钍地半导体
Tudi Semiconductor

Product Specification

TUDI-AD8646/AD8648

24 MHz Rail-to-Rail Amplifiers with Shutdown Option

网址 www.sztdbdt.com

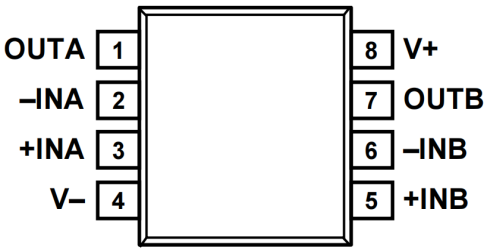
用芯智造·卓越品质

semiconductor device manufacturer

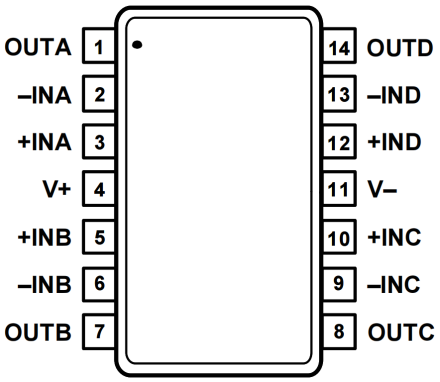
- Design
- research and development
- production
- and sales

FEATURES

Offset voltage: 2.5 mV maximum
Single-supply operation: 2.7 V to 5.5 V
Low noise: 8 nV/√Hz
Wide bandwidth: 24 MHz
Slew rate: 11 V/μs
Short-circuit output current: 120 mA
Qualified for automotive applications
No phase reversal
Low input bias current: 1 pA
Low supply current per amplifier: 2 mA
maximum Unity gain stable



8-Lead SOIC and MSOP



14-Lead SOIC and TSSOP

APPLICATIONS

Battery-powered instruments
Multipole filters
ADC front ends
Sensors
Barcode scanners
ASIC input or output amplifiers
Audio amplifiers
Photodiode amplifiers
Datapath/mux/switch control

GENERAL DESCRIPTION

The AD8646 and the AD8647 are the dual, and the AD8648 is the quad, rail-to-rail, input and output, single-supply amplifiers featuring low offset voltage, wide signal bandwidth, low input voltage, and low current noise. The AD8647 also has a low power shutdown function.
The combination of 24 MHz bandwidth, low offset, low noise, and very low input bias current makes these amplifiers useful in a wide variety of applications. Filters, integrators, photodiode amplifiers, and high impedance sensors all benefit from the combination of performance features. AC applications benefit from the wide bandwidth and low distortion. The AD8646/ AD8647/ AD8648 offer high output drive capability, which is excellent for audio line drivers and other low impedance applications. The AD8646 and AD8648 are available for automotive applications (see the Ordering Guide).
Applications include portable and low powered instrumenta-tion, audio amplification for portable devices, portable phone headsets, barcode scanners, and multipole filters. The ability to swing rail to rail at both the input and output enables designers to buffer CMOS ADCs, DACs, ASICs, and other wide output swing devices in single-supply systems.

SPECIFICATIONS

V_{SY} = 5 V, V_{CM} = V_{SY}/2, T_A = +25°C, unless otherwise noted.

Table 1.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}	V_{CM} = 0 V to 5 V		0.6	2.5	mV
		−40°C < T_A < +125°C			3.2	mV
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	−40°C < T_A < +125°C		1.8	7.5	µV/°C
Input Bias Current	I_B			0.3	1	pA
		−40°C < T_A < +85°C			50	pA
		−40°C < T_A < +125°C			550	pA
Input Offset Current	I_{OS}			0.1	0.5	pA
		−40°C < T_A < +85°C			50	pA
		−40°C < T_A < +125°C			250	pA
Input Voltage Range	V_{CM}		0		5	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = 0 V to 5 V	67	84		dB
Large Signal Voltage Gain	A_{VO}	R_L = 2 kΩ, V_O = 0.5 V to 4.5 V	104	116		dB
Input Capacitance						
Differential	C_{DIFF}			2.5		pF
Common Mode	C_{CM}			6.7		pF
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	I_{OUT} = 1 mA	4.98	4.99		V
		−40°C < T_A < +125°C	4.90			V
		I_{OUT} = 10 mA	4.85	4.92		V
		−40°C < T_A < +125°C	4.70			V
Output Voltage Low	V_{OL}	I_{OUT} = 1 mA		8.4	20	mV
		−40°C < T_A < +125°C			40	mV
		I_{OUT} = 10 mA		78	145	mV
		−40°C < T_A < +125°C			200	mV
Output Current	I_{sc}	Short circuit		±120		mA
Closed-Loop Output Impedance	Z_{OUT}	At 1 MHz, A_V = 1		5		Ω
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_{SY} = 2.7 V to 5.5 V	63	80		dB
Supply Current per Amplifier	I_{SY}			1.5	2.0	mA
		−40°C < T_A < +125°C			2.5	mA
Supply Current Shutdown Mode (AD8647 Only)	I_{SD}	Both amplifiers shut down, V_{IN_SDA} and V_{IN_SDB} = 0 V		10		nA
		−40°C < T_A < +125°C			1	µA
SHUTDOWN INPUTS (AD8647)						
Logic High Voltage (Enabled)	V_{INH}	−40°C < T_A < +125°C	+2.0			V
Logic Low Voltage (Power-Down)	V_{INL}	−40°C < T_A < +125°C			+0.8	V
Logic Input Current (Per Pin)	I_{IN}	−40°C < T_A < +125°C			1	µA
Output Pin Leakage Current		−40°C < T_A < +125°C (shutdown active)		1		nA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L = 2 kΩ		11		V/µs
Gain Bandwidth Product	GBP			24		MHz
Phase Margin	$Ø_m$			74		Degrees
Settling Time	t_s	To 0.1%		0.5		µs
Amplifier Turn-On Time (AD8647)	t_{on}	25°C, A_V = 1, R_L = 1 kΩ (see Figure 44)		1		µs
Amplifier Turn-Off Time (AD8647)	t_{off}	25°C, A_V = 1, R_L = 1 kΩ (see Figure 45)		1		µs

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
NOISE PERFORMANCE						
Peak-to-Peak Noise	e_n p-p	0.1 Hz to 10 Hz		2.3		μV
Voltage Noise Density	e_n	f = 1 kHz		8		nV/√Hz
		f = 10 kHz		6		nV/√Hz
Channel Separation	CS	f = 10 kHz		−115		dB
		f = 100 kHz		−110		dB
Total Harmonic Distortion Plus Noise	THD + N	V p-p = 0.1 V, R_L = 600 Ω, f = 25 kHz, T_A = 25°C				
		A_V = +1		0.010		%
		A_V = −10		0.021		%

ABSOLUTE MAXIMUM RATINGS

Table 3.

Parameter	Rating
Supply Voltage	6 V
Input Voltage	GND to V_{SY}
Differential Input Voltage	±6 V
Output Short Circuit to GND	Indefinite
Storage Temperature Range	−65°C to +150°C
Operating Temperature Range	−40°C to +125°C
Lead Temperature (Soldering 60 sec)	300°C
Junction Temperature	150°C

Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product 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 4. Thermal Resistance

Package Type	θ_{JA}	θ_{JC}	Unit
8-Lead SOIC_N	125	43	°C/W
8-Lead MSOP	210	45	°C/W
10-Lead MSOP	200	44	°C/W
14-Lead SOIC_N	120	36	°C/W
14-Lead TSSOP	180	35	°C/W

V_{SY} = 2.7 V, V_{CM} = V_{SY}/2, T_A = +25°C, unless otherwise noted.

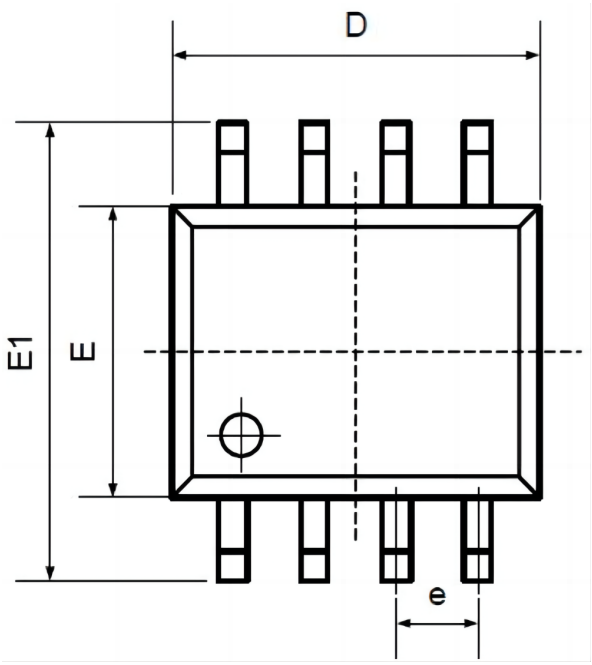
Table 2.

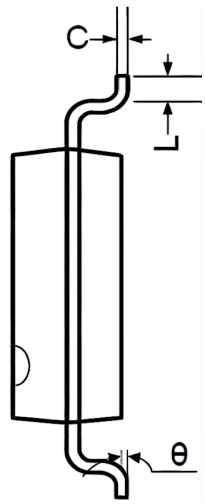
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
INPUT CHARACTERISTICS						
Offset Voltage	V_{OS}	V_{CM} = 0 V to 2.7 V		0.6	2.5	mV
		−40°C < T_A < +125°C			3.2	mV
Offset Voltage Drift	$\Delta V_{OS}/\Delta T$	−40°C < T_A < +125°C		1.8	7.0	µV/°C
Input Bias Current	I_B			0.2	1	pA
		−40°C < T_A < +85°C			50	pA
		−40°C < T_A < +125°C			550	pA
Input Offset Current	I_{OS}			0.1	0.5	pA
		−40°C < T_A < +85°C			50	pA
		−40°C < T_A < +125°C			250	pA
Input Voltage Range	V_{CM}		0		2.7	V
Common-Mode Rejection Ratio	CMRR	V_{CM} = 0 V to 2.7 V	62	79		dB
Large Signal Voltage Gain	A_{VO}	R_L = 2 kΩ, V_O = 0.5 V to 2.2 V	95	102		dB
Input Capacitance						
Differential	C_{DIFF}			2.5		pF
Common Mode	C_{CM}			7.8		pF
OUTPUT CHARACTERISTICS						
Output Voltage High	V_{OH}	I_{OUT} = 1 mA	2.65	2.68		V
		−40°C < T_A < +125°C	2.60			V
Output Voltage Low	V_{OL}	I_{OUT} = 1 mA		11	25	mV
		−40°C < T_A < +125°C			30	mV
Output Current	I_{sc}	Short circuit		±63		mA
Closed-Loop Output Impedance	Z_{OUT}	At 1 MHz, A_V = 1		5		Ω
POWER SUPPLY						
Power Supply Rejection Ratio	PSRR	V_{SY} = 2.7 V to 5.5 V	63	80		dB
Supply Current per Amplifier	I_{SY}			1.6	2.0	mA
		−40°C < T_A < +125°C			2.5	mA
Supply Current Shutdown Mode (AD8647 Only)	I_{SD}	Both amplifiers shut down, V_{IN_SDA} and V_{IN_SDB} = 0 V		10		nA
		−40°C < T_A < +125°C			1	µA
SHUTDOWN INPUTS (AD8647)						
Logic High Voltage (Enabled)	V_{INH}	−40°C < T_A < +125°C	+2.0			V
Logic Low Voltage (Power-Down)	V_{INL}	−40°C < T_A < +125°C			+0.8	V
Logic Input Current (Per Pin)	I_{IN}	−40°C < T_A < +125°C			1	µA
Output Pin Leakage Current		−40°C < T_A < +125°C (shutdown active)		1		nA
DYNAMIC PERFORMANCE						
Slew Rate	SR	R_L = 2 kΩ		11		V/µs
Gain Bandwidth Product	GBP			24		MHz
Phase Margin	$Ø_m$			53		Degrees
Settling Time	t_s	To 0.1%		0.3		µs
Amplifier Turn-On Time (AD8647)	t_{on}	25°C, A_V = 1, R_L = 1 kΩ (see Figure 41)		1.2		µs
Amplifier Turn-Off Time (AD8647)	t_{off}	25°C, A_V = 1, R_L = 1 kΩ (see Figure 42)		1		µs
NOISE PERFORMANCE						
Peak-to-Peak Noise	e_n p-p	0.1 Hz to 10 Hz		2.3		µV
Voltage Noise Density	e_n	f = 1 kHz		8		nV/√Hz
		f = 10 kHz		6		nV/√Hz
Channel Separation	CS	f = 10 kHz		−115		dB
		f = 100 kHz		−110		dB

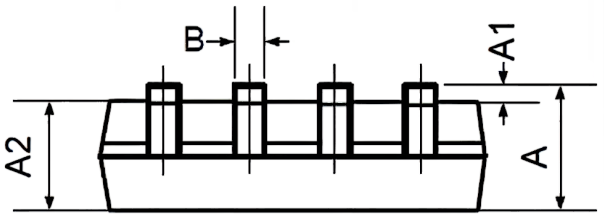
Order information

Order Number	Package	Package Quantity	Marking On The park
AD8646ARMZ-REEL-TUDI	MSOP8	Tape,Reel,2500	AD8646ARMZ-REEL
AD8646ARZ-REEL-TUDI	SOP8	Tape,Reel,2500	AD8646ARZ-REEL
AD8646WARMZ-RL-TUDI	MSOP8	Tape,Reel,2500	AD8646WARMZ-RL
AD8648ARUZ-REEL-TUDI	TSSOP14	Tape,Reel,2500	AD8648ARUZ-REEL
AD8648ARZ-REEL-TUDI	SOP14	Tape,Reel,2500	AD8648ARZ-REEL

Package SOP8

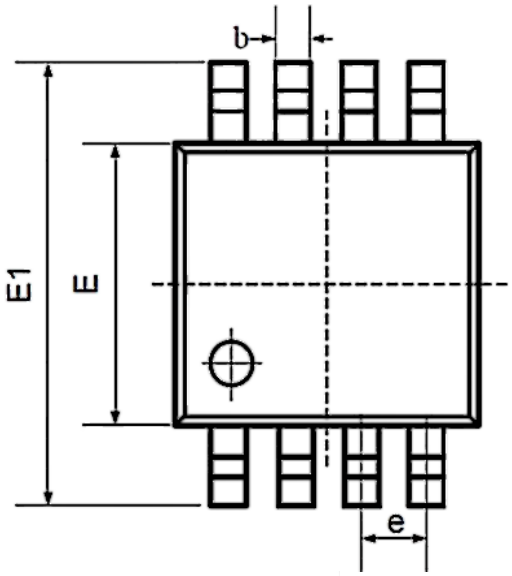


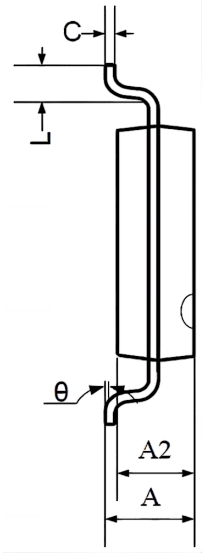


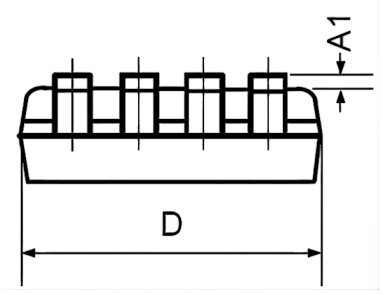


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.190	0.250	0.007	0.010
D	4.780	5.000	0.188	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270TYP		0.050TYP	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

Package MSOP8

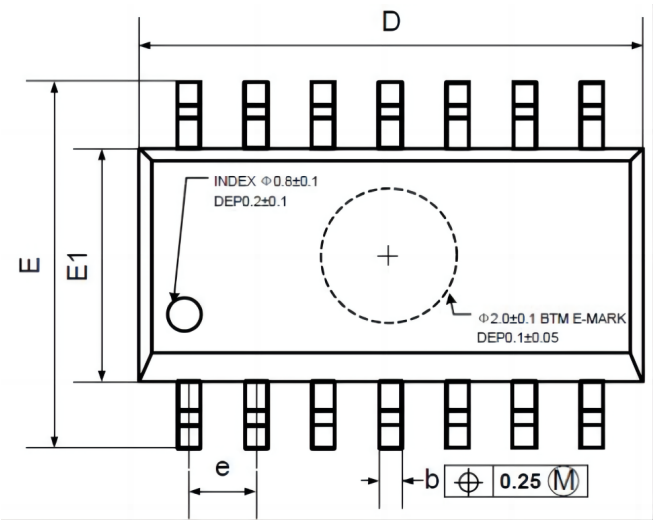


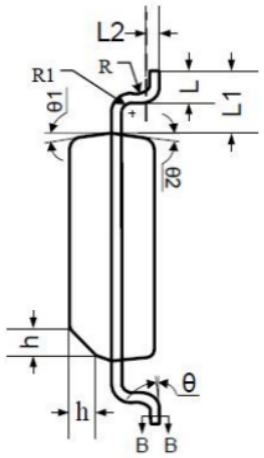


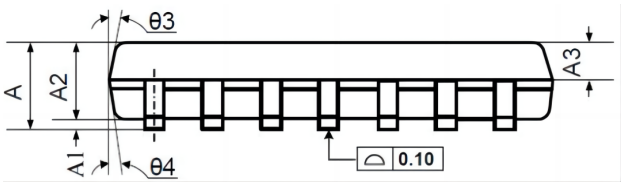


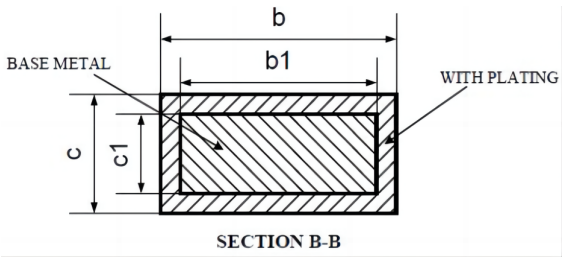
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.800	1.200	0.031	0.047
A1	0.000	0.200	0.000	0.008
A2	0.760	0.970	0.030	0.038
b	0.30 TYP		0.012 TYP	
C	0.15 TYP		0.006 TYP	
D	2.900	3.100	0.114	0.122
e	0.65 TYP		0.026 TYP	
E	2.900	3.100	0.114	0.122
E1	4.700	5.100	0.185	0.201
L	0.410	0.650	0.016	0.026
θ	0°	6°	0°	6°

Package SOP14



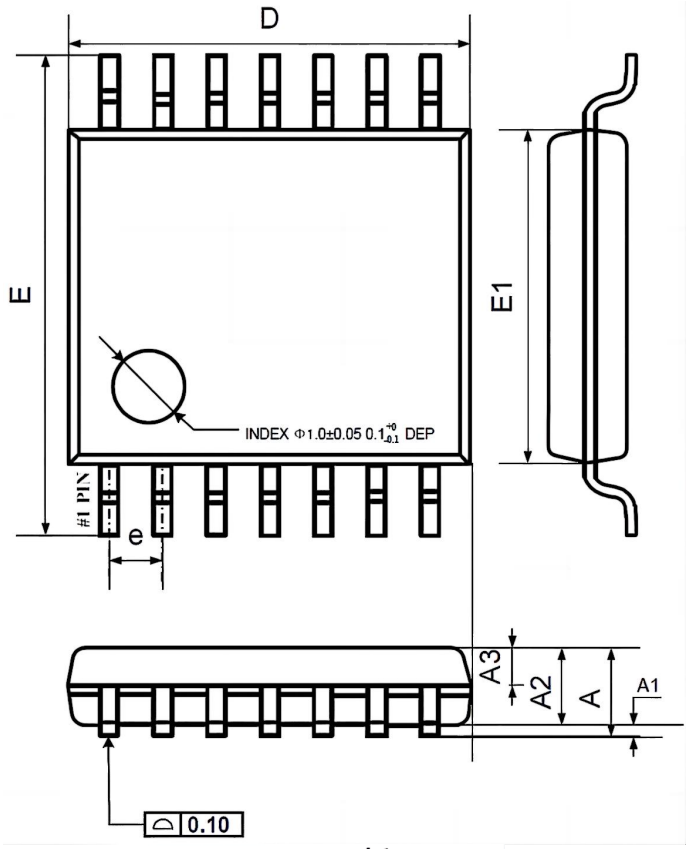


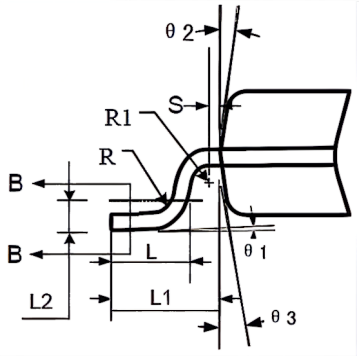


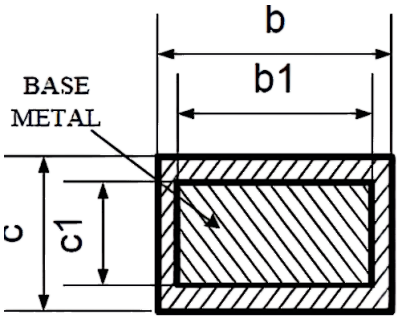


Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	1.35	1.60	1.75
A1	0.10	0.15	0.25
A2	1.25	1.45	1.65
A3	0.55	0.65	0.75
b	0.36		0.49
b1	0.35	0.40	0.45
C	0.16		0.25
c1	0.15	0.20	0.25
D	8.53	8.63	8.73
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27 BSC		
L	0.45	0.60	0.80
L1	1.04 REF		
L2	0.25 BSC		
R	0.07		
R1	0.07		
h	0.30	0.40	0.50
θ	0°		8°
θ1	6°	8°	10°
θ2	6°	8°	10°
θ3	5°	7°	9°
θ4	5°	7°	9°

Package TSSOP14







Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	—	—	1.20
A1	0.05	—	0.15
A2	0.90	1.00	1.05
A3	0.34	0.44	0.54
b	0.20	—	0.28
b1	0.20	0.22	0.24
C	0.10	—	0.19
c1	0.10	0.13	0.15
D	4.86	4.96	5.06
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e	0.65 BSC		
L	0.45	0.60	0.75
L1	1.00 REF		
L2	0.25 BSC		
R	0.09	—	—
R1	0.09	—	—
S	0.20	—	—
θ1	0°	—	8°
θ2	10°	12°	14°
θ3	10°	12°	14°

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