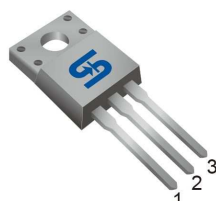
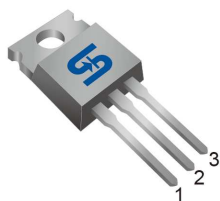


TO-220

ITO-220



**Pin Definition:**

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

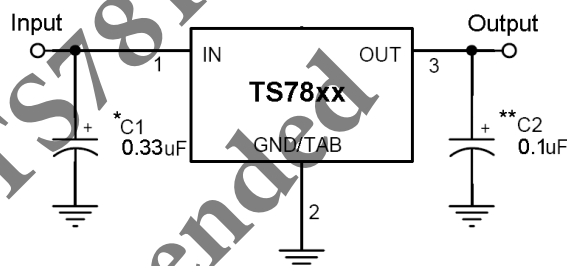
### General Description

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.

\* = C<sub>in</sub> is required if regulator is located an appreciable distance from power supply filter.

\*\* = C<sub>o</sub> is not needed for stability; however, it does improve transient response.

### Ordering Information

Part No.	Package	Packing
TS78xxCZ C0	TO-220	50pcs / Tube
TS78xxCI C0	ITO-220	50pcs / Tube

Note: Refer to detail ordering information table.

### Absolute Maximum Ratings (T<sub>A</sub> = 25°C unless otherwise noted)

Parameter	Symbol	Limit	Unit
Input Voltage	V <sub>IN</sub>	V <sub>OUT</sub> =5~18V	35
		V <sub>OUT</sub> =24V	40
Output Current	I <sub>OUT</sub>	Internal Limited	
Power Dissipation	P <sub>D</sub>	Internal Limited	
Operating Junction Temperature	T <sub>J</sub>	0~+125	°C
Storage Temperature Range	T <sub>STG</sub>	-65~+150	°C
Thermal Resistance - Junction to Case	R <sub>θJC</sub>	TO-220	5
		ITO-220	5
Thermal Resistance - Junction to Ambient	R <sub>θJA</sub>	TO-220	50
		ITO-220	60

**Note:** Absolute maximum ratings are those values beyond which damage to the device may occur.

Functional operation under these conditions are not implied.

### TS7805 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	
		$7.5V \leq V_{IN} \leq 20V$ , $10mA \leq I_{OUT} \leq 1A$ , $P_D \leq 15W$	4.75	5	5.25		
Line Regulation	$REG_{LINE}$	$T_J=25^{\circ}C$	$7.5V \leq V_{IN} \leq 25V$	--	3	100	mV
			$8V \leq V_{IN} \leq 12V$	--	1	50	
Load Regulation	$REG_{LOAD}$	$T_J=25^{\circ}C$	$10mA \leq I_{OUT} \leq 1A$	--	15	100	
			$250mA \leq I_{OUT} \leq 750mA$	--	5	50	
Quiescent Current	$I_Q$	$I_{OUT}=0$ , $T_J=25^{\circ}C$	--	4.2	8	mA	
Quiescent Current Change	$\Delta I_Q$	$7.5V \leq V_{IN} \leq 25V$	--	--	1.3		
		$10mA \leq I_{OUT} \leq 1A$	--	--	0.5		
Output Noise Voltage	$V_N$	$10Hz \leq f \leq 100KHz$ , $T_J=25^{\circ}C$	--	40	--	$\mu V$	
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	--	$mV / ^{\circ}C$	

### TS7808 Electrical Characteristics

( $V_{IN}=14V$ ,  $I_{OUT}=500mA$ ,  $0^{\circ}C \leq T_J \leq 125^{\circ}C$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ ; unless otherwise specified.)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit	
Output Voltage	$V_{OUT}$	$T_J=25^{\circ}C$	7.69	8	8.32	V	
		$10.5V \leq V_{IN} \leq 23V$ , $10mA \leq I_{OUT} \leq 1A$ , $P_D \leq 15W$	7.61	8	8.40		
Line Regulation	$REG_{LINE}$	$T_J=25^{\circ}C$	$10.5V \leq V_{IN} \leq 25V$	--	6	160	mV
			$11V \leq V_{IN} \leq 17V$	--	2	80	
Load Regulation	$REG_{LOAD}$	$T_J=25^{\circ}C$	$10mA \leq I_{OUT} \leq 1A$	--	12	160	
			$250mA \leq I_{OUT} \leq 750mA$	--	4	80	
Quiescent Current	$I_Q$	$I_{OUT}=0$ , $T_J=25^{\circ}C$	--	4.3	8	mA	
Quiescent Current Change	$\Delta I_Q$	$10.5V \leq V_{IN} \leq 25V$	--	--	1		
		$10mA \leq I_{OUT} \leq 1A$	--	--	0.5		
Output Noise Voltage	$V_N$	$10Hz \leq f \leq 100KHz$ , $T_J=25^{\circ}C$	--	52	--	$\mu V$	
Ripple Rejection Ratio	RR	$f=120Hz$ , $11V \leq V_{IN} \leq 21V$	56	72	--	dB	
Voltage Drop	$V_{DROP}$	$I_{OUT}=1.0A$ , $T_J=25^{\circ}C$	--	2	--	V	
Output Resistance	$R_{OUT}$	$f=1KHz$	--	16	--	$m\Omega$	
Output Short Circuit Current	$I_{OS}$	$T_J=25^{\circ}C$	--	450	--	mA	
Peak Output Current	$I_{O\ peak}$	$T_J=25^{\circ}C$	--	2.2	--	A	
Temperature Coefficient of Output Voltage	$\Delta V_{OUT} / \Delta T_J$	$I_{OUT}=10mA$ , $0^{\circ}C \leq T_J \leq 125^{\circ}C$	--	-0.8	--	$mV / ^{\circ}C$	

- 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.

### TS7809 Electrical Characteristics

( $V_{IN}=15V$ ,  $I_{OUT}=500mA$ ,  $0^{\circ}C \leq T_J \leq 125^{\circ}C$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ ; unless otherwise specified.)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit	
Output voltage	$V_{OUT}$	$T_J=25^{\circ}C$	8.65	9	9.36	V	
		$11.5V \leq V_{IN} \leq 23V$ , $10mA \leq I_{OUT} \leq 1A$ , $P_D \leq 15W$	8.57	9	9.45		
Line Regulation	$REG_{LINE}$	$T_J=25^{\circ}C$	$11.5V \leq V_{IN} \leq 26V$	--	6	180	mV
			$12V \leq V_{IN} \leq 17V$	--	2	90	
Load Regulation	$REG_{LOAD}$	$T_J=25^{\circ}C$	$10mA \leq I_{OUT} \leq 1A$	--	12	180	mV
			$250mA \leq I_{OUT} \leq 750mA$	--	4	90	
Quiescent Current	$I_Q$	$I_{OUT}=0$ , $T_J=25^{\circ}C$	--	4.3	8	mA	
Quiescent Current Change	$\Delta I_Q$	$11.5V \leq V_{IN} \leq 26V$	--	--	1		
		$10mA \leq I_{OUT} \leq 1A$	--	--	0.5		
Output Noise Voltage	$V_N$	$10Hz \leq f \leq 100KHz$ , $T_J=25^{\circ}C$	--	52	--	$\mu V$	
Ripple Rejection Ratio	RR	$f=120Hz$ , $12V \leq V_{IN} \leq 22V$	55	72	--	dB	
Voltage Drop	$V_{DROP}$	$I_{OUT}=1.0A$ , $T_J=25^{\circ}C$	--	2	--	V	
Output Resistance	$R_{OUT}$	$f=1KHz$	--	16	--	$m\Omega$	
Output Short Circuit Current	$I_{OS}$	$T_J=25^{\circ}C$	--	450	--	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	--	$mV/^{\circ}C$	

### TS7812 Electrical Characteristics

( $V_{IN}=19V$ ,  $I_{OUT}=500mA$ ,  $0^{\circ}C \leq T_J \leq 125^{\circ}C$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ ; unless otherwise specified.)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit	
Output Voltage	$V_{OUT}$	$T_J=25^{\circ}C$	11.53	12	12.48	V	
		$14.5V \leq V_{IN} \leq 27V$ , $10mA \leq I_{OUT} \leq 1A$ , $P_D \leq 15W$	11.42	12	12.60		
Line Regulation	$REG_{LINE}$	$T_J=25^{\circ}C$	$14.5V \leq V_{IN} \leq 30V$	--	10	240	mV
			$15V \leq V_{IN} \leq 19V$	--	3	120	
Load Regulation	$REG_{LOAD}$	$T_J=25^{\circ}C$	$10mA \leq I_{OUT} \leq 1A$	--	12	240	mV
			$250mA \leq I_{OUT} \leq 750mA$	--	4	120	
Quiescent Current	$I_Q$	$I_{OUT}=0$ , $T_J=25^{\circ}C$	--	4.3	8	mA	
Quiescent Current Change	$\Delta I_Q$	$14.5V \leq V_{IN} \leq 30V$	--	--	1		
		$10mA \leq I_{OUT} \leq 1A$	--	--	0.5		
Output Noise Voltage	$V_N$	$10Hz \leq f \leq 100KHz$ , $T_J=25^{\circ}C$	--	75	--	$\mu V$	
Ripple Rejection Ratio	RR	$f=120Hz$ , $15V \leq V_{IN} \leq 25V$	55	71	--	dB	
Voltage Drop	$V_{DROP}$	$I_{OUT}=1.0A$ , $T_J=25^{\circ}C$	--	2	--	V	
Output Resistance	$R_{OUT}$	$f=1KHz$	--	18	--	$m\Omega$	
Output Short Circuit Current	$I_{OS}$	$T_J=25^{\circ}C$	--	350	--	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	--	$mV/^{\circ}C$	

- 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.

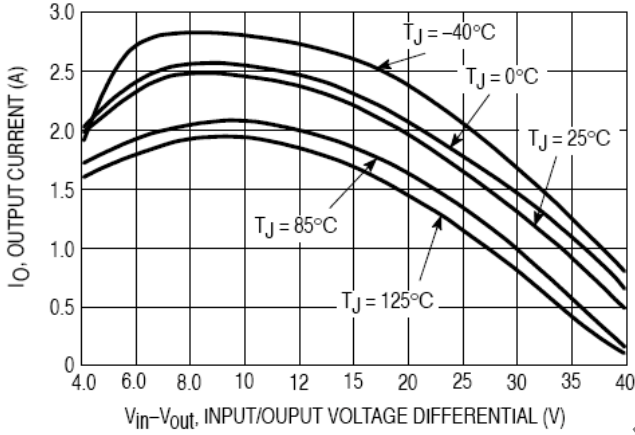
### TS7824 Electrical Characteristics

( $V_{IN}=24V$ ,  $I_{OUT}=500mA$ ,  $0^{\circ}C \leq T_J \leq 125^{\circ}C$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ ; unless otherwise specified.)

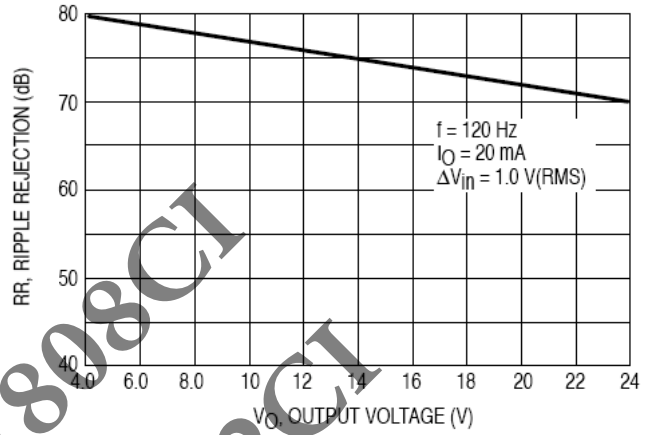
Parameter	Symbol	Test Condition	Min	Typ	Max	Unit	
Output voltage	$V_{OUT}$	$T_J=25^{\circ}C$	23.07	24	24.96	V	
		$27V \leq V_{IN} \leq 38V$ , $10mA \leq I_{OUT} \leq 1A$ , $P_D \leq 15W$	22.85	24	25.20		
Line Regulation	$REG_{LINE}$	$T_J=25^{\circ}C$	$27V \leq V_{IN} \leq 38V$	--	18	480	mV
			$28V \leq V_{IN} \leq 32V$	--	6	240	
Load Regulation	$REG_{LOAD}$	$T_J=25^{\circ}C$	$10mA \leq I_{OUT} \leq 1A$	--	12	480	mV
			$250mA \leq I_{OUT} \leq 750mA$	--	4	240	
Quiescent Current	$I_Q$	$I_{OUT}=0$ , $T_J=25^{\circ}C$	--	4.6	8	mA	
Quiescent Current Change	$\Delta I_Q$	$27V \leq V_{IN} \leq 38V$	--	--	1		
		$10mA \leq I_{OUT} \leq 1A$	--	--	0.5		
Output Noise Voltage	$V_N$	$10Hz \leq f \leq 100KHz$ , $T_J=25^{\circ}C$	--	170	--	$\mu V$	
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.

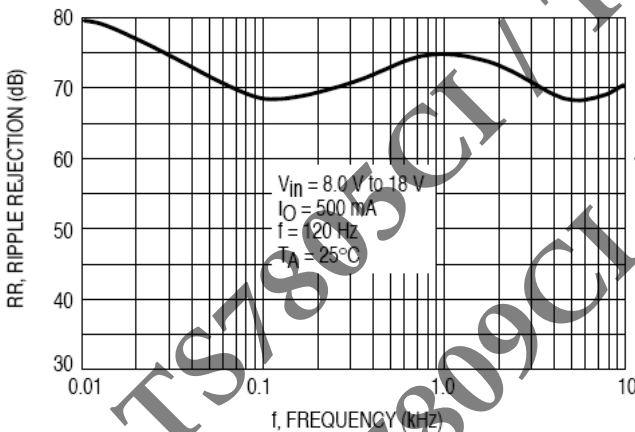
### Electrical Characteristics Curve



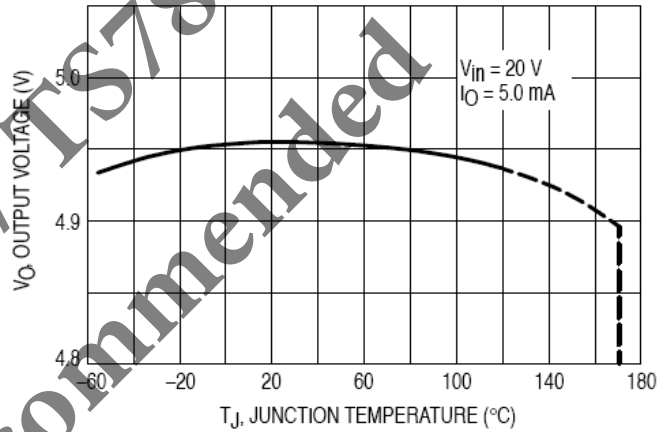
**Figure 1. Peak Output Current as a Function of Input-Output Differential Voltage**



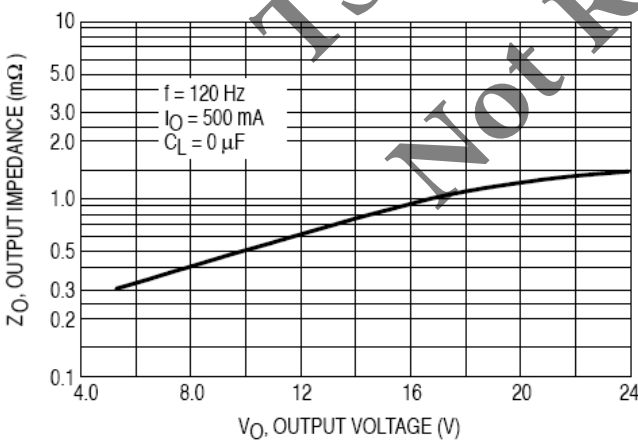
**Figure 2. Ripple Rejection as a Function of Output Voltage**



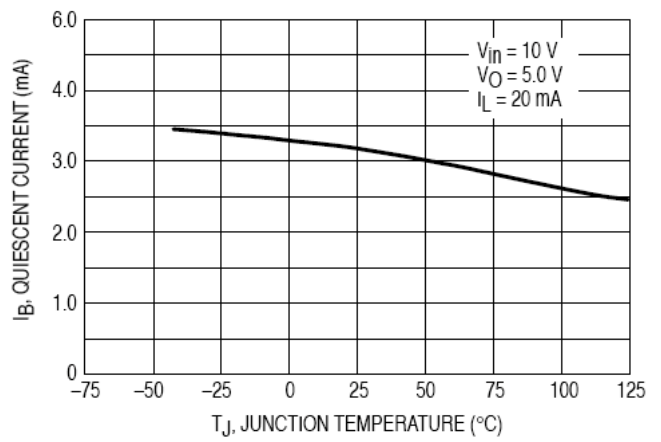
**Figure 3. Ripple Rejection as a Function of Frequency**



**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**

### Ordering information

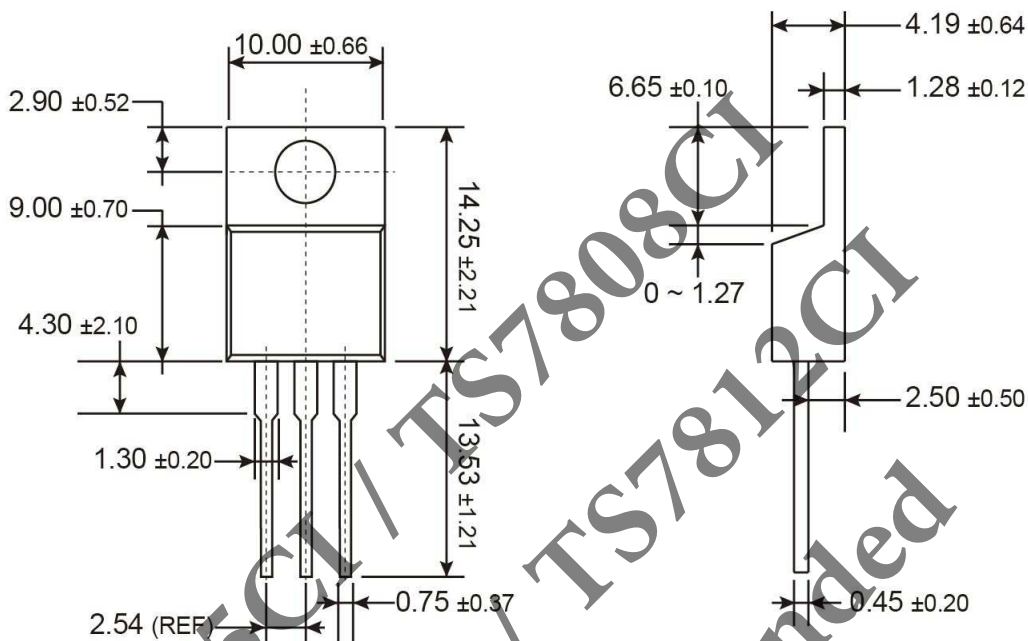
Voltage	TO-220	ITO-220
5V	TS7805CZ C0	TS7805CI C0
8V	TS7808CZ C0	TS7808CI C0
9V	TS7809CZ C0	TS7809CI C0
12V	TS7812CZ C0	TS7812CI C0
24V	TS7824CZ C0	

### Packing code information

Packing	50pcs / Tube	50pcs / Tube
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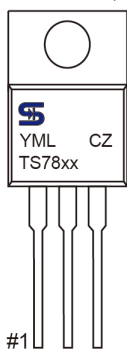
TS7805CI / TS7808CI  
 TS7809CI / TS7812CI  
 Not Recommended

### TO-220 Mechanical Drawing



Unit: Millimeters

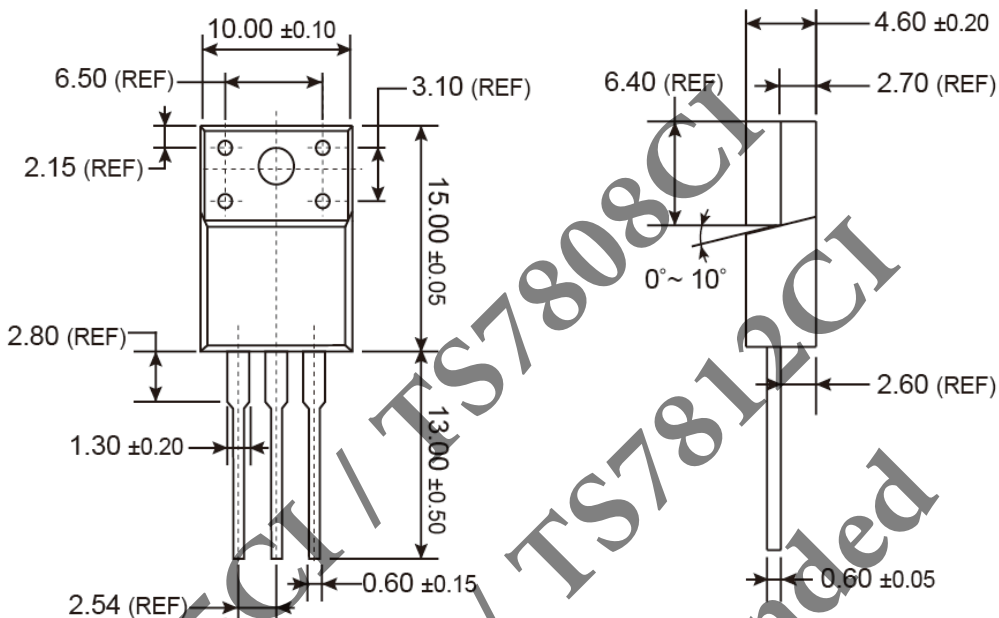
### Marking Diagram



- XX** = Output Voltage  
(05=5V, 08=8V, 09=9V, 12=12V, 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

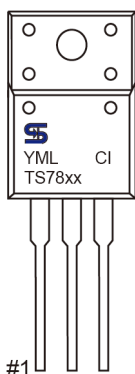


### ITO-220 Mechanical Drawing



Unit: Millimeters

### Marking Diagram



- XX** = Output Voltage  
(**05**=5V, **08**=8V, **09**=9V, **12**=12V)
- 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
- CI** = Package Code for ITO-220



# TS7800 Series

## 3-Terminal Fixed Positive Voltage Regulator

TS7805CI / TS7808CI  
TS7809CI / TS7812CI  
Not Recommended

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