



STB18N55M5, STD18N55M5 STF18N55M5, STP18N55M5

N-channel 550 V, 0.18 Ω , 13 A, MDmesh™ V Power MOSFET
in D²PAK, DPAK, TO-220FP and TO-220

Features

| Order codes | V _{DSS} @T _{Jmax} | R _{DS(on)} max | I _D |
|--|--|----------------------------|----------------|
| STB18N55M5 STD18N55M5 STF18N55M5 STP18N55M5 | 550 V | < 0.24 Ω | 13 A |

- DPAK worldwide best R_{DS(on)}
- Higher V_{DSS} rating
- High dv/dt capability
- Excellent switching performance
- Easy to drive
- 100% avalanche tested

Application

Switching applications

Description

The devices are N-channel MDmesh™ V Power MOSFET based on an innovative proprietary vertical process technology, which is combined with STMicroelectronics' well-known PowerMESH™ horizontal layout structure. The resulting product has extremely low on-resistance, which is unmatched among silicon-based Power MOSFETs, making it especially suitable for applications which require superior power density and outstanding efficiency.

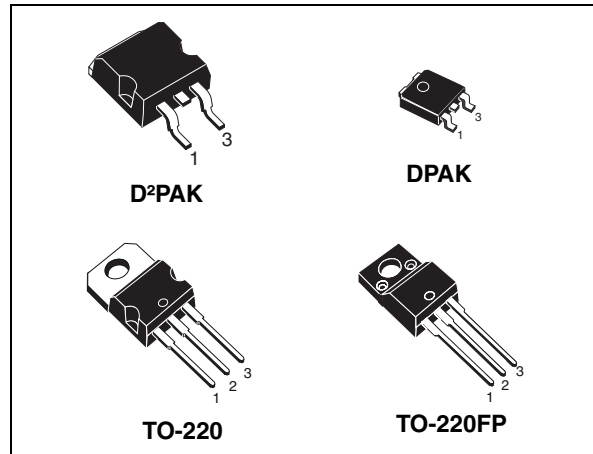


Figure 1. Internal schematic diagram



Table 1. Device summary

| Order codes | Marking | Package | Packaging |
|-------------|---------|--------------------|---------------|
| STB18N55M5 | 18N55M5 | D ² PAK | Tape and reel |
| STD18N55M | | DPAK | |
| STF18N55M5 | | TO-220FP | Tube |
| STP18N55M5 | | TO-220 | |

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1 Electrical ratings

Table 2. Absolute maximum ratings

| Symbol | Parameter | Value | | Unit |
|--------------------------------|---|----------------------------------|--------------------|------|
| | | TO-220, DPAK, D ² PAK | TO-220FP | |
| V _{GS} | Gate-source voltage | 25 | | V |
| I _D | Drain current (continuous) at T _C = 25 °C | 13 | 13 ⁽¹⁾ | A |
| I _D | Drain current (continuous) at T _C = 100 °C | 8.3 | 8.3 ⁽¹⁾ | A |
| I _{DM} ⁽²⁾ | Drain current (pulsed) | 52 | 52 ⁽¹⁾ | A |
| P _{TOT} | Total dissipation at T _C = 25 °C | 90 | 25 | W |
| I _{AR} | Avalanche current, repetitive or not-repetitive (pulse width limited by T _j max) | 4 | | A |
| E _{AS} | Single pulse avalanche energy (starting T _j = 25°C, I _D = I _{AR} , V _{DD} = 50 V) | 200 | | mJ |
| dv/dt ⁽³⁾ | Peak diode recovery voltage slope | 15 | | V/ns |
| V _{ISO} | Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s; T _C = 25 °C) | | 2500 | V |
| T _{stg} | Storage temperature | - 55 to 50 | | °C |
| T _j | Max. operating junction temperature | 150 | | °C |

1. Limited only by maximum temperature allowed.
2. Pulse width limited by safe operating area.
3. I_{SD} ≤13 A, di/dt ≤400 A/μs, V_{Peak} < V_{(BR)DSS}, V_{DD} = 400 V.

Table 3. Thermal data

| Symbol | Parameter | Value | | | | Unit |
|-----------------------|--|-------|--------------------|--------|----------|------|
| | | DPAK | D ² PAK | TO-220 | TO-220FP | |
| R _{thj-case} | Thermal resistance junction-case max | 1.39 | | 5 | | °C/W |
| R _{thj-amb} | Thermal resistance junction-ambient max | | | 62.5 | | °C/W |
| R _{thj-pcb} | Thermal resistance junction-pcb max | 50 | 30 | | | °C/W |
| T _l | Maximum lead temperature for soldering purpose | 300 | | | | °C |

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 | $I_D = 1\text{ mA}$, $V_{GS} = 0$ | 550 | | | V |
| I_{DSS} | Zero gate voltage drain current ($V_{GS} = 0$) | $V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating}$, $T_C = 125\text{ °C}$ | | | 1 100 | μA μA |
| I_{GSS} | Gate-body leakage current ($V_{DS} = 0$) | $V_{GS} = \pm 25\text{ V}$ | | | 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 | $V_{GS} = 10\text{ V}$, $I_D = 6.5\text{ A}$ | | 0.18 | 0.24 | Ω |

Table 5. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-------------------|---------------------------------------|--|------|------|------|----------|
| C_{iss} | Input capacitance | $V_{DS} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$ | - | 1352 | - | pF |
| C_{oss} | Output capacitance | | | 38 | | pF |
| C_{rss} | Reverse transfer capacitance | | | 3.7 | | pF |
| $C_{o(tr)}^{(1)}$ | Equivalent capacitance time related | $V_{DS} = 0\text{ to }440\text{ V}$ | - | 98 | - | pF |
| $C_{o(er)}^{(2)}$ | Equivalent capacitance energy related | | | 35 | | pF |
| R_G | Intrinsic gate resistance | $f = 1\text{ MHz}$ open drain | - | 1.7 | - | Ω |
| Q_g | Total gate charge | $V_{DD} = 440\text{ V}$, $I_D = 6.5\text{ A}$, $V_{GS} = 10\text{ V}$ (see Figure 19) | - | 31 | - | nC |
| Q_{gs} | Gate-source charge | | | 6.3 | | nC |
| Q_{gd} | Gate-drain charge | | | 14 | | nC |

- $C_{oss\text{ eq.}}$ time related 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}
- $C_{oss\text{ eq.}}$ energy related is defined as a constant equivalent capacitance giving the same stored energy as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}

Table 6. Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max | Unit |
|--------------|---------------------|--|------|------|-----|------|
| $t_{d(off)}$ | Turn-off delay time | $V_{DD} = 400\text{ V}$, $I_D = 9\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 18 , Figure 23) | | 29 | | ns |
| t_r | Rise time | | - | 9.5 | - | ns |
| t_c | Cross time | | | | 23 | ns |
| t_f | Fall time | | | | 13 | ns |

Table 7. Source drain diode

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------|--|------|------|------|---------------|
| I_{SD} | Source-drain current | | - | | 13 | A |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) | | | | 52 | A |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD} = 13\text{ A}$, $V_{GS} = 0$ | - | | 1.5 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 13\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ (see Figure 20) | - | 238 | | ns |
| Q_{rr} | Reverse recovery charge | | | 2.8 | | μC |
| I_{RRM} | Reverse recovery current | | | 23.5 | | A |
| t_{rr} | Reverse recovery time | $I_{SD} = 13\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ (see Figure 20) | - | 278 | | ns |
| Q_{rr} | Reverse recovery charge | | | 3.3 | | μC |
| I_{RRM} | Reverse recovery current | | | 24 | | 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 TO-220, D²PAK

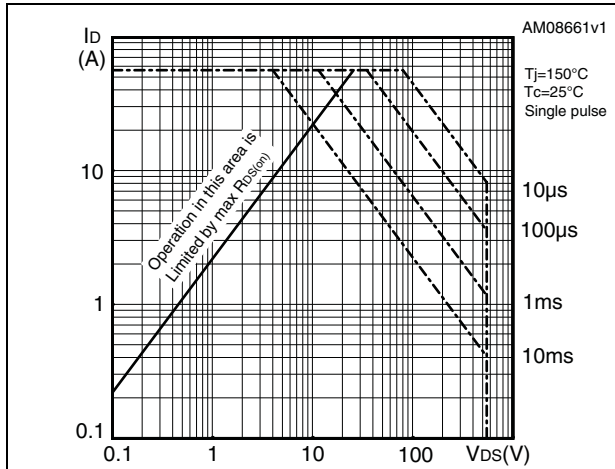


Figure 3. Thermal impedance for TO-220, D²PAK

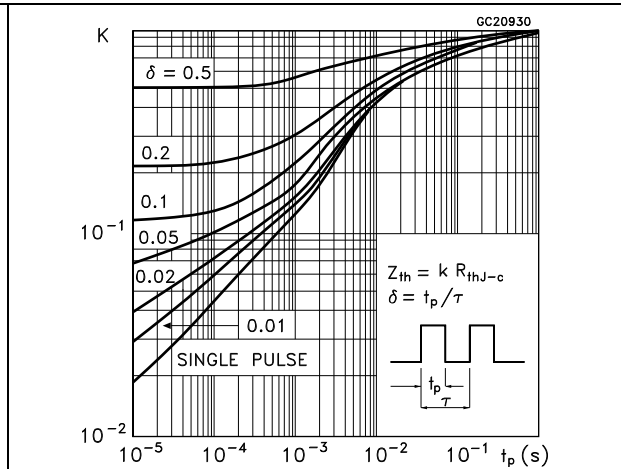


Figure 4. Safe operating area for DPAK

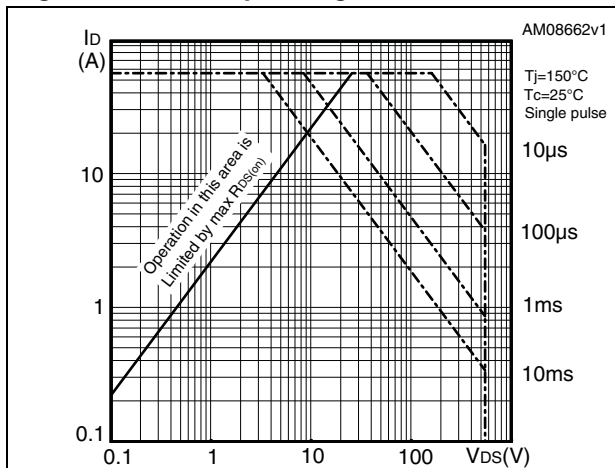


Figure 5. Thermal impedance for DPAK

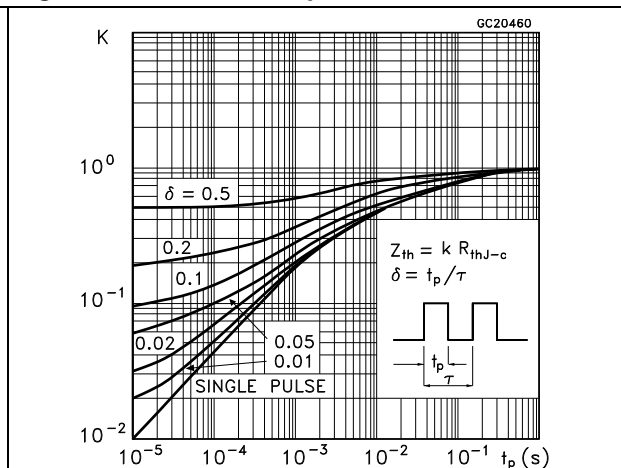


Figure 6. Safe operating area for TO-220FP

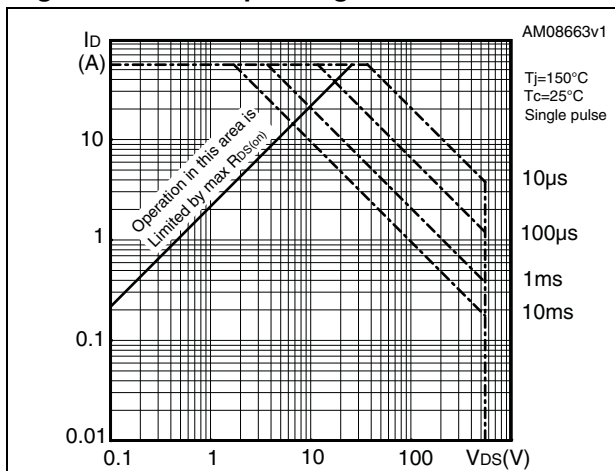


Figure 7. Thermal impedance for TO-220FP

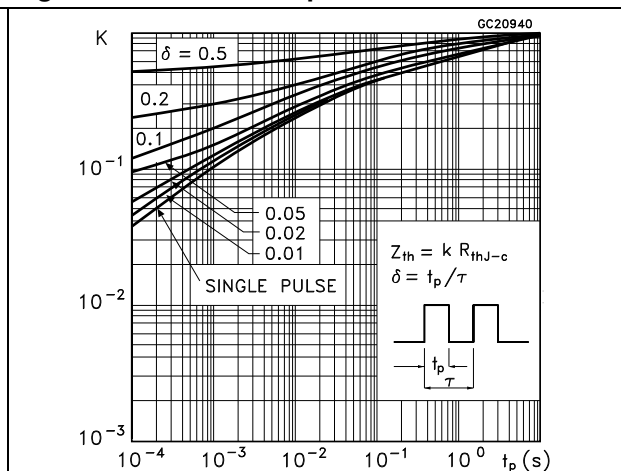


Figure 8. Output characteristics

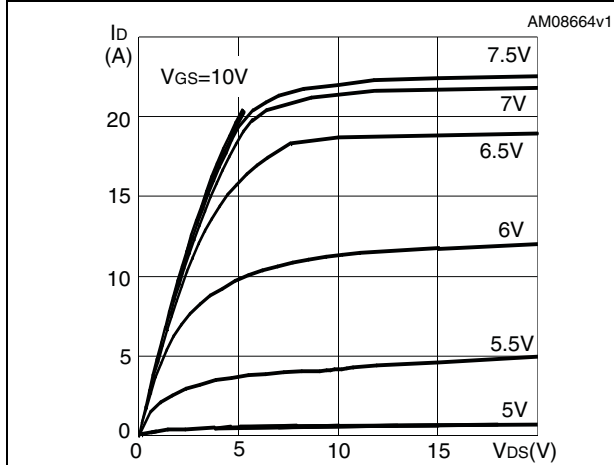


Figure 9. Transfer characteristics

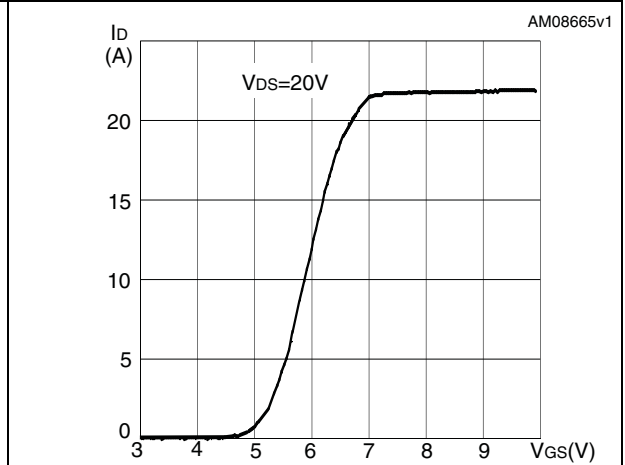


Figure 10. Gate charge vs gate-source voltage Figure 11. Static drain-source on resistance

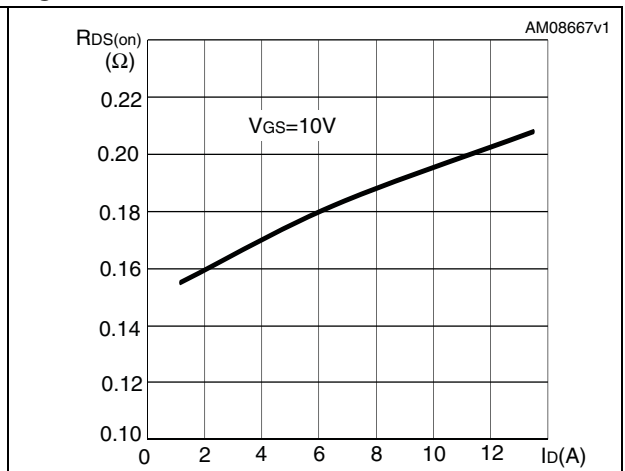
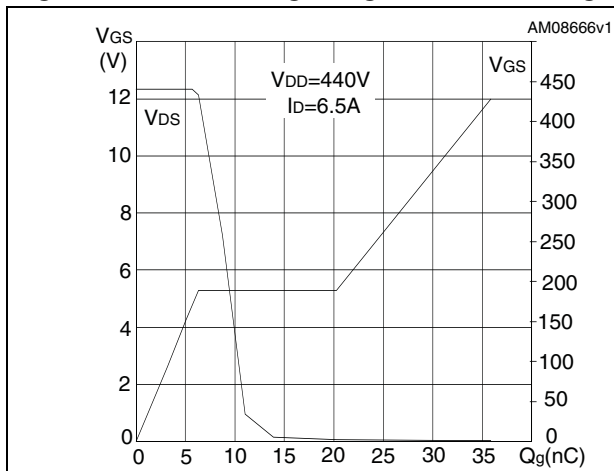


Figure 12. Capacitance variations

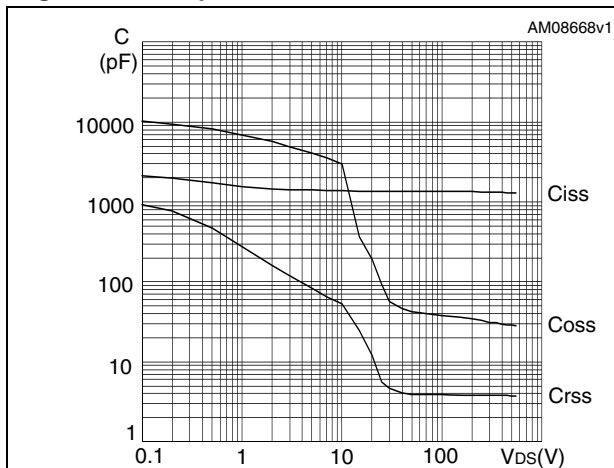


Figure 13. Output capacitance stored energy

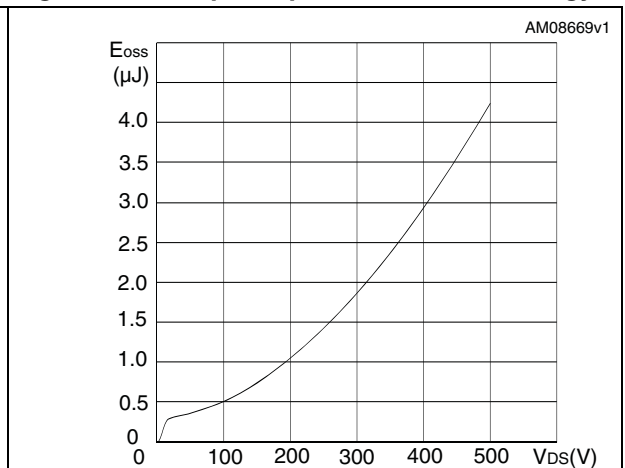


Figure 14. Normalized gate threshold voltage vs temperature

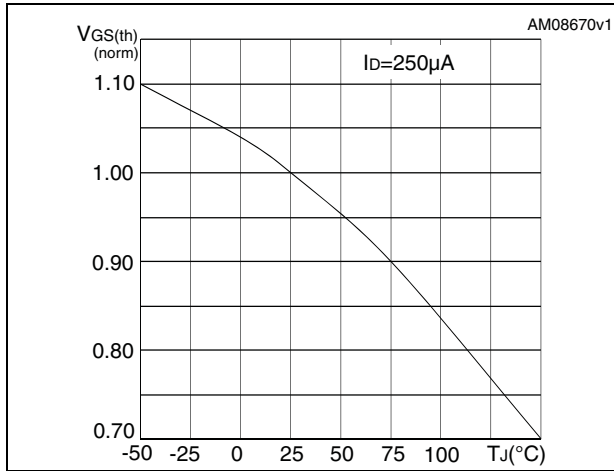


Figure 15. Normalized on resistance vs temperature

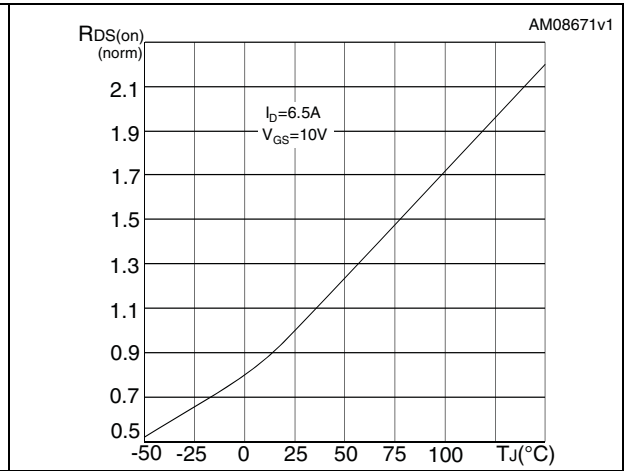


Figure 16. Switching losses vs gate resistance (1)

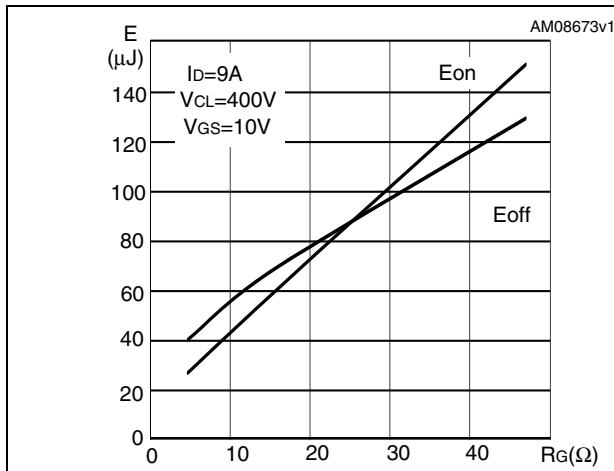
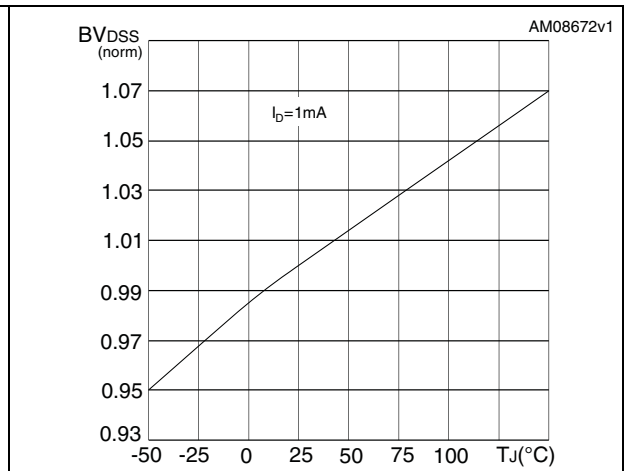


Figure 17. Normalized B_VDSS vs temperature



1. Eon including reverse recovery of a SiC diode

3 Test circuits

Figure 18. Switching times test circuit for resistive load

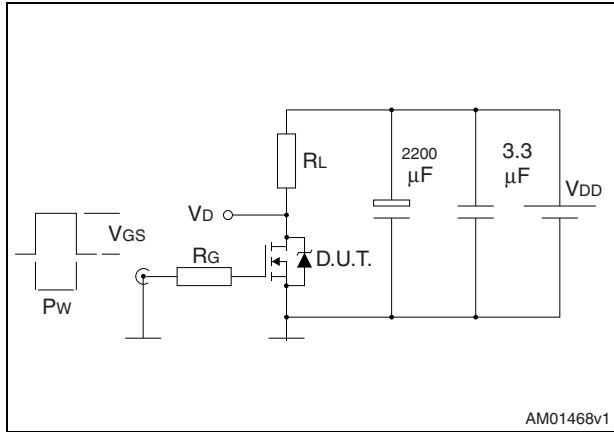


Figure 19. Gate charge test circuit

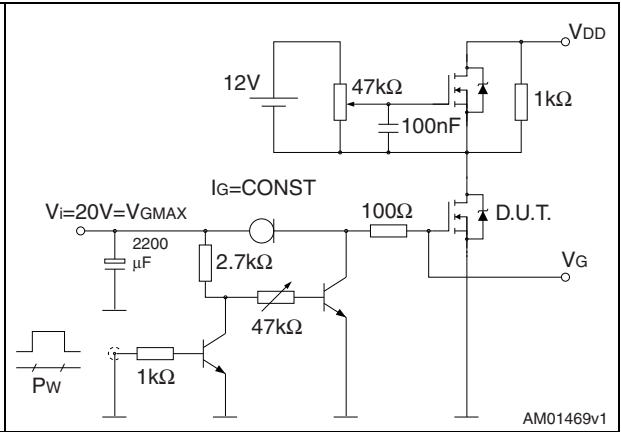


Figure 20. Test circuit for inductive load switching and diode recovery times

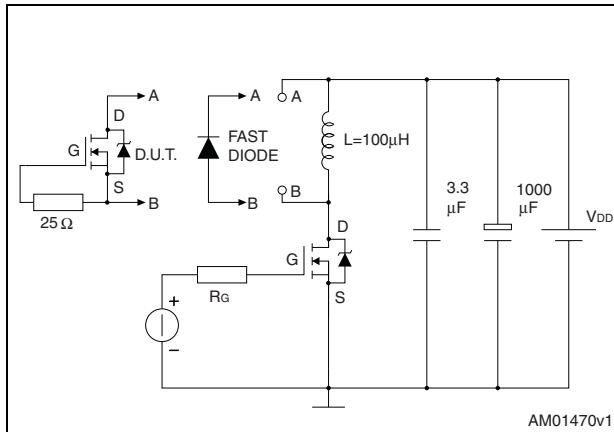


Figure 21. Unclamped inductive load test circuit

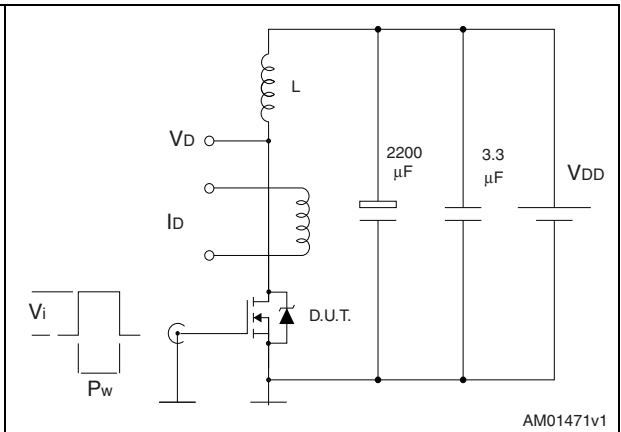


Figure 22. Unclamped inductive waveform

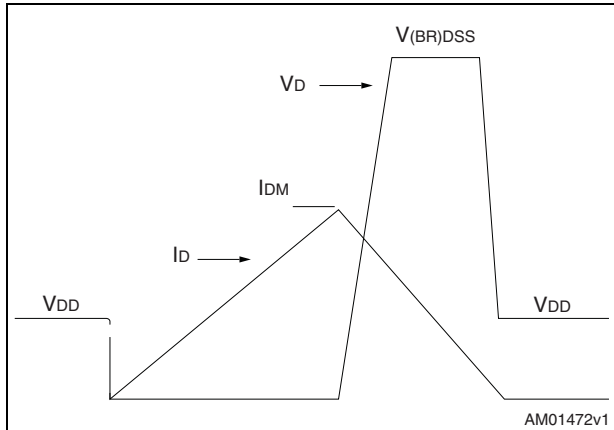
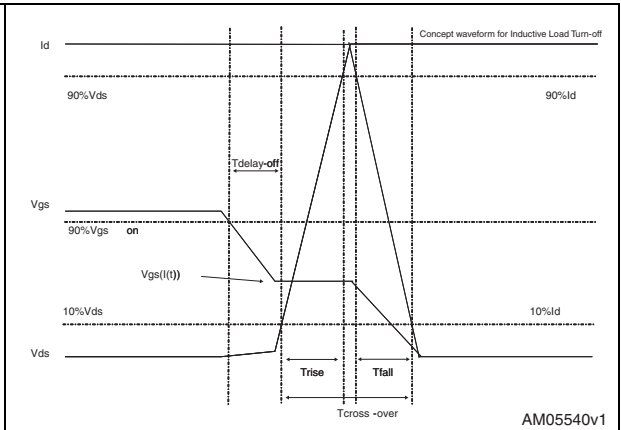


Figure 23. Switching time waveform



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.

Table 8. TO-220FP mechanical data

| Dim. | mm | | |
|------|------|------|------|
| | Min. | Typ. | Max. |
| A | 4.4 | | 4.6 |
| B | 2.5 | | 2.7 |
| D | 2.5 | | 2.75 |
| E | 0.45 | | 0.7 |
| F | 0.75 | | 1 |
| F1 | 1.15 | | 1.70 |
| F2 | 1.15 | | 1.70 |
| G | 4.95 | | 5.2 |
| G1 | 2.4 | | 2.7 |
| H | 10 | | 10.4 |
| L2 | | 16 | |
| L3 | 28.6 | | 30.6 |
| L4 | 9.8 | | 10.6 |
| L5 | 2.9 | | 3.6 |
| L6 | 15.9 | | 16.4 |
| L7 | 9 | | 9.3 |
| Dia | 3 | | 3.2 |

Figure 24. TO-220FP drawing

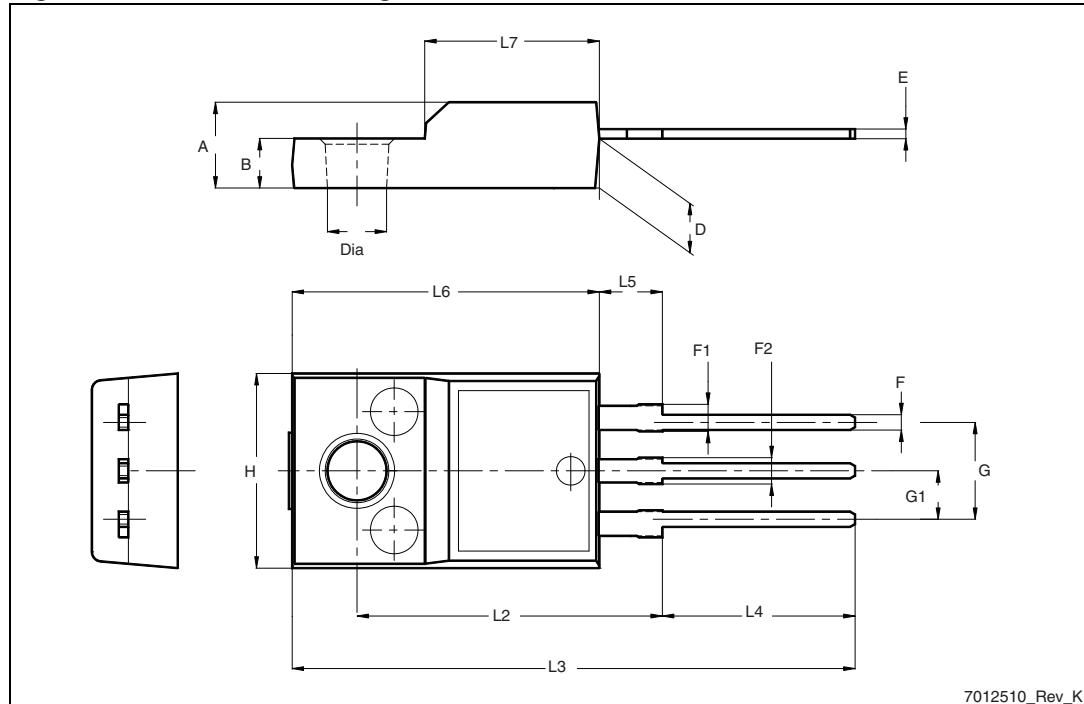
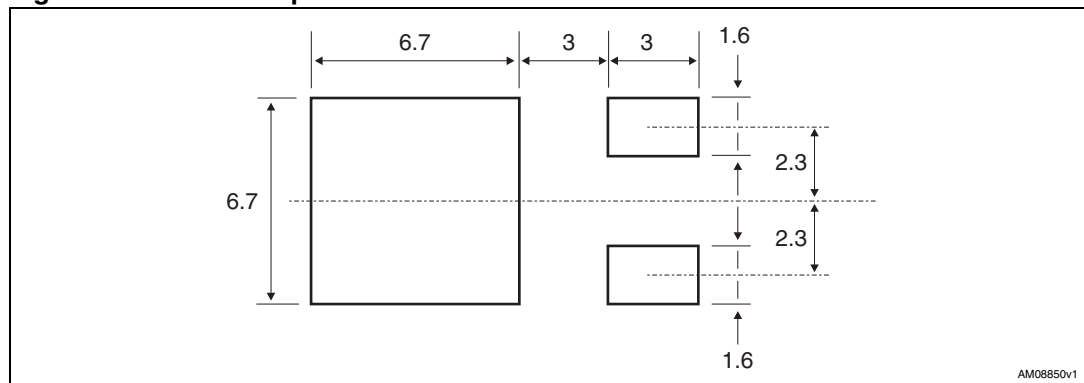


Table 9. DPAK (TO-252) mechanical data

| 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° |

Figure 25. DPAK footprint^(a)



a. All dimension are in millimeters

Figure 26. DPAK (TO-252) drawing

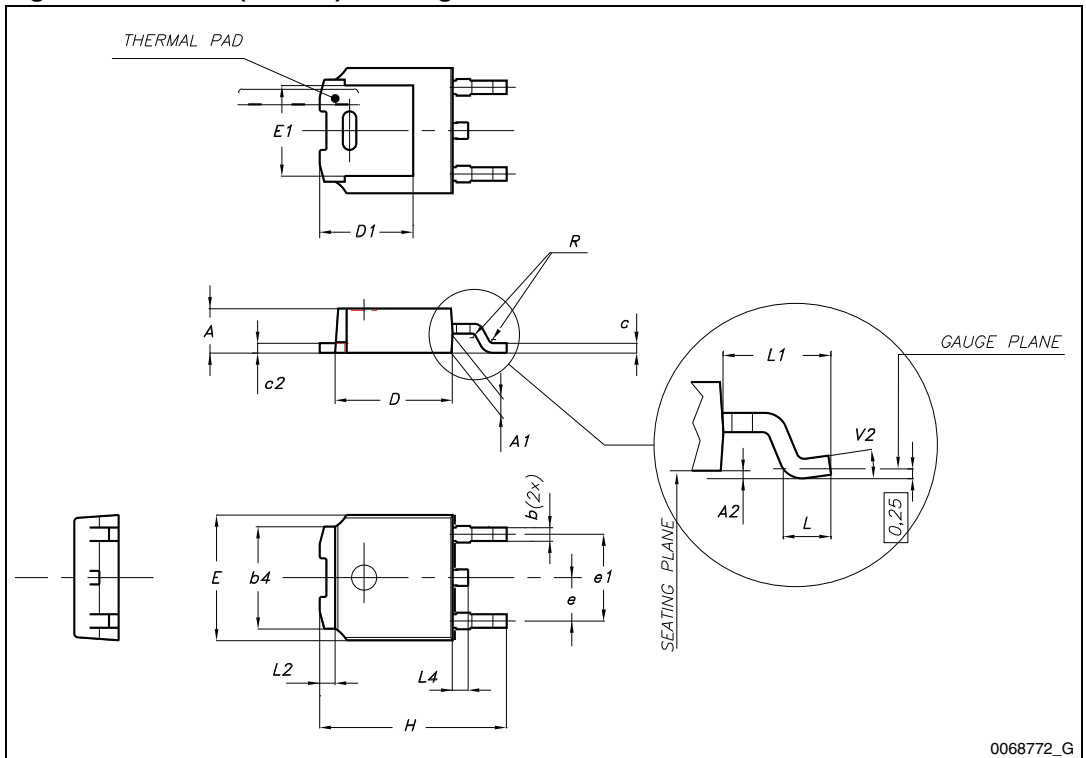
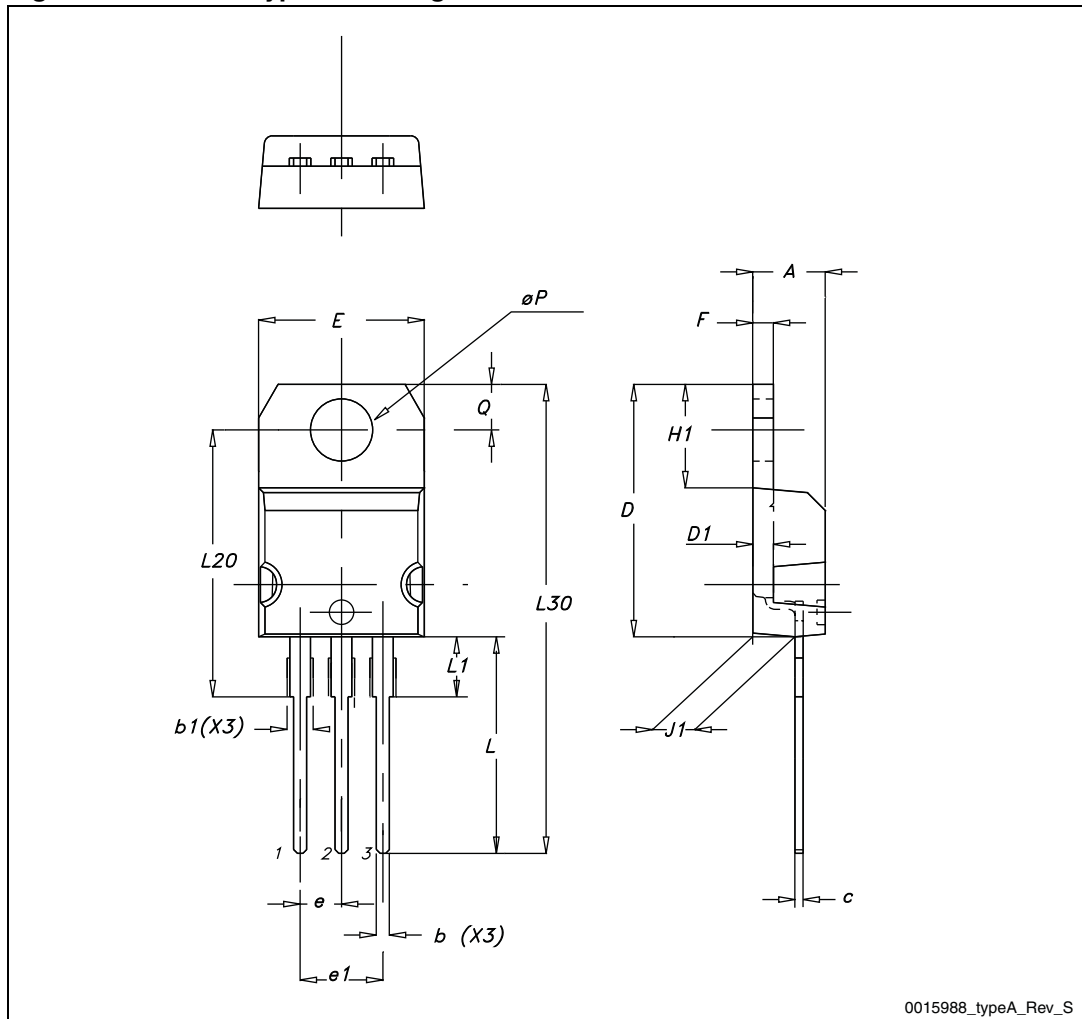


Table 10. TO-220 type A mechanical data

| Dim. | mm | | |
|------|-------|-------|-------|
| | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 |
| b | 0.61 | | 0.88 |
| b1 | 1.14 | | 1.70 |
| c | 0.48 | | 0.70 |
| D | 15.25 | | 15.75 |
| D1 | | 1.27 | |
| E | 10 | | 10.40 |
| e | 2.40 | | 2.70 |
| e1 | 4.95 | | 5.15 |
| F | 1.23 | | 1.32 |
| H1 | 6.20 | | 6.60 |
| J1 | 2.40 | | 2.72 |
| L | 13 | | 14 |
| L1 | 3.50 | | 3.93 |
| L20 | | 16.40 | |
| L30 | | 28.90 | |
| ØP | 3.75 | | 3.85 |
| Q | 2.65 | | 2.95 |

Figure 27. TO-220 type A drawing



0015988_typeA_Rev_S

Table 11. D²PAK (TO-263) 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 | | |
| E | 10 | | 10.40 |
| E1 | 8.50 | | |
| 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 28. D²PAK (TO-263) drawing

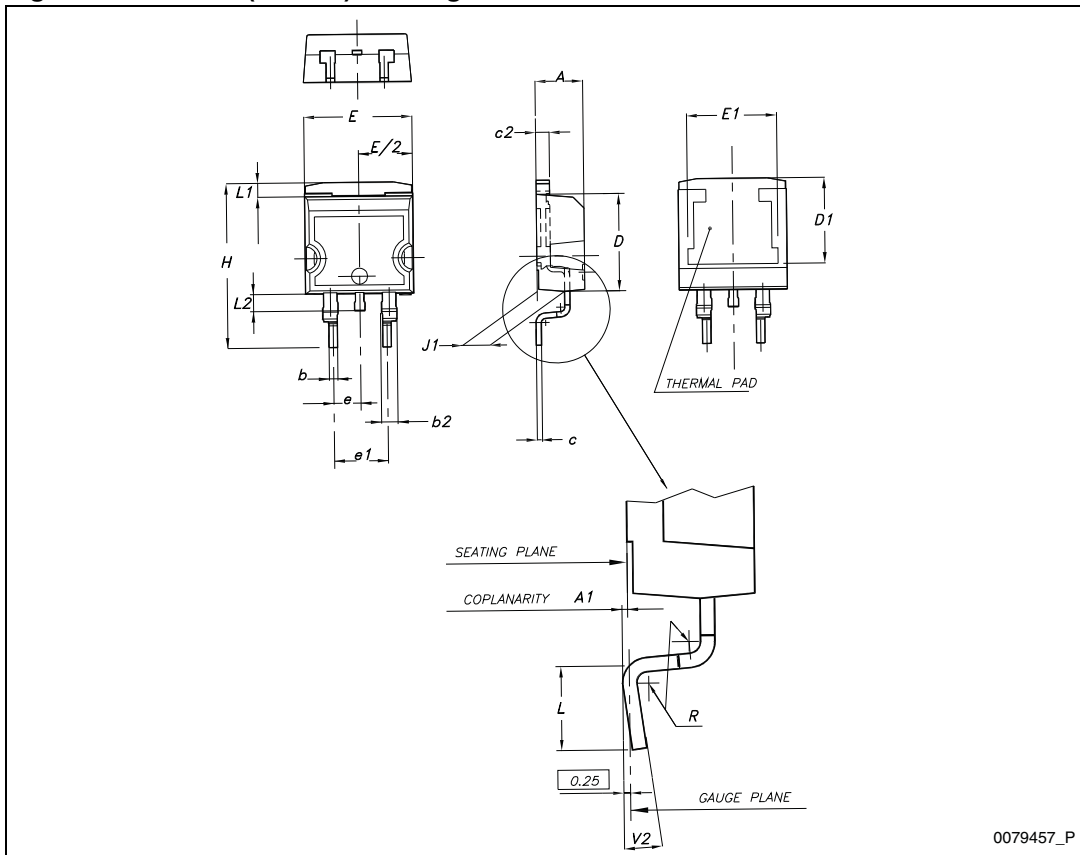
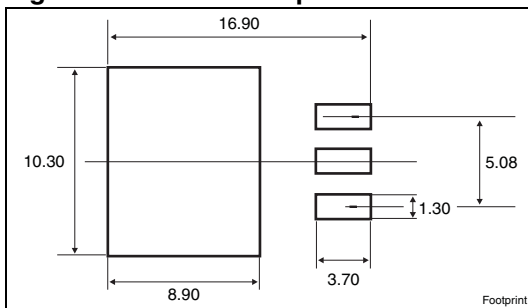


Figure 29. D²PAK footprint^(b)



b. All dimension are in millimeters

5 Packaging mechanical data

Table 12. D²PAK (TO-263) 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 | | | |

Table 13. 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 | | | |

Figure 30. Tape for DPAK and D²PAK

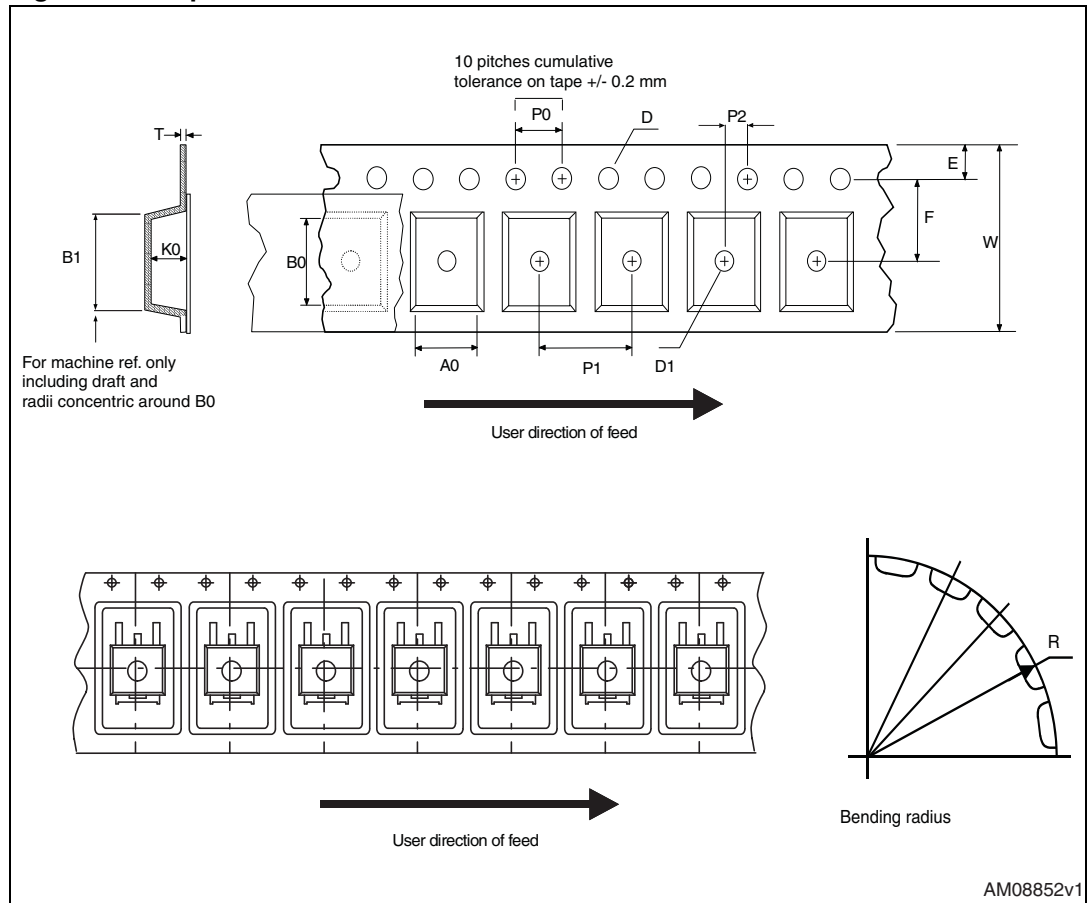
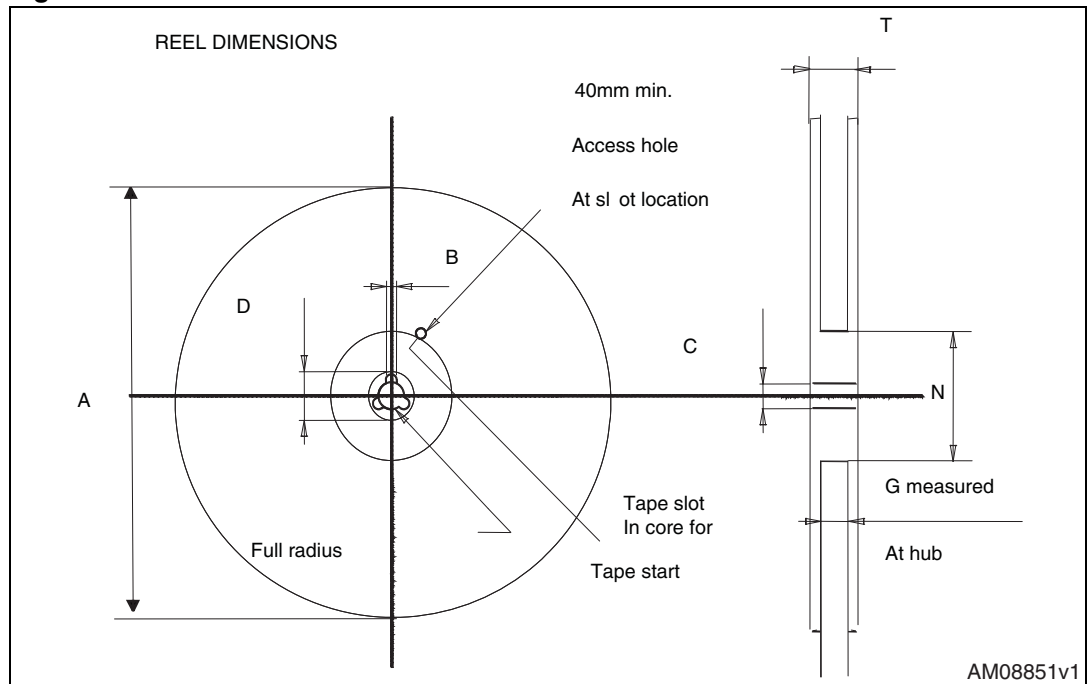


Figure 31. Reel for DPAK and D²PAK



6 Revision history

Table 14. Document revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 09-Feb-2010 | 1 | First release. |
| 04-Mar-2011 | 2 | – Document status promoted from preliminary data to datasheet; – Added new package, mechanical data: D ² PAK. |

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