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

PRODUCT DESCRIPTION

The MS761/MS762 is a high-precision comparator with low noise and low input offset voltage. The typical value of input offset voltage is 200µV in room temperature and maximum value is 1mV within full temperature range. The MS761 has a shutdown pin that can be used to disable the device and reduce the current consumption. The MS761/MS762 features CMOS input and push-pull output. It have low bias current and high input impedance with no need for an external pull-up resistor.

The MS761 is available in SOT23-6 and SOP8 package. The MS762 is available in SOP8 and MSOP8 package.

SOT23-6

SOP8

MSOP8

FEATURES

- Input Offset Voltage: 0.2mV, 1mV (max)
- Input Bias Current: 0.2pA
- Propagation Delay: 120ns
- Low Power Dissipation: 300µA
- Common-mode Rejection Ratio (CMRR): 100dB
- Power Supply Rejection Ratio (PSRR): 110dB
- Push-pull Output
- Operating Temperature: -40°C ~ 125°C
- Operating Voltage: 2.7V ~ 5V

APPLICATIONS

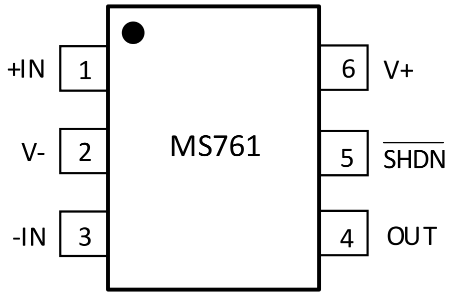
- Handheld and Battery-powered Systems
- Scanner and Set Top Box
- High-speed Differential Line Receiver
- Window Comparator and Zero-crossing Detector
- High-peed Sampling Circuit

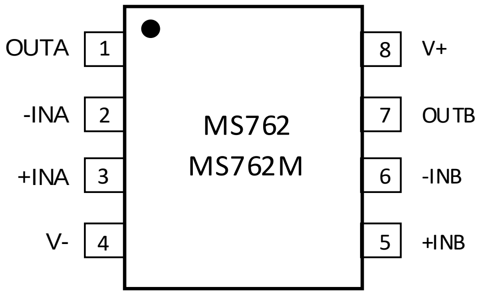
PRODUCT SPECIFICATION

Part Number	Package	Marking
MS761	SOT23-6	761
*MS762	SOP8	MS762
MS762M	MSOP8	MS762M

* The package is not available temporarily. If necessary, please contact Hangzhou Ruimeng Sales Department Center.

PIN CONFIGURATION





PIN DESCRIPTION

Pin	Name	Type	Description
		MS761	
1	+IN	I	Positive Input
2	V-	-	Negative Power Supply
3	-IN	I	Negative Input
4	OUT	O	Comparator Output
5	$\overline{\text{SHDN}}$	I	Shutdown Pin, Active Low
6	V+	-	Positive Power Supply
		MS762/MS762M	
1	OUTA	O	Channel A Output
2	-INA	I	Negative Input (Channel A)
3	+INA	I	Positive Input (Channel A)
4	V-	-	Negative Power Supply
5	+INB	I	Positive Input (Channel B)
6	-INB	I	Negative Input (Channel B)
7	OUTB	O	Channel B Output
8	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	Range	Unit
Power Supply	(V+)-(V-)	5.5	V
Differential Input Voltage	VID	Supply Voltage	V
Maximum Junction Temperature		+150	°C
Storage Temperature	T_{stg}	-60 ~ 150	°C
Lead Temperature(10s)		260	°C
ESD Voltage(HBM)		2000	V
ESD Voltage(MM)		200	V

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Range			Unit
		Min	Typ	Max	
Power Supply	(V+)-(V-)	2.7		5	V
Operating Temperature		-40	25	125	°C

ELECTRICAL CHARACTERISTICS

Unless otherwise noted, T_J= 25°C, V_{CM}= V+/2, V+ = 2.7V, V- = 0V.

Parameter		Symbol	Condition	Min	Typ[3]	Max	Unit
Input Offset Voltage		V_{OS}			0.2	1.0[2]	mV
Input Bias Current		I_B			0.2	50	pA
Input Offset Current		I_{OS}			0.01	5	pA
Common-mode Rejection Ratio		CMRR	0V < V_{CM} < V±1.3V	80	100		dB
Input Common-mode Voltage Range		CMVR	V+ = 2.7V			-0.3 ~ 1.5	V
Power Supply Rejection Ratio		PSRR	CMRR > 50dB	80	110		dB
Output Voltage	High-level	V_{OH}	I_L= 2mA, V_{ID}= 200mV	V+-0.35	V+-0.1		V
	Low-level	V_{OL}	I_L= -2mA, V_{ID}= -200mV		90	250	mV
Output Short-circuit Current[1]		I_{SC}	V_O= 1.35, V_{ID} = 200mV	6.0	20		mA
			V_O= 1.35, V_{ID}= -200mV	6.0	15		
Power Supply Current	Single Channel	I_S			275	700	μA
	Dual Channel				550	1400	
Output Leakage @Shutdown		$I_{OUT\_LEAKAGE}$	$\overline{SHDN}$ = GND, V_O = 2.7V		0.20		μA
Power Leakage @Shutdown		$I_{S\_LEAKAGE}$	$\overline{SHDN}$ = GND, V+ = 2.7V		0.20	2	μA
Rising Edge Propagation Delay R_L= 5.1kΩ, C_L= 50pF		t_{PD}	V_{CM}=0.4V, Overdrive= 500mV		100		ns
			V_{CM}=1.5V, Overdrive = 500mV		200		
Falling Edge Propagation Delay R_L= 5.1kΩ, C_L= 50pF		t_{PD}	Overdrive = 500mV		100		ns
Rising Time		t_r	10% ~ 90%		1.7		ns
Falling Time		t_f	90% ~ 10%		1.8		ns
Turn-on Time for Shutdown Pin		t_{on}			6		μs

Unless otherwise noted, T_J= 25°C, V_{CM}= V+/2, V+ = 5V, V- = 0V.

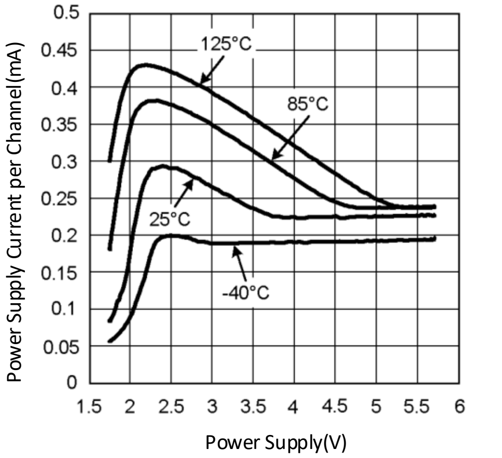
Parameter		Symbol	Condition	Min	Typ[3]	Max	Unit
Input Offset Voltage		V_{OS}			0.2	1.0[2]	mV
Input Bias Current		I_B			0.2	50	pA
Input Offset Current		I_{OS}			0.01	5	pA
Common-mode Rejection Ratio		CMRR	0V < V_{CM} < V+ -1.3V	80	100		dB
Input Common-mode Voltage Range		CMVR	V+ = 5V			-0.3 ~ 3.8	V
Power Supply Rejection Ratio		PSRR	CMRR > 50dB	80	110		dB
Output Voltage	High-level	V_{OH}	I_L= 4mA, V_{ID} = 200mV	V+ -0.35	V+ -0.1		V
	Low-level	V_{OL}	I_L = -4mA, V_{ID} = -200mV		120	250	mV
Output Short Circuit Current[1]		I_{SC}	V_O= 2.5, V_{ID} = 200mV	6.0	60		mA
			V_O= 2.5, V_{ID} = -200mV	6.0	40		
Power Supply Current	Single Channel	I_S			225	700	μA
	Dual Channel				450	1400	
Output Leakage @Shutdown		$I_{OUT\_LEAKAGE}$	$\overline{SHDN}$ = GND, V_O = 5V		0.20		μA
Power Leakage @Shutdown		$I_{S\_LEAKAGE}$	$\overline{SHDN}$ = GND, V+= 5V		0.20	2	μA
Rising Edge Propagation Delay R_L= 5.1kΩ, C_L= 50pF		t_{PD}	V_{CM}=1.1V, Overdrive = 500mV		190		ns
			V_{CM}=3.8V, Overdrive = 500mV		450		
Falling Edge Propagation Delay R_L= 5.1kΩ, C_L= 50pF		t_{PD}	Overdrive = 500mV		200		ns
Rising Time		t_r	10% ~ 90%		1.7		ns
Falling Time		t_f	90% ~ 10%		1.5		ns
Turn-on Time for Shutdown Pin		t_{on}			4		μs

Note:

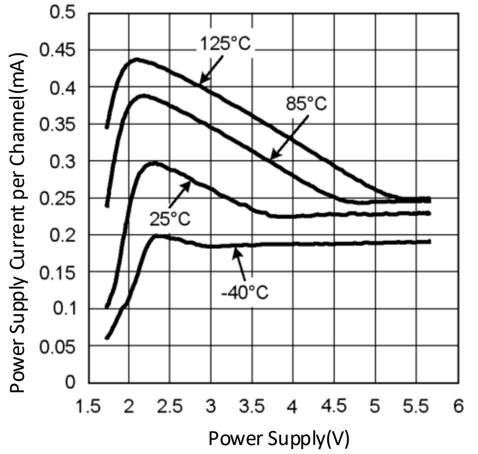
1. Electrical parameters only apply for factory testing conditions at the indicated temperature. Factory testing conditions would result in very small self-heating of the device such that T_J=T_A. No guarantee of parametric performance is indicated in the electrical parameters under conditions of self-heating where T_J>T_A.
2. Maximum temperature range: -40°C to 125°C .
3. Typical values represent the most of parameter characteristics.

TYPICAL CHARACTERISTICS CURVE

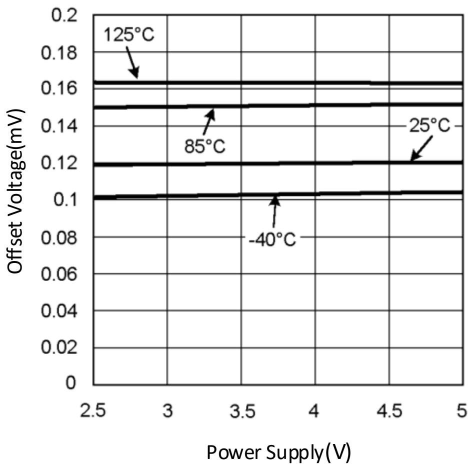
Power Supply Current VS. Power Supply(Vo=HIGH)



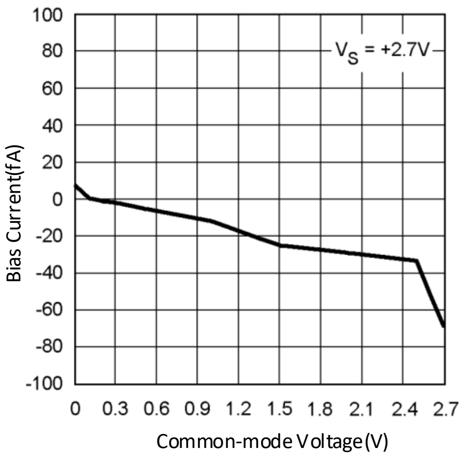
Power Supply Current VS. Power Supply(Vo=LOW)



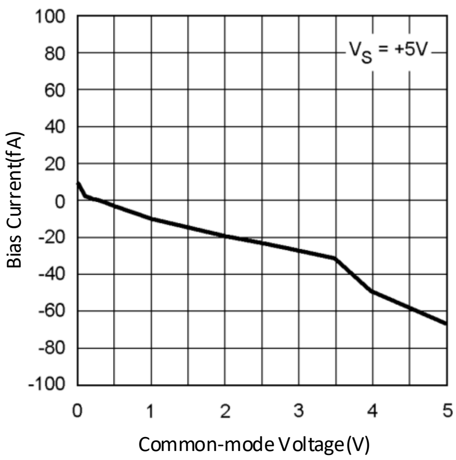
Offset Voltage VS. Power Supply



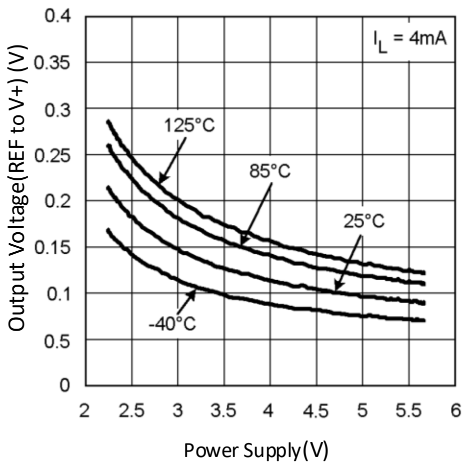
Bias Current VS. Common-mode Voltage @25°C

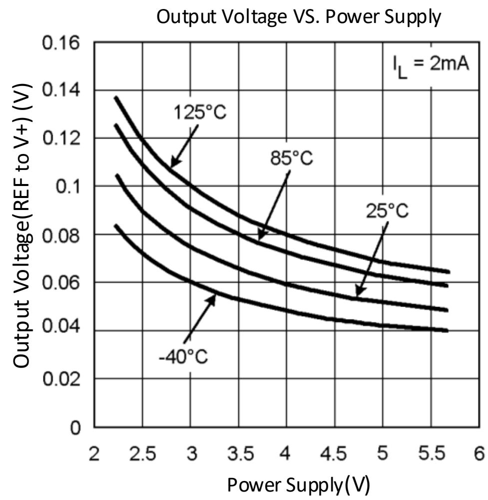


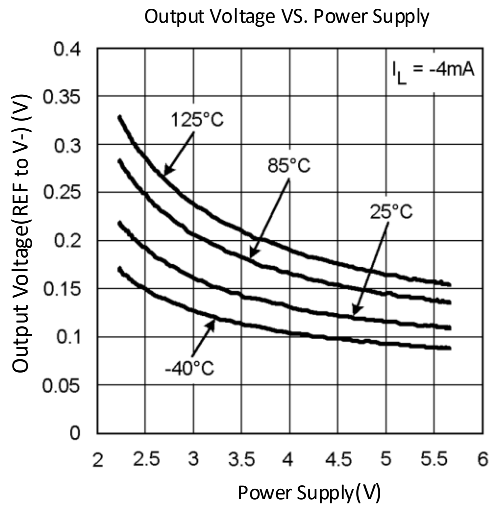
Bias Current VS. Common-mode Voltage @25°C

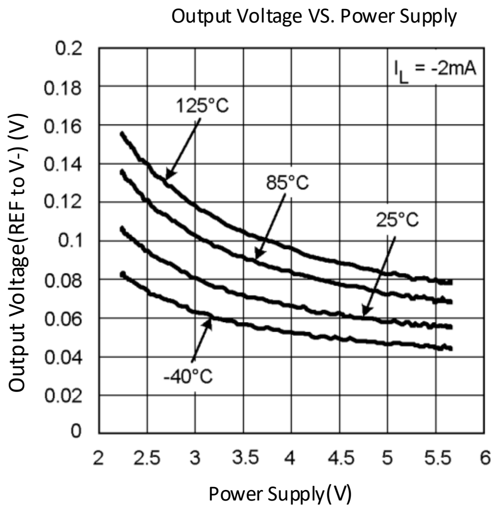


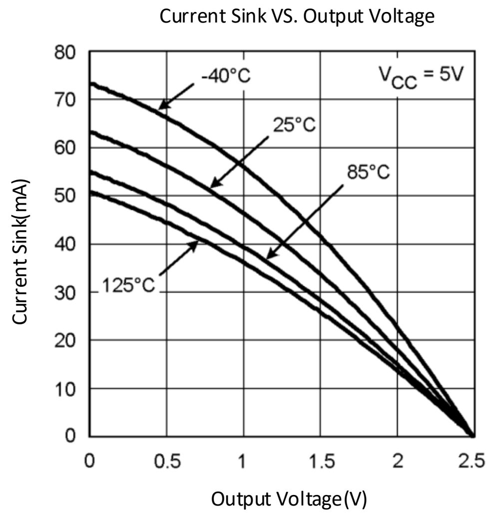
Output Voltage VS. Power Supply

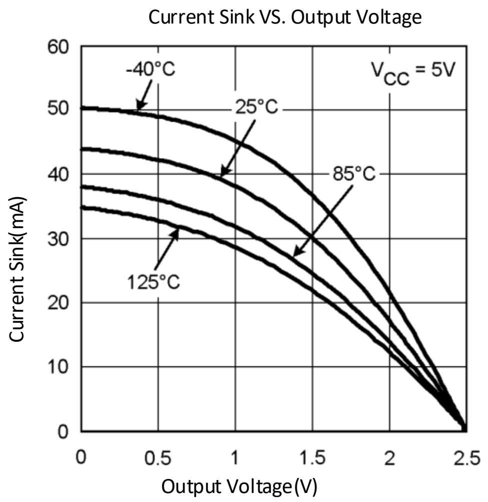


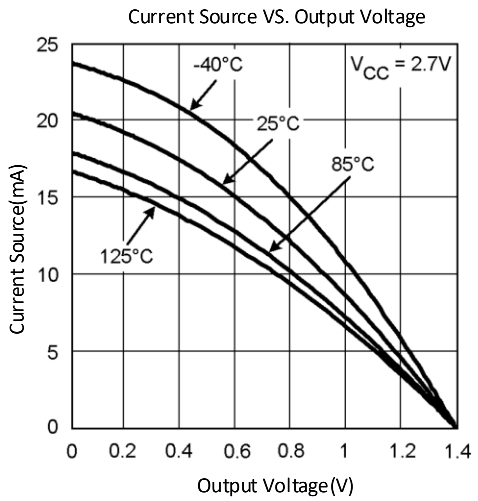

Output Voltage VS. Power Supply
I_L = 2mA
125°C
85°C
25°C
-40°C
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
2
2.5
3
3.5
4
4.5
5
5.5
6
Output Voltage(REF to V+) (V)
Power Supply(V)


Output Voltage VS. Power Supply
I_L = -4mA
125°C
85°C
25°C
-40°C
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2
2.5
3
3.5
4
4.5
5
5.5
6
Output Voltage(REF to V-) (V)
Power Supply(V)

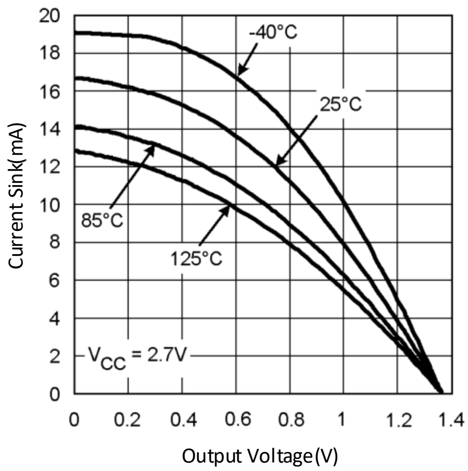

Output Voltage VS. Power Supply
I_L = -2mA
125°C
85°C
25°C
-40°C
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
2
2.5
3
3.5
4
4.5
5
5.5
6
Output Voltage(REF to V-) (V)
Power Supply(V)


Current Sink VS. Output Voltage
V_{CC} = 5V
-40°C
25°C
85°C
125°C
80
70
60
50
40
30
20
10
0
0
0.5
1
1.5
2
2.5
Current Sink(mA)
Output Voltage(V)

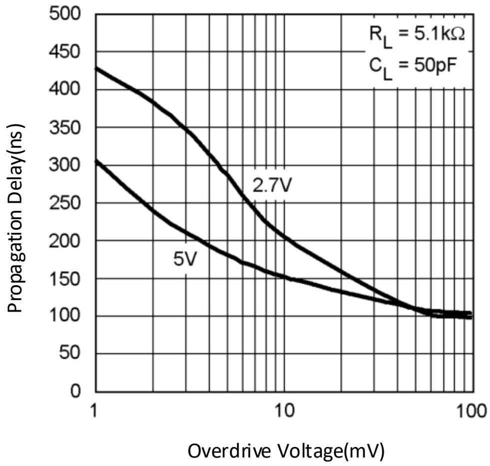

Current Sink VS. Output Voltage
V_{CC} = 5V
-40°C
25°C
85°C
125°C
60
50
40
30
20
10
0
0
0.5
1
1.5
2
2.5
Current Sink(mA)
Output Voltage(V)


Current Source VS. Output Voltage
V_{CC} = 2.7V
-40°C
25°C
85°C
125°C
25
20
15
10
5
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Current Source(mA)
Output Voltage(V)

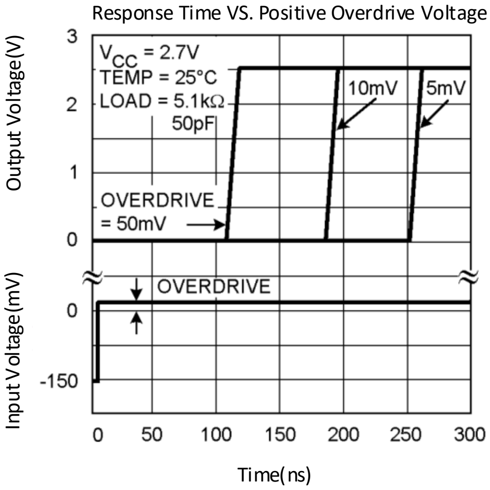
Current Sink VS. Output Voltage



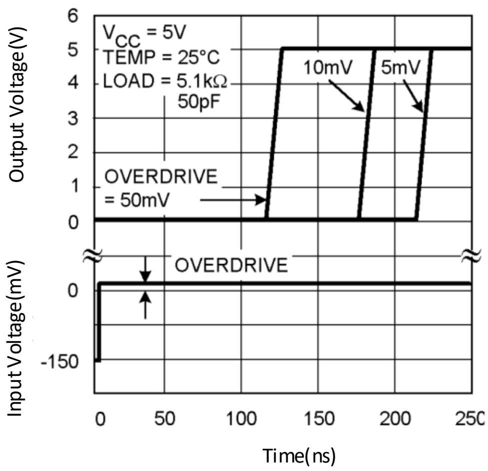
Propagation Delay VS. Overdrive Voltage



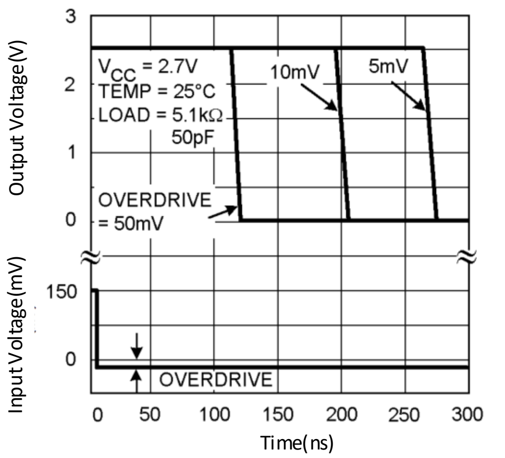
Response Time VS. Positive Overdrive Voltage



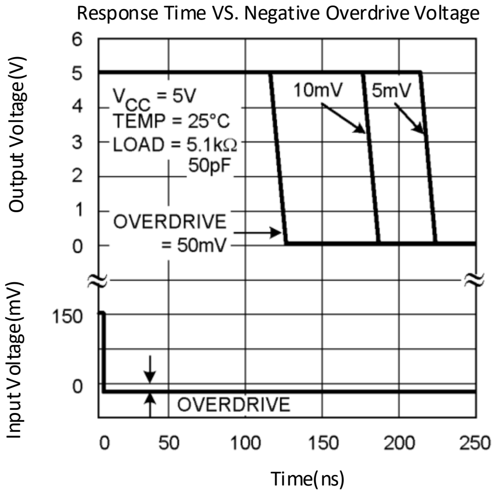
Response Time VS. Positive Overdrive Voltage



Response Time VS. Negative Overdrive Voltage



Response Time VS. Negative Overdrive Voltage



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.

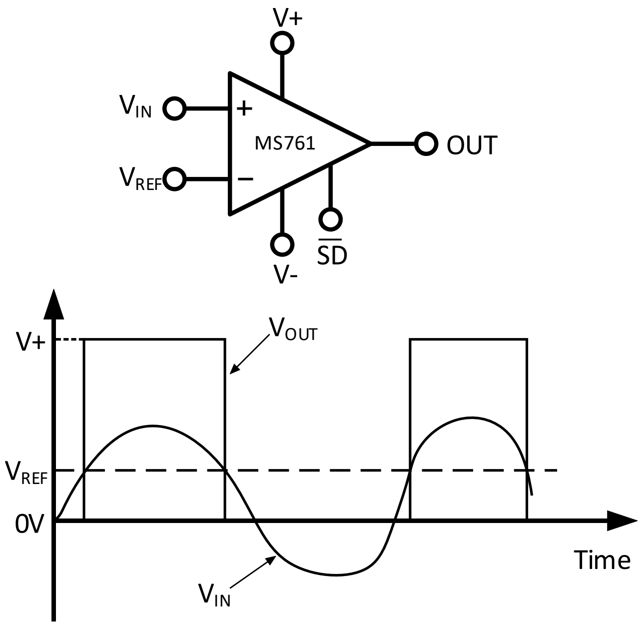


Figure 1. A Simple Comparator

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}:

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

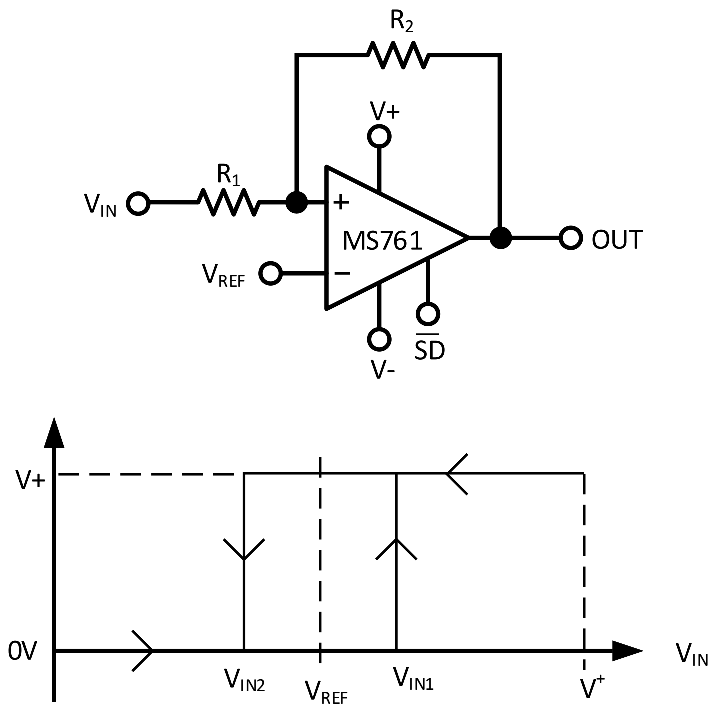


Figure 2. Non-inverting Comparator Circuit

Input

Input bias current of the MS761/MS762 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 .

Shutdown Mode

The MS761 has a low power dissipation shutdown pin. When $\overline{SHDN}$ pin is low, the MS761 is in shutdown mode. In shutdown mode, the output is in a high-impedance state, power supply current is reduced to 20nA, and the comparator is turned off. Driving $\overline{SHDN}$ pin to high would turn on the comparator. $\overline{SHDN}$ pin cannot be floating, because it is high-impedance input. If it is floating, the output voltage would be uncertain. And do not leave the $\overline{SHDN}$ pin in three-state.

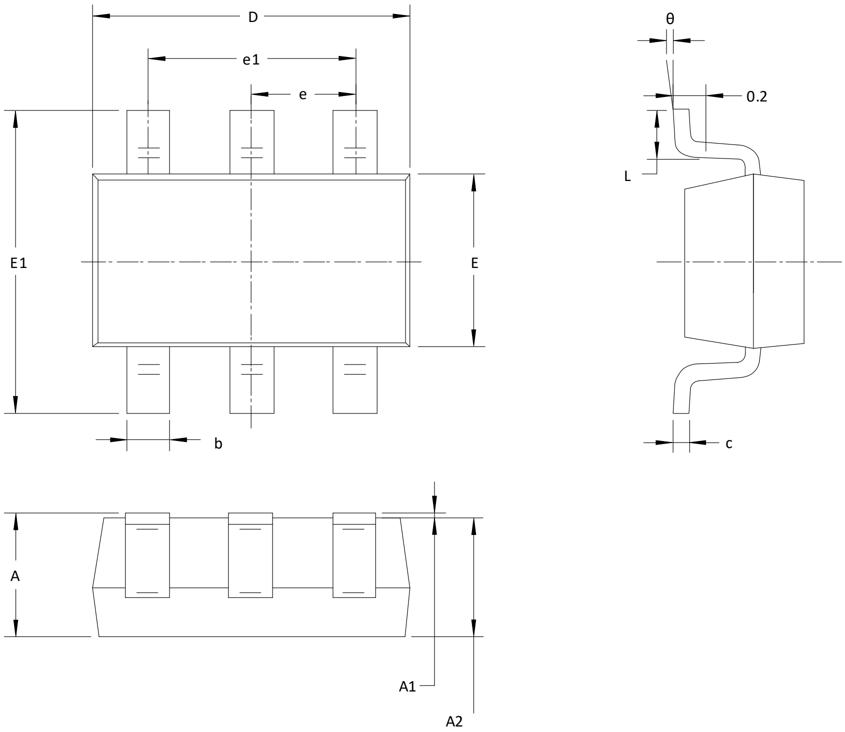
The maximum input voltage on $\overline{SHDN}$ pin is 5.5V, which is independent of V+. When V+ operates at a lower voltage (such as 3V), $\overline{SHDN}$ pin can be also driven by 5V. The logic threshold limits the voltage on $\overline{SHDN}$ pin, which is proportional to V+.

Board Layout and Bypassing

Although the MS761 is stable and has an anti-interference ability, it is important to use appropriate bypassing capacitors and ground pickups. The 0.1µF ceramic capacitor can provide clean power and the shortest signal line can reduce stray capacitance.

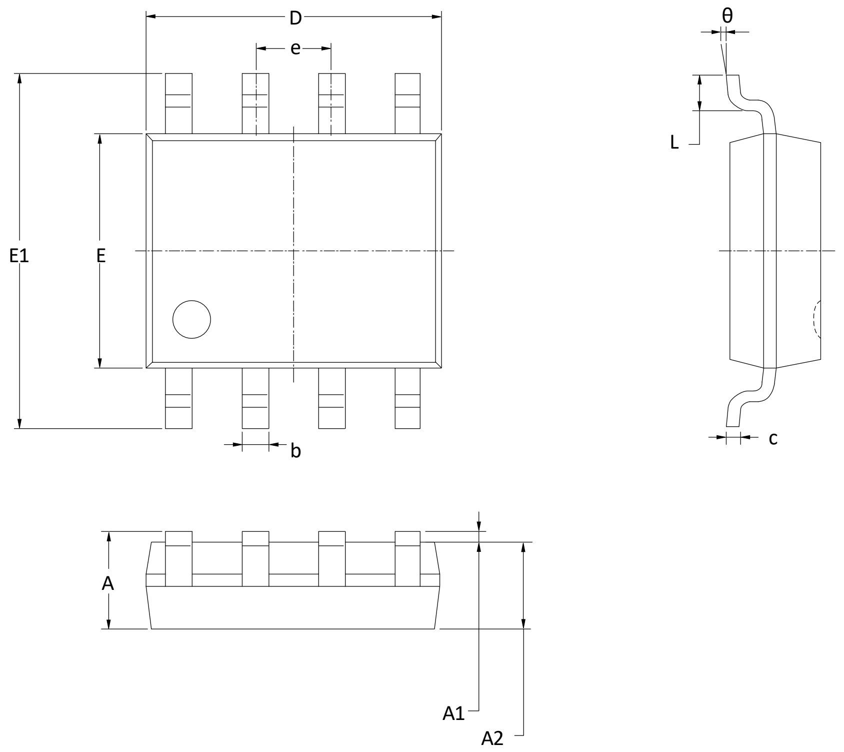
PACKAGE OUTLINE DIMENSIONS

SOT23-6



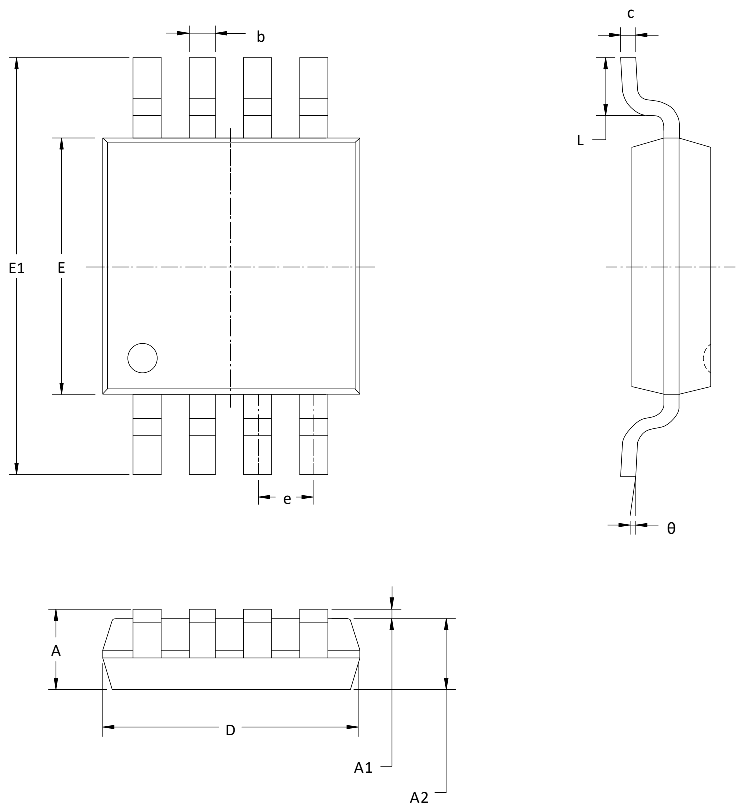
Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.900(BSC)		0.075(BSC)	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

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°

MSOP8



Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650(BSC)		0.026(BSC)	
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

MARKING and PACKAGING SPECIFICATION

1. Marking Drawing Description

Product Name: MS761, MS762M

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
MS761	SOT23-6	3000	10	30000	4	120000
MS762	SOP8	2500	1	2500	8	20000
MS762M	MSOP8	3000	1	3000	8	24000

STATEMENT

- All Revision Rights of Datasheets Reserved for Ruimeng. Don’t release additional notice.
  Customer should get latest version information and verify the integrity before placing order.
- When using Ruimeng products to design and produce, purchaser has the responsibility to observe safety standard and adopt corresponding precautions, in order to avoid personal injury and property loss caused by potential failure risk.
- 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.

+86-571-89966911

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http:// www.relmon.com