Dual, 30V Precision, Rail-to-Rail I/O Low Power Operational Amplifier

Preliminary Technical Data

ADA4084-2

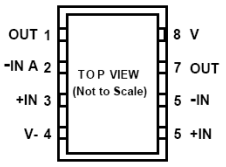
FEATURES

Rail-to-Rail Input/Output
Low Power: 650 µA typ
Wide bandwidth: 8.3 MHz Unity Gain Bandwidth
Low offset voltage: 100 µV max @ 25°C
Unity-gain stable
High slew rate: 4.0 V/µs typ
Low noise: 3.9 nV/√Hz typ

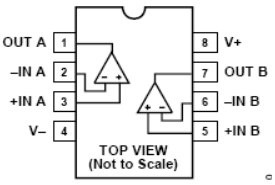
APPLICATIONS

Battery-powered instrumentation
Power supply control and protection
Telecom
DAC output amplifier
ADC input buffer

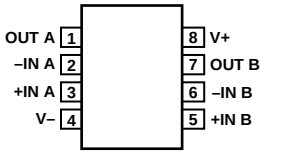
PIN CONFIGURATIONS



8-Lead LFCSP (CP)



8-Lead MSOP (RM-8)



8-Lead LFCSP (CP)

GENERAL DESCRIPTION

ADA4084-2 is a dual amplifier featuring 650µA per amplifier with single-supply operation, 8.3 MHz bandwidth, and rail-to-rail inputs and outputs. They are guaranteed to operate from 3 V to 30 V single supplies or ±1.5 V to ±15 V dual supplies.

These amplifiers are superb for single-supply and dual applications requiring both AC and precision DC performance with input voltage range and output swings very close to the power supply rails. The combination of bandwidth, low noise, low power, and precision makes the ADA4084 useful in a wide variety of applications, including filters and instrumentation.

Other applications for these amplifiers include portable telecom equipment, power supply control and protection, and as amplifiers or buffers for transducers with wide output ranges. Sensors requiring a rail-to-rail input amplifier include Hall Effect, piezoelectric, and resistive transducers.

The ability to swing rail-to-rail at both the input and output enables designers to build multistage filters in single-supply systems and to maintain high signal-to-noise ratios.

The ADA4084-2 is specified over the extended industrial temperature range of –40°C to +125°C. The ADA4084-2 is a dual available in 8-lead LFCSP (3x3mm), SOIC, and MSOP packages.

Table 1. 30V Rail-to-Rail I/O Op Amps

	Precision	Precision Low Power	Low Power
Single	OP184		
Dual	OP284	ADA4091-2	ADA4092-2
Quad	OP484	ADA4091-4	ADA4092-4

Rev. PrA

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SPECIFICATIONS

ELECTRICAL CHARACTERISTICS – VS = ±15V

V_S = ±15 V @ T_A = 25°C, V_{CM} = 0 V, V_{OUT} = 0 V, unless otherwise noted.

Table 2.

Parameter	Symbol	Test Conditions / Comments	Min	Typ	Max	Unit
INPUT CHARACTERISTICS						
Voltage Offset	V_{OS}				100	µV
		−40 ºC ≤ T_A ≤ +125°C			300	µV
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	−40 ºC ≤ T_A ≤ +125°C		0.2		µV/°C
Input Bias Current	I_B			80	450	nA
		−40 ºC ≤ T_A ≤ +125°C			575	nA
Bias Current Drift	$\Delta I_B/\Delta T$			150		pA/°C
Input Offset Current	I_{OS}				50	nA
		−40 ºC ≤ T_A ≤ +125°C			TBD	nA
Input Voltage Range			-15		+15	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = ±14 V, −40 ºC ≤ T_A≤ +125°C	86	90		dB
		V_{CM} = ±15 V	80			dB
Large Signal Voltage Gain	A_{VO}	R_L= 2 kΩ, −13.5 V ≤ V_O ≤ +13.5 V	104	120		dB
		-40ºC ≤ T_A≤ +125°C	97			dB
Input Resistance, Differential Mode	R_{INDM}			TBD		Ω
Input Resistance, Common Mode	R_{INCM}			TBD		Ω
Input Capacitance, Differential Mode	C_{INDM}			TBD		pF
Input Capacitance, Common Mode	C_{INCM}			TBD		pF
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	R_L = 10 kΩ to GND	14.8	TBD		V
		−40 ºC ≤ T_A ≤ +125°C	TBD			V
		R_L = 2 kΩ to GND	14.7	TBD		V
		−40 ºC ≤ T_A ≤ +125°C	TBD			V
Output Voltage Low	V_{OL}	R_L = 10 kΩ to GND		TBD	-14.8	V
		−40 ºC ≤ T_A ≤ +125°C			TBD	V
		R_L = 2 kΩ to GND		TBD	-14.7	V
		−40 ºC ≤ T_A ≤ +125°C			TBD	V
Output Current	I_{SC}			±10		mA
Output Closed-Loop Impedance	Z_{OUT}			TBD		Ω
POWER SUPPLY						
Power Supply Rejection	PSRR	V_S = ±2V to ±18 V	90	TBD		dB
		−40 ºC ≤ T_A ≤ +125°C	TBD			dB
Quiescent Current	I_{SY}	I_O = 0mA		650	750	µA
		−40°C ≤ T_A ≤ +125°C			1000	µA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L = 2 kΩ	2.4	4		V/µs
Unity Gain Bandwidth	UGB	TBD		8.3		MHz
Gain Bandwidth Product	GBWP	TBD		TBD		MHz
-3dB Bandwidth	-3dB	TBD		TBD		MHz
Full Power Bandwidth	BW_P	1% distortion, R_L = 2 kΩ, V_O = 29 V_{p-p}		TBD		kHz
Settling Time	t_S	To 0.01%, 10 V step		TBD		µs
Total Harmonic Distortion + Noise	THD+N			TBD		%
Phase Margin	$Ø_M$			60		Degrees
NOISE PERFORMANCE						
Input Voltage Noise	e_{np-p}	0.1 Hz to 10 Hz		0.1		µV p-p
Input Voltage Noise Density	e_n	f = 1 kHz		3.9		nV/√Hz
Input Current Noise Density	i_n	f = 1 kHz		TBD		pA/√Hz

ELECTRICAL CHARACTERISTICS – VS = ±5V

V_S = ±5 V @ T_A = 25°C, V_{CM} = 0 V, V_{OUT} = 0 V, unless otherwise noted.

Table 3.

Parameter	Symbol	Test Conditions / Comments	Min	Typ	Max	Unit
INPUT CHARACTERISTICS						
Voltage Offset	V_{OS}				100	µV
		−40 ºC ≤ T_A ≤ +125°C			300	µV
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	−40 ºC ≤ T_A ≤ +125°C		0.2		µV/°C
Input Bias Current	I_B			80	450	nA
		−40 ºC ≤ T_A ≤ +125°C			575	nA
Bias Current Drift	$\Delta I_B/\Delta T$			150		pA/°C
Input Offset Current	I_{OS}				50	nA
		−40 ºC ≤ T_A ≤ +125°C			TBD	nA
Input Voltage Range			-5		+5	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = ±4 V, −40 ºC ≤ T_A≤ +125°C	86	90		dB
		V_{CM} = ±5 V	80			dB
Large Signal Voltage Gain	A_{VO}	R_L= 2 kΩ, −4 V ≤ V_O ≤ +4 V	104	120		dB
		-40ºC ≤ T_A≤ +125°C	97			dB
Input Resistance, Differential Mode	R_{INDM}			TBD		Ω
Input Resistance, Common Mode	R_{INCM}			TBD		Ω
Input Capacitance, Differential Mode	C_{INDM}			TBD		pF
Input Capacitance, Common Mode	C_{INCM}			TBD		pF
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	R_L = 10 kΩ to GND	4.8	TBD		V
		−40 ºC ≤ T_A ≤ +125°C	TBD			V
		R_L = 2 kΩ to GND	4.7	TBD		V
		−40 ºC ≤ T_A ≤ +125°C	TBD			V
Output Voltage Low	V_{OL}	R_L = 10 kΩ to GND		TBD	-4.8	V
		−40 ºC ≤ T_A ≤ +125°C			TBD	V
		R_L = 2 kΩ to GND		TBD	-4.7	V
		−40 ºC ≤ T_A ≤ +125°C			TBD	V
Output Current	I_{SC}			±10		mA
Output Closed-Loop Impedance	Z_{OUT}			TBD		Ω
POWER SUPPLY						
Power Supply Rejection	PSRR	V_S = ±2 to ±18 V	90	TBD		dB
		−40 ºC ≤ T_A ≤ +125°C	TBD			dB
Quiescent Current	I_{SY}	I_O = 0mA		650	750	A
		−40°C ≤ T_A ≤ +125°C			1000	A
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L = 2 kΩ	2.4	4		V/s
Unity Gain Bandwidth	UGB	TBD		8.3		MHz
Gain Bandwidth Product	GBWP	TBD		TBD		MHz
-3dB Bandwidth	-3dB	TBD		TBD		MHz
Full Power Bandwidth	BW_P	1% distortion, R_L = 2 kΩ, V_O = 9 V_{p-p}		TBD		kHz
Settling Time	t_S	To 0.01%		TBD		s
Total Harmonic Distortion + Noise	THD+N			TBD		%
Phase Margin	$Ø_M$			60		Degrees
NOISE PERFORMANCE						
Input Voltage Noise	e_{np-p}	0.1 Hz to 10 Hz		0.1		µV p-p
Input Voltage Noise Density	e_n	f = 1 kHz		3.9		nV/√Hz
Input Current Noise Density	i_n	f = 1 kHz		TBD		pA/√Hz

ELECTRICAL CHARACTERISTICS – VS = +3V

V_S = +3 V @ T_A = 25°C, V_{CM} = +1.5 V, unless otherwise noted.

Table 4.

Parameter	Symbol	Test Conditions / Comments	Min	Typ	Max	Unit
INPUT CHARACTERISTICS						
Voltage Offset	V_{OS}				100	µV
		−40 ºC ≤ T_A ≤ +125°C			300	µV
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	−40 ºC ≤ T_A ≤ +125°C		0.2		µV/°C
Input Bias Current	I_B			80	450	nA
		−40 ºC ≤ T_A ≤ +125°C			575	nA
Bias Current Drift	$\Delta I_B/\Delta T$			150		pA/°C
Input Offset Current	I_{OS}				50	nA
		−40 ºC ≤ T_A ≤ +125°C			TBD	nA
Input Voltage Range			0		3	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = 0 V to 3V	86	90		dB
		−40 ºC ≤ T_A≤ +125°C	80			dB
Large Signal Voltage Gain	A_{VO}	R_L= 2 kΩ, 0.5 ≤ V_O ≤ +2.5 V	104	120		dB
		-40ºC ≤ T_A≤ +125°C	97			dB
Input Resistance, Differential Mode	R_{INDM}			TBD		Ω
Input Resistance, Common Mode	R_{INCM}			TBD		Ω
Input Capacitance, Differential Mode	C_{INDM}			TBD		pF
Input Capacitance, Common Mode	C_{INCM}			TBD		pF
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	R_L = 10 kΩ to V_{CM}	2.8	TBD		V
		−40 ºC ≤ T_A ≤ +125°C	TBD			V
		R_L = 2 kΩ to V_{CM}	2.7	TBD		V
		−40 ºC ≤ T_A ≤ +125°C	TBD			V
Output Voltage Low	V_{OL}	R_L = 10 kΩ to V_{CM}		TBD	0.2	V
		−40 ºC ≤ T_A ≤ +125°C			TBD	V
		R_L = 2 kΩ to V_{CM}		TBD	0.3	V
		−40 ºC ≤ T_A ≤ +125°C			TBD	V
Output Current	I_{SC}			±10		mA
Output Closed-Loop Impedance	Z_{OUT}			TBD		Ω
POWER SUPPLY						
Power Supply Rejection	PSRR	V_S = ±1.25 to ±1.75 V	90	TBD		dB
		−40 ºC ≤ T_A ≤ +125°C	TBD			dB
Quiescent Current	I_{SY}	I_O = 0mA		650	750	µA
		−40°C ≤ T_A ≤ +125°C			1000	µA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L = 2 kΩ	2.4	4		V/µs
Unity Gain Bandwidth	UGB	TBD		8.3		MHz
Gain Bandwidth Product	GBWP	TBD		TBD		MHz
-3dB Bandwidth	-3dB	TBD		TBD		MHz
Full Power Bandwidth	BW_P	1% distortion, R_L = 2 kΩ, V_O = TBD		35		kHz
Settling Time	t_S	To 0.01%		TBD		µs
Total Harmonic Distortion + Noise	THD+N			TBD		%
Phase Margin	$Ø_M$			60		Degrees
NOISE PERFORMANCE						
Input Voltage Noise	e_{np-p}	0.1 Hz to 10 Hz		0.1		µV p-p
Input Voltage Noise Density	e_n	f = 1 kHz		3.9		nV/√Hz
Input Current Noise Density	i_n	f = 1 kHz		TBD		pA/√Hz

ABSOLUTE MAXIMUM RATINGS

Table 5.

Parameter	Rating
Supply Voltage	36 V
Input Voltage	±V supply
Differential Input Voltage	$V^- \le (+IN - -IN) \le V^+$
Output Short-Circuit Duration to Gnd	Indefinite
Storage Temperature Range	−65°C to +150°C
Operating Temperature Range	−40°C to +125°C
Junction Temperature Range	−65°C to +150°C
Lead Temperature (Soldering, 60 sec)	300°C

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

THERMAL RESISTANCE

θ_{JA} is specified for the worst-case conditions, that is, a device soldered in a circuit board for surface-mount packages.

Table 6. Thermal Resistance

Package Type	θ_{JA}	θ_{JC}	Unit
8-Lead SOIC (R-8)	TBD	TBD	°C/W
8-Lead MSOP (RM-8)	TBD	TBD	°C/W
8-Lead LFCSP (CP-8)	TBD	TBD	°C/W

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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