



DESCRIPTION

The ES6168A Vibratto™S DVD processor is a super high-performance single-chip MPEG video decoding solution that provides not only DVD decoding, but also MPEG-4 support, allowing users to view video clips (from the Internet, a camcorder, or other source) on DVD players.

The ES6168A integrates a state-of-the-art progressive-scan video feature to provide brilliant and sharp, flicker-free output to the video display, built-in CPRM, and S/PDIF input and output support. The ES6168A performs audio/video stream data processing, TV encoding, Macrovision™ copy protection, DVD system navigation, system control, and housekeeping functions.

The Vibratto-S DVD processor is built on the ESS proprietary dual CPU Programmable Multimedia Processor (PMP) core consisting of 32-bit RISC and 64-bit DSP processors and offers the best DVD feature set. The processing units enable simultaneous parallel execution of system commands and data processing to perform specialized encoding and decoding tasks.

The RISC processor performs bit stream parsing, control audio data output, transfer video and audio data to the vector engine and service system control and housekeeping functions. The vector engine performs audio and video micro-code processing required by A/V standards, such as Dolby® Digital, MPEG and JPEG imaging. These processing tasks include video motion compensation and estimation, loop filtering, Discrete Cosine Transforms (DCT), inverse DCT, quantization, and inverse quantization.

The Vibratto-S DVD processor supports both parallel and serial DVD loader interfaces, industry standard I²S audio data input and output, EPROM and DRAM access, and audio/video data buffering. It also supports both letterbox and pan-and-scan displays, sub-picture overlay, and On-Screen Display (OSD). In addition, the Vibratto-S DVD solution plays Karaoke, CD+G, DVD-Audio, HDCD, CD-DA, MP3, and WMA.

The ES6168A DVD processor is available in a 208-pin Plastic Quad Flat Pack (PQFP) device package.

FEATURES

- Single-chip DVD processor.
- MPEG-4 Advanced Simple Profile* at full screen (D1).
- Integrated NTSC/PAL encoder with pixel-adaptive de-interlacer and five 10-bit 54 MHz video DACs.
- High-quality progressive scan video output for flicker-free video display.
- DVD-Video, DVD-VR, VCD 1.1 and 2.0, and SVCD.
- Full DVD-Audio support including MLP and LPCM decode, CPPM decryption, and watermark detection.
- Media playback with CD-ROM, CD-R/RW, DVD-R/RW, DVD+R/RW, and DVD-RAM.
- Up to 7.1 channel audio outputs.
- Interface for IDE devices, A/V DVD loaders.
- Interface for CF, MS, SD, MMC, and SM memory cards.
- Direct interface of 8-/16-bit DRAM up to 128-Mb capacity.
- Direct interface for up to 4 banks of 8-/16-bit EPROM or Flash EPROM for up to 4-MB for each bank.
- Macrovision 7.1 for NTSC/PAL interlaced video.
- Macrovision NTSC/PAL (480p/576p) progressive scan video.
- Simultaneous composite, S-video, and YUV outputs.
- CCIR 656/601 YUV 4:2:2 input and output.
- On-Screen Display controller supports 256 colors in 8 degrees of transparency.
- Subpicture Unit (SPU) decoder supports karaoke lyric, subtitles, and EIA-608 compliant Line 21 Captioning.
- SmartLogo™ for custom JPEG wallpaper.
- JPEG digital photo support (Kodak Picture CD™ and Fujifilm FujiColor CD™).
- ESS Music Slideshow™.
- Bass management.
- Dolby Digital (AC-3), Dolby Pro Logic™, and Pro Logic II.
- DTS™ surround.
- S/PDIF digital audio input and output.
- MPEG AAC and Multichannel.
- SRS TruSurround® and TruSurround XT™.
- Windows™ Media Audio decoding.
- Professional karaoke with full scoring scheme.

ES6168A PINOUT DIAGRAM

The device pinout for the ES6168A is shown in Figure 1.

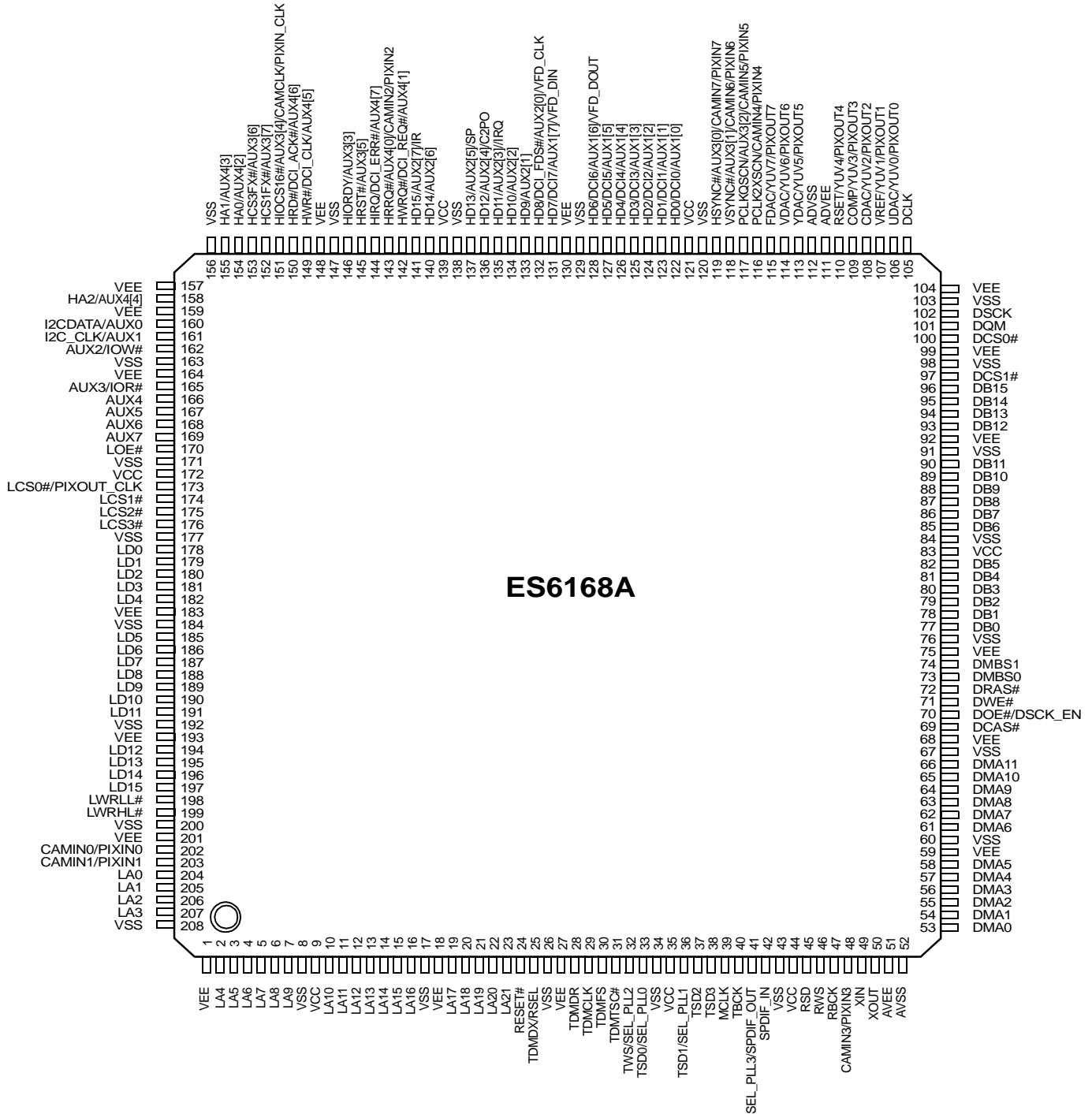


Figure 1 ES6168A Device Pinout

ES6168A PIN DESCRIPTION

Table 1 lists the pin descriptions for the ES6168A.

Table 1 ES6168A Pin Description

Name	Pin Numbers	I/O	Definition																																			
VEE	1,18, 27, 59, 68, 75, 92, 99, 104, 130, 148, 157, 159, 164, 183, 193, 201	P	I/O power supply.																																			
LA[21:0]	2-7, 10-16, 19-23, 204-207	O	RISC port address bus.																																			
VSS	8, 17, 26, 34, 43, 60, 67, 76, 84, 91, 98, 103, 120, 129, 138, 147, 156, 163, 171, 177, 184, 192, 200, 208	G	Ground.																																			
VCC	9, 35, 44, 83, 121, 139, 172	P	Core power supply.																																			
RESET#	24	I	Reset input; (5V tolerant input).																																			
TDMDX	25	O	TDM transmit data output.																																			
RSEL		I	LCS3 ROM Boot Data Width Select. Strapped to VCC or ground via 4.7-kΩ resistor; read only during reset. <table><tr><th>RSEL</th><th>Selection</th></tr><tr><td>0</td><td>16-bit ROM</td></tr><tr><td>1</td><td>8-bit ROM</td></tr></table>	RSEL	Selection	0	16-bit ROM	1	8-bit ROM																													
RSEL	Selection																																					
0	16-bit ROM																																					
1	8-bit ROM																																					
TDMDR	28	I	TDM receive data input; (5V tolerant input).																																			
TDMCLK	29	I	TDM clock input; (5V tolerant input).																																			
TDMFS	30	I	TDM frame sync input; (5V tolerant input).																																			
TDMTSC#	31	O	TDM output enable.																																			
TWS	32	O	Audio transmit frame sync output.																																			
SEL_PLL2		I	System and DSCK output clock frequency selection is made at the rising edge of RESET#. The matrix below lists the available clock frequencies and their respective PLL bit settings. Strapped to VCC or ground via 4.7-kΩ resistor; read only during reset. <table><tr><th>SEL_PLL2</th><th>SEL_PLL1</th><th>SEL_PLL0</th><th>PLL Settings</th></tr><tr><td>0</td><td>0</td><td>0</td><td>DCLK × 4.5</td></tr><tr><td>0</td><td>0</td><td>1</td><td>DCLK × 5.0</td></tr><tr><td>0</td><td>1</td><td>0</td><td>Bypass</td></tr><tr><td>0</td><td>1</td><td>1</td><td>DCLK × 4.0</td></tr><tr><td>1</td><td>0</td><td>0</td><td>DCLK × 4.25</td></tr><tr><td>1</td><td>0</td><td>1</td><td>DCLK × 4.75</td></tr><tr><td>1</td><td>1</td><td>0</td><td>DCLK × 5.5</td></tr><tr><td>1</td><td>1</td><td>1</td><td>DCLK × 6.0</td></tr></table>	SEL_PLL2	SEL_PLL1	SEL_PLL0	PLL Settings	0	0	0	DCLK × 4.5	0	0	1	DCLK × 5.0	0	1	0	Bypass	0	1	1	DCLK × 4.0	1	0	0	DCLK × 4.25	1	0	1	DCLK × 4.75	1	1	0	DCLK × 5.5	1	1	1
SEL_PLL2	SEL_PLL1	SEL_PLL0	PLL Settings																																			
0	0	0	DCLK × 4.5																																			
0	0	1	DCLK × 5.0																																			
0	1	0	Bypass																																			
0	1	1	DCLK × 4.0																																			
1	0	0	DCLK × 4.25																																			
1	0	1	DCLK × 4.75																																			
1	1	0	DCLK × 5.5																																			
1	1	1	DCLK × 6.0																																			

Table 1 ES6168A Pin Description (Continued)

Name	Pin Numbers	I/O	Definition						
TSD0	33	O	Audio transmit serial data output 0.						
SEL_PLL0		I	Refer to the description and matrix for SEL_PLL2 pin 32.						
TSD1	36	O	Audio transmit serial data output 1.						
SEL_PLL1		I	Refer to the description and matrix for SEL_PLL2 pin 32.						
TSD2	37	O	Audio transmit serial data output 2. This pin must be pulled down to VSS via a 4.7-kΩ resistor for proper operation.						
TSD3	38	O	Audio transmit serial data output 3.						
MCLK	39	I/O	Audio master clock for audio DAC.						
TBCK	40	I/O	Audio transmit bit clock. TBCK is an input during reset and subsequently is programmed as an output via the AUDIOXMT register (addr 0x2000D00Ch, bit 4).						
SEL_PLL3	41	I	Clock source select. Strapped to VCC or ground via 4.7-kΩ resistor; read only during reset. <div><table><tr><th>SEL_PLL3</th><th>Clock Source</th></tr><tr><td>0</td><td>Crystal oscillator</td></tr><tr><td>1</td><td>DCLK input</td></tr></table></div>	SEL_PLL3	Clock Source	0	Crystal oscillator	1	DCLK input
SEL_PLL3			Clock Source						
0			Crystal oscillator						
1			DCLK input						
SPDIF_OUT	O	S/PDIF output.							
SPDIF_IN	42	I	S/PDIF input; (5V tolerant input).						
RSD	45	I	Audio receive serial data; (5V tolerant input).						
RWS	46	I	Audio receive frame sync; (5V tolerant input).						
RBCK	47	I	Audio receive bit clock; (5V tolerant input).						
CAMIN3	48	I	Camera YUV 3.						
PIXIN3		I	CCIR656 input pixel 3.						
XIN	49	I	27-MHz crystal input.						
XOUT	50	O	27-MHz crystal output.						
AVEE	51	P	Analog power for PLL.						
AVSS	52	G	Analog ground for PLL.						
DMA[11:0]	53-58, 61-66	O	DRAM address bus.						
DCAS#	69	O	DRAM column address strobe.						
DOE#	70	O	DRAM output enable.						
DSCK_EN		O	DRAM clock enable.						
DWE#	71	O	DRAM write enable.						
DRAS#	72	O	DRAM row address strobe.						
DMBS0	73	O	DRAM bank select 0.						
DMBS1	74	O	DRAM bank select 1.						
DB[15:0]	77-82, 85-90, 93-96	I/O	DRAM data bus.						
DCS[1:0]#	97,100	O	DRAM chip select.						
DQM	101	O	Data input/output mask.						
DSCK	102	O	Output clock to DRAM.						

ES6168A PIN DESCRIPTION

Table 1 ES6168A Pin Description (Continued)

Name	Pin Numbers	I/O	Definition																																																																																																
DCLK	105	I	Clock input to PLL; (5V tolerant input).																																																																																																
UDAC	106	O	Video DAC output. <table><tr><th>Value</th><th>F DAC (pin 115)</th><th>V DAC (pin 114)</th><th>Y DAC (pin 113)</th><th>C DAC (pin 108)</th><th>U DAC (pin 106)</th></tr><tr><td>0</td><td>CVBS/Chroma</td><td>CVBS1</td><td>Y</td><td>C</td><td>N/A</td></tr><tr><td>1</td><td>CVBS/Chroma</td><td>CVBS1</td><td>Y</td><td>C</td><td>CVBS2</td></tr><tr><td>2</td><td>CVBS/Chroma</td><td>N/A</td><td>Y</td><td>C</td><td>N/A</td></tr><tr><td>3</td><td>CVBS/Chroma</td><td>CVBS1</td><td>N/A</td><td>N/A</td><td>CVBS2</td></tr><tr><td>4</td><td>CVBS/Chroma</td><td>CVBS1</td><td>N/A</td><td>N/A</td><td>N/A</td></tr><tr><td>5</td><td>CVBS/Chroma</td><td>CVBS1</td><td>Y</td><td>Pb</td><td>Pr</td></tr><tr><td>6</td><td>CVBS/Chroma</td><td>N/A</td><td>Y</td><td>Pb</td><td>Pr</td></tr><tr><td>7</td><td>N/A</td><td>SYNC</td><td>G</td><td>B</td><td>R</td></tr><tr><td>8</td><td>CVBS/Chroma</td><td>Chroma</td><td>Y</td><td>Pb</td><td>Pr</td></tr><tr><td>9</td><td>CVBS</td><td>CVBS1</td><td>G</td><td>B</td><td>R</td></tr><tr><td>10</td><td>CVBS</td><td>CVBS1</td><td>G</td><td>R</td><td>B</td></tr><tr><td>11</td><td>N/A</td><td>SYNC</td><td>G</td><td>R</td><td>B</td></tr><tr><td>12</td><td>CVBS/Chroma</td><td>N/A</td><td>Y</td><td>Pr</td><td>Pb</td></tr><tr><td>13</td><td>CVBS/Chroma</td><td>CVBS1</td><td>Y</td><td>Pr</td><td>Pb</td></tr><tr><td>14</td><td>Chroma</td><td>Y</td><td>G</td><td>R</td><td>B</td></tr></table> <p>F: CVBS/chroma signal for simultaneous mode. Y: Luma component for YUV and Y/C processing. C: Chrominance signal for Y/C processing. U: Chrominance component signal for YUV mode. V: Chrominance component signal for YUV mode.</p>	Value	F DAC (pin 115)	V DAC (pin 114)	Y DAC (pin 113)	C DAC (pin 108)	U DAC (pin 106)	0	CVBS/Chroma	CVBS1	Y	C	N/A	1	CVBS/Chroma	CVBS1	Y	C	CVBS2	2	CVBS/Chroma	N/A	Y	C	N/A	3	CVBS/Chroma	CVBS1	N/A	N/A	CVBS2	4	CVBS/Chroma	CVBS1	N/A	N/A	N/A	5	CVBS/Chroma	CVBS1	Y	Pb	Pr	6	CVBS/Chroma	N/A	Y	Pb	Pr	7	N/A	SYNC	G	B	R	8	CVBS/Chroma	Chroma	Y	Pb	Pr	9	CVBS	CVBS1	G	B	R	10	CVBS	CVBS1	G	R	B	11	N/A	SYNC	G	R	B	12	CVBS/Chroma	N/A	Y	Pr	Pb	13	CVBS/Chroma	CVBS1	Y	Pr	Pb	14	Chroma	Y	G	R	B
Value		F DAC (pin 115)	V DAC (pin 114)	Y DAC (pin 113)	C DAC (pin 108)	U DAC (pin 106)																																																																																													
0		CVBS/Chroma	CVBS1	Y	C	N/A																																																																																													
1		CVBS/Chroma	CVBS1	Y	C	CVBS2																																																																																													
2		CVBS/Chroma	N/A	Y	C	N/A																																																																																													
3		CVBS/Chroma	CVBS1	N/A	N/A	CVBS2																																																																																													
4		CVBS/Chroma	CVBS1	N/A	N/A	N/A																																																																																													
5		CVBS/Chroma	CVBS1	Y	Pb	Pr																																																																																													
6		CVBS/Chroma	N/A	Y	Pb	Pr																																																																																													
7		N/A	SYNC	G	B	R																																																																																													
8		CVBS/Chroma	Chroma	Y	Pb	Pr																																																																																													
9		CVBS	CVBS1	G	B	R																																																																																													
10		CVBS	CVBS1	G	R	B																																																																																													
11		N/A	SYNC	G	R	B																																																																																													
12		CVBS/Chroma	N/A	Y	Pr	Pb																																																																																													
13	CVBS/Chroma	CVBS1	Y	Pr	Pb																																																																																														
14	Chroma	Y	G	R	B																																																																																														
YUV0	O	YUV pixel 0 output data.																																																																																																	
PIXOUT0	O	CCIR656 output pixel 0.																																																																																																	
VREF	107	I	Internal voltage reference to video DAC. Bypass to ground with 0.1-μF capacitor.																																																																																																
YUV1		O	YUV pixel 1 output data.																																																																																																
PIXOUT1		O	CCIR656 output pixel 1.																																																																																																
CDAC	108	O	Video DAC output. Refer to description and matrix for UDAC pin 106.																																																																																																
YUV2		O	YUV pixel 2 output data.																																																																																																
PIXOUT2		O	CCIR656 output pixel 2.																																																																																																
COMP	109	I	Compensation input. Bypass to ADVEE with 0.1-μF capacitor.																																																																																																
YUV3		O	YUV pixel 3 output data.																																																																																																
PIXOUT3		O	CCIR656 output pixel 3.																																																																																																
RSET	110	I	DAC current adjustment resistor input.																																																																																																
YUV4		O	YUV pixel 4 output data.																																																																																																
PIXOUT4		O	CCIR656 output pixel 4.																																																																																																



Table 1 ES6168A Pin Description (Continued)

Name	Pin Numbers	I/O	Definition
ADVEE	111	P	Analog power for video DAC.
ADVSS	112	G	Analog ground for video DAC.
YDAC	113	O	Video DAC output. Refer to description and matrix for UDAC pin 106.
YUV5		O	YUV pixel 5 output data
PIXOUT5		O	CCIR656 output pixel 5.
VDAC	114	O	Video DAC output. Refer to description and matrix for UDAC pin 106.
YUV6		O	YUV pixel 6 output data.
PIXOUT6		O	CCIR656 output pixel 6.
FDAC	115	O	Video DAC output. Refer to description and matrix for UDAC pin 106.
YUV7		O	YUV pixel 7 output data.
PIXOUT7		O	CCIR656 output pixel 7.
PCLK2XSCN	116	I/O	27-MHz video output pixel clock.
CAMIN4		I	Camera YUV 4.
PIXIN4		I	CCIR656 input pixel 4.
PCLKQSCN	117	O	13.5-MHz video output pixel clock.
AUX3[2]		I/O	Aux3 data I/O; (5V tolerant input).
CAMIN5		I	Camera YUV 5.
PIXIN5		I	CCIR656 input pixel 5.
VSYN#	118	I/O	Vertical sync; (5V tolerant input).
AUX3[1]		I/O	Aux3 data I/O; (5V tolerant input).
CAMIN6		I	Camera YUV 6.
PIXIN6		I	CCIR656 input pixel 6.
HSYN#	119	I/O	Horizontal sync; (5V tolerant input).
AUX3[0]		I/O	Aux3 data I/O; (5V tolerant input).
CAMIN7		I	Camera YUV 7.
PIXIN7		I	CCIR656 input pixel 7.
HD[5:0]	122-127	I/O	Host data bus lines; (5V tolerant input).
DCI[5:0]		I/O	DVD channel data I/O; (5V tolerant input).
AUX1[5:0]		I/O	Aux1 data I/O; (5V tolerant input).
HD6	128	I/O	Host data bus line; (5V tolerant input).
DCI6		I/O	DVD channel data I/O; (5V tolerant input).
AUX1[6]		I/O	Aux1 data I/O; (5V tolerant input).
VFD_DOUT		I	VFD data output.
HD7	131	I/O	Host data bus line; (5V tolerant input).
DCI7		I/O	DVD channel data I/O; (5V tolerant input).
AUX1[7]		I/O	Aux1 data I/O; (5V tolerant input).
VFD_DIN		I	VFD data input.

Table 1 ES6168A Pin Description (Continued)

Name	Pin Numbers	I/O	Definition
HD8	132	I/O	Host data bus line; (5V tolerant input).
DCI_FDS#		I/O	DVD input sector start; (5V tolerant input).
AUX2[0]		I/O	Aux2 data I/O; (5V tolerant input).
VFD_CLK		I	VFD clock input.
HD9	133	I/O	Host data bus line; (5V tolerant input).
AUX2[1]		I/O	Aux2 data I/O; (5V tolerant input).
HD10	134	I/O	Host data bus line; (5V tolerant input).
AUX2[2]		I/O	Aux2 data I/O; (5V tolerant input).
HD11	135	I/O	Host data bus line; (5V tolerant input).
AUX2[3]		I/O	Aux2 data I/O; (5V tolerant input).
IRQ		O	IRQ.
HD12	136	I/O	Host data bus line; (5V tolerant input).
AUX2[4]		I/O	Aux2 data I/O; (5V tolerant input).
C2PO		I	C2PO error correction flag from CD-ROM; (5V tolerant input).
HD13	137	I/O	Host data bus line; (5V tolerant input).
AUX2[5]		I/O	Aux2 data I/O; (5V tolerant input).
SP		I	16550 UART serial port input.
HD14	140	I/O	Host data bus line; (5V tolerant input).
AUX2[6]		I/O	Aux2 data I/O; (5V tolerant input).
HD15	141	I/O	Host data bus line; (5V tolerant input).
AUX2[7]		I/O	Aux2 data I/O; (5V tolerant input).
IR		I	IR remote control input; (5V tolerant input).
HWRQ#	142	O	Host write request.
DCI_REQ#		O	DVD control interface request.
AUX4[1]		I/O	Aux4 data I/O; (5V tolerant input).
HRRQ#	143	O	Host read request.
AUX4[0]		I/O	Aux4 data I/O; (5V tolerant input).
CAMIN2		I	Camera YUV 2.
PIXIN2		I	CCIR656 input pixel 2.
HIRQ	144	I/O	Host interrupt.
DCI_ERR#		I/O	DVD channel data error; (5V tolerant input).
AUX4[7]		I/O	Aux4 data I/O; (5V tolerant input).
HRST#	145	O	Host reset.
AUX3[5]		I/O	Aux3 data I/O; (5V tolerant input).
HIORDY	146	I	Host I/O ready.
AUX3[3]		I/O	Aux3 data I/O; (5V tolerant input).

Table 1 ES6168A Pin Description (Continued)

Name	Pin Numbers	I/O	Definition
HWR#	149	I/O	Host write.
DCI_CLK		I/O	DVD channel data clock; (5V tolerant input).
AUX4[5]		I/O	Aux4 data I/O; (5V tolerant input).
HRD#	150	O	Host read.
DCI_ACK#		I/O	DVD channel data valid; (5V tolerant input).
AUX4[6]		I/O	Aux4 data I/O; (5V tolerant input).
HIOCS16#	151	I	Device 16-bit data transfer.
AUX3[4]		I/O	Aux3 data I/O; (5V tolerant input).
CAMCLK		I	Camera port pixel clock input.
PIXIN_CLK		I	CCIR656 input pixel clock.
HCS1FX#	152	O	Host select 1.
AUX3[7]		I/O	Aux3 data I/O; (5V tolerant input).
HCS3FX#	153	O	Host select 3.
AUX3[6]		I/O	Aux3 data I/O; (5V tolerant input).
HA[2:0]	154, 155, 158	I/O	Host address bus.
AUX4[4:2]		I/O	Aux4 data I/Os; (5V tolerant input).
AUX0	160	I/O	Auxiliary port 0 (open collector); (5V tolerant input).
I2CDATA		I/O	I ² C data I/O; (5V tolerant input).
AUX1	161	I/O	Auxiliary port 1 (open collector); (5V tolerant input).
I2C_CLK		I/O	I ² C clock I/O; (5V tolerant input).
AUX2	162	I/O	Auxiliary port; (5V tolerant input).
IOW#		O	I/O write strobe (LCS1).
AUX3	165	I/O	Auxiliary port; (5V tolerant input).
IOR#		O	I/O read strobe (LCS1).
AUX4-7	166-169	I/O	Auxiliary ports; (5V tolerant input).
LOE#	170	O	RISC port output enable.
LCS0#	173	O	RISC port chip select 0.
PIXOUT_CLK		O	CCIR656 output pixel clock.
LCS[3:1]#	174-176	O	RISC port chip select [3:1].
LD[15:0]	178-182, 185-191, 194-197	I/O	RISC port data bus; (5V tolerant input).
LWRLL#	198	O	RISC port low-byte write enable.
LWRHL#	199	O	RISC port high-byte write enable.
CAMIN0	202	I	Camera YUV 0.
PIXIN0		I	CCIR656 input pixel 0.
CAMIN1	203	I	Camera YUV 1.
PIXIN1		I	CCIR656 input pixel 1.

SYSTEM BLOCK DIAGRAM

A sample system block diagram for the ES6168A Vibratto-S DVD player board design is shown in Figure 2.

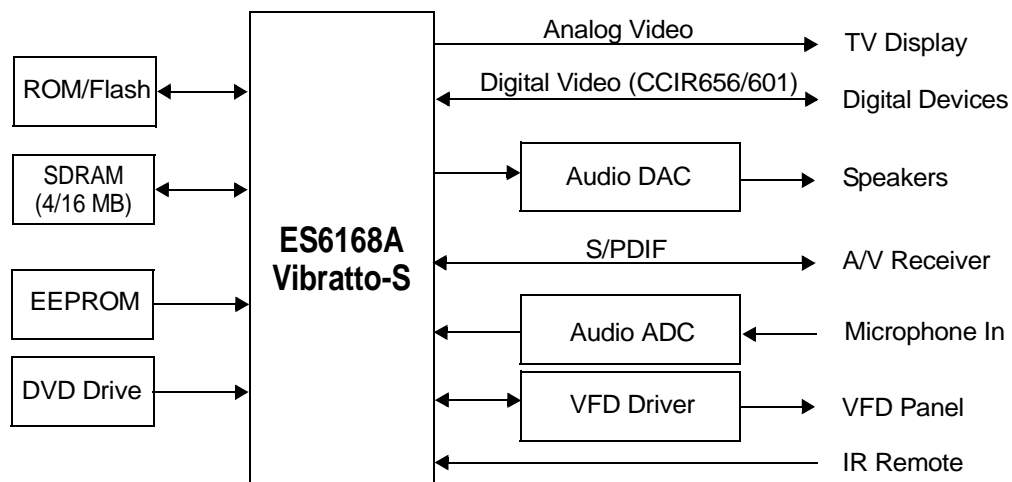


Figure 2 ES6168A Vibratto-S System Block Diagram

FUNCTIONAL DESCRIPTION

Figure 3 shows the internal block diagram for the ES6168A Vibratto-S DVD processor.

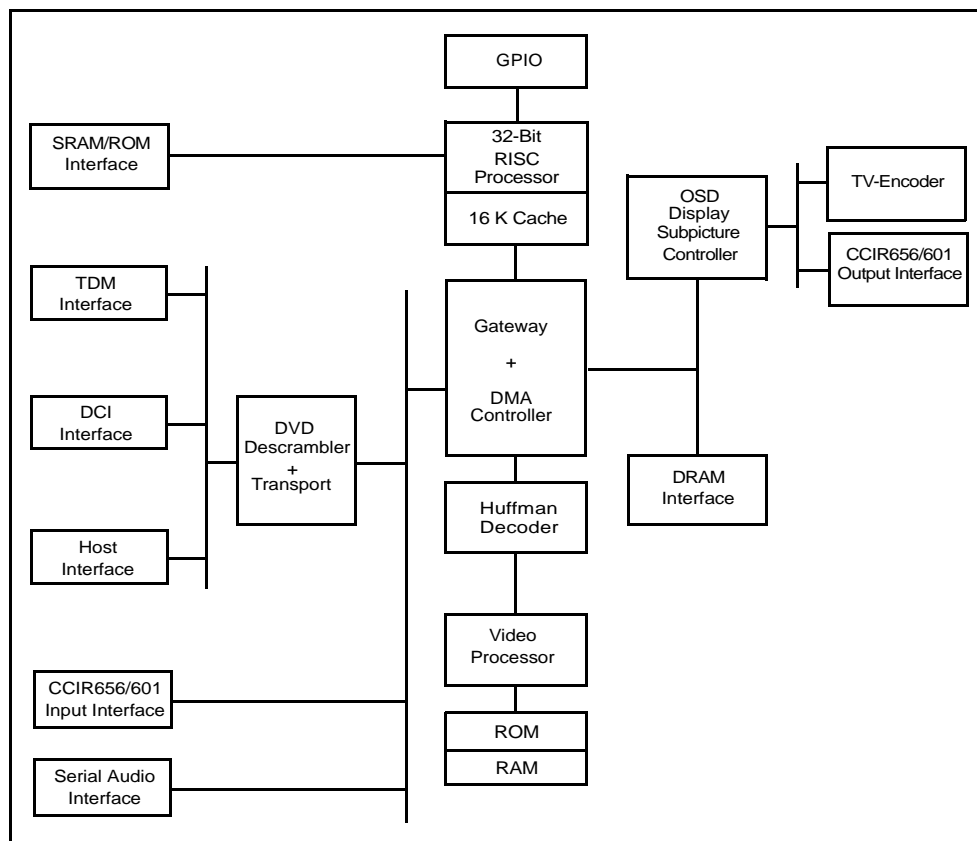


Figure 3 ES6168A Vibratto-S Block Diagram

ORDERING INFORMATION

Part Number	Description	Package
ES6168FA	Vibratto-S DVD, Progressive scan, MPEG-4, DVD-Audio, and TV encoder	208-pin PQFP

The letter F at the end of the ordering part number identifies the package type PQFP.

Other Vibratto-S DVD Processors

Part Number	Description	Package
ES6128F	Vibratto-S DVD, Progressive scan, and TV Encoder	208-pin PQFP
ES6178F	Vibratto-S DVD, Progressive scan, DivX (certified), DVD-Audio, and TV encoder	208-pin PQFP

The letter F at the end of the ordering part number identifies the package type PQFP.



ESS Technology, Inc.
48401 Fremont Blvd.
Fremont, CA 94538
Tel: (510) 492-1088
Fax: (510) 492-1898

No part of this publication may be reproduced, stored in a retrieval system, transmitted, or translated in any form or by any means, electronic, mechanical, manual, optical, or otherwise, without the prior written permission of ESS Technology, Inc.

ESS Technology, Inc. makes no representations or warranties regarding the content of this document.

All specifications are subject to change without prior notice.

ESS Technology, Inc. assumes no responsibility for any errors contained herein.

U.S. patents pending.

MPEG is the Moving Picture Experts Group of the ISO/IEC. References to MPEG in this document refer to the ISO/IEC JTC1 SC29 committee draft ISO 11172 dated January 9, 1992.

Vibratto, SmartBright, SmartLogo, SmartColor, and Music Slideshow are trademarks of ESS Technology, Inc.

Dolby is a trademark of Dolby Laboratories, Inc.

Trusurround, Trusurround XT, SRS, and (o) symbol are trademarks of SRS Labs., Inc.

All other trademarks are trademarks of their respective companies and are used for identification purposes only.