

## Series3-Terminal 0.1A Positive Voltage Regulators

# LR78LXX

### DESCRIPTION

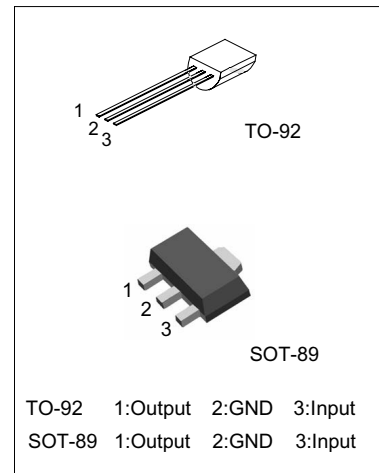
The LRC LR78LXX family is monolithic fixed voltage regulator integrated circuit. They are suitable for applications that required supply current up to 100mA.

### FEATURES

- \*Output current up to 100mA
- \*Fixed output voltage of 5V, 6V, 8V, 9V, 12V, 15V, 18V and 24V available
- \*Thermal overload shutdown protection
- \*Short circuit current limiting
- \*We declare that material of product compliance with ROHS requirements.

### ORDERING INFORMATION

- \*LR78Lxx: TO-92
- \*LR78LxxU: SOT89



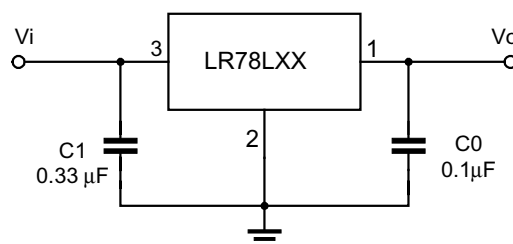
### ABSOLUTE MAXIMUM RATINGS

(Operating temperature range applies unless otherwise specified)

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Input voltage (for $V_o=5\sim 9V$ )	$V_i$		30	V
(for $V_o=12\sim 24V$ )	$V_i$		35	V
Output Current	$I_o$		100	mA
Power Dissipation	PD			mW
TO-92			625	
SOT-89			350	
Operating Junction Temperature	$T_J$	-55	+150	°C
Operating Ambient Temperature	$T_{OPR}$	-55	+125	°C
Storage Temperature Range	$T_{STG}$	-55	+150	°C

ESD: HBM 2000V

### APPLICATION CIRCUIT



Note 1: To specify an output voltage, substitute voltage value for "XX".

Note 2: Bypass capacitors are recommended for optimum stability and transient response and should be located as close as possible to the regulators.

## LR78L00 Series 3-Terminal 0.1A Positive Voltage Regulators

### LR78L05 ELECTRICAL CHARACTERISTICS

( $V_I=10V$ ,  $I_o=40mA$ ,  $-55^\circ C < T_j < 125^\circ C$ ,  $C_1=0.33\mu F$ ,  $C_o=0.1\mu F$ , unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP.	MAX	UNIT
Output Voltage	$V_o$	$T_j=25^\circ C$	4.80	5.0	5.20	V
		$7V \leq V_I \leq 20V, I_o=1mA-40mA$	4.75		5.25	V
		$7V \leq V_I \leq V_{MAX}, I_o=1mA-70mA$	4.75		5.25	V (note 2)
Load Regulation	$V_o$	$T_j=25^\circ C, I_o=1mA-100mA$		11	60	mV
		$T_j=25^\circ C, I_o=1mA-40mA$		5.0	30	mV
Line regulation	$V_o$	$7V \leq V_I \leq 20V, T_j=25^\circ C$		32	150	mV
		$8V \leq V_I \leq 20V, T_j=25^\circ C$		26	100	mV
Quiescent Current	$I_q$	$V_I=10V, I_o=0mA, T_j=25^\circ C$		3.8	6.1	mA
Quiescent Current Change	$\Delta I_q$	$8V \leq V_I \leq 20V$			1.5	mA
	$\Delta I_q$	$1mA \leq V_I \leq 40mA$			0.1	mA
Output Noise Voltage	$V_N$	$10Hz \leq f \leq 100kHz$		42		$\mu V$
Ripple Rejection	RR	$8V \leq V_I \leq 20V, f=120Hz, T_j=25^\circ C$	41	49		dB
Dropout Voltage	$V_d$	$T_j=25^\circ C$		1.7		V

### LR78L06 ELECTRICAL CHARACTERISTICS

( $V_I=12V$ ,  $I_o=40mA$ ,  $-55^\circ C < T_j < 125^\circ C$ ,  $C_1=0.33\mu F$ ,  $C_o=0.1\mu F$ , unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP.	MAX	UNIT
Output Voltage	$V_o$	$T_j=25^\circ C$	5.76	6.0	6.24	V
		$8.5V \leq V_I \leq 20V, I_o=1mA-40mA$	5.70		6.30	V
		$8.5V \leq V_I \leq V_{MAX}, I_o=1mA-70mA$	5.70		6.30	V (note 2)
Load Regulation	$V_o$	$T_j=25^\circ C, I_o=1mA-100mA$		12.8	80	mV
		$T_j=25^\circ C, I_o=1mA-70mA$		5.8	40	mV
Line regulation	$V_o$	$8.5V \leq V_I \leq 20V, T_j=25^\circ C$		64	175	mV
		$9V \leq V_I \leq 20V, T_j=25^\circ C$		54	125	mV
Quiescent Current	$I_q$	$V_I=12V, I_o=0mA, T_j=25^\circ C$		3.9	6.0	mA
Quiescent Current Change	$\Delta I_q$	$9V \leq V_I \leq 20V$			1.5	mA
	$\Delta I_q$	$1mA \leq V_I \leq 40mA$			0.1	mA
Output Noise Voltage	$V_N$	$10Hz \leq f \leq 100kHz$		49		$\mu V$
Ripple Rejection	RR	$10V \leq V_I \leq 20V, f=120Hz, T_j=25^\circ C$	40	46		dB
Dropout Voltage	$V_d$	$T_j=25^\circ C$		1.7		V

## LR78L00 Series 3-Terminal 0.1A Positive Voltage Regulators

### LR78L08 ELECTRICAL CHARACTERISTICS

( $V_I=14V, I_O=40mA, -55^{\circ}C < T_J < 125^{\circ}C, C_1=0.33\mu F, C_o=0.1\mu F$ , unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	Vo	Tj=25°C	7.68	8.0	8.32	V
		10.5V ≤ Vi ≤ 23V, Io=1mA-40mA	7.60		8.40	V
		10.5V ≤ Vi ≤ VMAX, Io=1mA-70mA	7.60		8.40	V (note 2)
Load Regulation	Vo	Tj=25°C, Io=1mA-100mA		18	80	mV
		Tj=25°C, Io=1mA-70mA		10	40	mV
Line regulation	Vo	10.5V ≤ Vi ≤ 23V, Tj=25°C		42	175	mV
		11V ≤ Vi ≤ 23V, Tj=25°C		36	125	mV
Quiescent Current	Iq	VIN=14V, Io=0mA, Tj=25°C		4.0	6.0	mA
Quiescent Current Change	ΔIq	11V ≤ Vi ≤ 23V			1.5	mA
	ΔIq	1mA ≤ Vi ≤ 40mA			0.1	mA
Output Noise Voltage	VN	10Hz ≤ f ≤ 100kHz		54		uV
Ripple Rejection	RR	11V ≤ Vi ≤ 23V, f=120Hz, Tj=25°C	39	46		dB
Dropout Voltage	Vd	Tj=25°C		1.7		V

### LR78L09 ELECTRICAL CHARACTERISTICS

( $V_I=15V, I_O=40mA, -55^{\circ}C < T_J < 125^{\circ}C, C_1=0.33\mu F, C_o=0.1\mu F$ , unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	Vo	Tj=25°C	8.64	9.0	9.36	V
		11.5V ≤ Vi ≤ 24V, Io=1mA-40mA	8.55		9.45	V
		11.5V ≤ Vi ≤ VMAX, Io=1mA-70mA	8.55		9.45	V (note 2)
Load Regulation	Vo	Tj=25°C, Io=1mA-100mA		20	90	mV
		Tj=25°C, Io=1mA-40mA		11	45	mV
Line regulation	Vo	11.5V ≤ Vi ≤ 24V, Tj=25°C		90	200	mV
		13V ≤ Vi ≤ 24V, Tj=25°C		100	150	mV
Quiescent Current	Iq	VIN=15V, Io=0mA, Tj=25°C		4.1	6.0	mA
Quiescent Current Change	ΔIq	13V ≤ Vi ≤ 24V			1.5	mA
	ΔIq	1mA ≤ Vi ≤ 40mA			0.1	mA
Output Noise Voltage	VN	10Hz ≤ f ≤ 100kHz		58		UV
Ripple Rejection	RR	12V ≤ Vi ≤ 23V, f=120Hz, Tj=25°C	38	44		dB
Dropout Voltage	Vd	Tj=25°C		1.7		V

## LR78L00 Series3-Terminal 0.1A Positive Voltage Regulators

### LR78L12 ELECTRICAL CHARACTERISTICS

( $V_I=19V, I_o=40mA, -55^{\circ}C < T_j < 125^{\circ}C, C_1=0.33\mu F, C_o=0.1\mu F$ , unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	Vo	Tj=25°C	11.5	12.0	12.5	V
		14.5V<=Vi<=27V, Io=1mA-40mA	11.40		12.60	V
		14.5V<=Vi<=VMAX, Io=1mA-70mA	11.40		12.60	V (note 2)
Load Regulation	Vo	Tj=25°C, Io=1mA-100mA		25	150	mV
		Tj=25°C, Io=1mA-40mA		12	75	mV
Line regulation	Vo	14.5V<=Vi<=27V, Tj=25°C		55	250	mV
		16V<=Vi<=27V, Tj=25°C		49	200	mV
Quiescent Current	Iq	VIN=19V, Io=0mA, Tj=25°C		4.3	6.5	mA
Quiescent Current Change	ΔIq	16V<=Vi<=27V			1.5	mA
	ΔIq	1mA<=Vi<=40mA			0.1	mA
Output Noise Voltage	VN	10Hz<=f<=100kHz		70		uV
Ripple Rejection	RR	15V<=Vi<=25V, f=120Hz, Tj=25°C	37	42		dB
Dropout Voltage	Vd	Tj=25°C		1.7		V

### LR78L15 ELECTRICAL CHARACTERISTICS

( $V_I=23V, I_o=40mA, -55^{\circ}C < T_j < 125^{\circ}C, C_1=0.33\mu F, C_o=0.1\mu F$ , unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	Vo	Tj=25°C	14.40	15.0	15.60	V
		17.5V<=Vi<=30V, Io=1mA-40mA	14.25		15.75	V
		17.5V<=Vi<=VMAX, Io=1mA-70mA	14.25		15.75	V (note 2)
Load Regulation	Vo	Tj=25°C, Io=1mA-100mA		20	150	mV
		Tj=25°C, Io=1mA-70mA		25	150	mV
Line regulation	Vo	17.5V<=Vi<=30V, Tj=25°C		25	150	mV
		20V<=Vi<=30V, Tj=25°C		15	75	mV
Quiescent Current	Iq	VIN=23V, Io=0mA, Tj=25°C		4.6	6.5	mA
Quiescent Current Change	ΔIq	20V<=Vi<=30V			1.5	mA
	ΔIq	1mA<=Vi<=40mA			0.1	mA
Output Noise Voltage	VN	10Hz<=f<=100kHz		82		uV
Ripple Rejection	RR	18.5V<=Vi<=28.5V, f=120Hz, Tj=25°C	34	39		dB
Dropout Voltage	Vd	Tj=25°C		1.7		V

## LR78L00 Series3-Terminal 0.1A Positive Voltage Regulators

### LR78L18 ELECTRICAL CHARACTERISTICS

( $V_I=27V, I_o=40mA, -55^{\circ}C < T_j < 125^{\circ}C, C_1=0.33\mu F, C_o=0.1\mu F$ , unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_o$	$T_j=25^{\circ}C$	17.30	18.0	18.70	V
		$21V \leq V_I \leq 33V, I_o=1mA-40mA$	17.10		18.90	V
		$21V \leq V_I \leq V_{MAX}, I_o=1mA-70mA$	17.10		18.90	V (note 2)
Load Regulation	$V_o$	$T_j=25^{\circ}C, I_o=1mA-100mA$		30	180	mV
		$T_j=25^{\circ}C, I_o=1mA-40mA$		19	90	mV
Line regulation	$V_o$	$21V \leq V_I \leq 33V, T_j=25^{\circ}C$		70	360	mV
		$22V \leq V_I \leq 33V, T_j=25^{\circ}C$		60	300	mV
Quiescent Current	$I_q$	$V_{IN}=27V, I_o=0mA, T_j=25^{\circ}C$		4.7	6.5	mA
Quiescent Current Change	$\Delta I_q$	$21V \leq V_I \leq 33V$			1.5	mA
	$\Delta I_q$	$1mA \leq V_I \leq 40mA$			0.1	mA
Output Noise Voltage	$V_N$	$10Hz \leq f \leq 100kHz$		150		$\mu V$
Ripple Rejection	RR	$23V \leq V_I \leq 33V, f=120Hz, T_j=25^{\circ}C$	32	36		dB
Dropout Voltage	$V_d$	$T_j=25^{\circ}C$		1.7		V

### LR78L24 ELECTRICAL CHARACTERISTICS

( $V_I=33V, I_o=40mA, -55^{\circ}C < T_j < 125^{\circ}C, C_1=0.33\mu F, C_o=0.1\mu F$ , unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_o$	$T_j=25^{\circ}C$	23.04	24.0	24.96	V
		$27V \leq V_I \leq 38V, I_o=1mA-40mA$	22.8		25.2	V
		$27V \leq V_I \leq V_{MAX}, I_o=1mA-70mA$	22.8		25.2	V (note 2)
Load Regulation	$V_o$	$T_j=25^{\circ}C, I_o=1mA-100mA$		40	200	mV
		$T_j=25^{\circ}C, I_o=1mA-40mA$		20	100	mV
Line regulation	$V_o$	$27V \leq V_I \leq 38V, T_j=25^{\circ}C$		160	360	mV
		$28V \leq V_I \leq 38V, T_j=25^{\circ}C$		150	300	mV
Quiescent Current	$I_q$	$V_{IN}=33V, I_o=0mA, T_j=25^{\circ}C$		4.7	6.5	mA
Quiescent Current Change	$\Delta I_q$	$27V \leq V_I \leq 38V$			1.5	mA
	$\Delta I_q$	$1mA \leq V_I \leq 40mA$			0.1	mA
Output Noise Voltage	$V_N$	$10Hz \leq f \leq 100kHz$		200		$\mu V$
Ripple Rejection	RR	$27V \leq V_I \leq 38V, f=120Hz, T_j=25^{\circ}C$	34	45		dB
Dropout Voltage	$V_d$	$T_j=25^{\circ}C$		1.7		V

Note 1: The Maximum steady state usable output current is dependent on input voltage, heat sinking, lead length of the package and copper pattern of PCB. The data above represent pulse test conditions with junction temperatures specified at the initiation of test.

Note 2: Power dissipation < 0.5W

Figure 1: Output Voltage Vs Ambient Temperature

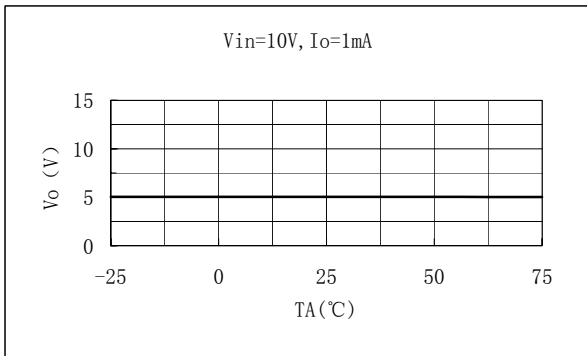


Figure 2: Quiescent Current Vs Output Current

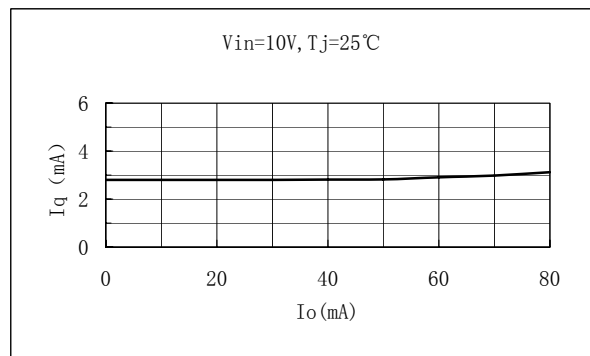


Figure3: Load Characteristics

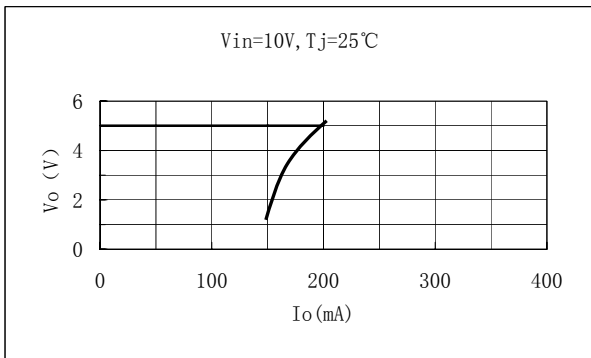


Figure4: Quiescent Current Vs Input Voltage

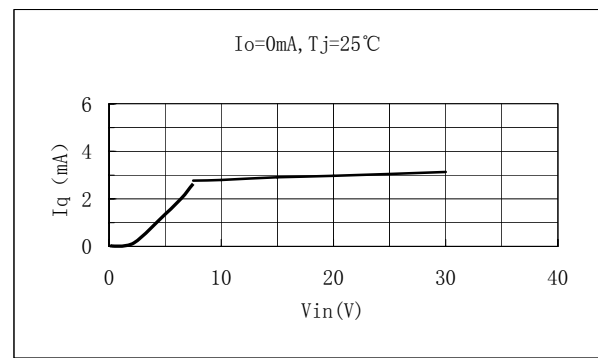


Figure 5: Thermal Shutdown

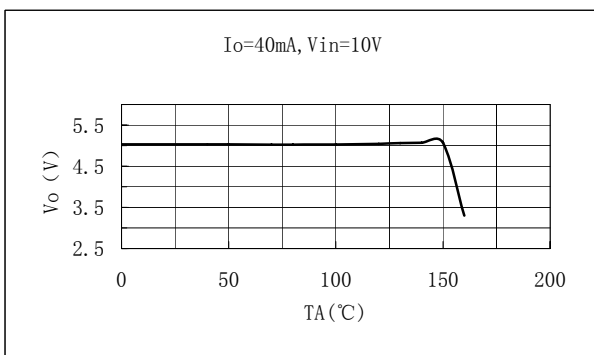
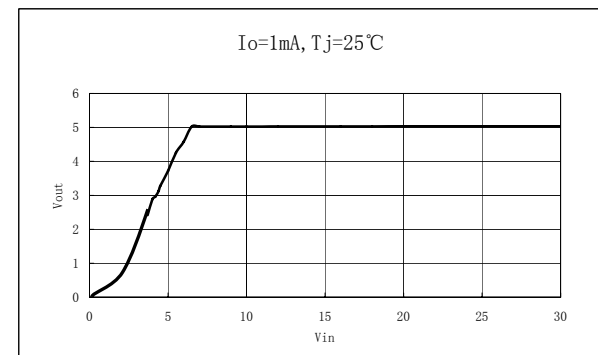
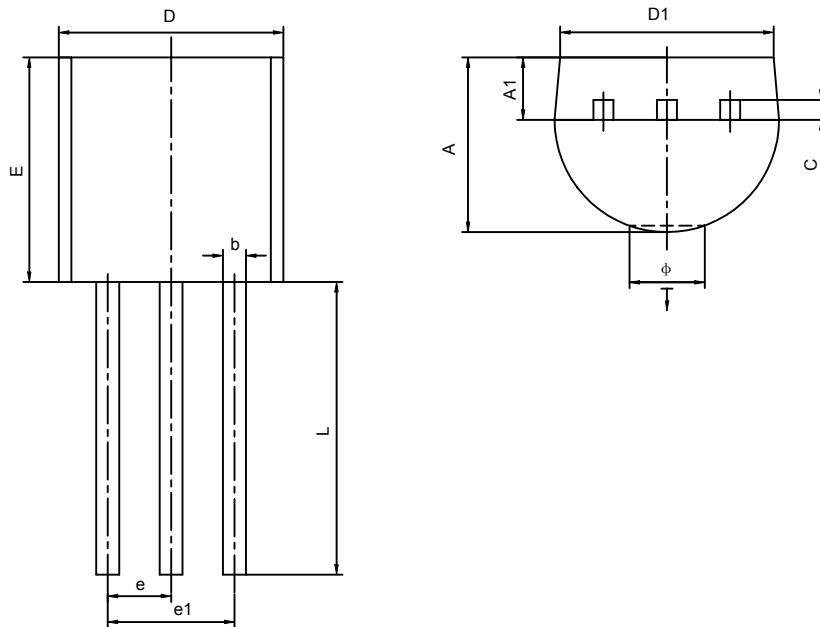


Figure 6: Output characteristics

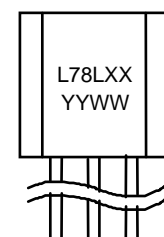


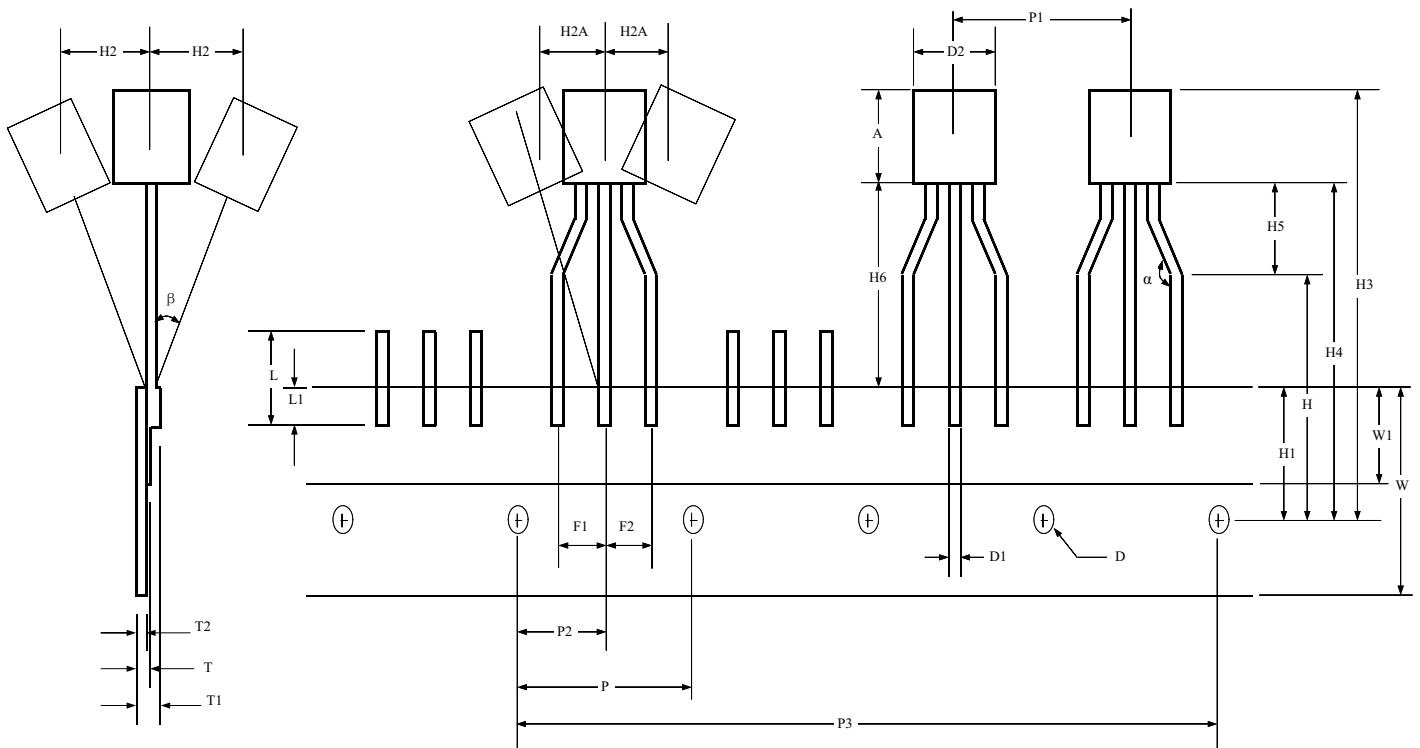
**TO-92 PACKAGE OUTLINE DIMENSIONS**


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.300	3.700	0.130	0.146
A1	1.100	1.400	0.043	0.055
b	0.380	0.550	0.015	0.022
c	0.360	0.510	0.014	0.020
D	4.400	4.700	0.173	0.185
D1	3.430		0.135	
E	4.300	4.700	0.169	0.185
e	1.270TYP		0.050TYP	
e1	2.440	2.640	0.096	0.104
L	14.100	14.500	0.555	0.571
Ö		1.600		0.063
↓	0.000	0.380	0.000	0.015

**SHIPPING INFORMATION**

1. Bag: 1000 Units/ Bag 10 Bag/ Box(240mm\*170mm\*96mm)  
4 Box/ Chest(365mm\*270mm\*210mm)
2. Tape: 2000 Units/ Box 10 Box/ Chest

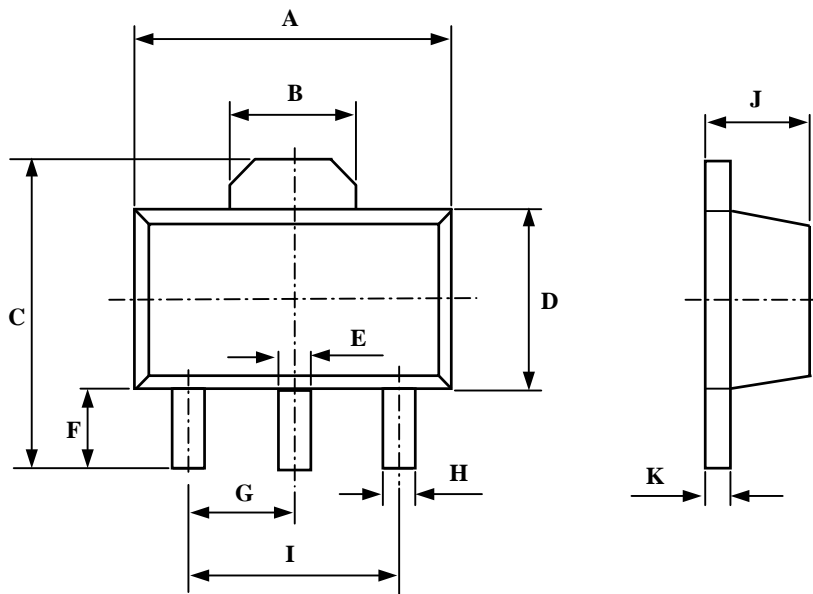
**MARKING**


**TO-92 TAPPING OUTLINE DIMENSIONS**


symbol	mm		inch		symbol	mm		inch	
	min	max	min	max		min	max	min	max
A	4.40	4.80	0.173	0.189	L	-	11.00	-	0.433
D	3.80	4.20	0.150	0.165	L1	2.50	-	0.098	-
D1	0.45	0.55	0.018	0.022	P	12.50	12.90	0.492	0.508
D2	4.40	4.80	0.173	0.189	P1	12.50	12.90	0.492	0.508
F1,F2	2.40	2.90	0.094	0.114	P2	6.31	6.39	0.248	0.252
F1-F2	-0.30	0.30	-0.012	0.012	P3	50.30	51.30	1.980	2.020
H	15.50	16.50	0.610	0.650	T	-	0.55	-	0.022
H1	8.50	9.50	0.335	0.374	T1	-	1.42	-	0.056
H2	-	1.00	-	0.039	T2	0.36	0.55	0.014	0.022
H2A	-	1.00	-	0.039	W	17.50	19.00	0.689	0.748
H3	-	26.00	-	1.024	W1	5.00	7.00	0.197	0.276
H4	-	21.00	-	0.827	W2	-	0.50	-	0.020
H5	3.00	5.00	0.118	0.197	α	145°	155°	145°	155°
H6	9.00	11.00	0.354	0.433	β	-	4°	-	4°



## SOT-89-3L PACKAGE OUTLINE DIMENSIONS



SYMBOL	Dimensions In Mmillimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	4.000	4.600	0.173	0.181
B	1.550 REF		0.061 REF	
C	3.940	4.250	0.155	0.167
D	2.300	2.600	0.091	0.102
E	0.400	0.580	0.016	0.023
F	0.900	1.200	0.035	0.047
G	1.5 TYP		0.06 TYP	
H	0.320	0.520	0.013	0.020
I	3 TYP		0.118 TYP	
J	1.400	1.600	0.055	0.063
K	0.350	0.440	0.014	0.017

### SHIPPING INFORMATION

Tape: 2500 Units/ Reel(13 inch)  
 2 Reel/ Box(340mm\*340mm\*50mm)  
 6 Box/ Chest(360mm\*360mm\*315mm)

### MARKING

