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July 2015

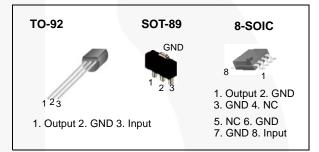
MC78LXXA / LM78LXXA 3-Terminal 0.1 A Positive Voltage Regulator

Features

- Maximum Output Current of 100 mA
- Output Voltage of 5 V, 6 V, 8 V, 12 V, and 15 V
- Thermal Overload Protection
- · Short-Circuit Current Limiting
- Output Voltage Offered in ±5% Tolerance

Description

The MC78LXXA / LM78LXXA series of fixed-voltage monolithic integrated circuit voltage regulators are suitable for applications that required supply current up to 100 mA.



Ordering Information

Product Number	Package	Packing Method	Output Voltage Tolerance	Operating Temperature				
LM78L05ACZ		Bulk						
LM78L05ACZX		Tape & Reel						
LM78L05ACZXA		Ammo						
LM78L12ACZ		Bulk						
LM78L12ACZX		Tape & Reel						
MC78L05ACP	TO-92	Bulk						
MC78L05ACPXA		Ammo						
MC78L06ACP		Bulk	±5%	-40 to +125°C				
MC78L08ACP			Bulk					
MC78L15ACP		Bulk						
MC78L15ACPXA		Ammo						
MC78L05ACD	8-SOIC	Rail						
MC78L05ACDX	6-30IC	Tape & Reel						
MC78L05ACHX	MC78L05ACHX							
MC78L08ACHX	SOT-89	Tape & Reel						

Block Diagram

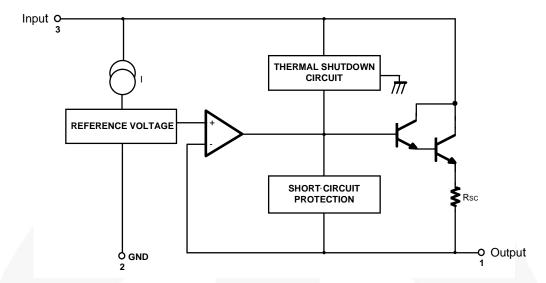


Figure 1. Block Diagram

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at $T_A = 25^{\circ}\text{C}$ unless otherwise noted.

Symbol	Paramete	r	Value	Unit
W	Input Voltage	V _O = 5 V to 8 V	30	V
VI	Input Voltage	V _O = 12 V to 15 V	35	V
T _{OPR}	Operating Temperature Range	-40 to +125°C	°C	
T _{J(MAX)}	Maximum Junction Temperature	150	°C	
T _{STG}	Storage Temperature Range	Storage Temperature Range		°C
$R_{\theta JC}$	Thermal Resistance, Junction-Case	TO-92	50	°C/W
		TO-92	150	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-Air	SOT-89	225	°C/W
	34.	8-SOIC	160	°C/W

Electrical Characteristics (MC78L05A / LM78L05A)

 $V_I = 10 \text{ V, } I_O = 40 \text{ mA, } -40^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C, } C_I = 0.33 \text{ } \mu\text{F, } C_O = 0.1 \text{ } \mu\text{F, unless otherwise specified.}$

Symbol	Parameter		Cond	ditions	Min.	Тур.	Max.	Unit
Vo	Output Voltage		T _J = 25°C		4.8	5.0	5.2	V
ΔV_{O}	Line Regulation ⁽¹⁾		T 25°C	$7 \text{ V} \leq \text{V}_1 \leq 20 \text{ V}$		8	150	mV
ΔνΟ	Line Regulation.		$T_J = 25^{\circ}C$	$8 \text{ V} \leq \text{V}_{\text{I}} \leq 20 \text{ V}$		6	100	mV
ΔV _O	Load Regulation ⁽¹⁾		T _{.1} = 25°C	$1 \text{ mA} \le I_{O} \le 100 \text{ mA}$		11	60	mV
7,0	Load Negulation		1	1 mA \leq I _O \leq 40 mA		5.0	30.0	mV
V	V _O Output Voltage		$7 \text{ V} \leq \text{V}_1 \leq 20 \text{ V}$	1 mA \leq I _O \leq 40 mA			5.25	V
٧٥			$7 \text{ V} \leq \text{V}_{\text{I}} \leq \text{V}_{\text{MAX}}^{(2)}$	1 mA \leq I _O \leq 70 mA	4.75		5.25	V
IQ	Quiescent Current		$T_J = 25^{\circ}C$			2.0	5.5	mA
ΔI_{Q}	Quiescent Current	With Line	$8 \text{ V} \leq \text{V}_{\text{I}} \leq 20 \text{ V}$				1.5	mA
ΔI_{Q}	Change	With Load	$1 \text{ mA} \le I_{O} \le 40 \text{ mA}$	1			0.1	mA
V _N	Output Noise Voltage		$T_A = 25^{\circ}C$, 10 Hz	≤ f ≤ 100 kHz		40		μV/Vo
$\Delta V_{O}/\Delta T$	Temperature Coefficient of V _O		$I_O = 5 \text{ mA}$			-0.65		mV/°C
RR	Ripple Rejection		f = 120 Hz, 8 V ≤ \	$V_{\rm I} \le 18 \text{ V}, T_{\rm J} = 25^{\circ}\text{C}$	41	80		dB
V_{D}	Dropout Voltage		T _J = 25°C			1.7		V

- 1. The maximum steady-state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represents pulse test conditions with junction temperature as indicated at the initiation of tests.
- 2. Power dissipation $P_D \le 0.75 \text{ W}$.

Electrical Characteristics (MC78L06A)

 $V_I = 12 \text{ V, I}_O = 40 \text{ mA, -}40^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C, C}_I = 0.33 \text{ }\mu\text{F, C}_O = 0.1 \text{ }\mu\text{F, unless otherwise specified.}$

Symbol	Parameter		Conditions		Min.	Тур.	Max.	Unit
Vo	Output Voltage		$T_J = 25^{\circ}C$		5.75	6.0	6.25	V
41/	Line Regulation ⁽³⁾		T _ 25°C	$8.5 \text{ V} \le \text{V}_1 \le 20 \text{ V}$ $9 \text{ V} \le \text{V}_1 \le 20 \text{ V}$		64	175	mV
ΔV_{O}	Line Regulation (*)		1 _J = 25 C	9 V ≤ V _I ≤ 20 V		54	125	mV
41/	Load Regulation ⁽³⁾		T _J = 25°C	1 mA ≤ I _O ≤ 100 mA		12.8	80.0	mV
ΔV_{O}	O Load Regulation (9)		1j = 25 C	$1 \text{ mA} \le I_O \le 70 \text{ mA}$		5.8	40.0	mV
V	V _O Output Voltage		8.5 V ≤ V _I ≤	≤ 20 V, 1 mA ≤ I _O ≤ 40 mA	5.7		6.3	V
v _O			8.5 V ≤ V _I ≤	$\leq V_{MAX}^{(4)}$, 1 mA $\leq I_{O} \leq$ 70 mA	5.7		6.3	V
1	Quiescent Current		$T_J = 25^{\circ}C$				5.5	mA
ΙQ			$T_J = 125^{\circ}C$			3.9	6.0	mA
ΔI_{Q}	Quiescent Current	With Line	9 V ≤ V _I ≤ 20 V				1.5	mA
ΔI_{Q}	Change	With Load	1 mA ≤ I _O ≤ 40 mA				0.1	mA
V _N	Output Noise Voltage		$T_A = 25^{\circ}C,$	10 Hz ≤ f ≤ 100 kHz		40		μV/Vo
$\Delta V_{O}/\Delta T$	Temperature Coefficient of V _O		$I_O = 5 \text{ mA}$			0.75		mV/°C
RR	Ripple Rejection		f = 120 Hz,	10 V \leq V _I \leq 20 V, T _J = 25°C	40	46		dB
V_D	Dropout Voltage	_	$T_J = 25^{\circ}C$			1.7		V

- 3. The maximum steady-state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represents pulse test conditions with junction temperature as indicated at the initiation of tests.

 4. Power dissipation P_D ≤ 0.75 W.

Electrical Characteristics (MC78L08A)

 $V_I = 14 \text{ V, } I_O = 40 \text{ mA, } -40^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C, } C_I = 0.33 \text{ } \mu\text{F, } C_O = 0.1 \text{ } \mu\text{F, unless otherwise specified.}$

Symbol	Parameter		Condi	itions	Min.	Тур.	Max.	Unit
Vo	Output Voltage		T _J = 25°C		7.7	8.0	8.3	V
ΔV_{O}	Line Regulation ⁽⁵⁾		T _{.J} = 25°C	$10.5~V \leq V_I \leq 23~V$		10	175	mV
7,0	Line Regulation		1) = 25 0	$11~V \leq V_I \leq 23~V$		8	125	mV
ΔV_{O}	Load Regulation ⁽⁵⁾		T _{.l} = 25°C	$1 \text{ mA} \le I_{O} \le 100 \text{ mA}$		15	80	mV
7,0	Load Negulation		1 J = 25 °C	$1 \text{ mA} \le I_{O} \le 40 \text{ mA}$		8	40	mV
V	V _O Output Voltage		$10.5V \le V_I \le 23V$	$1 \text{ mA} \le I_{O} \le 40 \text{ mA}$	7.6		8.4	V
Vo	Output voltage		$10.5V \le V_I \le V_{MAX}^{(6)}$	$1 \text{ mA} \le I_{O} \le 70 \text{ mA}$	7.6		8.4	V
IQ	Quiescent Current		$T_J = 25^{\circ}C$			2.0	5.5	mA
ΔI_{Q}	Quiescent Current	With Line	$11 \text{ V} \leq \text{V}_{\text{I}} \leq 23 \text{ V}$				1.5	mA
ΔI_{Q}	Change	With Load	$1 \text{ mA} \le I_{O} \le 40 \text{ mA}$				0.1	mA
V _N	Output Noise Voltage		$T_A = 25^{\circ}C$, 10 Hz \leq f	≤100 kHz		60		μV/Vo
$\Delta V_{O}/\Delta T$	Temperature Coefficient of V _O		I _O = 5 mA		_	-0.8		mV/°C
RR	Ripple Rejection		f = 120 Hz, 11 V ≤ V _I	≤ 21 V, T _J = 25°C	39	70		dB
V_D	Dropout Voltage		T _J = 25°C			1.7		V

- 5. The maximum steady-state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represents pulse test conditions with junction temperature as indicated at the initiation of tests.
- 6. Power dissipation $P_D \le 0.75 \text{ W}$.

Electrical Characteristics (MC78L12A / LM78L12A)

 $V_I = 19 \text{ V, } I_O = 40 \text{ mA, } -40^{\circ}C \leq T_J \leq 125^{\circ}C, \ C_I = 0.33 \ \mu\text{F, } C_O = 0.1 \ \mu\text{F, unless otherwise specified.}$

Symbol	Parame	eter	Conditions		Min.	Тур.	Max.	Unit
Vo	Output Voltage		$T_J = 25^{\circ}C$		11.5	12.0	12.5	V
ΔV_{O}	Line Regulation ⁽⁷⁾		T _{.l} = 25°C	$14.5 \text{ V} \le \text{V}_{\text{I}} \le 27 \text{ V}$		20	250	mV
ΔνΟ	Line Regulation	<i>'</i>	1j = 25 C	16 $V \le V_1 \le 27 V$		15	200	mV
ΔV _O	Load Regulation (7)	T _{.1} = 25°C	$1 \text{ mA} \le I_O \le 100 \text{ mA}$		20	100	mV
7,0	Load Regulation	,	1 _J = 25°C	$1 \text{ mA} \le I_O \le 40 \text{ mA}$		10	50	mV
V-	V Output Voltage		$14.5 \text{ V} \le \text{V}_1 \le 27 \text{ V}$	$1 \text{ mA} \le I_O \le 40 \text{ mA}$	11.4		12.6	V
Vo	Output Voltage		$14.5 \text{ V} \le \text{V}_{\text{I}} \le \text{V}_{\text{MAX}}^{(8)}$	$1 \text{ mA} \le I_O \le 70 \text{ mA}$	11.4		12.6	V
IQ	Quiescent Curren	t	$T_J = 25^{\circ}C$			2.1	6.0	mA
ΔI_{Q}	Quiescent	With Line	$16 \text{ V} \leq \text{V}_{\text{I}} \leq 27 \text{ V}$				1.5	mA
ΔI_{Q}	Current Change	With Load	$1 \text{ mA} \le I_{O} \le 40 \text{ mA}$				0.1	mA
V _N	Output Noise Voltage		$T_A = 25^{\circ}C, 10 \text{ Hz} \le f$	≤ 100 kHz		80		μV/Vo
$\Delta V_{O}/\Delta T$	Temperature Coefficient of V _O		I _O = 5 mA			-1.0		mV/°C
RR	Ripple Rejection		$f = 120 \text{ Hz}, 15 \text{ V} \le \text{V}_1$	≤ 25 V, T _J = 25°C	37	65		dB
V_{D}	Dropout Voltage		T _J = 25°C			1.7		V

- 7. The maximum steady-state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represents pulse test conditions with junction temperature as indicated at the initiation of tests.
- 8. Power dissipation $P_D \le 0.75 \text{ W}$.

Electrical Characteristics (MC78L15A)

 $V_I = 23~V,~I_O = 40~mA,~-40^{\circ}C \leq T_J \leq 125^{\circ}C,~C_I = 0.33~\mu F,~C_O = 0.1~\mu F,~unless~otherwise~specified.$

Symbol	Parame	ter	Condit	ions	Min.	Тур.	Max.	Unit
Vo	Output Voltage		T _J = 25°C		14.4	15.0	15.6	V
ΔV_{O}	ΔV_{O} Line Regulation ⁽⁹⁾		T _{.l} = 25°C	$17.5 \text{ V} \le \text{V}_{\text{I}} \le 30 \text{ V}$		25	300	mV
700	Line Regulation		1j = 25 C	$20~V \leq V_I \leq 30~V$		20	250	mV
۸\/ -	ΔV _O Load Regulation ⁽⁹⁾	9)	T _{.l} = 25°C	$1 \text{ mA} \le I_{O} \le 100 \text{ mA}$		25	150	mV
7,0		•	1) = 25 C	$1 \text{ mA} \le I_O \le 40 \text{ mA}$		12	75	mV
V	Output Voltage		$17.5 \text{ V} \le \text{V}_{\text{I}} \le 30 \text{ V}$	$1 \text{ mA} \le I_O \le 40 \text{ mA}$	14.25		15.75	V
Vo			$17.5 \text{ V} \le \text{V}_{\text{I}} \le \text{V}_{\text{MAX}}^{(10)}$	$1~\text{mA} \leq I_O \leq 70~\text{mA}$	14.25		15.75	V
IQ	Quiescent Curren	t	$T_J = 25^{\circ}C$			2.1	6.0	mA
ΔI_{Q}	Quiescent	With Line	$20~V \leq V_I \leq 30~V$				1.5	mA
ΔI_{Q}	Current Change	With Load	1 mA \leq I _O \leq 40 mA				0.1	mA
V _N	Output Noise Voltage		$T_A = 25^{\circ}C$, 10 Hz \leq f \leq	100 kHz		90		$\mu\text{V/Vo}$
$\Delta V_{O}/\Delta T$	Temperature Coefficient of V _O		$I_O = 5 \text{ mA}$			-1.3		mV/°C
RR	Ripple Rejection		$f = 120 \text{ Hz}, 18.5 \text{ V} \le \text{V}_{\text{I}}$	≤28.5 V, T _J = 25°C	34	60		dB
V_{D}	Dropout Voltage		T _J = 25°C			1.7		V

- 9. The maximum steady-state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represents pulse test conditions with junction temperature as indicated at the initiation of tests.
- 10. Power dissipation $P_D \le 0.75 \text{ W}$.

Typical Application

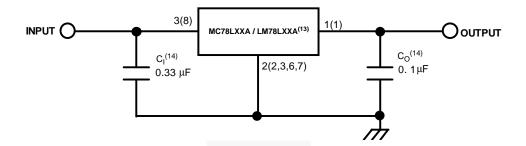
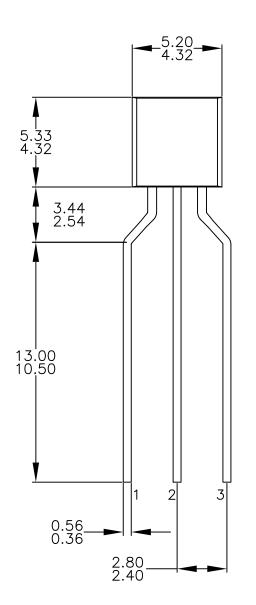
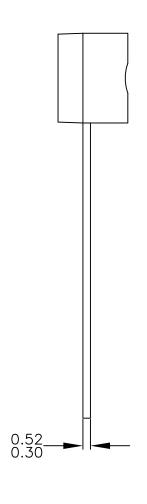


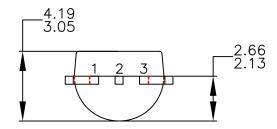
Figure 2. Typical Application

- 13. To specify an output voltage, substitute voltage value for "XX".
- 14. C_1 is required if the regulator is located an appreciable distance from the power supply filter. Though C_0 is not needed for stability, it improves transient response. Bypass capacitors are recommended for optimum stability and transient response and should be located as close as possible to the regulator.



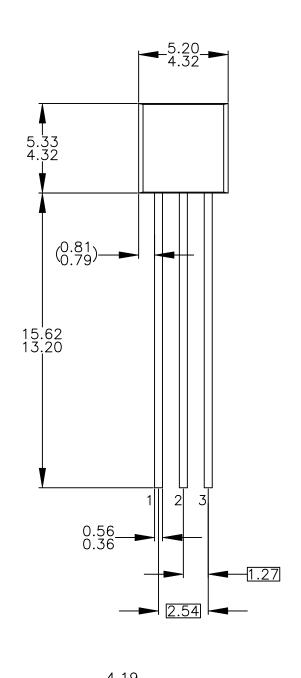


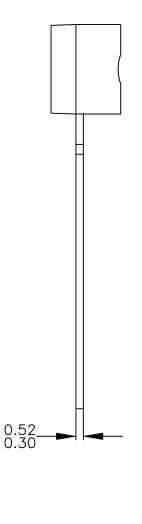




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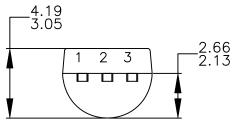
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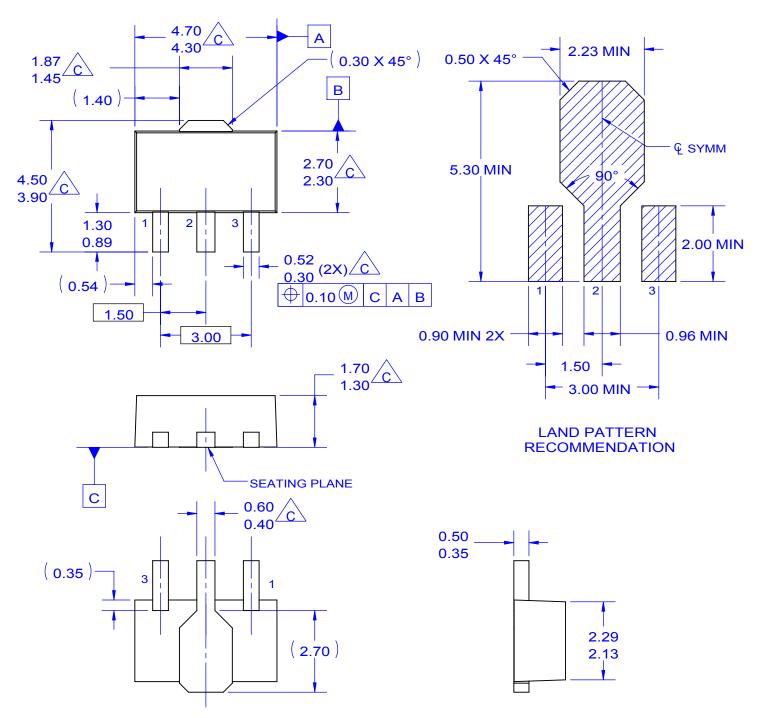


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