Low Power Dissipation, Low Noise, CMOS, Rail-to-Rail Input and Output Operational Amplifier

PRODUCT DESCRIPTION

The MS6001S1A is featured by ultra-low power dissipation, rail-to-rail input and output, low input offset voltage and low current noise. The specific characteristics could be expressed as follows: the MS6001S1A can operate in single power supply from 1.8V to 5V or dual power supply; low power dissipation and low noise features make the MS6001S1A used in mobile devices; rail-to-rail feature makes it used in the buffer of CMOS, ADCs, DACs, ASICs or the system with low power dissipation and wide output swing.

SOT23-5

FEATURES

- Low Offset Voltage: 3mV (Max)
- Low Input Bias Current: 10pA (Max@25°C)
- Single Power Supply:1.8V ~ 5V
- Low Noise: 31nV/$\sqrt{Hz}$ @10kHz
- Micro Power Dissipation (1.8V): 110μA
- No Phase Reversal
- Stable Unit Gain
- AEC-Q100

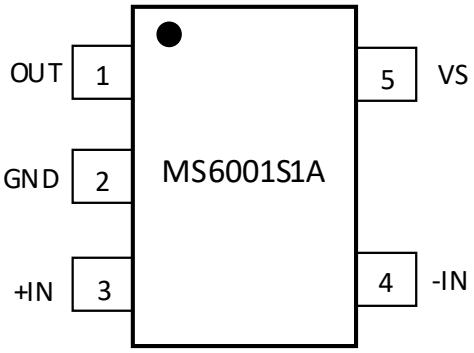
APPLICATIONS

- Battery-powered Device
- Multi-order Filter
- ADC Predriver
- DAC Driver/Level Shift
- Low Power Dissipation, ASIC Input and Output Amplifier

PRODUCT SPECIFICATION

Part Number	Package	Marking
MS6001S1A	SOT23-5	6001A

PIN CONFIGURATION



PIN DESCRIPTION

Pin	Name	Type	Description
1	OUT	O	Channel Output
2	GND	-	Ground
3	+IN	I	Positive Input
4	-IN	I	Negative Input
5	VS	-	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	Ratings	Unit
Power Supply	VS	6	V
Input Voltage		GND-0.3 ~ VS+0.3	V
Differential Input Voltage		±6	V
Junction Temperature	T_J	-65 ~ +150	°C
Operating Temperature	T_A	-40 ~ +125	°C
Storage Temperature	T_{STG}	-65 ~ +150	°C
Lead Temperature (60s)		260	°C

ELECTRICAL CHARACTERISTICS (5V)

Unless otherwise noted, VS=5V, V_{CM}=2.5V, T_A=25°C。

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Input Characteristics						
Input Offset Voltage	V_{OS}	-0.3V < V_{CM} < +5.3V		1	3	mV
		-40°C ≤ T_A ≤ +125°C			3	
Input Bias Current	I_B			2	10	pA
		-40°C ≤ T_A ≤ +85°C			110	pA
		-40°C ≤ T_A ≤ +125°C			780	pA
Input Offset Current	I_{OS}			0.1	0.5	pA
		-40°C ≤ T_A ≤ +85°C			50	pA
		-40°C ≤ T_A ≤ +125°C			250	pA
Common-mode Rejection Ratio	CMRR	0V< V_{CM} <5V		75		dB
		-40°C ≤ T_A ≤ +125°C	68			
Large Signal Gain	A_{VO}	R_L=10kΩ, V_O=0.5V ~ 4.5V	85	90		dB
Input Offset Voltage Drift	$\Delta V_{OS}/\Delta T_A$	-40°C ≤ T_A ≤ +125°C		5	10	μV/°C
Input Capacitance	C_{DIFF}			1.9		pF
	C_{CM}			2.5		pF
Output Characteristics						
Output High Voltage	V_{OH}	I_L=1mA	4.95	4.98		V
		-40°C ≤ T_A ≤ +125°C	4.9			
		I_L=10mA		4.7		V
		-40°C ≤ T_A ≤ +125°C	4.50			
Output Low Voltage	V_{OL}	I_L=1mA		20	30	mV
		-40°C ≤ T_A ≤ +125°C			50	
		I_L=10mA		190	275	mV
		-40°C ≤ T_A ≤ +125°C			335	
Short-circuit Current	I_{SC}			±70		mA
Closed-loop Output Impedance	Z_{OUT}	f=10kHz, A_V=1		15		Ω

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Power Supply						
Power Supply Rejection Ratio	PSRR	2.2V < V_{CM} < +5V	67	80		dB
		-40°C ≤ T_A ≤ +125°C	64			dB
Static Current	I_{SY}	V_O=V_S/2		110		µA
		-40°C ≤ T_A ≤ +125°C			150	
Dynamic Characteristics						
Gain Bandwidth Product	GBP	R_L=100kΩ		1.2		MHz
		R_L=10kΩ		1		MHz
Slew Rate	SR	R_L=10kΩ		0.4		V/µs
Setting Time 0.1%	t_S	G=±1,2V_{step}, C_L=20pF, R_L=1kΩ		23		µs
Phase Margin	Φ_O	R_L=100kΩ, R_L=10kΩ, C_L=20pF		65		Deg
Noise Characteristics						
Peak-to-Peak Noise				2.3	3.5	µV
Voltage Noise Density	e_n	f=1kHz		35		nV/$\sqrt{Hz}$
		f=10kHz		31		nV/$\sqrt{Hz}$
Current Noise Density	i_n	f=1kHz		0.05		pA/$\sqrt{Hz}$

ELECTRICAL CHARACTERISTICS (1.8V)

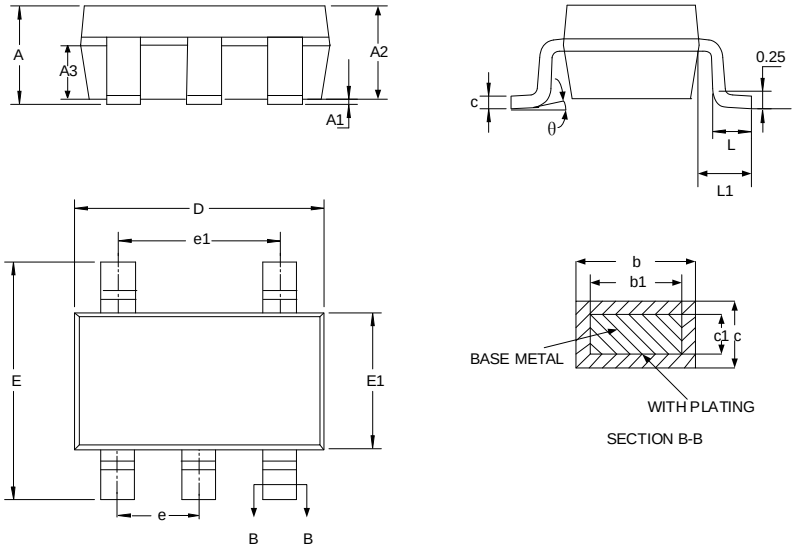
Unless otherwise noted, VS=1.8V, V_{CM}=0.9V, T_A=25°C。

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Input Characteristics						
Input Offset Voltage	V_{OS}	-0.3V < V_{CM} < +1.9V		1	3	mV
		-40°C ≤ T_A ≤ +125°C			3	
Input Bias Current	I_B			2	10	pA
		-40°C ≤ T_A ≤ +85°C			110	pA
		-40°C ≤ T_A ≤ +125°C			780	pA
Input Offset Current	I_{OS}			1	5	pA
		-40°C ≤ T_A ≤ +85°C			50	pA
		-40°C ≤ T_A ≤ +125°C			250	pA
Common-mode Rejection Ratio	CMRR	0V< V_{CM} <2.2V	58	75		dB
		-40°C ≤ T_A ≤ +125°C	55			
Large Signal Gain	A_{VO}	R_L=10kΩ, V_O=0.5V ~ 1.3V	85	90		dB
Input Offset Voltage Drift	$\Delta V_{OS}/\Delta T_A$	-40°C ≤ T_A ≤ +125°C		5	10	μV/°C
Input Capacitance	C_{DIFF}			2.1		pF
	C_{CM}			3.8		pF
Output Characteristics						
Output High Voltage	V_{OH}	I_L=1mA	1.65	1.73		V
		-40°C ≤ T_A ≤ +125°C	1.6			
Output Low Voltage	V_{OL}	I_L=1mA		44	60	mV
		-40°C ≤ T_A ≤ +125°C			80	
Short-circuit Current	I_{SC}			±70		mA
Closed-loop Output Impedance	Z_{OUT}	f=10kHz, A_V=1		15		Ω

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Power Supply						
Power Supply Rejection Ratio	PSRR	1.8V < V_{CM} < +5V	67	80		dB
		-40°C ≤ T_A ≤ +125°C	64			dB
Static Current	I_{SY}	V_O=V_S/2		110		µA
		-40°C ≤ T_A ≤ +125°C			150	
Dynamic Characteristics						
Gain Bandwidth Product	GBP	R_L=100kΩ		0.4		MHz
		R_L=10kΩ		0.4		MHz
Slew Rate	SR	R_L=10kΩ		0.35		V/µs
Setting Time 0.1%	t_S	G=±1,2V_{step} C_L=20pF, R_L=1kΩ		6.5		µs
Phase Margin	Φ_O	R_L=100kΩ, R_L=10kΩ, C_L=20pF		65		Deg
Noise Characteristics						
Peak-to-Peak Noise				2.3	3.5	µV
Voltage Noise Density	e_n	f=1kHz		35		nV/$\sqrt{Hz}$
		f=10kHz		31		nV/$\sqrt{Hz}$
Current Noise Density	i_n	f=1kHz		0.05		pA/$\sqrt{Hz}$

PACKAGE OUTLINE DIMENSIONS

SOT23-5



Symbol	Dimensions in Millimeters		
	Min	Typ	Max
A	-	-	1.25
A1	0.04	-	0.10
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.38	-	0.47
b1	0.37	0.40	0.43
c	0.13	-	0.17
c1	0.12	0.13	0.14
D	2.82	2.92	3.02
E	2.60	2.80	3.00
E1	1.50	1.60	1.70
e	0.95BSC		
e1	1.90BSC		
L	0.30	-	0.60
L1	0.60REF		
θ	0º	-	8º

MARKING and PACKAGING SPECIFICATION

1. Marking Drawing Description

Product Name: 6001A

Product Code: XXXXX

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
MS6001S1A	SOT23-5	3000	10	30000	4	120000

STATEMENT

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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.

+86-571-89966911

Rm701, No.9 Building, No. 1 WeiYe Road, Puyan Street, Binjiang District, Hangzhou, Zhejiang

http:// www.relmon.com