



### GENERAL DESCRIPTION

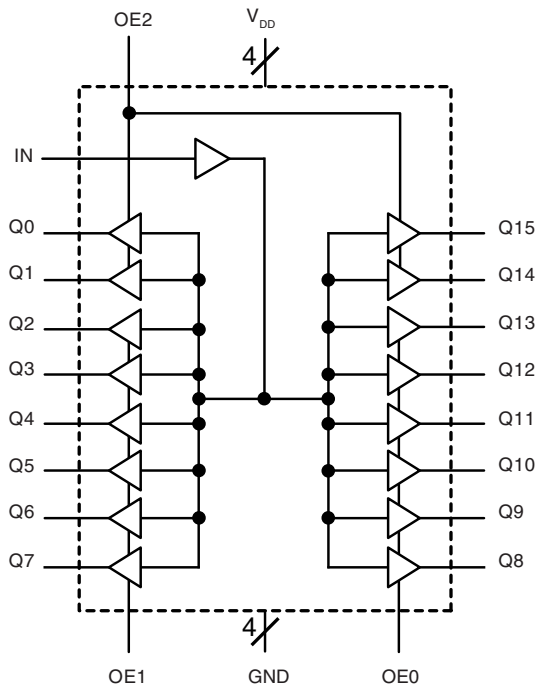


The ICS83115 is a low skew, 1-to-16 LVCMOS/LVTTTL Fanout Buffer and a member of the HiPerClockS™ family of High Performance Clock Solutions from ICS. The ICS83115 single ended clock input accepts LVCMOS or LVTTTL input levels. The ICS83115 operates at full 3.3V supply mode over the commercial temperature range. Guaranteed output and part-to-part skew characteristics make the ICS83115 ideal for those clock distribution applications demanding well defined performance and repeatability.

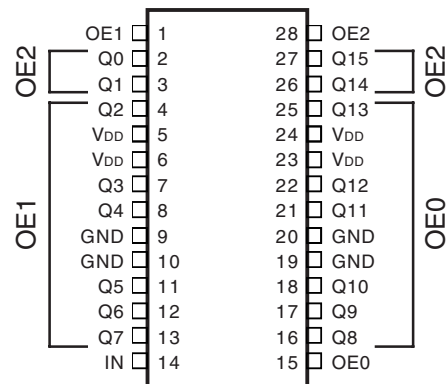
### FEATURES

- 16 LVCMOS/LVTTTL outputs
- 1 LVCMOS/LVTTTL clock input
- Maximum output frequency: 200MHz
- All inputs are 5V tolerant
- Output skew: 250ps (maximum)
- Part-to-part skew: 800ps (maximum)
- Additive phase jitter, RMS: 0.09ps (typical)
- 3.3V operating supply
- 0°C to 70°C ambient operating temperature
- Lead-Free package available
- Industrial temperature information available upon request

### BLOCK DIAGRAM



### PIN ASSIGNMENT



**ICS83115**  
28-Lead SSOP, 150mil  
9.9mm x 3.9mm x 1.7mm body package  
**R Package**  
(Top View)



**TABLE 1. PIN DESCRIPTIONS**

Number	Name	Type		Description
1	OE1	Input	Pullup	Output enable. When LOW, forces outputs Q2 thru Q7 to HiZ state. 5V tolerant. LVCMOS/LVTTTL interface levels.
2, 3, 4, 7, 8, 11, 12, 13, 16, 17, 18, 21, 22, 25, 26, 27	Q0, Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q10, Q11, Q12, Q13, Q14, Q15	Output		LVCMOS/LVTTTL clock outputs. 7Ω typical output impedance.
5, 6, 23, 24	V <sub>DD</sub>	Power		Core supply pin.
9, 10, 19, 20	GND	Power		Power supply ground.
14	IN	Input	Pulldown	LVCMOS/LVTTTL clock input / 5V tolerant.
15	OE0	Input	Pullup	Output enable. When LOW, forces outputs Q8 thru Q13 to HiZ state. 5V tolerant. LVCMOS/LVTTTL interface levels.
28	OE2	Input	Pullup	Output enable. When LOW, forces outputs Q0, Q1, Q15 and Q14 to HiZ state. 5V tolerant. 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> = 3.465V		11		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	V <sub>DD</sub> = 3.3V	5	7	12	Ω

**TABLE 3. FUNCTION TABLE**

Inputs			Outputs		
OE0	OE1	OE2	Q0, Q1, Q14, Q15 (Control OE2)	Q2:Q7 (Control OE1)	Q8:Q13 (Control OE0)
0	0	0	HiZ	HiZ	HiZ
0	0	1	Active	HiZ	HiZ
0	1	0	HiZ	Active	HiZ
0	1	1	Active	Active	HiZ
1	0	0	HiZ	HiZ	Active
1	0	1	Active	HiZ	Active
1	1	0	HiZ	Active	Active
1	1	1	Active	Active	Active

NOTE: OE0:OE2 are 5V tolerant.



**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 $V_{DD} + 0.5V$
Package Thermal Impedance, $\theta_{JA}$	49°C/W (0 lfp/m)
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 4A. POWER SUPPLY DC CHARACTERISTICS,  $V_{DD} = 3.3V \pm 5\%$ ,  $T_A = 0^\circ$  TO  $70^\circ C$**

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$V_{DD}$	Power Supply Voltage		3.135	3.3	3.465	V
$I_{DD}$	Power Supply Current				50	mA

**TABLE 4B. LVCMOS / LVTTTL DC CHARACTERISTICS,  $V_{DD} = 3.3V \pm 5\%$ ,  $T_A = 0^\circ$  TO  $70^\circ C$**

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$V_{IH}$	Input High Voltage	OE0:OE2	2		$V_{DD} + 0.3$	V
		IN	2		$V_{DD} + 0.3$	V
$V_{IL}$	Input Low Voltage	OE0:OE2	-0.3		0.8	V
		IN	-0.3		1.3	V
$I_{IH}$	Input High Current	OE0:OE2	$V_{DD} = V_{IN} = 3.465V$		5	$\mu A$
		IN	$V_{DD} = V_{IN} = 3.465V$		150	$\mu A$
$I_{IL}$	Input Low Current	OE0:OE2	$V_{DD} = 3.465V, V_{IN} = 0V$	-150		$\mu A$
		IN	$V_{DD} = 3.465V, V_{IN} = 0V$	-5		$\mu A$
$V_{OH}$	Output High Voltage; NOTE 1		2.6			V
$V_{OL}$	Output Low Voltage; NOTE 1				0.5	V
$I_{OZL}$	Output HiZ Current Low				5	$\mu A$
$I_{OZH}$	Output HiZ Current High				5	$\mu A$

NOTE 1: Outputs terminated with  $50\Omega$  to  $V_{DD}/2$ . See Parameter Measurement Information, 3.3V Output Load Test Circuit.



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

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$f_{MAX}$	Output Frequency				200	MHz
$t_{PLH}$	Propagation Delay; NOTE 1	$f \leq 200MHz$	1.7	2.4	3.1	ns
$f_{jit}(\emptyset)$	Buffer Additive Phase Jitter, RMS; refer to Additive Phase Jitter Section	Integration Range: 12KHz - 20MHz		0.09		ps
$t_{sk(o)}$	Output Skew; NOTE 2, 4	Measured on rising edge @ $V_{DD}/2$		150	250	ps
$t_{sk(pp)}$	Part-to-Part Skew; NOTE 3, 4	Measured on rising edge @ $V_{DD}/2$			800	ps
$t_R / t_F$	Output Rise/Fall Time	20% to 80%	650		1150	ps
odc	Output Duty Cycle		45		55	%
$t_{EN}$	Output Enable Time				20	ns
$t_{DIS}$	Output Disable Time				20	ns

All parameters measured at  $f_{MAX}$  unless noted otherwise.

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

NOTE 2: Defined as skew between outputs at the same supply voltage and with equal load conditions. Measured at  $V_{DD}/2$ .

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  $V_{DD}/2$ .

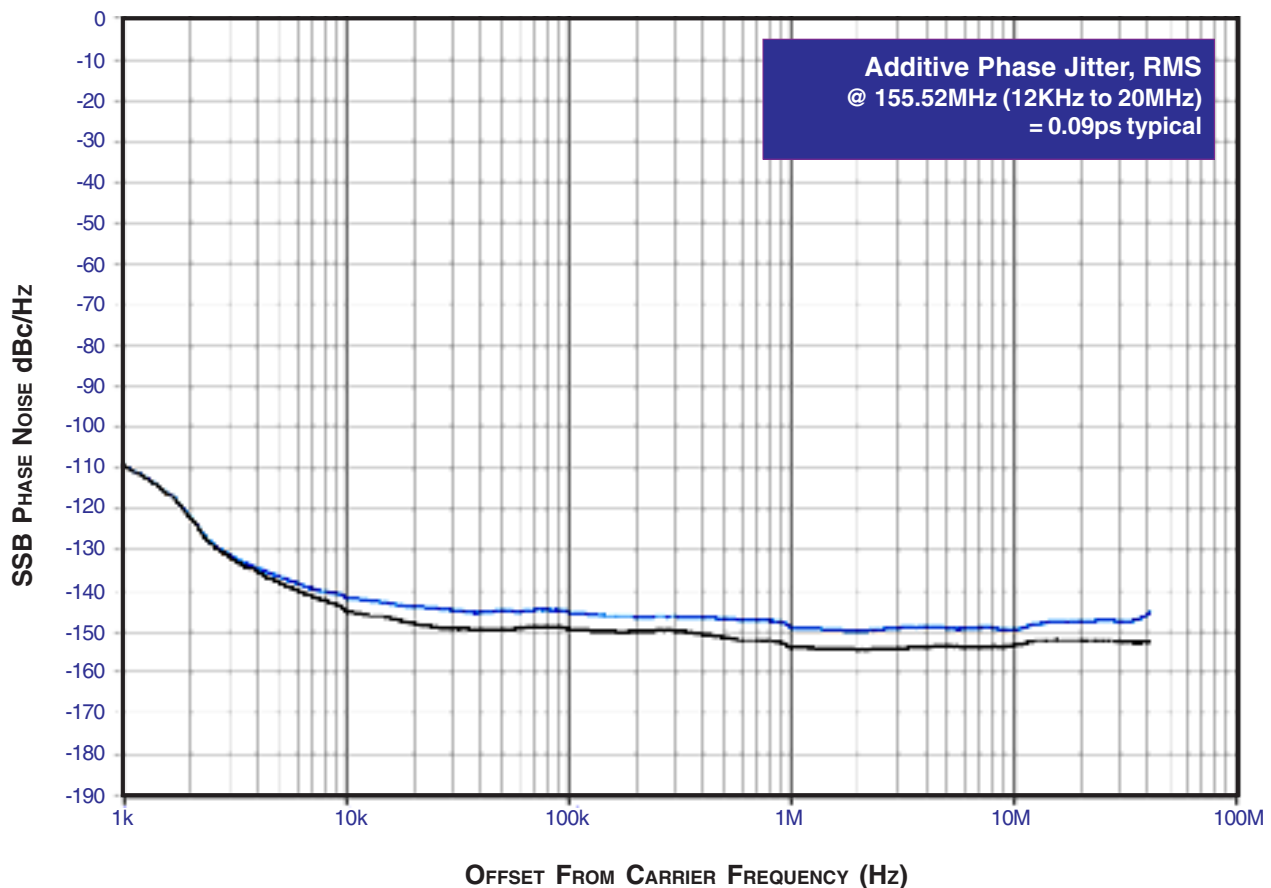
NOTE 4: This parameter is defined in accordance with JEDEC Standard 65.



### ADDITIVE PHASE JITTER

The spectral purity in a band at a specific offset from the fundamental compared to the power of the fundamental is called the ***dBc Phase Noise***. This value is normally expressed using a Phase noise plot and is most often the specified plot in many applications. Phase noise is defined as the ratio of the noise power present in a 1Hz band at a specified offset from the fundamental frequency to the power value of the fundamental. This ratio is expressed in decibels (dBm) or a ratio of the power in

the 1Hz band to the power in the fundamental. When the required offset is specified, the phase noise is called a ***dBc*** value, which simply means dBm at a specified offset from the fundamental. By investigating jitter in the frequency domain, we get a better understanding of its effects on the desired application over the entire time record of the signal. It is mathematically possible to calculate an expected bit error rate given a phase noise plot.

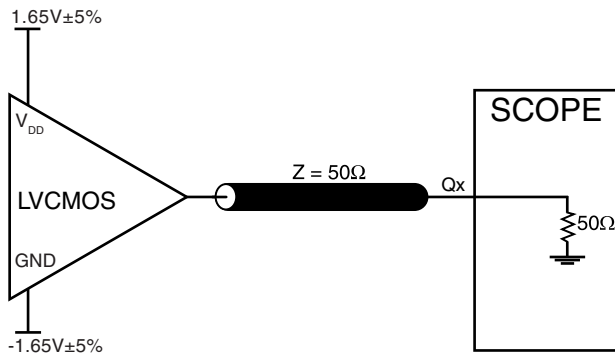


As with most timing specifications, phase noise measurements have issues. The primary issue relates to the limitations of the equipment. Often the noise floor of the equipment is higher than the noise floor of the device. This is illustrated above. The de-

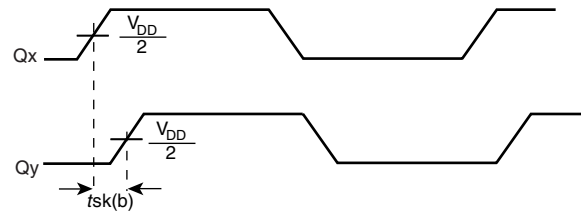
vice meets the noise floor of what is shown, but can actually be lower. The phase noise is dependant on the input source and measurement equipment.



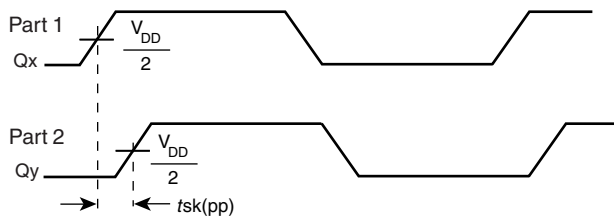
## PARAMETER MEASUREMENT INFORMATION



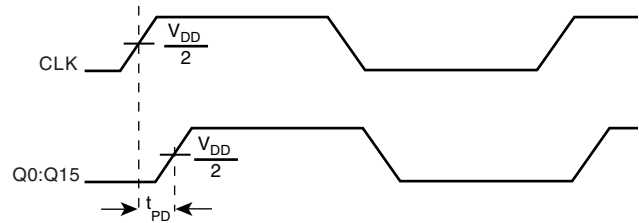
**3.3V OUTPUT LOAD AC TEST CIRCUIT**



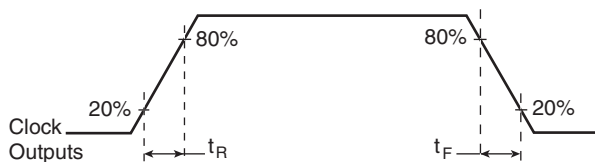
**OUTPUT SKEW**



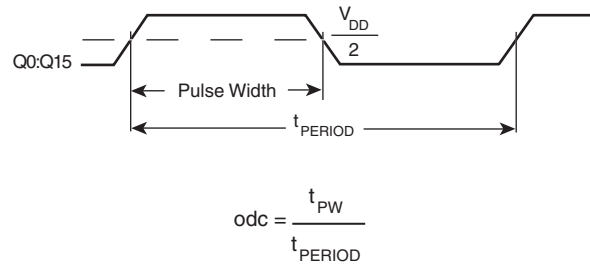
**PART-TO-PART SKEW**



**PROPAGATION DELAY**



**OUTPUT RISE/FALL TIME**



**OUTPUT DUTY CYCLE/PULSE WIDTH/PERIOD**



## RELIABILITY INFORMATION

TABLE 6.  $\theta_{JA}$  VS. AIR FLOW TABLE FOR 28 LEAD SSOP, 150MIL

$\theta_{JA}$ by Velocity (Linear Feet per Minute)			
	0	200	500
Multi-Layer PCB, JEDEC Standard Test Boards	49°C/W	36°C/W	30°C/W

NOTE: Most modern PCB designs use multi-layered boards.

### TRANSISTOR COUNT

The transistor count for ICS83115 is: 985



PACKAGE OUTLINE - R SUFFIX FOR 28 LEAD SSOP, 150 MIL

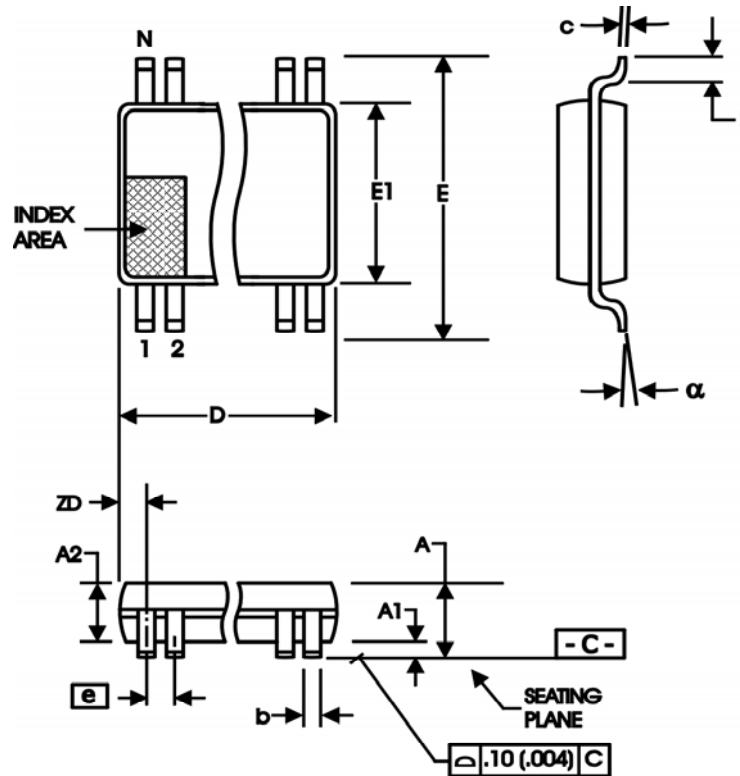


TABLE 7. PACKAGE DIMENSIONS

SYMBOL	Millimeters	
	Minimum	Maximum
N	28	
A	1.35	1.75
A1	0.10	0.25
A2		1.50
b	0.20	0.30
c	0.18	0.25
D	9.80	10.00
E	5.80	6.20
E1	3.80	4.00
e	0.635 BASIC	
L	0.40	1.27
$\alpha$	0°	8°
ZD	0.84 REF	

Reference Document: JEDEC Publication 95, MO-137





Integrated  
Circuit  
Systems, Inc.

**ICS83115**  
LOW SKEW, 1-TO-16  
LVCMOS / LVTTTL FANOUT BUFFER

**TABLE 8. ORDERING INFORMATION**

Part/Order Number	Marking	Package	Count	Temperature
ICS83115BR	ICS83115BR	28 Lead SSOP	48 per tube	0°C to 70°C
ICS83115BRT	ICS83115BR	28 Lead SSOP on Tape and Reel	2500	0°C to 70°C
ICS83115BRLF	ICS83115BRLF	28 Lead "Lead Free" SSOP	48 per tube	0°C to 70°C
ICS83115BRLFT	ICS83115BRLF	28 Lead "Lead Free" SSOP on Tape and Reel	2500	0°C to 70°C

The aforementioned trademark, HiPerClockS™ is a trademark of Integrated Circuit Systems, Inc. or its subsidiaries in the United States and/or other countries.

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.