CoreadDvices
承芯微电子

CD8045_CD8046_CD8047

Low-cost, general-purpose, rail-to-rail input/output operational amplifier

Version: Rev 1.0.0 Date: 2025-6-3

Features

- Single-Supply Operation from +1.4V ~ +5.5V
- Rail-to-Rail Input / Output
- Gain-Bandwidth Product: 100KHz (Typ)
- Low Input Bias Current: 1pA (Typ)
- Low Offset Voltage: 3mV (Max)
- stable for Gains≥10
- Quiescent Current: 600nA per Amplifier (Typ)
- Chip Select with CBM8047H(active High) and CBM8047L(active Low)
- Operating Temperature: -40°C ~ +125°C
- Embedded RF Anti-EMI Filter
- Small Package:

  CBM8045 Available in SOT23-5 and SC70-5 Packages

  CBM8046 Available in SOP-8 and MSOP-8 Packages

  CBM8047H Available in SOT23-6 and SC70-6 Packages

  CBM8047L Available in SOT23-6 and SC70-6 Packages

Application

- ASIC Input or Output
- Sensor Interface
- Medical Communication
- Smoke Detectors
- Audio Output
- Piezoelectric Transducer
- Medical Instrumentation
- Portable Systems

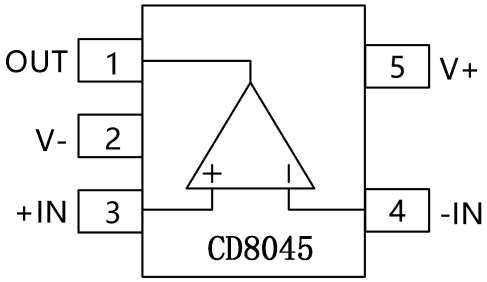
Description

The CBM804X family has a high gain-bandwidth product of 100KHz, a slew rate of 40V/ms, stable for gains≥10, and a quiescent current of 600nA/amplifier at 5V. The CBM804X family is 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 3mV for CBM804X family. They are specified over the extended industrial temperature range (-40℃ to +125℃). The operating range is from 1.4V to 5.5V. The CBM8045 single is available in Green SC70-5 and SOT23-5 packages. The CBM8046 Dual is available in Green SOP-8 and MSOP-8 packages. The CBM8047 single is available in Green SC70-6 and SOT23-6 packages.

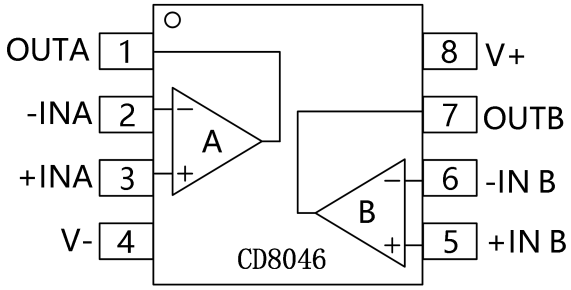
Chinese version:CD8045_CD8046_CD8047

Contents

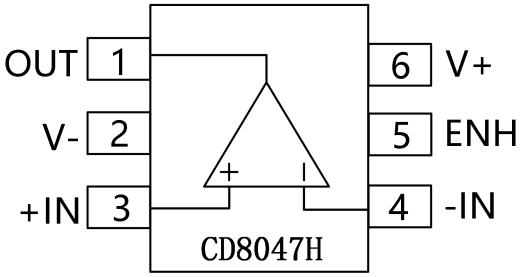
Pin Configurations

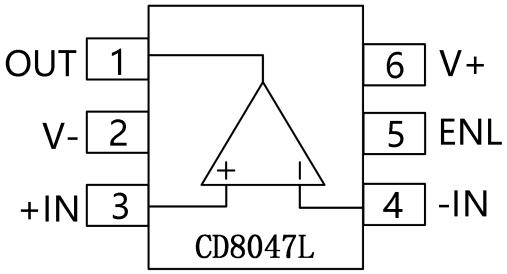


SOT23-5/SC70-5



SOIC-8(SOP8),MSOP-8





SOT23-6/SC70-6

**ENH active at high level, ENL active at low level

Absolute Maximum Ratings

Condition	Min	Max
Power Supply Voltage (V_{DD} to VSS)	-0.5V	+7.5V
Analog Input Voltage (IN+ or IN-)	VSS-0.5V	V_{DD}+0.5V
PDB Input Voltage	VSS-0.5V	+7V
Operating Temperature Range	-40℃	+125℃
Junction Temperature	+160℃	
Storage Temperature Range	-65℃	+150℃
Lead Temperature (soldering, 10sec)	+300℃	
Package Thermal Resistance (T_A=+25℃)		
SOP-8, θ_{JA}	125℃/W	
MSOP-8, θ_{JA}	216℃/W	
SOT23-5, θ_{JA}	190℃/W	

Chinese version:CD8045_CD8046_CD8047

SOT23-6, θ_{JA}	190°C/W
SC70-5, θ_{JA}	333°C/W
ESD Susceptibility	
HBM	6KV
MM	400V

Electrical characteristics

(At V_S = +5V, AV=10, R_L = 1MΩ connected to $V_S/2$, and V_{OUT} = $V_S/2$, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	CBM8045/CBM8046/CBM8047			UNIT
			MIN	TYP	MAX	
INPUT CHARACTERISTICS						
Input Offset Voltage	V_{OS}	V_{CM} = $V_S/2$	0.4		3	mV
Input Bias Current	I_B		1			pA
Input Offset Current	I_{OS}		1			pA
Common-Mode Voltage Range	V_{CM}	V_S = 5.5V	-0.1 to +5.6			V
Common-Mode Rejection Ratio	CMRR	V_S = 5V, V_{CM} = -0.1V to 2.5V	76	71		dB
		V_S = 5V, V_{CM} = -0.1V to 5.1V	82	68		
Open-Loop Voltage Gain	A_{OL}	V_S=1.4V, R_L = 50kΩ, V_O = Vs-0.1V	86	69		dB
		V_S=5V, R_L = 50kΩ, V_O = Vs-0.1V	92	84		
Input Offset Voltage Drift	$\Delta V_{OS}/\Delta_T$		2.5			μV/℃
OUTPUT CHARACTERISTICS						
Output Voltage Swing from Rail	V_{OH}	Vs=1.4V, R_L = 50kΩ	1.395	1.390		V
	V_{OL}		4.5		10	mV
	V_{OH}	Vs=5V, R_L = 50kΩ	4.997	4.990		V
	V_{OL}		3.5		10	mV
Output Current	I_{SOURCE}	R_L = 10Ω to $V_S/2$	20			mA
	I_{SINK}		20			
POWER SUPPLY						
Operating Voltage Range			1.4			V
			5.5			V
Power Supply Rejection Ratio	PSRR	VS = +1.4V to +5.5V, VCM = +0.5V	84	77		dB

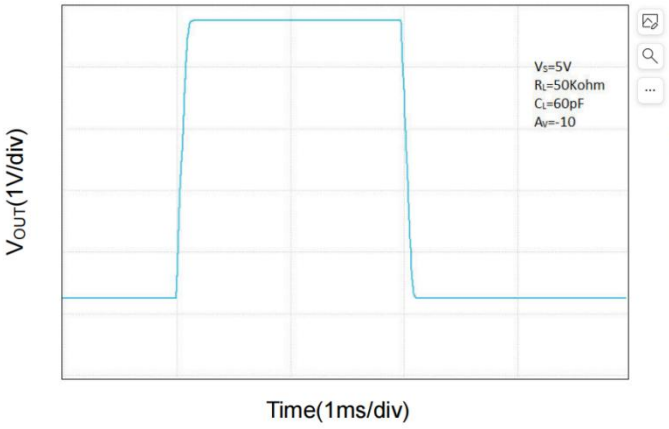
Chinese version:CD8045_CD8046_CD8047

Quiescent Current / Amplifier	I_Q		600			nA
Shutdown Current / Amplifier	I_{Q_off}	CBM8047H / CBM8047L	54			nA
DYNAMIC PERFORMANCE (CL = 100pF)						
Slew Rate	SR	G = +10, 2V Output Step	40			V/ms
Gain-Bandwidth Product	GBP		100			KHz

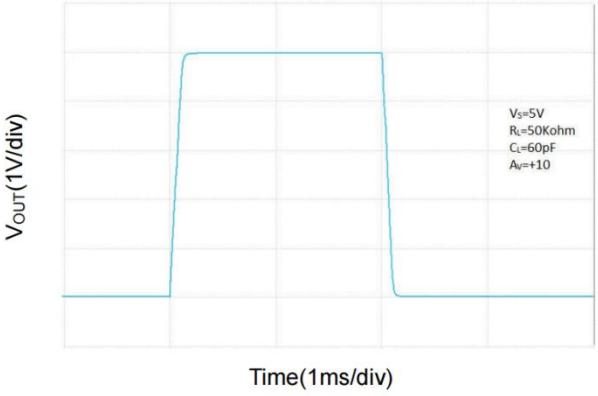
Typical Characteristics

At T_A=+25℃, V_S=+5V, AV=10, and R_L=100KΩ connected to V_S/2, unless otherwise noted.

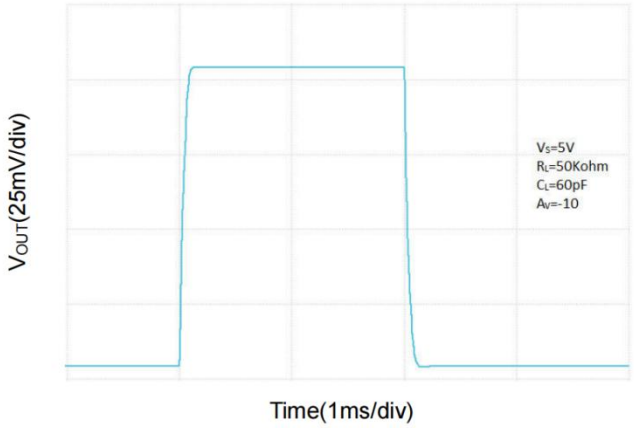
Large Signal Inverting Pulse Response



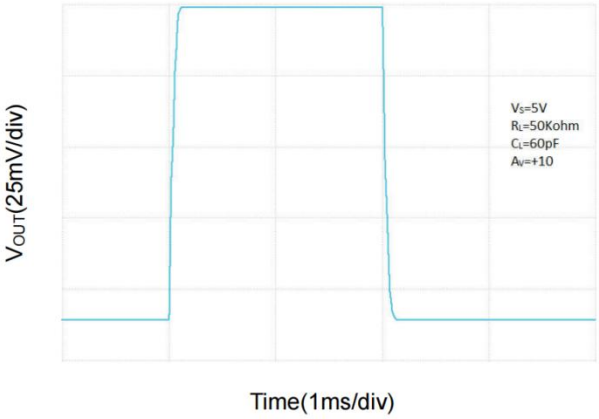
Large Signal Non-Inverting Pulse Response

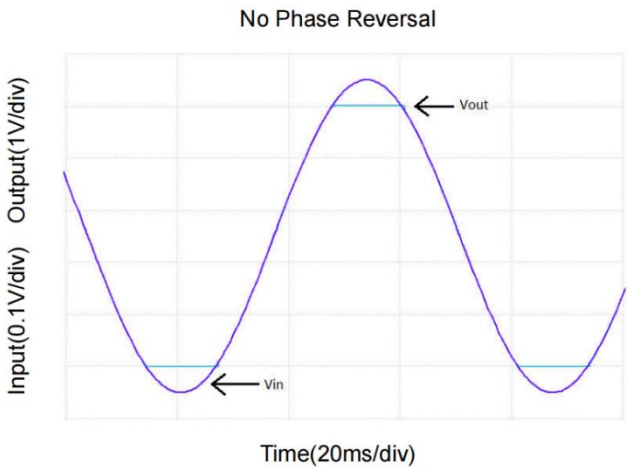


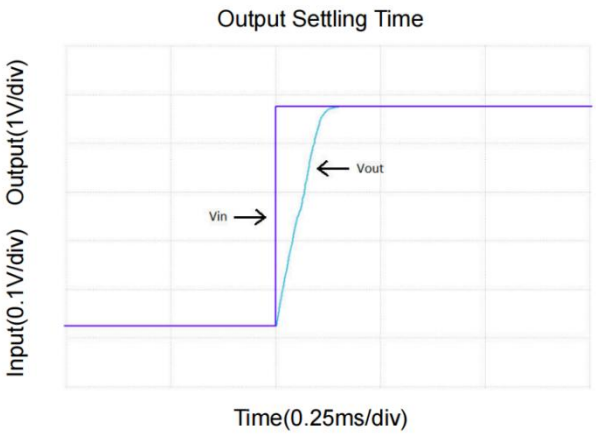
Small Signal Inverting Pulse Response



Small Signal Non-Inverting Pulse Response







Application Notes

Size

CBM804X family series op amps are stable for gains ≥ 10 and suitable for a wide range of general-purpose applications. The small footprints of the CBM804X family packages save space on printed circuit boards and enable the design of smaller electronic products.

Power Supply Bypassing and Board Layout

CBM804X family series operates from a single 1.4V to 5.5V supply or dual ±0.7V 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 600nA per channel) of CBM804X family will help to maximize battery life. They are ideal for battery powered systems.

Operating Voltage

CBM804X family operates under wide input supply voltage (1.4V 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 CBM804X family 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 CBM804X family can typically swing to less than 50mV from supply rail in light resistive loads (>50kΩ).

Capacitive Load Tolerance

The CBM804X 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 non-inverting gain circuit 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.

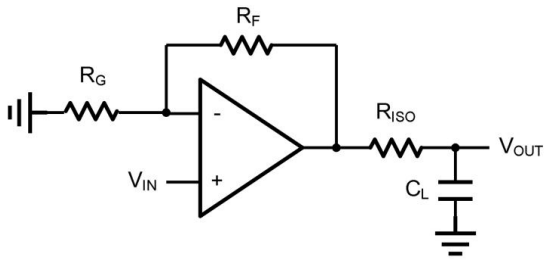


Figure 2. Indirectly Driving a Capacitive Load Using Isolation Resistor

The bigger the RISO resistor value, the more stable VOUT will be. However, if there is a resistive load RL in parallel with the capacitive load, a voltage divider (proportional to RISO/RL) is formed, this will result in a gain error.

The circuit in Figure 3 is an improvement to the one in Figure 2. RF provides the DC accuracy by feed-forward the VIN to RL. CF 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 CF. This in turn will slow down the pulse response.

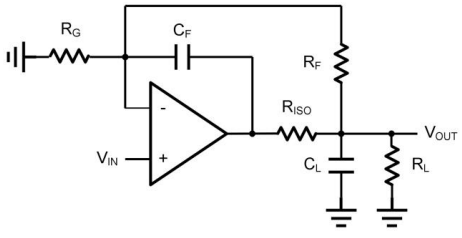


Figure 3. Indirectly Driving a Capacitive Load with DC Accuracy

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 CD804X.

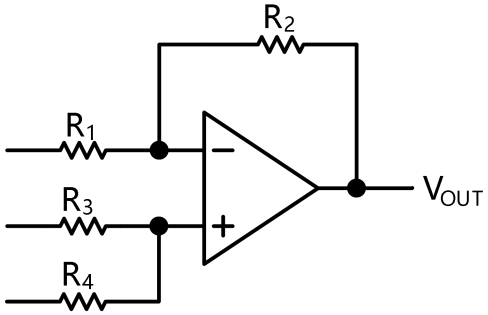


Figure 4. Differential Amplifier

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

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

$$V_{OUT} = \frac{R_2}{R_1}(V_{It} - V_{It}) + V_{Rth}$$

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/(2πR3C1).

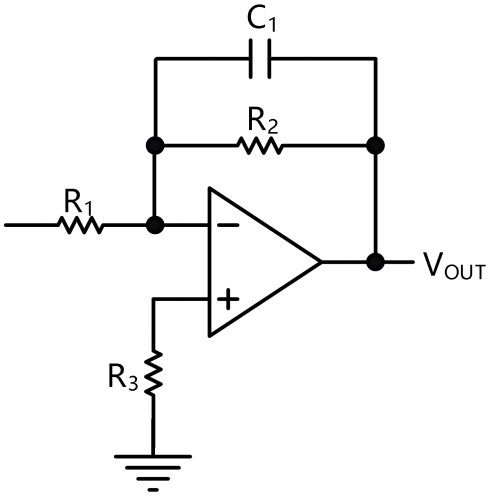
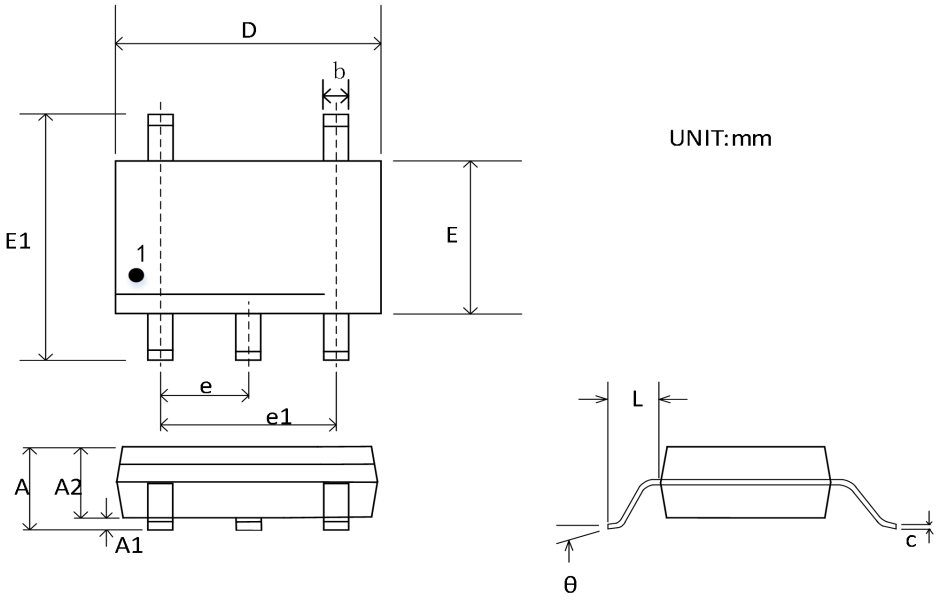


Figure 5. Low Pass Active Filter

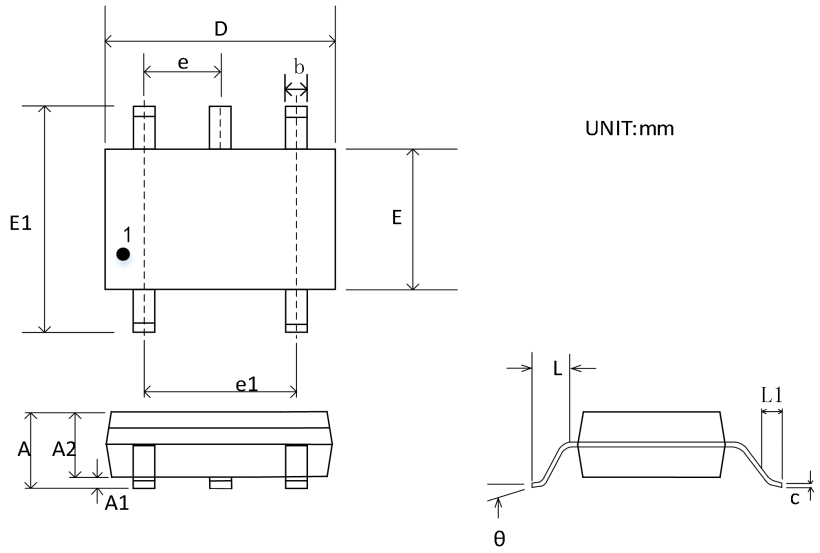
Package Outline Dimensions

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°

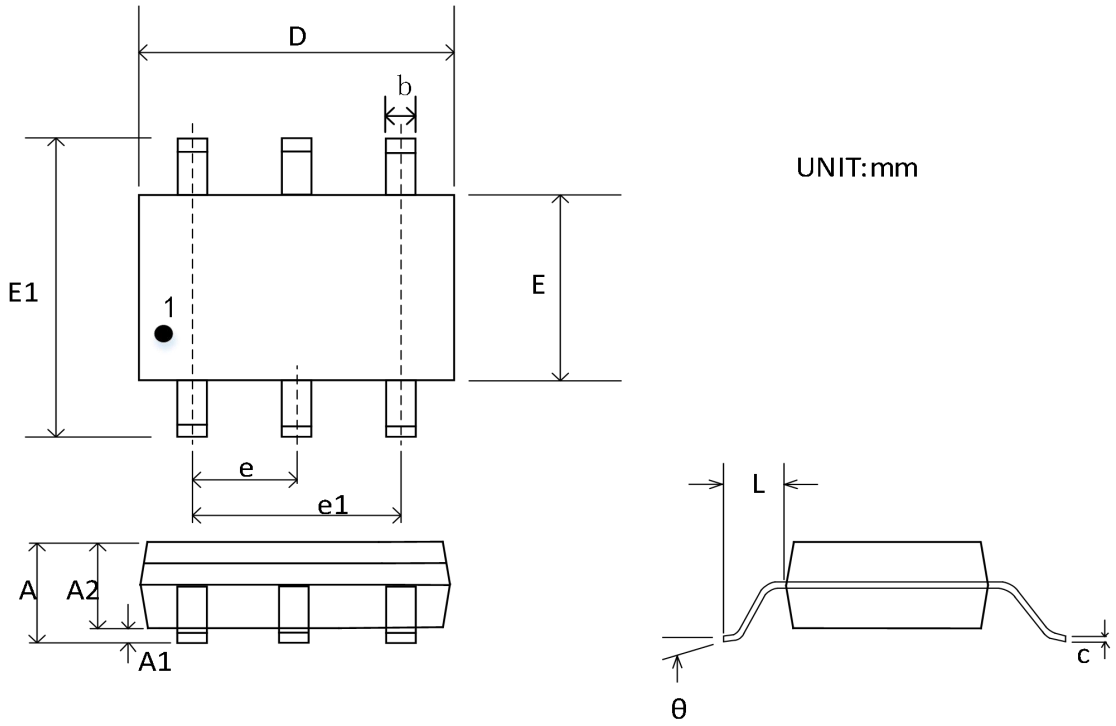
SC70-5



Symbol	Dimensions In Millimeters	
	Min	Max
A	0.900	1.100
A1	0.000	0.100
A2	0.900	1.000
b	0.150	0.350
C	0.080	0.150
D	2.000	2.200
E	1.150	1.350
E1	2.150	2.450
e	0.650 TYP	
e1	1.200	1.400
L	0.525 REF	
L1	0.260	0.460
θ	0°	8°

Chinese version:CD8045_CD8046_CD8047

SOT23-6

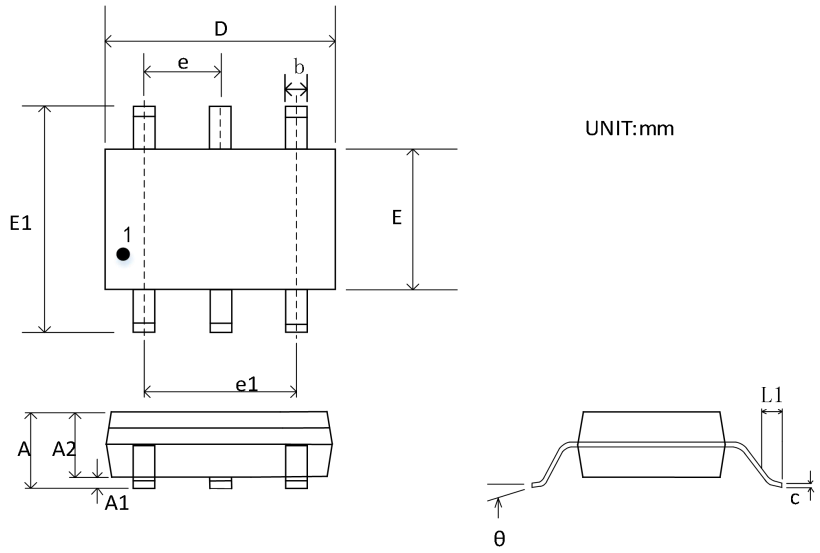


UNIT:mm

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:CD8045_CD8046_CD8047

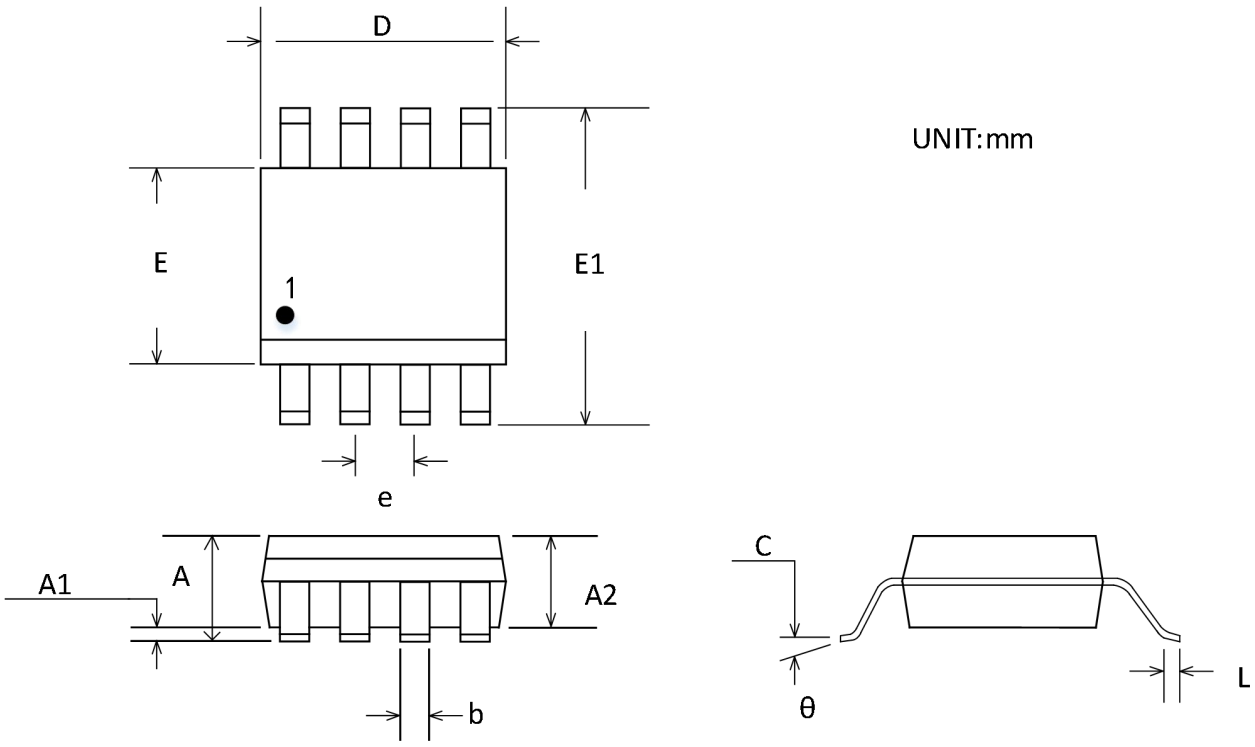
SC70-6



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	0.150BSC	
D	1.850	2.150
E	1.100	1.400
E1	1.800	2.400
e	0.650 TYP	
e1	1.200	1.400
L1	0.260	0.460
θ	0°	8°

Chinese version:CD8045_CD8046_CD8047

MSOP-8

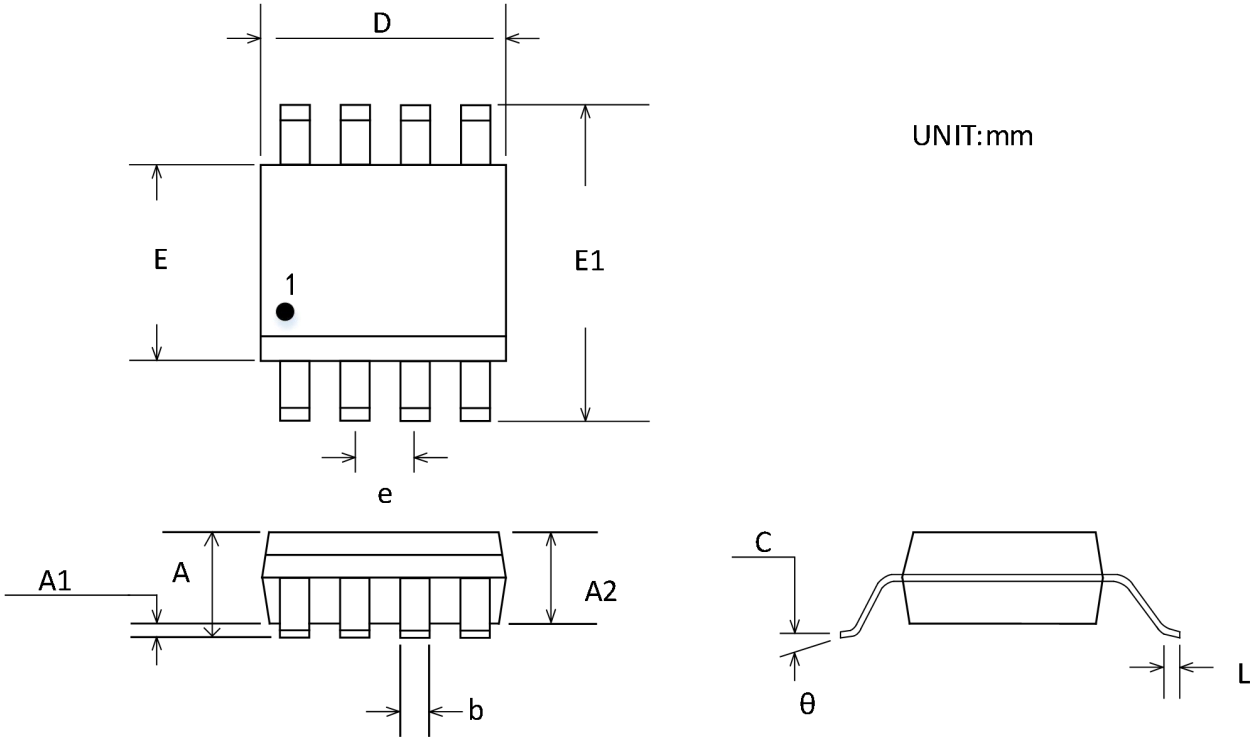


UNIT:mm

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°

Chinese version:CD8045_CD8046_CD8047

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°

Package/Ordering Information

MODEL	TEMPERATURE	PACKAGE DESCRIPTION	PACKAGE OPTION
CBM8045ASC7	-40℃~125℃	SC70-5	Tape and Reel, 3000
CBM8045AST5	-40℃~125℃	SOT23-5	Tape and Reel, 3000
CBM8046AS8	-40℃~125℃	SOP-8	Tape and Reel, 2500
CBM8046AS8-RL	-40℃~125℃	SOP-8	Tape and Reel, 3000
CBM8046AS8-REEL	-40℃~125℃	SOP-8	Tape and Reel, 4000
CBM8046AMS8	-40℃~125℃	MSOP-8	Tape and Reel, 3000
CBM8047HSC7	-40℃~125℃	SC70-6	Tape and Reel, 3000
CBM8047HST6	-40℃~125℃	SOT23-6	Tape and Reel, 3000
CBM8047LSC7	-40℃~125℃	SC70-6	Tape and Reel, 3000
CBM8047LST6	-40℃~125℃	SOT23-6	Tape and Reel, 3000

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	