CoreadDvices
承芯微电子

CD8631_CD8632_CD8634

Low Noise, Low Power consumption, CMOS, Rail-to-Rail, Input/Output Operational Amplifiers

Version: Rev 1.0.0 Date: 2025-6-3

Features

- Single-Supply Operation from +2.1V ~ +5.5V
- Rail-to-Rail Input / Output
- Gain-Bandwidth Product: 6MHz (Typ.)
- Low Input Bias Current: 1pA (Typ.)
- Low Offset Voltage: 3.5mV (Max.)
- Quiescent Current: 470μA per Amplifier (Typ.)
- Operating Temperature: -40°C ~ +125°C
- Small Package:
  CD8631 Available in SOT23-5, SOP-8 and
  CD8632 Available in SOP-8 and MSOP-8
  CD8634 Available in SOP-14 and TSSOP-14

Application

- Sensors
- Active Filters
- Cellular and Cordless Phones
- Laptops and PDAs
- Audio
- Handheld Test Equipment
- Battery-Powered Instrumentation
- A/D Converters

Description

The CD863X have a high gain-bandwidth product of 6MHz, a slew rate of 4.2V/μs, and a quiescent current of 470μA per amplifier at 5V. The CD863X are designed to provide optimal performance in low voltage and low noise systems. They provide rail-to-rail output swing into heavy loads. The input common mode voltage range includes ground, and the maximum input offset voltage is 3.5mV for CD863X. They are specified over the extended industrial temperature range (-40℃ to +125℃). The operating range is from 2.1V to 5.5V. The CD8631 single is available in Green SC70-5, SOT23-5 and SOP-8 packages. The CD8632 dual is available in Green SOP-8 and MSOP-8 packages. The CD8634 Quad is available in Green SOP-14 and TSSOP-14 packages.

Chinese version:CD8631_CD8632_CD8634

Contents

Pin Configurations

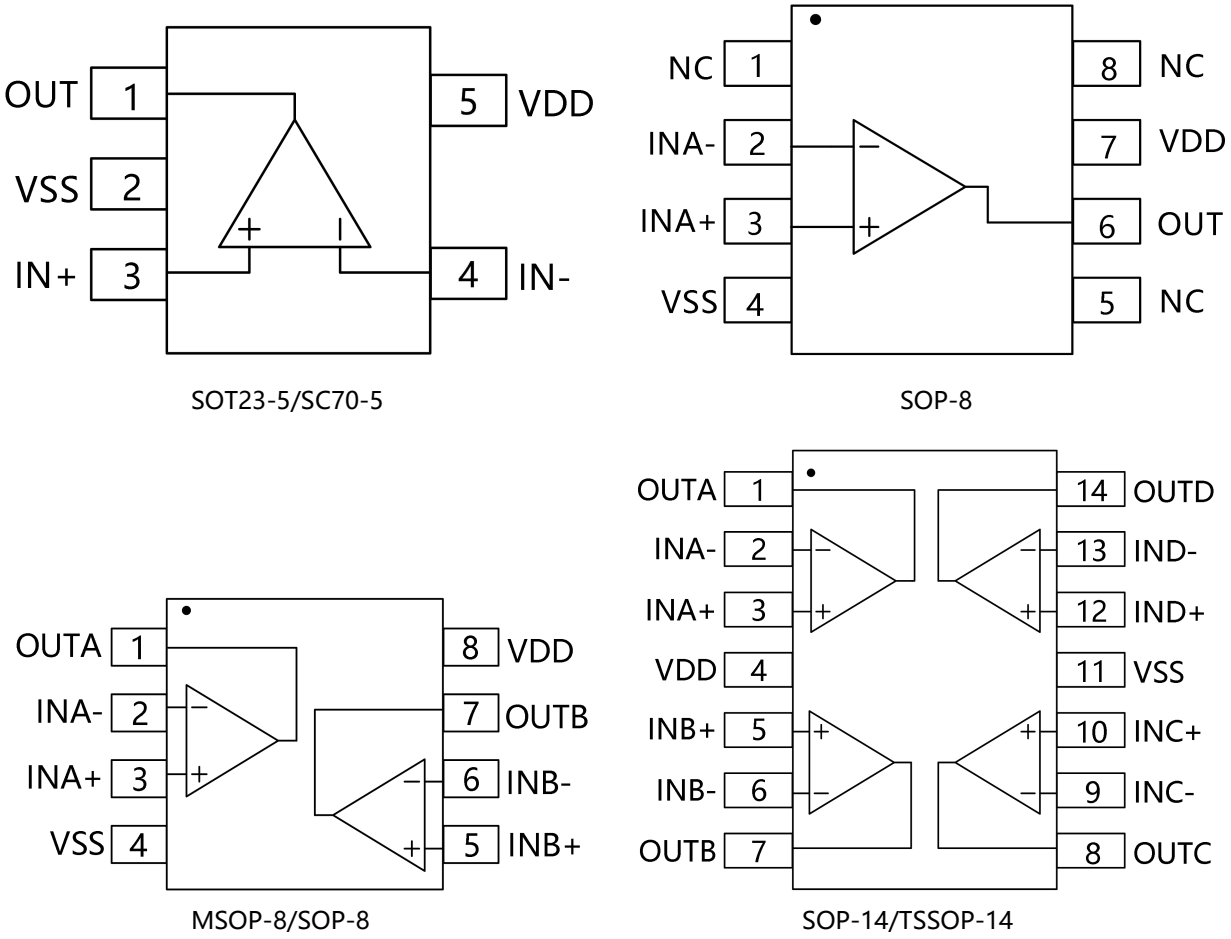

Figure 1. Pin Assignment Diagram

Absolute Maximum Ratings

Parameter	Range
Supply Voltage (VS)	7V
Input Voltage	− 0.5 to (V+) + 0.5V
Storage Temperature Range	−65℃ to +150℃
Operating Temperature Range	−40℃ to +125℃
Junction Temperature Range	−65℃ to +150℃
Lead Temperature (Soldering,60 sec)	300℃
Package Thermal Resistance @ T_A= +25°C	
SOP-8, θ_{JA}	125°C/W

MSOP-8, θ_{JA}	216°C/W
SOT23-5, θ_{JA}	190°C/W
SOT23-6, θ_{JA}	190°C/W
SC70-5, θ_{JA}	333°C/W
HBM	8000V
MM	400V

Electrical characteristics

(At Vs=5V, T_A = +25°C, V_{CM} = V_S/2, R_L = 600KΩ, unless otherwise noted.)

PARAMETER	CONDITION	CD8631/CD8632/CD8634						
		TYP	MIN/MAX OVER TEMPERATURE					
		+25°C	+25°C	0°C to 70°C	-40°C to 85°C	-40°C to 125°C	UNITS	MIN/MAX
INPUT CHARACTERISTICS								
Input Offset Voltage (V_{OS})		0.8	3.5	3.9	4.3	4.6	mV	MAX
Input Bias Current (I_B)		1					pA	TYP
Input Offset Current (I_{OS})	V_S = 5.5V	1					pA	TYP
Input Common Mode Voltage Range (V_{CM})		-0.1 to +5.6					V	TYP
Common-Mode Rejection Ratio (CMRR)	V_S = 5.5V, VCM = -0.1V to 4V	90	73	70	70	65	dB	MIN
	V_S = 5.5V, VCM =-0.1V to 5.6V	83					dB	MIN
Large Signal Voltage Gain (A_{VO})	R_L = 600Ω, VO = 0.15V to 4.85V	97	90	87	86	79	dB	MIN
	R_L = 10kΩ, VO = 0.05V to 4.95V	108					dB	MIN
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta_T$)		2.4					μV/°C	TYP
OUTPUT CHARACTERISTICS								
Output Voltage Swing	R_L = 600Ω	0.1					V	V

from Rail	R_L = 10kΩ	0.015					V	V
Output Current (I_{OUT})		53	49	45	40	35	mA	mV
Closed-Loop Output Impedance	f = 200kHz, G = 1	3					Ω	mA
POWER-DOWN DISABLE								
Turn-On Time		4						μs
Turn-Off Time		1.2						μs
POWER SUPPLY								
Operating Voltage Range		2.1	2.1	2.1	2.1	2.1	V	MIN
		5.5	5.5	5.5	5.5	5.5	V	MAX
Power Supply Rejection Ratio (PSRR)	V_S = +2.5V to +5.5V V_{CM} = (-VS) + 0.5V	91	74	72	72	68	dB	TYP
Quiescent Current/Amplifier (I_Q)	I_{OUT} = 0	470	650	727	750	815	μA	TYP
DYNAMIC PERFORMANCE								
Gain-Bandwidth Product (GBP)	R_L = 10kΩ, CL = 100pF	6					MHz	TYP
Phase Margin (φ_O)	R_L = 10kΩ, CL = 100pF	53					Degrees	TYP
Full Power Bandwidth (BWP)	＜1% distortion, R_L = 600Ω	250					kHz	TYP
Slew Rate (SR)	G = +1, 2V Step, R_L = 10kΩ	4.2					V/μs	TYP
Settling Time to 0.1% (T_S)	G = +1, 2V Step, R_L = 600Ω	0.4					μs	TYP
Overload Recovery Time	V_{IN} ·Gain = VS, R_L = 600Ω	2.5					μs	TYP
NOISE PERFORMANCE								
Voltage Noise Density (e_n)	R_L = 600Ω	13					$nV/\sqrt{Hz}$	TYP
	R_L = 10kΩ	9.5					$nV/\sqrt{Hz}$	TYP

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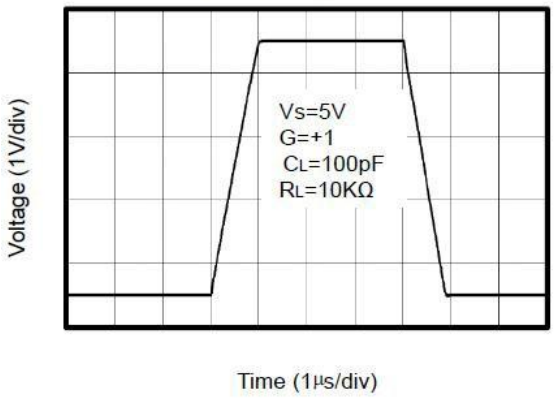
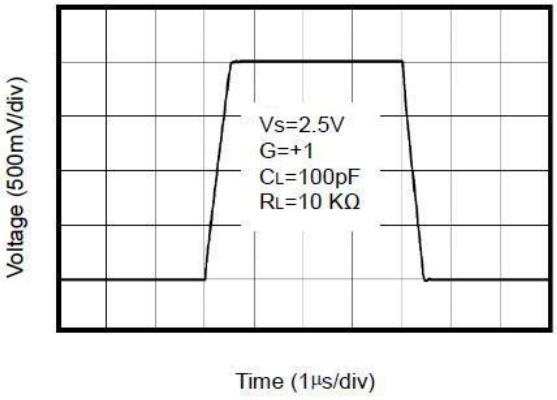
Typical Characteristics

(At Vs=5V, T_A = +25℃, V_{CM} = V_S/2, R_L = 600Ω, unless otherwise noted.)

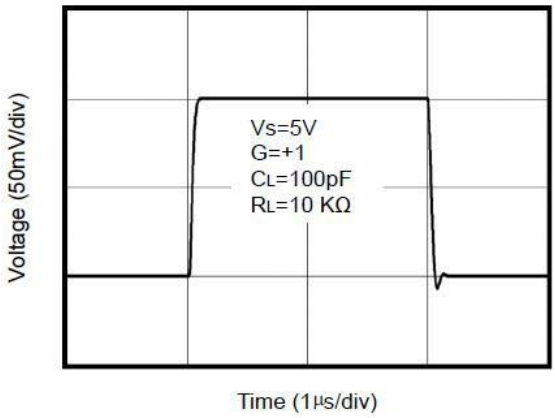
Large-Signal Step Response



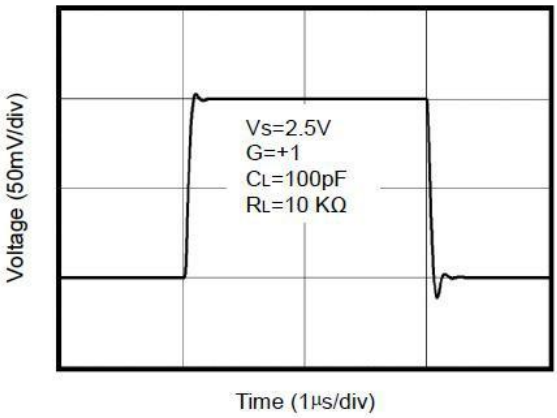
Large-Signal Step Response



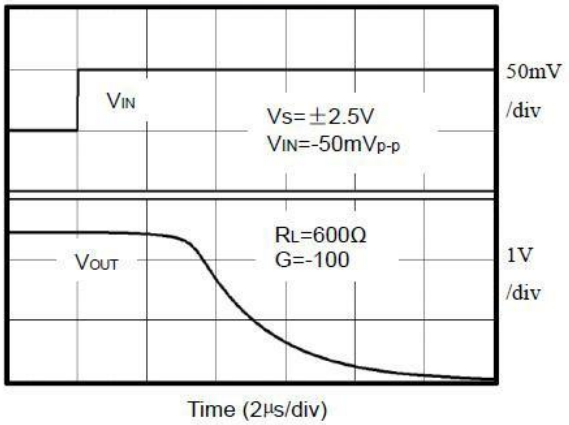
Small-Signal Step Response



Small-Signal Step Response



Positive Overload Recovery



Negative Overload Recovery

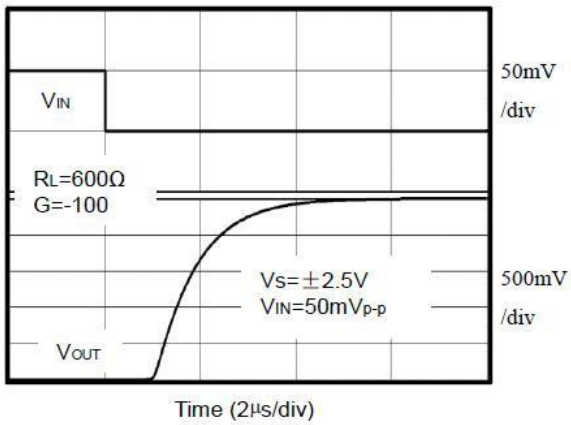


Figure 5. Input Offset Voltage Distribution

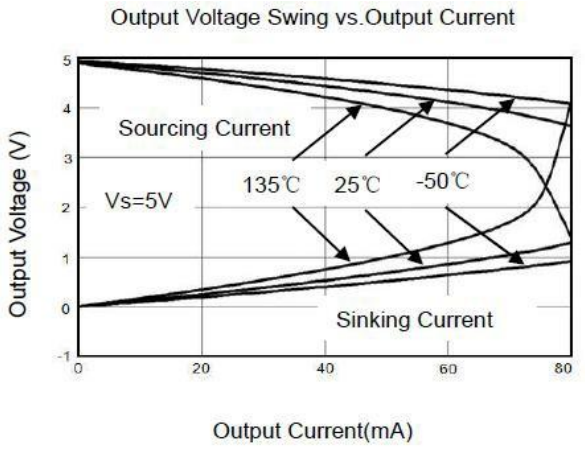
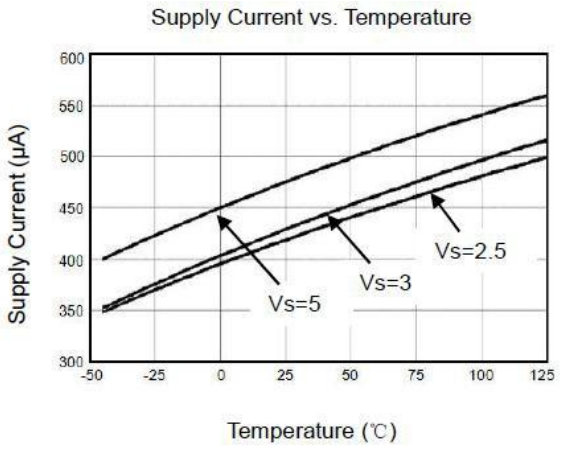
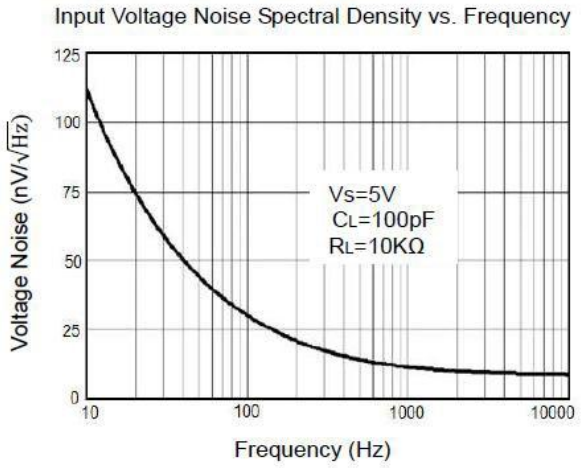
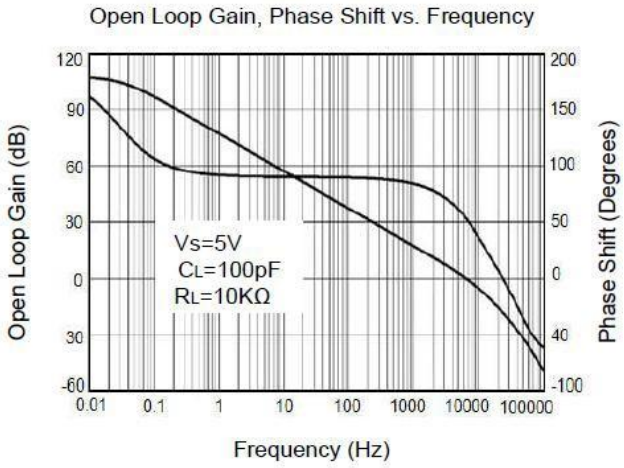
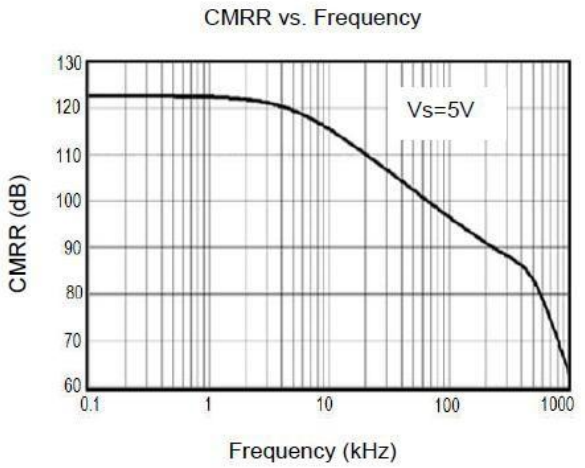


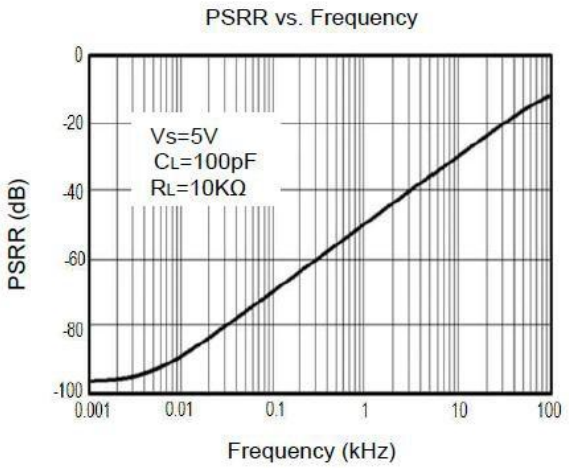
Figure 6. Input Offset Voltage Distribution











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Applications Information

Size

CD863X series op amps are unity-gain stable and suitable for a wide range of general-purpose applications. The small footprints of the CD863X series packages save space on printed circuit boards and enable the design of smaller electronic products.

Power Supply Bypassing and Board Layout

CD863X series operates from a single 2.1V to 5.5V supply or dual ±1.05V to ±2.75V supplies. For best performance, a 0.1μF ceramic capacitor should be placed close to the VDD pin in single supply operation. For dual supply operation, both VDD and VSS supplies should be bypassed to ground with separate 0.1μF ceramic capacitors.

Low Supply Current

The low supply current (typical 470uA per channel) of CD863X series will help to maximize battery life. They are ideal for battery powered systems

Operating Voltage

CD863X series operate under wide input supply voltage (2.1V to 5.5V). In addition, all temperature specifications apply from -40℃ to +125℃. Most behavior remains unchanged throughout the full operating voltage range. These guarantees ensure operation throughout the single Li-Ion battery lifetime

Rail-to-Rail Input

The input common-mode range of CD863X series extends 100mV beyond the supply rails (VSS-0.1V to VDD+0.1V). This is achieved by using complementary input stage. For normal operation, inputs should be limited to this range.

Rail-to-Rail Output

Rail-to-Rail output swing provides maximum possible dynamic range at the output. This is particularly important when operating in low supply voltages. The output voltage of CD863X series can typically swing to less than 2mV from supply rail in light resistive loads (>100kΩ), and 60mV of supply rail in moderate resistive loads (10kΩ).

Capacitive Load Tolerance

The CD863x family is optimized for bandwidth and speed, not for driving capacitive loads. Output capacitance will create a pole in the amplifier’s feedback path, leading to excessive peaking and potential oscillation. If dealing with load capacitance is a requirement of the application, the two strategies to consider are (1) using a small resistor in series with the amplifier’s output and the load capacitance and (2) reducing the bandwidth of the amplifier’s feedback loop by increasing the overall noise gain. Figure 2. shows a unity gain follower using the series resistor strategy. The resistor isolates the output from the capacitance and, more importantly, creates a zero in the feedback path that compensates for the pole created by the output capacitance.

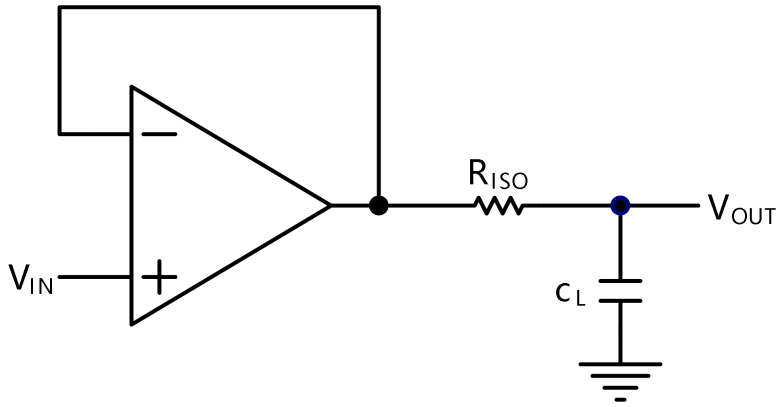

Figure 2. Indirectly Driving a Capacitive Load Using Isolation Resistor

The bigger the R_{ISO} resistor value, the more stable V_{OUT} will be. However, if there is a resistive load R_L in parallel with the capacitive load, a voltage divider (proportional to R_{ISO}/R_L) is formed, this will result in a gain error.

The circuit in Figure 3 is an improvement to the one in Figure 2. R_F provides the DC accuracy by feed-forward the V_{IN} to R_L. C_F and $_{RISO}$ serve to counteract the loss of phase margin by feeding the high frequency component of the output signal back to the amplifier' s inverting input, thereby preserving the phase margin in the overall feedback loop. Capacitive drive can be increased by increasing the value of C_F. This in turn will slow down the pulse response.

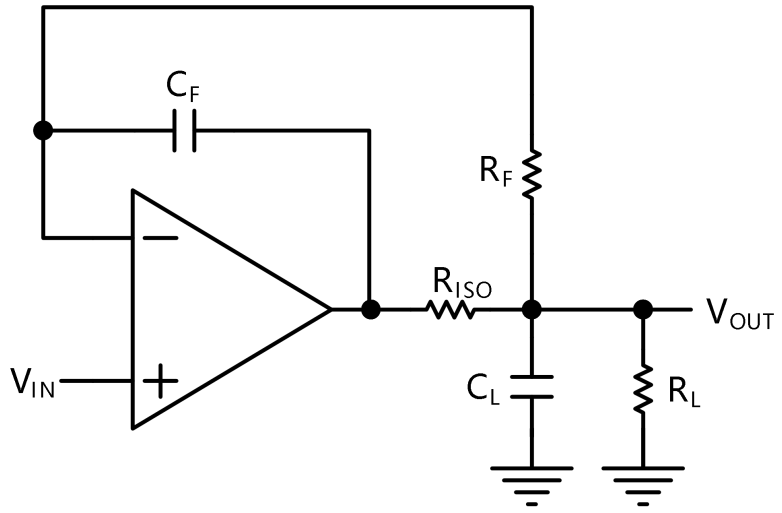

Figure 3. Indirectly Driving a Capacitive Load with DC Accuracy

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Typical Application Circuits

Differential amplifier

The differential amplifier allows the subtraction of two input voltages or cancellation of a signal common the two inputs. It is useful as a computational amplifier in making a differential to single-end conversion or in rejecting a common mode signal. Figure 4. shown the differential amplifier using CD863X.

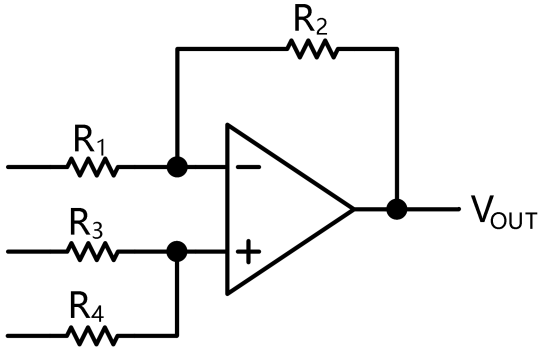


Figure 4. Differential Amplifier

$$V_{OUT} = \left(\frac{R_1 + R_2}{R_3 + R_4}\right)\frac{R_4}{R_1}V_{IN} - \frac{R2}{R1}V_{IP} + \left(\frac{R_1 + R_2}{R_3 + R_4}\right)\frac{R_3}{R_1}V_{REF}$$

If the resistor ratios are equal (i.e. R1=R3 and R2=R4), then

$$V_{OUT} = \frac{R_2}{R_1}(V_{IP} - V_{IN}) + V_{REF}$$

Low Pass Active Filter

The low pass active filter is shown in Figure 5. The DC gain is defined by –R2/R1. The filter has a -20dB/decade roll-off after its corner frequency fC=1/(2πR$_3$C$_1$).

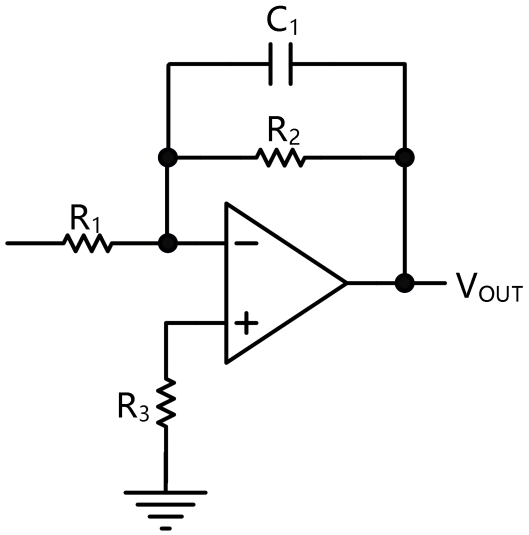


Figure 5. Low Pass Active Filter

Instrumentation Amplifier

The triple CD863X can be used to build a three-op-amp instrumentation amplifier as shown in Figure 6. The amplifier in Figure 6 is a high input impedance differential amplifier with gain of R_2/R_1. The two differential voltage followers assure the high input impedance of the amplifier.

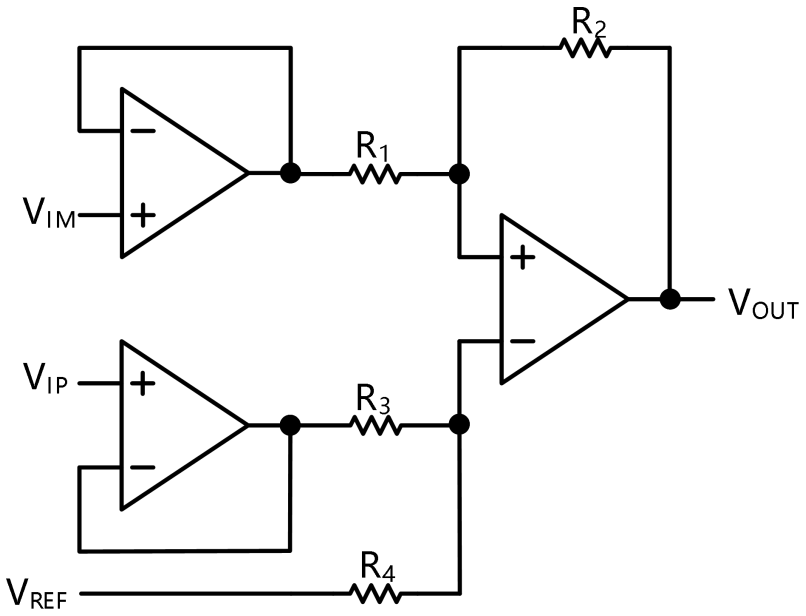
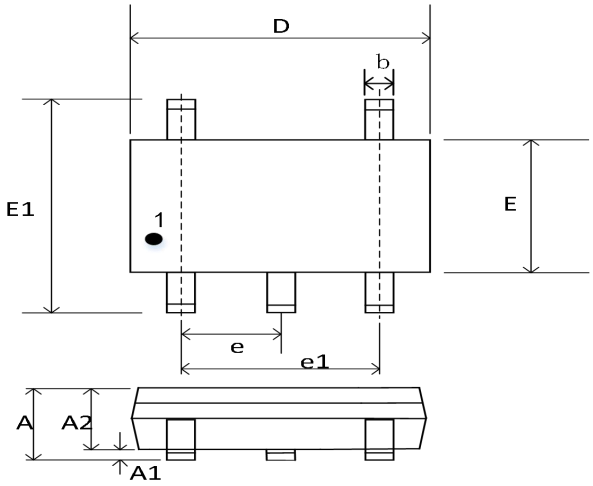


Figure 6. Instrument Amplifier

Package Outline Dimensions

SC70-5



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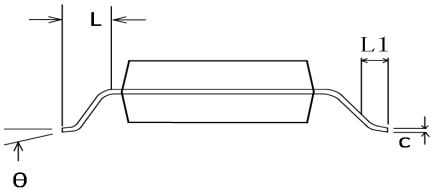

Symbol	Dimensions In Millimeters	
	Min	Max
A	0.800	1.100
A1	0.000	0.100
A2	0.700	1.000
b	0.150	0.300
c	0.080	0.220
D	1.800	2.200
E	1.150	1.350
E1	1.800	2.400
e	0.650 BSC	
e1	1.200	1.400
L	0.525 REF	
L1	0.260	0.460
θ	0°	8°

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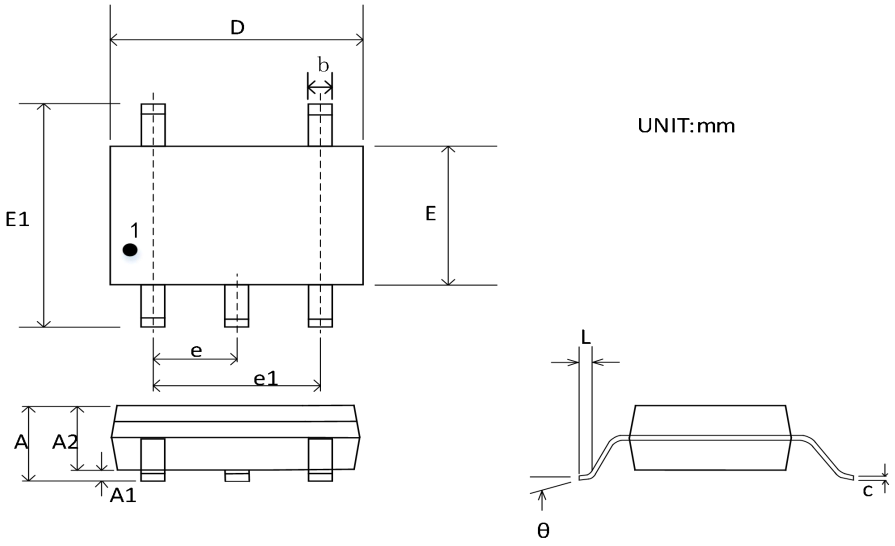
SOT23-5



Symbol	Dimensions In Millimeters	
	Min	Max
A	--	1.450
A1	--	0.150
A2	0.900	1.300
b	0.300	0.500
c	0.080	0.220
D	2.900 BSC	
E	1.600 BSC	
E1	2.80 BSC	
e	0.950 BSC	
e1	1.900 BSC	
L	0.300	0.600
θ	0°	8°

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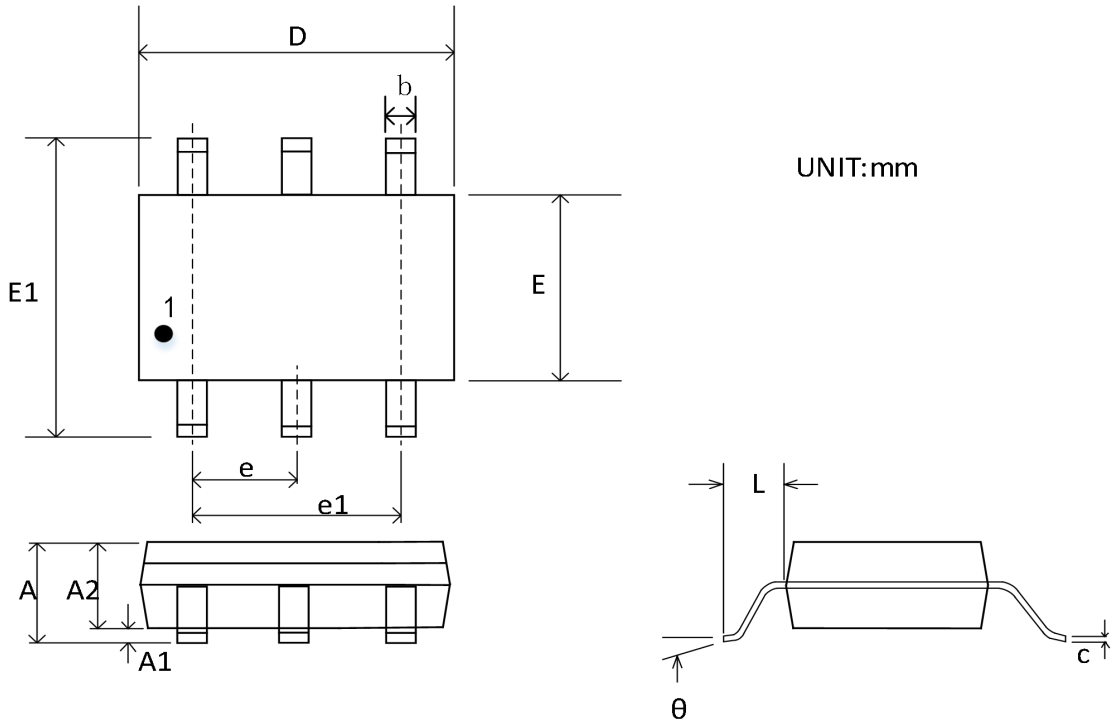
SOT23-6



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°

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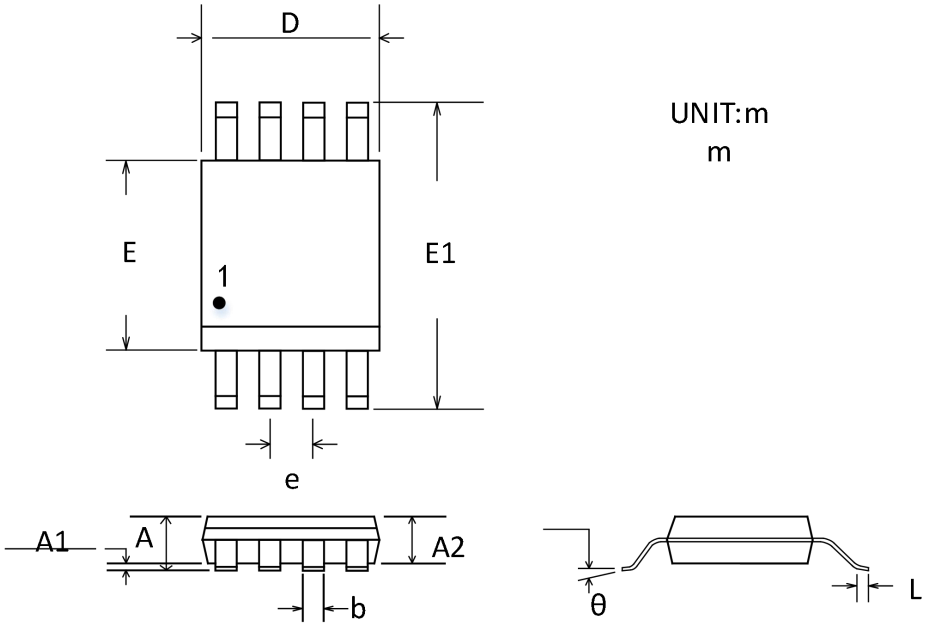
MSOP-8



UNIT:m
m

Symbol	Dimensions In Millimeters	
	Min	Max
A	0.820	1.100
A1	0.000	0.150
A2	0.750	0.950
b	0.220	0.380
D	2.800	3.200
E	2.800	3.200
E1	4.650	5.150
e	0.650 BSC	
L	0.400	0.800
θ	0°	8°

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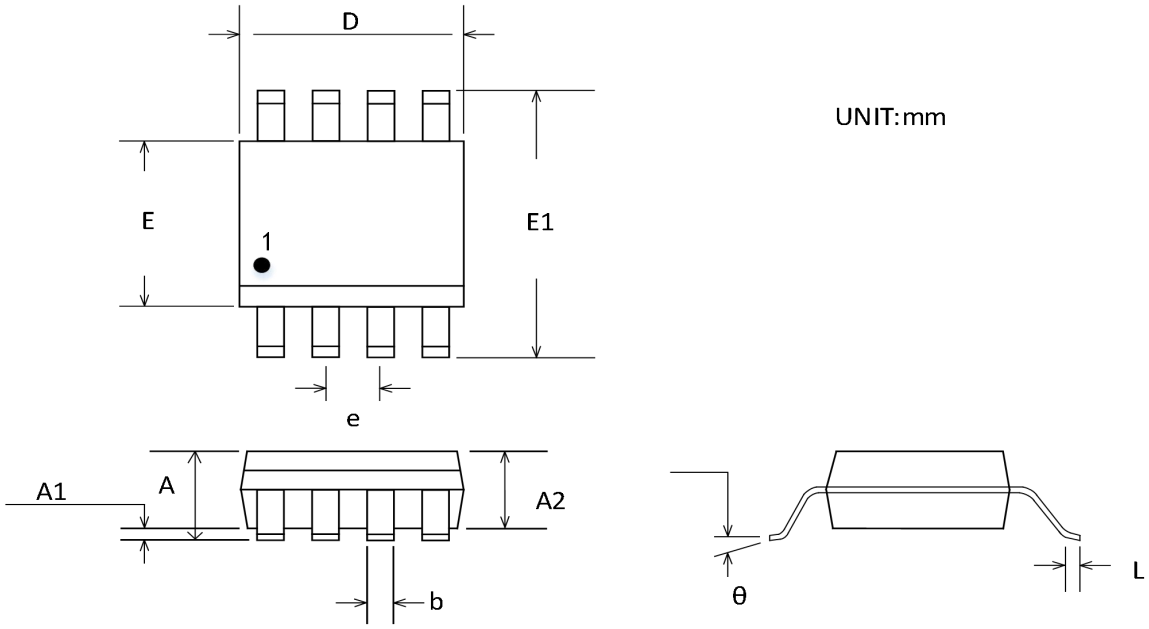
SOP-8



UNIT:mm

Symbol	Dimensions In Millimeters	
	Min	Max
A	1.350	1.750
A1	0.100	0.250
A2	1.350	1.550
b	0.310	0.510
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°

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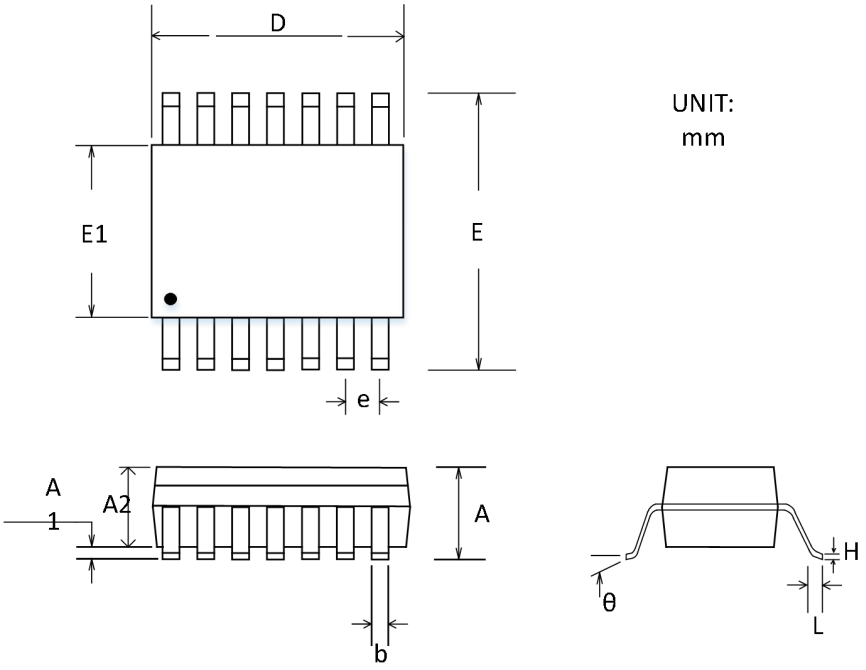
TSSOP-14

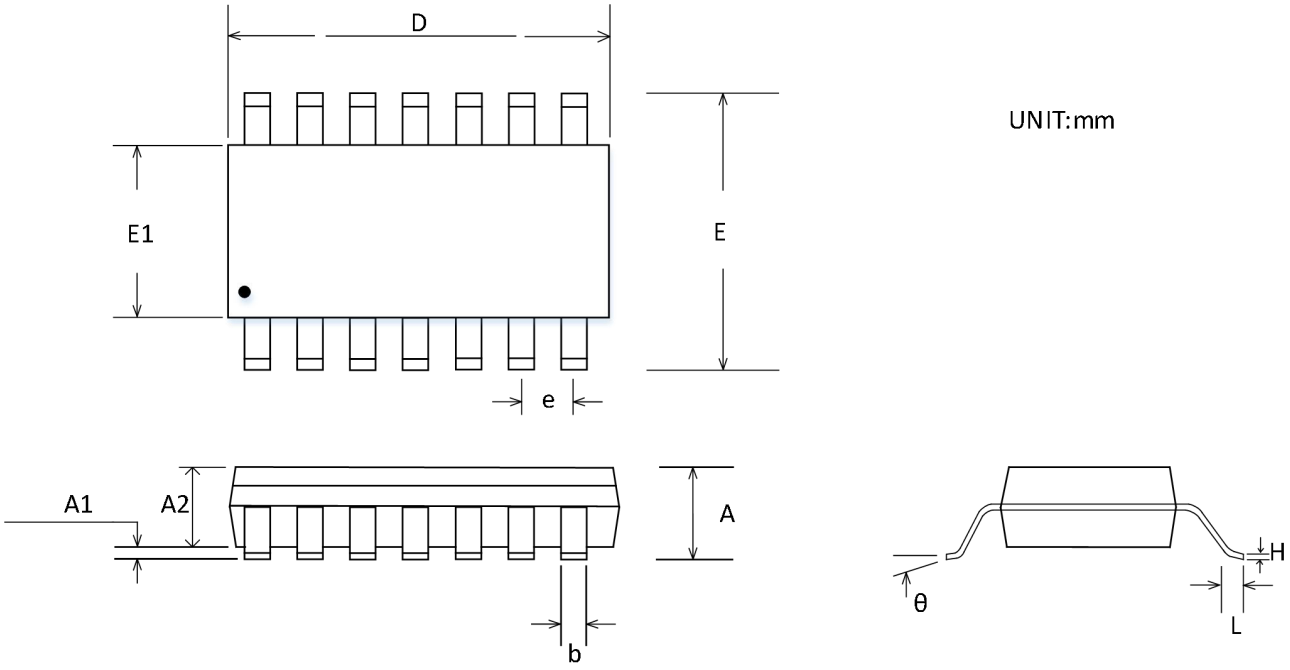


UNIT:
mm

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:CD8631_CD8632_CD8634

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
CD8631ASC7	-40℃~125℃	SC70-5	Tape and Reel,3000
CD8631AST5	-40℃~125℃	SOT23-5	Tape and Reel,3000
CD8631AS8	-40℃~125℃	SOP-8	Tape and Reel,2500
CD8631AS8-RL	-40℃~125℃	SOP-8	Tape and Reel,3000
CD8631AS8-REEL	-40℃~125℃	SOP-8	Tape and Reel,4000
CD8632AS8	-40℃~125℃	SOP8	Tape and Reel,2500
CD8632AS8-RL	-40℃~125℃	SOP8	Tape and Reel,3000
CD8632AS8-REEL	-40℃~125℃	SOP8	Tape and Reel,4000
CD8632AMS8	-40℃~125℃	MSOP-8	Tape and Reel,3000
CD8634AS14	-40℃~125℃	SOP-14	Tape and Reel,2500
CD8634AS14-RL	-40℃~125℃	SOP-14	Tape and Reel,3000
CD8634AS14-REEL	-40℃~125℃	SOP-14	Tape and Reel,4000
CD8634ATS14	-40℃~125℃	TSSOP-14	Tape and Reel,2500
CD8634ATS14-RL	-40℃~125℃	TSSOP-14	Tape and Reel,3000
CD8634ATS14-REEL	-40℃~125℃	TSSOP-14	Tape and Reel,4000

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	

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