

POSITIVE VOLTAGE REGULATOR

3-TERMINAL 0.1A POSITIVE VOLTAGE REGULATORS

IL78Lxx

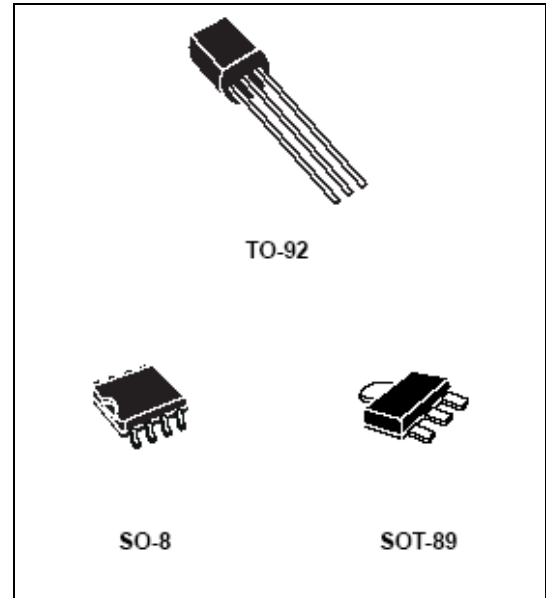
This series of fixed-voltage monolithic integrated-circuit voltage regulators is designed for a wide range of applications. These applications include on-card regulation for elimination of noise and distribution problems associated with single-point regulation. In addition, they can be used with power-pass 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

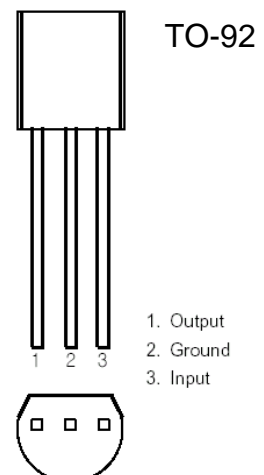
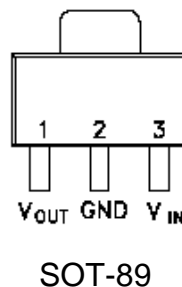
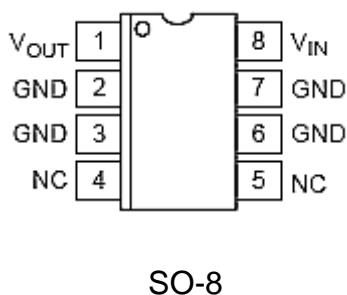
- Output current Up to 100mA
- No External Components
- Internal Thermal Overload Protection
- Internal Short-Circuit Limiting
- Output Voltage of 5V, 6V, 8V, 9V, 10V, 12V, 15V, 18V and 24V



ORDERING INFORMATION

Device	Operating Temperature Range	Package	Packing
IL78LXX	$T_A = -40^\circ \text{ to } 125^\circ \text{ C}$	TO-92	Bulk
IL78LXXTA		TO-92	Taping
IL78LXXDT		SO-8	Tape & Reel
IL78LXXPT		SOT-89	Tape & Reel

Pin Configuration



Absolute Maximum Ratings

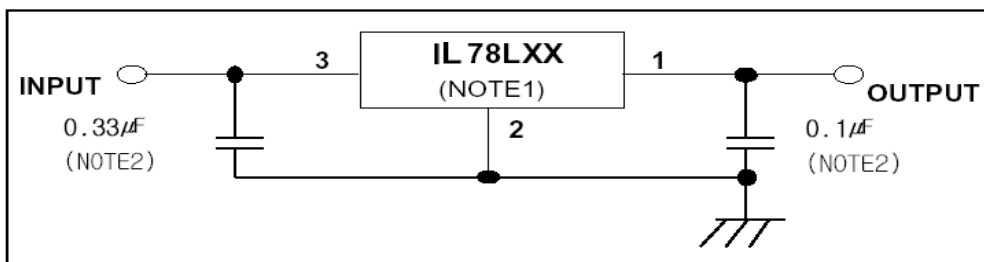
Characteristic		Symbol	Value	Unit
Input voltage	IL78L05 ~ IL78L10	VI	30	V
	IL78L12 ~ IL78L18		35	
	IL78L24		40	
Power Dissipation	TO-92	Pd	625	mW
	SOT-89		500	
	SOP-8		625	
Operating junction temperature		T _{opr}	-40 ~ +150	°C
Storage temperature		T _{stg}	-65 ~ +150	
Soldering temperature and time		T _{sol}	260/10sec	

* Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS

78Lxx		Min.	Max.	Unit
Input voltage, VI	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 _{out}	25 °C		4.8	5	5.2	V
		$1mA \leq I_o \leq 40mA$ $7V \leq V_I \leq V_{max}$	-40 ~ 125 °C	4.75	5	5.25	
		$1mA \leq I_o \leq 70mA$		4.75	5	5.25	
Line regulation	Reg line	$7 \leq V_I \leq 20V$	25 °C		32	150	mV
		$8 \leq V_I \leq 20V$			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	ΔI_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 _N	$10Hz \leq f \leq 100kHz$	25 °C		42		μV
Ripple rejection	RR	$8 \leq V_I \leq 20V$ $f=120Hz$	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.

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 _{out}		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 _B		25 °C		3.9	6	mA
			125 °C			5.5	
Bias current change	ΔI_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 _N	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 _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 0.33μF 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 _{out}		25 °C	7.7	8	8.3	V
		$1mA \leq I_o \leq 40mA$ $10.5V \leq V_I \leq 23V$	-40 ~ 125 °C	7.6	8	8.4	
		$1mA \leq I_o \leq 70mA$		7.6	8	8.4	
Line regulation	Reg line	$10.5 \leq V_I \leq 23V$	25 °C		42	175	mV
		$11 \leq V_I \leq 23V$			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	ΔI_B	$11 \leq V_I \leq 23V$	-40 ~ 125 °C			1.5	mA
		$1mA \leq I_o \leq 40mA$				0.1	
Output noise voltage	V _N	10Hz ≤ f ≤ 100kHz	25 °C		54		μV
Ripple rejection	RR	$13 \leq V_I \leq 23V$ 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 0.33μF 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.

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 _{out}		25 °C	806	9	9.4	V
		$1mA \leq I_o \leq 40mA$ $12V \leq V_I \leq 24V$	-40 ~ 125 °C	8.55	9	9.45	
		$1mA \leq I_o \leq 70mA$		8.55	9	9.45	
Line regulation	Reg line	$12 \leq V_I \leq 24V$	25 °C		45	175	mV
		$13 \leq V_I \leq 24V$			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	ΔI_B	$13 \leq V_I \leq 24V$	-40 ~ 125 °C			1.5	mA
		$1mA \leq I_o \leq 40mA$				0.1	
Output noise voltage	V _N	10Hz ≤ f ≤ 100kHz	25 °C		58		μV
Ripple rejection	RR	$13 \leq V_I \leq 23V$ 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 0.33μF 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 _{out}		25 °C	9.6	10	10.4	V
		$1mA \leq I_O \leq 40mA$ $13V \leq V_I \leq 25V$	-40 ~ 125 °C	9.5	10	10.5	
		$1mA \leq I_O \leq 70mA$		9.5	10	10.5	
Line regulation	Reg line	$13 \leq V_I \leq 25V$	25 °C		51	175	mV
		$14 \leq V_I \leq 25V$			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	ΔI_B	$14 \leq V_I \leq 25V$	-40 ~ 125 °C			1.5	mA
		$1mA \leq I_O \leq 40mA$				0.1	
Output noise voltage	V _N	10Hz ≤ f ≤ 100kHz	25 °C		62		μV
Ripple rejection	RR	$15 \leq V_I \leq 25V$ 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 0.33μF 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.

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 _{out}		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 _B		25 °C		4.3	6.5	mA
			125 °C			6	
Bias current change	ΔI_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 _N	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 _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 0.33μF capacitor across the input and a 0.1μF capacitor across the output.

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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 _{out}		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 _B		25 °C		4.2	6.5	mA
			125 °C			6	
Bias current change	ΔI_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 _N	10Hz ≤ f ≤ 100kHz	25 °C		82		μV
Ripple rejection	RR	$18.5 \leq V_I \leq 28.5V$ 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 0.33μF 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.

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 _{out}		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 _B		25 °C		4.7	6.5	mA
			125 °C			6	
Bias current change	ΔI_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 _N	10Hz ≤ f ≤ 100kHz	25 °C		82		μV
Ripple rejection	RR	$21.5 \leq V_I \leq 31.5V$ 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 0.33μF capacitor across the input and a 0.1μF 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 _{out}		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 _B		25 °C		4.8	6.5	mA
			125 °C			6	
Bias current change	ΔI_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 _N	$10Hz \leq f \leq 100kHz$	25 °C		82		μV
Ripple rejection	RR	$27.5 \leq V_I \leq 37.5V$ $f=120Hz$	25 °C	30	33		dB
Dropout voltage	V _D		25 °C		1.7		V

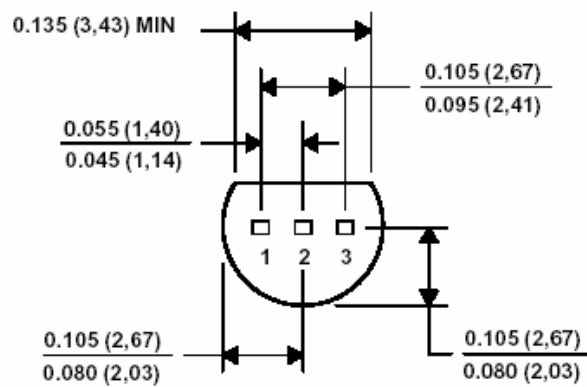
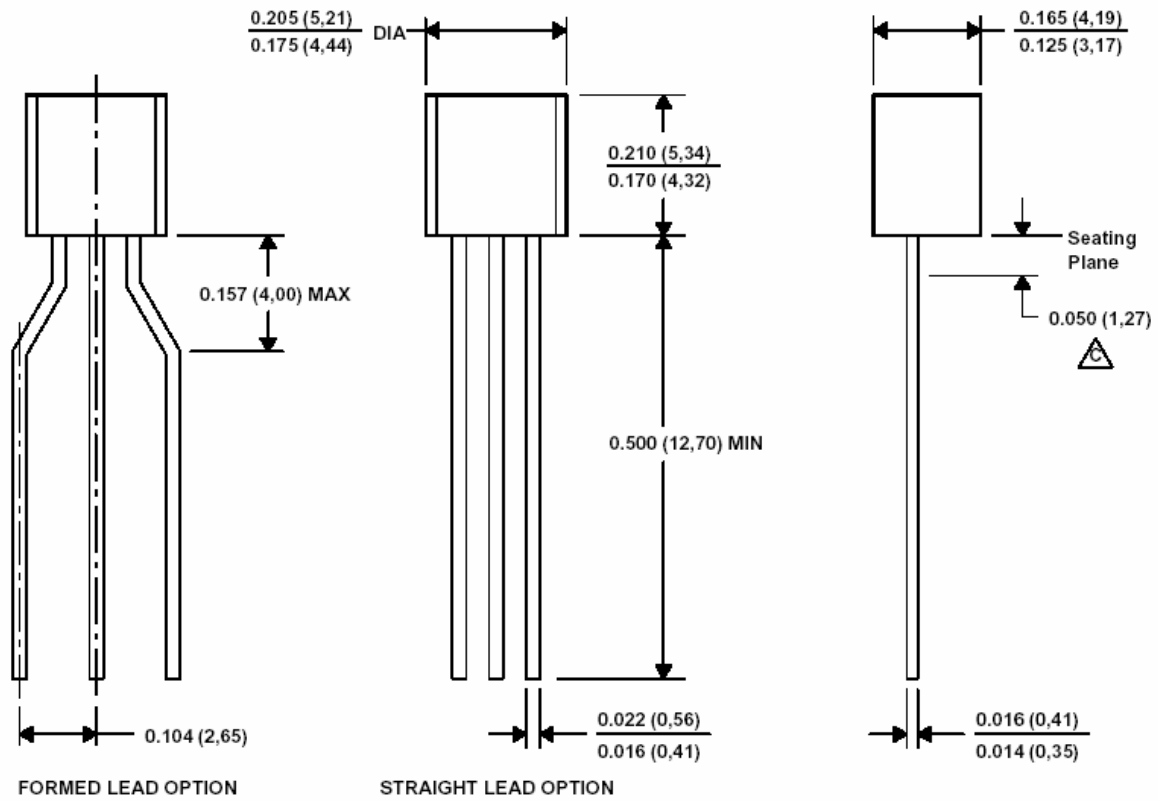
Notes

*. 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.

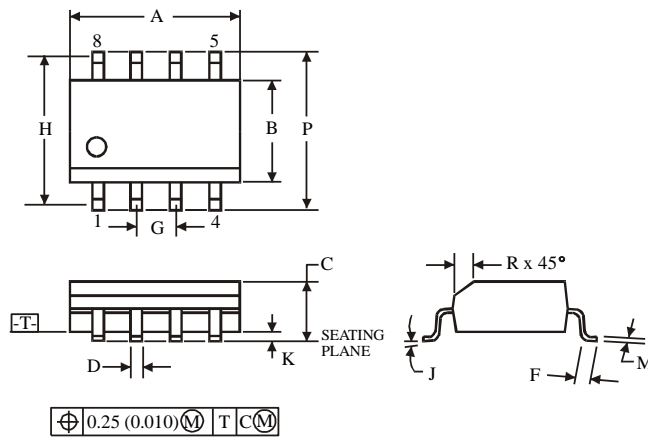
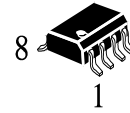
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• TO-92



• SO-8

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

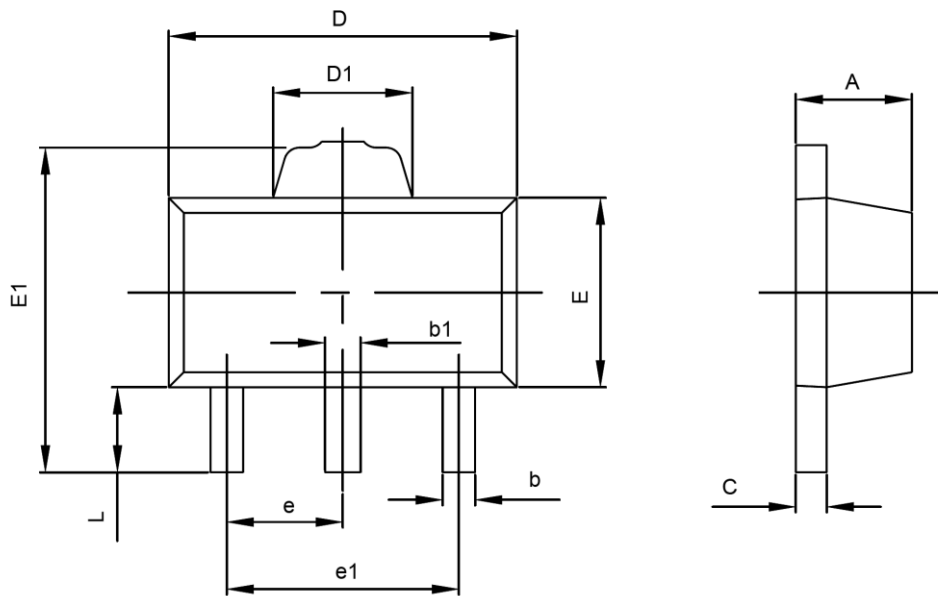


Symbol	Dimension, mm	
	MIN	MAX
A	4.8	5
B	3.8	4
C	1.35	1.75
D	0.33	0.51
F	0.4	1.27
G	1.27	
H	5.72	
J	0°	8°
K	0.1	0.25
M	0.19	0.25
P	5.8	6.2
R	0.25	0.5

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