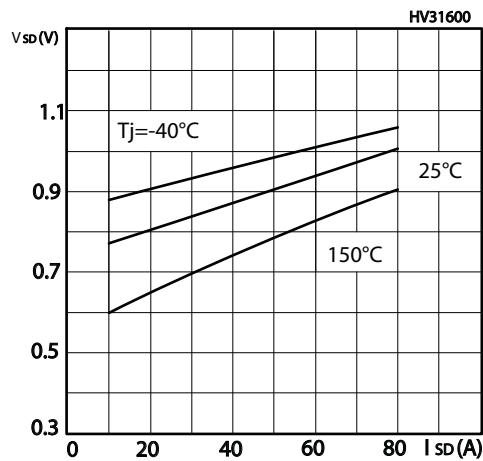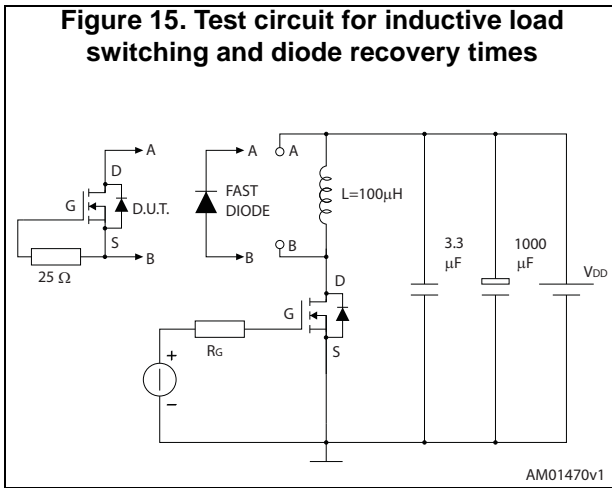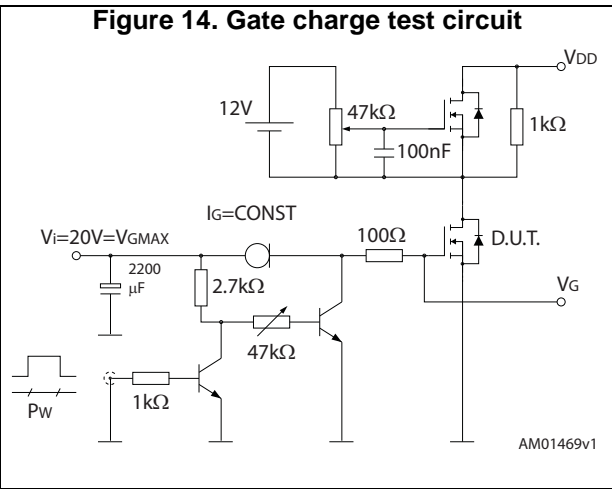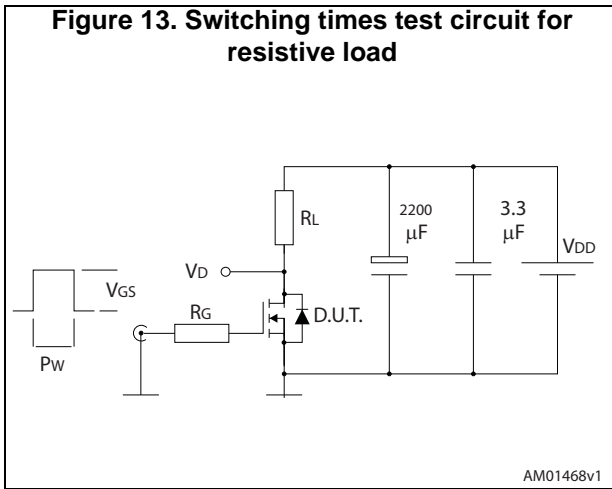
# 4    Package information

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    D²PAK package information
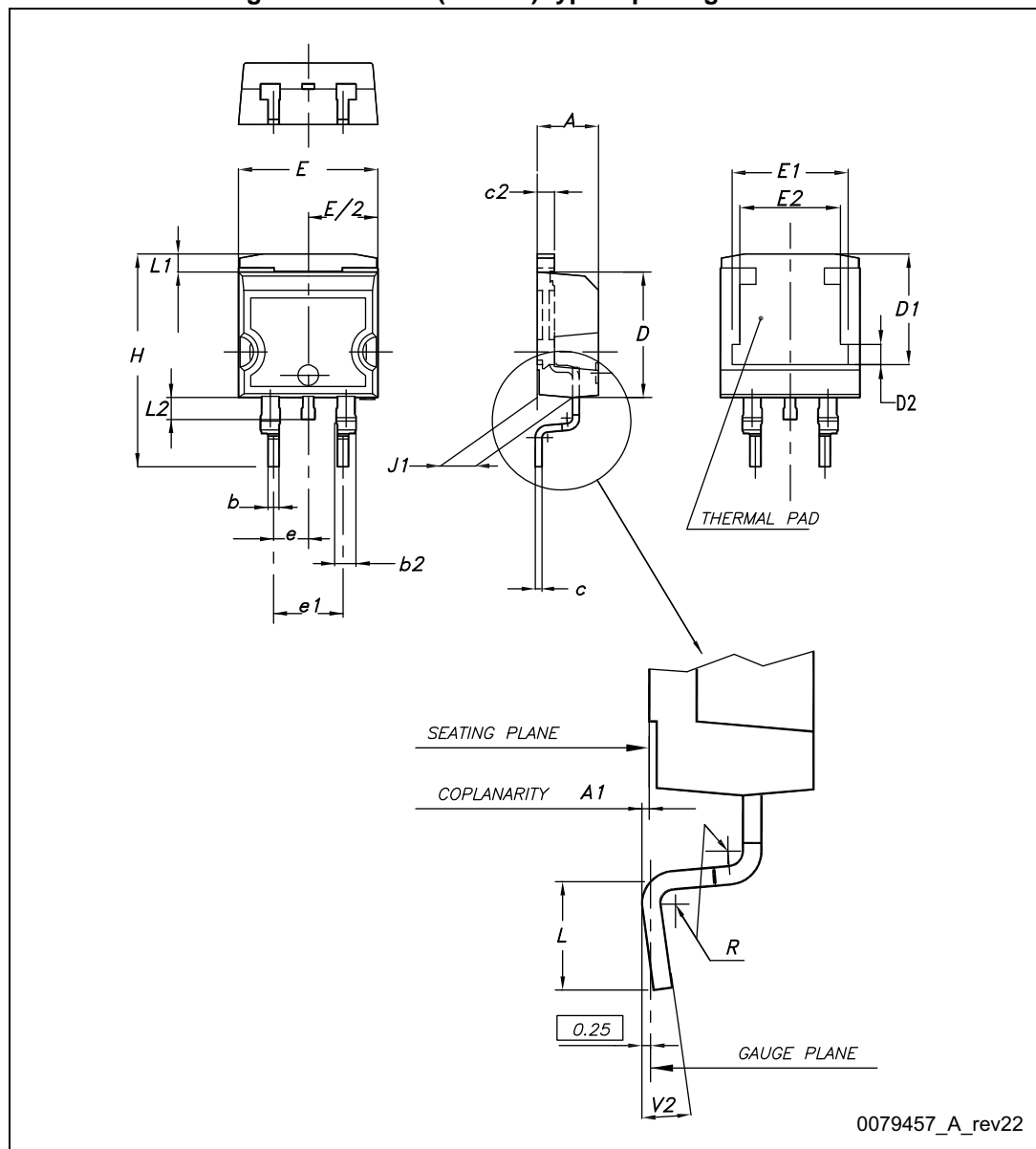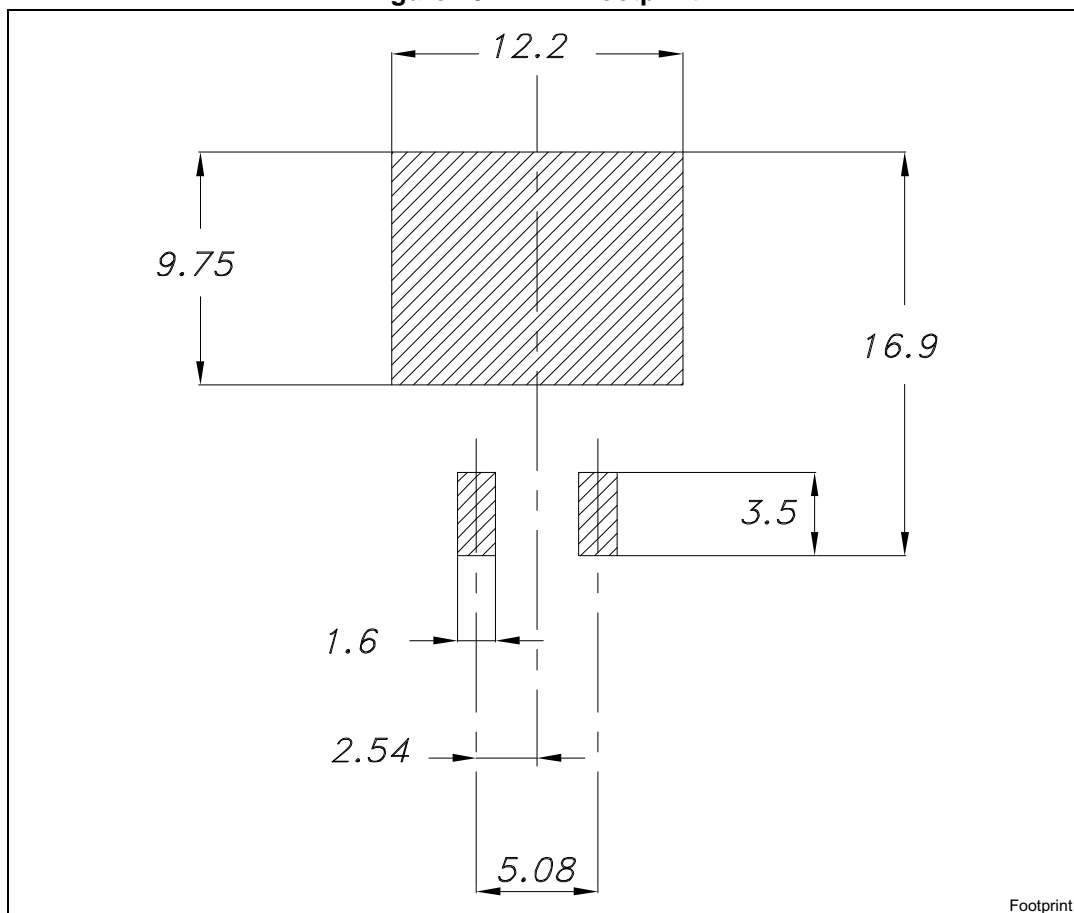
**Figure 19. D²PAK (TO-263) type A package outline**



0079457_A_rev22

**Table 9. D²PAK (TO-263) type A package mechanical data**

| Dim. | mm | | |
|:---:|:---:|:---:|:---:|
| | **Min.** | **Typ.** | **Max.** |
| A | 4.40 | | 4.60 |
| A1 | 0.03 | | 0.23 |
| b | 0.70 | | 0.93 |
| b2 | 1.14 | | 1.70 |
| c | 0.45 | | 0.60 |
| c2 | 1.23 | | 1.36 |
| D | 8.95 | | 9.35 |
| D1 | 7.50 | 7.75 | 8.00 |
| D2 | 1.10 | 1.30 | 1.50 |
| E | 10.00 | | 10.40 |
| E1 | 8.50 | 8.70 | 8.90 |
| E2 | 6.85 | 7.05 | 7.25 |
| e | | 2.54 | |
| e1 | 4.88 | | 5.28 |
| H | 15.00 | | 15.85 |
| J1 | 2.49 | | 2.69 |
| L | 2.29 | | 2.79 |
| L1 | 1.27 | | 1.40 |
| L2 | 1.30 | | 1.75 |
| R | | 0.4 | |
| V2 | 0° | | 8° |

**Figure 20. D²PAK footprint[a]**



a. All dimension are in millimeters

## 4.2 TO-220 type A package information

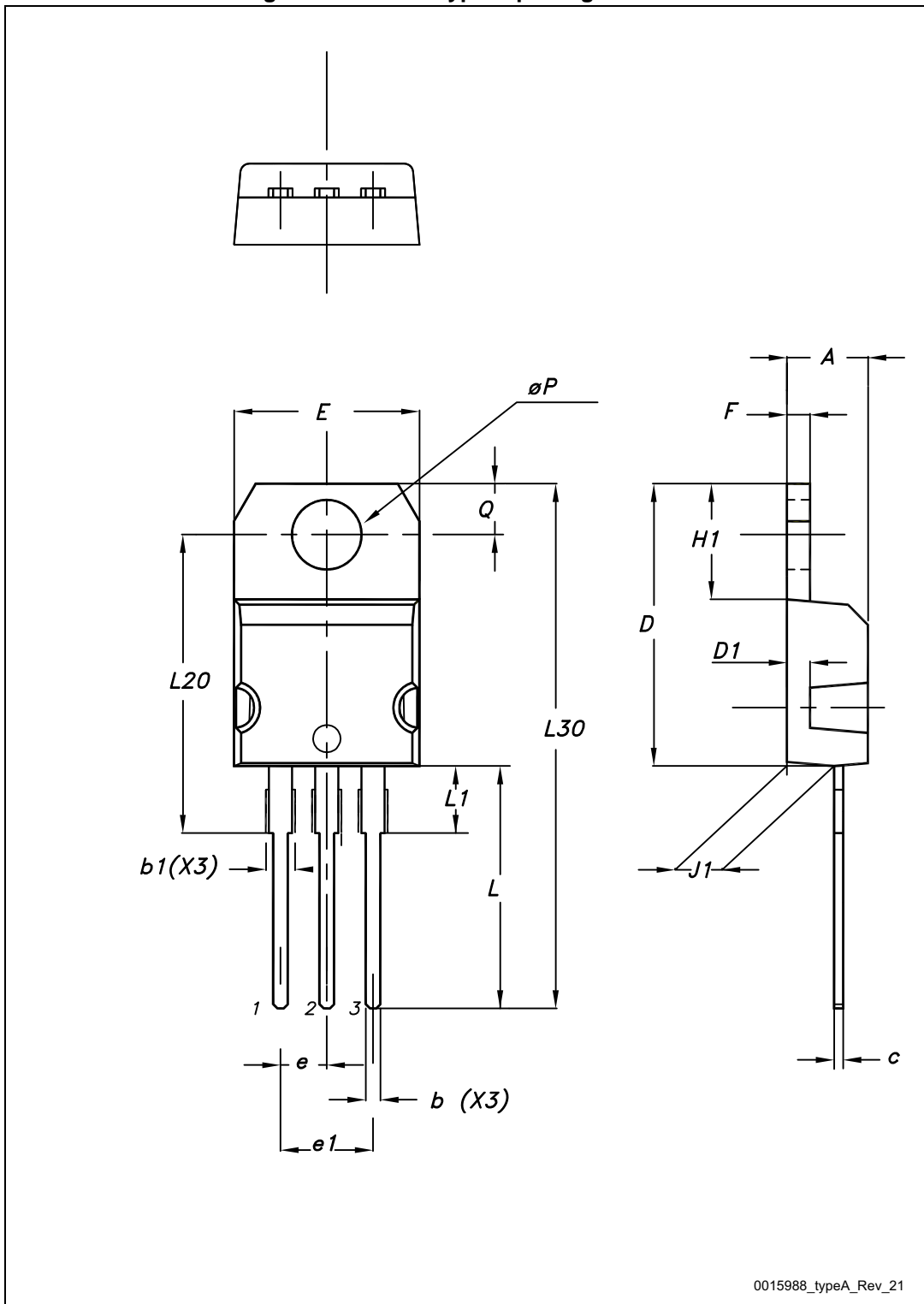**Figure 21. TO-220 type A package outline**



0015988_typeA_Rev_21

**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 | | 1.55 |
| c | 0.48 | | 0.70 |
| D | 15.25 | | 15.75 |
| D1 | | 1.27 | |
| E | 10.00 | | 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 | 13.00 | | 14.00 |
| L1 | 3.50 | | 3.93 |
| L20 | | 16.40 | |
| L30 | | 28.90 | |
| øP | 3.75 | | 3.85 |
| Q | 2.65 | | 2.95 |

# 5 Packing information

**Figure 22. Tape**
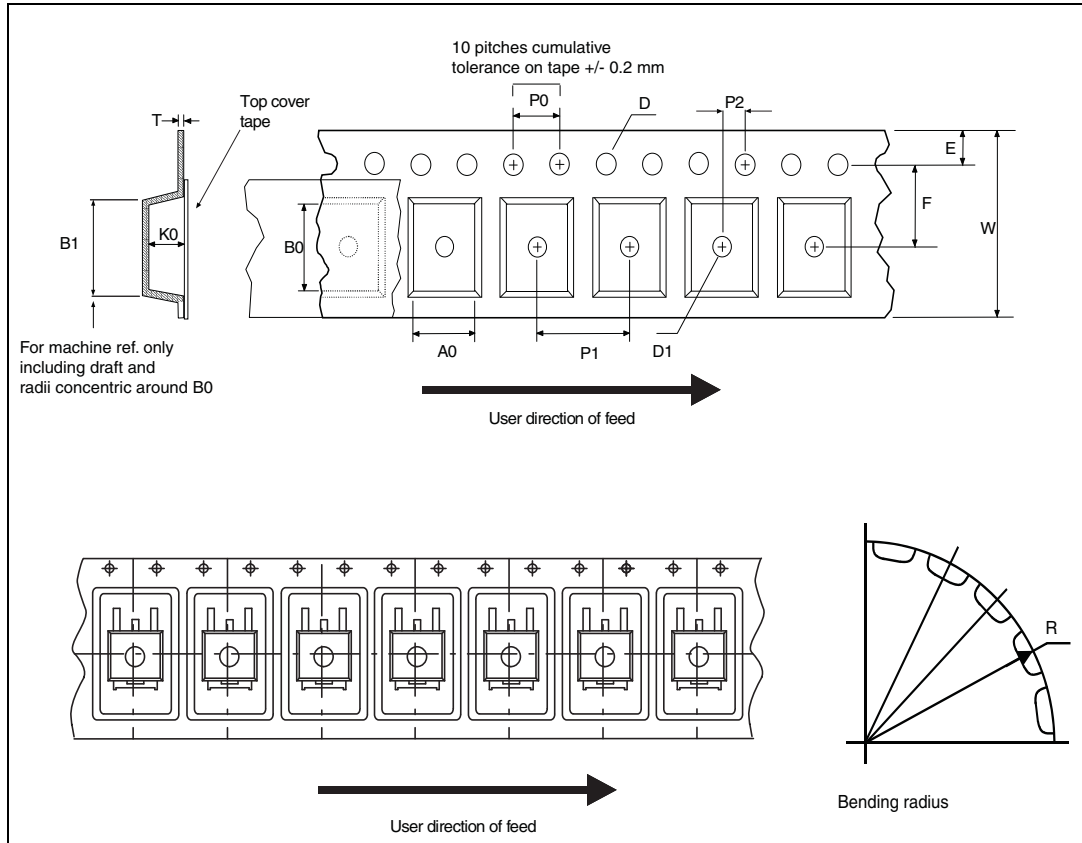
**Figure 23. Reel**
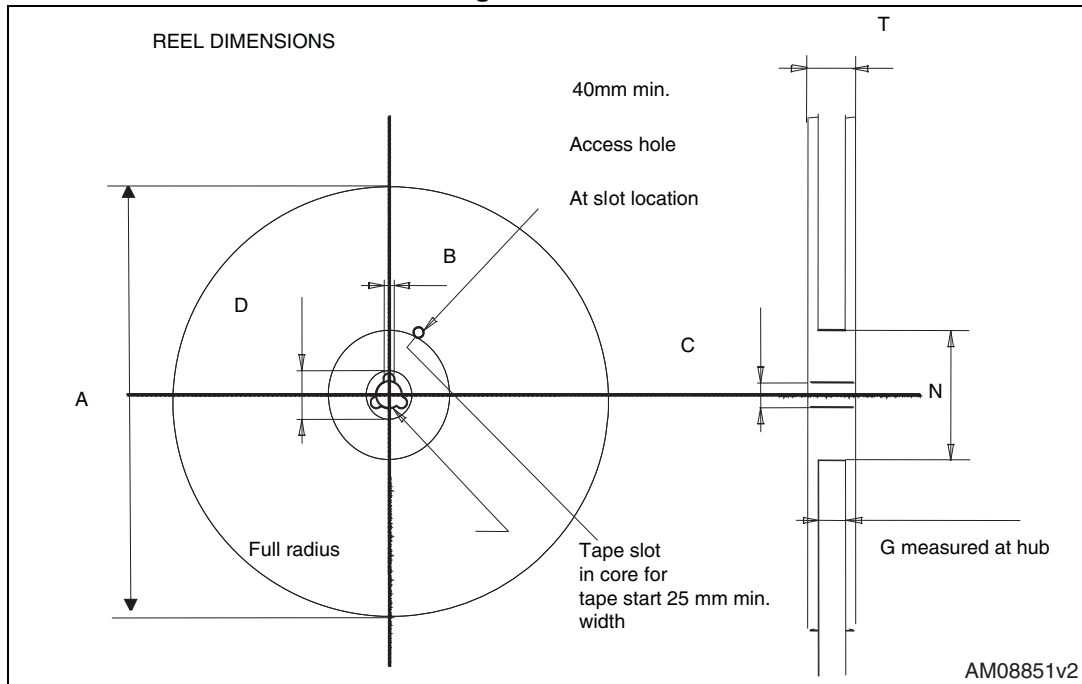


**Table 11. D²PAK (TO-263) tape and reel mechanical data**

| | 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

**Figure 24. Document revision history**

| Date | Revision | Changes |
|------|----------|---------|
| 07-Sep-2016 | 1 | First release |

**IMPORTANT NOTICE – PLEASE READ CAREFULLY**

DocID029701 Rev 1

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