Lattice Semiconductor Corporation - LAE3-35EA-6FN484E Datasheet

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Understanding Embedded - FPGAs (Field Programmable Gate Array)

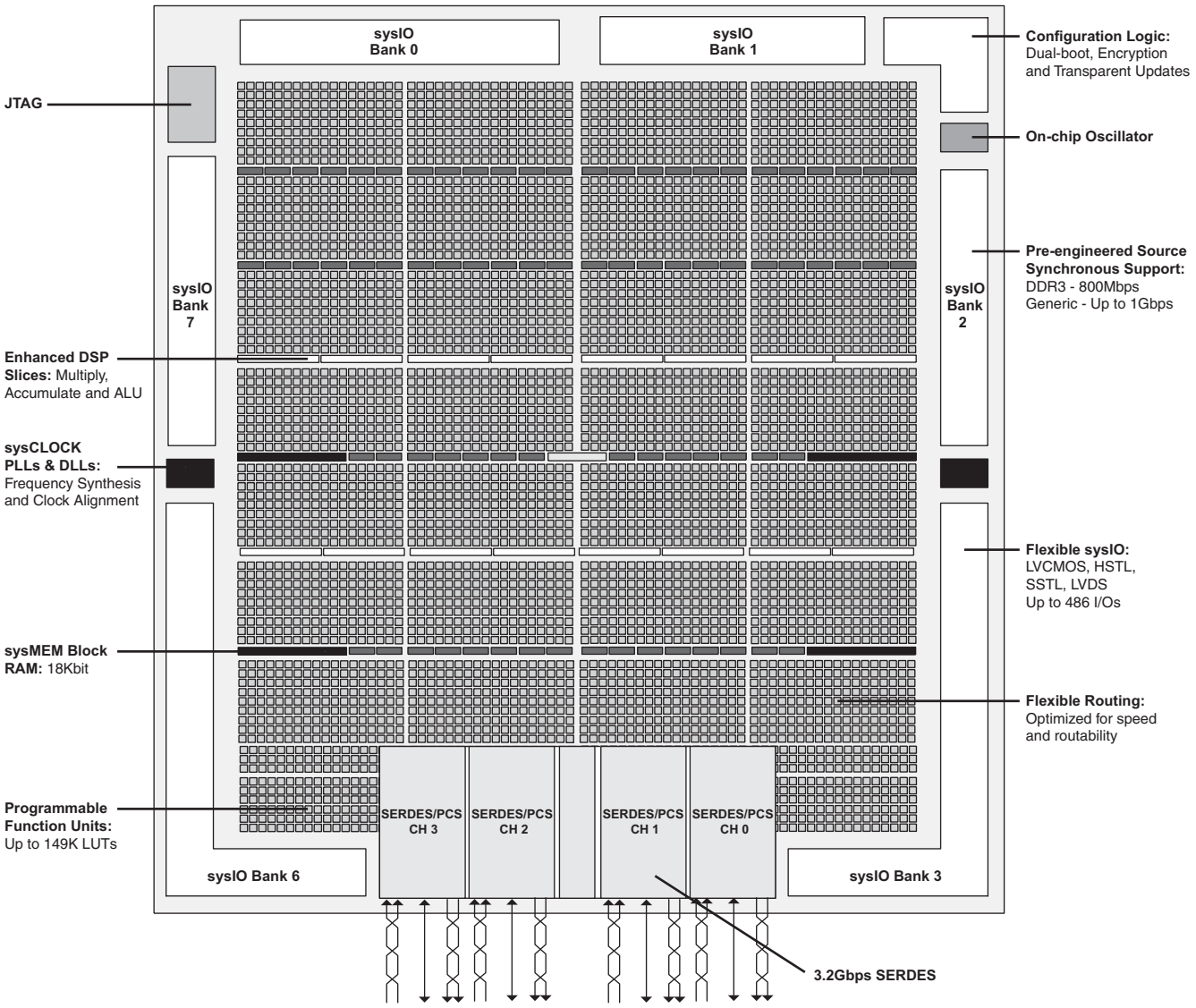
Embedded - FPGAs, or Field Programmable Gate Arrays, are advanced integrated circuits that offer unparalleled flexibility and performance for digital systems. Unlike traditional fixed-function logic devices, FPGAs can be programmed and reprogrammed to execute a wide array of logical operations, enabling customized functionality tailored to specific applications. This reprogrammability allows developers to iterate designs quickly and implement complex functions without the need for custom hardware.

Applications of Embedded - FPGAs

The versatility of Embedded - FPGAs makes them indispensable in numerous fields. In telecommunications.

Details	
Product Status	Active
Number of LABs/CLBs	4125
Number of Logic Elements/Cells	33000
Total RAM Bits	1358848
Number of I/O	295
Number of Gates	-
Voltage - Supply	1.14V ~ 1.26V
Mounting Type	Surface Mount
Operating Temperature	-40°C ~ 125°C (TJ)
Package / Case	484-BBGA
Supplier Device Package	484-FPBGA (23x23)
Purchase URL	https://www.e-xfl.com/product-detail/lattice-semiconductor/lae3-35ea-6fn484e

Figure 2-1. Simplified Block Diagram, LA-LatticeECP3-35 Device (Top Level)



Note: There is no Bank 4 or Bank 5 in LatticeECP3 devices.

PFU Blocks

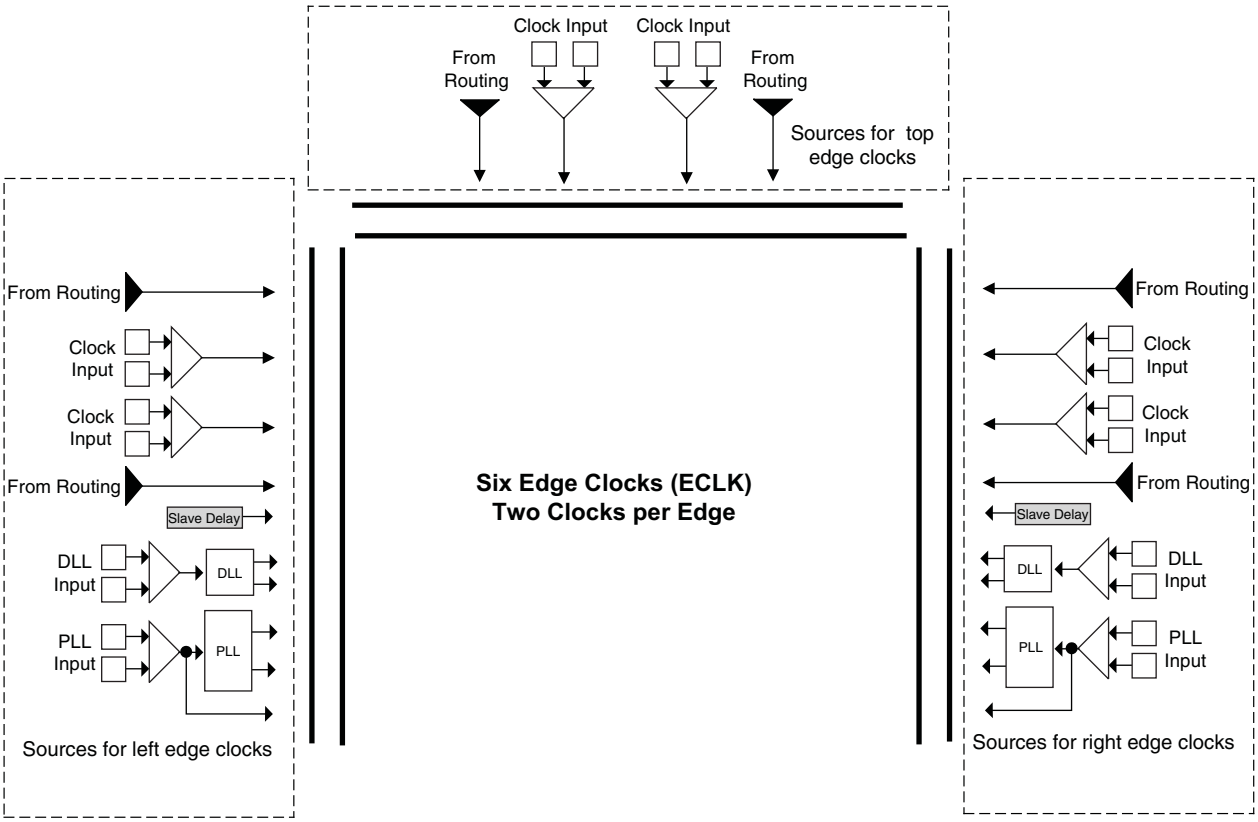
The core of the LA-LatticeECP3 device consists of PFU blocks, which are provided in two forms, the PFU and PFF. The PFUs can be programmed to perform Logic, Arithmetic, Distributed RAM and Distributed ROM functions. PFF blocks can be programmed to perform Logic, Arithmetic and ROM functions. Except where necessary, the remainder of this data sheet will use the term PFU to refer to both PFU and PFF blocks.

Each PFU block consists of four interconnected slices numbered 0-3 as shown in Figure 2-2. Each slice contains two LUTs. All the interconnections to and from PFU blocks are from routing. There are 50 inputs and 23 outputs associated with each PFU block.

Edge Clock Sources

Edge clock resources can be driven from a variety of sources at the same edge. Edge clock resources can be driven from adjacent edge clock PIOs, primary clock PIOs, PLLs, DLLs, Slave Delay and clock dividers as shown in Figure 2-18.

Figure 2-18. Edge Clock Sources



Notes:
1. Clock inputs can be configured in differential or single ended mode.
2. The two DLLs can also drive the two top edge clocks.
3. The top left and top right PLL can also drive the two top edge clocks.

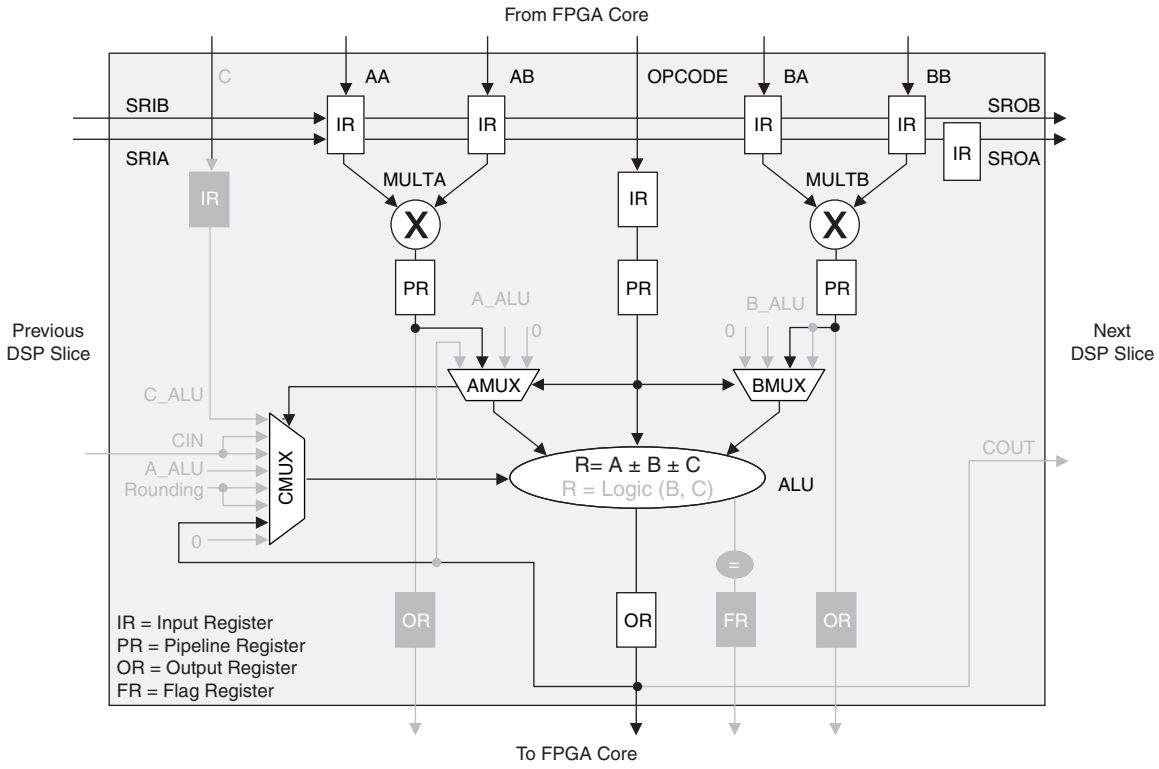
Edge Clock Routing

LA-LatticeECP3 devices have a number of high-speed edge clocks that are intended for use with the PIOs in the implementation of high-speed interfaces. There are six edge clocks per device: two edge clocks on each of the top, left, and right edges. Different PLL and DLL outputs are routed to the two muxes on the left and right sides of the device. In addition, the CLKINDEL signal (generated from the DLL Slave Delay Line block) is routed to all the edge clock muxes on the left and right sides of the device. Figure 2-19 shows the selection muxes for these clocks.

MMAC DSP Element

The LA-LatticeECP3 supports a MAC with two multipliers. This is called Multiply Multiply Accumulate or MMAC. In this case, the two operands, AA and AB, are multiplied and the result is added with the previous accumulated value and with the result of the multiplier operation of operands BA and BB. This accumulated value is available at the output. The user can enable the input and pipeline registers, but the output register is always enabled. The output register is used to store the accumulated value. The ALU is configured as the accumulator in the sysDSP slice. A registered overflow signal is also available. The overflow conditions are provided later in this document. Figure 2-27 shows the MMAC sysDSP element.

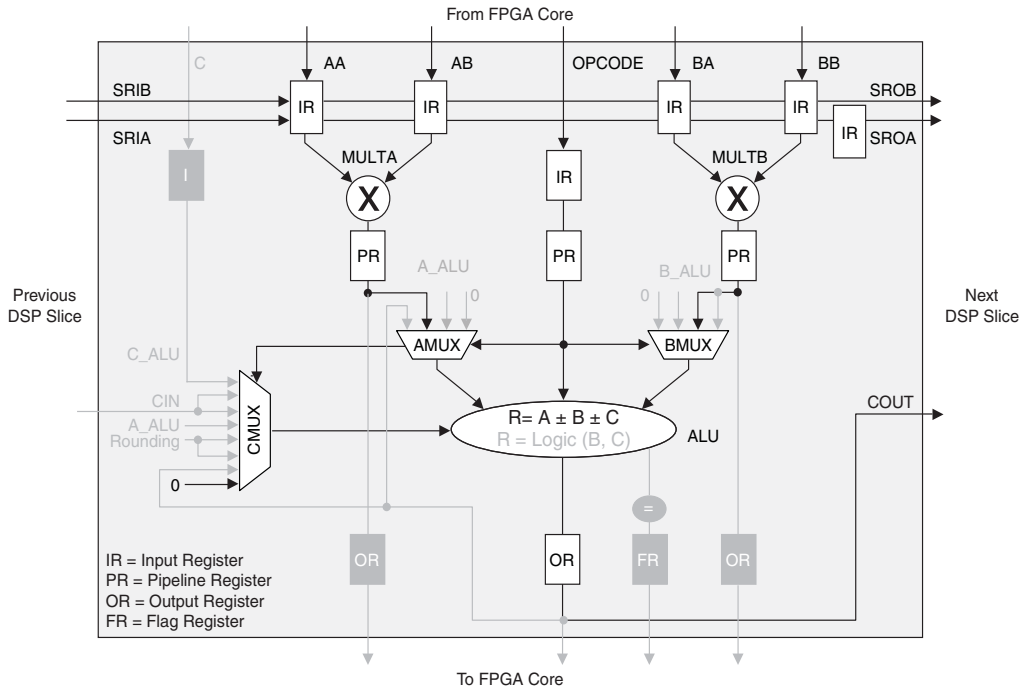
Figure 2-27. MMAC sysDSP Element



MULTADDSUBSUM DSP Element

In this case, the operands AA and AB are multiplied and the result is added/subtracted with the result of the multiplier operation of operands BA and BB of Slice 0. Additionally, the operands AA and AB are multiplied and the result is added/subtracted with the result of the multiplier operation of operands BA and BB of Slice 1. The results of both addition/subtractions are added by the second ALU following the slice cascade path. The user can enable the input, output and pipeline registers. Figure 2-29 and Figure 2-30 show the MULTADDSUBSUM sysDSP element.

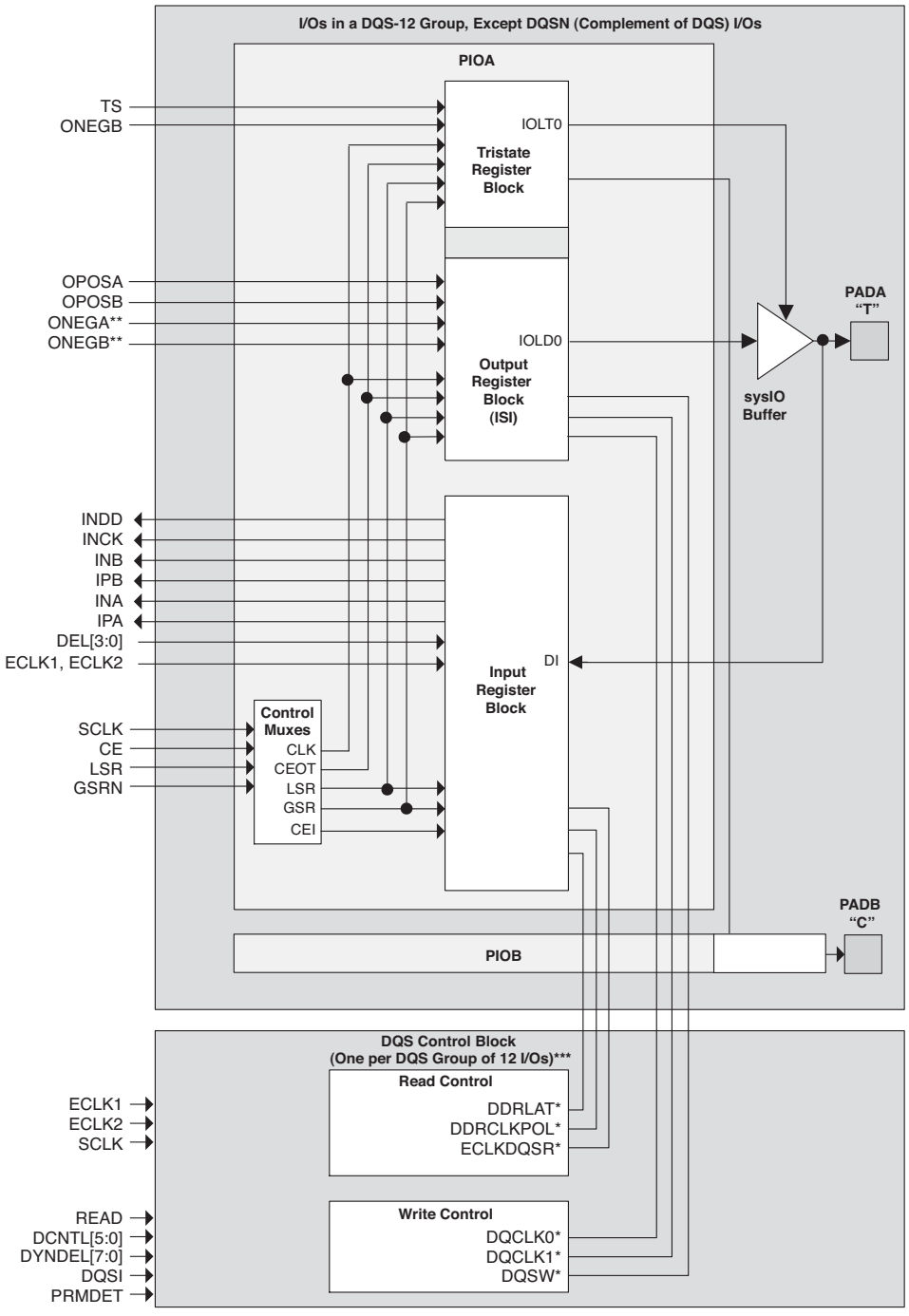
Figure 2-29. MULTADDSUBSUM Slice 0



Programmable I/O Cells (PIC)

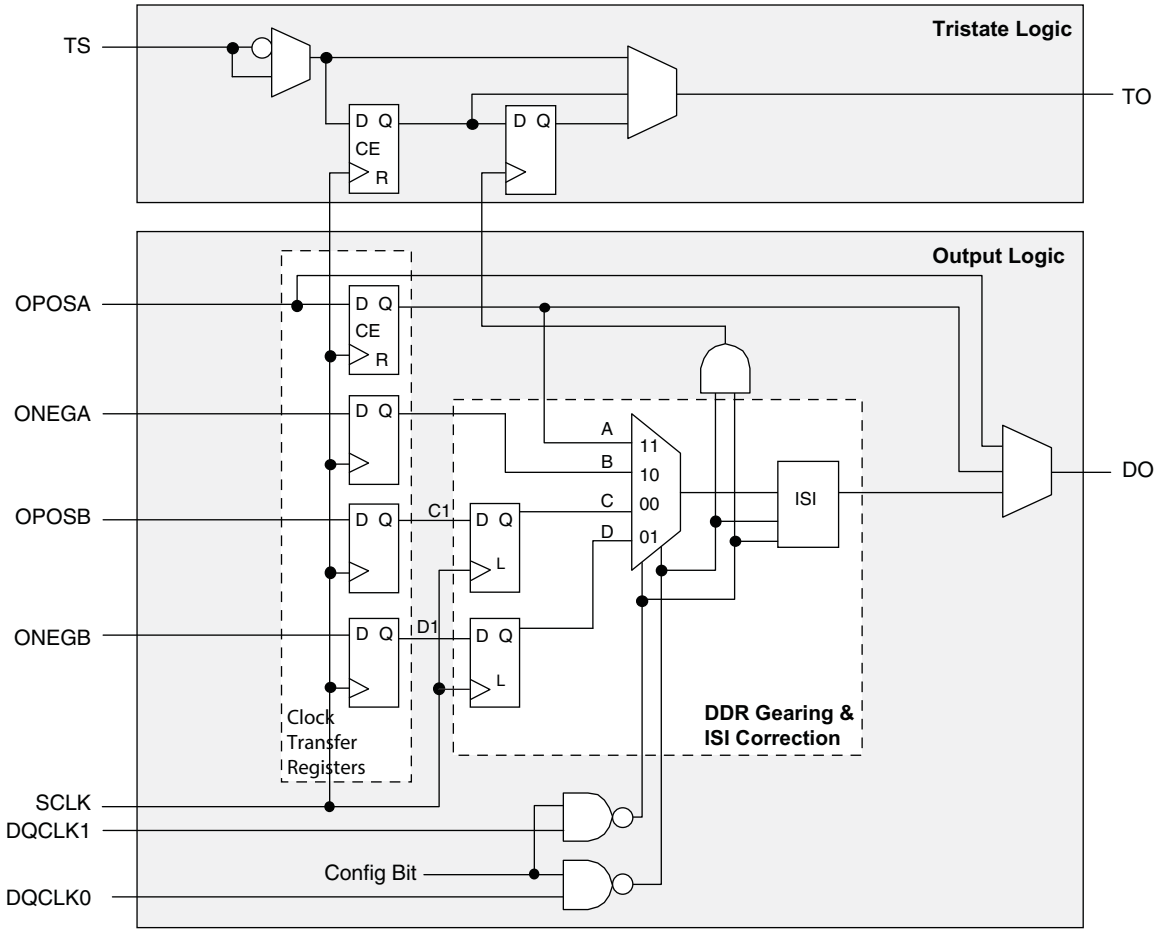
Each PIC contains two PIOs connected to their respective sysI/O buffers as shown in Figure 2-31. The PIO Block supplies the output data (DO) and the tri-state control signal (TO) to the sysI/O buffer and receives input from the buffer. Table 2-11 provides the PIO signal list.

Figure 2-31. PIC Diagram



* Signals are available on left/right/top edges only.
** Signals are available on the left and right sides only
*** Selected PIO.

Figure 2-33. Output and Tristate Block for Left and Right Edges



Tristate Register Block

The tristate register block registers tri-state control signals from the core of the device before they are passed to the sysI/O buffers. The block contains a register for SDR operation and an additional register for DDR operation.

In SDR and non-gearing DDR modes, TS input feeds one of the flip-flops that then feeds the output. In DDRX2 mode, the register TS input is fed into another register that is clocked using the DQCLK0 and DQCLK1 signals. The output of this register is used as a tristate control.

ISI Calibration

The setting for Inter-Symbol Interference (ISI) cancellation occurs in the output register block. ISI correction is only available in the DDRX2 modes. ISI calibration settings exist once per output register block, so each I/O in a DQS-12 group may have a different ISI calibration setting.

The ISI block extends output signals at certain times, as a function of recent signal history. So, if the output pattern consists of a long strings of 0's to long strings of 1's, there are no delays on output signals. However, if there are quick, successive transitions from 010, the block will stretch out the binary 1. This is because the long trail of 0's will cause these symbols to interfere with the logic 1. Likewise, if there are quick, successive transitions from 101, the block will stretch out the binary 0. This block is controlled by a 3-bit delay control that can be set in the DQS control logic block.

For more information about this topic, please see the list of technical documentation at the end of this data sheet.

Absolute Maximum Ratings[1, 2, 3]

Supply Voltage V_{CC} . . . . . -0.5 to 1.32V

Supply Voltage V_{CCAUX} . . . . . -0.5 to 3.75V

Supply Voltage V_{CCJ} . . . . . -0.5 to 3.75V

Output Supply Voltage V_{CCIO} . . . . . -0.5 to 3.75V

Input or I/O Tristate Voltage Applied[4]. . . . . -0.5 to 3.75V

Storage Temperature (Ambient) . . . . . -65 to 150°C

Junction Temperature (T_J) . . . . . +125°C

1. Stress above those listed under the "Absolute Maximum Ratings" may cause permanent damage to the device. Functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.
2. Compliance with the Lattice Thermal Management document is required.
3. All voltages referenced to GND.
4. Overshoot and undershoot of -2V to (V_{IHMAX} + 2) volts is permitted for a duration of <20ns.

Recommended Operating Conditions[1]

Symbol	Parameter	Min.	Max.	Units
V_{CC}[2]	Core Supply Voltage	1.14	1.26	V
V_{CCAUX}[2, 4]	Auxiliary Supply Voltage, Terminating Resistor Switching Power Supply (SERDES)	3.135	3.465	V
V_{CCPLL}	PLL Supply Voltage	3.135	3.465	V
V_{CCIO}[2, 3]	I/O Driver Supply Voltage	1.14	3.465	V
V_{CCJ}[2]	Supply Voltage for IEEE 1149.1 Test Access Port	1.14	3.465	V
V_{REF1} and V_{REF2}	Input Reference Voltage	0.5	1.7	V
V_{TT}[5]	Termination Voltage	0.5	1.3125	V
t_{AUTO}	Junction Temperature, Automotive Operation	-40	125	°C
SERDES External Power Supply[6]				
V_{CCIB}	Input Buffer Power Supply (1.2V)	1.14	1.26	V
	Input Buffer Power Supply (1.5V)	1.425	1.575	V
V_{CCOB}	Output Buffer Power Supply (1.2V)	1.14	1.26	V
	Output Buffer Power Supply (1.5V)	1.425	1.575	V
V_{CCA}	Transmit, Receive, PLL and Reference Clock Buffer Power Supply	1.14	1.26	V

1. For correct operation, all supplies except V_{REF} and V_{TT} must be held in their valid operation range. This is true independent of feature usage.
2. If V_{CCIO} or V_{CCJ} is set to 1.2V, they must be connected to the same power supply as V_{CC}. If V_{CCIO} or V_{CCJ} is set to 3.3V, they must be connected to the same power supply as V_{CCAUX}.
3. See recommended voltages by I/O standard in subsequent table.
4. V_{CCAUX} ramp rate must not exceed 30mV/µs during power-up when transitioning between 0V and 3.3V.
5. If not used, V_{TT} should be left floating.
6. See TN1176, LatticeECP3 SERDES/PCS Usage Guide for information on board considerations for SERDES power supplies.

MLVDS25

The LA-LatticeECP3 devices support the differential MLVDS standard. This standard is emulated using complementary LVCMOS outputs in conjunction with a parallel resistor across the driver outputs. The MLVDS input standard is supported by the LVDS differential input buffer. The scheme shown in Figure 3-5 is one possible solution for MLVDS standard implementation. Resistor values in Figure 3-5 are industry standard values for 1% resistors.

Figure 3-5. MLVDS25 (Multipoint Low Voltage Differential Signaling)

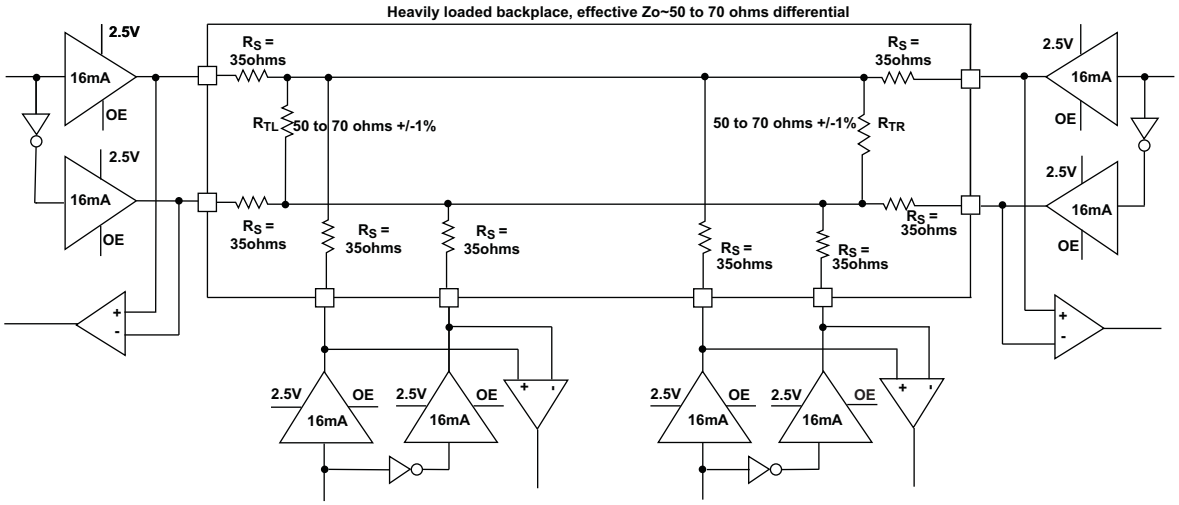


Table 3-7. MLVDS25 DC Conditions[1]

Parameter	Description	Typical		Units
		Zo=50Ω	Zo=70Ω	
V_{CCIO}	Output Driver Supply (+/-5%)	2.50	2.50	V
Z_{OUT}	Driver Impedance	10.00	10.00	Ω
R_S	Driver Series Resistor (+/-1%)	35.00	35.00	Ω
R_{TL}	Driver Parallel Resistor (+/-1%)	50.00	70.00	Ω
R_{TR}	Receiver Termination (+/-1%)	50.00	70.00	Ω
V_{OH}	Output High Voltage	1.52	1.60	V
V_{OL}	Output Low Voltage	0.98	0.90	V
V_{OD}	Output Differential Voltage	0.54	0.70	V
V_{CM}	Output Common Mode Voltage	1.25	1.25	V
I_{DC}	DC Output Current	21.74	20.00	mA

1. For input buffer, see LVDS table.

Derating Timing Tables

Logic timing provided in the following sections of this data sheet and the Diamond design tool are worst case numbers in the operating range. Actual delays at nominal temperature and voltage for best case process, can be much better than the values given in the tables. The Diamond design tool can provide logic timing numbers at a particular temperature and voltage.

Parameter	Description	Device	-6 / -6L		Units
			Min.	Max.	
Memory Interface					
DDR/DDR2 I/O Pin Parameters (Input Data are Strobe Edge Aligned, Output Strobe Edge is Data Centered)[4]					
t_{DVADQ}	Data Valid After DQS (DDR Read)	All Devices	-	0.225	UI
t_{DVEDQ}	Data Hold After DQS (DDR Read)	All Devices	0.64	-	UI
t_{DQVBS}	Data Valid Before DQS	All Devices	0.25	-	UI
t_{DQVAS}	Data Valid After DQS	All Devices	0.25	-	UI
f_{MAX_GDDR}	DDR Clock Frequency	All Devices	95	166	MHz
f_{MAX_GDDR2}	DDR2 Clock Frequency	All Devices	125	166	MHz
DDR3 (Using PLL for SCLK) I/O Pin Parameters					
t_{DVADQ}	Data Valid After DQS (DDR Read)	All Devices	-	0.225	UI
t_{DVEDQ}	Data Hold After DQS (DDR Read)	All Devices	0.64	-	UI
t_{DQVBS}	Data Valid Before DQS	All Devices	0.25	-	UI
t_{DQVAS}	Data Valid After DQS	All Devices	0.25	-	UI
f_{MAX_DDR3}	DDR3 Clock Frequency	All Devices	266	300	MHz
DDR3 Clock Timing					
t_{CH}	Average High Pulse Width	All Devices	0.47	0.53	UI
t_{CL}	Average Low Pulse Width	All Devices	0.47	0.53	UI
t_{JIT}	Output Clock Period Jitter During DLL Locking Period	All Devices	-90	90	ps
t_{JIT}	Output Cycle-to-Cycle Period Jitter During DLL Locking Period	All Devices	-	180	ps

1. Automotive timing numbers are shown.
2. General I/O timing numbers based on LVCMOS 2.5, 12mA, Fast Slew Rate, 0pf load.
3. Generic DDR timing numbers based on LVDS I/O.
4. DDR timing numbers based on SSTL25. DDR2 timing numbers based on SSTL18.
5. DDR3 timing numbers based on SSTL15.
6. Uses LVDS I/O standard.
7. Maximum clock frequencies are tested under best case conditions. System performance may vary upon the user environment.
8. Using settings generated by IPexpress.
9. These numbers are generated using best case PLL located in the center of the device.
10. Uses SSTL25 Class II Differential I/O Standard.
11. All numbers are generated with Diamond 2.x software.

LA-LatticeECP3 Family Timing Adders [1, 2, 3, 4, 5]

Over Recommended Operating Conditions

Buffer Type	Description	-6 / -6L	Units
Input Adjusters			
LVDS25E	LVDS, Emulated, VCCIO = 2.5V	-0.04	ns
LVDS25	LVDS, VCCIO = 2.5V	-0.04	ns
BLVDS25	BLVDS, Emulated, VCCIO = 2.5V	-0.04	ns
MLVDS25	MLVDS, Emulated, VCCIO = 2.5V	-0.04	ns
RSDS25	RSDS, VCCIO = 2.5V	-0.04	ns
PPLVDS	Point-to-Point LVDS	-0.04	ns
TRLVDS	Transition-Reduced LVDS	-0.04	ns
HYPT	HyperTransport	-0.04	ns
Mini MLVDS	Mini LVDS	-0.04	ns
LVPECL33	LVPECL, Emulated, VCCIO = 3.0V	-0.04	ns
HSTL18_I	HSTL_18 class I, VCCIO = 1.8V	0.14	ns
HSTL18_II	HSTL_18 class II, VCCIO = 1.8V	0.14	ns
HSTL18D_I	Differential HSTL 18 class I	0.14	ns
HSTL18D_II	Differential HSTL 18 class II	0.14	ns
HSTL15_I	HSTL_15 class I, VCCIO = 1.5V	0.14	ns
HSTL15D_I	Differential HSTL 15 class I	0.14	ns
SSTL33_I	SSTL_3 class I, VCCIO = 3.0V	0.30	ns
SSTL33_II	SSTL_3 class II, VCCIO = 3.0V	0.30	ns
SSTL33D_I	Differential SSTL_3 class I	0.30	ns
SSTL33D_II	Differential SSTL_3 class II	0.30	ns
SSTL25_I	SSTL_2 class I, VCCIO = 2.5V	0.17	ns
SSTL25_II	SSTL_2 class II, VCCIO = 2.5V	0.17	ns
SSTL25D_I	Differential SSTL_2 class I	0.17	ns
SSTL25D_II	Differential SSTL_2 class II	0.17	ns
SSTL18_I	SSTL_18 class I, VCCIO = 1.8V	0.04	ns
SSTL18_II	SSTL_18 class II, VCCIO = 1.8V	0.04	ns
SSTL18D_I	Differential SSTL_18 class I	0.04	ns
SSTL18D_II	Differential SSTL_18 class II	0.04	ns
SSTL15	SSTL_15, VCCIO = 1.5V	0.03	ns
SSTL15D	Differential SSTL_15	-0.04	ns
LVTTL33	LVTTL, VCCIO = 3.0V	0.05	ns
LVCMOS33	LVCMOS, VCCIO = 3.0V	0.05	ns
LVCMOS25	LVCMOS, VCCIO = 2.5V	0.00	ns
LVCMOS18	LVCMOS, VCCIO = 1.8V	0.11	ns
LVCMOS15	LVCMOS, VCCIO = 1.5V	0.26	ns
LVCMOS12	LVCMOS, VCCIO = 1.2V	0.09	ns
PCI33	PCI, VCCIO = 3.0V	0.05	ns
Output Adjusters			
LVDS25E	LVDS, Emulated, VCCIO = 2.5V	0.16	ns
LVDS25	LVDS, VCCIO = 2.5V	0.01	ns
BLVDS25	BLVDS, Emulated, VCCIO = 2.5V	-0.04	ns

sysCLOCK PLL Timing

Over Recommended Operating Conditions

Parameter	Descriptions	Conditions	Clock	Min.	Typ.	Max.	Units
f_{IN}	Input clock frequency (CLKI, CLKFB)		Edge clock	2	—	500	MHz
			Primary clock[4]	2	—	420	MHz
f_{OUT}	Output clock frequency (CLKOP, CLKOS)		Edge clock	4	—	500	MHz
			Primary clock[4]	4	—	420	MHz
f_{OUT1}	K-Divider output frequency	CLKOK		0.03125	—	250	MHz
f_{OUT2}	K2-Divider output frequency	CLKOK2		0.667	—	166	MHz
f_{VCO}	PLL VCO frequency			500	—	1000	MHz
f_{PFD}[3]	Phase detector input frequency		Edge clock	2	—	500	MHz
			Primary clock[4]	2	—	420	MHz
AC Characteristics							
t_{PA}	Programmable delay unit			65	130	260	ps
t_{DT}	Output clock duty cycle (CLKOS, at 50% setting)		Edge clock	45	50	55	%
		$f_{OUT} \leq 250$ MHz	Primary clock	45	50	55	%
		$f_{OUT} > 250$MHz	Primary clock	30	50	70	%
t_{CPA}	Coarse phase shift error (CLKOS, at all settings)			-5	0	+5	% of period
t_{OPW}	Output clock pulse width high or low (CLKOS)			1.8	—	—	ns
t_{OPJIT}[1]	Output clock period jitter	$f_{OUT} \geq 420$MHz		—	—	200	ps
		420MHz > $f_{OUT} \geq 100$MHz		—	—	250	ps
		$f_{OUT} < 100$MHz		—	—	0.025	UIPP
t_{SK}	Input clock to output clock skew when N/M = integer			—	—	500	ps
t_{LOCK}[2]	Lock time	2 to 25 MHz		—	—	200	us
		25 to 500 MHz		—	—	50	us
t_{UNLOCK}	Reset to PLL unlock time to ensure fast reset			—	—	50	ns
t_{HI}	Input clock high time	90% to 90%		0.5	—	—	ns
t_{LO}	Input clock low time	10% to 10%		0.5	—	—	ns
t_{IPJIT}	Input clock period jitter			—	—	400	ps
t_{RST}	Reset signal pulse width high, RSTK			10	—	—	ns
	Reset signal pulse width high, RST			500	—	—	ns

1. Jitter sample is taken over 10,000 samples of the primary PLL output with clean reference clock with no additional I/O toggling.
2. Output clock is valid after t_{LOCK} for PLL reset and dynamic delay adjustment.
3. Period jitter and cycle-to-cycle jitter numbers are guaranteed for $f_{PFD} > 4$MHz. For $f_{PFD} < 4$MHz, the jitter numbers may not be met in certain conditions. Please contact the factory for $f_{PFD} < 4$MHz.
4. When using internal feedback, maximum can be up to 500 MHz.

SERDES/PCS Block Latency

Table 3-10 describes the latency of each functional block in the transmitter and receiver. Latency is given in parallel clock cycles. Figure 3-12 shows the location of each block.

Table 3-10. SERDES/PCS Latency Breakdown

Item	Description	Min.	Avg.	Max.	Fixed	Bypass	Units
Transmit Data Latency[1]							
T1	FPGA Bridge - Gearing disabled with different clocks	1	3	5	—	1	word clk
	FPGA Bridge - Gearing disabled with same clocks	—	—	—	3	1	word clk
	FPGA Bridge - Gearing enabled	1	3	5	—	—	word clk
T2	8b10b Encoder	—	—	—	2	1	word clk
T3	SERDES Bridge transmit	—	—	—	2	1	word clk
T4	Serializer: 8-bit mode	—	—	—	15 + Δ1	—	UI + ps
	Serializer: 10-bit mode	—	—	—	18 + Δ1	—	UI + ps
T5	Pre-emphasis ON	—	—	—	1 + Δ2	—	UI + ps
	Pre-emphasis OFF	—	—	—	0 + Δ3	—	UI + ps
Receive Data Latency[2]							
R1	Equalization ON	—	—	—	Δ1	—	UI + ps
	Equalization OFF	—	—	—	Δ2	—	UI + ps
R2	Deserializer: 8-bit mode	—	—	—	10 + Δ3	—	UI + ps
	Deserializer: 10-bit mode	—	—	—	12 + Δ3	—	UI + ps
R3	SERDES Bridge receive	—	—	—	2	—	word clk
R4	Word alignment	3.1	—	4	—	—	word clk
R5	8b10b decoder	—	—	—	1	—	word clk
R6	Clock Tolerance Compensation	7	15	23	1	1	word clk
R7	FPGA Bridge - Gearing disabled with different clocks	1	3	5	—	1	word clk
	FPGA Bridge - Gearing disabled with same clocks	—	—	—	3	1	word clk
	FPGA Bridge - Gearing enabled	1	3	5	—	—	word clk

1. Δ1 = -245ps, Δ2 = +88ps, Δ3 = +112ps.
2. Δ1 = +118ps, Δ2 = +132ps, Δ3 = +700ps.

Figure 3-12. Transmitter and Receiver Latency Block Diagram

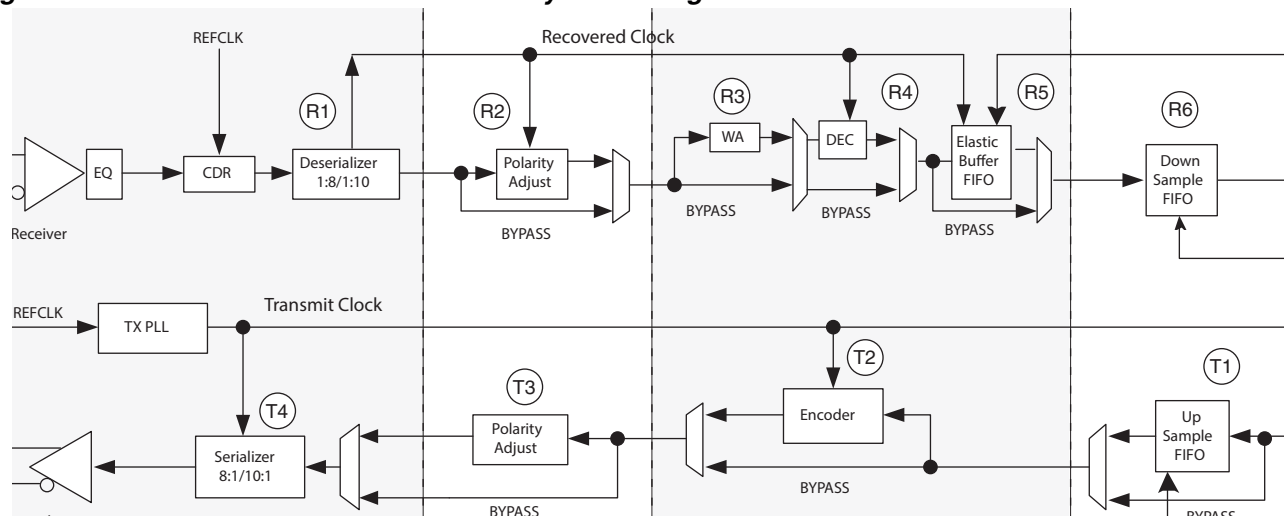


Table 3-13. Periodic Receiver Jitter Tolerance Specification

Description	Frequency	Condition	Min.	Typ.	Max.	Units
Periodic	2.97 Gbps	600 mV differential eye	—	—	0.24	UI, p-p
Periodic	2.5 Gbps	600 mV differential eye	—	—	0.22	UI, p-p
Periodic	1.485 Gbps	600 mV differential eye	—	—	0.24	UI, p-p
Periodic	622 Mbps	600 mV differential eye	—	—	0.15	UI, p-p
Periodic	150 Mbps	600 mV differential eye	—	—	0.5	UI, p-p

Note: Values are measured with PRBS 2^7-1, all channels operating, FPGA Logic active, I/Os around SERDES pins quiet, voltages are nominal, room temperature.

XAUI/Serial Rapid I/O Type 3/CPRI LV E.30 Electrical and Timing Characteristics

AC and DC Characteristics

Table 3-15. Transmit

Over Recommended Operating Conditions

Symbol	Description	Test Conditions	Min.	Typ.	Max.	Units
T_{RF}	Differential rise/fall time	20%-80%	—	80	—	ps
$Z_{TX\_DIFF\_DC}$	Differential impedance		80	100	120	Ohms
J_{TX_DDJ}[2, 3, 4]	Output data deterministic jitter		—	—	0.17	UI
J_{TX_TJ}[1, 2, 3, 4]	Total output data jitter		—	—	0.35	UI

1. Total jitter includes both deterministic jitter and random jitter.
2. Jitter values are measured with each CML output AC coupled into a 50-ohm impedance (100-ohm differential impedance).
3. Jitter and skew are specified between differential crossings of the 50% threshold of the reference signal.
4. Values are measured at 2.5 Gbps.

Table 3-16. Receive and Jitter Tolerance

Over Recommended Operating Conditions

Symbol	Description	Test Conditions	Min.	Typ.	Max.	Units
RL_{RX_DIFF}	Differential return loss	From 100 MHz to 3.125 GHz	10	—	—	dB
RL_{RX_CM}	Common mode return loss	From 100 MHz to 3.125 GHz	6	—	—	dB
Z_{RX_DIFF}	Differential termination resistance		80	100	120	Ohms
J_{RX_DJ}[1, 2, 3]	Deterministic jitter tolerance (peak-to-peak)		—	—	0.37	UI
J_{RX_RJ}[1, 2, 3]	Random jitter tolerance (peak-to-peak)		—	—	0.18	UI
J_{RX_SJ}[1, 2, 3]	Sinusoidal jitter tolerance (peak-to-peak)		—	—	0.10	UI
J_{RX_TJ}[1, 2, 3]	Total jitter tolerance (peak-to-peak)		—	—	0.65	UI
T_{RX_EYE}	Receiver eye opening		0.35	—	—	UI

1. Total jitter includes deterministic jitter, random jitter and sinusoidal jitter. The sinusoidal jitter tolerance mask is shown in Figure 3-18.
2. Jitter values are measured with each high-speed input AC coupled into a 50-ohm impedance.
3. Jitter and skew are specified between differential crossings of the 50% threshold of the reference signal.
4. Jitter tolerance parameters are characterized when Full Rx Equalization is enabled.
5. Values are measured at 2.5 Gbps.

SMPTE SD/HD-SDI/3G-SDI (Serial Digital Interface) Electrical and Timing Characteristics

AC and DC Characteristics

Table 3-21. Transmit

Symbol	Description	Test Conditions	Min.	Typ.	Max.	Units
BR_{SDO}	Serial data rate		270	—	2975	Mbps
$T_{JALIGNMENT}$ [2]	Serial output jitter, alignment	270 Mbps	—	—	0.20	UI
$T_{JALIGNMENT}$ [2]	Serial output jitter, alignment	1485 Mbps	—	—	0.20	UI
$T_{JALIGNMENT}$ [1, 2]	Serial output jitter, alignment	2970Mbps	—	—	0.30	UI
$T_{JTIMING}$	Serial output jitter, timing	270 Mbps	—	—	0.20	UI
$T_{JTIMING}$	Serial output jitter, timing	1485 Mbps	—	—	1.0	UI
$T_{JTIMING}$	Serial output jitter, timing	2970 Mbps	—	—	2.0	UI

Notes:
1. Timing jitter is measured in accordance with SMPTE RP 184-1996, SMPTE RP 192-1996 and the applicable serial data transmission standard, SMPTE 259M-1997 or SMPTE 292M (proposed). A color bar test pattern is used.The value of f_{SCLK} is 270 MHz or 360 MHz for SMPTE 259M, 540 MHz for SMPTE 344M or 1485 MHz for SMPTE 292M serial data rates. See the Timing Jitter Bandpass section.
2. Jitter is defined in accordance with SMPTE RP1 184-1996 as: jitter at an equipment output in the absence of input jitter.
3. All Tx jitter is measured at the output of an industry standard cable driver; connection to the cable driver is via a 50 ohm impedance differential signal from the Lattice SERDES device.
4. The cable driver drives: RL=75 ohm, AC-coupled at 270, 1485, or 2970 Mbps, RREFLVL=RREFPRE=4.75kohm 1%.

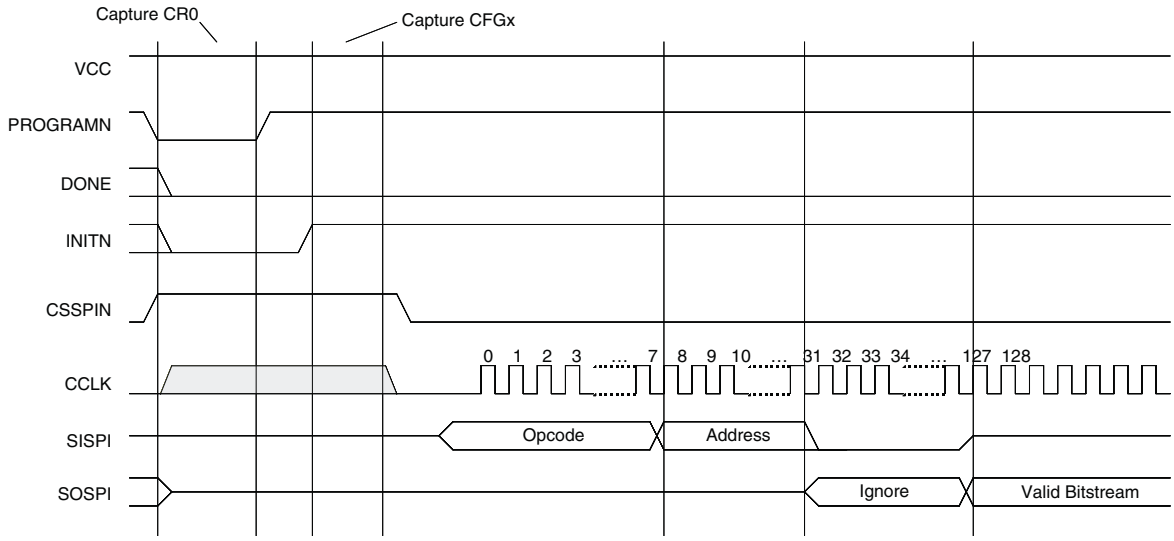
Table 3-22. Receive

Symbol	Description	Test Conditions	Min.	Typ.	Max.	Units
BR_{SDI}	Serial input data rate		270	—	2970	Mbps
CID	Stream of non-transitions (=Consecutive Identical Digits)		7(3G)/26(SMPTE Triple rates) @ 10-12 BER	—	—	Bits

Table 3-23. Reference Clock

Symbol	Description	Test Conditions	Min.	Typ.	Max.	Units
F_{VCLK}	Video output clock frequency		27	—	74.25	MHz
DC_V	Duty cycle, video clock		45	50	55	%

Table 3-25. Master SPI Configuration Waveforms



Signal Descriptions (Cont.)

Signal Name	I/O	Description
D7/SPID0	I/O	Parallel configuration I/O. SPI/SPIm data input. Open drain during configuration.
DI/CSSPI0N/CEN	I/O	Serial data input for slave serial mode. SPI/SPIm mode chip select.
Dedicated SERDES Signals[3]		
PCS[Index]_HDINNm	I	High-speed input, negative channel m
PCS[Index]_HDOUTNm	O	High-speed output, negative channel m
PCS[Index]_REFCLKN	I	Negative Reference Clock Input
PCS[Index]_HDINPm	I	High-speed input, positive channel m
PCS[Index]_HDOUTPm	O	High-speed output, positive channel m
PCS[Index]_REFCLKP	I	Positive Reference Clock Input
PCS[Index]_VCCOBm	—	Output buffer power supply, channel m (1.2V/1.5)
PCS[Index]_VCCIBm	—	Input buffer power supply, channel m (1.2V/1.5V)

1. When placing switching I/Os around these critical pins that are designed to supply the device with the proper reference or supply voltage, care must be given.
2. These pins are dedicated inputs or can be used as general purpose I/O.
3. m defines the associated channel in the quad.

LA-LatticeECP3 Automotive Family Data Sheet Ordering Information

June 2013 Advance Data Sheet DS1041

LA-LatticeECP3 Part Number Description

LAE3–XXX XX–X XXXXXX X

Device Family
ECP3 (LatticeECP3 FPGA + SERDES)

Logic Capacity
17 = 17K LUTs
35 = 33K LUTs

Supply Voltage
EA = 1.2V

Speed
-6 / -6L

Grade
E = Automotive

Package
FTN256 = 256-ball Lead-Free ftBGA
FN484 = 484-ball Lead-Free fpBGA
FN672 = 672-ball Lead-Free fpBGA
MG328 = 328-ball Green csBGA

Ordering Information

LA-LatticeECP3 devices have top-side markings, for automotive grades, as shown below:

Automotive

Note: See PCN 05A-12 for information regarding a change to the top-side mark logo.

Products are not designed, intended or warranted to be fail-safe and are not designed, intended or warranted for use in applications related to deployment of airbags. Further, products are not intended to be used, designed, or warranted for use in applications that affect the control of the vehicle unless there is a fail-safe or redundancy feature and also a warning signal to the operator of the vehicle upon failure. Use of products in such applications is fully at the risk of the customer, subject to applicable laws and regulations governing limitations on product liability.

LA-LatticeECP3 Devices, Green and Lead-Free Packaging

The following devices may have associated errata. Specific devices with associated errata will be notated with a footnote.

Part Number	Voltage	Grade	Package	Pins	Temp.	LUT (Ks)
LAE3-17EA-6FTN256E	1.2	6	Lead-Free ftBGA	256	Auto	17
LAE3-17EA-6LFTN256E	1.2	6L	Lead-Free ftBGA	256	Auto	17
LAE3-17EA-6MG328E	1.2	6	Green csBGA	328	Auto	17
LAE3-17EA-6LMG328E	1.2	6L	Green csBGA	328	Auto	17
LAE3-17EA-6FN484E	1.2	6	Lead-Free fpBGA	484	Auto	17
LAE3-17EA-6LFN484E	1.2	6L	Lead-Free fpBGA	484	Auto	17
LAE3-35EA-6LFTN256E	1.2	6L	Lead-Free ftBGA	256	Auto	35
LAE3-35EA-6FN484E	1.2	6	Lead-Free fpBGA	484	Auto	35
LAE3-35EA-6LFN484E	1.2	6L	Lead-Free fpBGA	484	Auto	35
LAE3-35EA-6FN672E	1.2	6	Lead-Free fpBGA	672	Auto	35
LAE3-35EA-6LFN672E	1.2	6L	Lead-Free fpBGA	672	Auto	35