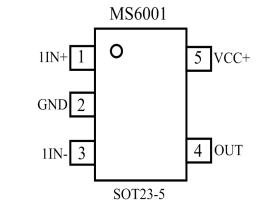
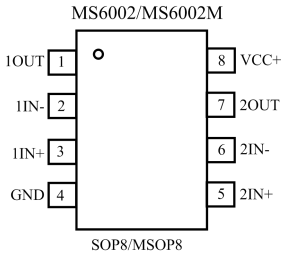
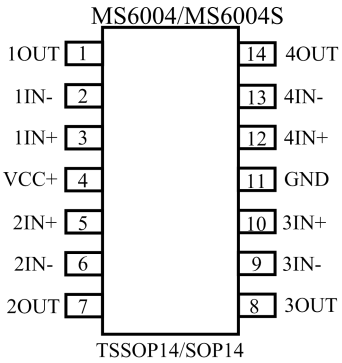
Low Supply,Rail-to-Rail Input/Output Amplifiers

PRODUCT DESCRIPTION

MS6001/2/4 are single , dule, and quad rail-to-rail input and output amplifiers. The amplifiers ‘s bandwidth is 1.2MHz(at VCC=5V), and phase margin is 65°. The Supply Voltage Range is 1.8V to 5.0V. MS6001 is available in SOT23-5 package, MS6002 is available in SOP8 and MSOP8 packages, MS6004 is available in TSSOP14 package,MS6004S is available in SOP14 package.







FEATURES

- supply voltage range :1.8V to 5.0V
- operating temperature range :- 40℃ to 125℃
- supply current:40uA/Amp(1.8V)
- phase margin:65°
- rail-to-rail input and output
- single , dule, and quad packages
- High ESD protect

  -HBM:5000V

APPLICATIONS

- AUTO
- Portable Equipment
- Piezo Electrical Amplifier
- Active Filters
- Medical Equipment
- Battery Powered Systems

PACKAGE/ORDERING INFORMATION

Product	Package	Mark
MS6001	SOT23-5	6001S
MS6002	SOP8	MS6002
MS6002M	MSOP8	MS6002M
MS6004	TSSOP14	MS6004
MS6004S	SOP14	MS6004S

ABSOLUTE MAXIMUM RATINGS

Stresses below those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions below those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Parameter	Range	UNIT
Supply Voltage	6(max)	V
Differential Input Voltage	±6	V
Input Voltage	-0.3～6	V
Storage Temperature Range	−65 to +150	℃
Operating Temperature Range	−40 to +125	℃
Junction Temperature Range	−65 to +150	℃

Electrical Characteristics(5V)

(VCC+ = 5 V, VCM = 2.5V, TA = 25℃, unless otherwise noted.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}	$-0.3V < V_{CM} < +5.3V$		1	3	mV
		$-40°C \le T_A \le 125°C$			3	
Input Bias Current	I_B			0.2	10	pA
		$-40°C \le T_A \le +85°C$			110	pA
		$-40°C \le T_A \le 125°C$			780	pA
Input Offset Current	I_{OS}			0.1	0.5	pA
		$-40°C \le T_A \le +85°C$			50	pA
		$-40°C \le T_A \le 125°C$			250	pA
Common-Mode Rejection Ratio	$CMRR$	$0V < V_{CM} < 5V$		75		dB
		$-40°C \le T_A \le 125°C$	68			
Large Signal Voltage Gain	A_{VO}	$R_L = 10k\Omega, V_0 = 0.5V \sim 4.5V$	85	90		dB
Offset Voltage Drift	$\Delta V_{OS} / \Delta_T$	$-40°C \le T_A \le 125°C$		5	10	μV/℃
Input Capacitance	C_{DIFF}			1.9		pF
	C_{CM}			2.5		pF
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	$I_L = 1mA$	4.95	4.98		V
		$-40°C \le T_A \le 125°C$	4.9			
		$I_L = 10mA$		4.7		V
		$-40°C \le T_A \le 125°C$	4.50			
Output Voltage Low	V_{OL}	$I_L = 1mA$		20	30	mV
		$-40°C \le T_A \le 125°C$			50	
		$I_L = 10mA$		190	275	mV
		$-40°C \le T_A \le 125°C$			335	
Short-Circuit Current	I_{SC}			±70		mA

Closed-Loop Output Impedance	Z_{OUT}	$f=10kHz, A_v=1$		15		Ω
POWER SUPPLY						
Power Supply Rejection Ratio	$PSRR$	$2.2V < V_{CM} < 5V$	67	80		dB
		$-40°C \le T_A \le 125°C$	64			dB
Supply Current/Amplifier	I_{SY}	$V_0 = V_{CC}/2$		110		μA
		$-40°C \le T_A \le 125°C$			120	
DYNAMIC PERFORMANCE						
Gain Bandwidth Product	GBP	$R_L=100k\Omega$		1.2		MHz
		$R_L=10k\Omega$		1		MHz
Slew Rate	SR	$R_L=10k\Omega$		0.4		$V/\mu s$
Settling Time 0.1%	t_s	$G=\pm1,2Vstep$ $C_L=20pF, R_L=1k\Omega$		23		us
Phase Margin	Φ_O	$R_L=100k\Omega, R_L=10k\Omega,$ $C_L=20pF$		65		Deg
NOISE PERFORMANCE						
Peak-to-Peak Noise				2.3	3.5	uV
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)

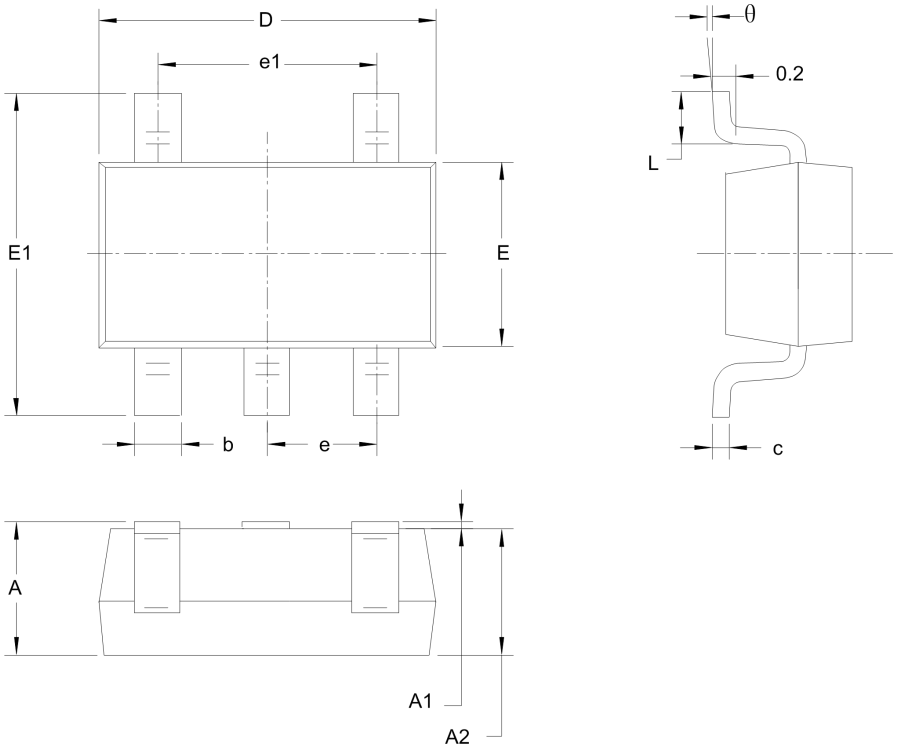
(VCC+ = 1.8 V, VCM = 0.9V, TA = 25℃, unless otherwise noted.)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}	$-0.3V < V_{CM} < +1.9V$		1	3	mV
		$-40°C \le T_A \le 125°C$			3	
Input Bias Current	I_B			0.2	10	pA
		$-40°C \le T_A \le +85°C$			110	pA
		$-40°C \le T_A \le 125°C$			780	pA
Input Offset Current	I_{OS}			1	5	pA
		$-40°C \le T_A \le +85°C$			50	pA
		$-40°C \le T_A \le 125°C$			250	pA
Common-Mode Rejection Ratio	$CMRR$	$0V < V_{CM} < 1.8V$	58	75		dB
		$-40°C \le T_A \le 125°C$	55			
Large Signal Voltage Gain	A_{VO}	$R_L = 10k\Omega, V_0 = 0.5V \sim 1.3V$	85	90		dB
Offset Voltage Drift	$\Delta V_{OS} / \Delta_T$	$-40°C \le T_A \le 125°C$		5	10	μV/℃
Input Capacitance	C_{DIFF}			2.1		pF
	C_{CM}			3.8		pF
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	$I_L = 1mA$	1.65	1.73		V
		$-40°C \le T_A \le 125°C$	1.6			
Output Voltage Low	V_{OL}	$I_L = 1mA$		44	60	mV
		$-40°C \le T_A \le 125°C$			80	
Short-Circuit Current	I_{SC}			±70		mA
Closed-Loop Output Impedance	Z_{OUT}	$f = 10kHz, A_v = 1$		15		Ω

POWER SUPPLY						
Power Supply Rejection Ratio	$PSRR$	$1.8V < V_{CM} < 5V$	67	90		dB
		$-40°C \le T_A \le 125°C$	64			dB
Supply Current/Amplifier	I_{SY}	$V_0 = V_S / 2$		40		μA
		$-40°C \le T_A \le 125°C$			50	
DYNAMIC PERFORMANCE						
Gain Bandwidth Product	GBP	$R_L = 100k\Omega$		0.4		MHz
		$R_L = 10k\Omega$		0.4		MHz
Slew Rate	SR	$R_L = 10k\Omega$		0.35		$V/\mu s$
Settling Time 0.1%	t_s	$G = \pm 1,2Vstep$ $C_L = 20pF, R_L = 1k\Omega$		6.5		us
Phase Margin	Φ_O	$R_L = 100k\Omega, R_L = 10k\Omega,$ $C_L = 20pF$		65		Deg
NOISE PERFORMANCE						
Peak-to-Peak Noise				2.3	3.5	uV
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		$pA/\sqrt{Hz}$

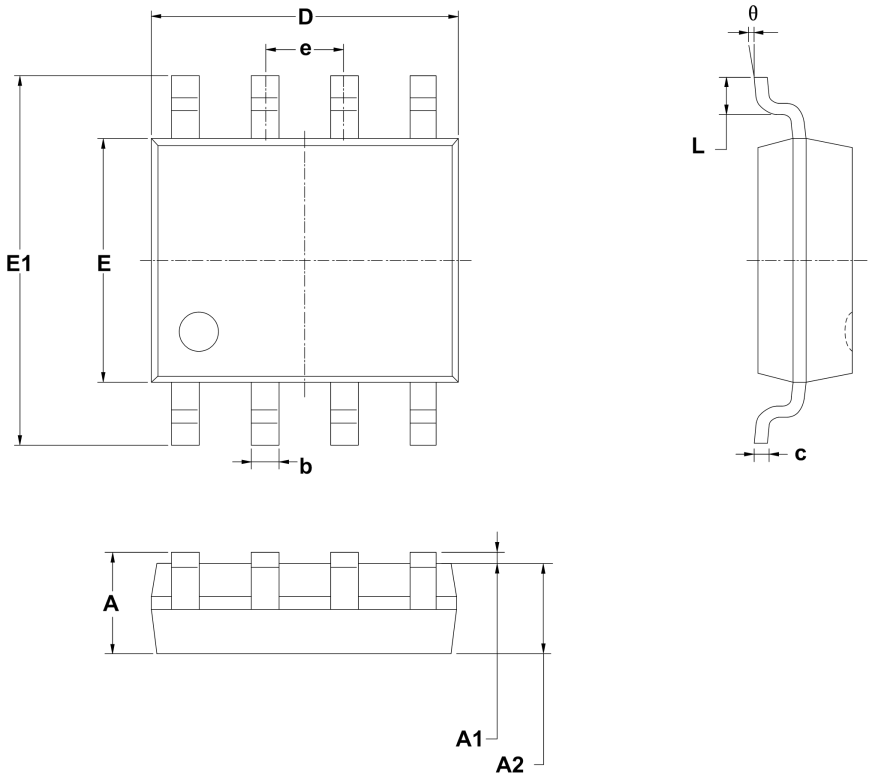
PACKAGE OUTLINE DIMENSIONS

SOT23-5:



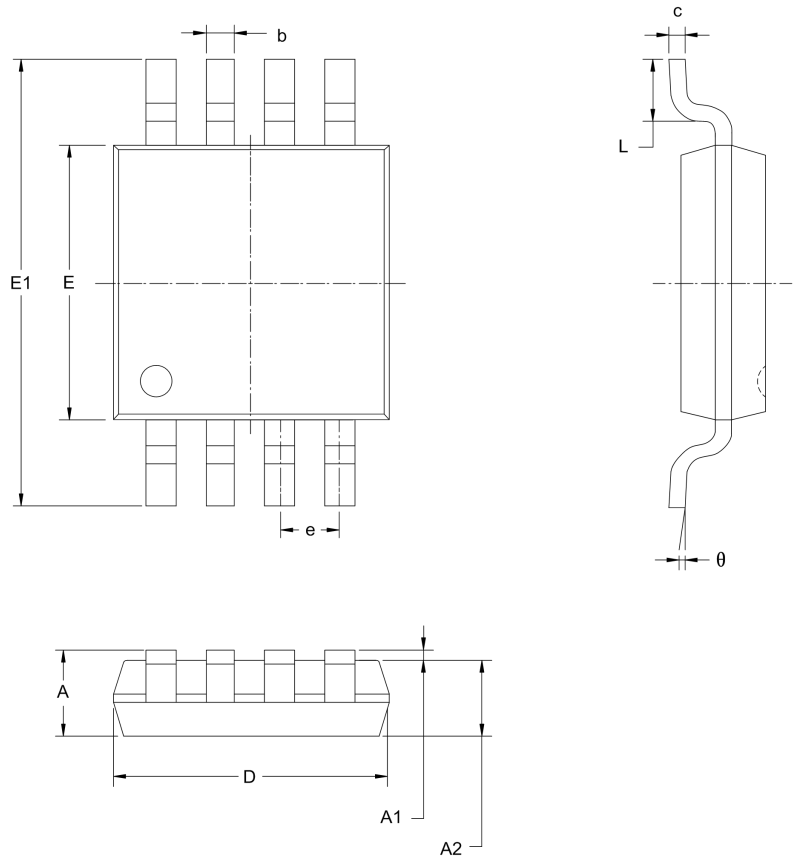
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037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

SOP8:



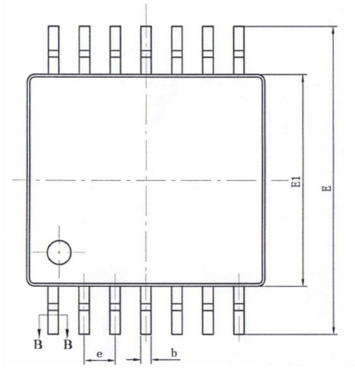
Symbol	Dimensions In Millimeters		
	Min	Nom	Max
A	--	--	1.75
A1	0.10	--	0.225
A2	1.30	1.40	1.50
b	0.39	--	0.47
c	0.20	--	0.24
D	4.80	4.90	5.00
E	3.80	3.90	4.00
E1	5.80	6.00	6.20
e	1.27BSC		
L	0.50	--	0.80
θ	0	--	8º

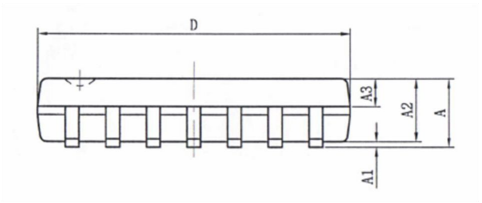
MSOP8:

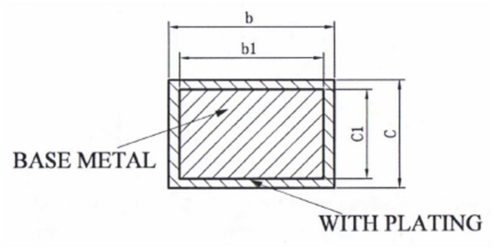


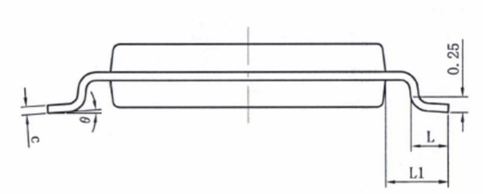
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650BSC		0.026BSC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

TSSOP14:



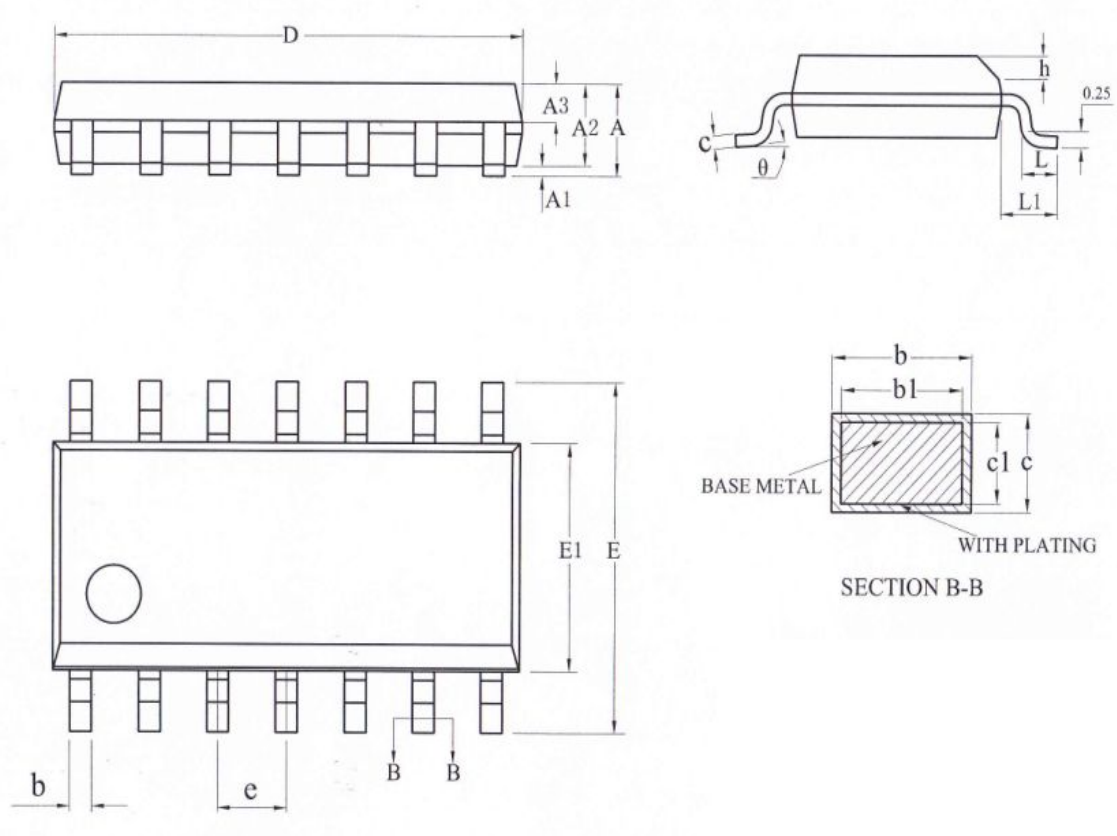






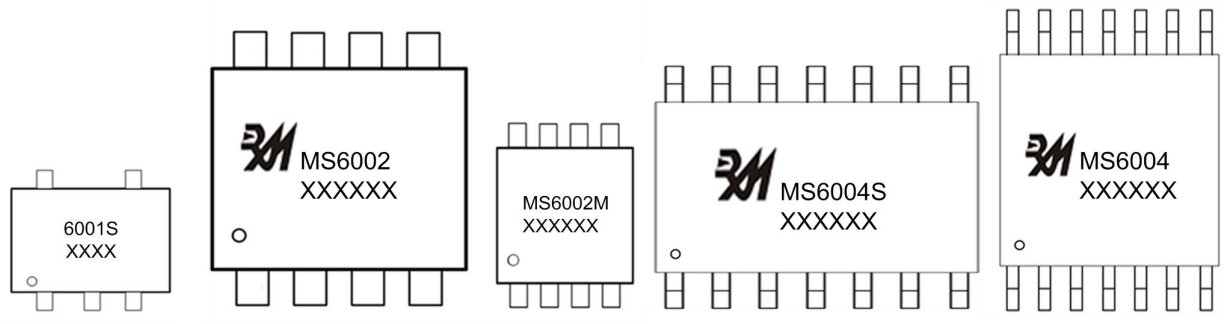
Symbol	Dimensions In Millimeters		
	Min	Nom	Max
A			1.20
A1	0.05		0.15
A2	0.90	1.00	1.05
A3	0.39	0.44	0.49
b	0.20		0.30
b1	0.19	0.22	0.25
c	0.13		0.19
c1	0.12	0.13	0.14
D	4.86	4.96	5.06
E1	4.30	4.40	4.50
E	6.20	6.40	6.60
e	0.65BSC		
L	0.45		0.75
L1	1.00BSC		
θ	0		8°

SOP14：



Symbol	Dimensions In Millimeters		
	Min	Nom	Max
A	--	--	1.75
A1	0.05	--	0.25
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.39	--	0.47
b1	0.38	0.41	0.44
c	0.20	--	0.24
c1	0.19	0.20	0.21
D	8.55	8.65	8.75
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27 BSC		
h	0.25	--	0.50
L	0.50	--	0.80
L1	1.05REF		
θ	0 º	--	8 º

Marking and Packaging Specifications



1、Marking drawing description

6001S、MS6002、MS6002M、MS6004S、MS6004：product name

XXXX、XXXXXX：Product code：

2、Marking drawing pattern

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

3、Packaging Specifications

Device	Package	piece/reel	reel/box	piece /box	box/carton	piece/carton
MS6001	SOT23-5	3000	10	30000	4	120000
MS6002	SOP8	2500	1	2500	8	20000
MS6002M	MSOP8	3000	1	3000	8	24000
MS6004	TSSOP14	3000	1	3000	8	24000
MS6004S	SOP14	2500	1	2500	8	20000

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 be used conductor packaging or antistatic materials packaging or transportation.

+86-571-89966911

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

http:// www.relmon.com