

LM723/LM723C Voltage Regulator

 Check for Samples: [LM723](#), [LM723C](#)

FEATURES

- 150 mA Output Current Without External Pass Transistor
- Output Currents in Excess of 10A Possible by Adding External Transistors
- Input Voltage 40V Max
- Output Voltage Adjustable from 2V to 37V
- Can be Used as Either a Linear or a Switching Regulator

DESCRIPTION

The LM723/LM723C is a voltage regulator designed primarily for series regulator applications. By itself, it will supply output currents up to 150 mA; but external transistors can be added to provide any desired load current. The circuit features extremely low standby current drain, and provision is made for either linear or foldback current limiting.

The LM723/LM723C is also useful in a wide range of other applications such as a shunt regulator, a current regulator or a temperature controller.

The LM723C is identical to the LM723 except that the LM723C has its performance ensured over a 0°C to +70°C temperature range, instead of -55°C to +125°C.

Connection Diagram

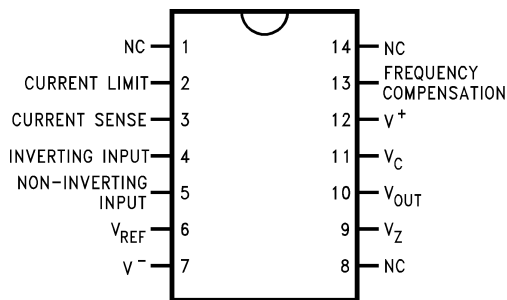
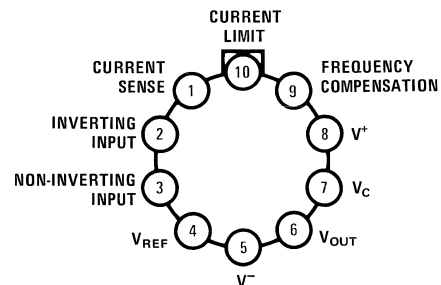


Figure 1. Top View
CDIP Package or PDIP Package
 See Package J or NFF0014A



Note: Pin 5 connected to case.

Figure 2. Top View
TO-100
 See Package LME

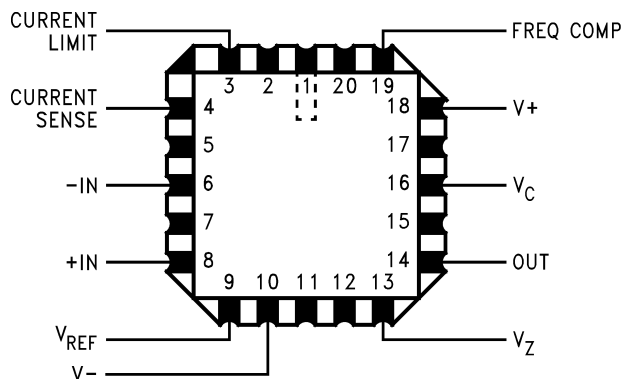


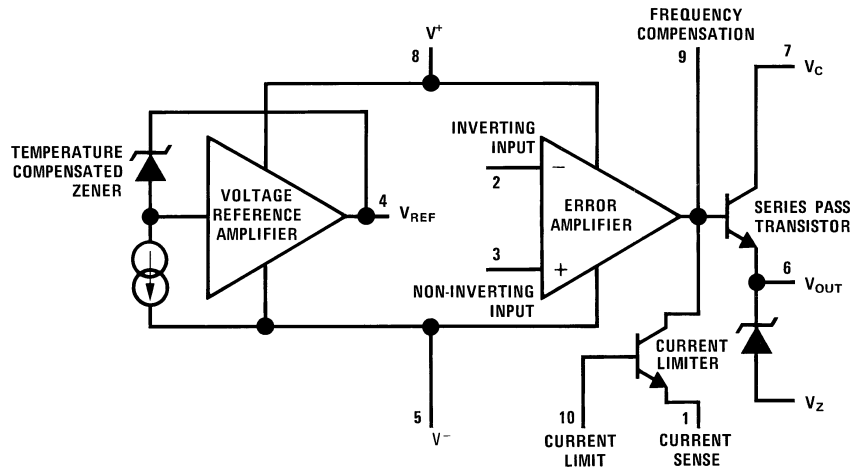
Figure 3. Top View
 See Package NAJ0020A



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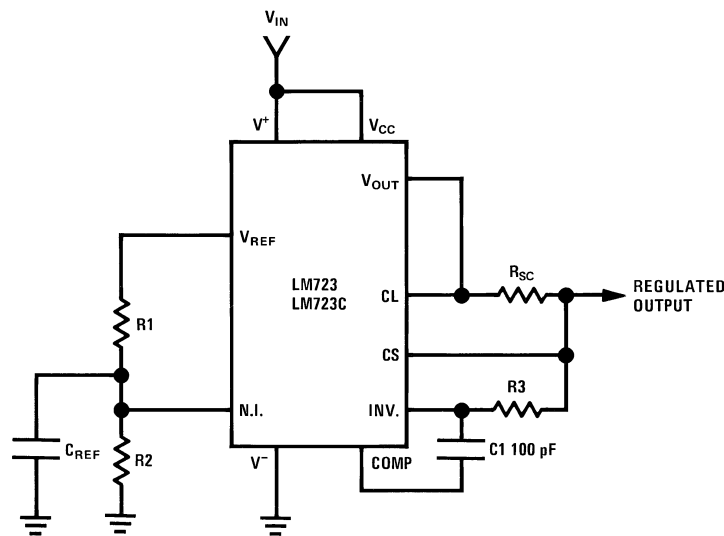
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Equivalent Circuit*



*Pin numbers refer to metal can package.

Typical Application



$$\text{Note: } R3 = \frac{R1 R2}{R1 + R2}$$

for minimum temperature drift.

Typical Performance

Regulated Output Voltage	5V
Line Regulation ($\Delta V_{IN} = 3V$)	0.5mV
Load Regulation ($\Delta I_L = 50 \text{ mA}$)	1.5mV

Figure 4. Basic Low Voltage Regulator ($V_{OUT} = 2$ to 7 Volts)



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⁾

Pulse Voltage from V^+ to V^- (50 ms)	50V
Continuous Voltage from V^+ to V^-	40V
Input-Output Voltage Differential	40V
Maximum Amplifier Input Voltage (Either Input)	8.5V
Maximum Amplifier Input Voltage (Differential)	5V
Current from V_Z	25 mA
Current from V_{REF}	15 mA
Internal Power Dissipation Metal Can ⁽³⁾	800 mW
CDIP ⁽³⁾	900 mW
PDIP ⁽³⁾	660 mW
Operating Temperature Range	
LM723	-55°C to +150°C
LM723C	0°C to +70°C
Storage Temperature Range Metal Can	
PDIP	-65°C to +150°C
Lead Temperature (Soldering, 4 sec. max.)	
Hermetic Package	300°C
Plastic Package	260°C
ESD Tolerance	
	1200V
(Human body model, 1.5 k Ω in series with 100 pF)	

- (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) A military RETS specification is available on request. At the time of printing, the LM723 RETS specification complied with the Min and Max limits in this table. The LM723E, H, and J may also be procured as a Standard Military Drawing.
- (3) See derating curves for maximum power rating above 25°C.

ELECTRICAL CHARACTERISTICS⁽¹⁾⁽²⁾⁽³⁾⁽⁴⁾

Parameter	Conditions	LM723			LM723C			Units
		Min	Typ	Max	Min	Typ	Max	
Line Regulation	$V_{IN} = 12V$ to $V_{IN} = 15V$		0.01	0.1		0.01	0.1	% V_{OUT}
	$-55^\circ C \leq T_A \leq +125^\circ C$			0.3				% V_{OUT}
	$0^\circ C \leq T_A \leq +70^\circ C$						0.3	% V_{OUT}
	$V_{IN} = 12V$ to $V_{IN} = 40V$		0.02	0.2		0.1	0.5	% V_{OUT}
Load Regulation	$I_L = 1$ mA to $I_L = 50$ mA		0.03	0.15		0.03	0.2	% V_{OUT}
	$-55^\circ C \leq T_A \leq +125^\circ C$			0.6				% V_{OUT}
	$0^\circ C \leq T_A \leq +70^\circ C$						0.6	% V_{OUT}
Ripple Rejection	$f = 50$ Hz to 10 kHz, $C_{REF} = 0$		74			74		dB
	$f = 50$ Hz to 10 kHz, $C_{REF} = 5$ μF		86			86		dB

- (1) Unless otherwise specified, $T_A = 25^\circ C$, $V_{IN} = V^+ = V_C = 12V$, $V^- = 0$, $V_{OUT} = 5V$, $I_L = 1$ mA, $R_{SC} = 0$, $C_1 = 100$ pF, $C_{REF} = 0$ and divider impedance as seen by error amplifier ≤ 10 k Ω connected as shown in Figure 4. Line and load regulation specifications are given for the condition of constant chip temperature. Temperature drifts must be taken into account separately for high dissipation conditions.
- (2) A military RETS specification is available on request. At the time of printing, the LM723 RETS specification complied with the Min and Max limits in this table. The LM723E, H, and J may also be procured as a Standard Military Drawing.
- (3) Specified by correlation to other tests.
- (4) L_1 is 40 turns of No. 20 enameled copper wire wound on Ferroxcube P36/22-3B7 pot core or equivalent with 0.009 in. air gap.

ELECTRICAL CHARACTERISTICS⁽¹⁾⁽²⁾⁽³⁾⁽⁴⁾ (continued)

Parameter	Conditions	LM723			LM723C			Units
		Min	Typ	Max	Min	Typ	Max	
Average Temperature Coefficient of Output Voltage ⁽⁵⁾	$-55^{\circ}\text{C} \leq T_A \leq +125^{\circ}\text{C}$		0.002	0.015				%/°C
	$0^{\circ}\text{C} \leq T_A \leq +70^{\circ}\text{C}$					0.003	0.015	%/°C
Short Circuit Current Limit	$R_{SC} = 10\Omega, V_{OUT} = 0$		65			65		mA
Reference Voltage		6.95	7.15	7.35	6.80	7.15	7.50	V
Output Noise Voltage	BW = 100 Hz to 10 kHz, $C_{REF} = 0$		86			86		μVrms
	BW = 100 Hz to 10 kHz, $C_{REF} = 5 \mu\text{F}$		2.5			2.5		μVrms
Long Term Stability			0.05			0.05		%/1000 hrs
Standby Current Drain	$I_L = 0, V_{IN} = 30\text{V}$		1.7	3.5		1.7	4.0	mA
Input Voltage Range		9.5		40	9.5		40	V
Output Voltage Range		2.0		37	2.0		37	V
Input-Output Voltage Differential		3.0		38	3.0		38	V
θ_{JA}	PDIP					105		°C/W
θ_{JA}	CDIP		150					°C/W
θ_{JA}	H10C Board Mount in Still Air		165			165		°C/W
θ_{JA}	H10C Board Mount in 400 LF/Min Air Flow		66			66		°C/W
θ_{JC}			22			22		°C/W

(5) For metal can applications where V_Z is required, an external 6.2V zener diode should be connected in series with V_{OUT} .