**1 Introduction**

**1.1 Introduction to DM6467 DMSoC (VPIF, McASP, GPIO, I2C)**

There are four DM6467 internal peripherals involved in implementing the HDMI applications discussed in this application note. These peripherals are: video port interface (VPIF), multichannel audio serial port (McASP), general-purpose input/output (GPIO), and inter-integrated circuit (I2C). The main features of each peripheral are discussed below.

The DM6467 VPIF is a receiver and transmitter of video data. It has both receiver and transmitter logic. The receiver is capable of receiving dual-channel 8-bit BT.656 and single-channel 16-bit BT.1120 (720p, 1080i, and 1080-30p), as well as 8/10/12-bit raw data. The transmitter is capable of transmitting dual-channel 8-bit BT.656 and single-channel 16-bit BT.1120 (720p, 1080i, and 1080-30p). For more details on the functionality of VPIF, see the *TMS320DM646x DMSoC Video Port Interface (VPIF) User’s Guide* (SPRUER9).
1.2 Introduction to Sil9134 HDMI Transmitter

The Sil9134 HDMI deep color transmitter is HDMI 1.3, high-bandwidth digital content protection (HDCP) 1.2, and digital video interface (DVI) 1.0 compliant. Some of the main features of Sil9134 are introduced below. For more details on the functionality, visit http://www.siliconimage.com.

- Integrated transition minimized differential signaling (TMD) core operating between 25 – 225 MHz and resolution up to 1080P
- Flexible video interface support
  - 24/30/36-bit RGB/YCbCr 4:4:4
  - 16/20/24-bit YCbCr 4:2:2
  - 8/10/12-bit YCbCr 4:2:2 (BT.656)
  - 12/15/18-bit dual-edge clocking input
  - BTA-T1004 video input
- Flexible video format conversion
- Flexible digital audio interface support
  - High bit rate compressed DTS HD and Dolby True HD audio
  - Dedicated 4-port (8-channel) I2S input
  - Dedicated 4-port (8-channel) DSD input for super audio CD (SACD)
  - Dedicated 1-port Sony/Philips digital interconnect format (SPDIF) input
  - IEC60958 or IEC61937 compatible
- Master I2C interface for DDC connection and Slave I2C interface for control from external processor
- Integrated HDCP encryption engine for transmitting protected audio and video content
- Monitor detection supported through hot plug and receiver detection
- Programmable data enable generator and sync extraction
1.3 Introduction to SiI9135 HDMI Receiver

The SiI9135 HDMI receiver with enhanced audio and deep color outputs is HDMI1.3, HDCP 1.1, and DVI 1.0 compliant. Some of the main features of SiI9135 are introduced below. For more details on the functionality, visit [http://www.siliconimage.com](http://www.siliconimage.com).

- Integrated TMDs core operating between 25 – 225 MHz and resolution up to 1080P
- Flexible video interface support
  - 36-bit RGB/YCbCr 4:4:4
  - 16/20/24-bit YCbCr 4:2:2
  - 8/10/12-bit YCbCr 4:2:2 (BT.656)
  - 12/15/18-bit dual-edge clocking output
- Flexible video format conversion
- Flexible digital audio interface support
  - High bit rate compressed DTS HD and Dolby True HD audio
  - Shared 4-port (8-channel) I2S input
  - Shared 3-port (6-channel) DSD input for SACD
  - Shared 1-port SPDIF input
  - IEC60958 or IEC61937 compatible
- Slave I2C interface for DDC connection and Slave I2C interface for control from external processor
- Integrated HDCP encryption engine for receiving protected audio and video content

2 HDMI Transmitter Logic

The transmitter side logic block diagram is detailed in Figure 1. There are three main blocks in this diagram: the DM6467 evaluation module (EVM) (DM6467 DMSoC), the SiI9134 deep color transmitter, and a generic HDMI connector.

![Figure 1. Transmit Logic Block Diagram](image-url)
• Signal connection between DM6467 EVM (DM6467 DMSoC) and SiI9134
  – Audio
    • 4-port I2S: AHCLKX0 → MCLK, ACLKX0 → SCK, AFSX0 → WS, and AXR0[3:0] → SD[3:0]
    • 1-port SPDIF: AHCLKX0 → MCLK and AXR0[0] → SPDIF
    • 4-port DSD (not supported by DM6467): DCLK, DL[3:0], and DR[3:0] need to be properly terminated
  – Video
    • CLK: VP_CLKO2 → IDCK
    • Data
      • Y/C 4:2:2: (Y) VP_DOUT[7:0] → D[23:16], (C) VP_DOUT[15:8] → D[35:28]
      • Y/C 4:2:2 muxed: (Y/C) VP_DOUT[15:8] → D[23:16], D[35:28] not connected
      • VSYNC, HSYNC, DE (not supported by DM6467): VSYNC, HSYNC, and DE need to be properly terminated
  – I2C Control (DM6467 Master, SiI9134 Slave)
    • CLK: SCL → CSCL
    • Data: SDA ↔ CSDA
    – INT (interrupt signal from SiI9134 to DM6467 via GPIO)
• Signal connection between SiI9134 and generic HDMI connector
  – Three transition minimized differential signaling (TMDS) pair data channel
    • TX0+ → Pin 7, TX0- → Pin 9, TX1+ → Pin 4, TX1- → Pin 6, TX2+ → Pin 1, TX2- → Pin 3
  – One TMDS pair clock channel
    • TXC+ → Pin 10, TXC- → Pin 12
  – I2C control connection (SiI9134 Master)
    • DSDA ↔ Pin 16, DSCL ↔ Pin 15
  – Hot Plug Detect (HPD)
    • HPD ↔ Pin 19
  – Consumer Electronics Control (CEC) currently unsupported
    • Pin 13 needs to be properly terminated
• Additional connection considerations
  – Optional electrostatic discharge (ESD) protection and choke logic support
  – On-board logic or DM6467 GPIO controlled SiI9134 RESET signal
  – SiI9134 signals that need to be properly terminated: CI2CA, EXT_SWING, power, and ground signals

To summarize, the following HDMI audio and video output modes are supported in this application note:
• Audio output modes
  – Up to 7.1 (4-port I2S)
  – 1-port SPDIF
• Video output modes
  – BT.656
  – BT.1120 (720p, 1080i, and 1080-30p)
3 HDMI Receiver Logic

The receiver side logic block diagram is detailed in Figure 2. There are three main blocks in this diagram: the DM6467 EVM (DM6467 DMSoc), the Sil9135 receiver, and two generic HDMI connectors.

Figure 2. Receive Logic Block Diagram

- Signal connection between DM6467 EVM (DM6467 DMSoc) and Sil9135
  - Audio
    - 4-port I2S: AHCLKR0 ← MCLK, ACLKR0 ← SCK, AFSR0 ← WS, and AXR0[3:0] ← SD[3:0]
    - MUTEOUT (not supported by DM6467): MUTEOUT needs to be properly terminated
  - Video
    - CLK: VP_CLKIN0 ← ODCK
    - Data
      - VSYNC, HSYNC, DE, EVNODD (not supported by DM6467): VSYNC, HSYNC, DE, and EVNODD need to be properly terminated
  - I2C Control (DM6467 Master, Sil9135 Slave)
    - CLK: SCL → CSCL
    - Data: SDA ↔ CSDA
    - INT (interrupt signal from Sil9135 to DM6467 via GPIO)
    - SCDT (active HDMI video indicator from Sil9135 to DM6467 via GPIO)
• Signal connection between SI9135 and generic HDMI connectors
  – Three transition minimized differential signaling (TMDS) pair data channel
    • To connector 0: R0X0+ ← Pin 7, R0X0- ← Pin 9, R0X1+ ← Pin 4, R0X1- ← Pin 6, R0X2+ ← Pin 1, R0X2- ← Pin 3
    • To connector 1: R1X0+ ← Pin 7, R1X0- ← Pin 9, R1X1+ ← Pin 4, R1X1- ← Pin 6, R1X2+ ← Pin 1, R1X2- ← Pin 3
  – One TMDS pair clock channel
    • To connector 0: R0C+ ← Pin 10, R0C- ← Pin 12
    • To connector 1: R1C+ ← Pin 10, R1C- ← Pin 12
  – I2C control connection (SI9135 Slave)
    • To connector 0: DSDA0 ← Pin 16, DSCL0 ← Pin 15
    • To connector 1: DSDA1 ← Pin 16, DSCL1 ← Pin 15
  – Consumer electronics control (CEC) currently unsupported
    • Pin 13 on both connectors need to be properly terminated

• Additional connection considerations
  – Optional ESD protection and choke logic support
  – External oscillator connected between XTALIN and XTALOUT for SI9135
  – On-board logic or DM6467 GPIO controlled SI9135 RESET signal
  – SI9135 signals that need to be properly terminated: CI2CA, R0PWR5V, R1PWR5V, power, and ground signals
  – Hot Plug Detect (HPD) signal from both HDMI connectors
    • Pin 19 on both connectors are fed directly from to DM6467 via GPIO

To summarize, the following HDMI audio and video input modes are supported in this application note:

• Audio input modes
  – Up to 7.1 (4-port I2S)

• Video input modes
  – BT.656
  – BT.1120 (720p, 1080i, and 1080-30p)

4 References

• TMS320DM646x DMSoC Multichannel Audio Serial Port (McASP) User’s Guide (SPRUE1)
• TMS320DM646x DMSoC Video Port Interface (VPIF) User’s Guide (SPRUE9)
• TMS320DM646x DMSoC General-Purpose Input/Output (GPIO) User’s Guide (SPRUE8)
• TMS320DM646x DMSoC Inter-Integrated Circuit (I2C) Module User’s Guide (SPRUE0)
• SI9134 HDMI Deep Color Transmitter Data Sheet (http://www.siliconimage.com/products/product.aspx?id=102)
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