TDA9983A

HDMI transmitter up to 150 MHz pixel rate with 3 × 8-bit video inputs and 4 × I²S-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_BC_R video stream (with a pixel rate up to 150 MHz for the TDA9983AHW/15 version), up to 4 I²S-bus audio streams (with an audio sampling rate up to 192 kHz) and the additional information required by all the HDMI 1.2a standards.
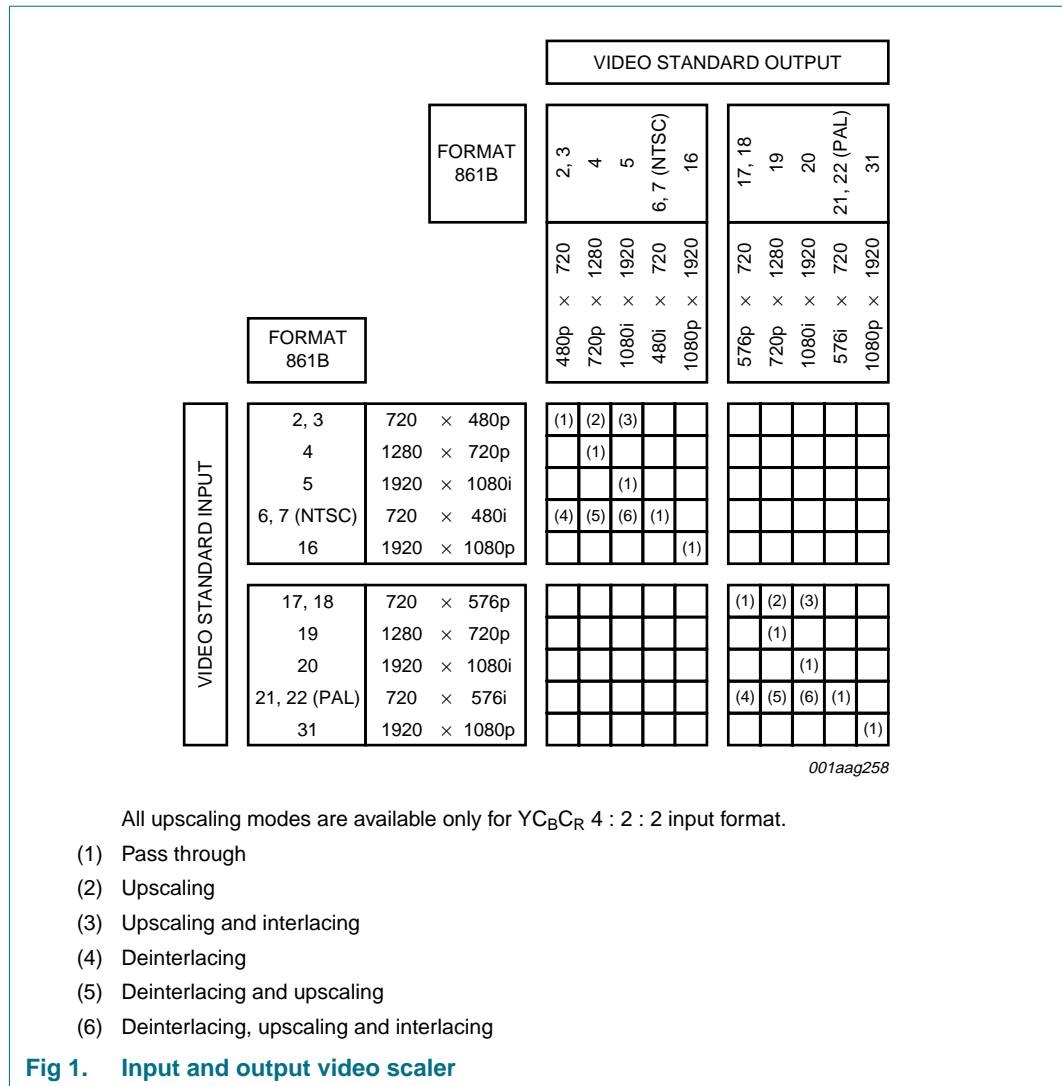
A programmable upscaling block enables a 720p/1080i output from a standard definition input. An intrafield deinterlacer is included in the scaler.

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_BC_R 4 : 4 : 4 (up to 3×8-bit), YC_BC_R 4 : 2 : 2 semi-planar (up to 2×12-bit), YC_BC_R 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 I²C-bus interface.

VIDEO STANDARD INPUT	FORMAT 861B			VIDEO STANDARD OUTPUT										
				FORMAT 861B	2, 3	4	5	6, 7 (NTSC)	16	17, 18	19	20	21, 22 (PAL)	31
					720 × 480p	1280 × 720p	1920 × 1080i	720 × 480i	1920 × 1080p	720 × 576p	1280 × 720p	1920 × 1080i	720 × 576i	1920 × 1080p
	2, 3	720 × 480p			(1)	(2)	(3)							
	4	1280 × 720p				(1)								
	5	1920 × 1080i					(1)							
	6, 7 (NTSC)	720 × 480i			(4)	(5)	(6)	(1)						
	16	1920 × 1080p							(1)					
	17, 18	720 × 576p								(1)	(2)	(3)		
	19	1280 × 720p									(1)			
	20	1920 × 1080i										(1)		
	21, 22 (PAL)	720 × 576i								(4)	(5)	(6)	(1)	
	31	1920 × 1080p												(1)

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All upscaling modes are available only for YC_BC_R 4 : 2 : 2 input format.

(1) Pass through
(2) Upscaling
(3) Upscaling and interlacing
(4) Deinterlacing
(5) Deinterlacing and upscaling
(6) Deinterlacing, upscaling and interlacing

Fig 1.   Input and output video scaler

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^2C-bus)
■ The TDA9983A has 4 I^2S-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_BC_R
   ◆ YC_BC_R 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^{2}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 V to 3.6 V; $V_{DDA(PLL\_3V3)}$ = 3.0 V to 3.6 V; $V_{DDH(3V3)}$ = 3.0 V to 3.6 V; $V_{DDD(3V3)}$ = 3.0 V to 3.6 V; $V_{DDC(1V8)}$ = 1.65 V to 1.95 V; V_{PP} = 0 V; T_{amb} = 0 °C to 70 °C. Typical values are measured at $V_{DDA(FRO\_3V3)}$ = $V_{DDA(PLL\_3V3)}$ = $V_{DDH(3V3)}$ = $V_{DDD(3V3)}$ = 3.3 V; $V_{DDC(1V8)}$ = 1.8 V; V_{PP} = 0 V and T_{amb} = 25 °C; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
TDA9983AHW/8 and TDA9983AHW/15						
$V_{DDA(FRO\_3V3)}$	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	°C
TDA9983AHW/8; up to 81 MHz						
$f_{clk(max)}$	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 V to 3.6 V; $V_{DDA(PLL\_3V3)}$ = 3.0 V to 3.6 V; $V_{DDH(3V3)}$ = 3.0 V to 3.6 V;
$V_{DDD(3V3)}$ = 3.0 V to 3.6 V; $V_{DDC(1V8)}$ = 1.65 V to 1.95 V; V_{PP} = 0 V; T_{amb} = 0 °C to 70 °C.
Typical values are measured at $V_{DDA(FRO\_3V3)}$ = $V_{DDA(PLL\_3V3)}$ = $V_{DDH(3V3)}$ = $V_{DDD(3V3)}$ = 3.3 V;
$V_{DDC(1V8)}$ = 1.8 V; V_{PP} = 0 V and T_{amb} = 25 °C; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
P_{pd}	power dissipation in power-down mode		-	13.5	38.4	mW
TDA9983AHW/15; up to 150 MHz						
$f_{clk(max)}$	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 (YC$_B$C$_R$ 4 : 2 : 2)

[2] Worst case video format:

    a) Input 480p (YC$_B$C$_R$ 4 : 2 : 2 semi-planar)

    b) Output 720p (YC$_B$C$_R$ 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		
	Name	**Description**	**Version**
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
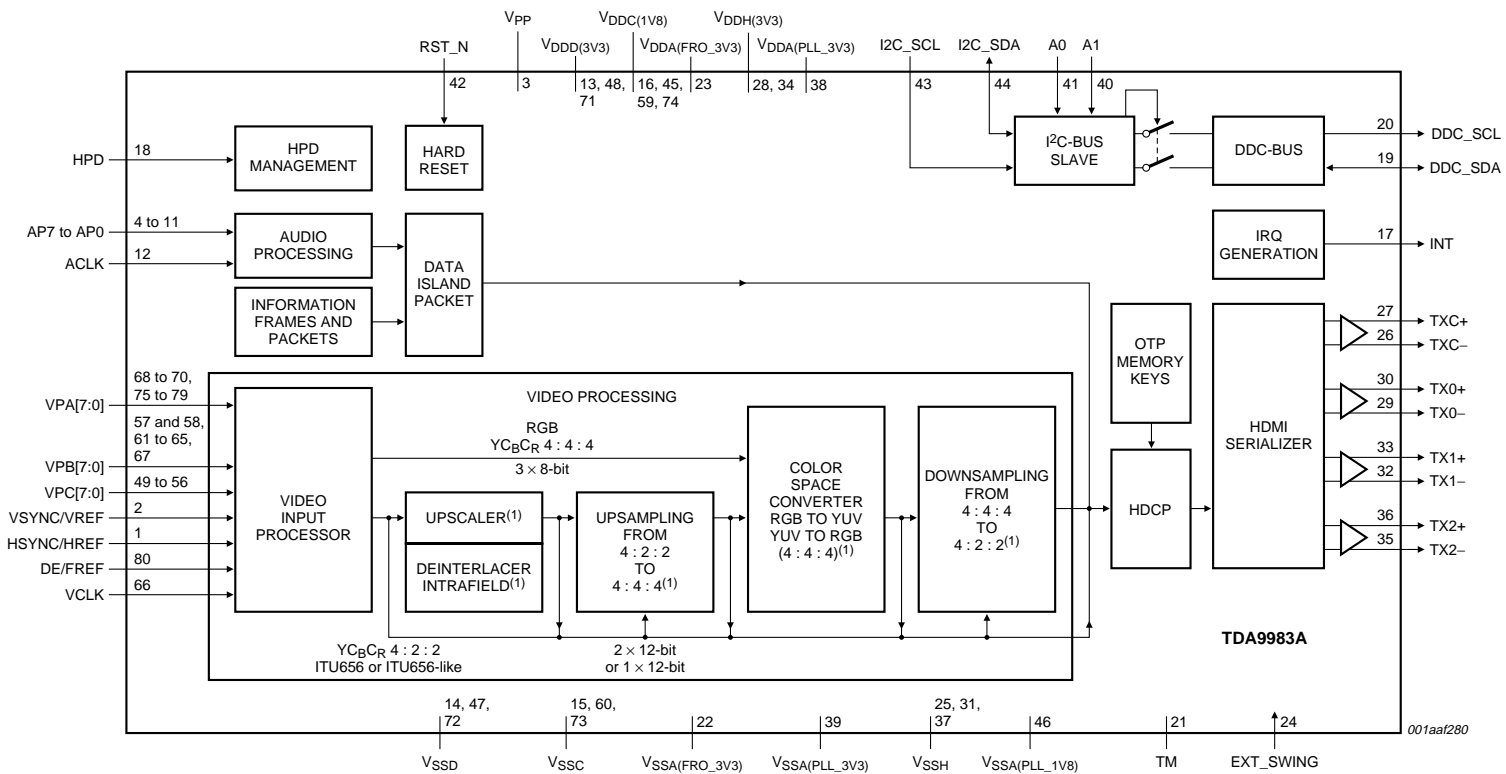
(1) Block can be bypassed.

Fig 2.   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
ΔV_{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
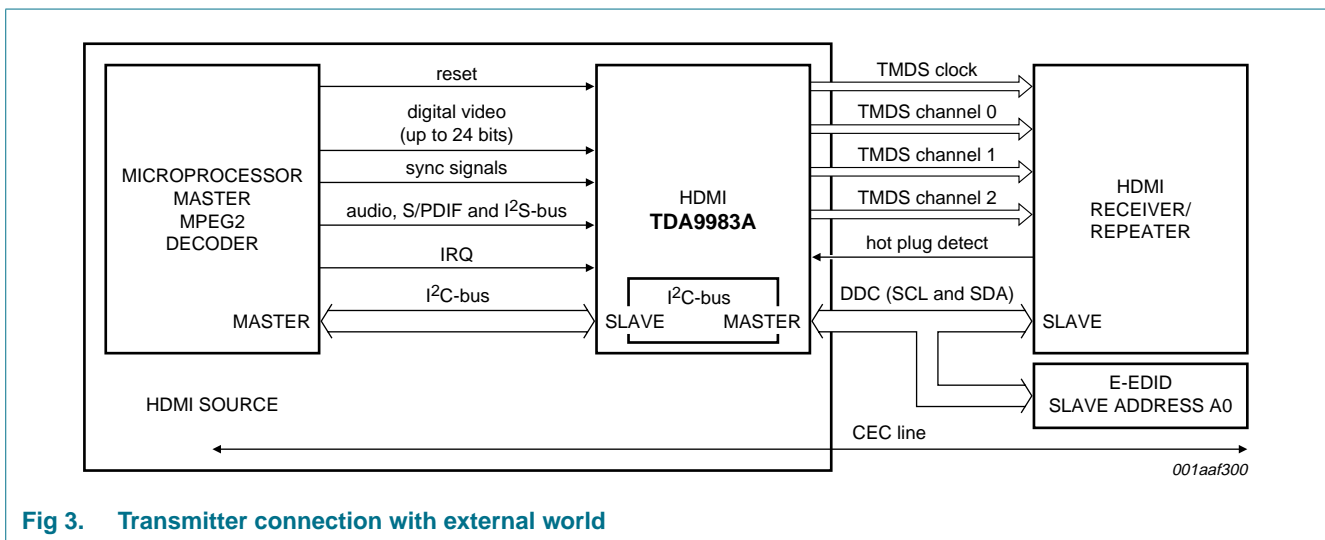
Fig 3. Transmitter connection with external world

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
YC_BC_R	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	-	-

TDA9983A_SDS_1

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11. Legal information

11.1 Data sheet status

Document status[1][2]	Product status[3]	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".

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