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SEMTECH
GENNUM PRODUCTS

GS2972

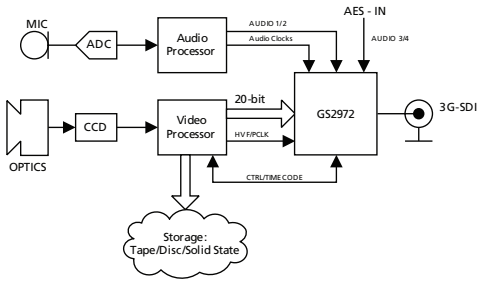
3G/HD/SD-SDI Serializer with Complete SMPTE Audio & Video Support

Key Features

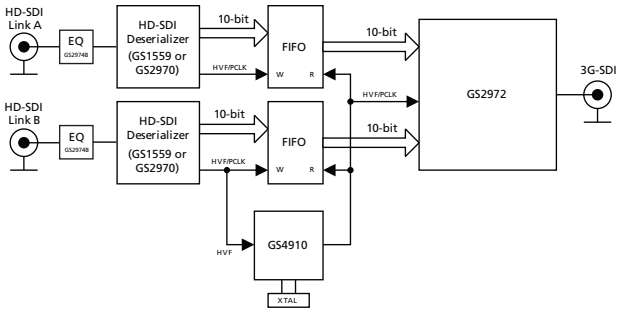
- Operation at 2.970Gb/s, 2.970/1.001Gb/s, 1.485Gb/s, 1.485/1.001Gb/s and 270Mb/s
- Supports SMPTE ST 425 (Level A and Level B), SMPTE ST 424, SMPTE ST 292, SMPTE ST 259-C and DVB-ASI
- Integrated Cable Driver
- Integrated, low-noise VCO
- Integrated Narrow-Bandwidth PLL
- Integrated Audio Embedder for up to 8 channels of 48kHz audio
- Ancillary data insertion
- Optional conversion from SMPTE ST 425 Level A to Level B for 1080p 50/60 4:2:2 10-bit
- Parallel data bus selectable as either 20-bit or 10-bit
- SMPTE video processing including TRS calculation and insertion, line number calculation and insertion, line based CRC calculation and insertion, illegal code re-mapping, SMPTE ST 352 payload identifier generation and insertion
- GSPI host interface
- +1.2V digital core power supply, +1.2V and +3.3V analog power supplies, and selectable +1.8V or +3.3V I/O power supply
- -20°C to +85°C operating temperature range
- Low power operation (typically at 400mW, including Cable Driver)
- Small 11mm x 11mm 100-ball BGA package
- Pb-free and RoHS compliant

Applications

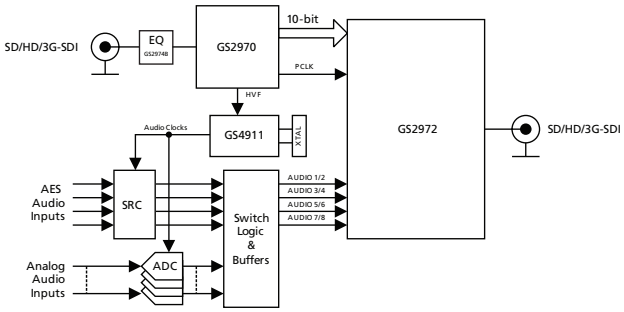
Application: 1080p 50/60 Camera/Camcorder



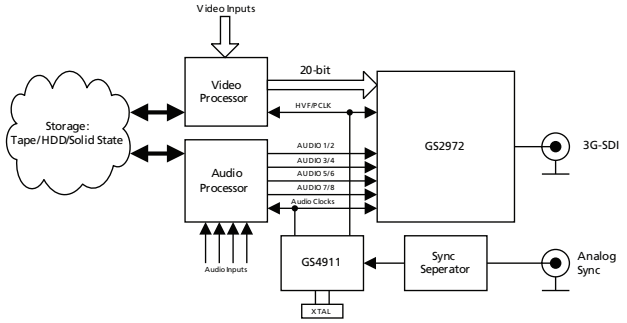
Application: Dual Link (HD-SDI) to Single Link (3G-SDI) Converter



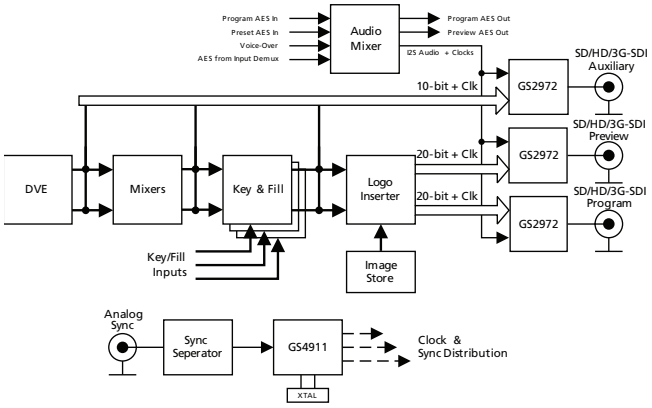
Application: Multi-format Audio Embedder Module



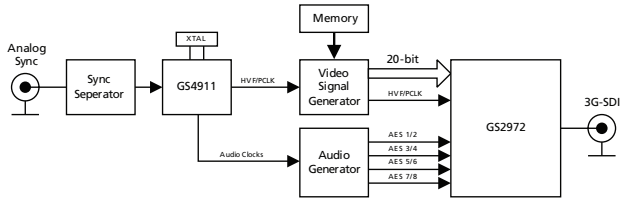
Application: Multi-format Digital VTR/Video Server



Application: Multi-format Presentation Switcher (Output Stage)



Application: 3Gb/s SDI Test Signal Generator



Description

The GS2972 is a complete SDI Transmitter, generating a SMPTE ST 424, SMPTE ST 292, SMPTE ST 259-C or DVB-ASI compliant serial digital output signal.

The integrated Narrow BW PLL allows the device to accept parallel clocks with high input jitter, and still provide a SMPTE compliant serial digital output.

The device can operate in four basic user selectable modes: SMPTE mode, DVB-ASI mode, Data-Through mode, or Standby mode.

In SMPTE mode, the GS2972 performs all SMPTE processing features. Both SMPTE ST 425 Level A and Level B formats are supported with optional conversion from Level A to Level B for 1080p 50/60 4:2:2 10-bit.

In DVB-ASI mode, the device will perform 8b/10b encoding prior to transmission.

In Data-Through mode, all SMPTE and DVB-ASI processing is disabled. The device can be used as a simple parallel to serial converter.

The device can also operate in a lower power Standby mode. In this mode, no signal is generated at the output.

The GS2972 integrates a fully SMPTE-compliant Cable Driver for SMPTE ST 259-C, SMPTE ST 292 and SMPTE ST 424 interfaces. It features automatic dual slew-rate selection, depending on 3Gb/s or HD or SD operational requirements.

In accordance with SMPTE ST 272 and SMPTE ST 299, up to eight channels (two audio groups) of serial digital audio may be embedded into the video data stream.The input audio signal formats supported by the device include AES/EBU, I^2S and serial audio. 16, 20 and 24-bit audio formats are supported at 48kHz synchronous for SD modes and 48kHz synchronous or asynchronous in HD, 3Gb/s modes.

Functional Block Diagram

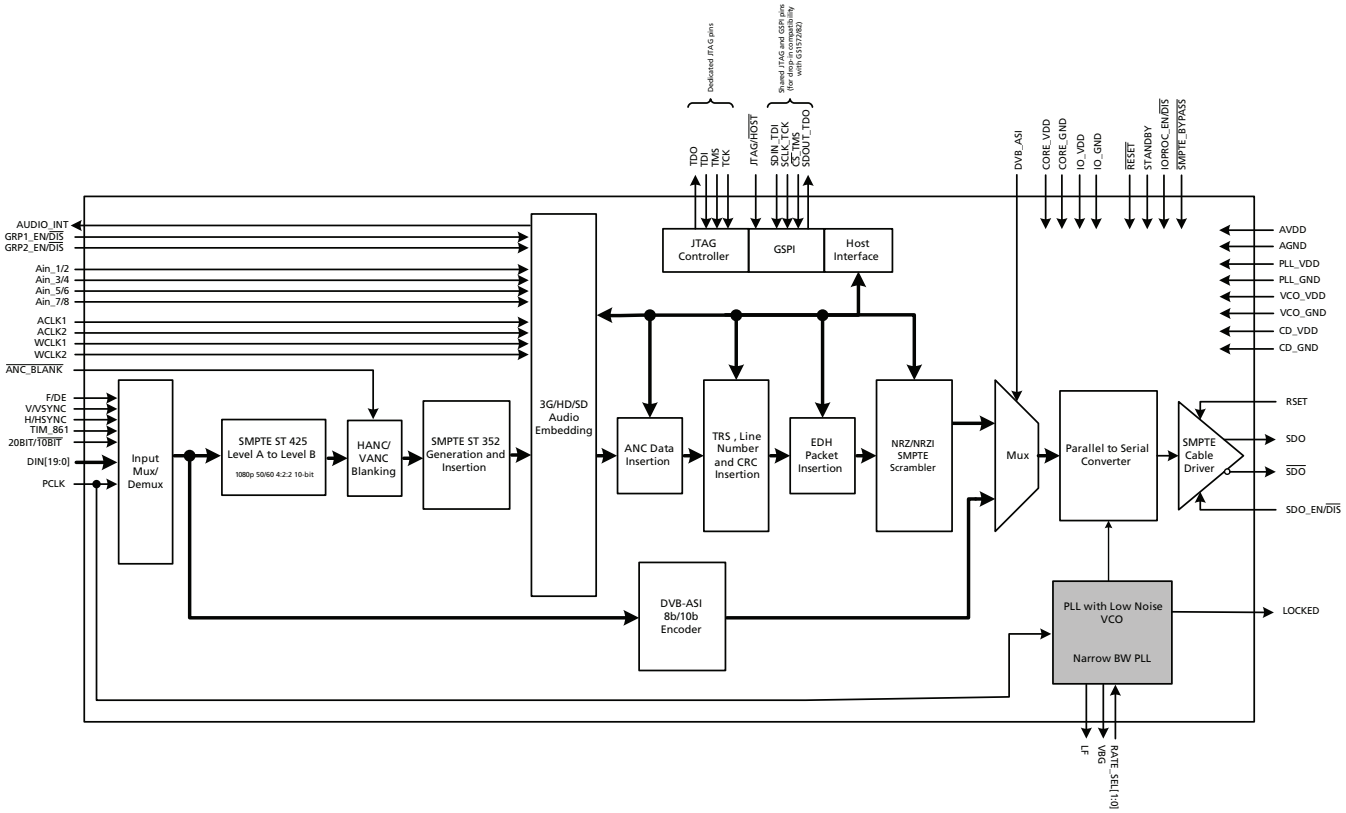


Figure A: GS2972 Functional Block Diagram

Revision History

Version	ECO	PCN	Date	Changes and/or Modifications
9	014806	–	September 2013	Updates throughout the document.
8	011355	–	February 2013	Updated to the Semtech Template.
7	155820	56554	February 2011	Added section 4.7.22.2 Blanking Values Following Audio Data Packet Insertion.
6	155608	–	January 2011	Clarified the function of the ACS_REGEN bit in Section 4.7.11 Audio Channel Status.
5	155080	56059	October 2010	Revised power rating in standby mode. Documented CSUM behaviour in Section 4.8, Section 4.9.4 and Video Core Configuration and Status Registers.
4	153717	–	March 2010	Updates throughout entire document. Added Figure 4-2, Figure 4-3 and Figure 4-4. Correction to registers 040h to 13Fh in Table 4-34: Video Core Configuration and Status Registers.
3	152220	–	July 2009	Updated Device Latency numbers in 2.4 AC Electrical Characteristics. Updates to 4.8 ANC Data Insertion. Replaced 7.3 Marking Diagram.
2	151320	–	January 2009	Correction to timing values in Table 4-1: GS2972 Digital Input AC Electrical Characteristics.
1	150803	–	December 2008	Converted to Data Sheet. Updates to all sections.
0	150717	–	October 2008	Converted to Preliminary Data Sheet.
D	149428	–	August 2008	Updated Typical Application Circuit. Applied new format to the document. Updates to all sections.
C	148810	–	February 2008	Updates to all sections.
B	148770	–	December 2007	Updates and revised 5.1 Typical Application Circuit.
A	147987	–	December 2007	New Document.

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1. Pin Out

1.1 Pin Assignment

	1	2	3	4	5	6	7	8	9	10
A	DIN17	DIN18	F/DE	H/HSYNC	CORE_VDD	PLL_VDD	LF	VBG	RSV	A_VDD
B	DIN15	DIN16	DIN19	PCLK	CORE_GND	PLL_VDD	VCO_VDD	VCO_GND	A_GND	A_GND
C	DIN13	DIN14	DIN12	V/VSYNC	CORE_GND	PLL_GND	PLL_GND	PLL_GND	CD_GND	SDO
D	DIN11	DIN10	STANDBY	SDO_EN/$\overline{\text{DIS}}$	RSV	RSV	RSV	RSV	CD_GND	$\overline{\text{SDO}}$
E	CORE_VDD	CORE_GND	RATE_SEL0	RATE_SEL1	CORE_GND	CORE_GND	TDI	TMS	CD_GND	CD_VDD
F	DIN9	DIN8	DETECT_TRS	RSV	CORE_GND	CORE_GND	RSV	TDO	CD_GND	RSET
G	IO_VDD	IO_GND	TIM_861	$\overline{\text{20bit}}$/10bit	DVB_ASI	$\overline{\text{SMPTE\_BYPASS}}$	IOPROC_EN/$\overline{\text{DIS}}$	$\overline{\text{RESET}}$	CORE_GND	CORE_VDD
H	DIN7	DIN6	$\overline{\text{ANC\_BLANK}}$	LOCKED	GRP2_EN/$\overline{\text{DIS}}$	GRP1_EN/$\overline{\text{DIS}}$	AUDIO_INT	$\overline{\text{JTAG/HOST}}$	IO_GND	IO_VDD
J	DIN5	DIN4	DIN1	AIN_5/6	WCLK2	AIN_1/2	WCLK1	TCK	SDOUT_TDO	SCLK_TCK
K	DIN3	DIN2	DIN0	AIN_7/8	ACLK2	AIN_3/4	ACLK1	CORE_VDD	$\overline{\text{CS}}$_TMS	SDIN_TDI

Figure 1-1: Pin Assignment

1.2 Pin Descriptions

Table 1-1: Pin Descriptions

Pin Number	Name	Timing	Type	Description	
B3, A2, A1, B2, B1, C2, C1, C3, D1, D2	DIN[19:10]		Input	PARALLEL DATA BUS. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility.	
				20-bit mode 20BIT/$\overline{10BIT}$ = HIGH	Data Stream 1/Luma data input in SMPTE mode ($\overline{SMPTE\_BYPASS}$ = HIGH) Data input in data through mode ($\overline{SMPTE\_BYPASS}$ = LOW)
				10-bit mode 20BIT/$\overline{10BIT}$ = LOW	Multiplexed Data Stream 1/Luma and Data Stream 2/Chroma data input in SMPTE mode ($\overline{SMPTE\_BYPASS}$ = HIGH) Data input in data through mode ($\overline{SMPTE\_BYPASS}$ = LOW) DVB-ASI data input in DVB-ASI mode ($\overline{SMPTE\_BYPASS}$ = LOW) (DVB_ASI = HIGH)
A3	F/DE	Synch-ronous with PCLK	Input	PARALLEL DATA TIMING. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. TIM_861 = LOW: Used to indicate the ODD / EVEN field of the video signal when DETECT_TRS is set LOW. The device will set the F bit in all outgoing TRS signals for the entire period that the F input signal is HIGH (IOPROC_EN/$\overline{DIS}$ must also be HIGH). The F signal should be set HIGH for the entire period of field 2 and should be set LOW for all lines in field 1 and for all lines in progressive scan systems. The F signal is ignored when DETECT_TRS = HIGH. TIM_861 = HIGH: The DE signal is used to indicate the active video period when DETECT_TRS is LOW. DE is HIGH for active data and LOW for blanking. See Section 4.3 and Section 4.3.2 for timing details. The DE signal is ignored when DETECT_TRS = HIGH.	

Table 1-1: Pin Descriptions (Continued)

Pin Number	Name	Timing	Type	Description
A4	H/HSYNC	Synch-ronous with PCLK	Input	PARALLEL DATA TIMING. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. TIM_861 is LOW: The H signal is used to indicate the portion of the video line containing active video data, when DETECT_TRS is set LOW. Active Line Blanking The H signal should be LOW for the active portion of the video line. The signal goes LOW at the first active pixel of the line, and then goes HIGH after the last active pixel of the line. The H signal should be set HIGH for the entire horizontal blanking period, including both EAV and SAV TRS words, and LOW otherwise. TRS Based Blanking (H_CONFIG = 1_h) The H signal should be set HIGH for the entire horizontal blanking period as indicated by the H bit in the received TRS ID words, and LOW otherwise. TIM_861 = HIGH: The HSYNC signal indicates horizontal timing. See Section 4.3. When DETECT_TRS is HIGH, this pin is ignored at all times. If DETECT_TRS is set HIGH and TIM_861 is set HIGH, the DETECT_TRS feature will take priority.
A5, E1, G10, K8	CORE_VDD		Input Power	Power supply connection for digital core logic. Connect to +1.2V DC digital.
A6, B6	PLL_VDD		Input Power	Power supply pin for PLL. Connect to +1.2V DC analog.
A7	LF		Analog Output	Loop Filter component connection.
A8	VBG		Output	Bandgap voltage filter connection.
A9, D6, D7, D8, F4	RSV		–	These pins are reserved and should be left unconnected.
A10	A_VDD		Input Power	VDD for sensitive analog circuitry. Connect to +3.3VDC analog.
B4	PCLK		Input	PARALLEL DATA BUS CLOCK. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. 3G 20-bit mode: PCLK @ 148.5MHz 3G 10-bit mode DDR: PCLK @ 148.5MHz HD 20-bit mode: PCLK @ 74.25MHz HD 10-bit mode: PCLK @ 148.5MHz SD 20-bit mode: PCLK @ 13.5MHz SD 10-bit mode: PCLK @ 27MHz DVB-ASI mode: PCLK @ 27MHz
B5, C5, E2, E5, E6, F5, F6, G9	CORE_GND		Input Power	GND connection for digital logic. Connect to digital GND.

Table 1-1: Pin Descriptions (Continued)

Pin Number	Name	Timing	Type	Description
B7	VCO_VDD		Input Power	Power pin for VCO. Connect to +1.2V DC analog followed by an RC filter (see Typical Application Circuit on page 120). VCO_VDD is nominally 0.7V.
B8	VCO_GND		Input Power	Ground connection for VCO. Connect to analog GND.
B9, B10	A_GND		Input Power	GND pins for sensitive analog circuitry. Connect to analog GND.
C4	V/VSYNC	Synch-ronous with PCLK	Input	PARALLEL DATA TIMING. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. TIM_861 = LOW: The V signal is used to indicate the portion of the video field/frame that is used for vertical blanking, when DETECT_TRS is set LOW. The V signal should be set HIGH for the entire vertical blanking period and should be set LOW for all lines outside of the vertical blanking interval. The V signal is ignored when DETECT_TRS = HIGH. TIM_861 = HIGH: The VSYNC signal indicates vertical timing. See Section 4.3 for timing details. The VSYNC signal is ignored when DETECT_TRS = HIGH.
C6, C7, C8	PLL_GND		Input Power	Ground connection for PLL. Connect to analog GND.
C9, D9, E9, F9	CD_GND		Input Power	Ground connection for the serial digital cable driver. Connect to analog GND.
C10, D10	SDO, $\overline{\text{SDO}}$		Output	Serial Data Output Signal. Serial digital output signal operating at 2.97Gb/s, 2.97/1.001Gbs, 1.485Gb/s, 1.485 /1.001Gb/s or 270Mb/s. The slew rate of the output is automatically controlled to meet SMPTE ST 424, SMPTE ST 292 and ST 259-C specifications according to the setting of the RATE_SEL0 and RATE_SEL1 pins.
D3	STANDBY		Input	Power Down input. HIGH to power down device.
D4	SDO_EN/$\overline{\text{DIS}}$		Input	CONTROL SIGNAL INPUT. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. Used to enable or disable the serial digital output stage. When SDO_EN/$\overline{\text{DIS}}$ is LOW, the serial digital output signals SDO and $\overline{\text{SDO}}$ are disabled and become high impedance. When SDO_EN/$\overline{\text{DIS}}$ is HIGH, the serial digital output signals SDO and $\overline{\text{SDO}}$ are enabled.
D5, F7	RSV		–	These pins are reserved and should be connected to CORE_GND.

Table 1-1: Pin Descriptions (Continued)

Pin Number	Name	Timing	Type	Description
E3, E4	RATE_SEL0, RATE_SEL1		Input	CONTROL SIGNAL INPUT. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. Used to configure the operating data rate. RATE_SEL0 / RATE_SEL1 / Data Rate 0 / 0 / 1.485 or 1.485/1.001Gb/s 0 / 1 / 2.97 or 2.97/1.001Gb/s 1 / X / 270Mb/s
E7	TDI		Input	COMMUNICATION SIGNAL INPUT. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. Dedicated JTAG pin. Test data in. This pin is used to shift JTAG test data into the device when the JTAG/$\overline{\text{HOST}}$ pin is LOW.
E8	TMS		Input	COMMUNICATION SIGNAL INPUT. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. Dedicated JTAG pin. Test mode start. This pin is JTAG Test Mode Start, used to control the operation of the JTAG test when the JTAG/$\overline{\text{HOST}}$ pin is LOW.
E10	CD_VDD		Input Power	Power for the serial digital cable driver. Connect to +3.3V DC analog.
F1, F2, H1, H2, J1, J2, K1, K2, J3, K3	DIN[9:0]		Input	PARALLEL DATA BUS. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. In 10-bit mode, these pins are not used. 20-bit mode 20BIT/$\overline{\text{10BIT}}$ = HIGH: Data Stream 2/Chroma data input in SMPTE mode $\overline{\text{SMPTE\_BYPASS}}$ = HIGH DVB_ASI = LOW 20-bit mode 20BIT/$\overline{\text{10BIT}}$ = HIGH: Data input in data through mode $\overline{\text{SMPTE\_BYPASS}}$ = LOW DVB_ASI = LOW 20-bit mode 20BIT/$\overline{\text{10BIT}}$ = HIGH: Not Used in DVB-ASI mode $\overline{\text{SMPTE\_BYPASS}}$ = LOW DVB_ASI = HIGH 10-bit mode 20BIT/$\overline{\text{10BIT}}$ = LOW: High impedance.

Table 1-1: Pin Descriptions (Continued)

Pin Number	Name	Timing	Type	Description
F3	DETECT_TRS		Input	CONTROL SIGNAL INPUT. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. Used to select external HVF timing mode or TRS extraction timing mode. When DETECT_TRS is LOW, the device extracts all internal timing from the supplied H:V:F or CEA-861 timing signals, dependent on the status of the TIM861 pin. When DETECT_TRS is HIGH, the device extracts all internal timing from TRS signals embedded in the supplied video stream.
F8	TDO		Output	COMMUNICATION SIGNAL OUTPUT. Please refer to the Output Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. Dedicated JTAG pin. JTAG Test Data Output. This pin is used to shift results from the device when the JTAG/$\overline{\text{HOST}}$ pin is LOW.
F10	RSET		Input	An external 1% resistor connected to this input is used to set the SDO/$\overline{\text{SDO}}$ output signal amplitude.
G1, H10	IO_VDD		Input Power	Power connection for digital I/O. Connect to +3.3V or +1.8V DC digital.
G2, H9	IO_GND		Input Power	Ground connection for digital I/O. Connect to digital GND.
G3	TIM_861		Input	CONTROL SIGNAL INPUT. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. Used to select external CEA-861 timing mode. When DETECT_TRS is LOW and TIM-861 is LOW, the device extracts all internal timing from the supplied H:V:F timing signals. When DETECT_TRS is LOW and TIM-861 is HIGH, the device extracts all internal timing from the supplied HSYNC, VSYNC, DE timing signals. When DETECT_TRS is HIGH, the device extracts all internal timing from TRS signals embedded in the supplied video stream.
G4	20BIT/$\overline{\text{10BIT}}$		Input	CONTROL SIGNAL INPUT. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. Used to select the input bus width.
G5	DVB_ASI		Input	CONTROL SIGNAL INPUT. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. Used to enable/disable the DVB-ASI data transmission. When DVB_ASI is set HIGH and $\overline{\text{SMPTE\_BYPASS}}$ is set LOW, then the device will carry out DVB-ASI word alignment, I/O processing and transmission. When $\overline{\text{SMPTE\_BYPASS}}$ and DVB_ASI are both set LOW, the device operates in data-through mode.

Table 1-1: Pin Descriptions (Continued)

Pin Number	Name	Timing	Type	Description
G6	$\overline{\text{SMPTE\_BYPASS}}$		Input	CONTROL SIGNAL INPUT. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. Used to enable / disable all forms of encoding / decoding, scrambling and EDH insertion. When set LOW, the device operates in data through mode (DVB_ASI= LOW), or in DVB-ASI mode (DVB_ASI = HIGH). No SMPTE scrambling takes place and none of the I/O processing features of the device are available when $\overline{\text{SMPTE\_BYPASS}}$ is set LOW. When set HIGH, the device carries out SMPTE scrambling and I/O processing.
G7	IOPROC_EN/$\overline{\text{DIS}}$		Input	CONTROL SIGNAL INPUT. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. Used to enable or disable the I/O processing features. When IOPROC_EN/$\overline{\text{DIS}}$ is HIGH, the I/O processing features of the device are enabled. When IOPROC_EN/$\overline{\text{DIS}}$ is LOW, the I/O processing features of the device are disabled. Only applicable in SMPTE mode.
G8	$\overline{\text{RESET}}$		Input	CONTROL SIGNAL INPUT. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. Used to reset the internal operating conditions to default settings and to reset the JTAG sequence. Normal mode (JTAG/$\overline{\text{HOST}}$ = LOW). When LOW, all functional blocks will be set to default conditions and all input and output signals become high impedance. When HIGH, normal operation of the device resumes. JTAG test mode (JTAG/$\overline{\text{HOST}}$ = HIGH). When LOW, all functional blocks will be set to default and the JTAG test sequence will be reset. When HIGH, normal operation of the JTAG test sequence resumes.
H3	$\overline{\text{ANC\_BLANK}}$		Input	CONTROL SIGNAL INPUT. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. When $\overline{\text{ANC\_BLANK}}$ is LOW, the Luma and Chroma input data is set to the appropriate blanking levels during the H and V blanking intervals. When $\overline{\text{ANC\_BLANK}}$ is HIGH, the Luma and Chroma data pass through the device unaltered. Only applicable in SMPTE mode.
H4	LOCKED		Output	STATUS SIGNAL OUTPUT. Please refer to the Output Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. PLL lock indication. HIGH indicates PLL is locked. LOW indicates PLL is not locked.

Table 1-1: Pin Descriptions (Continued)

Pin Number	Name	Timing	Type	Description
H5	GRP2_EN/$\overline{DIS}$		Input	Enables Audio Group 2 embedding. Set HIGH to enable. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility.
H6	GRP1_EN/$\overline{DIS}$		Input	Enables Audio Group 1 embedding. Set HIGH to enable. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility.
H7	AUDIO_INT		Output	STATUS SIGNAL OUTPUT. Please refer to the Output Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. Summary Interrupt from Audio Processing. This signal is set HIGH by the device to indicate a problem with the audio processing which requires the Host processor to interrogate the interrupt status registers. IO_VDD = +3.3V Drive Strength = 8mA IO_VDD = +1.8V Drive Strength = 4mA **Note:** By default, out of reset, the AUDIO_INT pin will output the HD_AUDIO_CLOCK, rather than the audio interrupt signal. In order to output the interrupt flags from the audio core as intended, the user must write 0001h to register 0232h.
H8	JTAG/$\overline{HOST}$		Input	CONTROL SIGNAL INPUT. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. Used to select JTAG test mode or host interface mode. When JTAG/$\overline{HOST}$ is HIGH, the host interface port is configured for JTAG test. When JTAG/$\overline{HOST}$ is LOW, normal operation of the host interface port resumes and the separate JTAG pins become the JTAG port.
J4	AIN_5/6		Input	Serial Audio Input; Channels 5 and 6. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility.
J5	WCLK2		Input	48kHz Word Clock associated with AIN_5/6 and AIN_7/8 (channels 5, 6, 7 and 8). Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility.
J6	AIN_1/2		Input	Serial Audio Input; Channels 1 and 2. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility.
J7	WCLK1		Input	48kHz Word Clock associated with AIN_1/2 and AIN_3/4 (channels 1, 2, 3 and 4). Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility.

Table 1-1: Pin Descriptions (Continued)

Pin Number	Name	Timing	Type	Description
J8	TCK		Input	COMMUNICATION SIGNAL INPUT. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. JTAG Serial Data Clock Signal. This pin is the JTAG clock when the JTAG/$\overline{\text{HOST}}$ pin is LOW.
J9	SDOUT_TDO		Output	COMMUNICATION SIGNAL OUTPUT. Please refer to the Output Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. Shared JTAG/$\overline{\text{HOST}}$ pin. Provided for compatibility with the GS1582. Serial Data Output/Test Data Output. Host Mode (JTAG/$\overline{\text{HOST}}$ = LOW) This pin operates as the host interface serial output, used to read status and configuration information from the internal registers of the device. JTAG Test Mode (JTAG/$\overline{\text{HOST}}$ = HIGH) This pin is used to shift test results and operates as the JTAG test data output, TDO (for new designs, use the dedicated JTAG port). **Note:** If the host interface is not being used leave this pin unconnected. IO_VDD = +3.3V Drive Strength = 12mA IO_VDD = +1.8V Drive Strength = 4mA
J10	SCLK_TCK		Input	COMMUNICATION SIGNAL INPUT. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. Shared JTAG/HOST pin. Provided for pin compatibility with GS1582. Serial data clock signal. Host Mode (JTAG/$\overline{\text{HOST}}$ = LOW) SCLK_TCK operates as the host interface burst clock, SCLK. Command and data read/write words are clocked into the device synchronously with this clock. JTAG Test Mode (JTAG/$\overline{\text{HOST}}$ = HIGH) This pin is the TEST MODE START pin, used to control the operation of the JTAG test clock, TCK (for new designs, use the dedicated JTAG port). **Note:** If the host interface is not being used, tie this pin HIGH.
K4	AIN_7/8		Input	Serial Audio Input; Channels 7 and 8.
K5	ACLK2		Input	64 x WCLK associated with AIN_5/6 and AIN_7/8 (channels 5, 6, 7 and 8).
K6	AIN_3/4		Input	Serial Audio Input; Channels 3 and 4.
K7	ACLK1		Input	64 x WCLK associated with AIN_1/2 and AIN_3/4 (channels 1, 2, 3and 4).

Table 1-1: Pin Descriptions (Continued)

Pin Number	Name	Timing	Type	Description
K9	$\overline{CS}$_TMS		Input	COMMUNICATION SIGNAL INPUT. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. Chip select / test mode start. JTAG Test mode (JTAG/$\overline{HOST}$ = HIGH) $\overline{CS}$_TMS operates as the JTAG test mode start, TMS, used to control the operation of the JTAG test, and is active HIGH (for new designs, use the dedicated JTAG port). Host mode (JTAG/$\overline{HOST}$ = LOW), $\overline{CS}$_TMS operates as the host interface Chip Select, $\overline{CS}$, and is active LOW.
K10	SDIN_TDI		Input	COMMUNICATION SIGNAL INPUT. Please refer to the Input Logic parameters in the DC Electrical Characteristics table for logic level threshold and compatibility. Shared JTAG/HOST pin. Provided for pin compatibility with GS1582. Serial data in/test data in. In JTAG mode, this pin is used to shift test data into the device (for new designs, use the dedicated JTAG port). In host interface mode, this pin is used to write address and configuration data words into the device.

2. Electrical Characteristics

2.1 Absolute Maximum Ratings

Table 2-1: Absolute Maximum Ratings

Parameter	Value/Units
Supply Voltage, Digital Core (CORE_VDD)	-0.3V to +1.5V
Supply Voltage, Digital I/O (IO_VDD)	-0.3V to +3.6V
Supply Voltage, Analog +1.2V (PLL_VDD, VCO_VDD)	-0.3V to +1.5V
Supply Voltage, Analog +3.3V (CD_VDD, A_VDD)	-0.3V to +3.6V
Input Voltage Range (RSET)	-0.3V to (CD_VDD + 0.3)V
Input Voltage Range (VBG)	-0.3V to (A_VDD + 0.3)V
Input Voltage Range (LF)	-0.3V to (PLL_VDD + 0.3)V
Input Voltage Range (digital inputs)	-2.0V to +5.25V
Temperature Range	-40°C to +85°C
Storage Temperature Range	-40°C to +125°C
Peak Reflow Temperature (JEDEC J-STD-020C)	260°C
ESD Sensitivity, HBM (JESD22-A114)	2kV

Note: Absolute Maximum Ratings are those values beyond which damage may occur. Functional operation outside of the ranges shown in Table 2-1 is not implied.

2.2 Recommended Operating Conditions

Table 2-2: Recommended Operating Conditions

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Note
Operating Temperature Range, Ambient	T_A	–	-20	–	85	°C	–
Supply Voltage, Digital Core	CORE_VDD	–	1.14	1.2	1.26	V	–
Supply Voltage, Digital I/O	IO_VDD	+1.8V mode	1.71	1.8	1.89	V	–
		+3.3V mode	3.13	3.3	3.47	V	–
Supply Voltage, PLL	PLL_VDD	–	1.14	1.2	1.26	V	–
Supply Voltage, VCO	VCO_VDD	–	–	0.7	–	V	1
Supply Voltage, Analog	A_VDD	–	3.13	3.3	3.47	V	–
Supply Voltage, CD	CD_VDD	–	3.13	3.3	3.47	V	–

Table 2-2: Recommended Operating Conditions (Continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Note
Operating Temperature Range	–	–	-20	–	85	°C	2
Functional Temperature Range	–	–	-40	–	85	°C	2

Notes:

1. This is 0.7V rather than 1.2V because there is a voltage drop across an external 105Ω resistor. See Typical Application Circuit.
2. Operating Temperature Range guarantees the parameters given in the DC Electrical Characteristics and AC Electrical Characteristics. Functional Temperature Range guarantees a device start-up.

2.3 DC Electrical Characteristics

Table 2-3: DC Electrical Characteristics

V_{CC} = +3.3V ±5%, T_A = -20°C to +85°C, unless otherwise shown

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Note
System							
+1.2V Supply Current	I_{1V2}	10bit 3G	–	135	200	mA	–
		20bit 3G	–	135	200	mA	–
		10/20bit HD	–	100	160	mA	–
		10/20bit SD	–	75	120	mA	–
		DVB_ASI	–	75	120	mA	–
+1.8V Supply Current	I_{1V8}	10bit 3G	–	15	30	mA	–
		20bit 3G	–	15	32	mA	–
		10/20bit HD	–	15	32	mA	–
		10/20bit SD	–	3	10	mA	–
		DVB_ASI	–	3	10	mA	–
+3.3V Supply Current	I_{3V3}	10bit 3G	–	90	110	mA	–
		20bit 3G	–	90	110	mA	–
		10/20bit HD	–	90	110	mA	–
		10/20bit SD	–	70	90	mA	–
		DVB_ASI	–	70	90	mA	–
Total Device Power (IO_VDD = +1.8V)	P_{1D8}	10bit 3G	–	400	560	mW	–
		20bit 3G	–	400	560	mW	–
		10/20bit HD	–	350	510	mW	–
		10/20bit SD	–	300	450	mW	–
		DVB_ASI	–	300	450	mW	–
		Reset	–	200	–	mW	–
		Standby	–	110	180	mW	1

Table 2-3: DC Electrical Characteristics (Continued)

V_{CC} = +3.3V ±5%, T_A = -20°C to +85°C, unless otherwise shown

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Note
Total Device Power (IO_VDD = +3.3V)	P_{3D3}	10bit 3G	–	430	600	mW	–
		20bit 3G	–	450	610	mW	–
		10/20bit HD	–	420	550	mW	–
		10/20bit SD	–	320	450	mW	–
		DVB_ASI	–	320	450	mW	–
		Reset	–	230	–	mW	–
		Standby	–	110	180	mW	1
Digital I/O							
Input Logic LOW	V_{IL}	+3.3V or +1.8V operation	IO_VSS-0.3	–	0.3 x IO_VDD	V	–
Input Logic HIGH	V_{IH}	+3.3V or +1.8V operation	0.7 x IO_VDD	–	IO_VDD+0.3	V	–
Output Logic LOW	V_{OL}	IOL=5mA, +1.8V operation	–	–	0.2	V	–
		IOL=8mA, +3.3V operation	–	–	0.4	V	–
Output Logic HIGH	V_{OH}	IOH=-5mA, +1.8V operation	1.4	–	–	V	–
		IOH=-8mA, +3.3V operation	2.4	–	–	V	–
Serial Output							
Serial Output Common Mode Voltage	V_{CMOUT}	75Ω load, R_{SET} = 750Ω SD and HD mode	–	CD_VDD - $V_{SDD/2}$	–	V	–

Note:

1. Devices manufactured prior 1to April 1, 2011 consume 150mW of power in Standby mode.

2.4 AC Electrical Characteristics

Table 2-4: AC Electrical Characteristics

V_{CC} = +3.3V ±5%, T_A = -20°C to +85°C, unless otherwise shown

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Note
System							
Device Latency	–	3G bypass (PCLK = 148.5 MHz)	–	54	–	PCLK	–
	–	3G SMPTE without audio (PCLK = 148.5 MHz)	–	95	–	PCLK	–
	–	3G SMPTE with audio (PCLK = 148.5 MHz)	–	1106	–	PCLK	–
	–	3G IOPROC disabled 20-bit mode (PCLK = 148.5MHz)	–	94	–	PCLK	–
	–	HD bypass (PCLK = 74.25 MHz)	–	54	–	PCLK	–
	–	HD SMPTE without audio (PCLK = 74.25 MHz)	–	95	–	PCLK	–
	–	HD SMPTE with audio (PCLK = 74.25 MHz)	–	1106	–	PCLK	–
	–	HD IOPROC disabled 10-bit mode (PCLK = 74.25MHz)		98			
	–	SD bypass (PCLK = 27 MHz)	–	54	–	PCLK	–
	–	SD SMPTE without audio	–	112	–	PCLK	–
	–	SD SMPTE with audio	–	638	–	PCLK	–
	–	SD IOPROC disabled 10-bit mode (PCLK = 27MHz)	–	94	–	PCLK	–
	–	DVB-ASI	–	52	–	PCLK	–
Reset Pulse Width	t_{reset}	–	1	–	–	ms	–
Parallel Input							
Parallel Clock Frequency	f_{PCLK}	–	13.5	–	148.5	MHz	–
Parallel Clock Duty Cycle	DC_{PCLK}	–	40	–	60	%	–
Input Data Setup Time	t_{su}	50% levels; +3.3V or +1.8V operation	1.2	–	–	ns	1
Input Data Hold Time	t_{ih}		0.8	–	–	ns	1
Serial Digital Output							

Table 2-4: AC Electrical Characteristics (Continued)

V_{CC} = +3.3V ±5%, T_A = -20°C to +85°C, unless otherwise shown

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Note
Serial Output Data Rate	DR_{SDO}	–	–	2.97	–	Gb/s	–
		–	–	2.97/1.001	–	Gb/s	–
		–	–	1.485	–	Gb/s	–
		–	–	1.485/1.001	–	Gb/s	–
		–	–	270	–	Mb/s	–
Serial Output Swing	V_{SDD}	R_{SET} = 750Ω 75Ω load	750	800	850	mV_{pp}	2
Serial Output Rise/Fall Time 20% ~ 80%	trf_{SDO}	3G/HD mode	–	120	135	ps	–
	trf_{SDO}	SD mode	400	660	800	ps	–
Mismatch in rise/fall time	Δt_r ,Δt_f	–	–	–	35	ps	–
Duty Cycle Distortion	–	–	–	–	5	%	2
Overshoot	–	3G/HD mode	–	5	10	%	2
	–	SD mode	–	3	8	%	2
Output Return Loss	ORL	1.485GHz - 2.97GHz	–	-12	–	dB	3
		5 MHz - 1.485 GHz	–	-18	–	dB	3
Serial Output Intrinsic Jitter	t_{OJ}	Pseudorandom and SMPTE Colour Bars 3G signal	–	40	68	ps	4, 6
	t_{OJ}	Pseudorandom and SMPTE Colour Bars HD signal	–	50	95	ps	4, 6
Serial Output Intrinsic Jitter	t_{OJ}	Pseudorandom and SMPTE Colour Bars SD signal	–	200	400	ps	5
GSPI							
GSPI Input Clock Frequency	f_{SCLK}	50% levels +3.3V or +1.8V operation	–	–	80	MHz	–
GSPI Input Clock Duty Cycle	DC_{SCLK}		40	50	60	%	–
GSPI Input Data Setup Time	–		1.5	–	–	ns	–
GSPI Input Data Hold Time	–		1.5	–	–	ns	–
GSPI Output Data Hold Time	–	15pF load	1.5	–	–	ns	–
$\overline{CS}$ low before SCLK rising edge	t_0	50% levels +3.3V or +1.8V operation	1.5	–	–	ns	–
Time between end of command word (or data in Auto-Increment mode) and the first SCLK of the following data word - write cycle	t_4	50% levels +3.3V or +1.8V operation	PCLK (MHz) / ns: unlocked 445; 13.5 74.2; 27.0 37.1; 74.25 13.5; 148.5 6.7	–	–	ns	–

Table 2-4: AC Electrical Characteristics (Continued)

V_{CC} = +3.3V ±5%, T_A = -20°C to +85°C, unless otherwise shown

Parameter	Symbol	Conditions	Min		Typ	Max	Units	Note
Time between end of command word (or data in Auto-Increment mode) and the first SCLK of the following data word - read cycle	t_5	50% levels +3.3V or +1.8V operation	PCLK (MHz)	ns	–	–	ns	–
			unlocked	1187				
			13.5	297				
			27.0	148.4				
			74.25	53.9				
			148.5	27				
$\overline{CS}$ high after SCLK falling edge	t_7	50% levels +3.3V or +1.8V operation	PCLK (MHz)	ns	–	–	ns	–
			unlocked	445				
			13.5	74.2				
			27.0	37.1				
			74.25	13.5				
			148.5	6.7				

Notes:

1. Input setup and hold time is dependent on the rise and fall time on the parallel input. Parallel clock and data with rise time or fall time greater than 500ps require larger setup and hold times.
2. Single Ended into 75Ω external load.
3. ORL depends on board design.
4. Alignment Jitter = measured from 100kHz to serial data rate/10.
5. Alignment Jitter = measured from 1kHz to 27MHz.
6. This is the maximum jitter for a BER of 10-12. The equivalent jitter value as per RP184 is 40ps max.