

EVALUATION KIT  
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# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-Coupled Input Buffers

## General Description

The MAX9586–MAX9589 are small, low-power, multi-channel video amplifiers with integrated reconstruction filters and input clamps. Specially suited for standard-definition video signals, these devices are ideal for a wide range of television and set-top box applications.

The video signals from the outputs of a digital-to-analog converter (DAC) are AC-coupled to the inputs of the MAX9586–MAX9589. External video signals, in which the DC bias is usually not known, can also be AC-coupled to the inputs of the MAX9586–MAX9589. The input sync-tip clamps set the DC level of composite video or luma signals, and the input bias circuits set the DC level of chroma signals.

The reconstruction filter typically has  $\pm 1$ dB passband flatness at 7MHz and 40dB attenuation at 27MHz. The amplifiers have 2V/V gain and the outputs can be DC-coupled to a 75 $\Omega$  load, which is the equivalent of two video loads, or AC-coupled to a 150 $\Omega$  load.

The MAX9586–MAX9589 operate from a 2.7V to 3.6V single supply and are specified over the  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  automotive temperature range. The MAX9586–MAX9589 are offered in small SOT23 and  $\mu\text{MAX}^{\circledR}$  packages.

## Applications

Set-Top Boxes

Televisions

$\mu\text{MAX}$  is a registered trademark of Maxim Integrated Products, Inc.

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

## Features

- ◆ Single- (MAX9586), Dual- (MAX9587), Triple- (MAX9588), and Quad- (MAX9589) Channel Devices
- ◆ 7MHz,  $\pm 1$ dB Passband
- ◆ 40dB Attenuation at 27MHz
- ◆ Fixed Gain of 2V/V
- ◆ Low Power: 4.25mA per Channel
- ◆ 2.7V to 3.6V Single-Supply Operation
- ◆ Small SOT23 and  $\mu\text{MAX}$  Packages

## Ordering Information

PART	PIN-PACKAGE	CHANNELS	PKG CODE
MAX9586AZK+T	5 Thin SOT23-5	1	Z5-1
MAX9586ATT+T*	6 TDFN-EP**	1	T633-2
MAX9587AZT+T*	6 Thin SOT23-6	2	Z6-1
MAX9587ALT+T*	6 $\mu\text{DFN}$ -6	2	L622-1
MAX9588AUA+T*	8 $\mu\text{MAX}$ -8	3	U8-1
MAX9588ALA+T*	8 $\mu\text{DFN}$ -8	3	L822-1
MAX9589AUB+T	10 $\mu\text{MAX}$ -10	4	U10-2
MAX9589ATC+T*	12 TQFN-EP**	4	T1233-4

**Note:** All devices are specified over the  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  operating temperature range.

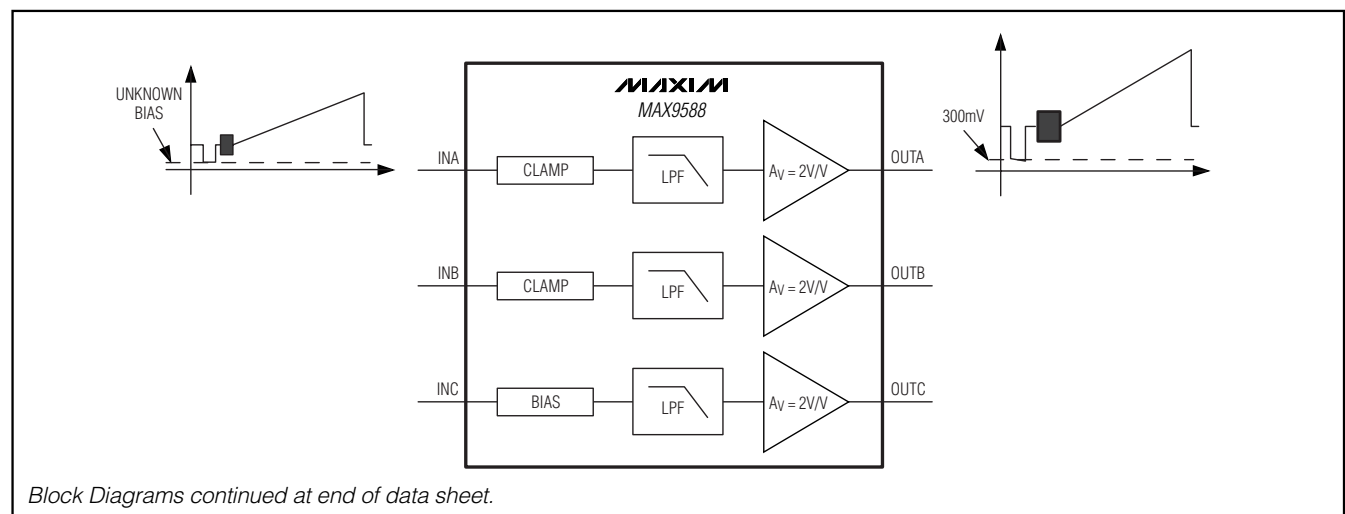
+ Denotes a lead-free package.

T = Tape and reel.

\* Future product—contact factory for availability.

\*\* EP = Exposed paddle.

## Block Diagrams



# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-Coupled Input Buffers

## ABSOLUTE MAXIMUM RATINGS

V <sub>DD</sub> to GND .....	-0.3V to +4V	6-Pin µDFN (derate 4.5mW/°C above +70°C) .....	358mW
IN <sub>-</sub> to GND .....	-0.3V to +4V	8-Pin µDFN (derate 4.8mW/°C above +70°C) .....	380.6mW
SHDN to GND .....	-0.3V to +4V	8-Pin µMAX (derate 4.5mW/°C above +70°C) .....	362mW
OUT <sub>-</sub> Short Circuit Duration to V <sub>DD</sub> , GND .....	Continuous	10-Pin µMAX (derate 5.6mW/°C above +70°C) .....	444mW
Continuous Input Current		12-Pin 3mm x 3mm TQFN (derate 14.7mW/°C above +70°C) .....	1177mW
IN <sub>-</sub> , SHDN .....	±20mA	Operating Temperature Range .....	-40°C to +125°C
Continuous Power Dissipation (T <sub>A</sub> = +70°C)		Junction Temperature .....	+150°C
5-Pin Thin SOT23 (derate 9.1mW/°C above +70°C) .....	727mW	Storage Temperature Range .....	-65°C to +150°C
6-Pin TDFN (derate 18.2mW/°C above +70°C) .....	1455mW	Lead Temperature (soldering, 10s) .....	+300°C
6-Pin Thin SOT23 (derate 9.1mW/°C above +70°C) .....	727mW		

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<sub>DD</sub> = 3.3V, GND = 0V, V<sub>RL</sub> = no load, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise noted. Typical values are at T<sub>A</sub> = +25°C.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Supply Voltage Range	V <sub>DD</sub>	Guaranteed by PSRR		2.7		3.6	V
Supply Current	I <sub>DD</sub>	Per channel			4.25	8	mA
Sync-Tip Clamp Level	V <sub>CCLP</sub>	Sync-tip clamp		0.24		0.41	V
Input Voltage Range	V <sub>IN</sub>	Guaranteed by DC voltage gain	V <sub>DD</sub> = 2.7V, sync-tip clamp input			1.05	V <sub>P-P</sub>
			V <sub>DD</sub> = 2.7V, bias input			1.05	
			V <sub>DD</sub> = 3V, sync-tip clamp input			1.2	
			V <sub>DD</sub> = 3V, bias input			1.2	
Sync Crush		Sync-tip clamp, percentage reduction in sync pulse (0.3V <sub>P-P</sub> ), guaranteed by input clamping current measurement, measured at input				2	%
Input Clamping Current		Sync-tip clamp			1	2	µA
Maximum Input Source Resistance					300		Ω
Bias Voltage	V <sub>BIAS</sub>	Bias circuit		0.40	0.50	0.62	V
Input Resistance		Bias circuit			11		kΩ
DC Voltage Gain (Note 2)	A <sub>V</sub>	R <sub>L</sub> = 150Ω to GND	V <sub>DD</sub> = 2.7V, V <sub>IN</sub> = V <sub>CCLP</sub> to (V <sub>CCLP</sub> + 1.05V)	1.95	2.00	2.04	V/V
			V <sub>DD</sub> = 3V, V <sub>IN</sub> = V <sub>CCLP</sub> to (V <sub>CCLP</sub> + 1.2V)	1.95	2.00	2.04	
			V <sub>DD</sub> = 2.7V, V <sub>IN</sub> = V <sub>BIAS</sub> ±0.525V	1.95	2.00	2.04	
			V <sub>DD</sub> = 3V, V <sub>IN</sub> = V <sub>BIAS</sub> ±0.600V	1.95	2.00	2.04	
DC Gain Matching		Guaranteed by DC voltage gain		-2	0	+2	%
Output Level		Measured at V <sub>OUT</sub> , IN <sub>-</sub> = 0.1µF to GND, R <sub>L</sub> = 150Ω to GND	Sync-tip clamp	0.2	0.3	0.4	V
			Bias circuit		1.3		

# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-Coupled Input Buffers

## ELECTRICAL CHARACTERISTICS (continued)

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

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	
Output-Voltage Swing		Sync-tip clamp	Measured at output, $V_{DD} = 2.7V$ , $V_{IN} = V_{CLP}$ to $(V_{CLP} + 1.05V)$ , $R_L = 150\Omega$ to $-0.2V$		2.1		VP-P
			Measured at output, $V_{DD} = 2.7V$ , $V_{IN} = V_{CLP}$ to $(V_{CLP} + 1.05V)$ , $R_L = 150\Omega$ to $V_{DD}/2$		2.1		
			Measured at output, $V_{DD} = 3V$ , $V_{IN} = V_{CLP}$ to $(V_{CLP} + 1.2V)$ , $R_L = 150\Omega$ to $-0.2V$		2.4		
			Measured at output, $V_{DD} = 3V$ , $V_{IN} = V_{CLP}$ to $(V_{CLP} + 1.2V)$ , $R_L = 150\Omega$ to $V_{DD}/2$		2.4		
			Measured at output, $V_{DD} = 3.135V$ , $V_{IN} = V_{CLP}$ to $(V_{CLP} + 1.05V)$ , $R_L = 75\Omega$ to $-0.2V$		2.1		
		Bias Circuit	Measured at output, $V_{DD} = 2.7V$ , $V_{IN} = V_{BIAS} \pm 0.525V$ , $R_L = 150\Omega$ to $-0.2V$		2.1		
			Measured at output, $V_{DD} = 2.7V$ , $V_{IN} = V_{BIAS} \pm 0.500V$ , $R_L = 150\Omega$ to $V_{DD}/2$		2.0		
			Measured at output, $V_{DD} = 3V$ , $V_{IN} = V_{BIAS} \pm 0.600V$ , $R_L = 150\Omega$ to $-0.2V$		2.4		
			Measured at output, $V_{DD} = 3V$ , $V_{IN} = V_{BIAS} \pm 0.500V$ , $R_L = 150\Omega$ to $V_{DD}/2$		2.0		
			Measured at output, $V_{DD} = 3.135V$ , $V_{IN} = V_{BIAS} \pm 0.525V$ , $R_L = 75\Omega$ to $-0.2V$		2.1		
Output Short-Circuit Current		Short to GND (sourcing)		140		mA	
		Short to $V_{DD}$ (sinking)		70			
Output Resistance	$R_{OUT}$	$V_{OUT} = 1.5V$ , $-10mA \leq I_{LOAD} \leq +10mA$		0.2		$\Omega$	

# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-Coupled Input Buffers

## ELECTRICAL CHARACTERISTICS (continued)

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

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS		
Power-Supply Rejection Ratio		$2.7V \leq V_{DD} \leq 3.6V$	48			dB		
		$f = 1MHz$ , $100mV_{P-P}$	29					
Standard-Definition Reconstruction Filter		$\pm 1dB$ passband flatness	7			MHz		
		$V_{OUT\_} = 2V_{P-P}$ , 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 18 $\mu s$ ; 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 18 $\mu s$ ; 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		$100kHz \leq f \leq 5.5MHz$ , outputs are $2V_{P-P}$	9			ns		
Peak Signal to RMS Noise		$100kHz \leq f \leq 5.5MHz$	71			dB		
Output Impedance		$f = 5.5MHz$	4.8			$\Omega$		
All-Hostile Crosstalk		$f = 4.43MHz$	-64			dB		

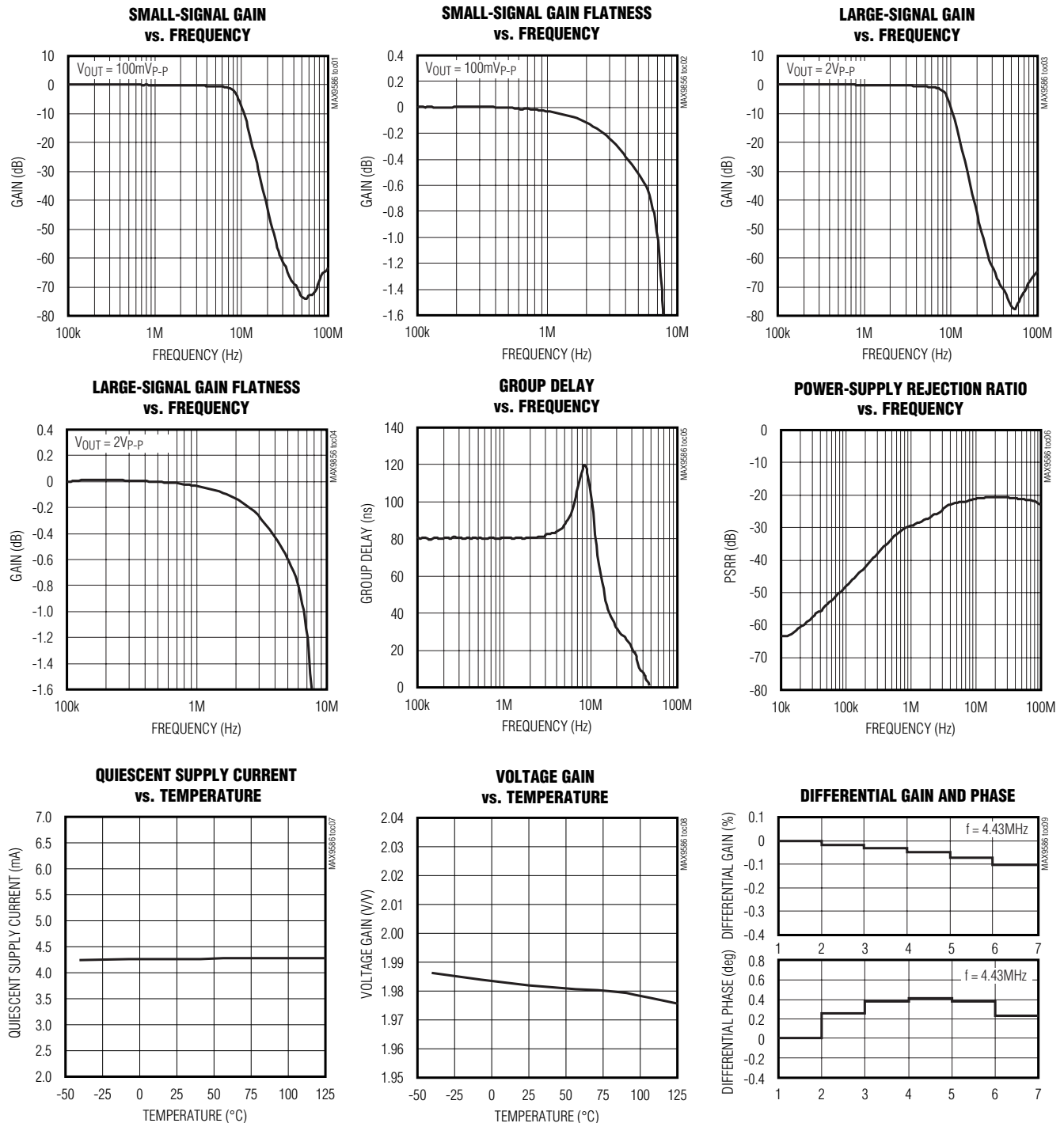
**Note 1:** All devices are 100% production tested at  $T_A = +25^\circ C$ . Specifications over temperature limits are guaranteed by design.

**Note 2:** Voltage gain ( $A_V$ ) is a two-point measurement in which the output-voltage swing is divided by the input-voltage swing.

# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-Coupled Input Buffers

## Typical Operating Characteristics

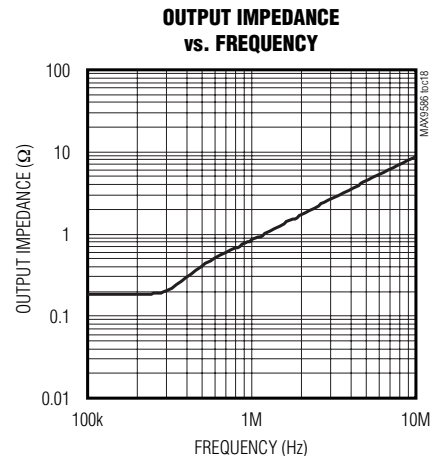
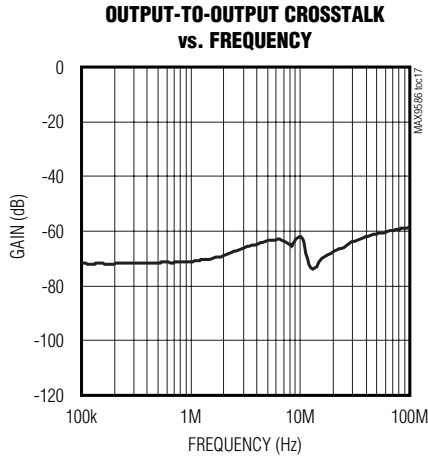
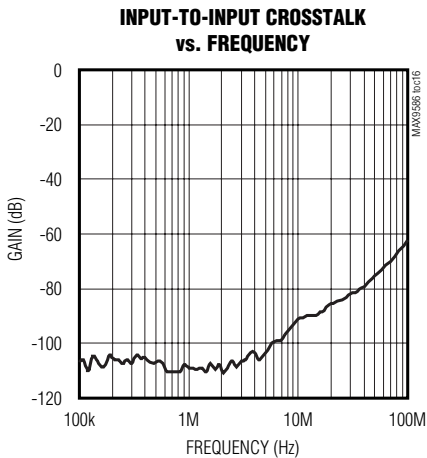
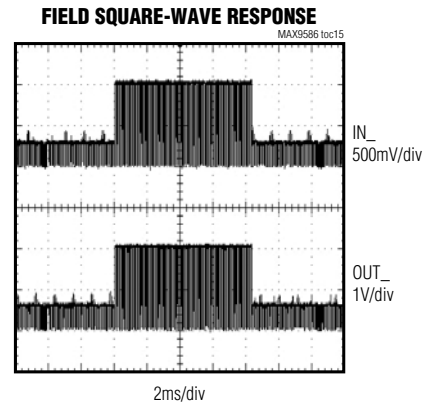
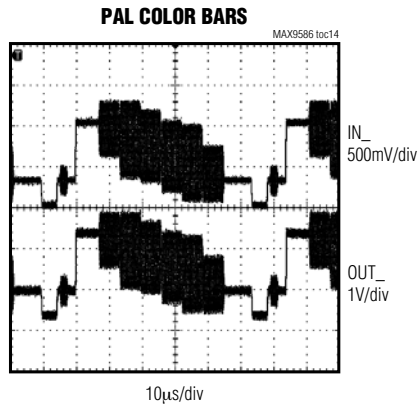
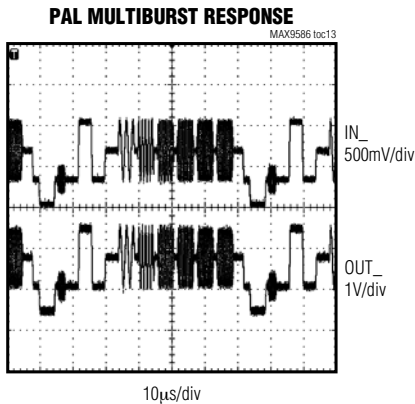
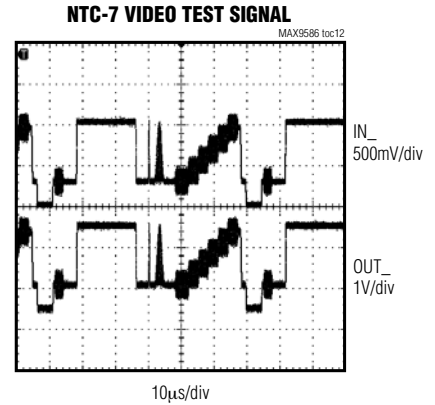
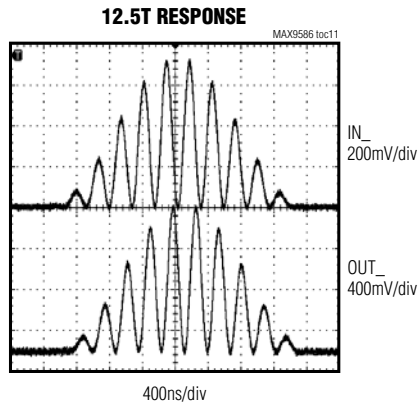
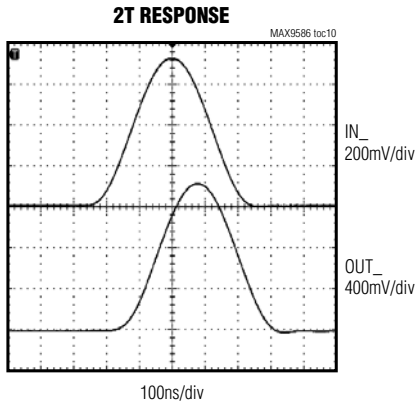
( $V_{DD} = \overline{SHDN} = +3.3V$ , video outputs have  $R_L = 150\Omega$  connected to GND,  $T_A = +25^\circ C$ , unless otherwise noted.)



# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-Coupled Input Buffers

## Typical Operating Characteristics (continued)

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



# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-Coupled Input Buffers

## Pin Description

PIN								NAME	FUNCTION
MAX9586		MAX9587		MAX9588		MAX9589			
5 SOT23	6 TDFN	6 SOT23	6 $\mu$ DFN	8 $\mu$ MAX	8 $\mu$ DFN	10 $\mu$ MAX	12 TQFN		
1	3	—	—	—	—	—	—	$\overline{\text{SHDN}}$	Active-Low Shutdown Input. Connect to GND to shut down.
2	1	2	2	4	4	5	7	GND	Ground
3	2	—	—	—	—	—	—	IN	Video Input
—	—	3	1	1	1	1	3	INA	Video Input A
—	—	1	3	2	2	2	4	INB	Video Input B
—	—	—	—	3	3	3	5	INC	Video Input C
—	—	—	—	—	—	4	6	IND	Video Input D
4	6	—	—	—	—	—	—	OUT	Video Output
—	—	4	6	7	7	9	12	OUTA	Video Output A
—	—	6	4	6	6	8	11	OUTB	Video Output B
—	—	—	—	5	5	7	10	OUTC	Video Output C
—	—	—	—	—	—	6	9	OUTD	Video Output D
5	4	5	5	8	8	10	1	V <sub>DD</sub>	Positive Power Supply. Bypass to GND with a 0.1 $\mu$ F capacitor.
—	5	—	—	—	—	—	2, 8	N.C.	No Connection. Not internally connected.
—	EP	—	—	—	—	—	EP	EP	Exposed Paddle. Connect EP to GND. EP is also internally connected to GND.

**MAX9586-MAX9589**

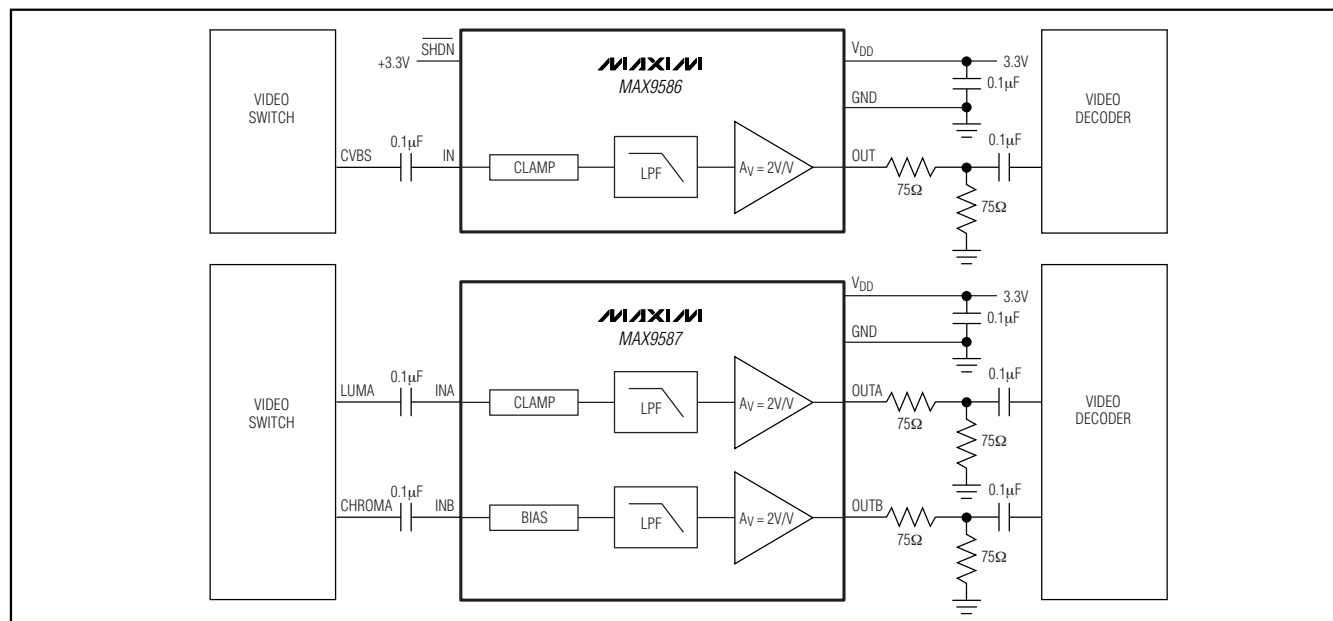


Figure 1. Typical Application Circuits for the MAX9586/MAX9587 (Anti-Alias Filter)

# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-Coupled Input Buffers

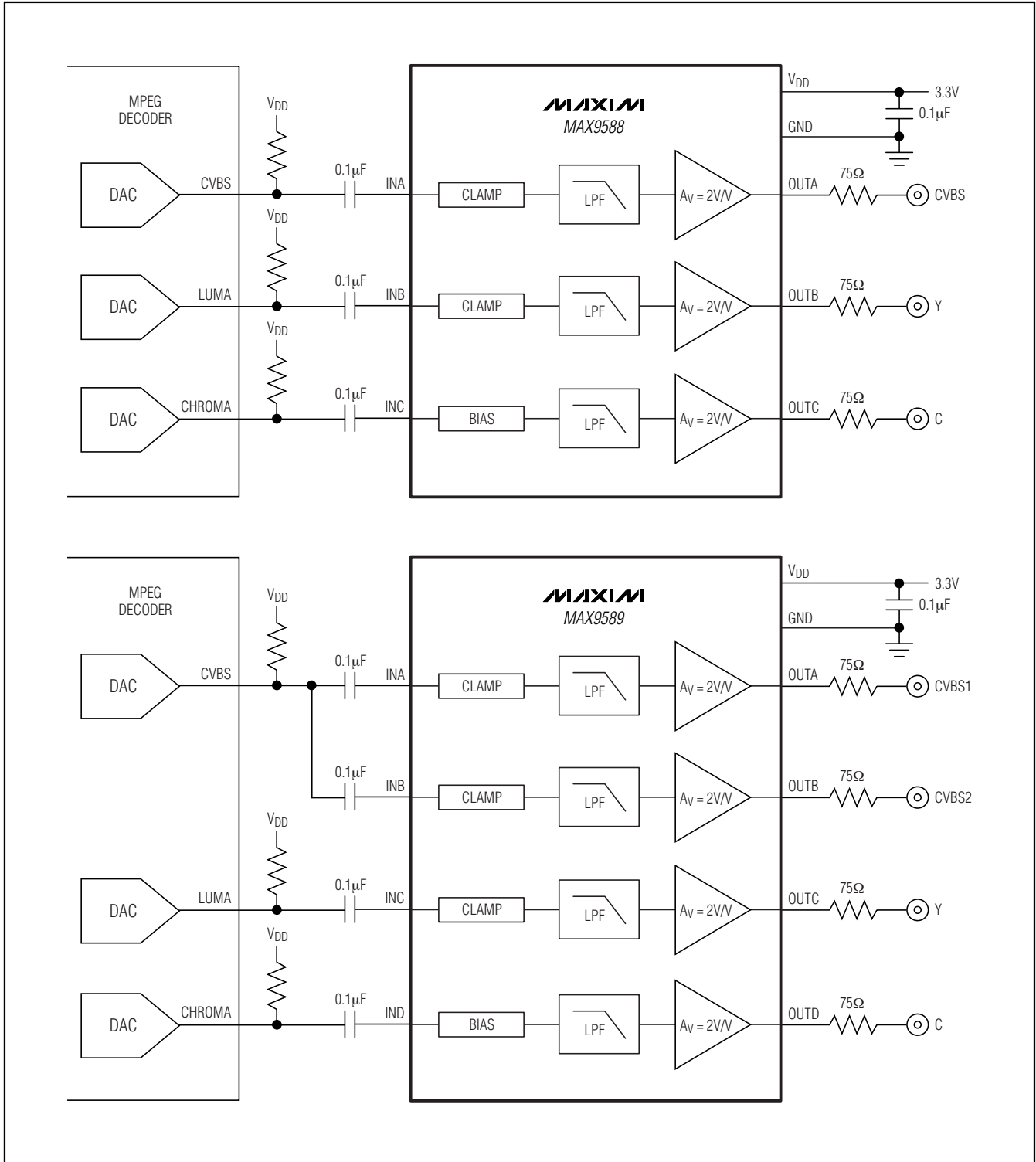


Figure 2. Typical Application Circuits for the MAX9588/MAX9589 (Reconstruction Filter)

# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-Coupled Input Buffers

## Detailed Description

The MAX9586-MAX9589 filter and amplify the video DAC output in applications such as set-top boxes and televisions. These devices consist of input clamps, input bias circuits, lowpass filters, and gain of 2V/V output amplifiers capable of driving a standard 150 $\Omega$  video load to ground.

### Inputs

The input stages of the MAX9586-MAX9589 are either sync-tip clamps or bias circuits. Sync-tip clamps accept AC-coupled CVBS or luma video signals with sync pulses. The sync-tip voltage is internally set to 300mV. Bias circuit inputs accept AC-coupled chroma, a subcarrier modulated with the color information. The bias voltage of the bias circuits is approximately 500mV.

### Video Filter

The filter passband ( $\pm 1$ dB) 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.

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.

### Shutdown (MAX9586)

The MAX9586 draws less than 1 $\mu$ A supply current when SHDN is low. In shutdown mode, the amplifier output becomes high impedance.

## Applications Information

### 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 220 $\mu$ F or greater to keep the highpass filter, formed by the 150 $\Omega$  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 MAX9586-MAX9589 operate from a single-supply voltage down to 2.7V, allowing for low-power operation. Bypass  $V_{DD}$  to GND with a 0.1 $\mu$ F capacitor. Place all external components as close as possible to the device.

# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-Coupled Input Buffers

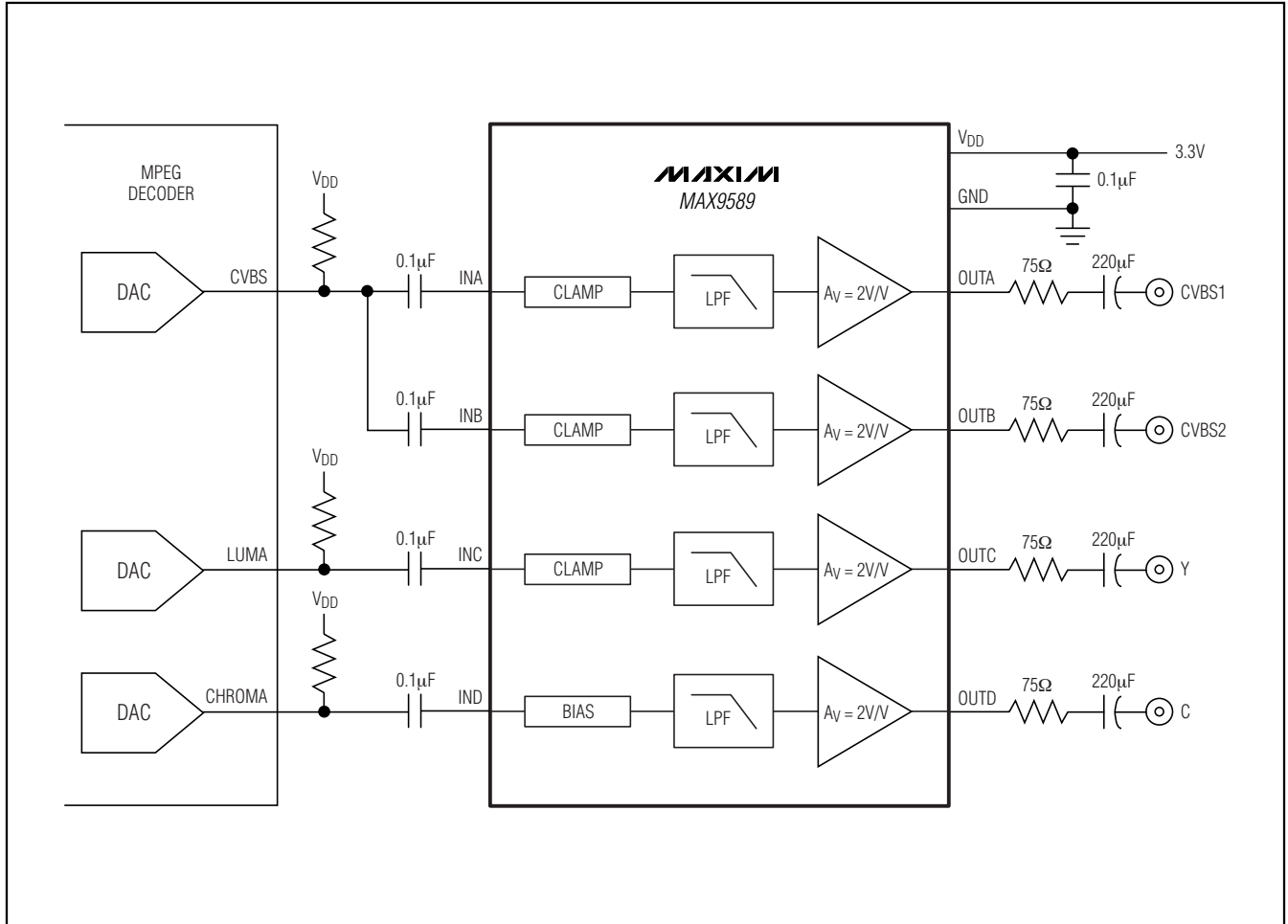
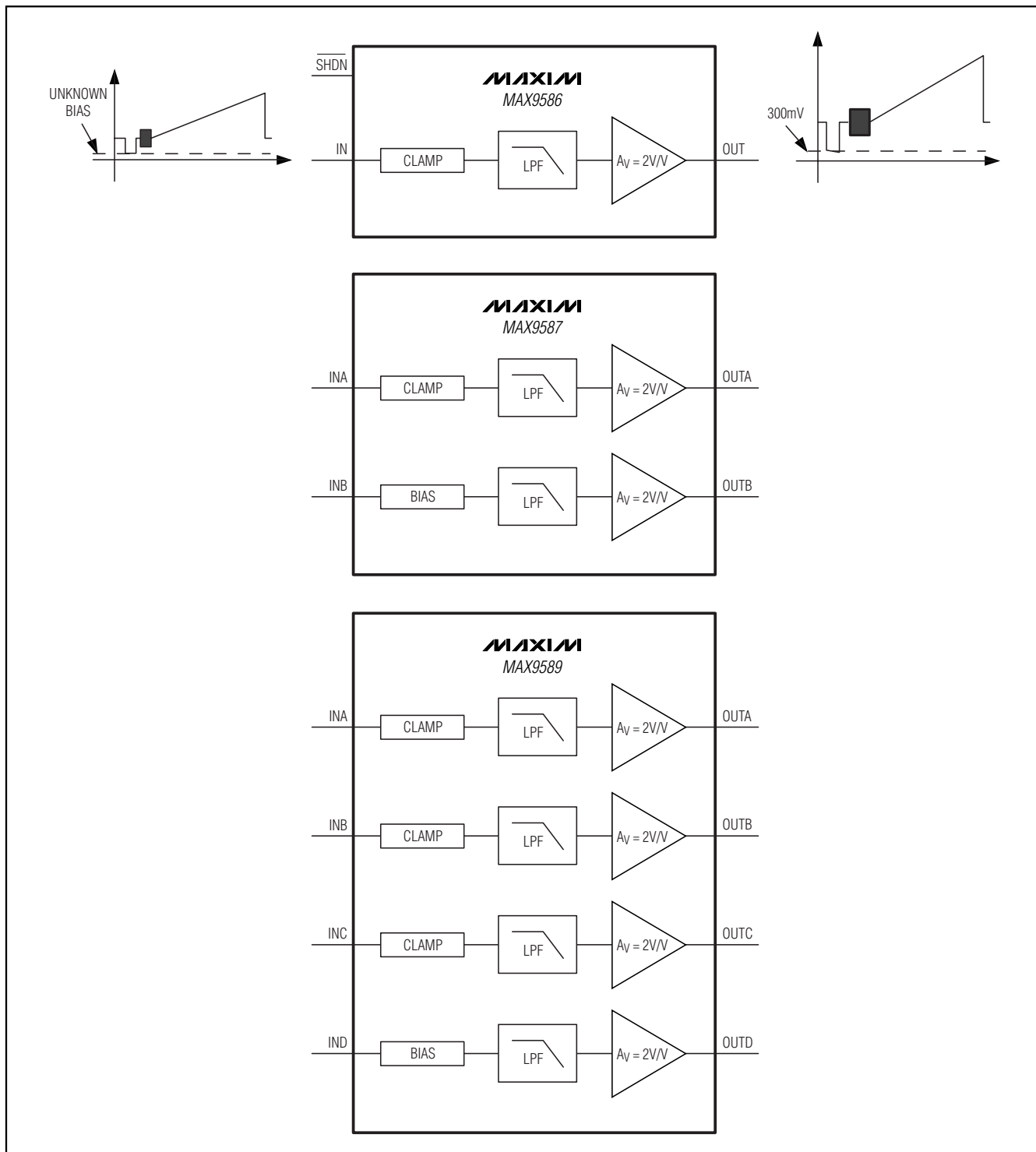


Figure 3. AC-Coupled Outputs

# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-Coupled Input Buffers

## Block Diagrams (continued)

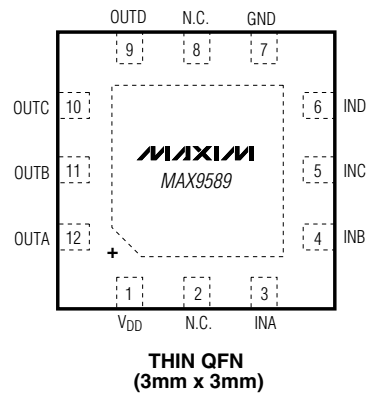
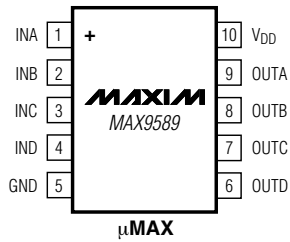
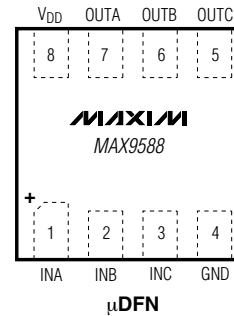
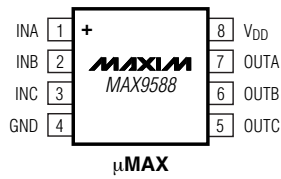
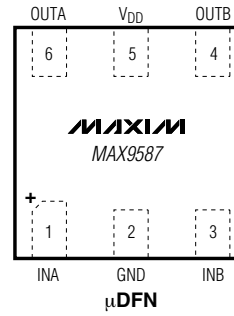
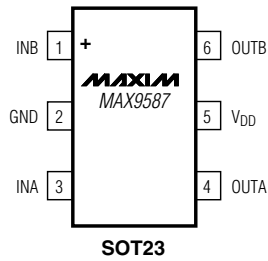
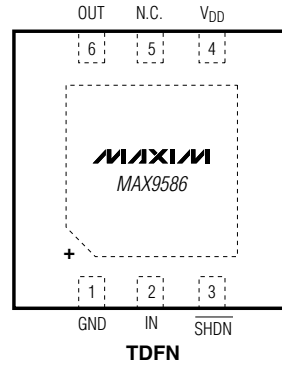
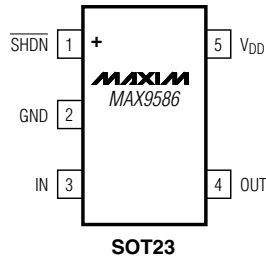


MAX9586-MAX9589

# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-Coupled Input Buffers

## Pin Configurations

TOP VIEW



# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-Coupled Input Buffers

## Selector Guide

PART	PIN-PACKAGE	PACKAGE SIZE	CHANNELS	TOP MARK
MAX9586AZK+T	5 SOT23-5	2.9mm x 1.6mm	1	ADSH
MAX9586ATT+T*	6 TDFN-EP**	3mm x 3mm	1	ATD
MAX9587AZT+T*	6 SOT23-6	2.9mm x 1.6mm	2	AADI
MAX9587ALT+T*	6 $\mu$ DFN-6	2mm x 2mm	2	ACD
MAX9588AUA+T*	8 $\mu$ MAX-8	3mm x 3mm	3	—
MAX9588ALA+T*	8 $\mu$ DFN-8	2mm x 2mm	3	ABW
MAX9589AUB+T	10 $\mu$ MAX-10	3mm x 3mm	4	—
MAX9589ATC+*	12 TQFN-EP**	3mm x 3mm	4	ABH

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

+Denotes a lead-free package.

\*Future product—contact factory for availability.

\*\*EP = Exposed paddle.

## Chip Information

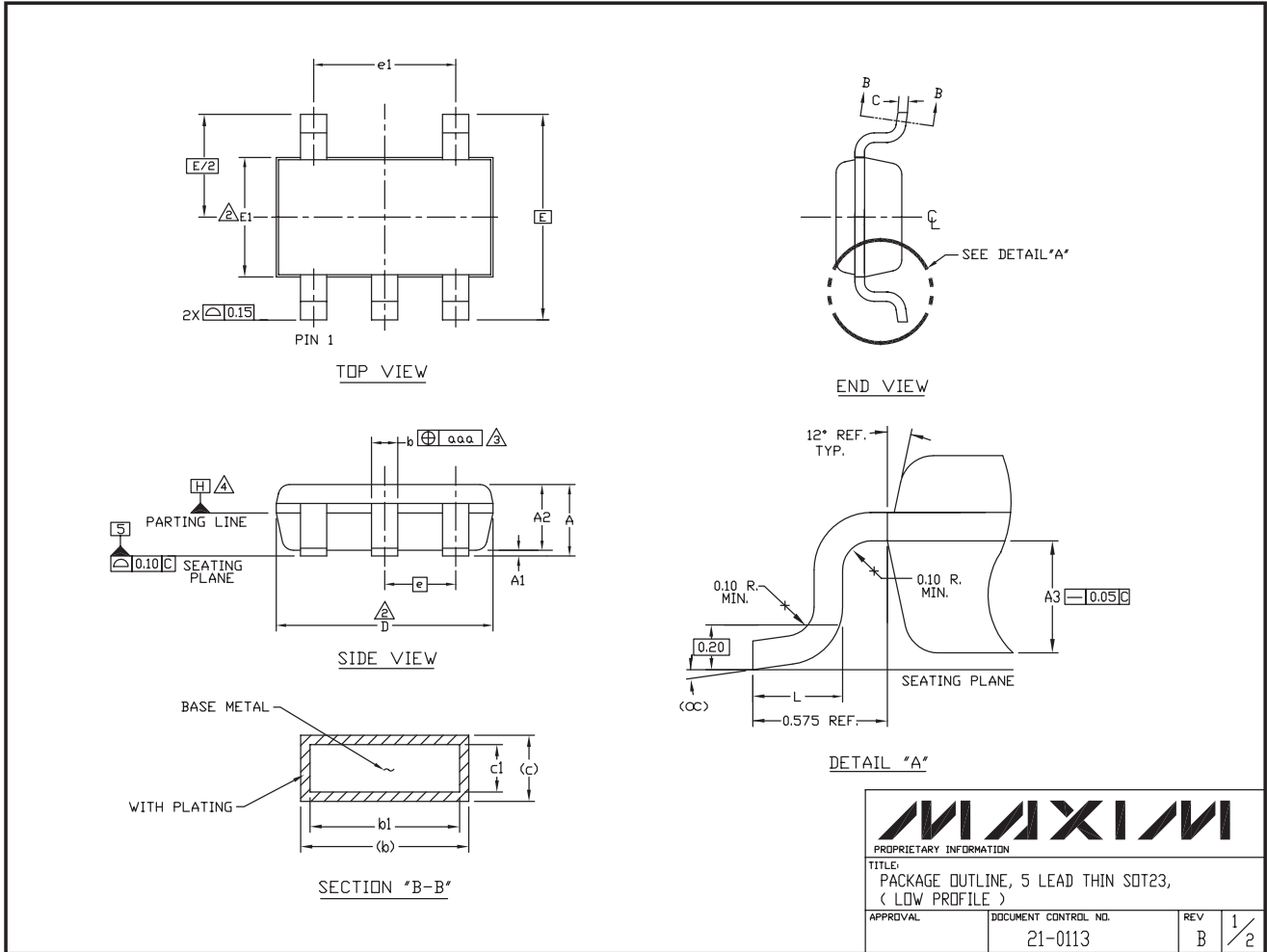
PROCESS: BiCMOS

MAX9586-MAX9589

# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-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](http://www.maxim-ic.com/packages).)



# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-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](http://www.maxim-ic.com/packages).)

MAX9586-MAX9589

### 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.

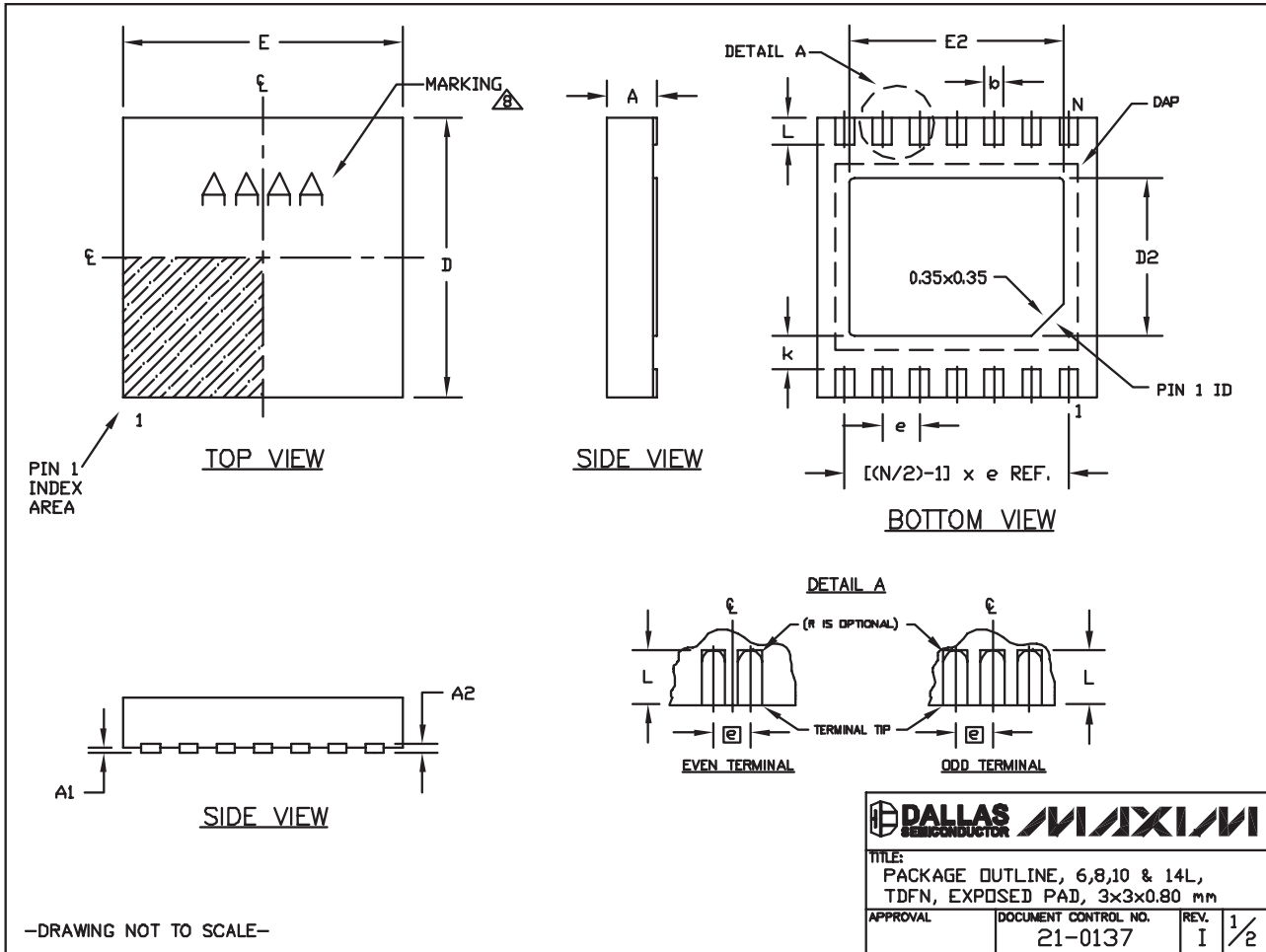
SYMBOLS			
	MIN	NOM	MAX
A	-	-	1.10
A1	0.05	0.075	0.10
A2	0.85	0.88	0.90
A3	0.50 BSC		
b	0.30	-	0.45
b1	0.25	0.35	0.40
c	0.15	-	0.20
c1	0.12	0.127	0.15
D	2.80	2.90	3.00
E	2.75 BSC		
E1	1.55	1.60	1.65
L	0.30	0.40	0.50
e1	1.90 BSC		
e	0.95 BSC		
OC	0°	4°	8°
aaa	0.20		

			
<small>PROPRIETARY INFORMATION</small>			
<small>TITLE</small> PACKAGE OUTLINE, 5 LEAD THIN SOT23, ( LOW PROFILE )			
<small>APPROVAL</small>	<small>DOCUMENT CONTROL NO.</small> 21-0113	<small>REV</small> B	<small>2</small> / 2

# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-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](http://www.maxim-ic.com/packages).)



# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-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](http://www.maxim-ic.com/packages).)

MAX9586-MAX9589



COMMON DIMENSIONS		
SYMBOL	MIN.	MAX.
A	0.70	0.80
D	2.90	3.10
E	2.90	3.10
A1	0.00	0.05
L	0.20	0.40
k	0.25 MIN.	
A2	0.20 REF.	

PACKAGE VARIATIONS								
PKG. CODE	N	D2	E2	e	JEDEC SPEC	b	[(N/2)-1] x e	
T633-2	6	1.50±0.10	2.30±0.10	0.95 BSC	MO229 / WEEA	0.40±0.05	1.90 REF	
T833-2	8	1.50±0.10	2.30±0.10	0.65 BSC	MO229 / WEEC	0.30±0.05	1.95 REF	
T833-3	8	1.50±0.10	2.30±0.10	0.65 BSC	MO229 / WEEC	0.30±0.05	1.95 REF	
T1033-1	10	1.50±0.10	2.30±0.10	0.50 BSC	MO229 / WEED-3	0.25±0.05	2.00 REF	
T1033-2	10	1.50±0.10	2.30±0.10	0.50 BSC	MO229 / WEED-3	0.25±0.05	2.00 REF	
T1433-1	14	1.70±0.10	2.30±0.10	0.40 BSC	----	0.20±0.05	2.40 REF	
T1433-2	14	1.70±0.10	2.30±0.10	0.40 BSC	----	0.20±0.05	2.40 REF	

**NOTES:**

1. ALL DIMENSIONS ARE IN mm. ANGLES IN DEGREES.
  2. COPLANARITY SHALL NOT EXCEED 0.08 mm.
  3. WARPAGE SHALL NOT EXCEED 0.10 mm.
  4. PACKAGE LENGTH/PACKAGE WIDTH ARE CONSIDERED AS SPECIAL CHARACTERISTIC(S).
  5. DRAWING CONFORMS TO JEDEC MO229, EXCEPT DIMENSIONS "D2" AND "E2", AND T1433-1 & T1433-2.
  6. "N" IS THE TOTAL NUMBER OF LEADS.
  7. NUMBER OF LEADS SHOWN ARE FOR REFERENCE ONLY.
-  MARKING IS FOR PACKAGE ORIENTATION REFERENCE ONLY.

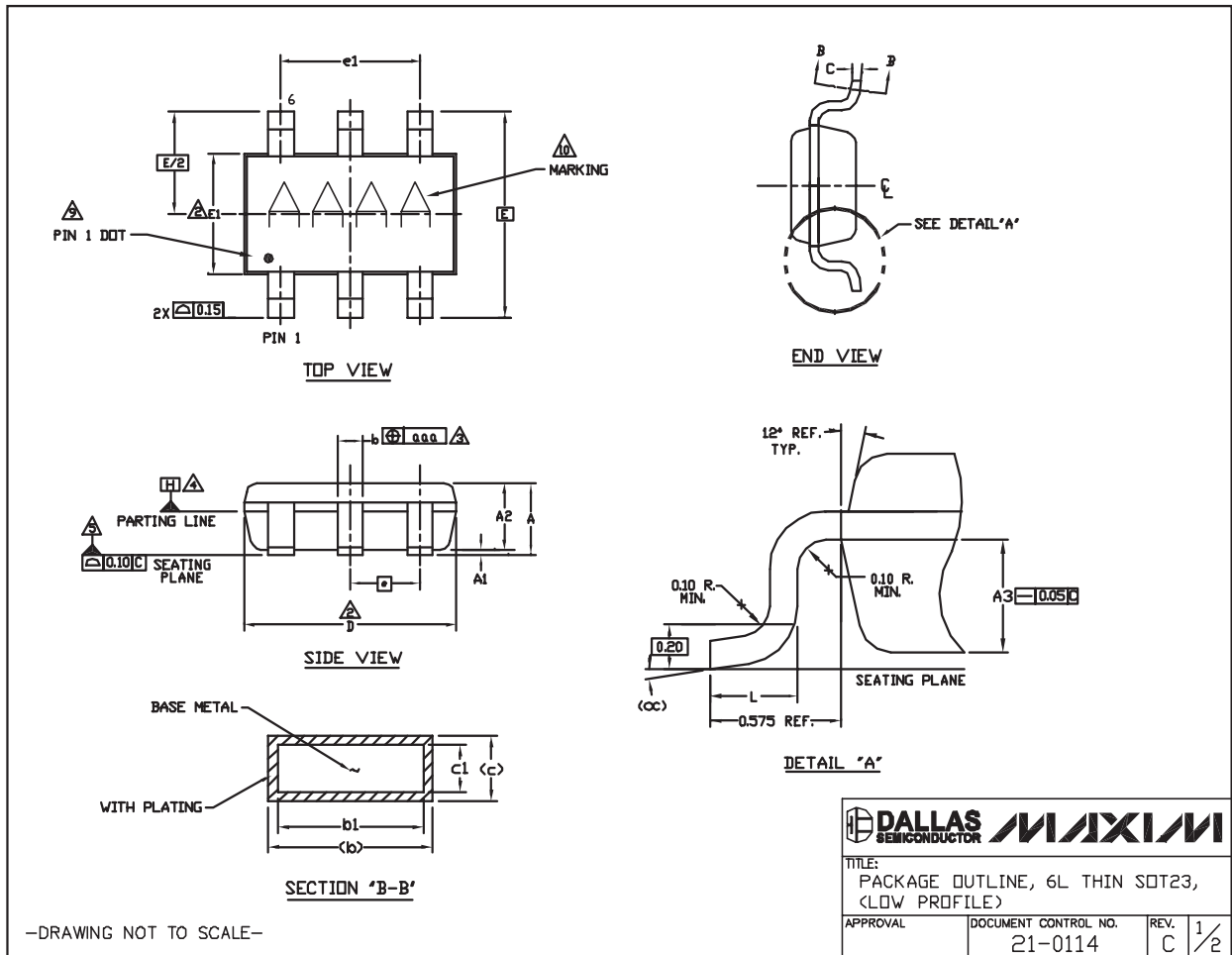
-DRAWING NOT TO SCALE-

 		
<b>TITLE:</b> PACKAGE OUTLINE, 6,8,10 & 14L, TDFN, EXPOSED PAD, 3x3x0.80 mm		
<b>APPROVAL</b>	<b>DOCUMENT CONTROL NO.</b> 21-0137	<b>REV.</b> I 2/2

# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-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](http://www.maxim-ic.com/packages).)



# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-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](http://www.maxim-ic.com/packages).)

MAX9586-MAX9589

### 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 LIE WITHIN A SPECIFIED TOLERANCE ZONE. THIS TOLERANCE ZONE IS DEFINED BY TWO PARALLEL LINES. ONE PLANE IS THE SEATING PLANE, DATUM [C-C-J] AND THE OTHER PLANE IS AT THE SPECIFIED DISTANCE FROM [C-C-J] 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 JEDEC 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	0.65	0.68	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		
OC	0°	4°	8°
aaa	0.20		
Pkg. codes: Z6-1, Z6-2			

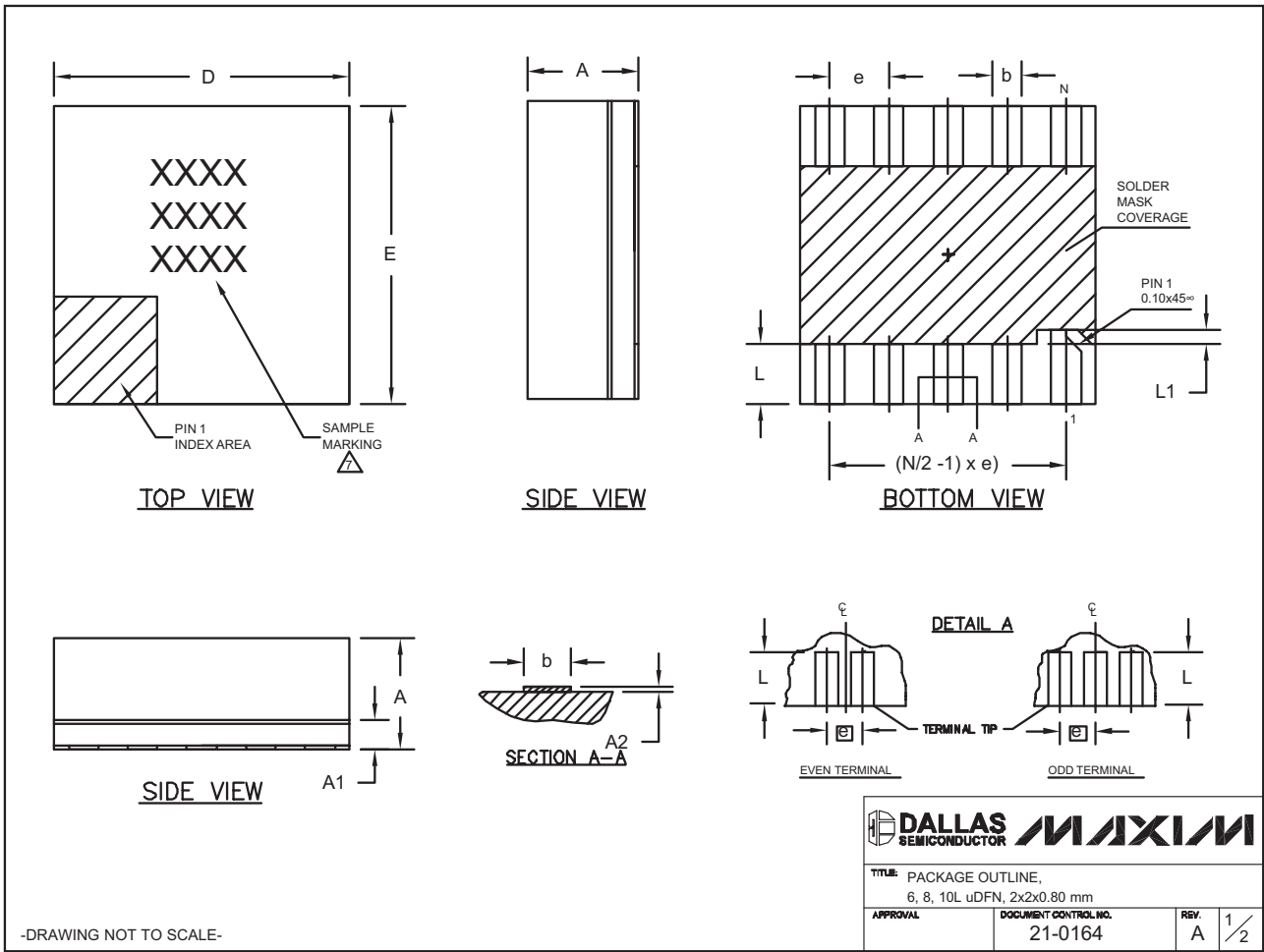
-DRAWING NOT TO SCALE-

	
TITLE: PACKAGE OUTLINE, 6L THIN SOT23, (LOW PROFILE)	
APPROVAL	DOCUMENT CONTROL NO. 21-0114
REV. C	2/2

# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-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](http://www.maxim-ic.com/packages).)



6, 8, 10L uDFN.EPS

-DRAWING NOT TO SCALE-

<b>TITLE:</b> PACKAGE OUTLINE, 6, 8, 10L uDFN, 2x2x0.80 mm	
<b>APPROVAL</b>	<b>DOCUMENT CONTROL NO.</b> 21-0164
<b>REV.</b> A	<b>REV.</b> 1/2

# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-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](http://www.maxim-ic.com/packages).)

COMMON DIMENSIONS			
SYMBOL	MIN.	NOM.	MAX.
A	0.70	0.75	0.80
A1	0.15	0.20	0.25
A2	0.020	0.025	0.035
D	1.95	2.00	2.05
E	1.95	2.00	2.05
L	0.30	0.40	0.50
L1	0.10 REF.		

PACKAGE VARIATIONS				
PKG. CODE	N	e	b	(N/2 -1) x e
L622-1	6	0.65 BSC	0.30±0.05	1.30 REF.
L822-1	8	0.50 BSC	0.25±0.05	1.50 REF.
L1022-1	10	0.40 BSC	0.20±0.03	1.60 REF.

**NOTES:**

1. ALL DIMENSIONS ARE IN mm. ANGLES IN DEGREES.
  2. COPLANARITY SHALL NOT EXCEED 0.08mm.
  3. WARPAGE SHALL NOT EXCEED 0.10mm.
  4. PACKAGE LENGTH/PACKAGE WIDTH ARE CONSIDERED AS SPECIAL CHARACTERISTIC(S).
  5. "N" IS THE TOTAL NUMBER OF LEADS.
  6. NUMBER OF LEADS SHOWN ARE FOR REFERENCE ONLY.
- MARKING IS FOR PACKAGE ORIENTATION REFERENCE ONLY.

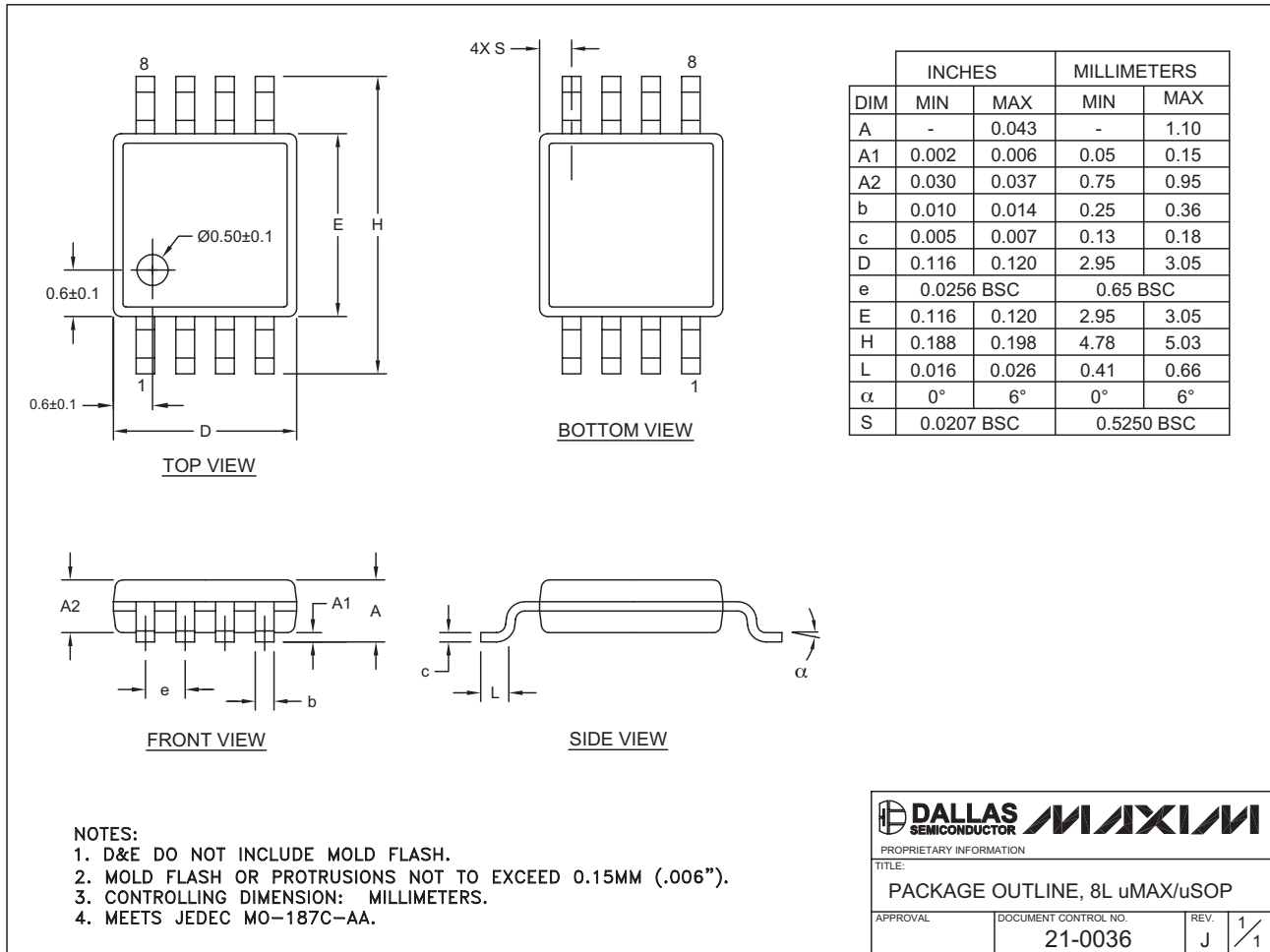
-DRAWING NOT TO SCALE-

<b>TITLE:</b> PACKAGE OUTLINE, 6, 8, 10L uDFN, 2x2x0.80 mm		
<b>APPROVAL</b>	<b>DOCUMENT CONTROL NO.</b> 21-0164	<b>REV.</b> A <span style="float: right;">2/2</span>

# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-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](http://www.maxim-ic.com/packages).)



8LUMAXD EPS

**DALLAS SEMICONDUCTOR** **MAXIM**  
 PROPRIETARY INFORMATION  
 TITLE: PACKAGE OUTLINE, 8L uMAX/uSOP  
 APPROVAL: \_\_\_\_\_ DOCUMENT CONTROL NO. 21-0036 REV. J 1/1

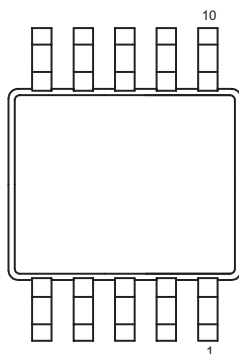
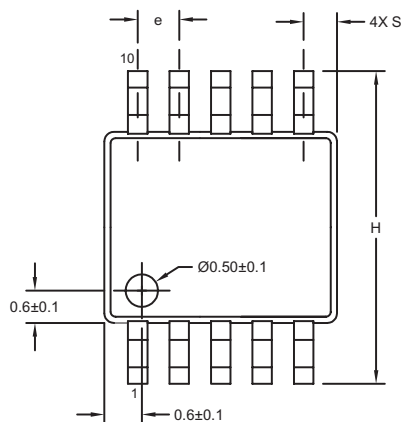
# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-Coupled Input Buffers

## Package Information (continued)

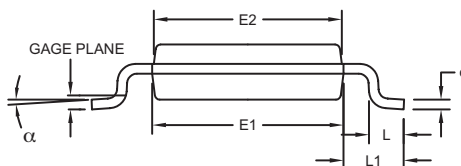
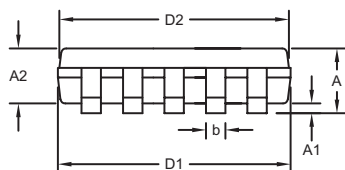
(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to [www.maxim-ic.com/packages](http://www.maxim-ic.com/packages).)

MAX9586-MAX9589

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

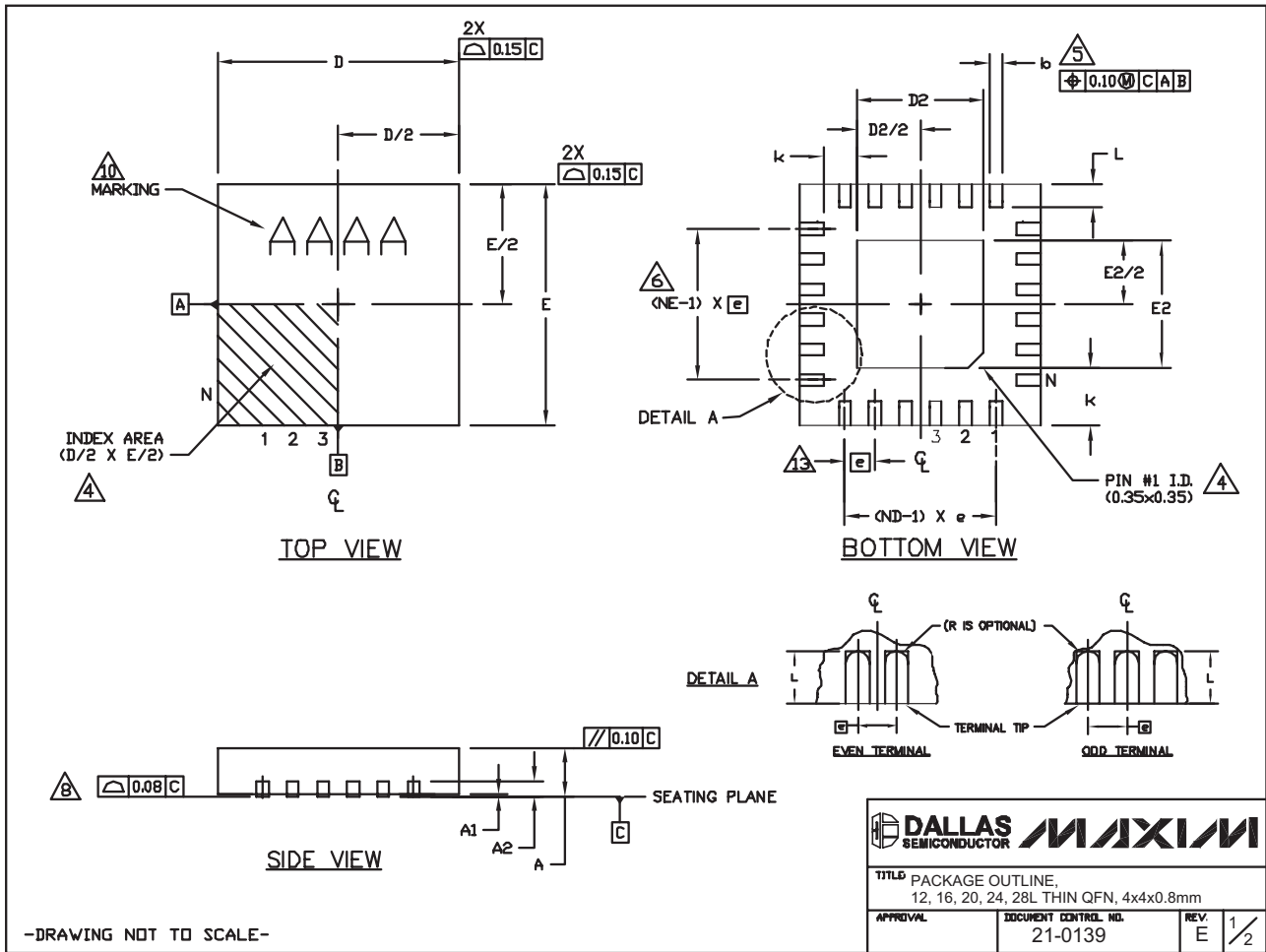
TITLE:  
PACKAGE OUTLINE, 10L uMAX/uSOP

APPROVAL	DOCUMENT CONTROL NO. 21-0061	REV. I	1/1
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# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-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](http://www.maxim-ic.com/packages).)



-DRAWING NOT TO SCALE-

TITLE: PACKAGE OUTLINE, 12, 16, 20, 24, 28L THIN QFN, 4x4x0.8mm		
APPROVAL	DOCUMENT CONTROL NO. 21-0139	REV. E 1/2

# Single, Dual, Triple, and Quad Standard-Definition Video Filter Amplifiers with AC-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](http://www.maxim-ic.com/packages).)

COMMON DIMENSIONS														EXPOSED PAD VARIATIONS										
PKG REF.	12L 4x4			16L 4x4			20L 4x4			24L 4x4			28L 4x4			PKG CODES	D2			E2			DOWN BONDS ALLOWED	
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.		MIN.	NOM.	MAX.	MIN.	NOM.	MAX.		
A	0.70	0.75	0.80	0.70	0.75	0.80	0.70	0.75	0.80	0.70	0.75	0.80	0.70	0.75	0.80	T1244-3	1.95	2.10	2.25	1.95	2.10	2.25	YES	
A1	0.0	0.02	0.05	0.0	0.02	0.05	0.0	0.02	0.05	0.0	0.02	0.05	0.0	0.02	0.05	T1244-4	1.95	2.10	2.25	1.95	2.10	2.25	NO	
A2	0.20 REF			0.20 REF			0.20 REF			0.20 REF			0.20 REF			T1644-3	1.95	2.10	2.25	1.95	2.10	2.25	YES	
b	0.25	0.30	0.35	0.25	0.30	0.35	0.20	0.25	0.30	0.18	0.23	0.30	0.15	0.20	0.25	T1644-4	1.95	2.10	2.25	1.95	2.10	2.25	NO	
D	3.90	4.00	4.10	3.90	4.00	4.10	3.90	4.00	4.10	3.90	4.00	4.10	3.90	4.00	4.10	T2044-2	1.95	2.10	2.25	1.95	2.10	2.25	YES	
E	3.90	4.00	4.10	3.90	4.00	4.10	3.90	4.00	4.10	3.90	4.00	4.10	3.90	4.00	4.10	T2044-3	1.95	2.10	2.25	1.95	2.10	2.25	NO	
e	0.80 BSC.			0.65 BSC.			0.50 BSC.			0.50 BSC.			0.40 BSC.			T2444-2	1.95	2.10	2.25	1.95	2.10	2.25	YES	
k	0.25	-	-	0.25	-	-	0.25	-	-	0.25	-	-	0.25	-	-	T2444-3	2.45	2.60	2.63	2.45	2.60	2.63	YES	
L	0.45	0.55	0.65	0.45	0.55	0.65	0.45	0.55	0.65	0.30	0.40	0.50	0.30	0.40	0.50	T2444-4	2.45	2.60	2.63	2.45	2.60	2.63	NO	
N	12			16			20			24			28			T2844-1	2.50	2.60	2.70	2.50	2.60	2.70	NO	
ND	3			4			5			6			7											
NE	3			4			5			6			7											
JeDEC Vpr	VGG8			VGGC			WGGD-1			WGGD-2			WGGE											

**NOTES:**

- DIMENSIONING & TOLERANCING CONFORM TO ASME Y14.5M-1994.
- ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
- N IS THE TOTAL NUMBER OF TERMINALS.
- THE TERMINAL #1 IDENTIFIER AND TERMINAL NUMBERING CONVENTION SHALL CONFORM TO JEDEC 95-1 SPP-012. DETAILS OF TERMINAL #1 IDENTIFIER ARE OPTIONAL, BUT MUST BE LOCATED WITHIN THE ZONE INDICATED. THE TERMINAL #1 IDENTIFIER MAY BE EITHER A MOLD OR MARKED FEATURE.
- DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.25 mm AND 0.30 mm FROM TERMINAL TIP.
- ND AND NE REFER TO THE NUMBER OF TERMINALS ON EACH D AND E SIDE RESPECTIVELY.
- DEPOPULATION IS POSSIBLE IN A SYMMETRICAL FASHION.
- COPLANARITY APPLIES TO THE EXPOSED HEAT SINK SLUG AS WELL AS THE TERMINALS.
- DRAWING CONFORMS TO JEDEC M0220, EXCEPT FOR T2444-3, T2444-4 AND T2844-1.
- MARKING IS FOR PACKAGE ORIENTATION REFERENCE ONLY.
- COPLANARITY SHALL NOT EXCEED 0.08mm
- WARPAGE SHALL NOT EXCEED 0.10mm
- LEAD CENTERLINES TO BE AT TRUE POSITION AS DEFINED BY BASIC DIMENSION "e", ±0.05.
- NUMBER OF LEADS SHOWN ARE FOR REFERENCE ONLY

-DRAWING NOT TO SCALE-

<b>DALLAS SEMICONDUCTOR</b>		<b>MAXIM</b>	
TITLE PACKAGE OUTLINE, 12, 16, 20, 24, 28L THIN QFN, 4x4x0.8mm			
APPROVAL	DOCUMENT CONTROL NO. 21-0139	REV. E	2/2

### Revision History

Pages changed at Rev 1: 1, 3, 24

Pages changed at Rev 2: 1-4, 13, 25

Maxim cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim product. No circuit patent licenses are implied. Maxim reserves the right to change the circuitry and specifications without notice at any time.

**Maxim Integrated Products, 120 San Gabriel Drive, Sunnyvale, CA 94086 408-737-7600** 25