

**1.4MHz, Low Power CMOS Operational Amplifiers**

The ICL761X series is a family of CMOS operational amplifiers. These devices provide the designer with high performance operation at low supply voltages and selectable quiescent currents, and are an ideal design tool when ultra low input current and low power dissipation are desired.

The basic amplifier will operate at supply voltages ranging from  $\pm 1V$  to  $\pm 8V$ , and may be operated from a single Lithium cell.

A unique quiescent current programming pin allows setting of standby current to 1mA, 100 $\mu A$ , or 10 $\mu A$ , with no external components. This results in power consumption as low as 20 $\mu W$ . The output swing ranges to within a few millivolts of the supply voltages.

Of particular significance is the extremely low (1pA) input current, input noise current of 0.01pA/ $\sqrt{Hz}$ , and  $10^{12}\Omega$  input impedance. These features optimize performance in very high source impedance applications.

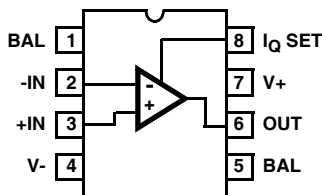
The inputs are internally protected. Outputs are fully protected against short circuits to ground or to either supply.

AC performance is excellent, with a slew rate of 1.6V/ $\mu s$ , and unity gain bandwidth of 1MHz at  $I_Q = 1mA$ .

Because of the low power dissipation, junction temperature rise and drift are quite low. Applications utilizing these features may include stable instruments, extended life designs, or high density packages.

**Pinouts**

**ICL7611, ICL7612**  
**(8 LD PDIP, 8 LD SOIC)**  
TOP VIEW



**Features**

- Wide Operating Voltage Range . . . . .  $\pm 1V$  to  $\pm 8V$
- High Input Impedance . . . . .  $10^{12}\Omega$
- Programmable Power Consumption . . . . . Low as 20 $\mu W$
- Input Current Lower Than BIFETs . . . . . 1pA (Typ)
- Output Voltage Swing . . . . .  $V+$  and  $V-$
- Input Common Mode Voltage Range Greater Than Supply Rails (ICL7612)
- Pb-Free Plus Anneal Available (RoHS Compliant)

**Applications**

- Portable Instruments
- Telephone Headsets
- Hearing Aid/Microphone Amplifiers
- Meter Amplifiers
- Medical Instruments
- High Impedance Buffers

## Ordering Information

PART NUMBER	PART MARKING	TEMP. RANGE (°C)	PACKAGE	PKG. DWG. #
ICL7611DCBA	7611 DCBA	0 to +70	8 Ld SOIC (150 mil)	M8.15
ICL7611DCBAZ (Note)	7611 DCBAZ	0 to +70	8 Ld SOIC (150 mil) (Pb-free)	M8.15
ICL7611DCBA-T	7611 DCBA	0 to +70	8 Ld SOIC (150 mil) Tape and Reel	M8.15
ICL7611DCBAZ-T (Note)	7611 DCBAZ	0 to +70	8 Ld SOIC (150 mil) Tape and Reel (Pb-free)	M8.15
ICL7611DCPA	7611 DCPA	0 to +70	8 Ld PDIP	E8.3
ICL7611DCPAZ (Note)	7611 DCPAZ	0 to +70	8 Ld PDIP* (Pb-free)	E8.3
ICL7612BCPA	7612 BCPA	0 to +70	8 Ld PDIP	E8.3
ICL7612BCPAZ	7612 BCPAZ	0 to +70	8 Ld PDIP* (Pb-free)	E8.3
ICL7612DCBA	7612 DCBA	0 to +70	8 Ld SOIC (150 mil)	M8.15
ICL7612DCBA-T	7612 DCBA	0 to +70	8 Ld SOIC (150 mil) Tape and Reel	M8.15
ICL7612DCBAZ (Note)	7612 DCBAZ	0 to +70	8 Ld SOIC (150 mil) (Pb-free)	M8.15
ICL7612DCBAZ-T (Note)	7612 DCBAZ	0 to +70	8 Ld SOIC (150 mil) Tape and Reel (Pb-free)	M8.15
ICL7612DCPA	7612 DCPA	0 to +70	8 Ld PDIP	E8.3
ICL7612DCPAZ (Note)	7612 DCPAZ	0 to +70	8 Ld PDIP* (Pb-free)	E8.3

\*Pb-free PDIPs can be used for through hole wave solder processing only. They are not intended for use in Reflow solder processing applications.  
 NOTE: Intersil Pb-free plus anneal products employ special Pb-free material sets; molding compounds/die attach materials and 100% matte tin plate termination finish, which are RoHS compliant and compatible with both SnPb and Pb-free soldering operations. Intersil Pb-free products are MSL classified at Pb-free peak reflow temperatures that meet or exceed the Pb-free requirements of IPC/JEDEC J STD-020.

# ICL7611, ICL7612

## Absolute Maximum Ratings

Supply Voltage  $V_+$  to  $V_-$  ..... 18V  
 Input Voltage .....  $V_- - 0.3$  to  $V_+ + 0.3$ V  
 Differential Input Voltage (Note 1) .....  $[(V_+ + 0.3) - (V_- - 0.3)]$ V  
 Duration of Output Short Circuit (Note 2) ..... Unlimited

## Operating Conditions

Temperature Range  
 ICL761XC ..... 0°C to +70°C

## Thermal Information

Thermal Resistance (Typical, Note 3)  $\theta_{JA}$  (°C/W)  
 PDIP Package\* ..... 130  
 SOIC Package ..... 170  
 Maximum Junction Temperature (Plastic Package) ..... +150°C  
 Maximum Storage Temperature Range ..... -65°C to +150°C  
 Pb-free reflow profile ..... see link below  
<http://www.intersil.com/pbfree/Pb-FreeReflow.asp>

\*Pb-free PDIPs can be used for through hole wave solder processing only. They are not intended for use in Reflow solder processing applications.

**CAUTION:** Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

### NOTES:

1. Long term offset voltage stability will be degraded if large input differential voltages are applied for long periods of time.
2. The outputs may be shorted to ground or to either supply, for  $V_{SUPPLY} \leq 10$ V. Care must be taken to insure that the dissipation rating is not exceeded.
3.  $\theta_{JA}$  is measured with the component mounted on an evaluation PC board in free air.

## Electrical Specifications $V_{SUPPLY} = \pm 5$ V, Unless Otherwise Specified.

PARAMETER	SYMBOL	TEST CONDITIONS	TEMP (°C)	ICL7612B			ICL7611D, ICL7612D			UNITS
				MIN	TYP	MAX	MIN	TYP	MAX	
Input Offset Voltage	$V_{OS}$	$R_S \leq 100k\Omega$	+25	-	-	5	-	-	15	mV
			Full	-	-	7	-	-	20	mV
Temperature Coefficient of $V_{OS}$	$\Delta V_{OS}/\Delta T$	$R_S \leq 100k\Omega$	-	-	15	-	-	25	-	$\mu V/^\circ C$
Input Offset Current	$I_{OS}$		+25	-	0.5	30	-	0.5	30	pA
			Full	-	-	300	-	-	300	pA
Input Bias Current	$I_{BIAS}$		+25	-	1.0	50	-	1.0	50	pA
			Full	-	-	400	-	-	400	pA
Common Mode Voltage Range (ICL7611 Only)	$V_{CMR}$	$I_Q = 10\mu A$	+25	-	-	-	$\pm 4.4$	-	-	V
		$I_Q = 100\mu A$	+25	-	-	-	$\pm 4.2$	-	-	V
		$I_Q = 1mA$	+25	-	-	-	$\pm 3.7$	-	-	V
Extended Common Mode Voltage Range (ICL7612 Only)	$V_{CMR}$	$I_Q = 10\mu A$	+25	$\pm 5.3$	-	-	$\pm 5.3$	-	-	V
		$I_Q = 100\mu A$	+25	+5.3, -5.1	-	-	+5.3, -5.1	-	-	V
		$I_Q = 1mA$	+25	+5.3, -4.5	-	-	+5.3, -4.5	-	-	V
Output Voltage Swing	$V_{OUT}$	$I_Q = 10\mu A, R_L = 1M\Omega$	+25	$\pm 4.9$	-	-	$\pm 4.9$	-	-	V
			Full	$\pm 4.8$	-	-	$\pm 4.8$	-	-	V
		$I_Q = 100\mu A, R_L = 100k\Omega$	+25	$\pm 4.9$	-	-	$\pm 4.9$	-	-	V
			Full	$\pm 4.8$	-	-	$\pm 4.8$	-	-	V
		$I_Q = 1mA, R_L = 10k\Omega$	+25	$\pm 4.5$	-	-	$\pm 4.5$	-	-	V
			Full	$\pm 4.3$	-	-	$\pm 4.3$	-	-	V
Large Signal Voltage Gain	$A_{VOL}$	$V_O = \pm 4.0V, R_L = 1M\Omega, I_Q = 10\mu A$	+25	80	104	-	80	104	-	dB
			Full	75	-	-	75	-	-	dB
		$V_O = \pm 4.0V, R_L = 100k\Omega, I_Q = 100\mu A$	+25	80	102	-	80	102	-	dB
			Full	75	-	-	75	-	-	dB
		$V_O = \pm 4.0V, R_L = 10k\Omega, I_Q = 1mA$	+25	76	83	-	76	83	-	dB
			Full	72	-	-	72	-	-	dB

## ICL7611, ICL7612

### Electrical Specifications $V_{SUPPLY} = \pm 5V$ , Unless Otherwise Specified. (Continued)

PARAMETER	SYMBOL	TEST CONDITIONS	TEMP (°C)	ICL7612B			ICL7611D, ICL7612D			UNITS
				MIN	TYP	MAX	MIN	TYP	MAX	
Unity Gain Bandwidth	GBW	$I_Q = 10\mu A$	+25	-	0.044	-	-	0.044	-	MHz
		$I_Q = 100\mu A$	+25	-	0.48	-	-	0.48	-	MHz
		$I_Q = 1mA$	+25	-	1.4	-	-	1.4	-	MHz
Input Resistance	$R_{IN}$		+25	-	$10^{12}$	-	-	$10^{12}$	-	$\Omega$
Common Mode Rejection Ratio	CMRR	$R_S \leq 100k\Omega, I_Q = 10\mu A$	+25	70	96	-	70	96	-	dB
		$R_S \leq 100k\Omega, I_Q = 100\mu A$	+25	70	91	-	70	91	-	dB
		$R_S \leq 100k\Omega, I_Q = 1mA$	+25	60	87	-	60	87	-	dB
Power Supply Rejection Ratio ( $V_{SUPPLY} = \pm 8V$ to $\pm 2V$ )	PSRR	$R_S \leq 100k\Omega, I_Q = 10\mu A$	+25	80	94	-	80	94	-	dB
		$R_S \leq 100k\Omega, I_Q = 100\mu A$	+25	80	86	-	80	86	-	dB
		$R_S \leq 100k\Omega, I_Q = 1mA$	+25	70	77	-	70	77	-	dB
Input Referred Noise Voltage	$e_N$	$R_S = 100\Omega, f = 1kHz$	+25	-	100	-	-	100	-	$nV/\sqrt{Hz}$
Input Referred Noise Current	$i_N$	$R_S = 100\Omega, f = 1kHz$	+25	-	0.01	-	-	0.01	-	$pA/\sqrt{Hz}$
Supply Current (No Signal, No Load)	$I_{SUPPLY}$	$I_Q SET = +5V, \text{Low Bias}$	+25	-	0.01	0.02	-	0.01	0.02	mA
		$I_Q SET = 0V, \text{Medium Bias}$	+25	-	0.1	0.25	-	0.1	0.25	mA
		$I_Q SET = -5V, \text{High Bias}$	+25	-	1.0	2.5	-	1.0	2.5	mA
Channel Separation	$V_{O1}/V_{O2}$	$A_V = 100$	+25	-	120	-	-	120	-	dB
Slew Rate ( $A_V = 1, C_L = 100pF, V_{IN} = 8V_{P-P}$ )	SR	$I_Q = 10\mu A, R_L = 1M\Omega$	+25	-	0.016	-	-	0.016	-	$V/\mu s$
		$I_Q = 100\mu A, R_L = 100k\Omega$	+25	-	0.16	-	-	0.16	-	$V/\mu s$
		$I_Q = 1mA, R_L = 10k\Omega$	+25	-	1.6	-	-	1.6	-	$V/\mu s$
Rise Time ( $V_{IN} = 50mV, C_L = 100pF$ )	$t_r$	$I_Q = 10\mu A, R_L = 1M\Omega$	+25	-	20	-	-	20	-	$\mu s$
		$I_Q = 100\mu A, R_L = 100k\Omega$	+25	-	2	-	-	2	-	$\mu s$
		$I_Q = 1mA, R_L = 10k\Omega$	+25	-	0.9	-	-	0.9	-	$\mu s$
Overshoot Factor ( $V_{IN} = 50mV, C_L = 100pF$ )	OS	$I_Q = 10\mu A, R_L = 1M\Omega$	+25	-	5	-	-	5	-	%
		$I_Q = 100\mu A, R_L = 100k\Omega$	+25	-	10	-	-	10	-	%
		$I_Q = 1mA, R_L = 10k\Omega$	+25	-	40	-	-	40	-	%

### Electrical Specifications $V_{SUPPLY} = \pm 1V, I_Q = 10\mu A$ , Unless Otherwise Specified.

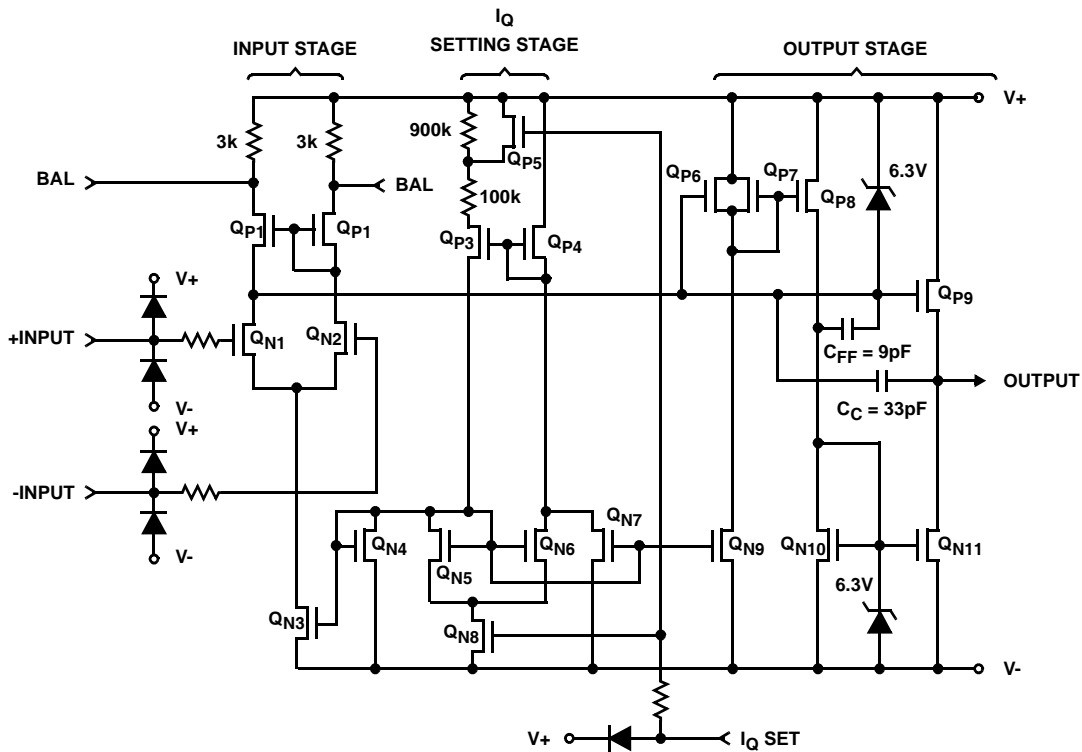
PARAMETER	SYMBOL	TEST CONDITIONS	TEMP (°C)	ICL7612B			UNITS
				MIN	TYP	MAX	
Input Offset Voltage	$V_{OS}$	$R_S \leq 100k\Omega$	+25	-	-	5	mV
			Full	-	-	7	mV
Temperature Coefficient of $V_{OS}$	$\Delta V_{OS}/\Delta T$	$R_S \leq 100k\Omega$	-	-	15	-	$\mu V/^\circ C$
Input Offset Current	$I_{OS}$		+25	-	0.5	30	pA
			Full	-	-	300	pA
Input Bias Current	$I_{BIAS}$		+25	-	1.0	50	pA
			Full	-	-	500	pA
Extended Common Mode Voltage Range	$V_{CMR}$		+25	+0.6 to -1.1	-	-	V

# ICL7611, ICL7612

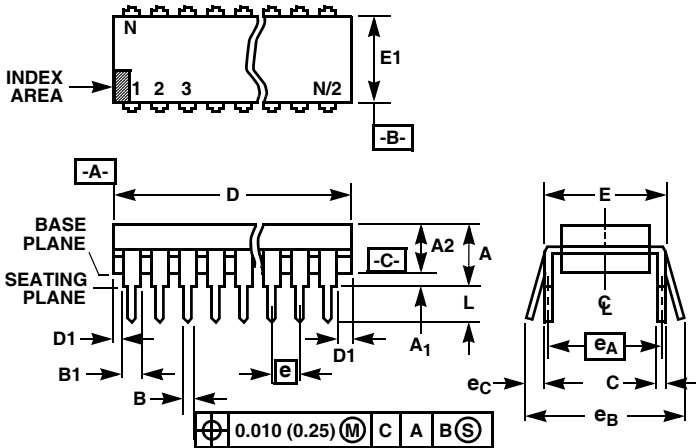
## Electrical Specifications $V_{SUPPLY} = \pm 1V$ , $I_Q = 10\mu A$ , Unless Otherwise Specified. (Continued)

PARAMETER	SYMBOL	TEST CONDITIONS	TEMP (°C)	ICL7612B			UNITS
				MIN	TYP	MAX	
Output Voltage Swing	$V_{OUT}$	$R_L = 1M\Omega$	+25	$\pm 0.98$	-	-	V
			Full	$\pm 0.96$	-	-	V
Large Signal Voltage Gain	$A_{VOL}$	$V_O = \pm 0.1V$ , $R_L = 1M\Omega$	+25	-	90	-	dB
			Full	-	80	-	dB
Unity Gain Bandwidth	GBW		+25	-	0.044	-	MHz
Input Resistance	$R_{IN}$		+25	-	$10^{12}$	-	$\Omega$
Common Mode Rejection Ratio	CMRR	$R_S \leq 100k\Omega$	+25	-	80	-	dB
Power Supply Rejection Ratio	PSRR	$R_S \leq 100k\Omega$	+25	-	80	-	dB
Input Referred Noise Voltage	$e_N$	$R_S = 100\Omega$ , $f = 1kHz$	+25	-	100	-	$nV/\sqrt{Hz}$
Input Referred Noise Current	$i_N$	$R_S = 100\Omega$ , $f = 1kHz$	+25	-	0.01	-	$pA/\sqrt{Hz}$
Supply Current	$I_{SUPPLY}$	No Signal, No Load	+25	-	6	15	$\mu A$
Slew Rate	SR	$A_V = 1$ , $C_L = 100pF$ , $V_{IN} = 0.2V_{P-P}$ , $R_L = 1M\Omega$	+25	-	0.016	-	$V/\mu s$
Rise Time	$t_r$	$V_{IN} = 50mV$ , $C_L = 100pF$ , $R_L = 1M\Omega$	+25	-	20	-	$\mu s$
Overshoot Factor	OS	$V_{IN} = 50mV$ , $C_L = 100pF$ , $R_L = 1M\Omega$	+25	-	5	-	%

## Schematic Diagram



Dual-In-Line Plastic Packages (PDIP)



NOTES:

- Controlling Dimensions: INCH. In case of conflict between English and Metric dimensions, the inch dimensions control.
- Dimensioning and tolerancing per ANSI Y14.5M-1982.
- Symbols are defined in the "MO Series Symbol List" in Section 2.2 of Publication No. 95.
- Dimensions A, A1 and L are measured with the package seated in JEDEC seating plane gauge GS-3.
- D, D1, and E1 dimensions do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.010 inch (0.25mm).
- E and e<sub>A</sub> are measured with the leads constrained to be perpendicular to datum -C-.
- e<sub>B</sub> and e<sub>C</sub> are measured at the lead tips with the leads unconstrained. e<sub>C</sub> must be zero or greater.
- B1 maximum dimensions do not include dambar protrusions. Dambar protrusions shall not exceed 0.010 inch (0.25mm).
- N is the maximum number of terminal positions.
- Corner leads (1, N, N/2 and N/2 + 1) for E8.3, E16.3, E18.3, E28.3, E42.6 will have a B1 dimension of 0.030 - 0.045 inch (0.76 - 1.14mm).

E8.3 (JEDEC MS-001-BA ISSUE D)  
8 LEAD DUAL-IN-LINE PLASTIC PACKAGE

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	-	0.210	-	5.33	4
A1	0.015	-	0.39	-	4
A2	0.115	0.195	2.93	4.95	-
B	0.014	0.022	0.356	0.558	-
B1	0.045	0.070	1.15	1.77	8, 10
C	0.008	0.014	0.204	0.355	-
D	0.355	0.400	9.01	10.16	5
D1	0.005	-	0.13	-	5
E	0.300	0.325	7.62	8.25	6
E1	0.240	0.280	6.10	7.11	5
e	0.100 BSC		2.54 BSC		-
e <sub>A</sub>	0.300 BSC		7.62 BSC		6
e <sub>B</sub>	-	0.430	-	10.92	7
L	0.115	0.150	2.93	3.81	4
N	8		8		9

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