



Voltage Regulator

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The MC1723C is a positive or negative voltage regulator designed to deliver load current to 150 mA dc. 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 mA dc Without External Pass Transistors
- 0.01% Line and 0.03% Load Regulation
- Adjustable Short Circuit Protection

Figure 1. Representative Schematic Diagram

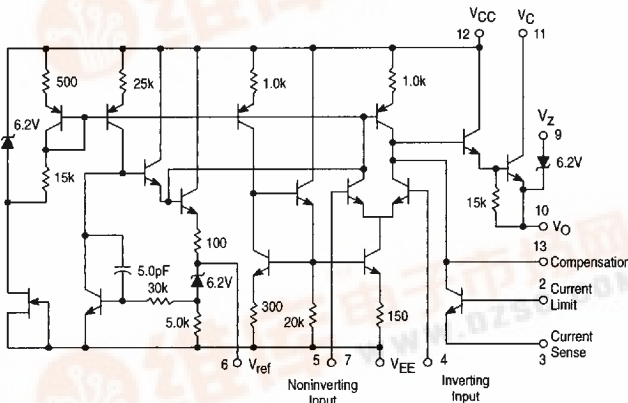
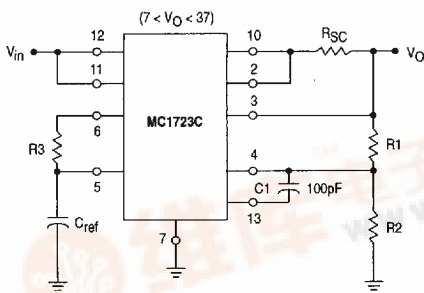


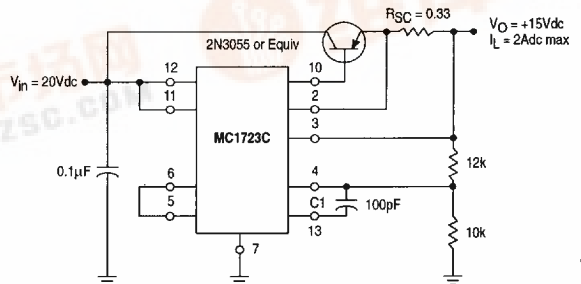
Figure 2. Typical Circuit Connection



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

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

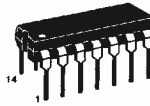
Figure 3. Typical NPN Current Boost Connection



MC1723C

VOLTAGE REGULATOR

SEMICONDUCTOR TECHNICAL DATA



P SUFFIX
PLASTIC PACKAGE
CASE 646



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

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



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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	V _{dc}
Input–Output Voltage Differential	V _{I–V_O}	40	V _{dc}
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	V _{dc}
Differential Input Voltage	V _{id}	±5.0	V _{dc}
Power Dissipation and Thermal Characteristics T _A = +25°C Derate above T _A = +25°C Thermal Resistance, Junction–to–Air	P _D 1/θ _{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	V _{dc}
Output Voltage Range	V _O	2.0	–	37	V _{dc}
Input–Output Voltage Differential	V _{I–V_O}	3.0	–	38	V _{dc}
Reference Voltage	V _{ref}	6.80	7.15	7.50	V _{dc}
Standby Current Drain (I _L = 0, V _{in} = 30 V)	I _B	–	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 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	ΔV _O /Δt	–	0.1	–	%/1000 Hr.

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

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

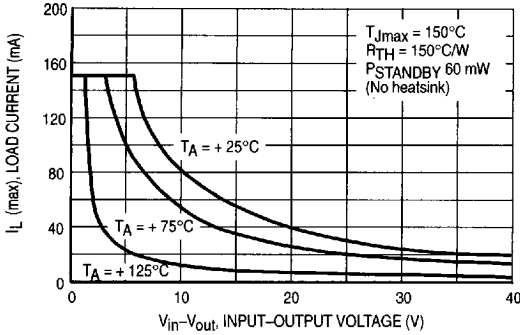


Figure 5. Load Regulation Characteristics Without Current Limiting

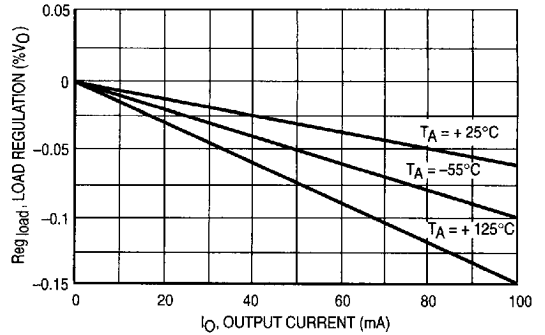


Figure 6. Load Regulation Characteristics With Current Limiting

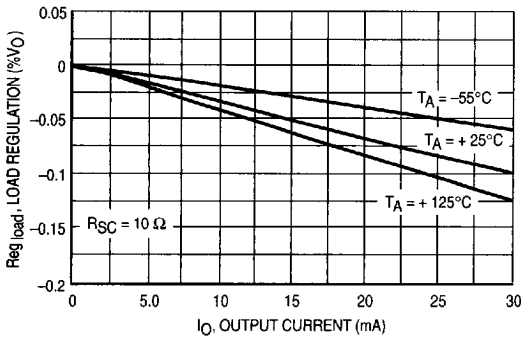


Figure 7. Load Regulation Characteristics With Current Limiting

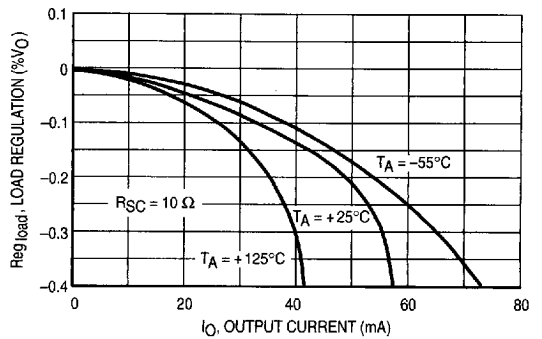


Figure 8. Current Limiting Characteristics

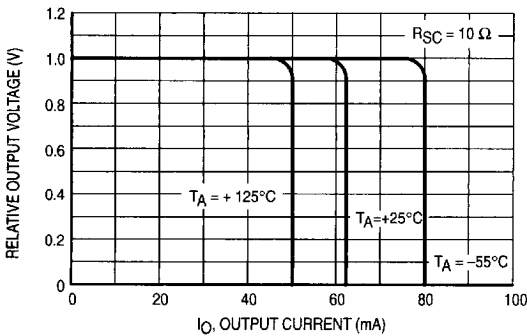
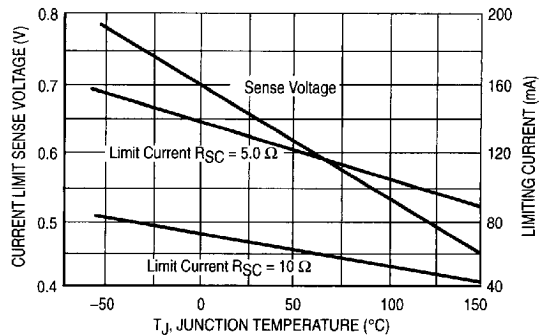


Figure 9. Current Limiting Characteristics as a Function of Junction Temperature



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

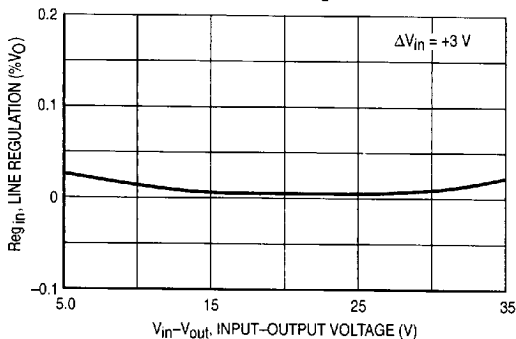


Figure 11. Load Regulation as a Function of Input-Output Voltage Differential

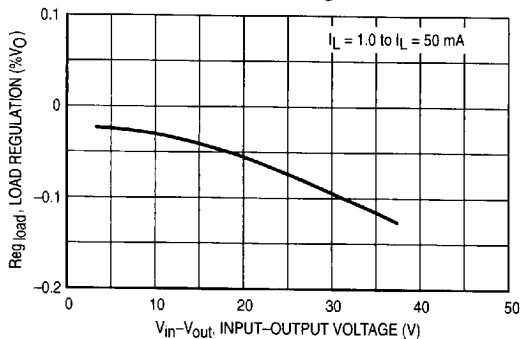


Figure 12. Standby Current Drain as a Function of Input Voltage

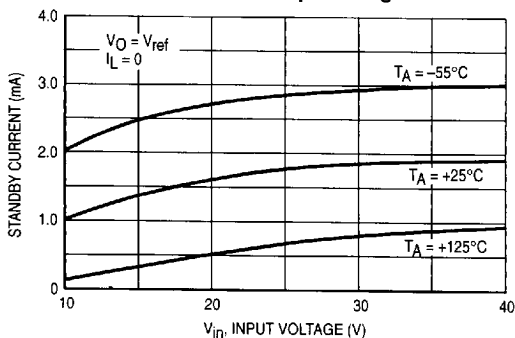


Figure 13. Line Transient Response

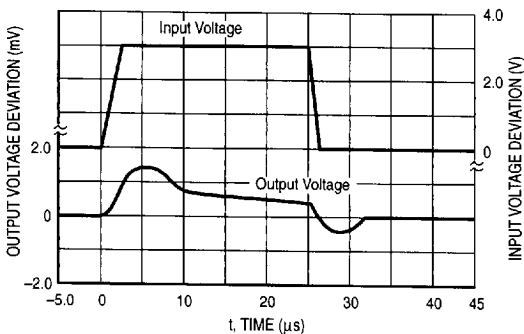


Figure 14. Load Transient Response

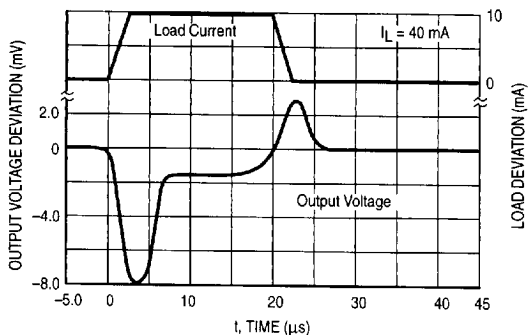
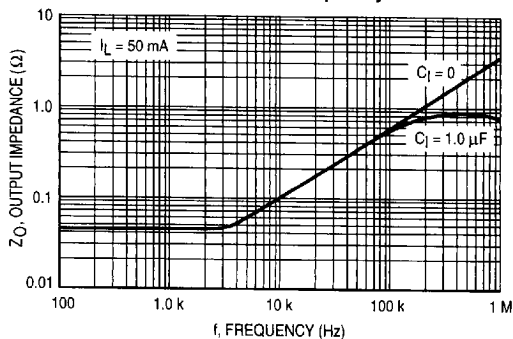
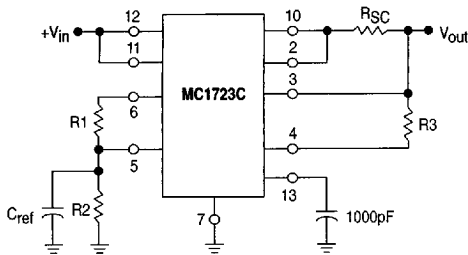


Figure 15. Output Impedance as a Function of Frequency



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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

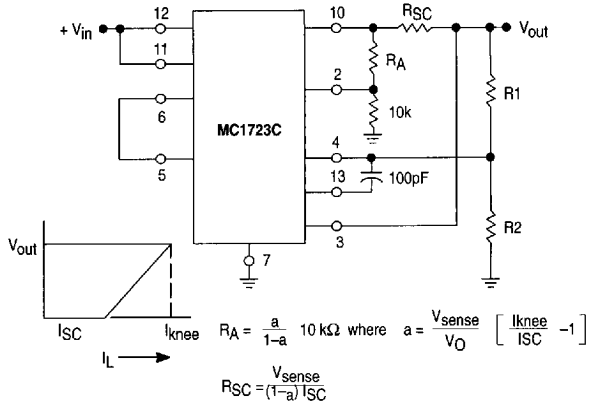


Figure 18. +5.0 V, 1.0 A Switching Regulator

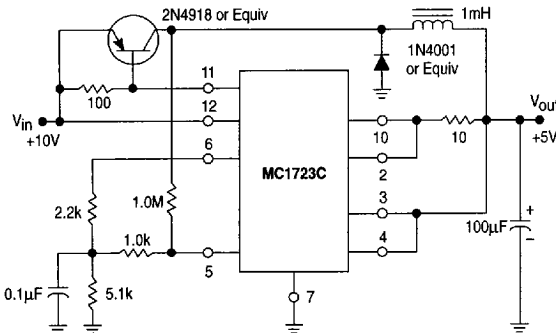


Figure 19. +5.0 V, 1.0 A High Efficiency Regulator

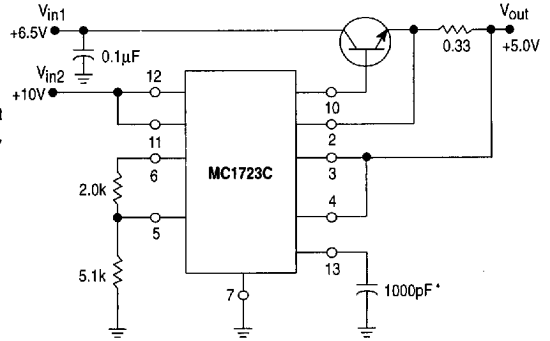


Figure 20. +15 V, 1.0 A Regulator with Remote Sense

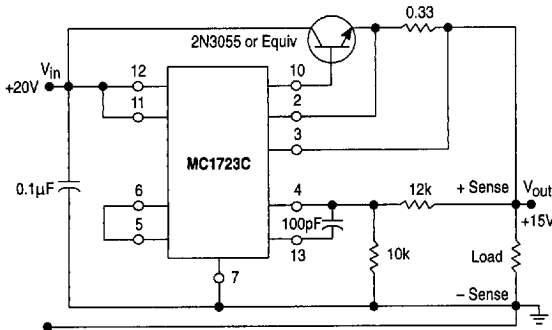
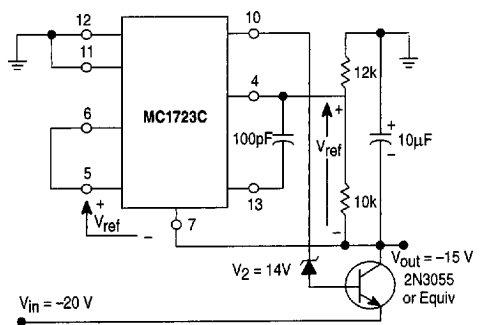


Figure 21. -15 V Negative Regulator



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

