ACE431S

Adjustable Precision Shunt Regulator

Description

The ACE431S is a low voltage three terminal adjustable shunt regulator with a guaranteed thermal stability over applicable temperature ranges. The output voltage can be set to any value between VREF (approximately 2.5 V) to 18V with two external resistors. This device has a typical output impedance of 0.08Ω. Active output circuitry provides a very sharp turn on characteristic, making this device excellent replacement for Zener diodes in many applications.

The ACE431S is characterized for operation from -40oC to 85oC, and five package options (SOT-23-3, SOT-23-5, SOP-8, TO-92 and SOT-89-3) allow the designer the opportunity to select the proper package for their applications.

Features

- Low voltage operation (2.5V)
- Adjustable output voltage V_0=V_{REF} to 18V
- Wide operating current range 150μA to 80mA
- Low dynamic output impedance 0.08Ω (Typ)
- Trimmed bandgap design up to +0.5%
- ESD rating is 6KV (Per MIL-STD-883D)
- ROHS Compliant and 100% Lead (Pb)-Free

Application

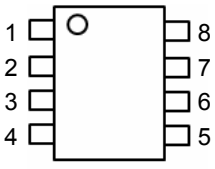
- Linear Regulators
- Adjustable Supplies
- Switching Power Supplies
- Battery Operated Computers
- Instrumentation
- Computer Disk Drives

Absolute Maximum Ratings

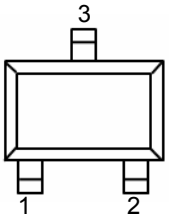
Parameter	Symbol	Max		Unit
Cathode Voltage	V_{KA}	18		V
Continuous Cathode Current	I_{KA}	80		mA
Reference Current	I_{REF}	1		mA
Operating Junction Temperature Range	T_J	-40 to 85		°C
Storage Temperature Range	T_{STG}	-65 to 150		°C
Thermal Resistance	θ_{JA}	SOT-89-3	120	°C/W
		SOT-23-3	230	
		SOT-23-5	230	
		SOP-8	150	
		TO-92	220	

Packaging Type

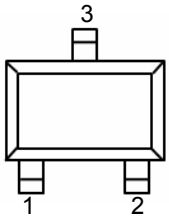
SOP-8



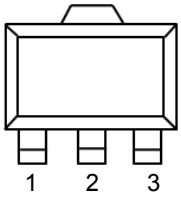
SOT-23-3



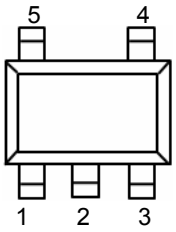
SOT-23-3(A)



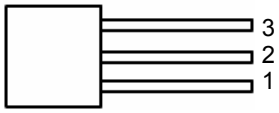
SOT-89-3



SOT-23-5



TO-92



Pin	SOP-8	SOT-23-3	SOT-23-3(A)	SOT-89-3	SOT-23-5	TO-92
Cathode	1	2	1	3	3	3
Anode	2.3.6.7	3	3	2	5	2
NC	4.5				1.2	
Ref	8	1	2	1	4	1

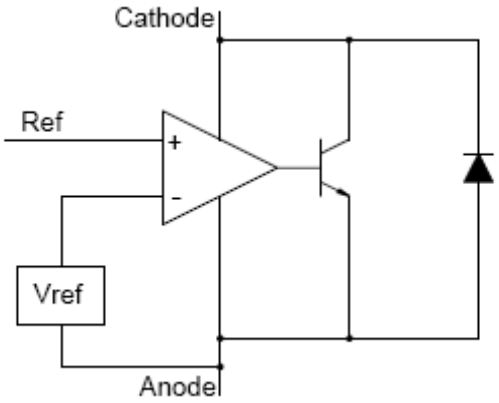
Ordering information

Selection Guide

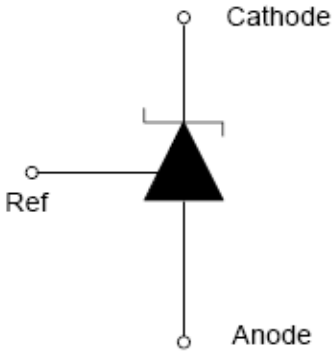
ACE431S X XX + H

- Halogen-free
- Pb-free
- BM : SOT-23-3
  BMA : SOT-23-3(A)
  BN : SOT-23-5
  AM : SOT-89-3
  EP : TO-92
  FM : SOP-8
- Reference Voltage accuracy :
  A : 0.5%
  B : 1%
  C : 2%

Block Diagram



Symbol Diagram



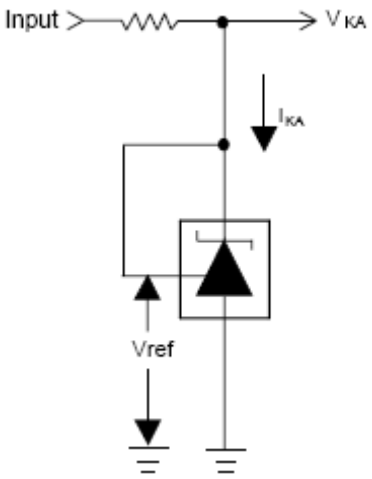
Electrical Characteristics

T_A=25℃ unless otherwise specified.

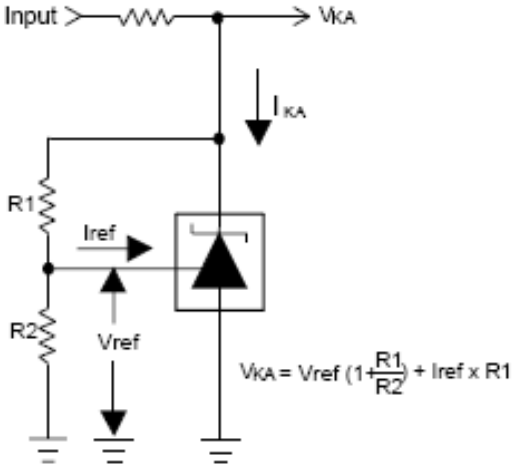
Parameter		Test Circuit	Symbol	Conditions	Min	Typ	Max	Units
Reference Voltage	0.5%	1	V_{REF}	$V_{KA}=V_{REF}$, I_{KA}=10mA	2483	2495	2507	mV
	1%				2470	2495	2520	
	2%				2445	2495	2545	
Deviation of reference voltage over full temperature range		1	$V_{I(Dev)}$	$V_{KA}=V_{REF}$, I_{KA}=10mA T_A=-40℃ to 85℃		-14		mV
Ration of change in reference voltage to the change in cathode voltage		2	$I\Delta V_{REF}/\Delta V_{KA}I$	I_{KA}=3 mA, ΔV_{KA}=10V- V_{REF}		0.2	2.7	mV/V
Minimum cathode current for Regulation		1	I_{MIN}	$V_{KA}=V_{REF}$		0.15	0.3	μA
Dynamic Impedance		1	Z_{KA}	$V_{KA}=V_{REF}$, I_{KA}=1 to 80mA, f≦1.0KHz		0.08	0.7	Ω
Reference Current		2	I_{REF}	I_{KA}=10mA,		0.3	4	μA

			R1=10KΩ, R2=∞				
Deviation of Reference current over Full Temperature Range	2	$I_{I(dev)}$	I_{KA}=10mA, R1=10KΩ, R2=∞, T_A=-40 to 85℃		-0.13		μA
Off-State cathode current	3	I_{OFF}	V_{KA}=18V, V_{REF}=0		0.4	1.0	μA

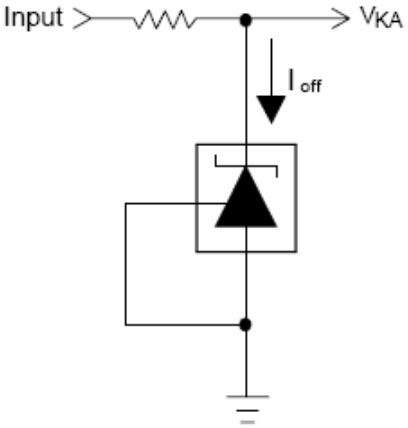
Typical Circuit



Test Circuit 1: $V_{KA}=V_{REF}$

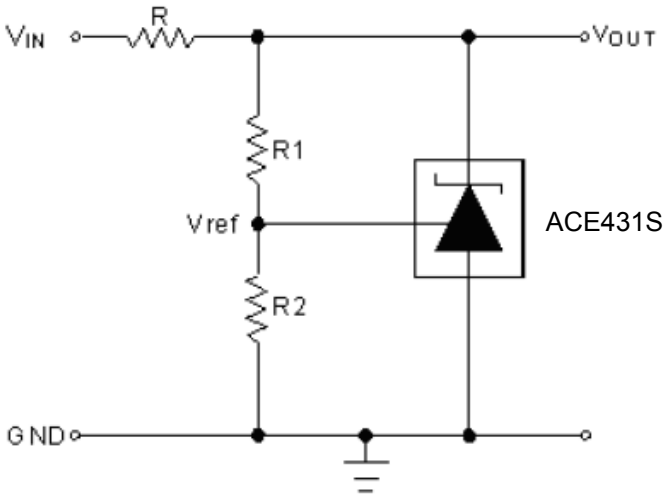


Test Circuit 2: $V_{KA}>V_{REF}$



Test Circuit 3: Off State Current

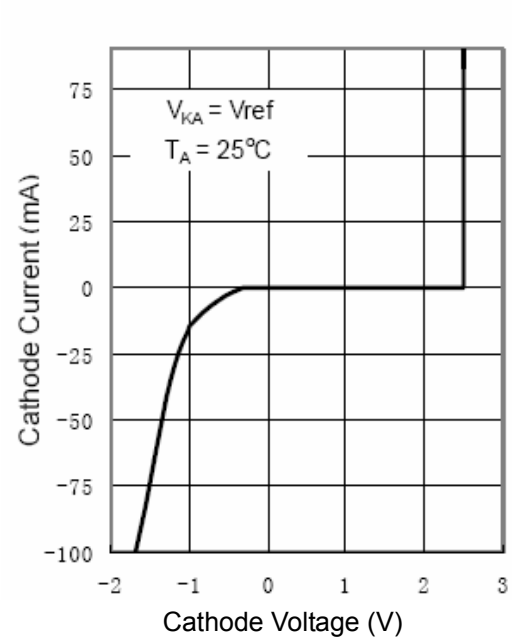
Application Diagram



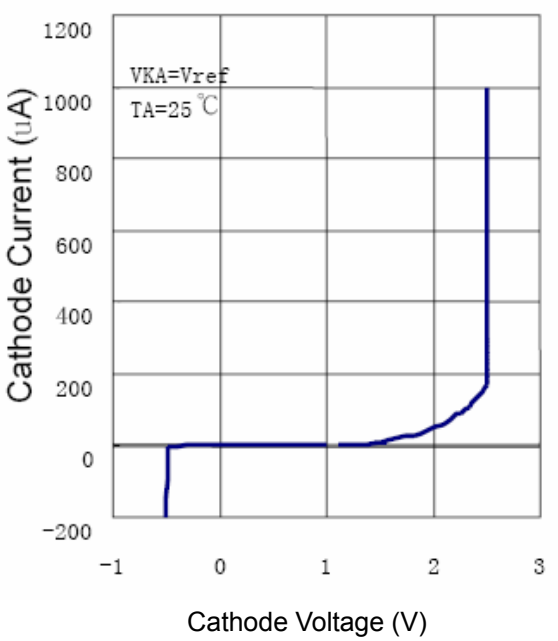
$$V_{OUT} = V_{ref}\left(1 + \frac{R1}{R2}\right)$$

Typical Performance Characteristics

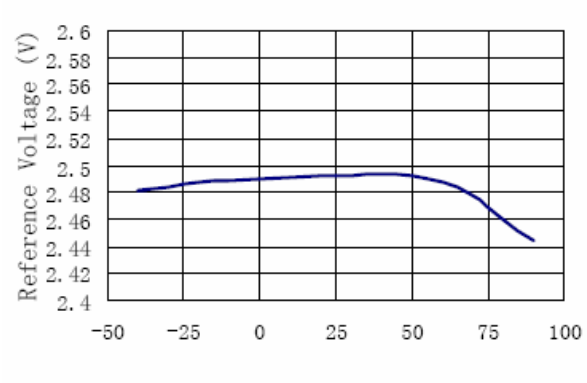
Cathode Current vs. Cathode Voltage



Cathode Current vs. Cathode Voltage

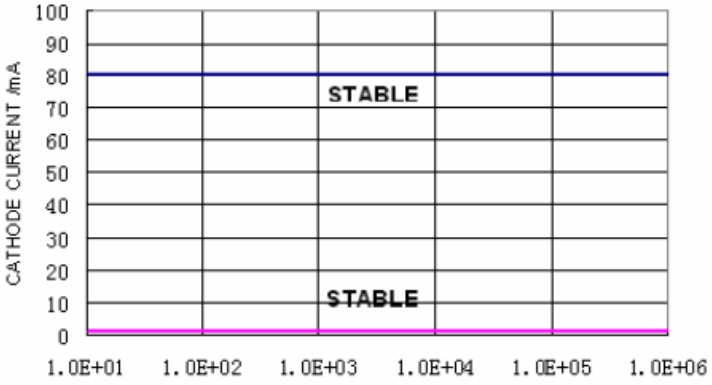


Reference Voltage vs. Junction Temperature



Junction Temperature (℃)

Stability Boundry Conditions



Load Capacitance /pf

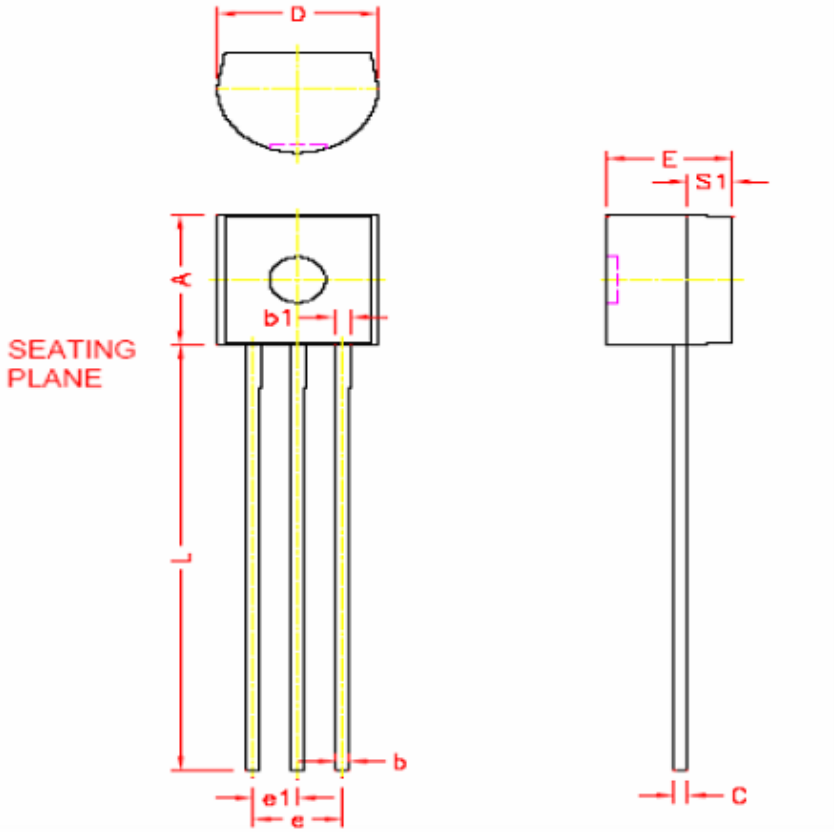
Thermal Consideration

Package	Power Rating (T_A=25℃)	Power Rating (T_A=50℃)	Power Rating (T_A=70℃)
SOT-23-3 (θ_{JA}=230℃/W)	435mW	326mW	239mW
SOT-23-5 (θ_{JA}=230℃/W)	435mW	326mW	239mW
TO-92 (θ_{JA}=220℃/W)	455mW	341mW	250mW

1. Maximum junction temperature is 125℃
2. θ_{JA} is measured with packages mounted onboard under still-air condition with 1W power applied.
3. Power rating is calculated using $P_D=(T_J-T_A)/\theta_{JA}$, where T_J denotes junction temperature and T_A denotes ambient temperature.

Packing Information

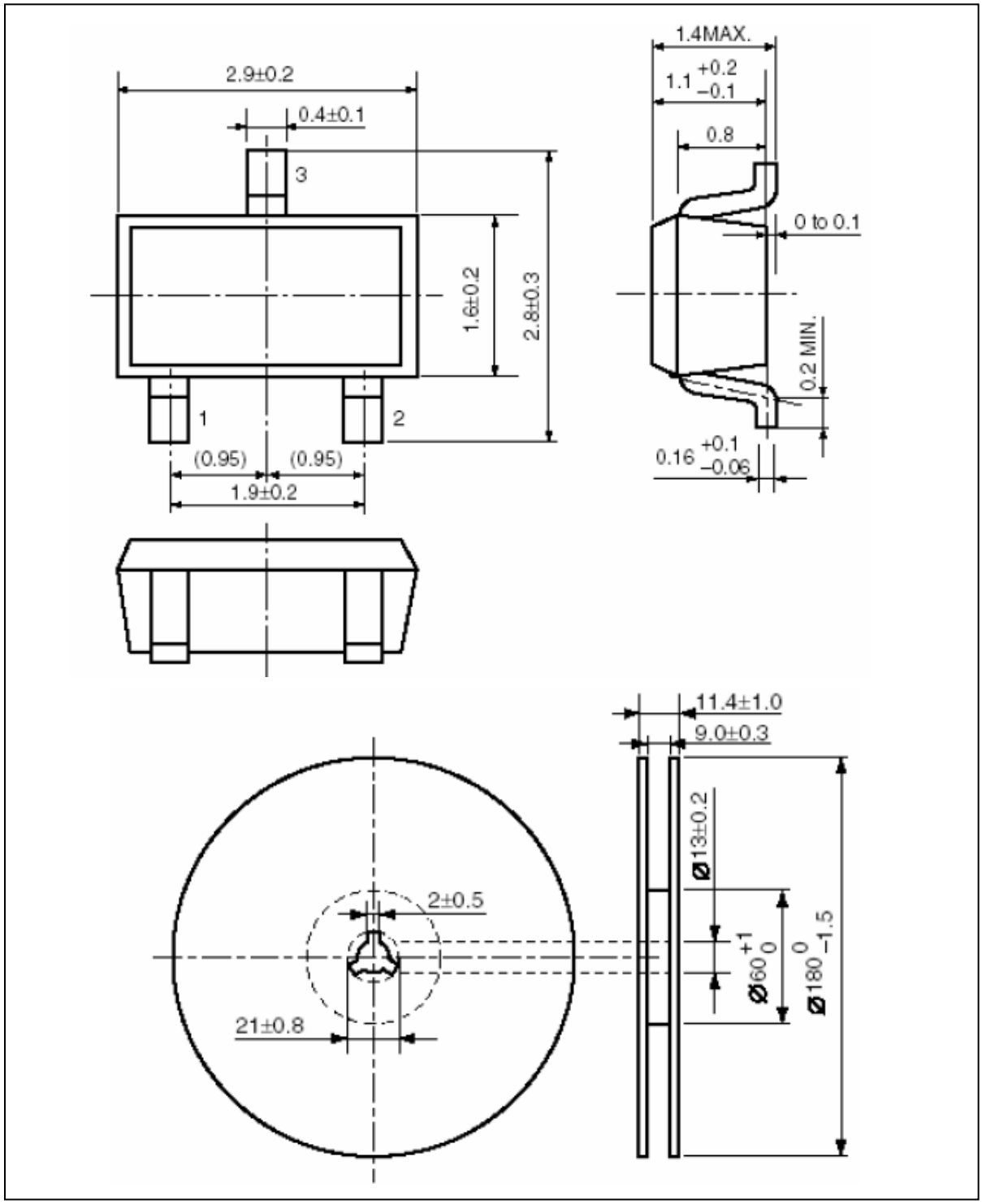
TO-92



REF.	Millimeter		REF.	Millimeter	
	Min.	Max.		Min.	Max.
A	4.45	4.70	D	4.44	4.7
S1	1.02	—	E	3.30	3.81
b	0.36	0.51	L	12.70	—
b1	0.36	0.76	e1	1.15	1.39
C	0.36	0.51	e	2.42	2.66

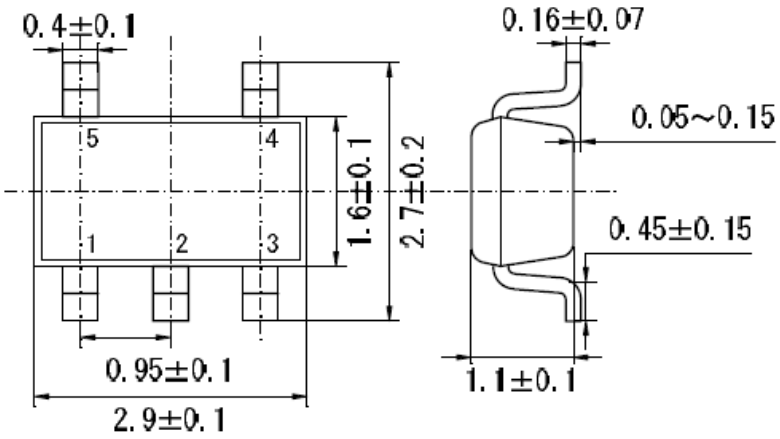
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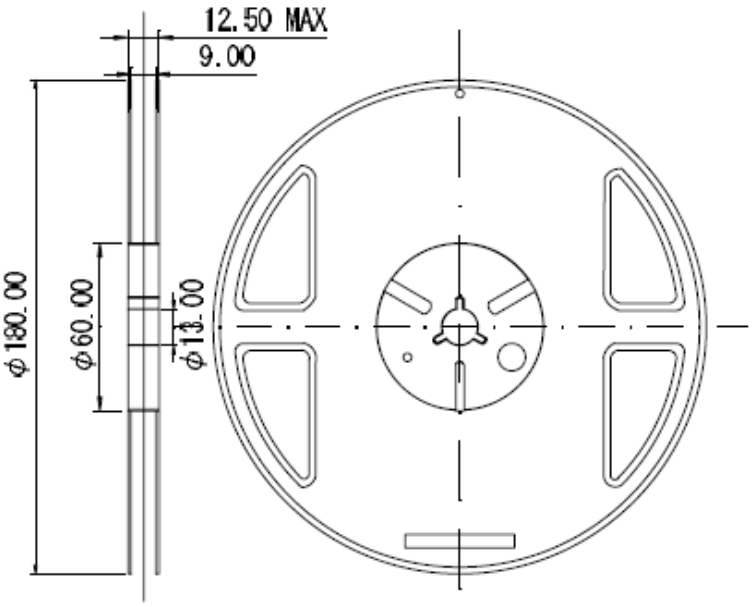
SOT-23-3



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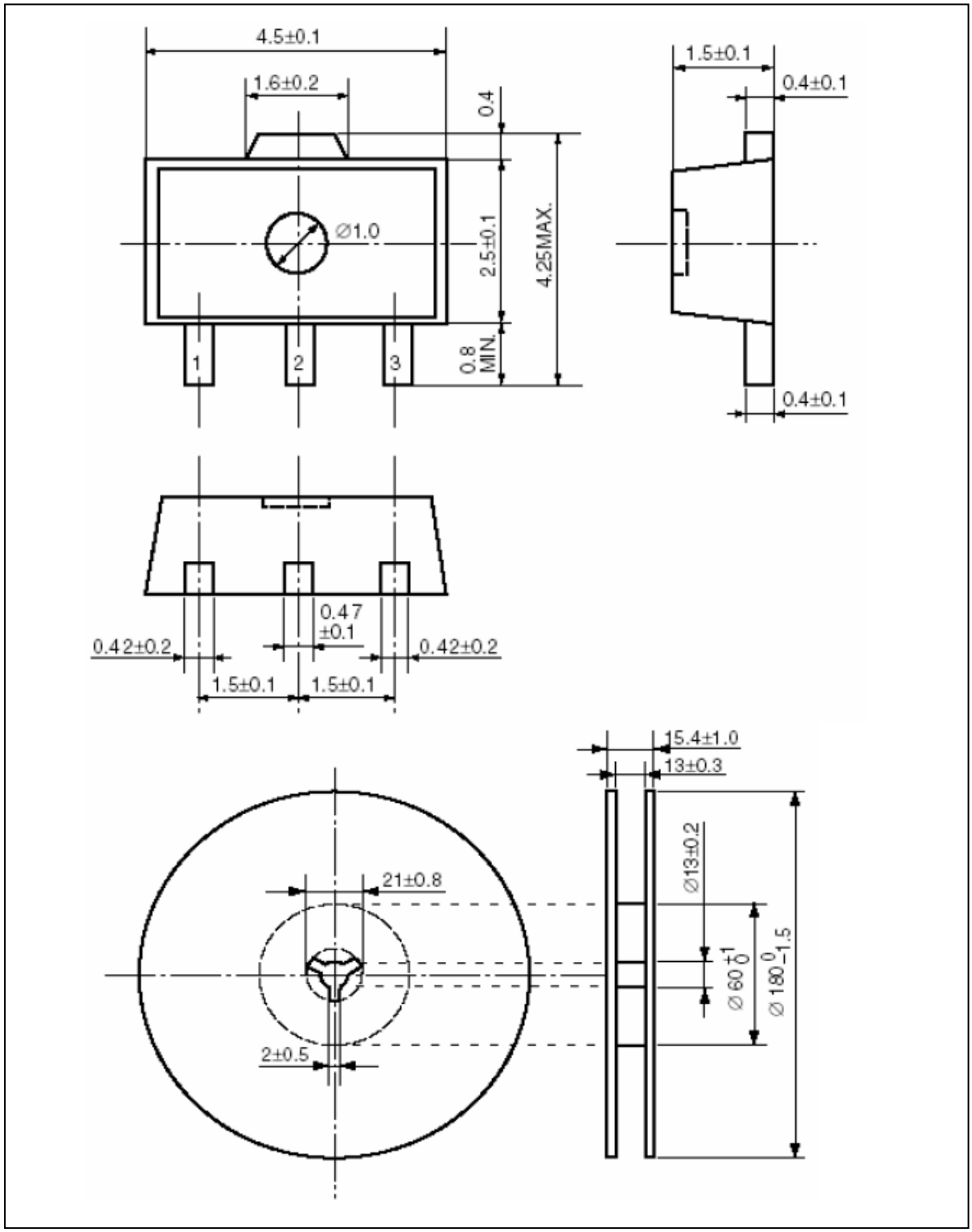
SOT-23-5





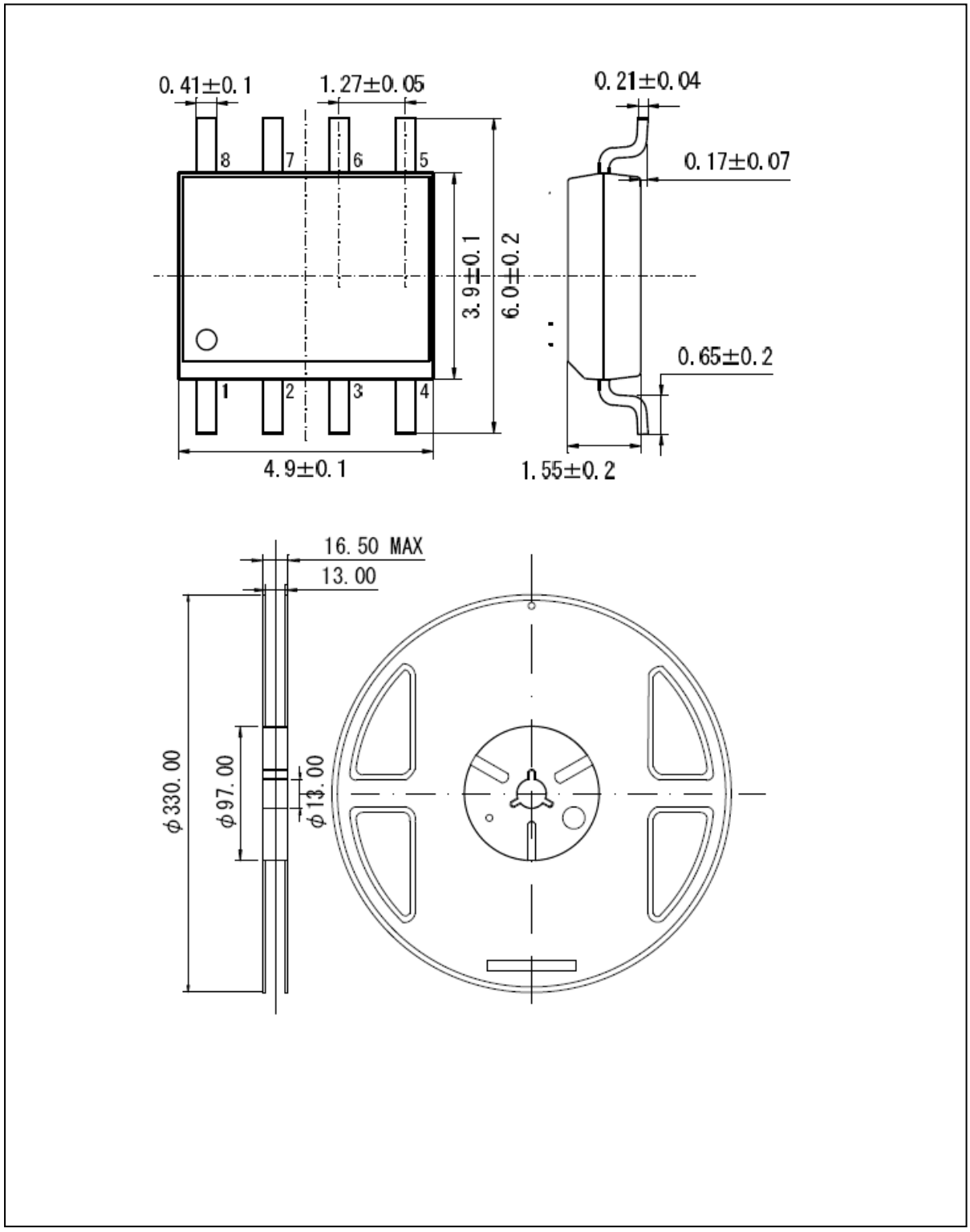
Packing Information

SOT-89-3



Packing Information

SOP-8



Notes

ACE does not assume any responsibility for use as critical components in life support devices or systems without the express written approval of the president and general counsel of ACE Electronics Co., LTD. As sued herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and shoes failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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