

TS7800B Series

3-Terminal Fixed Positive Voltage Regulator

TO-220

ITO-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.

Features

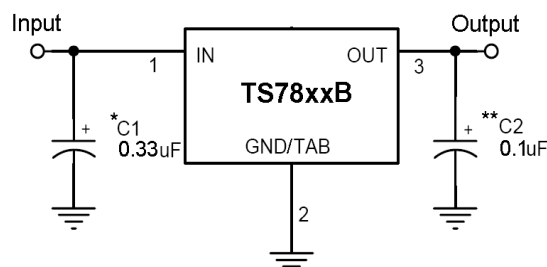
- Output Voltage Range 5 to 24V
- Output current up to 1.5A
- No external components required
- Internal thermal overload protection
- Internal short-circuit current limiting
- Output transistor safe-area compensation
- Output voltage offered in 4% tolerance

Ordering Information

Part No.	Package	Packing
TS78xxBCZ C0	TO-220	50pcs / Tube
TS78xxBCI C0	ITO-220	50pcs / Tube
TS78xxBCM 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	T _J	0~+125	°C
Storage Temperature Range	T _{STG}	-65~+150	°C

Note: * TS7805B to TS7818B

** TS7824B

*** Follow the derating curve

TS7805B Electrical Characteristics

($V_{in}=10V$, $I_{out}=500mA$, $0^{\circ}C \leq T_j \leq 125^{\circ}C$, $C_{in}=0.33\mu F$, $C_{out}=0.1\mu F$; unless otherwise specified.)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Output voltage	V_{out}	$T_j=25^{\circ}C$	4.80	5	5.20	V
		$7.5V \leq V_{in} \leq 20V$, $10mA \leq I_{out} \leq 1.5A$, $PD \leq 15W$	4.75	5	5.25	
Line Regulation	REG _{line}	$T_j=25^{\circ}C$				mV
		$7.5V \leq V_{in} \leq 25V$	--	3	100	
Load Regulation	REG _{load}	$T_j=25^{\circ}C$				
		$10mA \leq I_{out} \leq 1.5A$	--	15	100	
Quiescent Current	I_q	$I_{out}=0$, $T_j=25^{\circ}C$	--	4.2	8	mA
Quiescent Current Change	ΔI_q	$7.5V \leq V_{in} \leq 25V$	--	--	1.3	
		$10mA \leq I_{out} \leq 1.5A$	--	--	0.5	
Output Noise Voltage	V_n	$10Hz \leq f \leq 100KHz$, $T_j=25^{\circ}C$	--	40	--	μV
Ripple Rejection Ratio	RR	$f=120Hz$, $8V \leq V_{in} \leq 18V$	62	78	--	dB
Voltage Drop	V_{drop}	$I_{out}=1.0A$, $T_j=25^{\circ}C$	--	2	--	V
Output Resistance	R_{out}	$f=1KHz$	--	17	--	$m\Omega$
Output Short Circuit Current	I_{os}	$T_j=25^{\circ}C$	--	750	--	mA
Peak Output Current	$I_{o peak}$	$T_j=25^{\circ}C$	--	2.2	--	A
Temperature Coefficient of Output Voltage	$\Delta V_{out} / \Delta T_j$	$I_{out}=10mA$, $0^{\circ}C \leq T_j \leq 125^{\circ}C$	--	-0.6	--	mV/ $^{\circ}C$

TS7806B Electrical Characteristics

($V_{in}=11V$, $I_{out}=500mA$, $0^{\circ}C \leq T_j \leq 125^{\circ}C$, $C_{in}=0.33\mu F$, $C_{out}=0.1\mu F$; unless otherwise specified.)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Output Voltage	V_{out}	$T_j=25^{\circ}C$	5.75	6	6.25	V
		$8.5V \leq V_{in} \leq 21V$, $10mA \leq I_{out} \leq 1.5A$, $PD \leq 15W$	5.7	6	6.3	
Line Regulation	REG _{line}	$T_j=25^{\circ}C$				mV
		$8.5V \leq V_{in} \leq 25V$	--	5	120	
Load Regulation	REG _{load}	$T_j=25^{\circ}C$				
		$10mA \leq I_{out} \leq 1.5A$	--	14	120	
Quiescent Current	I_q	$I_{out}=0$, $T_j=25^{\circ}C$	--	4.3	8	mA
Quiescent Current Change	ΔI_q	$8.5V \leq V_{in} \leq 25V$	--	--	1.3	
		$10mA \leq I_{out} \leq 1.5A$	--	--	0.5	
Output Noise Voltage	V_n	$10Hz \leq f \leq 100KHz$, $T_j=25^{\circ}C$	--	45	--	μV
Ripple Rejection Ratio	RR	$f=120Hz$, $9V \leq V_{in} \leq 19V$	59	75	--	dB
Voltage Drop	V_{drop}	$I_{out}=1.0A$, $T_j=25^{\circ}C$	--	2	--	V
Output Resistance	R_{out}	$f=1KHz$	--	19	--	$m\Omega$
Output Short Circuit Current	I_{os}	$T_j=25^{\circ}C$	--	550	--	mA
Peak Output Current	$I_{o peak}$	$T_j=25^{\circ}C$	--	2.2	--	A
Temperature Coefficient of Output Voltage	$\Delta V_{out} / \Delta T_j$	$I_{out}=10mA$, $0^{\circ}C \leq T_j \leq 125^{\circ}C$	--	-0.7	--	mV/ $^{\circ}C$

- 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.

TS7808B 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≤1.5A, PD≤15W	7.61	8	8.40	
Line Regulation	REGline	Tj=25°C	10.5V≤Vin≤25V	--	6	mV
			11V≤Vin≤17V	--	2	
Load Regulation	REGload	Tj=25°C	10mA≤Iout≤1.5A	--	12	
			250mA≤Iout≤750mA	--	4	
Quiescent Current	Iq	Iout=0, Tj=25°C	--	4.3	8	mA
Quiescent Current Change	ΔIq	10.5V≤Vin≤25V	--	--	1	
		10mA≤Iout≤1.5A	--	--	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	I _{o 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

TS7809B 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≤1.5A, PD≤15W	8.57	9	9.45	
Line Regulation	REGline	Tj=25°C	11.5V≤Vin≤26V	--	6	mV
			12V≤Vin≤17V	--	2	
Load Regulation	REGload	Tj=25°C	10mA≤Iout≤1.5A	--	12	
			250mA≤Iout≤750mA	--	4	
Quiescent Current	Iq	Iout=0, Tj=25°C	--	4.3	8	mA
Quiescent Current Change	ΔIq	11.5V≤Vin≤26V	--	--	1	
		10mA≤Iout≤1.5A	--	--	0.5	
Output Noise Voltage	Vn	10Hz≤f≤100KHz, Tj=25°C	--	52	--	μV
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	I _{o 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.

TS7810B 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≤1.5A, PD≤15W	9.5	10	10.5	
Line Regulation	REGline	Tj=25°C				mV
		12.5V≤Vin≤28V	--	7	200	
		13V≤Vin≤17V	--	2	100	
Load Regulation	REGload	Tj=25°C				mV
		10mA≤Iout≤1.5A	--	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≤1.5A	--	--	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	I _{o peak}	Tj=25°C	--	2.2	--	A
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	Iout=10mA, 0°C≤Tj≤125°C	--	-1	--	mV/ °C

TS7812B 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≤1.5A, PD ≤15W	11.42	12	12.60	
Line Regulation	REGline	Tj=25°C				mV
		14.5V≤Vin≤30V	--	10	240	
		15V≤Vin≤19V	--	3	120	
Load Regulation	REGload	Tj=25°C				mV
		10mA≤Iout≤1.5A	--	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≤1.5A	--	--	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	I _{o 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.

TS7815B 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≤1.5A, PD ≤15W	14.28	15	15.75	
Line Regulation	REGline	Tj=25°C				mV
		17.5V≤Vin≤30V	--	12	300	
Load Regulation	REGload	Tj=25°C				
		10mA≤Iout≤1.5A	--	12	300	
Quiescent Current	Iq	Tj=25°C, Iout=0	--	4.3	8	mA
Quiescent Current Change	ΔIq	17.5V≤Vin≤30V	--	--	1	
		10mA≤Iout≤1.5A	--	--	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	I _{o peak}	Tj=25°C	--	2.2	--	A
Temperature Coefficient of Output Voltage	ΔVout/ ΔTj	Iout=10mA, 0°C≤Tj≤125°C	--	-1	--	mV/ °C

TS7818B 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≤1.5A, PD ≤15W	17.14	18	18.90	
Line Regulation	REGline	Tj=25°C				mV
		21V≤Vin≤33V	--	15	360	
Load Regulation	REGload	Tj=25°C				
		10mA≤Iout≤1.5A	--	12	360	
Quiescent Current	Iq	Tj=25°C, Iout=0	--	4.5	8	mA
Quiescent Current Change	ΔIq	21V≤Vin≤33V	--	--	1	
		10mA≤Iout≤1.5A	--	--	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	I _{o 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.

TS7800B Series

3-Terminal Fixed Positive Voltage Regulator

TS7824B Electrical Characteristics

$V_{in}=33V$, $I_{out}=500mA$, $0^{\circ}C \leq T_j \leq 125^{\circ}C$, $C_{in}=0.33\mu F$, $C_{out}=0.1\mu F$; unless otherwise specified.)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Output voltage	V_{out}	$T_j=25^{\circ}C$	23.07	24	24.96	V
		$27V \leq V_{in} \leq 38V$, $10mA \leq I_{out} \leq 1.5A$, $P_D \leq 15W$	22.85	24	25.20	
Line Regulation	REG _{line}	$T_j=25^{\circ}C$				mV
		$27V \leq V_{in} \leq 38V$	--	18	480	
Load Regulation	REG _{load}	$T_j=25^{\circ}C$				
		$10mA \leq I_{out} \leq 1.5A$	--	12	480	
Quiescent Current	I_q	$I_{out}=0$, $T_j=25^{\circ}C$	--	4.6	8	mA
		$27V \leq V_{in} \leq 38V$	--	--	1	
Quiescent Current Change	ΔI_q	$10mA \leq I_{out} \leq 1.5A$	--	--	0.5	
Output Noise Voltage	V_n	$10Hz \leq f \leq 100KHz$, $T_j=25^{\circ}C$	--	170	--	μV
Ripple Rejection Ratio	RR	$f=120Hz$, $27V \leq V_{in} \leq 37V$	54	70	--	dB
Voltage Drop	V_{drop}	$I_{out}=1.0A$, $T_j=25^{\circ}C$	--	2	--	V
Output Resistance	R_{out}	$f=1KHz$	--	28	--	$m\Omega$
Output Short Circuit Current	I_{os}	$T_j=25^{\circ}C$	--	150	--	mA
Peak Output Current	$I_{o peak}$	$T_j=25^{\circ}C$	--	2.2	--	A
Temperature Coefficient of Output Voltage	$\Delta V_{out} / \Delta T_j$	$I_{out}=10mA$, $0^{\circ}C \leq T_j \leq 125^{\circ}C$	--	-1.5	--	$mV / ^{\circ}C$

- 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

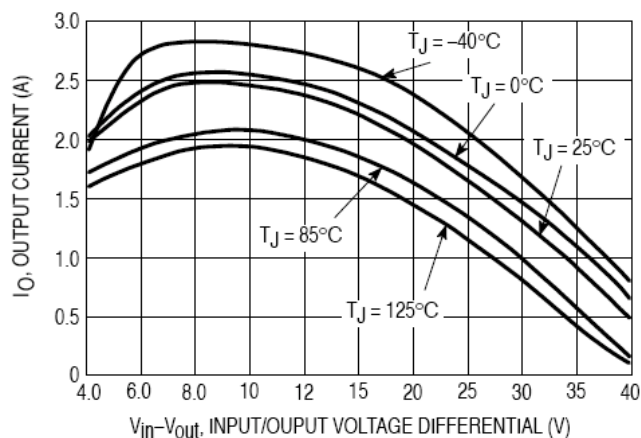


Figure 1. Peak Output Current as a Function of Input-Output Differential Voltage

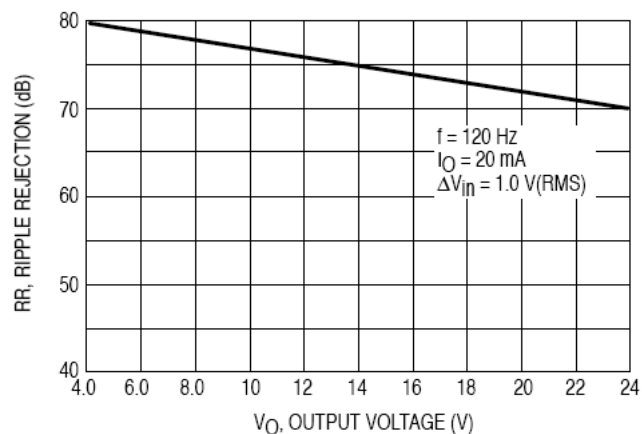


Figure 2. Ripple Rejection as a Function of Output Voltage

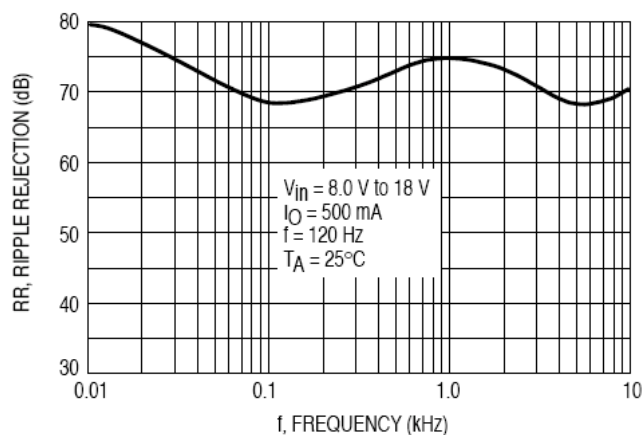


Figure 3. Ripple Rejection as a Function of Frequency

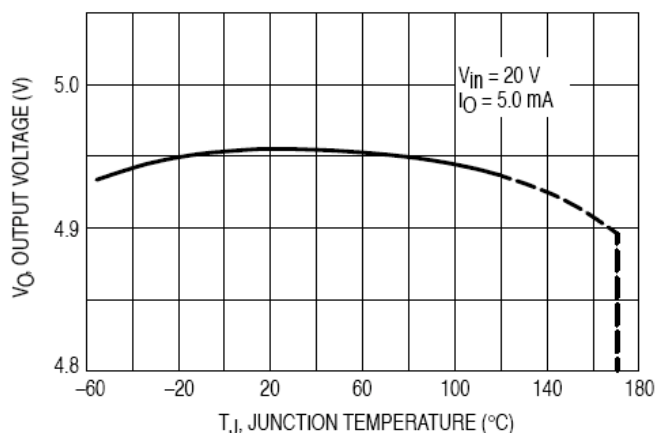


Figure 4. Output Voltage as a Function of Junction Temperature

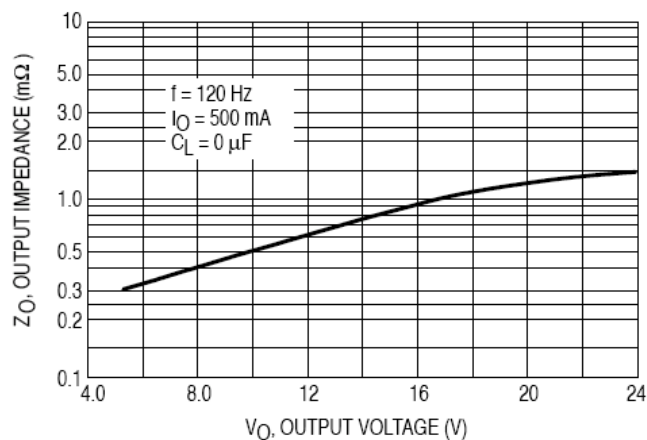


Figure 5. Output Impedance as a Function of Output Voltage

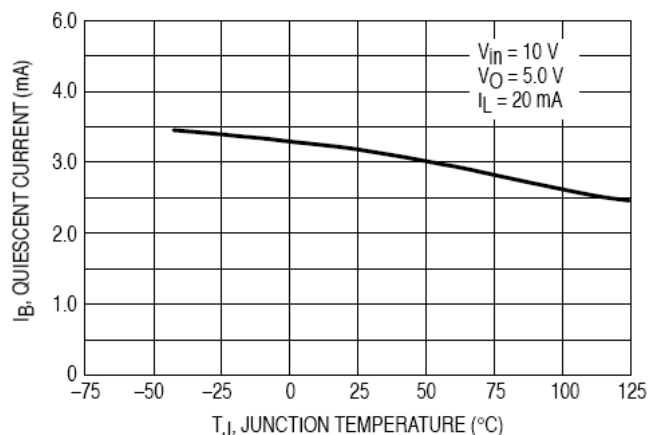


Figure 6. Quiescent Current as a Function of Temperature

Application Information

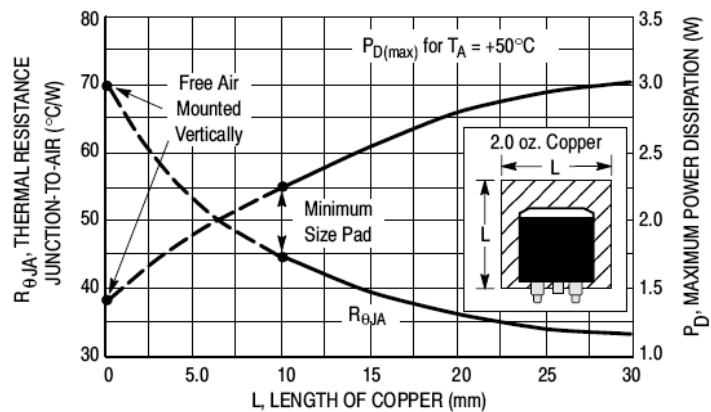
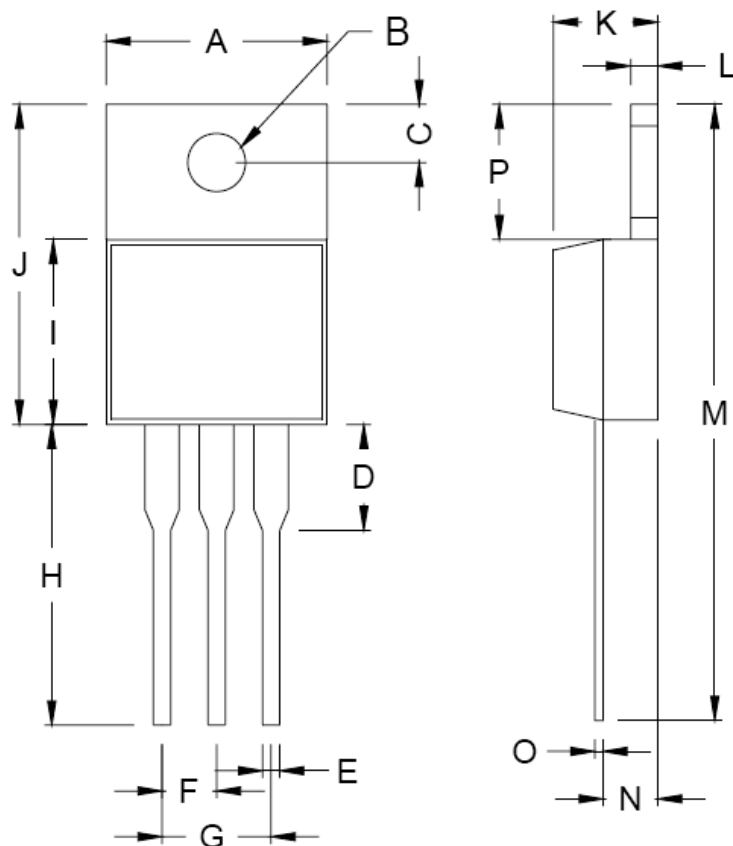


Figure 7. D²PAK Thermal Resistance and Maximum Power Dissipation vs. P.C.B Copper Length

TS7800B Series

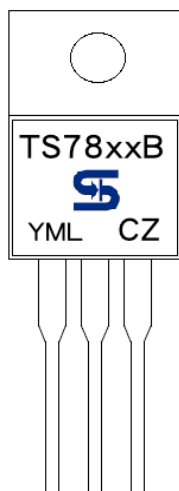
3-Terminal Fixed Positive Voltage Regulator

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

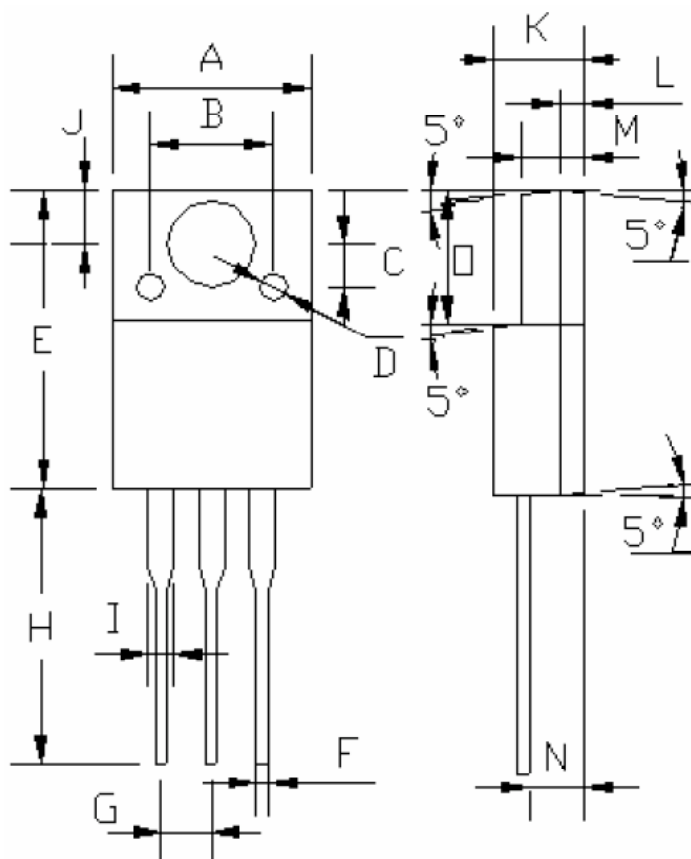


- XX** = Output Voltage
(05=5V, 06=6V, 08=8V, 09=9V, 10=10V, 12=12V, 15=15V, 18=18V, 24=24V)
- Y** = Year Code
- M** = Month Code
(A=Jan, B=Feb, C=Mar, D=Apr, E=May, F=Jun, G=Jul, H=Aug, I=Sep, J=Oct, K=Nov, L=Dec)
- L** = Lot Code
- CZ** = Package Code for TO-220

TS7800B Series

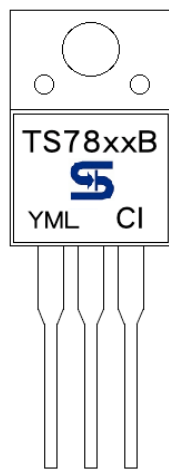
3-Terminal Fixed Positive Voltage Regulator

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

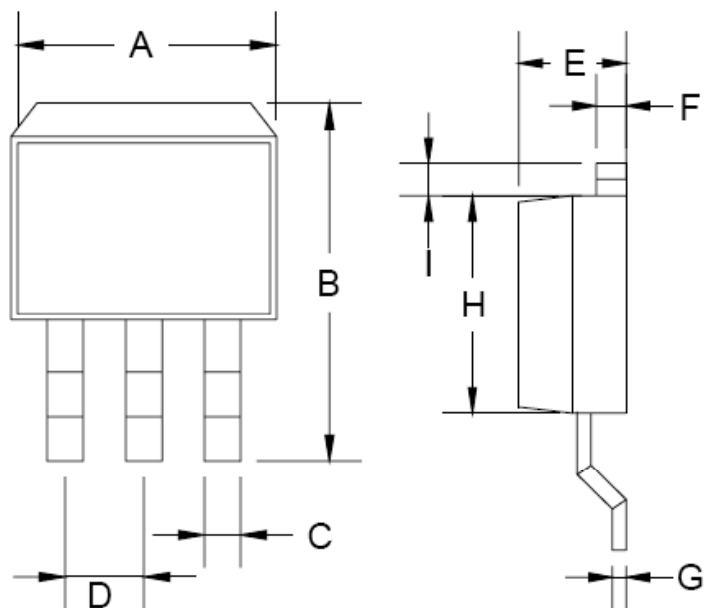


- XX** = Output Voltage
(05=5V, 06=6V, 08=8V, 09=9V, 10=10V, 12=12V, 15=15V, 18=18V, 24=24V)
- Y** = Year Code
- M** = Month Code
(A=Jan, B=Feb, C=Mar, D=Apl, E=May, F=Jun, G=Jul, H=Aug, I=Sep, J=Oct, K=Nov, L=Dec)
- L** = Lot Code
- CI** = Package Code for ITO-220

TS7800B Series

3-Terminal Fixed Positive Voltage Regulator

TO-263 Mechanical Drawing



DIM	TO-263 DIMENSION			
	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	10.000	10.500	0.394	0.413
B	14.605	15.875	0.575	0.625
C	0.508	0.991	0.020	0.039
D	2.420	2.660	0.095	0.105
E	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
H	8.280	8.800	0.325	0.346
I	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=Apr, 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

TS7800B Series

3-Terminal Fixed Positive Voltage Regulator

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.