LM134/LM234/LM334 3-Terminal Adjustable Current Sources

Check for Samples: LM134, LM234, LM334

FEATURES

- **Operates From 1V to 40V**
- **0.02%/V Current Regulation**
- **Programmable From 1µA to 10mA**
- **True 2-Terminal Operation**
- **Available as Fully Specified Temperature Sensor**
- **±3% Initial Accuracy**

DESCRIPTION

The LM134/LM234/LM334 are 3-terminal adjustable current sources featuring 10,000:1 range in operating current, excellent current regulation and a wide dynamic voltage range of 1V to 40V. Current is established with one external resistor and no other parts are required. Initial current accuracy is ±3%. The LM134/LM234/LM334 are true floating current sources with no separate power supply connections. In addition, reverse applied voltages of up to 20V will draw only a few dozen microamperes of current, allowing the devices to act as both a rectifier and current source in AC applications.

The sense voltage used to establish operating current in the LM134 is 64mV at 25°C and is directly proportional to absolute temperature (°K). The simplest one external resistor connection, then, generates a current with ≈+0.33%/°C temperature dependence. Zero drift operation can be obtained by adding one extra resistor and a diode.

Applications for the current sources include bias networks, surge protection, low power reference, ramp generation, LED driver, and temperature sensing. The LM234-3 and LM234-6 are specified as true temperature sensors with ensured initial accuracy of ±3°C and ±6°C, respectively. These devices are ideal in remote sense applications because series resistance in long wire runs does not affect accuracy. In addition, only 2 wires are required.

The LM134 is specified over a temperature range of −55°C to +125°C, the LM234 from −25°C to +100°C and the LM334 from 0°C to +70°C. These devices are available in TO hermetic, TO-92 and SOIC-8 plastic packages.

Connection Diagrams

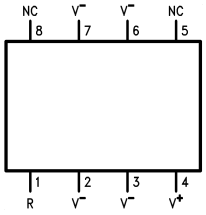

Figure 1. SOIC-8 Surface Mount Package
(LM334M; LM334M/NOPB; LM334MX; LM334MX/NOPB)
See Package Number D

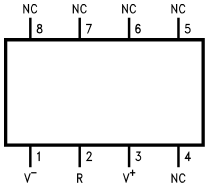

Figure 2. SOIC-8 Alternative Pinout Surface Mount Package
(LM334SM; LM334SM/NOPB; LM334SMX; LM334SMX/NOPB)
See Package Number D

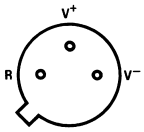

Figure 3. TO Metal Can Package (Bottom View)
See Package Number NDV

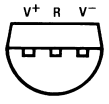

Figure 4. TO-92 Plastic Package (Bottom View)
See Package Number LP

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings(1)(2)

V^+ to V^- Forward Voltage		LM134/LM234/LM334	40V
		LM234-3/LM234-6	30V
V^+ to V^- Reverse Voltage			20V
R Pin to V^- Voltage			5V
Set Current			10 mA
Power Dissipation			400 mW
ESD Susceptibility(3)			2000V
Operating Temperature Range(4)		LM134	−55°C to +125°C
		LM234/LM234-3/LM234-6	−25°C to +100°C
		LM334	0°C to +70°C
Soldering Information	TO-92 Package (10 sec.)		260°C
	TO Package (10 sec.)		300°C
	SOIC Package	Vapor Phase (60 sec.)	215°C
		Infrared (15 sec.)	220°C

(1) "Absolute Maximum Ratings" indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not ensure specific performance limits.
(2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/Distributors for availability and specifications.
(3) Human body model, 100pF discharged through a 1.5kΩ resistor.
(4) For elevated temperature operation, T_J max is:

LM134	150°C
LM234	125°C
LM334	100°C

See Thermal Characteristics.

Thermal Characteristics

over operating free-air temperature range (unless otherwise noted)

Thermal Resistance	TO-92	TO	SOIC-8
θ_{ja} (Junction to Ambient)	180°C/W (0.4″ leads)	440°C/W	165°C/W
	160°C/W (0.125″ leads)		
θ_{jc} (Junction to Case)	N/A	32°C/W	80°C/W

Electrical Characteristics[1]

Parameter	Conditions		LM134/LM234			LM334			Units
			Min	Typ	Max	Min	Typ	Max	
Set Current Error, V^+=2.5V[2]	10µA ≤ I_{SET} ≤ 1mA				3			6	%
	1mA < I_{SET} ≤ 5mA				5			8	%
	2µA ≤ I_{SET} < 10µA				8			12	%
Ratio of Set Current to Bias Current	100µA ≤ I_{SET} ≤ 1mA		14	18	23	14	18	26	
	1mA ≤ I_{SET} ≤ 5mA			14			14		
	2 µA≤I_{SET}≤100 µA			18	23		18	26	
Minimum Operating Voltage	2µA ≤ I_{SET} ≤ 100µA			0.8			0.8		V
	100µA < I_{SET} ≤ 1mA			0.9			0.9		V
	1mA < I_{SET} ≤ 5mA			1.0			1.0		V
Average Change in Set Current with Input Voltage	2µA ≤ I_{SET} ≤ 1mA	1.5 ≤ V^+ ≤ 5V		0.02	0.05		0.02	0.1	%/V
		5V ≤ V^+ ≤ 40V		0.01	0.03		0.01	0.05	%/V
	1mA < I_{SET} ≤ 5mA	1.5V ≤ V ≤ 5V		0.03			0.03		%/V
		5V ≤ V ≤ 40V		0.02			0.02		%/V
Temperature Dependence of Set Current[3]	25µA ≤ I_{SET} ≤ 1mA		0.96T	T	1.04T	0.96T	T	1.04T	
Effective Shunt Capacitance				15			15		pF

(1) Unless otherwise specified, tests are performed at T_j = 25°C with pulse testing so that junction temperature does not change during test
(2) Set current is the current flowing into the V^+ pin. For the Basic 2-Terminal Current Source circuit shown in Figure 13. I_{SET} is determined by the following formula: I_{SET} = 67.7 mV/R_{SET} (@ 25°C). Set current error is expressed as a percent deviation from this amount. I_{SET} increases at 0.336%/°C @ T_j = 25°C (227 µV/°C).
(3) I_{SET} is directly proportional to absolute temperature (°K). I_{SET} at any temperature can be calculated from: $I_{SET} = I_o (T/T_o)$ where I_o is I_{SET} measured at T_o (°K).

Electrical Characteristics[1]

Parameter	Conditions		LM234-3			LM234-6			Units
			Min	Typ	Max	Min	Typ	Max	
Set Current Error, V^+=2.5V [2]	100µA ≤ I_{SET} ≤ 1mA				±1			±2	%
	T_J = 25°								
Equivalent Temperature Error					±3			±6	°C
Ratio of Set Current to Bias Current	100µA ≤ I_{SET} ≤ 1mA		14	18	26	14	18	26	
Minimum Operating Voltage	100µA I_{SET} ≤ 1mA			0.9			0.9		V
Average Change in Set Current with Input Voltage	100µA ≤ I_{SET} ≤ 1mA	1.5 ≤ V^+ ≤ 5V		0.02	0.05		0.02	0.01	%/V
		5V ≤ V^+ ≤ 30V		0.01	0.03		0.01	0.05	%/V
Temperature Dependence of Set Current[3]	100µA ≤ I_{SET} ≤ 1mA		0.98T	T	1.02T	0.97T	T	1.03T	
Equivalent Slope Error					±2			±3	%
Effective Shunt Capacitance				15			15		pF

(1) Unless otherwise specified, tests are performed at T_j = 25°C with pulse testing so that junction temperature does not change during test
(2) Set current is the current flowing into the V^+ pin. For the Basic 2-Terminal Current Source circuit shown in Figure 13. I_{SET} is determined by the following formula: I_{SET} = 67.7 mV/R_{SET} (@ 25°C). Set current error is expressed as a percent deviation from this amount. I_{SET} increases at 0.336%/°C @ T_j = 25°C (227 µV/°C).
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