Low Cost, High-Speed Rail-to-Rail Output Op-Amp

Preliminary Technical Data

ADA4851

FEATURES

High-Speed
- **175MHz –3dB Bandwidth**
- **250V/us Slew Rate**
- **25ns Settling time to 0.5%**

Wide Supply Range: 2.7-10V
Rail-to-Rail Output
Low power: 3mA/Amplifier
- **0.1dB Flatness: 15MHz**
- **Differential Gain: 0.05%**
- **Differential Phase: 0.05°**

Low input-referred noise: 10 nV/√Hz typical
Low Voltage Offsett: 5mV
High Output Current:50mA
Output Disable
Available in space-saving packages
SOT23-6, μSOIC-8 and TSSOP-14

APPLICATIONS

Consumer Video
Professional Video
Video Switchers
Active Filters

PRODUCT OVERVIEW

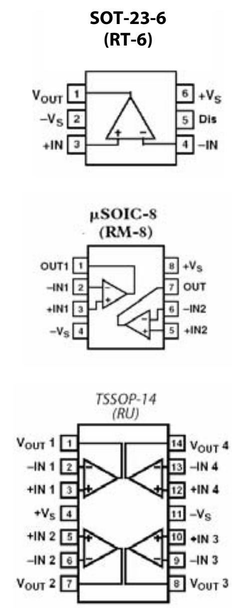
The ADA4851-1 (Single), ADA4851-2 (Dual) and ADA4851-4(Quad) are low cost, high speed, voltage feedback rail-to-rail output op-amps. Despite the low cost, this family of amplifiers has 175MHz Bandwidth, 250V/us slew rate, and can settle within 25ns to 0.1% using only 3mA/amplifer of quiescent current.

This family of amplifiers provides the user with true single supply capability, allowing the signal levels on the input to extend 200mV below negative rail and 1V within positive rail. On the output the amplifier can swing within 50mV of the either rail.

With 0.1dB flatness out to 15MHz and Differential gain and phase of 0.05% and 0.05° this family of amplifiers is ideal for video applications.

Combining its low cost with performance, these amplifiers are ideal in consumer applications.

FUNCTIONAL BLOCK DIAGRAM



The ADA4851 also has high output current making them ideal in driving video signals. The AD4851-1 contains a disable feature that will lower the power of the amplifier and put the output in high impedance mode which makes it possible for muxing applications.

These amplifers are rated to work in the extended temprature range (-40° to 125°C). The ADA4851-1 is available in SOT23-6. The ADA4851-2 is available in μSOIC and the ADA4851-4 is available in TSSOP-14.

Rev. PrA 7/30/2004

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REVISION HISTORY

Revision PrA: Initial Version

ADA4851 SPECIFICATIONS

Table 1. V_S = +3 V (@T_A = +25°C, G = +10, R_L = 1 kΩ, unless otherwise noted.)

Parameter	Conditions	Min	Typ	Max	Unit
DYNAMIC PERFORMANCE					
–3 dB Bandwidth	G = +1, V_O = 0.2 V p-p		175		MHz
	G = +1, V_O = 2 V p-p		25		MHz
Bandwidth for 0.1 dB Flatness	G = +1, V_O = 2 V p-p		15		MHz
Slew Rate	G = +1, V_O = 2V Step		250		V/µs
Settling Time to 0.1%	G = +2, V_O = 2 V Step		25		ns
NOISE/DISTORTION PERFORMANCE					
Harmonic Distortion (dBc) HD2/HD3	f_C = 1 MHz, V_O = 2 V p-p,G = +1		75		dBc
Input Voltage Noise	f = 100 kHz		9		nV/√Hz
Input Current Noise	f = 100 kHz, $\overline{\text{DISABLE}}$ pin floating		1.5		pA/√Hz
Differential Gain	G=+2		0.05		%
Differential Phase	G=+2		0.05		°
DC PERFORMANCE					
Input Offset Voltage				5	mV
Input Offset Voltage Drift			10		µV/°C
Input Bias Current			1.8		µA
Input Bias Current Drift			10		nA/°C
Input Bias Offset Current			0.1		µA
Open-Loop Gain					dB
INPUT CHARACTERISTICS					
Input Resistance	Differential mode		300		kΩ
Input Capacitance			1.4		pF
Input Common-Mode Voltage Range			-0.2 TO 2.0		V
Common-Mode Rejection Ratio	V_{CM} = +2 V		100		dB
$\overline{\text{DISABLE}}$ PIN					
$\overline{\text{DISABLE}}$ Input Voltage	Output disabled				V
Turn-Off Time					ns
Turn-On Time					ns
OUTPUT CHARACTERISTICS					
Output Overdrive Recovery Time (Rise/Fall)	V_{IN} = ±1.5V, G =+2				ns
Output Voltage Swing	R_L = 150Ω		0.05 to 2.95		V
Short-Circuit Current	Sinking and Sourcing				mA
POWER SUPPLY					
Operating Range		2.7		12	V
Quiescent Current			3		mA
Quiescent Current (Disabled)	$\overline{\text{DISABLE}}$ = Low		0.5		mA
Power Supply Rejection Ratio	Vs=1V		95		dB

ADA4851 SPECIFICATIONS

Table 2. V_S = +5 V (@T_A = +25°C, G = +10, R_L = 1 kΩ, unless otherwise noted.)

Parameter	Conditions	Min	Typ	Max	Unit
DYNAMIC PERFORMANCE					
–3 dB Bandwidth	G = +1, V_O = 0.2 V p-p		175		MHz
	G = +1, V_O = 2 V p-p		25		MHz
Bandwidth for 0.1 dB Flatness	G = +1, V_O = 2 V p-p		15		MHz
Slew Rate	G = +1, V_O = 2V Step		250		V/µs
Settling Time to 0.1%	G = +2, V_O = 2 V Step		25		ns
NOISE/DISTORTION PERFORMANCE					
Harmonic Distortion (dBc) HD2/HD3	f_C = 1 MHz, V_O = 2 V p-p,G = +1		75		dBc
Input Voltage Noise	f = 100 kHz		9		nV/√Hz
Input Current Noise	f = 100 kHz, $\overline{\text{DISABLE}}$ pin floating		1.5		pA/√Hz
Differential Gain	G=+2		0.05		%
Differential Phase	G=+2		0.05		°
DC PERFORMANCE					
Input Offset Voltage				5	mV
Input Offset Voltage Drift			10		µV/°C
Input Bias Current			1.8		µA
Input Bias Current Drift			10		nA/°C
Input Bias Offset Current			0.1		µA
Open-Loop Gain					dB
INPUT CHARACTERISTICS					
Input Resistance	Differential mode		300		kΩ
Input Capacitance			1.4		pF
Input Common-Mode Voltage Range			-0.2 TO 4.0		V
Common-Mode Rejection Ratio	V_{CM} = +4 V		100		dB
$\overline{\text{DISABLE}}$ PIN					
$\overline{\text{DISABLE}}$ Input Voltage	Output disabled				V
Turn-Off Time					ns
Turn-On Time					ns
OUTPUT CHARACTERISTICS					
Output Overdrive Recovery Time (Rise/Fall)	V_{IN} = ±1.5V, G =+2				ns
Output Voltage Swing	R_L = 150Ω		0.05 to 4.95		V
Short-Circuit Current	Sinking and Sourcing				mA
POWER SUPPLY					
Operating Range		2.7		12	V
Quiescent Current			3		mA
Quiescent Current (Disabled)	$\overline{\text{DISABLE}}$ = Low		0.5		mA
Power Supply Rejection Ratio	Vs=3		95		dB

ADA4851 SPECIFICATIONS

Table 3. V_S = ±5 V (@T_A = +25°C, G = +10, R_L = 1 kΩ, unless otherwise noted.)

Parameter	Conditions	Min	Typ	Max	Unit
DYNAMIC PERFORMANCE					
–3 dB Bandwidth	G = +1, V_O = 0.2 V p-p		175		MHz
	G = +1, V_O = 2 V p-p		25		MHz
Bandwidth for 0.1 dB Flatness	G = +1, V_O = 2 V p-p		15		MHz
Slew Rate	G = +1, V_O = 2V Step		250		V/μs
Settling Time to 0.1%	G = +2, V_O = 2 V Step		25		ns
NOISE/DISTORTION PERFORMANCE					
Harmonic Distortion (dBc) HD2/HD3	f_C = 1 MHz, V_O = 2 V p-p,G = +1		75		dBc
Input Voltage Noise	f = 100 kHz		9		nV/√Hz
Input Current Noise	f = 100 kHz, $\overline{\text{DISABLE}}$ pin floating		1.5		pA/√Hz
Differential Gain	G=+2		0.05		%
Differential Phase	G=+2		0.05		°
DC PERFORMANCE					
Input Offset Voltage				5	mV
Input Offset Voltage Drift			10		μV/°C
Input Bias Current			1.8		μA
Input Bias Current Drift			10		nA/°C
Input Bias Offset Current			0.1		μA
Open-Loop Gain					dB
INPUT CHARACTERISTICS					
Input Resistance	Differential mode		300		kΩ
Input Capacitance			1.4		pF
Input Common-Mode Voltage Range			-5.2 TO 5.0		V
Common-Mode Rejection Ratio	V_{CM} = +9 V		100		dB
$\overline{\text{DISABLE}}$ PIN					
$\overline{\text{DISABLE}}$ Input Voltage	Output disabled				V
Turn-Off Time					ns
Turn-On Time					ns
OUTPUT CHARACTERISTICS					
Output Overdrive Recovery Time (Rise/Fall)	V_{IN} = ±1.5V, G =+2				ns
Output Voltage Swing	R_L = 150Ω		-4.95 to 4.95		V
Short-Circuit Current	Sinking and Sourcing				mA
POWER SUPPLY					
Operating Range		2.7		12	V
Quiescent Current			3		mA
Quiescent Current (Disabled)	$\overline{\text{DISABLE}}$ = Low		0.5		mA
Power Supply Rejection Ratio	Vs=5		95		dB

ABSOLUTE MAXIMUM RATINGS

Table 4. ADA4851 Absolute Maximum Ratings

Parameter	Rating
Supply Voltage	12 V
Power Dissipation	See Figure 2
Common-Mode Input Voltage	VEE – 0.5 V to VCC + 0.5 V
Differential Input Voltage	1.8 V
Storage Temperature	–65°C to +125°C
Operating Temperature Range	–40°C to +85°C
Lead Temperature Range (Soldering 10 sec)	300°C
Junction Temperature	150°C

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other condition s 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, i.e., θ_{JA} is specified for device soldered in circuit board for surface mount packages.

Table 5. Thermal Resistance

Package Type	θ_{JA}	Unit
SOT23-6	180	°C/W
µSOIC-8	150	°C/W
TSSOP-14	120	°C/W

Maximum Power Dissipation

The maximum safe power dissipation in the ADA4851 package is limited by the associated rise in junction temperature (T_J) on the die. At approximately 150°C, which is the glass transition temperature, the plastic will change its properties. Even temporarily exceeding this temperature limit may change the stresses that the package exerts on the die, permanently shifting the parametric performance of the ADA4851. Exceeding a junction temperature of 175°C for an extended period of time can result in changes in the silicon devices potentially causing failure.

The power dissipated in the package (P_D) is the sum of the quiescent power dissipation and the power dissipated in the package due to the load drive for all outputs. The quiescent power is the voltage between the supply pins (V_S) times the quiescent current (I_S). Assuming the load (R_L) is mid-supply, then the total drive power is $V_S/2 \times I_{OUT,}$ some of which is dissipated in the package and some in the load ($V_{OUT} \times I_{OUT}$).

RMS output voltages should be considered. If R_L is referenced to V_{S-} as in single supply operation, the total power is $V_S \times I_{OUT}$.

In single supply with R_L to V_{S-} worst case is $V_{OUT} = V_S/2$.

Airflow will increase heat dissipation effectively reducing θ_{JA}. Also, more metal directly in contact with the package leads from metal traces, through holes, ground, and power planes will reduce the θ_{JA}.

OUTLINE DIMENSIONS

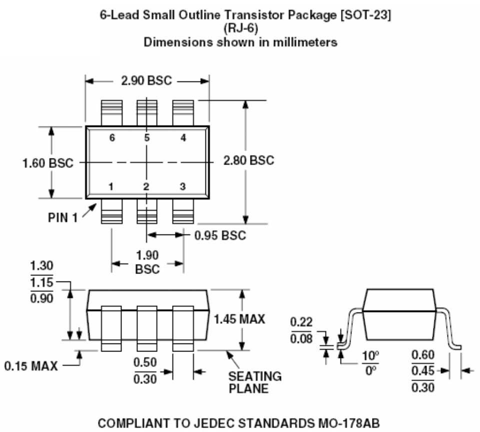

Figure 1. SOT23-6—Dimensions shown in millimeters

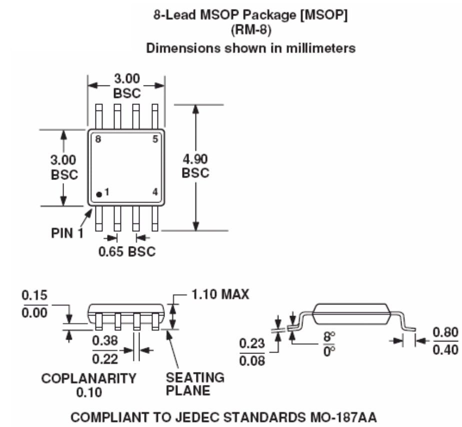

Figure 2. μSOIC-8 —Dimensions shown in millimeters

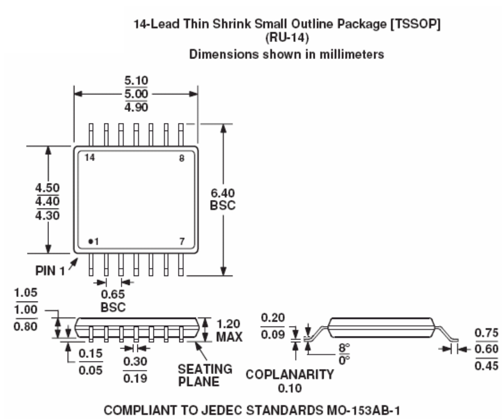

Figure 3. TSSOP-14 ---- Dimensions shown in millimeters

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although this product features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.

Table 6. Ordering Guide

ADA4851 Products	Temperature Package	Package Description	Package Outline	Branding
ADA4851-1ART-R2	–40°C to +125°C	6-Lead SOT-23	RT-6	HHB
ADA4851-1ART-REEL	–40°C to +125°C	6-Lead SOT-23	RT-6	HHB
ADA4851-1ART-REEL7	–40°C to +125°C	6-Lead SOT-23	RT-6	HHB
ADA4851-2ARM	–40°C to +125°C	8-Lead μSOIC	RM-8	HIB
ADA4851-2ARM-REEL	–40°C to +125°C	8-Lead μSOIC	RM-8	HIB
ADA4851-2ARM-REEL7	–40°C to +125°C	8-Lead μSOIC	RM-8	HIB
ADA4851-4ARU	–40°C to +125°C	14-Lead TSSOP	RU-14	
ADA4851-4ARU-REEL	–40°C to +125°C	14-Lead TSSOP	RU-14	
ADA4851-4ARU-REEL7	–40°C to +125°C	14-Lead TSSOP	RU-14	