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CY29947

2.5 V or 3.3 V, 200 MHz, 1:9 Clock Distribution Buffer

Features

- 2.5 V or 3.3 V operation
- 200 MHz clock support
- LVCMOS-/LVTTL-compatible inputs
- 9 clock outputs: drive up to 18 clock lines
- Synchronous Output Enable
- Output three-state control
- 250 ps max. output-to-output skew
- Pin compatible with MPC947, MPC9447
- Available in Industrial and Commercial temp. range
- 32-pin TQFP package

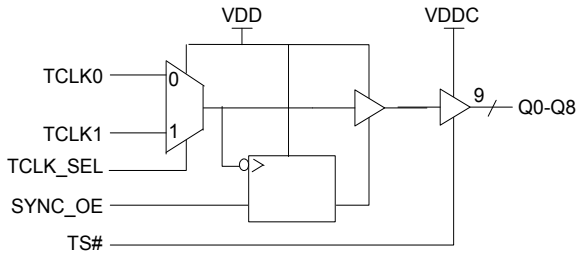
Functional Description

The CY29947 is a low-voltage 200 MHz clock distribution buffer with the capability to select one of two LVCMOS/LVTTL compatible clock inputs. The two clock sources can be used to provide for a test clock as well as the primary system clock. All other control inputs are LVCMOS/LVTTL compatible. The 9 outputs are LVCMOS or LVTTL compatible and can drive 50 Ω series or parallel terminated transmission lines.For series terminated transmission lines, each output can drive one or two traces giving the device an effective fanout of 1:18. The outputs can also be three-stated via the three-state input TS#. Low output-to-output skews make the CY29947 an ideal clock distribution buffer for nested clock trees in the most demanding of synchronous systems.

The CY29947 also provides a synchronous output enable input for enabling or disabling the output clocks. Since this input is internally synchronized to the input clock, potential output glitching or runt pulse generation is eliminated.

For a complete list of related documentation, click here.

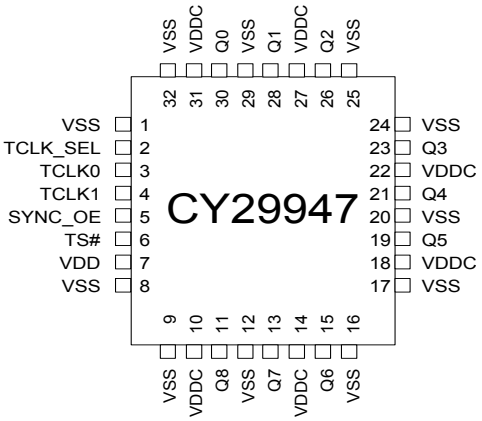
Block Diagram



Contents

Pinouts

Figure 1. 32-pin TQFP pinout



Pin Definitions

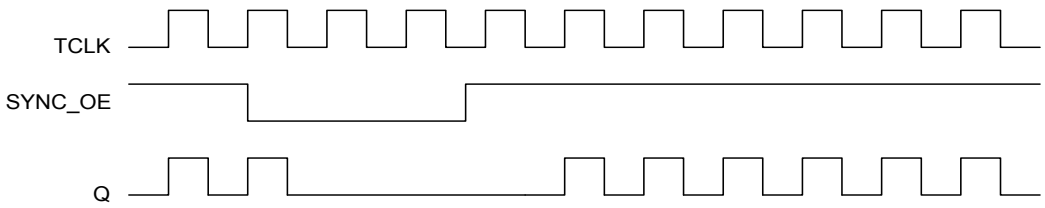
Pin	Name	PWR	I/O [1]	Description
3	TCLK0		I, PU	**Test Clock Input**
4	TCLK1		I, PU	**Test Clock Input**
2	TCLK_SEL		I, PU	**Test Clock Select Input**. When LOW, TCLK0 is selected. When asserted HIGH, TCLK1 is selected.
11, 13, 15, 19, 21, 23, 26, 28, 30	Q(8:0)	VDDC	O	**Clock Outputs**
5	SYNC_OE		I, PU	**Output Enable Input**. When asserted HIGH, the outputs are enabled and when set LOW the outputs are disabled in a LOW state.
6	TS#		I, PU	**Three-state Control Input**. When asserted LOW, the output buffers are three-stated. When set HIGH, the output buffers are enabled.
10, 14, 18, 22, 27, 31	VDDC			**3.3 V or 2.5 V Power Supply for Output Clock Buffers**
7	VDD			**3.3 V or 2.5 V Power Supply**
1, 8, 9, 12, 16, 17, 20, 24, 25, 29, 32	VSS			**Common Ground**

Note
1. PD = internal pull-down, PU = internal pull-up.

Output Enable/Disable

The CY29947 features a control input to enable or disable the outputs. This data is latched on the falling edge of the input clock. When SYNC_OE is asserted LOW, the outputs are disabled in a LOW state. When SYNC_OE is set HIGH, the outputs are enabled as shown in Figure 2.

Figure 2. SYNC_OE Timing Diagram



Maximum Ratings

Exceeding maximum ratings [2] may shorten the useful life of the device. User guidelines are not tested.

Maximum Input Voltage Relative to V_{SS}: ..... V_{SS} – 0.3 V

Maximum Input Voltage Relative to V_{DD}: ..... V_{DD} + 0.3 V

Storage Temperature: ..... –65 °C to + 150 °C

Operating Temperature: ..... –40 °C to +85 °C

Maximum ESD protection ..... 2 kV

Maximum Power Supply: ..... 5.5 V

Maximum Input Current: ..... ±20 mA

This device contains circuitry to protect the inputs against damage due to high static voltages or electric field; however, precautions should be taken to avoid application of any voltage higher than the maximum rated voltages to this circuit. For proper operation, V_{in} and V_{out} should be constrained to the range:

$V_{SS} < (V_{in} \text{ or } V_{out}) < V_{DD}$

Unused inputs must always be tied to an appropriate logic voltage level (either V_{SS} or V_{DD}).

DC Parameters

$V_{DD} = V_{DDC}$ = 3.3 V ± 10% or 2.5 V ± 5%, Over the specified temperature range

Parameter	Description	Conditions	Min	Typ	Max	Unit
V_{IL}	Input Low Voltage		V_{SS}	–	0.8	V
V_{IH}	Input High Voltage		2.0	–	V_{DD}	V
I_{IL}	Input Low Current[3]		–	–	–100	µA
I_{IH}	Input High Current[3]		–	–	10	µA
V_{OL}	Output Low Voltage[4]	I_{OL} = 20 mA	–	–	0.4	V
V_{OH}	Output High Voltage[4]	I_{OH} = –20 mA, V_{DD} = 3.3 V	2.5	–	–	V
		I_{OH} = –20 mA, V_{DD} = 2.5 V	1.8	–	–	
I_{DDQ}	Quiescent Supply Current		–	5	7	mA
I_{DD}	Dynamic Supply Current	V_{DD} = 3.3 V, Outputs @ 100 MHz, CL = 30 pF	–	120	–	mA
		V_{DD} = 3.3 V, Outputs @ 160 MHz, CL = 30 pF	–	200	–	
		V_{DD} = 2.5 V, Outputs @ 100 MHz, CL = 30 pF	–	85	–	
		V_{DD} = 2.5 V, Outputs @ 160 MHz, CL = 30 pF	–	140	–	
Zout	Output Impedance	V_{DD} = 3.3 V	12	15	18	Ω
		V_{DD} = 2.5 V	14	18	22	
C_{in}	Input Capacitance		–	4	–	pF

Thermal Resistance

Parameter [5]	Description	Test Conditions	32-pin TQFP	Unit
θ_{JA}	Thermal resistance (junction to ambient)	Test conditions follow standard test methods and procedures for measuring thermal impedance, in accordance with EIA/JESD51.	65	°C/W
θ_{JC}	Thermal resistance (junction to case)		12	°C/W

Notes

2. **Multiple Supplies:** The voltage on any input or I/O pin cannot exceed the power pin during power-up. Power supply sequencing is NOT required.
3. Inputs have pull-up/pull-down resistors that effect input current.
4. Driving series or parallel terminated 50 Ω (or 50 Ω to $V_{DD}/2$) transmission lines.
5. These parameters are guaranteed by design and are not tested.

AC Parameters

V_{DD} = V_{DDC} = 3.3 V ± 10% or 2.5 V ± 5%, Over the specified temperature range

Parameter [6]	Description	Conditions	Min	Typ	Max	Unit
Fmax	Input Frequency[7]	V_{DD} = 3.3 V	–	–	200	MHz
		V_{DD} = 2.5 V	–	–	170	
Tpd	TCLK To Q Delay[7]	V_{DD} = 3.3 V	4.75	–	9.25	ns
		V_{DD} = 2.5 V	6.50	–	10.50	
FoutDC	Output Duty Cycle[7, 8]	Measured at V_{DD}/2	45	–	55	%
tpZL, tpZH	Output Enable Time (all outputs)		2	–	10	ns
tpLZ, tpHZ	Output Disable Time (all outputs)		2	–	10	ns
Tskew	Output-to-Output Skew[7, 9]		–	150	250	ps
Tskew(pp)	Part-to-Part Skew[10]		–	–	2.0	ns
Ts	Set-up Time[7, 11]	SYNC_OE to TCLK	0.0	–	–	ps
Th	Hold Time[7, 11]	TCLK to SYNC_OE	1.0	–	–	ps
Tr/Tf	Output Clocks Rise/Fall Time[9]	0.8 V to 2.0 V, V_{DD} = 3.3 V	0.20	–	1.0	ns
		0.6 V to 1.8 V, V_{DD} = 2.5 V	0.20	–	1.3	

Notes
6. Parameters are guaranteed by design and characterization. Not 100% tested in production. All parameters specified with loaded outputs.
7. Outputs driving 50 Ω transmission lines.
8. 50% input duty cycle.
9. See Figure 3 on page 7.
10. Part-to-Part skew at a given temperature and voltage.
11. Set-up and hold times are relative to the falling edge of the input clock.

Figure 3. LVCMOS_CLK CY29947 Test Reference for V_{CC} = 3.3 V and V_{CC} = 2.5 V

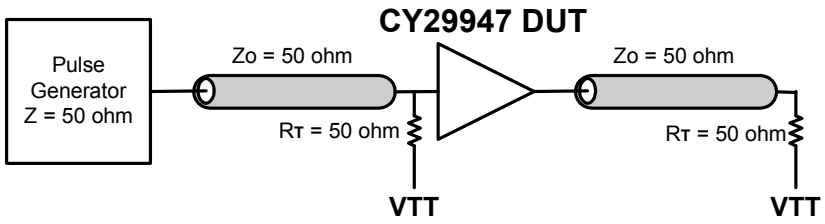


Figure 4. LVCMOS Propagation Delay (TPD) Test Reference

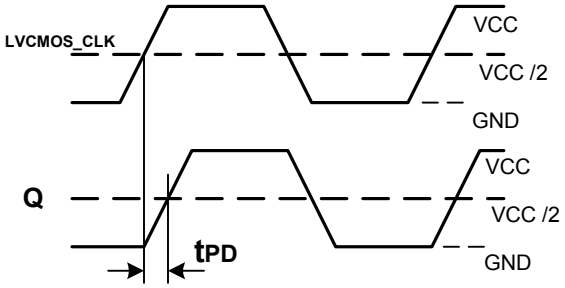


Figure 5. Output Duty Cycle (FoutDC)

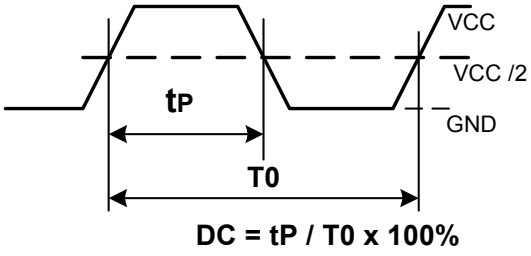
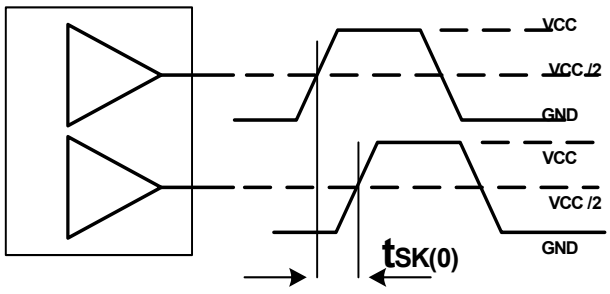


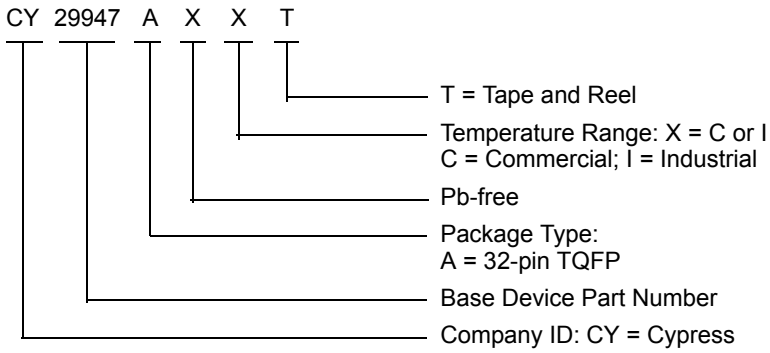
Figure 6. Output-to-Output Skew tsk(0)



Ordering Information

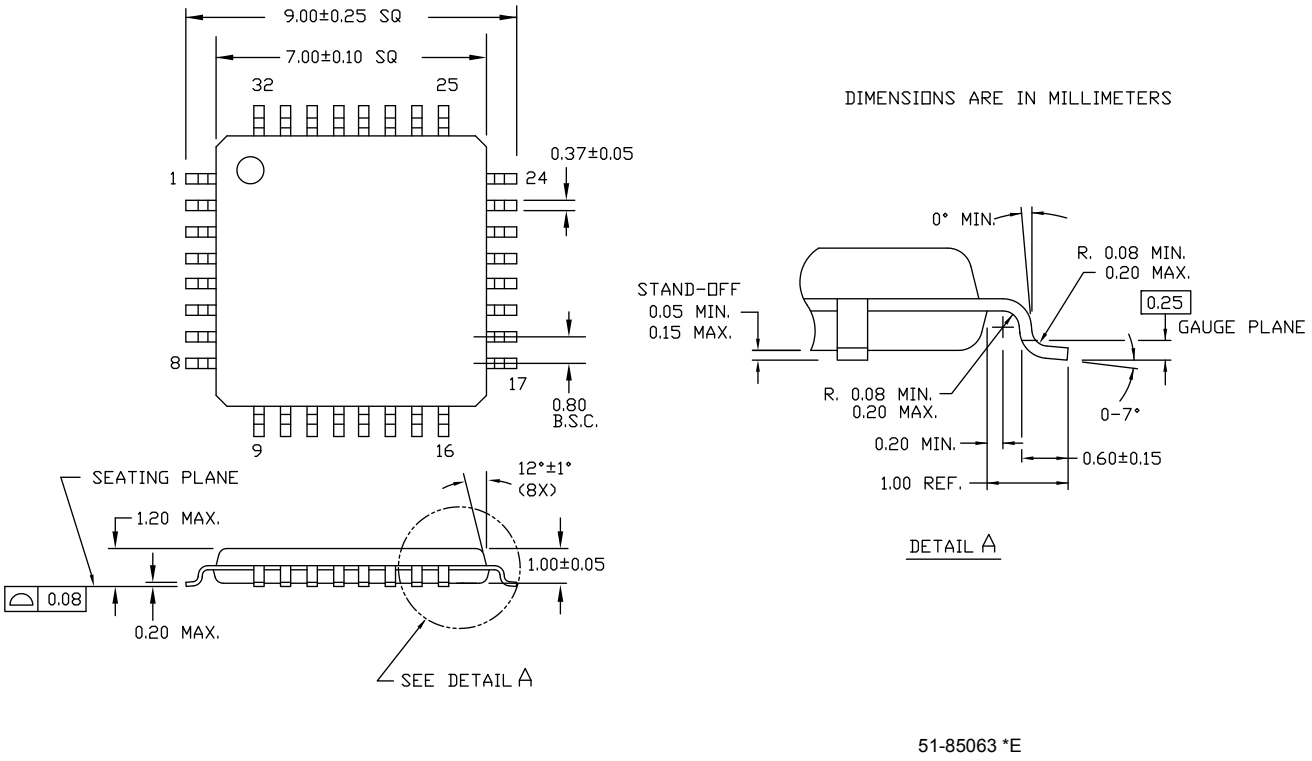
Part Number	Package Type	Production Flow
CY29947AXI	32-pin TQFP	Industrial, –40 °C to +85 °C
CY29947AXIT	32-pin TQFP – Tape and Reel	Industrial, –40 °C to +85 °C

Ordering Code Definitions



Package Drawing and Dimension

Figure 7. 32-pin TQFP (7 × 7 × 1.0 mm) Package Outline, 51-85063



Acronyms

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
ESD	Electrostatic Discharge
I/O	Input/Output
LVCMOS	Low Voltage Complementary Metal Oxide Semiconductor
LVTTL	Low Voltage Transistor-Transistor Logic
PLL	Phase Locked Loop
TQFP	Thin Quad Flat Pack
VCO	Voltage-Controlled Oscillator

Document Conventions

Units of Measure

Symbol	Unit of Measure
°C	degree Celsius
Hz	hertz
kHz	kilohertz
kV	kilovolt
MHz	megahertz
µA	microampere
mA	milliampere
ms	millisecond
mV	millivolt
ns	nanosecond
Ω	ohm
%	percent
pF	picofarad
ps	picosecond
V	volt
W	watt

Revision History

Document Title: CY29947, 2.5 V or 3.3 V, 200 MHz, 1:9 Clock Distribution Buffer Document Number: 38-07287				
Rev.	**ECN No.**	**Issue Date**	**Orig. of Change**	**Description of Change**
**	111098	02/07/02	BRK	New data sheet
*A	116781	08/14/02	HWT	Added Commercial Temperature Range in the ordering information
*B	118462	09/09/02	HWT	Corrected the Package Drawing and Dimension in page 6 from 32 LQFP to 32 TQFP
*C	122879	12/22/02	RBI	Added power up requirements to Maximum Ratings
*D	2899714	03/26/10	BASH	Removed inactive parts from the ordering table. Replaced with active parts. Updated package diagram
*E	3163585	02/05/2011	CXQ	Added Ordering Code Definitions. Added Acronyms and Units of Measure. Updated to new template.
*F	4311272	03/17/2014	CINM	Updated Package Drawing and Dimension: spec 51-85063 – Changed revision from *C to *D. Updated to new template. Completing Sunset Review.
*G	4586288	12/03/2014	CINM	Updated Functional Description: Added “For a complete list of related documentation, click here.” at the end. Updated Ordering Information: Removed the prune part numbers CY29947AXC and CY29947AXCT.
*H	5270507	05/13/2016	PSR	Added Thermal Resistance. Updated Package Drawing and Dimension: spec 51-85063 – Changed revision from *D to *E. Updated to new template.

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