Integrated Triple Video Filter and Buffer with Selectable Cutoff Frequencies and Multiplexed Inputs for GBR, HD/SD

Preliminary Technical Data

ADA4411-3

FEATURES

6th Order Adjustable Video Filters
36MHz, 18MHz, and 9MHz
Many video standards supported
GBR, YPbPr, YUV,SD,Y/C
2:1MUX on all inputs
Variable Gain: x2 or x4
DC Output Offset Adjust: +/-0.5V, input referred
Excellent Video Specifcations
Wide Supply Range
+4.5V to ±5V
Rail-to-Rail Output
Disable feature

APPLICATIONS

Set Top Boxes
Personal Video Recorders
DVD Players and Recorder
HDTV
Projectors

FUNCTIONAL BLOCK DIAGRAM

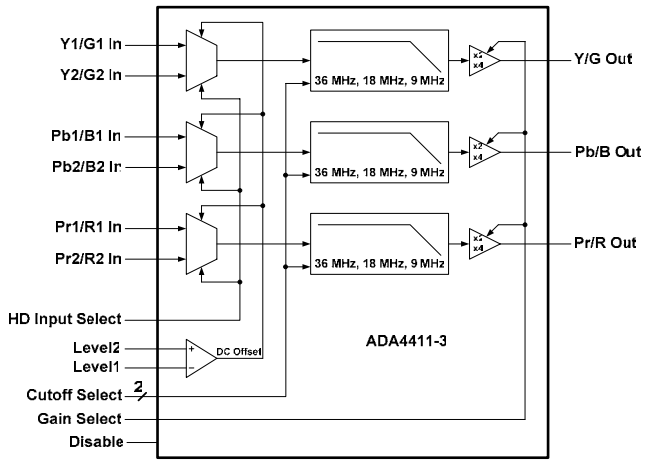

Figure 1.

PRODUCT OVERVIEW

The ADA4411-3 is a comprehensive filtering solution that is carefully designed to give designers the flexibility to easily filter and drive various video signals, including high definition video. Cutoff frequencies of the 6th order video filters range from 9 MHz to 36 MHz, and can be selected by two logic pins to obtain four filter combinations that are tuned for RGB, high definition, and standard definition video signals.

The ADA4411-3 offers gain and voltage offset adjustments. With a single logic pin the throughput filter gain can be selected to be x2 or x4. Output voltage offset is continuously adjustable over an input-referred range of ±500 mV by applying a differential voltage to an independent offset control input.

The ADA4411-3 offers 2:1 multiplexers on all of its video inputs, which are useful in applications where filtering is required for multiple sources of video signals.

The ADA4411-3 can operate on a single +5V supply as well as ±5V supplies. Single supply operation is ideal in applications where power consumption is critical. A disable feature allows for further power conservation.

Dual supply operation is best for applications where the negative-going video signal excursions must swing at or below ground while maintaining excellent video performance. The output buffers will have the ability to drive two 75 Ohm terminated loads that are either DC or AC coupled.

The ADA4411-3 is available in the 24 pin wide body QSOP, and is rated for operation over the commercial temperature range of -40° to +85°C.

Rev. PrA **04/05/05**

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REVISION HISTORY

Revision History: Rev PrA Originated 04/05/2005

ADA4411-3—SPECIFICATIONS

V_S = 5 V, @ T_A = 25°C, V_O = 1.4 V p-p, G = ×2, R_L = 150 Ω, unless otherwise noted.

Table 1.

Parameter	Test Conditions/Comments	Min	Typ	Max	Unit
OVERALL PERFORMANCE					
Offset Error	Input referred, all channels		10		mV
Offset Adjust Range	Input Referred		±500		mV
Input Voltage Range, All Inputs		V_{S-} − 0.1		V_{S+} − 2.0	V
Output Voltage Range, All Outputs	I_O = 15 mA, positive swing	V_{S+} − 0.5	V_{S+} − 0.25		V
	I_O = 15 mA, negative swing	V_{S-} + 0.4	V_{S-} + 0.12		V
Linear Output Current per Channel			30		mA
Integrated Voltage Noise, Referred to Input	All channels		500		μV_{rms}
Filter Input Bias Current	All channels		6.6		µA
Total Harmonic Distortion at 1 MHz	f_C = 36 MHz, f_C = 18 MHz/f_C = 9 MHz		0.01/0.07		%
FILTER DYNAMIC PERFORMANCE					
−1 dB Bandwidth	Cutoff frequency select = 36 MHz		30		MHz
	Cutoff frequency select = 18 MHz		15		MHz
	Cutoff frequency select = 9 MHz		8		MHz
−3 dB Bandwidth	Cutoff frequency select = 36 MHz		36		MHz
	Cutoff frequency select = 18 MHz		18		MHz
	Cutoff frequency select = 9 MHz		9		MHz
Out-of-Band Rejection	f = 75 MHz		−35		dB
Crosstalk	f = 5 MHz, f_C = 36 MHz		−68		dB
Input MUX Isolation	f = 1 MHz, R_{SOURCE} = 300 Ω		86		dB
Propagation Delay	f = 16 MHz, f_C = 36 MHz		20		ns
Group Delay Variation	Cutoff frequency select = 36 MHz		8		ns
	Cutoff frequency select = 18 MHz		15		ns
	Cutoff frequency select = 9 MHz		26		ns
CONTROL INPUT PERFORMANCE					
Input Logic 0 Voltage	All inputs except DISABLE			0.8	V
Input Logic 1 Voltage	All inputs except DISABLE	2.0			V
Input Bias Current	All inputs except DISABLE		7		µA
DISABLE PERFORMANCE					
DISABLE Assert Voltage			V_{S+} − 0.5		V
DISABLE Assert Time			100		ns
DISABLE De-Assert Time			130		ns
DISABLE Input Bias Current			12		µA
Input-to-Output Isolation—Disabled			100		dB
POWER SUPPLY					
Operating Range		4.5		12	V
Quiescent Current			65		mA
Quiescent Current—Disabled			15	150	µA
PSRR, Positive Supply	All channels		72		dB
PSRR, Negative Supply	All channels		62		dB

V_S = ±5 V, @ T_A = 25°C, V_O = 1.4 V p-p, G = ×2, R_L = 150 Ω, unless otherwise noted.

Table 2.

Parameter	Test Conditions/Comments	Min	Typ	Max	Unit
OVERALL PERFORMANCE					
Offset Error	Input referred, all channels		14		mV
Offset Adjust Range	Input Referred		±500		mV
Input Voltage Range, All Inputs		V_{S-} − 0.1		V_{S+} − 2.0	V
Output Voltage Range, All Outputs	I_O = 30 mA, positive swing	V_{S+} − 0.6	V_{S+} − 0.3		V
	I_O = 30 mA, negative swing	V_{S-} + 0.6	V_{S-} + 0.3		V
Linear Output Current per Channel			30		mA
Integrated Voltage Noise, Referred to Input	All channels		500		μV_{rms}
Filter Input Bias Current	All channels		6.3		µA
Total Harmonic Distortion at 1 MHz	f_C = 36 MHz, f_C = 18 MHz/f_C = 9 MHz		0.01/0.07		%
FILTER DYNAMIC PERFORMANCE					
−1 dB Bandwidth	Cutoff frequency select = 36 MHz		28		MHz
	Cutoff frequency select = 18 MHz		15		MHz
	Cutoff frequency select = 9 MHz		8		MHz
−3 dB Bandwidth	Cutoff frequency select = 36 MHz		35.5		MHz
	Cutoff frequency select = 18 MHz		18		MHz
	Cutoff frequency select = 9 MHz		9.5		MHz
Out-of-Band Rejection	f = 75 MHz		−32		dB
Crosstalk	f = 5 MHz, f_C = 36 MHz		−68		dB
Input MUX Isolation	f = 1 MHz, R_{SOURCE} = 300 Ω		86		dB
Propagation Delay	f = 5 MHz, f_C = 36 MHz		21		ns
Group Delay Variation	Cutoff frequency select = 36 MHz		6		ns
	Cutoff frequency select = 18 MHz		13		ns
	Cutoff frequency select = 9 MHz		23		ns
CONTROL INPUT PERFORMANCE					
Input Logic 0 Voltage	All inputs except DISABLE			0.8	V
Input Logic 1 Voltage	All inputs except DISABLE	2.0			V
Input Bias Current	All inputs except DISABLE		7		µA
DISABLE PERFORMANCE					
DISABLE Assert Voltage			V_{S+} − 0.5		V
DISABLE Assert Time			75		ns
DISABLE De-Assert Time			125		ns
DISABLE Input Bias Current			35		µA
Input-to-Output Isolation—Disabled			100		dB
POWER SUPPLY					
Operating Range		4.5		12	V
Quiescent Current			68		mA
Quiescent Current—Disabled			15	150	µA
PSRR, Positive Supply	All channels		72		dB
PSRR, Negative Supply	All channels		62		dB

ABSOLUTE MAXIMUM RATINGS

Table 3. ADA4411-3 Absolute Maximum Ratings

Parameter	Rating
Supply Voltage	12V
Power Dissipation	See Figure 2
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 4. Thermal Resistance

Package Type	θ_{JA}	θ_{JC}	Unit
24 Lead QSOP	83		°C/W

Maximum Power Dissipation

The maximum safe power dissipation in the ADA4411-3 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 changes 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 ADA4411-3. Exceeding a junction temperature of 150°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). The power dissipated due to load drive depends upon the particular application. For each output, the power due to load drive is calculated by multiplying the load current by the associated voltage drop across the device. The power dissipated due to all of the loads is equal to the sum of the power dissipations due to each individual load. RMS voltages and currents must be used in these calculations.

Airflow increases 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 reduces the θ_{JA}.

Figure 2 shows the maximum safe power dissipation in the package vs. the ambient temperature for the 24-lead QSOP (83°C/W) on a JEDEC standard 4-layer board. θ_{JA} values are approximations.

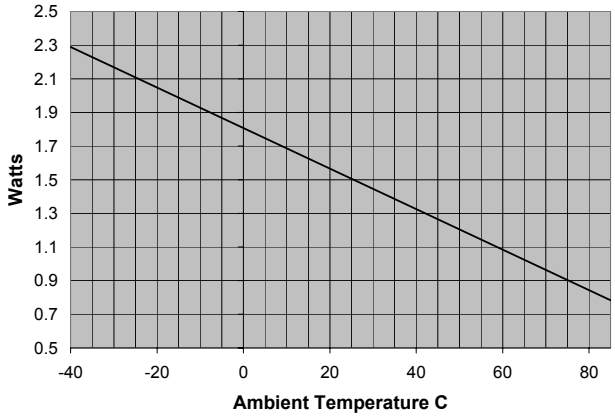

Figure 2. Maximum Power Dissipation vs. Temperature for a 4-layer board

PIN CONFIGURATIONS AND FUNCTIONAL DESCRIPTIONS

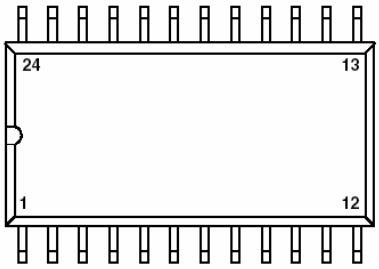

Figure 3. 24-Lead QSOP

Table 5. Pin Function Descriptions—
24-Lead QSOP (RQ-24 PACKAGE)

Pin No.	Name	Description
1	LEVEL1	DC Level Adjust Pin 1
2	DISABLE	Disable/Power Down
3	Y1/G1	Channel 1 Y/G High Definition Input
4	GND	Signal Ground Reference
5	Pb1/B1	Channel 1 Pb/B High Definition Input
6	GND	Signal Ground Reference
7	Pr1/R1	Channel 1 Pr/R High Definition Input
8	F_SEL_A	Filter Cutoff Select Input A
9	F_SEL_B	Filter Cutoff Select Input B
10	Y2/G2	Channel 2 Y/G High Definition Input
11	GND	Signal Ground Reference
12	Pb2/B2	Channel 2 Pb/B High Definition Input
13	DGND	Digital Ground Reference
14	Pr2/R2	Channel 2 Pr/R High Definition Input
15	MUX	Input MUX Select Line
16	VCC	Positive Power Supply
17	Pr/R_OUT	Pr/R High Definition Output
18	VEE	Negative Power Supply
19	Pb/B_OUT	Pb/B High Definition Output
20	VEE	Negative Power Supply
21	Y/G_OUT	Y/G High Definition Output
22	VCC	Positive Power Supply
23	G_SEL	Gain Select
24	LEVEL2	DC Level Adjust Pin 2

OUTLINE DIMENSIONS

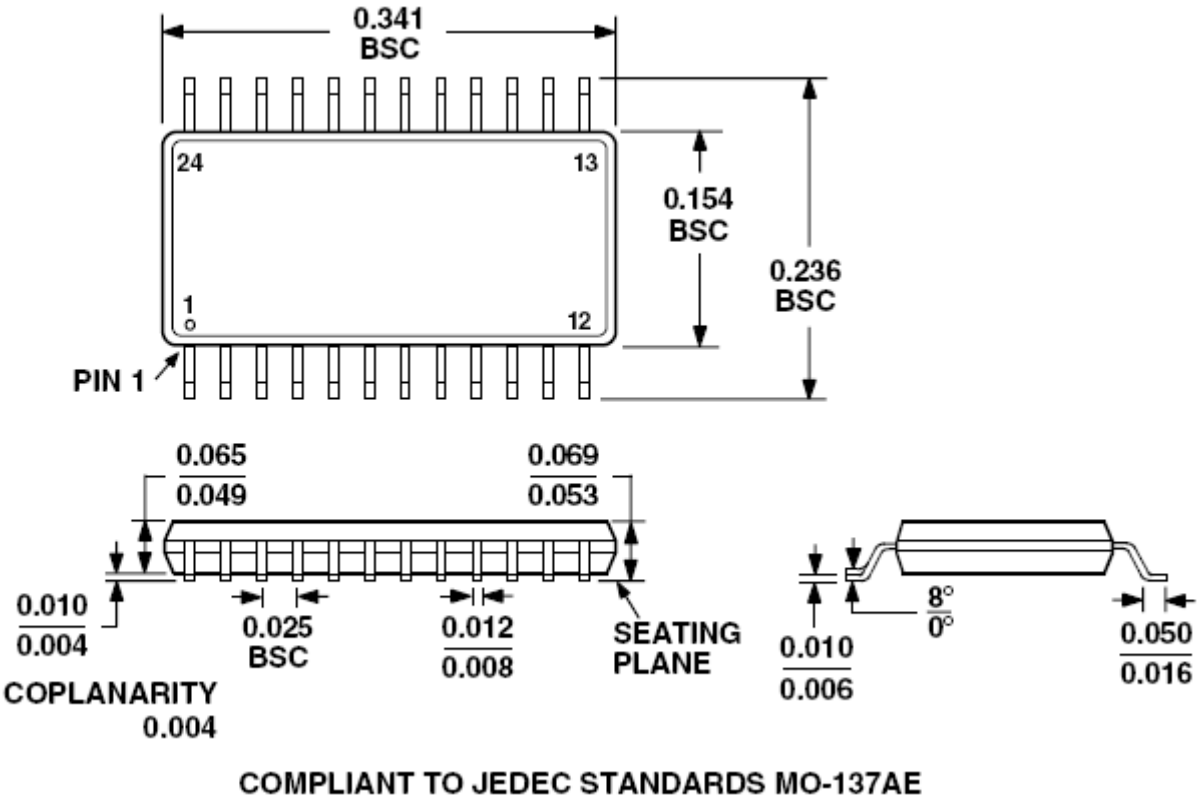

Figure 4. 24-Lead Standard Small Outline Package [QSOP] (RQ-24)—Dimensions shown in inches

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

ADA4411 Products	Temperature Range	Package Description	Package Outline
ADA4411-3ARQZ	–40°C to +85°C	24-Lead QSOP	RQ-24
ADA4411-3ARQZ-REEL7	–40°C to +85°C	24-Lead QSOP	RQ-24
ADA4411-3ARQZ-REEL	–40°C to +85°C	24-Lead QSOP	RQ-24

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