

**3-TERMINAL 0.1A POSITIVE VOLTAGE REGULATORS**

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 100mA of output current.

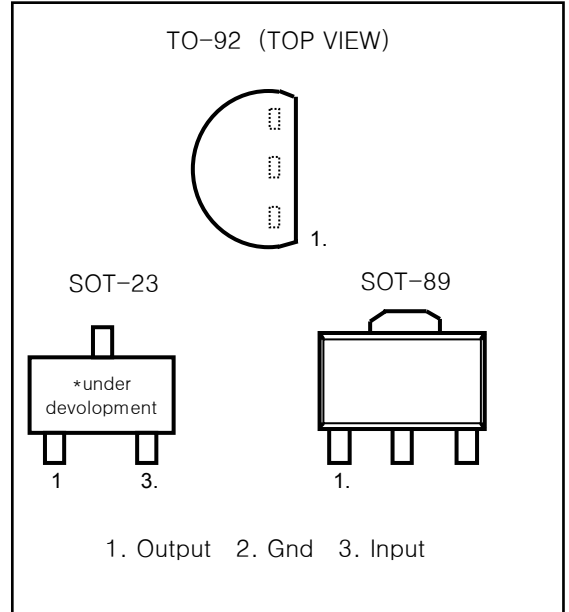
The internal limiting and thermal shutdown features of these regulators make them essentially immune to overload. When used as a replacement for a zener diode-resistor combination, an effective improvement in output impedance can be obtained together with lower-bias current.

**FEATURES**

- ◇ Output Current Up to 100mA
- ◇ No External Components
- ◇ Internal Thermal Overload Protection
- ◇ Internal Short-Circuit Limiting
- ◇ Output Voltage of 5V, 6V, 8V, 9V, 10V, 12V, 15V, 18V and 24V

**ABSOLUTE MAXIMUM RATINGS**

Characteristic		Symbol	Value	Unit
Input voltage	LM78L05 /A/C ~ LM78L10	$V_i$	30	V
	LM78L12 ~ LM78L18		35	
	LM78L24		40	
Operating junction temperature		$T_{opr}$	0 ~ +150	°C
Storage temperature		$T_{stg}$	-65 ~ +150	
Soldering temperature and time		$T_{sol}$	260/10sec	



**ORDERING INFORMATION**

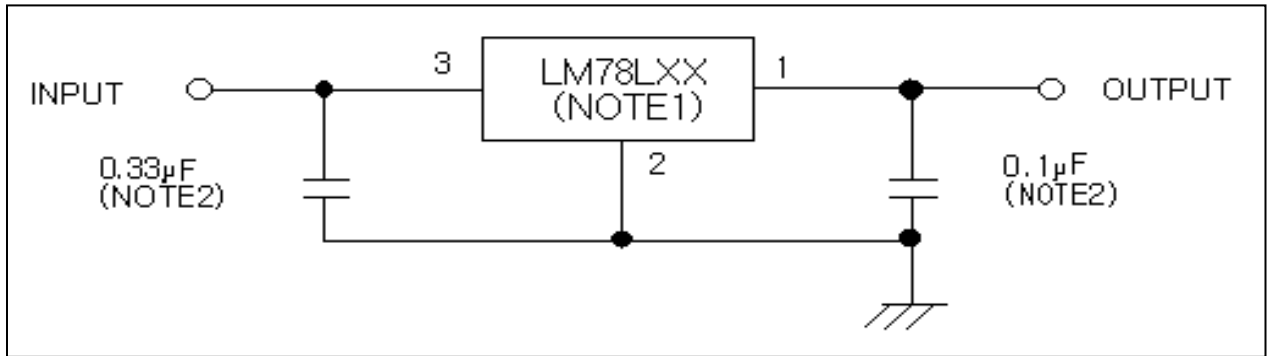
Device	Marking	Package
LM78LXX	LM78LXX	TO-92
LM78L05 /A /C	LM78L05 /A /C	
LM78L05NF	805	SOT-89
LM78L05AF/CF		
LM78L06F~24F	806~824	

XX = Output Voltage or Grade

RECOMMENDED OPERATING CONDITIONS

		Min.	Max.	Unit
Input voltage, $V_i$	LM78L05 / A / C	7	20	V
	LM78L06	8	20	
	LM78L08	10.5	23	
	LM78L09	11.5	24	
	LM78L10	12.5	25	
	LM78L12	14.5	27	
	LM78L15	17.5	30	
	LM78L18	20.5	33	
	LM78L24	26.5	39	
Output current, $I_o$			100	mA
Operating virtual junction temperature, $T_j$		0	125	°C

TYPICAL APPLICATION



Notes

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

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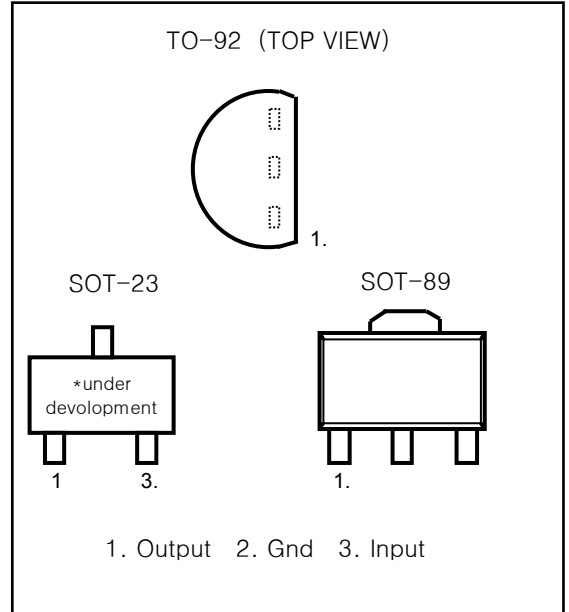
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**FEATURES**

- ◇ Output Current Up to 100mA
- ◇ No External Components
- ◇ Internal Thermal Overload Protection
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- ◇ Output Voltage of 5V, 6V, 8V, 9V, 10V, 12V, 15V, 18V and 24V

**ABSOLUTE MAXIMUM RATINGS**

Characteristic		Symbol	Value	Unit
Input voltage	LM78L05 /A/C ~ LM78L10	V <sub>i</sub>	30	V
	LM78L12 ~ LM78L18		35	
	LM78L24		40	
Operating junction temperature		T <sub>opr</sub>	0 ~ +150	°C
Storage temperature		T <sub>stg</sub>	-65 ~ +150	
Soldering temperature and time		T <sub>sol</sub>	260/10sec	



**ORDERING INFORMATION**

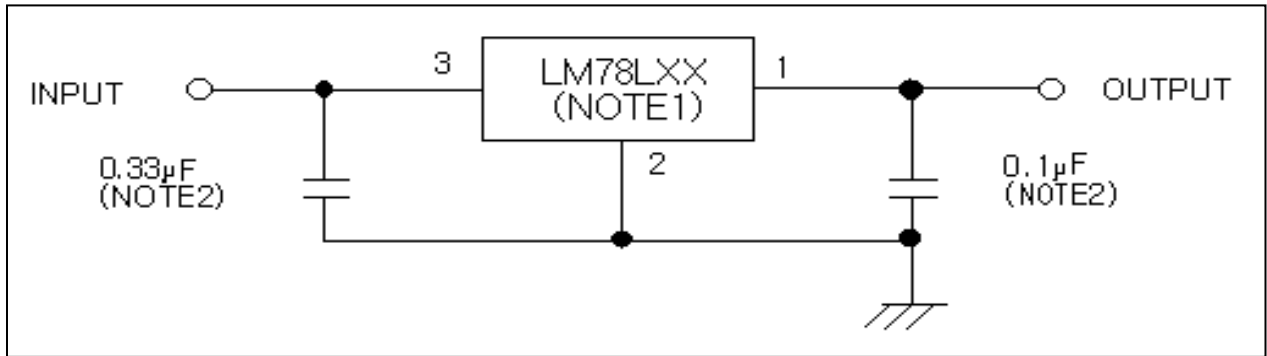
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LM78L05 /A /C	LM78L05 /A /C	
LM78L05NF	805	SOT-89
LM78L05AF/CF		
LM78L06F~24F	806~824	

XX = Output Voltage or Grade

RECOMMENDED OPERATING CONDITIONS

		Min.	Max.	Unit
Input voltage, $V_i$	LM78L05 / A / C	7	20	V
	LM78L06	8	20	
	LM78L08	10.5	23	
	LM78L09	11.5	24	
	LM78L10	12.5	25	
	LM78L12	14.5	27	
	LM78L15	17.5	30	
	LM78L18	20.5	33	
	LM78L24	26.5	39	
Output current, $I_o$			100	mA
Operating virtual junction temperature, $T_j$		0	125	°C

TYPICAL APPLICATION



Notes

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

**LM78L05 ELECTRICAL CHARACTERISTICS**

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

Characteristic	Symbol	Test condition *	Min.	Typ.	Max.	Unit	
Output voltage **	$V_{OUT}$		25°C	4.8	5	5.2	V
		$1mA \leq I_o \leq 40mA$ $7V \leq V_i \leq 20V$	0°C ~ 125°C	4.75	5	5.25	
		$1mA \leq I_o \leq 70mA$		4.75	5	5.25	
Line regulation	Reg line	$7V \leq V_i \leq 20V$	25°C		32	150	mV
		$8V \leq V_i \leq 20V$			26	100	
Load regulation	Reg load	$1mA \leq I_o \leq 100mA$	25°C		15	60	mV
		$1mA \leq I_o \leq 40mA$			8	30	
Bias current	$I_B$		25°C		3.8	6	mA
			125°C			5.5	
Bias current change	$\Delta I_B$	$9V \leq V_i \leq 20V$	0°C ~ 125°C			1.5	mA
		$1mA \leq I_o \leq 40mA$				0.1	
Output noise voltage	$V_N$	$10Hz \leq f \leq 100kHz$	25°C		42		$\mu V$
Ripple rejection	RR	$8V \leq V_i \leq 18V$ $f=120Hz$	25°C	41	49		dB
Dropout voltage	$V_D$		25°C		1.7		V

**Notes**

\*. 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.

\*\* . This specification applies only for DC power dissipation permitted by absolute maximum ratings.

**LM78L05A ELECTRICAL CHARACTERISTICS**

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

Characteristic	Symbol	Test condition *	Min.	Typ.	Max.	Unit	
Output voltage **	$V_{OUT}$		25°C	4.9	5	5.1	V
		$1mA \leq I_o \leq 40mA$ $7V \leq V_i \leq 20V$	0°C ~ 125°C	4.9	5	5.1	
		$1mA \leq I_o \leq 70mA$		4.9	5	5.1	
Line regulation	Reg line	$7V \leq V_i \leq 20V$	25°C		5	50	mV
		$8V \leq V_i \leq 20V$			3	25	
Load regulation	Reg load	$1mA \leq I_o \leq 100mA$	25°C		15	60	mV
		$1mA \leq I_o \leq 40mA$			8	30	
Bias current	$I_B$		25°C		3.8	6	mA
			125°C			5.5	
Bias current change	$\Delta I_B$	$9V \leq V_i \leq 20V$	0°C ~ 125°C			1.5	mA
		$1mA \leq I_o \leq 40mA$				0.1	
Output noise voltage	$V_N$	$10Hz \leq f \leq 100kHz$	25°C		42		$\mu V$
Ripple rejection	RR	$8V \leq V_i \leq 18V$ $f=120Hz$	25°C	41	49		dB
Dropout voltage	$V_D$		25°C		1.7		V

**Notes**

\*. 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.

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**LM78L05C ELECTRICAL CHARACTERISTICS**

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

Characteristic	Symbol	Test condition *		Min.	Typ.	Max.	Unit
Output voltage **	$V_{OUT}$		25°C	4.95	5	5.05	V
		$1mA \leq I_o \leq 40mA$ $7V \leq V_i \leq 20V$	0°C ~ 125°C	4.95	5	5.05	
		$1mA \leq I_o \leq 70mA$		4.95	5	5.05	
Line regulation	Reg line	$7V \leq V_i \leq 20V$	25°C		5	50	mV
		$8V \leq V_i \leq 20V$			3	25	
Load regulation	Reg load	$1mA \leq I_o \leq 100mA$	25°C		15	50	mV
		$1mA \leq I_o \leq 40mA$			8	25	
Bias current	$I_B$		25°C		3.8	6	mA
			125°C			5.5	
Bias current change	$\Delta I_B$	$9V \leq V_i \leq 20V$	0°C ~ 125°C			1.5	mA
		$1mA \leq I_o \leq 40mA$				0.1	
Output noise voltage	$V_N$	$10Hz \leq f \leq 100kHz$	25°C		42		$\mu V$
Ripple rejection	RR	$8V \leq V_i \leq 18V$ $f=120Hz$	25°C	41	49		dB
Dropout voltage	$V_D$		25°C		1.7		V

**Notes**

\*. 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.

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**LM78L06 ELECTRICAL CHARACTERISTICS**

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

Characteristic	Symbol	Test condition *		Min.	Typ.	Max.	Unit
Output voltage **	$V_{OUT}$		25°C	5.75	6	6.25	V
		$1mA \leq I_o \leq 40mA$ $8V \leq V_i \leq 20V$	0°C ~ 125°C	5.7	6	6.3	
		$1mA \leq I_o \leq 70mA$		5.7	6	6.3	
Line regulation	Reg line	$8V \leq V_i \leq 20V$	25°C		35	175	mV
		$9V \leq V_i \leq 20V$			29	125	
Load regulation	Reg load	$1mA \leq I_o \leq 100mA$	25°C		16	80	mV
		$1mA \leq I_o \leq 40mA$			9	40	
Bias current	$I_B$		25°C		3.9	6	mA
			125°C			5.5	
Bias current change	$\Delta I_B$	$9V \leq V_i \leq 20V$	0°C ~ 125°C			1.5	mA
		$1mA \leq I_o \leq 40mA$				0.1	
Output noise voltage	$V_N$	$10Hz \leq f \leq 100kHz$	25°C		46		$\mu V$
Ripple rejection	RR	$9V \leq V_i \leq 19V$ $f=120Hz$	25°C	40	48		dB
Dropout voltage	$V_D$		25°C		1.7		V

Notes

\*. 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.

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**LM78L08 ELECTRICAL CHARACTERISTICS**

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

Characteristic	Symbol	Test condition *		Min.	Typ.	Max.	Unit
Output voltage **	$V_{OUT}$		25°C	7.7	8	8.3	V
		$1mA \leq I_o \leq 40mA$ $10.5V \leq V_i \leq 23V$	0°C ~ 125°C	7.6	8	8.4	
		$1mA \leq I_o \leq 70mA$		7.6	8	8.4	
Line regulation	Reg line	$10.5V \leq V_i \leq 23V$	25°C		42	175	mV
		$11V \leq V_i \leq 23V$			36	125	
Load regulation	Reg load	$1mA \leq I_o \leq 100mA$	25°C		18	80	mV
		$1mA \leq I_o \leq 40mA$			10	40	
Bias current	$I_B$		25°C		4	6	mA
			125°C			5.5	
Bias current change	$\Delta I_B$	$11V \leq V_i \leq 23V$	0°C ~ 125°C			1.5	mA
		$1mA \leq I_o \leq 40mA$				0.1	
Output noise voltage	$V_N$	$10Hz \leq f \leq 100kHz$	25°C		54		$\mu V$
Ripple rejection	RR	$13V \leq V_i \leq 23V$ $f=120Hz$	25°C	37	46		dB
Dropout voltage	$V_D$		25°C		1.7		V

Notes

\*. 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.

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**LM78L09 ELECTRICAL CHARACTERISTICS**

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

Characteristic	Symbol	Test condition *		Min.	Typ.	Max.	Unit
Output voltage **	$V_{OUT}$		25°C	8.6	9	9.4	V
		$1mA \leq I_o \leq 40mA$ $12V \leq V_i \leq 24V$	0°C ~ 125°C	8.55	9	9.45	
		$1mA \leq I_o \leq 70mA$		8.55	9	9.45	
Line regulation	Reg line	$12V \leq V_i \leq 24V$	25°C		45	175	mV
		$13V \leq V_i \leq 24V$			40	125	
Load regulation	Reg load	$1mA \leq I_o \leq 100mA$	25°C		19	90	mV
		$1mA \leq I_o \leq 40mA$			11	40	
Bias current	$I_B$		25°C		4.1	6	mA
			125°C			5.5	
Bias current change	$\Delta I_B$	$13V \leq V_i \leq 24V$	0°C ~ 125°C			1.5	mA
		$1mA \leq I_o \leq 40mA$				0.1	
Output noise voltage	$V_N$	$10Hz \leq f \leq 100kHz$	25°C		58		$\mu V$
Ripple rejection	RR	$13V \leq V_i \leq 23V$ $f=120Hz$	25°C	38	45		dB
Dropout voltage	$V_D$		25°C		1.7		V

Notes

\*. 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.

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**LM78L10 ELECTRICAL CHARACTERISTICS**

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

Characteristic	Symbol	Test condition *		Min.	Typ.	Max.	Unit
Output voltage **	$V_{OUT}$		25°C	9.6	10	10.4	V
		$1mA \leq I_o \leq 40mA$ $13V \leq V_i \leq 25V$	0°C ~ 125°C	9.5	10	10.5	
		$1mA \leq I_o \leq 70mA$		9.5	10	10.5	
Line regulation	Reg line	$13V \leq V_i \leq 25V$	25°C		51	175	mV
		$14V \leq V_i \leq 25V$			42	125	
Load regulation	Reg load	$1mA \leq I_o \leq 100mA$	25°C		20	90	mV
		$1mA \leq I_o \leq 40mA$			11	40	
Bias current	$I_B$		25°C		4.2	6	mA
			125°C			5.5	
Bias current change	$\Delta I_B$	$14V \leq V_i \leq 25V$	0°C ~ 125°C			1.5	mA
		$1mA \leq I_o \leq 40mA$				0.1	
Output noise voltage	$V_N$	$10Hz \leq f \leq 100kHz$	25°C		62		$\mu V$
Ripple rejection	RR	$15V \leq V_i \leq 25V$ $f=120Hz$	25°C	37	44		dB
Dropout voltage	$V_D$		25°C		1.7		V

Notes

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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.

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**LM78L12 ELECTRICAL CHARACTERISTICS**

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

Characteristic	Symbol	Test condition *		Min.	Typ.	Max.	Unit
Output voltage **	$V_{OUT}$		25°C	11.5	12	12.5	V
		$1mA \leq I_o \leq 40mA$ $14V \leq V_i \leq 27V$	0°C ~ 125°C	11.4	12	12.6	
		$1mA \leq I_o \leq 70mA$		11.4	12	12.6	
Line regulation	Reg line	$14.5V \leq V_i \leq 27V$	25°C		55	250	mV
		$16V \leq V_i \leq 27V$			49	200	
Load regulation	Reg load	$1mA \leq I_o \leq 100mA$	25°C		22	100	mV
		$1mA \leq I_o \leq 40mA$			13	50	
Bias current	$I_B$		25°C		4.3	6.5	mA
			125°C			6	
Bias current change	$\Delta I_B$	$16V \leq V_i \leq 27V$	0°C ~ 125°C			1.5	mA
		$1mA \leq I_o \leq 40mA$				0.1	
Output noise voltage	$V_N$	$10Hz \leq f \leq 100kHz$	25°C		70		$\mu V$
Ripple rejection	RR	$15V \leq V_i \leq 25V$ $f=120Hz$	25°C	37	42		dB
Dropout voltage	$V_D$		25°C		1.7		V

Notes

\*. 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.

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**LM78L15 ELECTRICAL CHARACTERISTICS**

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

Characteristic	Symbol	Test condition *		Min.	Typ.	Max.	Unit
Output voltage **	$V_{OUT}$		25°C	14.4	15	15.6	V
		$1mA \leq I_o \leq 40mA$ $17.5V \leq V_i \leq 30V$	0°C ~ 125°C	14.25	15	15.75	
		$1mA \leq I_o \leq 70mA$		14.25	15	15.75	
Line regulation	Reg line	$17.5V \leq V_i \leq 30V$	25°C		65	300	mV
		$19V \leq V_i \leq 30V$			58	250	
Load regulation	Reg load	$1mA \leq I_o \leq 100mA$	25°C		25	150	mV
		$1mA \leq I_o \leq 40mA$			15	75	
Bias current	$I_B$		25°C		4.2	6.5	mA
			125°C			6	
Bias current change	$\Delta I_B$	$19V \leq V_i \leq 30V$	0°C ~ 125°C			1.5	mA
		$1mA \leq I_o \leq 40mA$				0.1	
Output noise voltage	$V_N$	$10Hz \leq f \leq 100kHz$	25°C		82		$\mu V$
Ripple rejection	RR	$18.5V \leq V_i \leq 28.5V$ $f=120Hz$	25°C	37	44		dB
Dropout voltage	$V_D$		25°C		1.7		V

Notes

\*. 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.

\*\* . This specification applies only for DC power dissipation permitted by absolute maximum ratings.

**LM78L18 ELECTRICAL CHARACTERISTICS**

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

Characteristic	Symbol	Test condition *	Min.	Typ.	Max.	Unit	
Output voltage **	$V_{OUT}$		25°C	17.3	18	18.7	V
		$1mA \leq I_o \leq 40mA$ $20.5V \leq V_i \leq 33V$	0°C ~ 125°C	17.1	18	18.9	
		$1mA \leq I_o \leq 70mA$		17.1	18	18.9	
Line regulation	Reg line	$20.5V \leq V_i \leq 33V$	25°C		70	360	mV
		$22V \leq V_i \leq 33V$			64	300	
Load regulation	Reg load	$1mA \leq I_o \leq 100mA$	25°C		27	180	mV
		$1mA \leq I_o \leq 40mA$			19	90	
Bias current	$I_B$		25°C		4.7	6.5	mA
			125°C			6	
Bias current change	$\Delta I_B$	$22V \leq V_i \leq 33V$	0°C ~ 125°C			1.5	mA
		$1mA \leq I_o \leq 40mA$				0.1	
Output noise voltage	$V_N$	$10Hz \leq f \leq 100kHz$	25°C		82		$\mu V$
Ripple rejection	RR	$21.5V \leq V_i \leq 31.5V$ $f=120Hz$	25°C	32	36		dB
Dropout voltage	$V_D$		25°C		1.7		V

**Notes**

\*. 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.

\*\* . This specification applies only for DC power dissipation permitted by absolute maximum ratings.

**LM78L24 ELECTRICAL CHARACTERISTICS**

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

Characteristic	Symbol	Test condition *		Min.	Typ.	Max.	Unit
Output voltage **	$V_{OUT}$		25°C	23	24	25	V
		$1mA \leq I_o \leq 40mA$ $26.5V \leq V_i \leq 39V$	0°C ~ 125°C	22.8	24	25.2	
		$1mA \leq I_o \leq 70mA$		22.8	24	25.2	
Line regulation	Reg line	$26.5V \leq V_i \leq 39V$	25°C		95	480	mV
		$29V \leq V_i \leq 39V$			78	400	
Load regulation	Reg load	$1mA \leq I_o \leq 100mA$	25°C		41	240	mV
		$1mA \leq I_o \leq 40mA$			28	120	
Bias current	$I_B$		25°C		4.8	6.5	mA
			125°C			6	
Bias current change	$\Delta I_B$	$28V \leq V_i \leq 39V$	0°C ~ 125°C			1.5	mA
		$1mA \leq I_o \leq 40mA$				0.1	
Output noise voltage	$V_N$	$10Hz \leq f \leq 100kHz$	25°C		82		$\mu V$
Ripple rejection	RR	$27.5V \leq V_i \leq 37.5V$ $f=120Hz$	25°C	30	33		dB
Dropout voltage	$V_D$		25°C		1.7		V

Notes

\*. 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.

\*\* . This specification applies only for DC power dissipation permitted by absolute maximum ratings.