



灵星芯微 芯片经营

深圳市灵星芯微电子科技有限公司

Shenzhen Lingxing Microelectronics Technology Co., Ltd.

Tab: 835-12-B5

LM224/LM324(LX) Quad Operational Amplifiers

Product Specification

Specification Revision History:

Version	Date	Description
2022-03	2022-03	New
2023-02-B1	2023-02	Replace the template
2023-06-B2	2023-06	Modify parameters
2024-08-B3	2024-08	Modify parameters



Contents

1、 General Description.....	1
2、 Block Diagram And Pin Description	3
2.1、 Block Diagram	3
2.2、 Pin Configurations.....	3
2.3、 Pin Description	4
3、 Electrical Parameter	4
3.1、 Absolute Maximum Ratings.....	4
3.2、 Recommended Operating Conditions.....	4
3.3、 Electrical Characteristics	5
3.3.1、 DC Characteristics	5
4、 Testing Circuit	6
5、 Typical Application Circuit And Application Note.....	6
5.1 Application Circuit.....	6
6、 Package Information	7
6.1、 DIP14	7
6.2、 SOP14	8
6.3、 TSSOP14.....	9
7、 Statements And Notes	10
7.1、 The name and content of Hazardous substances or Elements in the product.....	10
7.2、 Notes	10



灵星芯微 精密经营

1、General Description

LM224/LM324 consists of four independent high-gain frequency-compensated operational amplifiers that are appropriate for not only single power supplies with a wide voltage range but also dual power mode. Under recommended conditions, the supply current is independent of the supply voltage. Applications include sensing amplifier, audio amplifier, industrial control, DC amplification blocks and all the occasions using the conventional operational amplifiers.

Features:

- Wide Supply Ranges
Single Supply: 3V to 36V
Dual Supplies: $\pm 1.5\text{V}$ to $\pm 18\text{V}$
- Low Supply-Current Drain Independent of Supply Voltage: 0.8mA Typical
- Wide Unit Gain Bandwidth: 1.2MHz
- Built-in Frequency Compensation
- Low Input Bias and Offset Parameters
Input Offset Voltage: 3mV Typical
Input Offset Current: 2nA Typical
Input Bias Current: 20nA Typical
- Differential Input Voltage Range Equal to Maximum-Rated Supply Voltage: $\pm 36\text{V}$
- Open-Loop Differential Voltage Amplification: 100VdB Typical
- Packing Form: DIP14/SOP14/TSSOP14



灵星芯微 精密封装

Ordering Information:**Tube packing specifications:**

Part number	Packaging form	Marking code	Tube quantity	Boxed tube quantity	Boxed quantity	Notes
LM224DR(LX)	SOP14	LM224	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
LM324DR(LX)		LM324				
LM224N(LX)	DIP14	LM224N	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
LM324N(LX)		LM324N				
LM324PW(LX)	TSSOP14	LM324	96 PCS/tube	200 tube/box	19200 PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing: 0.65mm

Reel packing specifications:

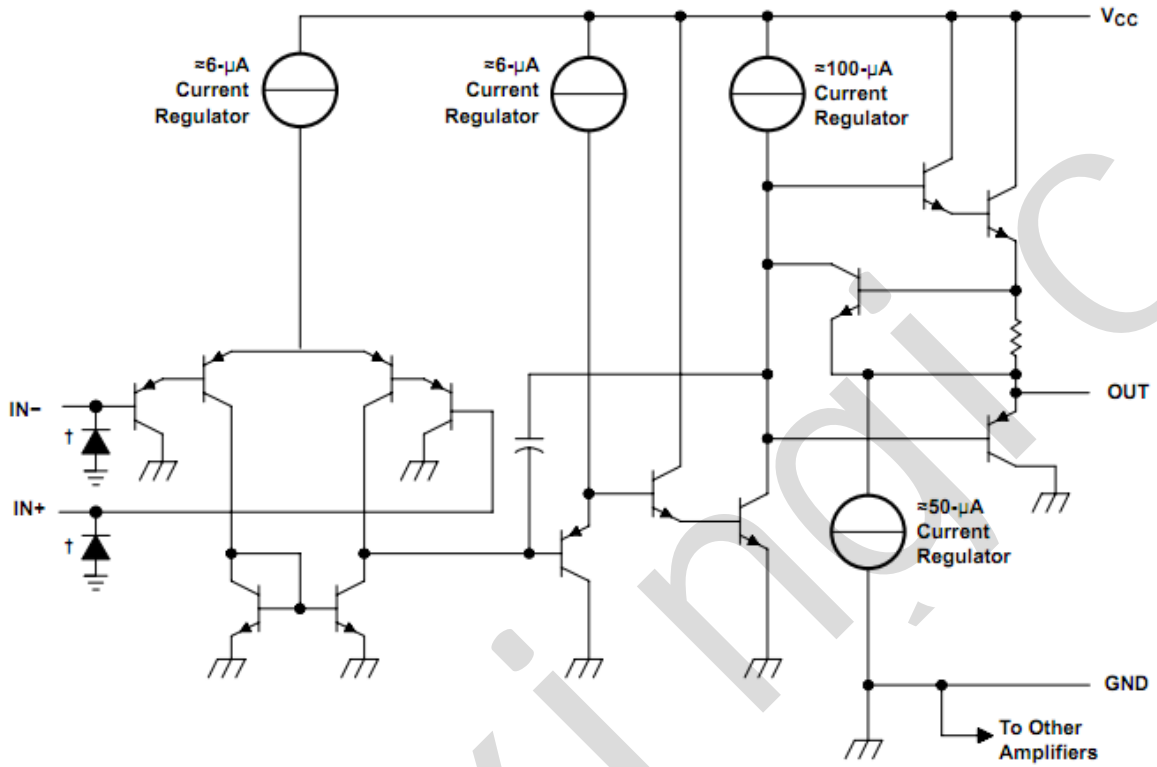
Part number	Packaging form	Marking code	Reel quantity	Boxed reel quantity	Notes
LM224DR(LX)	SOP14	LM224	4000PCS/reel	8000PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
LM324DR(LX)		LM324			
LM324PW(LX)	TSSOP14	LM324	5000PCS/reel	10000PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing: 0.65mm

Note: If the physical information is inconsistent with the ordering information, please refer to the actual product.

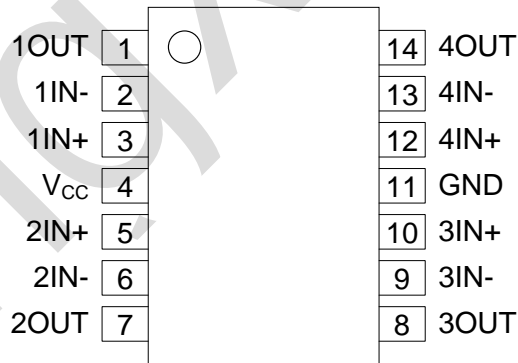


2、Block Diagram And Pin Description

2.1、Block Diagram



2.2、Pin Configurations





2.3、Pin Description

Pin No.	Pin Name	Description
1	1OUT	Channel 1 Output
2	1IN-	Channel 1 Negative input
3	1IN+	Channel 1 Positive input
4	V _{CC}	Power supply
5	2IN+	Channel 2 Positive input
6	2IN-	Channel 2 Negative input
7	2OUT	Channel 2 Output
8	3OUT	Channel 3 Output
9	3IN-	Channel 3 Negative input
10	3IN+	Channel 3 Positive input
11	GND	Ground
12	4IN+	Channel 4 Positive input
13	4IN-	Channel 4 Negative input
14	4OUT	Channel 4 Output

3、Electrical Parameter

3.1、Absolute Maximum Ratings

(T_{amb}=25℃, unless otherwise specified)

Characteristic	Symbol	Conditions	Value	Unit	
Supply Voltage	V _{CC}	-	40 or ±20	V	
Differential Input Voltage	V _{ID}	-	±40	V	
Input Voltage	V _I	-	-0.3~40	V	
Thermal Resistance	DIP14	θ _{JA}	88	℃/W	
	SOP14		131		
	TSSOP14		175		
Operating Junction Temperature	T _J	-	150	℃	
Storage Temperature	T _{stg}	-	-65~150	℃	
Soldering Temperature	T _L	10s	DIP	245	℃
			SOP/TSSOP	260	

3.2、Recommended Operating Conditions

Characteristic	Symbol	Conditions	Value	Unit	Characteristic	
Supply Voltage	V _{CC}	-	3	36	V	
Common-mode Voltage	V _{CM}	-	0	V _{CC} -2	V	
Operating Temperature Range	T _{amb}	-	LM224	-40	125	℃
			LM324	-40	85	



3.3、Electrical Characteristics

3.3.1、DC Characteristics

($V_{CC}=5V$, $T_{amb}=25^{\circ}C$, unless otherwise specified)

Characteristic	Symbol	Conditions	T_{amb}	Specification Parameters						Unit	
				LM224			LM324				
				最小	典型	最大	最小	典型	最大		
Input Offset Voltage	V_{IO}	$V_{CC}=5\sim 36V$, $V_{IC}=V_{ICR(min)}$, $V_O=1.4V$	$25^{\circ}C$	-	3	5	-	3	7	mV	
			Full range	-	-	7	-	-	9		
Input Offset Current	I_{IO}	$V_O=1.4V$	$25^{\circ}C$	-	2	30	-	2	50	nA	
			Full range	-	-	100	-	-	150		
Input Bias Current	I_{IB}	$V_O=1.4V$	$25^{\circ}C$	-	-20	-150	-	-20	-250	nA	
			Full range	-	-	-300	-	-	-500		
Common-mode Input Voltage Range	V_{ICR}	$V_{CC}=5\sim 36V$	$25^{\circ}C$	0~ $V_{CC}-1.5$	-	-	0~ $V_{CC}-1.5$	-	-	V	
			Full range	0~ $V_{CC}-2$	-	-	0~ $V_{CC}-2$	-	-		
High-level Output Voltage	V_{OH}	$V_{CC}=30V$	$RL=2k\Omega$	$25^{\circ}C$	3.5	-	-	3.5	-	V	
			$RL=2k\Omega$	Full range	26	-	-	26	-		-
				$RL\geq 10k\Omega$	Full range	27	28	-	27		28
Low-level Output Voltage	V_{OL}	$RL\leq 10k\Omega$	Full range	-	5	20	-	5	20	mV	
Large-signal Differential Voltage Amplification	A_{VD}	$V_{CC}=15V$, $V_O=1V\sim 11V$, $RL\geq 2k\Omega$	$25^{\circ}C$	50	100	-	25	100	-	V/mV	
			Full range	25	-	-	15	-	-		
Common-mode Rejection Ratio	CMRR	$V_{CC}=5\sim 36V$, $V_{IC}=V_{ICR(min)}$	$25^{\circ}C$	70	80	-	65	100	-	dB	
Supply-Voltage Rejection Ratio	PSRR	$V_{CC}=5\sim 36V$	$25^{\circ}C$	65	100	-	65	100	-	dB	
Crosstalk Attenuation	V_{O1}/V_{O2}	$f=1kHz\sim 20kHz$	$25^{\circ}C$	-	120	-	-	120	-	dB	
Output Current	I_O	$V_{CC}=15V$, $V_{ID}=1V$, $V_O=0$	Source	$25^{\circ}C$	-20	-30	-60	-20	-30	-60	mA
			Full range	-10	-	-	-10	-	-		
		Sink	$V_{CC}=15V$, $V_{ID}=-1V$, $V_O=15V$	$25^{\circ}C$	10	20	-	10	20	-	
			Full range	5	-	-	5	-	-		
		$V_{ID}=-1V$, $V_O=200mV$	$25^{\circ}C$	12	30	-	12	30	-	uA	
Short-circuit Output Current	I_{OS}	$V_{CC}=5V$, $V_O=0V$, $GND=-5V$	$25^{\circ}C$	-	± 40	± 60	-	± 40	± 60	mA	
Supply Current	I_{CC}	$V_O=2.5V$, No Load	Full range	-	0.8	1.2	-	0.8	1.2	mA	
		$V_{CC}=36V$, $V_O=0.5V_{CC}$, No Load	Full range	-	1.4	3.5	-	1.4	3.5		
Slew Rate	SR	$V_{CC}=\pm 18V$,	Full	-	0.5	-	-	0.5	-	V/us	



		$R_L=1M\Omega$, $C_L=30pF$, $V_I=\pm 10V$, 图 1	range							
Unity-gain Bandwidth	GBP	$V_{CC}=\pm 18V$, $R_L=1M\Omega$, $C_L=20pF$, 图 1	Full range	-	1.2	-	-	1.2	-	MHz
Equivalent Input Noise Voltage	e_N	$V_{CC}=\pm 18V$, $R_s=100\Omega$, $f=1kHz$, $V_I=0V$, 图 2	Full range	-	35	-	-	35	-	nV/√Hz

4、Testing Circuit

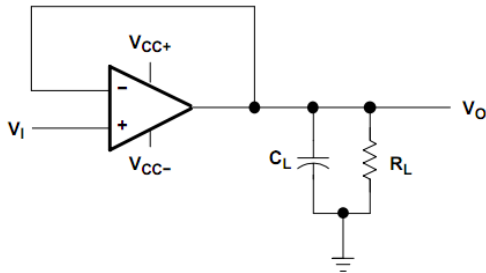


Figure 1: Unity-Gain Amplifier

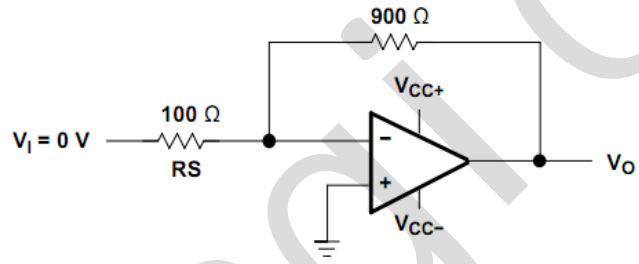
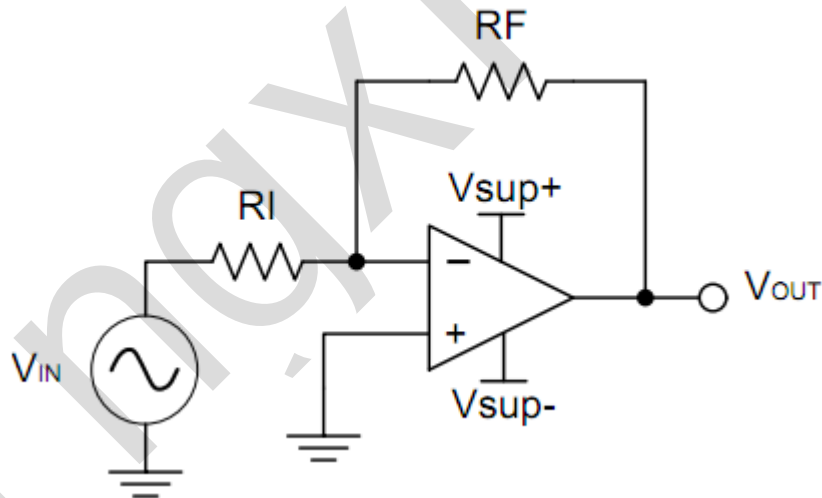


Figure 2: Noise-Test Circuit

5、Typical Application Circuit And Application Note

5.1 Application Circuit



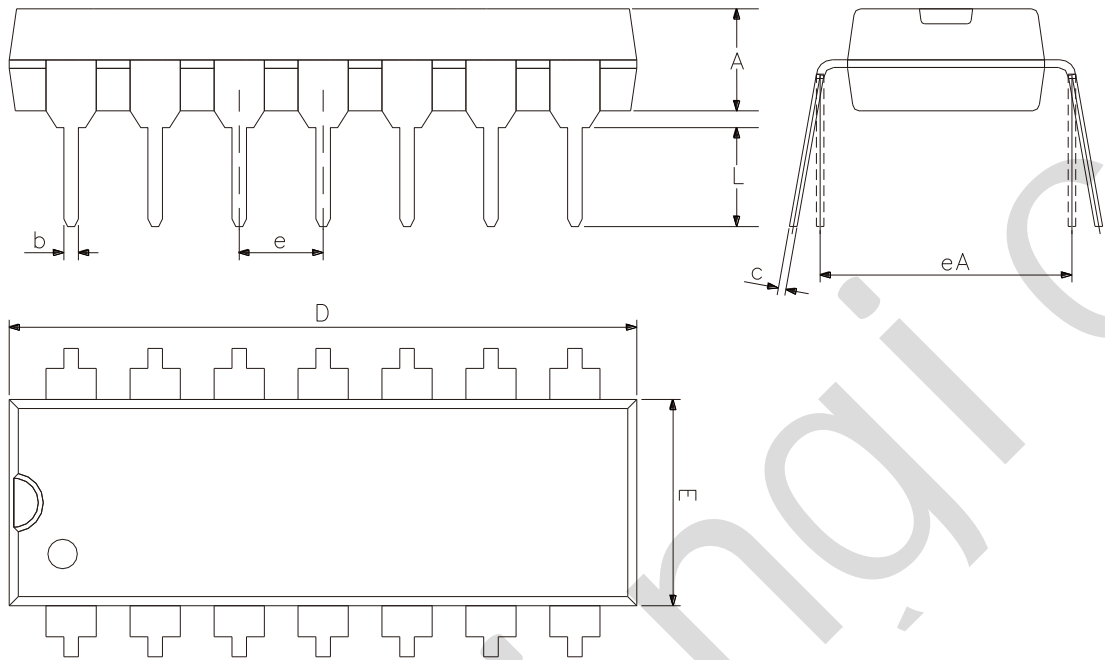
$$V_{OUT} = -R_F / R_I * V_{IN}$$



灵星芯微 精密制程

6、Package Information

6.1、DIP14

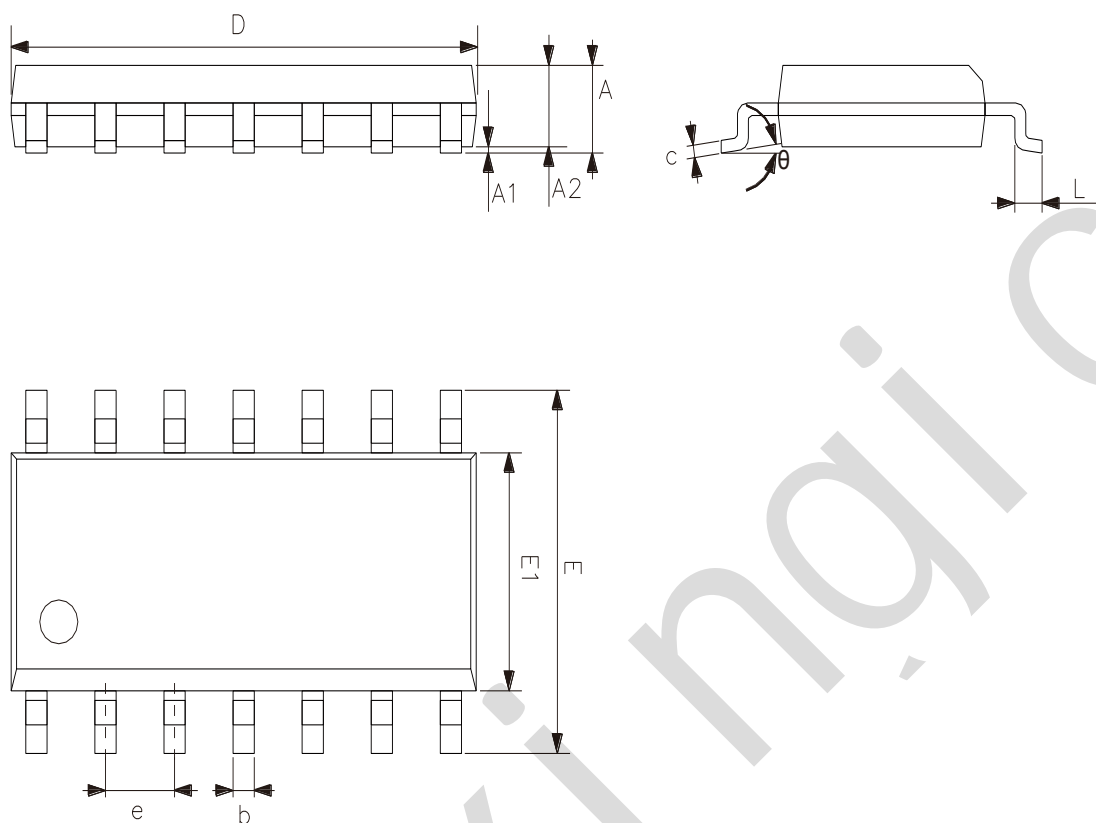


2023/12/A	Dimensions In Millimeters	
Symbol	Min	Max
A	3.05	3.60
b	0.33	0.56
c	0.20	0.36
D	18.80	19.40
E	6.20	6.60
e	2.54	
eA	7.62	10.90
L	2.92	—



灵星芯微 精密制程

6.2、SOP14

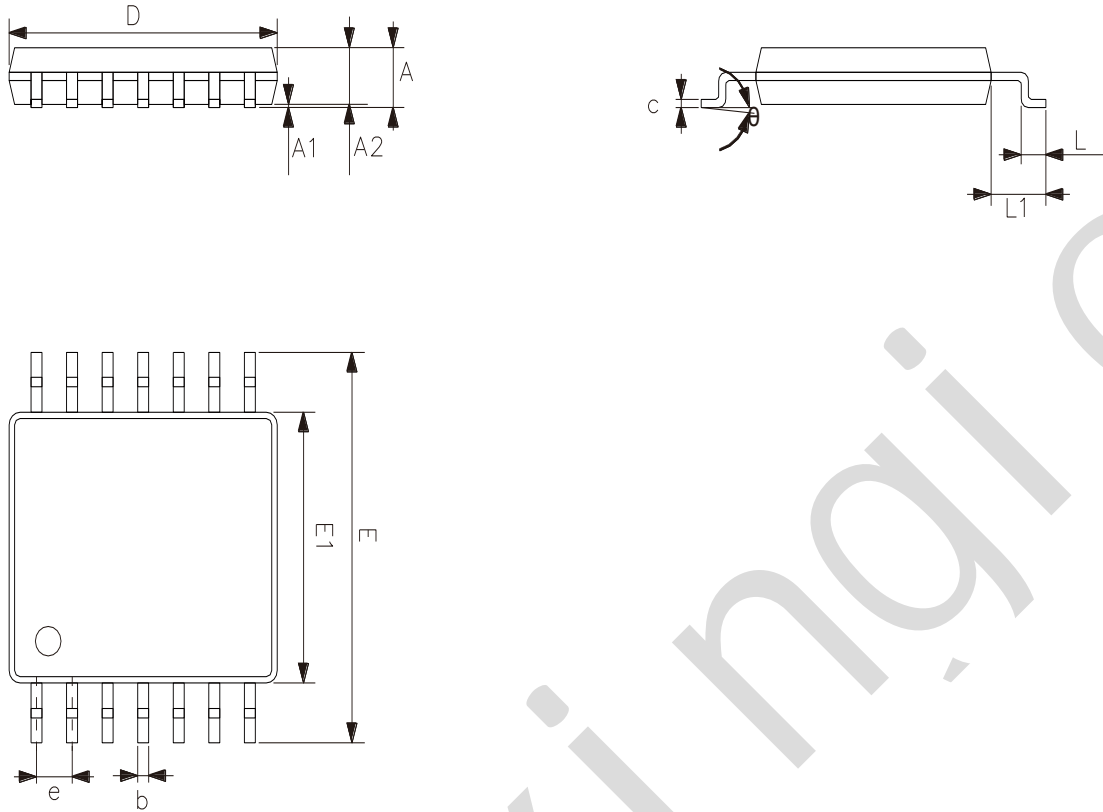


2023/12/A	Dimensions In Millimeters	
	Symbol	Min.
A	1.50	1.75
A1	0.05	0.25
A2	1.30	—
b	0.33	0.50
c	0.19	0.25
D	8.43	8.76
E	5.80	6.25
E1	3.75	4.00
e	1.27	
L	0.40	0.89
θ	0°	8°



灵星芯微 芯片封装

6.3、TSSOP14



2023/12/A	Dimensions In Millimeters		
	Symbol	Min	Max
	A	—	1.20
	A1	0.05	0.15
	A2	0.80	1.05
	b	0.19	0.30
	c	0.09	0.20
	D	4.90	5.10
	E1	4.30	4.50
	E	6.20	6.60
	e	0.65	
	L	0.45	0.75
	L1	1.00	
	θ	0°	8°



7、Statements And Notes

7.1、The name and content of Hazardous substances or Elements in the product

Part name	Hazardous substances or Elements									
	Lead and lead compounds	Mercury and mercury compounds	Cadmium and cadmium compounds	Hexavalent chromium compounds	Polybrominated biphenyls	Polybrominated biphenyl ethers	Dibutyl phthalate	Butylbenzyl phthalate	Di-2-ethylhexyl phthalate	Diisobutyl phthalate
Lead frame	○	○	○	○	○	○	○	○	○	○
Plastic resin	○	○	○	○	○	○	○	○	○	○
Chip	○	○	○	○	○	○	○	○	○	○
The lead	○	○	○	○	○	○	○	○	○	○
Plastic sheet installed	○	○	○	○	○	○	○	○	○	○
explanation	○: Indicates that the content of hazardous substances or elements in the detection limit of the following the SJ/T11363-2006 standard. ×: Indicates that the content of hazardous substances or elements exceeding the SJ/T11363-2006 Standard limit requirements.									

7.2、Notes

We recommend you to read this chapter carefully before using this product.

The information in this chapter is provided for reference only and LX disclaims any express or implied warranties, including but not limited to applicability, special application or non-infringement of third party rights.

This product is not suitable for critical equipment such as life-saving, life-sustaining or safety equipment. It is also not suitable for applications that may result in personal injury, death, or serious property or environmental damage due to product malfunction or failure. LX will not be liable for any damages incurred by the customers at their own risk for such applications.

The customer is responsible for conducting all necessary tests LX's application to avoid failure in the application or the application of the customer's third party users. LX does not accept any liability.

The Company reserves the right to change or improve the information published in this chapter at any time. The information in this chapter are subject to change without notice. We recommend the customer to consult our sales staff before purchasing.

Please obtain related materials form LX's regular channels and we are not responsible for its content if it is provided by sources other than our company.

In case of any conflict between the Chinese and English version, the version is subject to the Chinese one.