

Automotive-grade N-channel 100 V, 12.5 mΩ typ., 45 A, STripFET™ F7 Power MOSFET in a DPAK package

Datasheet - production data

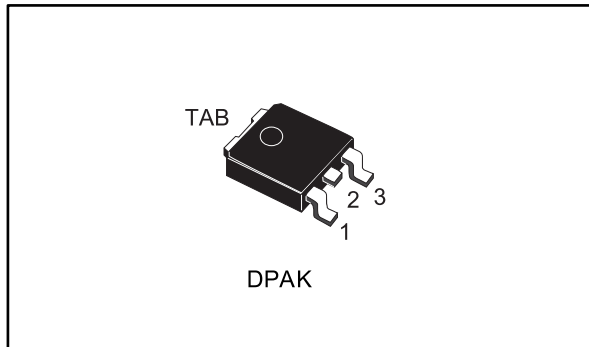
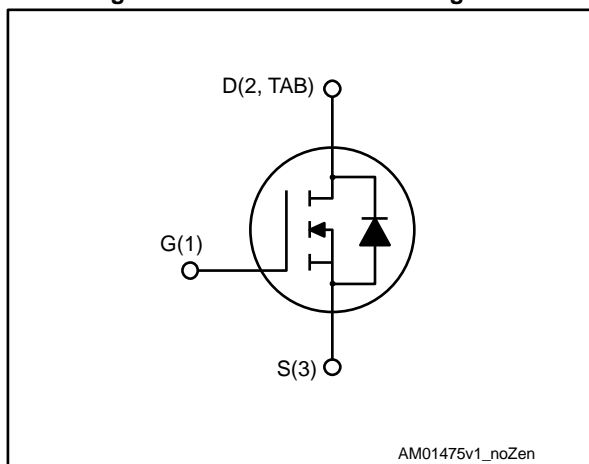


Figure 1: Internal schematic diagram



Features

| Order code | V _{DS} | R _{DS(on)} max. | I _D | P _{TOT} |
|--------------|-----------------|--------------------------|----------------|------------------|
| STD47N10F7AG | 100 V | 18 mΩ | 45 A | 60 W |



- AEC-Q101 qualified
- Among the lowest R_{DS(on)} on the market
- Excellent FoM (figure of merit)
- Low C_{rss}/C_{iss} ratio for EMI immunity
- High avalanche ruggedness

Applications

- Switching applications

Description

This N-channel Power MOSFET utilizes 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 code | Marking | Package | Packing |
|--------------|---------|---------|---------------|
| STD47N10F7AG | 47N10F7 | DPAK | Tape and reel |

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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 $T_C = 25\text{ }^\circ\text{C}$ | 45 | A |
| | Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$ | 32 | |
| $I_{DM}^{(1)}$ | Drain current (pulsed) | 180 | A |
| P_{TOT} | Total dissipation at $T_C = 25\text{ }^\circ\text{C}$ | 60 | W |
| T_J | Operating junction temperature range | -55 to 175 | $^\circ\text{C}$ |
| T_{stg} | Storage temperature range | | $^\circ\text{C}$ |

Notes:

⁽¹⁾Pulse width is limited by safe operating area

Table 3: Thermal data

| Symbol | Parameter | Value | Unit |
|---------------------|----------------------------------|-------|---------------------------|
| $R_{thj-case}$ | Thermal resistance junction-case | 2.5 | $^\circ\text{C}/\text{W}$ |
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb | 50 | |

Notes:

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

2 Electrical characteristics

($T_{\text{case}} = 25\text{ °C}$ unless otherwise specified)

Table 4: Static

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------------------|-----------------------------------|---|------|------|-----------|---------------|
| $V_{(\text{BR})\text{DSS}}$ | Drain-source breakdown voltage | $V_{\text{GS}} = 0\text{ V}$, $I_{\text{D}} = 1\text{ mA}$ | 100 | | | V |
| I_{DSS} | Zero gate voltage drain current | $V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 100\text{ V}$ | | | 10 | μA |
| | | $V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 100\text{ V}$, $T_{\text{C}} = 125\text{ °C}^{(1)}$ | | | 100 | |
| I_{GSS} | Gate-body leakage current | $V_{\text{DS}} = 0\text{ V}$, $V_{\text{GS}} = \pm 20\text{ V}$ | | | ± 100 | nA |
| $V_{\text{GS(th)}}$ | Gate threshold voltage | $V_{\text{DS}} = V_{\text{GS}}$, $I_{\text{D}} = 250\text{ }\mu\text{A}$ | 2.5 | | 4.5 | V |
| $R_{\text{DS(on)}}$ | Static drain-source on-resistance | $V_{\text{GS}} = 10\text{ V}$, $I_{\text{D}} = 22.5\text{ A}$ | | 12.5 | 18 | m Ω |

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 | $V_{\text{DS}} = 50\text{ V}$, $f = 1\text{ MHz}$, $V_{\text{GS}} = 0\text{ V}$ | - | 1640 | - | pF |
| C_{oss} | Output capacitance | | - | 360 | - | pF |
| C_{riss} | Reverse transfer capacitance | | - | 25 | - | pF |
| Q_{g} | Total gate charge | $V_{\text{DD}} = 50\text{ V}$, $I_{\text{D}} = 45\text{ A}$, $V_{\text{GS}} = 0\text{ to }10\text{ V}$ (see Figure 14: "Test circuit for gate charge behavior") | - | 25 | - | nC |
| Q_{gs} | Gate-source charge | | - | 5.1 | - | nC |
| Q_{gd} | Gate-drain charge | | - | 12.2 | - | nC |

Table 6: Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------------|---------------------|---|------|------|------|------|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD} = 50\text{ V}$, $I_D = 22.5\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see <i>Figure 13: "Test circuit for resistive load switching times"</i> and <i>Figure 18: "Switching time waveform"</i>) | - | 15 | - | ns |
| t_r | Rise time | | - | 17 | - | ns |
| $t_{d(off)}$ | Turn-off delay time | | - | 24 | - | ns |
| t_f | Fall time | | - | 8 | - | ns |

Table 7: Source-drain diode

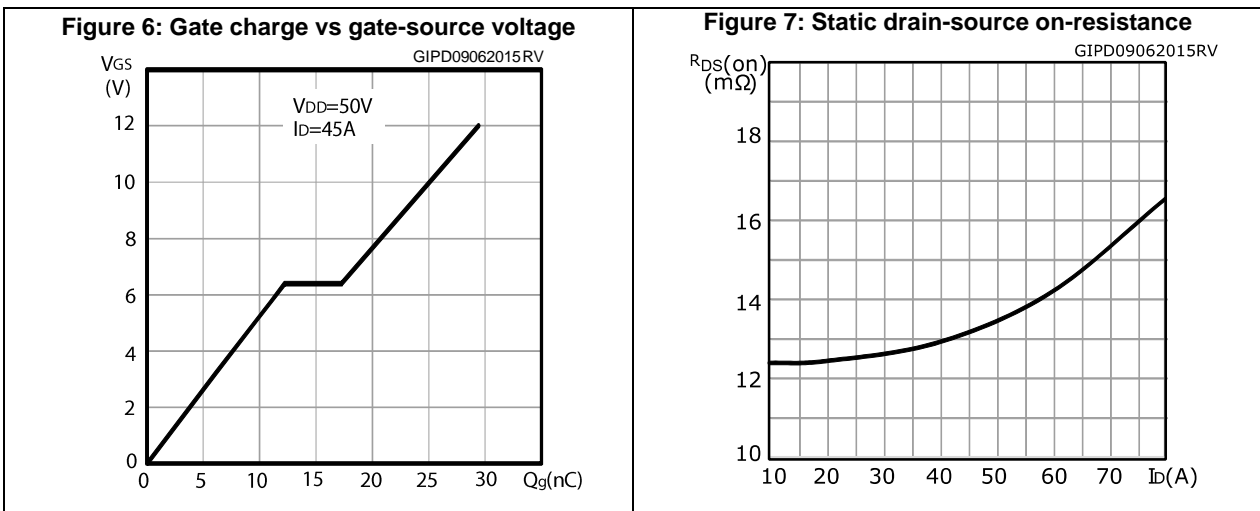
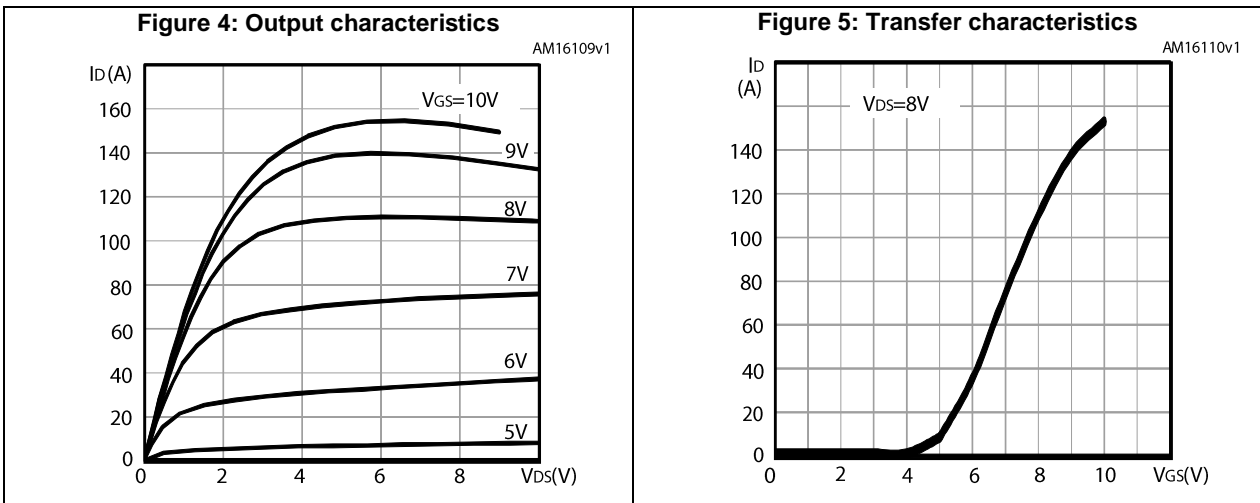
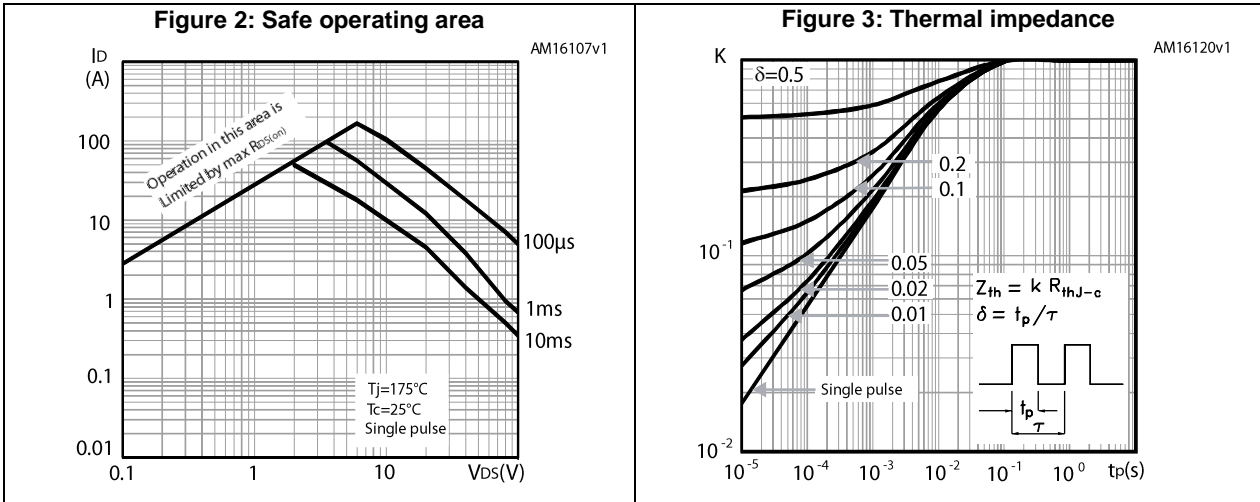
| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------|--|------|------|------|------|
| I_{SD} | Source-drain current | | - | | 45 | A |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) | | - | | 180 | A |
| $V_{SD}^{(2)}$ | Forward on voltage | $V_{GS} = 0\text{ V}$, $I_{SD} = 45\text{ A}$ | - | | 1.1 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 45\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 80\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$ (see <i>Figure 15: "Test circuit for inductive load switching and diode recovery times"</i>) | - | 53 | | ns |
| Q_{rr} | Reverse recovery charge | | - | 67 | | nC |
| I_{RRM} | Reverse recovery current | | - | 2.5 | | A |

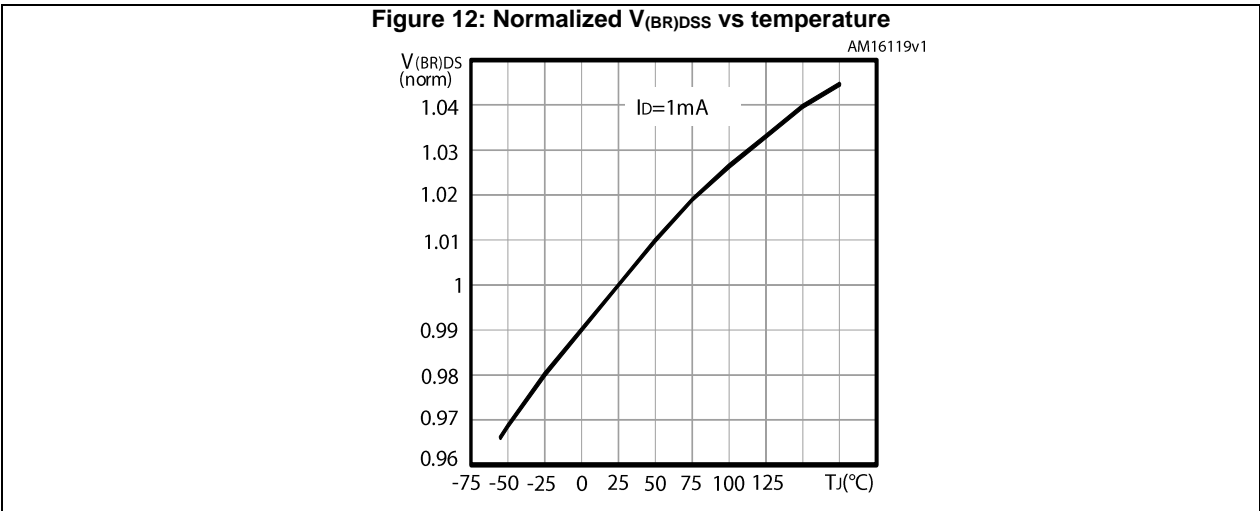
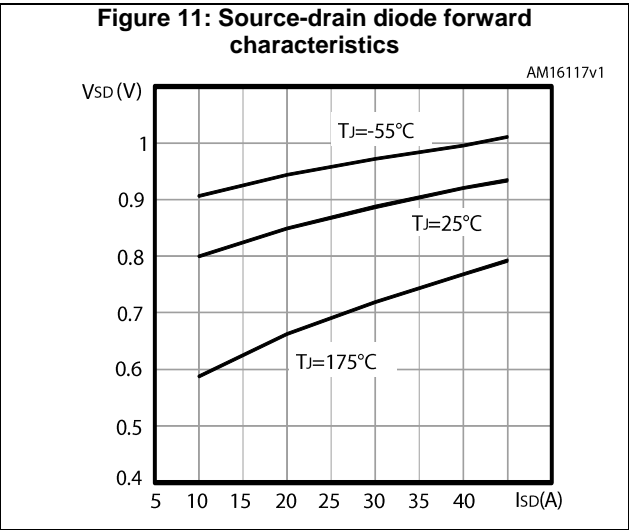
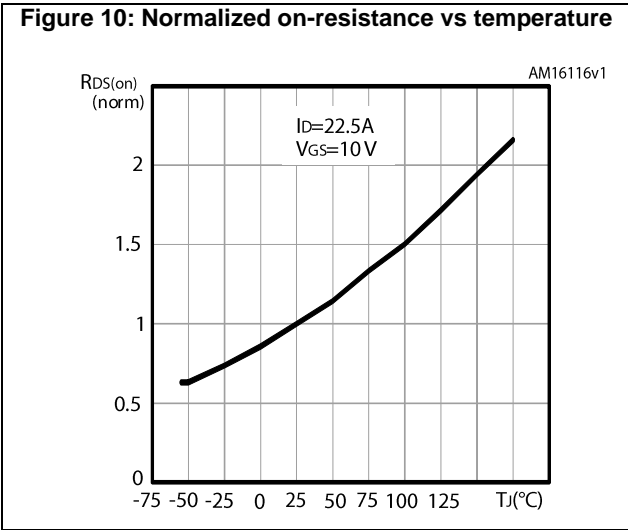
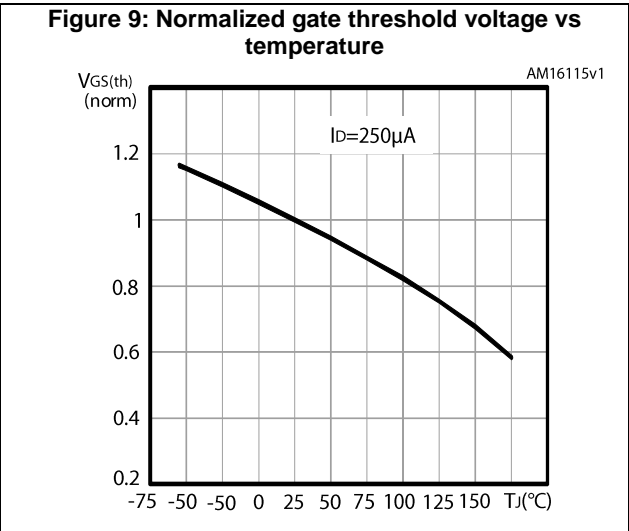
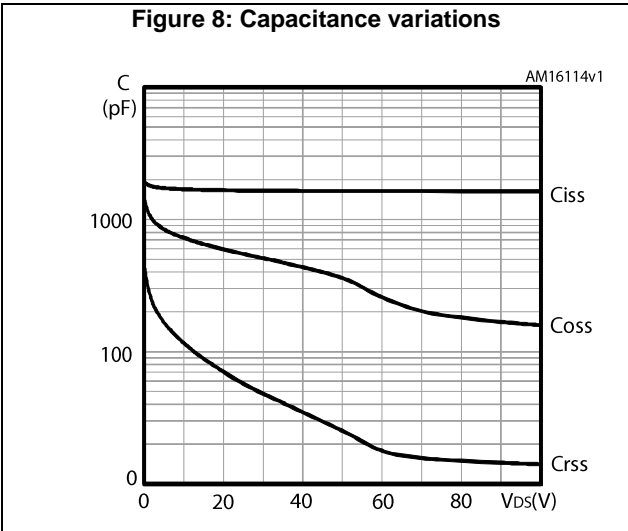
Notes:

⁽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



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Figure 14: Test circuit for gate charge behavior



AM01469v1

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



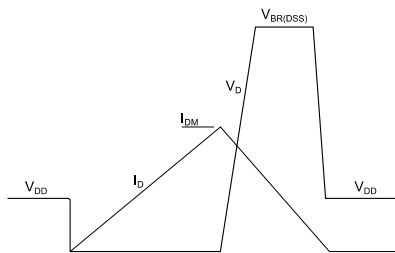
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Figure 16: Unclamped inductive load test circuit



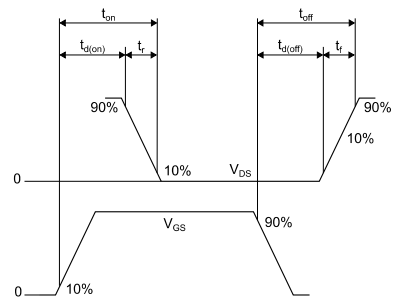
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Figure 17: Unclamped inductive waveform



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 DPAK (TO-252) type A2 package information

Figure 19: DPAK (TO-252) type A2 package outline

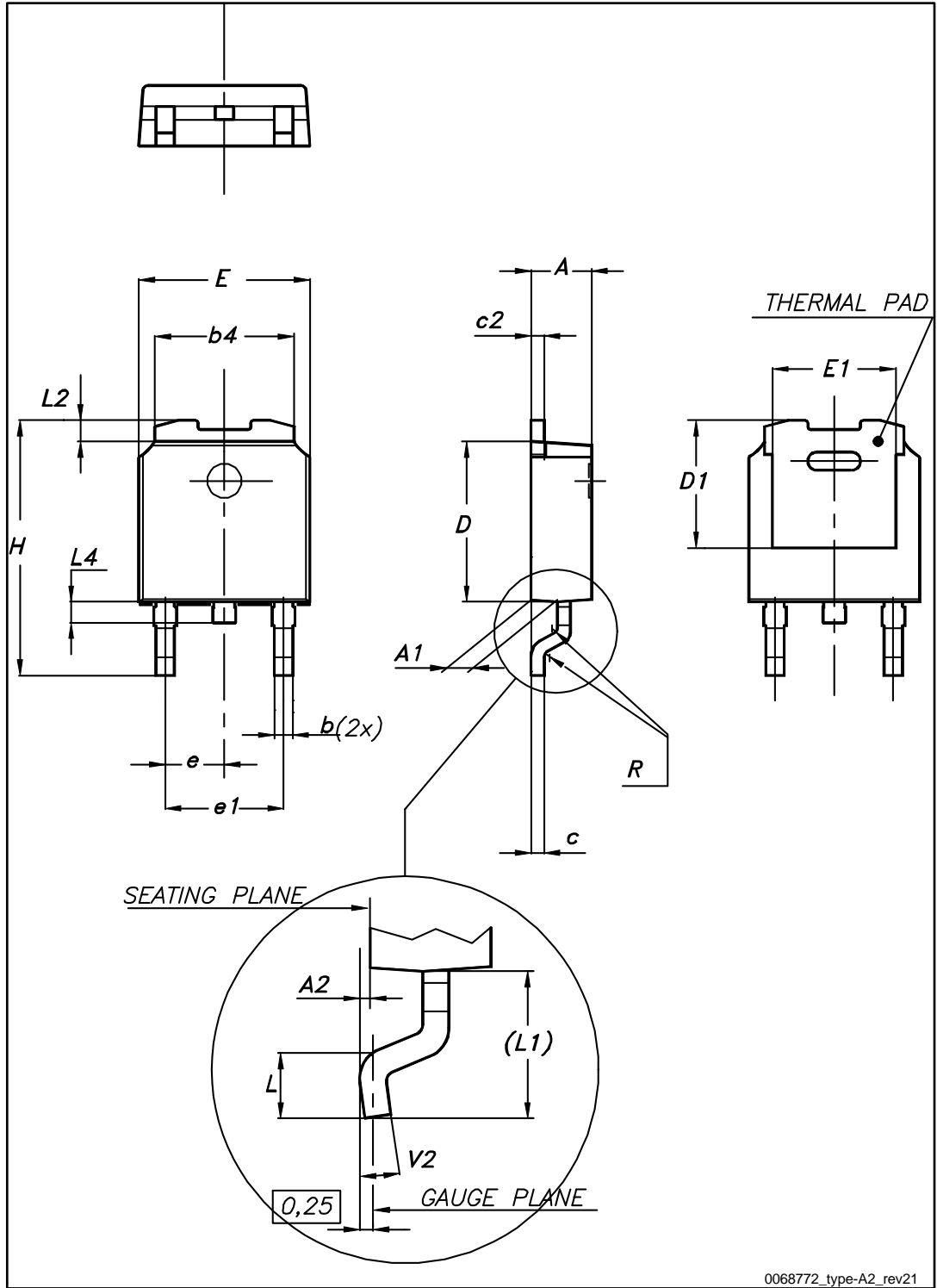
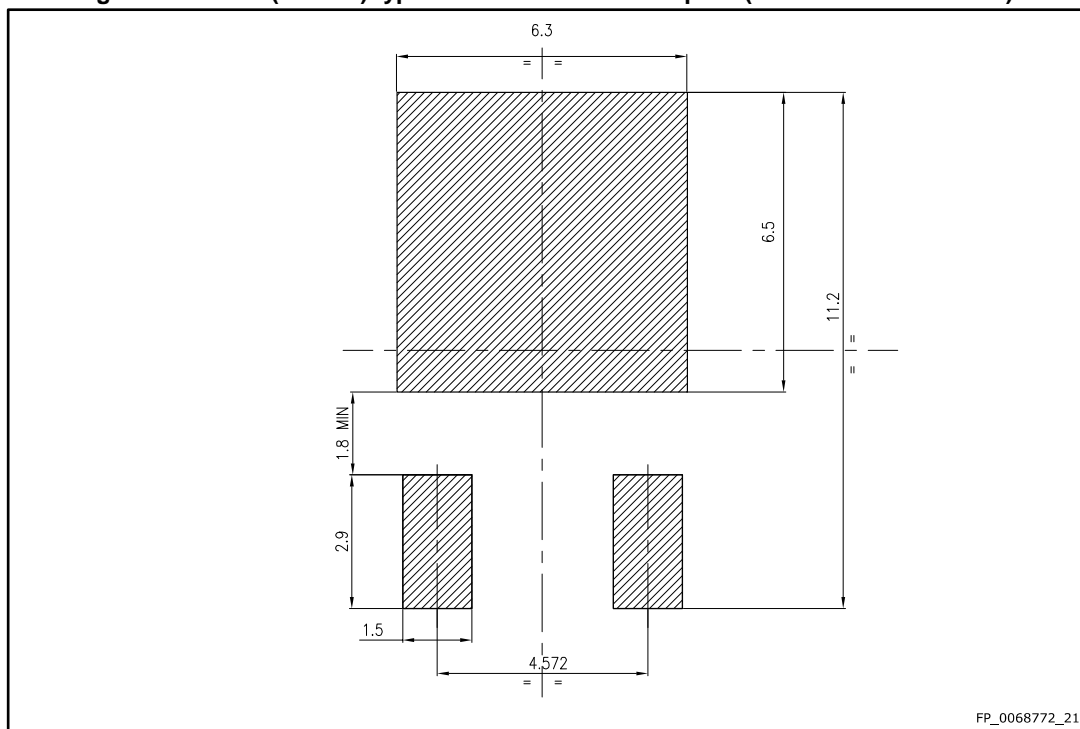


Table 8: DPAK (TO-252) type A2 mechanical data

| 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 | 5.10 | 5.20 | 5.30 |
| e | 2.16 | 2.28 | 2.40 |
| e1 | 4.40 | | 4.60 |
| 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° |

Figure 20: DPAK (TO-252) type A2 recommended footprint (dimensions are in mm)



4.2 DPAK (TO-252) packing information

Figure 21: DPAK (TO-252) tape outline

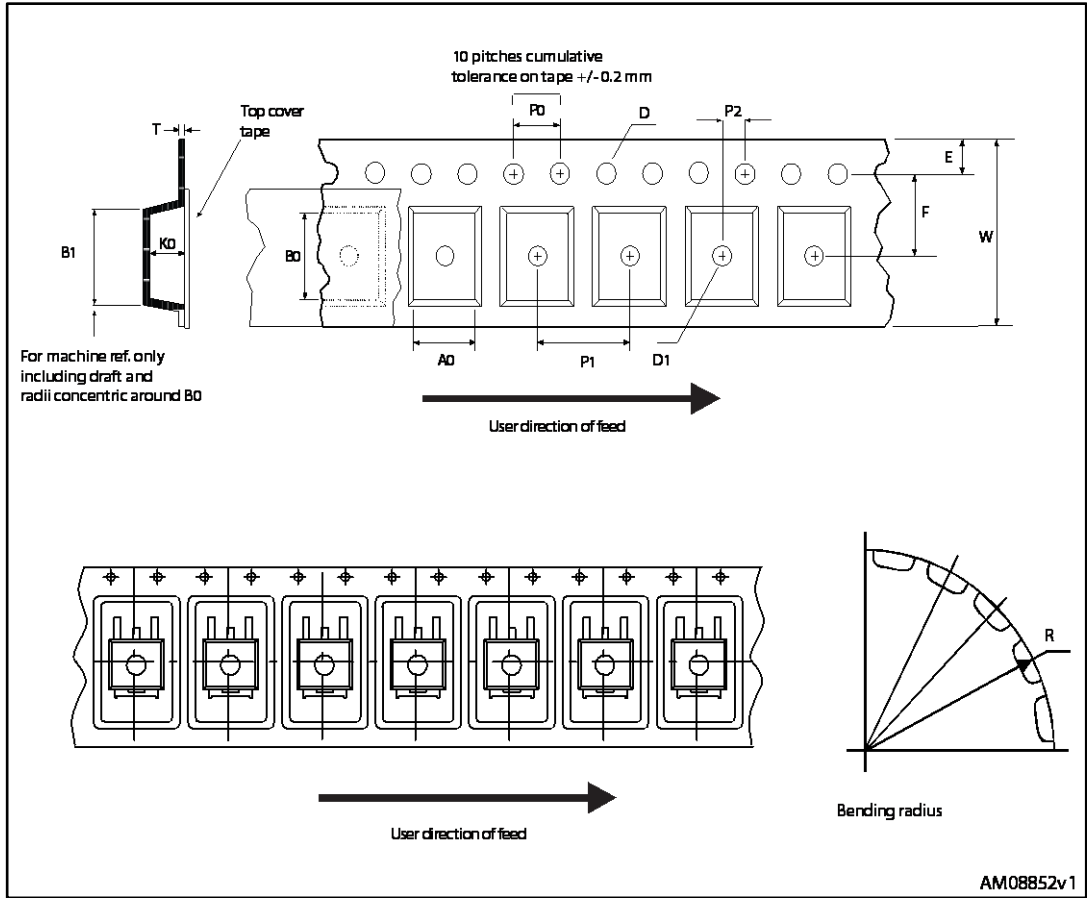


Figure 22: DPAK (TO-252) reel outline

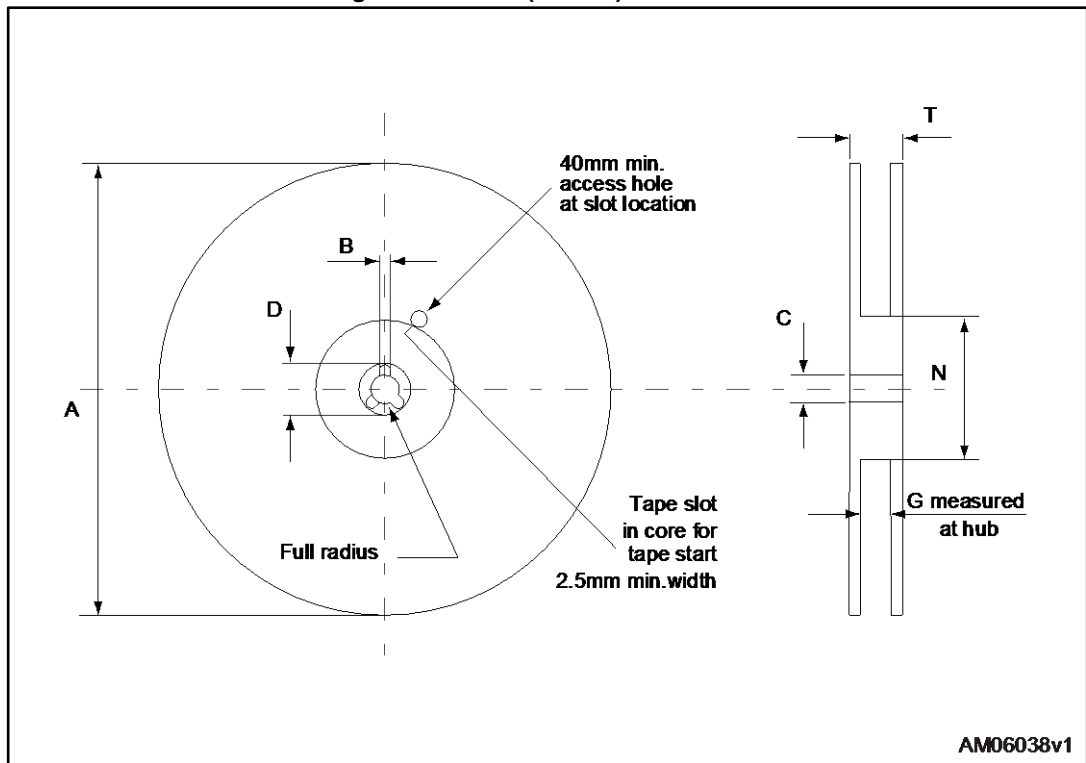


Table 9: DPAK (TO-252) tape and reel mechanical data

| 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 Revision history

Table 10: Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 23-Feb-2015 | 1 | First release |
| 17-Jun-2015 | 2 | Updated <i>Section 4: Package mechanical data</i> . Minor text changes |
| 01-Feb-2017 | 3 | Updated title and features on cover page. Updated <i>Section 1: "Electrical ratings"</i> and <i>Section 2: "Electrical characteristics"</i> . Minor text changes |

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