TSH103

Low cost triple video buffer/filter for standard video

Features

- Triple channels
- Internal 6 MHz reconstruction filter (4^{th} 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

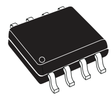
- Standard definition TVs
- Set-top boxes
- DVD players/recorders

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.

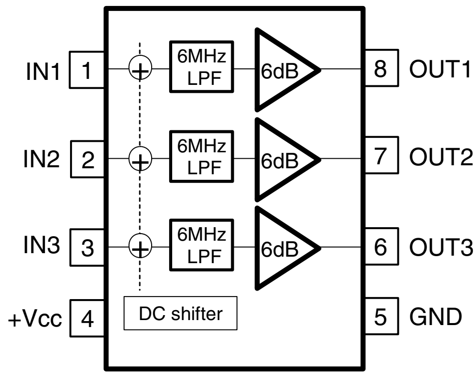
This triple channel is designed to drive either CVBS/Y-C or RGB or YPbPr or YUV formats. Each channel features an internal 6 MHz reconstruction filter and a 6 dB buffer (attenuation of 27 MHz sampling and good output impedance matching with the video line).

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



SO-8 plastic package

Pin connections



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) CDM: charged device model (3) MM: machine model (4)	3.5 1.5 200	kV kV 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 V single supply, T_{amb} = 25° C (unless otherwise specified)

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

Figure 1. Frequency response

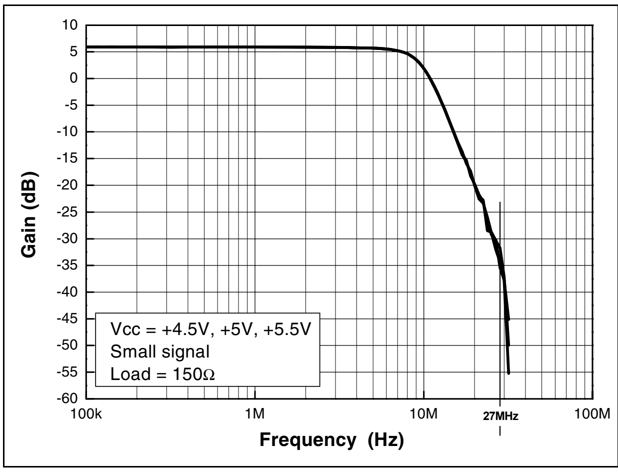


Figure 2. Gain flatness

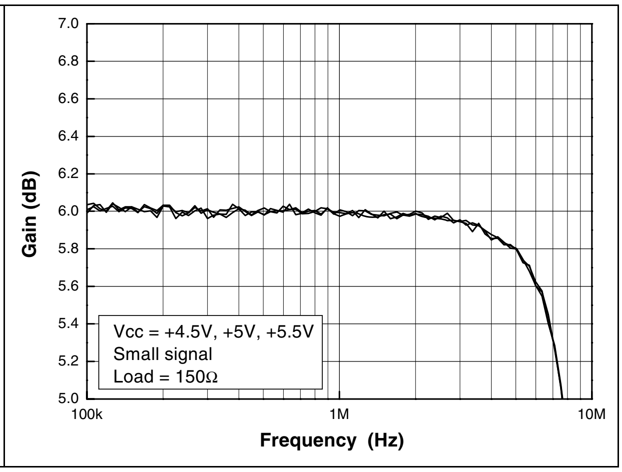


Figure 3. Frequency response (large signal)

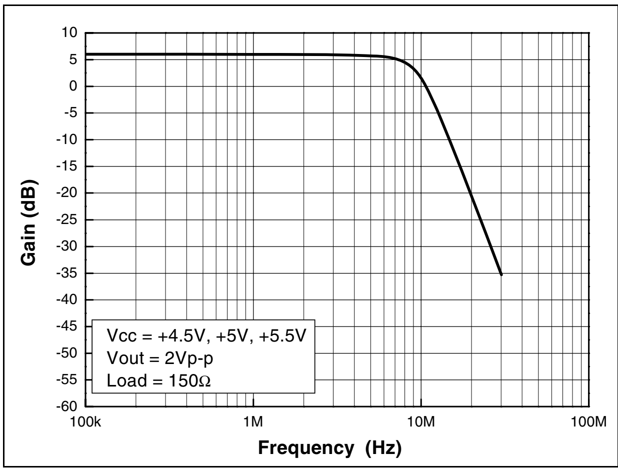


Figure 4. Distortion

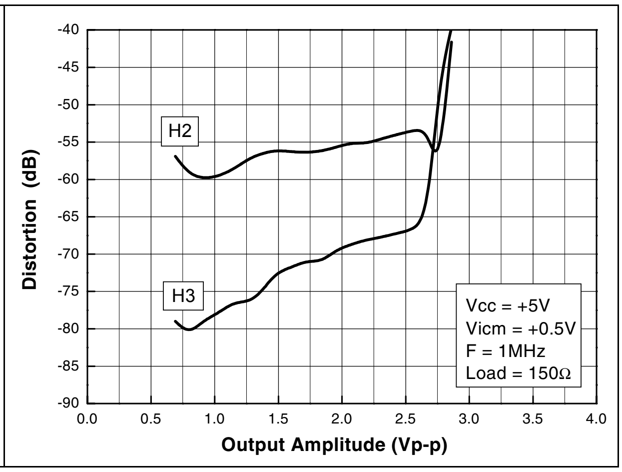


Figure 5. Quiescent current vs. supply

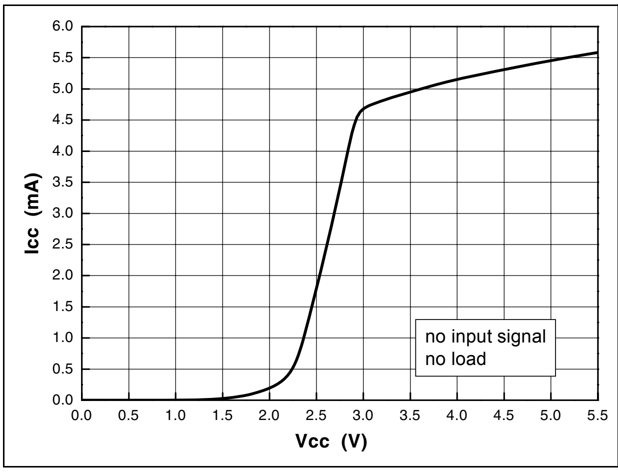
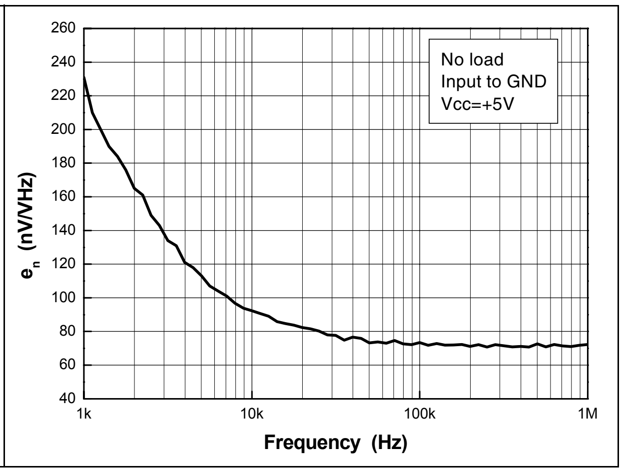


Figure 6. Input noise vs. frequency



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

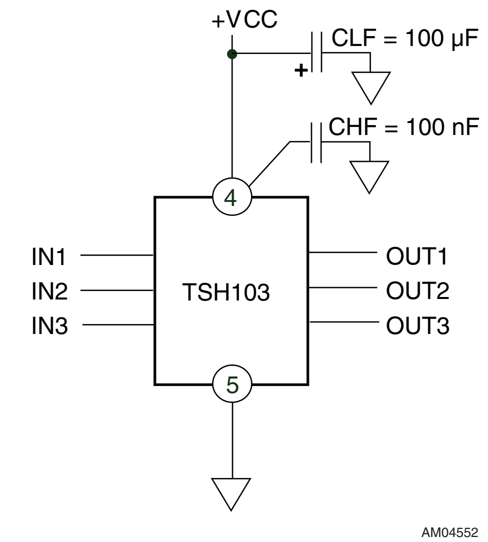
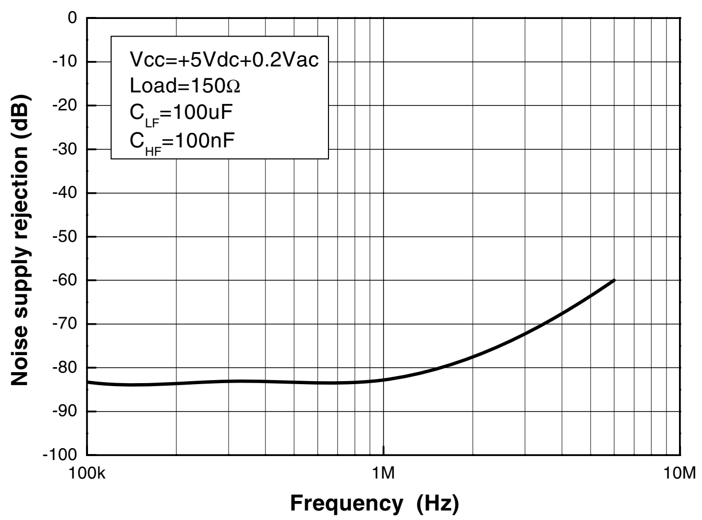
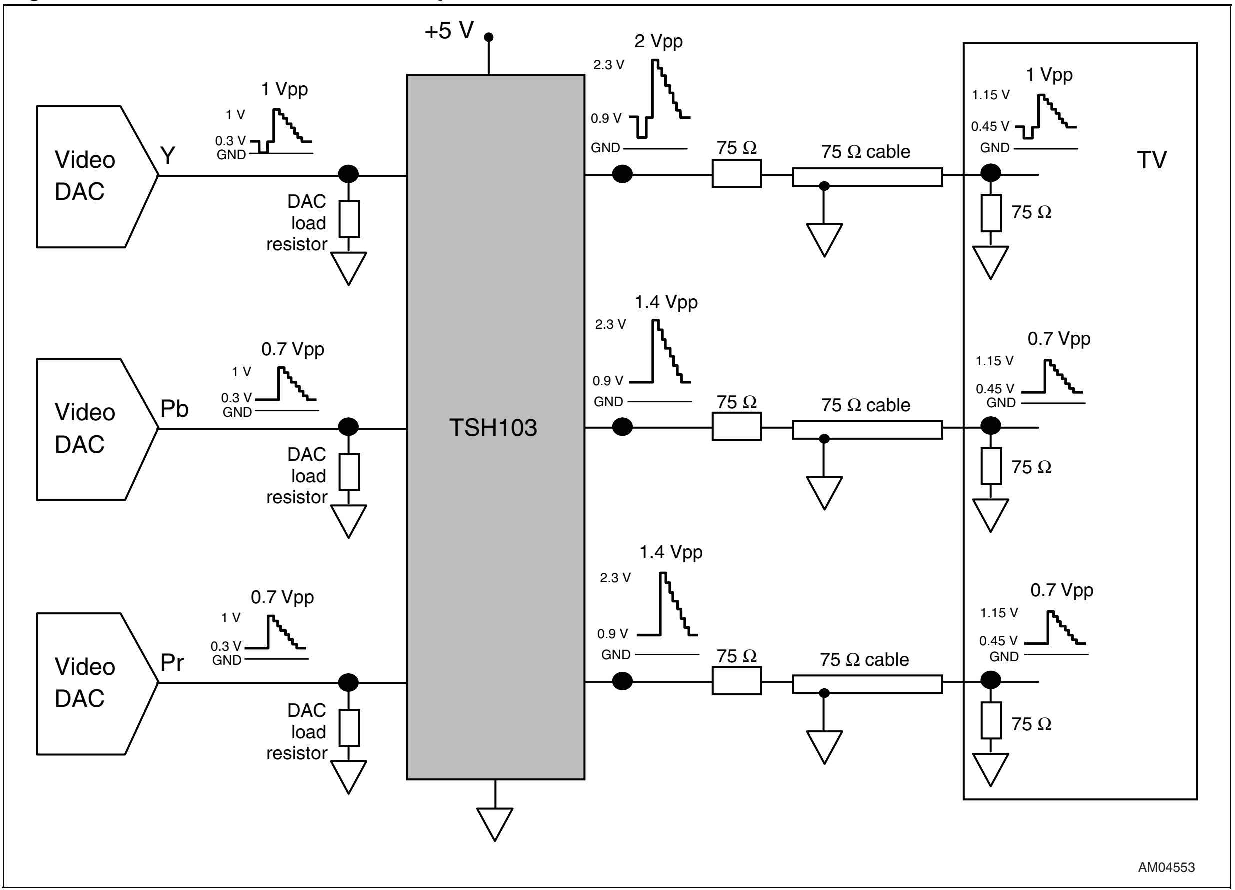


Figure 8. Noise supply rejection



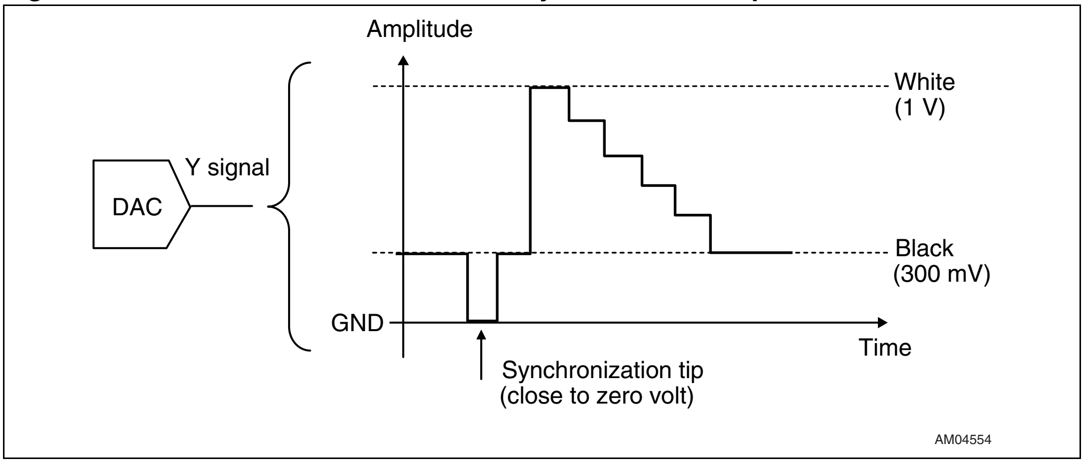
5 Using the TSH103 to drive video signals

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*).

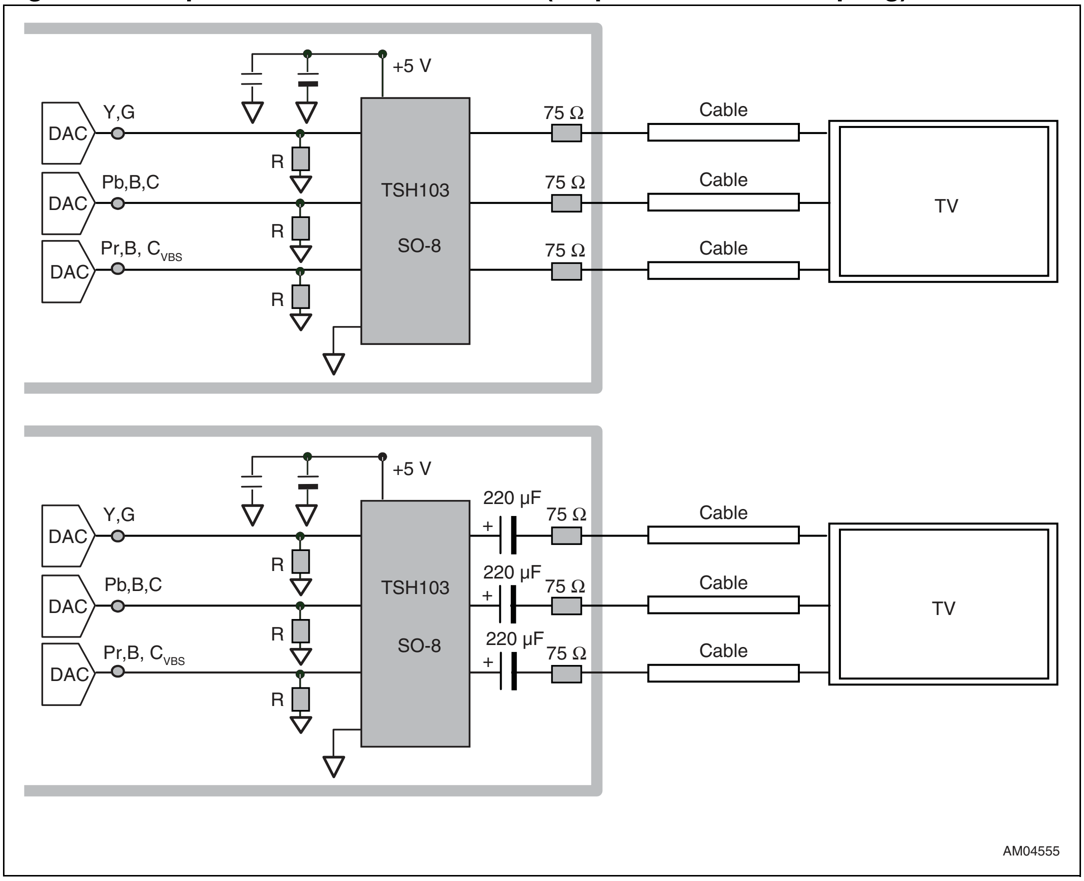
Figure 10. Details on Y or G or CVBS for synchronization tip



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

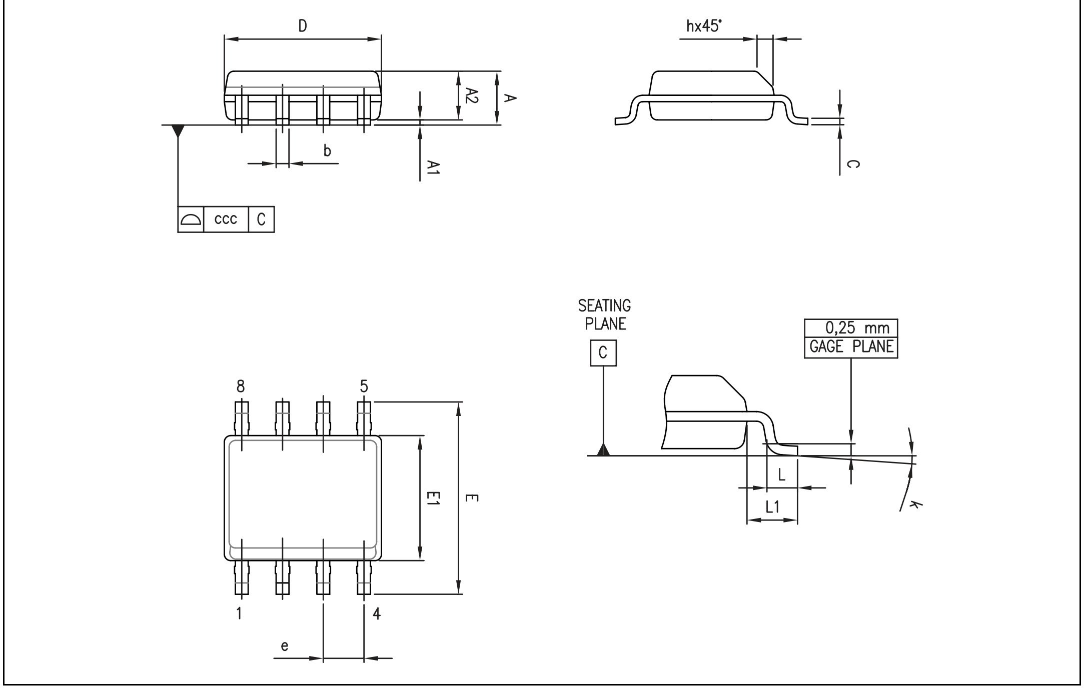


Table 4. SO-8 package mechanical data

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*.