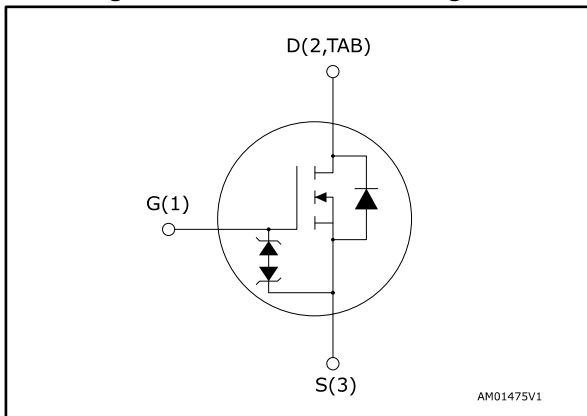


N-channel 600 V, 0.78 Ω typ., 6 A MDmesh™ DM2 Power MOSFET in a DPAK package

Datasheet - production data



Figure 1: Internal schematic diagram



Features

| Order code | V _{DS} | R _{DS(on)} max. | I _D | P _{TOT} |
|------------|-----------------|--------------------------|----------------|------------------|
| STD7N60DM2 | 600 V | 0.90 Ω | 6 A | 60 W |

- Fast-recovery body diode
- Extremely low gate charge and input capacitance
- Low on-resistance
- 100% avalanche tested
- Extremely high dv/dt ruggedness
- Zener-protected

Applications

- Switching applications

Description

This high voltage N-channel Power MOSFET is part of the MDmesh™ DM2 fast recovery diode series. It offers very low recovery charge (Q_{rr}) and time (t_{rr}) combined with low $R_{DS(on)}$, rendering it suitable for the most demanding high efficiency converters and ideal for bridge topologies and ZVS phase-shift converters.

Table 1: Device summary

| Order code | Marking | Package | Packing |
|------------|---------|---------|---------------|
| STD7N60DM2 | 7N60DM2 | DPAK | Tape and reel |

Contents

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1 Electrical ratings

Table 2: Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|----------------|--|------------|------------------|
| V_{GS} | Gate-source voltage | ± 25 | V |
| I_D | Drain current (continuous) at $T_{case} = 25\text{ }^\circ\text{C}$ | 6 | A |
| | Drain current (continuous) at $T_{case} = 100\text{ }^\circ\text{C}$ | 3.8 | |
| $I_{DM}^{(1)}$ | Drain current (pulsed) | 24 | A |
| P_{TOT} | Total dissipation at $T_{case} = 25\text{ }^\circ\text{C}$ | 60 | W |
| $dv/dt^{(2)}$ | Peak diode recovery voltage slope | 50 | V/ns |
| $dv/dt^{(3)}$ | MOSFET dv/dt ruggedness | 50 | |
| T_{stg} | Storage temperature range | -55 to 150 | $^\circ\text{C}$ |
| T_j | Operating junction temperature range | | |

Notes:

- (1) Pulse width is limited by safe operating area.
 (2) $I_{SD} \leq 6\text{ A}$, $di/dt=900\text{ A}/\mu\text{s}$; $V_{DS\text{ peak}} < V_{(BR)DSS}$, $V_{DD} = 480\text{ V}$.
 (3) $V_{DS} \leq 480\text{ V}$.

Table 3: Thermal data

| Symbol | Parameter | Value | Unit |
|---------------------|----------------------------------|-------|---------------------------|
| $R_{thj-case}$ | Thermal resistance junction-case | 2.08 | $^\circ\text{C}/\text{W}$ |
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb | 50 | |

Notes:

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

Table 4: Avalanche characteristics

| Symbol | Parameter | Value | Unit |
|----------------|---|-------|------|
| $I_{AR}^{(1)}$ | Avalanche current, repetitive or not repetitive | 1.5 | A |
| $E_{AS}^{(2)}$ | Single pulse avalanche energy | 160 | mJ |

Notes:

- (1) Pulse width limited by T_{jmax} .
 (2) Starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$.

2 Electrical characteristics

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

Table 5: Static

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------------------|-----------------------------------|---|------|------|---------|---------------|
| $V_{(\text{BR})\text{DSS}}$ | Drain-source breakdown voltage | $V_{\text{GS}} = 0\text{ V}$, $I_{\text{D}} = 1\text{ mA}$ | 600 | | | V |
| I_{DSS} | Zero gate voltage drain current | $V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 600\text{ V}$ | | | 1 | μA |
| | | $V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 600\text{ V}$, $T_{\text{case}} = 125\text{ °C}$ ⁽¹⁾ | | | 100 | |
| I_{GSS} | Gate-body leakage current | $V_{\text{DS}} = 0\text{ V}$, $V_{\text{GS}} = \pm 25\text{ V}$ | | | ± 5 | μA |
| $V_{\text{GS(th)}}$ | Gate threshold voltage | $V_{\text{DS}} = V_{\text{GS}}$, $I_{\text{D}} = 250\text{ }\mu\text{A}$ | 3.25 | 4 | 4.75 | V |
| $R_{\text{DS(on)}}$ | Static drain-source on-resistance | $V_{\text{GS}} = 10\text{ V}$, $I_{\text{D}} = 3\text{ A}$ | | 0.78 | 0.90 | Ω |

Notes:

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

Table 6: Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|----------------------------|-------------------------------|--|------|------|------|-------------|
| C_{ISS} | Input capacitance | $V_{\text{DS}} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{\text{GS}} = 0\text{ V}$ | - | 324 | - | pF |
| C_{OSS} | Output capacitance | | - | 18 | - | |
| C_{RSS} | Reverse transfer capacitance | | - | 2 | - | |
| $C_{\text{OSS eq.}}^{(1)}$ | Equivalent output capacitance | $V_{\text{DS}} = 0\text{ to }480\text{ V}$, $V_{\text{GS}} = 0\text{ V}$ | - | 25 | - | pF |
| R_{G} | Intrinsic gate resistance | $f = 1\text{ MHz}$, $I_{\text{D}} = 0\text{ A}$ | - | 6 | - | Ω |
| Q_{g} | Total gate charge | $V_{\text{DD}} = 480\text{ V}$, $I_{\text{D}} = 6\text{ A}$, $V_{\text{GS}} = 0\text{ to }10\text{ V}$ (see Figure 15: "Test circuit for gate charge behavior") | - | 7.5 | - | nC |
| Q_{gs} | Gate-source charge | | - | 2.2 | - | |
| Q_{gd} | Gate-drain charge | | - | 3.2 | - | |

Notes:

⁽¹⁾ $C_{\text{OSS eq.}}$ is defined as a constant equivalent capacitance giving the same charging time as C_{OSS} when V_{DS} increases from 0 to 80% V_{DSS} .

Table 7: Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------------|---------------------|--|------|------|------|-------------|
| $t_{\text{d(on)}}$ | Turn-on delay time | $V_{\text{DD}} = 300\text{ V}$, $I_{\text{D}} = 3\text{ A}$ $R_{\text{G}} = 4.7\text{ }\Omega$, $V_{\text{GS}} = 10\text{ V}$ (see Figure 14: "Test circuit for resistive load switching times" and Figure 19: "Switching time waveform") | - | 10 | - | ns |
| t_{r} | Rise time | | - | 6 | - | |
| $t_{\text{d(off)}}$ | Turn-off delay time | | - | 12.6 | - | |
| t_{f} | Fall time | | - | 22.6 | - | |

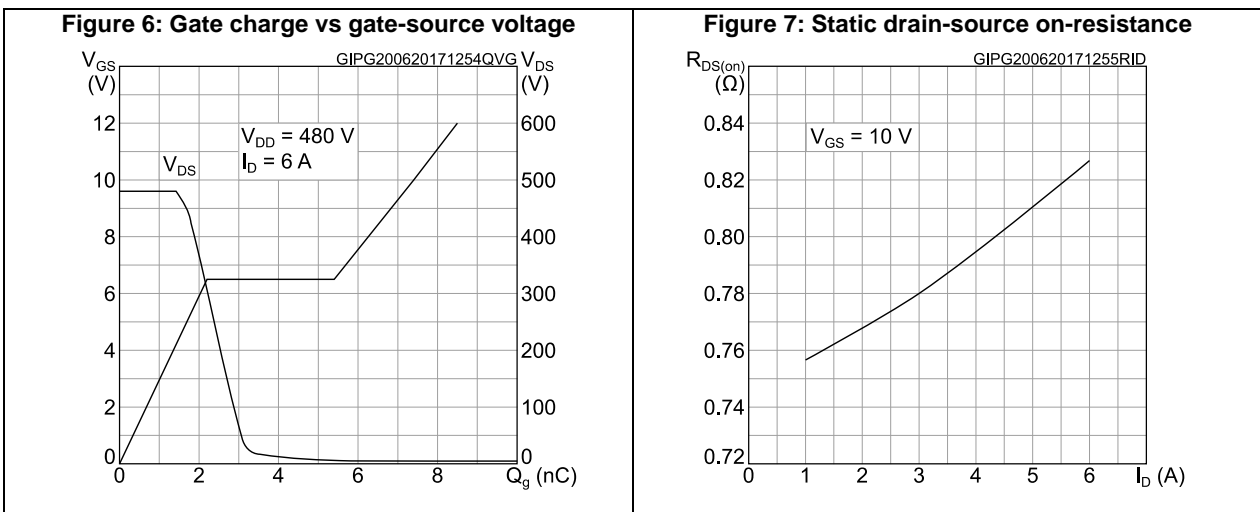
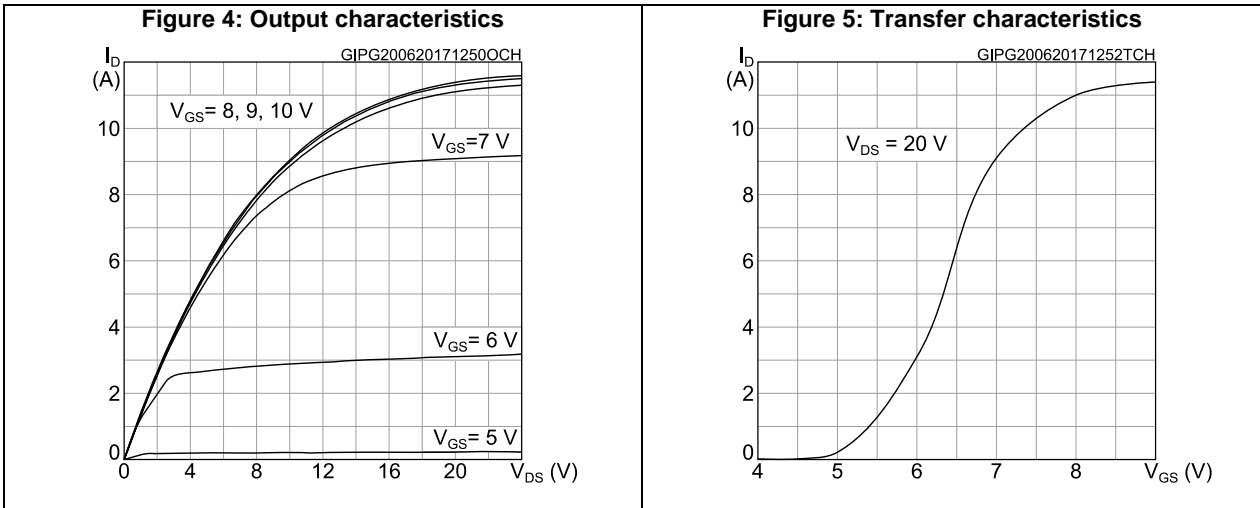
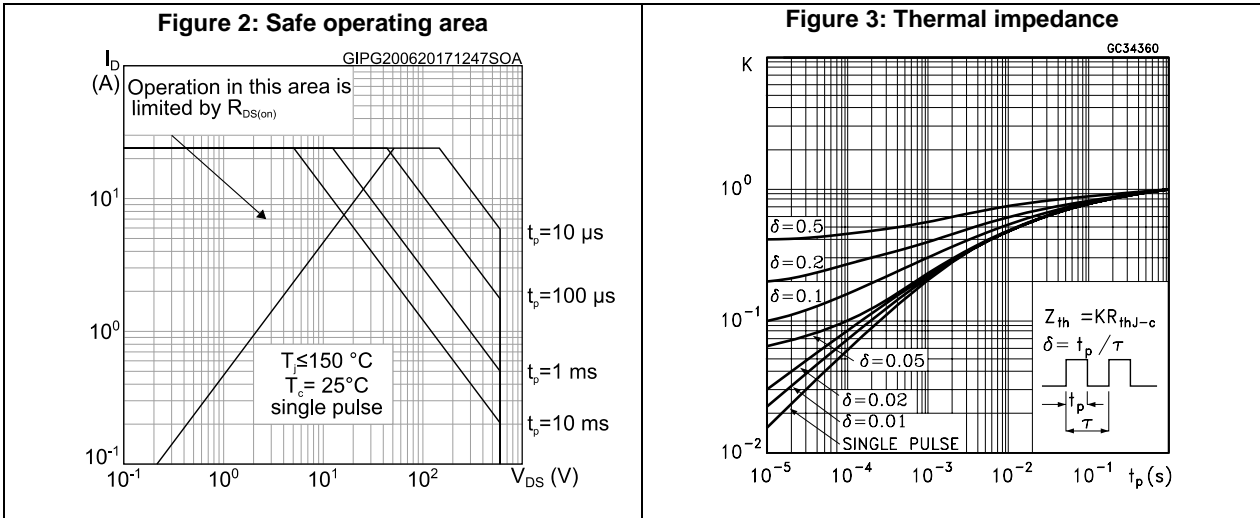
Table 8: Source-drain diode

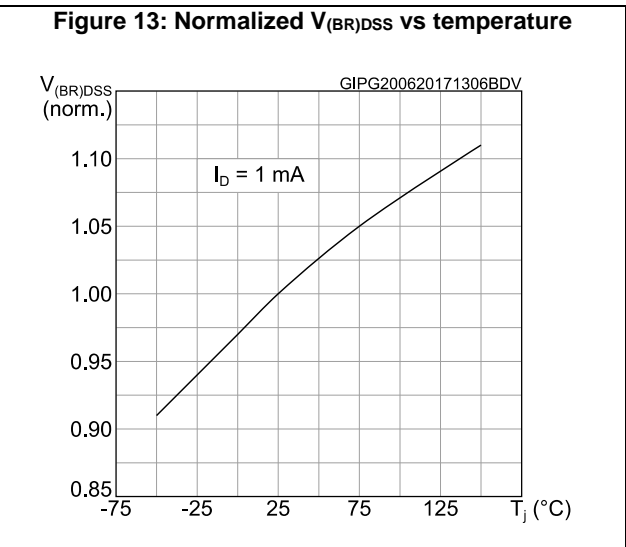
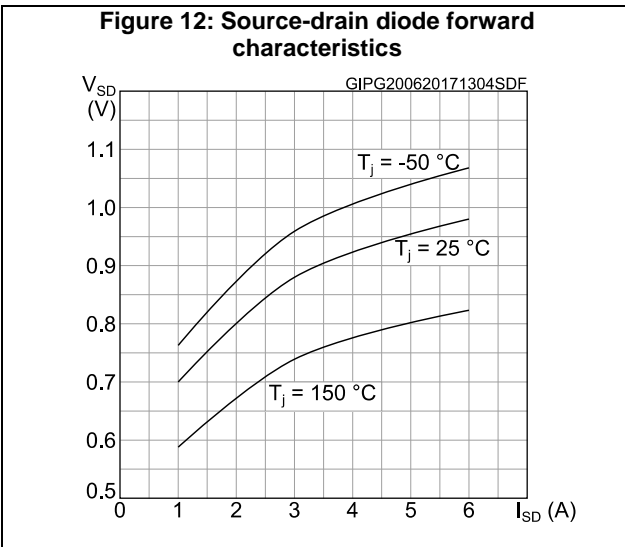
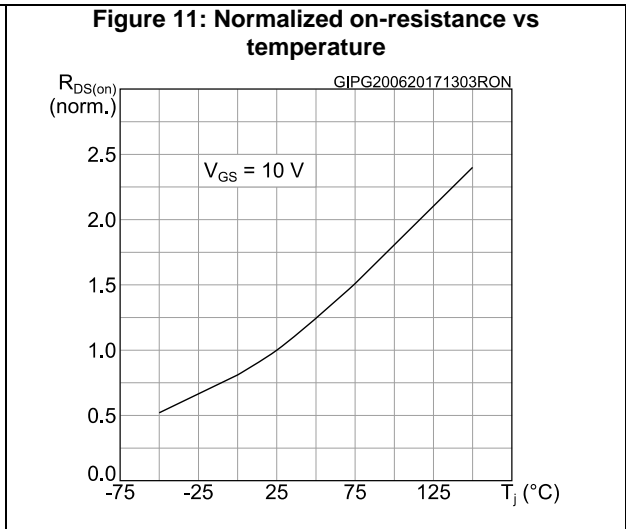
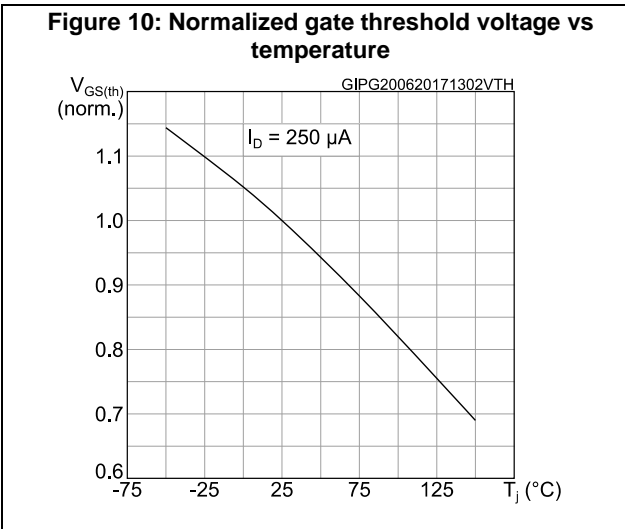
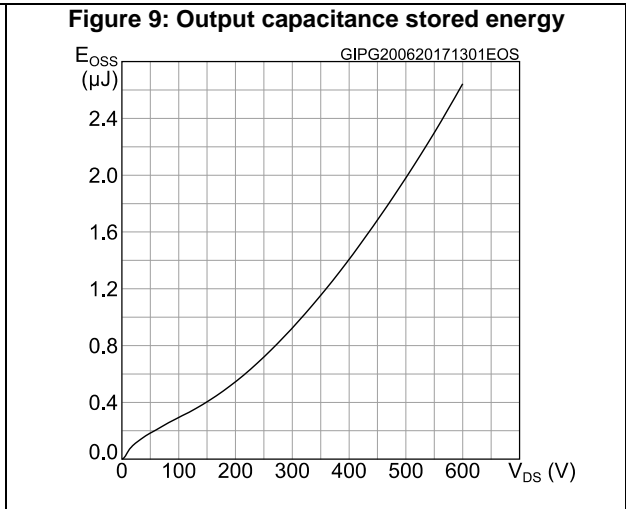
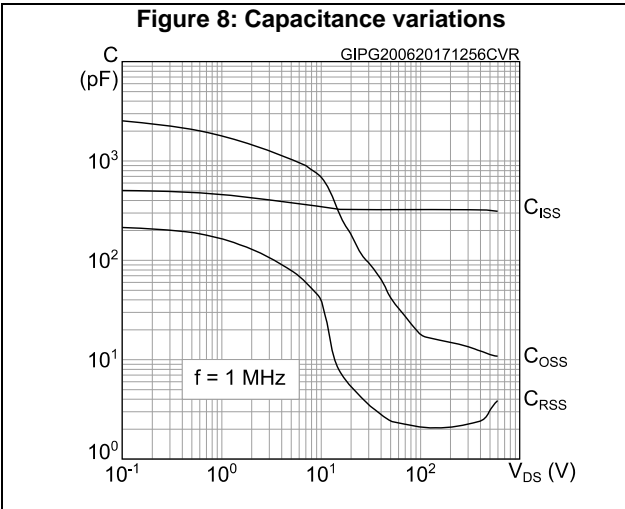
| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------|--|------|------|------|------|
| I_{SD} | Source-drain current | | - | | 6 | A |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) | | - | | 24 | A |
| $V_{SD}^{(2)}$ | Forward on voltage | $V_{GS} = 0\text{ V}$, $I_{SD} = 6\text{ A}$ | - | | 1.6 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 6\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$ (see Figure 16: "Test circuit for inductive load switching and diode recovery times") | - | 69 | | ns |
| Q_{rr} | Reverse recovery charge | | - | 164 | | nC |
| I_{RRM} | Reverse recovery current | | - | 4.8 | | A |
| t_{rr} | Reverse recovery time | $I_{SD} = 6\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$, $T_j = 150\text{ °C}$ (see Figure 16: "Test circuit for inductive load switching and diode recovery times") | - | 144 | | ns |
| Q_{rr} | Reverse recovery charge | | - | 492 | | nC |
| I_{RRM} | Reverse recovery current | | - | 6.8 | | A |

Notes:

- (1) Pulse width is limited by safe operating area.
(2) Pulse test: pulse duration = 300 μs , duty cycle 1.5%.

2.1 Electrical characteristics (curves)





3 Test circuits

Figure 14: Test circuit for resistive load switching times



AM01468v1

Figure 15: Test circuit for gate charge behavior



AM01469v1

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



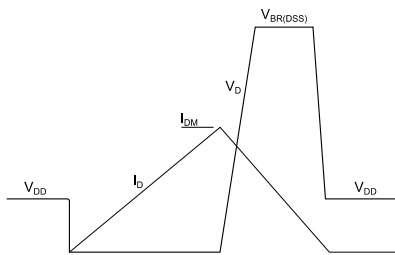
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Figure 17: Unclamped inductive load test circuit



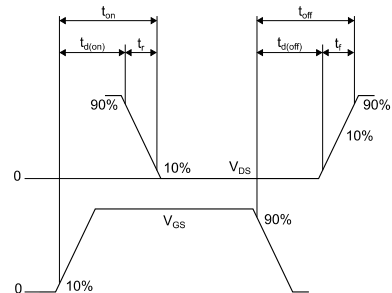
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Figure 18: Unclamped inductive waveform



AM01472v1

Figure 19: 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 A package information

Figure 20: DPAK (TO-252) type A package outline

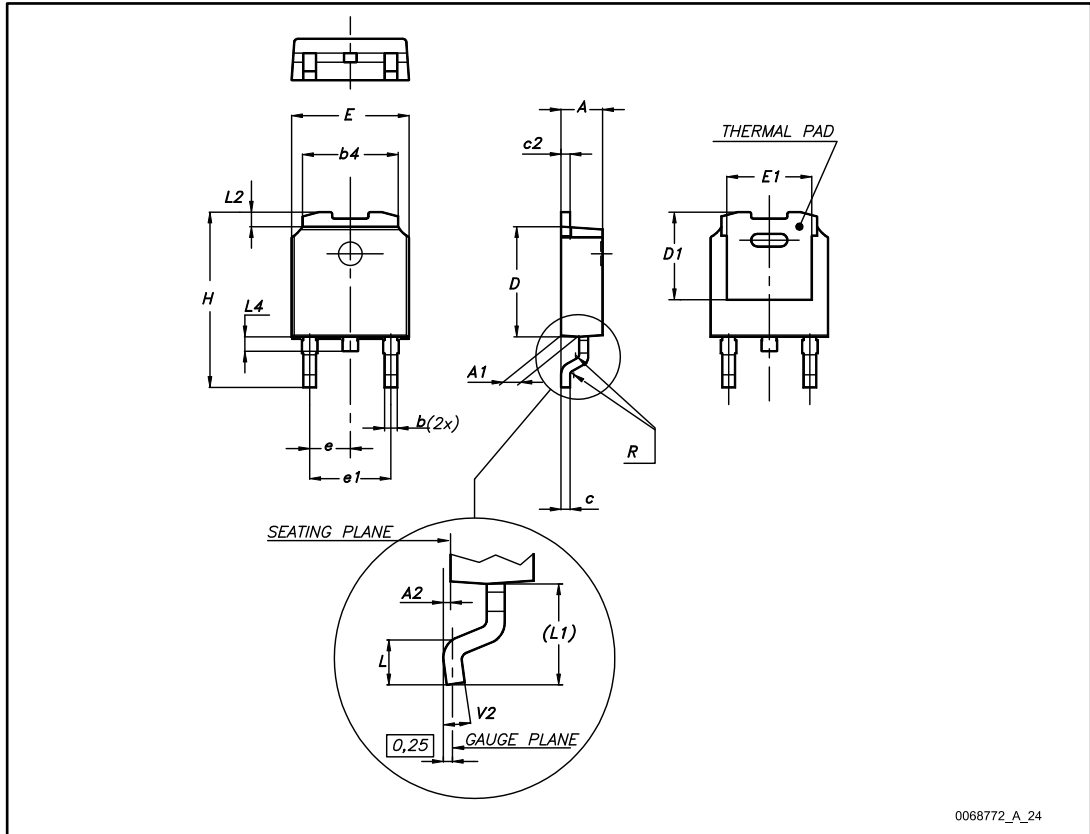
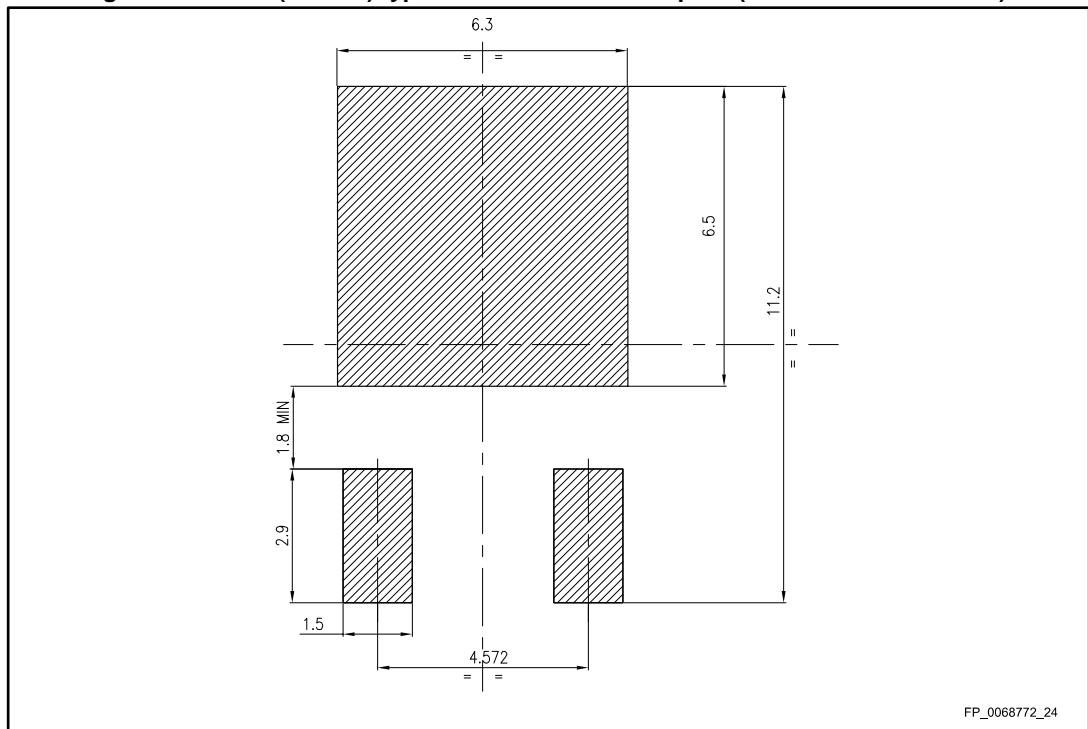


Table 9: DPAK (TO-252) type A mechanical data

| 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 21: DPAK (TO-252) type A recommended footprint (dimensions are in mm)



4.2 DPAK (TO-252) packing information

Figure 22: DPAK (TO-252) tape outline

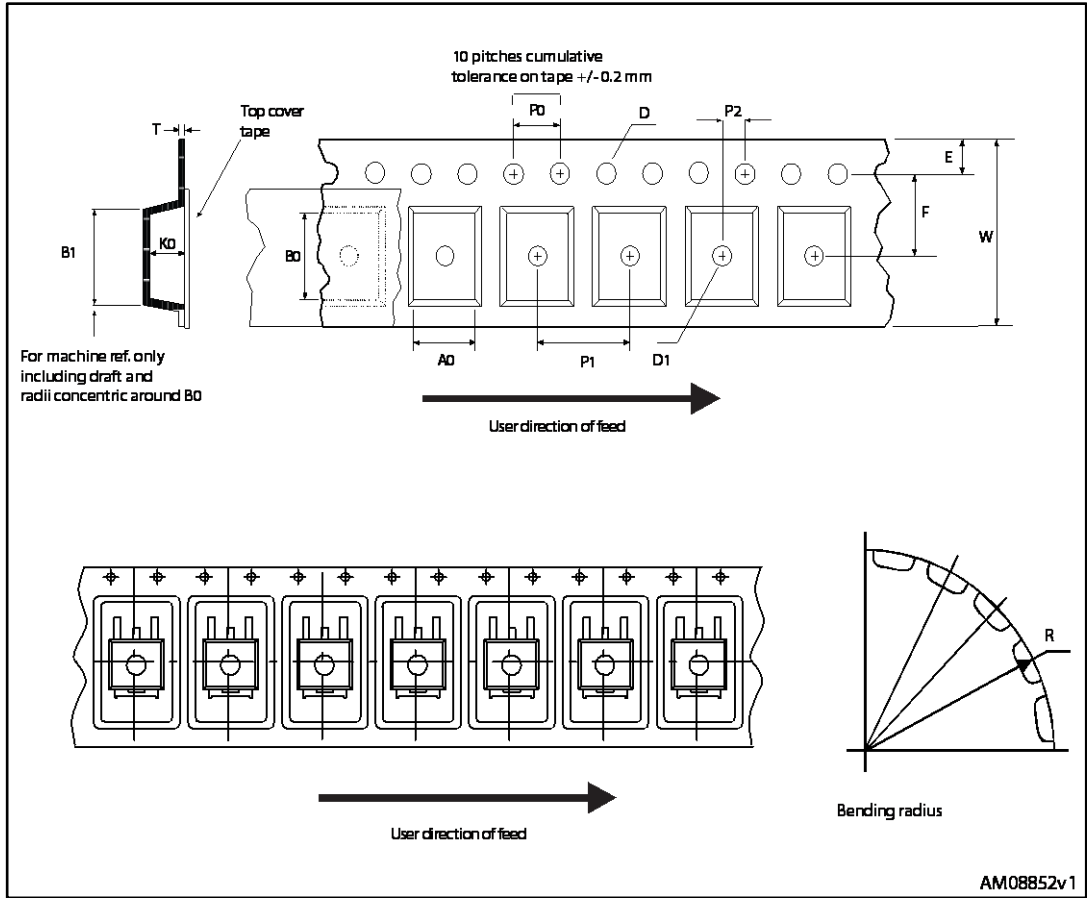
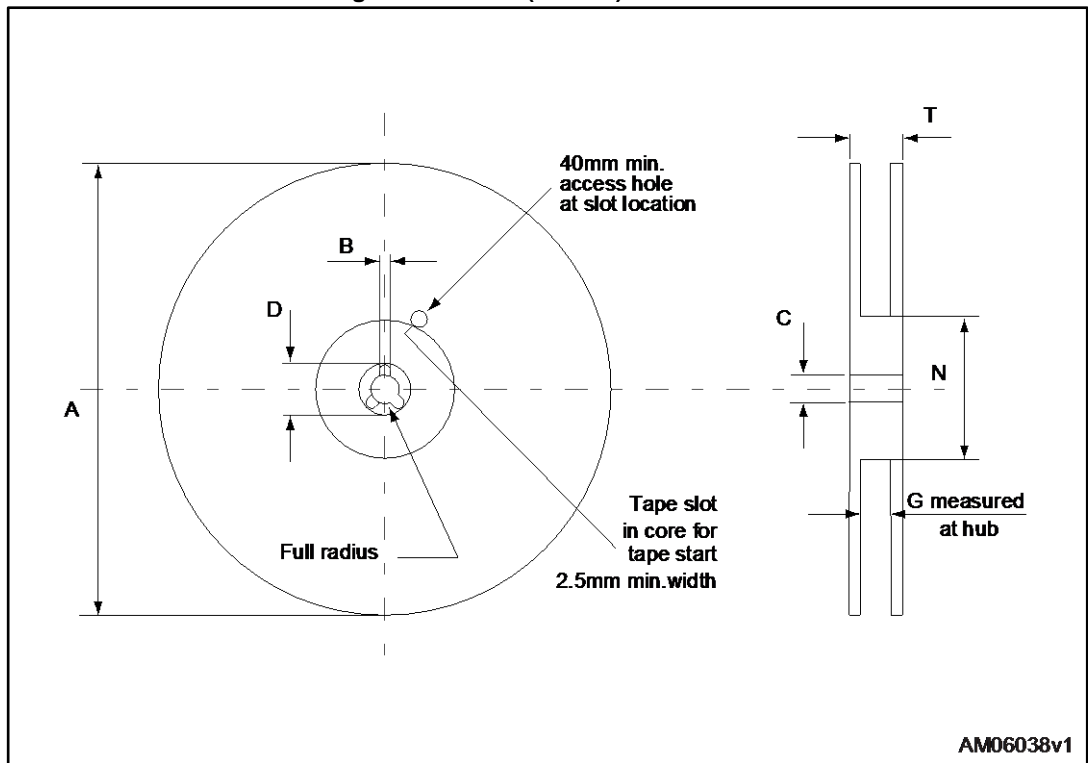


Figure 23: DPAK (TO-252) reel outline



AM06038v1

Table 10: 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 11: Document revision history

| Date | Revision | Changes |
|-------------|----------|----------------|
| 20-Jun-2017 | 1 | First release. |

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