



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/ μ s 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.

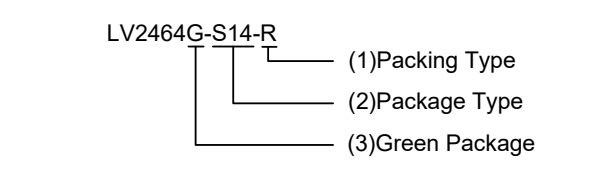
Good AC performance can be provided because of 6.4MHz of bandwidth and 1.6V/ μ s of slew rate. Furthermore, low input noise voltage (11nV/ $\sqrt{\text{Hz}}$) and low input offset voltage (100 μ V) make good DC performance.

■ FEATURES

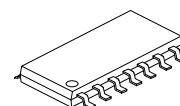
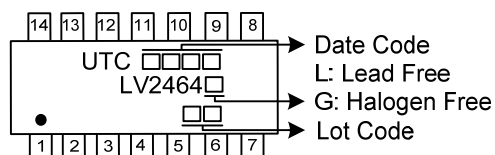
- * Rail-to-Rail Input/Output
- * $\pm 48\text{mA}$ Output Drive Capability ($V_{CC}=5\text{V}$)
- * Gain Bandwidth Product: 6.4MHz
- * Supply Current: 500 μ A/channel
- * Input Offset Voltage: 100 μ V
- * Input Noise Voltage: 11nV/ $\sqrt{\text{Hz}}$
- * Universal Operational Amplifier
- * Slew Rate: 1.6V/ μ s

■ ORDERING INFORMATION

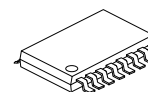
Ordering Number		Package	Packing
Lead Free	Halogen Free		
LV2464L-S14-R	LV2464G-S14-R	SOP-14	Tape Reel
LV2464L-P14-R	LV2464G-P14-R	TSSOP-14	Tape Reel

 LV2464G-S14-R (1) Packing Type (2) Package Type (3) Green Package	(1) R: Tape Reel (2) S14: SOP-14, P14: TSSOP-14 (3) G: Halogen Free and Lead Free, L: Lead Free
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■ MARKING

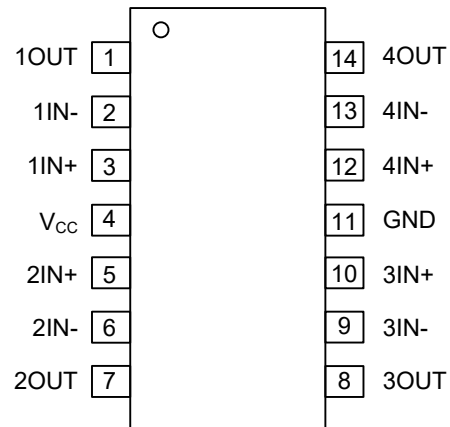


SOP-14



TSSOP-14

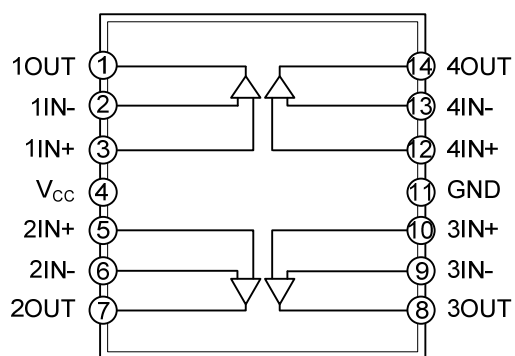
■ PIN CONFIGURATION



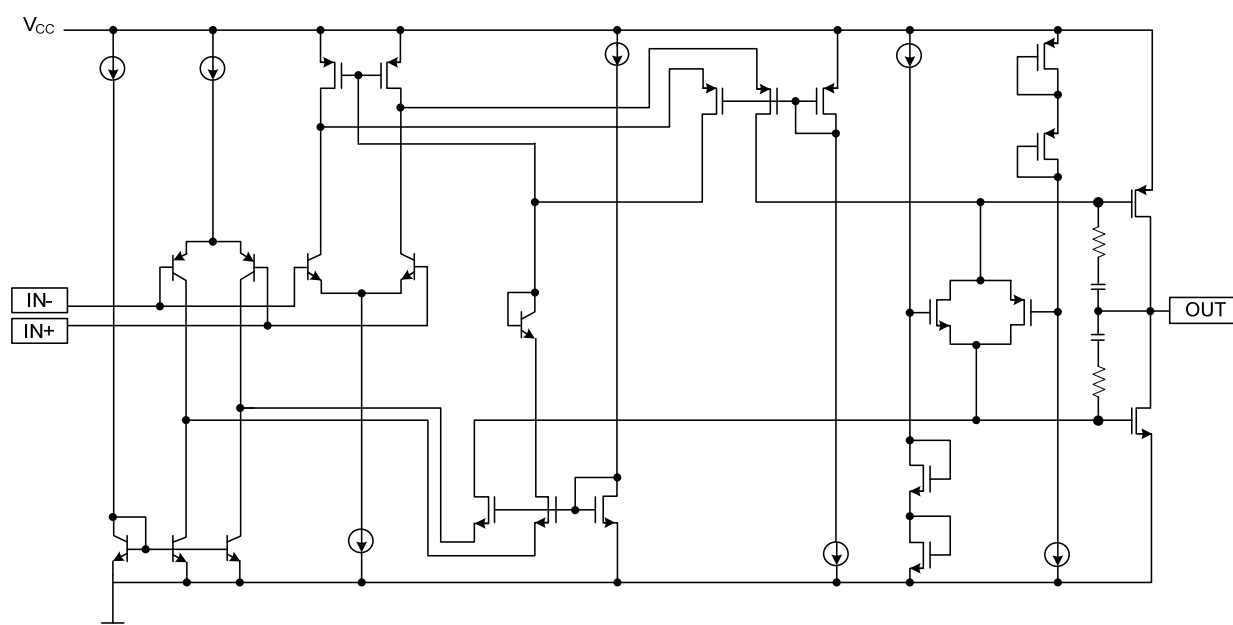
■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	1OUT	Output1
2	1IN-	Negative input1
3	1IN+	Positive input1
4	V _{CC}	Supply power
5	2IN+	Positive input2
6	2IN-	Negative input2
7	2OUT	Output2
8	3OUT	Output3
9	3IN-	Negative input3
10	3IN+	Positive input3
11	GND	Ground
12	4IN+	Positive input4
13	4IN-	Negative input4
14	4OUT	Output4

■ 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-14	P_D	1000	mW
	TSSOP-14		700	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 device operation is not implied.

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

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	SOP-14	θ_{JA}	125	$^{\circ}\text{C/W}$
	TSSOP-14		175	$^{\circ}\text{C/W}$
Junction to Case	SOP-14	θ_{JC}	27	$^{\circ}\text{C/W}$
	TSSOP-14		30	$^{\circ}\text{C/W}$

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

$V_{CC}=3\text{V}$ ($T_A=25^\circ\text{C}$, unless otherwise specified)

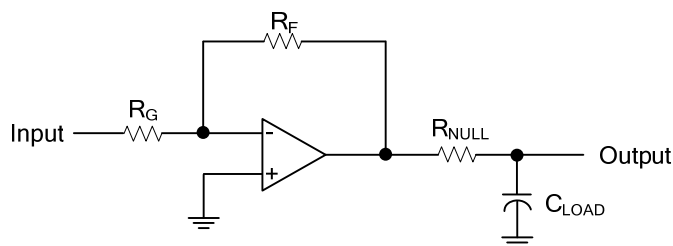
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Offset Voltage	V_{IO}	$V_{CC}=3\text{V}$, $V_{IC}=1.5\text{V}$, $V_O=1.5\text{V}$, $R_S=50\Omega$		500	2000	μV
Input Offset Current	I_{IO}	$V_{CC}=3\text{V}$, $V_{IC}=1.5\text{V}$, $V_O=1.5\text{V}$, $R_S=50\Omega$			20	nA
Input Bias Current	I_{IB}	$R_S=50\Omega$			100	nA
High-Level Output Voltage	V_{OH}	$I_{OH}=-2.5\text{mA}$		2.9		V
		$I_{OH}=-10\text{mA}$		2.7		V
Low-Level Output Voltage	V_{OL}	$V_{IC}=1.5\text{V}$, $I_{OL}=2.5\text{mA}$		0.1		V
		$V_{IC}=1.5\text{V}$, $I_{OL}=10\text{mA}$		0.3		V
Short-Circuit Output Current	I_{OS}	Sourcing		50		mA
		Sinking		40		mA
Output Current	I_O	Measured 1V form rail		± 40		mA
Large-Signal Differential Voltage Amplification	A_{VD}	$R_L=10\text{k}\Omega$, $V_{O(PP)}=1\text{V}$	90	105		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	$f=100\text{kHz}$, $A_V=10$, $T_A=25^\circ\text{C}$		33		Ω
Common-Mode Rejection Ratio	CMRR	$V_{ICR}=0\sim 3\text{V}$, $R_S=50\Omega$	66	80		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}	$V_O=1.5\text{V}$, No load		0.5	0.575	mA
OPWERAINING CHARACTERISTICS						
Slew Rate at Unity Gain	SR	$V_{O(PP)}=0.8\text{V}$, $R_L=10\text{k}\Omega$, $C_L=160\text{pF}$	0.9	1.6		V/ μs
Equivalent Input Noise Voltage	V_N	$f=100\text{Hz}$		16		nV/ $\sqrt{\text{Hz}}$
		$f=1\text{kHz}$		11		nV/ $\sqrt{\text{Hz}}$
Equivalent Input Noise Current	I_N	$f=1\text{kHz}$		0.13		pA/ $\sqrt{\text{Hz}}$
Total Harmonic Distortion Plus Noise	THD+N	$V_{O(PP)}=2\text{V}$, $R_L=10\text{k}\Omega$, $f=1\text{kHz}$, $A_V=1$		0.006		%
		$A_V=10$		0.02		%
		$A_V=100$		0.08		%
Gain-Bandwidth Product		$f=10\text{ kHz}$, $C_L=160\text{pF}$, $R_L=10\text{k}\Omega$		5.2		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%		1.47		μs
		0.01%		1.78		μs
		$V_{(STEP)PP}=2\text{V}$, $R_L=10\text{k}\Omega$, $A_V=-1$, $C_L=56\text{pF}$, 0.1%		1.77		μs
		0.01%		1.98		μs
Phase Margin at Unity Gain	Φ_M	$R_L=10\text{k}\Omega$, $C_L=160\text{pF}$		44		$^\circ$
Gain Margin				7		dB

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

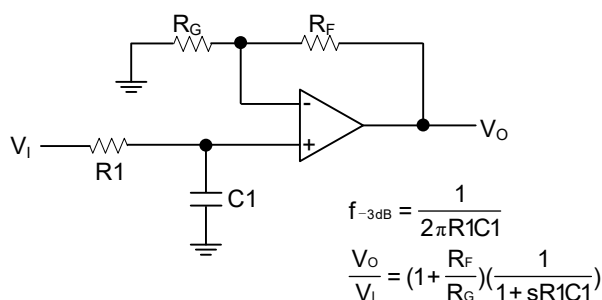
$V_{CC}=5\text{V}$ ($T_A=25^\circ\text{C}$, unless otherwise specified)

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 form 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

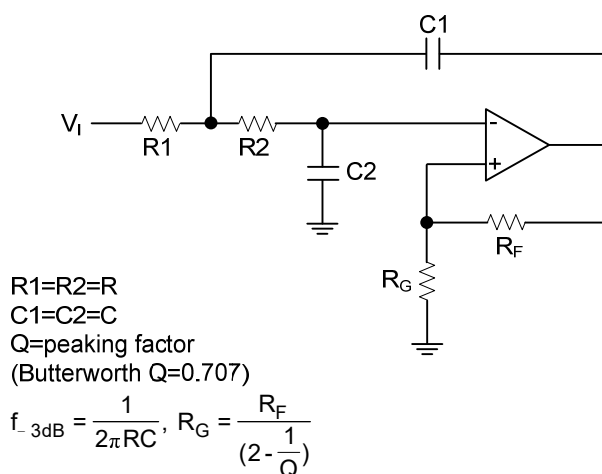
■ TYPICAL APPLICATION CIRCUIT



Driving A Capacitive Load



Single-Pole Low-Pass Filter



2-Pole Low-Pass Sallen-Key Filter

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