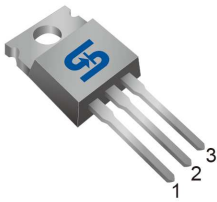
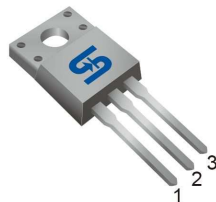


TO-220

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

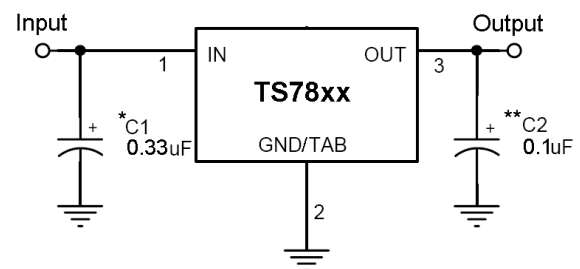
- Output Voltage Range 5 to 24V
- Output current up to 1A
- No external components required
- Internal thermal overload protection
- Internal short-circuit current limiting
- Output transistor safe-area compensation
- Output voltage offered in 4% tolerance

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.

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 Ratings (T_A = 25°C unless otherwise noted)

Parameter	Symbol	Limit	Unit	
Input Voltage	V _{IN}	V _{OUT} =5~18V	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	R _{θJC}	TO-220	5	°C/W
		ITO-220	5	
Thermal Resistance - Junction to Ambient	R _{θJA}	TO-220	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 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	ΔI_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	--	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	--	$mV / ^{\circ}C$	

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	ΔI_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	--	μV	
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	ΔI_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	--	μV	
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	ΔI_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	--	μV	
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	
			$250mA \leq I_{OUT} \leq 750mA$	--	4	240	
Quiescent Current	I_Q	$I_{OUT}=0$, $T_J=25^{\circ}C$	--	4.6	8	mA	
Quiescent Current Change	ΔI_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	--	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	$I_o \text{ peak}$	$T_J=25^{\circ}C$	--	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

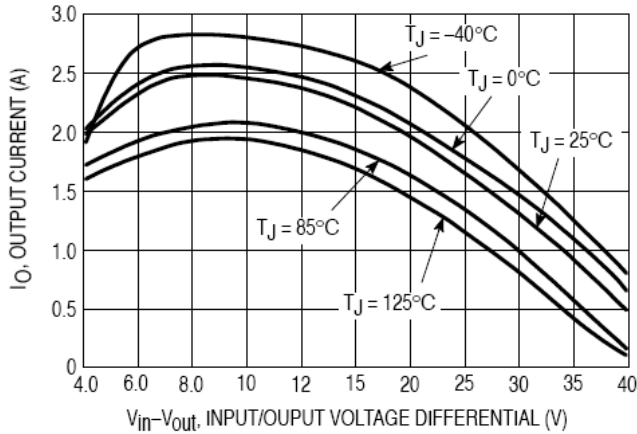


Figure 1. Peak Output Current as a Function of Input-Output Differential Voltage

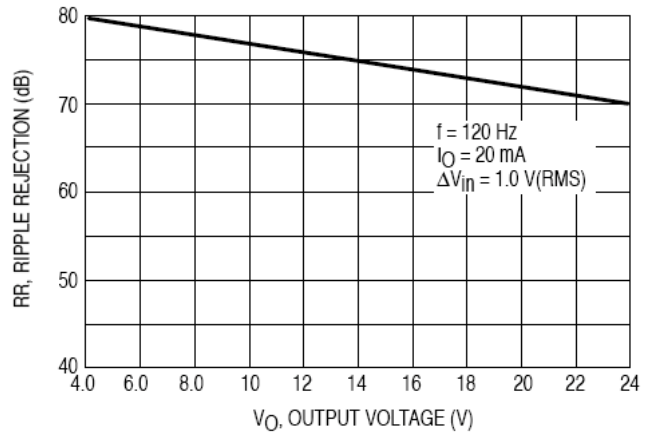


Figure 2. Ripple Rejection as a Function of Output Voltage

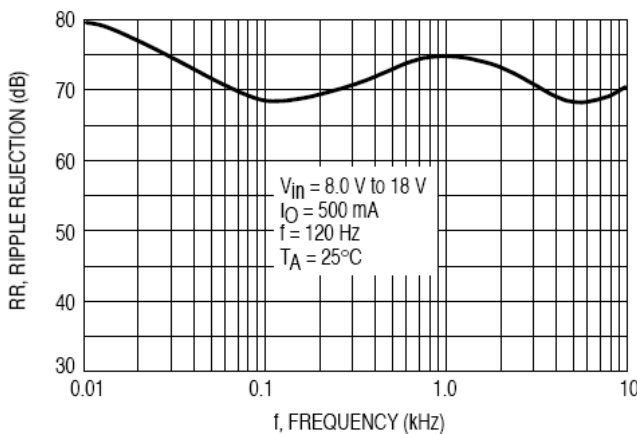


Figure 3. Ripple Rejection as a Function of Frequency

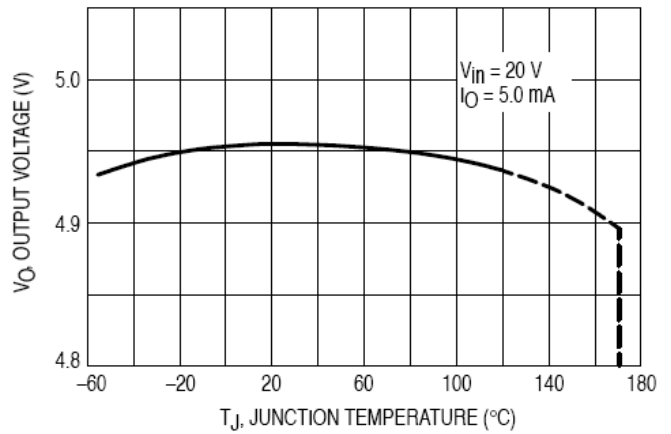


Figure 4. Output Voltage as a Function of Junction Temperature

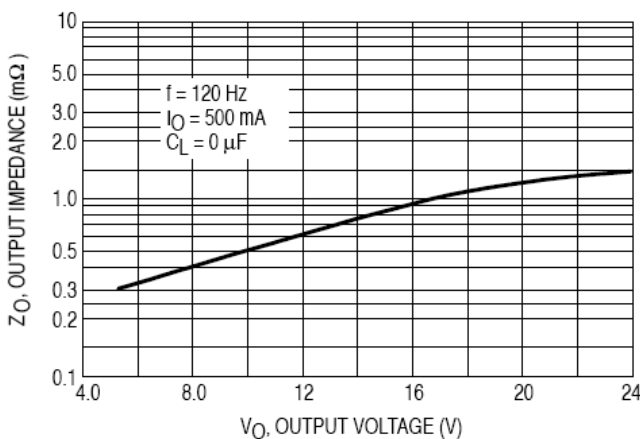


Figure 5. Output Impedance as a Function of Output Voltage

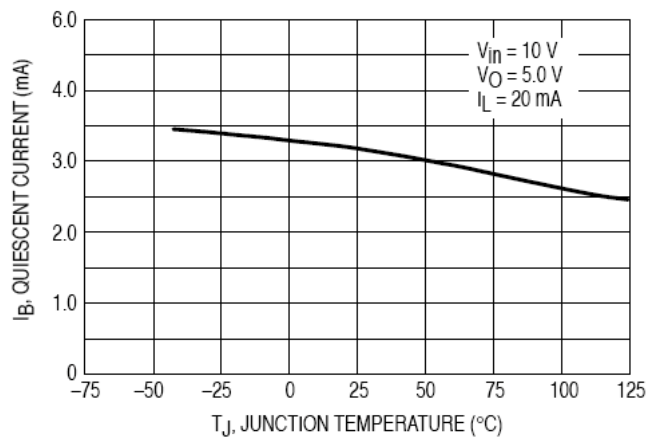


Figure 6. Quiescent Current as a Function of Temperature

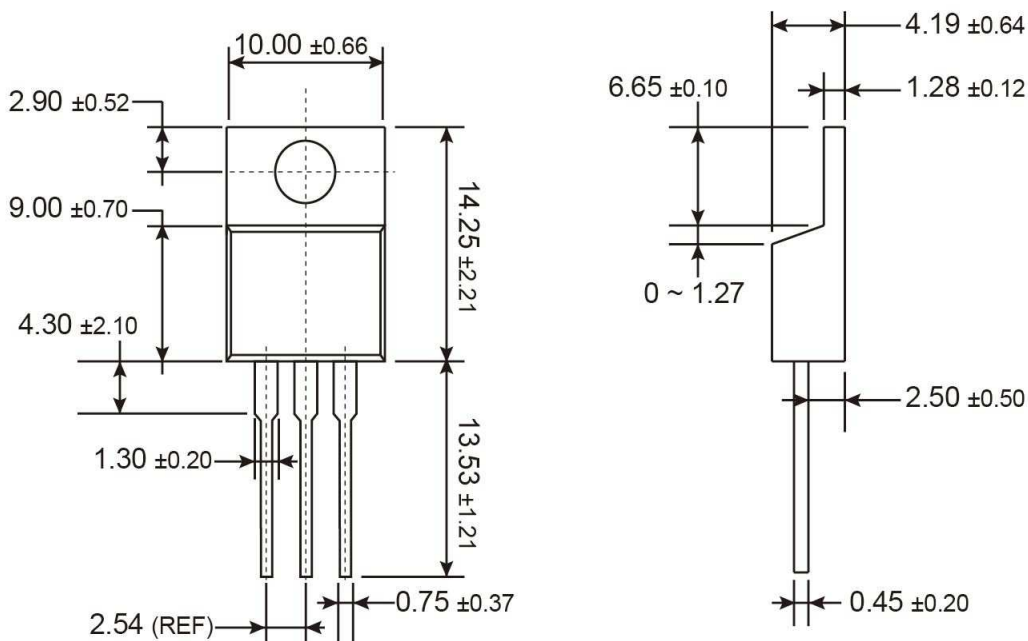
Ordering information

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

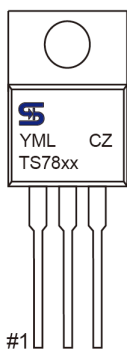
Packing	50pcs / Tube	50pcs / Tube

TO-220 Mechanical Drawing



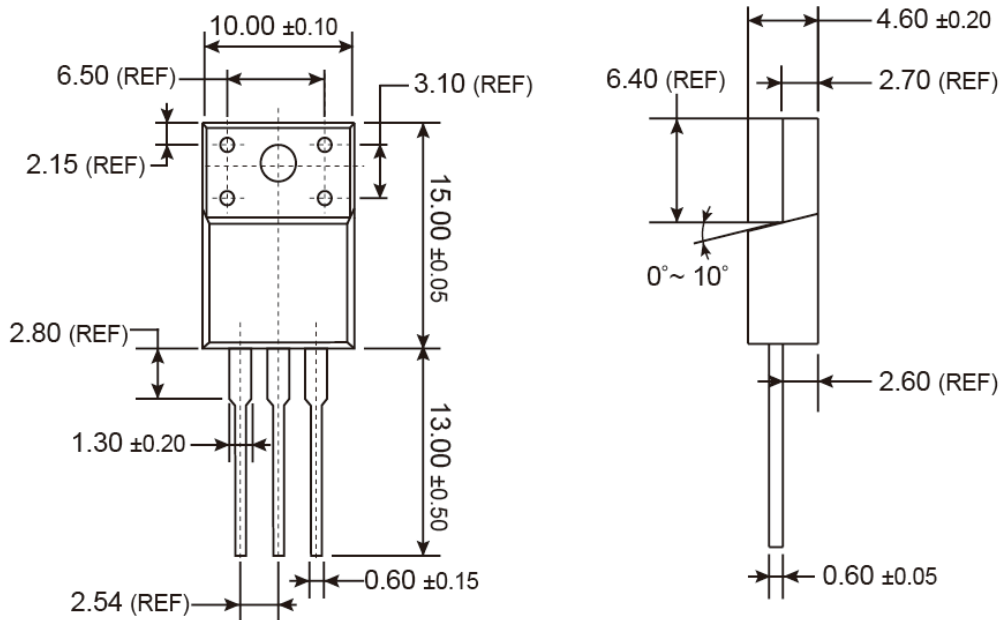
Unit: Millimeters

Marking Diagram



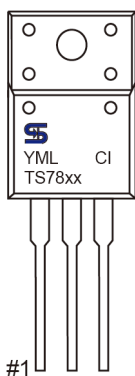
- XX** = Output Voltage
(**05**=5V, **08**=8V, **09**=9V, **12**=12V, **24**=24V)
- Y** = Year Code
- M** = Month Code
(**A**=Jan, **B**=Feb, **C**=Mar, **D**=Apr, **E**=May, **F**=Jun, **G**=Jul, **H**=Aug, **I**=Sep, **J**=Oct, **K**=Nov, **L**=Dec)
- L** = Lot Code
- CZ** = Package Code for TO-220

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

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