Integrated Circuit Systems, Inc.

ICS8302
LOW SKEW, 1-TO-2 LVCMOS / LVTTL FANOUT BUFFER

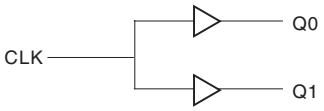
GENERAL DESCRIPTION

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

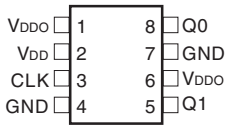
FEATURES

- 2 LVCMOS / LVTTL outputs
- LVCMOS / LVTTL clock input accepts LVCMOS or LVTTL input levels
- Maximum output frequency: 200MHz
- Output skew: 25ps (typical)
- Part-to-part skew: 250ps (typical)
- 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
- Lead-Free package fully RoHS compliant

BLOCK DIAGRAM



PIN ASSIGNMENT



ICS8302
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_{DDO}	Power		Output supply pins.
2	V_{DD}	Power		Core supply pin.
3	CLK	Input	Pulldown	LVCMOS / LVTTL clock input.
4,7	GND	Power		Power supply ground.
5	Q1	Output		Single clock output. LVCMOS / LVTTL interface levels.
8	Q0	Output		Single clock output. LVCMOS / LVTTL 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_{IN}	Input Capacitance			4		pF
C_{PD}	Power Dissipation Capacitance (per output)	V_{DD}, V_{DDO} = 3.465V		22		pF
		V_{DD} = 3.465V, V_{DDO} = 2.625V		16		pF
$R_{PULLDOWN}$	Input Pulldown Resistor			51		kΩ
R_{OUT}	Output Impedance		5	7	12	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} + 0.5V
Package Thermal Impedance, θ_{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±5%, TA = 0°C TO 70°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 / LVTTL DC CHARACTERISTICS, $V_{DD} = V_{DDO}$ = 3.3V±5%, TA = 0°C TO 70°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	µA
I_{IL}	Input Low Current	CLK	V_{DD} = 3.465V, V_{IN} = 0V	-5			µA
V_{OH}	Output High Voltage		50Ω to V_{DDO}/2	2.6			V
			I_{OH} = -100µA	2.9			V
V_{OL}	Output Low Voltage		50Ω to V_{DDO}/2			0.5	V
			I_{OL} = 100µA			0.2	V

TABLE 4A. AC CHARACTERISTICS, $V_{DD} = V_{DDO}$ = 3.3V±5%, TA = 0°C TO 70°C

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
f_{MAX}	Output Frequency				200	MHz
tp_{LH}	Propagation Delay, Low-to-High; NOTE 1	$f \leq$ 200MHz	1.9	2.35	2.8	ns
*t*sk(o)	Output Skew; NOTE 2, 4			25	85	ps
*t*sk(pp)	Part-to-Part Skew; NOTE 3, 4			250	800	ps
t_R	Output Rise Time	20% to 80%	300		800	ps
t_F	Output Fall Time	20% to 80%	300		800	ps
odc	Output Duty Cycle	$f \leq$ 133MHz	45		55	%
		133MHz < $f \leq$ 200MHz	40		60	%

Parameters measured at f_{MAX} unless otherwise noted.
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±5%, V_{DDO} = 2.5V±5%, TA = 0°C TO 70°C

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
V_{DD}	Core 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 / LVTTL DC CHARACTERISTICS, V_{DD} = 3.3V±5%, V_{DDO} = 2.5V±5%, TA = 0°C TO 70°C

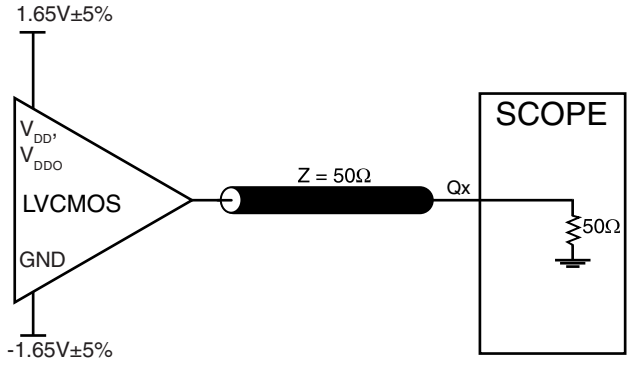
Symbol	Parameter		Test Conditions	Minimum	Typical	Maximum	Units
V_{IH}	Input High Voltage			2		V_{DD} + 0.3	V
V_{IL}	Input Low Voltage			-0.3		0.8	V
I_{IH}	Input High Current	CLK	V_{DD} = V_{IN} = 3.465V			150	µA
I_{IL}	Input Low Current	CLK	V_{DD} = 3.465V, V_{IN} = 0V	-5			µA
V_{OH}	Output High Voltage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

TABLE 4B. AC CHARACTERISTICS, V_{DD} = 3.3V±5%, V_{DDO} = 2.5V±5%, TA = 0°C TO 70°C

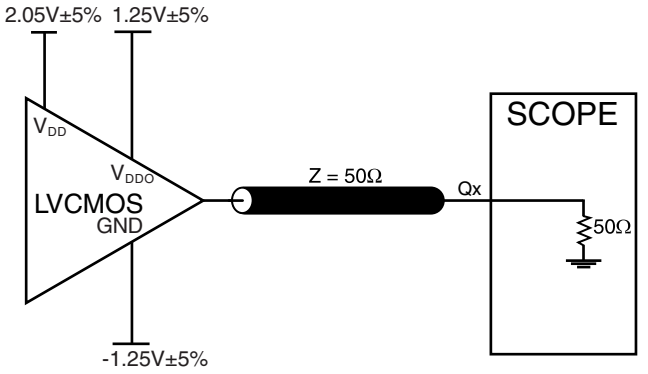
Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
f_{MAX}	Output Frequency				200	MHz
tp_{LH}	Propagation Delay, Low-to-High; NOTE 1	$f \leq$ 200MHz	2.3		3.3	ns
*t*sk(o)	Output Skew; NOTE 2, 4				85	ps
*t*sk(pp)	Part-to-Part Skew; NOTE 3, 4			250	800	ps
t_R	Output Rise Time	20% to 80%	250		650	ps
t_F	Output Fall Time	20% to 80%	250		650	ps
odc	Output Duty Cycle	$f \leq$ 133MHz	45		55	%
		133MHz < $f \leq$ 200MHz	40		60	%

Parameters measured at f_{MAX} unless otherwise noted.
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.

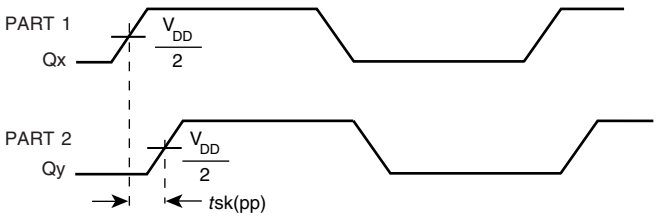
PARAMETER MEASUREMENT INFORMATION



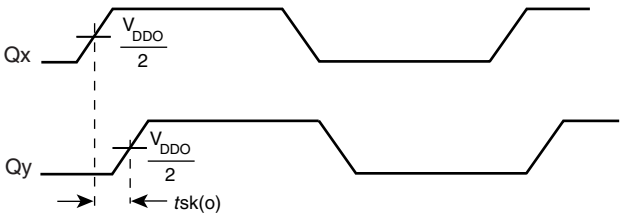
3.3V OUTPUT LOAD AC TEST CIRCUIT



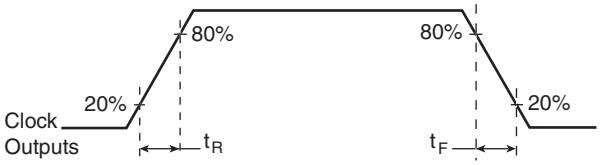
3.3V/2.5V OUTPUT LOAD AC TEST CIRCUIT



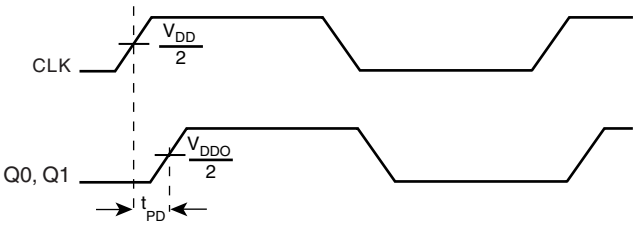
PART-TO-PART SKEW



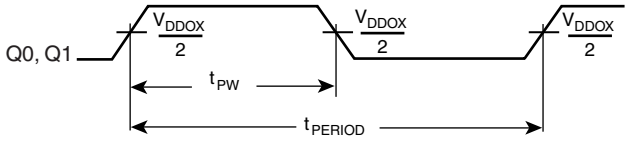
OUTPUT SKEW



OUTPUT RISE/FALL TIME



PROPAGATION DELAY



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

OUTPUT PULSE WIDTH/PERIOD

RELIABILITY INFORMATION

TABLE 5. θ_{JA} VS. AIR FLOW TABLE FOR 8 LEAD SOIC

θ_{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 is: 322

PACKAGE OUTLINE - SUFFIX M FOR 8 LEAD SOIC

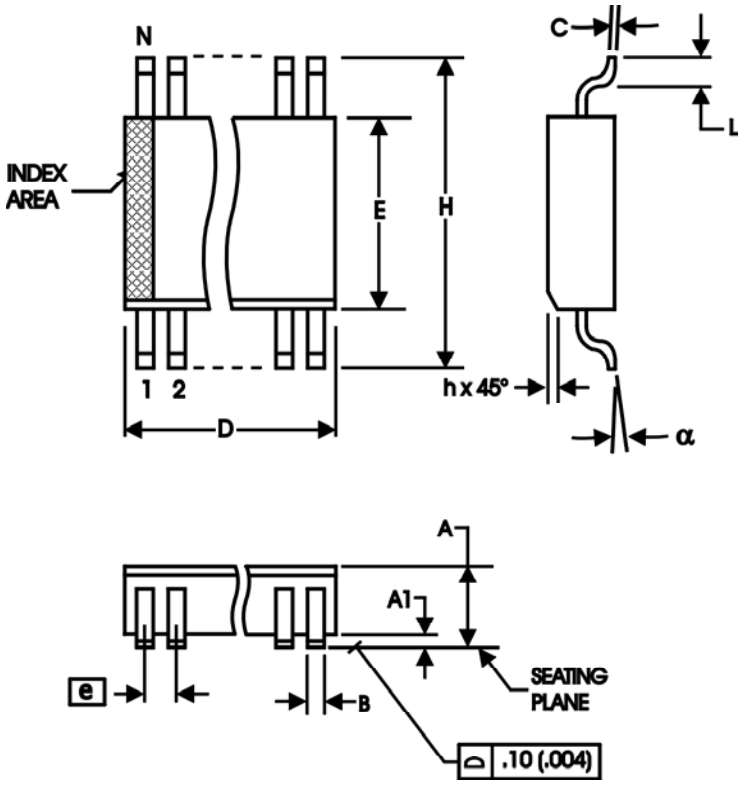


TABLE 6. PACKAGE DIMENSIONS

SYMBOL	Millimeters	
	MINIMUN	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
α	0°	8°

Reference Document: JEDEC Publication 95, MS-012

TABLE 7. ORDERING INFORMATION

Part/Order Number	Marking	Package	Shipping Packaging	Temperature
ICS8302AM	8302AM	8 lead SOIC	tube	0°C to 70°C
ICS8302AMT	8302AM	8 lead SOIC	2500 tape & reel	0°C to 70°C
ICS8302AMLF	8302AMLF	8 lead "Lead Free" SOIC	tube	0°C to 70°C
ICS8302AMLFT	8302AMLF	8 lead "Lead Free" SOIC	2500 tape & reel	0°C to 70°C

NOTE: Parts that are ordered with an "LF" suffix to the part number are the Pb-Free configuration and are RoHS compliant.

REVISION HISTORY SHEET				
Rev	**Table**	**Page**	**Description of Change**	**Date**
B	T1	2	Pin Description table, revised V_{DD} description.	2/4/03
	T2	2	Pin Characteristics table, deleted R_{PULLUP} row.	
	T3A & T3C	3, 4	Power Supply table, changed V_{DD} parameter to correspond with description.	
	T4A & T4B	3, 4	AC Characteristics tables - added note "Parameters measured at f_{MAX} unless otherwise noted."	
			tp_{LH} Test Conditions, added f ≤ 200MHz.	
C	T2	2	Pin Chararcteristics table - changed C_{IN} 4pF max. to 4pF typical. Added 5Ω min. and 12Ω max. to R_{OUT} row.	6/15/04
	T7	8	Ordering Information table - added "Lead-Free" part number.	
D	T3B & T3D	3, 4	LVCMOS DC Characteristics Table - changed V_{IL} max. from 1.3V to 0.8V.	5/17/05
	T7	8	Ordering Information Table - added Lead-Free note.	