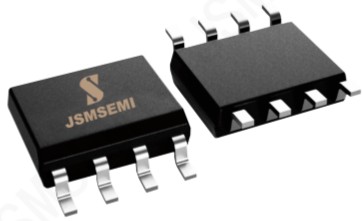
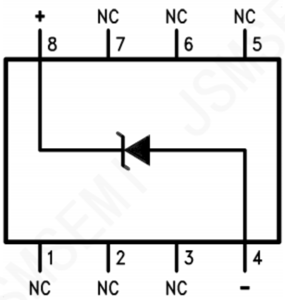
General description

LM285 is a low-power bandgap reference voltage source produced using bipolar process technology. It can provide a stable voltage reference within the working current range of 10 μ A to 20mA, with low dynamic resistance and good temperature stability. The built-in benchmark adjustment mechanism of the chip ensures a very small output voltage tolerance. Due to the fact that the bandgap reference components of LM285 consist only of transistors and resistors, the circuit has very low noise and good long-term stability. The LM285 design has carefully considered the possible problems encountered under various loads, making it highly adaptable to external loads and capable of handling the vast majority of reference voltage source applications. The wide dynamic working range of LM285 enables the chip to exhibit excellent adjustment capability even when the power supply changes significantly. LM285 provides precise reference while requiring extremely low load current, making it particularly suitable for low-power circuits, as a portable instrument powered by batteries, a voltage regulator, and a reference voltage source in general analog circuits.

LM285 is packaged in SOP-8 and can operate within a temperature range of -40 to 85 ℃.





Features and benefits

- ± 4mV (± 0.3%) maximum initial tolerance (Class A)
- Working current: 10 μ A~20mA
- 0.6 Ω maximum dynamic impedance (Class A)
- Low temperature coefficient

Applications

- Industrial control system
- Portable low-power device
- Universal Analog Circuit

ABSOLUTE MAXIMUM RATINGS(Exceeding this limit may result in damage)

Parameter	Max	Units
Reverse Current	30	mA
Forward Current	10	mA
Operating Temperature Range	-40 ~ 85	℃
Storage Temperature	-55 ~ 150	℃
Soldering Information(Spot welding, 10s)	245	℃

Note: The limit parameter refers to the limit value that cannot be exceeded under any conditions. If this limit is exceeded, it may cause physical damage such as product degradation; At the same time, it cannot be guaranteed that the chip can work normally when approaching the limit parameters.

Ordering Information

Ordernumber	Package	Marking	Operation Temperature Range	MSL Grade	Ship,Quantity	Green
LM285DR-1-2	SOP-8	LM285-1.2	-40 to 85°C	3	T&R,2500	Rohs
LM285DR-2-5	SOP-8	LM285-2.5	-40 to 85°C	3	T&R,2500	Rohs

ELECTRICAL CHARACTERISTICS

LM285DR-1-2（Ta=25℃,unless otherwise specified）

Parameter	Conditions	Min	Typ	Max	Units
Reverse Breakdown Voltage	Ta=25℃,10μA≤IR≤20mA	1.20	1.24	1.28	V
Minimum Operating Current			8	15	μA
Reverse Breakdown Voltage Change with Current	10μA≤IR≤1mA 1mA≤IR≤20mA		4 10	1.5 20	mV (Max) mV (Max)
Reverse Dynamic Impedance	I_R = 100 μA, f = 20 Hz		1.0		Ω
Wideband Noise (rms)	I_R = 100 μA 10 Hz ≤ f ≤ 10 kHz		60		μV
Long Term Stability	I_R = 100 μA, T = 1000 Hr, T_A = 25°C ±0.1°C		20		ppm
Average Temperature Coefficient	IR=100μA		80		ppm/°C

LM285DR-2-5（Ta=25℃,unless otherwise specified）

Parameter	Conditions	Min	Typ	Max	Units
Reverse Breakdown Voltage	Ta=25℃,10μA≤IR≤20mA	2.47	2.49	2.52	V
Minimum Operating Current			15	20	μA
Reverse Breakdown Voltage Change with Current	10μA≤IR≤1mA 1mA≤IR≤20mA		1 10	1.5 20	mV (Max) mV (Max)
Reverse Dynamic Impedance	I_R = 100 μA, f = 20 Hz		1.0		Ω
Wideband Noise (rms)	I_R = 100 μA 10 Hz ≤ f ≤ 10 kHz		60		μV
Long Term Stability	I_R = 100 μA, T = 1000 Hr, T_A = 25°C ±0.1°C		20		ppm
Average Temperature Coefficient	IR=100μA		80		ppm/°C

Application and Implementation

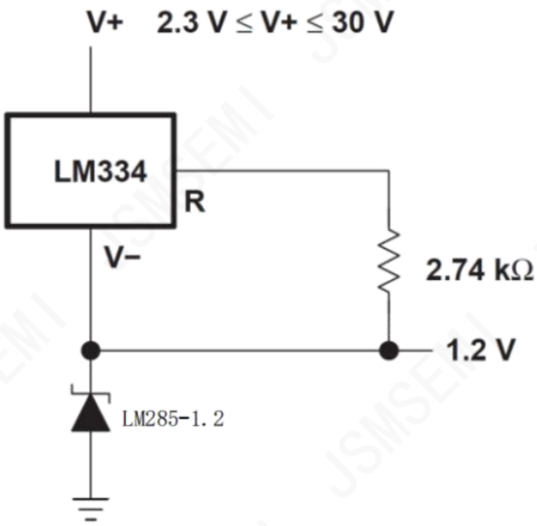


Figure1. Wide input range reference

Micro power reference

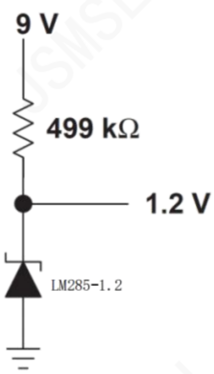


Figure2. 9V power supply

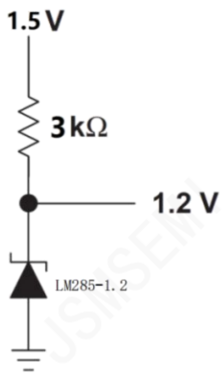


Figure3. 1.5V power supply

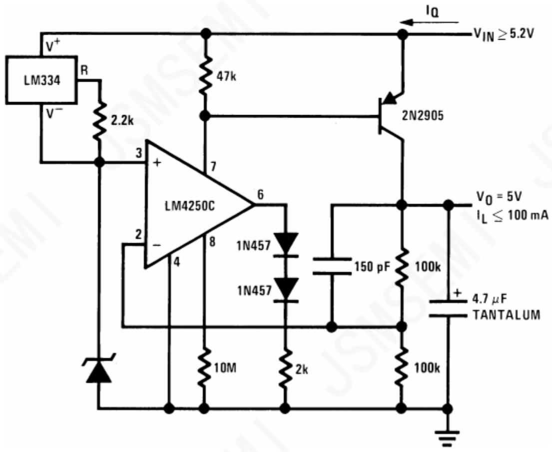
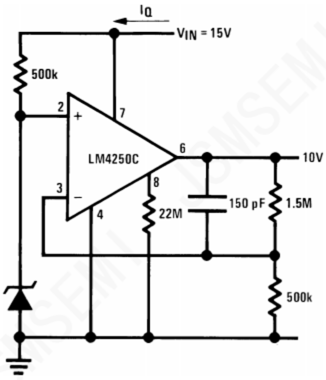


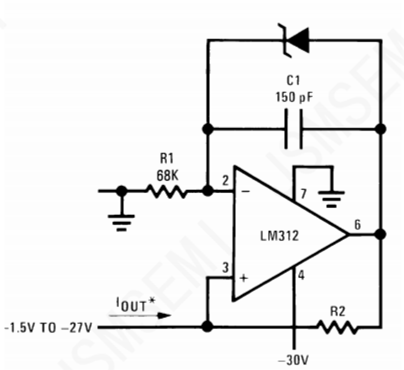
Figure4.Micropower 5V Reference



I_Q ≈ 20 μA standby current

Figure5.Micropower 10V Reference

PRECISION 1μA to 1mA CURRENT SOURCES



I_{OUT} = 1.23V/R2

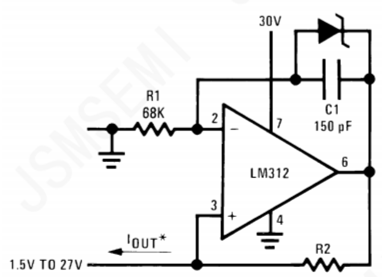
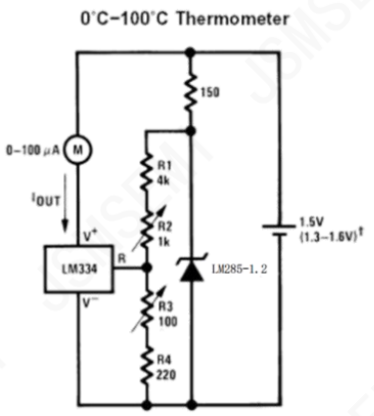
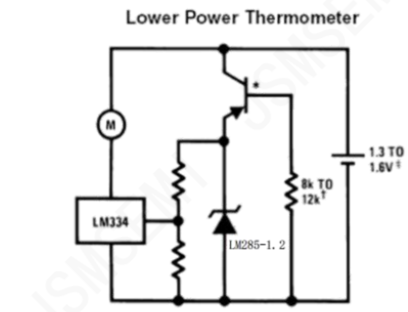


Figure6

METER THERMOMETERS





*2N3638 or 2N2907 select for inverse H_{FE} ≅ 5
†Select for operation at 1.3V
‡I_Q ≅ 600 μA to 900 μA

Figure7

Reverse HFE ≈ 5, choose device 2N3638 or 2N2907.

↑ Choose to work at 1.3V; ↕IQ=600μA~900μA

Short circuit LM285 and adjust R3 to make I_{OUT}= temp@1μA/ºK; Release the short circuit, adjust R2, and read the appropriate percentage temperature value: I_Q at 1.3V@500 μA; I_Q at 1.6V@2.4 mA

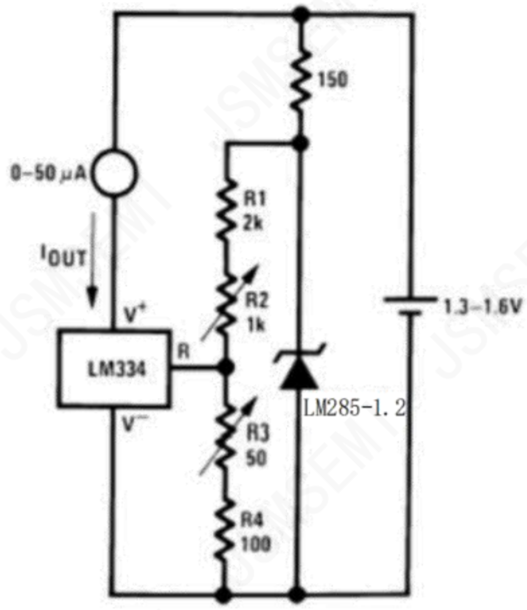


Figure8. 0～50˚F Thermometer

Short circuit LM285, adjust R3 to make I_{OUT}= temp@1.8μA/ºK; Release the short circuit, adjust R2, and read the correct value in .

Percentile Thermometer

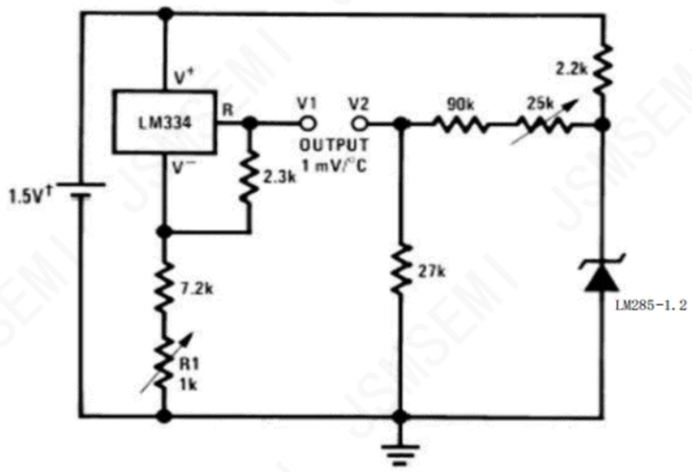


Figure9.Percentile Thermometer

Adjust R1 to make V1= temp@1mV/ºK /Adjust V2 to 273.2mV. IQ is a power supply voltage ranging from 1.3V to 1.6V; age=50~150μA

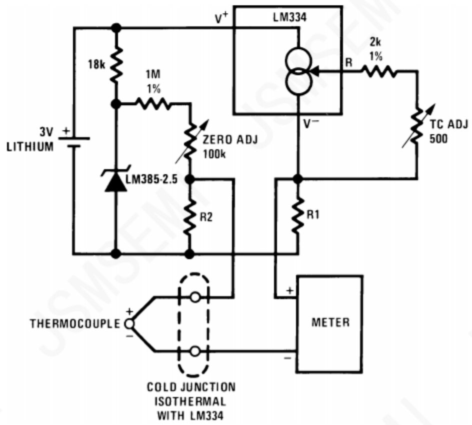


Figure10.Micropower Thermocouple Cold Junction Compensator

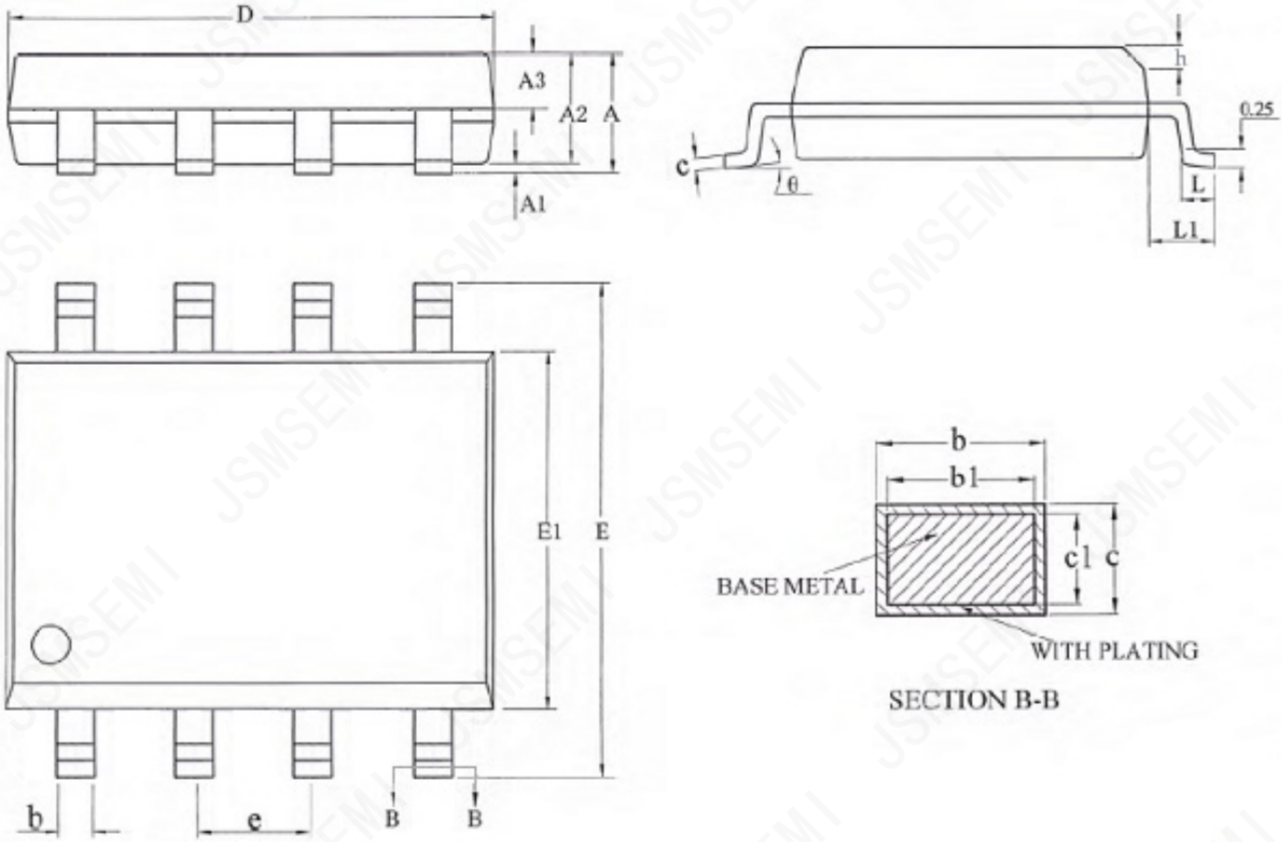
Adjustment Procedure

1. Adjust TC ADJ pot until voltage across R1 equals Kelvin temperature multiplied by the thermocouple Seebeck coefficient.
2. Adjust zero ADJ pot until voltage across R2 equals the thermocouple Seebeck coefficient multiplied by 273.2.

Thermocouple Type(1)	Seebeck Coefficient (μV/°C)	R1 (Ω)	R2 (Ω)	Voltage Across R1 @25°C (mV)	Voltage Across R2 (mV)
J	52.3	523	1.24k	15.60	14.32
T	42.8	432	1k	12.77	11.78
K	40.8	412	953Ω	12.17	11.17
S	6.4	63.4	150Ω	1.908	1.766

(1) Typical supply current 50 μA

SOP8 Package Outlines



SOIC-8 Package Dimensions

Size / Symbol	MIN(mm)	TYP(mm)	MAX(mm)	Size / Symbol	MIN(mm)	TYP(mm)	MAX(mm)
A	-	-	1.75	D	4.70	4.90	5.10
A1	0.10	-	0.225	E	5.80	6.00	6.20
A2	1.30	1.40	1.50	E1	3.70	3.90	4.10
A3	0.60	0.65	0.70	e		1.27BSC	
b	0.39	-	0.48	h	0.25	-	0.50
b1	0.38	0.41	0.43	L		0.50	
c	0.21	-	0.26	L1	1.05BSC		
c1	0.19	0.20	0.21	θ	0	-	8°

Revision History

Rev.	Change	Date
V1.0	First-generation version	4/25/2023

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