



AiP3201/AiP3201B/AiP3202/AiP3204

50ns, Low-Power, Push-Pull Output Comparators

Product Specification

Specification Revision History:

Version	Date	Description
2023-03-A1	2023-03	New
2023-05-A2	2023-05	Add SOT353 packaging information
2024-12-A3	2024-12	Add AiP3201B
2025-08-A4	2025-08	Add SOT23-5 package form for AiP3201B; modify the overview of function description



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1、General Description

The AiP3201, AiP3201B, AiP3202, and AiP3204 are single, dual, and quad-channel comparators, featuring fast response, low power consumption, rail-to-rail input voltage range, low offset voltage and large output drive current. The devices are ideal for a wide variety of applications, such as detection systems, test and measurement equipment, and high-speed sampling systems.

Features:

- Propagation delay: 50ns (Typical)
- Input common-mode voltage range: -0.2V to $V_{CC}+0.2V$
- Input offset voltage: 1mV
- Push-pull output
- Supply voltage range: +2.7V to 5.5V
- Ambient temperature range: -40°C to 125°C
- Packaging form:
 - AiP3201: SOT23-5/SOT353
 - AiP3201B: SOT553/SOT23-5
 - AiP3202: SOP8/MSOP8
 - AiP3204: SOP14/TSSOP14

Ordering Information:

Tube packing specifications:

Part number	Packaging form	Marking code	Tube quantity	Boxed tube quantity	Boxed quantity	Notes
AiP3202SA8.TB	SOP8	AiP3202	100 PCS/tube	100 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 4.9mm×3.9mm Pin spacing: 1.27mm
AiP3202MA8.TB	MSOP8	AiP3202	100 PCS/tube	100 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 3mm×3mm Pin spacing: 0.65mm
AiP3204SA14.TB	SOP14	AiP3204	50 PCS/tube	200 tube/box	10000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
AiP3204TA14.TB	TSSOP14	AiP3204	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
AiP3201GB235.TR	SOT23-5	3201XX	3000 PCS/reel	30000 PCS/box	Dimensions of plastic enclosure: 2.9mm×1.6mm Pin spacing: 0.95mm
AiP3201GC353.TR	SOT353	3201XX	3000 PCS/reel	30000 PCS/box	Dimensions of plastic enclosure: 2.1mm×1.3mm Pin spacing: 0.65mm
AiP3201BGG553.TR	SOT553	GWXX	3000 PCS/reel	30000 PCS/box	Dimensions of plastic enclosure: 1.6mm×1.2mm Pin spacing: 0.5mm
AiP3201BGB235.TR	SOT23-5	3201BXX	3000 PCS/reel	30000 PCS/box	Dimensions of plastic enclosure: 2.9mm×1.6mm Pin spacing: 0.95mm
AiP3202SA8.TR	SOP8	AiP3202	4000 PCS/reel	8000 PCS/box	Dimensions of plastic enclosure: 4.9mm×3.9mm Pin spacing: 1.27mm
AiP3202MA8.TR	MSOP8	AiP3202	5000 PCS/reel	10000 PCS/box	Dimensions of plastic enclosure: 3mm×3mm Pin spacing: 0.65mm
AiP3204SA14.TR	SOP14	AiP3204	4000 PCS/reel	8000 PCS/box	Dimensions of plastic enclosure: 8.7mm×3.9mm Pin spacing: 1.27mm
AiP3204TA14.TR	TSSOP14	AiP3204	5000 PCS/reel	10000 PCS/box	Dimensions of plastic enclosure: 5.0mm×4.4mm Pin spacing: 0.65mm

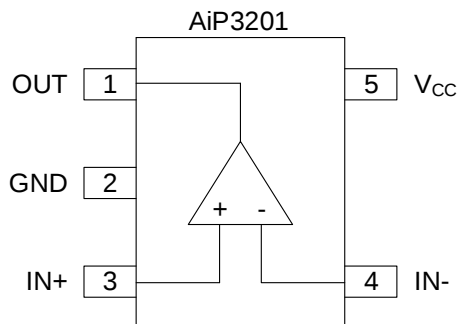
Note 1: “XX” refers to variable content, meaning year and package batch serial number.

Note 2: If the physical information is inconsistent with the ordering information, please refer to the actual product.

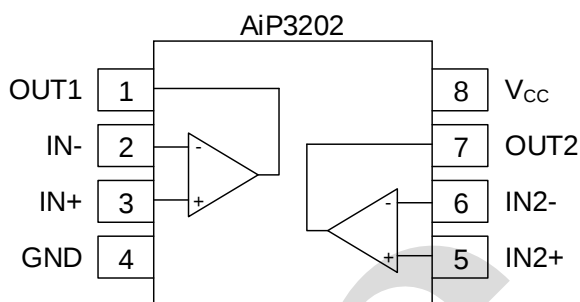


2、Pin Configurations and Description

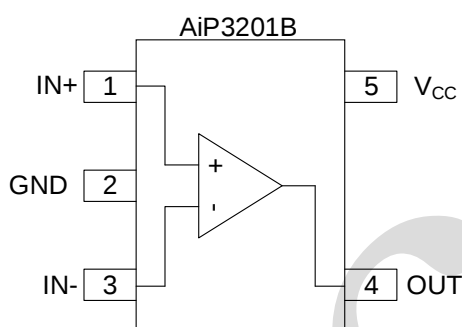
2.1、Pin Configurations



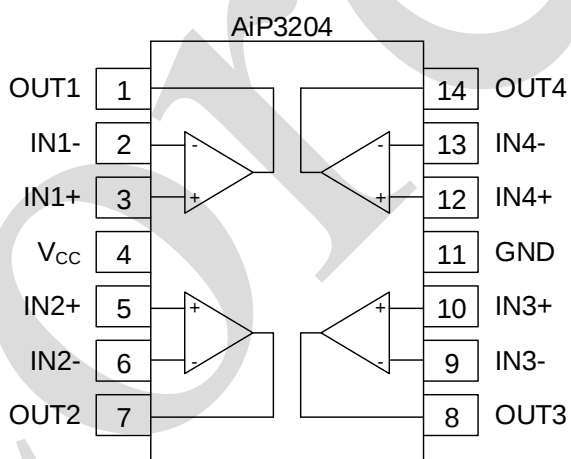
SOT23-5/SOT353



SOP8/MSOP8



SOT553/SOT23-5



SOP14/TSSOP14



2.2、Pin Description

2.2.1、AiP3201

Pin No.	Pin Name	Description
1	OUT	Output pin of the comparator
2	GND	Negative power, Ground
3	IN+	Positive input pin of the comparator
4	IN-	Negative input pin of the comparator
5	V _{CC}	Supply pin

2.2.2、AiP3201B

Pin Name	Pin Name	Description
1	IN+	Positive input pin of the comparator
2	GND	Negative, Ground
3	IN-	Negative input pin of the comparator
4	OUT	Output
5	V _{CC}	Positive power supply

2.2.3、AiP3202

Pin No.	Pin Name	Description	Pin No.	Pin Name	Description
1	OUT1	Comparator 1 output (negative)	5	IN2+	Comparator 2 input (positive)
2	IN1-	Comparator 1 input (negative)	6	IN2-	Comparator 2 input (negative)
3	IN1+	Comparator 1 input (positive)	7	OUT2	Comparator 2 output
4	GND	Negative power supply, Ground	8	V _{CC}	Positive power supply

2.2.4、AiP3204

Pin No.	Pin Name	Description	Pin No.	Pin Name	Description
1	OUT1	Comparator 1 output (negative)	8	OUT3	Comparator 3 output
2	IN1-	Comparator 1 input (negative)	9	IN3-	Comparator 3 input (negative)
3	IN1+	Comparator 1 input (positive)	10	IN3+	Comparator 3 input (positive)
4	V _{CC}	Positive supply voltage	11	GND	Negative power supply, Ground
5	IN2+	Comparator 2 input (positive)	12	IN4+	Comparator 4 input (positive)
6	IN2-	Comparator 2 input (negative)	13	IN4-	Comparator 4 input (negative)
7	OUT2	Comparator 2 output	14	OUT4	Comparator 4 output



3、Electrical Parameter

3.1、Absolute Maximum Ratings

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

Parameter		Symbol	Condition	Value	Unit
Supply voltage		V _{CC}	-	6	V
Signal input terminals	Voltage	V _I	-	-0.5 to (V _{CC})+0.5	V
	Current	I _I	-	±10	mA
Output short-circuit current to ground		I _O	-	100	mA
Maximum junction temperature		T _J	-	150	℃
Storage current		T _{stg}	-	-65 to +150	℃
Soldering temperature		T _L	10s	260	℃
ESD level		ESD	Human body model (HBM)	2000	V

3.2、Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	V _{CC}	2.7	-	5.5	V
Ambient temperature	T _{amb}	-40	-	+125	℃

3.3、Electrical Characteristics

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

Parameter	Symbol	Conditions	V _{CC} =2.7V			V _{CC} =5V			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Supply voltage									
Specified voltage	V _{CC}	-	2.7	-	5.5	2.7	-	5.5	V
Quiescent current (AiP3201)	I _Q	-	-	85	140	-	95	160	μA
		T _{amb} =-40℃ to +125℃	-	-	160	-	-	180	μA
Quiescent current (AiP3202)		-	-	85	140	-	95	160	μA
		T _{amb} =-40℃ to +125℃	-	-	160	-	-	180	μA
Quiescent current (AiP3204)		-	-	170	280	-	190	320	μA
		T _{amb} =-40℃ to +125℃	-	-	320	-	-	360	μA
Offset voltage									
Input offset voltage	V _{IO}	V _{CM} =V _{CC} /2	-	1	5	-	1	5	mV
		T _{amb} =-40℃ to +125℃	-	-	6	-	-	6	mV
Input offset voltage drift	dV _{OS} /dT	T _{amb} =-40℃ to +125℃	-	1	10	-	1	10	μV/℃
Power supply rejection ratio	PSRR	-	65	85	-	65	85	-	dB
Input hysteresis	-	-	-	1	-	-	1	-	mV



Input bias current										
Input bias current	I _{IB}	V _{CM} =V _{CC} /2	-	1	50	-	1	50	pA	
		T _{amb} =-40℃ to +125℃	-	-	5	-	-	5	nA	
Input offset current	I _{IO}	V _{CM} =V _{CC} /2	-	1	50	-	1	50	pA	
		T _{amb} =-40℃ to +125℃	-	-	2.5	-	-	2.5	nA	
Input voltage range										
Common-mode voltage range	V _{CM}	T _{amb} =-40℃ to +125℃	-0.2	-	V _{CC} +0.2	-0.2	-	V _{CC} +0.2	V	
Common-mode rejection ration	CMRR	-0.2V<V _{CM} <V _{CC} +0.2V	65	85	-	60	70	-	dB	
Input impedance										
Input resistance	R _{IN}	-	-	12.5	-	-	12.5	-	GΩ	
Input capacitance	C _{IN}	Differential mode	-	3.3	-	-	2.9	-	pF	
		Common mode	-	2.9	-	-	2.5	-	pF	
Switching characteristics										
Propagation delay	t _{pd}	Low to high	Input overdrive=20 mV,C _L =15pF	-	67	80	-	60	75	ns
			Input overdrive=100 mV,C _L =15pF	-	51	65	-	50	60	ns
			T _{amb} =-40℃ to +125℃	-	-	90	-	-	85	ns
		High to low	Input overdrive=20 mV, C _L =15pF	-	72	80	-	66	75	ns
			Input overdrive=100 mV,C _L =15pF	-	52	65	-	49	60	ns
			T _{amb} =-40℃ to +125℃	-	-	90	-	-	85	ns
Propagation delay skew	-	Input overdrive=20mV, C _L =15pF	-	5	-	-	6	-	ns	
Propagation delay matching(Ai P3202/4)	-	Input overdrive=20mV, C _L =15pF	-	-	10	-	-	10	ns	
Rise time	t _r	10% to 90%	-	3.5	-	-	2.6	-	ns	
Fall time	t _f	10% to 90%	-	3.6	-	-	2.8	-	ns	
Output										
Output swing from supply rail	ΔV _{OL}	I _{SINK} =4mA	-	196	260	-	160	190	mV	
		T _{amb} =-40℃ to +125℃	-	-	320	-	-	225	mV	



Short-circuit current (per comparator)	ΔV_{OH}	$I_{SOURCE}=4mA$	-	184	250	-	120	150	mV
		$T_{amb}=-40^{\circ}C$ to $+125^{\circ}C$	-	-	350	-	-	170	mV
	I_{SC}	I_{SC} Sinking current	18	23	-	40	55	-	mA
		$T_{amb}=-40^{\circ}C$ to $+125^{\circ}C$	15	-	-	35	-	-	mA
	I_{SC}	I_{SC} Source current	16	20	-	50	65	-	mA
		$T_{amb}=-40^{\circ}C$ to $+125^{\circ}C$	14	-	-	45	-	-	mA

4、Characteristic Curve

($T_{amb}=25^{\circ}C$, $V_{CC}=+5V$, Input overdrive (V_{OD})=20mV, unless otherwise specified)

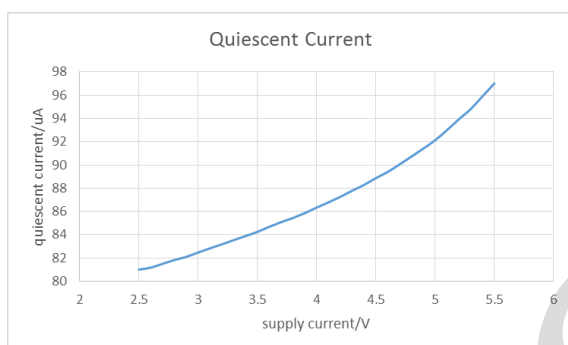


Figure 1. quiescent current vs supply voltage

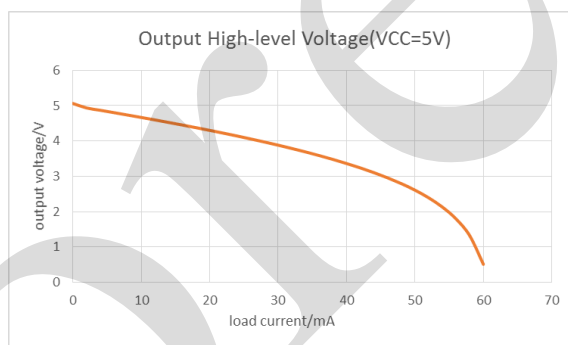


Figure 2. High-level output voltage vs load current ($V_{CC}=5V$)

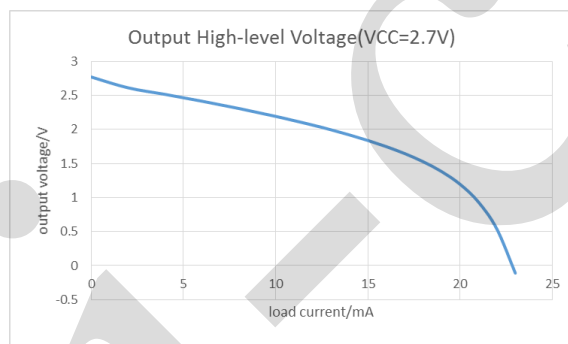


Figure 3. output High-level voltage vs load current ($V_{CC}=2.7V$)

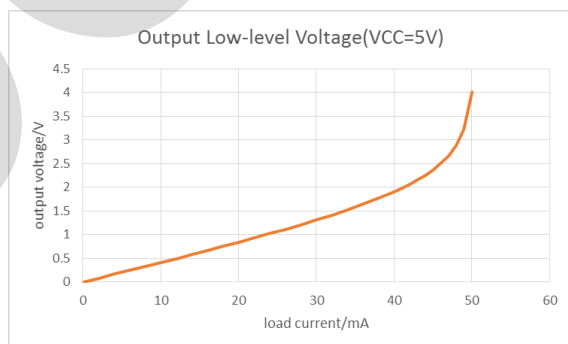


Figure 4. output Low-level voltage vs load current ($V_{CC}=5V$)

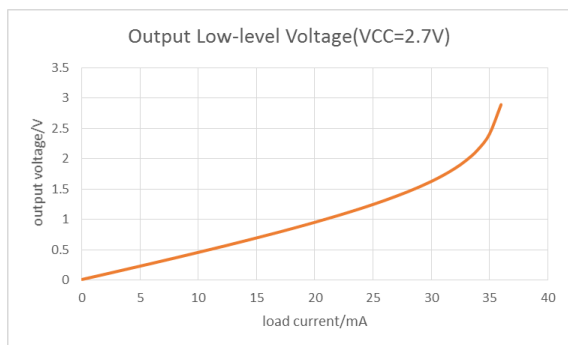


Figure 5. output Low-level voltage vs load current ($V_{CC}=2.7V$)

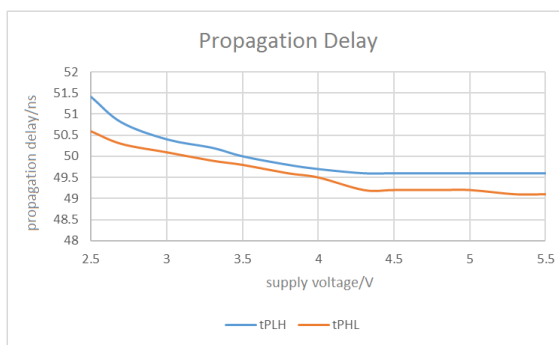


Figure 6. Propagation delay versus supply voltage

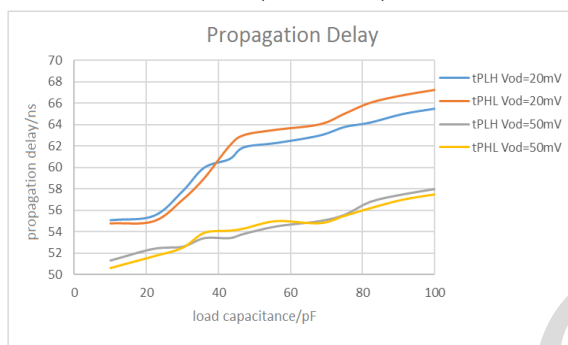


Figure 7. Propagation delay vs load capacitance

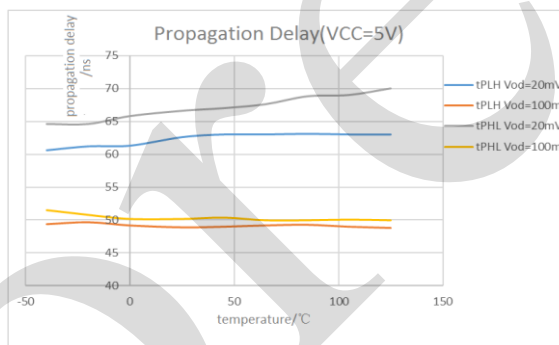


Figure 8. Propagation delay vs temperature ($V_{CC}=5V$)

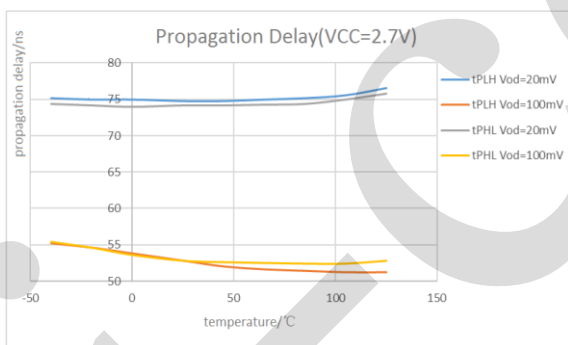


Figure 9. Propagation delay vs temperature ($V_{CC}=2.7V$)

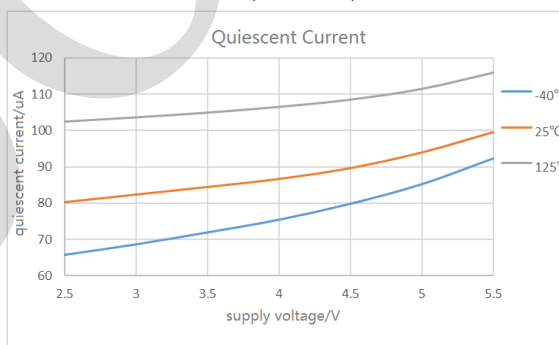


Figure 10 quiescent current vs temperature

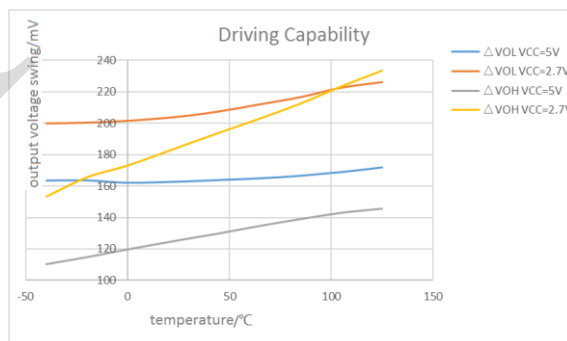


Figure 11. Driving capability vs temperature



5、Function Description

The AiP320x series are push-pull comparators featuring internal hysteresis, low propagation delay and low power consumption. The combination of rail-to-rail input voltage range and low-voltage single-supply operation make AiP320x ideal for portable, battery-powered devices.

The devices have an internal hysteresis of 1mV to prevent oscillations caused by noise or undesired parasitic feedback. The hysteresis in a comparator creates two trip points: one for the rising input voltage and one for the falling input voltage. The difference between the trip points is the hysteresis. The average of the trip points is the offset voltage. When the comparator's input voltages are equal, the hysteresis effectively causes one comparator input voltage to move quickly past the other, thus taking the input out of the region where oscillation occurs. To increase hysteresis and noise margin even more, external resistors can be used.

Figure 12 illustrates the case where $IN-$ is fixed and $IN+$ is varied. If the inputs were reversed, the waveform would look the same, except the output would be inverted.

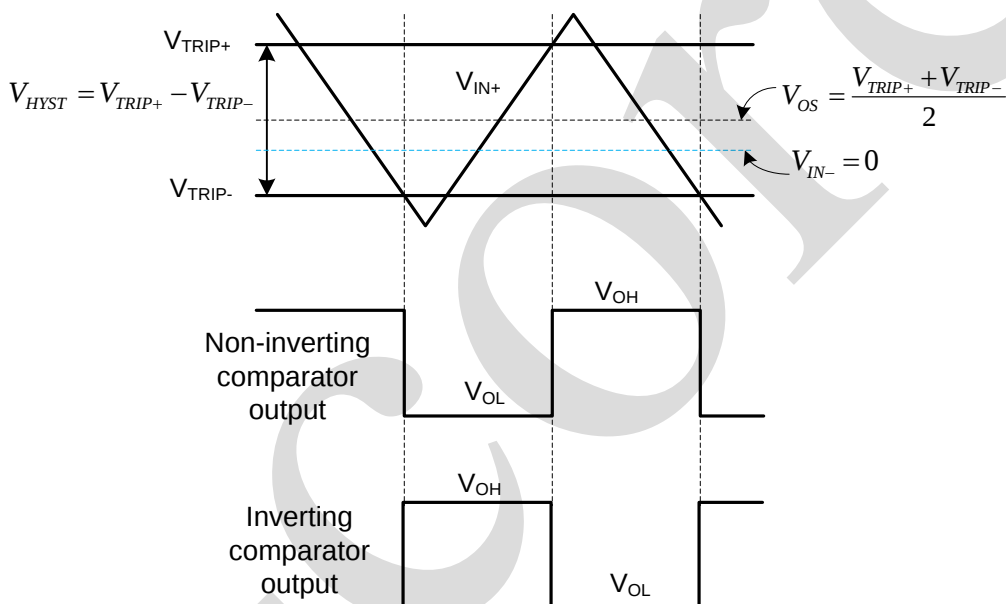
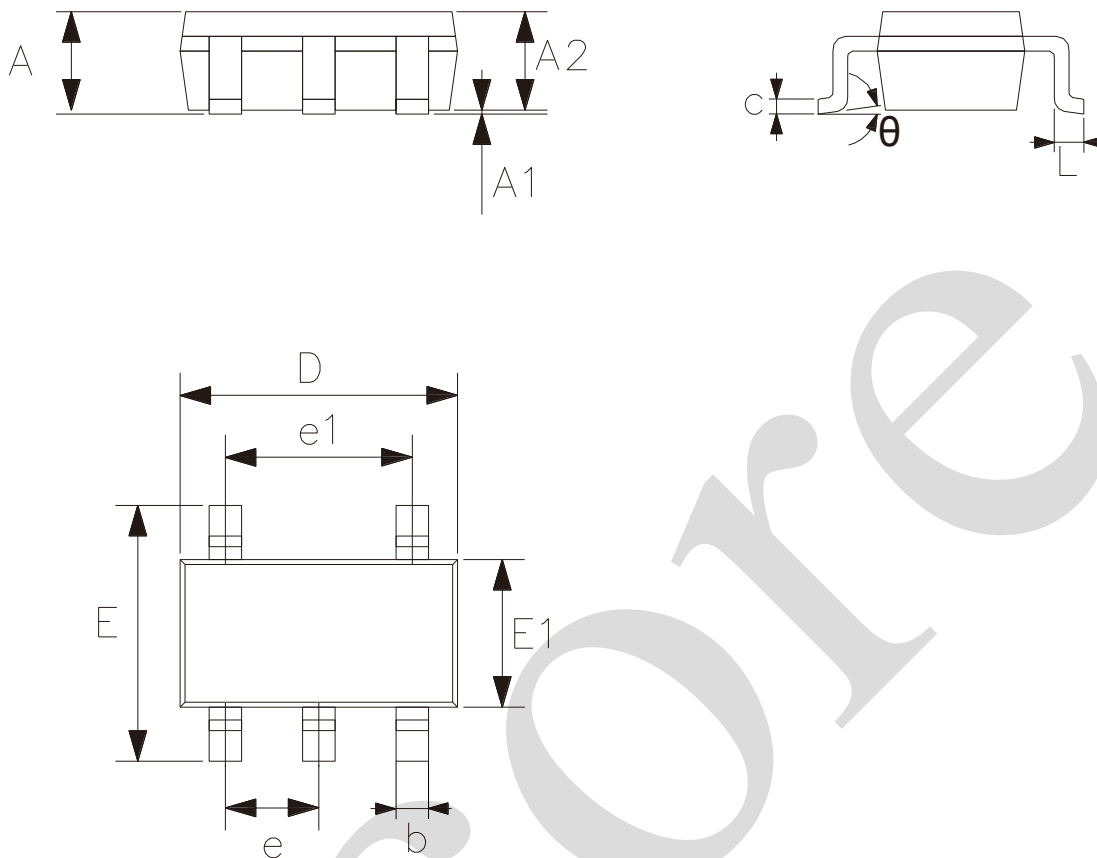


Figure 12. Comparator hysteresis and offset



6、Package Information

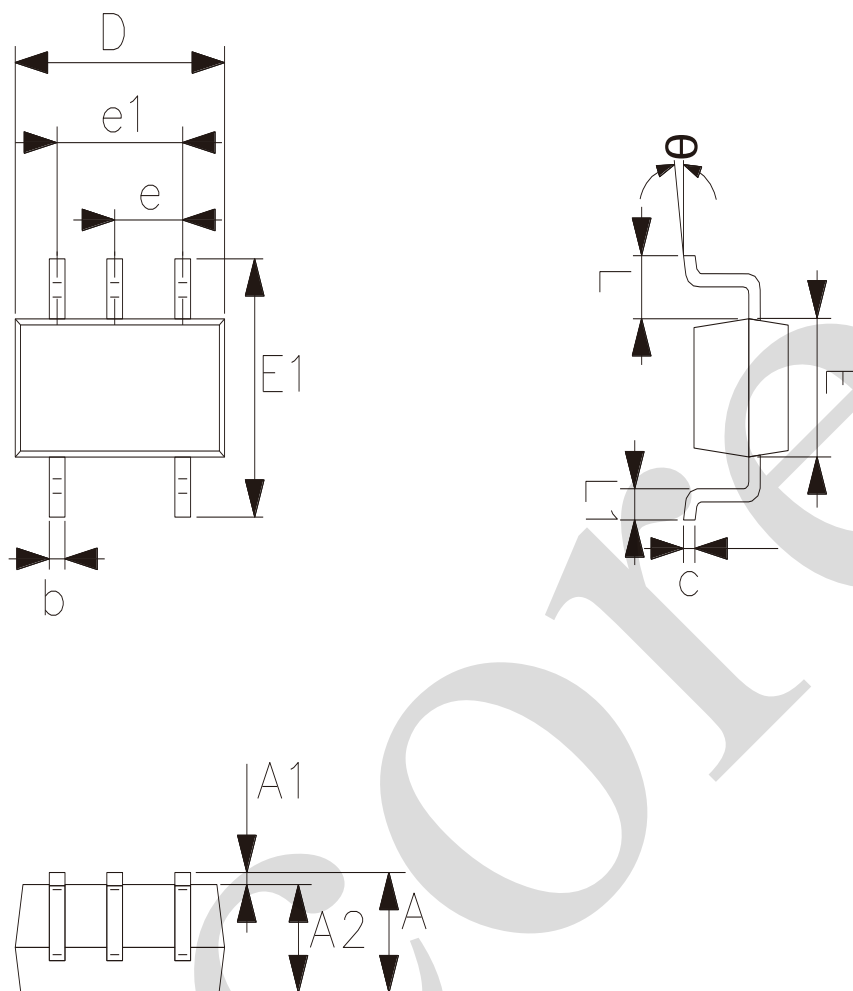
6.1、SOT23-5



2023/12/A	Dimensions In Millimeters	
Symbol	Min.	Max.
A	—	1.26
A1	0.00	0.12
A2	1.00	1.20
b	0.30	0.50
c	0.10	0.20
D	2.82	3.02
E	2.60	3.00
E1	1.50	1.70
e	0.95	
e1	1.80	2.00
L	0.30	0.60
θ	0°	8°



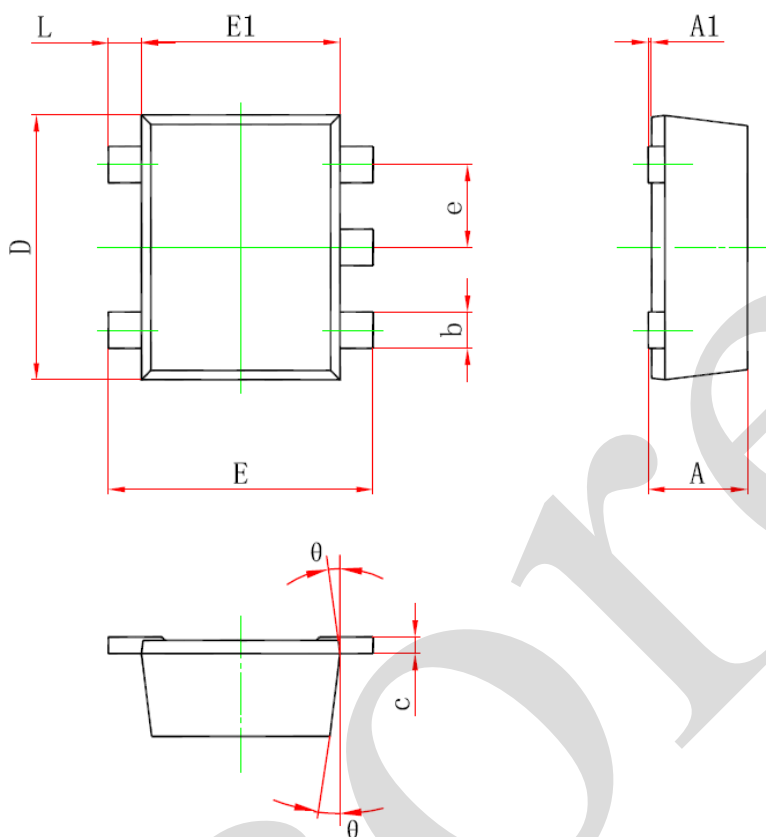
6.2、SOT353



2023/12/A	Dimensions In Millimeters	
Symbol	Min.	Max.
A	0.90	1.10
A1	0.00	0.10
A2	0.90	1.00
b	0.15	0.35
c	0.11	0.175
D	2.00	2.20
E	1.15	1.35
E1	2.15	2.45
e	0.65	
e1	1.20	1.40
L	0.525	
L1	0.26	0.46
θ	0°	8°



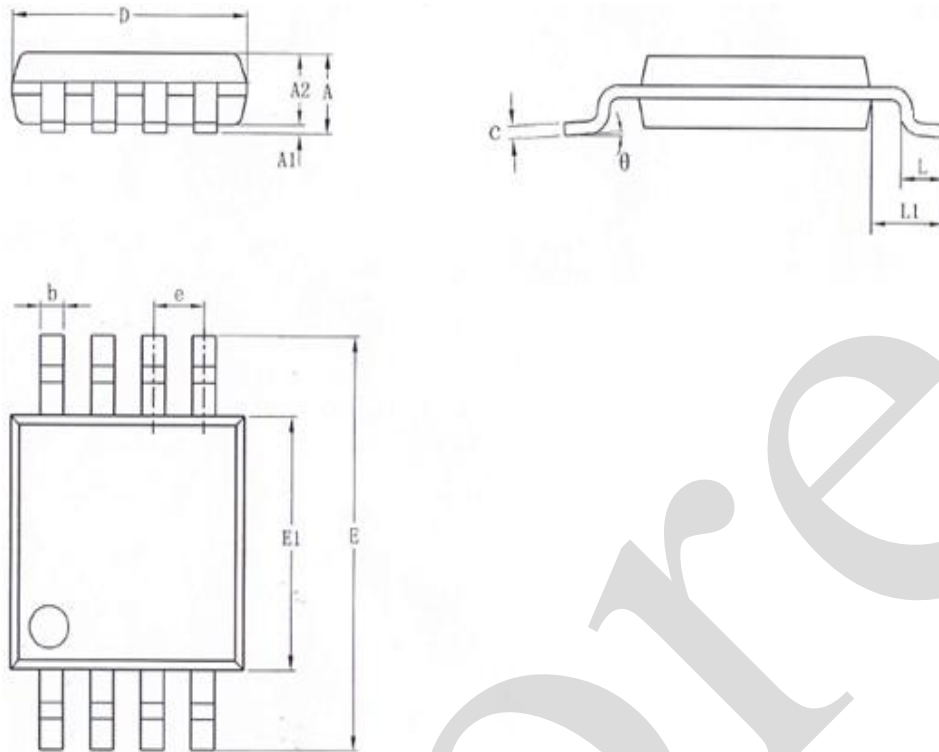
6.3、SOT553



2023/12/A	Dimensions In Millimeters	
Symbol	Min	Max
A	0.525	0.60
A1	0	0.05
e	0.45	0.55
c	0.09	0.16
D	1.50	1.70
b	0.17	0.27
E1	1.10	1.30
E	1.50	1.70
L	0.10	0.30
θ	7°	



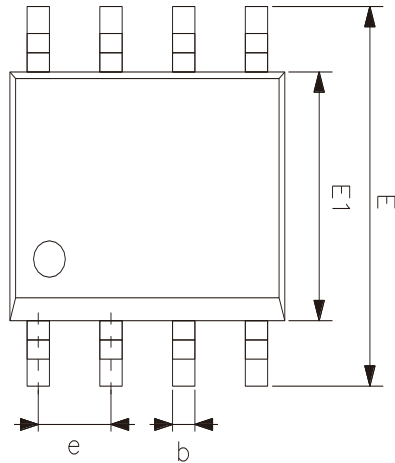
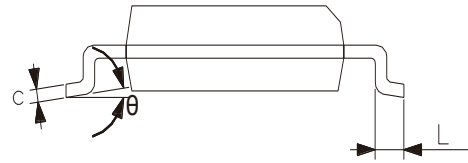
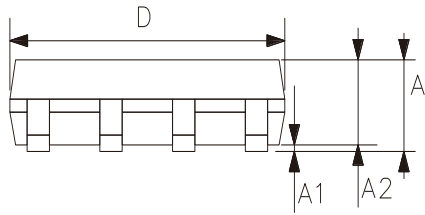
6.4、MSOP8



2023/12/A	Dimensions In Millimeters	
Symbol	Min	Max
A	—	1.10
A1	0.05	0.15
A2	0.75	0.95
b	0.22	0.38
c	0.08	0.23
D	2.90	3.10
E	4.70	5.10
E1	2.90	3.10
e	0.65	
L	0.40	0.80
L1	0.95	
θ	0°	8°



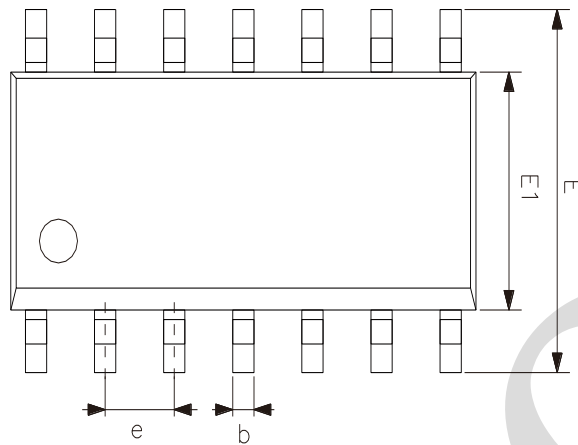
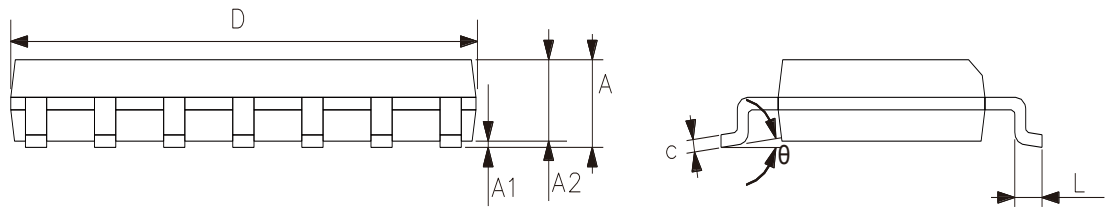
6.5、SOP8



2023/12/A	Dimensions In Millimeters	
Symbol	Min.	Max.
A	1.35	1.80
A1	0.05	0.25
A2	1.25	1.55
D	4.70	5.10
E	5.80	6.30
E1	3.70	4.10
b	0.306	0.51
c	0.19	0.25
e	1.27	
L	0.40	0.89
θ	0°	8°



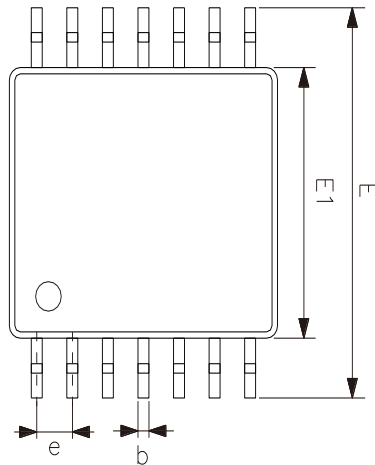
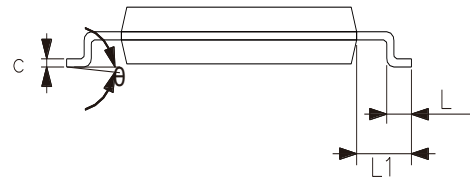
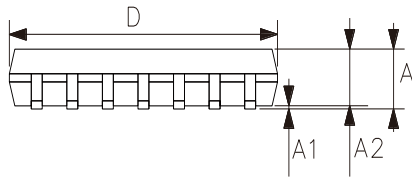
6.6、SOP14



2023/12/A	Dimensions In Millimeters	
Symbol	Min.	Max.
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°



6.7、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.

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