CoreadDvices
承芯微电子

CD8221_CD8222_CD8224

Low-power, general-purpose, rail-to-rail input/output amplifier

Version: Rev 1.0.0 Date: 2025-6-3

Features

- Gain Bandwidth : 500kHz
- Rail-To-Rail Input And Output
- 0.8mV Typical Vos
- Input Voltage Range : -0.1V to +5.6V with Vs = 5.5V
- Supply Range : +2.5V to +5.5V
- Shutdown : CD8221S/CD8222S
- Specified Up To +125°C
- Micro Size Packages : SOT23-5, SOT23-6

Application

- Sensors
- Photo diode Amplification
- Active Filters
- Test Equipment
- Driving A/D Converters

Description

The CD8221, CD8222, CD8224, CD8221S, CD8222S families of products offer low voltage operation and rail-to-rail input and output, as well as excellent speed/power consumption ratio, providing an excellent bandwidth (500kHz) and slew rate of 0.18V/us. The op-amps are unity gain stable and feature an ultra-low input bias current.

The devices are ideal for sensor interfaces, active filters and portable applications. The CD8221S, CD8222S include a shutdown mode. Under logic control, the amplifiers can be switched from normal operation to a standby current that is less than 1uA.The CD8221, CD8222, CD8224, CD8221S, CD8222S families of operational amplifiers are specified at the full temperature range of −40°C to +125°C under single or dual power supplies of 2.5V to 5.5V.

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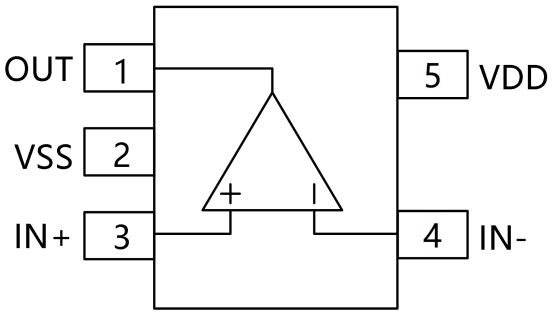
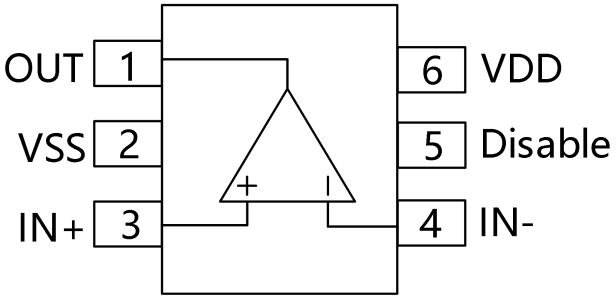
Contents

Pin Configurations



SOT23-5/SC70-5



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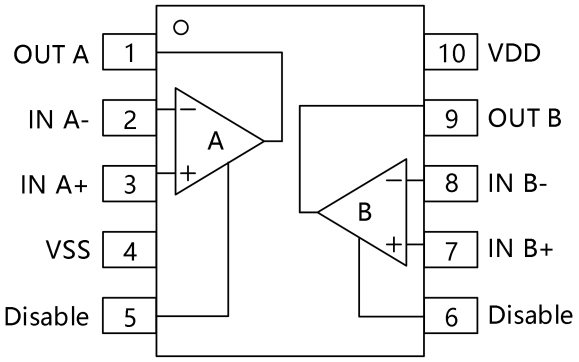
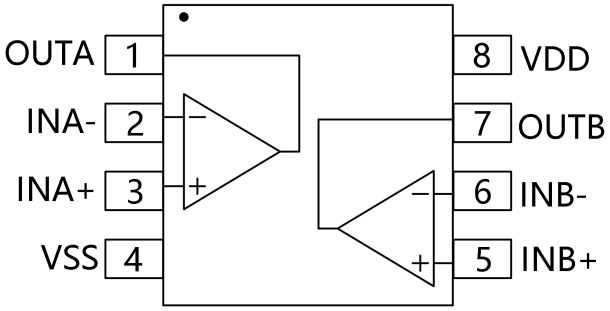


MSOP-10



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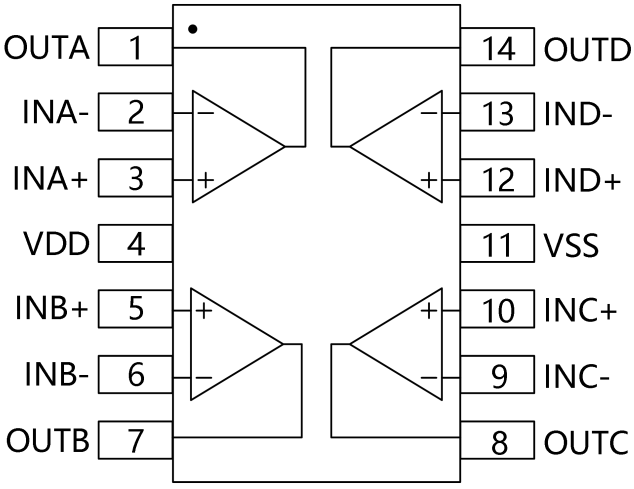

SOP-14/TSSOP-14

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Absolute Maximum Ratings

Parameter	Range
Supply Voltage (VS)	7V
Input Voltage	– 0.5 to (V+) + 0.5V
Input Current	±10mA
Storage Temperature Range	−65℃ to +150℃
Operating Temperature Range	−40℃ to +125℃
Junction Temperature Range	−65℃ to +150℃
Lead Temperature (Soldering,10 sec)	260℃
Package Thermal Resistance @ T_A= +25°C	
SOT23-5,SOT23-6	200°C/W
MSOP-10, SOIC-8	150°C/W
SOIC-14, TSSOP-14	100°C/W
HBM	5000V
MM	400V

Electrical characteristics

(At T_A = +25°C, V_S=5V, R_L = 10kΩ connected to V_S/2, and V_{OUT} = V_S/2, unless otherwise noted.)

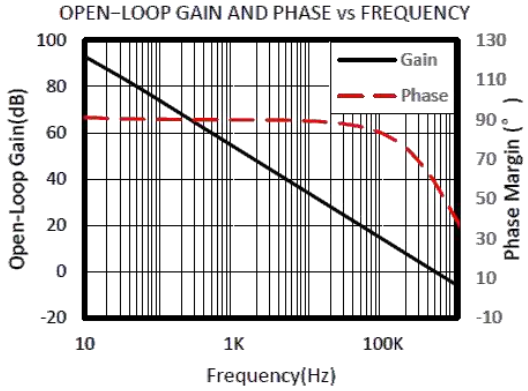
PARAMETER		CONDITIONS	TJ	CD8541, CD8542, CD8544			UNIT
				MIN	TYP	MAX	
POWER SUPPLY							
V_S	Operating Voltage Range		25℃	2.5		5.5	V
I_Q	Quiescent Current/Amplifier		25℃		18	32	uA
P_{SRR}	Power-Supply Rejection Ratio	Vs=2.5V to 5.5V, V_{CM}=(V-)+0.5V	25℃	73	90		dB
			-40℃ to 125℃	67			
INPUT							
V_{OS}	Input Offset Voltage		25℃		0.8	3.5	mV
V_{OS} TC	Input Offset Voltage Average Drift	-40℃ to 125℃			2.9		uV/℃
I_B	Input Bias Current		25℃		1	10	pA

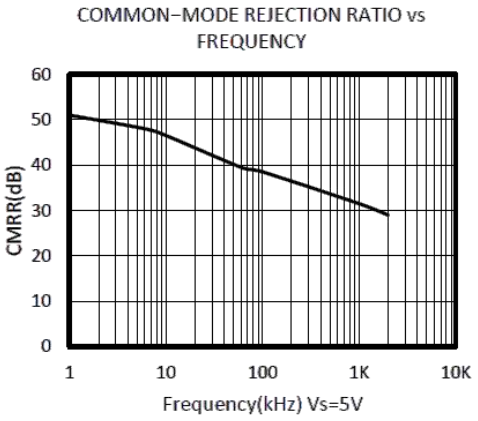
I_{OS}	Input Offset Current		25℃		1	10	pA
V_{CM}	Common-Mode Voltage Range	Vs= 5.5V	25℃	-0.1		5.6	V
C_{MRR}	Common-Mode Rejection Ratio	Vs= 5.5V, V_{CM}=-0.1V to 4V	25℃	74	90		dB
			-40℃ to 125℃	70			
		Vs= 5.5V, V_{CM}=-0.1V to 5.6V	25℃	62	75		
			-40℃ to 125℃	60			
OUTPUT							
A_{OL}	Open-Loop Voltage Gain	RL=2KΩ, V_O=0.15V to 4.85V	25℃	88	98		dB
			-40℃ to 125℃	82			
		R_L=10KΩ, V_O=0.05V to 4.95V	25℃	92	110		
			-40℃ to 125℃	88			
	Output Swing From Rail	RL=2KΩ	25℃		26		mV
		RL=10KΩ			6		
I_{OUT}	Output Short-Circuit Current		25℃		27		mA
FREQUENCY RESPONSE							
S_R	Slew Rate		25℃		0.18		V/us
G_{BP}	Gain-Bandwidth Product		25℃		500		KHz
P_M	Phase Margin		25℃		64		°
t_S	Setting Time,0.1%				14		us
	Overload Recovery Time	V_{IN}·Gain≥V_S			5		us
NOISE							
en	Input Voltage Noise Density	f = 1KHz	25℃		77		$\mathbf{nV}/\sqrt{\boldsymbol{Hz}}$
		f = 10KHz	25℃		39		$\mathbf{nV}/\sqrt{\boldsymbol{Hz}}$
ENABLE/SHUTDOWN(CD8541,CD8542)							
$I_{Q(OFF)}$	Supply Current in Shutdown		25℃		<1		uA
t_{OFF}			25℃		3		us
t_{ON}			25℃		20		us
V_L	Shut Down		25℃	V-		(V-)+0.8	V

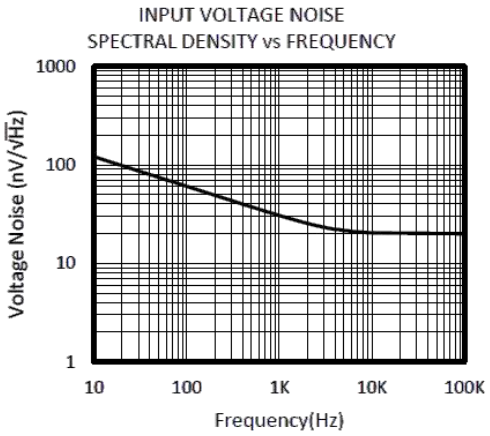
V_H	Amplifier Is Active		25℃	(V-)+2		V+	V

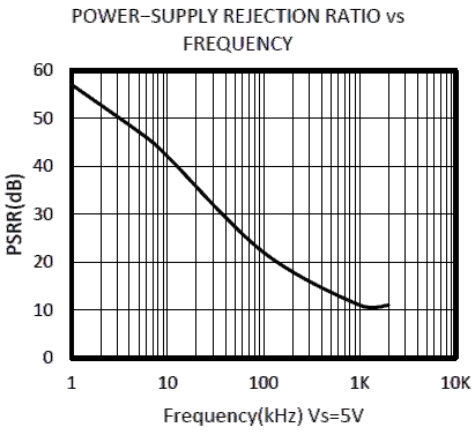
Typical Characteristics

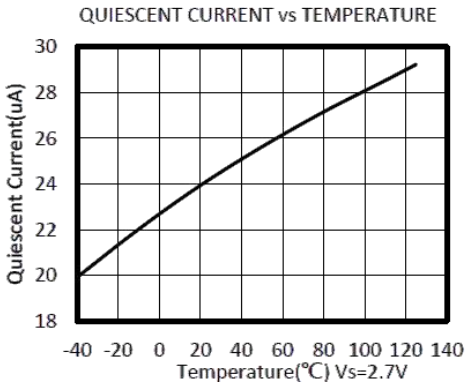
At T_A = +25℃, V_S=5V, R_L = 200kΩ connected to V_S/2, V_{OUT} = V_S/2, unless otherwise noted.

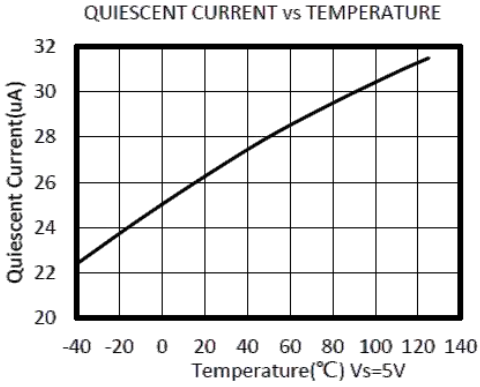












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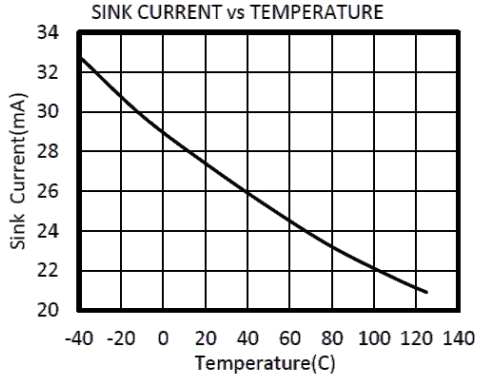
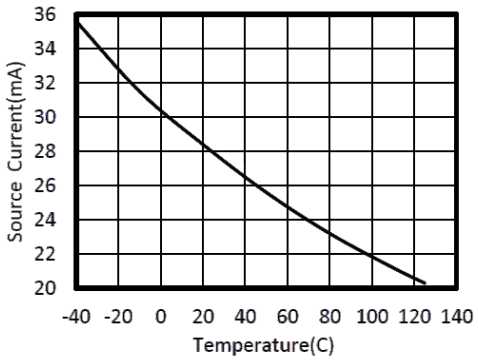
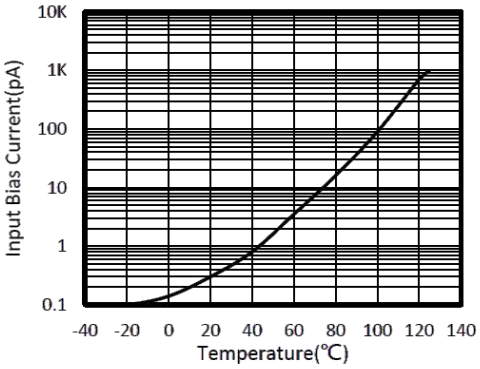
SINK CURRENT vs TEMPERATURE



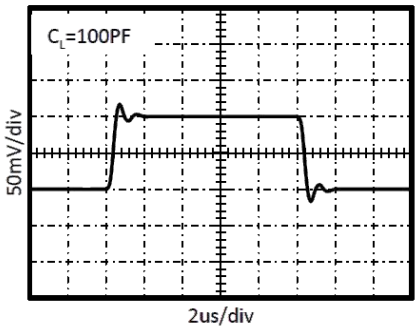
SOURCE CURRENT vs TEMPERATURE



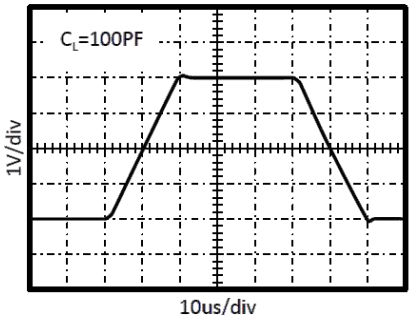
INPUT BIAS CURRENT vs TEMPERATURE



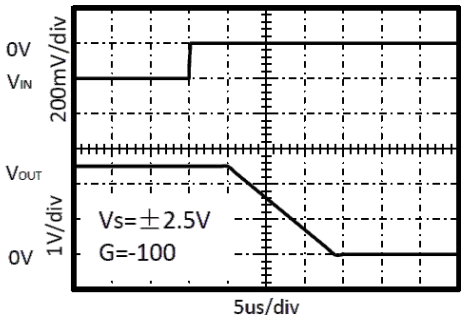
SMALL-SIGNAL STEP RESPONSE



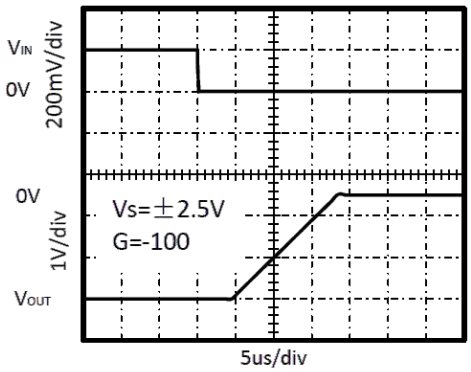
LARGE-SIGNAL STEP RESPONSE



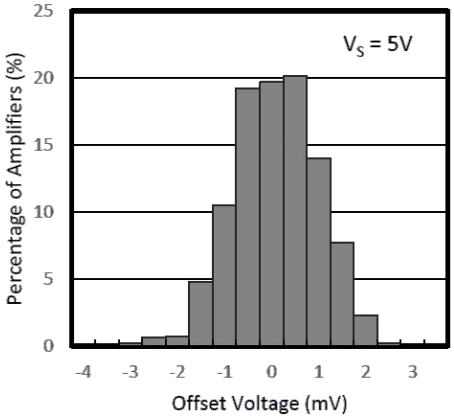
POSITIVE OVERVOLTAGE RECOVERY



NEGATIVE OVERVOLTAGE RECOVERY



Offset Voltage Production Distribution



Application Notes

The CD8221, CD8222, CD8224, CD8221S, CD8222S are high precision, rail-to-rail operational amplifiers that can be run from a single-supply voltage 2.5V to 5.5V (±1.25V to ±2.75V).Supply voltages higher than 7V (absolute maximum) can permanently damage the amplifier.
Rail-to-rail input and output swing significantly increases dynamic range, especially in low-supply applications.
Good layout practice mandates use of a 0.1uF capacitor place closely across the supply pins.

Layout Guidelines

Attention to good layout practices is always recommended. Keep traces short. When possible, use a PCB ground plane with surface-mount components placed as close to the device pins as possible. Place a 0.1uF capacitor closely across the supply pins.
These guidelines should be applied throughout the analog circuit to improve performance and provide benefits such as reducing the EMI susceptibility.

Instrumentation Amplifier

In the three-op amp, instrumentation amplifier configuration shown in Figure2.

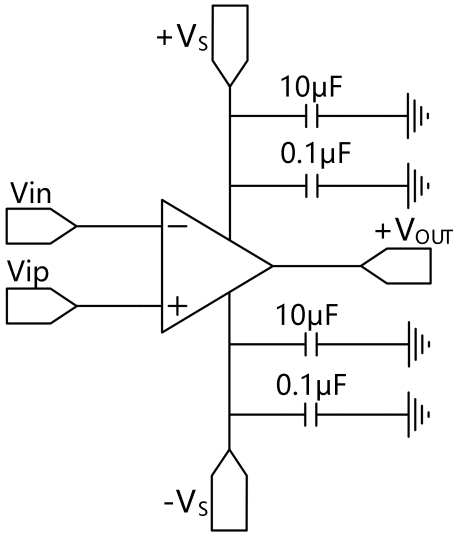


Figure 1. Amplifier with Bypass Capacitors

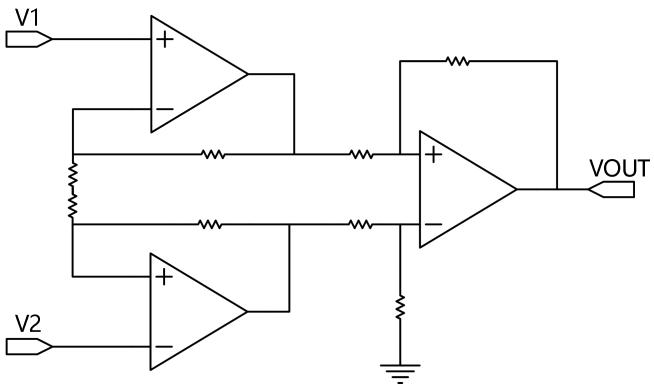
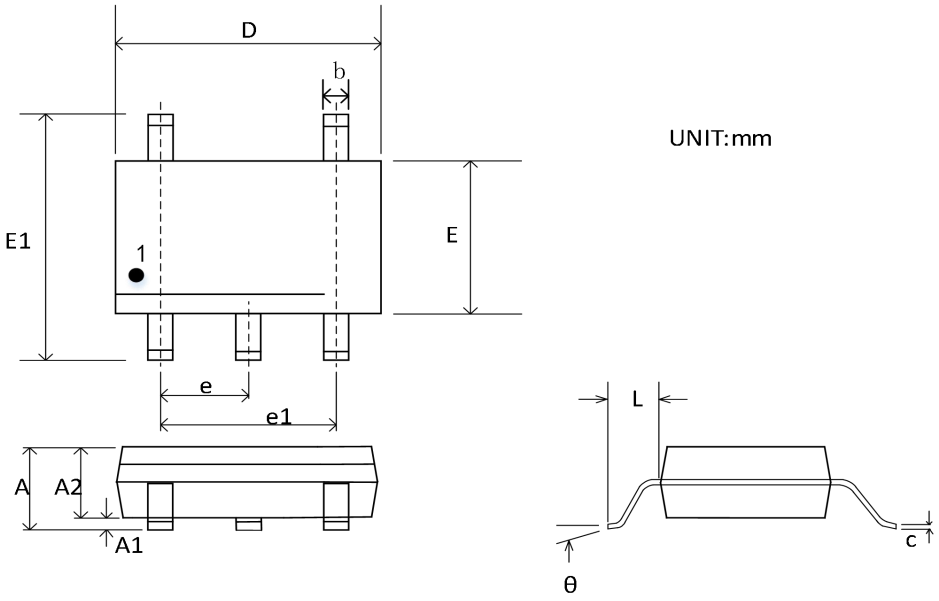


Figure2. Amplifier instrumentation amplifier

Package Outline Dimensions

SOT23-5



Symbol	Dimensions In Millimeters	
	Min	Max
A	1.050	1.250
A1	0.000	0.100
A2	1.050	1.150
b	0.300	0.500
c	0.100	0.200
D	2.820	3.020
E	1.500	1.700
E1	2.650	2.950
e	0.950 BSC	
e1	1.800	2.000
L	0.300	0.600
θ	0°	8°

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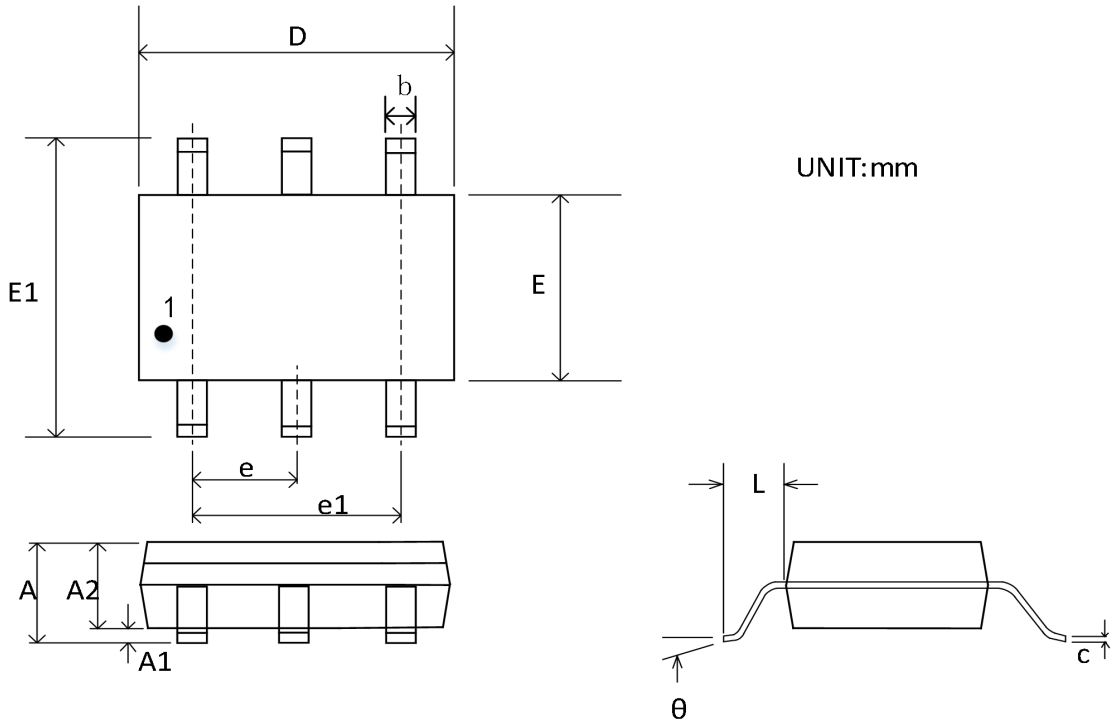
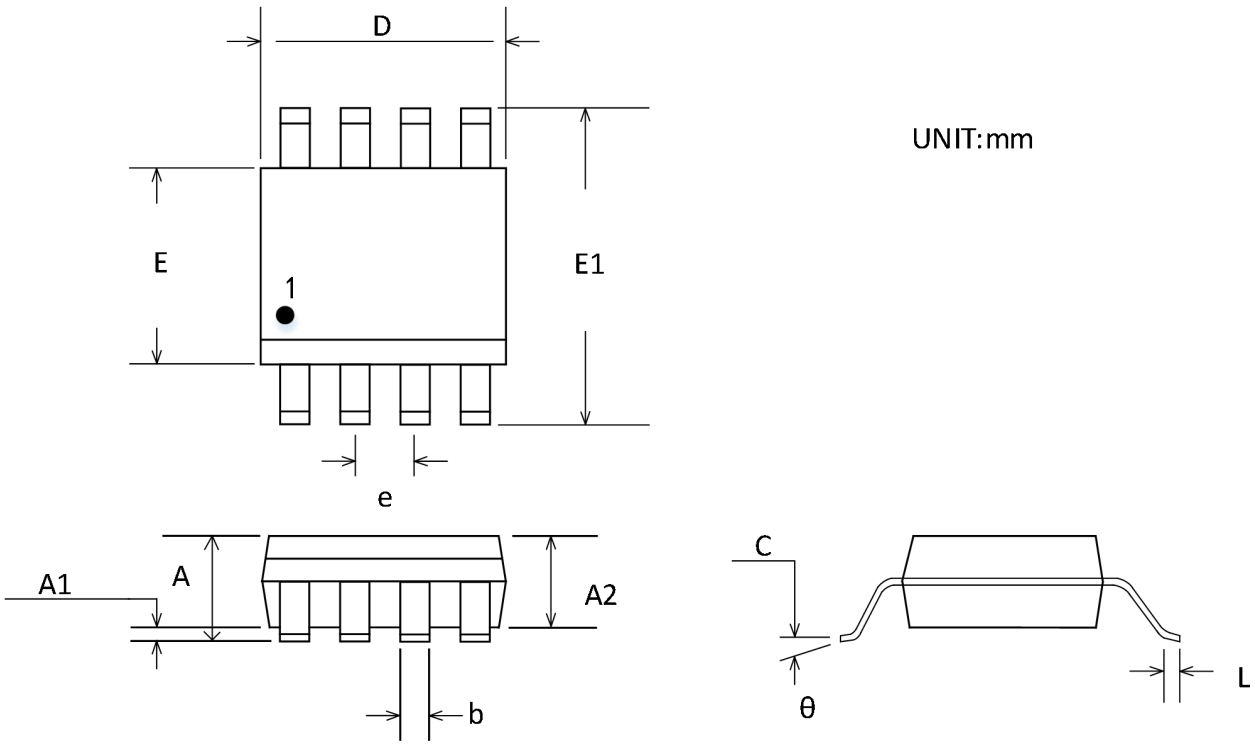
SOT23-6



Symbol	Dimensions In Millimeters	
	Min	Max
A	1.050	1.250
A1	0.000	0.100
A2	1.050	1.150
b	0.300	0.500
C	0.100	0.200
D	2.820	3.020
E	1.500	1.700
E1	2.650	2.950
e	0.950 BSC	
e1	1.900 BSC	0.075 BSC
L	0.300	
θ	0°	8°

Chinese version:CD8221_CD8222_CD8224

MSOP-8



UNIT:mm

Symbol	Dimensions In Millimeters	
	Min	Max
A	0.820	1.100
A1	0.020	0.150
A2	0.750	0.950
b	0.250	0.380
c	0.090	0.230
D	2.900	3.100
E	2.900	3.100
E1	4.750	5.050
e	0.650 BSC	
L	0.400	0.800
θ	0°	6°

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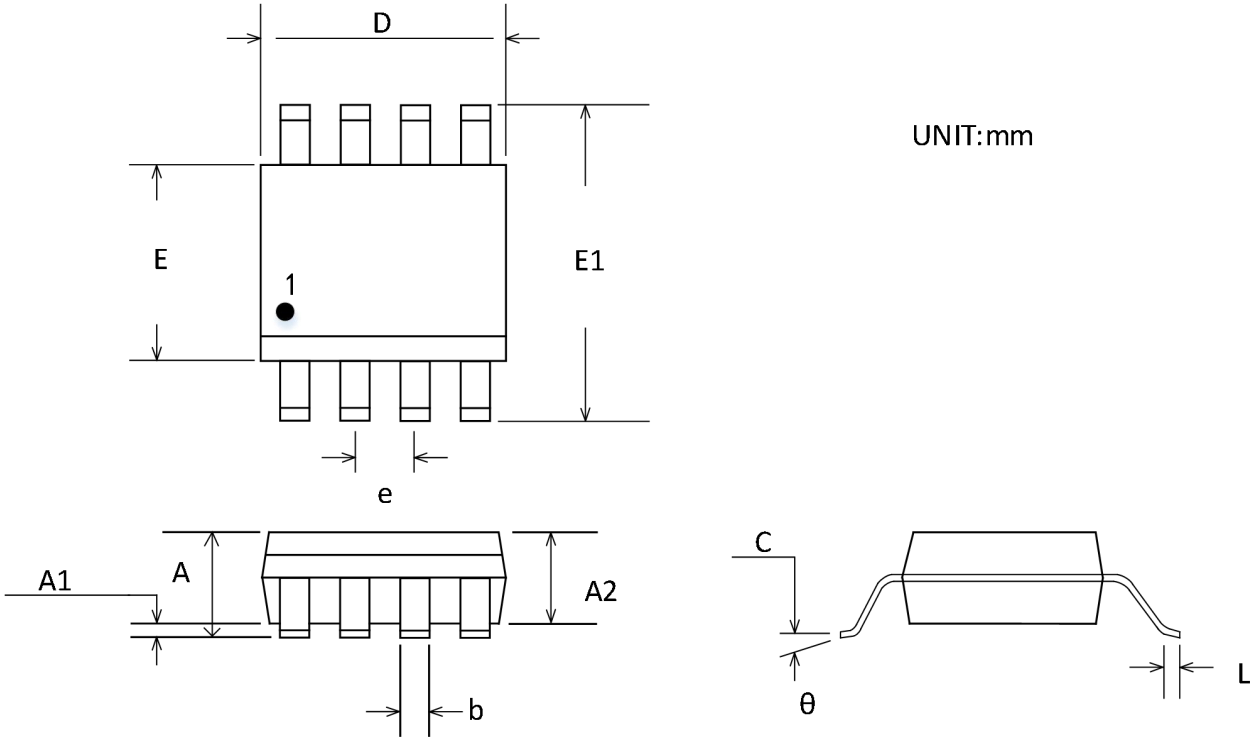
SOP-8

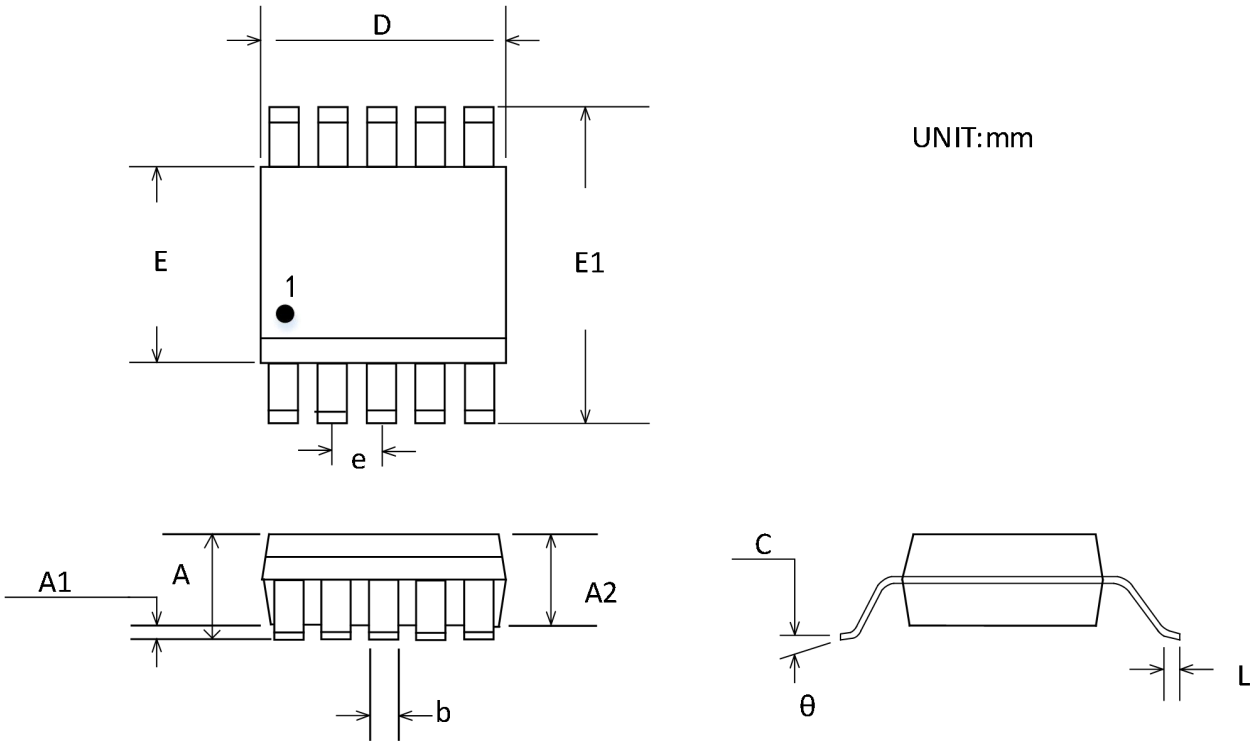


UNIT:mm

Symbol	Dimensions In Millimeters	
	Min	Max
A	1.350	1.750
A1	0.100	0.250
A2	1.350	1.550
b	0.330	0.510
c	0.170	0.250
D	4.800	5.000
E	3.800	4.000
E1	5.800	6.200
e	1.270 BSC	
L	0.400	1.270
θ	0°	8°

Chinese version:CD8221_CD8222_CD8224

MSOP-10



UNIT:mm

Symbol	Dimensions In Millimeters	
	Min	Max
A	0.820	1.100
A1	0.020	0.150
A2	0.750	0.950
b	0.180	0.280
c	0.090	0.230
D	2.900	3.100
E	2.900	3.100
E1	4.750	5.050
e	0.50 BSC	
L	0.400	0.800
θ	0°	6°

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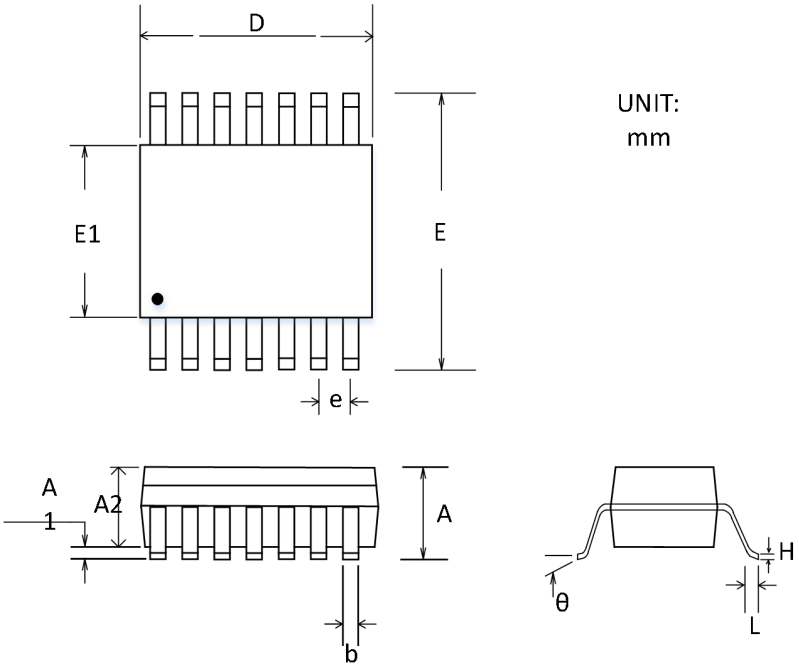
TSSOP-14

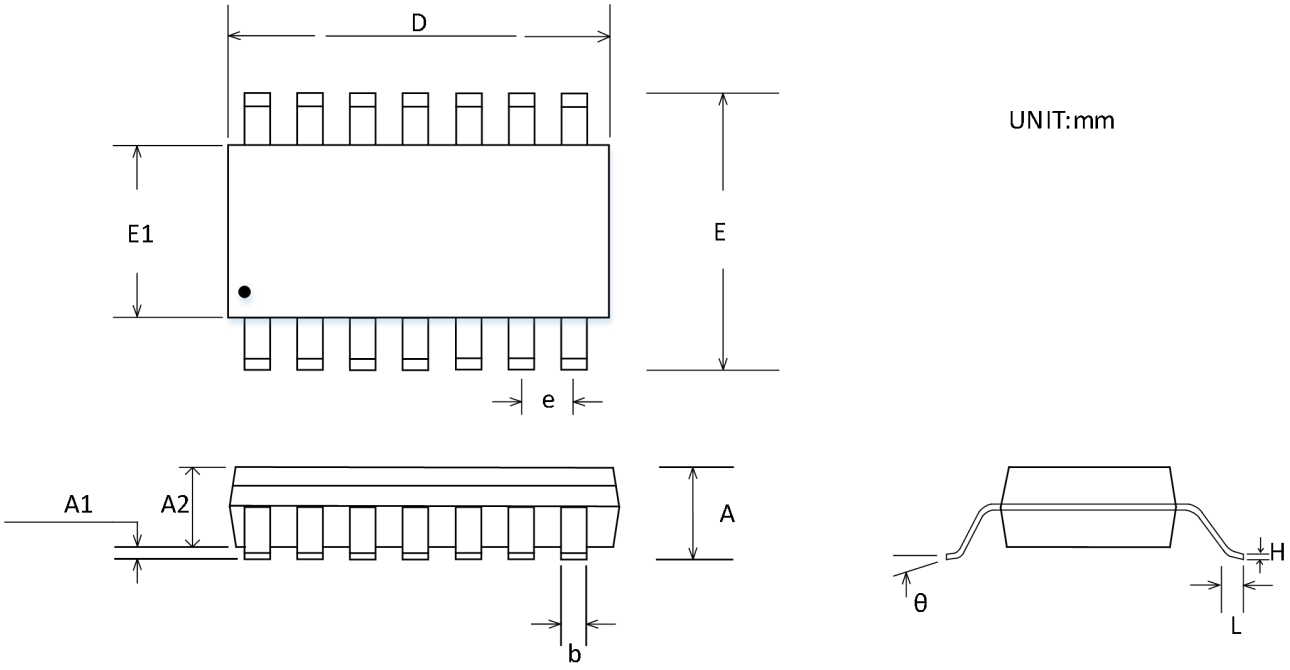


UNIT:
mm

Symbol	Dimensions In Millimeters	
	Min	Max
A	1.20MAX	
A1	0.05	0.15
A2	0.80	1.05
b	0.19	0.30
D	4.90	5.10
E	6.40BSC	
E1	4.30	4.50
e	0.65BSC	
H	0.09	0.20
L	0.45	0.75
θ	0°	8°

Chinese version:CD8221_CD8222_CD8224

SOP-14



UNIT:mm

Symbol	Dimensions In Millimeters	
	Min	Max
A	1.35	1.75
A1	0.10	0.25
A2	1.25	1.50
b	0.31	0.51
D	8.55	8.75
E	5.80	6.20
E1	3.80	4.00
e	1.27BSC	
H	0.17	0.25
L	0.40	1.27
θ	0°	8°

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Package/Ordering Information

MODEL	TEMPERATURE	PACKAGE DESCRIPTION	PACKAGE OPTION
CD8221AS8	-40℃~125℃	SOIC-8(SOP8)	Tape and Reel, 2500
CD8221AS8-RL	-40℃~125℃	SOIC-8(SOP8)	Tape and Reel, 3000
CD8221AS8-REEL	-40℃~125℃	SOIC-8(SOP8)	Tape and Reel, 4000
CD8221AST5	-40℃~125℃	SOT23-5	Tape and Reel, 3000
CD8221BST5	-40℃~125℃	SOT23-5	Tape and Reel, 3000
CD8221AMS8	-40℃~125℃	MSOP-8	Tape and Reel, 3000
CD8221SAS8	-40℃~125℃	SOIC-8(SOP8)	Tape and Reel, 2500
CD8221SAS8-RL	-40℃~125℃	SOIC-8(SOP8)	Tape and Reel, 3000
CD8221SAS8-REEL	-40℃~125℃	SOIC-8(SOP8)	Tape and Reel, 4000
CD8221SAST6	-40℃~125℃	SOT23-6	Tape and Reel, 3000
CD8222AS8	-40℃~125℃	SOIC-8(SOP8)	Tape and Reel, 2500
CD8222AS8-RL	-40℃~125℃	SOIC-8(SOP8)	Tape and Reel, 3000
CD8222AS8-REEL	-40℃~125℃	SOIC-8(SOP8)	Tape and Reel, 4000
CD8222AMS8	-40℃~125℃	MSOP-8	Tape and Reel, 3000
CD8222SAMS	-40℃~125℃	MSOP-10	Tape and Reel, 3000
CD8224AS14	-40℃~125℃	SOIC-14(SOP14)	Tape and Reel, 2500
CD8224AS14-RL	-40℃~125℃	SOIC-14(SOP14)	Tape and Reel, 3000
CD8224AS14-REEL	-40℃~125℃	SOIC-14(SOP14)	Tape and Reel, 4000
CD8224ATS14	-40℃~125℃	TSSOP-14	Tape and Reel, 2500
CD8224ATS14-RL	-40℃~125℃	TSSOP-14	Tape and Reel, 3000
CD8224ATS14-REEL	-40℃~125℃	TSSOP-14	Tape and Reel, 4000

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Revision Log

Version	Revision date	Change content	Reason for Change	Modified by	Reviewed By	Note
V1.0	2025.6.3	Initial version	Regular update	WW	LYL	

Chinese version:CD8221_CD8222_CD8224