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TS78L00 series

3-Terminal Low Current Positive Voltage Regulator

TO-92



SOT-89



SOP-8



Voltage Range 5V to 24V
Output Current up to 100mA

General Description

The TS78L00 Series of positive voltage Regulators are inexpensive, easy-to-use devices suitable for a multitude of applications that require a regulated supply of up to 100mA. Like their higher power TS7800 and TS78M00 Series cousins, these regulators feature internal current limiting and thermal shutdown making them remarkably rugged. No external components are required with the TS78L00 devices in many applications.

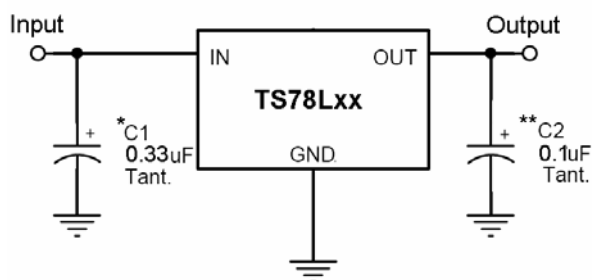
These devices offer a substantial performance advantage over the traditional zener diode-resistor combination, as output impedance and quiescent current are substantially reduced.

This series is offered in 3-pin TO-92, SOT-89 and 8-pin SOP-8 package.

Features

- ✧ Output current up to 100mA
- ✧ No external components required
- ✧ Internal thermal overload protection
- ✧ Internal short-circuit current limiting
- ✧ Output transistor safe-area compensation
- ✧ Output voltage offered in 4% tolerance

Standard Application



A common ground is required between the input and the output voltages. The input voltage must remain typically 2.0V above the output voltage even during the low point on the Input ripple voltage.

XX = these two digits of the type number indicate voltage.

* = Cin is required if regulator is located an appreciable distance from power supply filter.

** = Co is not needed for stability; however, it does improve transient response.

Ordering Information

Part No.	Operating Temp. (Ambient)	Package
TS78LxxCT	-20 ~ +85 °C	TO-92
TS78LxxCY		SOT-89
TS78LxxACY		SOT-89
TS78LxxCS		SOP-8

Note: Where xx denotes voltage option.

Pin Assignment

Pin No.				Pin Description
TS78L00CT	TS78L00ACY	TS78L00CY	TS78L00CS	
1	1	3	1	Output
2	2	2	2, 3, 6, 7	Ground
3	3	1	8	Input
			4, 5	Non connected



Absolute Maximum Rating			
Input Voltage	Vin *	35	V
Input Voltage	Vin **	40	V
Power Dissipation	TO-92 TO-89 SOP-8	Pd 0.625 0.5 0.5	W
Operating Junction Temperature Range	T _J	0 ~ +150	°C
Storage Temperature Range	T _{STG}	-65 ~ +150	°C
Note : * TS78L05 to TS78L18 ** TS78L24			

TS78L05 Electrical Characteristics							
(Vin=10V, Iout=40mA, 0°C≤Tj≤125°C, Cin=0.33uF, Cout=0.1uF; unless otherwise specified.)							
Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
Output voltage	Vout	Tj=25 °C		4.80	5	5.20	V
		7.5V≤Vin≤20V, 5mA≤Iout≤100mA		4.75	5	5.25	
Line Regulation	REGline	Tj=25 °C	7.5V≤Vin≤20V, Io=40mA	--	50	150	mV
Load Regulation	REGload	Tj=25 °C	5mA≤Iout≤100mA	--	20	60	
			5mA≤Iout≤40mA	--	10	30	
Quiescent Current	Iq	Iout=0, Tj=25 °C		--	3	6	mA
Quiescent Current Change	ΔIq	8V≤Vin≤20V		--	--	1.5	
		1mA≤Iout≤40mA		--	--	0.1	
Output Noise Voltage	Vn	10Hz≤f≤100KHz, Tj=25 °C		--	40	--	uV
Ripple Rejection Ratio	RR	f=120Hz, 8V≤Vin≤18V		41	49	--	dB
Voltage Drop	Vdrop	Tj=25 °C		--	1.7	--	V
Peak Output Current	Io peak	Tj=25 °C		--	0.15	--	A
Average Temperature Coefficient of Output Voltage	ΔVo/ ΔT	Io=5mA		--	-0.65	--	mV/°C

- Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible, and thermal effects must be taken into account separately.
- This specification applies only for DC power dissipation permitted by absolute maximum ratings.



TS78L06 Electrical Characteristics

($V_{in}=11V$, $I_{out}=40mA$, $0^{\circ}C \leq T_j \leq 125^{\circ}C$, $C_{in}=0.33\mu F$, $C_{out}=0.1\mu F$; unless otherwise specified.)

Parameter		Test Conditions	Min	Typ	Max	Unit
Output voltage	V_{out}	$T_j=25^{\circ}C$	5.76	6	6.24	V
		$8.5V \leq V_{in} \leq 21V$, $5mA \leq I_{out} \leq 100mA$	5.70	6	6.30	
Line Regulation	REG _{line}	$T_j=25^{\circ}C$ $8.5V \leq V_{in} \leq 21V$, $I_o=40mA$	--	50	150	mV
Load Regulation	REG _{load}	$T_j=25^{\circ}C$ $5mA \leq I_{out} \leq 100mA$	--	20	60	
		$5mA \leq I_{out} \leq 40mA$	--	10	30	
Quiescent Current	I_q	$I_{out}=0$, $T_j=25^{\circ}C$	--	3	6	mA
Quiescent Current Change	ΔI_q	$9V \leq V_{in} \leq 21V$	--	--	1.5	
		$1mA \leq I_{out} \leq 40mA$	--	--	0.1	
Output Noise Voltage	V_n	$10Hz \leq f \leq 100KHz$, $T_j=25^{\circ}C$	--	40	--	μV
Ripple Rejection Ratio	RR	$f=120Hz$, $9V \leq V_{in} \leq 19V$	41	49	--	dB
Voltage Drop	V_{drop}	$T_j=25^{\circ}C$	--	1.7	--	V
Peak Output Current	I_o peak	$T_j=25^{\circ}C$	--	0.15	--	A
Average Temperature Coefficient of Output Voltage	$\Delta V_o / \Delta T$	$I_o=5mA$	--	-0.75	--	$mV/^{\circ}C$

TS78L08 Electrical Characteristics

($V_{in}=14V$, $I_{out}=40mA$, $0^{\circ}C \leq T_j \leq 125^{\circ}C$, $C_{in}=0.33\mu F$, $C_{out}=0.1\mu F$; unless otherwise specified.)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Output Voltage	V_{out}	$T_j=25^{\circ}C$	7.69	8	8.32	V
		$10.5V \leq V_{in} \leq 23V$, $5mA \leq I_{out} \leq 100mA$	7.61	8	8.40	
Line Regulation	REG _{line}	$T_j=25^{\circ}C$ $10.5V \leq V_{in} \leq 23V$, $I_o=40mA$	--	80	160	mV
Load Regulation	REG _{load}	$T_j=25^{\circ}C$ $5mA \leq I_{out} \leq 100mA$	--	25	80	
		$5mA \leq I_{out} \leq 40mA$	--	10	40	
Quiescent Current	I_q	$I_{out}=0$, $T_j=25^{\circ}C$	--	3	6	mA
Quiescent Current Change	ΔI_q	$11V \leq V_{in} \leq 23V$	--	--	1.5	
		$1mA \leq I_{out} \leq 40mA$	--	--	0.1	
Output Noise Voltage	V_n	$10Hz \leq f \leq 100KHz$, $T_j=25^{\circ}C$	--	60	--	μV
Ripple Rejection Ratio	RR	$f=120Hz$, $13V \leq V_{in} \leq 23V$	37	57	--	dB
Voltage Drop	V_{drop}	$T_j=25^{\circ}C$	--	1.7	--	V
Peak Output Current	I_o peak	$T_j=25^{\circ}C$	--	0.15	--	A
Average Temperature Coefficient of Output Voltage	$\Delta V_o / \Delta T$	$I_o=5mA$	--	-0.8	--	$mV/^{\circ}C$

- Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible, and thermal effects must be taken into account separately.
- This specification applies only for DC power dissipation permitted by absolute maximum ratings.



TS78L09 Electrical Characteristics

($V_{in}=15V$, $I_{out}=40mA$, $0^{\circ}C \leq T_j \leq 125^{\circ}C$, $C_{in}=0.33\mu F$, $C_{out}=0.1\mu F$; unless otherwise specified.)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Output Voltage	V_{out}	$T_j=25^{\circ}C$	8.65	9	9.36	V
		$11.5V \leq V_{in} \leq 24V$, $5mA \leq I_{out} \leq 100mA$	8.57	9	9.45	
Line Regulation	REGline	$T_j=25^{\circ}C$ $11.5V \leq V_{in} \leq 24V$, $I_o=40mA$	--	90	180	mV
Load Regulation	REGload	$T_j=25^{\circ}C$ $5mA \leq I_{out} \leq 100mA$	--	30	90	
		$5mA \leq I_{out} \leq 40mA$	--	15	45	
Quiescent Current	I_q	$I_{out}=0$, $T_j=25^{\circ}C$	--	3	6	mA
Quiescent Current Change	ΔI_q	$12V \leq V_{in} \leq 24V$	--	--	0.8	
		$5mA \leq I_{out} \leq 40mA$	--	--	0.5	
Output Noise Voltage	V_n	$10Hz \leq f \leq 100KHz$, $T_j=25^{\circ}C$	--	60	--	μV
Ripple Rejection Ratio	RR	$f=120Hz$, $14V \leq V_{in} \leq 24V$	37	57	--	dB
Voltage Drop	V_{drop}	$T_j=25^{\circ}C$	--	1.7	--	V
Peak Output Current	I_o peak	$T_j=25^{\circ}C$	--	0.15	--	A
Average Temperature Coefficient of Output Voltage	$\Delta V_o / \Delta T$	$I_o=5mA$	--	-0.9	--	$mV/^{\circ}C$

TS78L12 Electrical Characteristics

($V_{in}=19V$, $I_{out}=40mA$, $0^{\circ}C \leq T_j \leq 125^{\circ}C$, $C_{in}=0.33\mu F$, $C_{out}=0.1\mu F$; unless otherwise specified.)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Output Voltage	V_{out}	$T_j=25^{\circ}C$	11.53	12	12.48	V
		$14.5V \leq V_{in} \leq 27V$, $5mA \leq I_{out} \leq 100mA$	11.42	12	12.60	
Line Regulation	REGline	$T_j=25^{\circ}C$ $14.5V \leq V_{in} \leq 27V$, $I_o=40mA$	--	120	240	mV
Load Regulation	REGload	$T_j=25^{\circ}C$ $5mA \leq I_{out} \leq 100mA$	--	40	120	
		$5mA \leq I_{out} \leq 40mA$	--	20	60	
Quiescent Current	I_q	$T_j=25^{\circ}C$, $I_{out}=0$	--	3	6.5	mA
Quiescent Current Change	ΔI_q	$16V \leq V_{in} \leq 27V$	--	--	1.5	
		$5mA \leq I_{out} \leq 40mA$	--	--	0.1	
Output Noise Voltage	V_n	$10Hz \leq f \leq 100KHz$, $T_j=25^{\circ}C$	--	80	--	μV
Ripple Rejection Ratio	RR	$f=120Hz$, $15V \leq V_{in} \leq 25V$	37	42	--	dB
Voltage Drop	V_{drop}	$T_j=25^{\circ}C$	--	1.7	--	V
Peak Output Current	I_o peak	$T_j=25^{\circ}C$	--	0.15	--	A
Average Temperature Coefficient of Output Voltage	$\Delta V_o / \Delta T$	$I_o=5mA$	--	-0.10	--	$mV/^{\circ}C$

- Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible, and thermal effects must be taken into account separately.
- This specification applies only for DC power dissipation permitted by absolute maximum ratings.



TS78L15 Electrical Characteristics

($V_{in}=23V$, $I_{out}=40mA$, $0^{\circ}C \leq T_j \leq 125^{\circ}C$, $C_{in}=0.33\mu F$, $C_{out}=0.1\mu F$; unless otherwise specified.)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Output Voltage	V_{out}	$T_j=25^{\circ}C$	14.42	15	15.60	V
		$17.5V \leq V_{in} \leq 30V$, $5mA \leq I_{out} \leq 100mA$	14.28	15	15.75	
Line Regulation	REGline	$T_j=25^{\circ}C$ $17.5V \leq V_{in} \leq 30V$, $I_o=200mA$	--	150	300	mV
Load Regulation	REGload	$T_j=25^{\circ}C$ $5mA \leq I_{out} \leq 100mA$	--	50	150	
		$5mA \leq I_{out} \leq 40mA$	--	25	75	
Quiescent Current	I_q	$T_j=25^{\circ}C$, $I_{out}=0$	--	3	6.5	mA
Quiescent Current Change	ΔI_q	$20V \leq V_{in} \leq 30V$	--	--	1.5	
		$5mA \leq I_{out} \leq 40mA$	--	--	0.1	
Output Noise Voltage	V_n	$10Hz \leq f \leq 100KHz$, $T_j=25^{\circ}C$	--	90	--	μV
Ripple Rejection Ratio	RR	$f=120Hz$, $18V \leq V_{in} \leq 28V$	34	39	--	dB
Voltage Drop	V_{drop}	$T_j=25^{\circ}C$	--	1.7	--	V
Peak Output Current	I_o peak	$T_j=25^{\circ}C$	--	0.15	--	A
Average Temperature Coefficient of Output Voltage	$\Delta V_o / \Delta T$	$I_o=5mA$	--	-1.3	--	$mV/^{\circ}C$

TS78L18 Electrical Characteristics

($V_{in}=27V$, $I_{out}=40mA$, $0^{\circ}C \leq T_j \leq 125^{\circ}C$, $C_{in}=0.33\mu F$, $C_{out}=0.1\mu F$; unless otherwise specified.)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Output Voltage	V_{out}	$T_j=25^{\circ}C$	17.30	18	18.72	V
		$21V \leq V_{in} \leq 33V$, $5mA \leq I_{out} \leq 100mA$	17.14	18	18.90	
Line Regulation	REGline	$T_j=25^{\circ}C$ $21V \leq V_{in} \leq 33V$, $I_o=40mA$	--	180	360	mV
Load Regulation	REGload	$T_j=25^{\circ}C$ $5mA \leq I_{out} \leq 100mA$	--	60	180	
		$5mA \leq I_{out} \leq 40mA$	--	30	90	
Quiescent Current	I_q	$T_j=25^{\circ}C$, $I_{out}=0$	--	3	6.5	mA
Quiescent Current Change	ΔI_q	$21V \leq V_{in} \leq 33V$	--	--	1.5	
		$5mA \leq I_{out} \leq 40mA$	--	--	0.1	
Output Noise Voltage	V_n	$10Hz \leq f \leq 100KHz$, $T_j=25^{\circ}C$	--	150	--	μV
Ripple Rejection Ratio	RR	$f=120Hz$, $23V \leq V_{in} \leq 33V$	33	48	--	dB
Voltage Drop	V_{drop}	$T_j=25^{\circ}C$	--	1.7	--	V
Peak Output Current	I_o peak	$T_j=25^{\circ}C$	--	0.15	--	A
Average Temperature Coefficient of Output Voltage	$\Delta V_o / \Delta T$	$I_o=5mA$	--	-1.5	--	$mV/^{\circ}C$

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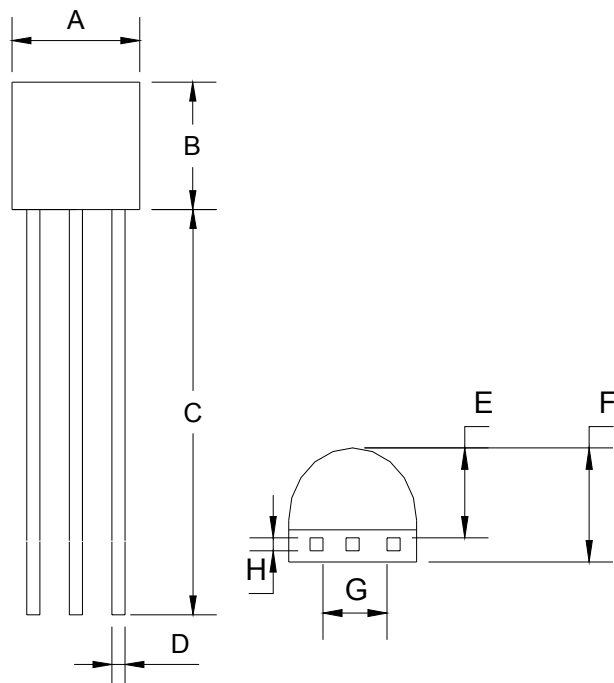
TS78L24 Electrical Characteristics

($V_{in}=33V$, $I_{out}=40mA$, $0^{\circ}C \leq T_j \leq 125^{\circ}C$, $C_{in}=0.33\mu F$, $C_{out}=0.1\mu F$; unless otherwise specified.)

Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	V_{out}	$T_j=25^{\circ}C$		23.07	24	24.96	V
		$27V \leq V_{in} \leq 38V$, $5mA \leq I_{out} \leq 100mA$		22.85	24	25.20	
Line Regulation	REGline	$T_j=25^{\circ}C$	$27V \leq V_{in} \leq 38V$, $I_o=40mA$	--	200	400	mV
Load Regulation	REGload	$T_j=25^{\circ}C$	$5mA \leq I_{out} \leq 100mA$	--	80	240	
			$5mA \leq I_{out} \leq 40mA$	--	40	120	
Quiescent Current	I_q	$I_{out}=0$, $T_j=25^{\circ}C$		--	4	7	mA
Quiescent Current Change	ΔI_q	$28V \leq V_{in} \leq 38V$		--	--	1.5	
		$5mA \leq I_{out} \leq 40mA$		--	--	0.1	
Output Noise Voltage	V_n	$10Hz \leq f \leq 100KHz$, $T_j=25^{\circ}C$		--	200	--	μV
Ripple Rejection Ratio	RR	$f=120Hz$, $29V \leq V_{in} \leq 35V$		31	45	--	dB
Voltage Drop	V_{drop}	$T_j=25^{\circ}C$		--	1.7	--	V
Peak Output Current	$I_{o \text{ peak}}$	$T_j=25^{\circ}C$		--	0.15	--	A
Average Temperature Coefficient of Output Voltage	$\Delta V_o / \Delta T$	$I_o=5mA$		--	-2.0	--	$mV/^{\circ}C$

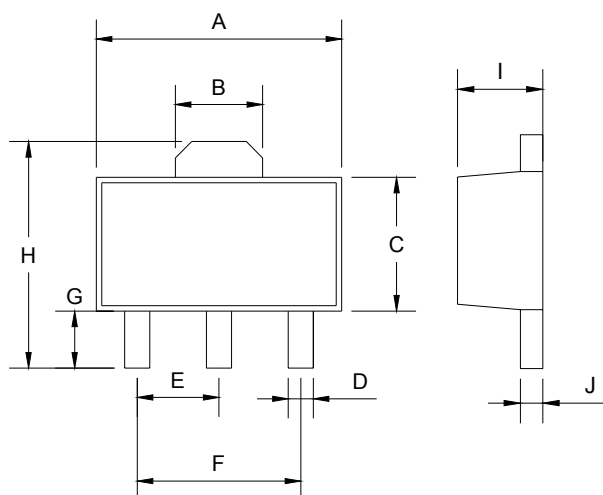
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TO-92 Mechanical Drawing



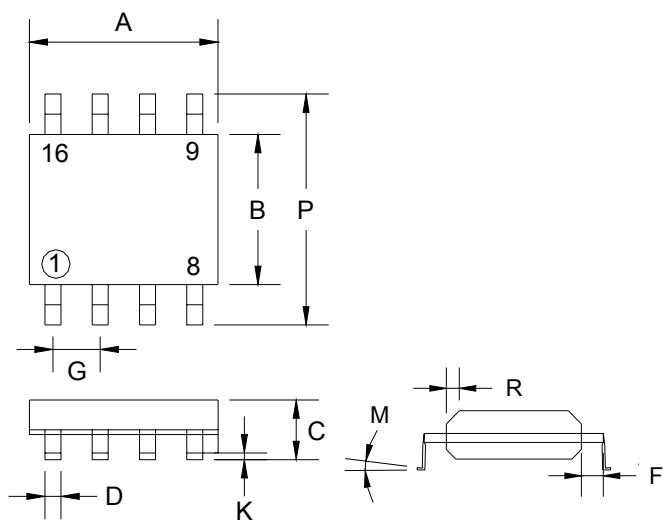
TO-92 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.70	0.169	0.185
B	4.30	4.70	0.169	0.185
C	14.30(typ)		0.563(typ)	
D	0.43	0.49	0.017	0.019
E	2.19	2.81	0.086	0.111
F	3.30	3.70	0.130	0.146
G	2.42	2.66	0.095	0.105
H	0.37	0.43	0.015	0.017

SOT-89 Mechanical Drawing



SOT-89 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.40	4.60	0.173	0.181
B	1.50	1.7	0.059	0.070
C	2.30	2.60	0.090	0.102
D	0.40	0.52	0.016	0.020
E	1.50	1.50	0.059	0.059
F	3.00	3.00	0.118	0.118
G	0.89	1.20	0.035	0.047
H	4.05	4.25	0.159	0.167
I	1.4	1.6	0.055	0.068
J	0.35	0.44	0.014	0.017

SOP-8 Mechanical Drawing



SOP-8 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.196
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 (typ)		0.05 (typ)	
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019