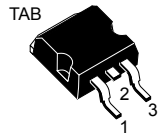
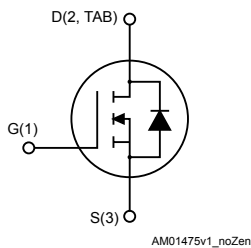


N-channel 300 V, 53 A, 0.037 Ω typ., MDmesh™ M5 Power MOSFET in a D²PAK package


 D²PAK


Features

| Order code | V _{DS} | R _{DS(on)} max. | I _D |
|------------|-----------------|--------------------------|----------------|
| STB45N30M5 | 300 V | 0.040 Ω | 53 A |

- Extremely low R_{DS(on)}
- Low gate charge and input capacitance
- Excellent switching performance
- 100% avalanche tested

Applications

- Switching applications

Description

This device is an N-channel Power MOSFET based on the MDmesh™ M5 innovative vertical process technology combined with the well-known PowerMESH™ horizontal layout. The resulting product offers extremely low on-resistance, making it particularly suitable for applications requiring high power and superior efficiency.

Product status link

[STB45N30M5](#)

Product summary

| | |
|-------------------|--------------------|
| Order code | STB45N30M5 |
| Marking | 45N30M5 |
| Package | D ² PAK |
| Packing | Tape and reel |

1 Electrical ratings

Table 1. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|----------------|--|------------|--------------------|
| V_{GS} | Gate-source voltage | ± 25 | V |
| I_D | Drain current (continuous) at $T_{case} = 25\text{ }^{\circ}\text{C}$ | 53 | A |
| | Drain current (continuous) at $T_{case} = 100\text{ }^{\circ}\text{C}$ | 34 | |
| $I_{DM}^{(1)}$ | Drain current (pulsed) | 212 | A |
| P_{TOT} | Total dissipation at $T_{case} = 25\text{ }^{\circ}\text{C}$ | 250 | W |
| $dv/dt^{(2)}$ | Peak diode recovery voltage slope | 15 | V/ns |
| T_{stg} | Storage temperature range | -55 to 150 | $^{\circ}\text{C}$ |
| T_j | Operating junction temperature range | | |

1. Pulse width is limited by safe operating area.

2. $I_{SD} \leq 53\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$, $V_{DS\text{ peak}} < V_{(BR)DSS}$, $V_{DD} = 240\text{ V}$

Table 2. Thermal data

| Symbol | Parameter | Value | Unit |
|---------------------|----------------------------------|-------|-----------------------------|
| $R_{thj-case}$ | Thermal resistance junction-case | 0.5 | $^{\circ}\text{C}/\text{W}$ |
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb | 30 | |

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

Table 3. Avalanche characteristics

| Symbol | Parameter | Value | Unit |
|----------|---|-------|------|
| I_{AR} | Avalanche current, repetitive or not repetitive (pulse width limited by $T_j\text{ max}$) | 16 | A |
| E_{AS} | Single pulse avalanche energy (starting $T_j = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$) | 550 | mJ |

2 Electrical characteristics

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

Table 4. On-/off-states

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|-----------------------------------|--|------|-------|-----------|---------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$ | 300 | | | V |
| I_{DSS} | Zero gate voltage drain current | $V_{GS} = 0\text{ V}$, $V_{DS} = 300\text{ V}$ | | | 1 | μA |
| | | $V_{GS} = 0\text{ V}$, $V_{DS} = 300\text{ V}$, $T_C = 125\text{ °C}^{(1)}$ | | | 100 | μA |
| I_{GSS} | Gate body leakage current | $V_{DS} = 0\text{ V}$, $V_{GS} = \pm 25\text{ V}$ | | | ± 100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$ | 3 | 4 | 5 | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS} = 10\text{ V}$, $I_D = 26.5\text{ A}$ | | 0.037 | 0.040 | Ω |

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

Table 5. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-------------------|---------------------------------------|---|------|------|------|----------|
| C_{iss} | Input capacitance | $V_{DS} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$ | - | 4240 | - | pF |
| C_{oss} | Output capacitance | | - | 205 | - | pF |
| C_{riss} | Reverse transfer capacitance | | - | 9.5 | - | pF |
| $C_{o(tr)}^{(1)}$ | Time-related equivalent capacitance | $V_{DS} = 0\text{ to }240\text{ V}$, $V_{GS} = 0\text{ V}$ | - | 373 | - | pF |
| $C_{o(er)}^{(2)}$ | Energy-related equivalent capacitance | | - | 202 | - | pF |
| R_G | Gate input resistance | $f = 1\text{ MHz}$, $I_D = 0\text{ A}$ | - | 1.4 | - | Ω |
| Q_g | Total gate charge | $V_{DD} = 240\text{ V}$, $I_D = 24\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$ (see Figure 15. Test circuit for gate charge behavior) | - | 95 | - | nC |
| Q_{gs} | Gate-source charge | | - | 23 | - | nC |
| Q_{gd} | Gate-drain charge | | - | 37 | - | nC |

1. $C_{o(tr)}$ is a constant capacitance value that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

2. $C_{o(er)}$ is a constant capacitance value that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

Table 6. Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------------|--------------------|---|------|------|------|------|
| $t_{d(v)}$ | Voltage delay time | $V_{DD} = 240\text{ V}$, $I_D = 32\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 16. Test circuit for inductive load switching and diode recovery times and Figure 19. Switching time waveform) | - | 66 | - | ns |
| $t_{r(v)}$ | Voltage rise time | | - | 15 | - | ns |
| $t_{f(i)}$ | Current fall time | | - | 24 | - | ns |
| $t_{c(off)}$ | Crossing time | | - | 22.5 | - | ns |

Table 7. Source-drain diode

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------|---|---|------|------|---------------|
| I_{SD} | Source-drain current | | - | | 53 | A |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) | | - | | 212 | A |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD} = 53 \text{ A}$, $V_{GS} = 0 \text{ V}$ | - | | 1.5 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 48 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$, $V_{DD} = 60 \text{ V}$ | - | 223 | | ns |
| Q_{rr} | Reverse recovery charge | | - | 2.5 | | μC |
| I_{RRM} | Reverse recovery current | (see Figure 16. Test circuit for inductive load switching and diode recovery times) | - | 23 | | A |
| t_{rr} | Reverse recovery time | $I_{SD} = 48 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$, $V_{DD} = 60 \text{ V}$, $T_j = 150 \text{ }^\circ\text{C}$ | - | 280 | | ns |
| Q_{rr} | Reverse recovery charge | | - | 3.9 | | μC |
| I_{RRM} | Reverse recovery current | | (see Figure 16. Test circuit for inductive load switching and diode recovery times) | - | 28 | |

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration = 300 μs , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

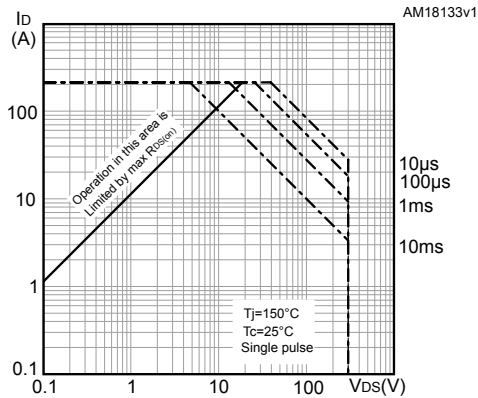


Figure 2. Thermal impedance

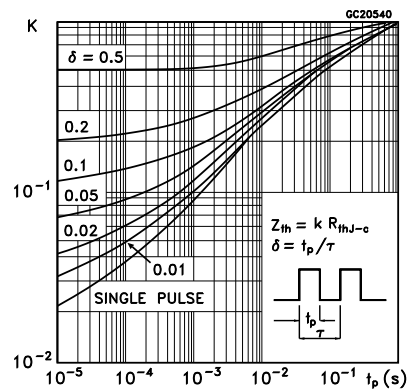


Figure 3. Output characteristics

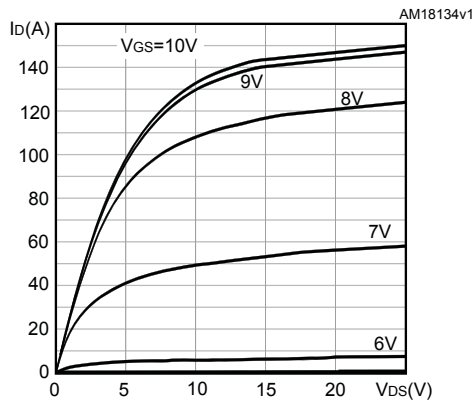


Figure 4. Transfer characteristics

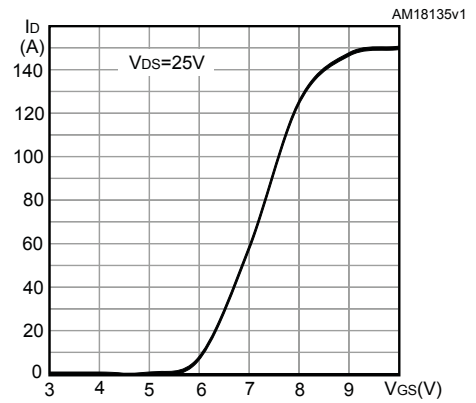


Figure 5. Gate charge vs gate-source voltage

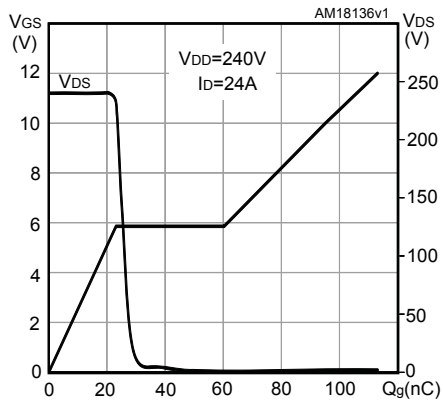


Figure 6. Static drain-source on-resistance

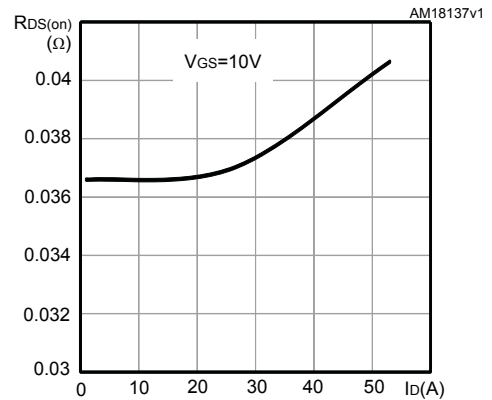


Figure 7. Capacitance variations

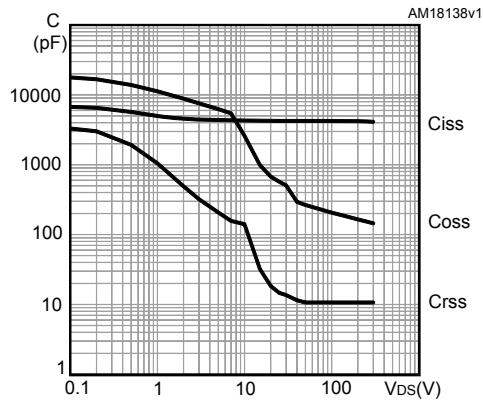


Figure 8. Output capacitance stored energy

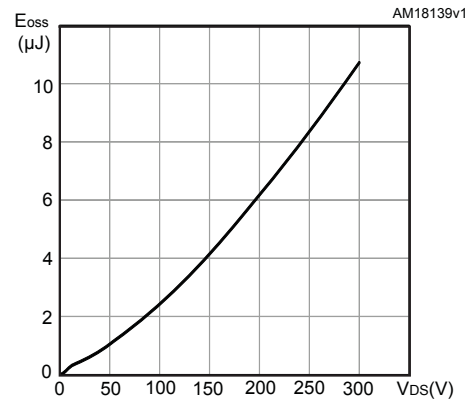


Figure 9. Normalized gate threshold voltage vs temperature

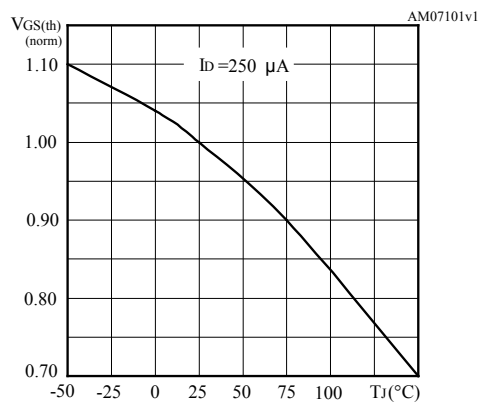


Figure 10. Normalized on-resistance vs temperature

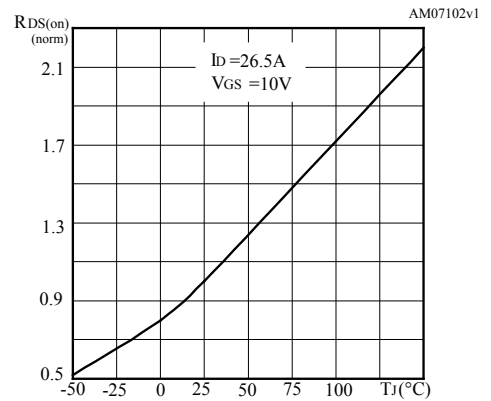


Figure 11. Normalized V_{(BR)DSS} vs temperature

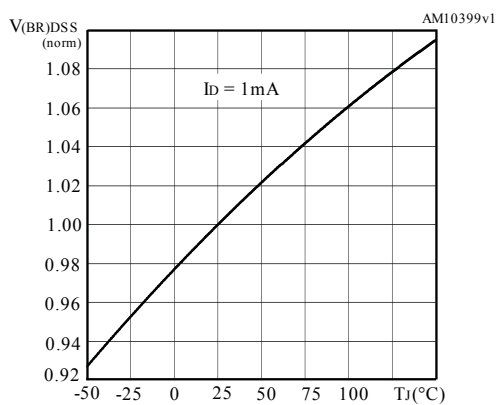


Figure 12. Source-drain diode forward characteristics

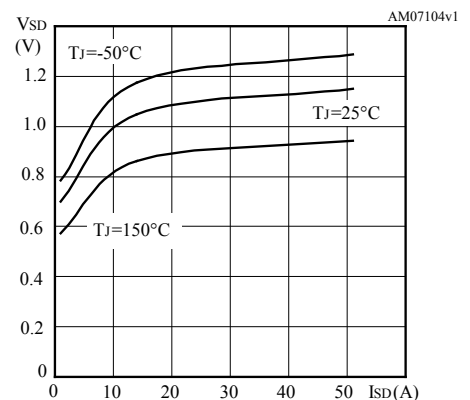
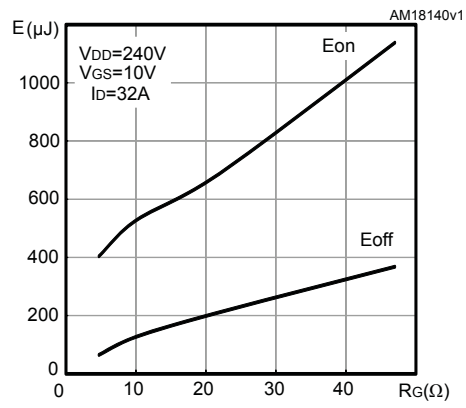
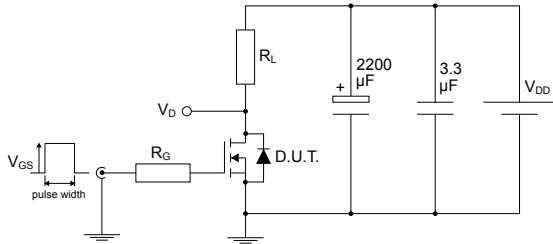


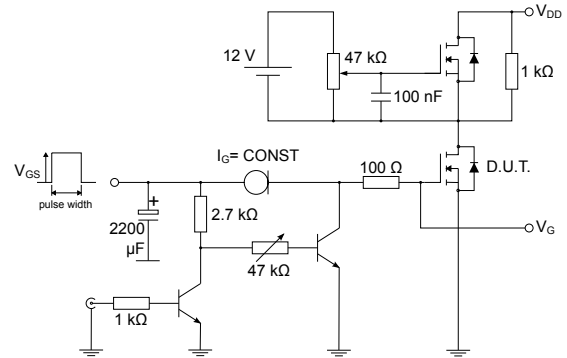
Figure 13. Switching energy vs gate resistance



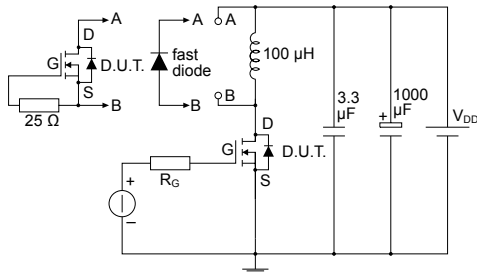
3 Test circuits

Figure 14. Test circuit for resistive load switching times


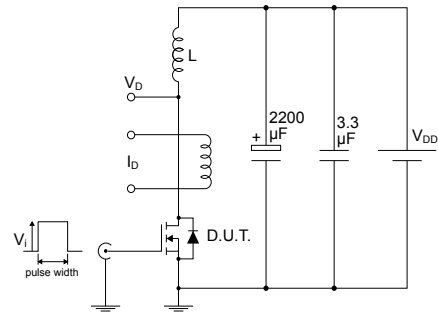
AM01488v1

Figure 15. Test circuit for gate charge behavior


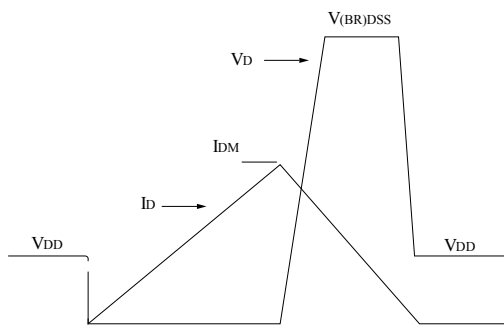
AM01469v1

Figure 16. Test circuit for inductive load switching and diode recovery times


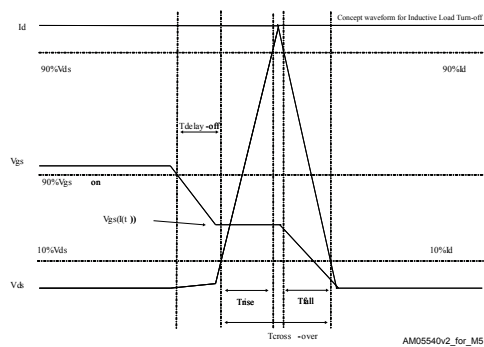
AM01470v1

Figure 17. Unclamped inductive load test circuit


AM01471v1

Figure 18. Unclamped inductive waveform


AM01472v1

Figure 19. Switching time waveform


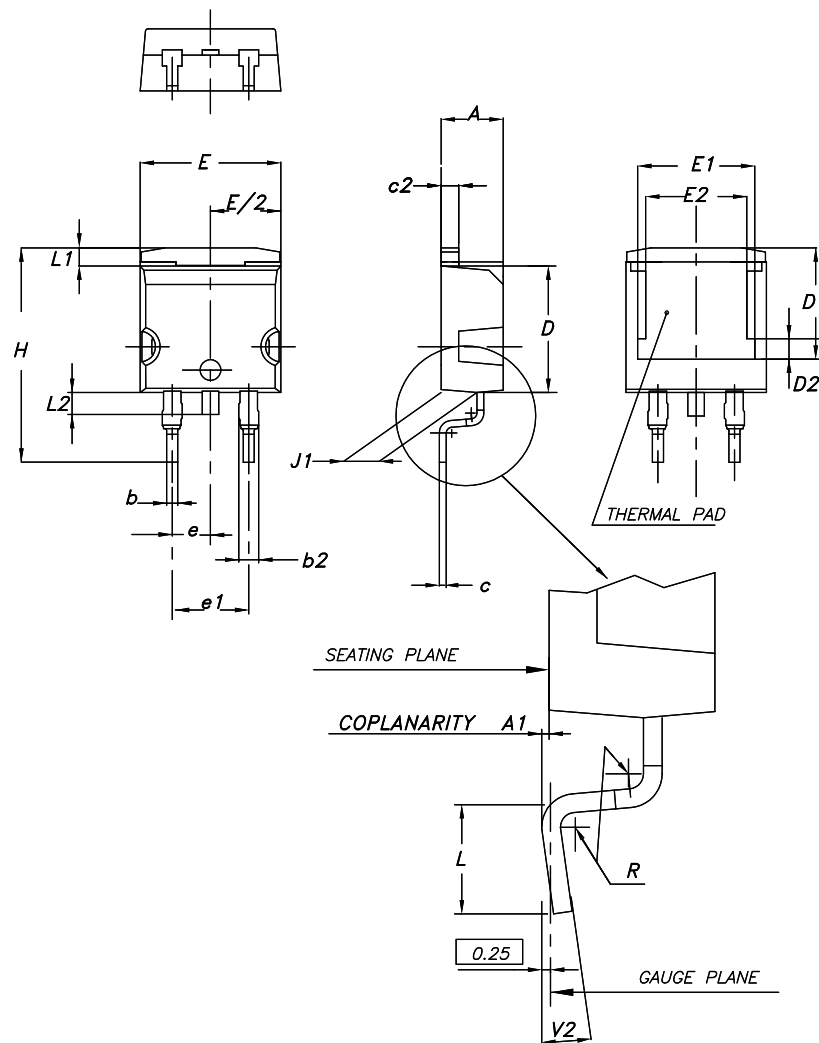
AM05540v2_for_M5

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

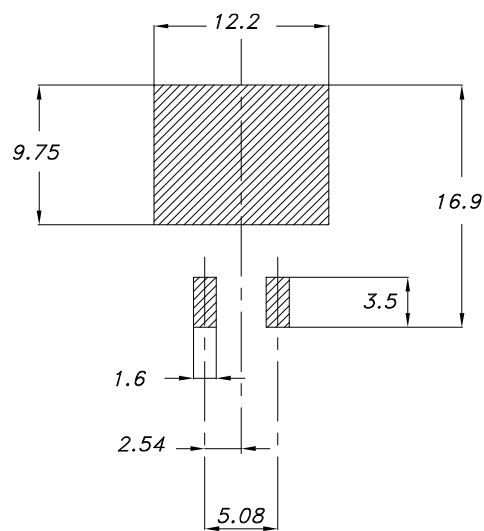
Figure 20. D²PAK (TO-263) type A2 package outline



0079457_A2_24

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

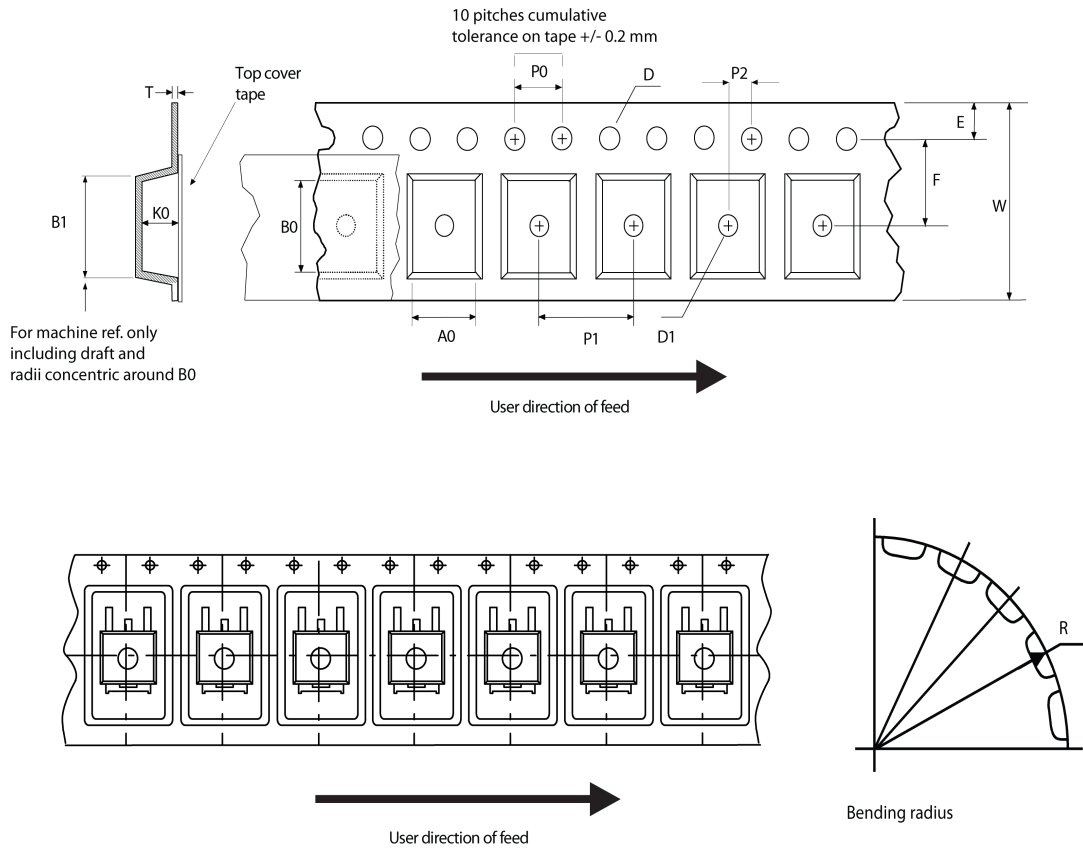
| Dim. | mm | | |
|------|-------|------|-------|
| | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 |
| A1 | 0.03 | | 0.23 |
| b | 0.70 | | 0.93 |
| b2 | 1.14 | | 1.70 |
| c | 0.45 | | 0.60 |
| c2 | 1.23 | | 1.36 |
| D | 8.95 | | 9.35 |
| D1 | 7.50 | 7.75 | 8.00 |
| D2 | 1.10 | 1.30 | 1.50 |
| E | 10.00 | | 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 21. D²PAK (TO-263) recommended footprint (dimensions are in mm)


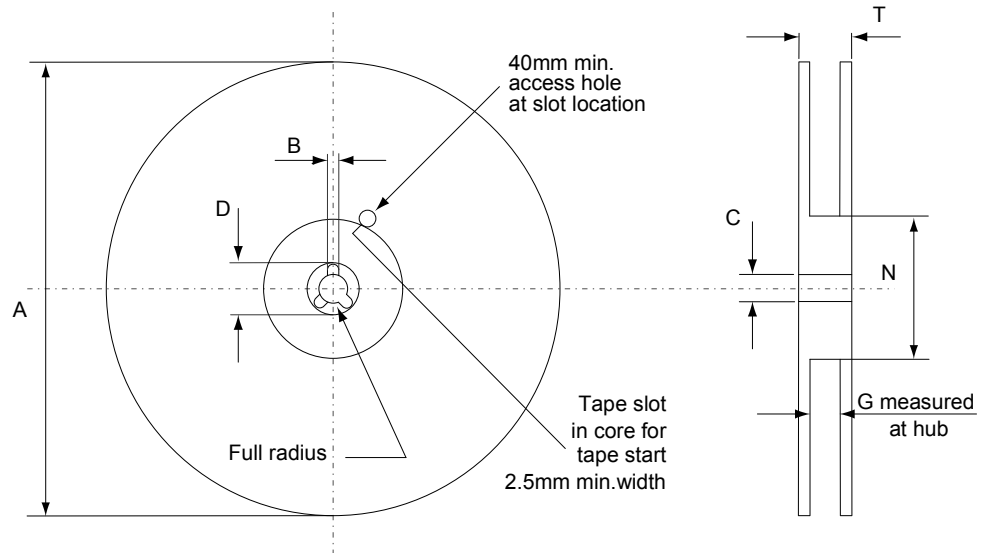
Footprint

4.2 D²PAK packing information

Figure 22. D²PAK tape outline



AM08852v1

Figure 23. 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 | Base quantity Bulk quantity | | | |
| P1 | 11.9 | 12.1 | | | | 1000 |
| P2 | 1.9 | 2.1 | | | | 1000 |
| R | 50 | | | | | |
| T | 0.25 | 0.35 | | | | |
| W | 23.7 | 24.3 | | | | |

Revision history

Table 10. Document revision history

| Date | Version | Changes |
|-------------|---------|-----------------|
| 16-May-2018 | 1 | Initial release |

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[SSM6P69NU,LF](#) [DMP22D4UFO-7B](#) [DMN1006UCA6-7](#)