



STB55NF06, STP55NF06, STP55NF06FP

N-channel 60 V, 0.015 Ω , 50 A STripFET™ II Power MOSFET in D²PAK, TO-220 and TO-220FP packages

Datasheet — production data

Features

| Order code | V _{DSS} | R _{DS(on)} max. | I _D |
|-------------|------------------|--------------------------|---------------------|
| STB55NF06 | 60 V | < 0.018 Ω | 50 A |
| STP55NF06 | | | 50 A ⁽¹⁾ |
| STP55NF06FP | | | 50 A ⁽¹⁾ |

1. Refer to soa for the max allowable current value on FP-type due to R_{th} value

- 100% avalanche tested
- Exceptional dv/dt capability

Applications

- Switching application

Description

These Power MOSFETs have been developed using STMicroelectronics' unique STripFET process, which is specifically designed to minimize input capacitance and gate charge. This renders the devices suitable for use as primary switch in advanced high-efficiency isolated DC-DC converters for telecom and computer applications, and applications with low gate charge driving requirements.

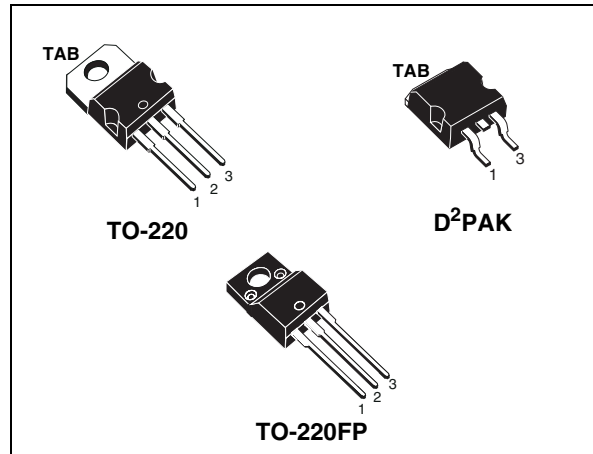
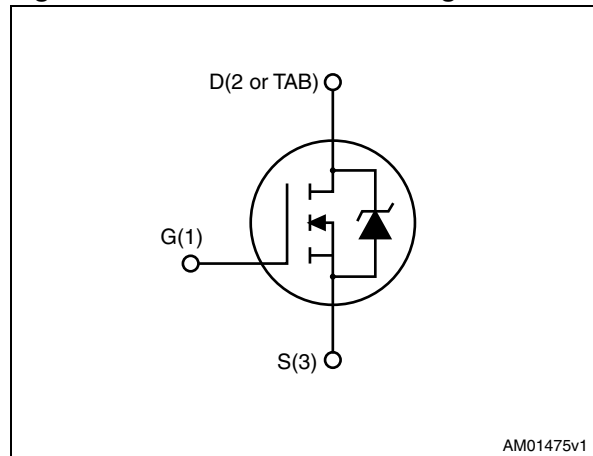


Figure 1. Internal schematic diagram



AM01475v1

Table 1. Device summary

| Order code | Marking | Package | Packaging |
|-------------|-----------|--------------------|---------------|
| STB55NF06 | B55NF06 | D ² PAK | Tape and reel |
| STP55NF06 | P55NF06 | TO-220 | Tube |
| STP55NF06FP | P55NF06FP | TO-220 | |

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1 Electrical ratings

Table 2. Absolute maximum ratings

| Symbol | Parameter | Value | | Unit |
|--------------------------------|---|-------------------------------|--------------------|------|
| | | TO-220, D ² PAK | TO-220FP | |
| V _{DS} | Drain-source voltage | 60 | | V |
| V _{GS} | Gate- source voltage | ± 20 | | V |
| I _D | Drain current (continuous) at T _C = 25 °C | 50 | 50 ⁽¹⁾ | A |
| I _D | Drain current (continuous) at T _C = 100 °C | 35 | 35 ⁽¹⁾ | A |
| I _{DM} ⁽²⁾ | Drain current (pulsed) | 200 | 200 ⁽¹⁾ | A |
| P _{tot} | Total dissipation at T _C = 25 °C | 110 | 30 | W |
| | Derating factor | 0.73 | 0.20 | W/°C |
| E _{AS} ⁽³⁾ | Single pulse avalanche energy | 340 | | mJ |
| dv/dt ⁽⁴⁾ | Peak diode recovery voltage slope | 7 | | V/ns |
| V _{ISO} | Insulation withstand voltage (DC) | | 2500 | V |
| T _{stg} | Storage temperature | -55 to 175 | | °C |
| T _j | Max. operating junction temperature | | | |

1. Refer to soa for the max allowable current value on FP-type due to R_{th} value
2. Pulse width limited by safe operating area.
3. Starting T_j = 25 °C, V_{DD} = 30 V, I_D = 25 A
4. I_{SD} ≤ 50 A, di/dt ≤ 400 A/μs, V_{DD} ≤ V_{(BR)DSS}, T_j ≤ T_{JMAX}

Table 3. Thermal data

| Symbol | Parameter | Value | | | Unit |
|-----------------------|---|--------------------|--------|----------|------|
| | | D ² PAK | TO-220 | TO-220FP | |
| R _{thj-case} | Thermal resistance junction-case max | 1.36 | | 5 | °C/W |
| R _{thj-amb} | Thermal resistance junction-ambient max | 62.5 | | | °C/W |

2 Electrical characteristics

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

Table 4. On/off states

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|--|--|------|-------|-----------|--------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $I_D = 250 \mu A, V_{GS} = 0$ | 60 | | | V |
| I_{DSS} | Zero gate voltage drain current ($V_{GS} = 0$) | $V_{DS} = 60 V$ $V_{DS} = 60 V, @ T_J = 125^{\circ}C$ | | | 1 10 | μA μA |
| I_{GSS} | Gate-body leakage current ($V_{DS} = 0$) | $V_{GS} = \pm 20 V$ | | | ± 100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS} = V_{GS}, I_D = 250 \mu A$ | 2 | 3 | 4 | V |
| $R_{DS(on)}$ | Static drain-source on-resistance | $V_{GS} = 10 V, I_D = 27.5 A$ | | 0.015 | 0.018 | Ω |

Table 5. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------------|------------------------------|--|------|------|------|------|
| C_{iss} | Input capacitance | $V_{DS} = 25 V, f = 1MHz,$ $V_{GS} = 0$ | - | 1300 | | pF |
| C_{oss} | Output capacitance | | | 300 | | pF |
| C_{rss} | Reverse transfer capacitance | | | 105 | | pF |
| $t_{d(on)}$ | Turn-on delay time | $V_{DD} = 30 V, I_D = 27.5 A$ $R_G = 4.7 \Omega, V_{GS} = 10 V$ (see Figure 15) | - | 20 | | ns |
| t_r | Rise time | | | 50 | | ns |
| $t_{d(off)}$ | Turn-off delay time | | | 36 | | ns |
| t_f | Fall time | | | 15 | | ns |
| Q_g | Total gate charge | $V_{DD} = 48 V, I_D = 55 A,$ $V_{GS} = 10 V$ (see Figure 16) | - | 44.5 | 60 | nC |
| Q_{gs} | Gate-source charge | | | 10.5 | | nC |
| Q_{gd} | Gate-drain charge | | | 17.5 | | nC |

Table 6. Source drain diode

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------------------------|--|--|------|------------------|-----------|---------------|
| I_{SD} $I_{SDM}^{(1)}$ | Source-drain current Source-drain current (pulsed) | | - | | 50 200 | A A |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD} = 50 \text{ A}$, $V_{GS} = 0$ | - | | 1.5 | V |
| t_{rr} Q_{rr} I_{RRM} | Reverse recovery time Reverse recovery charge Reverse recovery current | $I_{SD} = 50 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$, $V_{DD} = 30 \text{ V}$, $T_j = 150 \text{ }^\circ\text{C}$ (see Figure 17) | - | 75 170 4.5 | | ns nC 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

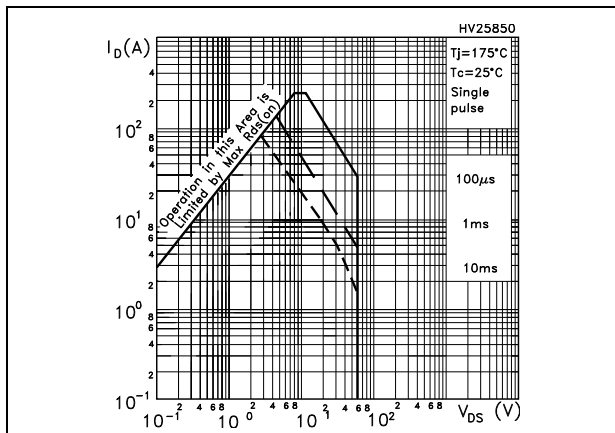


Figure 3. Thermal impedance for TO-220, D²PAK

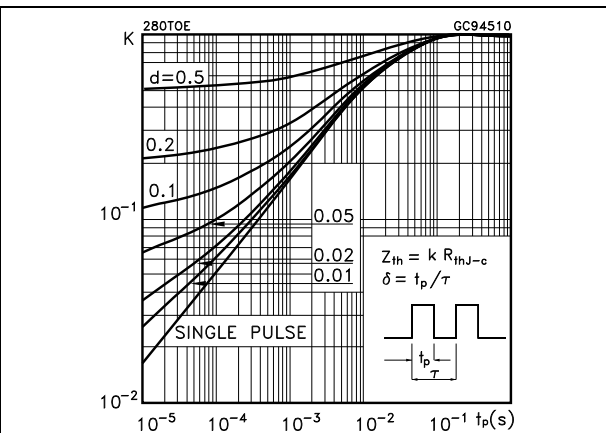


Figure 4. Safe operating area for TO-220FP

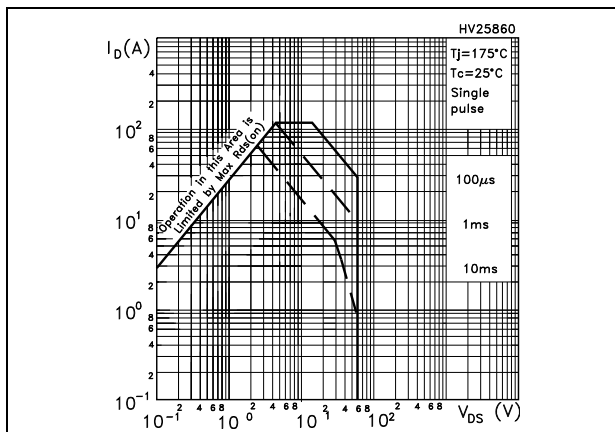


Figure 5. Thermal impedance TO-220FP

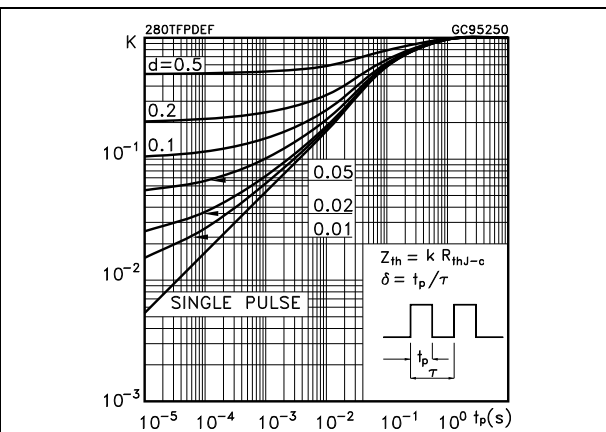


Figure 6. Output characteristics

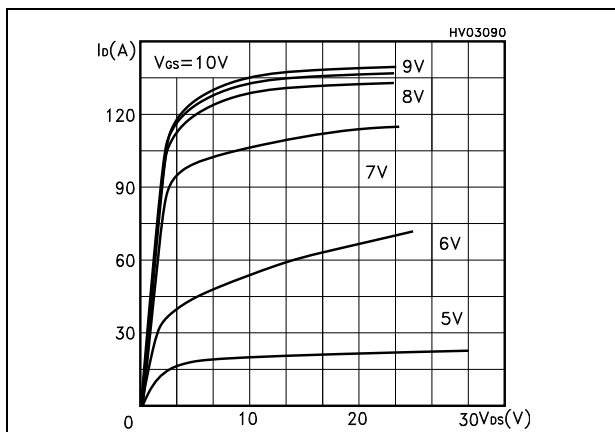


Figure 7. Transfer characteristics

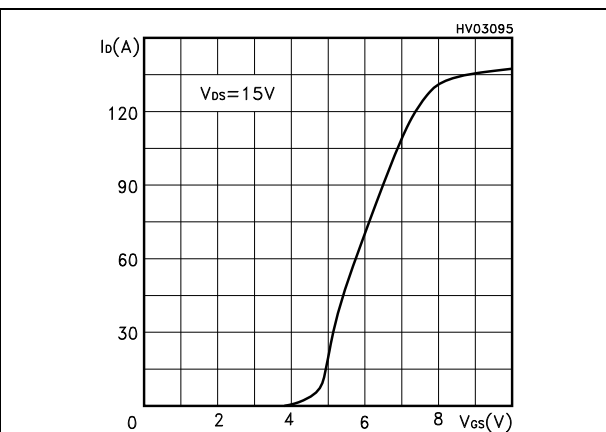


Figure 8. Transconductance

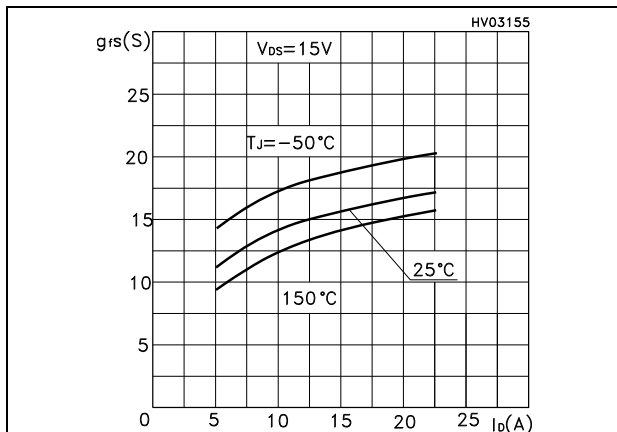


Figure 9. Static drain-source on-resistance

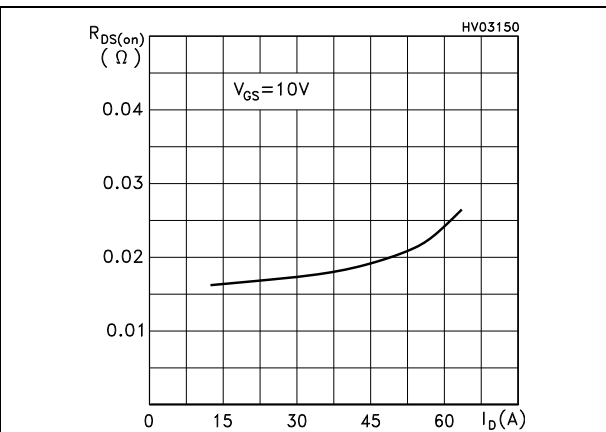


Figure 10. Gate charge vs gate-source voltage Figure 11. Capacitance variations

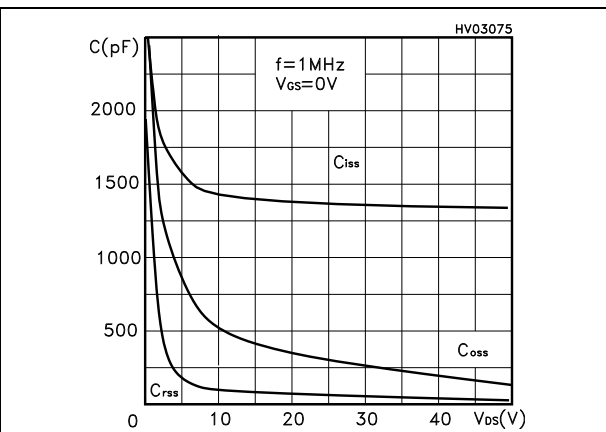
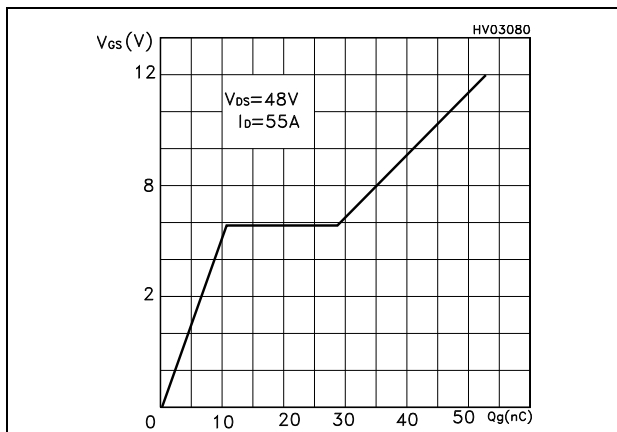


Figure 12. Normalized gate threshold voltage vs temperature

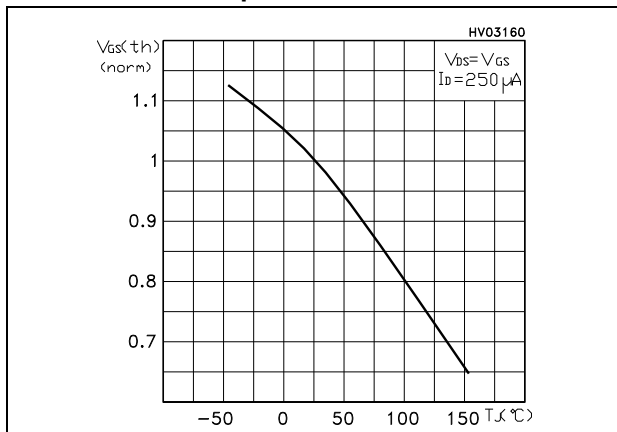


Figure 13. Normalized on-resistance vs temperature

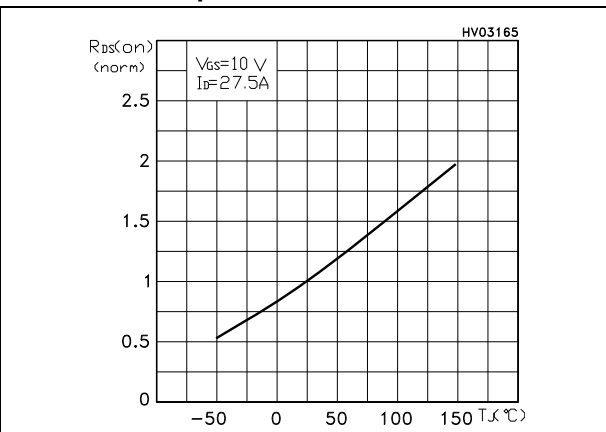
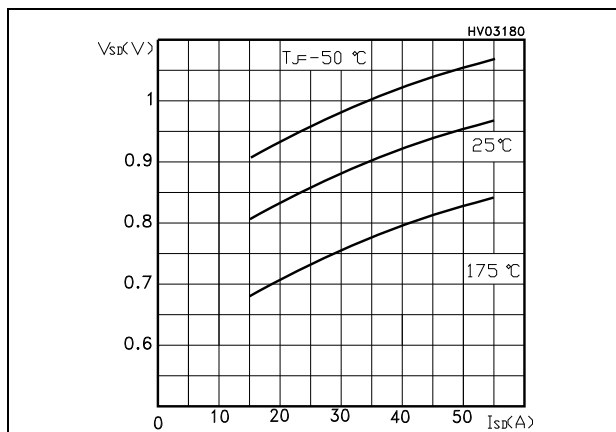


Figure 14. Source-drain diode forward characteristics



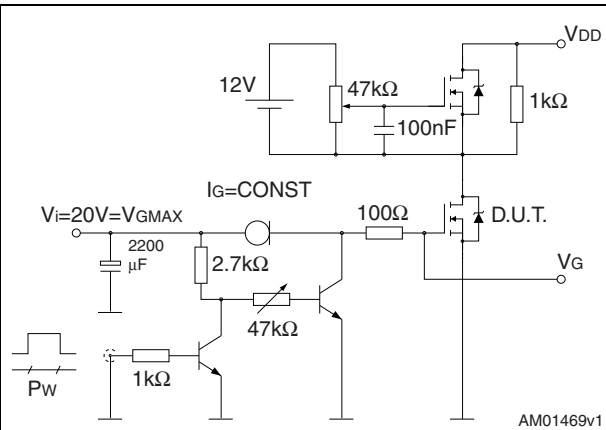
3 Test circuit

Figure 15. Switching times test circuit for resistive load



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Figure 16. Gate charge test circuit



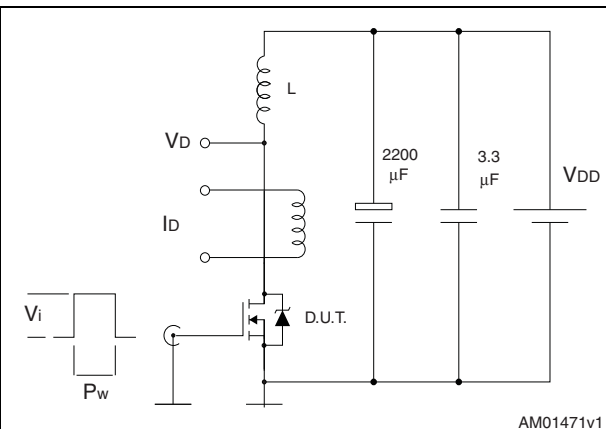
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Figure 17. Test circuit for inductive load switching and diode recovery times



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Figure 18. Unclamped inductive load test circuit



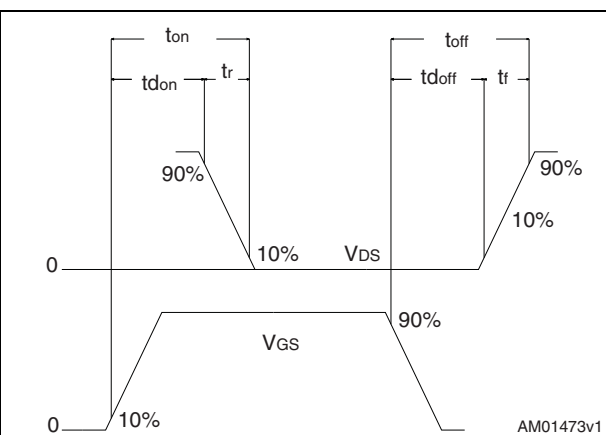
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Figure 19. Unclamped inductive waveform



AM01472v1

Figure 20. 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 7. 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 21. D²PAK (TO-263) drawing



Figure 22. D²PAK footprint^(a)



a. All dimensions are in millimeters

Table 8. 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 23. TO-220 type A drawing

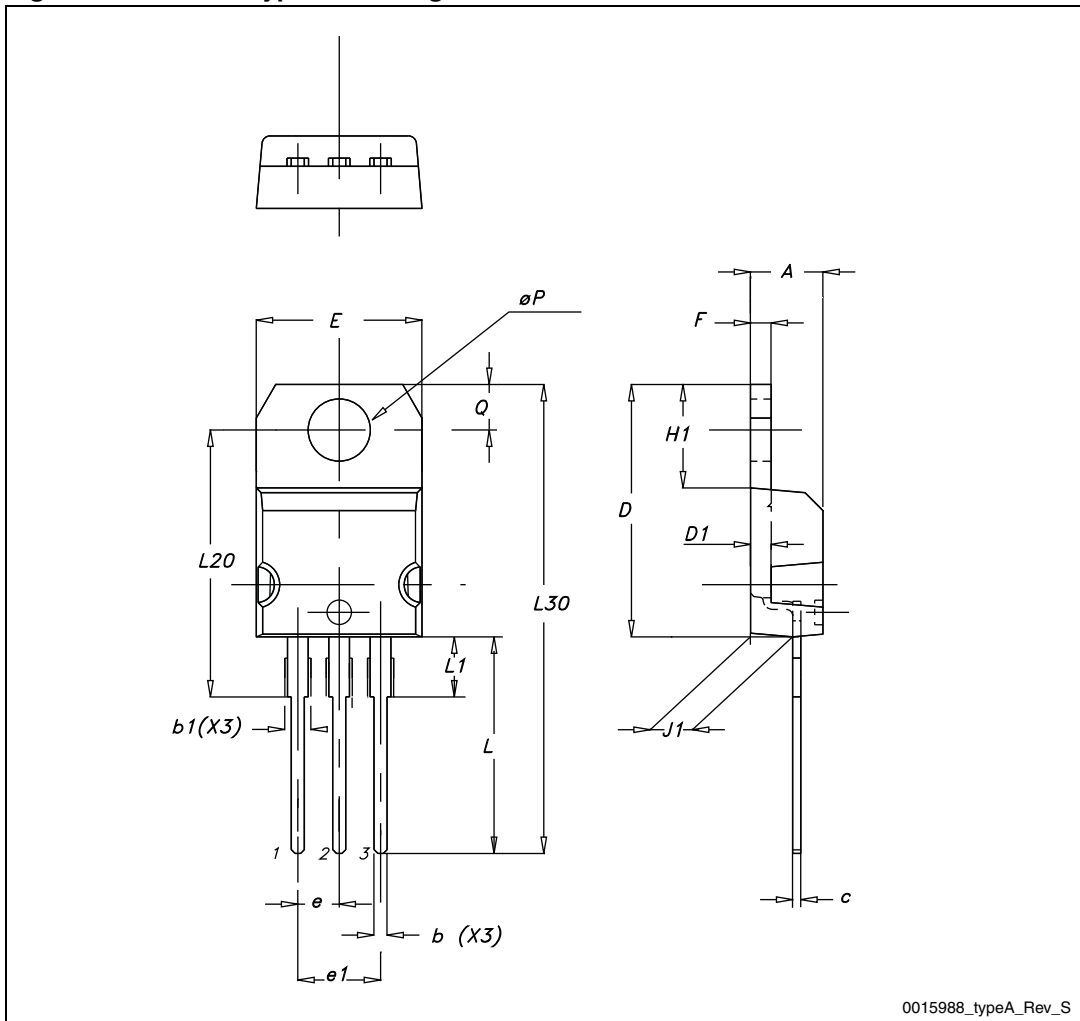
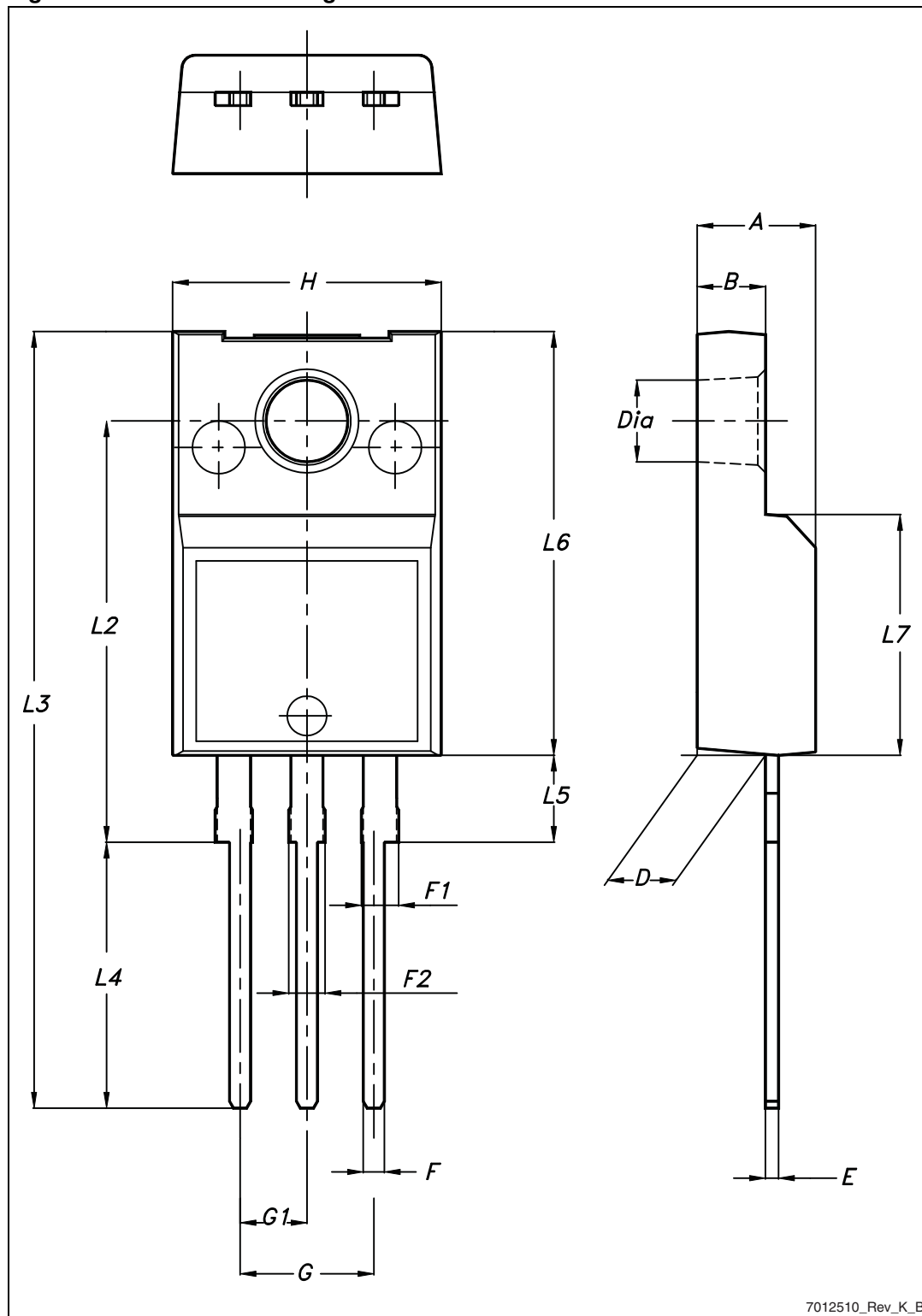


Table 9. TO-220FP mechanical data

| 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 24. TO-220FP drawing



5 Packaging mechanical data

Table 10. 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 | | | |

Figure 25. Tape

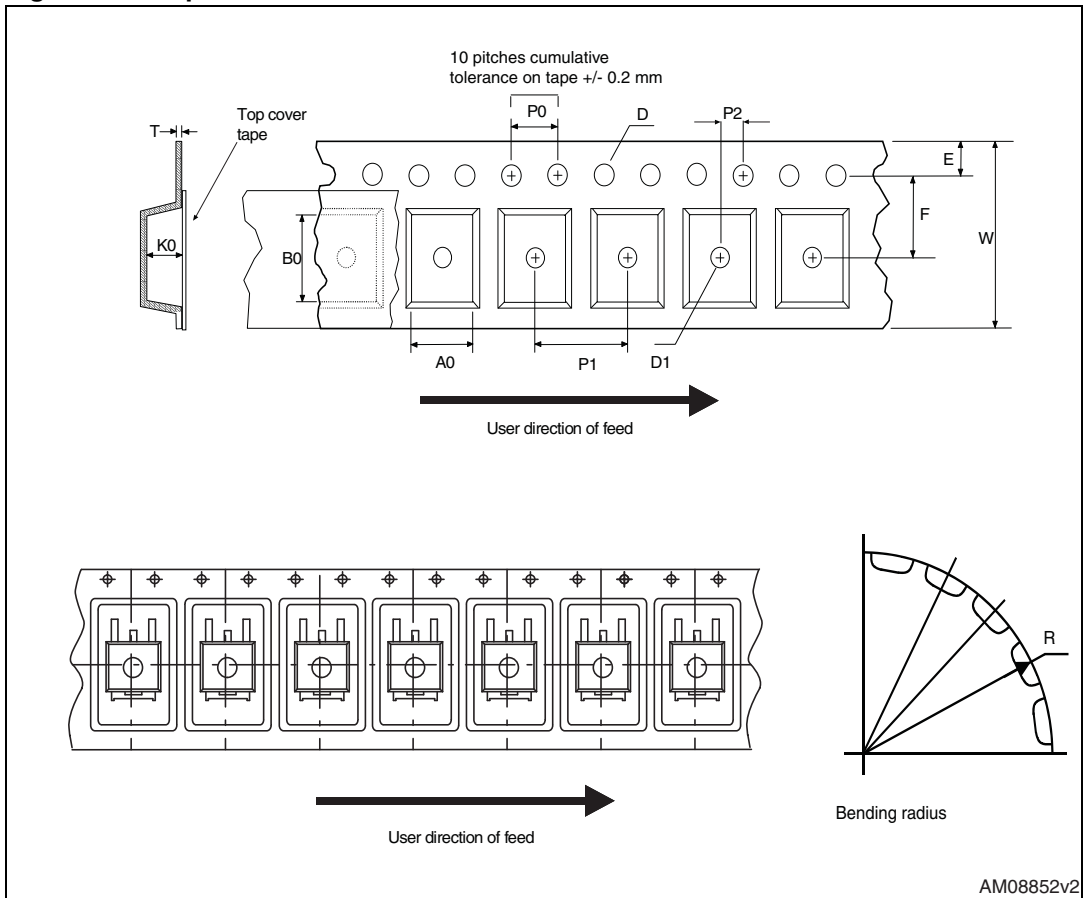
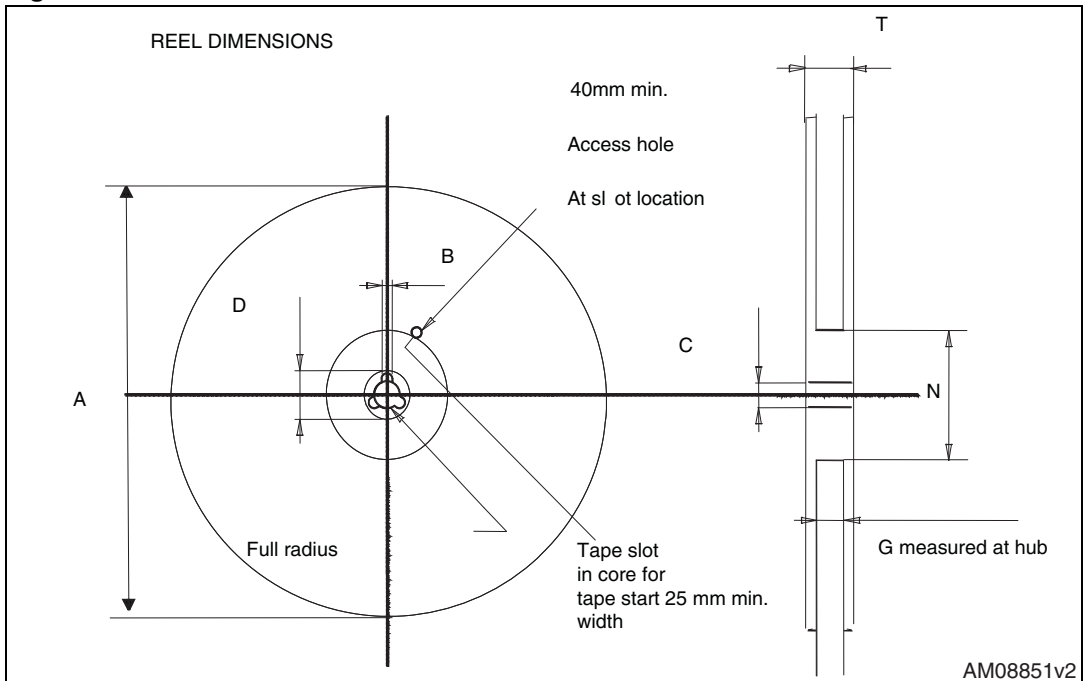


Figure 26. Reel



6 Revision history

Table 11. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 19-Oct-2005 | 7 | Preliminary document |
| 02-Dec-2005 | 8 | New datasheet according to PCN MLD-PMT/05/1115 |
| 28-Mar-2006 | 9 | Inserted ecopack indication |
| 26-Jun-2006 | 10 | New template, no content change |
| 25-May-2012 | 11 | Removed part number STB55NF06-1 in I ² PAK package <i>Section 4: Package mechanical data</i> and <i>Section 5: Packaging mechanical data</i> have been updated Minor text changes |

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