



## N-channel 100 V, 0.065 $\Omega$ typ., 4 A STripFET™ II Power MOSFET in SO-8 package

Datasheet — production data

### Features

| Order code | V <sub>DS</sub> | R <sub>DS(on)</sub> max | I <sub>D</sub> |
|------------|-----------------|-------------------------|----------------|
| STS4NF100  | 100 V           | 0.070 $\Omega$          | 4 A            |

- Exceptional dv/dt capability
- 100 % avalanche tested
- Application oriented characterization

### Applications

- Switching applications

### Description

This Power MOSFET has been developed using STMicroelectronics' unique STripFET process, which is specifically designed to minimize input capacitance and gate charge. This renders the device suitable for use as primary switch in advanced high-efficiency isolated DC-DC converters for telecom and computer applications, and applications with low gate charge driving requirements.

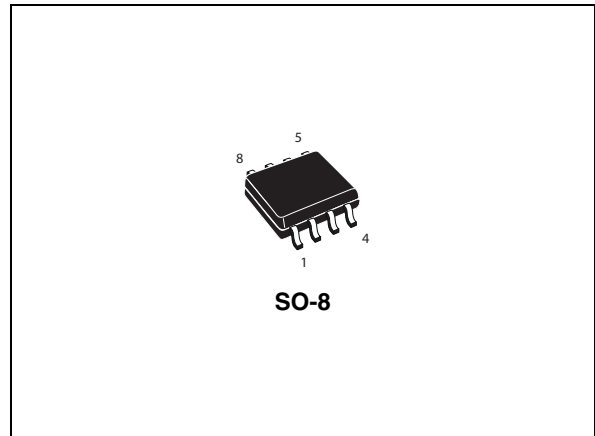


Figure 1. Internal schematic diagram

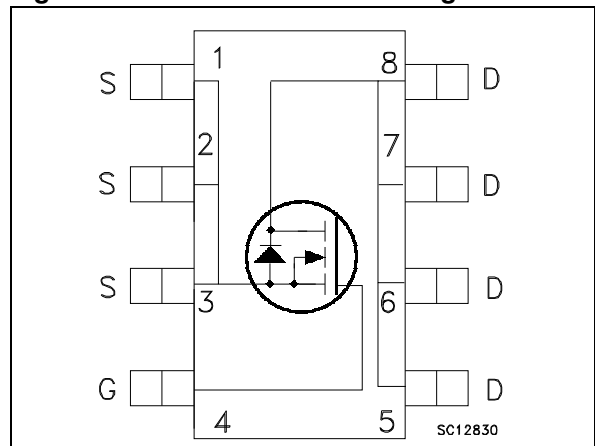


Table 1. Device summary

| Order code | Marking | Package | Packaging     |
|------------|---------|---------|---------------|
| STS4NF100  | 4NF100  | SO-8    | Tape and reel |

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol         | Parameter                                               | Value      | Unit             |
|----------------|---------------------------------------------------------|------------|------------------|
| $V_{DS}$       | Drain-source voltage                                    | 100        | V                |
| $V_{GS}$       | Gate- source voltage                                    | $\pm 20$   | V                |
| $I_D$          | Drain current (continuous) at $T_C = 25^\circ\text{C}$  | 4          | A                |
| $I_D$          | Drain current (continuous) at $T_C = 100^\circ\text{C}$ | 2.5        | A                |
| $I_{DM}^{(1)}$ | Drain current (pulsed)                                  | 16         | A                |
| $P_{TOT}$      | Total dissipation at $T_{amb} = 25^\circ\text{C}$       | 2.5        | W                |
| $T_J$          | Max. operating junction temperature                     | -55 to 150 | $^\circ\text{C}$ |
| $T_{stg}$      | Storage temperature                                     |            | $^\circ\text{C}$ |

1. Pulse width limited by safe operating area

**Table 3. Thermal data**

| Symbol      | Parameter                                              | Value | Unit               |
|-------------|--------------------------------------------------------|-------|--------------------|
| $R_{thj-a}$ | Thermal resistance junction-ambient max <sup>(1)</sup> | 50    | $^\circ\text{C/W}$ |

1. Mounted on FR-4 board (t 10 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                   | $I_D = 250\ \mu\text{A}$ , $V_{GS} = 0$                                          | 100  |       |           | V                              |
| $I_{DSS}$     | Zero gate voltage drain current ( $V_{GS} = 0$ ) | $V_{DS} = 100\ \text{V}$<br>$V_{DS} = 100\ \text{V}$ , $T_C=125^{\circ}\text{C}$ |      |       | 1<br>10   | $\mu\text{A}$<br>$\mu\text{A}$ |
| $I_{GSS}$     | Gate-body leakage current ( $V_{DS} = 0$ )       | $V_{GS} = \pm 20\ \text{V}$                                                      |      |       | $\pm 100$ | nA                             |
| $V_{GS(th)}$  | Gate threshold voltage                           | $V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$                                     | 2    | 3     | 4         | V                              |
| $R_{DS(on)}$  | Static drain-source on-resistance                | $V_{GS} = 10\ \text{V}$ , $I_D = 2\ \text{A}$                                    |      | 0.065 | 0.070     | $\Omega$                       |

**Table 5. Dynamic**

| Symbol         | Parameter                    | Test conditions                                                            | Min. | Typ. | Max. | Unit |
|----------------|------------------------------|----------------------------------------------------------------------------|------|------|------|------|
| $g_{fs}^{(1)}$ | Forward transconductance     | $V_{DS} > I_{D(on)} \times R_{DS(on)max}$<br>$I_D = 2\ \text{A}$           | -    | 10   |      | S    |
| $C_{iss}$      | Input capacitance            | $V_{DS} = 25\ \text{V}$ , $f = 1\ \text{MHz}$ ,<br>$V_{GS} = 0$            | -    | 870  |      | pF   |
| $C_{oss}$      | Output capacitance           |                                                                            | -    | 125  |      | pF   |
| $C_{rss}$      | Reverse transfer capacitance |                                                                            | -    | 52   |      | pF   |
| $Q_g$          | Total gate charge            | $V_{DD} = 80\ \text{V}$ , $I_D = 4\ \text{A}$ ,<br>$V_{GS} = 10\ \text{V}$ | -    | 30   | 41   | nC   |
| $Q_{gs}$       | Gate-source charge           |                                                                            | -    | 6    |      | nC   |
| $Q_{gd}$       | Gate-drain charge            |                                                                            | -    | 10   |      | nC   |

1. Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 .

**Table 6. Switching times**

| Symbol                | Parameter                        | Test conditions                                                                                                              | Min. | Typ.     | Max. | Unit     |
|-----------------------|----------------------------------|------------------------------------------------------------------------------------------------------------------------------|------|----------|------|----------|
| $t_{d(on)}$<br>$t_r$  | Turn-on delay time<br>rise time  | $V_{DD}=50\ \text{V}$ , $I_D=4\ \text{A}$ ,<br>$R_G=4.7\ \Omega$ , $V_{GS}=10\ \text{V}$<br>(see <a href="#">Figure 14</a> ) | -    | 58<br>45 | -    | ns<br>ns |
| $t_{d(off)}$<br>$t_f$ | Turn-off delay time<br>fall time | $V_{DD}=50\ \text{V}$ , $I_D=4\ \text{A}$ ,<br>$R_G=4.7\ \Omega$ , $V_{GS}=10\ \text{V}$<br>(see <a href="#">Figure 14</a> ) | -    | 49<br>17 | -    | ns<br>ns |

**Table 7. Source drain diode**

| Symbol                            | Parameter                                                                    | Test conditions                                                                                                                                                   | Min | Typ.              | Max. | Unit          |
|-----------------------------------|------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------------------|------|---------------|
| $I_{SD}$                          | Source-drain current                                                         |                                                                                                                                                                   | -   |                   | 4    | A             |
| $I_{SDM}^{(1)}$                   | Source-drain current (pulsed)                                                |                                                                                                                                                                   | -   |                   | 16   | A             |
| $V_{SD}^{(2)}$                    | Forward on voltage                                                           | $I_{SD} = 4\text{ A}$ , $V_{GS} = 0$                                                                                                                              | -   |                   | 1.2  | V             |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse recovery time<br>Reverse recovery charge<br>Reverse recovery current | $I_{SD} = 4\text{ A}$ , $V_{DD} = 30\text{ V}$<br>$di/dt = 100\text{ A}/\mu\text{s}$ ,<br>$T_j = 150\text{ }^{\circ}\text{C}$<br>(see <a href="#">Figure 15</a> ) | -   | 100<br>375<br>7.5 |      | ns<br>nC<br>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

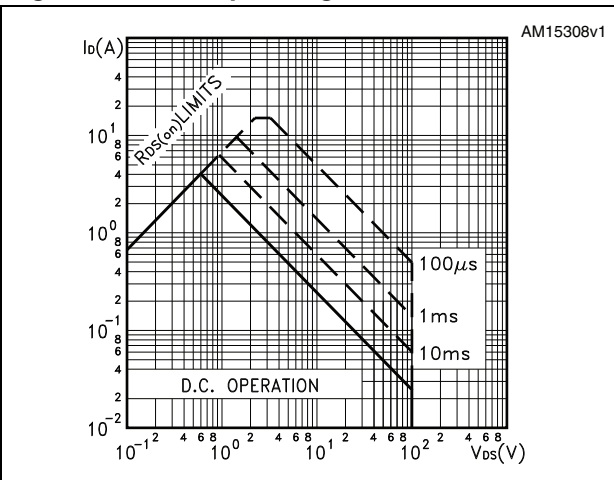


Figure 3. Thermal impedance

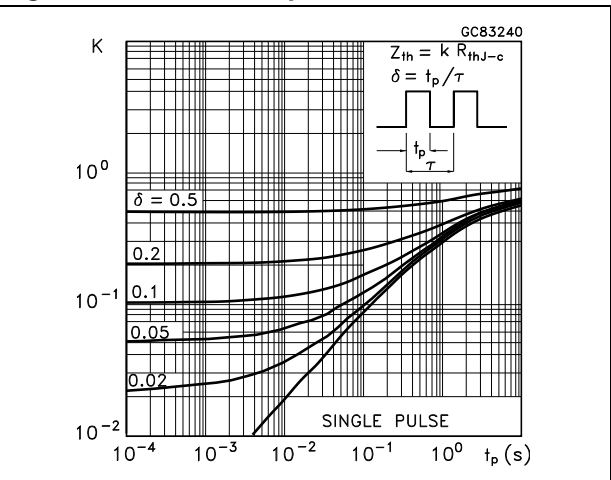


Figure 4. Output characteristics

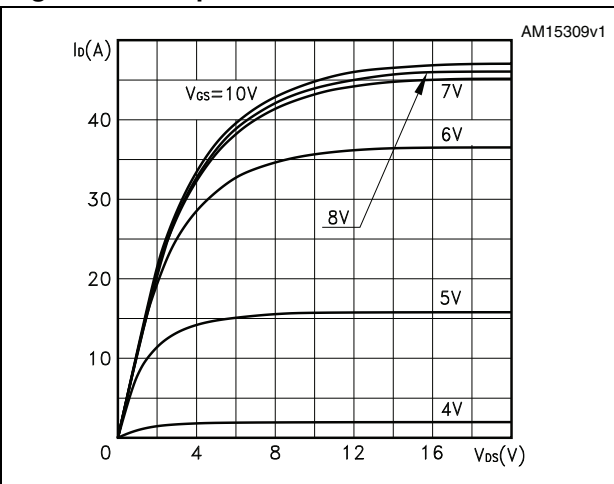


Figure 5. Transfer characteristics

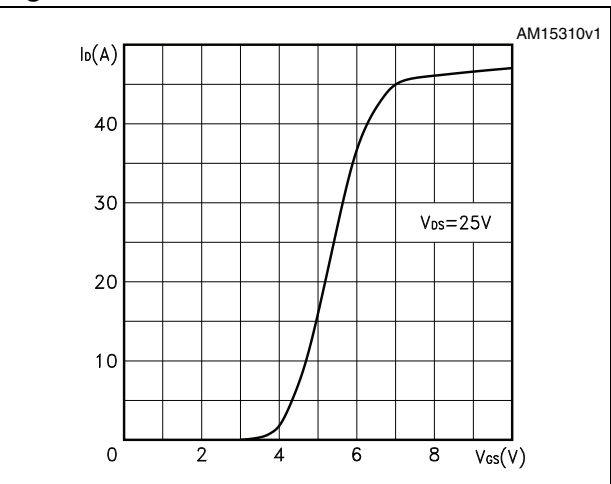


Figure 6. Transconductance

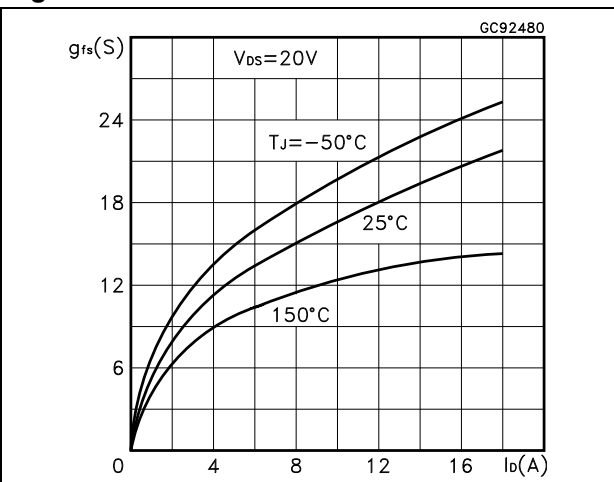


Figure 7. Static drain-source on-resistance

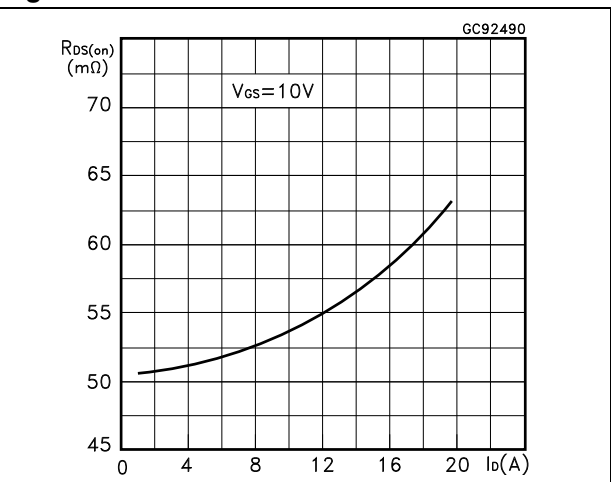


Figure 8. Gate charge vs gate-source voltage      Figure 9. Capacitance variations

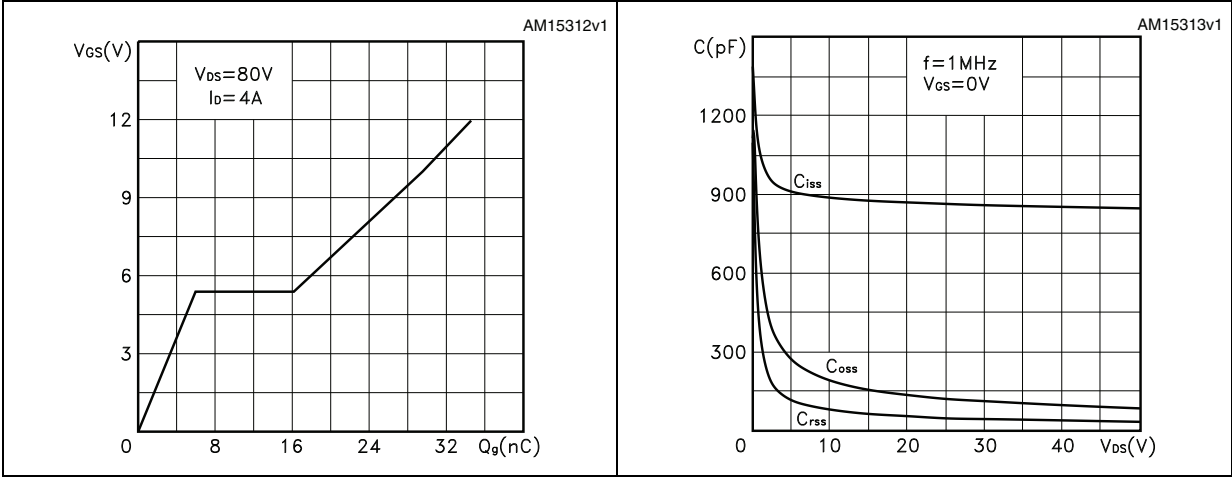


Figure 10. Normalized gate threshold voltage vs temperature      Figure 11. Normalized on-resistance vs temperature

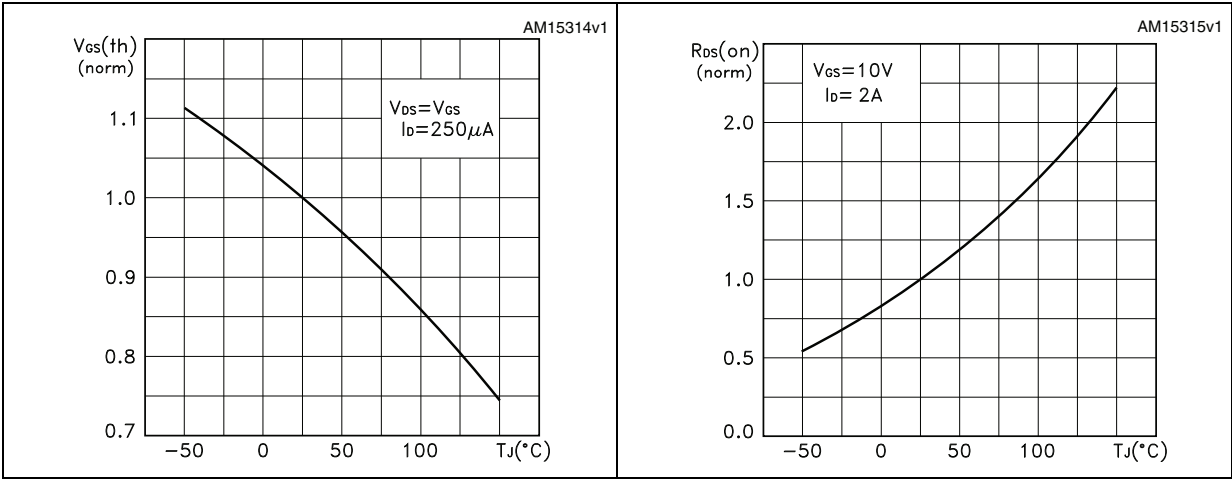
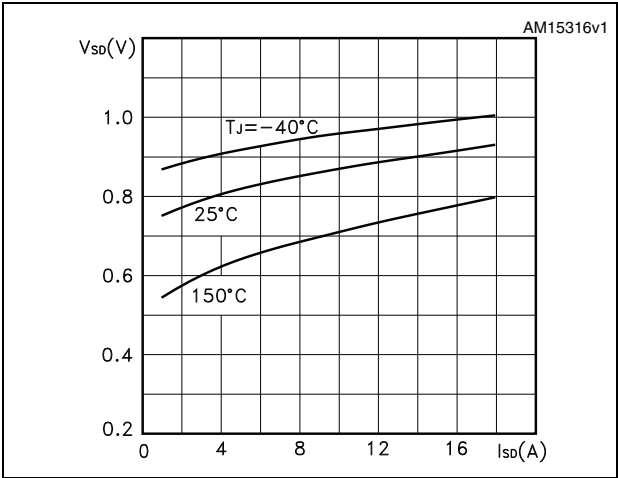
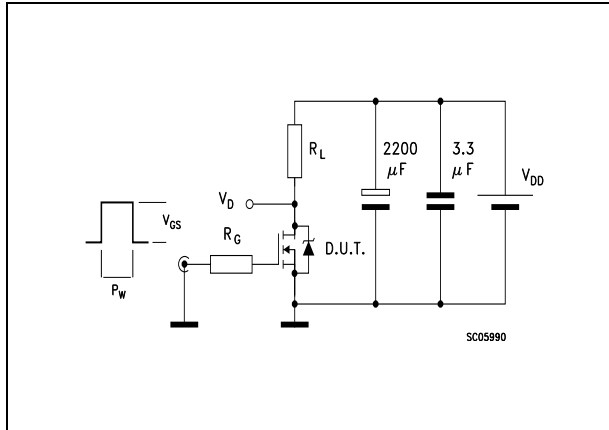


Figure 12. Source-drain diode forward characteristics

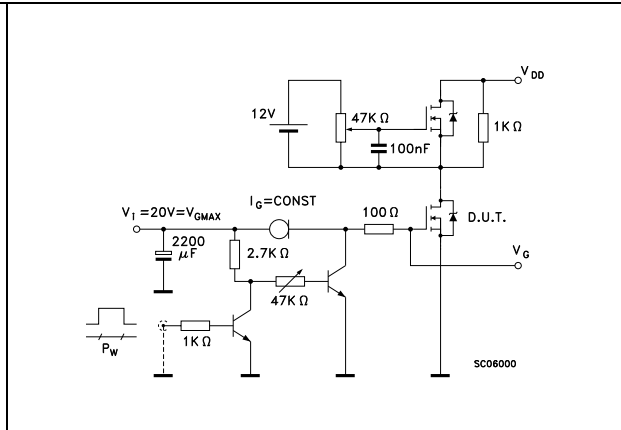


### 3 Test circuit

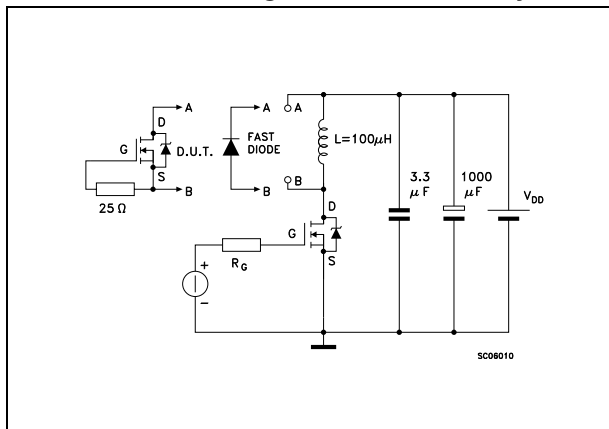
**Figure 13. Switching times test circuit for resistive load**



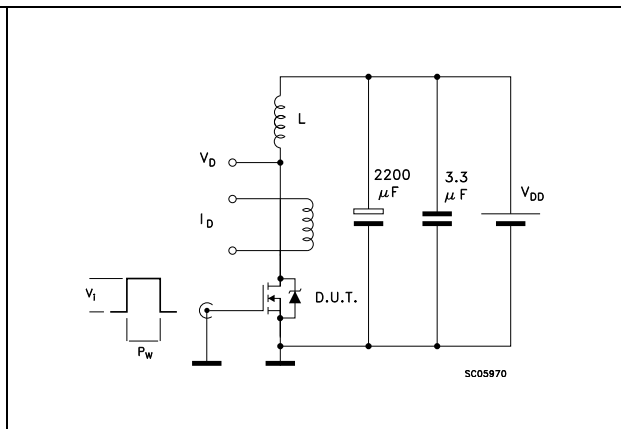
**Figure 14. Gate charge test circuit**



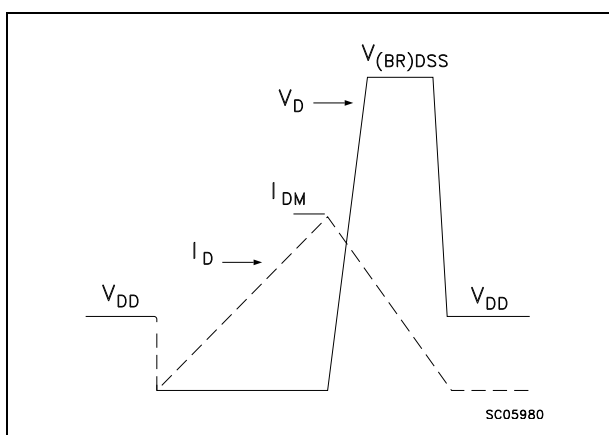
**Figure 15. Test circuit for inductive load switching and diode recovery times**



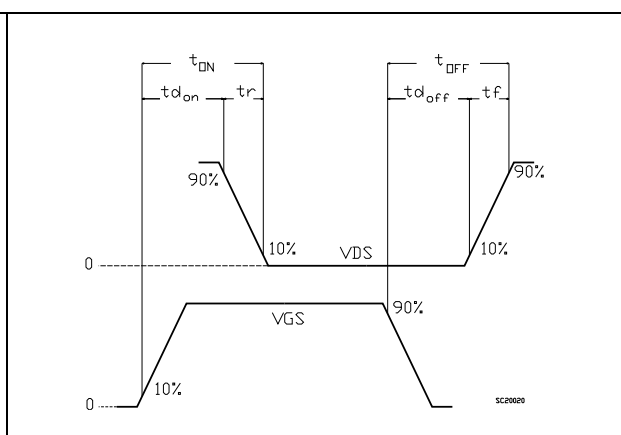
**Figure 16. Unclamped Inductive load test circuit**



**Figure 17. Unclamped inductive waveform**



**Figure 18. Switching time waveform**



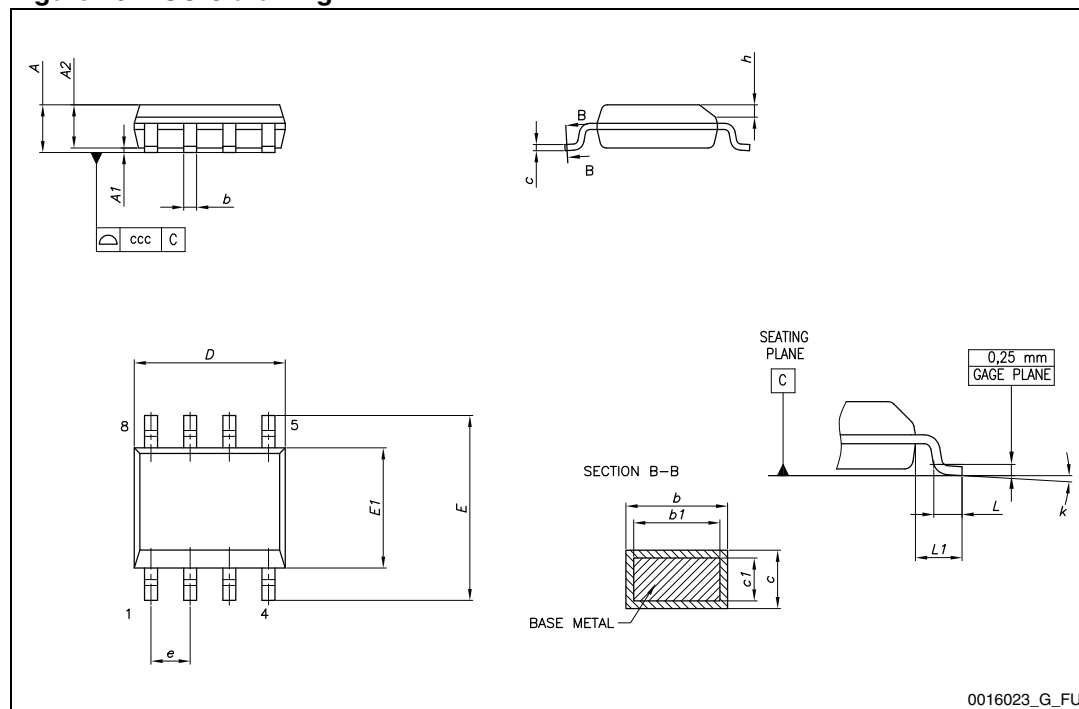
## 4 Package mechanical data

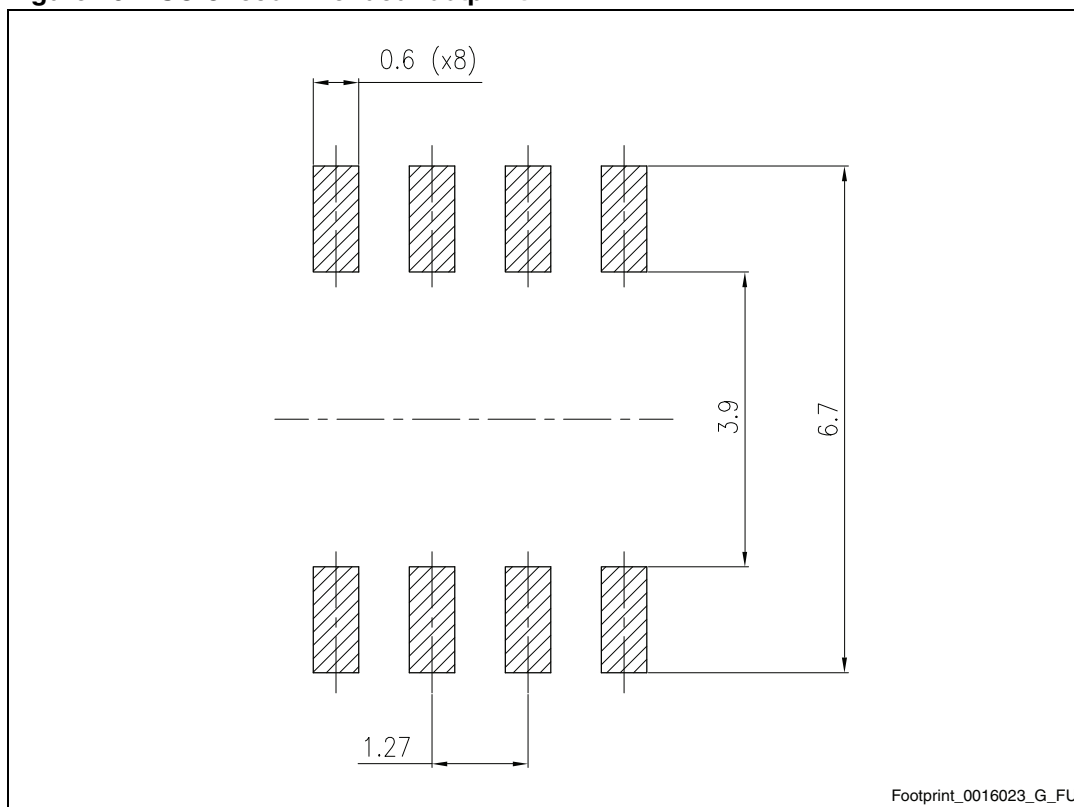
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Table 8. SO-8 mechanical data

| Dim. | mm   |      |      |
|------|------|------|------|
|      | Min. | Typ. | Max. |
| A    |      |      | 1.75 |
| A1   | 0.10 |      | 0.25 |
| A2   | 1.25 |      |      |
| b    | 0.31 |      | 0.51 |
| b1   | 0.28 |      | 0.48 |
| c    | 0.10 |      | 0.25 |
| c1   | 0.10 |      | 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 |      |
| L2   |      | 0.25 |      |
| k    | 0°   |      | 8°   |
| ccc  |      |      | 0.10 |

Figure 19. SO-8 drawing



**Figure 20. SO-8 recommended footprint<sup>(a)</sup>**

a. All dimensions are in millimeters.

## 5 Revision history

**Table 9. Revision history**

| Date        | Revision | Changes                                   |
|-------------|----------|-------------------------------------------|
| 11-Sep-2006 | 1        | First release                             |
| 15-Nov-2006 | 2        | The document has been reformatted         |
| 26-Jan-2007 | 3        | Typo mistake on <a href="#">Table 3</a> . |
| 19-Nov-2012 | 4        | Changed: marking in cover page            |

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