

## Description

This series of fixed-voltage monolithic integrated-circuit voltage regulators is designed for a wide range of applications. These applications include on-card regulation for elimination of noise and distribution problems associated with single-point regulation. In addition, they can be used with power-pass elements to make high-current voltage regulators. Each of these regulators can deliver up to 100 mA of output current. The internal limiting and thermal shutdown features of these regulators make them essentially immune to overload. When used as a replacement for a Zener diode-resistor combination, an effective improvement in output impedance can be obtained together with lower-bias current.

## Features

- 3-Terminal Regulators
- Output Current Up to 100 mA
- No External Components
- Internal Thermal Overload Protection
- Internal Short-Circuit Limiting

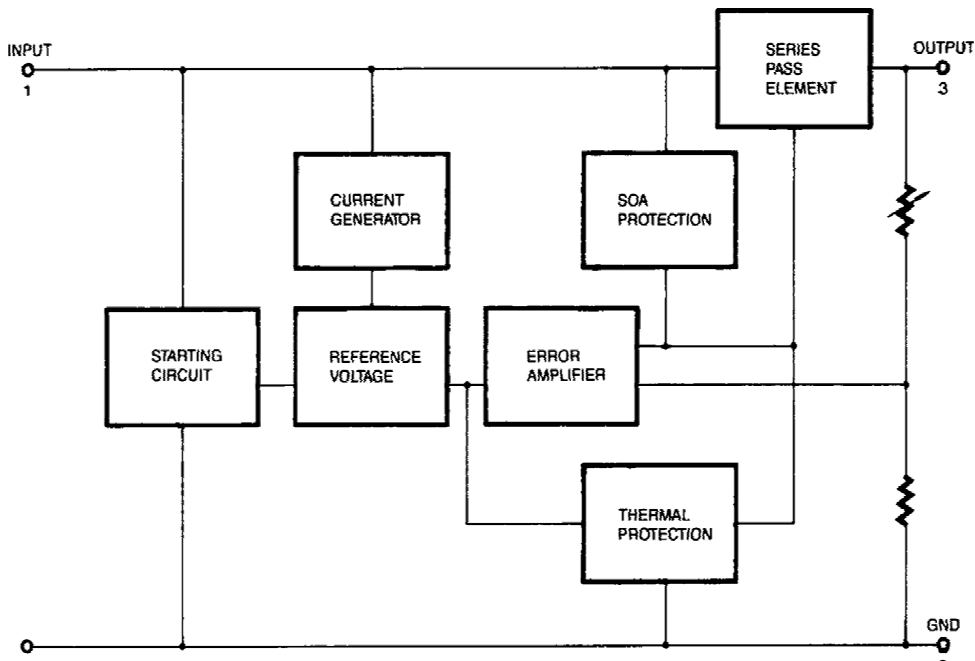


Package TO-92  
(top view)



Package

## Internal Block Diagram



## Absolute Maximum Ratings

over operating temperature range (unless otherwise noted)

Parameter	Maximum			Units
	78L05A thru 78L10A	78L12A thru 78L18A	78L24A	
Input voltage	30	35	40	V
Operating free-air, case, or virtual junction temperature range	0 to 150	0 to 150	0 to 150	°C
Storage temperature range	-65 to 150	-65 to 150	-65 to 150	
Lead temperature 1.6 mm (1/16 inch) from case for 10 seconds	260	260	260	

## Recommended Operating Conditions

Parameter		Min	Max	Units
Input voltage, $V_i$	78L05A	7	20	V
	78L06A	8	20	
	78L08A	10.5	23	
	78L09A	11.5	24	
	78L10A	12.5	25	
	78L12A	14.5	27	
	78L15A	17.5	30	
	78L18A	20.5	33	
	78L24A	26.5	39	
Output current, $I_o$			100	mA
Operating virtual junction temperature, $T_j$		0	125	°C

## Device Selection Guide

Device	Output Voltage
78L05A	5 V
78L06A	6 V
78L08A	8 V
78L09A	9 V
78L10A	10 V
78L12A	12 V
78L15A	15 V
78L18A	18 V
78L24A	24 V

## Electrical Characteristics 78L05A

Electrical characteristics at specified virtual junction temperature,  $V_i = 10V$ ,  $I_o = 40mA$  (unless otherwise noted)

Parameter	Test Conditions*		78L05A			Units
			Min	Typ	Max	
Output voltage**		25 °C	4.8	5	5.2	V
	$I_o = 1mA$ to 40 mA, $V_i = 7V$ to 20V	0 °C to 125 °C	4.75	5	5.25	
	$I_o = 1mA$ to 70mA,		4.75	5	5.25	
Input regulation	$V_i = 7V$ to 20V	25 °C		32	150	mV
	$V_i = 8V$ to 20V			26	100	
Ripple rejection	$V_i = 8V$ to 18V, $f = 120Hz$	25 °C	41	49		dB
Output regulation	$I_o = 1mA$ to 100mA	25 °C		15	60	mV
	$I_o = 1mA$ to 40mA			8	30	
Output noise voltage	$f = 10Hz$ to 100 KHz	25 °C		42		$\mu V$
Dropout voltage		25 °C		1.7		
V Bias current		25 °C		3.8	6	mA
		125 °C			5.5	
Bias current change	$V_i = 8V$ to 20V	0 °C to 125 °C			1.5	
	$I_o = 1mA$ to 40mA				0.1	

## Electrical Characteristics 78L06A

Electrical characteristics at specified virtual junction temperature,  $V_i = 11V$ ,  $I_o = 40mA$  (unless otherwise noted)

Parameter	Test Conditions*		78L06A			Units
			Min	Typ	Max	
Output voltage**		25 °C	5.75	6	6.25	V
	$I_o = 1mA$ to 40 mA, $V_i = 8V$ to 20V	0 °C to 125 °C	5.7	6	6.3	
	$I_o = 1mA$ to 70mA,		5.7	6	6.3	
Input regulation	$V_i = 8V$ to 20V	25 °C		35	175	mV
	$V_i = 9V$ to 20V			29	125	
Ripple rejection	$V_i = 9V$ to 19V, $f = 120Hz$	25 °C	40	48		dB
Output regulation	$I_o = 1mA$ to 100mA	25 °C		16	80	mV
	$I_o = 1mA$ to 40mA			9	40	
Output noise voltage	$f = 10Hz$ to 100 KHz	25 °C		46		$\mu V$
Dropout voltage		25 °C		1.7		
Bias current		25 °C		3.9	6	mA
		125 °C			5.5	
Bias current change	$V_i = 9V$ to 20V	0 °C to 125 °C			1.5	
	$I_o = 1mA$ to 40mA				0.1	

\* Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.33 $\mu F$  capacitor across the input and a

0.1 $\mu F$  capacitor across the output.

## Electrical Characteristics 78L08A

Electrical characteristics at specified virtual junction temperature,  $V_i = 14V$ ,  $I_o = 40mA$  (unless otherwise noted)

Parameter	Test Conditions*		78L08A			Units
			Min	Typ	Max	
Output voltage**		25 °C	7.7	8	8.3	V
	$I_o = 1mA$ to 40 mA, $V_i = 10.5V$ to 23V	0 °C to 125 °C	7.6	8	8.4	
	$I_o = 1mA$ to 70mA, $V_i = 10.5V$ to 23V		7.6	8	8.4	
Input regulation	$V_i = 10.5V$ to 23V	25 °C		42	175	mV
	$V_i = 11V$ to 23V			36	125	
Ripple rejection	$V_i = 13V$ to 23V, $f = 120Hz$	0 °C to 125 °C	37	46		dB
Output regulation	$I_o = 1mA$ to 100mA	25 °C		18	80	µV
	$I_o = 1mA$ to 40mA			10	40	
Output noise voltage	$f = 10Hz$ to 100 KHz	25 °C		54		mV
Dropout voltage		25 °C		1.7		
Bias current		25 °C		4	6	mA
		125 °C			5.5	
Bias current change	$V_i = 11V$ to 23V	0 °C to 125 °C			1.5	
	$I_o = 1mA$ to 40mA				0.1	

## Electrical Characteristics 78L09A

Electrical characteristics at specified virtual junction temperature,  $V_i = 16V$ ,  $I_o = 40mA$  (unless otherwise noted)

Parameter	Test Conditions*		78L09A			Units
			Min	Typ	Max	
Output voltage**		25 °C	8.6	9	9.4	V
	$I_o = 1mA$ to 40 mA, $V_i = 12V$ to 24V	0 °C to 125 °C	8.55	9	9.45	
	$I_o = 1mA$ to 70mA, $V_i = 12V$ to 24V		8.55	9	9.45	
Input regulation	$V_i = 12V$ to 24V	25 °C		45	175	mV
	$V_i = 13V$ to 24V			40	125	
Ripple rejection	$V_i = 15V$ to 25V, $f = 120Hz$	0 °C to 125 °C	38	45		dB
Output regulation	$I_o = 1mA$ to 100mA	25 °C		19	90	mV
	$I_o = 1mA$ to 40mA			11	40	
Output noise voltage	$f = 10Hz$ to 100 KHz	25 °C		58		µV
Dropout voltage		25 °C		1.7		
Bias current		25 °C		4.1	6	mA
		125 °C			5.5	
Bias current change	$V_i = 13V$ to 24V	0 °C to 125 °C			1.5	
	$I_o = 1mA$ to 40mA				0.1	

\* Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.33µF capacitor across the input and a

0.1µF capacitor across the output.

## Electrical Characteristics 78L10A

Electrical characteristics at specified virtual junction temperature,  $V_i = 17V$ ,  $I_o = 40mA$  (unless otherwise noted)

Parameter	Test Conditions*		78L10A			Units
			Min	Typ	Max	
Output voltage**		25 °C	9.6	10	10.4	V
	$I_o = 1mA$ to 40 mA, $V_i = 13V$ to 25V	0 °C to 125 °C	9.5	10	10.5	
	$I_o = 1mA$ to 70mA,		9.5	10	10.5	
Input regulation	$V_i = 13V$ to 25V	25 °C		51	175	mV
	$V_i = 14V$ to 25V			42	125	
Ripple rejection	$V_i = 15V$ to 25V, $f = 120Hz$	0 °C to 125 °C	37	44		dB
Output regulation	$I_o = 1mA$ to 100mA	25 °C		20	90	mV
	$I_o = 1mA$ to 40mA			11	40	
Output noise voltage	$f = 10Hz$ to 100 KHz	25 °C		62		$\mu V$
Dropout voltage		25 °C		1.7		V
Bias current		25 °C		4.2	6	mA
		125 °C			5.5	
Bias current change	$V_i = 14V$ to 25V	0 °C to 125 °C			1.5	
	$I_o = 1mA$ to 40mA				0.1	

## Electrical Characteristics 78L12A

Electrical characteristics at specified virtual junction temperature,  $V_i = 19V$ ,  $I_o = 40mA$  (unless otherwise noted)

Parameter	Test Conditions*		78L12A			Units
			Min	Typ	Max	
Output voltage**		25 °C	11.5	12	12.5	V
	$I_o = 1mA$ to 40mA, $V_i = 14V$ to 27V	0 °C to 125 °C	11.4	12	12.6	
	$I_o = 1mA$ to 70mA		11.4	12	12.6	
Input regulation	$V_i = 14.5V$ to 27V	25 °C		55	250	mV
	$V_i = 16V$ to 27V			49	200	
Ripple rejection	$V_i = 15V$ to 25V, $f = 120Hz$	0 °C to 125 °C	37	42		dB
Output regulation	$I_o = 1mA$ to 100mA	25 °C		22	100	mV
	$I_o = 1mA$ to 40mA			13	50	
Output noise voltage	$f = 10Hz$ to 100 KHz	25 °C		70		$\mu V$
Dropout voltage		25 °C		1.7		
V Bias current		25 °C		4.3	6.5	mA
		125 °C			6	
Bias current change	$V_i = 16V$ to 27V	0 °C to 125 °C			1.5	
	$I_o = 1mA$ to 40mA				0.1	

\* Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately. All characteristics are measured with a 0.33 $\mu F$  capacitor across the input and a

0.1 $\mu F$  capacitor across the output.

## Electrical Characteristics 78L15A

Electrical characteristics at specified virtual junction temperature,  $V_i = 23V$ ,  $I_o = 40mA$  (unless otherwise noted)

Parameter	Test Conditions*	78L15A			Units	
		Min	Typ	Max		
Output voltage**	$25^{\circ}C$	14.4	15	15.6	V	
	$I_o = 1mA$ to $40mA$ , $V_i = 17.5V$ to $30V$ $I_o = 1mA$ to $70mA$ $V_i = 17.5V$ to $30V$ $V_i = 19V$ to $30V$	$0^{\circ}C$ to $125^{\circ}C$	14.25	15		15.75
			14.25	15		15.75
Input regulation	$25^{\circ}C$		65	300	mV	
			58	250		
Ripple rejection	$V_i = 18.5V$ to $28.5V$ , $f = 120Hz$	$0^{\circ}C$ to $125^{\circ}C$	34	39	dB	
Output regulation	$I_o = 1mA$ to $100mA$	$25^{\circ}C$		25	150	mV
	$I_o = 1mA$ to $40mA$			15	75	
Output noise voltage	$f = 10Hz$ to $100KHz$	$25^{\circ}C$		82	$\mu V$	
Dropout voltage		$25^{\circ}C$		1.7	V	
Bias current		$25^{\circ}C$		4.6	6.5	mA
		$125^{\circ}C$			6	
Bias current change	$V_i = 19V$ to $30V$	$0^{\circ}C$ to $125^{\circ}C$			1.5	mA
	$I_o = 1mA$ to $40mA$				0.1	

## Electrical Characteristics 78L18A

Electrical characteristics at specified virtual junction temperature,  $V_i = 26V$ ,  $I_o = 40mA$  (unless otherwise noted)

Parameter	Test Conditions*	78L18A			Units	
		Min	Typ	Max		
Output voltage**	$25^{\circ}C$	17.3	18	18.7	V	
	$I_o = 1mA$ to $40mA$ , $V_i = 20.5V$ to $33V$ $I_o = 1mA$ to $70mA$ $V_i = 20.5V$ to $33V$ $V_i = 22V$ to $33V$	$0^{\circ}C$ to $125^{\circ}C$	17.1	18		18.9
			17.1	18		18.9
Input regulation	$25^{\circ}C$		70	360	mV	
			64	300		
Ripple rejection	$V_i = 21.5V$ to $31.5V$ , $f = 120Hz$	$0^{\circ}C$ to $125^{\circ}C$	32	36	dB	
Output regulation	$I_o = 1mA$ to $100mA$	$25^{\circ}C$		27	180	mV
	$I_o = 1mA$ to $40mA$			19	90	
Output noise voltage	$f = 10Hz$ to $100KHz$	$25^{\circ}C$		89	$\mu V$	
Dropout voltage		$25^{\circ}C$		1.7		
Bias current	V Bias current 6.5			$25^{\circ}C$	4.7	mA
		$125^{\circ}C$			6	
Bias current change	$V_i = 22V$ to $33V$	$0^{\circ}C$ to $125^{\circ}C$			1.5	mA
	$I_o = 1mA$ to $40mA$				0.1	

\* Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately. All characteristics are measured with a  $0.33\mu F$  capacitor across the input and a

$0.1\mu F$  capacitor across the output.

## Electrical Characteristics 78L24A

Electrical characteristics at specified virtual junction temperature,  $V_i = 32V$ ,  $I_o = 40mA$  (unless otherwise noted)

Parameter	Test Conditions*	78L24A			Units	
		Min	Typ	Max		
Output voltage**	$25^{\circ}C$	23	24	25	V	
	$I_o = 1mA \text{ to } 40mA$ , $V_i = 26.5V \text{ to } 39V$ $I_o = 1mA \text{ to } 70mA$ $V_i = 26.5V \text{ to } 39V$ $V_i = 29V \text{ to } 39V$	$0^{\circ}C \text{ to } 125^{\circ}C$	22.8	24		25.2
			22.8	24		25.2
Input regulation	$25^{\circ}C$		95	480	mV	
			78	400		
Ripple rejection	$V_i = 27.5V \text{ to } 37.5V$ , $f = 120Hz$	$0^{\circ}C \text{ to } 125^{\circ}C$	30	33	dB	
Output regulation	$I_o = 1mA \text{ to } 100mA$	$25^{\circ}C$		41	240	mV
	$I_o = 1mA \text{ to } 40mA$			28	120	
Output noise voltage	$f = 10Hz \text{ to } 100KHz$	$25^{\circ}C$		97	$\mu V$	
Dropout voltage		$25^{\circ}C$		1.7		
V Bias current		$25^{\circ}C$		4.8	6.5	mA
		$125^{\circ}C$			6	
Bias current change	$V_i = 28V \text{ to } 39V$	$0^{\circ}C \text{ to } 125^{\circ}C$			1.5	
	$I_o = 1mA \text{ to } 40mA$				0.1	

\* Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately. All characteristics are measured with a  $0.33\mu F$  capacitor across the input and a

$0.1\mu F$  capacitor across the output.

## Ordering Information

ORDERING NUMBER	PACKAGE	MARKING
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