



**THE DATASHEET OF  
2309NZ-1HDCGI**



**FEATURES:**

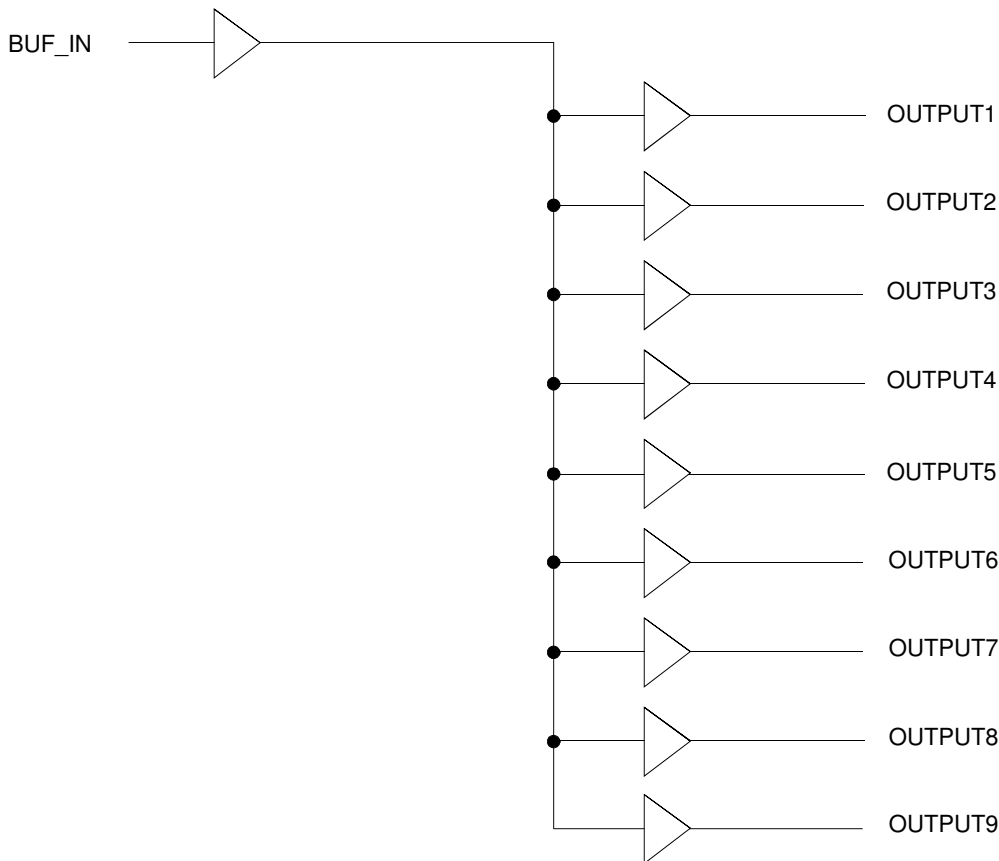
- One input to nine output buffer/driver
- Supports two DIMMs or four SO-DIMMs with one additional output for feedback to an external or chipset PLL
- Low power consumption for mobile applications: less than 32mA at 66.6MHz with unloaded outputs
- 8.7ns input-output delay
- Buffers all frequencies from DC to 133.33MHz
- Output-output skew < 250ps
- Multiple V<sub>DD</sub> and V<sub>SS</sub> pins for noise and EMI reduction
- 3.3V operation
- High drive capability
- Available in SOIC and TSSOP packages

**DESCRIPTION:**

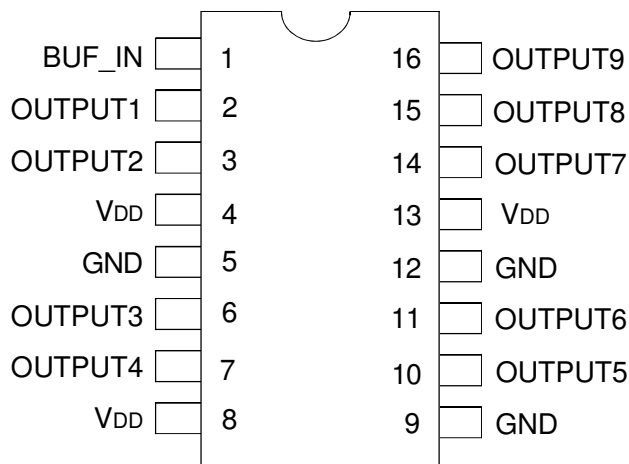
The IDT2309NZ is a low-cost buffer designed to distribute high-speed clocks in mobile PC systems and desktop PC systems with SDRAM support. This part has nine outputs, eight of which can be used to drive two DIMMs or four SO-DIMMs, and the remaining can be used for external feedback to a PLL. The IDT2309NZ operates at 3.3V and outputs can run up to 133.33MHz

The IDT2309NZ is designed for low EMI and power optimization. It has multiple V<sub>DD</sub> and V<sub>SS</sub> pins for noise optimization and consumes less than 32mA at 66.6MHz, making it ideal for the low power requirements of mobile systems.

**FUNCTIONAL BLOCK DIAGRAM**



## PIN CONFIGURATION



SOIC/ TSSOP  
TOP VIEW

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

Symbol	Rating	Max.	Unit
V <sub>DD</sub>	Supply Voltage Range	-0.5 to +4.6	V
V <sub>I</sub> <sup>(2)</sup>	Input Voltage Range (REF)	-0.5 to +5.5	V
V <sub>I</sub>	Input Voltage Range (except REF)	-0.5 to V <sub>DD</sub> +0.5	V
I <sub>IK</sub> (V <sub>I</sub> < 0)	Input Clamp Current	-50	mA
I <sub>O</sub> (V <sub>O</sub> = 0 to V <sub>DD</sub> )	Continuous Output Current	±50	mA
V <sub>DD</sub> or GND	Continuous Current	±100	mA
T <sub>A</sub> = 55°C (in still air) <sup>(3)</sup>	Maximum Power Dissipation	0.7	W
T <sub>STG</sub>	Storage Temperature Range	-65 to +150	°C
Operating Temperature	Commercial Temperature Range	0 to +70	°C
Operating Temperature	Industrial Temperature Range	-40 to +85	°C

### NOTES:

1. Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
2. The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
3. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils.

## PIN DESCRIPTION

Pin Name	Pin Number	Functional Description
V <sub>DD</sub>	4, 8, 13	3.3V Digital Voltage Supply
GND	5, 9, 12	Ground
BUF_IN	1	Input clock
OUTPUT <sub>[1:9]</sub>	2, 3, 6, 7, 10, 11, 14, 15, 16	Outputs

## OPERATING CONDITIONS - COMMERCIAL

Symbol	Parameter	Min.	Max.	Unit
V <sub>DD</sub>	Supply Voltage	3	3.6	V
T <sub>A</sub>	Operating Temperature (Ambient Temperature)	0	70	°C
C <sub>L</sub>	Load Capacitance, F <sub>OUT</sub> < 100MHz	—	30	pF
	Load Capacitance 100MHz < F <sub>OUT</sub> < 133.33MHz	—	15	
C <sub>IN</sub>	Input Capacitance	—	7	pF
BUF_IN, SDRAM <sub>[1:9]</sub>	Operating Frequency	DC	133.33	MHz

## OPERATING CONDITIONS - INDUSTRIAL

Symbol	Parameter	Min.	Max.	Unit
V <sub>DD</sub>	Supply Voltage	3	3.6	V
T <sub>A</sub>	Operating Temperature (Ambient Temperature)	-40	+85	°C
C <sub>L</sub>	Load Capacitance, F <sub>OUT</sub> < 100MHz	—	30	pF
	Load Capacitance 100MHz < F <sub>OUT</sub> < 133.33MHz	—	15	
C <sub>IN</sub>	Input Capacitance	—	7	pF
BUF_IN, SDRAM[1:9]	Operating Frequency	DC	133.33	MHz

## DC ELECTRICAL CHARACTERISTICS - COMMERCIAL

Symbol	Parameter	Conditions	Min.	Max.	Unit
V <sub>IL</sub>	Input LOW Voltage <sup>(1)</sup>		—	0.8	V
V <sub>IH</sub>	Input HIGH Voltage <sup>(1)</sup>		2	—	V
I <sub>IL</sub>	Input LOW Current	V <sub>IN</sub> = 0V	—	50	μA
I <sub>IH</sub>	Input HIGH Current	V <sub>IN</sub> = V <sub>DD</sub>	—	100	μA
V <sub>OL</sub>	Output LOW Voltage <sup>(2)</sup>	I <sub>OL</sub> = 8mA	—	0.4	V
V <sub>OH</sub>	Output HIGH Voltage <sup>(2)</sup>	I <sub>OH</sub> = -8mA	2.4	—	V
I <sub>DD</sub>	Supply Current	Unloaded Outputs at 66.66MHz	—	32	mA

### NOTES:

1. BUF\_IN input has a threshold voltage of V<sub>DD</sub>/2.
2. Parameter is guaranteed by design but not production tested.

## DC ELECTRICAL CHARACTERISTICS - INDUSTRIAL

Symbol	Parameter	Conditions	Min.	Max.	Unit
V <sub>IL</sub>	Input LOW Voltage <sup>(1)</sup>		—	0.8	V
V <sub>IH</sub>	Input HIGH Voltage <sup>(1)</sup>		2	—	V
I <sub>IL</sub>	Input LOW Current	V <sub>IN</sub> = 0V	—	50	μA
I <sub>IH</sub>	Input HIGH Current	V <sub>IN</sub> = V <sub>DD</sub>	—	100	μA
V <sub>OL</sub>	Output LOW Voltage <sup>(2)</sup>	I <sub>OL</sub> = 8mA	—	0.4	V
V <sub>OH</sub>	Output HIGH Voltage <sup>(2)</sup>	I <sub>OH</sub> = -8mA	2.4	—	V
I <sub>DD</sub>	Supply Current	Unloaded Outputs at 66.66MHz	—	35	mA

### NOTES:

1. BUF\_IN input has a threshold voltage of V<sub>DD</sub>/2.
2. Parameter is guaranteed by design but not production tested.

## SWITCHING CHARACTERISTICS - COMMERCIAL <sup>(1)</sup>

Symbol	Parameter <sup>(2)</sup>	Conditions	Min.	Typ.	Max.	Unit
t <sub>r</sub>	Rise Time	Measured between 0.8V and 2V	—	—	1.5	ns
t <sub>f</sub>	Fall Time	Measured between 0.8V and 2V	—	—	1.5	ns
t <sub>s</sub>	Output to Output Skew	All outputs equally loaded	—	—	250	ps
t <sub>p</sub>	Propagation Delay, BUF_IN Rising Edge to OUTPUT Rising Edge	Measured at V <sub>DD</sub> /2	1	5	8.7	ns

### NOTES:

1. All parameters specified with loaded outputs.
2. Parameter is guaranteed by design but not production tested.

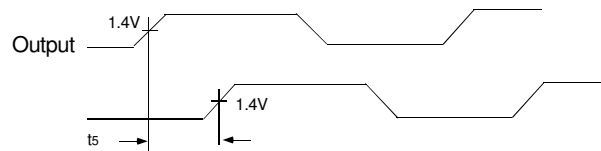
## SWITCHING CHARACTERISTICS - INDUSTRIAL <sup>(1)</sup>

Symbol	Parameter <sup>(2)</sup>	Conditions	Min.	Typ.	Max.	Unit
$t_3$	Rise Time	Measured between 0.8V and 2V	—	—	1.5	ns
$t_4$	Fall Time	Measured between 0.8V and 2V	—	—	1.5	ns
$t_5$	Output to Output Skew	All outputs equally loaded	—	—	250	ps
$t_6$	Propagation Delay, BUF_IN Rising Edge to OUTPUT Rising Edge	Measured at $V_{DD}/2$	1	5	8.7	ns

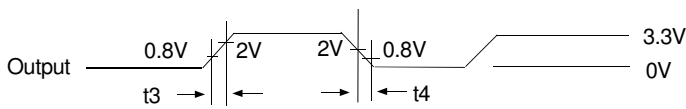
**NOTES:**

1. All parameters specified with loaded outputs.
2. Parameter is guaranteed by design but not production tested.

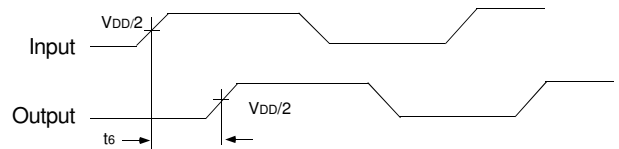
## SWITCHING WAVEFORMS



*Output to Output Skew*

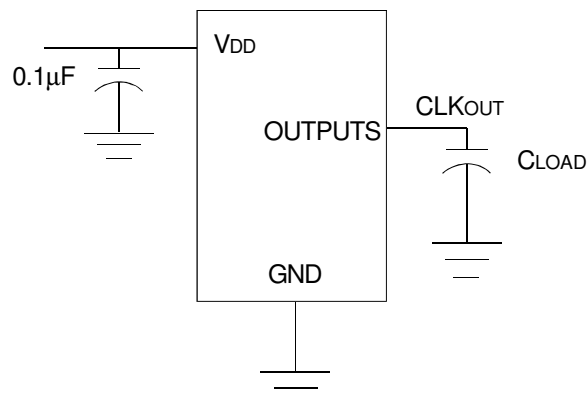


*All Outputs Rise/Fall Time*

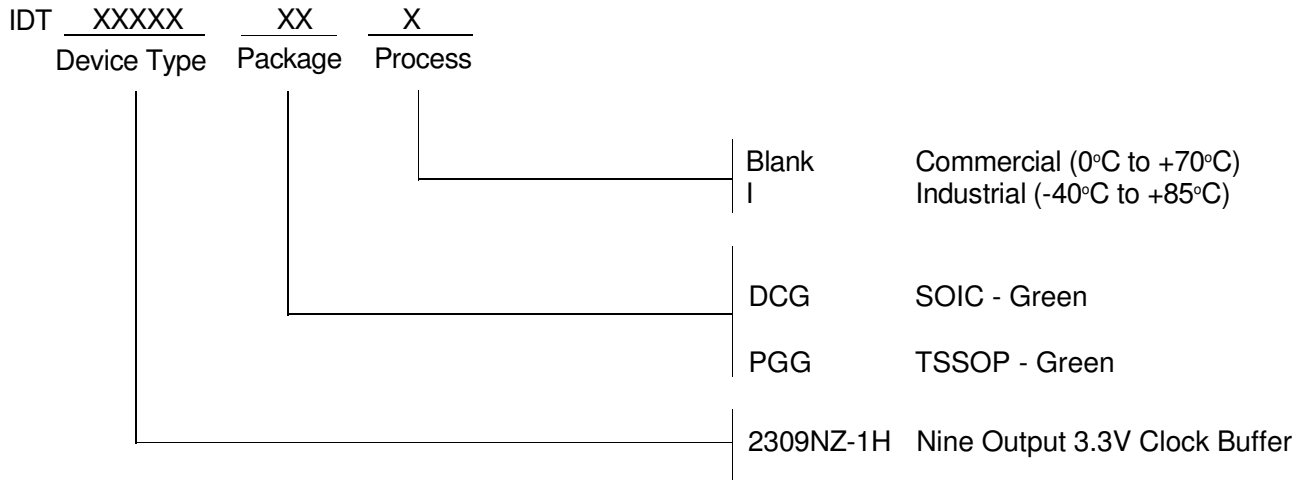


*Input to Output Propagation Delay*

## TEST CIRCUIT



## ORDERING INFORMATION



Part / Order Number	Shipping Packaging	Package	Temperature
2309NZ-1HDCG	Tubes	16-pin SOIC	0° to +70° C
2309NZ-1HDCG8	Tape and Reel	16-pin SOIC	0° to +70° C
2309NZ-1HDCGI	Tubes	16-pin SOIC	-40° to +85° C
2309NZ-1HDCGI8	Tape and Reel	16-pin SOIC	-40° to +85° C
2309NZ-1HPGG	Tubes	16-pin TSSOP	0° to +70° C
2309NZ-1HPGG8	Tape and Reel	16-pin TSSOP	0° to +70° C
2309NZ-1HPGGI	Tubes	16-pin TSSOP	-40° to +85° C
2309NZ-1HPGGI8	Tape and Reel	16-pin TSSOP	-40° to +85° C

## IMPORTANT NOTICE AND DISCLAIMER

RENESAS ELECTRONICS CORPORATION AND ITS SUBSIDIARIES (“RENESAS”) PROVIDES TECHNICAL SPECIFICATIONS AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT OF THIRD-PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for developers who are designing with Renesas products. You are solely responsible for (1) selecting the appropriate products for your application, (2) designing, validating, and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. Renesas grants you permission to use these resources only to develop an application that uses Renesas products. Other reproduction or use of these resources is strictly prohibited. No license is granted to any other Renesas intellectual property or to any third-party intellectual property. Renesas disclaims responsibility for, and you will fully indemnify Renesas and its representatives against, any claims, damages, costs, losses, or liabilities arising from your use of these resources. Renesas' products are provided only subject to Renesas' Terms and Conditions of Sale or other applicable terms agreed to in writing. No use of any Renesas resources expands or otherwise alters any applicable warranties or warranty disclaimers for these products.

(Disclaimer Rev.1.01 Jan 2024)

### Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,  
Koto-ku, Tokyo 135-0061, Japan  
[www.renesas.com](http://www.renesas.com)

### Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.

### Contact Information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit [www.renesas.com/contact-us/](http://www.renesas.com/contact-us/).

## Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

-  [View 2309NZ-1HDCGI on WIN SOURCE](#)
-  [Renesas Electronics America Information](#)

## Optimize Your Supply Chain with WIN SOURCE Solutions

-  Global Sourcing Solution
-  Obsolete Management
-  Cost Control Management
-  Shortage Management
-  Alternative Solution
-  Excess Inventory Management