



3-Terminal Fixed Positive Voltage Regulator

TO-220







TO-263 (D²PAK)



Pin Definition:

- 1. Input
- 2. Ground (tab)
- 3. Output

General Description

These voltage regulators are monolithic integrated circuits designed as fixed-voltage regulators for a wide variety of applications including local, on-card regulation. These regulators employ internal current limiting, thermal shutdown, and safe-area compensation. With adequate heatsink they can deliver output currents up to 1 ampere.

Although designed primarily as a fixed voltage regulator, these devices can be used with external components to obtain adjustable voltages and currents.

This series is offered in 3-pin TO-220, ITO-220 & TO-263 package.

Features

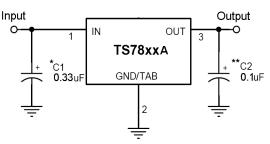
- Output Voltage Range 5 to 24V
- Output current up to 1A
- No external components required
- Internal thermal overload protection
- Internal short-circuit current limiting
- Output transistor safe-area compensation
- Output voltage offered in 2% tolerance

Ordering Information

Part No.	Package	Packing		
TS78 <u>xx</u> ACZ C0	TO-220	50pcs / Tube		
TS78 <u>xx</u> ACI C0	ITO-220	50pcs / Tube		
TS78 <u>xx</u> ACM RN	TO-263	800pcs / 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	TJ	0~+125	°C
Storage Temperature Range	T _{STG}	-65~+150	°C

Note: * TS7805A to TS7818A

^{**} TS7824A

^{***} Follow the derating curve





3-Terminal Fixed Positive Voltage Regulator

TS7805A Electrical Characteristics

(Vin=10V, lout=500mA, 0°C≤Tj≤125°C, Cin=0.33uF, Cout=0.1uF; unless otherwise specified.)

Parameter	Symbol	Te	Test Condition		Тур	Max	Unit
		Tj=25°C	Tj=25°C		5	5.10	
Output voltage	Vout		7.5V≤Vin≤20V, 10mA≤lout≤1A, PD≤15W		5	5.20	V
Line Regulation	REGline	Tj=25°	7.5V≤Vin≤25V	-	3	100	
Line Regulation	REGIIIIE	С	8V≤Vin≤12V	1	1	50	mV
Load Regulation	DECload	Tj=25°	10mA≤lout≤1A	1	15	100	IIIV
Load Regulation	REGload	С	250mA≤lout≤750mA	I	5	50	
Quiescent Current	Iq	lout=0, T	j=25°C	1	4.2	8	
Quiescent Current Change	Δlq	7.5V≤Vin≤25V		1		1.3	mA
Quiescent Current Change		10mA≤lout≤1A		I		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	lout=1.0	A, Tj=25°C	I	2		V
Output Resistance	Rout	f=1KHz			17		mΩ
Output Short Circuit Current	los	Tj=25°C			750		mA
Peak Output Current	lo peak	Tj=25°C			2.2		Α
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	lout=10m	nA, 0°C≤Tj≤125°C		-0.6		mV/ °C

TS7806A Electrical Characteristics

(Vin=11V, lout=500mA, 0°C≤Tj≤125°C, Cin=0.33uF, Cout=0.1uF; unless otherwise specified.)

		est Condition	Min	Тур	Max	Unit
	Tj=25°C		5.88	6	6.12	
out	8.5V≤Vin 10mA≤lo	≤21V, ut≤1A, PD≤15W	5.76	6	6.24	V
Clina	Tj=25°	8.5V≤Vin≤25V		5	120	
Jine	C	9V≤Vin≤13V		1.5	60	m\/
Nood	Tj=25°	10mA≤lout≤1A		14	120	mV
REGload	С	250mA≤lout≤750mA		4	60	
Iq	lout=0, T	j=25°C		4.3	8	
Δlq	8.5V≤Vin≤25V				1.3	mA
	10mA≤lout≤1A				0.5	
√n	10Hz≤f≤1	I00KHz, Tj=25°C		45		uV
RR	f=120Hz,	9V≤Vin≤19V	59	75		dB
drop	lout=1.0A	A, Tj=25°C		2		V
out	f=1KHz	-		19		mΩ
os	Tj=25°C			550		mA
peak	Tj=25°C			2.2		Α
ut/ ΔTj	lout=10m	ıA, 0°C≤Tj≤125°C		-0.7		mV/ °C
	Iq Vn RR drop out os peak ut/ ΔTj	C Tj=25° C C C C C C C C C	Gload C $9V \le V in \le 13V$ $10mA \le lout \le 1A$ $250mA \le lout \le 750mA$ $10mA \le lout \le 1A$ $10mA \le l$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$

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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3-Terminal Fixed Positive Voltage Regulator

TS7808A Electrical Characteristics

Vin=14V, Iout=500mA, 0°C≤Tj≤125°C, Cin=0.33uF, Cout=0.1uF; unless otherwise specified.)

Parameter	Symbol	Te	est Condition	Min	Тур	Max	Unit
		Tj=25°C		7.84	8	8.16	
Output voltage	Vout		10.5V≤Vin≤23V, 10mA≤lout≤1A, PD≤15W		8	8.32	V
Line Regulation	REGline	Tj=25°C	10.5V≤Vin≤25V	-	6	160	
Line Regulation	REGIIIIE	1j=25 C	11V≤Vin≤17V	-	2	80	mV
Lood Regulation	REGload	Tj=25°C	10mA≤lout≤1A	-	12	160	IIIV
Load Regulation	REGIOAU		250mA≤lout≤750mA	1	4	80	
Quiescent Current	Iq	lout=0, Tj	=25°C		4.3	8	
Outland and Comment Change		10.5V≤Vin≤25V		1		1	mA
Quiescent Current Change	Δlq	10mA≤lout≤1A		1		0.5	
Output Noise Voltage	Vn	10Hz≤f≤1	00KHz, Tj=25°C	1	52		μV
Ripple Rejection Ratio	RR	f=120Hz,	11V≤Vin≤21V	56	72		dB
Voltage Drop	Vdrop	Iout=1.0A	A, Tj=25°C		2		V
Output Resistance	Rout	f=1KHz			16		mΩ
Output Short Circuit Current	los	Tj=25°C			450		mA
Peak Output Current	lo peak	Tj=25°C			2.2		Α
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	lout=10m	A, 0°C≤Tj≤125°C		-0.8		mV/ °C

TS7809A Electrical Characteristics

(Vin=15V, lout=500mA, 0°C≤Tj≤125°C, Cin=0.33uF, Cout=0.1uF; unless otherwise specified.)

Parameter	Symbol	Te	est Condition	Min	Тур	Max	Unit
		Tj=25°C	Tj=25°C		9	9.18	
Output Voltage	Vout	11.5V≤Vi	11.5V≤Vin≤23V,		9	9.36	V
		10mA≤lo	ut≤1A, PD≤15W	8.64	9	9.30	
Line Regulation	REGline	Tj=25°C	11.5V≤Vin≤26V		6	180	
Line Regulation	REGIIIIE	1j=25 C	12V≤Vin≤17V		2	90	mV
Load Regulation	REGload	Tj=25°C	10mA≤lout≤1A		12	180	IIIV
Load Regulation	REGIOAU	1j-25 C	250mA≤lout≤750mA		4	90	1
Quiescent Current	Iq	Iout=0, T	j=25°C		4.3	8	
Outline and Outline to Observe	Δlq	11.5V≤Vin≤26V				1	mA
Quiescent Current Change		10mA≤lout≤1A				0.5	
Output Noise Voltage	Vn	10Hz≤f≤1	00KHz, Tj=25°C		52		uV
Ripple Rejection Ratio	RR	f=120Hz,	12V≤Vin≤22V	55	72		dB
Voltage Drop	Vdrop	lout=1.0A	A, Tj=25°C		2		V
Output Resistance	Rout	f=1KHz			16		mΩ
Output Short Circuit Current	los	Tj=25°C			450		mA
Peak Output Current	lo peak	Tj=25°C			2.2		Α
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj		A, 0°C≤Tj≤125°C		-1		mV/ °C

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3-Terminal Fixed Positive Voltage Regulator

TS7810A Electrical Characteristics

Vin=16V, Iout=500mA, 0°C≤Tj≤125°C, Cin=0.33uF, Cout=0.1uF; unless otherwise specified.)

Parameter	Symbol	Test Condition		Min	Тур	Max	Unit
		Tj=25°C	Tj=25°C		10	10.2	
Output voltage	Vout	12.5V≤Viı	n≤25V,	9.6	10	10.4	V
		10mA≤loเ	ut≤1A, PD≤15W	9.0	10		
Line Regulation	REGline	Tj=25°C	12.5V≤Vin≤28V		7	200	
Line Regulation	INLONINE	13-23 0	13V≤Vin≤17V		2	100	mV
Load Regulation	REGload	Tj=25°C	10mA≤lout≤1A		12	200	111 V
	REGIOAU	1]-23 C	250mA≤lout≤750mA		4	100	
Quiescent Current	Iq	lout=0, Tj	=25°C		4.3	8	
Quiescent Current Change	Δlq	12.5V≤Vin≤28V				1	mA
Quiescent Current Change	Діч	10mA≤lout≤1A				0.5	
Output Noise Voltage	Vn	10Hz≤f≤1	00KHz, Tj=25°C		70		μV
Ripple Rejection Ratio	RR	f=120Hz,	13V≤Vin≤23V	55	71		dB
Voltage Drop	Vdrop	lout=1.0A	, Tj=25°C		2		V
Output Resistance	Rout	f=1KHz			18		mΩ
Output Short Circuit Current	los	Tj=25°C			400		mA
Peak Output Current	lo peak	Tj=25°C			2.2		Α
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	lout=10m	A, 0°C≤Tj≤125°C		-1		mV/ °C

TS7812A Electrical Characteristics

(Vin=19V, lout=500mA, 0°C≤Tj≤125°C, Cin=0.33uF, Cout=0.1uF; unless otherwise specified.)

Parameter	Symbol	Test Condition		Min	Тур	Max	Unit
		Tj=25°C	Tj=25°C		12	12.24	
Output Voltage	Vout	14.5V≤Vi	14.5V≤Vin≤27V,		12	12.48	V
		10mA≤loı	ut≤1A, PD ≤15W	11.52	12	12.40	
Line Regulation	REGline	Tj=25°C	14.5V≤Vin≤30V		10	240	
Line Regulation	INLOHITE	1]-23 C	15V≤Vin≤19V		3	120	mV
Load Regulation	REGload	Tj=25°C	10mA≤lout≤1A	I	12	240	IIIV
Load Regulation	REGIOAU	1j=25 C	250mA≤lout≤750mA		4	120	
Quiescent Current	Iq	Tj=25°C,	lout=0		4.3	8	
Ouisseent Current Change	Δlq	14.5V≤Vin≤30V				1	mA
Quiescent Current Change		10mA≤lout≤1A				0.5	
Output Noise Voltage	Vn	10Hz≤f≤1	00KHz, Tj=25°C		75		uV
Ripple Rejection Ratio	RR	f=120Hz,	15V≤Vin≤25V	55	71		dB
Voltage Drop	Vdrop	Iout=1.0A	, Tj=25°C	-	2		V
Output Resistance	Rout	f=1KHz			18		mΩ
Output Short Circuit Current	los	Tj=25°C			350		mA
Peak Output Current	lo peak	Tj=25°C			2.2		Α
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	lout=10m	A, 0°C≤Tj≤125°C		-1		mV/ °C

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3-Terminal Fixed Positive Voltage Regulator

TS7815A Electrical Characteristics

Vin=23V, Iout=500mA, 0°C≤Ti≤125°C, Cin=0.33uF, Cout=0.1uF; unless otherwise specified.)

Parameter	Symbol	Test Condition		Min	Тур	Max	Unit
		Tj=25°C	Tj=25°C		15	15.30	
Output voltage	Vout		17.5V≤Vin≤30V, 10mA≤lout≤1A, PD ≤15W		15	15.60	V
Line Regulation	REGline	Tj=25°C	17.5V≤Vin≤30V		12	300	
Line Regulation	REGIIIIE	1j-25 C	18V≤Vin≤22V		3	150	mV
Load Regulation	DECload	Tj=25°C	10mA≤lout≤1A		12	300	IIIV
Load Regulation	REGload	1j=25 C	250mA≤lout≤750mA		4	150	1
Quiescent Current	Iq	Tj=25°C,	lout=0		4.3	8	
Ouissant Current Change	Δlα	17.5V≤Vin≤30V				1	mA
Quiescent Current Change	Δlq	10mA≤lout≤1A				0.5	
Output Noise Voltage	Vn	10Hz≤f≤1	00KHz, Tj=25°C		90		μV
Ripple Rejection Ratio	RR	f=120Hz,	18V≤Vin≤28V	54	70		dB
Voltage Drop	Vdrop	Iout=1.0A	ı, Tj=25°C		2		V
Output Resistance	Rout	f=1KHz			19		mΩ
Output Short Circuit Current	los	Tj=25°C			230		mA
Peak Output Current	lo peak	Tj=25°C			2.2		Α
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	lout=10m	A, 0°C≤Tj≤125°C		-1		mV/ °C

TS7818A Electrical Characteristics

(Vin=24V, lout=500mA, 0°C≤Tj≤125°C, Cin=0.33uF, Cout=0.1uF; unless otherwise specified.)

Parameter	Symbol	Test Condition		Min	Тур	Max	Unit
		Tj=25°C	Tj=25°C		18	18.36	
Output Voltage	Vout		21V≤Vin≤33V, 10mA≤lout≤1A, PD ≤15W		18	18.72	V
Line Regulation	REGline	Tj=25°C	21V≤Vin≤33V		15	360	
Line Regulation	REGIIIIE	1j-25 C	22V≤Vin≤26V		5	180	m\/
Load Dogulation	DECload	Tj=25°C	10mA≤lout≤1A		12	360	mV
Load Regulation	REGload	1j=25 C	250mA≤lout≤750mA		4	180	
Quiescent Current	Iq	Tj=25°C,	lout=0		4.5	8	
Outlean and Outlean Albanas	Δlq	21V≤Vin≤33V				1	mA
Quiescent Current Change		10mA≤lout≤1A				0.5	
Output Noise Voltage	Vn	10Hz≤f≤1	00KHz, Tj=25°C		110		uV
Ripple Rejection Ratio	RR	f=120Hz,	21V≤Vin≤31V	54	70		dB
Voltage Drop	Vdrop	lout=1.0A	, Tj=25°C		2		V
Output Resistance	Rout	f=1KHz			22		mΩ
Output Short Circuit Current	los	Tj=25°C			200		mA
Peak Output Current	lo peak	Tj=25°C			2.2		Α
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj		A, 0°C≤Tj≤125°C		-1		mV/ °C

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3-Terminal Fixed Positive Voltage Regulator

TS7824A Electrical Characteristics

Vin=33V, Iout=500mA, 0°C≤Tj≤125°C, Cin=0.33uF, Cout=0.1uF; unless otherwise specified.)

Parameter	Symbol	Te	Test Condition		Тур	Max	Unit
		Tj=25°C	Tj=25°C		24	24.48	
Output voltage	Vout		27V≤Vin≤38V, 10mA≤lout≤1A, PD ≤15W		24	25.96	V
Line Degulation	REGline	Tj=25°C	27V≤Vin≤38V	I	18	480	
Line Regulation	REGIIIIE	e 1j=25 C	28V≤Vin≤32V		6	240	m\/
Load Dogulation	DECload	Tj=25°C	10mA≤lout≤1A	1	12	480	mV
Load Regulation	REGload	1]=25°C	250mA≤lout≤750mA		4	240	1
Quiescent Current	Iq	lout=0, Tj=25°C			4.6	8	
Ovidence and Overse at Observe	Δlq	27V≤Vin≤38V		1	-	1	mA
Quiescent Current Change		10mA≤lout≤1A			-	0.5	
Output Noise Voltage	Vn	10Hz≤f≤1	00KHz, Tj=25°C		170		μV
Ripple Rejection Ratio	RR	f=120Hz,	27V≤Vin≤37V	54	70		dB
Voltage Drop	Vdrop	Iout=1.0A	, Tj=25°C		2		V
Output Resistance	Rout	f=1KHz			28		mΩ
Output Short Circuit Current	los	Tj=25°C			150		mA
Peak Output Current	lo peak	Tj=25°C			2.2		Α
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj		A, 0°C≤Tj≤125°C		-1.5		mV/ °C

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3-Terminal Fixed Positive Voltage Regulator

Electrical Characteristics Curve

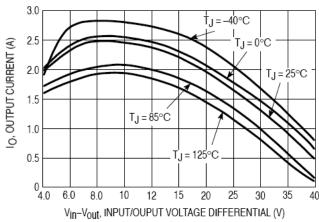


Figure 1. Peak Output Current as a Function of Input-Output Differential Voltage

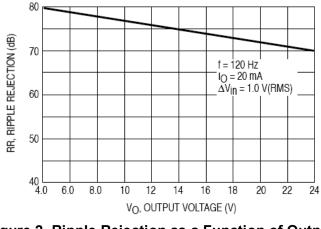


Figure 2. Ripple Rejection as a Function of Output Voltage

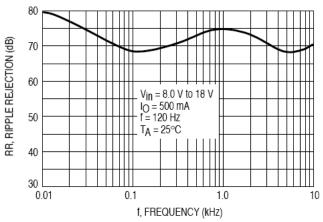


Figure 3. Ripple Rejection as a Function of Frequency

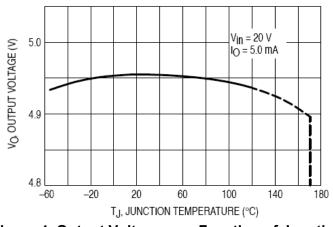


Figure 4. Output Voltage as a Function of Junction Temperature

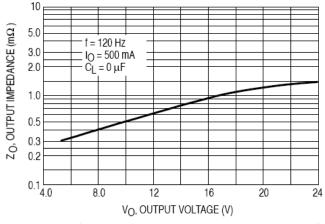


Figure 5. Output Impedance as a Function of Output Voltage

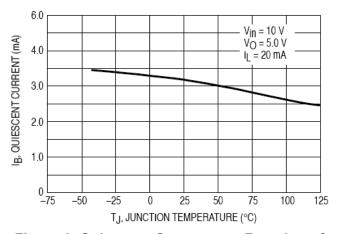


Figure 6. Quiescent Current as a Function of Temperature



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3-Terminal Fixed Positive Voltage Regulator

Application Information

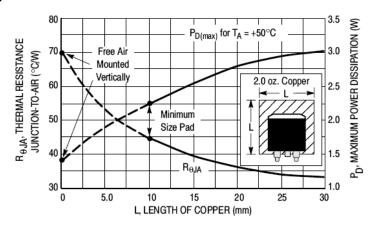


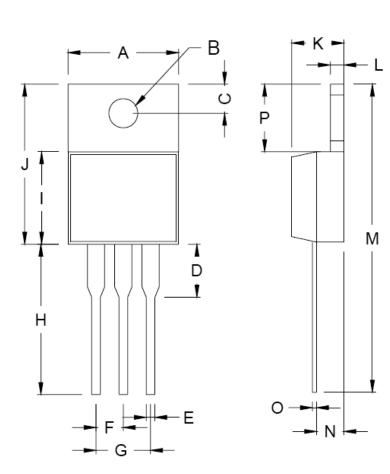
Figure 7. D²PAK Thermal Resistance and Maximum Power Dissipation vs. P.C.B Copper Length





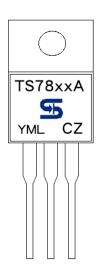
3-Terminal Fixed Positive Voltage Regulator

TO-220 Mechanical Drawing



TO-220 DIMENSION									
DIM	MILLIM	ETERS	INCHES						
וווט	MIN	MAX	MIN	MAX					
Α	10.000	10.500	0.394	0.413					
В	3.740	3.910	0.147	0.154					
O	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					
Η	12.700	14.732	0.500	0.581					
	8.382	9.017	0.330	0.355					
٦	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					
М	27.700	29.620	1.060	1.230					
Ν	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					

Marking Diagram



XX = Output Voltage

(05=5V, 06=6V, 08=8V, 09=9V, 10=10V, 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

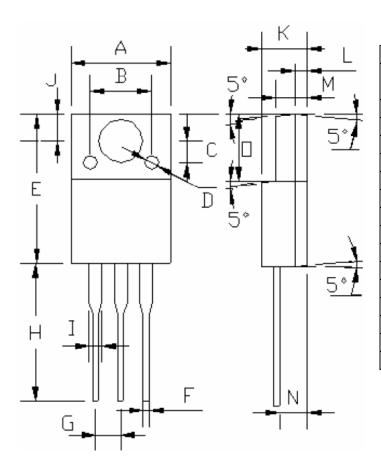
CZ = Package Code for TO-220





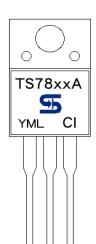
3-Terminal Fixed Positive Voltage Regulator

ITO-220 Mechanical Drawing



ITO-220 DIMENSION						
DIM	MILLIMETERS		INCHES			
	MIN	MAX	MIN	MAX		
Α	9.96	10.36	0.392	0.407		
В	6.20 (typ.)		0.244 (typ.)			
С	2.20 (typ.)		0.087 (typ.)			
D	§ 1.40 (typ.)		§ 0.055 (typ.)			
Е	15.07	16.07	0.593	0.632		
F	0.80 (typ.)		0.031 (typ.)			
G	2.44	2.64	0.096	0.104		
Н	13.08	13.48	0.514	0.530		
	1.47 (max.)		0.057 (max.)			
J	3.20	3.40	0.125	0.133		
K	4.60	4.80	0.181	0.188		
L	1.15 (typ.)		0.045 (typ.)			
М	2.44	2.64	0.096	0.104		
N	2.60	2.80	0.102	0.110		
0	6.55	6.65	0.258	0.262		

Marking Diagram



XX = Output Voltage

(05=5V, 06=6V, 08=8V, 09=9V, 10=10V, 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

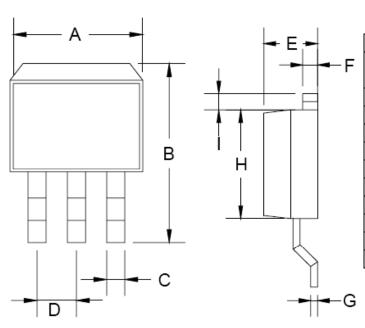
CI = Package Code for ITO-220





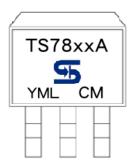
3-Terminal Fixed Positive Voltage Regulator

TO-263 Mechanical Drawing



TO-263 DIMENSION						
DIM	MILLIMETERS		INCHES			
	MIN	MAX	MIN	MAX		
Α	10.000	10.500	0.394	0.413		
В	14.605	15.875	0.575	0.625		
С	0.508	0.991	0.020	0.039		
D	2.420	2.660	0.095	0.105		
Е	4.064	4.830	0.160	0.190		
F	1.118	1.400	0.045	0.055		
G	0.450	0.730	0.018	0.029		
Н	8.280	8.800	0.325	0.346		
	1.140	1.400	0.044	0.055		
J	1.480	1.520	0.058	0.060		

Marking Diagram



XX = Output Voltage

(05=5V, 06=6V, 08=8V, 09=9V, 10=10V, 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

CM = Package Code for TO-263



3-Terminal Fixed Positive Voltage Regulator

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