

N-channel 100 V, 0.0145 Ω typ., 45 A, STripFET™ F7
Power MOSFETs in DPAK, I²PAK and TO-220 packages

Datasheet - production data

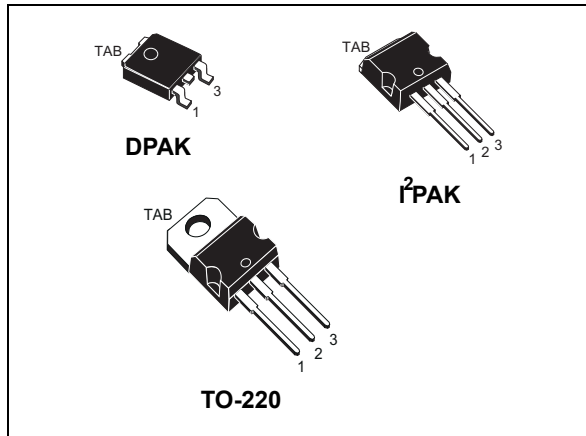
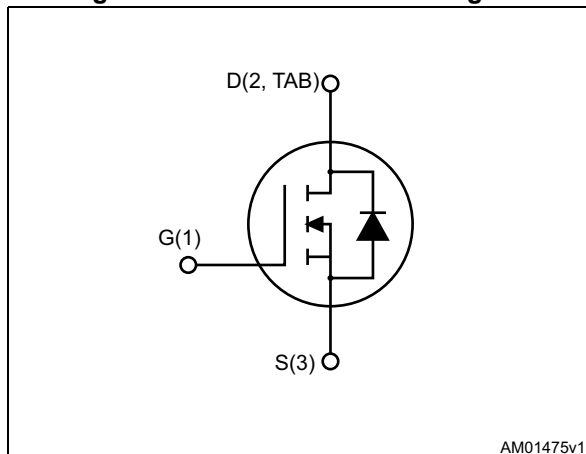


Figure 1. Internal schematic diagram



Features

| Order code | V _{DS} | R _{DS(on)} max. | I _D | P _{TOT} |
|------------|-----------------|--------------------------|----------------|------------------|
| STD45N10F7 | 100 V | 0.018 Ω | 45 A | 60 W |
| STI45N10F7 | | | | |
| STP45N10F7 | | | | |

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

Applications

- Switching applications

Description

These N-channel Power MOSFETs utilize 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 |
|------------|---------|--------------------|---------------|
| STD45N10F7 | 45N10F7 | DPAK | Tape and reel |
| STI45N10F7 | | I ² PAK | Tube |
| STP45N10F7 | | TO-220 | |

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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 |
| I_D | Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$ | 32 | A |
| $I_{DM}^{(1)}$ | Drain current (pulsed) | 180 | A |
| P_{TOT} | Total dissipation at $T_C = 25\text{ }^\circ\text{C}$ | 60 | W |
| $E_{AS}^{(2)}$ | Single pulse avalanche energy | 190 | mJ |
| T_J | Operating junction temperature | -55 to 175 | $^\circ\text{C}$ |
| T_{stg} | Storage temperature | | $^\circ\text{C}$ |

1. Pulse width limited by safe operating area.
2. Starting $T_J = 25\text{ }^\circ\text{C}$, $I_d = 10\text{ A}$, $V_{dd} = 50\text{ V}$

Table 3. Thermal resistance

| Symbol | Parameter | Value | | Unit |
|---------------------|-------------------------------------|-------|------------------------------|--------------------|
| | | DPAK | TO-220 I ² PAK | |
| $R_{thj-case}$ | Thermal resistance junction-case | 2.5 | 2.5 | $^\circ\text{C/W}$ |
| $R_{thj-amb}$ | Thermal resistance junction-ambient | | 62.5 | $^\circ\text{C/W}$ |
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb | 31.2 | | $^\circ\text{C/W}$ |

1. When mounted on FR-4 board of 1inch², 2oz Cu, $t < 10\text{ sec}$.

2 Electrical characteristics

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

Table 4. On/off states

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|--|---|------|--------|-----------|---------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage ($V_{GS} = 0$) | $I_D = 1\text{ mA}$ | 100 | | - | V |
| I_{DSS} | Zero gate voltage drain current ($V_{GS} = 0$) | $V_{DS} = 100\text{ V}$ | | | 10 | μA |
| | | $V_{DS} = 100\text{ V}; T_C = 125\text{ °C}$ | | | 100 | μA |
| I_{GSS} | Gate body leakage current ($V_{DS} = 0$) | $V_{GS} = \pm 20\text{ V}$ | | | ± 100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | 2.5 | | 4.5 | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS} = 10\text{ V}, I_D = 22.5\text{ A}$ | | 0.0145 | 0.018 | Ω |

Table 5. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|--|------|------|------|------|
| C_{iss} | Input capacitance | $V_{DS} = 50\text{ V}, f = 1\text{ MHz}, V_{GS} = 0$ | - | 1640 | - | pF |
| C_{oss} | Output capacitance | | - | 360 | - | pF |
| C_{rss} | Reverse transfer capacitance | | - | 25 | - | pF |
| Q_g | Total gate charge | $V_{DD} = 50\text{ V}, I_D = 45\text{ A}$ | - | 25 | - | nC |
| Q_{gs} | Gate-source charge | $V_{GS} = 10\text{ V}$ | - | 5.1 | - | nC |
| Q_{gd} | Gate-drain charge | Figure 14 | - | 12.2 | - | nC |

Table 6. Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------------|---------------------|---|------|------|------|------|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD} = 50\text{ V}, I_D = 22.5\text{ A}, R_G = 4.7\text{ }\Omega, V_{GS} = 10\text{ V}$ Figure 13 | - | 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 | $I_{SD} = 45 \text{ A}, V_{GS} = 0$ | - | | 1.1 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 45 \text{ A},$ $di/dt = 100 \text{ A}/\mu\text{s},$ $V_{DD} = 80 \text{ V}, T_j = 150 \text{ }^\circ\text{C}$ | - | 53 | | ns |
| Q_{rr} | Reverse recovery charge | | - | 67 | | nC |
| I_{RRM} | Reverse recovery current | | - | 2.5 | | 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

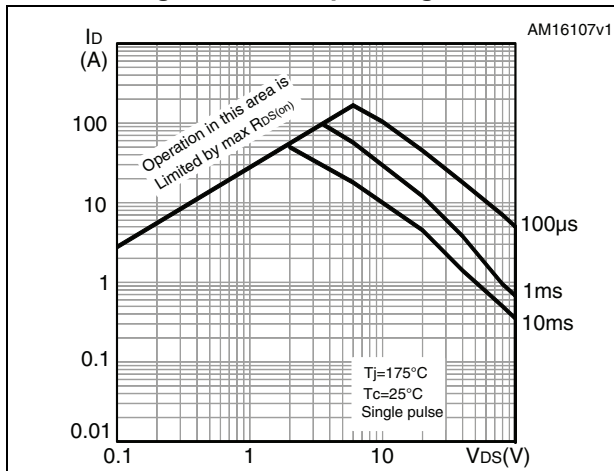


Figure 3. Thermal impedance

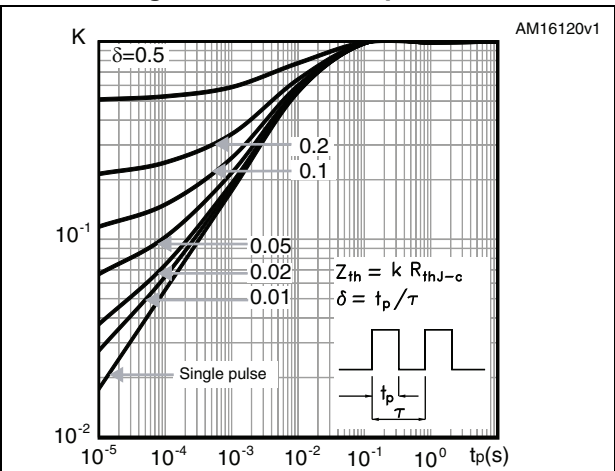


Figure 4. Output characteristics

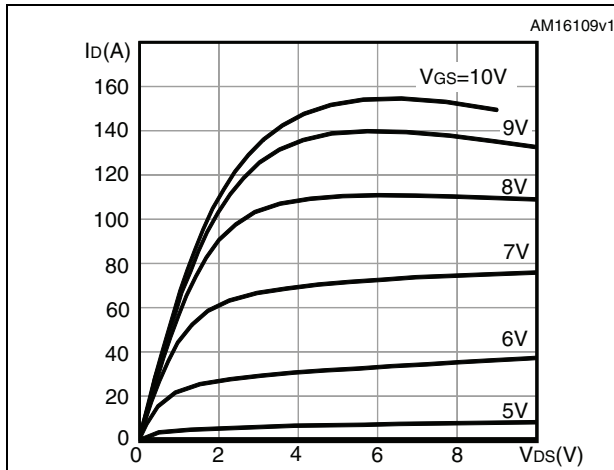


Figure 5. Transfer characteristics

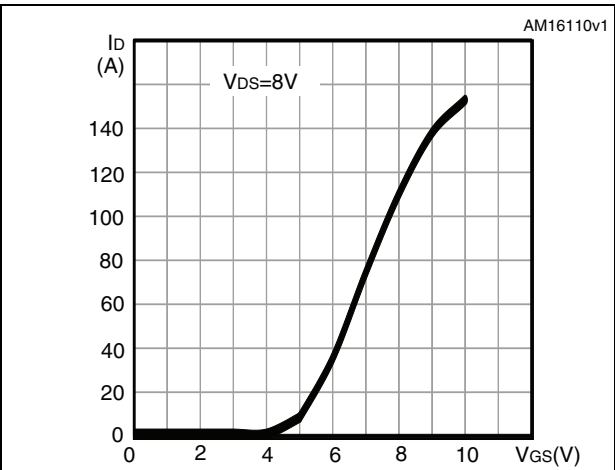


Figure 6. Gate charge vs gate-source voltage

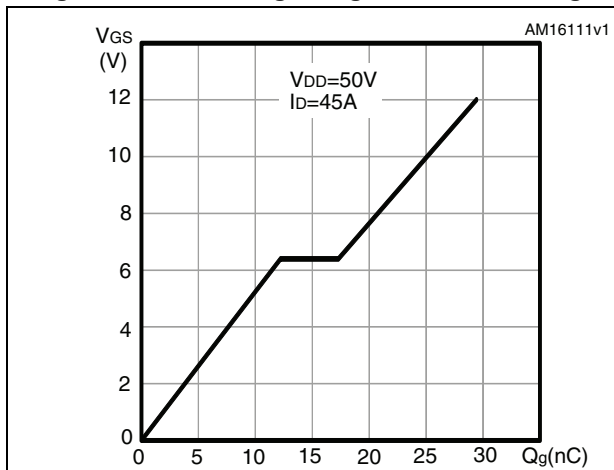


Figure 7. Static drain-source on-resistance

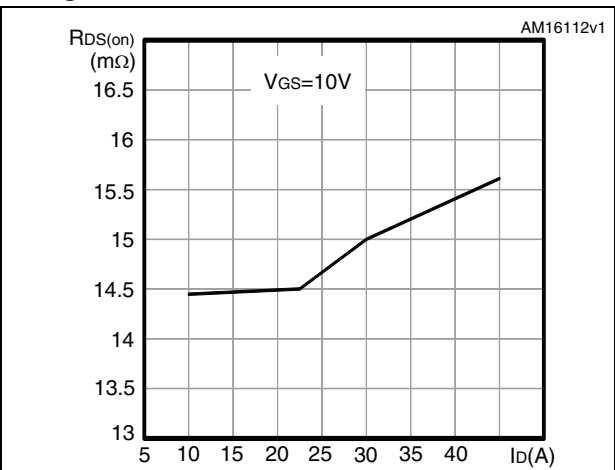


Figure 8. Capacitance variations

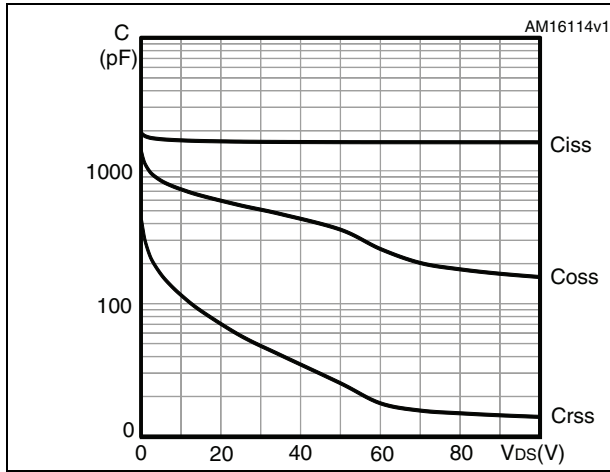


Figure 9. Normalized gate threshold voltage vs temperature

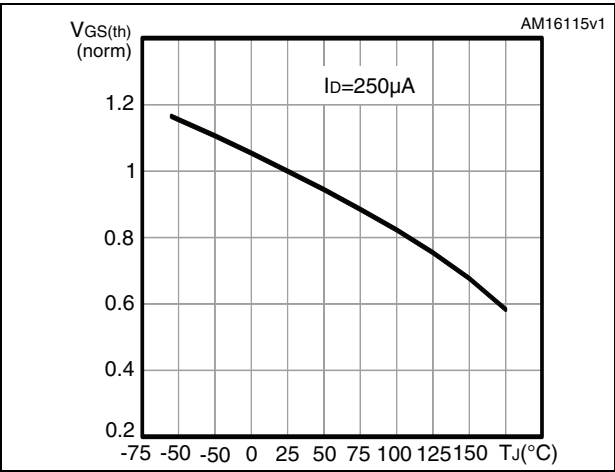


Figure 10. Normalized on-resistance vs temperature

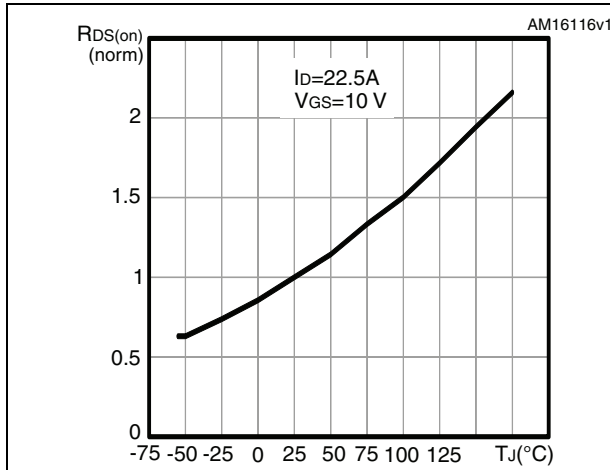


Figure 11. Source-drain diode forward characteristics

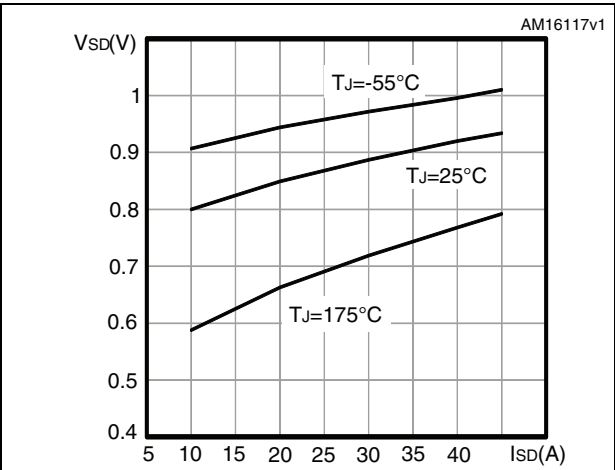
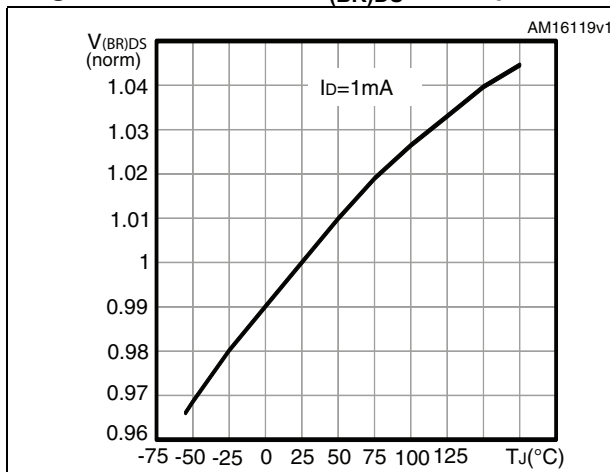
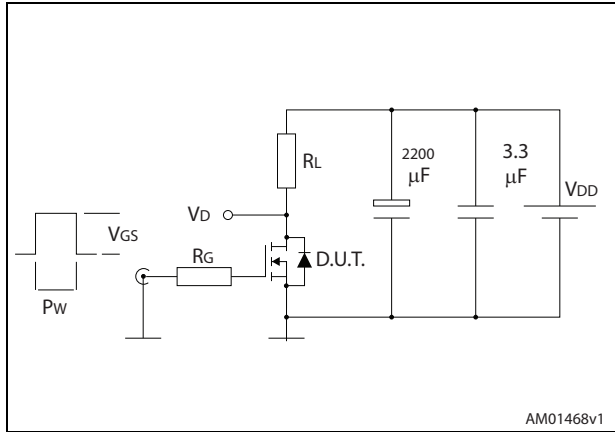


Figure 12. Normalized V(BR)DS vs temperature



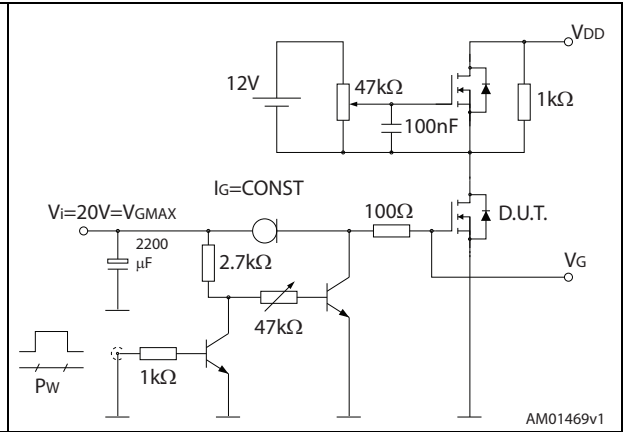
3 Test circuits

Figure 13. Switching times test circuit for resistive load



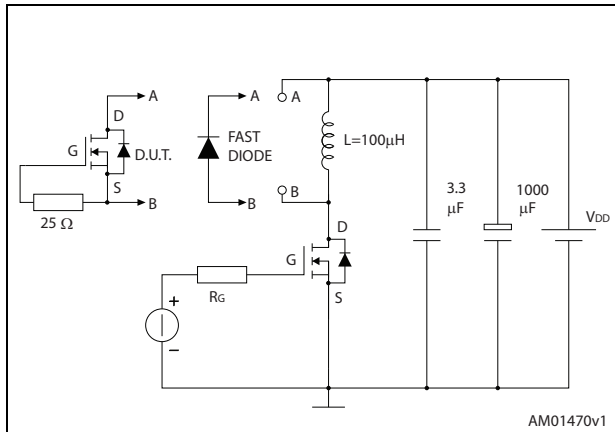
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Figure 14. Gate charge test circuit



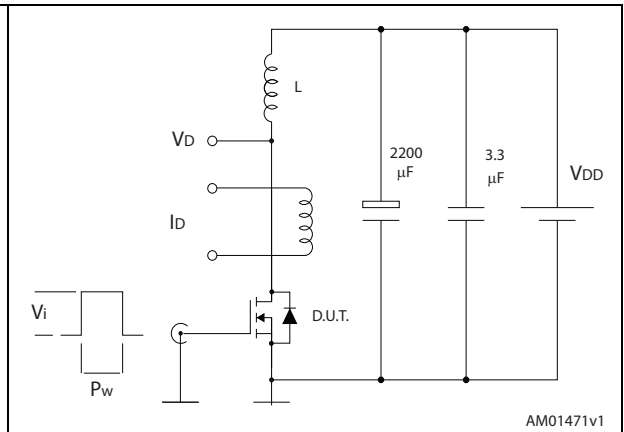
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Figure 15. Test circuit for inductive load switching and diode recovery times



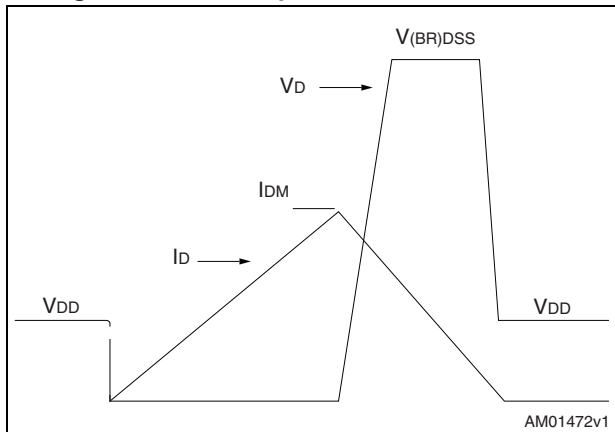
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Figure 16. Unclamped inductive load test circuit



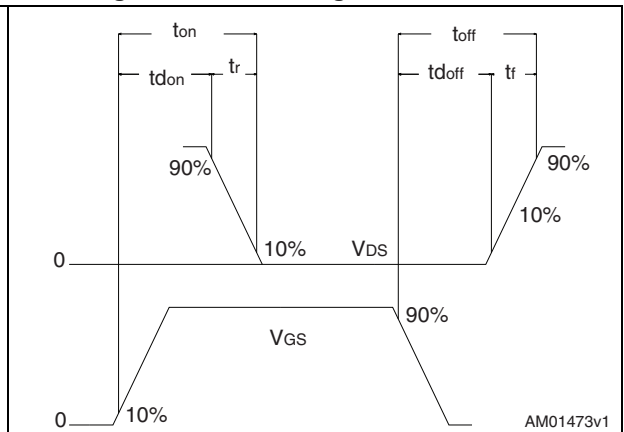
AM01471v1

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 DPAK (TO-252) package information

Figure 19. DPAK (TO-252) type A package outline

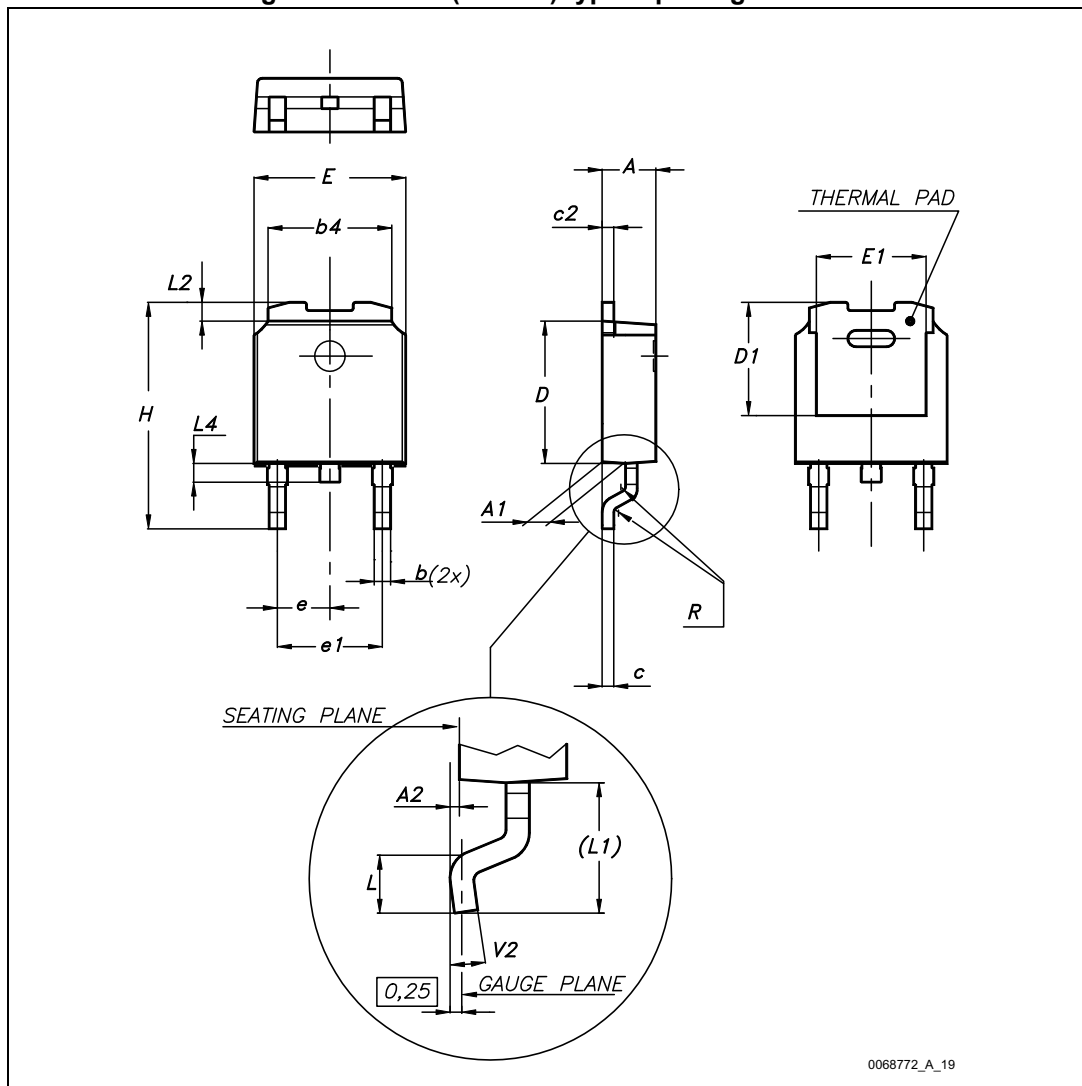
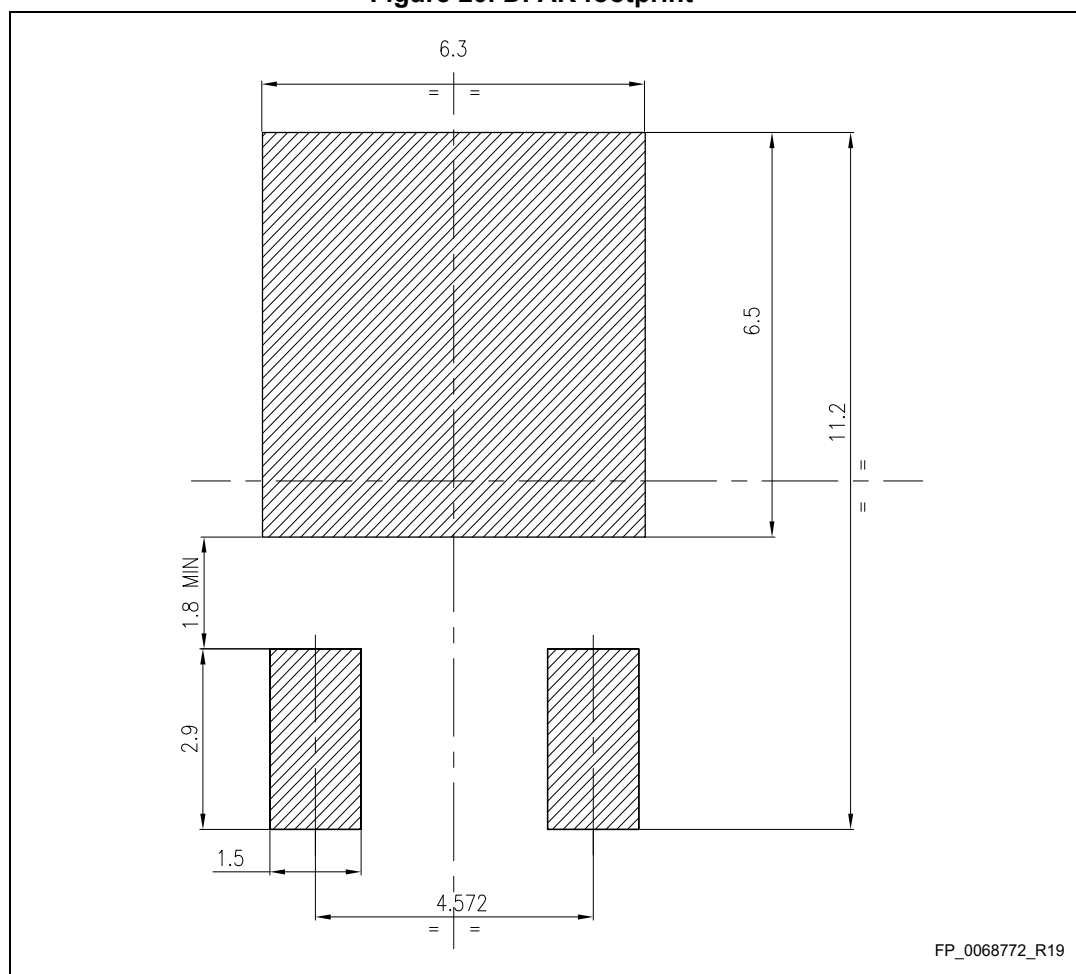


Table 8. DPAK (TO-252) type A mechanical data

| 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 | 2.16 | 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° |

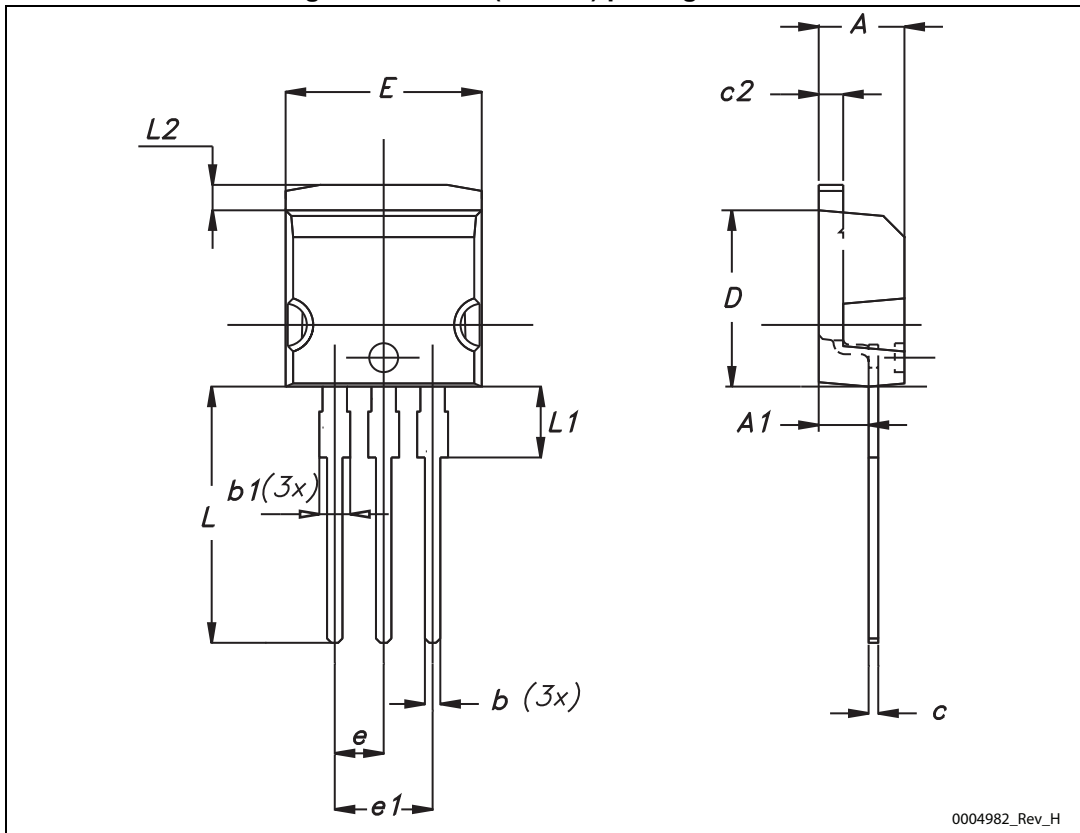
Figure 20. DPAK footprint (a)



a. All dimensions are in millimeters

4.2 I²PAK (TO-262) package information

Figure 21. I²PAK (TO-262) package outline



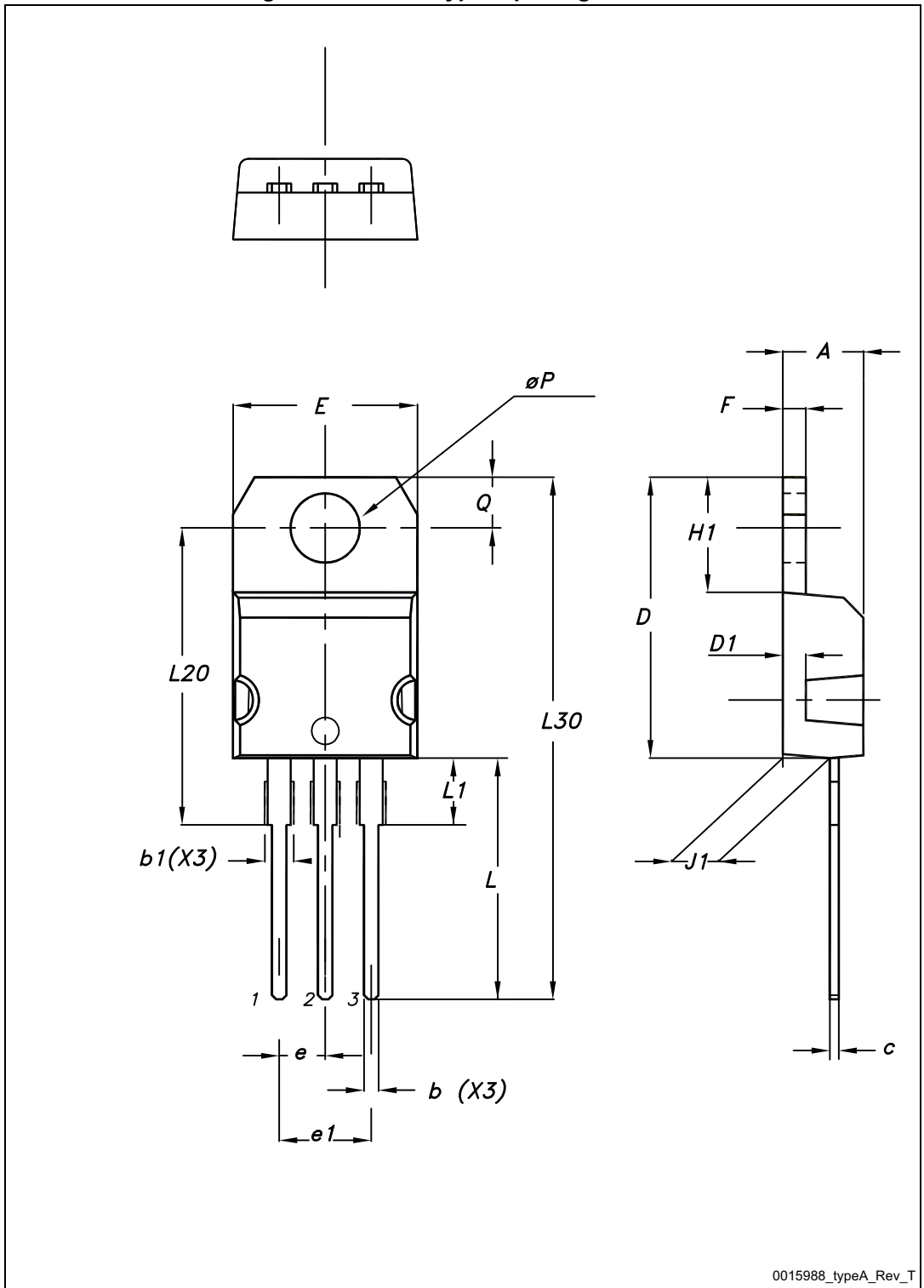
0004982_Rev_H

Table 9. I²PAK (TO-262) mechanical data

| Dim. | mm | | |
|------|------|------|-------|
| | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 |
| A1 | 2.40 | | 2.72 |
| b | 0.61 | | 0.88 |
| b1 | 1.14 | | 1.70 |
| c | 0.49 | | 0.70 |
| c2 | 1.23 | | 1.32 |
| D | 8.95 | | 9.35 |
| e | 2.40 | | 2.70 |
| e1 | 4.95 | | 5.15 |
| E | 10 | | 10.40 |
| L | 13 | | 14 |
| L1 | 3.50 | | 3.93 |
| L2 | 1.27 | | 1.40 |

4.3 TO-220 type A package information

Figure 22. TO-220 type A package outline



0015988_typeA_Rev_T

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 | | 1.70 |
| c | 0.48 | | 0.70 |
| D | 15.25 | | 15.75 |
| D1 | | 1.27 | |
| E | 10 | | 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 | | 14 |
| L1 | 3.50 | | 3.93 |
| L20 | | 16.40 | |
| L30 | | 28.90 | |
| ØP | 3.75 | | 3.85 |
| Q | 2.65 | | 2.95 |

5 Packing mechanical data

Figure 23. Tape

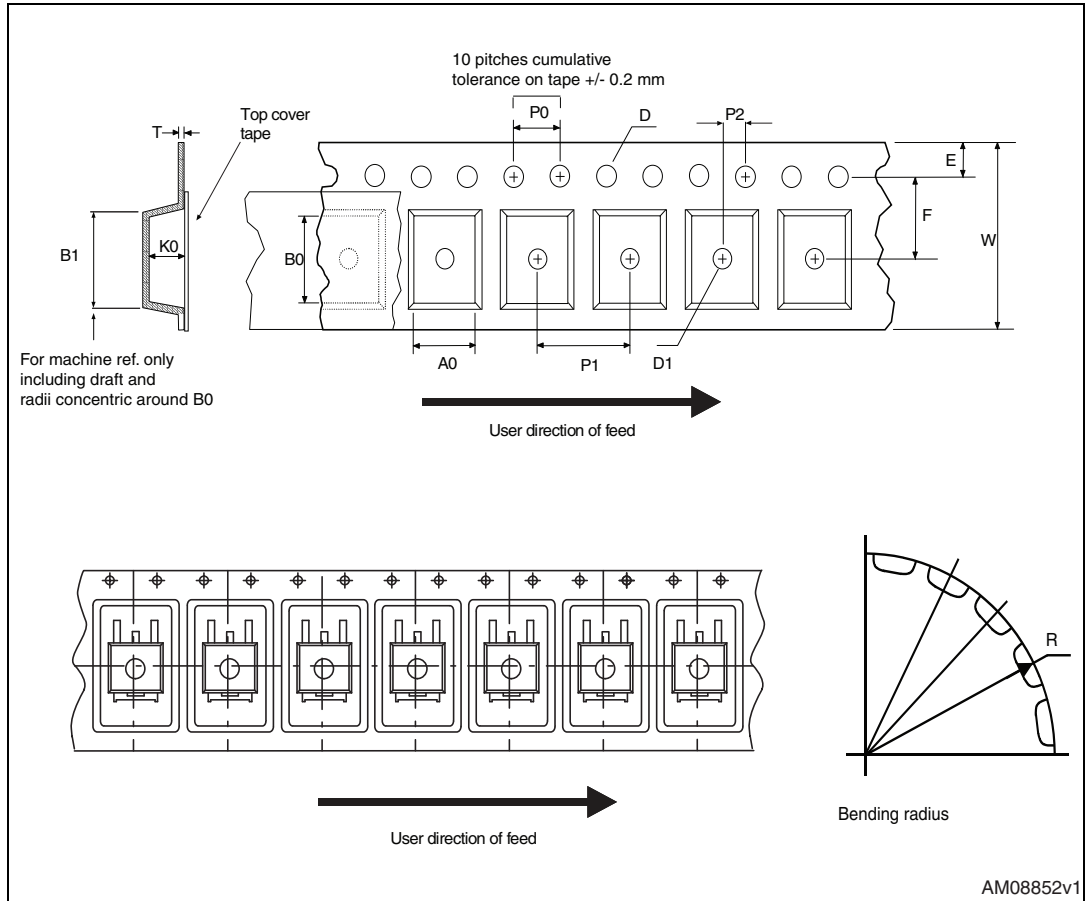


Figure 24. Reel

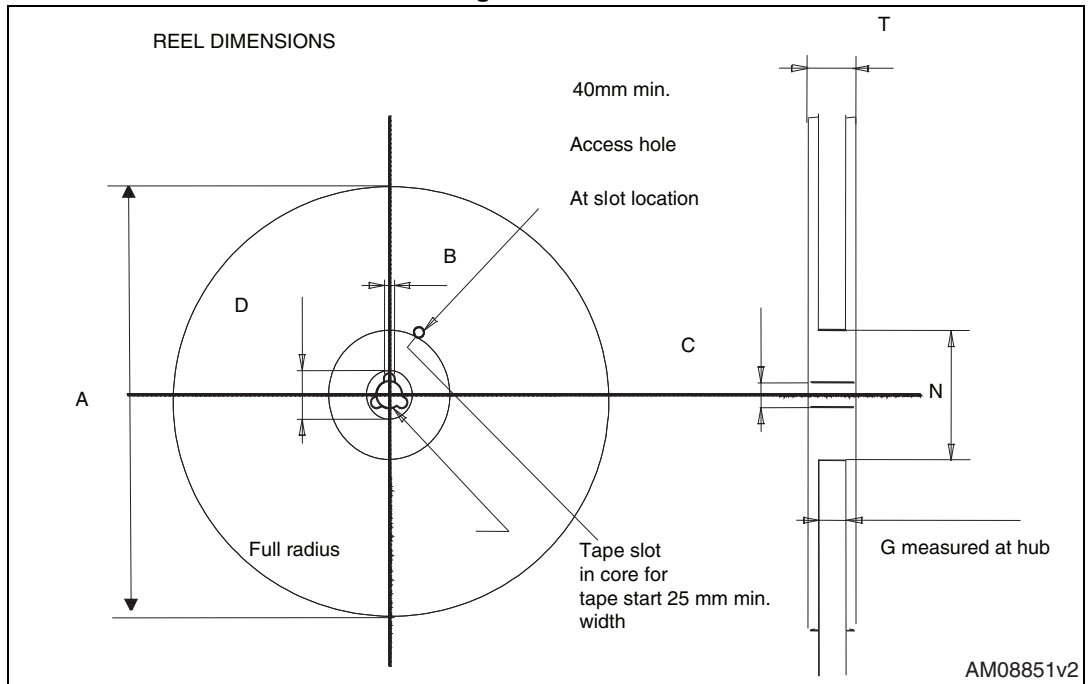


Table 11. DPAK (TO-252) tape and reel mechanical data

| 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 | | | |

6 Revision history

Table 12. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 10-Oct-2013 | 1 | First release. |
| 08-Sep-2015 | 2 | Updated title, features and description in cover page Updated Table 2.: Absolute maximum ratings Updated 4.1: DPAK (TO-252) package information Minor text changes. |

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