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2.5 V or 3.3 V, 200 MHz, 1:10 Clock Distribution Buffer

Features

- 2.5 V or 3.3 V operation
- 200 MHz clock support
- Two LVCMOS/LVTTL-compatible inputs
- Ten clock outputs: drive up to 20 clock lines
- 1× or 1/2× configurable outputs
- Output three-state control
- 250-ps max output-to-output skew
- Pin-compatible with MPC946, MPC9446
- Available in commercial and industrial temperature range
- 32-pin TQFP package

Functional Description

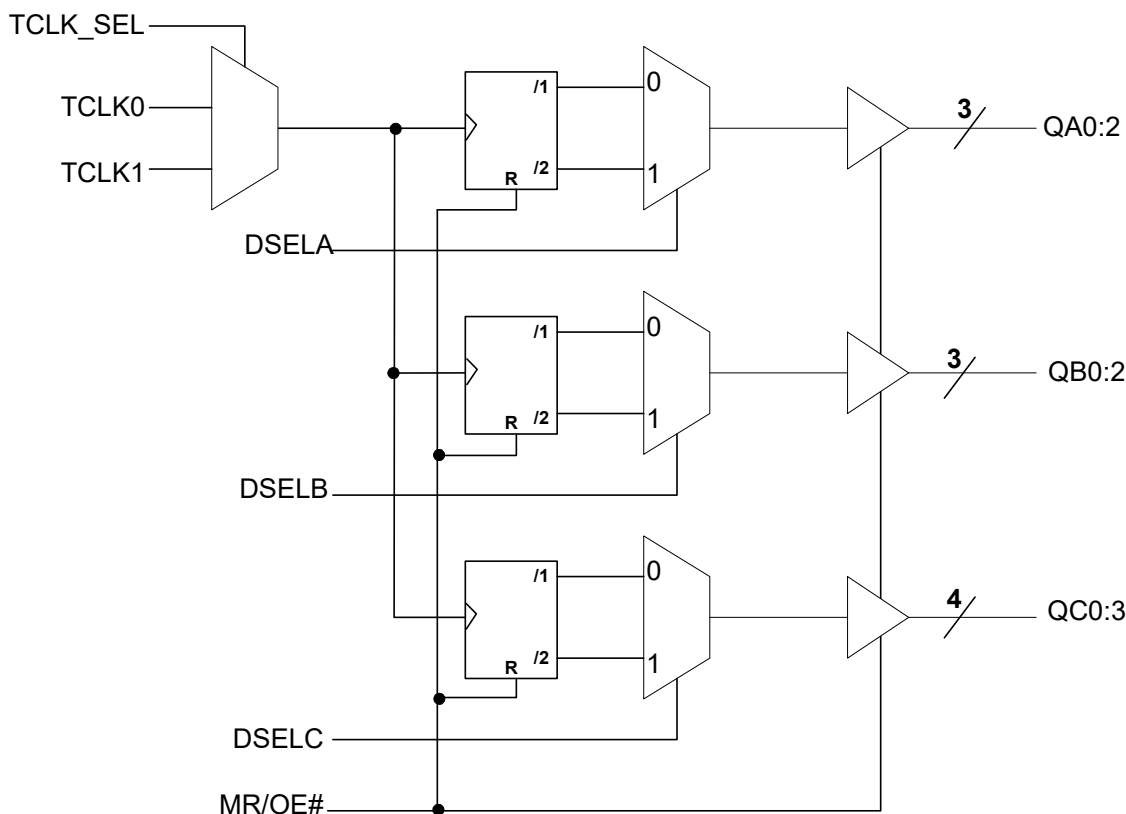
The CY29946 is a low-voltage 200-MHz clock distribution buffer with the capability to select one of two LVCMOS/LVTTL compatible input clocks. These clock sources can be used to provide for test clocks as well as the primary system clocks. All other control inputs are LVCMOS/LVTTL compatible. The 10 outputs 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 1:20.

The CY29946 is capable of generating 1× and 1/2× signals from a 1× source. These signals are generated and retimed internally to ensure minimal skew between the 1× and 1/2× signals. SEL(A:C) inputs allow flexibility in selecting the ratio of 1× to 1/2× outputs.

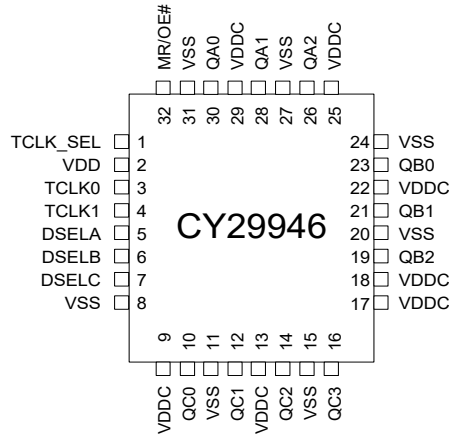
The CY29946 outputs can also be three-stated via MR/OE# input. When MR/OE# is set HIGH, it resets the internal flip-flops and three-states the outputs.

For a complete list of related documentation, [click here](#).

Block Diagram



Not Recommended for New Designs



Pin	Name	PWR	I/O [1]	Description
3, 4	TCLK(0,1)		I, PU	External Reference/Test Clock Input
26, 28, 30	QA(2:0)	VDDC	O	Clock Outputs
19, 21, 23	QB(2:0)	VDDC	O	Clock Outputs
10, 12, 14, 16	QC(0:3)	VDDC	O	Clock Outputs
5, 6, 7	DSEL(A:C)		I, PD	Divider Select Inputs. When HIGH, selects ÷2 input divider. When LOW, selects ÷1 input divider.
1	TCLK_SEL		I, PD	TCLK Select Input. When LOW, TCLK0 clock is selected and when HIGH TCLK1 is selected.
32	MR/OE#		I, PD	Output Enable Input. When asserted LOW, the outputs are enabled and when asserted HIGH, internal flip-flops are reset and the outputs are three-stated. If more than 1 Bank is being used in /2 Mode, a reset must be performed (MR/OE# Asserted High) after power-up to ensure all internal flip-flops are set to the same state.
9, 13, 17, 18, 22, 25, 29	VDDC			2.5 V or 3.3 V Power Supply for Output Clock Buffers
2	VDD			2.5 V or 3.3 V Power Supply
8, 11, 15, 20, 24, 27, 31	VSS			Common Ground

Absolute Maximum Conditions^[2]

Maximum Input Voltage Relative to V_{SS}	$V_{SS} - 0.3 \text{ V}$
Maximum Input Voltage Relative to V_{DD}	$V_{DD} + 0.3 \text{ V}$
Storage Temperature	-65°C to $+150^{\circ}\text{C}$
Operating Temperature.....	-40°C to $+85^{\circ}\text{C}$
Maximum ESD protection.....	2 kV
Maximum Power Supply.....	5.5 V
Maximum Input Current.....	$\pm 20 \text{ mA}$

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 Electrical Specifications

$V_{DD} = V_{DDC} = 3.3 \text{ V} \pm 10\%$ or $2.5 \text{ V} \pm 5\%$, 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]		–	–	100	μA
V_{OL}	Output Low Voltage ^[4]	$I_{OL} = 20 \text{ mA}$	–	–	0.4	V
V_{OH}	Output High Voltage ^[4]	$I_{OH} = -20 \text{ mA}, V_{DD} = 3.3 \text{ V}$	2.5	–	–	V
		$I_{OH} = -20 \text{ mA}, V_{DD} = 2.5 \text{ V}$	1.8	–	–	
I_{DDQ}	Quiescent Supply Current		–	5	7	mA
I_{DD}	Dynamic Supply Current	$V_{DD} = 3.3 \text{ V}$, Outputs @ 100 MHz, $C_L = 30 \text{ pF}$	–	130	–	mA
		$V_{DD} = 3.3 \text{ V}$, Outputs @ 160 MHz, $C_L = 30 \text{ pF}$	–	225	–	
		$V_{DD} = 2.5 \text{ V}$, Outputs @ 100 MHz, $C_L = 30 \text{ pF}$	–	95	–	
		$V_{DD} = 2.5 \text{ V}$, Outputs @ 160 MHz, $C_L = 30 \text{ pF}$	–	160	–	
Z_{Out}	Output Impedance	$V_{DD} = 3.3 \text{ V}$	12	15	18	W
		$V_{DD} = 2.5 \text{ V}$	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	$^{\circ}\text{C/W}$
θ_{JC}	Thermal resistance (junction to case)		12	$^{\circ}\text{C/W}$

Notes

- 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.
- Inputs have pull-up/pull-down resistors that effect input current.
- Driving series or parallel terminated 50Ω (or 50Ω to $V_{DD}/2$) transmission lines.
- These parameters are guaranteed by design and are not tested.

AC Electrical Specifications

$V_{DD} = V_{DDC} = 3.3 \text{ V} \pm 10\%$ or $2.5 \text{ V} \pm 5\%$, over the specified temperature range^[6]

Parameter	Description	Conditions	Min	Typ	Max	Unit
$F_{\max}$	Input Frequency ^[7]	$V_{DD} = 3.3 \text{ V}$	–	–	200	MHz
		$V_{DD} = 2.5 \text{ V}$	–	–	170	
T_{pd}	TTL_CLK To Q Delay ^[7]		5.0	–	11.5	ns
F_{outDC}	Output Duty Cycle ^[7, 8]	Measured at $V_{DD}/2$	45	–	55	%
t_{pZL}, t_{pZH}	Output enable time (all outputs)		2	–	10	ns
t_{pLZ}, t_{pHZ}	Output disable time (all outputs)		2	–	10	ns
T_{skew}	Output-to-Output Skew ^[7, 9]		–	150	250	ps
$T_{\text{skew(pp)}}$	Part-to-Part Skew ^[10]		–	2.0	4.5	ns
T_r/T_f	Output Clocks Rise/Fall Time ^[9]	0.8 V to 2.0 V, $V_{DD} = 3.3 \text{ V}$	0.10	–	1.0	ns
		0.6 V to 1.8 V, $V_{DD} = 2.5 \text{ V}$	0.10	–	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 50Ω transmission lines.
8. 50% input duty cycle.
9. See [Figure 1 on page 5](#).
10. Part-to-Part skew at a given temperature and voltage.

Figure 1. LVCMOS_CLK CY29946 Test Reference for $V_{CC} = 3.3\text{ V}$ and $V_{CC} = 2.5\text{ V}$

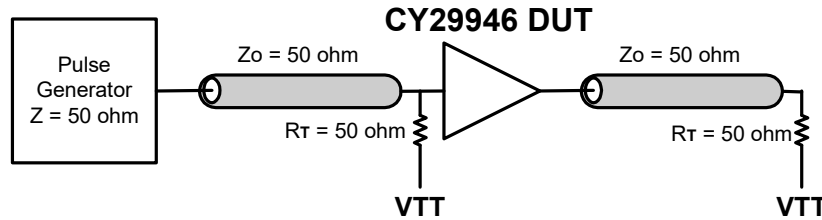


Figure 2. LVCMOS Propagation Delay (T_{PD}) Test Reference

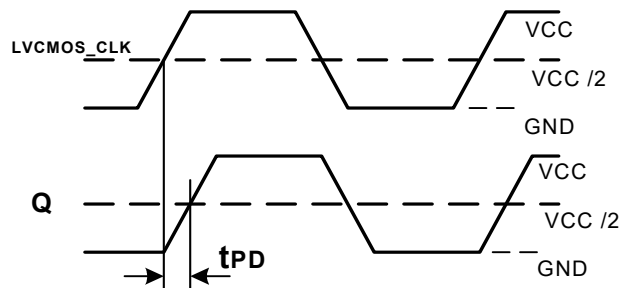


Figure 3. Output Duty Cycle (F_{outDC})

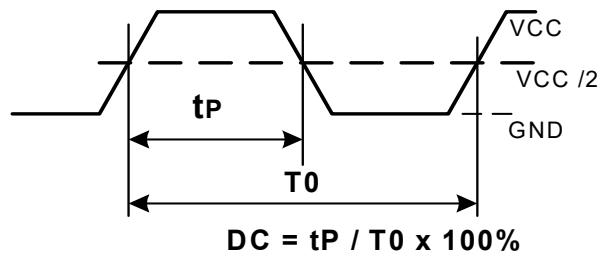
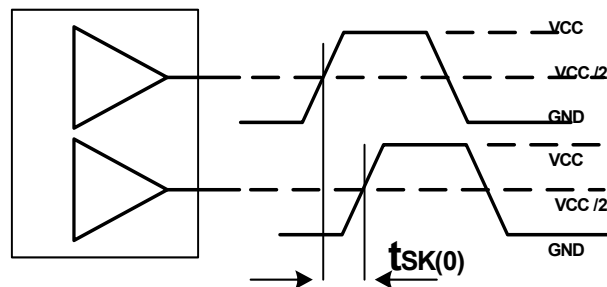


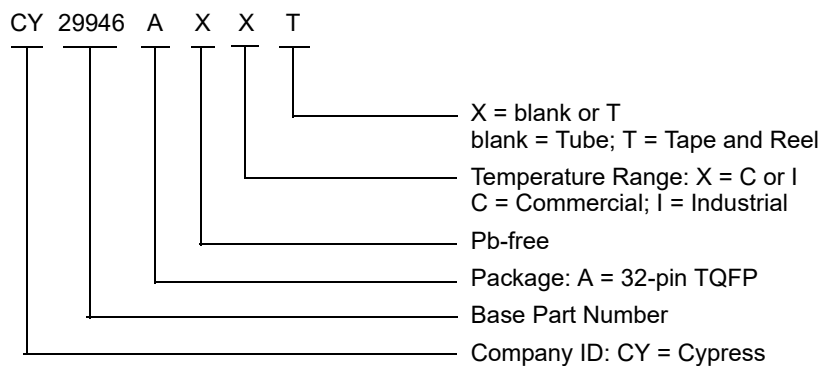
Figure 4. Output-to-Output Skew $t_{sk(0)}$



Ordering Information

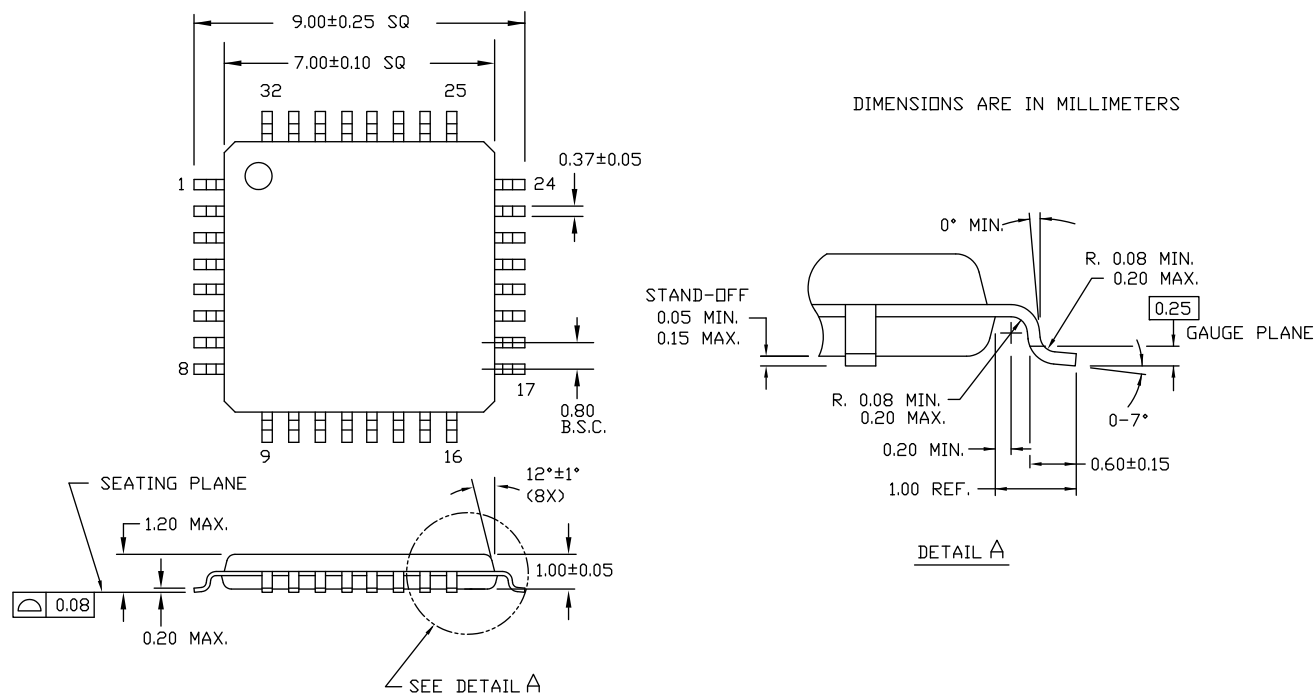
Part Number	Package Type	Production Flow
CY29946AXC	32-pin TQFP	Commercial, 0 °C to +70 °C
CY29946AXI	32-pin TQFP	Industrial, -40 °C to +85 °C
CY29946AXIT	32-pin TQFP – Tape and Reel	Industrial, -40 °C to +85 °C

Ordering Code Definitions



Package Drawing and Dimensions

Figure 5. 32-pin TQFP 7 × 7 × 1.0 mm A3210



51-85063 *E

Acronyms

Acronym	Description
ESD	electrostatic discharge
I/O	input/output
LVC MOS	low voltage complementary metal oxide semiconductor
LV TTL	low-voltage transistor-transistor logic
TQFP	thin quad flat pack

Document Conventions

Units of Measure

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

Document History Page

Document Title: CY29946, 2.5 V or 3.3 V, 200 MHz, 1:10 Clock Distribution Buffer Document Number: 38-07286			
Rev.	ECN No.	Submission Date	Description of Change
**	111097	02/07/2002	New data sheet.
*A	116780	08/15/2002	Added Commercial Temperature Range related information in all instances across the document. Updated Ordering Information : Updated part numbers. Updated Package Drawing and Dimensions : Removed existing spec. Added spec 51-85063 *B.
*B	122878	12/22/2002	Updated Absolute Maximum Conditions ^[2] : Added Note 2 and referred the same note in heading.
*C	130007	10/15/2003	Updated Block Diagram . Updated Pin Description : Updated details in "Description" column corresponding to MK/ØE pin.
*D	131375	11/21/2003	Updated Document History Page (Revision *C): To reflect changes that were not listed.
*E	221587	04/28/2004	Minor Change: Moved up the word Block Diagram in the first page.
*F	2899714	03/26/2010	Updated Ordering Information : Updated part numbers. Updated Package Drawing and Dimensions : spec 51-85063 – Changed revision from *B to *C.
*G	3254185	05/11/2011	Updated Ordering Information : No change in part numbers. Added Ordering Code Definitions . Added Acronyms and Units of Measure . Updated to new template. Completing Sunset Review.
*H	4389717	05/30/2014	Updated Package Drawing and Dimensions : spec 51-85063 – Changed revision from *C to *D. Completing Sunset Review.
*I	4586288	12/03/2014	Updated Functional Description : Added "For a complete list of related documentation, click here ." at the end.
*J	5270507	05/13/2016	Added Thermal Resistance . Updated Package Drawing and Dimensions : spec 51-85063 – Changed revision from *D to *E. Updated to new template.
*K	5754145	05/29/2017	Updated to new template. Completing Sunset Review.
*L	6903402	06/22/2020	Added watermark "Not Recommended for New Designs" across the document. Updated Ordering Information : Updated part numbers. Updated to new template. Completing Sunset Review.

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