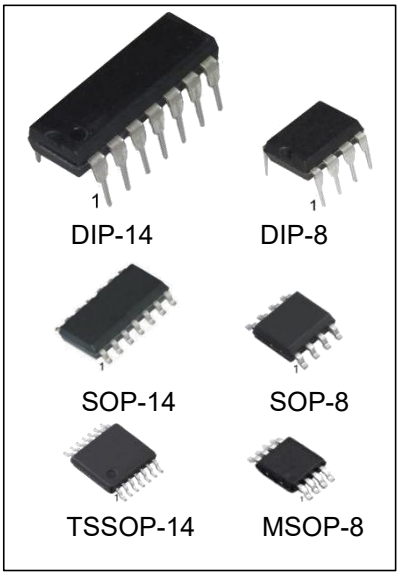
18V, Low Noise, Precision Operational Amplifiers

Features and Benefits

- Wide Supply: ±2.25 V to ±9 V, 4.5 V to 18 V
- Low Offset Voltage: ±150 μV Maximum
- Low Offset Voltage Drift: ±1 μV/°C
- Bandwidth: 1.1 MHz GBW
- Slew Rate: 0.8 V/μs
- Low Noise: 22 nV/√Hz at 10 kHz
- High Common-Mode Rejection: 110 dB
- Low Bias Current: ±20 pA
- EMI/RFI Filtered Inputs



Ordering Information

DEVICE	Package Type	MARKING	Packing	Packing Qty
LMC6081IN-HG	DIP-8	C6081	TUBE	2000pcs/box
LMC6081AIN-HG	DIP-8	C6081A	TUBE	2000pcs/box
LMC6081IM/TR-HG	SOP-8	C6081	REEL	2500pcs/reel
LMC6081AIM/TR-HG	SOP-8	C6081A	REEL	2500pcs/reel
LMC6082IN-HG	DIP-8	C6082	TUBE	2000pcs/box
LMC6082AIN-HG	DIP-8	C6082A	TUBE	2000pcs/box
LMC6082IM/TR-HG	SOP-8	C6082	REEL	2500pcs/reel
LMC6082AIM/TR-HG	SOP-8	C6082A	REEL	2500pcs/reel
LMC6082IMM/TR-HG	MSOP-8	6082	REEL	3000pcs/reel
LMC6082AIMM/TR-HG	MSOP-8	6082A	REEL	3000pcs/reel
LMC6084IN-HG	DIP-14	LMC6084	TUBE	1000pcs/box
LMC6084AIN-HG	DIP-14	LMC6084A	TUBE	1000pcs/box
LMC6084IM/TR-HG	SOP-14	LMC6084	REEL	2500pcs/reel
LMC6084AIM/TR-HG	SOP-14	LMC6084A	REEL	2500pcs/reel
LMC6084IMT/TR-HG	TSSOP-14	C6084	REEL	2500pcs/reel
LMC6084AIMT/TR-HG	TSSOP-14	C6084A	REEL	2500pcs/reel

General Description

The LMC608x is a new generation of high voltage (18V), low noise, precision operational amplifiers. These devices offer outstanding dc precision and ac performance, include low offset (±150 μV maximum), low drift (± 1μV/°C), 1.1-MHz bandwidth, and 22 nV/√Hz Input voltage noise density at 10 kHz. Unique features such as differential input-voltage range to the negative supply rail, high output current (±40 mA), and high capacitive load drive of up to 1 nF make the LMC608x high- performance op-amps for high-voltage industrial applications.

The robust design of the LMC608x family provides ease-of-use to the circuit designer: integrated RF/EMI rejection filter, no phase reversal in overdrive conditions, and high electro-static discharge (ESD) protection. The LMC608x are optimized for operation at voltages from +4.5 V (±2.25 V) to +18 V (±9 V) over the extended temperature range of −40°C to +125°C.

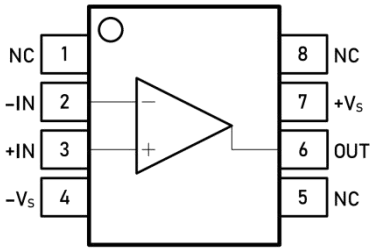
The LMC6081 (single) is available in both DIP-8 and SOP-8 packages.The LMC6082 (dual) is offered in DIP-8、SOP-8 and MSOP-8 packages.The quad-channel LMC6084 is offered in both DIP-14、SOP-14 and TSSOP-14 packages.

Applications

- High-side and low-side current sensing
- Analog input and output modules
- ADC driver and reference buffer amplifier
- High Precision Comparator
- Power delivery: UPS, server, and merchant network power
- Multiplexed Data-Acquisition Systems
- Test and Measurement Equipment
- Programmable Logic Controllers

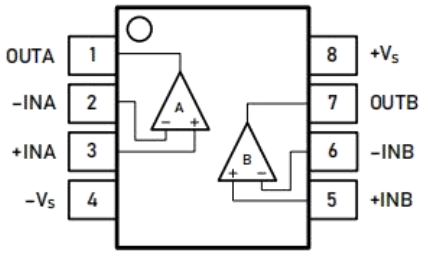
Pin Configuration (Top View)

LMC6081



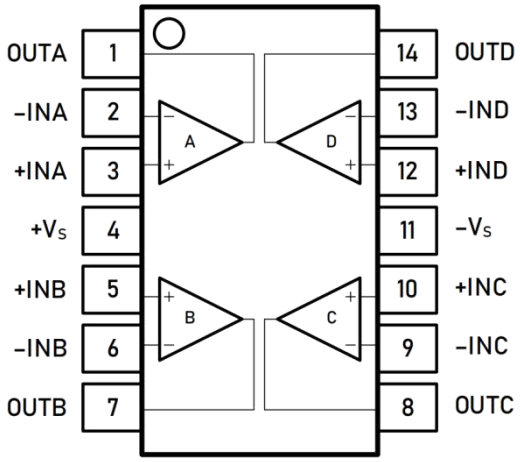
DIP-8/SOP-8

LMC6082



DIP-8/SOP-8/MSOP-8

LMC6084



DIP-14/SOP-14/TSSOP-14

Pin Description

Symbol	Description
–IN	Inverting input of the amplifier. The voltage range is from V_{S-} to V_{S+} – 2V.
+IN	Non-inverting input of the amplifier. This pin has the same voltage range as –IN.
$+V_S$	Positive power supply. The voltage is from 4.5V to 18V. Split supplies are possible as long as the voltage between V_{S+} and V_{S-} is from 4.5V to 18V.
$–V_S$	Negative power supply. It is normally tied to ground. It can also be tied to a voltage other than ground as long as the voltage between V_{S+} and V_{S-} is from 4.5V to 18V.
OUT	Amplifier output.
NC	No Connect.

Limiting Value

In accordance with the Absolute Maximum Rating System (IEC 60134).

Parameter	Absolute Maximum Rating
Supply Voltage, VS+ to VS–	18 V
Signal Input Terminals: Voltage, Current	$-V_S$ – 0.3V to $+V_S$ + 0.3V, ±10 mA
Output Short-Circuit	Continuous
Storage Temperature Range, Tstg	–65 °C to +150 °C
Operating Temperature Range, T_A(1)	−40 °C to +125 °C
Junction Temperature, TJ	150 °C
Lead Temperature Range (Soldering 10 sec)	260 °C

Note: Stress greater than those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions outside those indicated in the operational sections of this specification are not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

Note(1) :Operating temperature range: -40°C to +125°C. This product is designed for industrial grade applications. For automotive grade versions compliant with AEC-Q100, please conduct internal screening per the standard or contact our sales team for availability.

ESD Rating

Parameter	Item	Value	Unit
Electrostatic Discharge Voltage	Human body model (HBM), per MIL-STD-883J / Method 3015.9 (1)	±1 500	V
	Charged device model (CDM), per ESDA/JEDEC JS-002-2014 (2)	±1 000	
	Machine model (MM), per JESD22-A115C	±400	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 500-V HBM is possible if necessary precautions are taken.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 250-V CDM is possible if necessary precautions are taken.

Electrical Characteristics

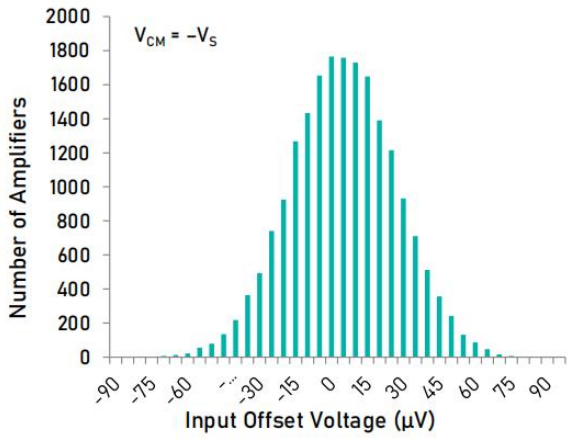
V_S = 4.5 V to 18 V, T_A = +25 °C, V_{CM} = V_S /2, V_O = V_S /2, and R_L = 10 kΩ connected to V_S /2, unless otherwise noted. **Boldface** limits apply over the specified temperature range, T_A = −40°C to +125°C.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
OFFSET VOLTAGE							
V_{OS}	Input offset voltage	LM608xAI			±150	±350	μV
			T_A = −40 to +125°C			**±800**	
		LM608xI			±150	±800	
			T_A = −40 to +125°C			**±1300**	
$V_{OS}TC$	Offset voltage drift	T_A = −40 to +125 °C			**±1**		μV/°C
PSRR	Power supply rejection ratio	V_S = 4.5 to 18 V, V_{CM} = 0.1 V			2		μV/V
		T_A = −40 to +125 °C			**6**		
INPUT BIAS CURRENT							
I_B	Input bias current				20		pA
		T_A = +85 °C			**150**		
		T_A = +125 °C			**600**		
I_{OS}	Input offset current				10		pA
NOISE							
V_n	Input voltage noise	f = 0.1 to 10 Hz			4		$μV_{P-P}$
e_n	Input voltage noise density	f = 1 kHz			25		nV/√Hz
		f = 10 kHz			22		
I_n	Input current noise density	f = 1 kHz			5		fA/√Hz
INPUT VOLTAGE							
V_{CM}	Common-mode voltage range			$-V_S$		$+V_S-2$	V
CMRR	Common-mode rejection ratio	V_S = 18 V, V_{CM} = 0 to 16 V			110		dB
		V_{CM} = 0.1 to 16 V, T_A = −40 to +125 °C			**98**		
		V_S = 5.0 V, V_{CM} = 0 to 3 V			85		
		V_{CM} = 0.1 to 3 V, T_A = −40 to +125 °C			**72**		
INPUT IMPEDANCE							
CIN	Input capacitance	Differential			2.0		pF
		Common mode			3.5		
OPEN-LOOP GAIN							
A_{VOL}	Open-loop voltage gain	V_S = 18 V, V_O = 0.1 to 16.9 V			116		dB
		T_A = −40 to +125 °C			**112**		
		V_S = 5 V, V_O = 0.1 to 4.9 V			101		
		T_A = −40 to +125 °C			**97**		

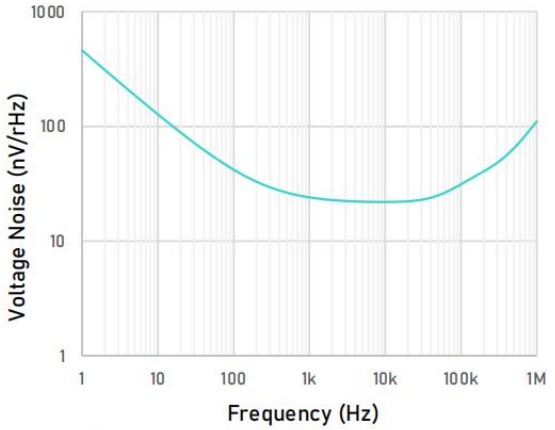
FREQUENCY RESPONSE						
GBW	Gain bandwidth product			1.1		MHz
SR	Slew rate	V_S = 18 V, G = +1, 9 V step		0.8		V/μs
THD+N	Total harmonic distortion + noise	G = +1, f = 1 kHz, V_O = 3 VRMS		0.02		%
t_S	Settling time	To 0.1%, VS = 18 V, G = +1, 5 V step		6		μs
		To 0.01%, V_S = 18 V, G = +1, 5 V step		12		
t_{OR}	Overload recovery time	V_{IN} × Gain > VS		3		μs
OUTPUT						
V_{OH}	High output voltage swing	V_S = ±9 V, R_L = 10 kΩ		$+V_S$−97		mV
		V_S = ±9 V, R_L = 2 kΩ		$+V_S$−257		
V_{OL}	Low output voltage swing	V_S = ±9 V, R_L = 10 kΩ		$-V_S$+52		mV
		V_S = ±9 V, R_L = 2 kΩ		$-V_S$+232		
I_{SC}	Short-circuit current			±40		mA
POWER SUPPLY						
V_S	Operating supply voltage	T_A = −40 to +125 °C	4.5		18	V
I_Q	Quiescent current (per amplifier)	V_S = 5 V		150		μA
		V_S = 18 V		220		
THERMAL CHARACTERISTICS						
θ_{JA}	Package Thermal Resistance	MSOP-8		201		°C/W
		SOP-8		125		
		SOP-14		115		
		TSSOP-14		112		

Typical Performance Characteristics

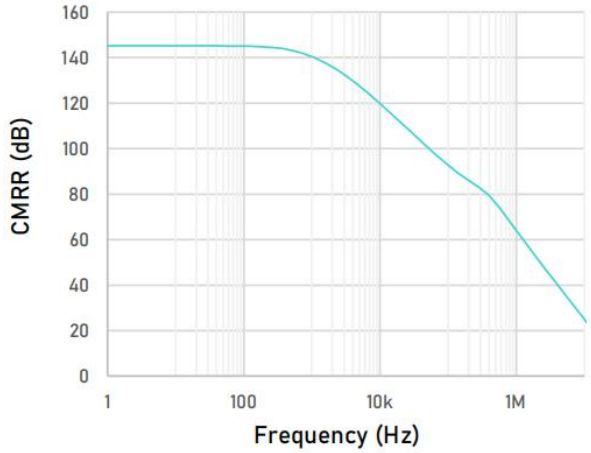
At T_A = +25 °C, V_{CM} = V_S /2, and R_L = 10 kΩ connected to V_S /2, unless otherwise noted.



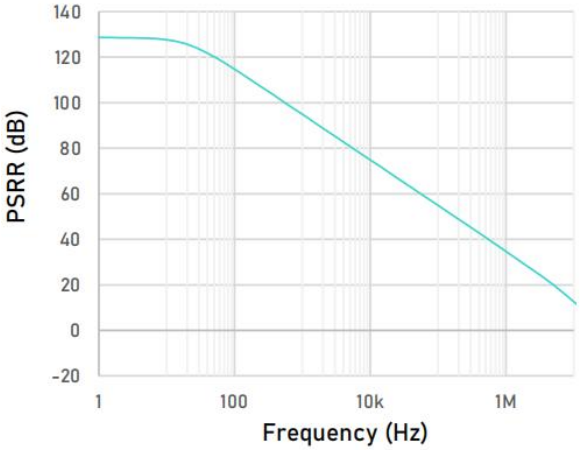
Offset Voltage Production Distribution



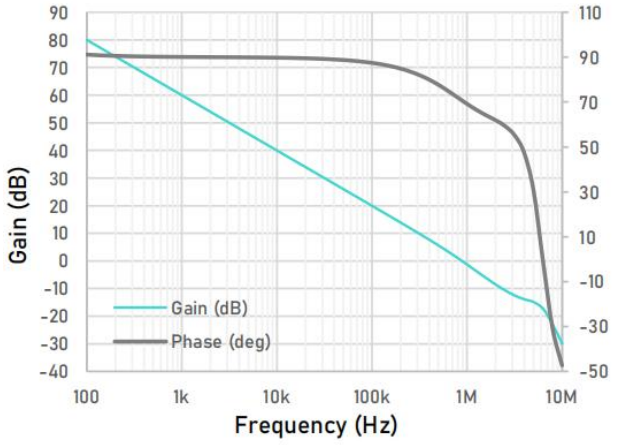
Input Voltage Noise Spectral Density as a function of Frequency



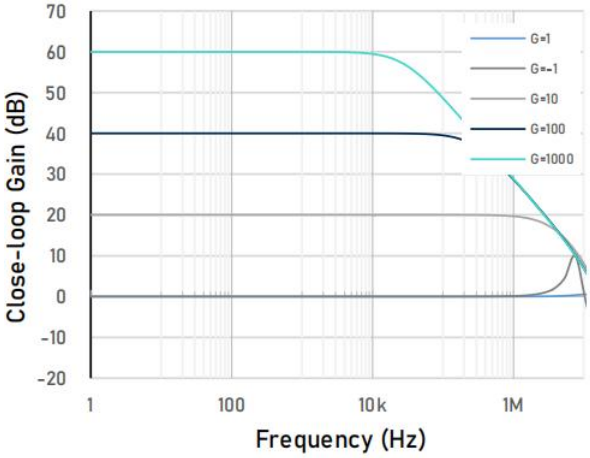
CMRR as a function of Frequency



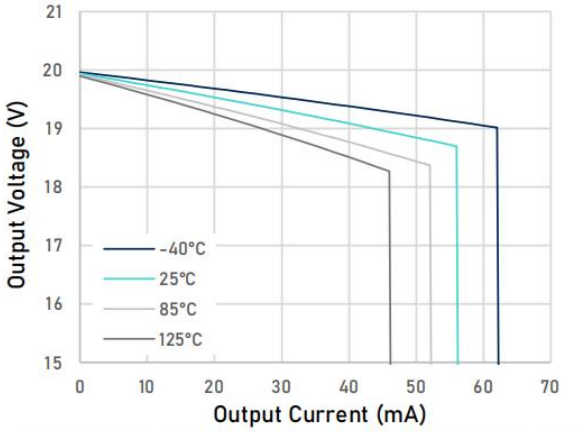
PSRR as a function of Frequency



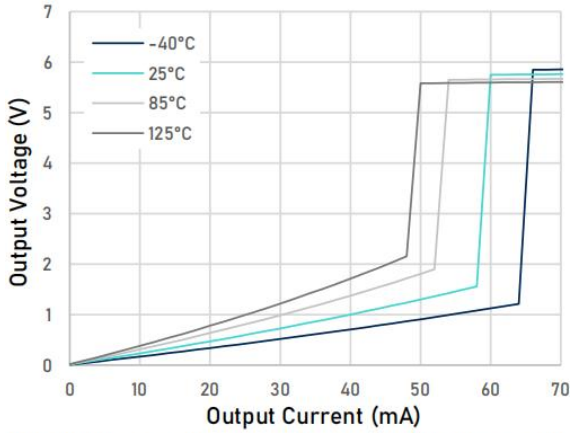
Open-loop Gain and Phase as a function of Frequency



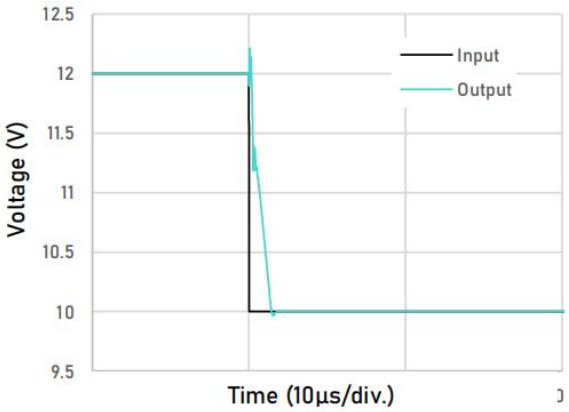
Close-loop Gain as a function of Frequency



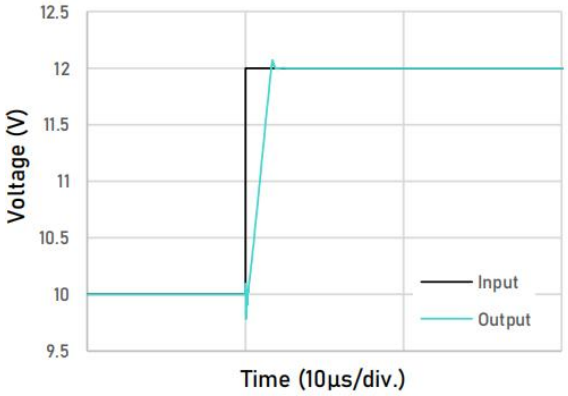
Output Voltage Swing as a function of Output Current (Sourcing, V_S = 20 V)



Output Voltage Swing as a function of Output Current (Sinking, V_S = 20 V)



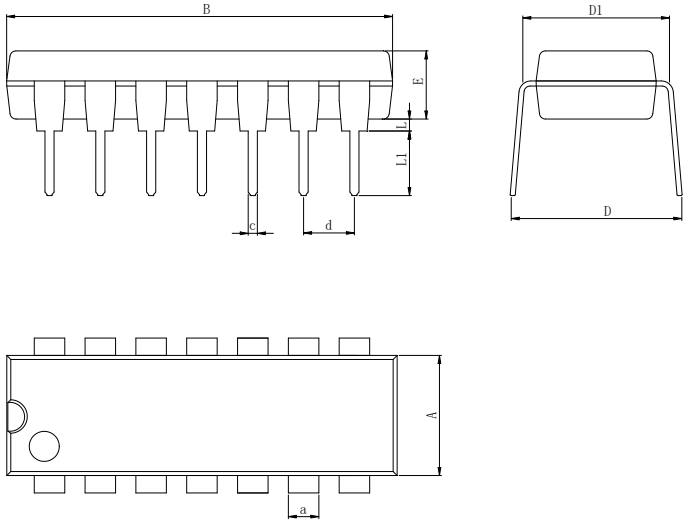
Large-Signal Step Response(Failing)



Large-Signal Step Response(Rising)

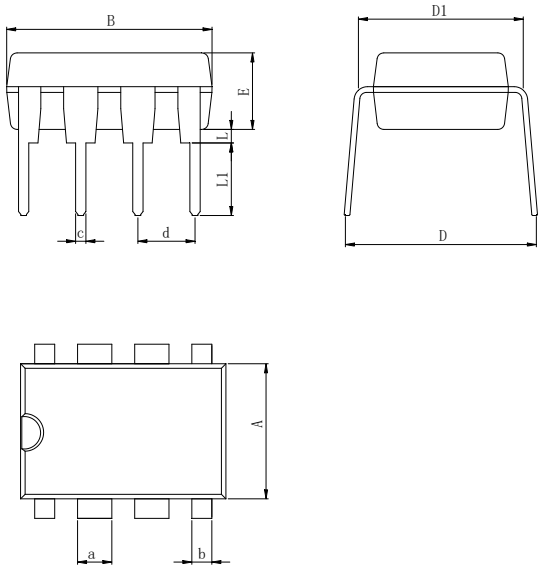
Physical Dimensions

DIP-14



Dimensions In Millimeters(DIP-14)										
Symbol:	**A**	**B**	**D**	**D1**	**E**	**L**	**L1**	**a**	**c**	**d**
Min:	6.10	18.94	8.10	7.42	3.10	0.50	3.00	1.50	0.40	2.54 BSC
Max:	6.68	19.56	10.9	7.82	3.55	0.70	3.60	1.75	0.50	

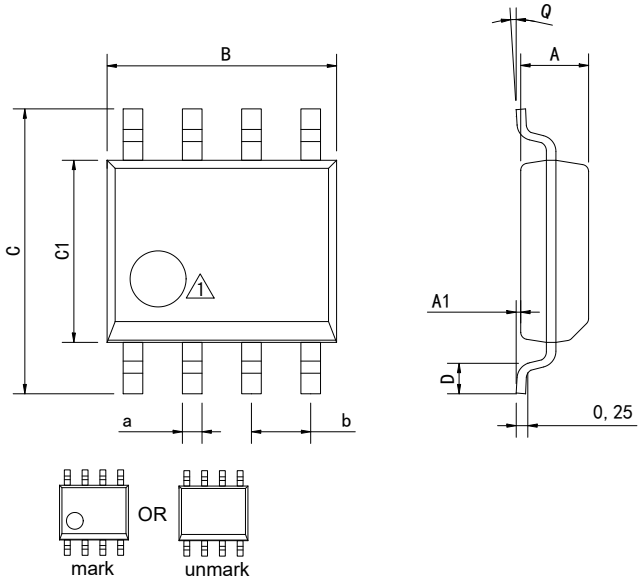
DIP-8



Dimensions In Millimeters(DIP-8)											
Symbol:	**A**	**B**	**D**	**D1**	**E**	**L**	**L1**	**a**	**b**	**c**	**d**
Min:	6.10	9.00	8.10	7.42	3.10	0.50	3.00	1.50	0.85	0.40	2.54 BSC
Max:	6.68	9.50	10.9	7.82	3.55	0.70	3.60	1.75	1.20	0.50	

Physical Dimensions

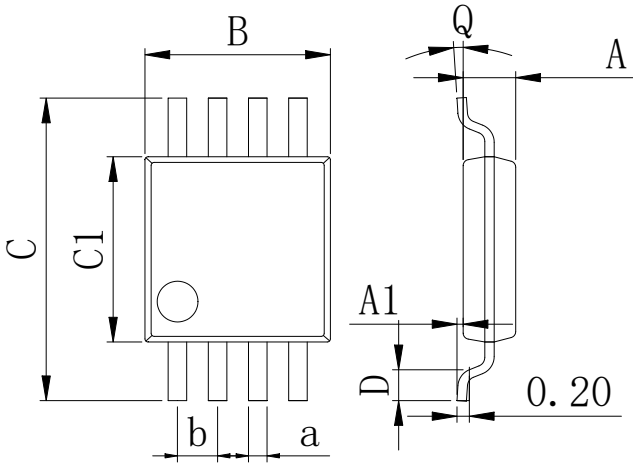
SOP-8



1 Package top mark may be in lower left corner or unmark

Dimensions In Millimeters(SOP-8)									
Symbol:	A	A1	B	C	C1	D	Q	a	b
Min:	1.35	0.05	4.90	5.80	3.80	0.40	0°	0.35	1.27 BSC
Max:	1.55	0.20	5.10	6.20	4.00	0.80	8°	0.45	

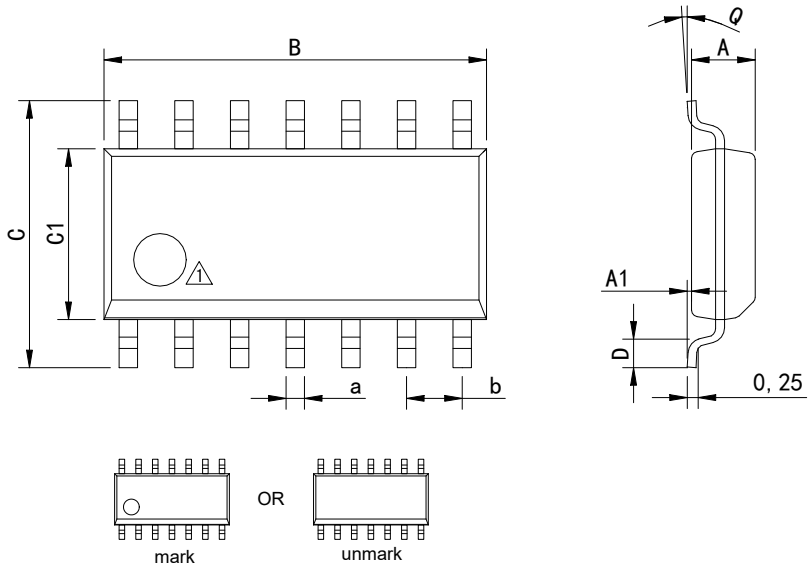
MSOP-8



Dimensions In Millimeters(MSOP-8)									
Symbol:	**A**	**A1**	**B**	**C**	**C1**	**D**	**Q**	**a**	**b**
Min:	0.80	0.05	2.90	4.75	2.90	0.35	0°	0.25	0.65 BSC
Max:	0.90	0.20	3.10	5.05	3.10	0.75	8°	0.35	

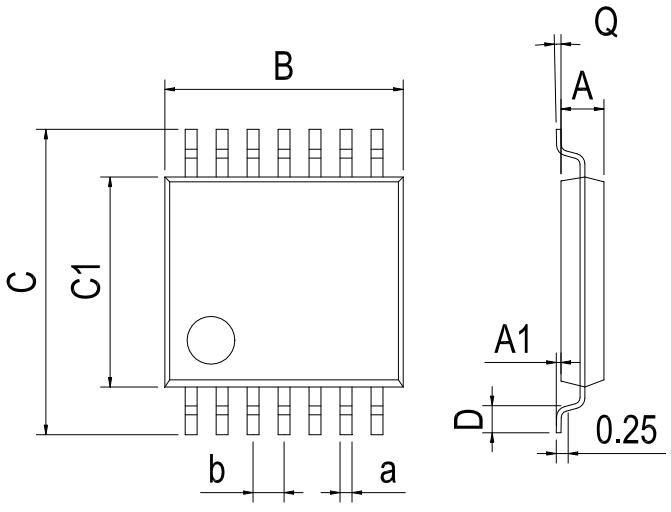
Physical Dimensions

SOP-14



Dimensions In Millimeters(SOP-14)									
Symbol:	**A**	**A1**	**B**	**C**	**C1**	**D**	**Q**	**a**	**b**
Min:	1.35	0.05	8.55	5.80	3.80	0.40	0°	0.35	1.27 BSC
Max:	1.55	0.20	8.95	6.20	4.00	0.80	8°	0.45	

TSSOP-14



Dimensions In Millimeters(TSSOP-14)									
Symbol:	**A**	**A1**	**B**	**C**	**C1**	**D**	**Q**	**a**	**b**
Min:	0.85	0.05	4.90	6.20	4.30	0.40	0°	0.20	0.65 BSC
Max:	0.95	0.20	5.10	6.60	4.50	0.80	8°	0.25	

Revision History

REVISION NUMBER	DATE	REVISION	PAGE
V1.0	2018-11	New	1-10
V1.1	2026-3	Document Reformatting	1-13

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