

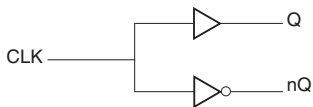
## DESCRIPTION

The 8302I-01 is a low skew, 1-to-2 LVCMOS/LVTTTL Fanout Buffer w/Complementary Output. The 8302I-01 has a single ended clock input. The single ended clock input accepts LVCMOS or LVTTTL input levels. The 8302I-01 is characterized at full 3.3V for input  $V_{DD}$ , and mixed 3.3V and 2.5V for output operating supply modes ( $V_{DDO}$ ). Guaranteed output and part-to-part skew characteristics make the 8302I-01 ideal for clock distribution applications demanding well defined performance and repeatability.

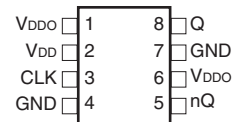
## FEATURES

- Complementary LVCMOS / LVTTTL output
- LVCMOS / LVTTTL clock input accepts LVCMOS or LVTTTL input levels
- Maximum output frequency: 250MHz
- Output skew: 165ps (maximum)
- Part-to-part skew: 800ps (maximum)
- Small 8 lead SOIC package saves board space
- Full 3.3V or 3.3V core/2.5V output supply modes
- -40°C to 85°C ambient operating temperature
- Available in lead-free compliant package

## BLOCK DIAGRAM



## PIN ASSIGNMENTS



### 8302I-01 8-Lead SOIC

3.8mm x 4.8mm, x 1.47mm package body

**M Package**  
Top View

**TABLE 1. PIN DESCRIPTIONS**

Number	Name	Type		Description
1, 6	V <sub>DDO</sub>	Power		Output supply pins.
2	V <sub>DD</sub>	Power		Power supply pin.
3	CLK	Input	Pulldown	LVC MOS / LV TTL clock input.
4,7	GND	Power		Power supply ground.
5	nQ	Output		Complementary clock output. LVC MOS / LV TTL interface levels.
8	Q	Output		Clock output. LVC MOS / LV TTL interface levels.

NOTE: *Pulldown* refer to internal input resistors. See Table 2, Pin Characteristics, for typical values.

**TABLE 2. PIN CHARACTERISTICS**

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
C <sub>IN</sub>	Input Capacitance			4		pF
C <sub>PD</sub>	Power Dissipation Capacitance (per output)	V <sub>DD</sub> , V <sub>DDO</sub> = 3.465V		22		pF
		V <sub>DD</sub> = 3.465V, V <sub>DDO</sub> = 2.625V		16		pF
R <sub>PULLDOWN</sub>	Input Pulldown Resistor			51		kΩ
R <sub>OUT</sub>	Output Impedance		5	7	12	Ω

### ABSOLUTE MAXIMUM RATINGS

Supply Voltage, $V_{DD}$	4.6V
Inputs, $V_I$	-0.5V to $V_{DD} + 0.5V$
Outputs, $V_O$	-0.5V to $V_{DDO} + 0.5V$
Package Thermal Impedance, $\theta_{JA}$	112.7°C/W (0 lfpm)
Storage Temperature, $T_{STG}$	-65°C to 150°C

NOTE: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These ratings are stress specifications only. Functional operation of product at these conditions or any conditions beyond those listed in the *DC Characteristics* or *AC Characteristics* is not implied. Exposure to absolute maximum rating conditions for extended periods may affect product reliability.

**TABLE 3A. POWER SUPPLY DC CHARACTERISTICS,  $V_{DD} = 3.3V \pm 5\%$ ,  $V_{DDO} = 3.3V \pm 5\%$  OR  $2.5V \pm 5\%$ ,  $T_A = -40^\circ\text{C}$  TO  $85^\circ\text{C}$**

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$V_{DD}$	Power Supply Voltage		3.135	3.3	3.465	V
$V_{DDO}$	Output Power Supply Voltage		3.135	3.3	3.465	V
			2.375	2.5	2.625	V
$I_{DD}$	Power Supply Current				13	mA
$I_{DDO}$	Output Supply Current				4	mA

**TABLE 3B. LVCMOS / LVTTTL DC CHARACTERISTICS,  $V_{DD} = 3.3V \pm 5\%$ ,  $V_{DDO} = 3.3V \pm 5\%$  OR  $2.5V \pm 5\%$ ,  $T_A = -40^\circ\text{C}$  TO  $85^\circ\text{C}$**

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$V_{IH}$	Input High Voltage		2		$V_{DD} + 0.3$	V
$V_{IL}$	Input Low Voltage		-0.3		0.8	V
$I_{IH}$	Input High Current	CLK $V_{DD} = V_{IN} = 3.465V$			150	$\mu\text{A}$
$I_{IL}$	Input Low Current	CLK $V_{DD} = 3.465V, V_{IN} = 0V$	-5			$\mu\text{A}$
$V_{OH}$	Output High Voltage	$V_{DDO} = 3.465, 50\Omega$ to $V_{DDO}/2$	2.6			V
		$V_{DDO} = 3.465, I_{OH} = -100\mu\text{A}$	2.9			V
		$V_{DDO} = 2.625, 50\Omega$ to $V_{DDO}/2$	1.8			V
		$V_{DDO} = 2.625, I_{OH} = -100\mu\text{A}$	2.2			V
$V_{OL}$	Output Low Voltage	$V_{DDO} = 3.465, 50\Omega$ to $V_{DDO}/2$			0.5	V
		$V_{DDO} = 3.465, I_{OL} = 100\mu\text{A}$			0.2	V
		$V_{DDO} = 2.625, 50\Omega$ to $V_{DDO}/2$			0.5	V
		$V_{DDO} = 2.625, I_{OL} = 100\mu\text{A}$			0.2	V

**TABLE 4A. AC CHARACTERISTICS,  $V_{DD} = V_{DDO} = 3.3V \pm 5\%$ ,  $T_A = -40^\circ\text{C}$  TO  $85^\circ\text{C}$** 

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$f_{MAX}$	Output Frequency				250	MHz
$t_{p_{LH}}$	Propagation Delay, Low-to-High; NOTE 1		1.8		2.7	ns
$t_{sk(o)}$	Output Skew; NOTE 2, 4				165	ps
$t_{sk(pp)}$	Part-to-Part Skew; NOTE 3, 4				800	ps
$t_R / t_F$	Output Rise/Fall Time	20% to 80%	300		800	ps
odc	Output Duty Cycle	$f \leq 133\text{MHz}$	45		55	%
		$133\text{MHz} < f \leq 250\text{MHz}$	40		60	%

NOTE 1: Measured from  $V_{DD}/2$  of the input to  $V_{DDO}/2$  of the output.

NOTE 2: Defined as skew between outputs at the same supply voltage and with equal load conditions.

Measured at  $V_{DDO}/2$ .

NOTE 3: Defined as skew between outputs on different devices operating at the same supply voltages and with equal load conditions. Using the same type of inputs on each device, the outputs are measured at  $V_{DDO}/2$ .

NOTE 4: This parameter is defined in accordance with JEDEC Standard 65.

**TABLE 4B. AC CHARACTERISTICS,  $V_{DD} = 3.3V \pm 5\%$ ,  $V_{DDO} = 2.5V \pm 5\%$ ,  $T_A = -40^\circ\text{C}$  TO  $85^\circ\text{C}$** 

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$f_{MAX}$	Output Frequency				250	MHz
$t_{p_{LH}}$	Propagation Delay, Low-to-High; NOTE 1		1.9		2.9	ns
$t_{sk(o)}$	Output Skew; NOTE 2, 4				250	ps
$t_{sk(pp)}$	Part-to-Part Skew; NOTE 3, 4				900	ps
$t_R / t_F$	Output Rise/Fall Time	20% to 80%	100		850	ps
odc	Output Duty Cycle	$f \leq 133\text{MHz}$	45		55	%
		$133\text{MHz} < f \leq 250\text{MHz}$	40		60	%

NOTE 1: Measured from  $V_{DD}/2$  of the input to  $V_{DDO}/2$  of the output.

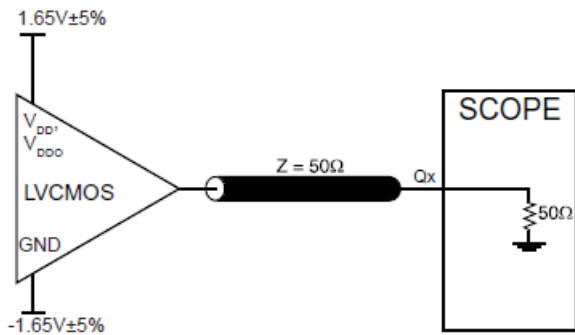
NOTE 2: Defined as skew between outputs at the same supply voltage and with equal load conditions.

Measured at  $V_{DDO}/2$ .

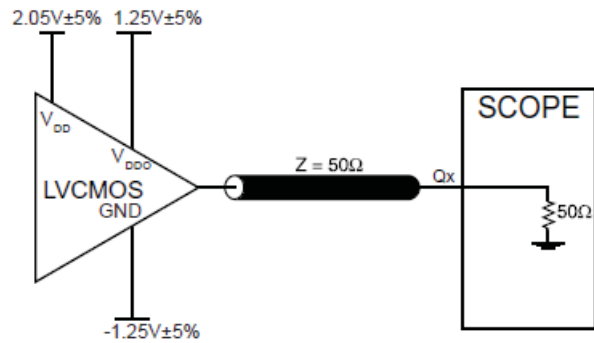
NOTE 3: Defined as skew between outputs on different devices operating at the same supply voltages and with equal load conditions. Using the same type of inputs on each device, the outputs are measured at  $V_{DDO}/2$ .

NOTE 4: This parameter is defined in accordance with JEDEC Standard 65.

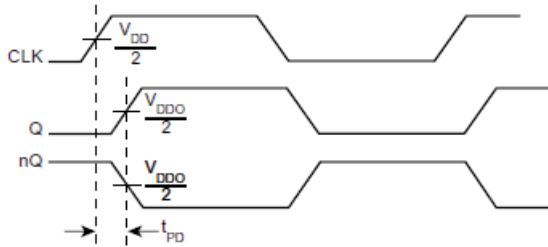
# PARAMETER MEASUREMENT INFORMATION



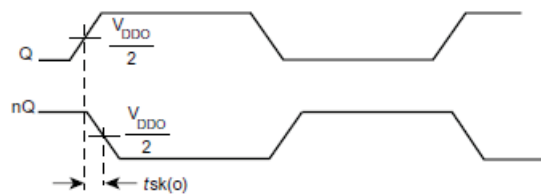
3.3V CORE/3.3V OUTPUT LOAD AC TEST CIRCUIT



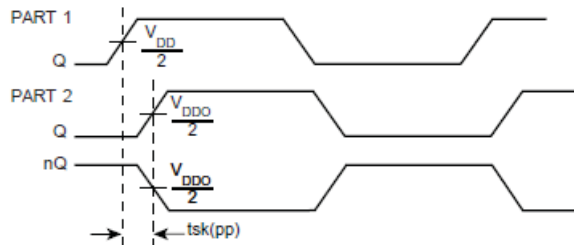
3.3V/2.5V OUTPUT LOAD AC TEST CIRCUIT



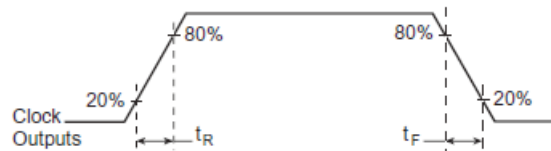
PROPAGATION DELAY



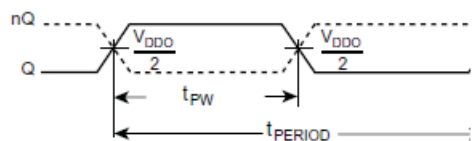
OUTPUT SKEW



PART-TO-PART SKEW



OUTPUT RISE/FALL TIME



$$odc = \frac{t_{PW}}{t_{PERIOD}}$$

OUTPUT DUTY CYCLE/PULSE WIDTH/PERIOD

## RELIABILITY INFORMATION

TABLE 5.  $\theta_{JA}$  vs. AIR FLOW TABLE FOR 8 LEAD SOIC

$\theta_{JA}$ by Velocity (Linear Feet per Minute)			
	0	200	500
Single-Layer PCB, JEDEC Standard Test Boards	153.3°C/W	128.5°C/W	115.5°C/W
Multi-Layer PCB, JEDEC Standard Test Boards	112.7°C/W	103.3°C/W	97.1°C/W

**NOTE:** Most modern PCB designs use multi-layered boards. The data in the second row pertains to most designs.

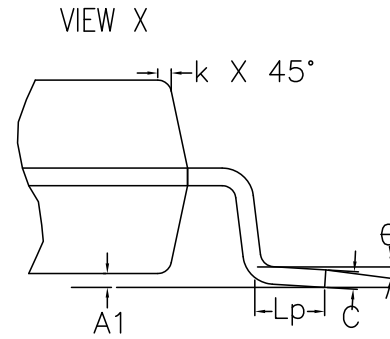
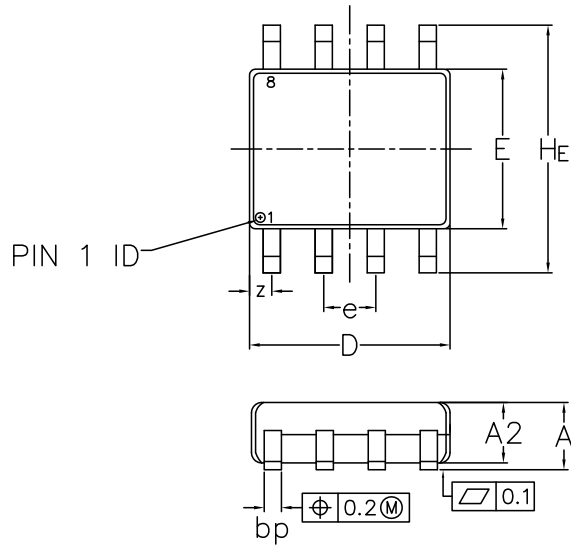
### TRANSISTOR COUNT

The transistor count for 8302I-01 is: 322

BASED ON IEC 191-2Q: TYPE 076E35 B  
1. DIMENSIONS

DIMENSIONS IN MILLIMETERS

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
00	INITIAL RELEASE	2/24/16	J.H



DIMENSIONS OF SUB-GROUP B1	
A max	1.95
bp min	0.35
bp max	0.49
e nom	1.27
HE min	5.80
HE max	6.30
Lpmin	0.40
Z max	0.635

DIMENSIONS OF SUB-GROUP C1	
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
θ max	0°
θ max	8°

- 2. WEIGHT ≤ 0.3 g
- 3. BODY MATERIAL LOW STRESS EPOXY
- 4. LEAD MATERIAL FeNi-ALLOY or Cu-ALLOY
- 5. LEAD FINISH SOLDER PLATING
- 6. LEAD FORM Z-BENDS

\* WITHOUT MOLD FLASH

TOLERANCES UNLESS SPECIFIED			6024 Silver Creek Valley Rd San Jose, CA 95138 PHONE: (408) 284-8200 FAX: (408) 284-3572
DECIMAL	ANGULAR		
XX±	±	www.IDT.com	
XXX±		APPROVALS DATE TITLE DCG8 PACKAGE OUTLINE	
XXXX±		DRAWN <i>RLC</i> 2/24/16 150 mil SOP	
CHECKED		SIZE C	DRAWING No. PSC-4068-03
			REV 00
DO NOT SCALE DRAWING			SHEET 1 OF 1

## Ordering Information

Orderable Part Number	Marking	Package	Carrier Type	Temperature
8302AMI-01LF	302AI01L	3.8 x 4.8 x 1.47 mm 8-SOIC	Tube	-40° to +85°C
8302AMI-01LF	302AI01L	3.8 x 4.8 x 1.47 mm 8-SOIC	Tape and Reel	-40° to +85°C

## Revision History

Revision Date	Description of Change
May 4, 2017	<ul style="list-style-type: none"> <li>▪ Corrected and updated the Ordering Information Table.</li> <li>▪ Updated package information.</li> <li>▪ Updated datasheet header/footer.</li> </ul>
March 9, 2016	<ul style="list-style-type: none"> <li>▪ Features section - removed reference to leaded package</li> <li>▪ Ordering Information table - removed quantity from tape and reel. Deleted LF note below table.</li> <li>▪ Added Contact Page</li> </ul>
July 29, 2010	<ul style="list-style-type: none"> <li>▪ Updated datasheet header/footer with IDT logo from ICS logo.</li> <li>▪ Ordering Information table - removed ICS prefix from Part/Order Number column.</li> <li>▪ Added Contact Page.</li> </ul>



## 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 skilled in the art 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 for development of 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 out of 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.

(Rev.1.0 Mar 2020)

### 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.