

# POSITIVE VOLTAGE REGULATOR

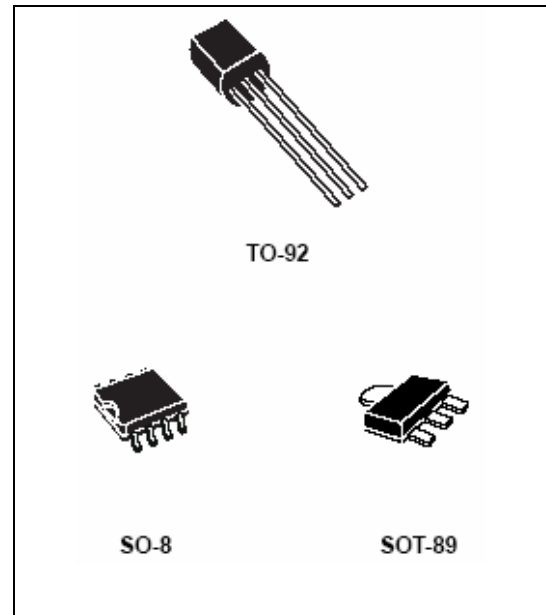
## 3-TERMINAL 0.1A POSITIVE VOLTAGE REGULATORS

**IL78Lxx**

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 output current.

The internal limiting and thermal shutdown features of these regulators make them essentially immune to overload.

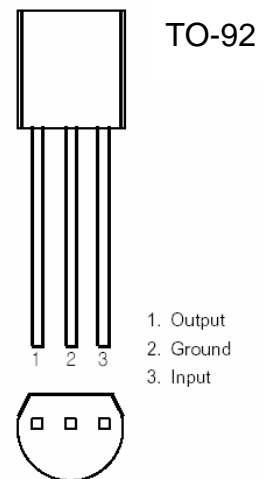
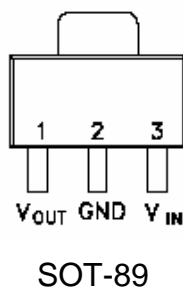
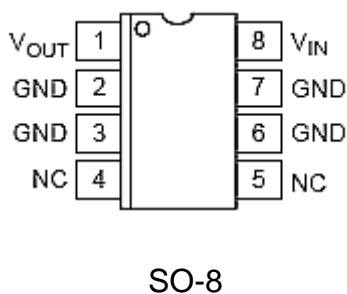
When used as a replacement for a zener diode-resistor combination, an effective improvement in output impedance can be obtained together with lower-bias current.



### 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

### Pin Configuration



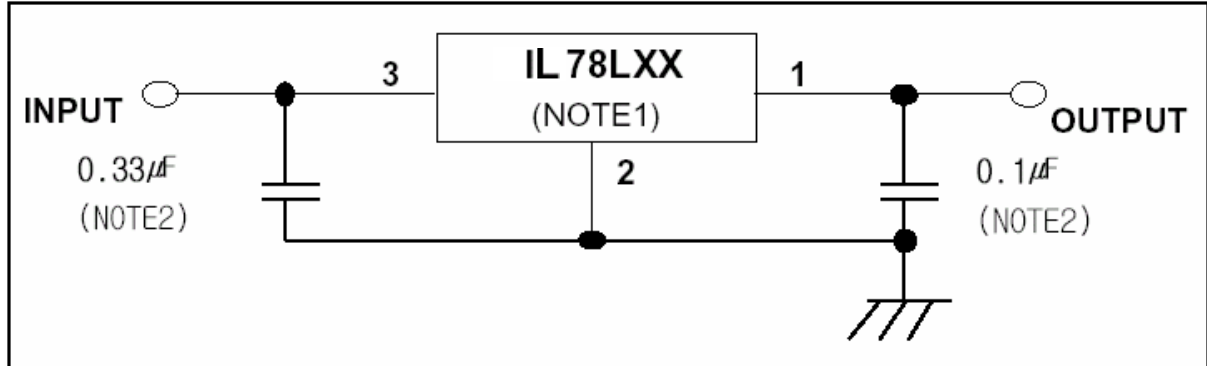
### Absolute Maximum Ratings

Characteristic		Symbol	Value	Unit
Input voltage	IL78L05 ~ IL78L10	VI	30	V
	IL78L12 ~ IL78L18		35	
	IL78L24		40	
Operating junction temperature		Topr	-40 ~ +150	°C
Storage temperature		Tstg	-65 ~ +150	
Soldering temperature and time		Tsol	260/10sec	

**RECOMMENDED OPERATING CONDITIONS**

78Lxx		Min.	Max.	Unit
Input voltage, $V_I$	IL78L05	7	20	V
	IL78L06	8	20	
	IL78L08	10.5	23	
	IL78L09	11.5	24	
	IL78L10	12.5	25	
	IL78L12	14.5	27	
	IL78L15	17.5	30	
	IL78L18	20.5	33	
	IL78L24	26.5	39	
Output current, $I_o$			100	mA
Operating virtual junction temperature, $T_j$		-40	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.

IL78L05 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 <sub>out</sub>	25 °C		4.8	5	5.2	V
		1 mA ≤ I <sub>o</sub> ≤ 40 mA 7V ≤ V <sub>I</sub> ≤ V <sub>max</sub>	-40 ~ 125 °C	4.75	5	5.25	
		1 mA ≤ I <sub>o</sub> ≤ 70 mA		4.75	5	5.25	
Line regulation	Reg line	7 ≤ V <sub>I</sub> ≤ 20V	25 °C		32	150	mV
		8 ≤ V <sub>I</sub> ≤ 20V			26	100	
Load regulation	Reg load	1 mA ≤ I <sub>o</sub> ≤ 100 mA	25 °C		15	60	mV
		1 mA ≤ I <sub>o</sub> ≤ 40 mA			8	30	
Bias current	I <sub>B</sub>		25 °C		3.8	6	mA
			125 °C			5.5	
Bias current change	ΔI <sub>B</sub>	9 ≤ V <sub>I</sub> ≤ 20V	-40 ~ 125 °C			1.5	mA
		1 mA ≤ I <sub>o</sub> ≤ 40 mA				0.1	
Output noise voltage	V <sub>N</sub>	10 Hz ≤ f ≤ 100 kHz	25 °C		42		μV
Ripple rejection	RR	8 ≤ V <sub>I</sub> ≤ 20V f=120 Hz	25 °C	41	49		dB
Dropout voltage	V <sub>D</sub>		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 μF capacitor across the input and a 0.1 μF capacitor across the output.
- \*\* This specification applies only for DC power dissipation permitted by absolute maximum ratings.

**IL78L06 ELECTRICAL CHARACTERISTICS**

 (At specified virtual junction temperature,  $V_I=12V$ ,  $I_o=40mA$  (unless otherwise noted))

Characteristic	Symbol	Test condition *		Min	Typ.	Max.	Unit
Output voltage **	V <sub>out</sub>		25 °C	5.75	6	6.25	V
		$1mA \leq I_o \leq 40mA$ $8V \leq V_I \leq 20V$	-40 ~ 125 °C	5.7	6	6.3	
		$1mA \leq I_o \leq 70mA$		5.7	6	6.3	
Line regulation	Reg line	$8 \leq V_I \leq 20V$	25 °C		35	175	mV
		$9 \leq V_I \leq 20V$			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 <sub>B</sub>		25 °C		3.9	6	mA
			125 °C			5.5	
Bias current change	$\Delta I_B$	$9 \leq V_I \leq 20V$	-40 ~ 125 °C			1.5	mA
		$1mA \leq I_o \leq 40mA$				0.1	
Output noise voltage	V <sub>N</sub>	10Hz ≤ f ≤ 100kHz	25 °C		46		μV
Ripple rejection	RR	$9 \leq V_I \leq 19V$ f=120Hz	25 °C	40	48		dB
Dropout voltage	V <sub>D</sub>		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 0.33μF capacitor across the input and a 0.1μF capacitor across the output.
- \*\* This specification applies only for DC power dissipation permitted by absolute maximum ratings.

**IL78L08 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 <sub>out</sub>		25 °C	7.7	8	8.3	V
		1 mA ≤ I <sub>o</sub> ≤ 40 mA 10.5 V ≤ V <sub>I</sub> ≤ 23 V	-40 ~ 125 °C	7.6	8	8.4	
		1 mA ≤ I <sub>o</sub> ≤ 70 mA		7.6	8	8.4	
Line regulation	Reg line	10.5 ≤ V <sub>I</sub> ≤ 23 V	25 °C		42	175	mV
		11 ≤ V <sub>I</sub> ≤ 23 V			36	125	
Load regulation	Reg load	1 mA ≤ I <sub>o</sub> ≤ 100 mA	25 °C		18	80	mV
		1 mA ≤ I <sub>o</sub> ≤ 40 mA			10	40	
Bias current	I <sub>B</sub>		25 °C		4	6	mA
			125 °C			5.5	
Bias current change	ΔI <sub>B</sub>	11 ≤ V <sub>I</sub> ≤ 23 V	-40 ~ 125 °C			1.5	mA
		1 mA ≤ I <sub>o</sub> ≤ 40 mA				0.1	
Output noise voltage	V <sub>N</sub>	10 Hz ≤ f ≤ 100 kHz	25 °C		54		μV
Ripple rejection	RR	13 ≤ V <sub>I</sub> ≤ 23 V f=120 Hz	25 °C	37	46		dB
Dropout voltage	V <sub>D</sub>		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 μF capacitor across the input and a 0.1 μF capacitor across the output.

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

**IL78L09 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 <sub>out</sub>		25 °C	806	9	9.4	V
		1 mA ≤ I <sub>o</sub> ≤ 40 mA 12V ≤ V <sub>I</sub> ≤ 24V	-40 ~ 125 °C	8.55	9	9.45	
		1 mA ≤ I <sub>o</sub> ≤ 70 mA		8.55	9	9.45	
Line regulation	Reg line	12 ≤ V <sub>I</sub> ≤ 24V	25 °C		45	175	mV
		13 ≤ V <sub>I</sub> ≤ 24V		40	125		
Load regulation	Reg load	1 mA ≤ I <sub>o</sub> ≤ 100 mA	25 °C		19	90	mV
		1 mA ≤ I <sub>o</sub> ≤ 40 mA		11	40		
Bias current	I <sub>B</sub>		25 °C		4.1	6	mA
			125 °C			5.5	
Bias current change	ΔI <sub>B</sub>	13 ≤ V <sub>I</sub> ≤ 24V	-40 ~ 125 °C			1.5	mA
		1 mA ≤ I <sub>o</sub> ≤ 40 mA				0.1	
Output noise voltage	V <sub>N</sub>	10Hz ≤ f ≤ 100kHz	25 °C		58		μV
Ripple rejection	RR	13 ≤ V <sub>I</sub> ≤ 23V f=120Hz	25 °C	38	45		dB
Dropout voltage	V <sub>D</sub>		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 0.33μF capacitor across the input and a 0.1μF capacitor across the output.

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

**IL78L10 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 <sub>out</sub>		25 °C	9.6	10	10.4	V
		1 mA ≤ I <sub>o</sub> ≤ 40 mA 13 V ≤ V <sub>I</sub> ≤ 25 V	-40 ~ 125 °C	9.5	10	10.5	
		1 mA ≤ I <sub>o</sub> ≤ 70 mA		9.5	10	10.5	
Line regulation	Reg line	13 ≤ V <sub>I</sub> ≤ 25 V	25 °C		51	175	mV
		14 ≤ V <sub>I</sub> ≤ 25 V			42	125	
Load regulation	Reg load	1 mA ≤ I <sub>o</sub> ≤ 100 mA	25 °C		20	90	mV
		1 mA ≤ I <sub>o</sub> ≤ 40 mA			11	40	
Bias current	I <sub>B</sub>		25 °C		4.2	6	mA
			125 °C			5.5	
Bias current change	ΔI <sub>B</sub>	14 ≤ V <sub>I</sub> ≤ 25 V	-40 ~ 125 °C			1.5	mA
		1 mA ≤ I <sub>o</sub> ≤ 40 mA				0.1	
Output noise voltage	V <sub>N</sub>	10 Hz ≤ f ≤ 100 kHz	25 °C		62		μV
Ripple rejection	RR	15 ≤ V <sub>I</sub> ≤ 25 V f=120 Hz	25 °C	37	44		dB
Dropout voltage	V <sub>D</sub>		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 μF capacitor across the input and a 0.1 μF capacitor across the output.

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

**IL78L12 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 <sub>out</sub>		25 °C	11.5	12	12.5	V
		$1mA \leq I_o \leq 40mA$ $14V \leq V_I \leq 27V$	-40 ~ 125 °C	11.4	12	12.6	
		$1mA \leq I_o \leq 70mA$		11.4	12	12.6	
Line regulation	Reg line	$14.5 \leq V_I \leq 27V$	25 °C		55	250	mV
		$16 \leq V_I \leq 27V$			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 <sub>B</sub>		25 °C		4.3	6.5	mA
			125 °C			6	
Bias current change	$\Delta I_B$	$16 \leq V_I \leq 27V$	-40 ~ 125 °C			1.5	mA
		$1mA \leq I_o \leq 40mA$				0.1	
Output noise voltage	V <sub>N</sub>	10Hz ≤ f ≤ 100kHz	25 °C		70		μV
Ripple rejection	RR	$15 \leq V_I \leq 25V$ f=120Hz	25 °C	37	42		dB
Dropout voltage	V <sub>D</sub>		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 0.33μF capacitor across the input and a 0.1μF capacitor across the output.

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



**IL78L15 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 <sub>out</sub>		25 °C	14.4	15	15.6	V
		$1mA \leq I_o \leq 40mA$ $17.5V \leq V_I \leq 30V$	-40 ~ 125 °C	14.25	15	15.75	
		$1mA \leq I_o \leq 70mA$		14.25	15	15.75	
Line regulation	Reg line	$17.5 \leq V_I \leq 30V$	25 °C		65	300	mV
		$19 \leq V_I \leq 30V$			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 <sub>B</sub>		25 °C		4.2	6.5	mA
			125 °C			6	
Bias current change	$\Delta I_B$	$19 \leq V_I \leq 30V$	-40 ~ 125 °C			1.5	mA
		$1mA \leq I_o \leq 40mA$				0.1	
Output noise voltage	V <sub>N</sub>	$10Hz \leq f \leq 100kHz$	25 °C		82		$\mu V$
Ripple rejection	RR	$18.5 \leq V_I \leq 28.5V$ $f=120Hz$	25 °C	37	44		dB
Dropout voltage	V <sub>D</sub>		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.

**IL78L18 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 <sub>out</sub>		25 °C	17.3	18	18.7	V
		$1mA \leq I_o \leq 40mA$ $20.5V \leq V_I \leq 33V$	-40 ~ 125 °C	17.1	18	18.9	
		$1mA \leq I_o \leq 70mA$		17.1	18	18.9	
Line regulation	Reg line	$20.5 \leq V_I \leq 33V$	25 °C		70	360	mV
		$22 \leq V_I \leq 33V$			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 <sub>B</sub>		25 °C		4.7	6.5	mA
			125 °C			6	
Bias current change	$\Delta I_B$	$22 \leq V_I \leq 33V$	-40 ~ 125 °C			1.5	mA
		$1mA \leq I_o \leq 40mA$				0.1	
Output noise voltage	V <sub>N</sub>	$10Hz \leq f \leq 100kHz$	25 °C		82		$\mu V$
Ripple rejection	RR	$21.5 \leq V_I \leq 31.5V$ $f=120Hz$	25 °C	32	36		dB
Dropout voltage	V <sub>D</sub>		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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**IL78L24 ELECTRICAL CHARACTERISTICS**

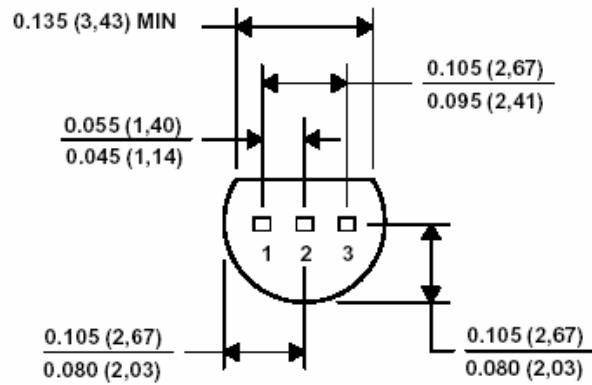
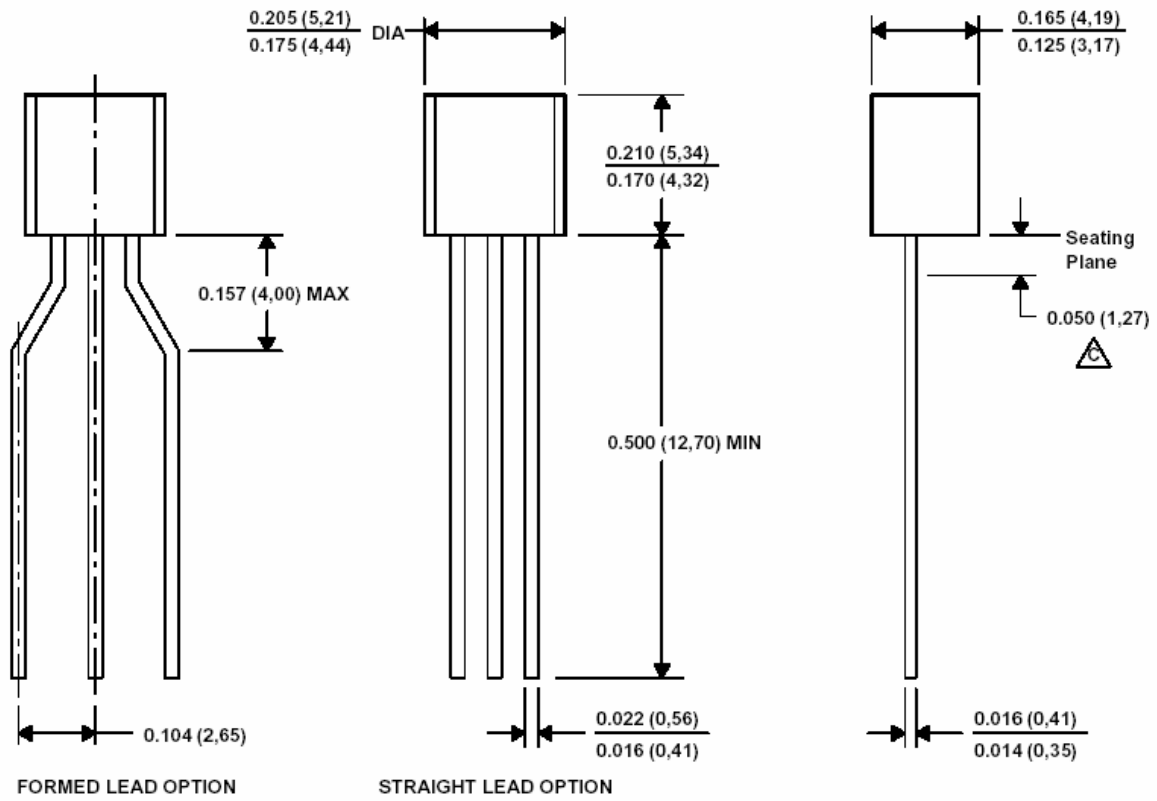
 (At specified virtual junction temperature,  $V_I=26V$ ,  $I_o=40mA$  (unless otherwise noted))

Characteristic	Symbol	Test condition *		Min	Typ.	Max.	Unit
Output voltage **	V <sub>out</sub>		25 °C	23	24	25	V
		$1mA \leq I_o \leq 40mA$ $26.5V \leq V_I \leq 39V$	-40 ~ 125 °C	22.8	24	25.2	
		$1mA \leq I_o \leq 70mA$		22.8	24	25.2	
Line regulation	Reg line	$26.5 \leq V_I \leq 39V$	25 °C		95	480	mV
		$29 \leq V_I \leq 39V$			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 <sub>B</sub>		25 °C		4.8	6.5	mA
			125 °C			6	
Bias current change	$\Delta I_B$	$28 \leq V_I \leq 39V$	-40 ~ 125 °C			1.5	mA
		$1mA \leq I_o \leq 40mA$				0.1	
Output noise voltage	V <sub>N</sub>	$10Hz \leq f \leq 100kHz$	25 °C		82		$\mu V$
Ripple rejection	RR	$27.5 \leq V_I \leq 37.5V$ $f=120Hz$	25 °C	30	33		dB
Dropout voltage	V <sub>D</sub>		25 °C		1.7		V

**Notes**

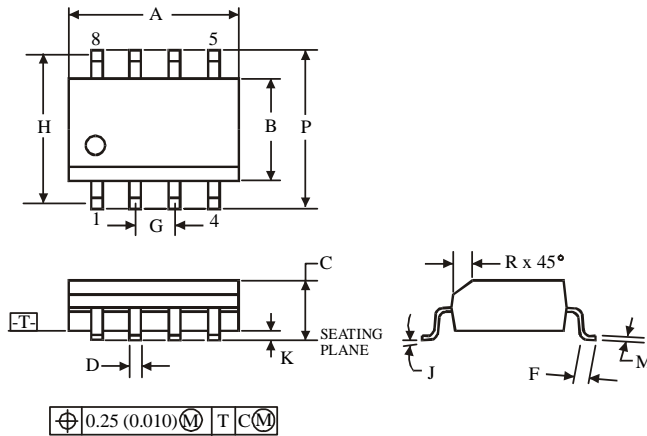
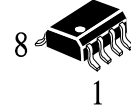
- \*. Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately.  
All characteristics are measured with a  $0.33\mu F$  capacitor across the input and a  $0.1\mu F$  capacitor across the output.
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• TO-92



• SO-8

**D SUFFIX SOIC  
(MS - 012AA)**

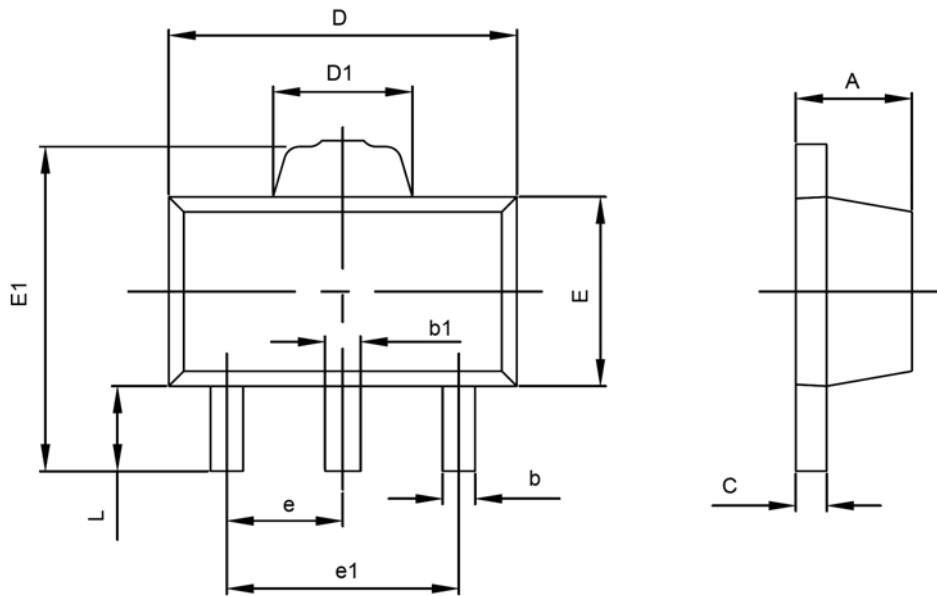


Symbol	Dimension, mm	
	MIN	MAX
A	4.8	5
B	3.8	4
C	1.35	1.75
D	0.33	0.51
F	0.4	1.27
G	1.27	
H	5.72	
J	0°	8°
K	0.1	0.25
M	0.19	0.25
P	5.8	6.2
R	0.25	0.5

**NOTES:**

1. Dimensions A and B do not include mold flash or protrusion.
2. Maximum mold flash or protrusion 0.15 mm (0.006) per side for A; for B - 0.25 mm (0.010) per side.

SOT-89-3L PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.360	0.560	0.014	0.022
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.400	1.800	0.055	0.071
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500TYP		0.060TYP	
e1	2.900	3.100	0.114	0.122
L	0.900	1.100	0.035	0.043