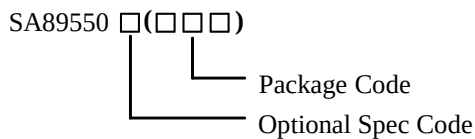


General Description

The SA89550 is a precision voltage reference available in SOT-23 surface-mount package. The design eliminates the need for an external stabilizing capacitor while ensuring stability with any capacitive load, thus making it easy to use.

The SA89550 utilizes fuse and Zener-zap reverse breakdown voltage trim during wafer sort to ensure that the parts have an accuracy of better than $\pm 0.1\%$ at 25°C . Bandgap reference temperature drift curvature correction and low dynamic voltage accuracy over a wide range of operating temperatures and currents.

Ordering Information



Ordering Number	Package type	Output Voltage
SA89550AOT	SOT-23	5.0V
SA89550BAOT	SOT-23	4.096V
SA89550CAOT	SOT-23	3.3V
SA89550DAOT	SOT-23	2.5V
SA89550EAOT	SOT-23	2.048V

Features

- No output Capacitor Required
- Tolerates Capacitive Loads
- Fixed Reverse Breakdown Voltage of 2.048V, 2.5V, 3.3V, 4.096V, 5V
- Output Voltage Tolerance $\pm 0.1\%$ (Maximum)
- Low output noise (10Hz to 10kHz) $38\mu\text{Vrms}$ (Typical)
- Wide Operating Current Range 15mA
- Industrial Temperature Range -40°C to 125°C
- Low Temperature Coefficient $\pm 50\text{ ppm}/^\circ\text{C}(\text{max})$
- Small Package: SOT-23

Applications

- Power Line Monitoring
- Portable, Battery-Powered Equipment
- Data Acquisition Systems
- Instrumentation
- Process Control
- Energy Management
- Product Testing
- Automotive
- Precision Audio Components

Block Diagram

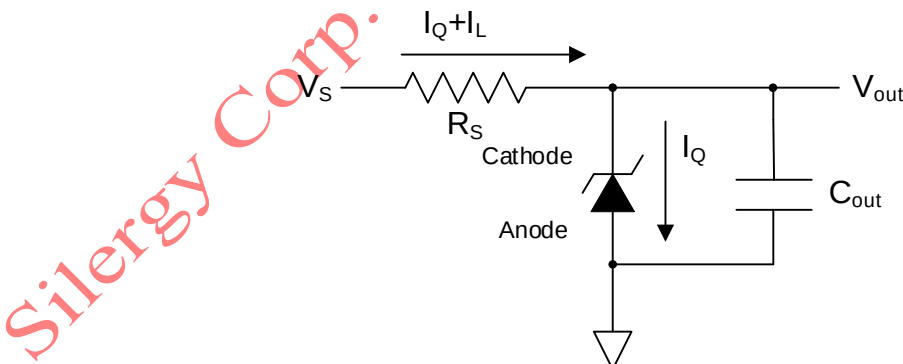
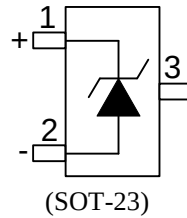


Figure 1. Function Block Diagram

Pinout (Top View)



Part Number	Package type	Top Mark ^①
SA89550AOT	SOT-23	4hxyz
SA89550BAOT	SOT-23	6dxyz
SA89550CAOT	SOT-23	6exyz
SA89550DAOT	SOT-23	6fxyz
SA89550EAOT	SOT-23	6gxyz

Note ①: x=year code, y=week code, z= lot number code.

Pin No.	Pin Name	I/O	Pin Description
1	Cathode	I/O	Shunt current and input voltage
2	Anode	O	Common pin, normally connected to ground
3	NC	—	No internal connection, this pin must be left floating or connected to pin 2.

Absolute Maximum Ratings (Note 1)

Input current into Pin 1 ----- -10mA to +20mA
 Power Dissipation, PD @ T_A = 25°C ----- 280mW
 Package Thermal Resistance (Note 2)
 θ_{JA} ----- TBD °C/W
 θ_{JC} ----- TBD °C/W
 Junction Temperature Range ----- -40°C to 150°C
 Storage Temperature Range ----- -60°C to 150°C

Recommended Operating Conditions

Input current into Pin 1 ----- I_{MIN} to +15mA
 Operating ambient temperature ----- -40°C to 125°C

Note 1: Stresses beyond the “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Electrical Characteristics 5V Option

T_A = 25°C, unless otherwise specified.

Parameter	Symbol	Test Conditions/Comments	Min	Typ	Max	Unit
Reverse Breakdown Voltage	V _R	I _R = 150μA	4.995	5.000	5.005	V
Reverse Breakdown Voltage Tolerance (Note 1)		I _R = 150μA, -40°C to 85°C	-22		22	mV
		I _R = 150μA, -40°C to 125°C	-30		30	
Minimum Operating Current	I _{MIN}	T _A = T _J = 25°C		TBD	TBD	μA
		-40°C to 125°C			TBD	
Average Reverse Breakdown Voltage Temperature Coefficient (Note 1)	ΔV _R /ΔT	I _R = 10 mA		±30		ppm/°C
		I _R = 1 mA		±20		
		I _R = 150μA, T _A = T _J = 25°C		±20		
		I _R = 150μA, -40°C to 125°C			±50	
Reverse Breakdown Voltage Changes with Operating Current Change (Note 2)	ΔV _R /ΔI _R	I _{RMIN} ≤ I _R ≤ 1mA, T _A = T _J = 25°C		0.2		mV
		I _{RMIN} ≤ I _R ≤ 1mA, -40°C to 125°C			TBD	
		1mA ≤ I _R ≤ 15mA, T _A = T _J = 25°C		2.5		
		1mA ≤ I _R ≤ 15mA, T _A = T _J = T _{MIN} to T _{MAX}			TBD	
Reverse Dynamic Impedance	Z _R	I _R = 1mA, f = 120Hz, I _{AC} = 0.1 I _R		0.5		Ω
Wideband Noise	e _N	I _R = 150μA, 10 Hz ≤ f ≤ 10 kHz		80		μV _{rms}
Reverse Breakdown Voltage Long Term Stability	ΔV _R	t = 1000hrs, T = 25°C ±0.1°C, I _R = 150μA		TBD		ppm
Thermal Hysteresis (Note 3)	V _{HYST}	-40°C to 125°C		TBD		mV

Electrical Characteristics: 4.096V Option

T_A = 25°C, unless otherwise specified.

Parameter	Symbol	Test Conditions/Comments	Min	Typ	Max	Unit
Reverse Breakdown Voltage	V _R	I _R = 150 μA	4.0919	4.096	4.100	V
Reverse Breakdown Voltage Tolerance (Note 1)		I _R = 150 μA, -40°C to 85°C	-18		18	mV
		I _R = 150 μA, -40°C to 125°C	-25		25	
Minimum Operating Current	I _{MIN}	T _A = T _J = 25°C		TBD	TBD	μA
		-40°C to 125°C			TBD	
Average Reverse Breakdown Voltage Temperature Coefficient (Note 1)	ΔV _R /ΔT	I _R = 10 mA		±30		ppm/°C
		I _R = 1 mA		±20		
		I _R = 150 μA, T _A = T _J = 25°C		±20		
		I _R = 150 μA, -40°C to 125°C			±50	
Reverse Breakdown Voltage Changes with Operating Current Change (Note 2)	ΔV _R /ΔI _R	I _{RMIN} ≤ I _R ≤ 1 mA, T _A = T _J = 25°C		0.5	TBD	mV
		I _{RMIN} ≤ I _R ≤ 1 mA, -40°C to 125°C			TBD	
		1 mA ≤ I _R ≤ 15 mA, T _A = T _J = 25°C		3	TBD	
		1 mA ≤ I _R ≤ 15 mA, T _A = T _J = T _{MIN} to T _{MAX}			TBD	
Reverse Dynamic Impedance	Z _R	I _R = 1 mA, f = 120 Hz, I _{AC} = 0.1 I _R		0.5		Ω
Wideband Noise	e _N	I _R = 150 μA, 10 Hz ≤ f ≤ 10 kHz		65		μV _{rms}
Reverse Breakdown Voltage Long Term Stability	ΔV _R	t = 1000 hrs, T = 25°C ±0.1°C, I _R = 150 μA		TBD		ppm
Thermal Hysteresis (Note 3)	V _{HYST}	-40°C to 125°C		TBD		mV

Electrical Characteristics: 3.3V Option

T_A = 25°C, unless otherwise specified.

Parameter	Symbol	Test Conditions/Comments	Min	Typ	Max	Unit
Reverse Breakdown Voltage	V _R	I _R = 150 μA	2.2967	3.3	3.3033	V
Reverse Breakdown Voltage Tolerance (Note 1)		I _R = 150 μA, -40°C to 85°C	-14.5		14.5	mV
		I _R = 150 μA, -40°C to 125°C	-19.8		19.8	
Minimum Operating Current	I _{MIN}	T _A = T _J = 25°C		TBD	TBD	μA
		-40°C to 125°C			TBD	
Average Reverse Breakdown Voltage Temperature Coefficient (Note 1)	ΔV _R /ΔT	I _R = 10 mA		±30		ppm/°C
		I _R = 1 mA		±20		
		I _R = 150 μA, T _A = T _J = 25°C		±20		
		I _R = 150 μA, -40°C to 125°C			±50	
Reverse Breakdown Voltage Changes with Operating Current Change (Note 2)	ΔV _R /ΔI _R	I _{RMIN} ≤ I _R ≤ 1 mA, T _A = T _J = 25°C		0.35	TBD	mV
		I _{RMIN} ≤ I _R ≤ 1 mA, -40°C to 125°C			TBD	
		1 mA ≤ I _R ≤ 15 mA, T _A = T _J = 25°C		3	TBD	
		1 mA ≤ I _R ≤ 15 mA, T _A = T _J = T _{MIN} to T _{MAX}			TBD	
Reverse Dynamic Impedance	Z _R	I _R = 1 mA, f = 120 Hz, I _{AC} = 0.1 I _R		0.5		Ω
Wideband Noise	e _N	I _R = 150 μA, 10 Hz ≤ f ≤ 10 kHz		76		μV _{rms}
Reverse Breakdown Voltage Long Term Stability	ΔV _R	t = 1000 hrs, T = 25°C ±0.1°C, I _R = 150 μA		TBD		ppm
Thermal Hysteresis (Note 3)	V _{HYST}	-40°C to 125°C		TBD		mV

Electrical Characteristics 2.5V Option

T_A = 25°C, unless otherwise specified.

Parameter	Symbol	Test Conditions/Comments	Min	Typ	Max	Unit
Reverse Breakdown Voltage	V _R	I _R = 150 μA	2.4975	2.500	2.5025	V
Reverse Breakdown Voltage Tolerance (Note 1)		I _R = 150 μA, -40°C to 85°C	-11		11	mV
		I _R = 150 μA, -40°C to 125°C	-15		15	
Minimum Operating Current	I _{MIN}	T _A = T _J = 25°C		TBD	TBD	μA
		-40°C to 125°C			TBD	
Average Reverse Breakdown Voltage Temperature Coefficient (Note 1)	ΔV _R /ΔT	I _R = 10 mA		±20		ppm/°C
		I _R = 1 mA		±15		
		I _R = 150 μA, T _A = T _J = 25°C		±15		
		I _R = 150 μA, -40°C to 125°C			±50	
Reverse Breakdown Voltage Changes with Operating Current Change (Note 2)	ΔV _R /ΔI _R	I _{RMIN} ≤ I _R ≤ 1 mA, T _A = T _J = 25°C		0.3		mV
		I _{RMIN} ≤ I _R ≤ 1 mA, -40°C to 125°C			TBD	
		1 mA ≤ I _R ≤ 15 mA, T _A = T _J = 25°C		2.3		
		1 mA ≤ I _R ≤ 15 mA, T _A = T _J = T _{MIN} to T _{MAX}			TBD	
Reverse Dynamic Impedance	Z _R	I _R = 1 mA, f = 120 Hz, I _{AC} = 0.1 I _R		0.3		Ω
Wideband Noise	e _N	I _R = 150 μA, 10 Hz ≤ f ≤ 10 kHz		38		μV _{rms}
Reverse Breakdown Voltage Long Term Stability	ΔV _R	t = 1000 hrs, T = 25°C ±0.1°C, I _R = 150 μA		TBD		ppm
Thermal Hysteresis (Note 3)	V _{HYST}	-40°C to 125°C		0.7		mV

Electrical Characteristics: 2.048V Option

$T_A = 25^\circ\text{C}$, unless otherwise specified.

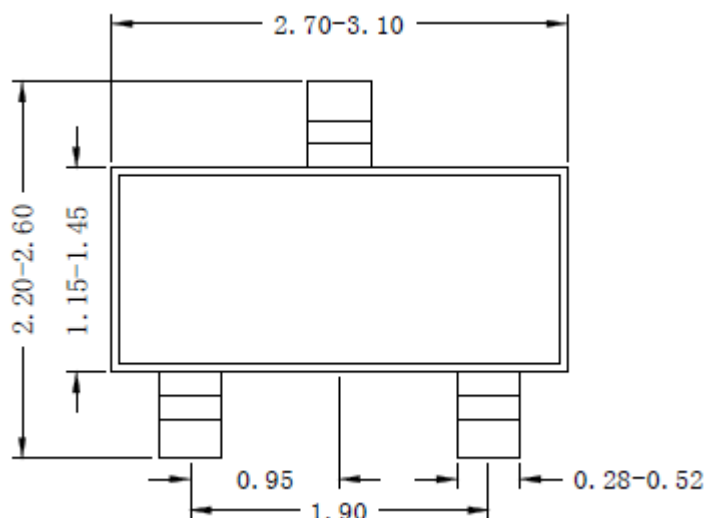
Parameter	Symbol	Test Conditions/Comments	Min	Typ	Max	Unit
Reverse Breakdown Voltage	V_R	$I_R = 150\ \mu\text{A}$	2.046	2.048	2.050	V
Reverse Breakdown Voltage Tolerance (Note 1)		$I_R = 150\ \mu\text{A}$, -40°C to 85°C	-9.012		9.012	mV
		$I_R = 150\ \mu\text{A}$, -40°C to 125°C	-12.288		12.288	
Minimum Operating Current	I_{MIN}	$T_A = T_J = 25^\circ\text{C}$		TBD	TBD	μA
		-40°C to 125°C			TBD	
Average Reverse Breakdown Voltage Temperature Coefficient (Note 1)	$\Delta V_R/\Delta T$	$I_R = 10\ \text{mA}$		± 20		ppm/ $^\circ\text{C}$
		$I_R = 1\ \text{mA}$		± 15		
		$I_R = 150\ \mu\text{A}$, $T_A = T_J = 25^\circ\text{C}$		± 15		
		$I_R = 150\ \mu\text{A}$, -40°C to 125°C			± 50	
Reverse Breakdown Voltage Changes with Operating Current Change (Note 2)	$\Delta V_R/\Delta I_R$	$I_{\text{RMIN}} \leq I_R \leq 1\ \text{mA}$, $T_A = T_J = 25^\circ\text{C}$		0.3	TBD	mV
		$I_{\text{RMIN}} \leq I_R \leq 1\ \text{mA}$, -40°C to 125°C			TBD	
		$1\ \text{mA} \leq I_R \leq 15\ \text{mA}$, $T_A = T_J = 25^\circ\text{C}$		2.5	TBD	
		$1\ \text{mA} \leq I_R \leq 15\ \text{mA}$, $T_A = T_J = T_{\text{MIN}}$ to T_{MAX}			TBD	
Reverse Dynamic Impedance	Z_R	$I_R = 1\ \text{mA}$, $f = 120\ \text{Hz}$, $I_{\text{AC}} = 0.1\ I_R$		0.3		Ω
Wideband Noise	e_N	$I_R = 150\ \mu\text{A}$, $10\ \text{Hz} \leq f \leq 10\ \text{kHz}$		33		μV_{rms}
Reverse Breakdown Voltage Long Term Stability	ΔV_R	$t = 1000\ \text{hrs}$, $T = 25^\circ\text{C} \pm 0.1^\circ\text{C}$, $I_R = 150\ \mu\text{A}$		TBD		ppm
Thermal Hysteresis (Note 3)	V_{HYST}	-40°C to 125°C		TBD		mV

Note 1: The overtemperature limit for Reverse Breakdown Voltage Tolerance is defined as the room temperature Reverse Breakdown Voltage Tolerance $\pm[(\Delta V_R/\Delta T)(\max\Delta T)(V_R)]$. Where, $\Delta V_R/\Delta T$ is the V_R temperature coefficient, $\max\Delta T$ is the maximum difference in temperature from the reference point of 25°C to T_{MIN} or T_{MAX} , and V_R is the reverse breakdown voltage.

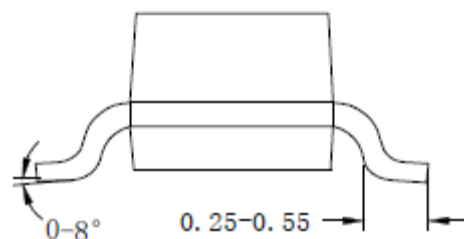
Note 2: Load regulation is measured on pulse basis from no load to the specified load current. Output changes due to die temperature change must be considered separately.

Note 3: Thermal hysteresis is defined as the difference in voltage measured at 25°C after cycling to temperature -40°C and the 25°C measurement after cycling to temperature 125°C .

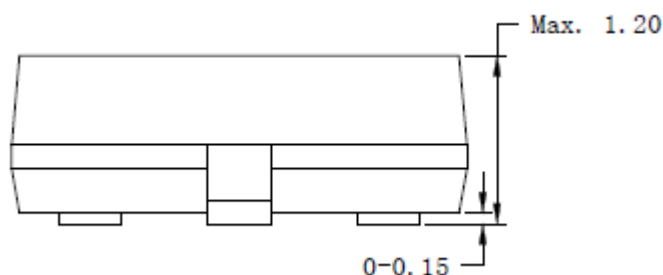
SOT-23 Package Outline Drawing



Top view



Side view A



Side view B

Notes: All dimension in millimeter and exclude mold flash & metal burr.