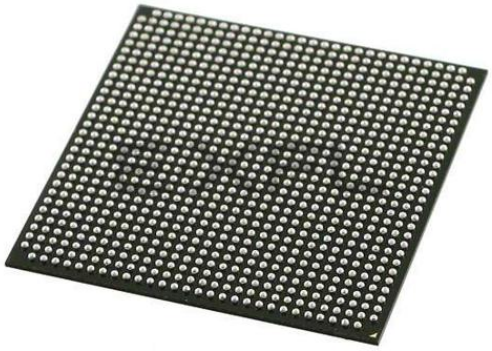

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Details	
Product Status	Obsolete
Number of LABs/CLBs	11460
Number of Logic Elements/Cells	242000
Total RAM Bits	15470592
Number of I/O	384
Number of Gates	-
Voltage - Supply	1.12V ~ 1.18V
Mounting Type	Surface Mount
Operating Temperature	-40°C ~ 100°C (TJ)
Package / Case	896-BBGA, FCBGA
Supplier Device Package	896-FBGA (31x31)
Purchase URL	https://www.e-xfl.com/product-detail/intel/5agtmc7g3f31i3n

Caution: Conditions outside the range listed in the following table may cause permanent damage tothe device. Additionally, device operation at the absolute maximum ratings for extended periods of time may have adverse effects on the device.

Table 1-1: Absolute Maximum Ratings for Arria V Devices

Symbol	Description	Minimum	Maximum	Unit
V_{CC}	Core voltage power supply	–0.50	1.43	V
V_{CCP}	Periphery circuitry, PCIe® hardIP block, and transceiver physical coding sublayer (PCS) power supply	–0.50	1.43	V
V_{CCPGM}	Configuration pins power supply	–0.50	3.90	V
V_{CC_AUX}	Auxiliary supply	–0.50	3.25	V
V_{CCBAT}	Battery back-up power supply for design security volatile key register	–0.50	3.90	V
V_{CCPD}	I/O pre-driver power supply	–0.50	3.90	V
V_{CCIO}	I/O power supply	–0.50	3.90	V
V_{CCD_FPLL}	Phase-locked loop (PLL) digital power supply	–0.50	1.80	V
V_{CCA_FPLL}	PLL analog power supply	–0.50	3.25	V
V_{CCA_GXB}	Transceiver high voltage power	–0.50	3.25	V
V_{CCH_GXB}	Transmitter output buffer power	–0.50	1.80	V
V_{CCR_GXB}	Receiver power	–0.50	1.50	V
V_{CCT_GXB}	Transmitter power	–0.50	1.50	V
V_{CCL_GXB}	Transceiver clock network power	–0.50	1.50	V
V_I	DC input voltage	–0.50	3.80	V
V_{CC_HPS}	HPS core voltage and periphery circuitry power supply	–0.50	1.43	V
V_{CCPD_HPS}	HPS I/O pre-driver power supply	–0.50	3.90	V
V_{CCIO_HPS}	HPS I/O power supply	–0.50	3.90	V
$V_{CCRSTCLK\_HPS}$	HPS reset and clock input pins power supply	–0.50	3.90	V

Symbol	Description	Condition	Minimum[1]	Typical	Maximum[1]	Unit
V_{CC}	Core voltage power supply	–C4, –I5, –C5, –C6	1.07	1.1	1.13	V
		–I3	1.12	1.15	1.18	V
V_{CCP}	Periphery circuitry, PCIe hard IP block, and transceiver PCS power supply	–C4, –I5, –C5, –C6	1.07	1.1	1.13	V
		–I3	1.12	1.15	1.18	V
V_{CCPGM}	Configuration pins power supply	3.3 V	3.135	3.3	3.465	V
		3.0 V	2.85	3.0	3.15	V
		2.5 V	2.375	2.5	2.625	V
		1.8 V	1.71	1.8	1.89	V
V_{CC_AUX}	Auxiliary supply	—	2.375	2.5	2.625	V
V_{CCBAT}[2]	Battery back-up power supply (For design security volatile key register)	—	1.2	—	3.0	V
V_{CCPD}[3]	I/O pre-driver power supply	3.3 V	3.135	3.3	3.465	V
		3.0 V	2.85	3.0	3.15	V
		2.5 V	2.375	2.5	2.625	V

(1) The power supply value describes the budget for the DC (static) power supply tolerance and does not include the dynamic tolerance requirements. Refer to the PDN tool for the additional budget for the dynamic tolerance requirements.
(2) If you do not use the design security feature in Arria V devices, connect V_{CCBAT} to a 1.5-V, 2.5-V, or 3.0-V power supply. Arria V power-on reset (POR) circuitry monitors V_{CCBAT}. Arria V devices do not exit POR if V_{CCBAT} is not powered up.
(3) V_{CCPD} must be 2.5 V when V_{CCIO} is 2.5, 1.8, 1.5, 1.35, 1.25, or 1.2 V. V_{CCPD} must be 3.0 V when V_{CCIO} is 3.0 V. V_{CCPD} must be 3.3 V when V_{CCIO} is 3.3 V.

Symbol	Description	Minimum[5]	Typical	Maximum[5]	Unit
V_{CCL_GXBL}	GX and SX speed grades—clock network power (left side)	1.08/1.12	1.1/1.15[6]	1.14/1.18	V
V_{CCL_GXBR}	GX and SX speed grades—clock network power (right side)				
V_{CCL_GXBL}	GT and ST speed grades—clock network power (left side)	1.17	1.20	1.23	V
V_{CCL_GXBR}	GT and ST speed grades—clock network power (right side)				

Related Information

Arria V GT, GX, ST, and SX Device Family Pin Connection Guidelines
Provides more information about the power supply connection for different data rates.

HPS Power Supply Operating Conditions

Table 1-5: HPS Power Supply Operating Conditions for Arria V SX and ST Devices

This table lists the steady-state voltage and current values expected from Arria V system-on-a-chip (SoC) devices with ARM®-based hard processor system (HPS). Power supply ramps must all be strictly monotonic, without plateaus. Refer to Recommended Operating Conditions for Arria V Devices table for the steady-state voltage values expected from the FPGA portion of the Arria V SoC devices.

Symbol	Description	Condition	Minimum[7]	Typical	Maximum[7]	Unit
V_{CC_HPS}	HPS core voltage and periphery circuitry power supply	–C4, –I5, –C5, –C6	1.07	1.1	1.13	V
		–I3	1.12	1.15	1.18	V

(5) The power supply value describes the budget for the DC (static) power supply tolerance and does not include the dynamic tolerance requirements. Refer to the PDN tool for the additional budget for the dynamic tolerance requirements.
(7) The power supply value describes the budget for the DC (static) power supply tolerance and does not include the dynamic tolerance requirements. Refer to the PDN tool for the additional budget for the dynamic tolerance requirements.

I/O Pin Leakage Current

Table 1-6: I/O Pin Leakage Current for Arria V Devices

Symbol	Description	Condition	Min	Typ	Max	Unit
I_I	Input pin	V_I = 0 V to $V_{CCIOMAX}$	–30	—	30	µA
I_{OZ}	Tri-stated I/O pin	V_O = 0 V to $V_{CCIOMAX}$	–30	—	30	µA

Bus Hold Specifications

Table 1-7: Bus Hold Parameters for Arria V Devices

The bus-hold trip points are based on calculated input voltages from the JEDEC standard.

Parameter	Symbol	Condition	V_{CCIO} (V)												Unit
			1.2		1.5		1.8		2.5		3.0		3.3		
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
Bus-hold, low, sustaining current	I_{SUSL}	$V_{IN} > V_{IL}$ (max)	8	—	12	—	30	—	50	—	70	—	70	—	µA
Bus-hold, high, sustaining current	I_{SUSH}	$V_{IN} < V_{IH}$ (min)	–8	—	–12	—	–30	—	–50	—	–70	—	–70	—	µA
Bus-hold, low, overdrive current	I_{ODL}	0 V < V_{IN} < V_{CCIO}	—	125	—	175	—	200	—	300	—	500	—	500	µA
Bus-hold, high, overdrive current	I_{ODH}	0 V < V_{IN} < V_{CCIO}	—	–125	—	–175	—	–200	—	–300	—	–500	—	–500	µA

Single-Ended SSTL, HSTL, and HSUL I/O Reference Voltage Specifications

Table 1-15: Single-Ended SSTL, HSTL, and HSUL I/O Reference Voltage Specifications for Arria V Devices

I/O Standard	V_{CCIO} (V)			V_{REF} (V)			V_{TT} (V)		
	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max
SSTL-2 Class I, II	2.375	2.5	2.625	0.49 × V_{CCIO}	0.5 × V_{CCIO}	0.51 × V_{CCIO}	V_{REF} – 0.04	V_{REF}	V_{REF} + 0.04
SSTL-18 Class I, II	1.71	1.8	1.89	0.833	0.9	0.969	V_{REF} – 0.04	V_{REF}	V_{REF} + 0.04
SSTL-15 Class I, II	1.425	1.5	1.575	0.49 × V_{CCIO}	0.5 × V_{CCIO}	0.51 × V_{CCIO}	0.49 × V_{CCIO}	0.5 × V_{CCIO}	0.51 × V_{CCIO}
SSTL-135 Class I, II	1.283	1.35	1.418	0.49 × V_{CCIO}	0.5 × V_{CCIO}	0.51 × V_{CCIO}	0.49 × V_{CCIO}	0.5 × V_{CCIO}	0.51 × V_{CCIO}
SSTL-125 Class I, II	1.19	1.25	1.26	0.49 × V_{CCIO}	0.5 × V_{CCIO}	0.51 × V_{CCIO}	0.49 × V_{CCIO}	0.5 × V_{CCIO}	0.51 × V_{CCIO}
HSTL-18 Class I, II	1.71	1.8	1.89	0.85	0.9	0.95	—	V_{CCIO}/2	—
HSTL-15 Class I, II	1.425	1.5	1.575	0.68	0.75	0.9	—	V_{CCIO}/2	—
HSTL-12 Class I, II	1.14	1.2	1.26	0.47 × V_{CCIO}	0.5 × V_{CCIO}	0.53 × V_{CCIO}	—	V_{CCIO}/2	—
HSUL-12	1.14	1.2	1.3	0.49 × V_{CCIO}	0.5 × V_{CCIO}	0.51 × V_{CCIO}	—	—	—

Table 1-21: Transceiver Clocks Specifications for Arria V GX and SX Devices

Symbol/Description	Condition	Transceiver Speed Grade 4			Transceiver Speed Grade 6			Unit
		Min	Typ	Max	Min	Typ	Max	
`fixedclk` clock frequency	PCIe Receiver Detect	—	125	—	—	125	—	MHz
Transceiver Reconfiguration Controller IP (`mgmt_clk_clk`) clock frequency	—	75	—	125	75	—	125	MHz

Table 1-22: Receiver Specifications for Arria V GX and SX Devices

Symbol/Description	Condition	Transceiver Speed Grade 4			Transceiver Speed Grade 6			Unit
		Min	Typ	Max	Min	Typ	Max	
Supported I/O standards	1.5 V PCML, 2.5 V PCML, LVPECL, and LVDS							
Data rate[28]	—	611	—	6553.6	611	—	3125	Mbps
Absolute V_{MAX} for a receiver pin[29]	—	—	—	1.2	—	—	1.2	V
Absolute V_{MIN} for a receiver pin	—	–0.4	—	—	–0.4	—	—	V
Maximum peak-to-peak differential input voltage V_{ID} (diff p-p) before device configuration	—	—	—	1.6	—	—	1.6	V
Maximum peak-to-peak differential input voltage V_{ID} (diff p-p) after device configuration	—	—	—	2.2	—	—	2.2	V

(28) To support data rates lower than the minimum specification through oversampling, use the CDR in LTR mode only.
(29) The device cannot tolerate prolonged operation at this absolute maximum.

For example, when V_{OD} = 800 mV, the corresponding V_{OD} value setting is 40. The following conditions show that the 1st post tap pre-emphasis setting = 2 is valid:

- $|B| + |C| \leq 60 \rightarrow 40 + 2 = 42$
- $|B| - |C| > 5 \rightarrow 40 - 2 = 38$
- $(V_{MAX}/V_{MIN} - 1)\% < 600\% \rightarrow (42/38 - 1)\% = 10.52\%$

To predict the pre-emphasis level for your specific data rate and pattern, run simulations using the Arria V HSSI HSPICE models.

Table 1-33: Transmitter Pre-Emphasis Levels for Arria V Devices

Quartus Prime 1st Post Tap Pre-Emphasis Setting	Quartus Prime V_{OD} Setting							Unit
	10 (200 mV)	20 (400 mV)	30 (600 mV)	35 (700 mV)	40 (800 mV)	45 (900 mV)	50 (1000 mV)	
0	0	0	0	0	0	0	0	dB
1	1.97	0.88	0.43	0.32	0.24	0.19	0.13	dB
2	3.58	1.67	0.95	0.76	0.61	0.5	0.41	dB
3	5.35	2.48	1.49	1.2	1	0.83	0.69	dB
4	7.27	3.31	2	1.63	1.36	1.14	0.96	dB
5	—	4.19	2.55	2.1	1.76	1.49	1.26	dB
6	—	5.08	3.11	2.56	2.17	1.83	1.56	dB
7	—	5.99	3.71	3.06	2.58	2.18	1.87	dB
8	—	6.92	4.22	3.47	2.93	2.48	2.11	dB
9	—	7.92	4.86	4	3.38	2.87	2.46	dB
10	—	9.04	5.46	4.51	3.79	3.23	2.77	dB
11	—	10.2	6.09	5.01	4.23	3.61	—	dB
12	—	11.56	6.74	5.51	4.68	3.97	—	dB
13	—	12.9	7.44	6.1	5.12	4.36	—	dB
14	—	14.44	8.12	6.64	5.57	4.76	—	dB
15	—	—	8.87	7.21	6.06	5.14	—	dB

Table 1-38: Memory Block Performance Specifications for Arria V Devices

Memory	Mode	Resources Used		Performance			Unit
		ALUTs	Memory	–I3, –C4	–I5, –C5	–C6	
MLAB	Single port, all supported widths	0	1	500	450	400	MHz
	Simple dual-port, all supported widths	0	1	500	450	400	MHz
	Simple dual-port with read and write at the same address	0	1	400	350	300	MHz
	ROM, all supported width	—	—	500	450	400	MHz
M10K Block	Single-port, all supported widths	0	1	400	350	285	MHz
	Simple dual-port, all supported widths	0	1	400	350	285	MHz
	Simple dual-port with the read-during-write option set to **Old Data**, all supported widths	0	1	315	275	240	MHz
	True dual port, all supported widths	0	1	400	350	285	MHz
	ROM, all supported widths	0	1	400	350	285	MHz

Internal Temperature Sensing Diode Specifications

Table 1-39: Internal Temperature Sensing Diode Specifications for Arria V Devices

Temperature Range	Accuracy	Offset Calibrated Option	Sampling Rate	Conversion Time	Resolution	Minimum Resolution with no Missing Codes
–40 to 100°C	±8°C	No	1 MHz	< 100 ms	8 bits	8 bits

Periphery Performance

This section describes the periphery performance, high-speed I/O, and external memory interface.

Actual achievable frequency depends on design and system specific factors. Ensure proper timing closure in your design and perform HSPICE/IBIS simulations based on your specific design and system setup to determine the maximum achievable frequency in your system.

LVDS Soft-CDR/DPA Sinusoidal Jitter Tolerance Specifications

Figure 1-5: LVDS Soft-Clock Data Recovery (CDR)/DPA Sinusoidal Jitter Tolerance Specification for a Data Rate Equal to 1.25 Gbps

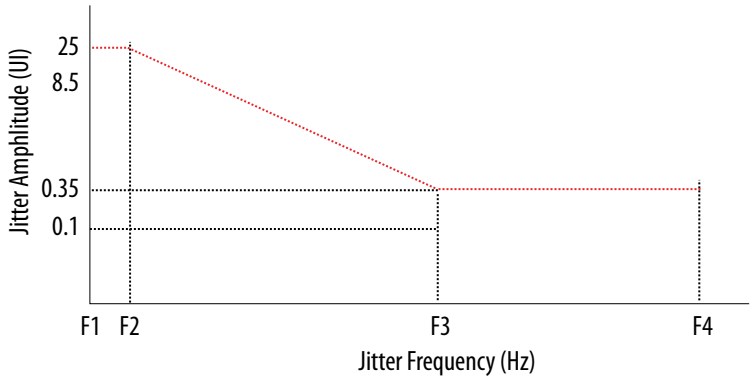


Table 1-42: LVDS Soft-CDR/DPA Sinusoidal Jitter Mask Values for a Data Rate Equal to 1.25 Gbps

Jitter Frequency (Hz)		Sinusoidal Jitter (UI)
F1	10,000	25.000
F2	17,565	25.000
F3	1,493,000	0.350
F4	50,000,000	0.350

Memory Output Clock Jitter Specifications

Table 1-45: Memory Output Clock Jitter Specifications for Arria V Devices

The memory output clock jitter measurements are for 200 consecutive clock cycles, as specified in the JEDEC DDR2/DDR3 SDRAM standard.

The memory output clock jitter is applicable when an input jitter of 30 ps (p-p) is applied with bit error rate (BER) 10^{-12}, equivalent to 14 sigma.

Altera recommends using the UniPHY intellectual property (IP) with PHYCLK connections for better jitter performance.

Parameter	Clock Network	Symbol	–I3, –C4		–I5, –C5		–C6		Unit
			Min	Max	Min	Max	Min	Max	
Clock period jitter	PHYCLK	$t_{JIT(per)}$	–41	41	–50	50	–55	55	ps
Cycle-to-cycle period jitter	PHYCLK	$t_{JIT(cc)}$	63		90		94		ps

OCT Calibration Block Specifications

Table 1-46: OCT Calibration Block Specifications for Arria V Devices

Symbol	Description	Min	Typ	Max	Unit
OCTUSRCLK	Clock required by OCT calibration blocks	—	—	20	MHz
T_{OCTCAL}	Number of OCTUSRCLK clock cycles required for R_S OCT/R_T OCT calibration	—	1000	—	Cycles
$T_{OCTSHIFT}$	Number of OCTUSRCLK clock cycles required for OCT code to shift out	—	32	—	Cycles
T_{RS_RT}	Time required between the dyn_term_ctrl and oe signal transitions in a bidirectional I/O buffer to dynamically switch between R_S OCT and R_T OCT	—	2.5	—	ns

Table 1-57: RGMII RX Timing Requirements for Arria V Devices

Symbol	Description	Min	Typ	Unit
T_{clk} (1000Base-T)	RX_CLK clock period	—	8	ns
T_{clk} (100Base-T)	RX_CLK clock period	—	40	ns
T_{clk} (10Base-T)	RX_CLK clock period	—	400	ns
T_{su}	RX_D/RX_CTL setup time	1	—	ns
T_h	RX_D/RX_CTL hold time	1	—	ns

Figure 1-14: RGMII RX Timing Diagram

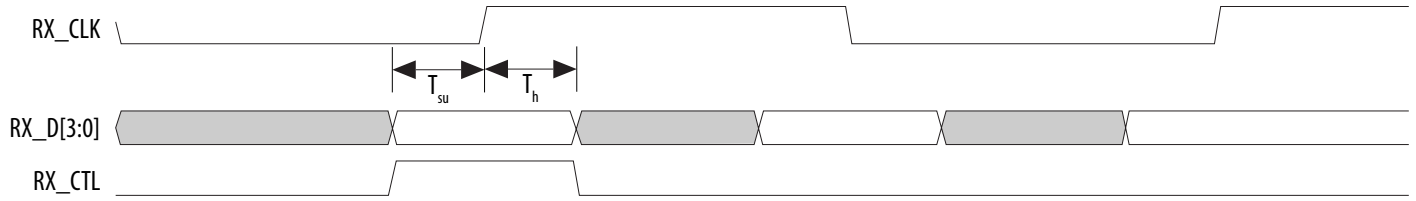
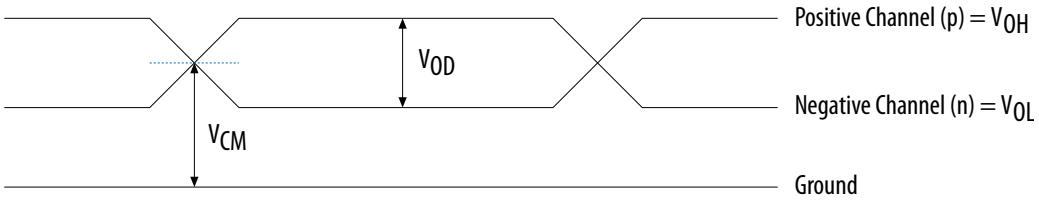
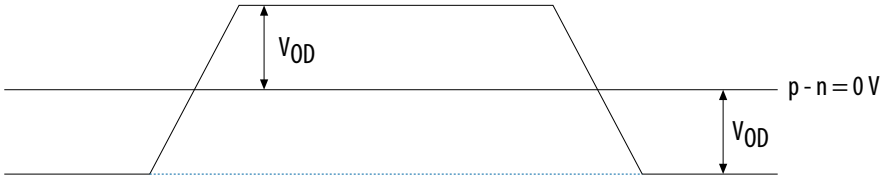
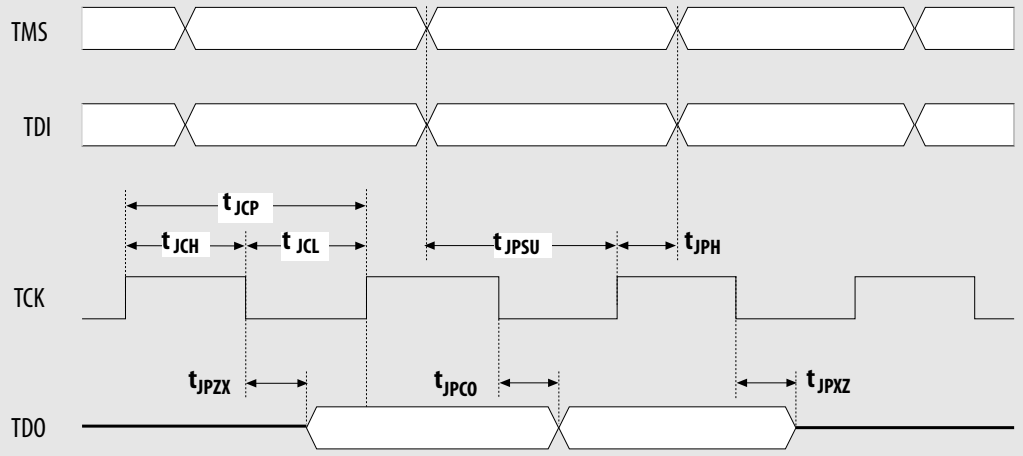


Table 1-58: Management Data Input/Output (MDIO) Timing Requirements for Arria V Devices

Symbol	Description	Min	Typ	Max	Unit
T_{clk}	MDC clock period	—	400	—	ns
T_d	MDC to MDIO output data delay	10	—	20	ns
T_s	Setup time for MDIO data	10	—	—	ns
T_h	Hold time for MDIO data	0	—	—	ns

Term	Definition
	Transmitter Output Waveforms **Single-Ended Waveform**  **Differential Waveform** 
f_{HSCLK}	Left/right PLL input clock frequency.
f_{HSDR}	High-speed I/O block—Maximum/minimum LVDS data transfer rate (f_{HSDR} =1/TUI), non-DPA.
$f_{HSDRDPA}$	High-speed I/O block—Maximum/minimum LVDS data transfer rate ($f_{HSDRDPA}$ =1/TUI), DPA.
J	High-speed I/O block—Deserialization factor (width of parallel data bus).

Term	Definition
JTAG timing specifications	JTAG Timing Specifications 

Hot Socketing

Table 2-14: Hot Socketing Specifications for Arria V GZ Devices

Symbol	Description	Maximum
$I_{IOPIN\ (DC)}$	DC current per I/O pin	300 µA
$I_{IOPIN\ (AC)}$	AC current per I/O pin	8 mA (124)
$I_{XCVR\text{-}TX\ (DC)}$	DC current per transceiver transmitter pin	100 mA
$I_{XCVR\text{-}RX\ (DC)}$	DC current per transceiver receiver pin	50 mA

Internal Weak Pull-Up Resistor

Table 2-15: Internal Weak Pull-Up Resistor for Arria V GZ Devices

All I/O pins have an option to enable the weak pull-up resistor except the configuration, test, and JTAG pins. The internal weak pull-down feature is only available for the JTAG TCK pin. The typical value for this internal weak pull-down resistor is approximately 25 kΩ .

Symbol	Description	V_{CCIO} Conditions (V) (125)	Value (126)	Unit
R_{PU}	Value of the I/O pin pull-up resistor before and during configuration, as well as user mode if you enable the programmable pull-up resistor option.	3.0 ±5%	25	k Ω
		2.5 ±5%	25	k Ω
		1.8 ±5%	25	k Ω
		1.5 ±5%	25	kΩ
		1.35 ±5%	25	k Ω
		1.25 ±5%	25	k Ω
		1.2 ±5%	25	k Ω

(124) The I/O ramp rate is 10 ns or more. For ramp rates faster than 10 ns, $|I_{IOPIN}| = C\ dv/dt$, in which C is the I/O pin capacitance and dv/dt is the slew rate.
(125) The pin pull-up resistance values may be lower if an external source drives the pin higher than V_{CCIO}.
(126) These specifications are valid with a ±10% tolerance to cover changes over PVT.

Symbol/Description	Conditions	Transceiver Speed Grade 2			Transceiver Speed Grade 3			Unit
		Min	Typ	Max	Min	Typ	Max	
Maximum peak-to-peak differential input voltage V_{ID} (diff p-p) before device configuration	—	—	—	1.6	—	—	1.6	V
Maximum peak-to-peak differential input voltage V_{ID} (diff p-p) after device configuration (146)	V_{CCR_GXB} = 1.0 V (V_{ICM} = 0.75 V)	—	—	1.8	—	—	1.8	V
	V_{CCR_GXB} = 0.85 V (V_{ICM} = 0.6 V)	—	—	2.4	—	—	2.4	V
Minimum differential eye opening at receiver serial input pins (147)(148)	—	85	—	—	85	—	—	mV
Differential on-chip termination resistors	85–Ω setting	—	85 ± 30%	—	—	85 ± 30%	—	Ω
	100–Ω setting	—	100 ± 30%	—	—	100 ± 30%	—	Ω
	120–Ω setting	—	120 ± 30%	—	—	120 ± 30%	—	Ω
	150–Ω setting	—	150 ± 30%	—	—	150 ± 30%	—	Ω

(146) The maximum peak to peak differential input voltage V_{ID} after device configuration is equal to 4 × (absolute V_{MAX} for receiver pin - V_{ICM}).

(147) The differential eye opening specification at the receiver input pins assumes that **Receiver Equalization** is disabled. If you enable **Receiver Equalization**, the receiver circuitry can tolerate a lower minimum eye opening, depending on the equalization level.

(148) Minimum eye opening of 85 mV is only for the unstressed input eye condition.

Typical VOD Settings

Table 2-32: Typical V_{OD} Setting for Arria V GZ Channel, TX Termination = 100 Ω

The tolerance is +/-20% for all VOD settings except for settings 2 and below.

Symbol	V_{OD} Setting	V_{OD} Value (mV)	V_{OD} Setting	V_{OD} Value (mV)
V_{OD} **differential peak to peak typical**	0 (166)	0	32	640
	1 (166)	20	33	660
	2 (166)	40	34	680
	3 (166)	60	35	700
	4 (166)	80	36	720
	5 (166)	100	37	740
	6	120	38	760
	7	140	39	780
	8	160	40	800
	9	180	41	820
	10	200	42	840
	11	220	43	860
	12	240	44	880
	13	260	45	900
	14	280	46	920

(166) If TX termination resistance = 100 Ω,this VOD setting is illegal.

OCT Calibration Block Specifications

Table 2-51: OCT Calibration Block Specifications for Arria V GZ Devices

Symbol	Description	Min	Typ	Max	Unit
OCTUSRCLK	Clock required by the OCT calibration blocks	—	—	20	MHz
T_{OCTCAL}	Number of OCTUSRCLK clock cycles required for OCT R_S/R_T calibration	—	1000	—	Cycles
$T_{OCTSHIFT}$	Number of OCTUSRCLK clock cycles required for the OCT code to shift out	—	32	—	Cycles
T_{RS_RT}	Time required between the `dyn_term_ctrl` and `oe` signal transitions in a bidirectional I/O buffer to dynamically switch between OCT R_S and R_T (See the figure below.)	—	2.5	—	ns

Figure 2-6: Timing Diagram for `oe` and `dyn_term_ctrl` Signals

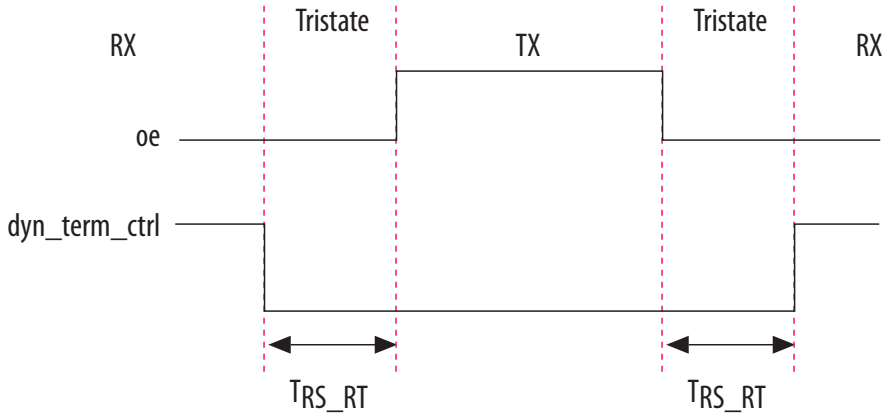


Table 2-55: DCLK-to-DATA[] Ratio for Arria V GZ Devices

Depending on the DCLK-to-DATA[] ratio, the host must send a DCLK frequency that is r times the data rate in bytes per second (Bps), or words per second (Wps). For example, in FPP ×16 when the DCLK-to-DATA[] ratio is 2, the DCLK frequency must be 2 times the data rate in Wps. Arria V GZ devices use the additional clock cycles to decrypt and decompress the configuration data.

Configuration Scheme	Decompression	Design Security	DCLK-to-DATA[] Ratio
FPP ×8	Disabled	Disabled	1
	Disabled	Enabled	1
	Enabled	Disabled	2
	Enabled	Enabled	2
FPP ×16	Disabled	Disabled	1
	Disabled	Enabled	2
	Enabled	Disabled	4
	Enabled	Enabled	4
FPP ×32	Disabled	Disabled	1
	Disabled	Enabled	4
	Enabled	Disabled	8
	Enabled	Enabled	8

Symbol	Parameter	Minimum	Maximum	Unit
t_{CD2CU}	CONF_DONE high to CLKUSR enabled	4 × maximum DCLK period	—	—
t_{CD2UMC}	CONF_DONE high to user mode with CLKUSR option on	t_{CD2CU} + (8576 × CLKUSR period) (209)	—	—

Related Information

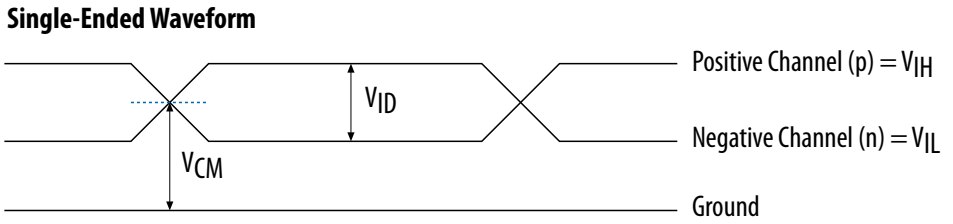
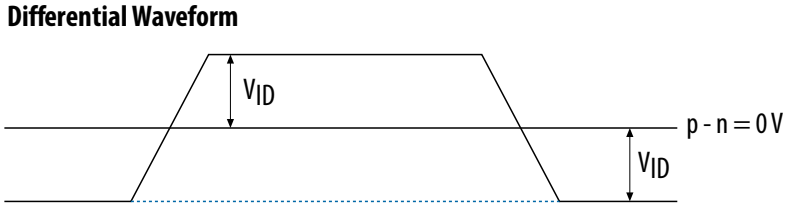
- **DCLK-to-DATA[] Ratio (r) for FPP Configuration** on page 2-57
- **Configuration, Design Security, and Remote System Upgrades in Arria V Devices**

(208) The minimum and maximum numbers apply only if you chose the internal oscillator as the clock source for initializing the device.

(209) To enable the CLKUSR pin as the initialization clock source and to obtain the maximum frequency specification on these pins, refer to the "Initialization" section of the *Configuration, Design Security, and Remote System Upgrades in Arria V Devices* chapter.

Glossary

Table 2-68: Glossary

Term	Definition
Differential I/O Standards	Receiver Input Waveforms   Transmitter Output Waveforms