Precision Low noise CMOS Rail-to-Rail Input/Output Operational Amplifiers

Preliminary Technical Data AD8605ACB*

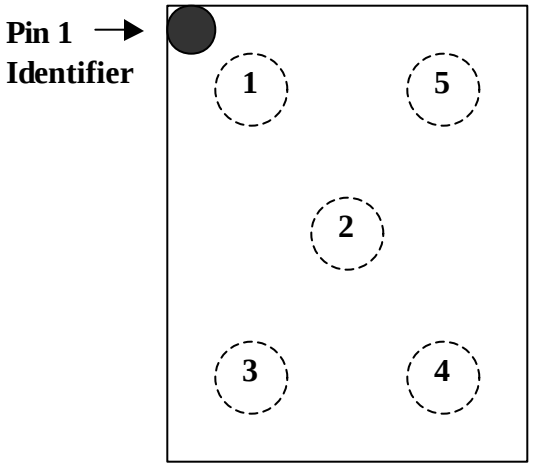
FEATURES
Low Offset Voltage: 65 mV max
Low Offset Variation: 300 mV max for any CMV and Vsy
Low Input Bias Currents: 1pA max
Low Noise: 8 nV/ÖHz
Wide Bandwidth: 10 MHz
Unity Gain Stable
Single-Supply Operation: 2.7 to 6 Volts

APPLICATIONS
Photodiode amplification
Battery Powered Instrumentation
Medical Instruments
Multi-pole Filters
Sensors
Portable Audio Devices

GENERAL DESCRIPTION
The AD8605ACB is a rail-to-rail input and output single supply amplifier featuring very low offset voltage, very low input bias current, low voltage and current noise and wide signal bandwidth. AD8605 utilizes patented DigiTrim® technology to achieve superior precision without laser trimming.
The combination of very high performance features makes these amplifiers useful in a wide variety of applications. Filters, integrators, photo-diode amplifiers and high impedance sensors all benefit from the performance of the AD8605. Audio and other AC applications benefit from the wide bandwidth and low distortion.
Applications for these amplifiers include laser diode control loops and optical sensing, portable and loop-powered instrumentation, audio amplification for portable devices and ASIC input/output amplifiers. The AD8605ACB is specified over the extended industrial (-40° to +125°C) temperature range. The AD8605ACB is available in the tiny 5-bump MicroCSP package and offers the smallest available footprint for any surface-mountable operational amplifier. MicroCSP versions are available in tape and reel only. Refer to the AD8605/AD8606/AD8608 family datasheet for the released AD8605 version in SOT package and for dual/quad versions.

Pin Configurations

AD8605 MicroCSP Topview
(Bump Side Down)



Pin No.	Functionality
1	OUT
2	V-
3	+IN
4	-IN
5	V+

*Protected by US patent No. 5,969,657; other patents pending

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AD8605

ELECTRICAL CHARACTERISTICS (V_S=+2.7V, V_{CM} = V_S/2, T_A=+25°C unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}	Vs=3.5V,V_{CM} = 1V, V_{CM} = 3V		20	65	µV
		Vs=2.7V, V_{CM} = 0V to 2.7V		80	300	µV
		-40°C < T_A < +125°C			750	µV
Input Bias Current	I_B			0.2	1	pA
		-40°C < T_A < +85°C			50	pA
		-40°C < T_A < +125°C			250	pA
Input Offset Current	I_{OS}			0.1	0.5	pA
		-40°C < T_A < +85°C			20	pA
		-40°C < T_A < +125°C			75	pA
Input Voltage Range			0		2.7	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = 0V to 2.7V	80	95		dB
		-40°C < T_A < +125°C	70	85		dB
Large Signal Voltage Gain	A_{VO}	R_L = 2 kΩ V_O= 0.5V to 2.2V	110	350		V/mV
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$			1	4.5	µV/°C
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	I_L = 1mA	2.6	2.66		V
		-40°C < T_A < +125°C	2.6			V
Output Voltage Low	V_{OL}	I_L = 1mA		25	40	mV
		-40°C < T_A < +125°C			50	mV
Output Current	I_{OUT}			±30		mA
Closed Loop Output Impedance	Z_{OUT}	f=1 MHz, A_V = 1		12		Ω
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_S = 2.7 V to 5.5 V	80	95		dB
		-40°C < T_A < +125°C	70	90		dB
Supply Current/Amplifier	I_{SY}	V_O = 0V		1.15	1.4	mA
		-40°C < T_A < +125°C			1.5	mA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L =2 kΩ		5		V/µs
Settling Time	t_s	To 0.01%		<0.5		µs
Gain Bandwidth Product	GBP			9		MHz
Phase Margin	Øo			50		degrees
NOISE PERFORMANCE						
Voltage Noise	$e_{n\,p-p}$	f = 0.1Hz to 10Hz		2.3	3.5	µV p-p
Voltage Noise Density	e_n	f = 1kHz		8	12	nV/√Hz
Voltage Noise Density	e_n	f = 10kHz		6.5		nV/√Hz
Current Noise Density	i_n	f = 1kHz		0.01		pA/√Hz

ELECTRICAL CHARACTERISTICS (@ V_S=+5.0V, V_{CM} = V_S/2, T_A=+25°C unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}	Vs=3.5V,V_{CM} = 1V, V_{CM} = 3V		20	65	µV
		Vs=5V, V_{CM} = 0V to 5V		80	300	µV
		-40°< T_A < +125°C			750	µV
Input Bias Current	I_B		0.2	1		pA
		-40°< T_A < +85°C			50	pA
		-40°< T_A < +125°C			200	pA
Input Offset Current	I_{OS}		0.1	0.5		pA
		-40°< T_A < +85°C			20	pA
		-40°< T_A < +125°C			75	pA
Input Voltage Range			0		5	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = 0V to 5V	85	100		dB
		-40°< T_A < +125°C	75	90		dB
Large Signal Voltage Gain	A_{VO}	V_O= 0.5V to 4.5V, R_L = 2 kΩ	300	1000		V/mV
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$			1	4.5	µV/°C
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	I_L = 1mA	4.96	4.98		V
		I_L = 10mA	4.7	4.79		V
		-40°< T_A < +125°C	4.6			V
Output Voltage Low	V_{OL}	I_L = 1mA		20	40	mV
Output Voltage High	V_{OL}	I_L = 10mA		170	210	mV
		-40°< T_A < +125°C			290	mV
Output Current	I_{OUT}			±80		mA
Closed Loop Output Impedance	Z_{OUT}	f=1 MHz, A_V = 1		10		Ω
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_S = 2.7 V to 5.5 V	80	95		dB
			70	90		dB
Supply Current/Amplifier	I_{SY}	V_O = 0V		1	1.2	mA
		-40°< T_A < +125°C			1.4	mA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L =2 kΩ		5		V/µs
Settling Time	t_s	To 0.01%		<1		µs
Full Power Bandwidth	BWp	<1% Distortion		360		kHz
Gain Bandwidth Product	GBP			10		MHz
Phase Margin	Øo			65		degrees
NOISE PERFORMANCE						
Voltage Noise	$e_{n\,p\text{-}p}$	f = 0.1Hz to 10Hz		2.3	3.5	µV p-p
Voltage Noise Density	e_n	f=1kHz		8	12	nV/√Hz
Voltage Noise Density	e_n	f=10kHz		6.5		nV/√Hz
Current Noise Density	i_n	f=1kHz		0.01		pA/√Hz

ABSOLUTE MAXIMUM RATINGS [1]

Supply voltage ..... +6V
Input Voltage ..... Gnd to Vs
Differential Input Voltage ..... ±6V
Output Short-Circuit Duration to Gnd[2] ... Observe Derating Curves
Storage Temperature Range
CB Package ..... -65°C to +150°C
Operating Temperature Range
AD8605 ..... -40°C to +125°C
Junction Temperature Range
CB Package ..... -65°C to +150°C
Lead Temperature Range (Soldering, 60 Sec) ..... +300°C

Package Type	θ_{JA}	θ_{JC}	Units
5-Bump MicroCSP (CB)	125[3]	--	°C/W

NOTES

[1] Absolute maximum ratings apply at 25°C, unless otherwise noted.

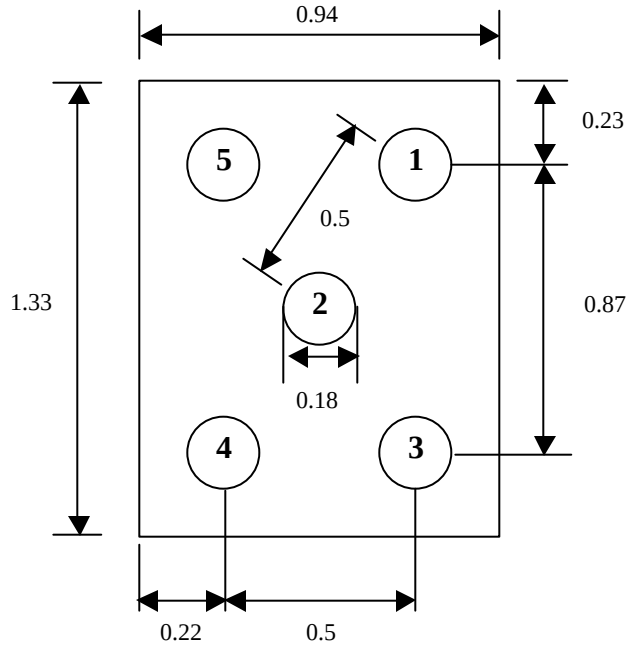
[2] θ_{JA} is specified for the worst-case conditions, i.e., θ_{JA} is specified for device soldered in circuit board for surface mount packages.

[3] Estimated value. Full study in process

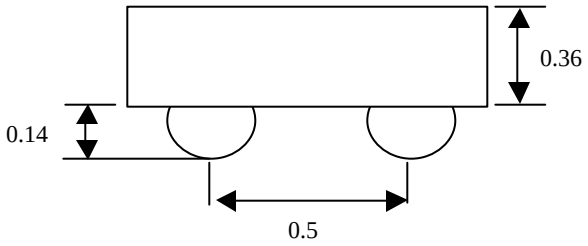
ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option
AD8605ACB	-40°C to +125°C	5 bump-MicroCSP	CB-5

AD8605 MicroCSP Package Dimension Drawing
Top View
(Bump Side Up, all dimensions in mm)



AD8605 MicroCSP Side View (all dimensions in mm)



Bump Locations referenced to die center

Pin No.	X (um)	Y (um)
1	250	433
2	0	0
3	250	-433
4	-250	-433
5	-250	433