

Three-Terminal Low Current Negative Voltage Regulators

The MC79L00, A Series negative voltage regulators are inexpensive, easy–to–use devices suitable for numerous applications requiring up to100 mA. Like the higher powered MC7900 Series negative regulators, this series features thermal shutdown and current limiting, making them remarkably rugged. In most applications, no external components are required for operation.

The MC79L00 devices are useful for on–card regulation or any other application where a regulated negative voltage at a modest current level is needed. These regulators offer substantial advantage over the common resistor/zener diode approach.

- No External Components Required
- Internal Short Circuit Current Limiting
- Internal Thermal Overload Protection
- Low Cost
- Complementary Positive Regulators Offered (MC78L00 Series)
- Available in Either ±5% (AC) or ±10% (C) Selections

Representative Schematic Diagram Gnd R8 R6₹ Q10 5 R9 R17 § **R18** ≸ R1 R7 Q8 Q14 Q9 R16 R4 \$ Output Q12 R2 § Q13 **★** Z1 С Q2 Q11 R3 Q6, R10 R11 R14 R15 Input

* Automotive temperature range selections are available with special test conditions and additional tests in 5, 12 and 15 V devices. Contact your local Motorola sales office for information.

MC79L00, A Series

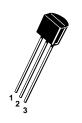
THREE-TERMINAL LOW CURRENT NEGATIVE FIXED VOLTAGE REGULATORS

SEMICONDUCTOR TECHNICAL DATA

P SUFFIX PLASTIC PACKAGE CASE 29

Pin 1. Ground 2. Input

3. Output





D SUFFIXPLASTIC PACKAGE CASE 751

(SOP-8)*

1. V_{Out} 5. GND 2. V_{in} 6. V_{in} 3. V_{in} 7. V_{in} 4. NC 8. NC

* SOP-8 is an internally modified SO-8 package. Pins 2, 3, 6, and 7 are electrically common to the die attach flag. This internal lead frame modification decreases package thermal resistance and increases power dissipation capability when appropriately mounted on a printed circuit board. SOP-8 conforms to all external dimensions of the standard SO-8 package.

Device No. ±10%	Device No. 5%	Nominal Voltage
MC79L05C	MC79L05AC	-5.0
MC79L12C	MC79L12AC	-12
MC79L15C	MC79L15AC	– 15
MC79L18C	MC79L18AC	-18
MC79L24C	MC79L24AC	-24

ORDERING INFORMATION

Device	Operating Temperature Range	Package
MC79LXXACD*		SOP-8
MC79LXXACP	T _J = 0° to +125°C	Plastic Power
MC79LXXCP		Plastic Power
MC79LXXABD*	T _{.1} = -40° to +125°C	SOP-8
MC79LXXABP*	1J = -+0 10 +123 C	Plastic Power

XX indicates nominal voltage

MC79L00, A Series

MAXIMUM RATINGS ($T_A = +25^{\circ}C$, unless otherwise noted.)

Rating	Symbol	Value	Unit
Input Voltage (-5 V) (-12, -15, -18 V) (-24 V)	VI	-30 -35 -40	Vdc
Storage Temperature Range	T _{stg}	-65 to +150	°C
Junction Temperature	TJ	+150	°C

ELECTRICAL CHARACTERISTICS (V_I = -10 V, I_O = 40 mA, C_I = 0.33 μ F, C_O = 0.1 μ F, -40°C < T_J +125°C (for MC79LXXAB), 0°C < T_J < +125°C (for MC79LXXAC)).

		MC79L05C, AB		MC79L05AC, AB				
Characteristics	Symbol	Min	Тур	Max	Min	Тур	Max	Unit
Output Voltage (T _J = +25°C)	Vo	-4.6	-5.0	-5.4	-4.8	-5.0	-5.2	Vdc
Input Regulation (T _J = +25°C)	Regline							mV
$-7.0 \text{ Vdc} \ge \text{V}_1 \ge -20 \text{ Vdc}$ -8.0 Vdc ≥ V ₁ ≥ -20 Vdc		_ _	_ _	200 150	_ _	_ _	150 100	
Load Regulation $T_J = +25^{\circ}C, 1.0 \text{ mA} \le I_O \le 100 \text{ mA}$ $1.0 \text{ mA} \le I_O \le 40 \text{ mA}$	Reg _{load}	_ _	_ _	60 30	_ _	_ _	60 30	mV
Output Voltage -7.0 Vdc \geq V _I \geq -20 Vdc, 1.0 mA \leq I _O \leq 40 mA V _I = -10 Vdc, 1.0 mA \leq I _O \leq 70 mA	VO	-4.5 -4.5	_ _	-5.5 -5.5	-4.75 -4.75	_ _	-5.25 -5.25	Vdc
Input Bias Current $(T_J = +25^{\circ}C)$ $(T_J = +125^{\circ}C)$	I _{IB}	_ _	_ _	6.0 5.5	_ _	_ _	6.0 5.5	mA
Input Bias Current Change $-8.0 \text{ Vdc} \ge \text{V}_{\text{I}} \ge -20 \text{ Vdc}$ $1.0 \text{ mA} \le \text{I}_{\text{O}} \le 40 \text{ mA}$	I _{IB}	_ _	_ _	1.5 0.2	_ _	_ _	1.5 0.1	mA
Output Noise Voltage $(T_A = +25^{\circ}C, 10 \text{ Hz} \le f \le 100 \text{ kHz})$	Vn	_	40	_	-	40	_	μV
Ripple Rejection $(-8.0 \ge V_J \ge -18 \text{ Vdc}, f = 120 \text{ Hz}, T_J = +25^{\circ}\text{C})$	RR	40	49	-	41	49	-	dB
Dropout Voltage ($I_O = 40 \text{ mA}, T_J = +25^{\circ}\text{C}$)	V _I -V _O	_	1.7	-	-	1.7	_	Vdc

ELECTRICAL CHARACTERISTICS (V_I = -19 V, I_O = 40 mA, C_I = 0.33 μ F, C_O = 0.1 μ F, -40°C < T_J +125°C (for MC79LXXAC), 0°C < T_J < +125°C (for MC79LXXAB)).

		MC79L12C, AB		MC79L12AC, AB				
Characteristics	Symbol	Min	Тур	Max	Min	Тур	Max	Unit
Output Voltage (T _J = +25°C)	Vo	-11.1	-12	-12.9	-11.5	-12	-12.5	Vdc
Input Regulation (T _J = +25°C)	Regline							mV
$-14.5 \text{ Vdc} \ge \text{V}_{\text{I}} \ge -27 \text{ Vdc}$ $-16 \text{ Vdc} \ge \text{V}_{\text{I}} \ge -27 \text{ Vdc}$		-	_ _	250 200	- -	_ _	250 200	
Load Regulation $T_J = +25^{\circ}C$, 1.0 mA $\leq I_O \leq$ 100 mA 1.0 mA $\leq I_O \leq$ 40 mA	Regload	_ _	_ _	100 50	_ _	_ _	100 50	mV
Output Voltage -14.5 Vdc \geq V _I \geq -27 Vdc, 1.0 mA \leq I _O \leq 40 mA V _I = -19 Vdc, 1.0 mA \leq I _O \leq 70 mA	VO	-10.8 -10.8	_ _	-13.2 -13.2	-11.4 -11.4	_ _	-12.6 -12.6	Vdc
Input Bias Current $(T_J = +25^{\circ}C)$ $(T_J = +125^{\circ}C)$	I _{IB}	_ _	_ _	6.5 6.0	_ _	_ _	6.5 6.0	mA
Input Bias Current Change -16 Vdc ≥ V _I ≥ -27 Vdc 1.0 mA ≤ I _O ≤ 40 mA	I _{IB}	_ _	_ _	1.5 0.2	_ _	_ _	1.5 0.2	mA
Output Noise Voltage $(T_A = +25^{\circ}C, 10 \text{ Hz} \le f \le 100 \text{ kHz})$	V _n	_	80	_	_	80	_	μV
Ripple Rejection (-15 \leq V _I \leq -25 Vdc, f = 120 Hz, T _J = +25°C)	RR	36	42	_	37	42	_	dB
Dropout Voltage (I _O = 40 mA, T _J = +25°C)	V -VO	_	1.7	-	-	1.7	_	Vdc

MC79L00, A Series

ELECTRICAL CHARACTERISTICS (V_I = -23 V, I_O = 40 mA, C_I = 0.33 μ F, C_O = 0.1 μ F, -40°C < T_J +125°C (for MC79LXXAB), 0°C < T_J < +125°C (for MC79LXXAC)).

		ı	MC79L15C		MC79L15AC, AB			
Characteristics	Symbol	Min	Тур	Max	Min	Тур	Max	Unit
Output Voltage (T _J = +25°C)	Vo	-13.8	-15	-16.2	-14.4	-15	-15.6	Vdc
Input Regulation $ (T_J = +25^{\circ}C) $ $ -17.5 \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$	Reg _{line}	_ _	_ _	300 250	_ _	_ _	300 250	mV
Load Regulation $T_J = +25^{\circ}C$, 1.0 mA $\leq I_O \leq$ 100 mA 1.0 mA $\leq I_O \leq$ 40 mA	Reg _{load}	_ _	- -	150 75	_ _	- -	150 75	mV
Output Voltage -17.5 Vdc \geq V _I \geq -Vdc, 1.0 mA \leq I _O \leq 40 mA V _I = -23 Vdc, 1.0 mA \leq I _O \leq 70 mA	Vo	-13.5 -13.5	- -	-16.5 -16.5	-14.25 -14.25	_ _	-15.75 -15.75	Vdc
Input Bias Current $(T_J = +25^{\circ}C)$ $(T_J = +125^{\circ}C)$	I _{IB}	_ _	_ _	6.5 6.0	_ _	_ _	6.5 6.0	mA
Input Bias Current Change -20 Vdc ≥ V _I ≥ -30 Vdc 1.0 mA ≤ I _O ≤ 40 mA	Δl _{IB}	_ _	- -	1.5 0.2	_ _	_ _	1.5 0.1	mA
Output Noise Voltage (TA = +25°C, 10 Hz \leq f \leq 100 kHz)	V _N	_	90	_	_	90	_	μV
Ripple Rejection (-18.5 \leq V _I \leq -28.5 Vdc, f = 120 Hz)	RR	33	39	_	34	39	_	dB
Dropout Voltage I _O = 40 mA, T _J = +25°C	V -VO	_	1.7	-	_	1.7	_	Vdc

ELECTRICAL CHARACTERISTICS (V_I = -27 V, I_O = 40 mA, C_I = 0.33 μ F, C_O = 0.1 μ F, 0° C < T_J > $+125^{\circ}$ C, unless otherwise noted).

		MC79L18C			MC79L18AC			
Characteristics	Symbol	Min	Тур	Max	Min	Тур	Max	Unit
Output Voltage (T _J = +25°C)	V _O	-16.6	-18	-19.4	-17.3	-18	-18.7	Vdc
Input Regulation (T,j = +25°C)	Reg _{line}							mV
-20.7 Vdc ≥ V _I ≥ -33 Vdc		_	_	_	-	_	325	
$-21.4 \text{ Vdc} \ge \text{V}_{\text{I}} \ge -33 \text{ Vdc}$		_	_	325	-	_	_	
$-22 \text{ Vdc} \ge \text{V}_{\text{I}} \ge -33 \text{ Vdc}$		_	_	275	-	_	-	
–21 Vdc ≥ V _I ≥ –33 Vdc		_	_	_	_	_	275	
Load Regulation	Reg _{load}							mV
$T_J = +25^{\circ}C$, 1.0 mA $\leq I_O \leq$ 100 mA		_	_	170	-	_	170	
$1.0 \text{ mA} \le I_{O} \le 40 \text{ mA}$		_	-	85	-	_	85	
Output Voltage	٧o							Vdc
$-20.7 \text{ Vdc} \ge \text{V}_{\text{I}} \ge -33 \text{ Vdc}, 1.0 \text{ mA} \le \text{I}_{\text{O}} \le 40 \text{ mA}$		l	_	-	-17.1	-	-18.9	
$-21.4 \text{ Vdc} \ge V_I \ge -33 \text{ Vdc}$, $1.0 \text{ mA} \le I_O \le 40 \text{ mA}$		-16.2 -16.2	-	-19.8	-	_	-	
$V_I = -27 \text{ Vdc}, 1.0 \text{ mA} \le I_O \le 70 \text{ mA}$		10.2	_	-19.8	-17.1	_	-18.9	
Input Bias Current	I _{IB}							mA
$(T_{J} = +25^{\circ}C)$		_	_	6.5	-	_	6.5	
$(T_J = +125^{\circ}C)$		_	-	6.0	-	_	6.0	
Input Bias Current Change	I _{IB}							mA
–21 Vdc ≥ V _I ≥ –33 Vdc	.5	_	_	_	-	_	1.5	
-27 Vdc ≥ V _I ≥ -33 Vdc		_	_	1.5	-	_	_	
$1.0 \text{ mA} \le I_{\text{O}} \le 40 \text{ mA}$		_	-	0.2	-	_	0.1	
Output Noise Voltage	Vn	_	150	_	_	150	_	μV
$(T_A = +25^{\circ}C, 10 \text{ Hz} \le f \le 100 \text{ kHz})$	"							
Ripple Rejection	RR	32	46	_	33	48	_	dB
$(-23 \le V_J \le -33 \text{ Vdc}, f = 120 \text{ Hz}, T_J = +25^{\circ}\text{C})$								
Dropout Voltage	V -VO	_	1.7	_	_	1.7	_	Vdc
$I_{O} = 40 \text{ mA}, T_{J} = +25^{\circ}\text{C}$								

MC79L00, A Series

ELECTRICAL CHARACTERISTICS (V_I = -33 V, I_O = 40 mA, C_I = 0.33 μ F, C_O = 0.1 μ F, 0°C < T_J < +125°C, unless otherwise noted).

		ı	MC79L240	C	l v	IC79L24A	c	
Characteristics	Symbol	Min	Тур	Max	Min	Тур	Max	Unit
Output Voltage (T _J = +25°C)	VO	-22.1	-24	-25.9	-23	-24	-25	Vdc
Input Regulation $ (T_J = +25^{\circ}C) $ $ -27 \text{ Vdc} \ge V_I \ge -38 \text{ Vdc} $ $ -27.5 \text{ Vdc} \ge V_I \ge -38 \text{ Vdc} $	Regline	_ _ _	_ _	_ 350	- -	_ _	350 -	mV
-28 Vdc ≥ V _I ≥ -38 Vdc		-	_	300	-	_	300	
Load Regulation $T_J = +25^{\circ}C$, 1.0 mA $\leq I_O \leq$ 100 mA 1.0 mA $\leq I_O \leq$ 40 mA	Reg _{load}	_ _	- -	200 100	_ _	_ _	200 100	mV
Output Voltage $-27 \text{ Vdc} \ge V_I \ge -38 \text{ V}, 1.0 \text{ mA} \le I_O \le 40 \text{ mA}$ $-28 \text{ Vdc} \ge V_I \ge -38 \text{ Vdc}, 1.0 \text{ mA} \le I_O \le 40 \text{ mA}$ $V_I = -33 \text{ Vdc}, 1.0 \text{ mA} \le I_O \le 70 \text{ mA}$	Vo	- -21.4 -21.4	- - -	- -26.4 -26.4	-22.8 - -22.8	- - -	-25.2 - -25.2	Vdc
Input Bias Current $(T_J = +25^{\circ}C)$ $(T_J = +125^{\circ}C)$	I _{IB}	_ _	- -	6.5 6.0	_ _	- -	6.5 6.0	mA
Input Bias Current Change $-28 \text{ Vdc} \ge \text{V}_{\text{I}} \ge -38 \text{ Vdc}$ $1.0 \text{ mA} \le \text{I}_{\text{O}} \le 40 \text{ mA}$	ΔlIB	_ _	- -	1.5 0.2	_ _	_ _	1.5 0.1	mA
Output Noise Voltage $(T_A = +25^{\circ}C, 10 \text{ Hz} \le f \le 100 \text{ kHz})$	V _n	-	200	-	-	200	_	μV
Ripple Rejection (-29 \leq V _I \leq -35 Vdc, f = 120 Hz, T _J = +25°C)	RR	30	43	-	31	47	_	dB
Dropout Voltage I _O = 40 mA, T _J = +25°C	V -VO		1.7			1.7	-	Vdc

APPLICATIONS INFORMATION

Design Considerations

The MC79L00, A Series of fixed voltage regulators are designed with Thermal Overload Protections that shuts down the circuit when subjected to an excessive power overload condition, Internal Short Circuit Protection that limits the maximum current the circuit will pass.

In many low current applications, compensation capacitors are not required. However, it is recommended that the regulator input be bypassed with a capacitor if the regulator is connected to the power supply filter with long wire length, or if the output load capacitance is large. An input

bypass capacitor should be selected to provide good high–frequency characteristics to insure stable operation under all load conditions. A 0.33 μF or larger tantalum, mylar, or other capacitor having low internal impedance at high frequencies should be chosen. The bypass capacitor should be mounted with the shortest possible leads directly across the regulator's input terminals. Normally good construction techniques should be used to minimize ground loops and lead resistance drops since the regulator has no external sense lead. Bypassing the output is also recommended.

Figure 1. Positive and Negative Regulator

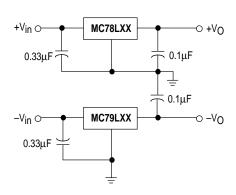
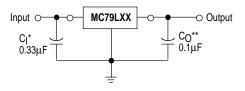


Figure 2. Standard Application



A common ground is required between the input and the output voltages. The input voltage must remain typically 2.0 V above the output voltage even during the low point on the ripple voltage.

^{*} C_I is required if regulator is located an appreciable distance from the power supply filter

^{**} CO improves stability and transient response.

MC79L00, A Series TYPICAL CHARACTERISTICS

 $(T_A = +25^{\circ}C, \text{ unless otherwise noted.})$

Figure 3. Dropout Characteristics

MC79L05C $V_O = -5.0 \text{ V}$ $T_J = 25^{\circ}\text{C}$ $I_O = 1.0 \text{ mA}$ $I_O = 100 \text{ mA}$

I_O = 40 mA

V_{in}, INPUT VOLTAGE (V)

-6.0

-0.8

-10

8.0

6.0

4.0

2.0

0

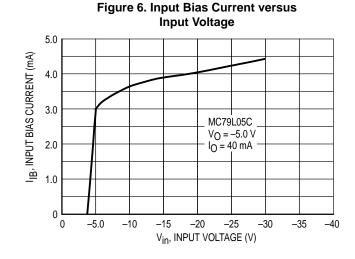
0

-2.0

V_O, OUTPUT VOLTAGE (V)

Figure 4. Dropout Voltage versus **Junction Temperature** -2.5 V I -VO , INPUT/OUTPUT DIFFERENTIAL -2.0 $I_0 = 70 \text{ mA}$ $I_O = 40 \text{ mA}$ VOLTAGE (V) $I_0 = 1.0 \text{ mA}$ -1.0 Dropout of Regulation is defined when -0.5 $\Delta V_O = 2\%$ of V_O 0 0 25 50 75 125 T_J, JUNCTION TEMPERATURE (°C)

Figure 5. Input Bias Current versus **Ambient Temperature** 4.2 I_{IB}, INPUT BIAS CURRENT (mA) 4.0 3.8 3.6 3.4 MC79L05C V_{in} = -10 V $V_0^{11} = -5.0 \text{ V}$ $l_0 = 40 \text{ mA}$ 3.0 0 -0 25 50 75 100 125 T_A, AMBIENT TEMPERATURE (°C)



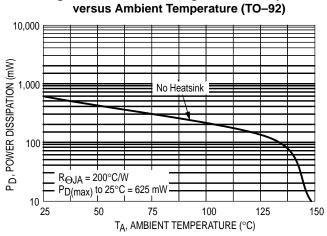


Figure 7. Maximum Average Power Dissipation

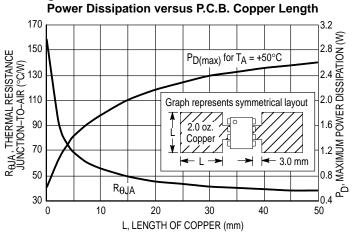
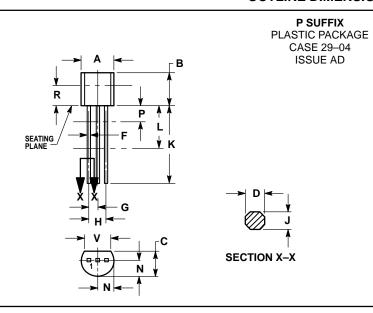


Figure 8. SOP-8 Thermal Resistance and Maximum

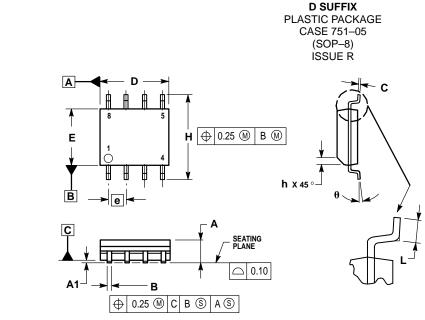
MC79L00, A Series OUTLINE DIMENSIONS



NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI
 Y14.5M, 1982.
- 2. CONTROLLING DIMENSION: INCH.
- 3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
- DIMENSION F APPLIES BETWEEN P AND L.
 DIMENSION D AND J APPLY BETWEEN L AND K
 MINIMUM. LEAD DIMENSION IS UNCONTROLLED
 IN P AND BEYOND DIMENSION K MINIMUM.

	INC	HES	MILLIN	IETERS
DIM	MIN	MAX	MIN	MAX
Α	0.175	0.205	4.45	5.20
В	0.170	0.210	4.32	5.33
С	0.125	0.165	3.18	4.19
D	0.016	0.022	0.41	0.55
F	F 0.016 0.019		0.41	0.48
G	0.045	0.055	1.15	1.39
Н	0.095	0.105	2.42	2.66
J	0.015	0.020	0.39	0.50
K	0.500		12.70	_
L	0.250		6.35	_
N	0.080	0.105	2.04	2.66
Р		0.100		2.54
R	0.115		2.93	
٧	V 0.135		3.43	



NOTES

- DIMENSIONING AND TOLERANCING PER ASME
 Y14 5M 1994
- Y14.5M, 1994. 2. DIMENSIONS ARE IN MILLIMETERS.
- DIMENSION D AND E DO NOT INCLUDE MOLD PROTRUSION.
- 4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
- DIMENSION B DOES NOT INCLUDE MOLD PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 TOTAL IN EXCESS OF THE B DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS						
DIM	MIN	MAX					
Α	1.35	1.75					
A1	0.10	0.25					
В	0.35	0.49					
C	0.18	0.25					
D	4.80	5.00					
Е	3.80	4.00					
е	1.27	BSC					
Н	5.80	6.20					
h	0.25	0.50					
L	0.40	1.25					
θ	0 °	7°					

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