



# TDA9983A

HDMI transmitter up to 150 MHz pixel rate with 3 × 8-bit video inputs and 4 × I<sup>2</sup>S-bus with S/PDIF

Rev. 01 — 13 March 2008

Product short data sheet



## 1. General description

---

The TDA9983A is an HDMI transmitter (which also supports DVI) that enables a 3 × 8-bit RGB or YC<sub>B</sub>C<sub>R</sub> video stream (with a pixel rate up to 150 MHz for the TDA9983AHW/15 version), up to 4 I<sup>2</sup>S-bus audio streams (with an audio sampling rate up to 192 kHz) and the additional information required by all the HDMI 1.2a standards.

A programmable upscaling block enables a 720p/1080i output from a standard definition input. An intrafield deinterlacer is included in the scaler.

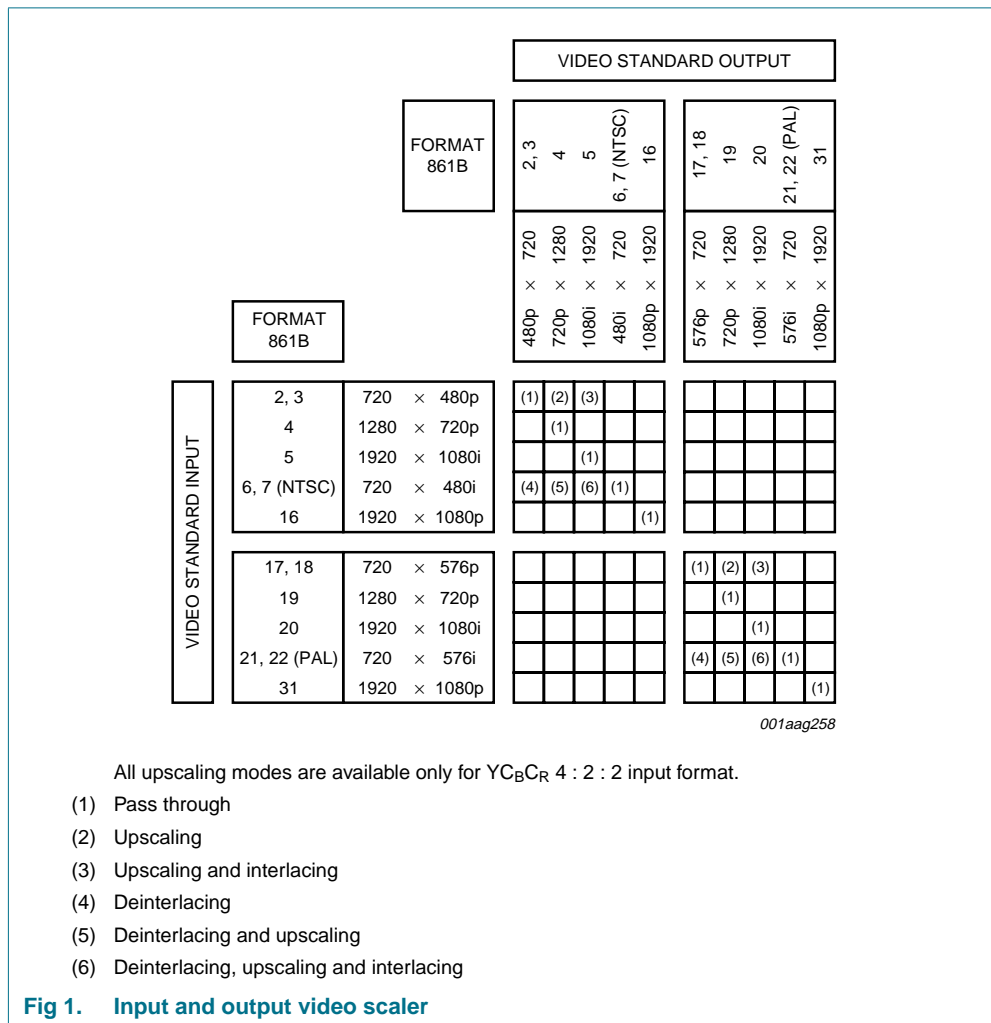
In order to be compatible with most applications, the TDA9983A integrates a full programmable input formatter and color space conversion block. The video input formats accepted are YC<sub>B</sub>C<sub>R</sub> 4 : 4 : 4 (up to 3 × 8-bit), YC<sub>B</sub>C<sub>R</sub> 4 : 2 : 2 semi-planar (up to 2 × 12-bit), YC<sub>B</sub>C<sub>R</sub> 4 : 2 : 2 compliant with ITU656 and ITU656-like (up to 1 × 12-bit).

For ITU656-like formats, double edges are supported so that data can be sampled on rising and falling edges.

The TDA9983A also includes a HDCP 1.1 compliant cipher block. The HDCP key set is stored internally in a One Time Programming (OTP) non-volatile memory for maximum security.

The device can be controlled via an I<sup>2</sup>C-bus interface.





## 2. Features

- 3 × 8-bit video data input bus, CMOS and LV-TTL compatible
- Horizontal synchronization, vertical synchronization and Data Enable (DE) inputs or VREF, HREF and FREF could be used for input data synchronization
- Pixel rate clock input can be made active on one or both edges (selectable by I<sup>2</sup>C-bus)
- The TDA9983A has 4 I<sup>2</sup>S-bus audio input channels and 1 S/PDIF channel; audio sampling rate up to 192 kHz
- 250 MHz to 1.50 GHz HDMI transmitter operation
- Programmable input formatter and upsampler/interpolator allows input of any of the 4 : 4 : 4, 4 : 2 : 2 semi-planar, 4 : 2 : 2 ITU656 and ITU656-like formats
- Programmable color space converter:
  - ◆ RGB to YC<sub>B</sub>C<sub>R</sub>
  - ◆ YC<sub>B</sub>C<sub>R</sub> to RGB

- The upscaler enables a 720p/1080i output from a standard definition input using intelligent edge interpolation
- Deals with multiple levels of HDCP receivers and repeaters
- Internal SHA-1 calculation
- Controllable via I<sup>2</sup>C-bus
- Low power dissipation
- 1.8 V and 3.3 V power supplies
- Power-down mode
- Hard reset

### 3. Applications

- DVD players and recorders
- Set-Top Box (STB)
- AV receivers and amplifiers (repeater)
- Camcorders
- Digital still cameras
- Media players
- PVRs
- Media centers PCs, graphics add-in boards, notebook PCs
- Switches

### 4. Quick reference data

**Table 1. Quick reference data**

$V_{DDA(FRO\_3V3)} = 3.0\text{ V to }3.6\text{ V}$ ;  $V_{DDA(PLL\_3V3)} = 3.0\text{ V to }3.6\text{ V}$ ;  $V_{DDH(3V3)} = 3.0\text{ V to }3.6\text{ V}$ ;  
 $V_{DDD(3V3)} = 3.0\text{ V to }3.6\text{ V}$ ;  $V_{DDC(1V8)} = 1.65\text{ V to }1.95\text{ V}$ ;  $V_{PP} = 0\text{ V}$ ;  $T_{amb} = 0\text{ }^{\circ}\text{C to }70\text{ }^{\circ}\text{C}$ .  
 Typical values are measured at  $V_{DDA(FRO\_3V3)} = V_{DDA(PLL\_3V3)} = V_{DDH(3V3)} = V_{DDD(3V3)} = 3.3\text{ V}$ ;  
 $V_{DDC(1V8)} = 1.8\text{ V}$ ;  $V_{PP} = 0\text{ V}$  and  $T_{amb} = 25\text{ }^{\circ}\text{C}$ ; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>TDA9983AHW/8 and TDA9983AHW/15</b>						
$V_{DDA(FRO\_3V3)}$	free running oscillator 3.3 V analog supply voltage		3.0	3.3	3.6	V
$V_{DDA(PLL\_3V3)}$	PLL 3.3 V analog supply voltage		3.0	3.3	3.6	V
$V_{DDD(3V3)}$	digital supply voltage (3.3 V)		3.0	3.3	3.6	V
$V_{DDH(3V3)}$	HDMI supply voltage (3.3 V)		3.0	3.3	3.6	V
$V_{DDC(1V8)}$	core supply voltage (1.8 V)		1.65	1.8	1.95	V
$T_{amb}$	ambient temperature		0	-	70	$^{\circ}\text{C}$
<b>TDA9983AHW/8; up to 81 MHz</b>						
$f_{clk(max)}$	maximum clock frequency	[1][2]	81	-	-	MHz
$P_{cons}$	power consumption	[1]	-	329	-	mW
		worst case [2]	-	343	512	mW
$P_{tot}$	total power dissipation	[1]	-	463	-	mW
		worst case [2]	-	477	661	mW

**Table 1. Quick reference data ...continued**

$V_{DDA(FRO\_3V3)} = 3.0\text{ V to }3.6\text{ V}$ ;  $V_{DDA(PLL\_3V3)} = 3.0\text{ V to }3.6\text{ V}$ ;  $V_{DDH(3V3)} = 3.0\text{ V to }3.6\text{ V}$ ;  
 $V_{DDD(3V3)} = 3.0\text{ V to }3.6\text{ V}$ ;  $V_{DDC(1V8)} = 1.65\text{ V to }1.95\text{ V}$ ;  $V_{PP} = 0\text{ V}$ ;  $T_{amb} = 0\text{ }^{\circ}\text{C to }70\text{ }^{\circ}\text{C}$ .  
 Typical values are measured at  $V_{DDA(FRO\_3V3)} = V_{DDA(PLL\_3V3)} = V_{DDH(3V3)} = V_{DDD(3V3)} = 3.3\text{ V}$ ;  
 $V_{DDC(1V8)} = 1.8\text{ V}$ ;  $V_{PP} = 0\text{ V}$  and  $T_{amb} = 25\text{ }^{\circ}\text{C}$ ; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$P_{pd}$	power dissipation in power-down mode		-	13.5	38.4	mW
<b>TDA9983AHW/15; up to 150 MHz</b>						
$f_{clk(max)}$	maximum clock frequency		[3] 150	-	-	MHz
$P_{cons}$	power consumption		[3] -	361	583	mW
$P_{tot}$	total power dissipation		[3] -	495	732	mW
$P_{pd}$	power dissipation in power-down mode		-	13.5	38.4	mW

- [1] Video format:  
 a) Input 480p (ITU656 embedded sync, rising edge)  
 b) Output 1080i (YCBCR 4 : 2 : 2)
- [2] Worst case video format:  
 a) Input 480p (YCBCR 4 : 2 : 2 semi-planar)  
 b) Output 720p (YCBCR 4 : 2 : 2)
- [3] Video format:  
 a) Input 1080p (RGB 4 : 4 : 4 external sync, rising edge)  
 b) Output 1080p (RGB 4 : 4 : 4)

## 5. Ordering information

**Table 2. Ordering information**

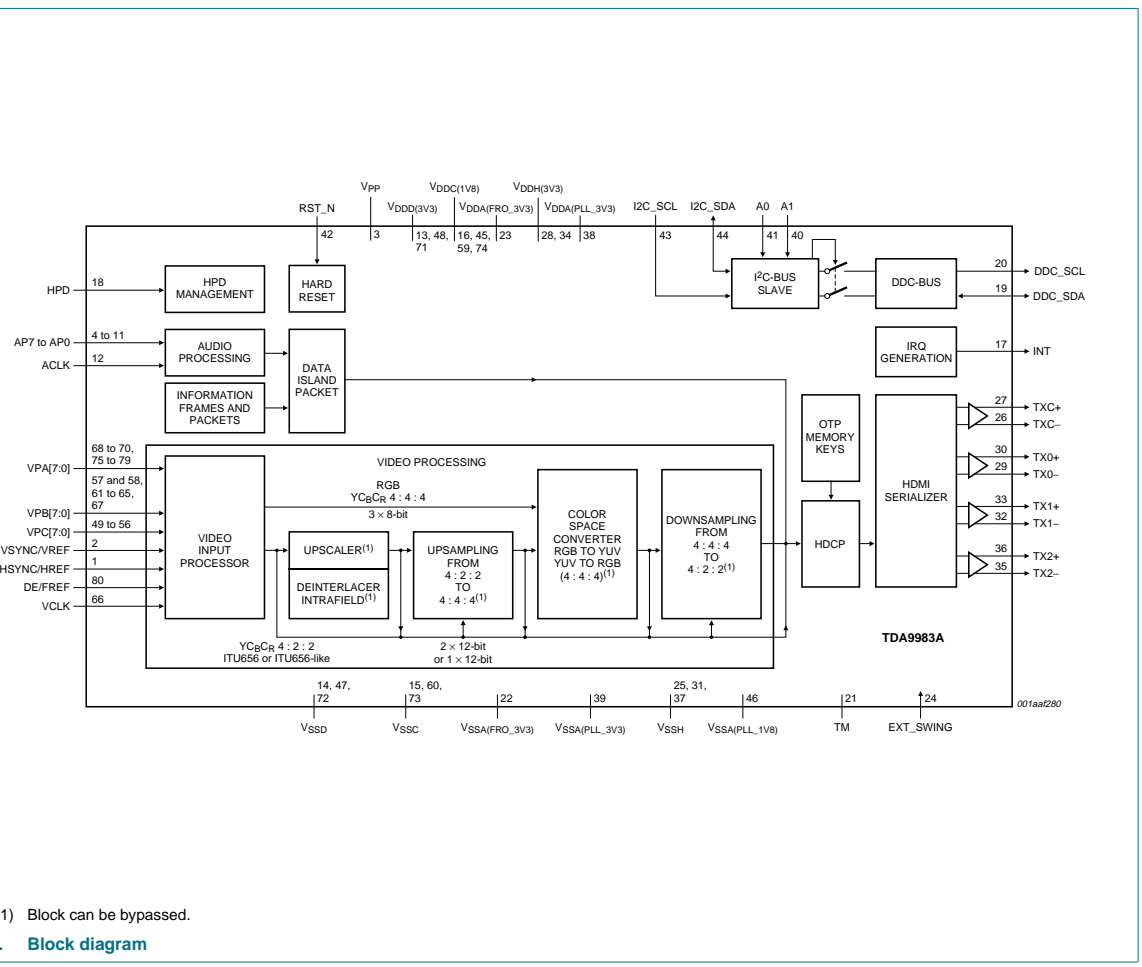
Type number	Package		Version
	Name	Description	
TDA9983AHW	HTQFP80	plastic thermal enhanced thin quad flat package; 80 leads; body 12 × 12 × 1 mm; exposed die pad	SOT841-4

### 5.1 Ordering options

**Table 3. Survey of type numbers**

Extended type number	Sampling frequency (Msample/s)	Application
TDA9983AHW/8/C1xx	81	customer specific version
TDA9983AHW/15/C1xx	150	customer specific version

6. Block diagram



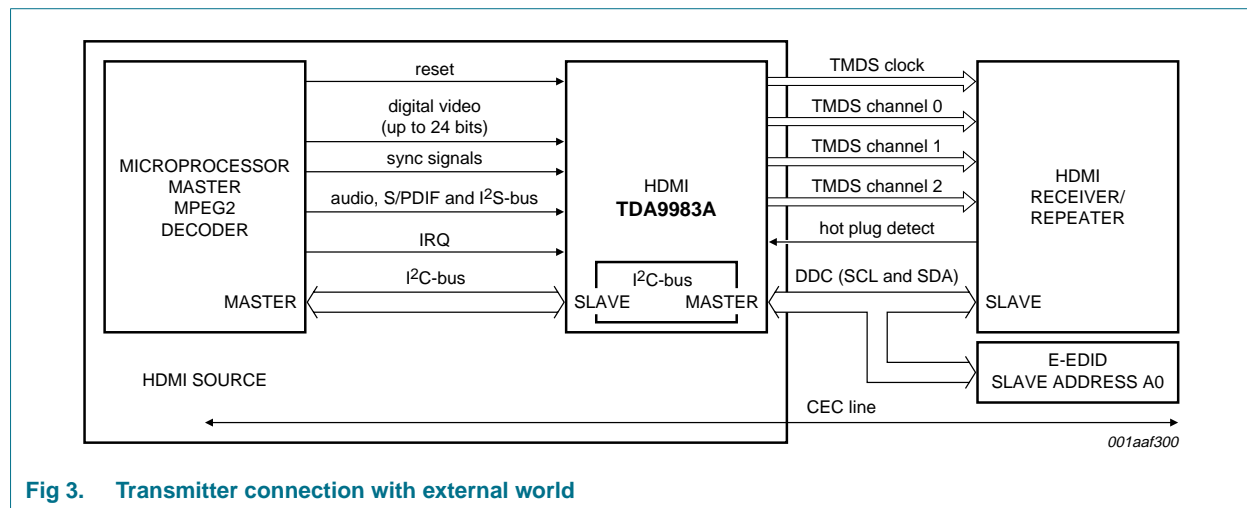
## 7. Limiting values

**Table 4. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DD(3V3)}$	supply voltage (3.3 V)		-0.5	+4.6	V
$V_{DD(1V8)}$	supply voltage (1.8 V)		-0.5	+2.5	V
$\Delta V_{DD}$	supply voltage difference		-0.5	+0.5	V
$T_{stg}$	storage temperature		-55	+150	°C
$T_{amb}$	ambient temperature		0	70	°C
$T_j$	junction temperature		-	125	°C
$V_{esd}$	electrostatic discharge voltage	HBM	-1500	+1500	V

## 8. Application information



**Fig 3. Transmitter connection with external world**

## 9. Abbreviations

**Table 5. Abbreviations**

Acronym	Description
CMOS	Complementary Metal-Oxide Semiconductor
DDC	Display Data Channel
DVI	Digital Visual Interface
HDCP	High-bandwidth Digital Content Protection
HBM	Human Body Model
HDMI	High-Definition Multimedia Interface
HPD	Hot Plug Detect
IRQ	Interrupt ReQuest
LV-TTL	Low-Voltage Transistor-Transistor Logic
OTP	One-Time Programmable

Table 5. Abbreviations ...continued

Acronym	Description
RGB	Red, Green, Blue
SHA-1	Secure Hash Algorithm 1
S/PDIF	Sony/Philips Digital Interface
Y <sub>C</sub> B <sub>R</sub>	color space originally defined by the ITU-R BT.601
YUV	color space used by the NTSC and PAL systems

## 10. Revision history

Table 6. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
TDA9983A_SDS_1	20080313	Product short data sheet	-	-

## 11. Legal information

### 11.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

### 11.2 Definitions

**Draft** — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

**Short data sheet** — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local NXP Semiconductors sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

### 11.3 Disclaimers

**General** — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information.

**Right to make changes** — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

**Suitability for use** — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in medical, military, aircraft, space or life support equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental

damage. NXP Semiconductors accepts no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

**Applications** — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

**Limiting values** — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) may cause permanent damage to the device. Limiting values are stress ratings only and operation of the device at these or any other conditions above those given in the Characteristics sections of this document is not implied. Exposure to limiting values for extended periods may affect device reliability.

**Terms and conditions of sale** — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at <http://www.nxp.com/profile/terms>, including those pertaining to warranty, intellectual property rights infringement and limitation of liability, unless explicitly otherwise agreed to in writing by NXP Semiconductors. In case of any inconsistency or conflict between information in this document and such terms and conditions, the latter will prevail.

**No offer to sell or license** — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

**Quick reference data** — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

### 11.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

**I<sup>2</sup>C-bus** — logo is a trademark of NXP B.V.

## 12. Contact information

For more information, please visit: <http://www.nxp.com>

For sales office addresses, please send an email to: [salesaddresses@nxp.com](mailto:salesaddresses@nxp.com)



## 13. Contents

<b>1</b>	<b>General description</b> .....	<b>1</b>
<b>2</b>	<b>Features</b> .....	<b>2</b>
<b>3</b>	<b>Applications</b> .....	<b>3</b>
<b>4</b>	<b>Quick reference data</b> .....	<b>3</b>
<b>5</b>	<b>Ordering information</b> .....	<b>4</b>
5.1	Ordering options .....	4
<b>6</b>	<b>Block diagram</b> .....	<b>5</b>
<b>7</b>	<b>Limiting values</b> .....	<b>6</b>
<b>8</b>	<b>Application information</b> .....	<b>6</b>
<b>9</b>	<b>Abbreviations</b> .....	<b>6</b>
<b>10</b>	<b>Revision history</b> .....	<b>7</b>
<b>11</b>	<b>Legal information</b> .....	<b>8</b>
11.1	Data sheet status .....	8
11.2	Definitions .....	8
11.3	Disclaimers .....	8
11.4	Trademarks .....	8
<b>12</b>	<b>Contact information</b> .....	<b>8</b>
<b>13</b>	<b>Contents</b> .....	<b>9</b>



Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.

© NXP B.V. 2008.

All rights reserved.

For more information, please visit: <http://www.nxp.com>

For sales office addresses, please send an email to: [salesaddresses@nxp.com](mailto:salesaddresses@nxp.com)

Date of release: 13 March 2008

Document identifier: TDA9983A\_SDS\_1