

N-channel 100 V, 0.027 Ω typ., 25 A, STripFET™ VII DeepGATE™ Power MOSFET in DPAK, TO-220FP and TO-220 packages

Datasheet - production data

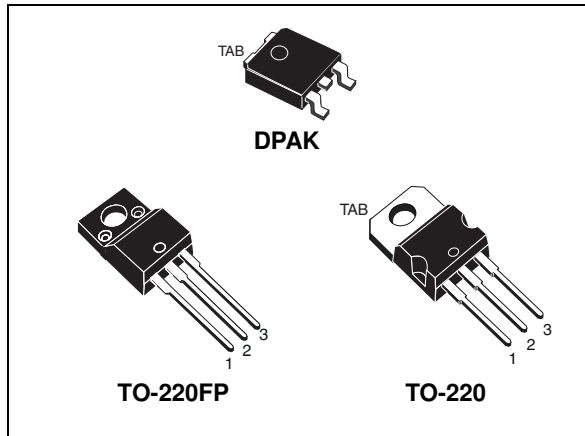
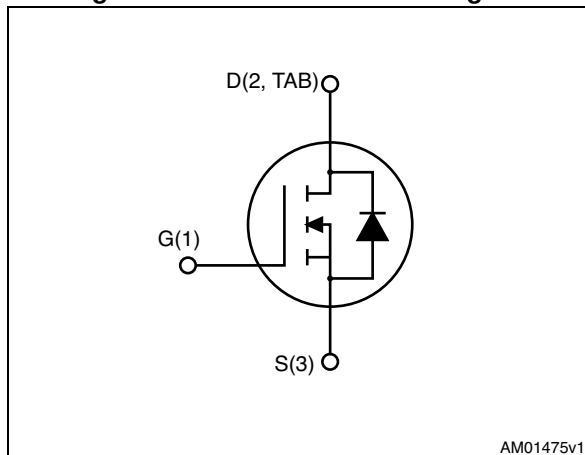


Figure 1. Internal schematic diagram



Features

| Order codes | V _{DSS} | R _{DS(on)} max. ⁽¹⁾ | I _D | P _{TOT} |
|-------------|------------------|---|----------------|------------------|
| STD25N10F7 | 100 V | 0.035 Ω | 25 A | 40 W |
| STF25N10F7 | 100 V | 0.035 Ω | 19 A | 25 W |
| STP25N10F7 | 100 V | 0.035 Ω | 25 A | 50 W |

1. @ V_{GS} = 10 V

- Ultra low on-resistance
- 100% avalanche tested

Applications

- Switching applications

Description

These devices utilize the 7th generation of design rules of ST's proprietary STripFET™ technology, with a new gate structure. The resulting Power MOSFET exhibits the lowest R_{DS(on)} in all packages.

Table 1. Device summary

| Order codes | Marking | Package | Packaging |
|-------------|---------|----------|---------------|
| STD25N10F7 | 25N10F7 | DPAK | Tape and reel |
| STF25N10F7 | 25N10F7 | TO-220FP | Tube |
| STP25N10F7 | 25N10F7 | TO-220 | Tube |

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1 Electrical ratings

Table 2. Absolute maximum ratings

| Symbol | Parameter | Value | | | Unit |
|-----------------|---|------------|--------|----------|------|
| | | DPAK | TO-220 | TO-220FP | |
| V_{DS} | Drain-source voltage | 100 | | | V |
| V_{GS} | Gate-source voltage | ± 20 | | | V |
| $I_D^{(1)}$ | Drain current (continuous) at $T_C = 25\text{ °C}$ | 25 | 25 | 19 | A |
| $I_D^{(1)}$ | Drain current (continuous) at $T_C = 100\text{ °C}$ | 18 | 18 | 13.5 | A |
| $I_{DM}^{(2)}$ | Drain current (pulsed) | 100 | 100 | 76 | A |
| $P_{TOT}^{(1)}$ | Total dissipation at $T_C = 25\text{ °C}$ | 40 | 50 | 25 | W |
| V_{ISO} | Insulation withstand voltage (RMS) from all three leads to external heat sink ($t = 1\text{ s}$; $T_C = 25\text{ °C}$) | - | | 2500 | V |
| T_J | Operating junction temperature | -55 to 175 | | | °C |
| T_{stg} | Storage temperature | | | | °C |

1. This value is rated according to R_{thj-c} .
2. Pulse width limited by safe operating area.

Table 3. Thermal resistance

| Symbol | Parameter | Value | | | Unit |
|----------------|-------------------------------------|-------|----------|--------|------|
| | | DPAK | TO-220FP | TO-220 | |
| $R_{thj-case}$ | Thermal resistance junction-case | 3.75 | 6 | 3 | °C/W |
| $R_{thj-amb}$ | Thermal resistance junction-ambient | 62.5 | | | °C/W |
| $R_{thj-pcb}$ | Thermal resistance junction-pcb | 50 | | | °C/W |

2 Electrical characteristics

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

Table 4. On/off states

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|--|---|------|-------|-----------|--------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage ($V_{GS} = 0$) | $I_D = 250\ \mu A$ | 100 | | - | V |
| I_{DSS} | Zero gate voltage drain current ($V_{GS} = 0$) | $V_{DS} = 100\text{ V}$ $V_{DS} = 100\text{ V}; T_C = 125\text{ °C}$ | | | 10 100 | 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 | $V_{DS} = V_{GS}, I_D = 250\ \mu A$ | 2.5 | | 4.5 | V |
| $R_{DS(on)}$ | Static drain-source on- resistance | $V_{GS} = 10\text{ V}, I_D = 12.5\text{ A}$ | | 0.027 | 0.035 | Ω |

Table 5. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|---|------|------|------|------|
| C_{iss} | Input capacitance | $V_{DS} = 50\text{ V}, f = 1\text{ MHz},$ $V_{GS} = 0$ | - | 920 | - | pF |
| C_{oss} | Output capacitance | | - | 215 | - | pF |
| C_{rss} | Reverse transfer capacitance | | - | 19 | - | pF |
| Q_g | Total gate charge | $V_{DD} = 50\text{ V}, I_D = 25\text{ A}$ $V_{GS} = 10\text{ V}$ <i>Figure 18</i> | - | 14 | - | nC |
| Q_{gs} | Gate-source charge | | - | 7 | - | nC |
| Q_{gd} | Gate-drain charge | | - | 3 | - | nC |

Table 6. Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------------|---------------------|--|------|------|------|------|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD} = 50\text{ V}$, $I_D = 12.5\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ <i>Figure 17</i> | - | 9.8 | - | ns |
| t_r | Rise time | | - | 14 | - | ns |
| $t_{d(off)}$ | Turn-off delay time | | - | 14.8 | - | ns |
| t_f | Fall time | | - | 4.6 | - | ns |

Table 7. Source-drain diode

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------|--|------|------|------|------|
| I_{SD} | Source-drain current | | - | | 25 | A |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) | | - | | 100 | A |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD} = 25\text{ A}$, $V_{GS} = 0$ | - | | 1.1 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 25\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 80\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ | - | 38 | | ns |
| Q_{rr} | Reverse recovery charge | | - | 29 | | nC |
| I_{RRM} | Reverse recovery current | | - | 1.7 | | 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 DPAK

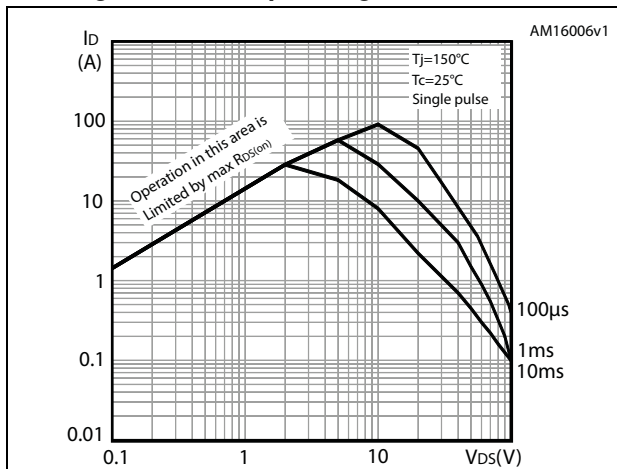


Figure 3. Thermal impedance for DPAK

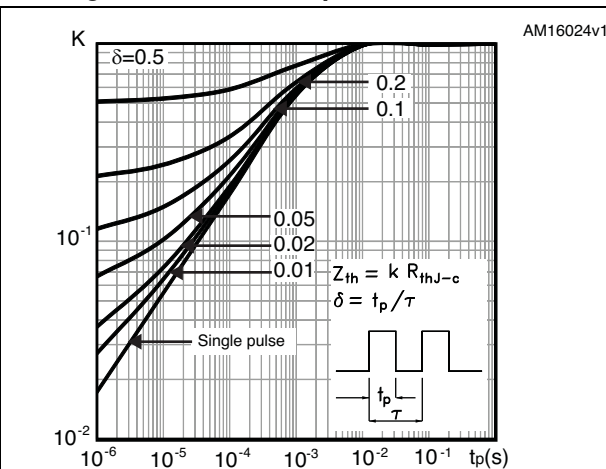


Figure 4. Safe operating area for TO-220FP

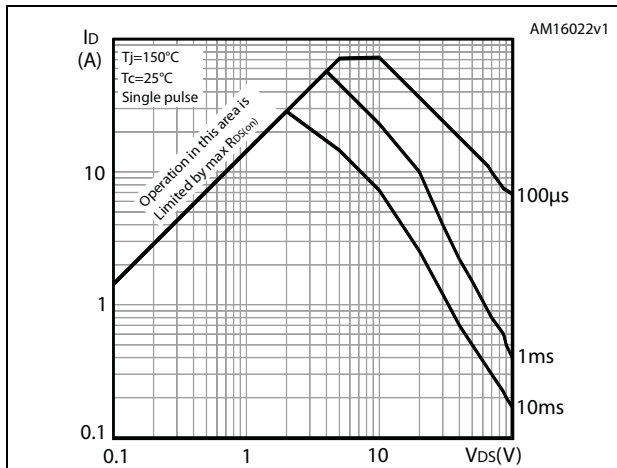


Figure 5. Thermal impedance for TO-220FP

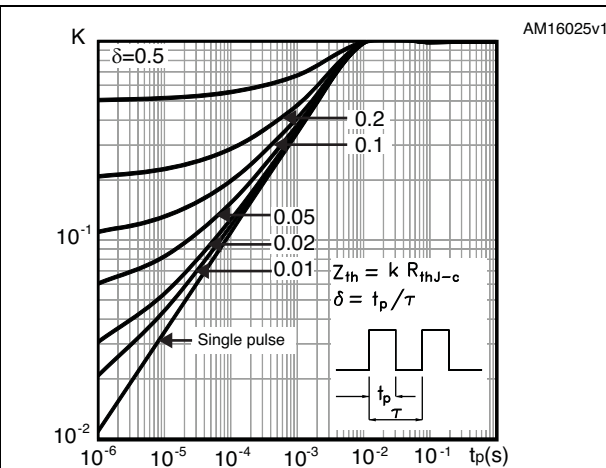


Figure 6. Safe operating area for TO-220

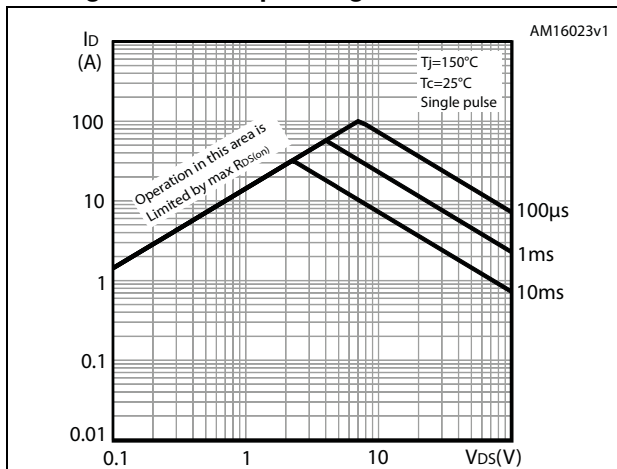


Figure 7. Thermal impedance for TO-220

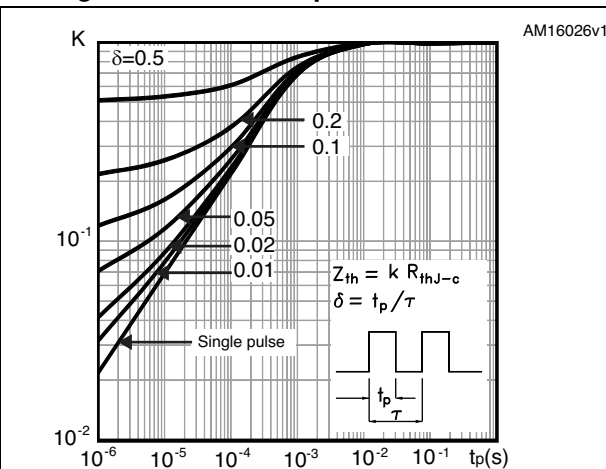


Figure 8. Output characteristics

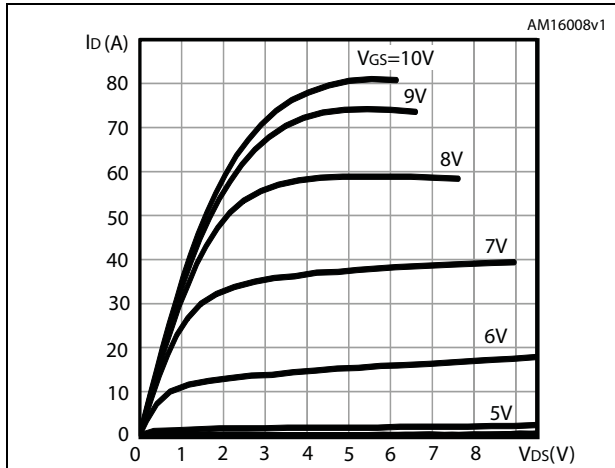


Figure 9. Transfer characteristics

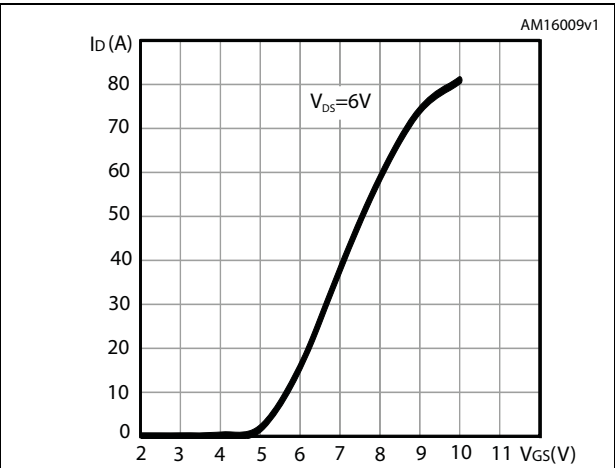


Figure 10. Gate charge vs gate-source voltage

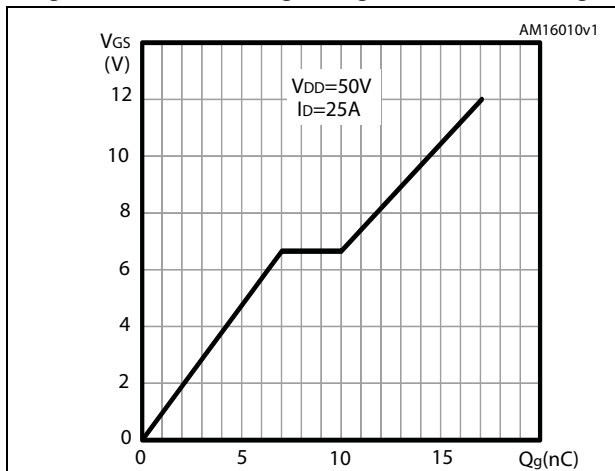


Figure 11. Static drain-source on-resistance

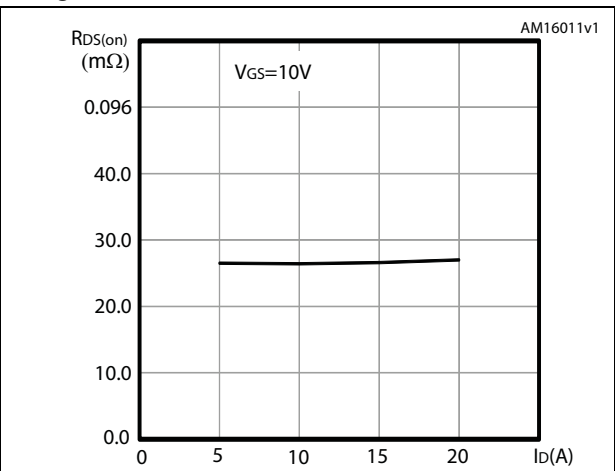


Figure 12. Capacitance variations

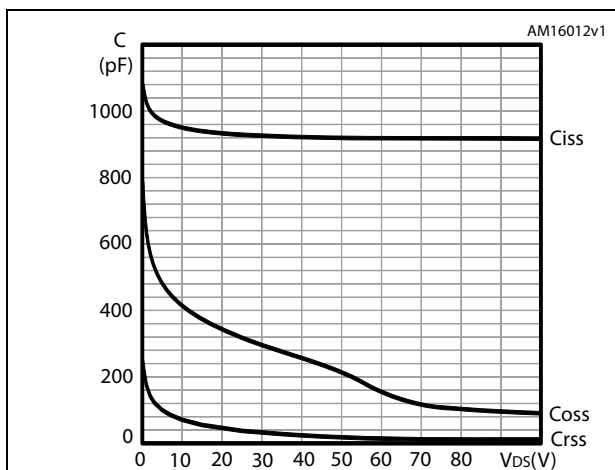


Figure 13. Normalized gate threshold voltage vs temperature

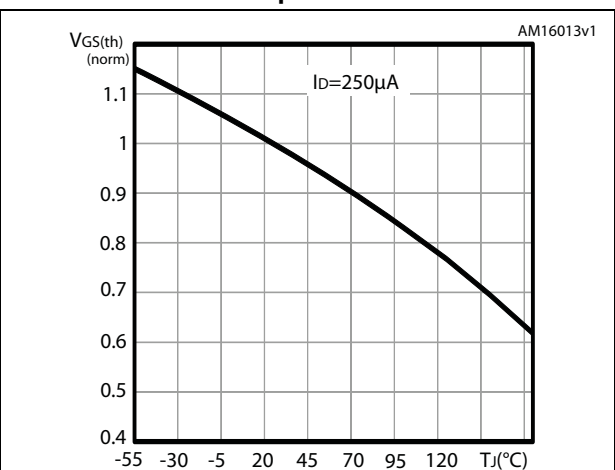


Figure 14. Normalized on-resistance vs temperature

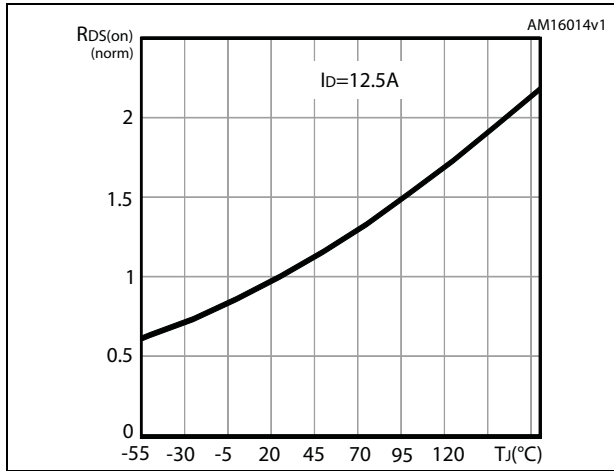


Figure 15. Normalized B_{VDSS} vs temperature

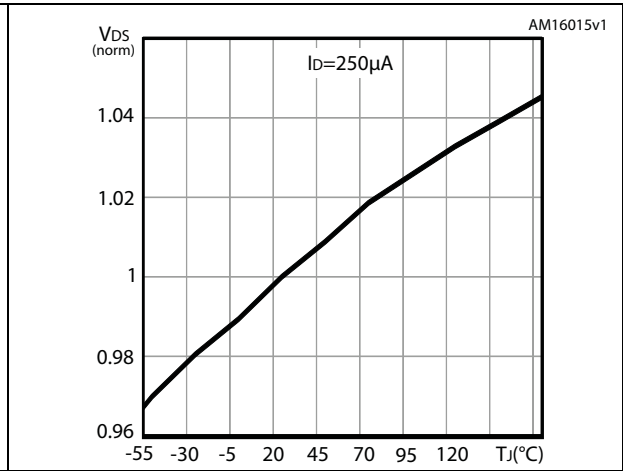
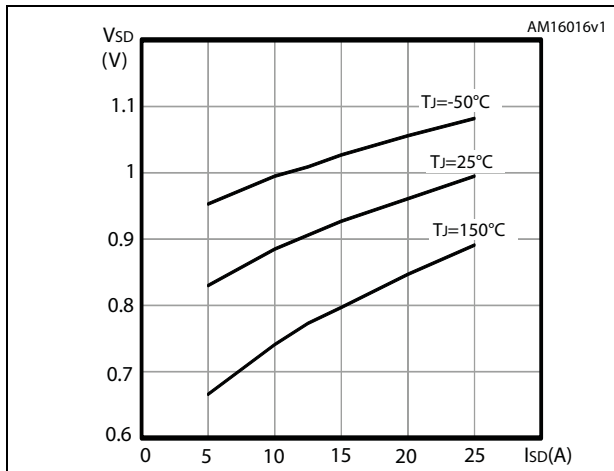
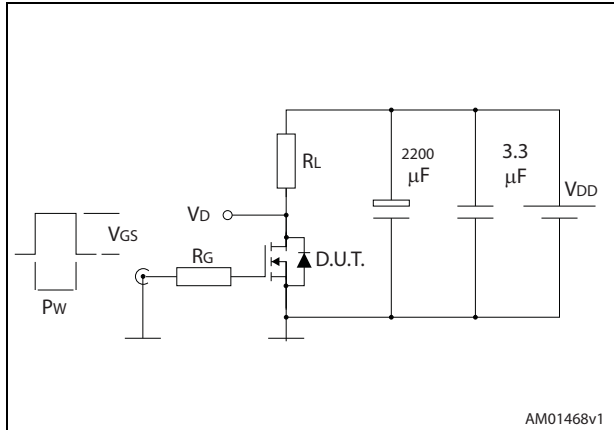


Figure 16. Source-drain diode forward characteristics



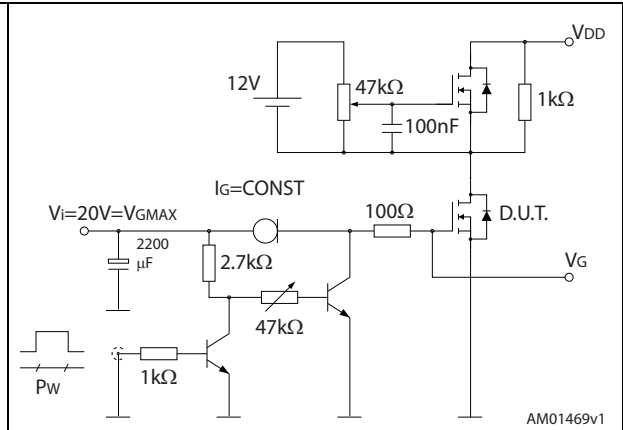
3 Test circuits

Figure 17. Switching times test circuit for resistive load



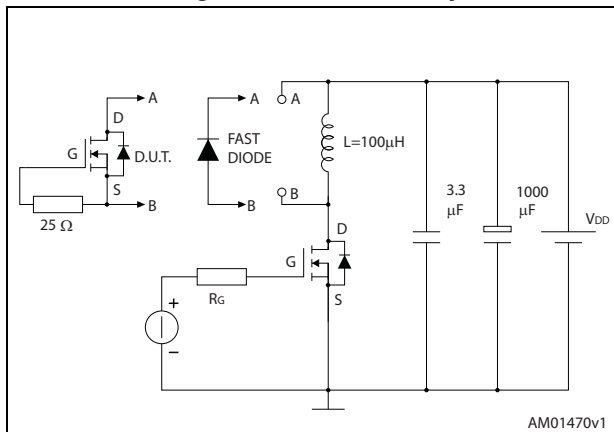
AM01468v1

Figure 18. Gate charge test circuit



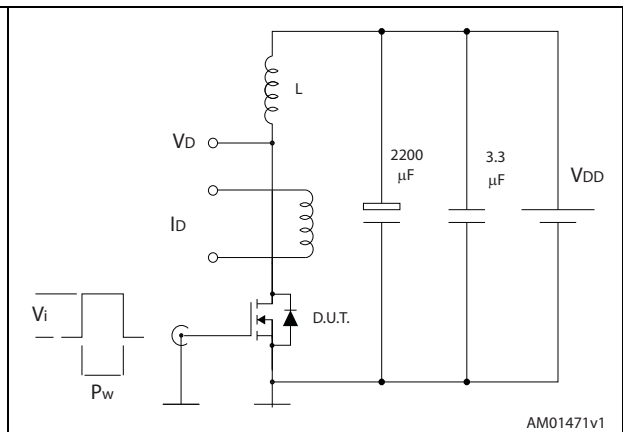
AM01469v1

Figure 19. Test circuit for inductive load switching and diode recovery times



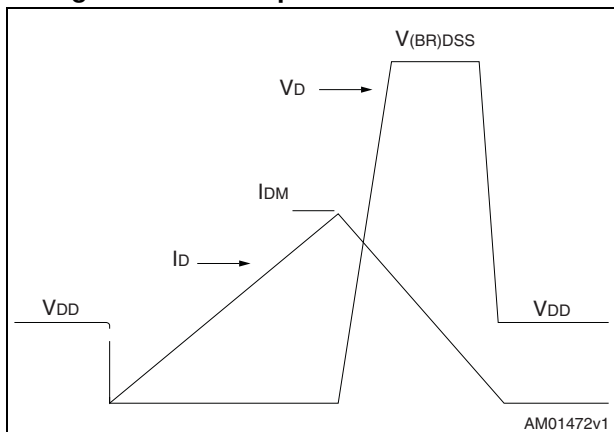
AM01470v1

Figure 20. Unclamped inductive load test circuit



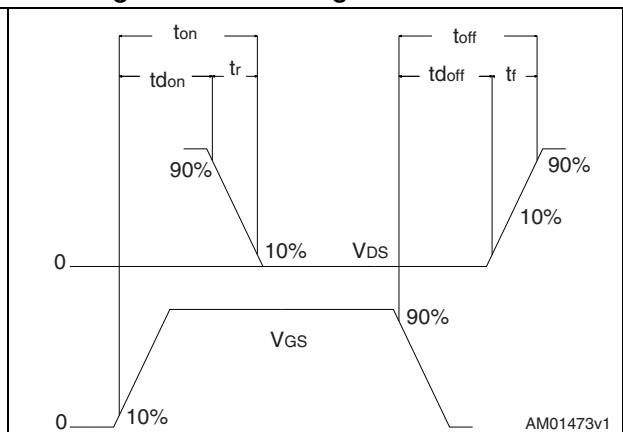
AM01471v1

Figure 21. Unclamped inductive waveform



AM01472v1

Figure 22. Switching time waveform



AM01473v1

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. 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 | 1.00 | | 1.50 |
| (L1) | | 2.80 | |
| L2 | | 0.80 | |
| L4 | 0.60 | | 1.00 |
| R | | 0.20 | |
| V2 | 0° | | 8° |

Figure 23. DPAK (TO-252) drawings

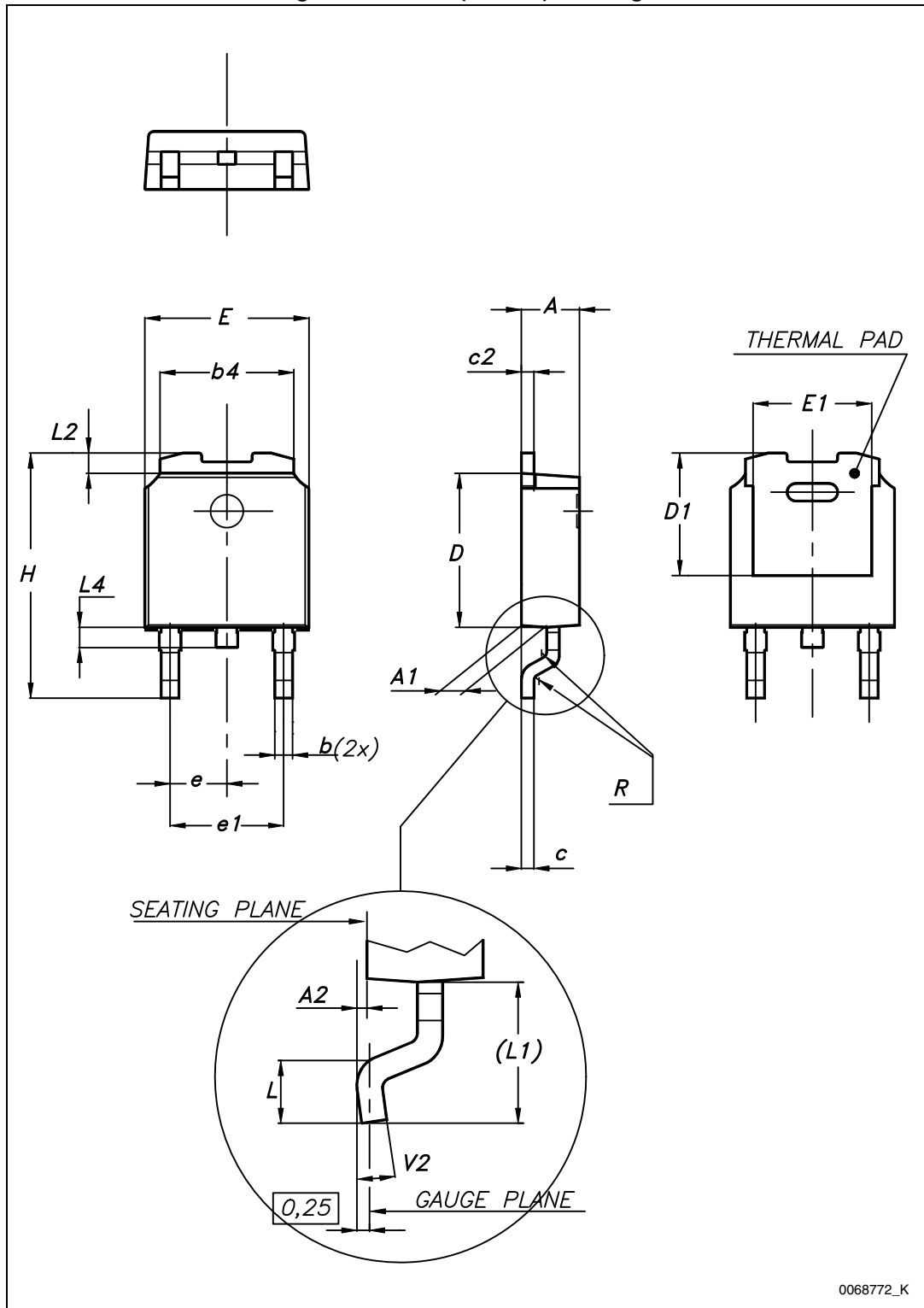
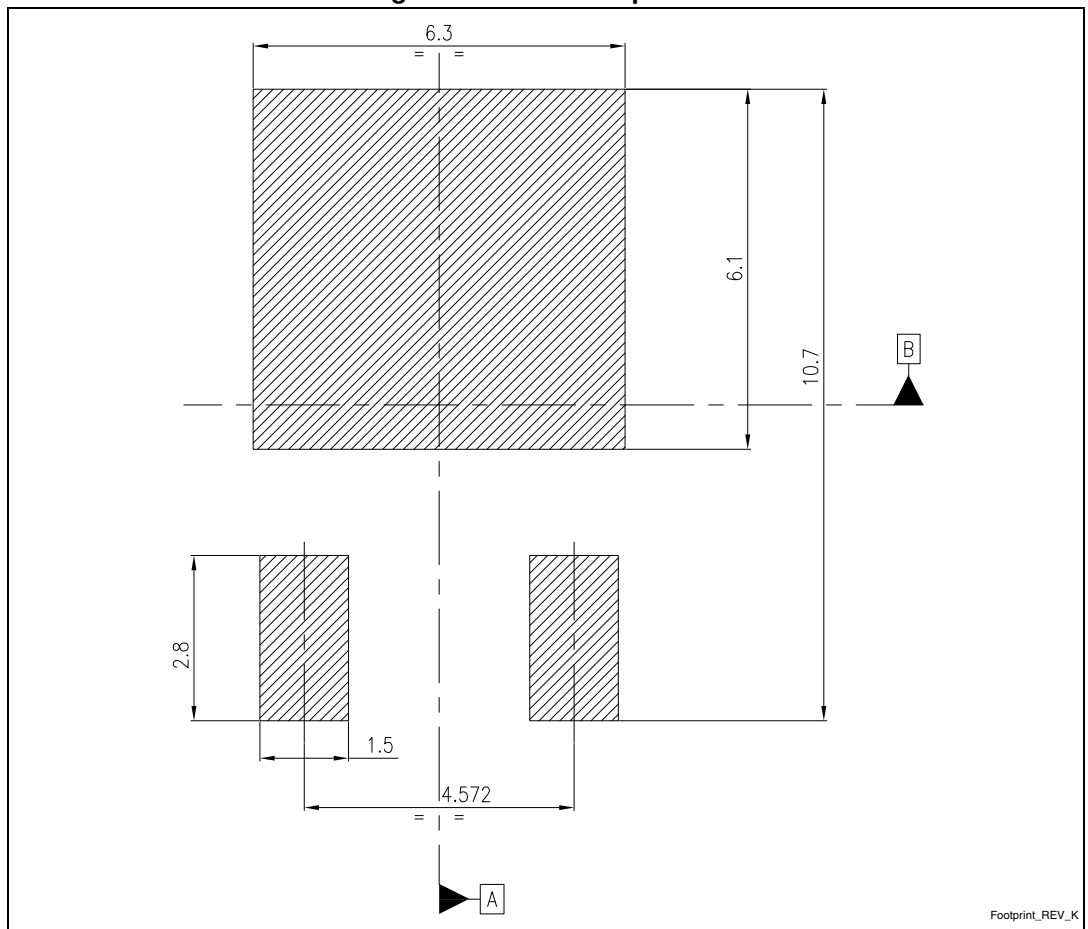


Figure 24. DPAK footprint (a)

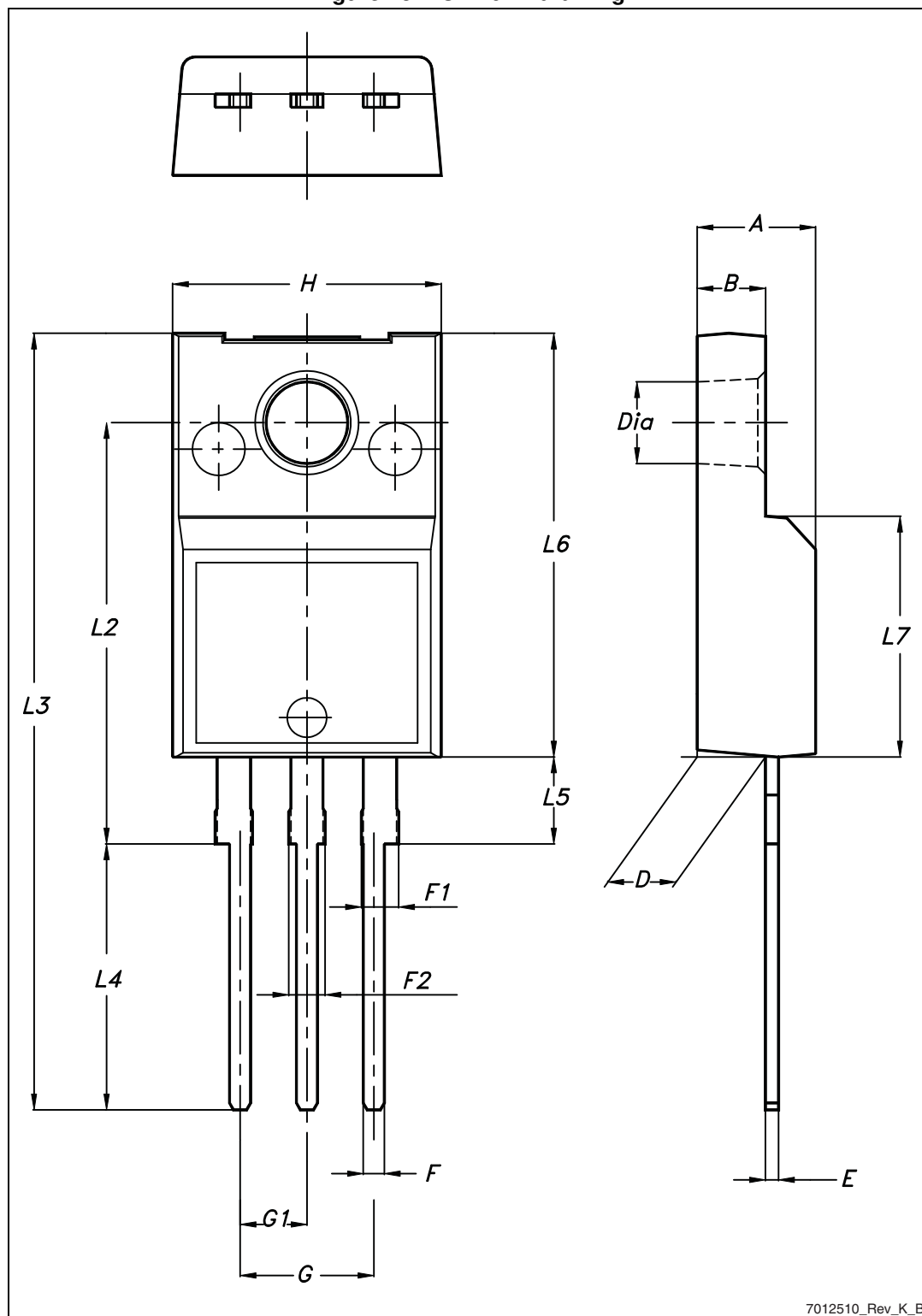


a. All dimensions are in millimeters

Table 9. 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 25. TO-220FP drawing

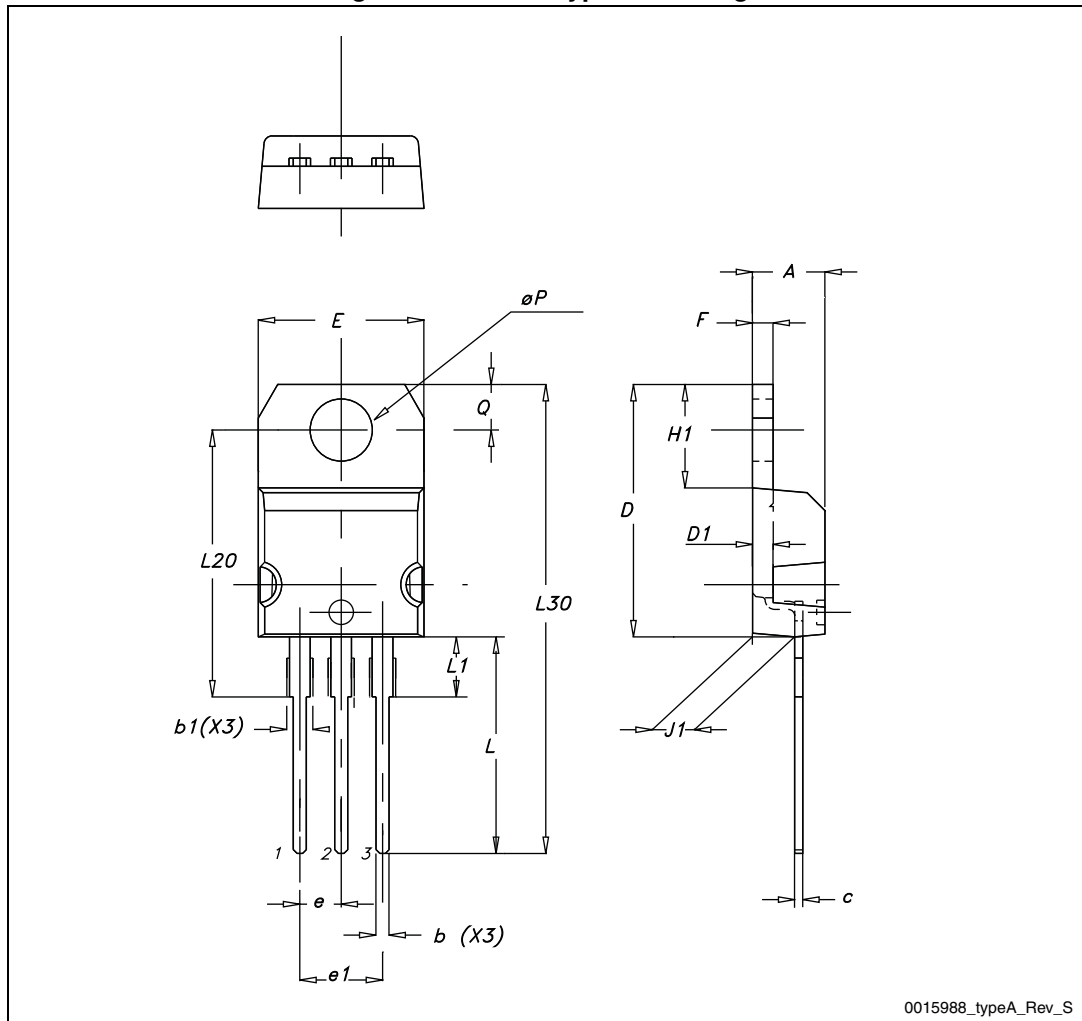


7012510_Rev_K_B

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 26. TO-220 type A drawings



0015988_typeA_Rev_S

5 Packaging mechanical data

Table 11. 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 27. Tape for DPAK (TO-252)

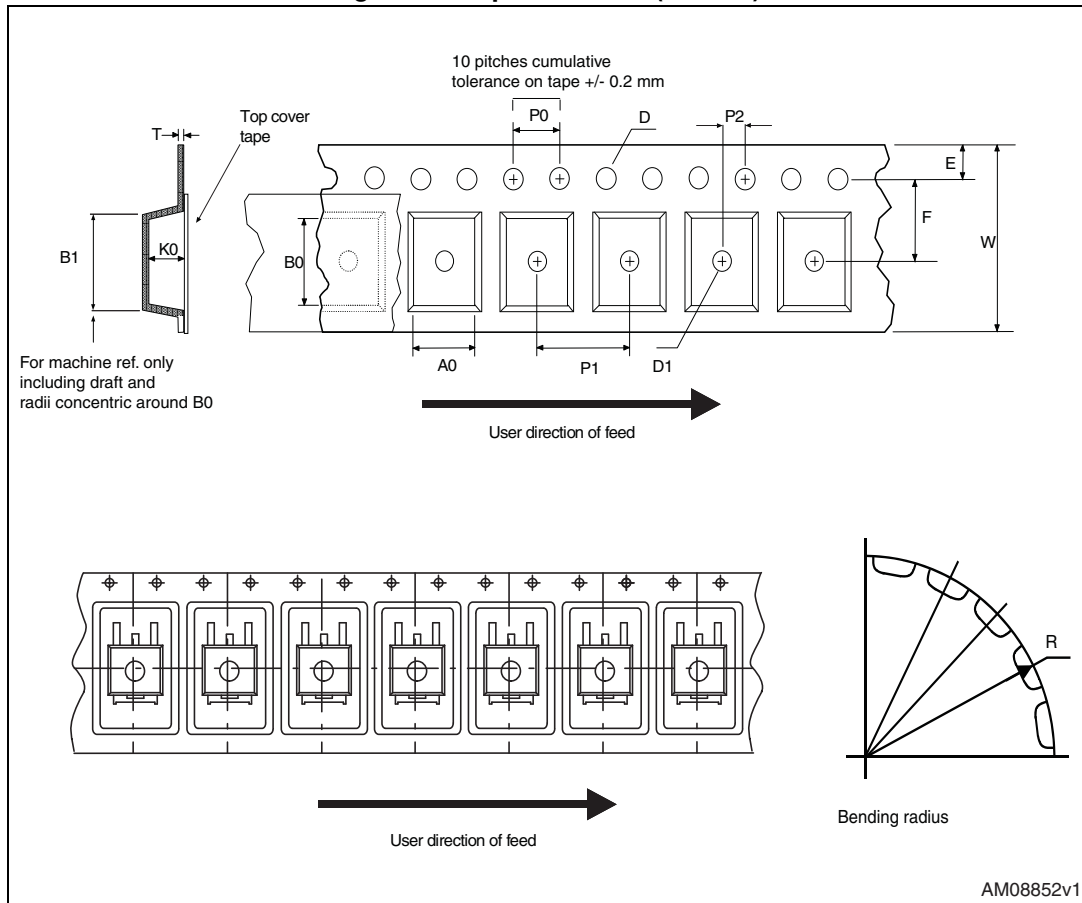
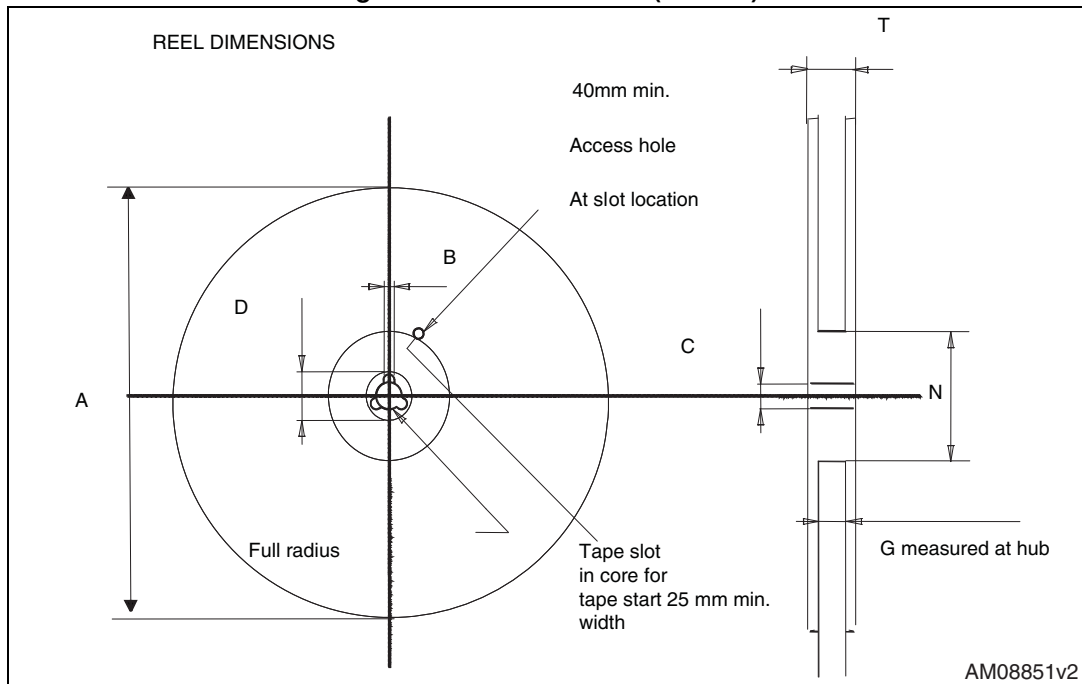


Figure 28. Reel for DPAK (TO-252)



6 Revision history

Table 12. Document revision history

| Date | Revision | Changes |
|-------------|----------|----------------|
| 17-Sep-2013 | 1 | First release. |

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