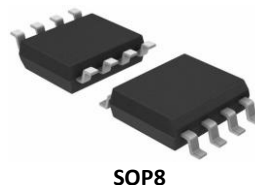


Low-Voltage, High-Precision, Push-Pull Output Comparator

PRODUCT DESCRIPTION

The MS8923/MS8923S is a differential input, high-speed and low power dissipation comparator with complementary TTL outputs. Its propagation delay is about 10ns and its common-mode input range includes the negative rail. The MS8923/MS8923S output can remain stable output in the linear region. The single power supply is +5.0V and the dual power supply is $\pm 5V$.

The MS8923 is available in SOP8 package. The MS8923S is available in SOT23-5 package.



SOP8



SOT23-5

FEATURES

- Fast Propagation Delay: 10ns
- Single Power Supply +5V or Dual Power Supply $\pm 5V$
- Low Power Dissipation: 6mA
- No Requirement for the Minimum Input Signal Changing Rate
- Stable in the Linear Region
- Input Offset Voltage: 0.8mV
- Operating Temperature: $-40^{\circ}\text{C} \sim 120^{\circ}\text{C}$

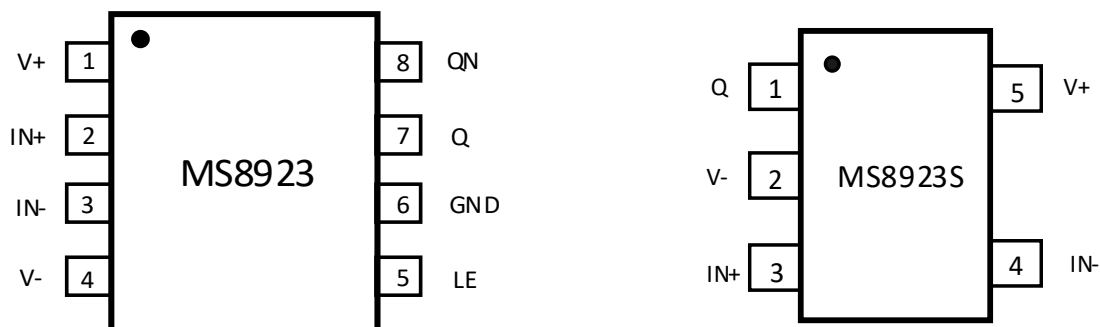
APPLICATIONS

- Handheld and Battery-powered System
- Scanner and Set Top Box
- High-Speed Differential Line Receiver
- Window Comparator
- Zero-Crossing Monitor
- High-Speed Sampling Circuit
- V/F Converter

PRODUCT SPECIFICATION

Part Number	Package	Marking
MS8923	SOP8	MS8923
MS8923S	SOT23-5	8923S

PIN CONFIGURATION



PIN DESCRIPTION

Pin	Name	Type	Description
MS8923			
1	V+	-	Positive Power Supply
2	IN+	I	Positive Input
3	IN-	I	Negative Input
4	V-	-	Negative Power Supply
5	LE	I	Latch Enable Pin. When LE is in high level or floating, Q and QN outputs are latched; When LE is in low level, the outputs of Q and QN change with input.
6	GND	-	Logic Ground
7	Q	O	Positive Output of Comparator
8	QN	O	Negative Output of Comparator
MS8923S			
1	Q	O	Positive Output of Comparator
2	V-	-	Negative Power Supply
3	IN+	I	Positive Input
4	IN-	I	Negative Input
5	V+	-	Positive Power Supply

ABSOLUTE MAXIMUM RATINGS

Any exceeding absolute maximum rating application causes permanent damage to device. Because long-time absolute operation state affects device reliability. Absolute ratings just conclude from a series of extreme tests. It doesn't represent chip can operate normally in these extreme conditions.

Parameter	Symbol	Rating	Unit
Positive Power Supply	V+	+7	V
Negative Power Supply	V-	-7	V
Power Supply	(V+)-(V-)	+13	V
Differential Input Voltage	V _{ID}	+8	V
Maximum Voltage on Latch Pin	V _{LE}	Power Supply	V
Maximum Junction Temperature	T _{JMAX}	+150	°C
Storage Temperature	T _{STG}	-60 ~ 150	°C
Soldering Temperature (10s)	T _{SOLDER}	260	°C
ESD (HBM)	V _{ESD}	±2000	V

ELECTRICAL CHARACTERISTICS

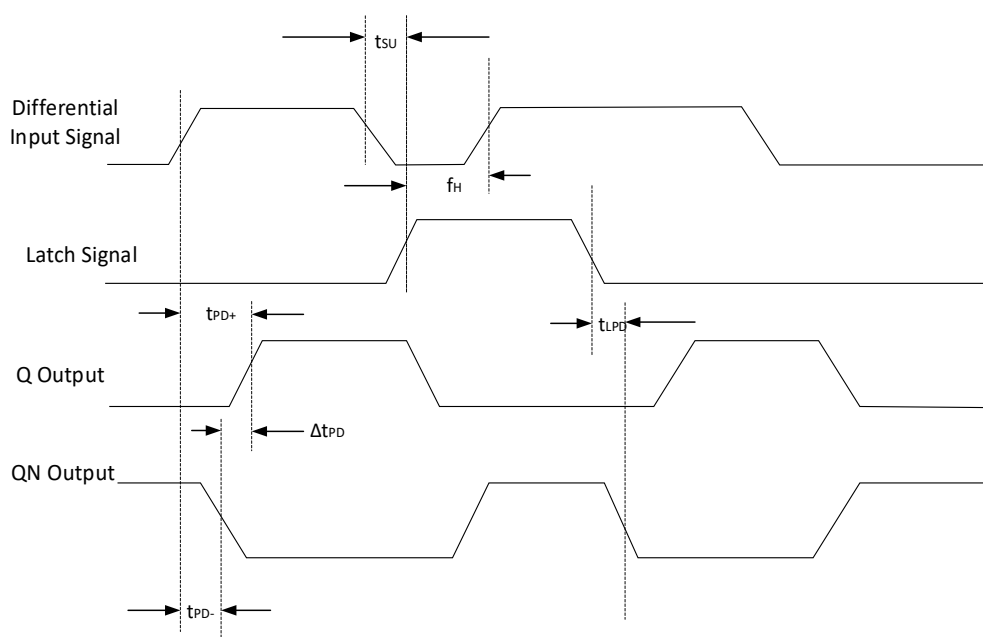
Unless otherwise noted, $T_A = 25^\circ\text{C}$, $V_Q = +1.4\text{V}$, $V_+ = +5\text{V}$, $V_- = -5\text{V}$, $V_{LE} = 0\text{V}$.

Parameter		Symbol	Condition	Min	Typ	Max	Unit
Input Offset Voltage		V _{OS}	R _s ≤100Ω		0.1	2	mV
Input Offset Drift		TCV _{OS}			2		μV/°C
Input Bias Current		I _B			2	5	μA
Input Offset Current		I _{OS}			0.3	0.5	μA
Common-mode Rejection Ratio		CMRR	-2V < V _{CM} < +3.5V	80	110		dB
Input Voltage		V _{IN}		-2		5	V
Input Common-mode Voltage	CMVR	Dual Power Supply: ±5V		-2		+3.5	V
		Single Power Supply: +5V		0.8		+3.5	
Power Supply Rejection Ratio	PSRR	Positive Power Supply: 4.5V≤V+≤5.5V		60	85		dB
		Negative Power Supply: -4.5V≤V+≤-5.5V		80	100		
Small Signal Voltage Gain		A _V	1V≤V _Q ≤2V	1500	3500		V/V
Output Voltage	High-level	V _{OH}	V+≥4.5V, I _{OUT} = 10mA	3.0	3.3		V
	Low-level	V _{OL}	I _{SINK} =4mA		0.3	0.5	
Positive Power Supply Current		I+			6.7	10	mA
Negative Power Supply Current		I-			1	2	mA
High-level Input on Latch Pin		V _{IH}		2.0			V
Low-level Input on Latch Pin		V _{IL}				0.8	V
Input Current on Latch Pin		I _{IL}	V _{LE} =0V		-3	-20	μA
Propagation Delay		t _{PD+}	ΔV _{IN} =100mV, V _{OD} =5mV		5.5	8	ns
		t _{PD-}	ΔV _{IN} =100mV, V _{OD} =20mV		5.5	8	
Propagation Delay Skew		Δt _{PD}			1	3	ns
Latch Setup Time ¹		t _{SU}		2	0		ns
Latch Hold Time ¹		t _H		5	2		ns
Latch Propagation Delay ²		t _{LPD}			7		ns

Note:

1. Latch setup time is the stable time when input signal is prior to latch signal. Latch hold time is the time when input signal remains unchanged after latch time.

2. Latch propagation delay time is the time from the change of latch signal to the output response.



TYPICAL APPLICATION DIAGRAM

Simple Comparator

A simple comparator is used to convert the analog input signal to digital output signal. The comparator compares an input voltage (V_{IN}) on the non-inverting pin with the reference voltage (V_{REF}) on the inverting pin. If V_{IN} is less than V_{REF} , the output voltage is low. If V_{IN} is greater than V_{REF} , the output voltage is high.

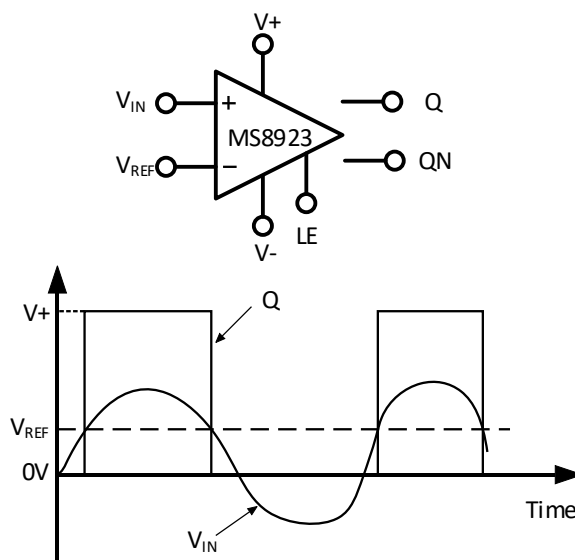


Figure 1. Simple Comparator

Hysteresis Effect

If the differential input of the simple comparator is close to the offset voltage, the comparator will oscillate or produce noisy oscillation. It usually occurs when one input voltage is equal or very close to the other input voltage. Hysteresis can address this problem. Hysteresis can produce two comparison thresholds (one for the rising process and the other for the falling process). Hysteresis value is the difference between two comparison thresholds. When both inputs are very close, hysteresis would cause one input voltage to exceed the other voltage quickly. Thus, the input voltage is moved out of the region in which oscillation may occur.

As shown in Figure 2, hysteresis can be formed by connecting two resistors to the non-inverting pin, which is the positive feedback. When V_{IN} rises up to V_{IN1} , the output would change from low to high. V_{IN1} can be calculated from the following formula:

$$V_{IN1} = V_{REF} \times \frac{R_1 + R_2}{R_2}$$

When V_{IN} falls to V_{IN2} , the output would change from high to low. V_{IN2} can be calculated from the following formula:

$$V_{IN2} = V_{REF} \times \frac{R_1 + R_2}{R_2} - (V+) \times \frac{R_1}{R_2}$$

The hysteresis value is the difference between V_{IN1} and V_{IN2} :

$$\Delta V_{IN} = V_{IN1} - V_{IN2} = V_{CC} \times \frac{R_1}{R_2}$$

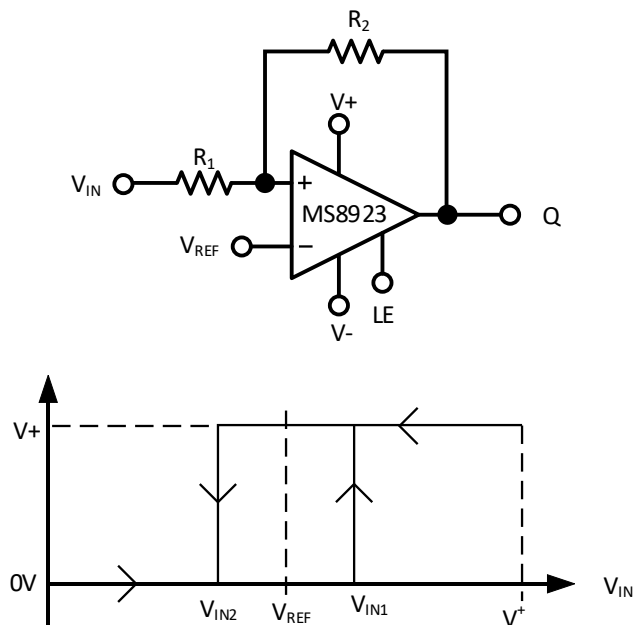


Figure 2. Non-inverting Comparator Circuit

Input

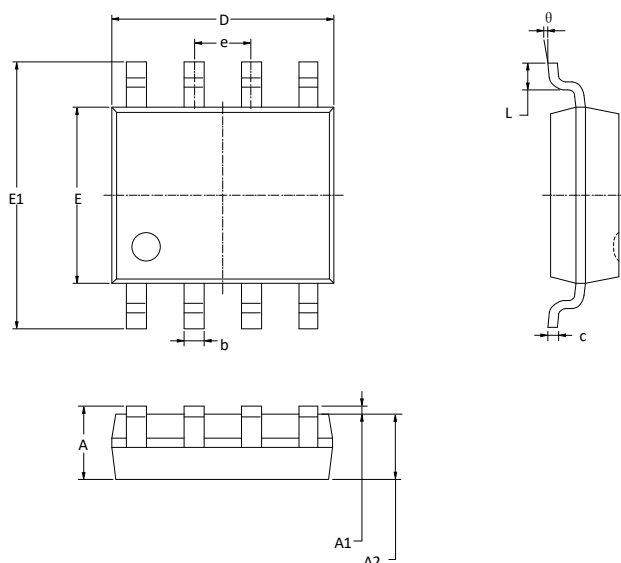
Input bias current of the MS8923/MS8923S is near zero, which allows the use of high-impedance circuit without considering impedance match. This also allows the use of small-capacitor in R-C type timing circuit and reduces the use of the capacitor and the space of circuit board.

Board Layout and Bypassing

Although the MS8923/MS8923S is stable and has an anti-interference ability, it is important to use appropriate bypassing capacitors and ground pickups. The 0.1 μ F ceramic capacitor can provide clean power and the shortest signal line can reduce stray capacitance.

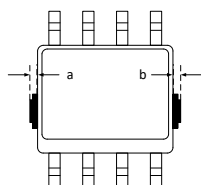
PACKAGE OUTLINE DIMENSION

SOP8

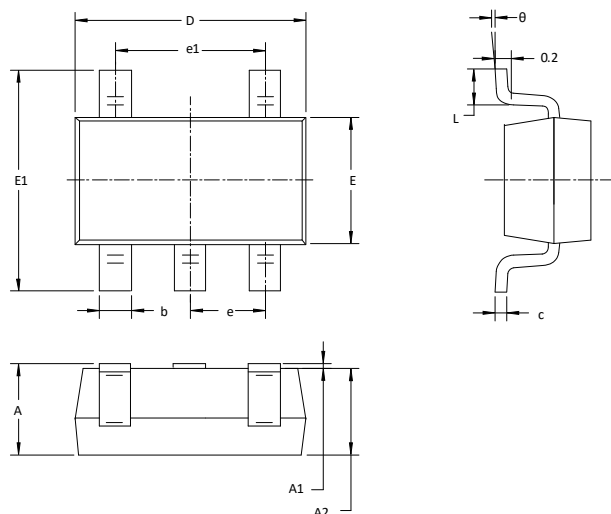


Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.225	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

Note: In addition to the package size, a and b are allowed to have the maximum size of 0.15mm for waste glue simultaneously.



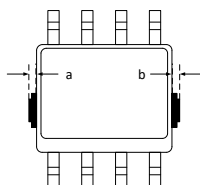
SOT23-5



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	1.900(BSC)		0.075(BSC)	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

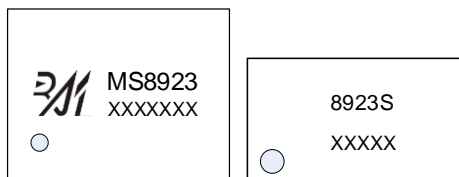
Note: In addition to the package size, a and b are allowed to have the maximum size of 0.15mm for waste glue simultaneously.

The diagram is as follows: taking SOP8 package as an example.



MARKING and PACKAGING SPECIFICATION

1. Marking Drawing Description



Product Name: MS8923, 8923S

Product Code: XXXXX, XXXXXXX

2. Marking Drawing Demand

Laser printing, contents in the middle, font type Arial.

3. Packaging Specification

Device	Package	Piece/Reel	Reel/Box	Piece /Box	Box/Carton	Piece/Carton
MS8923	SOP8	2500	1	2500	8	20000
MS8923S	SOT23-5	3000	10	30000	4	120000

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- The process of improving product is endless. And our company would sincerely provide more excellent product for customer.

**MOS CIRCUIT OPERATION PRECAUTIONS**

Static electricity can be generated in many places. The following precautions can be taken to effectively prevent the damage of MOS circuit caused by electrostatic discharge:

1. The operator shall ground through the anti-static wristband.
2. The equipment shell must be grounded.
3. The tools used in the assembly process must be grounded.
4. Must use conductor packaging or anti-static materials packaging or transportation.



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