

# LOW SKEW, 1-TO-2 LVCMOS / LVTTTL FANOUT BUFFER W/ COMPLEMENTARY OUTPUT

**ICS8302-01**

## GENERAL DESCRIPTION

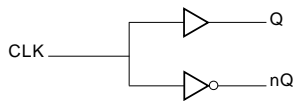


The ICS8302-01 is a low skew, 1-to-2 LVCMOS/LVTTTL Fanout Buffer w/Complementary Output and a member of the HiPerClockS™ family of High Performance Clock Solutions from ICS. The ICS8302-01 has a single ended clock input. The single ended clock input accepts LVCMOS or LVTTTL input levels. The ICS8302-01 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 ICS8302-01 ideal for clock distribution applications demanding well defined performance and repeatability.

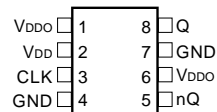
## FEATURES

- 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 supply modes
- 0°C to 70°C ambient operating temperature
- Industrial temperature information available upon request

## BLOCK DIAGRAM



## PIN ASSIGNMENT



**ICS8302-01**  
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		Core supply pin.
3	CLK	Input	Pulldown	LVCMOS / LVTTTL clock input.
4,7	GND	Power		Power supply ground.
5	nQ	Output		Complementary clock output. LVCMOS / LVTTTL interface levels.
8	Q	Output		Clock output. LVCMOS / LVTTTL interface levels.

NOTE: *Pullup* and *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>PULLUP</sub>	Input Pullup Resistor			51		KΩ
R <sub>PULLDOWN</sub>	Input Pulldown Resistor			51		KΩ
R <sub>OUT</sub>	Output Impedance			7		Ω

**ABSOLUTE MAXIMUM RATINGS**

Supply Voltage, $V_{DD}$	4.6V
Inputs, $V_I$	-0.5V to $V_{DD} + 0.5$ V
Outputs, $V_O$	-0.5V to $V_{DDO} + 0.5$ V
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,  $V_{DD} = V_{DDO} = 3.3V \pm 5\%$ ,  $T_A = 0^\circ\text{C}$  TO  $70^\circ\text{C}$** 

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

**TABLE 3B. LVCMOS / LVTTTL DC CHARACTERISTICS,  $V_{DD} = V_{DDO} = 3.3V \pm 5\%$ ,  $T_A = 0^\circ\text{C}$  TO  $70^\circ\text{C}$** 

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		1.3	V
$I_{IH}$	Input High Current	CLK $V_{DD} = V_{IN} = 3.465$ V			150	$\mu$ A
$I_{IL}$	Input Low Current	CLK $V_{DD} = 3.465$ V, $V_{IN} = 0$ V	-5			$\mu$ A
$V_{OH}$	Output High Voltage	$50\Omega$ to $V_{DDO}/2$	2.6			V
		$I_{OH} = -100\mu$ A	2.9			V
$V_{OL}$	Output Low Voltage	$50\Omega$ to $V_{DDO}/2$			0.5	V
		$I_{OL} = 100\mu$ A			0.2	V

**TABLE 4A. AC CHARACTERISTICS,  $V_{DD} = V_{DDO} = 3.3V \pm 5\%$ ,  $T_A = 0^\circ\text{C}$  TO  $70^\circ\text{C}$** 

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$f_{MAX}$	Output Frequency				250	MHz
$tp_{LH}$	Propagation Delay, Low-to-High; NOTE 1		1.8	2.18	2.7	ns
$tsk(o)$	Output Skew; NOTE 2, 4			50	165	ps
$tsk(pp)$	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	$f \leq 133$ MHz	45		55	%
		$133\text{MHz} < f \leq 250$ 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 3C. POWER SUPPLY DC CHARACTERISTICS,  $V_{DD} = 3.3V \pm 5\%$ ,  $V_{DDO} = 2.5V \pm 5\%$ ,  $T_A = 0^\circ C$  TO  $70^\circ C$** 

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

**TABLE 3D. LVCMOS / LVTTTL DC CHARACTERISTICS,  $V_{DD} = 3.3V \pm 5\%$ ,  $V_{DDO} = 2.5V \pm 5\%$ ,  $T_A = 0^\circ C$  TO  $70^\circ C$** 

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		1.3	V
$I_{IH}$	Input High Current	CLK $V_{DD} = V_{IN} = 3.465V$			150	$\mu A$
$I_{IL}$	Input Low Current	CLK $V_{DD} = 3.465V, V_{IN} = 0V$	-5			$\mu A$
$V_{OH}$	Output High Voltage	$50\Omega$ to $V_{DDO}/2$	1.8			V
		$I_{OH} = -100\mu A$	2.2			V
$V_{OL}$	Output Low Voltage	$50\Omega$ to $V_{DDO}/2$			0.5	V
		$I_{OL} = 100\mu A$			0.2	V

**TABLE 4B. AC CHARACTERISTICS,  $V_{DD} = 3.3V \pm 5\%$ ,  $V_{DDO} = 2.5V \pm 5\%$ ,  $T_A = 0^\circ C$  TO  $70^\circ C$** 

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$f_{MAX}$	Output Frequency				250	MHz
$tp_{LH}$	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%	250		650	ps
odc	Output Duty Cycle	$f \leq 133MHz$	45		55	%
		$133MHz < f \leq 250MHz$	40		60	%

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

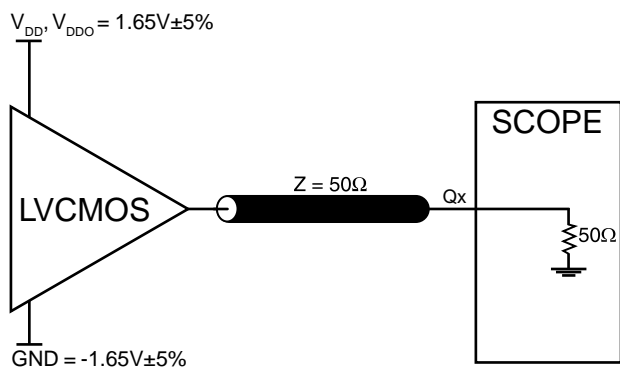
NOTE 2: Defined as skew between outputs at the same supply voltage and with equal load conditions.

Measured at  $V_{DDO}/2$ .

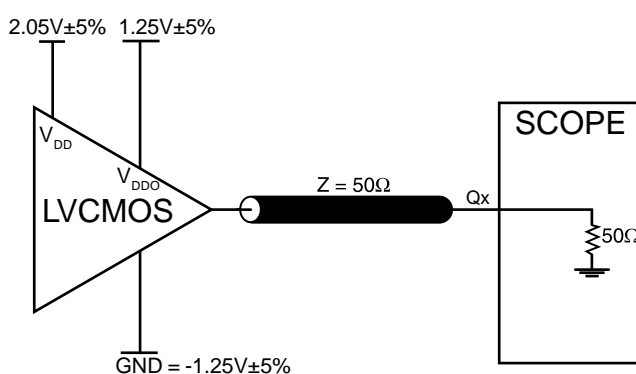
NOTE 3: Defined as skew between outputs on different devices operating at the same supply voltages and with equal load conditions. Using the same type of inputs on each device, the outputs are measured at  $V_{DDO}/2$ .

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

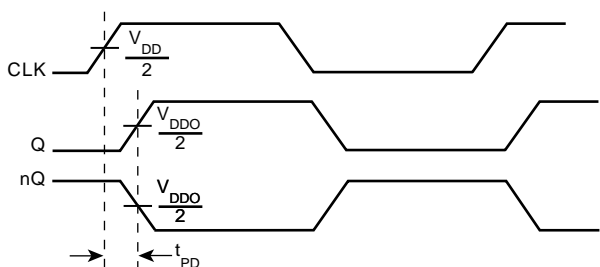
## PARAMETER MEASUREMENT INFORMATION



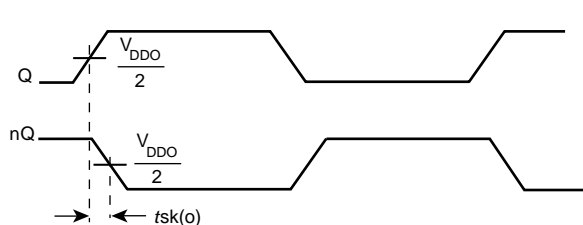
**3.3V OUTPUT LOAD AC TEST CIRCUIT**



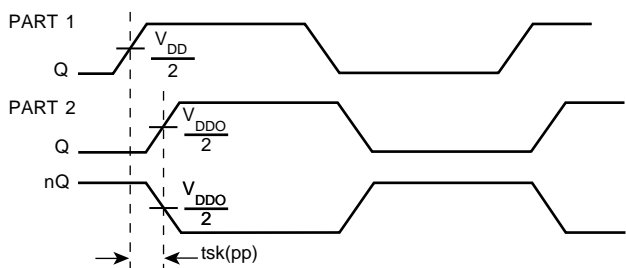
**3.3V/2.5V OUTPUT LOAD AC TEST CIRCUIT**



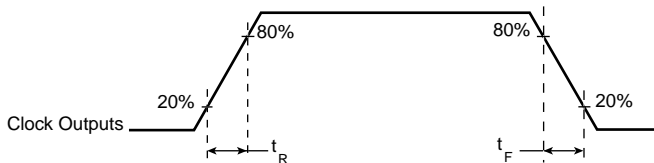
**PROPAGATION DELAY**



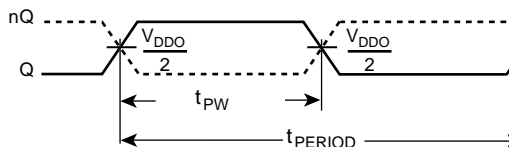
**OUTPUT SKEW**



**PART-TO-PART SKEW**



**OUTPUT RISE/FALL TIME**



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

**odc & t<sub>PERIOD</sub>**

## RELIABILITY INFORMATION

TABLE 5.  $\theta_{JA}$  VS. AIR FLOW TABLE

$\theta_{JA}$ 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 ICS8302-01 is: 322

## PACKAGE OUTLINE - SUFFIX M

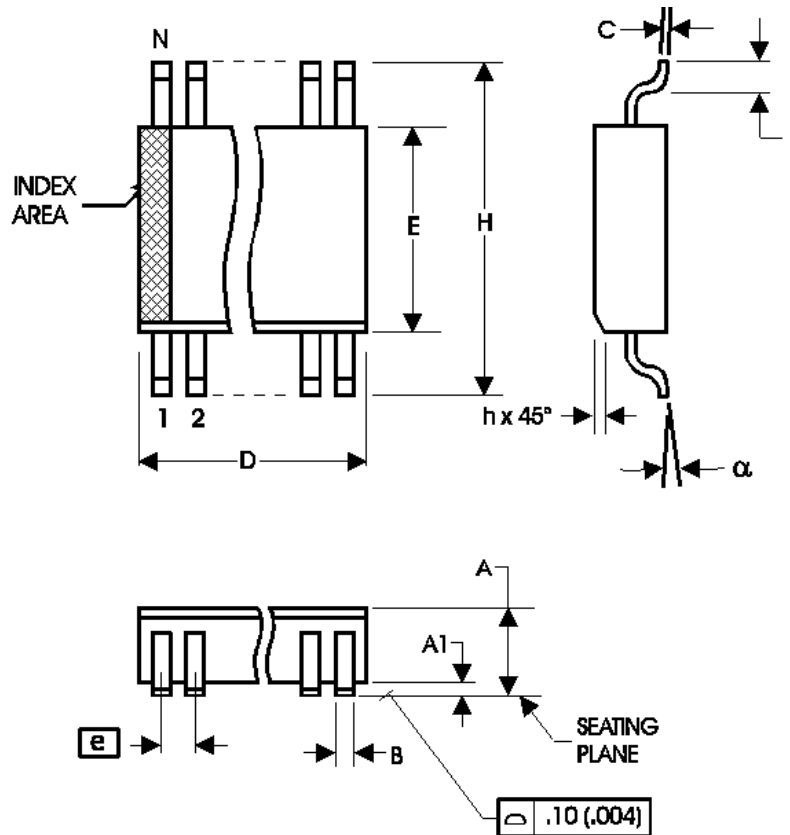


TABLE 6. PACKAGE DIMENSIONS

SYMBOL	Millimeters	
	MINIMUM	MAXIMUM
N	8	
A	1.35	1.75
A1	0.10	0.25
B	0.33	0.51
C	0.19	0.25
D	4.80	5.00
E	3.80	4.00
e	1.27 BASIC	
H	5.80	6.20
h	0.25	0.50
L	0.40	1.27
$\alpha$	0°	8°

Reference Document: JEDEC Publication 95, MS-012

TABLE 7. ORDERING INFORMATION

Part/Order Number	Marking	Package	Count	Temperature
ICS8302AM-01	8302A01	8 lead SOIC	96 per tube	0°C to 70°C
ICS8302AM-01T	8302A01	8 lead SOIC on Tape and Reel	2500	0°C to 70°C

While the information presented herein has been checked for both accuracy and reliability, Integrated Circuit Systems, Incorporated (ICS) assumes no responsibility for either its use or for infringement of any patents or other rights of third parties, which would result from its use. No other circuits, patents, or licenses are implied. This product is intended for use in normal commercial applications. Any other applications such as those requiring extended temperature range, high reliability, or other extraordinary environmental requirements are not recommended without additional processing by ICS. ICS reserves the right to change any circuitry or specifications without notice. ICS does not authorize or warrant any ICS product for use in life support devices or critical medical instruments.



Innovate with IDT and accelerate your future networks. Contact:

**www.IDT.com**

**For Sales**

800-345-7015  
408-284-8200  
Fax: 408-284-2775

**For Tech Support**

clockhelp@idt.com  
408-284-8200

---

**Corporate Headquarters**

Integrated Device Technology, Inc.  
6024 Silver Creek Valley Road  
San Jose, CA 95138  
United States  
800 345 7015  
+408 284 8200 (outside U.S.)

**Asia Pacific and Japan**

Integrated Device Technology  
Singapore (1997) Pte. Ltd.  
Reg. No. 199707558G  
435 Orchard Road  
#20-03 Wisma Atria  
Singapore 238877  
+65 6 887 5505

**Europe**

IDT Europe, Limited  
Prime House  
Barnett Wood Lane  
Leatherhead, Surrey  
United Kingdom KT22 7DE  
+44 1372 363 339