Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!

Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
Email & Skype: info@chipsmall.com Web: www.chipsmall.com
Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

Key Features

- SMPTE 292M and SMPTE 259M-C compliant scrambling and NRZ → NRZI encoding (with bypass)
- DVB-ASI sync word insertion and 8b/10b encoding
- Rejection of more than 300ps jitter on the input PCLK
- User selectable additional processing features including:
  - CRC, ANC data checksum, and line number calculation and insertion
  - TRS and EDH packet generation and insertion
  - illegal code remapping
- Internal flywheel for noise immune TRS generation
- 20-bit / 10-bit CMOS parallel input data bus
- 148.5MHz / 74.25MHz / 27MHz / 13.5MHz parallel digital input
- Automatic standards detection and indication
- 1.8V core power supply and 3.3V charge pump power supply
- 3.3V digital I/O supply
- JTAG test interface
- Available in a Pb-free package
- small footprint (11mm x 11mm)

Applications

- SMPTE 292M Serial Digital Interfaces
- SMPTE 259M-C Serial Digital Interfaces
- DVB-ASI Serial Digital Interfaces

Description

The GS1531 is a multi-standard serializer with an integrated cable driver. When used in conjunction with the GO1555/GO1525* Voltage Controlled Oscillator, a transmit solution can be realized for HD-SDI, SD-SDI and DVB-ASI applications.

The device features an internal PLL, which can be configured for loop bandwidth as narrow as 100kHz. Thus the GS1531 can tolerate in excess of 300ps jitter on the input PCLK and still provide output jitter well within SMPTE specification. Connect the output clocks from Gennum's GS4911 clock generator directly to the GS1531's PCLK input and configure the GS1531's loop bandwidth accordingly.

In addition to serializing the input, the GS1531 performs NRZ-to-NRZI encoding and scrambling as per SMPTE 292M/259M-C when operating in SMPTE mode. When operating in DVB-ASI mode, the device will insert K28.5 sync characters and 8b/10b encode the data prior to serialization.

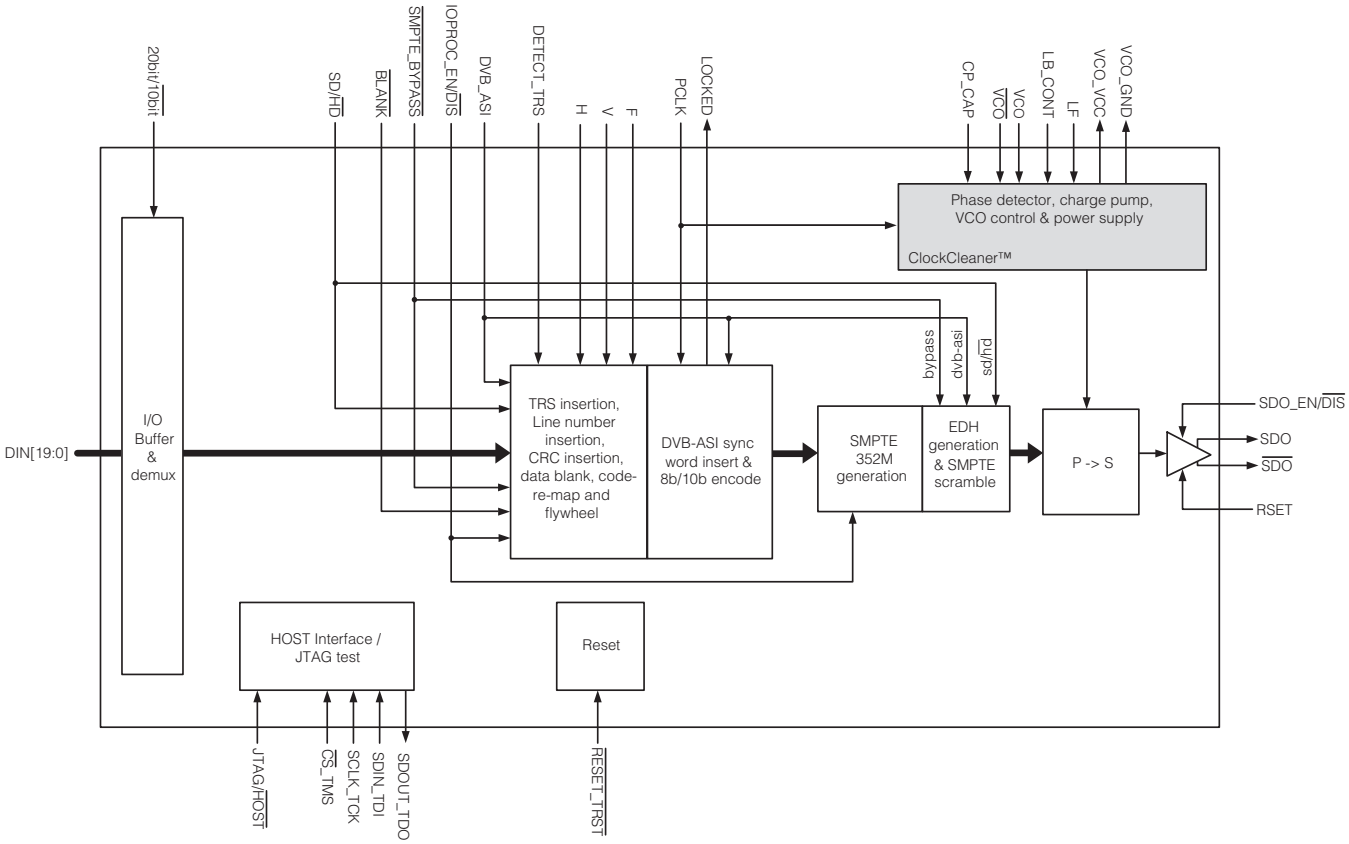
Parallel data inputs are provided for 10-bit multiplexed or 20-bit demultiplexed formats at both HD and SD signal rates. An appropriate parallel clock input signal is also required.

The integrated cable driver features an output mute on loss of parallel clock, high impedance mode, adjustable signal swing, and automatic dual slew rate selection depending on HD/SD operational requirements.

The GS1531 also includes a range of data processing functions including automatic standards detection and EDH support. The device can also insert TRS signals, calculate and insert line numbers and CRC's, re-map illegal code words and insert SMPTE 352M payload identifier packets. All processing features are optional and may be enabled/disabled via external control pin(s) and/or host interface programming.

*For new designs use GO1555

Functional Block Diagram



GS1531 Functional Block Diagram

Contents

1. Pin Out

1.1 Pin Assignment

	1	2	3	4	5	6	7	8	9	10
A	LF	VCO_ VCC	VCO_ GND	$\overline{\text{VCO}}$	VCO	NC	PCLK	IO_VDD	DIN18	DIN19
B	CP_CAP	CP_VDD	CP_GND	LB_ CONT	NC	NC	DETECT _TRS	IO_GND	DIN16	DIN17
C	NC	PD_VDD	PD_GND	NC	NC	NC	NC	NC	DIN14	DIN15
D	NC	NC	NC	NC	DVB_ASI	LOCKED	NC	NC	DIN12	DIN13
E	NC	NC	NC	SD/$\overline{\text{HD}}$	CORE _GND	CORE _VDD	NC	IO_VDD	DIN10	DIN11
F	RSV	NC	NC	20bit/ $\overline{\text{10bit}}$	CORE _GND	CORE _VDD	NC	IO_GND	DIN8	DIN9
G	NC	NC	NC	IOPROC _EN/$\overline{\text{DIS}}$	$\overline{\text{SMPTE\_ BYPASS}}$	$\overline{\text{RESET\_TRST}}$	NC	$\overline{\text{BLANK}}$	DIN6	DIN7
H	NC	NC	NC	$\overline{\text{CS\_ TMS}}$	SCLK _TCK	SDOUT _TDO	NC	H	DIN4	DIN5
J	NC	NC	NC	NC	SDO_EN /$\overline{\text{DIS}}$	SDIN _TDI	V	IO_GND	DIN2	DIN3
K	RSET	CD_VDD	SDO	$\overline{\text{SD0}}$	CD_GND	JTAG/ $\overline{\text{HOST}}$	F	IO_VDD	DIN0	DIN1

1.2 Pin Descriptions

Table 1-1: Pin Descriptions

Pin Number	Name	Timing	Type	Description	
A1	LF	Analog	Output	Control voltage to external voltage controlled oscillator. Nominally +1.25V DC.	
A2	VCO_VCC	–	Output Power	Power supply for the external voltage controlled oscillator. Connect to pin 7 of the GO1555/GO1525*. This pin is an output. Should be isolated from all other power supplies. *For new designs use GO1555	
A3	VCO_GND	–	Output Power	Ground reference for the external voltage controlled oscillator. Connect to pins 2, 4, 6, and 8 of the GO1555/GO1525*. This pin is an output. Should be isolated from all other grounds. *For new designs use GO1555	
A4, A5	$\overline{\text{VCO}}$, VCO	Analog	Input	Differential inputs for the external VCO reference signal. For single ended devices such as the GO1555/GO1525*, $\overline{\text{VCO}}$ should be AC coupled to VCO_GND. VCO is nominally 1.485GHz. *For new designs use GO1555	
A6, B5, B6, C1, C4, C5, C6, C7, C8, D1, D2, D3, D4, D7, D8, E1, E2, E3, E7, F2, F3, F7, G1, G2, G3, G7, H1, H2, H3, H7, J1, J2, J3, J4	NC	–	–	No connect.	
A7	PCLK	–	Input	PARALLEL DATA BUS CLOCK Signal levels are LVCMOS/LVTTL compatible.	
				HD 20-bit mode	PCLK = 74.25MHz or 74.25/1.001MHz
				HD 10-bit mode	PCLK = 148.5MHz or 148.5/1.001MHz
				SD 20-bit mode	PCLK = 13.5MHz
				SD 10-bit mode	PCLK = 27MHz
A8, E8, K8	IO_VDD	–	Power	Power supply connection for digital I/O buffers. Connect to +3.3V DC digital.	

Table 1-1: Pin Descriptions (Continued)

Pin Number	Name	Timing	Type	Description
A10, A9, B10, B9, C10, C9, D10, D9, E10, E9	DIN[19:10]	Synchronous with PCLK	Input	PARALLEL DATA BUS Signal levels are LVCMOS/LVTTL compatible. DIN19 is the MSB and DIN10 is the LSB. HD 20-bit mode SD/HD = LOW 20bit/10bit = HIGH Luma data input in SMPTE mode SMPTE_BYPASS = HIGH DVB_ASI = LOW Data input in Data-Through mode SMPTE_BYPASS = LOW DVB_ASI = LOW HD 10-bit mode SD/HD = LOW 20bit/10bit = LOW Multiplexed Luma and Chroma data input in SMPTE mode SMPTE_BYPASS = HIGH DVB_ASI = LOW Data input in Data-Through mode SMPTE_BYPASS = LOW DVB_ASI = LOW SD 20-bit mode SD/HD = HIGH 20bit/10bit = HIGH Luma data input in SMPTE mode SMPTE_BYPASS = HIGH DVB_ASI = LOW Data input in Data-Through mode SMPTE_BYPASS = LOW DVB_ASI = LOW DVB-ASI data input in DVB-ASI mode SMPTE_BYPASS = LOW DVB_ASI = HIGH SD 10-bit mode SD/HD = HIGH 20bit/10bit = LOW Multiplexed Luma and Chroma data input in SMPTE mode SMPTE_BYPASS = HIGH DVB_ASI = LOW Data input in data through mode SMPTE_BYPASS = LOW DVB_ASI = LOW DVB-ASI data input in DVB-ASI mode SMPTE_BYPASS = LOW DVB_ASI = HIGH
B1	CP_CAP	Analog	Input	PLL lock time constant capacitor connection.
B2	CP_VDD	–	Power	Power supply connection for the charge pump. Connect to +3.3V DC analog.
B3	CP_GND	–	Power	Ground connection for the charge pump. Connect to analog GND.
B4	LB_CONT	Analog	Input	Control voltage to set the loop bandwidth of the integrated reclocker.
B7	DETECT_TRS	Non Synchronous	Input	CONTROL SIGNAL INPUT Signal levels are LVCMOS/LVTTL compatible. Used to select the timing mode of the device. When set HIGH, the device will lock the internal flywheel to the embedded TRS timing signals in the parallel input data. When set LOW, the device will lock the internal flywheel to the externally supplied H, V, and F input signals.

Table 1-1: Pin Descriptions (Continued)

Pin Number	Name	Timing	Type	Description
B8, F8, J8	IO_GND	–	Power	Ground connection for digital I/O buffers. Connect to digital GND.
C2	PD_VDD	–	Power	Power supply connection for the phase detector. Connect to +1.8V DC analog.
C3	PD_GND	–	Power	Ground connection for the phase detector. Connect to analog GND.
D5	DVB_ASI	Non Synchronous	Input	CONTROL SIGNAL INPUT Signal levels are LVCMOS/LVTTL compatible. When set HIGH in conjunction with SD/$\overline{HD}$ = HIGH and $\overline{SMPTE\_BYPASS}$ = LOW, the device will be configured to operate in DVB-ASI mode. When set LOW, the device will not support the encoding of received DVB-ASI data.
D6	LOCKED	Synchronous with PCLK	Output	STATUS SIGNAL OUTPUT Signal levels are LVCMOS / LVTTL compatible. The LOCKED signal will be HIGH whenever the device has correctly received and locked to SMPTE compliant data in SMPTE mode or DVB-ASI compliant data in DVB-ASI mode, or when the device has achieved lock in Data-Through mode. It will be LOW otherwise.
E4	SD/$\overline{HD}$	Non Synchronous	Input	CONTROL SIGNAL INPUT Signal levels are LVCMOS/LVTTL compatible. When set LOW, the device will be configured to transmit signal rates of 1.485Gb/s or 1.485/1.001Gb/s only. When set HIGH, the device will be configured to transmit signal rates of 270Mb/s only.
E5, F5	CORE_GND	–	Power	Ground connection for the digital core logic. Connect to digital GND.
E6, F6	CORE_VDD	–	Power	Power supply connection for the digital core logic. Connect to +1.8V DC digital.
F1	RSV	–	–	Connect to Analog GND.
F4	20bit/$\overline{10bit}$	Non Synchronous	Input	CONTROL SIGNAL INPUT Signal levels are LVCMOS/LVTTL compatible. Used to select the input data bus width in SMPTE or Data-Through modes. When set HIGH, the parallel input will be 20-bit demultiplexed data. When set LOW, the parallel input will be 10-bit multiplexed data.

Table 1-1: Pin Descriptions (Continued)

Pin Number	Name	Timing	Type	Description	
F10, F9, G10, G9, H10, H9, J10, J9, K10, K9	DIN[9:0]	Synchronous with PCLK	Input	PARALLEL DATA BUS Signal levels are LVCMOS/LVTTL compatible. DIN9 is the MSB and DIN0 is the LSB.	
				HD 20-bit mode SD/$\overline{HD}$ = LOW 20bit/$\overline{10bit}$ = HIGH	Chroma data input in SMPTE mode $\overline{SMPTE\_BYPASS}$ =HIGH DVB_ASI = LOW Data input in Data-Through mode $\overline{SMPTE\_BYPASS}$ = LOW DVB_ASI = LOW
				HD 10-bit mode SD/$\overline{HD}$ = LOW 20bit/$\overline{10bit}$ = LOW	High impedance in all modes.
				SD 20-bit mode SD/$\overline{HD}$ = HIGH 20bit/$\overline{10bit}$ = HIGH	Chroma data input in SMPTE mode $\overline{SMPTE\_BYPASS}$ = HIGH DVB_ASI = LOW Data input in Data-Through mode $\overline{SMPTE\_BYPASS}$ = LOW DVB_ASI = LOW High impedance in DVB-ASI mode $\overline{SMPTE\_BYPASS}$ = LOW DVB_ASI = HIGH
				SD 10-bit mode SD/$\overline{HD}$ = HIGH 20bit/$\overline{10bit}$ = LOW	High impedance in all modes.
G4	IOPROC_EN/$\overline{DIS}$	Non Synchronous	Input	CONTROL SIGNAL INPUT Signal levels are LVCMOS/LVTTL compatible. Used to enable or disable I/O processing features. When set HIGH, the following I/O processing features of the device are enabled: • EDH Packet Generation and Insertion (SD-only) • SMPTE 352M Packet Generation and Insertion • ANC Data Checksum Calculation and Insertion • Line-based CRC Generation and Insertion (HD-only) • Line Number Generation and Insertion (HD-only) • TRS Generation and Insertion • Illegal Code Remapping To enable a subset of these features, keep IOPROC_EN/$\overline{DIS}$ HIGH and disable the individual feature(s) in the IOPROC_DISABLE register accessible via the host interface. When set LOW, the I/O processing features of the device are disabled, regardless of whether the features are enabled in the IOPROC_DISABLE register.	

Table 1-1: Pin Descriptions (Continued)

Pin Number	Name	Timing	Type	Description
G5	$\overline{\text{SMPTE\_BYPASS}}$	Non Synchronous	Input	CONTROL SIGNAL INPUT Signal levels are LVCMOS/LVTTL compatible. When set HIGH in conjunction with DVB_ASI = LOW, the device will be configured to operate in SMPTE mode. All I/O processing features may be enabled in this mode. When set LOW, the device will not support the scrambling or encoding of received SMPTE data. No I/O processing features will be available.
G6	$\overline{\text{RESET\_TRST}}$	Non Synchronous	Input	CONTROL SIGNAL INPUT Signal levels are LVCMOS/LVTTL compatible. Used to reset the internal operating conditions to default settings and to reset the JTAG test sequence. Host Mode (JTAG/$\overline{\text{HOST}}$ = LOW) When asserted LOW, all functional blocks will be set to default conditions and all input and output signals become high impedance, including the serial digital outputs SDO and $\overline{\text{SDO}}$. Must be set HIGH for normal device operation. JTAG Test Mode (JTAG/$\overline{\text{HOST}}$ = HIGH) When asserted LOW, all functional blocks will be set to default and the JTAG test sequence will be held in reset. When set HIGH, normal operation of the JTAG test sequence resumes.
G8	$\overline{\text{BLANK}}$	Synchronous with PCLK	Input	CONTROL SIGNAL INPUT Signal levels are LVCMOS/LVTTL compatible. Used to enable or disable input data blanking. When set LOW, the luma and chroma input data is set to the appropriate blanking levels. Horizontal and vertical ancillary spaces will also be set to blanking levels. When set HIGH, the luma and chroma input data pass through the device unaltered.
H4	$\overline{\text{CS}}$_TMS	Synchronous with SCLK_TCK	Input	CONTROL SIGNAL INPUT Signal levels are LVCMOS/LVTTL compatible. Chip Select / Test Mode Select Host Mode (JTAG/$\overline{\text{HOST}}$ = LOW) $\overline{\text{CS}}$_TMS operates as the host interface chip select, $\overline{\text{CS}}$, and is active LOW. JTAG Test Mode (JTAG/$\overline{\text{HOST}}$ = HIGH) $\overline{\text{CS}}$_TMS operates as the JTAG test mode select, TMS, and is active HIGH. NOTE: If the host interface is not being used, tie this pin HIGH.
H5	SCLK_TCK	Non Synchronous	Input	CONTROL SIGNAL INPUT Signal levels are LVCMOS/LVTTL compatible. Serial Data Clock / Test Clock. 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) SCLK_TCK operates as the JTAG test clock, TCK. NOTE: If the host interface is not being used, tie this pin HIGH.

Table 1-1: Pin Descriptions (Continued)

Pin Number	Name	Timing	Type	Description
H6	SDOUT_TDO	Synchronous with SCLK_TCK	Output	CONTROL SIGNAL OUTPUT Signal levels are LVCMOS/LVTTL compatible. Serial Data Output / Test Data Output Host Mode (JTAG/$\overline{\text{HOST}}$ = LOW) SDOUT_TDO operates as the host interface serial output, SDOUT, used to read status and configuration information from the internal registers of the device. JTAG Test Mode (JTAG/$\overline{\text{HOST}}$ = HIGH) SDOUT_TDO operates as the JTAG test data output, TDO.
H8	H	Synchronous with PCLK	Input	CONTROL SIGNAL INPUT Signal levels are LVCMOS/LVTTL compatible. Used to indicate the portion of the video line containing active video data when DETECT_TRS is set LOW. The device will set the H bit in all outgoing TRS signals for the entire period that the H input signal is HIGH (IOPROC_EN/$\overline{\text{DIS}}$ must also be HIGH). H signal timing is configurable via the H_CONFIG bit of the IOPROC_DISABLE register, accessible via the host interface. Active Line Blanking (H_CONFIG = 0_h) The H signal should be set HIGH for the entire horizontal blanking period, including the EAV and SAV TRS words, and LOW otherwise. This is the default setting. 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.
J5	SDO_EN/$\overline{\text{DIS}}$	Non Synchronous	Input	CONTROL SIGNAL INPUT Signal levels are LVCMOS/LVTTL compatible. Used to enable or disable the serial digital output stage. When set LOW, the serial digital output signals SDO and $\overline{\text{SDO}}$ are disabled and become high impedance. When set HIGH, the serial digital output signals SDO and $\overline{\text{SDO}}$ are enabled.
J6	SDIN_TDI	Synchronous with SCLK_TCK	Input	CONTROL SIGNAL INPUT Signal levels are LVCMOS/LVTTL compatible. Serial Data In / Test Data Input Host Mode (JTAG/$\overline{\text{HOST}}$ = LOW) SDIN_TDI operates as the host interface serial input, SDIN, used to write address and configuration information to the internal registers of the device. JTAG Test Mode (JTAG/$\overline{\text{HOST}}$ = HIGH) SDIN_TDI operates as the JTAG test data input, TDI. NOTE: If the host interface is not being used, tie this pin HIGH.

Table 1-1: Pin Descriptions (Continued)

Pin Number	Name	Timing	Type	Description
J7	V	Synchronous with PCLK	Input	CONTROL SIGNAL INPUT Signal levels are LVCMOS/LVTTL compatible. Used to indicate the portion of the video field / frame that is used for vertical blanking when DETECT_TRS is set LOW. The device will set the V bit in all outgoing TRS signals for the entire period that the V input signal is HIGH (IOPROC_EN/$\overline{\text{DIS}}$ must also be HIGH). 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.
K1	RSET	Analog	Input	Used to set the serial digital output signal amplitude. Connect to CD_VDD through 281Ω +/- 1% for 800mV_{p-p} single-ended output swing.
K2	CD_VDD	–	Power	Power supply connection for the serial digital cable driver. Connect to +1.8V DC analog.
K3, K4	SDO, $\overline{\text{SDO}}$	Analog	Output	Serial digital output signal operating at 1.485Gb/s, 1.485/1.001Gb/s, or 270Mb/s. The slew rate of these outputs is automatically controlled to meet SMPTE 292M and 259M requirements according to the setting of the SD/$\overline{\text{HD}}$ pin.
K5	CD_GND	–	Power	Ground connection for the serial digital cable driver. Connect to analog GND.
K6	JTAG/$\overline{\text{HOST}}$	Non Synchronous	Input	CONTROL SIGNAL INPUT Signal levels are LVCMOS/LVTTL compatible. Used to select JTAG Test Mode or Host Interface Mode. When set HIGH, $\overline{\text{CS}}$_TMS, SDOUT_TDO, SDI_TDI and SCLK_TCK are configured for JTAG boundary scan testing. When set LOW, $\overline{\text{CS}}$_TMS, SDOUT_TDO, SDI_TDI and SCLK_TCK are configured as GSPI pins for normal host interface operation.
K7	F	Synchronous with PCLK	Input	CONTROL SIGNAL INPUT Signal levels are LVCMOS/LVTTL compatible. 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/$\overline{\text{DIS}}$ 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.

2. Electrical Characteristics

2.1 Absolute Maximum Ratings

Parameter	Value/Units
Supply Voltage Core	-0.3V to +2.1V
Supply Voltage I/O	-0.3V to +4.6V
Input Voltage Range (any input)	-2.0V to + 5.25V
Ambient Operating Temperature	$-20°C \leq T_A \leq 85°C$
Storage Temperature	$-40°C \leq T_{STG} \leq 125°C$
ESD Protection On All Pins (see Note 1)	1kV

NOTES:
1. HBM, per JESDA-114B.

2.2 DC Electrical Characteristics

Table 2-1: DC Electrical Characteristics

T_A = 0°C to 70°C, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Test Level	Notes
System								
Operation Temperature Range	T_A	–	0	–	70	°C	3	1
Digital Core Supply Voltage	CORE_VDD	–	1.71	1.8	1.89	V	3	1
Digital I/O Supply Voltage	IO_VDD	–	3.13	3.3	3.47	V	3	1
Charge Pump Supply Voltage	CP_VDD	–	3.13	3.3	3.47	V	3	1
Phase Detector Supply Voltage	PD_VDD	–	1.71	1.8	1.89	V	3	1
Input Buffer Supply Voltage	BUFF_VDD	–	1.71	1.8	1.89	V	3	1
Cable Driver Supply Voltage	CD_VDD	–	1.71	1.8	1.89	V	3	1
External VCO Supply Voltage Output	VCO_VCC	–	2.25	–	2.75	V	1	–
+1.8V Supply Current	I_{1V8}	SDO Enabled	–	–	245	mA	3	3
+3.3V Supply Current	I_{3V3}	–	–	–	45	mA	3	4
Total Device Power	P_D	SDO Enabled	–	–	590	mW	3	–

Table 2-1: DC Electrical Characteristics (Continued)

T_A = 0°C to 70°C, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Test Level	Notes
Digital I/O								
Input Logic LOW	V_{IL}	–	–	–	0.8	V	4	–
Input Logic HIGH	V_{IH}	–	2.1	–	–	V	4	–
Output Logic LOW	V_{OL}	+8mA	–	0.2	0.4	V	4	–
Output Logic HIGH	V_{OH}	-8mA	IO_VDD - 0.4	–	–	V	4	–
Input								
RSET Voltage	V_{RSET}	RSET=281Ω	0.54	0.6	0.66	V	1	2
Output								
Output Common Mode Voltage	V_{CMOUT}	75Ω load, RSET=281Ω, SD and HD	0.8	1.0	1.2	V	1	–

TEST LEVELS

1. Production test at room temperature and nominal supply voltage with guardbands for supply and temperature ranges.
2. Production test at room temperature and nominal supply voltage with guardbands for supply and temperature ranges using correlated test.
3. Production test at room temperature and nominal supply voltage.
4. QA sample test.
5. Calculated result based on Level 1, 2, or 3.
6. Not tested. Guaranteed by design simulations.
7. Not tested. Based on characterization of nominal parts.
8. Not tested. Based on existing design/characterization data of similar product.
9. Indirect test.

NOTES

1. All DC and AC electrical parameters within specification.
2. Set by the value of the RSET resistor.
3. Sum of all 1.8V supplies.
4. Sum of all 3.3V supplies.

2.3 AC Electrical Characteristics

Table 2-2: AC Electrical Characteristics

T_A = 0°C to 70°C, unless otherwise shown

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Test Level	Notes
System								
Device Latency	–	10-bit SD	–	21	–	PCLK	8	–
	–	20-bit HD	–	19	–	PCLK	8	–
	–	DVB-ASI	–	11	–	PCLK	8	–
Reset Pulse Width	t_{reset}	–	1	–	–	ms	8	1

Table 2-2: AC Electrical Characteristics (Continued)

T_A = 0°C to 70°C, unless otherwise shown

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Test Level	Notes
Parallel Input								
Parallel Clock Frequency	f_{PCLK}	–	13.5	–	148.5	MHz	4	–
Parallel Clock Duty Cycle	DC_{PCLK}	–	40	–	60	%	6	–
Input Data Setup Time	t_{su}	–	2.0	–	–	ns	5	–
Input Data Hold Time	t_{ih}	–	1.5	–	–	ns	5	–
Serial Digital Output								
Serial Output Data Rate	DR_{SDO}	–	–	1.485	–	Gb/s	1	–
		–	–	1.485/1.001	–	Gb/s	9	–
		–	–	270	–	Mb/s	1	–
Serial Output Swing	ΔV_{SDD}	RSET = 281Ω 75Ω load	650	800	950	mVp-p	1	–
Serial Output Rise Time 20% ~ 80%	tr_{SDO}	HD signal	–	–	260	ps	1	–
	tr_{SDO}	SD signal	400	550	1500	ps	1	–
Serial Output Fall Time 20% ~ 80%	tf_{SDO}	HD signal	–	–	260	ps	1	–
	tf_{SDO}	SD signal	400	550	1500	ps	1	–
Serial Output Intrinsic Jitter	t_{IJ}	Pseudorandom and pathological HD signal	–	90	125	ps	5	–
	t_{IJ}	Pseudorandom and pathological SD signal	–	270	350	ps	5	–
GSPI								
GSPI Input Clock Frequency	f_{SCLK}	–	–	–	6.6	MHz	8	–
GSPI Input Clock Duty Cycle	DC_{SCLK}	–	40	–	60	%	8	–
GSPI Input Data Setup Time	–	–	0	–	–	ns	8	–
GSPI Input Data Hold Time	–	–	1.43	–	–	ns	8	–
GSPI Output Data Hold Time	–	–	2.1	–	–	ns	8	–
GSPI Output Data Delay Time	–	–	–	–	7.27	ns	8	–

TEST LEVELS

1. Production test at room temperature and nominal supply voltage with guardbands for supply and temperature ranges.
2. Production test at room temperature and nominal supply voltage with guardbands for supply and temperature ranges using correlated test.
3. Production test at room temperature and nominal supply voltage.
4. QA sample test.
5. Calculated result based on Level 1, 2, or 3.
6. Not tested. Guaranteed by design simulations.
7. Not tested. Based on characterization of nominal parts.
8. Not tested. Based on existing design/characterization data of similar product.
9. Indirect test.

NOTES

1. See Device Power Up on page 45, Figure 4-12.

2.4 Solder Reflow Profiles

The GS1531 is available in a Pb or Pb-free package. It is recommended that the Pb package be soldered with Pb paste using the Standard Eutectic profile shown in Figure 2-1, and the Pb-free package be soldered with Pb-free paste using the reflow profile shown in Figure 2-2.

NOTE: It is possible to solder a Pb-free package with Pb paste using a Standard Eutectic profile with a reflow temperature maintained at 245°C – 250°C.

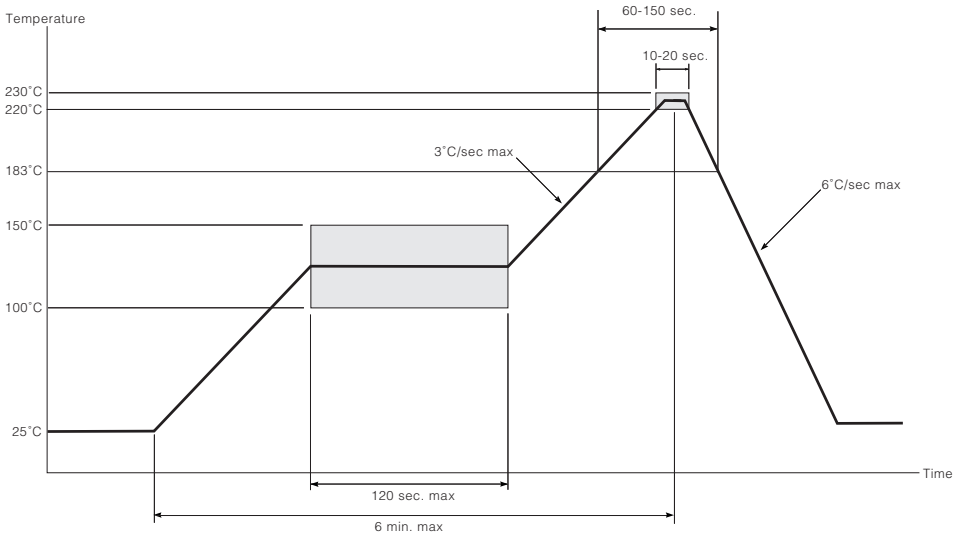


Figure 2-1: Standard Eutectic Solder Reflow Profile (Pb package, Pb paste)

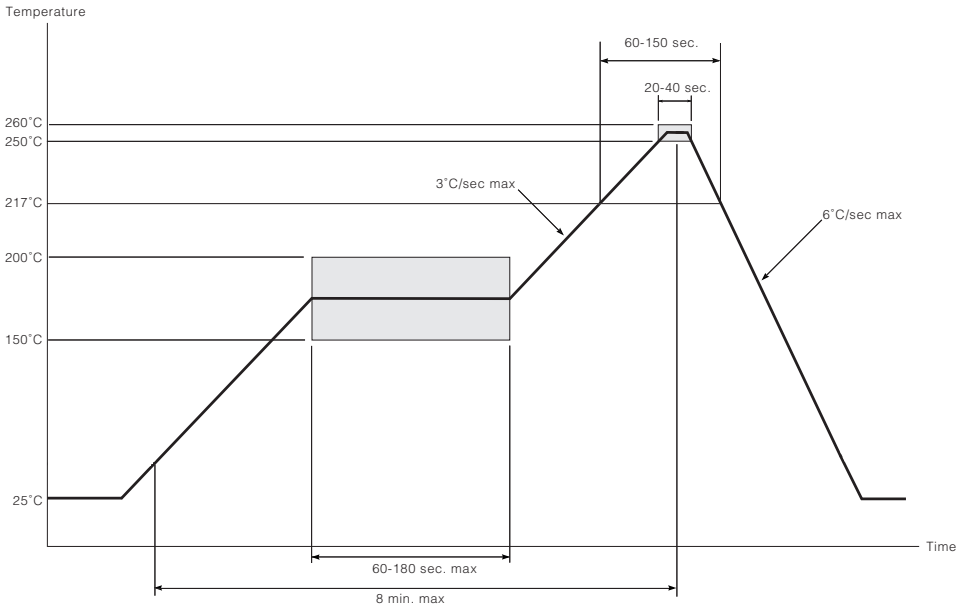


Figure 2-2: Maximum Pb-free Solder Reflow Profile (Pb-free package, Pb-free paste)

3. Input/Output Circuits

All resistors in ohms, all capacitors in farads, unless otherwise shown.

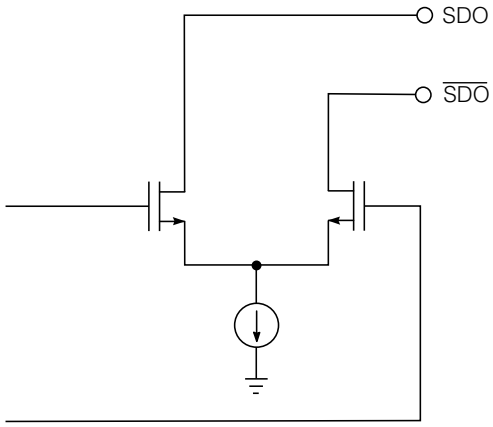


Figure 3-1: Serial Digital Output

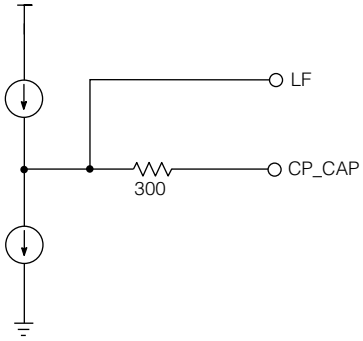


Figure 3-2: VCO Control Output & PLL Lock Time Capacitor

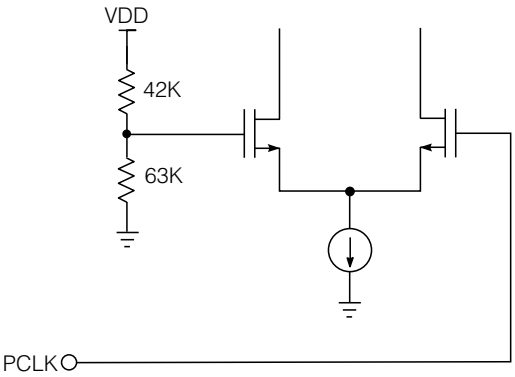


Figure 3-3: PCLK Input

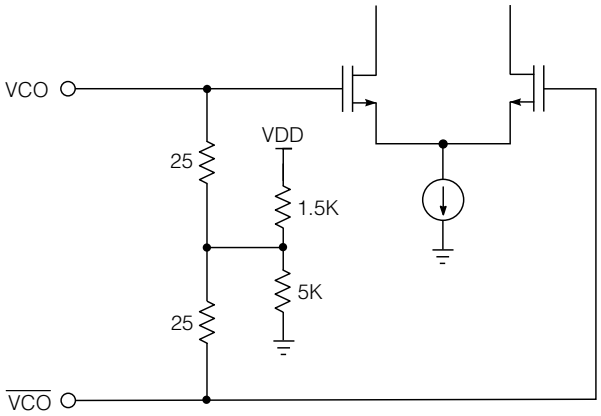


Figure 3-4: VCO Input

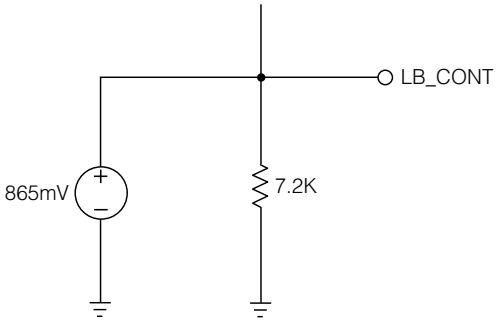


Figure 3-5: PLL Loop Bandwidth Control

3.1 Host Interface Maps

REGISTER NAME	ADDRESS	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
LINE_352M_f2	1Ch	Not Used	Not Used	Not Used	Not Used	Not Used	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
LINE_352M_f1	1Bh	Not Used	Not Used	Not Used	Not Used	Not Used	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
	1Ah																
FF_LINE_END_F1	19h	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
FF_LINE_START_F1	18h	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
FF_LINE_END_F0	17h	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
FF_LINE_START_F0	16h	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
AP_LINE_END_F1	15h	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
AP_LINE_START_F1	14h	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
AP_LINE_END_F0	13h	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
AP_LINE_START_F0	12h	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
RASTER_STRUCTURE4	11h	Not Used	Not Used	Not Used	Not Used	Not Used	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
RASTER_STRUCTURE3	10h	Not Used	Not Used	Not Used	Not Used	Not Used	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
RASTER_STRUCTURE2	0Fh	Not Used	Not Used	Not Used	Not Used	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
RASTER_STRUCTURE1	0Eh	Not Used	Not Used	Not Used	Not Used	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
	0Dh																
	0Ch																
VIDEO_FORMAT_B	0Bh	VF4-b7	VF4-b6	VF4-b5	VF4-b4	VF4-b3	VF4-b2	VF4-b1	VF4-b0	VF3-b7	VF3-b6	VF3-b5	VF3-b4	VF3-b3	VF3-b2	VF3-b1	VF3-b0
VIDEO_FORMAT_A	0Ah	VF2-b7	VF2-b6	VF2-b5	VF2-b4	VF2-b3	VF2-b2	VF2-b1	VF2-b0	VF1-b7	VF1-b6	VF1-b5	VF1-b4	VF1-b3	VF1-b2	VF1-b1	VF1-b0
	09h																
	08h																
	07h																
	06h																
	05h																
VIDEO_STANDARD	04h	Not Used	VDS-b4	VDS-b3	VDS-b2	VDS-b1	VDS-b0	INT_PROG	STD_ LOCK	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED
	03h																
EDH_FLAG	02h	Not Used	ANC-UES	ANC-IDA	ANC-IDH	ANC-EDA	ANC-EDH	FF-UES	FF-IDA	FF-IDH	FF-EDA	FF-EDH	AP-UES	AP-IDA	AP-IDH	AP-EDA	AP-EDH
	01h																
IOPROC_DISABLE	00h	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	Not Used	H_CONFIG	Not Used	352M_INS	ILLEGAL_RE MAP	EDH_CRC_IN S	ANC_ CSUM_INS	CRC_INS	LNUM_ INS	TRS_INS

3.1.1 Host Interface Map (Read Only Registers)

REGISTER NAME	ADDRESS	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	1Ch																
	1Bh																
	1Ah																
	19h																
	18h																
	17h																
	16h																
	15h																
	14h																
	13h																
	12h																
RASTER_STRUCTURE4	11h						b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
RASTER_STRUCTURE3	10h						b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
RASTER_STRUCTURE2	0Fh					b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
RASTER_STRUCTURE1	0Eh					b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
	0Dh																
	0Ch																
	0Bh																
	0Ah																
	09h																
	08h																
	07h																
	06h																
	05h																
VIDEO_STANDARD	04h		VDS-b4	VDS-b3	VDS-b2	VDS-b1	VDS-b0	INT_PROG	STD_ LOCK								
	03h																
	02h																
	01h																
	00h																

3.1.2 Host Interface Map (R/W Configurable Registers)

REGISTER NAME	ADDRESS	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
LINE_352M_f2	1Ch						b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
LINE_352M_f1	1Bh						b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
	1Ah																
FF_LINE_END_F1	19h							b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
FF_LINE_START_F1	18h							b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
FF_LINE_END_F0	17h							b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
FF_LINE_START_F0	16h							b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
AP_LINE_END_F1	15h							b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
AP_LINE_START_F1	14h							b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
AP_LINE_END_F0	13h							b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
AP_LINE_START_F0	12h							b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
	11h																
	10h																
	0Fh																
	0Eh																
	0Dh																
	0Ch																
VIDEO_FORMAT_B	0Bh	VF4-b7	VF4-b6	VF4-b5	VF4-b4	VF4-b3	VF4-b2	VF4-b1	VF4-b0	VF3-b7	VF3-b6	VF3-b5	VF3-b4	VF3-b3	VF3-b2	VF3-b1	VF3-b0
VIDEO_FORMAT_A	0Ah	VF2-b7	VF2-b6	VF2-b5	VF2-b4	VF2-b3	VF2-b2	VF2-b1	VF2-b0	VF1-b7	VF1-b6	VF1-b5	VF1-b4	VF1-b3	VF1-b2	VF1-b1	VF1-b0
	09h																
	08h																
	07h																
	06h																
	05h																
	04h																
	03h																
EDH_FLAG	02h		ANC-UES	ANC-IDA	ANC-IDH	ANC-EDA	ANC-EDH	FF-UES	FF-IDA	FF-IDH	FF-EDA	FF-EDH	AP-UES	AP-IDA	AP-IDH	AP-EDA	AP-EDH
	01h																
IOPROC_DISABLE	00h								H_CONFIG		352M_INS	ILLEGAL_REMAP	EDH_CRC_INS	ANC_CSUM_INS	CRC_INS	LNUM_ INS	TRS_INS

4. Detailed Description

4.1 Functional Overview

The GS1531 is a multi-rate serializer with an integrated cable driver. When used in conjunction with the external GO1555/GO1525* Voltage Controlled Oscillator, a transmit solution at 1.485Gb/s, 1.485/1.001Gb/s or 270Mb/s is realized.

The device has three different modes of operation which must be set through external device pins.

When SMPTE mode is enabled, the device will accept 10-bit multiplexed or 20-bit demultiplexed SMPTE compliant data at both HD and SD signal rates. The device's additional processing features are also enabled in this mode.

In DVB-ASI mode, the GS1531 will accept an 8-bit parallel DVB-ASI compliant transport stream on its upper input bus. The serial output data stream will be 8b/10b encoded and stuffed.

The GS1531's third mode allows for the serializing of data not conforming to SMPTE or DVB-ASI streams.

The provided serial digital outputs feature a high impedance mode, output mute on loss of parallel clock and adjustable signal swing. The output slew rate is automatically controlled by the SD/$\overline{\text{HD}}$ setting.

In the digital signal processing core, several data processing functions are implemented including SMPTE 352M and EDH data packet generation and insertion, and automatic video standards detection. These features are all enabled by default, but may be individually disabled via internal registers accessible through the GSPI host interface.

Finally, the GS1531 contains a JTAG interface for boundary scan test implementations.

*For new designs use GO1555

4.2 Parallel Data Inputs

Data inputs enter the device on the rising edge of PCLK as shown in Figure 4-1.

The input data format is defined by the setting of the external SD/$\overline{\text{HD}}$, $\overline{\text{SMPTE\_BYPASS}}$ and DVB_ASI pins and may be presented in 10-bit or 20-bit format. The input data bus width is controlled independently from the internal data bus width by the 20bit/$\overline{\text{10bit}}$ input pin.

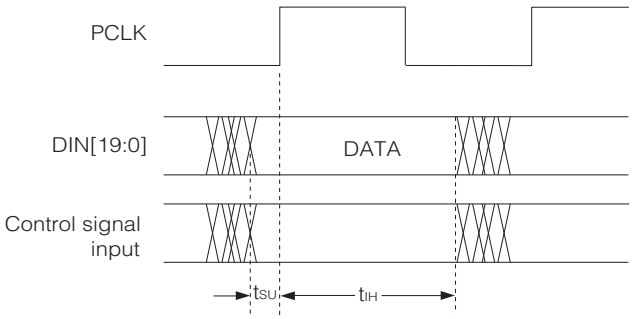


Figure 4-1: PCLK to Data Timing

4.2.1 Parallel Input in SMPTE Mode

When the device is operating in SMPTE mode, see SMPTE Mode on page 25, both SD and HD data may be presented to the input bus in either multiplexed or demultiplexed form depending on the setting of the 20bit/$\overline{10bit}$ input pin.

In 20-bit mode, (20bit/$\overline{10bit}$ = HIGH), the input data format should be word aligned, demultiplexed luma and chroma data. Luma words should be presented to DIN[19:10] while chroma words should occupy DIN[9:0].

In 10-bit mode, (20bit/$\overline{10bit}$ = LOW), the input data format should be word aligned, multiplexed luma and chroma data. The data should be presented to DIN[19:10]. DIN[9:0] will be high impedance in this mode.

4.2.2 Parallel Input in DVB-ASI Mode

When operating in DVB-ASI mode, see DVB-ASI mode on page 26, the GS1531 requires the input data bus to be configured for 10-bit operation (20bit/$\overline{10bit}$ = LOW).

The device accepts 8-bit data words on DIN[17:10] such that DIN17 = HIN is the most significant bit of the encoded transport stream data and DIN10 = AIN is the least significant bit.

In addition, DIN19 and DIN18 are configured as the DVB-ASI control signals INSSYNCIN and KIN respectively. See DVB-ASI mode on page 26 for a description of these DVB-ASI specific input signals.

The pins DIN[9:0] are high impedance when the GS1531 is operating in DVB-ASI mode.

4.2.3 Parallel Input in Data-Through Mode

When operating in Data-Through mode, see Data-Through Mode on page 28, the GS1531 passes data presented to the parallel input bus to the serial output without performing any encoding or scrambling.

The input data bus width accepted by the device in this mode is controlled by the setting of the 20bit/$\overline{10bit}$ pin.

4.2.4 Parallel Input Clock (PCLK)

The frequency of the PCLK input signal required by the GS1531 is determined by the input data format. Table 4-1 below lists the possible input signal formats and their corresponding parallel clock rates.

NOTE: DVB-ASI input requires a 10-bit wide input data bus (20bit/10$\overline{\text{bit}}$ = LOW).

Table 4-1: Parallel Data Input Format

Input Data Format	DIN [19:10]	DIN [9:0]	PCLK	Control Signals			
				20bit/10bit	SD/HD	SMPTE_BYPASS	DVB_ASI
SMPTE MODE							
20bit DEMULTIPLEXED SD	LUMA	CHROMA	13.5MHz	HIGH	HIGH	HIGH	LOW
10bit MULTIPLEXED SD	LUMA / CHROMA	HIGH IMPEDANCE	27MHz	LOW	HIGH	HIGH	LOW
20bit DEMULTIPLEXED HD	LUMA	CHROMA	74.25 or 74.25/1.001MHz	HIGH	LOW	HIGH	LOW
10bit MULTIPLEXED HD	LUMA / CHROMA	HIGH IMPEDANCE	148.5 or 148.5/1.001MHz	LOW	LOW	HIGH	LOW
DVB-ASI MODE							
10bit DVB-ASI	DVB-ASI DATA	HIGH IMPEDANCE	27MHz	LOW	HIGH	LOW	HIGH
				LOW	HIGH	LOW	HIGH
DATA-THROUGH MODE							
20bit DEMULTIPLEXED SD	DATA	DATA	13.5MHz	HIGH	HIGH	LOW	LOW
10bit MULTIPLEXED SD	DATA	HIGH IMPEDANCE	27MHz	LOW	HIGH	LOW	LOW
20bit DEMULTIPLEXED HD	DATA	DATA	74.25 or 74.25/1.001MHz	HIGH	LOW	LOW	LOW
10bit MULTIPLEXED HD	DATA	HIGH IMPEDANCE	148.5 or 148.5/1.001MHz	LOW	LOW	LOW	LOW

4.3 SMPTE Mode

The GS1531 is said to be in SMPTE mode when the $\overline{\text{SMPTE\_BYPASS}}$ pin is set HIGH and the DVB_ASI pin is set LOW.

In this mode, the parallel data will be scrambled according to SMPTE 259M or 292M, and NRZ-to-NRZI encoded prior to serialization.

4.3.1 Internal Flywheel

The GS1531 has an internal flywheel which is used in the generation of internal / external timing signals, and in automatic video standards detection. It is operational in SMPTE mode only.

The flywheel consists of a number of counters and comparators operating at video pixel and video line rates. These counters maintain information about the total line length, active line length, total number of lines per field / frame and total active lines per field / frame for the received video standard.

When DETECT_TRS is LOW, the flywheel will be locked to the externally supplied H, V, and F timing signals.

When DETECT_TRS is HIGH, the flywheel will be locked to the embedded TRS signals in the parallel input data. Both 8-bit and 10-bit TRS code words will be identified by the device.

The flywheel 'learns' the video standard by timing the horizontal and vertical reference information supplied a the H, V, and F input pins, or contained in the TRS ID words of the received video data. Full synchronization of the flywheel to the received video standard therefore requires one complete video frame.

Once synchronization has been achieved, the flywheel will continue to monitor the received TRS timing or the supplied H, V, and F timing information to maintain synchronization.

4.3.2 HVF Timing Signal Extraction

As discussed above, the GS1531's internal flywheel may be locked to externally provided H, V, and F signals when DETECT_TRS is set LOW.

The H signal timing should also be configured via the H_CONFIG bit of the internal IOPROC_DISABLE register as either active line based blanking or TRS based blanking, see Packet Generation and Insertion on page 30.

Active line based blanking is enabled when the H_CONFIG bit is set LOW. In this mode, the H input should be HIGH for the entire horizontal blanking period, including the EAV and SAV TRS words. This is the default H timing assumed by the device.

When H_CONFIG is set HIGH, TRS based blanking is enabled. In this case, the H input should be set HIGH for the entire horizontal blanking period as indicated by the H bit in the associated TRS words.

The timing of these signals is shown in Figure 4-2.