



AiP224/AiP324

Quadruple Operational Amplifiers

Product Specification

Specification Revision History:

Version	Date	Description
2019-11-A1	2019-11	New
2021-12-A2	2021-12	Modify supply voltage range; Add TSSOP14 packing information



1、 General Description

AiP224/AiP324 consist of four independent high-gain frequency-compensated operational amplifiers that are designed specifically to operate from a single supply over a wide range of voltages. Operation from split supplies also is possible if the difference between the two supplies is 3V to 30V, and V_{CC} is at least 1.5V more positive than the input common-mode voltage. The low supply-current drain is independent of the magnitude of the supply voltage.

Applications include transducer amplifiers, DC amplification blocks, and all the conventional operational-amplifier circuits that now can be more easily implemented in single-supply-voltage systems.

Features:

- Wide Supply Ranges
 - Single Supply: 3V to 36V
 - Dual Supplies: $\pm 1.5V$ to $\pm 18V$
- Low Supply-Current Drain Independent of Supply Voltage: 0.8mA Typical
- Common-Mode Input Voltage Range Includes Ground, Allowing Direct Sensing Near Ground
- 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: $\pm 36V$
- Open-Loop Differential Voltage Amplification: 100V/mV Typical
- Internal Frequency Compensation
- Packing Form: DIP14/SOP14/TSSOP14

**Ordering Information:****Tube packing specifications:**

Part number	Packaging form	Marking code	Tube quantity	Boxed tube quantity	Boxed quantity	Notes
AiP224SA14.TB	SOP14	AiP224	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
AiP324SA14.TB		AiP324				
AiP224DA14.TB	DIP14	AiP224	25 PCS/tube	40 tube/box	1000 PCS/box	Dimensions of plastic enclosure: 19.0mm×6.4mm Pin spacing: 2.54mm
AiP324DA14.TB		AiP324				
AiP324TA14.TB	TSSOP14	AiP324	94 PCS/tube	200 tube/box	18800 PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing: 0.65mm

Reel packing specifications:

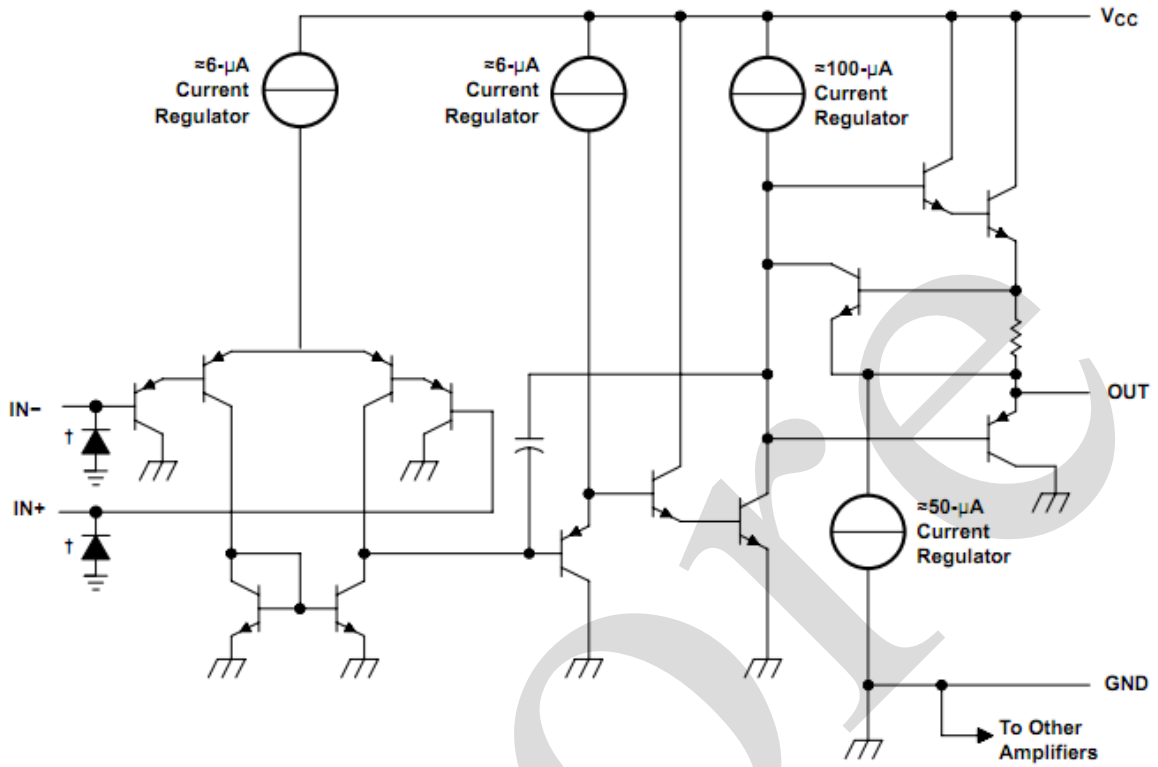
Part number	Packaging form	Marking code	Reel quantity	Boxed reel quantity	Notes
AiP224SA14.TR	SOP14	AiP224	4000 PCS/reel	8000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing:1.27mm
AiP324SA14.TR		AiP324			
AiP324TA14.TR	TSSOP14	AiP324	5000 PCS/reel	10000 PCS/box	Dimensions of plastic 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.

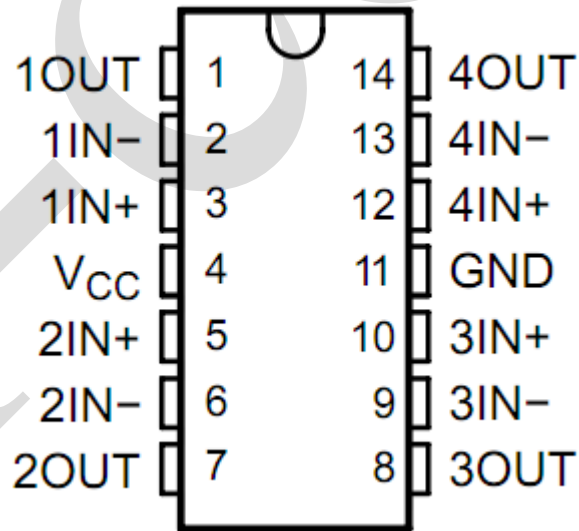


2、Block Diagram And Pin Description

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℃, All voltage referenced to GND, unless otherwise specified)

Characteristic	Symbol	Conditions	Value		Unit
			AiP224	AiP324	
supply voltage	V _{CC}	-	40 or ±20		V
differential input voltage	V _{ID}	-	±40		V
input voltage	V _I	-	40		V
operating temperature	T _{amb}	-	-40 to 125	-40 to 85	℃
operating virtual junction temperature	T _J	-	150		℃
storage temperature	T _{stg}	-	-65 to 150		℃
soldering temperature	T _L	10s	DIP14	245	℃
			SOP14	250	

3.2、Recommended Operating Conditions

Characteristic	Symbol	Conditions	Min	Max	Unit
Supply voltage	V _{CC}	-	AiP224	3	36
			AiP324		
Common-mode voltage	V _{CM}	-	AiP224	0	V _{CC} -2
			AiP324		
Operating free air temperature	T _{amb}	-	AiP224	-40	125
			AiP324	-40	85



3.3、Electrical Characteristics

3.3.1、Electrical Characteristics

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

Characteristic	Symbol	Conditions		T_{amb}	Specification parameters						Unit
					AiP224			AiP324			
					Min.	Typ.	Max.	Min.	Typ.	Max.	
input offset voltage	V_{IO}	$V_{CC}=5$ to $36V$, $V_{IC}=V_{ICR(min)}$, $V_O=1.4V$		$25^{\circ}C$	-	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 to $V_{CC}-1.5$	-	-	0 to $V_{CC}-1.5$	-	-	V
				Full range	0 to $V_{CC}-2$	-	-	0 to $V_{CC}-2$	-	-	
High-level output voltage	V_{OH}	$R_L=2k\Omega$		$25^{\circ}C$	3.5	-	-	3.5	-	-	V
		$V_{CC}=36V$	$R_L=2k\Omega$	Full range	26	-	-	26	-	-	
			$R_L\geq 10k\Omega$	Full range	27	28	-	27	28	-	
Low-level output voltage	V_{OL}	$R_L\leq 10k\Omega$		Full range	-	5	20	-	5	20	mV
large-signal differential voltage amplification	A_{VD}	$V_{CC}=15V$, $V_O=1V$ to $11V$, $R_L\geq 2k\Omega$		$25^{\circ}C$	50	100	-	25	100	-	V/mV
				Full range	25	-	-	15	-	-	
common-mode rejection ratio	CMRR	$V_{CC}=5$ to $36V$, $V_{IC}=V_{ICR(min)}$		$25^{\circ}C$	70	80	-	65	80	-	dB
supply-voltage rejection ratio ($\Delta V_{CC}/\Delta V_{IO}$)	k_{SVR}	$V_{CC}=5$ to $36V$		$25^{\circ}C$	65	100	-	65	100	-	dB
crosstalk attenuation	V_{O1}/V_{O2}	$f=1kHz$ to $20kHz$		$25^{\circ}C$	-	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	-	-	
		$V_{CC}=15V$, $V_{ID}=-1V$, $V_O=15V$	Sink	$25^{\circ}C$	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(four amplifiers)	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	-	1.4	3	
slew rate at unity gain	SR	$V_{CC}=\pm 18V$, $R_L=1M\Omega$, $C_L=30pF$, $V_I=\pm 10V$, Figure 11	Full range	-	0.5	-	-	0.5	-	V/us
unity-gain bandwidth	B_1	$V_{CC}=\pm 18V$, $R_L=1M\Omega$, $C_L=20pF$, Figure 11	Full range	-	1.2	-	-	1.2	-	MHz
equivalent input noise voltage	V_n	$V_{CC}=\pm 18V$, $R_s=100\Omega$, $f=1kHz$, $V_I=0V$, Figure 12	Full range	-	35	-	-	35	-	nV/ \sqrt{Hz}

4. Characteristic Curve

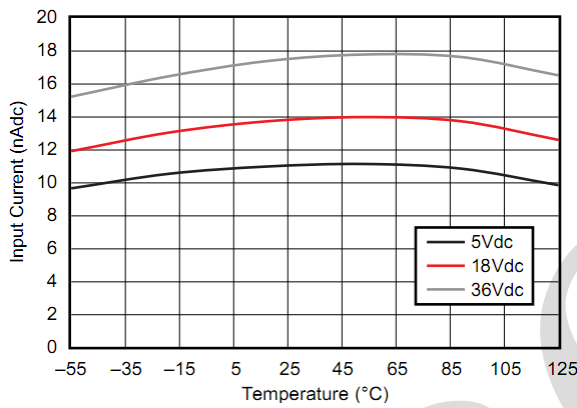


Figure 1: Input Current with Temperature

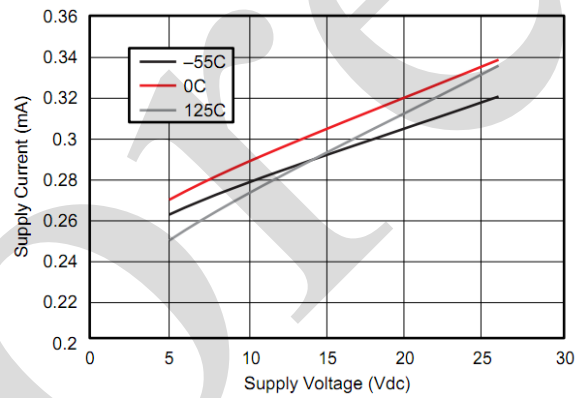


Figure 2: Supply Current with Supply Voltage

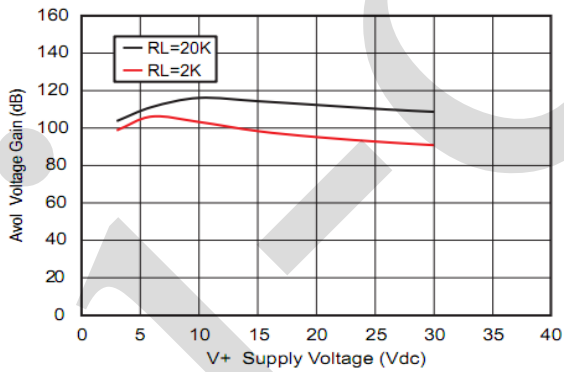


Figure 3: Avol Voltage Gain with V+ Supply Voltage

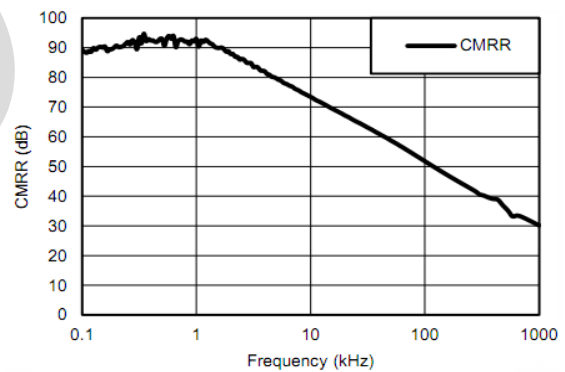


Figure 4: CMRR with Frequency

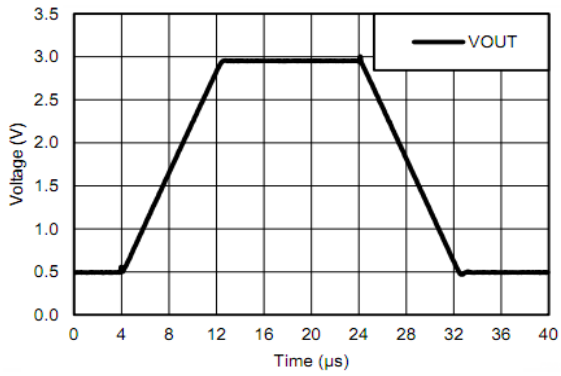


Figure 5: Large Signal Response (50 pF)

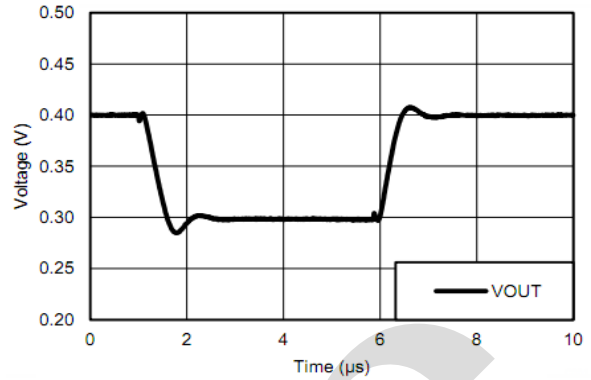


Figure 6: Small Signal Response (50 pF)

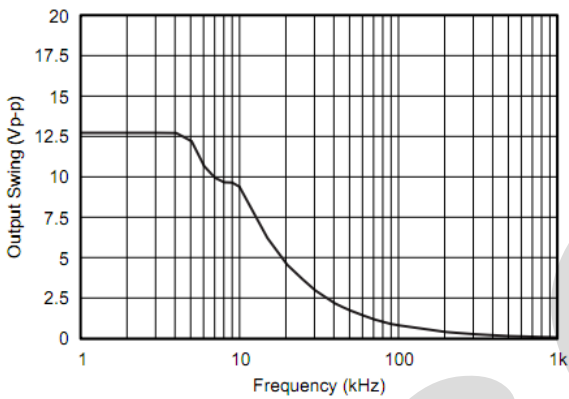


Figure 7: Output Swing with Frequency

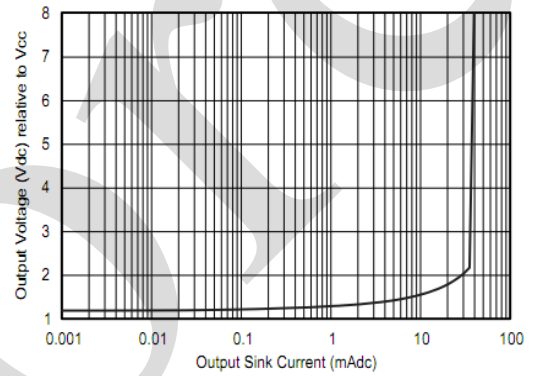


Figure 8: Output Voltage with Output Sink Current

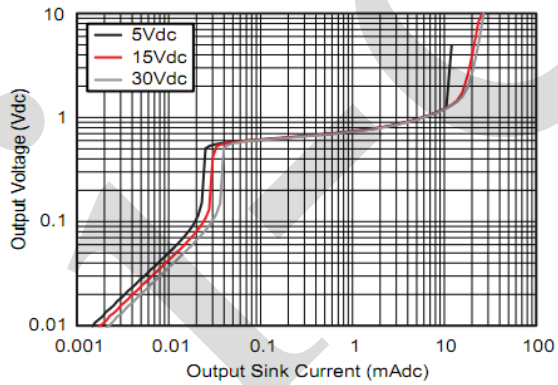


Figure 9: Output Voltage with Output Sink Current

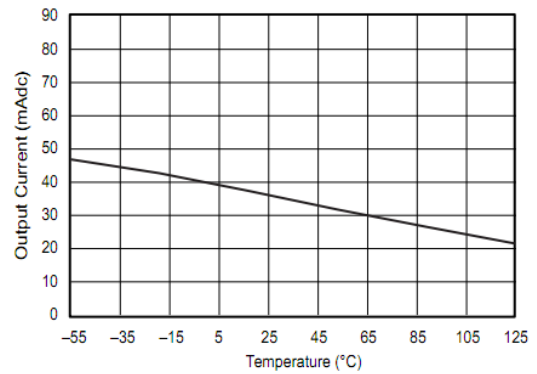


Figure 10: Output Current with Temperature



5、 Testing Circuit

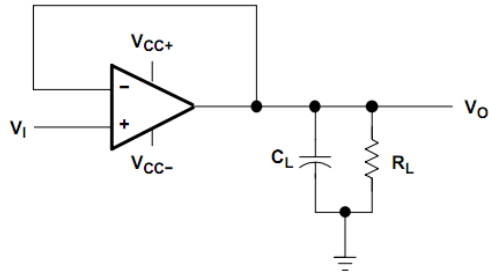


Figure 11: Unity-Gain Amplifier

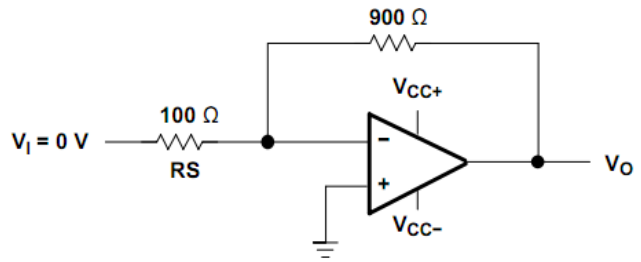
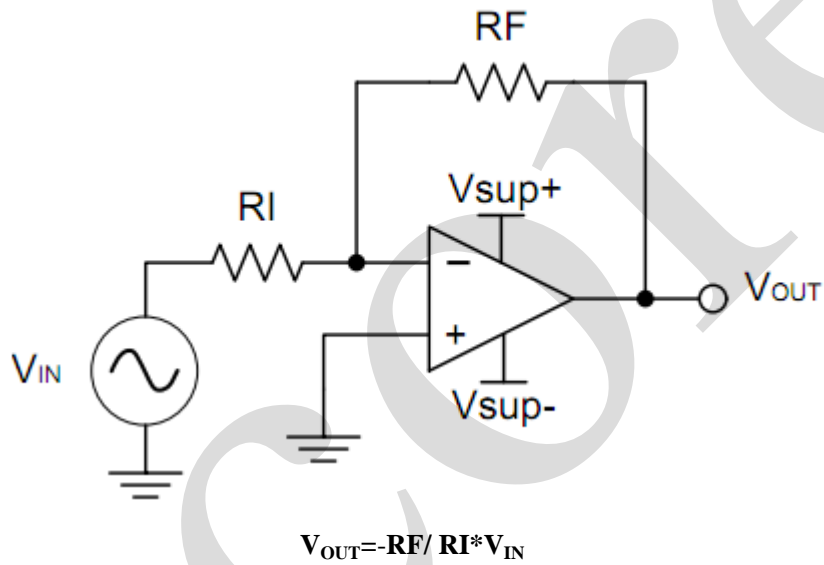


Figure 12: Noise-Test Circuit

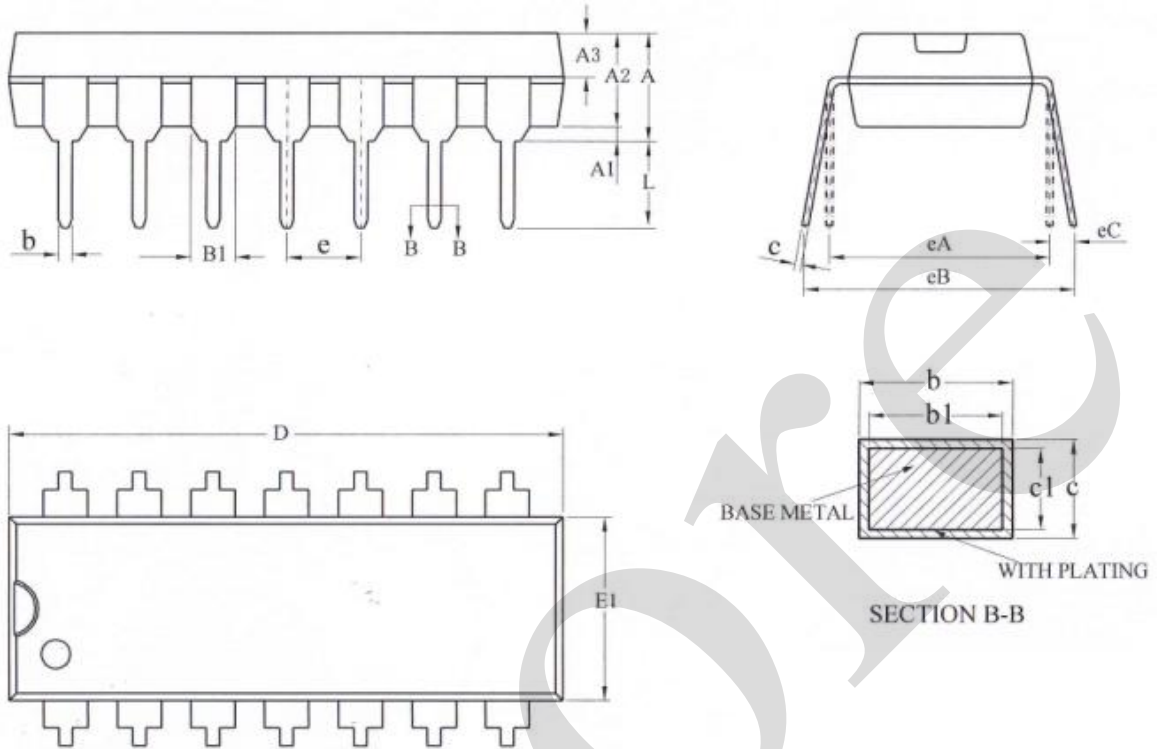
6、 Typical Application Circuit And Application Note





7、Package Information

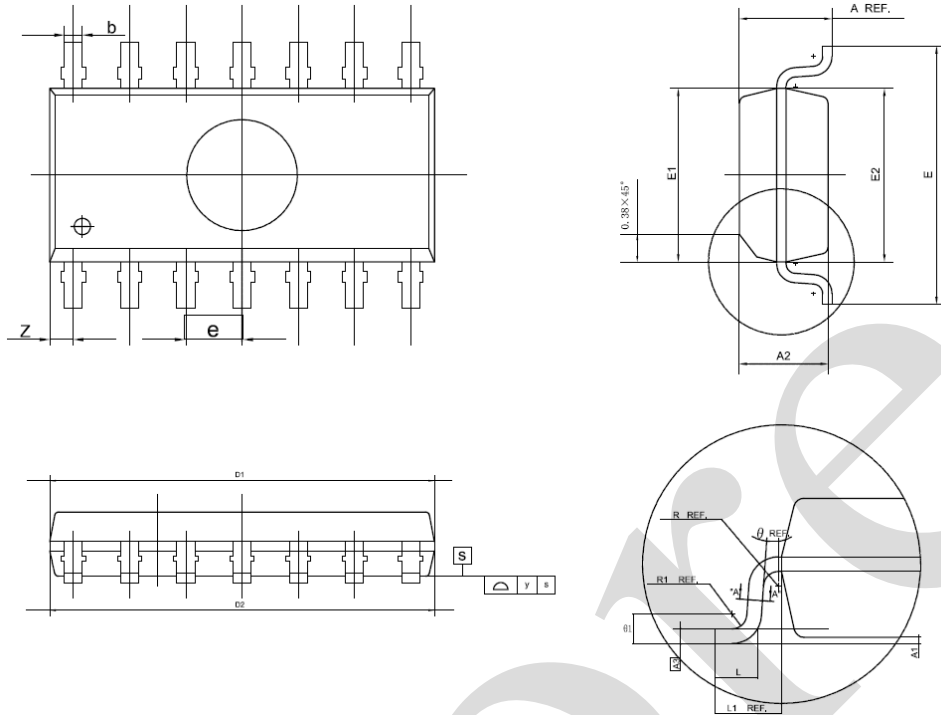
7.1、DIP14



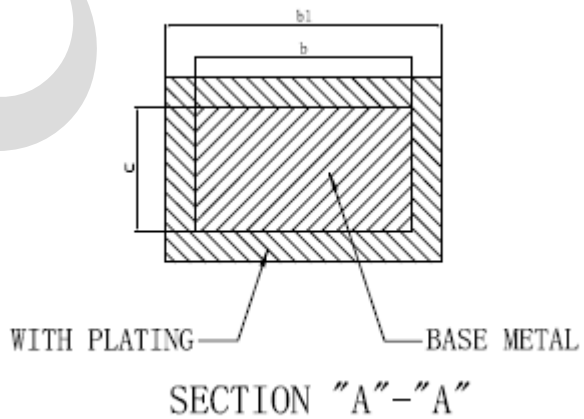
SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	3.60	3.80	4.00
A1	0.51	—	—
A2	3.20	3.30	3.40
A3	1.47	1.52	1.57
b	0.44	—	0.52
b1	0.43	0.46	0.49
B1	1.52REF		
c	0.25	—	0.29
c1	0.24	0.25	0.26
D	19.00	19.10	19.20
E1	6.25	6.35	6.45
e	2.54BSC		
eA	7.62REF		
eB	7.62	—	9.30
eC	0	—	0.84
L	3.00	—	—



7.2、SOP14



Symbol	Min	Nom	Max
A	1.500	1.600	1.700
A1	0.100	0.150	0.200
A2	1.400	1.450	1.500
A3	-----	0.223	-----
b	0.356	0.406	0.456
b1	0.366	0.426	0.486
c	-----	0.203	-----
D1	8.600	8.650	8.700
D2	8.610	8.660	8.710
E	5.900	6.000	6.100
E1	3.800	3.900	4.000
E2	3.850	3.950	4.050
e	-----	1.270	-----
L	0.560	0.660	0.760
L1	0.950	1.050	1.150
R	-----	0.200	-----
R1	-----	0.300	-----
θ	0	-----	-----
θ 1	0	-----	10°
y	-----	-----	0.1
Z	-----	0.520	-----





8、 Statements And Notes:

8.1、 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.									

8.2、 Notion:

Recommended carefully reading this information before the use of this product;

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