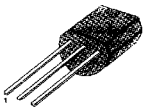
LM78LXX (KA78LXX, MC78LXX) FIXED VOLTAGE REGULATOR (POSITIVE)

3-TERMINAL 0.1A POSITIVE VOLTAGE REGULATORS

The LM78LXX series of fixed voltage monolithic integrated circuit voltage regulators are suitable for application that required supply up to 100mA.

TO-92



1: Output 2: GND 3: Input

8 SOP

1: Output 2: GND 3: GND 4: NC
5: NC 6: GND 7: GND 8: Input

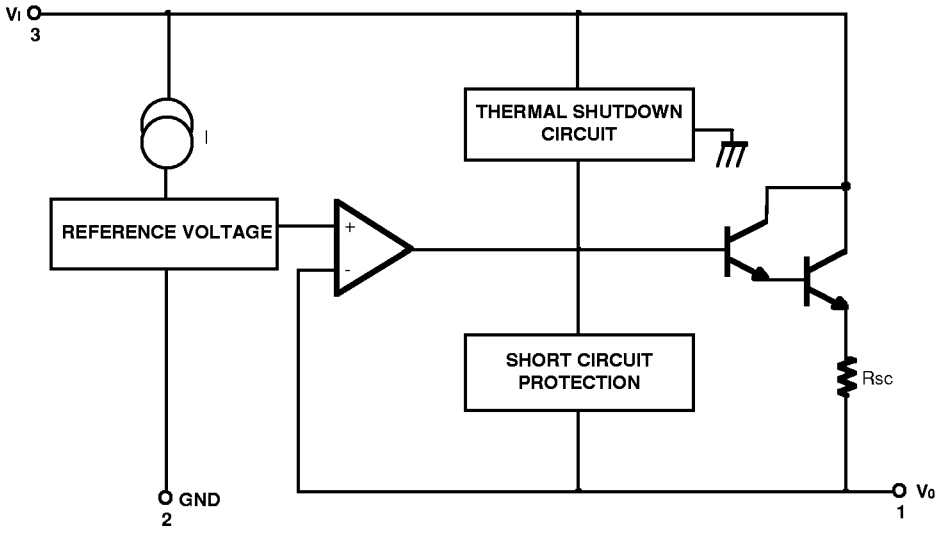
FEATURES

- Maximum Output Current of 100mA
- Output Voltage of 5V, 6V, 8V, 9V, 10V, 12V, 15V, 18V and 24V
- Thermal Overload Protection
- Short Circuit Current Limiting
- Output Voltage Offered in ± 5% Tolerance

ORDERING INFORMATION

Device	Package	Operating Temperature
LM78LXXACZ	TO-92	- 45 ~ + 125°C
LM78LXXM	8 SOP	0 ~ + 125°C

BLOCK DIAGRAM



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ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C, unless otherwise specified)

Characteristic	Symbol	Value	Unit
Input Voltage (for V_O = 5V, 8V) (for V_O = 12V, 15V)	V_I	30 35	V V
Operating Junction Temperature Range	T_J	0 ~ +150	°C
Storage Temperature Range	T_{STG}	-65 ~ +150	°C

LM78L05 ELECTRICAL CHARACTERISTICS

(V_I = 10V, I_O = 40mA, 0 °C ≤ T_J ≤ 125 °C, C_I = 0.33 µF, C_O = 0.1µF, unless otherwise specified. (Note 1)

Characteristic		Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage		V_O	T_J = 25 °C		4.8	5.0	5.2	V
Line Regulation		ΔV_O	T_J = 25°C	7V ≤ V_I ≤ 20V		8	150	mV
				8V ≤ V_I ≤ 20V		6	100	mV
Load Regulation		ΔV_O	T_J = 25 °C	1mA ≤ I_O ≤ 100mA		11	60	mV
				1mA ≤ I_O ≤ 40mA		5.0	30	mV
Output Voltage		V_O	7V ≤V_I ≤ 0V	1mA ≤ I_O ≤ 40mA			5.25	V
			7V ≤V_I ≤ V_{MAX} (Note 2)	1mA ≤ I_O ≤ 70mA	4.75		5.25	V
Quiescent Current		I_Q	T_J = 25 °C			2.0	5.5	mA
Quiescent Current Change	with line	ΔI_Q	8V ≤V_I ≤ 20V				1.5	mA
	with load	ΔI_Q	1mA ≤ I_O ≤ 40 mA				0.1	mA
Output Noise Voltage		V_N	T_A = 25 °C, 10Hz ≤ f ≤ 100KHz			40		µV/V_O
Temperature Coefficient of V_O		$\Delta V_O/\Delta T$	I_O = 5mA			-0.65		mV/°C
Ripple Rejection		RR	f = 120Hz, 8V ≤ V_I ≤ 18V, T_J = 25 °C		41	80		dB
Dropout Voltage		V_D	T_J = 25 °C			1.7		V

LM78L06 ELECTRICAL CHARACTERISTICS

(V_I = 12V, I_O = 40mA, 0 °C ≤ T_J ≤ 125 °C , C_I = 0.33μF, C_O = 0.1μF, unless otherwise specified. (Note 1)

Characteristic		Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage		V_O	T_J = 25 °C		5.75	6.0	6.25	V
Line Regulation		ΔV_O	T_J =25 °C	8.5V < V_I < 20V		64	175	mV
				9V ≥ V_I ≥ 20V		54	125	mV
Load Regulation		ΔV_O	T_J =25 °C	1mA < I_O < 100mA		12.8	80	mV
				1mA < I_O < 70mA		5.8	40	mV
Output Voltage		V_O	8.5 < V_I < 20V, 1mA < I_O < 40mA		5.7		6.3	V
			8.5 < V_I < V_{MAX}(Note), 1mA < I_O < 70mA		5.7		6.3	
Quiescent Current		I_Q	T_J = 25 °C			3.9	6.0	mA
			T_J = 125 °C				5.5	
Quiescent Current Change	with line	ΔI_Q	9 < V_I < 20V				1.5	mA
	with load	ΔI_Q	1mA < I_O < 40mA				0.1	
Output Noise Voltage		V_N	T_A = 25 °C, 10Hz < f < 100KHz			40		μV/V_O
Temperature Coefficient of V_O		$\Delta V_O/\Delta T$	I_O = 5mA			0.75		mV/°C
Ripple Rejection		RR	f = 120Hz, 10V < V_I < 20V, T_J = 25 °C		40	46		dB
Dropout Voltage		V_D	T_J = 25 °C			1.7		V

LM78L08 ELECTRICAL CHARACTERISTICS

(V_I = 14V, I_O = 40mA, 0 °C ≤ T_J ≤ 125 °C, C_I = 0.33 μF, C_O = 0.1μF, unless otherwise specified. (Note 1)

Characteristic		Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage		V_O	T_J = 25 °C		7.7	8.0	8.3	V
Line Regulation		ΔV_O	T_J =25 °C	10.5V ≤ V_I ≤ 23V		10	175	mV
				11V ≤ V_I ≤ 23V		8	125	mV
Load Regulation		ΔV_O	T_J =25 °C	1mA ≤ I_O ≤ 100mA		15	80	mV
				1mA ≤ I_O ≤ 40mA		8.0	40	mV
Output Voltage		V_O	10.5V ≤ V_I ≤ 23V	1mA ≤ I_O ≤ 40mA	7.6		8.4	V
			10.5V ≤ V_I ≤ V_{MAX} (Note 2)	1mA ≤ I_O ≤ 70mA	7.6		8.4	V
Quiescent Current		I_Q	T_J = 25 °C			2.0	5.5	mA
Quiescent Current Change	with line	ΔI_Q	11V ≤ V_I ≤ 23V				1.5	mA
	with load	ΔI_Q	1mA ≤ I_O ≤ 40mA				0.1	mA
Output Noise Voltage		V_N	T_A = 25 °C, 10Hz ≤ f ≤100KHz			60		μV/V_O
Temperature Coefficient of V_O		$\Delta V_O/\Delta T$	I_O = 5mA			-0.8		mV/°C
Ripple Rejection		RR	f = 120Hz, 11V ≤ V_I ≤ 21V, T_J = 25 °C		39	70		dB
Dropout Voltage		V_D	T_J = 25 °C			1.7		V

LM78L09 ELECTRICAL CHARACTERISTICS

(V_I = 15V, I_O = 40mA, 0 °C ≤ T_J ≤ 125 °C, C_I = 0.33 µF, C_O = 0.1µF, unless otherwise specified. (Note 1)

Characteristic		Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage		V_O	T_J = 25 °C		8.64	9.0	9.36	V
Line Regulation		ΔV_O	T_J =25 °C	11.5V ≤ V_I ≤ 24V		90	200	mV
				13V ≤ V_I ≤ 24V		100	150	mV
Load Regulation		ΔV_O	T_J =25 °C	1mA ≤ I_O ≤ 100mA		20	90	mV
				1mA ≤ I_O ≤ 40mA		10	45	mV
Output Voltage		V_O	11.5V ≤ V_I ≤ 24V	1mA ≤ I_O ≤ 40mA	8.55		9.45	V
			11.5V ≤ V_I ≤ V_{MAX} (Note 2)	1mA ≤ I_O ≤ 70mA	8.55		9.45	V
Quiescent Current		I_Q	T_J = 25 °C			2.1	6.0	mA
Quiescent Current	with line	ΔI_Q	13V ≤ V_I ≤ 24V				1.5	mA
Change	with load	ΔI_Q	1mA ≤ I_O ≤ 40mA				0.1	mA
Output Noise Voltage		V_N	T_A = 25 °C, 10Hz ≤ f ≤ 100KHz			70		µV/V_O
Temperature Coefficient of V_O		$\Delta V_O/\Delta T$	I_O = 5mA			-0.9		mV/°C
Ripple Rejection		RR	f = 120Hz, 12V ≤ V_I ≤ 22V, T_J = 25 °C		38	44		dB
Dropout Voltage		V_D	T_J = 25 °C			1.7		V

LM78L10 ELECTRICAL CHARACTERISTICS

(V_I = 16V, I_O = 40mA, 0 °C < T_J < 125 °C, C_I = 0.33 µF, C_O = 0.1µF, unless otherwise specified. (Note 1)

Characteristic		Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage		V_O	T_J = 25 °C		9.6	10.0	10.4	V
Line Regulation		ΔV_O	T_J =25 °C	12.5 < V_I < 25V		100	220	mV
				14V ≥ V_I ≥ 25V		100	170	mV
Load Regulation		ΔV_O	T_J =25 °C	1mA < I_O < 100mA		20	94	mV
				1mA < I_O < 70mA		10	47	mV
Output Voltage		V_O	12.5 < V_I < 25V, 1mA < I_O < 40mA		9.5		10.5	V
			12.5 < V_I < V_{MAX}(Note), 1mA < I_O < 70mA		9.5		10.5	
Quiescent Current		I_Q	T_J = 25 °C			4.2	6.5	mA
			T_J = 125 °C				6.0	
Quiescent Current	with line	ΔI_Q	12.5 < V_I < 25V				1.5	mA
Change	with load	ΔI_Q	1mA < I_O < 40mA				0.1	
Output Noise Voltage		V_N	T_A = 25 °C, 10Hz < f < 100KHz			74		µV/V_O
Temperature Coefficient of V_O		$\Delta V_O/\Delta T$	I_O = 5mA			0.95		mV/°C
Ripple Rejection		RR	f = 120Hz, 15V < V_I < 25V, T_J = 25 °C		38	43		dB
Dropout Voltage		V_D	T_J = 25 °C			1.7		V

LM78L12 ELECTRICAL CHARACTERISTICS

(V_I = 19V, I_O = 40mA, 0 °C ≤T_J ≤ 125 °C, C_I = 0.33 µF, C_O = 0.1µF, unless otherwise specified. (Note 1)

Characteristic		Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage		V_O	T_J = 25 °C		11.5	12	12.5	V
Line Regulation		ΔV_O	T_J =25 °C	14.5V ≤ V_I ≤ 27V		20	250	mV
				16V ≤ V_I ≤ 27V		15	200	mV
Load Regulation		ΔV_O	T_J =25 °C	1mA ≤ I_O ≤ 100mA		20	100	mV
				1mA ≤ I_O ≤ 40mA		10	50	mV
Output Voltage		V_O	14.5V ≤ V_I ≤ 27V	1mA ≤ I_O ≤ 40mA	11.4		12.6	V
			14.5V ≤ V_I ≤ V_{MAX} (Note 2)	1mA ≤ I_O ≤ 70mA	11.4		12.6	V
Quiescent Current		I_Q	T_J = 25 °C			2.1	6.0	mA
Quiescent Current	with line	ΔI_Q	16V ≤ V_I ≤ 27V				1.5	mA
Change	with load	ΔI_Q	1mA ≤ I_O ≤ 40mA				0.1	mA
Output Noise Voltage		V_N	T_A = 25 °C, 10Hz ≤ f ≤ 100KHz			80		µV/V_O
Temperature Coefficient of V_O		$\Delta V_O/\Delta T$	I_O = 5mA			-1.0		mV/°C
Ripple Rejection		RR	f = 120Hz, 15V ≤ V_I ≤ 25V, T_J = 25 °C		37	65		dB
Dropout Voltage		V_D	T_J = 25 °C			1.7		V

LM78L15 ELECTRICAL CHARACTERISTICS

(V_I = 23V, I_O = 40mA, 0 °C ≤ T_J ≤ 125°C, C_I = 0.33 µF, C_O = 0.1µF, unless otherwise specified. (Note 1)

Characteristic		Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage		V_O	T_J = 25 °C		14.4	15	15.6	V
Line Regulation		ΔV_O	T_J =25 °C	17.5V ≤ V_I ≤ 30V		25	300	mV
				20V ≤ V_I ≤ 30V		20	250	mV
Load Regulation		ΔV_O	T_J =25 °C	1mA ≤ I_O ≤ 100mA		25	150	mV
				1mA ≤ I_O ≤ 40mA		12	75	mV
Output Voltage		V_O	17.5V ≤ V_I ≤ 30V	1mA ≤ I_O ≤ 40mA	14.25		15.75	V
			17.5V ≤ V_I ≤ V_{MAX} (Note 2)	1mA ≤ I_O ≤ 70mA	14.25		15.75	V
Quiescent Current		I_Q	T_J = 25 °C			2.1	6.0	mA
Quiescent Current	with line	ΔI_Q	20V ≤ V_I ≤ 30V				1.5	mA
Change	with load	ΔI_Q	1mA ≤ I_O ≤ 40mA				0.1	mA
Output Noise Voltage		V_N	T_A = 25 °C, 10Hz ≤ f ≤ 100KHz			90		µV/V_O
Temperature Coefficient of V_O		$\Delta V_O/\Delta T$	I_O = 5mA			-1.3		mV/°C
Ripple Rejection		RR	f = 120Hz, 18.5V ≤ V_I ≤ 28.5V, T_J = 25 °C		34	60		dB
Dropout Voltage		V_D	T_J = 25 °C			1.7		V

LM78L18 ELECTRICAL CHARACTERISTICS

(V_I = 27V, I_O = 40mA, 0 °C ≤ T_J ≤ 125 °C, C_I = 0.33 µF, C_O = 0.1µF, unless otherwise specified. (Note 1)

Characteristic		Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage		V_O	T_J = 25 °C		17.3	18	18.7	V
Line Regulation		ΔV_O	T_J =25 °C	21V ≤ V_I ≤ 33V		145	300	mV
				22V ≤ V_I ≤ 33V		135	250	mV
Load Regulation		ΔV_O	T_J =25 °C	1mA ≤ I_O≤100mA		30	170	mV
				1mA ≤ I_O ≤ 40mA		15	85	mV
Output Voltage		V_O	21V ≤ V_I ≤ 33V	1mA ≤ I_O ≤ 40mA	17.1		18.9	V
			21V ≤ V_I ≤ V_{MAX} (Note 2)	1mA ≤ I_O ≤ 70mA	17.1		18.9	V
Quiescent Current		I_Q	T_J = 25 °C			2.2	6.0	mA
Quiescent Current	with line	ΔI_Q	21V ≤ V_I ≤ 33V				1.5	mA
Change	with load	ΔI_Q	1mA ≤ I_O ≤ 40mA				0.1	mA
Output Noise Voltage		V_N	T_A = 25 °C, 10Hz ≤ f ≤ 100KHz			150		µV/V_O
Temperature Coefficient of V_O		$\Delta V_O/\Delta T$	I_O = 5mA			-1.8		mV/°C
Ripple Rejection		RR	f = 120Hz, 23V ≤ V_I ≤ 33V, T_J = 25 °C		34	48		dB
Dropout Voltage		V_D	T_J = 25 °C			1.7		V

LM78L24 ELECTRICAL CHARACTERISTICS

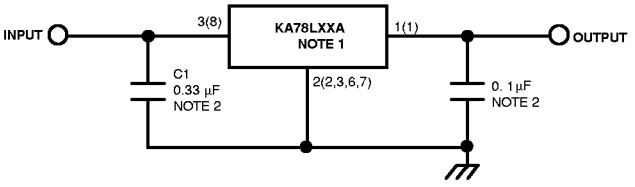
(V_I = 33V, I_O = 40mA, 0 °C ≤ T_J ≤ 125 °C, C_I = 0.33 µF, C_O = 0.1µF, unless otherwise specified. (Note 1)

Characteristic		Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage		V_O	T_J = 25 °C		23	24	25	V
Line Regulation		ΔV_O	T_J =25 °C	27V ≤ V_I ≤ 38V		160	300	mV
				28V ≤ V_I ≤ 38V		150	250	mV
Load Regulation		ΔV_O	T_J =25 °C	1mA ≤ I_O ≤ 100mA		40	200	mV
				1mA ≤ I_O ≤ 40mA		20	100	mV
Output Voltage		V_O	27V ≤ V_I ≤ 38V	1mA ≤ I_O ≤ 40mA	22.8		25.2	V
			27V ≤ V_I ≤ V_{MAX} (Note 2)	1mA ≤ I_O ≤ 70mA	22.8		25.2	V
Quiescent Current		I_Q	T_J = 25°C			2.2	6.0	mA
Quiescent Current	with line	ΔI_Q	28V ≤ V_I ≤ 38V				1.5	mA
Change	with load	ΔI_Q	1mA ≤ I_O ≤ 40mA				0.1	mA
Output Noise Voltage		V_N	T_A = 25 °C, 10Hz ≤ f ≤ 100KHz			200		µV/V_O
Temperature Coefficient of V_O		$\Delta V_O/\Delta T$	I_O = 5mA			-2.0		mV/°C
Ripple Rejection		RR	f = 120Hz, 28V ≤ V_I ≤ 38V, T_J = 25 °C		34	45		dB
Dropout Voltage		V_D	T_J = 25 °C			1.7		V

Notes

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 represent pulse test conditions with junction temperature as indicated at the initiation of tests.
2. Power dissipation ≤ 0.75W.

TYPICAL APPLICATION



'( )' : 8SOP Type

Notes

1. To specify an output voltage, substitute voltage value for "XX".
2. Bypass Capacitors are recommend for optimum stability and transient response and should be located as close as possible to the regulator

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
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