

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

Datasheet - production data

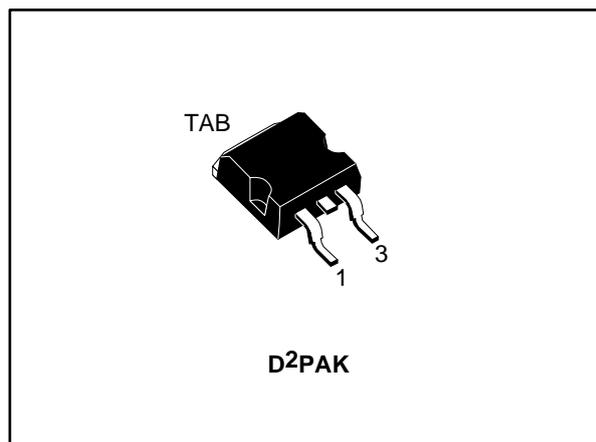
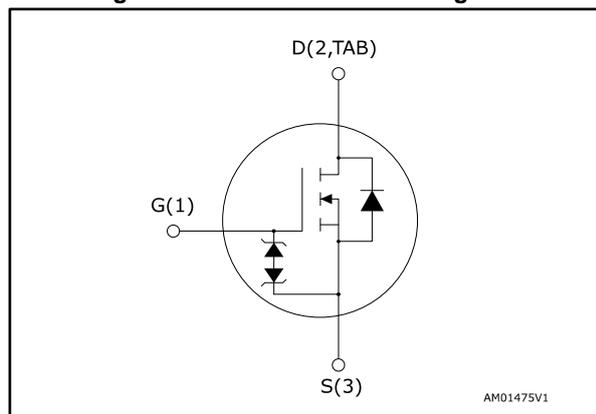


Figure 1: Internal schematic diagram



Features

| Order code | V _{DS} @ T _{Jmax.} | R _{DS(on)} max. | I _D | P _{TOT} |
|---------------|--------------------------------------|--------------------------|----------------|------------------|
| STB45N60DM2AG | 650 V | 0.093 Ω | 34 A | 250 W |

- Designed for automotive applications and AEC-Q101 qualified
- 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 |
|---------------|----------|--------------------|---------------|
| STB45N60DM2AG | 45N60DM2 | D ² PAK | Tape and reel |

Contents

| | | |
|----------|--|-----------|
| 1 | Electrical ratings | 3 |
| 2 | Electrical characteristics | 4 |
| | 2.1 Electrical characteristics (curves)..... | 6 |
| 3 | Test circuits | 8 |
| 4 | Package information | 9 |
| | 4.1 D ² PAK (TO-263) type A package information | 9 |
| | 4.2 D ² PAK packing information | 12 |
| 5 | Revision history | 14 |

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 $T_{case} = 25\text{ }^\circ\text{C}$ | 34 | A |
| | Drain current (continuous) at $T_{case} = 100\text{ }^\circ\text{C}$ | 21 | |
| $I_{DM}^{(1)}$ | Drain current (pulsed) | 136 | A |
| P_{TOT} | Total dissipation at $T_{case} = 25\text{ }^\circ\text{C}$ | 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 | $^\circ\text{C}$ |
| T_j | Operating junction temperature | | |

Notes:

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

⁽²⁾ $I_{SD} \leq 34\text{ A}$, $di/dt=800\text{ A}/\mu\text{s}$; $V_{DS\text{ peak}} < V_{(BR)DSS}$, $V_{DD} = 80\% V_{(BR)DSS}$.

⁽³⁾ $V_{DS} \leq 480\text{ V}$.

Table 3: Thermal data

| Symbol | Parameter | Value | Unit |
|---------------------|----------------------------------|-------|---------------------------|
| $R_{thj-case}$ | Thermal resistance junction-case | 0.50 | $^\circ\text{C}/\text{W}$ |
| $R_{thj-pcb}^{(1)}$ | 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 $T_j = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$.

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 |
| | | $V_{\text{GS}} = 0\text{ V}$, $V_{\text{DS}} = 600\text{ V}$, $T_{\text{case}} = 125\text{ °C}$ | | | 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 | 4 | 5 | V |
| $R_{\text{DS(on)}}$ | Static drain-source on-resistance | $V_{\text{GS}} = 10\text{ V}$, $I_{\text{D}} = 17\text{ A}$ | | 0.085 | 0.09 _3 | Ω |

Table 6: Dynamic

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

Notes:

⁽¹⁾ $C_{\text{oss eq.}}$ 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 | $V_{\text{DD}} = 300\text{ V}$, $I_{\text{D}} = 25\text{ A}$ $R_{\text{G}} = 4.7\text{ }\Omega$, $V_{\text{GS}} = 10\text{ V}$ (see Figure 14: "Switching times test circuit for resistive load" and Figure 19: "Switching time waveform") | - | 29 | - | ns |
| t_{r} | Rise time | | - | 27 | - | |
| $t_{\text{d(off)}}$ | 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)

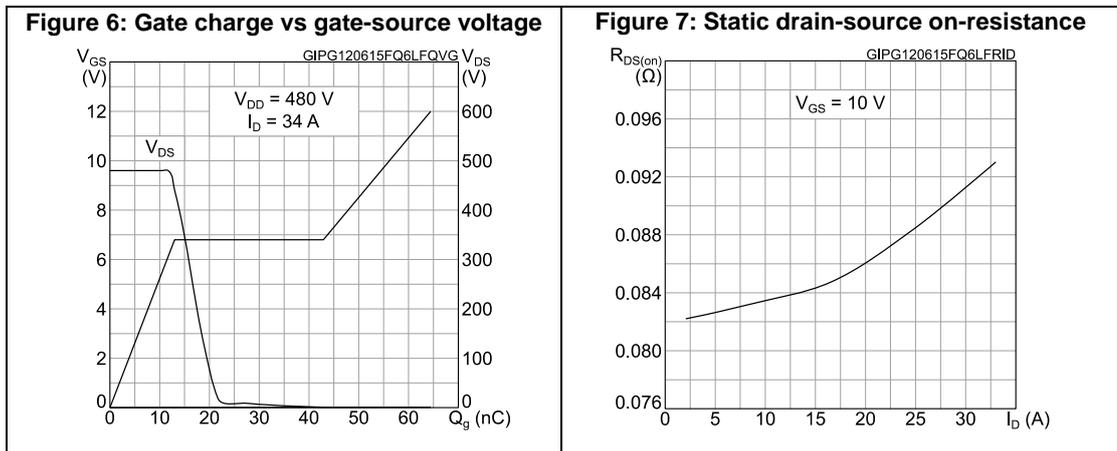
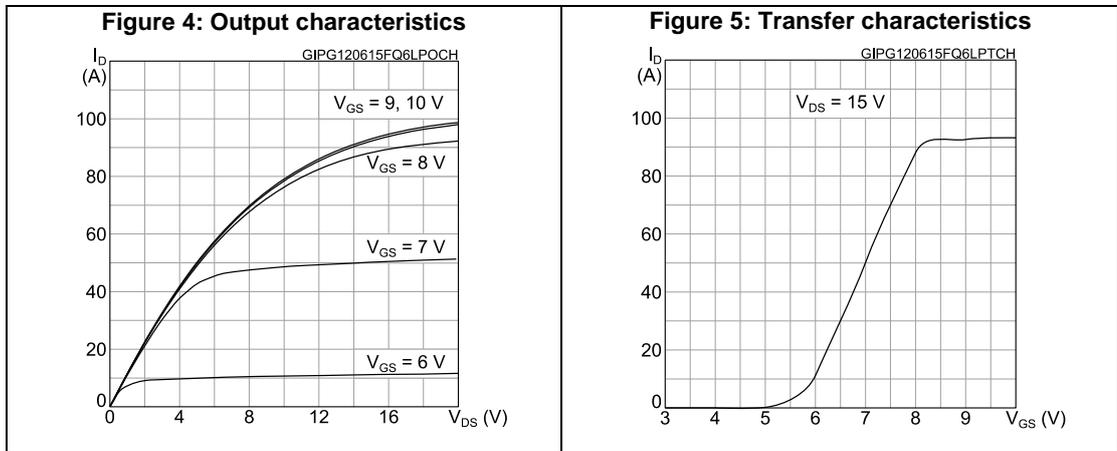
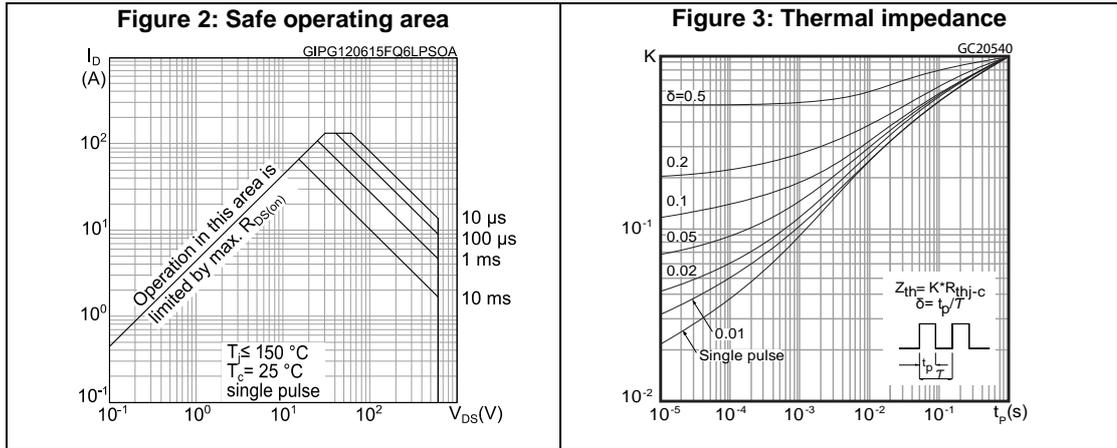


Figure 8: Capacitance variations

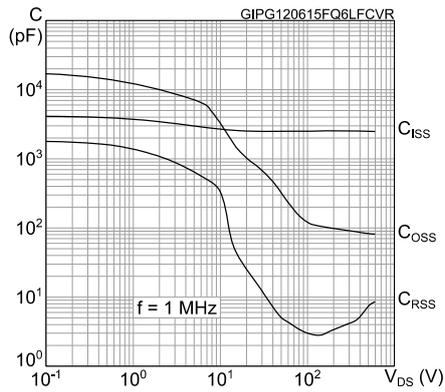


Figure 9: Normalized gate threshold voltage vs temperature

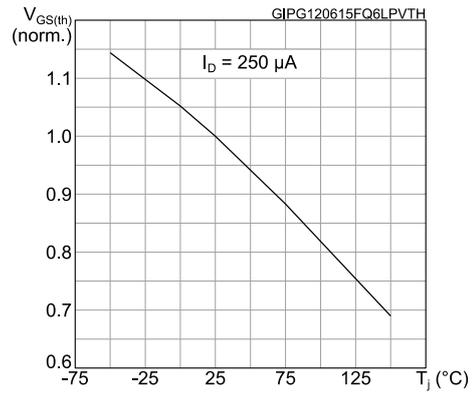


Figure 10: Normalized on-resistance vs temperature

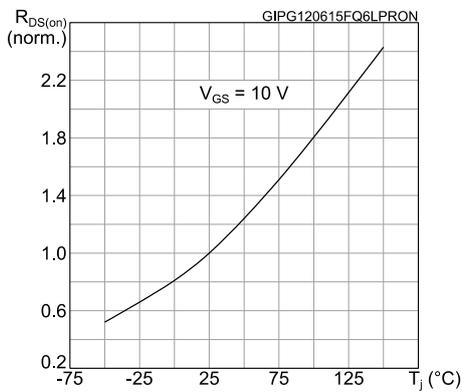


Figure 11: Normalized V(BR)DSS vs temperature

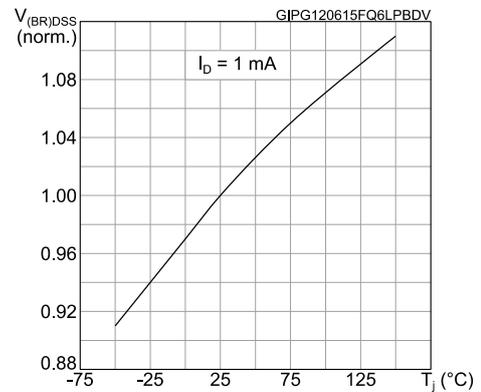


Figure 12: Output capacitance stored energy

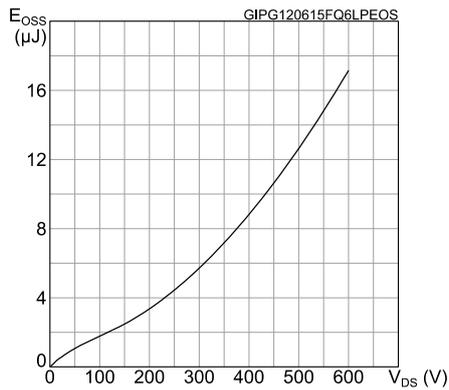
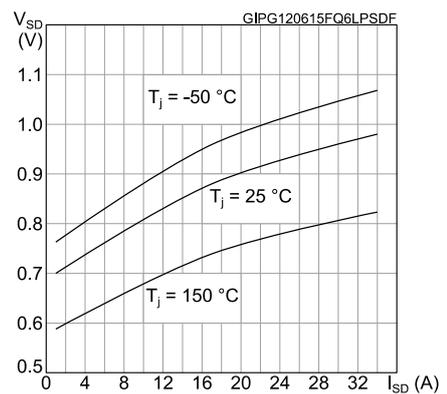
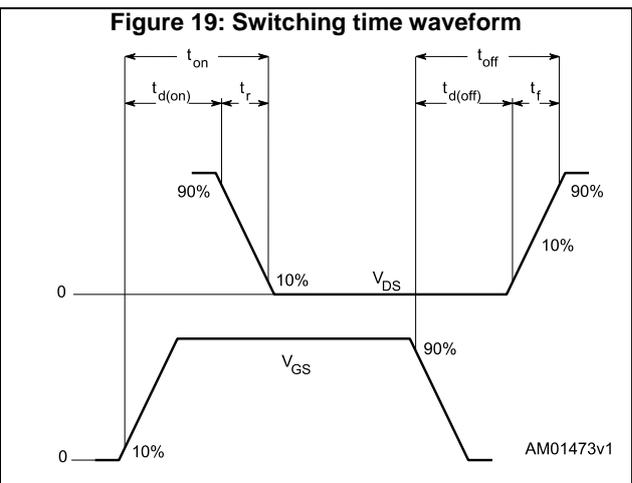
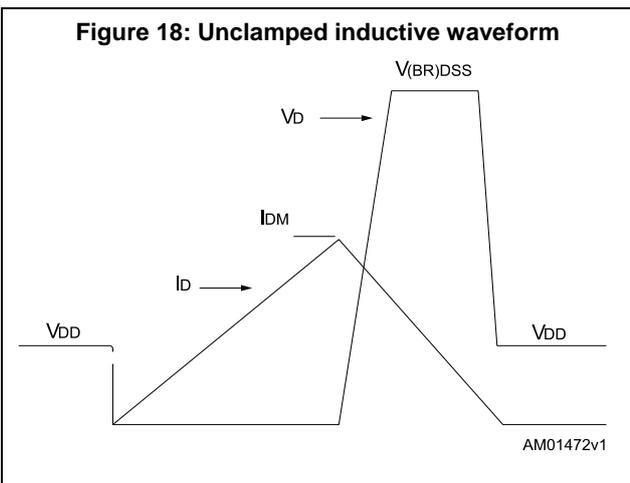
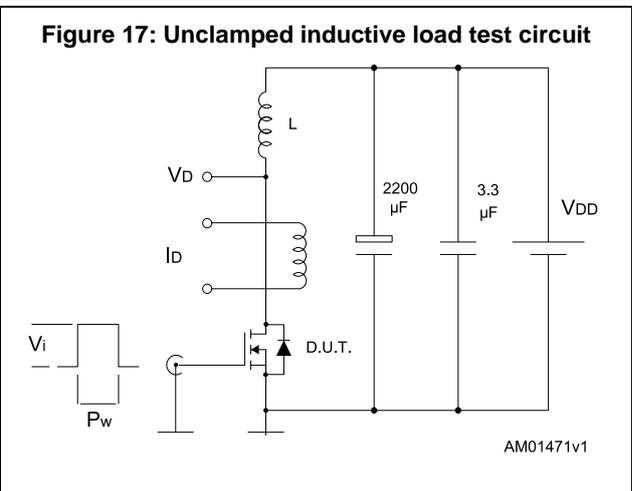
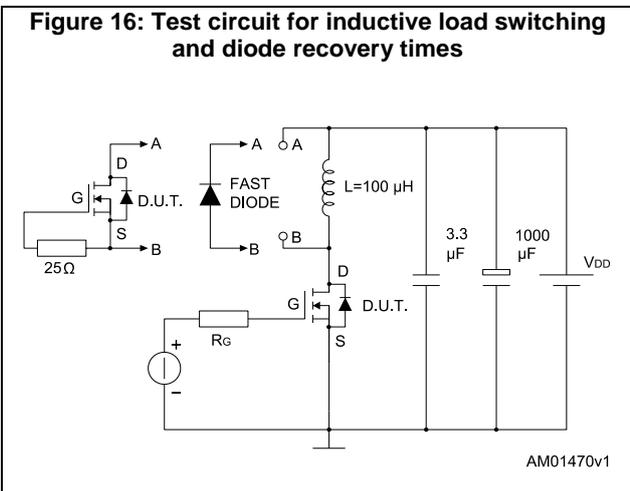
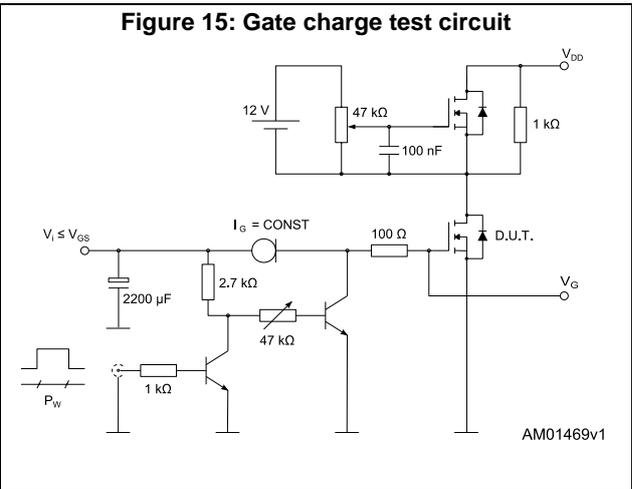
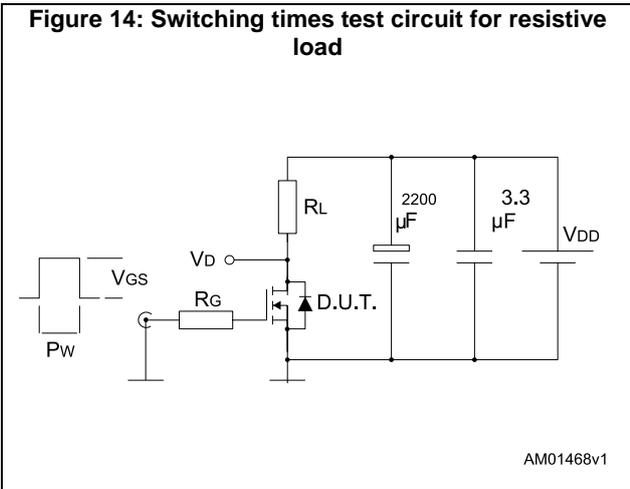


Figure 13: Source-drain diode forward characteristics



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

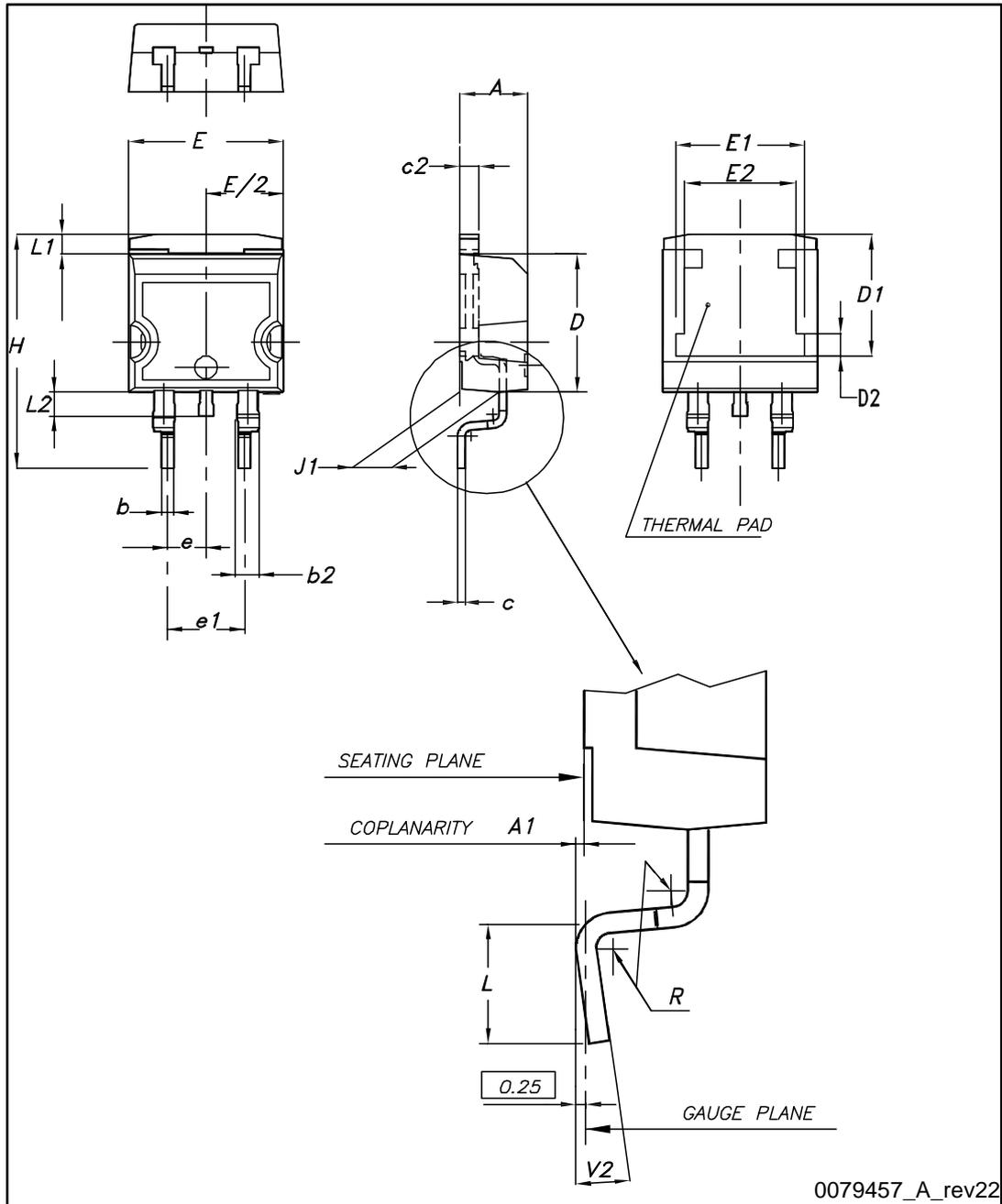
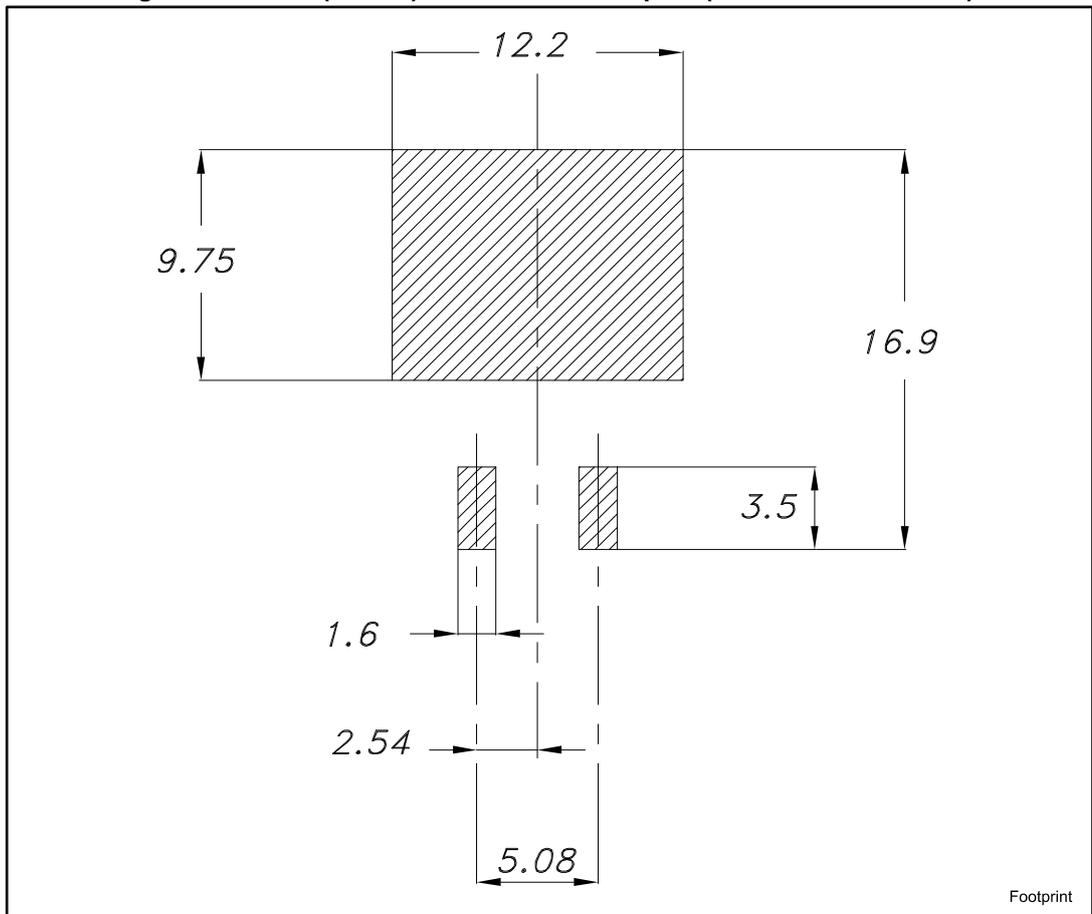


Table 9: D²PAK (TO-263) type A package mechanical data

| 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

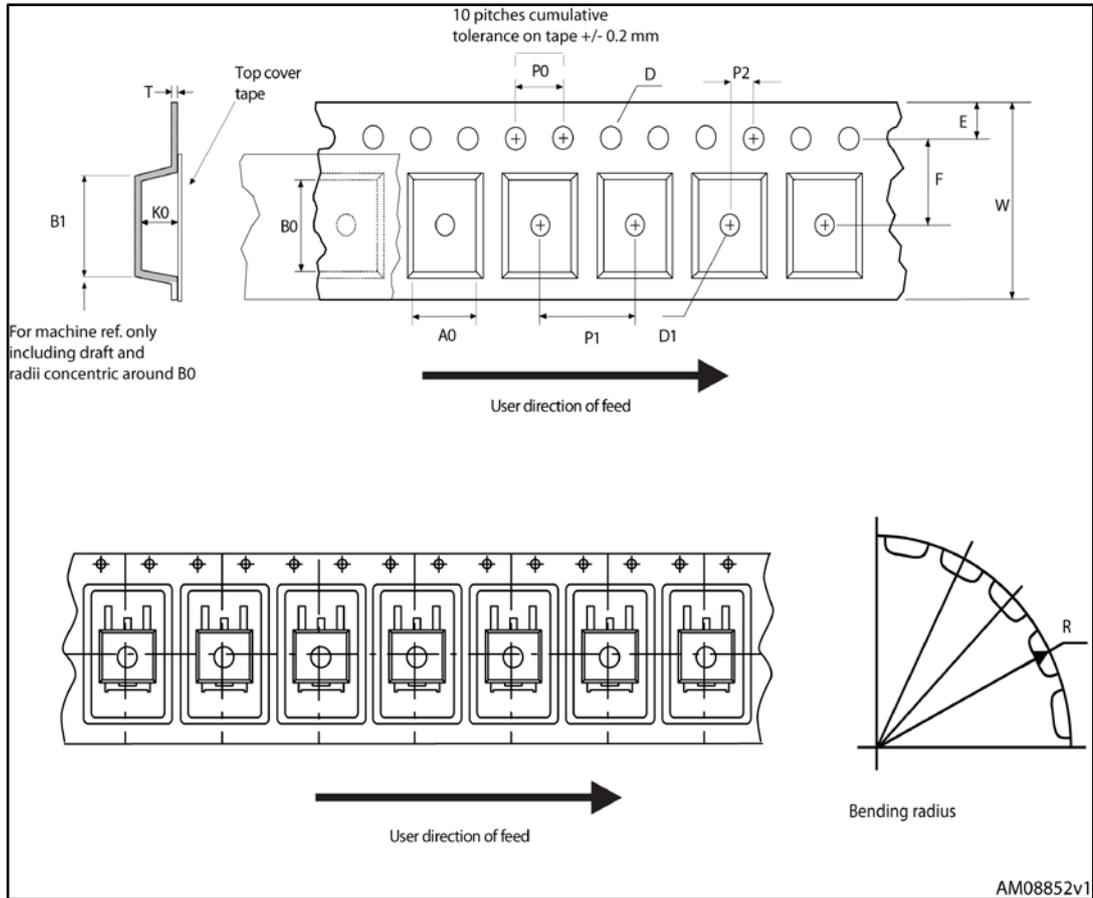
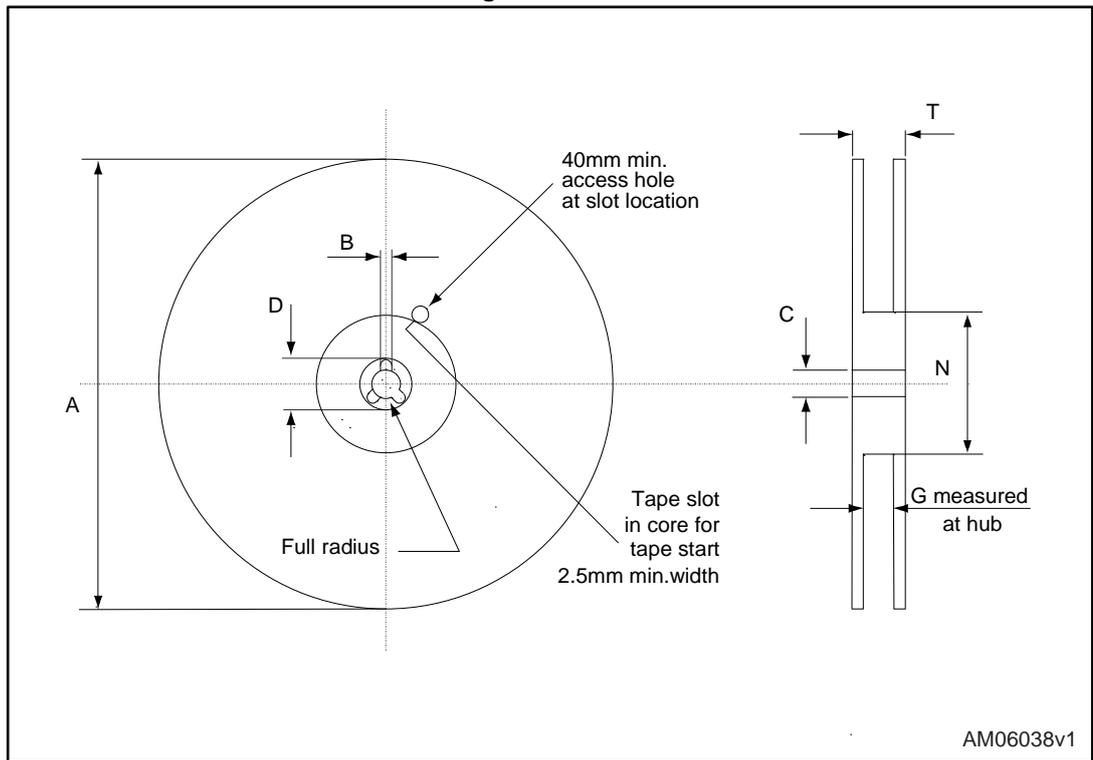


Figure 23: Reel



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. |

IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2015 STMicroelectronics – All rights reserved



Стандарт Электрон Связь

Мы молодая и активно развивающаяся компания в области поставок электронных компонентов. Мы поставляем электронные компоненты отечественного и импортного производства напрямую от производителей и с крупнейших складов мира.

Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

Собственная эффективная логистика и склад в обеспечивает надежную поставку продукции в точно указанные сроки по всей России.

Мы осуществляем техническую поддержку нашим клиентам и предпродажную проверку качества продукции. На все поставляемые продукты мы предоставляем гарантию .

Осуществляем поставки продукции под контролем ВП МО РФ на предприятия военно-промышленного комплекса России , а также работаем в рамках 275 ФЗ с открытием отдельных счетов в уполномоченном банке. Система менеджмента качества компании соответствует требованиям ГОСТ ISO 9001.

Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научно-исследовательскими институтами России.

С нами вы становитесь еще успешнее!

Наши контакты:

Телефон: +7 812 627 14 35

Электронная почта: sales@st-electron.ru

Адрес: 198099, Санкт-Петербург,
Промышленная ул, дом № 19, литера Н,
помещение 100-Н Офис 331