



# STS25NH3LL

N-channel 30 V - 0.0032  $\Omega$  - 25 A - SO-8  
STripFET™ III Power MOSFET for DC/DC conversion

## Features

| Type       | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub>      |
|------------|------------------|---------------------|---------------------|
| STS25NH3LL | 30 V             | <0.0035 $\Omega$    | 25 A <sup>(1)</sup> |

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

- Optimal R<sub>DS(on)</sub> x Q<sub>g</sub> trade off @ 4.5 V
- Conduction losses reduced
- Switching losses reduced

## Applications

- Switching applications

## Description

This device utilizes the advanced design rules of ST's proprietary STripFET™ technology. The innovative process coupled with unique metallization techniques makes it possible to produce the most advanced low voltage Power MOSFET in an SO-8 package. The device is therefore suitable for demanding DC-DC converter applications where high efficiency at high output current is needed.

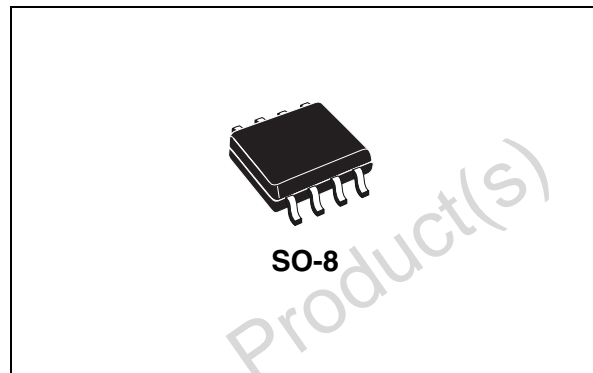


Figure 1. Internal schematic diagram

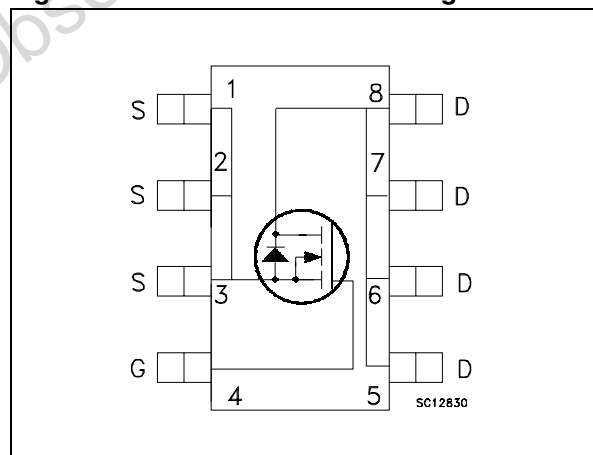


Table 1. Device summary

| Order code | Marking | Package | Packaging   |
|------------|---------|---------|-------------|
| STS25NH3LL | 25H3LL  | SO-8    | Tape & reel |

# 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  | $\pm 18$ | V    |
| $I_D^{(1)}$     | Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$ | 25       | A    |
| $I_D$           | Drain current (continuous) at $T_C=100\text{ }^\circ\text{C}$  | 18       | A    |
| $I_{DM}^{(2)}$  | Drain current (pulsed)   | 100      | A    |
| $P_{TOT}^{(1)}$ | Total dissipation at $T_C = 25\text{ }^\circ\text{C}$          | 3.2      | W    |

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

**Table 3. Thermal data**

| Symbol              | Parameter   | Value      | Unit                      |
|---------------------|---|------------|---------------------------|
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-amb max                   | 47         | $^\circ\text{C}/\text{W}$ |
| $T_j$<br>$T_{stg}$  | Operation junction temperature<br>Storage temperature | -55 to 175 | $^\circ\text{C}$          |

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

**Table 4. Avalanche characteristics**

| Symbol   | Parameter  | Value | Unit |
|----------|--|-------|------|
| $I_{AV}$ | Not-repetitive avalanche current (pulse width limited by $T_j$ max.)   | 12.5  | A    |
| $E_{AS}$ | Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$ , $I_D = I_{AV}$ , $V_{DD} = 24\text{ V}$ ) | 1.3   | J    |

## 2 Electrical characteristics

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

**Table 5. On/off states**

| Symbol        | Parameter  | Test conditions  | Min. | Typ.            | Max.            | Unit                 |
|---------------|--|--|------|-----------------|-----------------|----------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage                   | $I_D = 250 \mu A, V_{GS} = 0$  | 30   |                 |                 | V                    |
| $I_{DSS}$     | Zero gate voltage drain current ( $V_{GS} = 0$ ) | $V_{DS} = \text{Max rating},$<br>$V_{DS} = \text{Max rating} @ 125^{\circ}C$ |      |                 | 1<br>10         | $\mu A$<br>$\mu A$   |
| $I_{GSS}$     | Gate body leakage current ( $V_{DS} = 0$ )       | $V_{GS} = \pm 18 V$  |      |                 | $\pm 100$       | 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                | $V_{GS} = 10 V, I_D = 12.5 A$<br>$V_{GS} = 4.5 V, I_D = 12.5 A$              |      | 0.0032<br>0.004 | 0.0035<br>0.005 | $\Omega$<br>$\Omega$ |

**Table 6. Dynamic**

| Symbol          | Parameter                    | Test conditions  | Min. | Typ. | Max. | Unit     |
|-----------------|------------------------------|--|------|------|------|----------|
| $g_{fs}^{(1)}$  | Forward transconductance     | $V_{DS} = 10 V, I_D = 12.5 A$  |      | 30   |      | S        |
| $C_{iss}$       | Input capacitance            | $V_{DS} = 25 V, f = 1 \text{ MHz},$<br>$V_{GS} = 0$                                      |      | 4450 |      | pF       |
| $C_{oss}$       | Output capacitance           |  |      | 655  |      | pF       |
| $C_{rss}$       | Reverse transfer capacitance |  |      | 50   |      | pF       |
| $Q_g$           | Total gate charge            | $V_{DD} = 15 V, I_D = 25 A$<br>$V_{GS} = 4.5 V$<br><i>Figure 14</i>                      |      | 30   | 40   | nC       |
| $Q_{gs}$        | Gate-source charge           |  |      | 12.5 |      | nC       |
| $Q_{gd}$        | Gate-drain charge            |  |      | 10   |      | nC       |
| $Q_{OSS}^{(2)}$ | Output charge                | $V_{DD} = 24 V, V_{GS} = 0$  |      | 23   |      | nC       |
| $R_G$           | Gate input resistance        | $f = 1 \text{ MHz}, \text{ gate DC bias} = 0$<br>test signal level = 20 mV<br>open drain | 1    | 2    | 3    | $\Omega$ |

1. Pulsed: pulse duration=300  $\mu s$ , duty cycle 1.5%

2.  $Q_{OSS} = C_{OSS} * \Delta V_{in}$ ,  $C_{OSS} = C_{gd} + C_{ds}$

**Table 7. Switching times**

| Symbol       | Parameter           | Test conditions  | Min. | Typ. | Max. | Unit |
|--------------|---------------------|--|------|------|------|------|
| $t_{d(on)}$  | Turn-on delay time  | $V_{DD} = 15\text{ V}$ , $I_D = 12.5\text{ A}$ ,<br>$R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$<br><i>Figure 13</i> |      | 18   |      | ns   |
| $t_r$        | Rise time           |  |      | 50   |      | ns   |
| $t_{d(off)}$ | Turn-off delay time |  |      | 75   |      | ns   |
| $t_f$        | Fall time           |  |      | 8    |      | ns   |

**Table 8. Source drain diode**

| Symbol          | Parameter                     | Test conditions  | Min | Typ. | Max | Unit |
|-----------------|-------------------------------|--|-----|------|-----|------|
| $I_{SD}$        | Source-drain current          |  |     |      | 25  | A    |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) |  |     |      | 100 | A    |
| $V_{SD}^{(2)}$  | Forward on voltage            | $I_{SD} = 25\text{ A}$ , $V_{GS} = 0$  |     |      | 1.3 | V    |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 25\text{ A}$ ,<br>$di/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_{DD} = 25\text{ V}$ , $T_J = 150\text{ }^\circ\text{C}$<br><i>Figure 18</i> |     | 32   |     | ns   |
| $Q_{rr}$        | Reverse recovery charge       |  |     | 34   |     | nC   |
| $I_{RRM}$       | Reverse recovery current      |  |     | 2.1  |     | 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

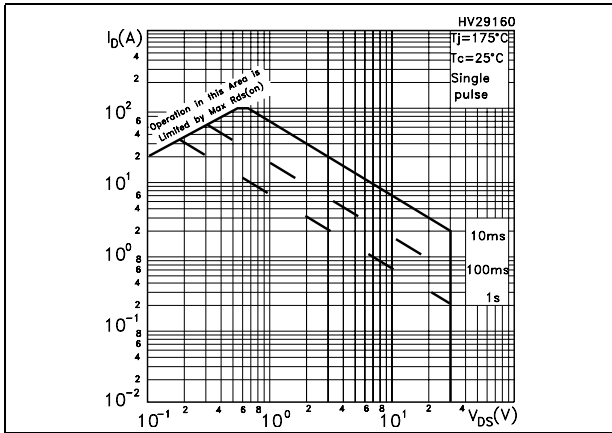


Figure 3. Thermal impedance

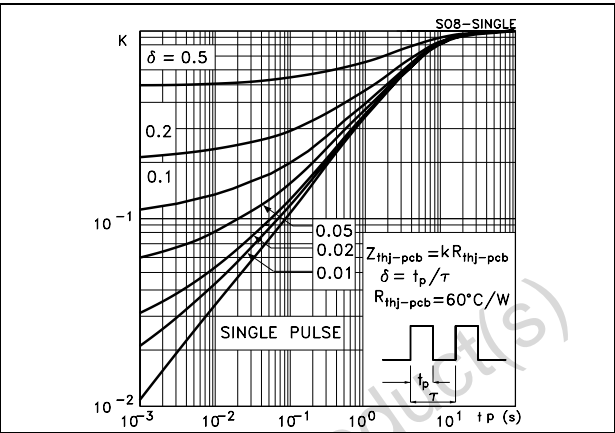


Figure 4. Output characteristics

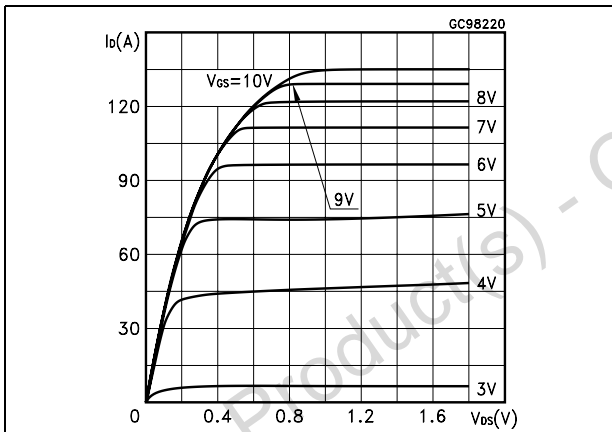


Figure 5. Transfer characteristics

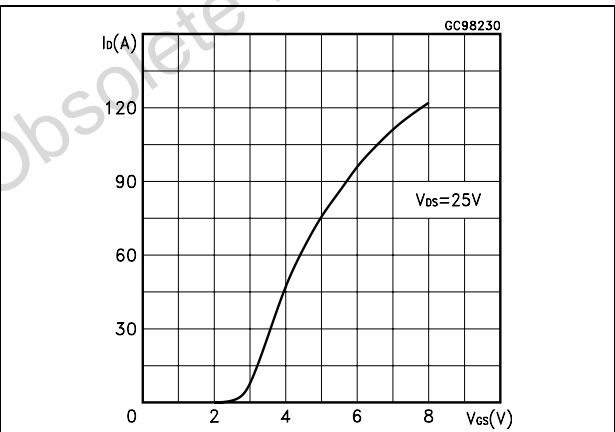


Figure 6. Normalized  $B_{V_{DS}}$  vs temperature

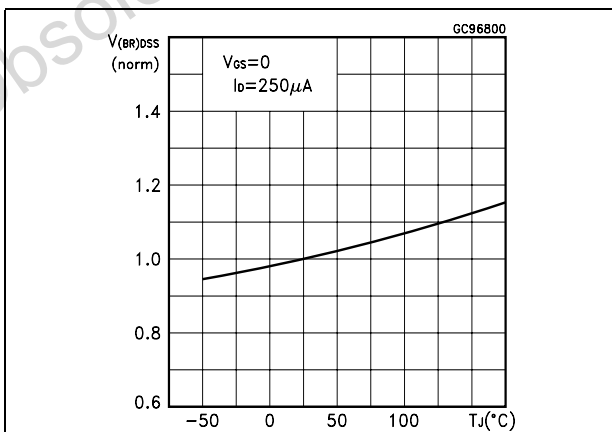


Figure 7. Static drain-source on resistance

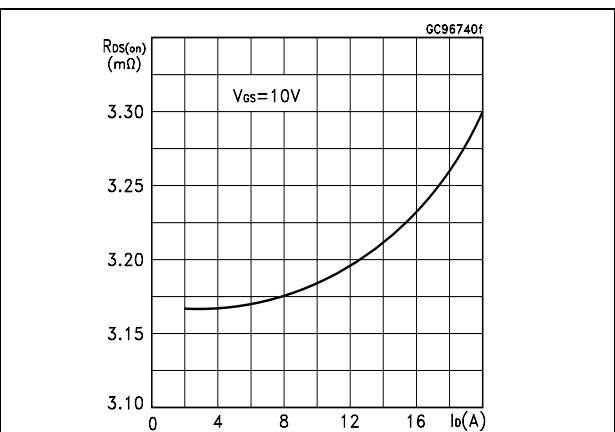


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

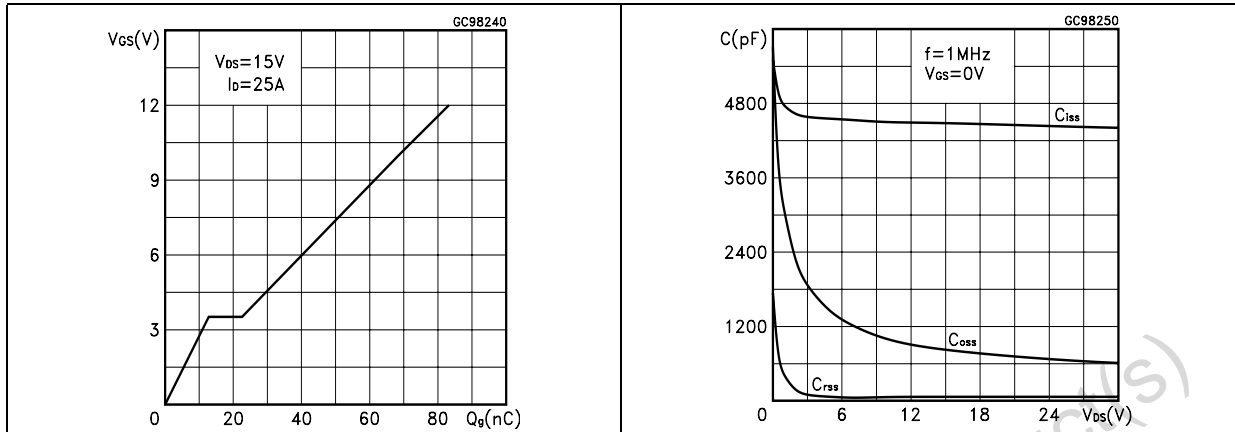


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

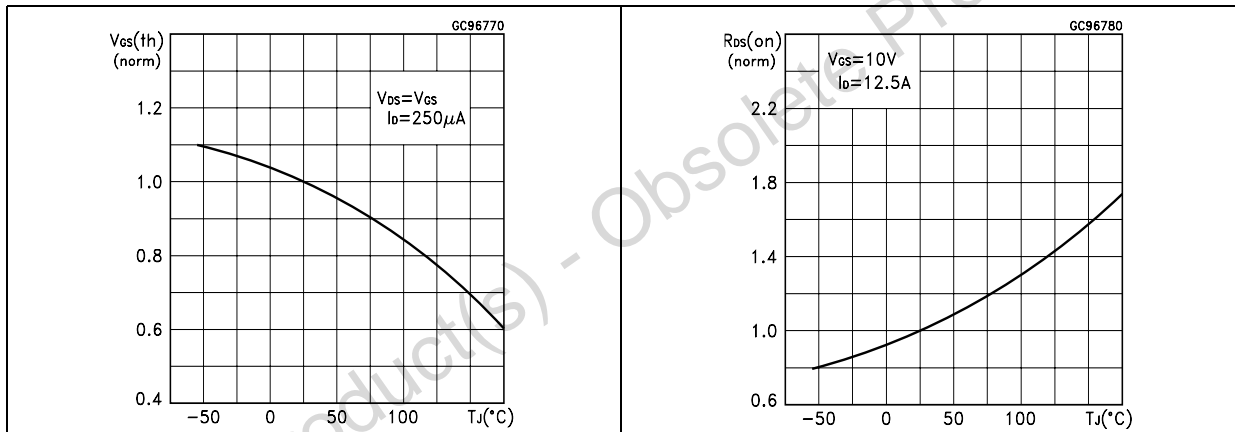
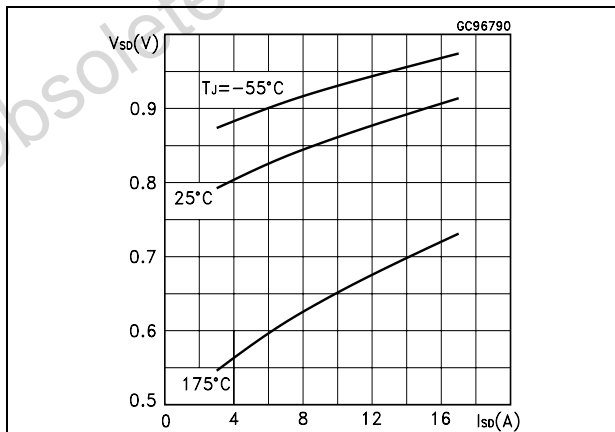


Figure 12. Source-drain diode forward characteristics



### 3 Test circuit

Figure 13. Switching times test circuit for resistive load

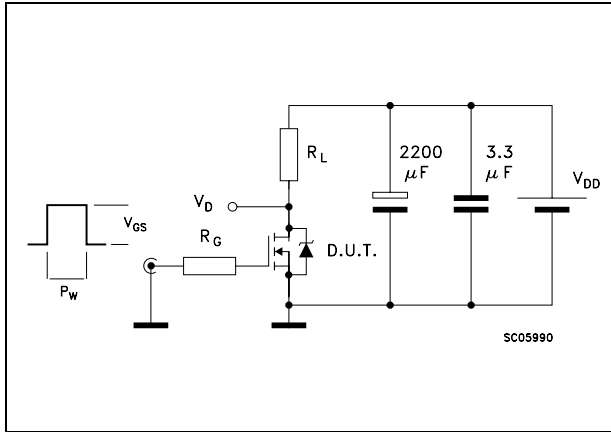


Figure 14. Gate charge test circuit

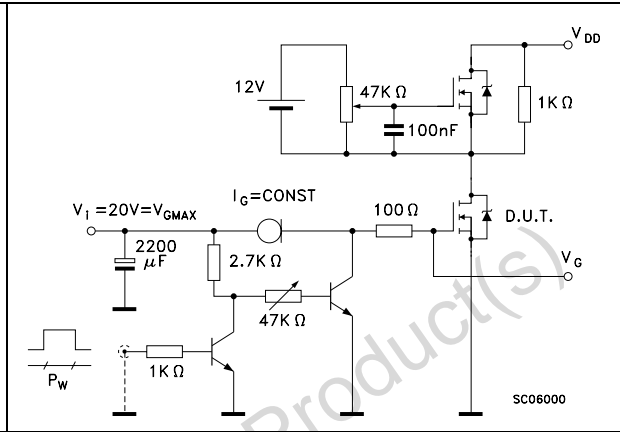


Figure 15. Test circuit for inductive load switching and diode recovery times

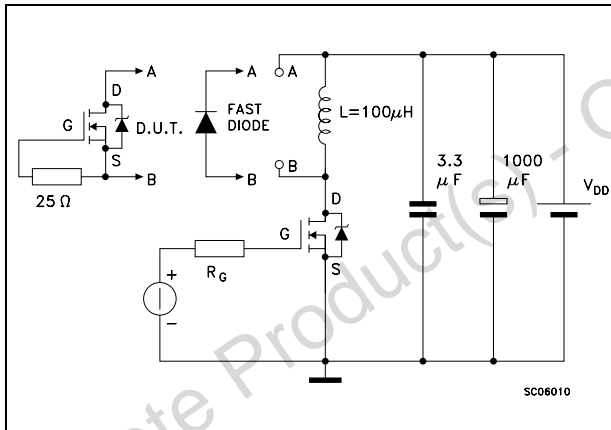


Figure 16. Unclamped inductive load test circuit

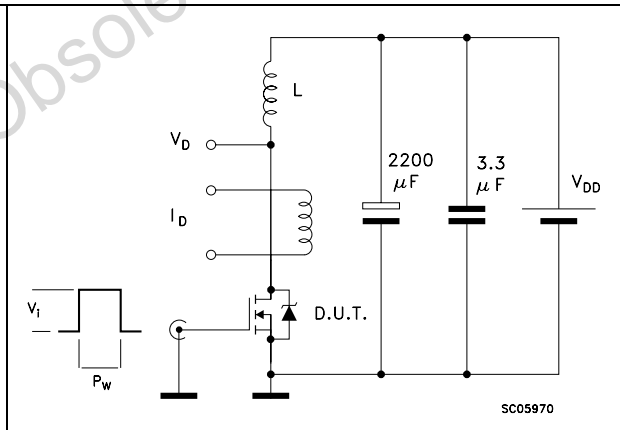


Figure 17. Unclamped inductive waveform

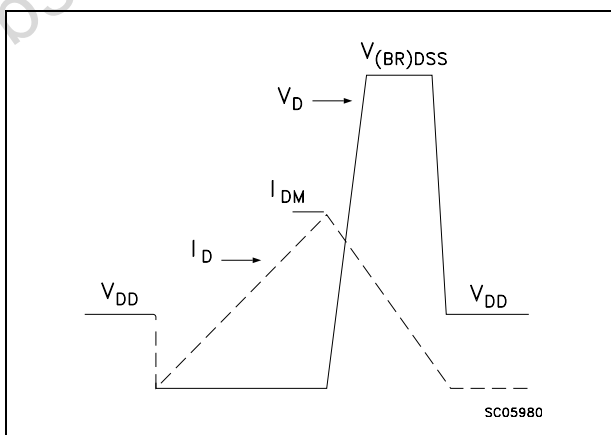
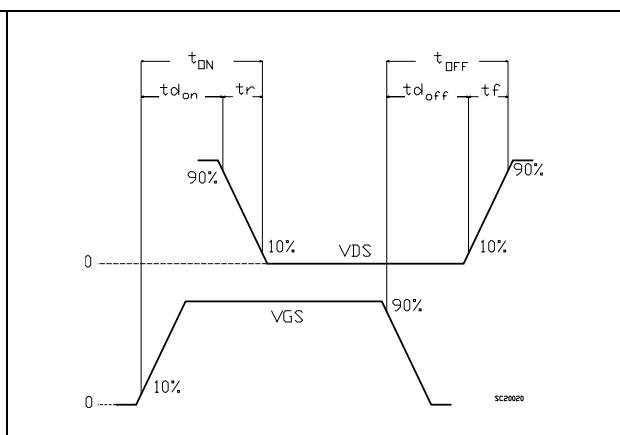


Figure 18. Switching time waveform



## 4 Package mechanical data

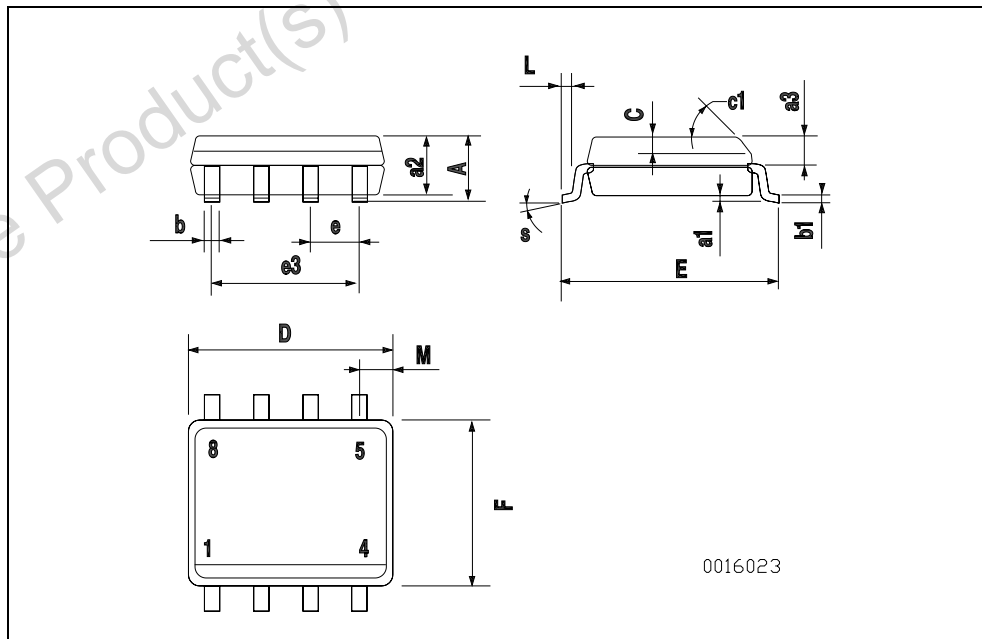
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**SO-8 MECHANICAL DATA**

| 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   |
|-------------|----------|---|
| 19-Nov-2007 | 10       | Document status promoted from preliminary data to datasheet |

Obsolete Product(s) - Obsolete Product(s)

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