

FEATURES

Quad HDMI® 1.4 fast switching receiver

HDMI support

Audio return channel (ARC)

3D TV support

Content type bits

CEC 1.4-compatible

Extended colorimetry

HDMI 225 MHz receiver

Xpressview fast switching of HDMI ports

2 ARC interfaces for ARC support

SPDIF interface for ARC support

3D video format support, including frame packing 1080p

24 Hz, 720p 50 Hz, 720p 60 Hz

Full colorimetry support including sYCC601, Adobe RGB, Adobe YCC 601

36-/30-bit Deep Color and 24-bit color support

HDCP 1.4 support with internal HDCP keys

5 V detect and hot plug assert for each HDMI port

Adaptive HDMI equalizer

Integrated CEC controller

HDMI repeater support

HDMI audio support including HBR and DSD

Advanced audio mute feature

Flexible digital audio output interfaces

Supports up to 5 S/PDIF outputs

Supports up to 4 I²S outputs

Video and graphics digitizer

Four 170 MHz, 12-bit ADCs

12-channel analog input mux

525i-/625i-component analog input

525p-/625p-component progressive scan support

720p-/1080i-/1080p-component HDTV support

Low refresh rates (24/25/30 Hz) support for 720p/1080p

Digitizes RGB graphics up to 1600 × 1200 at 60 Hz (UXGA)

SCART fast blank support

3D video decoder

NTSC/PAL/SECAM color standards support

NTSC/PAL 2D/3D motion detecting comb filter

Advanced time-base correction (TBC) with frame synchronization

Interlaced-to-progressive conversion for 525i and 625i

IF compensation filters

Vertical peaking and horizontal peaking filters

Robust synchronization extraction for poor video source

Advanced VBI data slicer

General

Highly flexible 36-bit pixel output interface

Internal EDID RAM for HDMI and graphics

Dual STDI (standard identification) function support

Any-to-any, 3 × 3 color space conversion (CSC) matrix

2 programmable interrupt request output pins

Simultaneous analog processing and HDMI monitoring

APPLICATIONS

Advanced TVs

PDP HDTVs

LCD TVs (HDTV ready)

LCD/DLP® rear projection HDTVs

LCoS™ HDTVs

AVR video receivers

HDTV STBs with PVR

Projectors

FUNCTIONAL BLOCK DIAGRAM

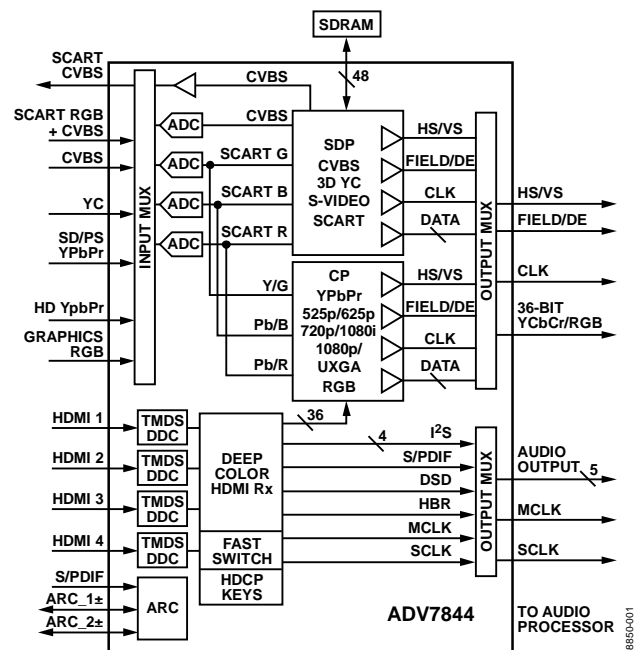


Figure 1.

ADV7844* PRODUCT PAGE QUICK LINKS

Last Content Update: 02/23/2017

COMPARABLE PARTS

View a parametric search of comparable parts.

DOCUMENTATION

Application Notes

- AN-1180: Optimizing Video Platforms for Automated Post-Production Self-Tests
- AN-1260: Crystal Design Considerations for Video Decoders, HDMI Receivers, and Transceivers

Data Sheet

- ADV7844: Quad HDMI Fast Switching Receiver with 12-Bit, 170 MHz Video and Graphics Digitizer and 3D Comb Filter Decoder Data Sheet

User Guides

- ADV7844 Design Support Files (EngineerZone site)

TOOLS AND SIMULATIONS

- ADV7xx Limit MCLK Output Frequency

DESIGN RESOURCES

- ADV7844 Material Declaration
- PCN-PDN Information
- Quality And Reliability
- Symbols and Footprints

DISCUSSIONS

View all ADV7844 EngineerZone Discussions.

SAMPLE AND BUY

Visit the product page to see pricing options.

TECHNICAL SUPPORT

Submit a technical question or find your regional support number.

DOCUMENT FEEDBACK

Submit feedback for this data sheet.

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REVISION HISTORY

4/12—Rev. B: Initial Version

GENERAL DESCRIPTION

The ADV7844 is a high quality, single-chip, 4:1 multiplexed HDMI receiver and graphics digitizer with an integrated multiformat video decoder.

The ADV7844 incorporates a quad input HDMI-compatible receiver that supports all HDTV formats up to 1080p and display resolutions up to UXGA (1600 × 1200 at 60 Hz).

The ADV7844 incorporates Xpressview™ fast switching on all input HDMI ports. Using the Analog Devices, Inc., hardware-based HDCP engine that minimizes software overhead, Xpressview™ technology allows fast switching between any HDMI input ports in less than 1 second.

The ADV7844 supports all mandatory HDMI 3D TV formats in addition to all HDTV formats up to 1080p 36-bit Deep Color.

The ADV7844 also integrates an HDMI CEC controller that supports the capability discovery and control (CDC) feature.

The ADV7844 offers a flexible audio output port for the audio data decoded from the HDMI stream. HDMI audio formats, including super audio CD (SACD) via DSD and HBR are supported. The ADV7844 also features the audio return channel (ARC) feature. ARC simplifies cabling by combining upstream audio capability in a conventional HDMI cable.

Each HDMI port has dedicated 5 V detect and hot plug assert pins. The HDMI receiver also includes an integrated equalizer that ensures robust operation of the interface with cable lengths up to 30 meters. The HDMI receiver has advanced audio functionality, such as a mute controller, that prevents audible extraneous noise in the audio output.

The multiformat 3D comb filter decoder supports the conversion of PAL, NTSC, and SECAM standards in the form of a composite or an S-Video input signal into a digital ITU-R BT.656 format. SCART and overlay functionality are enabled by the ability of the ADV7844 to process CVBS and standard definition RGB signals simultaneously.

The ADV7844 contains one main component processor (CP), which processes YPbPr and RGB component formats, including RGB graphics. The CP also processes the video signals from the HDMI receiver. The ADV7844 can operate in quad HDMI and analog input mode, thus allowing for fast switching between the ADCs and HDMI.

The ADV7844 supports the decoding of a component RGB/YPbPr video signal into a digital YCbCr or RGB pixel output stream. The support for component video includes 525i, 625i, 525p, 625p, 720p, 1080i, 1080p, and 1250i standards, as well as many other SMPTE and HD standards.

The ADV7844 supports graphics digitization. The ADV7844 is capable of digitizing RGB graphics signals from VGA to UXGA rates and converting them into a digital RGB or YCbCr pixel output stream. Internal EDID is available for one graphic port.

Fabricated in an advanced CMOS process, the ADV7844 is provided in a 19 mm × 19 mm, 425-ball, CSP BGA, surface-mount, RoHS-compliant package, and is specified over the 0°C to 70°C temperature range.

DETAILED FUNCTIONAL BLOCK DIAGRAM

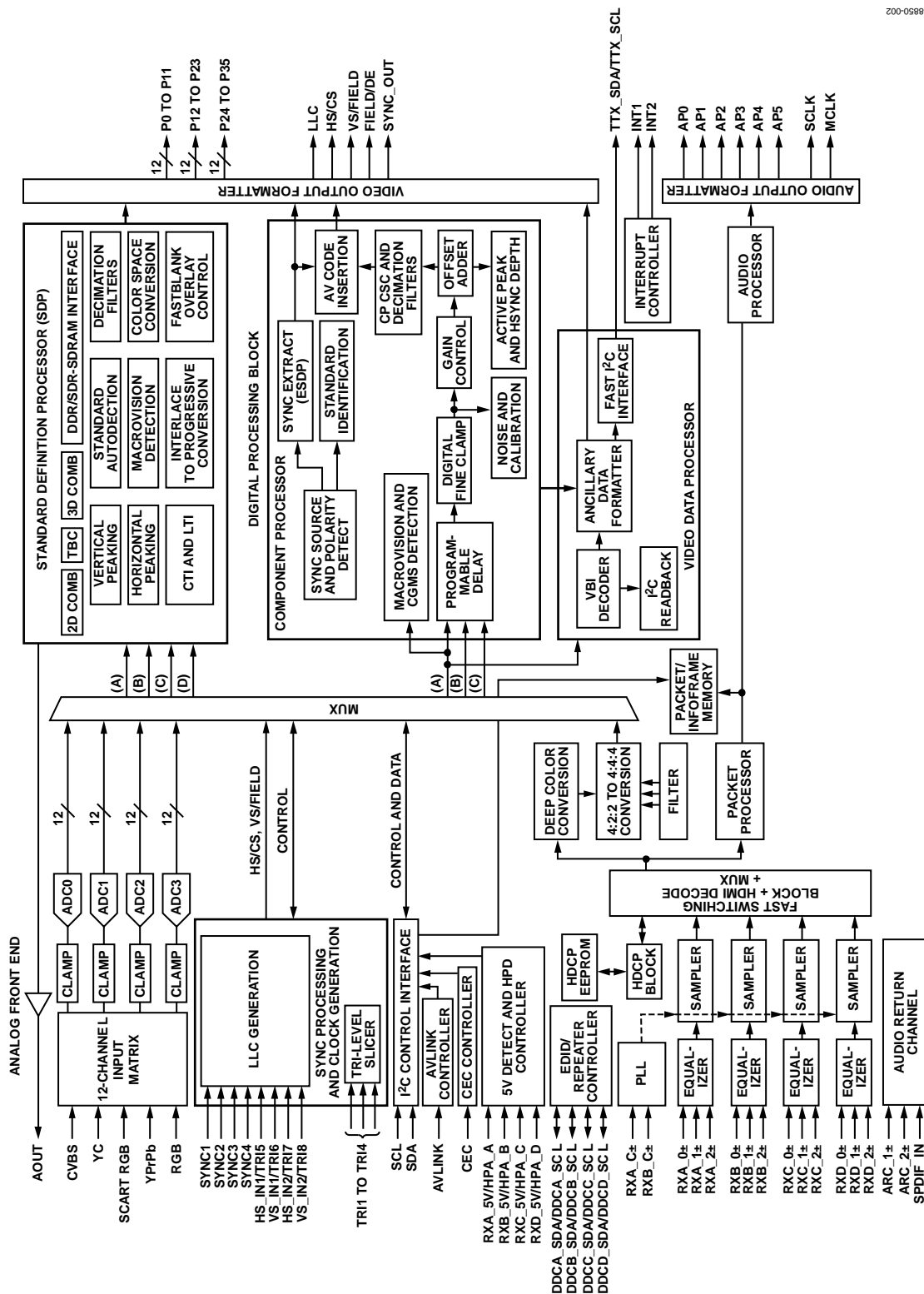


Figure 2. Detailed Functional Block Diagram

SPECIFICATIONS

AVDD = 1.8 V \pm 5%, CVDD = 1.8 V \pm 5%, DVDD = 1.8 V \pm 5%, PVDD = 1.8 V \pm 5%, DVDDIO = 3.3 V \pm 5%, TVDD = 3.3 V \pm 5%, VDD_SDRAM = 3.2 V to 3.4 V (SDR), VDD_SDRAM = 2.35 V to 2.65 V (DDR). T_{MIN} to T_{MAX} = 0°C to 70°C, unless otherwise noted.

ELECTRICAL CHARACTERISTICS

Table 1.

| Parameter | Symbol | Test Conditions/Comments | Min | Typ | Max | Unit |
|--|-------------------|-------------------------------|-----------------|--------------|-----|------|
| STATIC PERFORMANCE | | | | | | |
| Resolution (Each ADC) | N | | | | 12 | Bits |
| Integral Nonlinearity | INL | 27 MHz (at a 12-bit level) | | –3.0 to +8.0 | | LSB |
| | | 54 MHz (at a 12-bit level) | | –3.0 to +8.0 | | LSB |
| | | 74.25 MHz (at a 12-bit level) | | –4.0 to +7.0 | | LSB |
| | | 108 MHz (at a 11-bit level) | | –3.5 to +8.0 | | LSB |
| | | 170 MHz (at a 9-bit level) | | –0.7 to +1.5 | | LSB |
| | DNL | 27 MHz (at a 12-bit level) | | –0.7 to +0.8 | | LSB |
| | | 54 MHz (at a 12-bit level) | | –0.7 to +0.8 | | LSB |
| | | 75 MHz (at a 12-bit level) | | –0.7 to +0.8 | | LSB |
| | | 108 MHz (at a 11-bit level) | | –0.7 to +0.8 | | LSB |
| | | 170 MHz (at a 9-bit level) | | –0.6 to +0.5 | | LSB |
| DIGITAL INPUTS | | | | | | |
| Input High Voltage | V _{IH} | XTALN and XTALP pins | 1.2 | | | V |
| Input Low Voltage | V _{IL} | XTALN and XTALP pins | | | 0.4 | V |
| Input Current | V _{IH} | Other digital inputs | 2 | | | V |
| | V _{IL} | Other digital inputs | | | 0.8 | V |
| | I _{IN} | Reset pin | | | ±60 | μA |
| | | EP_MISO pin | | | ±60 | μA |
| | | SPDIF_IN pin | | | ±60 | μA |
| | | TEST4 pin | | | ±60 | μA |
| | | TEST6 pin | | | ±60 | μA |
| | | Other digital inputs | | | ±10 | μA |
| | | Input Capacitance | C _{IN} | | | 10 |
| DIGITAL INPUTS (5 V TOLERANT) ¹ | | | | | | |
| Input High Voltage | V _{IH} | | 2.6 | | | V |
| Input Low Voltage | V _{IL} | | | | 0.8 | V |
| Input Current | I _{IN} | | –82 | | +82 | μA |
| DIGITAL OUTPUTS | | | | | | |
| Output High Voltage | V _{OH} | | 2.4 | | | V |
| Output Low Voltage | V _{OL} | | | | 0.4 | V |
| High Impedance Leakage Current | I _{LEAK} | | | 10 | | μA |
| Output Capacitance | C _{OUT} | | | | 20 | pF |

¹ The following pins are 5 V tolerant: HS_IN1/TRI5, HS_IN2/TRI7, VS_IN1/TRI6, VS_IN2/TRI8, RXA_5V, RXB_5V, RxC_5V, RXD_5V, DDCA_SCL, DDCA_SDA, DDCB_SCL, DDCB_SDA, DDCC_SCL, DDCC_SDA, DDGD_SCL, and DDGD_SDA.

POWER SPECIFICATIONS

Table 2.

| Parameter | Symbol | Min | Typ | Max | Unit | Test Conditions/Comments |
|--|---------------------|------|-----|------|------|---|
| POWER REQUIREMENTS | | | | | | |
| Digital Core Power Supply | VDD | 1.75 | 1.8 | 1.85 | V | |
| Digital I/O Power Supply | DVDDIO | 3.14 | 3.3 | 3.46 | V | |
| SDRAM Power Supply | VDD_SDRAM | 3.2 | 3.3 | 3.4 | V | SDR memory |
| | | 2.35 | 2.5 | 2.65 | V | DDR memory |
| PLL Power Supply | PVDD | 1.71 | 1.8 | 1.89 | V | |
| Analog Power Supply | AVDD | 1.71 | 1.8 | 1.89 | V | |
| Terminator Power Supply | TVDD | 3.14 | 3.3 | 3.46 | V | |
| Comparator Power Supply | CVDD | 1.71 | 1.8 | 1.89 | V | |
| CURRENT CONSUMPTION ^{1, 2, 3} | | | | | | |
| Digital Core Supply Current | I _{VDD} | 155 | 220 | | mA | Analog 1080p sampling at 148 MHz |
| | | 149 | 205 | | mA | RGB graphics sampling at 162 MHz |
| | | 365 | 445 | | mA | RGB graphics sampling at 162 MHz in simultaneous mode with all background ports enabled |
| | | 148 | 210 | | mA | HDMI 1080p: 12-bit Deep Color |
| | | 298 | 385 | | mA | HDMI 1080p: 12-bit Deep Color with all background ports enabled |
| | | 440 | 475 | | mA | SD core 576i processing in simultaneous mode with all background ports enabled |
| | | 480 | 525 | | mA | SCART processing in simultaneous mode with all background ports enabled |
| | | | | | | |
| Digital I/O Supply Current | I _{DVDDIO} | 55 | 120 | | mA | Analog 1080p sampling at 148 MHz |
| | | 40 | 122 | | mA | RGB graphics sampling at 162 MHz |
| | | 37 | 120 | | mA | RGB graphics sampling at 162 MHz in simultaneous mode with all background ports enabled |
| | | 15 | 175 | | mA | HDMI 1080p: 12-bit Deep Color |
| | | 14 | 175 | | mA | HDMI 1080p: 12-bit Deep Color with all background ports enabled |
| | | 9 | 11 | | mA | SD core 576i processing in simultaneous mode with all background ports enabled |
| | | 9 | 10 | | mA | SCART processing in simultaneous mode with all background ports enabled |
| | | | | | | |
| PLL Supply Current | I _{PVDD} | 27 | 30 | | mA | Analog 1080p sampling at 148 MHz |
| | | 25 | 29 | | mA | RGB graphics sampling at 162 MHz |
| | | 24 | 28 | | mA | RGB graphics sampling at 162 MHz in simultaneous mode with all background ports enabled |
| | | 34 | 37 | | mA | HDMI 1080p: 12-bit Deep Color |
| | | 35 | 38 | | mA | HDMI 1080p: 12-bit Deep Color with all background ports enabled |
| | | 33 | 36 | | mA | SD core 576i processing in simultaneous mode with all background ports enabled |
| | | 33 | 38 | | mA | SCART processing in simultaneous mode with all background ports enabled |
| | | | | | | |

| Parameter | Symbol | Min | Typ | Max | Unit | Test Conditions/Comments |
|--|------------------------|-----|-----|-----|------|---|
| Analog Supply Current | I _{AVDD} | 210 | 235 | | mA | Analog 1080p sampling at 148 MHz |
| | | 215 | 240 | | mA | RGB graphics sampling at 162 MHz |
| | | 214 | 235 | | mA | RGB graphics sampling at 162 MHz in simultaneous mode with all background ports enabled |
| | | 0 | 0.1 | | mA | HDMI 1080p: 12-bit Deep Color |
| | | 0 | 0.1 | | mA | HDMI 1080p: 12-bit Deep Color with all background ports enabled |
| | | 80 | 90 | | mA | SD core 576i processing in simultaneous mode with all background ports enabled |
| | | 260 | 285 | | mA | SCART processing in simultaneous mode with all background ports enabled |
| Terminator Supply Current ⁴ | I _{TVDD} | 85 | 95 | | mA | One port connected |
| | | 260 | 280 | | mA | Four ports connected |
| Comparator Supply Current | I _{CVDD} | 105 | 120 | | mA | HDMI 1080p: 12-bit Deep Color |
| | | 420 | 440 | | mA | HDMI 1080p: 12-bit Deep Color in simultaneous mode with all background ports enabled |
| Memory Interface Supply Current | I _{VDD_SDRAM} | 28 | 35 | | mA | CVBS input sampling at 54 MHz |
| Power-Down Currents ⁵ | I _{DVDDIO} | | 0.1 | | mA | |
| | I _{VDD_SDRAM} | | 2.6 | | mA | |
| | I _{VDD} | | 10 | | mA | |
| | I _{AVDD} | | 0.1 | | mA | |
| | I _{CVDD} | | 0.5 | | mA | |
| | I _{TVDD} | | 2.2 | | mA | |
| | I _{PVDD} | | 1.7 | | mA | |
| Power-Up Time | t _{PWRUP} | | 25 | | ms | |

¹ All maximum current values are guaranteed by characterization to assist in power supply design.

² Typical current consumption values are recorded with nominal voltage supply levels, SMPTE bar video pattern, and at room temperature.

³ Maximum current consumption values are recorded with maximum rated voltage supply levels, MoireX video pattern, and at maximum rated temperature.

⁴ Termination power supply includes TVDD current consumed off chip.

⁵ Power-down mode entered by setting Bit POWER_DOWN high.

ANALOG SPECIFICATIONS

Table 3.

| Parameter | Test Conditions/Comments | Min | Typ | Max | Unit |
|------------------------------|-----------------------------------|-----|-------------|-----|------|
| CLAMP CIRCUITRY ¹ | | | | | |
| Input Impedance | Clamps switched off | | 10 | | MΩ |
| Analog (AIN1 – AIN12) | | | | | |
| ADC Midscale (CML) | | | 0.91 | | V |
| ADC Full-Scale Level | | | CML + 0.55 | | V |
| ADC Zero-Scale Level | | | CML – 0.55 | | V |
| ADC Dynamic Range | | | 1.1 | | V |
| Clamp Level (When Locked) | Component input, Y signal | | CML – 0.12 | | V |
| | Component input, Pr signal | | CML | | V |
| | Component input, Pb signal | | CML | | V |
| | PC RGB input (R, G, B signals) | | CML – 0.12 | | V |
| | CVBS input | | CML – 0.205 | | V |
| | SCART RGB input (R, G, B signals) | | CML – 0.205 | | V |
| | S-Video input (Y Signal) | | CML – 0.205 | | V |
| | S-Video input (C Signal) | | CML | | V |
| Large Clamp Source Current | SDP only | | 0.3 | | mA |
| Large Clamp Sink Current | SDP only | | 0.4 | | mA |
| Fine Clamp Source Current | SDP only | | 9 | | μA |
| Fine Clamp Sink Current | SDP only | | 8 | | μA |

¹ Specified for external clamp capacitor of 100 nF.

VIDEO SPECIFICATIONS

Table 4.

| Parameter | Symbol | Test Conditions/Comments | Min | Typ | Max | Unit |
|--------------------------------|-----------------|-------------------------------------|-----|------|-----|---------|
| NONLINEAR SPECIFICATIONS | | | | | | |
| Differential Phase | DP | CVBS input (modulated five-step) | | 0.6 | | Degrees |
| Differential Gain | DG | CVBS input (modulated five-step) | | 0.8 | | % |
| Luma Nonlinearity | LNL | CVBS input (modulated five-step) | | 0.9 | | % |
| NOISE SPECIFICATIONS | | | | | | |
| SNR Unweighted | | Measured at 27 MHz LLC Luma ramp | | 63 | | dB |
| SNR Unweighted | | Luma flat field | | 64 | | dB |
| Analog Front-End Crosstalk | | | | 60 | | dB |
| LOCK TIME SPECIFICATIONS (SDP) | | | | | | |
| Horizontal Lock Range | f _{sc} | | 40 | ±5 | 70 | % |
| Vertical Lock Range | | | | | | Hz |
| Subcarrier Lock Range | | | | ±0.8 | | kHz |
| Color Lock-In Time | | | | 60 | | Lines |
| Sync Depth Range ¹ | | | 20 | | 200 | % |
| Color Burst Range | | | 1 | | 200 | % |
| Vertical Lock Time | | | | 300 | | ms |
| Horizontal Lock Time | | | | 100 | | Lines |
| CHROMA SPECIFICATIONS (SDP) | | | | | | |
| Chroma Amplitude Error | | | | 0.9 | | % |
| Chroma Phase Error | | | | 0.3 | | Degrees |
| Chroma Luma Intermodulation | | | | 0.3 | | % |

TIMING CHARACTERISTICS**Data and I²C Timing Characteristics**

Table 5.

| Parameter ¹ | Symbol | Test Conditions/Comments | Min | Typ | Max | Unit |
|---------------------------------------|----------------------------------|--|--------|----------|-------|--------------|
| CLOCK AND CRYSTAL | | | | | | |
| Crystal Frequency, XTAL | | | | 28.63636 | | MHz |
| Crystal Frequency Stability | | | | | ±50 | ppm |
| Horizontal Sync Input Frequency | | | 10 | | 110 | kHz |
| LLC Frequency Range | | | 12.825 | | 170 | MHz |
| I ² C PORTS | | | | | | |
| SCL Frequency | | | | | 400 | kHz |
| SCL Minimum Pulse Width High | t ₁ | | 600 | | | ns |
| SCL Minimum Pulse Width Low | t ₂ | | 1.3 | | | μs |
| Start Condition Hold Time | t ₃ | | 600 | | | ns |
| Start Condition Setup Time | t ₄ | | 600 | | | ns |
| SDA Setup Time | t ₅ | | 100 | | | ns |
| SCL and SDA Rise Time | t ₆ | | | | 1000 | ns |
| SCL and SDA Fall Time | t ₇ | | | | 300 | ns |
| Stop Condition Setup Time | t ₈ | | 0.6 | | | μs |
| TTX I ² C PORTS | | | | | | |
| SCL Frequency | | | | | 3.4 | MHz |
| SCL Minimum Pulse Width High | t ₁ | | 60 | | | ns |
| SCL Minimum Pulse Width Low | t ₂ | | 160 | | | ns |
| Start Condition Hold Time | t ₃ | | 160 | | | ns |
| Start Condition Setup Time | t ₄ | | 160 | | | ns |
| SDA Setup Time | t ₅ | | 10 | | | ns |
| SCL and SDA Rise Time | t ₆ | | 10 | | 80 | ns |
| SCL and SDA Fall Time | t ₇ | | 10 | | 80 | ns |
| Stop Condition Setup Time | t ₈ | | 160 | | | ns |
| RESET FEATURE | | | | | | |
| Reset Pulse Width | | | 5 | | | ms |
| CLOCK OUTPUTS | | | | | | |
| LLC Mark-Space Ratio | t ₉ :t ₁₀ | | 45:55 | | 55:45 | % duty cycle |
| DATA AND CONTROL OUTPUTS ² | | | | | | |
| Data Output Transition Time SDR (SDP) | t ₁₁ | End of valid data to negative clock edge | | 2.9 | 4.6 | ns |
| Data Output Transition Time SDR (SDP) | t ₁₂ | Negative clock edge to start of valid data | | 0.2 | 0.6 | ns |
| Data Output Transition Time SDR (CP) | t ₁₃ | End of valid data to negative clock edge | | 1.5 | 2.2 | ns |
| Data Output Transition Time SDR (CP) | t ₁₄ | Negative clock edge to start of valid data | | 0.1 | 0.3 | ns |
| I ² S PORT, MASTER MODE | | | | | | |
| SCLK Mark-Space Ratio | t ₁₅ :t ₁₆ | | 45:55 | | 55:45 | % duty cycle |
| LRCLK Data Transition Time | t ₁₇ | End of valid data to negative SCLK edge | | | 10 | ns |
| LRCLK Data Transition Time | t ₁₈ | Negative SCLK edge to start of valid data | | | 10 | ns |
| I2Sx Data Transition Time | t ₁₉ | End of valid data to negative SCLK edge | | | 5 | ns |
| I2Sx Data Transition Time | t ₂₀ | Negative SCLK edge to start of valid data | | | 5 | ns |

¹ Guaranteed by characterization.² With the DLL block on output clock bypassed.

TIMING DIAGRAMS

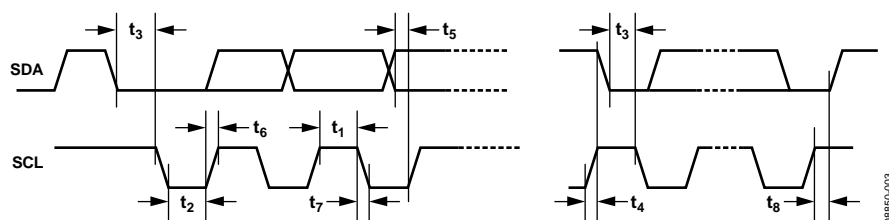


Figure 3. I²C Timing

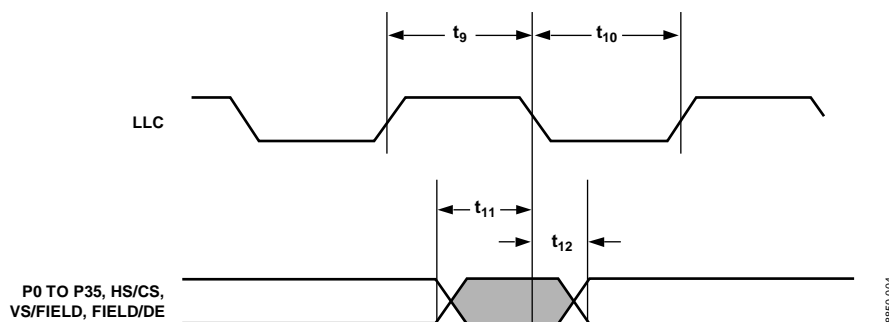


Figure 4. Pixel Port and Control SDR Output Timing (SDP)

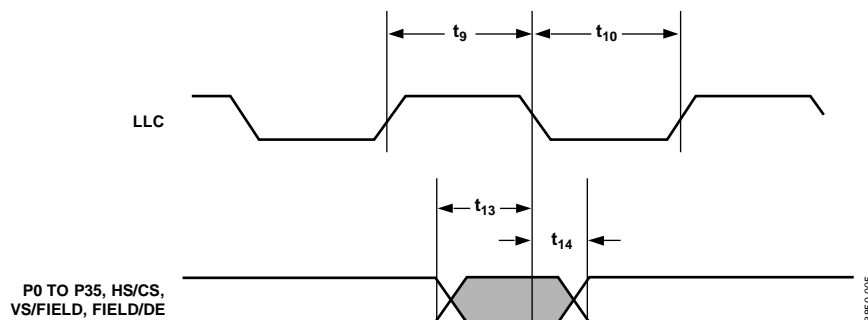
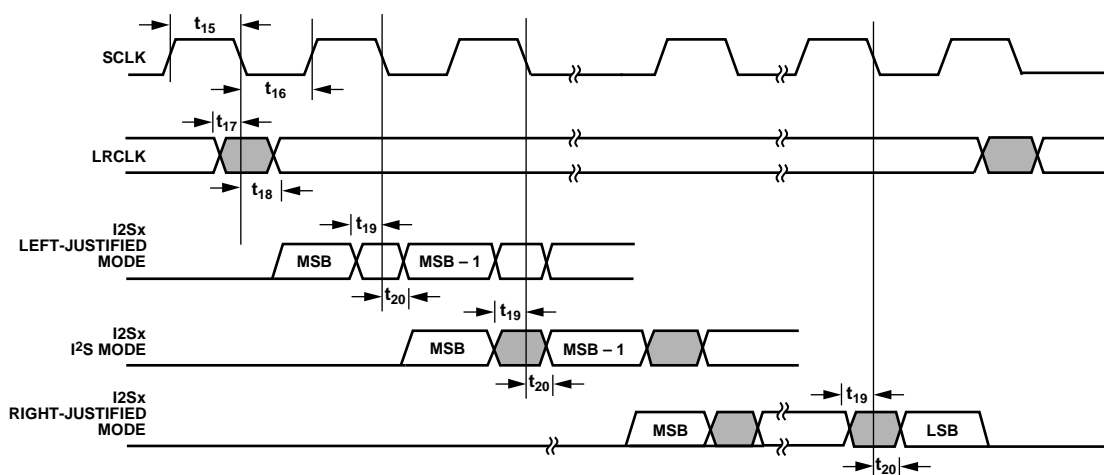


Figure 5. Pixel Port and Control SDR Output Timing (CP)



NOTES

1. THE SUFFIX x REFERS TO 0, 1, 2, AND 3 ENDING PIN NAMES.
2. LRCLK IS A SIGNAL ACCESSIBLE VIA AP5 PIN.
3. I2Sx ARE SIGNALS ACCESSIBLE VIA AP1 TO AP4 PINS.

Figure 6. I²S Timing

ABSOLUTE MAXIMUM RATINGS

Table 6.

| Parameter | Rating |
|---|--------------------------|
| AVDD to GND | 2.2 V |
| VDD to GND | 2.2 V |
| PVDD to GND | 2.2 V |
| DVDDIO to GND | 4.0 V |
| VDD_SDRAM to GND | 4.0 V |
| CVDD to GND | 2.2 V |
| TVDD to GND | 4.0 V |
| AVDD to PVDD | −0.3 V to +0.3 V |
| AVDD to VDD | −0.3 V to +0.3 V |
| TVDD to CVDD | −0.3 V to +2.2 V |
| DVDDIO to VDD_SDRAM | −0.3 V to +3.3 V |
| VDD_SDRAM to AVDD | −0.3 V to +2 V |
| VDD_SDRAM to VDD | −0.3 V to +2 V |
| Digital Inputs Voltage to GND | −0.3 V to DVDDIO + 0.3 V |
| Digital Outputs Voltage to GND | −0.3 V to DVDDIO + 0.3 V |
| 5 V Tolerant Digital Inputs to GND ¹ | 5.5 V |
| Analog Inputs to GND | −0.3 V to AVDD + 0.3 V |
| XTALN and XTALP to GND | −0.3 V to PVDD + 0.3 V |
| Maximum Junction Temperature (T _J MAX) | 125°C |
| Storage Temperature Range | −65°C to +150°C |
| Infrared Reflow Soldering (20 sec) | 260°C |

¹ The following inputs are 3.3 V inputs but are 5 V tolerant: HS_IN1/TRI5, HS_IN2/TRI7, VS_IN1/TRI6, VS_IN2/TRI8, DDCA_SCL, DDCA_SDA, DDCB_SCL, DDCB_SDA, DDCC_SCL, DDCC_SDA, DDCD_SCL, and DDCD_SDA.

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

PACKAGE THERMAL PERFORMANCE

To reduce power consumption when using the ADV7844, the user is advised to turn off unused sections of the part.

Due to PCB metal variation, and therefore variation in PCB heat conductivity, the value of θ_{JA} may differ for various PCBs.

The most efficient measurement solution is obtained using the package surface temperature to estimate the die temperature because this eliminates the variance associated with the θ_{JA} value.

The maximum junction temperature (T_J MAX) of 125°C must not be exceeded. The following equation calculates the junction temperature using the measured package surface temperature and applies only when no heat sink is used on the device under test (DUT):

$$T_J = T_S + (\Psi_{JT} \times W_{TOTAL})$$

where:

T_S is the package surface temperature (°C).

Ψ_{JT} = 0.7°C/W for the 425-ball CSP_BGA.

$$W_{TOTAL} = (PVDD \times I_{PVDD}) + (0.4 \times TVDD \times I_{TVDD}) + (CVDD \times I_{CVDD}) + (AVDD \times I_{AVDD}) + (VDD \times I_{VDD}) + (A \times DVDDIO \times I_{DVDDIO}) + (VDD_SDRAM \times I_{VDD_SDRAM})$$

where 0.4 reflects the 40% of TVDD power that is dissipated on the part itself.

A = 0.5 when the output pixel clock is >74 MHz.

A = 0.75 when the output pixel clock is ≤74 MHz.

ESD CAUTION



ESD (electrostatic discharge) sensitive device.

Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | |
|----|--------|----------|---------|----------|------|-----------|-----------|----------|-----------|-----------|------------|-----------|-----------|------------|------------|------------|------------|-----------|----------|-------------|-------------|-------------|--------|----|
| A | GND | VS/FIELD | TEST6 | TEST7 | TVDD | RXD_2- | RXD_1- | RXD_0- | RXD_C- | ARC_2- | TVDD | RXC_2- | RXC_1- | RXC_0- | RXC_C- | NC | TVDD | RXB_2- | RXB_1- | RXB_0- | RXB_C- | ARC_1- | GND | A |
| B | HS/CS | FIELD/DE | TEST8 | TEST9 | TVDD | RXD_2+ | RXD_1+ | RXD_0+ | RXD_C+ | ARC_2+ | TVDD | RXC_2+ | RXC_1+ | RXC_0+ | RXC_C+ | NC | TVDD | RXB_2+ | RXB_1+ | RXB_0+ | RXB_C+ | ARC_1+ | GND | B |
| C | P0 | P1 | TEST10 | TEST11 | TVDD | PWRDN1 | TEST14 | HPA_D | RXD_5V | RXC_5V | TVDD | GND | GND | GND | GND | GND | GND | TVDD | TVDD | TVDD | TVDD | TVDD | TVDD | C |
| D | P2 | P3 | TEST12 | TEST13 | TVDD | SYNC_OUT | CEC | HPA_C | RXB_5V | HPA_B | TVDD | RXA_5V | HPA_A | DDCD_SDA | DDCD_SCL | DDCC_SDA | DDCC_SCL | RTERM | DDCB_SDA | DDCB_SCL | TVDD | RXA_2+ | RXA_2- | D |
| E | DVDDIO | DVDDIO | GND | GND | | | | | | | | | | | | | | | | DDCA_SDA | CVDD | RXA_1+ | RXA_1- | E |
| F | P5 | P4 | EP_MISO | EP_MOSI | | | | | | | | | | | | | | | | DDCA_SCL | CVDD | RXA_0+ | RXA_0- | F |
| G | P7 | P6 | EP_CS | EP_SCK | | | | GND | GND | GND | GND | TEST1 | TEST2 | GND | GND | CVDD | CVDD | CVDD | | VGA_SCL | CVDD | RXA_C+ | RXA_C- | G |
| H | P9 | P8 | TTX_SDA | TTX_SCL | | | | GND | GND | GND | GND | GND | GND | GND | GND | CVDD | CVDD | CVDD | | VGA_SDA | CVDD | NC | NC | H |
| J | P11 | P10 | MCLK | AP0 | | | | GND | GND | GND | GND | GND | GND | GND | GND | GND | GND | GND | | PVDD | TEST3 | GND | GND | J |
| K | P13 | P12 | AP5 | SCLK | | | | VDD | GND | GND | GND | GND | GND | GND | GND | GND | GND | GND | | PVDD | GND | XTALN | XTALP | K |
| L | DVDDIO | DVDDIO | GND | GND | | | | VDD | GND | GND | GND | GND | GND | GND | GND | GND | GND | GND | | GND | GND | GND | GND | L |
| M | P15 | P14 | AP4 | AP3 | | | | VDD | GND | GND | GND | GND | GND | GND | GND | GND | GND | GND | | GND | GND | REFN | REFP | M |
| N | P17 | P16 | AP2 | AP1 | | | | VDD | GND | GND | GND | GND | GND | GND | GND | GND | GND | GND | | AVDD | AVDD | AVDD | AVDD | N |
| P | P18 | P19 | SCL | SDA | | | | VDD | GND | GND | GND | GND | GND | GND | GND | GND | GND | GND | | AVDD | AVDD | AIN11 | AIN12 | P |
| R | P20 | P21 | TEST4 | INT1 | | | | VDD | GND | GND | GND | GND | GND | GND | GND | GND | GND | GND | | HS_IN2/TR17 | VS_IN2/TR18 | SYNC4 | AIN10 | R |
| T | P22 | P23 | TEST5 | INT2 | | | | VDD | GND | GND | GND | GND | GND | GND | GND | GND | GND | GND | | GND | GND | GND | GND | T |
| U | DVDDIO | DVDDIO | DVDDIO | DVDDIO | | | | VDD | VDD | VDD | VDD | VDD | VDD | VDD | VDD | GND | GND | GND | | TRI4 | TRI3 | AIN9 | AIN8 | U |
| V | LLC | P24 | RESET | AVLINK | | | | | | | | | | | | | | | | TRI1 | TRI2 | SYNC3 | AIN7 | V |
| W | P25 | P26 | NC | SPDIF_IN | | | | | | | | | | | | | | | | AVDD | AVDD | AVDD | AVDD | W |
| Y | P27 | P28 | GND | GND | GND | VDD_SDRAM | SDRAM_A11 | SDRAM_A6 | SDRAM_A2 | SDRAM_CS | SDRAM_LDQS | GND | SDRAM_DQ6 | SDRAM_DQ2 | SDRAM_DQ15 | SDRAM_DQ11 | SDRAM_CKE | VDD_SDRAM | GND | AOUT | NC | AIN5 | AIN6 | Y |
| AA | P29 | P30 | GND | GND | GND | VDD_SDRAM | SDRAM_A9 | SDRAM_A5 | SDRAM_A1 | SDRAM_RAS | SDRAM_DQ7 | GND | SDRAM_DQ5 | SDRAM_DQ1 | SDRAM_DQ12 | SDRAM_DQ8 | SDRAM_CK | VDD_SDRAM | GND | NC | NC | SYNC2 | AIN4 | AA |
| AB | P31 | P32 | P34 | NC | GND | DVDDIO | SDRAM_A8 | SDRAM_A4 | SDRAM_A0 | SDRAM_BA1 | SDRAM_CAS | VDD_SDRAM | SDRAM_DQ4 | SDRAM_DQ0 | SDRAM_DQ13 | SDRAM_DQ9 | SDRAM_CK | VDD_SDRAM | GND | SYNC1 | HS_IN1/TR15 | VS_IN1/TR16 | GND | AB |
| AC | GND | P33 | P35 | NC | GND | DVDDIO | SDRAM_A7 | SDRAM_A3 | SDRAM_A10 | SDRAM_BA0 | SDRAM_WE | VDD_SDRAM | SDRAM_DQ3 | SDRAM_VREF | SDRAM_DQ14 | SDRAM_DQ10 | SDRAM_UDQS | VDD_SDRAM | GND | AIN1 | AIN2 | AIN3 | GND | AC |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | |

Figure 7. Pin Configuration

Table 7. Pin Function Descriptions

| Pin No. | Mnemonic | Type | Description |
|---------|----------|-----------------------|--|
| A1 | GND | Ground | Ground. |
| A2 | VS/FIELD | Digital video output | Vertical Synchronization Output Signal (VS). Field Synchronization Output Signal in All Interlaced Video Modes (FIELD). VS or FIELD can be configured for this pin. |
| A3 | TEST6 | Test pin | Float this pin. |
| A4 | TEST7 | Test pin | Float this pin. |
| A5 | TVDD | Power | Terminator Supply Voltage (3.3 V). |
| A6 | RXD_2– | HDMI input | Digital Input Channel 2 Complement of Port D in the HDMI Interface. |
| A7 | RXD_1– | HDMI input | Digital Input Channel 1 Complement of Port D in the HDMI Interface. |
| A8 | RXD_0– | HDMI input | Digital Input Channel 0 Complement of Port D in the HDMI Interface. |
| A9 | RXD_C– | HDMI input | Digital Input Clock Complement of Port D in the HDMI Interface. |
| A10 | ARC_2– | HDMI input/output | Audio Return Channel (ARC) Complement in ARC Interface 2. |
| A11 | TVDD | Power | Terminator Supply Voltage (3.3 V). |
| A12 | RXC_2– | HDMI input | Digital Input Channel 2 Complement of Port C in the HDMI Interface. |
| A13 | RXC_1– | HDMI input | Digital Input Channel 1 Complement of Port C in the HDMI Interface. |
| A14 | RXC_0– | HDMI input | Digital Input Channel 0 Complement of Port C in the HDMI Interface. |
| A15 | RXC_C– | HDMI input | Digital Input Clock Complement of Port C in the HDMI Interface. |
| A16 | NC | No connect | No Connect. |
| A17 | TVDD | Power | Terminator Supply Voltage (3.3 V). |
| A18 | RXB_2– | HDMI input | Digital Input Channel 2 Complement of Port B in the HDMI Interface. |
| A19 | RXB_1– | HDMI input | Digital Input Channel 1 Complement of Port B in the HDMI Interface. |
| A20 | RXB_0– | HDMI input | Digital Input Channel 0 Complement of Port B in the HDMI Interface. |
| A21 | RXB_C– | HDMI input | Digital Input Clock Complement of Port B in the HDMI Interface. |
| A22 | ARC_1– | HDMI input/output | Audio Return Channel (ARC) Complement in ARC Interface 1. |
| A23 | GND | Ground | Ground. |
| B1 | HS/CS | Digital video output | Horizontal Synchronization Output Signal (HS). Composite Synchronization Signal (CS). CS is a single signal containing both horizontal and vertical synchronization pulses. HS or CS can be configured for this pin. |
| B2 | FIELD/DE | Miscellaneous digital | Field Synchronization Output Signal in All Interlaced Video Modes (FIELD). Data Enable (DE). DE is a signal that indicates active pixel data. DE or FIELD can be configured for this pin. |
| B3 | TEST8 | Test pin | Float this pin. |
| B4 | TEST9 | Test pin | Float this pin. |
| B5 | TVDD | Power | Terminator Supply Voltage (3.3 V). |
| B6 | RXD_2+ | HDMI input | Digital Input Channel 2 True of Port D in the HDMI Interface. |
| B7 | RXD_1+ | HDMI input | Digital Input Channel 1 True of Port D in the HDMI Interface. |
| B8 | RXD_0+ | HDMI input | Digital Input Channel 0 True of Port D in the HDMI Interface. |
| B9 | RXD_C+ | HDMI input | Digital Input Clock True of Port D in the HDMI Interface. |
| B10 | ARC_2+ | HDMI input/output | Audio Return Channel (ARC) True in ARC Interface 2. |
| B11 | TVDD | Power | Terminator Supply Voltage (3.3 V). |
| B12 | RXC_2+ | HDMI input | Digital Input Channel 2 True Of Port C in the HDMI Interface. |
| B13 | RXC_1+ | HDMI input | Digital Input Channel 1 True Of Port C in the HDMI Interface. |
| B14 | RXC_0+ | HDMI input | Digital Input Channel 0 True Of Port C in the HDMI Interface. |
| B15 | RXC_C+ | HDMI input | Digital Input Clock True Of Port C in the HDMI Interface. |
| B16 | NC | No Connect | No Connect. |
| B17 | TVDD | Power | Terminator Supply Voltage (3.3 V). |
| B18 | RXB_2+ | HDMI input | Digital Input Channel 2 True of Port B in the HDMI Interface. |
| B19 | RXB_1+ | HDMI input | Digital Input Channel 1 True of Port B in the HDMI Interface. |
| B20 | RXB_0+ | HDMI input | Digital Input Channel 0 True of Port B in the HDMI Interface. |
| B21 | RXB_C+ | HDMI input | Digital Input Clock True of Port B in the HDMI Interface. |
| B22 | ARC_1+ | HDMI input/output | Audio Return Channel (ARC) True in ARC Interface 1. |
| B23 | GND | Ground | Ground. |

| Pin No. | Mnemonic | Type | Description |
|---------|----------|-----------------------|--|
| C1 | P0 | Digital video output | Video Pixel Output Port. |
| C2 | P1 | Digital video output | Video Pixel Output Port. |
| C3 | TEST10 | Test pin | Float this pin. |
| C4 | TEST11 | Test pin | Float this pin. |
| C5 | TVDD | Power | Terminator Supply Voltage (3.3 V). |
| C6 | PWRDN1 | Miscellaneous digital | Controls the Power-Up of the ADV7844. Should be connected to a digital 3.3 V I/O supply to power up the ADV7844. |
| C7 | TEST14 | Test pin | Tie this pin to ground via a 4.7 k Ω resistor. |
| C8 | HPA_D | Miscellaneous digital | Hot Plug Assert Signal Output for HDMI Port D. |
| C9 | RXD_5V | HDMI input | 5 V Detect Pin for Port D in the HDMI Interface. |
| C10 | RXC_5V | HDMI input | 5 V Detect Pin for Port C in the HDMI Interface. |
| C11 | TVDD | Power | Terminator Supply Voltage (3.3 V). |
| C12 | GND | Ground | Ground. |
| C13 | GND | Ground | Ground. |
| C14 | GND | Ground | Ground. |
| C15 | GND | Ground | Ground. |
| C16 | GND | Ground | Ground. |
| C17 | GND | Ground | Ground. |
| C18 | TVDD | Power | Terminator Supply Voltage (3.3 V). |
| C19 | TVDD | Power | Terminator Supply Voltage (3.3 V). |
| C20 | TVDD | Power | Terminator Supply Voltage (3.3 V). |
| C21 | TVDD | Power | Terminator Supply Voltage (3.3 V). |
| C22 | TVDD | Power | Terminator Supply Voltage (3.3 V). |
| C23 | TVDD | Power | Terminator Supply Voltage (3.3 V). |
| D1 | P2 | Digital video output | Video Pixel Output Port. |
| D2 | P3 | Digital video output | Video Pixel Output Port. |
| D3 | TEST12 | Test pin | Float this pin. |
| D4 | TEST13 | Test pin | Float this pin. |
| D5 | TVDD | Power | Terminator Supply Voltage (3.3 V). |
| D6 | SYNC_OUT | Miscellaneous digital | Sliced synchronization output. |
| D7 | CEC | Digital input/output | Consumer Electronic Control Channel. |
| D8 | HPA_C | Miscellaneous digital | Hot Plug Assert Signal Output for HDMI Port C. |
| D9 | RXB_5V | HDMI input | 5 V Detect Pin for Port B in the HDMI Interface. |
| D10 | HPA_B | Miscellaneous digital | Hot Plug Assert Signal Output for HDMI Port B. |
| D11 | TVDD | Power | Terminator Supply Voltage (3.3 V). |
| D12 | RXA_5V | HDMI input | 5 V Detect Pin for Port A in the HDMI Interface. |
| D13 | HPA_A | Miscellaneous digital | Hot Plug Assert Signal Output for HDMI Port A. |
| D14 | DDCD_SDA | Digital input/output | HDCP Slave Serial Data Port D. DDCCD_SDA is a 3.3 V input/output that is 5 V tolerant. |
| D15 | DDCD_SCL | Digital input | HDCP Slave Serial Clock Port D. DDCCD_SCL is a 3.3 V input that is 5 V tolerant. |
| D16 | DDCC_SDA | Digital input/output | HDCP Slave Serial Data Port C. DDCC_SDA is a 3.3 V input/output that is 5 V tolerant. |
| D17 | DDCC_SCL | Digital input | HDCP Slave Serial Clock Port C. DDCC_SCL is a 3.3 V input that is 5 V tolerant. |
| D18 | RTERM | Miscellaneous analog | Sets Internal Termination Resistance. A 500 Ω resistor between this pin and GND should be used. |
| D19 | DDCB_SDA | Digital input/output | HDCP Slave Serial Data Port B. DDCB_SDA is a 3.3 V input/output that is 5 V tolerant. |
| D20 | DDCB_SCL | Digital input | HDCP Slave Serial Clock Port B. DDCB_SCL is a 3.3 V input that is 5 V tolerant. |
| D21 | TVDD | Power | Terminator Supply Voltage (3.3 V). |
| D22 | RXA_2+ | HDMI input | Digital Input Channel 2 True of Port A in the HDMI Interface. |
| D23 | RXA_2- | HDMI input | Digital Input Channel 2 Complement of Port A in the HDMI Interface. |
| E1 | DVDDIO | Power | Digital I/O Supply Voltage (3.3 V). |
| E2 | DVDDIO | Power | Digital I/O Supply Voltage (3.3 V). |
| E3 | GND | Ground | Ground. |
| E4 | GND | Ground | Ground. |
| E20 | DDCA_SDA | Digital input/output | HDCP Slave Serial Data Port A. DDCA_SDA is a 3.3 V input/output that is 5 V tolerant. |
| E21 | CVDD | Power | Comparator Supply Voltage (1.8 V). |

| Pin No. | Mnemonic | Type | Description |
|---------|----------|-----------------------|---|
| E22 | RXA_1+ | HDMI input | Digital Input Channel 1 True of Port A in the HDMI Interface. |
| E23 | RXA_1– | HDMI input | Digital Input Channel 1 Complement of Port A in the HDMI Interface. |
| F1 | P5 | Digital video output | Video Pixel Output Port. |
| F2 | P4 | Digital video output | Video Pixel Output Port. |
| F3 | EP_MISO | Digital output | SPI Master In/Slave Out for External EDID Interface. |
| F4 | EP_MOSI | Digital input | SPI Master Out/Slave In for External EDID Interface. |
| F20 | DDCA_SCL | Digital input | HDCP Slave Serial Clock Port A. DDCA_SCL is a 3.3 V input that is 5 V tolerant. |
| F21 | CVDD | Power | Comparator Supply Voltage (1.8 V). |
| F22 | RXA_0+ | HDMI input | Digital Input Channel 0 True of Port A in the HDMI Interface. |
| F23 | RXA_0– | HDMI input | Digital Input Channel 0 Complement of Port A in the HDMI Interface. |
| G1 | P7 | Digital video output | Video Pixel Output Port. |
| G2 | P6 | Digital video output | Video Pixel Output Port. |
| G3 | EP_CS | Digital output | SPI Chip Select for External EDID Interface. |
| G4 | EP_SCK | Digital output | SPI Clock for External EDID Interface. |
| G7 | GND | Ground | Ground. |
| G8 | GND | Ground | Ground. |
| G9 | GND | Ground | Ground. |
| G10 | GND | Ground | Ground. |
| G11 | TEST1 | Test | Do Not Connect. |
| G12 | TEST2 | Test | Do Not Connect. |
| G13 | GND | Ground | Ground. |
| G14 | GND | Ground | Ground. |
| G15 | CVDD | Power | Comparator Supply Voltage (1.8 V). |
| G16 | CVDD | Power | Comparator Supply Voltage (1.8 V). |
| G17 | CVDD | Power | Comparator Supply Voltage (1.8 V). |
| G20 | VGA_SCL | Miscellaneous digital | DDC Port Serial Clock Input for VGA. |
| G21 | CVDD | Power | Comparator Supply Voltage (1.8 V). |
| G22 | RXA_C+ | HDMI input | Digital Input Clock True of Port A in the HDMI Interface. |
| G23 | RXA_C– | HDMI input | Digital Input Clock Complement of Port A in the HDMI Interface. |
| H1 | P9 | Digital video output | Video Pixel Output Port. |
| H2 | P8 | Digital video output | Video Pixel Output Port. |
| H3 | TTX_SDA | Miscellaneous digital | I ² C Port Serial Data Input/Output. SDA is the data line for the teletext port. |
| H4 | TTX_SCL | Miscellaneous digital | I ² C Port Serial Clock Input. SCL is the clock line for the teletext port. |
| H7 | GND | Ground | Ground. |
| H8 | GND | Ground | Ground. |
| H9 | GND | Ground | Ground. |
| H10 | GND | Ground | Ground. |
| H11 | GND | Ground | Ground. |
| H12 | GND | Ground | Ground. |
| H13 | GND | Ground | Ground. |
| H14 | GND | Ground | Ground. |
| H15 | CVDD | Power | Comparator Supply Voltage (1.8 V). |
| H16 | CVDD | Power | Comparator Supply Voltage (1.8 V). |
| H17 | CVDD | Power | Comparator Supply Voltage (1.8 V). |
| H20 | VGA_SDA | Miscellaneous digital | DDC Port Serial Data Input/Output for VGA. |
| H21 | CVDD | Power | Comparator Supply Voltage (1.8 V). |
| H22 | NC | No Connect | No Connect. |
| H23 | NC | No Connect | No Connect. |
| J1 | P11 | Digital video output | Video Pixel Output Port. |
| J2 | P10 | Digital video output | Video Pixel Output Port. |
| J3 | MCLK | Miscellaneous | Audio Master Clock Output. |
| J4 | AP0 | Miscellaneous | Audio Output. |
| J7 | GND | Ground | Ground. |

| Pin No. | Mnemonic | Type | Description |
|---------|----------|-----------------------|---|
| J8 | GND | Ground | Ground. |
| J9 | GND | Ground | Ground. |
| J10 | GND | Ground | Ground. |
| J11 | GND | Ground | Ground. |
| J12 | GND | Ground | Ground. |
| J13 | GND | Ground | Ground. |
| J14 | GND | Ground | Ground. |
| J15 | GND | Ground | Ground. |
| J16 | GND | Ground | Ground. |
| J17 | GND | Ground | Ground. |
| J20 | PVDD | Power | PLL Supply Voltage (1.8 V). |
| J21 | TEST3 | Test | Do Not Connect. |
| J22 | GND | Ground | Ground. |
| J23 | GND | Ground | Ground. |
| K1 | P13 | Digital video output | Video Pixel Output Port. |
| K2 | P12 | Digital video output | Video Pixel Output Port. |
| K3 | AP5 | Miscellaneous | Audio Output. |
| K4 | SCLK | Miscellaneous digital | Audio Serial Clock Output. |
| K7 | VDD | Power | Digital Core Supply Voltage (1.8 V). |
| K8 | GND | Ground | Ground. |
| K9 | GND | Ground | Ground. |
| K10 | GND | Ground | Ground. |
| K11 | GND | Ground | Ground. |
| K12 | GND | Ground | Ground. |
| K13 | GND | Ground | Ground. |
| K14 | GND | Ground | Ground. |
| K15 | GND | Ground | Ground. |
| K16 | GND | Ground | Ground. |
| K17 | GND | Ground | Ground. |
| K20 | PVDD | Power | PLL Supply Voltage (1.8 V). |
| K21 | GND | Ground | Ground. |
| K22 | XTALN | Miscellaneous analog | Input Pin for 28.63636 MHz Crystal. |
| K23 | XTALP | Miscellaneous analog | Input pin for 28.63636 MHz Crystal or an external 1.8 V, 28.63636 MHz Clock Oscillator Source to Clock the ADV7844. |
| L1 | DVDDIO | Power | Digital I/O Supply Voltage (3.3 V). |
| L2 | DVDDIO | Power | Digital I/O Supply Voltage (3.3 V). |
| L3 | GND | Ground | Ground. |
| L4 | GND | Ground | Ground. |
| L7 | VDD | Power | Digital Core Supply Voltage (1.8 V). |
| L8 | GND | Ground | Ground. |
| L9 | GND | Ground | Ground. |
| L10 | GND | Ground | Ground. |
| L11 | GND | Ground | Ground. |
| L12 | GND | Ground | Ground. |
| L13 | GND | Ground | Ground. |
| L14 | GND | Ground | Ground. |
| L15 | GND | Ground | Ground. |
| L16 | GND | Ground | Ground. |
| L17 | GND | Ground | Ground. |
| L20 | GND | Ground | Ground. |
| L21 | GND | Ground | Ground. |
| L22 | GND | Ground | Ground. |
| L23 | GND | Ground | Ground. |

| Pin No. | Mnemonic | Type | Description |
|---------|----------|-----------------------|--|
| M1 | P15 | Digital video output | Video Pixel Output Port. |
| M2 | P14 | Digital video output | Video Pixel Output Port. |
| M3 | AP4 | Miscellaneous | Audio Output. |
| M4 | AP3 | Miscellaneous | Audio Output. |
| M7 | VDD | Power | Digital Core Supply Voltage (1.8 V). |
| M8 | GND | Ground | Ground. |
| M9 | GND | Ground | Ground. |
| M10 | GND | Ground | Ground. |
| M11 | GND | Ground | Ground. |
| M12 | GND | Ground | Ground. |
| M13 | GND | Ground | Ground. |
| M14 | GND | Ground | Ground. |
| M15 | GND | Ground | Ground. |
| M16 | GND | Ground | Ground. |
| M17 | GND | Ground | Ground. |
| M20 | GND | Ground | Ground. |
| M21 | GND | Ground | Ground. |
| M22 | REFN | Miscellaneous analog | Internal Voltage Reference Output. |
| M23 | REFP | Miscellaneous analog | Internal Voltage Reference Output. |
| N1 | P17 | Digital video output | Video Pixel Output Port. |
| N2 | P16 | Digital video output | Video Pixel Output Port. |
| N3 | AP2 | Miscellaneous | Audio Output. |
| N4 | AP1 | Miscellaneous | Audio Output. |
| N7 | VDD | Power | Digital Core Supply Voltage (1.8 V). |
| N8 | GND | Ground | Ground. |
| N9 | GND | Ground | Ground. |
| N10 | GND | Ground | Ground. |
| N11 | GND | Ground | Ground. |
| N12 | GND | Ground | Ground. |
| N13 | GND | Ground | Ground. |
| N14 | GND | Ground | Ground. |
| N15 | GND | Ground | Ground. |
| N16 | GND | Ground | Ground. |
| N17 | GND | Ground | Ground. |
| N20 | AVDD | Power | Analog Supply Voltage (1.8 V). |
| N21 | AVDD | Power | Analog Supply Voltage (1.8 V). |
| N22 | AVDD | Power | Analog Supply Voltage (1.8 V). |
| N23 | AVDD | Power | Analog Supply Voltage (1.8 V). |
| P1 | P18 | Digital video output | Video Pixel Output Port. |
| P2 | P19 | Digital video output | Video Pixel Output Port. |
| P3 | SCL | Miscellaneous digital | I ² C Port Serial Clock Input. SCL is the clock line for the control port. |
| P4 | SDA | Miscellaneous digital | I ² C Port Serial Data Input/Output. SDA is the data line for the control port. |
| P7 | VDD | Power | Digital Core Supply Voltage (1.8 V). |
| P8 | GND | Ground | Ground. |
| P9 | GND | Ground | Ground. |
| P10 | GND | Ground | Ground. |
| P11 | GND | Ground | Ground. |
| P12 | GND | Ground | Ground. |
| P13 | GND | Ground | Ground. |
| P14 | GND | Ground | Ground. |
| P15 | GND | Ground | Ground. |
| P16 | GND | Ground | Ground. |
| P17 | GND | Ground | Ground. |

| Pin No. | Mnemonic | Type | Description |
|---------|-------------|-----------------------|---|
| P20 | AVDD | Power | Analog Supply Voltage (1.8 V). |
| P21 | AVDD | Power | Analog Supply Voltage (1.8 V). |
| P22 | AIN11 | Analog video input | Analog Video Input Channel. |
| P23 | AIN12 | Analog video input | Analog Video Input Channel. |
| R1 | P20 | Digital video output | Video Pixel Output Port. |
| R2 | P21 | Digital video output | Video Pixel Output Port. |
| R3 | TEST4 | Test | This pin should be tied to ground. |
| R4 | INT1 | Miscellaneous digital | Interrupt. This pin can be active low or active high. When status bits change, this pin is triggered. The events that trigger an interrupt are under user control. |
| R7 | VDD | Power | Digital Core Supply Voltage (1.8 V). |
| R8 | GND | Ground | Ground. |
| R9 | GND | Ground | Ground. |
| R10 | GND | Ground | Ground. |
| R11 | GND | Ground | Ground. |
| R12 | GND | Ground | Ground. |
| R13 | GND | Ground | Ground. |
| R14 | GND | Ground | Ground. |
| R15 | GND | Ground | Ground. |
| R16 | GND | Ground | Ground. |
| R17 | GND | Ground | Ground. |
| R20 | HS_IN2/TRI7 | Miscellaneous analog | HS on Graphics Port 2 (HS_IN2). The HS input signal is used for 5-wire timing mode. Trilevel/Bilevel Input on the SCART or D-Terminal Connector (TRI7). (Selection available via the I ² C.) |
| R21 | VS_IN2/TRI8 | Miscellaneous analog | VS on Graphics Port 2 (VS_IN2). The VS input signal is used for 5-wire timing mode. Trilevel/Bilevel Input on the SCART or D-Terminal Connector (TRI8). (Selection available via the I ² C.) |
| R22 | SYNC4 | Miscellaneous analog | This is a synchronization on green or luma input (SOG/SOY) used in embedded synchronization mode. User configurable. |
| R23 | AIN10 | Analog video input | Analog Video Input Channel. |
| T1 | P22 | Digital video output | Video Pixel Output Port. |
| T2 | P23 | Digital video output | Video Pixel Output Port. |
| T3 | TEST5 | Test | Do Not Connect. |
| T4 | INT2 | Miscellaneous digital | Interrupt. This pin can be active low or active high. When status bits change, this pin is triggered. The events that trigger an interrupt are under user control. |
| T7 | VDD | Power | Digital Core Supply Voltage (1.8 V). |
| T8 | GND | Ground | Ground. |
| T9 | GND | Ground | Ground. |
| T10 | GND | Ground | Ground. |
| T11 | GND | Ground | Ground. |
| T12 | GND | Ground | Ground. |
| T13 | GND | Ground | Ground. |
| T14 | GND | Ground | Ground. |
| T15 | GND | Ground | Ground. |
| T16 | GND | Ground | Ground. |
| T17 | GND | Ground | Ground. |
| T20 | GND | Ground | Ground. |
| T21 | GND | Ground | Ground. |
| T22 | GND | Ground | Ground. |
| T23 | GND | Ground | Ground. |
| U1 | DVDDIO | Power | Digital I/O Supply Voltage (3.3 V). |
| U2 | DVDDIO | Power | Digital I/O Supply Voltage (3.3 V). |
| U3 | DVDDIO | Power | Digital I/O Supply Voltage (3.3 V). |
| U4 | DVDDIO | Power | Digital I/O Supply Voltage (3.3 V). |
| U7 | VDD | Power | Digital Core Supply Voltage (1.8 V). |

| Pin No. | Mnemonic | Type | Description |
|---------|------------|-----------------------|---|
| U8 | VDD | Power | Digital Core Supply Voltage (1.8 V). |
| U9 | VDD | Power | Digital Core Supply Voltage (1.8 V). |
| U10 | VDD | Power | Digital Core Supply Voltage (1.8 V). |
| U11 | VDD | Power | Digital Core Supply Voltage (1.8 V). |
| U12 | VDD | Power | Digital Core Supply Voltage (1.8 V). |
| U13 | VDD | Power | Digital Core Supply Voltage (1.8 V). |
| U14 | VDD | Power | Digital Core Supply Voltage (1.8 V). |
| U15 | GND | Ground | Ground. |
| U16 | GND | Ground | Ground. |
| U17 | GND | Ground | Ground. |
| U20 | TRI4 | Miscellaneous analog | Trilevel or Bilevel Input on the SCART or D-Type Connector. (Selection available via the I ² C.) |
| U21 | TRI3 | Miscellaneous analog | Trilevel or Bilevel Input on the SCART or D-Type Connector. (Selection available via the I ² C.) |
| U22 | AIN9 | Analog video input | Analog Video Input Channel. |
| U23 | AIN8 | Analog video input | Analog Video Input Channel. |
| V1 | LLC | Digital video output | Line-Locked Output Clock for the Pixel Data. |
| V2 | P24 | Digital video output | Video Pixel Output Port. |
| V3 | RESET | Miscellaneous digital | System Reset Input. Active low. A minimum low reset pulse width of 5 ms is required to reset the ADV7844 circuitry. |
| V4 | AVLINK | Digital input/output | Digital SCART Control Channel. |
| V20 | TRI1 | Miscellaneous analog | Trilevel or Bilevel Input on the SCART or D-Type Connector. (Selection available via the I ² C.) |
| V21 | TRI2 | Miscellaneous analog | Trilevel or Bilevel Input on the SCART or D-Type Connector. (Selection available via the I ² C.) |
| V22 | SYNC3 | Miscellaneous analog | This is a synchronization on green or luma input (SOG/SOY) used in embedded synchronization mode. User configurable. |
| V23 | AIN7 | Analog video input | Analog Video Input Channel. |
| W1 | P25 | Digital video output | Video Pixel Output Port. |
| W2 | P26 | Digital video output | Video Pixel Output Port. |
| W3 | NC | No connect | No Connect. |
| W4 | SPDIF_IN | Miscellaneous digital | S/PDIF Stream Input. |
| W20 | AVDD | Power | Analog Supply Voltage (1.8 V). |
| W21 | AVDD | Power | Analog Supply Voltage (1.8 V). |
| W22 | AVDD | Power | Analog Supply Voltage (1.8 V). |
| W23 | AVDD | Power | Analog Supply Voltage (1.8 V). |
| Y1 | P27 | Digital video output | Video Pixel Output Port. |
| Y2 | P28 | Digital video output | Video Pixel Output Port. |
| Y3 | GND | Ground | Ground. |
| Y4 | GND | Ground | Ground. |
| Y5 | GND | Ground | Ground. |
| Y6 | VDD_SDRAM | Power | External Memory Interface Digital Input/Output Supply (DDR 2.5 V or SDR 3.3 V). |
| Y7 | SDRAM_A11 | SDRAM interface | Address Output. Interface to external RAM address lines. |
| Y8 | SDRAM_A6 | SDRAM interface | Address Output. Interface to external RAM address lines. |
| Y9 | SDRAM_A2 | SDRAM interface | Address Output. Interface to external RAM address lines. |
| Y10 | SDRAM_CS | SDRAM interface | Chip Select. SDRAM_CS enables and disables the command decoder on the RAM. One of four command signals to the external SDRAM. |
| Y11 | SDRAM_LDQS | SDRAM interface | Lower Data Strobe Pin. Data strobe pins are used for the RAM interface. This is an input when reading data from external memory and output when writing data to external memory. It is edge-aligned when reading from external memory and centered with data when reading to external memory. SDRAM_LDQS corresponds to the data on SDRAM_DQ7 to SDRAM_DQ0. |
| Y12 | GND | Ground | Ground. |
| Y13 | SDRAM_DQ6 | SDRAM interface | Data Bus. Interface to external RAM 16-bit data bus. |
| Y14 | SDRAM_DQ2 | SDRAM interface | Data Bus. Interface to external RAM 16-bit data bus. |

| Pin No. | Mnemonic | Type | Description |
|---------|------------|-----------------------|---|
| Y15 | SDRAM_DQ15 | SDRAM interface | Data Bus. Interface to external RAM 16-bit data bus. |
| Y16 | SDRAM_DQ11 | SDRAM interface | Data Bus. Interface to external RAM 16-bit data bus. |
| Y17 | SDRAM_CKE | SDRAM interface | Clock Enable. This pin acts as an enable to the clock signals of the external RAM. |
| Y18 | VDD_SDRAM | Power | External Memory Interface Digital Input/Output Supply (DDR 2.5 V or SDR 3.3 V). |
| Y19 | GND | Ground | Ground. |
| Y20 | AOUT | Analog monitor output | Analog Monitor Output. |
| Y21 | NC | No connect | No Connect. |
| Y22 | AIN5 | Analog video input | Analog Video Input Channel. |
| Y23 | AIN6 | Analog video input | Analog Video Input Channel. |
| AA1 | P29 | Digital video output | Video Pixel Output Port. |
| AA2 | P30 | Digital video output | Video Pixel Output Port. |
| AA3 | GND | Ground | Ground. |
| AA4 | GND | Ground | Ground. |
| AA5 | GND | Ground | Ground. |
| AA6 | VDD_SDRAM | Power | External Memory Interface Digital Input/Output Supply (DDR 2.5 V or SDR 3.3 V). |
| AA7 | SDRAM_A9 | SDRAM interface | Address Output. Interface to external RAM address lines. |
| AA8 | SDRAM_A5 | SDRAM interface | Address Output. Interface to external RAM address lines. |
| AA9 | SDRAM_A1 | SDRAM interface | Address Output. Interface to external RAM address lines. |
| AA10 | SDRAM_RAS | SDRAM interface | Row Address Select Command Signal. One of four command signals to the external SDRAM. |
| AA11 | SDRAM_DQ7 | SDRAM interface | Data Bus. Interface to external RAM 16-bit data bus. |
| AA12 | GND | Ground | Ground. |
| AA13 | SDRAM_DQ5 | SDRAM interface | Data Bus. Interface to external RAM 16-bit data bus. |
| AA14 | SDRAM_DQ1 | SDRAM interface | Data Bus. Interface to external RAM 16-bit data bus. |
| AA15 | SDRAM_DQ12 | SDRAM interface | Data Bus. Interface to external RAM 16-bit data bus. |
| AA16 | SDRAM_DQ8 | SDRAM interface | Data Bus. Interface to external RAM 16-bit data bus. |
| AA17 | SDRAM_CK | SDRAM interface | Differential Clock Output. All address and control output signals to the RAM should be sampled on the positive edge of SDRAM_CK and on the negative edge of SDRAM_CK. |
| AA18 | VDD_SDRAM | Power | External Memory Interface Digital Input/Output Supply (DDR 2.5 V or SDR 3.3 V). |
| AA19 | GND | Ground | Ground. |
| AA20 | NC | No connect | No Connect. |
| AA21 | NC | No connect | No Connect. |
| AA22 | SYNC2 | Miscellaneous analog | This is a synchronization on green or luma input (SOG/SOY) used in embedded synchronization mode. User configurable. |
| AA23 | AIN4 | Analog video input | Analog Video Input Channel. |
| AB1 | P31 | Digital video output | Video Pixel Output Port. |
| AB2 | P32 | Digital video output | Video Pixel Output Port. |
| AB3 | P34 | Digital video output | Video Pixel Output Port. |
| AB4 | NC | No connect | No Connect. |
| AB5 | GND | Ground | Ground. |
| AB6 | DVDDIO | Power | Digital I/O Supply Voltage (3.3 V). |
| AB7 | SDRAM_A8 | SDRAM interface | Address Output. Interface to external RAM address lines. |
| AB8 | SDRAM_A4 | SDRAM interface | Address Output. Interface to external RAM address lines. |
| AB9 | SDRAM_A0 | SDRAM interface | Address Output. Interface to external RAM address lines. |
| AB10 | SDRAM_BA1 | SDRAM interface | Bank Address Output. Interface to external RAM bank address lines. |
| AB11 | SDRAM_CAS | SDRAM interface | Column Address Select Command Signal. One of four command signals to the external SDRAM. |
| AB12 | VDD_SDRAM | Power | External Memory Interface Digital Input/Output Supply (DDR 2.5 V or SDR 3.3 V). |
| AB13 | SDRAM_DQ4 | SDRAM interface | Data Bus. Interface to external RAM 16-bit data bus. |
| AB14 | SDRAM_DQ0 | SDRAM interface | Data Bus. Interface to external RAM 16-bit data bus. |
| AB15 | SDRAM_DQ13 | SDRAM interface | Data Bus. Interface to external RAM 16-bit data bus. |
| AB16 | SDRAM_DQ9 | SDRAM interface | Data Bus. Interface to external RAM 16-bit data bus. |

| Pin No. | Mnemonic | Type | Description |
|---------|-------------|----------------------|---|
| AB17 | SDRAM_CK | SDRAM interface | Differential Clock Output. All address and control output signals to the RAM should be sampled on the positive edge of SDRAM_CK and on the negative edge of SDRAM_CK. |
| AB18 | VDD_SDRAM | Power | External Memory Interface Digital Input/Output Supply (DDR 2.5 V or SDR 3.3 V). |
| AB19 | GND | Ground | Ground. |
| AB20 | SYNC1 | Miscellaneous analog | This is a synchronization on green or luma input (SOG/SOY) used in embedded synchronization mode. User configurable. |
| AB21 | HS_IN1/TRI5 | Miscellaneous analog | HS on Graphics Port 1 (HS_IN1). The HS input signal is used for 5-wire timing mode. Trilevel/Bilevel Input on the SCART or D-Terminal Connector (TRI5). (Selection available via the I ² C.) |
| AB22 | VS_IN1/TRI6 | Miscellaneous analog | VS on Graphics Port 1 (VS_IN2). The VS input signal is used for 5-wire timing mode. Trilevel/Bilevel Input on the SCART or D-Terminal Connector (TRI6). (Selection available via the I ² C.) |
| AB23 | GND | Ground | Ground. |
| AC1 | GND | Ground | Ground. |
| AC2 | P33 | Digital video output | Video Pixel Output Port. |
| AC3 | P35 | Digital video output | Video Pixel Output Port. |
| AC4 | NC | No connect | No Connect. |
| AC5 | GND | Ground | Ground. |
| AC6 | DVDDIO | Power | Digital I/O Supply Voltage (3.3 V). |
| AC7 | SDRAM_A7 | SDRAM interface | Address Output. Interface to external RAM address lines. |
| AC8 | SDRAM_A3 | SDRAM interface | Address Output. Interface to external RAM address lines. |
| AC9 | SDRAM_A10 | SDRAM interface | Address Output. Interface to external RAM address lines. |
| AC10 | SDRAM_BA0 | SDRAM interface | Bank Address Output. Interface to external RAM bank address lines. |
| AC11 | SDRAM_WE | SDRAM interface | Write Enable Output Command Signal. One of four command signals to the external SDRAM. |
| AC12 | VDD_SDRAM | Power | External Memory Interface Digital Input/Output Supply (DDR 2.5 V or SDR 3.3 V). |
| AC13 | SDRAM_DQ3 | SDRAM interface | Data Bus. Interface to external RAM 16-bit data bus. |
| AC14 | SDRAM_VREF | SDRAM interface | 1.25 V Reference for DDR SDRAM Interface or 1.65 V for SDR. |
| AC15 | SDRAM_DQ14 | SDRAM interface | Data Bus. Interface to external RAM 16-bit data bus. |
| AC16 | SDRAM_DQ10 | SDRAM interface | Data Bus. Interface to external RAM 16-bit data bus. |
| AC17 | SDRAM_UDQS | SDRAM interface | Upper Data Strobe Pin. Data strobe pins are used for the RAM interface. This is an input when reading data from external memory and an output when writing data to external memory. It is edge-aligned with data when reading from external memory and centered with data when writing to external memory. SDRAM_UDQS corresponds to the data on SDRAM_DQ15 to SDRAM_DQ8. |
| AC18 | VDD_SDRAM | Power | External Memory Interface Digital Input/Output Supply (DDR 2.5 V or SDR 3.3 V). |
| AC19 | GND | Ground | Ground. |
| AC20 | AIN1 | Analog video input | Analog Video Input Channel. |
| AC21 | AIN2 | Analog video input | Analog Video Input Channel. |
| AC22 | AIN3 | Analog video input | Analog Video Input Channel. |
| AC23 | GND | Ground | Ground. |

POWER SUPPLY SEQUENCING

POWER-UP SEQUENCE

The recommended power-up sequence of the ADV7844 is as follows:

1. 3.3 V supplies
2. 2.5 V supply (applies only if using DDR memory)
3. 1.8 V supplies

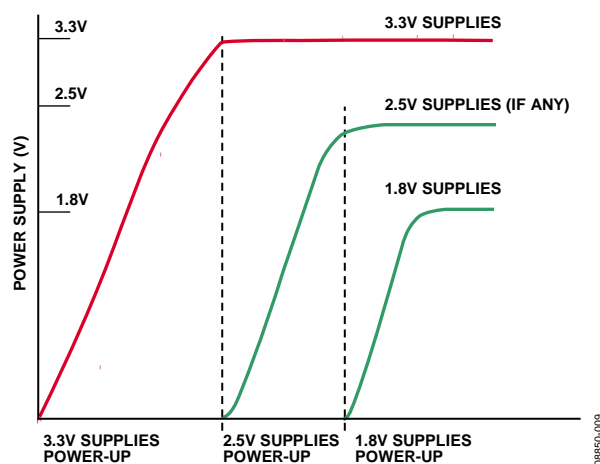


Figure 8. Recommended Power-Up Sequence

Notes

Reset should be held low while the supplies are being powered up.

- 3.3 V supplies should be powered up first.
- 2.5 V supply should be powered after the 3.3 V supplies are established but before the 1.8 V supplies.
- 1.8 V supplies should be powered up last.

The ADV7844 can alternatively be powered up by asserting all supplies simultaneously.

In this case, care must be taken to ensure that a lower rated supply does not go above a higher rated supply level, as the supplies are being established.

POWER-DOWN SEQUENCE

The ADV7844 supplies can be deasserted simultaneously as long as a higher rated supply does not go below a lower rated supply.

FUNCTIONAL OVERVIEW

HDMI RECEIVER

The ADV7844 front end incorporates a 4:1 multiplexed HDMI receiver with Xpressview fast switching technology and support for HDMI features including ARC and 3D TV. Building on the feature set of Analog Devices existing HDMI devices, the ADV7844 also offers support for all HD TV formats up to 12-bit, 1080p Deep Color and all display resolutions up to UXGA (1600 × 1200 at 60 Hz). Xpressview fast switching technology, using Analog Devices hardware-based HDCP engine that minimizes software overhead, allows switching between any two input ports in less than 1 second.

With the inclusion of HDCP 1.4, the ADV7844 can receive encrypted video content. The HDMI interface of the ADV7844 allows for authentication of a video receiver, decryption of encoded data at the receiver, and renewal of that authentication during transmission, as specified by the HDCP 1.4 protocol. Repeater support is also offered by the ADV7844.

The ADV7844 supports the audio return channel feature. There is a dedicated S/PDIF input on which audio can be received for retransmission on the HDMI input. A wide range of 3D video formats is supported, including frame packing 1080p 24 Hz, 720p 50 Hz, and 720p 60 Hz.

The HDMI receiver incorporates active equalization of the HDMI data signals. This equalization compensates for the high frequency losses inherent in HDMI and DVI cabling, especially at longer lengths and higher frequencies. It is capable of equalizing for cable lengths up to 30 meters to achieve robust receiver performance at even the highest HDMI data rates.

The HDMI receiver offers advanced audio functionality. It supports multichannel I²S audio for up to eight channels. It also supports a 6-DSD channel interface with each channel carrying an oversampled 1-bit representation of the audio signal as delivered on SACD. The ADV7844 can also receive HBR audio packet streams and outputs them through the HBR interface in an S/PDIF format conforming to the IEC60958 standard.

The receiver contains an audio mute controller that can detect a variety of conditions that may result in audible extraneous noise in the audio output. On detection of these conditions, the audio signal can be ramped to mute to prevent audio clicks or pops.

HDMI receiver features include:

- 4:1 multiplexed HDMI receiver
- HDMI, ARC, and 3D format support, DVI 1.0
- 225 MHz HDMI receiver
- Integrated equalizer
- High-bandwidth Digital Content Protection (HDCP 1.4) on background ports
- Internal HDCP keys
- 36-/30-bit Deep Color support
- PCM, HBR, and DSD audio packet support
- Repeater support
- Internal E-EDID RAM
- Hot plug assert output pin for each HDMI port
- CEC controller

ANALOG FRONT END

The ADV7844 analog front end comprises four 170 MHz, 12-bit ADCs that digitize the analog video signal before applying it to the standard definition processor (SDP) or component processor (CP). The analog front end uses differential channels to each ADC to ensure high performance in a mixed-signal application.

The front end also includes a 12-channel input mux that enables multiple video signals to be applied to the ADV7844 without the requirement of an external mux.

Current and voltage clamp control loops ensure that any dc offsets are removed from the video signal. The clamps are positioned in front of each ADC to ensure that the video signal remains within the range of the converter.

The ADCs are configured to run up to 8× oversampling mode when decoding composite or S-Video inputs. For component 525i, 625i, 525p, and 625p sources, 4× oversampling is performed. All other video standards are 1× oversampled. Oversampling the video signals reduces the cost and complexity of external antialiasing filters with the benefit of an increased signal-to-noise ratio (SNR).

Optional internal antialiasing filters with programmable bandwidth are positioned in front of each ADC. These filters can be used to band limit video signals, removing spurious, out-of-band noise.

The ADV7844 can support the simultaneous processing of CVBS and RGB standard definition signals to enable SCART compatibility and overlay functionality. A combination of CVBS and RGB inputs can be mixed with the output under the control of I²C registers.

Analog front-end features include:

- Four 170 MHz, NSV, 12-bit ADCs that enable true 12-bit video decoding
- 12-channel analog input mux that enables multiple source connections without the requirement of an external mux
- Four current and voltage clamp control loops that ensure any dc offsets are removed from the video signal
- SCART functionality and SD RGB overlay on CVBS controlled by fast blank input
- SCART source switching detection through the TRI1 to TRI8 inputs
- Four programmable antialiasing filters

STANDARD DEFINITION PROCESSOR

The SDP is capable of decoding a large selection of baseband video signals in composite and S-Video formats. The video standards supported by the SDP include PAL, PAL 60, PAL M, PAL N, PAL NC, NTSC M/J, NTSC 4.43, and SECAM. The ADV7844 can automatically detect the video standard and process it accordingly.

The SDP has a 3D temporal comb filter and a five-line adaptive 2D comb filter that gives superior chrominance and luminance separation when decoding a composite video signal. This highly adaptive filter automatically adjusts its processing mode according to the video standard and signal quality with no user intervention required. The SDP has an IF filter block that compensates for attenuation in the high frequency chroma spectrum due to a tuner SAW filter. The SDP has specific luminance and chrominance parameter controls for brightness, contrast, saturation, and hue.

The ADV7844 implements a patented Adaptive Digital Line Length Tracking (ADLLT™) algorithm to track varying video line lengths from sources such as a VCR. ADLLT enables the ADV7844 to track and decode poor quality video sources (such as VCRs) and noisy sources (such as tuner outputs, VCR players, and camcorders). Frame TBC ensures stable clock synchronization between the decoder and the downstream devices.

The SDP also contains both a luma transient improvement (LTI) block and a chroma transient improvement (CTI) block. These increase the edge rate on the luma and chroma transitions, resulting in a sharper video image.

The SDP has a Macrovision® detection circuit that allows Type I, Type II, and Type III Macrovision protection levels. The decoder is also fully robust to all Macrovision signal inputs.

SDP features include:

- Advanced adaptive 3D comb (using either external DDR or SDR SDRAM memory)
- Adaptive 2D five-line comb filters for NTSC and PAL that give superior chrominance and luminance separation for composite video
- Full automatic detection and autoswitching of all worldwide standards (PAL, NTSC, and SECAM)
- Automatic gain control with white peak mode that ensures the video is always processed without loss of the video processing range
- Proprietary architecture for locking to weak, noisy, and unstable sources from VCRs and tuners
- IF filter block that compensates for high frequency luma attenuation due to tuner SAW filter
- LTI and CTI
- Vertical and horizontal programmable luma peaking filters
- 8× oversampling (108 MHz) for CVBS, and S-Video modes
- Line-locked clock (LLC) output
- Free-run output mode that provides stable timing when no video input is present or video lock is lost

- Internal color bar test pattern
- Advanced TBC with frame synchronization, which ensures nominal clock and data for nonstandard input
- Interlace-to-progressive conversion for 525i and 625i formats, enabling direct drive of HDMI Tx devices
- Color controls that include hue, brightness, saturation, and contrast

COMPONENT PROCESSOR

The CP section of the ADV7844 is capable of decoding and digitizing a wide range of component video formats in any color space. Component video standards supported by the CP are 525i, 625i, 525p, 625p, 720p, 1080i, 1080p, 1250i, VGA up to UXGA at 60 Hz, and many other standards.

The any-to-any, 3×3 CSC matrix is placed between the analog front end and the CP section. This enables YPbPr to RGB and RGB to YCbCr conversions. Many other standards of color space can be implemented using the color space converter.

The CP section contains circuitry to enable the detection of Macrovision encoded YPbPr signals for 525i, 625i, 525p, and 625p. It is designed to be fully robust when decoding these types of signals.

VBI extraction of CGMS data is performed by the CP section of the ADV7844 for interlaced, progressive, and high definition scanning rates. The data extracted can be read back over the I²C interface.

CP features include:

- 525i, 625i, 525p, 625p, 720p, 1080i, 1080p, and many other HDTV formats are supported
- Supports 720p 24 Hz/25 Hz formats
- Manual adjustments including gain (contrast), offset (brightness), hue, and saturation
- Support for analog component YPbPr and RGB video formats with embedded synchronization, composite synchronization or separate HS and VS
- Any-to-any, 3×3 CSC matrix that supports YCbCr-to-RGB and RGB-to-YCbCr, fully programmable or preprogrammable configurations
- Synchronization source polarity detector (SSPD) that determines the source and polarity of the synchronization signals that accompany the input video
- Macrovision copy protection detection on component formats (525i, 625i, 525p, and 625p)
- Free-run output mode that provides stable timing when no video input is present or video lock is lost
- Arbitrary pixel sampling support for nonstandard video sources
- 170 MHz conversion rate, which supports RGB input resolutions up to 1600×1200 at 60 Hz
- Automatic or manual clamp-and-gain controls for graphics modes
- Contrast, brightness, hue, and saturation controls

- 32-phase ADC DLL that allows optimum pixel clock sampling
- Automatic detection of synchronization source and polarity by SSPD block
- Standard identification enabled by STDI block
- RGB that can be color space converted to YCbCr and decimated to a 4:2:2 format for video-centric back-end IC interfacing
- Data enable (DE) output signal supplied for direct connection to HDMI/DVI Tx IC

OTHER FEATURES

The ADV7844 has HS, VS, FIELD, and DE output signals with programmable position, polarity, and width, and two I²C host port interfaces (control and VBI).

The ADV7844 has two programmable interrupt request output pins, INT1 and INT2. It also features a number of low power modes and a full power-down mode.

The ADV7844 is provided in a 19 mm × 19 mm, RoHS-compliant CSP_BGA package, and is specified over the 0°C to +70°C temperature range.

For more detailed product information about the ADV7844, contact your local Analog Devices sales office.

EXTERNAL MEMORY REQUIREMENTS

The ADV7844 uses external SD RAM for 3D comb and frame synchronizer. The ADV7844 supports either SDR or DDR SD RAM.

SINGLE DATA RATE (SDR)

The ADV7844 can use SDR external memory to provide 3D comb or frame synchronizer operation nonconcurrently.

There is a 64 Mb SDR SDRAM minimum memory requirement. The required memory architecture is four banks of 1 Mb \times 16 (4M16) with a speed grade of 133 MHz at CAS latency (CL) 3. Using 22 Ω series termination resistors is recommended for this configuration.

Recommended SDR memory that is compatible with the ADV7844 includes Winbond W9864G6PH-7.

DOUBLE DATA RATE (DDR)

The ADV7844 can use DDR external memory to simultaneously provide 3D comb and frame synchronizer operation.

There is a 128 Mb DDR SDRAM minimum memory requirement. The required memory architecture is four banks of 2 Mb \times 16 (8M16) with a speed grade of 133 MHz at CL 2.5. Using 22 Ω series termination resistors is recommended for this configuration.

Recommended DDR memory that is compatible with the ADV7844 includes the K4H561638J-LCB3 from Samsung, the MT46V16M16P-6T from Micron Technology, Inc., and the H5DU1262GTR-E3C from Hynix, Inc.

PIXEL INPUT/OUTPUT FORMATTING

The output section of the ADV7844 is highly flexible. The pixel output bus can support up to 36-bit 4:4:4. The pixel data supports both single and double data rates modes. In SDR mode, a 16-/20-/24-bit 4:2:2 or 24-/30-/36-bit 4:4:4 output is possible. In DDR mode, the pixel output port can be configured in 8-/10-/12-bit 4:2:2 modes or 24-/30-/36-bit 4:4:4 modes. Bus rotation and bus inversion are also supported. All output modes are controlled via I²C controls.

PIXEL DATA OUTPUT MODES FEATURES

The output pixel port features include the following:

- 8-/10-/12-bit ITU-R BT.656 4:2:2 with embedded time codes and/or HS, VS, and FIELD output signals
- SDR 16-/20-/24-/30-/36 bit with embedded time codes and/or HS and VS/FIELD pin timing
- DDR 8-/10-/12-bit 4:2:2 with embedded time codes and/or HS, VS, and FIELD output signals
- DDR 24-/30-/36 bit 4:4:4 with embedded time codes and/or HS, VS, and FIELD output signals

Note that DDR modes are supported up to 54 MHz by characterization.

REGISTER MAP ARCHITECTURE

The registers of the ADV7844 are controlled via a 2-wire serial (I²C-compatible) interface. The ADV7844 has 12 maps. The IO map has a static I²C address. All other map addresses must be

programmed; this ensures no addressing clashes on the system. Figure 9 shows the register map architecture.

Table 8.

| Register Map Name | Default Address | Programmable Address | Location at Which Address Can Be Programmed |
|-------------------|-----------------|----------------------|---|
| IO Map | 0x40 | Not programmable | Not applicable |
| CP Map | 0x00 | Programmable | IO map, Register 0xFD |
| SDP Map | 0x00 | Programmable | IO map, Register 0xF1 |
| SDP_IO Map | 0x00 | Programmable | IO map, Register 0xF2 |
| VDP Map | 0x00 | Programmable | IO map, Register 0xFE |
| AVLINK Map | 0x00 | Programmable | IO map, Register 0xF3 |
| CEC Map | 0x00 | Programmable | IO map, Register 0xF4 |
| HDMI Map | 0x00 | Programmable | IO map, Register 0xFB |
| EDID Map | 0x00 | Programmable | IO map, Register 0xFA |
| Repeater Map | 0x00 | Programmable | IO map, Register 0xF9 |
| AFE, DPLL Map | 0x00 | Programmable | IO map, Register 0xF8 |
| InfoFrame Map | 0x00 | Programmable | IO map, Register 0xF5 |

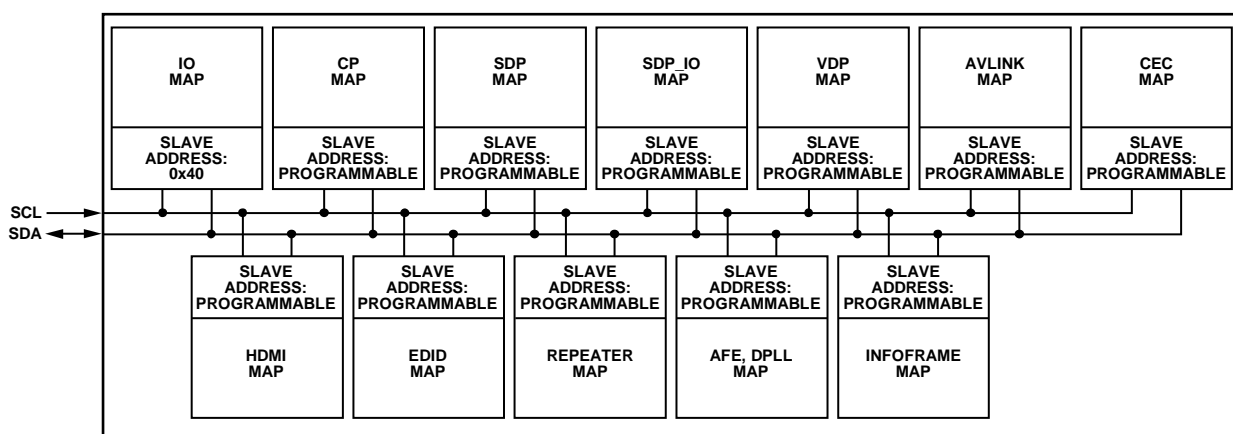
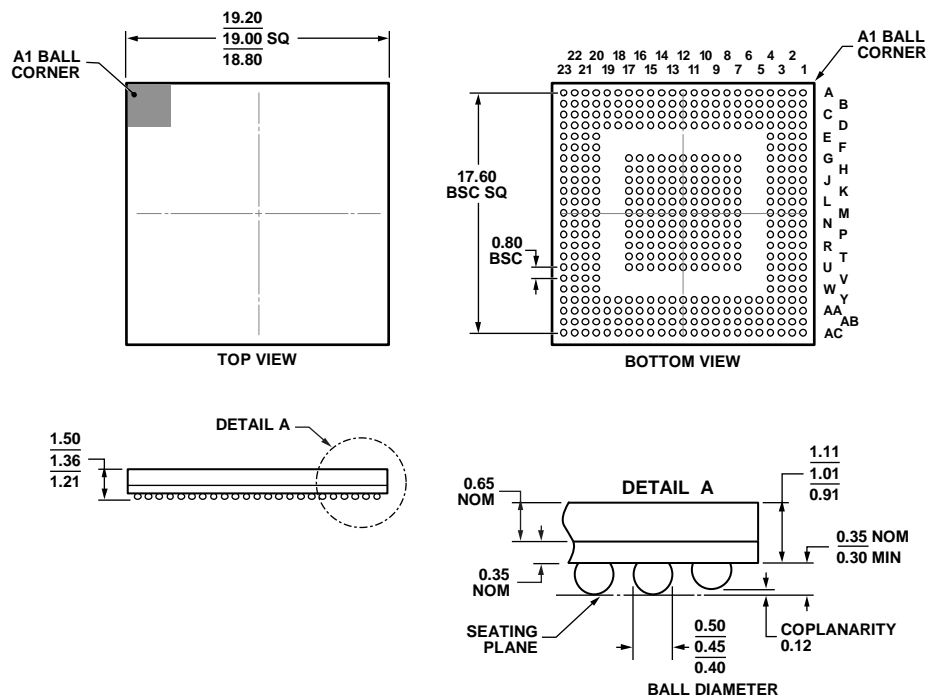


Figure 9. Register Map Architecture

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OUTLINE DIMENSIONS



COMPLIANT TO JEDEC STANDARDS MO-275-PPAB-2.

Figure 10. 425-Ball Chip Scale Package Ball Grid Array [CSP_BGA]
(BC-425-1)

Dimensions shown in millimeters

11-22-2011-A

ORDERING GUIDE

| Model ¹ | Notes | Temperature Range | Package Description | Package Option |
|--------------------|---------|-------------------|---|----------------|
| ADV7844KBCZ-5 | 2, 3 | 0°C to +70°C | 425-Ball Chip Scale Package Ball Grid Array [CSP_BGA] | BC-425-1 |
| EVAL-ADV7844EB1Z | 3, 4, 5 | 0°C to +70°C | Front-End Evaluation Board | |

¹ Z = RoHS-Compliant Part.

² Speed grade: 5 = 170 MHz.

³ This part is programmed with internal HDCP keys. Customers must have HDCP adopter status (consult Digital Content Protection, LLC, for licensing requirements) to purchase any components with internal HDCP keys.

⁴ An ATV motherboard is also required to process the ADV7844 digital outputs and achieve video output. An ATV video output board is optional to evaluate performance through an HDMI transmitter and video encoder.

⁵ Front-end board for the ATV video evaluation platform, fitted with ADV7844KBCZ-5 decoder.

NOTES

NOTES

I²C refers to a communications protocol originally developed by Phillips Semiconductors (now NXP Semiconductors).

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