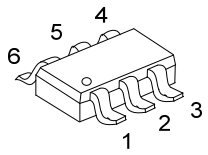
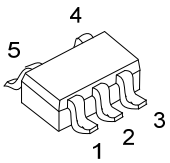
FAMILY OF LOW-POWER RAIL-TO-RAIL INPUT/OUTPUT OPERATIONAL AMPLIFIERS WITH SHUTDOWN



SOT-26



SOT-25

■ DESCRIPTION

The UTC **LV2460/2461** is a low-power rail-to-rail input/output op amplifier with low supply current (500uA) and low voltage (2.7-6V), that can be designed into a wide range of applications. The UTC **LV2460** offers a shutdown terminal, which places the amplifier in an ultralow supply current mode (I_{CC}= 0.3μA).

The UTC **LV2460/2461** have a guaranteed 1.6 V/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 includes ground and V_{CC}. Besides, they are also able to drive large capacitive loads.

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

■ FEATURES

* Rail-to-Rail Output Swing
* Gain Bandwidth Product: 6.4 MHz
* ±48mA Output Drive Capability
* Supply Current: 500μA
* Input Offset Voltage: 100μV
* Input Noise Voltage: 11nV/$\sqrt{Hz}$
* Slew Rate: 1.6V/μs
* Universal Operational Amplifier
* Micropower shutdown mode (LV2460) 0.3μA

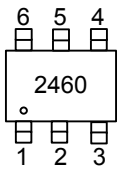
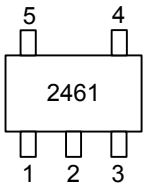
■ ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
LV2460L-AG6-R	LV2460G-AG6-R	SOT-26	Tape Reel
LV2461L-AF5-R	LV2461G-AF5-R	SOT-25	Tape Reel

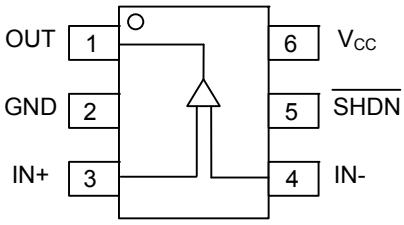
LV2460G-AG6-R
(1)Packing Type
(2)Package Type
(3)Green Package

(1) R: Tape Reel
(2) AG6: SOT-26, AF5: SOT-25
(3) G: Halogen Free and Lead Free, , L: Lead Free

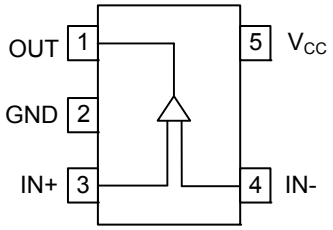
■ MARKING

LV2460	LV2461
	

■ PIN CONFIGURATION



LV2460



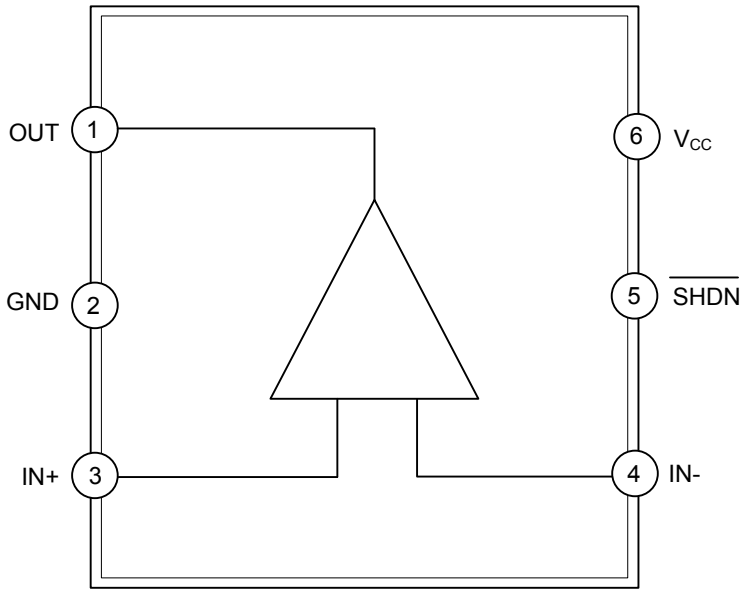
LV2461

■ PIN DESCRIPTION

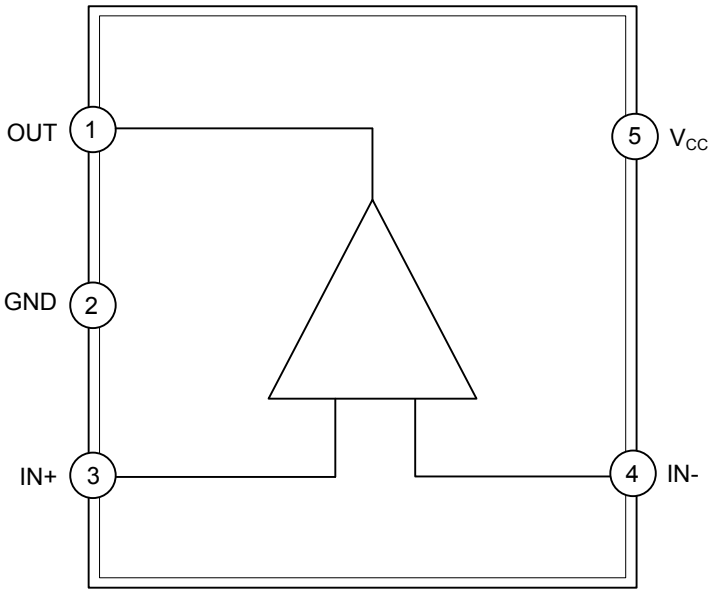
PIN NO.		PIN NAME	DESCRIPTION
LV2460	LV2461		
1	1	OUT	Output
2	2	GND	Ground
3	3	IN+	Positive input
4	4	IN-	Negative input
5	-	$\overline{SHDN}$	Shutdown
6	5	V_{CC}	Supply power

■ BLOCK DIAGRAM

For LV2460

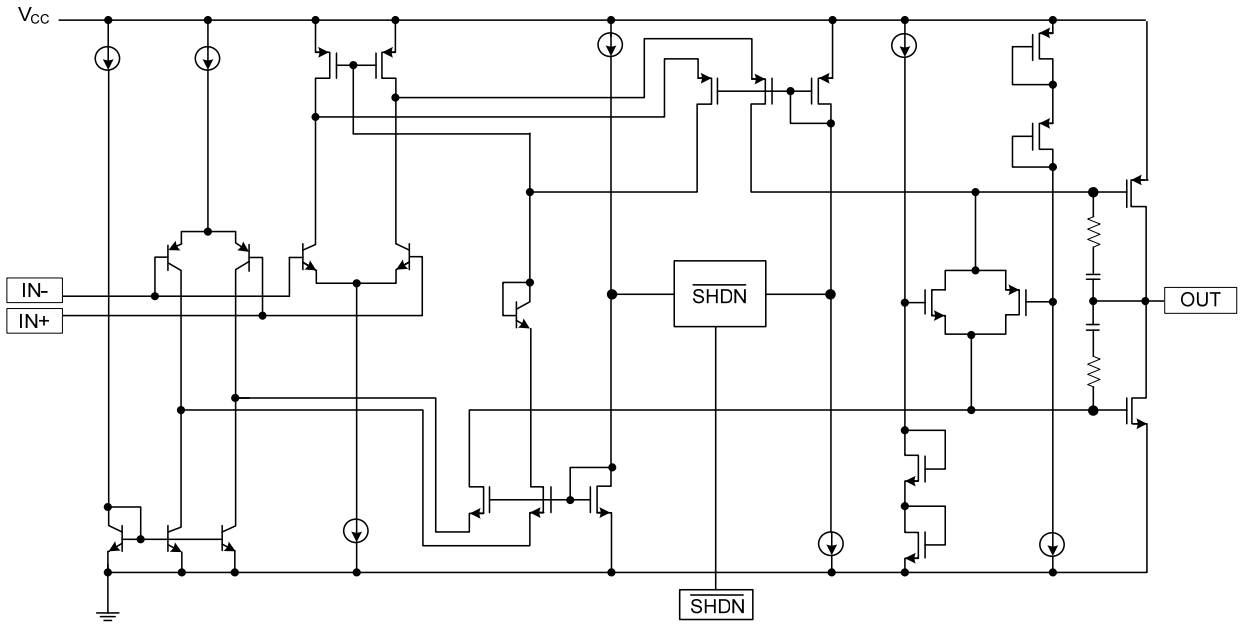


For LV2461

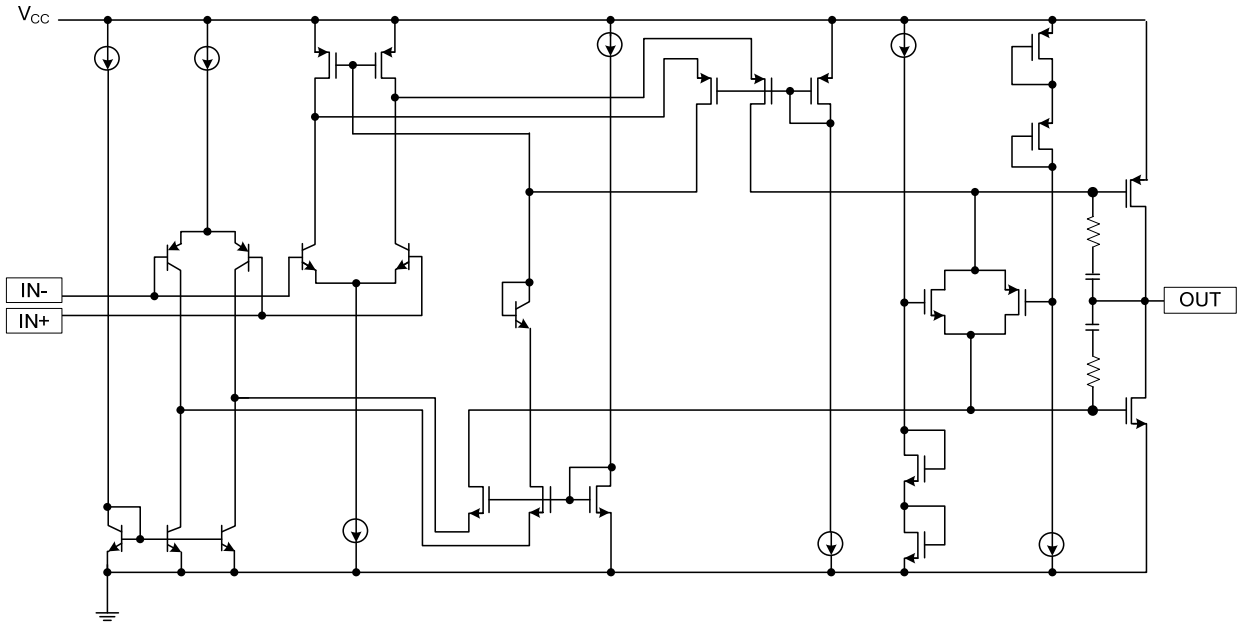


■ INTERNAL SIMPLE CIRCUIT

For LV2460



For LV2461



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

PARAMETER			SYMBOL	RATINGS	UNIT
Supply Voltage (Note 1)			V_{CC}	6	V
Differential Input Voltage			V_{ID}	-0.2 ~ V_{CC}+0.2	V
Output Current			I_O	±175	mA
Power Dissipation	T_A ≤ 25°C	SOT-25	P_D	385	mW
	T_A ≤ 25°C	SOT-26		425	
Operating Free-Air Temperature			T_A	-40 ~ +125	°C
Junction Temperature			T_J	+150	°C
Storage Temperature			T_{STG}	-60 ~ +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 voltages, are with respect to GND.

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	SOT-25	θ_{JA}	324	°C/W
	SOT-26		294	°C/W
Junction to Case	SOT-25	θ_{JC}	55	°C/W
	SOT-26		55	°C/W

■ RECOMMENDED OPWRAING CONDITIONS

PARAMETER		SYMBOL	RATINGS	UNIT
Supply Voltage	Single supply	V_{CC}	2.7 ~ 6	V
	Split supply		±1.35 ~ ±3	V
Common-Mode Input Voltage		V_{ICR}	0 ~ V_{CC}	V
Operating Free-Air Temperature		T_A	-40 ~ +125	°C
Shutdown on/off voltage level (Note 1)		$V_{IH\ MIN}$	2	V
		$V_{IL\ MAX}$	0.7	V

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

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

V_{CC}=3V

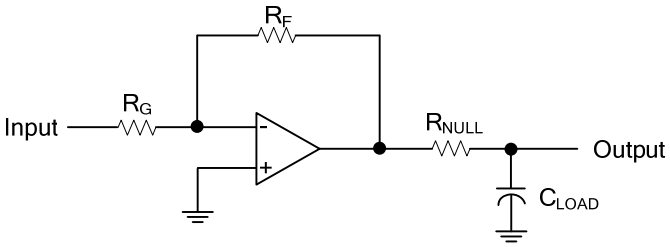
PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Input Offset Voltage	V_{IO}	V_{CC}=3V, V_{IC}=1.5V, V_O=1.5V, R_S=50Ω			500	2000	μV
Input Offset Current	I_{IO}	V_{CC}=3V, V_{IC}=1.5V,			2.8	7	nA
Input Bias Current	I_{IB}	V_O=1.5V, R_S=50Ω			4.4	14	nA
High-Level Output Voltage	V_{OH}	I_{OH}= -2.5mA			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 form 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 ($\Delta V_{CC}/\Delta V_{IO}$)	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	I_{CC}	V_O=1.5V, No load			0.5	0.575	mA
Supply current in shutdown(LV2460)	$I_{CC(\overline{SHDN})}$	$\overline{SHDN}$ <0.7V			0.3		μA
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/$\sqrt{Hz}$
		f=1kHz			11		
Equivalent Input Noise Current	I_N	f=1kHz			0.13		pA/$\sqrt{Hz}$
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 (Cont.)

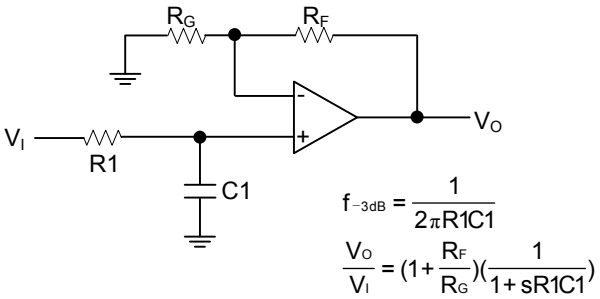
V_{CC}=5V

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Input Offset Voltage	V_{IO}	V_{CC}=5V, V_{IC}=2.5V, V_O=2.5V, R_S=50Ω			500	2000	μV
Input Offset Current	I_{IO}	V_{CC}=5V, V_{IC}=2.5V, V_O=2.5V, R_S=50Ω			0.3	7	nA
Input Bias Current	I_{IB}				1.3	14	nA
High-Level Output Voltage	V_{OH}	I_{OH}=-2.5mA			4.9		V
		I_{OH}=-10mA			4.8		V
Low-Level Output Voltage	V_{OL}	V_{IC}=2.5V, I_{OL}=2.5mA			0.1		V
		V_{IC}=2.5V, I_{OL}=10mA			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}=2.5V, R_L=10kΩ, V_O=1~4V		92	109		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			29		Ω
Common-Mode Rejection Ratio	CMRR	V_{ICR}=0~5V, R_S=50Ω		71	85		dB
Supply Voltage Rejection Ratio ($\Delta V_{CC}/\Delta V_{IO}$)	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	I_{CC}	V_O=2.5V, No load			0.55	0.65	mA
Supply current in shutdown(LV2460)	$I_{CC(\overline{SHDN})}$	$\overline{SHDN}$ <0.7V			1		μA
Slew Rate at Unity Gain	SR			0.9	1.6		V/μs
Equivalent Input Noise Voltage	V_N	f=100Hz			14		nV/$\sqrt{Hz}$
		f=1kHz			11		
Equivalent Input Noise Current	I_N	f=1kHz			0.13		pA/$\sqrt{Hz}$
Total Harmonic Distortion Plus Noise	THD+N	$V_{O(PP)}$=4V, R_L=10kΩ, f=1kHz	A_V=1		0.004		%
			A_V=10		0.01		%
			A_V=100		0.04		%
Gain-Bandwidth Product		f=10 kHz, C_L=160pF, R_L=10kΩ			6.4		MHz
Setting Time	t_S	$V_{(STEP)PP}$=2V,R_L=10kΩ, A_V= -1, C_L=10pF	0.1%		1.53		μs
			0.01%		1.83		μs
		$V_{(STEP)PP}$=2V,R_L=10kΩ, A_V= -1, C_L=56pF	0.1%		3.13		μs
			0.01%		3.33		μs
Phase Margin at Unity Gain	φ_M	R_L=10kΩ, C_L=160pF			45		°
Gain Margin					7		dB

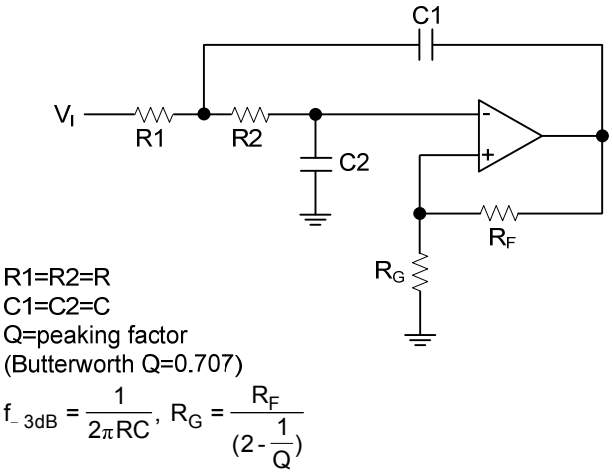
■ TYPICAL APPLICATION CIRCUIT



Driving A Capacitive Load



Single-Pole Low-Pass Filter



2-Pole Low-Pass Sallen-Key Filter