# STB10N60M2, STD10N60M2, STP10N60M2

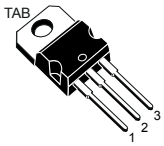
Datasheet

## N-channel 600 V, 0.55 Ω typ., 7.5 A MDmesh M2 Power MOSFET in a D²PAK, DPAK and TO-220 packages

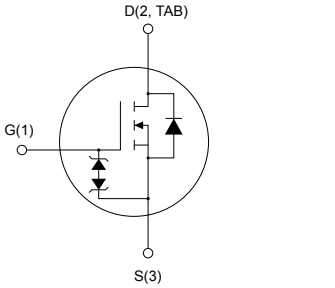

D²PAK




DPAK




TO-220




AM01476v1_tab

## Features

| Order codes | $V_{DS}$ @ $T_J$ max. | $R_{DS(on)}$ max. | $I_D$ | Package |
|---|---|---|---|---|
| STB10N60M2 | 650 V | 0.60 Ω | 7.5 A | D²PAK |
| STD10N60M2 | | | | DPAK |
| STP10N60M2 | | | | TO-220 |

- Extremely low gate charge
- Excellent output capacitance ($C_{oss}$) profile
- 100% avalanche tested
- Zener-protected

## Applications

- Switching applications

## Description

These devices are N-channel Power MOSFETs developed using the MDmesh M2 technology. Thanks to their strip layout and improved vertical structure, these devices exhibit low on-resistance and optimized switching characteristics, rendering them suitable for the most demanding high-efficiency converters.

| Product status links |
|---|
| STB10N60M2 |
| STD10N60M2 |
| STP10N60M2 |

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{GS}$ | Gate-source voltage | ±25 | V |
| $I_D$ | Drain current (continuous) at $T_C$ = 25 °C | 7.5 | A |
| | Drain current (continuous) at $T_C$ = 100 °C | 4.9 | |
| $I_{DM}$(1) | Drain current (pulsed) | 30 | A |
| $P_{TOT}$ | Total power dissipation at $T_C$ = 25 °C | 85 | W |
| dv/dt(2) | Peak diode recovery voltage slope | 15 | V/ns |
| dv/dt(3) | MOSFET dv/dt ruggedness | 50 | |
| $T_{stg}$ | Storage temperature range | -55 to 150 | °C |
| $T_J$ | Operating junction temperature range | | °C |

1. *Pulse limited by safe operating area.*
2. *$I_{SD}$ ≤ 7.5 A, di/dt ≤ 400 A/µs, $V_{DS}$(peak) < $V_{(BR)DSS}$, $V_{DD}$ = 400 V.*
3. *$V_{DS}$ ≤ 480 V.*

**Table 2. Thermal data**

| Symbol | Parameter | Value | | | Unit |
|---|---|---|---|---|---|
| | | $D^2PAK$ | DPAK | TO-220 | |
| $R_{thJC}$ | Thermal resistance, junction-to-case | 1.47 | | | °C/W |
| $R_{thJA}$ | Thermal resistance, junction-to-ambient | 30(1) | 50(1) | 62.5 | °C/W |

1. *When mounted on a standard 1 inch² area of FR-4 PCB with 2-oz copper.*

**Table 3. Avalanche characteristics**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $I_{AR}$(1) | Avalanche current, repetitive or not repetitive | 1.5 | A |
| $E_{AS}$(2) | Single pulse avalanche energy | 110 | mJ |

1. *Pulse width limited by $T_J$ max.*
2. *Starting $T_J$ = 25 °C, $I_D$ = $I_{AR}$, $V_{DD}$ = 50 V.*

# 2 Electrical characteristics

($T_C$ = 25 °C unless otherwise specified).

**Table 4. Static**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $V_{GS}$ = 0 V, $I_D$ = 1 mA | 600 | | | V |
| $I_{DSS}$ | Zero gate voltage drain current | $V_{GS}$ = 0 V, $V_{DS}$ = 600 V | | | 1 | µA |
| | | $V_{GS}$ = 0 V, $V_{DS}$ = 600 V, $T_C$ = 125 °C(1) | | | 100 | |
| $I_{GSS}$ | Gate-body leakage current | $V_{DS}$ = 0 V, $V_{GS}$ = ±25 V | | | ±10 | µA |
| $V_{GS(th)}$ | 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, $I_D$ = 3 A | | 0.55 | 0.60 | Ω |

1. *Specified by design, not tested in production.*

**Table 5. Dynamic**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input capacitance | $V_{DS}$ = 100 V, f = 1 MHz, $V_{GS}$ = 0 V | - | 400 | - | pF |
| $C_{oss}$ | Output capacitance | | - | 22 | - | pF |
| $C_{rss}$ | Reverse transfer capacitance | | - | 0.84 | - | pF |
| $C_{oss\ eq.}$(1) | Equivalent output capacitance | $V_{DS}$ = 0 to 480 V, $V_{GS}$ = 0 V | - | 83 | - | pF |
| $R_G$ | Intrinsic gate resistance | f = 1 MHz, $I_D$ = 0 A | - | 6.4 | - | Ω |
| $Q_g$ | Total gate charge | $V_{DD}$ = 480 V, $I_D$ = 7.5 A, $V_{GS}$ = 0 to 10 V (see Figure 16. Test circuit for gate charge behavior) | - | 13.5 | - | nC |
| $Q_{gs}$ | Gate-source charge | | - | 2.1 | - | nC |
| $Q_{gd}$ | Gate-drain charge | | - | 7.2 | - | nC |

1. *$C_{oss\ eq.}$ is defined as a constant equivalent capacitance giving the same charging time as $C_{oss}$ when $V_{DS}$ increases from 0 to 80% $V_{DSS}$.*

**Table 6. Switching times**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD}$ = 300 V, $I_D$ = 3.75 A, $R_G$ = 4.7 Ω, $V_{GS}$ = 10 V (see Figure 15. Test circuit for resistive load switching times and Figure 20. Switching time waveform) | - | 8.8 | - | ns |
| $t_r$ | Rise time | | - | 8 | - | ns |
| $t_{d(off)}$ | Turn-off delay time | | - | 32.5 | - | ns |
| $t_f$ | Fall time | | - | 13.2 | - | ns |

**Table 7. Source-drain diode**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$ | Source-drain current | | - | | 7.5 | A |
| $I_{SDM}$ (1) | Source-drain current (pulsed) | | - | | 30 | A |
| $V_{SD}$ (2) | Forward on voltage | $V_{GS}$ = 0 V, $I_{SD}$ = 7.5 A | - | | 1.6 | V |
| $t_{rr}$ | Reverse recovery time | $I_{SD}$ = 7.5 A, di/dt = 100 A/µs, $V_{DD}$ = 60 V (see Figure 17. Test circuit for inductive load switching and diode recovery times) | - | 270 | | ns |
| $Q_{rr}$ | Reverse recovery charge | | - | 2 | | µC |
| $I_{RRM}$ | Reverse recovery current | | - | 14.4 | | A |
| $t_{rr}$ | Reverse recovery time | $I_{SD}$ = 7.5 A, di/dt = 100 A/µs, $V_{DD}$ = 60 V, $T_J$ = 150 °C (see Figure 17. Test circuit for inductive load switching and diode recovery times) | - | 376 | | ns |
| $Q_{rr}$ | Reverse recovery charge | | - | 2.8 | | µC |
| $I_{RRM}$ | Reverse recovery current | | - | 15 | | A |

1. *Pulse width is limited by safe operating area.*
2. *Pulse test: pulse duration = 300 µs, duty cycle 1.5%.*

## 2.1 Electrical characteristics (curves)

**Figure 1. Safe operating area for D²PAK and TO-220**

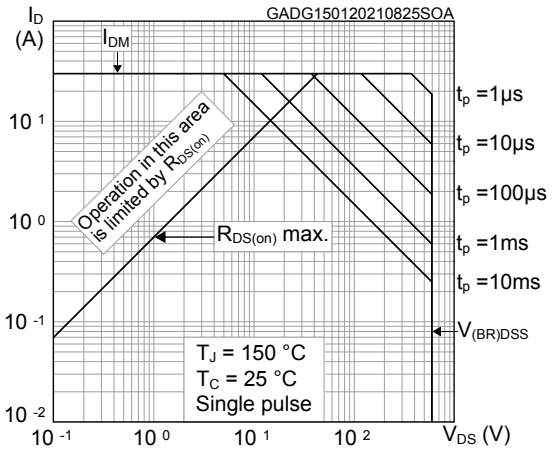



**Figure 2. Maximum transient thermal impedance for D²PAK and TO-220**

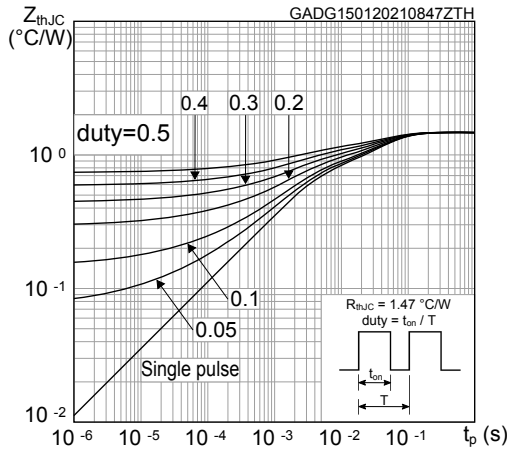



**Figure 3. Safe operating area for DPAK**

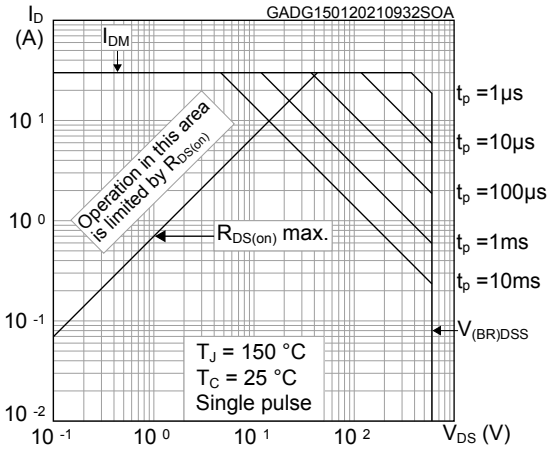



**Figure 4. Maximum transient thermal impedance for DPAK**

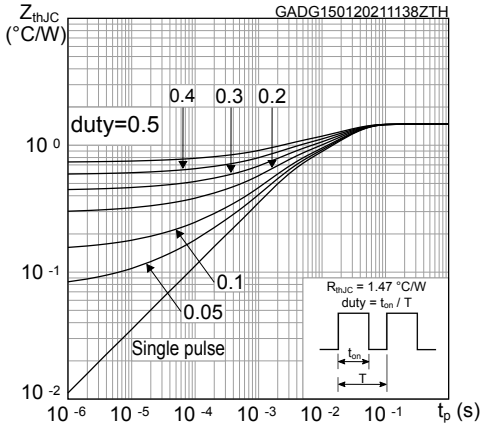



**Figure 5. Output characteristics**

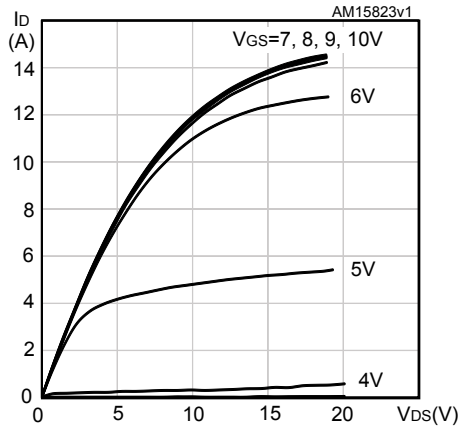



**Figure 6. Transfer characteristics**

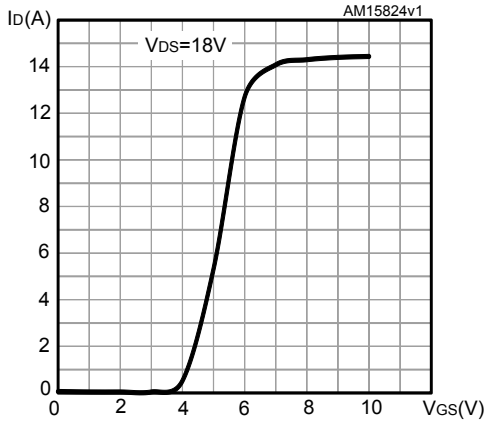


**Figure 7. Gate charge vs gate-source voltage**

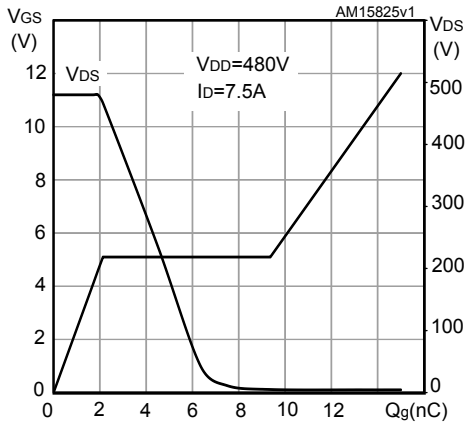



**Figure 8. Static drain-source on-resistance**

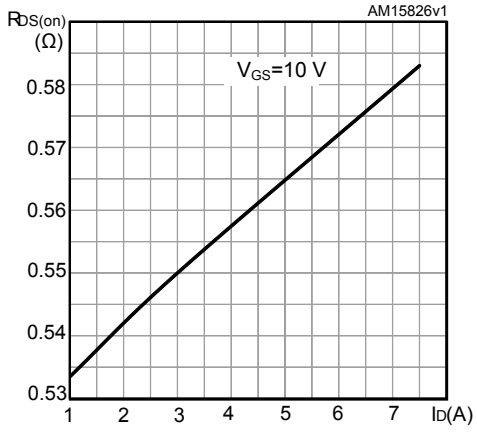



**Figure 9. Capacitance variations**

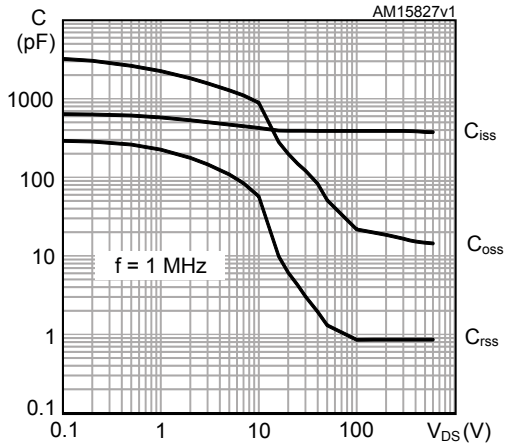



**Figure 10. Normalized gate threshold voltage vs temperature**

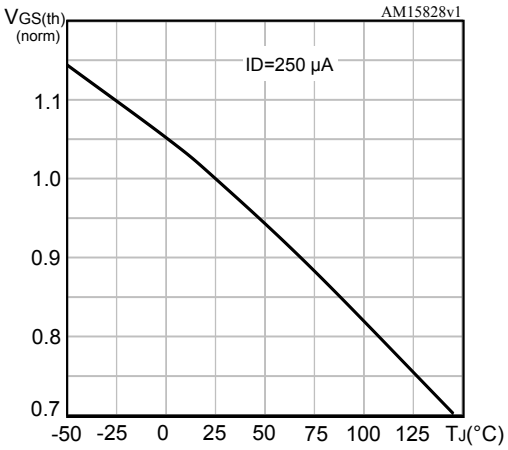



**Figure 11. Normalized on-resistance vs temperature**

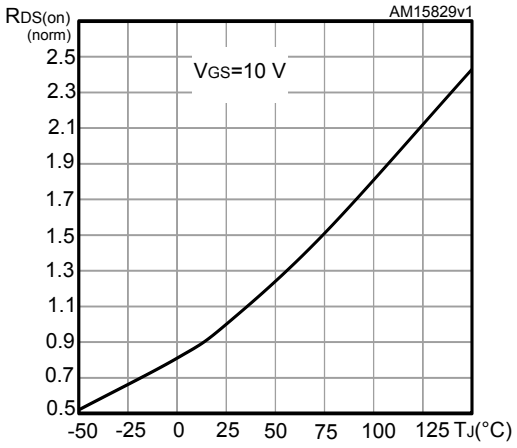



**Figure 12. Normalized $V_{(BR)DSS}$ vs temperature**

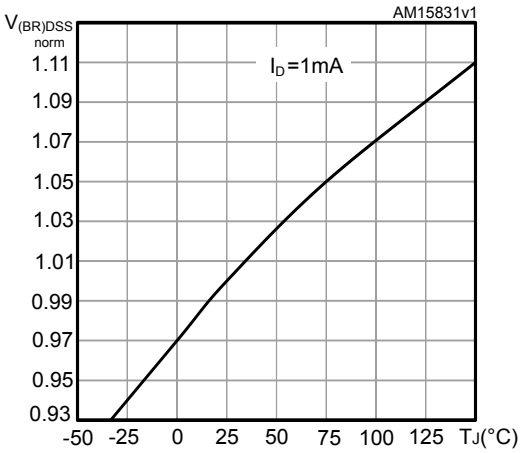


**Figure 13. Source-drain diode forward characteristics**

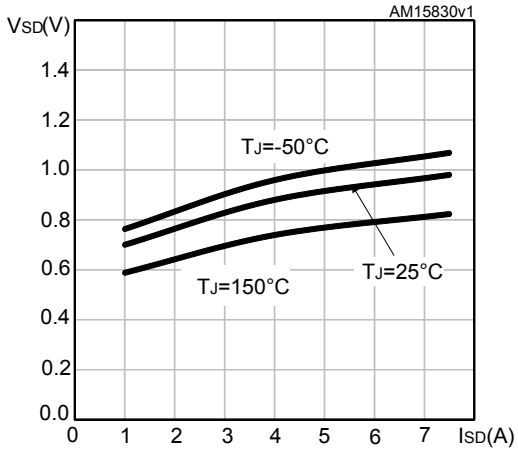
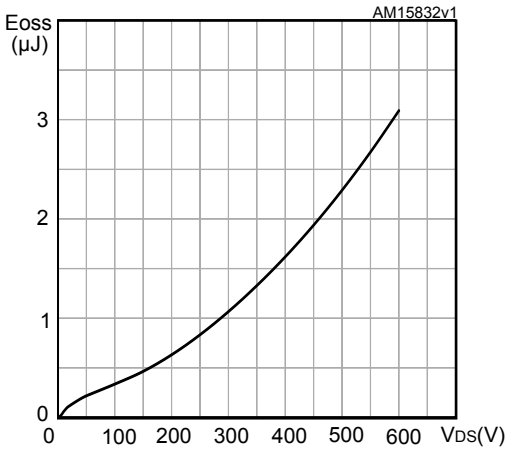
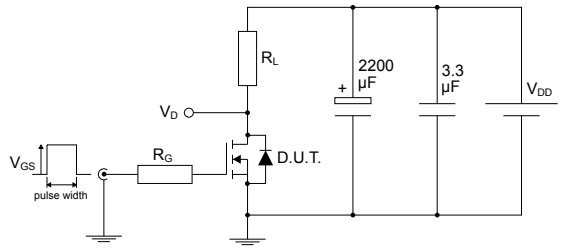



**Figure 14. Output capacitance stored energy**



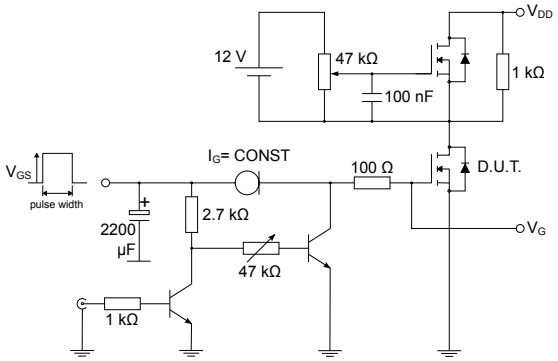
# 3 Test circuits

**Figure 15. Test circuit for resistive load switching times**



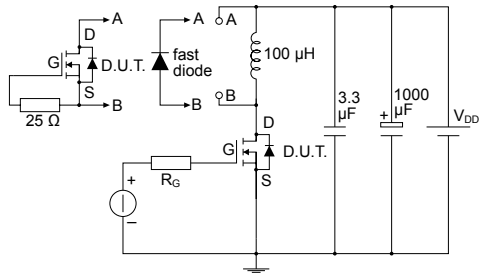

AM01468v1

**Figure 16. Test circuit for gate charge behavior**



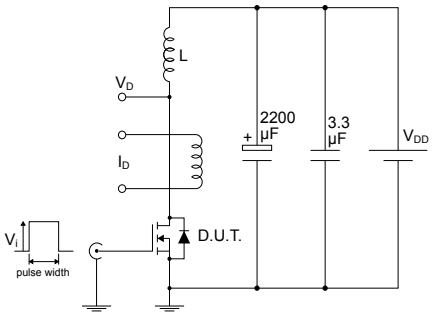

AM01469v1

**Figure 17. Test circuit for inductive load switching and diode recovery times**



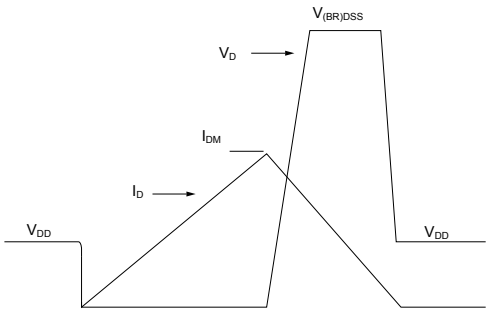

AM01470v1

**Figure 18. Unclamped inductive load test circuit**



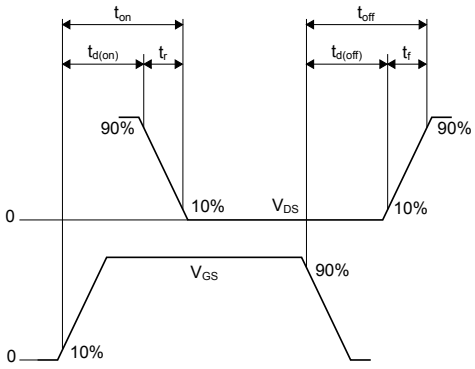

AM01471v1

**Figure 19. Unclamped inductive waveform**




AM01472v1

**Figure 20. Switching time waveform**




AM01473v1

# 4 Package information

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 (TO-263) type A package information

Figure 21. **D²PAK (TO-263) type A package outline**

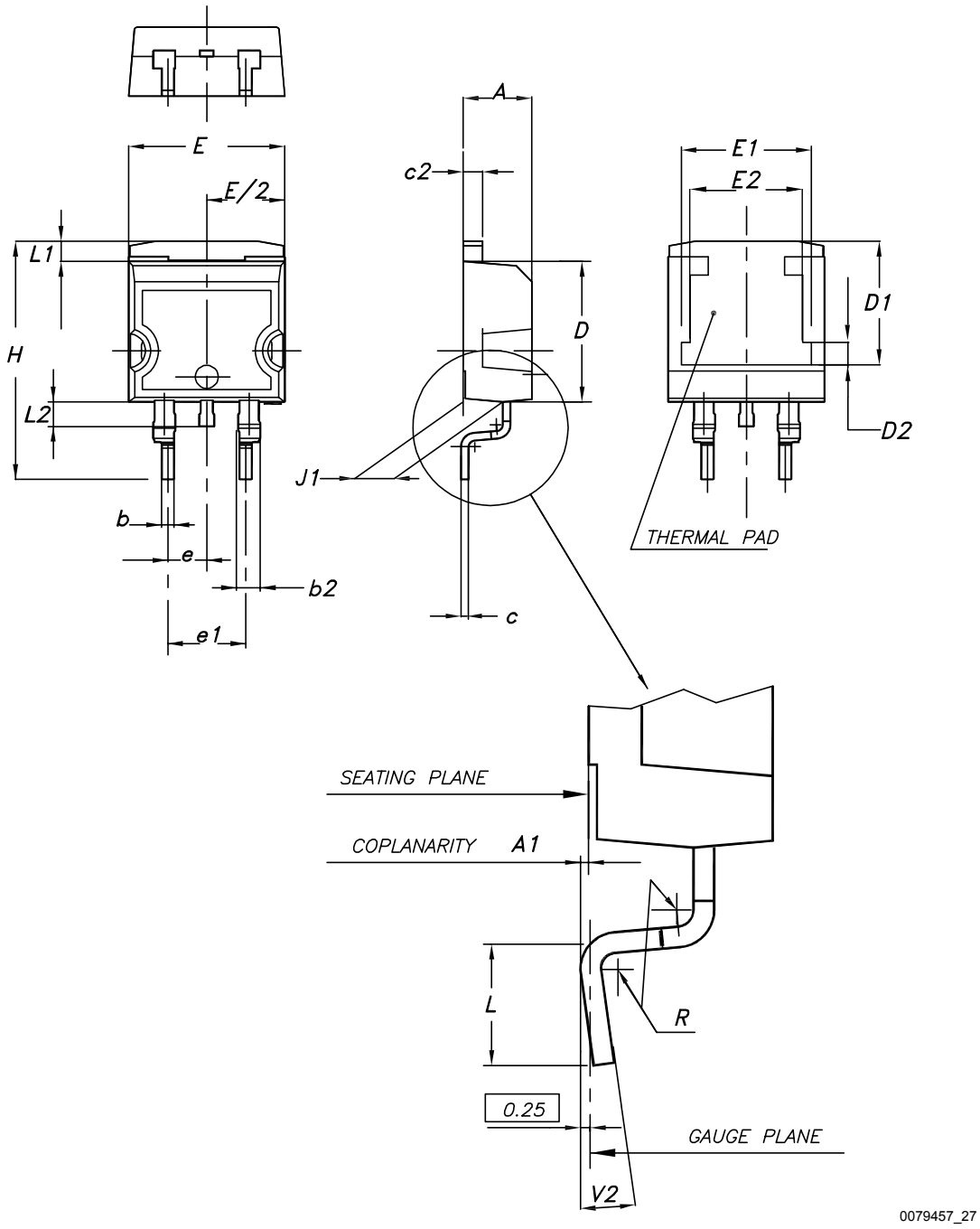
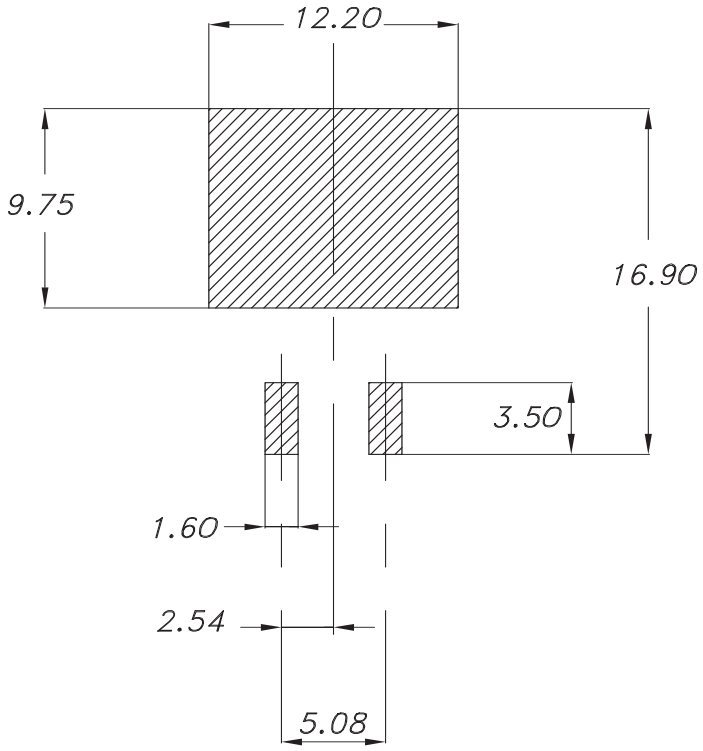


Table 8. D²PAK (TO-263) type A package mechanical data

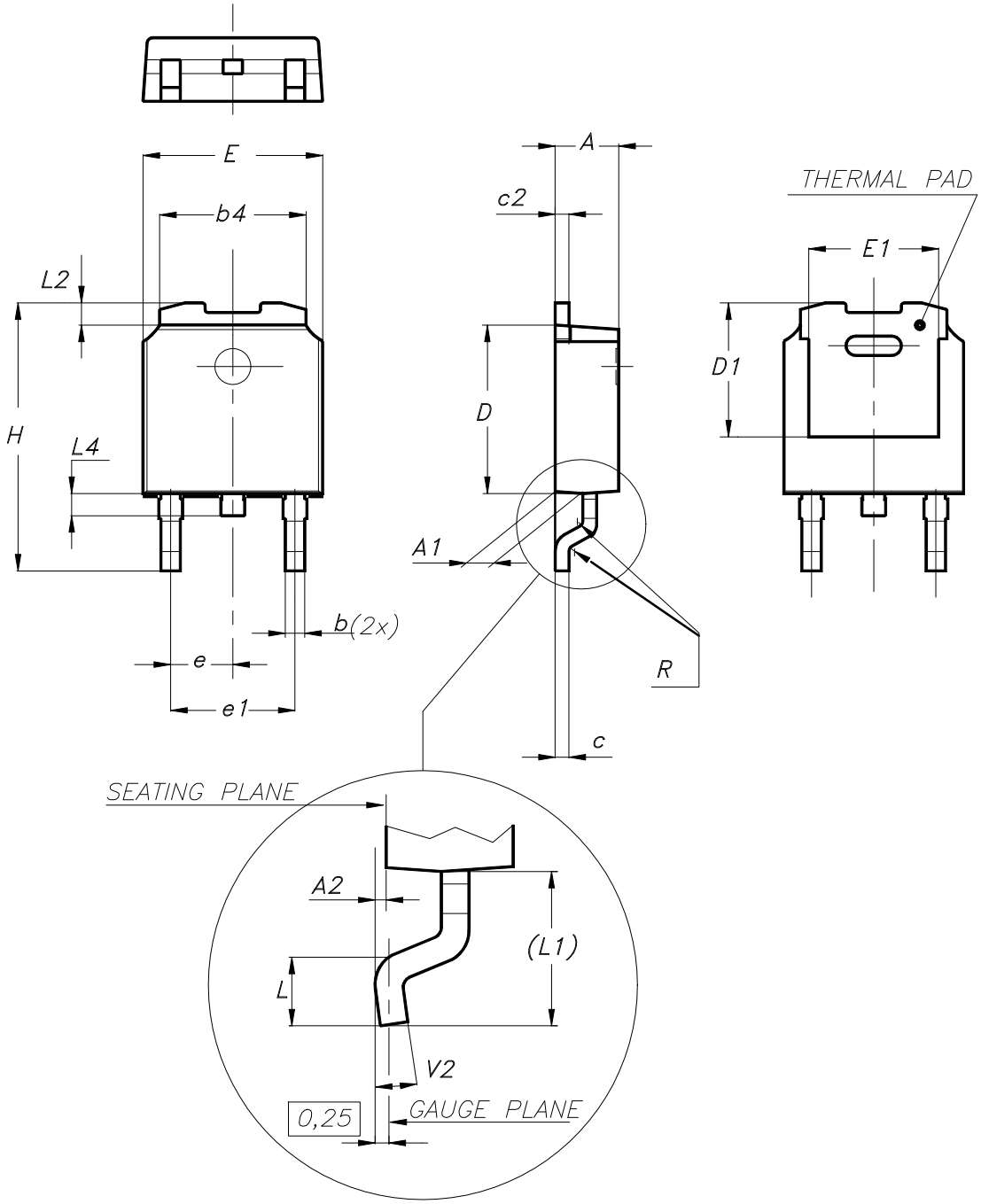
| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 |
| A1 | 0.03 | | 0.23 |
| b | 0.70 | | 0.93 |
| b2 | 1.14 | | 1.70 |
| c | 0.45 | | 0.60 |
| c2 | 1.23 | | 1.36 |
| D | 8.95 | | 9.35 |
| D1 | 7.50 | 7.75 | 8.00 |
| D2 | 1.10 | 1.30 | 1.50 |
| E | 10.00 | | 10.40 |
| E1 | 8.30 | 8.50 | 8.70 |
| 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 | | 0.40 | |
| V2 | 0° | | 8° |

Figure 22. D²PAK (TO-263) recommended footprint (dimensions are in mm)



## 4.2 DPAK (TO-252) type A package information

Figure 23. **DPAK (TO-252) type A package outline**



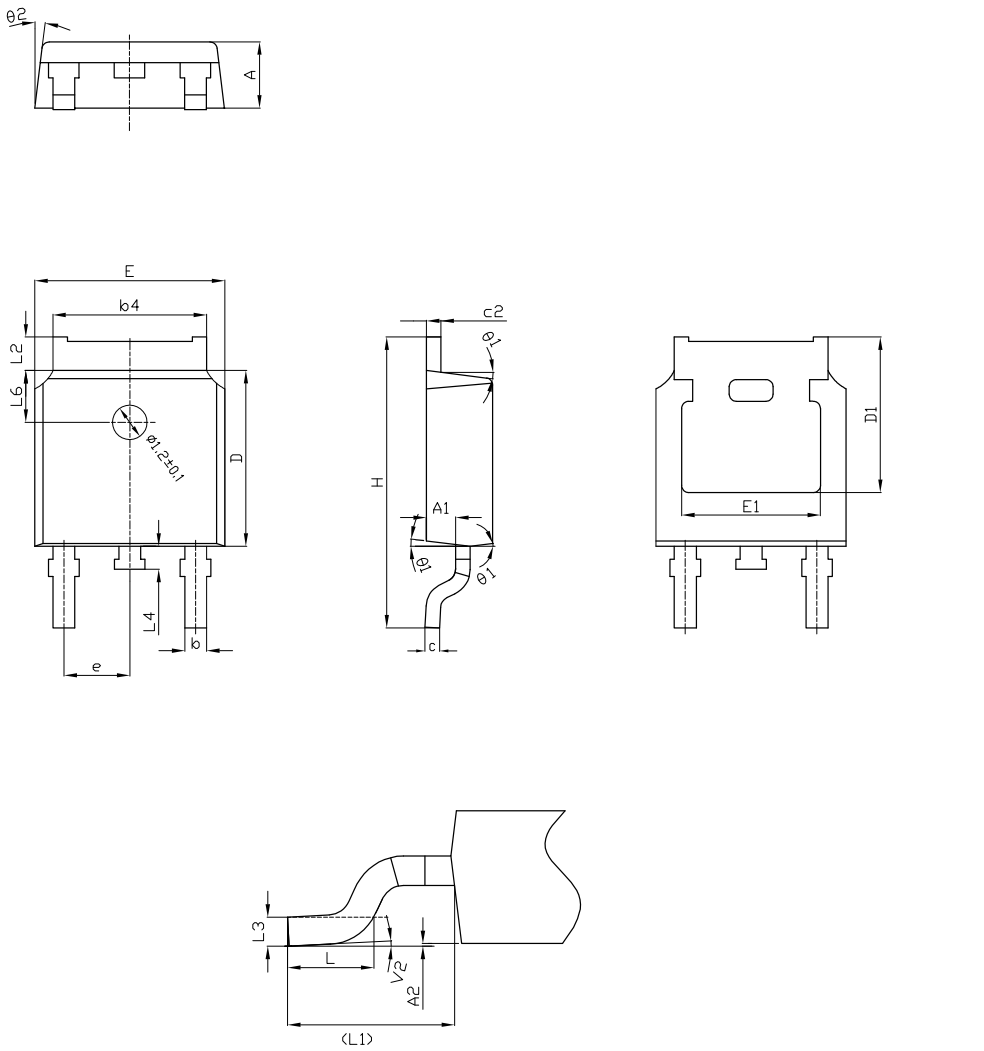

0068772_A_36

Table 9. **DPAK (TO-252) type A mechanical data**

| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 2.20 | | 2.40 |
| A1 | 0.90 | | 1.10 |
| A2 | 0.03 | | 0.23 |
| b | 0.64 | | 0.90 |
| b4 | 5.20 | | 5.40 |
| c | 0.45 | | 0.60 |
| c2 | 0.48 | | 0.60 |
| D | 6.00 | | 6.20 |
| D1 | 4.95 | 5.10 | 5.25 |
| E | 6.40 | | 6.60 |
| E1 | 4.60 | 4.70 | 4.80 |
| e | 2.159 | 2.286 | 2.413 |
| e1 | 4.445 | 4.572 | 4.699 |
| H | 9.35 | | 10.10 |
| L | 1.00 | | 1.50 |
| (L1) | 2.60 | 2.80 | 3.00 |
| L2 | 0.65 | 0.80 | 0.95 |
| L4 | 0.60 | | 1.00 |
| R | | 0.20 | |
| V2 | 0° | | 8° |

## 4.3 DPAK (TO-252) type C package information

Figure 24. **DPAK (TO-252) type C package outline**



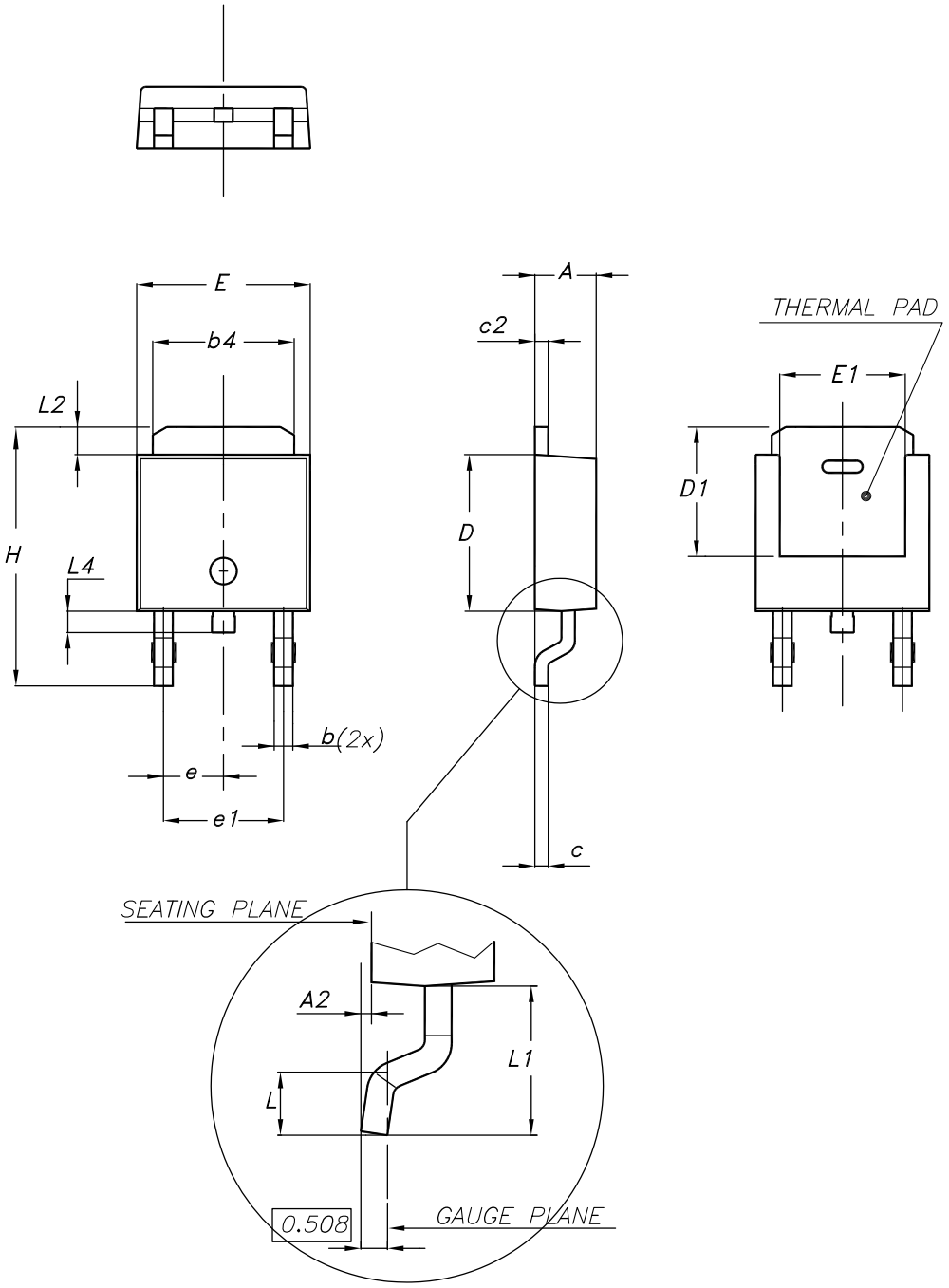

0068772_C_36

Table 10. **DPAK (TO-252) type C mechanical data**

| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 2.20 | 2.30 | 2.38 |
| A1 | 0.90 | 1.01 | 1.10 |
| A2 | 0.00 | | 0.10 |
| b | 0.72 | | 0.85 |
| b4 | 5.13 | 5.33 | 5.46 |
| c | 0.47 | | 0.60 |
| c2 | 0.47 | | 0.60 |
| D | 6.00 | 6.10 | 6.20 |
| D1 | 5.15 | 5.40 | 5.65 |
| E | 6.50 | 6.60 | 6.70 |
| E1 | 4.70 | 4.85 | 5.00 |
| e | 2.186 | 2.286 | 2.386 |
| H | 9.80 | 10.10 | 10.40 |
| L | 1.40 | 1.50 | 1.70 |
| L1 | | 2.90 REF | |
| L2 | 0.90 | | 1.25 |
| L3 | | 0.51 BSC | |
| L4 | 0.60 | 0.80 | 1.00 |
| L6 | | 1.80 BSC | |
| θ1 | 5° | 7° | 9° |
| θ2 | 5° | 7° | 9° |
| V2 | 0° | | 8° |

## 4.4 DPAK (TO-252) type E package information

Figure 25. **DPAK (TO-252) type E package outline**

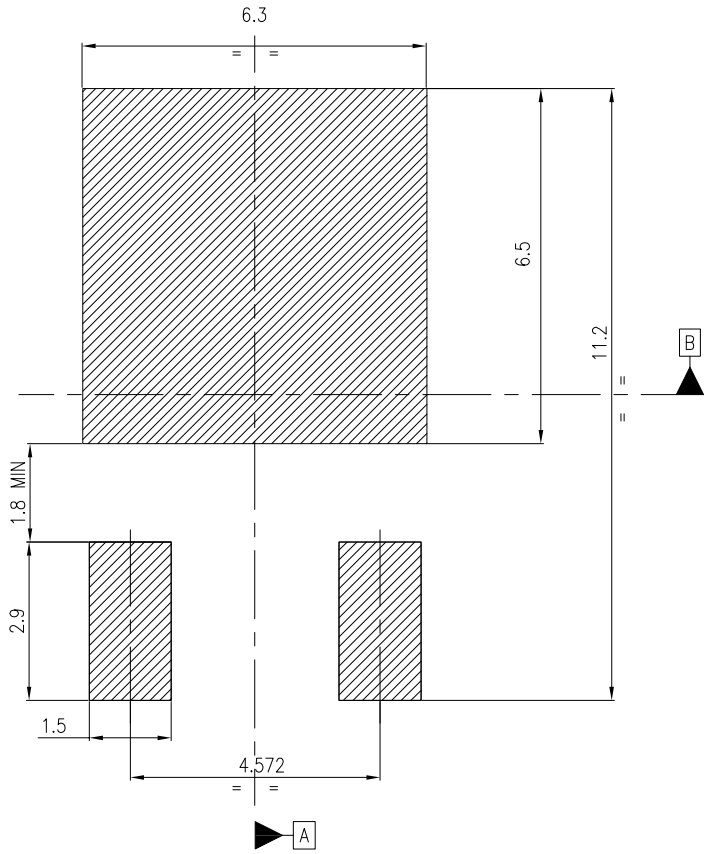



0068772_typeE_rev.36

Table 11. **DPAK (TO-252) type E mechanical data**

| Dim. | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 2.18 | | 2.39 |
| A2 | | | 0.13 |
| b | 0.65 | | 0.884 |
| b4 | 4.95 | | 5.46 |
| c | 0.46 | | 0.61 |
| c2 | 0.46 | | 0.60 |
| D | 5.97 | | 6.22 |
| D1 | 5.21 | | |
| E | 6.35 | | 6.73 |
| E1 | 4.32 | | |
| e | | 2.286 | |
| e1 | | 4.572 | |
| H | 9.94 | | 10.34 |
| L | 1.50 | | 1.78 |
| L1 | | 2.74 | |
| L2 | 0.89 | | 1.27 |
| L4 | | | 1.02 |

**Figure 26. DPAK (TO-252) recommended footprint (dimensions are in mm)**




Notes:

1) This footprint is able to ensure insulation up to 630 Vrms (according to CEI IEC 664−1)

2) The device must be positioned within ⌖ 0.05 A B

FP_0068772_36

## 4.5 TO-220 type A package information

Figure 27. **TO-220 type A package outline**

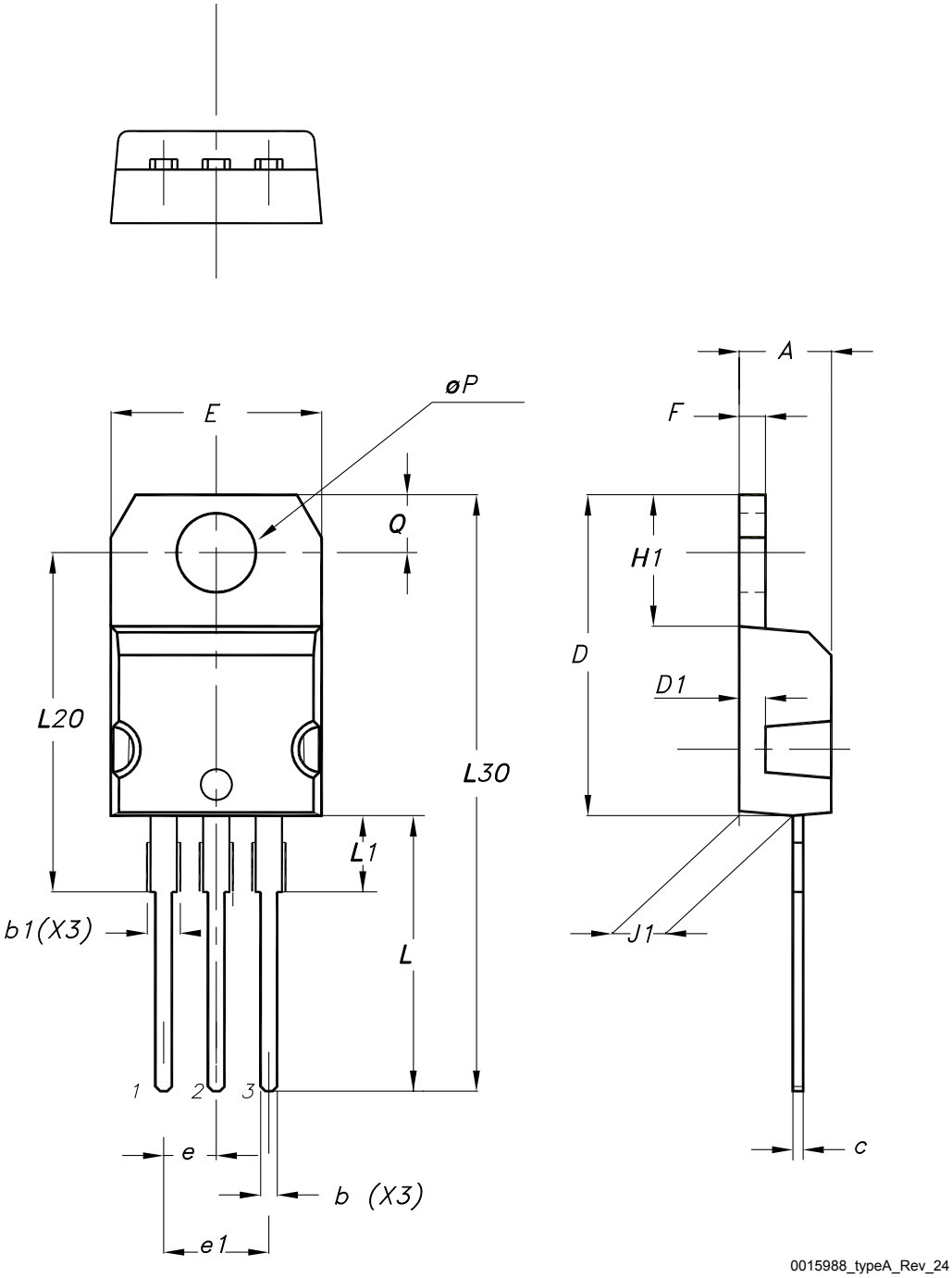
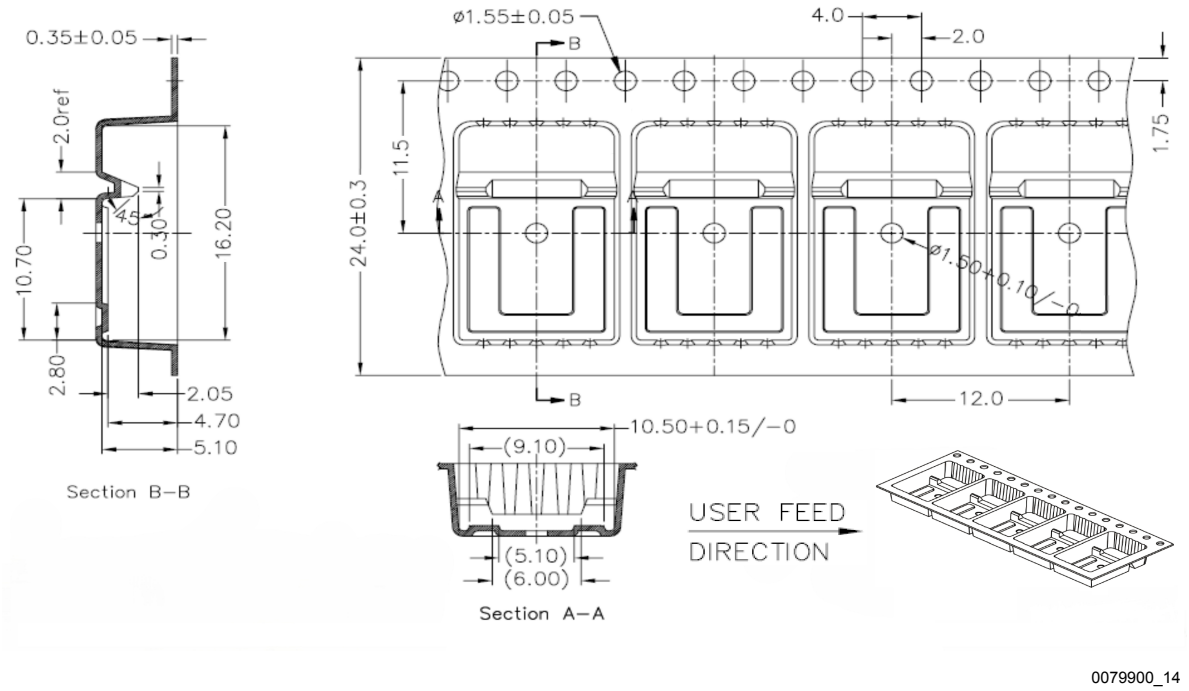


Table 12. **TO-220 type A package mechanical data**

| 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 |
| Slug flatness | | 0.03 | 0.10 |

## 4.6 D²PAK packing information

Figure 28. **D²PAK tape drawing (dimensions are in mm)**



## 4.7 DPAK packing information

Figure 29. **DPAK tape outline**

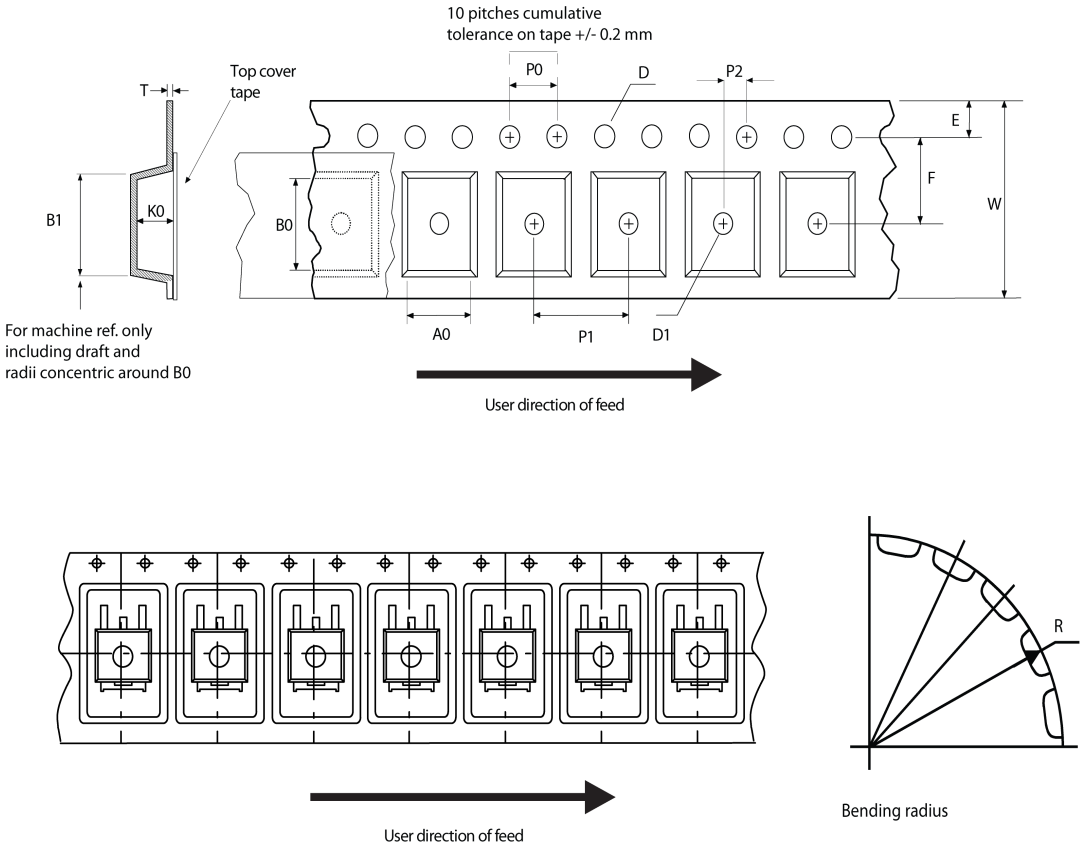
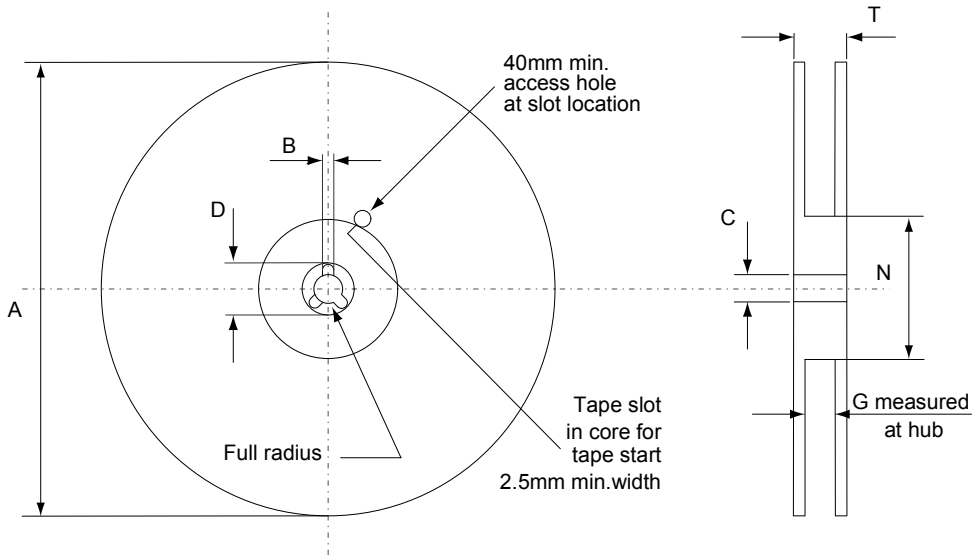


Figure 30. **DPAK reel outline**




AM06038v1

Table 13. **DPAK tape and reel mechanical data**

| Tape | | | Reel | | |
|---|---|---|---|---|---|
| Dim. | mm | | Dim. | mm | |
| | Min. | Max. | | Min. | Max. |
| A0 | 6.8 | 7 | A | | 330 |
| B0 | 10.4 | 10.6 | B | 1.5 | |
| B1 | | 12.1 | C | 12.8 | 13.2 |
| D | 1.5 | 1.6 | D | 20.2 | |
| D1 | 1.5 | | G | 16.4 | 18.4 |
| E | 1.65 | 1.85 | N | 50 | |
| F | 7.4 | 7.6 | T | | 22.4 |
| K0 | 2.55 | 2.75 | | | |
| P0 | 3.9 | 4.1 | Base qty. | | 2500 |
| P1 | 7.9 | 8.1 | Bulk qty. | | 2500 |
| P2 | 1.9 | 2.1 | | | |
| R | 40 | | | | |
| T | 0.25 | 0.35 | | | |
| W | 15.7 | 16.3 | | | |

# 5 Order codes

Table 14. **Device summary**

| Order code | Marking | Package | Packing |
|---|---|---|---|
| STB10N60M2 | 10N60M2 | D²PAK | Tape and reel |
| STD10N60M2 | | DPAK | |
| STP10N60M2 | | TO-220 | Tube |

## Revision history

Table 15. **Document revision history**

| Date | Version | Changes |
|---|---|---|
| 29-May-2013 | 1 | First release. |
| 06-Dec-2013 | 2 | – Added: D²PAK package<br>– Modified: title and $R_{DS(on)}$ values in cover page<br>– Modified: $R_{DS(on)}$ values in *Table 5*<br>– Modified: $R_G$ value in *Table 6*<br>– Modified: *Figure 9* and $I_D$ value in *Figure 12*<br>– Added: *Table 9*, *13*, *Figure 22* and *23*<br>– Updated: *Table 10*, *11*, *Figure 24*, *25* and *26*<br>Minor text changes. |
| 08-Mar-2017 | 3 | Updated the title and the description in cover page.<br>Updated *Table 4: "Avalanche characteristics"*.<br>Updated *Section 4.2: "DPAK (TO-252) type A package information"*.<br>Added *Section 4.4: "DPAK (TO-252) type E package information"*, and *Section 4.7: "IPAK (TO-251) type C package information"*.<br>Minor text changes. |
| 19-Jan-2021 | 4 | The part number STU10N60M2 have been removed and the document has been updated accordingly.<br>Updated *Figure 1. Safe operating area for D²PAK and TO-220*, *Figure 2. Maximum transient thermal impedance for D²PAK and TO-220*, *Figure 3. Safe operating area for DPAK* and *Figure 4. Maximum transient thermal impedance for DPAK*.<br>Minor text changes. |
| 08-Jul-2025 | 5 | Updated Section 4: Package information.<br>Minor text changes. |

# Contents

**IMPORTANT NOTICE – READ CAREFULLY**

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgment.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, refer to www.st.com/trademarks. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2025 STMicroelectronics – All rights reserved