Nine-Output 3.3V Buffer

Features

- **One-input to nine-output buffer/driver**
- **Supports two DIMMs or four SO-DIMMs with one additional output for feedback to an external or chipset PLL**
- **Low power consumption for mobile applications**
  - **Less than 32 mA at 66.6 MHz with unloaded outputs**
- **8.7-ns Input-Output delay**
- **Buffers all frequencies from DC to 133.33 MHz**
- **Output-output skew less than 250 ps**
- **Multiple V_{DD} and V_{SS} pins for noise and electromagnetic interference (EMI) reduction**
- **Space-saving 16-pin 150-mil SOIC package**
- **3.3V operation**
- **Industrial temperature available**
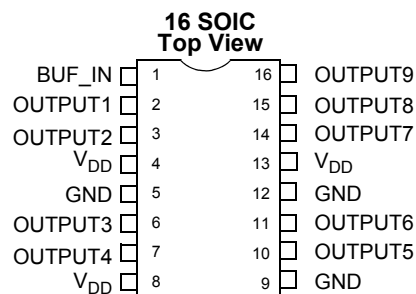
Functional Description

The CY2309NZ is a low-cost buffer designed to distribute high-speed clocks in mobile PC systems and desktop PC systems with SDRAM support. The part has nine outputs, eight of which can be used to drive 2 DIMMs or 4 SO-DIMMs, and the remaining can be used for external feedback to a PLL. The device operates at 3.3V and outputs can run up to 133.33 MHz.

The CY2309NZ is designed for low EMI and power optimization. It has multiple V_{SS} and V_{DD} pins for noise optimization and consumes less than 32 mA at 66.6 MHz, making it ideal for the low-power requirements of mobile systems. It is available in an ultra-compact 150-mil 16-pin SOIC package.

Block Diagram
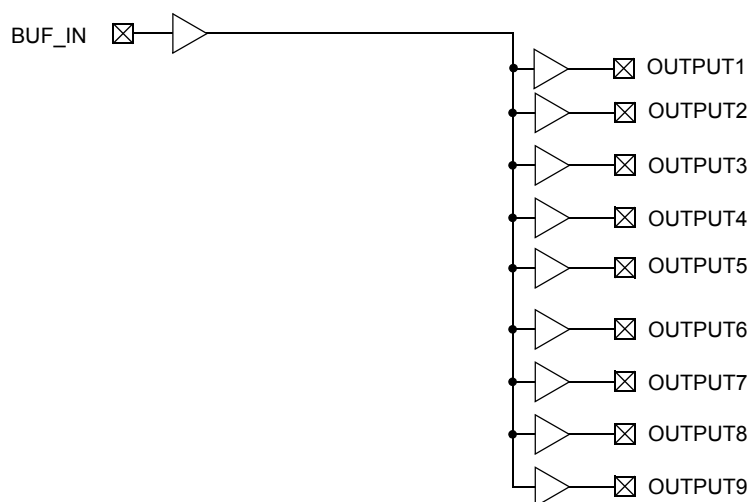
Pin Configuration

Pin Description for CY2309NZ

Pin	Signal	Description
4, 8, 13	V_{DD}	3.3V Digital Voltage Supply
5, 9, 12	GND	Ground
1	BUF_IN	Input Clock
2, 3, 6, 7, 10, 11, 14, 15, 16	OUTPUT [1:9]	Outputs

Maximum Ratings

Supply Voltage to Ground Potential .... −0.5V to +7.0V

DC Input Voltage (Except REF) ....−0.5V to V_{DD} + 0.5V

DC Input Voltage REF.. −0.5V to 7V

Storage Temperature ....−65°C to +150°C

Junction Temperature.. 150°C

Static Discharge Voltage
(per MIL-STD-883, Method 3015) ....>2,000V

Operating Conditions for Commercial and Industrial Temperature Devices

Parameter	Description	Min.	Max.	Unit
V_{DD}	Supply Voltage	3.0	3.6	V
T_A	(Ambient Operating Temperature) Commercial	0	70	°C
	(Ambient Operating Temperature) Industrial	−40	85	°C
C_L	Load Capacitance, Fout < 100 MHz		30	pF
	Load Capacitance,100 MHz < Fout < 133.33 MHz		15	pF
C_{IN}	Input Capacitance		7	pF
BUF_IN, SDRAM [1:9]	Operating Frequency	DC	133.33	MHz
t_{PU}	Power-up time for all VDDs to reach minimum specified voltage (power ramps must be monotonic)	0.05	50	ms

## Electrical Characteristics for Commercial and Industrial Temperature Devices

Parameter	Description	Test Conditions	Min.	Max.	Unit
V_{IL}	Input LOW Voltage[1]			0.8	V
V_{IH}	Input HIGH Voltage[1]		2.0		V
I_{IL}	Input LOW Current	V_{IN} = 0V		50.0	μA
I_{IH}	Input HIGH Current	V_{IN} = V_{DD}		100.0	μA
V_{OL}	Output LOW Voltage[2]	I_{OL} = 8 mA		0.4	V
V_{OH}	Output HIGH Voltage[2]	I_{OH} = −8 mA	2.4		V
I_{DD}	Supply Current	Unloaded outputs at 66.66 MHz		32	mA

Switching Characteristics for Commercial and Industrial Temperature Devices[3]

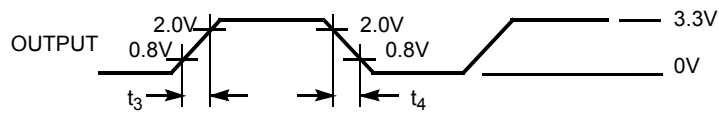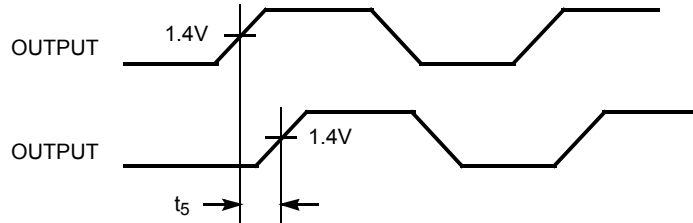| Parameter	Name	Description	Min.	Typ.	Max.	Unit
	Duty Cycle[2] = $t_2 \div t_1$	Measured at 1.4V	40.0	50.0	60.0	%
t_3	Rise Time[2]	Measured between 0.8V and 2.0V			1.50	ns
t_4	Fall Time[2]	Measured between 0.8V and 2.0V			1.50	ns
t_5	Output to Output Skew[2]	All outputs equally loaded			250	ps
t_6	Propagation Delay, BUF_IN Rising Edge to OUTPUT Rising Edge[2]	Measured at V_{DD}/2	1	5	9.2	ns

Switching Waveforms

Duty Cycle Timing
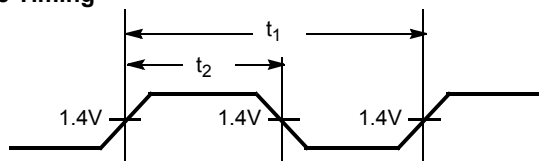
Notes:
1. BUF_IN input has a threshold voltage of V_{DD}/2.
2. Parameter is guaranteed by design and characterization. It is not 100% tested in production.
3. All parameters specified with loaded outputs.
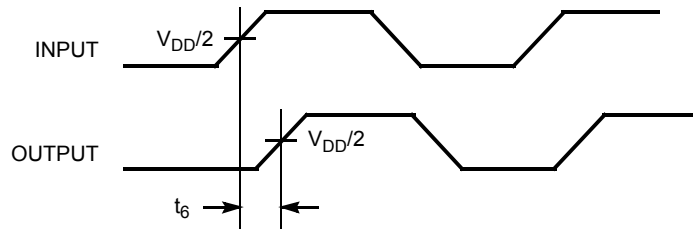
Switching Waveforms (continued)
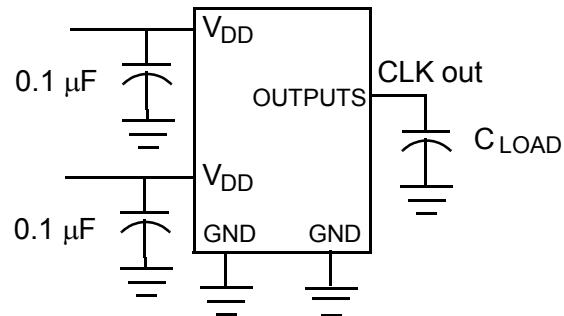
All Outputs Rise/Fall Time

OUTPUT 2.0V 0.8V 2.0V 0.8V 3.3V 0V

t_3 t_4

Output-Output Skew

OUTPUT 1.4V

OUTPUT 1.4V

t_5

Input-Output Propagation Delay

INPUT $V_{DD}/2$

OUTPUT $V_{DD}/2$

t_6

Test Circuits

V_{DD}
$0.1\ \mu F$
OUTPUTS CLK out
C_{LOAD}
V_{DD}
$0.1\ \mu F$
GND   GND

Ordering Information

Ordering Code	Package Name	Package Type	Operating Range
CY2309NZSC–1H	S16	16-pin 150-mil SOIC	Commercial
CY2309NZSI-1H	S16	16-pin 150-mil SOIC	Industrial

Package Diagram

16-Lead (150-Mil) SOIC S16

PIN 1 ID

8   1

0.150[3.810]
0.157[3.987]

0.230[5.842]
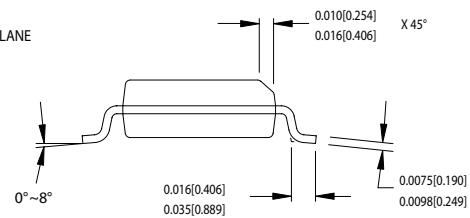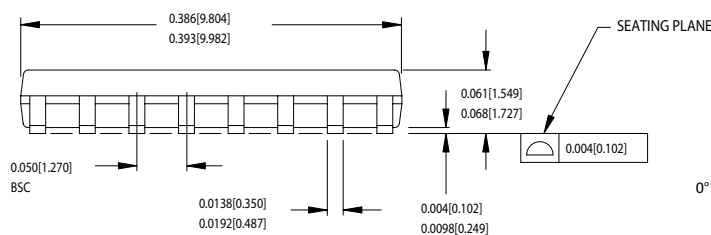0.244[6.197]

9   16
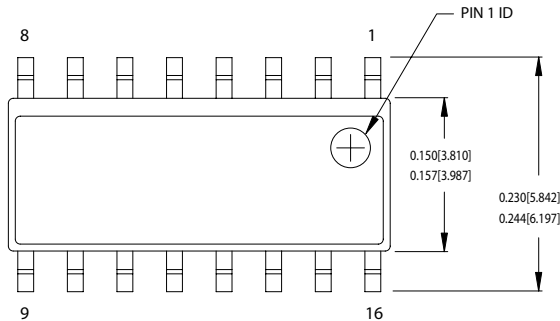
DIMENSIONS IN INCHES[MM] MIN.

MAX.

REFERENCE JEDEC MS-012

PACKAGE WEIGHT 0.15gms

PART #
S16.15 STANDARD PKG.
SZ16.15 LEAD FREE PKG.

0.386[9.804]
0.393[9.982]

SEATING PLANE

0.010[0.254]
0.016[0.406]

X 45°

0.061[1.549]
0.068[1.727]

0.004[0.102]

0.050[1.270]
BSC

0.0138[0.350]
0.0192[0.487]

0.004[0.102]
0.0098[0.249]

0°~8°

0.016[0.406]
0.035[0.889]

0.0075[0.190]
0.0098[0.249]

51-85068-*B

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Document History Page

Document Title: CY2309NZ Nine-Output 3.3V Buffer				
Document Number: 38-07182				
REV.	**ECN NO.**	**Issue Date**	**Orig. of Change**	**Description of Change**
**	111858	12/09/01	DSG	Change from Spec number: 38-00709 to 38-07182
*A	121834	12/14/02	RBI	Power-up requirements added to Operating Conditions Information
*B	130563	10/23/03	SDR	Added industrial operating temperature to operating conditions
*C	212991	See ECN	RGL/GGK	Updated the propagation delay T_6 spec to 9.2 ns in the Switching Characteristics table