

Low Jitter and Skew DC to 140MHz Clock Buffer

Key Features

- DC to 140 MHz operating frequency range
- Low output clock skew: 50ps-typ
- Low part-to-part output skew: 100 ps-typ
- Low output propagation delay: 2.5ns-typ
- 3.3V +/-10% operation supply voltage
- Low power dissipation:
 - - 7 mA-typ at 33MHz
 - - 9 mA-typ at 66MHz
 - - 12 mA-typ at 133MHz
- One input to four output fanout buffer drivers
- Output Enable (OE) control function
- Available in 8-pin TSSOP package
- Available in Commercial and Industrial grades
- Available in Lead (Pb) free package

Applications

- General Purpose PCI/PCI-X Clock Buffer
- Printers, MFPs and Digital Copiers
- PCs and Work Stations
- Routers, Switches and Servers
- Datacom and Telecom
- High-Speed Digital Embedded Systems

Description

The SL2304NZ is a low skew, jitter and power fanout Buffer designed to produce up to four (4) clock outputs from one (1) reference input clock, for high speed clock distribution, including PCI/PCI-X applications.

The SL2304NZ products operate from DC to 140MHz.

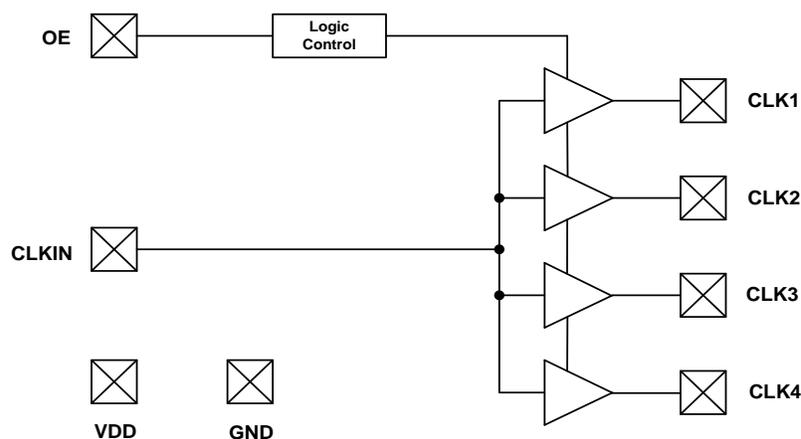
The only difference between SL2304NZ-1 and SL2304NZ-1Z is the OE logic implementation. Refer to the Available OE Logic Configuration Table. 1

Refer to SL23EP04NZ products for DC to 220MHz-max frequency range and 2.5V to 3.3V power supply operation, improved skew, jitter and higher drive options.

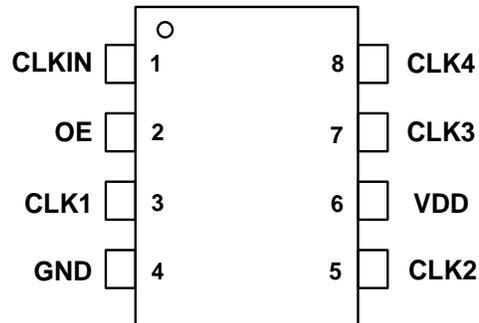
Benefits

- Up to four (4) distribution of input clock
- Low propagation delay
- Low output-to-output skew
- Low output clock Jitter
- Low power dissipation

Block Diagram



Pin Configuration



8-Pin TSSOP

Pin Description

| Pin Number | Pin Name | Pin Type | Pin Description |
|------------|----------|----------|--|
| 1 | CLKIN | Input | Reference Clock Input |
| 2 | OE | Output | Output Enable. Refer to the Table. 1 for Logic Table |
| 3 | CLK1 | Output | Buffered Clock Output 1 |
| 4 | GND | Power | Power Ground. |
| 5 | CLK2 | Output | Buffered Clock Output 2 |
| 6 | VDD | Output | 3.3V Power Supply |
| 7 | CLK3 | Power | Buffered Clock Output 3 |
| 8 | CLK4 | Input | Buffered Clock Output 4 |

General Description

The SL2304NZ is a low skew, jitter and power fanout Buffer designed to produce up to four (4) clock outputs from one (1) reference input clock, for high speed clock distribution, including PCI/PCI-X applications.

Input and output Frequency Range

The input and output frequency is the same (1x) for SL2304NZ-1 and SL2304NZ-1Z and operates from DC to 140MHz clock range with up to 25pF output load.

OE (Output Enable) Function

The only difference between SL2304-1 and SL2304NZ-1Z is the OE logic implementation. When OE=0, SL2304NZ-1 outputs are disabled and outputs are at Logic Low. In the case of SL2304NZ-1Z the outputs are at High-Z. Refer to the Available OE Logic Configuration Table. 1 below.

Output Clock Skew

All outputs should drive the similar load to achieve output-to-output skew and input-to-output delay specifications as given in the switching electrical tables.

Power Supply Range (VDD)

The SL2304NZ is designed to operate 3.3V+/-10% (3.63V-max to 2.97V-min) VDD power supply range. An internal on-chip voltage regulator is used to provide to constant power supply of 1.8V, leading to a consistent and stable electrical performance in terms of skew and jitter. The SL2304NZ I/O is powered by using VDD.

Refer to SL23EP04NZ products for DC to 220MHz-max frequency range, 2.5V to 3.3V power supply operation, improved skew, jitter and higher drive options.

Contact SLI for 1.8V power supply Fan-Out Buffer and ZDB products.

| CLKIN (Pin-1) | OE (Pin-2) | SL2304NZ-1 CLKOUT [1:4] | SL2304NZ-1Z CLKOUT [1:4] |
|---------------|------------|----------------------------|-----------------------------|
| Low | Low | Low | High-Z |
| High | Low | Low | High-Z |
| Low | High | Low | Low |
| High | High | High | High |

Table 1. Available SL2304 CLKIN and OE Logic Configurations

Absolute Maximum Ratings (All Products)

| Description | Condition | Min | Max | Unit |
|----------------------------------|--------------------------------|--------|---------|------|
| Supply voltage, VDD | | -0.5 | 4.6 | V |
| All Inputs and Outputs | | -0.5 | VDD+0.5 | V |
| Ambient Operating Temperature | In operation, C-Grade | 0 | 70 | °C |
| Ambient Operating Temperature | In operation, I-Grade | -40 | 85 | °C |
| Storage Temperature | No power is applied | -65 | 150 | °C |
| Junction Temperature | In operation, power is applied | – | 125 | °C |
| Soldering Temperature | | – | 260 | °C |
| ESD Rating (Human Body Model) | JEDEC22-A114D | -4,000 | 4,000 | V |
| ESD Rating (Charge Device Model) | JEDEC22-C101C | -1,500 | 1,500 | V |
| ESD Rating (Machine Model) | JEDEC22-A115D | -200 | 200 | V |

Operating Conditions (C-Grade and VDD=3.3V)

Unless otherwise stated VDD= 3.3V+/- 10%, CL=15pF and Ambient Temperature range 0 to +70°C

| Description | Symbol | Condition | Min | Typ | Max | Unit |
|---------------------------|--------|----------------------------|------|-----|------|------|
| Operating Voltage | VDD | VDD+/-10% | 2.97 | 3.3 | 3.63 | V |
| Operating Temperature | TA | Ambient Temperature | 0 | – | 70 | °C |
| Input Capacitance | VIH | Pins 1 and 2 | – | 3 | 5 | pF |
| Output Capacitance | CL1 | All outputs≤100MHz | – | – | 30 | pF |
| | CL2 | All outputs≤140MHz | – | – | 15 | pF |
| Input Operating Frequency | CLKIN | Input Clock Range | DC | – | 140 | MHz |
| Input Operating Frequency | CLKN2 | Input Clock Range, CL=30pF | DC | – | 100 | MHz |

DC Electrical Characteristics (C-Grade and VDD=3.3V)

Unless otherwise stated VDD= 3.3V+/- 10%, CL=15pF and Ambient Temperature range 0 to +70°C

| Description | Symbol | Condition | Min | Typ | Max | Unit |
|----------------------|--------|---|-----|------|---------|------|
| Input Low Voltage | VINL | CLKIN and OE | – | – | 0.8 | V |
| Input High Voltage | VINH | CLKIN and OE | 2.0 | – | VDD+0.3 | V |
| Input Low Current | IINL | 0 < VIN < 0.8V | -5 | +/-2 | 5 | µA |
| Input High Current | IINH | 2.4V < VIN < VDD | -5 | +/-2 | 5 | µA |
| Output Low Voltage | VOL1 | IoL=24mA | – | – | 0.80 | V |
| | VOL2 | IoL=12mA | – | – | 0.55 | V |
| Output High Voltage | VOH1 | IoH=-24mA | 2.0 | – | – | V |
| | VOH1 | IoH=-12mA | 2.4 | – | – | V |
| Power Supply Current | IDD1 | CLKIN=33MHz CL=0 (No load at outputs) | – | 7 | 11 | mA |
| Power Supply Current | IDD2 | CLKIN=66MHz CL=0 (No load at outputs) | – | 9 | 14 | mA |
| Power Supply Current | IDD3 | CLKIN=133MHz CL=0 (No load at outputs) | – | 12 | 18 | mA |

Switching Electrical Characteristics (C-Grade and VDD=3.3V)

Unless otherwise stated VDD= 3.3V+/- 10%, CL=15pF and Ambient Temperature range 0 to +70°C

| Description | Symbol | Condition | Min | Typ | Max | Unit |
|------------------------|--------|---|-----|-----|-----|------|
| Output Frequency Range | FOUT1 | CL=15pF | DC | – | 140 | MHz |
| | FOUT1 | CL=30pF | DC | – | 100 | MHz |
| Output Rise/Fall Time | tr/f-1 | Measured at 0.8V to 2.0V CL=15pF | – | – | 2.0 | ns |
| Output Rise/Fall Time | tr/f-2 | Measured at 0.8V to 2.0V CL=30pF | – | – | 2.4 | ns |
| Input Duty Cycle | DC1 | Measured at VDD/2 | 20 | 50 | 80 | % |
| Output Duty Cycle | DC2 | CL=15pF, Fout=140MHz Measured at VDD/2 | 45 | – | 55 | % |
| Output Duty Cycle | DC3 | CL=30pF, Fout=100MHz Measured at VDD/2 | 40 | – | 60 | % |
| Output to Output Skew | SKW1 | Measured at VDD/2 and Outputs are equally loaded | – | 50 | 100 | ps |
| Part to Part Skew | SKW2 | Measured at VDD/2 and Outputs are equally loaded | – | 100 | 200 | ps |
| Propagation Delay Time | PDT | Measured at VDD/2 from CLKIN to Output Clock rising edge | 1.5 | 2.5 | 3.5 | ns |
| Cycle-to-Cycle Jitter | CCJ1 | CLKIN=66MHz and CL=15 | – | 75 | 150 | ps |
| Cycle-to-Cycle Jitter | CCJ2 | CLKIN=133MHz and CL=15 | – | 50 | 100 | ps |

Operating Conditions (I-Grade and VDD=3.3V)

Unless otherwise stated VDD= 3.3V+/- 10%, CL=15pF and Ambient Temperature range -40 to +85°C

| Description | Symbol | Condition | Min | Typ | Max | Unit |
|---------------------------|--------|----------------------------|------|-----|------|------|
| Operating Voltage | VDD | VDD+/-10% | 2.97 | 3.3 | 3.63 | V |
| Operating Temperature | TA | Ambient Temperature | -40 | – | 85 | °C |
| Input Capacitance | VIH | Pins 1 and 2 | – | 3 | 6 | pF |
| Output Capacitance | CL1 | All outputs≤100MHz | – | – | 30 | pF |
| | CL2 | All outputs≤140MHz | – | – | 15 | pF |
| Input Operating Frequency | CLKN1 | Input Clock Range, CL=15pF | DC | – | 140 | MHz |
| Input Operating Frequency | CLKN2 | Input Clock Range, CL=30pF | DC | – | 100 | MHz |

DC Electrical Characteristics (I-Grade and VDD=3.3V)

Unless otherwise stated VDD= 3.3V+/- 10%, CL=15pF and Ambient Temperature range -40 to +85°C

| Description | Symbol | Condition | Min | Typ | Max | Unit |
|----------------------|--------|---|-----|------|---------|------|
| Input LOW Voltage | VINL | CLKIN and OE | – | – | 0.8 | V |
| Input HIGH Voltage | VINH | CLKIN and OE | 2.0 | – | VDD+0.3 | V |
| Input LOW Current | IINL | 0 < VIN < 0.8V | -6 | +/-3 | 6 | μA |
| Input HIGH Current | IINH | 2.4V < VIN < VDD | -6 | +/-3 | 6 | μA |
| Output Low Voltage | VOL | IoL=24mA | – | – | 0.80 | V |
| | | IoL=12mA | – | – | 0.55 | V |
| Output High Voltage | VOH | IoH=-24mA | 2.0 | – | – | V |
| | | IoH=-12mA | 2.4 | – | – | V |
| Power Supply Current | IDD1 | CLKIN=33MHz CL=0 (No load at outputs) | – | 8 | 12 | mA |
| Power Supply Current | IDD2 | CLKIN=66MHz CL=0 (No load at outputs) | – | 10 | 15 | mA |
| Power Supply Current | IDD3 | CLKIN=133MHz CL=0 (No load at outputs) | – | 14 | 20 | mA |

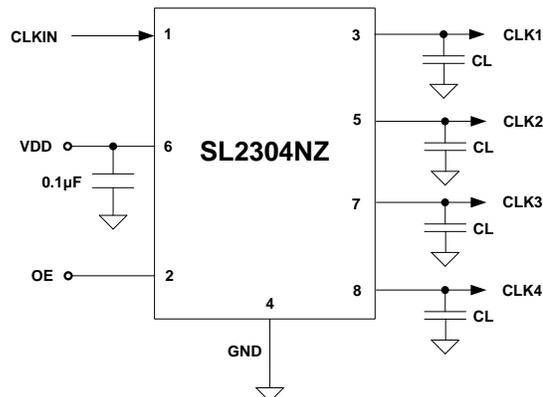
Switching Electrical Characteristics (I-Grade and VDD=3.3V)

Unless otherwise stated VDD= 3.3V+/- 10%, CL=15pF and Ambient Temperature range -40 to +85°C

| Description | Symbol | Condition | Min | Typ | Max | Unit |
|------------------------|--------|---|-----|-----|-----|------|
| Output Frequency Range | FOUT1 | CL=15pF | DC | – | 140 | MHz |
| | FOUT2 | CL=30pF | DC | – | 100 | MHz |
| Output Rise/fall Time | tr/f-1 | CL=15pF, measured at 0.8V to 2.0V | – | – | 2.2 | ns |
| Output Rise/Fall Time | tr/f-2 | CL=30pF, measured at 0.8V to 2.0V | – | – | 2.6 | ns |
| Input Duty Cycle | DC1 | Measured at VDD/2 | 20 | – | 80 | % |
| Output Duty Cycle | DC2 | CL=15pF, Fout=140MHz Measured at VDD/2 | 45 | – | 55 | % |
| Output Duty Cycle | DC3 | CL=30pF, Fout=100MHz Measured at VDD/2 | 40 | – | 60 | % |
| Output to Output Skew | SKW1 | Measured at VDD/2 and Outputs are equally loaded | – | 60 | 120 | ps |
| Part to Part Skew | SKW2 | Measured at VDD/2 and Outputs are equally loaded | – | 120 | 240 | ps |
| Propagation Delay Time | PDT | Measured at VDD/2 from CLKIN to Output Clock rising edge and Outputs are equally loaded | 1.2 | 2.5 | 3.8 | ns |
| Cycle-to-Cycle Jitter | CCJ1 | CLKIN=66MHz and CL=15 | – | 80 | 160 | ps |
| Cycle-to-Cycle Jitter | CCJ2 | CLKIN=133MHz and CL=15 | – | 60 | 120 | ps |

External Components & Design Considerations

Typical Application Schematic

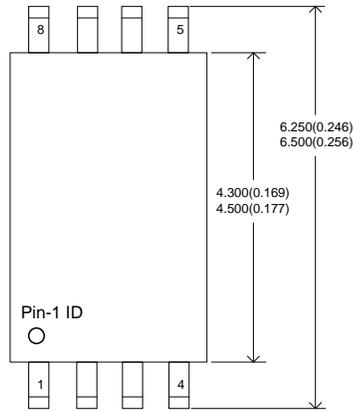


Recommendations

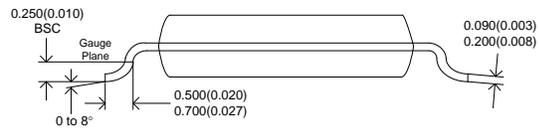
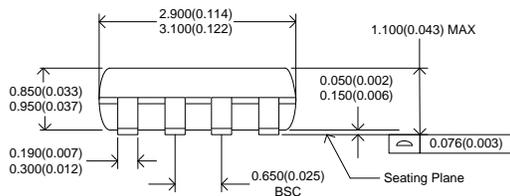
Decoupling Capacitor: A decoupling capacitor of 0.1µF must be used between VDD and VSS pins. Place the capacitor on the component side of the PCB as close to the VDD pin as possible. The PCB trace to the VDD pin and to the GND via should be kept as short as possible. Do not use vias between the decoupling capacitor and the VDD pin.

Package Outline and Package Dimensions

8-Pin TSSOP (4.4 mm)



Dimensions are in millimeters(inches).
Top line: (MIN) and Bottom line: (Max)



Thermal Characteristics

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|--|---------------|-------------------------|-----|-----|-----|------|
| Thermal Resistance Junction to Ambient | θ_{JA} | Still air | - | 110 | - | °C/W |
| | θ_{JA} | 1 m/s air flow | - | 100 | - | °C/W |
| | θ_{JA} | 3m/s air flow | - | 80 | - | °C/W |
| Thermal Resistance Junction to Case | θ_{JC} | Independent of air flow | - | 35 | - | °C/W |

Ordering Information ^[1]

| Ordering Number | Marking | Shipping Package | Package | Temperature |
|-----------------|--------------|------------------|-------------|-------------|
| SL2304NZZC-1 | SL2304Nzc-1 | Tube | 8-pin TSSOP | 0 to 70°C |
| SL2304NZZC-1T | SL2304Nzc-1 | Tape and Reel | 8-pin TSSOP | 0 to 70°C |
| SL2304NZZI-1 | SL2304Nzi-1 | Tube | 8-pin TSSOP | -40 to 85°C |
| SL2304NZZI-1T | SL2304Nzi-1 | Tape and Reel | 8-pin TSSOP | -40 to 85°C |
| SL2304NZZC-1Z | SL2304Nzc-1Z | Tube | 8-pin TSSOP | 0 to 70°C |
| SL2304NZZC-1ZT | SL2304Nzc-1Z | Tape and Reel | 8-pin TSSOP | 0 to 70°C |
| SL2304NZZI-1Z | SL2304Nzi-1Z | Tube | 8-pin TSSOP | -40 to 85°C |
| SL2304NZZI-1ZT | SL2304Nzi-1Z | Tape and Reel | 8-pin TSSOP | -40 to 85°C |

Notes:

1. The SL2304NZ products are RoHS compliant.

The information in this document is believed to be accurate in all respects at the time of publication but is subject to change without notice. Silicon Laboratories assumes no responsibility for errors and omissions, and disclaims responsibility for any consequences resulting from the use of information included herein. Additionally, Silicon Laboratories assumes no responsibility for the functioning of undescribed features or parameters. Silicon Laboratories reserves the right to make changes without further notice. Silicon Laboratories makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Silicon Laboratories assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. Silicon Laboratories products are not designed, intended, or authorized for use in applications intended to support or sustain life, or for any other application in which the failure of the Silicon Laboratories product could create a situation where personal injury or death may occur. Should Buyer purchase or use Silicon Laboratories products for any such unintended or unauthorized application, Buyer shall indemnify and hold Silicon Laboratories harmless against all claims and damages.