9ZXL06x2E/9ZXL08xxE/9ZXL12x2E

6 to 12-Output Buffers for PCIe Gen1–7 and UPI with SMBus Write Protect

Description

The 9ZXL revision E Zero-Delay/Fanout Buffers (ZDB, FOB) with SMBus Write Protect are 2nd-generation enhanced performance buffers for PCIe and CPU applications. The devices have hardware SMBUS write protection to prevent accidental writes. The family meets all published QPI/UPI, DB2000Q and PCIe Gen1–7 jitter specifications. Devices range from 6 to 12 outputs, with each output having an OE# pin to support the PCIe CLKREQ# function for low power states. All devices meet DB2000Q, DB1200ZL and DB800ZL jitter and skew requirements.

Applications

- Servers/High-performance Computing
- nVME Storage
- Networking
- Accelerators
- Industrial Control

Key Specifications

- Fanout Buffer Mode additive phase jitter:
  - PCIe Gen7 CC, UPI > 20Gb/s < 8.6fs RMS
  - DB2000Q additive jitter < 28fs RMS
  - IF-UPI additive jitter < 70fs RMS
- ZDB Mode phase jitter:
  - PCIe Gen5 CC, UPI > 20Gb/s < 22fs RMS
  - QPI/UPI 11.4GB/s < 120fs RMS
  - IF-UPI additive jitter < 130fs RMS
- Cycle-to-cycle jitter < 50ps
- Output-to-output skew < 50ps

Features

- SMBus Write Protect pin prevents SMBus against accidental writes
- 6–12 Low-power HCSL (LP-HCSL) outputs
- Integrated terminations eliminate up to 4 resistors per output pair
- Dedicated OE# pins support PCIe CLKREQ# function
- Up to 9 selectable SMBus addresses (9ZXL12xx, 9ZXL0853)
- Selectable PLL bandwidths minimizes jitter peaking in cascaded PLL topologies
- Hardware/SMBus control of ZDB and FOB modes allow change without power cycle
- Spread spectrum compatible
- 1–400MHz FOB operation (all devices)
- 100MHz and 133.33MHz ZDB mode (9ZXL12xx, 9ZXL08xx)
- 100MHz ZDB mode (9ZXL06xx)
- -40°C to +85°C operating temperature range
- Packages: See Ordering Information for more details

PCIe Cocking Architectures

- Common Clocked (CC)
- Independent Reference (IR) with and without spread spectrum (SRIS, SRNS)

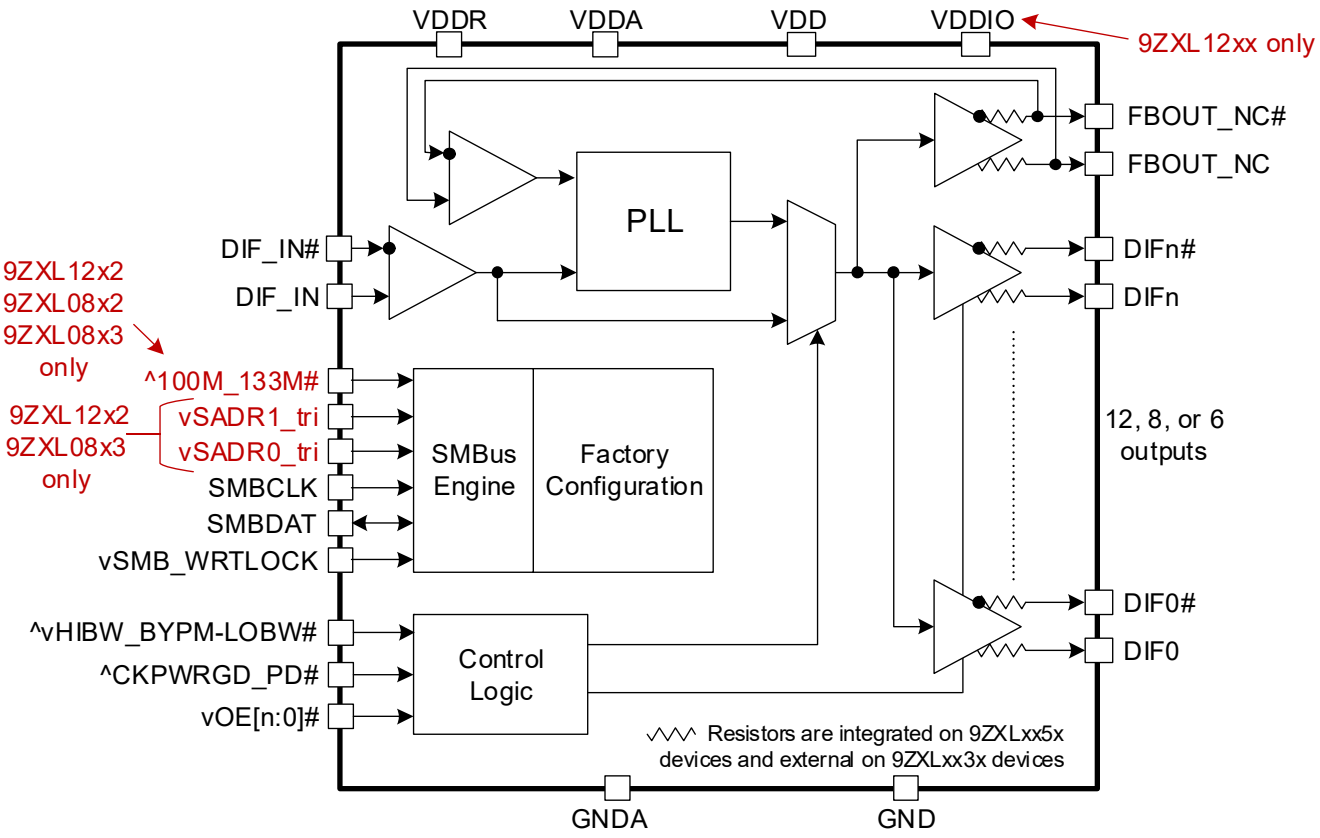
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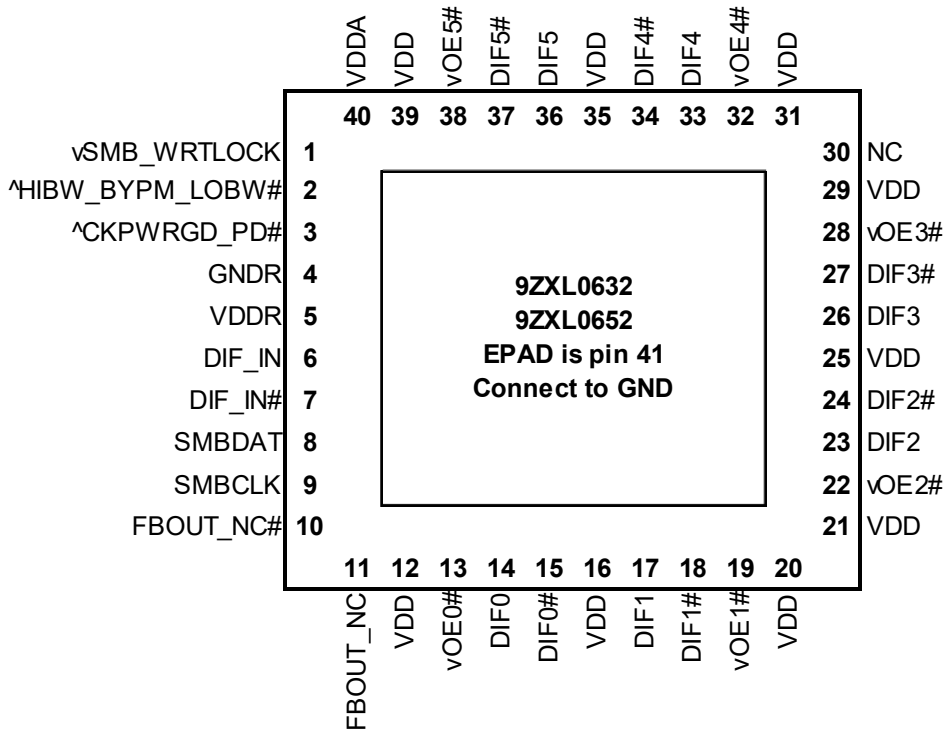
1. Overview

1.1 Block Diagram



2. Pin Information

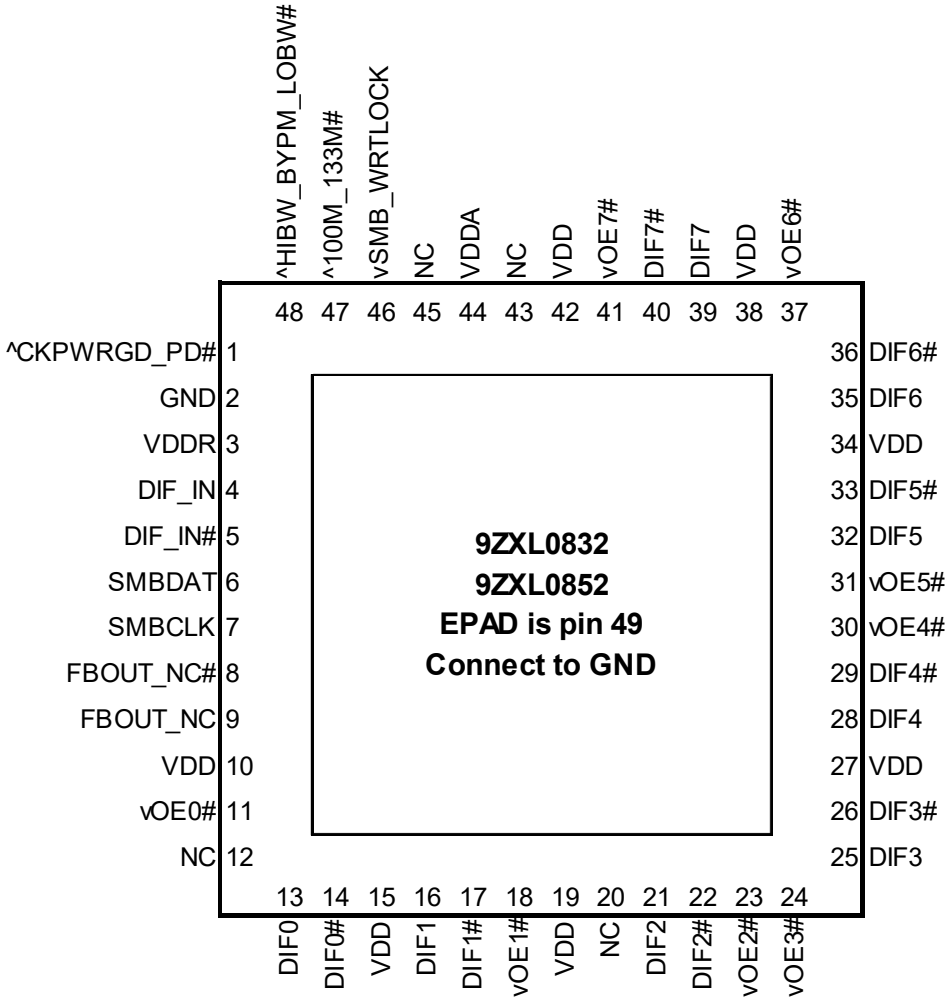
2.1 9ZXL06x2E Pin Assignments



5 × 5 mm, 0.40mm pitch 40-VFQFPN
Pins with ^ prefix have internal 120kohm pull-up
Pins with v prefix have internal 120kohm pull-down

Figure 1. Pin Assignment for 5 × 5 mm 40-VFQFPN Package – Top View

2.2 9ZXL08x2E Pin Assignments



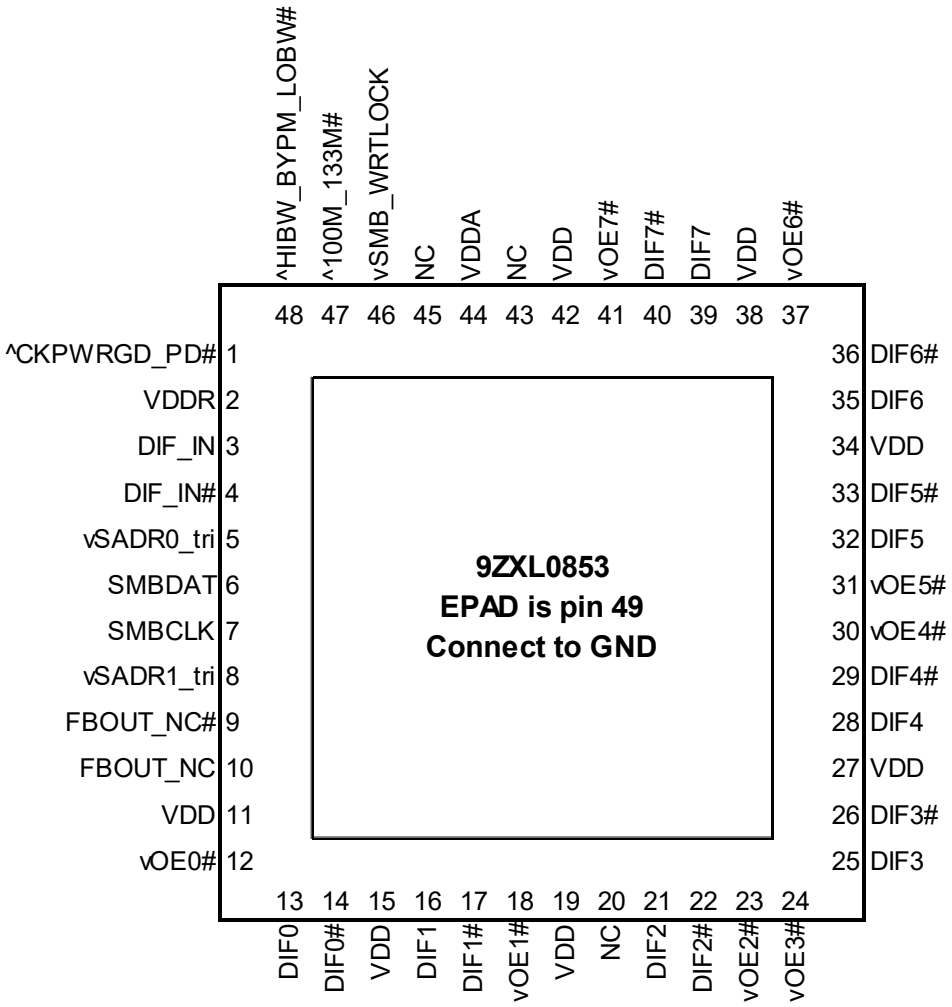
6 × 6 mm, 0.4mm pitch 48-VFQFPN

Pins with ^ prefix have internal 120kohm pull-up

Pins with v prefix have internal 120kohm pull-down

Figure 2. Pin Assignment for 6 × 6 mm 48-VFQFPN Package – Top View

2.3 9ZXL0853E Pin Assignments



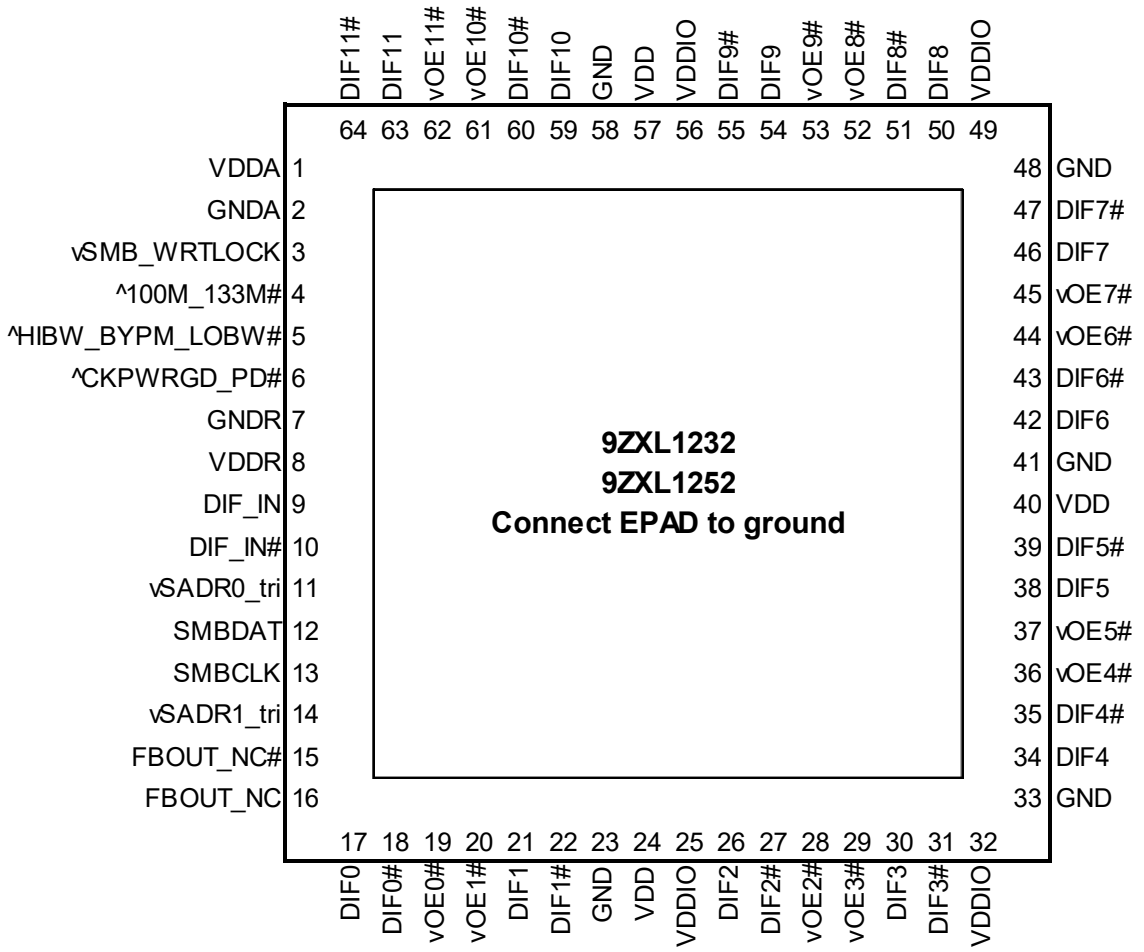
6 × 6 mm, 0.4mm pitch 48-VFQFPN

Pins with ^ prefix have internal 120kohm pull-up

Pins with v prefix have internal 120kohm pull-down

Figure 3. Pin Assignment for 6 × 6 mm 48-VFQFPN Package – Top View

2.4 9ZXL12x2E Pin Assignments



9 × 9 mm, 0.5mm pitch 64-VFQFPN

Pins with ^ prefix have internal 120kohm pull-up

Pins with v prefix have internal 120kohm pull-down

Figure 4. Pin Assignment for 9 × 9 mm 64-VFQFPN Package – Top View

2.5 Pin Descriptions

Table 1. Pin Descriptions

Name	Type	Description	9ZXL12x2 Pin No.	9ZXL08x2 Pin No.	9ZXL0853 Pin No.	9ZXL06x2 Pin No.
^100M_133M#	Latched In	3.3V Input to select operating frequency. This pin has an internal pull-up resistor. See <Hyperlink>Frequency Selection (PLL Mode) table for definition.	4	47	47	-
^CKPWRGD_PD#	Input	Input notifies device to sample latched inputs and start up on first high assertion. Low enters Power Down Mode, subsequent high assertions exit Power Down Mode. This pin has internal pull-up resistor.	6	1	1	3

Table 1. Pin Descriptions (Cont.)

Name	Type	Description	9ZXL12x2 Pin No.	9ZXL08x2 Pin No.	9ZXL0853 Pin No.	9ZXL06x2 Pin No.
^HIBW_BYPM_LOBW#	Latched In	Tri-level input to select High BW, Bypass or Low BW Mode. This pin has an internal pull-up resistor. See <Hyperlink>PLL Operating Mode table for details.	5	48	48	2
DIF_IN	Input	HCSL true input.	9	4	3	6
DIF_IN#	Input	HCSL complementary input.	10	5	4	7
DIF0	Output	Differential true clock output.	17	13	13	14
DIF0#	Output	Differential complementary clock output.	18	14	14	15
DIF1	Output	Differential true clock output.	21	16	16	17
DIF1#	Output	Differential complementary clock output.	22	17	17	18
DIF10	Output	Differential true clock output.	59	-	-	-
DIF10#	Output	Differential complementary clock output.	60	-	-	-
DIF11	Output	Differential true clock output.	63	-	-	-
DIF11#	Output	Differential complementary clock output.	64	-	-	-
DIF2	Output	Differential true clock output.	26	21	21	23
DIF2#	Output	Differential complementary clock output.	27	22	22	24
DIF3	Output	Differential true clock output.	30	25	25	26
DIF3#	Output	Differential complementary clock output.	31	26	26	27
DIF4	Output	Differential true clock output.	34	28	28	33
DIF4#	Output	Differential complementary clock output.	35	29	29	34
DIF5	Output	Differential true clock output.	38	32	32	36
DIF5#	Output	Differential complementary clock output.	39	33	33	37
DIF6	Output	Differential true clock output.	42	35	35	-
DIF6#	Output	Differential complementary clock output.	43	36	36	-
DIF7	Output	Differential true clock output.	46	39	39	-
DIF7#	Output	Differential complementary clock output.	47	40	40	-
DIF8	Output	Differential true clock output.	50	-	-	-
DIF8#	Output	Differential complementary clock output.	51	-	-	-
DIF9	Output	Differential true clock output.	54	-	-	-
DIF9#	Output	Differential complementary clock output.	55	-	-	-
EPAD	GND	Connect EPAD to ground.	65	49	49	41
FBOUT_NC	Output	True half of differential feedback output. This pin should NOT be connected to anything outside the chip. It exists to provide delay path matching to get 0 propagation delay.	16	9	10	11
FBOUT_NC#	Output	Complementary half of differential feedback output. This pin should NOT be connected to anything outside the chip. It exists to provide delay path matching to get 0 propagation delay.	15	8	9	10
GND	GND	Ground pin.	23	49	49	41

Table 1. Pin Descriptions (Cont.)

Name	Type	Description	9ZXL12x2 Pin No.	9ZXL08x2 Pin No.	9ZXL0853 Pin No.	9ZXL06x2 Pin No.
GND	GND	Ground pin.	33	49	49	41
GND	GND	Ground pin.	41	49	49	-
GND	GND	Ground pin.	48	49	49	-
GND	GND	Ground pin.	58	-	-	-
GNDA	GND	Ground pin for the PLL core.	2	49	49	41
GNDR	GND	Analog ground pin for the differential input (receiver).	7	2	49	4
NC	-	No connect.	-	12,20,43,45	20,43,45	30
SMBCLK	Input	Clock pin of SMBUS circuitry.	13	7	7	9
SMBDAT	I/O	Data pin of SMBUS circuitry.	12	6	6	8
VDD	Power	Power supply, nominally 3.3V.	24	10,15,19, 27,34,38,42	11,15,19, 27,34,38, 42	12,16,20, 21,25,29, 31,35,39
VDD	Power	Power supply, nominally 3.3V.	40	-	-	-
VDD	Power	Power supply, nominally 3.3V.	57	-	-	-
VDDA	Power	Power supply for PLL core.	1	44	44	40
VDDIO	Power	Power supply for differential outputs.	25	-	-	-
VDDIO	Power	Power supply for differential outputs.	32	-	-	-
VDDIO	Power	Power supply for differential outputs.	49	-	-	-
VDDIO	Power	Power supply for differential outputs.	56	-	-	-
VDDR	Power	Power supply for differential input clock (receiver). This VDD should be treated as an analog power rail and filtered appropriately. Nominally 3.3V.	8	3	2	5
vOE0#	Input	Active low input for enabling output 0. This pin has an internal pull-down. 1 = disable output, 0 = enable output.	19	11	12	13
vOE1#	Input	Active low input for enabling output 1. This pin has an internal pull-down. 1 = disable output, 0 = enable output.	20	18	18	19
vOE10#	Input	Active low input for enabling output 10. This pin has an internal pull-down. 1 = disable output, 0 = enable output.	61	-	-	-
vOE11#	Input	Active low input for enabling output 11. This pin has an internal pull-down. 1 = disable output, 0 = enable output.	62	-	-	-
vOE2#	Input	Active low input for enabling output 2. This pin has an internal pull-down. 1 = disable output, 0 = enable output.	28	23	23	22
vOE3#	Input	Active low input for enabling output 3. This pin has an internal pull-down. 1 = disable output, 0 = enable output.	29	24	24	28

Table 1. Pin Descriptions (Cont.)

Name	Type	Description	9ZXL12x2 Pin No.	9ZXL08x2 Pin No.	9ZXL0853 Pin No.	9ZXL06x2 Pin No.
vOE4#	Input	Active low input for enabling output 4. This pin has an internal pull-down. 1 = disable output, 0 = enable output.	36	30	30	32
vOE5#	Input	Active low input for enabling output 5. This pin has an internal pull-down. 1 = disable output, 0 = enable output.	37	31	31	38
vOE6#	Input	Active low input for enabling output 6. This pin has an internal pull-down. 1 = disable output, 0 = enable output.	44	37	37	-
vOE7#	Input	Active low input for enabling output 7. This pin has an internal pull-down. 1 = disable output, 0 = enable output.	45	41	41	-
vOE8#	Input	Active low input for enabling output 8. This pin has an internal pull-down. 1 = disable output, 0 = enable output.	52	-	-	-
vOE9#	Input	Active low input for enabling output 9. This pin has an internal pull-down. 1 = disable output, 0 = enable output.	53	-	-	-
vSADR0_tri	Input	SMBus address bit. This is a tri-level input that works in conjunction with other SADR pins, if present, to decode SMBus Addresses. It has an internal pull-down resistor. See the <Hyperlink>SMBus Addressing table.	11	-	5	-
vSADR1_tri	Input	SMBus address bit. This is a tri-level input that works in conjunction with other SADR pins, if present, to decode SMBus Addresses. It has an internal pull-down resistor. See the <Hyperlink>SMBus Addressing table.	14	-	8	-
vSMB_WRTLOCK	Input	This pin prevents SMBus writes when asserted. SMBus reads are not affected. This pin has an internal pull-down. 0 = SMBus writes allows, 1 = SMBus writes blocked.	3	46	46	1

3. Specifications

3.1 Absolute Maximum Ratings

CAUTION: Do not operate at or near the maximum ratings listed for extended periods of time. Exposure to such conditions can adversely impact product reliability and result in failures not covered by warranty.

Table 2. Absolute Maximum Ratings

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Supply Voltage [1][2]	VDDx	-	-	-	3.9	V
Input Low Voltage [1]	V_{IL}	-	GND - 0.5	-	-	V
Input High Voltage [1][3]	V_{IH}	Except for SMBus interface.	-	-	V_{DD} + 0.5	V
Input High Voltage [1]	V_{IHSMB}	SMBus clock and data pins.	-	-	3.9	V
Storage Temperature [1]	Ts	-	-65	-	150	°C
Junction Temperature [1]	Tj	-	-	-	125	°C

1. Confirmed by design and characterization, not 100% tested in production.
2. Operation under these conditions is neither implied nor guaranteed.
3. Not to exceed 3.9V.

3.2 ESD Ratings

ESD Model/Test	Rating	Unit
Human Body Model, Input ESD Protection (Tested per JS-001-2017) [1]	2500	V

1. Confirmed by design and characterization, not 100% tested in production.

3.3 Thermal Specifications

Table 3. Thermal Characteristics [1]

Parameter	Symbol	Conditions	Package	Typical Values	Unit
9ZXL12 Thermal Resistance	θ_{JC}	Junction to case.	NLG64	14	°C/W
	θ_{Jb}	Junction to base.		1	°C/W
	θ_{JA0}	Junction to air, still air.		28	°C/W
	θ_{JA1}	Junction to air, 1 m/s air flow.		21	°C/W
	θ_{JA3}	Junction to air, 3 m/s air flow.		19	°C/W
	θ_{JA5}	Junction to air, 5 m/s air flow.		18	°C/W
9ZXL08 Thermal Resistance	θ_{JC}	Junction to case.	NDG48	19	°C/W
	θ_{Jb}	Junction to base.		0	°C/W
	θ_{JA0}	Junction to air, still air.		30	°C/W
	θ_{JA1}	Junction to air, 1 m/s air flow.		23	°C/W
	θ_{JA3}	Junction to air, 3 m/s air flow.		20	°C/W
	θ_{JA5}	Junction to air, 5 m/s air flow.		19	°C/W

Table 3. Thermal Characteristics (Cont.) [1]

Parameter	Symbol	Conditions	Package	Typical Values	Unit
9ZXL06 Thermal Resistance	θ_{JC}	Junction to case.	NDG40	32	°C/W
	θ_{Jb}	Junction to base.		2	°C/W
	θ_{JA0}	Junction to air, still air.		44	°C/W
	θ_{JA1}	Junction to air, 1 m/s air flow.		37	°C/W
	θ_{JA3}	Junction to air, 3 m/s air flow.		33	°C/W
	θ_{JA5}	Junction to air, 5 m/s air flow.		31	°C/W

1. EPAD soldered to ground.

3.4 Electrical Specifications

$T_A = T_{AMB}$. Supply voltages per normal operation conditions; see Test Loads for loading conditions.

Table 4. SMBus Parameters

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Unit
SMBus Input Low Voltage	V_{ILSMB}	-	-	-	0.8	V
SMBus Input High Voltage	V_{IHSMB}	-	2.1	-	V_{DDSMB}	V
SMBus Output Low Voltage	V_{OLSMB}	At I_{PULLUP}.	-	-	0.4	V
SMBus Sink Current	I_{PULLUP}	At V_{OL}.	4	-	-	mA
Nominal Bus Voltage [1]	V_{DDSMB}	-	2.7	-	3.6	V
SCLK/SDATA Rise Time [1]	t_{RSMB}	(Max V_{IL} - 0.15V) to (Min V_{IH} + 0.15V).	-	-	1000	ns
SCLK/SDATA Fall Time [1]	t_{FSMB}	(Min V_{IH} + 0.15V) to (Max V_{IL} - 0.15V).	-	-	300	ns
SMBus Operating Frequency [2]	f_{SMB}	SMBus operating frequency.	-	-	400	kHz

1. Confirmed by design and characterization, not 100% tested in production.
2. The differential input clock must be running for the SMBus to be active.
3. Control input must be monotonic from 20% to 80% of input swing.
4. Time from deassertion until outputs are > 200mV.
5. DIF_IN input.

Table 5. DIF_IN Clock Input Parameters

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Input Crossover Voltage – DIF_IN [1]	V_{CROSS}	Crossover voltage.	150	-	900	mV
Input Swing – DIF_IN [1]	V_{SWING}	Differential value.	300	-	-	mV
Input Slew Rate – DIF_IN [1][2]	dv/dt	Measured differentially.	0.4	-	8	V/ns
Input Leakage Current	I_{IN}	$V_{IN} = V_{DD}$, V_{IN} = GND.	-5	-	5	µA
Input Duty Cycle [1]	d_{tin}	Measurement from differential waveform.	45	-	55	%
Input Jitter – Cycle to Cycle [1]	J_{DIFIn}	Differential measurement.	0	-	125	ps

1. Confirmed by design and characterization, not 100% tested in production.
2. Slew rate measured through ±75mV window centered around differential zero.

Table 6. Input/Supply/Common Parameters

T_{AMB} = over the specified operating range. Supply voltages per normal operation conditions; see Test Loads for loading conditions.

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Supply Voltage	$V_{DD}x$	Supply voltage for core and analog.	3.135	3.3	3.465	V
Output Supply Voltage [1]	V_{DDIO}	Supply voltage for DIF outputs, if present.	0.95	1.05	3.465	V
Ambient Operating Temperature [2]	T_{AMB}	Extended Industrial range (T_{EXIND}).	-40	25	105	°C
		Industrial range (T_{IND}).	-40	25	85	°C
Input High Voltage	V_{IH}	Single-ended inputs, except SMBus, tri-level inputs.	2	-	V_{DD} + 0.3	V
Input Low Voltage	V_{IL}	Single-ended inputs, except SMBus, tri-level inputs.	GND - 0.3	-	0.8	V
Input High Voltage	V_{IH}	Tri-level inputs.	2.2	-	V_{DD} + 0.3	V
Input Mid Voltage	V_{IM}	Tri-level inputs.	1.2	$V_{DD}/2$	1.8	V
Input Low Voltage	V_{IL}	Tri-level inputs.	GND - 0.3	-	0.8	V
Input Current	I_{IN}	Single-ended inputs, V_{IN} = GND, V_{IN} = V_{DD}.	-5	-	5	µA
	I_{INP}	Single-ended inputs. V_{IN} = 0 V; inputs with internal pull-up resistors. V_{IN} = V_{DD}; inputs with internal pull-down resistors.	-50	-	50	µA
Input Frequency	F_{ibyp}	V_{DD} = 3.3V, Bypass Mode.	1	-	400	MHz
	F_{ipll}	V_{DD} = 3.3V, 100MHz PLL Mode.	98.5	100.00	102.5	MHz
	F_{ipll}	V_{DD} = 3.3V, 133.33MHz PLL Mode. [3]	132	133.33	135	MHz
ppm Error Contribution	ppm	ppm error contributed to input clock.		0		ppm
Pin Inductance [4]	L_{pin}	-	-	-	7	nH
Capacitance	C_{IN}	Logic inputs, except DIF_IN.[4]	1.5	-	5	pF
	C_{INDIF_IN}	DIF_IN differential clock inputs. [4][5]	1.5	-	2.7	pF
	C_{OUT}	Output pin capacitance. [4]	-	-	6	pF
Clk Stabilization	T_{STAB}	From V_{DD} power-up and after input clock stabilization or deassertion of PD# to 1st clock. [4][6]	-	1	1.8	ms
Input SS Modulation Frequency PCIe	$f_{MODINPCIe}$	Allowable frequency for PCIe applications (Triangular modulation).	30	-	33	kHz
OE# Latency [4][6][7]	$t_{LATOE\#}$	DIF start after OE# assertion. DIF stop after OE# deassertion.	4	5	10	clocks
Tdrive_PD# [4][7]	t_{DRVPD}	DIF output enable after PD# deassertion.	-	-	N/A	µs
Tfall [6]	t_F	Fall time of control inputs.	-	-	5	ns
Trise [6]	t_R	Rise time of control inputs.	-	-	5	ns

1. 9ZXL12x2 only.
2. Not all devices are available in this temperature range. See Ordering Informationfor details.
3. 9ZXL12x2 and 9ZXL08x2 only.
4. Confirmed by design and characterization, not 100% tested in production.

5. DIF_IN input.
6. Control input must be monotonic from 20% to 80% of input swing.
7. This spec only applies to current-mode HCSL outputs and is defined as the time from PD# deassertion until outputs are > 200mV. The limit is 300µsec. LP-HCSL stay parked low/low until enabled and then drive differentially within 10 clock cycles which is < 300µsec.

Table 7. Current Consumption – 9ZXL12

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Operating Supply Current	I_{DDA}	V_{DDA}, PLL Mode at 100MHz. [1]	-	38	46	mA
		V_{DDA}, Fanout Buffer Mode at 100MHz. [1]	-	4	5	mA
	I_{DD}	All other V_{DD} pins.	-	25	34	mA
	I_{DDOIO}	V_{DDIO} for LP-HCSL outputs, if applicable.	-	90	107	mA
Power Down Current	I_{DDAPD}	V_{DDA}, CKPWRGD_PD# = 0. [1]	-	3	4	mA
	I_{DDPD}	All other V_{DD} pins, CKPWRGD_PD# = 0.	-	1	2	mA

1. Includes V_{DDR}.

Table 8. Current Consumption – 9ZXL08

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Operating Supply Current	I_{DDA}	V_{DDA}, PLL Mode at 100MHz. [1]	-	37	45	mA
		V_{DDA}, Fanout Buffer Mode at 100MHz. [1]	-	4	5	mA
	I_{DD}	All other V_{DD} pins at 100MHz.	-	60	68	mA
Power Down Current	I_{DDAPD}	V_{DDA}, CKPWRGD_PD# = 0. [1]	-	3	4	mA
	I_{DDPD}	All other V_{DD} pins, CKPWRGD_PD# = 0.	-	1	2	mA

1. Includes V_{DDR}.

Table 9. Current Consumption – 9ZXL06

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Operating Supply Current	I_{DDA}	V_{DDA}, PLL Mode at 100MHz. [1]	-	37	45	mA
		V_{DDA}, Fanout Buffer Mode at 100MHz. [1]	-	4	5	mA
	I_{DD}	All other V_{DD} pins at 100MHz.	-	42	50	mA
Power Down Current	I_{DDAPD}	V_{DDA}, CKPWRGD_PD# = 0. [1]	-	3	4	mA
	I_{DDPD}	All other V_{DD} pins, CKPWRGD_PD# = 0.	-	1	2	mA

1. Includes V_{DDR}.

Table 10. Skew and Differential Jitter Parameters

T_{AMB} = over the specified operating range. Supply voltages per normal operation conditions; see Test Loads for loading conditions.

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Unit
CLK_IN, DIF[x:0] [1][2][3][4][5]	t_{SPO_PLL}	Input-to-output skew in PLL Mode at 100MHz, nominal temperature and voltage.	-100	-	100	ps
CLK_IN, DIF[x:0] [1][2][4][5][6]	t_{PD_BYP}	Input-to-output skew in Bypass Mode at 100MHz, nominal temperature and voltage.	2	2.6	3	ns
CLK_IN, DIF[x:0] [1][2][4][5][6]	t_{DSPO_PLL}	Input-to-output skew variation in PLL Mode at 100MHz, across voltage and temperature.	-50	-	50	ps
CLK_IN, DIF[x:0]	t_{DSPO_BYP}	Input-to-output skew variation in Bypass Mode at 100MHz, across voltage and temperature, T_{AMB} = 0C to +70°C. [1][2][4][5][6]	-250	-	250	ps
		Input-to-output skew variation in Bypass mode at 100MHz, across voltage and temperature, T_{AMB} = -40°C to +85°C. [1][2][4][5][6]	-350	-	350	ps
CLK_IN, DIF[x:0] [1][2][4][5][6]	t_{DTE}	Random Differential Tracking error between two 9ZX devices in Hi BW Mode at the same temperature and voltage (SSC Off).	-	-	5	ps (rms)
CLK_IN, DIF[x:0] [1][2][4][5][6]	t_{DSSTE}	Random Differential Spread Spectrum Tracking error between two 9ZX devices in Hi BW Mode at the same temperature and voltage (-0.5% SSC).	-	-	50	ps
DIF[x:0] [1][2][5][6]	t_{SKEW_ALL}	Output-to-output skew across all outputs, common to PLL and Bypass Mode, at 100MHz.	-	-	50	ps
PLL Jitter Peaking	$j_{peak\text{-}hibw}$	LOBW#_BYPASS_HIBW = 1.[5][7]	0	1.3	2.5	dB
PLL Jitter Peaking	$j_{peak\text{-}lobw}$	LOBW#_BYPASS_HIBW = 0.[5][7]	0	1.3	2	dB
PLL Bandwidth	pll_{HIBW}	LOBW#_BYPASS_HIBW = 1. [5][8]	2	2.6	4	MHz
PLL Bandwidth	pll_{LOBW}	LOBW#_BYPASS_HIBW = 0. [5][8]	0.7	1.0	1.4	MHz
Duty Cycle	t_{DC}	Measured differentially, PLL Mode.[1]	45	50	55	%
Duty Cycle Distortion	t_{DCD}	Measured differentially, Bypass Mode at 100MHz. [1][9]	-1	0	1	%
Jitter, Cycle to Cycle	$t_{jcyc\text{-}cyc}$	PLL Mode. [1][10]	-	20	50	ps
		Additive jitter in Bypass Mode. [1][10]	-	0.1	5	ps

1. Measured into fixed 2pF load cap. Input-to-output skew is measured at the first output edge following the corresponding input.
2. Measured from differential cross-point to differential cross-point. This parameter can be tuned with external feedback path, if present.
3. This parameter is deterministic for a given device.
4. Measured with scope averaging on to find mean value.
5. Confirmed by design and characterization, not 100% tested in production.
6. All Bypass Mode input-to-output specs refer to the timing between an input edge and the specific output edge created by it.
7. Measured as maximum pass band gain. At frequencies within the loop BW, highest point of magnification is called PLL jitter peaking.
8. Measured at 3db down or half power point.
9. Duty cycle distortion is the difference in duty cycle between the output and the input clock when the device is operated in Bypass Mode.
10. Measured from differential waveform.

Table 11. LP-HCSL Outputs

T_{AMB} = over the specified operating range. Supply voltages per normal operation conditions; see Test Loads for loading conditions.

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Specification Limits	Unit
Slew Rate [1][2][3]	dV/dt	Scope averaging on.	2	3.1	4.3	1–4.5	V/ns
Slew Rate Matching [1][4][5]	ΔdV/dt	Single-ended measurement.	-	7.1	20	20	%
Maximum Voltage [5][6]	Vmax	Measurement on single-ended signal using absolute value (scope averaging off).	700	787	850	150	mV
Minimum Voltage [5][6]	Vmin		-150	-44	150	-300	
Crossing Voltage (abs) [1][5][7]	Vcross_abs	Scope averaging off.	300	369	450	250–550	mV
Crossing Voltage (var) [1][5][8]	Δ-Vcross	Scope averaging off.	-	19	50	140	mV

1. Confirmed by design and characterization, not 100% tested in production
2. Measured from differential waveform.
3. Slew rate is measured through the Vswing voltage range centered around differential 0 V. This results in a ±150mV window around differential 0V.
4. Matching applies to rising edge rate for Clock and falling edge rate for Clock#. It is measured using a ±75mV window centered on the average cross point where Clock rising meets Clock# falling. The median cross point is used to calculate the voltage thresholds the oscilloscope is to use for the edge rate calculations.
5. At default SMBus settings.
6. Includes previously separate values of +300mV overshoot and -300mV of undershoot.
7. Vcross is defined as voltage where Clock = Clock# measured on a component test board and only applies to the differential rising edge (i.e. Clock rising and Clock# falling).
8. The total variation of all Vcross measurements in any particular system. Note that this is a subset of Vcross_min/max (Vcross absolute) allowed. The intent is to limit Vcross induced modulation by setting Δ-Vcross to be smaller than Vcross absolute.

Table 12. PCIe Phase Jitter Parameters–High-Bandwidth ZBD Mode

T_{AMB} = over the specified operating range. Supply voltages per normal operation conditions; see Test Loads for loading conditions.

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Specification	Unit
PCIe Phase Jitter Common Clocked Architecture (SSC off)	$t_{jphPCIeG1-CC}$	PCIe Gen 1 (2.5 GT/s) [1][2]	-	4260	7030	86000	fs Pk-Pk
	$t_{jphPCIeG2-CC}$	PCIe Gen 2 Hi Band (5.0 GT/s) [1][2]	-	150	250	3100	fs RMS
		PCIe Gen 2 Lo Band (5.0 GT/s) [1][2]	-	80	120	3000	
	$t_{jphPCIeG3-CC}$	PCIe Gen 3 (8.0 GT/s) [1][2]	-	76	126	1000	
	$t_{jphPCIeG4-CC}$	PCIe Gen 4 (16.0 GT/s) [1][2][3]	-	76	126	500	
	$t_{jphPCIeG5-CC}$	PCIe Gen 5 (32.0 GT/s) [1][2][3][4]	-	26	41	150	
PCIe Phase Jitter IR Architectures (SSC off)	$t_{jphPCIeG2-IR}$	PCIe Gen 2 (5.0 GT/s) [1][2][5]	-	819	1331	N/A	
	$t_{jphPCIeG3-IR}$	PCIe Gen 3 (8.0 GT/s) [1][2][5]	-	312	480		
	$t_{jphPCIeG4-IR}$	PCIe Gen 4 (16.0 GT/s) [1][2][3][5]	-	217	284		
	$t_{jphPCIeG5-IR}$	PCIe Gen 5 (32.0 GT/s) [1][2][3][5]	-	84	118		

1. The Refclk jitter is measured after applying the filter functions found in PCI Express Base Specification 7.0, Revision 1.0. See the Test Loads section of the data sheet for the exact measurement setup. If oscilloscope data is used, equipment noise is removed from all results.
2. Jitter measurements shall be made with a capture of at least 100,000 clock cycles captured by a real-time oscilloscope (RTO) with a sample rate of 20GS/s or greater. Broadband oscilloscope noise must be minimized in the measurement. The measured PP jitter is used (no extrapolation) for RTO measurements. Alternately, jitter measurements may be used with a Phase Noise Analyzer (PNA) extending (flat) and integrating and folding the frequency content up to an offset from the carrier frequency of at least 200MHz (at 300MHz absolute frequency) below the Nyquist frequency. For PNA measurements for the 2.5GT/s data rate, the RMS jitter is converted to peak-to-peak jitter using a multiplication factor of 8.83. In the case where real-time oscilloscope and PNA measurements have both been done and produce different results, the RTO result must be used.
3. SSC spurs from the fundamental and harmonics are removed up to a cutoff frequency of 2MHz taking care to minimize removal of any non-SSC content.
4. This specification also applied to UPI data rates > 20Gb/s.
5. The PCI Express Base Specification 7.0, Revision 1.0 provides the filters necessary to calculate IR jitter values, however, it does not provide specification limits, hence the n/a in the Limit column. IR values are informative only. In general, a clock operating in an IR system must be twice as good as a clock operating in a Common Clock system. For RMS values, twice as good is equivalent to dividing the CC value by √2. For IR architectures operating at Gen4, Gen5 or Gen6 data rates, an additional consideration is which jitter value to divide by √2. The conservative approach is to divide the ref clock jitter limit. However, if the clock is close to the SOC, the case can be made for allocating the channel noise budget to the ref clock jitter budget. Then the channel simulation values mentioned above would be divided by √2. An example for Gen4 is as follows: A “rule-of-thumb” IR limit would be either 0.5ps RMS/√2 = 0.35ps RMS or 0.7ps RMS/√2 = 0.5ps RMS depending on whether the ref clock jitter limit, or channel noise budget were used (the ref clock is close to the SOC).

Table 13. PCIe Phase Jitter Parameters–Low-Bandwidth ZBD Mode

T_{AMB} = over the specified operating range. Supply voltages per normal operation conditions; see Test Loads for loading conditions.

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Specification	Unit
PCIe Phase Jitter Common Clocked Architecture (SSC off)	$t_{jphPCIeG1-CC}$	PCIe Gen 1 (2.5 GT/s) [1][2]	-	2300	5460	86000	fs Pk-Pk
	$t_{jphPCIeG2-CC}$	PCIe Gen 2 Hi Band (5.0 GT/s) [1][2]	-	80	130	3100	fs RMS
		PCIe Gen 2 Lo Band (5.0 GT/s) [1][2]	-	70	120	3000	
	$t_{jphPCIeG3-CC}$	PCIe Gen 3 (8.0 GT/s) [1][2]	-	42	68	1000	
	$t_{jphPCIeG4-CC}$	PCIe Gen 4 (16.0 GT/s) [1][2][3]	-	42	68	500	
	$t_{jphPCIeG5-CC}$	PCIe Gen 5 (32.0 GT/s) [1][2][3][4]	-	16	24	150	
PCIe Phase Jitter IR Architectures (SSC off)	$t_{jphPCIeG2-IR}$	PCIe Gen 2 (5.0 GT/s) [1][2][5]	-	780	1350	N/A	
	$t_{jphPCIeG3-IR}$	PCIe Gen 3 (8.0 GT/s) [1][2][5]	-	303	504		
	$t_{jphPCIeG4-IR}$	PCIe Gen 4 (16.0 GT/s) [1][2][3][5]	-	193	288		
	$t_{jphPCIeG5-IR}$	PCIe Gen 5 (32.0 GT/s) [1][2][3][5]	-	78	122		

1. The Refclk jitter is measured after applying the filter functions found in PCI Express Base Specification 7.0, Revision 1.0. See the Test Loads section of the data sheet for the exact measurement setup. If oscilloscope data is used, equipment noise is removed from all results.
2. Jitter measurements shall be made with a capture of at least 100,000 clock cycles captured by a real-time oscilloscope (RTO) with a sample rate of 20GS/s or greater. Broadband oscilloscope noise must be minimized in the measurement. The measured PP jitter is used (no extrapolation) for RTO measurements. Alternately, jitter measurements may be used with a Phase Noise Analyzer (PNA) extending (flat) and integrating and folding the frequency content up to an offset from the carrier frequency of at least 200MHz (at 300MHz absolute frequency) below the Nyquist frequency. For PNA measurements for the 2.5GT/s data rate, the RMS jitter is converted to peak-to-peak jitter using a multiplication factor of 8.83. In the case where real-time oscilloscope and PNA measurements have both been done and produce different results, the RTO result must be used.
3. SSC spurs from the fundamental and harmonics are removed up to a cutoff frequency of 2MHz taking care to minimize removal of any non-SSC content.
4. This specification also applied to UPI data rates > 20Gb/s.
5. The PCI Express Base Specification 7.0, Revision 1.0 provides the filters necessary to calculate IR jitter values, however, it does not provide specification limits, hence the n/a in the Limit column. IR values are informative only. In general, a clock operating in an IR system must be twice as good as a clock operating in a Common Clock system. For RMS values, twice as good is equivalent to dividing the CC value by √2. For IR architectures operating at Gen4, Gen5 or Gen6 data rates, an additional consideration is which jitter value to divide by √2. The conservative approach is to divide the ref clock jitter limit. However, if the clock is close to the SOC, the case can be made for allocating the channel noise budget to the ref clock jitter budget. Then the channel simulation values mentioned above would be divided by √2. An example for Gen4 is as follows: A “rule-of-thumb” IR limit would be either 0.5ps RMS/√2 = 0.35ps RMS or 0.7ps RMS/√2 = 0.5ps RMS depending on whether the ref clock jitter limit, or channel noise budget were used (the ref clock is close to the SOC).

Table 14. Additive PCIe Phase Jitter for Fanout Buffer Mode

T_{AMB} = over the specified operating range. Supply voltages per normal operation conditions; see Test Loads for loading conditions.

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Industry Limit	Unit
Additive PCIe Phase Jitter (Common Clocked Architecture)	$t_{jphPCIeG1-CC}$	PCIe Gen1 (2.5 GT/s) [1][2][3]	-	900	1400	86000	fs Pk-Pk
	$t_{jphPCIeG2-CC}$	PCIe Gen2 Hi Band (5.0 GT/s) [1][2][3]	-	60	130	3100	fs RMS
		PCIe Gen2 Lo Band (5.0 GT/s) [1][2][3]	-	40	70	3000	
	$t_{jphPCIeG3-CC}$	PCIe Gen3 (8.0 GT/s) [1][2][3]	-	40	68	1000	
	$t_{jphPCIeG4-CC}$	PCIe Gen4 (16.0 GT/s) [1][2][3][4][5]	-	40	68	500	
	$t_{jphPCIeG5-CC}$	PCIe Gen5 (32.0 GT/s) [1][2][4][4][6]	-	16	28	150	
	$t_{jphPCIeG6-CC}$	PCIe Gen6 (64.0 GT/s) [1][2][4][4][7]	-	9.5	17.8	100	
	$t_{jphPCIeG7-CC}$	PCIe Gen7 (128.0 GT/s) [1][2][4][8]	-	6.7	8.6	67	
Additive PCIe Phase Jitter (IR Architecture)	$t_{jphPCIeG2-IR}$	PCIe Gen2 (5.0 GT/s) [1][2][9]	-	100	151	N/A	
	$t_{jphPCIeG3-IR}$	PCIe Gen3 (8.0 GT/s) [1][2][9]	-	26	42		
	$t_{jphPCIeG4-IR}$	PCIe Gen4 (16.0 GT/s) [1][2][9]	-	27	43		
	$t_{jphPCIeG5-IR}$	PCIe Gen5 (32.0 GT/s) [1][2][9]	-	24	41		
	$t_{jphPCIeG6-IR}$	PCIe Gen6 (64.0 GT/s) [1][2][9]	-	8.5	22.8		
	$t_{jphPCIeG7-IR}$	PCIe Gen7 (128.0 GT/s) [1][2][9]	-	6.0	16.1		

1. The Refclk jitter is measured after applying the filter functions found in PCI Express Base Specification 7.0. For the exact measurement setup, see the Test Loads. The worst case results for each data rate are summarized in this table. Equipment noise is removed from all measurements.
2. Jitter measurements shall be made with a capture of at least 100,000 clock cycles captured by a real-time oscilloscope (RTO) with a sample rate of 20GS/s or greater. Broadband oscilloscope noise must be minimized in the measurement. The measured PP jitter is used (no extrapolation) for RTO measurements. Alternately, jitter measurements may be used with a Phase Noise Analyzer (PNA) extending (flat) and integrating and folding the frequency content up to an offset from the carrier frequency of at least 200MHz (at 300MHz absolute frequency) below the Nyquist frequency. For PNA measurements for the 2.5GT/s data rate, the RMS jitter is converted to peak-to-peak jitter using a multiplication factor of 8.83.
3. Differential input swing ≥ 1600mV and input slew rate ≥ 3.5V/ns. The rms sum of the source jitter and the additive jitter (arithmetic sum for PCIe Gen1) must be less than the jitter specification listed.
4. SSC spurs from the fundamental and harmonics are removed up to a cutoff frequency of 2MHz taking care to minimize removal of any non-SSC content.
5. Note that 0.7ps RMS is to be used in channel simulations to account for additional noise in a real system.
6. Note that 0.25ps RMS is to be used in channel simulations to account for additional noise in a real system.
7. Note that 0.15ps RMS is to be used in channel simulations to account for additional noise in a real system.
8. Note that 0.10ps RMS is to be used in channel simulations to account for additional noise in a real system.
9. The PCI Express Base Specification 7.0 provides the filters necessary to calculate IR jitter values, however, it does not provide specification limits, hence the n/a in the Limit column. IR values are informative only. A common practice is to split the common clock budget in half. For 16GT/s data rates and above, the user must choose whether to use the output jitter specification, or the input jitter specification, which includes an allocation for the jitter added by the channel. Using 32GT/s, the Refclk jitter budget is 150fs RMS. One half of the Refclk jitter budget is 106fs RMS. At the clock input, the system must deliver 250fs RMS. One half of this value is 177fs RMS. If the clock is placed next to the PCIe device in an SRIS system, the channel is very short and the user can choose to use this more relaxed value as the jitter limit.

Table 15. Filtered Phase Jitter Parameters – QPI/UPI, IF-UPI and DB2000Q

T_{AMB} = over the specified operating range. Supply voltages per normal operation conditions; see Test Loads for loading conditions.

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Specification Limits	Unit
Additive Phase Jitter, Fanout Mode	$t_{jphIF-UPI}$	IF-UPI, Lo-BW ZDB Mode [1][2][3]	-	0.10	0.13	1	ps (RMS)
		IF-UPI, Hi-BW ZDB Mode [1][2][3]	-	0.17	0.20	1	ps (RMS)
		IF-UPI, Fanout Mode [1][2][3]	-	0.06	0.07	1	ps (RMS)
	$t_{jphDB2000Q}$	DB2000Q, Fanout Mode [1][4]	-	26	28	80	fs (RMS)

1. Applies to all differential outputs, guaranteed by design and characterization. See Test Loads for measurement setup details. Legacy QPI and UPI specifications (100MHz or 133.33MHz clocking with data rates of 4.8Gb/s to 11.4Gb/s are automatically met in all operating modes when the PCI Gen5 CC requirements are met. See Table 12 and Table 14.
2. For RMS values, additive jitter is calculated by solving for “b” where b = √(c2 - a2), “a” is rms input jitter and “c” is rms total jitter.
3. Calculated from phase noise analyzer with Intel-specified brick-wall filter applied. This is an additive jitter specification regardless of buffer operating mode. The enhanced 9ZXL devices meet this specification in all operating modes.
4. Calculated from Intel-supplied clock jitter tool.

Table 16. Phase Jitter Parameters – 12kHz to 20MHz

T_{AMB} = over the specified operating range. Supply voltages per normal operation conditions; see Test Loads for loading conditions.

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Specification Limits	Unit
12kHz–20MHz Additive Phase Jitter, Fanout Buffer Mode [1][2][3]	$t_{jph12k-20MFOB}$	Fanout Buffer Mode, SSC OFF, 100MHz	-	120	131	N/A	fs (RMS)

1. Applies to all differential outputs, guaranteed by design and characterization. See Test Loadsfor measurement setup details.
2. 12kHz to 20MHz brick wall filter.
3. For RMS values, additive jitter is calculated by solving for “b” where b = √(c2 - a2), “a” is rms input jitter and “c” is rms total jitter.

4. Power Management

Table 17. Power Management

CKPWRGD_PD#	DIF_IN	SMBus EN bit	OE[x]# Pin	DIF[x]	PLL State (in ZDB Mode)
0	X	X	X	Low/Low	OFF
1	Running	0	0	Low/Low	ON
		0	1	Low/Low	ON
		1	0	Running	ON
		1	1	Low/Low	ON

Table 18. Frequency Selection (PLL Mode)

100M_133M#	DIF_IN MHz	DIF[x]
1	100.00	DIF_IN
0	133.33	DIF_IN

Note: 9ZXL12xx and 9ZXL08xx only. 9ZXL06xx is 100MHz only.

Table 19. PLL Operating Mode

HiBW_BypM_LoBW#	Mode	PLL
Low	PLL Lo BW	Running
Mid	Bypass	Off
High	PLL Hi BW	Running

Note: See SMBus Byte 0, bits 7 and 6 for additional information.

5. Test Loads

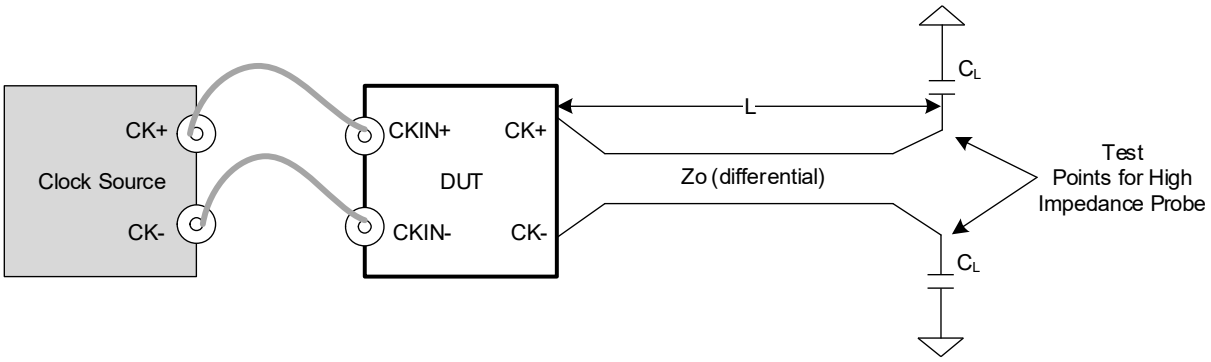


Figure 5. Test Load for AC/DC Measurements

Table 20. Parameters for AC/DC Measurements

Clock Source	Device Under Test (DUT)	Rs (Ω)	Differential Zo (Ω)	L (cm)	C_L (pF)	Parameters Measured
SMA100B	9ZXLxx3x	27 External	85	25.4	2	AC/DC parameters
SMA100B	9ZXLxx5x	Internal	85	25.4	2	

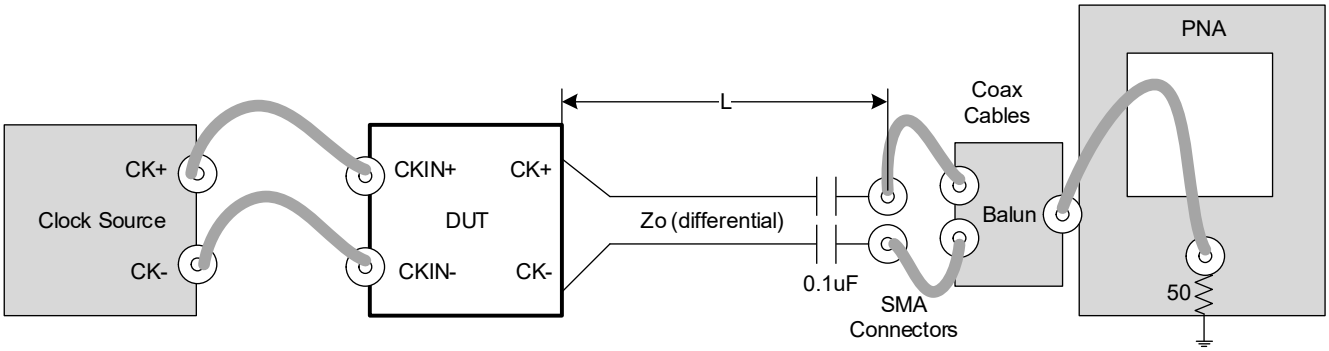


Figure 6. Test Load for Phase Jitter Measurements using Phase Noise Analyzer

Table 21. Parameters for Phase Jitter Measurements using Phase Noise Analyzer

Clock Source	Device Under Test (DUT)	Rs (Ω)	Differential Zo (Ω)	L (cm)	C_L (pF)	Notes	Parameters Measured
SMA100B	9ZXLxx3x	27 External	85	25.4	N/A	Fanout Mode	PCIe, IF-UPI, DB2000Q
9FGV1006	9ZXLxx3x	27 External	85	25.4		ZDB Mode	
SMA100B	9ZXLxx5x	Internal	85	25.4		Fanout Mode	
9FGV1006 or 9SQ440	9ZXLxx5x	Internal	85	25.4		ZDB Mode	

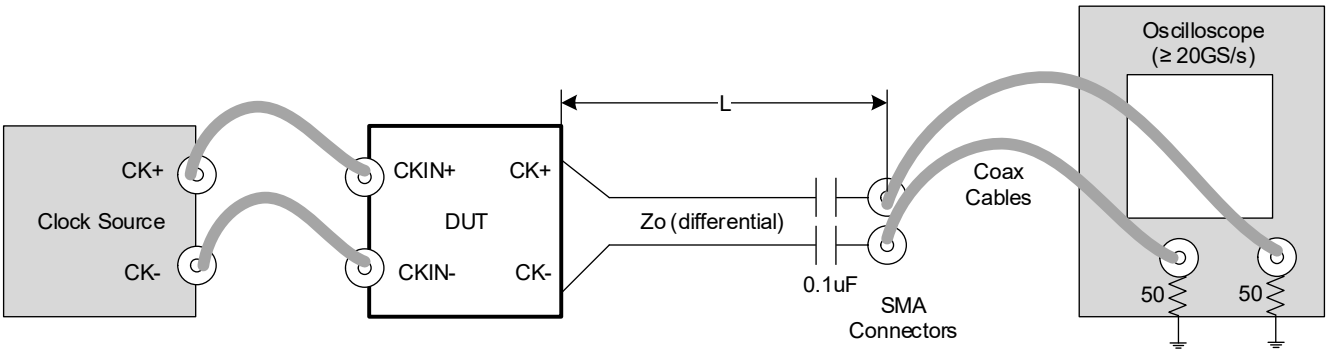


Figure 7. Test Load for Phase Jitter Measurements using Oscilloscope

Table 22. Parameters for Phase Jitter Measurements using Oscilloscope

Clock Source	Device Under Test (DUT)	Rs (Ω)	Differential Zo (Ω)	L (cm)	C_L (pF)	Notes	Parameters Measured
SMA100B	9ZXLxx3x	27 External	85	25.4	N/A	Fanout Mode	QPI/UPI
9FGV1006	9ZXLxx3x	27 External	85	25.4		ZDB Mode	
SMA100B	9ZXLxx5x	Internal	85	25.4		Fanout Mode	
9FGV1006 or 9SQ440	9ZXLxx5x	Internal	85	25.4		ZDB Mode	

6. General SMBus Serial Interface Information

6.1 How to Write

- Controller (host) sends a start bit
- Controller (host) sends the write address
- Renesas clock will **acknowledge**
- Controller (host) sends the beginning byte location = N
- Renesas clock will **acknowledge**
- Controller (host) sends the byte count = X
- Renesas clock will **acknowledge**
- Controller (host) starts sending Byte **N through Byte N+X-1**
- Renesas clock will **acknowledg**e each byte **one at a time**
- Controller (host) sends a stop bit

Index Block Write Operation			
Controller (Host)			**Renesas (Slave/Receiver)**
T	starT bit		
Slave Address			
WR	WRite		
			ACK
Beginning Byte = N			
			ACK
Data Byte Count = X			
			ACK
Beginning Byte N		X Byte	
			ACK
O			
O			O
O			O
			O
Byte N + X - 1			
			ACK
P	stoP bit		

6.2 How to Read

- Controller (host) will send a start bit
- Controller (host) sends the write address
- Renesas clock will **acknowledge**
- Controller (host) sends the beginning byte location = N
- Renesas clock will **acknowledge**
- Controller (host) will send a separate start bit
- Controller (host) sends the read address
- Renesas clock will **acknowledge**
- Renesas clock will send the data byte count = X
- Renesas clock sends Byte **N+X-1**
- Renesas clock sends **Byte 0 through Byte X (if $X_{(H)}$ was written to Byte 8)**
- Controller (host) will need to acknowledge each byte
- Controller (host) will send a not acknowledge bit
- Controller (host) will send a stop bit

Index Block Read Operation			
Controller (Host)			**Renesas**
T	starT bit		
Slave Address			
WR	WRite		
			ACK
Beginning Byte = N			
			ACK
RT	Repeat starT		
Slave Address			
RD	ReaD		
			ACK
			Data Byte Count = X
ACK			
		X Byte	Beginning Byte N
ACK			
			O
O			O
O			O
O			
			Byte N + X - 1
N	Not acknowledge		
P	stoP bit		

Table 23. SMBus Addressing

Pin		SMBus Address		
SADR1_tri	**SADR0_tri**	**9ZXL12x2 9ZXL0853**	**9ZXL08x2**	**9ZXL06x2**
0	0	D8	D8	D8
0	M	DA	-	-
0	1	DE	-	-
M	0	C2	-	-
M	M	C4	-	-
M	1	C6	-	-
1	0	CA	-	-
1	M	CC	-	-
1	1	CE	-	-

Note: 9ZXL08x2 and 9ZXL06x2 do not have SMBus address select pins. Their address is D8.

Table 24. Byte 0: PLL Mode and Frequency Select Register

Byte 0	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Control Function	PLL Operating Mode Readback 1	PLL Operating Mode Readback 0	Reserved	Reserved	Enable software control of PLL BW	PLL Operating Mode 1	PLL Operating Mode 0	Frequency Select Readback
Type	R	R			RW	RW	RW	R
0	00 = Low BW ZDB Mode	01 = Bypass (Fanout Buffer)			HW Latch	00 = Low BW ZDB Mode	01 = Bypass (Fanout Buffer)	133MHz
1	10 = Reserved	11 = High BW ZDB Mode			SMBus Control	10 = Reserved	11 = High BW ZDB Mode	100MHz
Name	PLL Rdbk[1]	PLL Rdbk[0]			PLL_SW_EN	PLL Mode[1]	PLL Mode[0]	100M_133M#
Default	Latch	Latch	0	0	0	1	1	Latch

Note: Setting bit 3 to '1' allows the user to override the latch value from pin 5 via use of bits 2 and 1. A warm system reset is required if the user changes these bits. Bit 0 defaults to 1 on the 9ZXL06x2 devices.

Table 25. Byte 1: Output Control Register 1

Byte 1	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Control Function	Output Enable							
Type	RW							
0	Low/Low							
1	OE# Pin Control							
9ZXL12xx Name	DIF7_en	DIF6_en	DIF5_en	DIF4_en	DIF3_en	DIF2_en	DIF1_en	DIF0_en
9ZXL12xx Default	1	1	1	1	1	1	1	1
9ZXL08xx Name	DIF5_en	DIF4_en	DIF3_en	DIF2_en	Reserved	DIF1_en	DIF0_en	Reserved
9ZXL08xx Default	1	1	1	1	0	1	1	0
9ZXL06xx Name	Reserved	DIF3_en	DIF2_en	Reserved	Reserved	DIF1_en	DIF0_en	Reserved
9ZXL06xx Default	0	1	1	0	0	1	1	0

Table 26. Byte 2: Output Control Register 2

Byte 2	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Control Function	Output _enable							
Type	RW							
0	Low/Low							
1	OE# Pin Control							
9ZXL12xx Name	Reserved	Reserved	Reserved	Reserved	DIF11_en	DIF10_en	DIF9_en	DIF8_en
9ZXL12xx Default	0	0	0	0	1	1	1	1
9ZXL08xx Name	Reserved	Reserved	Reserved	Reserved	Reserved	DIF7_en	Reserved	DIF6_en
9ZXL08xx Default	0	0	0	0	0	1	0	1
9ZXL06xx Name	Reserved	Reserved	Reserved	Reserved	Reserved	DIF5_en	DIF4_en	Reserved
9ZXL06xx Default	0	0	0	0	0	1	1	0

Bytes 3 and 4 are Reserved

Table 27. Byte 5: Revision and Vendor ID Register

Byte 5	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Control Function	Revision ID				Vendor ID			
Type	R	R	R	R	R	R	R	R
0	E rev = 0010				IDT/Renesas = 0001			
1								
Name	RID3	RID2	RID1	RID0	VID3	VID2	VID1	VID0
Default	0	1	0	0	0	0	0	1

Table 28. Byte 6: Device ID Register

Byte 6	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Control Function	N/A							
Type	R	R	R	R	R	R	R	R
0	Device ID							
1								
Name	DevID 7	DevID 6	DevID 5	DevID 4	DevID 3	DevID 2	DevID 1	DevID 0
9ZXL1232E	0hE8							
9ZXL1252E	0hF8							
9ZXL0832E	0hE6							
9ZXL0852E	0hF6							
9ZXL0853E								
9ZXL0632E	0hE4							
9ZXL0652E	0hF4							

Table 29. Byte 7: Byte Count Register

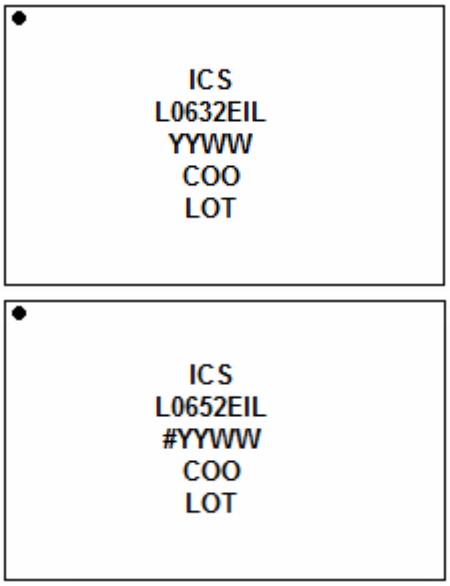
Byte 7	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Control Function	Reserved	Reserved	Reserved	Writing to this register configures how many bytes will be read back on a block read.				
Type				RW	RW	RW	RW	RW
0				Default value is 8.				
1								
Name				BC4	BC3	BC2	BC1	BC0
Default	0	0	0	0	1	0	0	0

7. Package Outline Drawings

The package outline drawings are located at the end of this document and are accessible from the Renesas website (see Ordering Information for POD links). The package information is the most current data available and is subject to change without revision of this document.

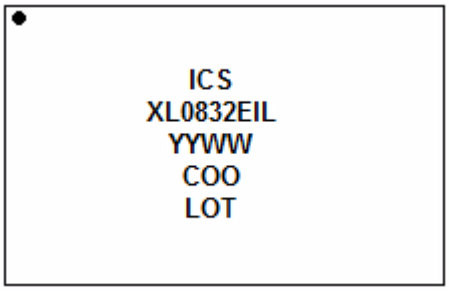
8. Marking Diagrams

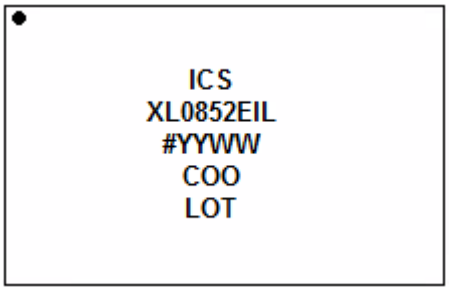
8.1 9ZXL06x2E

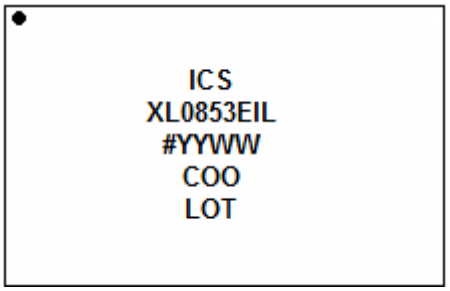


- Lines 1 and 2: truncated part number
- Line 3:
  - “#” denotes the stepping number.
  - “YYWW” is the last two digits of the year and the work week the part was assembled.
- Line 4: “COO” denotes country of origin.
- Line 5: “LOT” denotes the lot number.

8.2 9ZXL08xxE

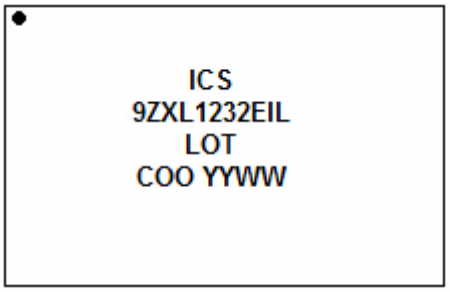


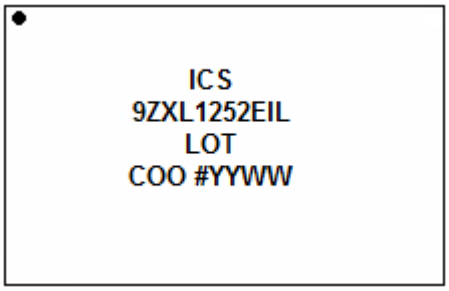




- Lines 1 and 2: truncated part number
- Line 3:
  - “#” denotes the stepping number.
  - “YYWW” is the last two digits of the year and the work week the part was assembled.
- Line 4: “COO” denotes country of origin.
- Line 5: “LOT” denotes the lot number.

8.3 9ZXL12x2E





- Lines 1 and 2: truncated part number
- Line 3: “LOT” denotes the lot number.
- Line 4: “COO” denotes country of origin; “#” denotes the stepping number; “YYWW” is the last two digits of the year and the work week the part was assembled.

9. Ordering Information

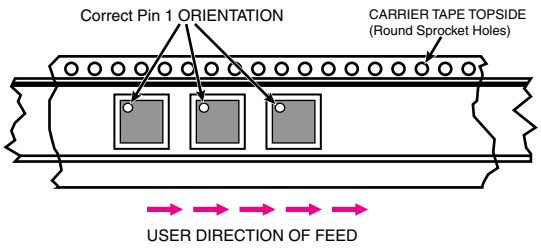
Table 30. Ordering Information

Number of Clock Outputs	Output Impedance	Part Number	Temperature Range	Package	Part Number Suffix and Shipping Method
6	33Ω	9ZXL0632EKILF	-40° to +85°C	5 × 5 × 0.4 mm 40-VFQFPN	None = Trays “T” = Tape and Reel, Pin 1 Orientation: EIA-481C (see <Hyperlink>Table 31 for more details)
		9ZXL0632EKILFT			
	85Ω	9ZXL0652EKILF			
		9ZXL0652EKILFT			
8	33Ω	9ZXL0832EKILF	-40° to +85°C	6 × 6 × 0.4 mm 48-VFQFPN	
		9ZXL0832EKILFT			
	85Ω	9ZXL0852EKILF			
		9ZXL0852EKILFT			
	85Ω	9ZXL0853EKILF			
		9ZXL0853EKILFT			
12	33Ω	9ZXL1232EKILF	-40° to +85°C	9 × 9 × 0.5 mm 64-VFQFPN	
		9ZXL1232EKILFT			
	85Ω	9ZXL1252EKILF			
		9ZXL1252EKILFT			

“E” is the device revision designator (will not correlate with the datasheet revision).

“LF” denotes Pb-free configuration, RoHS compliant.

Table 31. Pin 1 Orientation in Tape and Reel Packaging

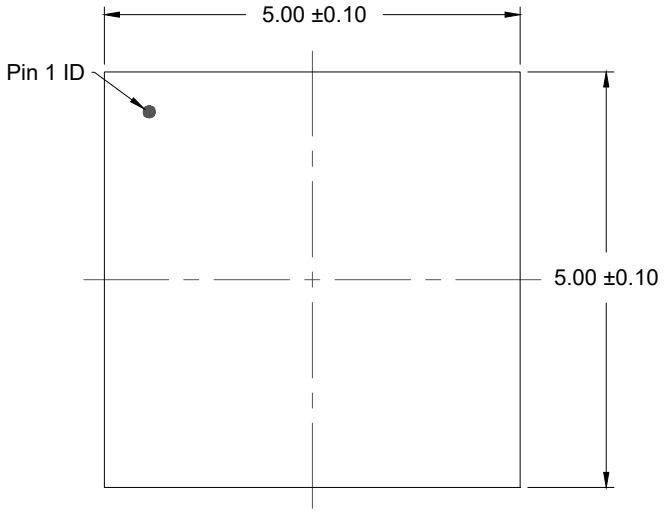
Part Number Suffix	Pin 1 Orientation	Illustration
T	Quadrant 1 (EIA-481-C)	

10. Revision History

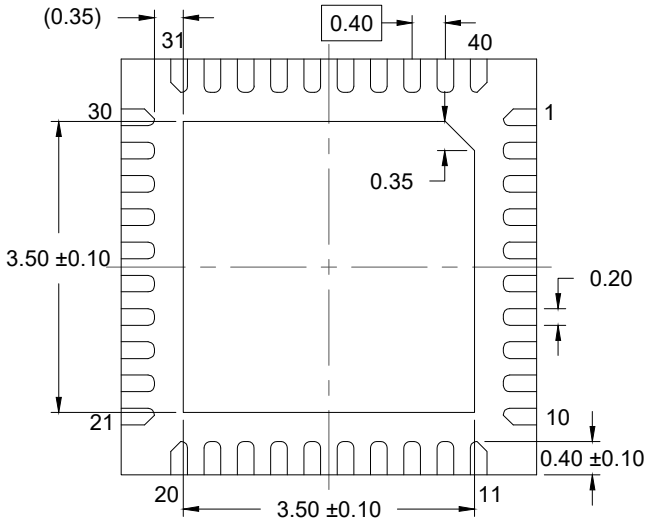
Revision	Date	Description
1.05	Nov 10, 2026	▪ Updated max values for PCIeG3-IR and PCIeG4-IR in Table 14.
1.04	Aug 27, 2026	Updated Marking Diagrams.
1.03	Mar 2, 2026	▪ Updated PCIe Phase Jitter Parameters table into two separate tables: • Table 12 PCIe Phase Jitter Parameters–High-Bandwidth ZBD Mode • Table 13 PCIe Phase Jitter Parameters–Low-Bandwidth ZBD Mode ▪ Updated values in Table 14.
1.02	Dec 22, 2022	▪ Minor updates to electrical tables and minor formatting fixes. ▪ Removed legacy QPI/UPI data since meeting that specification is guaranteed by meeting the PCIe Gen5 specifications. ▪ Reformatted datasheet to the latest template.
-	Aug 25, 2020	Updated PCIe Gen5 CC, DB2000Q, and QPI/UPI specifications in Key Specifications section on front page.
-	May 21, 2020	Initial release.

Package Outline Drawing

PSC-4292-02
NDG40P2
40-VFQFPN 5.0 x 5.0 x 0.9 mm Body, 0.4 mm Pitch
Rev.03, May 20, 2025



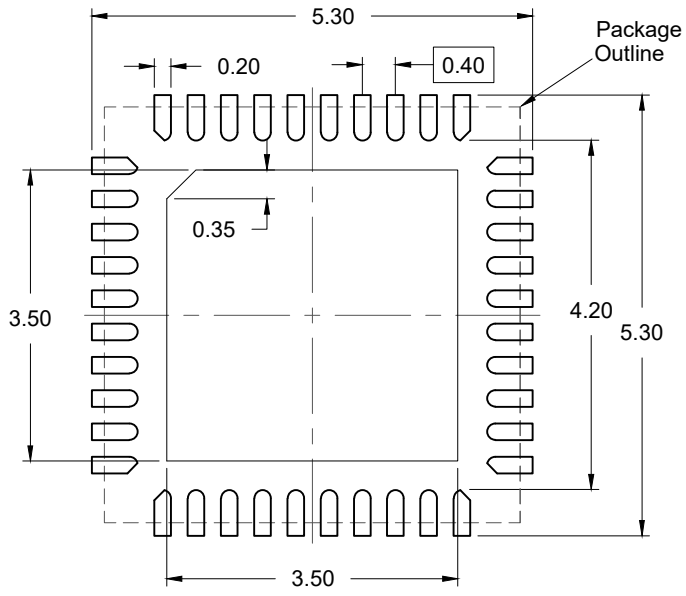
TOP VIEW



BOTTOM VIEW



SIDE VIEW



RECOMMENDED LAND PATTERN
(PCB Top View, NSMD Design)

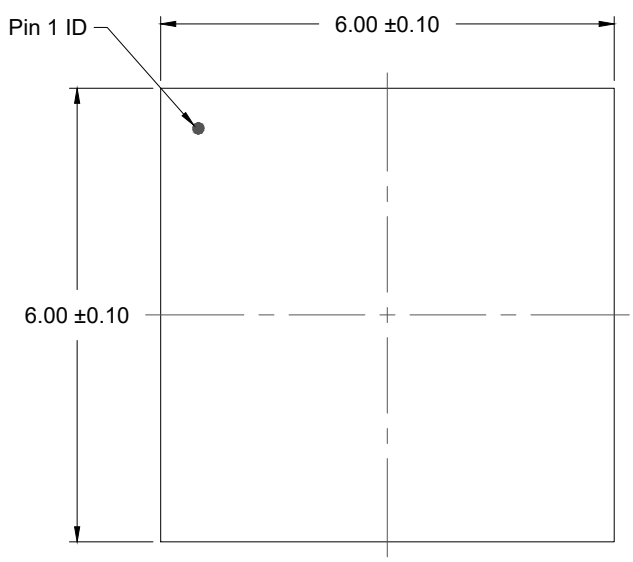
NOTES:

1. JEDEC compatible.
2. All dimensions are in mm and angles are in degrees.
3. Use ±0.05 mm for the non-toleranced dimensions.
4. Numbers in ( ) are for references only.

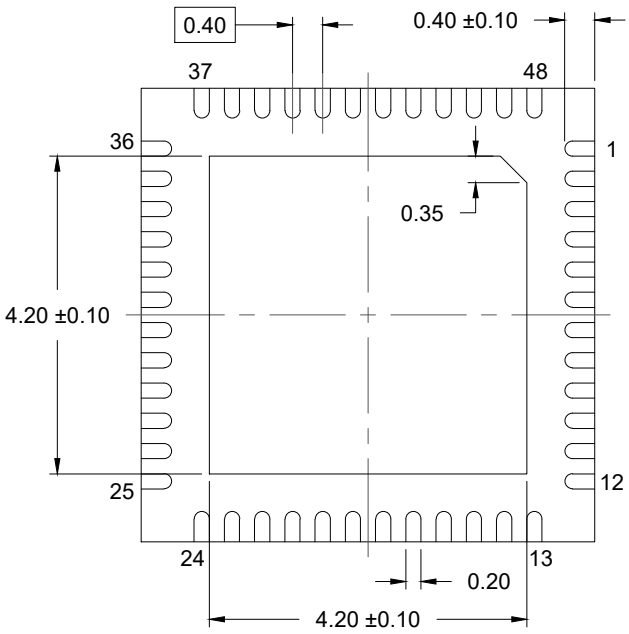
© Renesas Electronics Corporation

Package Outline Drawing

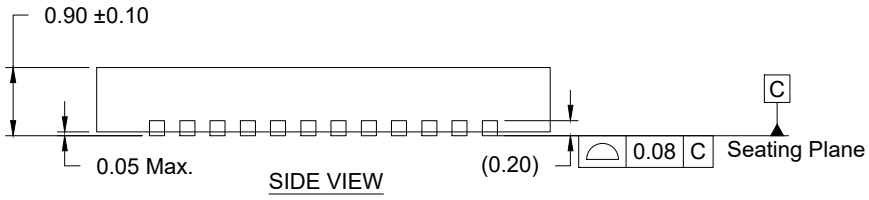
Package Code:NDG48P2
48-VFQFPN 6.0 x 6.0 x 0.9 mm Body, 0.4mm Pitch
PSC-4212-02, Revision: 04, Date Created: Sep 28, 2022



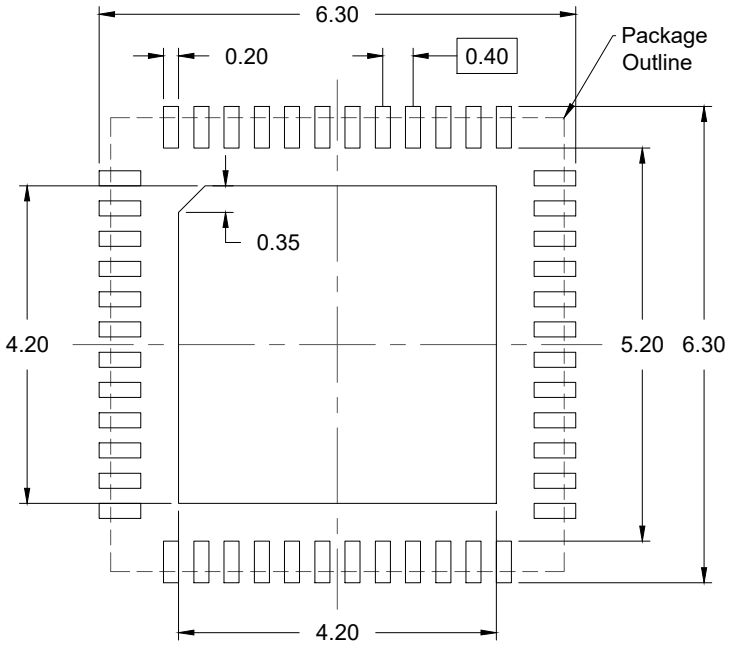
TOP VIEW



BOTTOM VIEW



SIDE VIEW



RECOMMENDED LAND PATTERN
(PCB Top View, NSMD Design)

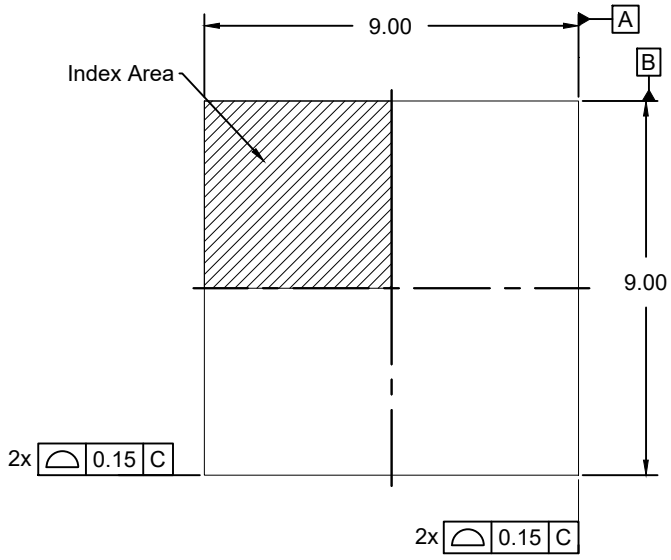
NOTES:

1. JEDEC compatible.
2. All dimensions are in mm and angles are in degrees.
3. Use ±0.05 mm for the non-toleranced dimensions.
4. Numbers in ( ) are for references only.

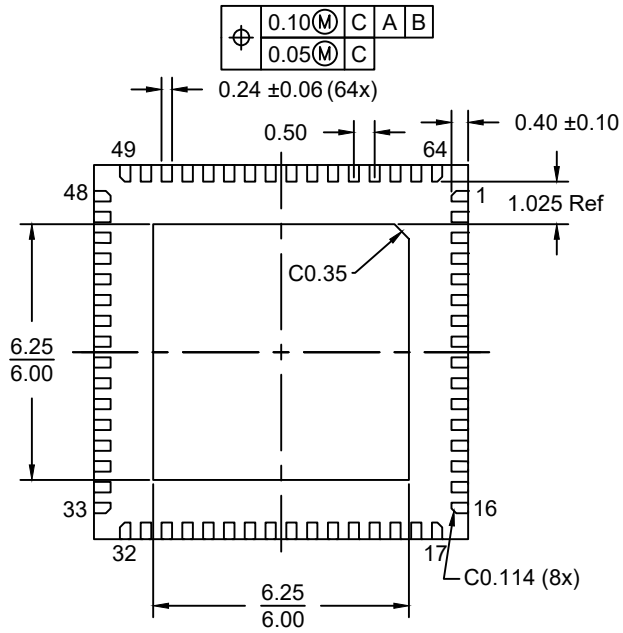
© Renesas Electronics Corporation

Package Outline Drawing

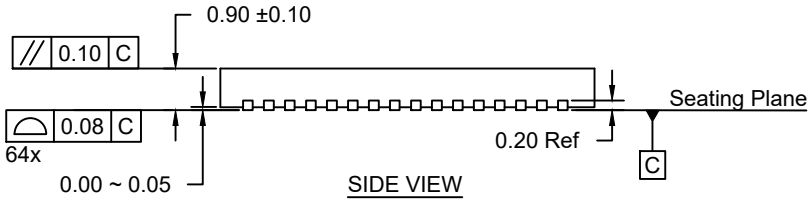
Package Code: NLG64P2
64-VFQFPN 9.0 x 9.0 x 0.9 mm Body, 0.50mm Pitch
PSC-4147-02, Revision: 04, Date Created: Sep 2, 2025



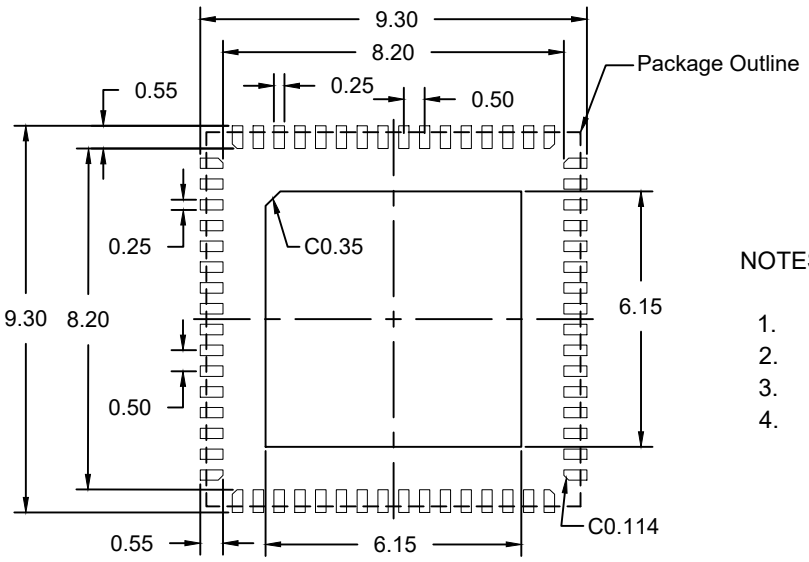
TOP VIEW



BOTTOM VIEW



SIDE VIEW



RECOMMENDED LAND PATTERN
(PCB Top View, NSMD Design)

NOTES:

1. JEDEC compatible.
2. All dimensions are in mm and angles are in degrees.
3. Use ±0.05 mm for the non-toleranced dimensions.
4. Numbers in ( ) are for references only.

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