

Boca Semiconductor Corp. (BSC)

MC78LXXA (LM78LXX, KA78LXXA)

FIXED VOLTAGE REGULATOR (POSITIVE)

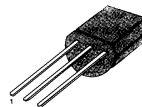
3-TERMINAL 0.1A POSITIVE VOLTAGE REGULATORS

The MC78LXX series of fixed voltage monolithic integrated circuit voltage regulators are suitable for application that required supply up to 100mA.

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 $\pm 5\%$ Tolerance

TO-92



1: Output 2: GND 3: Input

8 SOP

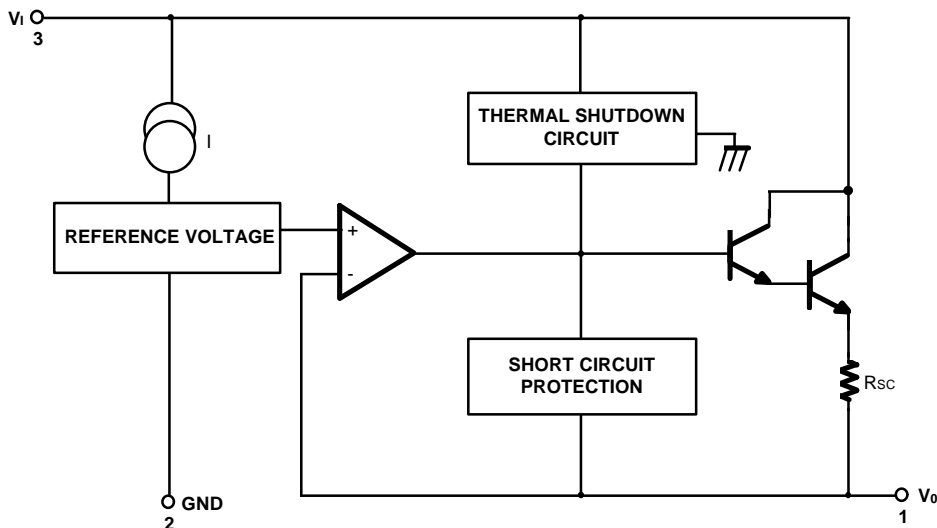


1: Output 2: GND 3: GND 4: NC
5: NC 6: GND 7: GND 8: Input

ORDERING INFORMATION

Device	Package	Operating Temperature
MC78LXXACP (LM78LXXACZ) (KA78LXXAZ)	TO-92	- 45 ~ + 125°C
MC78LXXACD (KA78LXXAD)	8 SOP	0 ~ + 125°C

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$, unless otherwise specified)

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

LM78L05 ELECTRICAL CHARACTERISTICS

($V_I = 10\text{V}$, $I_O = 40\text{mA}$, $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$, $C_I = 0.33\ \mu\text{F}$, $C_O = 0.1\ \mu\text{F}$, unless otherwise specified. (Note 1))

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

LM78L06 ELECTRICAL CHARACTERISTICS

($V_I = 12V$, $I_O = 40mA$, $0^\circ C \leq T_J \leq 125^\circ C$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, unless otherwise specified. (Note 1))

Characteristic		Symbol	Test Conditions	Min	Typ	Max	Unit
Output Voltage		V_O	$T_J = 25^\circ C$	5.75	6.0	6.25	V
Line Regulation		ΔV_O	$T_J = 25^\circ C$	$8.5V < V_I < 20V$	64	175	mV
				$9V \geq V_I \geq 20V$	54	125	mV
Load Regulation		ΔV_O	$T_J = 25^\circ C$	$1mA < I_O < 100mA$	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
			$8.5 < V_I < V_{MAX}(\text{Note})$, $1mA < I_O < 70mA$	5.7		6.3	
Quiescent Current		I_Q	$T_J = 25^\circ C$		3.9	6.0	mA
			$T_J = 125^\circ C$			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	$T_A = 25^\circ C$, $10Hz < f < 100KHz$		40		$\mu V/V_O$
Temperature Coefficient of V_O		$\Delta V_O/\Delta T$	$I_O = 5mA$		0.75		$mV/^\circ C$
Ripple Rejection		RR	$f = 120Hz$, $10V < V_I < 20V$, $T_J = 25^\circ C$	40	46		dB
Dropout Voltage		V_D	$T_J = 25^\circ C$		1.7		V

LM78L08 ELECTRICAL CHARACTERISTICS

($V_I = 14V$, $I_O = 40mA$, $0^\circ C \leq T_J \leq 125^\circ C$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, unless otherwise specified. (Note 1))

Characteristic		Symbol	Test Conditions	Min	Typ	Max	Unit
Output Voltage		V_O	$T_J = 25^\circ C$	7.7	8.0	8.3	V
Line Regulation		ΔV_O	$T_J = 25^\circ C$	$10.5V \leq V_I \leq 23V$	10	175	mV
				$11V \leq V_I \leq 23V$	8	125	mV
Load Regulation		ΔV_O	$T_J = 25^\circ C$	$1mA \leq I_O \leq 100mA$	15	80	mV
				$1mA \leq I_O \leq 40mA$	8.0	40	mV
Output Voltage		V_O	$10.5V \leq V_I \leq 23V$	7.6		8.4	V
			$10.5V \leq V_I \leq V_{MAX}(\text{Note 2})$	7.6		8.4	V
Quiescent Current		I_Q	$T_J = 25^\circ C$		2.0	5.5	mA
Quiescent Current Change	with line	ΔI_Q	$11V \leq V_I \leq 23V$			1.5	mA
	with load	ΔI_Q	$1mA \leq I_O \leq 40mA$			0.1	mA
Output Noise Voltage		V_N	$T_A = 25^\circ C$, $10Hz \leq f \leq 100KHz$		60		$\mu V/V_O$
Temperature Coefficient of V_O		$\Delta V_O/\Delta T$	$I_O = 5mA$		-0.8		$mV/^\circ C$
Ripple Rejection		RR	$f = 120Hz$, $11V \leq V_I \leq 21V$, $T_J = 25^\circ C$	39	70		dB
Dropout Voltage		V_D	$T_J = 25^\circ C$		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	8.55		9.45	V
			11.5V ≤ V _I ≤ V _{MAX} (Note 2)	8.55		9.45	V
Quiescent Current		I _O	T _J = 25 °C		2.1	6.0	mA
Quiescent Current Change	with line	ΔI _O	13V ≤ V _I ≤ 24V			1.5	mA
	with load	ΔI _O	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		ΔV _O /ΔT	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 _O	T _J = 25 °C		4.2	6.5	mA
			T _J = 125 °C			6.0	
Quiescent Current Change	with line	ΔI _O	12.5 < V _I < 25V			1.5	mA
	with load	ΔI _O	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		ΔV _O /ΔT	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 = 0.1 μF, 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 _O	T _J = 25 °C		2.1	6.0	mA
Quiescent Current Change	with line	ΔI _O	16V ≤ V _I ≤ 27V			1.5	mA
	with load	ΔI _O	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		ΔV _O /ΔT	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 = 0.1 μF, 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 _O	T _J = 25 °C		2.1	6.0	mA
Quiescent Current Change	with line	ΔI _O	20V ≤ V _I ≤ 30V			1.5	mA
	with load	ΔI _O	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		ΔV _O /ΔT	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 = 0.1 μF, 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 21V ≤ V _I ≤ V _{MAX} (Note 2)	1mA ≤ I _O ≤ 40mA	17.1		18.9	V
			1mA ≤ I _O ≤ 70mA	17.1		18.9	V
Quiescent Current	I _Q	T _J = 25 °C			2.2	6.0	mA
Quiescent Current Change	with line	ΔI _Q	21V ≤ V _I ≤ 33V			1.5	mA
	with load		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	ΔV _O /ΔT	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

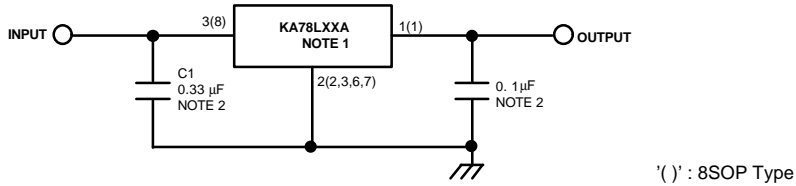
LM78L24 ELECTRICAL CHARACTERISTICS(V_I = 33V, I_O = 40mA, 0 °C ≤ T_J ≤ 125 °C, C_I = 0.33 μF, C_O = 0.1 μF, unless otherwise specified. (Note 1))

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 27V ≤ V _I ≤ V _{MAX} (Note 2)	1mA ≤ I _O ≤ 40mA	22.8		25.2	V
			1mA ≤ I _O ≤ 70mA	22.8		25.2	V
Quiescent Current	I _Q	T _J = 25 °C			2.2	6.0	mA
Quiescent Current Change	with line	ΔI _Q	28V ≤ V _I ≤ 38V			1.5	mA
	with load		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	ΔV _O /ΔT	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

- 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.
- Power dissipation ≤ 0.75W.

TYPICAL APPLICATION



Notes

1. To specify an output voltage, substitute voltage value for "XX".
2. 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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