



# STS12N3LLH5

N-channel 30 V, 0.0068  $\Omega$ , 12 A, SO-8  
STripFET™ V Power MOSFET

Datasheet — production data

## Features

| Type        | V <sub>DSS</sub> | R <sub>DS(on)</sub><br>max | I <sub>D</sub>      |
|-------------|------------------|----------------------------|---------------------|
| STS12N3LLH5 | 30 V             | < 0.0075 $\Omega$          | 12 A <sup>(1)</sup> |

1. The value is rated according to R<sub>thj-pcb</sub>

- R<sub>DS(on)</sub> \* Q<sub>g</sub> industry benchmark
- Extremely low on-resistance R<sub>DS(on)</sub>
- Very low switching gate charge
- High avalanche ruggedness
- Low gate drive power losses

## Application

- Switching applications

## Description

This device is an N-channel Power MOSFET developed using STMicroelectronics' STripFET™V technology. The device has been optimized to achieve very low on-state resistance, contributing to an FOM that is among the best in its class.

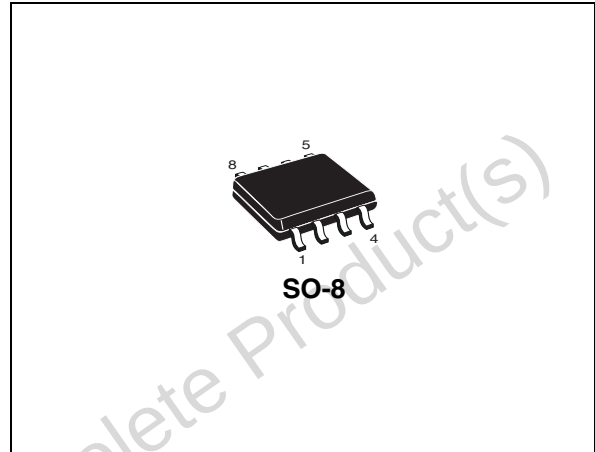


Figure 1. Internal schematic diagram

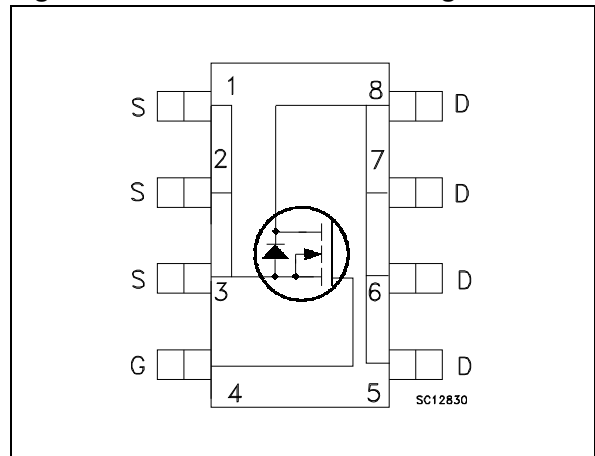


Table 1. Device summary

| Order code  | Marking | Package | Packaging     |
|-------------|---------|---------|---------------|
| STS12N3LLH5 | 12D3L   | SO-8    | Tape and reel |

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Obsolete Product(s) - Obsolete Product(s)



# 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/-20    | V                     |
| $I_D^{(1)}$        | Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$  | 12         | A                     |
| $I_D^{(1)}$        | Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$ | 8.75       | A                     |
| $I_{DM}^{(2)}$     | Drain current (pulsed)                                            | 48         | A                     |
| $P_{TOT}^{(2)}$    | Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$           | 2.7        | W                     |
|                    | Derating factor                                                   | 0.02       | W/ $^{\circ}\text{C}$ |
| $T_J$<br>$T_{stg}$ | Operating junction temperature<br>Storage temperature             | -55 to 150 | $^{\circ}\text{C}$    |

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

**Table 3. Thermal resistance**

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

1. When mounted on FR-4 board of 1inch<sup>2</sup>, 2oz Cu,  $t < 10\text{sec}$

## 2 Electrical characteristics

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

**Table 4. On/off states**

| Symbol        | Parameter                                        | Test conditions                                                                                 | Min. | Typ.             | Max.             | Unit                           |
|---------------|--------------------------------------------------|-------------------------------------------------------------------------------------------------|------|------------------|------------------|--------------------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage                   | $I_D = 250\ \mu\text{A}$ , $V_{GS} = 0$                                                         | 30   |                  |                  | V                              |
| $I_{DSS}$     | Zero gate voltage drain current ( $V_{GS} = 0$ ) | $V_{DS} = \text{max rating}$ ,<br>$V_{DS} = \text{max rating @ } 125^{\circ}\text{C}$           |      |                  | 1<br>10          | $\mu\text{A}$<br>$\mu\text{A}$ |
| $I_{GSS}$     | Gate body leakage current ( $V_{DS} = 0$ )       | $V_{GS} = +22/-20\ \text{V}$                                                                    |      |                  | $\pm 100$        | nA                             |
| $V_{GS(th)}$  | Gate threshold voltage                           | $V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$                                                    | 1    |                  |                  | V                              |
| $R_{DS(on)}$  | Static drain-source on-resistance                | $V_{GS} = 10\ \text{V}$ , $I_D = 6\ \text{A}$<br>$V_{GS} = 4.5\ \text{V}$ , $I_D = 6\ \text{A}$ |      | 0.0068<br>0.0084 | 0.0075<br>0.0092 | $\Omega$<br>$\Omega$           |

**Table 5. Dynamic**

| Symbol    | Parameter                    | Test conditions                                                 | Min. | Typ. | Max. | Unit |
|-----------|------------------------------|-----------------------------------------------------------------|------|------|------|------|
| $C_{iss}$ | Input capacitance            | $V_{DS} = 25\ \text{V}$ , $f = 1\ \text{MHz}$ ,<br>$V_{GS} = 0$ | -    | 1290 |      | pF   |
| $C_{oss}$ | Output capacitance           |                                                                 |      | 240  |      | pF   |
| $C_{rss}$ | Reverse transfer capacitance |                                                                 |      | 32   |      | pF   |
| $Q_g$     | Total gate charge            | $V_{DD} = 15\ \text{V}$ , $I_D = 12\ \text{A}$                  | -    | 8    |      | nC   |
| $Q_{gs}$  | Gate-source charge           | $V_{GS} = 4.5\ \text{V}$                                        |      | 3.6  |      | nC   |
| $Q_{gd}$  | Gate-drain charge            | <a href="#">Figure 14</a>                                       |      | 3.4  |      | nC   |

**Table 6. Switching times**

| Symbol       | Parameter           | Test conditions                                                                                                               | Min. | Typ. | Max. | Unit |
|--------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $t_{d(on)}$  | Turn-on delay time  | $V_{DD} = 15\ \text{V}$ , $I_D = 6\ \text{A}$ ,<br>$R_G = 4.7\ \Omega$ , $V_{GS} = 10\ \text{V}$<br><a href="#">Figure 13</a> | -    | 8.6  |      | ns   |
| $t_r$        | Rise time           |                                                                                                                               |      | 11.2 |      | ns   |
| $t_{d(off)}$ | Turn-off delay time |                                                                                                                               |      | 32.4 | -    | ns   |
| $t_f$        | Fall time           |                                                                                                                               |      | 6    |      | ns   |

**Table 7. Source drain diode**

| Symbol          | Parameter                     | Test conditions                                            | Min | Typ. | Max | Unit |
|-----------------|-------------------------------|------------------------------------------------------------|-----|------|-----|------|
| $I_{SD}$        | Source-drain current          |                                                            | -   |      | 12  | A    |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) |                                                            | -   |      | 48  | A    |
| $V_{SD}^{(2)}$  | Forward on voltage            | $I_{SD} = 12\text{ A}$ , $V_{GS}=0$                        | -   |      | 1.1 | V    |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 12\text{ A}$ ,                                   |     | 22   |     | ns   |
| $Q_{rr}$        | Reverse recovery charge       | $di/dt = 100\text{ A}/\mu\text{s}$ ,                       | -   | 15   |     | nC   |
| $I_{RRM}$       | Reverse recovery current      | $V_{DD} = 25\text{ V}$ , $T_J = 150\text{ }^\circ\text{C}$ |     | 1.4  |     | A    |

1. Pulse width limited by safe operating area

2. Pulsed: pulse duration=300 $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

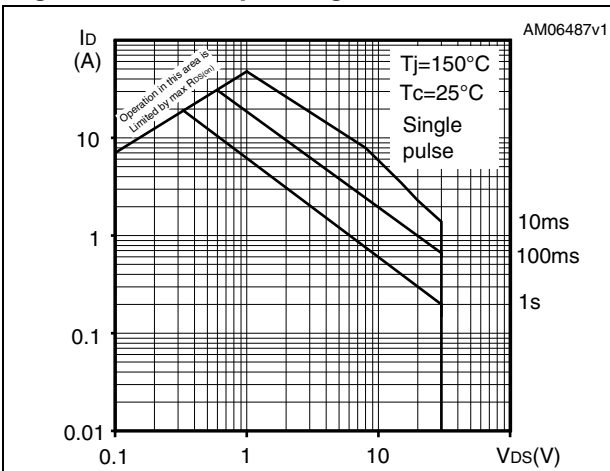


Figure 3. Thermal impedance

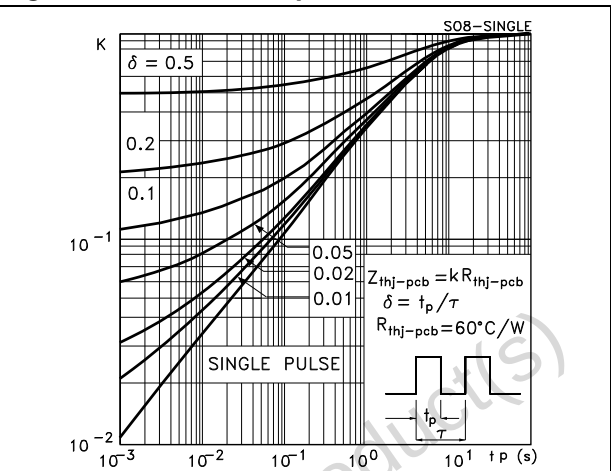


Figure 4. Output characteristics

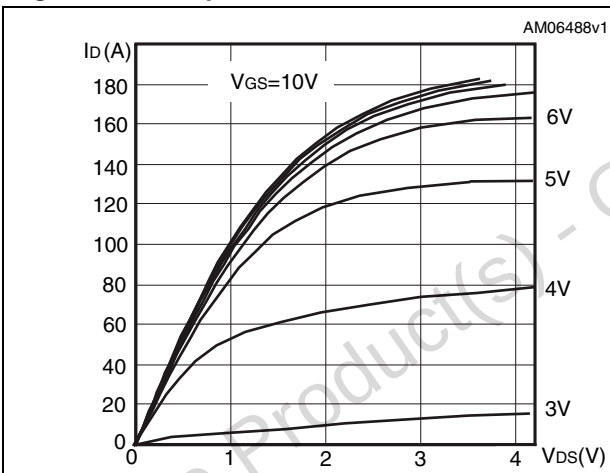


Figure 5. Transfer characteristics

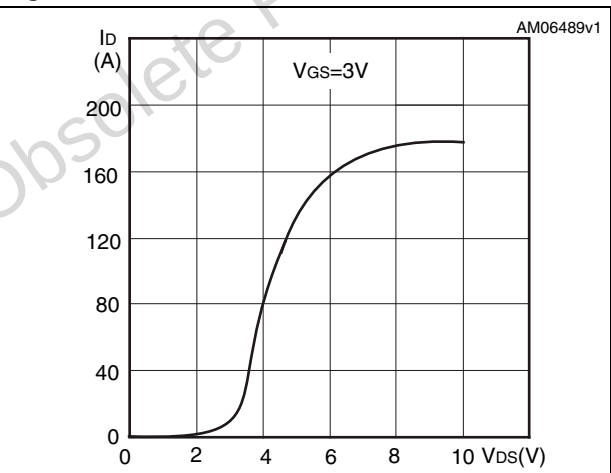


Figure 6. Normalized  $B_{V_{DS}}$  vs temperature

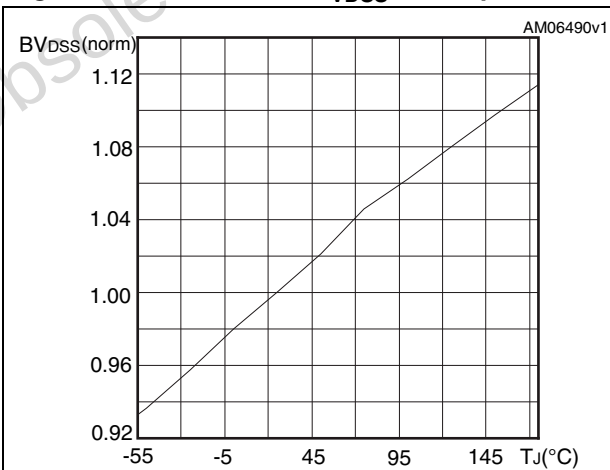


Figure 7. Static drain-source on-resistance

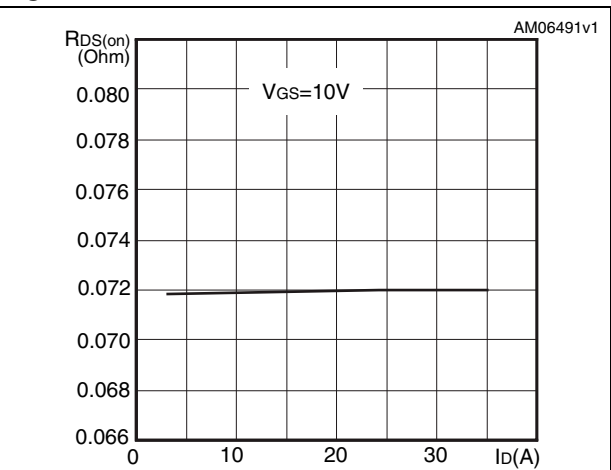


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

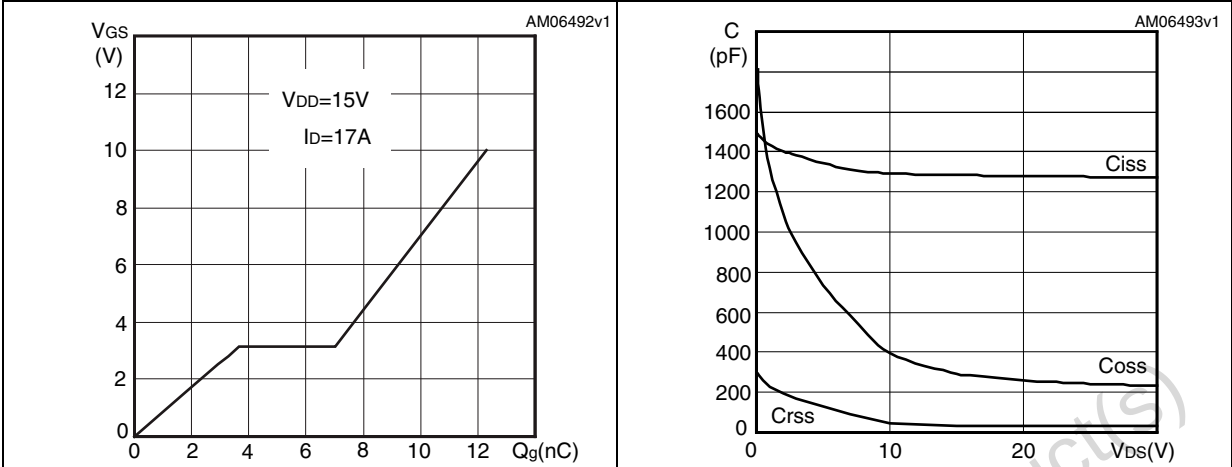


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on-resistance vs temperature

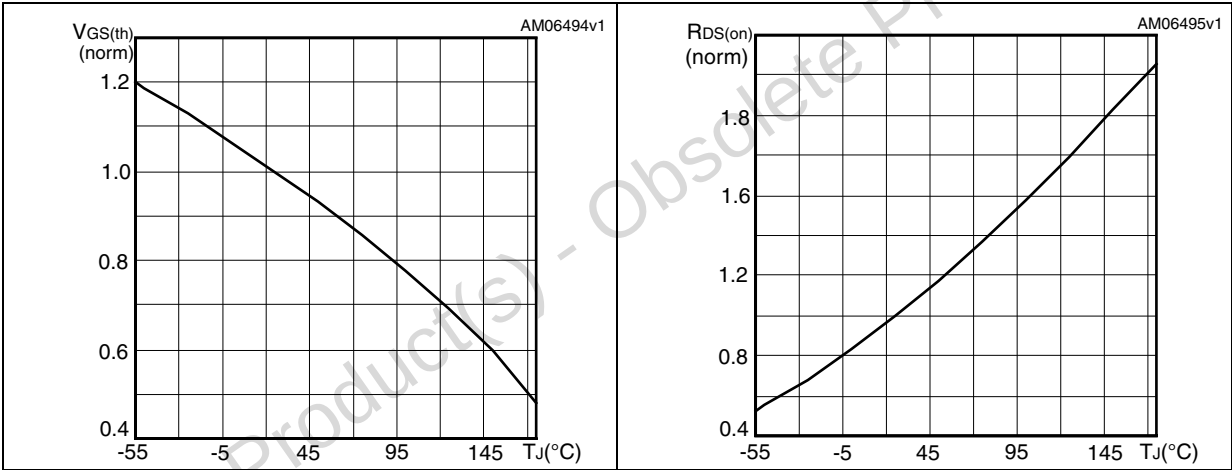
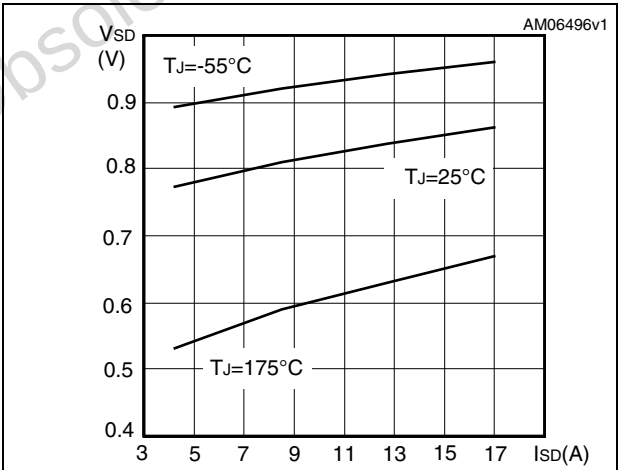
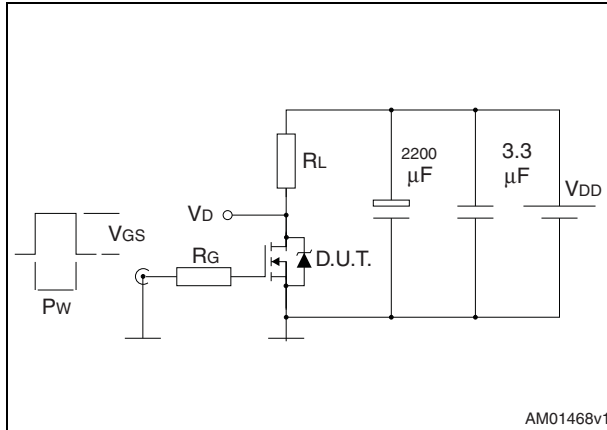


Figure 12. Source-drain diode forward characteristics

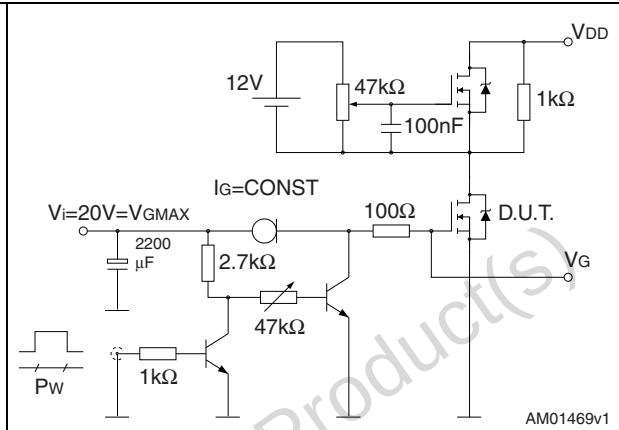


### 3 Test circuits

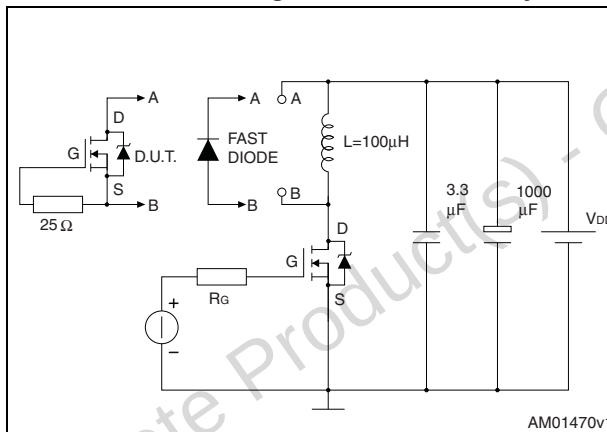
**Figure 13. Switching times test circuit for resistive load**



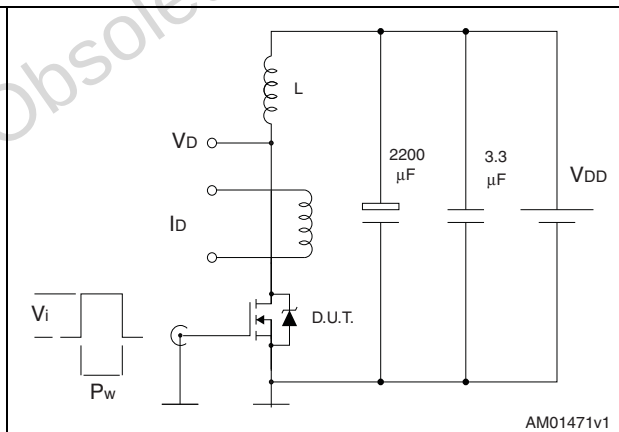
**Figure 14. Gate charge test circuit**



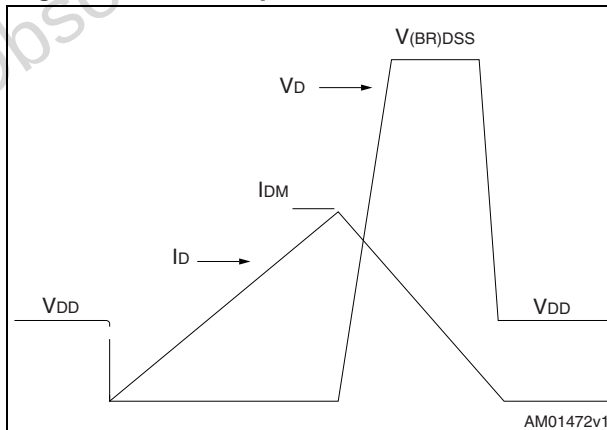
**Figure 15. Test circuit for inductive load switching and diode recovery times**



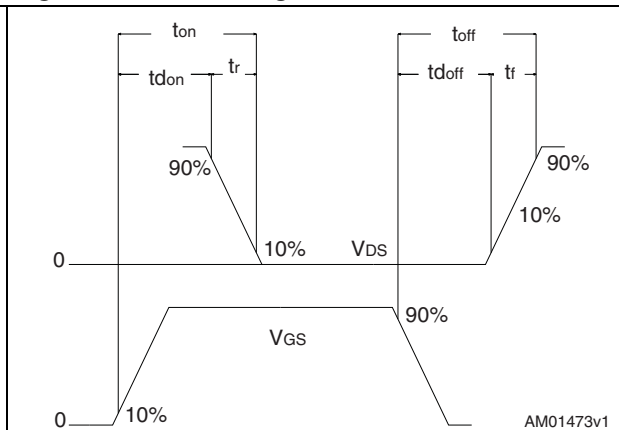
**Figure 16. Unclamped inductive load test circuit**



**Figure 17. Unclamped inductive waveform**



**Figure 18. Switching time waveform**



## 4 Package mechanical data

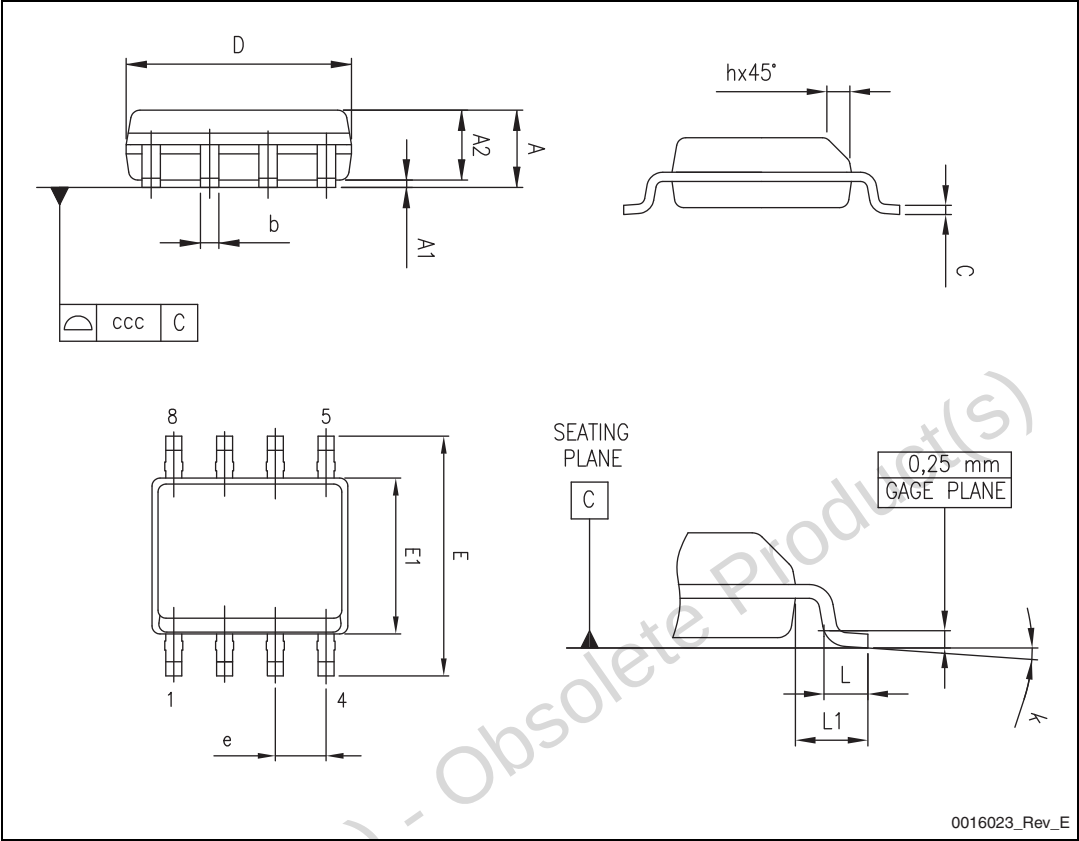
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Table 8. SO-8 mechanical data

| 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 |

Figure 19. SO-8 drawing



## 5 Revision history

**Table 9. Document revision history**

| Date        | Revision | Changes                                                                                                                    |
|-------------|----------|----------------------------------------------------------------------------------------------------------------------------|
| 19-Feb-2010 | 1        | First release.                                                                                                             |
| 01-Jul-2011 | 2        | Datasheet status promoted from preliminary data to datasheet.<br>Modified: <a href="#">Table 2</a> and <a href="#">4</a> . |
| 07-Jun-2012 | 3        | Updated mechanical data.<br>Minor text changes.                                                                            |

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