TAIWAN SEMICONDUCTOR

RoHS COMPLIANCE

TS78M00A Series

3-Terminal 500mA Positive Voltage Regulator

TO-220



TO-252 (DPAK)



Pin Definition:
1. Input
2. Ground (tab)
3. Output

General Description

The TS78M00A Series positive voltage regulators are identical to the popular TS7800A Series devices, except that they are specified for only half the output current. Like the TS7800A devices, the TS78M00A 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

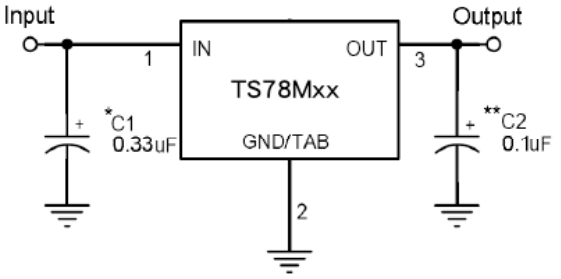
- Output Voltage Range 5 to 24V
- Output current up to 500mA
- No external components required
- Internal thermal overload protection
- Internal short-circuit current limiting
- Output transistor safe-area compensation
- Output voltage offered in 2% tolerance

Ordering Information

Part No.	Package	Packing
TS78M**xx**ACZ C0	TO-220	50pcs / Tube
TS78M**xx**ACP RO	TO-252	2.5Kpcs / 13” Reel

Note: Where **xx** denote voltage option

Standard Application Circuit



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.

Absolute Maximum Rating (Ta = 25°C unless otherwise noted)

Parameter	Symbol	Limit	Unit
Input Voltage	V_{IN}*	35	V
Input Voltage	V_{IN}**	40	V
Power Dissipation	P_D	Internal Limited	W
Operating Junction Temperature	T_J	0~+125	°C
Storage Temperature Range	T_{STG}	-65~+150	°C

Note: * TS78M05A to TS78M18A
** TS78M24A
*** Follow the derating curve

TS78M00A Series

3-Terminal 500mA Positive Voltage Regulator

TS78M05A Electrical Characteristics

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

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
Output voltage	Vout	Tj=25°C		4.90	5	5.10	V
		7.5V≤Vin≤20V, 5mA≤Iout≤350mA		4.80	5	5.20	
Line Regulation	REGline	Tj=25°C	7.5V≤Vin≤25V	--	3	100	mV
			8V≤Vin≤12V	--	1	50	
Load Regulation	REGload	Tj=25°C	5mA≤Iout≤500mA	--	15	100	
			5mA≤Iout≤200mA	--	5	50	
Quiescent Current	Iq	Iout=0, Tj=25°C		--	3	6	mA
Quiescent Current Change	ΔIq	7.5V≤Vin≤25V		--	--	0.8	
		5mA≤Iout≤350mA		--	--	0.5	
Output Noise Voltage	Vn	10Hz≤f≤100KHz, Tj=25°C		--	40	--	μV
Ripple Rejection Ratio	RR	f=120Hz, 8V≤Vin≤18V		62	78	--	dB
Voltage Drop	Vdrop	Iout=500mA, Tj=25°C		--	2	--	V
Output Resistance	Rout	f=1KHz		--	17	--	mΩ
Output Short Circuit Current	Ios	Tj=25°C		--	50	--	mA
Peak Output Current	Io peak	Tj=25°C		--	0.7	--	A
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	Iout= 5mA, 0°C≤Tj≤125°C		--	-0.2	--	mV/ °C

TS78M06A Electrical Characteristics

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

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
Output Voltage	Vout	Tj=25°C		5.88	6	6.12	V
		8.5V≤Vin≤21V, 5mA≤Iout≤350mA		5.76	6	6.24	
Line Regulation	REGline	Tj=25°C	8.5V≤Vin≤25V	--	5	120	mV
			9V≤Vin≤13V	--	1.5	60	
Load Regulation	REGload	Tj=25°C	5mA≤Iout≤500mA	--	14	120	
			5mA≤Iout≤200mA	--	4	60	
Quiescent Current	Iq	Iout=0, Tj=25°C		--	3	6	mA
Quiescent Current Change	ΔIq	8.5V≤Vin≤25V		--	--	0.8	
		5mA≤Iout≤350mA		--	--	0.5	
Output Noise Voltage	Vn	10Hz≤f≤100KHz, Tj=25°C		--	45	--	uV
Ripple Rejection Ratio	RR	F=120Hz, 9V≤Vin≤19V		59	80	--	dB
Voltage Drop	Vdrop	Iout=500mA, Tj=25°C		--	2	--	V
Output Resistance	Rout	F=1KHz		--	19	--	mΩ
Output Short Circuit Current	Ios	Tj=25°C		--	50	--	mA
Peak Output Current	Io peak	Tj=25°C		--	0.7	--	A
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	Iout= 5mA, 0°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.

TS78M00A Series

3-Terminal 500mA Positive Voltage Regulator

TS78M08A Electrical Characteristics

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

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
Output voltage	Vout	Tj=25°C		7.84	8	8.16	V
		10.5V≤Vin≤23V, 5mA≤Iout≤350mA		7.68	8	8.32	
Line Regulation	REGline	Tj=25°C	10.5V≤Vin≤25V	--	6	160	mV
			11V≤Vin≤17V	--	2	80	
Load Regulation	REGload	Tj=25°C	5mA≤Iout≤500mA	--	12	160	
			5mA≤Iout≤200mA	--	4	80	
Quiescent Current	Iq	Iout=0, Tj=25°C		--	3	6	mA
Quiescent Current Change	ΔIq	10.5V≤Vin≤25V		--	--	0.8	
		5mA≤Iout≤350mA		--	--	0.5	
Output Noise Voltage	Vn	10Hz≤f≤100KHz, Tj=25°C		--	52	--	μV
Ripple Rejection Ratio	RR	f=120Hz, 11V≤Vin≤21V		56	80	--	dB
Voltage Drop	Vdrop	Iout=500mA, Tj=25°C		--	2	--	V
Output Resistance	Rout	f=1KHz		--	16	--	mΩ
Output Short Circuit Current	Ios	Tj=25°C		--	50	--	mA
Peak Output Current	Io peak	Tj=25°C		--	0.7	--	A
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	Iout= 5mA, 0°C≤Tj≤125°C		--	-0.2	--	mV/ °C

TS78M09A Electrical Characteristics

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

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
Output Voltage	Vout	Tj=25°C		8.82	9	9.18	V
		11.5V≤Vin≤23V, 5mA≤Iout≤350mA		8.64	9	9.36	
Line Regulation	REGline	Tj=25°C	11.5V≤Vin≤26V	--	6	180	mV
			12V≤Vin≤17V	--	2	90	
Load Regulation	REGload	Tj=25°C	5mA≤Iout≤500mA	--	12	180	
			5mA≤Iout≤200mA	--	4	90	
Quiescent Current	Iq	Iout=0, Tj=25°C		--	3	6	mA
Quiescent Current Change	ΔIq	11.5V≤Vin≤26V		--	--	0.8	
		5mA≤Iout≤350mA		--	--	0.5	
Output Noise Voltage	Vn	10Hz≤f≤100KHz, Tj=25°C		--	52	--	uV
Ripple Rejection Ratio	RR	f=120Hz, 12V≤Vin≤22V		55	80	--	dB
Voltage Drop	Vdrop	Iout=500mA, Tj=25°C		--	2	--	V
Output Resistance	Rout	f=1KHz		--	16	--	mΩ
Output Short Circuit Current	Ios	Tj=25°C		--	50	--	mA
Peak Output Current	Io peak	Tj=25°C		--	0.7	--	A
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	Iout= 5mA, 0°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.

TS78M12A Electrical Characteristics

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

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
Output Voltage	Vout	Tj=25°C		11.76	12	12.24	V
		14.5V≤Vin≤27V, 5mA≤Iout≤350mA		11.52	12	12.48	
Line Regulation	REGline	Tj=25°C	14.5V≤Vin≤30V	--	10	240	mV
			15V≤Vin≤19V	--	3	120	
Load Regulation	REGload	Tj=25°C	5mA≤Iout≤500mA	--	12	240	
			5mA≤Iout≤200mA	--	4	120	
Quiescent Current	Iq	Tj=25°C, Iout=0		--	3	6	mA
Quiescent Current Change	ΔIq	14.5V≤Vin≤30V		--	--	0.8	
		5mA≤Iout≤500mA		--	--	0.5	
Output Noise Voltage	Vn	10Hz≤f≤100KHz, Tj=25°C		--	75	--	uV
Ripple Rejection Ratio	RR	f=120Hz, 15V≤Vin≤25V		55	80	--	dB
Voltage Drop	Vdrop	Iout=500mA, Tj=25°C		--	2	--	V
Output Resistance	Rout	f=1KHz		--	18	--	mΩ
Output Short Circuit Current	Ios	Tj=25°C		--	50	--	mA
Peak Output Current	Io peak	Tj=25°C		--	0.7	--	A
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	Iout=5mA, 0°C≤Tj≤125°C		--	-0.3	--	mV/ °C

TS78M15A Electrical Characteristics

(Vin=23V, Iout=350mA, 0°C≤Tj≤125°C, Cin=0.33uF, Cout=0.1uF; unless otherwise specified.)

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
Output voltage	Vout	Tj=25°C		14.70	15	15.30	V
		17.5V≤Vin≤30V, 5mA≤Iout≤350mA		14.40	15	15.60	
Line Regulation	REGline	Tj=25°C	17.5V≤Vin≤30V	--	12	300	mV
			18V≤Vin≤22V	--	3	150	
Load Regulation	REGload	Tj=25°C	5mA≤Iout≤500mA	--	12	300	
			5mA≤Iout≤200mA	--	4	150	
Quiescent Current	Iq	Tj=25°C, Iout=0		--	3	6	mA
Quiescent Current Change	ΔIq	17.5V≤Vin≤30V		--	--	0.8	
		5mA≤Iout≤500mA		--	--	0.5	
Output Noise Voltage	Vn	10Hz≤f≤100KHz, Tj=25°C		--	90	--	μV
Ripple Rejection Ratio	RR	f=120Hz, 18V≤Vin≤28V		54	80	--	dB
Voltage Drop	Vdrop	Iout=500mA, Tj=25°C		--	2	--	V
Output Resistance	Rout	f=1KHz		--	19	--	mΩ
Output Short Circuit Current	Ios	Tj=25°C		--	50	--	mA
Peak Output Current	Io peak	Tj=25°C		--	0.7	--	A
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	Iout=10mA, 0°C≤Tj≤125°C		--	-0.3	--	mV/ °C

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

TS78M00A Series

3-Terminal 500mA Positive Voltage Regulator

TS78M18A Electrical Characteristics

(Vin=24V, Iout=350mA, 0°C≤Tj≤125°C, Cin=0.33uF, Cout=0.1uF; unless otherwise specified.)

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
Output Voltage	Vout	Tj=25°C		17.64	18	18.36	V
		21V≤Vin≤33V, 5mA≤Iout≤350mA		17.28	18	18.72	
Line Regulation	REGline	Tj=25°C	21V≤Vin≤33V	--	15	360	mV
			22V≤Vin≤26V	--	5	180	
Load Regulation	REGload	Tj=25°C	5mA≤Iout≤500mA	--	12	360	
			5mA≤Iout≤200mA	--	4	180	
Quiescent Current	Iq	Tj=25°C, Iout=0		--	3	6	mA
Quiescent Current Change	ΔIq	21V≤Vin≤33V		--	--	0.8	
		5mA≤Iout≤500mA		--	--	0.5	
Output Noise Voltage	Vn	10Hz≤f≤100KHz, Tj=25°C		--	110	--	uV
Ripple Rejection Ratio	RR	f=120Hz, 21V≤Vin≤31V		54	80	--	dB
Voltage Drop	Vdrop	Iout=500mA, Tj=25°C		--	2	--	V
Output Resistance	Rout	f=1KHz		--	22	--	mΩ
Output Short Circuit Current	Ios	Tj=25°C		--	50	--	mA
Peak Output Current	Io peak	Tj=25°C		--	0.7	--	A
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	Iout= 5mA, 0°C≤Tj≤125°C		--	-0.5	--	mV/ °C

TS78M24A Electrical Characteristics

Vin=33V, Iout=350mA, 0°C≤Tj≤125°C, Cin=0.33uF, Cout=0.1uF; unless otherwise specified.)

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
Output voltage	Vout	Tj=25°C		23.52	24	24.48	V
		27V≤Vin≤38V, 5mA≤Iout≤350mA		23.07	24	25.96	
Line Regulation	REGline	Tj=25°C	27V≤Vin≤38V	--	18	480	mV
			28V≤Vin≤32V	--	6	240	
Load Regulation	REGload	Tj=25°C	5mA≤Iout≤500mA	--	12	480	
			5mA≤Iout≤200mA	--	4	240	
Quiescent Current	Iq	Iout=0, Tj=25°C		--	3	6	mA
Quiescent Current Change	ΔIq	27V≤Vin≤38V		--	--	0.8	
		5mA≤Iout≤500mA		--	--	0.5	
Output Noise Voltage	Vn	10Hz≤f≤100KHz, Tj=25°C		--	170	--	μV
Ripple Rejection Ratio	RR	f=120Hz, 27V≤Vin≤37V		54	80	--	dB
Voltage Drop	Vdrop	Iout=500mA, Tj=25°C		--	2	--	V
Output Resistance	Rout	f=1KHz		--	28	--	mΩ
Output Short Circuit Current	Ios	Tj=25°C		--	50	--	mA
Peak Output Current	Io peak	Tj=25°C		--	0.7	--	A
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	Iout= 5mA, 0°C≤Tj≤125°C		--	-0.5	--	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.
- This specification applies only for DC power dissipation permitted by absolute maximum ratings.

TS78M00A Series

3-Terminal 500mA Positive Voltage Regulator

Electrical Characteristics Curve

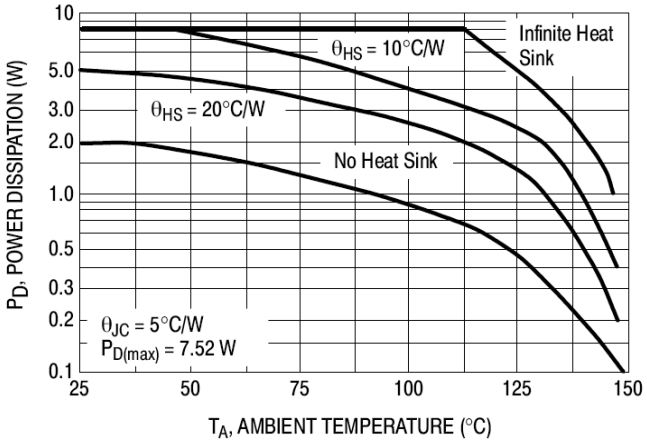


Figure 1. Worst Case Power Dissipation vs. Ambient Temperature (TO-220)

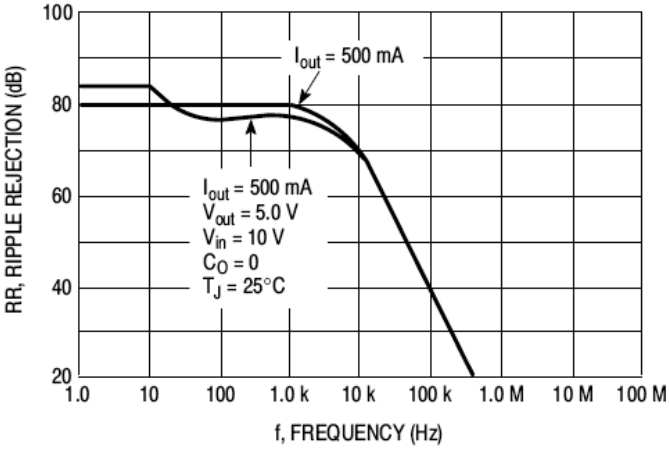


Figure 3. Ripple Rejection vs. Frequency

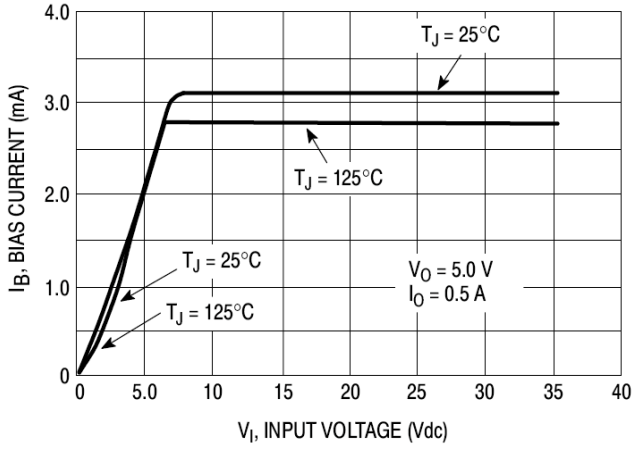


Figure 3. Bias Current vs. Input Voltage

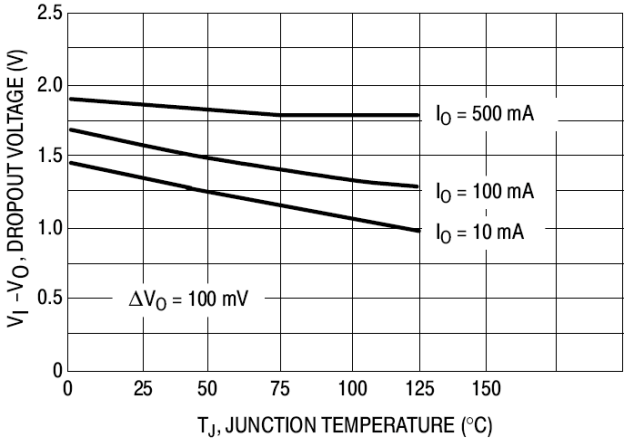


Figure 4. Dropout Voltage vs. Junction Temperature

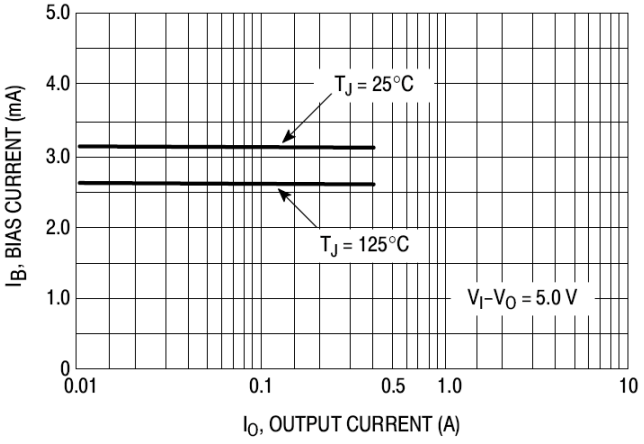


Figure 5. Bias Current vs. Output Current

Application information

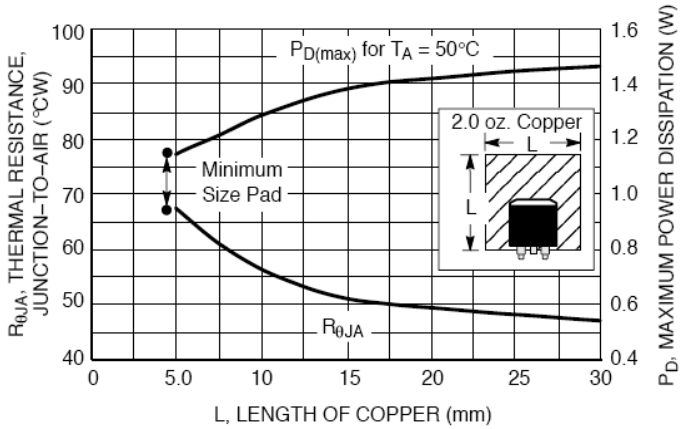
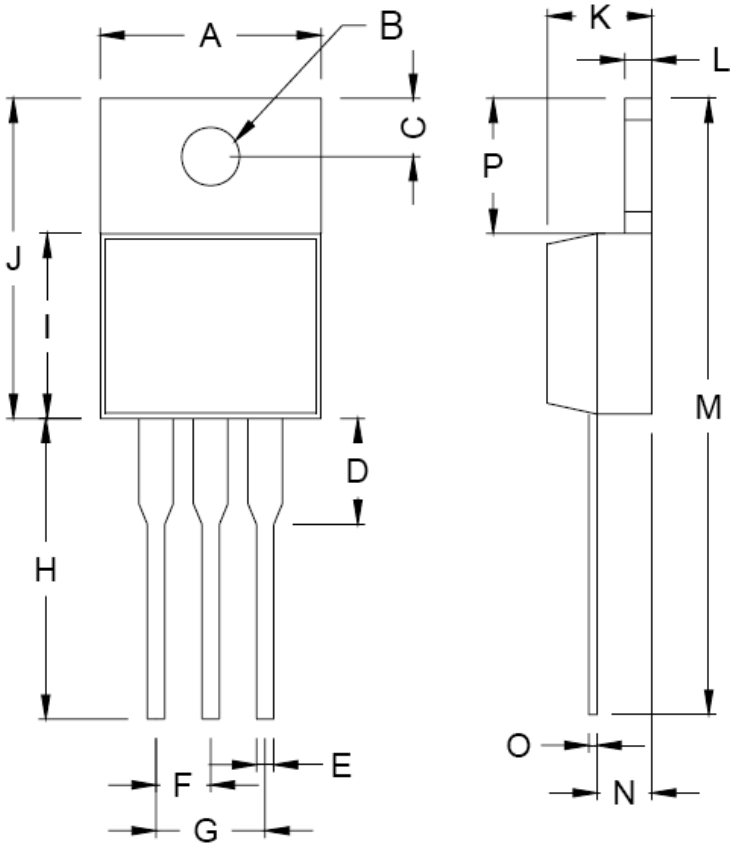


Figure 7. DPAK Thermal Resistance and Maximum Power Dissipation vs. P.C.B Copper Length

TS78M00A Series

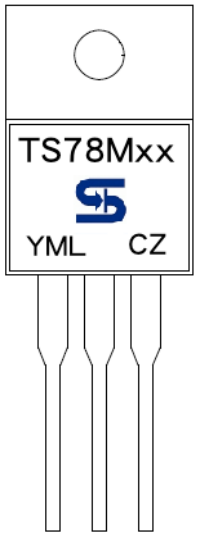
3-Terminal 500mA Positive Voltage Regulator

TO-220 Mechanical Drawing



TO-220 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	10.000	10.500	0.394	0.413
B	3.740	3.910	0.147	0.154
C	2.440	2.940	0.096	0.116
D	-	6.350	-	0.250
E	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
H	12.700	14.732	0.500	0.581
I	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
L	0.508	1.397	0.020	0.055
M	27.700	29.620	1.060	1.230
N	2.032	2.921	0.080	0.115
O	0.255	0.610	0.010	0.024
P	5.842	6.858	0.230	0.270

Marking Diagram



XX = Output Voltage
(05=5V, 08=8V, 09=9V, 12=12V, 15=15V, 18=18V, 24=24V)
Y = Year Code
M = Month Code
(**A**=Jan, **B**=Feb, **C**=Mar, **D**=Apl, **E**=May, **F**=Jun, **G**=Jul, **H**=Aug, **I**=Sep, **J**=Oct, **K**=Nov, **L**=Dec)
L = Lot Code
CZ = Package Code for TO-220

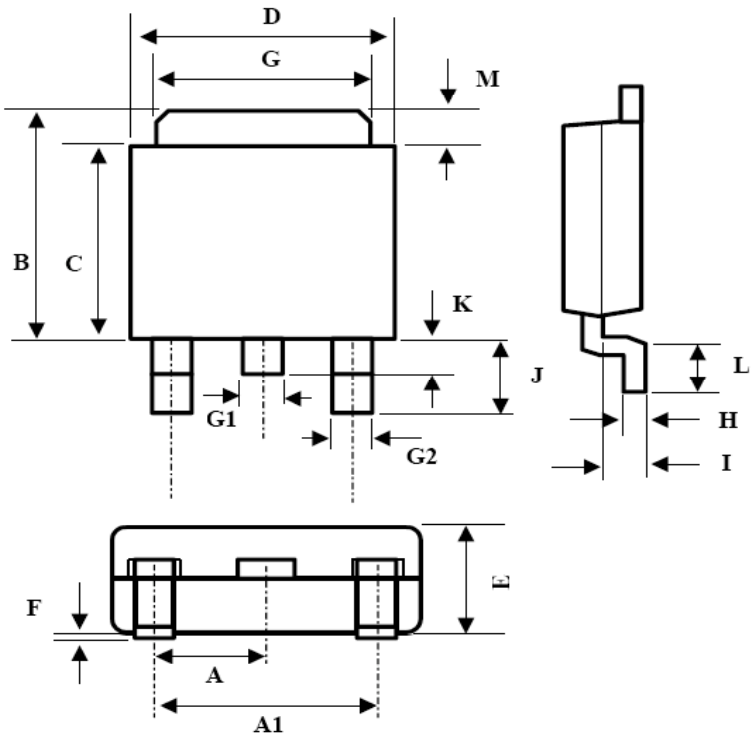
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TS78M00A Series

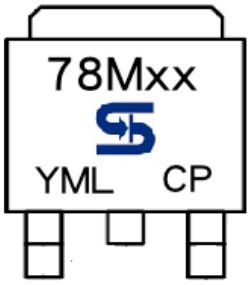
3-Terminal 500mA Positive Voltage Regulator

TO-252 Mechanical Drawing



TO-252 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.3BSC		0.09BSC	
A1	4.6BSC		0.18BSC	
B	6.80	7.20	0.268	0.283
C	5.40	5.60	0.213	0.220
D	6.40	6.65	0.252	0.262
E	2.20	2.40	0.087	0.094
F	0.00	0.20	0.000	0.008
G	5.20	5.40	0.205	0.213
G1	0.75	0.85	0.030	0.033
G2	0.55	0.65	0.022	0.026
H	0.35	0.65	0.014	0.026
I	0.90	1.50	0.035	0.059
J	2.20	2.80	0.087	0.110
K	0.50	1.10	0.020	0.043
L	0.90	1.50	0.035	0.059
M	1.30	1.70	0.051	0.67

Marking Diagram



XX = Output Voltage
(05=5V, 08=8V, 09=9V, 12=12V, 15=15V, 18=18V, 24=24V)

Y = Year Code

M = Month Code
(**A**=Jan, **B**=Feb, **C**=Mar, **D**=Apl, **E**=May, **F**=Jun, **G**=Jul, **H**=Aug, **I**=Sep, **J**=Oct, **K**=Nov, **L**=Dec)

L = Lot Code

CP = Package Code for TO-252

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