



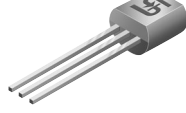
TS78L00

3-Terminal Low Current Positive Voltage Regulators

SOT-89



TO-92



SOP-8



Voltage Range
5 to 24 Volts
Current
0.1 Ampere

Features

- ✧ Wide Range of Available, Fixed Output Voltages
- ✧ Low Cost
- ✧ Internal Short Circuit Current Limiting
- ✧ Internal Thermal Overload Protection
- ✧ No External Components Required
- ✧ Complementary Negative Regulators Offered (TS79L00 Series)
- ✧ Available in $\pm 4\%$ Voltage Tolerance

Ordering Informations

Device	Operating Temperature (Ambient)	Package
TS78LxxCT	-20°C ~ +85°C	TO-92
TS78LxxCS		SOP-8
TS78LxxCY		SOT-89

Absolute Maximum Ratings (T_A=+25°C unless otherwise noted.)

Parameter	Symbol	Value	Unit
Input Voltage	V _i *1	35	V
Input Voltage	V _i *2	40	V
Storage Junction Temperature Range	T _{stg}	-65 to +150	°C
Operating Junction Temperature Range	T _j	0 to +150	°C

Note: *1: TS78L05 to TS78L18 *2: TS78L24

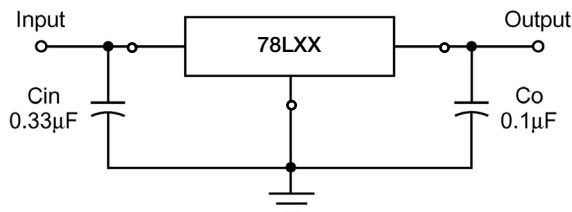
- This specification applies only for DC power dissipation permitted by absolute maximum ratings.
- Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately. All characteristics are measured with 1 0.33μF capacitor across the input and a 0.1μF capacitor across the output.

Standard Application

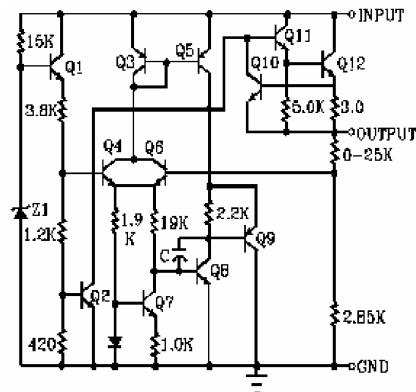
A common ground is required between the input and the output voltages. The input voltage must remain typical 2.0V above the output voltage even during the low point on the input ripple voltage.

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.



Representative Circuit Schematic



Rev. 1 04/2003



TS78L05 Electrical Characteristics					
$(V_I = 10V, I_O = 40mA, C_I = 0.33\mu F, C_O = 0.1\mu F, 0^\circ C < T_J < +125^\circ C \text{ unless otherwise noted.})$					
Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage ($T_J = +25^\circ C$)	V_O	4.8	5.0	5.2	Vdc
Line Regulation ($T_J = +25^\circ C, I_O = 40mA$)	REGline	--	55	150	mV
$7.0V \leq V_I \leq 20V$		--	45	100	mV
$8.0V \leq V_I \leq 20V$		--			
Load Regulation	REGload	--	11	60	mV
$T_J = +25^\circ C, 1.0mA \leq I_O \leq 100mA$		--	5.0	30	mV
$T_J = +25^\circ C, 1.0mA \leq I_O \leq 40mA$		--			
Output Voltage	V_O	4.75	--	5.25	Vdc
$7.0V \leq V_I \leq 20V, 1.0mA \leq I_O \leq 40mA$		4.75	--	5.25	Vdc
$V_I = 10V, 1.0mA \leq I_O \leq 70mA$					
Input Bias Current	I_{IB}	--	3.8	6.0	mA
($T_J = +25^\circ C$)		--	--	5.5	mA
($T_J = +125^\circ C$)		--			
Input Bias Current Change	ΔI_{IB}	--	--	1.5	mA
$8.0V \leq V_I \leq 20V$		--	--	0.1	mA
$1.0mA \leq I_O \leq 40mA$		--			
Output Noise Voltage ($T_A = +25^\circ C, 10Hz \leq f \leq 100kHz$)	V_n	--	40	--	μV
Ripple Rejection ($I_O = 40mA, f = 120Hz, 8.0V \leq V_I \leq 18V, T_J = +25^\circ C$)	RR	41	49	--	dB
Dropout Voltage	$V_i - V_o$	--	1.7	--	Vdc
TS78L08 Electrical Characteristics					
$(V_I = 14V, I_O = 40mA, C_I = 0.33\mu F, C_O = 0.1\mu F, 0^\circ C < T_J < +125^\circ C \text{ unless otherwise noted.})$					
Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage ($T_J = +25^\circ C$)	V_O	7.7	8.0	8.3	Vdc
Line Regulation ($T_J = +25^\circ C, I_O = 40mA$)	REGline	--	20	175	mV
$10.5V \leq V_I \leq 23V$		--	12	125	mV
$11V \leq V_I \leq 23V$		--			
Load Regulation	REGload	--	15	80	mV
$T_J = +25^\circ C, 1.0mA \leq I_O \leq 100mA$		--	8.0	40	mV
$T_J = +25^\circ C, 1.0mA \leq I_O \leq 40mA$		--			
Output Voltage	V_O	7.6	--	8.4	Vdc
$10.5V \leq V_I \leq 23V, 1.0mA \leq I_O \leq 40mA$		7.6	--	8.4	Vdc
$V_I = 14V, 1.0mA \leq I_O \leq 70mA$					
Input Bias Current	I_{IB}	--	3.0	6.0	mA
($T_J = +25^\circ C$)		--	--	5.5	mA
($T_J = +125^\circ C$)		--			
Input Bias Current Change	ΔI_{IB}	--	--	1.5	mA
$11V \leq V_I \leq 23V$		--	--	0.1	mA
$1.0mA \leq I_O \leq 40mA$		--			
Output Noise Voltage ($T_A = +25^\circ C, 10Hz \leq f \leq 100kHz$)	V_n	--	60	--	μV
Ripple Rejection ($I_O = 40mA, f = 120Hz, 12V \leq V_I \leq 23V, T_J = +25^\circ C$)	RR	37	57	--	dB
Dropout Voltage ($T_J = +25^\circ C$)	$V_i - V_o$	--	1.7	--	Vdc

Rev. 1 04/2003



TS78L09 Electrical Characteristics ($V_I=15V$, $I_O=40mA$, $C_I=0.33\mu F$, $C_O=0.1\mu F$, $-40^\circ C < T_J < +125^\circ C$ (for TS78LXX), $0^\circ C < T_J < 125^\circ C$ (for TS78LXX), unless otherwise noted.)					
Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage ($T_J=+25^\circ C$)	V_O	8.6	9.0	9.4	Vdc
Line Regulation ($T_J=+25^\circ C$, $I_O=40mA$) $11.5V \leq V_I \leq 24V$ $12V \leq V_I \leq 24V$	REGline	--	20	175	mV
		--	12	125	mV
Load Regulation $T_J=+25^\circ C$, $1.0mA \leq I_O \leq 100mA$ $T_J=+25^\circ C$, $1.0mA \leq I_O \leq 40mA$	REGload	--	15	90	mV
		--	8.0	40	mV
Output Voltage $11.5V \leq V_I \leq 24V$, $1.0mA \leq I_O \leq 40mA$ $V_I=15V$, $1.0mA \leq I_O \leq 70mA$	V_O	8.5	--	9.5	Vdc
		8.5	--	9.5	Vdc
Input Bias Current ($T_J=+25^\circ C$) ($T_J=+125^\circ C$)	I_{IB}	--	3.0	6.0	mA
		--	--	5.5	mA
Input Bias Current Change $11V \leq V_I \leq 23V$ $1.0mA \leq I_O \leq 40mA$	ΔI_{IB}	--	--	1.5	mA
		--	--	0.1	mA
Output Noise Voltage ($T_A=+25^\circ C$, $10Hz \leq f \leq 100kHz$)	V_n	--	60	--	μV
Ripple Rejection ($I_O=40mA$, $f=120Hz$, $12V \leq V_I \leq 23V$, $T_J=+25^\circ C$)	RR	37	57	--	dB
Dropout Voltage ($T_J=+25^\circ C$)	V_i-V_o	--	1.7	--	Vdc
TS78L12 Electrical Characteristics ($V_I=19V$, $I_O=40mA$, $C_I=0.33\mu F$, $C_O=0.1\mu F$, $0^\circ C < T_J < +125^\circ C$ unless otherwise noted.)					
Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage ($T_J=+25^\circ C$)	V_O	11.5	12	12.5	Vdc
Line Regulation ($T_J=+25^\circ C$, $I_O=40mA$) $14.5V \leq V_I \leq 27V$ $16V \leq T_J \leq 27V$	REGline	--	120	250	mV
		--	100	200	mV
Load Regulation $T_J=+25^\circ C$, $1.0mA \leq I_O \leq 100mA$ $T_J=+25^\circ C$, $1.0mA \leq I_O \leq 40mA$	REGload	--	20	100	mV
		--	10	50	mV
Output Voltage $14.5V \leq V_I \leq 27V$, $1.0mA \leq I_O \leq 40mA$ $V_I=19V$, $1.0mA \leq I_O \leq 70mA$	V_O	11.4	--	12.6	Vdc
		11.4	--	12.6	Vdc
Input Bias Current ($T_J=+25^\circ C$) ($T_J=+125^\circ C$)	I_{IB}	--	42	6.5	mA
		--	--	6.0	mA
Input Bias Current Change $16V \leq V_I \leq 27V$ $1.0mA \leq I_O \leq 40mA$	ΔI_{IB}	--	--	1.5	mA
		--	--	0.1	mA
Output Noise Voltage ($T_A=+25^\circ C$, $10Hz \leq f \leq 100kHz$)	V_n	--	80	--	μV
Ripple Rejection ($I_O=40mA$, $f=120Hz$, $15V \leq V_I \leq 25V$, $T_J=+25^\circ C$)	RR	36	42	--	dB
Dropout Voltage ($T_J=+25^\circ C$)	V_i-V_o	--	1.7	--	Vdc

Rev. 1 04/2003



TS78L15 Electrical Characteristics					
$(V_I=23V, I_O=40mA, C_I=0.33\mu F, C_O=0.1\mu F, 0^\circ C < T_J < +125^\circ C$ unless otherwise noted.)					
Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage ($T_J=+25^\circ C$)	V_O	14.4	15	15.6	Vdc
Line Regulation ($T_J=+25^\circ C, I_O=40mA$)	REGline	--	130	300	mV
$17.5V \leq V_I \leq 30V$		--	110	250	mV
$20V \leq V_I \leq 30V$					
Load Regulation	REGload	--	25	150	mV
$T_J=+25^\circ C, 1.0mA \leq I_O \leq 100mA$		--	12	75	mV
$T_J=+25^\circ C, 1.0mA \leq I_O \leq 40mA$					
Output Voltage	V_O	14.25	--	15.75	Vdc
$17.5V < V_I < 30V, 1.0mA \leq I_O \leq 40mA$		14.25	--	15.75	Vdc
$V_I=23V, 1.0mA \leq I_O \leq 70mA$					
Input Bias Current	I_{IB}	--	4.4	6.5	mA
($T_J=+25^\circ C$)		--	--	6.0	mA
($T_J=+125^\circ C$)					
Input Bias Current Change	ΔI_{IB}	--	--	1.5	mA
$20V \leq V_I \leq 30V$		--	--	0.1	mA
$1.0mA \leq I_O \leq 40mA$					
Output Noise Voltage ($T_A=+25^\circ C, 10Hz \leq f \leq 100kHz$)	V_n	--	90	--	μV
Ripple Rejection ($I_O=40mA, f=120Hz, 18.5V \leq V_I \leq 28.5V, T_J=+25^\circ C$)	RR	34	39	--	dB
Dropout Voltage ($T_J=+25^\circ C$)	V_I-V_O	--	1.7	--	Vdc
TS78L18 Electrical Characteristics					
$(V_I=27V, I_O=40mA, C_I=0.33\mu F, C_O=0.1\mu F, 0^\circ C < T_J < +125^\circ C$ unless otherwise noted.)					
Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage ($T_J=+25^\circ C$)	V_O	17.3	18	18.7	Vdc
Line Regulation ($T_J=+25^\circ C, I_O=40mA$)	REGline	--	45	325	mV
$20.7V \leq V_I \leq 33V$		--	35	275	mV
$21V \leq V_I \leq 33V$					
Load Regulation	REGload	--	30	170	mV
$T_J=+25^\circ C, 1.0mA \leq I_O \leq 100mA$		--	15	85	mV
$T_J=+25^\circ C, 1.0mA \leq I_O \leq 40mA$					
Output Voltage	V_O	17.1	--	18.9	Vdc
$21.5V \leq V_I \leq 33V, 1.0mA \leq I_O \leq 40mA$		17.1	--	18.9	Vdc
$V_I=27V, 1.0mA \leq I_O \leq 70mA$					
Input Bias Current	I_{IB}	--	3.1	6.5	mA
($T_J=+25^\circ C$)		--	--	6.0	mA
($T_J=+125^\circ C$)					
Input Bias Current Change	ΔI_{IB}	--	--	1.5	mA
$22V \leq V_I \leq 33V$		--	--	0.1	mA
$1.0mA \leq I_O \leq 40mA$					
Output Noise Voltage ($T_A=+25^\circ C, 10Hz \leq f \leq 100kHz$)	V_n	--	150	--	μV
Ripple Rejection ($I_O=40mA, f=120Hz, 23V \leq V_I \leq 33V, T_J=+25^\circ C$)	RR	31	45	--	dB
Dropout Voltage ($T_J=+25^\circ C$)	V_I-V_O	--	1.7	--	Vdc

Rev. 1 04/2003



TS78L24 Electrical Characteristics

($V_I = 33V$, $I_O = 40mA$, $C_I = 0.33\mu F$, $C_O = 0.1\mu F$, $0^\circ C < T_J < +125^\circ C$ unless otherwise noted.)

Characteristics	Symbol	Min	Typ	Max	Unit
Output Voltage ($T_J = +25^\circ C$)	V_O	23	24	24	Vdc
Line Regulation ($T_J = +25^\circ C$), $I_O = 40mA$ $27.5V \leq V_I \leq 38V$ $28V \leq V_I \leq 80V$	REGline	--	50 60	350 300	mV mV
Load Regulation $T_J = +25^\circ C$, $1.0mA \leq I_O \leq 100mA$ $T_J = +25^\circ C$, $1.0mA \leq I_O \leq 40mA$	REGload	--	40 20	200 100	mV mV
Output Voltage $28V \leq V_I \leq 38V$, $1.0mA \leq I_O \leq 40mA$ $28V \leq V_I \leq 33V$, $1.0mA \leq I_O \leq 70mA$	V_O	22.8 22.8	--	25.2 25.2	Vdc Vdc
Input Bias Current ($T_J = +25^\circ C$) ($T_J = +125^\circ C$)	I_{IB}	--	3.1 --	6.5 6.0	mA mA
Input Bias Current Change $28V \leq V_I \leq 38V$ $1.0mA \leq I_O \leq 40mA$	ΔI_{IB}	--	--	1.5 0.1	mA mA
Output Noise Voltage ($T_a = +25^\circ C$, $10Hz \leq f \leq 100kHz$)	V_n	--	200	--	μV
Ripple Rejection ($I_O = 40mA$, $f = 120Hz$, $29V \leq V_I \leq 35V$, $T_J = +25^\circ C$)	RR	31	45	--	dB
Dropout Voltage ($T_J = +25^\circ C$)	$V_I - V_O$	--	1.7	--	Vdc

FIGURE 1 - DROPOUT CHARACTERISTICS

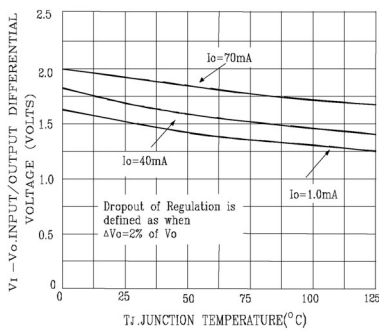


FIGURE 2 - DROPOUT VOLTAGE versus JUNCTION TEMPERATURE

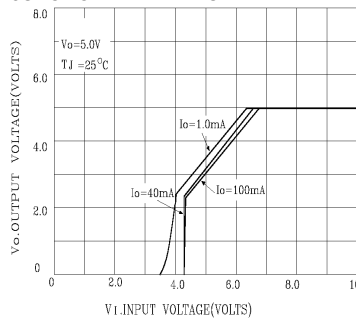


FIGURE 3 - INPUT BIAS CURRENT versus AMBIENT TEMPERATURE

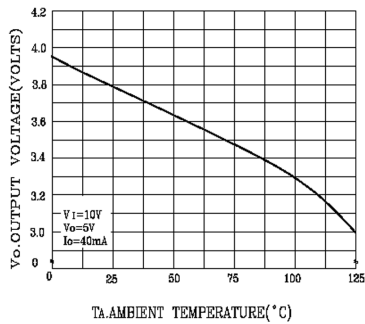


FIGURE 4 - INPUT BIAS CURRENT versus INPUT VOLTAGE

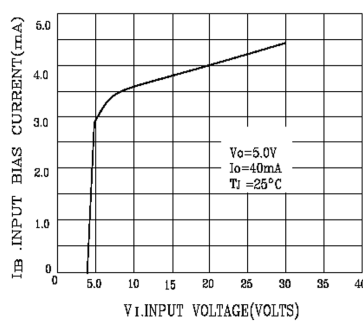
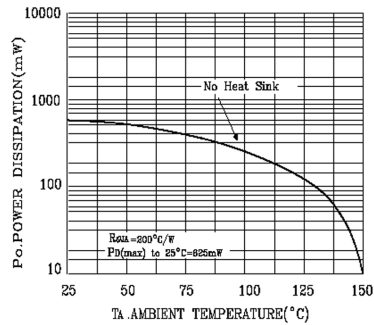
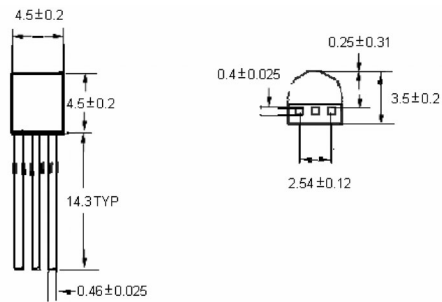


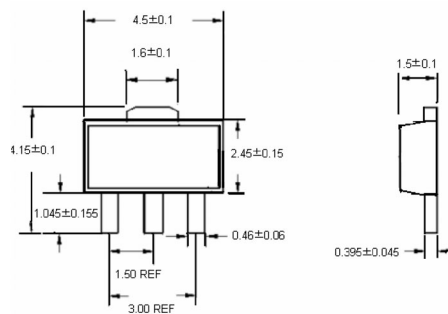
FIGURE 5 - MAXIMUM AVERAGE POWER DISSIPATION versus AMBIENT TEMPERATURE



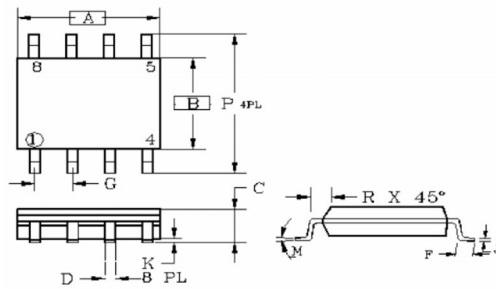
TO-92
Unit: mm



SOT-89
Unit: mm



SOP-8
Unit: mm



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 BSC		0.05 BSC	
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