

FEATURES:

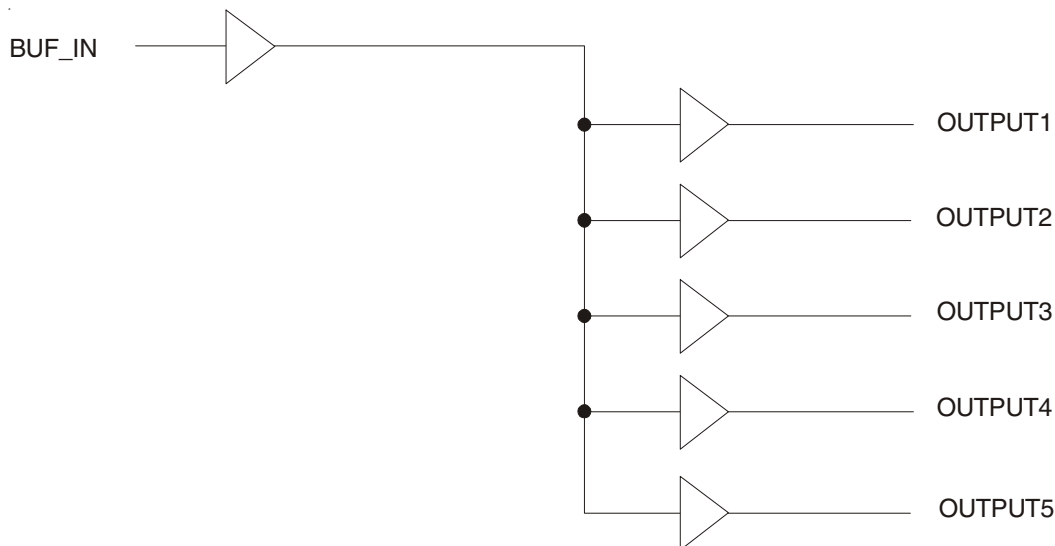
- One input to five output buffer/driver
- Low power consumption for mobile applications: less than 32mA at 66.6MHz with unloaded outputs
- 8.7ns max input-output delay
- Buffers all frequencies from DC to 133.33MHz
- Output-output skew < 250ps
- 3.3V operation
- High drive capability
- Available in SOIC package

DESCRIPTION:

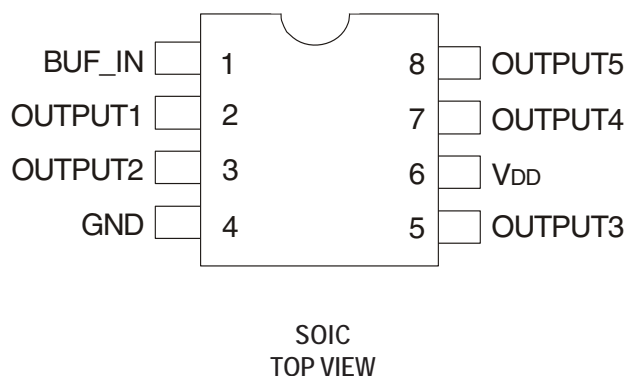
The IDT2305NZ is a low-cost buffer designed to distribute high-speed clocks in mobile PC systems and desktop PC systems. The IDT2305NZ operates at 3.3V with five outputs that can run up to 133.33MHz

The IDT2305NZ is an 8-pin version of the IDT2309NZ. It is designed for low EMI and power 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



## 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>	6	3.3V Digital Voltage Supply
GND	4	Ground
BUF_IN	1	Input clock
OUTPUT <sub>[1:5]</sub>	2, 3, 6, 7, 10	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, OUTPUT <sub>[1:5]</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, OUTPUT <sub>[1:5]</sub>	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> = 12mA	—	0.4	V
V <sub>OH</sub>	Output HIGH Voltage <sup>(2)</sup>	I <sub>OH</sub> = -12mA	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> = 12mA	—	0.4	V
V <sub>OH</sub>	Output HIGH Voltage <sup>(2)</sup>	I <sub>OH</sub> = -12mA	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
DC	Duty Cycle	Measured at V <sub>DD</sub> /2	45	—	55	%

NOTES:

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

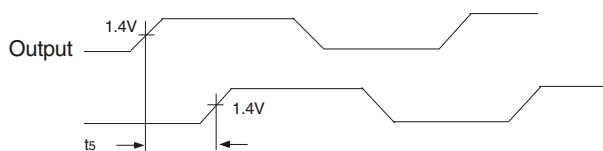
## SWITCHING CHARACTERISTICS - INDUSTRIAL <sup>(1)</sup>

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
DC	Duty Cycle	Measured at $V_{DD}/2$	45	—	55	%

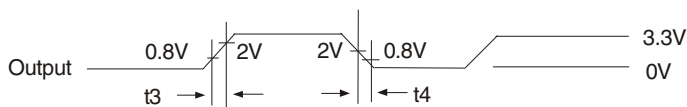
NOTES:

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

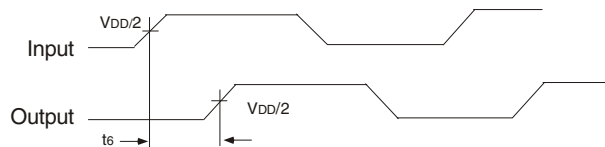
## SWITCHING WAVEFORMS



*Output to Output Skew*

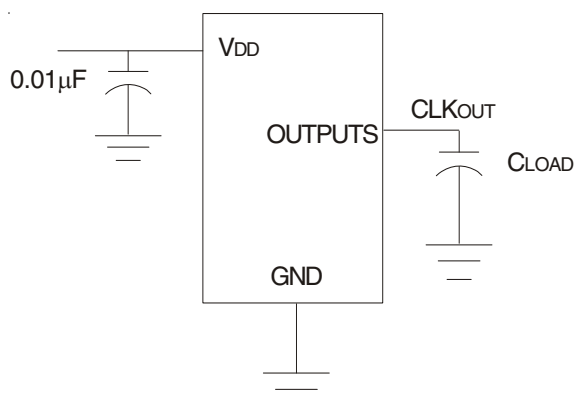


*All Outputs Rise/Fall Time*



*Input to Output Propagation Delay*

## TEST CIRCUIT



PACKAGE OUTLINE AND DIMENSIONS

<p>REV: 00</p> <p>DESCRIPTION: INITIAL RELEASE</p> <p>DATE: 2/24/16</p> <p>APPROVED: JH</p>	<p>REVISIONS:</p>	<p>DIMENSIONS IN MILLIMETERS</p>																													
<p>BASED ON IEC 191-20: TYPE 076E35 B</p> <p>1. DIMENSIONS</p>			<table border="1" style="width: 100%; border-collapse: collapse;"> <caption>DIMENSIONS OF SUB-GROUP B1</caption> <tr><td>A max</td><td>1.95</td></tr> <tr><td>bp min</td><td>0.35</td></tr> <tr><td>bp max</td><td>0.49</td></tr> <tr><td>e nom</td><td>1.27</td></tr> <tr><td>He min</td><td>5.80</td></tr> <tr><td>He max</td><td>6.30</td></tr> <tr><td>Lp min</td><td>0.40</td></tr> <tr><td>Z max</td><td>0.635</td></tr> </table>	A max	1.95	bp min	0.35	bp max	0.49	e nom	1.27	He min	5.80	He max	6.30	Lp min	0.40	Z max	0.635												
A max	1.95																														
bp min	0.35																														
bp max	0.49																														
e nom	1.27																														
He min	5.80																														
He max	6.30																														
Lp min	0.40																														
Z max	0.635																														
<p>VIEW X</p>			<table border="1" style="width: 100%; border-collapse: collapse;"> <caption>DIMENSIONS OF SUB-GROUP C1</caption> <tr><td>A min</td><td>1.55</td></tr> <tr><td>A1 min</td><td>0.10</td></tr> <tr><td>A1 max</td><td>0.30</td></tr> <tr><td>A2 min</td><td>1.40</td></tr> <tr><td>A2 max</td><td>1.80</td></tr> <tr><td>c min</td><td>0.15</td></tr> <tr><td>c max</td><td>0.25</td></tr> <tr><td>D min*</td><td>4.80</td></tr> <tr><td>D max*</td><td>5.00</td></tr> <tr><td>E min*</td><td>3.80</td></tr> <tr><td>E max*</td><td>4.00</td></tr> <tr><td>k min</td><td>0.33</td></tr> <tr><td>ϕ max</td><td>0*</td></tr> <tr><td>ϕ max</td><td>8*</td></tr> </table>	A min	1.55	A1 min	0.10	A1 max	0.30	A2 min	1.40	A2 max	1.80	c min	0.15	c max	0.25	D min*	4.80	D max*	5.00	E min*	3.80	E max*	4.00	k min	0.33	ϕ max	0*	ϕ max	8*
A min	1.55																														
A1 min	0.10																														
A1 max	0.30																														
A2 min	1.40																														
A2 max	1.80																														
c min	0.15																														
c max	0.25																														
D min*	4.80																														
D max*	5.00																														
E min*	3.80																														
E max*	4.00																														
k min	0.33																														
ϕ max	0*																														
ϕ max	8*																														
<p>UNLESS SPECIFIED DECIMAL ANGULAR UNITS ARE IN DEGREES</p> <p>APPROVALS: DRAWN: DATE: CHECKED: DATE:</p> <p>DATE: 03/08/2016</p> <p>TITLE: DCSB PACKAGE OUTLINE</p> <p>150 mil SOP</p>		<p>★ WITHOUT MOLD FLASH</p>	<p>2. WEIGHT ≤ 0.3 g</p> <p>3. BODY MATERIAL LOW STRESS EPOXY</p> <p>4. LEAD MATERIAL FeNi-ALLOY or Cu-ALLOY</p> <p>5. LEAD FINISH SOLDER PLATING</p> <p>6. LEAD FORM Z-BENDS</p>																												
<p>6001 Silver Creek Valley Rd San Jose, CA 95138 PHONE: (408) 244-8000 FAX: (408) 244-8072</p> <p><b>IDT</b> www.IDT.com</p>		<p>DO NOT SCALE DRAWING</p>	<p>REV: 00</p> <p>DATE: 2/24/16</p> <p>APPROVED: JH</p>																												

## ORDERING INFORMATION

Part / Order Number	Shipping Packaging	Package	Temperature
2305NZ-1HDCG	Tubes	8-pin SOIC	0 to +70°
2305NZ-1HDCG8	Tape and Reel	8-pin SOIC	0 to +70°
2305NZ-1HDCGI	Tubes	8-pin SOIC	-40 to +85°
2305NZ-1HDCGI8	Tape and Reel	8-pin SOIC	-40 to +85°

"G" after the two-letter package code denotes Pb-free configuration, RoHS compliant

## Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.
  - "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.
  - "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user's manual or other Renesas Electronics document.
6. When using Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
7. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
9. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
10. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
11. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Note1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.

(Note2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Rev.4.0-1 November 2017)

## Corporate Headquarters

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

## 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/](http://www.renesas.com/contact/)

## Trademarks

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