



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

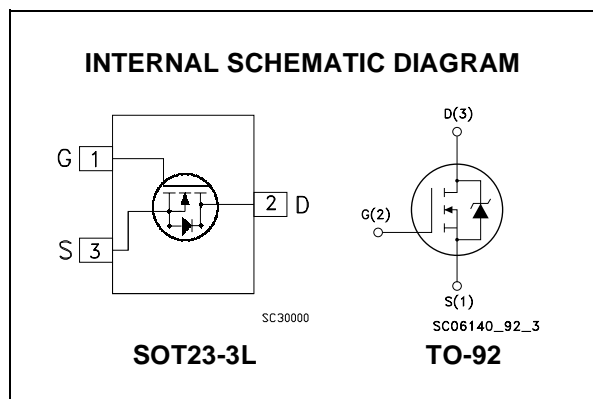
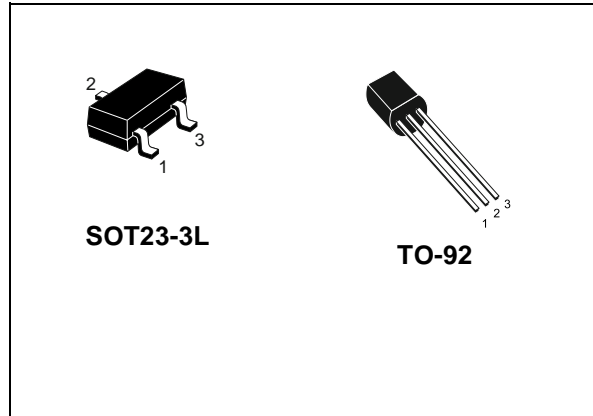
- TYPICAL R_{DS(on)} = 1.8Ω @10V
- LOW Q_g
- LOW THRESHOLD DRIVE

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

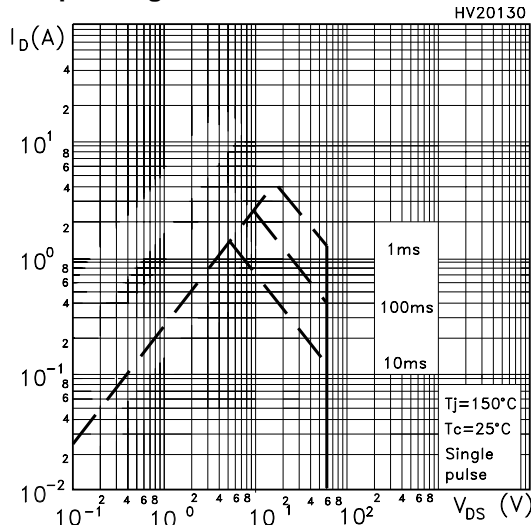
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$ t_f	Turn-Off Delay Time Fall Time	$V_{DD} = 30\text{ V}$, $I_D = 0.5\text{ A}$, $R_G = 4.7\Omega$, $V_{GS} = 4.5\text{ V}$ (see test circuit, Figure 1)		7 8		ns ns

SOURCE DRAIN DIODE

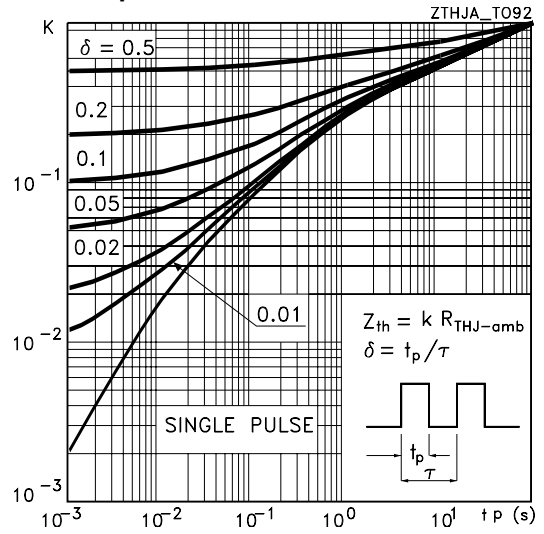
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (2)	Source-drain Current Source-drain Current (pulsed)				0.35 1.40	A A
V_{SD} (1)	Forward On Voltage	$I_{SD} = 1\text{ A}$, $V_{GS} = 0$			1.2	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current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

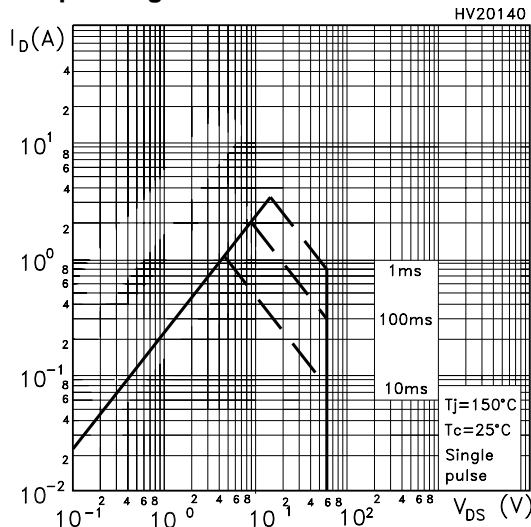
Safe Operating Area For TO-92



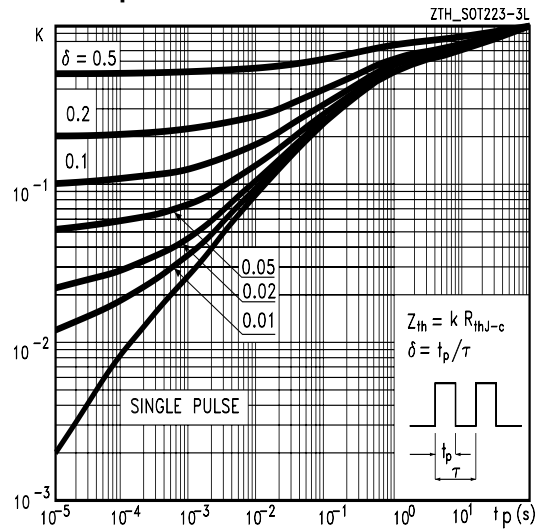
Thermal Impedance For TO-92



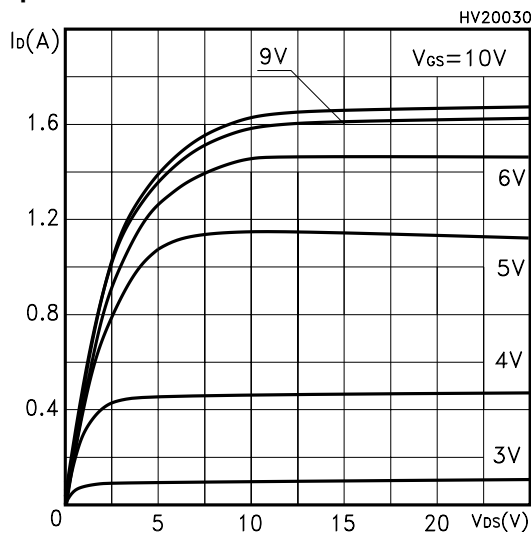
Safe Operating Area For SOT23-3L



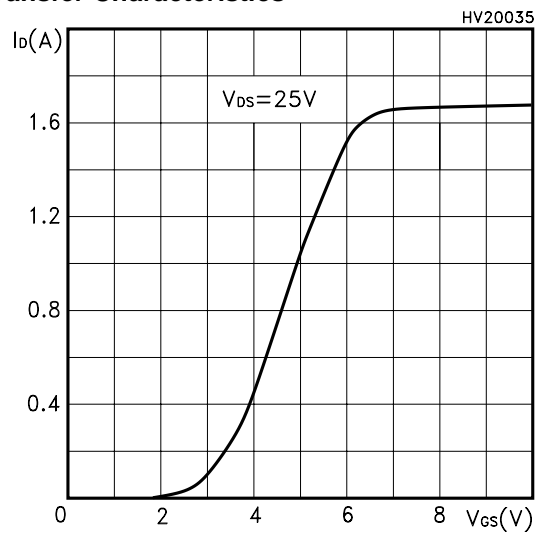
Thermal Impedance For SOT23-3L



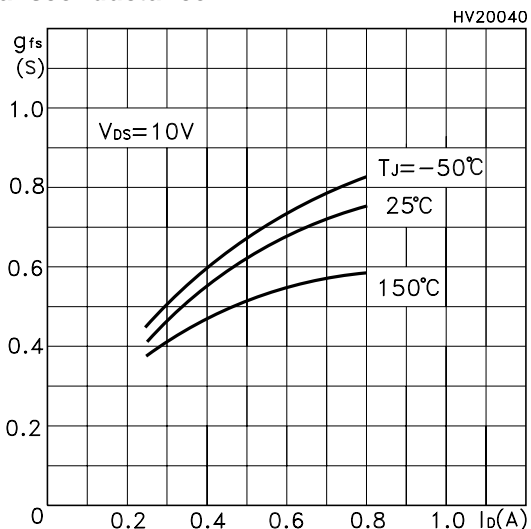
Output Characteristics



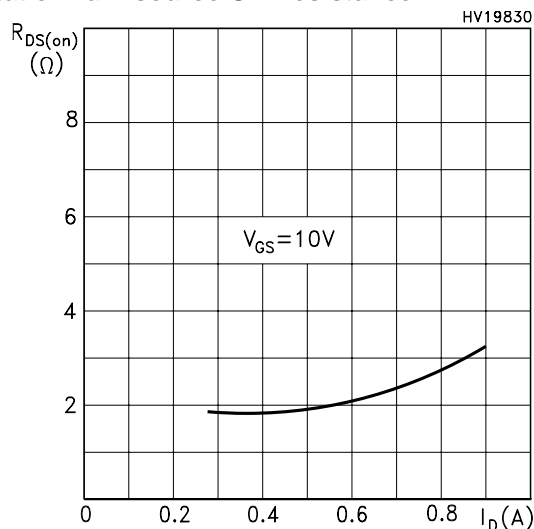
Transfer Characteristics



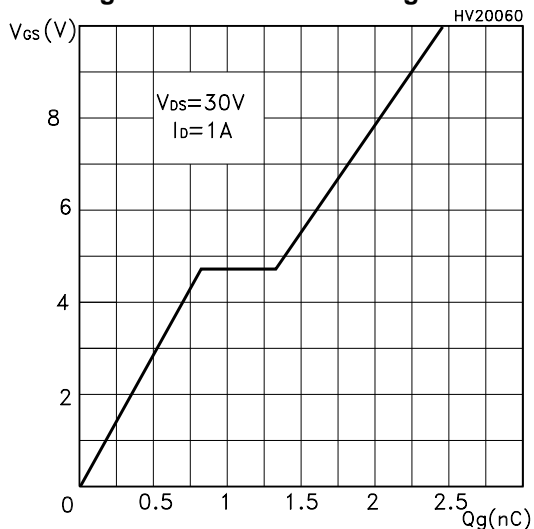
Transconductance



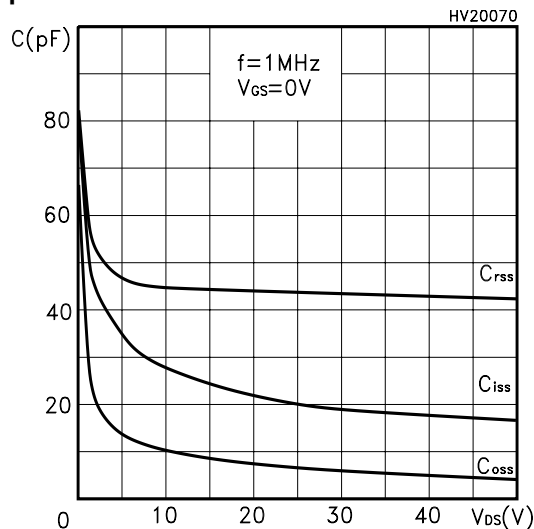
Static Drain-source On Resistance



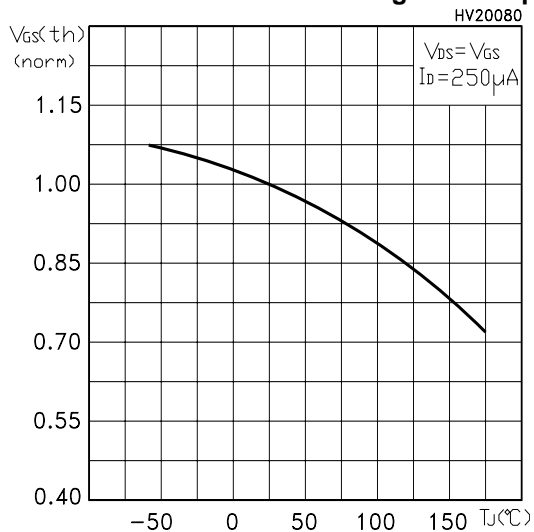
Gate Charge vs Gate-source Voltage



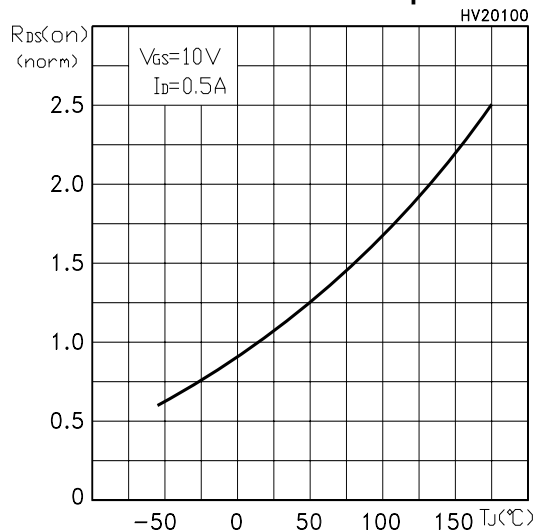
Capacitance Variations



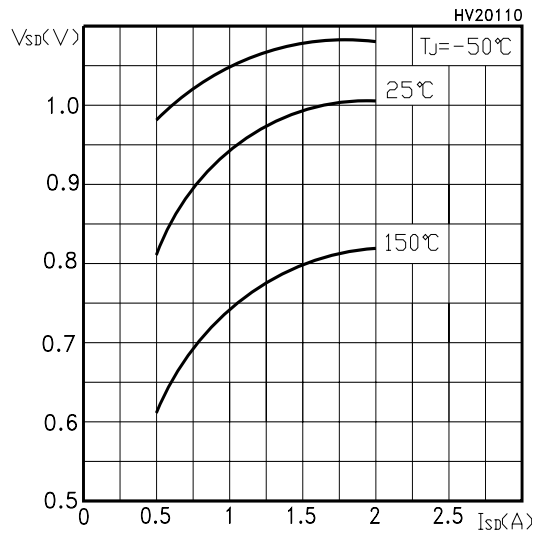
Normalized Gate Threshold Voltage vs Temp.



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics



Normalized BVDSS vs Temperature

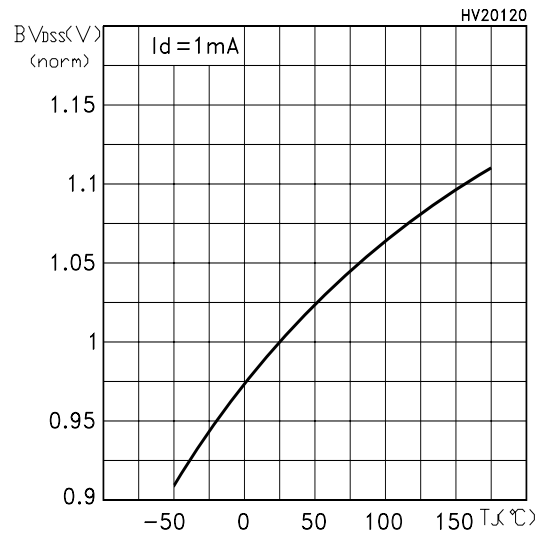


Fig. 1: Switching Times Test Circuit For Resistive Load

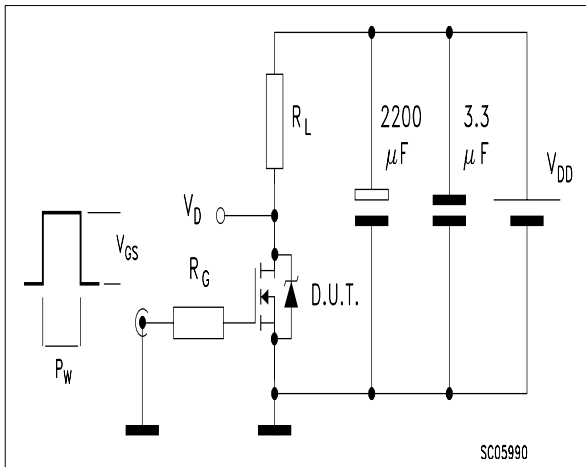


Fig. 2: Gate Charge test Circuit

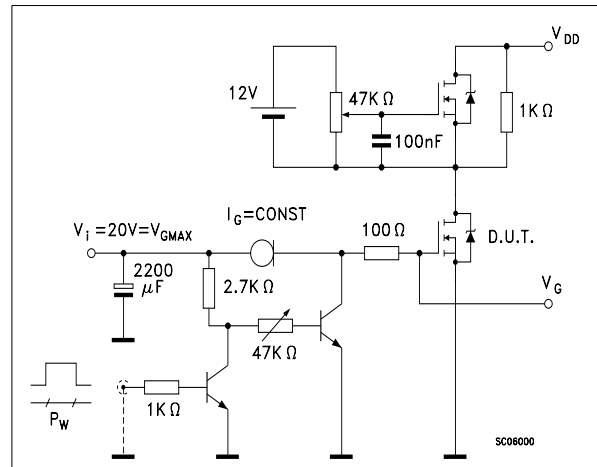
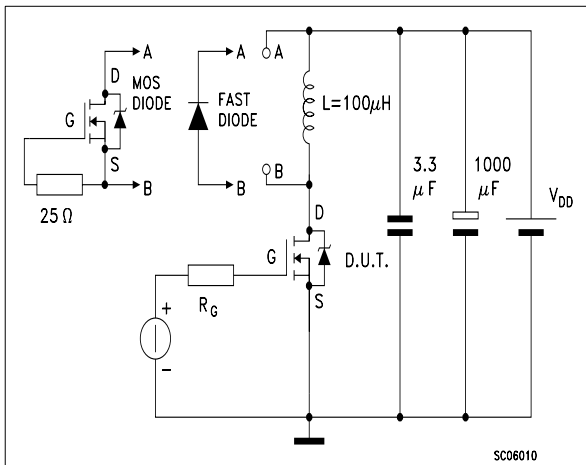
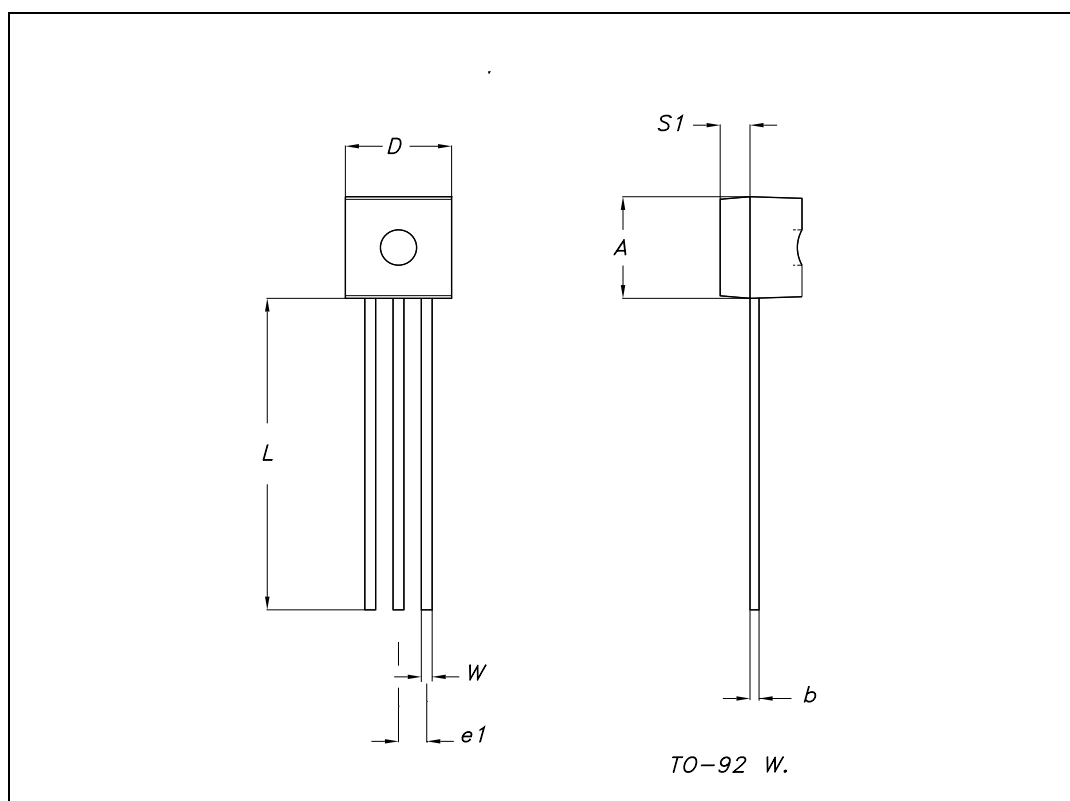


Fig. 3: Test Circuit For Diode Recovery Behaviour



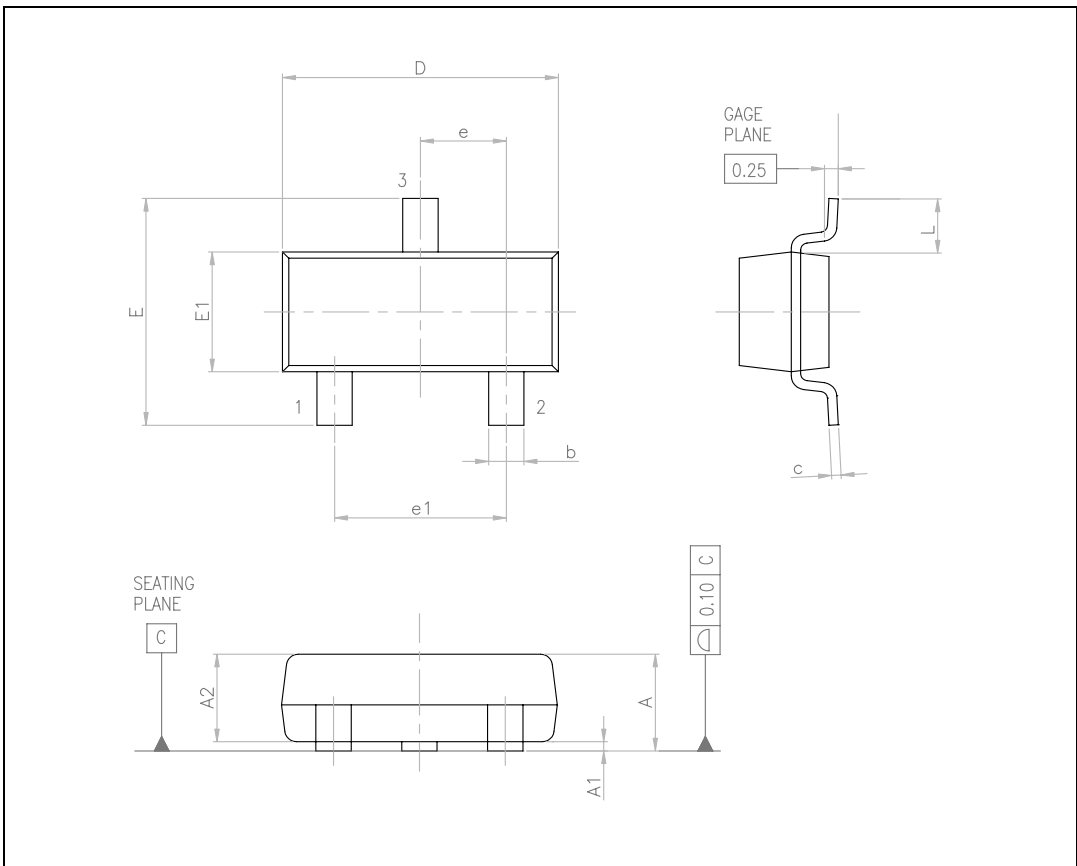
TO-92 MECHANICAL DATA

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



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