



STB12NM50ND STD12NM50ND, STF12NM50ND

N-channel 500 V, 0.29 Ω , 11 A, FDmesh™ II Power MOSFET
(with fast diode) in D²PAK, DPAK, TO-220FP

Features

| Type | V _{DSS} (@T _{jmax}) | R _{DS(on)} max | I _D |
|-------------|--|-------------------------|----------------|
| STB12NM50ND | 550 V | 0.38 Ω | 11 A |
| STD12NM50ND | 550 V | 0.38 Ω | 11 A |
| STF12NM50ND | 550 V | 0.38 Ω | 11 A |

- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance

Application

- Switching applications

Description

FDmesh™ technology combines the MDmesh™ features with an intrinsic fast-recovery body diode. The resulting product has reduced on-resistance and fast switching commutations, making it especially suitable for bridge topologies where low t_{rr} is required.

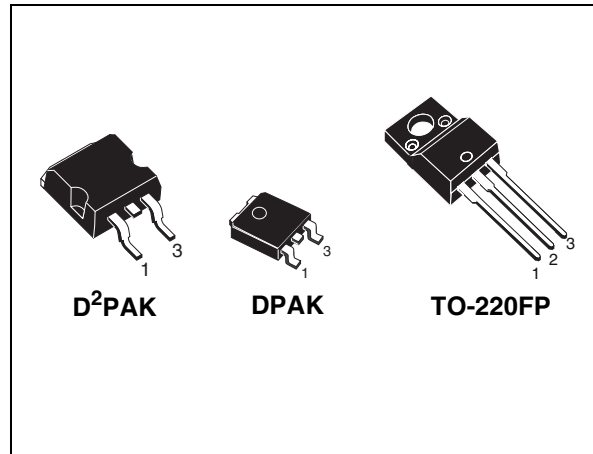


Figure 1. Internal schematic diagram

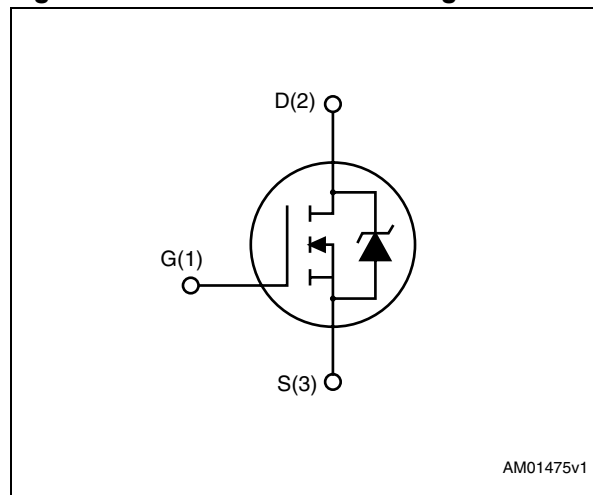


Table 1. Device summary

| Order codes | Marking | Package | Packaging |
|-------------|----------|--------------------|---------------|
| STB12NM50ND | 12NM50ND | D ² PAK | Tape and reel |
| STD12NM50ND | 12NM50ND | DPAK | Tape and reel |
| STF12NM50ND | 12NM50ND | TO-220FP | Tube |

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1 Electrical ratings

Table 2. Absolute maximum ratings

| Symbol | Parameter | Value | | | Unit |
|--------------------------------|--|--------------------|------|--------------------|------|
| | | D ² PAK | DPAK | TO-220FP | |
| V _{DS} | Drain-source voltage (V _{GS} =0) | 500 | | | V |
| V _{GS} | Gate-source voltage | ± 25 | | | V |
| I _D | Drain current (continuous) at T _C = 25 °C | 11 | | 11 ⁽¹⁾ | A |
| I _D | Drain current (continuous) at T _C = 100 °C | 6.9 | | 6.9 ⁽¹⁾ | A |
| I _{DM} ⁽²⁾ | Drain current (pulsed) | 44 | | 44 ⁽¹⁾ | A |
| P _{TOT} | Total dissipation at T _C = 25 °C | 100 | | 25 | W |
| V _{ISO} | Insulation withstand voltage (RMS) from all three leads to external heat sink (t=1 s; T _C =25 °C) | | | 2500 | V |
| dv/dt ⁽³⁾ | Peak diode recovery voltage slope | 40 | | | V/ns |
| T _{stg} | Storage temperature | -55 to 150 | | | °C |
| T _j | Operating junction temperature | 150 | | | °C |

- Limited only by maximum temperature allowed
- Pulse width limited by safe operating area
- I_{SD} ≤ 11 A, di/dt ≤ 600 A/μs, V_{DD} = 80% V_{(BR)DSS}

Table 3. Thermal data

| Symbol | Parameter | Value | | | Unit |
|-----------------------|---|--------------------|------|----------|------|
| | | D ² PAK | DPAK | TO-220FP | |
| R _{thj-case} | Thermal resistance junction-case max | 1.25 | | 5 | °C/W |
| R _{thj-pcb} | Thermal resistance junction-pcb max | 30 | 50 | | °C/W |
| R _{thj-amb} | Thermal resistance junction-amb max | | | 62.5 | °C/W |
| T _l | Maximum lead temperature for soldering purposes | 300 | | | °C |

Table 4. Avalanche characteristics

| Symbol | Parameter | Max value | Unit |
|-----------------|--|-----------|------|
| I _{AS} | Avalanche current, repetitive or not-repetitive (pulse width limited by T _j max) | 5 | A |
| E _{AS} | Single pulse avalanche energy (starting T _j = 25 °C, I _D = I _{AS} , V _{DD} = 50 V) | 350 | mJ |

2 Electrical characteristics

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

Table 5. On/off states

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|--|--|------|------|----------|--------------------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $I_D = 1\text{ mA}$, $V_{GS} = 0$ | 500 | | | V |
| $dv/dt^{(1)}$ | Drain-source voltage slope | $V_{DD} = 400\text{ V}$, $I_D = 11\text{ A}$, $V_{GS} = 10\text{ V}$ | 44 | | | V/ns |
| I_{DSS} | Zero gate voltage drain current ($V_{GS} = 0$) | $V_{DS} = \text{Max rating}$, $V_{DS} = \text{Max rating}$, @ 125 °C | | | 1 100 | μA μA |
| I_{GSS} | Gate body leakage current ($V_{DS} = 0$) | $V_{GS} = \pm 20\text{ V}$ | | | 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 | $V_{GS} = 10\text{ V}$, $I_D = 5.5\text{ A}$ | | 0.29 | 0.38 | Ω |

1. Value measured at turn off under inductive load

Table 6. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-------------------------------------|---|---|------|----------------|------|----------------|
| $g_{fs}^{(1)}$ | Forward transconductance | $V_{DS} = 15\text{ V}$, $I_D = 5.5\text{ A}$ | - | 8 | - | S |
| C_{iss} C_{oss} C_{rss} | Input capacitance Output capacitance Reverse transfer capacitance | $V_{DS} = 50\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$ | - | 850 48 5 | - | pF pF pF |
| $C_{oss\text{ eq.}}^{(2)}$ | Equivalent output capacitance | $V_{GS} = 0$, $V_{DS} = 0\text{ to }400\text{ V}$ | - | 100 | - | pF |
| R_g | Gate input resistance | $f = 1\text{ MHz}$ Gate DC Bias = 0 Test signal level = 20 mV open drain | - | 4.5 | - | Ω |
| Q_g Q_{gs} Q_{gd} | Total gate charge Gate-source charge Gate-drain charge | $V_{DD} = 400\text{ V}$, $I_D = 11\text{ A}$ $V_{GS} = 10\text{ V}$ <i>Figure 19</i> | - | 30 6 17 | - | nC nC nC |

1. Pulsed: pulse duration = 300 μs , duty cycle 1.5%

2. $C_{oss\text{ eq.}}$ 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 | $V_{DD} = 250\text{ V}$, $I_D = 5.5\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ <i>Figure 18</i> | - | 12 | - | ns |
| t_r | Rise time | | - | 15 | - | ns |
| $t_{d(off)}$ | Turn-off delay time | | - | 40 | - | ns |
| t_f | Fall time | | - | 17 | - | ns |

Table 8. Source drain diode

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------|--|------|------|------|------|
| I_{SD} | Source-drain current | | - | | 11 | A |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) | | - | | 44 | A |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD} = 11\text{ A}$, $V_{GS} = 0$ | - | | 1.6 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 11\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 100\text{ V}$ <i>Figure 20</i> | - | 122 | | ns |
| Q_{rr} | Reverse recovery charge | | - | 650 | | nC |
| I_{RRM} | Reverse recovery current | | - | 11 | | A |
| t_{rr} | Reverse recovery time | $V_{DD} = 100\text{ V}$ $di/dt = 100\text{ A}/\mu\text{s}$, $I_{SD} = 11\text{ A}$ $T_j = 150\text{ }^\circ\text{C}$, <i>Figure 20</i> | - | 160 | | ns |
| Q_{rr} | Reverse recovery charge | | - | 940 | | nC |
| I_{RRM} | Reverse recovery current | | - | 12 | | A |

1. Pulse width limited by safe operating area

2. Pulsed: pulse duration = 300 μs , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for D²PAK

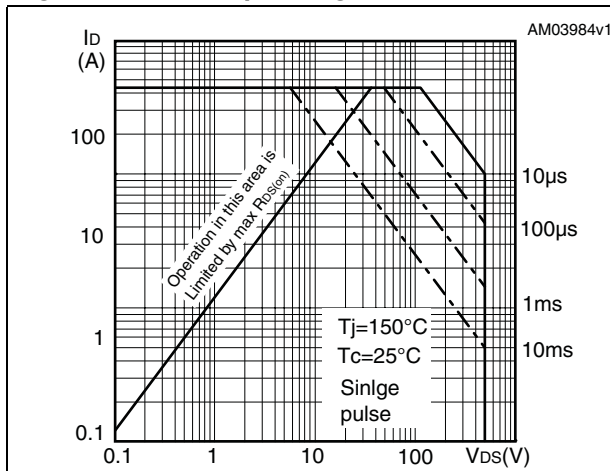


Figure 3. Thermal impedance for D²PAK

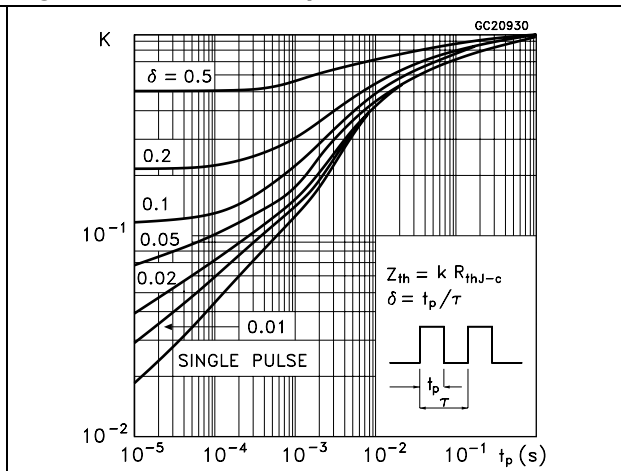


Figure 4. Safe operating area for TO-220FP

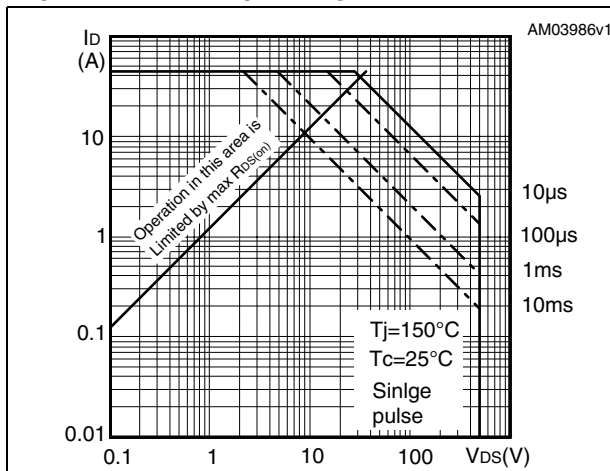


Figure 5. Thermal impedance for TO-220FP

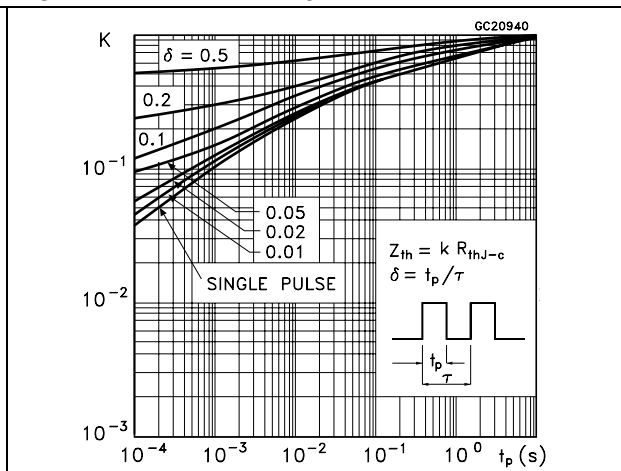


Figure 6. Safe operating area for DPAK

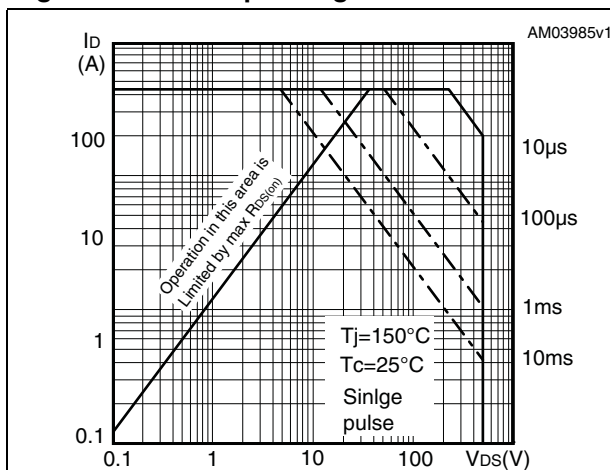


Figure 7. Thermal impedance for DPAK

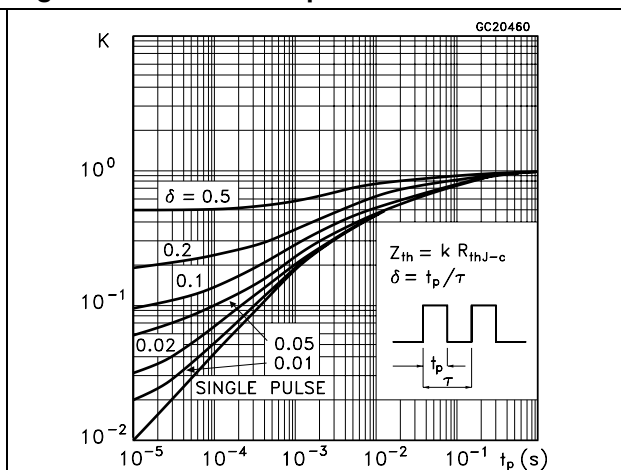


Figure 8. Output characteristics

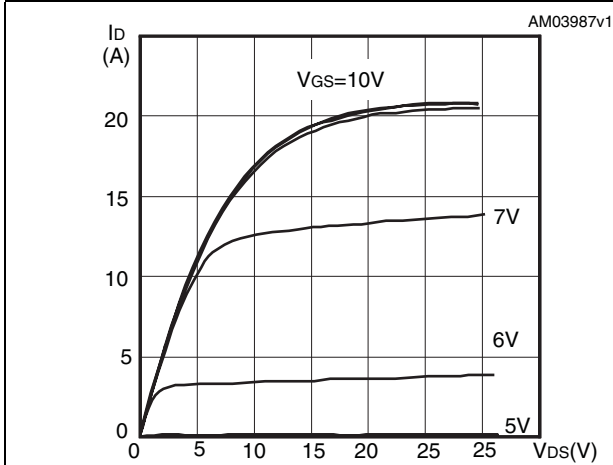


Figure 9. Transfer characteristics

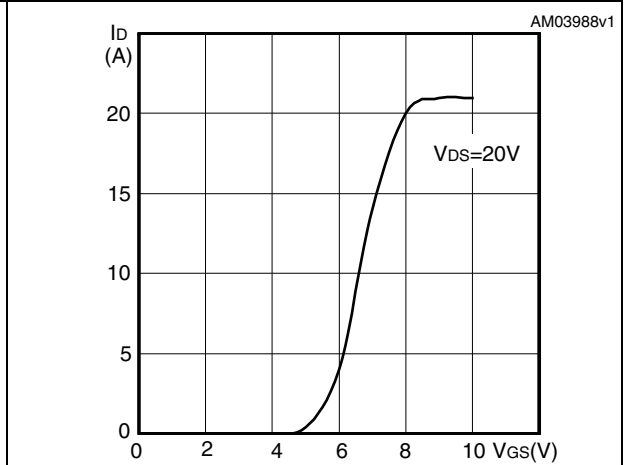


Figure 10. Transconductance

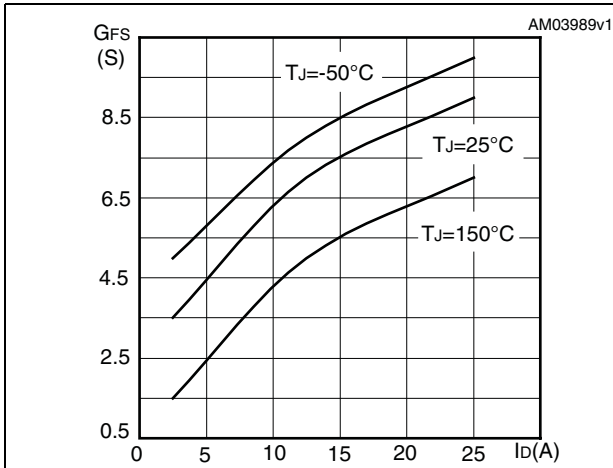


Figure 11. Static drain-source on resistance

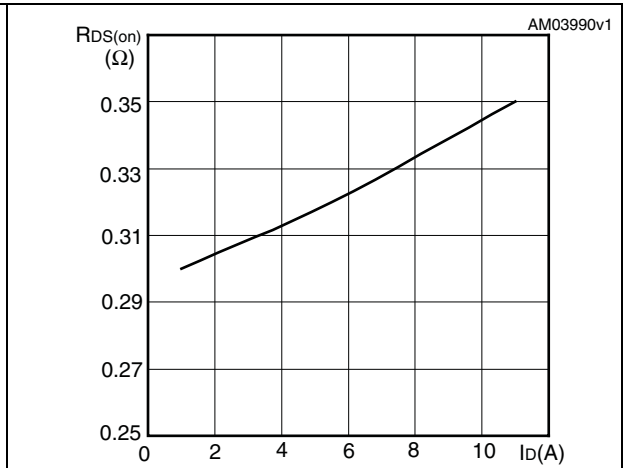


Figure 12. Gate charge vs gate-source voltage

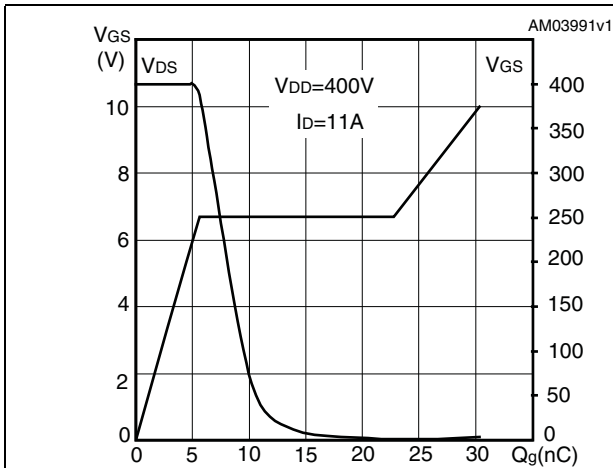


Figure 13. Capacitance variations

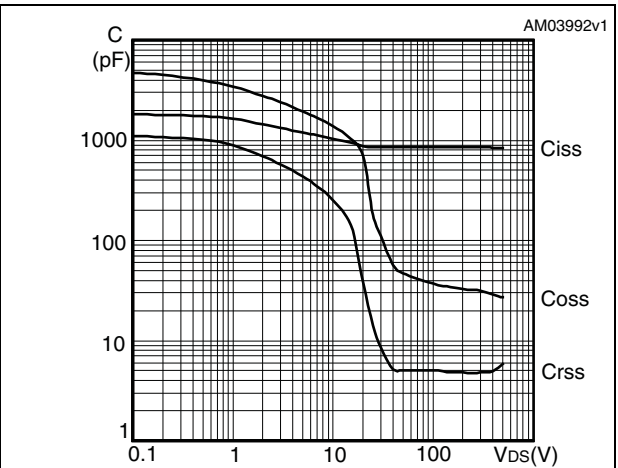


Figure 14. Normalized gate threshold voltage vs temperature

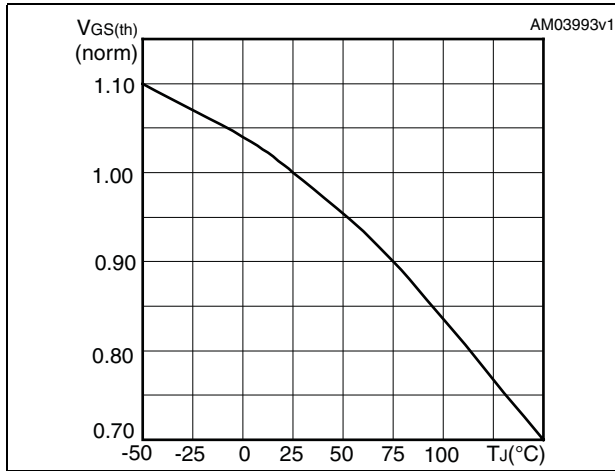


Figure 15. Normalized on resistance vs temperature

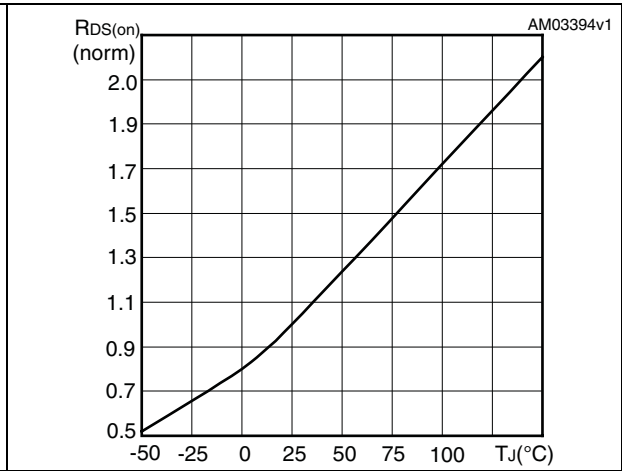


Figure 16. Source-drain diode forward characteristics

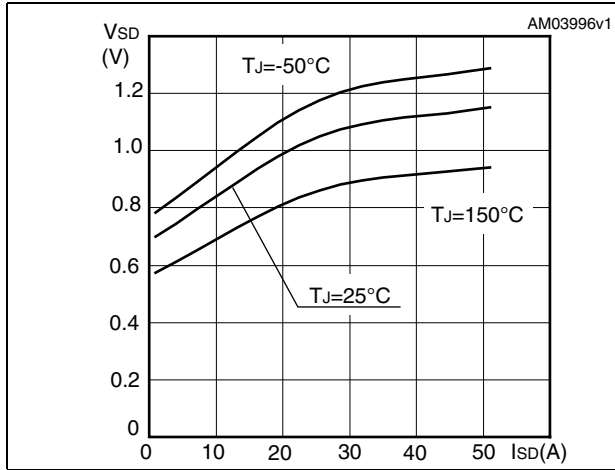
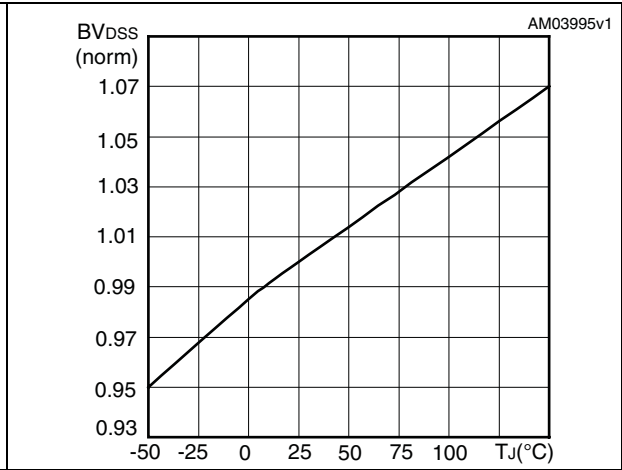


Figure 17. Normalized BV_{DSS} vs temperature



3 Test circuits

Figure 18. Switching times test circuit for resistive load

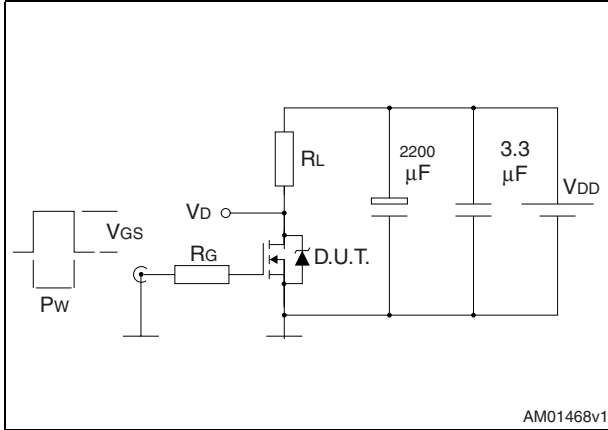


Figure 19. Gate charge test circuit

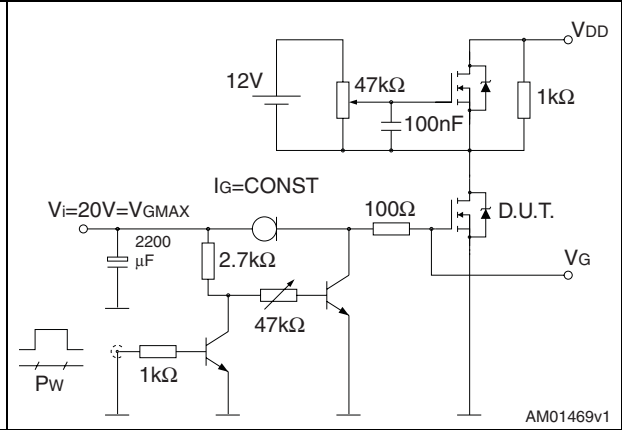


Figure 20. Test circuit for inductive load switching and diode recovery times

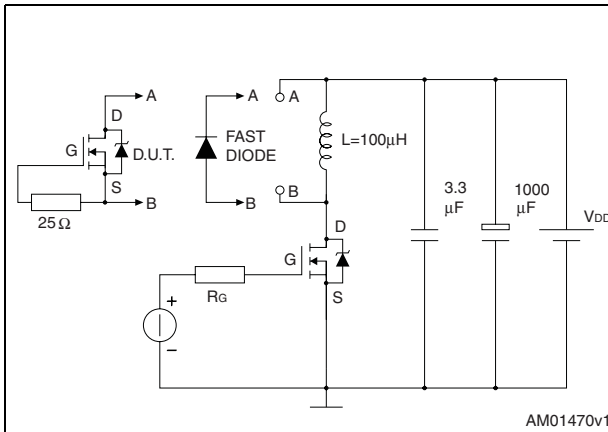


Figure 21. Unclamped inductive load test circuit

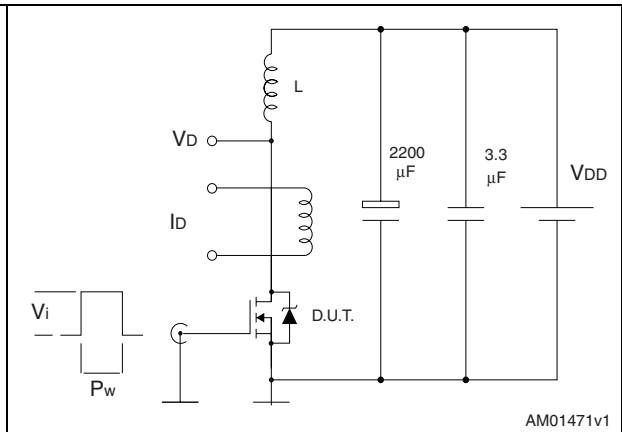


Figure 22. Unclamped inductive waveform

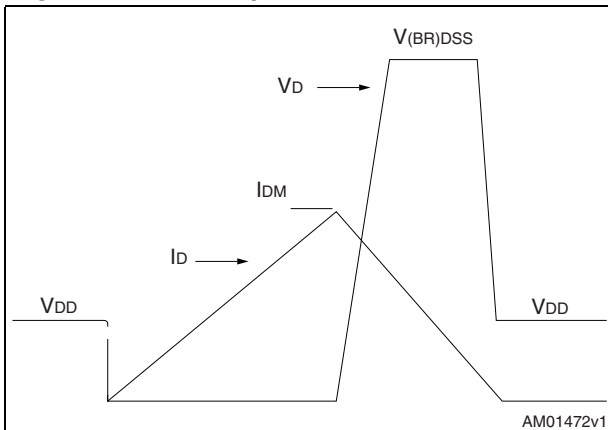
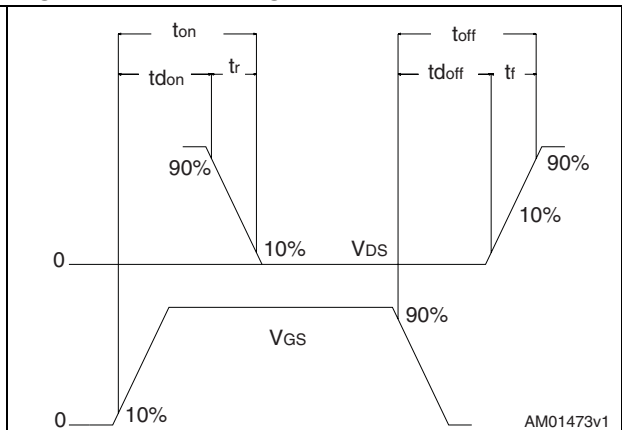


Figure 23. Switching time waveform

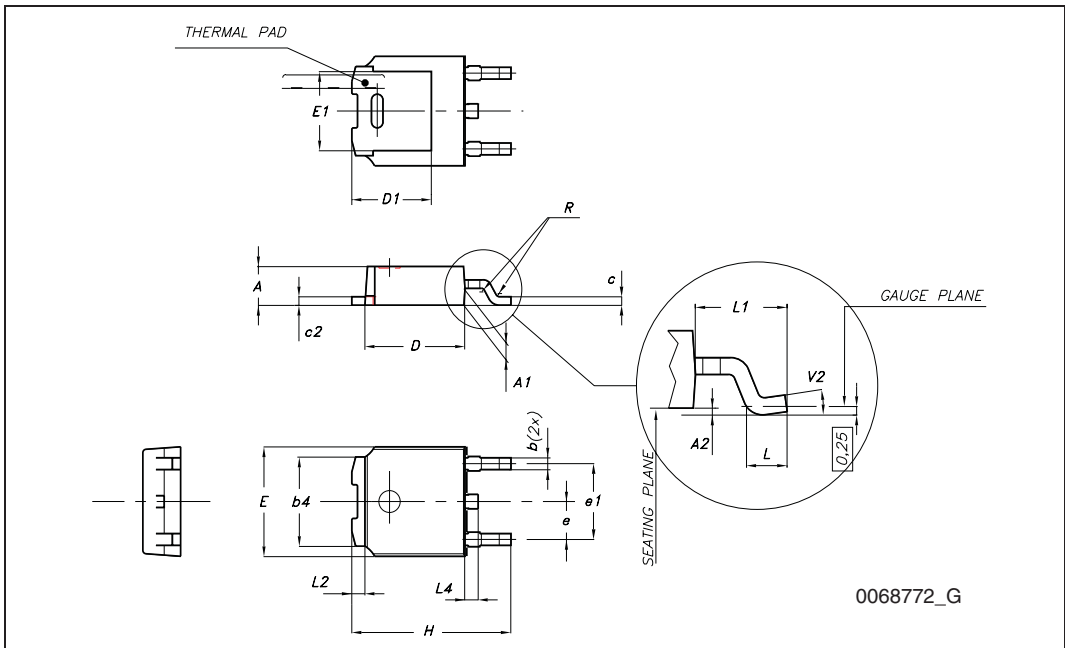


4 Package mechanical data

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.

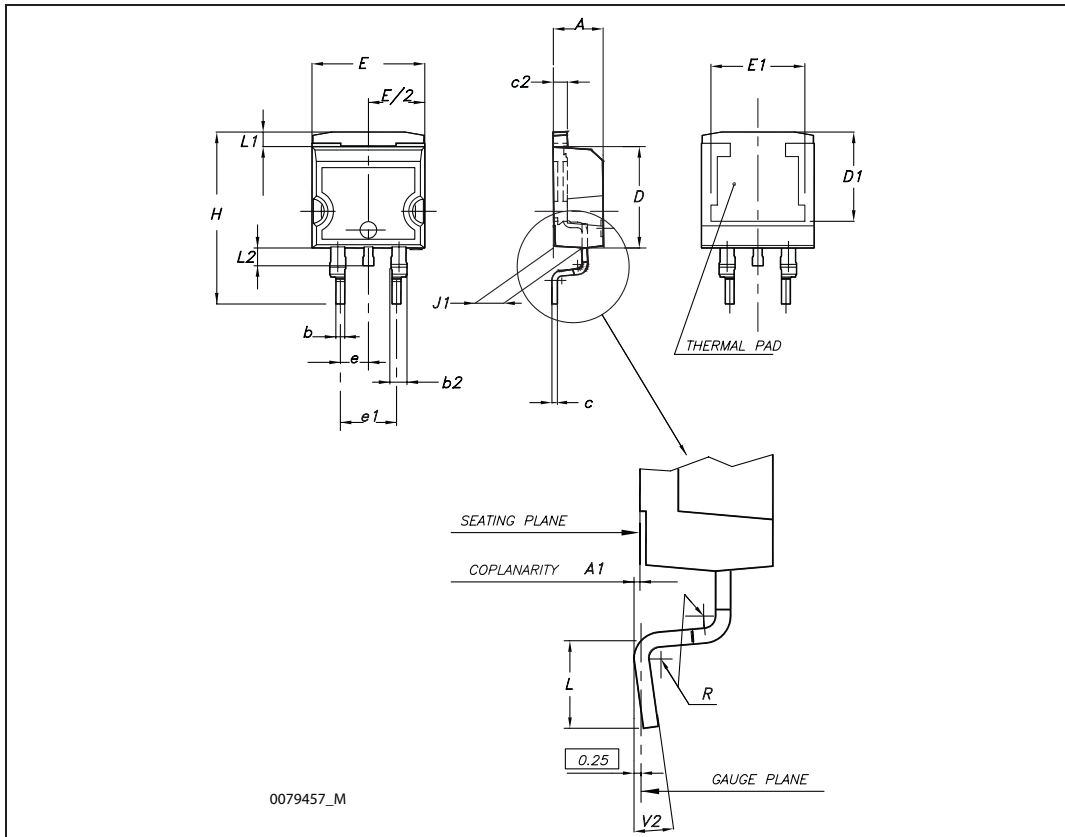
TO-252 (DPAK) mechanical data

| 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 | | 5.10 | |
| E | 6.40 | | 6.60 |
| E1 | | 4.70 | |
| e | | 2.28 | |
| e1 | 4.40 | | 4.60 |
| H | 9.35 | | 10.10 |
| L | 1 | | |
| L1 | | 2.80 | |
| L2 | | 0.80 | |
| L4 | 0.60 | | 1 |
| R | | 0.20 | |
| V2 | 0° | | 8° |



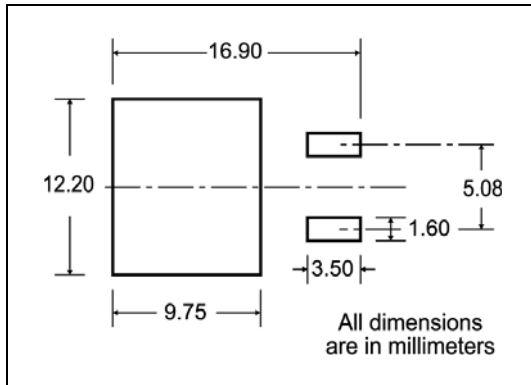
D²PAK (TO-263) mechanical data

| Dim | mm | | | inch | | |
|-----|------|------|-------|-------|-------|-------|
| | Min | Typ | Max | Min | Typ | Max |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| A1 | 0.03 | | 0.23 | 0.001 | | 0.009 |
| b | 0.70 | | 0.93 | 0.027 | | 0.037 |
| b2 | 1.14 | | 1.70 | 0.045 | | 0.067 |
| c | 0.45 | | 0.60 | 0.017 | | 0.024 |
| c2 | 1.23 | | 1.36 | 0.048 | | 0.053 |
| D | 8.95 | | 9.35 | 0.352 | | 0.368 |
| D1 | 7.50 | | | 0.295 | | |
| E | 10 | | 10.40 | 0.394 | | 0.409 |
| E1 | 8.50 | | | 0.334 | | |
| e | | 2.54 | | | 0.1 | |
| e1 | 4.88 | | 5.28 | 0.192 | | 0.208 |
| H | 15 | | 15.85 | 0.590 | | 0.624 |
| J1 | 2.49 | | 2.69 | 0.099 | | 0.106 |
| L | 2.29 | | 2.79 | 0.090 | | 0.110 |
| L1 | 1.27 | | 1.40 | 0.05 | | 0.055 |
| L2 | 1.30 | | 1.75 | 0.051 | | 0.069 |
| R | | 0.4 | | | 0.016 | |
| V2 | 0° | | 8° | 0° | | 8° |



5 Packaging mechanical data

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT

TAPE MECHANICAL DATA

| DIM. | mm | | inch | |
|------|------|------|--------|--------|
| | MIN. | MAX. | MIN. | MAX. |
| A0 | 10.5 | 10.7 | 0.413 | 0.421 |
| B0 | 15.7 | 15.9 | 0.618 | 0.626 |
| D | 1.5 | 1.6 | 0.059 | 0.063 |
| D1 | 1.59 | 1.61 | 0.062 | 0.063 |
| E | 1.65 | 1.85 | 0.065 | 0.073 |
| F | 11.4 | 11.6 | 0.449 | 0.456 |
| K0 | 4.8 | 5.0 | 0.189 | 0.197 |
| P0 | 3.9 | 4.1 | 0.153 | 0.161 |
| P1 | 11.9 | 12.1 | 0.468 | 0.476 |
| P2 | 1.9 | 2.1 | 0.075 | 0.082 |
| R | 50 | | 1.574 | |
| T | 0.25 | 0.35 | 0.0098 | 0.0137 |
| W | 23.7 | 24.3 | 0.933 | 0.956 |

REEL MECHANICAL DATA

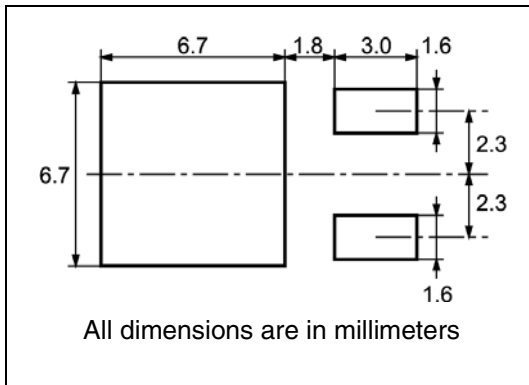
| DIM. | mm | | inch | |
|------|------|------|-------|--------|
| | MIN. | MAX. | MIN. | MAX. |
| A | | 330 | | 12.992 |
| B | 1.5 | | 0.059 | |
| C | 12.8 | 13.2 | 0.504 | 0.520 |
| D | 20.2 | | 0.795 | |
| G | 24.4 | 26.4 | 0.960 | 1.039 |
| N | 100 | | 3.937 | |
| T | | 30.4 | | 1.197 |

| BASE QTY | BULK QTY |
|----------|----------|
| 1000 | 1000 |

10 pitches cumulative tolerance on tape + / - 0.2 mm

* on sales type

DPAK FOOTPRINT



TAPE AND REEL SHIPMENT

40 mm min. Access hole at slot location

Full radius

Tape slot in core for tape start 2.5mm min. width

G measured at hub

| DIM. | mm | | inch | |
|------|------|------|-------|--------|
| | MIN. | MAX. | MIN. | MAX. |
| A | | 330 | | 12.992 |
| B | 1.5 | | 0.059 | |
| C | 12.8 | 13.2 | 0.504 | 0.520 |
| D | 20.2 | | 0.795 | |
| G | 16.4 | 18.4 | 0.645 | 0.724 |
| N | 50 | | 1.968 | |
| T | | 22.4 | | 0.881 |

| BASE QTY | | BULK QTY | |
|----------|--|----------|--|
| 2500 | | 2500 | |

TAPE MECHANICAL DATA

| DIM. | mm | | inch | |
|------|------|------|-------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A0 | 6.8 | 7 | 0.267 | 0.275 |
| B0 | 10.4 | 10.6 | 0.409 | 0.417 |
| B1 | | 12.1 | | 0.476 |
| D | 1.5 | 1.6 | 0.059 | 0.063 |
| D1 | 1.5 | | 0.059 | |
| E | 1.65 | 1.85 | 0.065 | 0.073 |
| F | 7.4 | 7.6 | 0.291 | 0.299 |
| K0 | 2.55 | 2.75 | 0.100 | 0.108 |
| P0 | 3.9 | 4.1 | 0.153 | 0.161 |
| P1 | 7.9 | 8.1 | 0.311 | 0.319 |
| P2 | 1.9 | 2.1 | 0.075 | 0.082 |
| R | 40 | | 1.574 | |
| W | 15.7 | 16.3 | 0.618 | 0.641 |

For machine ref. only including draft and radii concentric around B0

10 pitches cumulative tolerance on tape +/- 0.2 mm

Center line of cavity

TRL

FEED DIRECTION

Bending radius R min.

6 Revision history

Table 9. Document revision history

| Date | Revision | Changes |
|-------------|-----------------|--|
| 23-Sep-2008 | 1 | First release |
| 10-Jun-2009 | 2 | Added new package, mechanical data: TO-220FP |

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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!

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