UM0576
User manual

HDMI and video switches using the STEVAL-CCH002V1 demonstration board

Introduction

This document explains the functioning and operation of the STEVAL-CCH002V1 demonstration board which demonstrates the functionalities of the STMAV335, STMAV340, STHDMI002A and STDVE003A analog and digital video switches.

The objective of this demonstration board is to display the capabilities of ST's video switches and buffers and also the appropriate use of signal line protection devices, which have been exhaustively used in this demonstration board at all I/O lines, whether it is standard analog or high-speed transition minimized differential signaling (TMDS) digital signals.

Demonstration of the various devices is done by appropriate jumper settings on the demonstration board, and all necessary I/O interface connectors as applicable for each signal format are provided. Standard interconnects available in the market can be used to evaluate the demonstration board.

The demonstration board has a 16 character x 2 line backlit LCD which shows the selection status and a preprogrammed microcontroller senses all the control signals and appropriately displays it on the LCD.

The demonstration board may be powered by the 9 V adapter supplied or by a standard 9V adapter with a current capacity of at least 500 mA. The source need not be regulated. On board regulators supply +5 V and +3.3 V as required.

To summarize, the STEVAL-CCH002V1 serves to demonstrate the following:

■ STMAV335 analog video switch

■ STMAV340 analog video switch

■ STHDMI002A HDMI switch

■ STDVE003A HDMI switch with equalizer/buffer

■ TSH343 analog buffer

■ TSH72 analog buffer

■ ST4300 I^{2}C buffer

■ Various ESD protection devices in the signal I/O ports

The board also demonstrates to a large extent, the recommended PCB layout in end applications utilizing these devices. Especially critical layout aspects in high-speed HDMI bus have been carefully addressed in this demonstration board.

Contents

List of figures

1 Getting started

1.1 System requirements

The system operates in standalone mode by powering externally using the supplied power adaptor, or with any general purpose 9 V adaptor with a current rating of 500 mA.

1.2 Package content

The HDMI and video switches demonstration board package includes:

● Hardware
  – One demonstration board, type STEVAL-CCH002V1
  – One power supply (9 V adaptor)
● Documentation
  – User manual

1.3 Hardware installation

The demonstration board can be powered through the external power supply adaptor.

Figure 1. HDMI and video switches demonstration board, STEVAL-CCH002V1
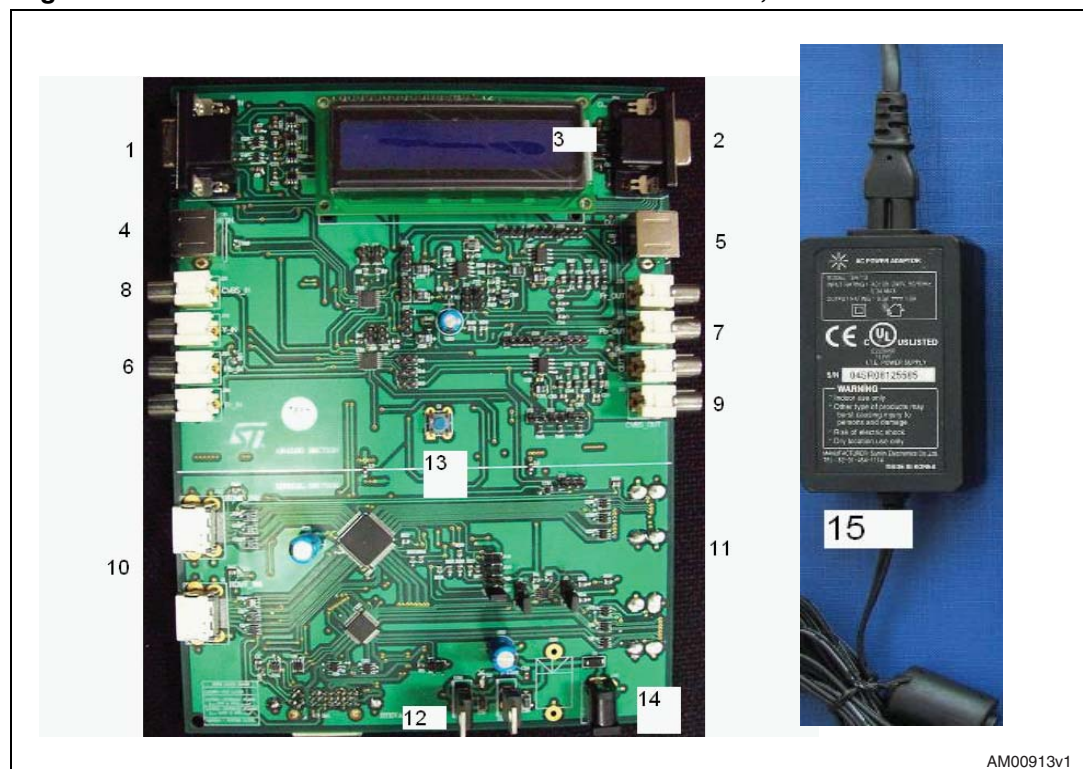
The major components present on the demonstration board are the following (see *Figure 1*):

1. VGA input connector
2. VGA output connector
3. Backlit LCD, 16 char x 2 line alphanumeric
4. S-video input connector
5. S-video output connector
6. Y, Pb, Pr input connector set
7. Y, Pb, Pr output connector set
8. CVBS input connector
9. CVBS output connector
10. HDMI input connector set
11. HDMI output connector set
12. DVI-I connector
13. Reset switch
14. Power supply jack

Several jumpers are also visible, but their application/significance is explained in *Section 2.2: The jumpers*.

1.4 Powering on the system

As soon as the 9 V DC power supply is plugged in, the system is up and running

Figure 2. Power supply connections

AM00914v1
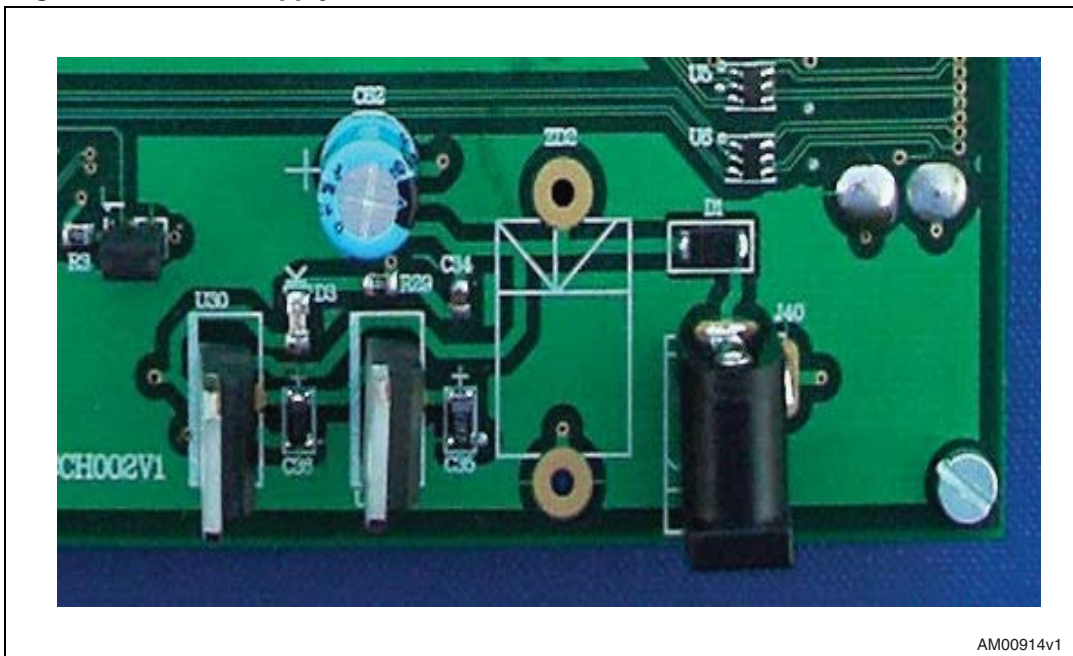
Connect the 9V DC adaptor jack to this connector as shown in *Figure 2*.

At power-on a startup message appears as shown below, and persists for about 2 seconds.

Figure 3.   Power-on condition

AM00915v1

After a short delay, the current state of selection is displayed.

Note: *Display may differ from case to case, depending on the state of the jumpers.*

1.5   **Default setting of the system**

Figure 4.   System stable, ready to use

AM00916v1

The demonstration board is factory-set as STDVE003A DVI-I DIGITAL.

2 Using the HDMI and video switches demonstration board

2.1 The various input/output connectors

Industry-standard connectors with appropriate genders have been provided on the board for the various video formats supported. Standard interconnects available on the market may be used during evaluation of the devices. However, the quality of the cables should be ensured so as not to introduce artifacts within the signal, resulting in apparent degradation in performance.

2.1.1 VGA I/O

Standard 15-pin female type shell connectors have been provided on the board for the VGA in/outs. These are similar to PC analog monitor video connectors.

Figure 5.   VGA connectors

AM00917v1
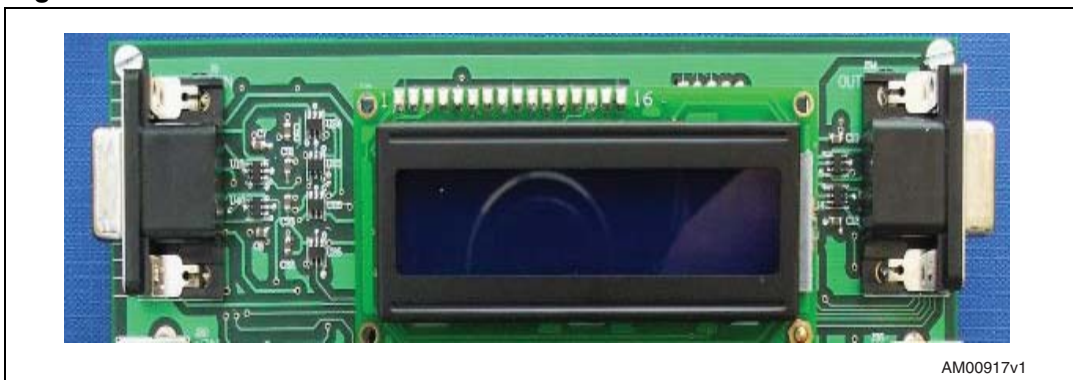
2.1.2 S-video I/O

Shielded 4-pin mini DIN, female industry-standard connectors have been provided for S-video signals found in DVD players, AV receivers, and laptop outputs

Figure 6.   S-video connector

AM00918v1
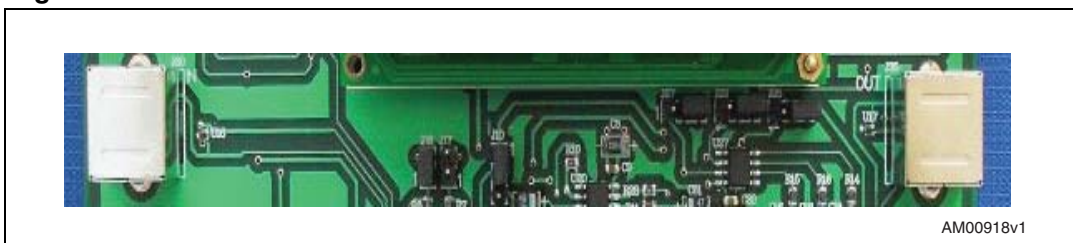
2.1.3 CVBS connector (composite video)

Female RCA connectors for accepting standard male RCA jacks have been provided for CVBS in/outs.

2.1.4 Y, Pb, Pr connectors (component video)

 A set of three female RCA sockets have been provided. One set is for the input, the other set for the output.

Figure 7. RCA jacks for CVBS and Y/Pb/Pr

AM00919v1
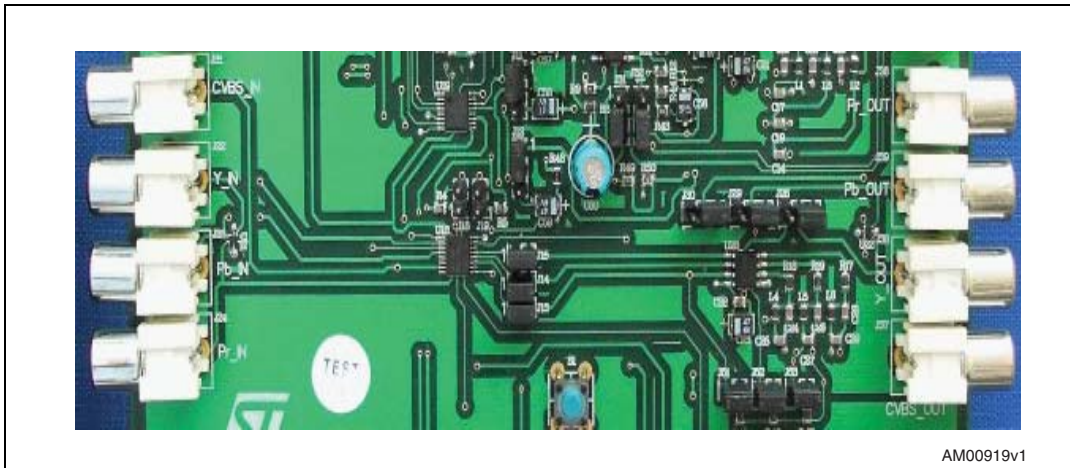
2.1.5 HDMI connectors

A set of two HDMI connectors has been provided for the input side while another set of two connectors has been provided for the output side. These are standard type A sockets and accept commercially available HDMI receptacles.

Figure 8. HDMI connectors

AM00920v1
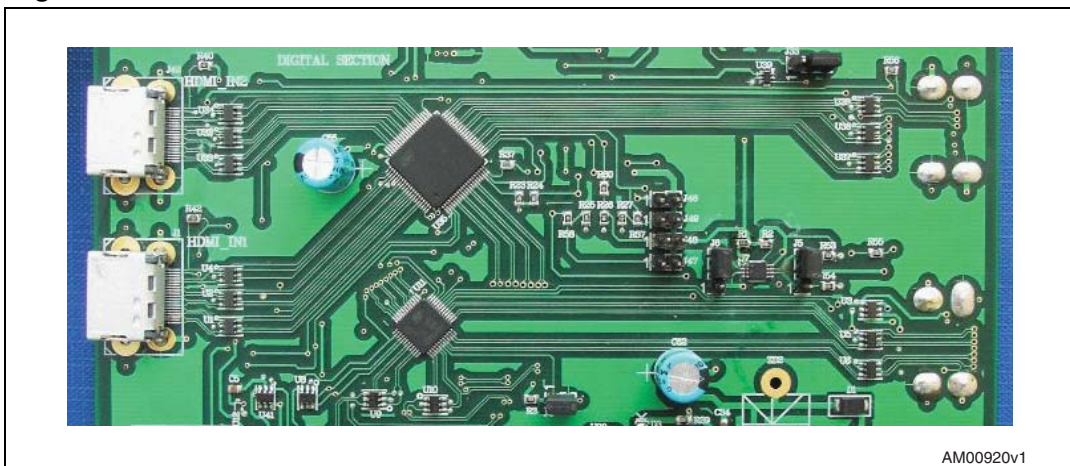
2.1.6 DVI connector

One DVI-I combined analog and digital, female connector has been provided. The output is routed to any one of the VGA or HDMI connectors, for analog and digital respectively.

Figure 9.   DVI connector

AM00921v1
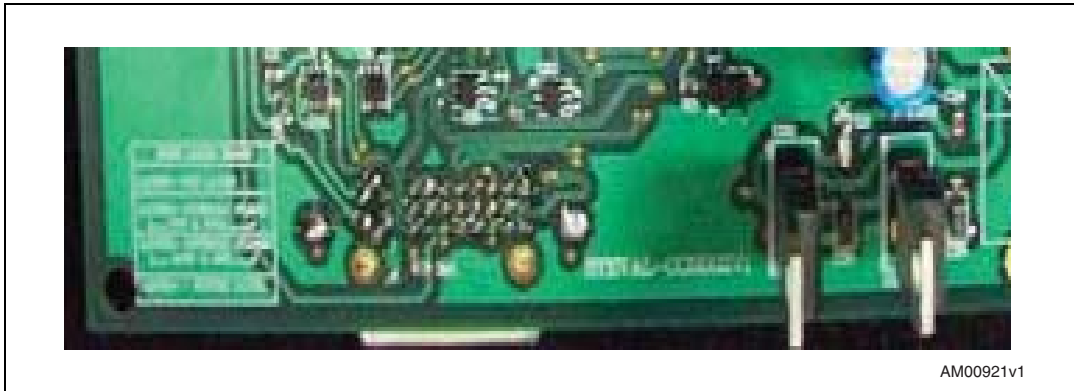
It is placed on the bottom side of the demonstration board along with two HDMI output connectors, as shown below.

Figure 10.   Placement of DVI and HDMI output connectors

AM00922v1
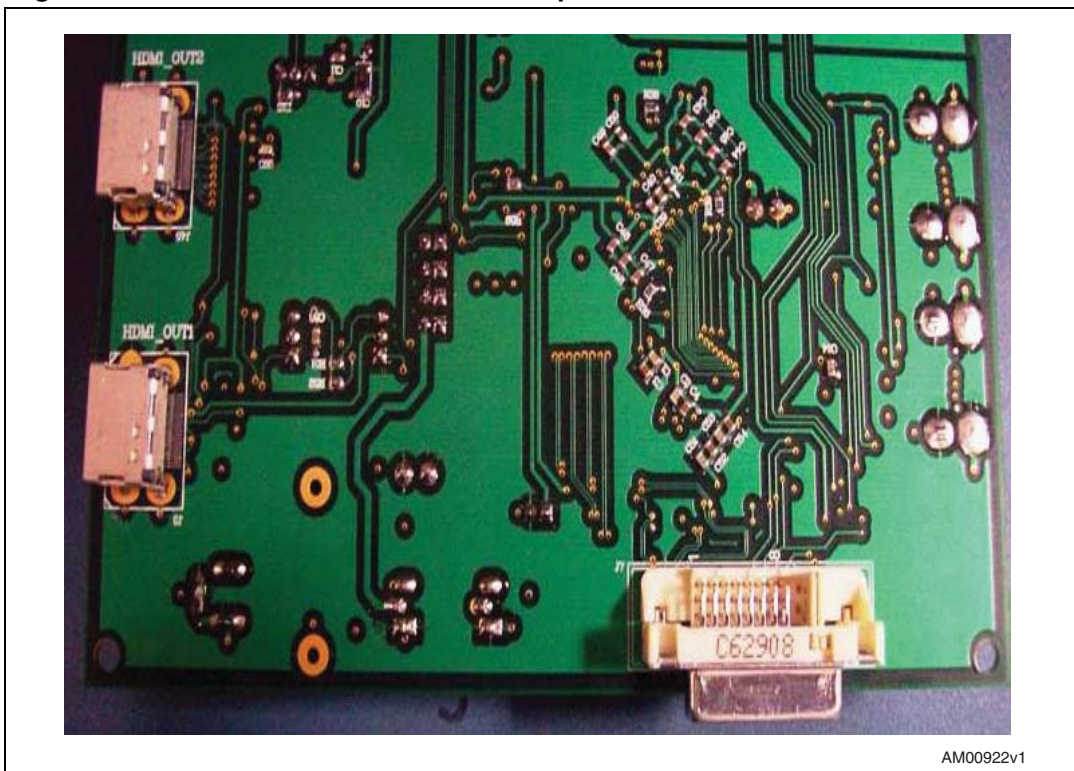
2.1.7 RESET button

The RESET button actually resets the processor in case it gets "hung up". It does NOT affect the functionality of the demonstration board, except that the display might become irrelevant for a moment, after recovering from a RESET.

Figure 11. The RESET button

AM00923v

2.1.8 DC supply socket

A standard adaptor socket has been provided as a power inlet port for the demonstration board. It is polarity protected to accept a center positive adaptor, e.g. the one supplied with the demonstration board.

Figure 12. DC power socket

AM00924v1
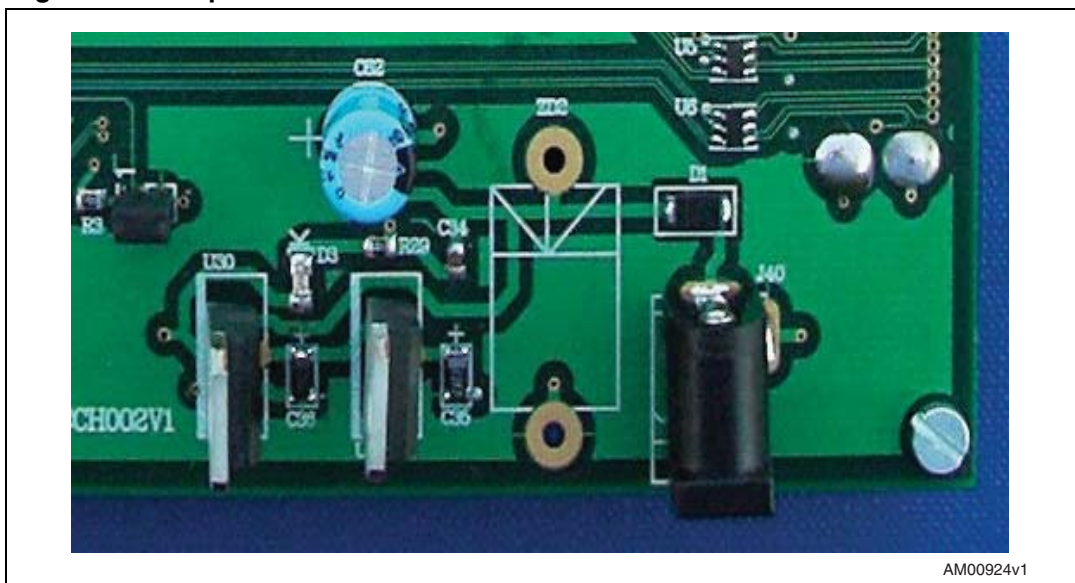
2.2 The jumpers

There are several jumpers on the board, some of which determine demonstration board functionality, some may be left as it is, or may be used for signal tracing/factory debugging. We will start with the essential ones, case by case, as required for demonstrating the various functions of the demonstration board.

2.2.1 Demonstrating the STMAV335: VGA active

Figure 13. Jumper settings for VGA input through the STMAV335
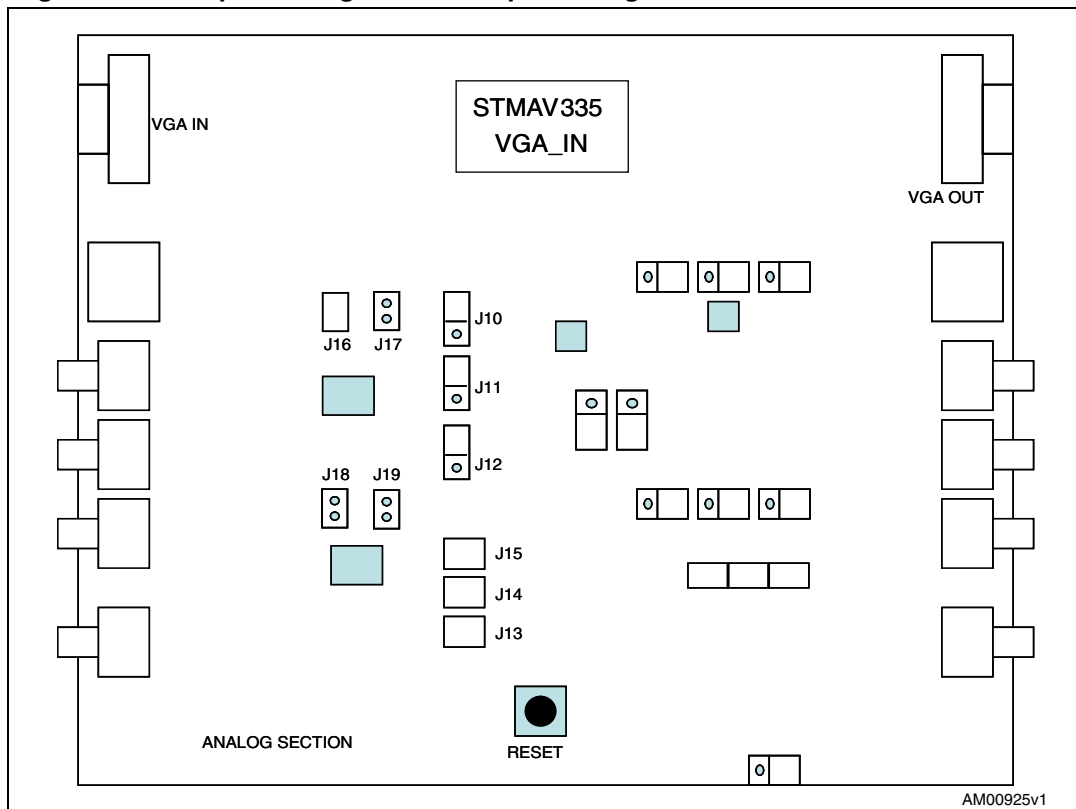
2.2.2 Demonstrating the STMAV335: S-video and CVBS active

Figure 14. Jumper settings for S-video and CVBS input through the STMAV335

AM00926v1
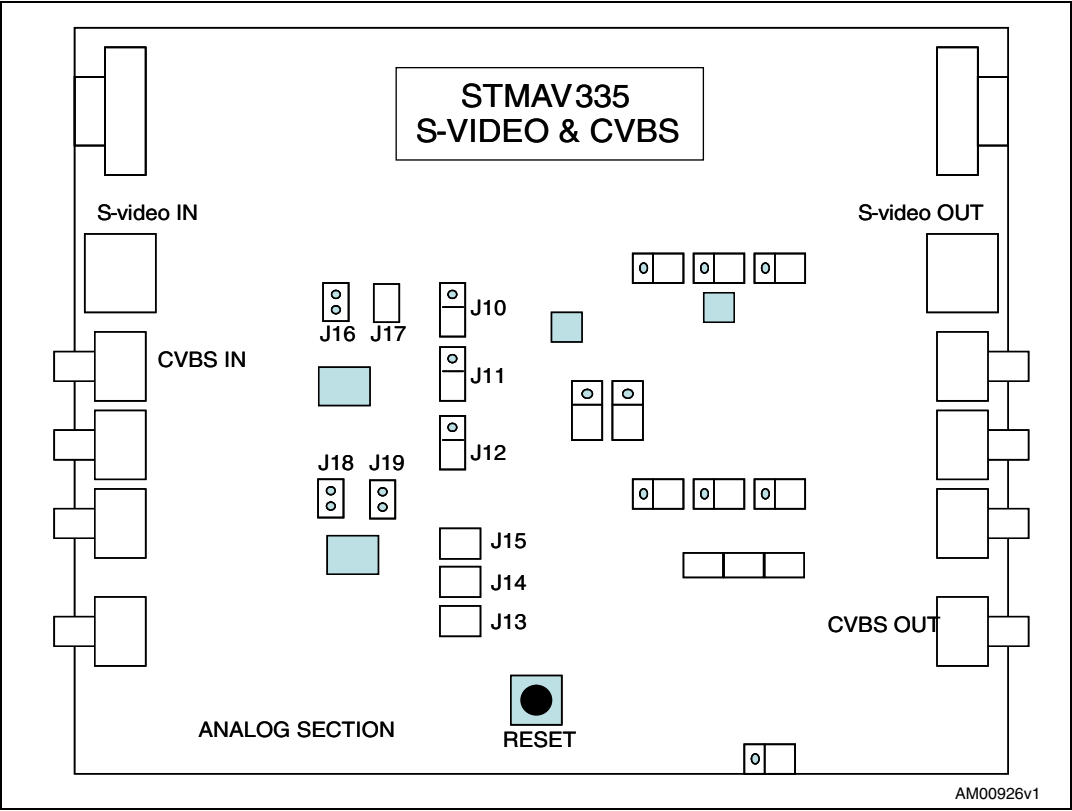
2.2.3   Demonstrating the STMAV335: DVI-I analog active

Figure 15.   Jumper settings for DVI analog through the STMAV335
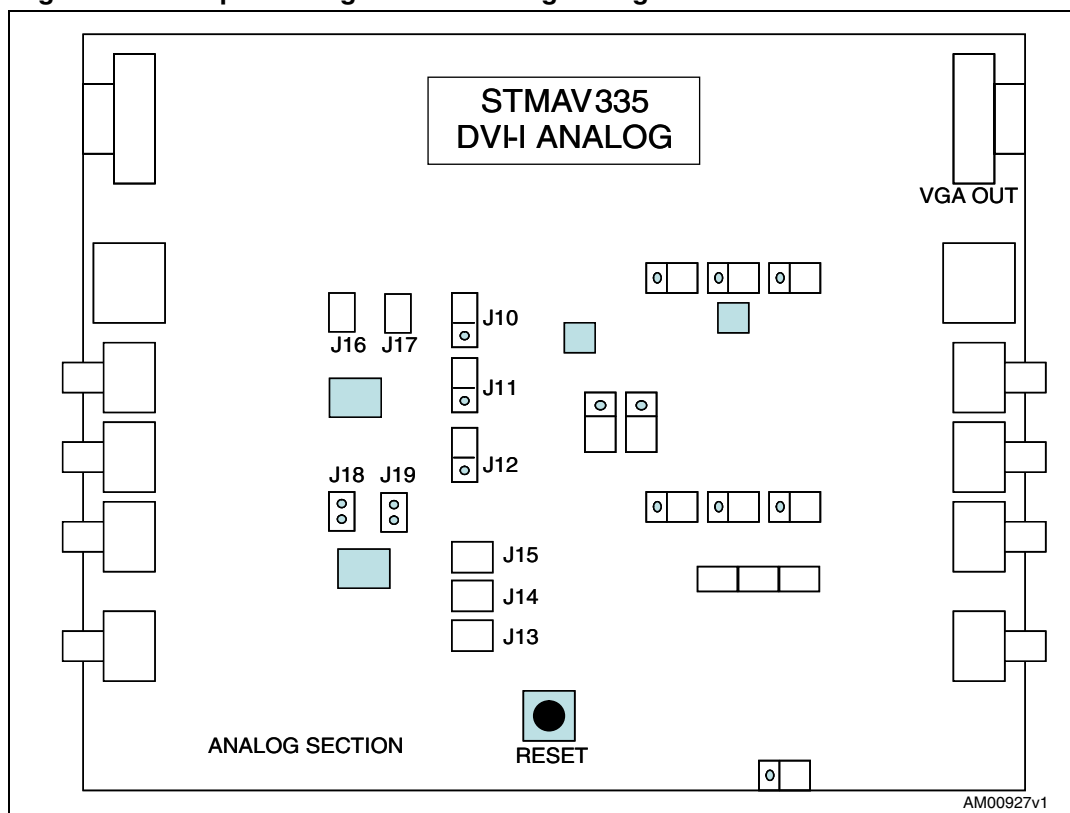
2.2.4 Demonstrating the STMAV340: Y, Pb, Pr active

Figure 16. Jumper settings for Y/Pb/Pr input through the STMAV340
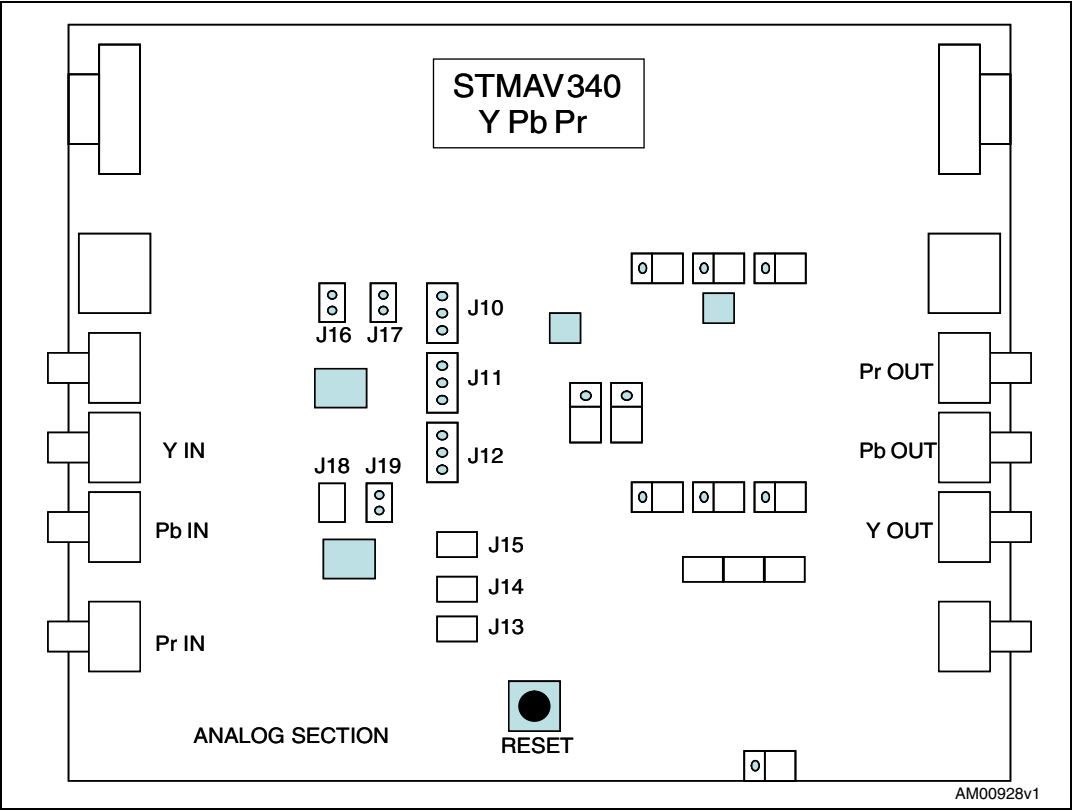
2.2.5 Demonstrating the STMAV340: VGA and CVBS active

Figure 17. Jumper settings for VGA and CVBS input through the STMAV340
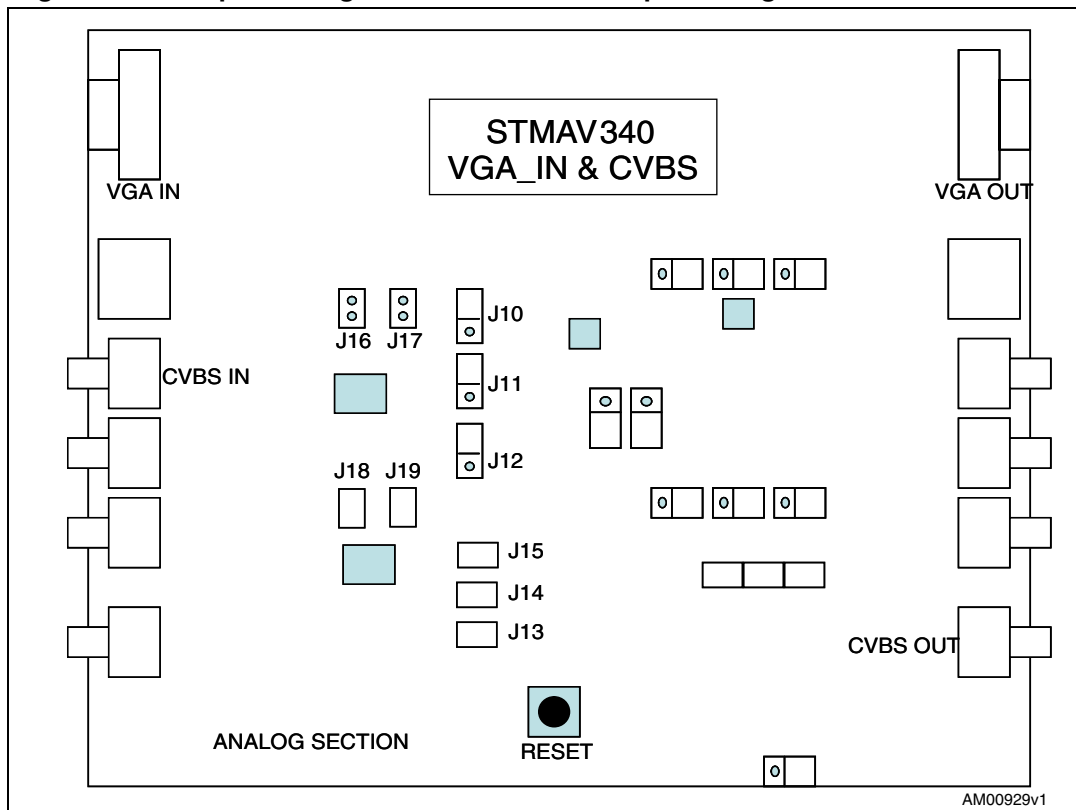
2.2.6 Demonstrating the STDVE003A: HDMI IN1 active

Figure 18. Jumper settings for HDMI IN1 input through the STDVE003A
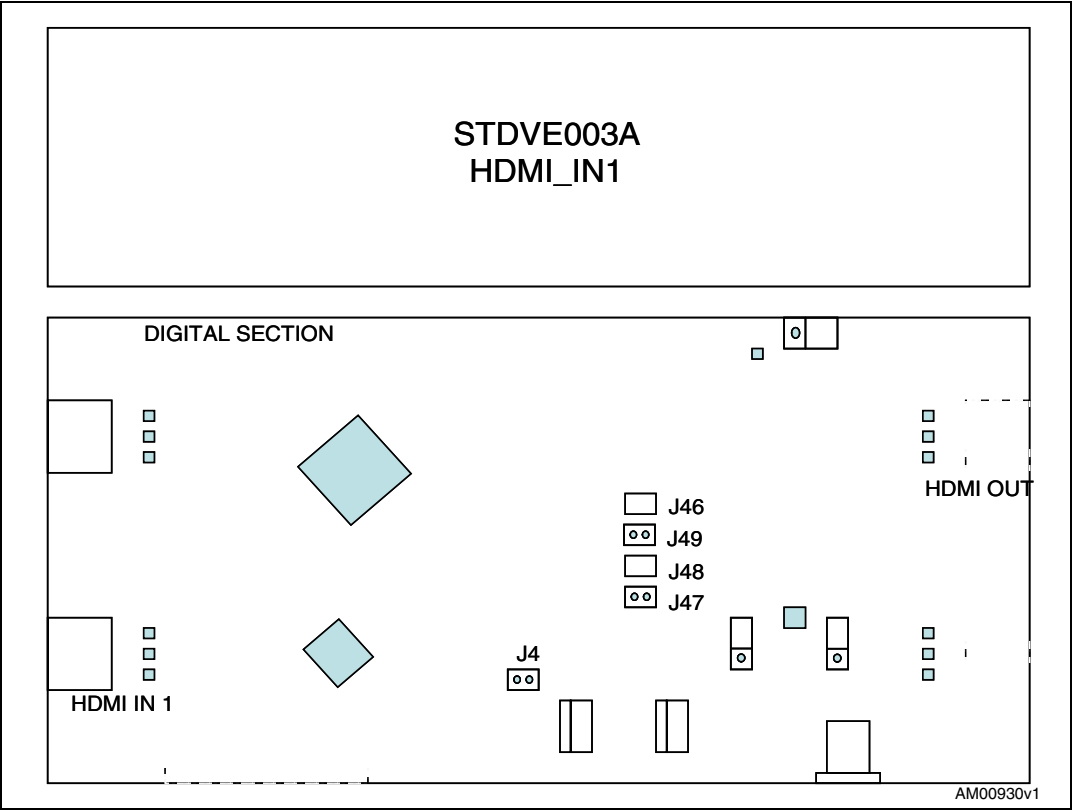
2.2.7 Demonstrating the STDVE003A: HDMI IN2 active

Figure 19. Jumper settings for HDMI IN2 input through the STDVE003A
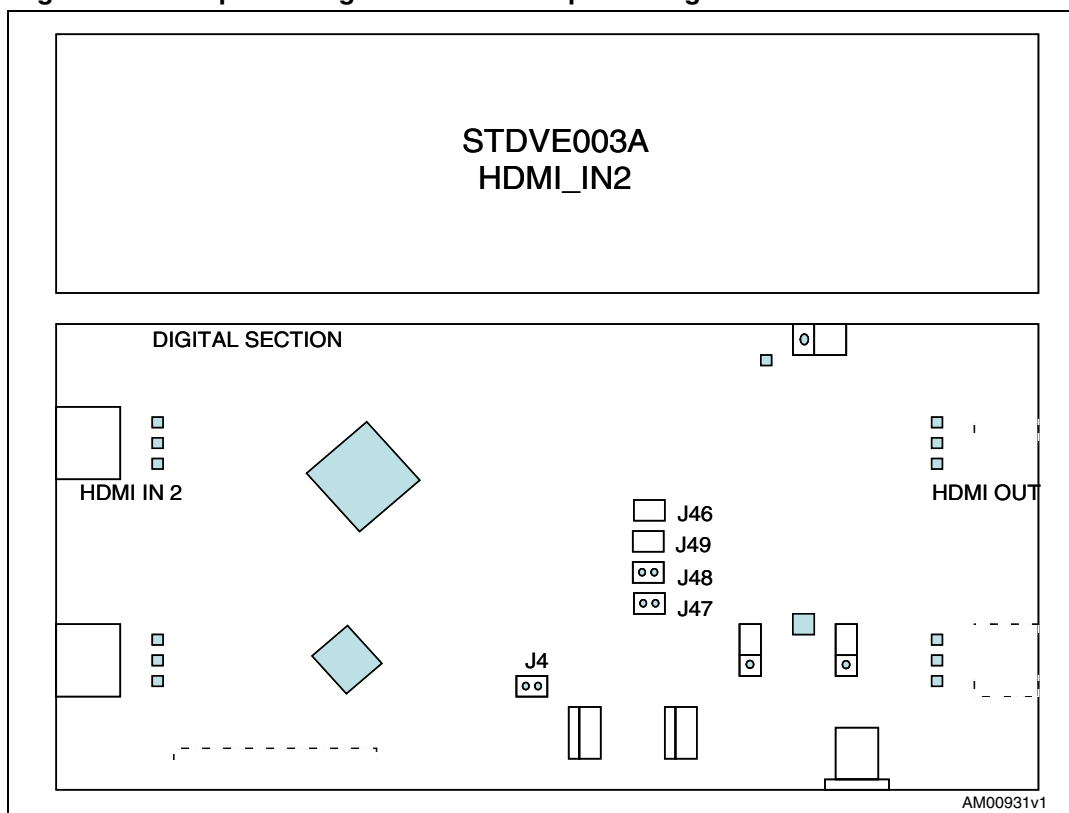
2.2.8 Demonstrating the STDVE003A: DVI-I active

Figure 20. Jumper settings for DVI-I input through the STDVE003A
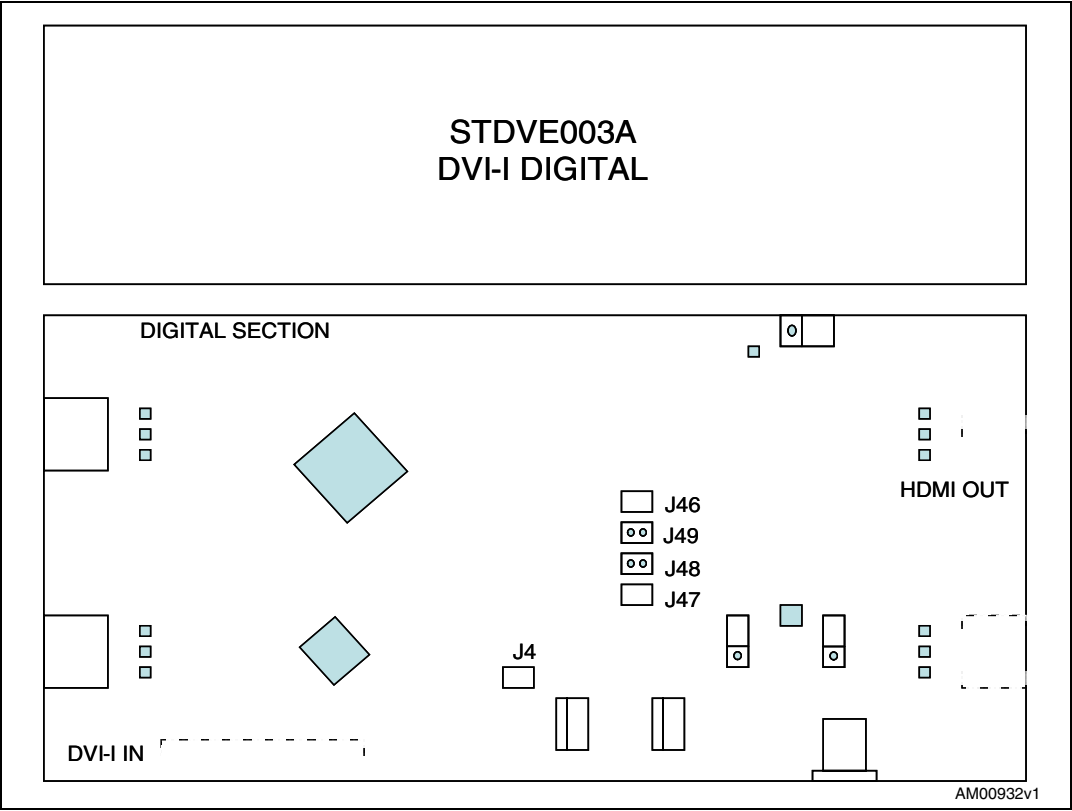
2.2.9   Demonstrating the STHDMI002A: DVI-I active

Figure 21.   Jumper settings for DVI-I input through the STHDMI002A
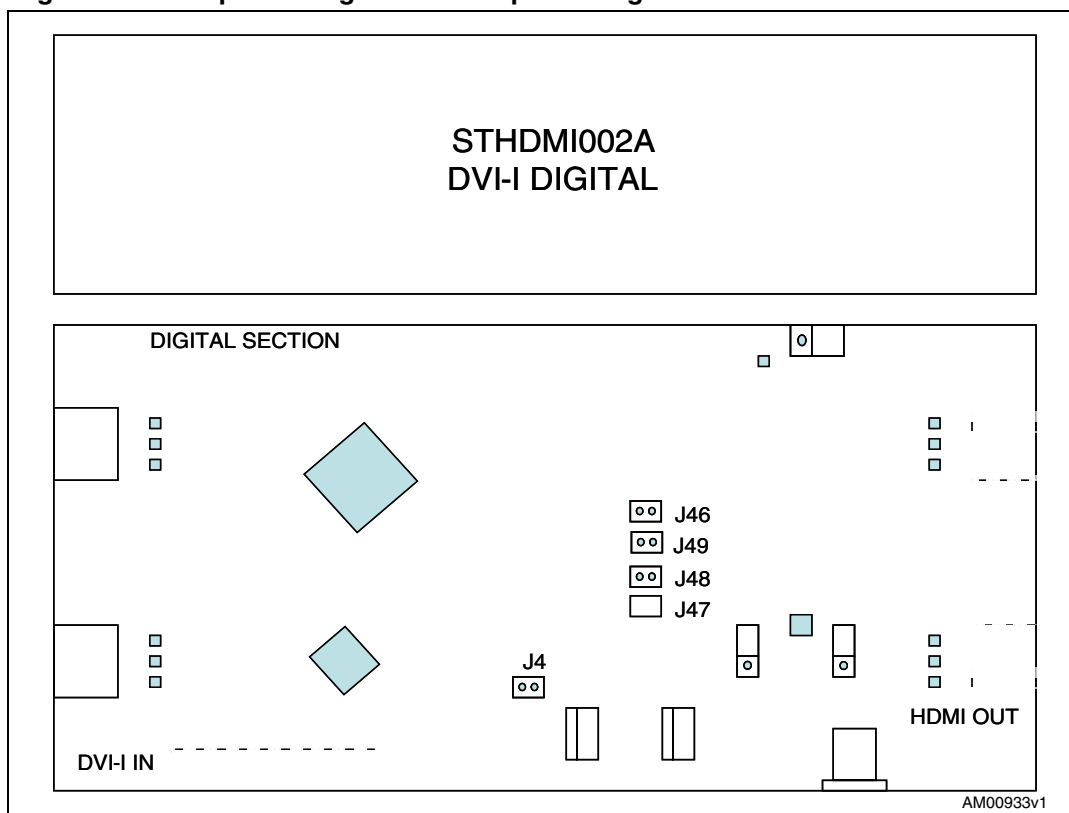
2.2.10 Demonstrating the STHDMI002A: HDMI-1 active

Figure 22. Jumper settings for HDMI IN1 input through the STHDMI002A
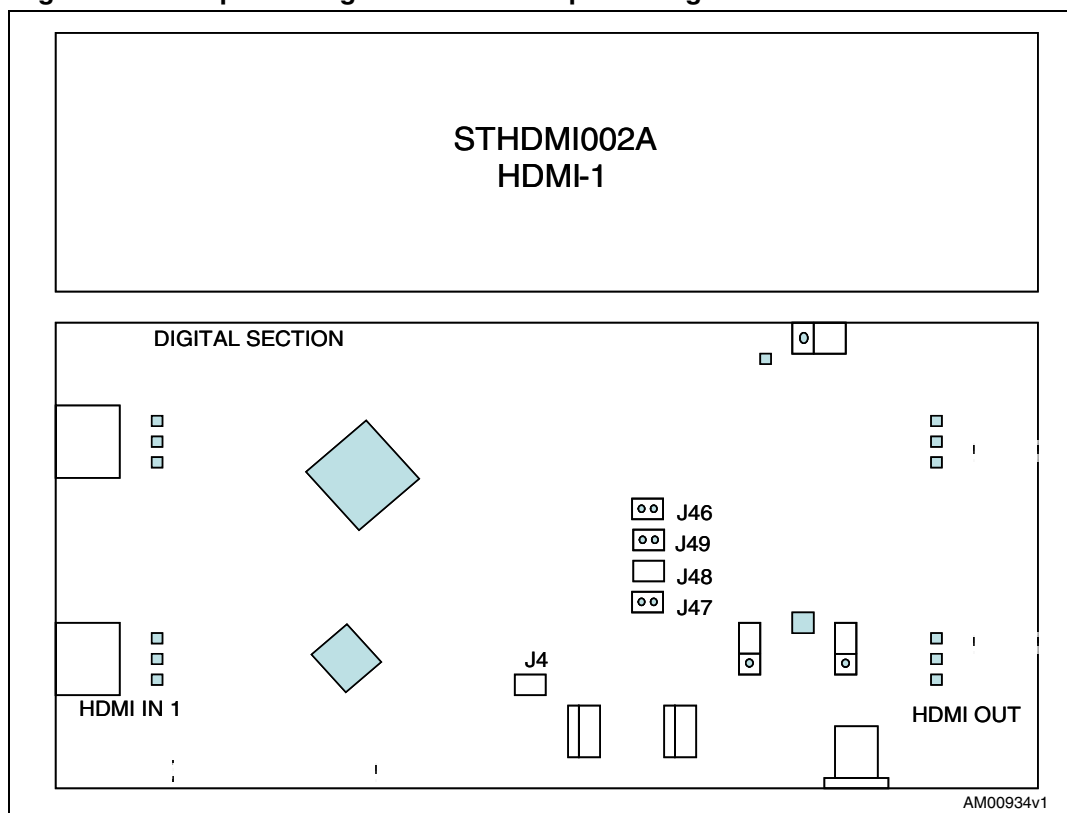
Appendix A   Abbreviations

Table 1.   Abbreviations

No.	Acronym	Definition
1	VGA	Video graphics array
2	HDMI	High-definition multimedia interface
3	DVI	Digital video interconnect
4	LCD	Liquid crystal display
5	LED	Light emitting diode
6	DVD	Digital versatile disc
7	S-video	Two-wire analog video format
8	ICC	In-circuit communication
9	GND	Ground
10	Y, Pb, Pr	Component video, analog format, three-wire
11	CVBS	Composite video, analog format, single wire

Appendix B Schematic

Figure 23. Schematic (part 1)

Figure 24.   Schematic (part 2)

AM01036v1

Figure 25. Schematic (part 3)

AM01037v1

Appendix C Bill of material

Table 2. **Bill of material**

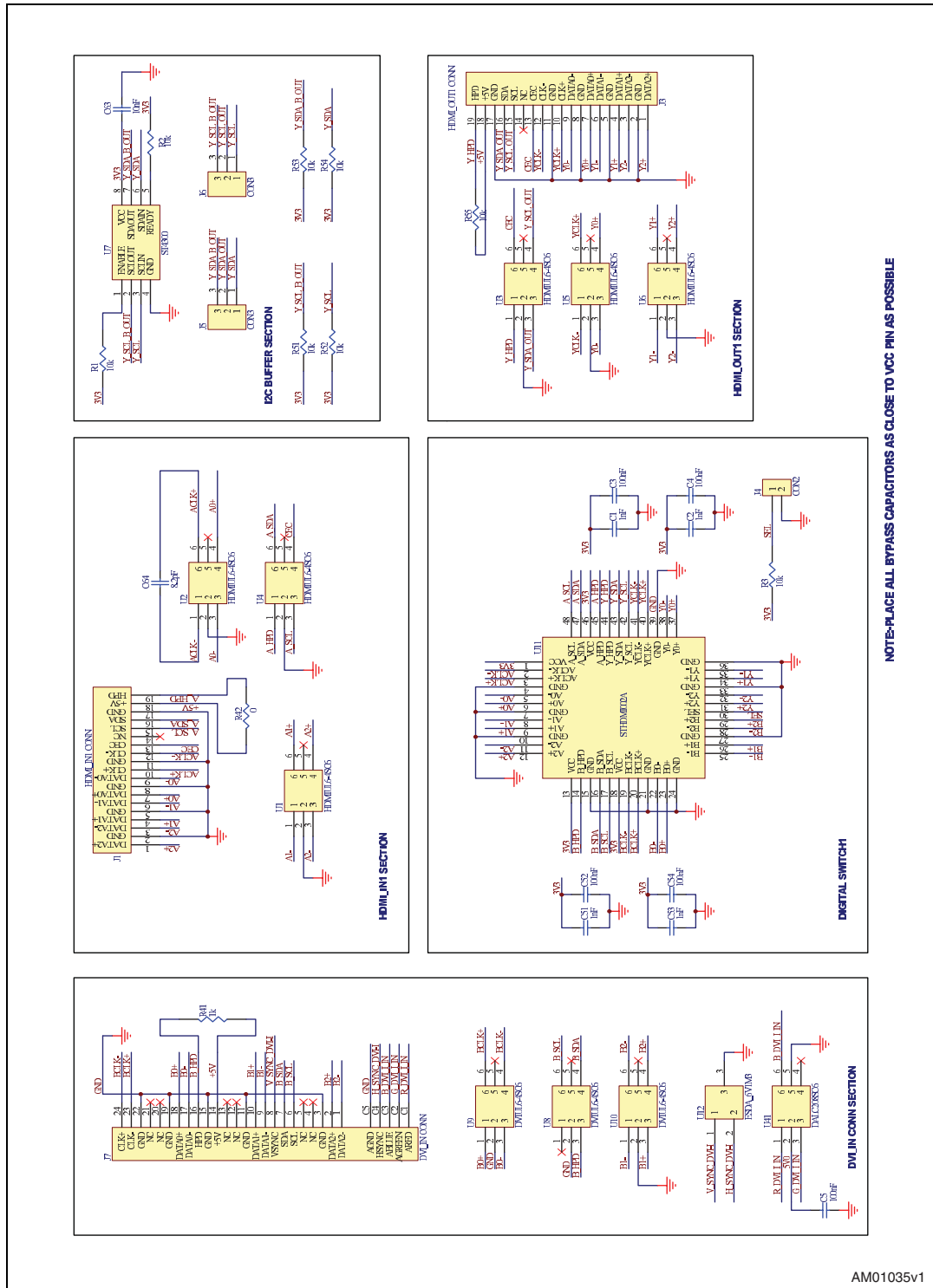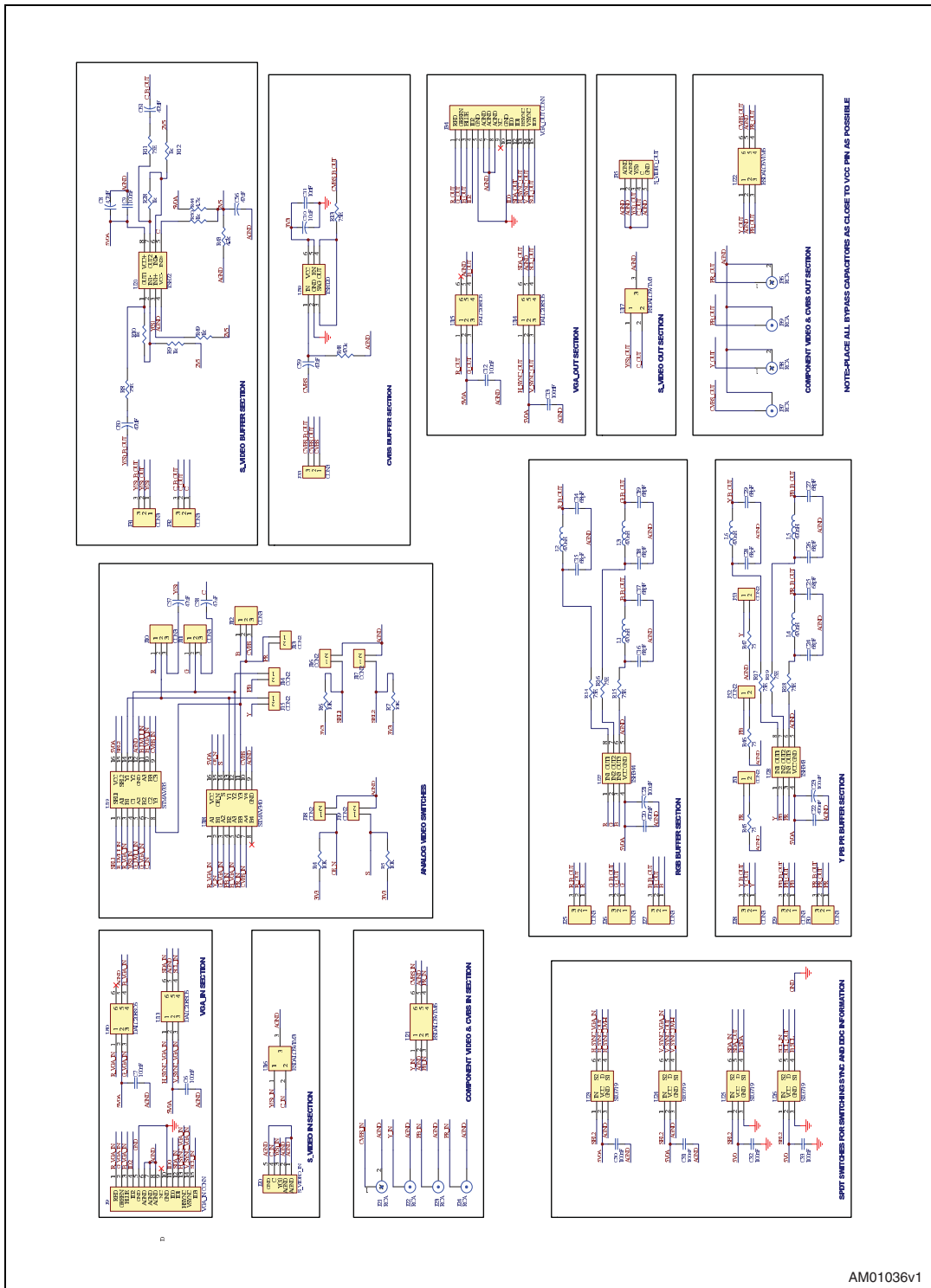| Designator	Qty	Reference	Value/ generic part number	Package	Manufacturer
U11	1	HDMI/DVI 2:1 switch	STHDMI002A	TQFP48	STMicroelectronics
U35	1	HDMI/DVI 3:1 switch and equalizer	STDVE003A	TQFP80	STMicroelectronics
U19	1	Analog video switch	STMAV335	TSSOP16	STMicroelectronics
U18	1	Analog video switch	STMAV340	TSSOP16	STMicroelectronics
U7	1	I^{2}C buffer	ST4300	MSO-8L	STMicroelectronics
U20	1	S-video buffer	TSH72	SO8	STMicroelectronics
U39	1	CVBS buffer	TSH120	SOT323-6	STMicroelectronics
U28	1	Y Pb Pr buffer	TSH343	SO8	STMicroelectronics
U27	1	RGB buffer	TSH344	SO8	STMicroelectronics
U31	1	ST7-MCU	ST7FLITE39	SO20	STMicroelectronics
U23,U24,U25,U26	4	Electronic SPDT switches	STG719	SOT23-6L	STMicroelectronics
U29	1	3.3 V voltage regulator	LD1117V33	TO-220	STMicroelectronics
U30	1	5 V voltage regulator	LD1117V50	TO-220	STMicroelectronics
U13,U40,U14,U41,U15	5	Protection device (analog video lines)	DALC208-4SC6	SOT23-6L	STMicroelectronics
U8,U9,U10	3	Protection device (DVI lines)	DVIUL6-4SC6	SOT23-6L	STMicroelectronics
U21,U22	2	Protection device (analog video lines)	ESDALC6V1M6	MICRO QFN	STMicroelectronics
U12,U16,U17	3	Protection device (analog video lines)	ESDALC6V1M3	SOT883	STMicroelectronics
U1,U2,U3,U4,U5,U6,U32, U33,U34,U36,U37,U38	12	Protection device (HDMI lines)	HDMIUL6-4SC6	SOT23-6L	STMicroelectronics
ICC	1	ICC connector		Header 5x2/ IDC-10B	
ZD2	1	Transil	BZW50-15		STMicroelectronics
D3	1	LED	SMD LED	SMD	
D1	1	Schottky diode	STPS1L30A	SMA	STMicroelectronics
J1,J42,J3,J45	4	HDMI connector(19-pin)		SMT	Microcross
J7	1	DVI-I connector			Microcross

Table 2.   Bill of material (continued)

Designator	Qty	Reference	Value/ generic part number	Package	Manufacturer
J21,J22,J23,J24,J36,J37, J38,J39	8	RCA connectors			CUI Inc
J20,J35	2	S-video connectors (4-pin)			Kobiconn
J9,J34	2	VGA connectors (15-pin)			Kobiconn
S1	1	Switch	09-03290-01		
J40	1	Power jack			
J41	1	16 pin connector (16x2 alphanumeric LCD)	GDM1602A	ALPHANUMERIC LCD	XIAMEN OCULAR
J4,J13,J14,J15,J16,J17, J18,J19,J46,J47,J48,J49, J51,J52,J53	15	CON2 (2-pin connector)		SIP-2 (berg strip)	Any
J5,J6J11,J12,J26,J27, J28,J29,J30,J31,J32,J33, J10,J25	14	CON3 (3-pin connector)		SIP-3 (berg strip)	Any
R36.R37,R38,R39,R42	5	Resistance	0E	805	Any
R9,R10,R12,R28,R40, R41,R49,R50,R56,R57,R 58,R59,R60	13	Resistance	1 kΩ	805	Any
R21	1	Resistance	2.7 kΩ	805	Any
R23,R43,R44	3	Resistance	4.7 kΩ	805	Any
R1,R2,R3,R4,R5,R6,R7, R27,R20,R26,R24,R30, R31,R32,R33,R34,R35, R25,R51,R52,R53,R54, R55	23	Resistance	10 kΩ	805	Any
R8,R11,R13,R14,R15, R16,R17,R18,R19,R45, R46,R47	12	Resistance	75E	805	Any
R22	1	Resistance	100E	805	Any
R29	1	Resistance	330E	805	Any
R48	1	Resistance	470 kΩ	805	Any
L1,L2,L3,L4,L5,L6	6	Inductor	470 nH	805	
L7,L8	2	Feriite beads		805	MURATA
C1,C2,C51,C53	4	Capacitor	1 nF	805	Any
C65	1	Capacitor	4.7 pF	805	Any
C64	1	Capacitor	8.2 pF	805	Any

Table 2.   Bill of material (continued)

Designator	Qty	Reference	Value/ generic part number	Package	Manufacturer
C8	1	Capacitor	4.7 µF	1206	Any
C42,C43,C45,C44,C41, C40,C49,C50,C48,C39, C11,C47,C46,C63,C35, C10,C36	17	Capacitor	10 nF	805	Any
C14,C15,C16,C17,C18, C19,C24,C25,C26,C27, C28,C29	12	Capacitor	68 pF	805	
C56,C57,C58,C59,C60, C61	6	Capacitor	47 µF	1206	Any
C3,C4,C5,C6,C7,C9,C12, C13,C30,C31,C33,C34, C37,C32,C38,C52,C54	17	Capacitor	100 nF	805	Any
C21,C23	2	Capacitor	100 µF	1206	Any
C55,C62	2	Capacitor	220 µF	Thru hole	Any
C20,C22	2	Capacitor	470 nF	805	Any

Revision history

Table 3. **Document revision history**

Date	Revision	Changes
20-Aug-2008	1	Initial release

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