

**Description**

The μA723 is a monolithic voltage regulator constructed using the Fairchild Planar Epitaxial process. The device consists of a temperature compensated reference amplifier, error amplifier, power series pass transistor and current-limit circuitry. Additional NPN or PNP pass elements may be used when output currents exceeding 150 mA are required. Provisions are made for adjustable current-limiting and remote shutdown. In addition to the above, the device features low standby current drain, low temperature drift and high ripple rejection. The μA723 is intended for use with positive or negative supplies as a series, shunt, switching or floating regulator. Applications include laboratory power supplies, isolation regulators for low level data amplifiers, logic card regulators, small instrument power supplies, airborne systems and other power supplies for digital and linear circuits.

- **Positive Or Negative Supply Operation**
- **Series, Shunt, Switching Or Floating Operation**
- **0.01% Line And Load Regulation**
- **Output Voltage Adjustable From 2 V To 37 V**
- **Output Current To 150 mA Without External Pass Transistor**

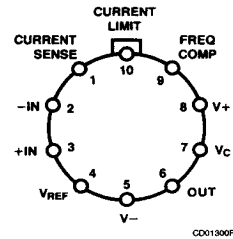
**Absolute Maximum Ratings**

<b>Storage Temperature Range</b>	
Ceramic DIP/Metal Can	-65°C to +175°C
Molded DIP/SO Package	-55°C to +150°C
<b>Operating Temperature Range</b>	
Extended (μA723M)	-55°C to +125°C
Commercial (μA723C)	0°C to +70°C
<b>Lead Temperature</b>	
Ceramic DIP/Metal Can (soldering, 60 s)	300°C
Molded DIP/SO-14 (soldering, 10 s)	265°C
<b>Internal Power Dissipation<sup>1,2</sup></b>	
10L-Metal Can	1.07 W
14L-Ceramic DIP	1.36 W
14L-Molded DIP	1.04 W
SO-14	0.93 W
<b>Pulse Voltage from V+ to V-, (50 ms) (μA723M)</b>	
	50 V
<b>Continuous Voltage from V+ to V-</b>	
	40 V
<b>Input/Output Voltage Differential</b>	
	40 V
<b>Differential Input Voltage</b>	
	± 5.0 V
<b>Voltage Between Non-Inverting Input and V-</b>	
	8.0 V
<b>Current from Vz</b>	
	25 mA
<b>Current from VREF</b>	
	15 mA

**Notes**

1. T<sub>J</sub> Max = 150°C for the Molded DIP, and 175°C for the Metal Can and Ceramic DIP.
2. Ratings supply to ambient temperature at 25°C. Above this temperature, derate the 10L-Metal Can at 7.1 mW/°C, the 14L-Ceramic DIP at 9.1 mW/°C, the 14L-Molded DIP at 8.3 mW/°C, and the SO-14 at 7.5 mW/°C.

**Connection Diagram  
10-Lead Metal Package  
(Top View)**

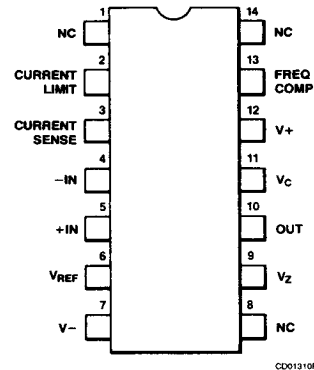


Lead 5 connected to case.

**Order Information**

Device Code	Package Code	Package Description
μA723HM	5X	Metal
μA723HC	5X	Metal

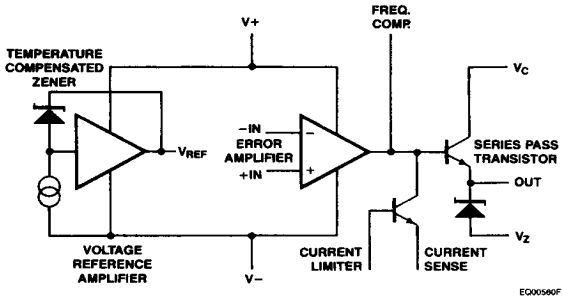
**Connection Diagram  
14-Lead DIP and SO-14 Package  
(Top View)**



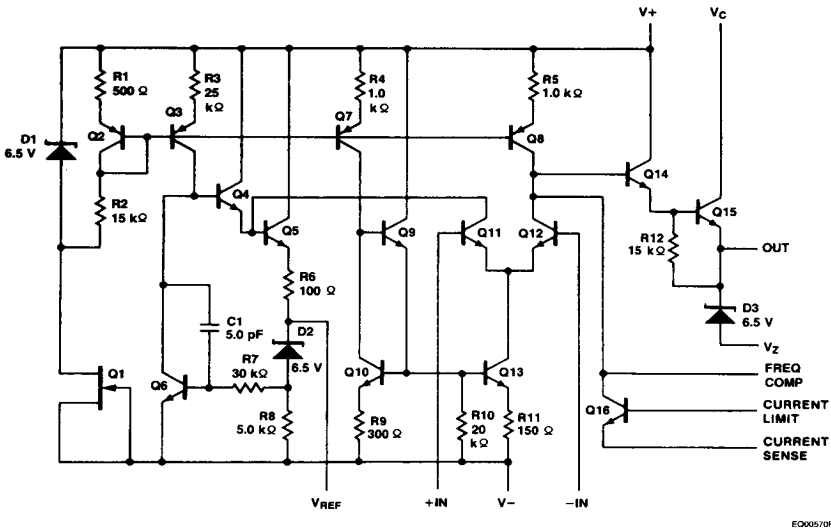
**Order Information**

Device Code	Package Code	Package Description
μA723DM	6A	Ceramic DIP
μA723DC	6A	Ceramic DIP
μA723PC	9A	Molded DIP
μA723SC	KD	Molded Surface Mount

Block Diagram



Equivalent Circuit



## μA723

### μA723M

**Electrical Characteristics**  $T_A = 25^\circ\text{C}$ ,  $V_I = V_+ = V_C = 12\text{ V}$ ,  $V_- = 0$ ,  $V_O = 5\text{ V}$ ,  $I_L = 1\text{ mA}$ ,  $R_{SC} = 0$ ,  $C_1 = 100\text{ pF}$ ,  $C_{REF} = 0$ , unless otherwise specified.

Symbol	Characteristic <sup>1</sup>	Condition	Min	Typ	Max	Unit
$V_{R\text{ LINE}}$	Line Regulation	$V_I = 12\text{ V}$ to $V_I = 15\text{ V}$		0.01	0.1	% $V_O$
		$V_I = 12\text{ V}$ to $V_I = 40\text{ V}$		0.02	0.2	
		$-55^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$ , $V_I = 12\text{ V}$ to $V_I = 15\text{ V}$			0.3	
$V_{R\text{ LOAD}}$	Load Regulation	$I_L = 1\text{ mA}$ to $I_L = 50\text{ mA}$		0.03	0.15	% $V_O$
		$-55^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$ , $I_L = 1\text{ mA}$ to $I_L = 50\text{ mA}$			0.6	
$\Delta V_I / \Delta V_O$	Ripple Rejection	$f = 50\text{ Hz}$ to $10\text{ kHz}$		74		dB
		$f = 50\text{ Hz}$ to $10\text{ kHz}$ , $C_{REF} = 0.5\text{ }\mu\text{F}$		86		
$\Delta V_O / \Delta T$	Average Temperature Coefficient of Output Voltage	$-55^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$		0.002	0.015	%/ $^\circ\text{C}$
$I_{OS}$	Output Short Circuit Current	$R_{SC} = 10\text{ }\Omega$ , $V_O = 0$		65		mA
$V_{REF}$	Reference Voltage	$I_{REF} = 0.1\text{ mA}$	6.95	7.15	7.35	V
$V_{REF(\text{Load})}$	Reference Voltage Change With Load	$I_{REF} = 0.1\text{ mA}$ to $5\text{ mA}$			20	mV
$N_O$	Noise	$BW = 100\text{ Hz}$ to $10\text{ kHz}$ , $C_{REF} = 0$		20		$\mu\text{V}_{\text{rms}}$
		$BW = 100\text{ Hz}$ to $10\text{ kHz}$ , $C_{REF} = 5.0\text{ }\mu\text{F}$		2.0		
S	Long Term Stability	$T_J = T_{J\text{ Max}}$   $T_A = 25^\circ\text{C}$ For End Point Measurement		0.1		%/1000 hrs
$I_{SCD}$	Standby Current Drain	$I_L = 0$ , $V_I = 30\text{ V}$		2.3	3.5	mA
$V_{IR}$	Input Voltage Range		9.5		40	V
$V_{OR}$	Output Voltage Range		2.0		37	V
$V_I - V_O$	Input/Output Voltage Differential		3.0		38	V

# μA723

## μA723C

**Electrical Characteristics**  $T_A = 25^\circ\text{C}$ ,  $V_I = V_+ = V_C = 12\text{ V}$ ,  $V_- = 0$ ,  $V_O = 5\text{ V}$ ,  $I_L = 1\text{ mA}$ ,  $R_{SC} = 0$ ,  $C_1 = 100\text{ pF}$ ,  $C_{REF} = 0$ , unless otherwise specified.

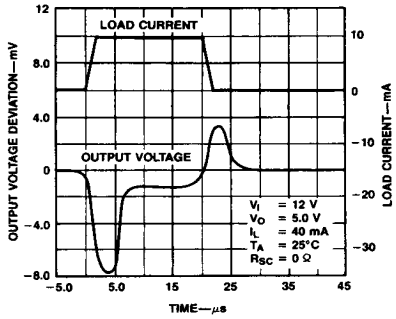
Symbol	Characteristic <sup>1</sup>	Condition	Min	Typ	Max	Unit
$V_R$ LINE	Line Regulation	$V_I = 12\text{ V}$ to $V_I = 15\text{ V}$		0.01	0.1	% $V_O$
		$V_I = 12\text{ V}$ to $V_I = 40\text{ V}$		0.1	0.5	
		$0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$ , $V_I = 12\text{ V}$ to $V_I = 15\text{ V}$			0.3	
$V_R$ LOAD	Load Regulation	$I_L = 1.0\text{ mA}$ to $I_L = 50\text{ mA}$		0.03	0.2	% $V_O$
		$0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$ , $I_L = 1.0\text{ mA}$ to $I_L = 50\text{ mA}$			0.6	
$\Delta V_I / \Delta V_O$	Ripple Rejection	$f = 50\text{ Hz}$ to $10\text{ kHz}$		74		dB
		$f = 50\text{ Hz}$ to $10\text{ kHz}$ , $C_{REF} = 5\text{ }\mu\text{F}$		86		
$\Delta V_O / \Delta T$	Average Temperature Coefficient of Output Voltage	$0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$		0.003	0.015	%/ $^\circ\text{C}$
$I_{OS}$	Output Short Circuit Current	$R_{SC} = 10\text{ }\Omega$ , $V_O = 0$		65		mA
$V_{REF}$	Reference Voltage	$I_{REF} = 0.1\text{ mA}$	6.80	7.15	7.50	V
$V_{REF}(\text{Load})$	Reference Voltage Change With Load	$I_{REF} = 0.1\text{ mA}$ to $5\text{ mA}$			20	mV
$N_O$	Noise	$BW = 100\text{ Hz}$ to $10\text{ kHz}$ , $C_{REF} = 0$		20		$\mu\text{V}_{rms}$
		$BW = 100\text{ Hz}$ to $10\text{ kHz}$ , $C_{REF} = 5\text{ }\mu\text{F}$		2.0		
S	Long Term Stability	$T_J = T_{J\text{ Max}}$ $T_A = 25^\circ\text{C}$ For End Point Measurement		0.1		%/1000 hrs
$I_{SCD}$	Standby Current Drain	$I_L = 0$ , $V_I = 30\text{ V}$		2.3	4.0	mA
$V_{IR}$	Input Voltage Range		9.5		40	V
$V_{OR}$	Output Voltage Range		2.0		37	V
$V_I - V_O$	Input/Output Voltage Differential		3.0		38	V

**Note**

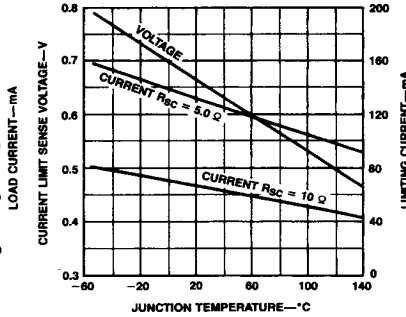
1. Divider impedance as seen by error amplifier  $\leq 10\text{ k}\Omega$  connected as shown in Figure 1. Line and load regulation specifications are given for the condition of constant chip temperature. Temperature drifts must be taken into account separately for high dissipation conditions.

Typical Performance Curves for μA723 and μA723C

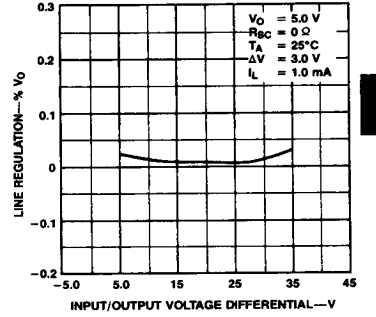
Load Transient Response



Current-Limiting Characteristics vs Junction Temperature

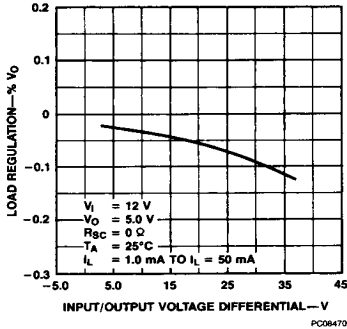


Line Regulation vs Input/Output Voltage Differential

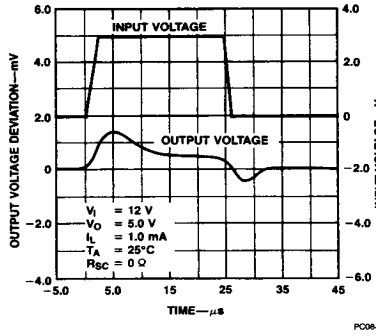


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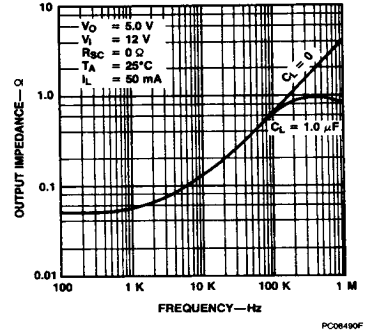
Load Regulation vs Input/Output Voltage Differential



Line Transient Response

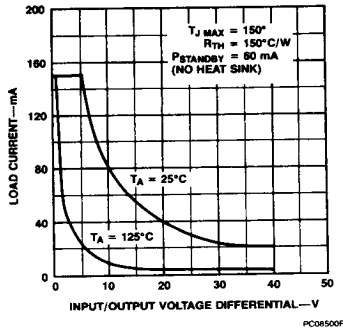


Output Impedance vs Frequency

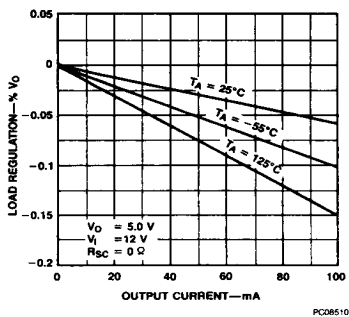


Typical Performance Curves for μA723

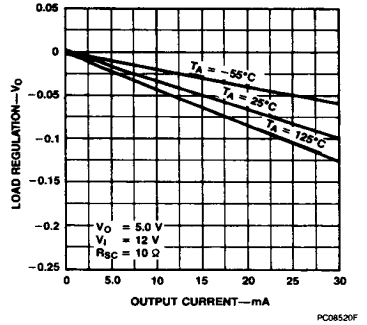
Maximum Load Current vs Input/Output Voltage Differential



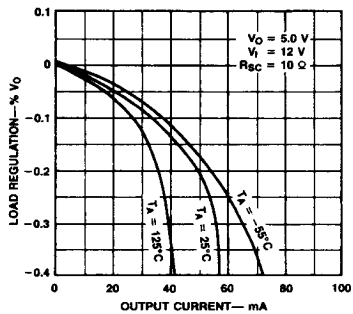
Load Regulation Characteristics Without Current-Limiting



Load Regulation Characteristics With Current-Limiting

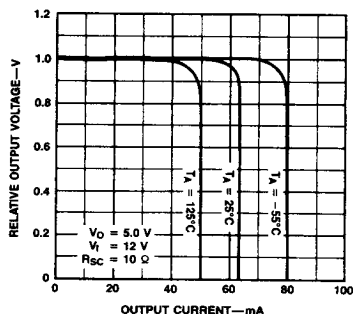


**Typical Performance Curves for μA723**  
**Load Regulation Characteristics With Current-Limiting**



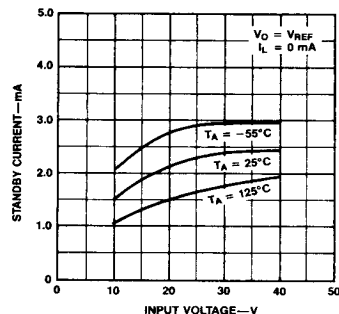
PC08530F

**Current-Limiting Characteristics**



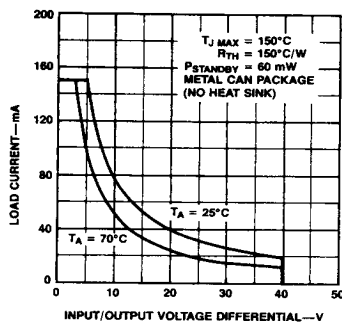
PC08540F

**Standby Current Drain vs Input Voltage**



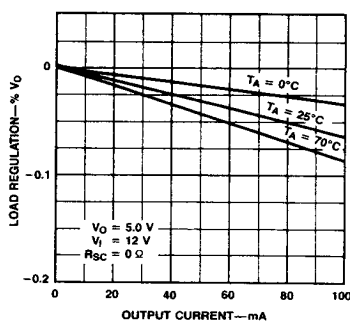
PC08550F

**Typical Performance Curves for μA723C**  
**Maximum Load Current vs Input/Output Voltage Differential**



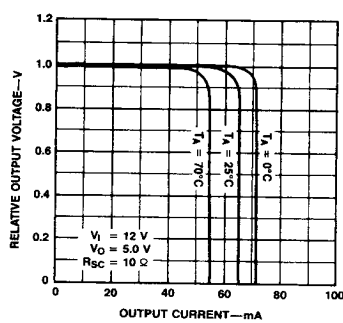
PC08560F

**Load Regulation Characteristics Without Current-Limiting**



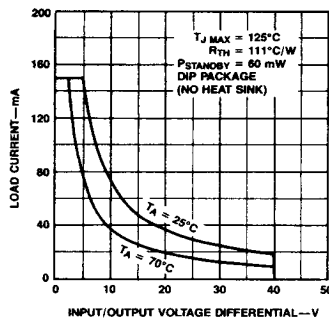
PC08570F

**Current-Limiting Characteristics**



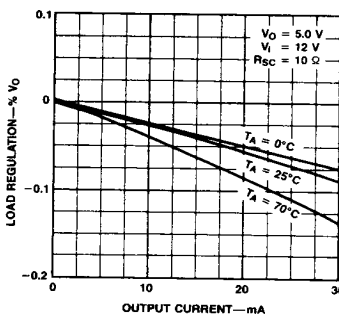
PC08580F

**Maximum Load Current vs Input/Output Voltage Differential**



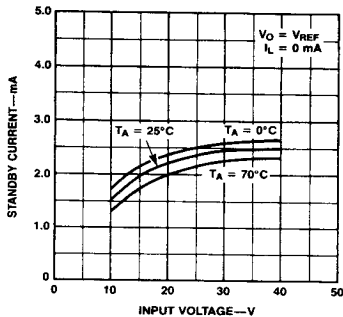
PC08590F

**Load Regulation Characteristics With Current-Limiting**



PC08600F

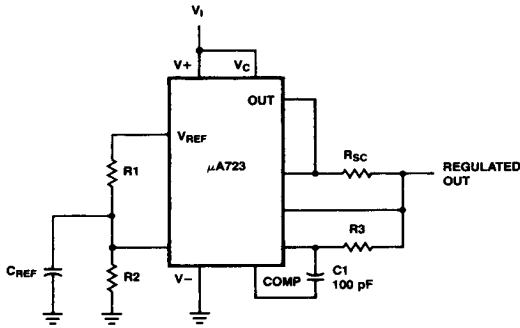
**Standby Current Drain vs Input Voltage**



PC08610F

Typical Applications

Figure 1 Basic Low Voltage Regulator  
( $V_O = 2.0 \text{ V to } 7.0 \text{ V}$ )



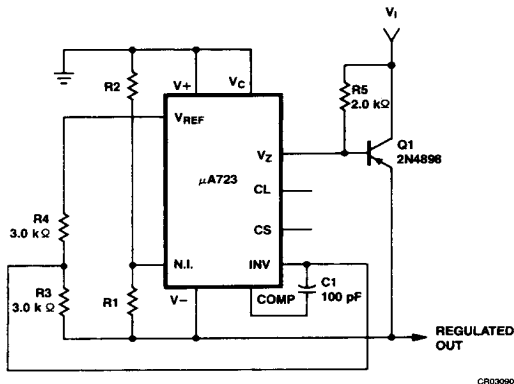
CR03070F

Typical Performance

Regulated Output Voltage	+ 5.0 V
Line Regulation ( $\Delta V_I = 3.0 \text{ V}$ )	0.5 mV
Load Regulation ( $\Delta I_L = 50 \text{ mA}$ )	1.5 mV

$$R_3 = \frac{R_1 R_2}{R_1 + R_2} \text{ for minimum temperature drift.}$$

Figure 3 Negative Voltage Regulator (Note 1)



CR03090F

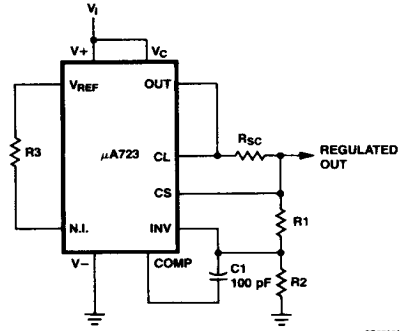
Typical Performance

Regulated Output Voltage	-15 V
Line Regulation ( $\Delta V_I = 3.0 \text{ V}$ )	1 mV
Load Regulation ( $\Delta I_L = 100 \text{ mA}$ )	2 mV

Note

- For metal can applications where  $V_Z$  is required, an external 6.2 V Zener diode should be connected in series with  $V_O$ .

Figure 2 Basic High Voltage Regulator  
( $V_O = 7.0 \text{ V to } 37 \text{ V}$ )



CR03080F

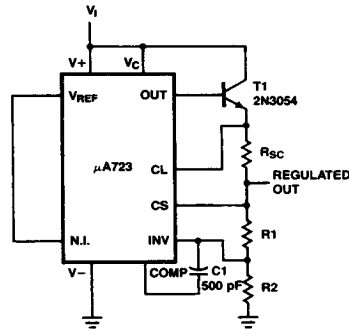
Typical Performance

Regulated Output Voltage	+ 15 V
Line Regulation ( $\Delta V_I = 3.0 \text{ V}$ )	1.5 mV
Load Regulation ( $\Delta I_L = 50 \text{ mA}$ )	4.5 mV

$$R_3 = \frac{R_1 R_2}{R_1 + R_2} \text{ for minimum temperature drift.}$$

$R_3$  may be eliminated for minimum component count.

Figure 4 Positive Voltage Regulator (External NPN Pass Transistor)



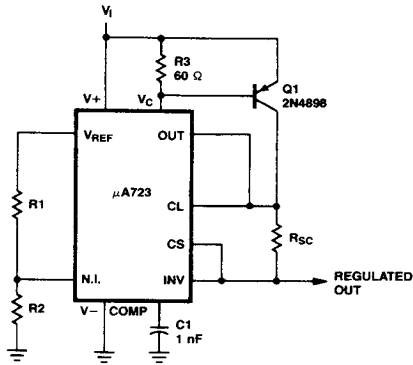
CR03100F

Typical Performance

Regulated Output Voltage	+ 15 V
Line Regulation ( $\Delta V_I = 3.0 \text{ V}$ )	1.5 mV
Load Regulation ( $\Delta I_L = 1.0 \text{ A}$ )	15 mV

Typical Applications (Cont.)

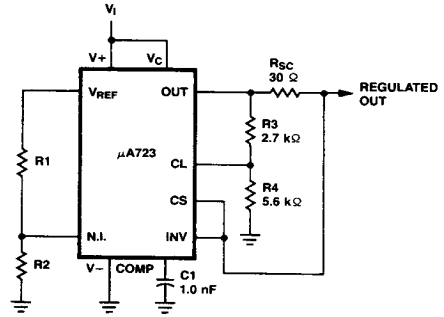
Figure 5 Positive Voltage Regulator (External PNP Pass Transistor)



Typical Performance  
 Regulated Output Voltage +5.0 V  
 Line Regulation ( $\Delta V_I = 3.0$  V) 0.5 mV  
 Load Regulation ( $\Delta I_L = 1.0$  A) 5.0 mV

CR03110F

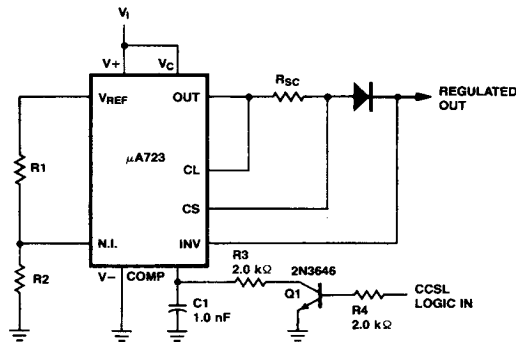
Figure 6 Foldback Current-Limiting



CR03120F

Typical Performance  
 Regulated Output Voltage +5.0 V  
 Line Regulation ( $\Delta V_I = 3.0$  V) 0.5 mV  
 Load Regulation ( $\Delta I_L = 10$  mA) 1.0 mV  
 Short Circuit Current 20 mA

Figure 7 Remote Shutdown Regulator with Current-Limiting (Note 1)

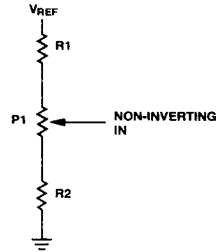


CR03131F

Typical Performance  
 Regulated Output Voltage +5.0 V  
 Line Regulation ( $\Delta V_I = 3.0$  V) 0.5 mV  
 Load Regulation ( $\Delta I_L = 50$  mA) 1.5 mV

**Note**  
 1. Current limit transistor may be used for shutdown if current limiting is not required. Add diode if  $V_O > 10$  V.

Figure 8 Output Voltage Adjust



CR03140F