19-0817; Rev 3; 7/07

EVALUATION KIT AVAILABLE

Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with DC-Coupled Input Buffers

General Description

The MAX9583/MAX9584/MAX9585 are small, low-power, multichannel video amplifiers with integrated reconstruction filters. Specially suited for standard-definition video signals, these devices are ideal for a wide range of television, set-top box, and portable applications.

The MAX9583/MAX9584/MAX9585 inputs can be directly connected to the outputs of a video digital-to-analog converter (DAC). The reconstruction filter typically has ±1dB passband flatness at 7MHz and 40dB attenuation at 27MHz. The amplifiers have a 2V/V gain and the outputs can be DC-coupled to a 75Ω load which is the equivalent of two video loads, or AC-coupled to a 150Ω load.

The MAX9583/MAX9584/MAX9585 operate from a 2.7V to 3.6V single supply and are specified over the -40°C to +125°C automotive temperature range. The MAX9583 is offered in a small, 6-pin thin SOT23 package. The MAX9584 is offered in a small, 8-pin µMAX® package, and the MAX9585 is offered in a small, 10-pin µMAX package.

Applications

Set-Top Boxes

Televisions

Portable

Pin Configurations and Selector Guide located at end of data sheet.

µMAX is a registered trademark of Maxim Integrated Products, Inc.

Features

- ♦ **Dual- (MAX9583), Triple- (MAX9584), and Quad- (MAX9585) Channel Devices**
- ♦ **7MHz, ±1dB Passband**
- ♦ **40dB Attenuation at 27MHz**
- ♦ **Fixed Gain of 2V/V**
- ♦ **Low Power: 3.5mA per Channel**
- ♦ **2.7V to 3.6V Single-Supply Operation**
- ♦ **Small SOT23 and µMAX Packages**

Ordering Information

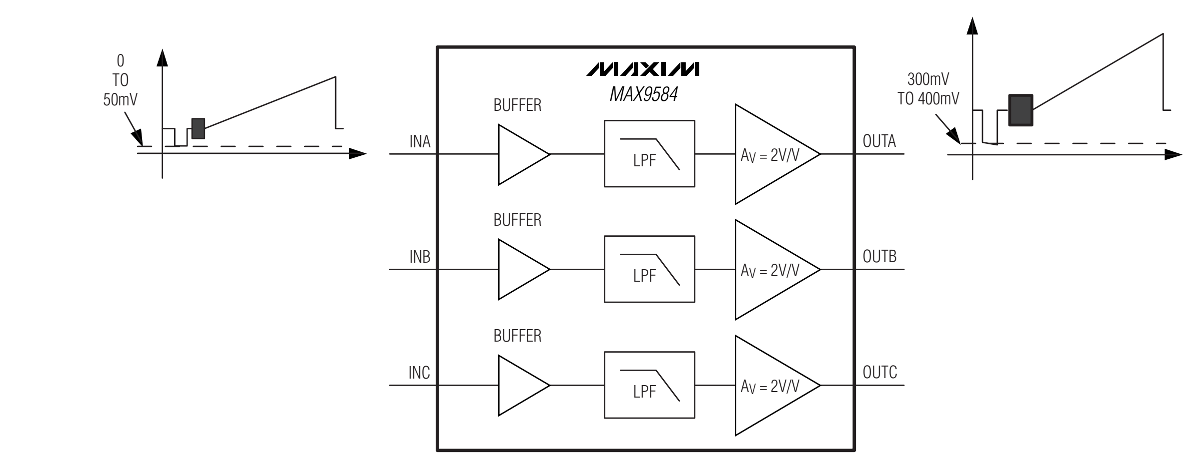
PART	PIN-PACKAGE	CHANNELS	PKG CODE
MAX9583AZT+T	6 Thin SOT23-6	2	Z6+1
MAX9584AUA+T	8 µMAX-8	3	U8+1
MAX9585AUB+T	10 µMAX-10	4	U10+2

Note: *All devices are specified over the -40°C to +125°C operating temperature range.*

+Denotes a lead-free package.

T = Tape and reel.

Block Diagrams



Block Diagrams continued at end of data sheet.

Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with DC-Coupled Input Buffers

ABSOLUTE MAXIMUM RATINGS

V_{DD} to GND ....-0.3V to +4V
IN_ to GND ....-0.3V to +4V
OUT_ Short-Circuit Duration to V_{DD}, GND ....Continuous
Continuous Input Current
IN_ ....±20mA
Continuous Power Dissipation (T_A = +70°C)
6-Pin Thin SOT23 (derate 9.1mW/°C above +70°C)....727mW
8-Pin µMAX (derate 4.5mW/°C above +70°C) 362mW
10-Pin µMAX (derate 5.6mW/°C above +70°C) 444mW
Operating Temperature Range ....-40°C to +125°C
Junction Temperature ....+150°C
Storage Temperature Range ....-65°C to +150°C
Lead Temperature (soldering, 10s) ....+300°C

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

(V_{DD} = 3.3V, GND = 0V, R_L = no load, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C) (Note 1)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Supply Voltage Range	V_{DD}	Guaranteed by PSRR		2.7		3.6	V
Supply Current	I_{DD}	Per channel			3.5	7	mA
Input Voltage Range	V_{IN}	Guaranteed by DC voltage gain	V_{DD} = 2.7V	0		1.05	V_{P-P}
			V_{DD} = 3V	0		1.2	
Input Current	I_{IN}	V_{IN} = 0V			0.6	10	µA
Input Resistance	R_{IN}				25		MΩ
DC Voltage Gain (Note 2)	Av	R_L = 150Ω to GND	V_{DD} = 2.7V, 0V ≤ V_{IN} ≤ 1.05V	1.96	2	2.04	V/V
			V_{DD} = 3V, 0V ≤ V_{IN} ≤ 1.2V	1.96	2	2.04	
DC Gain Matching		Guaranteed by DC voltage gain		-2	0	+2	%
Output Level		Measured at V_{OUT}, V_{IN} = 0V, R_L = 150Ω to GND		0.210	0.300	0.410	V
Output-Voltage Swing		Measured at output, V_{DD} = 2.7V, 0V ≤ V_{IN} ≤ 1.05V, R_L = 150Ω to -0.2V			2.1		V_{P-P}
		Measured at output, V_{DD} = 2.7V, 0V ≤ V_{IN} ≤ 1.05V, R_L = 150Ω to V_{DD}/2			2.1		
		Measured at output, V_{DD} = 3V, 0V ≤ V_{IN} ≤ 1. 2V, R_L = 150Ω to -0.2V			2.4		
		Measured at output, V_{DD} = 3V, 0V ≤ V_{IN} ≤ 1. 2V, R_L = 150Ω to V_{DD}/2			2.4		
		Measured at output, V_{DD} = 3.135V, 0V ≤ V_{IN} ≤ 1.05V, R_L = 75Ω to -0.2V			2.1		
Output Short-Circuit Current		Short to GND (sourcing)			140		mA
		Short to V_{DD} (sinking)			70		
Output Resistance	R_{OUT}	V_{OUT} = 1.5V, -10mA ≤ I_{LOAD} ≤ 10mA			0.2		Ω
Power-Supply Rejection Ratio	PSRR	2.7V ≤ V_{DD} ≤ 3.6V		48			dB
		f = 1MHz, 100mV_{P-P}			29		

ELECTRICAL CHARACTERISTICS (continued)

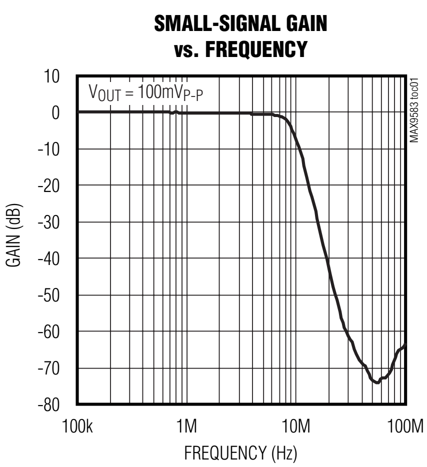
(V_{DD} = 3.3V, GND = 0V, R_L = no load, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C) (Note 1)

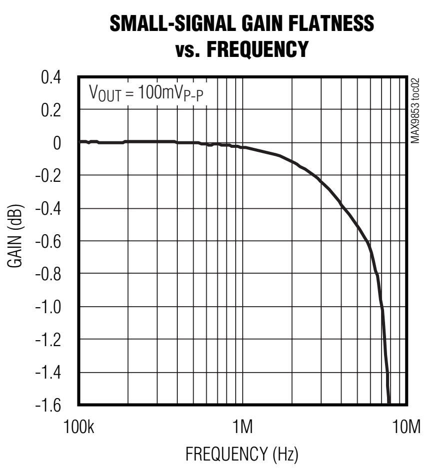
PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Standard-Definition Reconstruction Filter		±1dB passband flatness			7		MHz
		V_{IN} = $1V_{P-P}$, reference frequency is 100kHz	f = 5.5MHz		-0.5		dB
			f = 8.5MHz		-3		
			f = 27MHz		-40		
Differential Gain	DG	5-step modulated staircase of 129mV step size and 286mV peak-to-peak subcarrier amplitude, f = 4.43MHz			0.1		%
Differential Phase	DP	5-step modulated staircase of 129mV step size and 286mV peak-to-peak subcarrier amplitude, f = 4.43MHz			0.4		Degrees
2T Pulse-to-Bar K Rating		2T = 200ns, bar time is 18µs. The beginning 2.5% and the ending 2.5% of the bar time are ignored			0.6		K%
2T Pulse Response		2T = 200ns			0.2		K%
2T Bar Response		2T = 200ns, bar time is 18µs. The beginning 2.5% and the ending 2.5% of the bar time are ignored			0.2		K%
Nonlinearity		5-step staircase			0		%
Group Delay Distortion		100kHz ≤ f ≤ 5.5MHz, outputs are $2V_{P-P}$			9		ns
Peak Signal to RMS Noise		100kHz ≤ f ≤ 5.5MHz			71		dB
Output Impedance		f = 5.5MHz			4.8		Ω
All Hostile Crosstalk		f = 4.43MHz			-64		dB

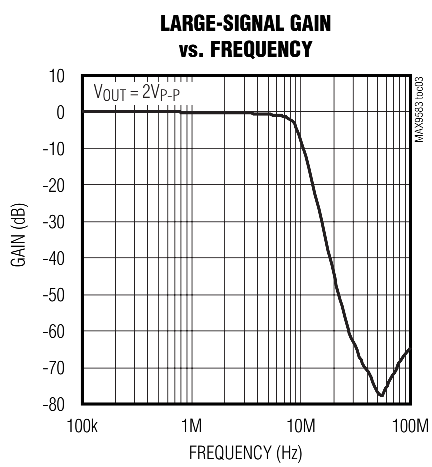
Note 1: All devices are 100% production tested at T_A = +25°C. Specifications over temperature limits are guaranteed by design.
Note 2: Voltage gain (A_V) is a two-point measurement in which the output voltage swing is divided by the input voltage swing.

Typical Operating Characteristics

(V_{DD} = $\overline{SHDN}$ = 3.3V, video outputs have R_L = 150Ω connected to GND, T_A = +25°C, unless otherwise noted.)





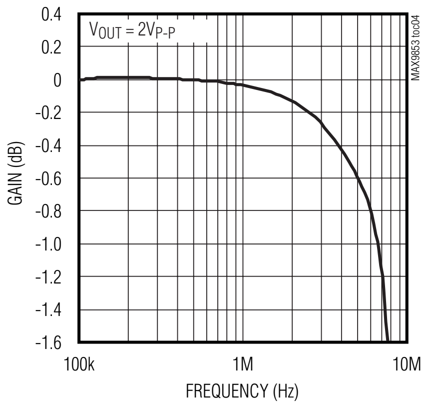


Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with DC-Coupled Input Buffers

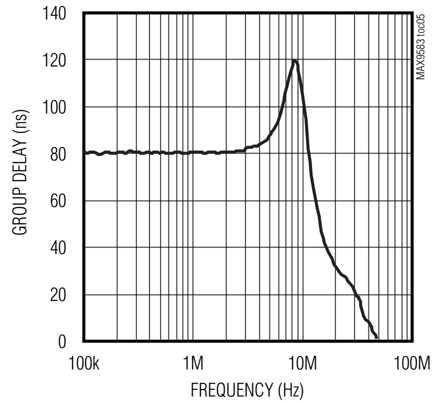
Typical Operating Characteristics (continued)

(V_{DD} = $\overline{SHDN}$ = 3.3V, video outputs have R_L = 150Ω connected to GND, T_A = +25°C, unless otherwise noted.)

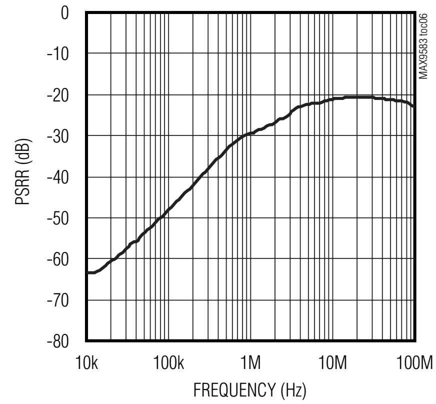
LARGE-SIGNAL GAIN FLATNESS vs. FREQUENCY



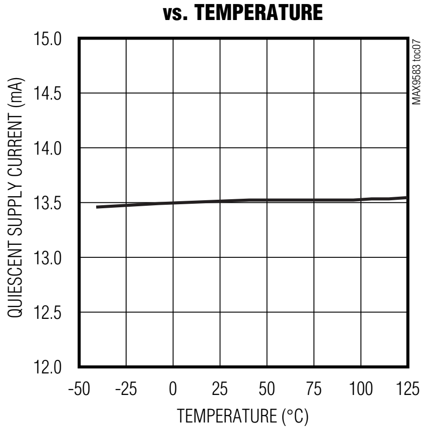
GROUP DELAY vs. FREQUENCY



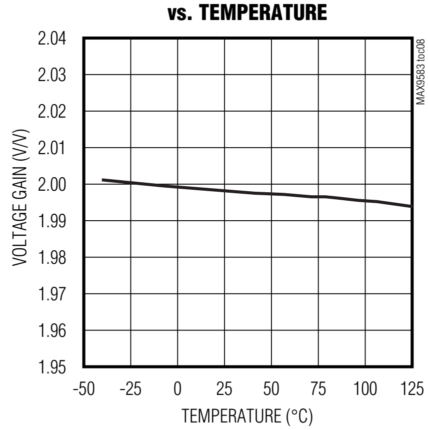
POWER-SUPPLY REJECTION RATIO vs. FREQUENCY



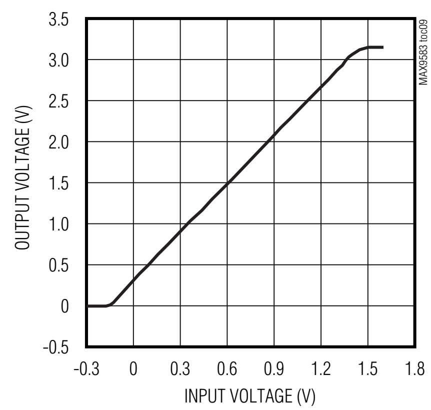
QUIESCENT SUPPLY CURRENT vs. TEMPERATURE



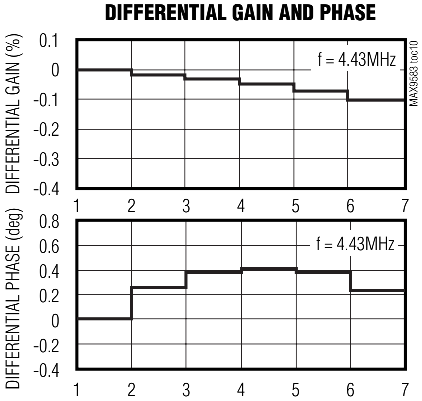
VOLTAGE GAIN vs. TEMPERATURE



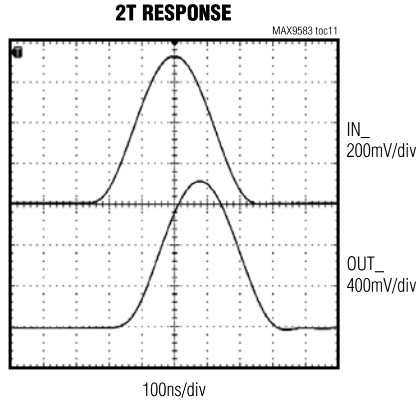
OUTPUT VOLTAGE vs. INPUT VOLTAGE



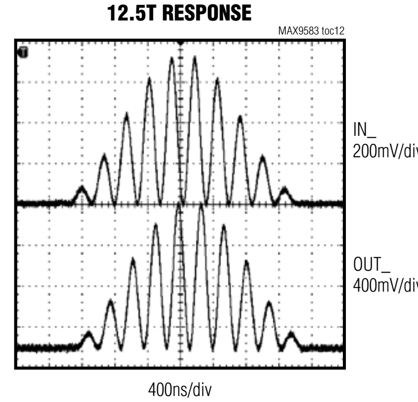
DIFFERENTIAL GAIN AND PHASE



2T RESPONSE



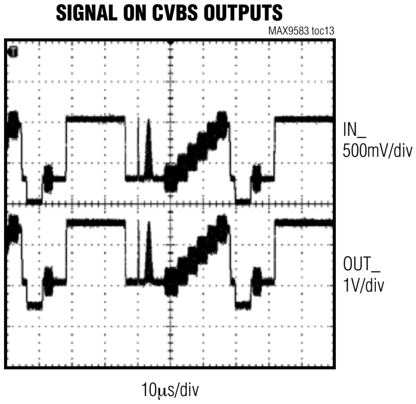
12.5T RESPONSE



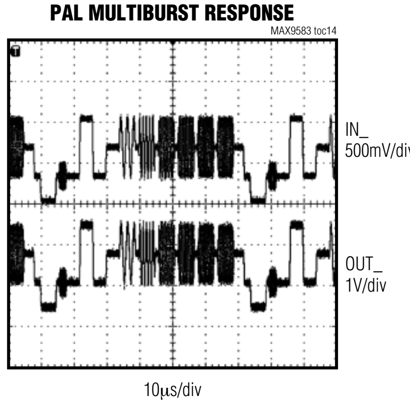
Typical Operating Characteristics (continued)

(V_{DD} = $\overline{SHDN}$ = 3.3V, video outputs have R_L = 150Ω connected to GND, T_A = +25°C, unless otherwise noted.)

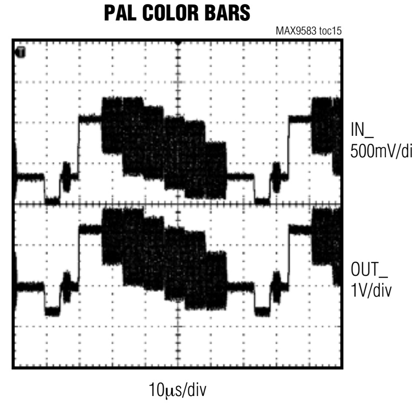
NTC-7 VIDEO TEST SIGNAL ON CVBS OUTPUTS



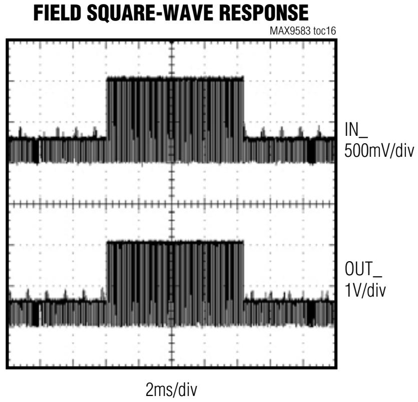
PAL MULTIBURST RESPONSE



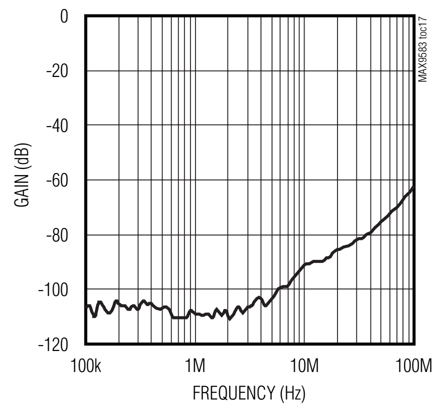
PAL COLOR BARS



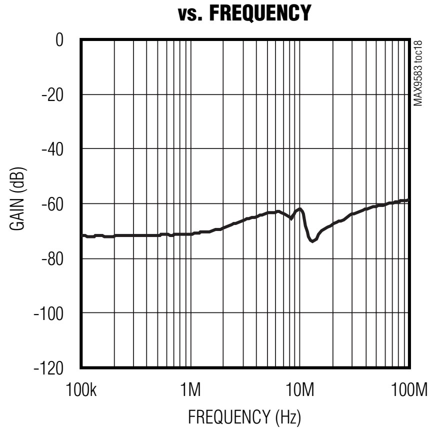
FIELD SQUARE-WAVE RESPONSE



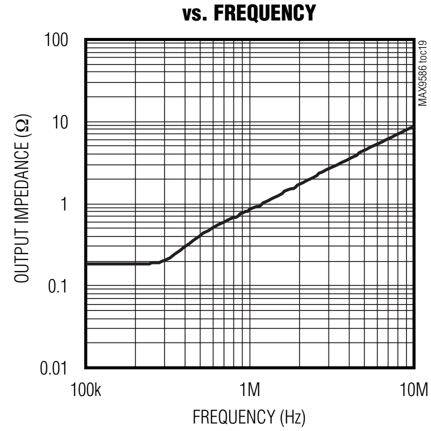
INPUT-TO-INPUT CROSSTALK vs. FREQUENCY



OUTPUT-TO-OUTPUT CROSSTALK vs. FREQUENCY



OUTPUT IMPEDANCE vs. FREQUENCY

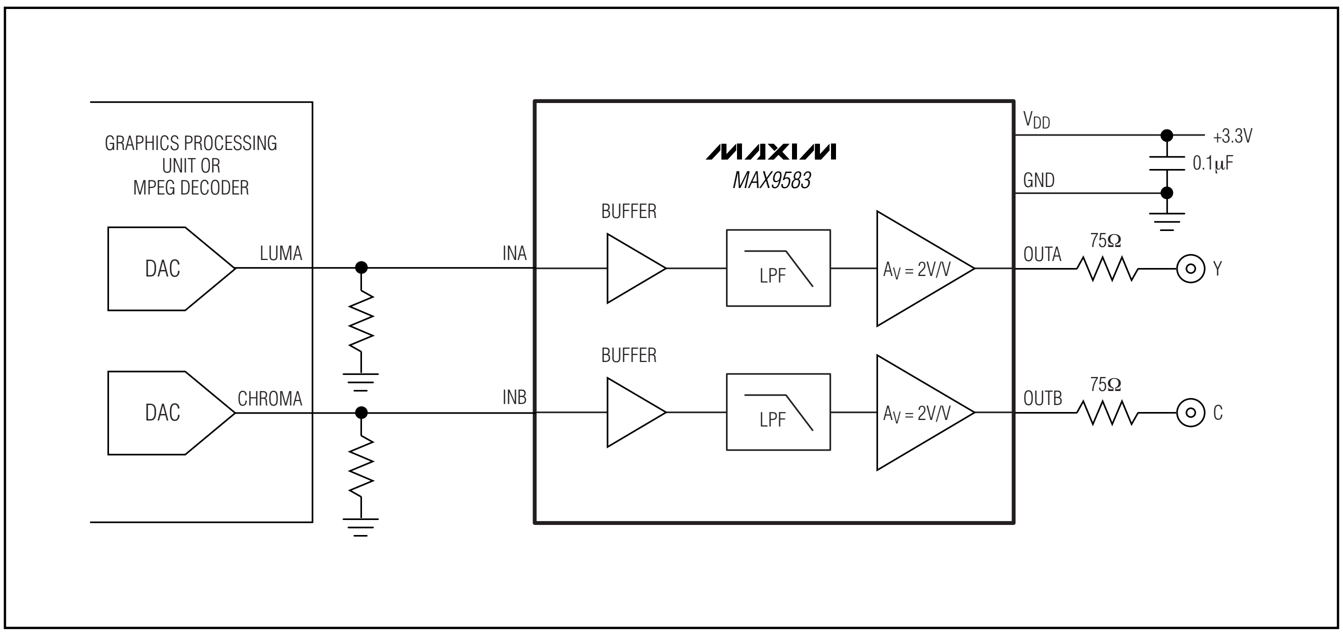


Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with DC-Coupled Input Buffers

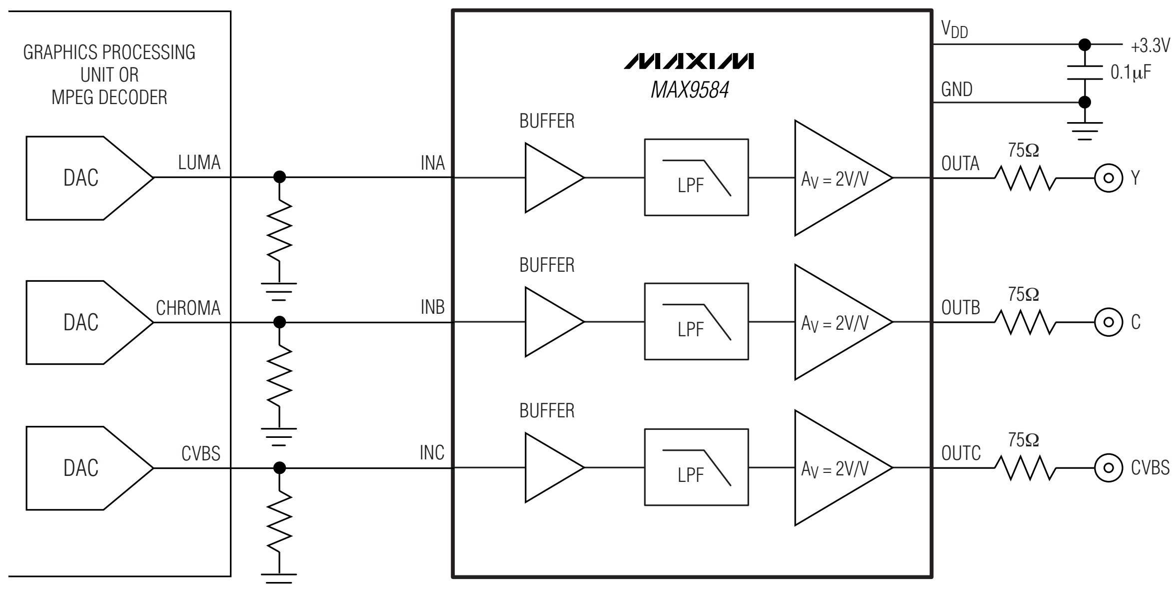
Pin Description

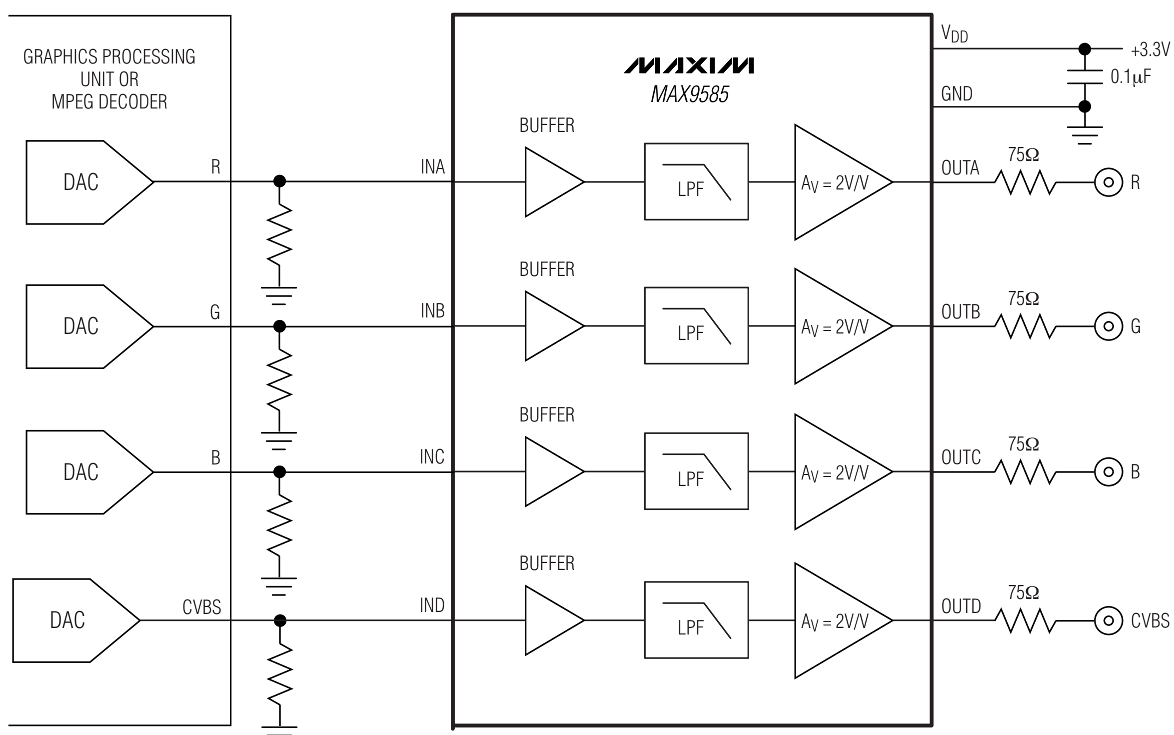
MAX9583 6 SOT23	MAX9584 8 µMAX	MAX9585 10 µMAX	NAME	FUNCTION
2	4	5	GND	Ground
3	1	1	INA	Video Input A
1	2	2	INB	Video Input B
—	3	3	INC	Video Input C
—	—	4	IND	Video Input D
4	7	9	OUTA	Video Output A
6	6	8	OUTB	Video Output B
—	5	7	OUTC	Video Output C
—	—	6	OUTD	Video Output D
5	8	10	V_{DD}	Positive Power Supply. Bypass to GND with a 0.1µF capacitor.

Typical Application Circuits



Typical Application Circuits (continued)





Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with DC-Coupled Input Buffers

Detailed Description

The MAX9583/MAX9584/MAX9585 filter and amplify the video DAC output in applications such as set-top boxes and televisions. These devices consist of input buffers, lowpass filters, and gain of 2V/V output amplifiers capable of driving a standard 150Ω video load to ground.

Inputs

The video inputs should be directly connected to the output of the video current DAC. DC coupling ensures that the input signals are ground referenced so that the sync tip of composite or luma signals is within 50mV of ground and the blank level of the chroma signal is between 0.5V and 0.65V. Since the input buffers are identical, any standard-definition video signal can be applied to those inputs provided the signal is between ground and 1.05V when V_{DD} = 2.7V. For example, three composite video signals could be applied to INA, INB, and INC of the MAX9584. The RGB set or the YPbPr set can also be inputs to INA, INB, and INC of the MAX9584.

Video Filter

The filter passband (±1dB) is typically 7MHz, which makes the device suitable for standard-definition video signals from all sources (e.g., broadcast and DVD). Broadcast video signals are channel limited: NTSC signals have 4.2MHz bandwidth and PAL signals have 5MHz bandwidth. Video signals from a DVD player, however, are not channel limited, so the bandwidth of DVD video signals can approach the Nyquist limit of 6.75MHz. (Recommendation ITU-R BT.601-5 specifies 13.5MHz as the sampling rate for standard-definition video). Therefore, the maximum bandwidth of the signal is 6.75MHz. To ease the filtering requirements, most modern video systems oversample by two times, clocking the video current DAC at 27MHz.

Outputs

The video output amplifiers can both source and sink load current, allowing output loads to be DC- or AC-coupled. The amplifier output stage needs approximately 300mV of headroom from either supply rail. The devices have an internal level-shift circuit that positions the sync tip at approximately 300mV at the output. The blank level of the chroma output is positioned at approximately 1.3V if the blank level of the chroma input signal is 0.5V. The blank level of the chroma output is positioned at approximately 1.5V if the blank level of the chroma input signal is 0.6V.

If the supply voltage is greater than 3.135V (5% below a 3.3V supply), each amplifier can drive two DC-coupled video loads to ground. If the supply is less than 3.135V, each amplifier can drive only one DC-coupled or AC-coupled video load.

Applications Information

Reducing Power Consumption in the Video DACs

The MAX9583/MAX9584/MAX9585 have high-impedance input buffers that work with source resistances as high as 300Ω. To reduce power dissipation in the video DACs, the DAC output resistor can be scaled up in value. The reference resistor that sets the reference current inside the video DACs must also be similarly scaled up. For instance, if the output resistor is 37.5Ω, the DAC must source 26.7mA when the output is 1V. If the output resistor is increased to 300Ω, then the DAC only needs to source 3.33mA when the output is 1V.

There is parasitic capacitance from the DAC output to ground. That capacitance, in parallel with the DAC output resistor, forms a pole that can potentially roll off the frequency response of the video signal. For example, 300Ω in parallel with 50pF create a pole at 10.6MHz. To minimize this capacitance, reduce the area of the signal trace attached to the DAC output as much as possible, and place the MAX9583/MAX9584/MAX9585 as close as possible to the video DAC outputs.

AC-Coupling the Outputs

The outputs can be AC-coupled since the output stage can source and sink current as shown in Figure 1. Coupling capacitors should be 220µF or greater to keep the highpass filter, formed by the 150Ω equivalent resistance of the video transmission line, to a corner frequency of 4.8Hz or below. The frame rate of PAL systems is 25Hz, and the frame rate of NTSC systems is 30Hz. The corner frequency should be well below the frame rate.

Power-Supply Bypassing and Ground

The MAX9583/MAX9584/MAX9585 operate from a single-supply voltage down to 2.7V, allowing for low-power operation. Bypass V_{DD} to GND with a 0.1µF capacitor. Place all external components as close as possible to the device.

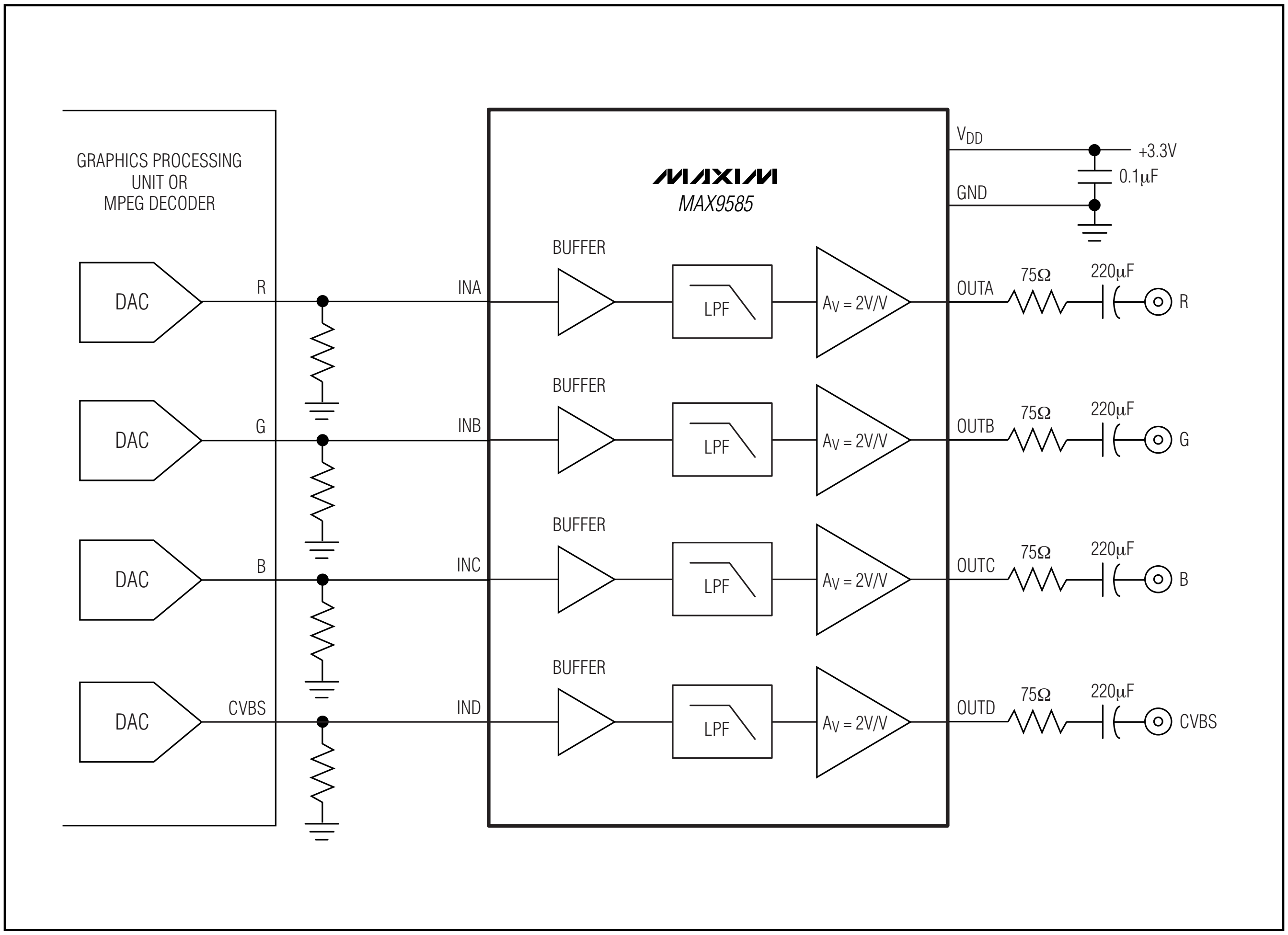
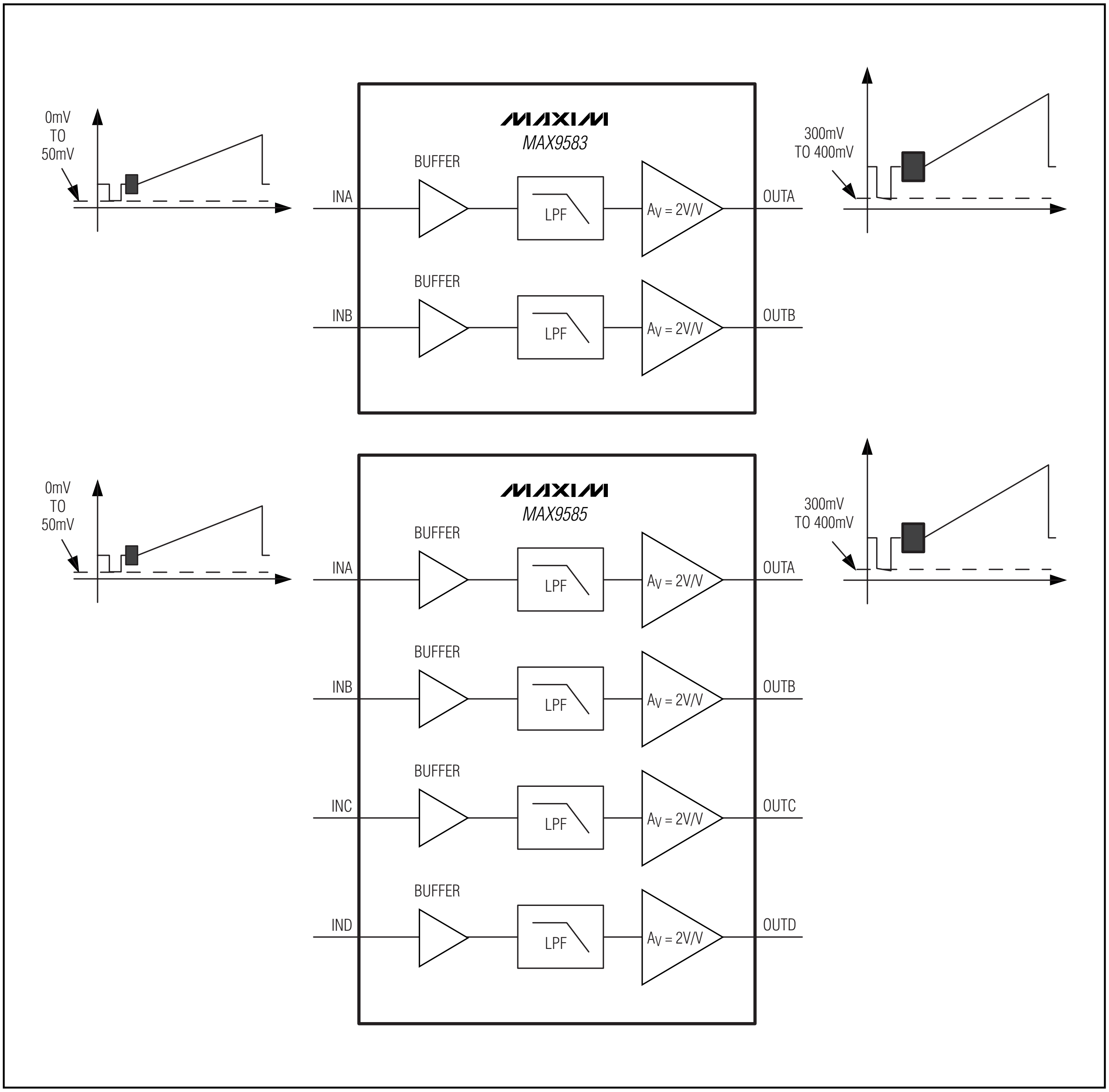


Figure 1. AC-Coupled Outputs

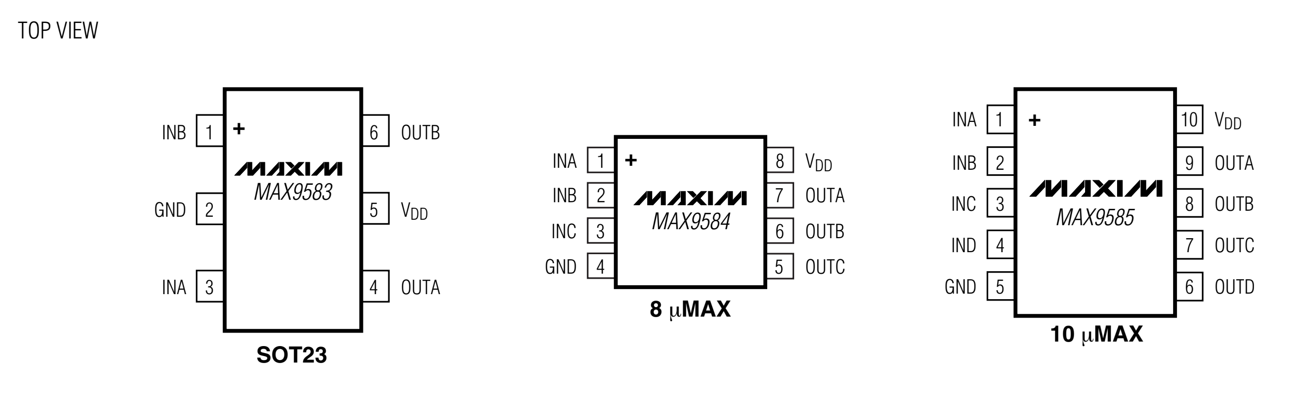
Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with DC-Coupled Input Buffers

Block Diagrams (continued)



Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with DC-Coupled Input Buffers

Pin Configurations



Selector Guide

PART	PIN-PACKAGE	PACKAGE SIZE	CHANNELS	TOP MARK	PKG CODE
MAX9583AZT+	6 Thin SOT23-6	2.9mm x 1.6mm	2	AADJ	Z6+1
MAX9584AUA+	8 µMAX-8	3mm x 3mm	3	—	U8+1
MAX9585AUB+	10 µMAX-10	3mm x 3mm	4	—	U10+2

Note: *All devices are specified over the -40°C to +125°C operating temperature range.*
+Denotes a lead-free package.

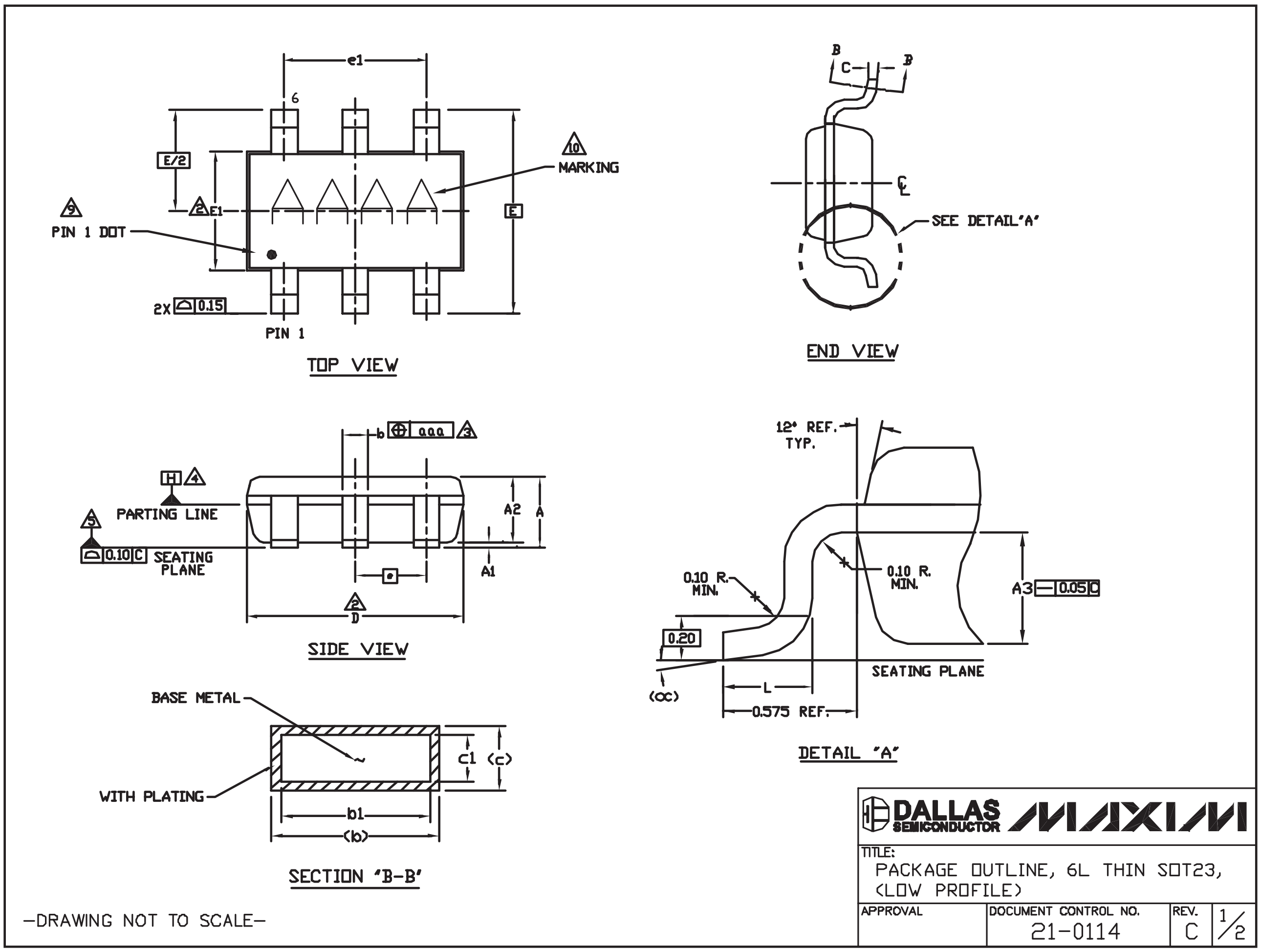
Chip Information

PROCESS: BiCMOS

Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with DC-Coupled Input Buffers

Package Information

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)



6L THIN SOT23.EPS

Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. "D" AND "E1" ARE REFERENCE DATUM AND DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS, AND ARE MEASURED AT THE BOTTOM PARTING LINE. MOLD FLASH OR PROTRUSION SHALL NOT EXCEED 0.15mm ON "D" AND 0.25mm ON "E" PER SIDE.
3. THE LEAD WIDTH DIMENSION DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.07mm TOTAL IN EXCESS OF THE LEAD WIDTH DIMENSION AT MAXIMUM MATERIAL CONDITION.
4. DATUM PLANE "H" LOCATED AT MOLD PARTING LINE AND COINCIDENT WITH LEAD, WHERE LEAD EXITS PLASTIC BODY AT THE BOTTOM OF PARTING LINE.
5. THE LEAD TIPS MUST LINE WITHIN A SPECIFIED TOLERANCE ZONE. THIS TOLERANCE ZONE IS DEFINED BY TWO PARALLEL LINES. ONE PLANE IS THE SEATING PLANE, DATUM [-C-]; AND THE OTHER PLANE IS AT THE SPECIFIED DISTANCE FROM [-C-] IN THE DIRECTION INDICATED. FORMED LEADS SHALL BE PLANAR WITH RESPECT TO ONE ANOTHER WITH 0.10mm AT SEATING PLANE.
6. THIS PART IS COMPLIANT WITH JEDEC SPECIFICATION MO-193 EXCEPT FOR THE "e" DIMENSION WHICH IS 0.95mm INSTEAD OF 1.00mm. THIS PART IS IN FULL COMPLIANCE TO EIAJ SPECIFICATION SC-74.
7. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS. COPLANARITY SHALL NOT EXCEED 0.08mm.
8. WARPAGE SHALL NOT EXCEED 0.10mm.
9. THE TERMINAL #1 IDENTIFIER AND TERMINAL NUMBERING CONVENTION SHALL CONFORM TO JESD 95-1 PP-012. DETAILS OF TERMINAL #1 IDENTIFIER ARE OPTIONAL. THE TERMINAL #1 IDENTIFIER MAY BE EITHER A MOLD OR MARKED FEATURE.
10. MARKING IS FOR PACKAGE ORIENTATION REFERENCE ONLY.
11. ALL DIMENSIONS APPLY TO BOTH LEADED (-) AND LEAD FREE (+) PACKAGE CODES.

SYMBOLS	MIN	NOM	MAX
A	-	-	1.10
A1	0.00	0.075	0.10
A2	0.85	0.88	0.90
A3	0.50 BSC		
b	0.30	-	0.45
b1	0.25	0.35	0.40
c	0.15	-	0.20
c1	0.12	0.127	0.15
D	2.80	2.90	3.00
E	2.75 BSC		
E1	1.55	1.60	1.65
L	0.30	0.40	0.50
e1	1.90 BSC		
e	0.95 BSC		
α	0°	4°	8°
aaa	0.20		

Pkg. codes: Z6-1; Z6-2

DALLAS SEMICONDUCTOR MAXIM

TITLE: PACKAGE OUTLINE, 6L THIN SOT23, (LOW PROFILE)

APPROVAL	DOCUMENT CONTROL NO.	REV.	
	21-0114	C	2/2

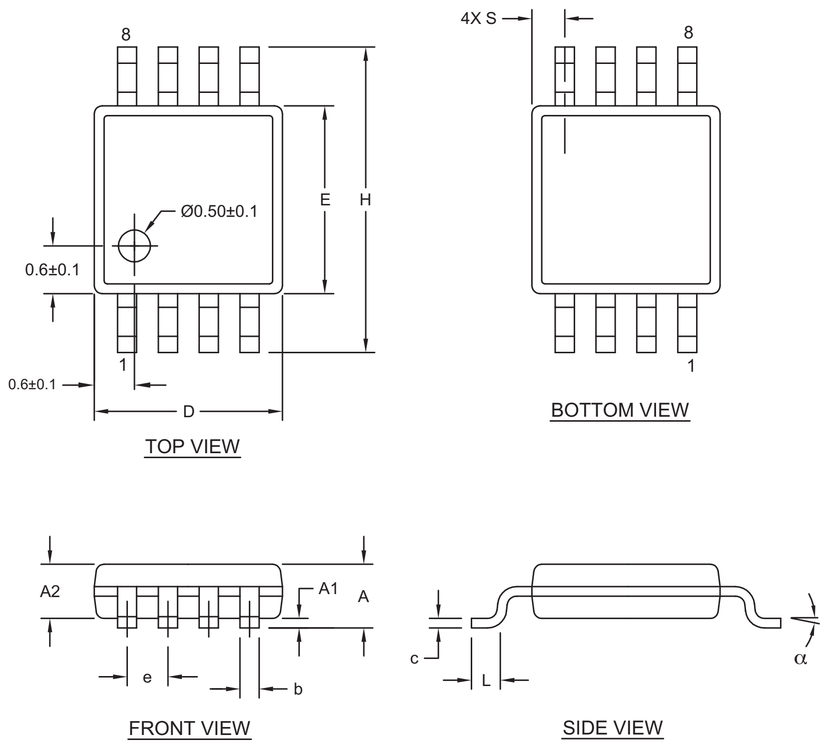
-DRAWING NOT TO SCALE-

Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with DC-Coupled Input Buffers

Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)

8LUMAXD.EPS



	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	-	0.043	-	1.10
A1	0.002	0.006	0.05	0.15
A2	0.030	0.037	0.75	0.95
b	0.010	0.014	0.25	0.36
c	0.005	0.007	0.13	0.18
D	0.116	0.120	2.95	3.05
e	0.0256 BSC		0.65 BSC	
E	0.116	0.120	2.95	3.05
H	0.188	0.198	4.78	5.03
L	0.016	0.026	0.41	0.66
α	0°	6°	0°	6°
S	0.0207 BSC		0.5250 BSC	

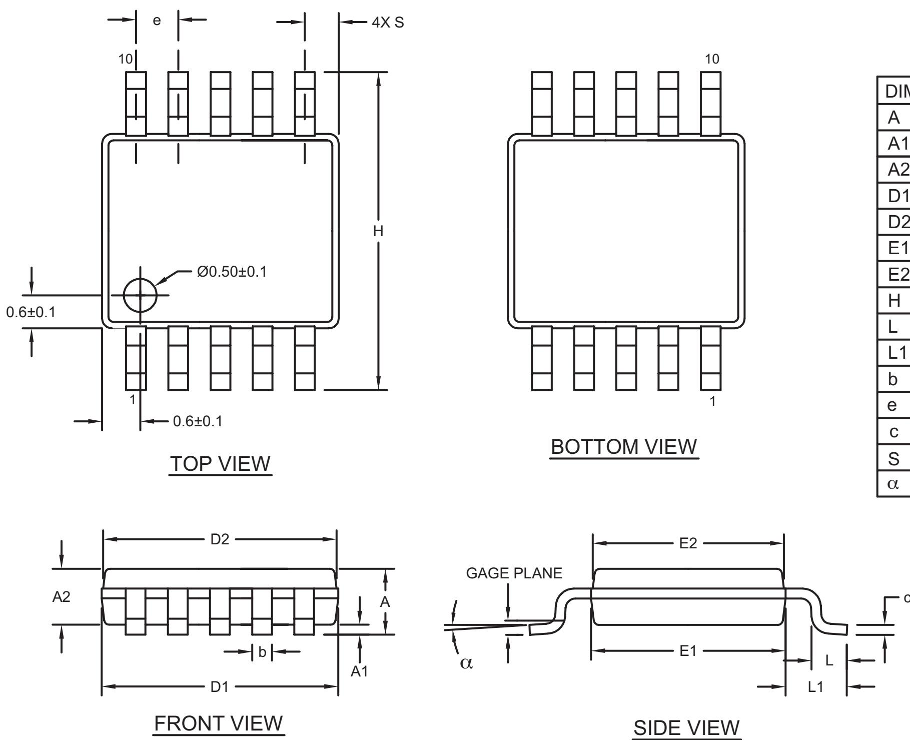
NOTES:
1. D&E DO NOT INCLUDE MOLD FLASH.
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED 0.15MM (.006").
3. CONTROLLING DIMENSION: MILLIMETERS.
4. MEETS JEDEC MO-187C-AA.

DALLAS SEMICONDUCTOR MAXIM
PROPRIETARY INFORMATION
TITLE:
PACKAGE OUTLINE, 8L uMAX/uSOP

APPROVAL	DOCUMENT CONTROL NO.	REV.	
	21-0036	J	1/1

Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)



10LUMAX.EPS

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	-	0.043	-	1.10
A1	0.002	0.006	0.05	0.15
A2	0.030	0.037	0.75	0.95
D1	0.116	0.120	2.95	3.05
D2	0.114	0.118	2.89	3.00
E1	0.116	0.120	2.95	3.05
E2	0.114	0.118	2.89	3.00
H	0.187	0.199	4.75	5.05
L	0.0157	0.0275	0.40	0.70
L1	0.037 REF		0.940 REF	
b	0.007	0.0106	0.177	0.270
e	0.0197 BSC		0.500 BSC	
c	0.0035	0.0078	0.090	0.200
S	0.0196 REF		0.498 REF	
α	0°	6°	0°	6°

NOTES:
1. D&E DO NOT INCLUDE MOLD FLASH.
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED 0.15mm (.006").
3. CONTROLLING DIMENSION: MILLIMETERS.
4. MEETS JEDEC MO-187C-BA.

DALLAS SEMICONDUCTOR MAXIM
PROPRIETARY INFORMATION
TITLE:
PACKAGE OUTLINE, 10L uMAX/uSOP

APPROVAL	DOCUMENT CONTROL NO.	REV.	
	21-0061	I	1/1

Revision History

Pages changed at Rev 1: 1, 2, 20

Pages changed at Rev 2: 1, 2, 6, 11–15 (deleted some package outlines)

Pages changed at Rev 3: 1, 15