

## Low Offset Operational Amplifier

### PRODUCT DESCRIPTION

The OP07 is a low offset voltage operational amplifier, which uses wafer-level trim to eliminate offset and further reduces offset voltage through external circuit. It also has low bias current and high open-loop gain. All of these characteristics make the OP07 suitable to be used as a high-gain instrumentation amplifier.

The OP07 has  $\pm 14V$  wide input voltage range, 106dB common-mode rejection ratio (CMRR) and high input impedance. These features make the amplifier high-precise when amplifying signals. Excellent linearity and precision are guaranteed even at high closed-loop gain. After removal of external offset, the precision and stability of the OP07 make itself become the industry standard for instrument applications.



SOP8



DIP8

### FEATURES

- Low Offset Voltage Drift:  $0.3\mu V/^{\circ}C$
- Low Noise:  $0.35\mu Vp-p$
- Wide Input Voltage Range:  $\pm 14V$  (Typ)
- Wide Power Supply:  $\pm 3V$  to  $\pm 18V$

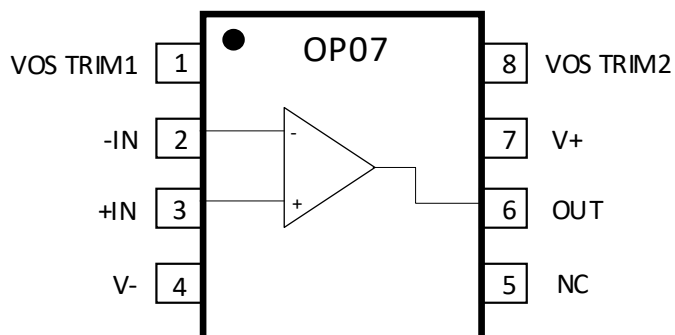
### APPLICATIONS

- Wireless Base Station Control Circuit
- Optical Fiber Network Control Circuit
- Instrumentation Amplifier
- Sensor and Controller
- Thermocouple
- Thermal Resistance Detection
- Strain Bridge
- Parallel Current Detection
- Precision Filter

### PRODUCT SPECIFICATION

Part Number	Package	Marking
OP07	SOP8	OP07
OP07D	DIP8	OP07D

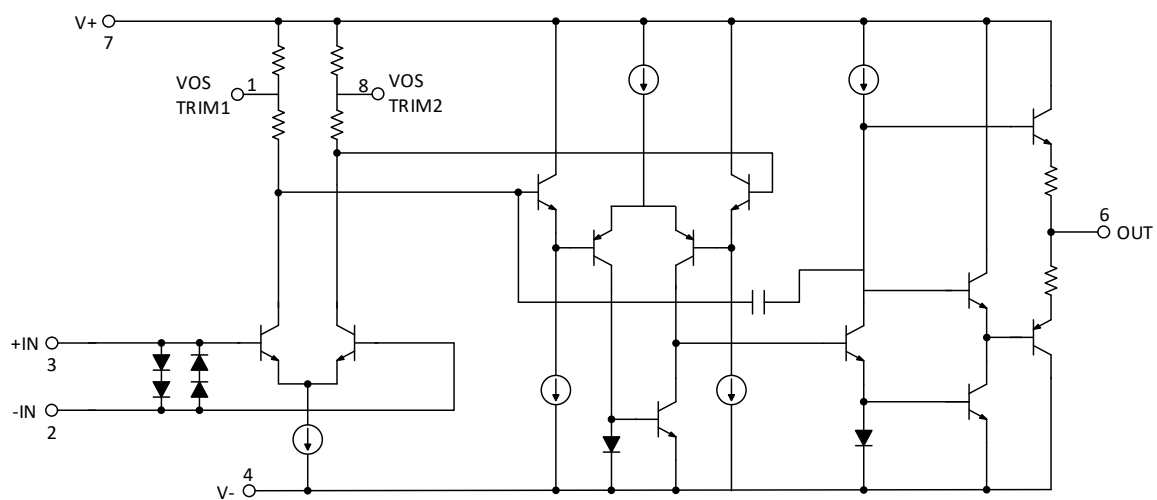
## PIN CONFIGURATION



## PIN DESCRIPTION

Pin	Name	Type	Description
1	VOS TRIM1	IO	Offset Voltage Trim 1
2	-IN	I	Negative Input
3	+IN	I	Positive Input
4	V-	-	Negative Power Supply
5	NC	-	No Connection
6	OUT	O	Output
7	V+	-	Positive Power Supply
8	VOS TRIM2	IO	Offset Voltage Trim 2

## BLOCK DIAGRAM



**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	$V_S$	$\pm 22$	V
Input Voltage <sup>1</sup>	$V_{IN}$	$\pm 22$	V
Differential Input Voltage	$V_{IN}$	$\pm 30$	V
Storage Temperature Range	$T_{STG}$	-65 ~ +150	°C
Operating Temperature Range	$T_A$	-40 ~ +125	°C
Maximum Junction Temperature	$T_{JMAX}$	150	°C
Lead Temperature(10s)		260	°C

Note 1: When power supply is less than  $\pm 22V$ , the absolute maximum value of input voltage is equal to power supply.

## ELECTRICAL CHARACTERISTICS

Unless otherwise noted,  $V_S = \pm 15V$ .

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Input Characteristics						
Input Offset Voltage	V <sub>OS</sub>	T <sub>A</sub> =25°C, Grade A			25	μV
		T <sub>A</sub> =25°C, Grade B			75	
		T <sub>A</sub> =25°C, Grade C			150	
Offset Voltage Long-term Stability	V <sub>OS</sub> /Time			0.3		μV/Month
Input Offset Voltage Drift	ΔV <sub>OS</sub> /ΔT <sub>A</sub>	-0°C ≤ T <sub>A</sub> ≤ +70°C		0.3		μV/°C
Input Bias Current	I <sub>B</sub>			22		nA
Input Offset Current	I <sub>OS</sub>			7		nA
Input Difference-mode Resistance	R <sub>IN</sub>		15	50		MΩ
Input Common-mode Resistance	R <sub>INCM</sub>			160		GΩ
Input Voltage Range	V <sub>CMR</sub>		±13	±14		V
		-0°C ≤ T <sub>A</sub> ≤ +70°C	±13	±13.5		
Common-mode Rejection Ratio	CMRR	V <sub>CM</sub> =±13V	106	123		dB
		-0°C ≤ T <sub>A</sub> ≤ +70°C	103	123		
Large Signal Gain	A <sub>VO</sub>	R <sub>L</sub> ≥2kΩ, V <sub>O</sub> =±10V	106	114		dB
		R <sub>L</sub> ≥500Ω, V <sub>O</sub> =±10V	103	112		
		-0°C ≤ T <sub>A</sub> ≤ +70°C , R <sub>L</sub> ≥2kΩ, V <sub>O</sub> =±10V	105	113		
Output Characteristics						
Output Voltage Magnitude	V <sub>O</sub>	R <sub>L</sub> ≥10kΩ	±12.5	±13.0		V
		R <sub>L</sub> ≥2kΩ	±12.0	±12.8		
		R <sub>L</sub> ≥1kΩ	±10.5	±12.0		
		-0°C ≤ T <sub>A</sub> ≤ +70°C, R <sub>L</sub> ≥2kΩ	±12.0	±12.6		
Output Short-circuit Current	I <sub>SC</sub>			21		mA
Power Supply						
Power Supply Rejection Ratio	PSRR	V <sub>S</sub> =±3V to ±18V	94	106		dB
		-0°C ≤ T <sub>A</sub> ≤ +70°C	90	103		
Quiescent Power Dissipation	P <sub>Q</sub>	V <sub>S</sub> =±15V, No Load		80	120	mW
		V <sub>S</sub> =±3V, No Load		5.5	8	

Parameters	Symbol	Condition	Min	Typ	Max	Unit
<b>Dynamic Characteristics</b>						
Gain Bandwidth Product	GBP	$A_V=1$		1.3		MHz
Slew Rate	SR	$R_L \geq 2k\Omega$		0.3		V/ $\mu$ s
Offset Voltage Adjustment Range		$R_P=20k\Omega$		$\pm 3.6$		mV
<b>Noise Characteristics</b>						
Voltage Noise	$e_{np-p}$	0.1Hz to 10Hz		0.35		$\mu$ Vp-p
Voltage Noise Density	$e_n$	$f_o=10\text{Hz}$		10.3		$nV/\sqrt{\text{Hz}}$
		$f_o=100\text{Hz}$		10.0		
		$f_o=1\text{kHz}$		9.6		
Current Noise	$I_{np-p}$			14		pAp-p
Current Noise Density	$I_n$	$f_o=10\text{Hz}$		0.32		$pA/\sqrt{\text{Hz}}$
		$f_o=100\text{Hz}$		0.14		
		$f_o=1\text{kHz}$		0.12		

## TYPICAL CHARACTERISTICS CURVE

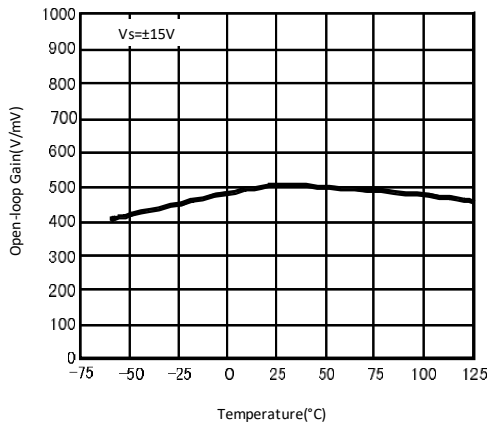


Figure 1. Open-loop Gain VS. Temperature

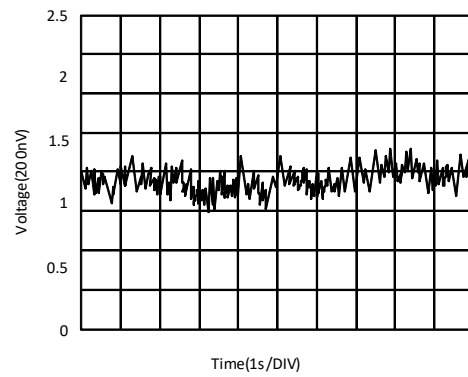


Figure 2. Low-frequency Noise

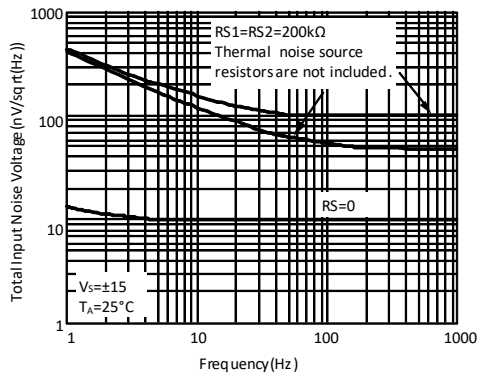


Figure 3. Total Input Noise Voltage VS. Frequency

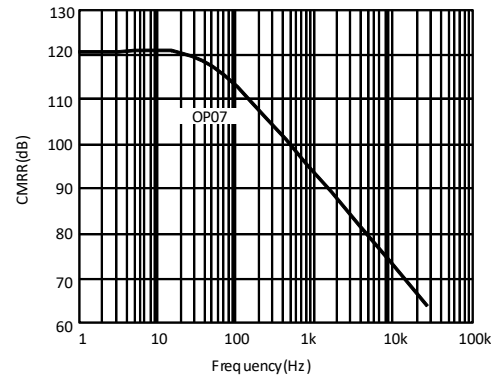


Figure 4. CMRR VS. Frequency

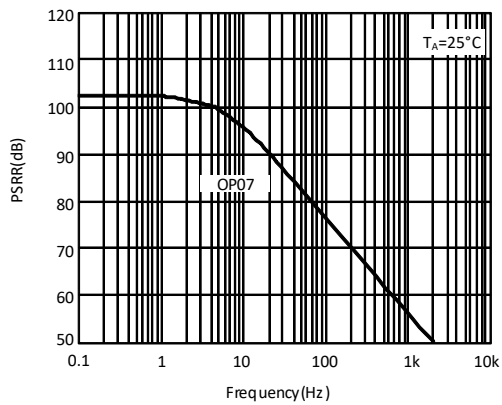


Figure 5. PSRR VS. Frequency

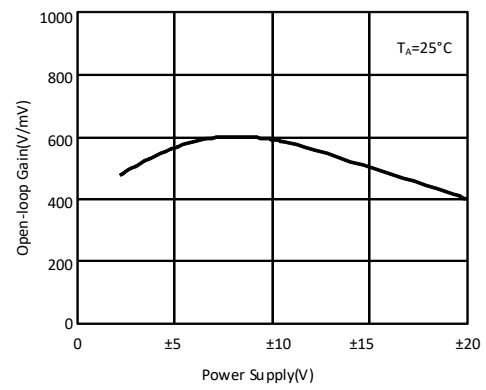


Figure 6. Open-loop Gain VS. Power Supply

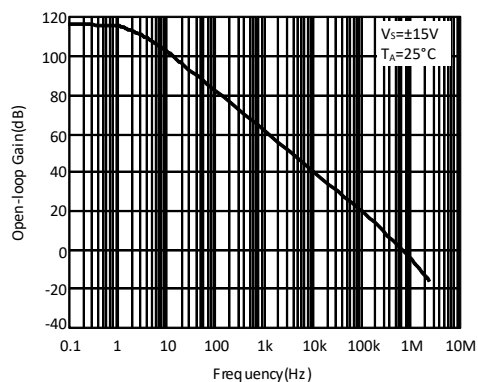


Figure 7. Open-loop Gain Frequency Response

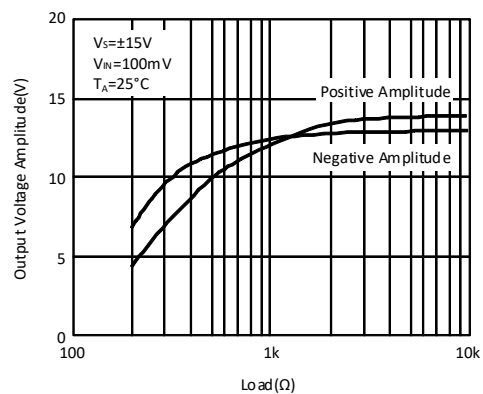


Figure 8. Output Voltage Amplitude VS. Load

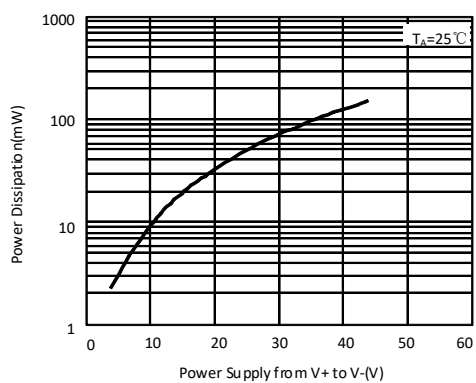


Figure 9. Power Dissipation VS. Power Supply

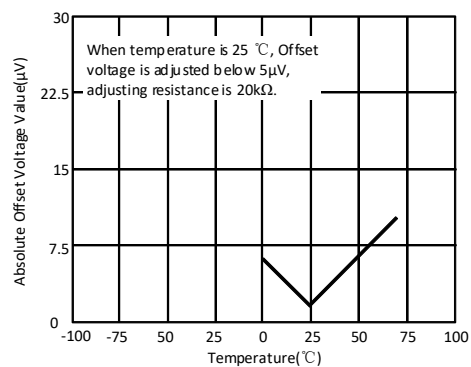


Figure 10. Trimmed Offset Voltage VS. Temperature

## TYPICAL APPLICATION

In case of 500pF load capacitance and  $\pm 10\text{V}$  amplitude, the OP07 can provide stable operating characteristics. And large load capacitance needs to be isolated by  $50\Omega$  resistance.

The stray difference-temperature voltage generated by different metals in touch with the input terminals can deteriorate the drift performance. Therefore, the best operating environment is to keep the two inputs contact at the same temperature. It is better to approach the package temperature.

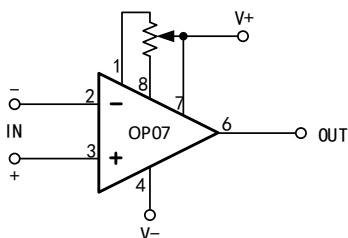


Figure 11. Optical Offset Elimination Circuit

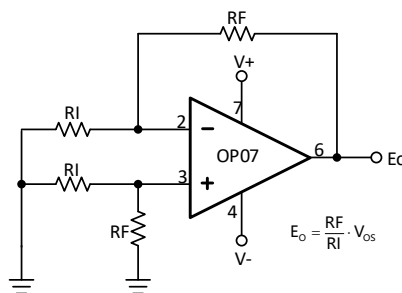


Figure 12. Typical Offset Voltage Measurement Circuit

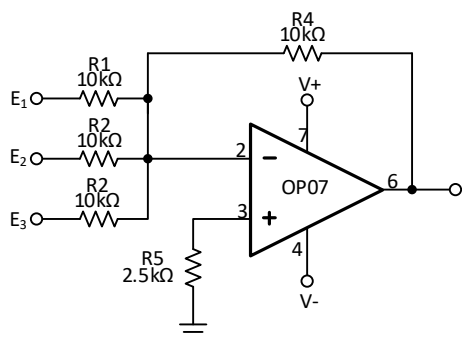


Figure 13. Precise Summing Circuit

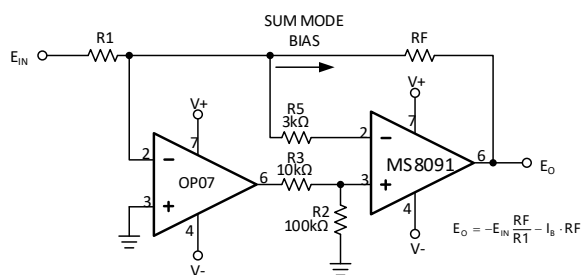


Figure 14. High-speed, Low Offset Compound Amplifier

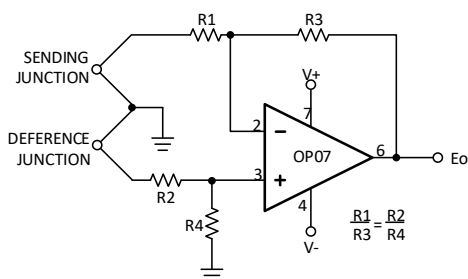


Figure 15. High-Stable Thermocouple Amplifier

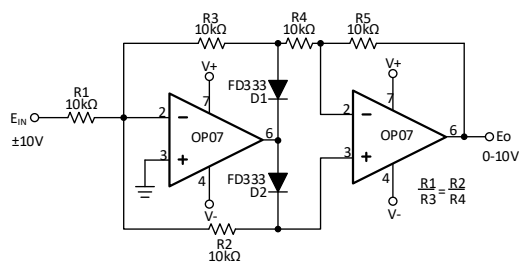
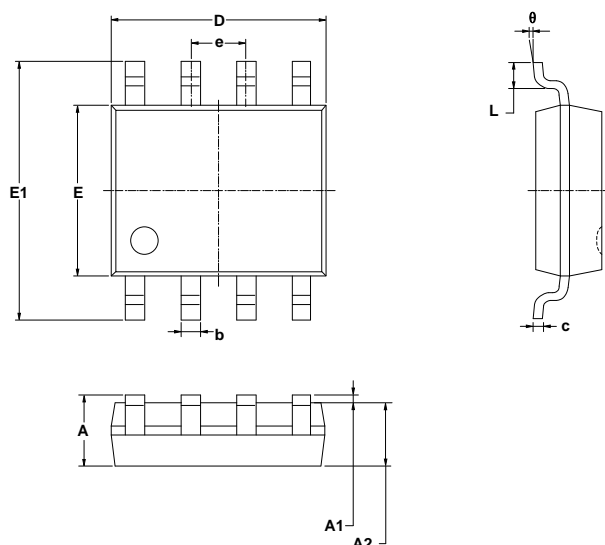


Figure 16. Precise Absolute Value Circuit

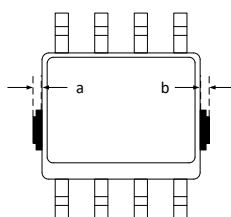
# PACKAGE OUTLINE DIMENSIONS

## SOP8

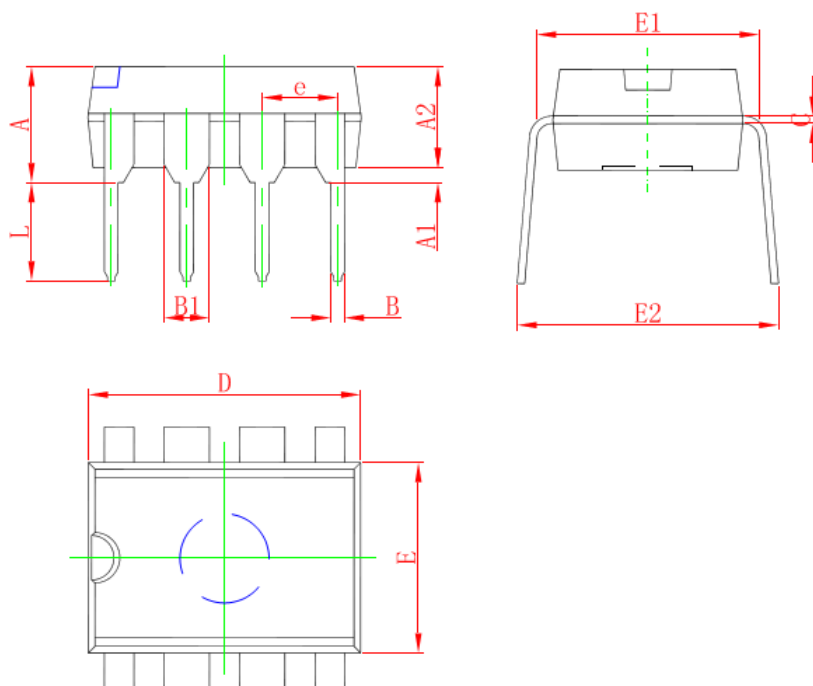


Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27(BSC)		0.050(BSC)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

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



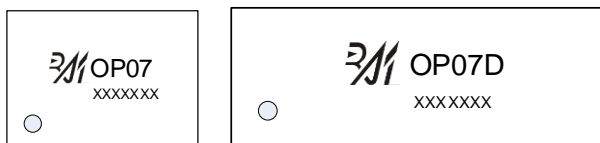
DIP8



Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	3.710	4.310	0.146	0.170
A1	0.510		0.020	
A2	3.200	3.600	0.126	0.142
B	0.380	0.570	0.015	0.022
B1	1.524(BSC)		0.060(BSC)	
C	0.204	0.360	0.008	0.014
D	9.000	9.400	0.354	0.370
E	6.200	6.600	0.244	0.260
E1	7.320	7.920	0.288	0.312
e	2.540(BSC)		0.100(BSC)	
L	3.000	3.600	0.118	0.142
E2	8.400	9.000	0.331	0.354

## MARKING and PACKAGING SPECIFICATION

### 1. Marking Drawing Description



Product Name: OP07, OP07D

Product Code: 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
OP07	SOP8	2500	1	2500	8	20000

Device	Package	Piece/Tube	Tube/Box	Piece/Box	Box/Carton	Piece/Carton
OP07D	DIP8	50	40	2000	10	20000

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**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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