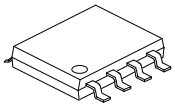
ULV912 **Advance** ***CMOS IC***

RAIL-TO-RAIL INPUT/OUTPUT 8 MHz OPERATIONAL AMPLIFIERS



SOP-8

■ DESCRIPTION

The UTC **ULV912** operational amplifiers offer low voltage operation and rail-to-rail input and output, as well as an excellent speed/power consumption ratio, providing an 8 MHz gain-bandwidth product. The op-amps are unity gain stable and feature an ultra-low input bias current.

The devices are ideal for sensor interfaces, battery-supplied and portable applications, as well as active filtering.

■ FEATURES

* Rail-to-rail input and output
* Wide bandwidth
* Unity gain stability
* High output current: 35 mA
* Operating from 2.5 V to 5.5 V

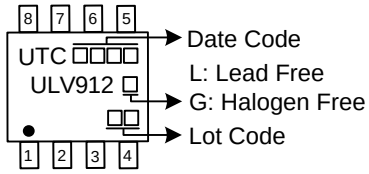
■ ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
ULV912L-S08-R	ULV912G-S08-R	SOP-8	Tape Reel

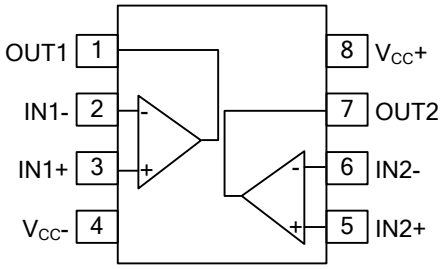
ULV912G-S08-R
(1)Packing Type
(2)Package Type
(3)Green Package

(1) R: Tape Reel
(2) S08: SOP-8
(3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING



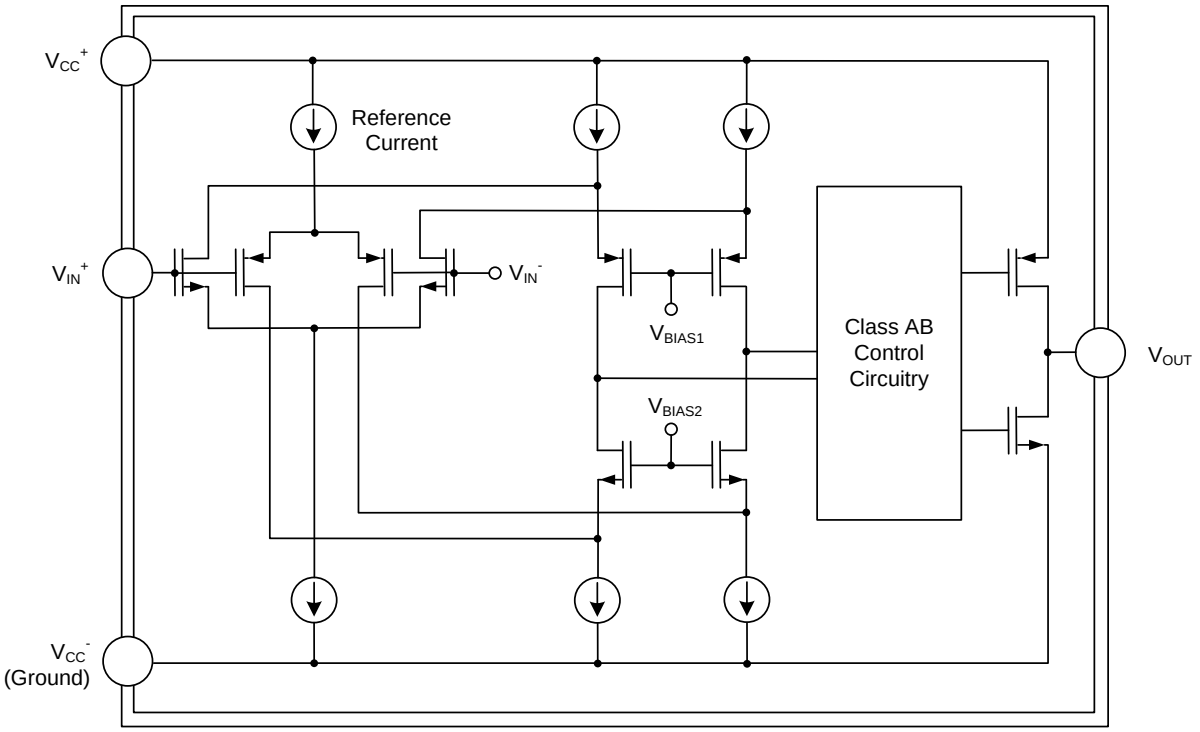
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	OUT1	Output, channel 1
2	IN1-	Inverting input, channel 1
3	IN1+	Noninverting input, channel 1
4	V_{CC}-	Negative (lowest) supply or ground (for single-supply operation)
5	IN2+	Noninverting input, channel 2
6	IN2-	Inverting input, channel 2
7	OUT2	Output, channel 2
8	V_{CC}+	Positive (highest) supply

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage (Note 2)	V_{CC}	6	V
Differential Input Voltage (Note 3)	V_{ID}	$\pm V_{CC}$	v
Input Voltage (Note 4)	V_{IN}	V_{CC-} -0.2 to V_{CC+}+0.2	V
Input Current (Note 5)	I_{IN}	10	mA
Junction Temperature	T_J	+150	°C
Storage Temperature Range	T_{STG}	-65 ~ +150	°C

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. All voltage values, except differential voltage, are with respect to network ground terminal.
3. Differential voltages are the non-inverting input terminal with respect to the inverting input terminal.
4. V_{CC}-Vin must not exceed 6 V.
5. Input current must be limited by a resistor in series with the inputs.

■ OPERATING CONDITIONS

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V_{CC}	2.5 ~ 5.5	V
Common Mode Input Voltage Range	V_{ICM}	V_{CC-} -0.1 ~ V_{CC+} +0.1	V
Operating Free Air Temperature Range	T_{OPR}	-40 ~ +125	°C

■ ELECTRICAL CHARACTERISTICS

(V_{CC+} =+2.5V with V_{CC-}=0V, V_{ICM}=V_{CC}/2, R_L connected to V_{CC}/2, T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
DC performance						
Offset Voltage	V_{IO}			0.1	4.5	mV
Input Offset Current (Note 2)	I_{IO}			1	10	pA
Input Bias Current (Note 2)	I_{IB}			1	10	pA
Common Mode Rejection Ratio 20 log ($\Delta V_{ic}/\Delta V_{io}$)	CMR	0V to 2.5V, V_{OUT}=1.25V	58	75		dB
Large Signal Voltage Gain	A_{VD}	R_L=10kΩ, V_{OUT}=0.5V to 2V	80	89		dB
High Level Output Voltage	V_{CC}-V_{OH}	R_L=10kΩ		15	40	mV
		R_L=600Ω		45	150	mV
Low Level Output Voltage	V_{OL}	R_L=10kΩ		15	40	mV
		R_L=600Ω		45	150	mV
I_{SINK}	I_{OUT}	V_O=2.5V	18	32		mA
I_{SOURCE}		V_O=0V	18	35		mA
Supply Current (per operator)	I_{CC}	No Load, V_{OUT}=V_{CC}/2		0.78	1.1	mA
AC performance						
Gain Bandwidth Product	GBP	R_L=2kΩ, C_L=100pF, f=100kHz		8		MHz
Unity Gain Frequency	Fu	R_L=2kΩ, C_L=100pF		7.2		MHz
Phase Margin	φm	R_L=2kΩ, C_L=100pF		45		Degrees
Gain Margin	G_m	R_L=2kΩ, C_L=100pF		8		dB
Slew Rate	SR	R_L=2kΩ, C_L=100pF, Av=1		4.5		V/μs
Equivalent Input Noise Voltage	e_n	f=10kHz		21		$\frac{nV}{\sqrt{Hz}}$
Total Harmonic Distortion	THD+e_n	G=1, f=1kHz, R_L=2kΩ, BW=22kHz, V_{ICM}=(V_{CC}+1)/2, V_{OUT}=1.1V_{pp}		0.001		%

■ ELECTRICAL CHARACTERISTICS

(V_{CC+} =+3.3V with V_{CC-}=0V, V_{ICM}=V_{CC}/2, R_L connected to V_{CC}/2, T_A=25°C, unless otherwise specified)

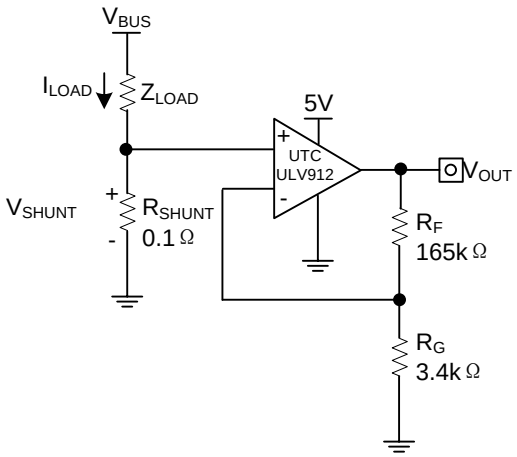
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
DC Performance						
Offset Voltage	V_{IO}			0.1	4.5	mV
Input Offset Current (Note 2)	I_{IO}			1	10	pA
Input Bias Current (Note 2)	I_{IB}			1	10	pA
Common Mode Rejection Ratio 20 log ($\Delta V_{ic}/\Delta V_{io}$)	CMR	0V to 3.3V, V_{OUT}=1.65V	60	78		dB
Large Signal Voltage Gain	A_{VD}	R_L= 10kΩ, V_{OUT}=0.5V to 2.8V	80	89		dB
High Level Output Voltage	V_{CC}-V_{OH}	R_L =10kΩ		15	40	mV
		R_L =600Ω		45	150	mV
Low Level Output Voltage	V_{OL}	R_L =10kΩ		15	40	mV
		R_L =600Ω		45	150	mV
I_{SINK}	I_{OUT}	V_O=3.3V	18	32		mA
I_{SOURCE}		V_O=0V	18	35		mA
Supply Current (per operator)	I_{CC}	No Load, V_{OUT}=V_{CC}/2		0.8	1.1	mA
AC Performance						
Gain Bandwidth Product	GBP	R_L=2kΩ, C_L=100pF, f =100kHz		8		MHz
Unity Gain Frequency	Fu	R_L=2kΩ, C_L=100pF		7.2		MHz
Phase Margin	φm	R_L=2kΩ, C_L=100pF		45		Degrees
Gain Margin	G_m	R_L=2kΩ, C_L=100pF		8		dB
Slew Rate	SR	R_L=2kΩ, C_L=100pF, Av=1		4.5		V/μs
Equivalent Input Noise Voltage	e_n	f=10kHz		27		$\frac{nV}{\sqrt{Hz}}$
Total Harmonic Distortion	THD+e_n	G=1, f=1kHz, R_L=2kΩ, BW= 22kHz, V_{ICM}=(V_{CC}+1)/2, V_{OUT}=1.9V_{pp}		0.0007		%

■ ELECTRICAL CHARACTERISTICS

(V_{CC+}=+5V with V_{CC-}=0V, V_{ICM}=V_{CC}/2, R_L connected to V_{CC}/2, T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
DC Performance						
Offset Voltage	V_{IO}			0.1	4.5	mV
Input Offset Current (Note 2)	I_{IO}			1	10	pA
Input Bias Current (Note 2)	I_{IB}			1	10	pA
Common Mode Rejection Ratio 20 log ($\Delta V_{ic}/\Delta V_{io}$)	C_{MR}	0V to 5V, V_{OUT}=2.5V	62	82		dB
Supply Voltage Rejection Ratio 20 log ($\Delta V_C C/\Delta V_{io}$)	S_{VR}	V_{CC}=2.5 to 5V	70	86		dB
Large Signal Voltage Gain	A_{VD}	R_L=10kΩ, V_{OUT}=0.5V to 4.5V	80	91		dB
High Level Output Voltage	V_{CC}-V_{OH}	R_L =10kΩ		15	40	mV
		R_L=600Ω		45	150	mV
Low Level Output Voltage	V_{OL}	R_L=10kΩ		15	40	mV
		R_L=600Ω		45	150	mV
I_{SINK}	I_{OM}	V_O=5V	18	32		mA
I_{SOURCE}		V_O=0V	18	35		mA
Supply Current (per operator)	I_{CC}	No Load, V_{OUT}=2.5V		0.78	1.1	mA
AC Performance						
Gain Bandwidth Product	GBP	R_L=2kΩ, C_L=100pF, f =100kHz		8		MHz
Unity Gain Frequency	Fu	R_L=2kΩ, C_L= 100pF		7.5		MHz
Phase Margin	φm	R_L=2kΩ, C_L= 100pF		45		Degrees
Gain Margin	G_m	R_L=2kΩ, $C_{L=}$ 100pF		8		dB
Slew Rate	SR	R_L=2kΩ, C_L=100pF, Av=1		4.5		V/μs
Equivalent Input Noise Voltage	e_n	f=10kHz		27		$\frac{nV}{\sqrt{Hz}}$
Total Harmonic Distortion	THD+e_n	G=1, f=1kHz, R_L=2kΩ, BW= 22kHz, V_{ICM}=(V_{CC}+1)/2, V_{OUT}=3.6V_{pp}		0.0004		%

■ TYPICAL APPLICATION CIRCUIT



Low-Side, Motor-Control Application