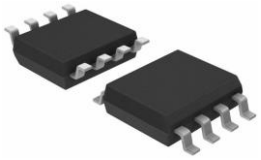
Low Power Dissipation Operational Amplifier

PRODUCT DESCRIPTION

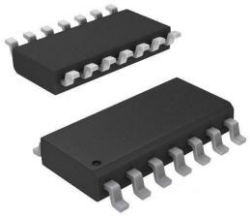
The MS321, MS358, MS324 are single channel, dual channel, four channel amplifiers respectively. It has high unit gain bandwidth and the slew rate could be up to 0.4V/μs on specific condition. Each amplifier only has 430μA quiescent current at 5V. The input common-mode range could be grounded. In addition, the device supports single or dual power operation, and easily drive large capacitance load.

The MS321, MS358, MS324 have lead SOT23-5, SOP8, SOP14/TSSOP14 and QFN16 packages respectively. The device is featured by low power dissipation, wide power supply range and economical price, allowing it to be applied widely.

SOT23-5

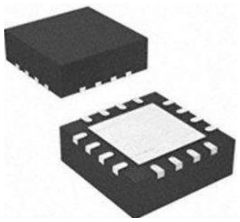


SOP8



SOP14

TSSOP14



QFN16

FEATURES

- Gain Bandwidth : 1MHz@25°C
- Low Power Supply Current: 430μA
- Low Input Bias Current: 30nA
- Power Supply Range: 2.5V to 36V
- Maintain Stable in Large Capacitance Load

APPLICATIONS

- Charger
- Power Supply
- Industrial Control Tools
- Desktop Computer
- Communication

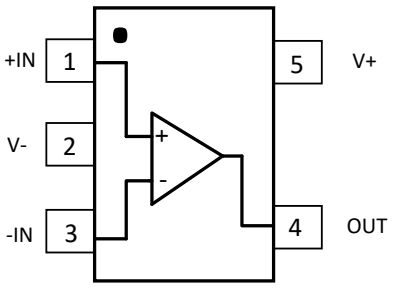
PRODUCT SPECIFICATION

Part Number	Package	Marking
MS321	SOT23-5	321
MS358	SOP8	MS358
MS324	SOP14	MS324
MS324T	TSSOP14	MS324T
*MS324N	QFN16	MS324N

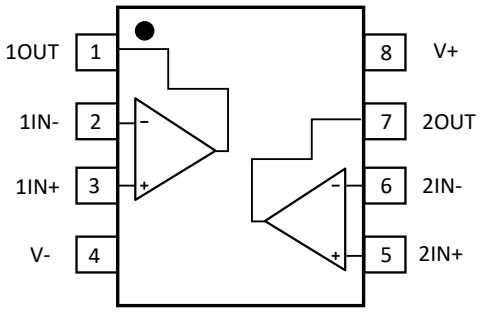
* The package is not available temporarily. If necessary, please contact Hangzhou Ruimeng Sales Department Center.

PIN CONFIGURATION

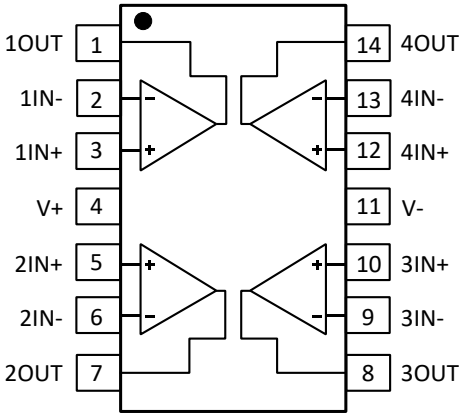
MS321

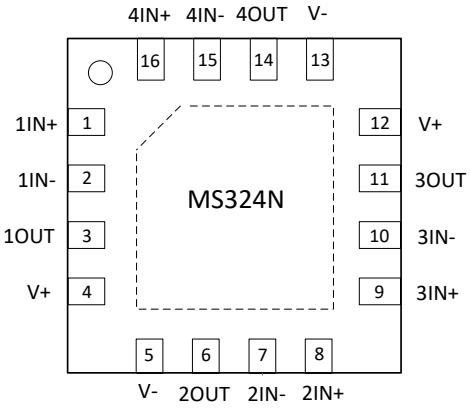


MS358



MS324/MS324T





PIN DESCRIPTION

Pin	Name	Type	Description
MS321			
1	+IN	I	Non-inverting Input
2	V-	-	Negative Power Supply
3	-IN	I	Inverting Input
4	OUT	O	Channel Output
5	V+	-	Positive Power Supply
MS358			
1	1OUT	O	Channel 1 Output
2	1IN-	I	Inverting Input (Channel 1)
3	1IN+	I	Non-inverting Input (Channel 1)
4	V-	-	Negative Power Supply
5	2IN+	I	Non-inverting Input (Channel 2)
6	2IN-	I	Inverting Input (Channel 2)
7	2OUT	O	Channel 2 Output
8	V+	-	Positive Power Supply
MS324/MS324T			
1	1OUT	O	Channel 1 Output
2	1IN-	I	Inverting Input (Channel 1)
3	1IN+	I	Non-inverting Input (Channel 1)
4	V+	-	Positive Power Supply
5	2IN+	I	Non-inverting Input (Channel 2)
6	2IN-	I	Inverting Input (Channel 2)
7	2OUT	O	Channel 2 Output
8	3OUT	O	Channel 3 Output
9	3IN-	I	Inverting Input (Channel 3)
10	3IN+	I	Non-inverting Input (Channel 3)
11	V-	-	Negative Power Supply
12	4IN+	I	Non-inverting Input (Channel 4)
13	4IN-	I	Inverting Input (Channel 4)
14	4OUT	O	Channel 4 Output

Pin	Name	Type	Description
MS324N			
1	1IN+	I	Non-inverting Input (Channel 1)
2	1IN-	I	Inverting Input (Channel 1)
3	1OUT	O	Channel 1 Output
4	V+	-	Positive Power Supply
5	V-	-	Negative Power Supply
6	2OUT	O	Channel 2 Output
7	2IN-	I	Inverting Input (Channel 2)
8	2IN+	I	Non-inverting Input (Channel 2)
9	3IN+	I	Non-inverting Input (Channel 3)
10	3IN-	I	Inverting Input (Channel 3)
11	3OUT	O	Channel 3 Output
12	V+	-	Positive Power Supply
13	V-	-	Negative Power Supply
14	4OUT	O	Channel 4 Output
15	4IN-	I	Inverting Input (Channel 4)
16	4IN+	I	Non-inverting Input (Channel 4)

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	Ratings	Unit
Differential Input Voltage	± Power Supply	
Input Current (V_{IN} < -0.3V)	50	mA
Power Supply (V+ - V-)	40	V
Input Voltage	-0.3 ~ 40	V
Junction Temperature	150	°C
Operating Temperature	-40 ~ 125	°C
Soldering Temperature (10s)	260	°C
Storage Temperature (T_{STG})	-65 ~ 150	°C

ELECTRICAL CHARACTERISTICS

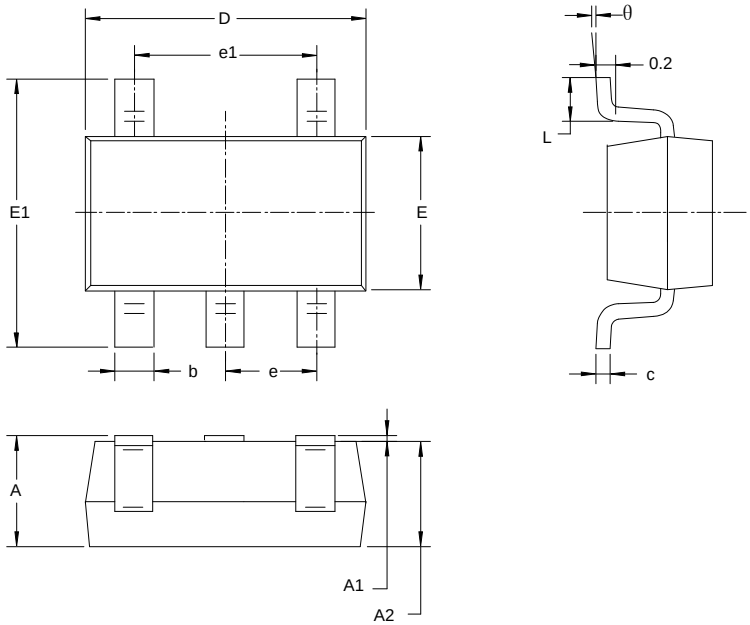
Unless otherwise noted, T_A=25°C, V+=5V, V-=0V, V_O=1.4V.

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Input Characteristics						
Input Offset Voltage	V_{OS}	T_A=25°C		2	7	mV
		-40°C ≤ T_A ≤125°C			9	
Input Bias Current	I_B	T_A=25°C		30	250	nA
		-40°C ≤ T_A ≤125°C			500	
Input Offset Current	I_{OS}	T_A=25°C		5	50	nA
		-40°C ≤ T_A ≤ 125°C			150	
Input Common-mode Voltage	V_{CM}	V+=30V, CMRR>=50dB	0		(V+)-1.5	V
		V+=30V, CMRR>=50dB			(V+)- 2	
Common-mode Rejection Ratio	CMRR	R_S≤10kΩ	65	85		dB
Large Signal Gain	A_{VO}	V+=15V, R_L=2kΩ, V_O=1.4V~11.4V	88	100		dB
		V+=15V, R_L=2kΩ, V_O=1.4V ~11.4V -40°C ≤ T_J≤ 125°C	83			
Output Characteristics						
Output Voltage	V_{OH}	V+=30V, R_L=2kΩ, -40°C ≤ T_J≤ 125°C	26			V
		V+=30V, R_L=10kΩ -40°C ≤ T_J≤ 125°C	27	28		
	V_{OL}	V+=5V, R_L=10kΩ -40°C ≤ T_J ≤ 125°C		5	20	mV
Output Current Source	I_{SOURCE}	V_{ID}=+1V, V+=15V, V_O=2V	20	30		mA
		V_{ID}=+1V, V+=15V, V_O=2V -40°C ≤ T_J ≤ 125°C	10	20		
Output Current Sink	I_{SINK}	V_{ID}=-1V, V+=15V, V_O=2V	5	8		mA
		V_{ID}=-1V, V+=15V, V_O=2V -40°C ≤ T_J≤ 125°C	3	6		
		V_{ID}=-1V, V+=15V, V_O=0.2V	12	100		μA
Output Short-circuit Current	I_O	V+=15V		30	85	mA

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Power Dissipation						
Power Supply Rejection Ratio	PSRR	R_S ≤10kΩ, V+ ≤5V~30V	65	100		dB
Quiescent Current/Amplifier	I_Q	V+=5V		0.430	1.15	mA
		V+=5V, -40°C ≤ T_J ≤ 125°C		0.7	1.2	
		V+=30V		0.660	2.85	
		V+=30V, -40°C ≤ T_J ≤ 125°C		1.5	3	
Dynamic Characteristics						
Gain Bandwidth Product	GBW	T_A=25°C, V+=30V, f=100kHz V_{IN}=10mV, R_L=2kΩ, C_L=100pF		1		MHz
		T_A=125°C, V+=30V, f=100kHz V_{IN}=10mV, R_L=2kΩ, C_L=100pF		0.7		
Slew Rate	SR	V+=15V, R_L=2kΩ, V_{IN}=0.5V~3V C_L=100pF, Unit Gain		0.4		V/μs
Phase Margin	Z			60		Degrees
Others						
Voltage Noise Density	en	f=1kHz, R_S=100Ω, V+=30V		60		$nV/\sqrt{Hz}$
Total Harmonic Distortion	THD	f=1kHz, A_V=20dB, R_L=2kΩ V_O=2VPP, C_L=100pF, V+=30V		0.015		%

PACKAGE OUTLINE DIMENSIONS

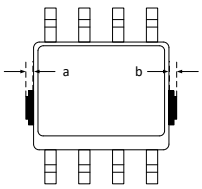
SOT23-5



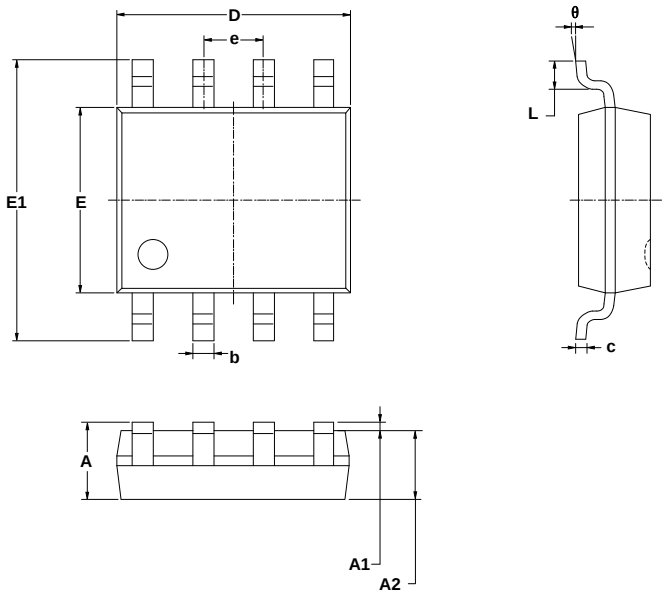
Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 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.

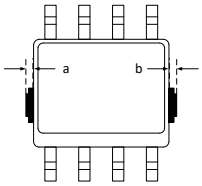


SOP8

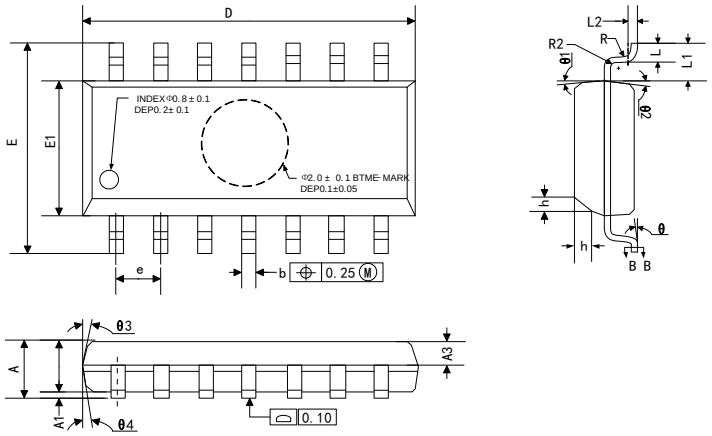


Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050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

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



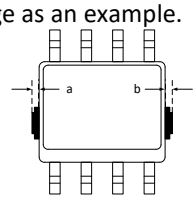
SOP14



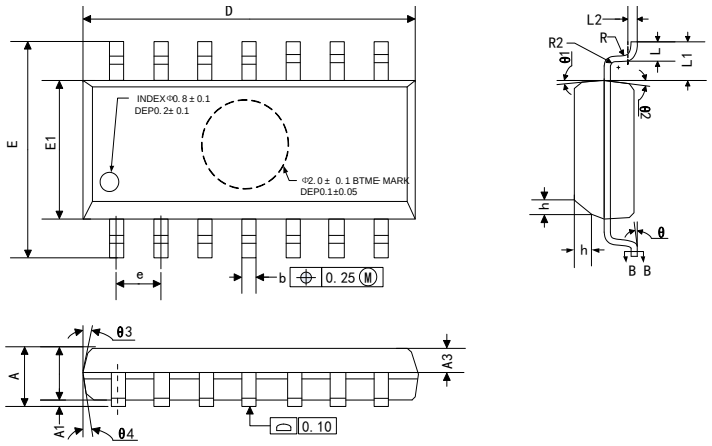
Symbol	Dimensions in Millimeters		
	Min	Typ	Max
A	1.35		1.75
A1	0.10		0.25
A2	1.25		1.65
A3	0.55		0.75
D	8.53		8.73
E	5.80		6.20
E1	3.80		4.00
e	1.27 BSC		
L	0.45		0.80
L1	1.04 REF		
L2	0.25 BSC		
R	0.07		
R1	0.07		
h	0.30		0.50
θ	0 º		8 º
θ1	6 º	8º	10 º
θ2	6 º	8º	10 º
θ3	5 º	7º	9 º
θ4	5 º	7º	9 º

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.



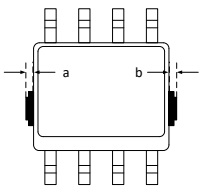
TSSOP14



Symbol	Dimensions in Millimeters		
	Min	Typ	Max
A			1.20
A1	0.05		0.15
A2	0.90	1.00	1.05
A3	0.39	0.44	0.49
b	0.20		0.30
b1	0.19	0.22	0.25
c	0.13		0.19
c1	0.12	0.13	0.14
D	4.86	4.96	5.06
E1	4.30	4.40	4.50
E	6.20	6.40	6.60
e	0.65BSC		
L	0.45		0.75
L1	1.00BSC		
θ	0		8°
L/F Carrier Size(mil)	79×79		90×110
	118×153		

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 SPECIFICATIONS

1. Marking Drawing Description

Product Name : 321, MS358, MS324, MS324T, MS324N

Product Code: XXXX, XXXXXX

2. Marking Drawing Demand

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

3. Packaging Specifications

Device	Package	Piece/Tray	Tray/Box	Piece /Box	Box/Carton	Piece/Carton
MS321	SOT23-5	3000	10	30000	4	120000
MS358	SOP8	2500	1	2500	8	20000
MS324	SOP14	2500	1	2500	8	20000
MS324T	TSSOP14	3000	1	3000	8	24000
MS324N	QFN16	4000	1	4000	8	32000

STATEMENT

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  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.