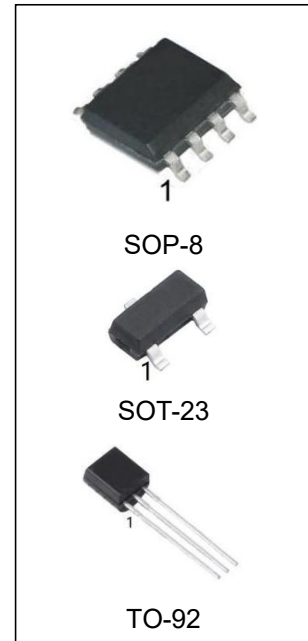


Micro power Voltage Reference Diodes

Features

- Operating Current from 10 μ A to 20 mA
- 1.5% and 3.0% Initial Tolerance Grades
- Low Temperature Coefficient
- 1.0 Ω Dynamic Impedance
- Surface Mount Package Available
- Pb-Free Packages are Available



Ordering Information

DEVICE	Package Type	MARKING	Packing	Packing Qty
LM385Z-1.2	TO-92	LM385-1.2	BAG	1000pcs/box
LM385Z-2.5	TO-92	LM385-2.5	BAG	1000pcs/box
LM385M-1.2/TR	SOP-8	385-1.2	REEL	2500pcs/reel
LM385M-2.5/TR	SOP-8	385-2.5	REEL	2500pcs/reel
LM385M3-1.2/TR	SOT-23	R11	REEL	3000pcs/reel
LM385M3-2.5/TR	SOT-23	R12	REEL	3000pcs/reel

General Description

The LM385 series are micropower two-terminal bandgap voltage regulator diodes. Designed to operate over a wide current range of 10 μ A to 20 mA, these devices feature exceptionally low dynamic impedance, low noise and stable operation over time and temperature. Tight voltage tolerances are achieved by on-chip trimming. The large dynamic operating range enables these devices to be used in applications with widely varying supplies with excellent regulation. Extremely low operating current make these devices ideal for micropower circuitry like portable instrumentation, regulators and other analog circuitry where extended battery life is required.

The LM385 is also available in a surface mount plastic package in voltages of 1.235 V and 2.500 V.

Functional Diagram

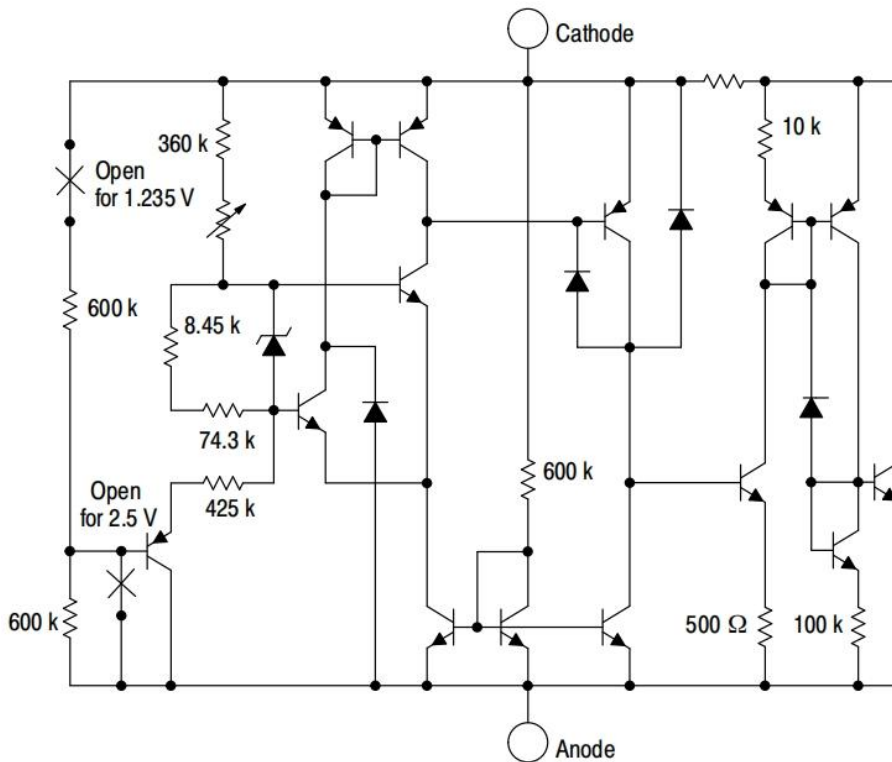
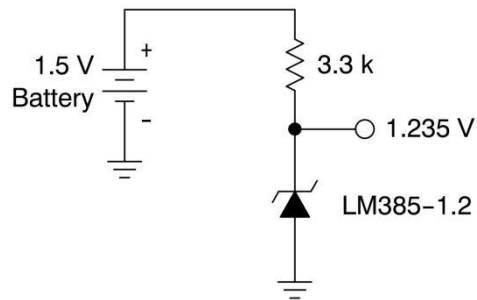


Figure 1. Representative Schematic Diagram

Standard Application



Maximum Ratings

($T_A = 25^\circ\text{C}$, unless otherwise noted)

Rating		Symbol	Value	Unit
Reverse Current		I_R	30	mA
Forward Current		I_F	10	mA
Operating Ambient Temperature Range		T_A	0 to +70	$^\circ\text{C}$
Operating Junction Temperature		T_J	+150	$^\circ\text{C}$
Lead Temperature (Soldering, 10 seconds)		T_L	+245	$^\circ\text{C}$
Storage Temperature Range		T_{stg}	-65 to + 150	$^\circ\text{C}$
Electrostatic Discharge Sensitivity (ESD)	Human Body Model (HBM)	ESD	4000	V
	Machine Model (MM)		400	
	Charged Device Model (CDM)		2000	

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Electrical Characteristics

LM385-1.2, $T_A = 25^\circ\text{C}$, unless otherwise noted

Characteristic	Symbol	LM385-1.2			Unit
		Min	Typ	Max	
Reverse Breakdown Voltage ($I_{Rmin} \leq I_R \leq 20 \text{ mA}$) $T_A = T_{low} \text{ to } T_{high}$ (Note 1)	$V_{(BR)R}$	1.210 1.192	1.235 -	1.260 1.273	V
Minimum Operating Current $T_A = 25^\circ\text{C}$ $T_A = T_{low} \text{ to } T_{high}$ (Note 1)	I_{Rmin}	- -	8.0 -	15 20	μA
Reverse Breakdown Voltage Change with Current $I_{Rmin} \leq I_R \leq 1.0 \text{ mA}$, $T_A = +25^\circ\text{C}$ $T_A = T_{low} \text{ to } T_{high}$ (Note 1) $1.0 \text{ mA} \leq I_R \leq 20 \text{ mA}$, $T_A = +25^\circ\text{C}$ $T_A = T_{low} \text{ to } T_{high}$ (Note 1)	$\Delta V_{(BR)R}$	- - - -	- - - -	1.0 1.5 20 25	mV
Reverse Dynamic Impedance $I_R = 100 \mu\text{A}$, $T_A = +25^\circ\text{C}$	Z	-	0.6	-	Ω
Average Temperature Coefficient $10 \mu\text{A} \leq I_R \leq 20 \text{ mA}$, $T_A = T_{low} \text{ to } T_{high}$ (Note 1)	$\Delta V_{(BR)}/\Delta T$	-	80	-	ppm/ $^\circ\text{C}$
Wideband Noise (RMS) $I_R = 100 \mu\text{A}$, $10 \text{ Hz} \leq f \leq 10 \text{ kHz}$	n	-	60	-	μV
Long Term Stability $I_R = 100 \mu\text{A}$, $T_A = +25^\circ\text{C} \pm 0.1^\circ\text{C}$	S	-	20	-	ppm/kHR

LM385-2.5, $T_A = 25^\circ\text{C}$, unless otherwise noted

Characteristic	Symbol	LM385-2.5			Unit
		Min	Typ	Max	
Reverse Breakdown Voltage ($I_{Rmin} \leq I_R \leq 20 \text{ mA}$) $T_A = T_{low} \text{ to } T_{high}$ (Note 1)	$V_{(BR)R}$	2.46 2.42	2.5 -	2.54 2.60	V
Minimum Operating Current $T_A = 25^\circ\text{C}$ $T_A = T_{low} \text{ to } T_{high}$ (Note 1)	I_{Rmin}	- -	13 -	20 30	μA
Reverse Breakdown Voltage Change with Current $I_{Rmin} \leq I_R \leq 1.0 \text{ mA}$, $T_A = +25^\circ\text{C}$ $T_A = T_{low} \text{ to } T_{high}$ (Note 2) $1.0 \text{ mA} \leq I_R \leq 20 \text{ mA}$, $T_A = +25^\circ\text{C}$ $T_A = T_{low} \text{ to } T_{high}$ (Note 2)	$\Delta V_{(BR)R}$	- - - -	- - - -	2.0 2.5 20 25	mV
Reverse Dynamic Impedance $I_R = 100 \mu\text{A}$, $T_A = +25^\circ\text{C}$	Z	-	0.6	-	Ω
Average Temperature Coefficient $20 \mu\text{A} \leq I_R \leq 20 \text{ mA}$, $T_A = T_{low} \text{ to } T_{high}$ (Note 1)	$\Delta V_{(BR)}/\Delta T$	-	80	-	ppm/ $^\circ\text{C}$
Wideband Noise (RMS) $I_R = 100 \mu\text{A}$, $10 \text{ Hz} \leq f \leq 10 \text{ kHz}$	n	-	120	-	μV
Long Term Stability $I_R = 100 \mu\text{A}$, $T_A = +25^\circ\text{C} \pm 0.1^\circ\text{C}$	S	-	20	-	ppm/kHR

Note 1: $T_{low} = 0^\circ\text{C}$ for LM385-1.2, LM385-2.5; $T_{high} = +70^\circ\text{C}$ for LM385-1.2, LM385-2.5

Typical Performance Curves

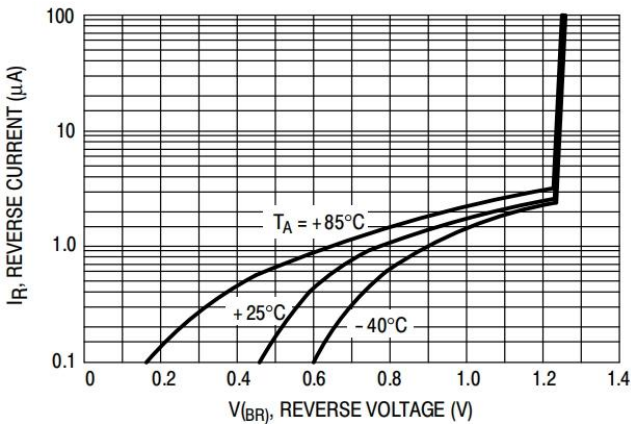


Figure 2. Reverse Characteristics

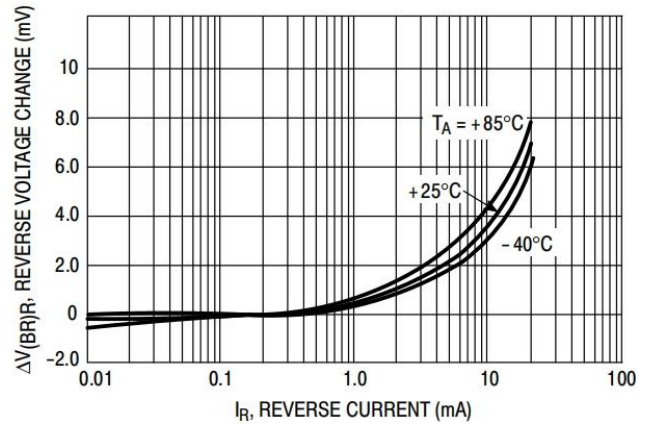


Figure 3. Reverse Characteristics

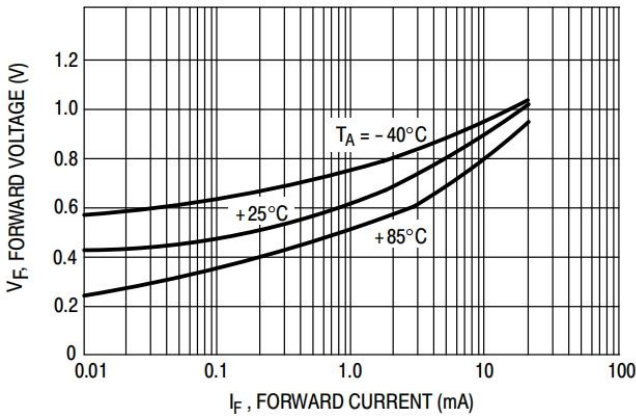


Figure 4. Forward Characteristics

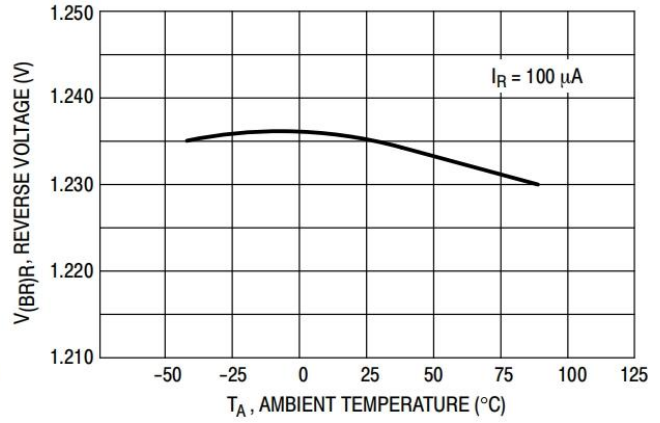


Figure 5. Temperature Drift

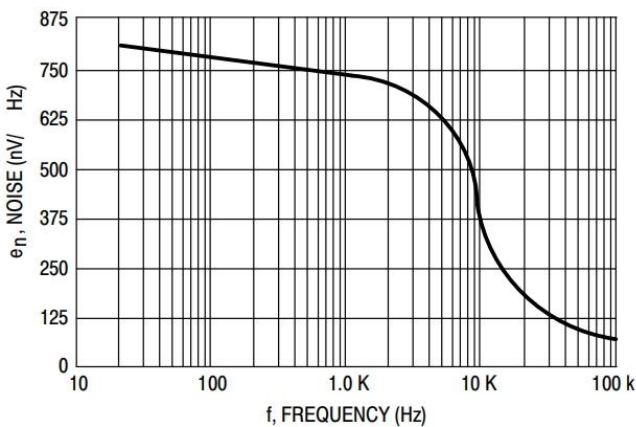


Figure 6. Noise Voltage

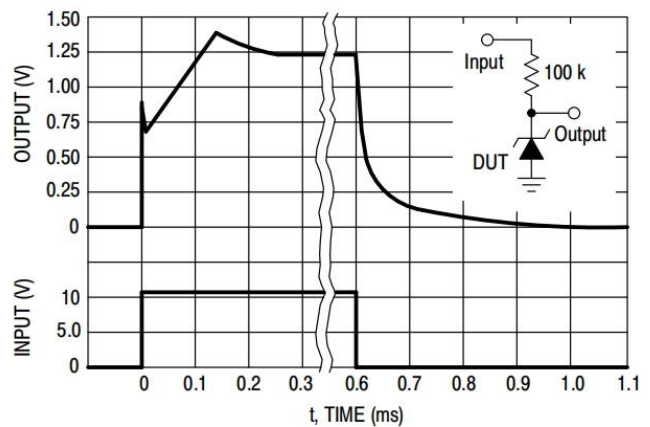


Figure 7. Response Time

Typical Performance Curves

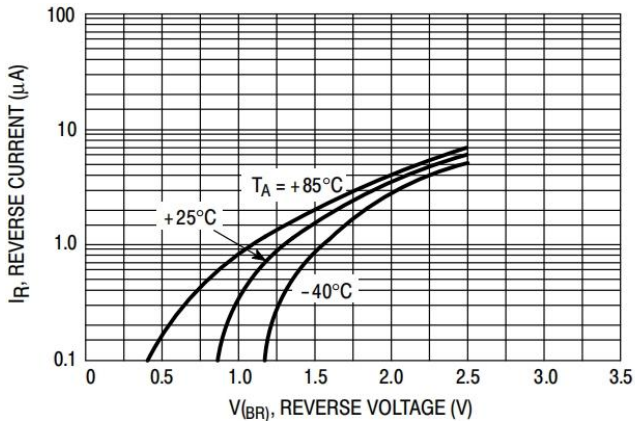


Figure 8. Reverse Characteristics

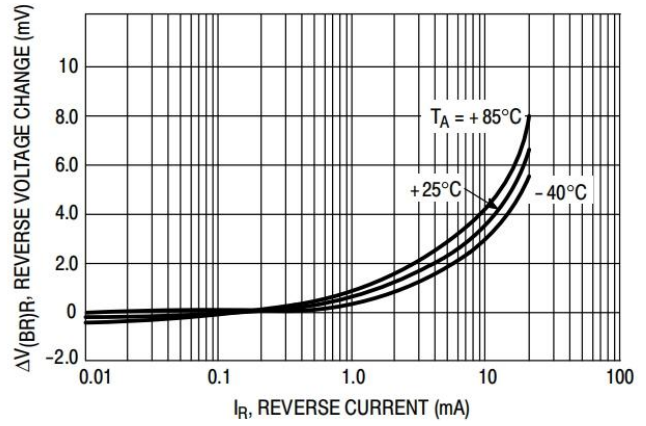


Figure 9. Reverse Characteristics

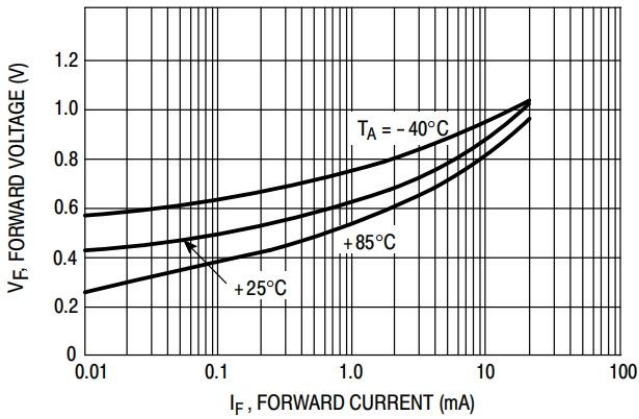


Figure 10. Forward Characteristics

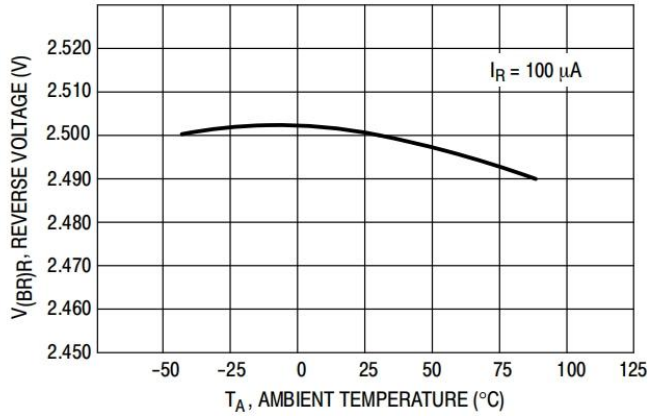


Figure 11. Temperature Drift

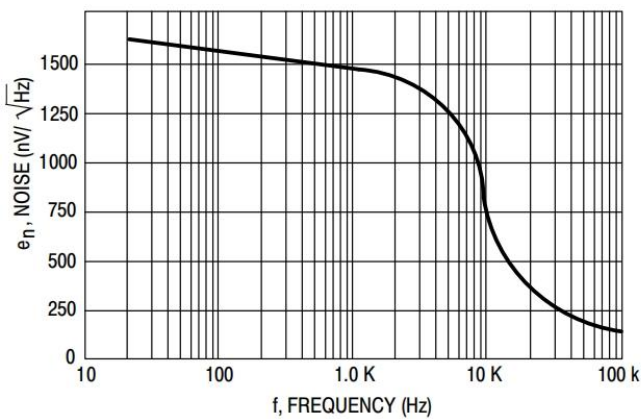


Figure 12. Noise Voltage

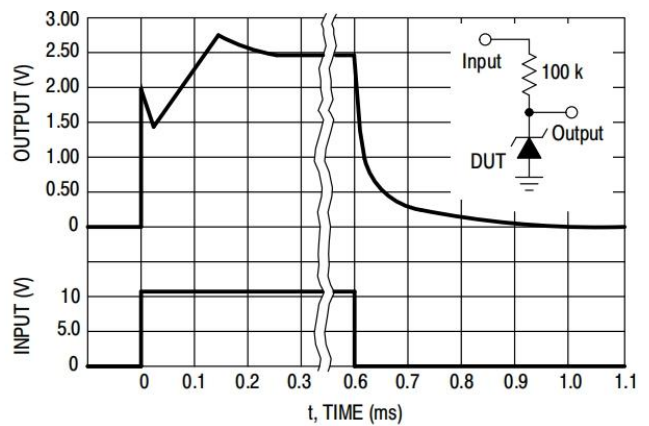
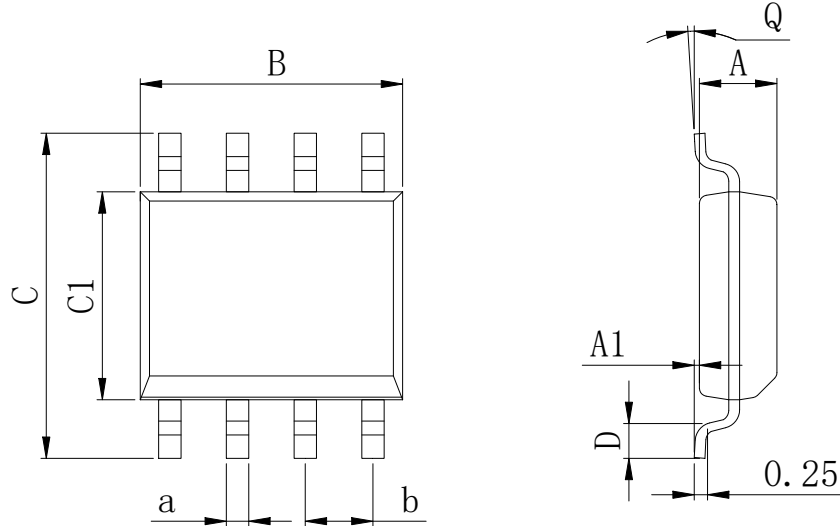


Figure 13. Response Time

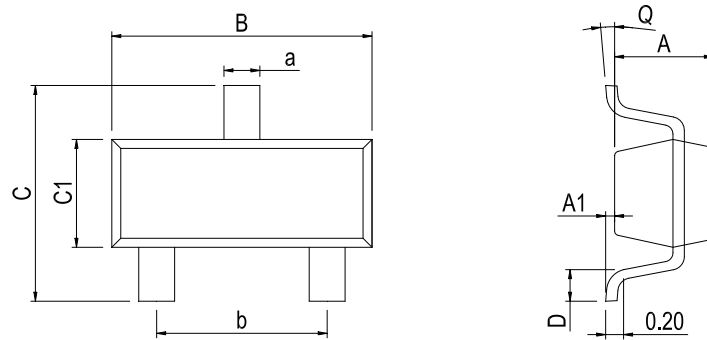
Physical Dimensions

SOP-8 (150mil)



Dimensions In Millimeters(SOP-8)									
Symbol:	A	A1	B	C	C1	D	Q	a	b
Min:	1.35	0.05	4.90	5.80	3.80	0.40	0°	0.35	1.27 BSC
Max:	1.55	0.20	5.10	6.20	4.00	0.80	8°	0.45	

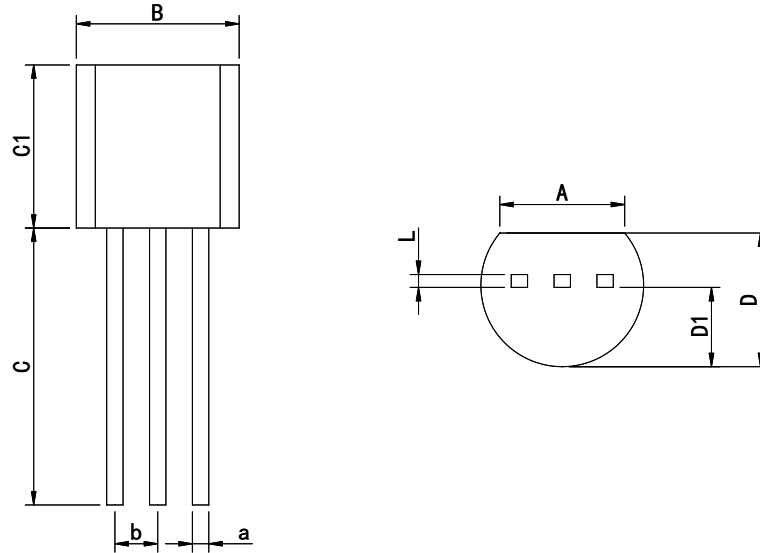
SOT-23



Dimensions In Millimeters(SOT-23)									
Symbol:	A	A1	B	C	C1	D	Q	a	b
Min:	0.90	0.00	2.80	2.25	1.20	0.13	0°	0.30	1.90 BSC
Max:	1.05	0.15	3.00	2.55	1.40	0.41	8°	0.50	

Physical Dimensions

TO-92



Dimensions In Millimeters(TO-92)									
Symbol:	A	B	C	C1	D	D1	L	a	b
Min:	3.43	4.44	13.5	4.32	3.17	2.03	0.33	0.40	1.27BSC
Max:	3.83	5.21	15.3	5.34	4.19	2.67	0.42	0.52	

Revision History

DATE	REVISION	PAGE
2015-10-25	New	1-10
2024-3-13	Document Reformatting	1-10

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