



LV2464

CMOS IC

FAMILY OF LOW-POWER RAIL-TO-RAIL INPUT/OUTPUT OPERATIONAL AMPLIFIERS

■ DESCRIPTION

The UTC **LV2464** is a quad low-power rail-to-rail input/output op amplifier with low supply current (500uA/op) and low voltage (2.7-6V), that can be designed into a wide range of applications.

The UTC **LV2464** has a guaranteed 1.6V/μs slew rate and low supply current. Rail-to-rail output and high output current make the IC's ideal for buffering analog-to-digital converters. And the input common-mode voltage range including ground and V_{CC}. Besides, they are also able to driving large capacitive loads.

Good AC performance can be provided because of 6.4MHz of bandwidth and 1.6V/μs of slew rate. Furthermore, low input noise voltage (11nV/√Hz) and low input offset voltage (100μV) make good DC performance.

■ FEATURES

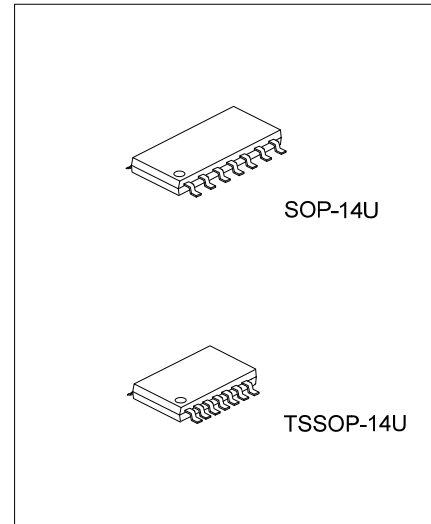
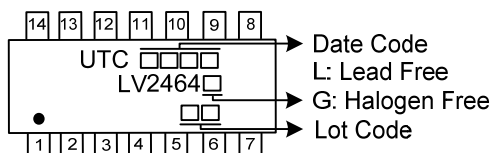
- * Rail-to-Rail Input/Output
- * ±48mA Output Drive Capability (V_{CC}=5V)
- * Gain Bandwidth Product: 6.4MHz
- * Supply Current: 500μA/channel
- * Input Offset Voltage: 100μV
- * Input Noise Voltage: 11nV/√Hz
- * Universal Operational Amplifier
- * Slew Rate: 1.6V/μs

■ ORDERING INFORMATION

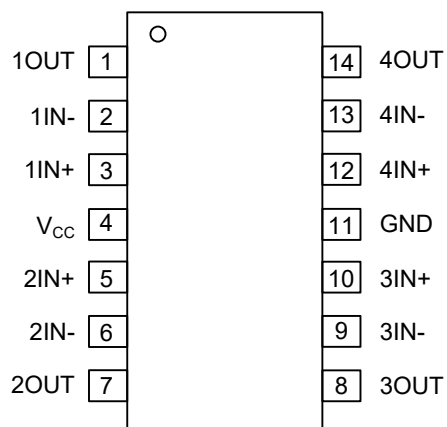
Ordering Number		Package	Packing
Lead Free	Halogen Free		
LV2464L-UEA-R	LV2464G-UEA-R	SOP-14U	Tape Reel
LV2464L-UEB-R	LV2464G-UEB-R	TSSOP-14U	Tape Reel

LV2464G-UEA-R (1) Packing Type (2) Package Type (3) Green Package	(1) R: Tape Reel (2) UEA: SOP-14U, UEB: TSSOP-14U (3) G: Halogen Free and Lead Free, L: Lead Free
---	--

■ MARKING



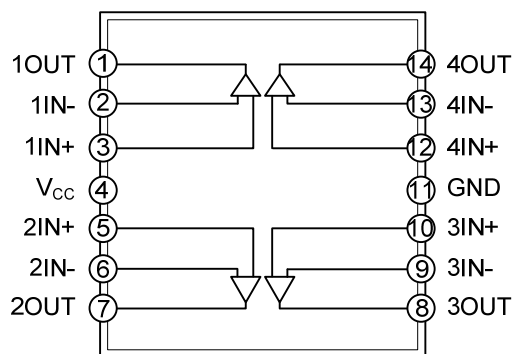
■ PIN CONFIGURATION



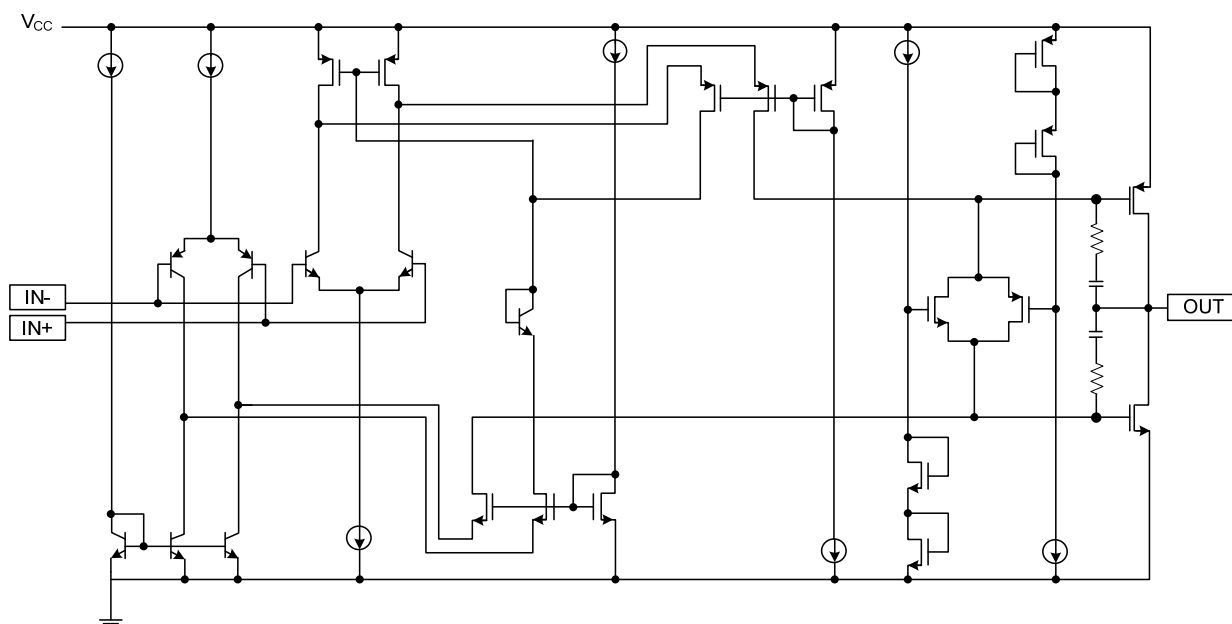
■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	1OUT	Output 1
2	1IN-	Negative input 1
3	1IN+	Positive input 1
4	V _{CC}	Supply power
5	2IN+	Positive input 2
6	2IN-	Negative input 2
7	2OUT	Output 2
8	3OUT	Output 3
9	3IN-	Negative input 3
10	3IN+	Positive input 3
11	GND	Ground
12	4IN+	Positive input 4
13	4IN-	Negative input 4
14	4OUT	Output 4

■ BLOCK DIAGRAM



■ INTERNAL SIMPLE CIRCUIT



■ **ABSOLUTE MAXIMUM RATING** ($T_A=25^{\circ}\text{C}$, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Supply Voltage (Note 2)		V_{CC}	6	V
Differential Input Voltage		V_{ID}	$-0.2 \sim V_{CC}+0.2$	V
Output Current		I_O	± 175	mA
Power Dissipation	SOP-14U	P_D	900	mW
	TSSOP-14U		600	mW
Operating Free-Air Temperature		T_A	$-40 \sim +125$	$^{\circ}\text{C}$
Junction Temperature		T_J	+150	$^{\circ}\text{C}$
Storage Temperature		T_{STG}	$-60 \sim +150$	$^{\circ}\text{C}$

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 operation is not implied.

2. All voltage values, except differential voltages, are with respect to GND.

■ **RECOMMENDED OPERATING CONDITIONS**

PARAMETER		SYMBOL	RATINGS	UNIT
Supply Voltage	Single supply	V_{CC}	$2.7 \sim 6$	V
	Split supply		$\pm 1.35 \sim \pm 3$	V
Common-Mode Input Voltage		V_{ICR}	$0 \sim V_{CC}$	V
Operating Free-Air Temperature		T_A	$-40 \sim +125$	$^{\circ}\text{C}$

Note: Relative to voltage on the GND terminal of the device.

■ ELECTRICAL CHARACTERISTICS (T_A=25°C, unless otherwise specified)

V_{CC}=3V (T_A=25°C, unless otherwise specified)

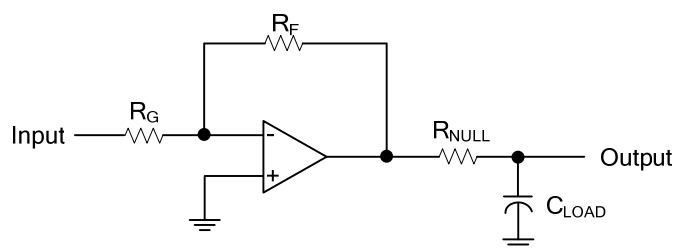
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Offset Voltage	V _{IO}	V _{CC} =3V, V _{IC} =1.5V, V _O =1.5V, R _S =50Ω		500	2000	μV
Input Offset Current	I _{IO}	V _{CC} =3V, V _{IC} =1.5V, V _O =1.5V, R _S =50Ω			20	nA
Input Bias Current	I _{IB}				100	nA
High-Level Output Voltage	V _{OH}	I _{OH} =-2.5mA		2.9		V
		I _{OH} =-10mA		2.7		V
Low-Level Output Voltage	V _{OL}	V _{IC} =1.5V, I _{OL} =2.5mA		0.1		V
		V _{IC} =1.5V, I _{OL} =10mA		0.3		V
Short-Circuit Output Current	I _{OS}	Sourcing		50		mA
		Sinking		40		mA
Output Current	I _O	Measured 1V from rail		±40		mA
Large-Signal Differential Voltage Amplification	A _{VD}	R _L =10kΩ, V _{O(PP)} =1V	90	105		dB
Differential Input Resistance	r _{I(D)}	T _A =25°C		10 ⁹		Ω
Common-Mode Input Capacitance	C _{I(C)}	f=10kHz, T _A =25°C		7		pF
Closed-Loop Output Impedance	Z _O	f=100kHz, A _V =10, T _A =25°C		33		Ω
Common-Mode Rejection Ratio	CMRR	V _{ICR} =0~3V, R _S =50Ω	66	80		dB
Supply Voltage Rejection Ratio (ΔV _{CC} /ΔV _{IO})	k _{SVR}	V _{CC} =2.7~6V, V _{IC} =V _{CC} /2, No load	80	85		dB
		V _{CC} =3~5V, V _{IC} =V _{CC} /2, No load	85	95		dB
Supply Current(per channels)	I _{CC}	V _O =1.5V, No load		0.5	0.575	mA
OPWERAIN CHARACTERISTICS						
Slew Rate at Unity Gain	SR	V _{O(PP)} =0.8V, R _L =10kΩ, C _L =160pF	0.9	1.6		V/μs
Equivalent Input Noise Voltage	V _N	f=100Hz		16		nV/√Hz
		f=1kHz		11		√Hz
Equivalent Input Noise Current	I _N	f=1kHz		0.13		pA/√Hz
Total Harmonic Distortion Plus Noise	THD+N	V _{O(PP)} =2V, R _L =10kΩ, f=1kHz	A _V =1	0.006		%
			A _V =10	0.02		%
			A _V =100	0.08		%
Gain-Bandwidth Product		f=10 kHz, C _L =160pF, R _L =10kΩ		5.2		MHz
Setting Time	t _S	V _{(STEP)PP} =2V, R _L =10kΩ, A _V =-1, C _L =10pF	0.1%	1.47		μs
			0.01%	1.78		μs
		V _{(STEP)PP} =2V, R _L =10kΩ, A _V =-1, C _L =56pF,	0.1%	1.77		μs
			0.01%	1.98		μs
Phase Margin at Unity Gain	Φ _M	R _L =10kΩ, C _L =160pF		44		°
Gain Margin				7		dB

ELECTRICAL CHARACTERISTICS ($T_A=25^{\circ}\text{C}$, unless otherwise specified)

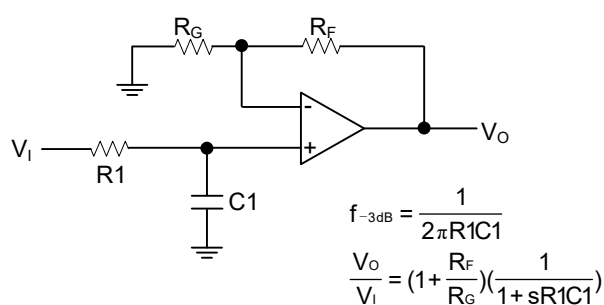
$V_{CC}=5\text{V}$ ($T_A=25^{\circ}\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Offset Voltage	V_{IO}	$V_{CC}=5\text{V}$, $V_{IC}=2.5\text{V}$, $V_O=2.5\text{V}$, $R_S=50\Omega$		500	2000	μV
Input Offset Current	I_{IO}	$V_{CC}=5\text{V}$, $V_{IC}=2.5\text{V}$, $V_O=2.5\text{V}$, $R_S=50\Omega$		7	20	nA
Input Bias Current	I_{IB}			45	100	nA
High-Level Output Voltage	V_{OH}	$I_{OH}=-2.5\text{mA}$		4.9		V
		$I_{OH}=-10\text{mA}$		4.8		V
Low-Level Output Voltage	V_{OL}	$V_{IC}=2.5\text{V}$, $I_{OL}=2.5\text{mA}$		0.1		V
		$V_{IC}=2.5\text{V}$, $I_{OL}=10\text{mA}$		0.2		V
Short-Circuit Output Current	I_{OS}	Sourcing		145		mA
		Sinking		100		mA
Output Current	I_O	Measured 1V from rail		± 48		mA
Large-Signal Differential Voltage Amplification	A_{VD}	$V_{IC}=2.5\text{V}$, $R_L=10\text{k}\Omega$, $V_O=1\sim 4\text{V}$	92	109		dB
Differential Input Resistance	$r_{I(D)}$	$T_A=25^{\circ}\text{C}$		10^9		Ω
Common-Mode Input Capacitance	$C_{I(C)}$	$f=10\text{kHz}$, $T_A=25^{\circ}\text{C}$		7		pF
Closed-Loop Output Impedance	Z_O	$f=100\text{kHz}$, $A_V=10$, $T_A=25^{\circ}\text{C}$		29		Ω
Common-Mode Rejection Ratio	CMRR	$V_{ICR}=0\sim 5\text{V}$, $R_S=50\Omega$	71	85		dB
Supply Voltage Rejection Ratio ($\Delta V_{CC}/\Delta V_{IO}$)	k_{SVR}	$V_{CC}=2.7\sim 6\text{V}$, $V_{IC}=V_{CC}/2$, No load	80	85		dB
		$V_{CC}=3\sim 5\text{V}$, $V_{IC}=V_{CC}/2$, No load	85	95		dB
Supply Current (per channels)	I_{CC}	$V_O=2.5\text{V}$, No load		0.55	0.65	mA
OPWERAING CHARACTERISTICS						
Slew Rate at Unity Gain	SR	$V_{O(PP)}=2\text{V}$, $C_L=160\text{pF}$, $R_L=10\text{k}\Omega$	0.9	1.6		V/ μs
Equivalent Input Noise Voltage	V_N	$f=100\text{Hz}$		14		nV/ $\sqrt{\text{Hz}}$
		$f=1\text{kHz}$		11		$\sqrt{\text{Hz}}$
Equivalent Input Noise Current	I_N	$f=1\text{kHz}$		0.13		pA/ $\sqrt{\text{Hz}}$
Total Harmonic Distortion Plus Noise	THD+N	$V_{O(PP)}=4\text{V}$, $R_L=10\text{k}\Omega$, $f=1\text{kHz}$	$A_V=1$	0.004		%
			$A_V=10$	0.01		%
			$A_V=100$	0.04		%
Gain-Bandwidth Product		$f=10\text{kHz}$, $C_L=160\text{pF}$, $R_L=10\text{k}\Omega$		6.4		MHz
Setting Time	t_s	$V_{(STEP)PP}=2\text{V}$, $R_L=10\text{k}\Omega$, $A_V=-1$, $C_L=10\text{pF}$	0.1%	1.53		μs
			0.01%	1.83		μs
		$V_{(STEP)PP}=2\text{V}$, $R_L=10\text{k}\Omega$, $A_V=-1$, $C_L=56\text{pF}$	0.1%	3.13		μs
			0.01%	3.33		μs
Phase Margin at Unity Gain	Φ_M	$R_L=10\text{k}\Omega$, $C_L=160\text{pF}$		45		$^{\circ}$
Gain Margin				7		dB

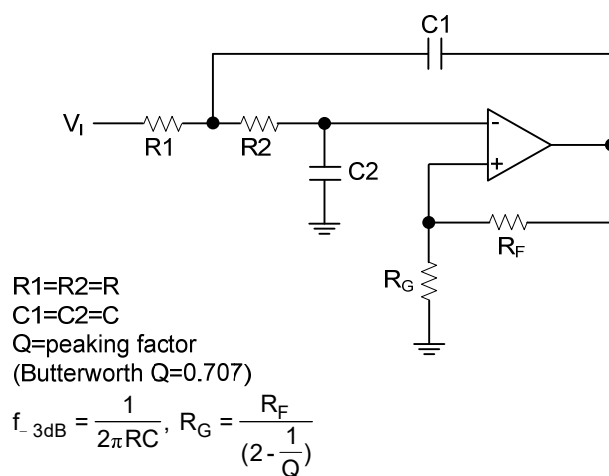
■ TYPICAL APPLICATION CIRCUIT



Driving A Capacitive Load

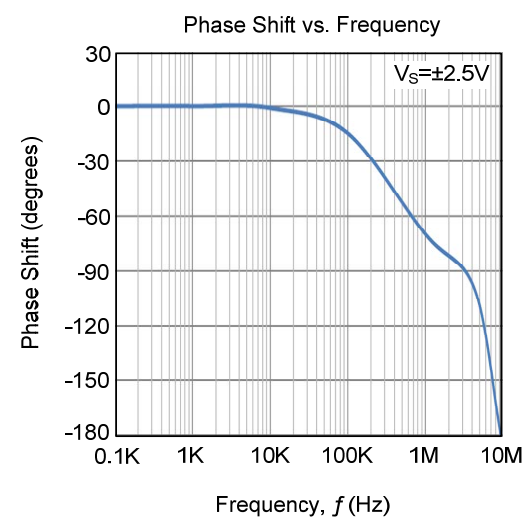
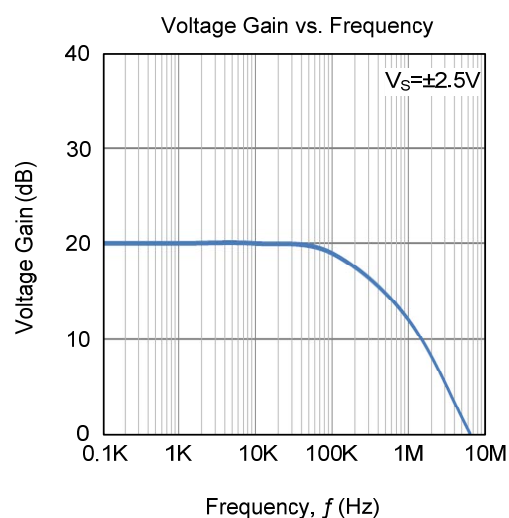
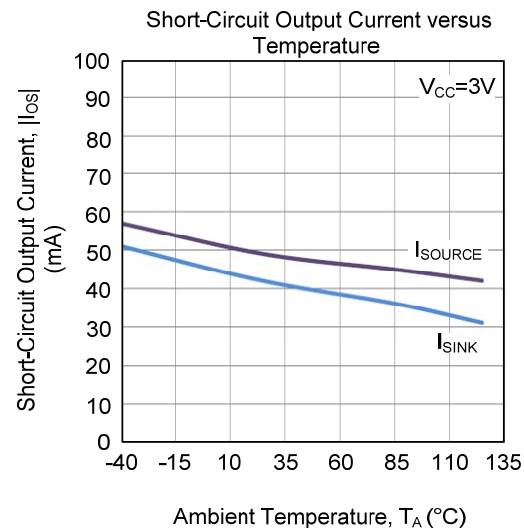
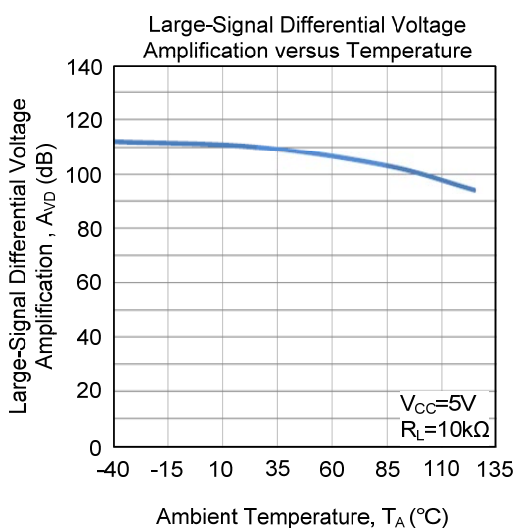
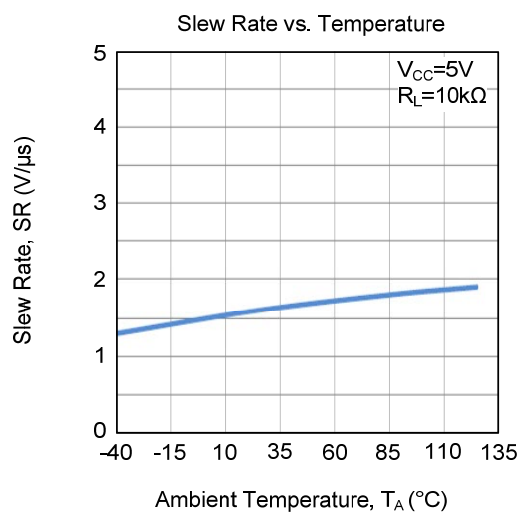
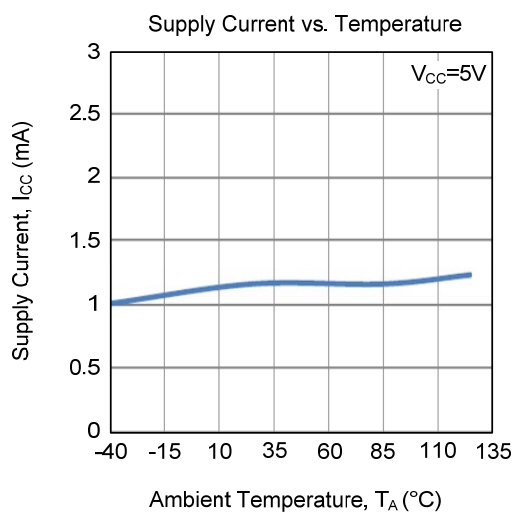


Single-Pole Low-Pass Filter



2-Pole Low-Pass Sallen-Key Filter

■ TYPICAL CHARACTERISTICS



UTC assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all UTC products described or contained herein. UTC products are not designed for use in life support appliances, devices or systems where malfunction of these products can be reasonably expected to result in personal injury. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. UTC reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.