

RS431

Adjustable Precision Shunt Regulator

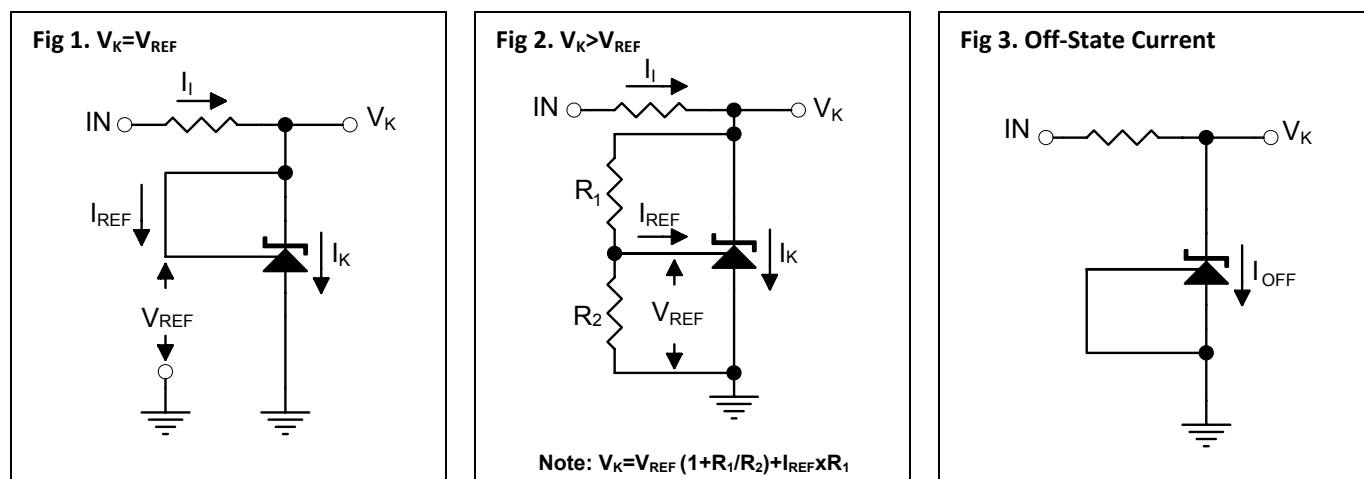
General Description

The RS431 series are three-terminal adjustable regulators with guaranteed thermal stability over applicable temperature ranges. The output voltage may be set to any value between V_{REF} (approximately 2.5 volts) and 36 volts with two external resistors. These devices have a typical dynamic output impedance of 0.2Ω . Active output circuitry provides a very sharp turn-on characteristic, making these devices excellent replacement for zener diodes in many applications.

Features

- Programmable Precise Output Voltage from 2.5V to 36V
- High Stability under Capacitive Load
- Low Temperature Deviation: 4.5mV Typical
- Low Dynamic Output Resistance: 0.2Ω Typical
- Sink Current Capacity from 1mA to 100mA
- Low Output Noise
- Wide Operating Range of -40 to 125°C
- Low Equivalent Full-range Temperature Coefficient with 20PPM/ $^\circ\text{C}$ Typical

Application Circuits

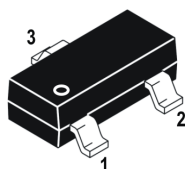


This integrated circuit can be damaged by ESD. Orister Corporation recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

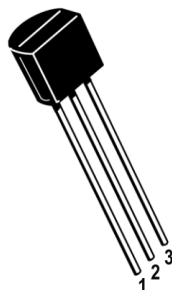
ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

Pin Assignments

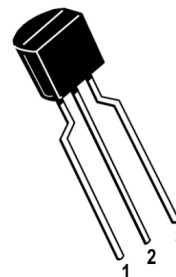
SOT-23



**TO-92
(STRAIGHT LEAD OPTION)**



**TO-92
(FORMED LEAD OPTION)**



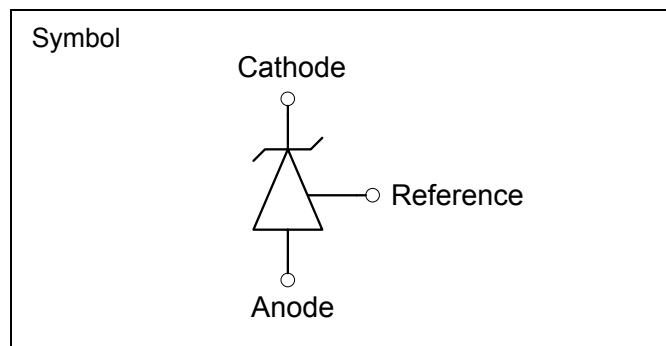
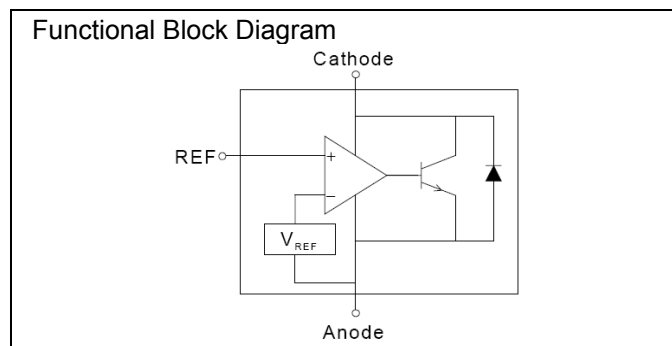
PACKAGE	PIN	DESCRIPTION
SOT-23	1	REFERENCE
	2	CATHODE
	3	ANODE

PACKAGE	PIN	DESCRIPTION
TO-92	1	REFERENCE
	2	ANODE
	3	CATHODE

Ordering Information

DEVICE	DEVICE CODE
RS431 X YY Z	X is Reference voltage precision designator: A: 2.5V $\pm$0.4% B: 2.5V $\pm$0.8% YY is package designator : A: TO-92 (Straight lead option) AT: TO-92 (Formed lead option) N: SOT-23 Z is Lead Free designator : P: Commercial Standard, Lead (Pb) Free and Phosphorous (P) Free Package G: Green (Halogen Free with Commercial Standard)

Block Diagram



Absolute Maximum Ratings (Operating temperature range applies unless otherwise specified)

Characteristics	Symbol	Value	Unit
Cathode Voltage	V_{KA}	40	V
Cathode Current Range (Continuous)	I_K	-100 - +150	mA
Reference Input Current Range	I_{REF}	0.05 - +10	mA
Power Dissipation	P_D	SOT-23	370
		TO-92	770
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		--	--
Operating Temperature Range (Max.)	T_{OPR}	-40 - +125	°C
Storage Temperature Range	T_{STG}	-65 - +150	°C

Operating Conditions

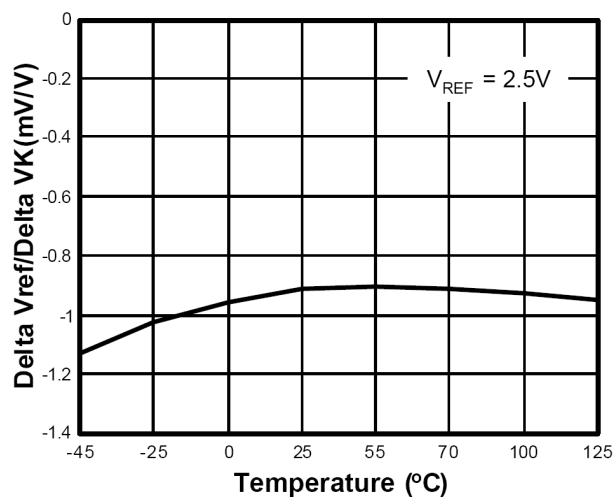
Characteristics	Symbol	Min.	Max.	Unit
Cathode Voltage	V_{KA}	V_{REF}	36	V
Cathode Current Range (Continuous)	I_K	1	100	mA
Operating Ambient Temperature Range	T_{OPR}	-40	125	°C

Electrical Characteristics ($T_A=25^{\circ}\text{C}$, unless otherwise specified)

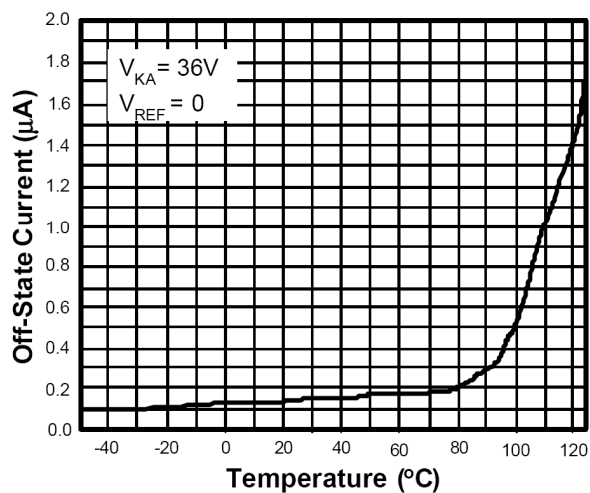
Characteristics	Symbol	Test Conditions	Min	Typ	Max	Unit
Reference Input Voltage (Fig1)	V_{REF}	$V_K=V_{REF}, I_K=10\text{mA}$	2.49	2.50	2.51	V
			2.48	2.50	2.52	
Deviation of Reference Input Voltage Over-Temperature (Fig1)	$V_{REF(dev)}$	$V_K=V_{REF}, I_K=10\text{mA}$ $T_{MIN} \leq T_A \leq T_{MAX} (-40 - +125^{\circ}\text{C})$	-	4.5	16	mV
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage (Fig2)	$\Delta V_{REF}/\Delta V_K$	$I_K=10\text{mA}, \Delta V_K=10\text{V to } V_{REF}$	-	1.0	2.7	mV/V
		$I_K=10\text{mA}, \Delta V_K=36\text{V to } 10\text{V}$	-	0.5	2.0	mV/V
Reference Input Current (Fig2)	I_{REF}	$I_K=10\text{mA}, R1=10\text{K}\Omega, R2=\infty$	-	0.7	4	uA
Deviation of Reference Input Current Over Full Temperature Range (Fig2)	$I_{REF(dev)}$	$I_K=10\text{mA}, R1=10\text{K}\Omega$ $R2=\infty, T_A=-40 - +125^{\circ}\text{C}$	-	0.4	1.2	uA
Minimum Cathode Current for Regulation (Fig1)	$I_{K(min)}$	$V_K=V_{REF}$	-	0.4	1.0	mA
Off-State Cathode Current (Fig3)	$I_{K(off)}$	$V_K=36\text{V}, V_{REF}=0$	-	0.05	1.0	uA
Dynamic Output Impedance (Fig1)	Z_K	$V_K=V_{REF}, f \leq 1\text{kHz}, I_K=1 \text{ to } 100\text{mA}$	-	0.15	0.5	Ω

Typical Performance Characteristics

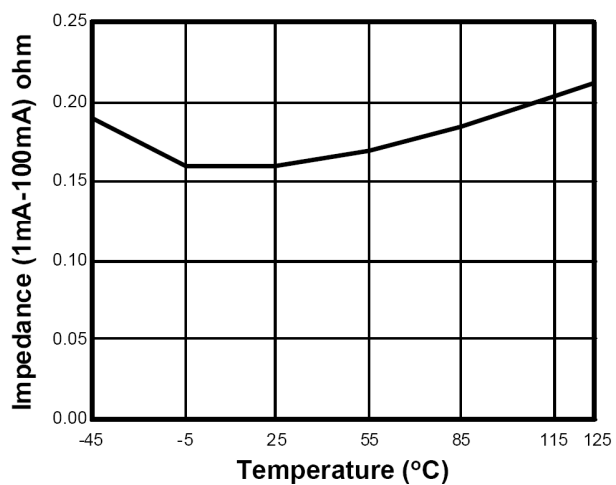
Delta Reference Voltage vs. Temperature



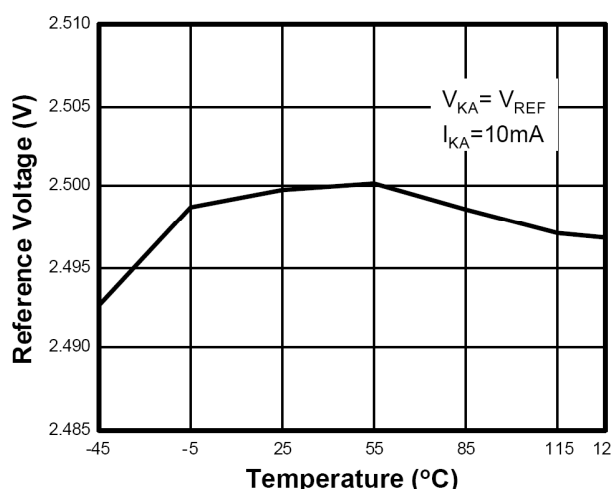
Off-State Current vs. Temperature



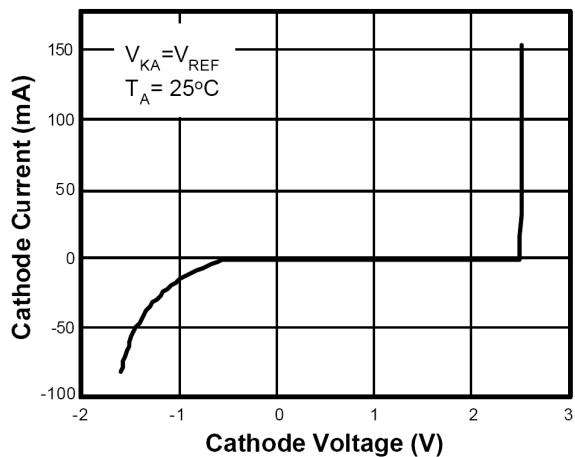
Impedance vs. Temperature



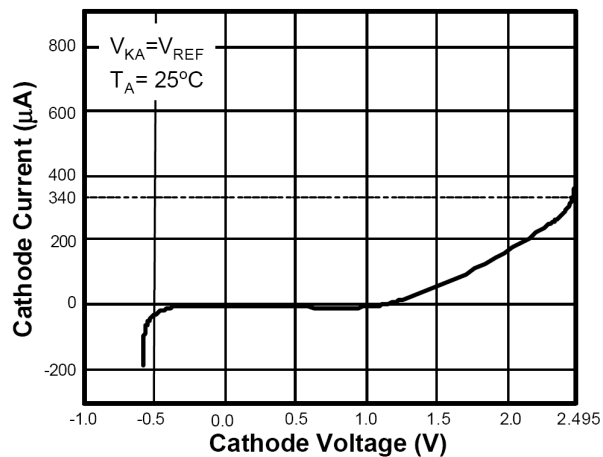
Reference Voltage vs. Temperature



Cathode Current vs. Cathode Voltage

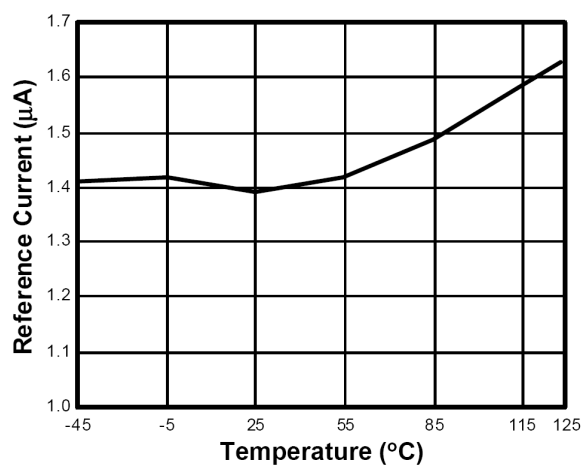


Current vs. Cathode Voltage

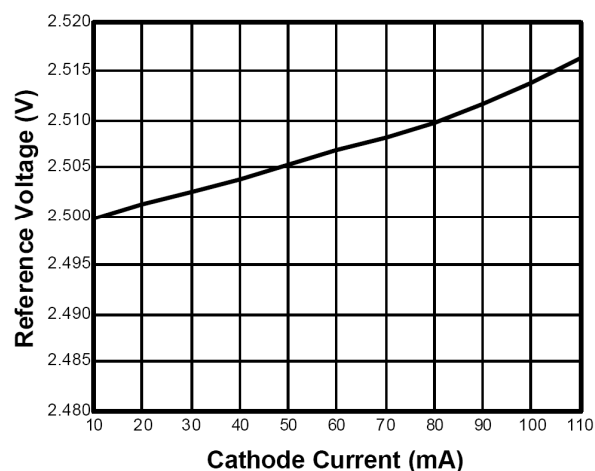


Typical Performance Characteristics (Continued)

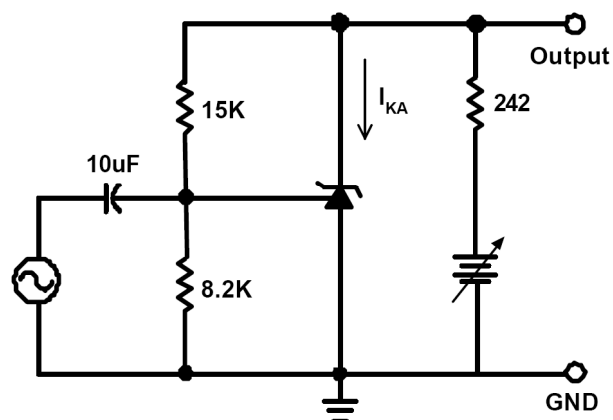
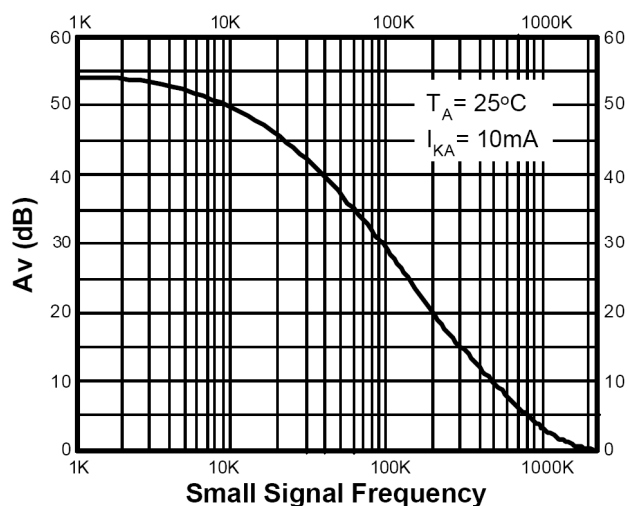
Reference Current vs. Temperature



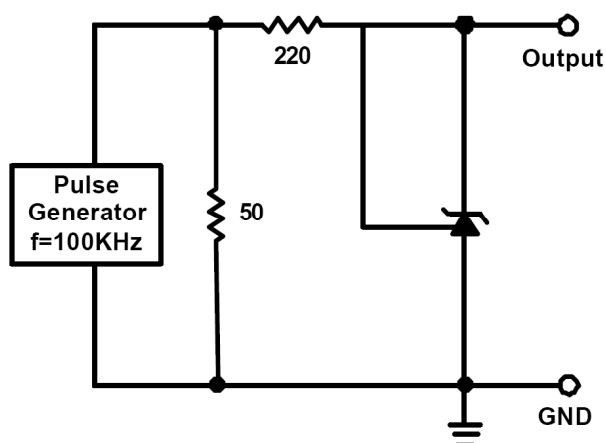
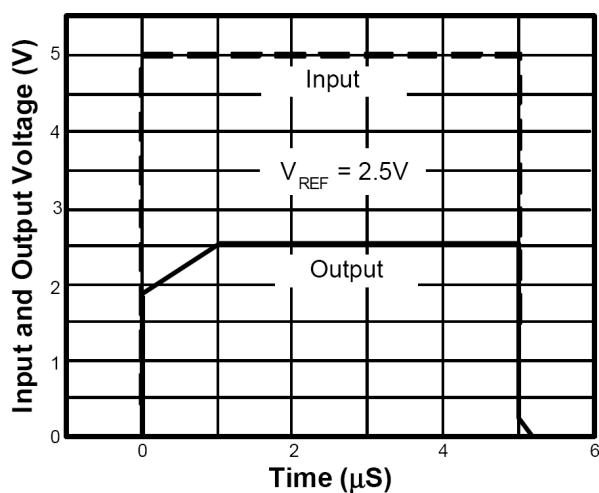
Reference Voltage vs. Cathode Current



Small Signal Voltage Gain vs. Frequency

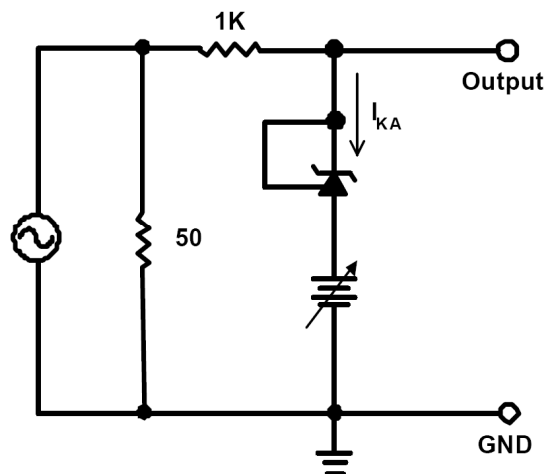
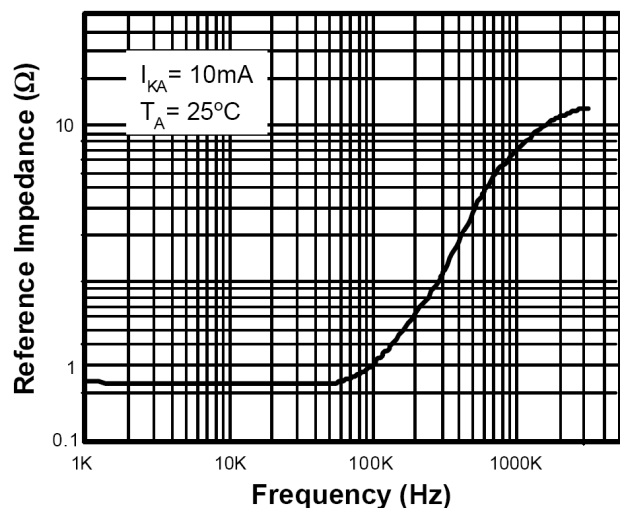


Small Signal Voltage Gain vs. Frequency

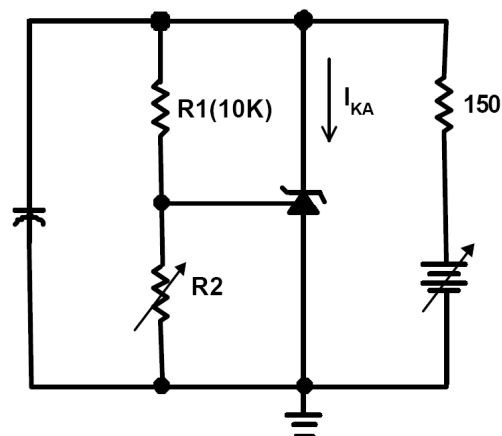
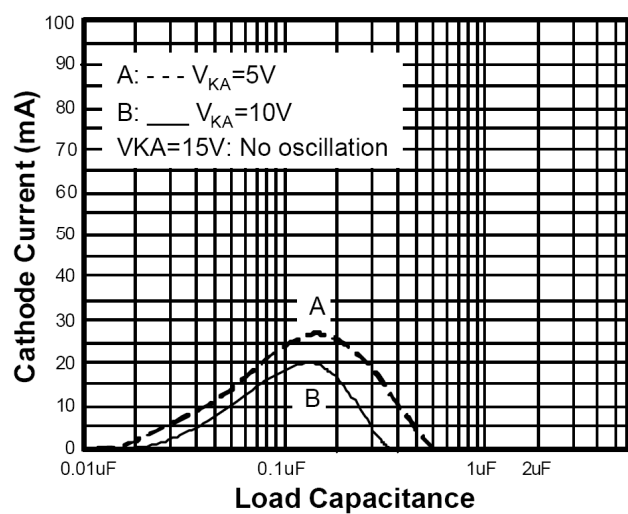


Typical Performance Characteristics (Continued)

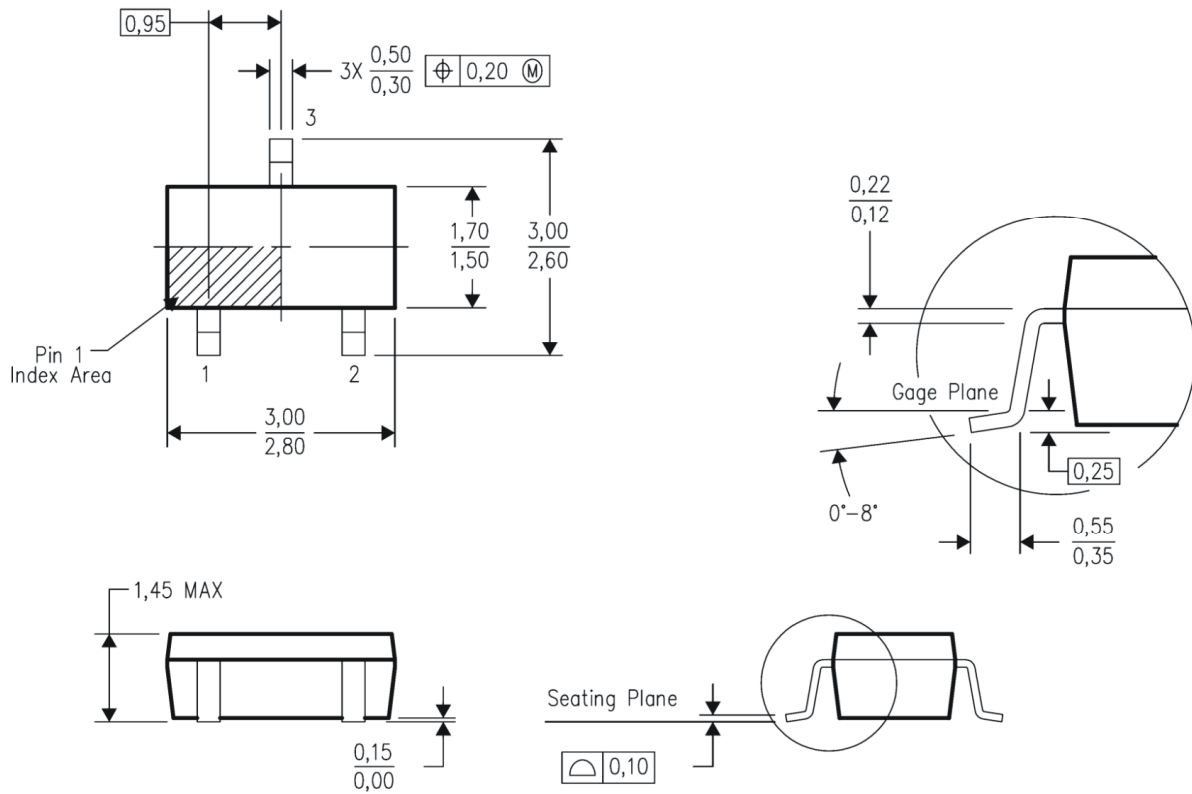
Reference Impedance vs. Frequency



Stability Boundary Conditions vs. Load Capacitance



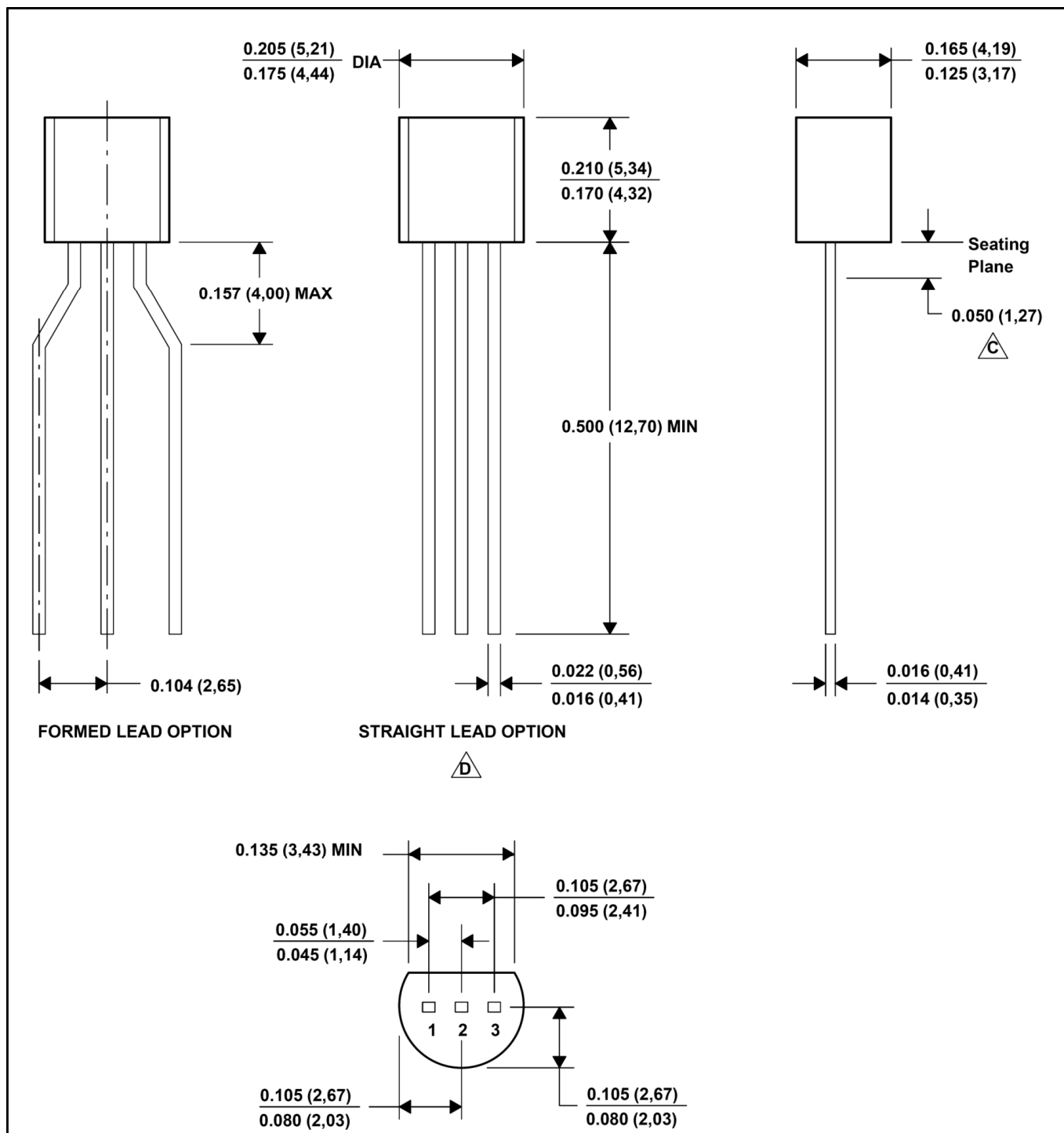
SOT-23 Dimension



NOTES:

- All linear dimensions are in millimeters.
- This drawing is subject to change without notice.
- Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.

TO-92 Dimension



NOTES:

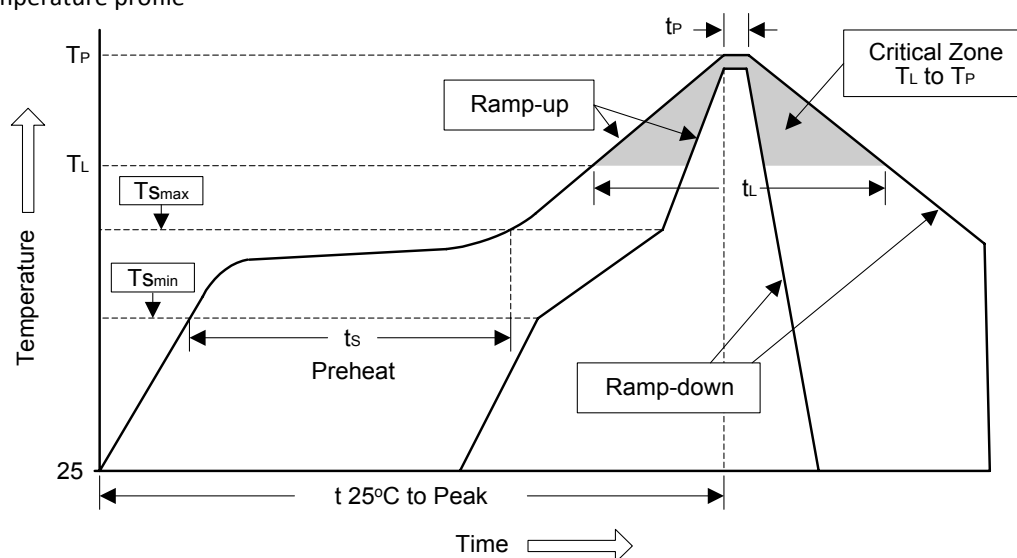
- All linear dimensions are in inches (millimeters).
- This drawing is subject to change without notice.
- Lead dimensions are not controlled within this area.
- Falls within JEDEC TO-226 variation AA (TO-226 replaces TO-92)
- Shipping Method:
Straight lead option available in bulk pack only.
Formed lead option available in tape & reel or ammo pack.

Soldering Methods for Orister's Products

1. Storage environment: Temperature=10°C~35°C Humidity=65%±15%

2. Reflow soldering of surface-mount devices

Figure 1: Temperature profile



Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (T_L to T_P)	<3°C/sec	<3°C/sec
Preheat		
- Temperature Min (T_{smin})	100°C	150°C
- Temperature Max (T_{smax})	150°C	200°C
- Time (min to max) (t_s)	60~120 sec	60~180 sec
T_{smax} to T_L		
- Ramp-up Rate	<3°C/sec	<3°C/sec
Time maintained above:		
- Temperature (T_L)	183°C	217°C
- Time (t_L)	60~150 sec	60~150 sec
Peak Temperature (T_P)	240°C +0/-5°C	260°C +0/-5°C
Time within 5°C of actual Peak Temperature (t_p)	10~30 sec	20~40 sec
Ramp-down Rate	<6°C/sec	<6°C/sec
Time 25°C to Peak Temperature	<6 minutes	<8 minutes

3. Flow (wave) soldering (solder dipping)

Products	Peak temperature	Dipping time
Pb devices.	245°C ±5°C	5sec ±1sec
Pb-Free devices.	260°C +0/-5°C	5sec ±1sec

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