

Features

- Low offset voltage: 80 μ V (typ)
- Low supply current: 750 μ A/Amplifier
- Single-supply operation: 2.7 V to 5.5 V
- Wide bandwidth: 8.5 MHz
- Slew rate: 5 V/ μ s
- Unity gain stable
- Low input currents

Application

- Barcode scanners
- Multipole filters
- Battery-powered instrumentation
- Current sensing
- Sensors
- PA controls
- Audio

Description

The CBM8601, CBM8602, and CBM8604 are single, dual, and quad rail-to-rail, input and output, single-supply amplifiers featuring very low offset voltage and Gain bandwidth product characteristics up to 8.5MHz. These amplifiers use a new, patented trimming technique that achieves superior performance without laser trimming. All are fully specified to operate on a 2.7 V to 5.5 V single supply.

The combination of low offsets, very low input bias currents, and high speed make these amplifiers useful in a wide variety of applications. Filters, integrators, diode amplifiers, shunt current sensors, and high impedance sensors all benefit from the combination of performance features. Audio and other ac applications benefit from the wide bandwidth and low distortion.

Applications for these amplifiers include audio amplification for portable devices, portable phone headsets, bar code scanners, portable instruments, cellular PA controls, and multipole filters.

The ability to swing rail-to-rail at both the input and output enables designers to buffer CMOS ADCs, DACs, ASICs, and other wide output swing devices in single-supply systems.

The CBM8601, CBM8602, and CBM8604 are specified over the extended industrial (-40°C to $+125^{\circ}\text{C}$) temperature range. The CBM8601, single, is available in a tiny, 5-lead SOT-23 package. The CBM8602, dual, is available in 8-lead MSOP and 8-lead, narrow SOIC surface-mount packages. The CBM8604, quad, is available in 14-lead TSSOP, 14-lead SOIC, and 16-lead QSOP packages.

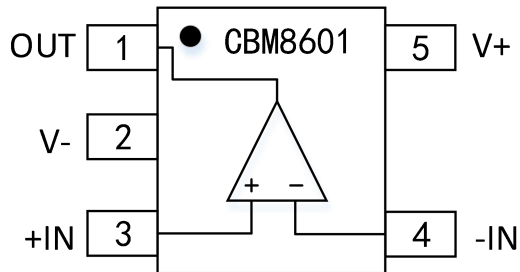
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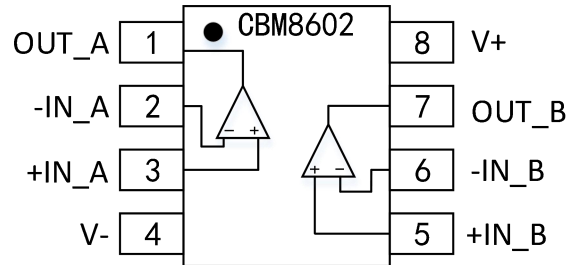
Revision Log

Version	Revision date	Change content	Reason for Change	Modified by	Reviewed By	Note
V1.0	2025.1.22	Update the marking information of CBM8602AMS8.	Error	WW	LYL	
V1.0	2025.1.23	Add product application information	Regular Update	WW	LYL	

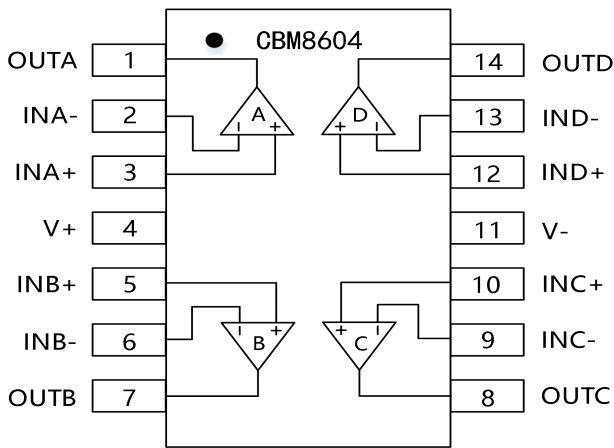
Pin Configurations



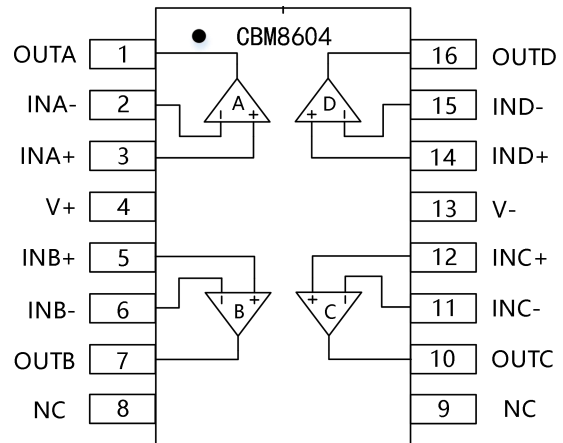
SOT23 Pin Configuration



MSOP/SOP Pin Configuration



TSSOP/SOP Pin Configuration



QSOP Pin Configuration

*NC is not connected

Pin Description

PIN N°	SYMBOL(CBM8601)	NAME AND FUNCTION
1	OUT	Output
2	V-	Negative power supply
3	+IN	None inverting input
4	-IN	inverting input
5	V+	Positive power supply
PIN N°	SYMBOL(CBM8602)	NAME AND FUNCTION
1	OUT_A	Output A
2	-IN_A	inverting input A
3	+IN_A	None inverting input A

4	V-	Negative power supply
5	+IN_B	V+/None inverting input B
6	-IN_B	inverting input B
7	OUT_B	Output B
8	V+	Positive power supply
PIN N°	SYMBOL (CBM8604)	NAME AND FUNCTION
1	OUT_A	Output A
2	-IN_A	inverting input A
3	+IN_A	None inverting input A
4	V+	Positive power supply
5	+IN_B	None inverting input B
6	-IN_B	inverting input B
7	OUT_B	Output B
8	OUT_C	Output C
9	-IN_C	inverting input C
10	+IN_C	None inverting input C
11	V-	Negative power supply
12	+IN_D	None inverting input D
13	-IN_D	inverting input D
14	OUT_D	Output D

Absolute Maximum Ratings ⁽¹⁾

- Supply Voltage : 6V
- Input Voltage : GND to VS
- Differential Input Voltage : $\pm 6V$
- Storage Temperature Range : $-65^{\circ}C$ to $+150^{\circ}C$
- Operating Temperature Range : $-40^{\circ}C$ to $+125^{\circ}C$
- Junction Temperature Range : $-65^{\circ}C$ to $+150^{\circ}C$
- Lead Temperature (Soldering, 60s) : $300^{\circ}C$
- ESD(CBM8601): 5kV (HBM)
- ESD(CBM8602): 4.5kV (HBM)

Electrical Characteristics

($V_S = 5\text{ V}$, $V_{CM} = V_S/2$, $T_A = 25^\circ\text{C}$, unless otherwise noted.)

Table1.

PARAMETER	CONDITION	CBM8601,CBM8602,CBM8604			
		MIN	TYP	MAX	UNIT
INPUT CHARACTERISTICS					
Input Offset Voltage (V_{OS})	$V_{CM} = 0\text{V}\sim 5\text{V}$		80	500	μV
Offset Voltage Drift ($\Delta V_{OS}/\Delta T$)			2		$\mu\text{V}/^\circ\text{C}$
Input Bias Current (I_B)			0.2	60	pA
Input Offset Current (I_{OS})			0.1	30	pA
Common-Mode Rejection Ratio (CMRR)	$V_{CM}=0\text{V}\sim 5\text{V}$	74	89		dB
Open-Loop Voltage Gain (A_{OL})	$V_O=0.5\text{V to } 4.5\text{V}, R_L=2\text{k}\Omega, V_{CM}=0\text{V}$	30	80		V/mV
OUTPUT CHARACTERISTICS					
Output Voltage High (V_{OH})	$I_L = 1\text{ mA}$	4.925	4.978		V
	$I_L = 10\text{mA}$	4.7	4.78		V
Output Voltage Low (V_{OL})	$I_L = 1\text{ mA}$		14	30	mV
	$I_L = 10\text{mA}$		135	175	mV
Output Current (I_{OUT})			± 50		mA
NOISE PERFORMANCE					
Voltage Noise Density (e_n)	$f = 1\text{ kHz}$		33		$\text{nV}/\sqrt{\text{Hz}}$
	$f=10\text{KHz}$		18		$\text{nV}/\sqrt{\text{Hz}}$
Current Noise Density (i_n)	$f=1\text{kHz}$		0.05		$\text{pA}/\sqrt{\text{Hz}}$
POWER SUPPLY					
Power Supply Rejection Ratio (PSRR)	$V_S=2.7\text{V}\sim 5.5\text{V}$	67	85		dB
Supply Current/Amplifier (I_{SV})	$V_O = 0\text{V}$		550	1200	μA
DYNAMIC PERFORMANCE					
Slew Rate (SR)	$R_L = 2\text{ k}\Omega$		5.5		$\text{V}/\mu\text{s}$
Gain-Bandwidth Product (GBW)			8.5		MHz
Settling Time	To 0.01%		<1		μs

($V_S = 3V$, $V_{CM} = V_S/2$, $T_A = 25^\circ C$, unless otherwise noted.)

Table 2.

PARAMETER	CONDITION	CBM8601,CBM8602,CBM8604			
		MIN	TYP	MAX	UNIT
INPUT CHARACTERISTICS					
Input Offset Voltage (V_{OS})	$V_{CM} = 0V \sim 1.3V$		80	500	μV
Offset Voltage Drift ($\Delta V_{OS}/\Delta T$)			2		$\mu V/^\circ C$
Input Bias Current (I_B)			0.2	60	pA
Input Offset Current (I_{OS})			0.1	30	pA
Common-Mode Rejection Ratio (CMRR)	$V_{CM} = 0V \sim 3V$	68	83		dB
Open-Loop Voltage Gain (A_{OL})	$V_O = 0.5V$ to $2.5V, R_L = 2K\Omega, V_{CM} = 0V$	30	100		V/mV
OUTPUT CHARACTERISTICS					
Output Voltage High (V_{OH})	$I_L = 1 mA$	2.92	2.95		V
Output Voltage Low (V_{OL})	$I_L = 1 mA$		20	35	mV
Output Current (I_{OUT})			± 30		mA
NOISE PERFORMANCE					
Voltage Noise Density (e_n)	$f = 1 kHz$		33		nV/\sqrt{Hz}
	$f = 10KHz$		18		nV/\sqrt{Hz}
Current Noise Density (i_n)			0.05		pA/\sqrt{Hz}
POWER SUPPLY					
Power Supply Rejection Ratio (PSRR)	$V_S = 2.7V \sim 5.5V$	67	80		dB
Supply Current/Amplifier (I_{SV})	$V_O = 0V$		450	1000	μA
DYNAMIC PERFORMANCE					
Slew Rate (SR)	$R_L = 2 k\Omega$		5.5		V/ μs
Gain-Bandwidth Product (GBW)			8.5		MHz
Settling Time	To 0.01%		<1		μs

Typical Characteristics

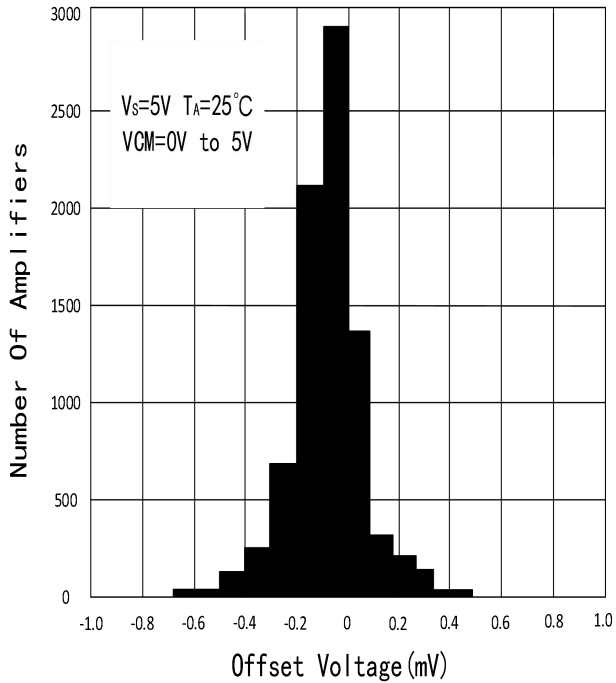


Figure1.Input Offset Voltage Distribution

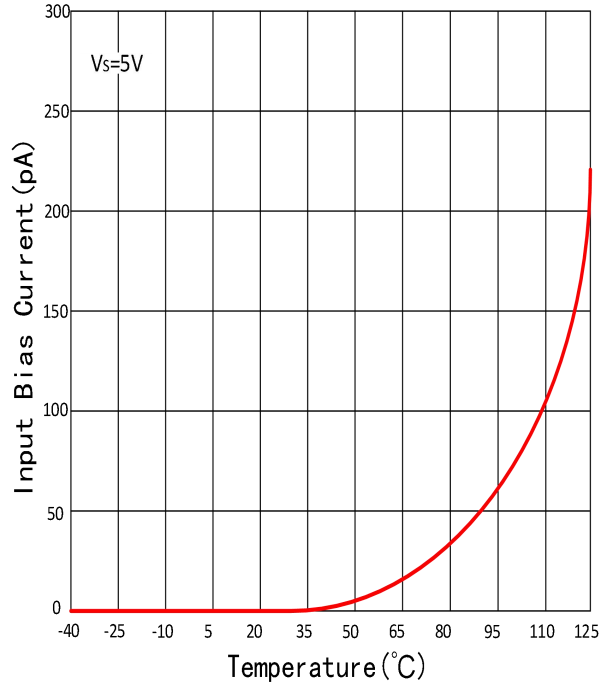


Figure2.Input Bias Current vs. Temperature

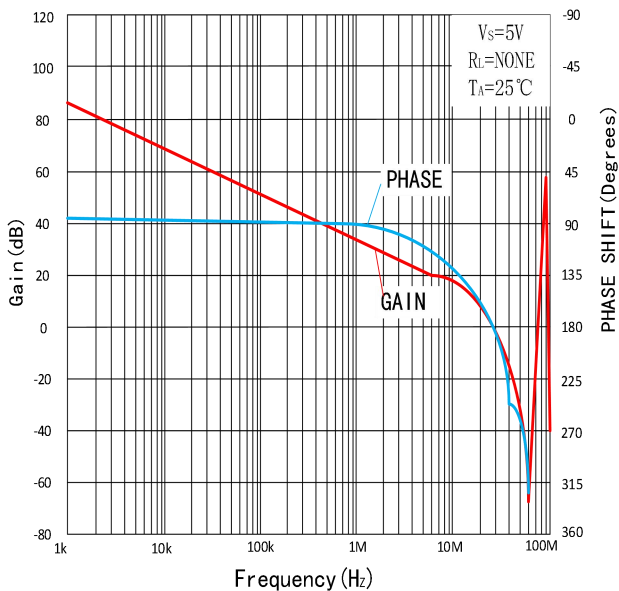


Figure3.Open-Loop Gain and Phase vs. Frequency

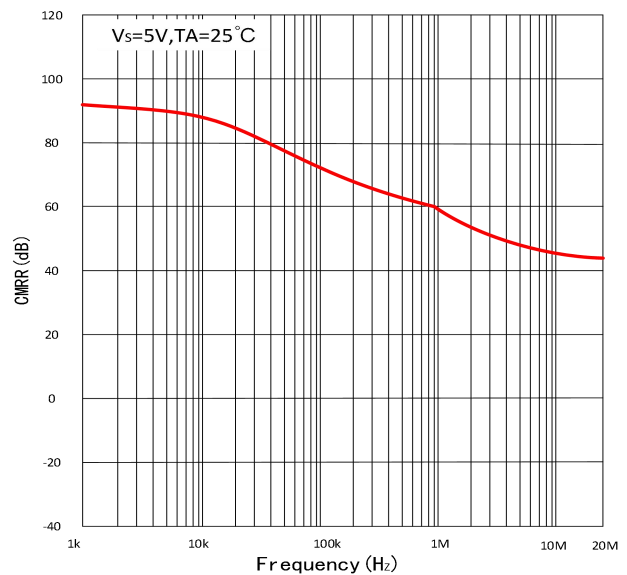


Figure4.Common-Mode Rejection Ratio (CMRR) vs. Frequency

Applications Information

Rail-to-rail input stage

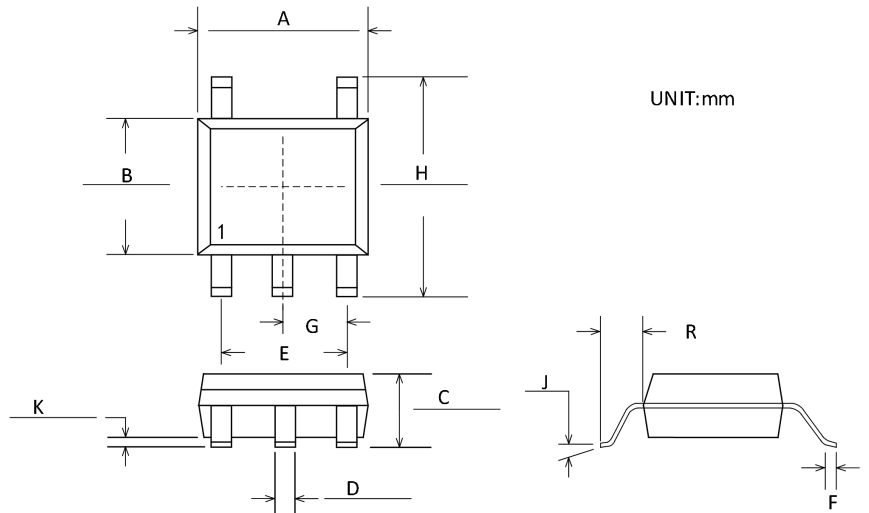
The input common-mode voltage range of the CBM860x extends to both the positive and negative supply voltages. This maximizes the usable voltage range of the amplifier, an important feature for single-supply and low voltage applications. This rail-to-rail input range is achieved by using two input differential pairs, one NMOS and one PMOS, placed in parallel. The NMOS pair is active at the upper end of the common-mode voltage range, and the PMOS pair is active at the lower end.

Input overvoltage protection

As with any semiconductor device, if a condition could exist that could cause the input voltage to exceed the power supply, the device' s input overvoltage characteristic must be considered. Excess input voltage energizes the internal PN junctions in the CBM860x, allowing current to flow from the input to the supplies. This input current does not damage the amplifier, provided it is limited to 5 mA or less. This can be ensured by placing a resistor in series with the input. For example, if the input voltage could exceed the supply by 5 V, the series resistor should be at least $(5 \text{ V}/5 \text{ mA}) = 1 \text{ k}\Omega$. With the input voltage within the supply rails, a minimal amount of current is drawn into the inputs, which, in turn, causes a negligible voltage drop across the series resistor. Therefore, adding the series resistor does not adversely affect circuit performance.

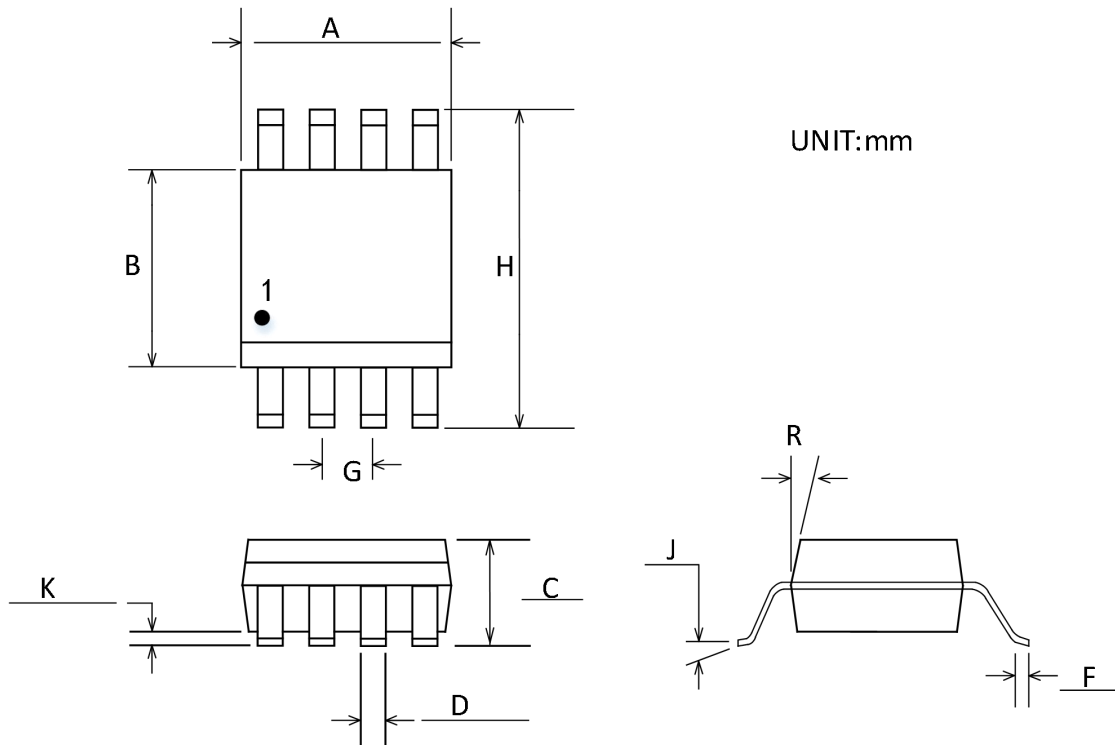
Package Outline Dimensions

SOT23-5



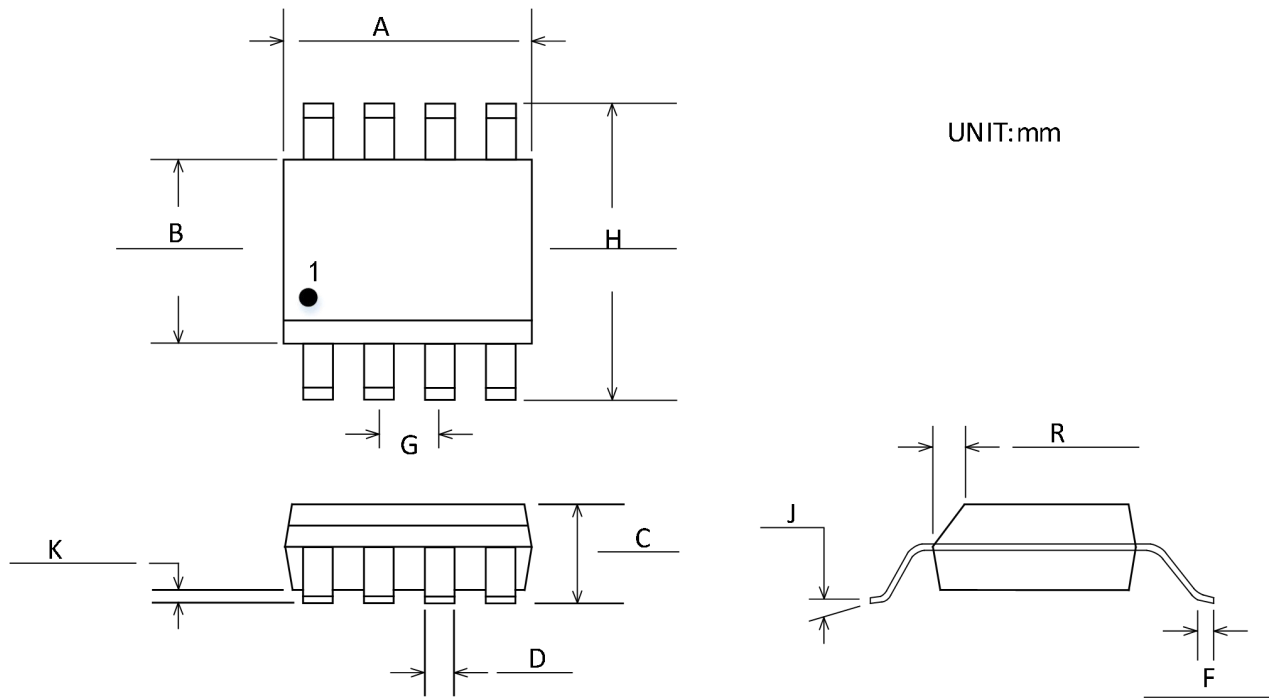
Symbol	Dimensions In Millimeters	
	Min	Max
A	2.80	3.00
B	1.50	1.70
C	0.95	1.45
D	0.35	0.50
E	1.90BSC	
F	0.35	0.55
G	0.95BSC	
H	2.60	3.00
J	0°	10°
K	0.05	0.15
R	0.60BSC	

MSOP-8



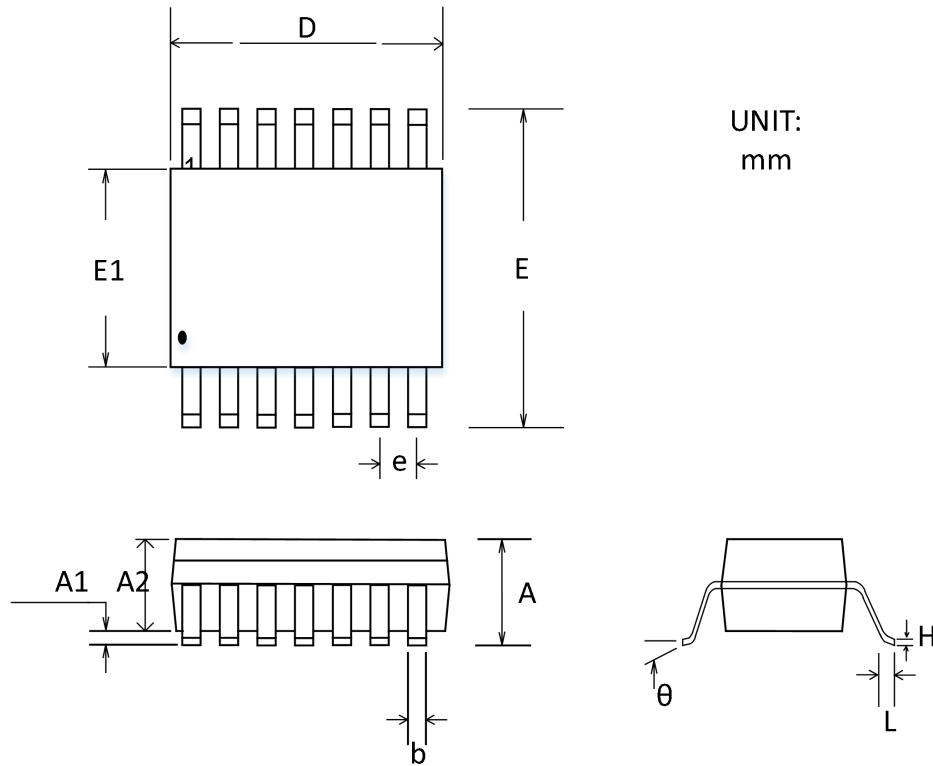
Symbol	Dimensions In Millimeters	
	Min	Max
A	2.80	3.20
B	2.80	3.20
C	1.10MAX	
D	0.25	0.40
F	0.40	0.80
G	0.650 BSC	
H	4.65	5.15
J	0°	6°
K	0.05	0.15
R	15°MAX	

SOP-8



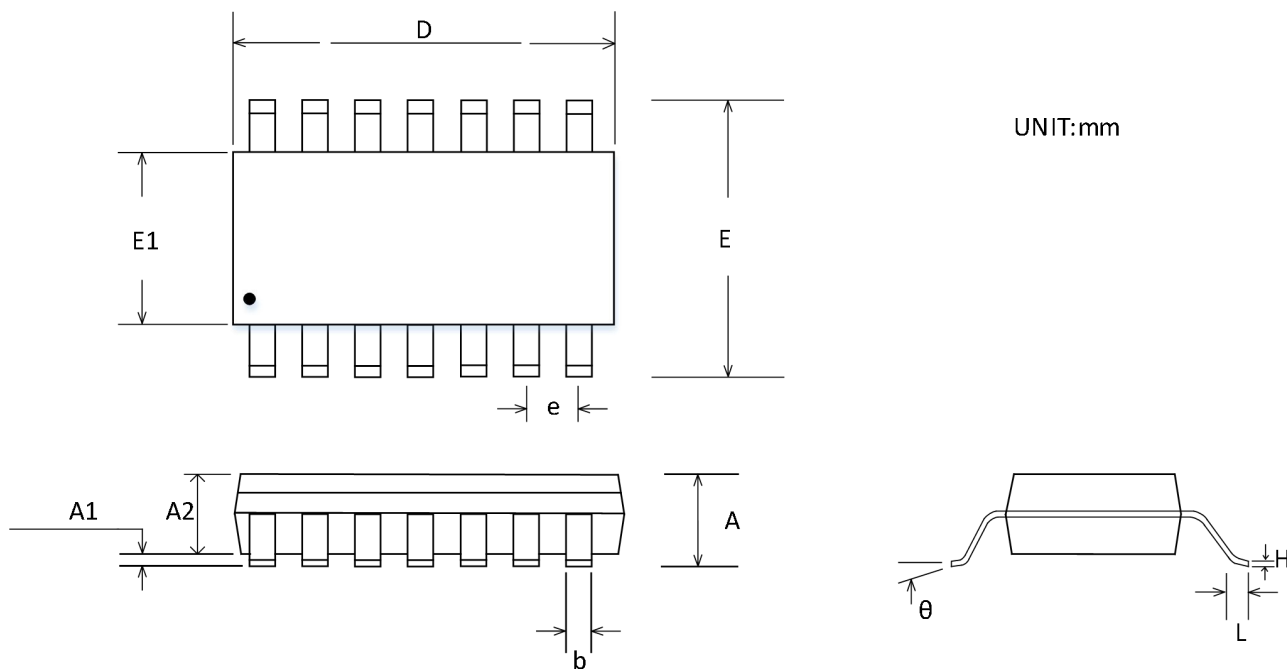
Symbol	Dimensions In Millimeters	
	Min	Max
A	4.80	5.00
B	3.80	4.00
C	1.35	1.75
D	0.31	0.51
F	0.40	1.27
G	1.27BSC	
H	5.80	6.20
J	0°	8°
K	0.10	0.25
R	0.25	0.50

TSSOP-14



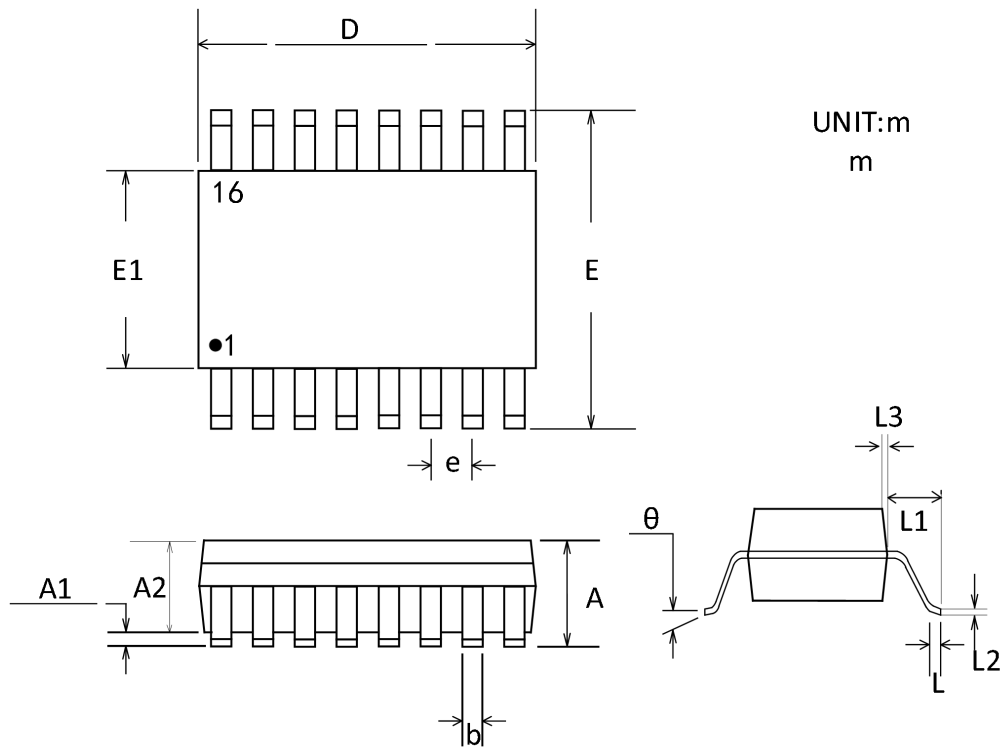
Symbol	Dimensions In Millimeters	
	Min	Max
A	1.20MAX	
A1	0.05	0.15
A2	0.80	1.05
b	0.19	0.30
D	4.90	5.10
E	6.40BSC	
E1	4.30	4.50
e	0.65BSC	
H	0.09	0.20
L	0.45	0.75
θ	0°	8°

SOP-14



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°

QSOP-16



Symbol	Dimensions In Millimeters	
	Min	Max
A	1.35	1.75
A1	0.10	0.25
A2	1.25	1.65
b	0.20	0.30
D	4.80	5.00
E	5.79	6.20
E1	3.81	4.01
e	0.64BSC	
L	0.041	1.27
L1	1.04REF	
L2	0.15	0.25
L3	0.25	0.51
θ	0°	8°

Package/Ordering Information

PRODUCT TYPE	OPERATING TEMPERATURE	PACKAGE	PACKAGE MARKING	NUMBER OF PACKAGES
CBM8601AST5	-40°C~125°C	SOT23-5	S601	Tape and Reel, 3000
CBM8602AMS8	-40°C~125°C	MSOP-8	M02	Tape and Reel, 3000
CBM8602AS8	-40°C~125°C	SOP-8	CBM8602A	Tape and Reel, 2500
CBM8602AS8-RL	-40°C~125°C	SOP-8	CBM8602A	Tape and Reel, 3000
CBM8602AS8-REEL	-40°C~125°C	SOP-8	CBM8602A	Tape and Reel, 4000
CBM8604ATS14	-40°C~125°C	TSSOP-14	CBM8604AT	Tape and Reel, 2500
CBM8604ATS14-RL	-40°C~125°C	TSSOP-14	CBM8604AT	Tape and Reel, 3000
CBM8604ATS14-REEL	-40°C~125°C	TSSOP-14	CBM8604AT	Tape and Reel, 4000
CBM8604AS14	-40°C~125°C	SOP-14	CBM8604AS	Tape and Reel, 2500
CBM8604AS14-RL	-40°C~125°C	SOP-14	CBM8604AS	Tape and Reel, 3000
CBM8604AS14-REEL	-40°C~125°C	SOP-14	CBM8604AS	Tape and Reel, 4000
CBM8604AQS16	-40°C~125°C	QSOP-16	CBM8604AQ	Tape and Reel, 2500