

Low cost triple video buffer/filter for standard video

Features

- Triple channels
- Internal 6 MHz reconstruction filter (4th order)
- 6 dB gain buffer for 75 Ω lines
- 5 V single supply
- Bottom of video signal close to 0 V
- Data min. and max. physically tested and guaranteed during production

Applications

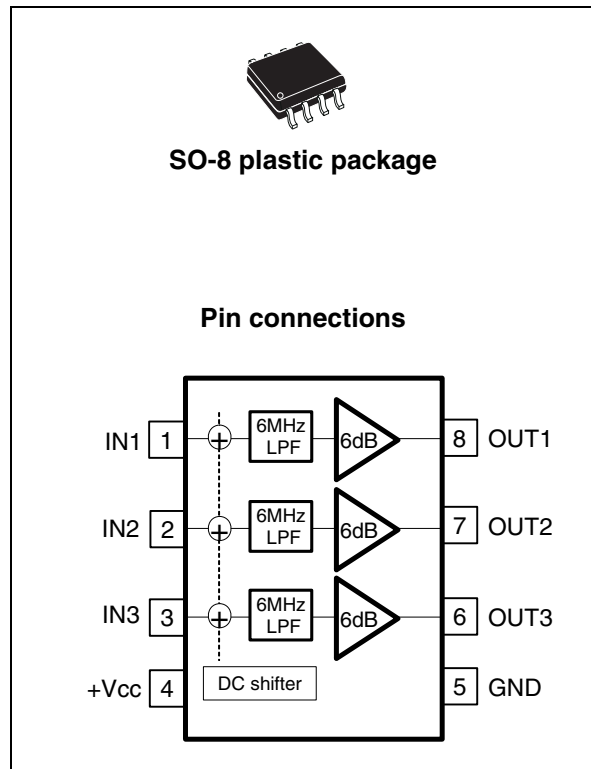
- Standard definition TVs
- Set-top boxes
- DVD players/recorders

Description

The TSH103 is a low-cost video buffer. It is dedicated to drive video signals from any video DAC output on 75 Ω video lines in standard definition. With a real benefit in terms of integration and cost saving, this product is particularly efficient for the replacement of current discrete solutions using transistors, coil and capacitors for buffering and filtering.

This triple channel is designed to drive either CVBS/Y-C or RGB or YPbPr or YUV formats. Each channel features an internal 6 MHz reconstruction filter and a 6 dB buffer (attenuation of 27 MHz sampling and good output impedance matching with the video line).

The TSH103 requires a single 5 V power supply. It is available in an SO-8 plastic package.



1 Absolute maximum ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V _{CC}	Supply voltage ⁽¹⁾	6	V
V _{in}	Maximum input voltage swing	0 to 1.5	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}	SO-8 thermal resistance junction to case	28	°C/W
R _{thja}	SO-8 thermal resistance junction to ambient area	157	°C/W
ESD	HBM: human body model ⁽²⁾	3.5	kV
	CDM: charged device model ⁽³⁾	1.5	kV
	MM: machine model ⁽⁴⁾	200	V
	Output short-circuit	(5)	

1. All voltage values are with respect to network terminal.
2. Human body model: 100 pF discharged through a 1.5 kΩ resistor between two pins of the device, done for all couples of pin combinations with other pins floating.
3. Charged device model: all pins plus package are charged together to the specified voltage and then discharged directly to the ground.
4. Machine model: a 200 pF capacitor is charged to the specified voltage, then discharged directly between two pins of the device with no external series resistor (internal resistor < 5 Ω), done for all couples of pin combinations with other pins floating.
5. 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. This range is guaranteed by design (the product is tested in full production at a 5 V single power supply).

3 Electrical characteristics

Table 3. $V_{CC} = +5\text{ V}$ single supply, $T_{amb} = 25^\circ\text{ C}$ (unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
DC performance						
V_{DC}	Output DC shift	$R_L = 150\ \Omega$	100	310	430	mV
		$-40^\circ\text{ C} < T_{amb} < +85^\circ\text{ C}$		312		
I_{ib}	Input bias current	$V_{in} = 0\text{ V}$		1.2		μA
		$-40^\circ\text{ C} < T_{amb} < +85^\circ\text{ C}$		1.4		
I_{CC}	Supply current per channel	$V_{in} = 0.5\text{ V DC}$		5.5	7.1	mA
		$-40^\circ\text{ C} < T_{amb} < +85^\circ\text{ C}$		5.6		
G	DC voltage gain	$R_L = 150\ \Omega$	1.93	1.97	2	V/V
		$-40^\circ\text{ C} < T_{amb} < +85^\circ\text{ C}$		1.96		
V_{OH}	High level output voltage	$R_L = 150\ \Omega$		3.9		V
V_{OL}	Low level output voltage	$R_L = 150\ \Omega$		41	46	mV
I_{OUT}	I_{sink}/I_{source}			56		mA
Video performance						
F_{Cut}	-3 dB bandwidth	Small signal, $R_L = 150\ \Omega$		9.4		MHz
	-1 dB bandwidth	Small signal, $R_L = 150\ \Omega$	5.1	7.4		
F_{att}	Filter attenuation	Small signal, $F = 27\text{ MHz}$		37		dB
gd	Group delay	0 to 5 MHz		10		ns
dG	Differential gain	$R_L = 150\ \Omega$		0.5		%
dPh	Differential phase	$R_L = 150\ \Omega$		0.5		$^\circ$
Noise						
e_n	Input voltage noise	100 kHz		76		nV/ $\sqrt{\text{Hz}}$

Figure 1. Frequency response

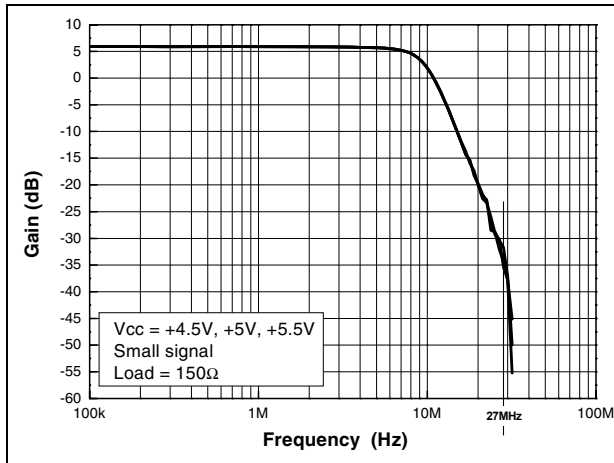


Figure 2. Gain flatness

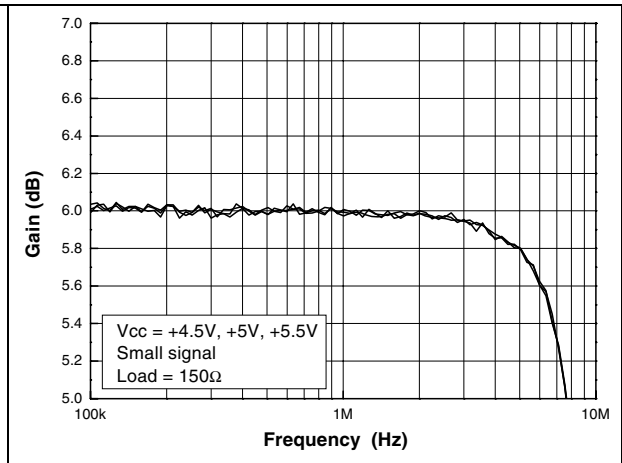


Figure 3. Frequency response (large signal)

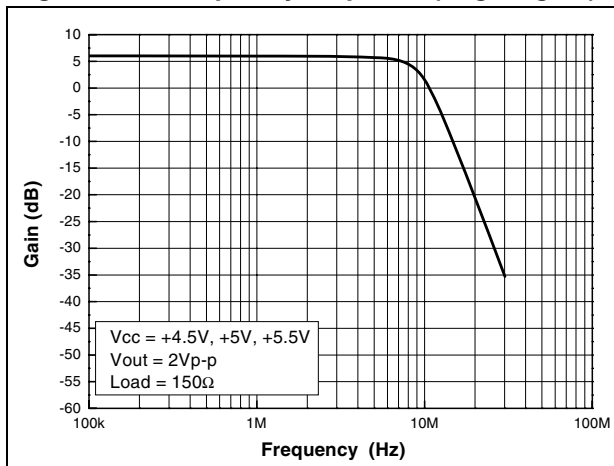


Figure 4. Distortion

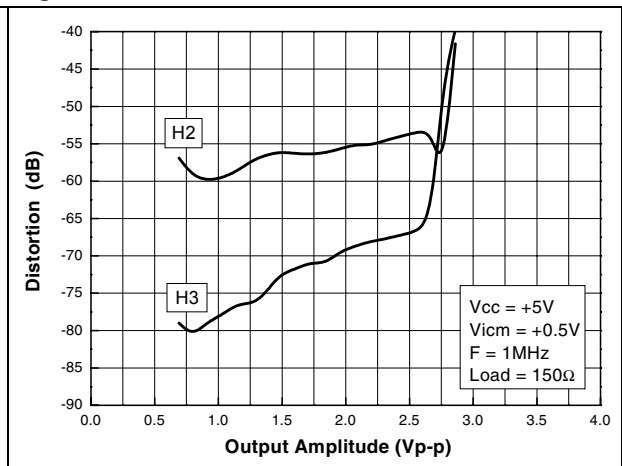


Figure 5. Quiescent current vs. supply

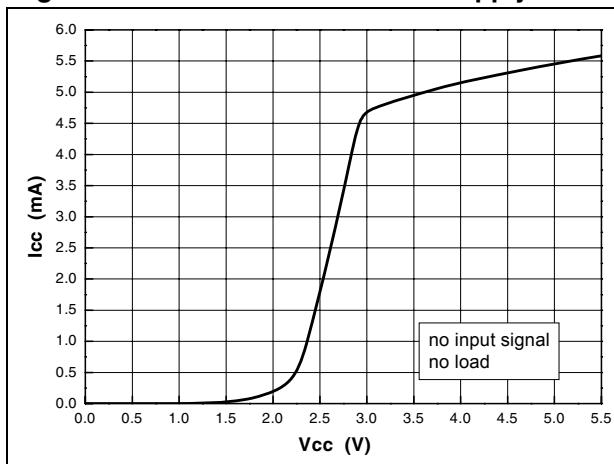
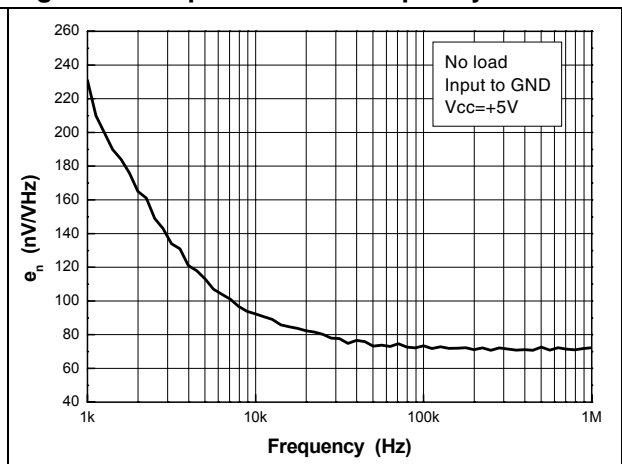


Figure 6. Input noise vs. frequency



4 Power supply considerations

Correct power supply bypassing is very important for optimizing performance in high-frequency ranges. The bypass capacitors should be placed as close as possible to the IC pins to improve high-frequency bypassing. A capacitor of 100 μF is necessary to minimize the power supply noise in low frequencies. For better quality bypassing, we recommend adding a CMS 100 nF capacitor, also placed as close as possible to the IC pins.

Figure 7. Circuit for power supply bypassing

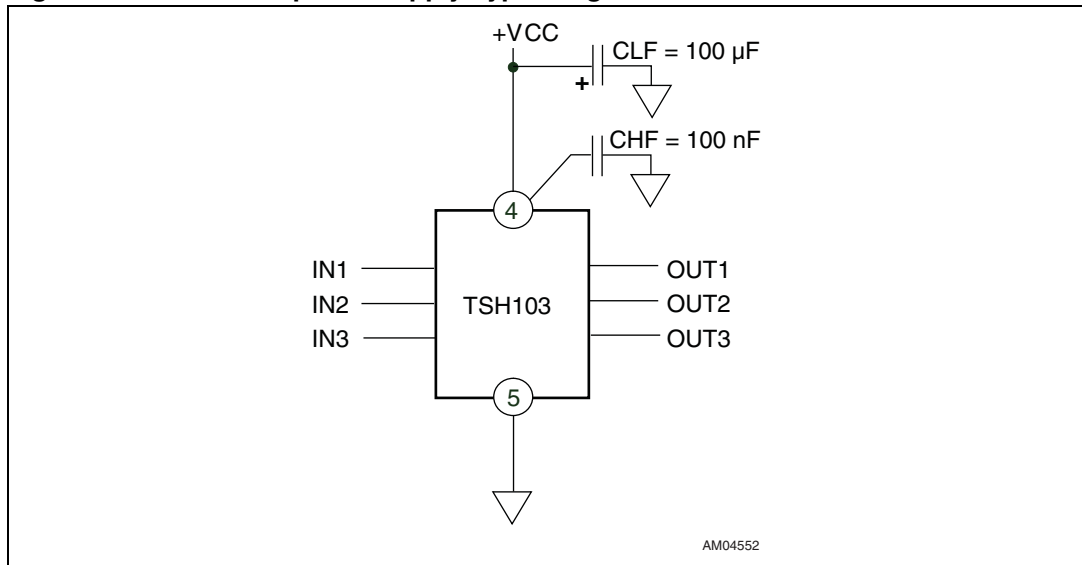
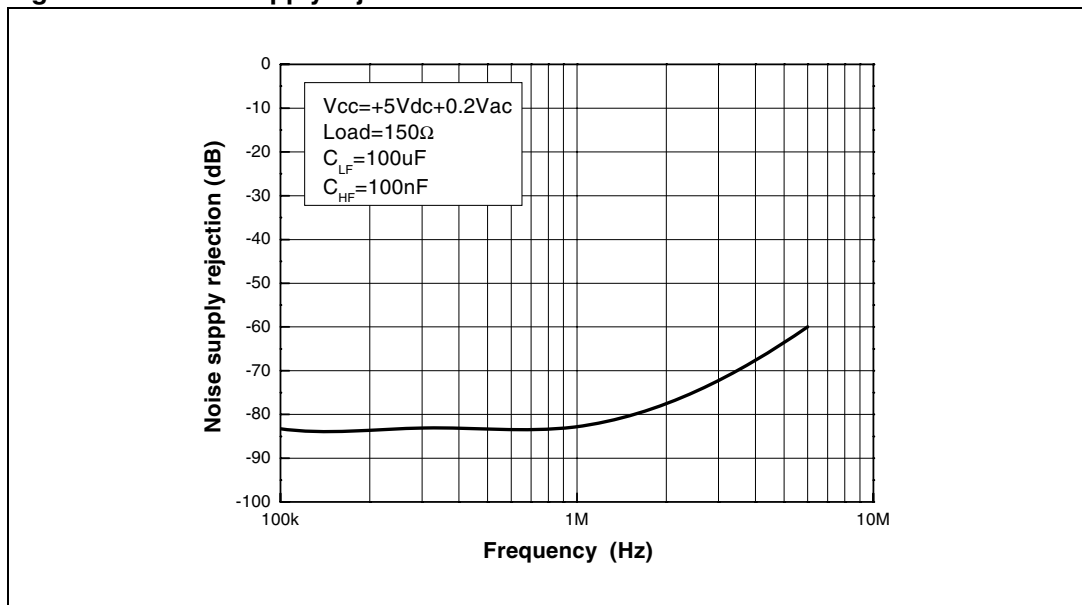
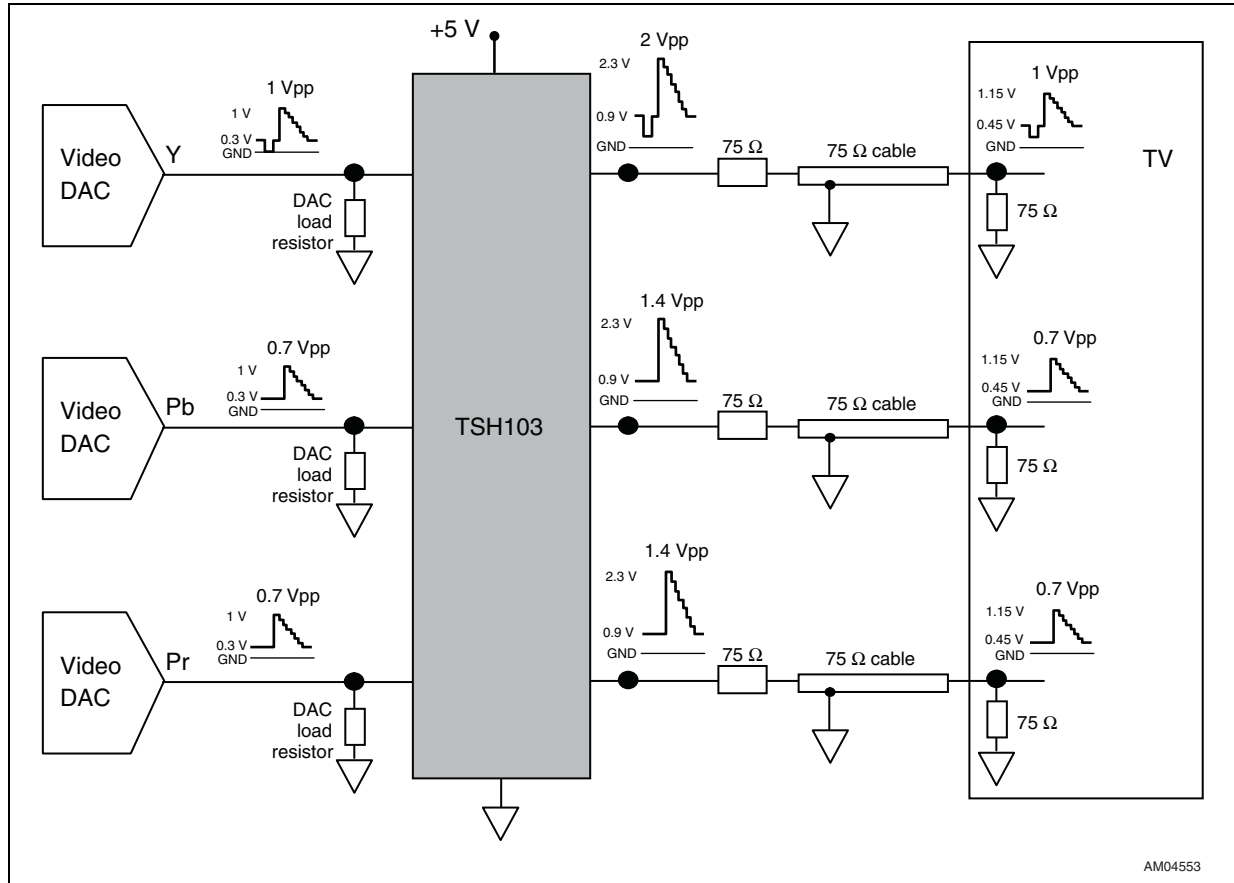


Figure 8. Noise supply rejection



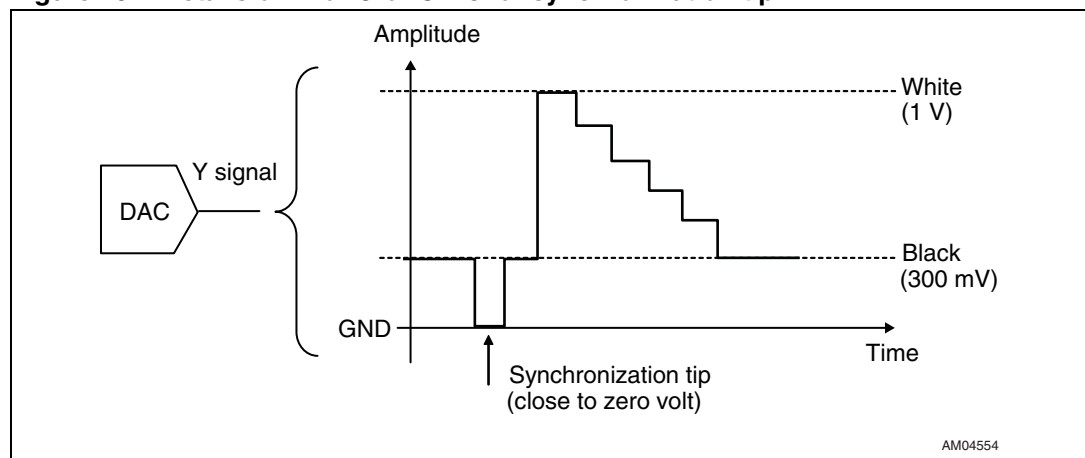
5 Using the TSH103 to drive video signals

Figure 9. Video line interface implementation schematics



The bottom of the synchronization tip at the DAC output can be as low as 0 mV. In this case, the bottom is equal to 310 mV typical at the TSH103 output (see values of the output DC shift in [Table 3](#)). The Y signal can be properly driven by the TSH103 because its low output rail (V_{OL}) is lower than 46 mV ([Table 3](#)).

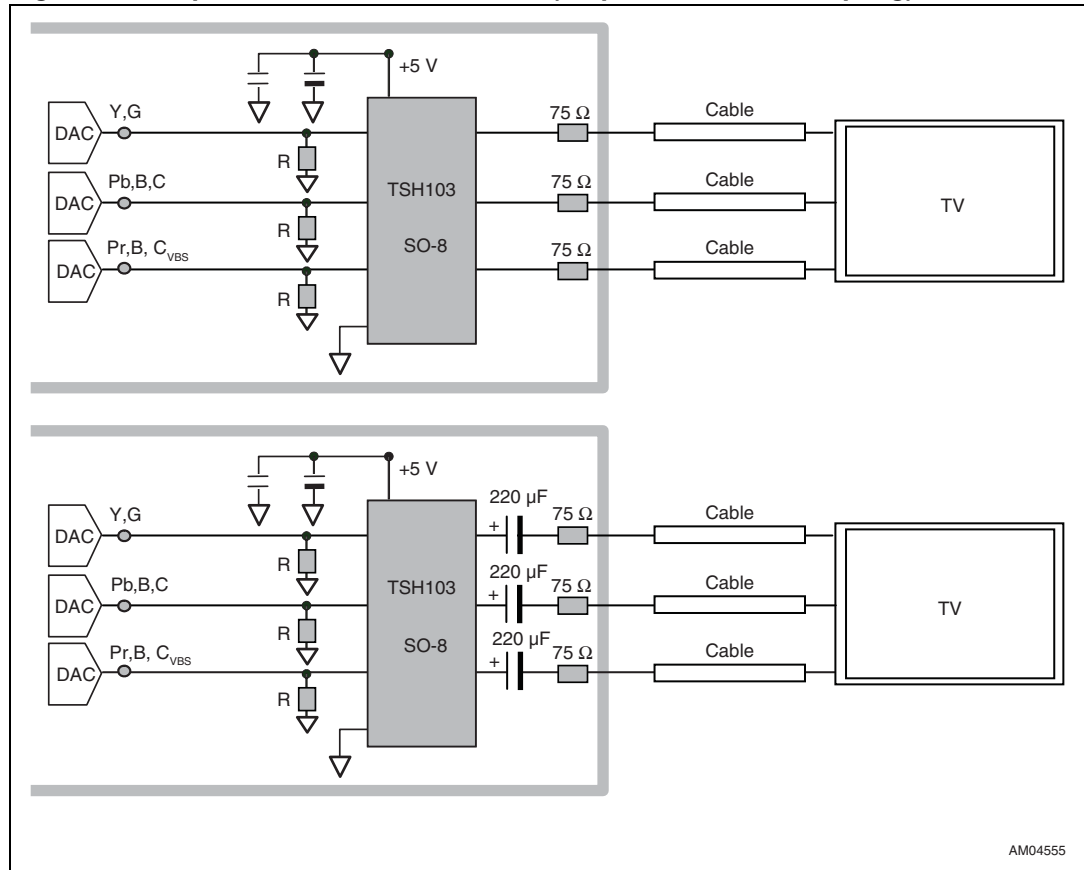
Figure 10. Details on Y or G or CvBs for synchronization tip



The interface is illustrated in *Figure 11*. It is composed of:

- three 75-Ω resistors
- three matching resistors
- one 10 μF power supply decoupling capacitor
- one 10 nF power supply decoupling capacitor

Figure 11. Implementation of the TSH103 (output DC and AC coupling)



1. Note that the TSH103 is input DC coupling only, and not AC coupling.

6 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK[®] packages, depending on their level of environmental compliance. ECOPACK[®] specifications, grade definitions and product status are available at: www.st.com. ECOPACK[®] is an ST trademark.

6.1 SO-8 package information

Figure 12. SO-8 package mechanical drawing

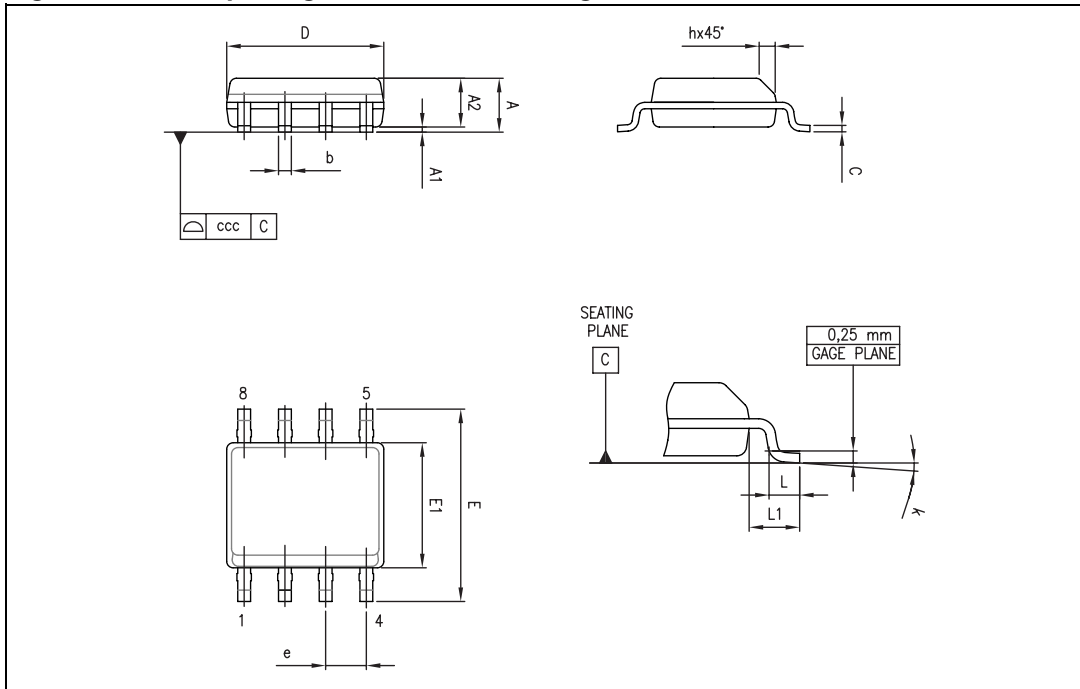


Table 4. SO-8 package mechanical data

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
A1	0.10		0.25	0.004		0.010
A2	1.25			0.049		
b	0.28		0.48	0.011		0.019
c	0.17		0.23	0.007		0.010
D	4.80	4.90	5.00	0.189	0.193	0.197
E	5.80	6.00	6.20	0.228	0.236	0.244
E1	3.80	3.90	4.00	0.150	0.154	0.157
e		1.27			0.050	
h	0.25		0.50	0.010		0.020
L	0.40		1.27	0.016		0.050
L1		1.04			0.040	
k	0		8°	1°		8°
ccc			0.10			0.004

7 Ordering information

Table 5. Order codes

Part number	Temperature range	Package	Packing	Marking
TSH103ID	-40° C to +85° C	SO-8	Tube	TSH103I
TSH103IDT	-40° C to +85° C	SO-8	Tape & reel	TSH103I

8 Revision history

Table 6. Document revision history

Date	Revision	Changes
19-Sep-2007	1	Initial release.
20-Aug-2009	2	Document reformatted and graphics improved. Added ESD notes under Table 1: Absolute maximum ratings . Updated SO-8 package information in Chapter 6 .

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2009 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com