



STB140NF55 - STB140NF55-1 STP140NF55

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

General features

| Type | V _{DSS} | R _{DS(on)} | I _D ⁽¹⁾ |
|--------------|------------------|---------------------|-------------------------------|
| STB140NF55 | 55V | <0.008Ω | 80A |
| STB140NF55-1 | 55V | <0.008Ω | 80A |
| STP140NF55 | 55V | <0.008Ω | 80A |

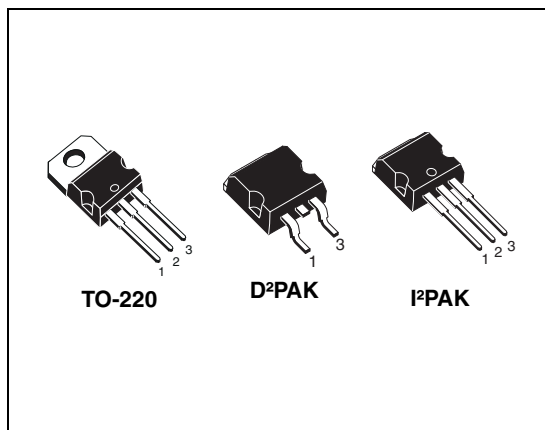
1. Current limited by package

Description

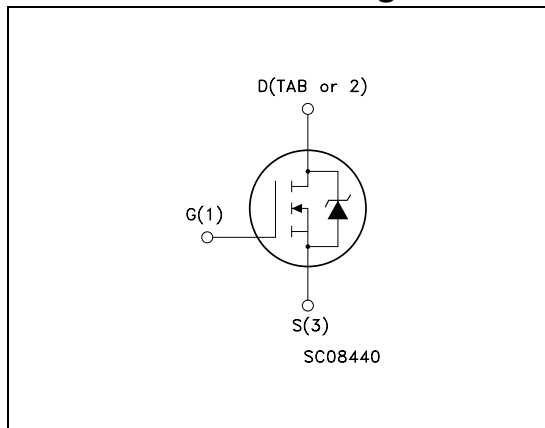
This Power MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

Applications

- Motor control
- High current, switching application



Internal schematic diagram



Order codes

| Part number | Marking | Package | Packaging |
|--------------|----------|--------------------|-------------|
| STB140NF55 | B140NF55 | D ² PAK | Tape & reel |
| STB140NF55-1 | B140NF55 | I ² PAK | Tube |
| STP140NF55 | P140NF55 | TO-220 | Tube |

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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 $T_C = 25^\circ\text{C}$ | 80 | A |
| $I_D^{(1)}$ | Drain current (continuous) at $T_C = 100^\circ\text{C}$ | 80 | A |
| $I_{DM}^{(2)}$ | Drain current (pulsed) | 320 | A |
| P_{TOT} | Total dissipation at $T_C = 25^\circ\text{C}$ | 300 | W |
| | Derating factor | 2 | W/ $^\circ\text{C}$ |
| $dv/dt^{(3)}$ | Peak diode recovery voltage slope | 10 | V/ns |
| $E_{AS}^{(4)}$ | Single pulse avalanche energy | 1.3 | J |
| T_{stg} | Storage temperature | -55 to 175 | $^\circ\text{C}$ |
| T_j | Operating junction temperature | | |

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

Table 2. Thermal data

| Symbol | Parameter | Value | | Unit |
|---------------------|--|-----------------------------|--------------------|---------------------------|
| | | TO-220 - I ² PAK | D ² PAK | |
| $R_{thj-case}$ | Thermal resistance junction-case max | 0.5 | | $^\circ\text{C}/\text{W}$ |
| $R_{thj-amb}$ | Thermal resistance junction-ambient max | 62.5 | -- | $^\circ\text{C}/\text{W}$ |
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb max | -- | 35 | $^\circ\text{C}/\text{W}$ |
| T_I | Maximum lead temperature for soldering purpose (for 10 sec, 1.6mm from case) | 300 | | $^\circ\text{C}$ |

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

2 Electrical characteristics

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

Table 3. On/off states

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|--|--|------|--------|-----------|--------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $I_D = 250 \mu A, V_{GS} = 0$ | 55 | | | V |
| I_{DSS} | Zero gate voltage drain current ($V_{GS} = 0$) | $V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating}, T_C = 125^{\circ}C$ | | | 1 10 | μA μA |
| I_{GSS} | Gate-body leakage current ($V_{DS} = 0$) | $V_{GS} = \pm 20V$ | | | ± 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 | $V_{GS} = 10 V, I_D = 40 A$ | | 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} | Input capacitance | $V_{DS} = 25V, f = 1 \text{ MHz}$ $V_{GS} = 0$ | | 5300 | | pF |
| C_{oss} | Output capacitance | | | 1000 | | pF |
| C_{rss} | Reverse transfer capacitance | | | 290 | | pF |
| Q_g | Total gate charge | $V_{DD} = 44V, I_D = 80A$ | | 142 | | nC |
| Q_{gs} | Gate-source charge | $V_{GS} = 10V$ | | 27 | | nC |
| Q_{gd} | Gate-drain charge | (see Figure 14) | | 55 | | nC |

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

Table 5. Switching times

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

Table 6. Source drain diode

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

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

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

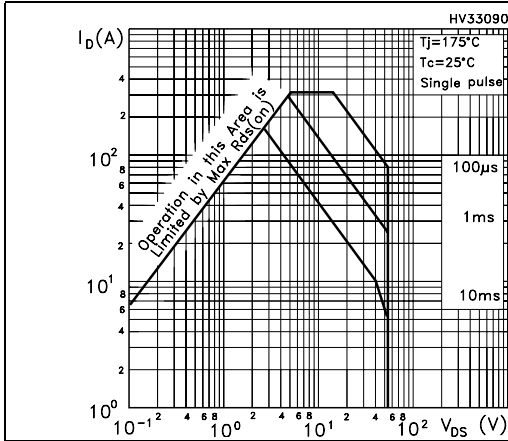


Figure 2. Thermal impedance

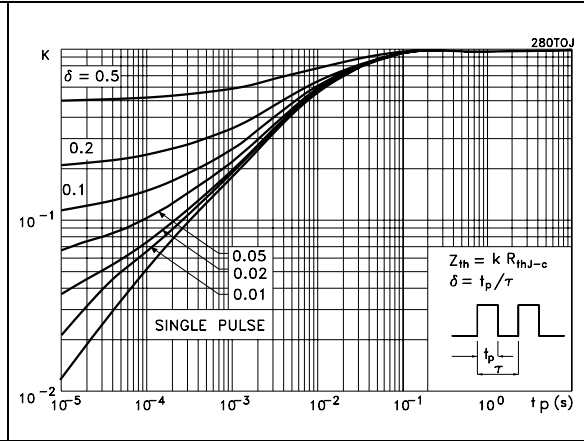


Figure 3. Output characteristics

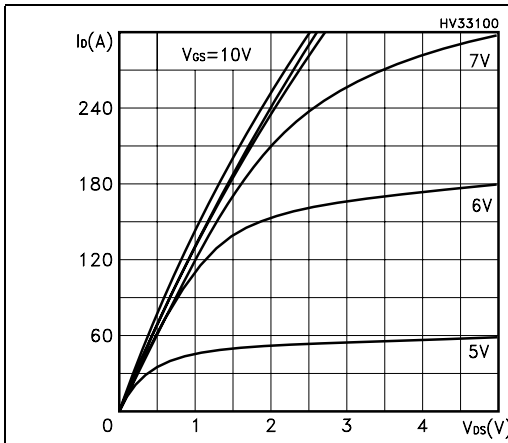


Figure 4. Transfer characteristics

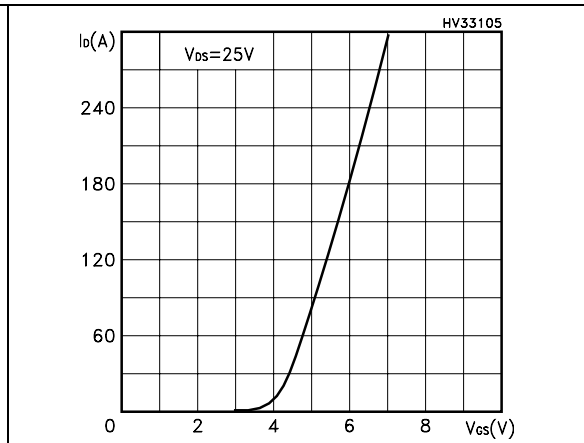


Figure 5. Transconductance

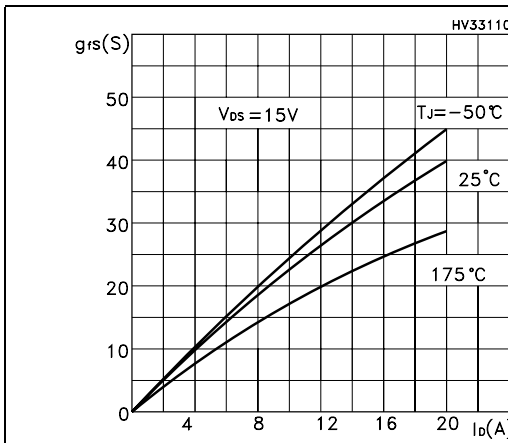


Figure 6. Static drain-source on resistance

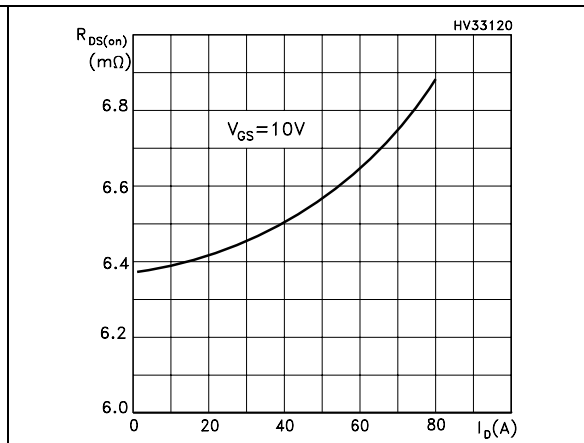


Figure 7. Gate charge vs gate-source voltage Figure 8. Capacitance variations

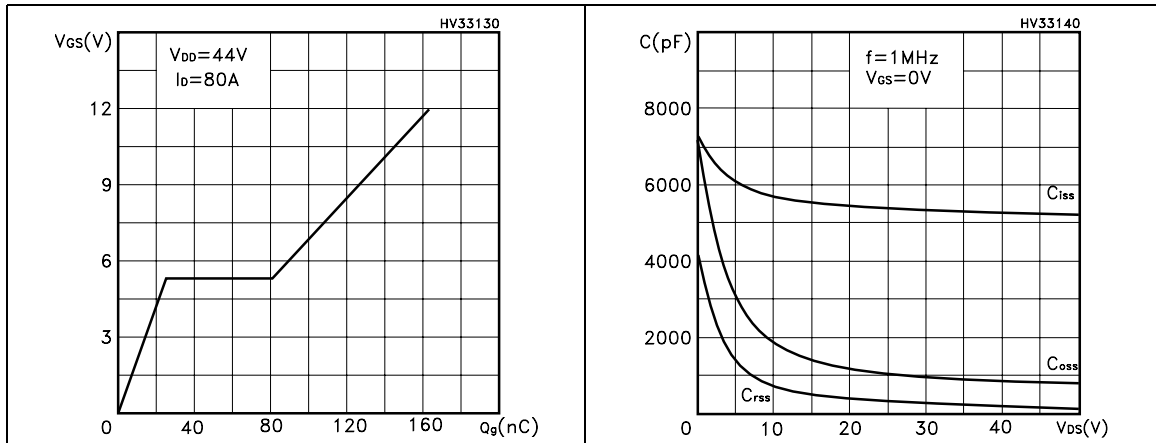


Figure 9. Normalized gate threshold voltage vs temperature Figure 10. Normalized on resistance vs temperature

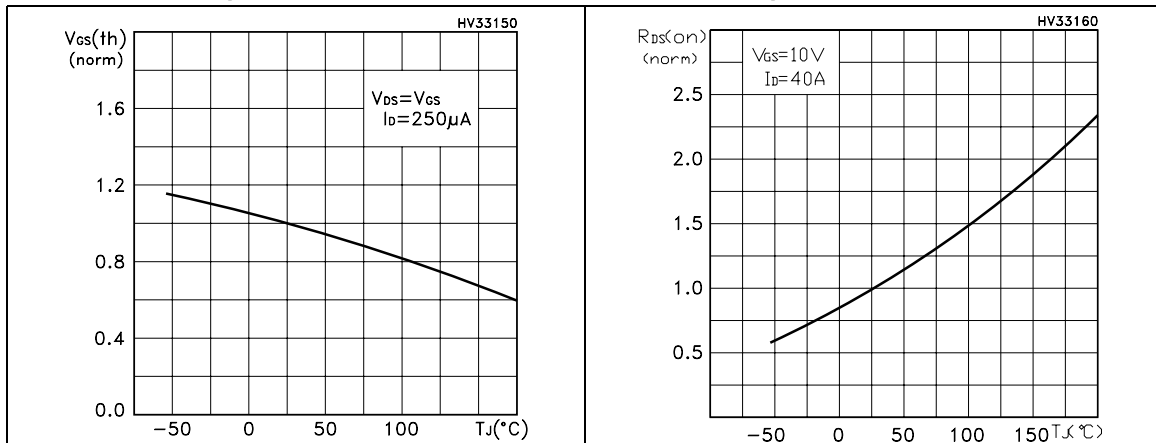
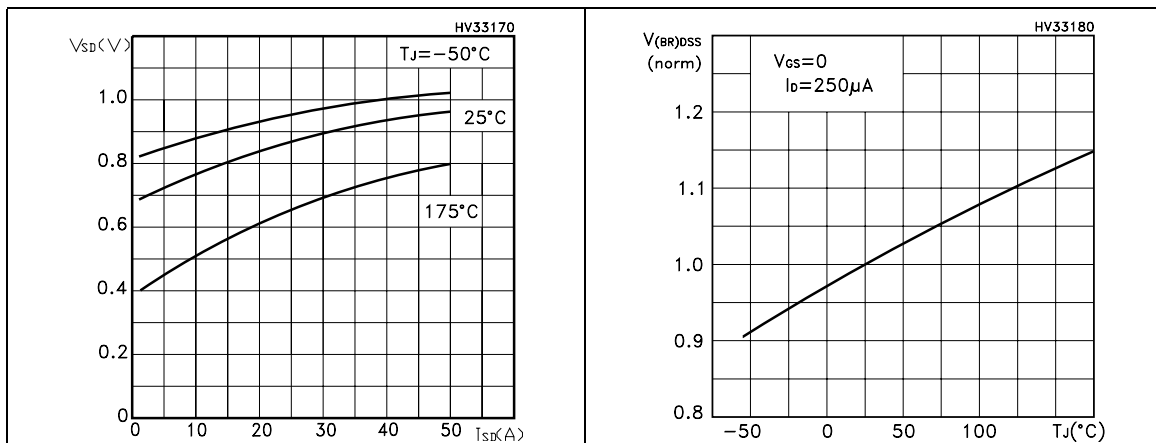


Figure 11. Source-drain diode forward characteristics Figure 12. Normalized $B_{V_{DS}}$ vs temperature



3 Test circuit

Figure 13. Switching times test circuit for resistive load

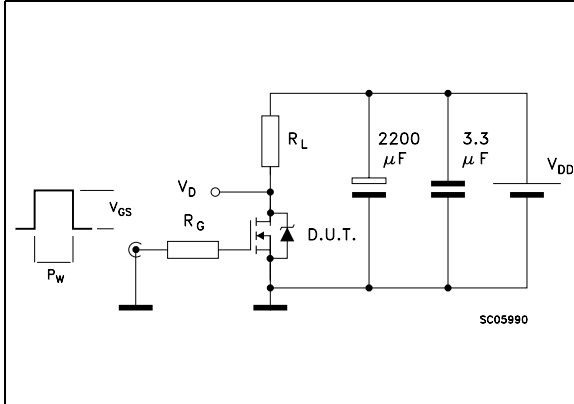


Figure 14. Gate charge test circuit

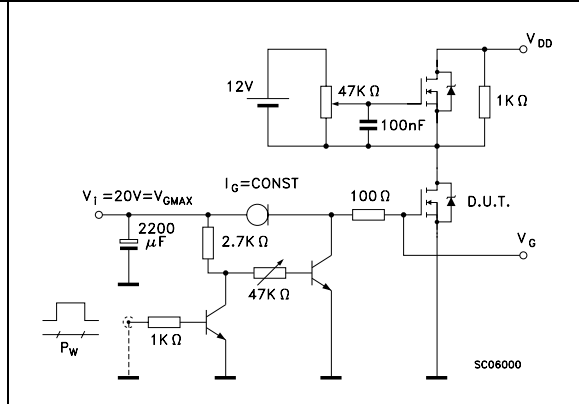


Figure 15. Test circuit for inductive load switching and diode recovery times

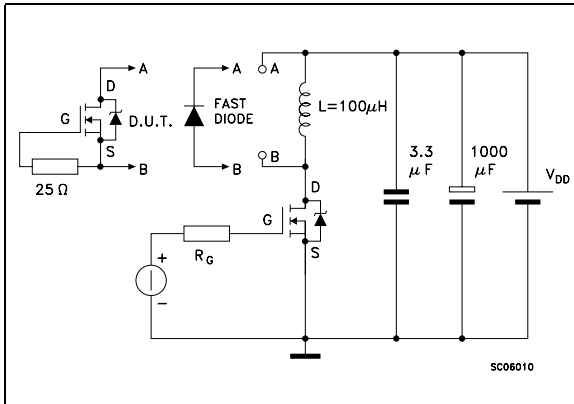


Figure 16. Unclamped inductive load test circuit

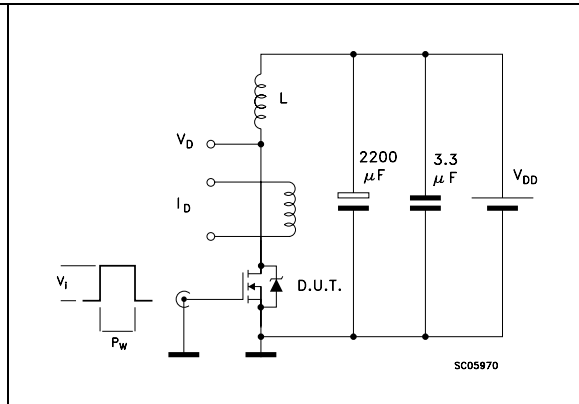


Figure 17. Unclamped inductive waveform

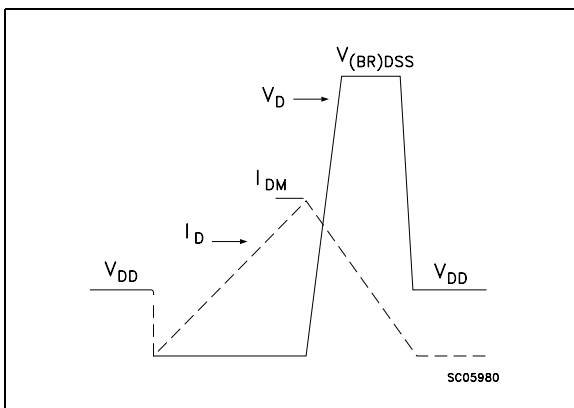
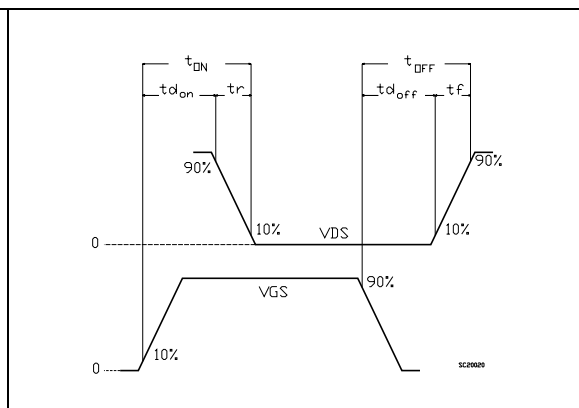


Figure 18. Switching time waveform

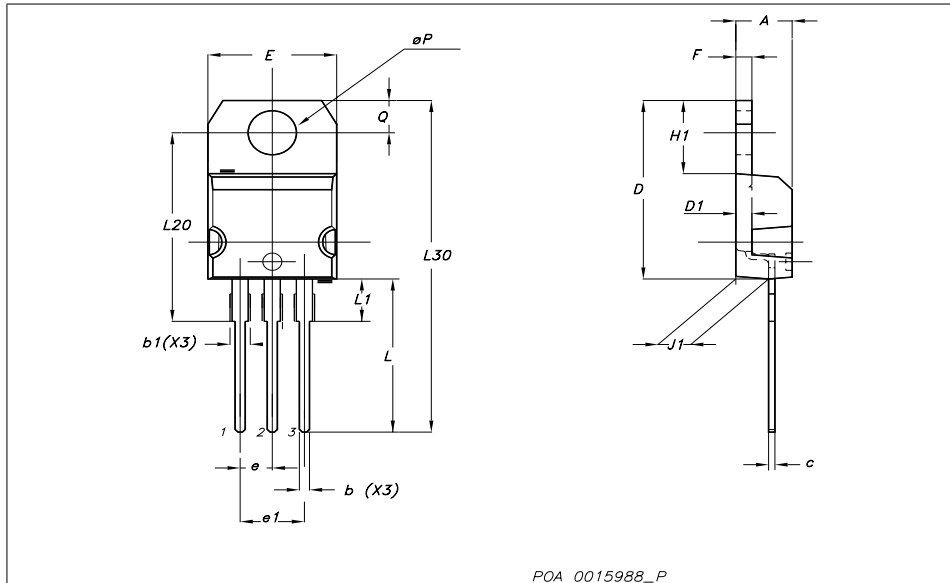


4 Package mechanical data

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

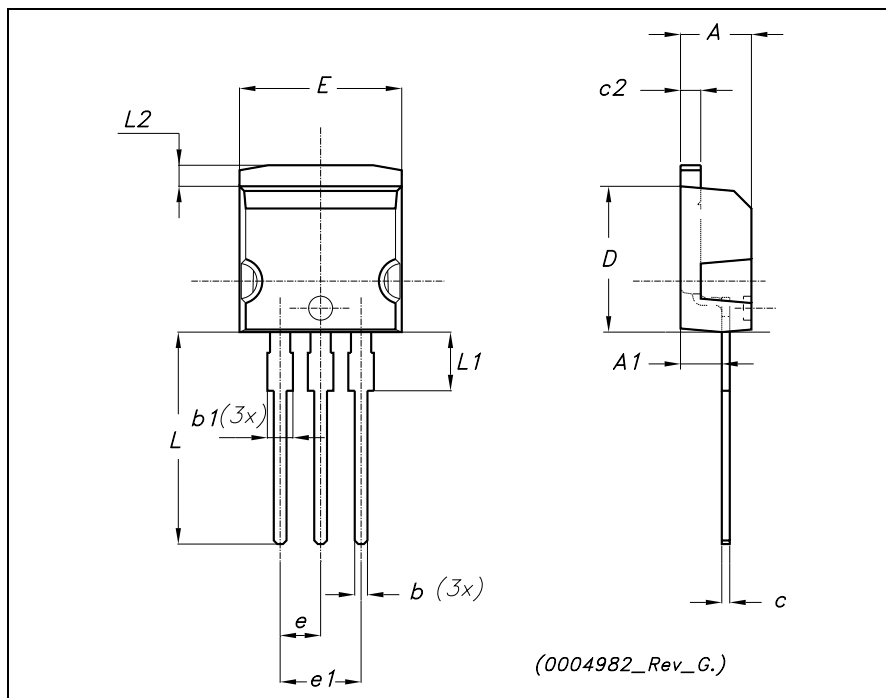
TO-220 mechanical data

| 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 | |
| øP | 3.75 | | 3.85 | 0.147 | | 0.151 |
| Q | 2.65 | | 2.95 | 0.104 | | 0.116 |



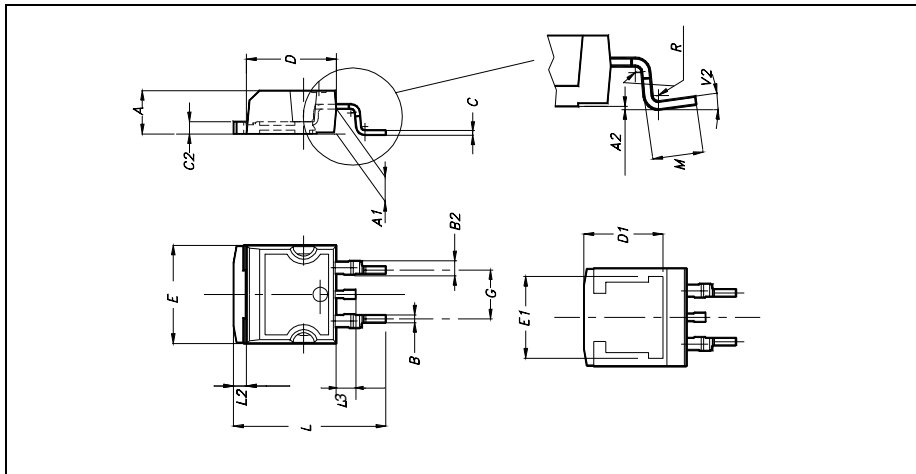
TO-262 (I²PAK) MECHANICAL DATA

| 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 |



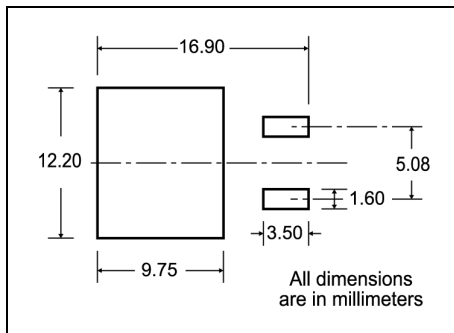
D²PAK MECHANICAL DATA

| 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 | 0° | | 4° | | | |



5 Packaging mechanical data

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT

40 mm min. Access hole at slot location

Full radius

Tape slot in core for tape start 2.5mm min. width

G measured at hub

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 | | 0.795 | |
| 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 |

TOP COVER TAPE

Center line of cavity

User Direction of Feed

FEED DIRECTION

Bending radius R min.

* on sales type

6 Revision history

Table 7. Revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 07-Dec-2004 | 1 | Initial release. |
| 07-Apr-2006 | 2 | Updated Figure 8 |
| 04-Aug-2006 | 3 | New template, modified Figure 1 |
| 02-Mar-2007 | 4 | Applications have been updated |

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