



STB80NF55-06 - STB80NF55-06-1 STP80NF55-06 - STP80NF55-06FP

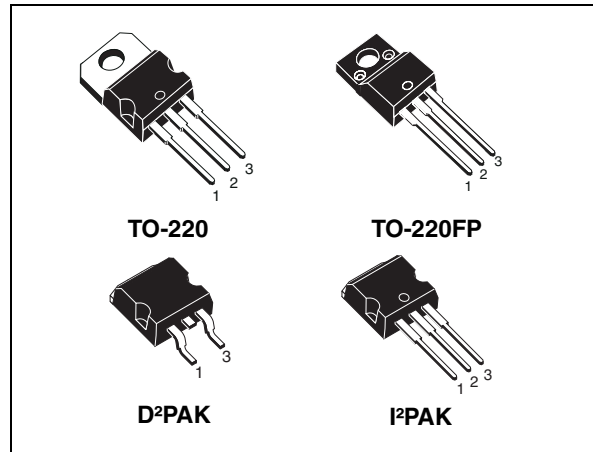
N-channel 55V - 0.005Ω - 80A - TO-220 /FP - I²PAK - D²PAK
STripFET™ II Power MOSFET

General features

| Type | V _{DSS} | R _{DS(on)} | I _D |
|----------------|------------------|---------------------|--------------------|
| STB80NF55-06 | 55V | <0.0065Ω | 80A ⁽¹⁾ |
| STB80NF55-06-1 | 55V | <0.0065Ω | 80A ⁽¹⁾ |
| STP80NF55-06 | 55V | <0.0065Ω | 80A ⁽¹⁾ |
| STP80NF55-06FP | 55V | <0.0065Ω | 60A ⁽¹⁾ |

1. Limited by package

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



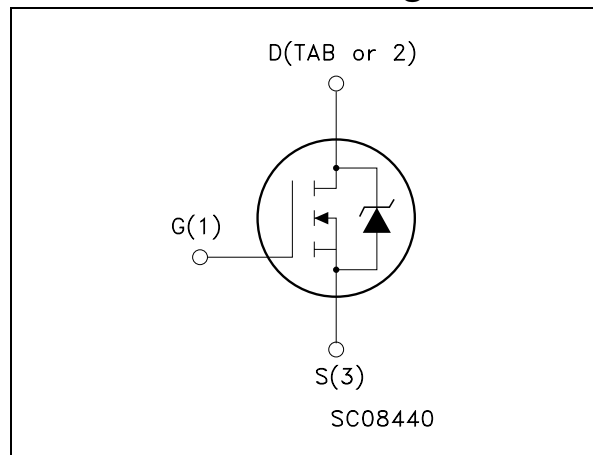
Description

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

- Switching application

Internal schematic diagram



Order codes

| Part number | Marking | Package | Packaging |
|----------------|--------------|--------------------|-------------|
| STB80NF55-06T4 | B80NF55-06 | D ² PAK | Tape & reel |
| STB80NF55-06-1 | B80NF55-06-1 | I ² PAK | Tube |
| STP80NF55-06 | P80NF55-06 | TO-220 | Tube |
| STP80NF55-06FP | P80NF55-06FP | TO-220FP | Tube |

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1 Electrical ratings

Table 1. Absolute maximum ratings

| Symbol | Parameter | Value | | Unit |
|------------------------------------|---|--|--------------------|------|
| | | TO-220 / D ² / I ² PAK | TO-220FP | |
| 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 | 60 ⁽²⁾ | A |
| I _D ⁽¹⁾ | Drain current (continuous) at T _C =100°C | 80 | 42 ⁽²⁾ | A |
| I _{DM} ⁽³⁾ | Drain current (pulsed) | 320 | 240 ⁽²⁾ | A |
| P _{TOT} | Total dissipation at T _C = 25°C | 300 | 45 | W |
| | Derating factor | 2 | 0.30 | W/°C |
| dv/dt ⁽⁴⁾ | Peak diode recovery voltage slope | 7 | | V/ns |
| E _{AS} ⁽⁵⁾ | Single pulse avalanche energy | 1.3 | | J |
| V _{ISO} | Insulation withstand voltage (DC) | -- | 2500 | V |
| T _J T _{stg} | Operating junction temperature Storage temperature | -55 to 175 | | °C |

- Limited by Package
- Limited only by maximum temperature allowed
- Pulse width limited by safe operating area
-) I_{SD} ≤ 80A, di/dt ≤ 400A/μs, V_{DD} ≤ V_{(BR)DSS}, T_J ≤ T_{JMAX}
- Starting T_J = 25 °C, I_D = 40A, V_{DD} = 45V

Table 2. Thermal data

| Symbol | Parameter | Value | | Unit |
|-------------------|--|--|----------|------|
| | | TO-220 / D ² / I ² PAK | TO-220FP | |
| R _{thJC} | Thermal resistance junction-case max | 0.5 | 3.33 | °C/W |
| R _{thJA} | Thermal resistance junction-ambient max | 62.5 | | °C/W |
| T _l | Maximum lead temperature for soldering purpose | 300 | | °C |

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 ($V_{GS} = 0$) | $V_{DS} = \text{Max rating},$ $V_{DS} = \text{Max rating} @ 125^{\circ}C$ | | | 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 | $V_{GS} = 10V, I_D = 40A$ | | 0.005 | 0.0065 | Ω |

Table 4. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-------------------------------------|---|---|------|---------------------|------|----------------|
| $g_{fs}^{(1)}$ | Forward transconductance | $V_{DS} = 15V, I_D = 40A$ | | 150 | | S |
| C_{iss} C_{oss} C_{rss} | Input capacitance Output capacitance Reverse transfer capacitance | $V_{DS} = 25V, f = 1 \text{ MHz}, V_{GS} = 0$ | | 4400 1020 350 | | pF pF pF |
| Q_g Q_{gs} Q_{gd} | Total gate charge Gate-source charge Gate-drain charge | $V_{DD} = 44V, I_D = 80A$ $V_{GS} = 10V$ | | 142 29 60.5 | 189 | nC nC nC |

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

Table 5. Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------------|---------------------|--|------|------|------|------|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD} = 50 \text{ V}, I_D = 40A,$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see Figure 15) | | 27 | | ns |
| t_r | Rise time | | | 155 | | ns |
| $t_{d(off)}$ | Turn-off delay time | | | 125 | | ns |
| t_f | Fall time | | | 65 | | 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 | $I_{SD}=80A, V_{GS}=0$ | | | 1.5 | V |
| t_{rr} | Reverse recovery time | $I_{SD}=80A,$ $di/dt = 100A/\mu s,$ $V_{DD}=35V, T_J = 150^\circ C$ | | 100 | | ns |
| Q_{rr} | Reverse recovery charge | | | 0.32 | | μC |
| I_{RRM} | Reverse recovery current | | | 6.5 | | 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 1. Safe operating area for TO-220/
D²PAK/ I²PAK

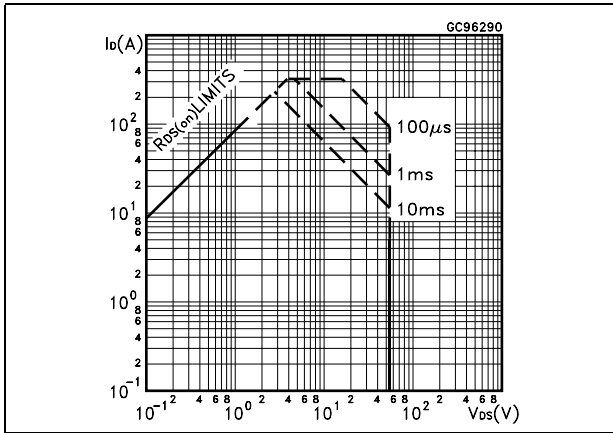


Figure 2. Thermal impedance for TO-220/
D²PAK/ I²PAK

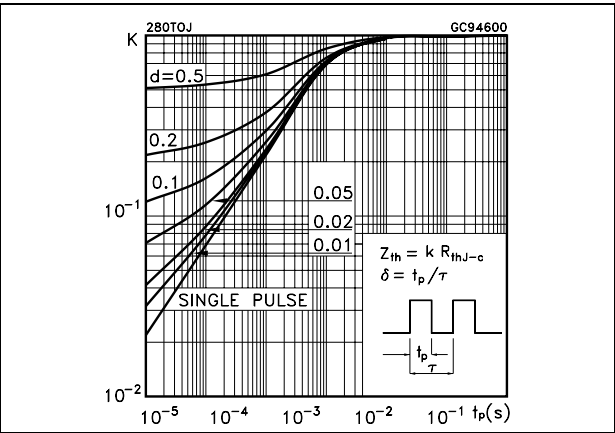


Figure 3. Safe operating area for TO-220FP

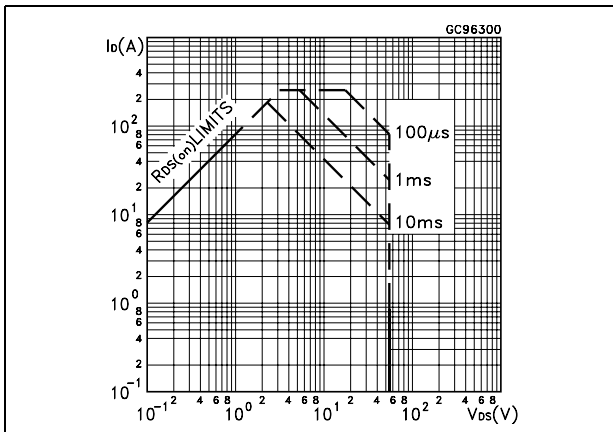


Figure 4. Thermal impedance for TO-220FP

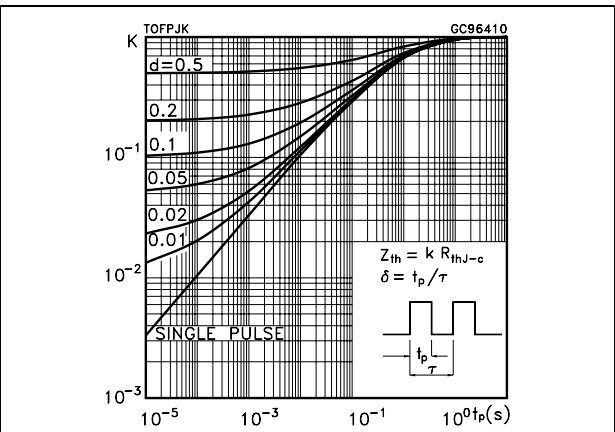


Figure 5. Output characteristics

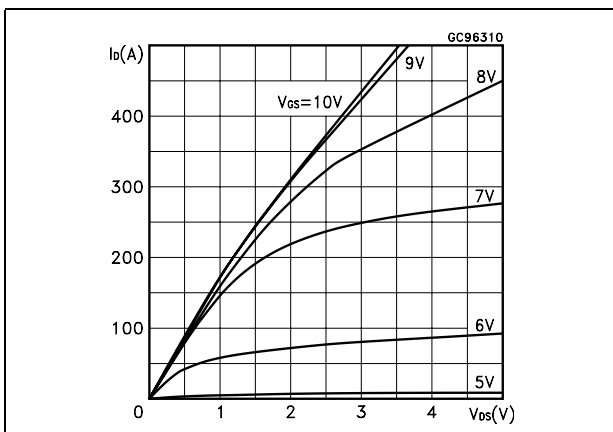


Figure 6. Transfer characteristics

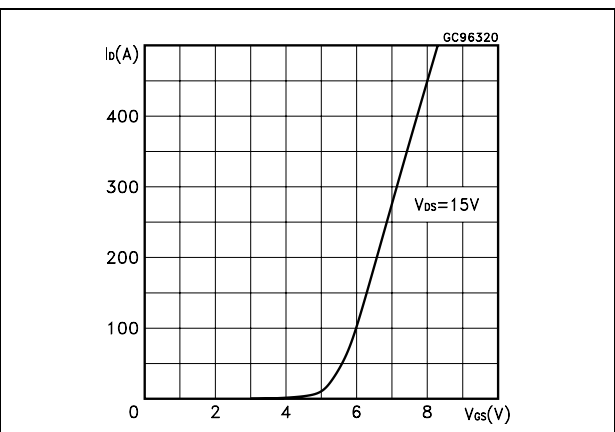


Figure 7. Transconductance

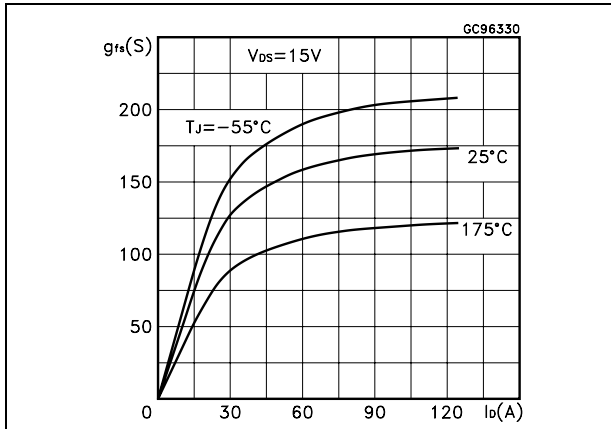


Figure 8. Static drain-source on resistance

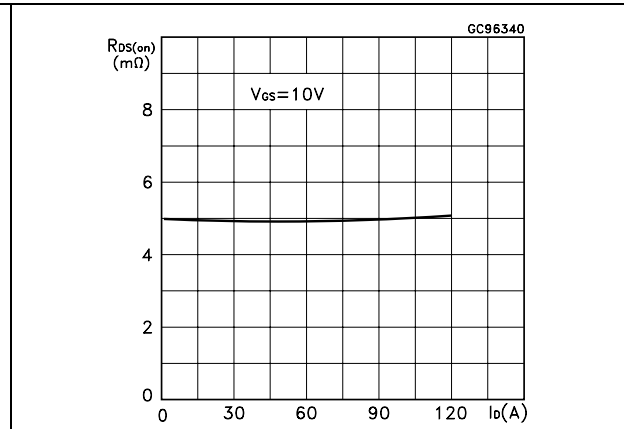


Figure 9. Gate charge vs gate-source voltage

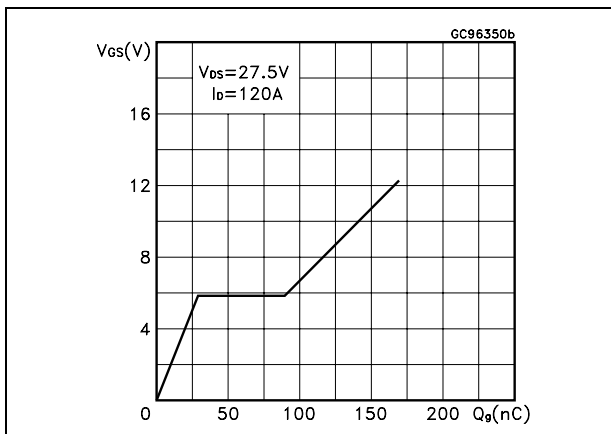


Figure 10. Capacitance variations

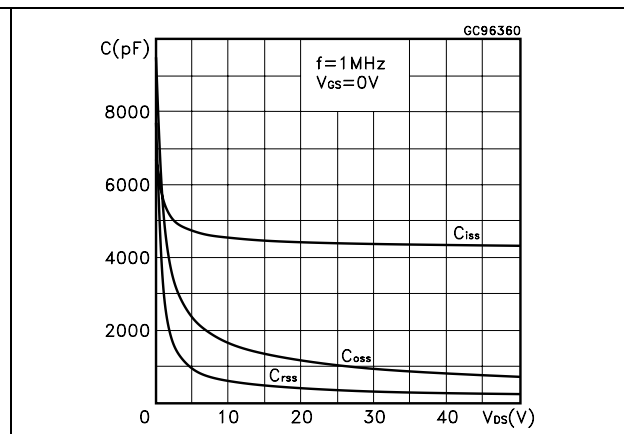


Figure 11. Normalized gate threshold voltage vs temperature

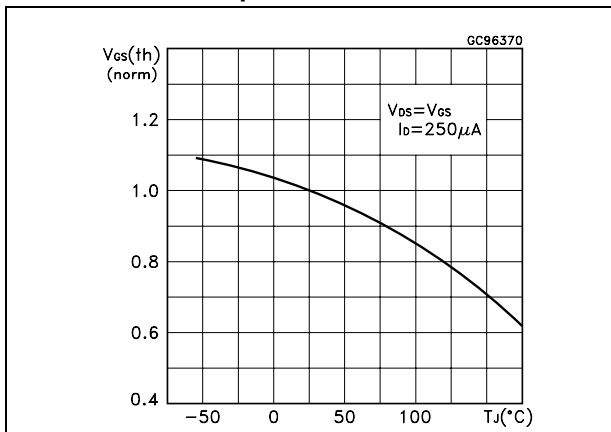


Figure 12. Normalized on resistance vs temperature

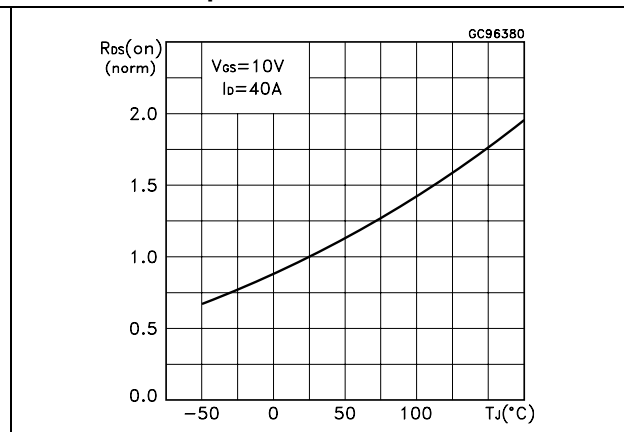


Figure 13. Source-drain diode forward characteristics

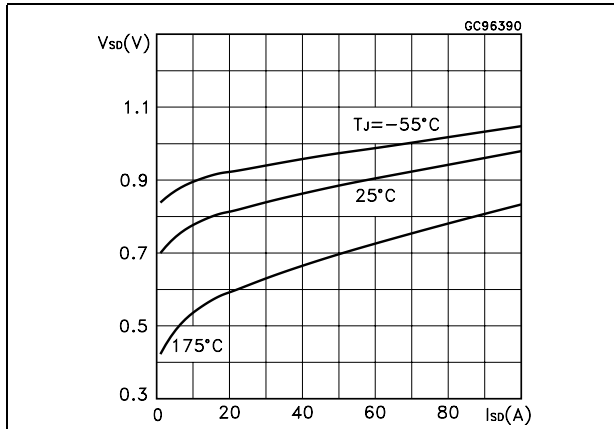
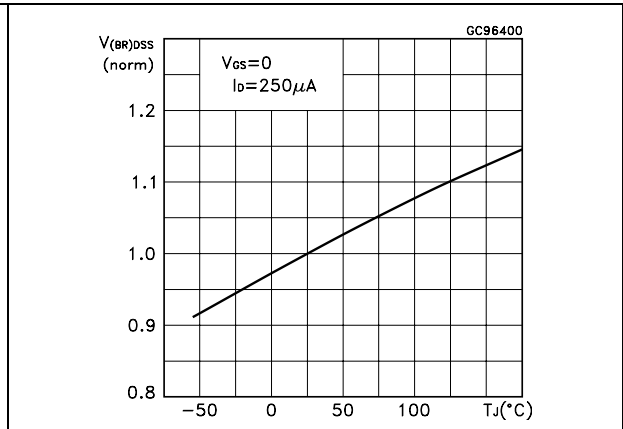


Figure 14. Normalized B_{VDSS} vs temperature



3 Test circuit

Figure 15. Switching times test circuit for resistive load



Figure 16. Gate charge test circuit



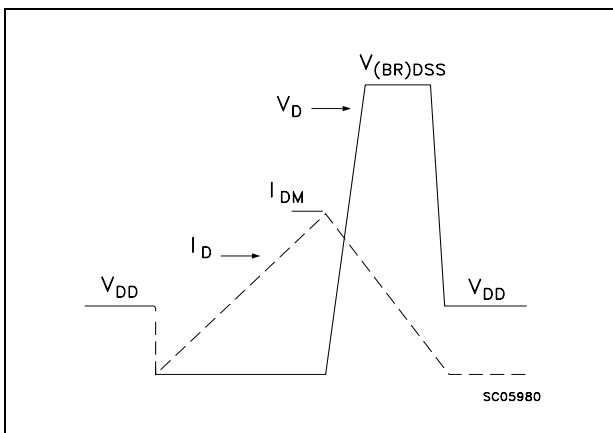
Figure 17. Test circuit for inductive load switching and diode recovery times



Figure 18. Unclamped Inductive load test circuit



Figure 19. Unclamped inductive waveform

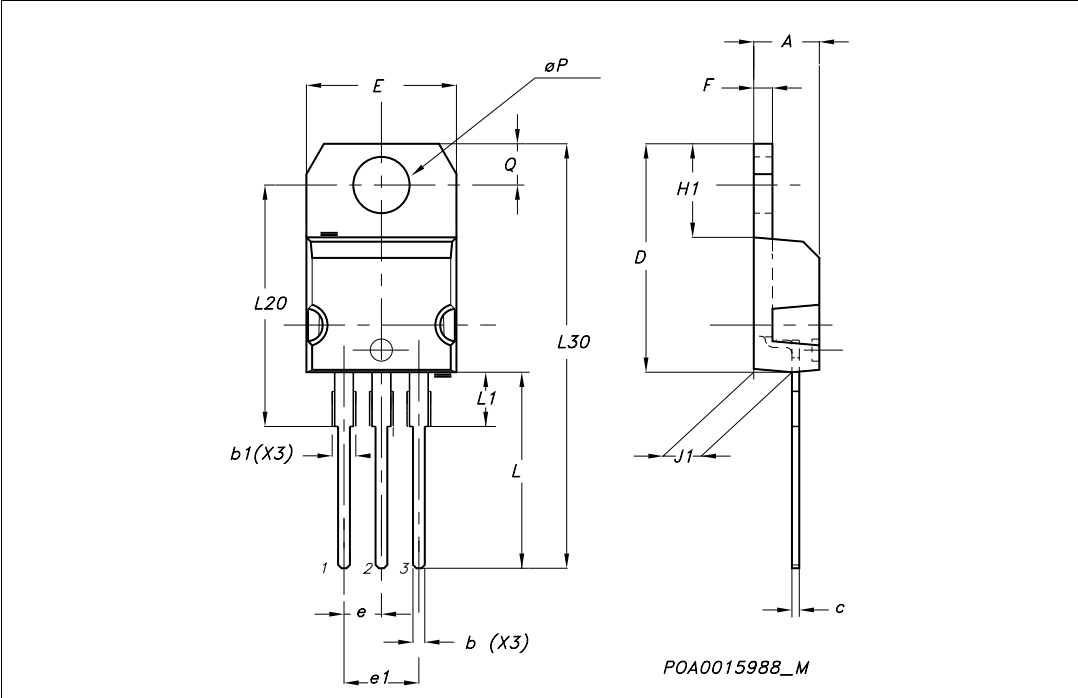


4 Package mechanical data

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

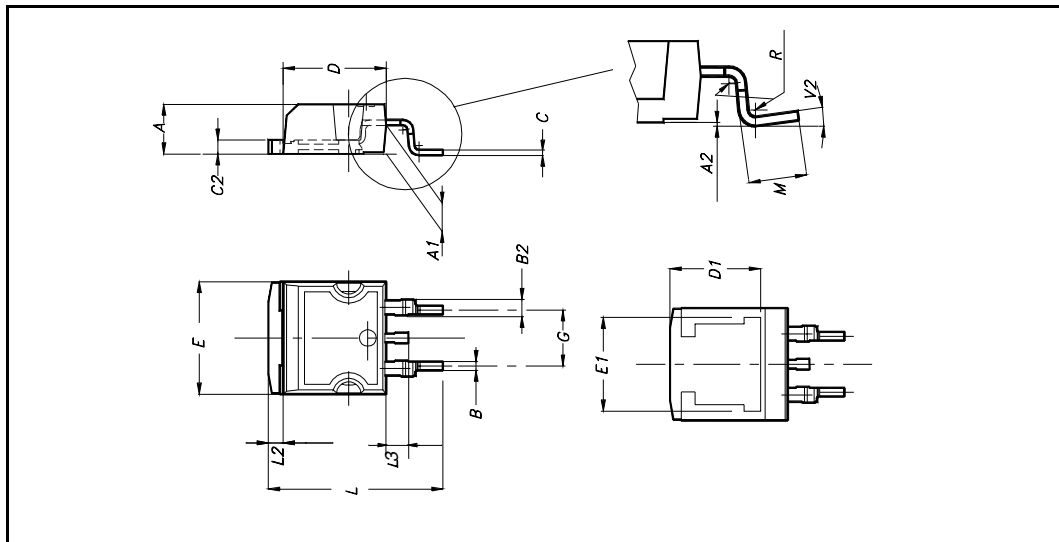
TO-220 MECHANICAL DATA

| 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 | 1.15 | | 1.70 | 0.045 | | 0.066 |
| c | 0.49 | | 0.70 | 0.019 | | 0.027 |
| D | 15.25 | | 15.75 | 0.60 | | 0.620 |
| 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 | | 0.052 |
| 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 |



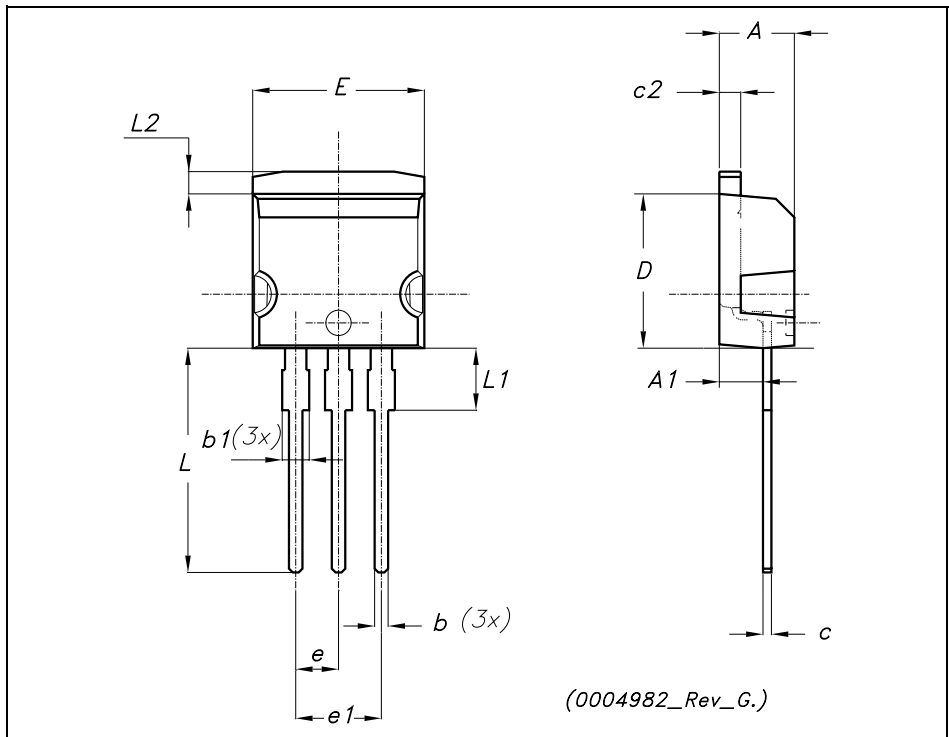
D²PAK MECHANICAL DATA

| 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° | | | |



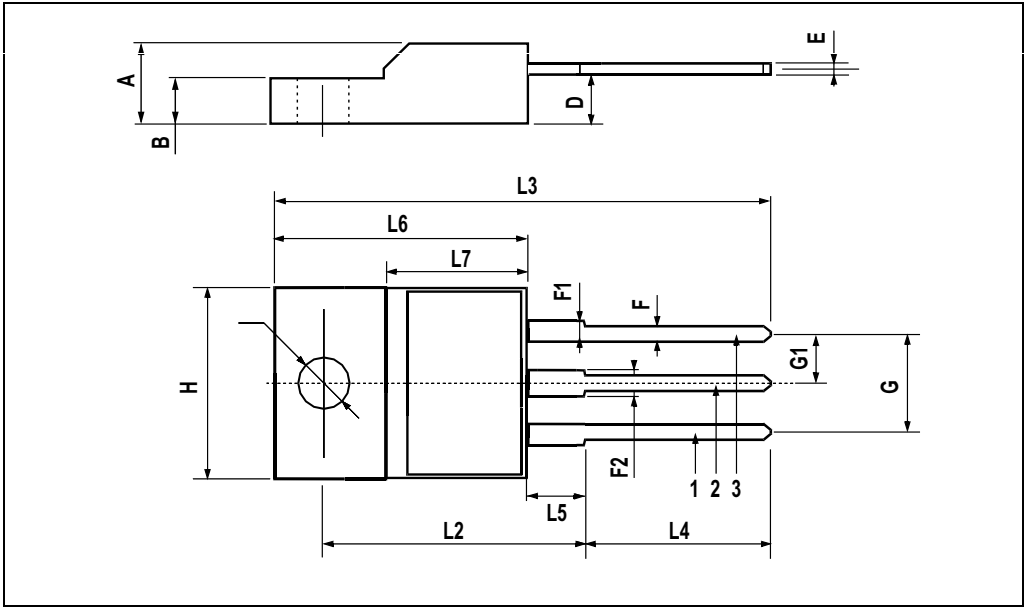
TO-262 (I²PAK) MECHANICAL DATA

| 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 |



TO-220FP MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|------|------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.4 | | 4.6 | 0.173 | | 0.181 |
| B | 2.5 | | 2.7 | 0.098 | | 0.106 |
| D | 2.5 | | 2.75 | 0.098 | | 0.108 |
| E | 0.45 | | 0.7 | 0.017 | | 0.027 |
| F | 0.75 | | 1 | 0.030 | | 0.039 |
| F1 | 1.15 | | 1.7 | 0.045 | | 0.067 |
| F2 | 1.15 | | 1.7 | 0.045 | | 0.067 |
| G | 4.95 | | 5.2 | 0.195 | | 0.204 |
| G1 | 2.4 | | 2.7 | 0.094 | | 0.106 |
| H | 10 | | 10.4 | 0.393 | | 0.409 |
| L2 | | 16 | | | 0.630 | |
| L3 | 28.6 | | 30.6 | 1.126 | | 1.204 |
| L4 | 9.8 | | 10.6 | .0385 | | 0.417 |
| L5 | 2.9 | | 3.6 | 0.114 | | 0.141 |
| L6 | 15.9 | | 16.4 | 0.626 | | 0.645 |
| L7 | 9 | | 9.3 | 0.354 | | 0.366 |
| Ø | 3 | | 3.2 | 0.118 | | 0.126 |



5 Packaging mechanical data

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT

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 |

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 |

10 pitches cumulative tolerance on tape +/- 0.2 mm

Center line of cavity

User Direction of Feed

FEED DIRECTION

TRL

Bending radius R min.

* on sales type

6 Revision history

Table 7. Revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 21-Jun-2004 | 5 | Complete version |
| 13-Mar-2005 | 6 | Package inserted: I ² PAK |
| 20-Jul-2006 | 7 | New template, no content change |
| 24-Oct-2006 | 8 | Corrected value on Table 1.: Absolute maximum ratings |

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