



Features

- Vin Range Up to 100V
- Output Range: 2.8V~5.0V
- Maximum Output Current: 200mA
- PSRR: 70dB@1KHz
- Dropout Voltage: 0.6V Typ.@I_{OUT}=100mA
- Low Quiescent Current:
2μA @VIN=(V_{OUT}+1) V
- Output Voltage Tolerances: ±2%
- Internal Temperature Protection
- Built-in Foldback Current Limit

Applications

- E-meters, Water Meters and Gas Meters
- Cellphones, Radiophone and Digital Cameras
- Fire Alarm, Smoke Detector
- Appliances, White Goods

General Description

TX81221A is an ultra-low quiescent current regulator with low dropout voltage. It features 2μA quiescent current at no load. TX81221A retains all the common features of low dropout regulators, including a low dropout PMOS pass device, foldback current limiter, and thermal shutdown.

voltage, excellent load transient response. It operates over a temperature range of -40°C to 125°C and maintains ±2% output voltage tolerance across the entire output current, input voltage, and temperature range.

TX81221A regulators are available in standard SOT23-3L, SOT89-3 and SOT223 packages.

TX81221A offers 100V maximum operating

Order Information

TX81221A-①②③④

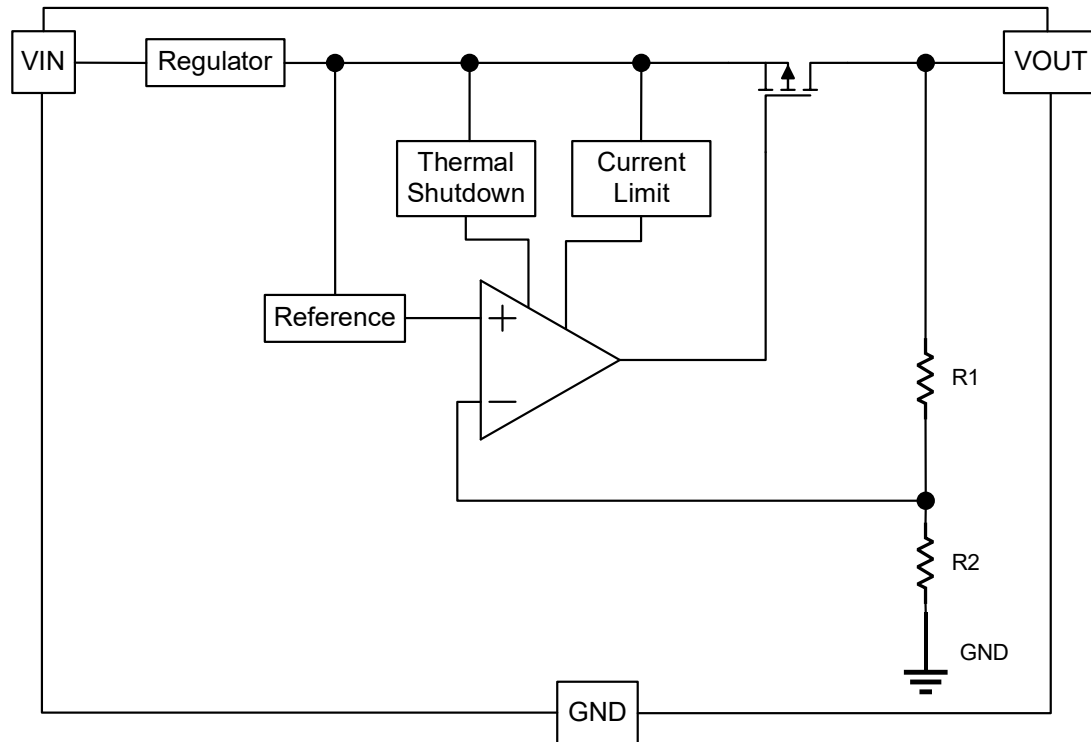
Designator	Symbol	Description
①②	Integer	Output Voltage(2.8~5.0V)
③	M	Package: SOT23-3L
	P	Package: SOT89-3
	G	Package: SOT223
④	R	Rohs / Pb-Free
	G	Halogen-Free

Selection Table

Part number	Package	Tape & Reel
TX81221A-XXMR	SOT23-3L	3000pcs/REEL
TX81221A-XXPR	SOT89-3	1000pcs/ REEL
TX81221A-XXGR	SOT223	2500pcs/REEL



Block Diagram





Pin Assignment

SOT23-3L (Top View)

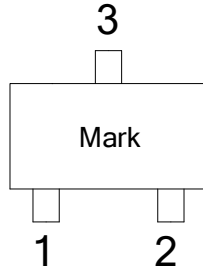


Table1: TX81221A-XXMR series (SOT23-3L PKG)

PIN NO.	PIN NAME	FUNCTION
1	GND	GND pin
2	VOUT	Output voltage pin
3	VIN	Input voltage pin

SOT89-3 (Top View)

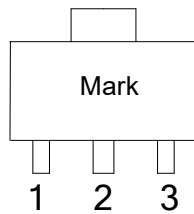


Table2: TX81221A-XXPR series (SOT89-3 PKG)

PIN NO.	PIN NAME	FUNCTION
1	GND	GND pin
2	VIN	Input voltage pin
3	VOUT	Output voltage pin

SOT223 (Top View)

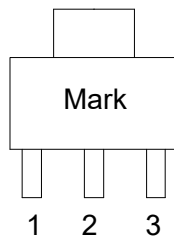


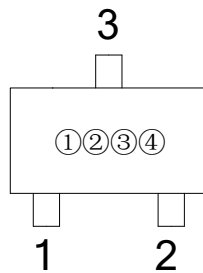
Table3: TX81221A-XXGR series (SOT223 PKG)

PIN NO.	PIN NAME	FUNCTION
1	GND	GND pin
2	VIN	Input voltage pin
3	VOUT	Output voltage pin

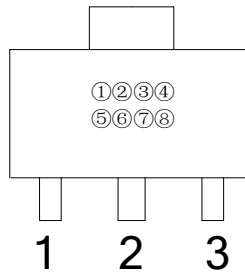


Marking Rule

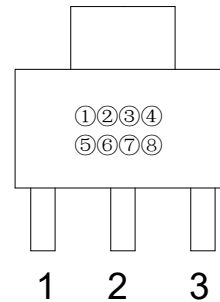
SOT23-3L (Top View)



SOT89-3 (Top View)



SOT223 (Top View)



Designator	Symbol	Description
①②	Integer	Output Voltage (eg.3.3V: 33)
③	A	Product Code
④	X	Product Code
⑤⑥⑦⑧	Letters or Numbers	Lot NO

**Absolute Maximum Ratings**

Input Voltage.....	-0.3V to 120V
V _{OUT}	-0.3V to 6V
HBM ESD Rating.....	7.5kV
Storage Temperature.....	-55℃ to 150℃
Lead Temperature (Soldering, 10 sec)	260℃
Operating Temperature.....	-40℃ to 125℃

Note: These are stress ratings only. Stresses exceeding the range specified under "Absolute Maximum Ratings" may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

Electrical Characteristics

The following specifications apply for V_{IN}=12V, C_{IN}=C_{OUT}=2.2uF, T_J=25℃, unless specified otherwise.

SYMBOL	ITEMS	CONDITIONS	MIN	TYP	MAX	UNIT
V _{IN}	Input Voltage Range		2.9		100	V
V _{OUT}	Output Voltage Range		2.8		5.0	V
ΔV _{OUT}	Output Voltage Accuracy		-2	V _{OUT}	2	%
I _Q	Quiescent Current	V _{IN} =(V _{OUT} +1)V	--	2	--	μA
V _{DROP}	Dropout Voltage	I _{OUT} =100mA	--	0.6	--	V
ΔV _{LINE}	Line Regulation	V _{IN} = V _{OUT} + 1V to 80V, I _{OUT} = 1mA	--	20	--	mV
ΔV _{LOAD}	Load Regulation	V _{IN} =10V, I _{OUT} = 1mA to 100mA	--	20	--	mV
T _{SD}	Thermal Shutdown		---	150	---	℃
T _{HY}	Thermal Shutdown Hysteresis		---	20	---	℃
PSRR	Power Supply Rejection Rate	Freq=1kHz, V _{IN} =9V, Ripple=0.2Vp-p, I _{OUT} =10mA	--	70	--	dB
I _{SHORT}	I _{OUT} @ V _{OUT} Short to Ground	V _{IN} =6V, V _{OUT} =0V	--	10	20	mA

Note1: The parameters of C_{in} and C_{out} must be greater than 2.2uF.



Application Circuits

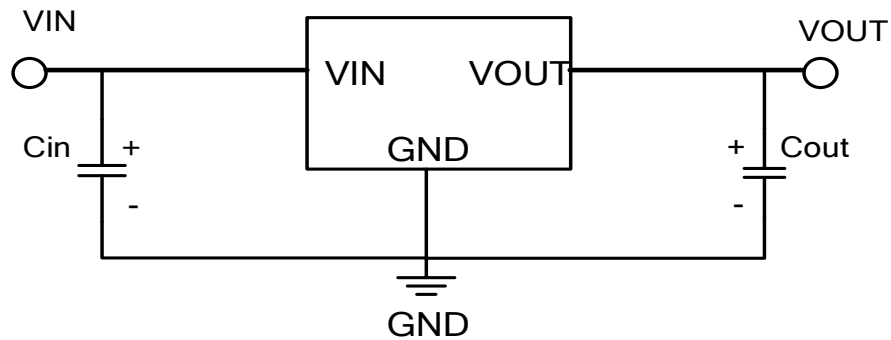


Figure1

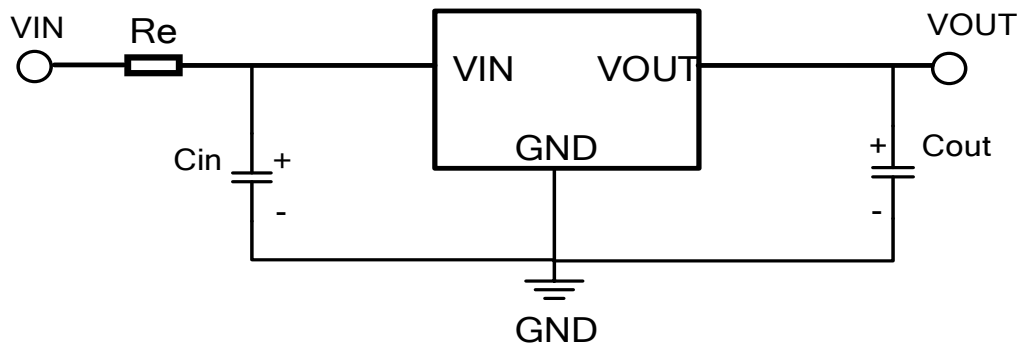


Figure2

Note1: The parameters of Cin and Cout must be greater than 2.2uF.

Note2: If $V_{IN} > 50V$, you'd better add a resistor to the input. The resistance value of R1 should be set to 0.25Ω~2Ω.

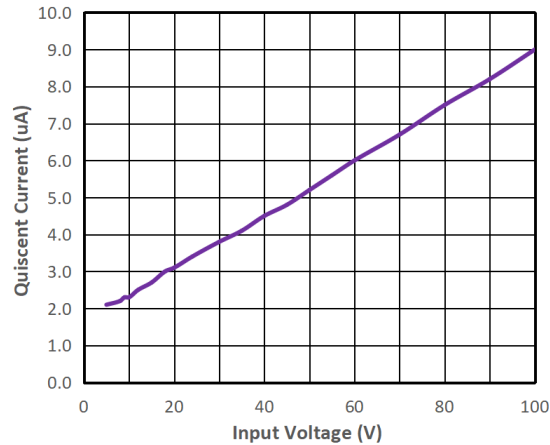


TX81221A series

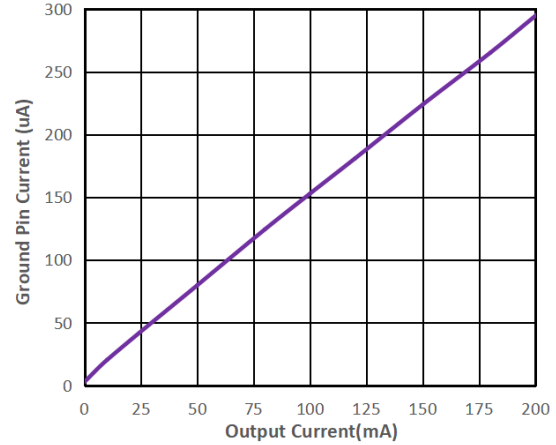
Typical Performance Characteristics

C_{IN}=10uF, C_{OUT}=10uF, T_J=25°C, unless specified otherwise

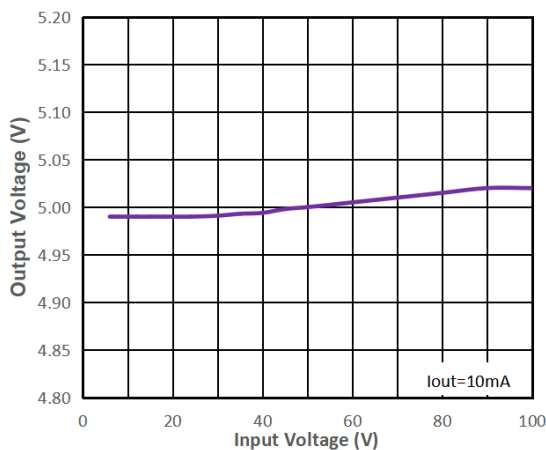
(1) Quiescent Current vs Input Voltage



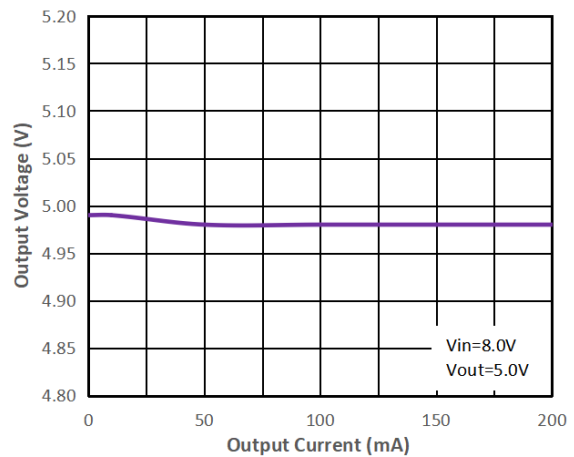
(2) Ground Pin Current vs Output Current



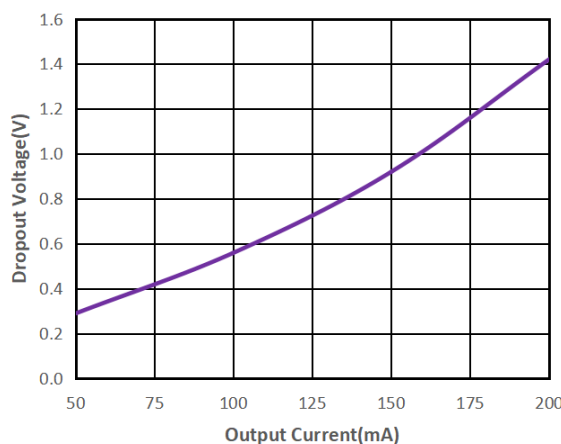
(3) Output Voltage vs Input Voltage



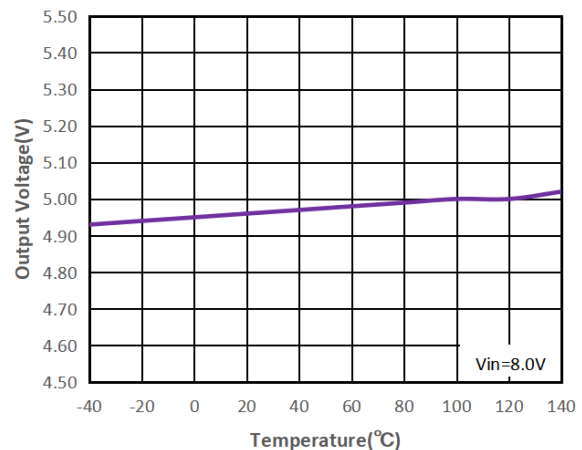
(4) Output Voltage vs Output Current



(5) Dropout Voltage vs Output Current

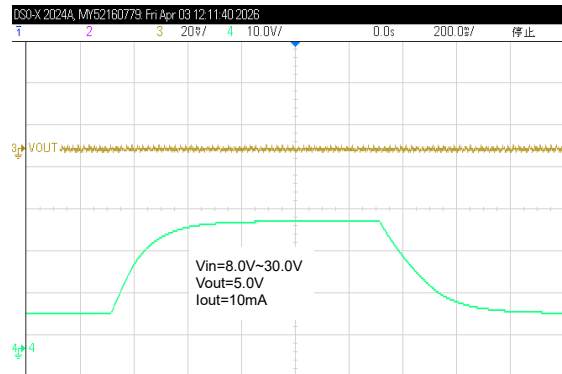
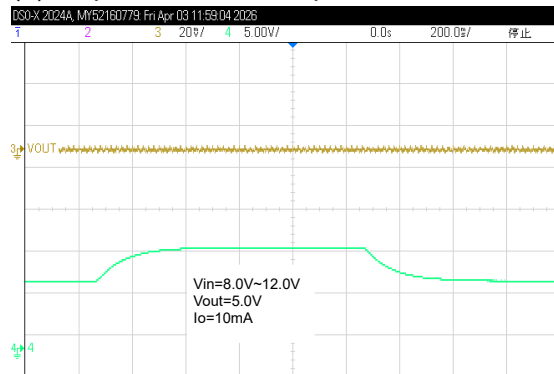


(6) Output Voltage vs Temperature

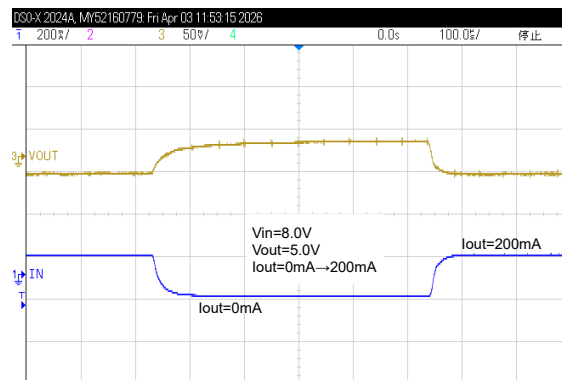
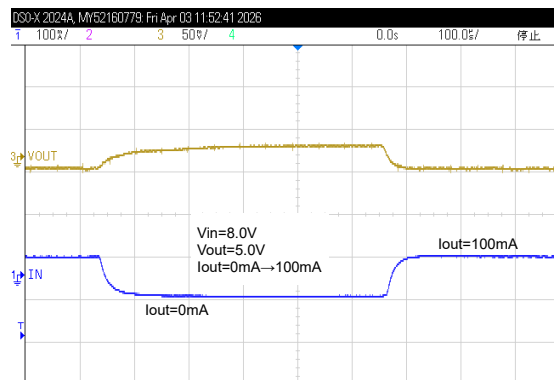




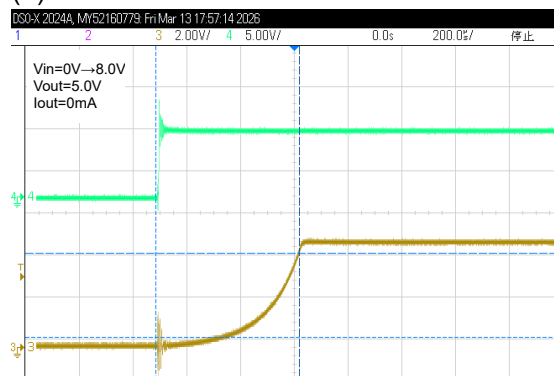
(7) Input Transient Response



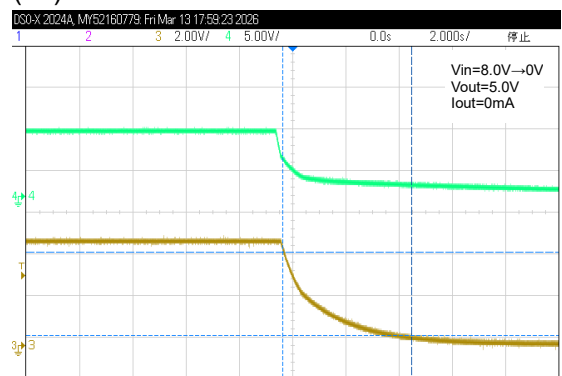
(8) Load Transient Response



(9) Power ON



(10) Power OFF





Functional Description

OPERATION

The TX81221A is a linear regulator that supplies power to systems with high voltage batteries. It includes a wide 2.9V to 100V input range, low dropout voltage and low quiescent supply current. The TX81221A provides wide variety of fixed output voltage options: 2.8V~5.0V.

The regulator output current is internally limited, and the device is protected against over-load and over-temperature conditions. The peak output current is limited to around 260mA, which exceeds the 200mA recommended continuous output current. The characteristic shown in the figure3 below is much more commonly found in voltage regulators and is called as "current fold-back" limiting. The short circuit current is much lower than the maximum output current. The most obvious reason to employ this type of profile is to limit the power dissipation in the regulator. This method is also used to protect the pass transistor in the regulator from moving outside of its Safe-Operating-Area (SOA). Finally, using a fold-back type profile will limit the short circuit current to a small value while still allowing the regulator to provide its full rated output current. It is very important if continuous short circuit faults need to be accommodated.

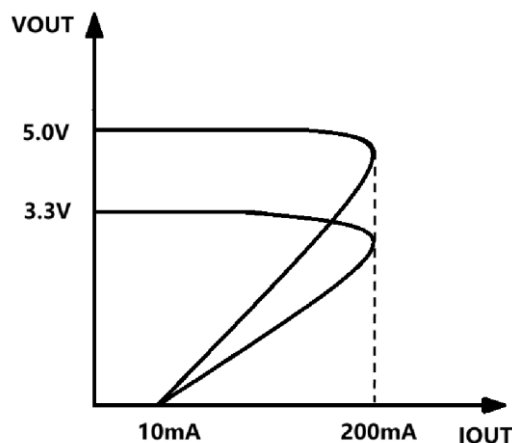


Figure3

When the junction temperature is too high, the thermal sensor sends a signal to the control logic that will shut down the IC. The IC will restart when the temperature has sufficiently cooled.

The maximum power output current is a function of the package's maximum power dissipation for a given temperature.

The maximum power dissipation is dependent on the thermal resistance of the case and the circuit board, the temperature difference, between the die junction and the ambient air, and the rate of air flow. The GND pin and Exposed Pad must be connected to the ground plane for proper dissipation.

Input Capacitor

For proper operation, place a ceramic capacitor (Cin) between 1μF and 10μF of dielectric type X5R or X7R between the input pin and ground. Larger values in this range will help improve line transient response.



Output Capacitor

For stable operation, use a ceramic capacitor (Cout) of type X5R or X7R between 2.2 μ F and 10 μ F. Larger values in this range will help improve load transient response, reduce noise. Output capacitors of other dielectric types can be used, but are not recommended as their capacitance can deviate greatly from their rated value over-temperature.

External Reverse Voltage Protection

In some situations, e.g. a backup battery is connected as TX81221A load, the output voltage may be held up while the input is either pulled to ground, pulled to some intermediate voltage or is floating. Thus, the output voltage is higher than input voltage. Since the TX81221A PMOS pass element has a body diode, a current will conduct from the output to input and is not internally limited. It's possible that the IC will be damaged by this unlimited reverse current. To avoid this, it's recommended to place an external diode at input like figure4.

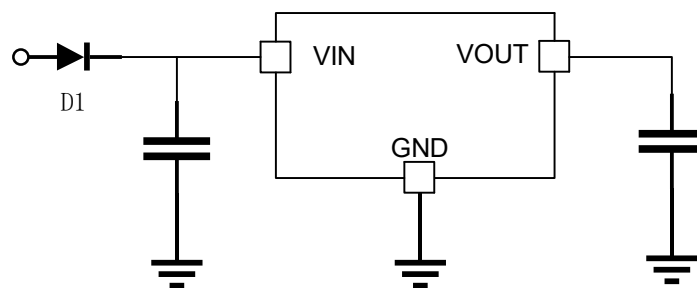


Figure4



PCB Layout Guide

PCB layout is very important to achieve good regulation, ripple rejection, transient response and thermal performance. It is highly recommended to duplicate EVB layout for optimum performance. If change is necessary, please follow these guidelines.

- 1) Input and output bypass ceramic capacitors are suggested to be put close to the IN Pin and OUT Pin respectively.
- 2) Connect IN, OUT and especially GND respectively to a large copper area to cool the chip to improve thermal performance and long-term reliability.

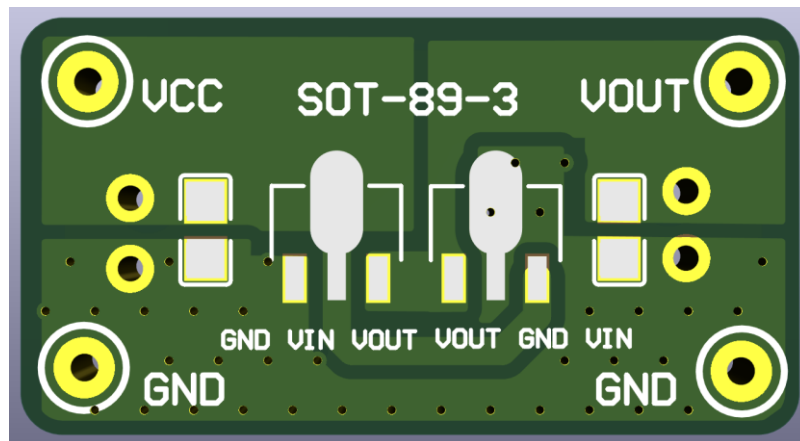


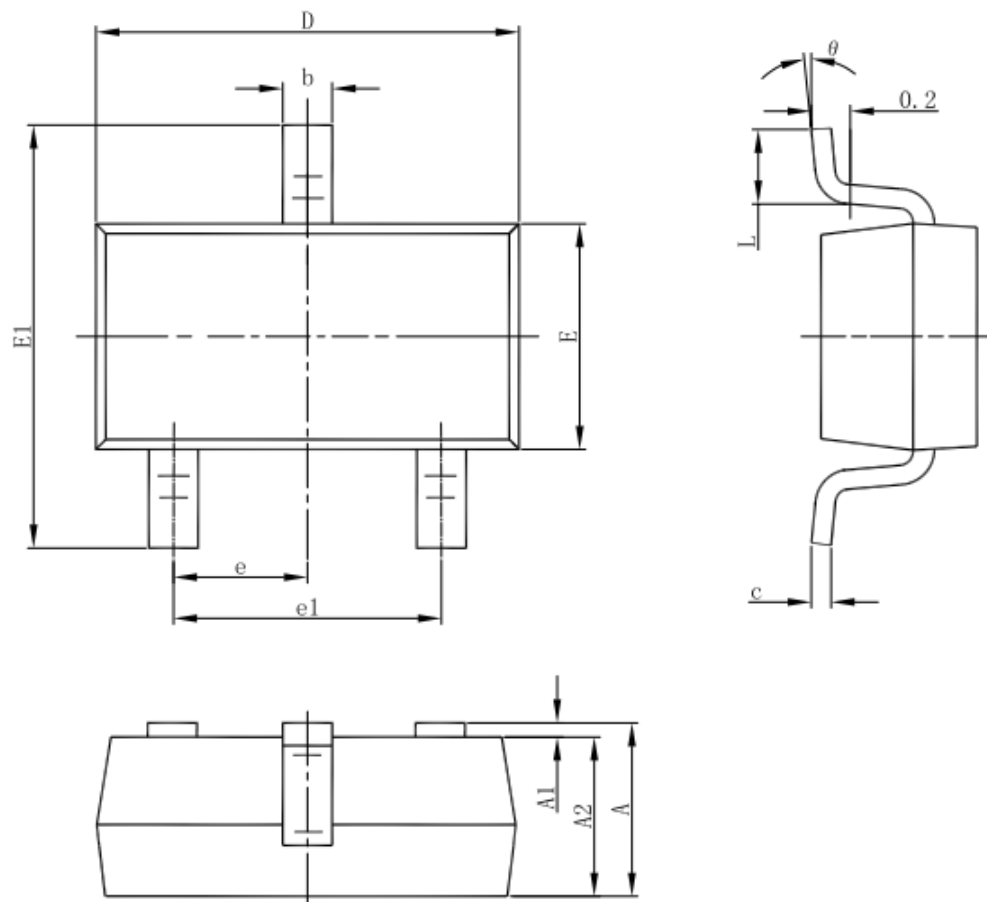
Figure5



TX81221A series

Package Information

3-pin SOT23-3 Outline Dimensions

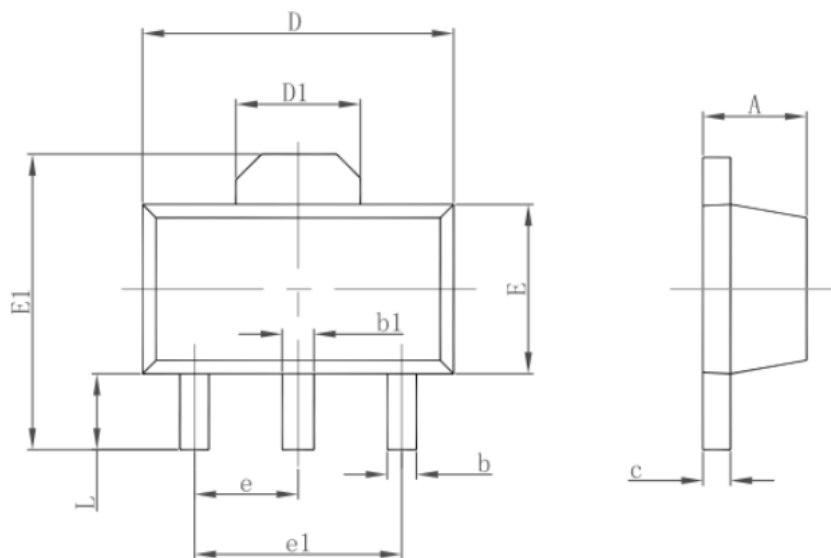


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°



TX81221A series

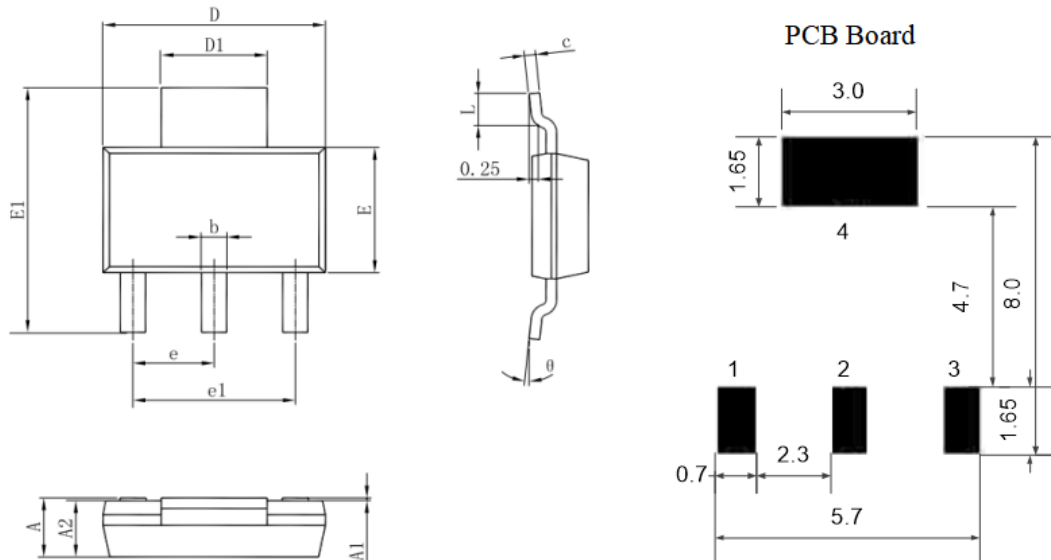
SOT89-3L Outline Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.400	0.580	0.016	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550 REF.		0.061 REF.	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP.		0.060 TYP.	
e1	3.000 TYP.		0.118 TYP.	
L	0.900	1.200	0.035	0.047



SOT223 Outline Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.520	1.800	0.060	0.071
A1	0.000	0.100	0.000	0.004
A2	1.500	1.700	0.059	0.067
b	0.660	0.820	0.026	0.032
c	0.250	0.350	0.010	0.014
D	6.200	6.400	0.244	0.252
D1	2.900	3.100	0.114	0.122
E	3.300	3.700	0.130	0.146
E1	6.830	7.070	0.269	0.278
e	2.300(BSC)		0.091(BSC)	
e1	4.500	4.700	0.177	0.185
L	0.900	1.150	0.035	0.045
θ	0°	10°	0°	10°



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