



STN4NF03L

N-channel 30 V - 0.039 Ω - 6.5 A - SOT-223
STripFET™ II Power MOSFET

Features

| Type | V _{DSS} | R _{DS(on)} | I _D |
|-----------|------------------|---------------------|----------------|
| STN4NF03L | 30 V | <0.05 Ω | 6.5 A |

- Low threshold drive

Application

- Switching applications

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.

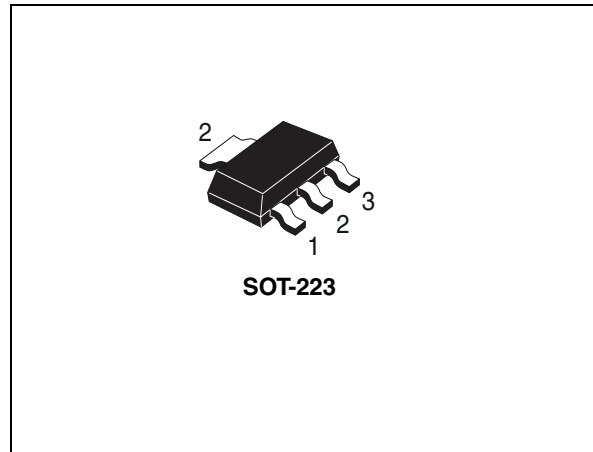


Figure 1. Internal schematic diagram

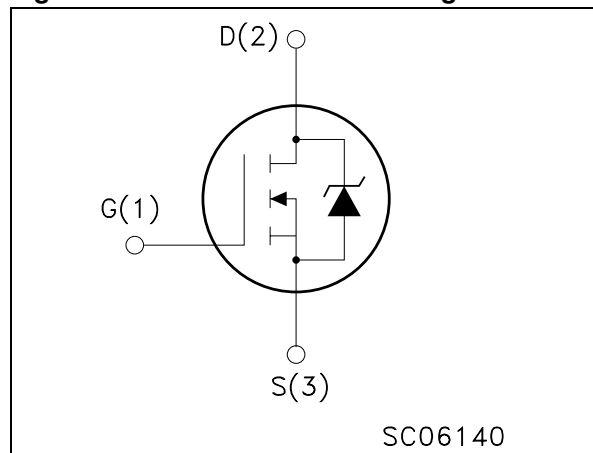


Table 1. Device summary

| Order code | Marking | Package | Packaging |
|------------|---------|---------|-------------|
| STN4NF03L | 4NF03L | SOT-223 | Tape & reel |

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 | Revision history | 11 |

1 Electrical ratings

Table 2. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|--------------------|---|------------|---------------------|
| V_{DS} | Drain-source voltage ($V_{GS} = 0$) | 30 | V |
| V_{GS} | Gate-source voltage | ± 16 | V |
| I_D | Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$ | 6.5 | A |
| I_D | Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$ | 4.5 | A |
| $I_{DM}^{(1)}$ | Drain current (pulsed) | 26 | A |
| P_{TOT} | Total dissipation at $T_C = 25\text{ }^\circ\text{C}$ | 3.3 | W |
| | Derating factor | 0.026 | W/ $^\circ\text{C}$ |
| $E_{AS}^{(2)}$ | Single pulse avalanche energy | 100 | mJ |
| T_J T_{stg} | Operating junction temperature Storage temperature | -55 to 150 | $^\circ\text{C}$ |

1. Pulse width limited by safe operating area
2. Starting $T_J = 25\text{ }^\circ\text{C}$, $I_D = 6\text{ A}$

Table 3. Thermal data

| Symbol | Parameter | Value | Unit |
|---------------|---|-------|---------------------------|
| $R_{thj-pcb}$ | Thermal resistance junction-PCB ⁽¹⁾ max | 38 | $^\circ\text{C}/\text{W}$ |
| $R_{thj-pcb}$ | Thermal resistance junction-PCB ⁽²⁾ max | 100 | $^\circ\text{C}/\text{W}$ |
| T_l | Maximum lead temperature for soldering purpose (for 10 sec. 1.6 mm from case) typ | 260 | $^\circ\text{C}$ |

1. When mounted on 1 inch² FR-4 board, 2 oz. Cu., $t < 10\text{ s}$
2. Minimum recommended footprint

2 Electrical characteristics

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

Table 4. On/off states

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|--|--|------|----------------|--------------|----------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $I_D = 250 \mu A, V_{GS} = 0$ | 30 | | | V |
| I_{DSS} | Zero gate voltage drain current ($V_{GS} = 0$) | $V_{DS} = \text{max rating},$ $V_{DS} = \text{max rating} @ 125^{\circ}C$ | | | 1 10 | μA μA |
| I_{GSS} | Gate body leakage current ($V_{DS} = 0$) | $V_{GS} = \pm 16 V$ | | | ± 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 | $V_{GS} = 10 V, I_D = 2 A$ $V_{GS} = 5 V, I_D = 2 A$ | | 0.039 0.046 | 0.05 0.06 | Ω Ω |

Table 5. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-------------------------------------|---|--|------|-----------------|------|----------------|
| $g_{fs}^{(1)}$ | Forward transconductance | $V_{DS} = 10 V, I_D = 1 A$ | 3 | 6 | | S |
| C_{iss} C_{oss} C_{rss} | Input capacitance Output capacitance Reverse transfer capacitance | $V_{DS} = 25 V, f = 1 \text{ MHz}, V_{GS} = 0$ | | 330 90 40 | | pF pF pF |
| Q_g Q_{gs} Q_{gd} | Total gate charge Gate-source charge Gate-drain charge | $V_{DD} = 24 V, I_D = 4 A$ $V_{GS} = 10 V$ (see Figure 14) | | 6.5 3.2 2 | 9 | nC nC nC |

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

Table 6. Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------------|----------------------------------|--|------|-----------|------|----------|
| $t_{d(on)}$ t_r | Turn-on delay time rise time | $V_{DD} = 15 V, I_D = 2 A,$ $R_G = 4.7 \Omega, V_{GS} = 4.5 V$ (see Figure 15) | | 11 100 | | ns ns |
| $t_{d(off)}$ t_f | Turn-off-delay time fall time | $V_{DD} = 15 V, I_D = 2 A,$ $R_G = 4.7 \Omega, V_{GS} = 4.5 V$ (see Figure 15) | | 35 22 | | ns ns |

Table 7. Source drain diode

| Symbol | Parameter | Test conditions | Min. | Typ. | Max | Unit |
|-----------------|-------------------------------|--|------|------|-----|------|
| I_{SD} | Source-drain current | | | | 6.5 | A |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) | | | | 26 | A |
| $V_{SD}^{(2)}$ | Forward on voltage | $I_{SD} = 6.5 \text{ A}, V_{GS} = 0$ | | | 1.5 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 6.5 \text{ A},$ $di/dt = 100 \text{ A}/\mu\text{s},$ $V_{DD} = 15 \text{ V}, T_j = 150 \text{ }^\circ\text{C}$ <i>(see Figure 15)</i> | | 34 | | ns |
| Q_{rr} | Reverse recovery charge | | | 25 | | nC |
| I_{RRM} | Reverse recovery current | | | 1.4 | | 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 2. Safe operating area

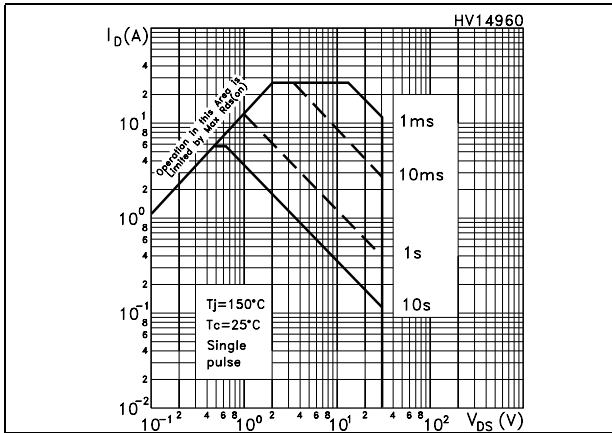


Figure 3. Thermal impedance junction-PCB

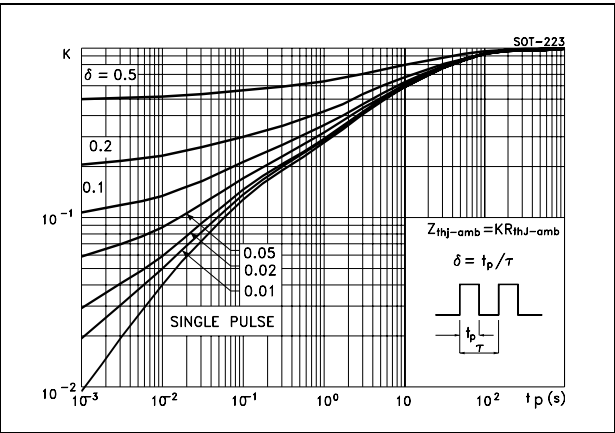


Figure 4. Output characteristics

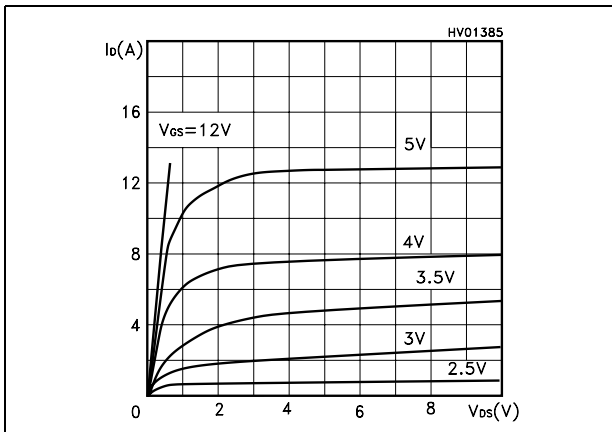


Figure 5. Transfer characteristics

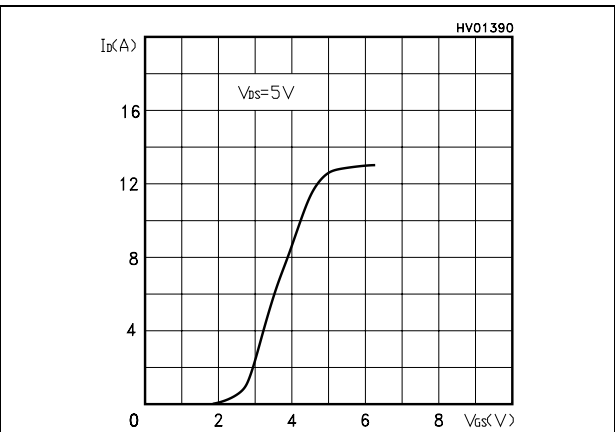


Figure 6. Transconductance

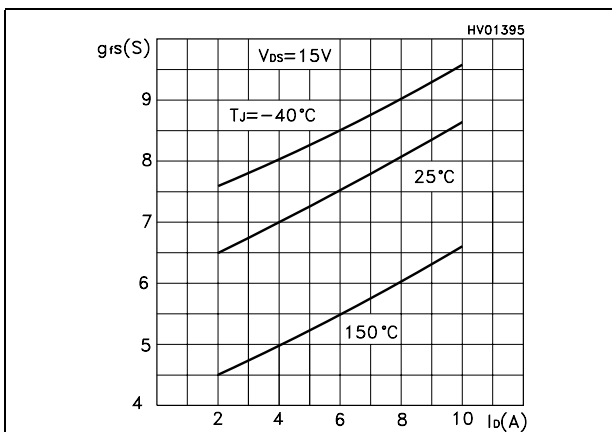


Figure 7. Static drain-source on resistance

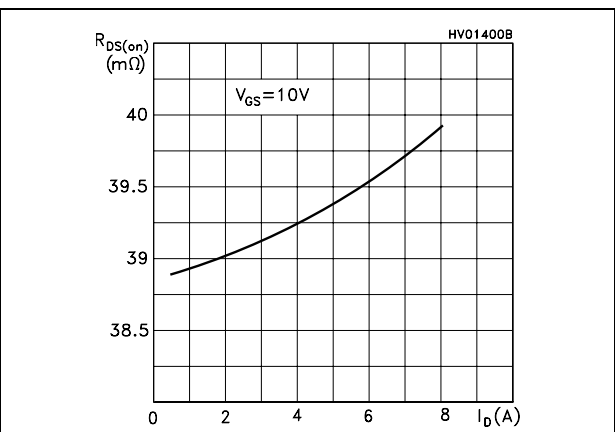


Figure 8. Gate charge vs. gate-source voltage Figure 9. Capacitance variations

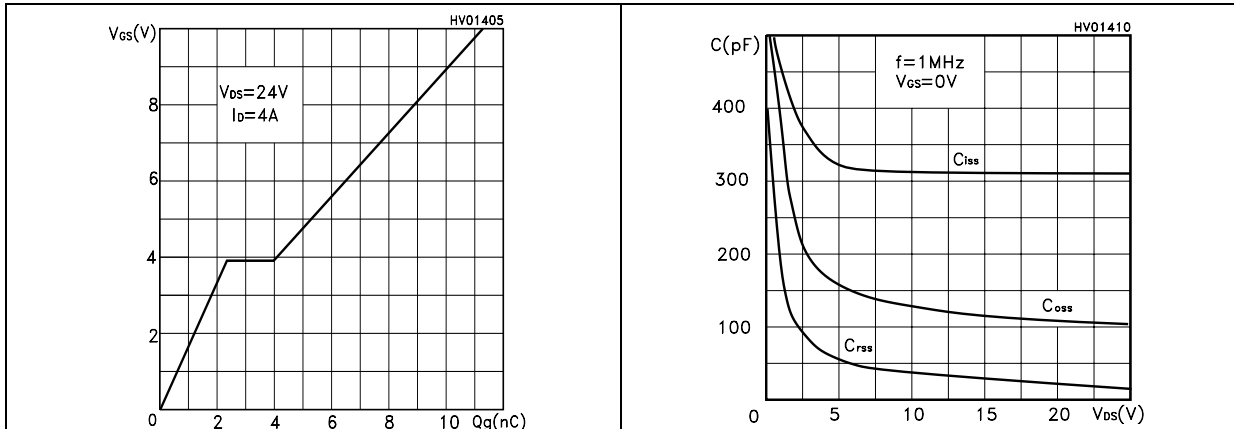


Figure 10. Normalized gate threshold voltage vs. temperature Figure 11. Normalized on resistance vs. temperature

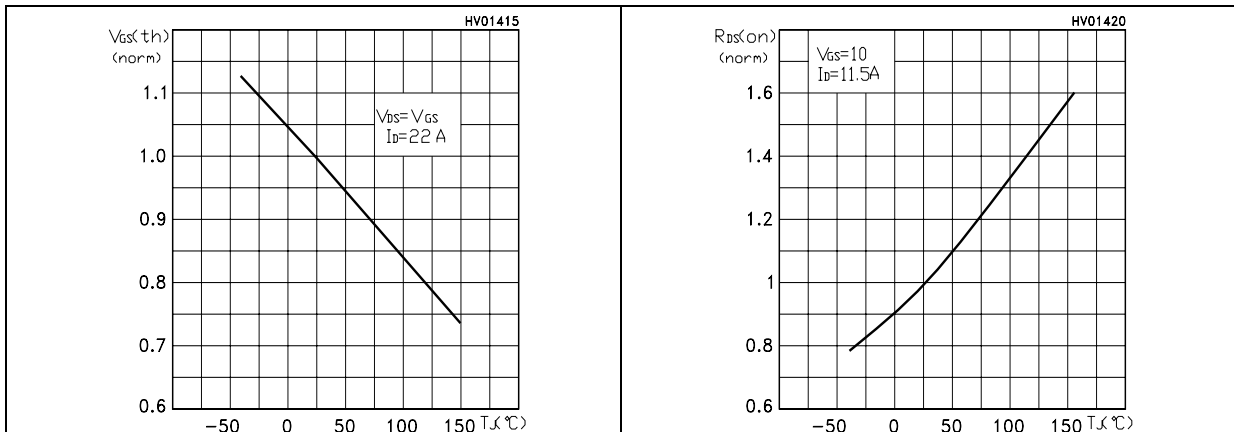
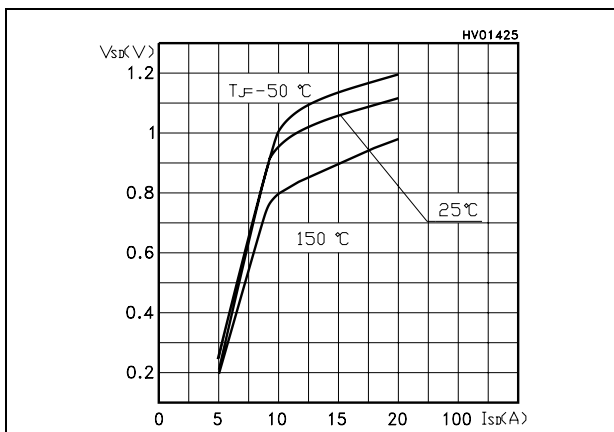


Figure 12. Source-drain diode forward characteristics



3 Test circuit

Figure 13. Switching times test circuit for resistive load

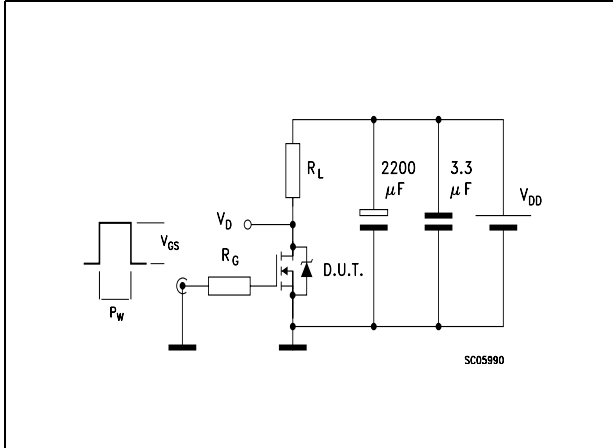


Figure 14. Gate charge test circuit

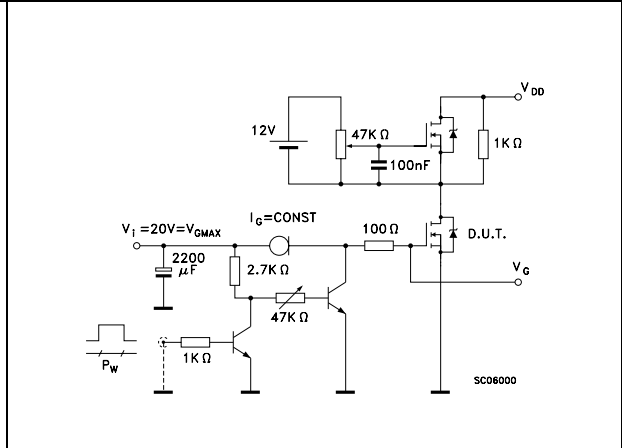


Figure 15. Test circuit for inductive load switching and diode recovery times



Figure 16. Unclamped inductive load test circuit

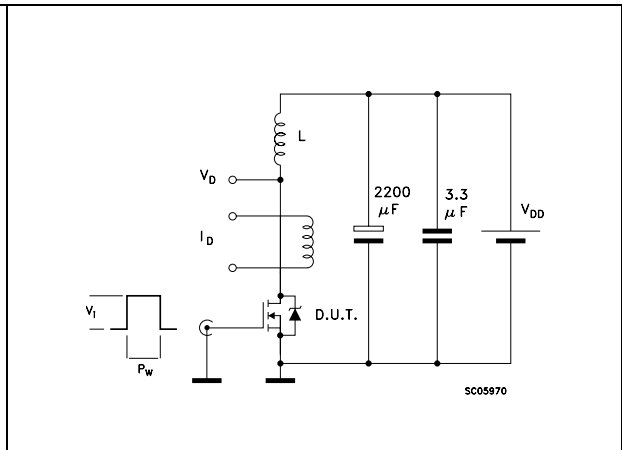


Figure 17. Unclamped inductive waveform

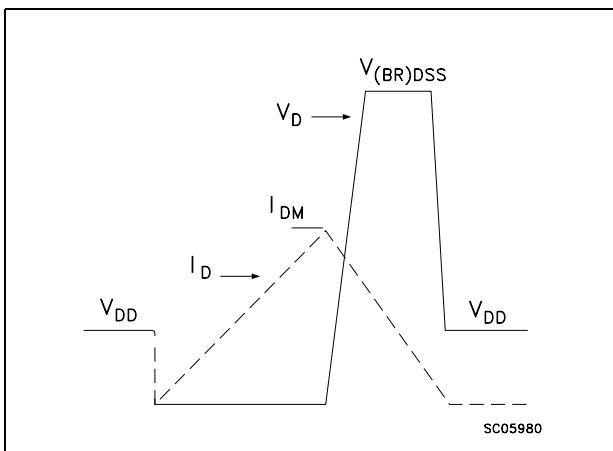
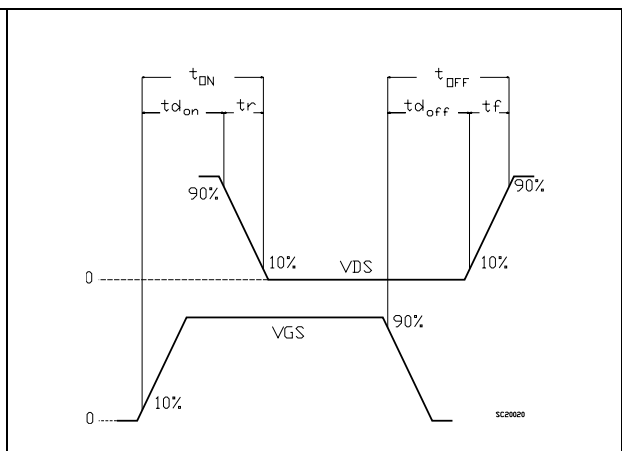


Figure 18. Switching time waveform

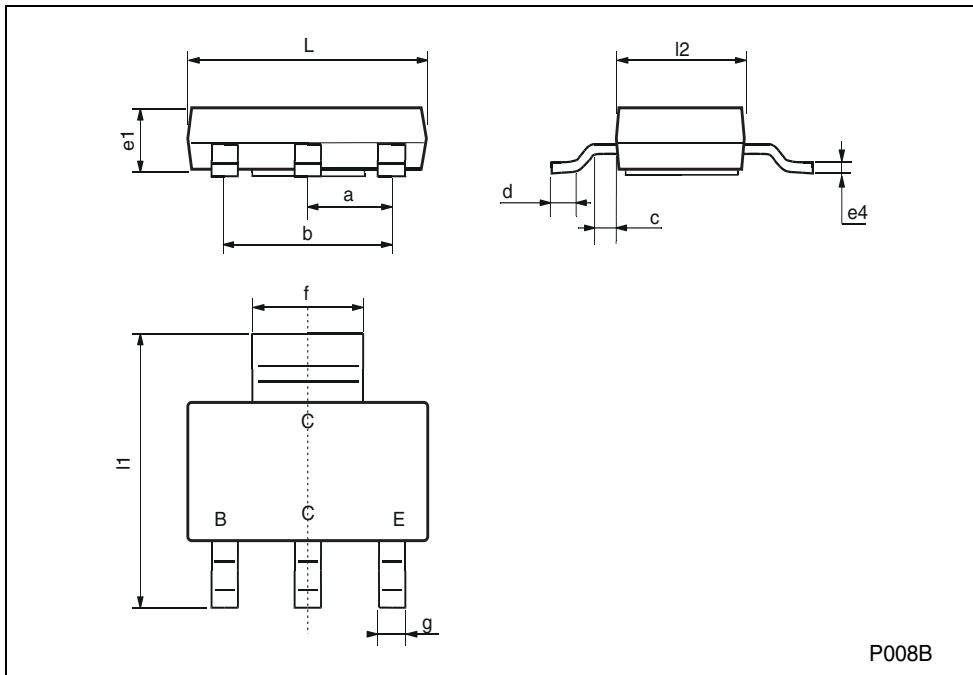


4 Package mechanical data

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

SOT-223 MECHANICAL DATA

| DIM. | mm | | | mils | | |
|------|------|------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| a | 2.27 | 2.3 | 2.33 | 89.4 | 90.6 | 91.7 |
| b | 4.57 | 4.6 | 4.63 | 179.9 | 181.1 | 182.3 |
| c | 0.2 | 0.4 | 0.6 | 7.9 | 15.7 | 23.6 |
| d | 0.63 | 0.65 | 0.67 | 24.8 | 25.6 | 26.4 |
| e1 | 1.5 | 1.6 | 1.7 | 59.1 | 63 | 66.9 |
| e4 | | | 0.32 | | | 12.6 |
| f | 2.9 | 3 | 3.1 | 114.2 | 118.1 | 122.1 |
| g | 0.67 | 0.7 | 0.73 | 26.4 | 27.6 | 28.7 |
| l1 | 6.7 | 7 | 7.3 | 263.8 | 275.6 | 287.4 |
| l2 | 3.5 | 3.5 | 3.7 | 137.8 | 137.8 | 145.7 |
| L | 6.3 | 6.5 | 6.7 | 248 | 255.9 | 263.8 |



5 Revision history

Table 8. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 21-Jun-2004 | 3 | – Initial electronic version. – Document status promoted from preliminary data to datasheet |
| 09-Oct-2006 | 4 | Document reformatted no content change |
| 27-Nov-2007 | 5 | Updated marking on Table 1: Device summary |
| 11-Dec-2007 | 6 | Updated E _{AS} value on Table 2: Absolute maximum ratings |

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