钍地半导体
Tudi Semiconductor

Product Specification

TUDI-LM385/LM285

Micropower Voltage Reference Diode

网址 www.sztdbdt.com

用芯智造·卓越品质

semiconductor device manufacturer

- Design
- research and development
- production
- and sales

Features

- ± 3% Initial Tolerance
- Operating Current of 100μA to 20mA
- 0.8Ω Dynamic Impedance
- Low Temperature Coefficient
- Low Voltage Reference—1.235V
- 2.5V Device Also Available

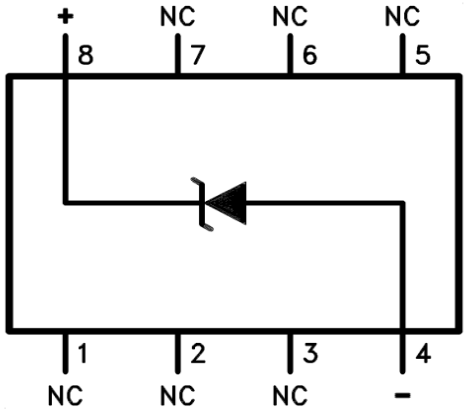


Figure 1. SOP8 Pin Diagram

Description

The LM385/285 is a micro-power-bandgap reference voltage source fabricated using bipolar process technology.

It delivers stable voltage reference across an operating current range of 100μA to 20mA, featuring low dynamic resistance and excellent temperature stability. The integrated reference adjustment mechanism ensures minimal output voltage tolerance. With its bandgap reference architecture consisting solely of transistors and resistors, the circuit exhibits low noise levels and superior long-term stability.

The LM385/285 design has been meticulously engineered to address potential challenges under diverse load conditions, ensuring exceptional adaptability to external loads and reliable performance across most reference voltage source applications. Its wide dynamic operating range enables the chip to maintain outstanding adjustment capabilities even when power supply fluctuations occur significantly.

The LM385/285 delivers precise reference voltage with minimal load current, making it ideal for low-power circuits as a reference voltage source in battery-powered portable devices, regulated power supplies, and general analog circuits.

The LM385/285 series products are available in two fixed voltage specifications: 1.2V and 2.5V .

Standard package types for the LM385/285 include TO-92, SOT-23 and SOP-8.

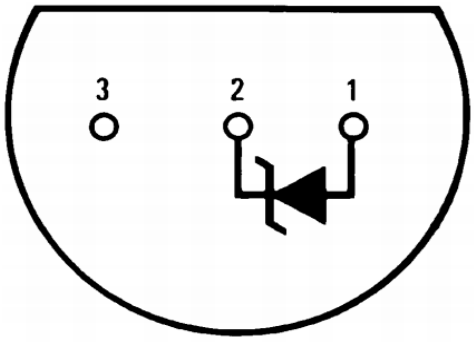


Figure 2. TO92 Pin Diagram

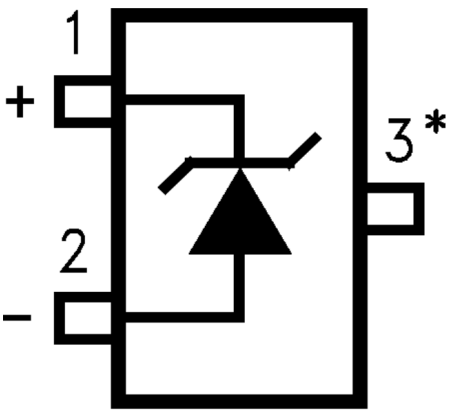


Figure 3. SOT23 Pin Diagram

Pin Description

Pin number			Name	Function
TO92	SOT23	SOP8		
2	1	8	Anode	Positive pole
1	2	4	Cathode	Negatve pole
3	3	1,2,3,5,6,7	NC	No internal connections

Absolute Rating

Project	Parameter values	Unit
Back current	30	mA
Forward currentt	10	mA
Operating temperature range	-40~85	℃
Storage temperature	-55~150	℃
Welding temperature(spot welding,10 seconds)	260	℃

Note: Limit parameters refer to the maximum values that must not be exceeded under any conditions. Exceeding these limits may cause physical damage such as product degradation. Additionally, normal chip operation cannot be guaranteed when approaching limit parameters.

Electrical parameters (1) LM385/285-1.2V (Ta=25℃, unless otherwise specified)

Parameter	Test condition	Representative value	LM385/285B-1.2		LM385/285		Unit
			Least	Crest	Least	Crest	
Breakdown reverse voltage	Ta=25℃,100μA≤IR≤20mA	1.235	1.223	1.247	1.205	1.260	V
Minimum working current		100		120		120	μA
Rate of change of reverse breakdown voltage with current	100μA≤IR≤1mA			1.5		1.5	mV
	1mA≤IR≤20mA			25		25	
Reverse dynamic impedance	IR=100μA,f=20Hz	1					Ω
Multi-frequency noise(rms)	IR=100μA,10 Hz≤f≤10kHz	60					μV
Long term stability	IR=100μA,T=1000Hr, TA=25℃±0.1℃	20					ppm
Mean temperature coefficient	IR=100 μA	80		150		150	ppm/℃

Electrical parameters (2) LM385/285-2.5V (Ta=25℃, unless otherwise specified)

Parameter	Test condition	Representatlve value	LM385/285A-2.5		LM385/285B-2.5		LM385/285-2.5		Unit
			Least	Crest	Least	Crest	Least	Crest	
Breakdown reverse voltage	Ta=25℃,100μA≤IR≤20mA	2.5	2.480	2.520	2.462	2.538	2.425	2.575	V
Minimum working current		100		120		130		130	μA
Rate of change of reverse breakdown voltage with current	100μA≤IR≤1mA			1.5		2.5		2.5	mV
	1mA≤IR≤20mA			20		25		25	
Reverse dynamic impedance	IR=100μA,f=20Hz	1							Ω
Multi-frequency noise(rms)	IR=100μA,10Hz≤f≤10kHz	120							μV
Long term stability	IR=100μA,T=1000Hr, TA=25℃±0.1℃	20							ppm
Mean temperature coefficient	IR=100 μA	80		150		150		150	ppm/℃

Application circuit diagram and working principle explanation for wide

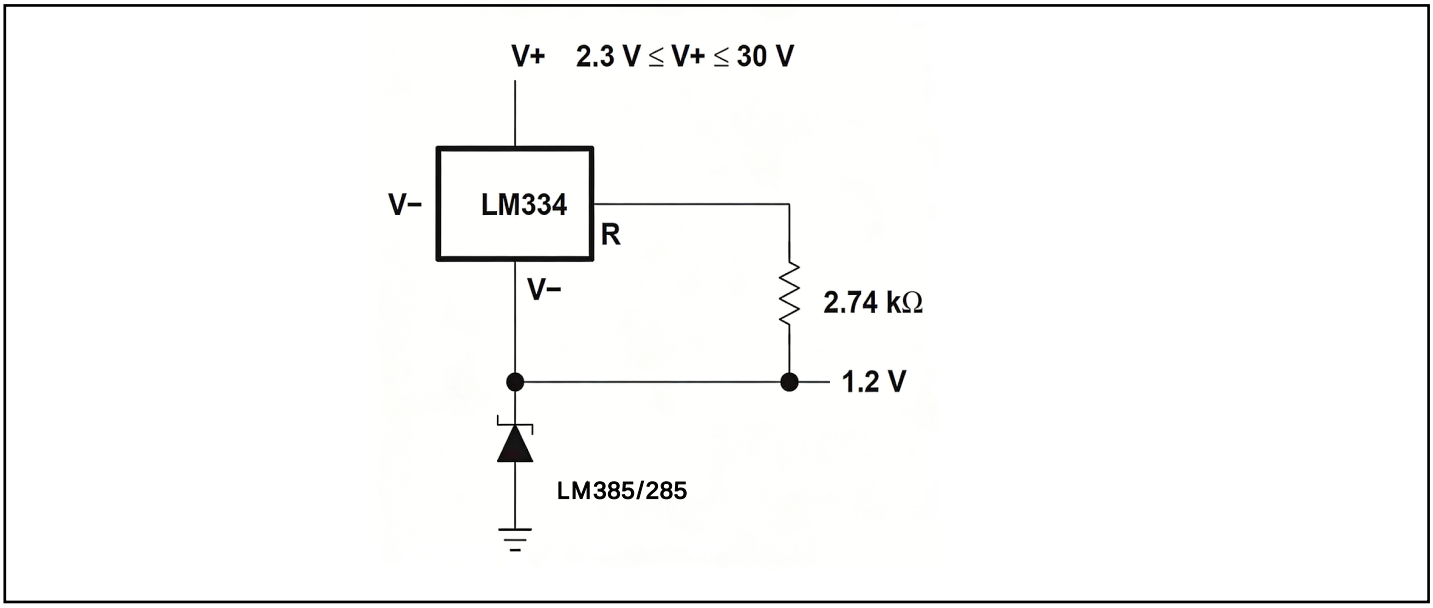


Figure 4 Input range reference

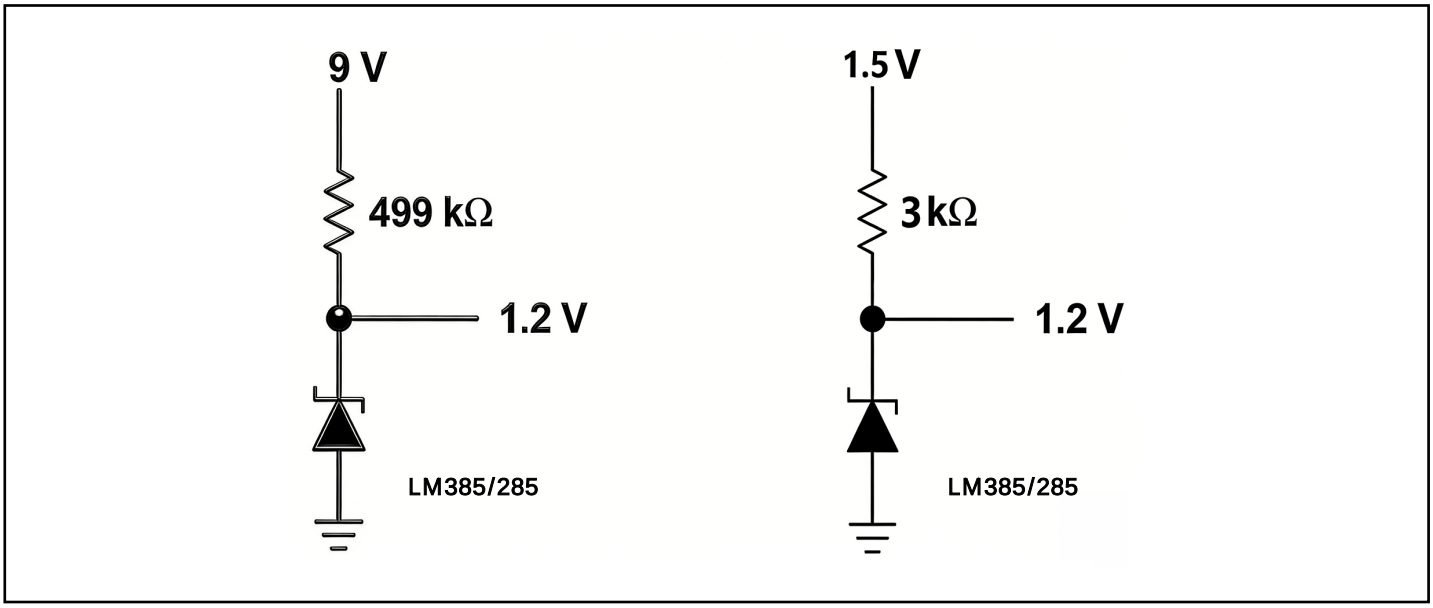


Figure 5 Micro Power Supply Reference (9V and 1.5V)

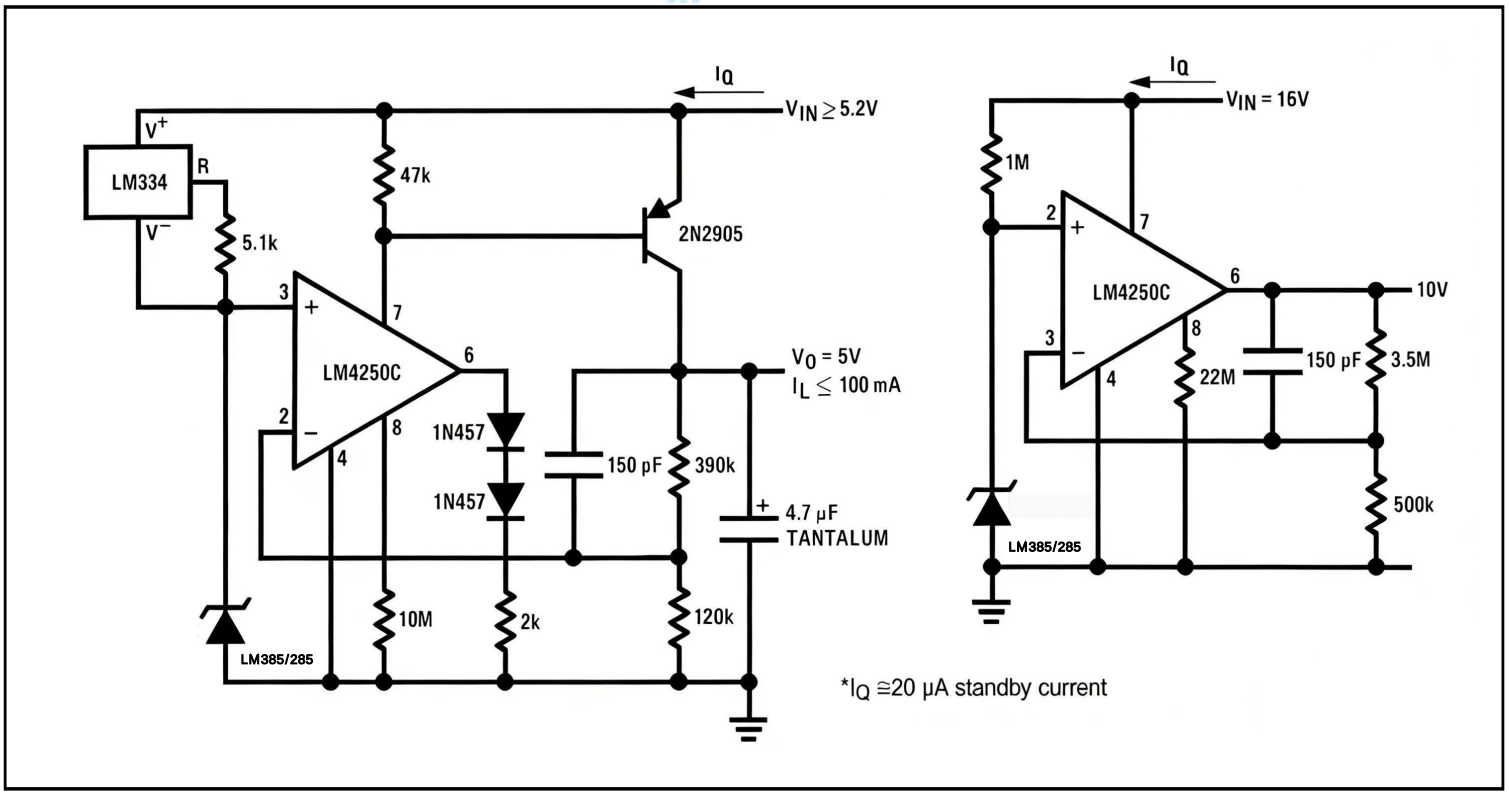


Figure 6 5V Regulator and 10V Reference Voltage Source

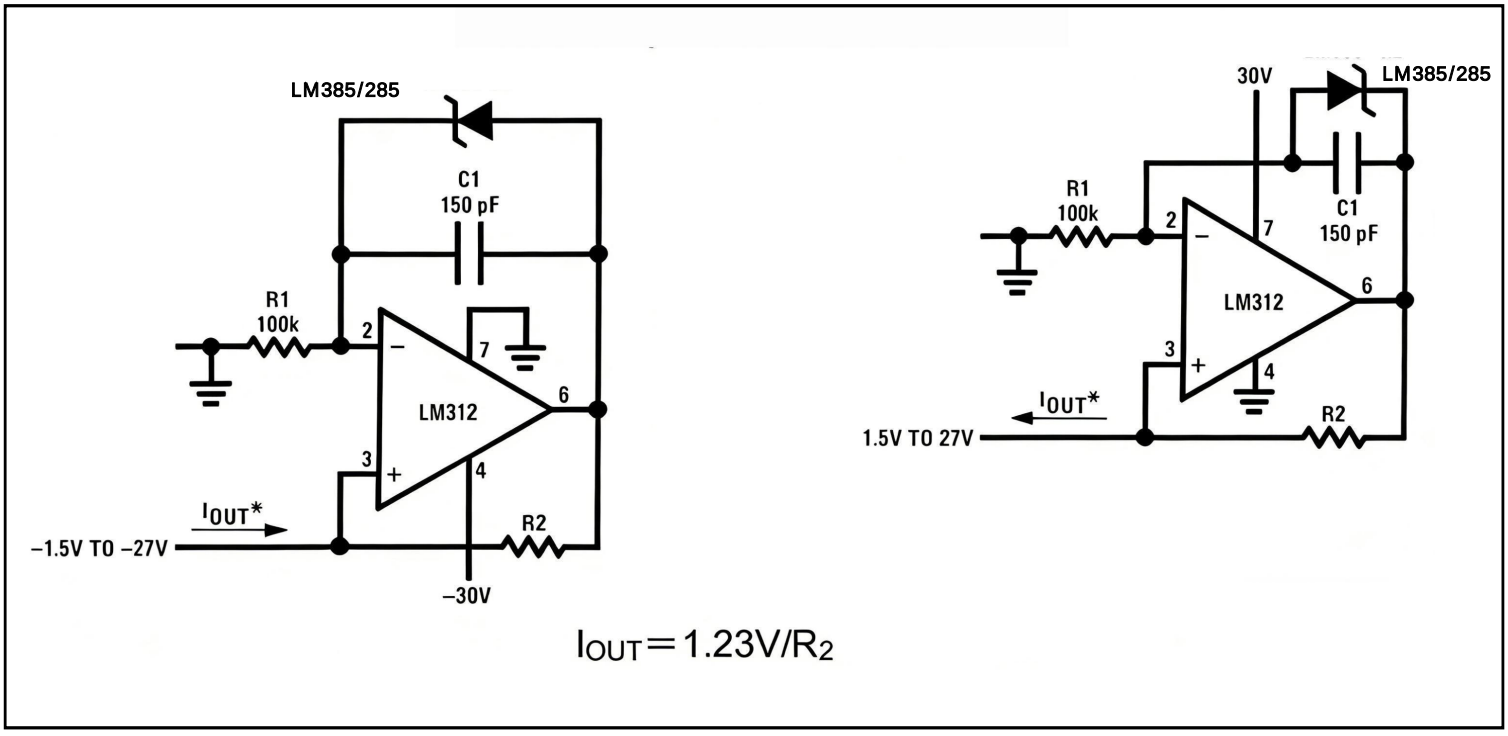


Figure 7 1µA to 1mA Precision Current Source

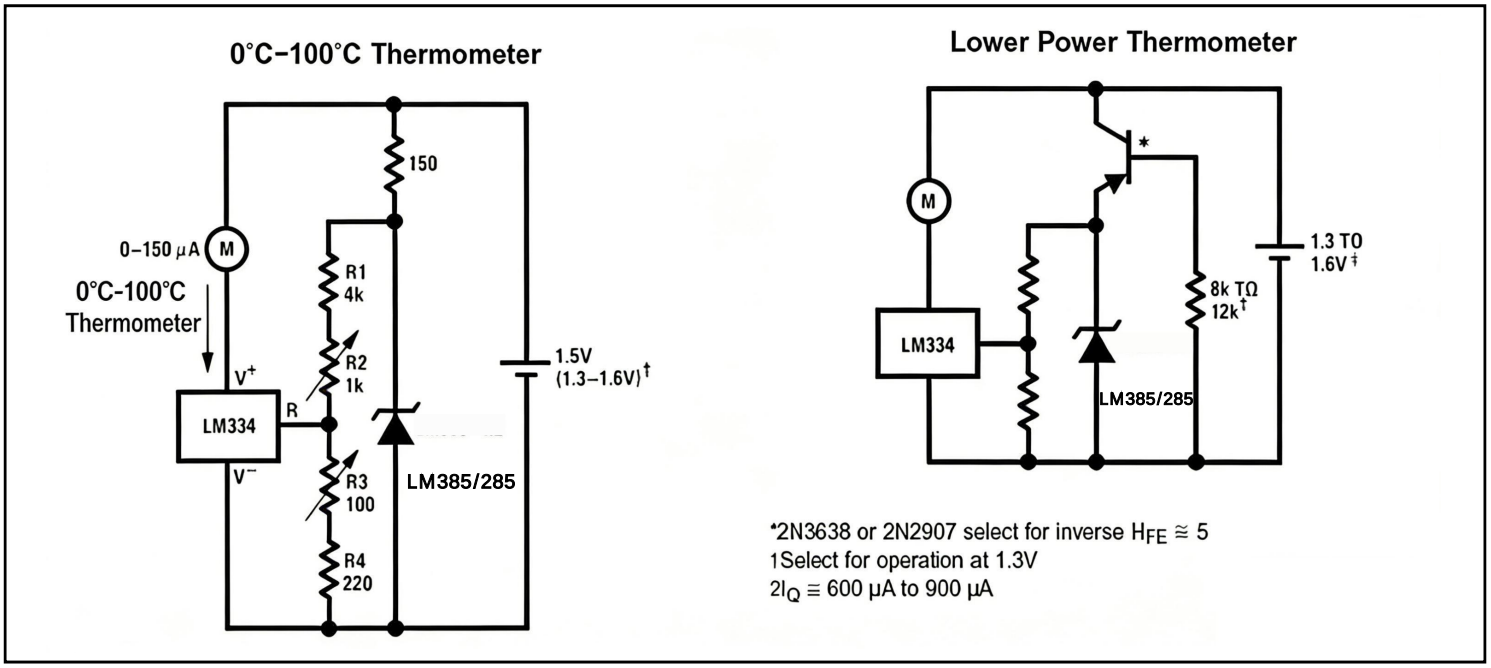


Figure 8 Thermometer

Reverse HFE≈5, select device as 2N3638 or 2N2907.
↑Select to opere at 1.3V; ↕IQ=600μA~900μA
Short-circuit LM285, adjust R3 to make IOU=temp@1μA/ºK; remove short-circuit, adjust R2, read out appropriate percentage temperature value: IQ at 1.3V@500 A; IQ at 1.6V@2.4 mA

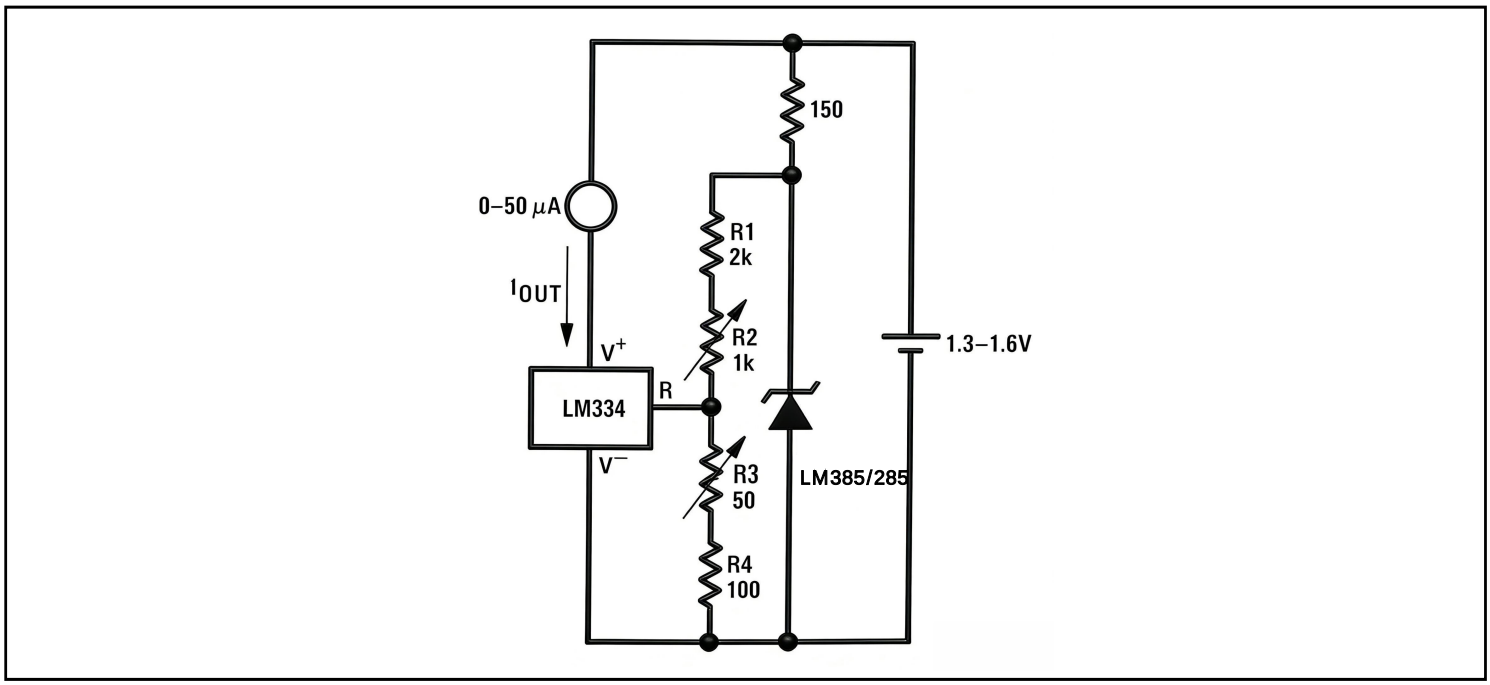


Figure 9 0-50°C Thermometer

Short-Circuit the LM285 and Adjust R3 to Set IOUT=temp@ 1.8 μA/° K; Remove the Short Circuit, Adjust R2, and Read the Correct Value in Units of T.

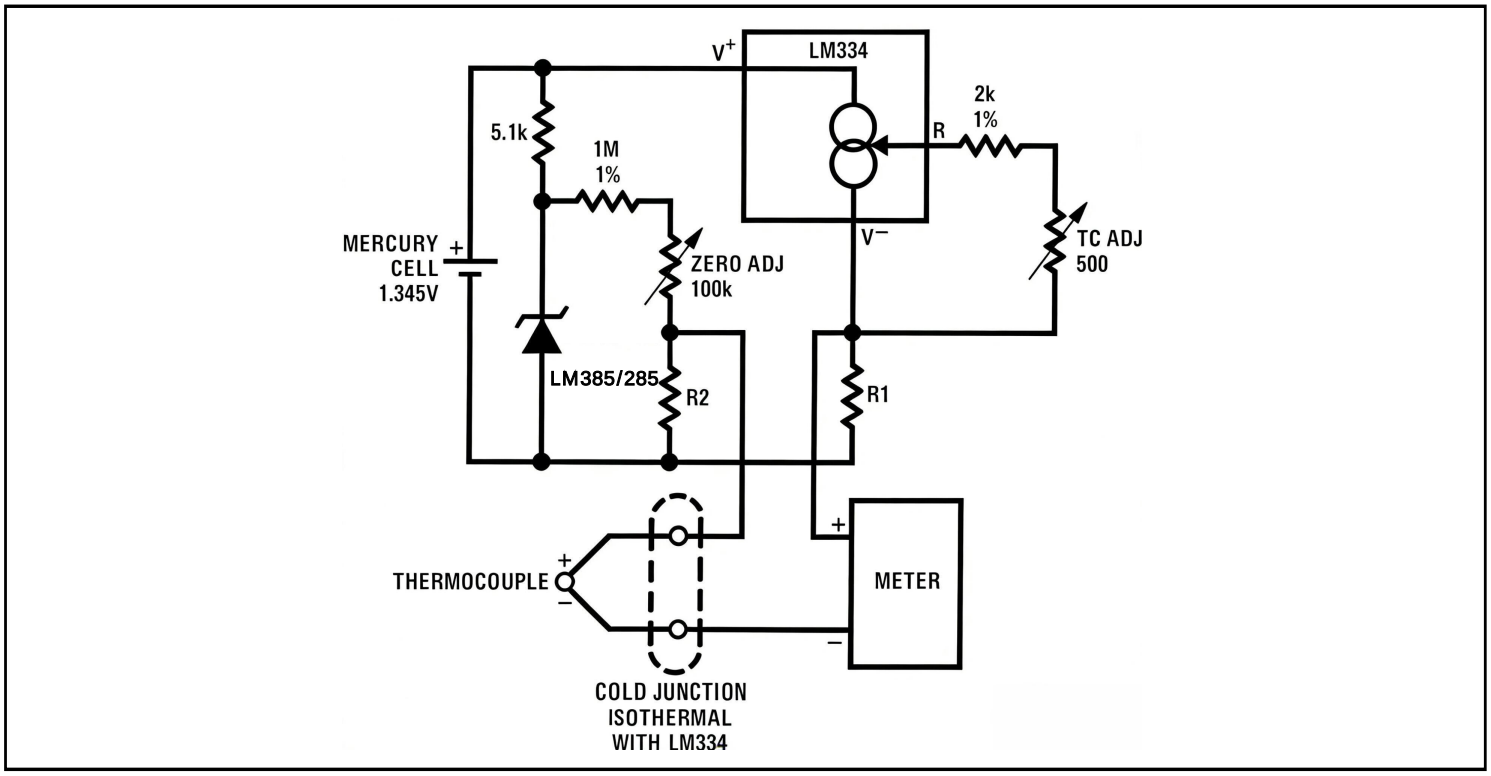


Figure 10 Low-Power Thermal Corner Room Temperature Connection Compensator

● Adjust TC ADJ until the voltage across R1 and the thermoelectric figure of merit corresponding to absolute temperature are in proportional relationship.
● Adjust ZERO ADJ until the voltage across R2 becomes proportional to the thermoelectric figure of merit corresponding to the relative temperature (273.2K).

Thermoelectric corner type	Proportionality co-efficient (μV1℃)	R1(Ω)	R2(Ω)	Voltage across the R1 terminals@25℃	Voltage across the R2 terminals@25℃
J	52.3	523	1.24K	15.60	14.32
T	42.8	432	1K	12.77	11.78
K	40.8	412	953	12.17	11.17
S	6.4	63.4	150	1.908	1.766

The typical power supply current is 50μA.

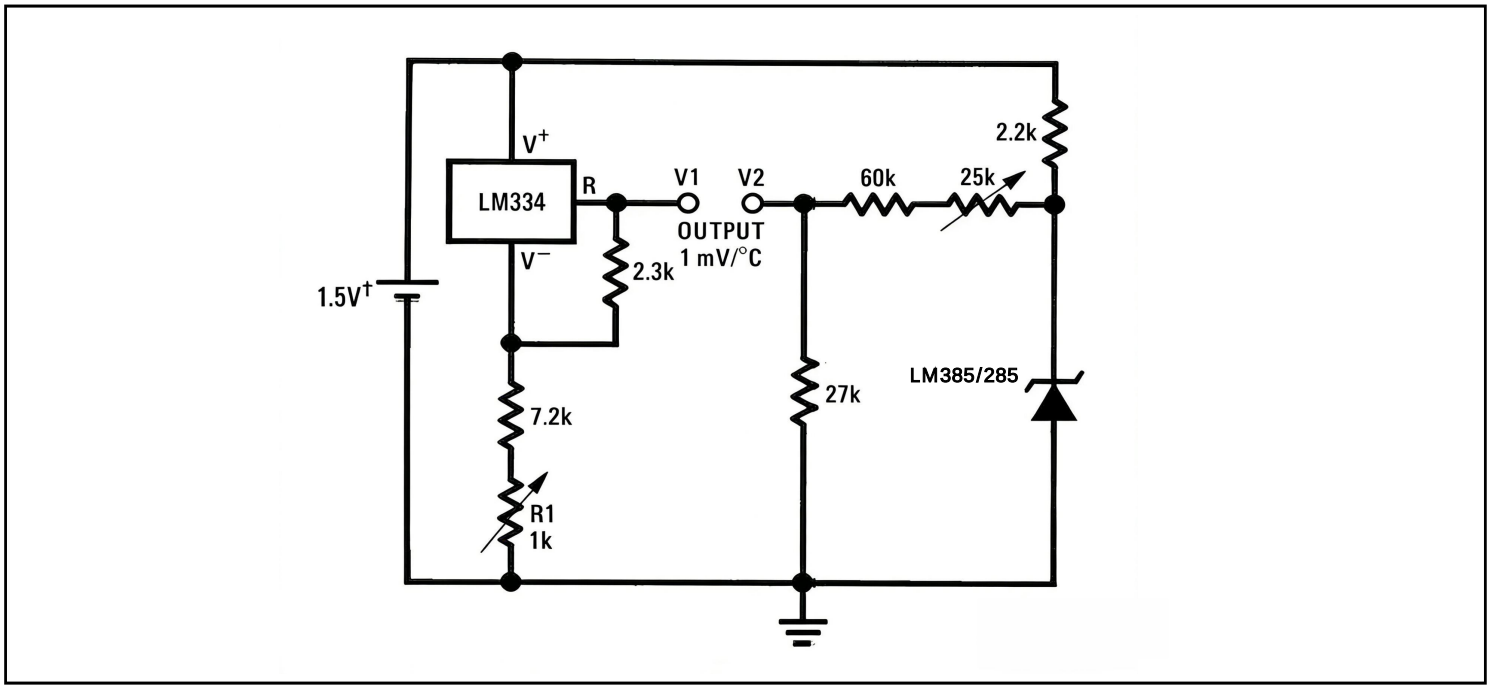


Figure 11Percentage Thermometer

Adjust R1 to set V1 = temp@ 1mV/° K; adjust V2 to 273.2mV. IQ ranges from 1.3V to 1.6V power supply voltage; age = 50~150 μA

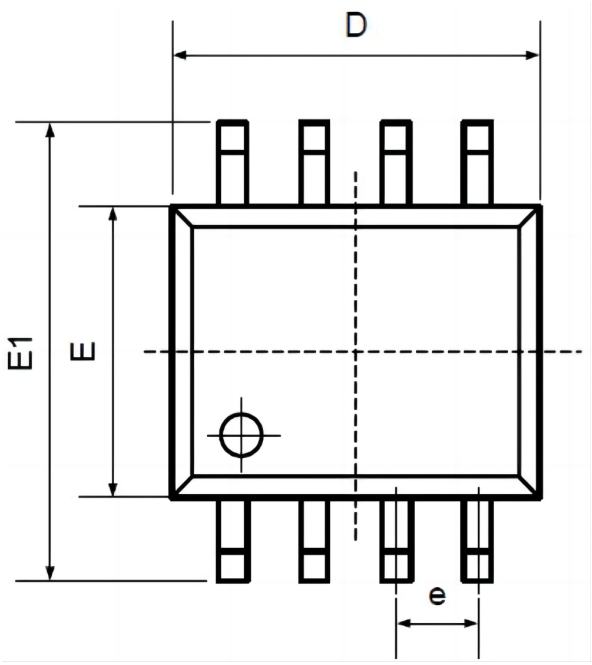
Order information

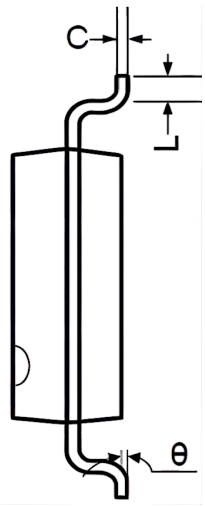
Order Number	Package	Package Quantity	Marking On The park	Temperature	Data Rate
LM385BMX-1.2/NOPB-TUDI	SOP8	Tape,Reel,2500	LM385BM1.2	0℃ to 70℃	1.235V
LM385BXMX-1.2/NOPB-TUDI	SOP8	Tape,Reel,2500	385BXM1.2		
LM385BXZ-1.2/NOPB-TUDI	TO92-3	A box of 1800	385BXZ-1.2		
LM385BYMX-1.2/NOPB-TUDI	SOP8	Tape,Reel,2500	385BYM1.2		
LM385BYZ-1.2/NOPB-TUDI	TO92-3	A box of 1800	385BYZ-1.2		
LM385BZ-1.2/NOPB-TUDI	TO92-3	A box of 1800	LM385BZ1.2		
LM385MX-1.2/NOPB-TUDI	SOP8	Tape,Reel,2500	LM385M1.2		
LM385M3X-1.2/NOPB-TUDI	SOT23-3	Tape,Reel,3000	R11		
LM385Z-1.2/NOPB-TUDI	TO92-3	A box of 1800	LM385Z-1.2		

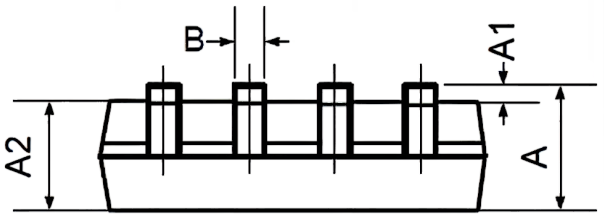
Order Number	Package	Package Quantity	Marking On The park	Temperature	Data Rate
LM385BMX-2.5/NOPB-TUDI	SOP8	Tape,Reel,2500	LM385BM2.5	0℃ to 70℃	2.5V
LM385BXMX-2.5/NOPB-TUDI	SOP8	Tape,Reel,2500	385BXM2.5		
LM385BXZ-2.5/NOPB-TUDI	TO92-3	A box of 1800	385BXZ-2.5		
LM385BYMX-2.5/NOPB-TUDI	SOP8	Tape,Reel,2500	385BYM2.5		
LM385BYZ-2.5/NOPB-TUDI	TO92-3	A box of 1800	385BYZ-2.5		
LM385BZ-2.5/NOPB-TUDI	TO92-3	A box of 1800	LM385BZ2.5		
LM385MX-2.5/NOPB-TUDI	SOP8	Tape,Reel,2500	LM385M2.5		
LM385M3X-2.5/NOPB-TUDI	SOT23-3	Tape,Reel,3000	R12		
LM385Z-2.5/NOPB-TUDI	TO92-3	A box of 1800	LM385Z2.5		
LM285BMX-1.2/NOPB-TUDI	SOP8	Tape,Reel,2500	LM285BM1.2	-40℃ to 85℃	1.235V
LM285BXMX-1.2/NOPB-TUDI	SOP8	Tape,Reel,2500	285BXM1.2		
LM285BXZ-1.2/NOPB-TUDI	TO92-3	A box of 1800	285BXZ-1.2		
LM285BYMX-1.2/NOPB-TUDI	SOP8	Tape,Reel,2500	285BYM1.2		
LM285BYZ-1.2/NOPB-TUDI	TO92-3	A box of 1800	285BYZ-1.2		
LM285BZ-1.2/NOPB-TUDI	TO92-3	A box of 1800	LM285BZ1.2		
LM285MX-1.2/NOPB-TUDI	SOP8	Tape,Reel,2500	LM285M1.2		
LM285M3X-1.2/NOPB-TUDI	SOT23-3	Tape,Reel,3000	R13		
LM285Z-1.2/NOPB-TUDI	TO92-3	A box of 1800	LM285Z-1.2		
LM285BMX-2.5/NOPB-TUDI	SOP8	Tape,Reel,2500	LM285BM2.5		2.5V
LM285BXMX-2.5/NOPB-TUDI	SOP8	Tape,Reel,2500	285BXM2.5		
LM285BXZ-2.5/NOPB-TUDI	TO92-3	A box of 1800	285BXZ-2.5		
LM285BYMX-2.5/NOPB-TUDI	SOP8	Tape,Reel,2500	285BYM2.5		
LM285BYZ-2.5/NOPB-TUDI	TO92-3	A box of 1800	285BYZ-2.5		
LM285BZ-2.5/NOPB-TUDI	TO92-3	A box of 1800	LM285BZ2.5		
LM285MX-2.5/NOPB-TUDI	SOP8	Tape,Reel,2500	LM285M2.5		
LM285M3X-2.5/NOPB-TUDI	SOT23-3	Tape,Reel,3000	R14		
LM285Z-2.5/NOPB-TUDI	TO92-3	A box of 1800	LM285Z2.5		

Order Number	Package	Package Quantity	Marking On The park	Temperature	Data Rate
LM385AMX-1.2/NOPB-TUDI	SOP8	Tape,Reel,2500	LM385AM1.2	0℃ to 70℃	1.235V
LM385AXMX-1.2/NOPB-TUDI	SOP8	Tape,Reel,2500	385AXM1.2		
LM385AXZ-1.2/NOPB-TUDI	TO92-3	A box of 1800	385AXZ-1.2		
LM385AYMX-1.2/NOPB-TUDI	SOP8	Tape,Reel,2500	385AYM1.2		
LM385AYZ-1.2/NOPB-TUDI	TO92-3	A box of 1800	385AYZ-1.2		
LM385AZ-1.2/NOPB-TUDI	TO92-3	A box of 1800	LM385AZ1.2		
LM385AM3X-1.2/NOPB-TUDI	SOT23-3	Tape,Reel,3000	R15		
LM385AMX-2.5/NOPB-TUDI	SOP8	Tape,Reel,2500	LM385AM2.5		2.5V
LM385AXMX-2.5/NOPB-TUDI	SOP8	Tape,Reel,2500	385AXM2.5		
LM385AXZ-2.5/NOPB-TUDI	TO92-3	A box of 1800	385AXZ-2.5		
LM385AYMX-2.5/NOPB-TUDI	SOP8	Tape,Reel,2500	385AYM2.5		
LM385AYZ-2.5/NOPB-TUDI	TO92-3	A box of 1800	385AYZ-2.5		
LM385AZ-2.5/NOPB-TUDI	TO92-3	A box of 1800	LM385AZ2.5		
LM385AM3X-2.5/NOPB-TUDI	SOT23-3	Tape,Reel,3000	R16		
LM285AMX-1.2/NOPB-TUDI	SOP8	Tape,Reel,2500	LM285AM1.2	-40℃ to 85℃	1.235V
LM285AXMX-1.2/NOPB-TUDI	SOP8	Tape,Reel,2500	285AXM1.2		
LM285AXZ-1.2/NOPB-TUDI	TO92-3	A box of 1800	285AXZ-1.2		
LM285AYMX-1.2/NOPB-TUDI	SOP8	Tape,Reel,2500	285AYM1.2		
LM285AYZ-1.2/NOPB-TUDI	TO92-3	A box of 1800	285AYZ-1.2		
LM285AZ-1.2/NOPB-TUDI	TO92-3	A box of 1800	LM285AZ1.2		
LM285AM3X-1.2/NOPB-TUDI	SOT23-3	Tape,Reel,3000	R17		
LM285AMX-2.5/NOPB-TUDI	SOP8	Tape,Reel,2500	LM285AM2.5		2.5V
LM285AXMX-2.5/NOPB-TUDI	SOP8	Tape,Reel,2500	285AXM2.5		
LM285AXZ-2.5/NOPB-TUDI	TO92-3	A box of 1800	285AXZ-2.5		
LM285AYMX-2.5/NOPB-TUDI	SOP8	Tape,Reel,2500	285AYM2.5		
LM285AYZ-2.5/NOPB-TUDI	TO92-3	A box of 1800	285AYZ-2.5		
LM285AZ-2.5/NOPB-TUDI	TO92-3	A box of 1800	LM285AZ2.5		
LM285AM3X-2.5/NOPB-TUDI	SOT23-3	Tape,Reel,3000	R18		

Package SOP8

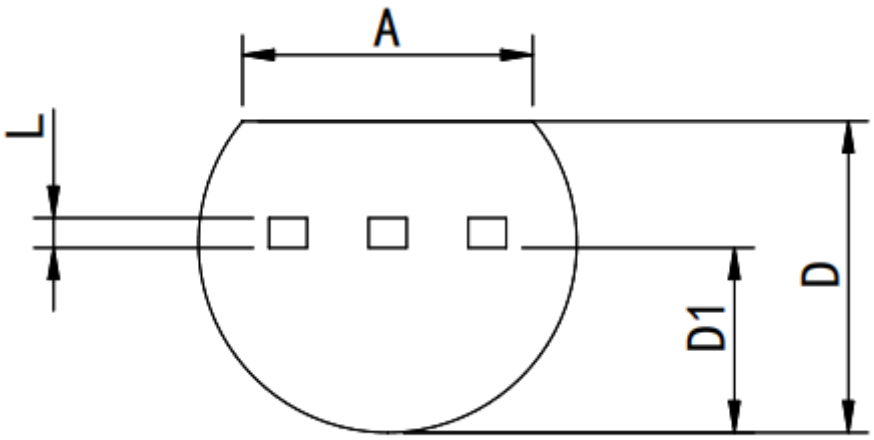


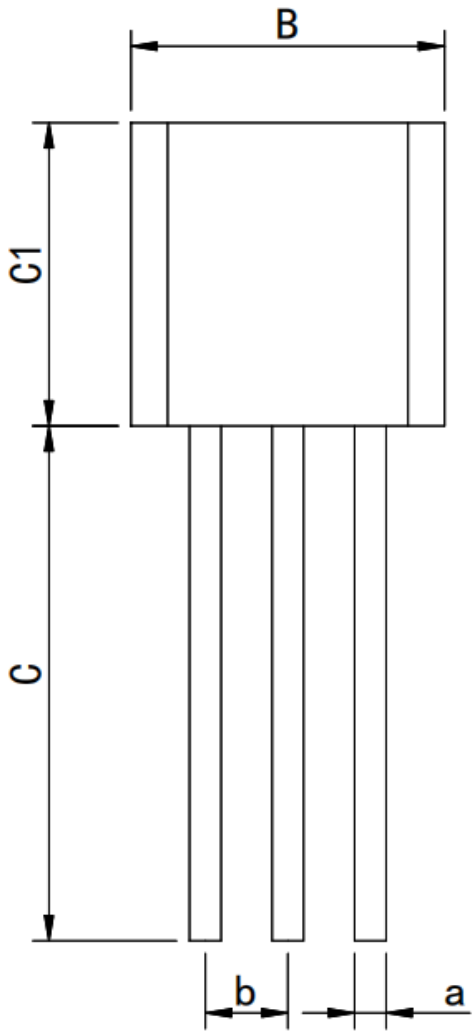




Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.190	0.250	0.007	0.010
D	4.780	5.000	0.188	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270TYP		0.050TYP	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

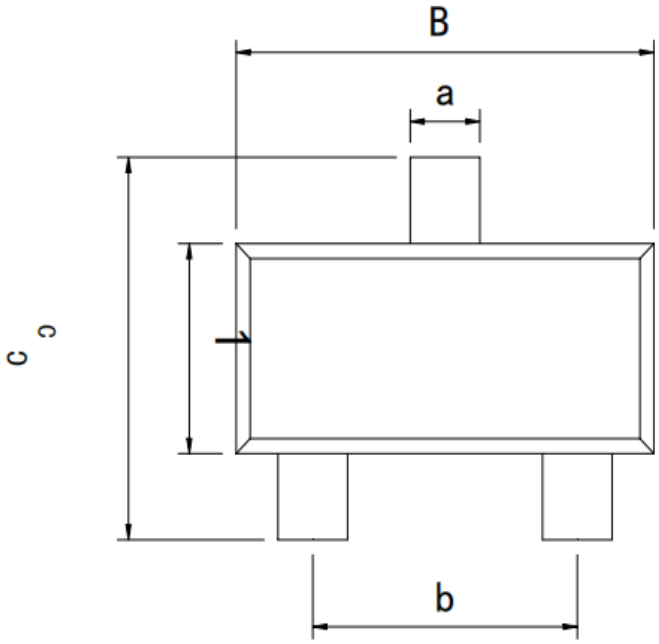
Package TO92

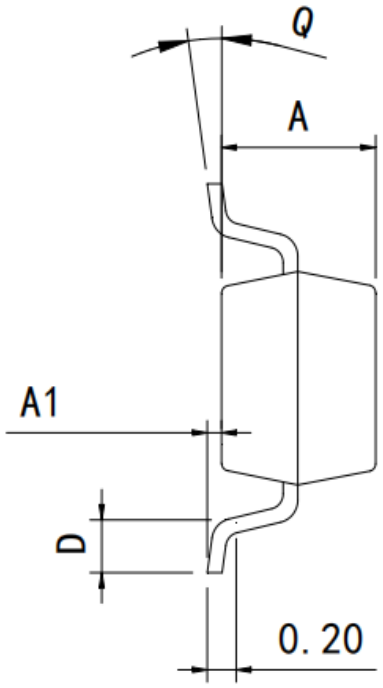




Symbol	Min	Max
A	3.43	4.13
B	4.44	5.21
C	13.5	15.3
C1	4.32	5.34
D	3.17	4.19
D1	2.03	2.67
L	0.33	0.42
a	0.40	0.52
b	1.27BSC	

Package SOT23





Symbol	Min	Max
A	0.90	1.05
A1	0.00	0.15
B	2.80	3.00
C	2.25	2.55
C1	1.20	1.40
D	0.13	0.41
Q	0°	8°
a	0.30	0.50
b	1.90 BSC	

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