



2N7000
2N7002

N-CHANNEL 60V - 1.8Ω - 0.35A SOT23-3L - TO-92
STripFET™II MOSFET

| TYPE | V _{DSS} | R _{DS(on)} | I _D |
|--------|------------------|---------------------|----------------|
| 2N7000 | 60 V | < 5 Ω (@ 10V) | 0.35 A |
| 2N7002 | 60 V | < 5 Ω (@ 10V) | 0.20 A |

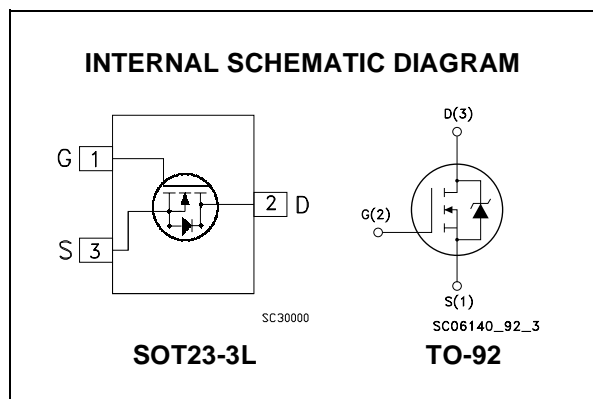
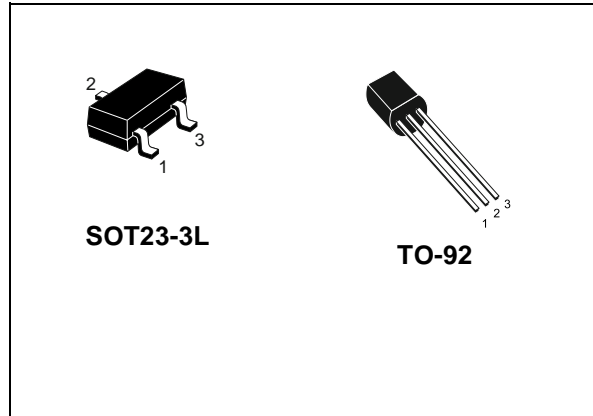
- TYPICAL R_{DS(on)} = 1.8Ω @10V
- LOW Q_g
- LOW THRESHOLD DRIVE

DESCRIPTION

This MOSFET is the second generation 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

- HIGH SWITCHING APPLICATIONS



ORDER CODE

| PART NUMBER | MARKING | PACKAGE | PACKAGING |
|-------------|---------|----------|-------------|
| 2N7000 | 2N7000G | TO-92 | BULK |
| 2N7002 | ST2N | SOT23-3L | TAPE & REEL |

2N7000 - 2N7002

ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | | Unit |
|--------------------|--|----------|----------|------|
| | | TO-92 | STO23-3L | |
| V_{DS} | Drain-source Voltage ($V_{GS} = 0$) | 60 | | V |
| V_{DGR} | Drain-gate Voltage ($R_{GS} = 20\text{ k}\Omega$) | 60 | | V |
| V_{GS} | Gate- source Voltage | ± 18 | | V |
| I_D | Drain Current (continuous) at $T_C = 25^\circ\text{C}$ | 0.35 | 0.25 | A |
| $I_{DM} (\bullet)$ | Drain Current (pulsed) | 1.4 | 1 | A |
| P_{TOT} | Total Dissipation at $T_C = 25^\circ\text{C}$ | 1 | 0.35 | W |

(\bullet)Pulse width limited by safe operating area

THERMAL DATA

| | | TO-92 | SOT23-3L | |
|--------------------|---|-------------|-----------|---------------------------|
| $R_{thj-amb}$ | Thermal Resistance Junction-ambient Max | 125 | 357.1 (*) | $^\circ\text{C}/\text{W}$ |
| T_J T_{stg} | Operating Junction Temperature Storage Temperature | - 55 to 150 | | $^\circ\text{C}$ |

(*) DEVICE MOUNTED ON A PCB AREA OF 1cm^2

ON/OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---------------|--|---|------|----------|-----------|--------------------------------|
| $V_{(BR)DSS}$ | Drain-source Breakdown Voltage | $I_D = 250\ \mu\text{A}$, $V_{GS} = 0$ | 60 | | | V |
| I_{DSS} | Zero Gate Voltage Drain Current ($V_{GS} = 0$) | $V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating}$, $T_C = 125^\circ\text{C}$ | | | 1 10 | μA μA |
| I_{GSS} | Gate-body Leakage Current ($V_{DS} = 0$) | $V_{GS} = \pm 18\text{ V}$ | | | ± 100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{A}$ | 1 | 2.1 | 3 | V |
| $R_{DS(on)}$ | Static Drain-source On Resistance | $V_{GS} = 10\text{ V}$, $I_D = 0.5\text{ A}$ $V_{GS} = 4.5\text{ V}$, $I_D = 0.5\text{ A}$ | | 1.8 2 | 5 5.3 | Ω Ω |

ELECTRICAL CHARACTERISTICS ($T_{CASE} = 25\text{ }^{\circ}\text{C}$ UNLESS OTHERWISE SPECIFIED)
DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-------------------------------------|---|--|------|---------------|------|----------------|
| g_{fs} (1) | Forward Transconductance | $V_{DS} = 10\text{ V}$, $I_D = 0.5\text{ A}$ | | 0.6 | | S |
| C_{iss} C_{oss} C_{rss} | Input Capacitance Output Capacitance Reverse Transfer Capacitance | $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$ | | 43 20 6 | | pF pF pF |

SWITCHING ON

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-------------------------------|--|--|------|-------------------|------|----------------|
| $t_{d(on)}$ t_r | Turn-on Delay Time Rise Time | $V_{DD} = 30\text{ V}$, $I_D = 0.5\text{ A}$ $R_G = 4.7\Omega$, $V_{GS} = 4.5\text{ V}$ (see test circuit, Figure 1) | | 5 15 | | ns ns |
| Q_g Q_{gs} Q_{gd} | Total Gate Charge Gate-Source Charge Gate-Drain Charge | $V_{DD} = 30\text{ V}$, $I_D = 1\text{ A}$, $V_{GS} = 5\text{ V}$ (see test circuit, Figure 2) | | 1.4 0.8 0.5 | 2 | nC nC nC |

SWITCHING OFF

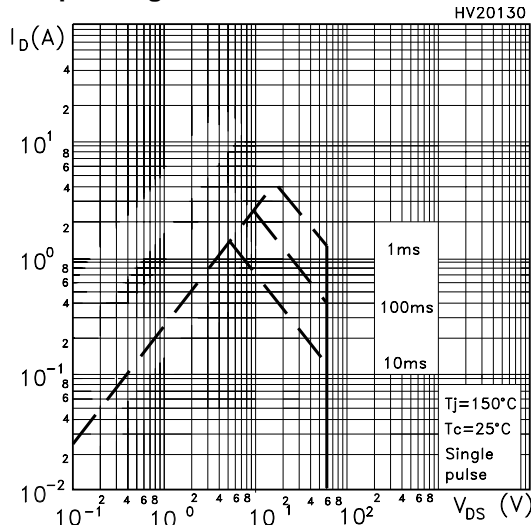
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-----------------------|----------------------------------|--|------|--------|------|----------|
| $t_{d(off)}$ t_f | Turn-Off Delay Time Fall Time | $V_{DD} = 30\text{ V}$, $I_D = 0.5\text{ A}$, $R_G = 4.7\Omega$, $V_{GS} = 4.5\text{ V}$ (see test circuit, Figure 1) | | 7 8 | | ns ns |

SOURCE DRAIN DIODE

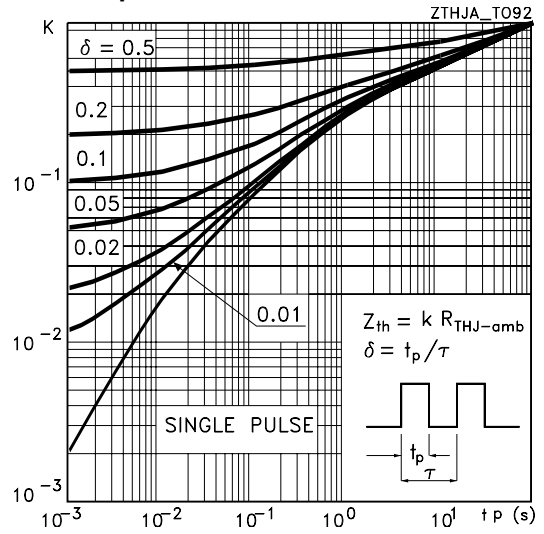
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-----------------------------------|--|--|------|-----------------|--------------|---------------|
| I_{SD} I_{SDM} (2) | Source-drain Current Source-drain Current (pulsed) | | | | 0.35 1.40 | A A |
| V_{SD} (1) | Forward On Voltage | $I_{SD} = 1\text{ A}$, $V_{GS} = 0$ | | | 1.2 | V |
| t_{rr} Q_{rr} I_{RRM} | Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current | $I_{SD} = 1\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 20\text{ V}$, $T_j = 150^{\circ}\text{C}$ (see test circuit, Figure 3) | | 32 25 1.6 | | ns nC A |

Note: 1. Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %.
2. Pulse width limited by safe operating area.

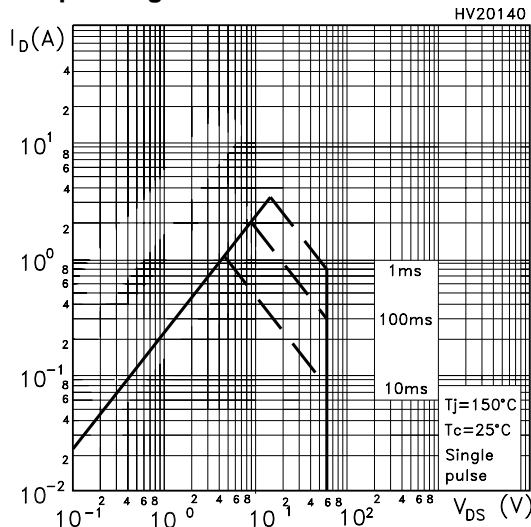
Safe Operating Area For TO-92



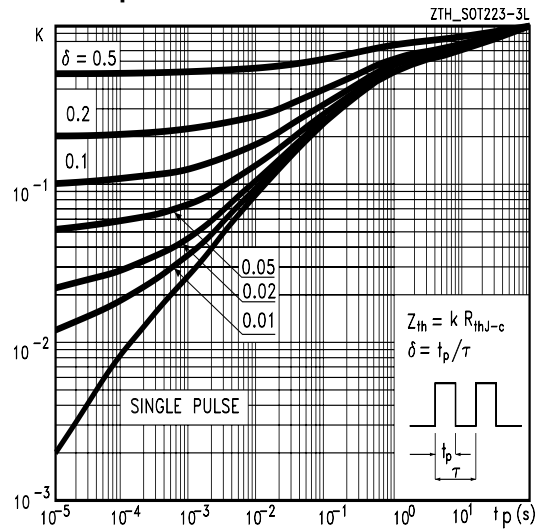
Thermal Impedance For TO-92



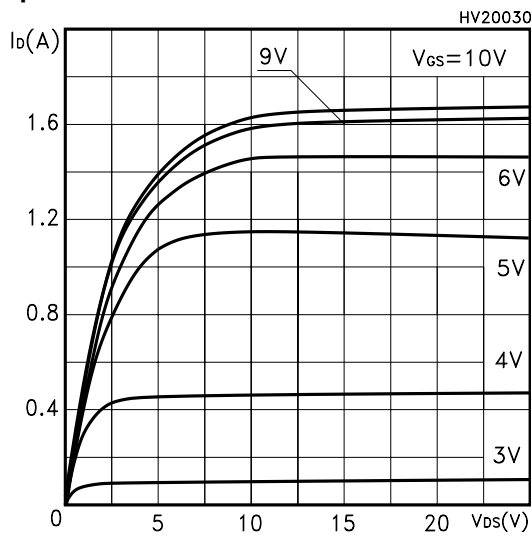
Safe Operating Area For SOT23-3L



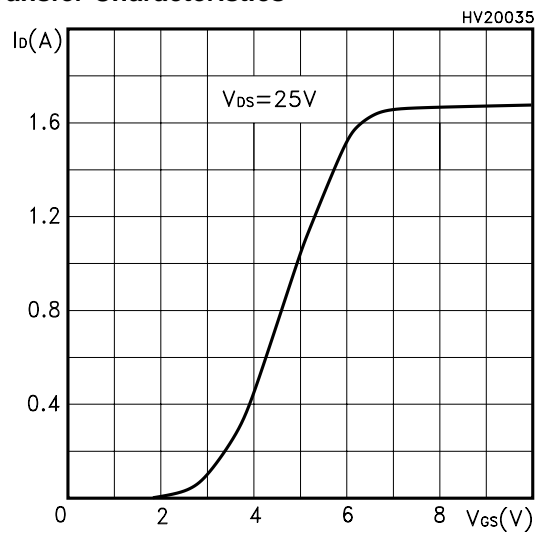
Thermal Impedance For SOT23-3L



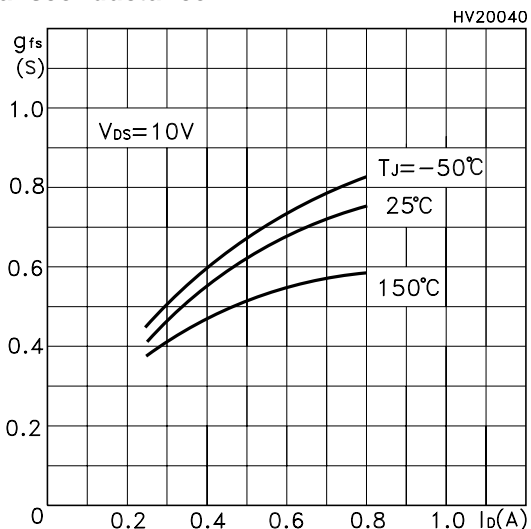
Output Characteristics



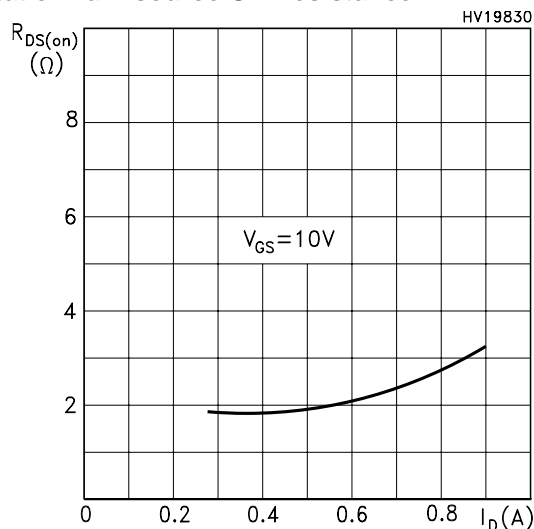
Transfer Characteristics



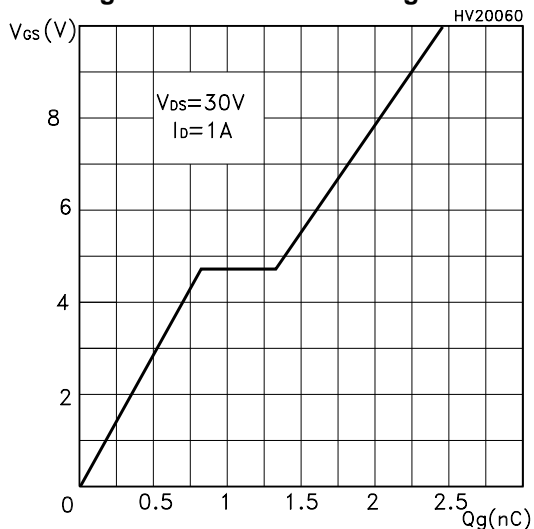
Transconductance



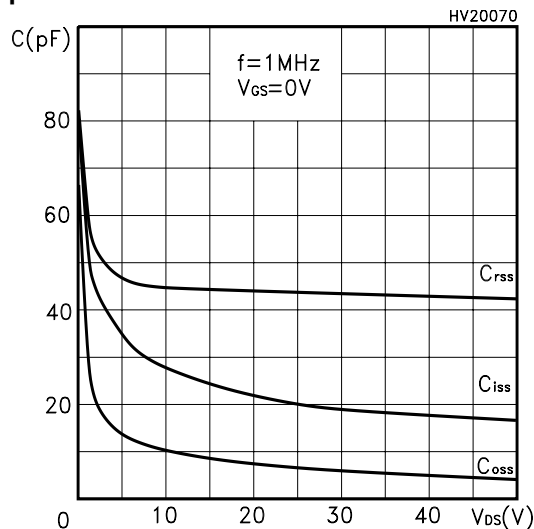
Static Drain-source On Resistance



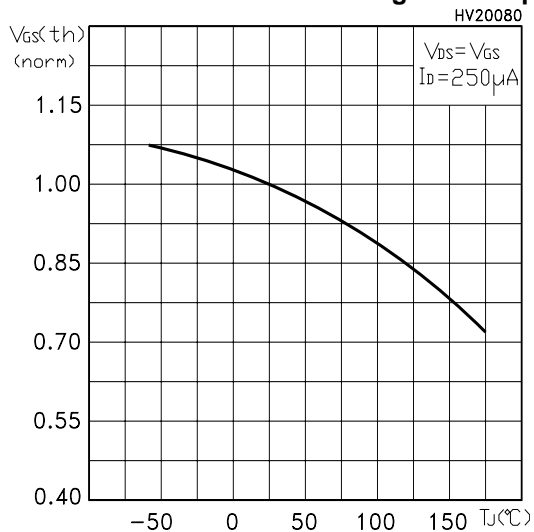
Gate Charge vs Gate-source Voltage



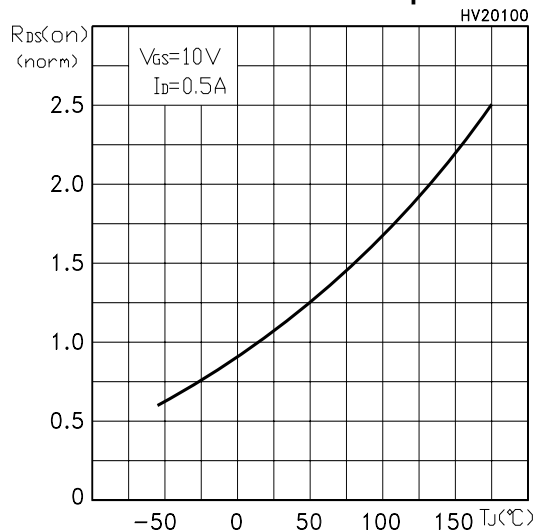
Capacitance Variations



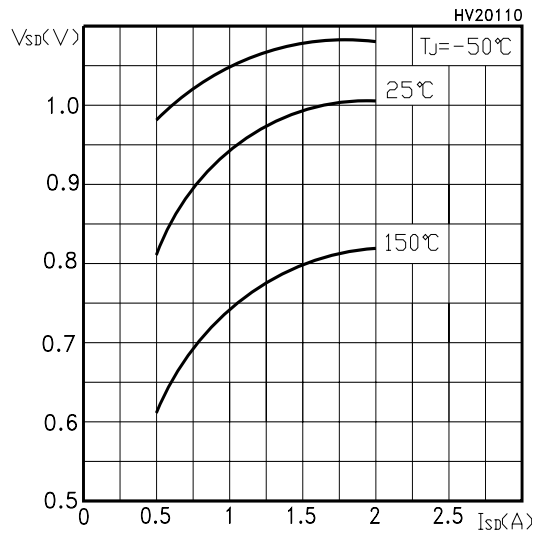
Normalized Gate Threshold Voltage vs Temp.



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics



Normalized BVDSS vs Temperature

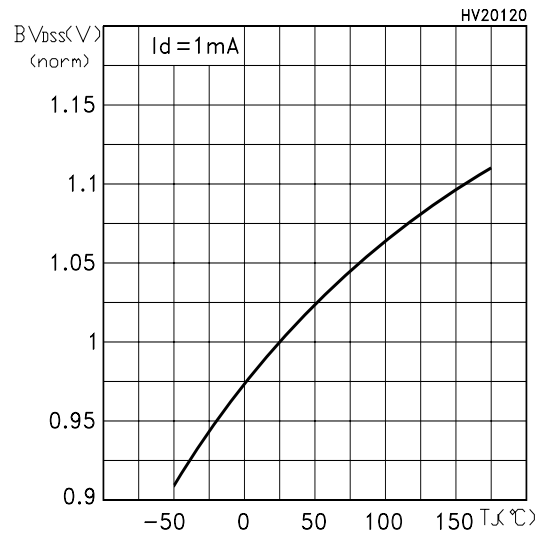


Fig. 1: Switching Times Test Circuit For Resistive Load

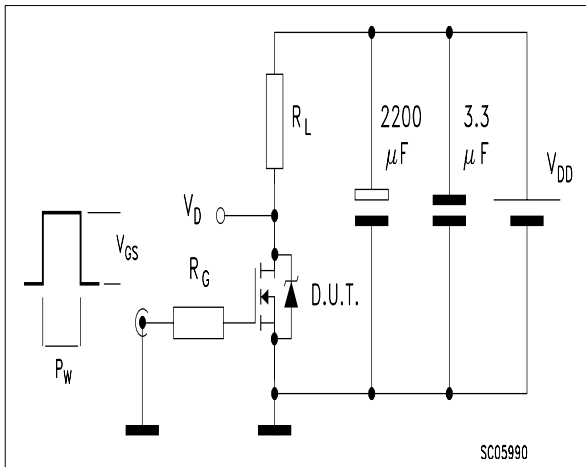


Fig. 2: Gate Charge test Circuit

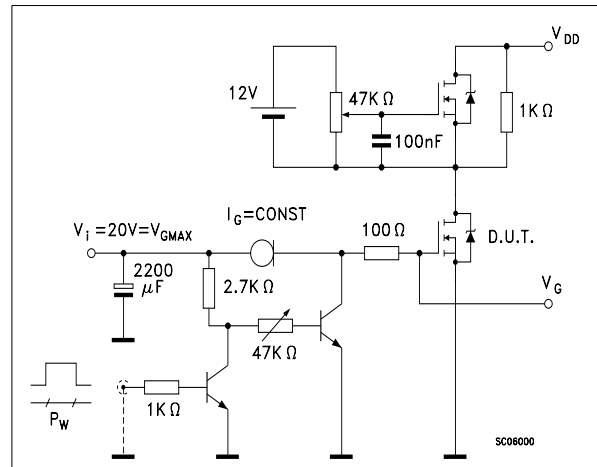
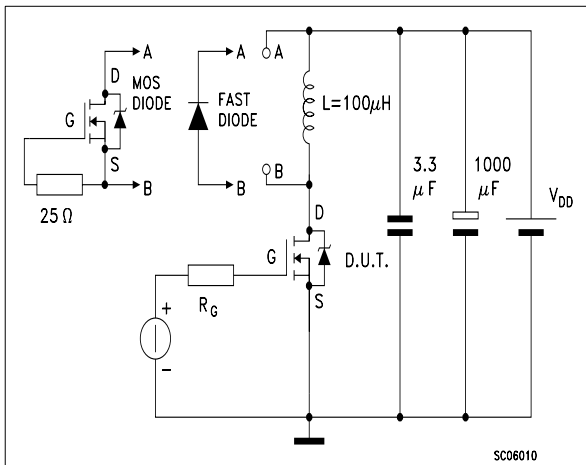
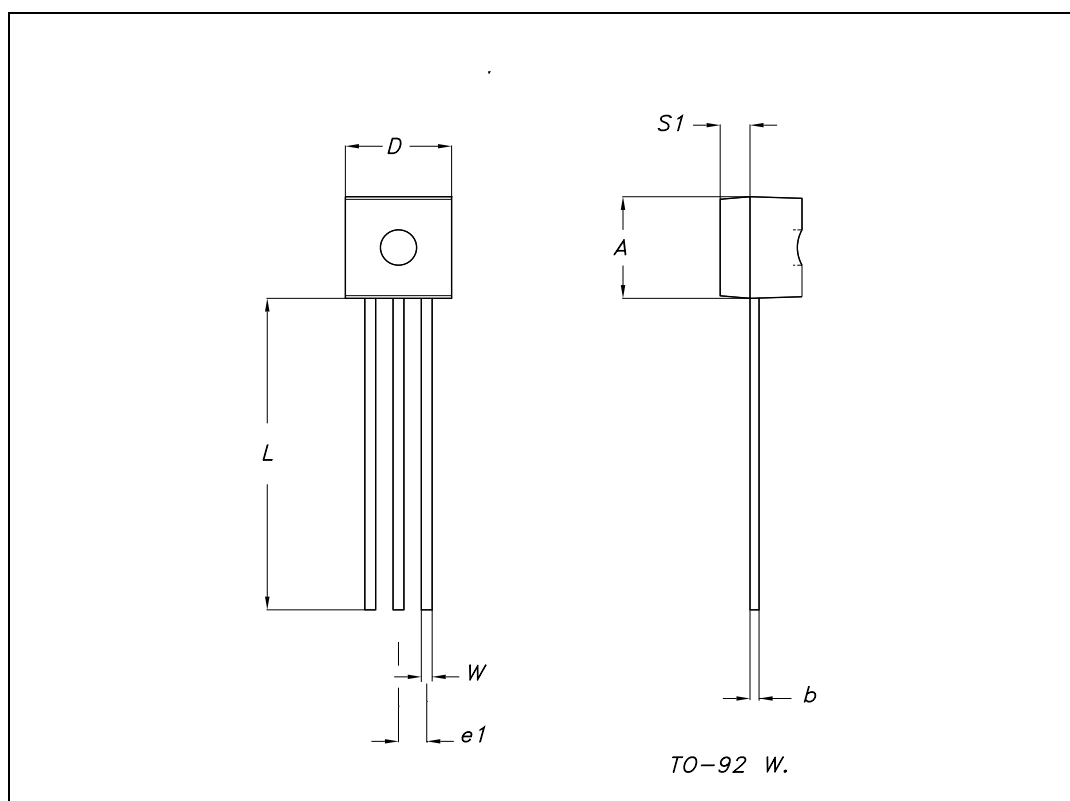


Fig. 3: Test Circuit For Diode Recovery Behaviour



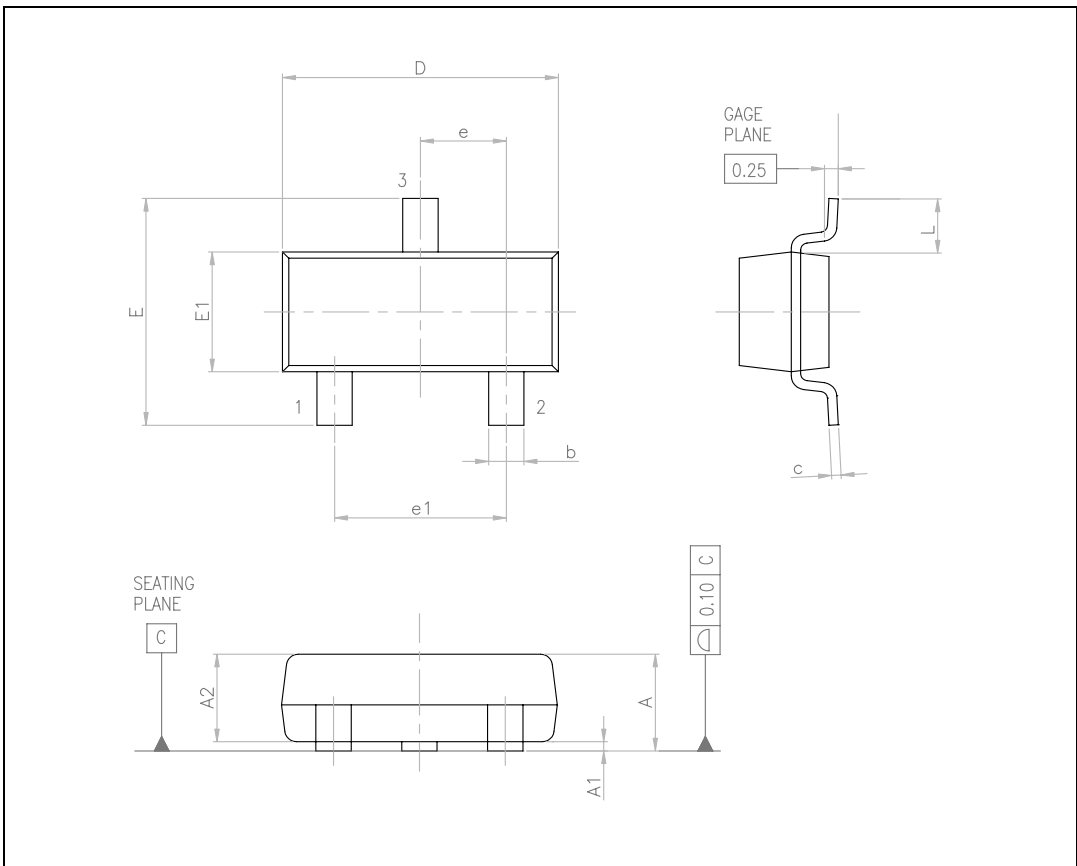
TO-92 MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|-------|------|-------|-------|------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.38 | | 4.78 | 0.17 | | 0.188 |
| b | 0.33 | | 0.48 | 0.013 | | 0.018 |
| D | 4.43 | | 4.83 | 0.174 | | 0.190 |
| E | | | 3.86 | | | 0.152 |
| e1 | 1.07 | | 1.74 | 0.042 | | 0.068 |
| L | 14.07 | | 14.87 | 0.553 | | 0.585 |
| S1 | 0.92 | | 1.12 | 0.036 | | 0.044 |
| W | 0.36 | | 0.56 | 0.014 | | 0.022 |
| V | | 4° | | | 4° | |



SOT23-3L MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|-------|------|-------|--------|------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 0.903 | | 1.220 | 0.035 | | 0.048 |
| A1 | 0.013 | | 0.100 | 0.0005 | | 0.004 |
| A2 | 0.890 | | 1.120 | 0.035 | | 0.044 |
| b | 0.370 | | 0.510 | 0.014 | | 0.020 |
| C | 0.085 | | 0.180 | 0.003 | | 0.007 |
| D | 2.800 | | 3.040 | 0.110 | | 0.120 |
| E | 2.100 | | 2.64 | 0.082 | | 0.104 |
| E1 | 1.200 | | 1.400 | 0.047 | | 0.055 |
| e | 0.890 | | 1.030 | 0.035 | | 0.040 |
| e1 | 1.780 | | 2.050 | 0.070 | | 0.080 |
| L | 0.400 | | 0.600 | 0.015 | | 0.023 |



Information furnished is believed to be accurate and reliable. However, STMicroelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of STMicroelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. STMicroelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of STMicroelectronics.

The ST logo is a registered trademark of STMicroelectronics
All other names are the property of their respective owners

© 2004 STMicroelectronics - All Rights Reserved
STMicroelectronics GROUP OF COMPANIES

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan -
Malaysia - Malta - Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States.
<http://www.st.com>