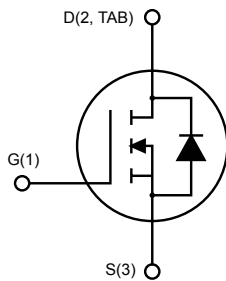
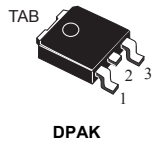


## N-channel 200 V, 290 mΩ typ., 7 A, STripFET™ Power MOSFET in a DPAK package



AM01475v1\_noZen



### Product status link

[STD7NS20T4](#)

### Product summary

|            |               |
|------------|---------------|
| Order code | STD7NS20T4    |
| Marking    | D7NS20        |
| Package    | DPAK          |
| Packing    | Tape and reel |

### Features

| Order code | V <sub>DS</sub> | R <sub>DS(on)</sub> max. | I <sub>D</sub> |
|------------|-----------------|--------------------------|----------------|
| STD7NS20T4 | 200 V           | 400 mΩ                   | 7 A            |

- Extremely high dv/dt capability
- Very low intrinsic capacitance
- Gate charge minimized

### Applications

- Switching applications

### Description

This Power MOSFET series realized with STMicroelectronics unique STripFET™ process has specifically been designed to minimize input capacitance and gate charge. It is therefore suitable as primary switch in advanced high-efficiency isolated DC-DC converters.

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol         | Parameter   | Value      | Unit             |
|----------------|---|------------|------------------|
| $V_{DSS}$      | Drain-source voltage ( $V_{GS} = 0\text{ V}$ )                  | 200        | V                |
| $V_{DGR}$      | Drain-gate voltage ( $R_{GS} = 20\text{ k}\Omega$ )             | 200        | V                |
| $V_{GS}$       | Gate-source voltage   | $\pm 20$   | V                |
| $I_D$          | Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$  | 7          | A                |
|                | Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$ | 4.4        | A                |
| $I_{DM}^{(1)}$ | Drain current (pulsed)  | 28         | A                |
| $P_{TOT}$      | Total power dissipation at $T_C = 25\text{ }^\circ\text{C}$     | 86         | W                |
| $E_{AS}^{(2)}$ | Single pulse avalanche energy                                   | 110        | mJ               |
| $dv/dt^{(3)}$  | Drain-body diode dynamic $dv/dt$ ruggedness                     | 5.8        | V/ns             |
| $T_{stg}$      | Storage temperature range                                       | -65 to 175 | $^\circ\text{C}$ |
| $T_J$          | Operating junction temperature range                            |            |                  |

1. Pulse width is limited by safe operating area.
2. Starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $I_D = 4.5\text{ A}$
3.  $I_{SD} = 7\text{ A}$ ,  $di/dt = 520\text{ A}/\mu\text{s}$ ,  $V_{DD} = 50\text{ V}$ ,  $T_J < T_{Jmax}$

**Table 2. Thermal data**

| Symbol              | Parameter                        | Value | Unit                      |
|---------------------|----------------------------------|-------|---------------------------|
| $R_{thj-case}$      | Thermal resistance junction-case | 1.74  | $^\circ\text{C}/\text{W}$ |
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb  | 50    | $^\circ\text{C}/\text{W}$ |

1. When mounted on an 1-inch<sup>2</sup> FR-4, 2 Oz copper board.

## 2 Electrical characteristics

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

**Table 3. On/off states**

| Symbol        | Parameter                         | Test conditions  | Min. | Typ. | Max.      | Unit          |
|---------------|-----------------------------------|--|------|------|-----------|---------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage    | $I_D = 250\text{ }\mu\text{A}$ , $V_{GS} = 0\text{ V}$                           | 200  |      |           | V             |
| $I_{DSS}$     | Zero gate voltage drain current   | $V_{DS} = 200\text{ V}$ , $V_{GS} = 0\text{ V}$                                  |      |      | 1         | $\mu\text{A}$ |
|               |                                   | $V_{DS} = 200\text{ V}$ , $V_{GS} = 0\text{ V}$ ,<br>$T_C = 125\text{ °C}^{(1)}$ |      |      | 100       | $\mu\text{A}$ |
| $I_{GSS}$     | Gate body leakage current         | $V_{GS} = \pm 20\text{ V}$ , $V_{DS} = 0\text{ V}$                               |      |      | $\pm 100$ | nA            |
| $V_{GS(th)}$  | Gate threshold voltage            | $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$                               | 2    | 3    | 4         | V             |
| $R_{DS(on)}$  | Static drain-source on-resistance | $V_{GS} = 10\text{ V}$ , $I_D = 3.5\text{ A}$                                    |      | 290  | 400       | m $\Omega$    |

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

**Table 4. Dynamic**

| Symbol    | Parameter                    | Test conditions  | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|--|------|------|------|------|
| $C_{iss}$ | Input capacitance            | $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ ,<br>$V_{GS} = 0\text{ V}$   | -    | 370  | -    | pF   |
| $C_{oss}$ | Output capacitance           |  | -    | 77   | -    | pF   |
| $C_{rss}$ | Reverse transfer capacitance |  | -    | 14   | -    | pF   |
| $Q_g$     | Total gate charge            | $V_{DD} = 160\text{ V}$ , $I_D = 7\text{ A}$<br>$V_{GS} = 0\text{ to }10\text{ V}$<br>(see Figure 13. Test circuit for gate charge behavior) | -    | 11.6 | -    | nC   |
| $Q_{gs}$  | Gate-source charge           |  | -    | 2.2  | -    | nC   |
| $Q_{gd}$  | Gate-drain charge            |  | -    | 5.4  | -    | nC   |

**Table 5. Switching times**

| Symbol      | Parameter          | Test conditions   | Min. | Typ. | Max. | Unit |
|-------------|--------------------|---|------|------|------|------|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD} = 100\text{ V}$ , $I_D = 4.5\text{ A}$ ,<br>$R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$<br>(see Figure 12. Test circuit for resistive load switching times and Figure 17. Switching time waveform) | -    | 5.6  | -    | ns   |
| $t_r$       | Rise time          |   | -    | 2.6  | -    | ns   |

**Table 6. Source-drain diode**

| Symbol         | Parameter                | Test conditions  | Min. | Typ.  | Max. | Unit |
|----------------|--------------------------|--|------|-------|------|------|
| $V_{SD}^{(1)}$ | Forward on voltage       | $I_{SD} = 7\text{ A}$ , $V_{GS} = 0\text{ V}$  | -    |       | 1.5  | V    |
| $t_{rr}$       | Reverse recovery time    | $I_{SD} = 7\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_{DD} = 50\text{ V}$<br>(see <a href="#">Figure 14. Test circuit for inductive load switching and diode recovery times</a> ) | -    | 118.5 |      | ns   |
| $Q_{rr}$       | Reverse recovery charge  |  | -    | 393   |      | nC   |
| $I_{RRM}$      | Reverse recovery current |  | -    | 6.6   |      | A    |

1. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

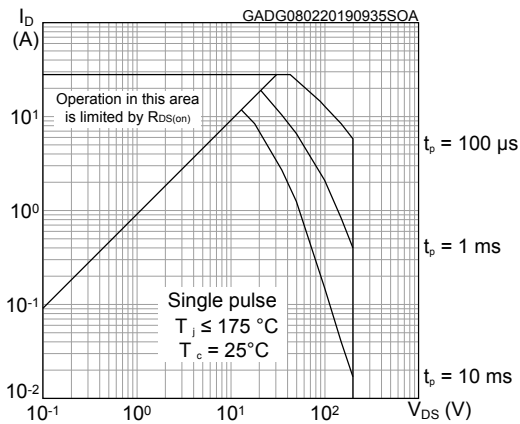


Figure 2. Thermal impedance

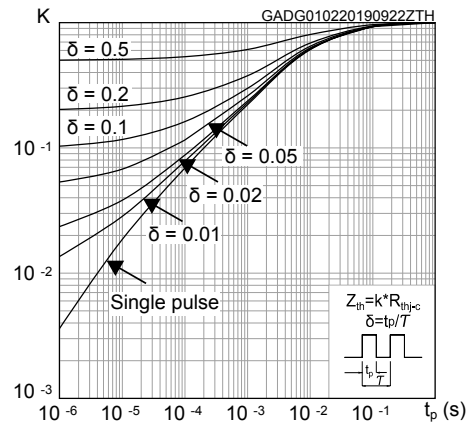


Figure 3. Output characteristics

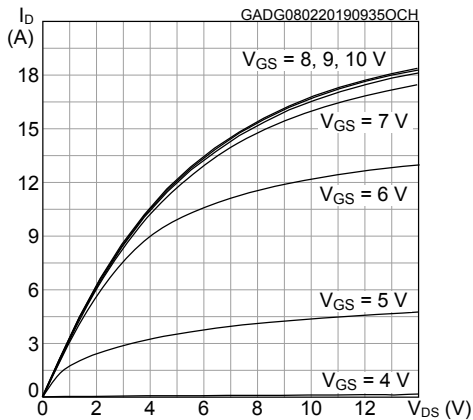


Figure 4. Transfer characteristics

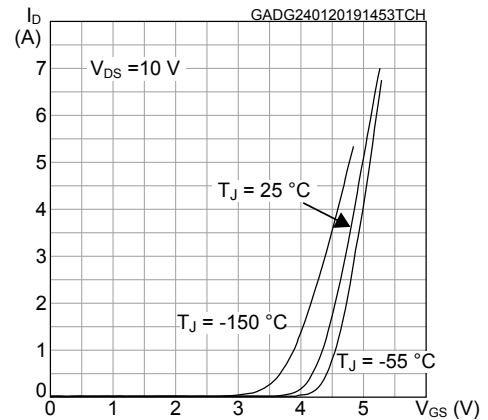


Figure 5. Gate charge vs gate-source voltage

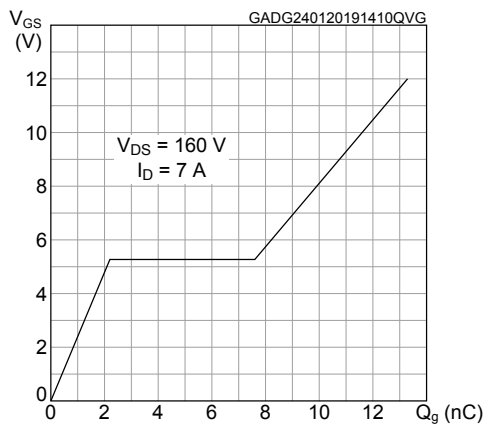


Figure 6. Static drain-source on-resistance

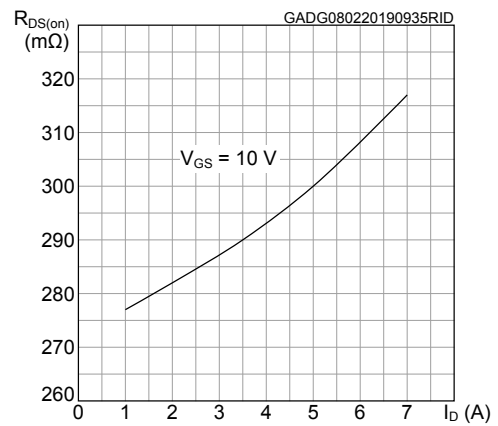


Figure 7. Capacitance variations

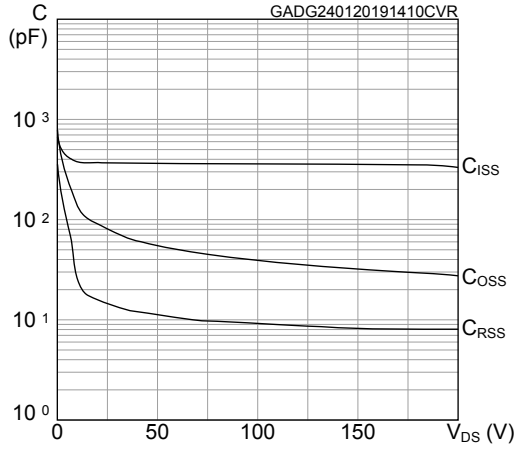


Figure 8. Normalized gate threshold voltage vs temperature

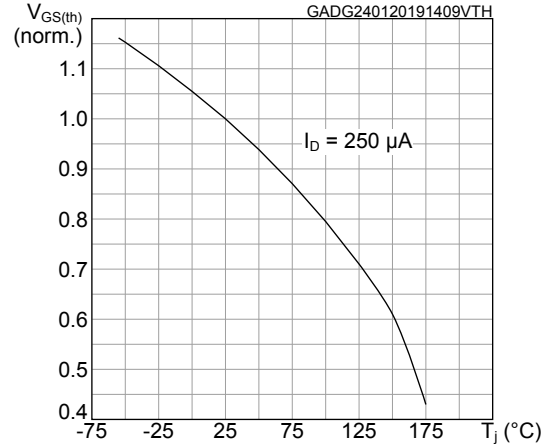


Figure 9. Normalized on-resistance vs temperature

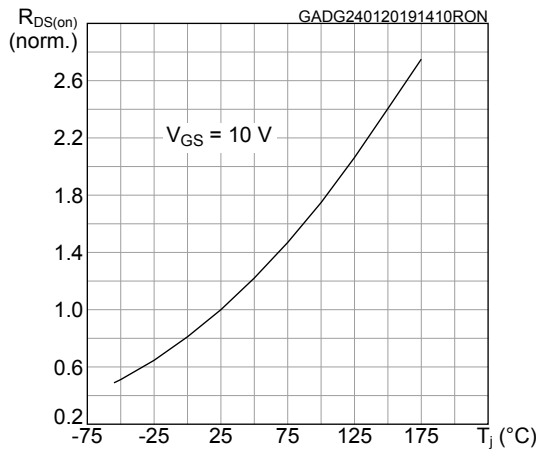


Figure 10. Normalized  $V_{(BR)DSS}$  vs temperature

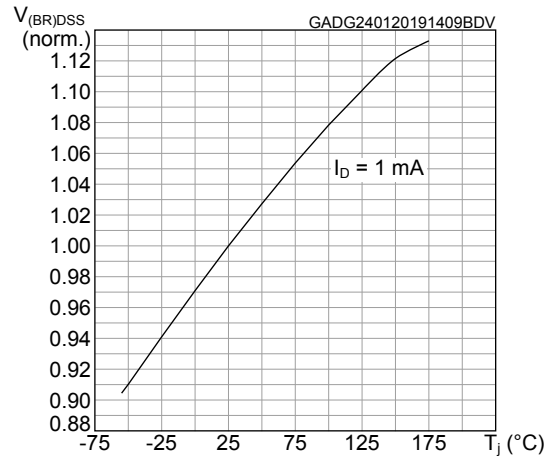
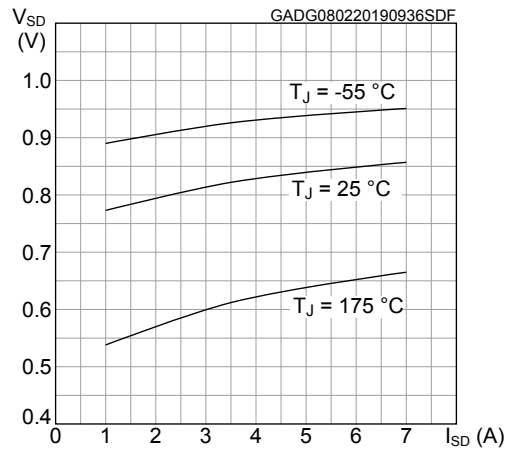
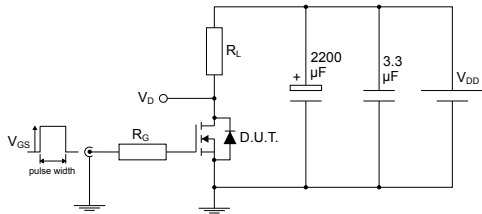


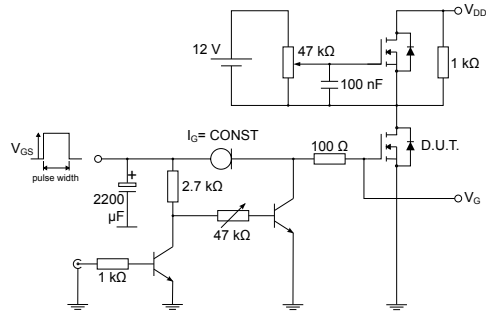
Figure 11. Source-drain diode forward characteristics



### 3 Test circuits

**Figure 12. Test circuit for resistive load switching times**


AM01468v1

**Figure 13. Test circuit for gate charge behavior**


AM01469v1

**Figure 14. Test circuit for inductive load switching and diode recovery times**

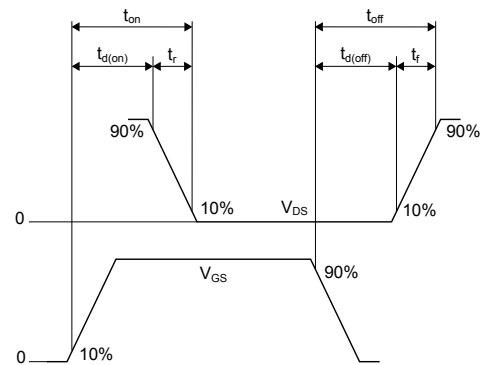

AM01470v1

**Figure 15. Unclamped inductive load test circuit**


AM01471v1

**Figure 16. Unclamped inductive waveform**


AM01472v1

**Figure 17. Switching time waveform**


AM01473v1

## 4 Package information

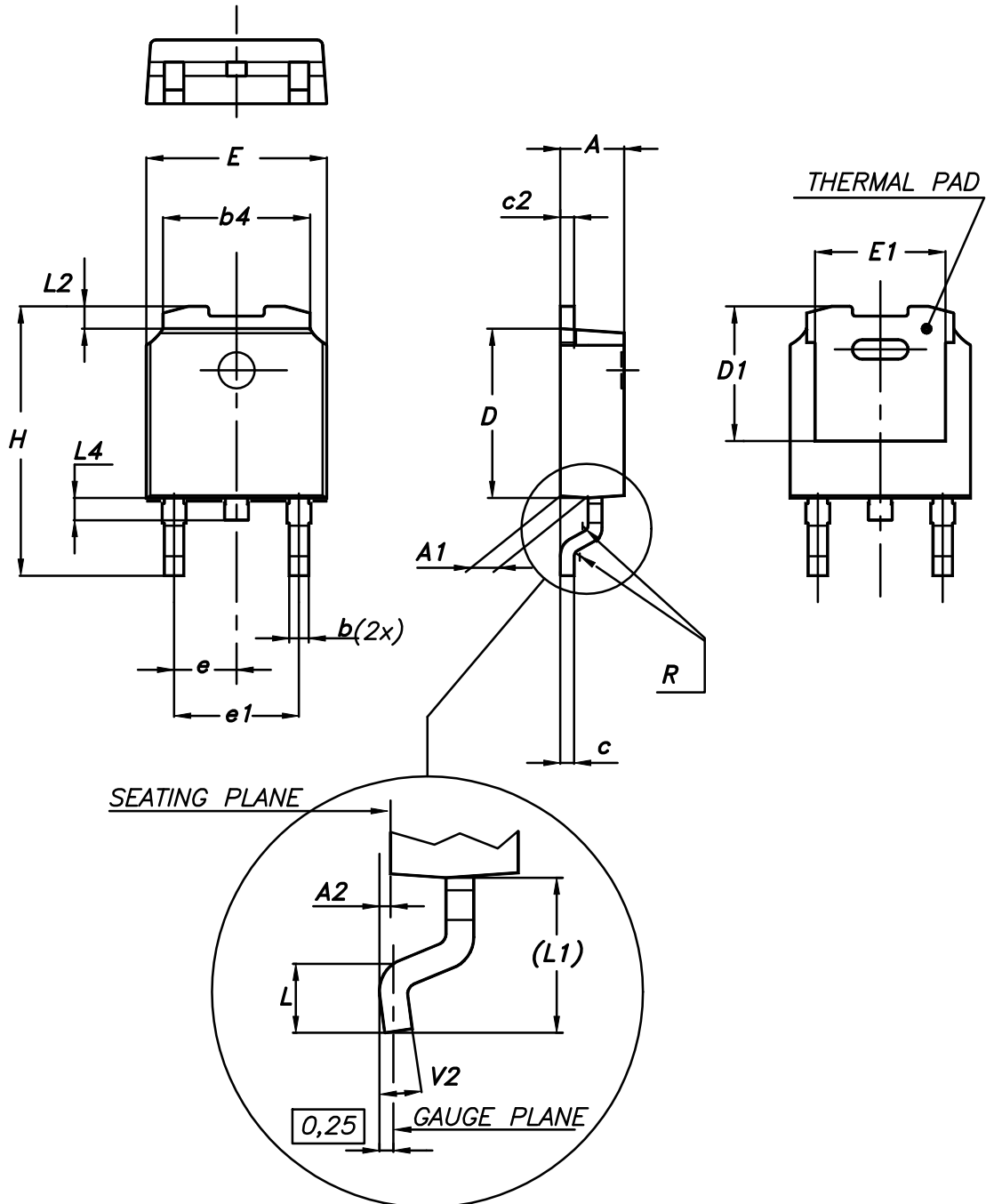
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In order to meet environmental requirements, ST offers these devices in different grades of **ECOPACK®** packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK® is an ST trademark.



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

Figure 18. DPAK (TO-252) type A package outline

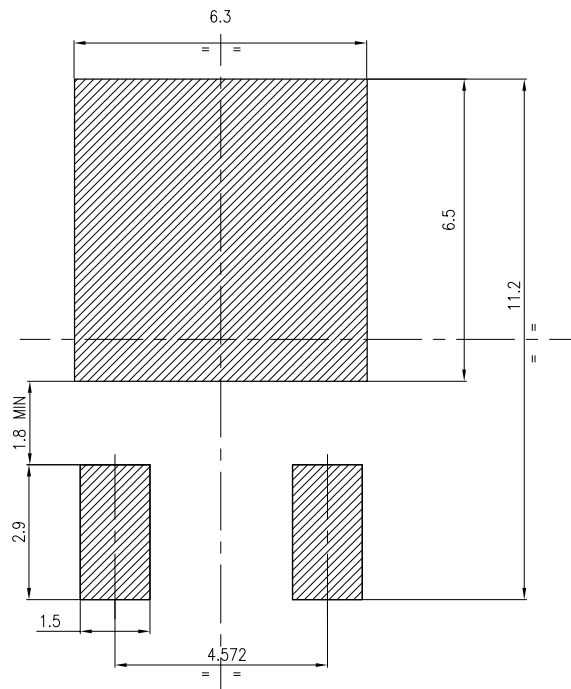


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**Table 7. DPAK (TO-252) type A mechanical data**

| 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°    |

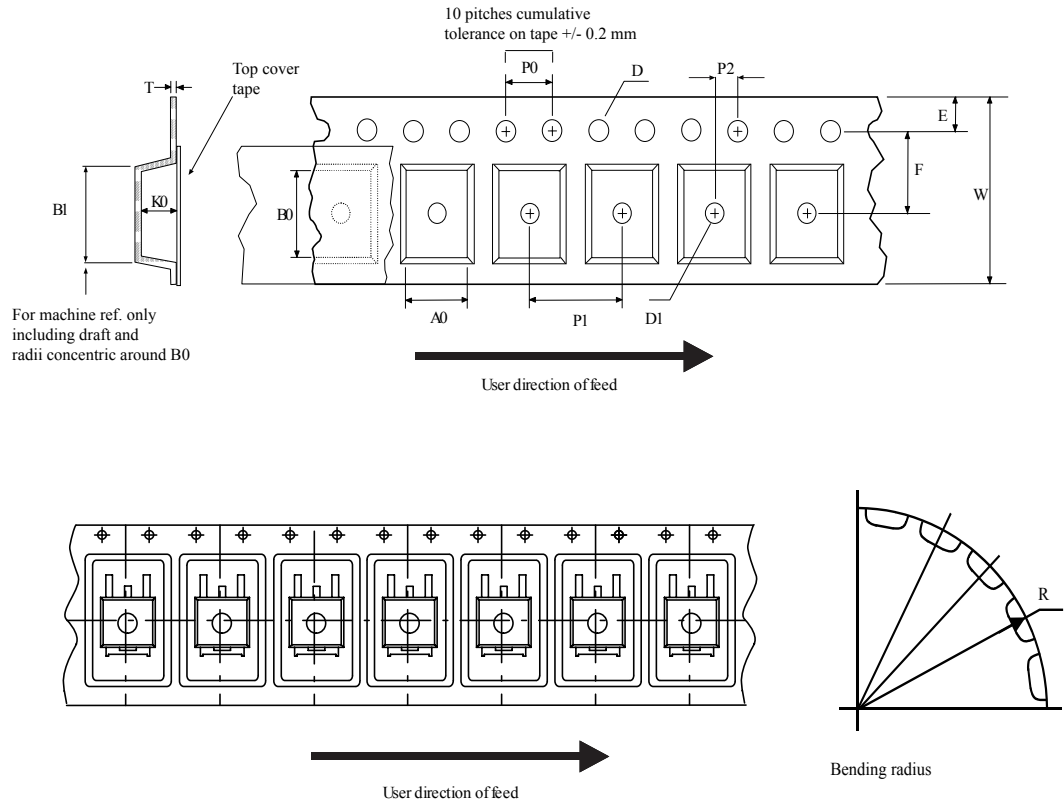
Figure 19. DPAK (TO-252) type A recommended footprint (dimensions are in mm)



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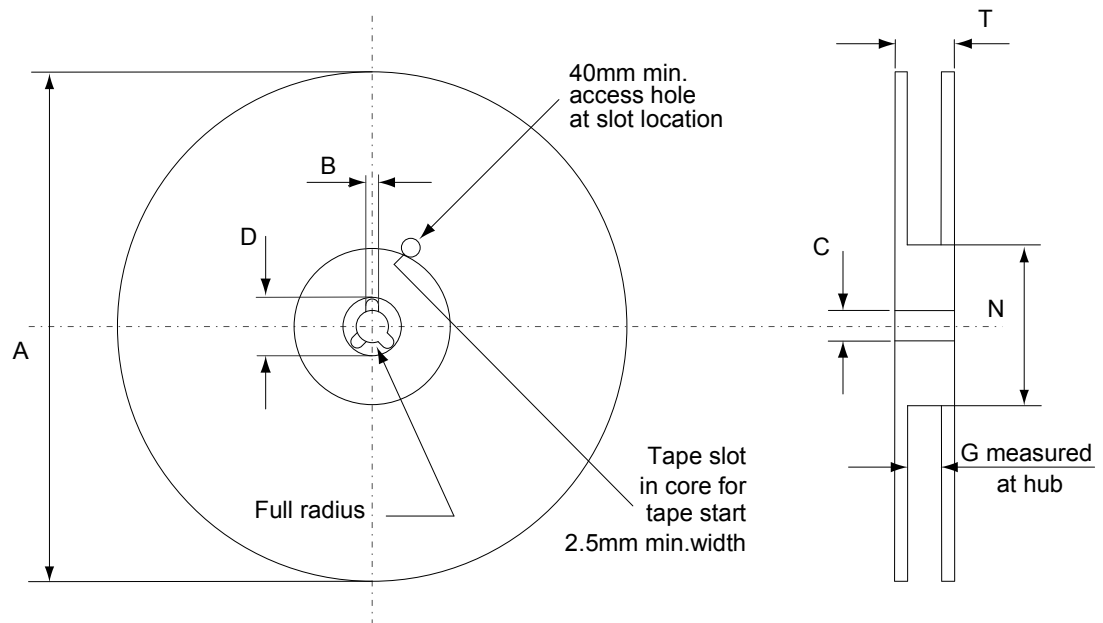
## 4.2 DPAK (TO-252) packing information

Figure 20. DPAK (TO-252) tape outline



AM08852v1

**Figure 21. DPAK (TO-252) reel outline**



AM06038v1

**Table 8. 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 |      |           |      |

## Revision history

**Table 9. Document revision history**

| Date        | Version | Changes        |
|-------------|---------|----------------|
| 11-Feb-2019 | 1       | First release. |

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