# STS14N3LLH5

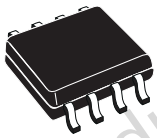
## N-channel 30 V, 0.005 Ω, 14 A, SO-8 STripFET™ V Power MOSFET

## Features

| Type | $V_{DSS}$ | $R_{DS(on)}$ | $I_D$ |
|---|---|---|---|
| STS14N3LLH5 | 30 V | <0.006 Ω | 14 A (1) |

1. The value is rated according $R_{thj\text{-}pcb}$

- $R_{DS(on)}$ * $Q_g$ industry benchmark
- Extremely low on-resistance $R_{DS(on)}$
- Very low switching gate charge
- High avalanche ruggedness
- Low gate drive power losses



SO-8

## Application

- Switching applications

## Description

This product utilizes the 5th generation of design rules of ST's proprietary STripFET™ technology. The lowest available $R_{DS(on)}$*$Q_g$, in SO-8 package, makes this device suitable for the most demanding DC-DC converter applications, where high power density is to be achieved.

**Figure 1. Internal schematic diagram**

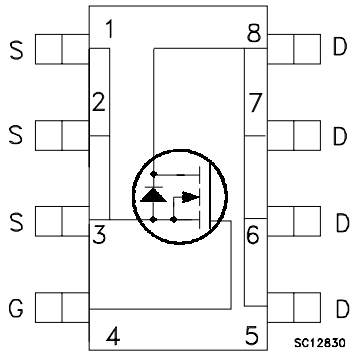



**Table 1. Device summary**

| Order code | Marking | Package | Packaging |
|---|---|---|---|
| STS14N3LLH5 | 14D3L | SO-8 | Tape and reel |

# Contents

# 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 | ± 22 | V |
| $I_D$ (1) | Drain current (continuous) at $T_C$ = 25 °C | 14 | A |
| $I_D$ (1) | Drain current (continuous) at $T_C$=100 °C | 8.75 | A |
| $I_{DM}$ (2) | Drain current (pulsed) | 56 | A |
| $P_{TOT}$ (2) | Total dissipation at $T_C$ = 25 °C | 2.7 | W |
| | Derating factor | 0.02 | W/°C |
| $T_J$<br>$T_{stg}$ | Operating junction temperature<br>Storage temperature | -55 to 150 | °C |

1. The value is rated according $R_{thj\text{-}pcb}$
2. Pulse width limited by safe operating area

**Table 3. Thermal resistance**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{thj\text{-}pcb}$ (1) | Thermal resistance junction-ambient | 47 | °C/W |

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

**Table 4. Avalanche data**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $I_{AV}$ | Not-repetitive avalanche current,<br>(pulse width limited by Tj Max) | 8.5 | A |
| $E_{AS}$ | Single pulse avalanche energy<br>(starting $T_J$ = 25 °C, $I_D$ = $I_{AV}$ , $V_{DD}$ = 24 V) | 180 | mJ |

# 2 Electrical characteristics

($T_{CASE}$=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 | $I_D$ = 250 µA, $V_{GS}$= 0 | 30 | | | V |
| $I_{DSS}$ | Zero gate voltage drain current ($V_{GS}$ = 0) | $V_{DS}$ = max rating,<br>$V_{DS}$ =max rating @125 °C | | | 1<br>10 | µA<br>µA |
| $I_{GSS}$ | Gate body leakage current ($V_{DS}$ = 0) | $V_{GS}$ = ±22 V | | | ±100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS}$= $V_{GS}$, $I_D$ = 250 µA | 1 | | | V |
| $R_{DS(on)}$ | Static drain-source on resistance | $V_{GS}$= 10 V, $I_D$= 7 A<br>$V_{GS}$= 4.5 V, $I_D$= 7 A | | 0.005<br>0.0062 | 0.006<br>0.0077 | Ω<br>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, $V_{GS}$=0 | - | 1500<br>295<br>39 | | pF<br>pF<br>pF |
| $R_G$ | Intrinsic gate resistance | f = 1 MHz open drain | | 1 | 1.25 | Ω |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total gate charge<br>Gate-source charge<br>Gate-drain charge | $V_{DD}$=15 V, $I_D$ = 14 A<br>$V_{GS}$= 4.5 V<br>*(see Figure 14)* | - | 12<br>4<br>4.7 | 14.5 | nC<br>nC<br>nC |

**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 | $V_{DD}$=15 V, $I_D$= 7 A,<br>$R_G$=4.7 Ω, $V_{GS}$ =10 V<br>*(see Figure 13)* | - | 9.3<br>14.5<br>22.7<br>4.5 | - | 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 | | - | | 14 | A |
| $I_{SDM}$(1) | Source-drain current (pulsed) | | - | | 56 | A |
| $V_{SD}$(2) | Forward on voltage | $I_{SD}$ = 14 A, $V_{GS}$=0 | - | | 1.1 | V |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse recovery time<br>Reverse recovery charge<br>Reverse recovery current | $I_{SD}$ = 14 A,<br>di/dt = 100 A/µs,<br>$V_{DD}$= 25 V, Tj=150 °C | - | 25<br>17.5<br>1.4 | | 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**

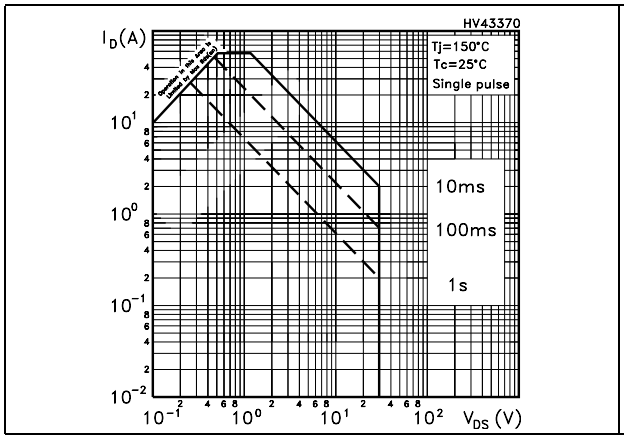



**Figure 3. Thermal impedance**

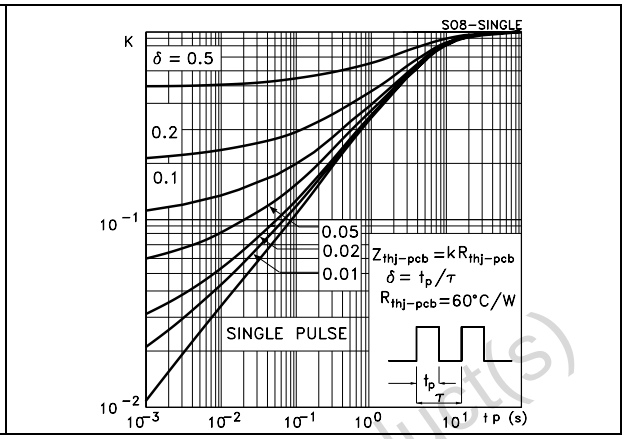



**Figure 4. Output characteristics**

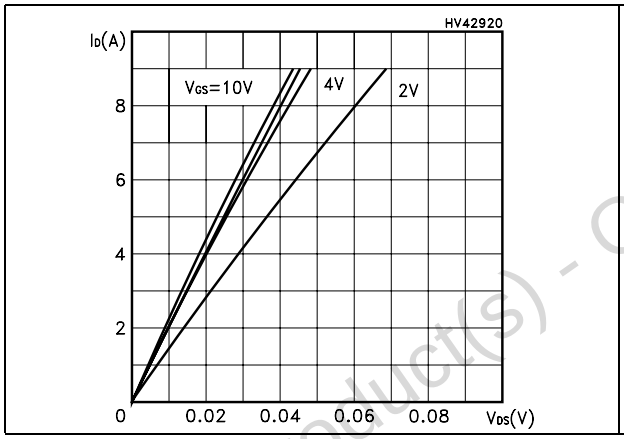



**Figure 5. Transfer characteristics**

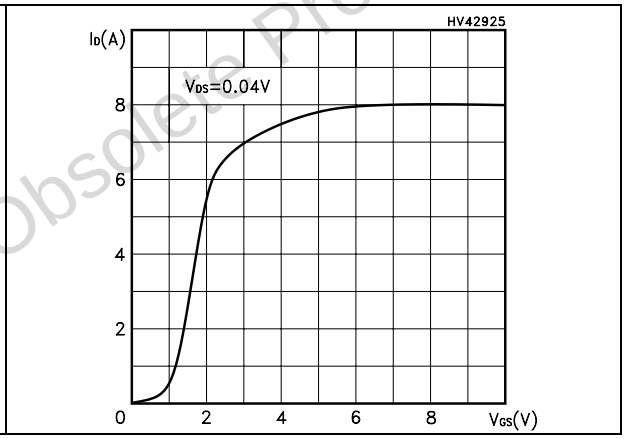



**Figure 6. Normalized $B_{VDSS}$ vs temperature**

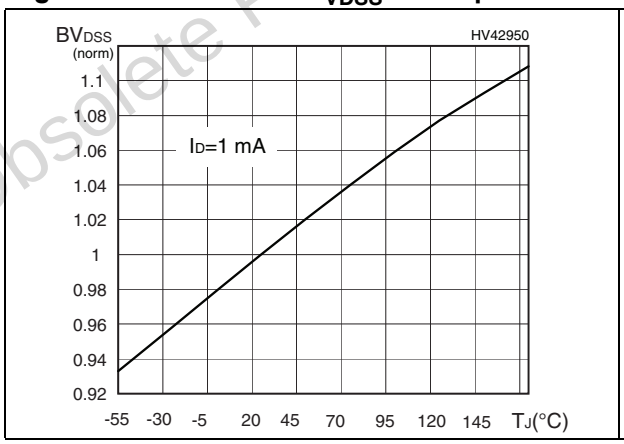



**Figure 7. Static drain-source on resistance**

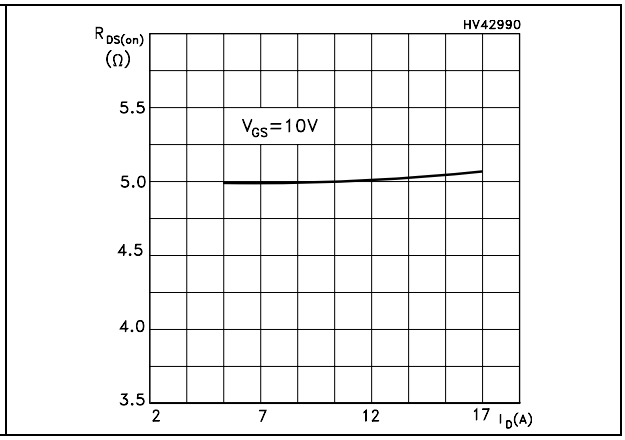


**Figure 8. Gate charge vs gate-source voltage**

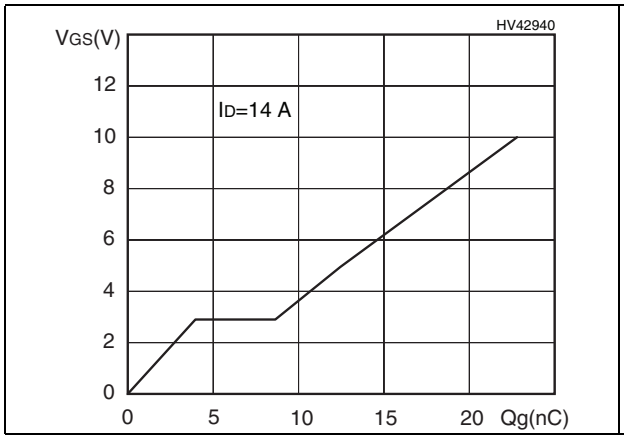



**Figure 9. Capacitance variations**

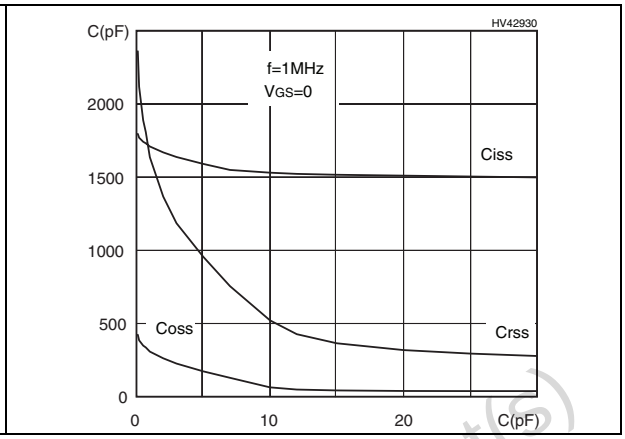



**Figure 10. Normalized gate threshold voltage vs temperature**

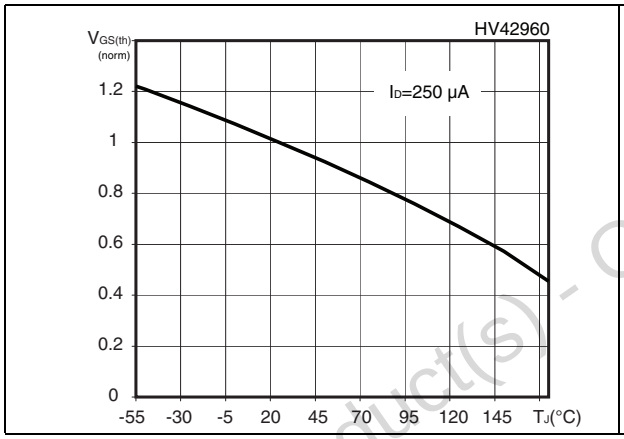



**Figure 11. Normalized on resistance vs temperature**

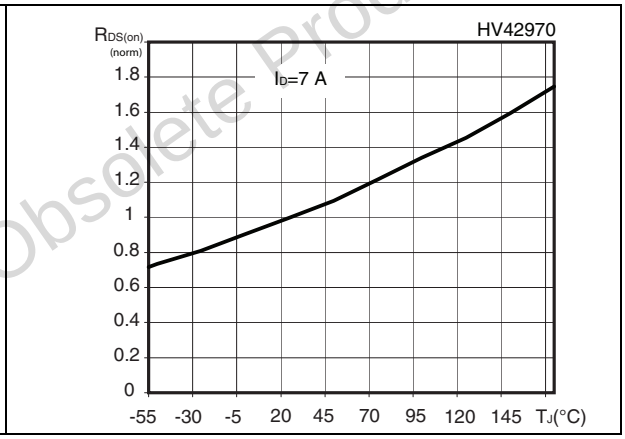
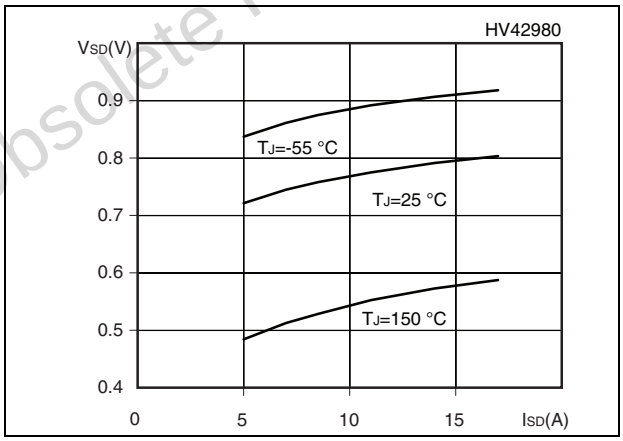



**Figure 12. Source-drain diode forward characteristics**



# 3 Test circuits

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

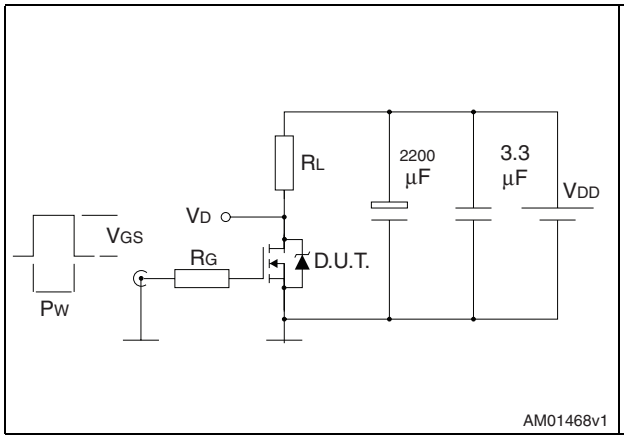



**Figure 14. Gate charge test circuit**

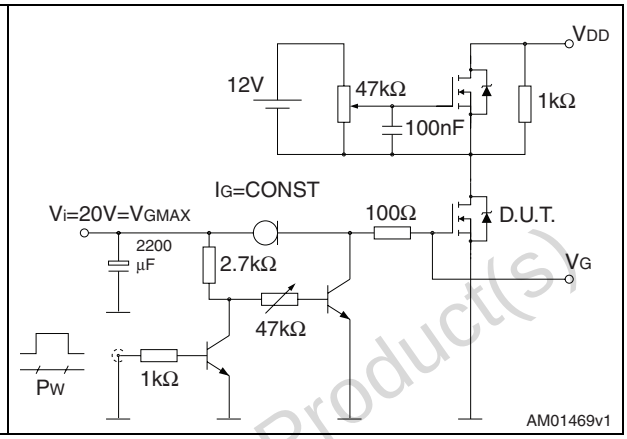



**Figure 15. Test circuit for inductive load switching and diode recovery times**

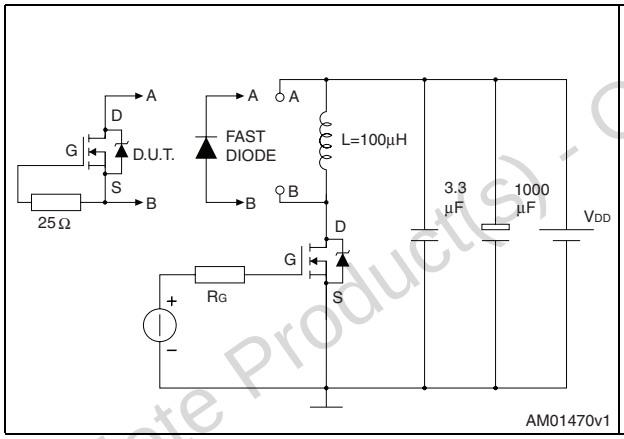



**Figure 16. Unclamped inductive load test circuit**

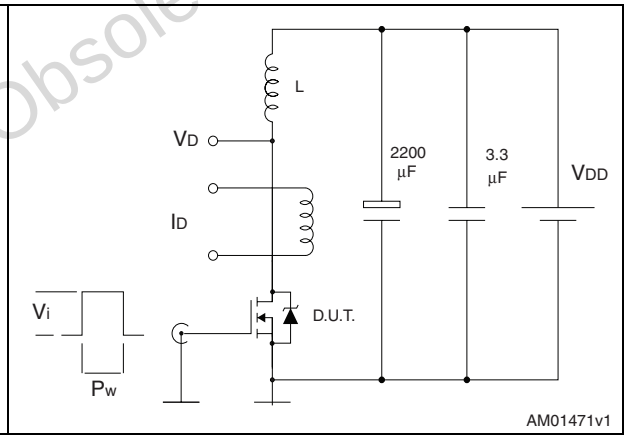



**Figure 17. Unclamped inductive waveform**

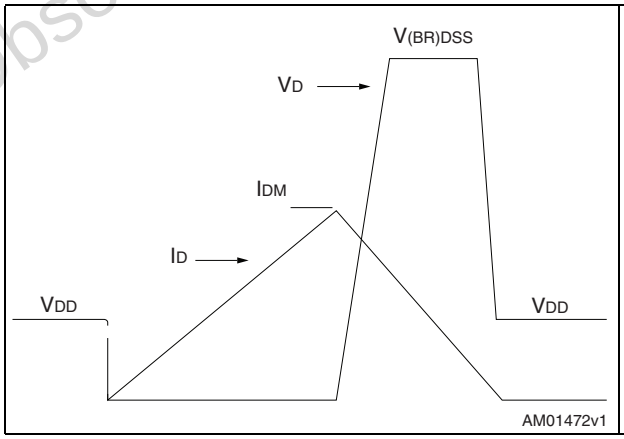
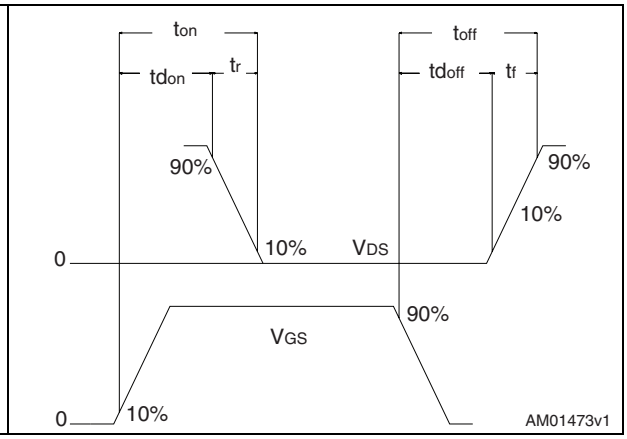



**Figure 18. Switching time waveform**

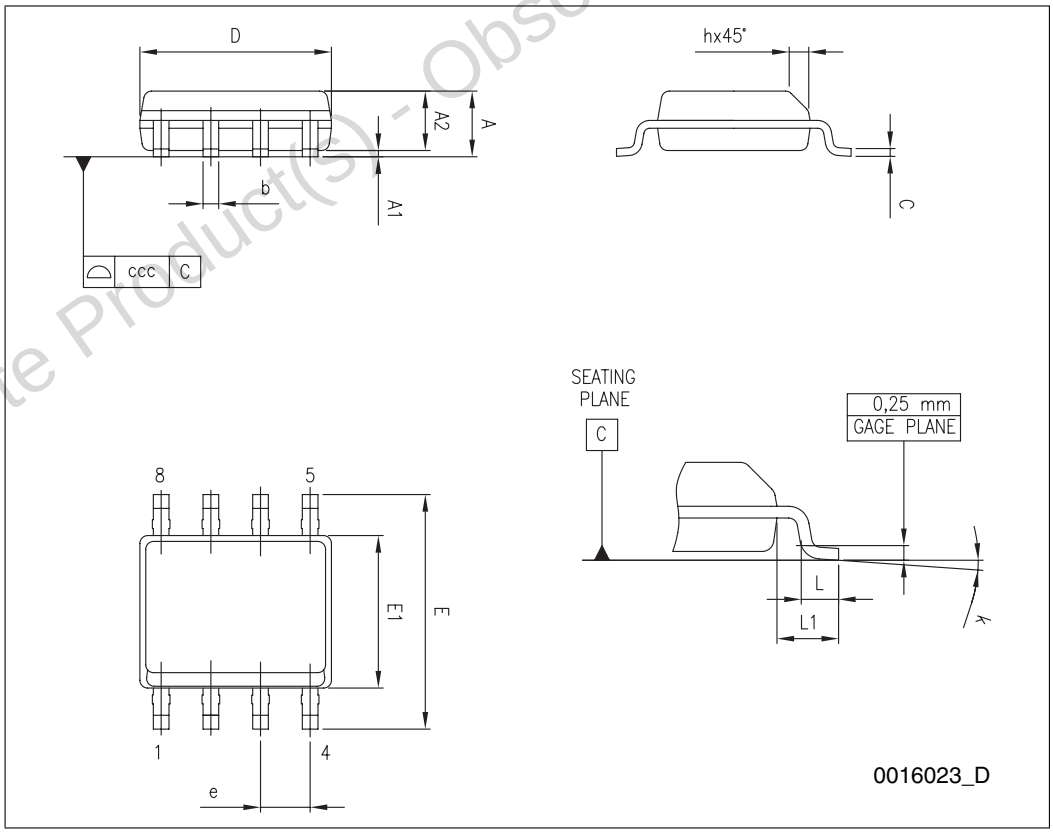


# 4 Package mechanical data

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 | | |
|---|---|---|---|
| | Min. | Typ. | Max. |
| A | | | 1.75 |
| A1 | 0.10 | | 0.25 |
| A2 | 1.25 | | |
| b | 0.28 | | 0.48 |
| c | 0.17 | | 0.23 |
| D | 4.80 | 4.90 | 5.00 |
| E | 5.80 | 6.00 | 6.20 |
| E1 | 3.80 | 3.90 | 4.00 |
| e | | 1.27 | |
| h | 0.25 | | 0.50 |
| L | 0.40 | | 1.27 |
| L1 | | 1.04 | |
| k | 0° | | 8° |
| ccc | | | 0.10 |



# 5 Revision history

**Table 9. Document revision history**

| Date | Revision | Changes |
|---|---|---|
| 12-Nov-2007 | 1 | First release |
| 15-Apr-2008 | 2 | – Updated *Figure 1: Internal schematic diagram*<br>– Document status promoted from preliminary data to datasheet. |
| 23-Sep-2008 | 3 | $V_{GS}$ value has been changed on *Table 2* and *Table 5* |
| 19-Nov-2009 | 4 | – Added $Q_g$ max. value in *Table 6*<br>– Added new row in *Table 6* |