

N-channel 100 V, 0.0145  $\Omega$  typ., 45 A, STripFET™ F7  
Power MOSFETs in DPAK, I<sup>2</sup>PAK and TO-220 packages

Datasheet - production data

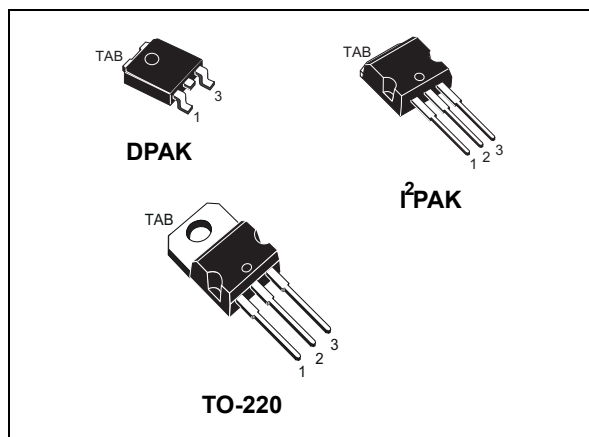
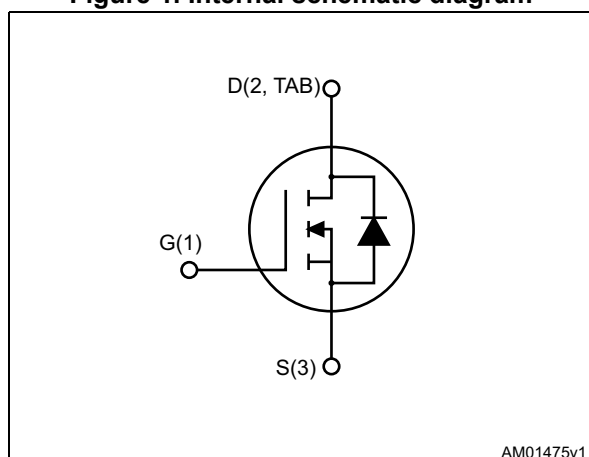


Figure 1. Internal schematic diagram



## Features

| Order code | V <sub>DS</sub> | R <sub>DS(on)</sub><br>max. | I <sub>D</sub> | P <sub>TOT</sub> |
|------------|-----------------|-----------------------------|----------------|------------------|
| STD45N10F7 | 100 V           | 0.018 $\Omega$              | 45 A           | 60 W             |
| STI45N10F7 |                 |                             |                |                  |
| STP45N10F7 |                 |                             |                |                  |

- Among the lowest R<sub>DS(on)</sub> on the market
- Excellent figure of merit (FoM)
- Low C<sub>rss</sub>/C<sub>iss</sub> 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 <sup>2</sup> 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                                               | $\pm 20$   | 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  $T_J = 25^{\circ}\text{C}$ ,  $I_d = 10\text{ A}$ ,  $V_{dd} = 50\text{ V}$

**Table 3. Thermal resistance**

| Symbol              | Parameter                           | Value |                              | Unit                 |
|---------------------|-------------------------------------|-------|------------------------------|----------------------|
|                     |                                     | DPAK  | TO-220<br>I <sup>2</sup> 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 1inch<sup>2</sup>, 2oz Cu,  $t < 10\text{ sec}$ .

## 2 Electrical characteristics

( $T_{CASE} = 25\text{ }^{\circ}\text{C}$  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        | $\mu\text{A}$ |
|               |                                                  | $V_{DS} = 100\text{ V}; T_C = 125\text{ }^{\circ}\text{C}$ |      |        | 100       | $\mu\text{A}$ |
| $I_{GSS}$     | Gate body leakage current ( $V_{DS} = 0$ )       | $V_{GS} = \pm 20\text{ V}$                                 |      |        | $\pm 100$ | 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     | $\Omega$      |

**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            | $V_{DD} = 50\text{ V}, I_D = 45\text{ A}$<br>$V_{GS} = 10\text{ V}$<br><a href="#">Figure 14</a> | -    | 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  | $V_{DD} = 50\text{ V}, I_D = 22.5\text{ A},$<br>$R_G = 4.7\text{ }\Omega, V_{GS} = 10\text{ V}$<br><a href="#">Figure 13</a> | -    | 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         | $I_{SD} = 45\text{ A}$ ,<br>$di/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_{DD} = 80\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$ | -    | 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  $\mu\text{s}$ , duty cycle 1.5%.

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

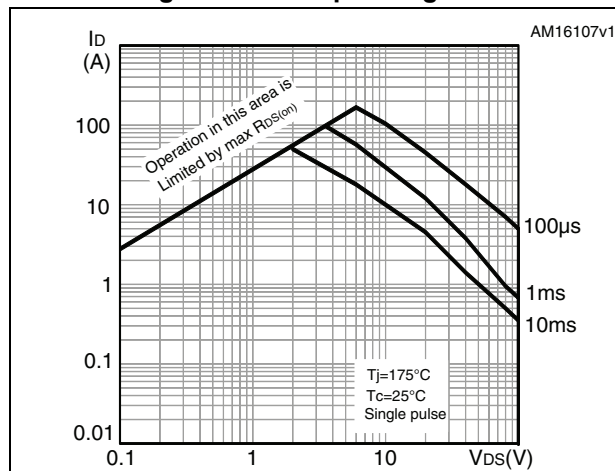


Figure 3. Thermal impedance

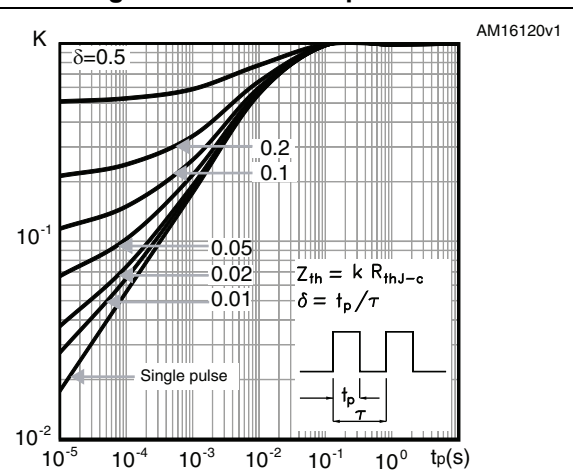


Figure 4. Output characteristics

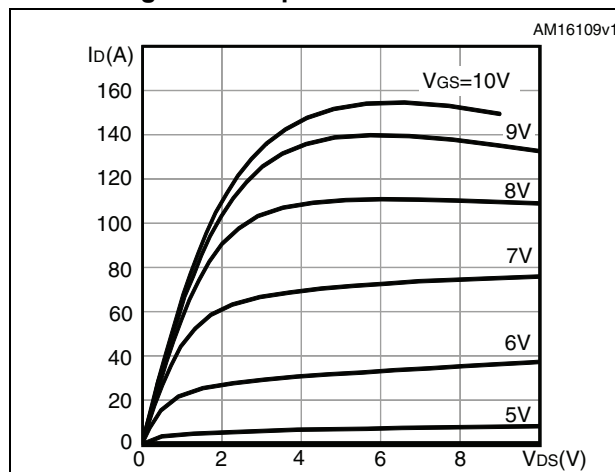


Figure 5. Transfer characteristics

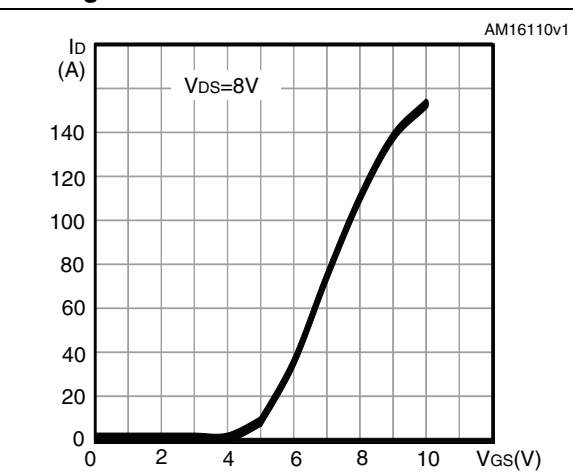


Figure 6. Gate charge vs gate-source voltage

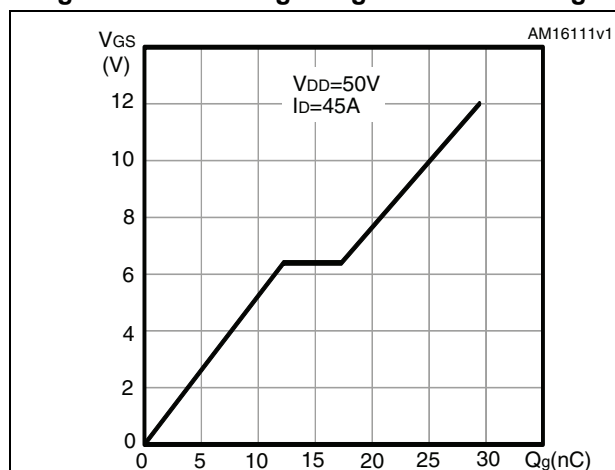


Figure 7. Static drain-source on-resistance

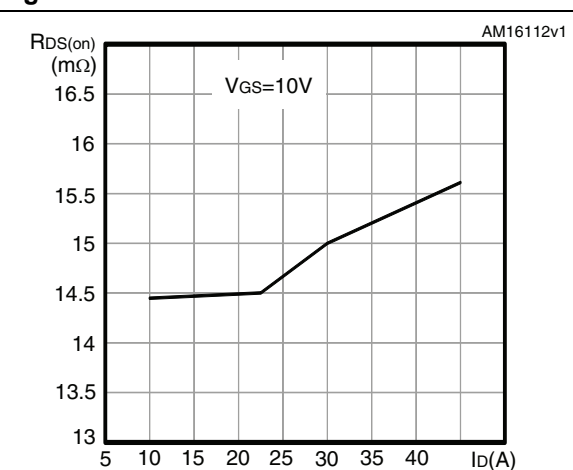


Figure 8. Capacitance variations

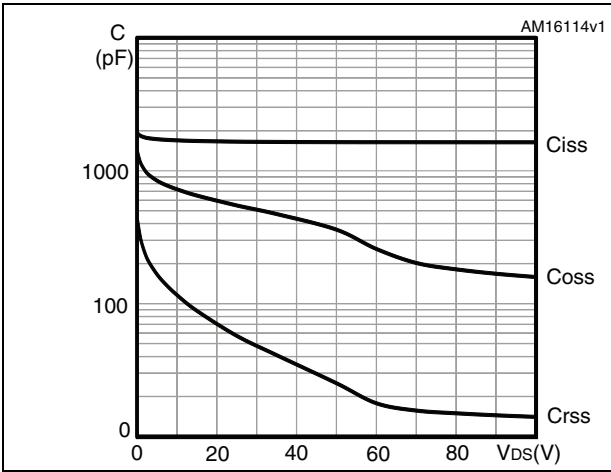


Figure 9. Normalized gate threshold voltage vs temperature

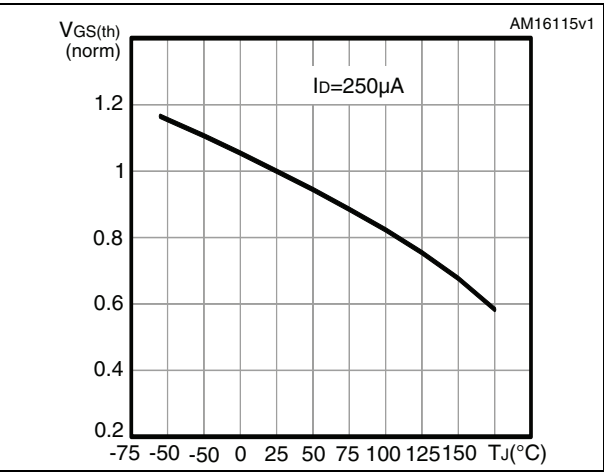


Figure 10. Normalized on-resistance vs temperature

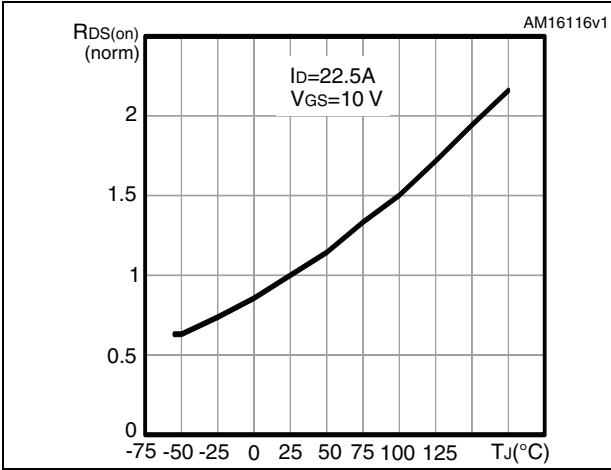


Figure 11. Source-drain diode forward characteristics

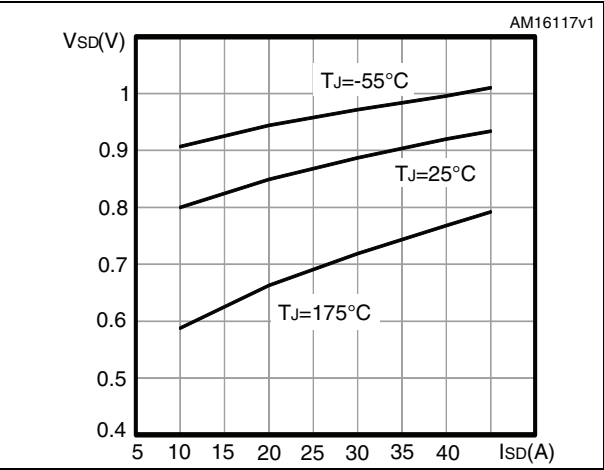
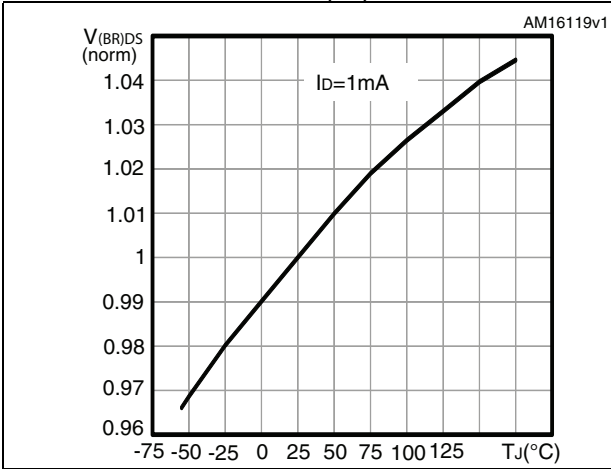
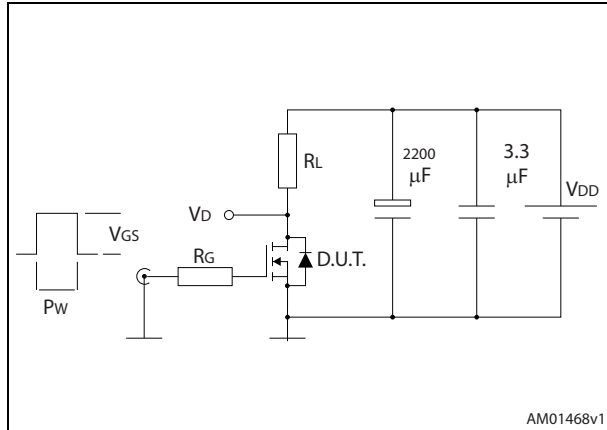


Figure 12. Normalized  $V_{(BR)DS}$  vs temperature

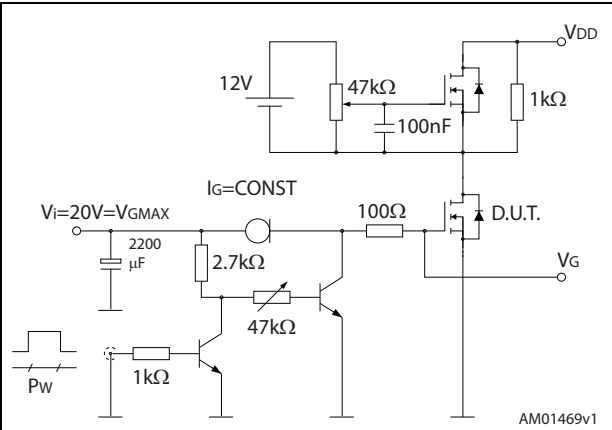


### 3 Test circuits

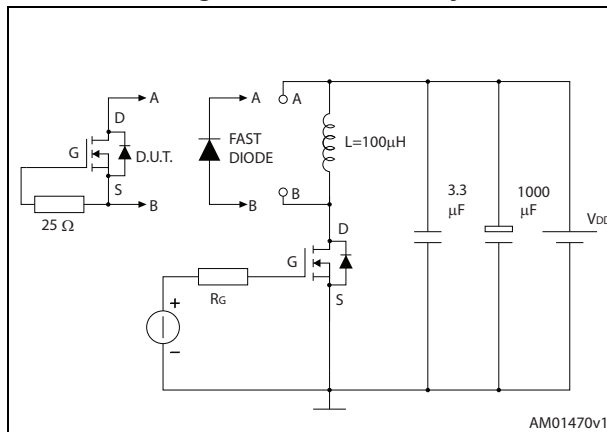
**Figure 13. Switching times test circuit for resistive load**



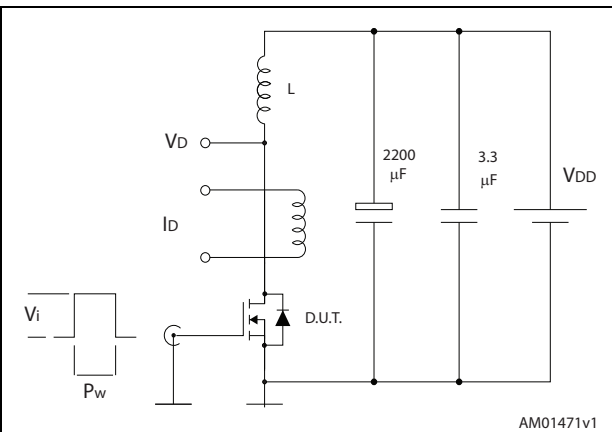
**Figure 14. Gate charge test circuit**



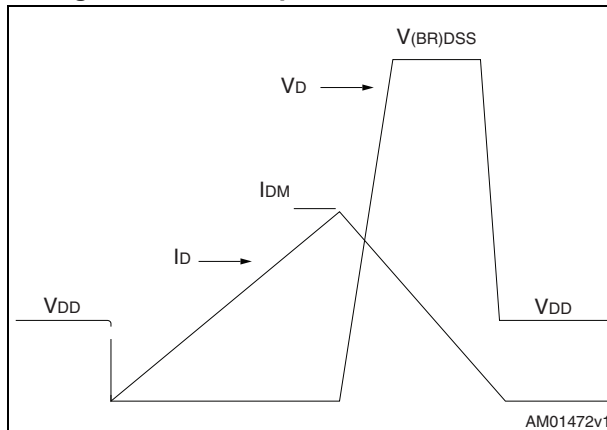
**Figure 15. Test circuit for inductive load switching and diode recovery times**



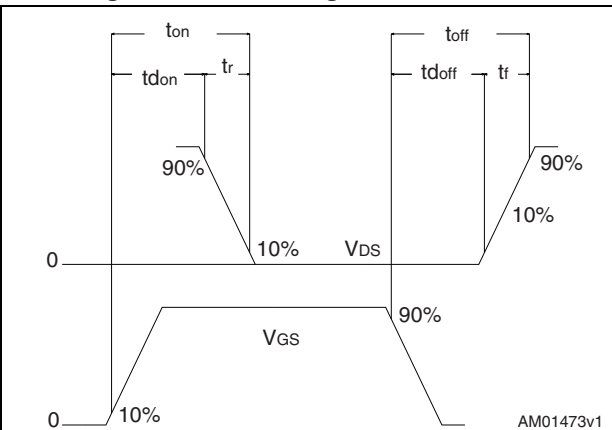
**Figure 16. Unclamped inductive load test circuit**



**Figure 17. Unclamped inductive waveform**



**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](http://www.st.com). ECOPACK® is an ST trademark.

### 4.1 DPAK (TO-252) package information

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

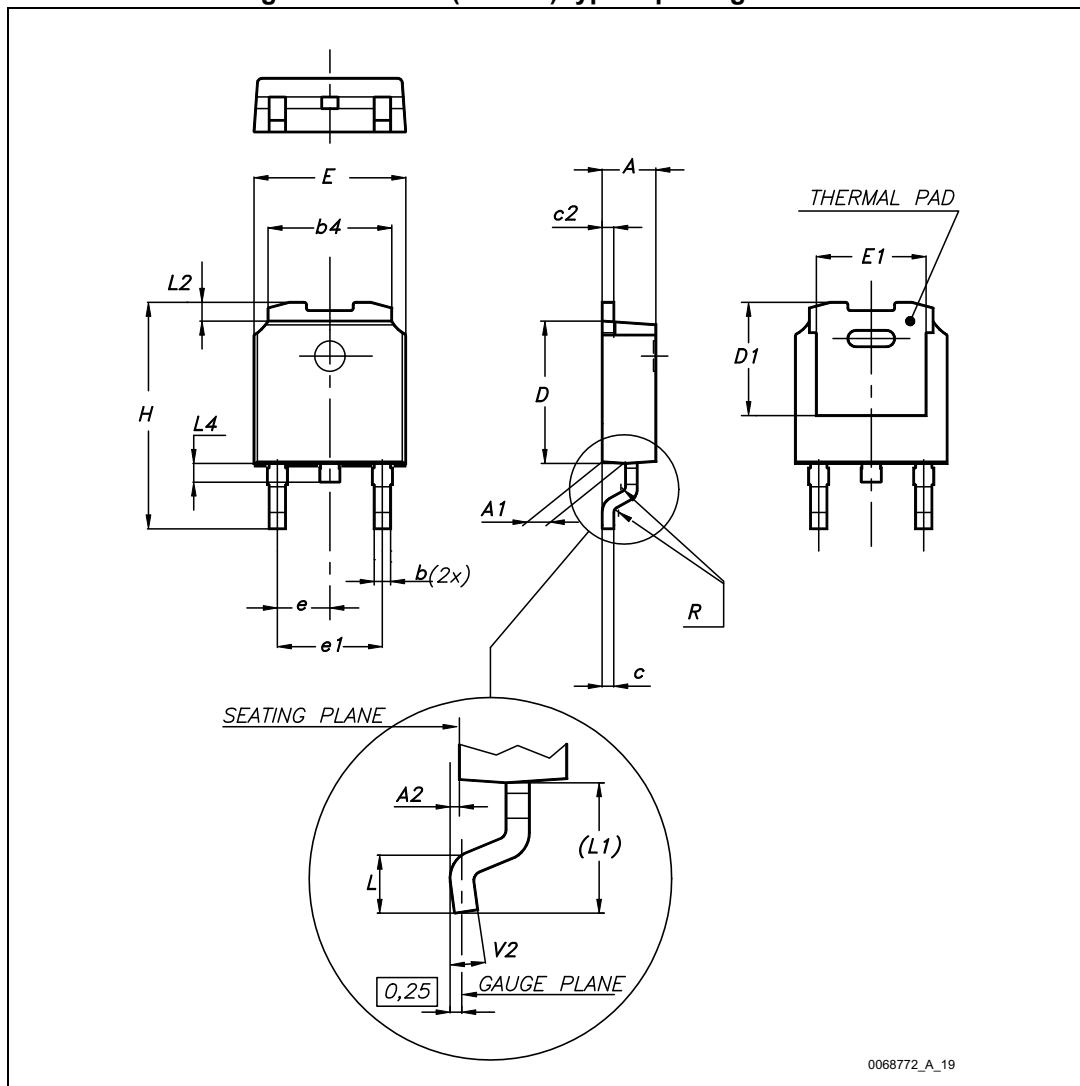
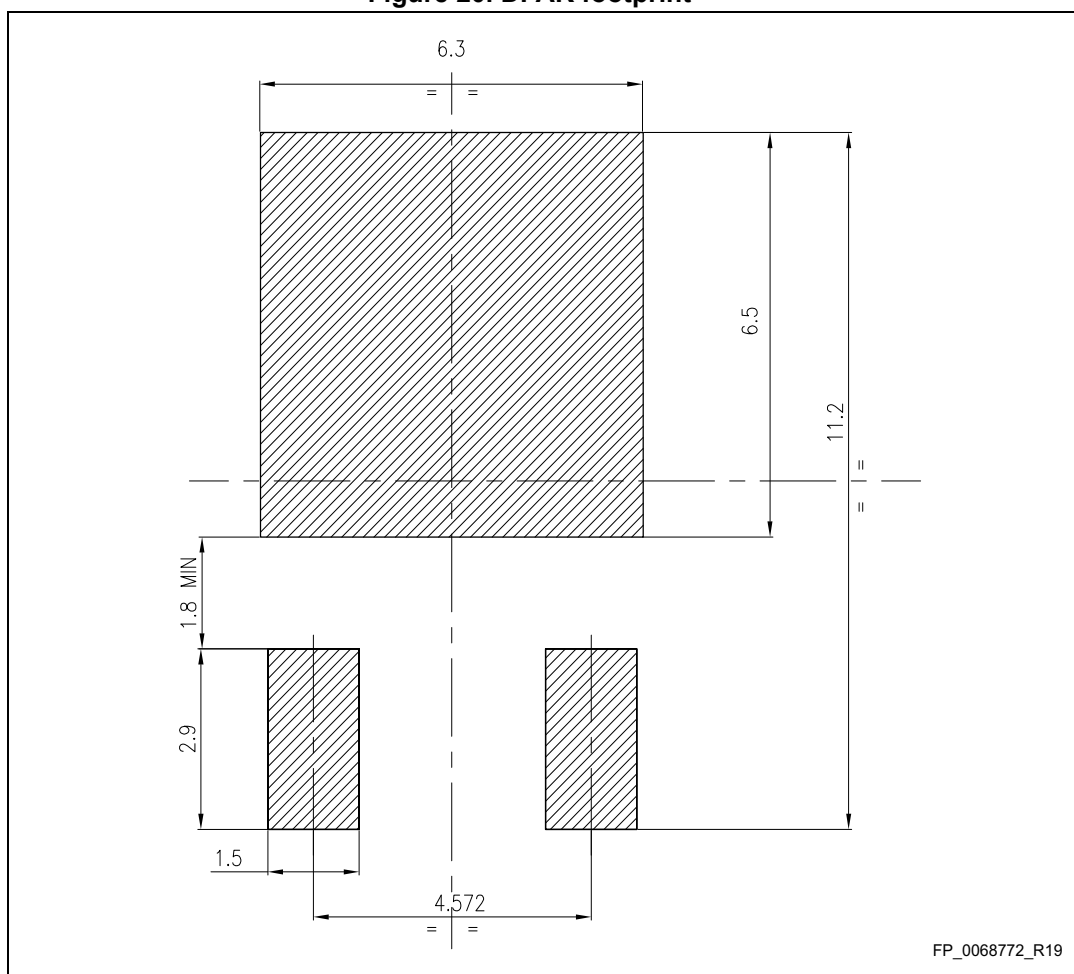


Table 8. DPAK (TO-252) type A mechanical data

| 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 I<sup>2</sup>PAK (TO-262) package information

Figure 21. I<sup>2</sup>PAK (TO-262) package outline

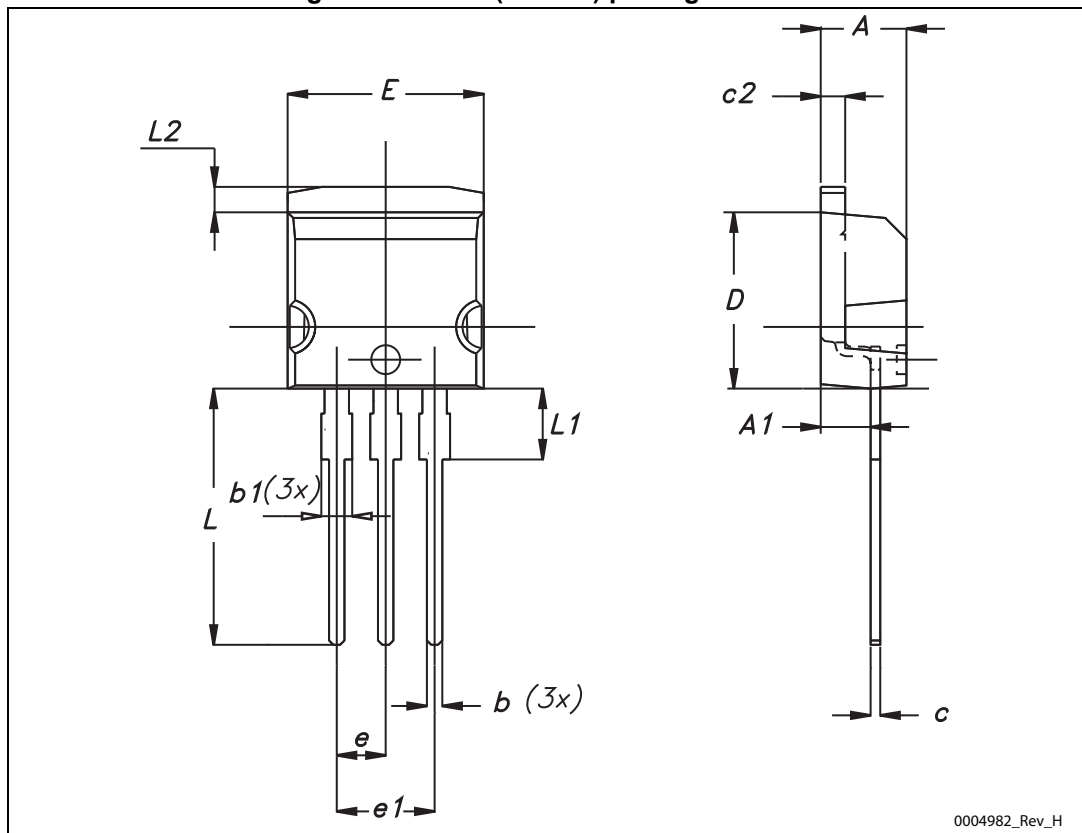


Table 9. I<sup>2</sup>PAK (TO-262) mechanical data

| 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

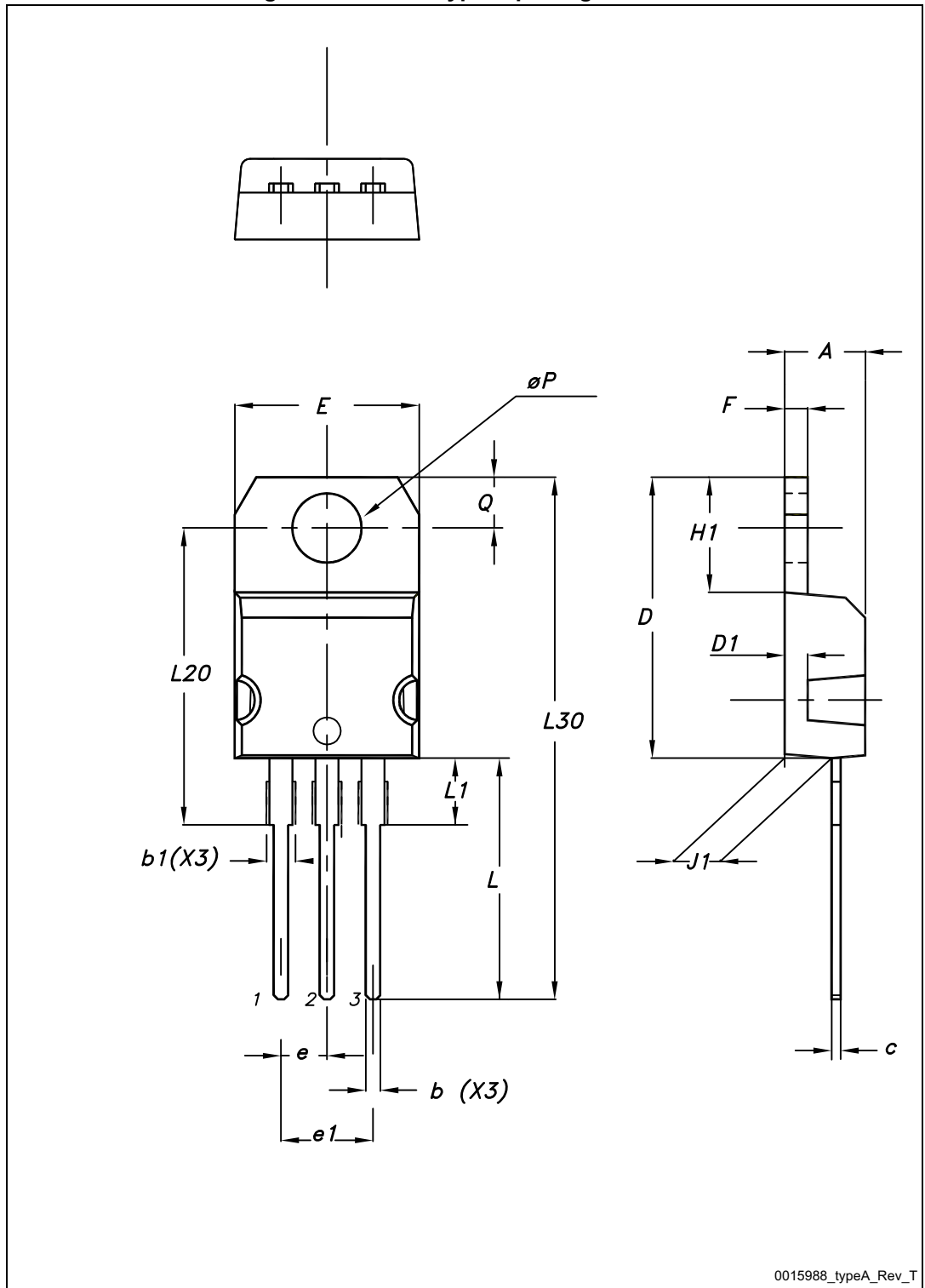


Table 10. TO-220 type A mechanical data

| 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

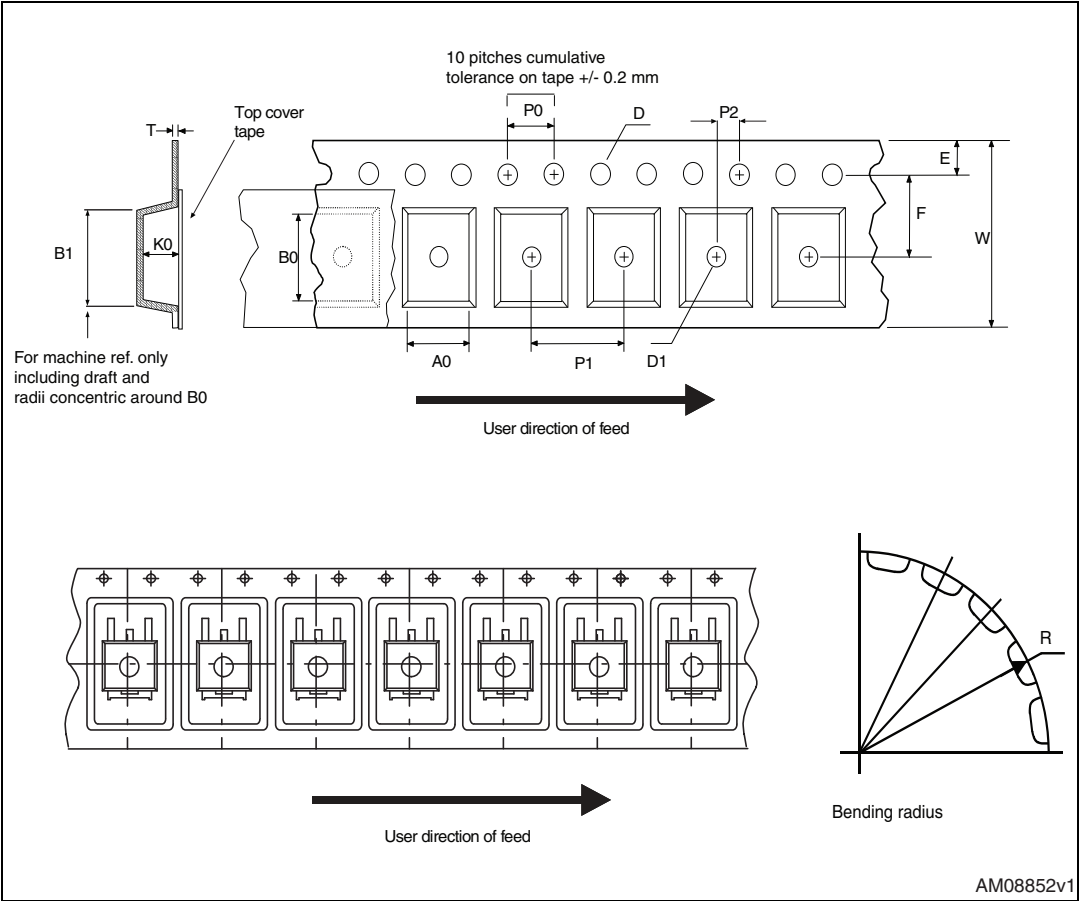




Figure 24. Reel

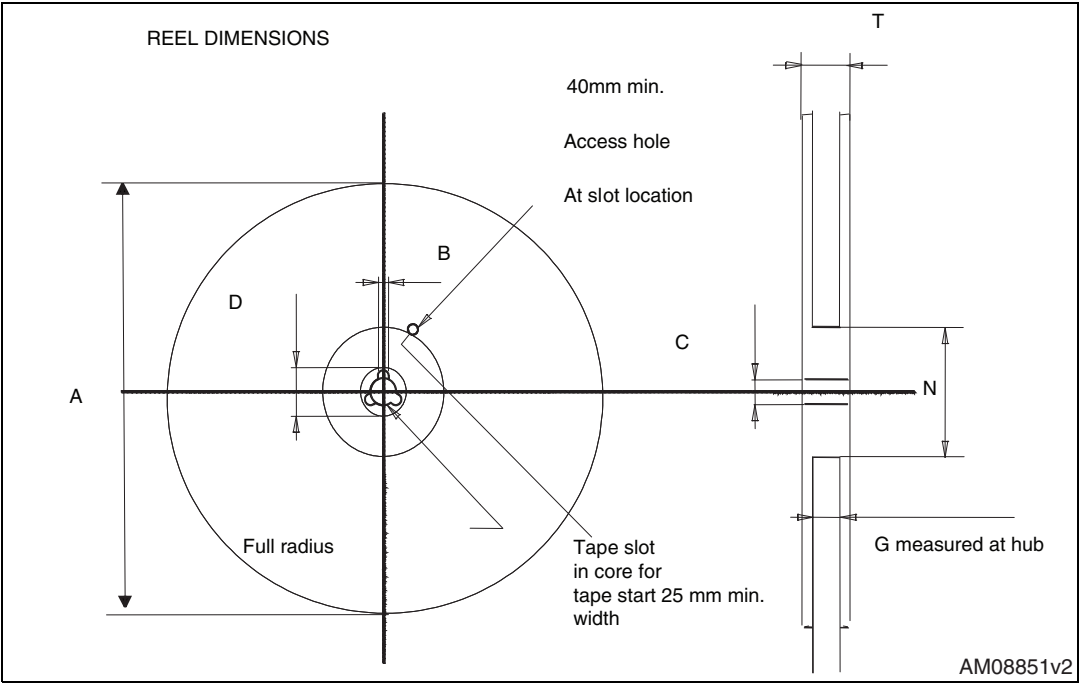


Table 11. DPAK (TO-252) tape and reel mechanical data

| 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<br>Updated <a href="#">Table 2.: Absolute maximum ratings</a><br>Updated <a href="#">4.1: DPAK (TO-252) package information</a><br>Minor text changes. |

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