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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.

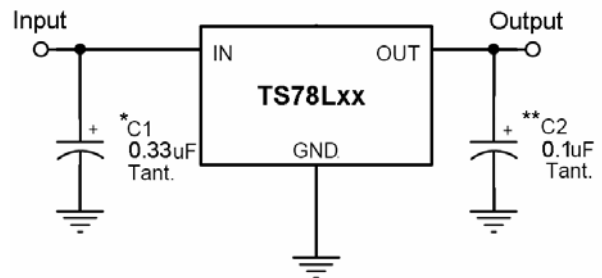
These devices offer a substantial performance advantage over the traditional zener diode-resistor combination, as output impedance and quiescent current are substantially reduced.

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.

* = C_{in} is required if regulator is located an appreciable distance from power supply filter.

** = C_o 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		V _{in} *	35	V
Input Voltage		V _{in} **	40	V
Power Dissipation	TO-92	P _d	0.625	W
	TO-89		0.5	
	SOP-8		0.5	
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

(V_{in}=10V, I_{out}=40mA, 0°C≤T_j≤125°C, C_{in}=0.33uF, C_{out}=0.1uF; unless otherwise specified.)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Output voltage	V _{out}	T _j =25°C	4.80	5	5.20	V
		7.5V≤V _{in} ≤20V, 5mA≤I _{out} ≤100mA	4.75	5	5.25	
Line Regulation	REG _{line}	T _j =25°C 7.5V≤V _{in} ≤20V, I _o =40mA	--	50	150	mV
Load Regulation	REG _{load}	T _j =25°C 5mA≤I _{out} ≤100mA	--	20	60	
		5mA≤I _{out} ≤40mA	--	10	30	
Quiescent Current	I _q	I _{out} =0, T _j =25°C	--	3	6	mA
Quiescent Current Change	ΔI _q	8V≤V _{in} ≤20V	--	--	1.5	
		1mA≤I _{out} ≤40mA	--	--	0.1	
Output Noise Voltage	V _n	10Hz≤f≤100KHz, T _j =25°C	--	40	--	uV
Ripple Rejection Ratio	RR	f=120Hz, 8V≤V _{in} ≤18V	41	49	--	dB
Voltage Drop	V _{drop}	T _j =25°C	--	1.7	--	V
Peak Output Current	I _{o peak}	T _j =25°C	--	0.15	--	A
Average Temperature Coefficient of Output Voltage	ΔV _o / ΔT	I _o =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	Vout	$T_j=25^{\circ}C$	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	REGline	$T_j=25^{\circ}C$	--	50	150	mV
Load Regulation	REGload	$T_j=25^{\circ}C$				
			$5mA \leq I_{out} \leq 40mA$	10	30	
Quiescent Current	Iq	$I_{out}=0$, $T_j=25^{\circ}C$	--	3	6	mA
Quiescent Current Change	ΔIq	$9V \leq V_{in} \leq 21V$	--	--	1.5	
		$1mA \leq I_{out} \leq 40mA$	--	--	0.1	
Output Noise Voltage	Vn	$10Hz \leq f \leq 100KHz$, $T_j=25^{\circ}C$	--	40	--	μV
Ripple Rejection Ratio	RR	$f=120Hz$, $9V \leq V_{in} \leq 19V$	41	49	--	dB
Voltage Drop	Vdrop	$T_j=25^{\circ}C$	--	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	Vout	$T_j=25^{\circ}C$	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	REGline	$T_j=25^{\circ}C$	--	80	160	mV
Load Regulation	REGload	$T_j=25^{\circ}C$				
			$5mA \leq I_{out} \leq 40mA$	10	40	
Quiescent Current	Iq	$I_{out}=0$, $T_j=25^{\circ}C$	--	3	6	mA
Quiescent Current Change	ΔIq	$11V \leq V_{in} \leq 23V$	--	--	1.5	
		$1mA \leq I_{out} \leq 40mA$	--	--	0.1	
Output Noise Voltage	Vn	$10Hz \leq f \leq 100KHz$, $T_j=25^{\circ}C$	--	60	--	μV
Ripple Rejection Ratio	RR	$f=120Hz$, $13V \leq V_{in} \leq 23V$	37	57	--	dB
Voltage Drop	Vdrop	$T_j=25^{\circ}C$	--	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	REG _{line}	$T_j=25^{\circ}C$ $11.5V \leq V_{in} \leq 24V$, $I_o=40mA$	--	90	180	mV
Load Regulation	REG _{load}	$T_j=25^{\circ}C$ $5mA \leq I_{out} \leq 100mA$	--	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	REG _{line}	$T_j=25^{\circ}C$ $14.5V \leq V_{in} \leq 27V$, $I_o=40mA$	--	120	240	mV
Load Regulation	REG _{load}	$T_j=25^{\circ}C$ $5mA \leq I_{out} \leq 100mA$	--	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							
(Vin=23V, 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		14.42	15	15.60	V
		17.5V≤Vin≤30V, 5mA≤Iout≤100mA		14.28	15	15.75	
Line Regulation	REGline	Tj=25 °C	17.5V≤Vin≤30V, Io=200mA	--	150	300	mV
Load Regulation	REGload	Tj=25 °C	5mA≤Iout≤100mA	--	50	150	
			5mA≤Iout≤40mA	--	25	75	
Quiescent Current	Iq	Tj=25 °C, Iout=0		--	3	6.5	mA
Quiescent Current Change	ΔIq	20V≤Vin≤30V		--	--	1.5	
		5mA≤Iout≤40mA		--	--	0.1	
Output Noise Voltage	Vn	10Hz≤f≤100KHz, Tj=25 °C		--	90	--	uV
Ripple Rejection Ratio	RR	f=120Hz, 18V≤Vin≤28V		34	39	--	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		--	-1.3	--	mV/°C
TS78L18 Electrical Characteristics							
(Vin=27V, 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		17.30	18	18.72	V
		21V≤Vin≤33V, 5mA≤Iout≤100mA		17.14	18	18.90	
Line Regulation	REGline	Tj=25 °C	21V≤Vin≤33V, Io=40mA	--	180	360	mV
Load Regulation	REGload	Tj=25 °C	5mA≤Iout≤100mA	--	60	180	
			5mA≤Iout≤40mA	--	30	90	
Quiescent Current	Iq	Tj=25 °C, Iout=0		--	3	6.5	mA
Quiescent Current Change	ΔIq	21V≤Vin≤33V		--	--	1.5	
		5mA≤Iout≤40mA		--	--	0.1	
Output Noise Voltage	Vn	10Hz≤f≤100KHz, Tj=25 °C		--	150	--	uV
Ripple Rejection Ratio	RR	f=120Hz, 23V≤Vin≤33V		33	48	--	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		--	-1.5	--	mV/°C

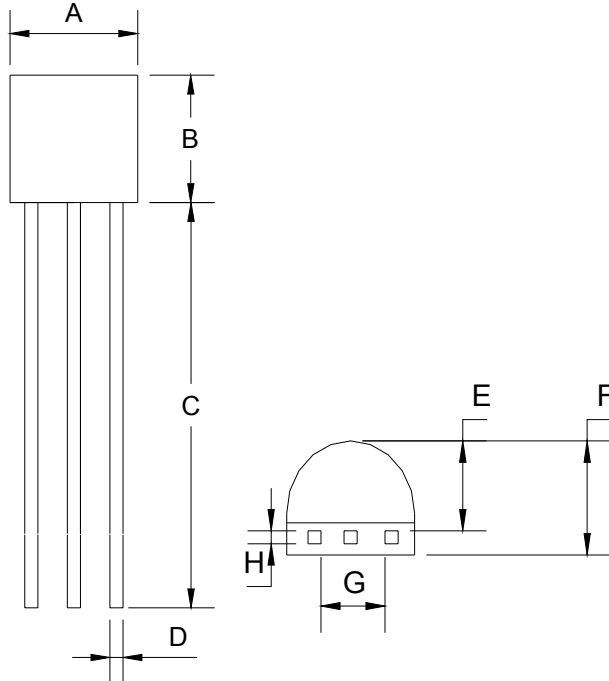
- Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible, and thermal effects must be taken into account separately.
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TS78L24 Electrical Characteristics							
(Vin=33V, Iout=40mA, 0 °C≤Tj≤125 °C, Cin=0.33uF, Cout=0.1uF; unless otherwise specified.)							
Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
Output Voltage	Vout	Tj=25 °C		23.07	24	24.96	V
		27V≤Vin≤38V, 5mA≤Iout≤100mA		22.85	24	25.20	
Line Regulation	REGline	Tj=25 °C	27V≤Vin≤38V, Io=40mA	--	200	400	mV
Load Regulation	REGload	Tj=25 °C	5mA≤Iout≤100mA	--	80	240	
			5mA≤Iout≤40mA	--	40	120	
Quiescent Current	Iq	Iout=0, Tj=25 °C		--	4	7	mA
Quiescent Current Change	ΔIq	28V≤Vin≤38V		--	--	1.5	
		5mA≤Iout≤40mA		--	--	0.1	
Output Noise Voltage	Vn	10Hz≤f≤100KHz, Tj=25 °C		--	200	--	uV
Ripple Rejection Ratio	RR	f=120Hz, 29V≤Vin≤35V		31	45	--	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		--	-2.0	--	mV/°C

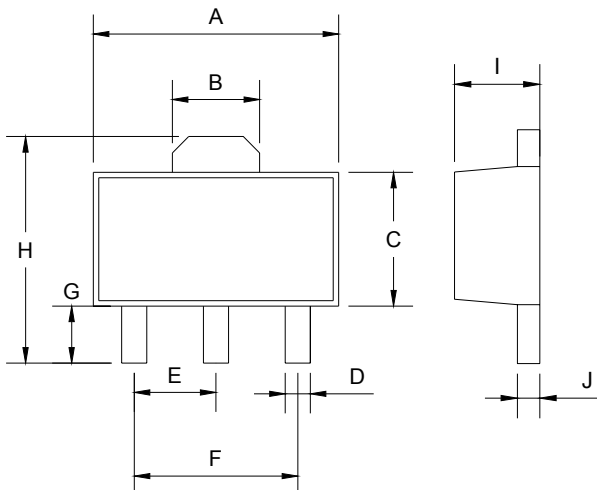
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- This specification applies only for DC power dissipation permitted by absolute maximum ratings.

TO-92 Mechanical Drawing



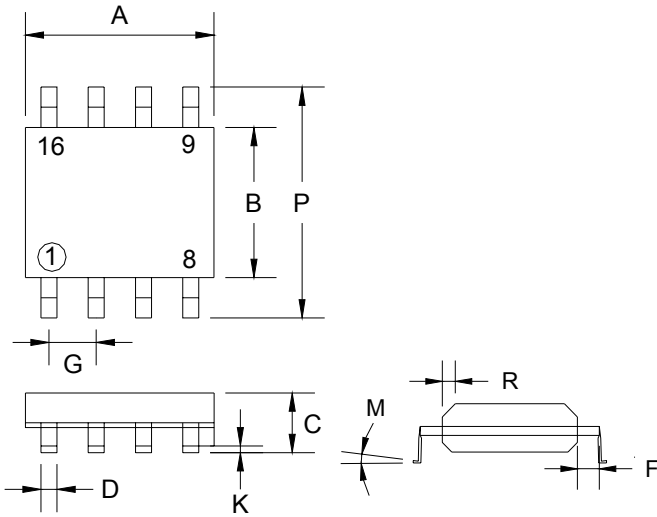
TO-92 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.70	0.169	0.185
B	4.30	4.70	0.169	0.185
C	14.30(typ)		0.563(typ)	
D	0.43	0.49	0.017	0.019
E	2.19	2.81	0.086	0.111
F	3.30	3.70	0.130	0.146
G	2.42	2.66	0.095	0.105
H	0.37	0.43	0.015	0.017

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