- **150-mA Load Current Without External Power Transistor**
- **Typically 0.02% Input Regulation and 0.03% Load Regulation (uA723M)**
- **Adjustable Current Limiting Capability**
- **Input Voltages to 40 V**
- **Output Adjustable From 2 V to 37 V**
- **Direct Replacement for Fairchild μA723C and μA723M**

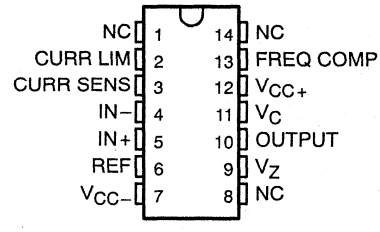
description

The uA723C and uA723M are precision monolithic integrated circuit voltage regulators featuring high ripple rejection, excellent input and load regulation, excellent temperature stability, and low standby current. The circuit consists of a temperature-compensated reference voltage amplifier, an error amplifier, a 150-mA output transistor, and an adjustable output current limiter.

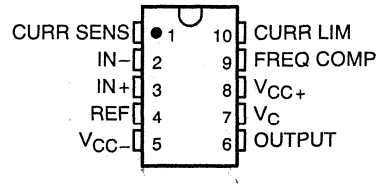
The uA723C and uA723M are designed for use in positive or negative power supplies as a series, shunt, switching, or floating regulator. For output currents exceeding 150 mA, additional pass elements may be connected as shown in Figures 4 and 5.

The uA723C is characterized for operation from 0°C to 70°C. The uA723M is characterized for operation over the full military temperature range of –55°C to 125°C.

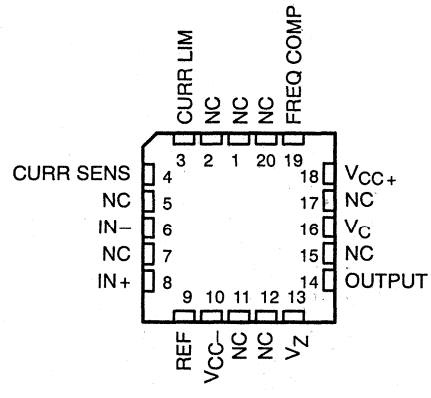
uA723C . . . D OR N PACKAGE
uA723M . . . J PACKAGE
(TOP VIEW)



uA723M . . . U PACKAGE
(TOP VIEW)

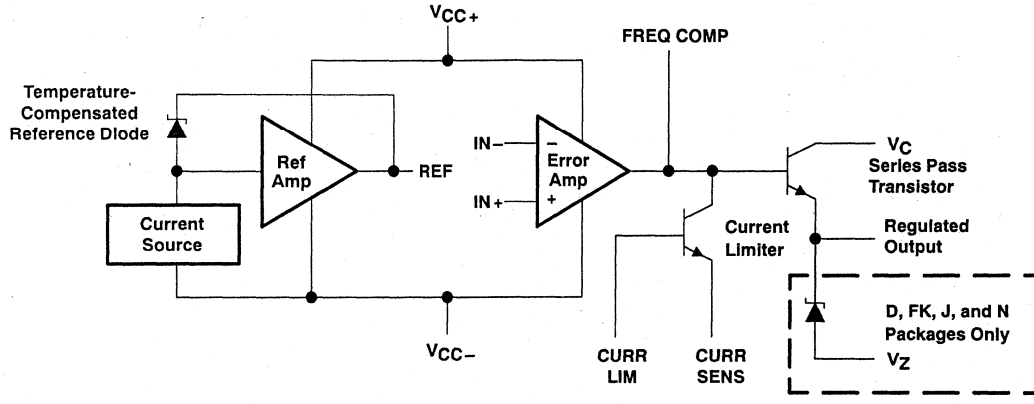


uA723M . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

functional block diagram



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

Peak voltage from V_{CC+} to V_{CC-} ($t_w \leq 50$ ms) ..... 50 V
Continuous voltage from V_{CC+} to V_{CC-} ..... 40 V
Input-to-output voltage differential ..... 40 V
Differential input voltage to error amplifier ..... ±5 V
Voltage between noninverting input and V_{CC-} ..... 8 V
Current from V_Z ..... 25 mA
Current from REF ..... 15 mA
Continuous total dissipation (see Note 1) ..... See Dissipation Rating Table
Operating free-air temperature range: uA723C ..... 0°C to 70°C
uA723M ..... −55°C to 125°C
Storage temperature range ..... −65°C to 150°C
Case temperature for 60 seconds: FK package ..... 260°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: J or U package ..... 300°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or N package ..... 260°C

NOTE 1: Power dissipation = $[I_{(standby)} + I_{(ref)}] V_{CC} + [V_C - V_O] I_O$.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25°C$ POWER RATING	DERATING FACTOR	DERATE ABOVE T_A	$T_A = 70°C$ POWER RATING	$T_A = 125°C$ POWER RATING
D	950 mW	7.6 mW/°C	25°C	608 mW	
FK and J	1000 mW	11.0 mW/°C	59°C	880 mW	275 mW
N	1000 mW	9.2 mW/°C	41°C	736 mW	
U	675 mW	5.4 mW/°C	25°C	432 mW	135 mW

recommended operating conditions

	MIN	MAX	UNIT
Input voltage, V_I	9.5	40	V
Output voltage, V_O	2	37	V
Input-to-output voltage differential, $V_C - V_O$	3	38	V
Output current, I_O		150	mA

electrical characteristics at specified free-air temperature (see Notes 2 and 3)

PARAMETER	TEST CONDITIONS		T_A†	uA723C			uA723M			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
Input regulation	V_I = 12 V to V_I = 15 V		25°C		0.01%	0.1%		0.01%	0.1%	
	V_I = 12 V to V_I = 40 V		25°C		0.1%	0.5%		0.02%	0.2%	
	V_I = 12 V to V_I = 15 V		Full range			0.3%			0.3%	
Ripple rejection	f = 50 H_Z to 10 kHz,	C_{ref} = 0	25°C		74			74		dB
	f = 50 Hz to 10 kHz,	C_{ref} = 5 μF	25°C		86			86		
Output regulation	I_O = 1 mA to 50 mA		25°C		−0.03%	−0.2%		−0.03%	−0.15%	
			Full range			−0.6%			−0.6%	
Reference voltage, V_{ref}			25°C	6.8	7.15	7.5	6.95	7.15	7.35	V
Standby current	V_I = 30 V,	I_O = 0	25°C		2.3	4		2.3	3.5	mA
Temperature coefficient of output voltage			Full range		0.003	0.015		0.002	0.015*	%/°C
Short-circuit output current	R_{SC} = 10 Ω,	V_O = 0	25°C		65			65		mA
Output noise voltage	BW = 100 Hz to 10 kHz,	C_{ref} = 0	25°C		20			20		μV
	BW = 100 Hz to 10 kHz,	C_{ref} = 5 μF	25°C		2.5			2.5		

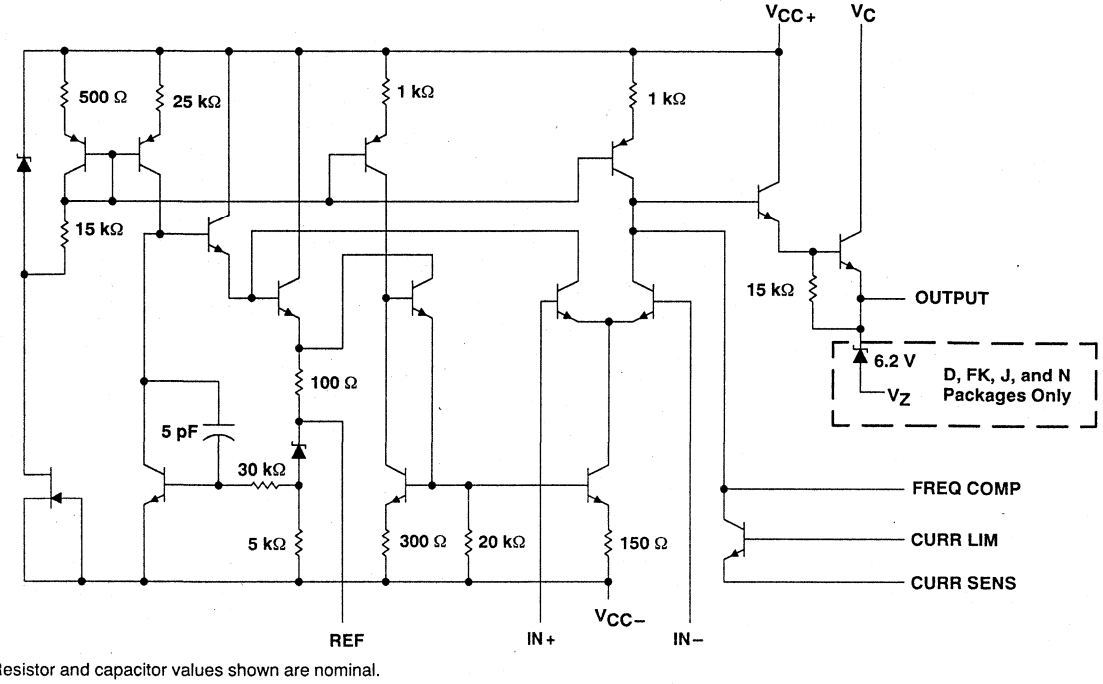
*On products compliant to MIL-STD-883, Class B, this parameter is not production tested.

† Full range for uA723C is 0°C to 70°C and for uA723M is −55°C to 125°C.

NOTES: 2. For all values in this table, the device is connected as shown in Figure 1 with the divider resistance as seen by the error amplifier ≤ 10 kΩ. Unless otherwise specified, $V_I = V_{CC+} = V_C$ = 12 V, V_{CC-} = 0, V_O = 5 V, I_O = 1 mA, R_{SC} = 0, and C_{ref} = 0.

3. Pulse-testing techniques must be used that will maintain the junction temperature as close to the ambient temperature as possible.

schematic



Resistor and capacitor values shown are nominal.

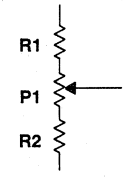
APPLICATION INFORMATION

Table 1. Resistor Values (kΩ) for Standard Output Voltages

OUTPUT VOLTAGE (V)	APPLICABLE FIGURES (SEE NOTE 4)	FIXED OUTPUT ±5%		OUTPUT ADJUSTABLE ±10% (SEE NOTE 5)		
		R1 (kΩ)	R2 (kΩ)	R1 (kΩ)	P1 (kΩ)	P2 (kΩ)
3.0	1,5,6,9,11, 12 (4)	4.12	3.01	1.8	0.5	1.2
3.6	1,5,6,9,11, 12 (4)	3.57	3.65	1.5	0.5	1.5
5.0	1,5,6,9,11, 12 (4)	2.15	4.99	0.75	0.5	2.2
6.0	1,5,6,9,11, 12 (4)	1.15	6.04	0.5	0.5	2.7
9.0	2,4,(5,6, 9,12)	1.87	7.15	0.75	1.0	2.7
12	2,4,(5,6, 9,12)	4.87	7.15	2.0	1.0	3.0
15	2,4,(5,6, 9,12)	7.87	7.15	3.3	1.0	3.0
28	2,4,(5,6, 9,12)	21.0	7.15	5.6	1.0	2.0
45	7	3.57	48.7	2.2	10	39
75	7	3.57	78.7	2.2	10	68
100	7	3.57	105	2.2	10	91
250	7	3.57	255	2.2	10	240
−6 (Note 6)	3, 10	3.57	2.43	1.2	0.5	0.75
−9	3, 10	3.48	5.36	1.2	0.5	2.0
−12	3, 10	3.57	8.45	1.2	0.5	3.3
−15	3, 10	3.57	11.5	1.2	0.5	4.3
−28	3, 10	3.57	24.3	1.2	0.5	10
−45	8	3.57	41.2	2.2	10	33
−100	8	3.57	95.3	2.2	10	91
−250	8	3.57	249	2.2	10	240

NOTES: 4. The R1/R2 divider may be across either V_O or $V_{(ref)}$. If the divider is across $V_{(ref)}$, use the figure numbers without parentheses. If the divider is across V_O, use the figure numbers in parentheses.

5. To make the voltage adjustable, the R1/R2 divider shown in the figures must be replaced by the divider shown below.



Adjustable Output Circuit

6. For Figures 3, 8, and 10, the device requires a minimum of 9 V between V_{CC+} and V_{CC-} when V_O is equal to or more positive than −9 V.

APPLICATION INFORMATION

Table 2. Formulas for Intermediate Output Voltages

Outputs from 2 V to 7 V See Figures 1,5,6,9, 11, 12 (4) and Note 4 $V_O = V_{(ref)} \times \frac{R2}{R1 + R2}$	Outputs from 4 V to 250 V See Figure 7 and Note 4 $V_O = \frac{V_{(ref)}}{2} \times \frac{R2 - R1}{R1}$; R3 = R4	Current Limiting $I_{(limit)} \approx \frac{0.65\ V}{R_{SC}}$
Outputs from 7 V to 37 V See Figures 2,4,(5,6,9, 11, 12) and Note 4 $V_O = V_{(ref)} \times \frac{R1 + R2}{R2}$	Outputs from −6 V to −250 V See Figures 3, 8, 10 and Notes 4 and 6 $V_O = -\frac{V_{(ref)}}{2} \times \frac{R1 + R2}{R1}$; R3 = R4	Foldback Current Limiting See Figure 6 $I_{(knee)} \approx \frac{V_O R3 + (R3 + R4)\ 0.65\ V}{R_{SC} R4}$; $I_{OS} \approx \frac{0.65\ V}{R_{SC}} \times \frac{R3 + R4}{R4}$

NOTES: 4. The R1/R2 divider may be across either V_O or $V_{(ref)}$. If the divider is across $V_{(ref)}$, use figure numbers without parentheses. If the divider is across V_O, use the figure numbers in parentheses.

6. For Figures 3, 8, and 10, the device requires a minimum of 9 V between V_{CC+} and V_{CC-} when V_O is equal to or more positive than −9 V.

APPLICATION INFORMATION

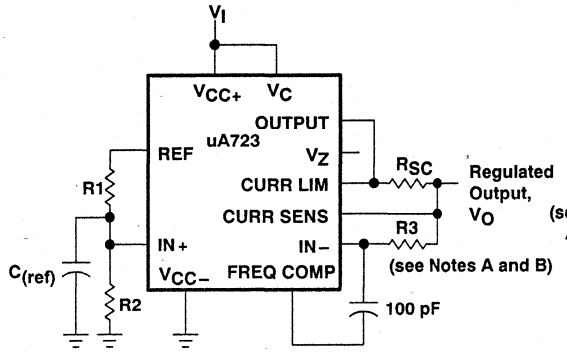


Figure 1. Basic Low-Voltage Regulator (V_O = 2 V to 7 V)

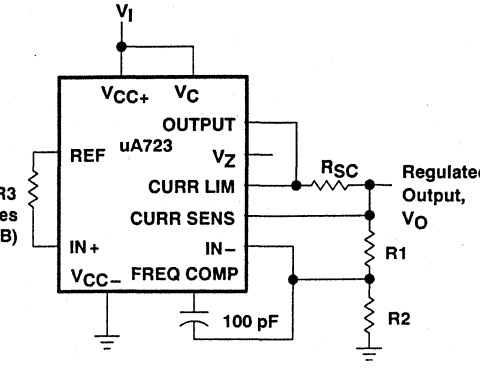


Figure 2. Basic High-Voltage Regulator (V_O = 7 V to 37 V)

NOTES: A. $R3 = \frac{R1 \cdot R2}{R1 + R2}$ for minimum α_{VO}.

B. R3 may be eliminated for minimum component count. Use direct connection (i.e., $R_3 = 0$).

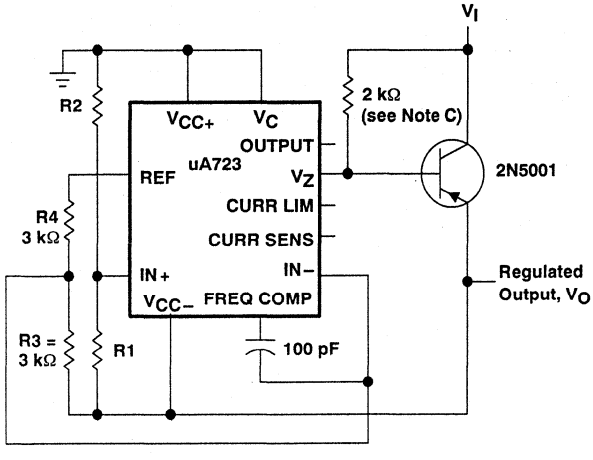


Figure 3. Negative-Voltage Regulator

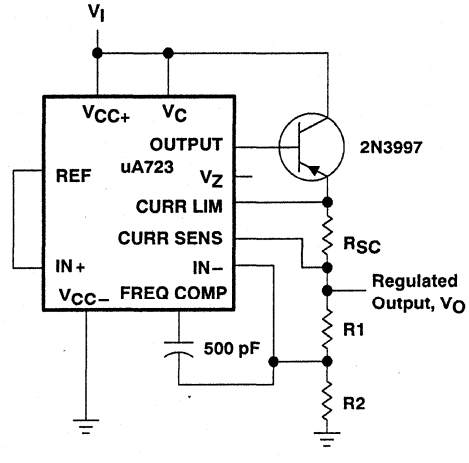


Figure 4. Positive-Voltage Regulator (External N-P-N Pass Terminator)

NOTE C: When 10-lead uA723U devices are used in applications requiring V_Z, an external 6.2-V regulator diode must be connected in series with OUTPUT.

APPLICATION INFORMATION

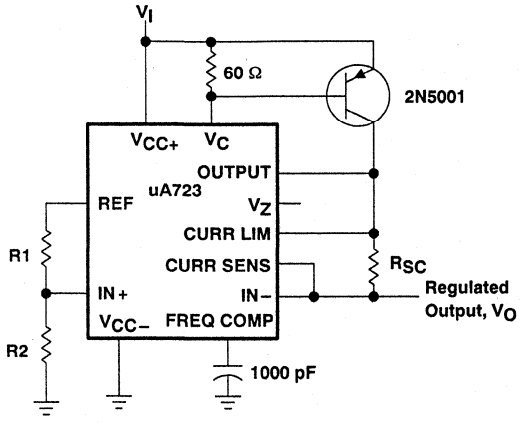


Figure 5. Positive-Voltage Regulator
(External P-N-P Pass Transistor)

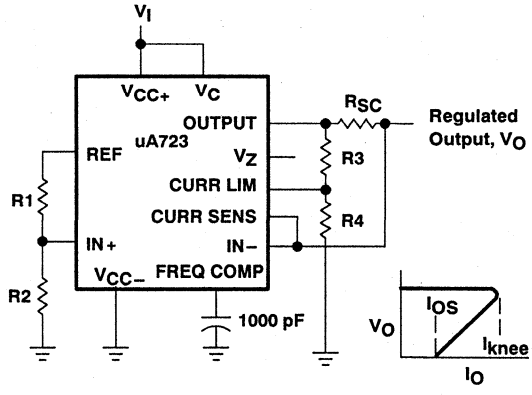


Figure 6. Foldback Current Limiting

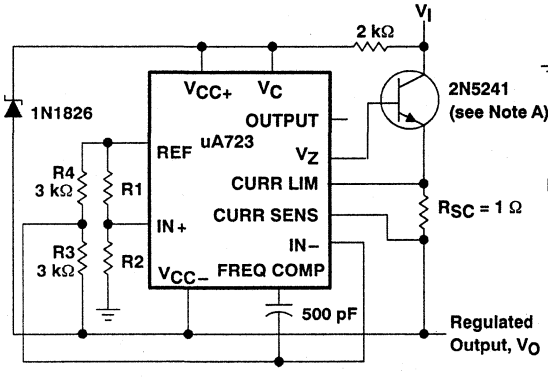


Figure 7. Positive Floating Regulator

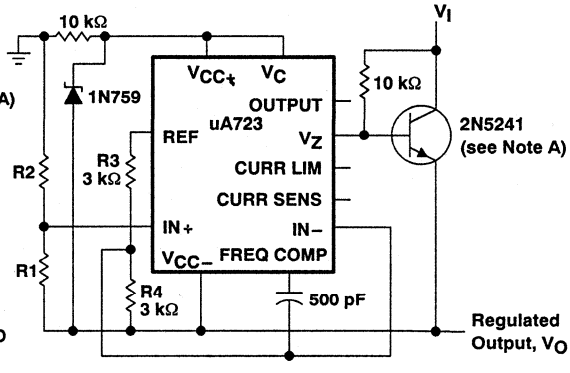


Figure 8. Negative Floating Regulator

NOTE A: When 10-lead uA723U devices are used in applications requiring V_Z, an external 6.2-V regulator diode must be connected in series with OUTPUT.

APPLICATION INFORMATION

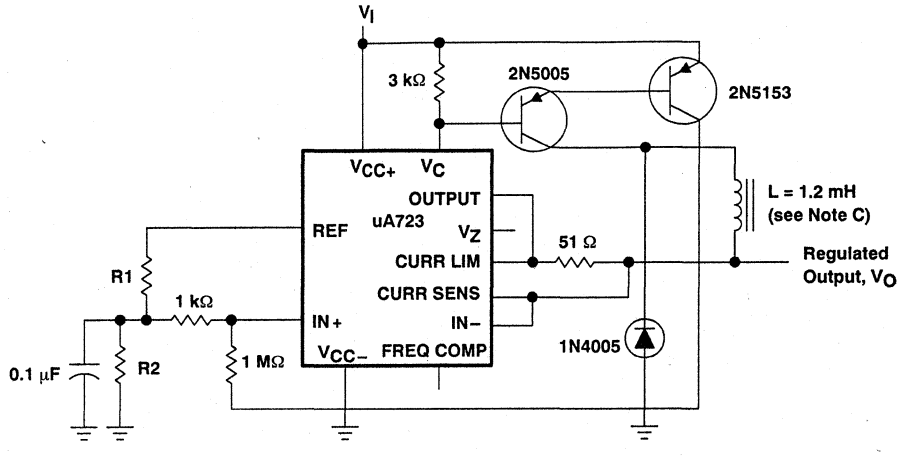


Figure 9. Positive Switching Regulator

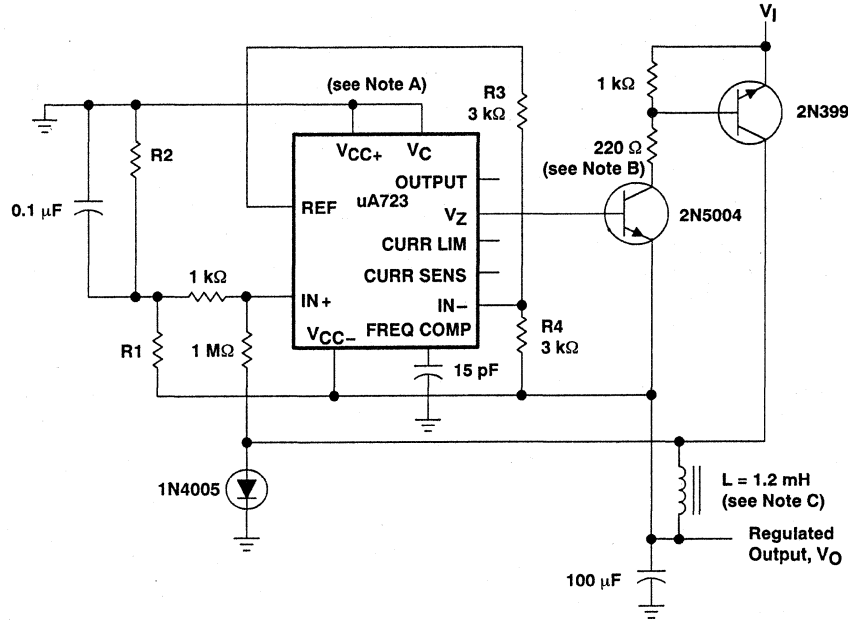
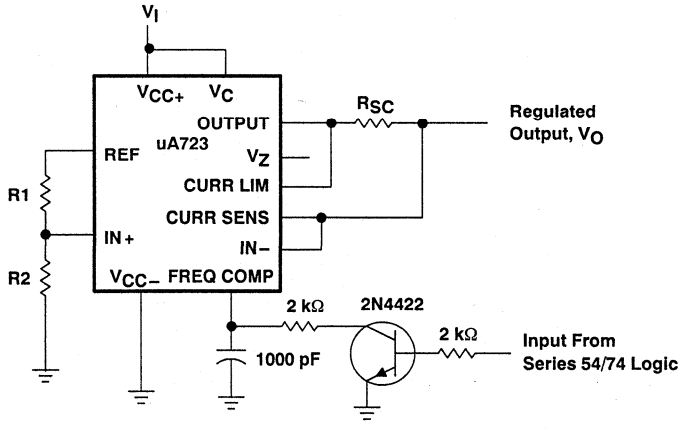


Figure 10. Negative Switching Regulator

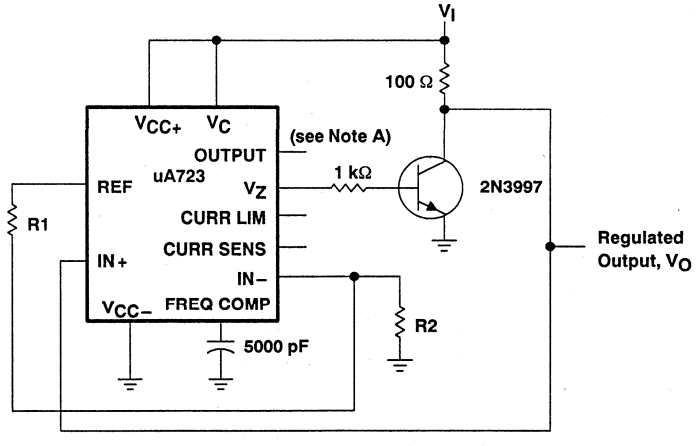
NOTES: A. The device requires a minimum of 9 V between V_{CC+} and V_{CC-} when V_O is equal to or more positive than −9 V.
B. When 10-lead uA723U devices are used in applications requiring V_Z, an external 6.2-V regulator diode must be connected in series with OUTPUT.
C. L is 40 turns of No. 20 enameled copper wire wound on Ferroxcube P36/22-3B7 potted core or equivalent, with a 0.009-inch air gap.

APPLICATION INFORMATION



NOTE A: A current-limit transistor may be used for shutdown if current limiting is not required.

Figure 11. Remote Shutdown Regulator With Current Limiting



NOTE A: When 10-lead uA723U devices are used in applications requiring V_Z, an external 6.2-V regulator diode must be connected in series with OUTPUT.

Figure 12. Shunt Regulator