National Semiconductor

LM123A/LM123/LM323A/LM323
3-Amp, 5-Volt Positive Regulator

General Description

The LM123 is a three-terminal positive regulator with a preset 5V output and a load driving capability of 3 amps. New circuit design and processing techniques are used to provide the high output current without sacrificing the regulation characteristics of lower current devices.

The LM123A and LM323A offer improved precision over the standard LM123 and LM323. Parameters with tightened specifications include output voltage tolerance, line regulation, and load regulation.

The 3 amp regulator is virtually blowout proof. Current limiting, power limiting, and thermal shutdown provide the same high level of reliability obtained with these techniques in the LM109 1 amp regulator.

No external components are required for operation of the LM123. If the device is more than 4 inches from the filter capacitor, however, a 1 μF solid tantalum capacitor should be used on the input. A 0.1 μF or larger capacitor may be used on the output to reduce load transient spikes created by fast switching digital logic, or to swamp out stray load capacitance.

An overall worst case specification for the combined effects of input voltage, load currents, ambient temperature, and power dissipation ensure that the LM123 will perform satisfactorily as a system element.

For applications requiring other voltages, see LM150 series adjustable regulator data sheet.

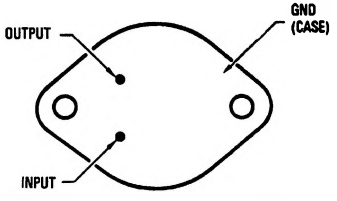
Operation is guaranteed over the junction temperature range −55°C to +150°C for LM123A/LM123, −40°C to +125°C for LM323A, and 0°C to +125°C for LM323. A hermetic TO-3 package is used for high reliability and low thermal resistance.

Features

- Guaranteed 1% initial accuracy (A version)
- 3 amp output current
- Internal current and thermal limiting
- 0.01Ω typical output impedance
- 7.5V minimum input voltage
- 30W power dissipation
- P+ Product Enhancement tested

Connection Diagram

Metal Can Package



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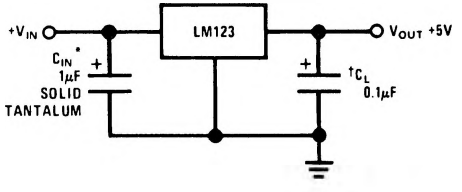
Order Number LM123AK STEEL, LM123K STEEL, LM323AK STEEL or LM323K STEEL
See NS Package Number K02A

Typical Applications

Basic 3 Amp Regulator



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*Required if LM123 is more than 4" from filter capacitor.

†Regulator is stable with no load capacitor into resistive loads.

Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications. (Note 4)

Input Voltage	20V
Power Dissipation	Internally Limited
Operating Junction Temperature Range	
LM123A, LM123	−55°C to +150°C
LM323A	−40°C to +125°C
LM323	0°C to +125°C
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Soldering, 10 sec.)	300°C
ESD Tolerance (Note 5)	2000V

LM123A/LM123 Electrical Characteristics (Note 1)

Parameter	Conditions	LM123A			LM123			Units
		Min	Typ	Max	Min	Typ	Max	
Output Voltage	$T_j = 25°C$ $V_{IN} = 7.5V$, $I_{OUT} = 0A$	4.95	5	5.05	4.7	5	5.3	V
	$7.5V \le V_{IN} \le 15V$ $0A \le I_{OUT} \le 3A$, $P \le 30W$	4.85		5.15	4.6		5.4	V
Line Regulation (Note 3)	$T_j = 25°C$ $7.5V \le V_{IN} \le 15V$		5	10		5	25	mV
Load Regulation (Note 3)	$T_j = 25°C$, $V_{IN} = 7.5V$, $0A \le I_{OUT} \le 3A$		25	50		25	100	mV
Quiescent Current	$7.5V \le V_{IN} \le 15V$, $0A \le I_{OUT} \le 3A$		12	20		12	20	mA
Output Noise Voltage	$T_j = 25°C$ $10\ Hz \le f \le 100\ kHz$		40			40		μVrms
Short Circuit Current Limit	$T_j = 25°C$ $V_{IN} = 15V$ $V_{IN} = 7.5V$		 3 4	 4.5 6		 3 4	 4.5 5	 A A
Long Term Stability				35			35	mV
Thermal Resistance Junction to Case (Note 2)			2			2		°C/W

LM323A/LM323 Electrical Characteristics (Note 1)

Parameter	Conditions	LM323A			LM323			Units
		Min	Typ	Max	Min	Typ	Max	
Output Voltage	$T_j = 25°C$ $V_{IN} = 7.5V$, $I_{OUT} = 0A$	4.95	5	5.05	4.8	5	5.2	V
	$7.5V \le V_{IN} \le 15V$ $0A \le I_{OUT} \le 3A$, $P \le 30W$	4.85		5.15	4.75		5.25	V
Line Regulation (Note 3)	$T_j = 25°C$ $7.5V \le V_{IN} \le 15V$		5	10		5	25	mV
Load Regulation (Note 3)	$T_j = 25°C$, $V_{IN} = 7.5V$, $0A \le I_{OUT} \le 3A$		25	50		25	100	mV
Quiescent Current	$7.5V \le V_{IN} \le 15V$, $0A \le I_{OUT} \le 3A$		12	20		12	20	mA
Output Noise Voltage	$T_j = 25°C$ 10 Hz ≤ f ≤ 100 kHz		40			40		μVrms
Short Circuit Current Limit	$T_j = 25°C$ $V_{IN} = 15V$ $V_{IN} = 7.5V$		3 4	4.5 6		3 4	4.5 5	A A
Long Term Stability				35			35	mV
Thermal Resistance Junction to Case (Note 2)			2			2		°C/W

Note 1: Unless otherwise noted, specifications apply for $-55°C \le T_j \le +150°C$ for the LM123A and LM123, $-40°C \le T_j \le +125°C$ for the LM323A, and $0°C \le T_j \le +125°C$ for the LM323. Although power dissipation is internally limited, specifications apply only for $P \le 30W$.

Note 2: Without a heat sink, the thermal resistance of the TO-3 package is about 35°C/W. With a heat sink, the effective thermal resistance can only approach the specified values of 2°C/W, depending on the efficiency of the heat sink.

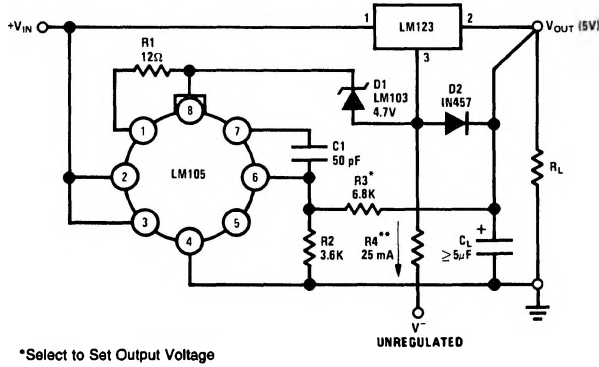
Note 3: Load and line regulation are specified at constant junction temperature. Pulse testing is required with a pulse width ≤ 1 ms and a duty cycle ≤ 5%.

Note 4: Refer to RETS123K drawing for LM123K, and to RETS123AK for LM123AK military specifications.

Note 5: Human body model, 1.5 kΩ in series with 100 pF.

Typical Applications (Continued)

Adjustable Output 5V–10V 0.1% Regulation



*Select to Set Output Voltage

**Select to Draw 25 mA from V⁻

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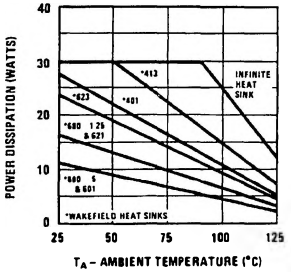
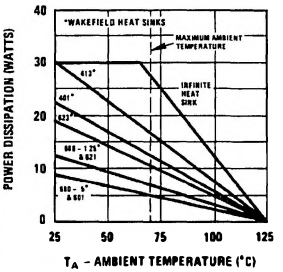
Typical Performance Characteristics

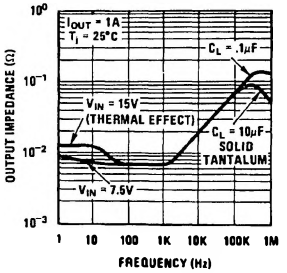
Maximum Average Power Dissipation for LM123A, LM123



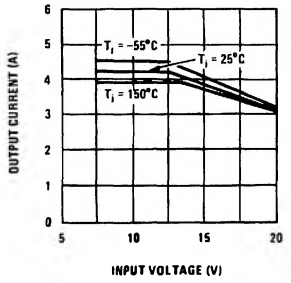
Maximum Average Power Dissipation for LM323A, LM323



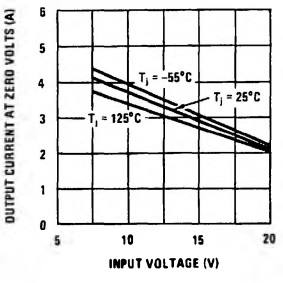
Output Impedance



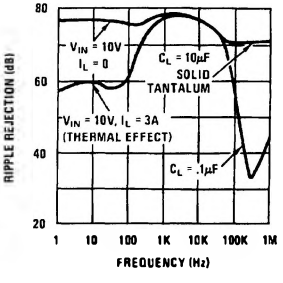
Peak Available Output Current



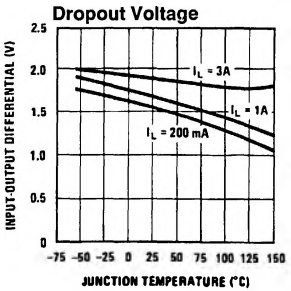
Short Circuit Current



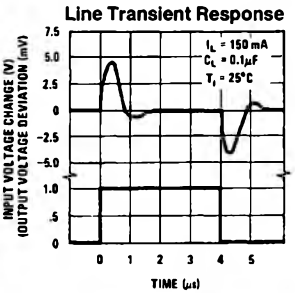
Ripple Rejection



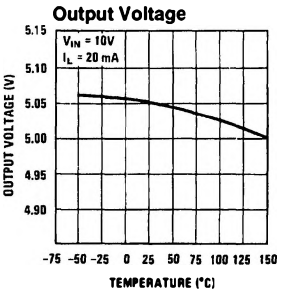
Dropout Voltage



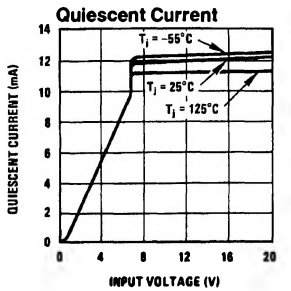
Line Transient Response



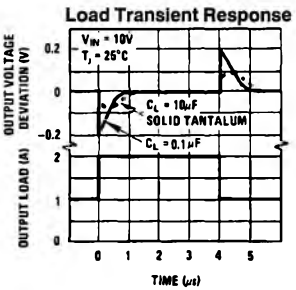
Output Voltage



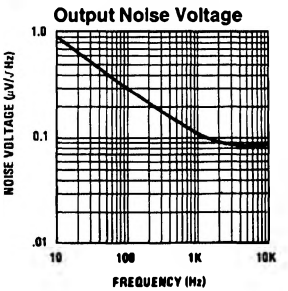
Quiescent Current



Load Transient Response



Output Noise Voltage



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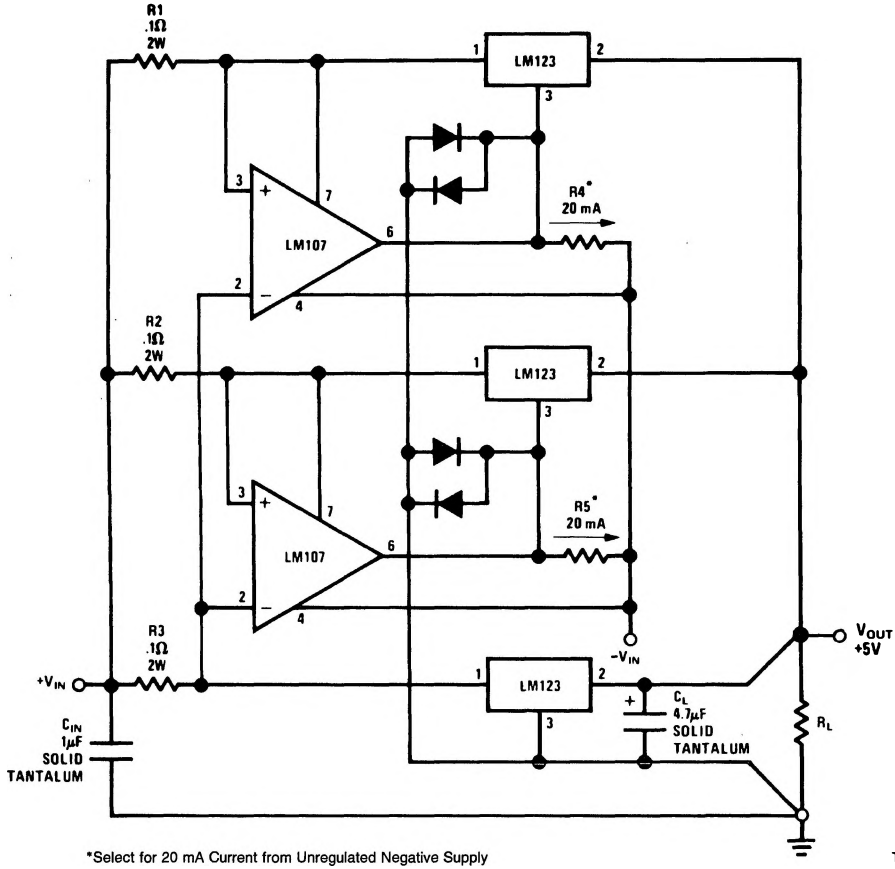
Typical Applications (Continued)

10 Amp Regulator with Complete Overload Protection



*Select for 20 mA Current from Unregulated Negative Supply

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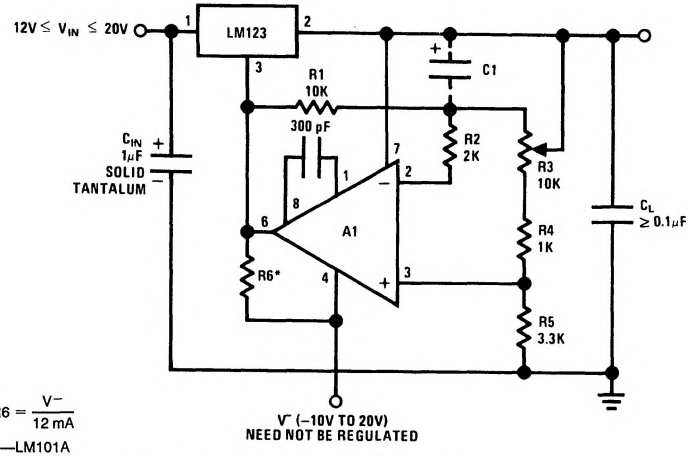
Adjustable Regulator 0V–10V @ 3A



$$*R6 = \frac{V^-}{12\ mA}$$

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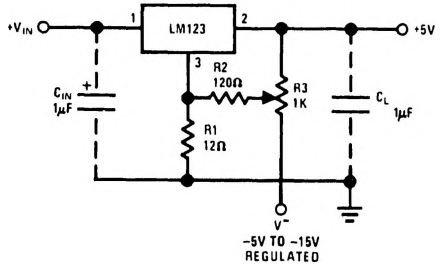
A_1—LM101A

C_1—2 μF Optional—Improves Ripple Rejection, Noise, and Transient Response

Typical Applications (Continued)

Trimming Output to 5V



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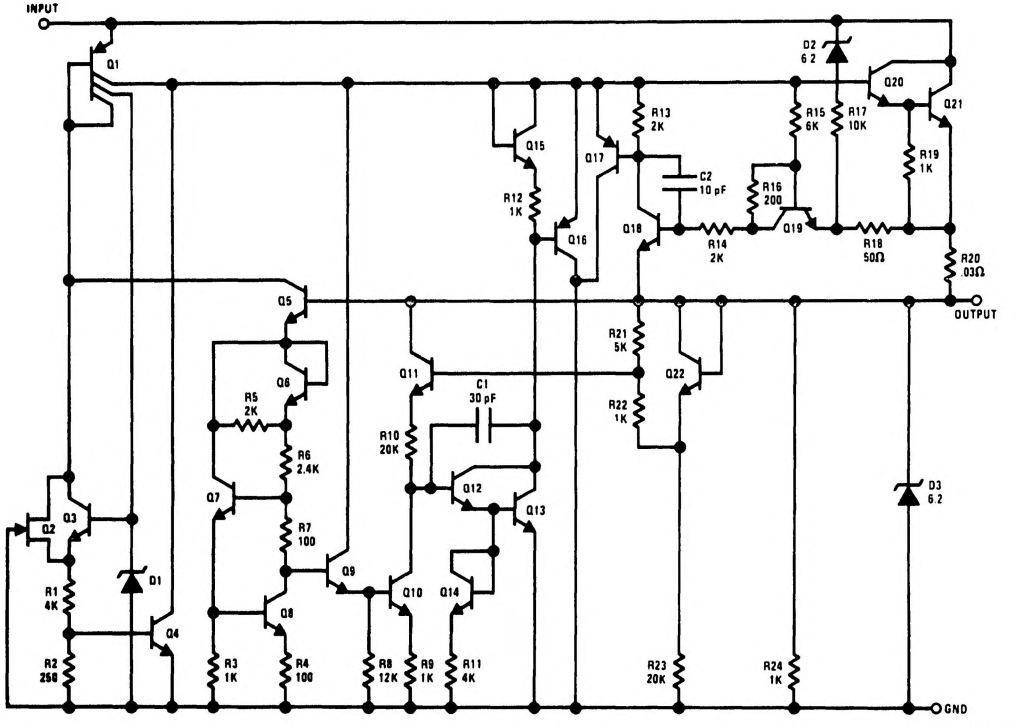
Schematic Diagram



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