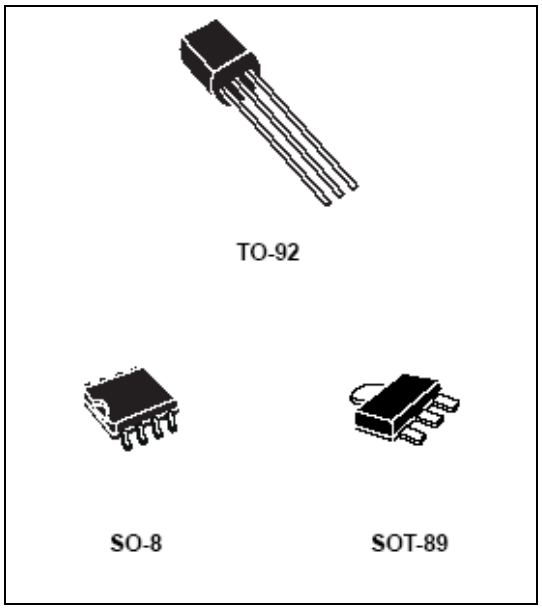
POSITIVE VOLTAGE REGULATOR

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 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.



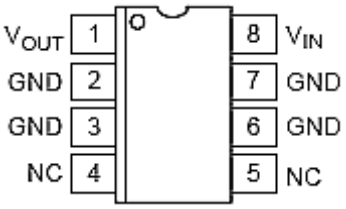
Features

- 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

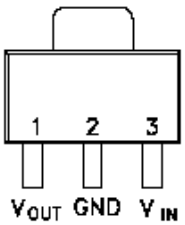
ORDERING INFORMATION

Device	Operating Temperature Range	Package	Packing
HM78LXX	T_A = -40° to 125° C	TO-92	Bulk
HM78LXXTA		TO-92	Taping
HM78LXXDT		SO-8	Tape & Reel
HM78LXXPT		SOT-89	Tape & Reel

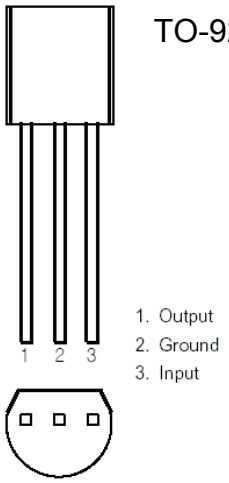
Pin Configuration



SO-8



SOT-89



Absolute Maximum Ratings

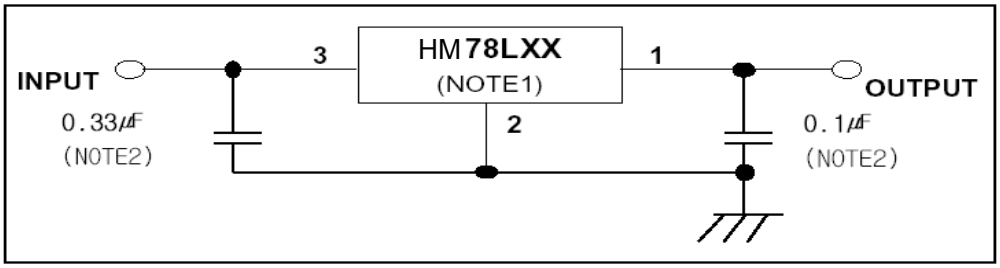
Characteristic		Symbol	Value	Unit
Input voltage	HM78L05 ~ HM78L10	VI	30	V
	HM78L12 ~ HM78L18		35	
	HM78L24		40	
Power Dissipation	TO-92	Pd	625	mW
	SOT-89		500	
	SOP-8		625	
Operating junction temperature		Topr	-40 ~ +150	℃
Storage temperature		Tstg	-65 ~ +150	
Soldering temperature and time		Tsol	260/10sec	

* 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	HM78L05	7	20	V
	HM78L06	8	20	
	HM78L08	10.5	23	
	HM78L09	11.5	24	
	HM78L10	12.5	25	
	HM78L12	14.5	27	
	HM78L15	17.5	30	
	HM78L18	20.5	33	
	HM78L24	26.5	39	
Output current, Io			100	mA
Operating virtual junction temperature, Tj		-40	125	℃

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.

HM78L05 ELECTRICAL CHARACTERISTICS

(At specified virtual junction temperature, V_I=10V, I_O=40mA (unless otherwise noted)

Characteistic	Symbol	Test condition *		Min	Typ.	Max.	Unit
Output voltage **	Vout	25℃		4.8	5	5.2	V
		1mA≤ Io≤ 40mA 7V≤ VI≤ Vmax	-40 ~ 125℃	4.75	5	5.25	
		1mA≤Io≤ 70mA		4.75	5	5.25	
Line regulation	Reg line	7≤ VI≤ 20V	25℃		32	150	mV
		8≤ VI≤ 20V			26	100	
Load regulation	Reg load	1mA≤ Io≤ 100mA	25℃		15	60	mV
		1mA≤ Io≤ 40mA			8	30	
Bias current	I_B		25℃		3.8	6	mA
			125℃			5.5	
Bias current change	$\triangle I_B$	9≤ VI≤ 20V	-40 ~ 125℃			1.5	mA
		1mA≤ Io≤ 40mA				0.1	
Output noise voltage	V_N	10Hz≤ f≤ 100kHz	25℃		42		μV
Ripple rejection	RR	8≤ VI≤ 20V f=120Hz	25℃	41	49		dB
Dropout voltage	V_D		25℃		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.

HM78L06 ELECTRICAL CHARACTERISTICS

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

Characteistic	Symbol	Test condition *		Min	Typ.	Max.	Unit
Output voltage **	Vout		25℃	5.75	6	6.25	V
		1mA≤ Io≤ 40mA 8V≤ VI≤ 20V	-40 ~ 125℃	5.7	6	6.3	
		1mA≤Io≤ 70mA		5.7	6	6.3	
Line regulation	Reg line	8≤ VI≤ 20V	25℃		35	175	mV
		9≤ VI≤ 20V			29	125	
Load regulation	Reg load	1mA≤ Io≤ 100mA	25℃		16	80	mV
		1mA≤ Io≤ 40mA			9	40	
Bias current	I_B		25℃		3.9	6	mA
			125℃			5.5	
Bias current change	$\triangle I_B$	9≤ VI≤ 20V	-40 ~ 125℃			1.5	mA
		1mA≤ Io≤ 40mA				0.1	
Output noise voltage	V_N	10Hz ≤ f≤ 100kHz	25℃		46		μV
Ripple rejection	RR	9≤ VI≤ 19V f=120Hz	25℃	40	48		dB
Dropout voltage	V_D		25℃		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.

HM78L08 ELECTRICAL CHARACTERISTICS

(At specified virtual junction temperature, V_I=14V, I_O=40mA (unless otherwise noted)

Characteistic	Symbol	Test condition *		Min	Typ.	Max.	Unit
Output voltage **	Vout		25℃	7.7	8	8.3	V
		1mA≤ Io≤ 40mA 10.5V≤ VI≤ 23V	-40 ~ 125℃	7.6	8	8.4	
		1mA≤Io≤ 70mA		7.6	8	8.4	
Line regulation	Reg line	10.5≤ VI≤ 23V	25℃		42	175	mV
		11≤ VI≤ 23V			36	125	
Load regulation	Reg load	1mA≤ Io≤ 100mA	25℃		18	80	mV
		1mA≤ Io≤ 40mA			10	40	
Bias current	I_B		25℃		4	6	mA
			125℃			5.5	
Bias current change	$\triangle I_B$	11≤ VI≤ 23V	-40 ~ 125℃			1.5	mA
		1mA≤ Io≤ 40mA				0.1	
Output noise voltage	V_N	10Hz ≤ f≤ 100kHz	25℃		54		μV
Ripple rejection	RR	13≤ VI≤ 23V f=120Hz	25℃	37	46		dB
Dropout voltage	V_D		25℃		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.

HM78L09 ELECTRICAL CHARACTERISTICS

(At specified virtual junction temperature, V_I=14V, I_O=40mA (unless otherwise noted)

Characteistic	Symbol	Test condition *		Min	Typ.	Max.	Unit
Output voltage **	Vout		25℃	806	9	9.4	V
		1mA≤ Io≤ 40mA 12V≤ VI≤ 24V	-40 ~ 125℃	8.55	9	9.45	
		1mA≤Io≤ 70mA		8.55	9	9.45	
Line regulation	Reg line	12≤ VI≤ 24V	25℃		45	175	mV
		13≤ VI≤ 24V			40	125	
Load regulation	Reg load	1mA≤ Io≤ 100mA	25℃		19	90	mV
		1mA≤ Io≤ 40mA			11	40	
Bias current	I_B		25℃		4.1	6	mA
			125℃			5.5	
Bias current change	$\triangle I_B$	13≤ VI≤ 24V	-40 ~ 125℃			1.5	mA
		1mA≤ Io≤ 40mA				0.1	
Output noise voltage	V_N	10Hz ≤ f≤ 100kHz	25℃		58		μV
Ripple rejection	RR	13≤ VI≤ 23V f=120Hz	25℃	38	45		dB
Dropout voltage	V_D		25℃		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.

HM78L10 ELECTRICAL CHARACTERISTICS

(At specified virtual junction temperature, V_I=16V, I_O=40mA (unless otherwise noted)

Characteistic	Symbol	Test condition *		Min	Typ.	Max.	Unit
Output voltage **	Vout		25℃	9.6	10	10.4	V
		1mA≤ Io≤ 40mA 13V≤ VI≤ 25V	-40 ~ 125℃	9.5	10	10.5	
		1mA≤Io≤ 70mA		9.5	10	10.5	
Line regulation	Reg line	13≤ VI≤ 25V	25℃		51	175	mV
		14≤ VI≤ 25V			42	125	
Load regulation	Reg load	1mA≤ Io≤ 100mA	25℃		20	90	mV
		1mA≤ Io≤ 40mA			11	40	
Bias current	I_B		25℃		4.2	6	mA
			125℃			5.5	
Bias current change	$\triangle I_B$	14≤ VI≤ 25V	-40 ~ 125℃			1.5	mA
		1mA≤ Io≤ 40mA				0.1	
Output noise voltage	V_N	10Hz ≤ f≤ 100kHz	25℃		62		μV
Ripple rejection	RR	15≤ VI≤ 25V f=120Hz	25℃	37	44		dB
Dropout voltage	V_D		25℃		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.

HM78L12 ELECTRICAL CHARACTERISTICS

(At specified virtual junction temperature, V_I=17V, I_O=40mA (unless otherwise noted)

Characteistic	Symbol	Test condition *		Min	Typ.	Max.	Unit
Output voltage **	Vout		25℃	11.5	12	12.5	V
		1mA≤ Io≤ 40mA 14V≤ VI≤ 27V	-40 ~ 125℃	11.4	12	12.6	
		1mA≤Io≤ 70mA		11.4	12	12.6	
Line regulation	Reg line	14.5≤ VI≤ 27V	25℃		55	250	mV
		16≤ VI≤ 27V			49	200	
Load regulation	Reg load	1mA≤ Io≤ 100mA	25℃		22	100	mV
		1mA≤ Io≤ 40mA			13	50	
Bias current	I_B		25℃		4.3	6.5	mA
			125℃			6	
Bias current change	$\triangle I_B$	16≤ VI≤ 27V	-40 ~ 125℃			1.5	mA
		1mA≤ Io≤ 40mA				0.1	
Output noise voltage	V_N	10Hz ≤ f≤ 100kHz	25℃		70		μV
Ripple rejection	RR	15≤ VI≤ 25V f=120Hz	25℃	37	42		dB
Dropout voltage	V_D		25℃		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.

HM78L15 ELECTRICAL CHARACTERISTICS

(At specified virtual junction temperature, V_I=19V, I_O=40mA (unless otherwise noted)

Characteistic	Symbol	Test condition *		Min	Typ.	Max.	Unit
Output voltage **	Vout		25℃	14.4	15	15.6	V
		1mA≤ Io≤ 40mA 17.5V≤ VI≤ 30V	-40 ~ 125℃	14.25	15	15.75	
		1mA≤Io≤ 70mA		14.25	15	15.75	
Line regulation	Reg line	17.5≤ VI≤ 30V	25℃		65	300	mV
		19≤ VI≤ 30V			58	250	
Load regulation	Reg load	1mA≤ Io≤ 100mA	25℃		25	150	mV
		1mA≤ Io≤ 40mA			15	75	
Bias current	I_B		25℃		4.2	6.5	mA
			125℃			6	
Bias current change	$\triangle I_B$	19≤ VI≤ 30V	-40 ~ 125℃			1.5	mA
		1mA≤ Io≤ 40mA				0.1	
Output noise voltage	V_N	10Hz ≤ f≤ 100kHz	25℃		82		μV
Ripple rejection	RR	18.5≤ VI≤ 28.5V f=120Hz	25℃	37	44		dB
Dropout voltage	V_D		25℃		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.

HM78L18 ELECTRICAL CHARACTERISTICS

(At specified virtual junction temperature, V_I=23V, I_O=40mA (unless otherwise noted)

Characteistic	Symbol	Test condition *		Min	Typ.	Max.	Unit
Output voltage **	Vout		25℃	17.3	18	18.7	V
		1mA≤ Io≤ 40mA 20.5V≤ VI≤ 33V	-40 ~ 125℃	17.1	18	18.9	
		1mA≤Io≤ 70mA		17.1	18	18.9	
Line regulation	Reg line	20.5≤ VI≤ 33V	25℃		70	360	mV
		22≤ VI≤ 33V			64	300	
Load regulation	Reg load	1mA≤ Io≤ 100mA	25℃		27	180	mV
		1mA≤ Io≤ 40mA			19	90	
Bias current	I_B		25℃		4.7	6.5	mA
			125℃			6	
Bias current change	$\triangle I_B$	22≤ VI≤ 33V	-40 ~ 125℃			1.5	mA
		1mA≤ Io≤ 40mA				0.1	
Output noise voltage	V_N	10Hz ≤ f≤ 100kHz	25℃		82		μV
Ripple rejection	RR	21.5≤ VI≤ 31.5V f=120Hz	25℃	32	36		dB
Dropout voltage	V_D		25℃		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.

HM78L24 ELECTRICAL CHARACTERISTICS

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

Characteistic	Symbol	Test condition *		Min	Typ.	Max.	Unit
Output voltage **	Vout		25℃	23	24	25	V
		1mA≤ Io≤ 40mA 26.5V≤ VI≤ 39V	-40 ~ 125℃	22.8	24	25.2	
		1mA≤Io≤ 70mA		22.8	24	25.2	
Line regulation	Reg line	26.5≤ VI≤ 39V	25℃		95	480	mV
		29≤ VI≤ 39V			78	400	
Load regulation	Reg load	1mA≤ Io≤ 100mA	25℃		41	240	mV
		1mA≤ Io≤ 40mA			28	120	
Bias current	I_B		25℃		4.8	6.5	mA
			125℃			6	
Bias current change	$\triangle I_B$	28≤ VI≤ 39V	-40 ~ 125℃			1.5	mA
		1mA≤ Io≤ 40mA				0.1	
Output noise voltage	V_N	10Hz ≤ f≤ 100kHz	25℃		82		μV
Ripple rejection	RR	27.5≤ VI≤ 37.5V f=120Hz	25℃	30	33		dB
Dropout voltage	V_D		25℃		1.7		V

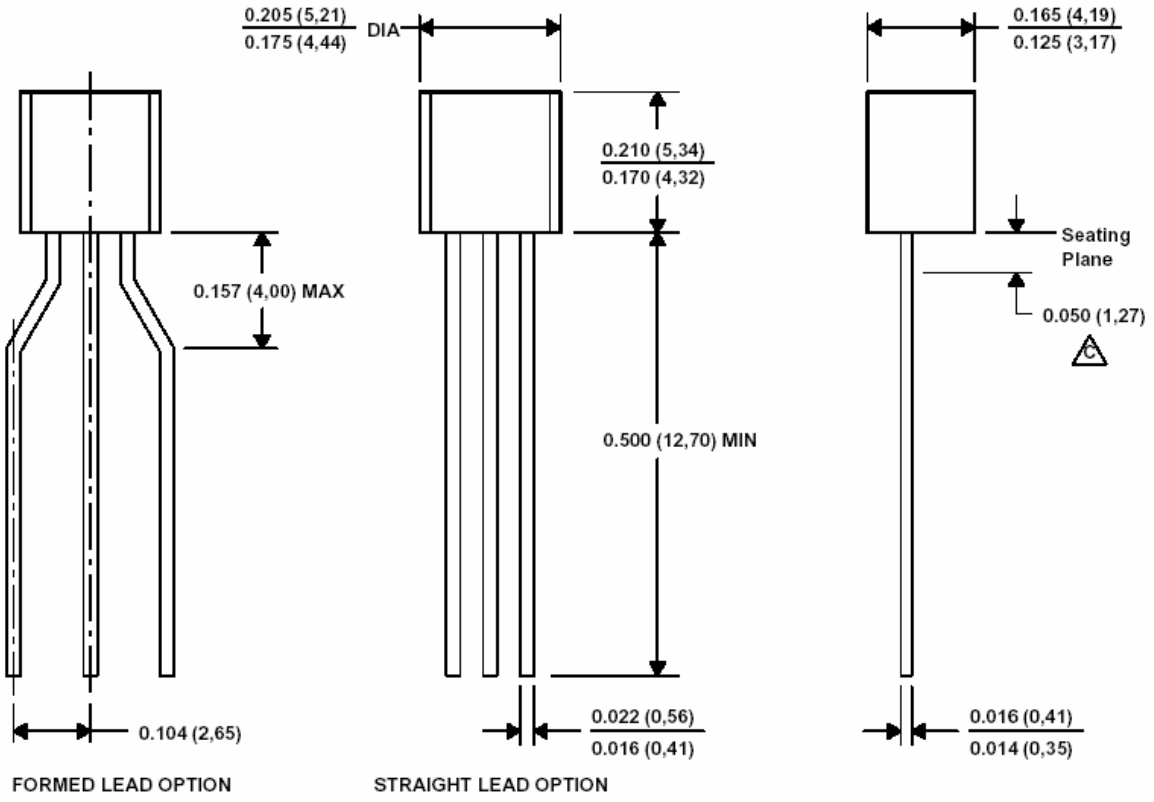
Notes

*. 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.

• TO-92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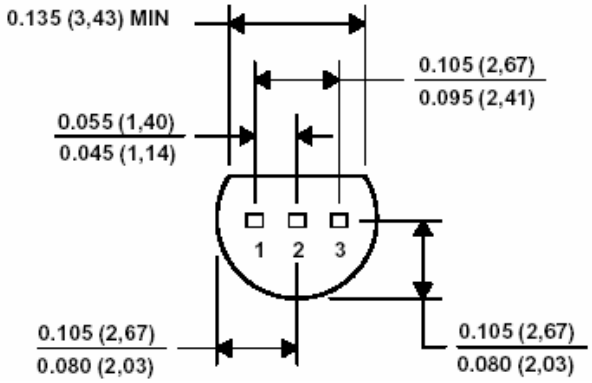
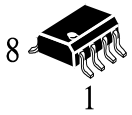
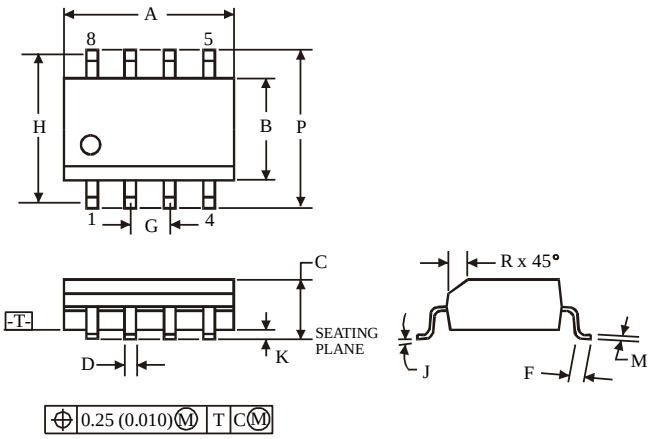
0.175 (4,44)
DIA
0.165 (4,19)
0.125 (3,17)
0.210 (5,34)
0.170 (4,32)
Seating
Plane
0.157 (4,00) MAX
0.050 (1,27)
0.500 (12,70) MIN
0.104 (2,65)
0.022 (0,56)
0.016 (0,41)
0.016 (0,41)
0.014 (0,35)
FORMED LEAD OPTION
STRAIGHT LEAD OPTION


0.135 (3,43) MIN
0.105 (2,67)
0.095 (2,41)
0.055 (1,40)
0.045 (1,14)
1
2
3
0.105 (2,67)
0.080 (2,03)
0.105 (2,67)
0.080 (2,03)

- **SO-8**

D SUFFIX SOIC
(MS - 012AA)



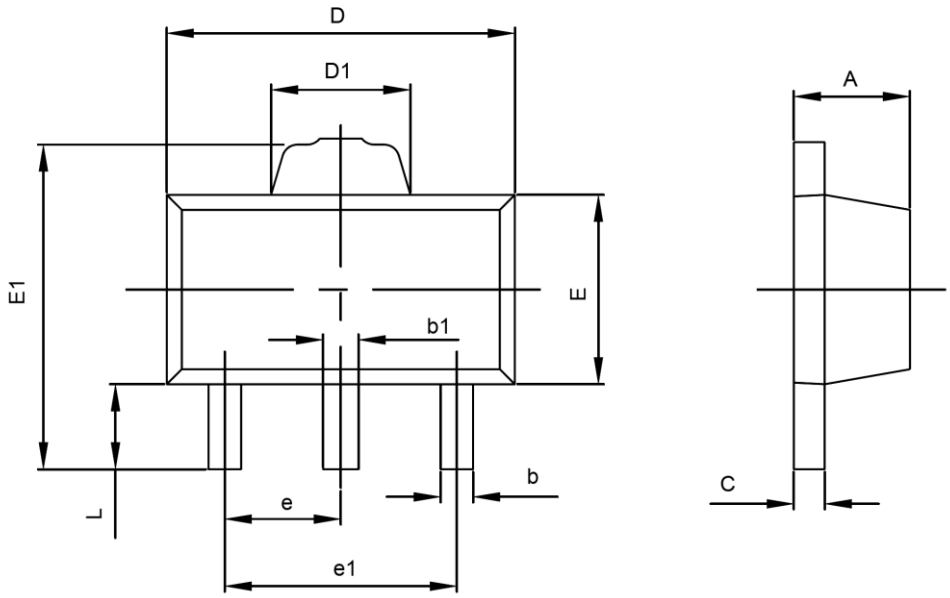


	Dimension, mm	
Symbol	**MIN**	**MAX**
A	4.8	5
B	3.8	4
C	1.35	1.75
D	0.33	0.51
F	0.4	1.27
G	1.27	
H	5.72	
J	0°	8°
K	0.1	0.25
M	0.19	0.25
P	5.8	6.2
R	0.25	0.5

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