# STB141NF55 - STB141NF55-1
# STP141NF55

## N-channel 55V - 0.0065Ω - 80A - D²PAK - I²PAK - TO-220
## STripFET™ II Power MOSFET

## Features

| Type | $V_{DSS}$ | $R_{DS(on)}$ | $I_D$ (1) |
|---|---|---|---|
| STB141NF55 | 55V | <0.008Ω | 80A |
| STB141NF55-1 | 55V | <0.008Ω | 80A |
| STP141NF55 | 55V | <0.008Ω | 80A |

1. Current limited by package


TO-220 D²PAK I²PAK

## Description

This Power MOSFET is 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 avalance characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

## Applications

- Motor control
- High current, switching application
- Automotive environment

**Figure 1. Internal schematic diagram**

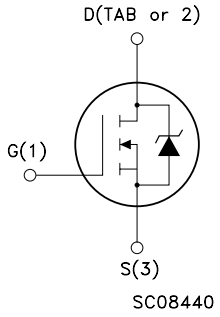



**Table 1. Device summary**

| Order code | Marking | Package | Packaging |
|---|---|---|---|
| STB141NF55 | B141NF55 | D²PAK | Tape & reel |
| STB141NF55-1 | B141NF55 | I²PAK | Tube |
| STP141NF55 | P141NF55 | TO-220 | Tube |

# Contents

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DS}$ | Drain-source voltage ($V_{GS}$ = 0) | 55 | V |
| $V_{GS}$ | Gate- source voltage | ±20 | V |
| $I_D$ (1) | Drain current (continuous) at $T_C$ = 25°C | 80 | A |
| $I_D$ (1) | Drain current (continuous) at $T_C$ = 100°C | 80 | 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 | 10 | V/ns |
| $E_{AS}$ (4) | Single pulse avalance energy | 1.3 | J |
| $T_{stg}$ | Storage temperature | –55 to 175 | °C |
| $T_j$ | Operating junction temperature | | |

1. Current limited by package
2. Pulse width limited by safe operating area
3. $I_{SD} \leq 80A$, di/dt ≤ 300A/µs, $V_{DD}$=80%$V_{(BR)DSS}$
4. Starting Tj = 25°C, $I_D$ = 40A, $V_{DD}$ = 30V

**Table 2. Thermal data**

| Symbol | Parameter | Value | | Unit |
|---|---|---|---|---|
| | | TO-220 - I²PAK | D²PAK | |
| Rthj-case | Thermal resistance junction-case max | 0.5 | | °C/W |
| Rthj-amb | Thermal resistance junction-ambient max | 62.5 | -- | °C/W |
| Rthj-pcb (1) | Thermal resistance junction-pcb max | -- | 35 | °C/W |
| $T_l$ | Maximum lead temperature for soldering purpose (for 10 sec, 1.6mm from case) | 300 | | °C |

1. When mounted on 1 inch², FR4 board, 2 oz Cu

# 2 Electrical characteristics

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

**Table 3. On/off states**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $I_D$ = 250 µA, $V_{GS}$ = 0 | 55 | | | V |
| $I_{DSS}$ | Zero gate voltage drain current ($V_{GS}$ = 0) | $V_{DS}$ = 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) | $V_{GS}$ = ±20V | | | ±100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS}$ = $V_{GS}$, $I_D$ = 250µA | 2 | 3 | 4 | V |
| $R_{DS(on)}$ | Static drain-source on resistance | $V_{GS}$ = 10 V, $I_D$ = 40 A | | 0.0065 | 0.008 | Ω |

**Table 4. Dynamic**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $g_{fs}$ (1) | Forward transconductance | $V_{DS}$ = 15V, $I_D$= 40 A | | 100 | | S |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$ | Input capacitance<br>Output capacitance<br>Reverse transfer capacitance | $V_{DS}$ = 25V, f = 1 MHz<br>$V_{GS}$ = 0 | | 5300<br>1000<br>290 | | pF<br>pF<br>pF |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total gate charge<br>Gate-source charge<br>Gate-drain charge | $V_{DD}$ = 44V, $I_D$= 80A<br>$V_{GS}$ =10V<br>*(see Figure 14)* | | 142<br>27<br>55 | | nC<br>nC<br>nC |

1. Pulsed: pulse duration = 300µs, duty cycle 1.5%

**Table 5. Switching times**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$<br>$t_r$ | Turn-on delay time<br>Rise time | $V_{DD}$ = 27.5 V, $I_D$ = 40A<br>$R_G$ = 4.7Ω , $V_{GS}$ = 10V<br>*(see Figure 13)* | | 30<br>150 | | ns<br>ns |
| $t_{d(off)}$<br>$t_f$ | Turn-off-delay time<br>Fall time | $V_{DD}$ = 27.5V, $I_D$ = 40A,<br>$R_G$ = 4.7Ω, $V_{GS}$ = 10V<br>*(see Figure 13)* | | 125<br>45 | | ns<br>ns |

**Table 6. Source drain diode**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$<br>$I_{SDM}$ (1) | Source-drain current<br>Source-drain current (pulsed) | | | | 80<br>320 | A<br>A |
| $V_{SD}$ (2) | Forward on voltage | $I_{SD}$ = 80A, $V_{GS}$ = 0 | | | 1.5 | V |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse recovery time<br>Reverse recovery charge<br>Reverse recovery current | $I_{SD}$ = 80A, di/dt = 100 A/µs,<br>$V_{DD}$ = 20V, $T_j$ = 150°C<br>*(see Figure 15)* | | 90<br>275<br>6.5 | | ns<br>nC<br>A |

1. Pulse width limited safe operating area
2. Pulsed: pulse duration = 300µs, duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

**Figure 1. Safe operating area**

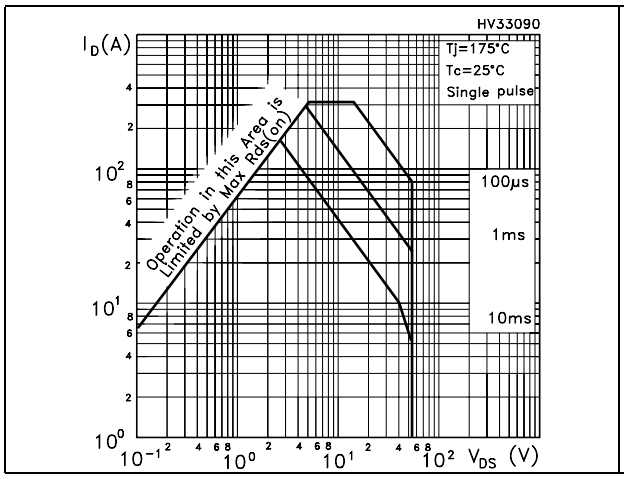



**Figure 2. Thermal impedance**

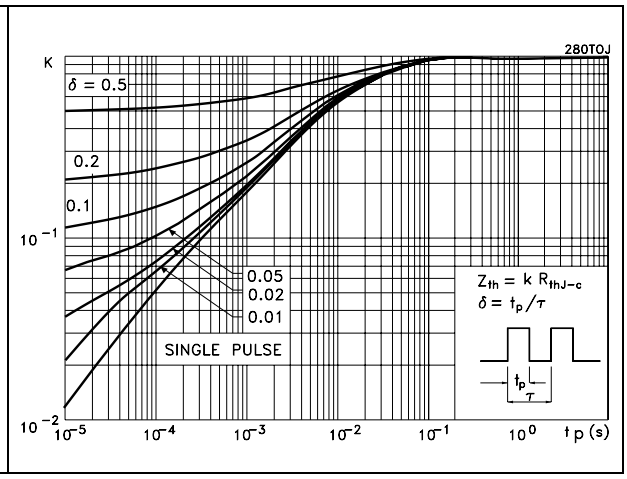



**Figure 3. Output characteristics**

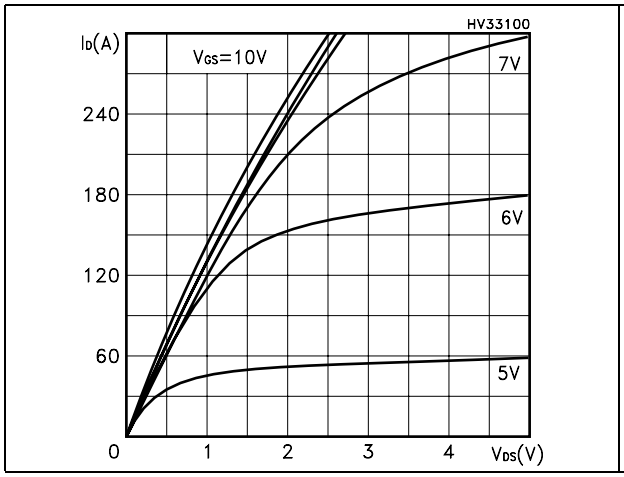



**Figure 4. Transfer characteristics**

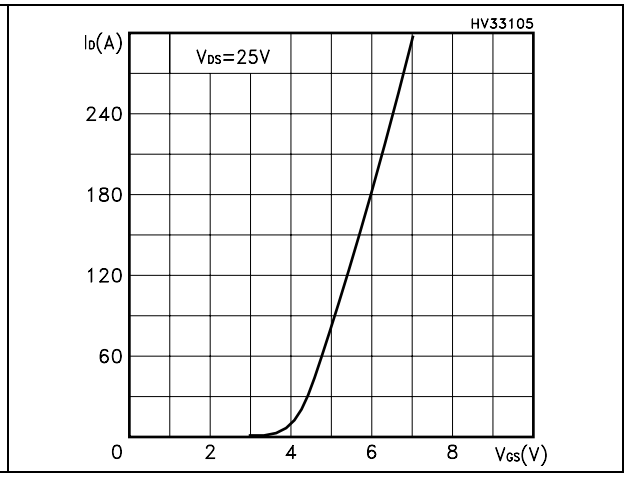



**Figure 5. Transconductance**

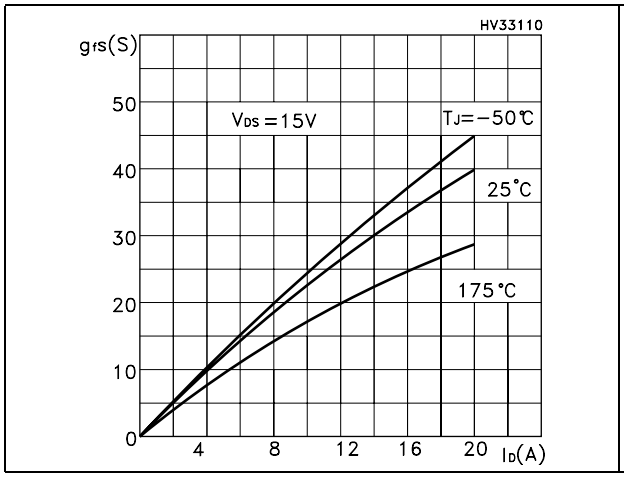



**Figure 6. Static drain-source on resistance**

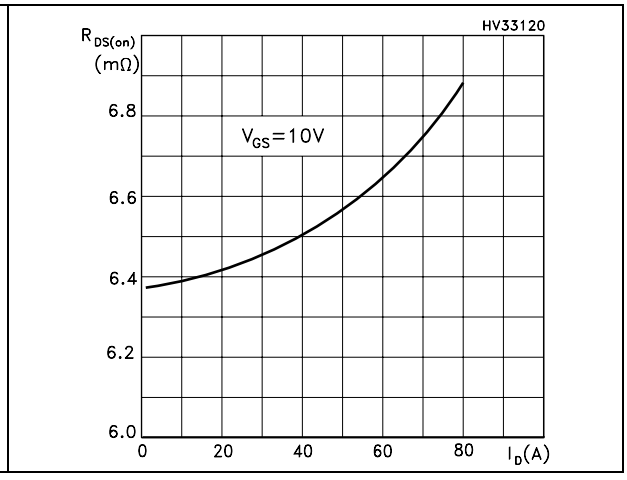


**Figure 7. Gate charge vs gate-source voltage**

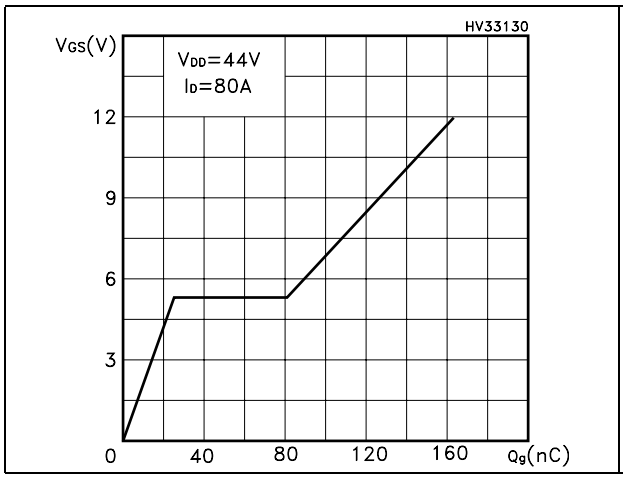



**Figure 8. Capacitance variations**

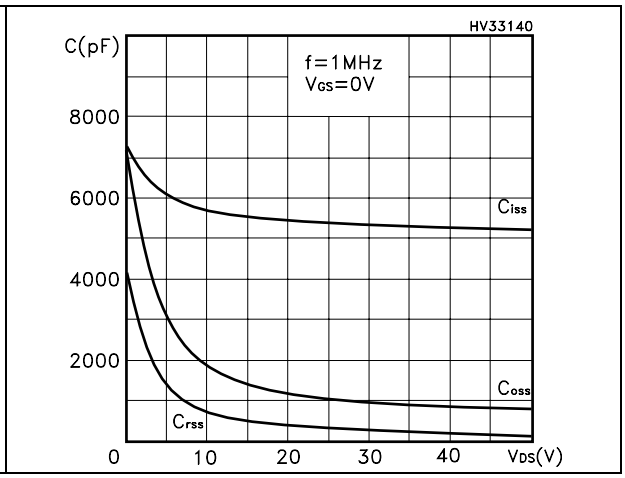



**Figure 9. Normalized gate threshold voltage vs temperature**

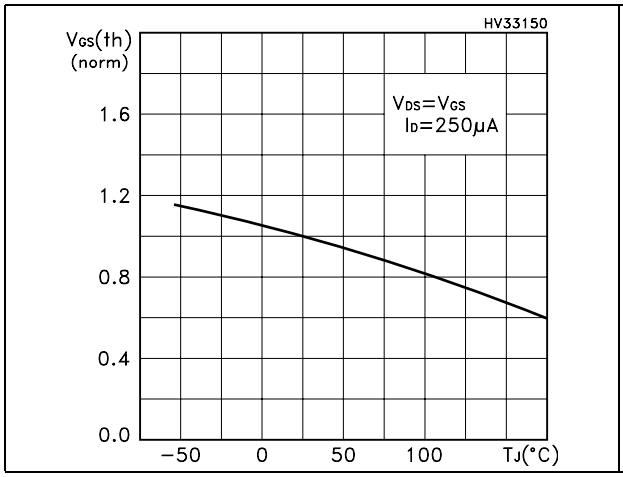



**Figure 10. Normalized on resistance vs temperature**

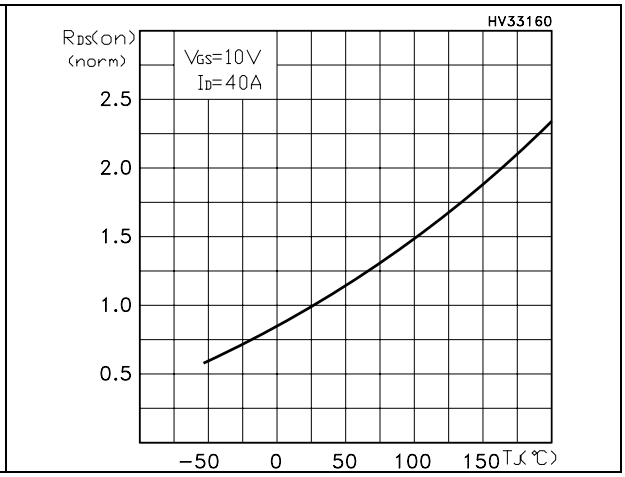



**Figure 11. Source-drain diode forward characteristics**

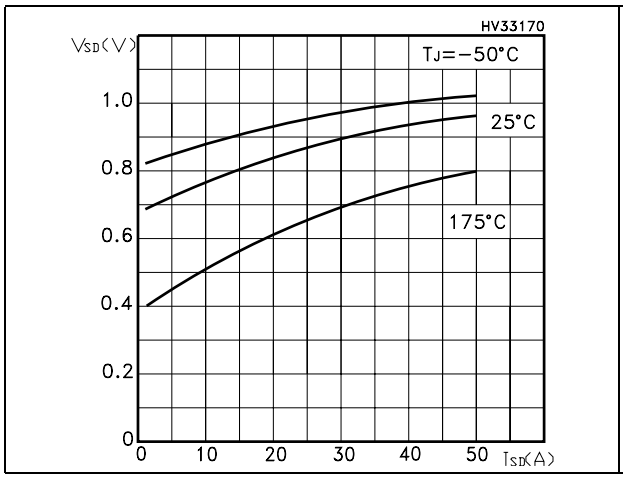
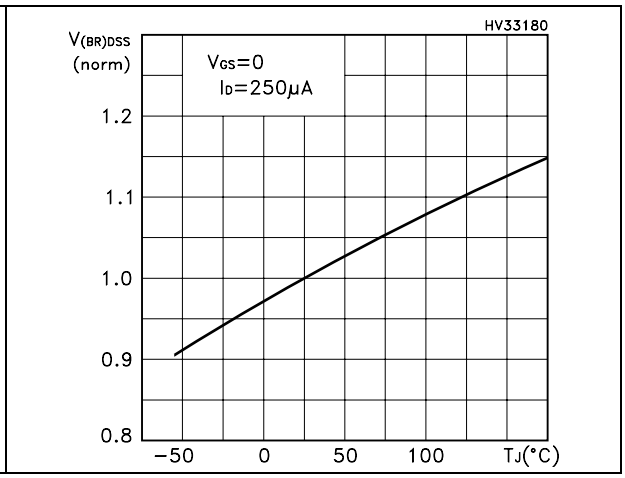



**Figure 12. Normalized $B_{VDSS}$ vs temperature**



# 3 Test circuit

**Figure 13. Switching times test circuit for resistive load**

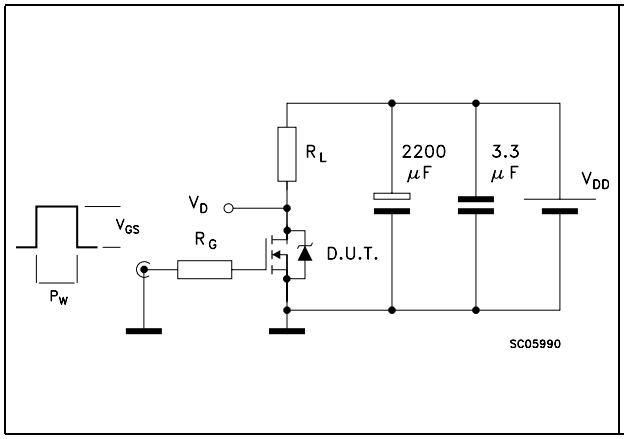



**Figure 14. Gate charge test circuit**

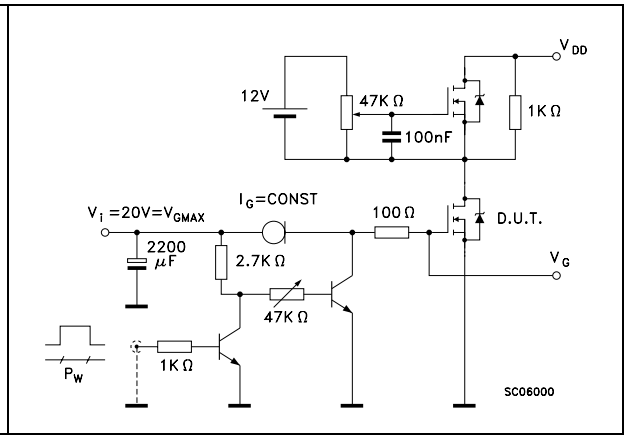



**Figure 15. Test circuit for inductive load switching and diode recovery times**

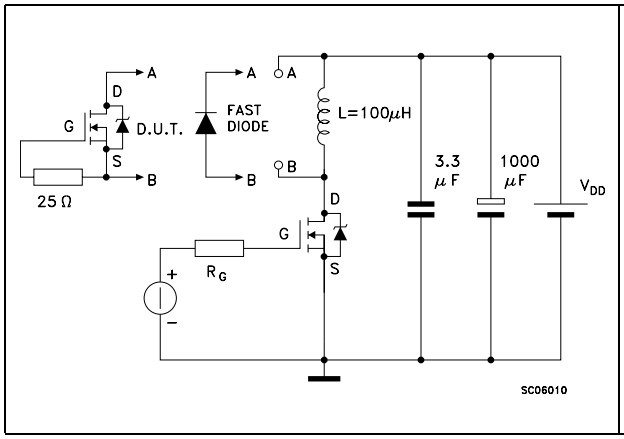



**Figure 16. Unclamped inductive load test circuit**

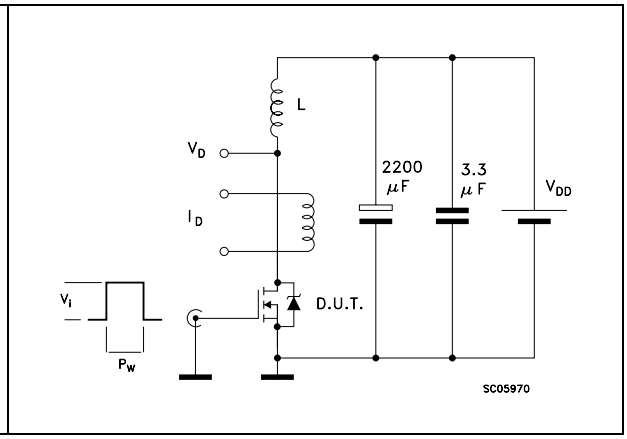



**Figure 17. Unclamped inductive waveform**

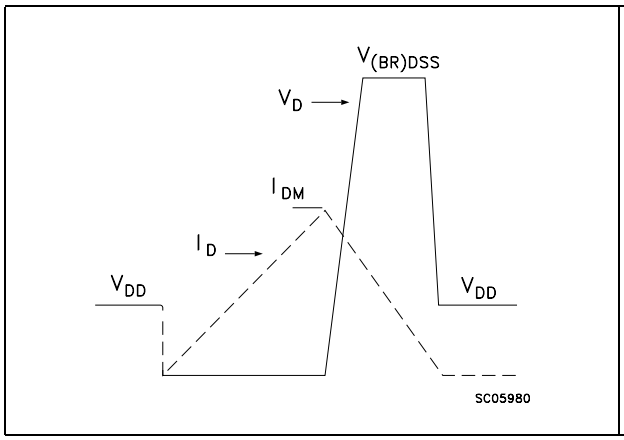
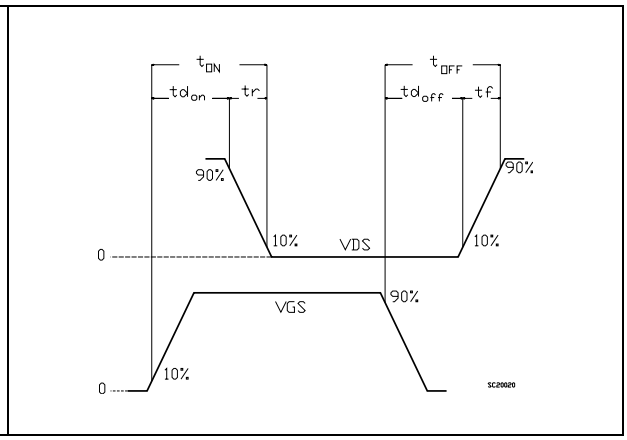



**Figure 18. Switching time waveform**

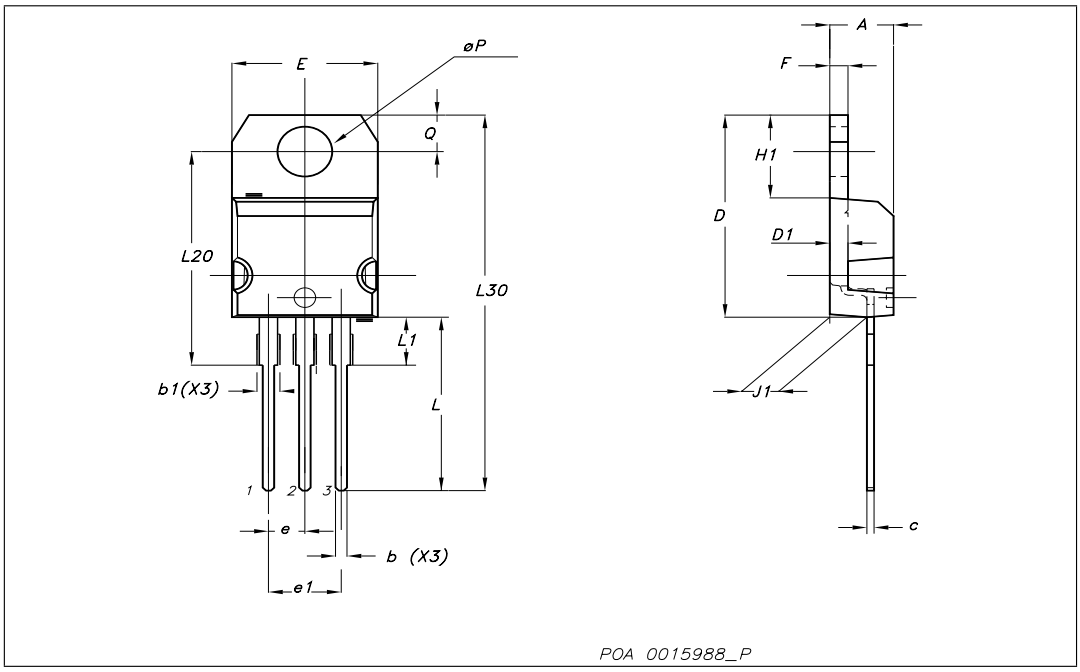


# 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: *www.st.com*

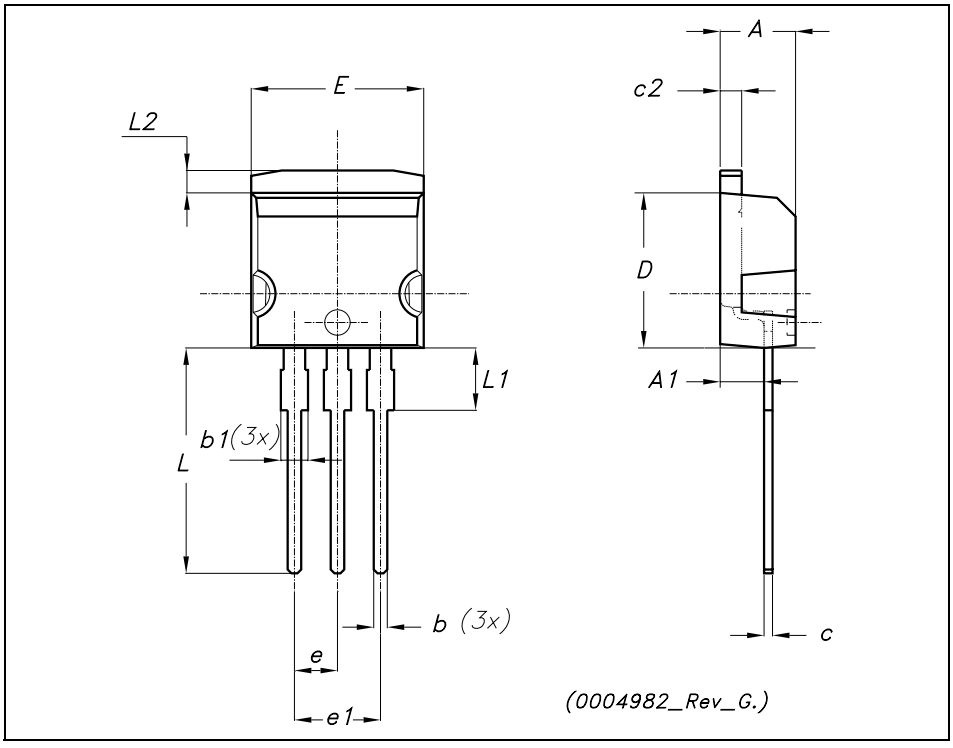
## TO-220 mechanical data

| Dim | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | Min | Typ | Max | Min | Typ | Max |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| b | 0.61 | | 0.88 | 0.024 | | 0.034 |
| b1 | 1.14 | | 1.70 | 0.044 | | 0.066 |
| c | 0.49 | | 0.70 | 0.019 | | 0.027 |
| D | 15.25 | | 15.75 | 0.6 | | 0.62 |
| D1 | | 1.27 | | | 0.050 | |
| E | 10 | | 10.40 | 0.393 | | 0.409 |
| e | 2.40 | | 2.70 | 0.094 | | 0.106 |
| e1 | 4.95 | | 5.15 | 0.194 | | 0.202 |
| F | 1.23 | | 1.32 | 0.048 | | 0.051 |
| H1 | 6.20 | | 6.60 | 0.244 | | 0.256 |
| J1 | 2.40 | | 2.72 | 0.094 | | 0.107 |
| L | 13 | | 14 | 0.511 | | 0.551 |
| L1 | 3.50 | | 3.93 | 0.137 | | 0.154 |
| L20 | | 16.40 | | | 0.645 | |
| L30 | | 28.90 | | | 1.137 | |
| θP | 3.75 | | 3.85 | 0.147 | | 0.151 |
| Q | 2.65 | | 2.95 | 0.104 | | 0.116 |



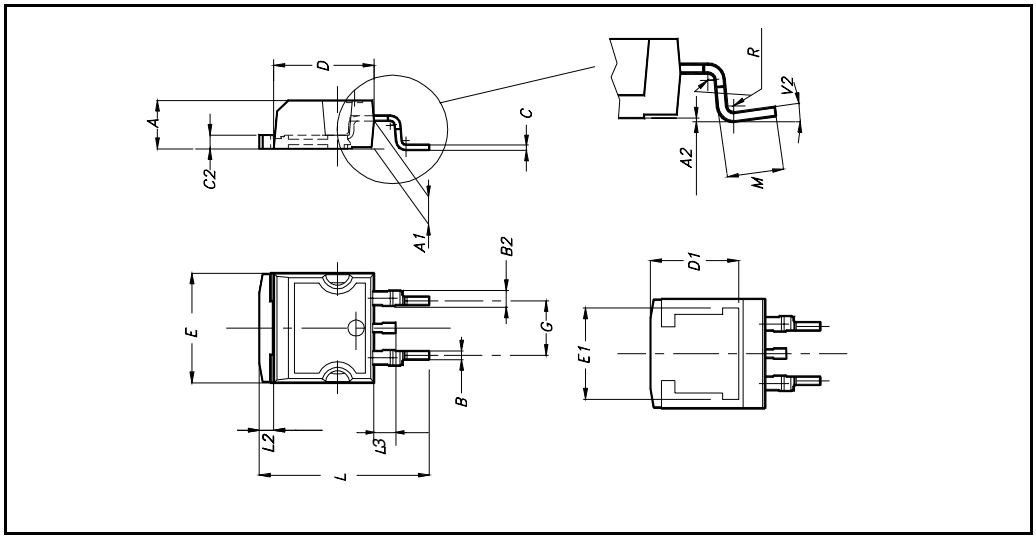
## TO-262 ($I^2$PAK) MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| A1 | 2.40 | | 2.72 | 0.094 | | 0.107 |
| b | 0.61 | | 0.88 | 0.024 | | 0.034 |
| b1 | 1.14 | | 1.70 | 0.044 | | 0.066 |
| c | 0.49 | | 0.70 | 0.019 | | 0.027 |
| c2 | 1.23 | | 1.32 | 0.048 | | 0.052 |
| D | 8.95 | | 9.35 | 0.352 | | 0.368 |
| e | 2.40 | | 2.70 | 0.094 | | 0.106 |
| e1 | 4.95 | | 5.15 | 0.194 | | 0.202 |
| E | 10 | | 10.40 | 0.393 | | 0.410 |
| L | 13 | | 14 | 0.511 | | 0.551 |
| L1 | 3.50 | | 3.93 | 0.137 | | 0.154 |
| L2 | 1.27 | | 1.40 | 0.050 | | 0.055 |



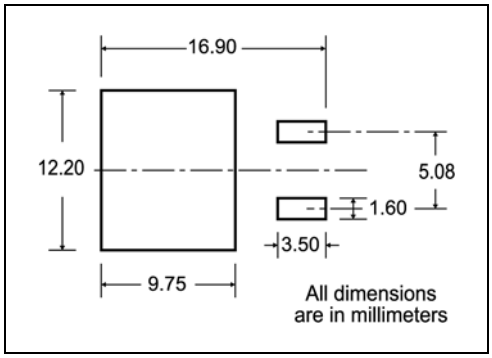
## $D^2PAK$ MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | 4.4 | | 4.6 | 0.173 | | 0.181 |
| A1 | 2.49 | | 2.69 | 0.098 | | 0.106 |
| A2 | 0.03 | | 0.23 | 0.001 | | 0.009 |
| B | 0.7 | | 0.93 | 0.027 | | 0.036 |
| B2 | 1.14 | | 1.7 | 0.044 | | 0.067 |
| C | 0.45 | | 0.6 | 0.017 | | 0.023 |
| C2 | 1.23 | | 1.36 | 0.048 | | 0.053 |
| D | 8.95 | | 9.35 | 0.352 | | 0.368 |
| D1 | | 8 | | | 0.315 | |
| E | 10 | | 10.4 | 0.393 | | |
| E1 | | 8.5 | | | 0.334 | |
| G | 4.88 | | 5.28 | 0.192 | | 0.208 |
| L | 15 | | 15.85 | 0.590 | | 0.625 |
| L2 | 1.27 | | 1.4 | 0.050 | | 0.055 |
| L3 | 1.4 | | 1.75 | 0.055 | | 0.068 |
| M | 2.4 | | 3.2 | 0.094 | | 0.126 |
| R | | 0.4 | | | 0.015 | |
| V2 | 0º | | 4º | | | |

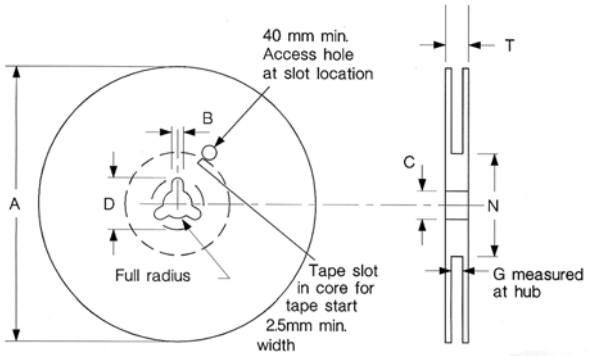


# 5 Packaging mechanical data

### D²PAK FOOTPRINT




### TAPE AND REEL SHIPMENT



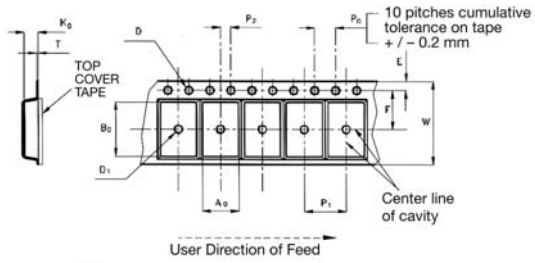

REEL MECHANICAL DATA

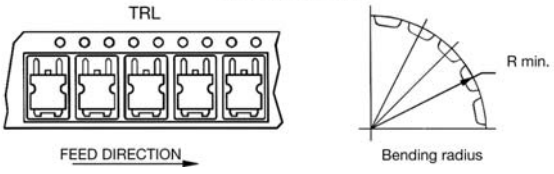
| DIM. | mm | | inch | |
|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. |
| A | | 330 | | 12.992 |
| B | 1.5 | | 0.059 | |
| C | 12.8 | 13.2 | 0.504 | 0.520 |
| D | 20.2 | | 0795 | |
| G | 24.4 | 26.4 | 0.960 | 1.039 |
| N | 100 | | 3.937 | |
| T | | 30.4 | | 1.197 |

| 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 7. Document revision history

| Date | Revision | Changes |
|---|---|---|
| 01-Aug-2007 | 1 | Initial release. |