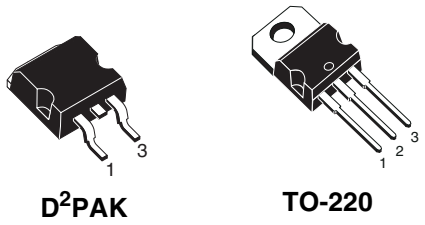
# STB80PF55
# STP80PF55

## P-channel 55 V, 0.016 Ω, 80 A TO-220, D²PAK STripFET™ II Power MOSFET

## Features

| Type | $V_{DSS}$ | $R_{DS(on)}$ | $I_D$ |
|---|---|---|---|
| STP80PF55 | 55V | <0.018Ω | 80A |
| STB80PF55 | 55V | <0.018Ω | 80A |

- Extremely dv/dt capability
- 100% avalanche tested
- Application oriented characterization




D²PAK TO-220

## Application

- Switching applications

## Description

These Power MOSFETs are the latest development of STMicroelectronics unique "single feature size" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps allowing remarkable manufacturing reproducibility.

**Figure 1. Internal schematic diagram**

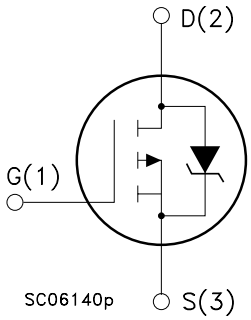



**Table 1. Device summary**

| Order code | Marking | Package | Packaging |
|---|---|---|---|
| STP80PF55 | P80PF55 | TO-220 | Tube |
| STB80PF55 | B80PF55 | D²PAK | Tape and reel |

# Contents

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DS}$ | Drain-source voltage ($V_{GS}$ = 0) | 55 | V |
| $V_{GS}$ | Gate-source voltage | ±16 | V |
| $I_D$ (1) | Drain current (continuous) at $T_C$ = 25°C | 80 | A |
| $I_D$ | Drain current (continuous) at $T_C$ = 100°C | 57 | A |
| $I_{DM}$ (2) | Drain current (pulsed) | 320 | A |
| $P_{TOT}$ | Total dissipation at $T_C$ = 25°C | 300 | W |
| | Derating factor | 2 | W/°C |
| dv/dt (3) | Peak diode recovery voltage slope | 7 | V/ns |
| $E_{AS}$ (4) | Single pulse avalanche energy | 1.4 | J |
| $T_j$<br>$T_{stg}$ | Operating junction temperature<br>Storage temperature | -55 to 175 | °C |

1. Current limited by package.
2. Pulse width limited by safe operating area .
3. $I_{SD} \leq 40A$, di/dt ≤ 300 A/µs, $V_{DD}$=80% $V_{(BR)DSS}$.
4. Starting Tj=25°C, $I_D$=80A, $V_{DD}$=40V.

**Table 3. Thermal data**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{thj\text{-}case}$ | Thermal resistance junction-case max | 0.5 | °C/W |
| $R_{thj\text{-}a}$ | Thermal resistance junction-ambient max | 62.5 | °C/W |
| $T_l$ | Maximum lead temperature for soldering purpose | 300 | °C |

*Note: For the P-CHANNEL MOSFET actual polarity of voltages and current has to be reversed*

# 2 Electrical characteristics

($T_{CASE}$=25°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 mA, $V_{GS}$ = 0 | 55 | | | V |
| $I_{DSS}$ | Zero gate voltage drain current ($V_{GS}$ = 0)<br>$V_{DS}$ = Max rating<br>$V_{DS}$ = Max rating, $T_C$=125 °C | | | | 1<br>10 | µA<br>µA |
| $I_{GSS}$ | Gate-body leakage current ($V_{DS}$ = 0) | $V_{GS}$ = ±16 V | | | ±10 | µA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | 2 | 3 | 4 | V |
| $R_{DS(on)}$ | Static drain-source on resistance | $V_{GS}$ = 10 V, $I_D$ = 40 A | | 0.016 | 0.018 | Ω |

**Table 5. Dynamic**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $g_{fs}$ | Forward transconductance | $V_{DS}$ > $I_{D(on)}$ x $R_{DS(on)max}$, $I_D$= 40 A | - | 32 | | S |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$ | Input capacitance<br>Output capacitance<br>Reverse transfer capacitance | $V_{DS}$ = 25 V, f = 1MHz, $V_{GS}$ = 0 | - | 5500<br>1130<br>600 | | pF<br>pF<br>pF |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total gate charge<br>Gate-source charge<br>Gate-drain charge | $I_D$ = 25 A, $V_{DD}$ = 80 V, $V_{GS}$ = 10 V *(see Figure 15)* | - | 190<br>27<br>65 | 258 | nC<br>nC<br>nC |

**Table 6. Switching times**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$<br>$t_r$ | Turn-on delay time<br>Rise time | $V_{DD}$=25 V, $I_D$=40 A, $R_G$=4.7 Ω, $V_{GS}$=10 V *(see Figure 14)* | - | 35<br>190 | - | ns<br>ns |
| $t_{d(off)}$<br>$t_f$ | Turn-off delay time<br>Fall time | $V_{DD}$=25 V, $I_D$=40 A, $R_G$=4.7 Ω, $V_{GS}$=10 V *(see Figure 14)* | - | 165<br>80 | - | ns<br>ns |
| $t_{r(Voff)}$<br>$t_f$<br>$t_c$ | Off-voltage rise time<br>Fall time<br>Cross-over time | $V_{clamp}$=40 V, $I_D$=80 A, $R_G$=4.7 Ω, $V_{GS}$=10 V *(see Figure 14)* | - | 60<br>40<br>85 | - | ns<br>ns<br>ns |

**Table 7. Source drain diode**

| Symbol | Parameter | Test condictions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$<br>$I_{SDM}$ (1) | Source-drain current<br>Source-drain current (pulsed) | | - | | 10<br>40 | A<br>A |
| $V_{SD}$ (2) | Forward on voltage | $I_{SD}$ = 80 A, $V_{GS}$ = 0 | - | | 1.6 | V |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse recovery time<br>Reverse recovery charge<br>Reverse recovery current | $I_{SD}$ = 80 A, di/dt = 100 A/µs<br>$V_{DD}$ = 25 V, $T_j$ =150 °C | - | 110<br>495<br>9 | | ns<br>µC<br>A |

1. Pulse width limited by Tjmax .
2. Pulsed: pulse duration = 300 µs, duty cycle 1.5 %.

*Note: For the P-CHANNEL MOSFET actual polarity of voltages and current has to be reversed*

## 2.1 Electrical characteristics (curves)

**Figure 2. Safe operating area for TO-220 and D²PAK**

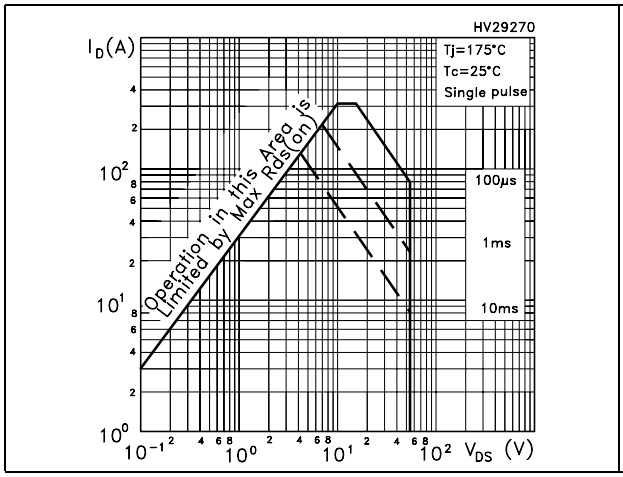



**Figure 3. Thermal impedance for TO-220 and D²PAK**

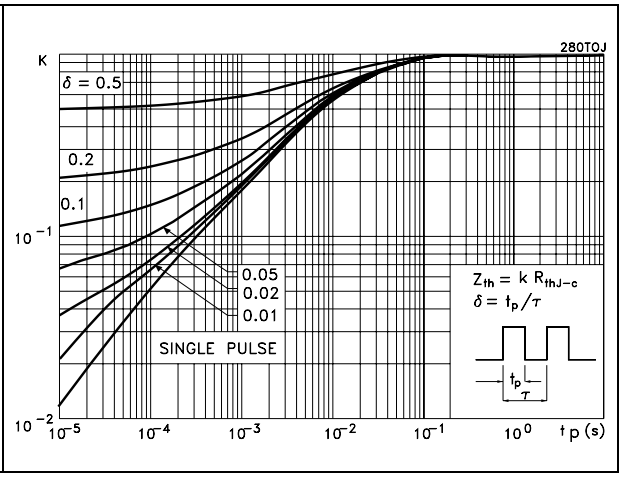



**Figure 4. Output characterisics**

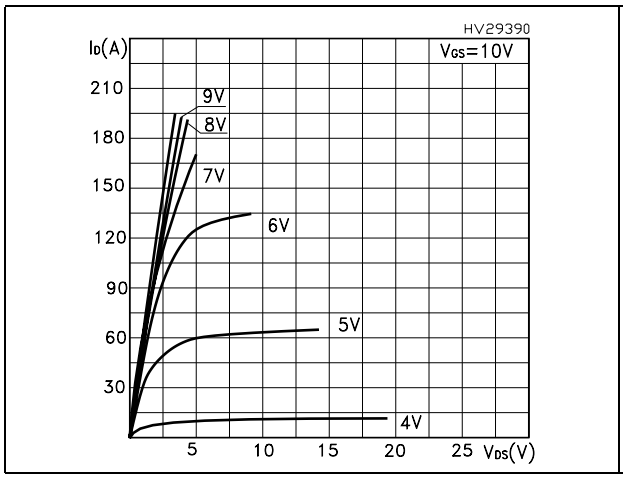



**Figure 5. Transfer characteristics**

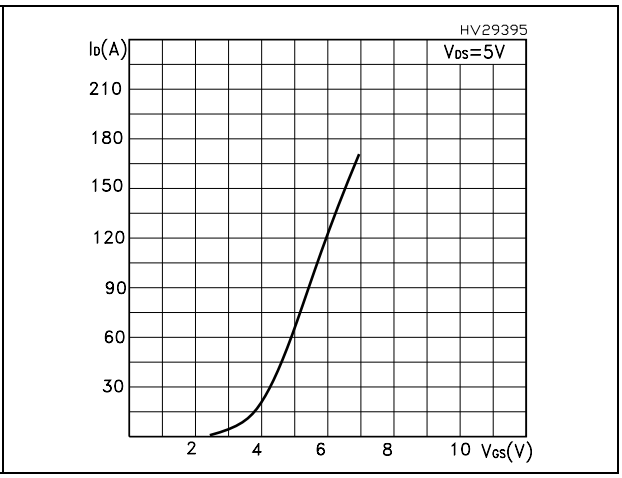



**Figure 6. Transconductance**

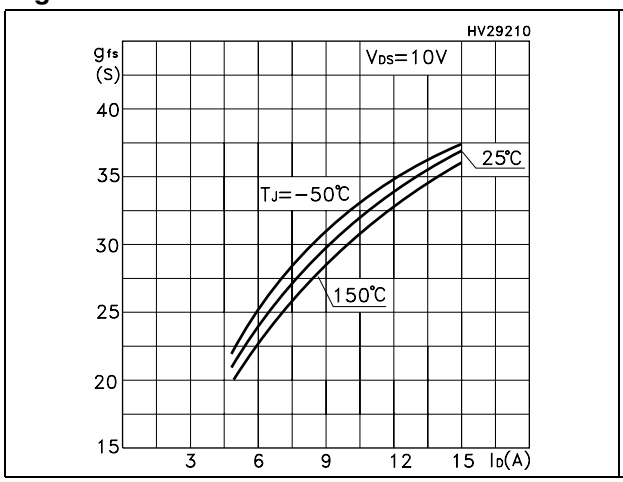



**Figure 7. Static drain-source on resistance**

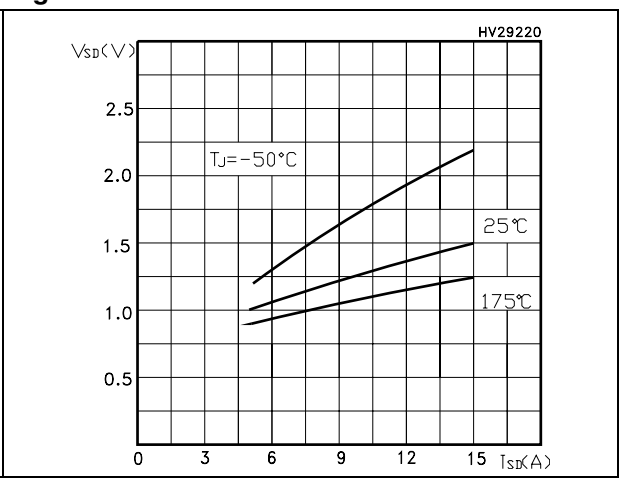


**Figure 8. Gate charge vs gate-source voltage**

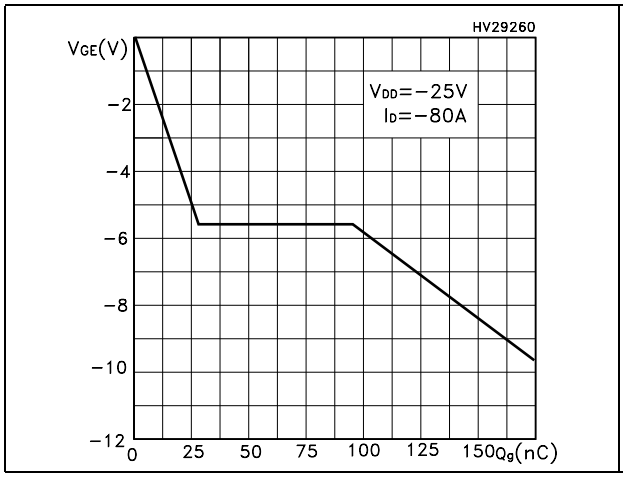



**Figure 9. Capacitance variations**

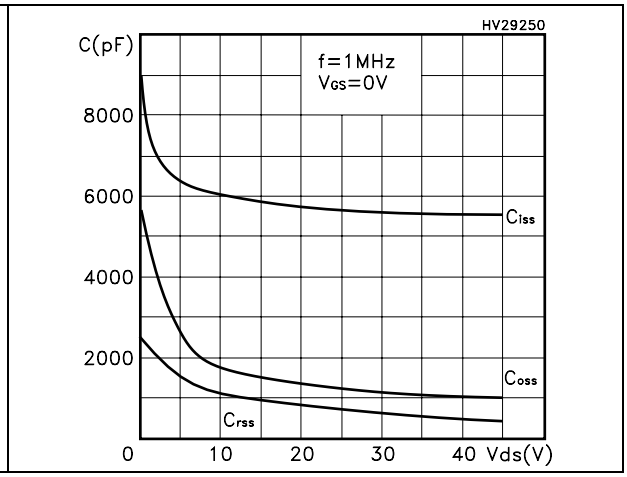



**Figure 10. Normalized gate threshold voltage vs temperature**

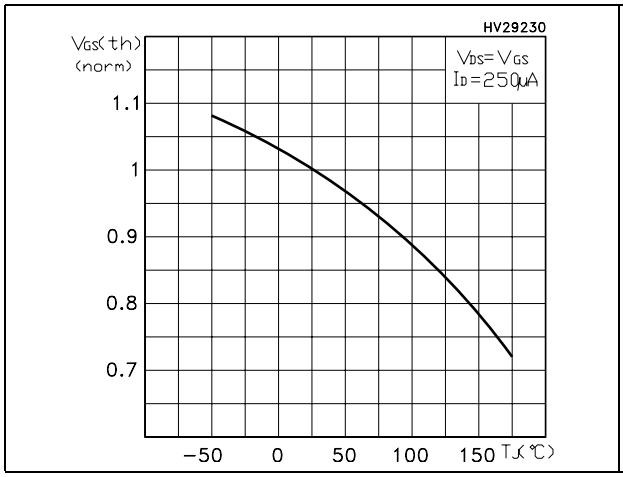



**Figure 11. Normalized on resistance vs temperature**

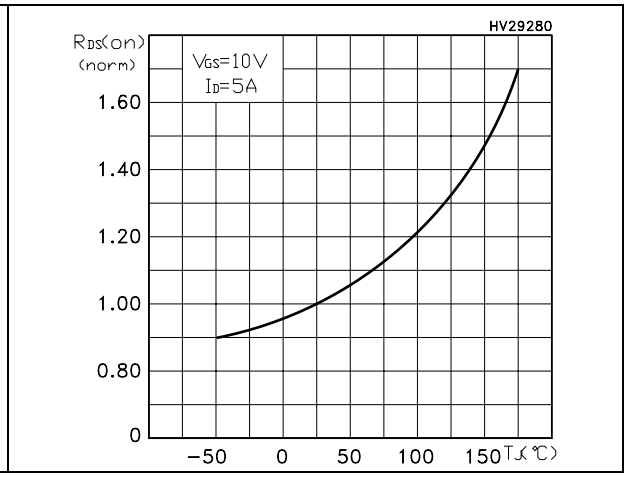



**Figure 12. Source-drain diode forward characteristics**

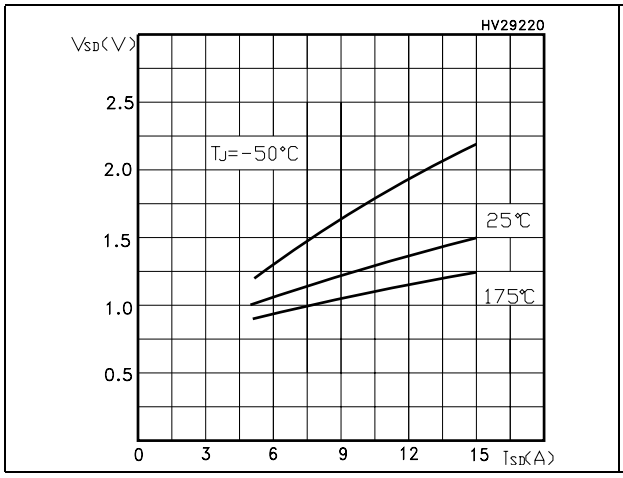
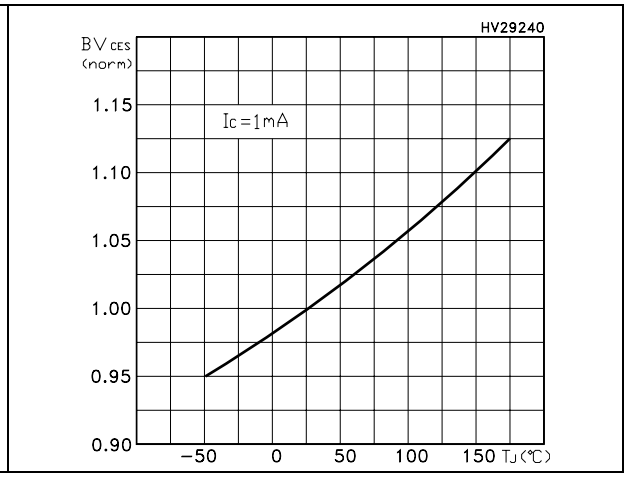



**Figure 13. Normalized $BV_{DSS}$ vs temperature**



# 3 Test circuits

**Figure 14. Switching times test circuit for resistive load**

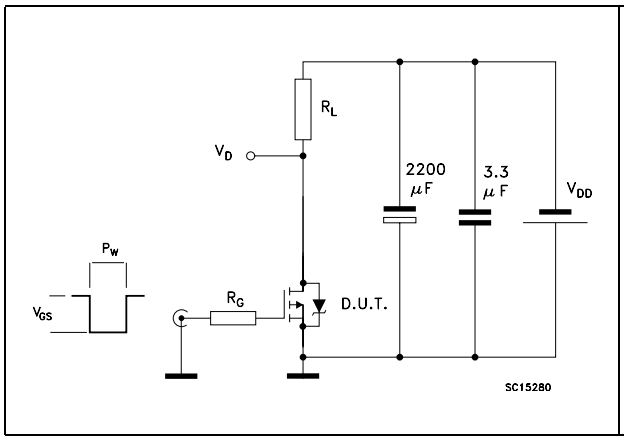



**Figure 15. Gate charge test circuit**

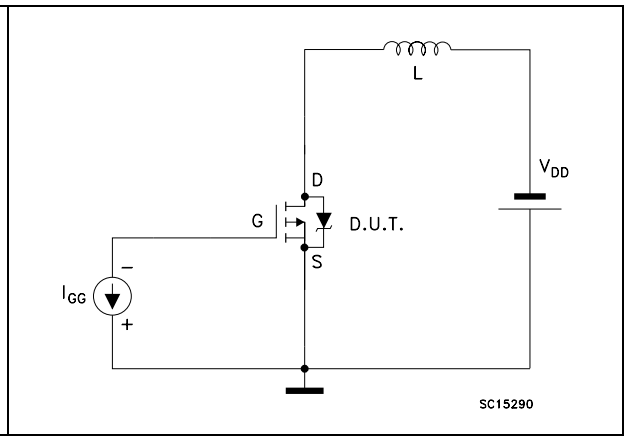
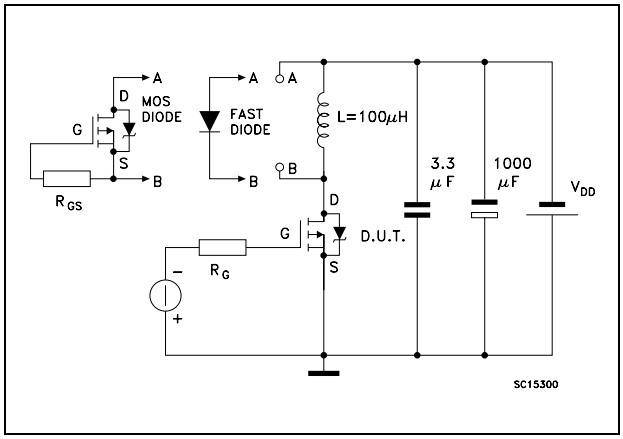



**Figure 16. Test circuit for inductive load switching and diode recovery times**



# 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. $D^2PAK$ 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° |

Figure 17. $D^2PAK$ drawing

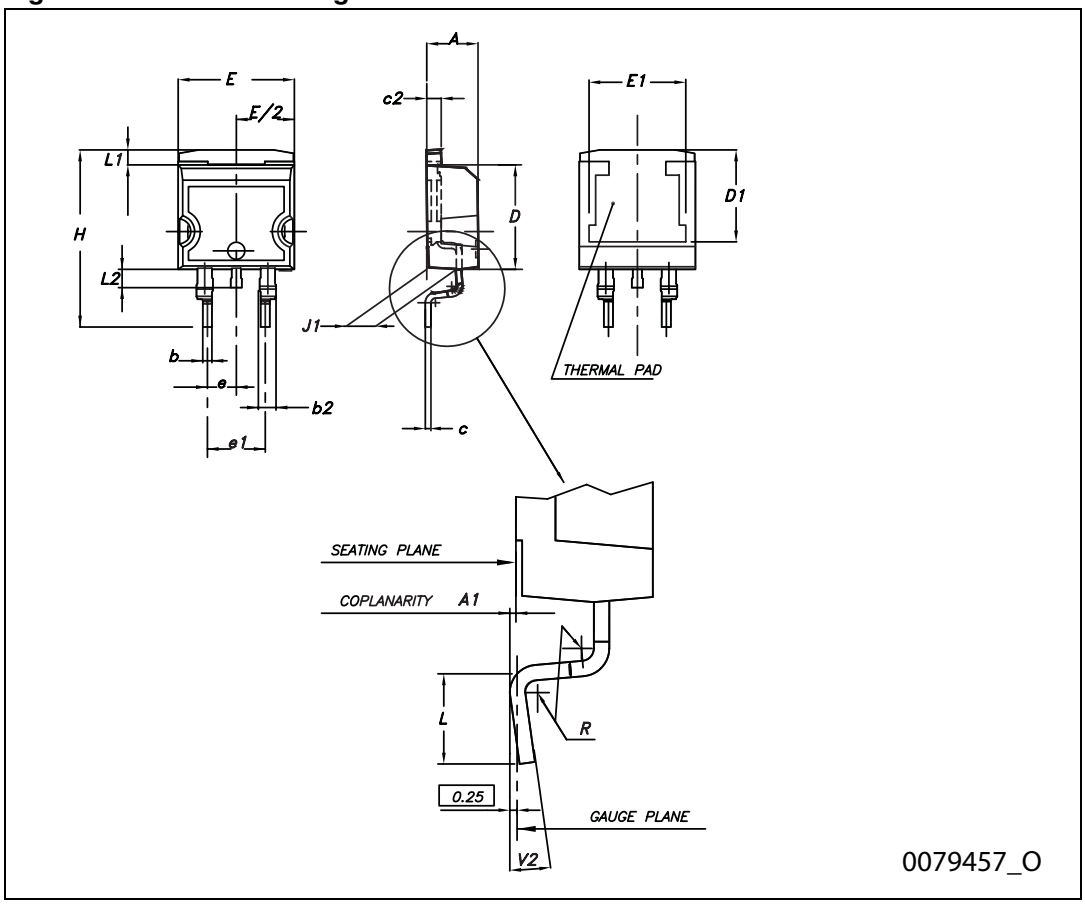
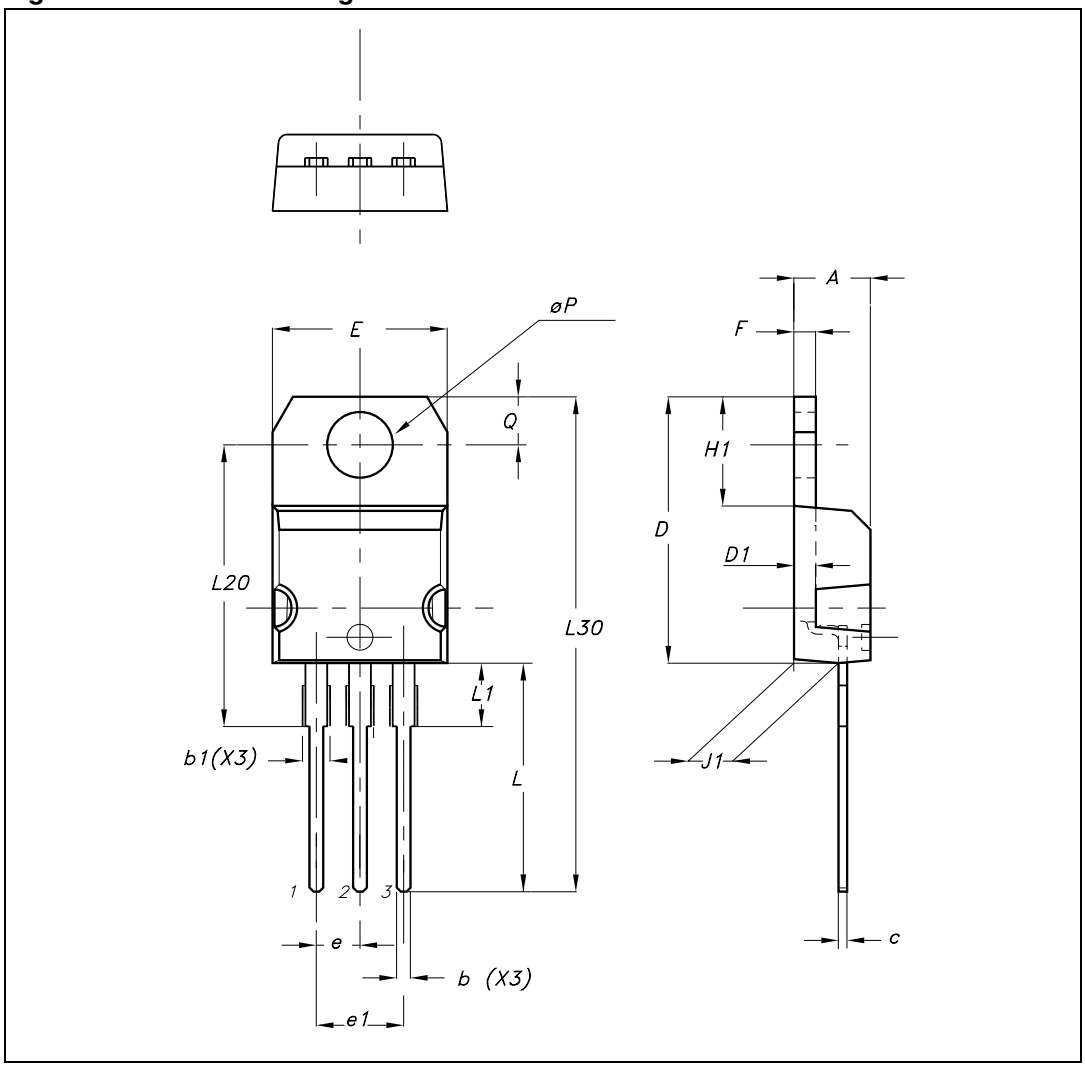


Table 9. TO-220 mechanical data

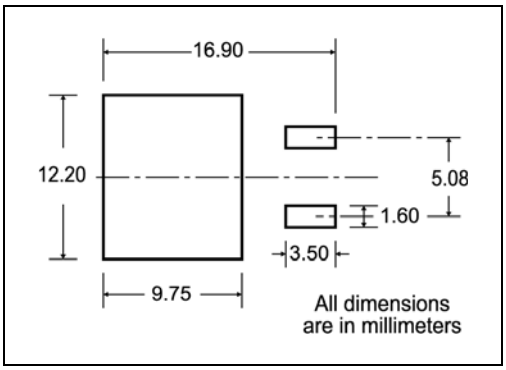
| Dim | mm | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 |
| b | 0.61 | | 0.88 |
| b1 | 1.14 | | 1.70 |
| c | 0.48 | | 0.70 |
| D | 15.25 | | 15.75 |
| D1 | | 1.27 | |
| E | 10 | | 10.40 |
| e | 2.40 | | 2.70 |
| e1 | 4.95 | | 5.15 |
| F | 1.23 | | 1.32 |
| H1 | 6.20 | | 6.60 |
| 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 18. TO-220 drawing**

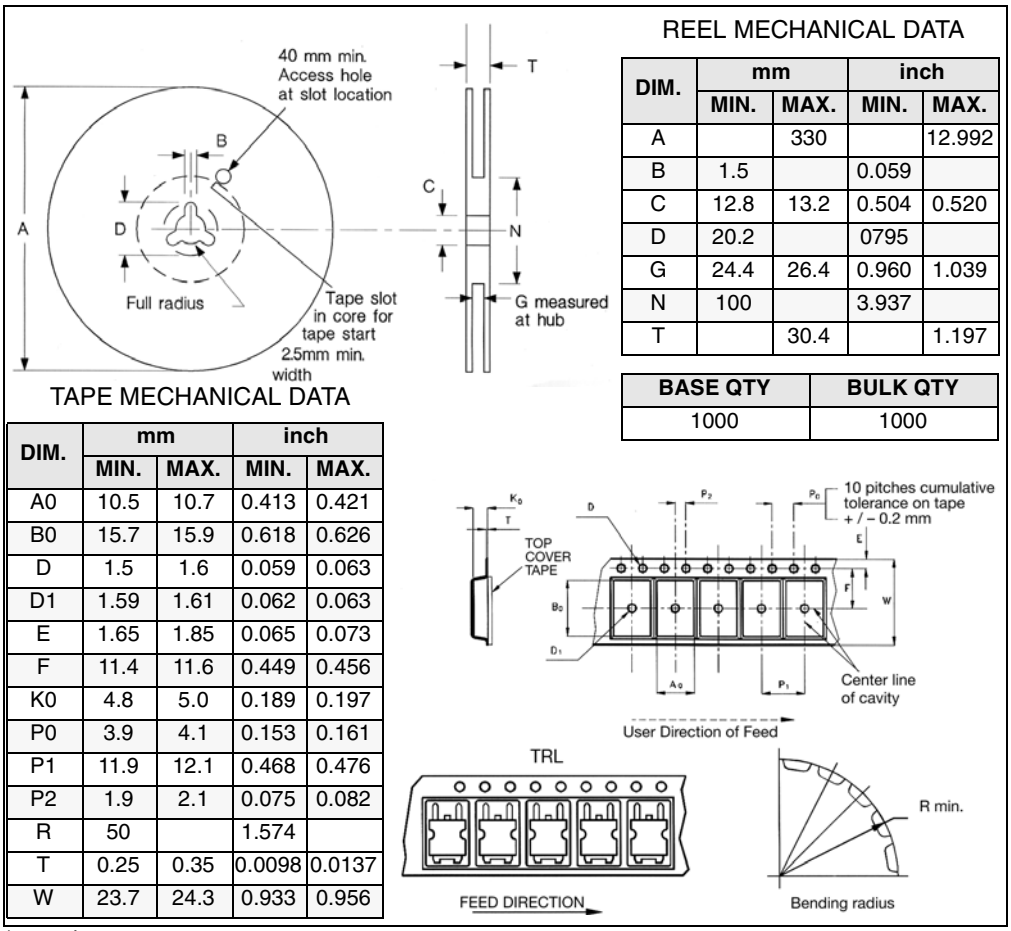


# 5 Packaging mechanical data

## D²PAK FOOTPRINT




## TAPE AND REEL SHIPMENT




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 | | 0795 | |
| G | 24.4 | 26.4 | 0.960 | 1.039 |
| N | 100 | | 3.937 | |
| T | | 30.4 | | 1.197 |

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

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 |

* on sales type

# 6 Revision history

Table 10. Document revision history

| Date | Revision | Changes |
|---|---|---|
| 09-Sep-2004 | 4 | Revalidation |
| 12-Sep-2006 | 5 | New template, $D^2PAK$ added |
| 09-Aug-2010 | 6 | Content reworked to improve readability, no technical changes. |

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