



STB70NF03L STP70NF03L - STB70NF03L-1

N-channel 30V - 0.0075Ω - 70A - D²PAK - I²PAK - TO-220
Low gate charge STripFET™ II Power MOSFET

General features

| Type | V _{DSS} | R _{DS(on)} | I _D |
|--------------|------------------|---------------------|----------------|
| STB70NF03L | 30V | < 0.0095Ω | 70A |
| STP70NF03L | 30V | < 0.0095Ω | 70A |
| STB70NF03L-1 | 30V | < 0.0095Ω | 70A |

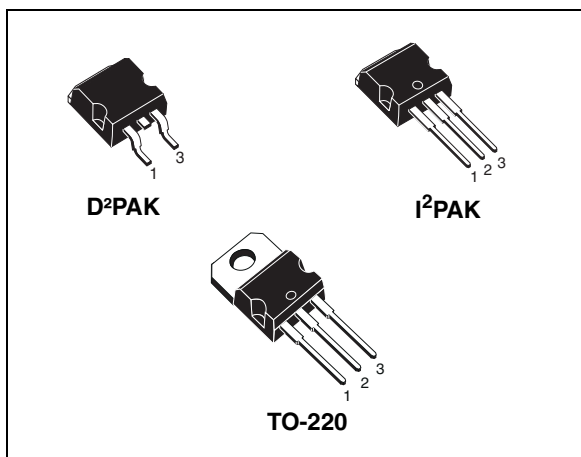
- Conduction losses reduced
- Switching losses reduced

Description

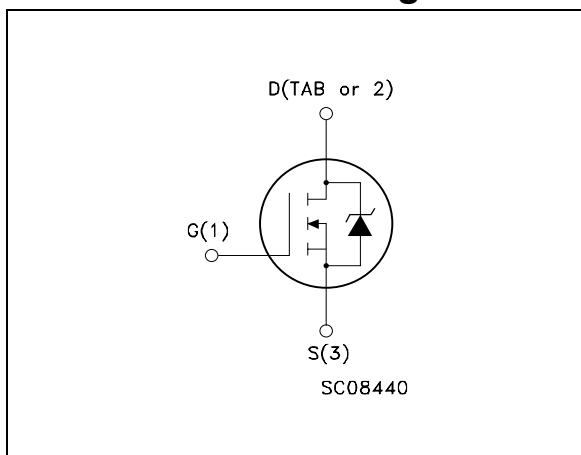
This application specific Power MOSFET is the third generation of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows the best trade-off between on-resistance and gate charge. When used as high and low side in buck regulators, it gives the best performance in terms of both conduction and switching losses. This is extremely important for motherboards where fast switching and high efficiency are of paramount importance.

Applications

- Switching application



Internal schematic diagram



Order codes

| Part number | Marking | Package | Packaging |
|--------------|----------|--------------------|-------------|
| STB70NF03L | B70NF03L | D ² PAK | Tape & reel |
| STP70NF03L | P70NF03L | TO-220 | Tube |
| STB70NF03L-1 | B70NF03L | I ² PAK | Tube |

Contents

| | | |
|----------|---|-----------|
| 1 | Electrical ratings | 3 |
| 2 | Electrical characteristics | 4 |
| | 2.1 Electrical characteristics (curves) | 6 |
| 3 | Test circuit | 8 |
| 4 | Package mechanical data | 9 |
| 5 | Packaging mechanical data | 13 |
| 6 | Revision history | 14 |

1 Electrical ratings

Table 1. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|----------------|---|------------|------|
| V_{DS} | Drain-source voltage ($V_{GS} = 0$) | 30 | V |
| V_{DGR} | Drain-gate voltage ($R_{GS} = 20k\Omega$) | 30 | V |
| V_{GS} | Gate- source voltage | ± 18 | V |
| I_D | Drain current (continuous) at $T_C = 25^\circ\text{C}$ | 70 | A |
| I_D | Drain current (continuous) at $T_C = 100^\circ\text{C}$ | 50 | A |
| $I_{DM}^{(1)}$ | Drain current (pulsed) | 280 | A |
| P_{TOT} | Total dissipation at $T_C = 25^\circ\text{C}$ | 100 | W |
| | Derating factor | 0.67 | W/°C |
| $dv/dt^{(2)}$ | Peak diode recovery voltage slope | 5.5 | V/ns |
| $E_{AS}^{(3)}$ | Single pulse avalanche energy | 500 | mJ |
| T_{stg} | Storage temperature | -55 to 175 | °C |
| T_J | Operating junction temperature | | |

1. Current limited by the package
2. $I_{SD} \leq 0A$, $di/dt \leq 50A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq T_{JMAX}$
3. Starting $T_J = 25^\circ\text{C}$, $I_D = 35A$, $V_{DD} = 25V$

Table 2. Thermal data

| Symbol | Parameter | Value | Unit |
|------------|--|-------|------|
| R_{thJC} | Thermal resistance junction-case Max | 1.5 | °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 | $I_D = 250\mu A, V_{GS} = 0$ | 30 | | | 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 ($V_{DS} = 0$) | $V_{GS} = \pm 18V$ | | | ± 100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS} = V_{GS}$ $I_D = 250\mu A$ | 1 | | | V |
| $R_{DS(on)}$ | Static drain-source on resistance | $V_{GS} = 10 V$ $I_D = 35A$ $V_{GS} = 5 V$ $I_D = 18A$ | | 0.0075 0.0135 | 0.0095 0.018 | W W |

Table 4. Dynamic

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|-------------------------------------|--|---|-----|--------------------|-----|----------------|
| $g_{fs}^{(*)}$ | Forward transconductance | $V_{DS} = 15V$ $I_D = 35A$ | | 25 | | S |
| C_{iss} C_{oss} C_{rss} | Input capacitance Output capacitance Reverse transfer capacitance | $V_{DS} = 25V$ $f = 1 \text{ MHz}$ $V_{GS} = 0$ | | 1440 560 135 | | pF pF pF |

Table 5. Switching times

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|-------------------------------|--|--|-----|-----------------|-----|----------------|
| $t_{d(on)}$ t_r | Turn-on delay time Rise time | $V_{DD} = 15V$ $I_D = 35A$ $R_G = 4.7\Omega$ $V_{GS} = 5V$ <i>Figure 16.</i> | | 22 165 | | ns ns |
| Q_g Q_{gs} Q_{gd} | Total gate charge Gate-source charge Gate-drain charge | $V_{DD} = 15V$ $I_D = 70A$ $V_{GS} = 5V$ | | 22.5 9 12 | 30 | nC nC nC |
| $t_{d(off)}$ t_f | Turn-off delay time Fall time | $V_{DD} = 15V$ $I_D = 35A$ $R_G = 4.7\Omega$ $V_{GS} = 5V$ <i>Figure 16.</i> | | 21 25 | | ns ns |

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) | | | | 70 280 | A A |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD} = 70A$ $V_{GS} = 0$ | | | 1.3 | V |
| t_{rr} Q_{rr} I_{RRM} | Reverse recovery time Reverse recovery charge Reverse recovery current | $I_{SD} = 70A$ $di/dt = 100A/\mu s$ $V_{DD} = 20V$ $T_J = 150^\circ C$ <i>Figure 15.</i> | | 42 52 2.5 | | 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 1. Safe operating area

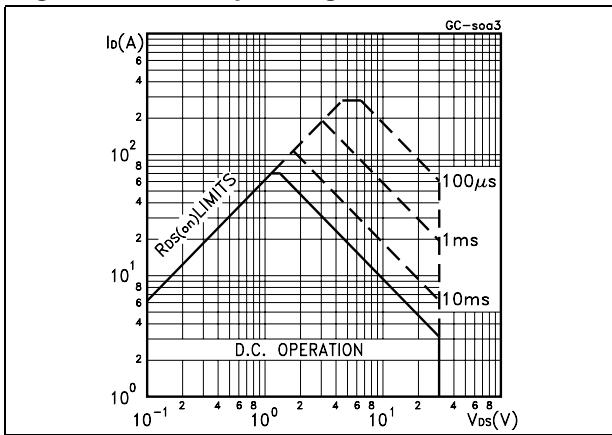


Figure 2. Thermal impedance

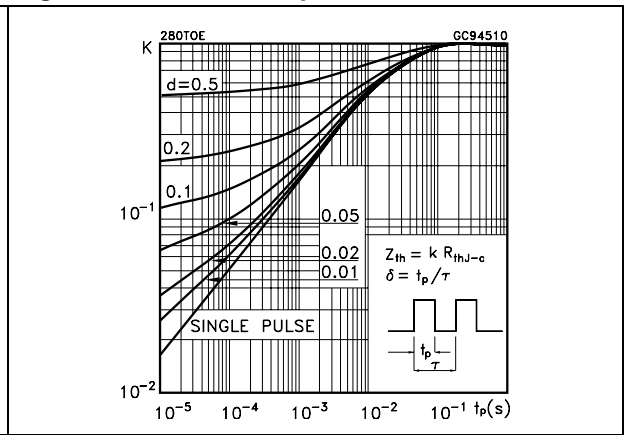


Figure 3. Output characteristics

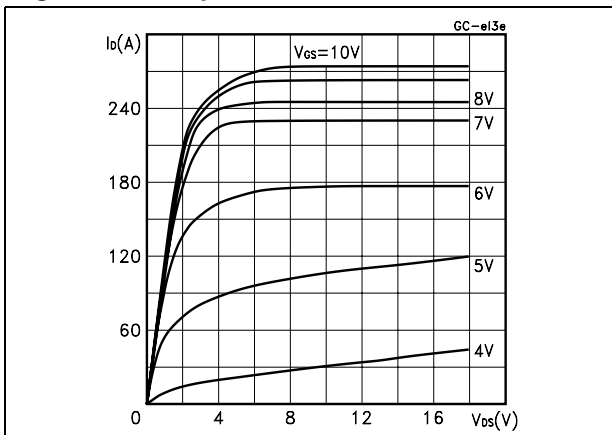


Figure 4. Transfer characteristics

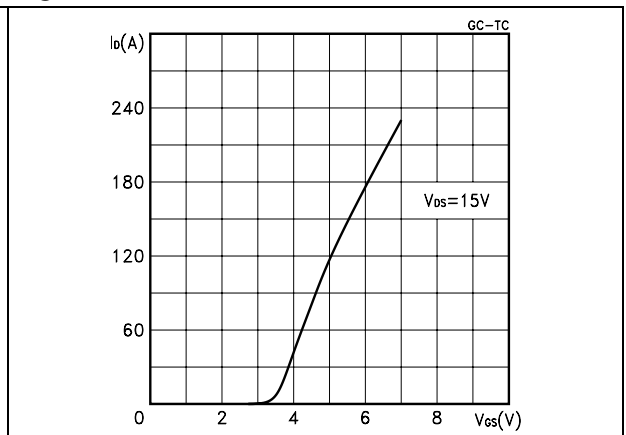


Figure 5. Transconductance

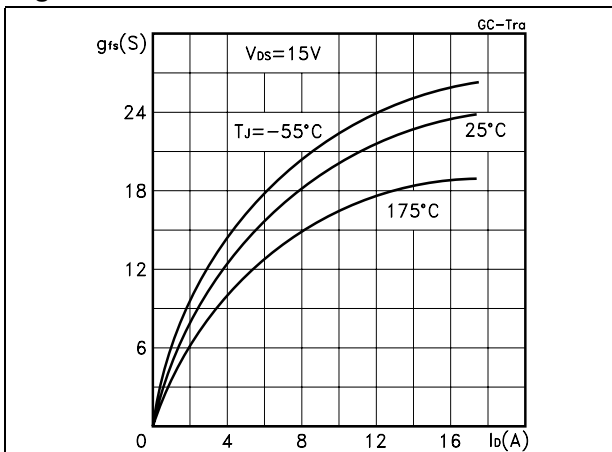


Figure 6. Static drain-source on resistance

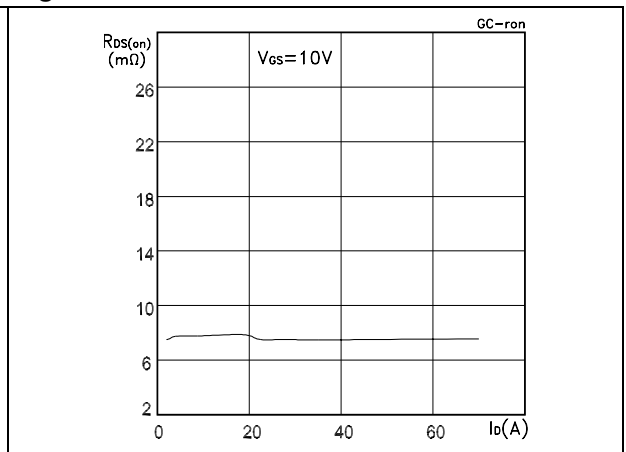


Figure 7. Gate charge vs gate-source voltage Figure 8. Capacitance variations

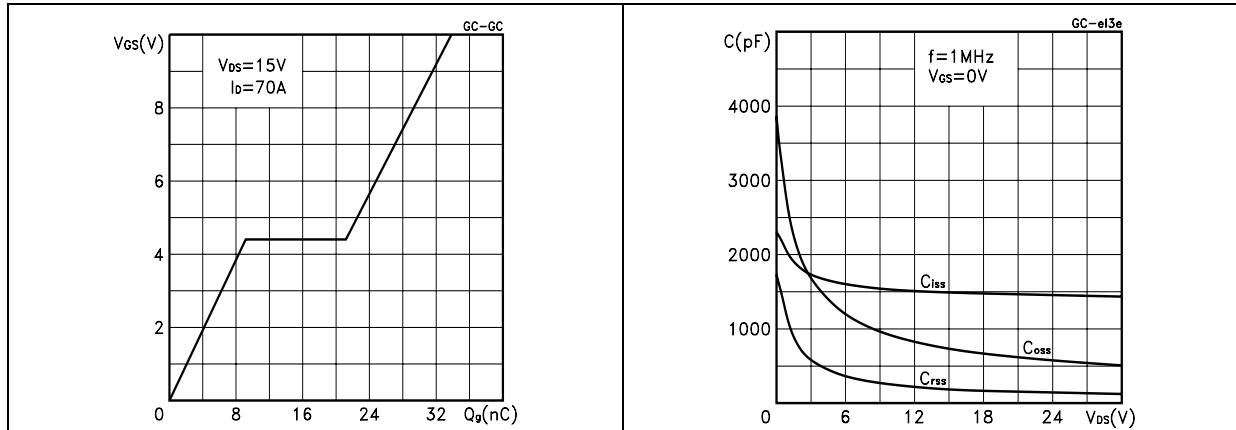


Figure 9. Normalized gate threshold voltage vs temperature Figure 10. Normalized on resistance vs temperature

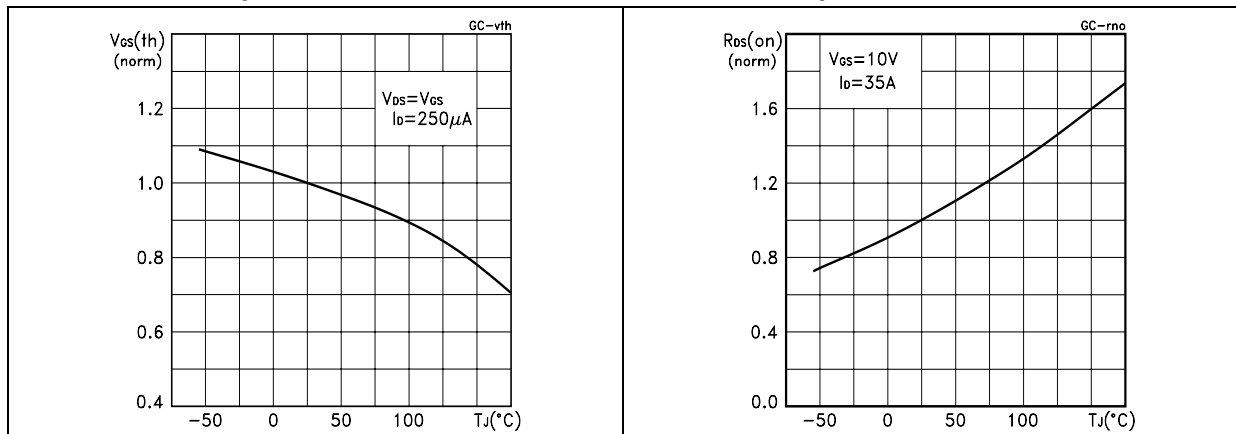
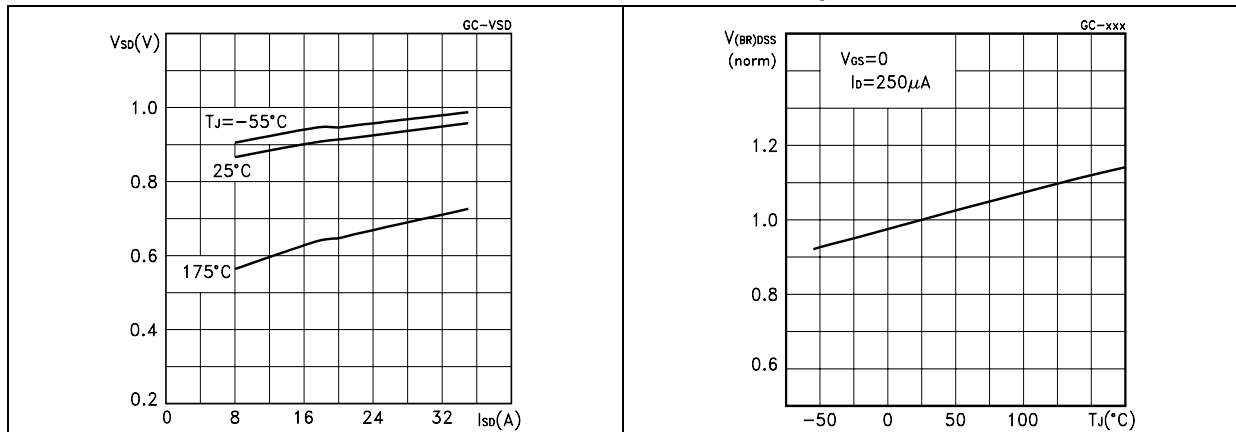


Figure 11. Source-drain diode forward characteristics Figure 12. Normalized Breakdown vs temperature



3 Test circuit

Figure 13. Switching times test circuit for resistive load

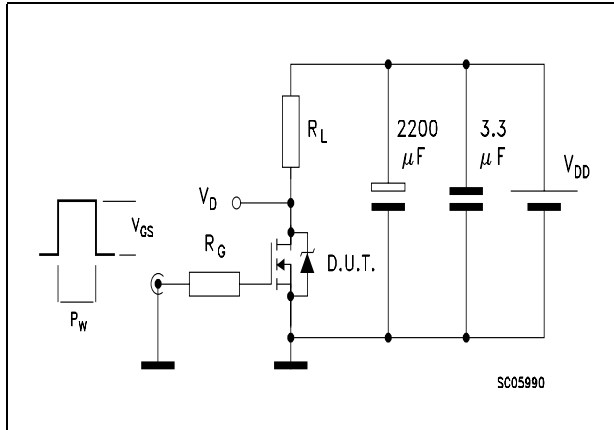


Figure 14. Gate charge test circuit

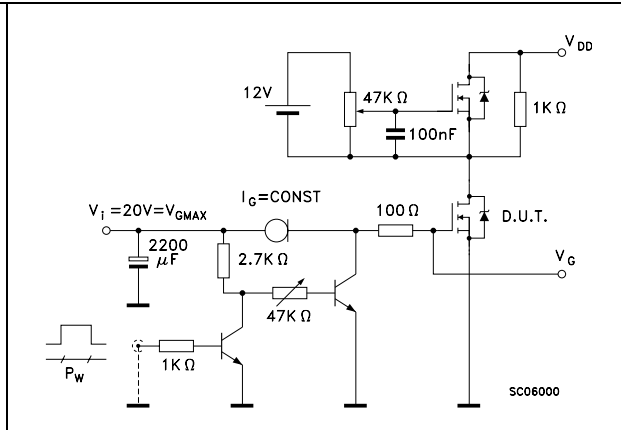


Figure 15. Test circuit for inductive load switching and diode recovery times

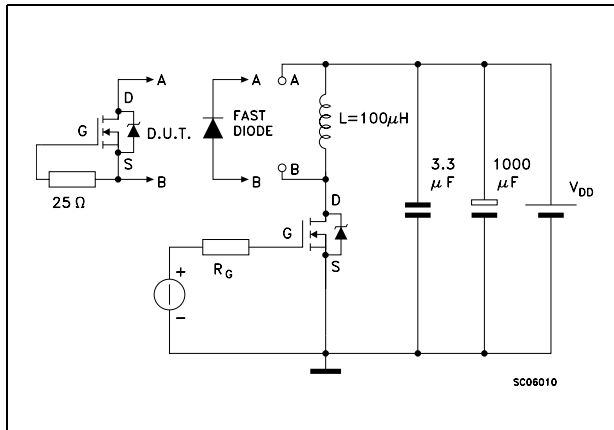


Figure 16. Unclamped Inductive load test circuit

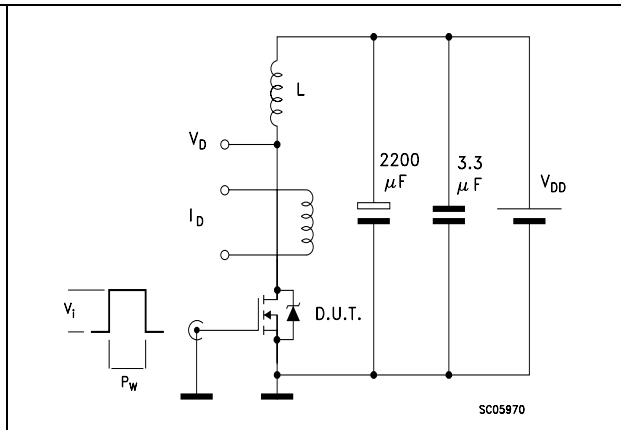
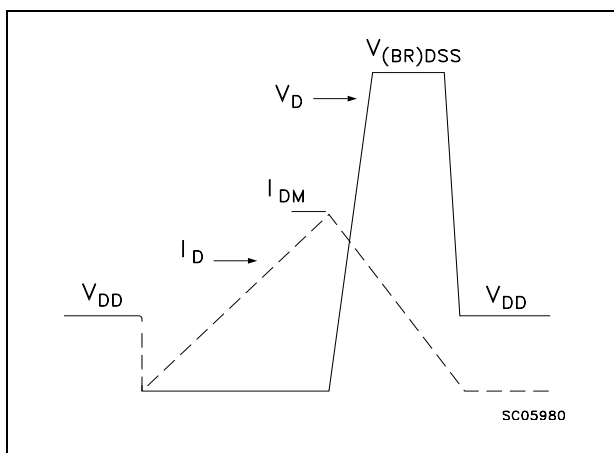


Figure 17. Unclamped inductive waveform

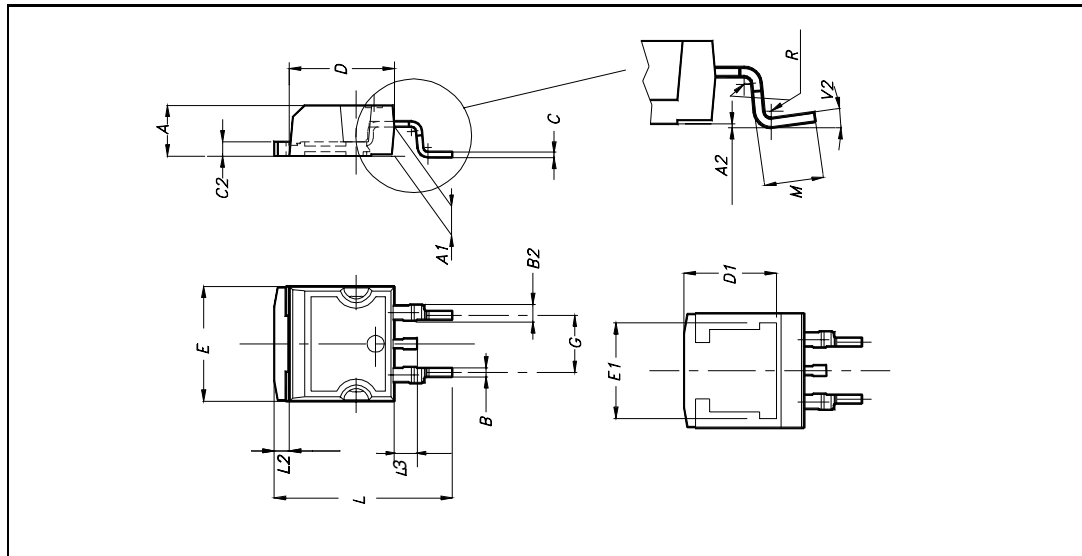


4 Package mechanical data

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

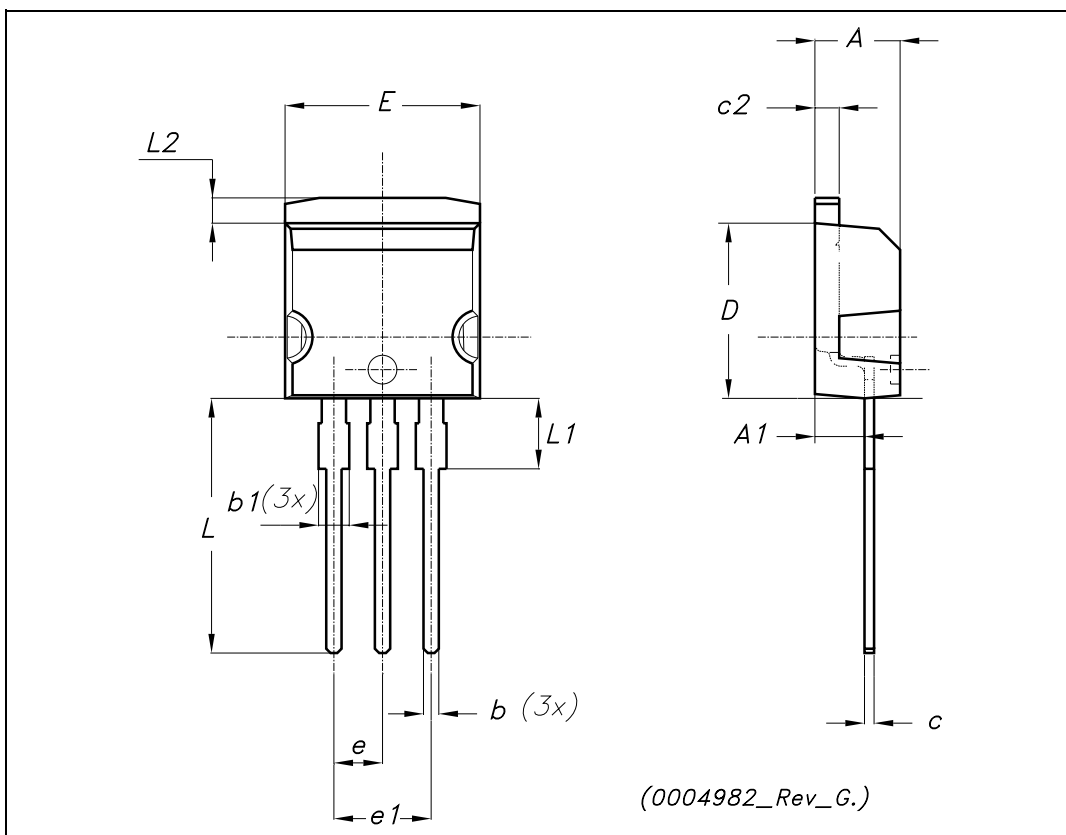
D²PAK MECHANICAL DATA

| 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° | | | |



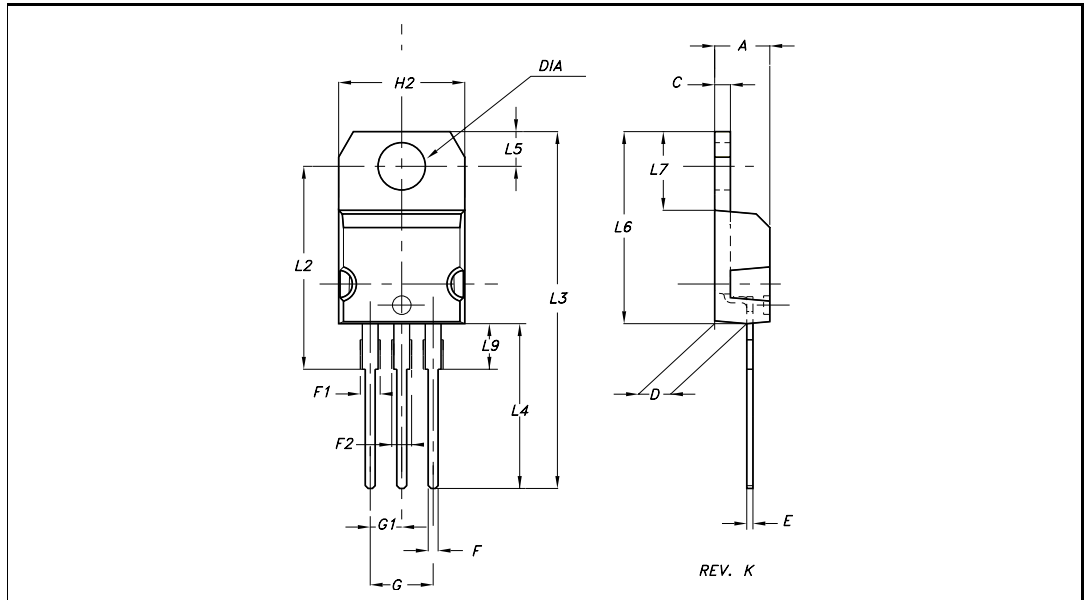
TO-262 (I²PAK) MECHANICAL DATA

| 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 |



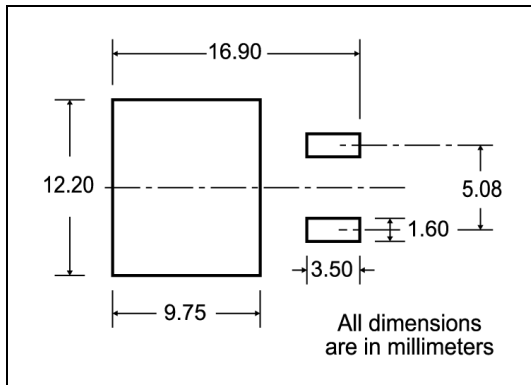
TO-220 MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|-------|-------|-------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| C | 1.23 | | 1.32 | 0.048 | | 0.051 |
| D | 2.40 | | 2.72 | 0.094 | | 0.107 |
| E | 0.49 | | 0.70 | 0.019 | | 0.027 |
| F | 0.61 | | 0.88 | 0.024 | | 0.034 |
| F1 | 1.14 | | 1.70 | 0.044 | | 0.066 |
| F2 | 1.14 | | 1.70 | 0.044 | | 0.066 |
| G | 4.95 | | 5.15 | 0.194 | | 0.202 |
| G1 | 2.40 | | 2.70 | 0.094 | | 0.106 |
| H2 | 10 | | 10.40 | 0.393 | | 0.409 |
| L2 | | 16.40 | | | 0.645 | |
| L3 | | 28.90 | | | 1.137 | |
| L4 | 13 | | 14 | 0.511 | | 0.551 |
| L5 | 2.65 | | 2.95 | 0.104 | | 0.116 |
| L6 | 15.25 | | 15.75 | 0.600 | | 0.620 |
| L7 | 6.20 | | 6.60 | 0.244 | | 0.259 |
| L9 | 3.50 | | 3.93 | 0.137 | | 0.154 |
| DIA | 3.75 | | 3.85 | 0.147 | | 0.151 |



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 |

* on sales type

6 Revision history

Table 7. Revision history

| Date | Revision | Changes |
|-------------|-----------------|---------------------------------|
| 21-Jun-2004 | 9 | Preliminary version |
| 25-Jul-2006 | 10 | New template, no content change |

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