



STSJ60NH3LL

N-channel 30V - 0.004Ω - 15A - PowerSO-8™
STripFET™ Power MOSFET for DC-DC conversion

Features

| Type | V _{DSS} | R _{DS(on)} | I _D |
|-------------|------------------|---------------------|--------------------|
| STSJ60NH3LL | 30V | <0.0057Ω | 15A ⁽²⁾ |

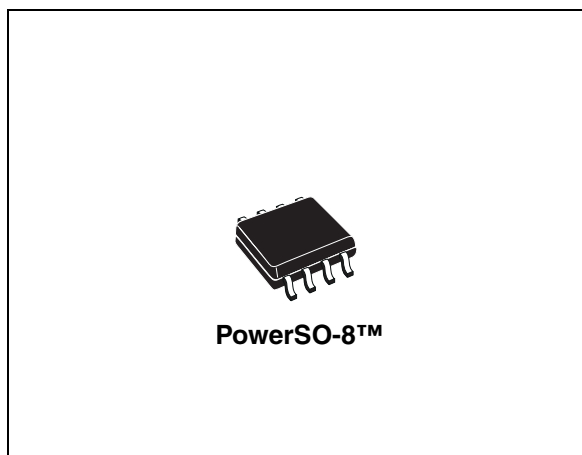
- Optimal R_{DS(on)} x Qg trade-off @ 4.5 V
- Conduction losses reduced
- Improved junction-case thermal resistance
- Low threshold device

Description

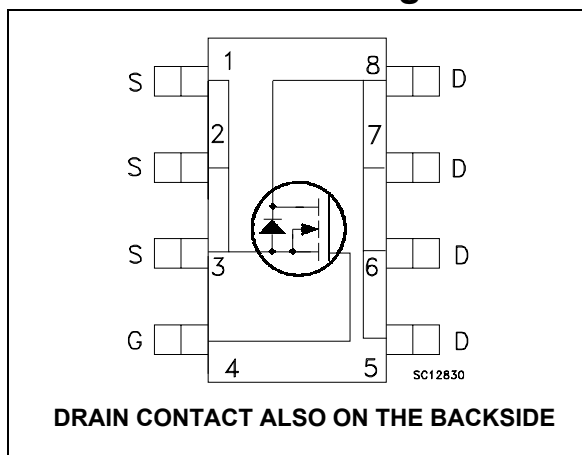
This device utilizes the latest advanced design rules of ST's proprietary STripFET™ technology. This process coupled to unique metallization techniques realizes the most advanced low voltage Power MOSFET in SO-8 ever produced. The exposed slug reduces the R_{thj-c} improving the current capability.

Application

- Switching application



Internal schematic diagram



Order code

| Part number | Marking | Package | Packaging |
|-------------|---------|------------|-------------|
| STSJ60NH3LL | 60H3LL- | PowerSO-8™ | Tape & reel |

Contents

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1 Electrical ratings

Table 1. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|-----------------|---------------------------------------------------------|------------|------------------|
| V_{DS} | Drain-source voltage ($V_{GS} = 0$) | 30 | V |
| V_{GS} | Gate- source voltage | ± 16 | V |
| $I_D^{(1)}$ | Drain current (continuous) at $T_C = 25^\circ\text{C}$ | 60 | A |
| I_D | Drain current (continuous) at $T_C = 100^\circ\text{C}$ | 37.5 | A |
| $I_D^{(2)}$ | Drain current (continuous) at $T_C = 25^\circ\text{C}$ | 15 | A |
| I_D | Drain current (continuous) at $T_C = 100^\circ\text{C}$ | 9.4 | A |
| $I_{DM}^{(3)}$ | Drain current (pulsed) | 60 | A |
| $P_{tot}^{(1)}$ | Total dissipation at $T_C = 25^\circ\text{C}$ | 50 | W |
| $P_{tot}^{(2)}$ | Total dissipation at $T_C = 25^\circ\text{C}$ | 3 | W |
| T_{stg} | Storage temperature | -55 to 150 | $^\circ\text{C}$ |
| T_j | Operating junction temperature | | |

1. This value is rated according to R_{thj-c}
2. This value is rated according to $R_{thj-pcb}$
3. Pulse width limited by safe operating area

Table 2. Thermal resistance

| Symbol | Parameter | Value | Unit |
|----------------|----------------------------------------------|-------|---------------------------|
| $R_{thj-case}$ | Thermal resistance junction-case (drain) Max | 2.5 | $^\circ\text{C}/\text{W}$ |
| $R_{thj-pcb}$ | Thermal resistance junction-pcb Max | 42 | $^\circ\text{C}/\text{W}$ |

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 ($V_{GS} = 0$) | $V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating @ } 125^{\circ}C$ | | | 1 10 | μA μA |
| I_{GSS} | Gate-body leakage current ($V_{DS} = 0$) | $V_{GS} = \pm 16V$ | | | ± 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 | $V_{GS} = 10V, I_D = 7.5A$ $V_{GS} = 4.5V, I_D = 7.5A$ | | 0.004 0.005 | 0.0057 0.0075 | Ω Ω |

Table 4. Dynamic

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------|------|-------------------|------|----------------|
| C_{iss} C_{oss} C_{rss} | Input capacitance Output capacitance Reverse transfer capacitance | $V_{DS}=25V, f=1MHz, V_{GS} = 0$ | | 1810 565 41 | | pF pF pF |
| Q_g Q_{gs} Q_{gd} | Total gate charge Gate-source charge Gate-drain charge | $V_{DD}=15V, I_D=15A$ $V_{GS}=4.5V$ (see Figure 13) | | 18 4.8 5.3 | 24 | nC nC nC |
| R_G | Gate input resistance | $f=1 \text{ MHz}$ Gate DC Bias = 0 Test signal level = 20mV open drain | 0.5 | 1.5 | 3 | Ω |

Table 5. Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------------|----------------------------------|----------------------------------------------------------------------------------|------|----------|------|----------|
| $t_{d(on)}$ t_r | Turn-on delay time Rise Time | $V_{DD} = 15V, I_D = 7.5A$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see Figure 12) | | 8 65 | | ns ns |
| $t_{d(off)}$ t_f | Turn-off delay time Fall time | $V_{DD} = 15V, I_D = 7.5A$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see Figure 12) | | 38 20 | | ns ns |

Table 6. Source drain diode

| Symbol | Parameter | Test conditions | Min | Typ. | Max | Unit |
|----------------|-------------------------------|------------------------------------|-----|------|-----|------|
| I_{SD} | Source-drain current | | | | 15 | A |
| I_{SDM} | Source-drain current (pulsed) | | | | 60 | A |
| $V_{SD}^{(1)}$ | Forward On Voltage | $I_{SD} = 15A, V_{GS} = 0$ | | | 1.3 | V |
| t_{rr} | Reverse recovery time | $I_{SD} = 15A, di/dt = 100A/\mu s$ | | 22 | | ns |
| Q_{rr} | Reverse recovery charge | $V_{DD} = 15V, T_j = 25^\circ C$ | | 32 | | nC |
| I_{RRM} | Reverse recovery current | (see Figure 17) | | 1.9 | | A |

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

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

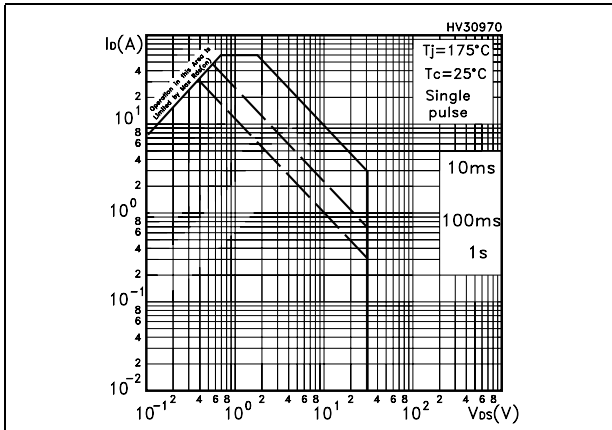


Figure 2. Thermal impedance

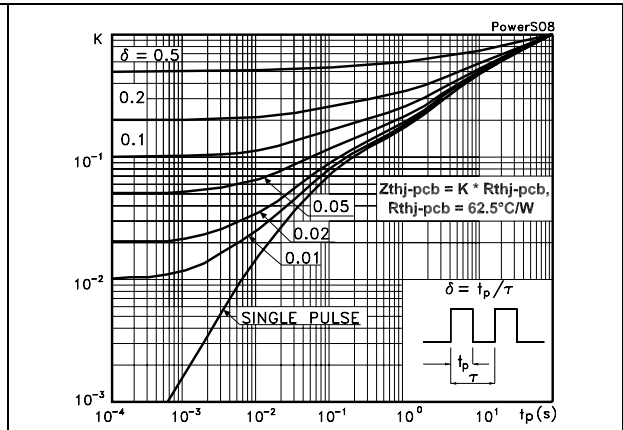


Figure 3. Output characteristics

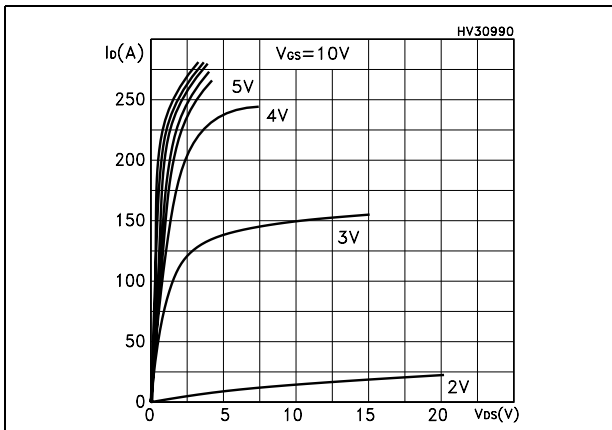


Figure 4. Transfer characteristics

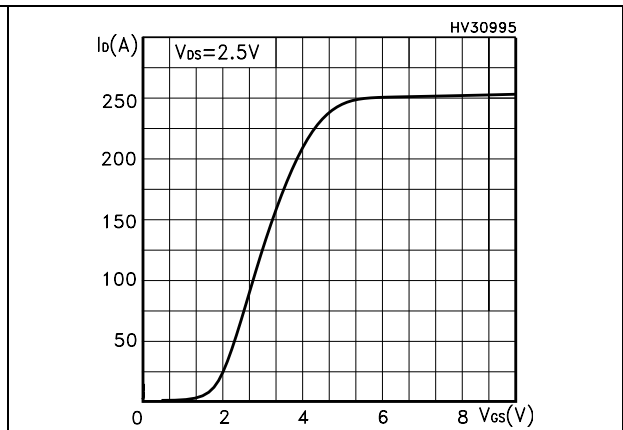


Figure 5. Normalized $B_{V_{DS}}$ vs temperature

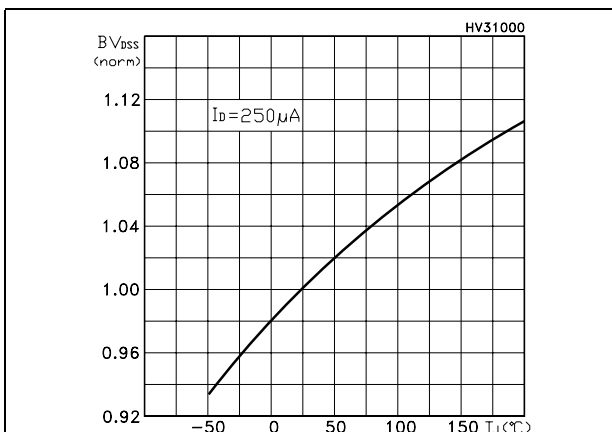


Figure 6. Static drain-source on resistance

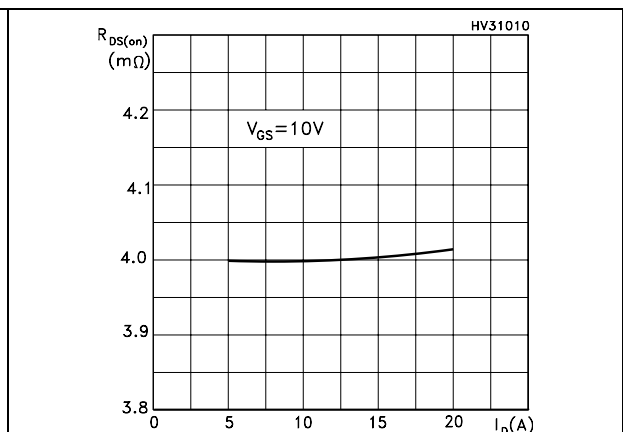


Figure 7. Gate charge vs gate-source voltage Figure 8. Capacitance variations

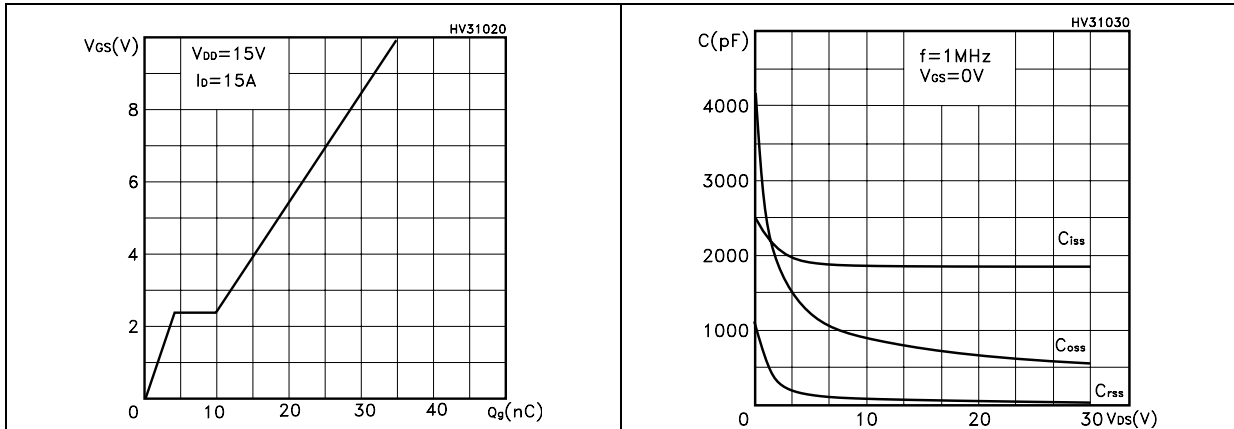


Figure 9. Normalized gate threshold voltage vs temperature Figure 10. Normalized on resistance vs temperature

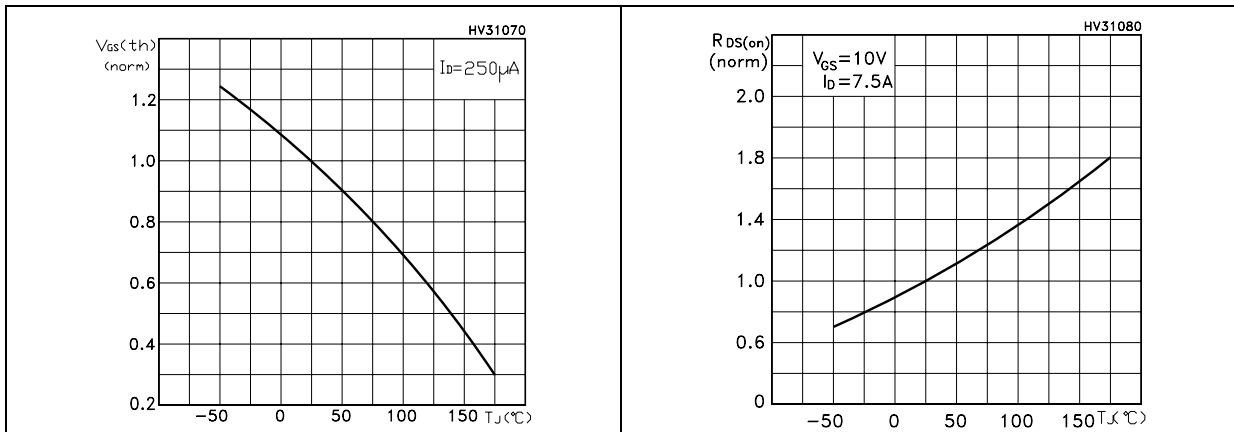
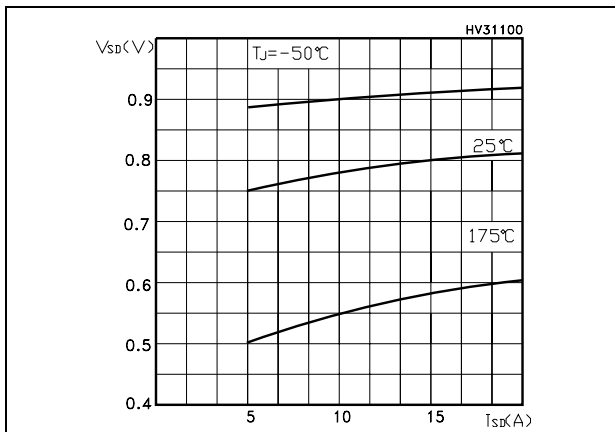


Figure 11. Source-drain diode forward characteristics



3 Test circuit

Figure 12. Switching times test circuit for resistive load

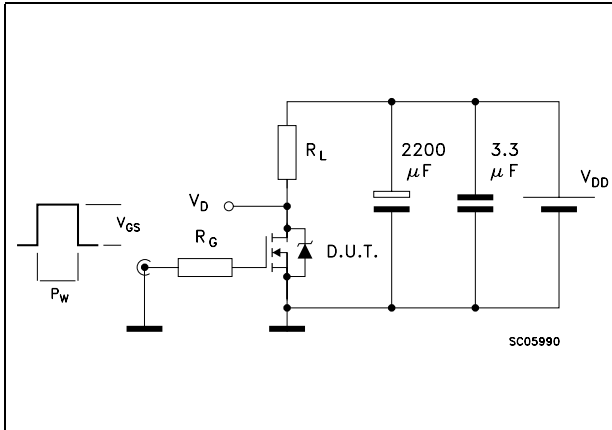


Figure 13. Gate charge test circuit

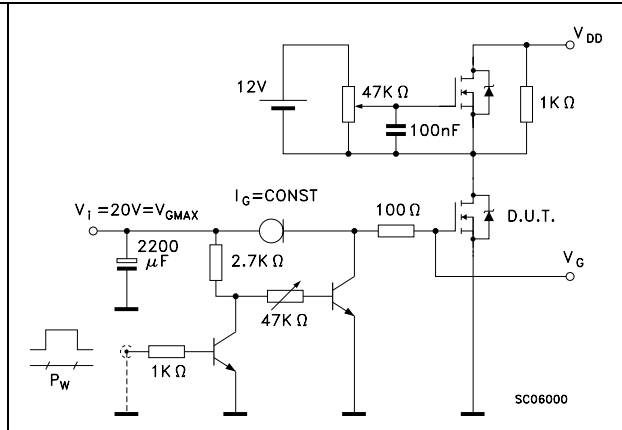


Figure 14. Test circuit for inductive load switching and diode recovery times

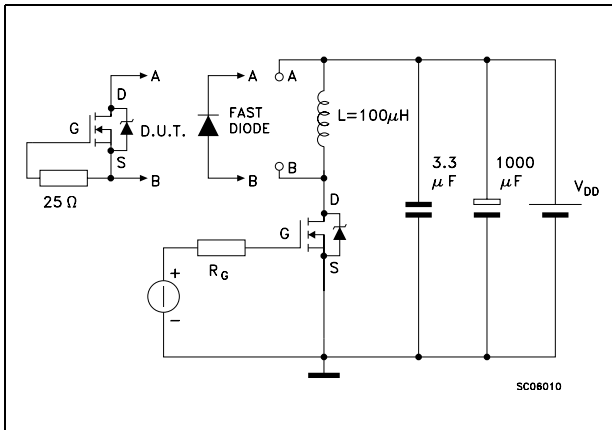


Figure 15. Unclamped inductive load test circuit

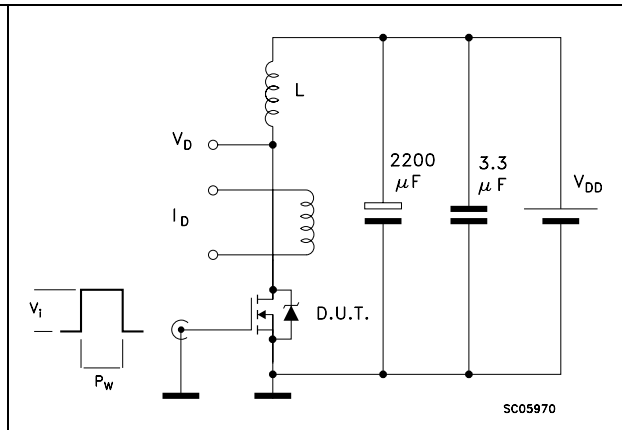


Figure 16. Unclamped inductive waveform

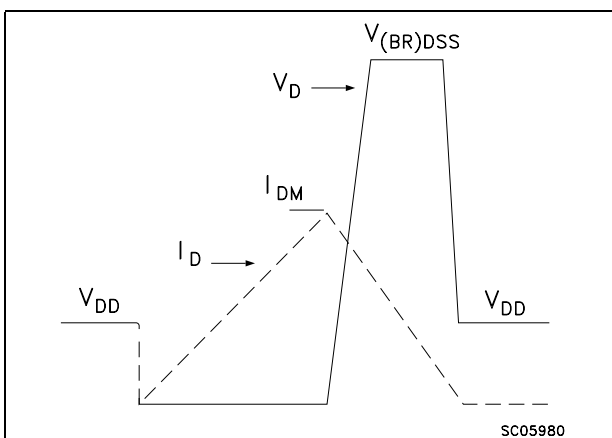
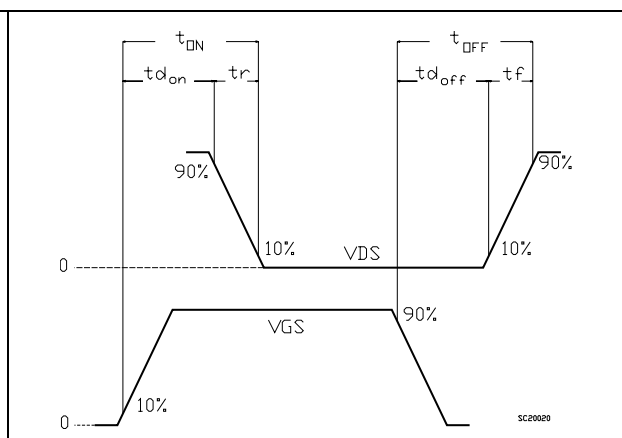


Figure 17. Switching time waveform

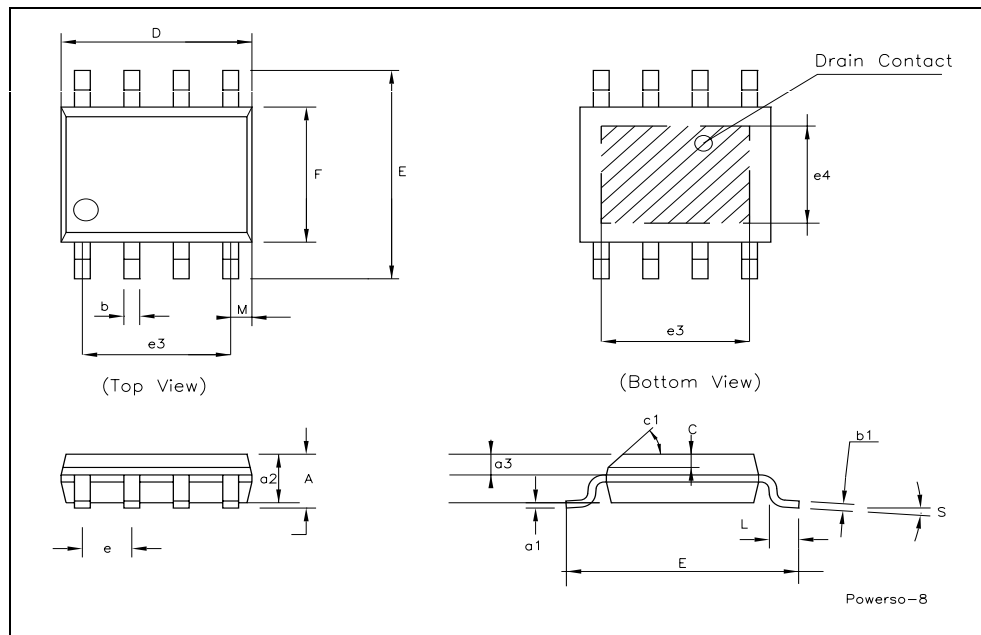


4 Package mechanical data

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

PowerSO-8™ MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|------------|------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.75 | | | 0.068 |
| a1 | 0.1 | | 0.25 | 0.003 | | 0.009 |
| a2 | | | 1.65 | | | 0.064 |
| a3 | 0.65 | | 0.85 | 0.025 | | 0.033 |
| b | 0.35 | | 0.48 | 0.013 | | 0.018 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | 0.25 | | 0.5 | 0.010 | | 0.019 |
| c1 | 45° (typ.) | | | | | |
| D | 4.8 | | 5.0 | 0.188 | | 0.196 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 3.81 | | | 0.150 | |
| e4 | | 2.79 | | | 0.110 | |
| F | 3.8 | | 4.0 | 0.14 | | 0.157 |
| L | 0.4 | | 1.27 | 0.015 | | 0.050 |
| M | | | 0.6 | | | 0.023 |
| S | 8° (max.) | | | | | |



5 Revision history

Table 7. Revision history

| Date | Revision | Changes |
|-------------|----------|------------------------------------------|
| 12-Apr-2006 | 1 | First release |
| 17-May-2007 | 2 | Table 2 has been updated |

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