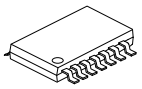
Low-POWER RAIL-TO-RAIL I/O CMOS QUAD OPERATIONAL AMPLIFIER



TSSOP-14

■ DESCRIPTION

The UTC **ULV724** (quad) is a low cost rail to rail input and output quad OP AMP. The UTC **ULV724** is low noise, low voltage, and low power supply current, that can be designed into a wide range of applications. The UTC **ULV724** is designed to provide optimal performance in low voltage and low noise systems. It provides rail-to-rail output swing into heavy loads.

Low quiescent current 1.3mA per channel at 5V can supply 11MHz bandwidth and 8.5V/μs slew rate. The UTC **ULV724** suits for Sensors, Active Filters, Audio, A/D Converters, Test Equipment, Communications, Battery-Powered Instrumentation and photodiode amplifiers, Cellular and Cordless Phones, Laptops and PDAs.

The quad version UTC **ULV724** is specified over the extended industrial temperature range (-40°C~+125°C). The operating supply range is from 2.1V to 5.5V.

■ FEATURES

* Supply Voltage Range: 2.1V~5.5V
* Input Voltage Range =- 0.1V~+5.6V with V_S=5.5V
* Low Supply Current: 1.3mA/Amplifier
* Low offset voltage : 1.5mV Typical
* Rail-to-Rail Input and Output
* High Gain Bandwidth Product: 11MHz
* High Slew Rate: 8.5V/μs

■ ORDERING INFORMATION

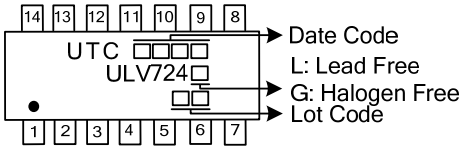
Ordering Number		Package	Packing
Lead Free	Halogen Free		
ULV724L-P14-R	ULV724G-P14-R	TSSOP-14	Tape Reel

Note: xx: Output Voltage, refer to Marking Information.

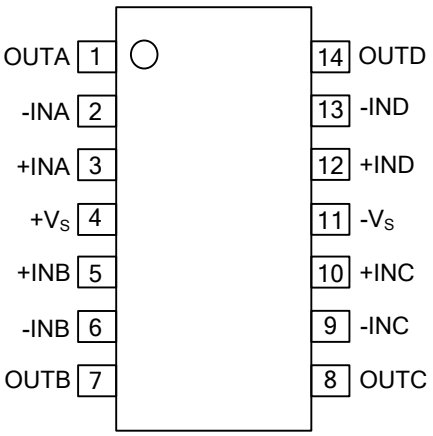
ULV724G-P14-R
- (1)Packing Type
- (2)Package Type
- (3)Green Package

(1) R: Tape Reel
(2) P14: TSSOP-14
(3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING



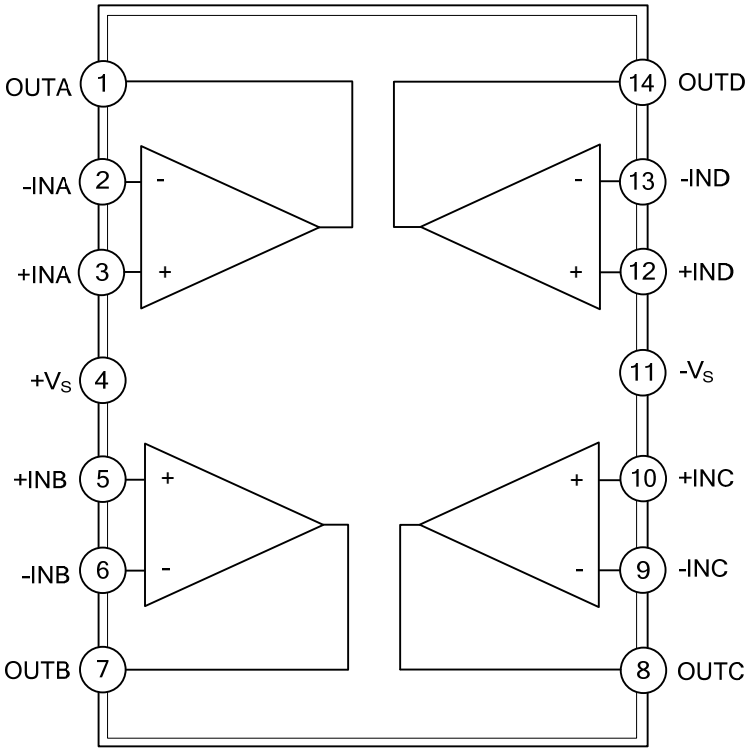
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	OUTA	Output of A AMP
2	-INA	Invert input of A AMP
3	+INA	Non-invert input of A AMP
4	$+V_S$	Positive supply
5	+INB	Non-invert input of B AMP
6	-INB	Invert input of B AMP
7	OUTB	Output of B AMP
8	OUTC	Output of C AMP
9	-INC	Invert input of C AMP
10	+INC	Non-invert input of C AMP
11	$-V_S$	Negative supply
12	+IND	Non-invert input of D AMP
13	-IND	Invert input of D AMP
14	OUTD	Output of D AMP

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING (T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage, $+V_S$ to $-V_S$	V_S	7	V
Input Common Mode Voltage Range	V_{CM}	$(-V_S)$-0.3 ~ $(+V_S)$+0.3	V
Junction Temperature	T_J	+150	°C
Operating Temperature Range	T_{OPR}	-40 ~ +125	°C
Storage Temperature Range	T_{STG}	-65 ~ +150	°C

Note: 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.

■ ELECTRICAL CHARACTERISTICS

(T_A=25°C, V_S=+5V, V_{CM}=V_S/2, R_L=600Ω, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
INPUT CHARACTERISTICS						
Input Offset Voltage	V_{OS}			1.5	4	mV
Input Bias Current	I_B			1		pA
Input Offset Current	I_{OS}			1		pA
Common-Mode Voltage Range	V_{CM}	V_S=5.5V		-0.1~+ 5.6		V
Common-Mode Rejection Ratio	CMRR	V_S=5.5V, V_{CM}=-0.1V~4V	67	83		dB
		V_S=5.5V, V_{CM}=-0.1V~5.6V	60	75		dB
Open-Loop Voltage Gain	A_{OL}	R_L=600Ω, Vo=0.15V~4.85V	82	89		dB
		R_L=10kΩ, Vo=0.05V~4.95V	96	102		dB
Input Offset Voltage Drift	$\Delta V_{OS}/\Delta_T$			2.1		μV/°C
OUTPUT CHARACTERISTICS						
Output Voltage Swing from Rail	V_O	R_L=600Ω		0.076		V
		R_L=10kΩ		0.006		V
Output Current	I_{OUT}		52	67		mA
Closed-Loop Output Impedance		f =1MHz, G=1		8.5		Ω
POWER SUPPLY						
Operating Voltage Range			2.1		5.5	V
Power Supply Rejection Ratio	PSRR	Vs=+2.1V~+5.5V V_{CM}=$(-V_S)$+0.5V	68	82		dB
Quiescent Current / Amplifier	I_Q	I_{OUT}=0		1.3	1.6	mA
DYNAMIC PERFORMANCE						
Gain-Bandwidth Product	GBP			11		MHz
Phase Margin	φ_O			62		°
Full Power Bandwidth	BW_P	<1% Distortion		400		kHz
Slew Rate	SR	G=1, 2V Output Step		8.5		V/μs
Settling Time to 0.1%	t_S	G=1, 2V Output Step		0.21		μs
Overload Recovery Time	t_{OR}	V_{IN} ×Gain=V_S		0.6		μs
NOISE PERFORMANCE						
Voltage Noise Density	e_N	f=1kHz		12.5		nV/$\sqrt{Hz}$
		f=10kHz		8.5		nV/$\sqrt{Hz}$

■ TYPICAL APPLICATION CIRCUIT

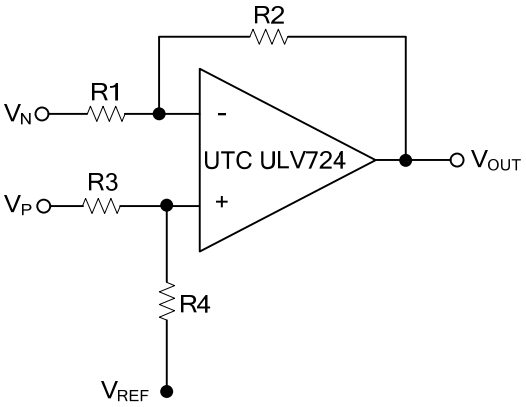


Figure 1. Differential Amplifier

Figure 1 is the differential amplifier. If the resistors ratios are equal (R4/R3=R2/R1), then $V_{OUT}=(V_P-V_N)\times R2/R1+V_{REF}$.

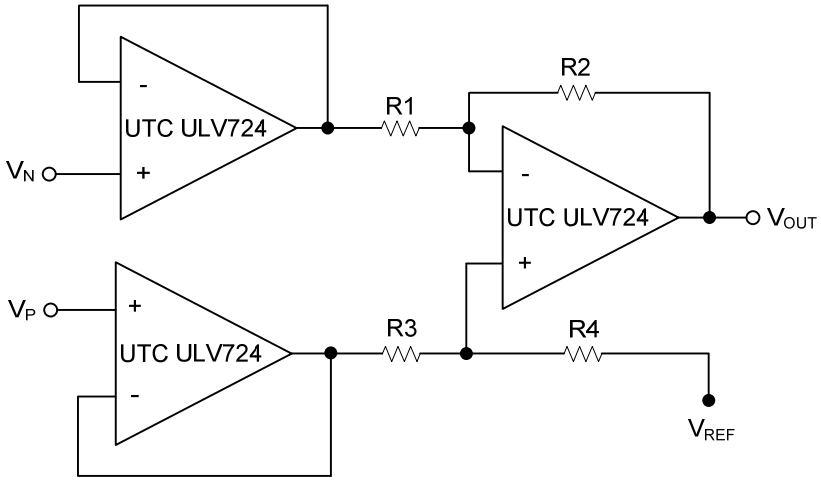


Figure 2. Instrumentation Amplifier

The circuit in Figure 2 performs the same function as that in Figure 1 but with the high input impedance.

■ TYPICAL APPLICATION CIRCUIT (Cont.)

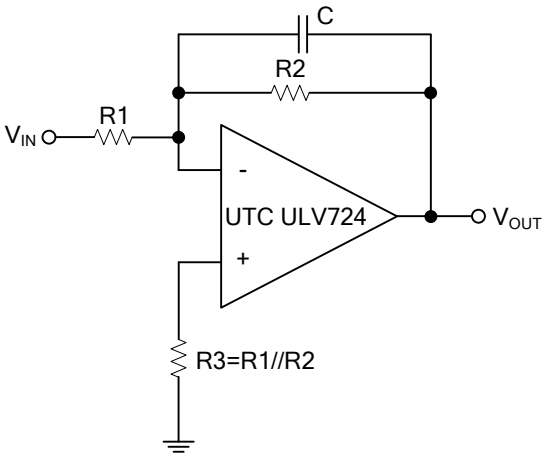


Figure 3. Low Pass Active Filter

Figure 3 is the low pass filter. It's DC gain is -R2/R1 and the -3dB corner frequency is $1/2\pi R_2C$.