

N-channel 600 V, 0.085 Ω typ., 34 A MDmesh™ DM2 Power MOSFET in a D²PAK package

Datasheet - production data

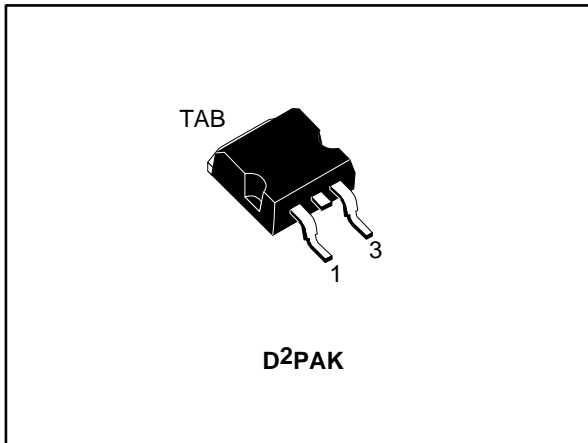
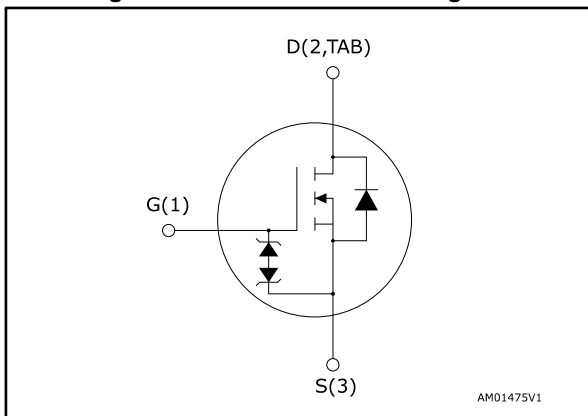


Figure 1: Internal schematic diagram



Features

| Order code | V _{DS} @ T _{Jmax.} | R _{DS(on)} max. | I _D | P _{TOT} |
|-------------|--------------------------------------|--------------------------|----------------|------------------|
| STB43N60DM2 | 650 V | 0.093 Ω | 34 A | 250 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 |
|-------------|----------|--------------------|---------------|
| STB43N60DM2 | 43N60DM2 | D ² PAK | 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 $T_{case} = 25\text{ °C}$ | 34 | A |
| | Drain current (continuous) at $T_{case} = 100\text{ °C}$ | 21 | |
| $I_{DM}^{(1)}$ | Drain current (pulsed) | 136 | A |
| P_{TOT} | Total dissipation at $T_{case} = 25\text{ °C}$ | 250 | W |
| $dv/dt^{(2)}$ | Peak diode recovery voltage slope | 50 | V/ns |
| $dv/dt^{(3)}$ | MOSFET dv/dt ruggedness | 50 | |
| T_{stg} | Storage temperature | -55 to 150 | °C |
| T_j | Operating junction temperature | | |

Notes:

(1) Pulse width is limited by safe operating area.

(2) $I_{SD} \leq 34\text{ A}$, $di/dt=900\text{ A}/\mu\text{s}$; $V_{DS\text{ peak}} < V_{(BR)DSS}$, $V_{DD} = 400\text{ V}$.

(3) $V_{DS} \leq 480\text{ V}$.

Table 3: Thermal data

| Symbol | Parameter | Value | Unit |
|---------------------|----------------------------------|-------|------|
| $R_{thj-case}$ | Thermal resistance junction-case | 0.50 | °C/W |
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb | 30 | |

Notes:

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

Table 4: Avalanche characteristics

| Symbol | Parameter | Value | Unit |
|----------------|---|-------|------|
| I_{AR} | Avalanche current, repetitive or not repetitive | 6 | A |
| $E_{AS}^{(1)}$ | Single pulse avalanche energy | 800 | mJ |

Notes:

(1) starting $T_j = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$.

2 Electrical characteristics

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

Table 5: Static

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|-----------------------------------|--|------|-------|---------|---------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$ | 600 | | | V |
| I_{DSS} | Zero gate voltage drain current | $V_{GS} = 0\text{ V}$, $V_{DS} = 600\text{ V}$ | | | 1 | μA |
| | | $V_{GS} = 0\text{ V}$, $V_{DS} = 600\text{ V}$, $T_{\text{case}} = 125\text{ °C}$ | | | 100 | |
| I_{GSS} | Gate-body leakage current | $V_{DS} = 0\text{ V}$, $V_{GS} = \pm 25\text{ V}$ | | | ± 5 | μA |
| $V_{GS(th)}$ | 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 | $V_{GS} = 10\text{ V}$, $I_D = 17\text{ A}$ | | 0.085 | 0.093 | Ω |

Table 6: Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|----------------------------|-------------------------------|--|------|------|------|-------------|
| C_{ISS} | Input capacitance | $V_{DS} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$ | - | 2500 | - | pF |
| C_{OSS} | Output capacitance | | - | 120 | - | |
| C_{RSS} | Reverse transfer capacitance | | - | 3 | - | |
| $C_{OSS\text{ eq.}}^{(1)}$ | Equivalent output capacitance | $V_{DS} = 0\text{ to }480\text{ V}$, $V_{GS} = 0\text{ V}$ | - | 200 | - | pF |
| R_G | Intrinsic gate resistance | $f = 1\text{ MHz}$, $I_D = 0\text{ A}$ | - | 4 | - | Ω |
| Q_g | Total gate charge | $V_{DD} = 480\text{ V}$, $I_D = 34\text{ A}$, $V_{GS} = 10\text{ V}$ (see Figure 15: "Gate charge test circuit") | - | 56 | - | nC |
| Q_{gs} | Gate-source charge | | - | 13 | - | |
| Q_{gd} | Gate-drain charge | | - | 30 | - | |

Notes:

⁽¹⁾ $C_{OSS\text{ eq.}}$ 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 |
|--------------|---------------------|--|------|------|------|-------------|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD} = 300\text{ V}$, $I_D = 25\text{ A}$ $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 14: "Switching times test circuit for resistive load" and Figure 19: "Switching time waveform") | - | 29 | - | ns |
| t_r | Rise time | | - | 27 | - | |
| $t_{d(off)}$ | Turn-off delay time | | - | 85 | - | |
| t_f | Fall time | | - | 6 | - | |

Table 8: Source-drain diode

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------|--|------|------|------|---------------|
| I_{SD} | Source-drain current | | - | | 34 | A |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) | | - | | 136 | A |
| $V_{SD}^{(2)}$ | Forward on voltage | $V_{GS} = 0\text{ V}$, $I_{SD} = 34\text{ A}$ | - | | 1.6 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 34\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$ (see Figure 16: "Test circuit for inductive load switching and diode recovery times") | - | 120 | | ns |
| Q_{rr} | Reverse recovery charge | | - | 0.6 | | μC |
| I_{RRM} | Reverse recovery current | | - | 10.4 | | A |
| t_{rr} | Reverse recovery time | $I_{SD} = 34\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ (see Figure 16: "Test circuit for inductive load switching and diode recovery times") | - | 240 | | ns |
| Q_{rr} | Reverse recovery charge | | - | 2.4 | | μC |
| I_{RRM} | Reverse recovery current | | - | 20.5 | | 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)

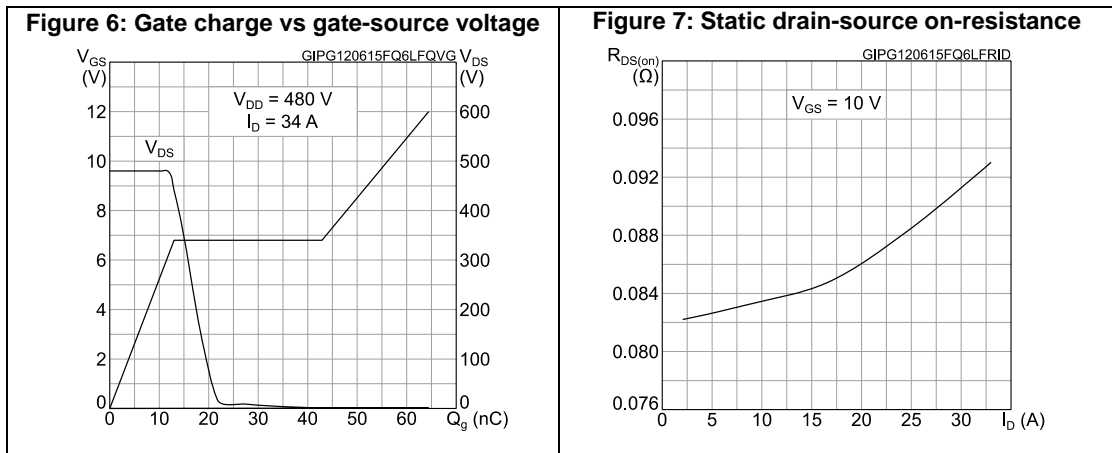
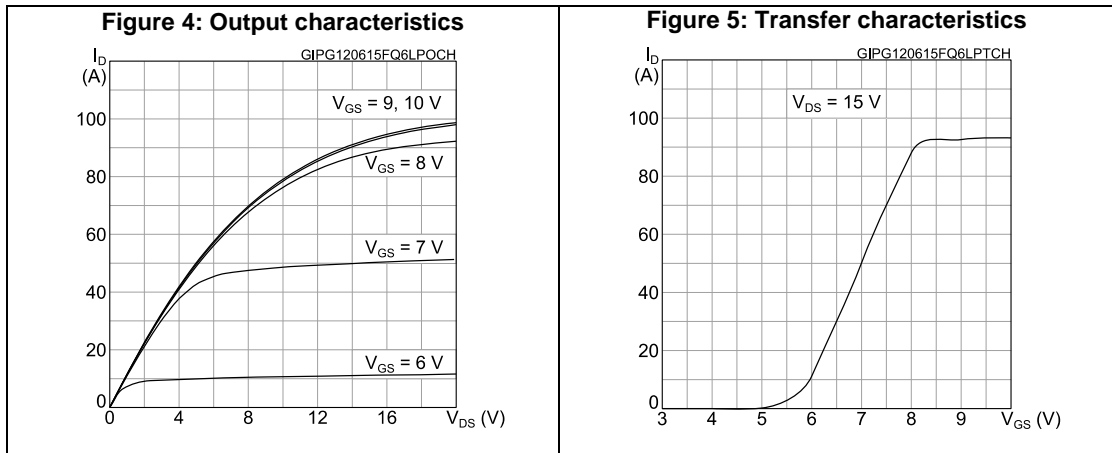
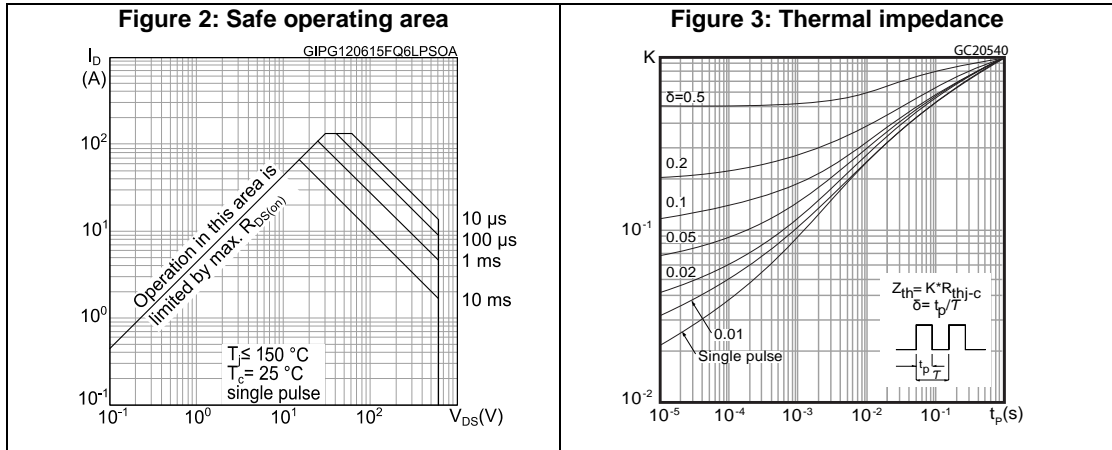


Figure 8: Capacitance variations

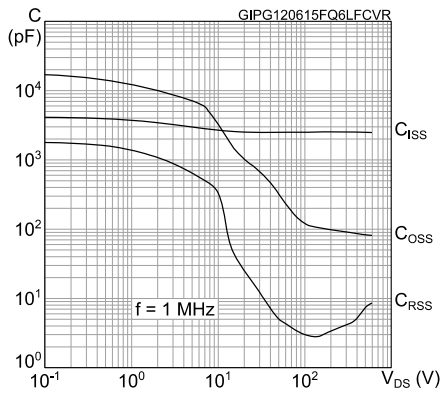


Figure 9: Normalized gate threshold voltage vs temperature

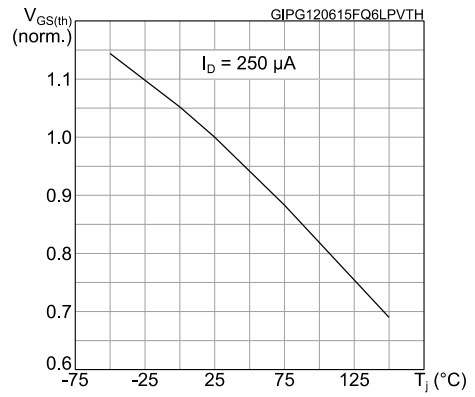


Figure 10: Normalized on-resistance vs temperature

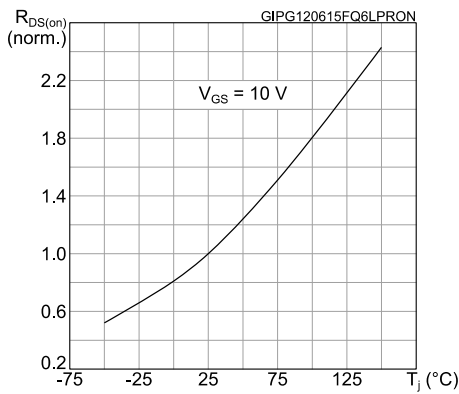


Figure 11: Normalized V(BR)DSS vs temperature

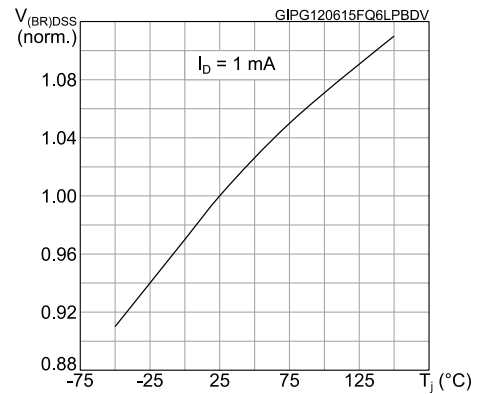


Figure 12: Output capacitance stored energy

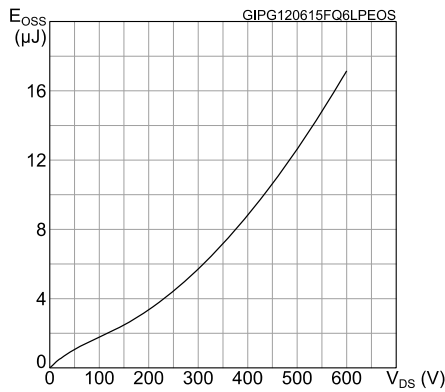
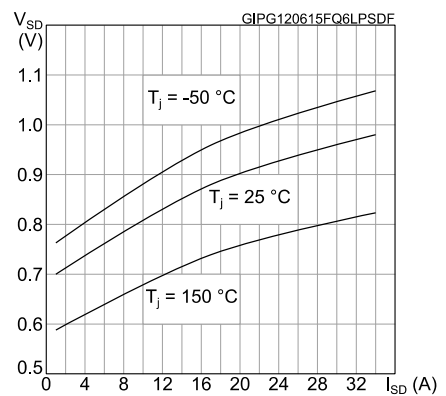
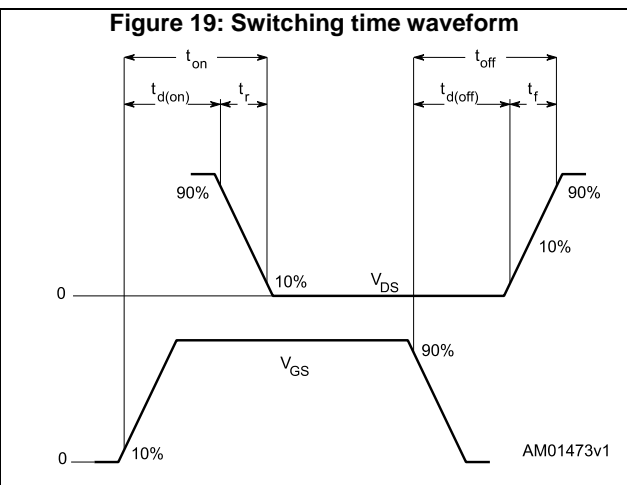
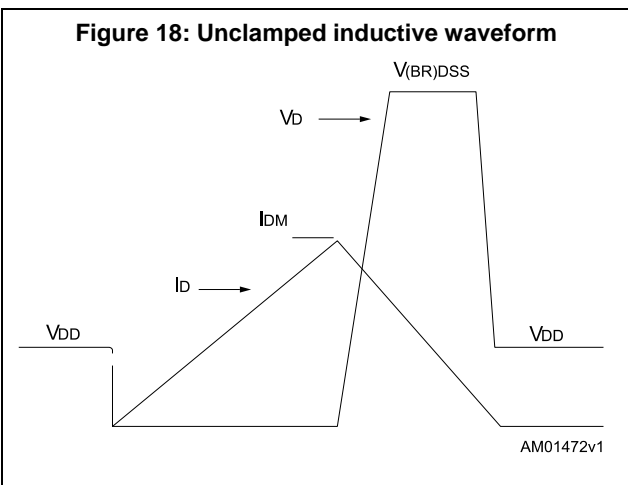
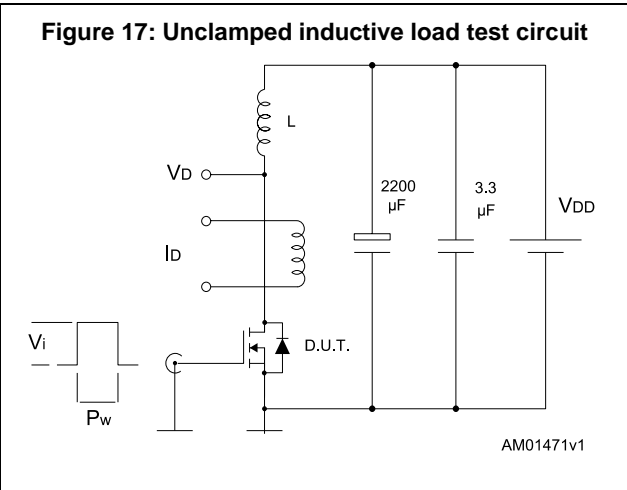
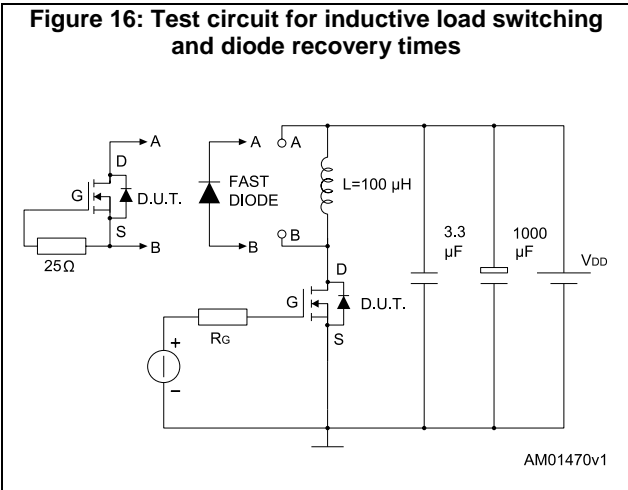
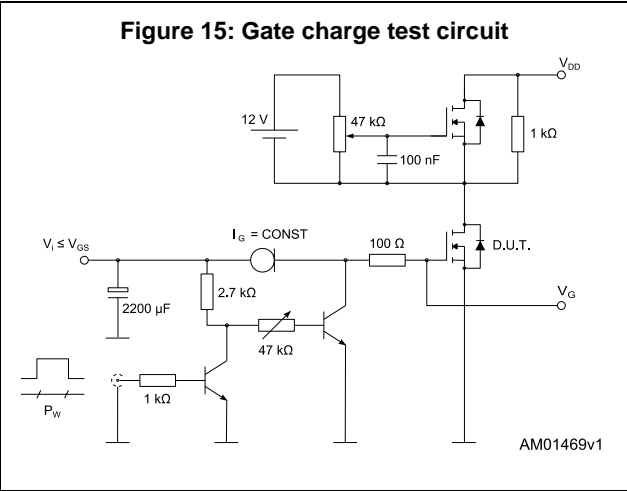
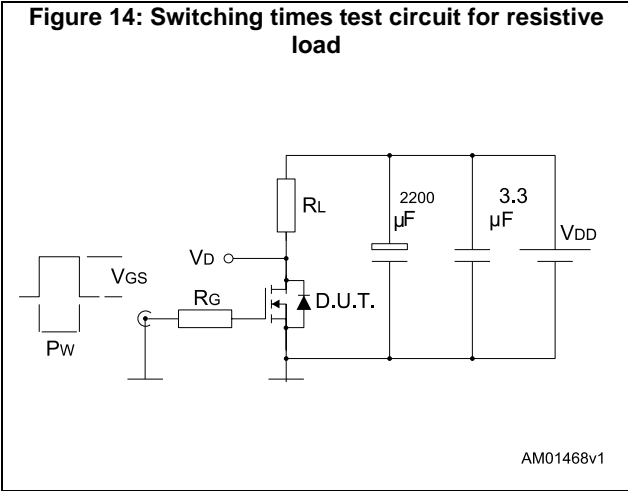


Figure 13: Source-drain diode forward characteristics



3 Test circuits



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 A package information

Figure 20: D²PAK (TO-263) type A package outline

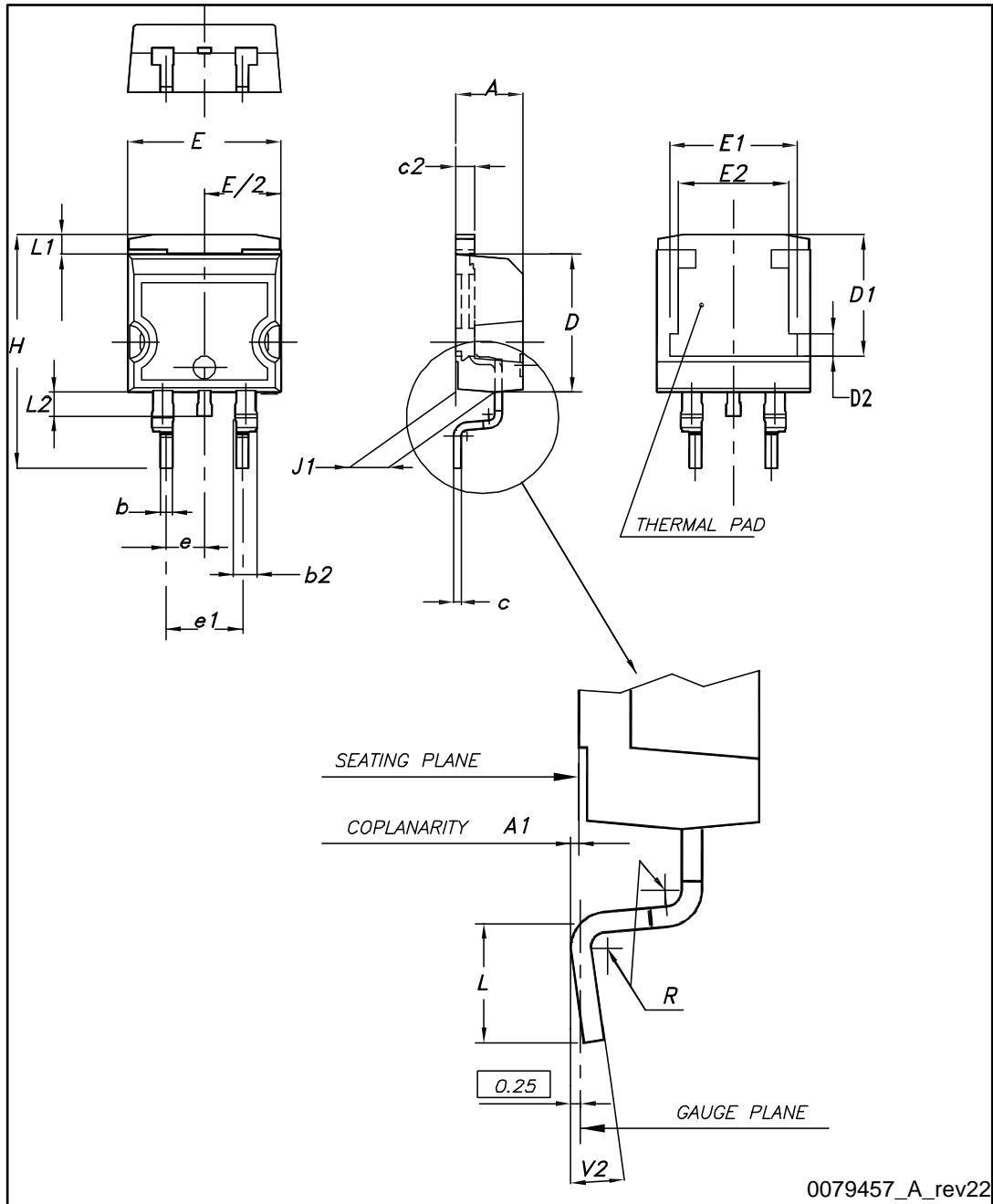
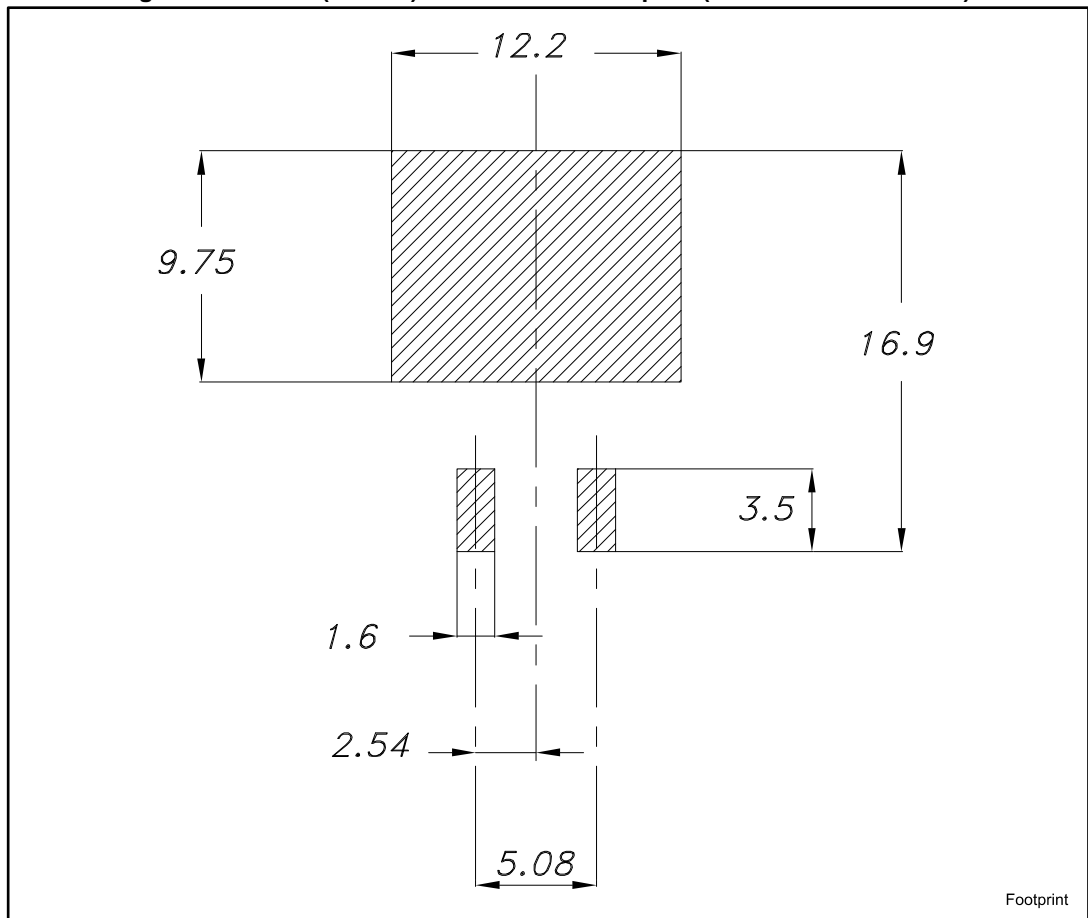


Table 9: D²PAK (TO-263) type A package mechanical data

| 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 | | 10.40 |
| E1 | 8.50 | 8.70 | 8.90 |
| E2 | 6.85 | 7.05 | 7.25 |
| e | | 2.54 | |
| e1 | 4.88 | | 5.28 |
| H | 15 | | 15.85 |
| J1 | 2.49 | | 2.69 |
| L | 2.29 | | 2.79 |
| L1 | 1.27 | | 1.40 |
| L2 | 1.30 | | 1.75 |
| R | | 0.4 | |
| V2 | 0° | | 8° |

Figure 21: D²PAK (TO-263) recommended footprint (dimensions are in mm)



4.2 D²PAK packing information

Figure 22: Tape

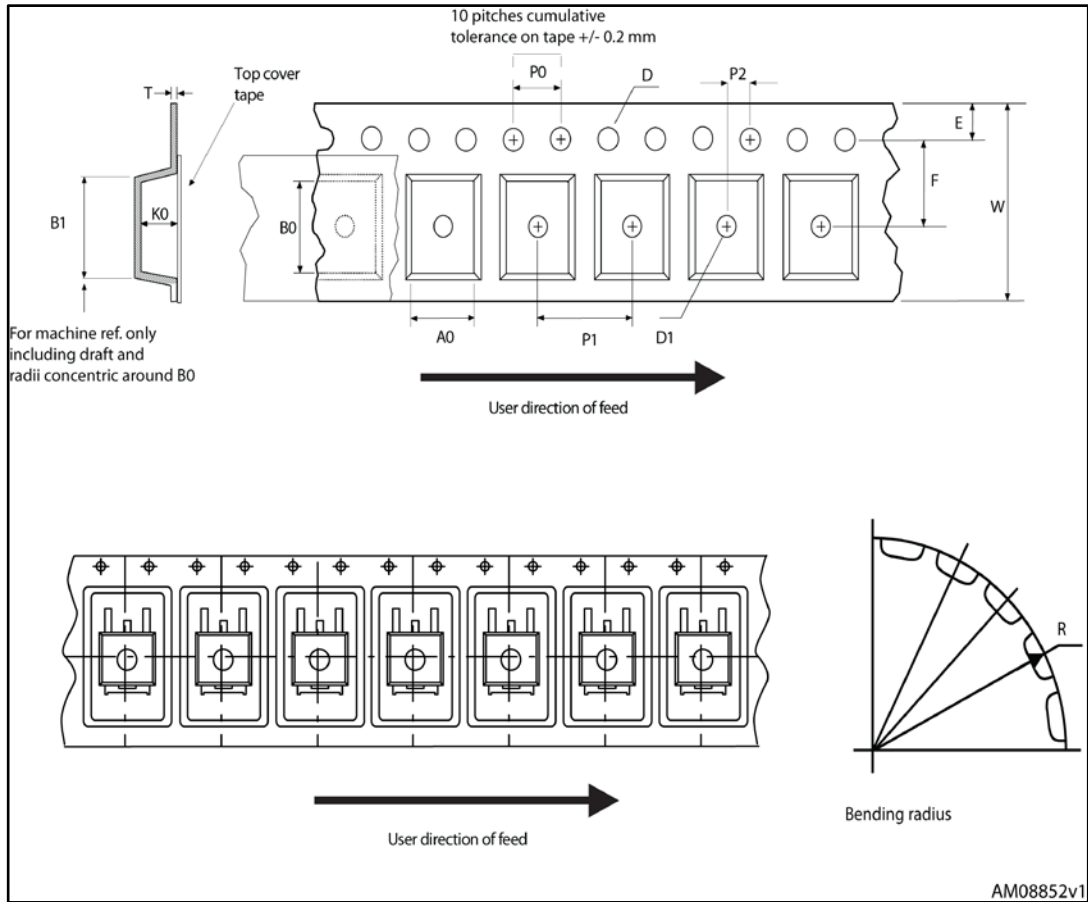
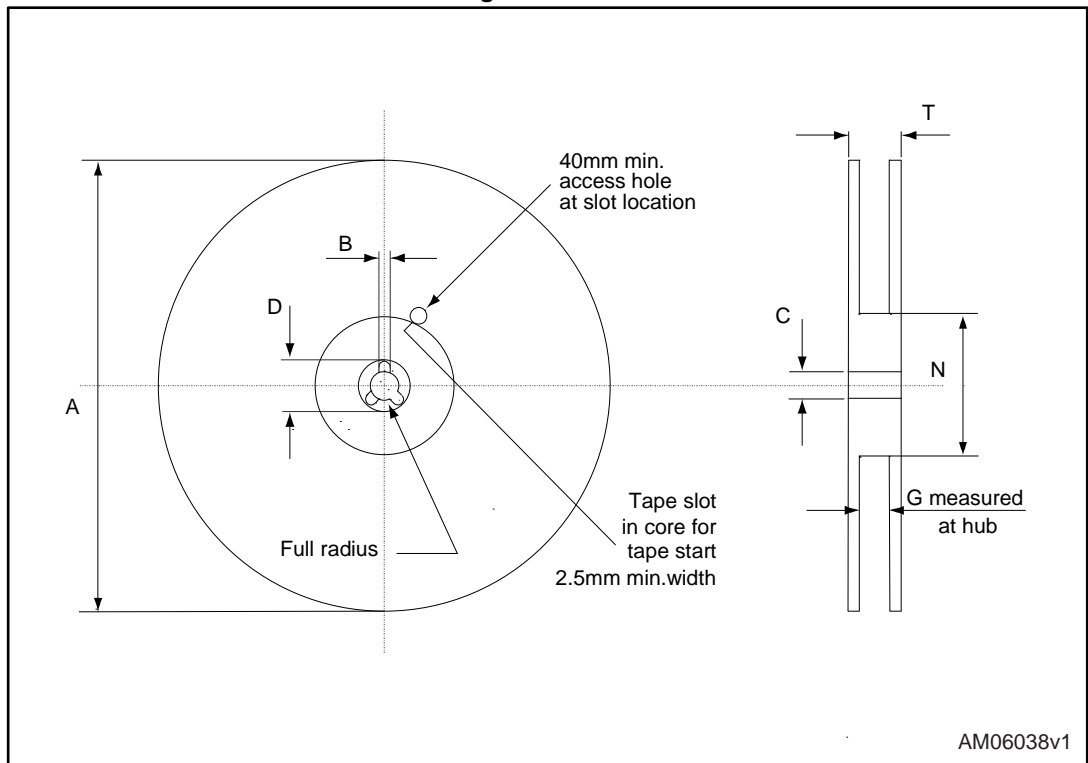


Figure 23: Reel



AM06038v1

Table 10: 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 | | | |
| P1 | 11.9 | 12.1 | Base qty | | 1000 |
| P2 | 1.9 | 2.1 | Bulk qty | | 1000 |
| R | 50 | | | | |
| T | 0.25 | 0.35 | | | |
| W | 23.7 | 24.3 | | | |

5 Revision history

Table 11: Document revision history

| Date | Revision | Changes |
|-------------|----------|------------------|
| 02-Jul-2015 | 1 | Initial release. |

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