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Precision Low Noise JFET Operational Amplifiers

Preliminary Technical Data

AD8510/AD8512/AD8513

FEATURES
Low Offset Voltage: 400µV max
Low TcVos: 2uv/°C typ
Low input bias current: 30pA max.
Dual-Supply Operation: ±5V to ±15V Volts
Low Noise: 8 nV/√Hz
Fast settling: 10V step to 0.01% in 600ns
No Phase Reversal
Unity Gain Stable

APPLICATIONS
Instrumentation
Multi-pole filters
Precision current measurement
Photo-diode amplifiers
Sensors
Audio

GENERAL DESCRIPTION

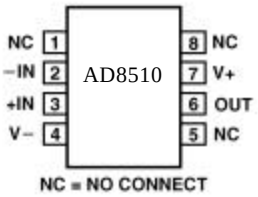
The AD8510, AD8512 and AD8513 are single, dual and quad precision JFET amplifiers featuring low offset voltage, low input bias current and low input voltage and current noise.

The combination of low offsets, low noise and very low input bias currents make these amplifiers especially suitable for high impedance sensor amplification and precise current measurements using shunts. Unlike many older JFET amplifiers these parts do not suffer from output phase reversal when input voltages exceed the maximum common mode voltage range.

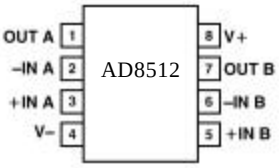
The AD8510, AD8512 and AD8513 are specified over the extended industrial (-40° to +125°C) temperature range. The AD8510, single, and AD8512, dual, are available in the 8 lead MSOP and narrow SOIC surface mount packages. The AD8513 is available in the 14 lead TSSOP and narrow SOIC packages. MSOP and TSSOP versions are available in tape and reel only.

PIN CONFIGURATIONS

8-Lead MSOP (RM-8)



8-Lead SO (R-8)



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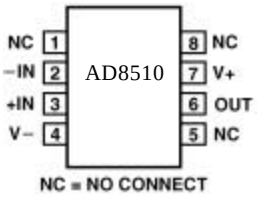
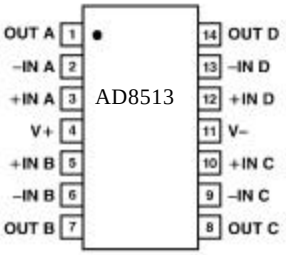
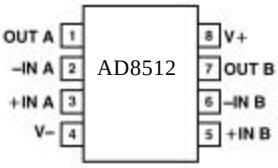


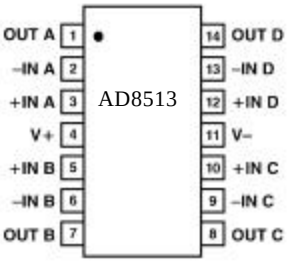
14-Lead TSSOP (RU-14)



8-Lead MSOP (RM-8)



14-Lead SO (R-14)



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ELECTRICAL CHARACTERISTICS (V_S=±5V, V_{CM} = 0V, T_A=+25°C unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
INPUT CHARACTERISTICS						
Offset Voltage (A Grade)	V_{OS}				1	mV
		-40°< T_A < +125°C			1.8	mV
Offset Voltage (B Grade)	V_{OS}				.4	mV
		-40°< T_A < +125°C			0.8	mV
Input Bias Current	I_B				30	pA
		-40°< T_A < +85°C			2	nA
		-40°< T_A < +125°C			30	nA
Input Offset Current	I_{OS}				25	pA
		-40°< T_A < +85°C			1.6	nA
		-40°< T_A < +125°C			13	nA
Input Voltage Range			-4		3.2	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = -3.5V to 3V	86			dB
Large Signal Voltage Gain	A_{VO}	R_L = 2 kΩ V_O= -3V to 3V	150	200		V/mV
Offset Voltage Drift (A Grade)	$\Delta V_{OS}/\Delta T$			3	10	µV/°C
Offset Voltage Drift (B Grade)	$\Delta V_{OS}/\Delta T$			2	10	µV/°C
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	I_L = 1mA	3.5			V
		-40°C < T_A < +125°C	3.4			V
Output Voltage Low	V_{OL}	I_L = 1mA			-4	V
		-40°C < T_A < +125°C			-3.4	V
Output Current	I_{OUT}		±25	±35		mA
Closed Loop Output Impedance	Z_{OUT}	f=10 kHz, A_V = 1		tbd		Ω
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_S = 2.7 V to 5.5 V	86			dB
Supply Current/Amplifier	I_{SY}	V_O = 0V		1.8	3	mA
		-40°< T_A < +125°C			4	mA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L =2 kΩ		20		V/µs
Gain Bandwidth Product	GBP			7.5		MHz
Settling Time	ts	to 0.01%, 0V to 4V step		.3		µs
THD+Noise	THD+N			.0001		%
Phase Margin	Øo			60		degrees
NOISE PERFORMANCE						
Voltage Noise Density	e_n	f=1kHz		8		nV/√Hz
Voltage Noise Density	e_n	f=10kHz		8		nV/√Hz
Current Noise Density	i_n	f=1kHz		0.01		pA/√Hz

ELECTRICAL CHARACTERISTICS (@ V_S=±15.0V, V_{CM} = 0V, T_A=+25°C unless otherwise noted)

Parameter	Symbol	Conditions	A Grade			Units
			Min	Typ	Max	
INPUT CHARACTERISTICS						
Offset Voltage (A Grade)	V_{OS}				1	mV
		-40°< T_A < +125°C			1.8	mV
Offset Voltage (B Grade)	V_{OS}				.4	mV
		-40°< T_A < +125°C			0.8	mV
Input Bias Current	I_B				30	pA
		-40°< T_A < +85°C			2	nA
		-40°< T_A < +125°C			30	nA
Input Offset Current	I_{OS}				25	pA
		-40°< T_A < +85°C			1.6	nA
		-40°< T_A < +125°C			13	nA
Input Voltage Range			-13.5		13	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = -12.5V to 12.5V	86			dB
Large Signal Voltage Gain	A_{VO}	V_O= -13V to 13V, R_L = 2 kΩ , V_{CM}= 0V	150	200		V/mV
Offset Voltage Drift (A Grade)	$\Delta V_{OS}/\Delta T$			3	10	µV/°C
Offset Voltage Drift (B Grade)	$\Delta V_{OS}/\Delta T$			2	10	µV/°C
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	I_L = 1mA	13.5			V
		I_L = 10mA	13			V
		-40°C to +125°C	12			V
Output Voltage Low	V_{OL}	I_L = 1mA			-13.5	V
Output Voltage High	V_{OL}	I_L = 10mA			-13	V
		-40°C to +125°C			-12	V
Output Current	I_{OUT}			±50		mA
Closed Loop Output Impedance	Z_{OUT}	f=10 kHz, A_V = 1		tbd		Ω
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_S = 2.7 V to 5.5 V	86			dB
Supply Current/Amplifier	I_{SY}	V_O = 0V		1.8	3.5	mA
		-40°< T_A < +125°C			4.5	mA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L =2 kΩ		20		V/µs
Gain Bandwidth Product	GBP			7.5		MHz
Settling Time	ts	to 0.01%, 0V to 10V step		.9		µs
THD+Noise	THD+N			.0001		%
Phase Margin	Øo			60		degrees

NOISE PERFORMANCE				
Voltage Noise Density	e_n	f=1kHz	8	nV/√Hz
Voltage Noise Density	e_n	f=10kHz	8	nV/√Hz
Current Noise Density	i_n	f=1kHz	0.015	pA/√Hz

ABSOLUTE MAXIMUM RATINGS [1]

Supply voltage .....±18V
Input Voltage..... ±Vs
Output Short-Circuit Duration to Gnd[2] ... Observe Derating Curves
Storage Temperature Range
R, RM, RU Package .....-65°C to +150°C
Operating Temperature Range
AD8510/AD8512/AD8513.....-40°C to +125°C
Junction Temperature Range
R, RM, RU Package .....-65°C to +150°C
Lead Temperature Range (Soldering, 60 Sec).....+300°C
Electrostatic Discharge (HBM)……...…2000V

Package Type	θ_{JA}	θ_{JC}	Units
8-Pin MSOP (RM)	210	45	°C/W
8-Pin SOIC (R)	158	43	°C/W
14-Pin TSSOP (RU)	158	43	°C/W
14-Pin SOIC (R)	158	43	°C/W

NOTES

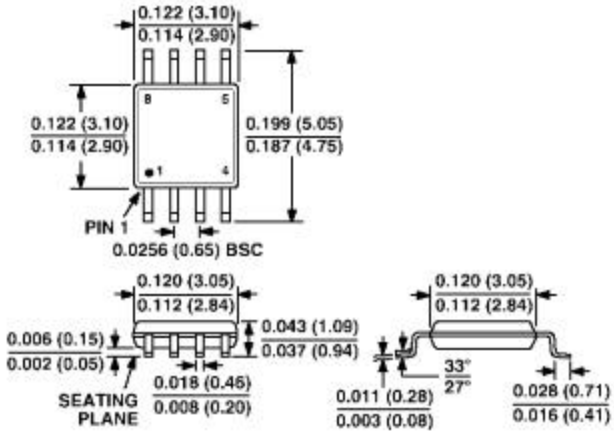
[1] Absolute maximum ratings apply at 25°C, unless otherwise noted.

[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.

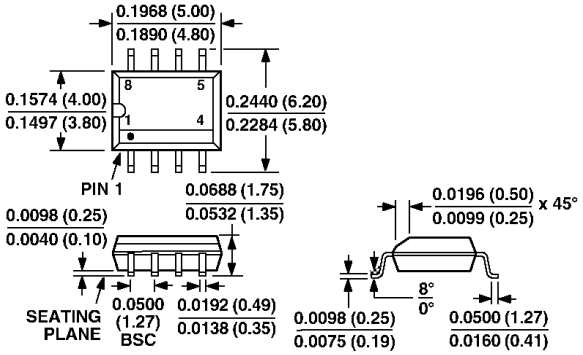
ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option	Marking Code
AD8510ARM	-40°C to +125°C	8-Pin MSOP	RM-8	B7A
AD8510AR	-40°C to +125°C	8-Pin SOIC	R-8	
AD8510BR	-40°C to +125°C	8-Pin SOIC	R-8	
AD8512ARM	-40°C to +125°C	8-Pin MSOP	RM-8	B8A
AD8512AR	-40°C to +125°C	8-Pin SOIC	R-8	
AD8512BR	-40°C to +125°C	8-Pin SOIC	R-8	
AD8513ARU	-40°C to +125°C	14-Pin TSSOP	RU-14	
AD8513AR	-40°C to +125°C	14-Pin SOIC	R-14	

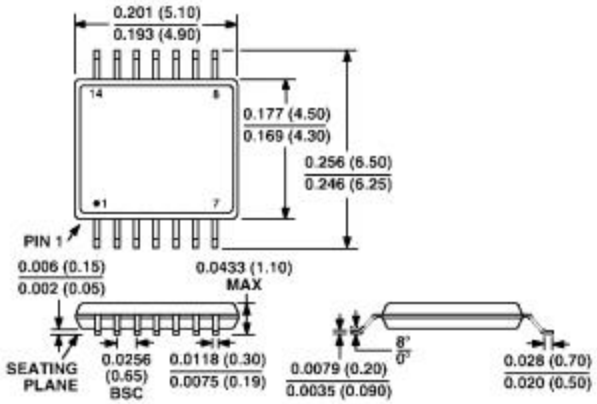
8-Lead ■SOIC
(RM-8)



8-Lead SO
(R-8)



14-Lead TSSOP
(RU-14)



14-Lead SO
(R-14)