TSH173

Triple video buffer with filter for SD video

Features

- 4.5V to 5.5V single supply operation
- R-G-B, Y-Pb-Pr, Y-C-CVBS driving
- 3 channels with 6dB gain buffer
- 3 video reconstruction filters for SD
- 3 internal input DC level shifter
- No input capacitor is required
- Very low harmonic distortion
- Each output can drive AC- or DC-coupled 150Ω loads
- Tested on 5V power supply
- Data min. and max. are tested during production

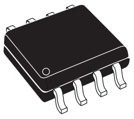
Applications

- Set top boxes
- DVD players/recorders
- High-end video systems
- Standard definition TV (SD)
- Multimedia products

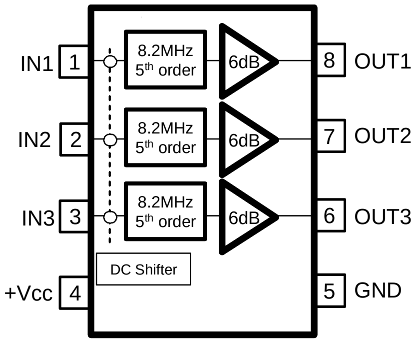
Description

The TSH173 is a single supply triple video buffer featuring an internal gain of 6dB and an internal low pass filter of 8.2MHz cut-off frequency for each channel to fit with Standard Definition requirements for video line interfaces.

Another advantage of the TSH173 is its input DC level shifter to drive the video signal on a 75Ω video line without any damage to the synchronization tip, while using a single 5V power supply with no input capacitor. The DC level shifter is internally fixed and optimized to keep the output video signal between low and high output rails in the best position to improve linearity.



Pin connections (top view)



SO8

This datasheet gives technical information on using the TSH173 as a R-G-B, Y-Pb-Pr, or Y-C-CVBS driver for video DAC outputs on a video line.

The TSH173 is available in SO8 plastic package.

Contents

1 Absolute maximum ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CC}	Supply voltage (1)	6	V
T_{oper}	Operating free air temperature range	-40 to +85	°C
T_{stg}	Storage temperature	-65 to +150	°C
T_j	Maximum junction temperature	150	°C
R_{thjc}	SO8 thermal resistance junction to case	28	°C/W
R_{thja}	SO8 thermal resistance junction to ambient area	157	°C/W
$P_{max.}$	Maximum power dissipation (@T_{amb}=25°C) for T_j=150°C	800	mW
ESD	CDM: charged device model HBM: human body model MM: machine model	1.5 2 200	kV kV V
	Output short-circuit	(2)	

1. All voltage values, except differential voltage, are with respect to network terminal.
2. An output current limitation protects the circuit from transient currents. Short-circuits can cause excessive heating. Destructive dissipation can result from short-circuits on amplifiers.

2 Operating conditions

Table 2. Operating conditions

Symbol	Parameter	Value	Unit
V_{CC}	Power supply voltage	4.5 to 5.5(1)	V

1. Tested in full production at 0V/5V single power supply.

3 Electrical characteristics

Table 3. V_{CC} = +5V single supply, load: R_L = 150Ω, T_{amb} = 25°C (unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
DC performance						
V_{DC}	Output DC shift		0.6	0.9	1.2	V
		-40°C < T_{amb} < +85°C		0.95		
I_{ib}	Input bias current	V_{CC}=+5V, V_{icm}=100mV		3	6	µA
		-40°C < T_{amb} < +85°C		5		
PSRR	Power supply rejection ratio 20 log ($\Delta V_{cc}/\Delta V_{out}$)	V_{CC}=+5V, ΔV_{CC}=200mVp-p, F=1MHz (without any improvement of the power supply noise rejection)		37		dB
I_{CC}	Supply current per channel	V_{icm}=100mV, no load		7.4	9	mA
		-40°C < T_{amb} < +85°C		8		
G	DC voltage gain		1.95	2	2.05	V/V
		-40°C < T_{amb} < +85°C		1.95		
GM	Gain matching			0.5	2	%
V_{OH}	High level output voltage		3.3	3.8		V
V_{OL}	Low level output voltage			210		mV
I_{OUT}	I_{sink}	V_{in}=0.5V DC V_{out} is fixed by a generator at 2.5V	25	34		mA
	I_{source}	V_{in}=0.5V DC V_{out} is fixed by a generator at 1V	-28	-38		
Dynamic performance (5th order filter)						
$F_{C\text{-}SD}$	-3dB bandwidth	Small signal		8.2		MHz
	-1dB bandwidth	Small signal Large signal (V_{out}=2Vp-p)	5.5 5	6.5 6.3		
F_{att}	Filter attenuation	Small signal, F=27MHz	40	50		dB
Flatness	Gain flatness along a 4.5MHz band	10kHz to 4.5MHz V_{out}=2Vp-p		+/-0.1		dB
gd	Group delay	0 to 6MHz		17		ns
D	Delay between each channel	0 to 6MHz		0.5		ns
dG	Differential gain			0.6		%
dPh	Differential phase			0.15		°
Noise						
SNR	Signal-to-noise ratio	Bw = 10kHz to 6MHz		62		dB

Figure 1. Frequency response

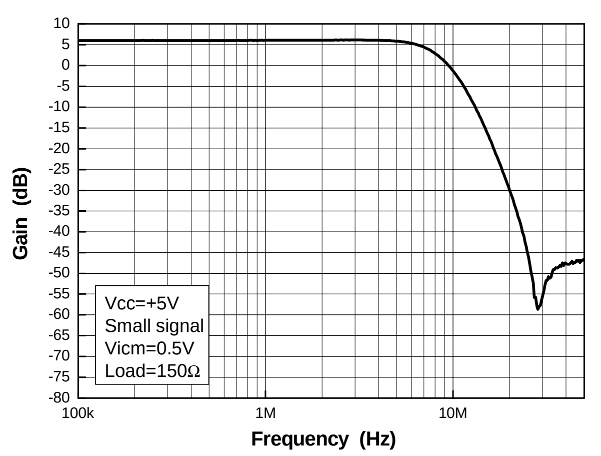


Figure 2. Gain flatness

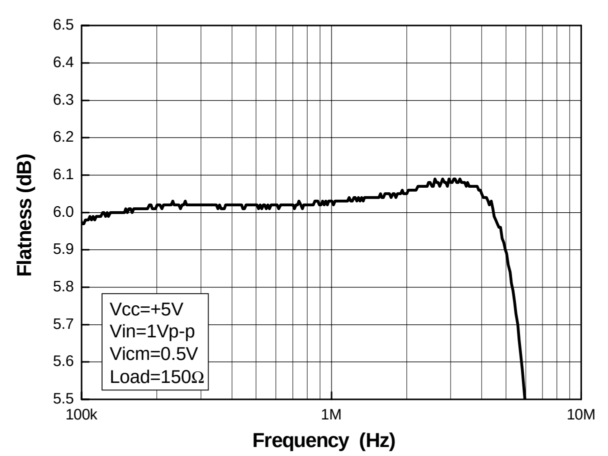


Figure 3. Total input noise vs. frequency

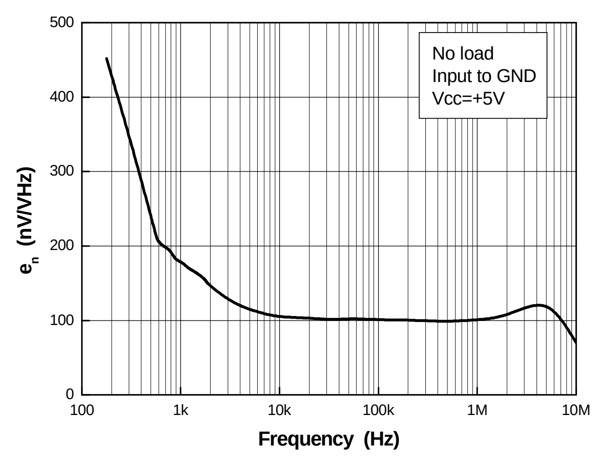


Figure 4. Distortion on 150Ω load

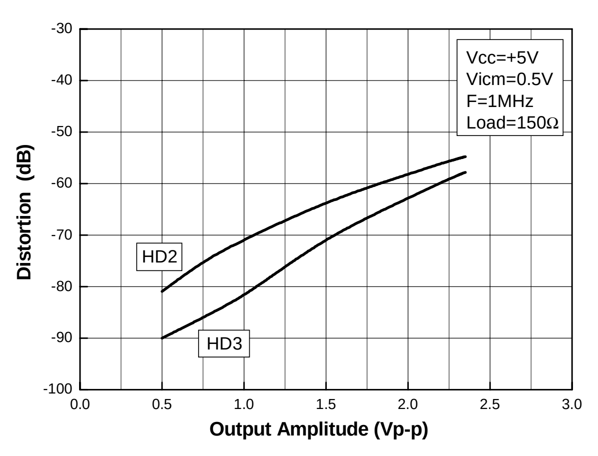


Figure 5. Cross-talk vs. frequency

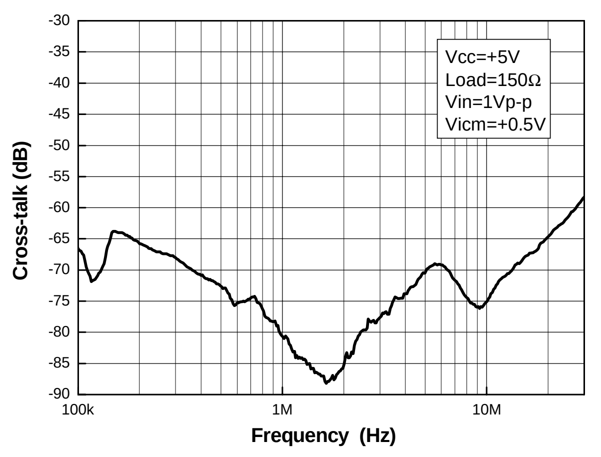


Figure 6. Output voltage swing vs. supply

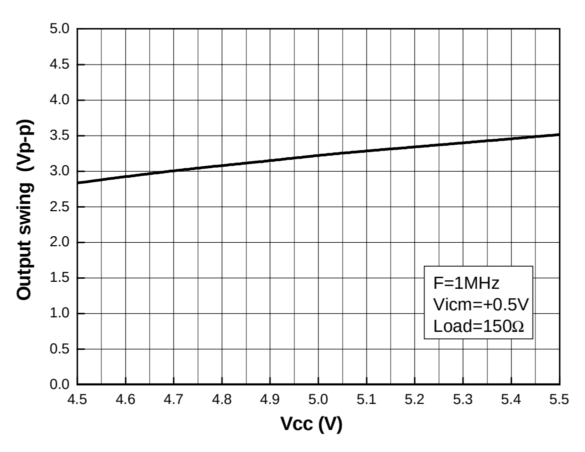


Figure 7. Quiescent current vs. supply

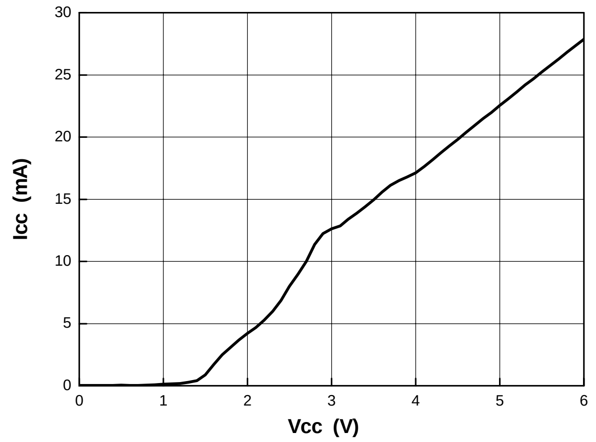


Figure 8. I_{sink} and I_{source}

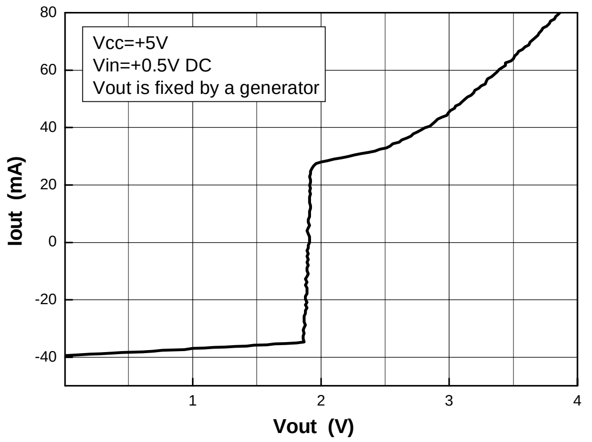


Figure 9. Supply current vs. T_{amb}

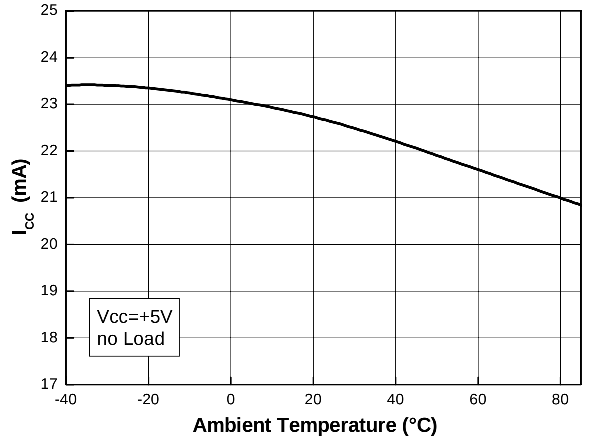


Figure 10. Output DC shift vs. T_{amb}

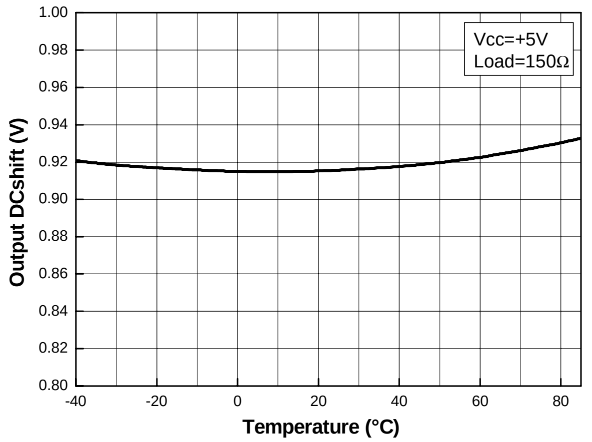


Figure 11. Voltage gain vs. T_{amb}

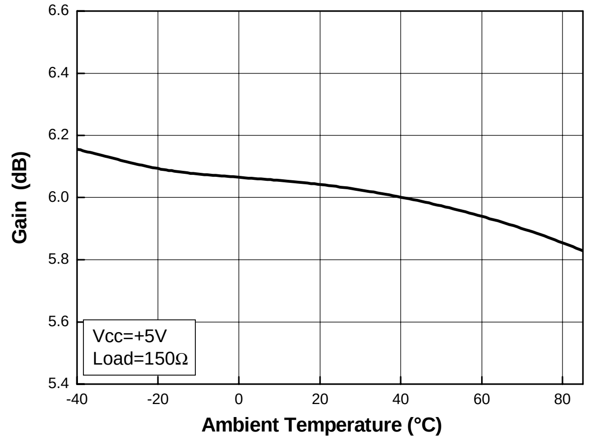


Figure 12. -1dB bandwidth vs. T_{amb}

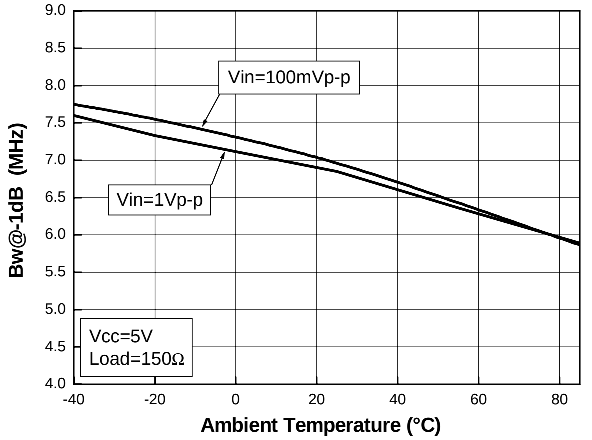


Figure 13. Higher output rail vs. T_{amb}

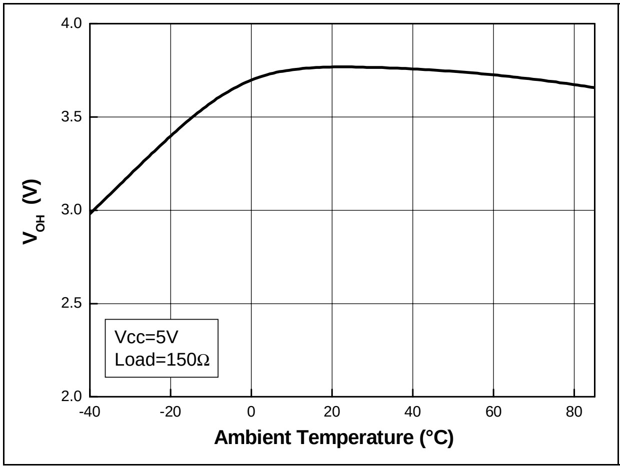


Figure 14. Gain matching vs. T_{amb}

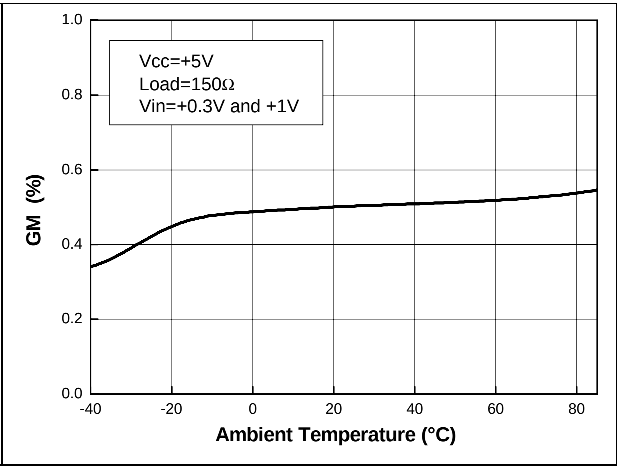


Figure 15. I_{sink} vs. T_{amb}

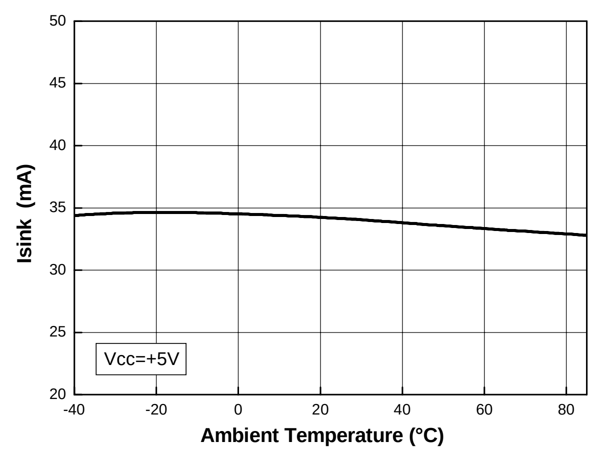


Figure 16. I_{source} vs. T_{amb}

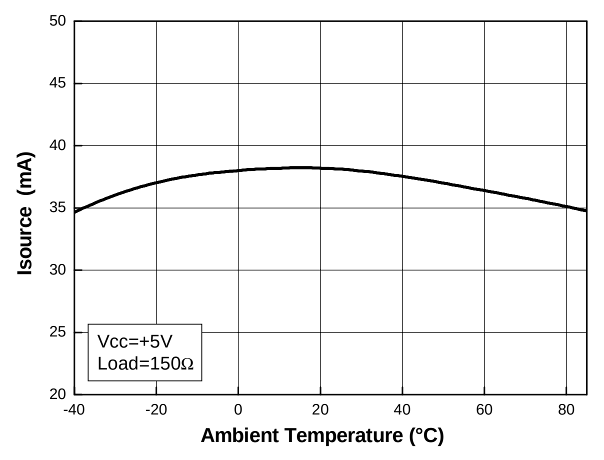
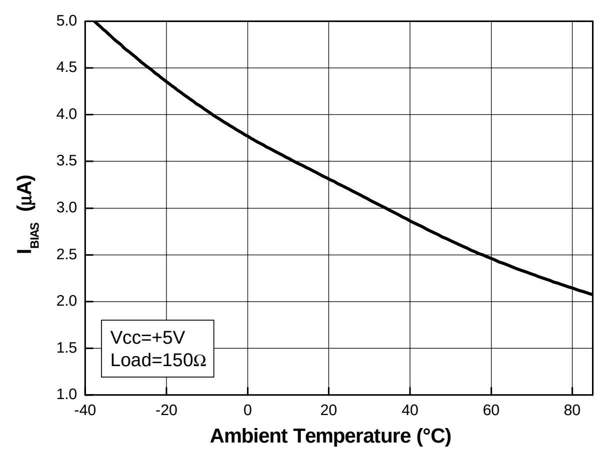


Figure 17. I_{bias} vs. T_{amb}



3.1 Synchronization tip

The TSH173, in single 0/5V supply, is designed to drive the video signal on the line without any damage to the synchronization tip. This is achieved by a small internal DC shift and a very low output rail. The DAC offset, as shown in *Figure 18*, can be as low as 0V. Nevertheless, in order to minimize the DC component on the line, the output can be AC coupled by a capacitor (*Figure 20*).

Figure 18. Input signal

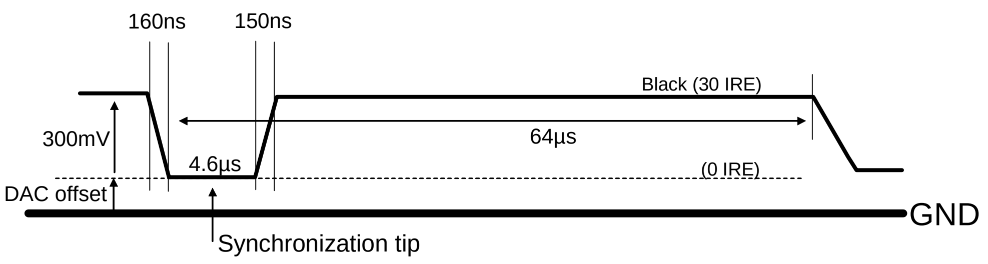


Figure 19. DC coupled output configuration

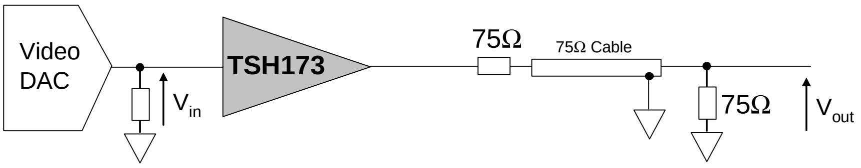
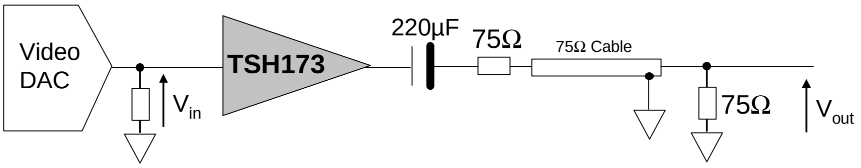


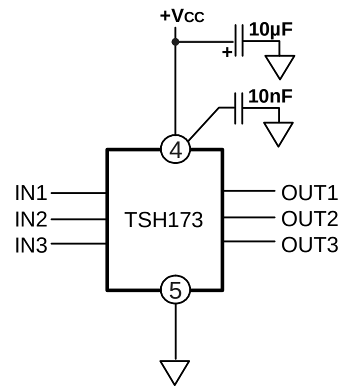
Figure 20. AC coupled output configuration



3.2 Power supply considerations

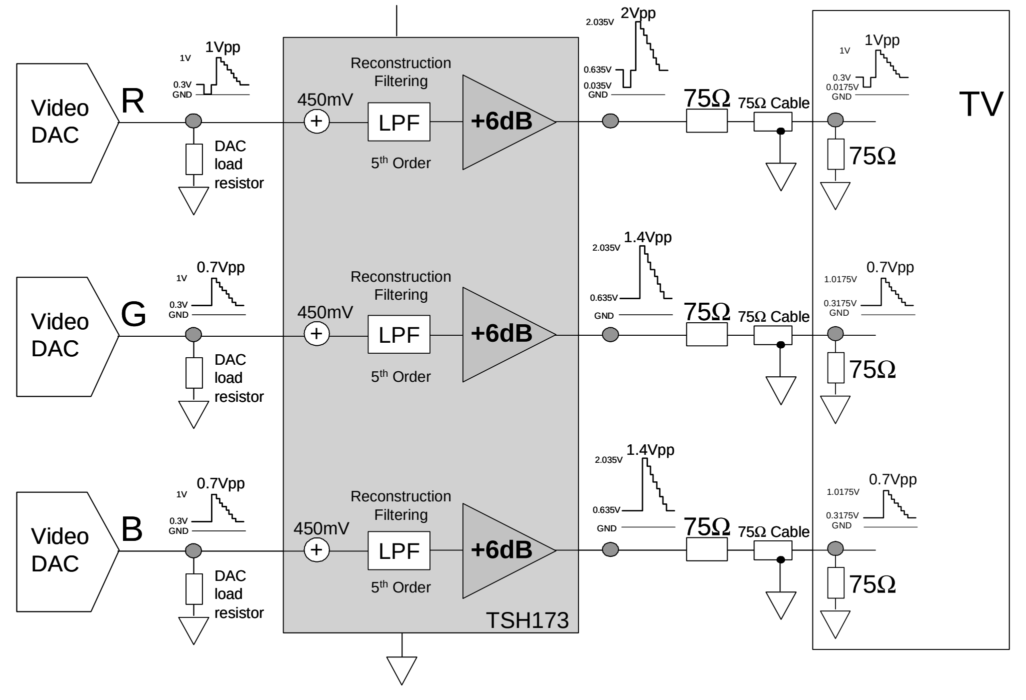
Correct power supply bypassing is very important for optimizing performance in high-frequency ranges. Bypass capacitors should be placed as close as possible to the IC pins to improve high-frequency bypassing. A capacitor greater than 10µF is necessary to minimize the distortion. For better quality bypassing, we recommend to add a 10nF capacitor, also placed as close as possible to the IC pins. Bypass capacitors must be incorporated for both the negative and the positive supply.

Figure 21. Circuit for power supply bypassing



4 Using the TSH173 to drive video components

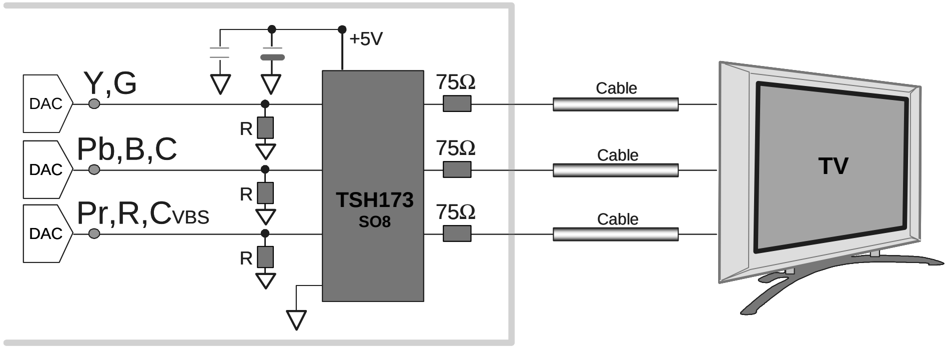
Figure 22. Video line interface implementation schematics



The interface is illustrated in *Figure 23*. It is composed of:

- Three 75-ohm resistors
- Three matching resistors
- One 10µF power supply decoupling capacitor
- One 10nF power supply decoupling capacitor

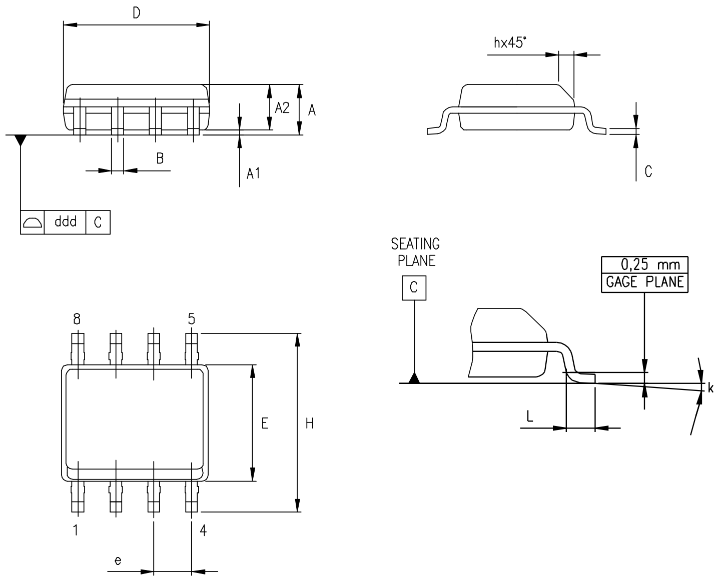
Figure 23. Bill of materials of the interface



5 Package mechanical data

Figure 24. SO-8 package

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	1.35		1.75	0.053		0.069
A1	0.10		0.25	0.04		0.010
A2	1.10		1.65	0.043		0.065
B	0.33		0.51	0.013		0.020
C	0.19		0.25	0.007		0.010
D	4.80		5.00	0.189		0.197
E	3.80		4.00	0.150		0.157
e		1.27			0.050	
H	5.80		6.20	0.228		0.244
h	0.25		0.50	0.010		0.020
L	0.40		1.27	0.016		0.050
k	8° (max.)					
ddd			0.1			0.04



6 Ordering information

Table 4. Order codes

Part number	Temperature range	Package	Packaging	Marking
TSH173ID	-40°C to +85°C	SO-8	Tube	TSH173I
TSH173IDT		SO-8	Tape & reel	TSH173I

7 Revision history

Date	Revision	Changes
21-Mar-2007	1	Initial release.

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