



**MOTOROLA**

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# MC1723C

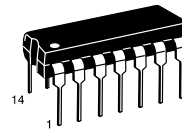
## Voltage Regulator

The MC1723C is a positive or negative voltage regulator designed to deliver load current to 150 mAdc. Output current capability can be increased to several amperes through use of one or more external pass transistors. MC1723C is specified for operation over the commercial temperature range (0° to +70°C).

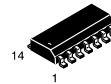
- Output Voltage Adjustable from 2.0 Vdc to 37 Vdc
- Output Current to 150 mAdc Without External Pass Transistors
- 0.01% Line and 0.03% Load Regulation
- Adjustable Short Circuit Protection

## VOLTAGE REGULATOR

### SEMICONDUCTOR TECHNICAL DATA



**P SUFFIX**  
PLASTIC PACKAGE  
CASE 646



**D SUFFIX**  
PLASTIC PACKAGE  
CASE 751A  
(SO-14)

Figure 1. Representative Schematic Diagram

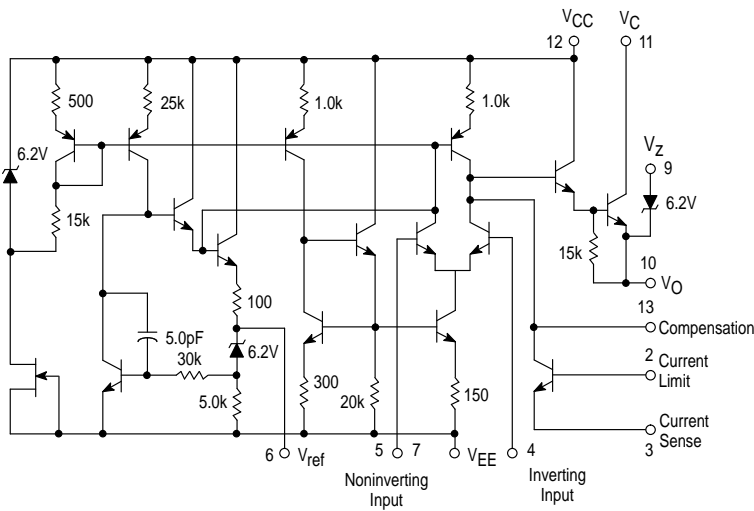
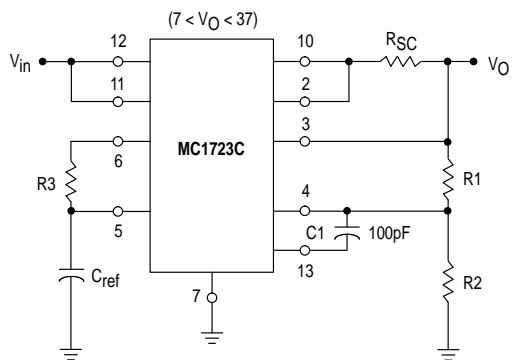


Figure 2. Typical Circuit Connection



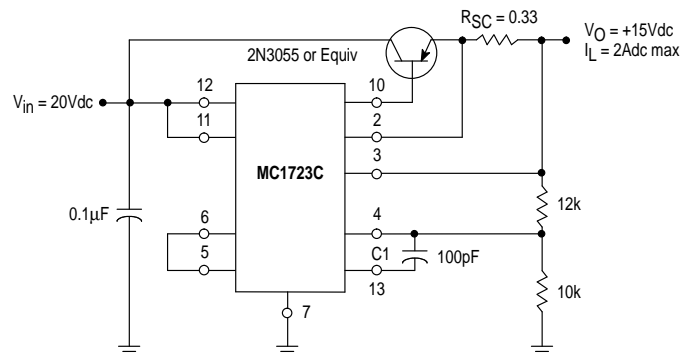
$$V_O \cong 7 \left( \frac{R_1 + R_2}{R_2} \right) \quad I_{SC} = \frac{V_{sense}}{R_{SC}} = \frac{0.66}{R_{SC}} \text{ at } T_J = +25^\circ\text{C}$$

For best results  $10 \text{ k} < R_2 < 100 \text{ k}$   
For minimum drift  $R_3 = R_1 \parallel R_2$

### ORDERING INFORMATION

Device	Alternate	Operating Temperature Range	Package
MC1723CD	—	$T_A = 0^\circ \text{ to } +70^\circ\text{C}$	SO-14
MC1723CP	LM723CN $\mu\text{A}723\text{PC}$		Plastic DIP

Figure 3. Typical NPN Current Boost Connection



## MC1723C

### MAXIMUM RATINGS (T<sub>A</sub> = +25°C, unless otherwise noted.)

Rating	Symbol	Value	Unit
Pulse Voltage from V <sub>CC</sub> to V <sub>EE</sub> (50 ms)	V <sub>I(p)</sub>	50	V <sub>pk</sub>
Continuous Voltage from V <sub>CC</sub> to V <sub>EE</sub>	V <sub>I</sub>	40	V <sub>dc</sub>
Input–Output Voltage Differential	V <sub>I</sub> –V <sub>O</sub>	40	V <sub>dc</sub>
Maximum Output Current	I <sub>L</sub>	150	mAdc
Current from V <sub>ref</sub>	I <sub>ref</sub>	15	mAdc
Current from V <sub>Z</sub>	I <sub>Z</sub>	25	mA
Voltage Between Noninverting Input and V <sub>EE</sub>	V <sub>ie</sub>	8.0	V <sub>dc</sub>
Differential Input Voltage	V <sub>id</sub>	±5.0	V <sub>dc</sub>
Power Dissipation and Thermal Characteristics T <sub>A</sub> = +25°C Derate above T <sub>A</sub> = +25°C Thermal Resistance, Junction–to–Air	P <sub>D</sub> 1/θ <sub>JA</sub> θ <sub>JA</sub>	1.25 10 100	W mW/°C °C/W
Operating and Storage Junction Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	–65 to +175	°C
Operating Ambient Temperature Range	T <sub>A</sub>	0 to +70	°C

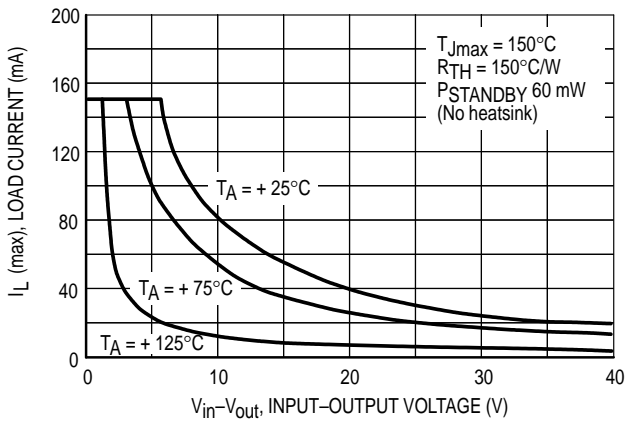
### ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = +25°C, V<sub>in</sub> 12 Vdc, V<sub>O</sub> = 5.0 Vdc, I<sub>L</sub> = 1.0 mAdc, R<sub>SC</sub> = 0, C<sub>1</sub> = 100 pF, C<sub>ref</sub> = 0 and divider impedance as seen by the error amplifier ≤ 10 kΩ connected as shown in Figure 2, unless otherwise noted.)

Characteristics	Symbol	Min	Typ	Max	Unit
Input Voltage Range	V <sub>I</sub>	9.5	–	40	V <sub>dc</sub>
Output Voltage Range	V <sub>O</sub>	2.0	–	37	V <sub>dc</sub>
Input–Output Voltage Differential	V <sub>I</sub> –V <sub>O</sub>	3.0	–	38	V <sub>dc</sub>
Reference Voltage	V <sub>ref</sub>	6.80	7.15	7.50	V <sub>dc</sub>
Standby Current Drain ( I <sub>L</sub> = 0, V <sub>in</sub> = 30 V)	I <sub>IB</sub>	–	2.3	4.0	mAdc
Output Noise Voltage (f = 100 Hz to 10 kHz) C <sub>ref</sub> = 0 C <sub>ref</sub> = 5.0 μF	V <sub>n</sub>	– –	20 2.5	– –	μV(RMS)
Average Temperature Coefficient of Output Voltage (T <sub>low</sub> < T <sub>A</sub> < T <sub>high</sub> )	TCV <sub>O</sub>	–	0.003	0.015	%/°C
Line Regulation (T <sub>A</sub> = 25°C) { 12 V < V <sub>in</sub> < 15 V 12 V < V <sub>in</sub> < 40 V (T <sub>low</sub> < T <sub>A</sub> < T <sub>high</sub> ) 12 V < V <sub>in</sub> < 15 V	Reg <sub>line</sub>	– – –	0.01 0.1 –	0.1 0.5 0.3	% V <sub>O</sub>
Load Regulation (1.0 mA < I <sub>L</sub> < 50 mA) T <sub>A</sub> = 25°C T <sub>low</sub> < T <sub>A</sub> < T <sub>high</sub>	Reg <sub>load</sub>	– –	0.03 –	0.2 0.6	% V <sub>O</sub>
Ripple Rejection (f = 50 Hz to 10 kHz) C <sub>ref</sub> = 0 C <sub>ref</sub> = 5.0 μF	RR	– –	74 86	– –	dB
Short Circuit Current Limit (R <sub>SC</sub> = 10 Ω, V <sub>O</sub> = 0)	I <sub>SC</sub>	–	65	–	mAdc
Long Term Stability	ΔV <sub>O</sub> /Δt	–	0.1	–	%/1000 Hr.

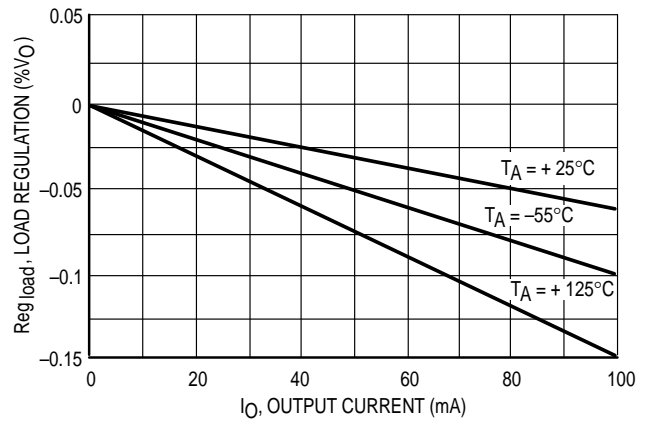
NOTE: T<sub>low</sub> to T<sub>high</sub> = 0° to +70°C

# MC1723C

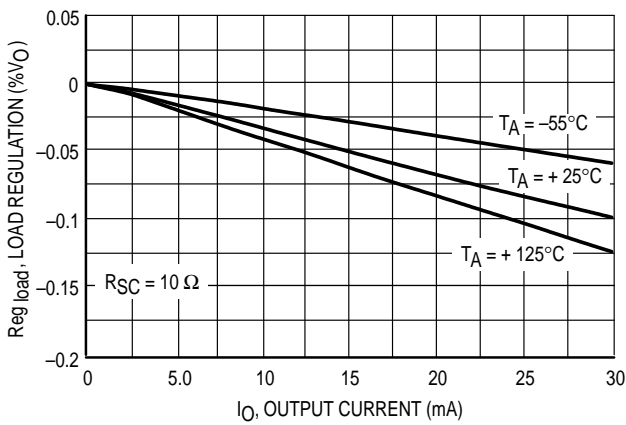
**Figure 4. Maximum Load Current as a Function of Input–Output Voltage Differential**



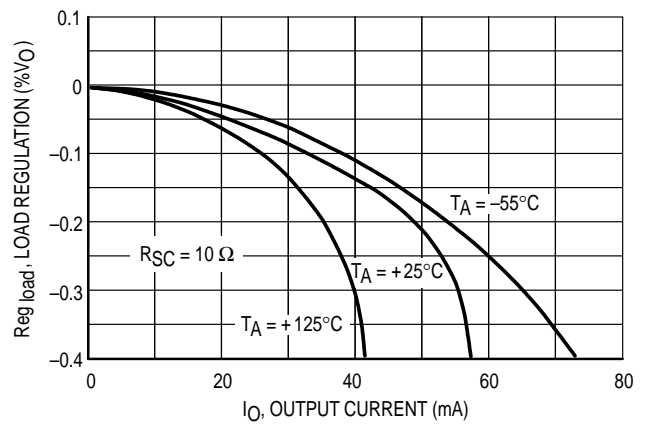
**Figure 5. Load Regulation Characteristics Without Current Limiting**



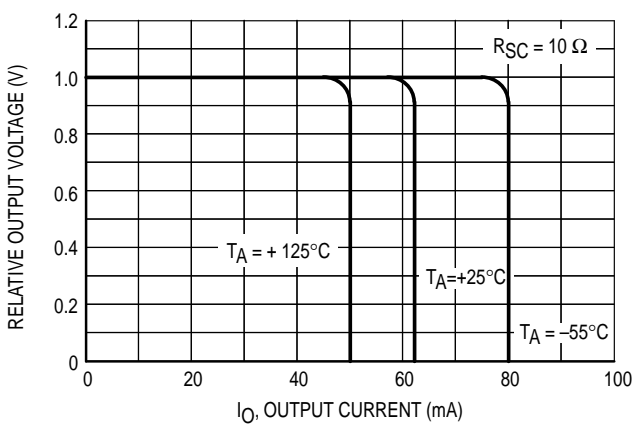
**Figure 6. Load Regulation Characteristics With Current Limiting**



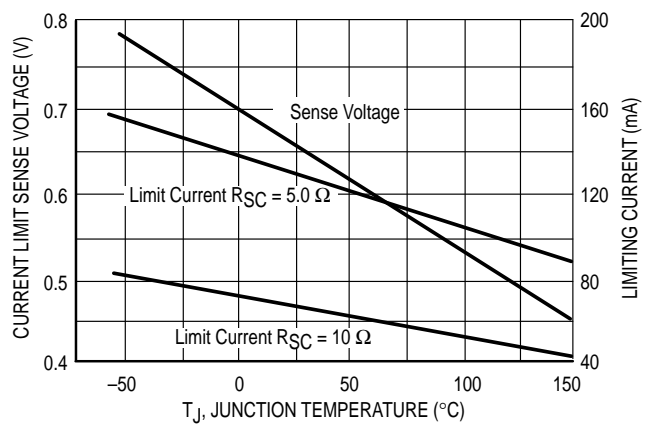
**Figure 7. Load Regulation Characteristics With Current Limiting**



**Figure 8. Current Limiting Characteristics**

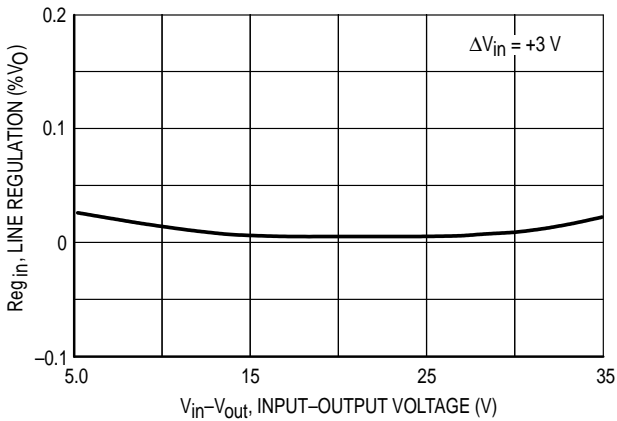


**Figure 9. Current Limiting Characteristics as a Function of Junction Temperature**

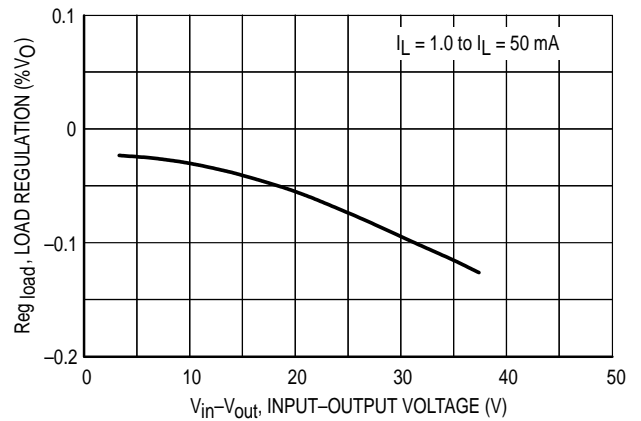


# MC1723C

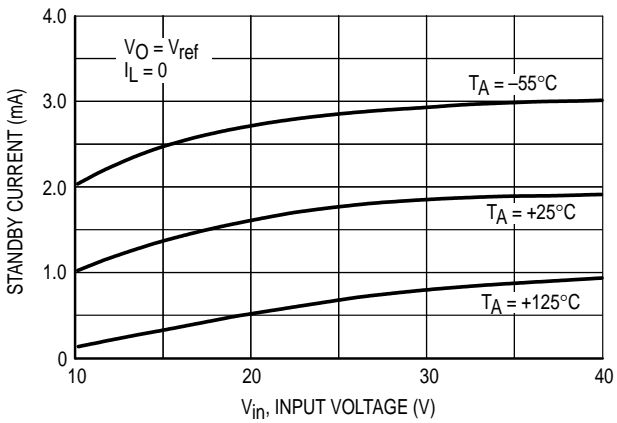
**Figure 10. Line Regulation as a Function of Input-Output Voltage Differential**



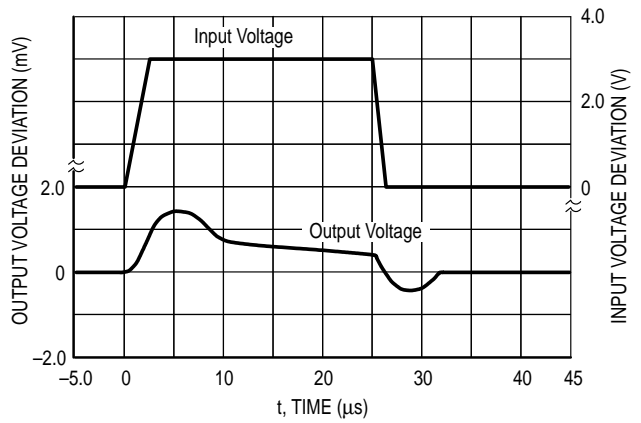
**Figure 11. Load Regulation as a Function of Input-Output Voltage Differential**



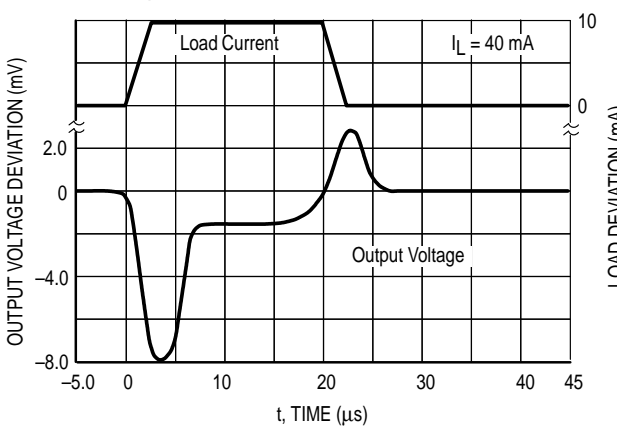
**Figure 12. Standby Current Drain as a Function of Input Voltage**



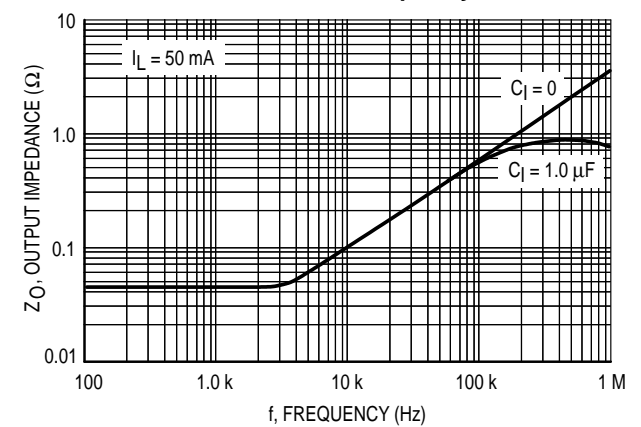
**Figure 13. Line Transient Response**



**Figure 14. Load Transient Response**

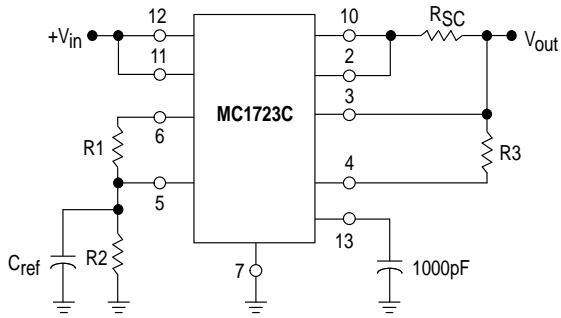


**Figure 15. Output Impedance as Function of Frequency**



# MC1723C

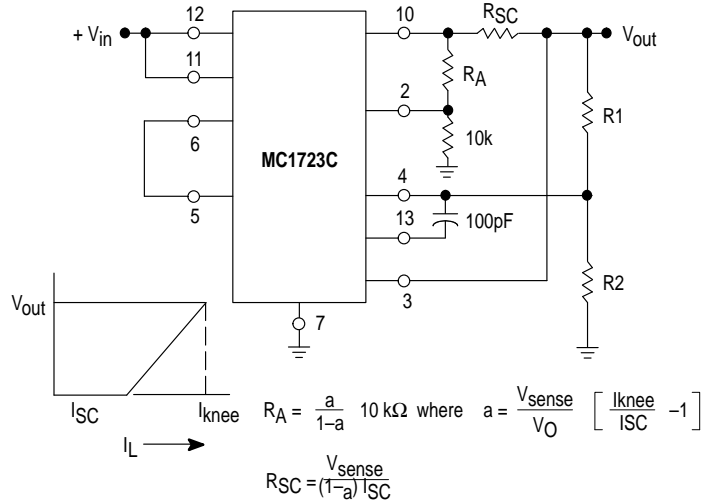
**Figure 16. Typical Connection for  $2 < V_O < 7$**



$$V_O \cong 7 \left[ \frac{R_2}{R_1 + R_2} \right] \quad I_{SC} = \frac{V_{sense}}{R_{SC}} \cong \frac{0.66}{R_{SC}} \text{ at } T_J = +25^\circ\text{C}$$

For best results  $10 \text{ k} < R_1 + R_2 < 100 \text{ k}$   
For minimum drift  $R_3 = R_1 R_2$

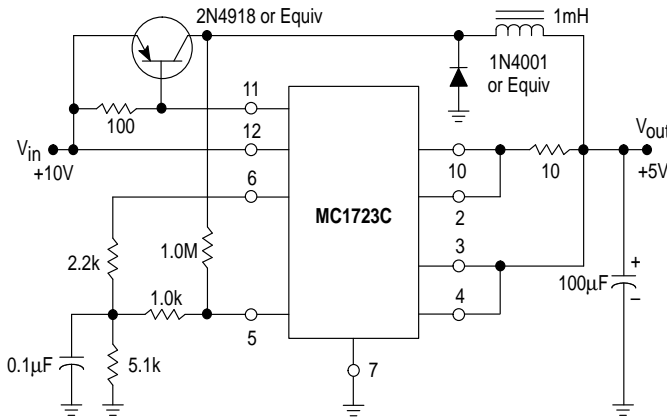
**Figure 17. Foldback Connection**



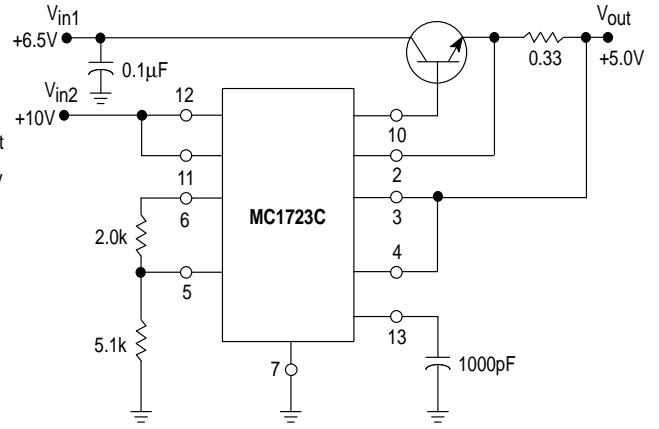
$$R_A = \frac{a}{1-a} 10 \text{ k}\Omega \text{ where } a = \frac{V_{sense}}{V_O} \left[ \frac{I_{knee}}{I_{SC}} - 1 \right]$$

$$R_{SC} = \frac{V_{sense}}{(1-a) I_{SC}}$$

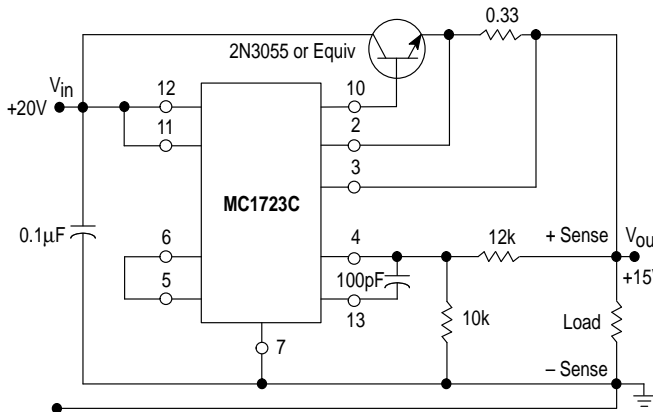
**Figure 18. +5.0 V, 1.0 A Switching Regulator**



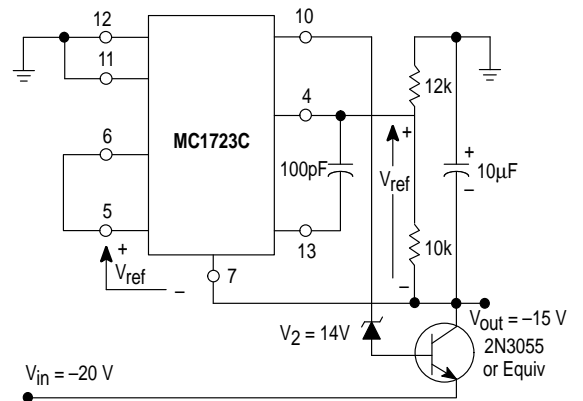
**Figure 19. +5.0 V, 1.0 A High Efficiency Regulator**



**Figure 20. +15 V, 1.0 A Regulator with Remote Sense**

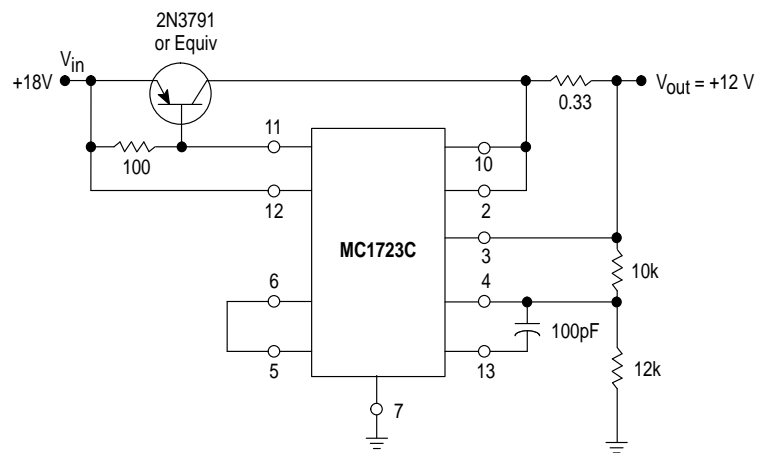


**Figure 21. -15 V Negative Regulator**



## MC1723C

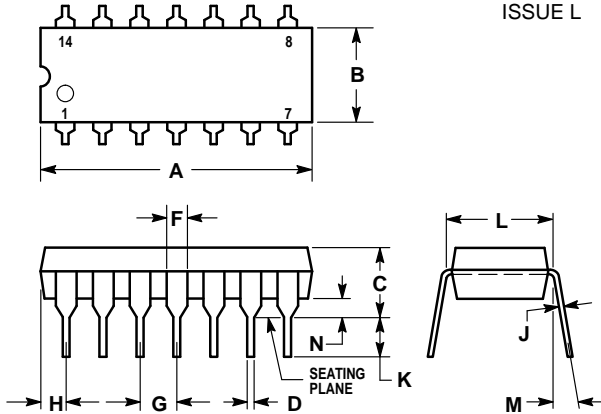
**Figure 22. +12V, 1.0 A Regulator**  
(Using PNP Current Boost)



# MC1723C

## OUTLINE DIMENSIONS

### P SUFFIX PLASTIC PACKAGE CASE 646-06 ISSUE L

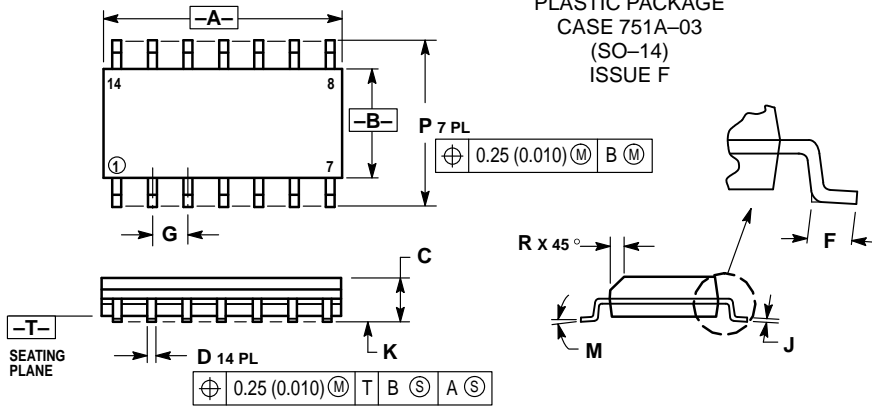


**NOTES:**

1. LEADS WITHIN 0.13 (0.005) RADIUS OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
2. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
3. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
4. ROUNDED CORNERS OPTIONAL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.715	0.770	18.16	19.56
B	0.240	0.260	6.10	6.60
C	0.145	0.185	3.69	4.69
D	0.015	0.021	0.38	0.53
F	0.040	0.070	1.02	1.78
G	0.100 BSC		2.54 BSC	
H	0.052	0.095	1.32	2.41
J	0.008	0.015	0.20	0.38
K	0.115	0.135	2.92	3.43
L	0.300 BSC		7.62 BSC	
M	0°	10°	0°	10°
N	0.015	0.039	0.39	1.01

### D SUFFIX PLASTIC PACKAGE CASE 751A-03 (SO-14) ISSUE F




**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	8.55	8.75	0.337	0.344
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.228	0.244
R	0.25	0.50	0.010	0.019

# MC1723C

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MC1723C/D

