



# STS6NF20V

## N-CHANNEL 20V - 0.030 Ω - 6A SO-8 2.7V-DRIVE STripFET™ II POWER MOSFET

| TYPE      | V <sub>DSS</sub> | R <sub>DS(on)</sub>                            | I <sub>D</sub> |
|-----------|------------------|--|----------------|
| STS6NF20V | 20 V             | < 0.040 Ω ( @ 4.5 V )<br>< 0.045 Ω ( @ 2.7 V ) | 6 A            |

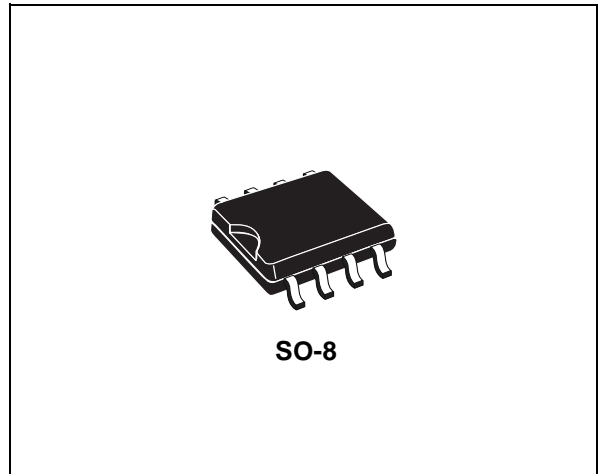
- TYPICAL R<sub>DS(on)</sub> = 0.030 Ω @ 4.5 V
- TYPICAL R<sub>DS(on)</sub> = 0.037 Ω @ 2.7 V
- ULTRA LOW THRESHOLD GATE DRIVE (2.7 V)
- STANDARD OUTLINE FOR EASY AUTOMATED SURFACE MOUNT ASSEMBLY

### DESCRIPTION

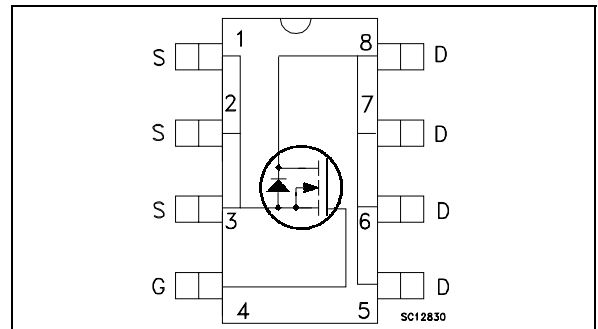
This Power MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

### APPLICATIONS

- DC MOTOR DRIVE
- DC-DC CONVERTERS
- BATTERY MANAGEMENT IN NOMADIC EQUIPMENT
- POWER MANAGEMENT IN PORTABLE/DESKTOP PCs



### INTERNAL SCHEMATIC DIAGRAM



### ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter  | Value | Unit |
|---------------------|--|-------|------|
| V <sub>DS</sub>     | Drain-source Voltage (V <sub>GS</sub> = 0)           | 20    | V    |
| V <sub>DGR</sub>    | Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)         | 20    | V    |
| V <sub>GS</sub>     | Gate- source Voltage                                 | ± 12  | V    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>C</sub> = 25°C  | 6     | A    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>C</sub> = 100°C | 3.8   | A    |
| I <sub>DM</sub> (●) | Drain Current (pulsed)                               | 24    | A    |
| P <sub>tot</sub>    | Total Dissipation at T <sub>C</sub> = 25°C           | 2.5   | W    |

(●) Pulse width limited by safe operating area.

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## THERMAL DATA

|                  |                                     |     |            |      |
|------------------|-------------------------------------|-----|------------|------|
| Rthj-amb         | Thermal Resistance Junction-ambient | Max | 50         | °C/W |
| T <sub>j</sub>   | Max. Operating Junction Temperature |     | -55 to 150 | °C   |
| T <sub>stg</sub> | Storage Temperature                 |     | -55 to 150 | °C   |

## ELECTRICAL CHARACTERISTICS (T<sub>case</sub> = 25 °C unless otherwise specified)

OFF

| Symbol               | Parameter   | Test Conditions   | Min. | Typ. | Max.    | Unit     |
|----------------------|---|---|------|------|---------|----------|
| V <sub>(BR)DSS</sub> | Drain-source Breakdown Voltage                        | I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0  | 20   |      |         | V        |
| I <sub>DSS</sub>     | Zero Gate Voltage Drain Current (V <sub>GS</sub> = 0) | V <sub>DS</sub> = Max Rating<br>V <sub>DS</sub> = Max Rating T <sub>C</sub> = 125°C |      |      | 1<br>10 | μA<br>μA |
| I <sub>GSS</sub>     | Gate-body Leakage Current (V <sub>DS</sub> = 0)       | V <sub>GS</sub> = ± 12V   |      |      | ±100    | nA       |

ON (\*)

| Symbol              | Parameter                         | Test Conditions  | Min. | Typ.           | Max.           | Unit   |
|---------------------|-----------------------------------|--|------|----------------|----------------|--------|
| V <sub>GS(th)</sub> | Gate Threshold Voltage            | V <sub>DS</sub> = V <sub>GS</sub> I <sub>D</sub> = 250 μA                                    | 0.6  |                |                | V      |
| R <sub>DS(on)</sub> | Static Drain-source On Resistance | V <sub>GS</sub> = 4.5 V I <sub>D</sub> = 3 A<br>V <sub>GS</sub> = 2.7 V I <sub>D</sub> = 3 A |      | 0.030<br>0.037 | 0.040<br>0.045 | Ω<br>Ω |

DYNAMIC

| Symbol              | Parameter                    | Test Conditions                                      | Min. | Typ. | Max. | Unit |
|---------------------|------------------------------|--|------|------|------|------|
| g <sub>fs</sub> (*) | Forward Transconductance     | V <sub>DS</sub> =15 V I <sub>D</sub> = 3 A           |      | 10   |      | S    |
| C <sub>iss</sub>    | Input Capacitance            | V <sub>DS</sub> = 15V f = 1 MHz, V <sub>GS</sub> = 0 |      | 460  |      | pF   |
| C <sub>OSS</sub>    | Output Capacitance           |  |      | 200  |      | pF   |
| C <sub>rSS</sub>    | Reverse Transfer Capacitance |  |      | 50   |      | pF   |

**ELECTRICAL CHARACTERISTICS** (continued)

**SWITCHING ON**

| Symbol                        | Parameter  | Test Conditions  | Min. | Typ.              | Max. | Unit           |
|-------------------------------|--|--|------|-------------------|------|----------------|
| $t_{d(on)}$<br>$t_r$          | Turn-on Delay Time<br>Rise Time                              | $V_{DD} = 10\text{ V}$ $I_D = 3\text{ A}$<br>$R_G = 4.7\ \Omega$ $V_{GS} = 4.5\text{ V}$<br>(Resistive Load, Figure 1) |      | 7<br>33           |      | ns<br>ns       |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total Gate Charge<br>Gate-Source Charge<br>Gate-Drain Charge | $V_{DD} = 16\text{ V}$ $I_D = 6\text{ A}$ $V_{GS} = 4.5\text{ V}$<br>(see test circuit, Figure 2)                      |      | 8.5<br>1.8<br>2.4 | 11.5 | nC<br>nC<br>nC |

**SWITCHING OFF**

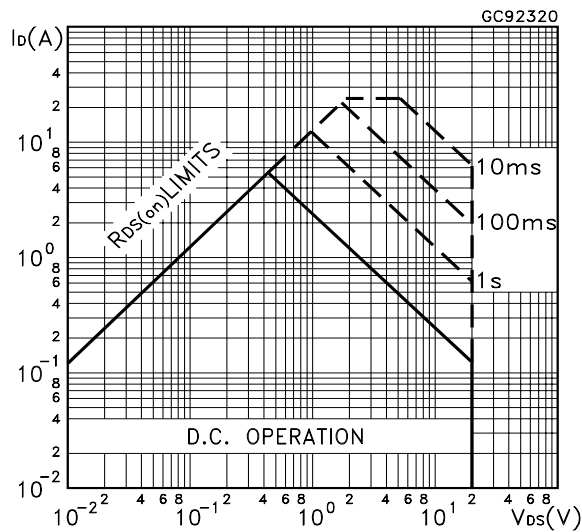
| Symbol                | Parameter                        | Test Conditions  | Min. | Typ.     | Max. | Unit     |
|-----------------------|----------------------------------|--|------|----------|------|----------|
| $t_{d(off)}$<br>$t_f$ | Turn-off Delay Time<br>Fall Time | $V_{DD} = 10\text{ V}$ $I_D = 3\text{ A}$<br>$R_G = 4.7\ \Omega$ , $V_{GS} = 4.5\text{ V}$<br>(Resistive Load, Figure 1) |      | 27<br>10 |      | ns<br>ns |

**SOURCE DRAIN DIODE**

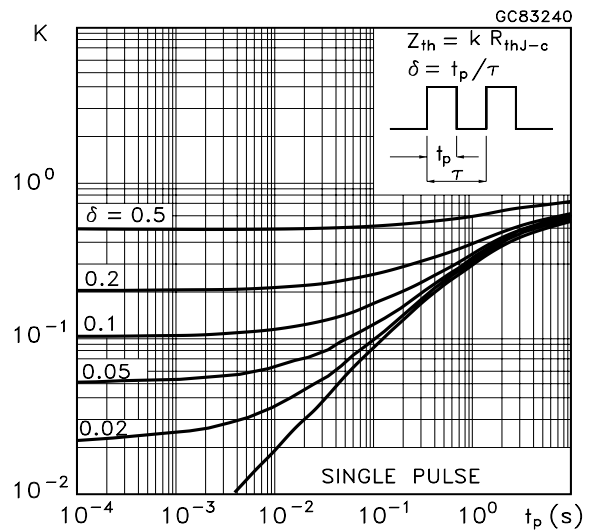
| Symbol                            | Parameter  | Test Conditions  | Min. | Typ.          | Max.    | Unit          |
|-----------------------------------|--|--|------|---------------|---------|---------------|
| $I_{SD}$<br>$I_{SDM} (\bullet)$   | Source-drain Current<br>Source-drain Current (pulsed)                        |  |      |               | 6<br>24 | A<br>A        |
| $V_{SD} (*)$                      | Forward On Voltage   | $I_{SD} = 6\text{ A}$ $V_{GS} = 0$   |      |               | 1.2     | V             |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse Recovery Time<br>Reverse Recovery Charge<br>Reverse Recovery Current | $I_{SD} = 6\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$<br>$V_{DD} = 10\text{ V}$ $T_j = 150^\circ\text{C}$<br>(see test circuit, Figure 3) |      | 26<br>13<br>1 |         | ns<br>nC<br>A |

(\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.  
 (•) Pulse width limited by safe operating area.

**Safe Operating Area**

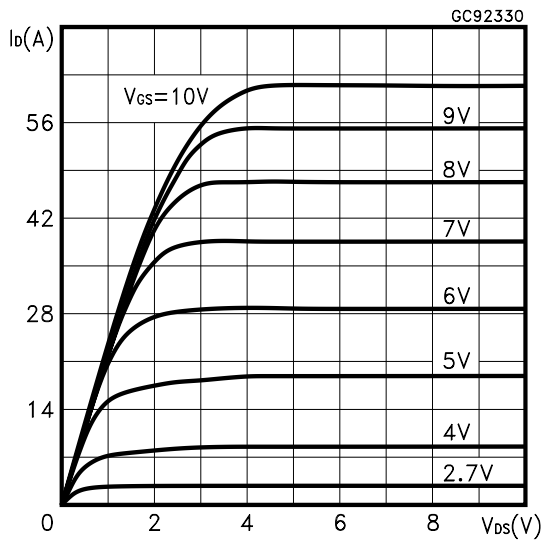


**Thermal Impedance**

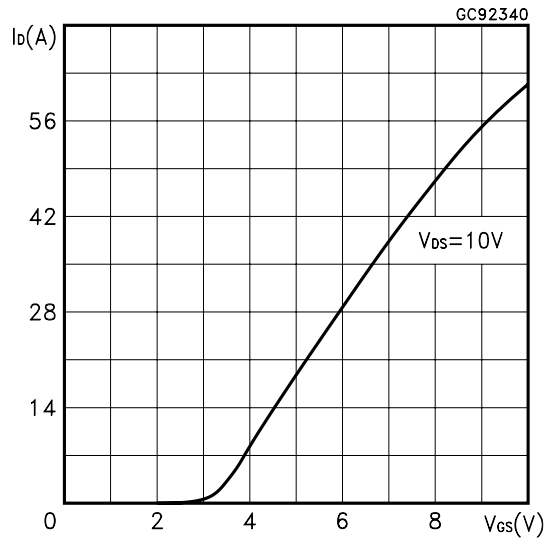


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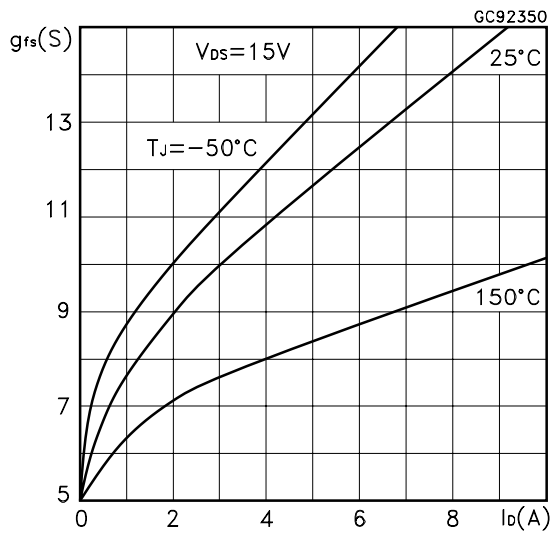
Output Characteristics



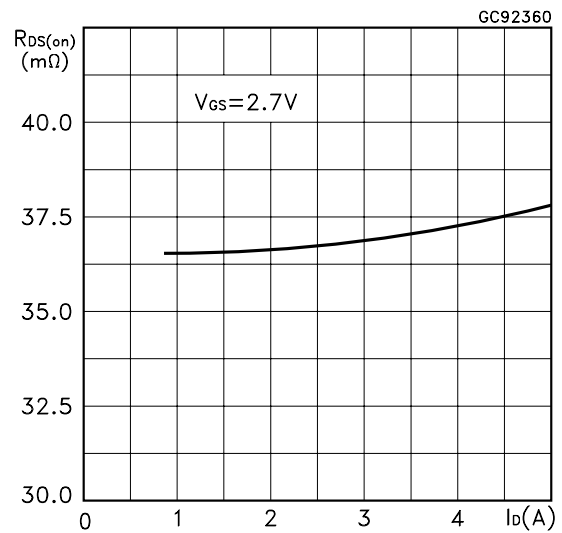
Transfer Characteristics



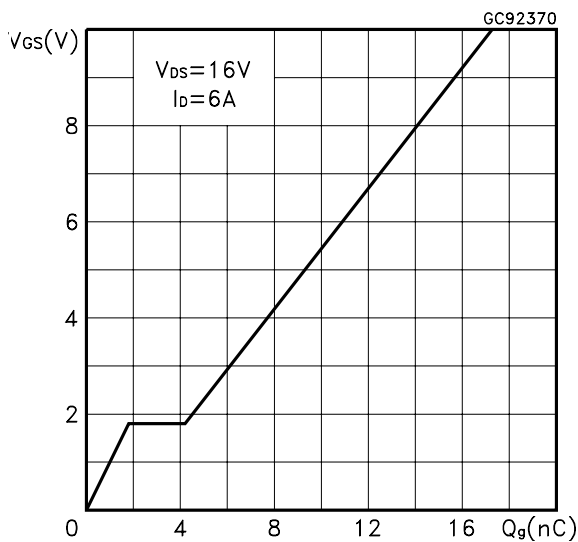
Transconductance



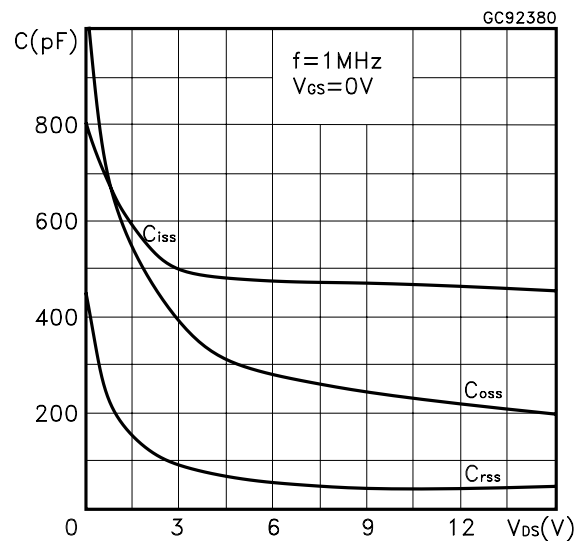
Static Drain-source On Resistance



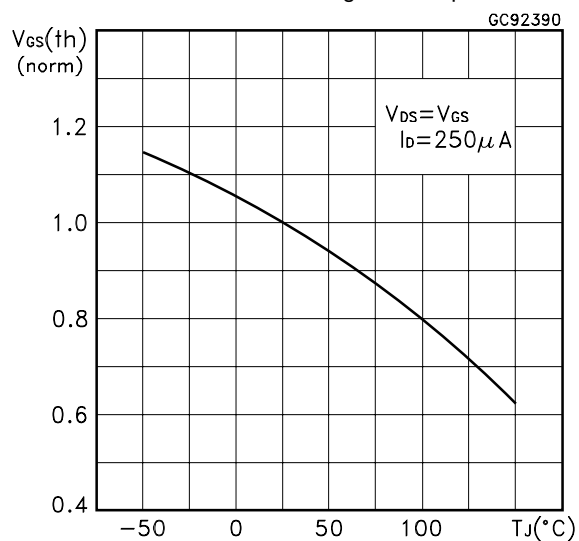
Gate Charge vs Gate-source Voltage



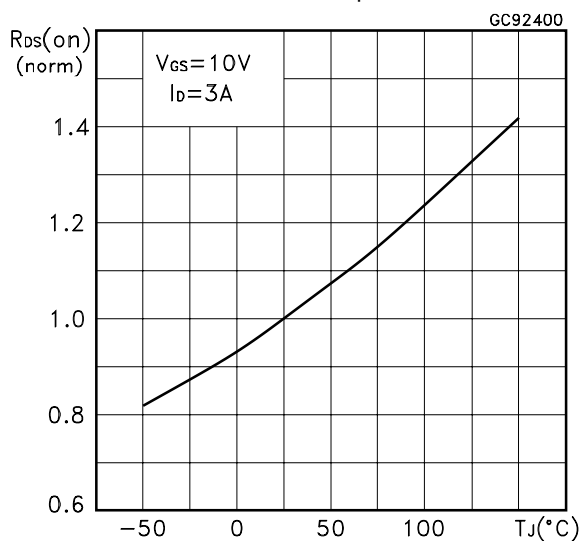
Capacitance Variations



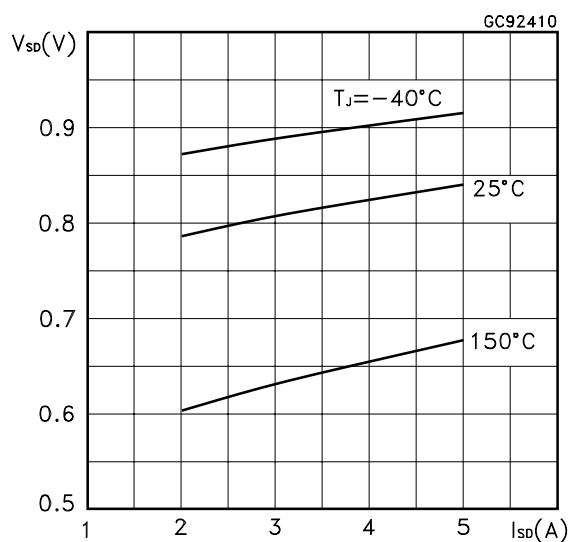
Normalized Gate Threshold Voltage vs Temperature



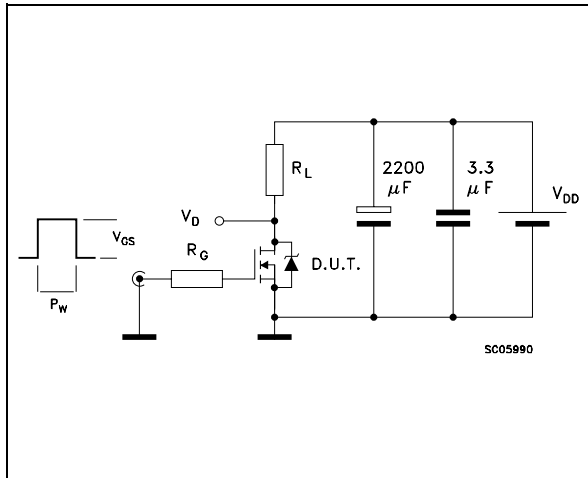
Normalized on Resistance vs Temperature



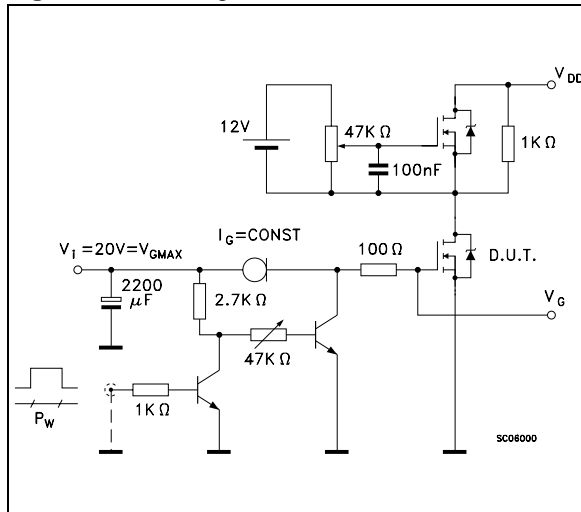
Source-drain Diode Forward Characteristics



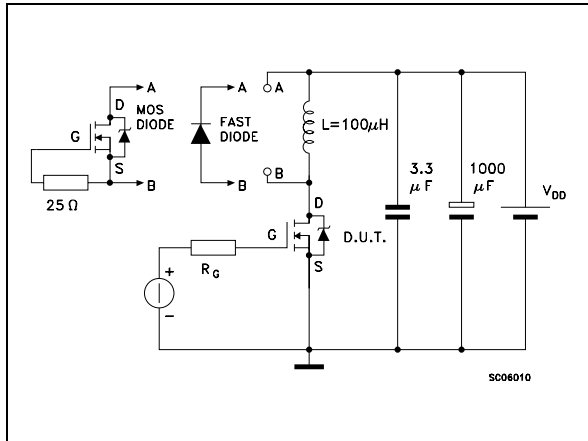
**Fig. 1: Switching Times Test Circuits For Resistive Load**



**Fig. 2: Gate Charge test Circuit**

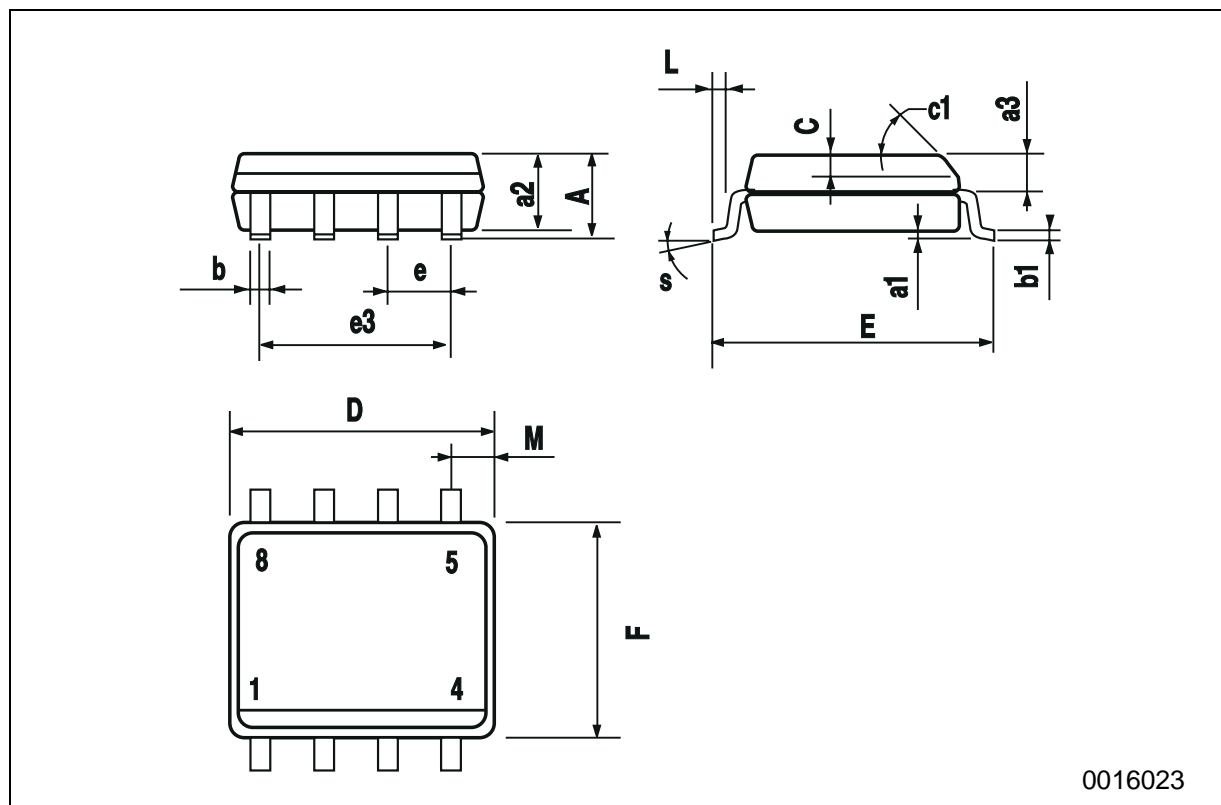


**Fig. 3: Test Circuit For Diode Recovery Behaviour**



**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.)  |      |      |       |       |       |



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