

## 14 Output, 3.3V SDRAM Buffer for Desktop PCs with 3 DIMMs

### Features

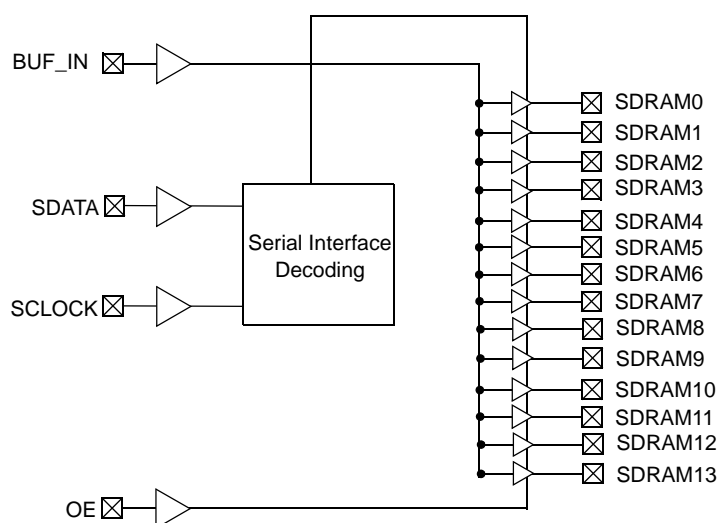
- One input to 14 output buffer or driver
- Supports up to three SDRAM DIMMs
- Two additional outputs for feedback
- Serial interface for output control
- Low skew outputs
- Up to 100 MHz operation
- Multiple  $V_{DD}$  and  $V_{SS}$  pins for noise reduction
- Dedicated OE pin for testing
- Low EMI outputs
- 28-pin SOIC (300-mil) package
- 3.3V operation

### Functional Description

The CY2314ANZ is a 3.3V buffer designed to distribute high speed clocks in desktop PC applications. The part has 14 outputs, 12 of which can be used to drive up to three SDRAM DIMMs. The remaining can be used for external feedback to a PLL. The device operates at 3.3V and outputs can run up to 100 MHz.

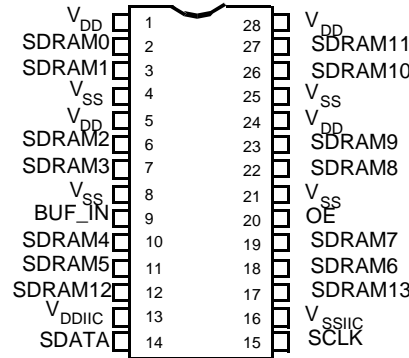
The CY2314ANZ also includes a serial interface which can enable or disable each output clock. On power up, all output clocks are enabled. A separate Output Enable pin facilitates testing on ATE.

### Logic Block Diagram



## Pin Configuration

Figure 1. 28-Pin SOIC Top View



## Device Functionality

| OE | SDRAM [0-13] |
|----|--------------|
| 0  | High-Z       |
| 1  | 1 x BUF_IN   |

## Serial Configuration Map

- The serial bits are read by the clock driver in the following order:

Byte 0 - Bits 7, 6, 5, 4, 3, 2, 1, 0

Byte 1 - Bits 7, 6, 5, 4, 3, 2, 1, 0

Byte N - Bits 7, 6, 5, 4, 3, 2, 1, 0

- Reserved and unused bits should be programmed to “0”

- Serial interface address for the CY2314ANZ is:

| A6 | A5 | A4 | A3 | A2 | A1 | A0 | R/W  |
|----|----|----|----|----|----|----|------|
| 1  | 1  | 0  | 1  | 0  | 0  | 1  | ---- |

Table 1. Byte 0: SDRAM Active/Inactive Register (1 = Enable, 0 = Disable), Default = Enabled

| Bit   | Pin # | Description              |
|-------|-------|--------------------------|
| Bit 7 | 11    | SDRAM5 (Active/Inactive) |
| Bit 6 | 10    | SDRAM4 (Active/Inactive) |
| Bit 5 | --    | Reserved, Drive to 0     |
| Bit 4 | --    | Reserved, Drive to 0     |
| Bit 3 | 7     | SDRAM3 (Active/Inactive) |
| Bit 2 | 6     | SDRAM2 (Active/Inactive) |
| Bit 1 | 3     | SDRAM1 (Active/Inactive) |
| Bit 0 | 2     | SDRAM0 (Active/Inactive) |

Table 2. Byte 1: SDRAM Active/Inactive Register (1 = Active, 0 = Inactive), Default = Active

| Bit   | Pin # | Description               |
|-------|-------|---------------------------|
| Bit 7 | 27    | SDRAM11 (Active/Inactive) |
| Bit 6 | 26    | SDRAM10 (Active/Inactive) |
| Bit 5 | 23    | SDRAM9 (Active/Inactive)  |
| Bit 4 | 22    | SDRAM8 (Active/Inactive)  |
| Bit 3 | --    | Reserved, Drive to 0      |
| Bit 2 | --    | Reserved, Drive to 0      |
| Bit 1 | 19    | SDRAM7 (Active/Inactive)  |
| Bit 0 | 18    | SDRAM6 (Active/Inactive)  |

Table 3. Byte 2: SDRAM Active/Inactive Register (1 = Active, 0 = Inactive), Default = Active

| Bit   | Pin # | Description               |
|-------|-------|---------------------------|
| Bit 7 | 17    | SDRAM13 (Active/Inactive) |
| Bit 6 | 12    | SDRAM12 (Active/Inactive) |
| Bit 5 | --    | Reserved, Drive to 0      |
| Bit 4 | --    | Reserved, Drive to 0      |
| Bit 3 | --    | Reserved, Drive to 0      |
| Bit 2 | --    | Reserved, Drive to 0      |
| Bit 1 | --    | Reserved, Drive to 0      |
| Bit 0 | --    | Reserved, Drive to 0      |

## Maximum Ratings

Supply Voltage to Ground Potential.....-0.5V to +7.0V  
 DC Input Voltage (Except BUF\_IN) ..... -0.5V to  $V_{DD} + 0.5V$   
 DC Input Voltage (BUF\_IN) .....-0.5V to +7.0V

Storage Temperature ..... -65°C to +150°C  
 Junction Temperature..... 150°C  
 Static Discharge Voltage  
 (per MIL-STD-883, Method 3015) ..... >2000V

## Operating Conditions <sup>[1]</sup>

| Parameter | Description   | Min   | Max   | Unit |
|-----------|---|-------|-------|------|
| $V_{DD}$  | Supply Voltage  | 3.135 | 3.465 | V    |
| $T_A$     | Operating Temperature (Ambient Temperature)   | 0     | 70    | °C   |
| $C_L$     | Load Capacitance  |       | 30    | pF   |
| $C_{IN}$  | Input Capacitance   |       | 7     | pF   |
| $t_{PU}$  | Power up time for all VDDs to reach minimum specified voltage (power ramps must be monotonic) | 0.05  | 50    | ms   |

## Electrical Characteristics Over the Operating Range

| Parameter   | Description                           | Test Conditions  | Min | Max | Unit |
|-------------|---------------------------------------|--|-----|-----|------|
| $V_{IL}$    | Input LOW Voltage <sup>[2]</sup>      | Except serial interface pins                                 |     | 0.8 | V    |
| $V_{ILiic}$ | Input LOW Voltage                     | For serial interface pins only                               |     | 0.7 | V    |
| $V_{IH}$    | Input HIGH Voltage <sup>[2]</sup>     |  | 2.0 |     | V    |
| $I_{IL}$    | Input LOW Current (BUF_IN input)      | $V_{IN} = 0V$  | -10 | 10  | μA   |
| $I_{IL}$    | Input LOW Current (Except BUF_IN Pin) | $V_{IN} = 0V$  |     | 100 | μA   |
| $I_{IH}$    | Input HIGH Current                    | $V_{IN} = V_{DD}$  | -10 | 10  | μA   |
| $V_{OL}$    | Output LOW Voltage <sup>[3]</sup>     | $I_{OL} = 25\text{ mA}$                                      |     | 0.4 | V    |
| $V_{OH}$    | Output HIGH Voltage <sup>[3]</sup>    | $I_{OH} = -36\text{ mA}$                                     | 2.4 |     | V    |
| $I_{DD}$    | Supply Current <sup>[3]</sup>         | Unloaded outputs, 100 MHz                                    |     | 200 | mA   |
| $I_{DD}$    | Supply Current <sup>[3]</sup>         | Loaded outputs, 100 MHz                                      |     | 290 | mA   |
| $I_{DD}$    | Supply Current <sup>[3]</sup>         | Unloaded outputs, 66.67 MHz                                  |     | 150 | mA   |
| $I_{DD}$    | Supply Current <sup>[3]</sup>         | Loaded outputs, 66.67 MHz                                    |     | 185 | mA   |
| $I_{DDs}$   | Supply Current                        | BUF_IN= $V_{DD}$ or $V_{SS}$<br>All other inputs at $V_{DD}$ |     | 500 | μA   |

### Notes

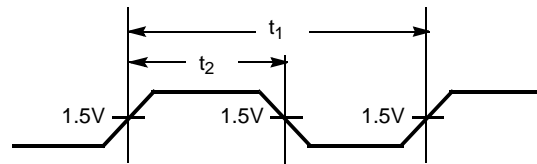
- Electrical parameters are guaranteed under the operating conditions specified.
- BUF\_IN input has a threshold voltage of  $V_{DD}/2$ .
- Parameter is guaranteed by design and characterization. Not 100% tested in production.

**Switching Characteristics<sup>[4]</sup> Over the Operating Range**

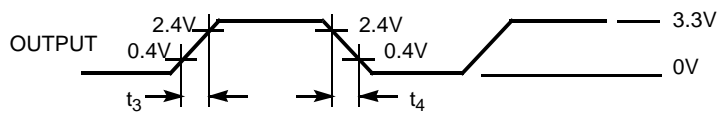
| Parameter | Name   | Test Conditions                | Min  | Typ  | Max  | Unit |
|-----------|--|--------------------------------|------|------|------|------|
|           | Maximum Operating Frequency                      |                                |      |      | 100  | MHz  |
|           | Duty Cycle <sup>[3, 5]</sup> = $t_2 \div t_1$    | Measured at 1.5V               | 45.0 | 50.0 | 55.0 | %    |
| $t_3$     | Rising Edge Rate <sup>[3]</sup>                  | Measured between 0.4V and 2.4V | 0.9  | 1.5  | 4.0  | V/ns |
| $t_4$     | Falling Edge Rate <sup>[3]</sup>                 | Measured between 2.4V and 0.4V | 0.9  | 1.5  | 4.0  | V/ns |
| $t_5$     | Output to Output Skew <sup>[3]</sup>             | All outputs equally loaded     | -250 |      | +250 | ps   |
| $t_6$     | SDRAM Buffer LH Propagation Delay <sup>[3]</sup> | Input edge greater than 1 V/ns | 1.0  | 3.5  | 5.0  | ns   |
| $t_7$     | SDRAM Buffer HL Propagation Delay <sup>[3]</sup> | Input edge greater than 1 V/ns | 1.0  | 3.5  | 5.0  | ns   |
| $t_8$     | SDRAM Buffer Enable Delay <sup>[3]</sup>         | Input edge greater than 1 V/ns | 1.0  | 5    | 12   | ns   |
| $t_9$     | SDRAM Buffer Disable Delay <sup>[3]</sup>        | Input edge greater than 1 V/ns | 1.0  | 20   | 30   | ns   |

**Switching Waveforms**

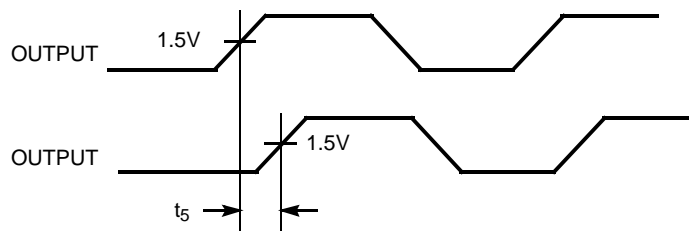
**Figure 2. Duty Cycle Timing**



**Figure 3. All Outputs Rise/Fall Time**



**Figure 4. Output-Output Skew**



**Notes**

- 4. All parameters specified with loaded outputs.
- 5. Duty cycle of input clock is 50%. Rising and falling edge rate of the input clock is greater than 1 V/ns.

Switching Waveforms (continued)

Figure 5. SDRAM Buffer LH and HL Propagation Delay

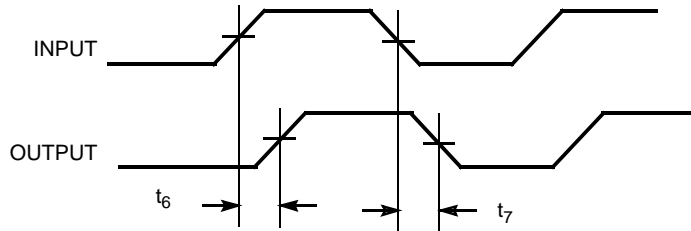
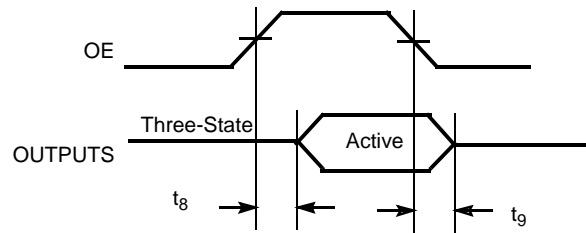
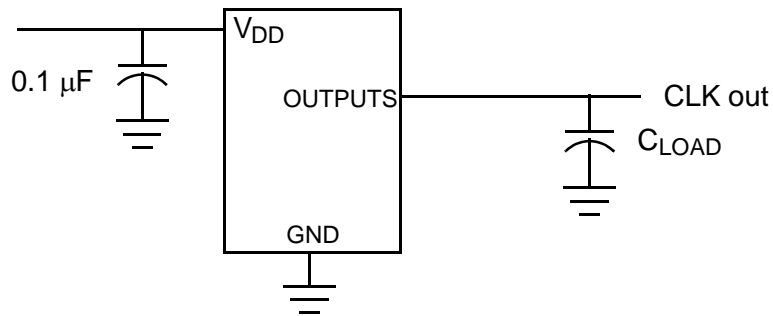


Figure 6. SDRAM Buffer Enable and Disable Times



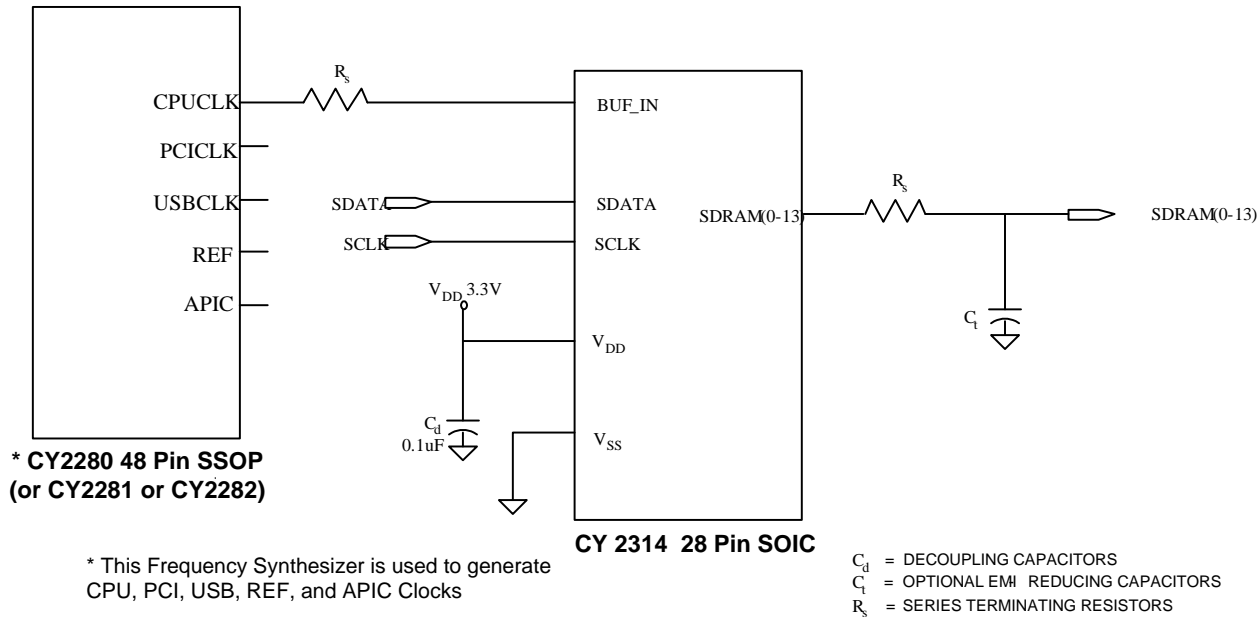
Test Circuit



## Application Information

Clock traces must be terminated with either series or parallel termination, as is normally done.

Figure 7. Application Circuit



## Recommendation

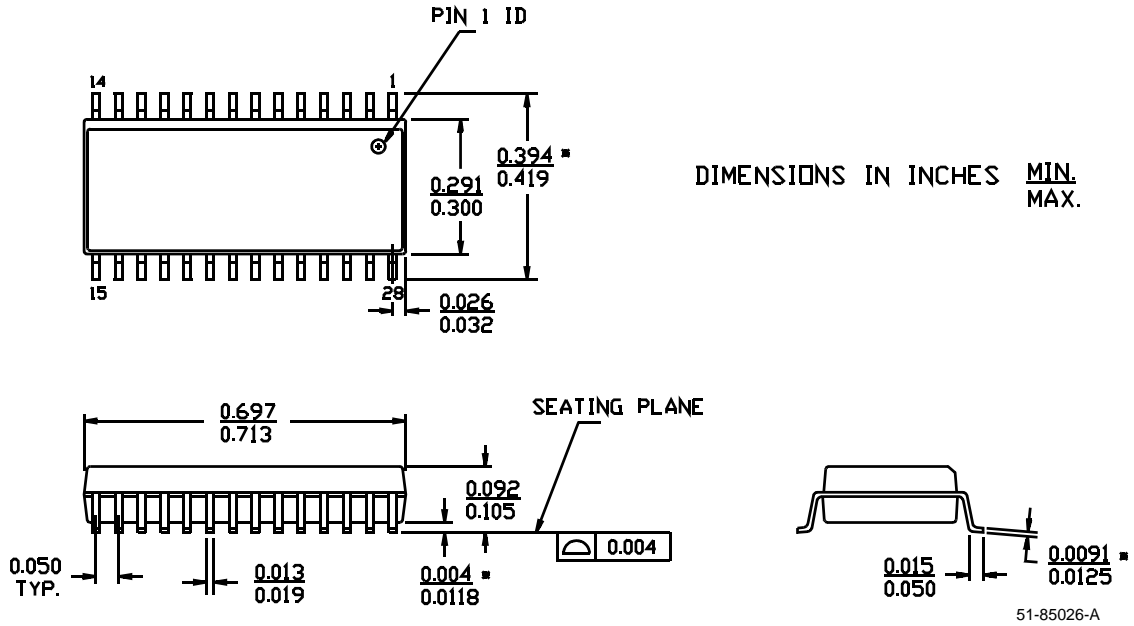
- Surface mount, low ESR, and ceramic capacitors must be used for filtering. Typically, these capacitors have a value of 0.1 μF. In some cases, smaller value capacitors may be required.
- The value of the series terminating resistor satisfies the following equation, where R<sub>trace</sub> is the loaded characteristic impedance of the trace, R<sub>out</sub> is the output impedance of the buffer (typically 25Ω), and R<sub>series</sub> is the series terminating resistor.  
 $R_{series} > R_{trace} - R_{out}$
- Footprints must be laid out for optional EMI reducing capacitors, which should be placed as close to the terminating resistor as is physically possible. Typical values of these capacitors range from 4.7 pF to 22 pF.
- A ferrite bead **may** be used to isolate the board V<sub>DD</sub> from the clock generator V<sub>DD</sub> island. Ensure that the ferrite bead offers greater than 50Ω impedance at the clock frequency, under loaded DC conditions. Refer to the application note [Layout and Termination Techniques for Cypress Clock Generators](#) for more details.
- If a ferrite bead is used, a 10 μF to 22 μF tantalum bypass capacitor should be placed close to the ferrite bead. This capacitor prevents power supply droop during current surges.

## Ordering Information

| Ordering Code   | Package Name | Package Type                | Operating Range |
|-----------------|--------------|-----------------------------|-----------------|
| <b>Pb-Free</b>  |              |                             |                 |
| CY2314ANZSXC-1  | SZ283        | 28-Pin SOIC                 | Commercial      |
| CY2314ANZSXC-1T | SZ283        | 28-Pin SOIC - Tape and Reel | Commercial      |

Package Diagram

Figure 8. 28-Pin (300-Mil) Molded SOIC SZ283



## Document History Page

| Document Title: CY2314ANZ 14 Output, 3.3V SDRAM Buffer for Desktop PCs with 3 DIMMs<br>Document Number: 38-07143 |         |                 |                 |  |
|--|---------|-----------------|-----------------|--|
| Rev.   | ECN No. | Orig. of Change | Submission Date | Description of Change  |
| **   | 110252  | DSG             | 11/18/01        | Change from Spec number: 38-00687 to 38-07143  |
| *A   | 121830  | RBI             | 12/14/02        | Power up requirements added to Operating Conditions Information  |
| *B   | 2606695 | KVM/PYRS        | 11/13/08        | Update Ordering Information Table:<br>Remove CY2314ANZSC-1<br>Add Pb-free devices CY2314ANZSXC-1 and CY2314ANZSXC-1T |

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