MOTOROLA

MC1723C

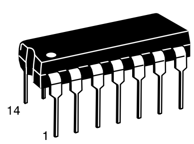
Voltage Regulator

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).

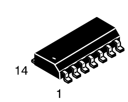
- Output Voltage Adjustable from 2.0 Vdc to 37 Vdc
- Output Current to 150 mAdc Without External Pass Transistors
- 0.01% Line and 0.03% Load Regulation
- Adjustable Short Circuit Protection

VOLTAGE REGULATOR

SEMICONDUCTOR TECHNICAL DATA

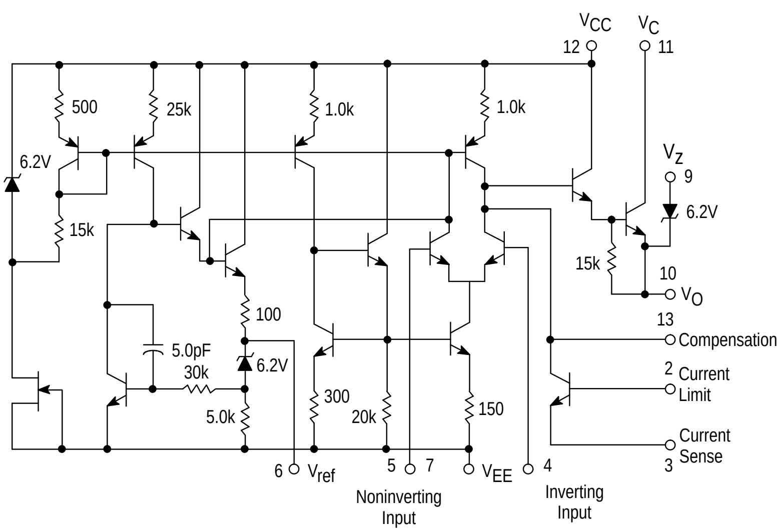


P SUFFIX
PLASTIC PACKAGE
CASE 646



D SUFFIX
PLASTIC PACKAGE
CASE 751A
(SO–14)

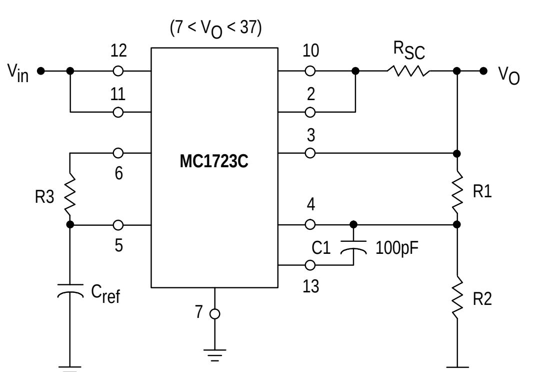
Figure 1. Representative Schematic Diagram



ORDERING INFORMATION

Device	Alternate	Operating Temperature Range	Package
MC1723CD	–	T_A = 0° to +70°C	SO–14
MC1723CP	LM723CN µA723PC		Plastic DIP

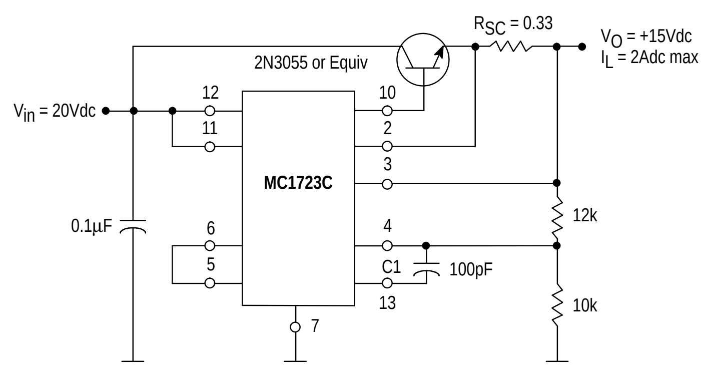
Figure 2. Typical Circuit Connection



$V_O \cong 7 \left(\frac{R1 + R2}{R2}\right)$ $I_{SC} = \frac{V_{sense}}{R_{SC}} = \frac{0.66}{R_{SC}}$ at T_J = + 25°C

For best results 10 k < R2 < 100 k
For minimum drift R3 = R1 | | R2

Figure 3. Typical NPN Current Boost Connection



MAXIMUM RATINGS (T_A = +25°C, unless otherwise noted.)

Rating	Symbol	Value	Unit
Pulse Voltage from V_{CC} to V_{EE} (50 ms)	$V_{I(p)}$	50	V_{pk}
Continuous Voltage from V_{CC} to V_{EE}	V_I	40	Vdc
Input–Output Voltage Differential	$V_I–V_O$	40	Vdc
Maximum Output Current	I_L	150	mAdc
Current from V_{ref}	I_{ref}	15	mAdc
Current from V_z	I_z	25	mA
Voltage Between Noninverting Input and V_{EE}	V_{ie}	8.0	Vdc
Differential Input Voltage	V_{id}	±5.0	Vdc
Power Dissipation and Thermal Characteristics T_A = +25°C Derate above T_A = +25°C Thermal Resistance, Junction–to–Air	 P_D $1/\theta_{JA}$ θ_{JA}	 1.25 10 100	 W mW/°C °C/W
Operating and Storage Junction Temperature Range	T_J, T_{stg}	–65 to +175	°C
Operating Ambient Temperature Range	T_A	0 to +70	°C

ELECTRICAL CHARACTERISTICS (T_A = +25°C, V_{in} 12 Vdc, V_O = 5.0 Vdc, I_L = 1.0 mAdc, R_{SC} = 0, C1 = 100 pF, C_{ref} = 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_I	9.5	–	40	Vdc
Output Voltage Range	V_O	2.0	–	37	Vdc
Input–Output Voltage Differential	$V_I–V_O$	3.0	–	38	Vdc
Reference Voltage	V_{ref}	6.80	7.15	7.50	Vdc
Standby Current Drain (I_L = 0, V_{in} = 30 V)	I_{IB}	–	2.3	4.0	mAdc
Output Noise Voltage (f = 100 Hz to 10 kHz) C_{ref} = 0 C_{ref} = 5.0 µF	V_n	 – –	 20 2.5	 – –	µV(RMS)
Average Temperature Coefficient of Output Voltage (T_{low} < T_A < T_{high})	TCV_O	–	0.003	0.015	%/°C
Line Regulation (T_A = 25°C) 12 V < V_{in} < 15 V (T_A = 25°C) 12 V < V_{in} < 40 V (T_{low} < T_A < T_{high}) 12 V < V_{in} < 15 V	Reg_{line}	 – – –	 0.01 0.1 –	 0.1 0.5 0.3	% V_O
Load Regulation (1.0 mA < I_L < 50 mA) T_A = 25°C T_{low} < T_A < T_{high}	Reg_{load}	 – –	 0.03 –	 0.2 0.6	% V_O
Ripple Rejection (f = 50 Hz to 10 kHz) C_{ref} = 0 C_{ref} = 5.0 µF	RR	 – –	 74 86	 – –	dB
Short Circuit Current Limit (R_{SC} = 10 Ω, V_O = 0)	I_{SC}	–	65	–	mAdc
Long Term Stability	^V_O/^t	–	0.1	–	%/1000 Hr.

NOTE: T_{low} to T_{high} = 0° to +70°C

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

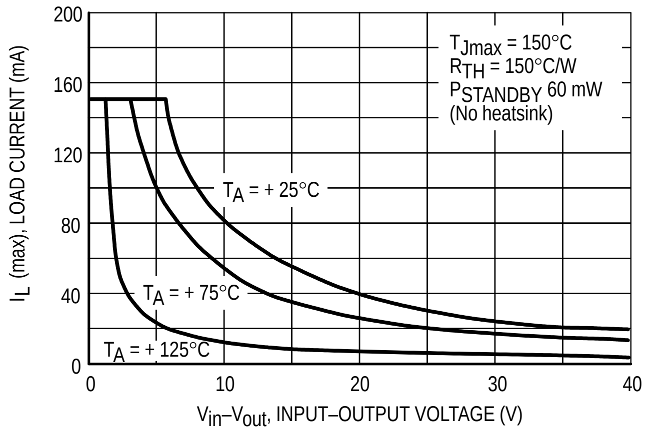


Figure 5. Load Regulation Characteristics Without Current Limiting

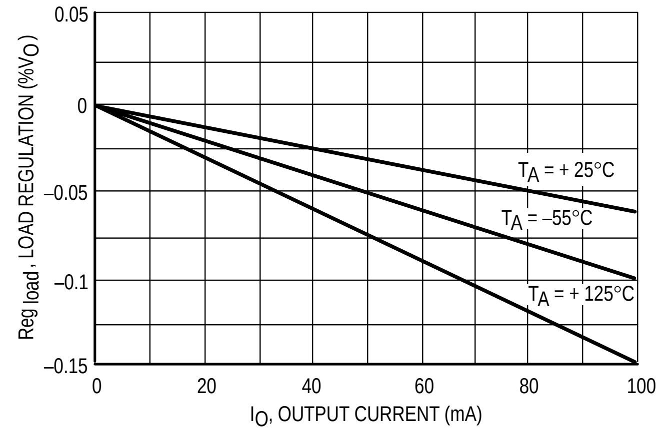


Figure 6. Load Regulation Characteristics With Current Limiting

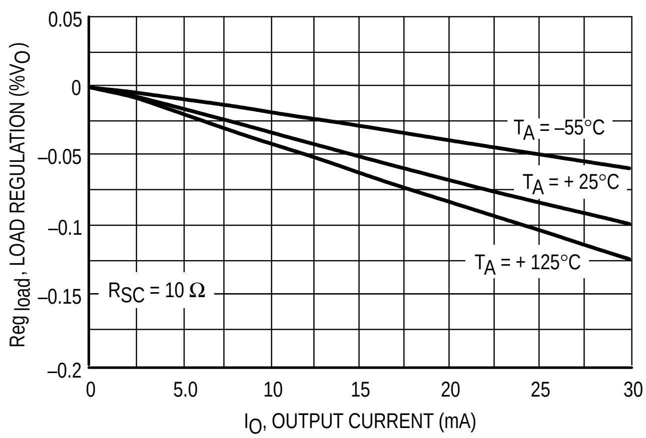


Figure 7. Load Regulation Characteristics With Current Limiting

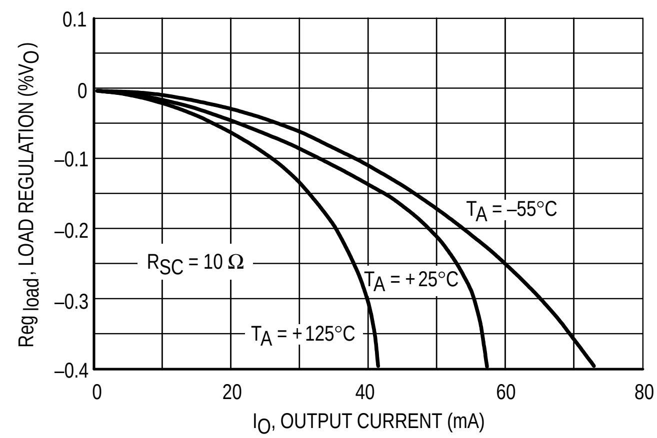


Figure 8. Current Limiting Characteristics

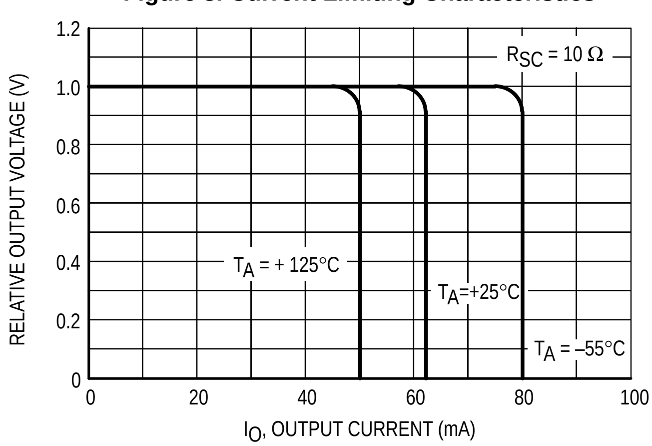


Figure 9. Current Limiting Characteristics as a Function of Junction Temperature

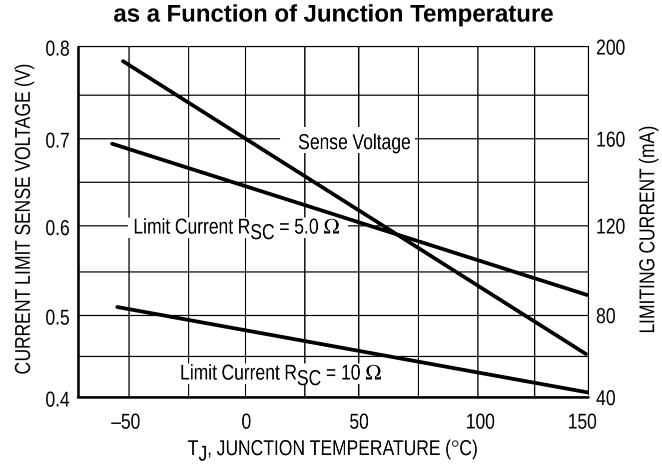


Figure 10. Line Regulation as a Function of Input–Output Voltage Differential

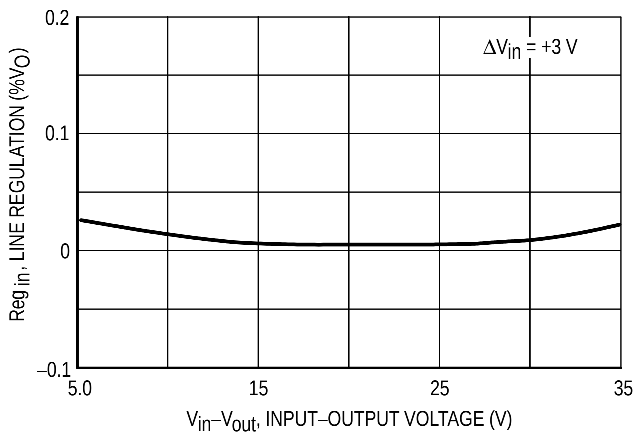


Figure 11. Load Regulation as a Function of Input–Output Voltage Differential

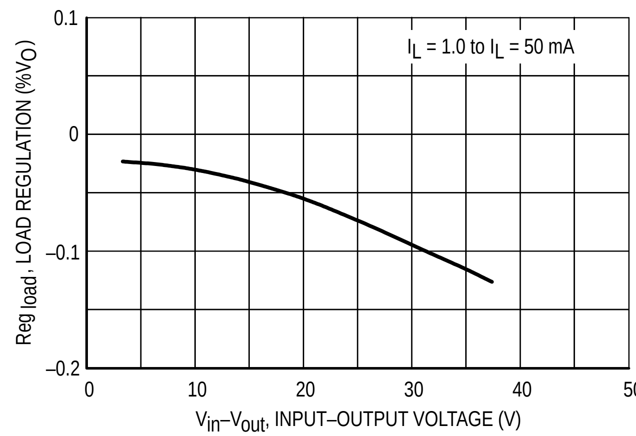


Figure 12. Standby Current Drain as a Function of Input Voltage

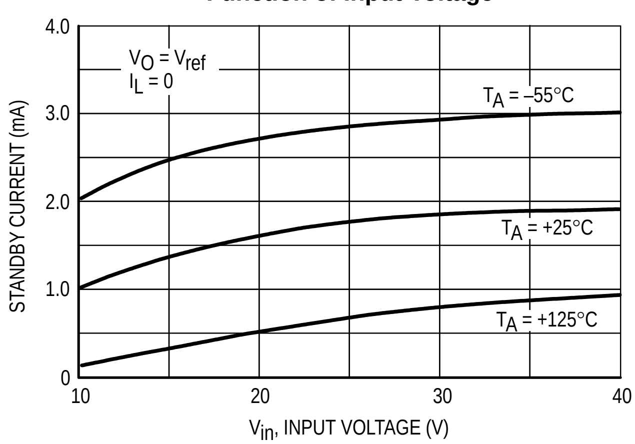


Figure 13. Line Transient Response

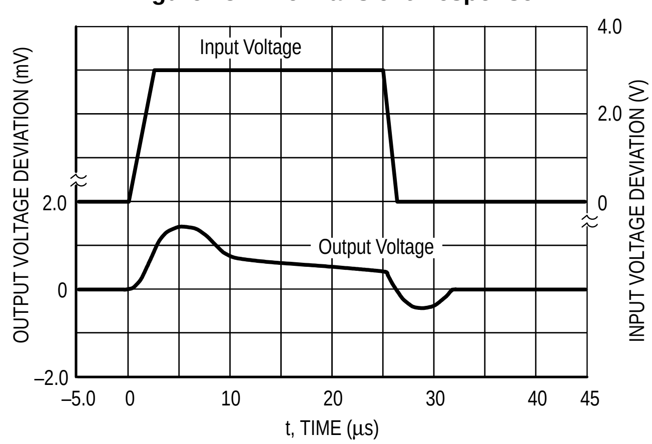


Figure 14. Load Transient Response

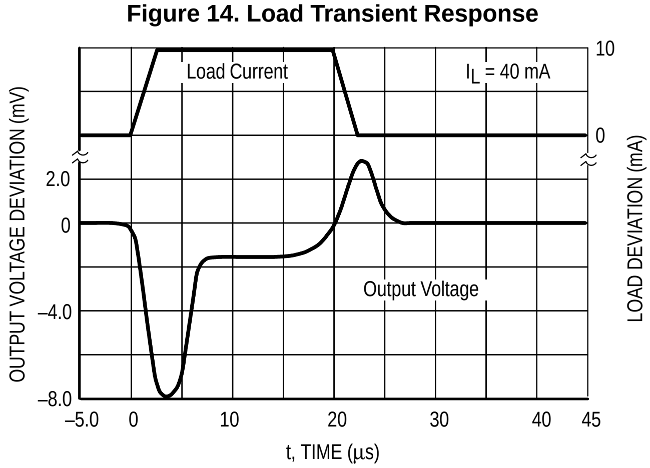


Figure 15. Output Impedance as Function of Frequency

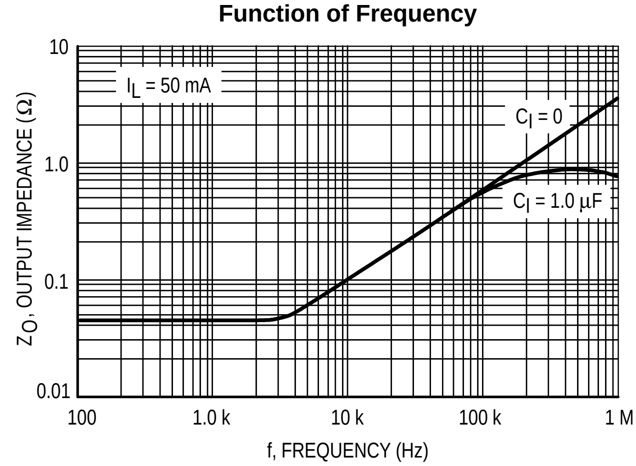
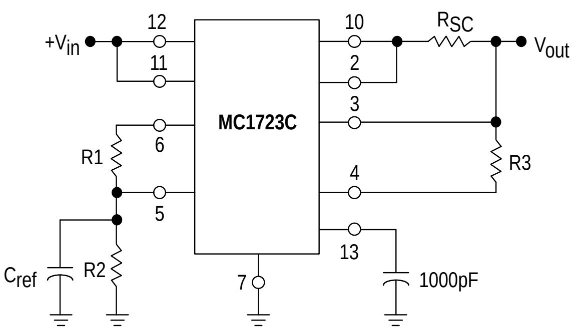


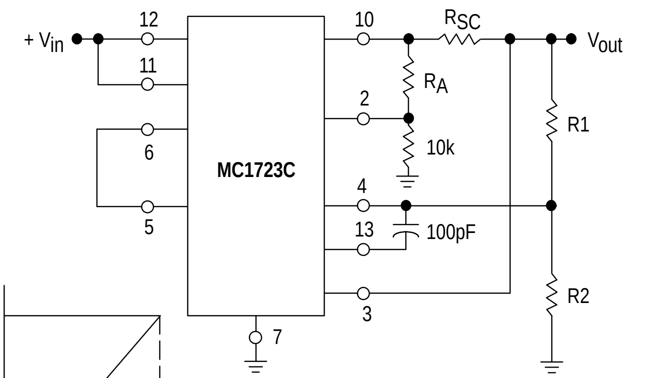
Figure 16. Typical Connection for $2 < V_O < 7$

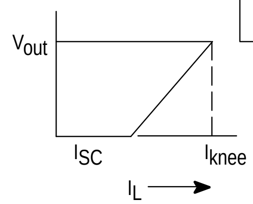


$V_O \cong 7\left[\frac{R2}{R1 + R2}\right]$ $\quad I_{SC} = \frac{V_{sense}}{R_{SC}} \cong \frac{0.66}{RSC}$ at $T_J = +25°C$

For best results 10 k < R1 +R2 < 100 k
For minimum drift R3 = R1 R2

Figure 17. Foldback Connection





$R_A = \frac{a}{1-a}$ 10 kΩ 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

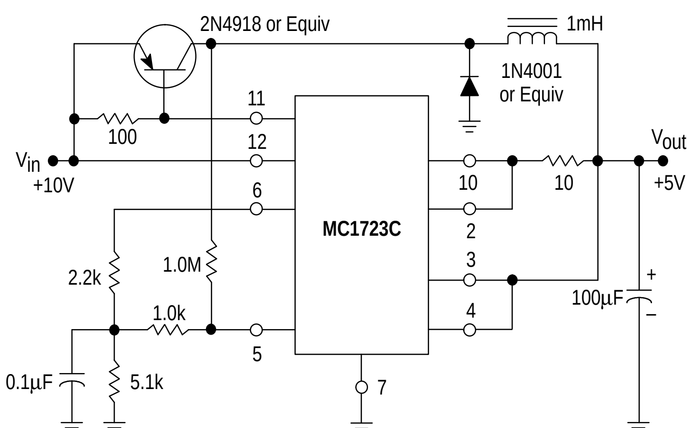


Figure 19. +5.0 V, 1.0 A High Efficiency Regulator

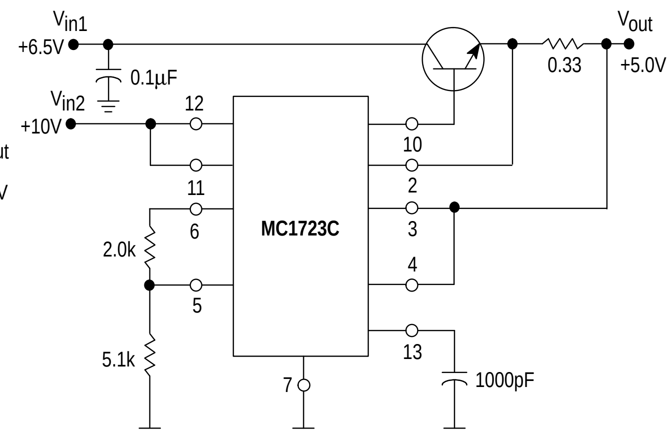


Figure 20. +15 V, 1.0 A Regulator with Remote Sense

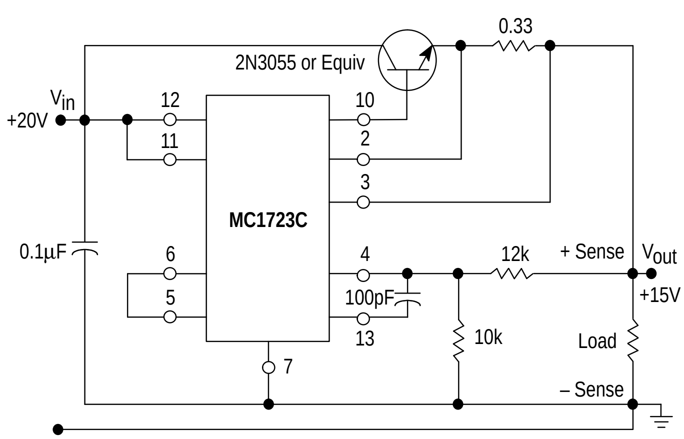


Figure 21. –15 V Negative Regulator

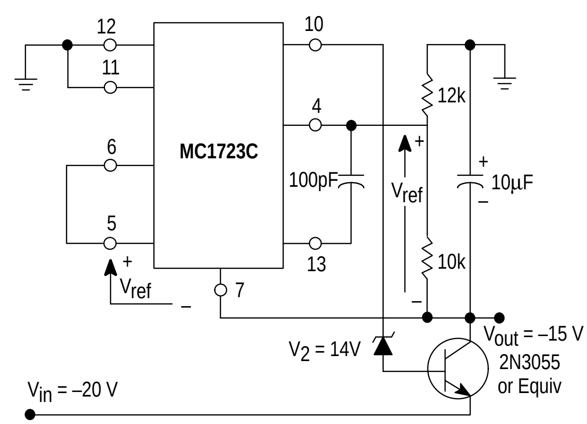
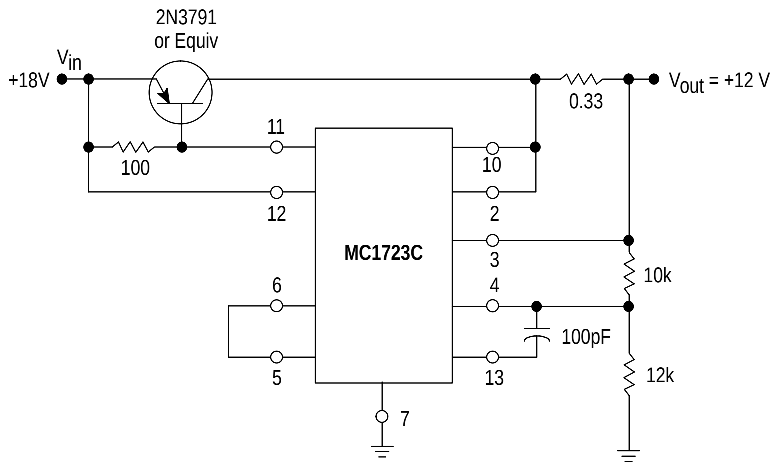
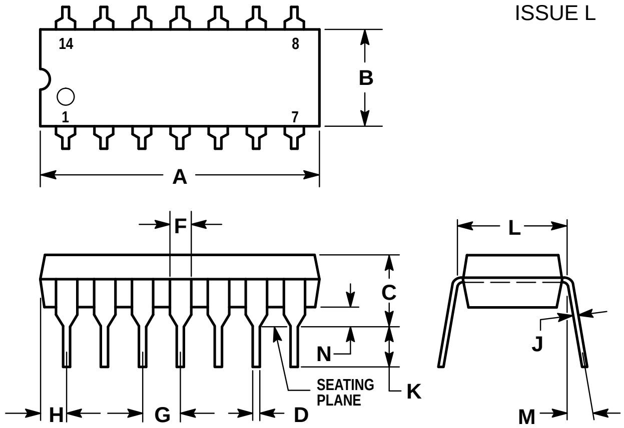


Figure 22. +12V, 1.0 A Regulator
(Using PNP Current Boost)



OUTLINE DIMENSIONS

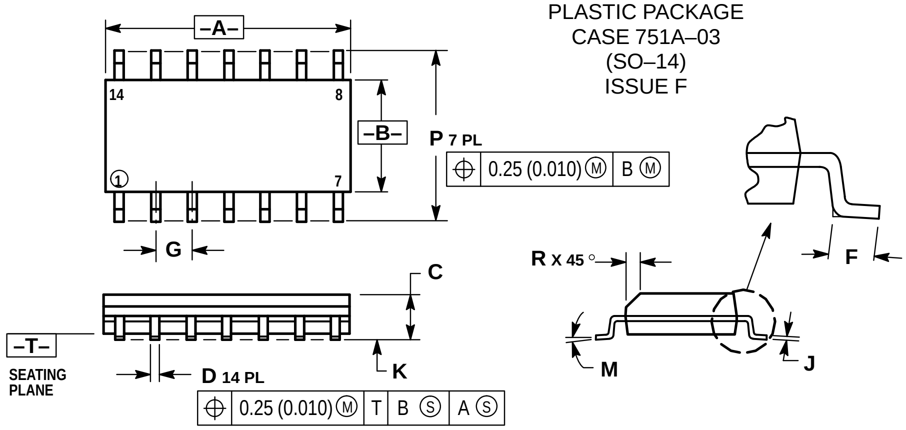
P SUFFIX
PLASTIC PACKAGE
CASE 646–06
ISSUE L



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.

	INCHES		MILLIMETERS	
DIM	**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.

	MILLIMETERS		INCHES	
DIM	**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

How to reach us:
USA / EUROPE / Locations Not Listed: Motorola Literature Distribution;
P.O. Box 5405, Denver, Colorado 80217. 1–303–675–2140 or 1–800–441–2447

JAPAN: Motorola Japan Ltd.; SPD, Strategic Planning Office, 141,
4–32–1 Nishi–Gotanda, Shinagawa–ku, Tokyo, Japan. 81–3–5487–8488

Customer Focus Center: 1–800–521–6274

Mfax™: RMFAX0@email.sps.mot.com – TOUCHTONE 1–602–244–6609
Motorola Fax Back System – US & Canada ONLY 1–800–774–1848
– http://sps.motorola.com/mfax/

ASIA / PACIFIC: Motorola Semiconductors H.K. Ltd.; Silicon Harbour Centre,
2, Dai King Street, Tai Po Industrial Estate, Tai Po, N.T., Hong Kong.
852–26629298

HOME PAGE: http://motorola.com/sps/

MOTOROLA