LOW SKEW, 1-TO-9 LVCMOS FANOUT BUFFER

ICS83947I

General Description

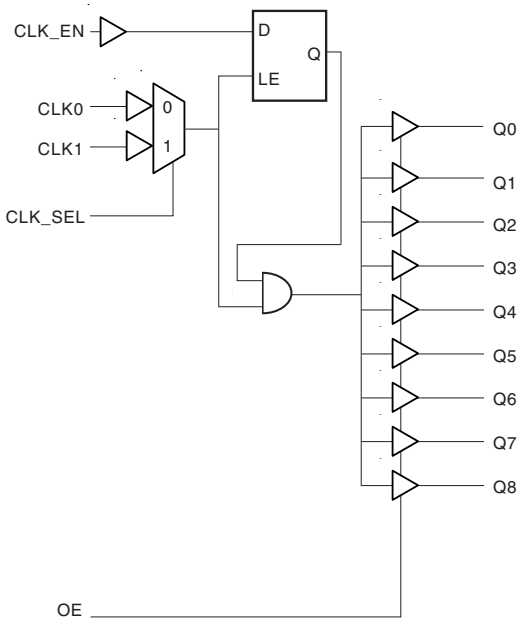
The ICS83947I is a low skew, 1-to-9 LVCMOS Fanout Buffer and a member of the HiPerClockS™ family of High Performance Clock Solutions from ICS. The low impedance LVCMOS/LVTTL outputs are designed to drive 50Ω series or parallel terminated transmission lines. The effective fanout can be increased from 9 to 18 by utilizing the ability of the outputs to drive two series terminated lines.

Guaranteed output and part-to-part skew characteristics make the ICS83947I ideal for high performance, single ended applications that also require a limited output voltage.

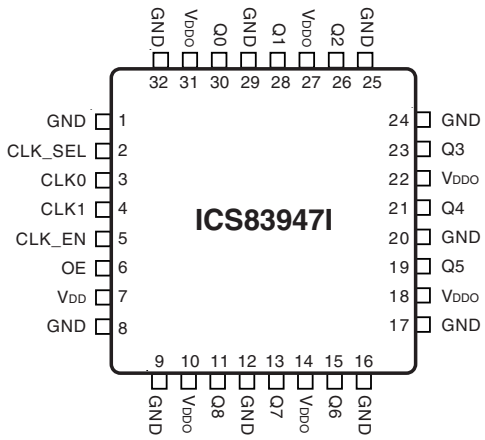
Features

- 9 LVCMOS/LVTTL outputs
- Selectable CLK0 and CLK1 can accept the following input levels: LVCMOS and LVTTL
- Maximum output frequency: 110MHz
- Output skew: 500ps (maximum)
- Part-to-part skew: 2ns (maximum)
- 3.3V operating supply
- -40°C to 85°C ambient operating temperature
- Lead-Free package available
- Pin compatible with the MPC947

Block Diagram



Pin Assignment



32-Lead LQFP
7mm x 7mm x 1.4mm package body
Y Package
Top View

TABLE 1. PIN DESCRIPTIONS

Number	Name	Type		Description
1, 8, 9, 12, 16, 17, 20, 24, 25, 29, 32	GND	Power		Power supply ground.
2	CLK_SEL	Input	Pullup	Clock select input. When HIGH, selects CLK1. When LOW, selects CLK0. LVCMOS / LVTTL interface levels.
3, 4	CLK0, CLK1	Input	Pullup	Reference clock inputs. LVCMOS / LVTTL interface levels.
5	CLK_EN	Input	Pullup	Clock enable. LVCMOS / LVTTL interface levels.
6	OE	Input	Pullup	Output enable. LVCMOS / LVTTL interface levels.
7	V_{DD}	Power		Coree supply pin.
10, 14, 18, 22, 27, 31	V_{DDO}	Power		Output supply pins.
11, 13, 15, 19, 21, 23, 26, 28, 30	Q8, Q7, Q6, Q5, Q4, Q3, Q2, Q1, Q0	Output		Q0 thru Q8 clock outputs. LVCMOS / LVTTL interface levels.

NOTE: *Pullup* refers 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)			25		pF
R_{PULLUP}	Input Pullup Resistor			51		KΩ
$R_{PULLDOWN}$	Input Pulldown Resistor			51		KΩ
R_{OUT}	Output Impedance		5	7	12	Ω

TABLE 3. OUTPUT ENABLE AND CLOCK ENABLE FUNCTION TABLE

Control Inputs		Output
OE	**CLK_EN**	**Q0:Q8**
0	X	Hi-Z
1	0	LOW
1	1	Follows CLK input

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}	47.9°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 4A. Power Supply DC Characteristics, $V_{DD} = V_{DDO} = 3.3V \pm 0.3V$, T_A = -40°C to 85°C

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
V_{DD}	Coret Supply Voltage		3.0	3.3	3.6	V
V_{DDO}	Output Supply Voltage		3.0	3.3	3.6	V
I_{DD}	Input Supply Current			33	50	mA

Table 4B. LVCMOS/LVTTL DC Characteristics, $V_{DD} = V_{DDO} = 3.3V \pm 0.3V$, T_A = -40°C to 85°C

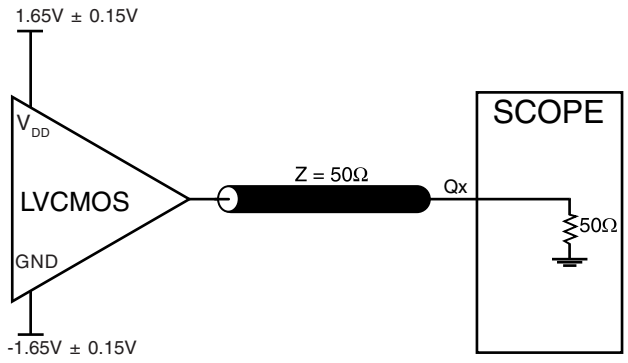
Symbol	Parameter		Test Conditions	Minimum	Typical	Maximum	Units
V_{IH}	Input High Voltage			2		3.6	V
V_{IL}	Input Low Voltage					0.8	V
I_{IN}	Input Current	CLK0, CLK1, CLK_SEL, OE, CLK_EN		-100			µA
V_{OH}	Output High Voltage		I_{OH} = -20mA	2.5			V
V_{OL}	Output Low Voltage		I_{OL} = 20mA			0.4	V

TABLE 5. AC CHARACTERISTICS, $V_{DD} = V_{DDO} = 3.3V \pm 0.3V$, T_A = -40°C TO 85°C

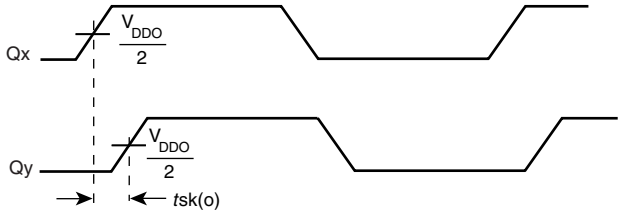
Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
f_{MAX}	Output Frequency		110			MHz
t_{PD}	Propagation Delay, NOTE 1	CLK to Q	1.8		4.5	ns
*t*sk(o)	Output Skew; NOTE 2, 5	Measured on rising edge @$V_{DDO}/2$			500	ps
*t*sk(pp)	Part-to-Part Skew; NOTE 3, 5	Measured on rising edge @$V_{DDO}/2$			2	ns
t_{PW}	Output Pulse Width		tPeriod/2 - 800		tPeriod/2 + 800	ps
t_S	Clock Enable Setup Time; NOTE 6	CLK_EN to CLK	0			ns
t_H	Clock Enable Hold Time; NOTE 6	CLK_EN to CLK	1			ns
t_{ZL}, t_{ZH}	Output Enable Time; NOTE 4				11	ns
t_{LZ}, t_{HZ}	Output Disable Time; NOTE 4				11	ns
t_R	Output Rise Time	0.8V to 2.0V	0.2		1	ns
t_F	Output Fall Time	0.8V to 2.0V	0.2		1	ns

All parameters measured at f_{MAX} unless noted otherwise.
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: These parameters are guaranteed by characterization. Not tested in production.
NOTE 5: This parameter is defined in accordance with JEDEC Standard 65.
NOTE 6: Setup and Hold times are relative to the rising edge of the input clock.

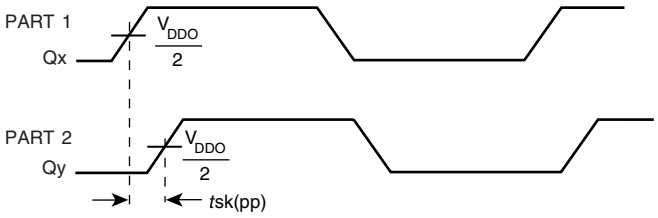
PARAMETER MEASUREMENT INFORMATION



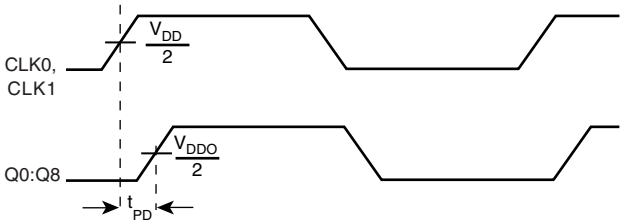
3.3V OUTPUT LOAD AC TEST CIRCUIT



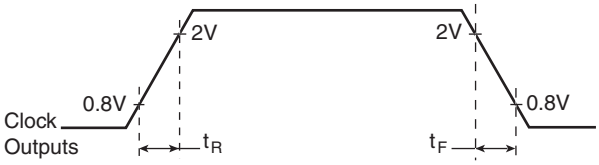
OUTPUT SKEW



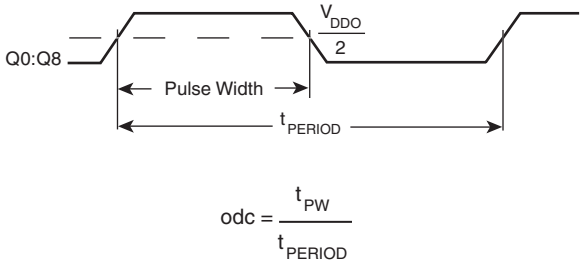
PART-TO-PART SKEW



PROPAGATION DELAY



OUTPUT RISE/FALL TIME



OUTPUT DUTY CYCLE/PULSE WIDTH/PERIOD

Reliability Information

Table 6. θ_{JA} vs. Air Flow Table for 32 Lead LQFP

θ_{JA} by Velocity (Linear Feet per Minute)			
	0	**200**	**500**
Single-Layer PCB, JEDEC Standard Test Boards	67.8°C/W	55.9°C/W	50.1°C/W
Multi-Layer PCB, JEDEC Standard Test Boards	47.9°C/W	42.1°C/W	39.4°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 ICS83947I is: 1040

Package Outline - Y Suffix for 32 Lead LQFP

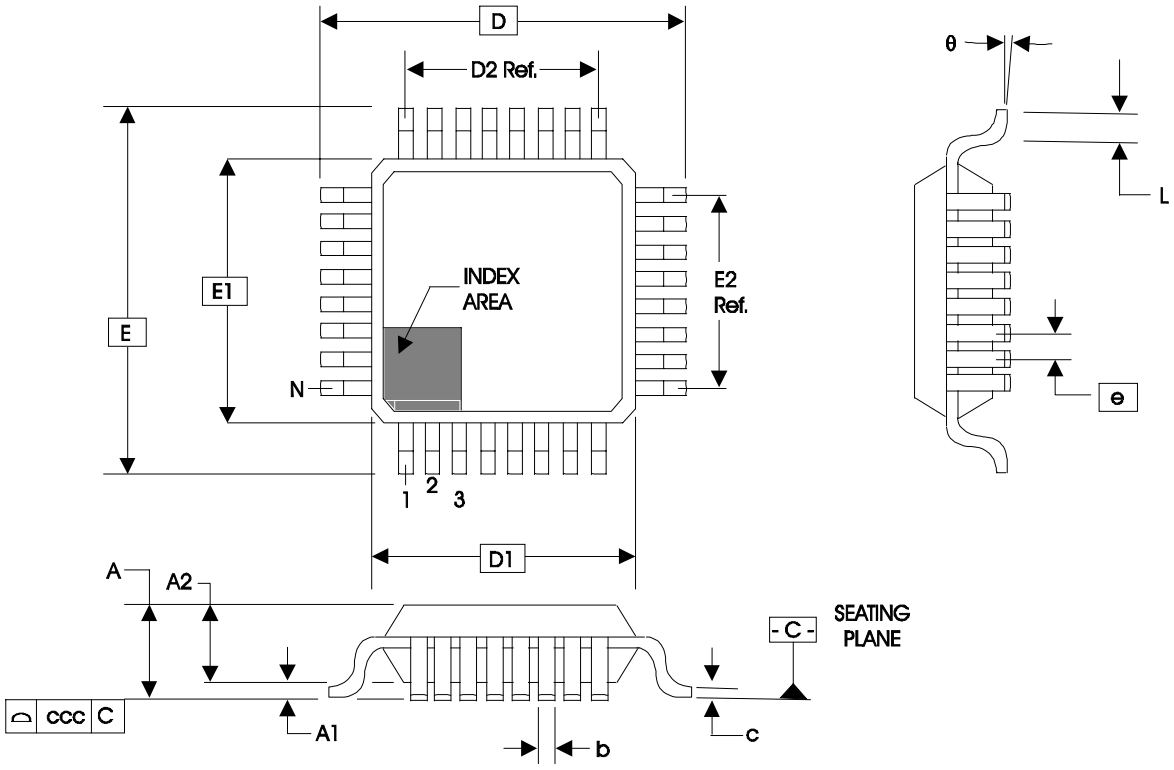


Table 7. Package Dimensions

JEDEC VARIATION ALL DIMENSIONS IN MILLIMETERS			
SYMBOL	BBA		
	MINIMUM	NOMINAL	MAXIMUM
N		32	
A	--	--	1.60
A1	0.05	--	0.15
A2	1.35	1.40	1.45
b	0.30	0.37	0.45
c	0.09	--	0.20
D		9.00 BASIC	
D1		7.00 BASIC	
D2		5.60 Ref.	
E		9.00 BASIC	
E1		7.00 BASIC	
E2		5.60 Ref.	
e		0.80 BASIC	
L	0.45	0.60	0.75
θ	0°	--	7°
ccc	--	--	0.10

Reference Document: JEDEC Publication 95, MS-026

TABLE 8. ORDERING INFORMATION

Part/Order Number	Marking	Package	Count	Temperature
83947AYI	ICS83947AYI	32 Lead LQFP	250 per tray	-40°C to 85°C
83947AYIT	ICS83947AYI	32 Lead LQFP on Tape and Reel	1000	-40°C to 85°C
83947AYILN	ICS3947AYIN	32 Lead "Lead-Free/Annealed" LQFP	250 per tray	-40°C to 85°C
83947AYILNT	ICS3947AYIN	32 Lead "Lead-Free/Annealed" LQFP on Tape and Reel	1000	-40°C to 85°C

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REVISION HISTORY SHEET				
Rev	**Table**	**Page**	**Description of Change**	**Date**
A	T5	4	AC Characterisitics Table, t_S and t_H rows- revised Test Conditions to read CLK_EN to CLK.	6/21/02
B		1	Added Lead Free bullet in Features section.	10/11/04
	T2	2	Pin Characteristics Table - changed C_{IN} from 4pF max. to 4pF min. R_{OUT} added 5Ω min and 12Ω max.	
	T8	8	Ordering Information Table - add Lead-Free part. Updated format throughout data sheet.	

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