

TS78M00 series

3-Terminal Medium Current Positive Voltage Regulator

TO-220



TO-252



Pin assignment:

- 1. Input
- Ground
- Output

(Heatsink surface connected to Pin 2)

Voltage Range 5V to 24V Output Current up to 0.5A

General Description

The TS78M00 Series positive voltage regulators are identical to the popular TS7800 Series devices, except that they are specified for only half the output current. Like the TS7800 devices, the TS78M00 Series 3-Terminal regulators are intended for local, on-card voltage regulation.

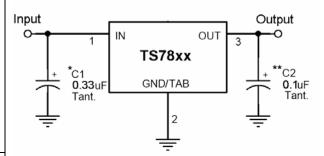
Internal current limiting, thermal shutdown circuitry and safe-area compensation for the internal pass transistor combine to make these devices remarkably rugged under most operating conditions. Maximum output current with adequate heatsink is 500mA

This series is offered in 3-pin TO-220, TO-252 package.

Features

- Output current up to 0.5A
- 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
TS78MxxCZ	-20 ~ +85°C	TO-220
TS78MxxCP		TO-252

Note: Where xx denotes voltage option.

Absolute Maximum Rating

Input Voltage		Vin *	35	V
Input Voltage		Vin **	40	V
Power Dissipation	TO-220	Without heatsink	2	
	TO-220	Pt ***	15	W
	TO-252	Without heatsink	1	
Operating Junction Temperature Range		TJ	0 ~ +150	°C
Storage Temperature Ran	ge	T _{STG}	-65 ~ +150	°C

Note: * TS78M05 to TS78M18

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^{**} TS78M24

^{***} Follow the derating curve



TS78M05 Electrical Characteristics

(Vin=10V, lout=350mA, 0 °C≤Tj≤125 °C, Cin=0.33uF, Cout=0.1uF; unless otherwise specified.)

Parameter	Symbol	Test Conditions		Min	Тур	Max	Unit
		Tj=25°C	Tj=25 °C		5	5.20	
Output voltage	Vout	7.5V≤Vin≤	20V,	4.75	5	5.25	V
		5mA≤lout≤	≤350mA, PD≤5W				
Line Regulation	REGline	Tj=25°C	7.5V≤Vin≤25V, Io=200mA		3	50	mV
Load Regulation	DEOL	Tj=25°C	5mA≤lout≤500mA		20	100	
	REGload	1j-25 C	5mA≤lout≤200mA		10	50	
Quiescent Current	Iq	lout=0, Tj=	=25 °C		3	6	
Outcoant Current Change	Δlα	7.5V≤Vin≤25V				0.8	mA
Quiescent Current Change	Δlq	5mA≤lout≤350mA				0.5	
Output Noise Voltage	Vn	10Hz≤f≤10	00KHz, Tj=25°C		40	1	uV
Ripple Rejection Ratio	RR	f=120Hz, 8	3V≤Vin≤18V	62	80		dB
Voltage Drop	Vdrop	Iout=350mA, Tj=25 °C			2	-	V
Peak Output Current	lo peak	Tj=25°C			0.7	-	Α
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	lout=5mA,	0 °C≤Tj≤125 °C		-0.2	-	mV/ °C

TS78M06 Electrical Characteristics

(Vin=11V, lout=350mA, 0 °C \leq Tj \leq 125 °C, Cin=0.33uF, Cout=0.1uF; unless otherwise specified.)

Parameter	Symbol	Tes	t Conditions	Min	Тур	Max	Unit
		Tj=25 °C	Tj=25 °C		6	6.25	
Output Voltage	Vout	8.5V≤Vin≤2	1V,	6.3	6	6.3	V
		5mA≤lout≤3	350mA, PD≤5W				
Line Regulation	REGline	Tj=25 °C	8.5V≤Vin≤25V, Io=200mA		3	50	mV
Lood Dogulation	DEClark	T:-05 00	5mA≤lout≤500A		20	120	
Load Regulation	REGload Tj=25°C		5mA≤lout≤200mA		10	60	
Quiescent Current	lq	lout=0, Tj=25 °C			3	6	
Quiocoont Current Change	Δlq	8.5V≤Vin≤2	5V			0.8	mA
Quiescent Current Change	Δίζ	5mA≤lout≤350mA				0.5	
Output Noise Voltage	Vn	10Hz≤f≤100	KHz, Tj=25 °C		45		uV
Ripple Rejection Ratio	RR	f=120Hz, 9\	/≤Vin≤19V	59	80		dB
Voltage Drop	Vdrop	lout=350m/	A, Tj=25 °C		2		V
Output Short Circuit Current	los	Tj=25°C			50		mA
Peak Output Current	lo peak	Tj=25°C			0.7		Α
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	lout=5mA, () °C≤Tj≤125 °C		-0.2	-	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.



TS78M08 Electrical Characteristics

(Vin=14V, Iout=350mA, 0 °C≤Tj≤125 °C, Cin=0.33uF, Cout=0.1uF; unless otherwise specified.)

Parameter	Symbol	Tes	t Conditions	Min	Тур	Max	Unit
		Tj=25 °C		7.69	8	8.32	
Output Voltage	Vout	10.5V≤Vin≤	23V,	7.61	8	8.40	V
		5mA≤lout≤3	350mA, PD≤5W				
Line Regulation	REGline	Tj=25 °C	10.5V≤Vin≤25V, lo=200mA		6	50	mV
Lond Demilation	DECLERA	T:-05 00	5mA≤lout≤500mA		25	160	
Load Regulation	REGload	Tj=25°C	5mA≤lout≤200mA		10	80	
Quiescent Current	Iq	lout=0, Tj=2	25°C		3	6	
0 '	A1	10.5V≤Vin≤	25V			0.8	mA
Quiescent Current Change	Δlq	5mA≤lout≤350mA				0.5	
Output Noise Voltage	Vn	10Hz≤f≤100	KHz, Tj=25 °C		52		uV
Ripple Rejection Ratio	RR	f=120Hz, 1	1V≤Vin≤21V	56	80		dB
Voltage Drop	Vdrop	lout=350m/	A, Tj=25 °C		2		V
Output Short Circuit Current	los	Tj=25 °C			50		mA
Peak Output Current	lo peak	Tj=25 °C			0.7		Α
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	lout=5mA, () °C≤Tj≤125 °C		-0.2		mV/ °C

TS78M09 Electrical Characteristics

(Vin=15V, lout=350mA, 0 °C \leq Tj \leq 125 °C, Cin=0.33uF, Cout=0.1uF; unless otherwise specified.)

Parameter	Symbol	Tes	t Conditions	Min	Тур	Max	Unit
		Tj=25 °C	Tj=25 °C		9	9.36	
Output Voltage	Vout	11.5V≤Vin≤	23V,	8.57	9	9.45	V
		5mA≤lout≤3	350mA, PD≤5W				
Line Degulation	REGline	Tj=25°C	11.5V≤Vin≤26V,		6	50	
Line Regulation	REGIIIIE	1j-25 C	Io=200mA				mV
Load Population	REGload	Tj=25°C	5mA≤lout≤500mA		25	180	
Load Regulation	REGIOAU	1j-25 C	5mA≤lout≤200mA		10	90	
Quiescent Current	Iq	lout=0, Tj=2	25°C		3	6	
Outroport Comment Change	A 1	11.5V≤Vin≤	26V			0.8	mA
Quiescent Current Change	Δlq	5mA≤lout≤350mA				0.5	
Output Noise Voltage	Vn	10Hz≤f≤100	KHz, Tj=25 °C		52	-	uV
Ripple Rejection Ratio	RR	f=120Hz, 12	2V≤Vin≤22V	55	80		dB
Voltage Drop	Vdrop	lout=350mA	A, Tj=25 °C		2		V
Output Short Circuit Current	los	Tj=25°C			50		mA
Peak Output Current	lo peak	Tj=25 °C			0.7	-	Α
Temperature Coefficient of	A)/	lout=5mA, 0 °C≤Tj≤125 °C			0.0		mV/
Output Voltage	ΔVout/ ΔTj	iout=5mA, (J USIJST25 U		-0.2		°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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[•] This specification applies only for DC power dissipation permitted by absolute maximum ratings.



TS78M12 Electrical Characteristics

(Vin=19V, lout=350mA, 0 °C≤Tj≤125 °C, Cin=0.33uF, Cout=0.1uF; unless otherwise specified.)

Parameter	Symbol	Test Conditions		Min	Тур	Max	Unit
		Tj=25 °C		11.53	12	12.48	
Output Voltage	Vout	14.5V≤Vin≤	27V,	11.42	12	12.60	V
		5mA≤lout≤3	350mA, PD ≤5W				
Line Regulation	REGline	Tj=25 °C 14.5V≤Vin≤30V, Io=200mA			8	50	mV
Lead Dec. Jeffer	DEOLESI	T: 05 00	5mA≤lout≤500mA		25	240	
Load Regulation	REGload	I Tj=25 °C	0mA≤lout≤200mA		10	120	
Quiescent Current	lq	Tj=25 °C, lout=0			3	6	
Oviese and Oversent Observe	۸۱۵	14.5V≤Vin≤30V				0.8	mA
Quiescent Current Change	Δlq	5mA≤lout≤200mA				0.5	
Output Noise Voltage	Vn	10Hz≤f≤100	OKHz, Tj=25 °C		75		uV
Ripple Rejection Ratio	RR	f=120Hz, 1	5V≤Vin≤25V	55	80		dB
Voltage Drop	Vdrop	lout=350m/	A, Tj=25°C		2		V
Output Short Circuit Current	los	Tj=25°C			50		mA
Peak Output Current	lo peak	Tj=25 °C			0.7		Α
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	lout=5mA, () °C≤Tj≤125 °C		-0.3		mV/ °C

TS78M15 Electrical Characteristics

(Vin=23V, lout=350mA, 0 $^{\circ}$ C \leq Tj \leq 125 $^{\circ}$ C, Cin=0.33uF, Cout=0.1uF; unless otherwise specified.)

Parameter			Test Conditions	Min	Тур	Max	Unit
		Tj=25 °C		14.42	15	15.60	
Output Voltage	Vout	17.5V≤Viı	n≤30V,	14.28	15	15.75	V
		5mA≤lout	t≤350mA, PD ≤5W				
Line Degulation	REGline	Tj=25	17.5V≤Vin≤30V,		8	50	
Line Regulation	REGIIIIE	°C	Io=200mA				mV
Load Regulation	REGload	Tj=25	5mA≤lout≤500mA		25	300	
Load Regulation	REGIOAU	°C	5mA≤lout≤200mA		10	150	
Quiescent Current	lq	Tj=25°C,	lout=0		3	6	
Outlease to Comment Observes	A 1	17.5V≤Vii	n≤30V			0.8	mA
Quiescent Current Change	Δlq	5mA≤lout≤350mA				0.5	
Output Noise Voltage	Vn	10Hz≤f≤1	00KHz, Tj=25°C		90	-	uV
Ripple Rejection Ratio	RR	f=120Hz,	18V≤Vin≤28V	54	70		dB
Voltage Drop	Vdrop	lout=350r	mA, Tj=25 °C		2		V
Output Short Circuit Current	los	Tj=25°C			50		mA
Peak Output Current	lo peak	Tj=25°C			0.7		Α
Temperature Coefficient of	A)/+/ AT:	L (5 A 0 00 T; (05 00					mV/
Output Voltage	ΔVout/ ΔTj	iout=5mA	a, 0 °C≤Tj≤125 °C		-0.3		°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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[•] This specification applies only for DC power dissipation permitted by absolute maximum ratings.



TS78M18 Electrical Characteristics

(Vin=27V, lout=350mA, 0 °C≤Tj≤125 °C, Cin=0.33uF, Cout=0.1uF; unless otherwise specified.)

Parameter	Symbol	Test Conditions		Min	Тур	Max	Unit
		Tj=25 °C		17.30	18	18.72	
Output Voltage	Vout	21V≤Vin≤3	3V,	17.14	18	18.90	V
		5mA≤lout≤3	350mA, PD ≤5W				
Line Regulation	REGline	Tj=25 °C 21V≤Vin≤33V, Io=200mA			8	50	mV
Load Decidation	DECIMA	T:-05 00	5mA≤lout≤500mA		25	360	
Load Regulation	REGload	Tj=25°C	5mA≤lout≤200mA		10	180	
Quiescent Current	lq	Tj=25 °C, Ic	out=0		3	6	
O increase O must Observe	A1	21V≤Vin≤3	3V			0.8	mA
Quiescent Current Change	Δία	Δlq 5mA≤lout≤350nA				0.5	
Output Noise Voltage	Vn	10Hz≤f≤100	OKHz, Tj=25 °C		110		uV
Ripple Rejection Ratio	RR	f=120Hz, 2	1V≤Vin≤31V	54	70		dB
Voltage Drop	Vdrop	lout=350m/	A, Tj=25 °C		2		V
Output Short Circuit Current	los	Tj=25 °C			50		mA
Peak Output Current	lo peak	Tj=25°C			0.7		Α
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	lout=5mA, () °C≤Tj≤125 °C		-0.5		mV/ °C

TS78M24 Electrical Characteristics

(Vin=33V, lout=350mA, 0 $^{\circ}$ C \leq Tj \leq 125 $^{\circ}$ C, Cin=0.33uF, Cout=0.1uF; unless otherwise specified.)

Parameter	Symbol	Tes	t Conditions	Min	Тур	Max	Unit
		Tj=25 °C	Tj=25 °C		24	24.96	
Output Voltage	Vout	27V≤Vin≤38	BV,	22.85	24	25.20	V
		5mA≤lout≤3	850mA, PD ≤5W				
Line Regulation	REGline	Tj=25°C	27V≤Vin≤38V,		10	50	
		., _0	Io=200mA				mV
Load Population	REGload	Tj=25°C	5mA≤lout≤500mA		30	480	
Load Regulation	REGIOAU	1j=25 C	5mA≤lout≤200mA		10	240	
Quiescent Current	lq	lout=0, Tj=2	25°C		4	7	
Ouissant Current Change	Δlα	27V≤Vin≤38	3V			0.8	mA
Quiescent Current Change	Δlq	5mA≤lout≤3	350mA			0.5	
Output Noise Voltage	Vn	10Hz≤f≤100)KHz, Tj=25 °C		170	1	uV
Ripple Rejection Ratio	RR	f=120Hz, 27	7V≤Vin≤37V	50	70		dB
Voltage Drop	Vdrop	lout=350m/	A, Tj=25 °C		2		V
Output Short Circuit Current	los	Tj=25 °C			50		mA
Peak Output Current	lo peak	Tj=25°C			0.7	1	Α
Temperature Coefficient of	ΔVout/ ΔTj	lout=5mA, 0 °C≤Tj≤125 °C		:<40F ⁰ C	-0.5 -		mV/
Output Voltage	Δνουί/ Δ1	TOUL-SITIA, C) (≥1j≥120 C		-0.5		°C

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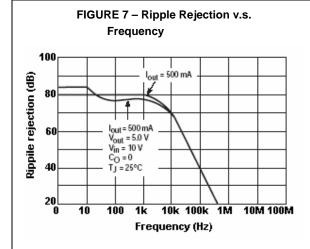


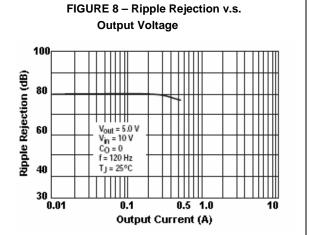
Electrical Characteristics Curve FIGURE 1 - Worst Case Power Dissipation v.s. FIGURE 2 - Peak Output Current v.s. **Ambient Temperature Dropout Voltage** 10 1.0 Infinite Heat θHS = 10°C/W 0.9 Power Dissipation (W) 5.0 Output Current (A) Tj = 25°C 0.8 3.0 θ_{HS} = 20°C/W 0.7 2.0 0.6 0.5 1.0 0.4 T_J = 125°C 0.3 0.5 0.3 0.2 θJC = 5°C/W 0.2 0.1 75 100 125 150 5 15 20 30 35 Ambient Temperature (^OC) Dropout Voltage (V) FIGURE 3 - Quiescent Current v.s. FIGURE 4 - Dropout Voltage v.s. Input Voltage **Junction Temperature** 4.0 2.5 Tj = 25°C Quescient Current (mA) 2.0 Dropput Voltage (V) IO = 500 mA 1.5 Tj = 125°C IO = 100 mA 2.0 1.0 I_O = 10 mA Tj = 25°C V_O = 5.0 V I_O = 0.5 A 1.0 $\Delta V_{O} = 100 \text{ mV}$ T_J = 125°C 0١ 10 15 20 25 30 35 40 25 75 100 125 Junction Temperature (OC) Input Voltage (V) FIGURE 5 - Quiescent Current v.s. FIGURE 6 - TO-252 Thermal Resistance and Pd(max) v.s. P.C.B Copper Length **Output Current** 5.0 100 PD(max) for TA = 50°C Free Air Quescient Current (mA) Thermal Resistance Junction to Air(^OC/W) Mounted 2.0 oz. Copper 60 Reja **40**l 0.01 0.5 1.0 5 30 10 15 20 25 Output Current (A) Length of Copper (mm)

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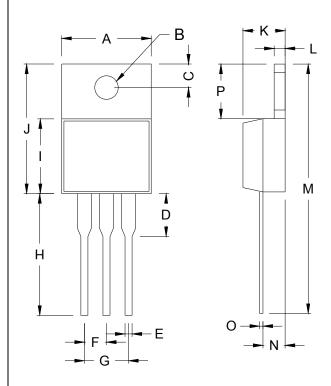
Electrical Characteristics Curve





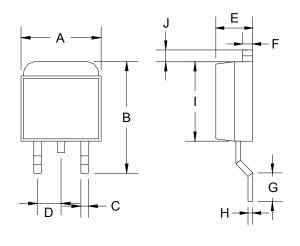


TO-220 Mechanical Drawing



TO-220 DIMENSION								
DIM	MILLIM	ETERS	INCHES					
ואווט	MIN	MAX	MIN	MAX				
Α	10.000	10.500	0.394	0.413				
В	3.240	4.440	0.128	0.175				
C	2.440	2.940	0.096	0.116				
D	ı	6.350	ı	0.250				
Е	0.381	1.106	0.015	0.040				
F	2.345	2.715	0.092	0.058				
G	4.690	5.430	0.092	0.107				
Н	12.700	14.732	0.500	0.581				
	8.382	9.017	0.330	0.355				
J	14.224	16.510	0.560	0.650				
K	3.556	4.826	0.140	0.190				
Ш	0.508	1.397	0.020	0.055				
М	27.700	29.620	1.060	1.230				
N	2.032	2.921	0.080	0.115				
0	0.255	0.610	0.010	0.024				
Р	5.842	6.858	0.230	0.270				

TO-252 Mechanical Drawing



TO-252 DIMENSION								
DIM	MILLIM	ETERS	INCHES					
ואווט	MIN	MAX	MIN	MAX				
Α	6.570	6.840	0.259	0.269				
В	9.250	10.400	0.364	0.409				
O	0.550	0.700	0.022	0.028				
D	2.560	2.670	0.101	0.105				
Е	2.300	2.390	0.090	0.094				
F	0.490	0.570	0.019	0.022				
G	1.460	1.580	0.057	0.062				
Η	0.520	0.570	0.020	0.022				
I	5.340	5.550	0.210	0.219				
J	1.460	1.640	0.057	0.065				