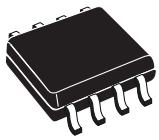
# STS5N15F4

## N-channel 150 V, 0.057Ω, 5 A, SO-8 STripFET™ DeepGATE™ Power MOSFET

## Features

| Type | $V_{DSS}$ | $R_{DS(on)}$ max | $I_D$ |
|---|---|---|---|
| STS5N15F4 | 150 V | < 0.063 Ω | 5 A |

- N-channel enhancement mode
- 100% avalanched rated
- Low gate charge
- Very low on-resistance



SO-8

## Application

- Switching applications

## Description

This STripFET™ DeepGATE™ Power MOSFET technology is among the latest improvements, which have been especially tailored to minimize on-state resistance, with a new gate structure, providing superior switching performances.

**Figure 1. Internal schematic diagram**

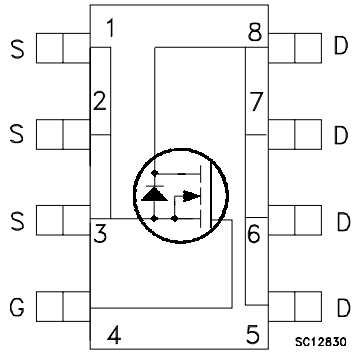



**Table 1. Device summary**

| Order code | Marking | Package | Packaging |
|---|---|---|---|
| STS5N15F4 | 5U15- | SO-8 | Tape and reel |

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DS}$ | Drain-source voltage ($V_{GS}$ = 0) | 150 | V |
| $V_{GS}$ | Gate-source voltage | ± 20 | V |
| $I_D$ | Drain current (continuous) at $T_C$ = 25 °C | 5 | A |
| $I_D$ | Drain current (continuous) at $T_C$=100 °C | 3 | A |
| $I_{DM}$ (1) | Drain current (pulsed) | 20 | A |
| $P_{TOT}$ | Total dissipation at $T_C$ = 25 °C | 2.5 | W |
| $T_{stg}$ | Storage temperature | -55 to 150 | °C |
| $T_j$ | Operating junction temperature | | |

1. Pulse width limited by safe operating area

**Table 3. Thermal data**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{thj\text{-}pcb}$ (1) | Thermal resistance junction-pcb max | 50 | °C/W |

1. When mounted on FR-4 board of 1 inch², 2 oz Cu, t < 10 sec

**Table 4. Avalanche characteristics**

| Symbol | Parameter | Max value | Unit |
|---|---|---|---|
| $I_{AS}$ | Avalanche current, repetitive or not-repetitive (pulse width limited by $T_j$ max) | 5 | A |
| $E_{AS}$ | Single pulse avalanche energy (starting $T_j$ = 25 °C, $I_D$ = $I_{AS}$, $V_{DD}$ = 140 V) | 125 | mJ |

# 2 Electrical characteristics

($T_J$ = 25 °C unless otherwise specified)

**Table 5. On/off states**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $I_D$ = 1 mA, $V_{GS}$= 0 | 150 | | | V |
| $I_{DSS}$ | Zero gate voltage drain current ($V_{GS}$ = 0) | $V_{DS}$ = 150 V,<br>$V_{DS}$ = 150 V, @125 °C | | | 1<br>10 | µA<br>µA |
| $I_{GSS}$ | Gate body leakage current ($V_{DS}$ = 0) | $V_{GS}$ = ±20 V | | | ±100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS}$= $V_{GS}$, $I_D$ = 250 µA | 2 | | 4 | V |
| $R_{DS(on)}$ | Static drain-source on resistance | $V_{GS}$= 10 V, $I_D$= 2.5 A | | 0.057 | 0.063 | Ω |

**Table 6. Dynamic**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$ | Input capacitance<br>Output capacitance<br>Reverse transfer capacitance | $V_{DS}$ =25 V, f = 1 MHz,<br>$V_{GS}$ = 0 | - | 2710<br>180<br>69.5 | - | pF<br>pF<br>pF |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total gate charge<br>Gate-source charge<br>Gate-drain charge | $V_{DD}$ = 75 V, $I_D$ = 5 A<br>$V_{GS}$ =10 V<br>*Figure 14 on page 7* | - | 48<br>10.8<br>13.7 | - | nC<br>nC<br>nC |
| $R_g$ | Gate input resistance | f=1 MHz Gate DC Bias=0<br>Test signal level=20 mV<br>open drain | - | 1.9 | - | Ω |

**Table 7. Switching times**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$<br>$t_r$<br>$t_{d(off)}$<br>$t_f$ | Turn-on delay time<br>Rise time<br>Turn-off delay time<br>Fall time | $V_{DD}$= 75 V, $I_D$= 3 A,<br>$R_G$=4.7 Ω, $V_{GS}$=10 V<br>*Figure 13 on page 7* | - | 13.5<br>5.1<br>39.7<br>11.4 | - | ns<br>ns<br>ns<br>ns |

**Table 8. Source drain diode**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$ | Source-drain current | | - | | 5 | A |
| $I_{SDM}$(1) | Source-drain current (pulsed) | | - | | 20 | A |
| $V_{SD}$(2) | Forward on voltage | $I_{SD}$ = 6 A, $V_{GS}$ = 0 | - | | 1.3 | V |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse recovery time<br>Reverse recovery charge<br>Reverse recovery current | $I_{SD}$ = 6 A,<br>di/dt = 100 A/µs,<br>$V_R$ = 120 V, $T_J$ = 150 °C<br>*Figure 15 on page 7* | - | 85.2<br>277.6<br>8.2 | | ns<br>nC<br>A |

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

## 2.1 Electrical characteristics (curves)

**Figure 2. Safe operating area**

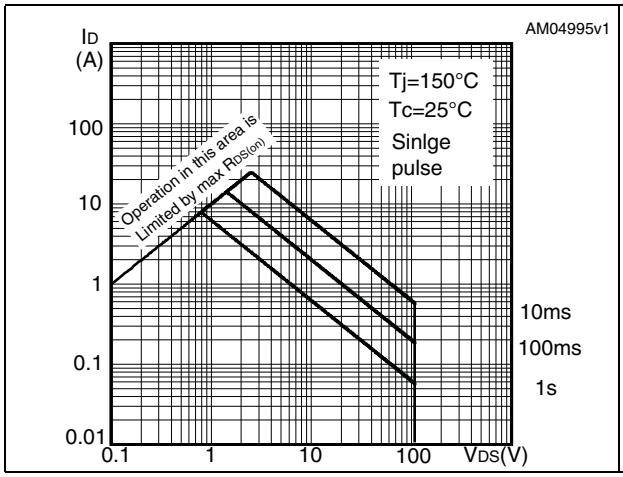



**Figure 3. Thermal impedance**

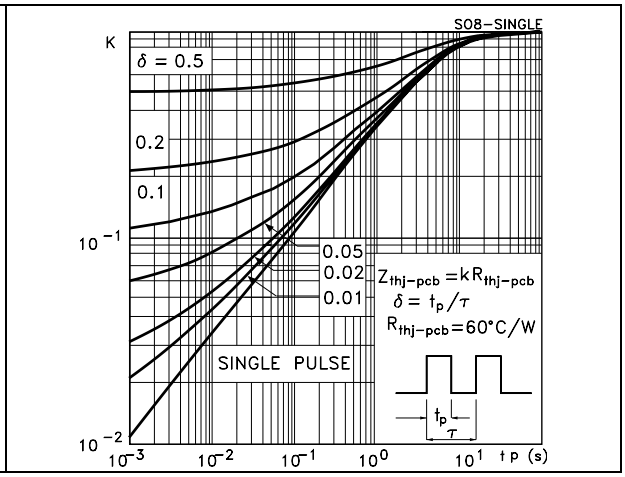



**Figure 4. Output characteristics**

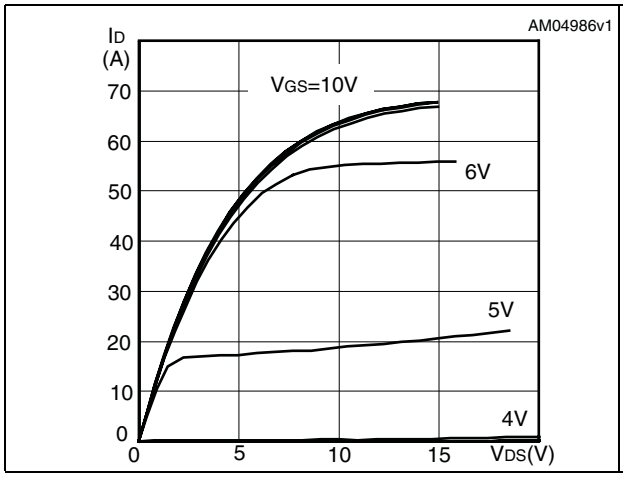



**Figure 5. Transfer characteristics**

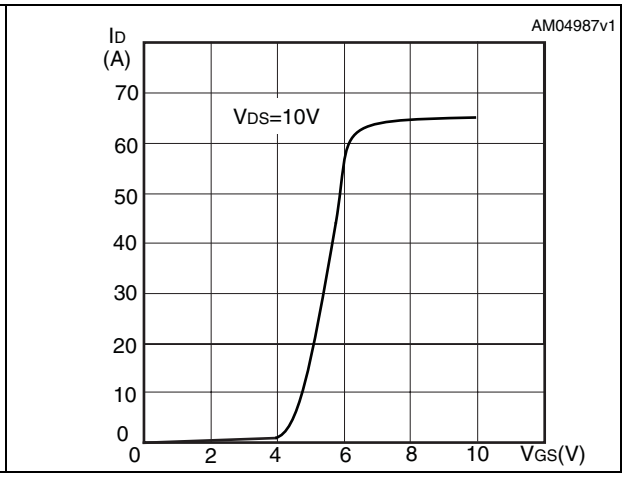



**Figure 6. Normalized $B_{VDSS}$ vs temperature**

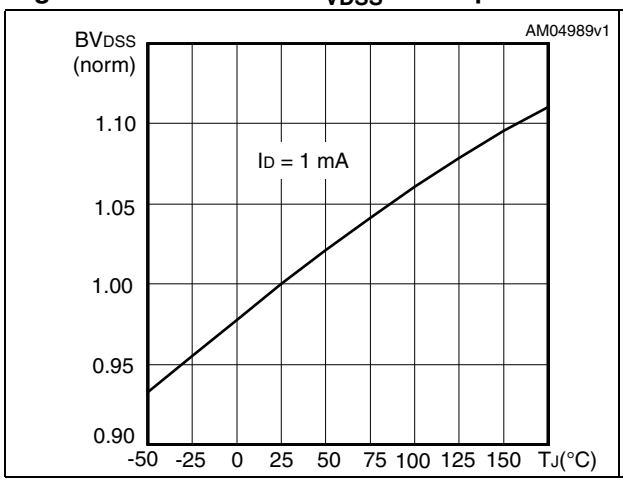



**Figure 7. Static drain-source on resistance**

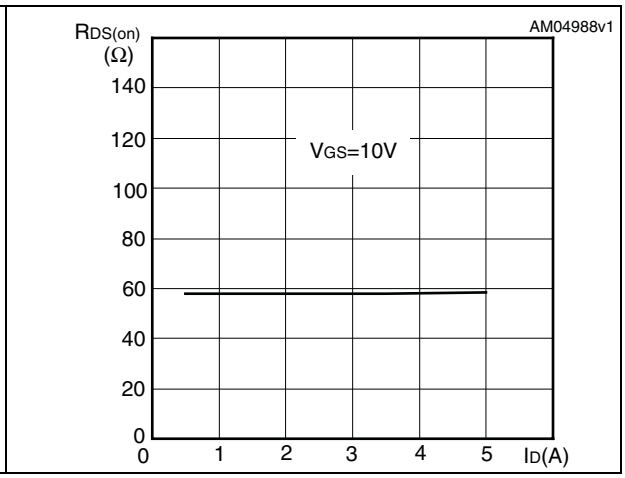


**Figure 8. Gate charge vs gate-source voltage**

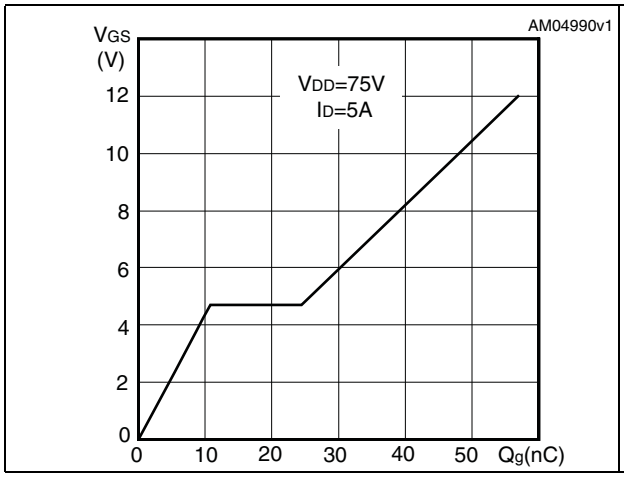



**Figure 9. Capacitance variations**

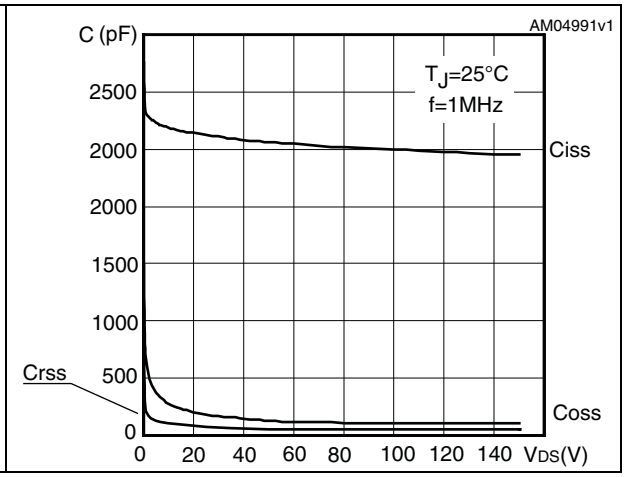



**Figure 10. Normalized gate threshold voltage vs temperature**

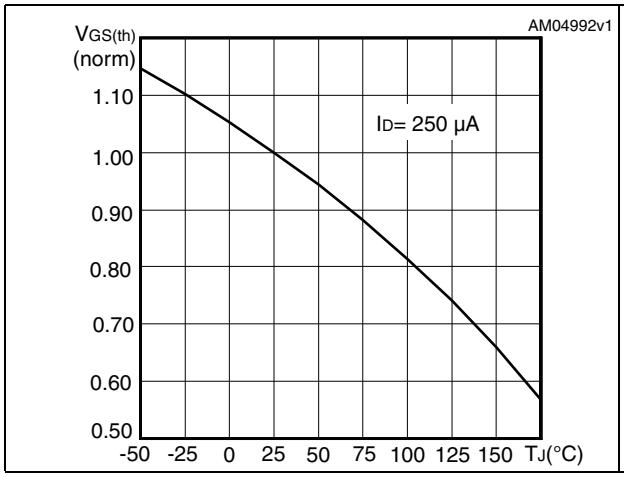



**Figure 11. Normalized on resistance vs temperature**

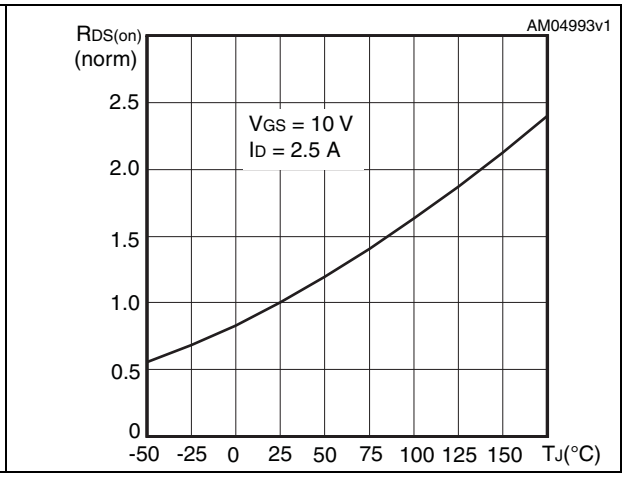
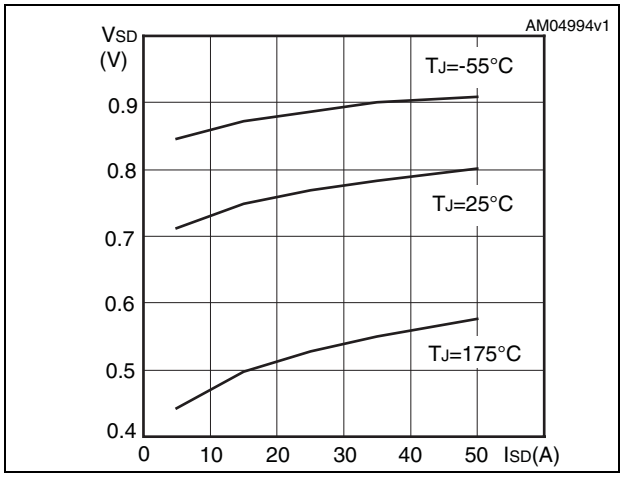



**Figure 12. Source-drain diode forward characteristics**



# 3 Test circuits

**Figure 13. Switching times test circuit for resistive load**

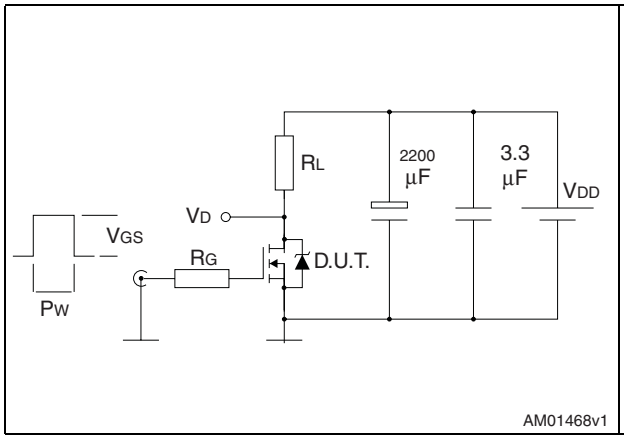



**Figure 14. Gate charge test circuit**

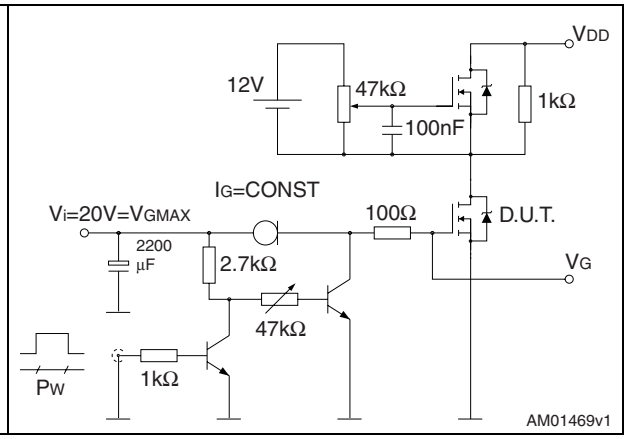



**Figure 15. Test circuit for inductive load switching and diode recovery times**

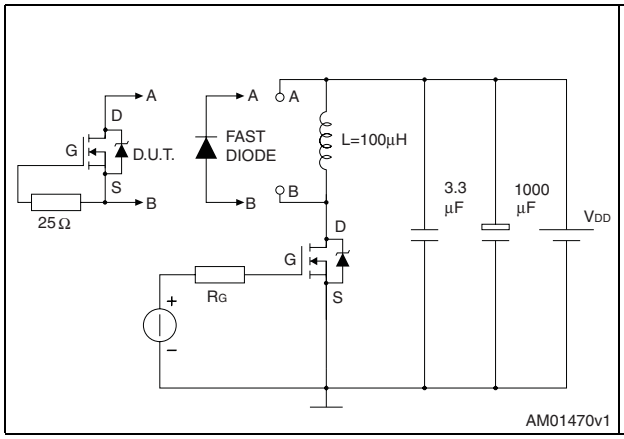



**Figure 16. Unclamped inductive load test circuit**

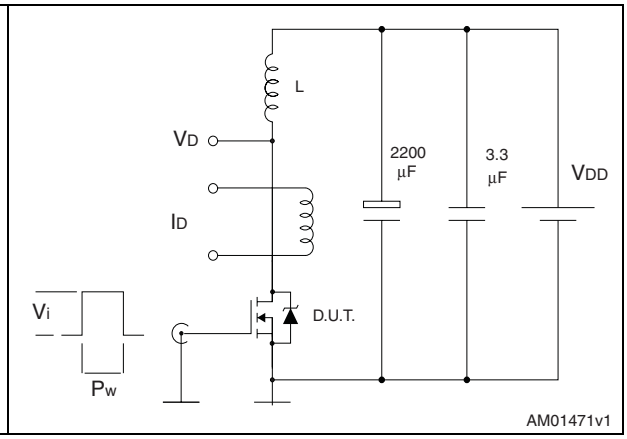



**Figure 17. Unclamped inductive waveform**

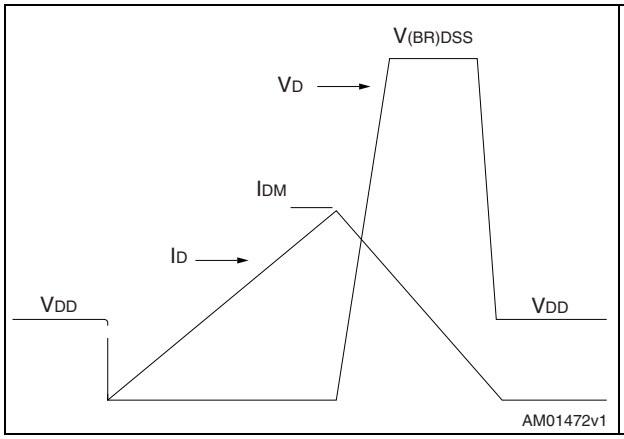
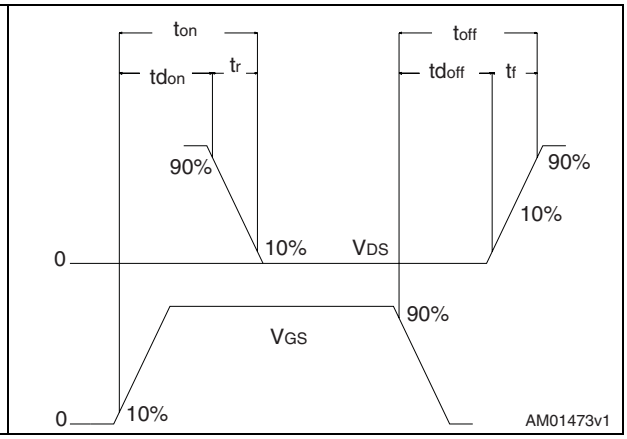



**Figure 18. Switching time waveform**

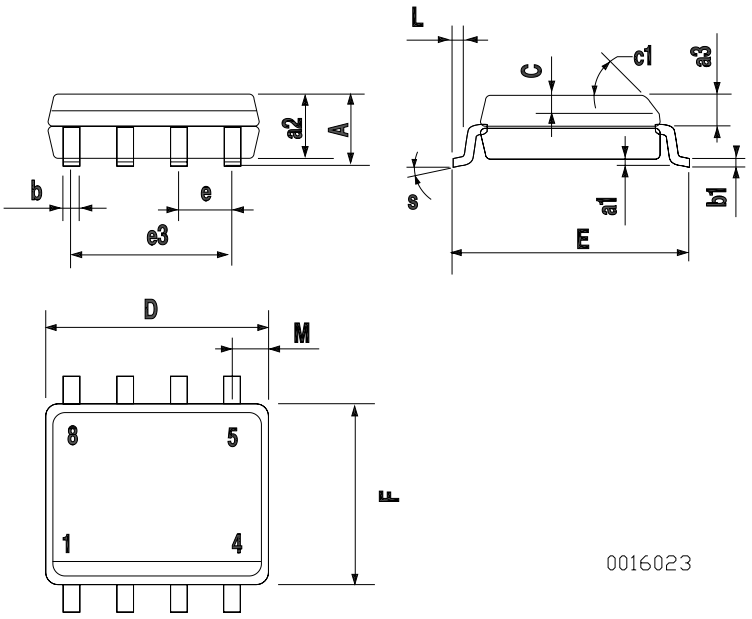


# 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

## SO-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 | |
| 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 9. Document revision history

| Date | Revision | Changes |
|---|---|---|
| 23-Jul-2009 | 1 | First release |
| 03-Aug-2009 | 2 | Updated figures *6*, *7*, *10* and *11* |

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