

ICL7611/7612/7621

单/双/四运算、低功耗放大器
运算放大器

ICL7611/7612/7621/7664系列单片CMOS运算放大器在宽电源电压范围内将超低输入电流与低功耗运算相结合。具有引脚可选静态电流，每个放大器的电源供电，或从2V至9V的单电源供电。CMOS输出摆动到电源电压。

超低偏置电流使这一系列的运算放大器非常适合长期常数积分器、皮安计、低下降率采样/保持放大器，以及其他对输入偏置和偏置电流至关重要的应用。放大器等高原阻抗应用中的最佳性能

适用于

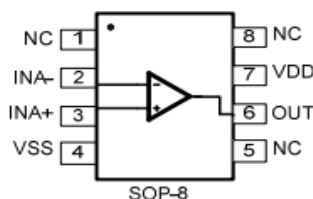
低漏损放大器
长期恒定集成器
低频有源滤波器
助听器和麦克风放大器
低垂率采样/保持放大器
微量表

Low Input Bias Current: 1pA (Typ.)
Low Offset Voltage: 3.5mV (Max.)
High Slew Rate: 9V/ μ s
Settling Time to 0.1% with 2V Step: 0.3 μ s
Low Noise : 8nV/ Hz @10kHz

Pin Configuration

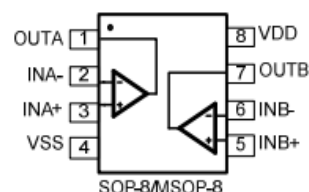
ICL7611

DIP/SOP

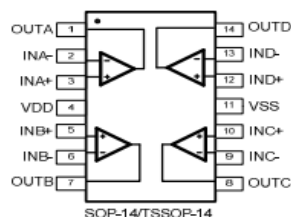


ICL7621

DIP/SOP

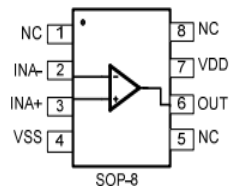


ICL7614



ICL7612

DIP/SOP



TUDI选型替代进口ICL76**系列 我们将持续优化

型号	封装	丝印	工作电压	最高电压
ICL7612ACSA-TUDI	SOP8	7612ACSA	1.7-5.5	6-9V
ICL7612BCSA-TUDI	SOP8	7612BCSA	1.7-5.5	6-9V
ICL7612BESA-TUDI	SOP8	7612BESA	1.7-5.5	6-9V
ICL7612DCSA-TUDI	SOP8	7612DCSA	1.7-5.5	6-9V
ICL7612DCBAZ-T-TUDI	SOP8	7612DCBAZ	1.7-5.5	6-9V
ICL7612DESA-TUDI	SOP8	7612DESA	1.7-5.5	6-9V
ICL7612ACPA-TUDI	DIP8	ICL7612ACPA	1.7-5.5	6-9V
ICL7612BCPA-TUDI	DIP8	ICL7612BCPA	1.7-5.5	6-9V
ICL7612DCPA-TUDI	DIP8	ICL7612DCPA	1.7-5.5	6-9V
ICL7611ACPA-TUDI	DIP8	ICL7611ACPA	1.7-5.5	6-9V
ICL7611ACSA-TUDI	SOP8	7611ACSA	1.7-5.5	6-9V
ICL7611BCPA-TUDI	DIP8	ICL7611BCPA	1.7-5.5	6-9V
ICL7611BCSA-TUDI	SOP8	7611BCSA	1.7-5.5	6-9V
ICL7611DCBAZ-T-TUDI	SOP8	7611DCBAZ	1.7-5.5	6-9V
ICL7611DCPA-TUDI	DIP8	ICL7611DCPA	1.7-5.5	6-9V
ICL7611DCSAZ-T-TUDI	SOP8	7611DCSAZ	1.7-5.5	6-9V
ICL7621ACPA-TUDI	DIP8	ICL7621ACPA	1.7-5.5	6-9V
ICL7621ACSA-TUDI	SOP8	7621ACSA	1.7-5.5	6-9V
ICL7621BCPA-TUDI	DIP8	ICL7621BCPA	1.7-5.5	6-9V
ICL7621BCSA-TUDI	SOP8	7621BCSA	1.7-5.5	6-9V
ICL7621DCPA-TUDI	DIP8	ICL7621DCPA	1.7-5.5	6-9V
ICL7621DCSA-TUDI	SOP8	7621DCSA	1.7-5.5	6-9V
ICL7621ECSA-TUDI	SOP8	7621ECSA	1.7-5.5	6-9V
ICL7621ECSD-TUDI	SOP8	7621ECSD	1.7-5.5	6-9V

文档仅供参考，实际应用测试为准

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Absolute Maximum Ratings

Condition	Min	Max
Power Supply Voltage (V _{DD} to V _{SS})	-0.5V	+7.5V
Analog Input Voltage (IN+ or IN-)	V _{SS} -0.5V	V _{DD} +0.5V
PDB Input Voltage	V _{SS} -0.5V	+7V
Operating Temperature Range	-40°C	+125°C
Junction Temperature	+160°C	
Storage Temperature Range	-10°C	+120°C
Lead Temperature (soldering, 10sec)	+260°C	
Package Thermal Resistance (TA=+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	
ESD Susceptibility		
HBM	8KV	
MM	400V	

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.

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Electrical Characteristics

(At $V_S=5V$, $T_A = +25^{\circ}C$, $V_{CM} = V_S/2$, $R_L = 600\Omega$, unless otherwise noted.)

PARAMETER	CONDITIONS	ICL7611/7612/7611/7664						
		TYP	MIN/MAX OVER TEMPERATURE					
		+25℃	+25℃	0℃ to 70℃	-40℃ to 85℃	-40℃ to 125℃	UNITS	MIN / MAX
INPUT CHARACTERISTICS								
Input Offset Voltage (V _{OS})	V _S = 5.5V	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})		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, V _{CM} = -0.1V to 4V	82	65	64	64	63	dB	MIN
	V _S = 5.5V, V _{CM} = -0.1V to 5.6V	75					dB	MIN
Open-Loop Voltage Gain (A _{OL})	R _L = 600Ω,V _O = 0.15V to 4.85V	90	80	76	75	68	dB	MIN
	R _L = 10kΩ,V _O = 0.05V to 4.95V	108					dB	MIN
Input Offset Voltage Drift (ΔV _{OS} /ΔT)		2.4					μV/℃	TYP
OUTPUT CHARACTERISTICS								
Output Voltage Swing from Rail	R _L = 600Ω	0.1					V	TYP
	R _L = 10kΩ	0.015					V	TYP
Output Current (I _{OUT})		70	55	45	42	38	mA	MIN
Closed-Loop Output Impedance	f = 100kHz, G = 1	7.5					Ω	TYP
POWER-DOWN DISABLE								
Turn-On Time		1.1					μs	TYP
Turn-Off Time		0.3					μs	TYP
DISABLE Voltage-Off			0.8				V	MAX
DISABLE Voltage-On			2				V	MIN
POWER SUPPLY								
Operating Voltage Range	V _S = +2.5V to +5.5V V _{CM} = (-V _S) + 0.5V		2.1	2.1	2.1	2.1	V	MIN
			5.5	5.5	5.5	5.5	V	MAX
Power Supply Rejection Ratio (PSRR)								
Quiescent Current/Amplifier (I _Q)			91	74	72	72	68	dB
	I _{OUT} = 0	1.1	1.5	1.65	1.7	1.85	mA	MAX

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Electrical Characteristics

(At $V_S=5V$, $T_A = +25^{\circ}C$, $V_{CM} = V_S/2$, $R_L = 600\Omega$, unless otherwise noted.)

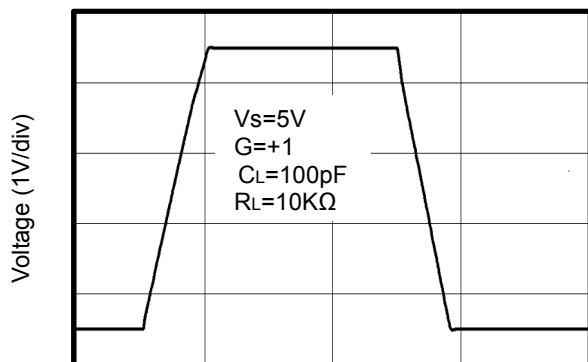
PARAMETER	CONDITIONS	MICL7611/7612/7621						
		TYP	MIN/MAX OVER TEMPERATURE					
		+25℃	+25℃	0℃ to 70℃	-40℃ to 85℃	-40℃to 125℃	UNITS	MIN / MAX
DYNAMIC PERFORMANCE								
Gain-Bandwidth Product (GBP)	R _L = 10kΩ, C _L = 100pF	11					MHz	TYP
Phase Margin (φ _o)	R _L = 10kΩ, C _L = 100pF	51					Degrees	TYP
Full Power Bandwidth (BWP)	< 1% distortion, R _L = 600Ω	400					kHz	TYP
Slew Rate (SR)	G = +1, 2V Step, R _L = 10kΩ	9					V/μs	TYP
Settling Time to 0.1% (t _s)	G = +1, 2V Step, R _L = 600Ω	0.3					μs	TYP
Overload Recovery Time	V _{IN} ·Gain = VS, R _L = 600Ω	1.5					μs	TYP
NOISE PERFORMANCE								
Voltage Noise Density (e _n)	f = 1kHz	11.5					nV / √Hz	TYP
	f = 10kHz	8					nV / √Hz	TYP

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Typical Performance characteristics

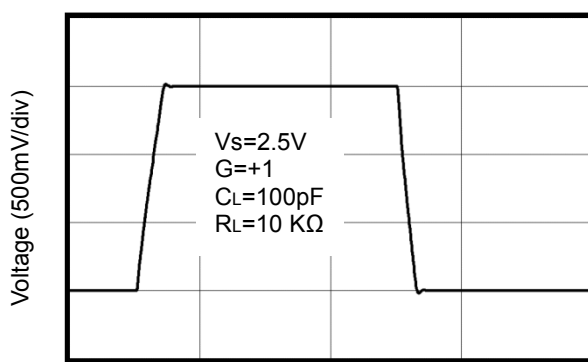
(At $V_s=5V$, $T_A = +25^\circ C$, $V_{CM} = V_s/2$, $R_L = 600\Omega$, unless otherwise noted.)

Large-Signal Step Response



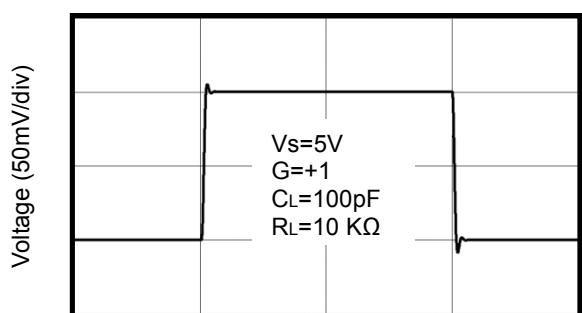
Time (1 μs /div)

Large-Signal Step Response



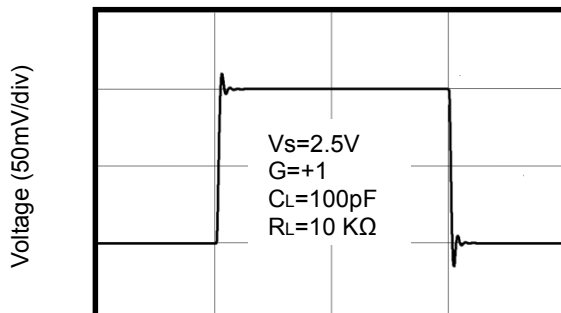
Time (1 μs /div)

Small-Signal Step Response



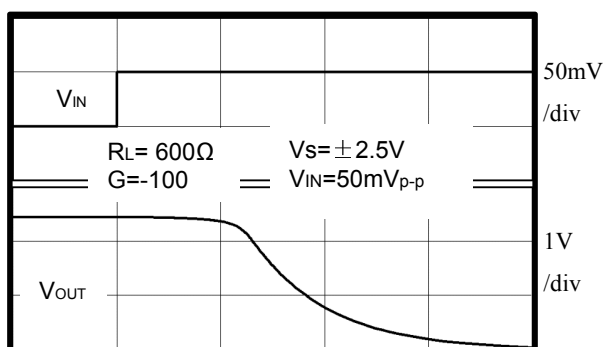
Time (1 μs /div)

Small-Signal Step Response



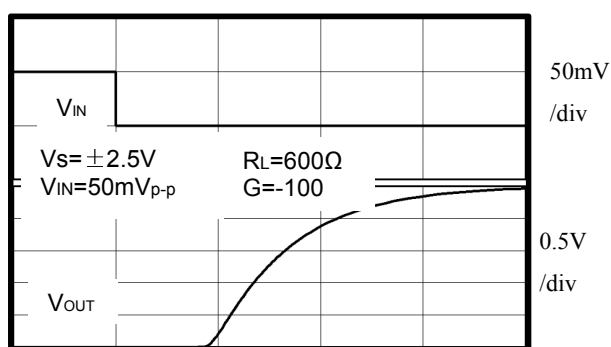
Time (1 μs /div)

Positive Overload Recovery



Time (2 μs /div)

Negative Overload Recovery



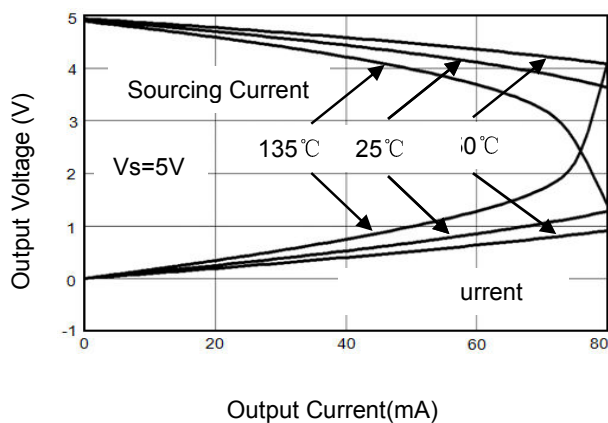
Time (2 μs /div)

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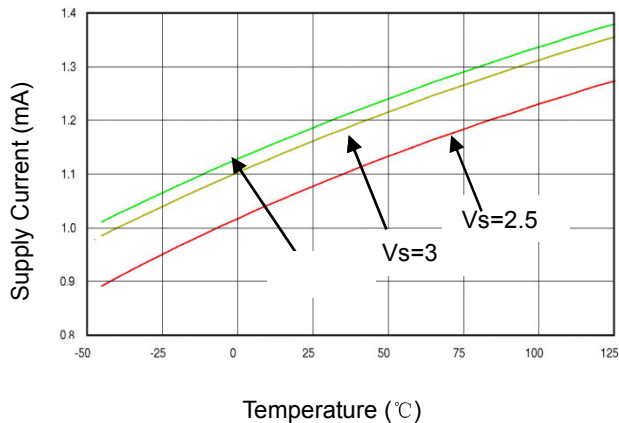
Typical Performance characteristics

(At $V_s=5V$, $T_A = +25^\circ C$, $V_{CM} = V_s/2$, $R_L = 600\Omega$, unless otherwise noted.)

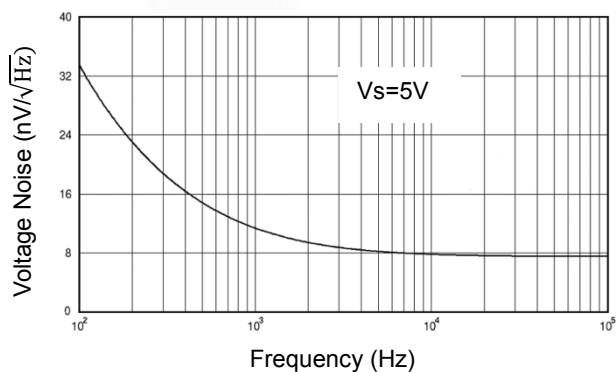
Output Voltage Swing vs. Output Current



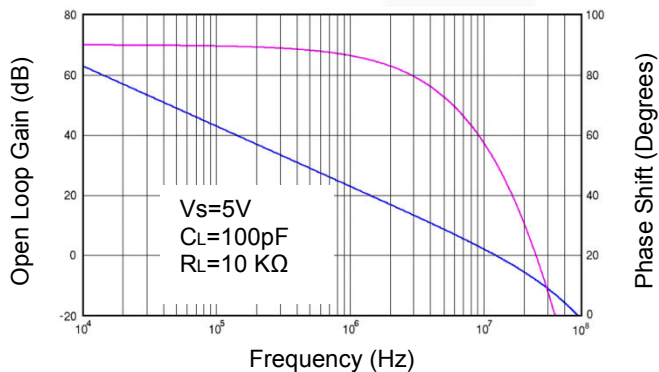
Supply Current vs. Temperature



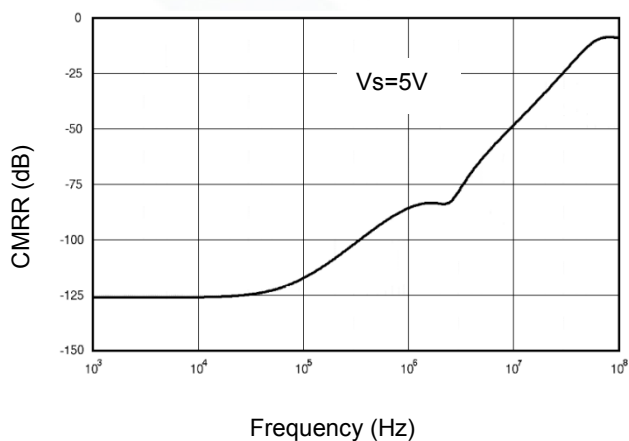
Input Voltage Noise Spectral Density vs. Frequency



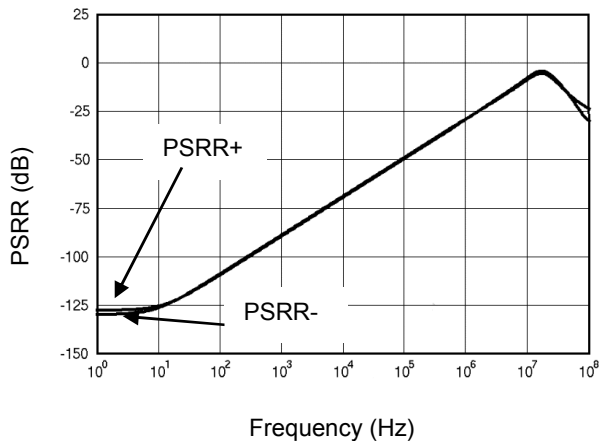
Open Loop Gain, Phase Shift vs. Frequency



CMRR vs. Frequency



PSRR vs. Frequency



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Application Note

Size

ICL7X series op amps are unity-gain stable and suitable for a wide range of general-purpose applications. The small footprints of the ICL7X series packages save space on printed circuit boards and enable the design of smaller electronic products.

Power Supply Bypassing and Board Layout

ICL7X series operates from a single 2.1V to 5.5V supply or dual $\pm 1.05\text{V}$ to $\pm 2.75\text{V}$ supplies. For best performance, a $0.1\mu\text{F}$ ceramic capacitor should be placed close to the V_{DD} pin in single supply operation. For dual supply operation, both V_{DD} and V_{SS} supplies should be bypassed to ground with separate $0.1\mu\text{F}$ ceramic capacitors.

Low Supply Current

The low supply current (typical 1.1mA per channel) of ICL7X series will help to maximize battery life. They are ideal for battery powered systems

Operating Voltage

ICL7X series operate under wide input supply voltage (2.1V to 5.5V). In addition, all temperature specifications apply from -40°C to $+125^{\circ}\text{C}$. 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 ICL7X series extends 100mV beyond the supply rails ($V_{\text{SS}}-0.1\text{V}$ to $V_{\text{DD}}+0.1\text{V}$). 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 ICL7X series can typically swing to less than 2mV from supply rail in light resistive loads ($>100\text{k}\Omega$), and 15mV of supply rail in moderate resistive loads ($10\text{k}\Omega$).

Capacitive Load Tolerance

The ICL7X 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.

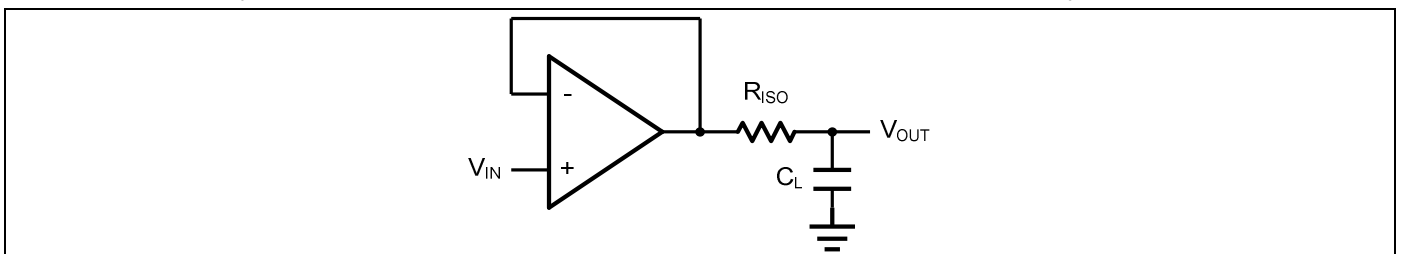


Figure 2. Indirectly Driving a Capacitive Load Using Isolation Resistor

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 $R_{\text{ISO}}/R_{\text{L}}$) 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}

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and R_{ISO} 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.

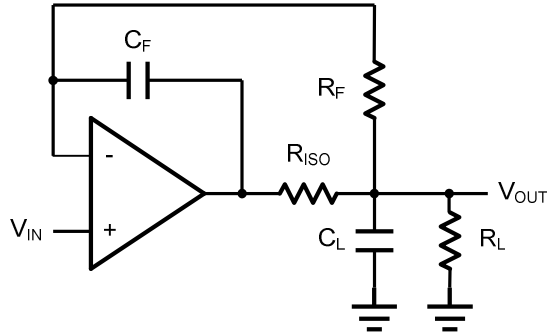


Figure 3. Indirectly Driving a Capacitive Load with DC Accuracy

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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 to 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. shows the differential amplifier using ICL7X.

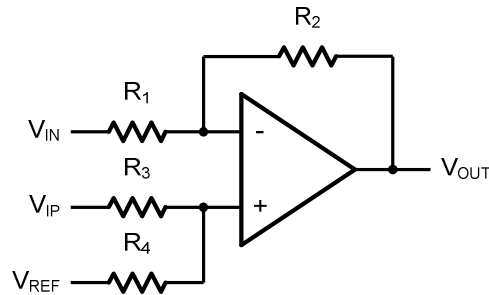


Figure 4. Differential Amplifier

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

If the resistor ratios are equal (i.e. $R_1 = R_3$ and $R_2 = R_4$), 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 $-R_2/R_1$. The filter has a -20dB/decade roll-off after its corner frequency $f_c = 1/(2\pi R_3 C_1)$.

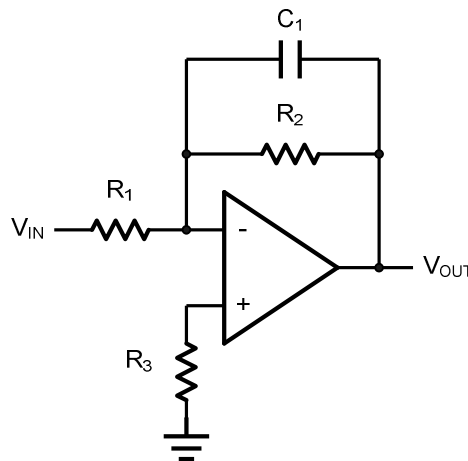


Figure 5. Low Pass Active Filter

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Instrumentation Amplifier

The triple ICL7X 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.

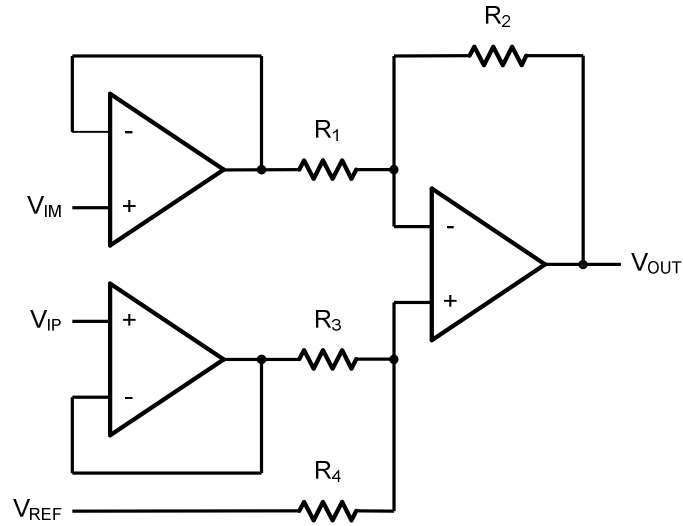
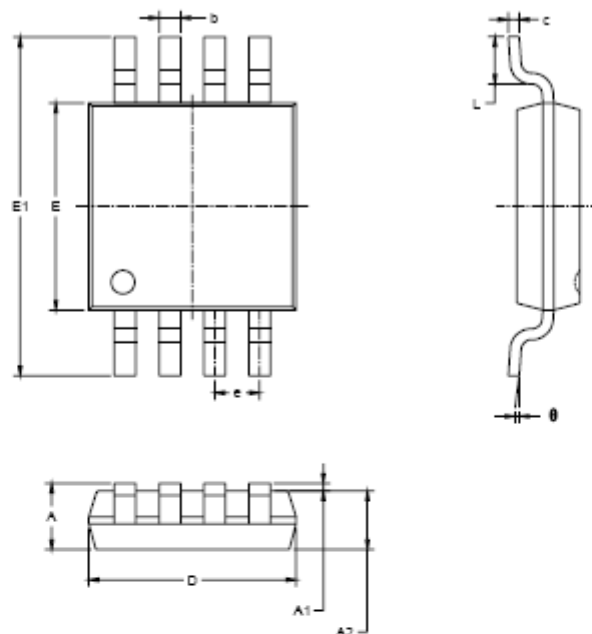


Figure 6. Instrument Amplifier

ICL7611/7612/7621

Package Information

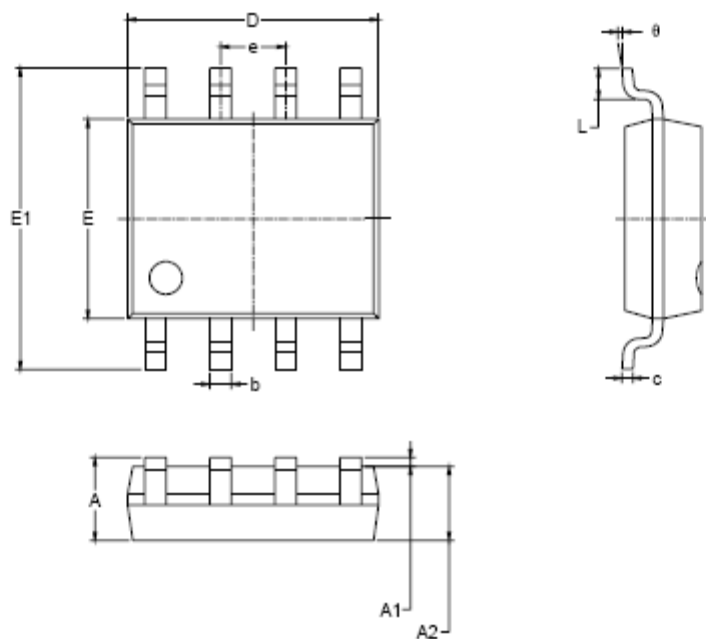
MSOP-8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026 BSC	
L	0.400	0.800	0.016	0.031
θ	0°	8°	0°	8°

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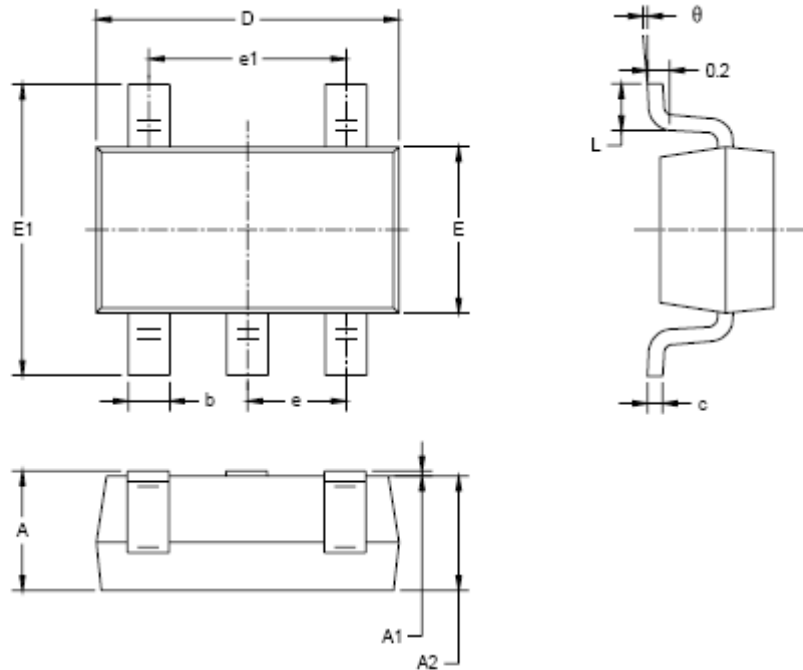
SOP-8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050 BSC	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

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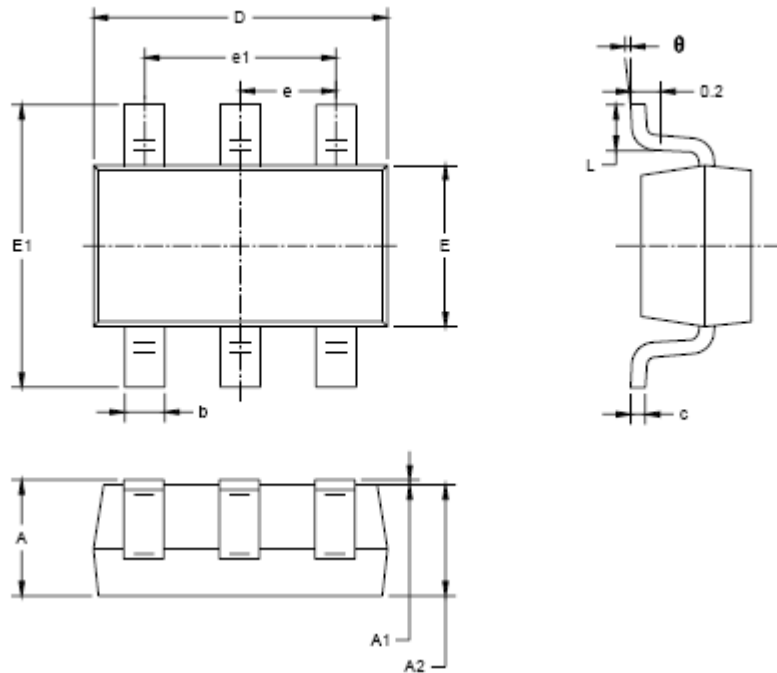
SOT23-5



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

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SOT23-6



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

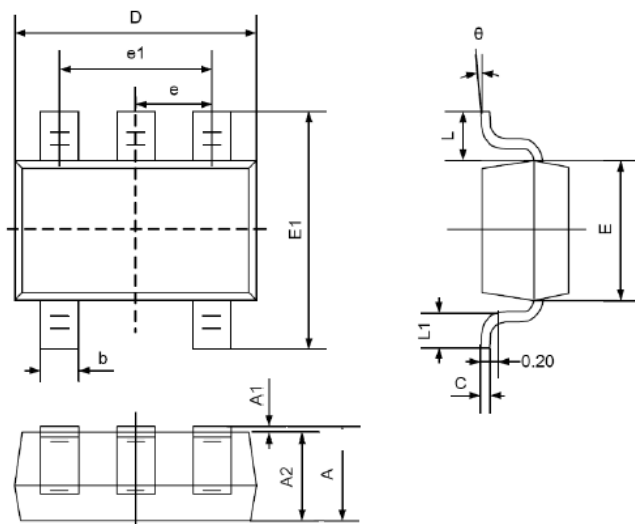
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ICL7611/7612/7621

SC70-5



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
C	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650TYP		0.026TYP	
e1	1.200	1.400	0.047	0.055
L	0.525REF		0.021REF	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°

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（2）设计、验证和测试您的应用程序；（3）确保您的应用程序符合适用的标准和任何其他安全、

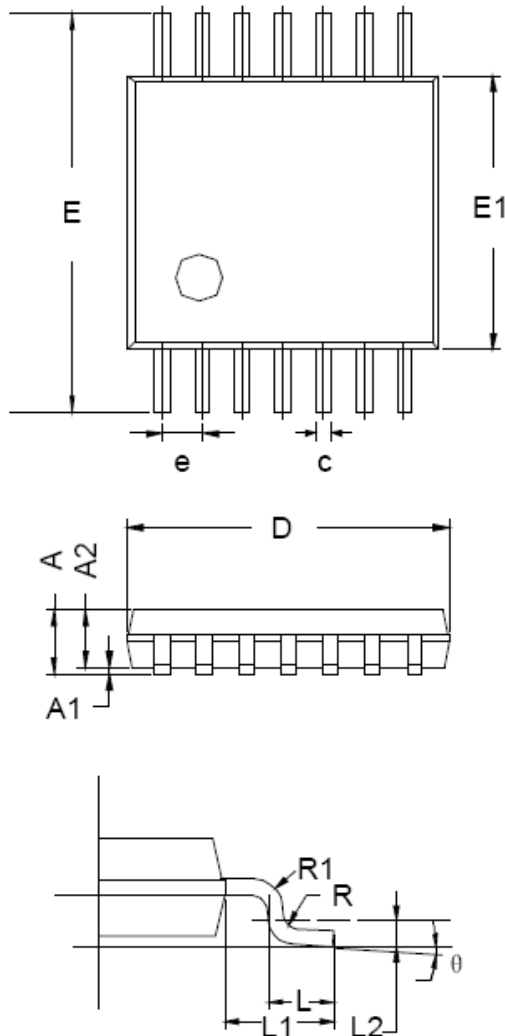
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ICL7611/7612/7621

TSSOP-14



Symbol	Dimensions In Millimeters		
	MIN	TYP	MAX
A	-	-	1.20
A1	0.05	-	0.15
A2	0.90	1.00	1.05
b	0.20	-	0.28
c	0.10	-	0.19
D	4.86	4.96	5.06
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e	0.65 BSC		
L	0.45	0.60	0.75
L1	1.00 REF		
L2	0.25 BSC		
R	0.09	-	-
θ	0°	-	8°

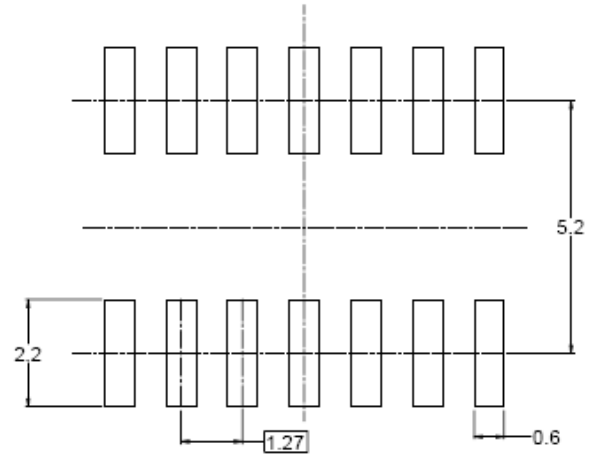
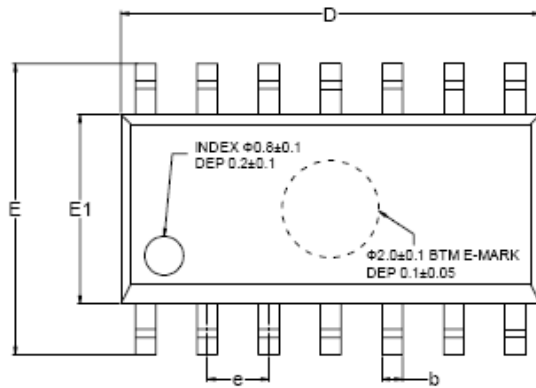
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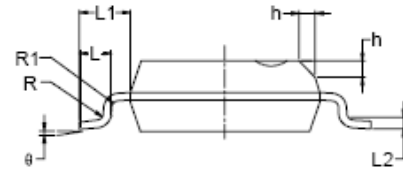
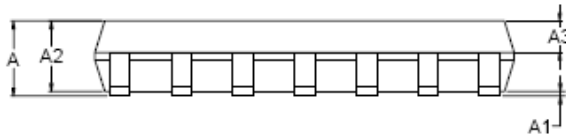
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SOP-14



RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	MIN	MOD	MAX	MIN	MOD	MAX
A	1.35		1.75	0.053		0.069
A1	0.10		0.25	0.004		0.010
A2	1.25		1.65	0.049		0.065
A3	0.55		0.75	0.022		0.030
b	0.36		0.49	0.014		0.019
D	8.53		8.73	0.336		0.344
E	5.80		6.20	0.228		0.244
E1	3.80		4.00	0.150		0.157
e	1.27 BSC			0.050 BSC		
L	0.45		0.80	0.018		0.032
L1	1.04 REF			0.040 REF		
L2	0.25 BSC			0.01 BSC		
R	0.07			0.003		
R1	0.07			0.003		
h	0.30		0.50	0.012		0.020
θ	0°		8°	0°		8°

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