UM0912
User manual

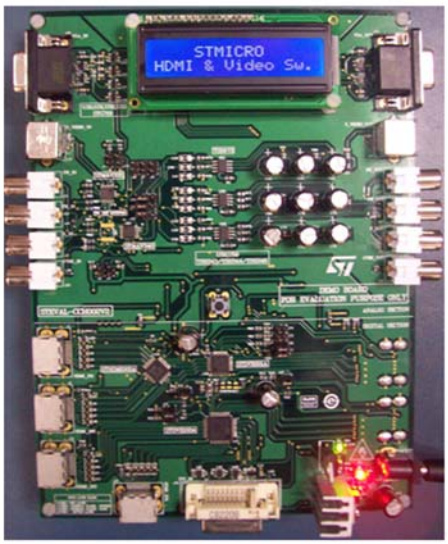
STEVAL-CCH002V2: HDMI and video switches demonstration board

Introduction

This user manual explains the functions and operation of a demonstration board which supports STHDMI002A, STDVE103A, STDVE001A, STMAV340, and STHDMI002A digital switches/equalizers, and STMAV335 and STMAV340 analog switches, and also different analog buffers and protection devices for analog and digital lines.

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, analog video lines, and high speed transition minimized differential signaling (TMDS) digital signals. The board consists of different input/output connectors and supports various signal formats - VGA (RGB), Y Pb Pr (component video), DVI-I Analog, CVBS (composite video), and S-video in the analog domain and HDMI, DVI-I digital in the digital domain. Demonstration of the various devices is done through appropriate jumper settings on the demonstration board. A 16 character x 2 line backlit alphanumeric LCD, driven by a pre-programmed microcontroller, is also present, which senses the selection lines and displays the active device/signals, switched on, on the LCD.

Figure 1. STEVAL-CCH002V2 demonstration board



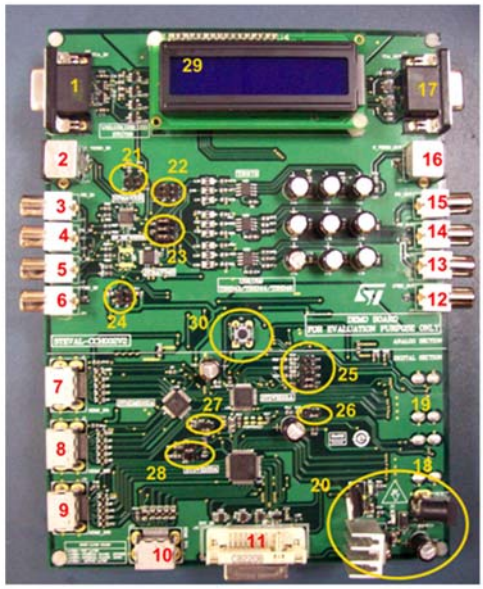
The demonstration board also demonstrates, to a large extent, the recommended PCB layout in end applications utilizing these devices especially for high speed HDMI data lines.

Contents

List of figures

1 Hardware description

Figure 2. STEVAL-CCH002V2 board



Please refer to *Figure 2* above.

Major components present on the board are:

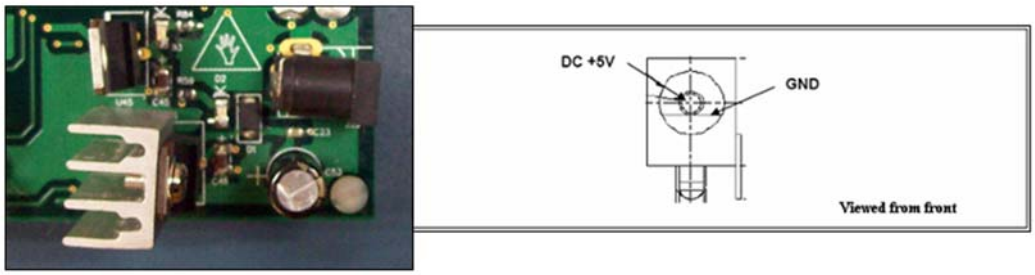
- VGA input connector (1)
- S-Video input connector (2)
- Y Pb Pr input connector set (3,4,5)
- CVBS input connector (6)
- VGA output connector (17)
- S-Video output connector (16)
- Y Pb Pr output connector set (15,14,13)
- CVBS output connector (12)
- HDMI input connectors (7,8,9,10)
- HDMI Output connectors (18,19: bottom side)
- DVI input connector (11)
- Analog switches selection jumper set (21,22,23,24)
- Digital switches selection jumper set (25,26,27,28)
- Power supply section (20)
- Reset switch (30)
- 16 * 2 alphanumeric LCD (29)

1.1 Power supply unit

The board is equipped with a power jack into which an external DC adaptor (7 V-12 V: 1 A) can be plugged into. The source need not be regulated and the onboard regulators supply 5 V or 3.3 V as required. The two LEDs D2 (red) and D3 (green) show the presence of 5 V and 3.3 V supplies onboard.

Note: Care must be taken while operating as the heat sink onboard may become significantly hot.

Figure 3. Power section



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1.2 Various input/output connectors

The demonstration board supports different video connectors supporting corresponding signal formats:

- VGA input - output connectors
- S-video input -output connectors
- Y Pb Pr input-output connector set
- CVBS input - output connectors
- HDMI input-output connectors
- DVI-I connector

Figure 4. VGA connector

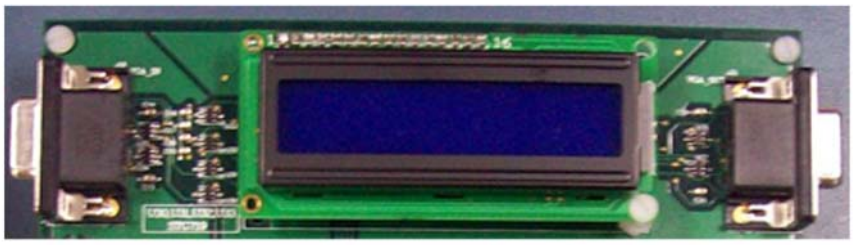

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Figure 5. Component and CVBS connector

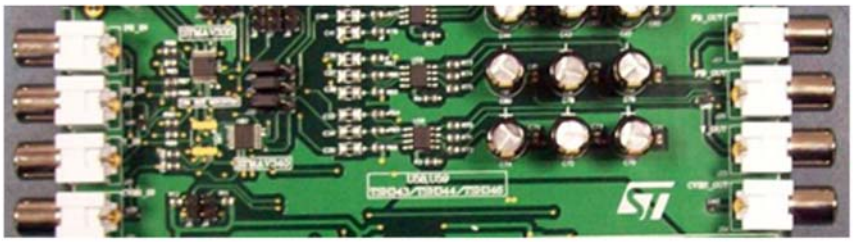


Figure 6. S-Video connector

Figure 7. HDMI and DVI input connector

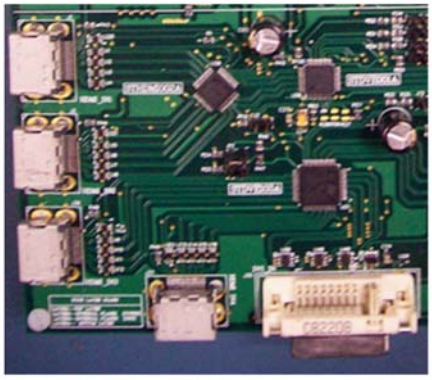
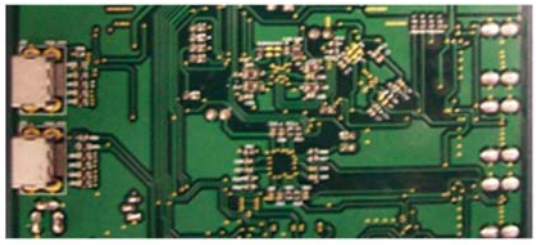


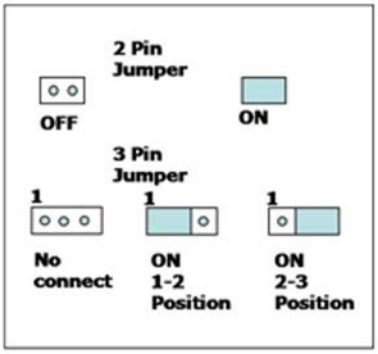
Figure 8. HDMI output connector



1.3 Onboard jumpers

The board consists of different sets of jumpers for operating the switches. Jumper sets 21, 22, 23 and 24, as depicted in *Figure 2*, are for selection and operation of analog switches (STMAV335 and STMAV340), while jumper sets 25, 26, 27 and 28 are used for selection and operation of digital switches (STHDMI002A/STDVE001A and STDVE103A).

Figure 9. Jumper configurations



1.4 Alphanumeric display

An alphanumeric LCD is provided on the board which displays the current active switch and the signal set being switched by this switch from input to output. In the case of the wrong selection, an error message “Improper Sel” is displayed. The display changes according to the configuration of the jumpers (J4, J5, J9, J10, J16, J17, J3, J11, and J12) present on the board.

1.5 Reset switch

The RESET button resets the processor in case it gets “hung up”. Pressing the reset button DOES NOT affect the functioning of the board except the display.

2 Getting started

2.1 Package contents

The HDMI and Video switches demonstration board package includes:

- Hardware: one demonstration board - STEVAL-CCH002V2
- Documentation: user manual
- Schematic, BOM, Gerber files
- Firmware: pre-programmed onboard microcontroller

2.2 System requirements

The system operates in standalone mode through external powering using any general purpose 9 V adaptor with a current rating greater or equal to 1 A.

2.3 Powering on the system

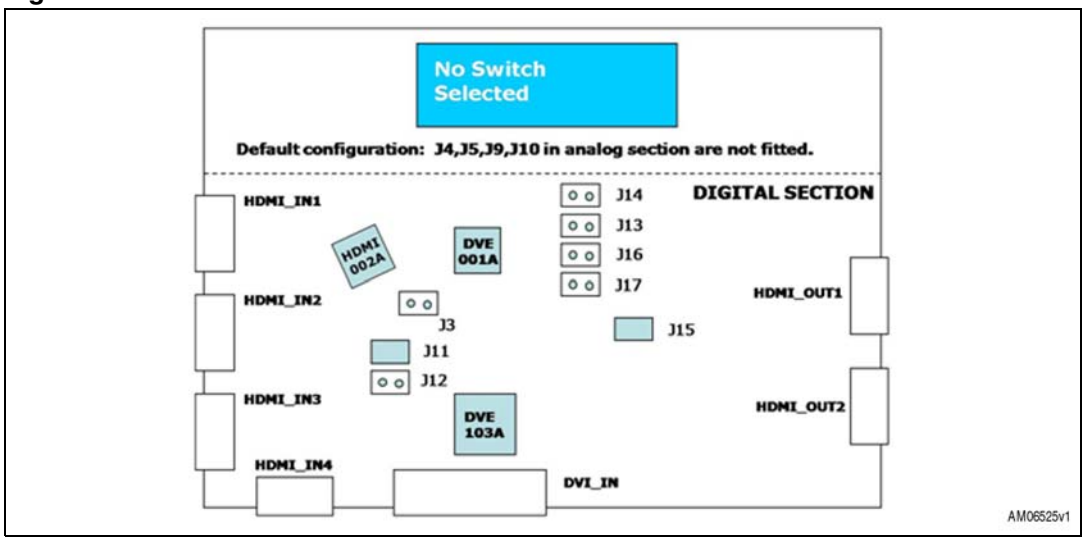
Connect the 9 V DC adaptor to the DC jack connector. At power-on a startup message appears, as shown in *Figure 10*, and remains for about 2 seconds.

Figure 10. Alphanumeric LCD

After about 2 seconds, the display changes to show the current selection. (Active switch and signals being switched, if any).

Jumper selection, as shown in *Figure 11*, “No switch active”, means no switch/equalizer is active and the corresponding message is shown on the LCD.

Figure 11. No switch active

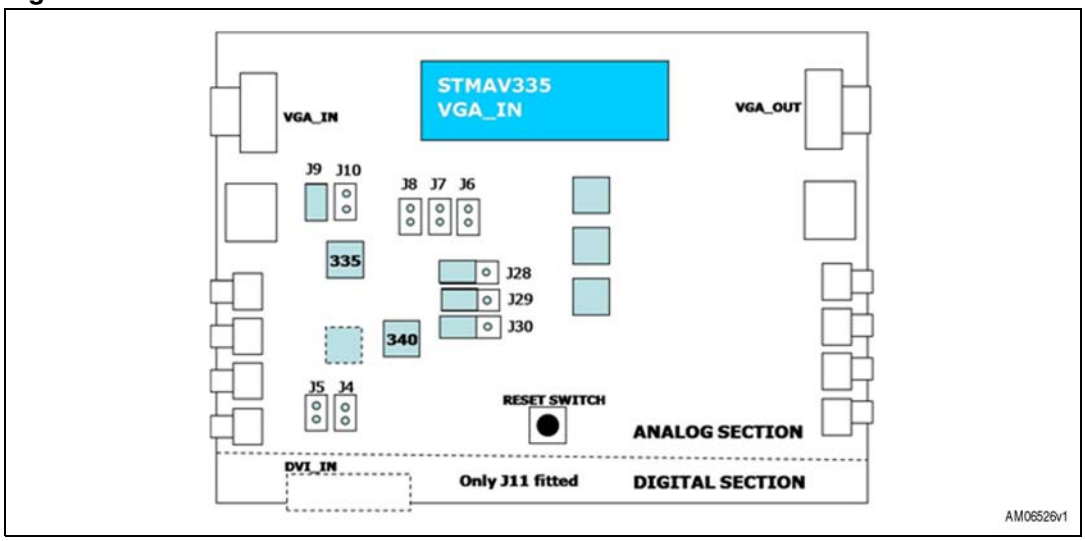


3 Demonstration of switches/buffers

3.1 Demonstrating STMAV335: VGA Active

Place the jumper connections, as depicted in *Figure 12*. The appropriate message is displayed. Connect one VGA cable from source to VGA_IN (onboard) and another VGA cable from VGA_OUT (board) to sink (TV). The corresponding display can be seen on the TV/Monitor after its appropriate source selection.

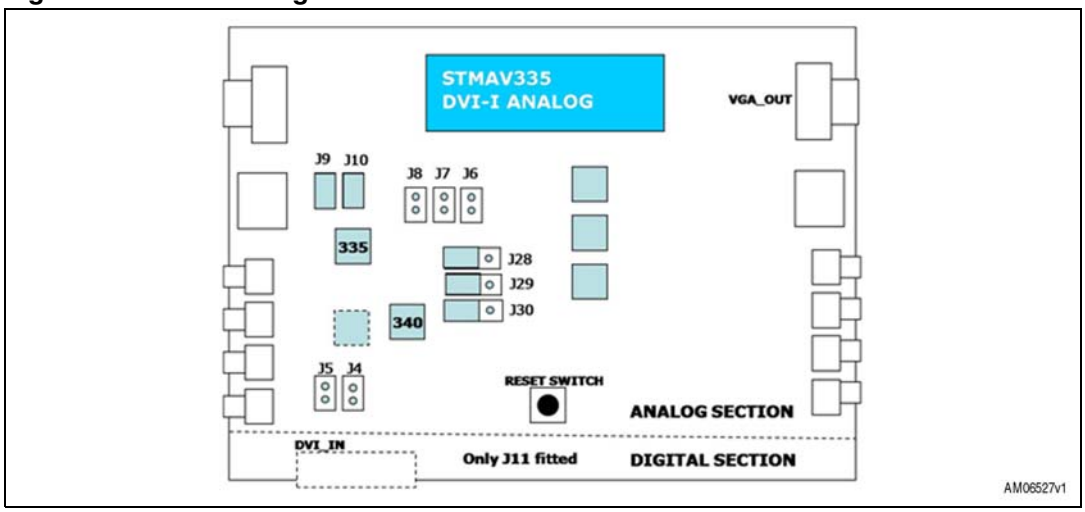
Figure 12. VGA active



3.2 Demonstrating STMAV335: DVI-I analog active

Place the jumper connections, as shown in *Figure 13*. The appropriate message is displayed. Connect one DVI-I cable from source to DVI_IN and a VGA cable from VGA_OUT to sink (TV). The corresponding display can be seen on the TV/Monitor after its appropriate source selection.

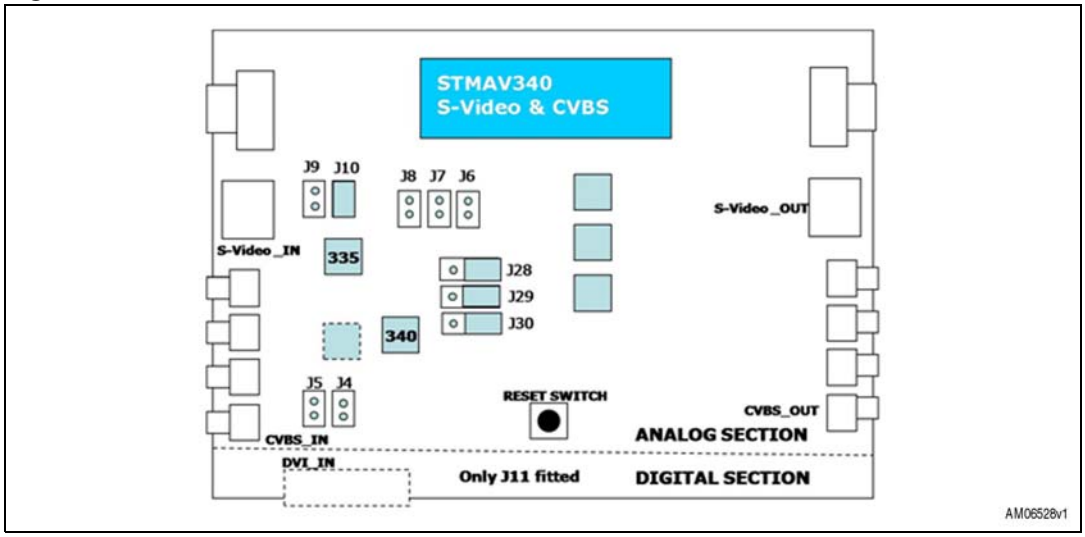
Figure 13. DVI-I analog active



3.3 Demonstrating STMAV335: S-Video and CVBS active

Place the jumper connections, as shown in *Figure 14*. Connect one S-Video cable and one RCA cable from source to S_VIDEO_IN and CVBS_IN respectively, and another pair from S_VIDEO_OUT and CVBS_OUT to the respective sink inputs. The corresponding display can be seen on the TV after its appropriate source selection.

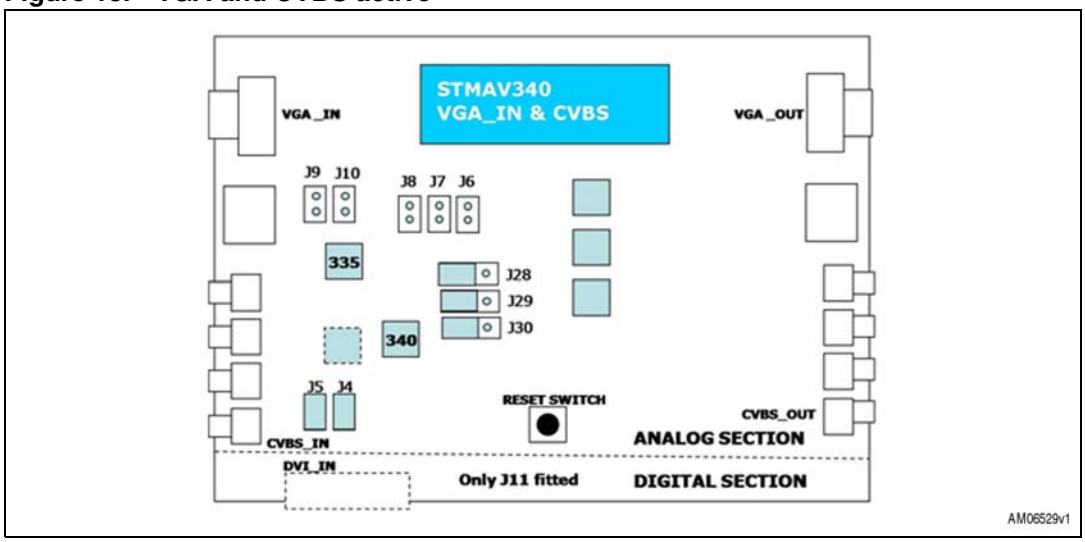
Figure 14. S-Video and CVBS active



3.4 Demonstrating STMAV340: VGA and CVBS active

Place the jumper connections, as shown in *Figure 15*. Connect one VGA cable and RCA cable from source to VGA_IN and CVBS_IN respectively, and another pair from VGA_OUT and CVBS_OUT to the respective sink inputs. The corresponding display can be seen on the TV after its appropriate source selection.

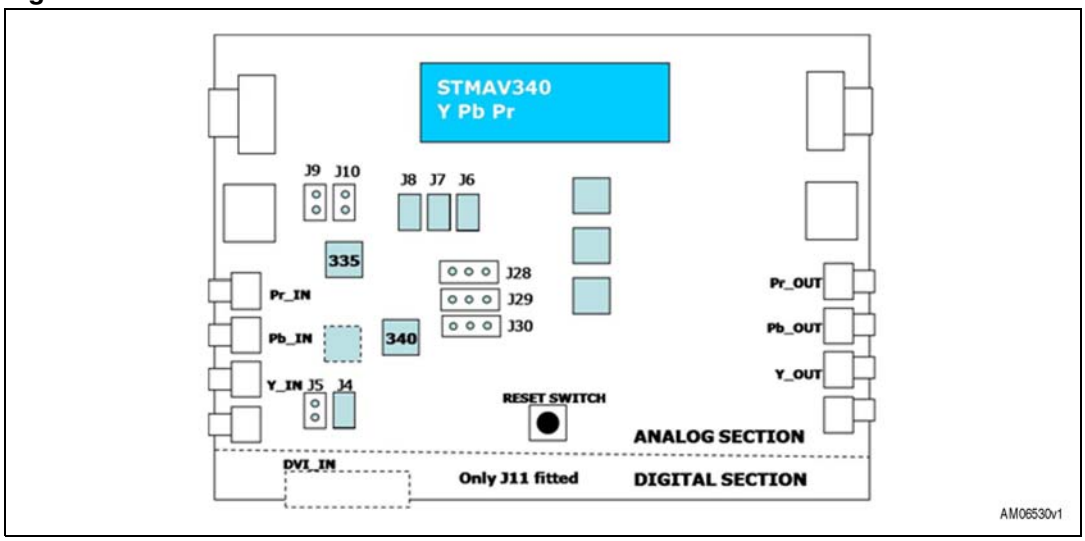
Figure 15. VGA and CVBS active



3.5 Demonstrating STMAV340: Y Pb Pr active

Place the jumper connections, as shown in *Figure 16*. Connect three RCA cables from source to Y_IN, PB_IN, PR_IN and another group from Y_OUT, PB_OUT, PR_OUT to the respective sink inputs. The corresponding display can be seen on the TV after its appropriate source selection.

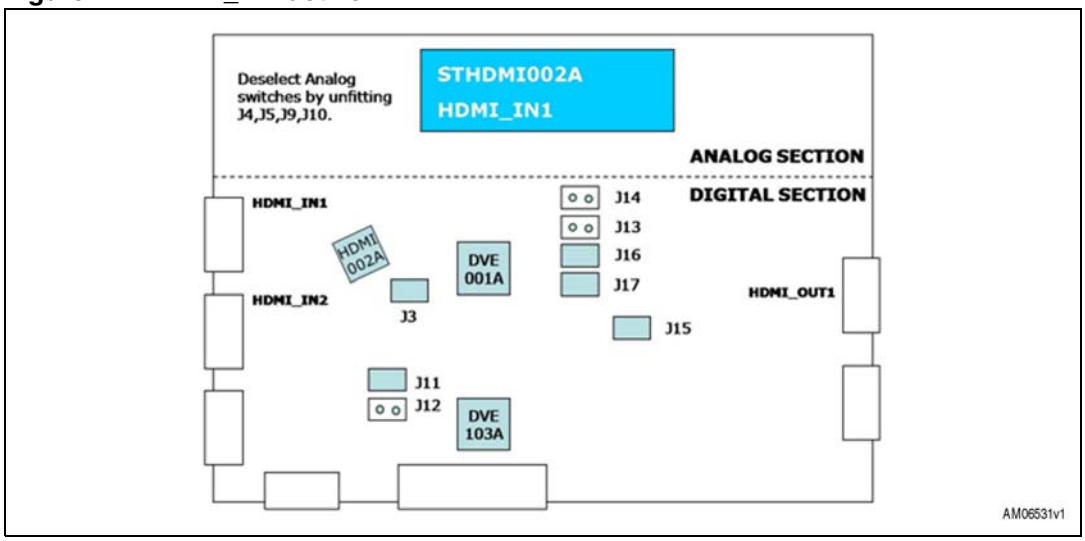
Figure 16. Y Pb Pr active



3.6 Demonstrating STHDMI002A/STDVE001A: HDMI_IN1 active

Place the jumper connections, as shown in *Figure 17*. Connect a HDMI cable from source to HDMI_IN1 and another one from HDMI_OUT1 to the respective sink input. The corresponding display can be seen on the TV after its appropriate source selection.

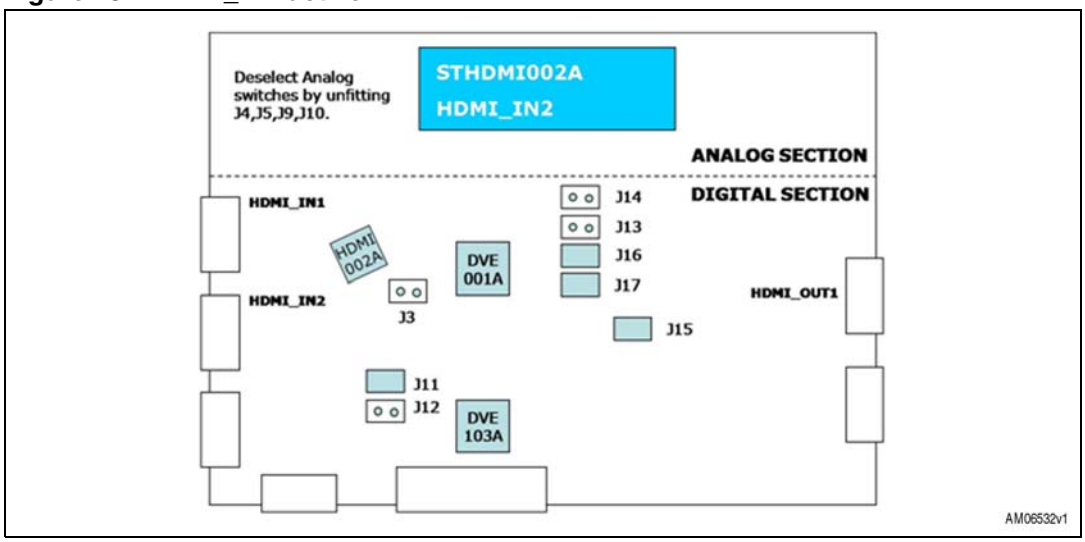
Figure 17. HDMI_IN1 active



3.7 Demonstrating STHDMI002A/STDVE001A: HDMI_IN2 Active

Place the jumper connections, as shown in *Figure 18*. Connect a HDMI cable from source to HDMI_IN2 and another one from HDMI_OUT1 to the respective sink input. The corresponding display can be seen on the TV after its appropriate source selection.

Figure 18. HDMI_IN2 active



3.8 Demonstrating STDVE103A: HDMI_IN3 Active

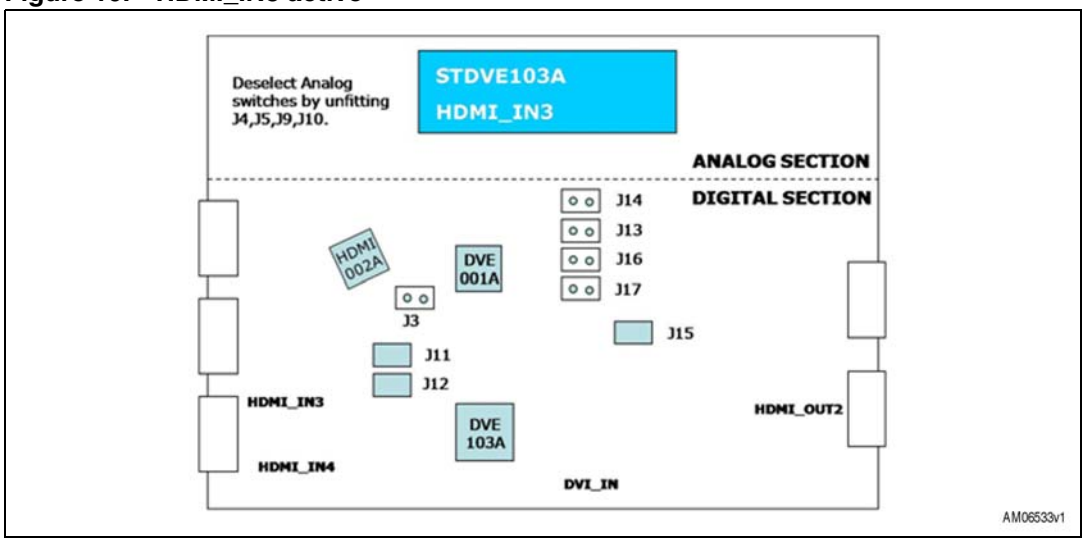
Place the jumper connections, as shown in *Figure 19*. Connect a HDMI cable from source to HDMI_IN3 and another one from HDMI_OUT2 to the respective sink input. The corresponding display can be seen on the TV after its appropriate source selection.

Note: J13, J14 can be used for the Equalizer settings of STDVE001A, and J15 for output de-emphasis adjustment. (J15 On =>3 dB, J15 Off =>0dB).

- J13 on, J14 on: 16 dB
- J13 on, J14 off: 9 dB
- J13 off, J14 on: 4 dB
- J13 off, J14 off: 11 dB

The default configuration is: J13, J14 off and J15 on.

Figure 19. HDMI_IN3 active



3.9 Demonstrating STDVE103A: HDMI_IN4 active

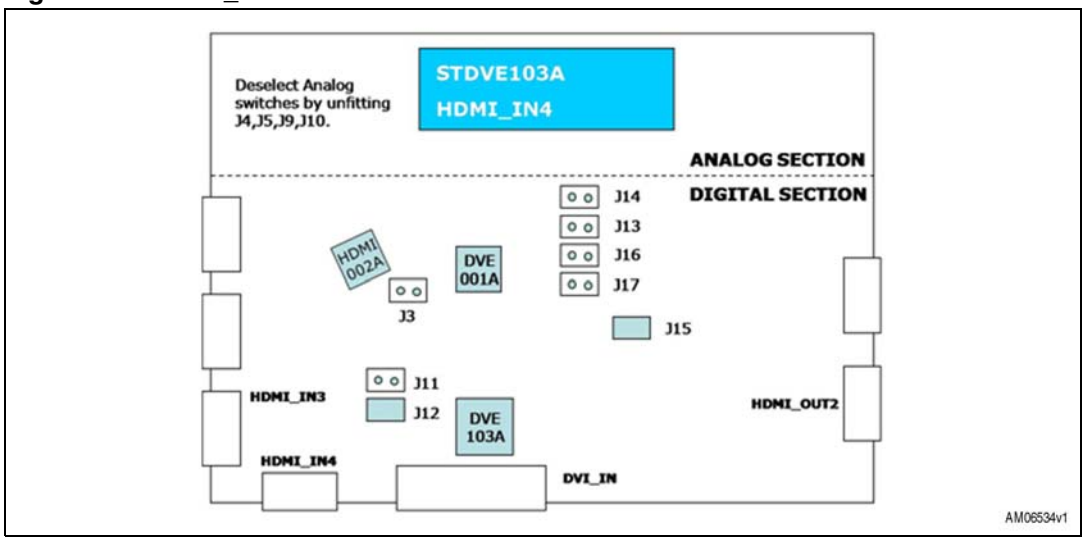
Place the jumper connections, as shown in *Figure 20*. Connect a HDMI cable from source to HDMI_IN4 and another one from HDMI_OUT2 to the respective sink input. The corresponding display can be seen on the TV after its appropriate source selection.

Note: J13 and J14 can be used for the equalizer settings of STDVE001A, and J15 for output de-emphasis adjustment. (J15 On =>3 dB, J15 Off =>0dB).

- J13 on, J14 on: 16 dB
- J13 on, J14 off: 9 dB
- J13 off, J14 on: 4 dB
- J13 off, J14 off: 11 dB

The default configuration is: J13, J14 off and J15 on.

Figure 20. HDMI_IN4 active



3.10 Demonstrating STDVE103A: DVI-I digital active

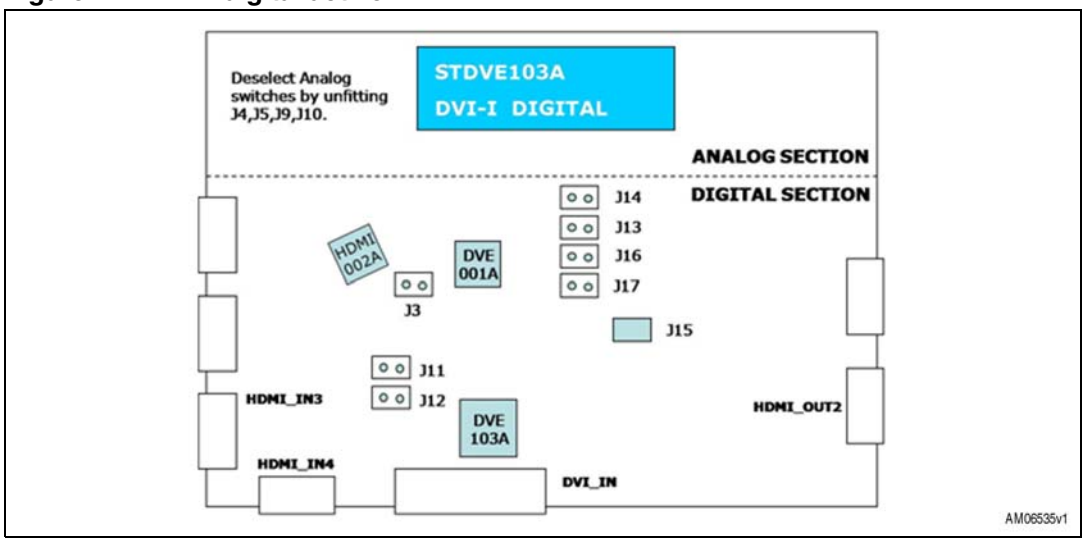
Place the jumper connections, as shown in figure below. Connect a DVI-I cable from source to DVI_IN and another one from HDMI_OUT2 to the respective sink input. The corresponding display can be seen on the TV after its appropriate source selection.

Note: J13 and J14 can be used for the equalizer settings of STDVE001A, and J15 for output de-emphasis adjustment. (J15 on =>3 dB, J15 off =>0dB).

- J13 on, J14 on: 16 dB
- J13 on, J14 off: 9 dB
- J13 off, J14 on: 4 dB
- J13 off, J14 off: 11 dB

The default configuration is: J13, J14 off and J15 on.

Figure 21. DVI-I digital active



4 Schematics

Figure 22. Schematic_HDMI002A_HDMI_Conn

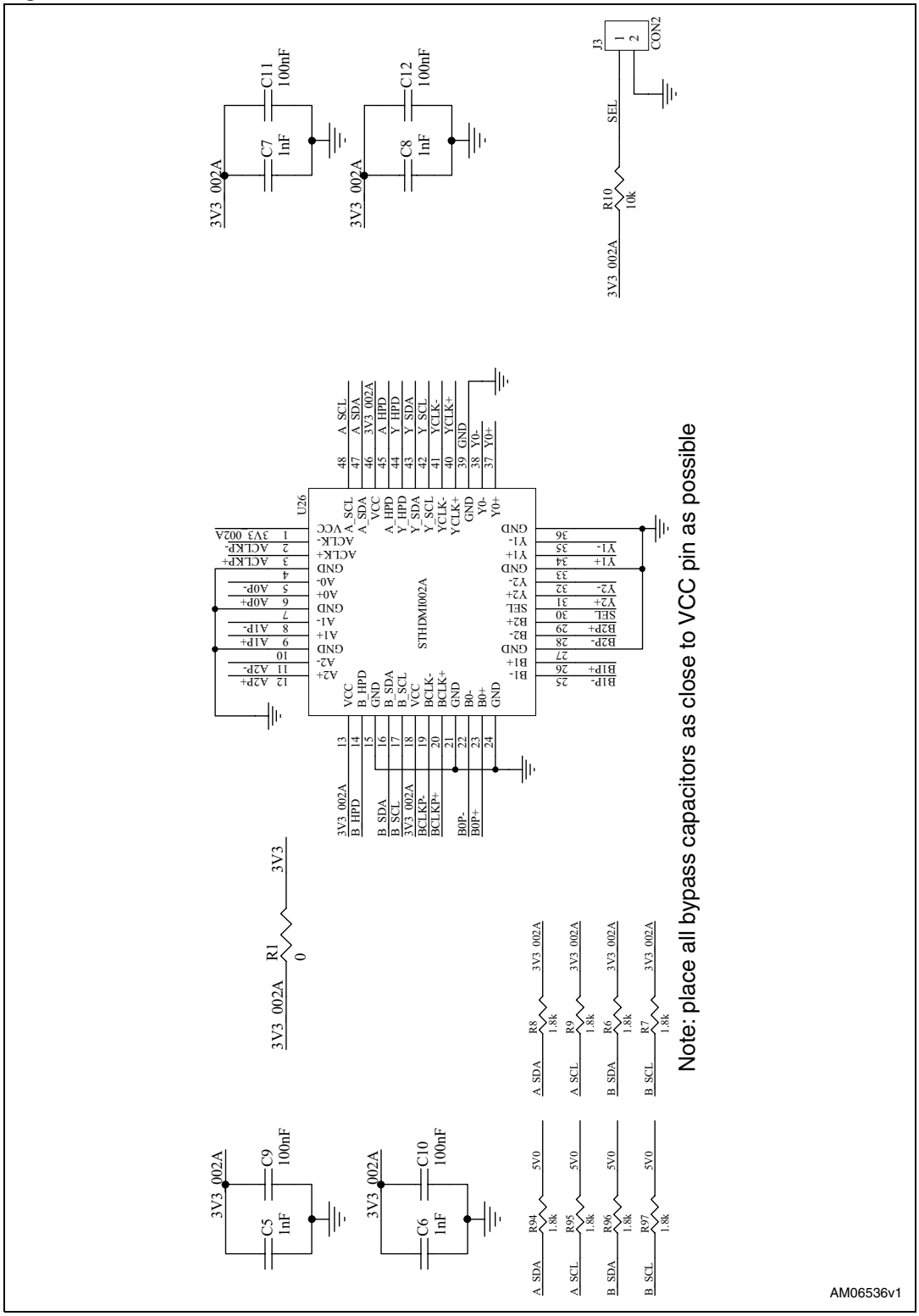


Figure 23. HDMI_IN1 section

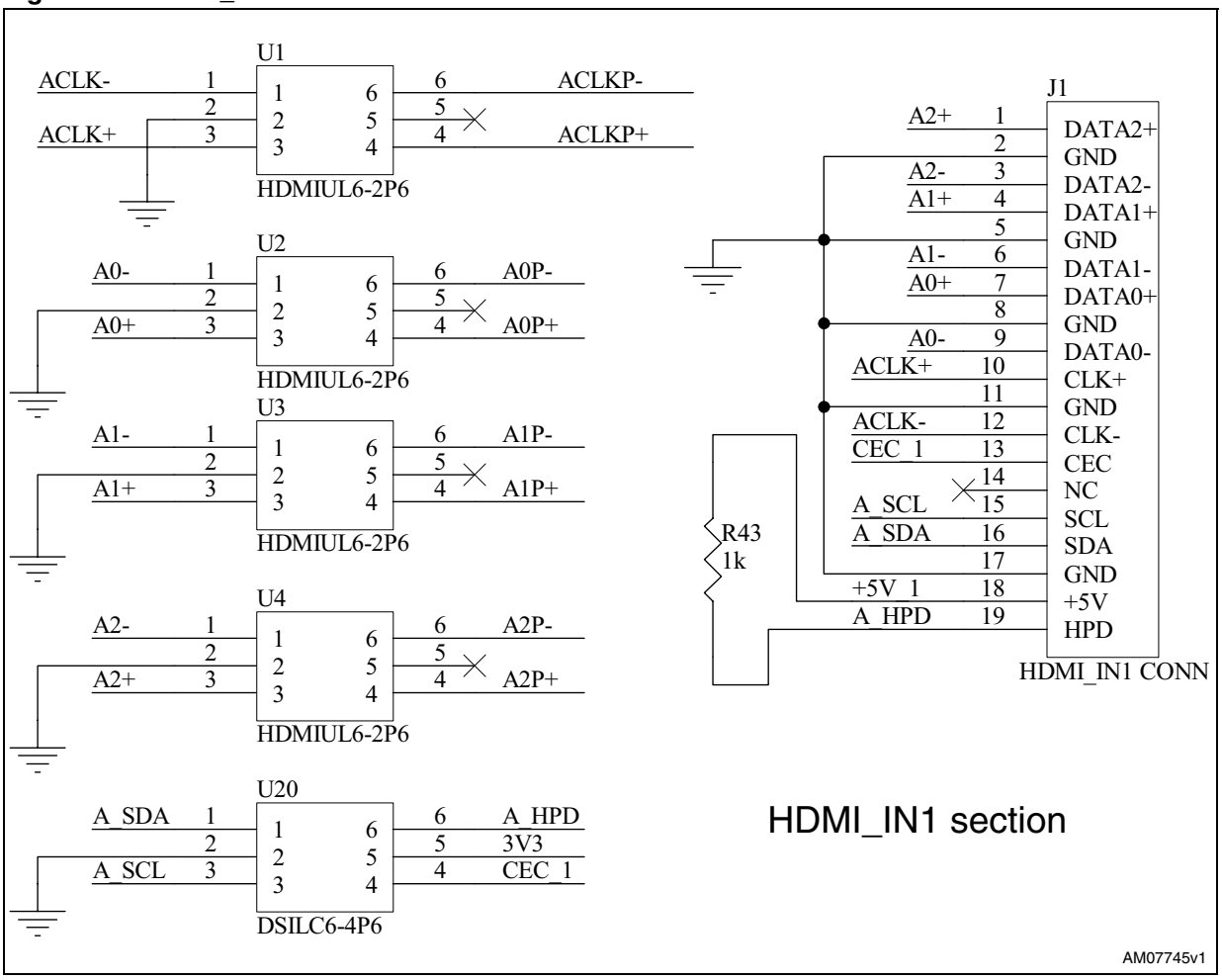


Figure 24. HDMI_IN2 section

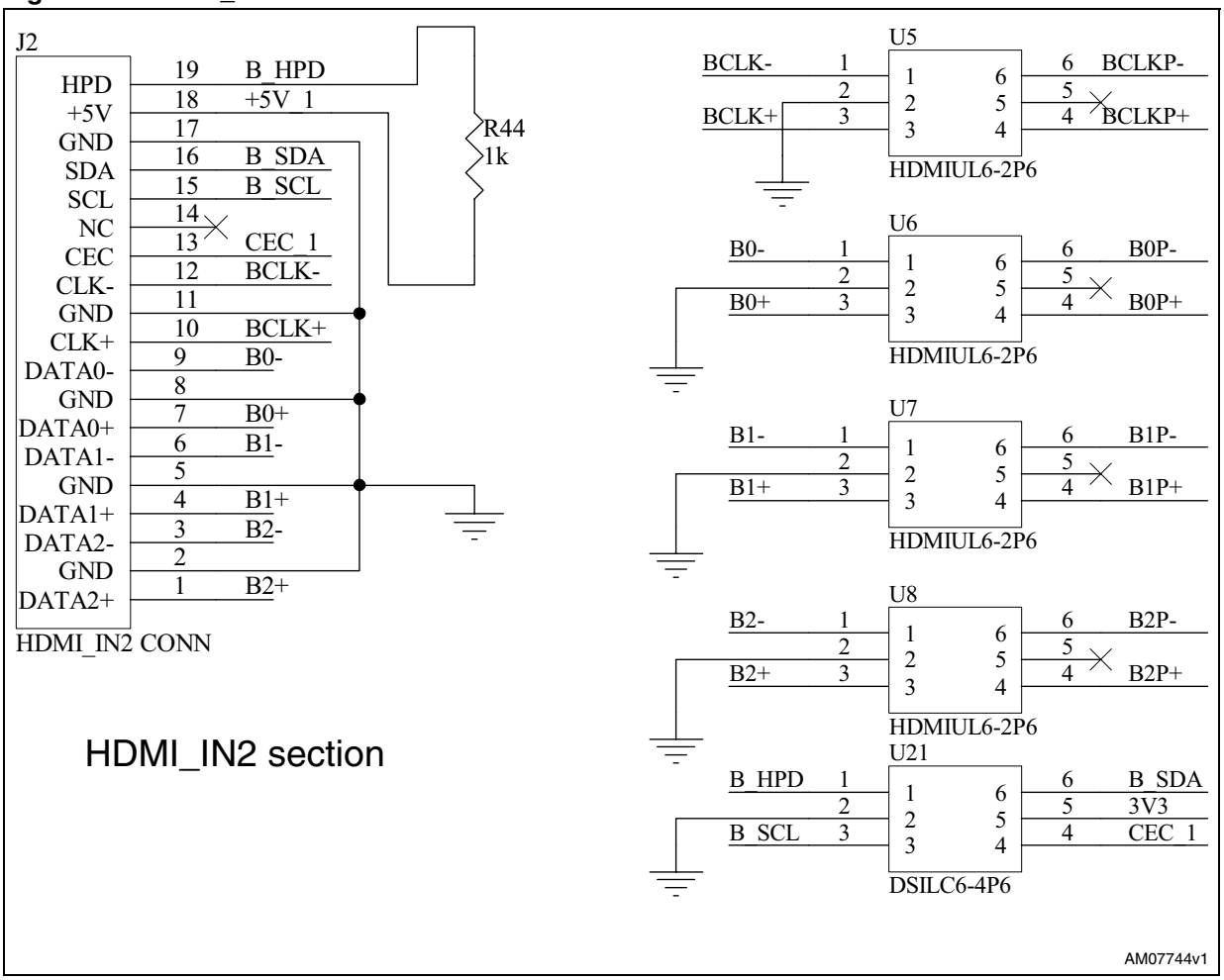


Figure 25. Schematic_AnalogSwitches_Conn (part 1)

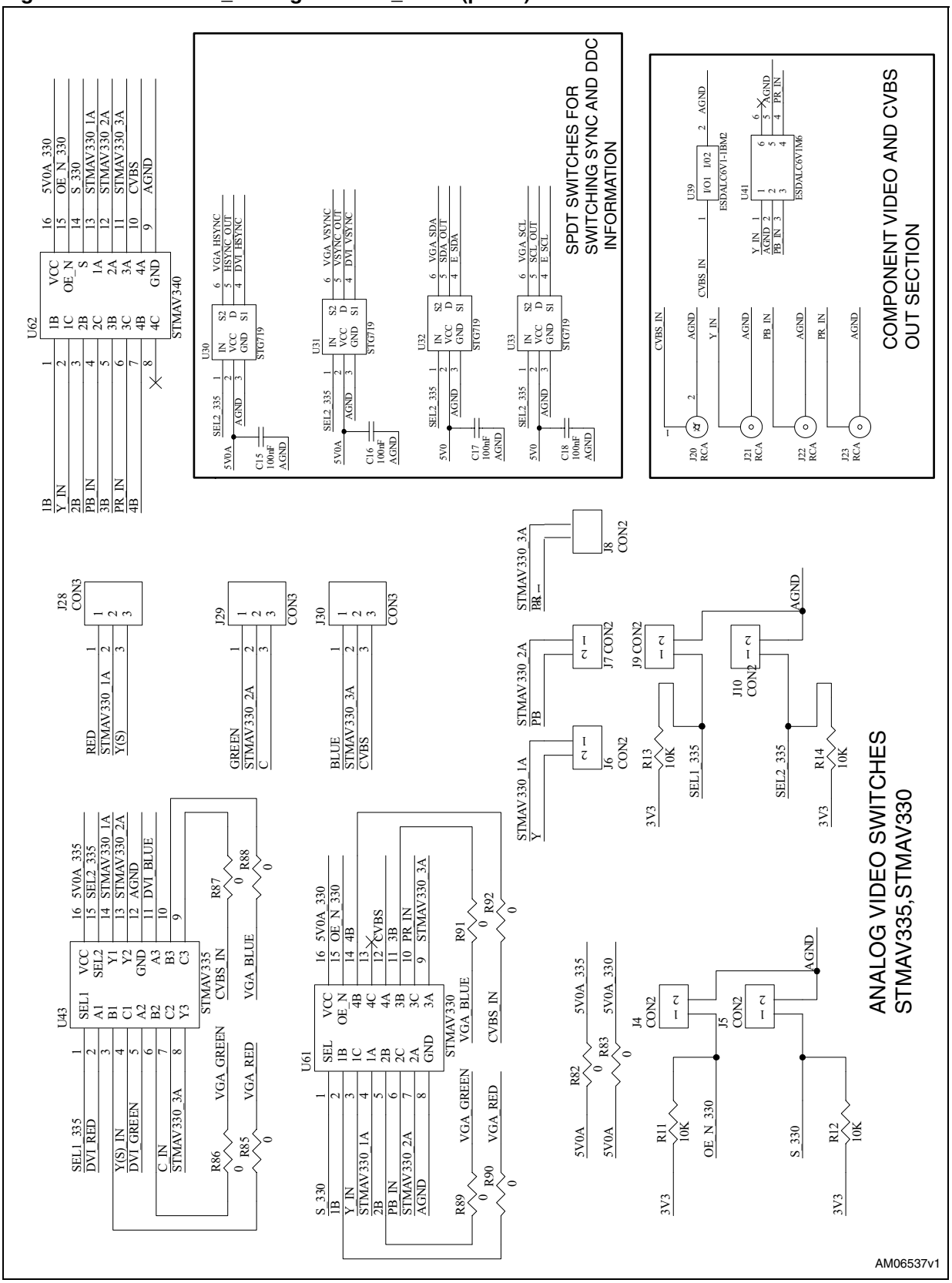


Figure 26. Schematic_AnalogSwitches_Conn (part 2)

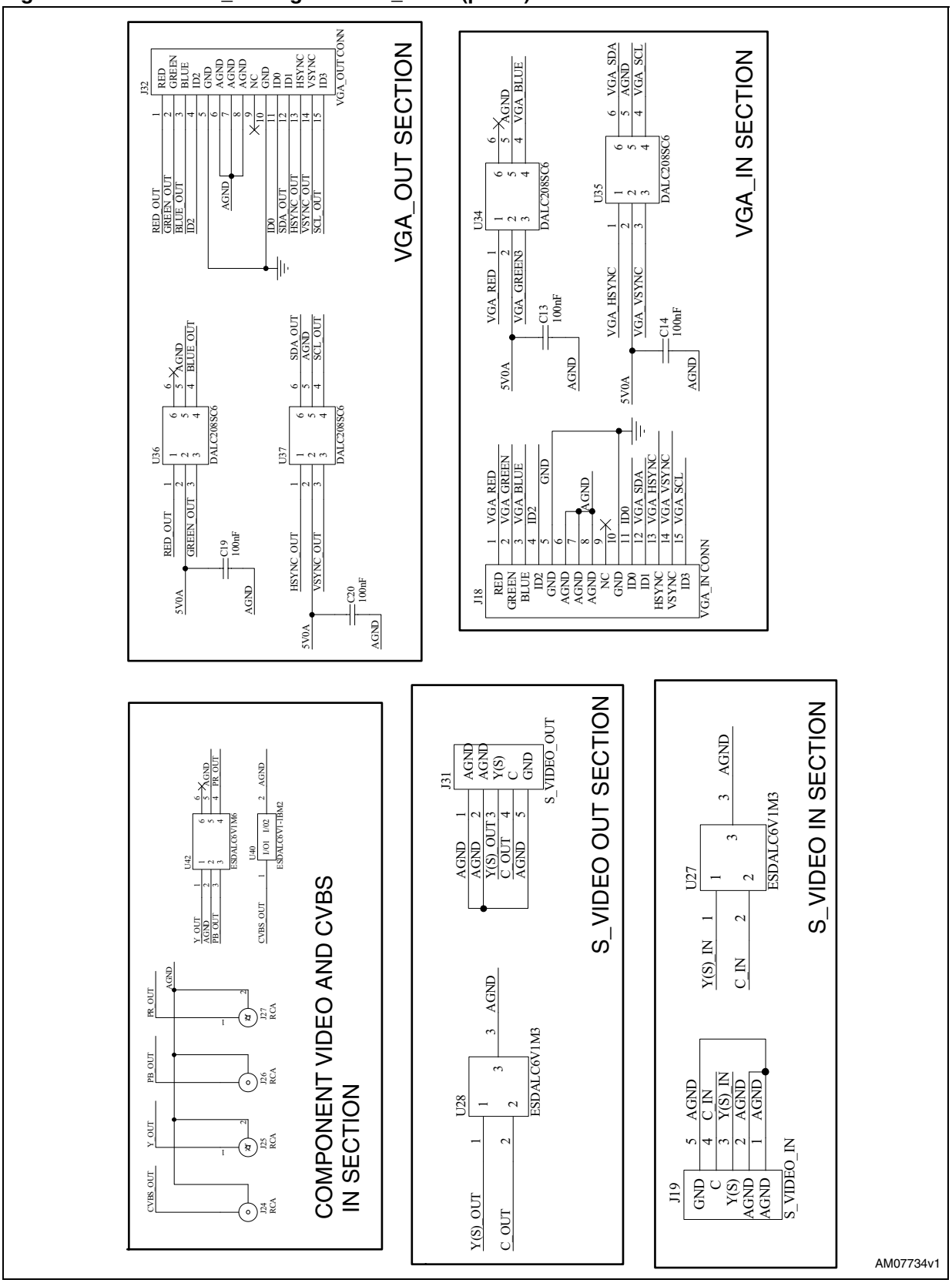


Figure 27. Schematic_Power_Micro

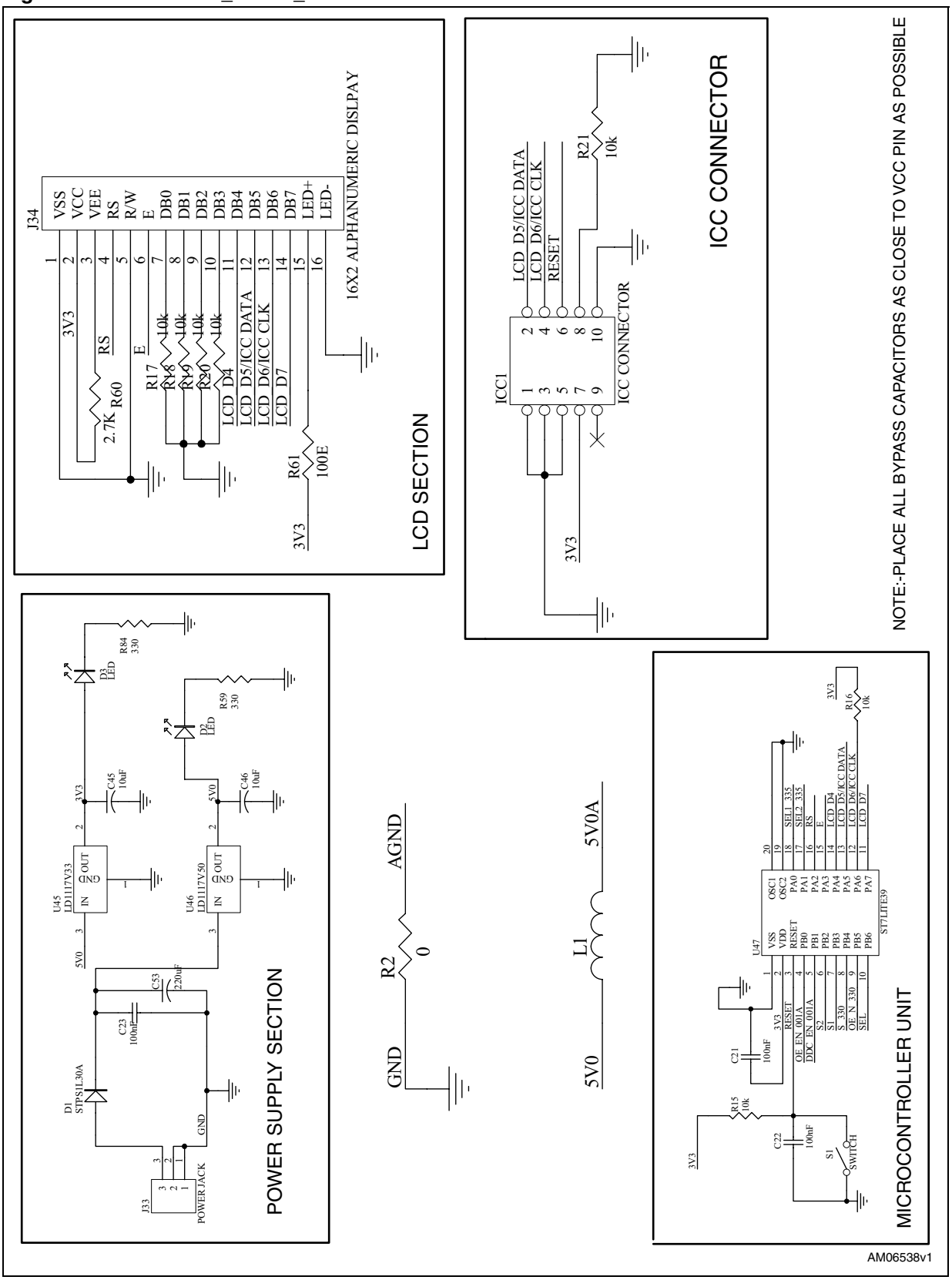


Figure 28. Schematic_DVE103A_HDMI_Conn (part 1)

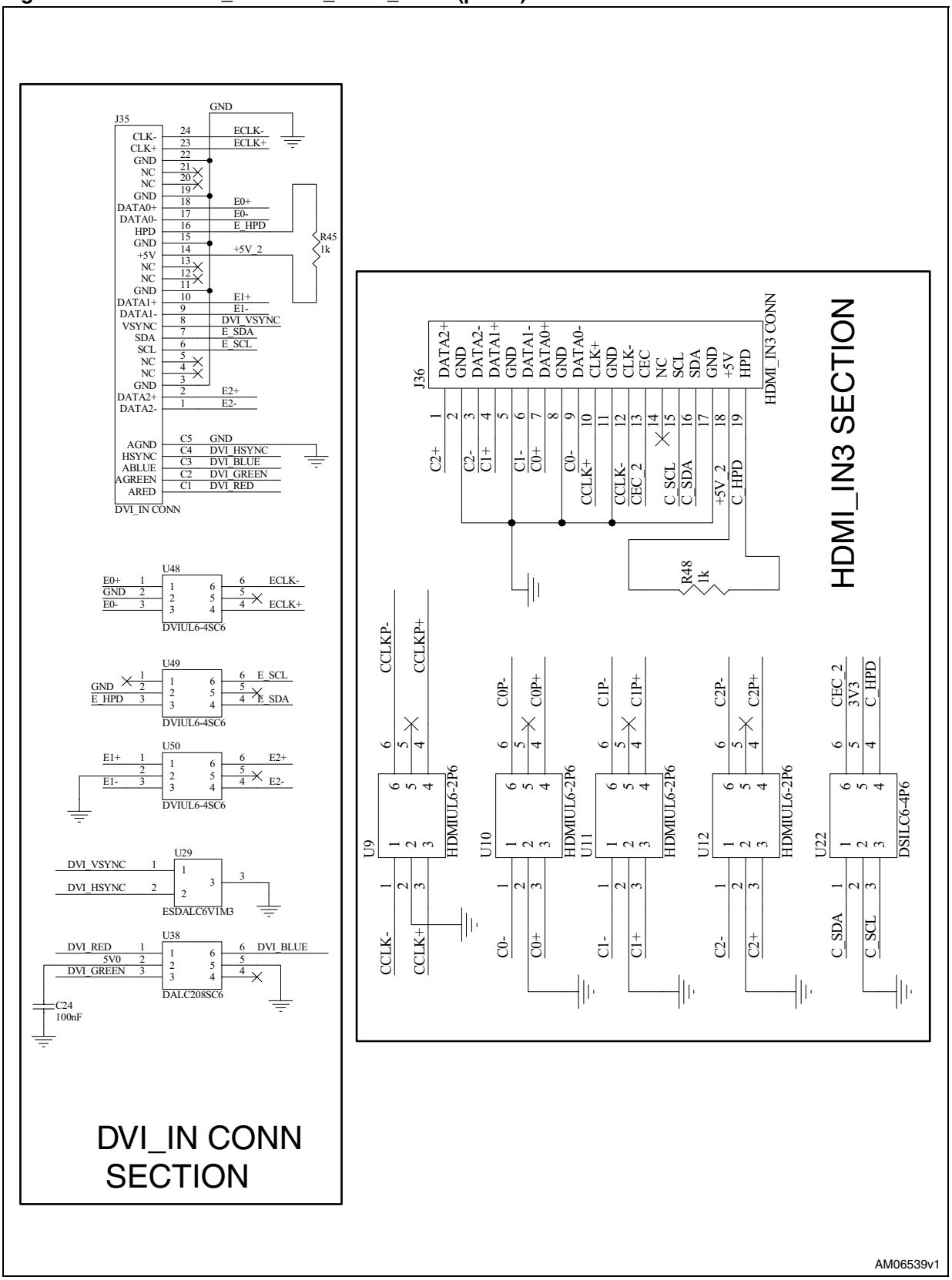


Figure 29. Schematic_DVE103A_HDMI_Conn (part 2)

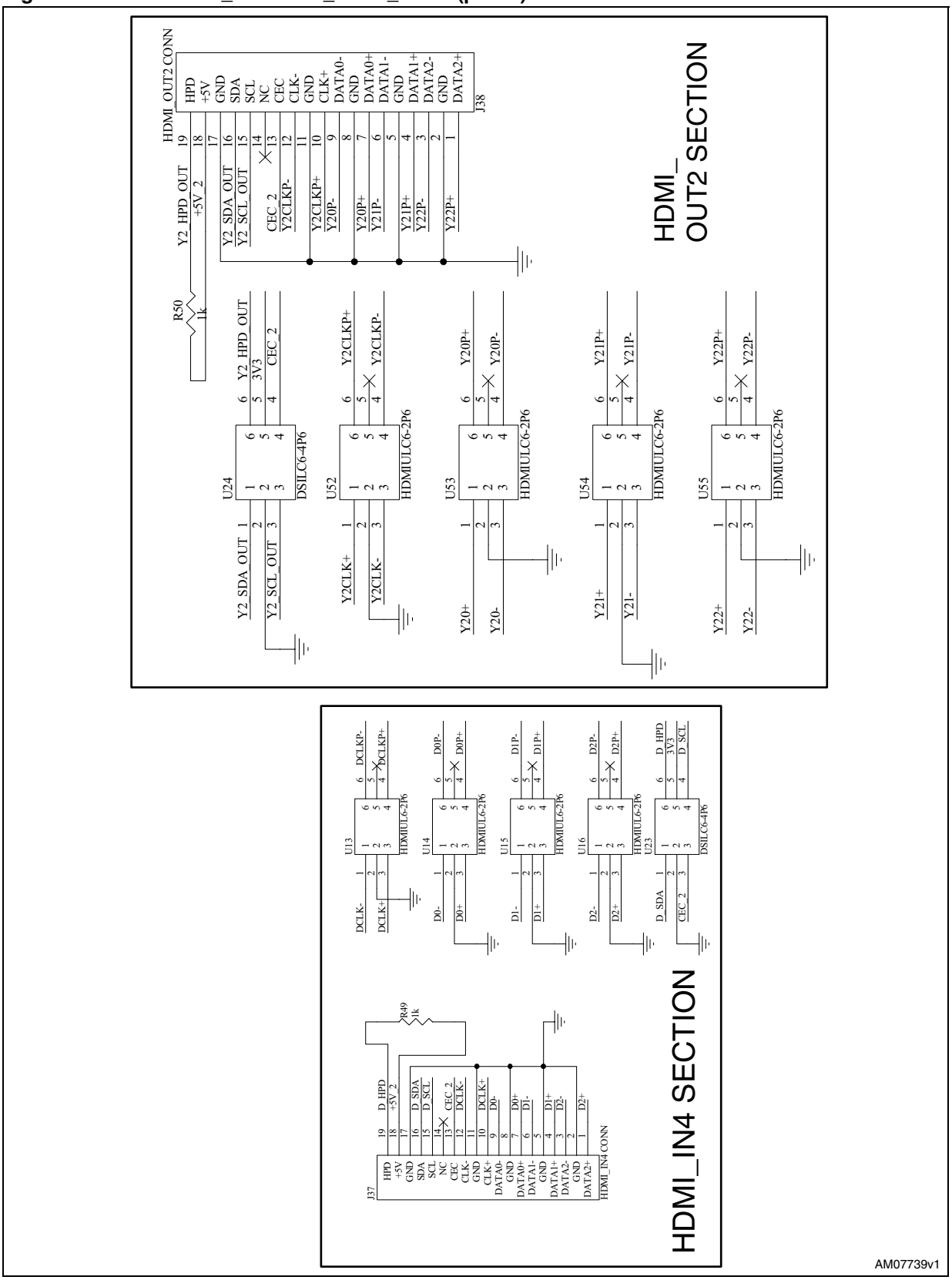


Figure 30. Schematic_DVE103A_HDMI_Conn (part 3)

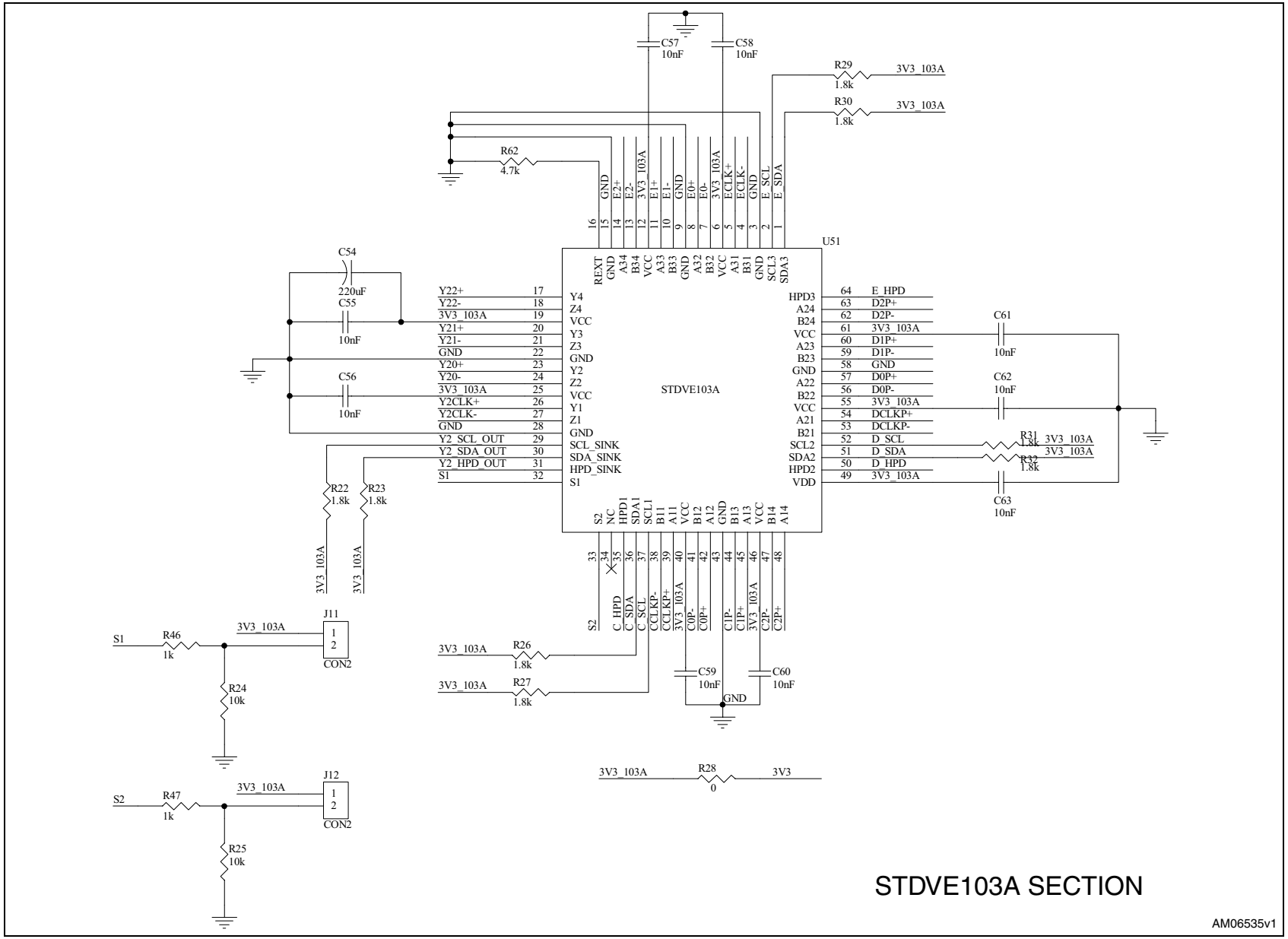


Figure 31. Schematic_DVE001A_HDMI_Conn (part 1)

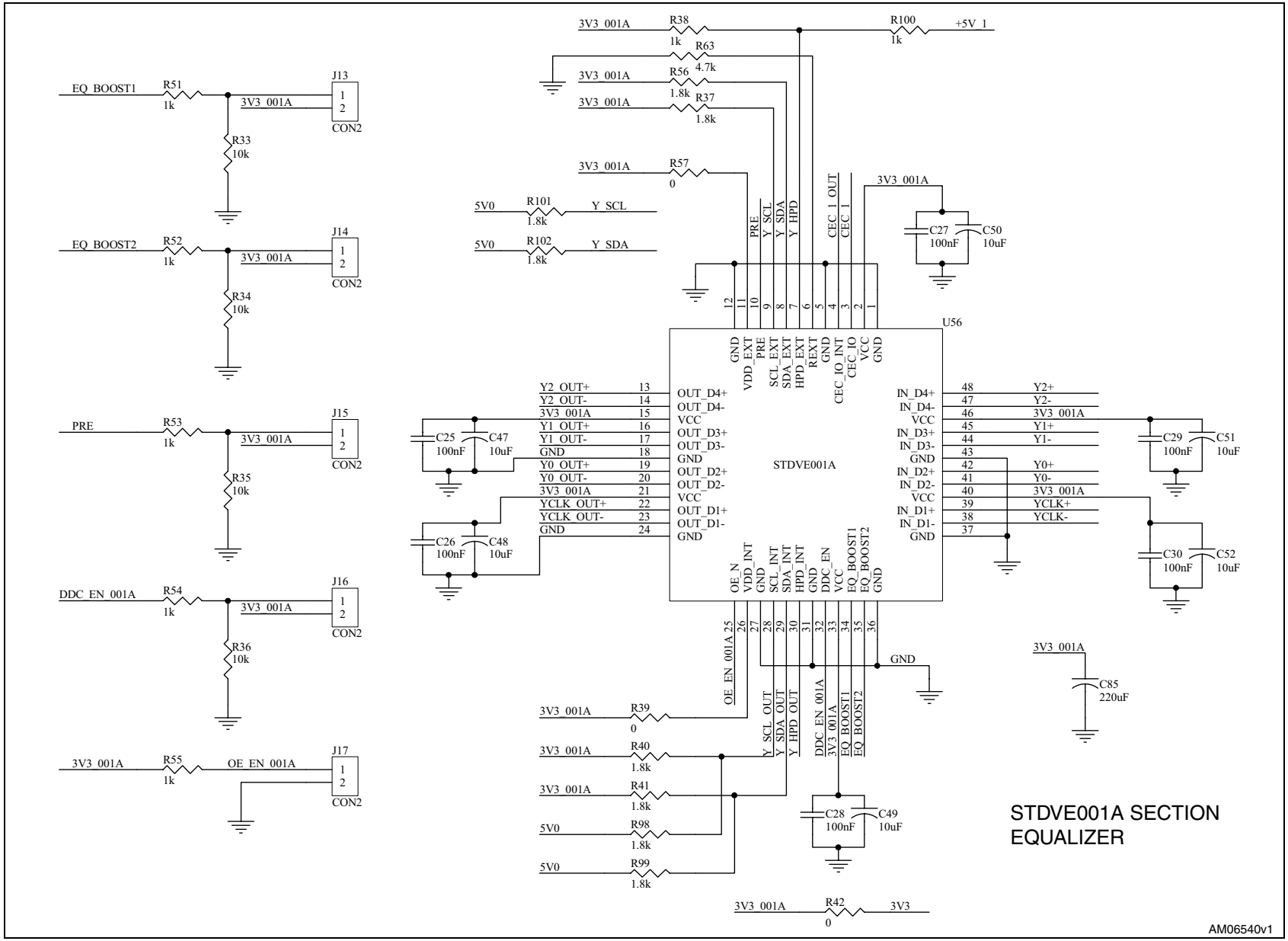


Figure 32. Schematic_DVE001A_HDMI_Conn (part 2)

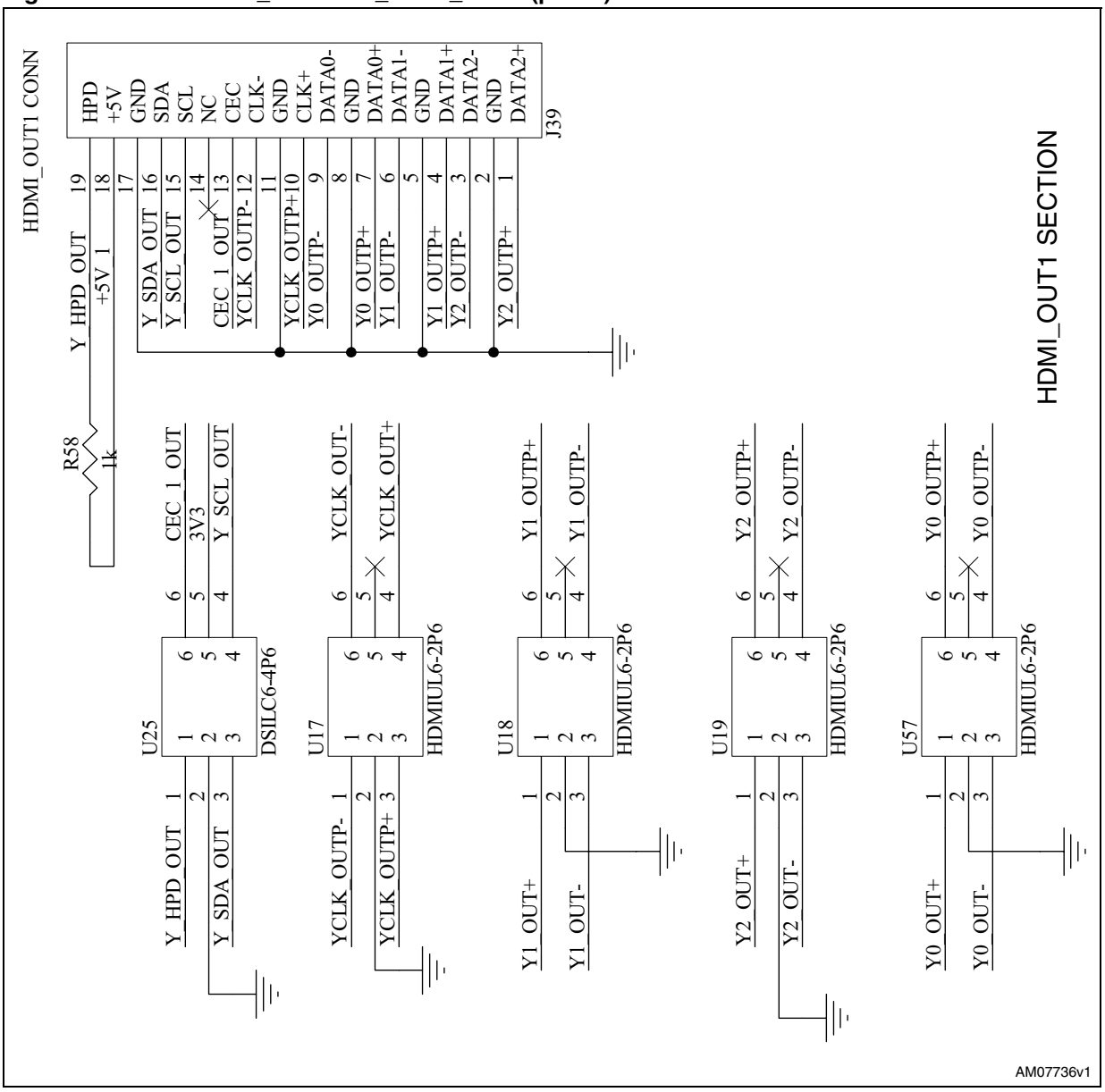


Figure 33. Schematic_AnalogBuffers (part 1)

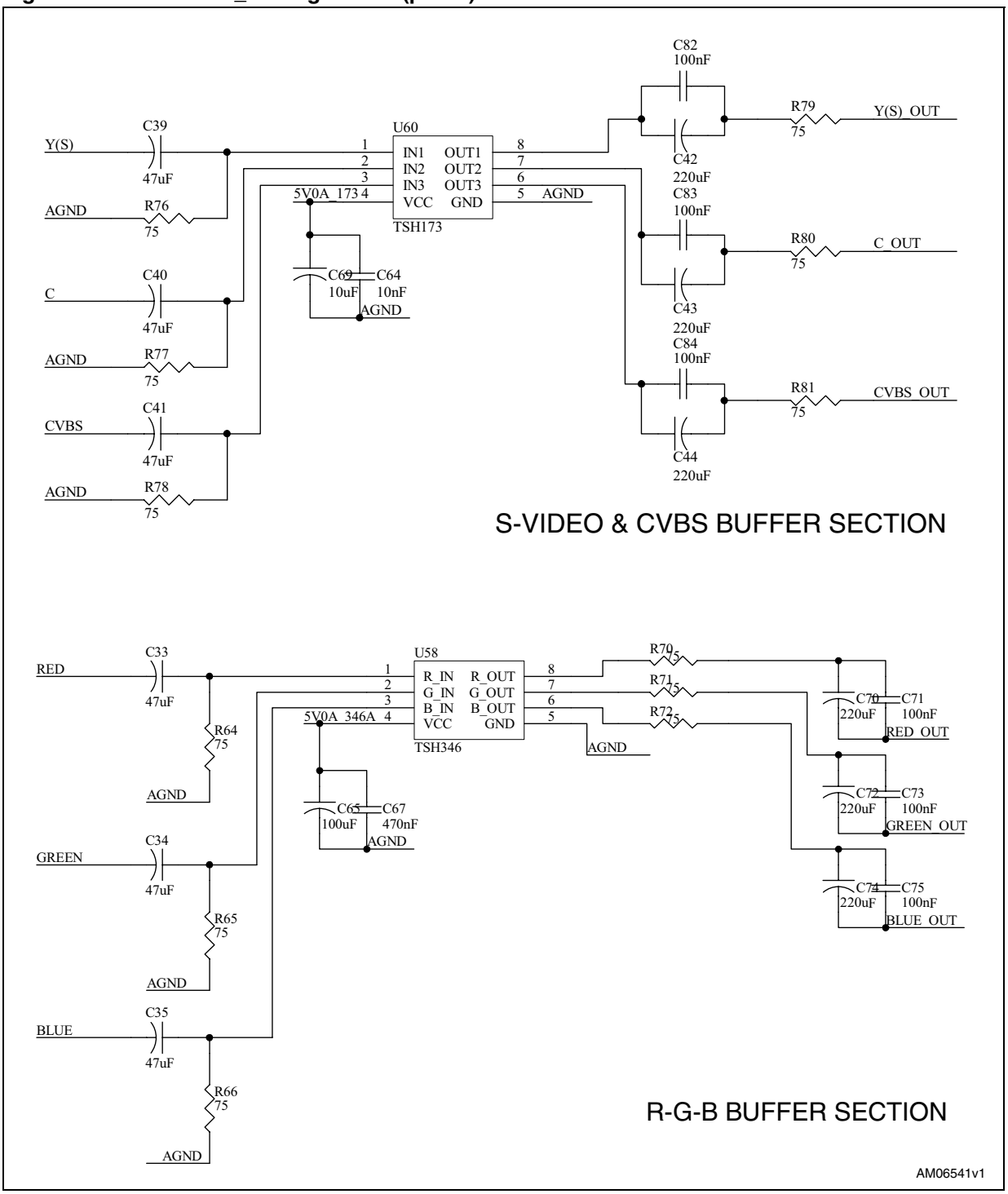
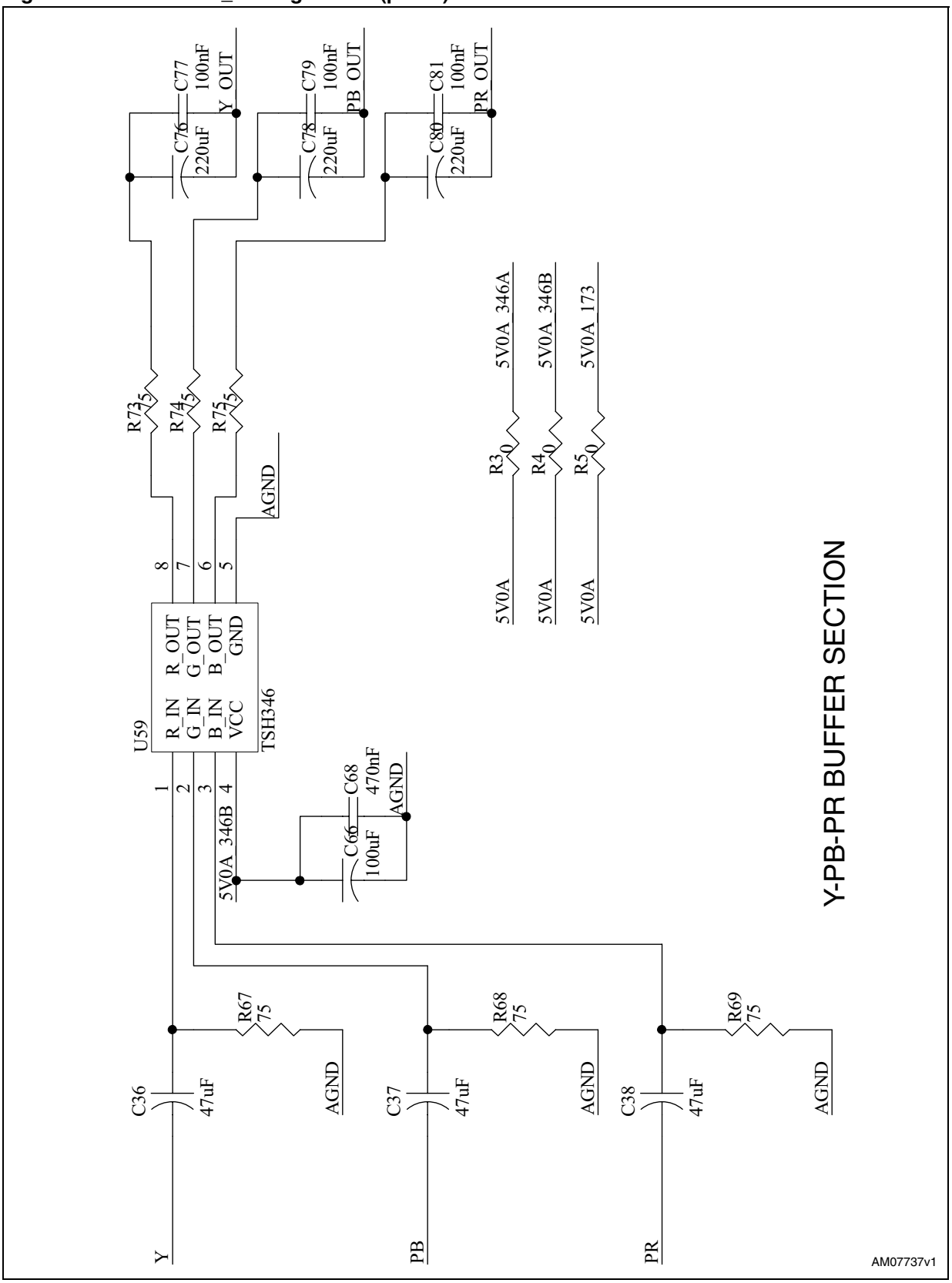


Figure 34. Schematic_AnalogBuffers (part 2)



5 Bill of material

Table 1. BOM

Reference designator	Component description	Package	Manufacturer	Manufacturer's ordering code / orderable part number	Supplier	Supplier ordering code
U26	HDMI/DVI 2:1 switch	TQFP48	STMicroelectronics	STHDMI002ABTR	STMicroelectronics	STHDMI002ABTR
U51	HDMI/DVI 3:1 switch and equalizer	TQFP64	STMicroelectronics	STDVE103ABTR	STMicroelectronics	STDVE103ABTR
U56	HDMI/DVI equalizer	TQFP48	STMicroelectronics	STDVE001ABTR	STMicroelectronics	STDVE001ABTR
U43	Analog video switch	TSSOP16	STMicroelectronics	STMAV335TTR	STMicroelectronics	STMAV335TTR
U62	Analog video switch	TSSOP16	STMicroelectronics	STMAV340TTR	STMicroelectronics	STMAV340TTR
U61 (do not mount)	Analog video switch	TSSOP16	STMicroelectronics	STMAV330TTR	STMicroelectronics	STMAV330TTR
U60	S-Video/CVBS buffer	TSSOP16	STMicroelectronics	TSH173TTR	STMicroelectronics	TSH173TTR
U59	Y Pb Pr buffer	SO8	STMicroelectronics	TSH343IDT	STMicroelectronics	TSH343IDT
U58	RGB buffer	SO8	STMicroelectronics	TSH344IDT	STMicroelectronics	TSH344IDT
U47	ST7-MCU	SO20	STMicroelectronics	ST7FLITE39F2M6	STMicroelectronics	ST7FLITE39F2M6
U30,U31,U32,U33	Electronic SPDT switches	SOT23-6L	STMicroelectronics	STG719STR	STMicroelectronics	STG719STR
U45	3.3 V voltage regulator	TO-220	STMicroelectronics	LD1117V33	STMicroelectronics	LD1117V33
U46	5 V voltage regulator	TO-220	STMicroelectronics	LD1117V50	STMicroelectronics	LD1117V50
U34,U35,U36,U37, U38	Protection device (analog video lines)	SOT23-6L	STMicroelectronics	DALC208SC6	STMicroelectronics	DALC208SC6
U48,U49,U50	Protection device(DVI lines)	SOT23-6L	STMicroelectronics	DVIUCL6-4SC6	STMicroelectronics	DVIUCL6-4SC6
U41,U42	Protection device (analog video lines)	MICRO QFN	STMicroelectronics	ESDALC6V1M6	STMicroelectronics	ESDALC6V1M6

Table 1. BOM (continued)

Reference designator	Component description	Package	Manufacturer	Manufacturer's ordering code / orderable part number	Supplier	Supplier ordering code
U27,U28,U29	Protection device (analog video lines)	SOT883	STMicroelectronics	ESDALC6V1M3	STMicroelectronics	ESDALC6V1M3
U1,U2,U3,U4,U5,U6, U7,U8,U9,U10,U11, U12,U13,U14,U15, U16,U17,U18,U19, U52,U53,U54,U55, U57	Protection device (HDMI lines)	SOT666	STMicroelectronics	HDMIULC6-2P6	STMicroelectronics	HDMIULC6-2P6
U20,U21,U22,U23, U24,U25,	Protection device (I^2C lines)	SOT666	STMicroelectronics	DSILC6-4P6	STMicroelectronics	DSILC6-4P6
D1	Schottky diode	STPS1L30A	STMicroelectronics	STPS1L30A	STMicroelectronics	STPS1L30A
J1,J2,J36,J37,J38, J39	HDMI connector (19-pin)	19-pin SMD	Microcross	500254-1927	Digi-Key	WM19084TR-ND
J35	DVI-I connector	29-pin through hole	Microcross	74320-1004	Digi-Key	WM5600-ND
J20,J21,J22,J23,J24, J25,J26,J27,J39	RCA connectors	2-pin through hole	CUI Inc	CP-1420-ND	Digi-Key	RCJ-043
J19,J31	S-video connectors (4-pin)	4-pin mini din	CUI Inc	MD-40SMK	Digi-Key	CP-4040-ND
J18,J32	VGA connectors (15-pin)	15-pin D-SUB	KYCON	K66X-E15S-N	MOUSER	806-K66X-E15S-N
S1	Switch	Pushbutton	Tyco Electronics	FSM2JH	Farnell	1555981
J33	Power jack	2.5 mm right angle locking type	Protectron	PDCJ01-08	Protectron	PDCJ01-08
J34	16-pin connector (16x2 alphanumeric LCD)	16-pin female bergstrip connector	Protectron	P9401-40-21	Protectron	P9401-40-21

Table 1. BOM (continued)

Reference designator	Component description	Package	Manufacturer	Manufacturer's ordering code / orderable part number	Supplier	Supplier ordering code
J3,J4,J5,J6,J7,J8,J9, J10,J11,J12,J13,J14, J15,J16,J17	CON2 (2-pin connector)	SIP-2 (berg strip)	Protectron	P9102-40-12-1	Protectron	P9102-40-12-1
J28,J29,J30	CON3 (3-pin connector)	SIP-3 (berg strip)	Protectron	P9101-03-12-1	Protectron	P9101-03-12-1
ICC1	ICC connector	Header 5x2/ IDC-10B	Protectron	P9603-10-15-1	Protectron	P9603-10-15-1
D2	Red LED	SMD	Dura opto technologies	LED-CG170HRF-CTRed 0805	Dura opto technologies	LED-CG170HRF-CTRed 0805
D3	Green LED	SMD	Dura opto technologies	LED-CG170HRF-CTGreen0805	Dura opto technologies	LED-CG170HRF-CTGreen0805
C5,C6,C7,C8	1 nF	SMD0805	Johanson dielectrics Inc	101X14W102MV4T	Digi-Key	709-1204-2-ND
C9,C10,C11,C12,C13 ,C14,C15,C16,C17, C18,C19,C20,C21, C22,C23,C24,C25, C26,C27,C28,C29, C30,C75,C77,C79, C81,C82,C83,C84, C71,C73	100 nF	SMD0805	Panasonic-ECG	ECJ-2VB1E104K or equivalent	Digi-Key	PCC1828CT-ND
C31,C32,C33,C34, C35,C36,C37,C38, C39,C40,C41 (mount 0 Ω resistance)	47 µF	6032-28 (EIA)	Nichicon	UPS1H470MED	MOUSER	647-UPS1H470MED
C55,C56,C57,C58, C59,C60,C61,C62, C63,C64	10 nF	SMD0805	Panasonic-ECG	ECJ-2VB1H103K	Digi-Key	PCC103BNCT-ND
C67,C68	470 nF	SMD0805	Murata electronics north America	GRM21BF51E474Z A01L or equivalent	Digi-Key	490-1730-1-ND

Table 1. BOM (continued)

Reference designator	Component description	Package	Manufacturer	Manufacturer's ordering code / orderable part number	Supplier	Supplier ordering code
C45,C46,C47,C48, C49,C50,C51,C52, C69, C65, C66	10 µF	Case A	Vishay/Sprague or equivalent	293D106X96R3A2TE3 or equivalent	MOUSER	74-293D106X96R3A2TE3
C42,C43,C44,C53, C54,C70,C72,C74, C76,C78,C80,C85	220 µF	Through hole	Panasonic-ECG	EEU-FM1E221	Digi-Key	P12383-ND
R1,R2,R3,R4,R5,R28 ,R42,R82,R83,R85, R86,R87,R88,R89, R90,R92,R92, R39, R57	0E	SMD0805	Panasonic-ECG	ERJ-6GEY0R00V or equivalent	Digi-Key	P0.0ATR-ND or equivalent
R6,R7,R8,R9,R22, R23,R26,R27,R29, R30,R31,R32,R37, R38,R40,R41, R56, R94, R95, R96, R97, R98, R99, R101, R102, (do not mount: R40,R41, R6, R7, R8, R9, R56, R37)	1.8 kΩ	SMD0805	Panasonic-ECG	ERJ-6GEYJ182V or equivalent	Digi-Key	P1.8KATR-ND
R38, R43,R44,R45,R46, R47,R48,R49,R50, R51,R52,R53,R54, R55,R56,R57,R58, R100 (do not mount: R38)	1 kΩ	SMD0805	Panasonic-ECG	ERJ-6GEYJ102V or equivalent	Digi-Key	P1.0KATR-ND
R60	2.7 kΩ	SMD0805	Local	ERJ-6GEYJ272V or equivalent	Digi-Key	P2.7KATR-ND
R62,R63	4.7 kΩ	SMD0805	Local	ERJ-6GEYJ472V or equivalent	Digi-Key	P4.7KATR-ND

Table 1. BOM (continued)

Reference designator	Component description	Package	Manufacturer	Manufacturer's ordering code / orderable part number	Supplier	Supplier ordering code
R59,R84	330 E	SMD0805	Local	ERJ-6GEYJ331V	Digi-Key	P330ATR-ND
R61	100 E	SMD0805	Panasonic - ECG	ERJ-6GEYJ101V	Digi-Key	P100ATR-ND
R64,R65,R66,R67,R68,R69,R70,R71,R72, R73,R74,R75,R76, R77,R78,R79,R80, R81	75 Ω	SMD0805	Local			
R10, R11, R12, R13, R14, R15, R24, R25, R33, R34, R35, R36, R16,R17,R18,R19, R20, R21	10 kΩ	SMD0805	Panasonic - ECG	ERJ-6GEYJ103V or equivalent	Digi-Key	P10KATR-ND
L1	Ferrite beads	SMD0805	MURATA electronics	BLM21BD601SN1D	Digi-Key	490-1046-1-ND
J34 (LCD)	16 * 2 alphanumeric LCD	16-pin 2.5 mm pitch	Oriole electronics Pvt.Ltd.	ODM16216-9SL3/AX	Oriole electronics Pvt.Ltd.	ODM16216-9SL3/AX

6 Revision history

Table 2. Document revision history

Date	Revision	Changes
12-Jul-2010	1	Initial release.

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