

ADJUSTABLE PRECISION SHUNT REGULATORS

Introduction

(General Description)

The EC50431S series ICs are three-terminal adjustable shunt regulators with guaranteed thermal stability over a full operation range. These ICs feature sharp turn on characteristics, low temperature coefficient and low output impedance, which make them ideal substitutes for Zener diodes in applications such as switching power supply, charger and other adjustable regulators.

The EC50431S series ICs contain two voltage types, 36V. The output voltage of both types can be set to any value between V_{REF} (2.50V) and the corresponding maximum cathode voltage.

The EC50431S precision reference is offered in two bandgap tolerance: 0.5%.

These ICs are available SOT-23-3

Applications

- Voltage Adapter
- Switching Power Supply
- Graphic Card
- Precision Voltage Reference



SOT-23-3

Figure1. Package Types of EC50431S

Features

- Programmable Precise Output Voltage from V_{REF} to 36V.
- Very Accurate Reference Voltage: 0.5% Typical
- High Stability under Capacitive Load
- Sink Current Capacity from 1 mA to 100 mA
- Low Output Noise
- Wide Operating Range of -40°C to 85°C
- Available in RoHS Compliant Packages.

ADJUSTABLE PRECISION SHUNT REGULATORS

Functional Block Diagram (Typical Applications)

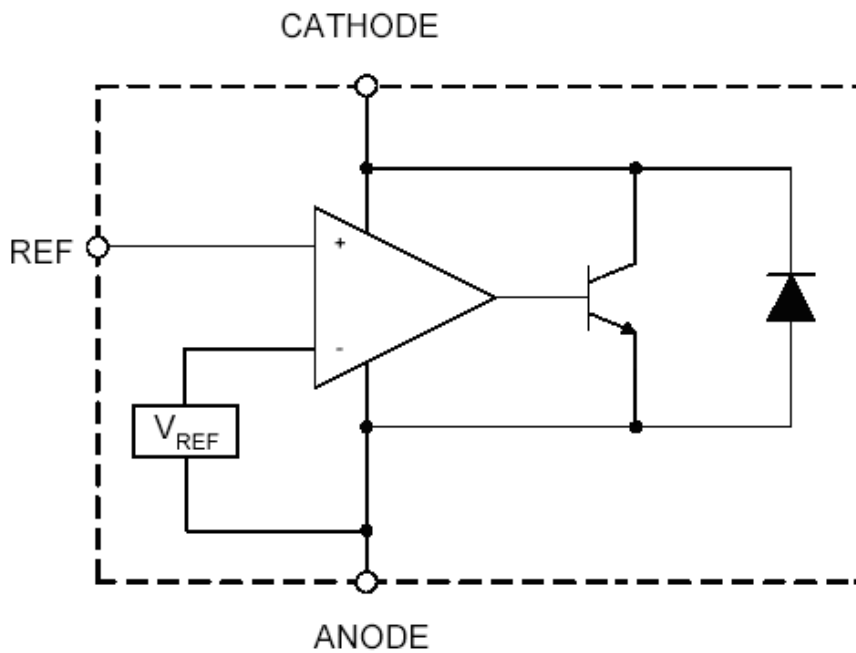


Figure2. Functional Block Diagram of EC50431S

Pin configuration

SOT-23-3 Package

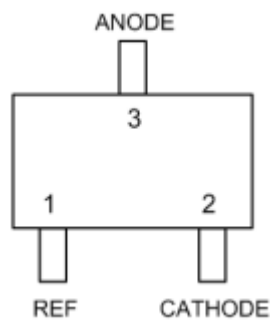


Figure3. Pin Configuration of EC50431S (Top View)

ADJUSTABLE PRECISION SHUNT REGULATORS
Absolute maximum ratings (Note 1)

Parameter	Symbol	Value	Unit
Cathode Voltage	V_{KA}	36	V
Cathode Current Range (Continuous)	I_{KA}	-10~+100	mA
Reference Input Current	I_{REF}	10	mA
Junction Temperature	T_J	+150	°C
Storage Temperature Range	T_{STG}	-65 ~ +150	°C
Package Thermal Impedance	θ_{JC}	214	°C/W
Package Thermal Impedance	θ_{JA}	405	°C/W
Power Dissipation, $T_A=25^\circ\text{C}$	P_D	0.309	W

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are Stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Cathode Voltage	V_{KA}	V_{REF}	36	V
Cathode Current	I_{KA}	1.0	100	mA

ADJUSTABLE PRECISION SHUNT REGULATORS
Electrical Characteristics for EC50431S

 Operating Conditions: $T_A=25^\circ\text{C}$ unless otherwise specified.

Parameter		Test Circuit	Symbol	Conditions	Min	Typ	Max	Unit	
Reference Voltage	0.5%	4	V_{REF}	$V_{KA}=V_{REF}, I_{KA}=10\text{mA}$	2.483	2.500	2.507	V	
Deviation of Reference Voltage Over-Temperature		4	ΔV_{REF}	$V_{KA}=V_{REF}$ $I_{KA}=10\text{mA}$	–	4.5	17	mV	
Ratio of Change in Reference Voltage to the Change in Cathode Voltage		5	$\Delta V_{REF}/\Delta V_{KA}$	$I_{KA}=10\text{mA}$	$\Delta V_{KA} = 10\text{V to } V_{REF}$	–	-1.1	-2.7	mV / V
					$\Delta V_{KA} = 10\text{V to } 36\text{V}$	–	-1.1	-2.0	
Reference Current		5	I_{REF}	$I_{KA}=10\text{mA}, R1=10\text{K}\Omega, R2=\infty$	–	1.5	4	μA	
Deviation of Reference Current Over Full Temperature Range		5	$\Delta I_{REF}/\Delta T$	$I_{KA}=10\text{mA}, R1=10\text{K}\Omega, R2=\infty$	–	0.4	1.2	μA	
Minimum Cathode Current for Regulation		4	$I_{KA}(\text{MIN})$	$V_{KA}=V_{REF}$	–	0.45	1.0	mA	
Off-State Cathode Current		6	$I_{KA}(\text{OFF})$	$V_{KA}=36\text{V}, V_{REF}=0$	–	0.05	1.0	μA	
Dynamic Impedance		4	Z_{KA}	$V_{KA}=V_{REF}, I_{KA}=1\text{ to }100\text{mA}, f \leq 1.0\text{KHz}$	–	0.15	0.5	Ω	

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Electrical Characteristics (Continued)

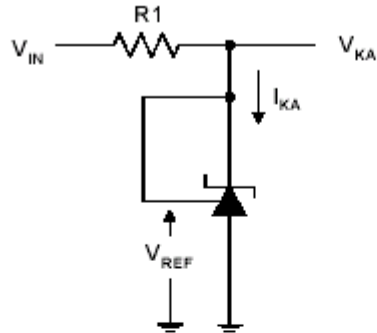


Figure 4. Test Circuit 4 for $V_{KA} = V_{ref}$

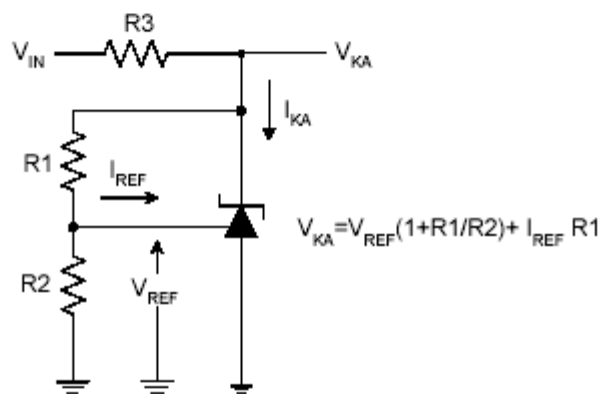


Figure 5. Test Circuit 5 for $V_{KA} > V_{ref}$

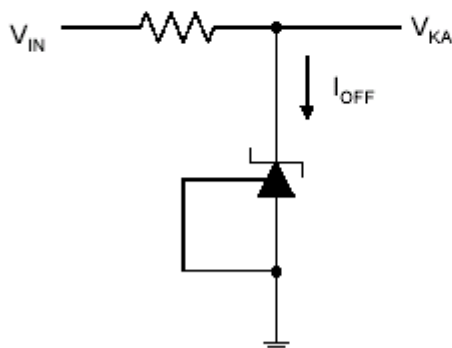
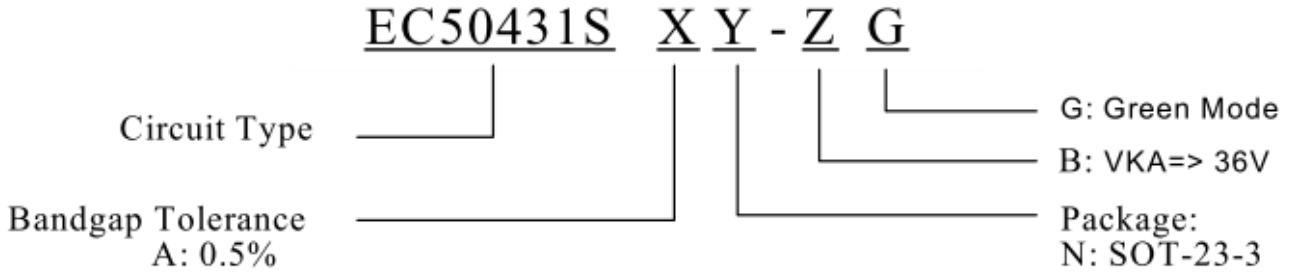


Figure 6. Test Circuit 6 for I_{OFF}

ADJUSTABLE PRECISION SHUNT REGULATORS

Ordering Information for 36V Products



Package	Temperature Range	Voltage Tolerance	Part Number
SOT-23-3	-40 to 85°C	0.50%	EC50431SAN-BG

Marking Information

Package	Voltage Tolerance	Part Number	Marking	Production Year /Week Code	GREEN Package
SOT-23-3	0.5%	EC50431SAN-BG	431S YYWW	YY is the year of production. 09 means the product is manufactured in year of 2009. WW is the week of production. 25 means the product is manufactured in the 25 th week.	Green package

ADJUSTABLE PRECISION SHUNT REGULATORS

Typical Performance Characteristics

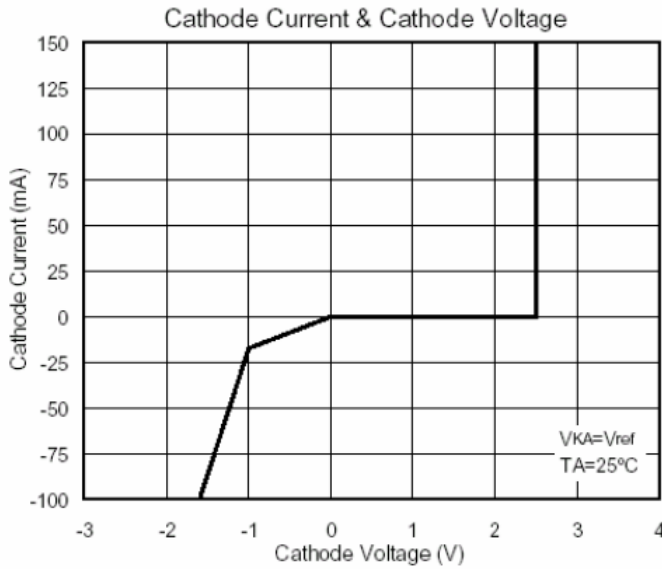


Figure 7

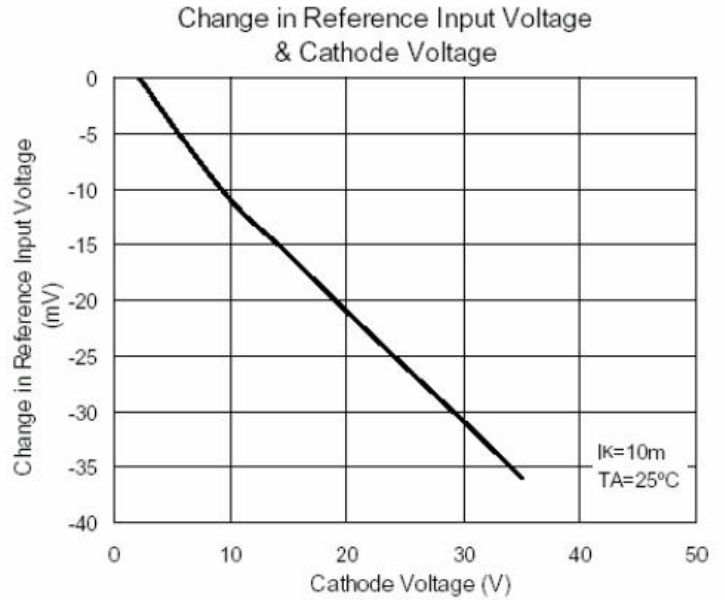


Figure 8

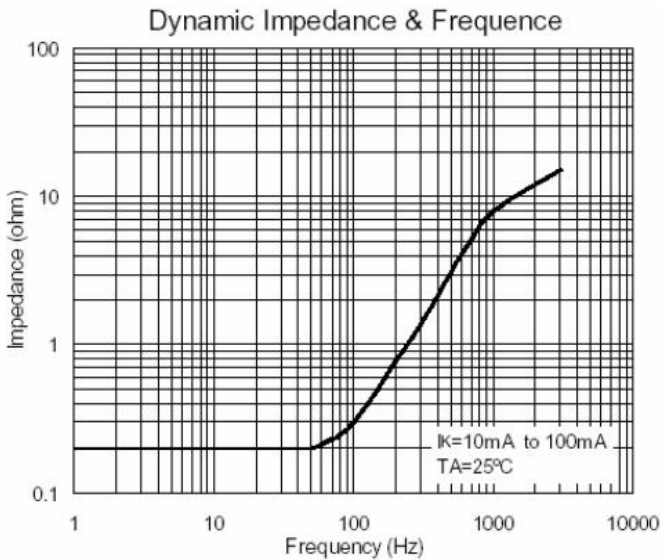


Figure 9

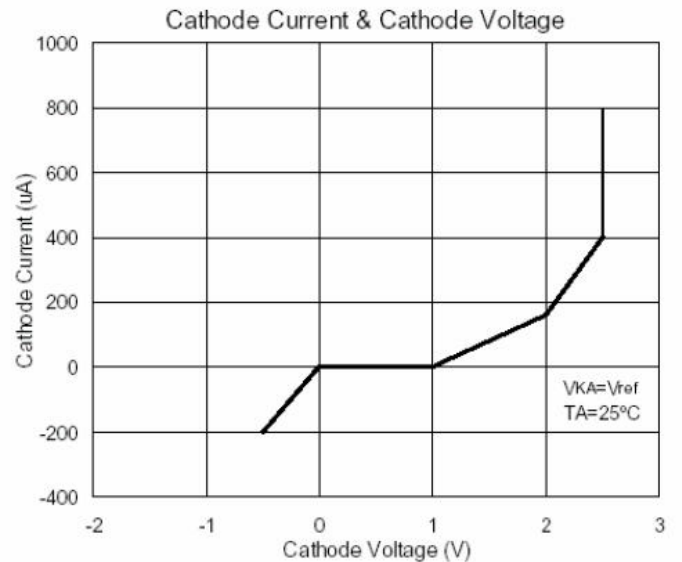


Figure 10

ADJUSTABLE PRECISION SHUNT REGULATORS

Typical Performance Characteristics (Continued)

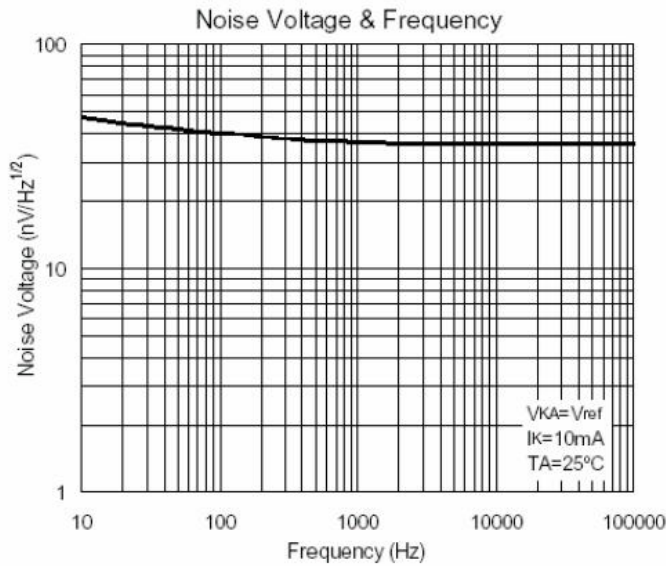


Figure 11

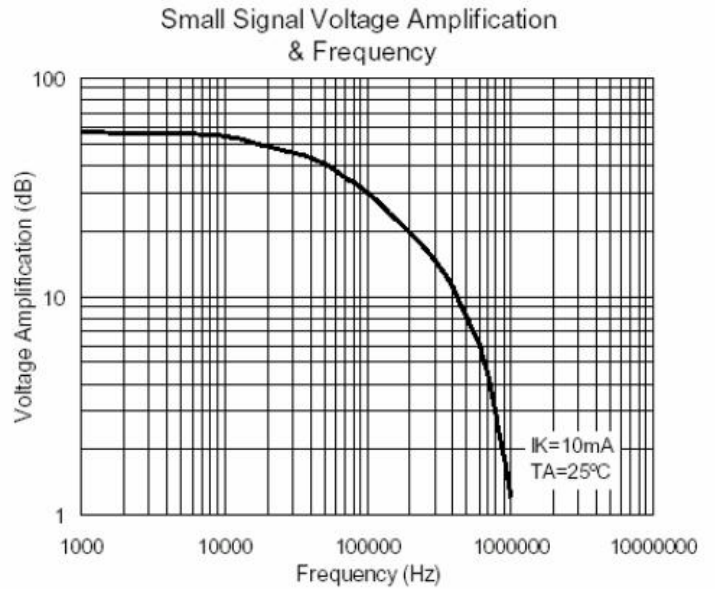


Figure 12

Thermal Information

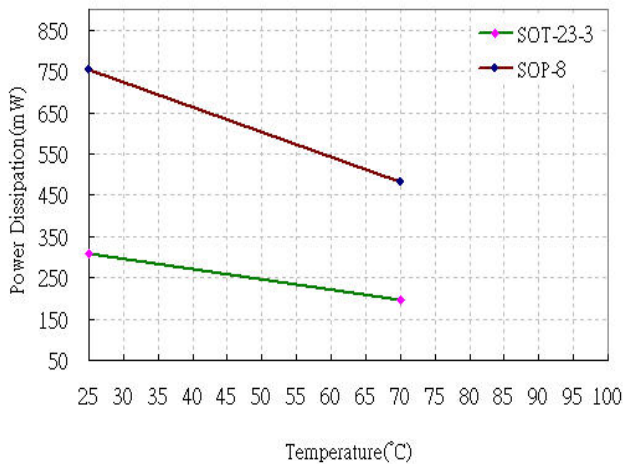


Figure 13

Reference Voltage vs. TA Temperature (VKA=5Vref, IkA=12mA)

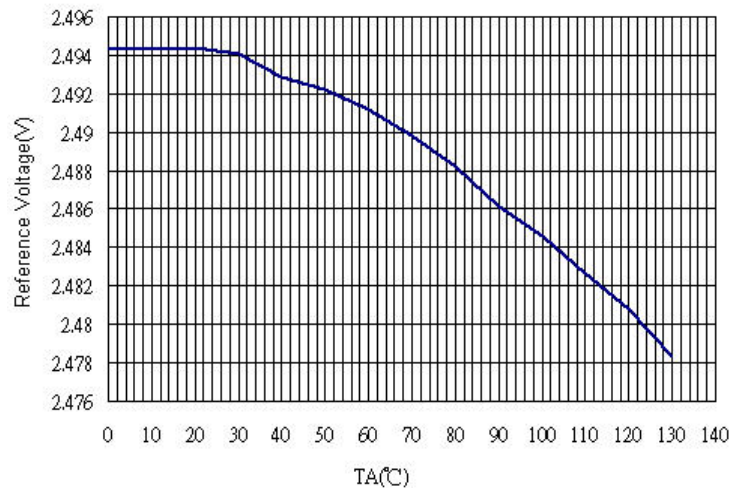


Figure 14

ADJUSTABLE PRECISION SHUNT REGULATORS

Typical Applications

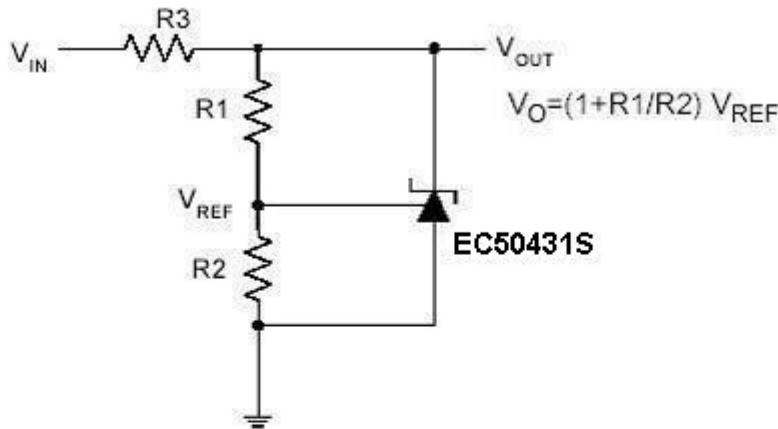


Figure15. Shunt Regulator

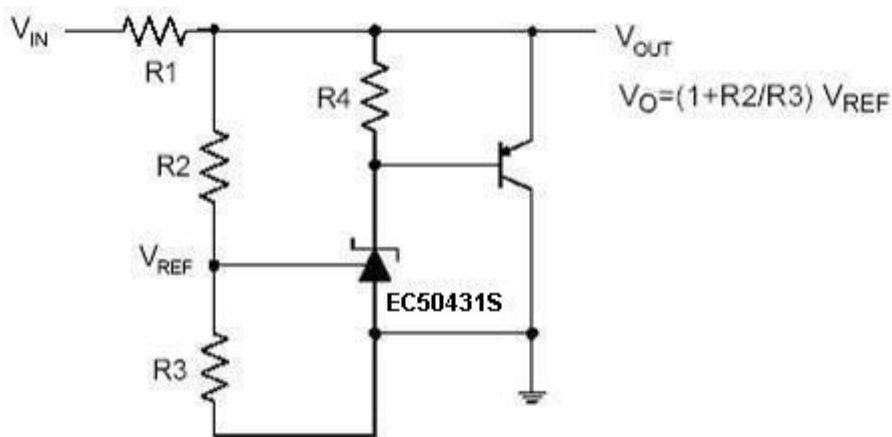


Figure16 . High Current Shunt Regulator

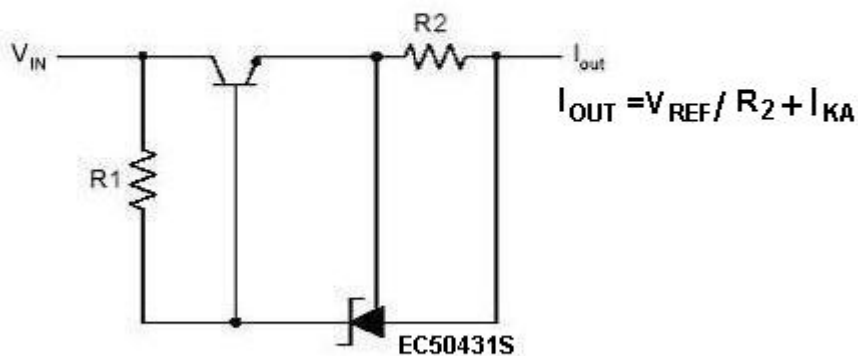


Figure17 . Current Source or Current Limit

ADJUSTABLE PRECISION SHUNT REGULATORS

Typical Applications (Continued)

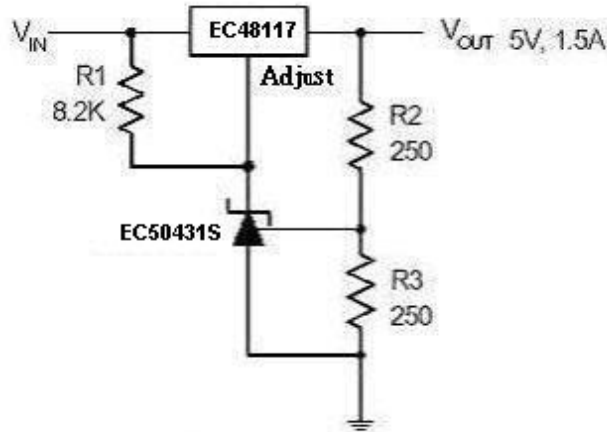


Figure18. Precision 5V 1.5A Regulator

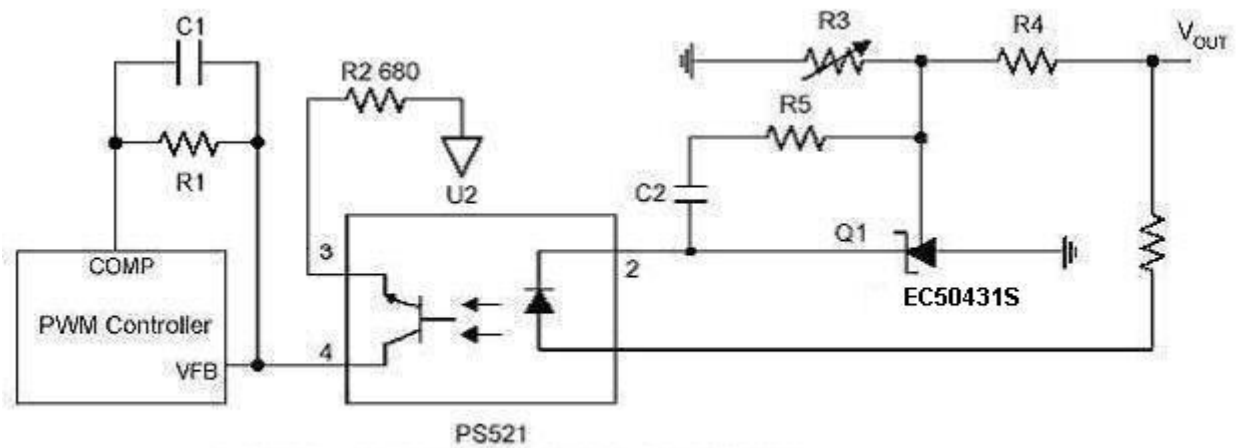
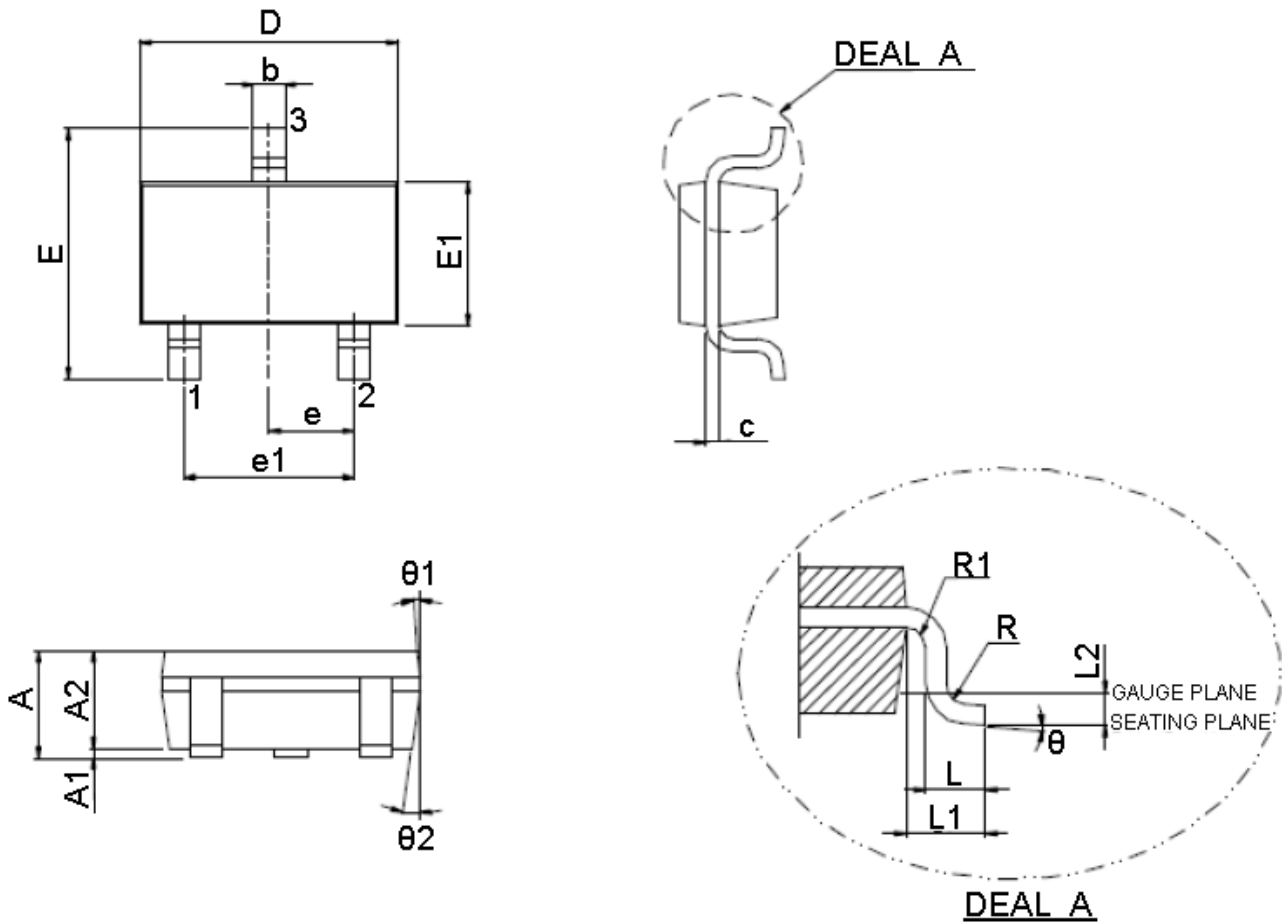


Figure19. PWM Converter with Reference

ADJUSTABLE PRECISION SHUNT REGULATORS

Mechanical Dimensions

Outline Dimensions: SOT-23-3



DIMENSIONS					
DIM ^N	MM		DIM ^N	MM	
	MIN	MAX		MIN	MAX
A	-	1.45	L	0.30	0.60
A1	-	0.15	L1	0.6 REF	
A2	0.9	1.30	L2	0.25BSC	
b	0.30	0.50	R	0.10	-
c	0.08	0.22	R1	0.10	0.25
D	2.80	3.00	θ	0°	8°
E	2.60	3.00	θ1	5°	15°
E1	1.50	1.70	e	0.95BSC	
e1	1.90BSC				