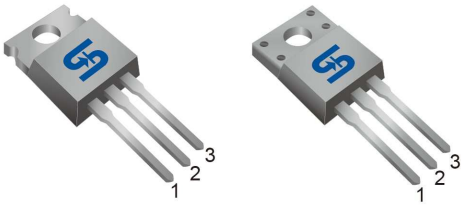
TAIWAN SEMICONDUCTOR

RoHS COMPLIANCE

TS7800 Series

3-Terminal Fixed Positive Voltage Regulator

TO-220 **ITO-220**



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

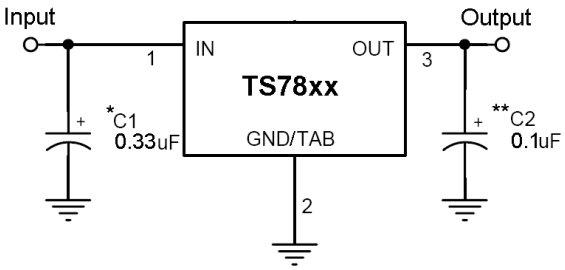
General Description

The TS7800 series 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.

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 4% tolerance

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.

Ordering Information

Part No.	Package	Packing
TS78**xx**CZ C0	TO-220	50pcs / Tube
TS78**xx**CI C0	ITO-220	50pcs / Tube

Note: Where **xx** denote voltage option, available are:
05=5V, **06**=6V, **08**=9V, **09**=9V, **10**=10V
12=12V, **15**=15V, **18**=18V, **24**=24V

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

Parameter		Symbol	Limit	Unit
Input Voltage	V_{OUT}=5~18V	V_{IN}	35	V
	V_{OUT}=24V		40	
Output Current		I_{OUT}	Internal Limited	
Power Dissipation		P_D	Internal Limited	
Operating Junction Temperature		T_J	0~+125	°C
Storage Temperature Range		T_{STG}	-65~+150	°C
Thermal Resistance - Junction to Case	TO-220	$R\Theta_{JC}$	5	°C/W
	ITO-220		5	
Thermal Resistance - Junction to Ambient	TO-220	$R\Theta_{JA}$	50	°C/W
	ITO-220		60	

Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

TS7805 Electrical Characteristics

(Vin=10V, Iout=500mA, 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		4.80	5	5.20	V
		7.5V≤Vin≤20V, 10mA≤Iout≤1A, PD≤15W		4.75	5	5.25	
Line Regulation	REGline	Tj=25°C	7.5V≤Vin≤25V	--	3	100	mV
			8V≤Vin≤12V	--	1	50	
Load Regulation	REGload	Tj=25°C	10mA≤Iout≤1A	--	15	100	
			250mA≤Iout≤750mA	--	5	50	
Quiescent Current	Iq	Iout=0, Tj=25°C		--	4.2	8	mA
Quiescent Current Change	ΔIq	7.5V≤Vin≤25V		--	--	1.3	
		10mA≤Iout≤1A		--	--	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=1.0A, Tj=25°C		--	2	--	V
Output Resistance	Rout	f=1KHz		--	17	--	mΩ
Output Short Circuit Current	Ios	Tj=25°C		--	750	--	mA
Peak Output Current	Io peak	Tj=25°C		--	2.2	--	A
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	Iout=10mA, 0°C≤Tj≤125°C		--	-0.6	--	mV/ °C

TS7806 Electrical Characteristics

(Vin=11V, Iout=500mA, 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		5.75	6	6.25	V
		8.5V≤Vin≤21V, 10mA≤Iout≤1A, PD≤15W		5.7	6	6.3	
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	10mA≤Iout≤1A	--	14	120	
			250mA≤Iout≤750mA	--	4	60	
Quiescent Current	Iq	Iout=0, Tj=25°C		--	4.3	8	mA
Quiescent Current Change	ΔIq	8.5V≤Vin≤25V		--	--	1.3	
		10mA≤Iout≤1A		--	--	0.5	
Output Noise Voltage	Vn	10Hz≤f≤100KHz, Tj=25°C		--	45	--	uV
Ripple Rejection Ratio	RR	f=120Hz, 9V≤Vin≤19V		59	75	--	dB
Voltage Drop	Vdrop	Iout=1.0A, Tj=25°C		--	2	--	V
Output Resistance	Rout	f=1KHz		--	19	--	mΩ
Output Short Circuit Current	Ios	Tj=25°C		--	550	--	mA
Peak Output Current	Io peak	Tj=25°C		--	2.2	--	A
Temperature Coefficient of Output Voltage	ΔVout/ΔTj	Iout=10mA, 0°C≤Tj≤125°C		--	-0.7	--	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.

TS7800 Series

3-Terminal Fixed Positive Voltage Regulator

TS7808 Electrical Characteristics

Vin=14V, Iout=500mA, 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		7.69	8	8.32	V
		10.5V≤Vin≤23V, 10mA≤Iout≤1A, PD≤15W		7.61	8	8.40	
Line Regulation	REGline	Tj=25°C	10.5V≤Vin≤25V	--	6	160	mV
			11V≤Vin≤17V	--	2	80	
Load Regulation	REGload	Tj=25°C	10mA≤Iout≤1A	--	12	160	
			250mA≤Iout≤750mA	--	4	80	
Quiescent Current	Iq	Iout=0, Tj=25°C		--	4.3	8	mA
Quiescent Current Change	ΔIq	10.5V≤Vin≤25V		--	--	1	
		10mA≤Iout≤1A		--	--	0.5	
Output Noise Voltage	Vn	10Hz≤f≤100KHz, Tj=25°C		--	52	--	μV
Ripple Rejection Ratio	RR	f=120Hz, 11V≤Vin≤21V		56	72	--	dB
Voltage Drop	Vdrop	Iout=1.0A, Tj=25°C		--	2	--	V
Output Resistance	Rout	f=1KHz		--	16	--	mΩ
Output Short Circuit Current	Ios	Tj=25°C		--	450	--	mA
Peak Output Current	Io peak	Tj=25°C		--	2.2	--	A
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	Iout=10mA, 0°C≤Tj≤125°C		--	-0.8	--	mV/ °C

TS7809 Electrical Characteristics

(Vin=15V, Iout=500mA, 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		8.65	9	9.36	V
		11.5V≤Vin≤23V, 10mA≤Iout≤1A, PD≤15W		8.57	9	9.45	
Line Regulation	REGline	Tj=25°C	11.5V≤Vin≤26V	--	6	180	mV
			12V≤Vin≤17V	--	2	90	
Load Regulation	REGload	Tj=25°C	10mA≤Iout≤1A	--	12	180	
			250mA≤Iout≤750mA	--	4	90	
Quiescent Current	Iq	Iout=0, Tj=25°C		--	4.3	8	mA
Quiescent Current Change	ΔIq	11.5V≤Vin≤26V		--	--	1	
		10mA≤Iout≤1A		--	--	0.5	
Output Noise Voltage	Vn	10Hz≤f≤100KHz, Tj=25°C		--	52	--	uV
Ripple Rejection Ratio	RR	f=120Hz, 12V≤Vin≤22V		55	72	--	dB
Voltage Drop	Vdrop	Iout=1.0A, Tj=25°C		--	2	--	V
Output Resistance	Rout	f=1KHz		--	16	--	mΩ
Output Short Circuit Current	Ios	Tj=25°C		--	450	--	mA
Peak Output Current	Io peak	Tj=25°C		--	2.2	--	A
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	Iout=10mA, 0°C≤Tj≤125°C		--	-1	--	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.

TS7800 Series

3-Terminal Fixed Positive Voltage Regulator

TS7810 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	Typ	Max	Unit
Output voltage	Vout	Tj=25°C		9.6	10	10.4	V
		12.5V≤Vin≤25V, 10mA≤Iout≤1A, PD≤15W		9.5	10	10.5	
Line Regulation	REGline	Tj=25°C	12.5V≤Vin≤28V	--	7	200	mV
			13V≤Vin≤17V	--	2	100	
Load Regulation	REGload	Tj=25°C	10mA≤Iout≤1A	--	12	200	
			250mA≤Iout≤750mA	--	4	100	
Quiescent Current	Iq	Iout=0, Tj=25°C		--	4.3	8	mA
Quiescent Current Change	ΔIq	12.5V≤Vin≤28V		--	--	1	
		10mA≤Iout≤1A		--	--	0.5	
Output Noise Voltage	Vn	10Hz≤f≤100KHz, Tj=25°C		--	70	--	μV
Ripple Rejection Ratio	RR	f=120Hz, 13V≤Vin≤23V		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	Ios	Tj=25°C		--	400	--	mA
Peak Output Current	Io peak	Tj=25°C		--	2.2	--	A
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	Iout=10mA, 0°C≤Tj≤125°C		--	-1	--	mV/ °C

TS7812 Electrical Characteristics

(Vin=19V, Iout=500mA, 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		11.53	12	12.48	V
		14.5V≤Vin≤27V, 10mA≤Iout≤1A, PD ≤15W		11.42	12	12.60	
Line Regulation	REGline	Tj=25°C	14.5V≤Vin≤30V	--	10	240	mV
			15V≤Vin≤19V	--	3	120	
Load Regulation	REGload	Tj=25°C	10mA≤Iout≤1A	--	12	240	
			250mA≤Iout≤750mA	--	4	120	
Quiescent Current	Iq	Tj=25°C, Iout=0		--	4.3	8	mA
Quiescent Current Change	ΔIq	14.5V≤Vin≤30V		--	--	1	
		10mA≤Iout≤1A		--	--	0.5	
Output Noise Voltage	Vn	10Hz≤f≤100KHz, 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	Ios	Tj=25°C		--	350	--	mA
Peak Output Current	Io peak	Tj=25°C		--	2.2	--	A
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	Iout=10mA, 0°C≤Tj≤125°C		--	-1	--	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.

TS7815 Electrical Characteristics

Vin=23V, Iout=500mA, 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		14.42	15	15.60	V
		17.5V≤Vin≤30V, 10mA≤Iout≤1A, PD ≤15W		14.28	15	15.75	
Line Regulation	REGline	Tj=25°C	17.5V≤Vin≤30V	--	12	300	mV
			18V≤Vin≤22V	--	3	150	
Load Regulation	REGload	Tj=25°C	10mA≤Iout≤1A	--	12	300	
			250mA≤Iout≤750mA	--	4	150	
Quiescent Current	Iq	Tj=25°C, Iout=0		--	4.3	8	mA
Quiescent Current Change	ΔIq	17.5V≤Vin≤30V		--	--	1	
		10mA≤Iout≤1A		--	--	0.5	
Output Noise Voltage	Vn	10Hz≤f≤100KHz, Tj=25°C		--	90	--	μV
Ripple Rejection Ratio	RR	f=120Hz, 18V≤Vin≤28V		54	70	--	dB
Voltage Drop	Vdrop	Iout=1.0A, Tj=25°C		--	2	--	V
Output Resistance	Rout	f=1KHz		--	19	--	mΩ
Output Short Circuit Current	Ios	Tj=25°C		--	230	--	mA
Peak Output Current	Io peak	Tj=25°C		--	2.2	--	A
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	Iout=10mA, 0°C≤Tj≤125°C		--	-1	--	mV/ °C

TS7818 Electrical Characteristics

(Vin=24V, Iout=500mA, 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		17.30	18	18.72	V
		21V≤Vin≤33V, 10mA≤Iout≤1A, PD ≤15W		17.14	18	18.90	
Line Regulation	REGline	Tj=25°C	21V≤Vin≤33V	--	15	360	mV
			22V≤Vin≤26V	--	5	180	
Load Regulation	REGload	Tj=25°C	10mA≤Iout≤1A	--	12	360	
			250mA≤Iout≤750mA	--	4	180	
Quiescent Current	Iq	Tj=25°C, Iout=0		--	4.5	8	mA
Quiescent Current Change	ΔIq	21V≤Vin≤33V		--	--	1	
		10mA≤Iout≤1A		--	--	0.5	
Output Noise Voltage	Vn	10Hz≤f≤100KHz, Tj=25°C		--	110	--	uV
Ripple Rejection Ratio	RR	f=120Hz, 21V≤Vin≤31V		54	70	--	dB
Voltage Drop	Vdrop	Iout=1.0A, Tj=25°C		--	2	--	V
Output Resistance	Rout	f=1KHz		--	22	--	mΩ
Output Short Circuit Current	Ios	Tj=25°C		--	200	--	mA
Peak Output Current	Io peak	Tj=25°C		--	2.2	--	A
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	Iout=10mA, 0°C≤Tj≤125°C		--	-1	--	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.

TS7824 Electrical Characteristics

Vin=33V, Iout=500mA, 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		23.07	24	24.96	V
		27V≤Vin≤38V, 10mA≤Iout≤1A, PD ≤15W		22.85	24	25.20	
Line Regulation	REGline	Tj=25°C	27V≤Vin≤38V	--	18	480	mV
			28V≤Vin≤32V	--	6	240	
Load Regulation	REGload	Tj=25°C	10mA≤Iout≤1A	--	12	480	
			250mA≤Iout≤750mA	--	4	240	
Quiescent Current	Iq	Iout=0, Tj=25°C		--	4.6	8	mA
Quiescent Current Change	ΔIq	27V≤Vin≤38V		--	--	1	
		10mA≤Iout≤1A		--	--	0.5	
Output Noise Voltage	Vn	10Hz≤f≤100KHz, 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	Ios	Tj=25°C		--	150	--	mA
Peak Output Current	Io peak	Tj=25°C		--	2.2	--	A
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	Iout=10mA, 0°C≤Tj≤125°C		--	-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.
- This specification applies only for DC power dissipation permitted by absolute maximum ratings.

Electrical Characteristics Curve

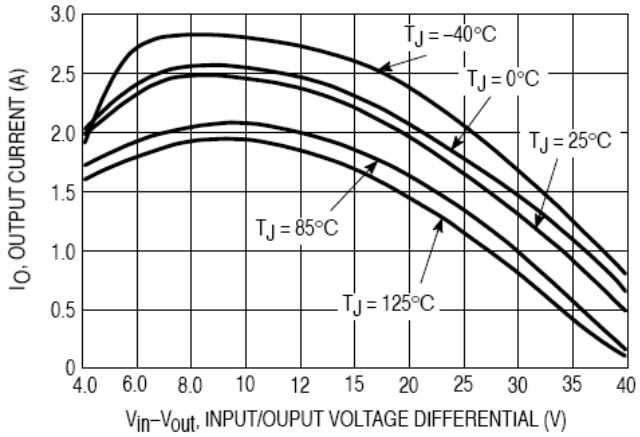


Figure 1. Peak Output Current as a Function of Input-Output Differential Voltage

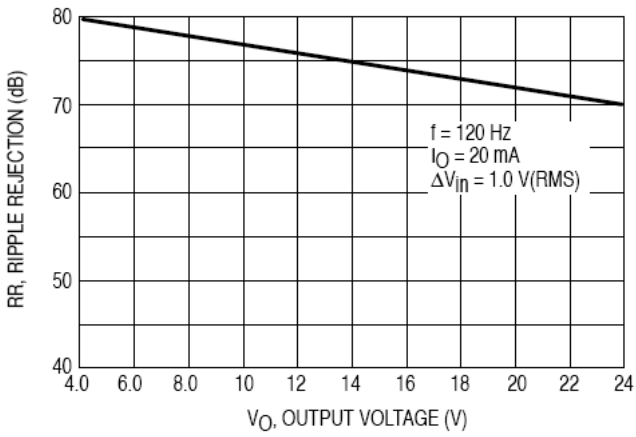


Figure 2. Ripple Rejection as a Function of Output Voltage

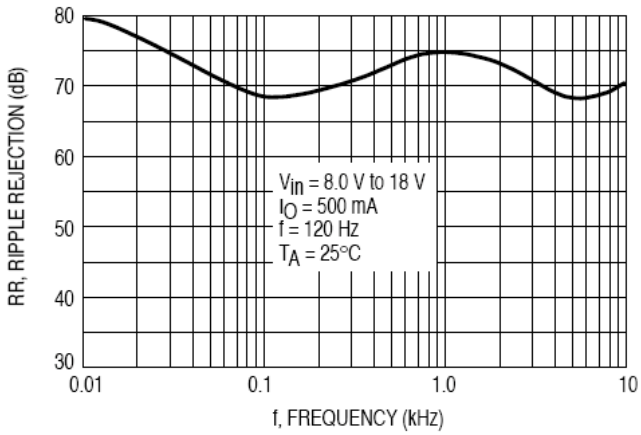


Figure 3. Ripple Rejection as a Function of Frequency

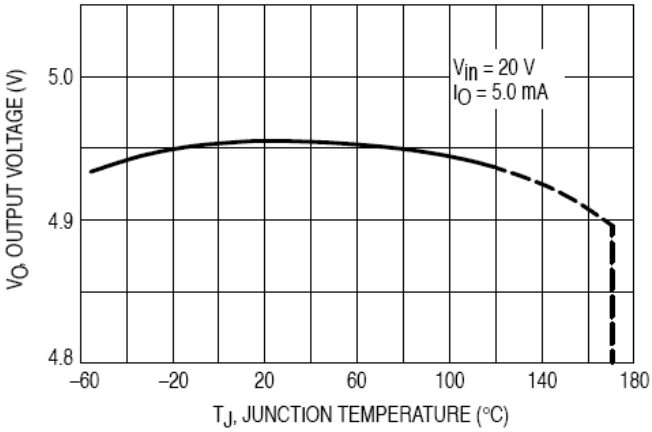


Figure 4. Output Voltage as a Function of Junction Temperature

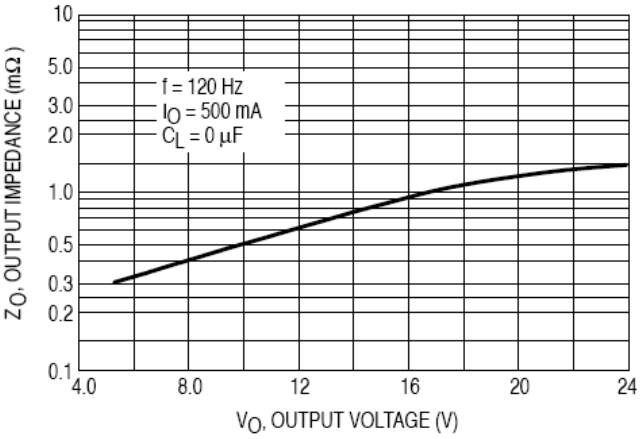


Figure 5. Output Impedance as a Function of Output Voltage

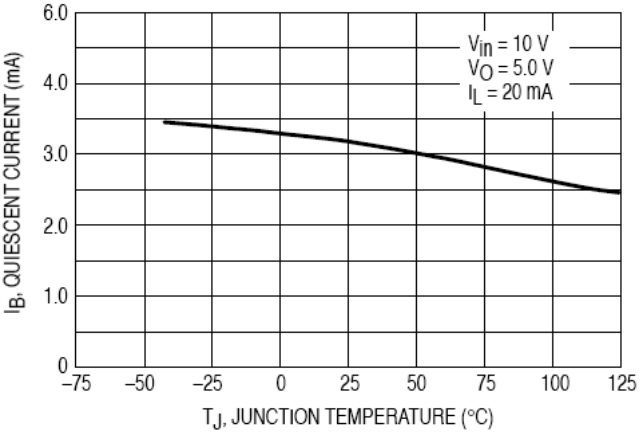
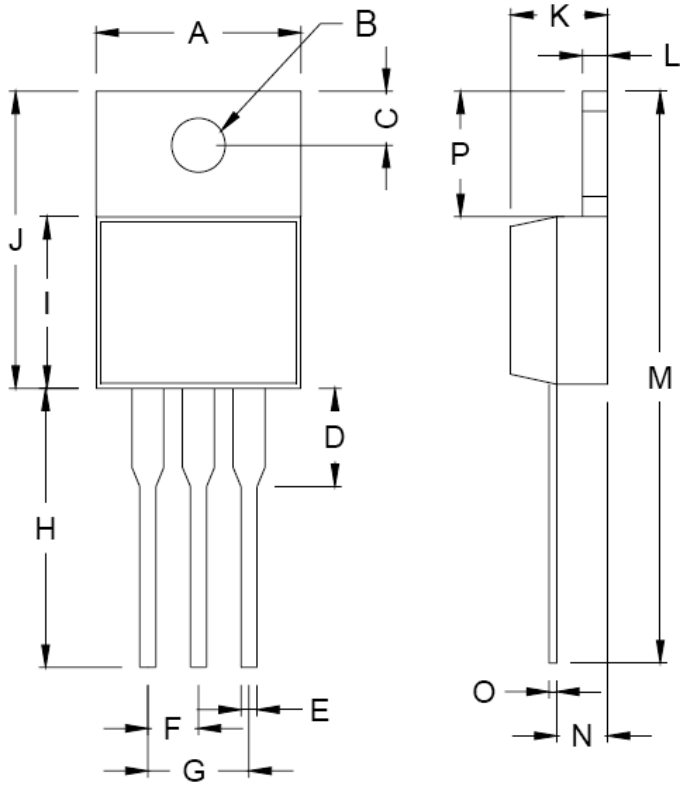


Figure 6. Quiescent Current as a Function of Temperature

TS7800 Series

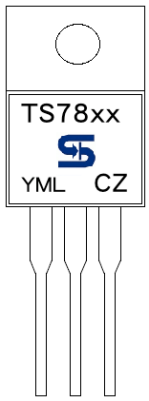
3-Terminal Fixed Positive Voltage Regulator

TO-220 Mechanical Drawing



TO-220 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.31	10.50	0.367	0.413
B	3.74	3.91	0.147	0.154
C	2.36	3.24	0.093	0.128
D	2.22	3.22	0.087	0.127
E	0.78	0.98	0.031	0.039
F	--	2.65	--	0.104
G	--	5.30	--	0.209
H	12.32	13.88	0.485	0.546
I	8.74	9.26	0.344	0.365
J	15.07	16.47	0.593	0.648
K	4.35	4.65	0.171	0.183
L	1.16	1.40	0.046	0.055
M	28.37	30.35	1.117	1.195
N	1.78	2.67	0.070	0.105
O	0.255	0.610	0.010	0.024
P	5.75	7.65	0.226	0.301

Marking Diagram

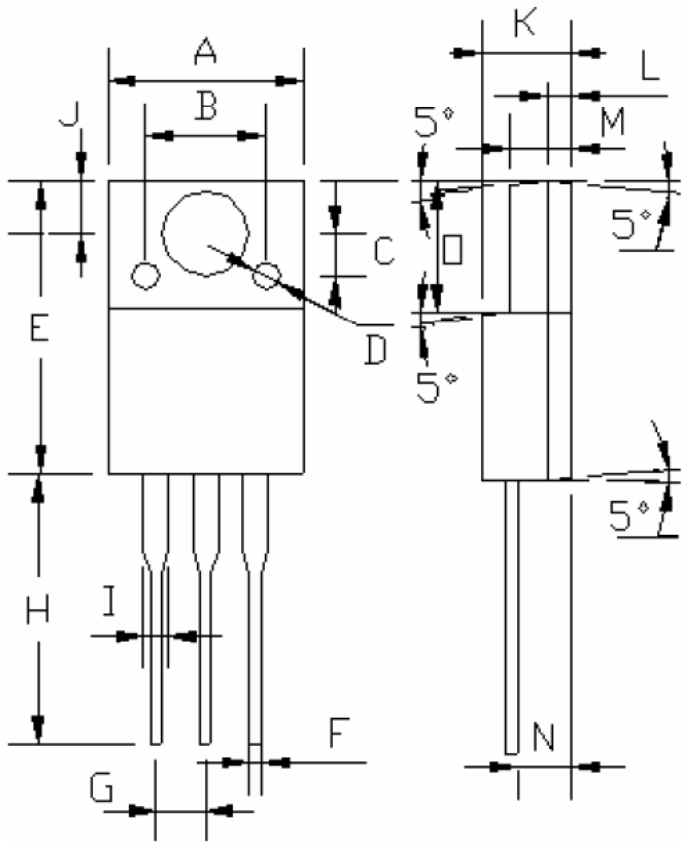


XX = Output Voltage
(**05**=5V, **06**=6V, **08**=8V, **09**=9V, **10**=10V, **12**=12V, **15**=15V, **18**=18V, **24**=24V)
Y = Year Code
M = Month Code
(**A**=Jan, **B**=Feb, **C**=Mar, **D**=Apl, **E**=May, **F**=Jun, **G**=Jul, **H**=Aug, **I**=Sep, **J**=Oct, **K**=Nov, **L**=Dec)
L = Lot Code
CZ = Package Code for TO-220

TS7800 Series

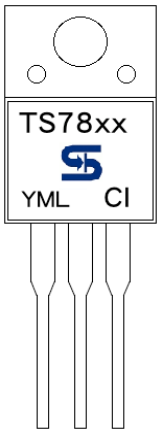
3-Terminal Fixed Positive Voltage Regulator

ITO-220 Mechanical Drawing



ITO-220 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.96	10.36	0.392	0.407
B	6.20 (typ.)		0.244 (typ.)	
C	2.20 (typ.)		0.087 (typ.)	
D	∮ 1.40 (typ.)		∮ 0.055 (typ.)	
E	15.07	16.07	0.593	0.632
F	0.80 (typ.)		0.031 (typ.)	
G	2.44	2.64	0.096	0.104
H	13.08	13.48	0.514	0.530
I	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.)	
M	2.44	2.64	0.096	0.104
N	2.60	2.80	0.102	0.110
O	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

Notice

Specifications of the products displayed herein are subject to change without notice. TSC or anyone on its behalf, assumes no responsibility or liability for any errors or inaccuracies.

Information contained herein is intended to provide a product description only. No license, express or implied, to any intellectual property rights is granted by this document. Except as provided in TSC's terms and conditions of sale for such products, TSC assumes no liability whatsoever, and disclaims any express or implied warranty, relating to sale and/or use of TSC products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright, or other intellectual property right.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify TSC for any damages resulting from such improper use or sale.