

N-channel 100 V, 9.0 mΩ typ., 110 A STripFET™ II Power MOSFETs in D²PAK, TO-220 and TO-247 packages

Datasheet - production data

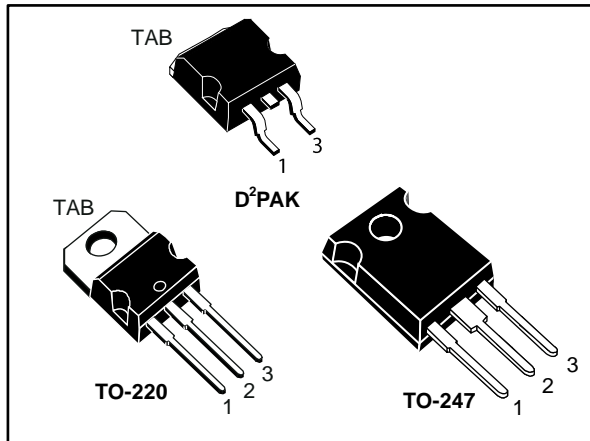
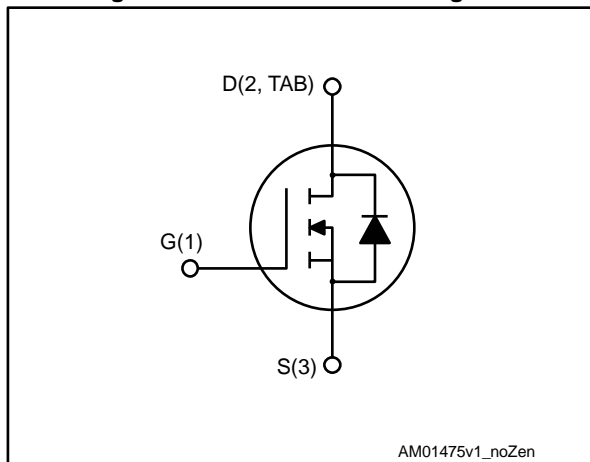


Figure 1: Internal schematic diagram



Features

| Order code | V _{DS} | R _{DS(on)} max. | I _D |
|--------------|-----------------|--------------------------|----------------|
| STB120NF10T4 | 100 V | 10.5 mΩ | 110 A |
| STP120NF10 | | | |
| STW120NF10 | | | |

- Exceptional dv/dt capability
- 100% avalanche tested
- Low gate charge

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 | Package | Packing |
|--------------|----------|--------------------|---------------|
| STB120NF10T4 | B120NF10 | D ² PAK | Tape and reel |
| STP120NF10 | P120NF10 | TO-220 | Tube |
| STW120NF10 | 120NF10 | TO-247 | |

Contents

| | | |
|----------|---|-----------|
| 1 | Electrical ratings | 3 |
| 2 | Electrical characteristics | 4 |
| | 2.1 Electrical characteristics (curves) | 6 |
| 3 | Test circuits | 8 |
| 4 | Package information | 9 |
| | 4.1 D ² PAK (TO-263) type A2 package information | 9 |
| | 4.2 D ² PAK packing information | 12 |
| | 4.3 TO-220 package information..... | 14 |
| | 4.4 TO-247 package information..... | 16 |
| 5 | Revision history | 18 |

1 Electrical ratings

Table 2: Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|--------------------------------|---|------------|------|
| V _{DS} | Drain-source voltage | 100 | V |
| V _{GS} | Gate-source voltage | ±20 | V |
| I _D | Drain current (continuous) at T _C = 25 °C | 110 | A |
| | Drain current (continuous) at T _C = 100 °C | 77 | A |
| I _{DM} ⁽¹⁾ | Drain current (pulsed) | 440 | A |
| P _{TOT} | Total dissipation at T _C = 25 °C | 312 | W |
| dv/dt ⁽²⁾ | Peak diode recovery voltage slope | 10 | V/ns |
| E _{AS} ⁽³⁾ | Single pulse avalanche energy | 550 | mJ |
| T _j | Operating junction temperature range | -55 to 175 | °C |
| T _{stg} | Storage temperature range | | |

Notes:

⁽¹⁾Pulse width is limited by safe operating area.

⁽²⁾I_{SD} ≤ 110 A, di/dt ≤ 300 A/μs, V_{DD} = 80% V_{(BR)DSS}

⁽³⁾Starting T_j = 25 °C, I_D = 60 A, V_{DD} = 50 V

Table 3: Thermal data

| Symbol | Parameter | Value | | | Unit |
|-----------------------|--|--------|--------|--------------------|------|
| | | TO-220 | TO-247 | D ² PAK | |
| R _{thj-case} | Thermal resistance junction-case | 0.48 | | | °C/W |
| R _{thj-amb} | Thermal resistance junction-ambient | 62.5 | | | °C/W |
| R _{thj-pcb} | Thermal resistance junction-pcb ⁽¹⁾ | 35 | | | °C/W |

Notes:

⁽¹⁾When mounted on an 1-inch² FR-4, 2 Oz copper board.

2 Electrical characteristics

(T_{CASE} = 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 V, I _D = 250 μA | 100 | | | V |
| I _{DSS} | Zero gate voltage drain current | V _{GS} = 0 V, V _{DS} = 100 V | | | 1 | μA |
| | | V _{GS} = 0 V, V _{DS} = 100 V, T _c = 125 °C ⁽¹⁾ | | | 10 | μA |
| I _{GSS} | Gate-source 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 | | 4 | V |
| R _{DS(on)} | Static drain-source on-resistance | V _{GS} = 10 V, I _D = 60 A | | 9.0 | 10.5 | mΩ |

Notes:

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

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 V | - | 5200 | | pF |
| C _{OSS} | Output capacitance | | | 785 | | pF |
| C _{rSS} | Reverse transfer capacitance | | | 325 | | pF |
| Q _g | Total gate charge | V _{DD} = 80 V, I _D = 120 A, V _{GS} = 0 to 10 V (see Figure 14: "Test circuit for gate charge behavior") | - | 172 | 233 ⁽¹⁾ | nC |
| Q _{gs} | Gate-source charge | | | 32 | | nC |
| Q _{gd} | Gate-drain charge | | | 64 | | nC |

Notes:

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

Table 6: Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------------|---------------------|---|------|------|------|------|
| t _{d(on)} | Turn-on delay time | V _{DD} = 50 V, I _D = 60 A, R _G = 4.7 Ω, V _{GS} = 10 V (see Figure 13: "Test circuit for resistive load switching times" and Figure 18: "Switching time waveform") | - | 25 | - | ns |
| t _r | Rise time | | - | 90 | - | ns |
| t _{d(off)} | Turn-off delay time | | - | 132 | - | ns |
| t _f | Fall time | | - | 68 | - | ns |

Table 7: Source drain diode

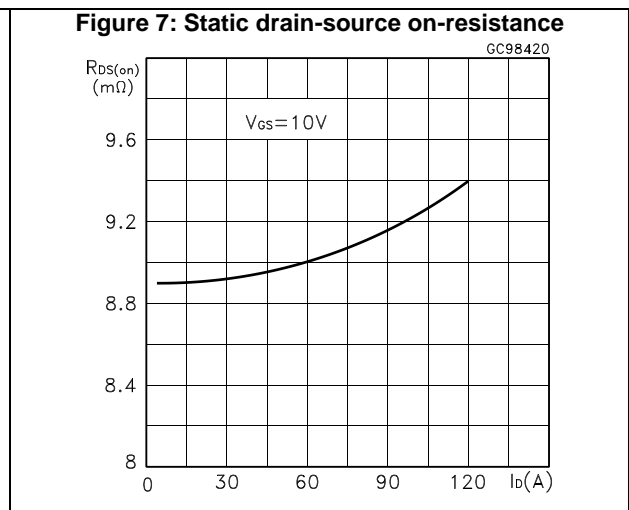
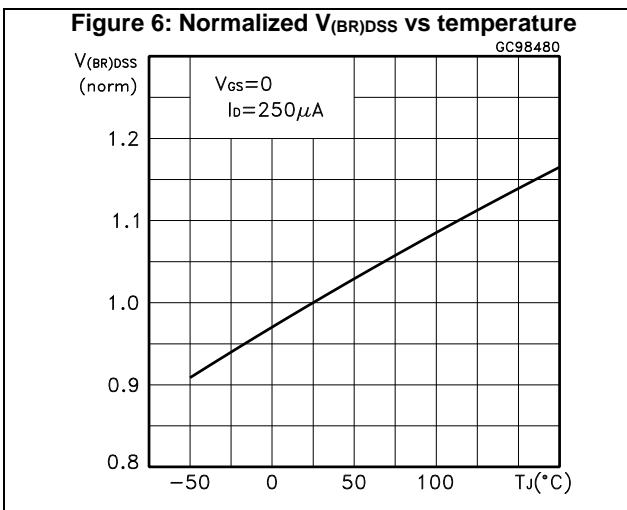
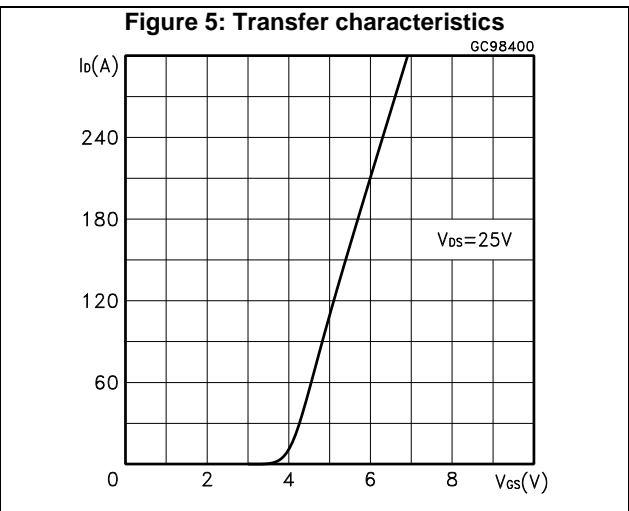
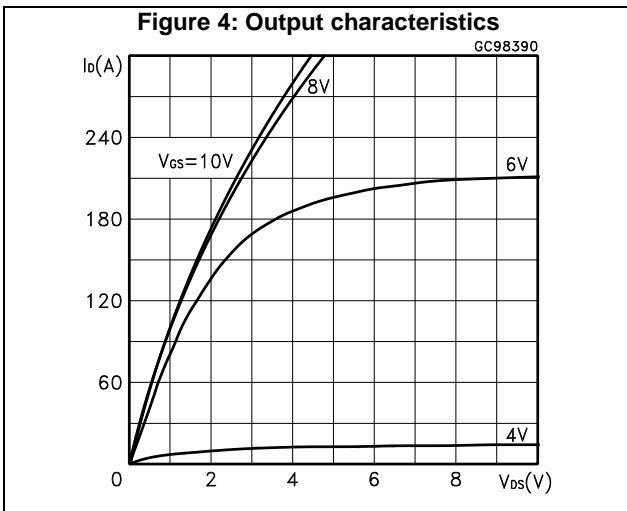
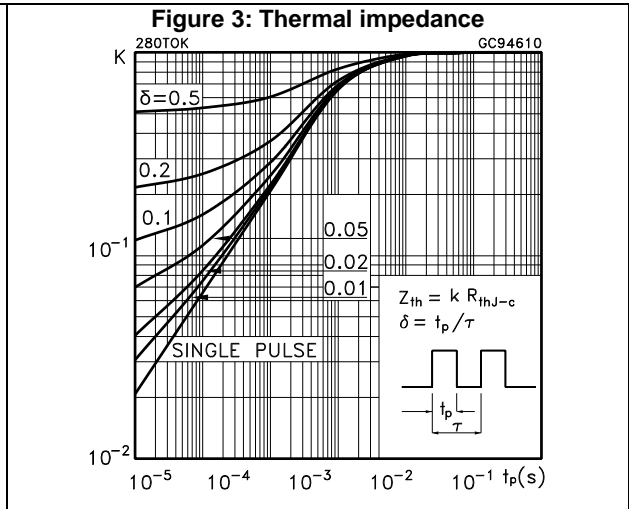
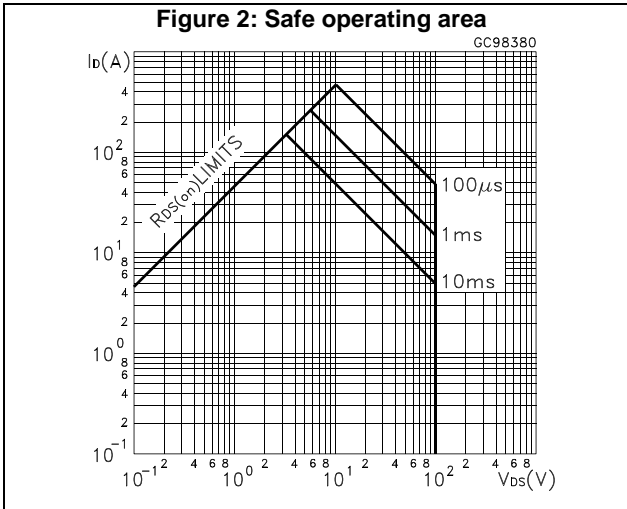
| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------|--|------|------|------|------|
| I_{SD} | Source drain current | | - | | 110 | A |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) | | - | | 440 | A |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD} = 120 \text{ A}$, $V_{GS} = 0 \text{ V}$ | - | | 1.3 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 120 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$, $V_{DD} = 40 \text{ V}$, $T_j = 150 \text{ }^\circ\text{C}$ (see Figure 15: "Test circuit for inductive load switching and diode recovery times") | - | 152 | | ns |
| Q_{rr} | Reverse recovery charge | | - | 760 | | nC |
| I_{RRM} | Reverse recovery current | | - | 10 | | A |

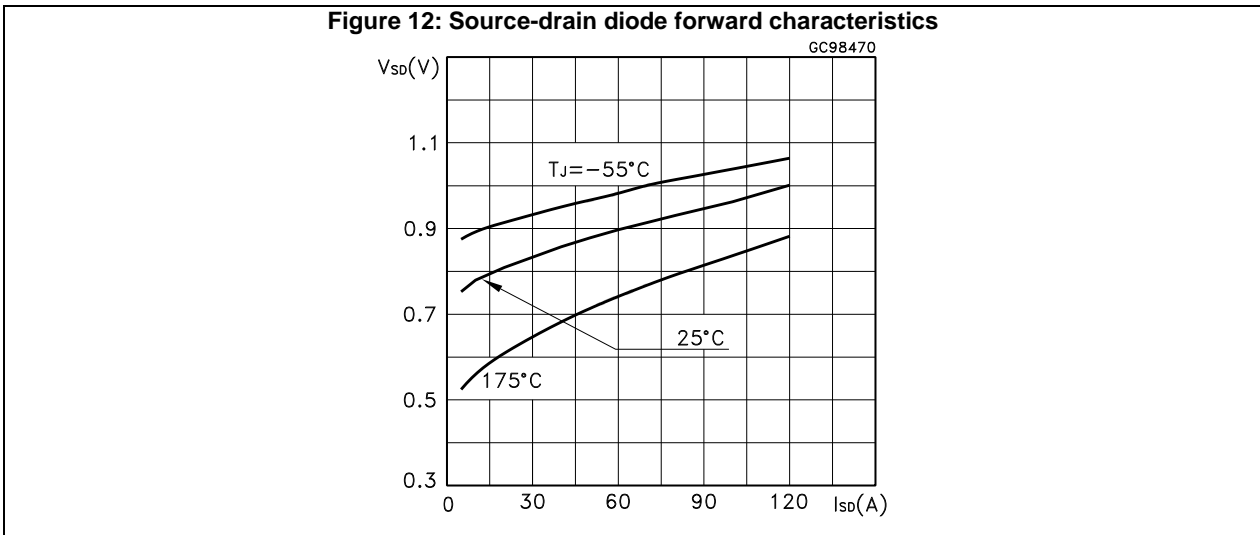
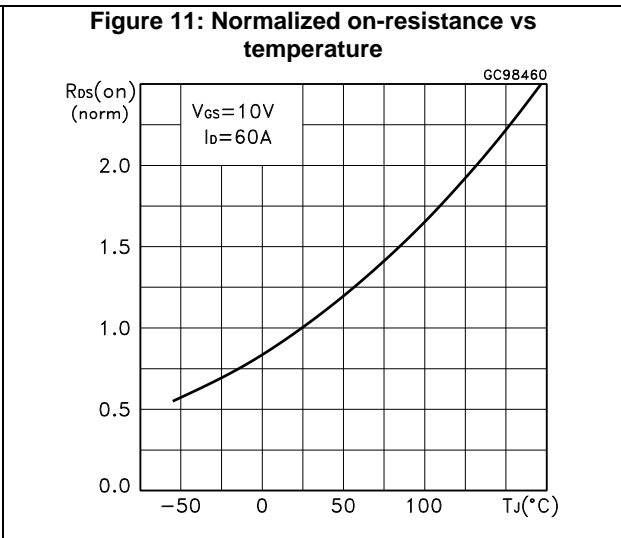
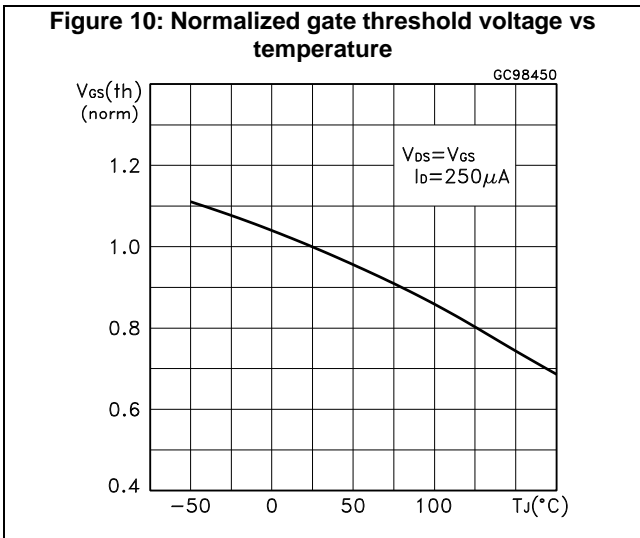
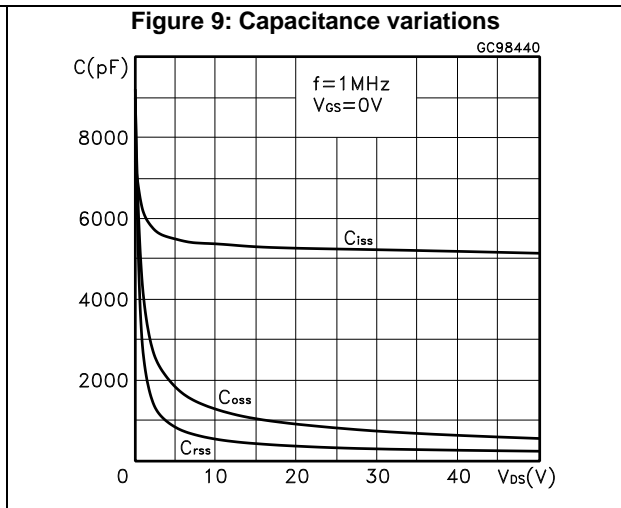
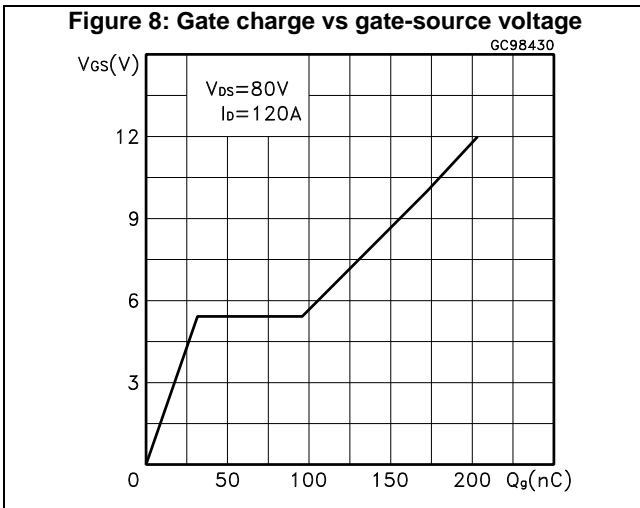
Notes:

⁽¹⁾Pulse width is limited by safe operating area.

⁽²⁾Pulsed: pulse duration = 300 μs , duty cycle 1.5%

2.1 Electrical characteristics (curves)





3 Test circuits

Figure 13: Test circuit for resistive load switching times



AM01468v1

Figure 14: Test circuit for gate charge behavior



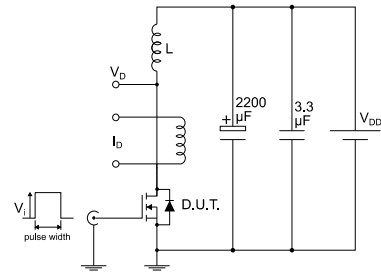
AM01469v1

Figure 15: Test circuit for inductive load switching and diode recovery times



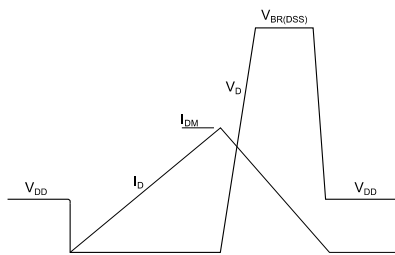
AM01470v1

Figure 16: Unclamped inductive load test circuit



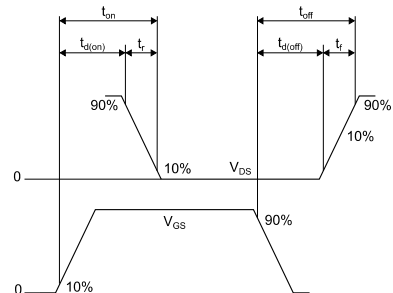
AM01471v1

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 D²PAK (TO-263) type A2 package information

Figure 19: D²PAK (TO-263) type A2 package outline

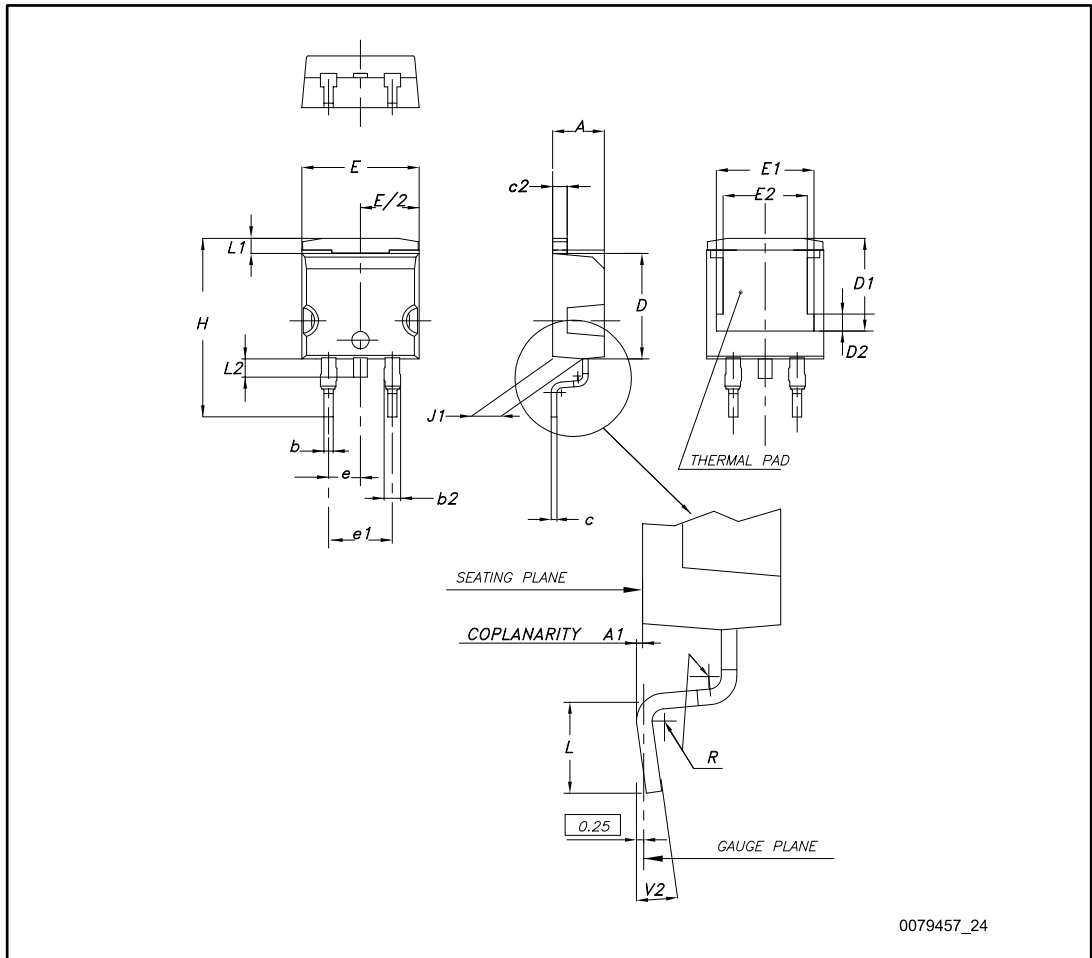
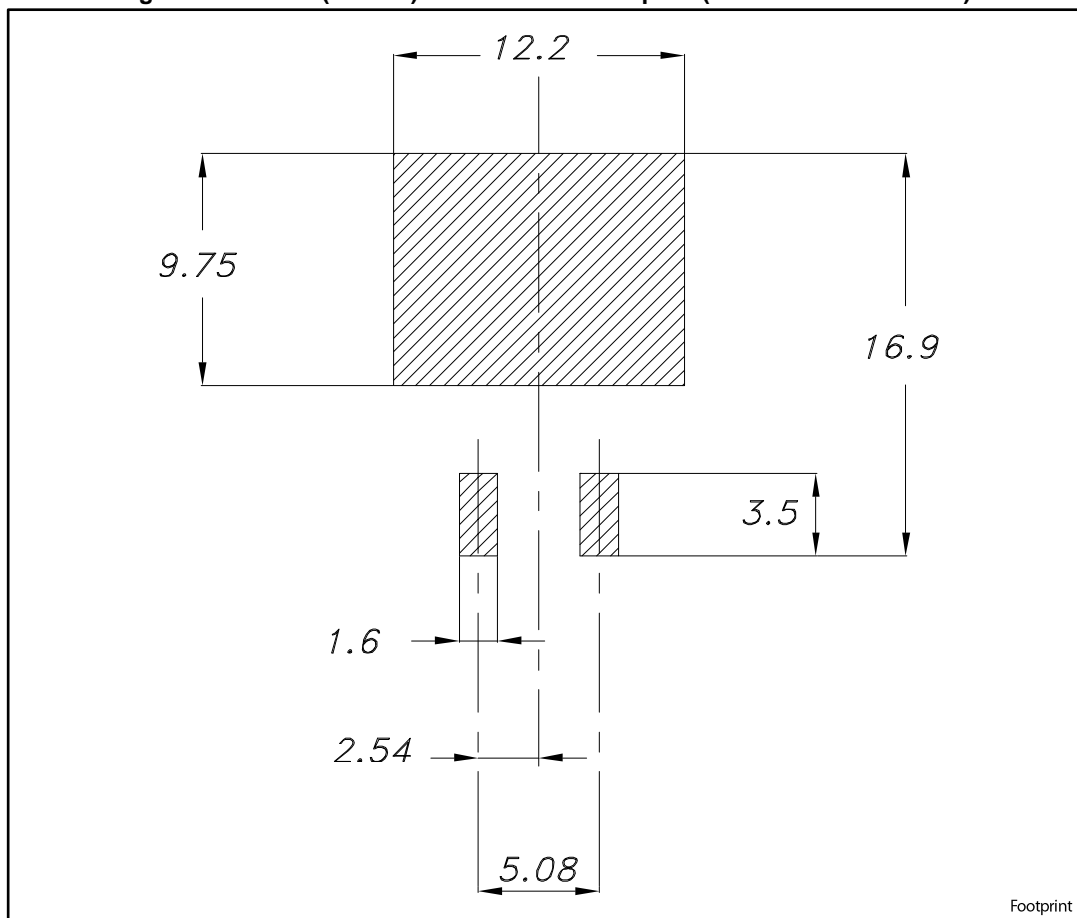


Table 8: D²PAK (TO-263) type A2 package mechanical data

| 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 | 8.70 | 8.90 | 9.10 |
| E2 | 7.30 | 7.50 | 7.70 |
| 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 20: D²PAK (TO-263) recommended footprint (dimensions are in mm)



4.2 D²PAK packing information

Figure 21: D²PAK tape outline

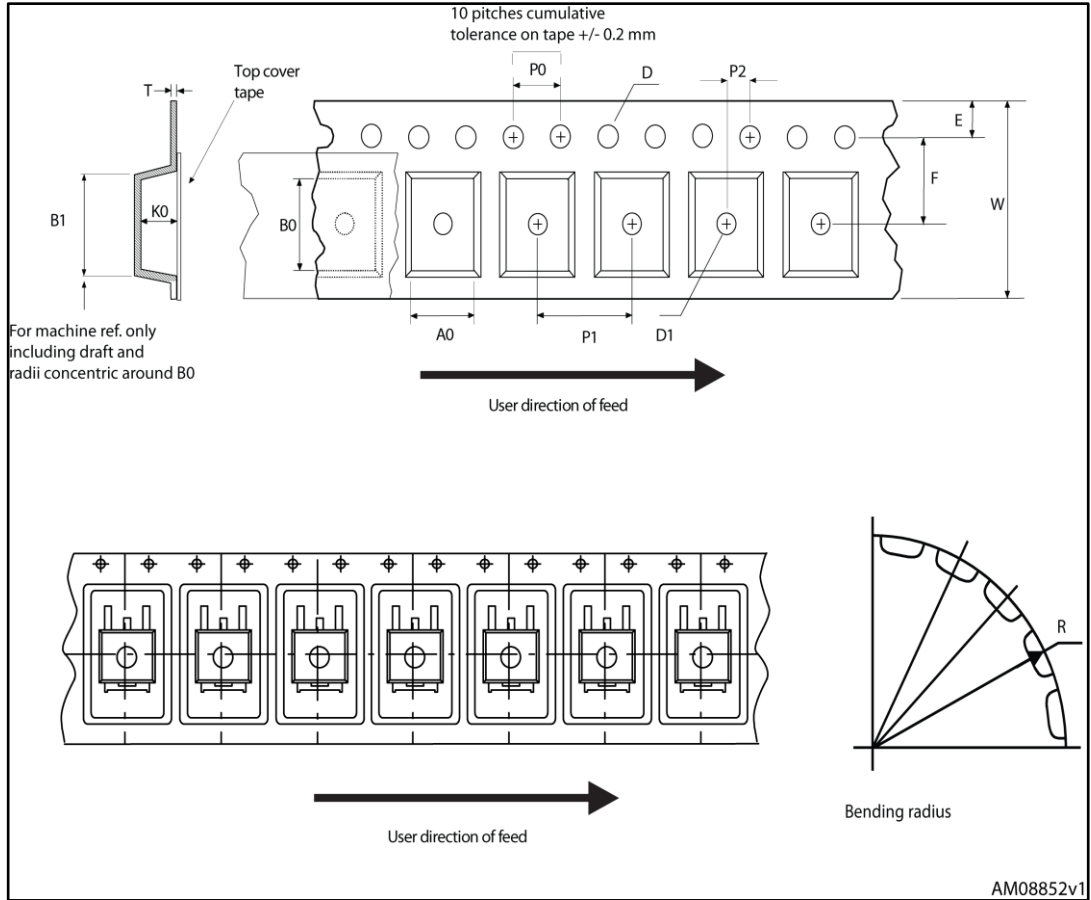
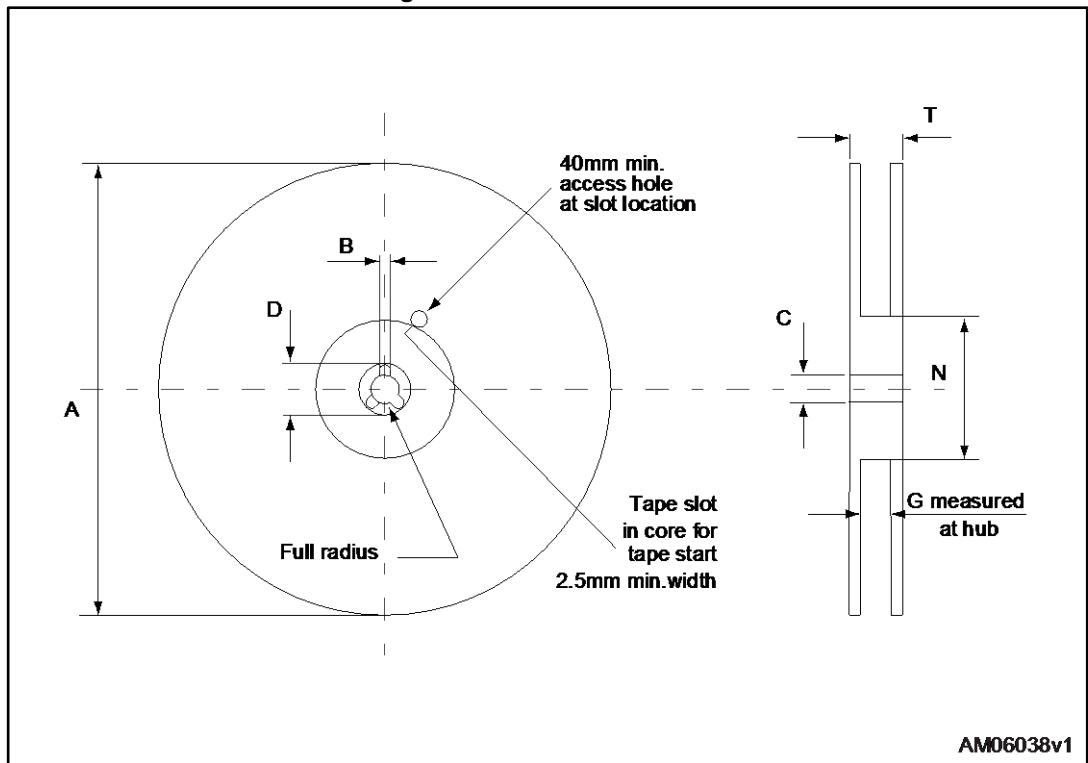


Figure 22: D²PAK reel outline



AM06038v1

Table 9: D²PAK 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 | | | |

4.3 TO-220 package information

Figure 23: TO-220 type A package outline

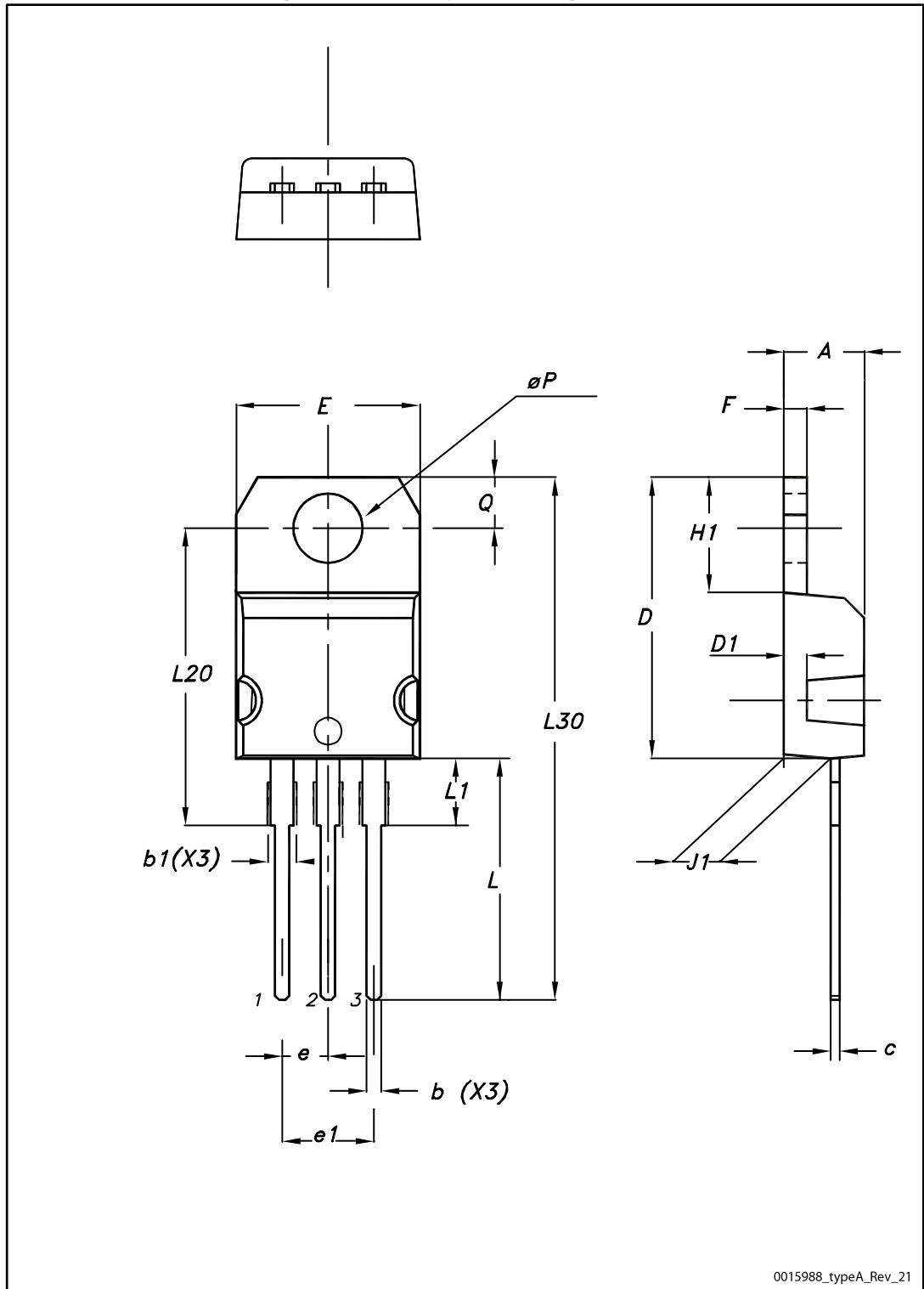


Table 10: TO-220 type A package mechanical data

| 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 |

4.4 TO-247 package information

Figure 24: TO-247 package outline

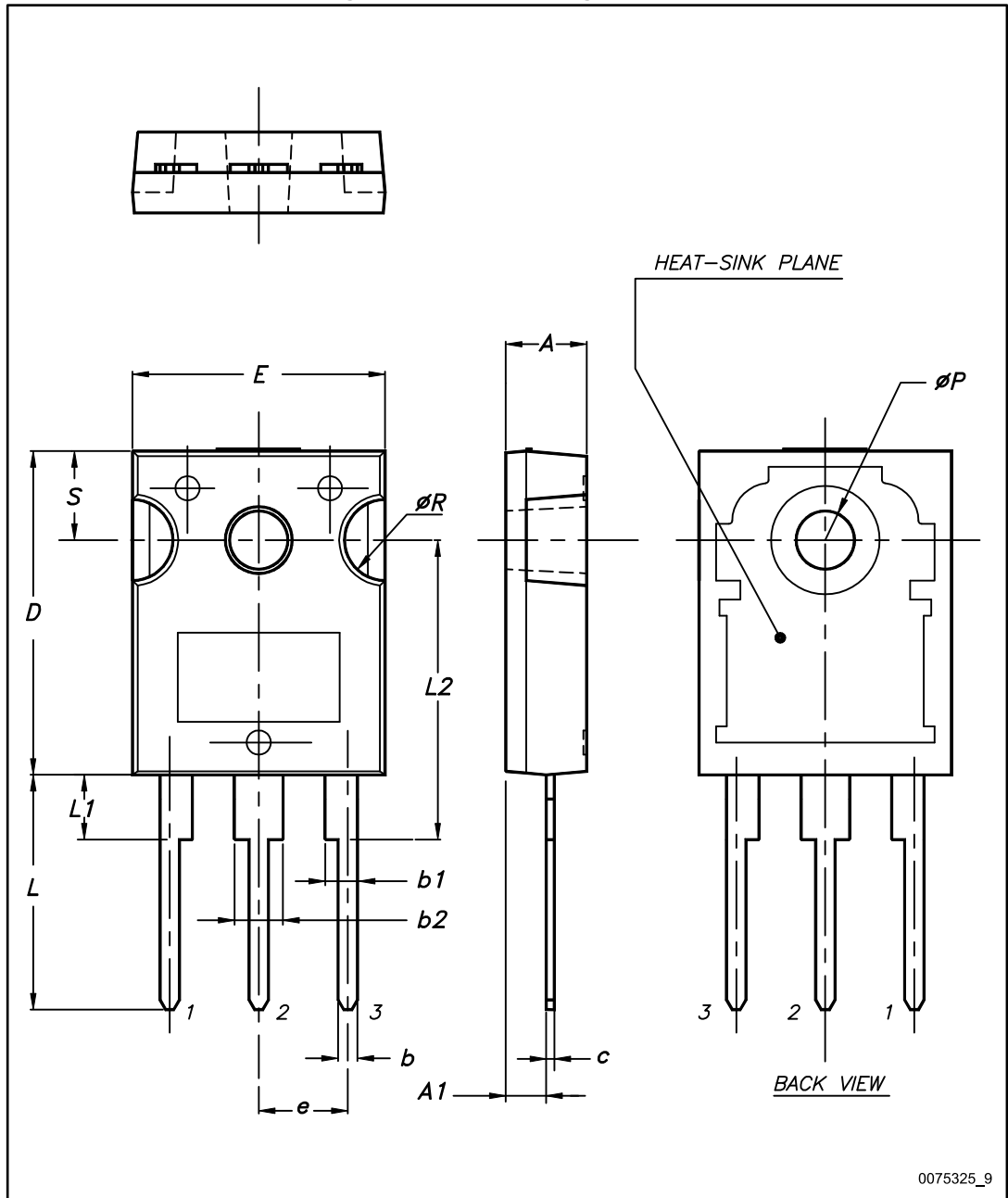


Table 11: TO-247 package mechanical data

| Dim. | mm | | |
|------|-------|-------|-------|
| | Min. | Typ. | Max. |
| A | 4.85 | | 5.15 |
| A1 | 2.20 | | 2.60 |
| b | 1.0 | | 1.40 |
| b1 | 2.0 | | 2.40 |
| b2 | 3.0 | | 3.40 |
| c | 0.40 | | 0.80 |
| D | 19.85 | | 20.15 |
| E | 15.45 | | 15.75 |
| e | 5.30 | 5.45 | 5.60 |
| L | 14.20 | | 14.80 |
| L1 | 3.70 | | 4.30 |
| L2 | | 18.50 | |
| ØP | 3.55 | | 3.65 |
| ØR | 4.50 | | 5.50 |
| S | 5.30 | 5.50 | 5.70 |

5 Revision history

Table 12: Document revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 20-Mar-2006 | 2 | Preliminary datasheet |
| 31-Mar-2006 | 3 | Typing error |
| 19-Jun-2006 | 4 | New template, no content change |
| 28-Jun-2006 | 5 | New I _D value on <i>Table 2</i> |
| 05-Oct-2006 | 6 | New value on <i>Table 7</i> |
| 11-May-2011 | 7 | Added new package and mechanical data: TO-220FP |
| 03-Nov-2017 | 8 | Part number STF120NF10 has been moved to a separate datasheet. Updated features, description and device summary on cover page. Updated <i>Table 2: "Absolute maximum ratings"</i> , <i>Table 3: "Thermal data"</i> and <i>Table 4: "On/off states"</i> . Updated <i>Section 4: "Package information"</i> . Minor text changes |

IMPORTANT NOTICE – PLEASE 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 acknowledgement.

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. 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.

© 2017 STMicroelectronics – All rights reserved

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[STMicroelectronics:](#)

[STP120NF10](#) [STB120NF10T4](#) [STW120NF10](#)