



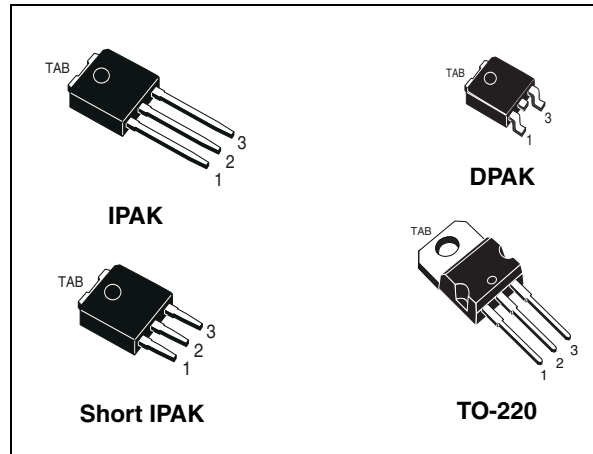
STD75N3LLH6, STP75N3LLH6 STU75N3LLH6, STU75N3LLH6-S

N-channel 30 V, 0.0042 Ω , 75 A, DPAK, TO-220, IPAK, Short IPAK
STripFET™ VI DeepGATE™ Power MOSFET

Features

| Order codes | V _{DSS} | R _{DS(on)} max | I _D |
|---------------|------------------|-------------------------|----------------|
| STD75N3LLH6 | 30 V | < 0.0055 Ω | 75 A |
| STP75N3LLH6 | | < 0.0059 Ω | |
| STU75N3LLH6 | | | |
| STU75N3LLH6-S | | | |

- R_{DS(on)} * Q_g industry benchmark
- Extremely low on-resistance R_{DS(on)}
- High avalanche ruggedness
- Low gate drive power losses



Application

Switching applications

Description

This N-Channel Power MOSFET product utilizes the 6th 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.

Figure 1. Internal schematic diagram

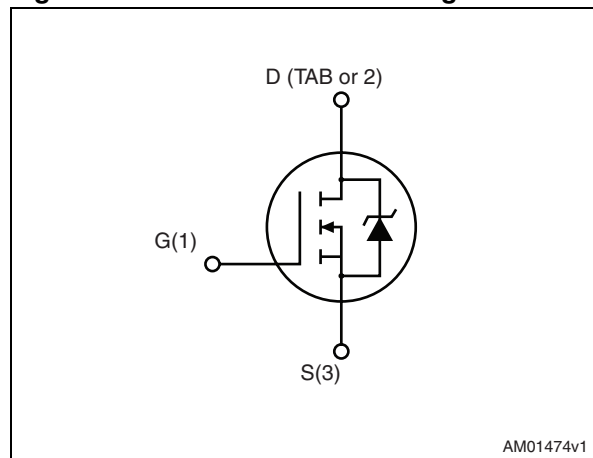


Table 1. Device summary

| Order codes | Marking | Package | Packaging |
|---------------|----------|------------|---------------|
| STD75N3LLH6 | 75N3LLH6 | DPAK | Tape and reel |
| STP75N3LLH6 | | TO-220 | Tube |
| STU75N3LLH6 | | IPAK | |
| STU75N3LLH6-S | | Short IPAK | |

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1 Electrical ratings

Table 2. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|--------------------|---|------------|---------------------|
| V_{DS} | Drain-source voltage ($V_{GS} = 0$) | 30 | V |
| V_{GS} | Gate-source voltage | ± 20 | V |
| $I_D^{(1)}$ | Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$ | 75 | A |
| I_D | Drain current (continuous) at $T_C = 70\text{ }^\circ\text{C}$ | 56 | A |
| I_D | Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$ | 47 | A |
| $I_{DM}^{(2)}$ | Drain current (pulsed) | 300 | A |
| P_{TOT} | Total dissipation at $T_C = 25\text{ }^\circ\text{C}$ | 60 | W |
| | Derating factor | 0.4 | W/ $^\circ\text{C}$ |
| T_j T_{stg} | Operating junction temperature storage temperature | -55 to 175 | $^\circ\text{C}$ |

1. The value is rated according to Rthj-case
2. Pulse width limited by safe operating area

Table 3. Thermal data

| Symbol | Parameter | Value | | | | Unit |
|---------------------|---|-------|--------|------|------------|---------------------------|
| | | DKAK | TO-220 | IPAK | Short IPAK | |
| $R_{thj-case}$ | Thermal resistance junction-case (drain) (steady state) | 2.5 | | | | $^\circ\text{C}/\text{W}$ |
| $R_{thj-amb}$ | Thermal resistance junction-amb max | 100 | 62.5 | 100 | | $^\circ\text{C}/\text{W}$ |
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb max | 35 | | | | $^\circ\text{C}/\text{W}$ |
| T_J | Maximum lead temperature for soldering purpose | 275 | 300 | 275 | | $^\circ\text{C}$ |

1. When mounted on FR-4 board of 1in², 2oz Cu. t < 10 sec

2 Electrical characteristics

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

Table 4. On/off states

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|--|---|------|--------|-----------|--------------------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage ($V_{GS} = 0$) | $I_D = 250 \mu\text{A}$ | 30 | | | V |
| I_{DSS} | Zero gate voltage drain current ($V_{GS} = 0$) | $V_{DS} = 30 \text{ V}$ $V_{DS} = 30 \text{ V } T_C = 125^{\circ}\text{C}$ | | | 1 10 | 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 | $V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$ | 1 | 1.7 | 2.5 | V |
| $R_{DS(on)}$ | Static drain-source on resistance | $V_{GS} = 10 \text{ V}, I_D = 37.5 \text{ A}$ SMD version | | 0.0042 | 0.0055 | Ω |
| | | $V_{GS} = 10 \text{ V}, I_D = 37.5 \text{ A}$ | | 0.0046 | 0.0059 | Ω |
| | | $V_{GS} = 4.5 \text{ V}, I_D = 37.5 \text{ A}$ SMD version | | 0.0065 | 0.008 | Ω |
| | | $V_{GS} = 4.5 \text{ V}, I_D = 37.5 \text{ A}$ | | 0.0069 | 0.0084 | Ω |

Table 5. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|-------------------------------------|--|------|------|------|----------|
| C_{iss} | Input capacitance | $V_{DS} = 25 \text{ V}, f = 1 \text{ MHz},$ $V_{GS} = 0$ | 1350 | 1690 | 2030 | pF |
| C_{oss} | Output capacitance | | 230 | 290 | 350 | pF |
| C_{rss} | Reverse transfer capacitance | | 140 | 176 | 210 | pF |
| Q_g | Total gate charge | $V_{DD} = 15 \text{ V}, I_D = 75 \text{ A},$ $V_{GS} = 4.5 \text{ V}$ (see Figure 14) | | 17 | 23.8 | nC |
| Q_{gs} | Gate-source charge | | 8 | 11.2 | nC | |
| Q_{gd} | Gate-drain charge | | 6 | 8.4 | nC | |
| Q_{gs1} | Pre V_{th} gate-to-source charge | $V_{DD} = 15 \text{ V}, I_D = 75 \text{ A}$ $V_{GS} = 5 \text{ V}$ (Figure 19) | | 3.9 | 5.5 | nC |
| Q_{gs2} | Post V_{th} gate-to-source charge | | 4.1 | 5.7 | nC | |
| R_G | Gate input resistance | f=1 MHz gate bias Bias=0 test signal level=20 mV open drain | 1.25 | 1.7 | 2 | Ω |

Table 6. Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max | Unit |
|--------------|---------------------|---|------|------|-----|------|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD} = 15\text{ V}$, $I_D = 37.5\text{ A}$ $R_G = 4.7\ \Omega$ $V_{GS} = 5\text{ V}$ (see Figure 13) | - | 9.5 | - | ns |
| t_r | Rise time | | | 30 | | ns |
| $t_{d(off)}$ | Turn-off delay time | | | 37 | | ns |
| t_f | Fall time | | | 12 | | ns |

Table 7. Source drain diode

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------|--|------|------|------|------|
| I_{SD} | Source-drain current | | - | | 75 | A |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) | | | | 300 | A |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD} = 37.5\text{ A}$, $V_{GS} = 0$ | - | | 1.1 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 75\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 24\text{ V}$ (see Figure 15) | - | 24 | | ns |
| Q_{rr} | Reverse recovery charge | | | 16.8 | | nC |
| I_{RRM} | Reverse recovery current | | | 1.4 | | 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

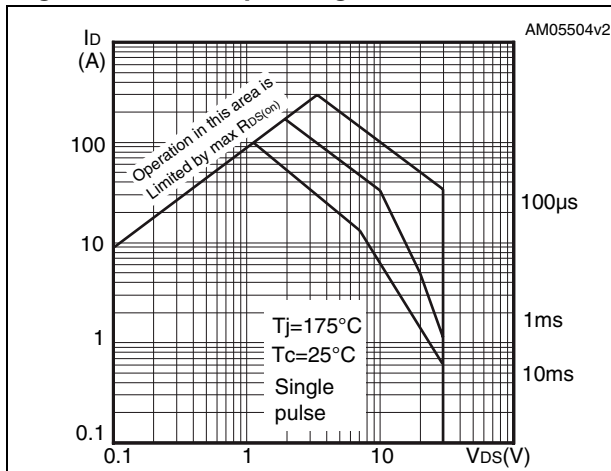


Figure 3. Thermal impedance

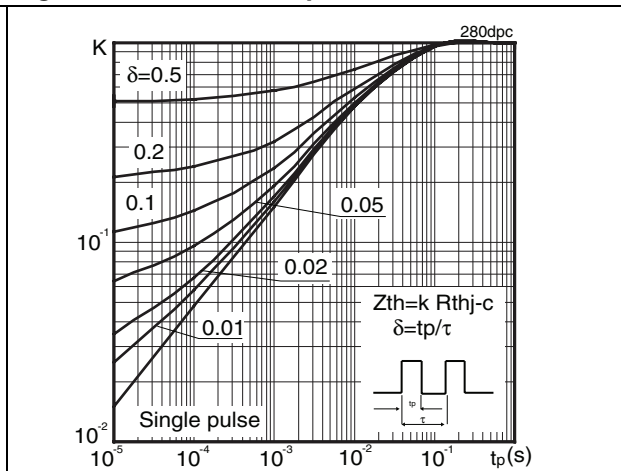


Figure 4. Output characteristics

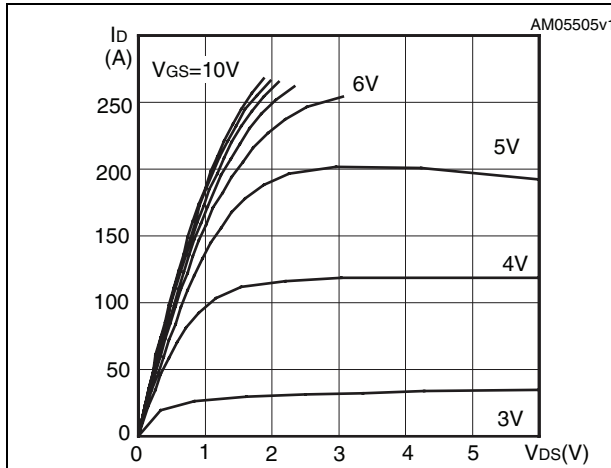


Figure 5. Transfer characteristics

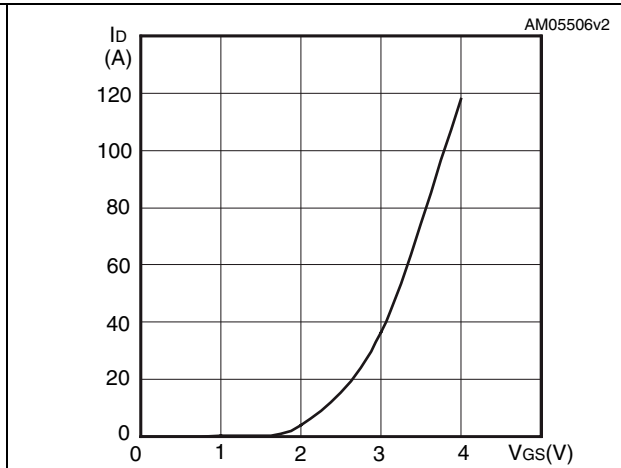


Figure 6. Normalized BV_{DSS} vs temperature

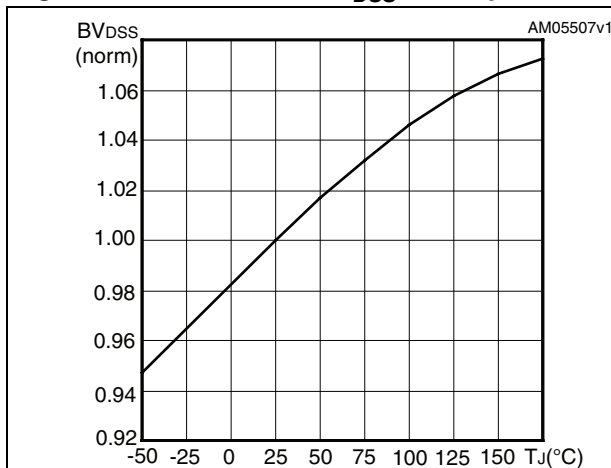


Figure 7. Static drain-source on resistance

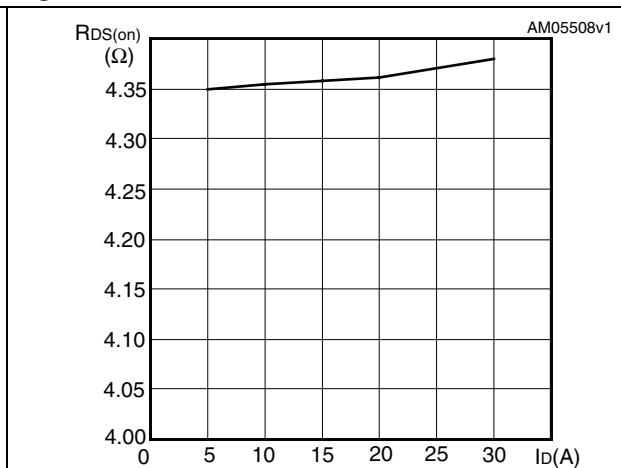


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

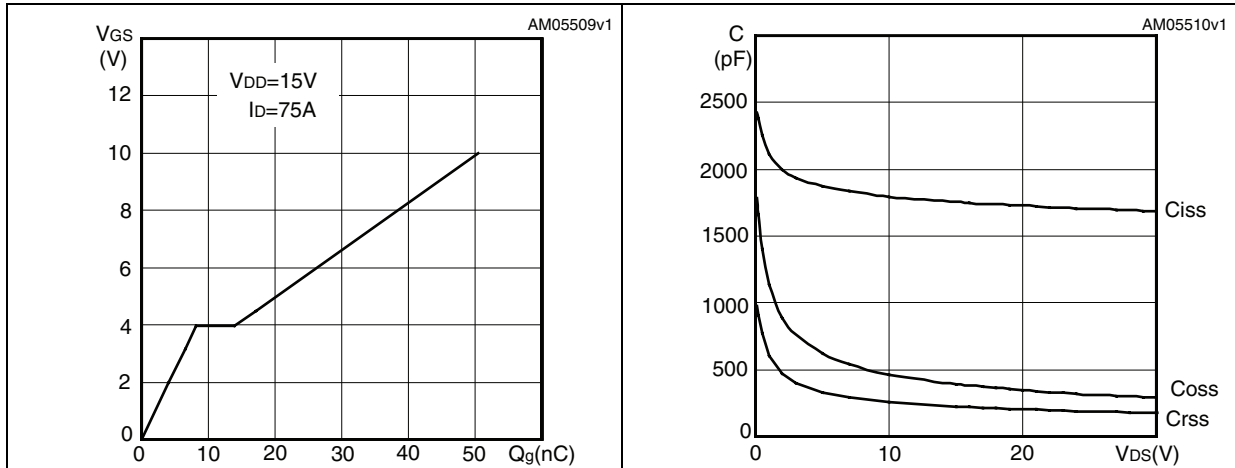


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

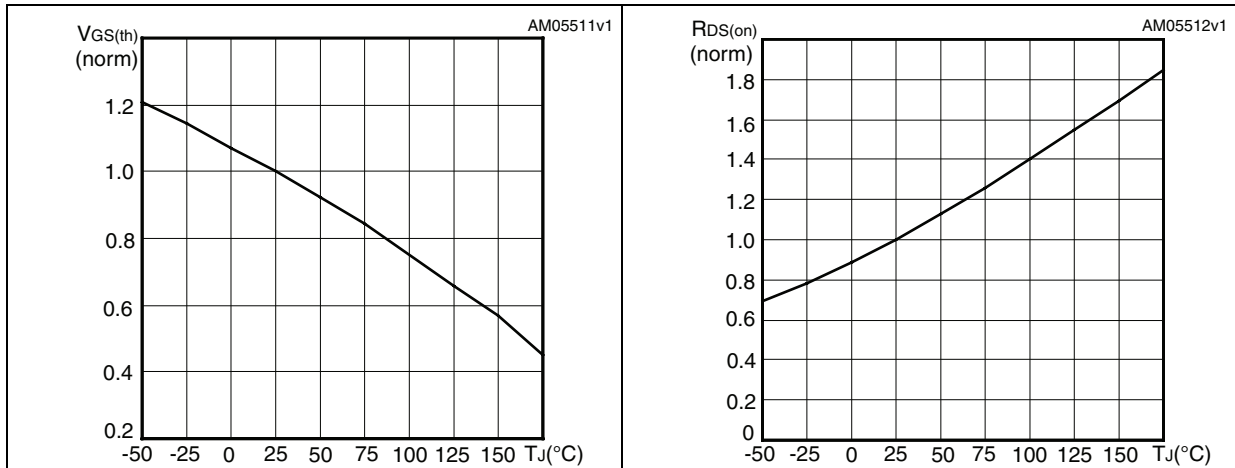
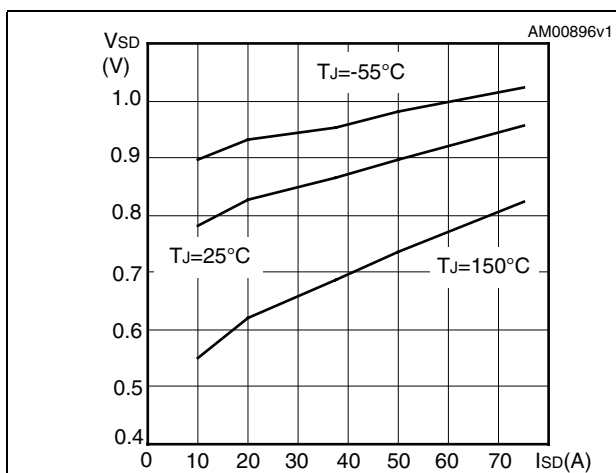


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

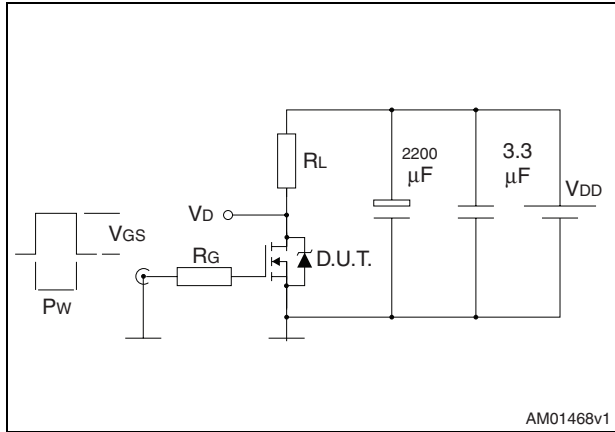


Figure 14. Gate charge test circuit

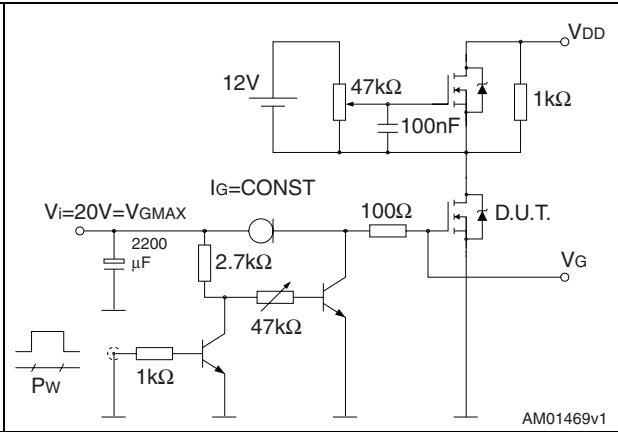


Figure 15. Test circuit for inductive load switching and diode recovery times

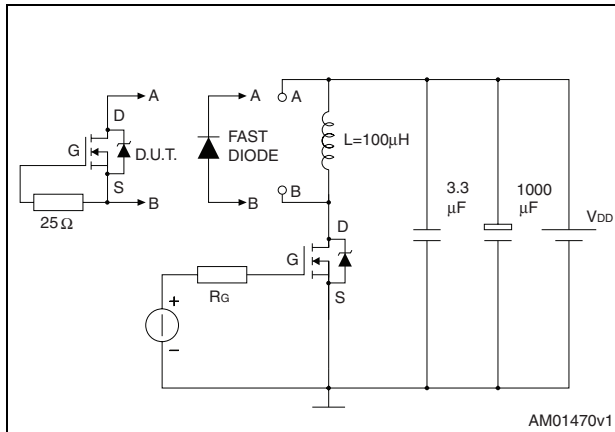


Figure 16. Unclamped inductive load test circuit

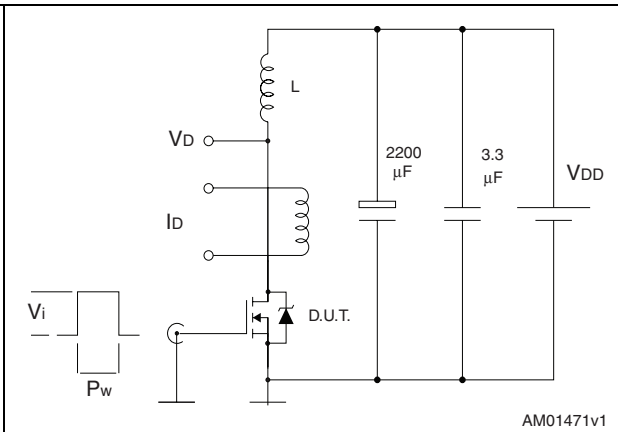


Figure 17. Unclamped inductive waveform

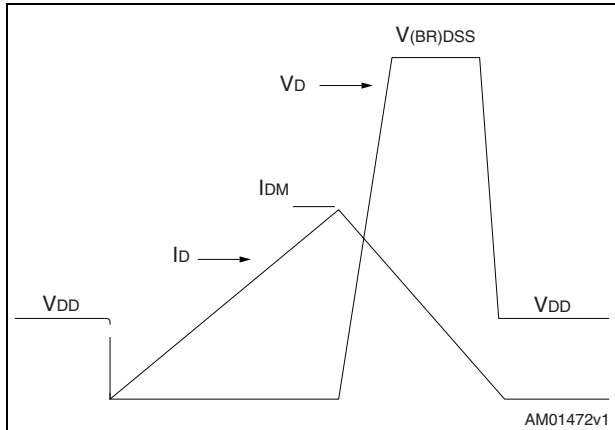


Figure 18. Switching time waveform

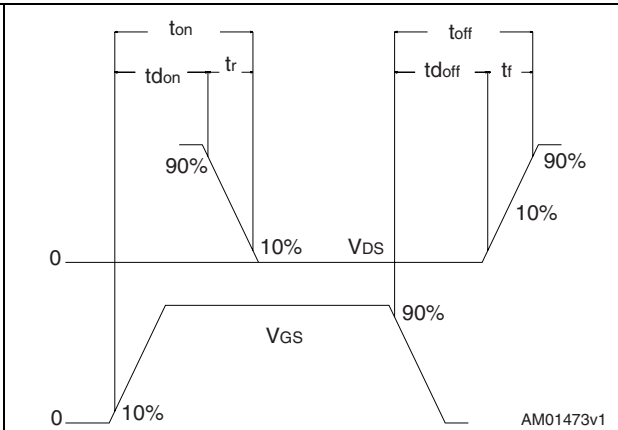
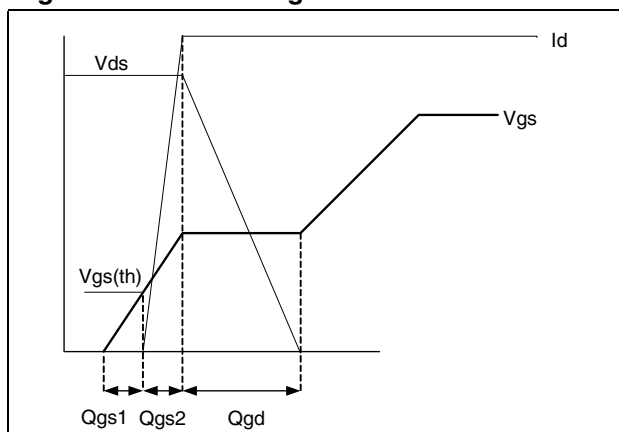


Figure 19. Gate charge waveform



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. Short IPAK mechanical dimensions

| Dim. | mm | | |
|------|------|------|-------|
| | Min | Typ | Max |
| A | 2.20 | | 2.40 |
| A1 | 0.90 | | 1.10 |
| b | 0.64 | | 0.90 |
| b2 | | | 0.95 |
| b4 | 5.20 | | 5.40 |
| c | 0.45 | | 0.60 |
| c2 | 0.48 | | 0.60 |
| D | 6.00 | | 6.20 |
| E | 6.40 | | 6.60 |
| e | | 2.25 | |
| e1 | 4.40 | | 4.60 |
| H | 9.80 | | 10.40 |
| L | 3.00 | | 3.40 |
| L1 | 0.80 | | 1.20 |
| L2 | | 0.80 | 1.00 |

Figure 20. Short IPAK mechanical drawing

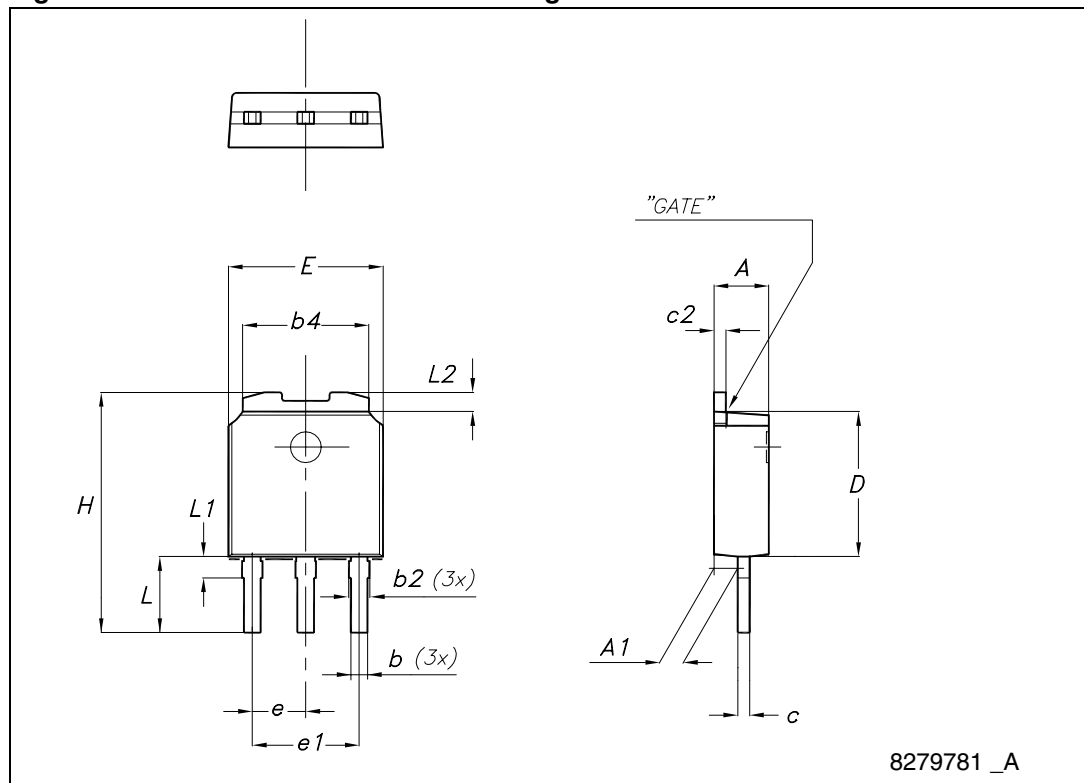
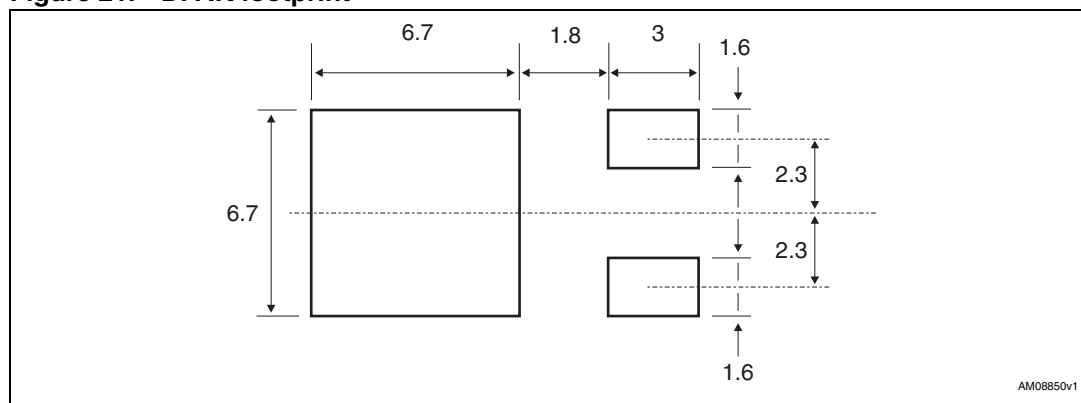


Table 9. DPAK (TO-252) mechanical data

| 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 | | 1.50 |
| L1 | | 2.80 | |
| L2 | | 0.80 | |
| L4 | 0.60 | | 1 |
| R | | 0.20 | |
| V2 | 0° | | 8° |

Figure 21. DPAK footprint^(a)



a. All dimension are in millimeters

Figure 22. DPAK (TO-252) drawing

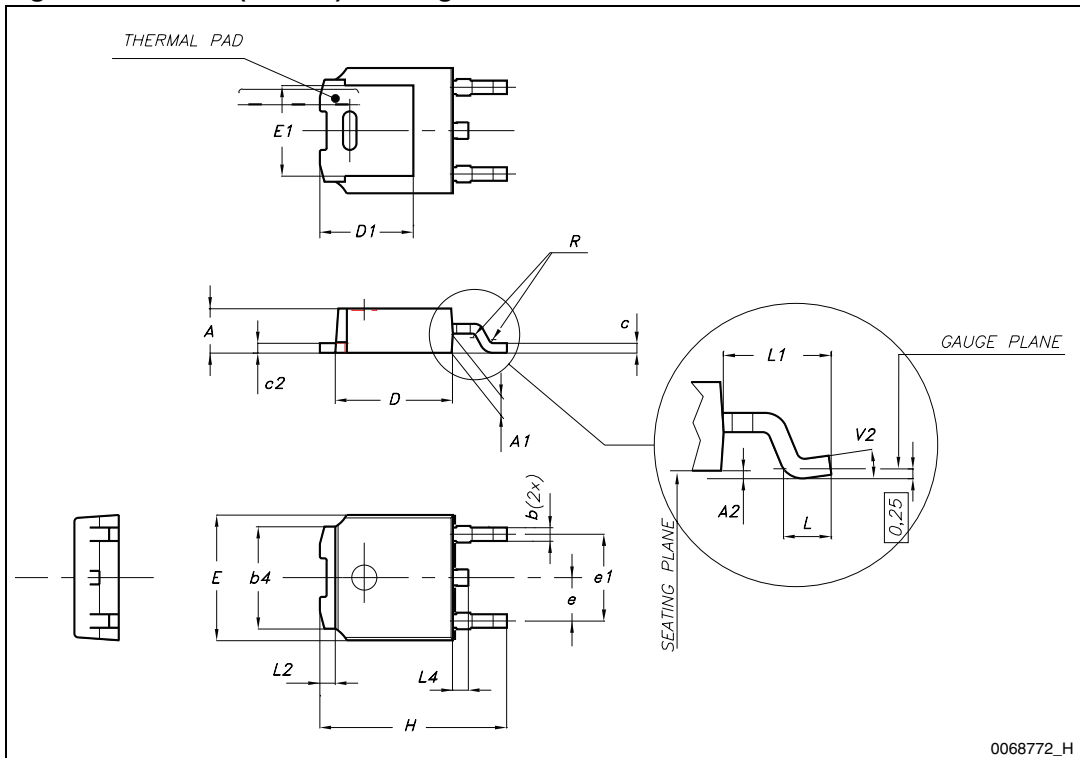


Table 10. IPAK (TO-251) mechanical data

| DIM. | mm. | | |
|------|------|-------|------|
| | min. | typ | max. |
| A | 2.20 | | 2.40 |
| A1 | 0.90 | | 1.10 |
| b | 0.64 | | 0.90 |
| b2 | | | 0.95 |
| b4 | 5.20 | | 5.40 |
| B5 | | 0.3 | |
| c | 0.45 | | 0.60 |
| c2 | 0.48 | | 0.60 |
| D | 6.00 | | 6.20 |
| E | 6.40 | | 6.60 |
| e | | 2.28 | |
| e1 | 4.40 | | 4.60 |
| H | | 16.10 | |
| L | 9.00 | | 9.40 |
| L1 | 0.80 | | 1.20 |
| L2 | | 0.80 | 1.00 |
| V1 | | 10° | |

Figure 23. IPAK (TO-251) drawing

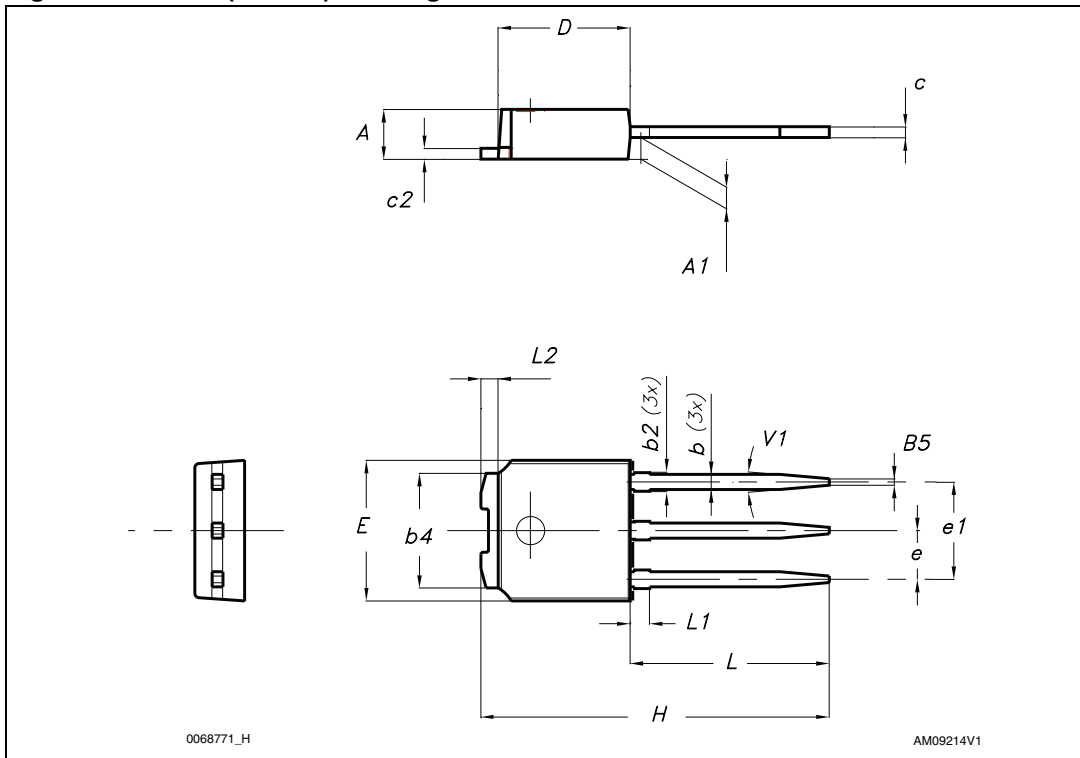
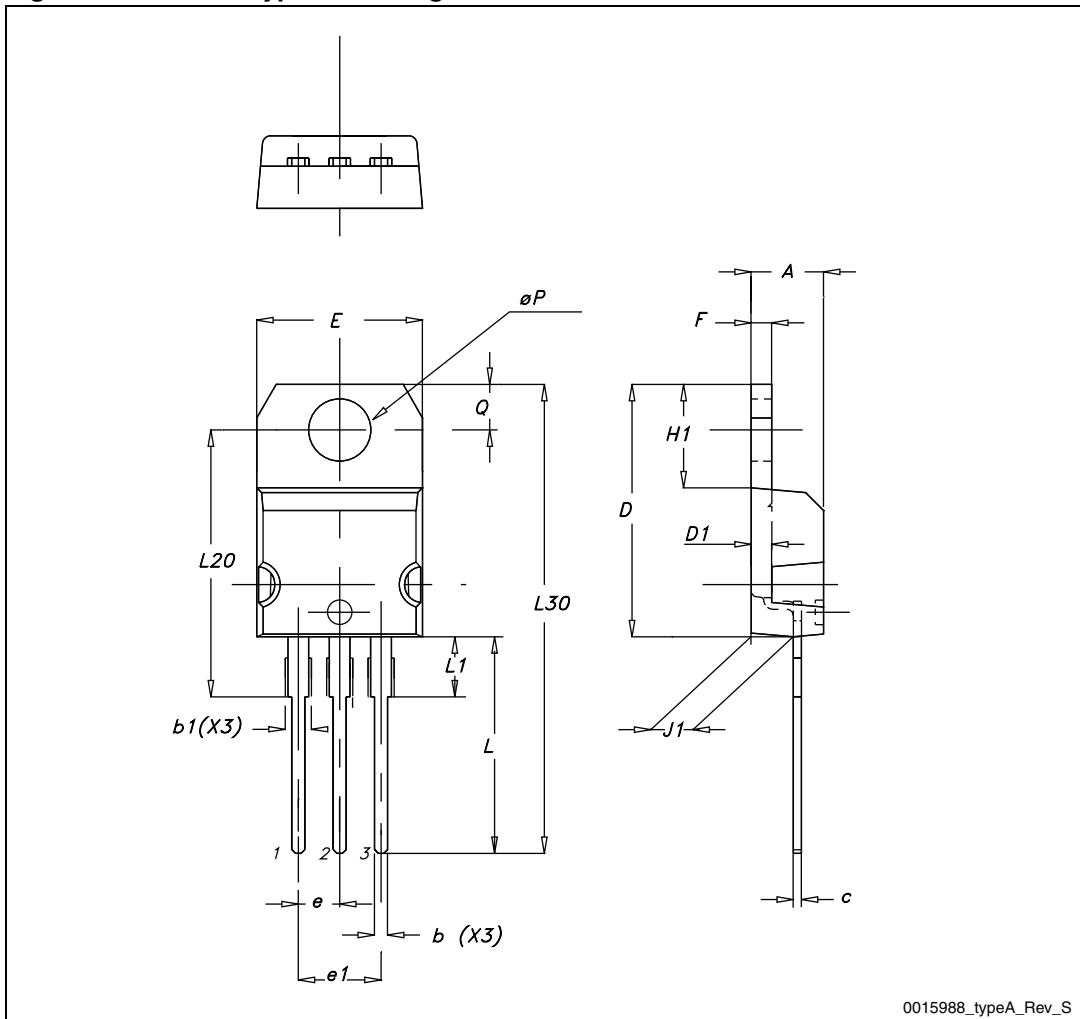


Table 11. TO-220 type A mechanical data

| 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 | |
| ∅P | 3.75 | | 3.85 |
| Q | 2.65 | | 2.95 |

Figure 24. TO-220 type A drawing



5 Packaging mechanical data

Table 12. 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 25. Tape for DPAK (TO-252)

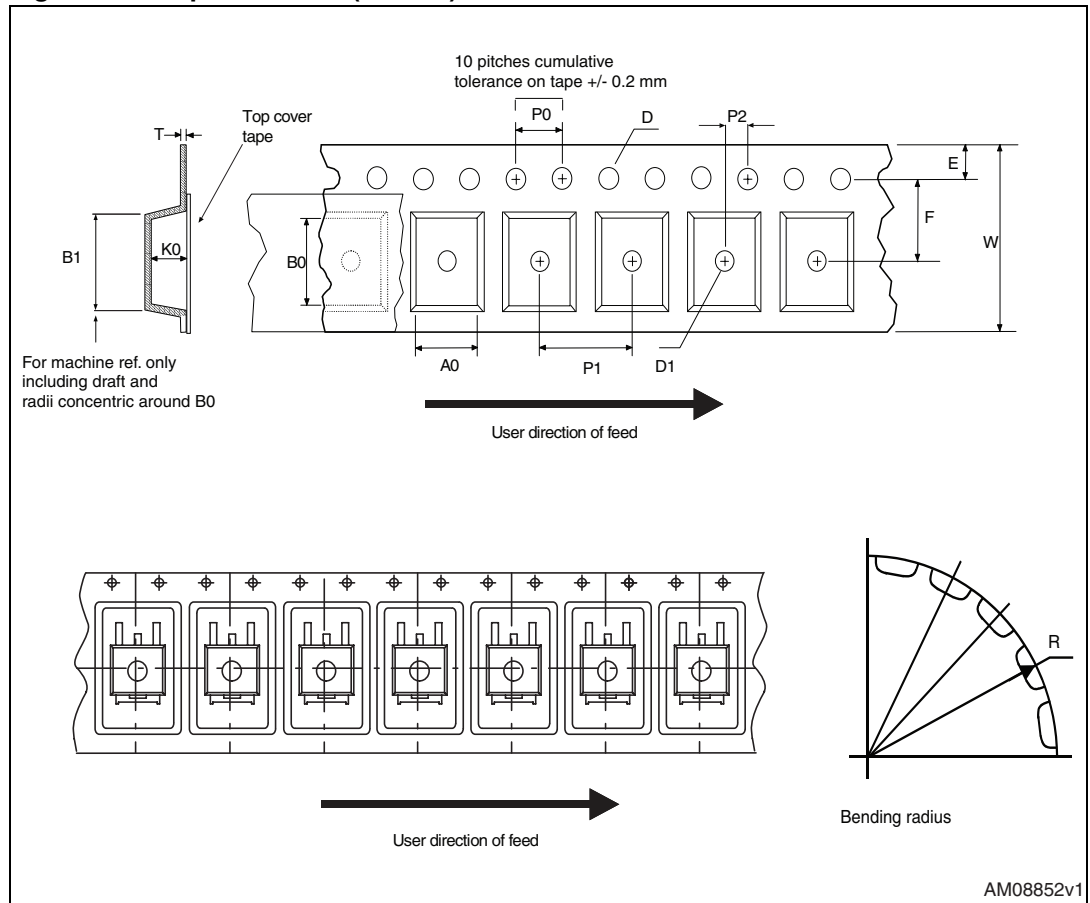
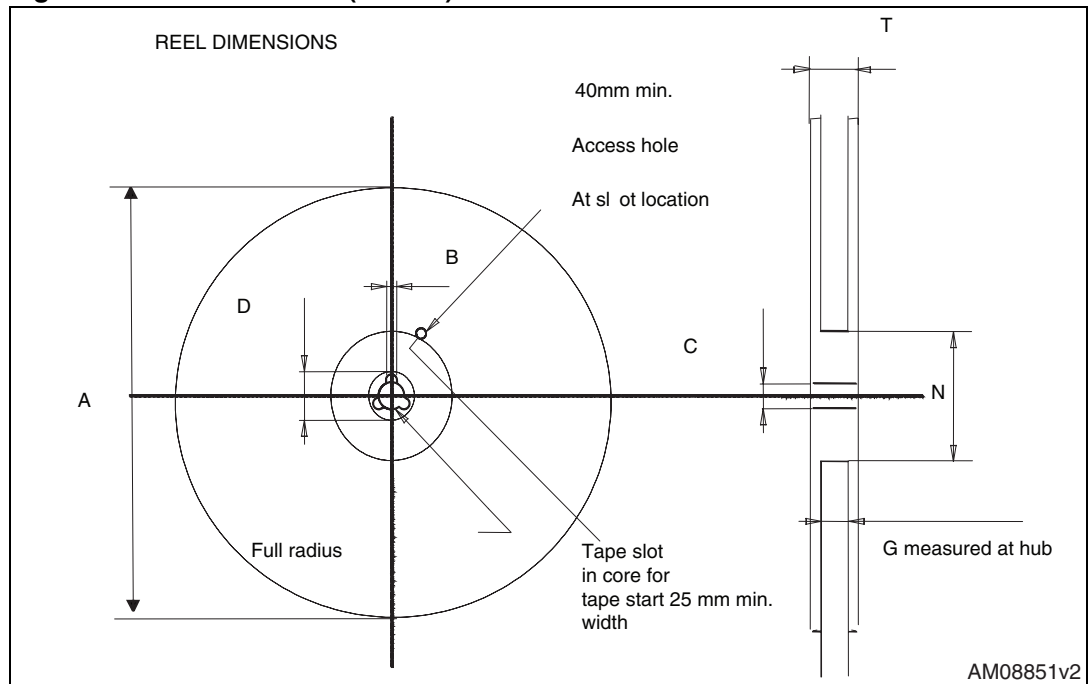


Figure 26. Reel for DPAK (TO-252)



6 Revision history

Table 13. Document revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 01-Jul-2009 | 1 | First issue. |
| 02-Oct-2009 | 2 | – Added device in Short IPAK. – Document status promoted from preliminary data to datasheet. |
| 19-Apr-2011 | 3 | – Added max values in Table 5: Dynamic . – Added new package and mechanical data. – Inserted new I_D value @ 70 °C (see Table 2: Absolute maximum ratings) |
| 04-Jul-2011 | 4 | Updated: mechanical data |

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