

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-/LVTTTL-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

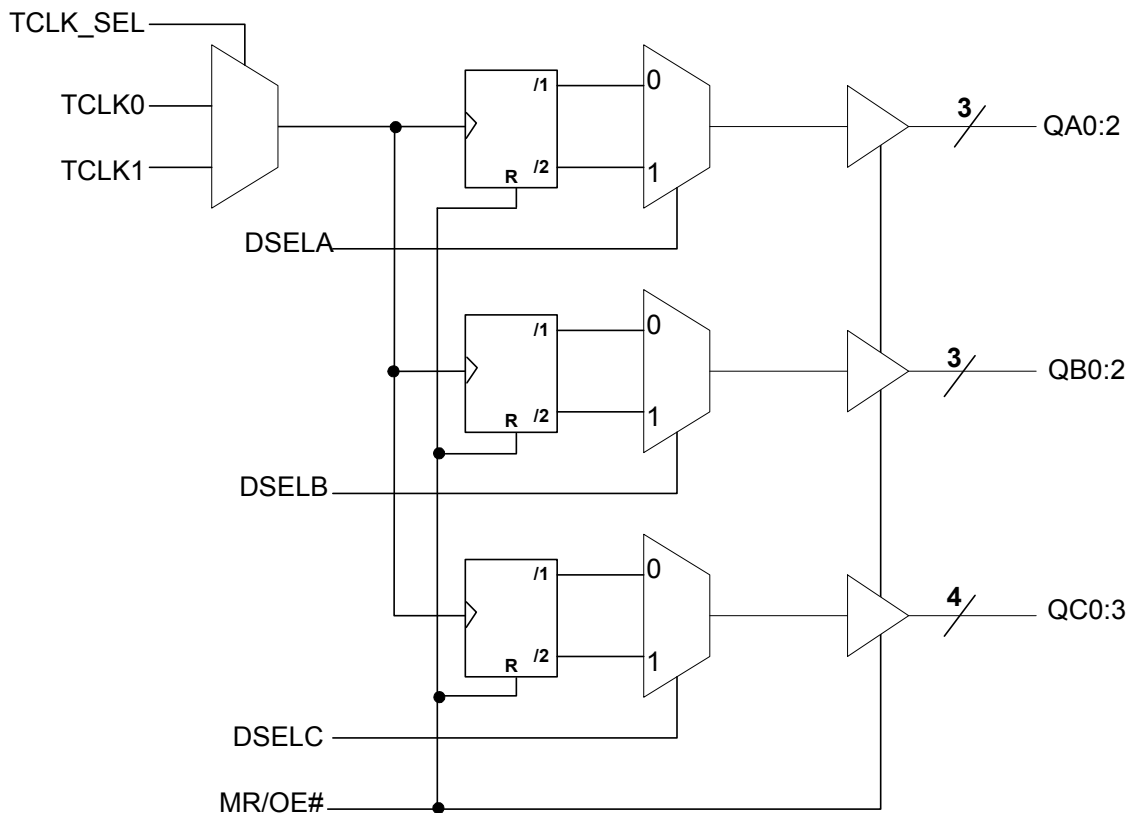
Description

The CY29946 is a low-voltage 200-MHz clock distribution buffer with the capability to select one of two LVCMOS/LVTTTL 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/LVTTTL compatible. The 10 outputs are LVCMOS or LVTTTL 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.

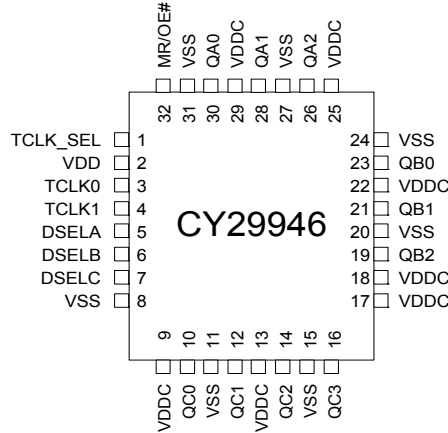
The CY29946 is capable of generating 1× and 1/2× signals from a 1× source. These signals are generated and retimed internally to ensure minimal skew between the 1× and 1/2× signals. SEL(A:C) inputs allow flexibility in selecting the ratio of 1× to 1/2× outputs.

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.

Block Diagram



Pin Configuration



Pin Description^[1]

Pin	Name	PWR	I/O	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

Note

1. PD = Internal pull-down. PU = Internal pull-up.

Absolute Maximum Conditions^[2]

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 Electrical Specifications

$V_{DD} = V_{DDC} = 3.3$ V $\pm 10\%$ or 2.5 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	μ A
I_{IH}	Input High Current ^[3]		–	–	100	μ A
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	–	130	–	mA
		$V_{DD} = 3.3$ V, Outputs @ 160 MHz, CL = 30 pF	–	225	–	
		$V_{DD} = 2.5$ V, Outputs @ 100 MHz, CL = 30 pF	–	95	–	
		$V_{DD} = 2.5$ V, Outputs @ 160 MHz, CL = 30 pF	–	160	–	
Z_{Out}	Output Impedance	$V_{DD} = 3.3$ V	12	15	18	W
		$V_{DD} = 2.5$ V	14	18	22	
C_{in}	Input Capacitance		–	4	–	pF

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.

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^[5]

Parameter	Description	Conditions	Min	Typ	Max	Unit
F_{max}	Input Frequency ^[6]	$V_{DD} = 3.3\text{ V}$	–	–	200	MHz
		$V_{DD} = 2.5\text{ V}$	–	–	170	
T_{pd}	TTL_CLK To Q Delay ^[6]		5.0	–	11.5	ns
F_{outDC}	Output Duty Cycle ^[6, 7]	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 ^[6, 8]		–	150	250	ps
$T_{skew(pp)}$	Part-to-Part Skew ^[9]		–	2.0	4.5	ns
T_r/T_f	Output Clocks Rise/Fall Time ^[8]	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

5. Parameters are guaranteed by design and characterization. Not 100% tested in production. All parameters specified with loaded outputs.
6. Outputs driving 50Ω transmission lines.
7. 50% input duty cycle.
8. See [Figure 1 on page 5](#).
9. 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 $V_{CC} = 2.5\text{ V}$

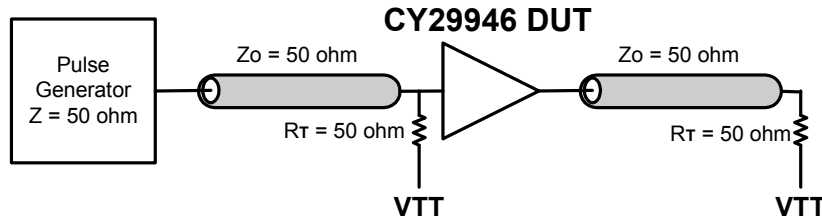


Figure 2. LVCMOS Propagation Delay (T_{PD}) Test Reference

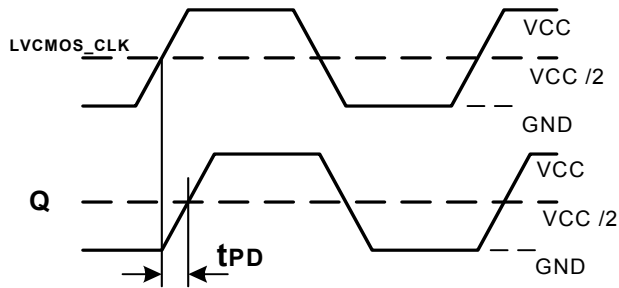


Figure 3. Output Duty Cycle (F_{outDC})

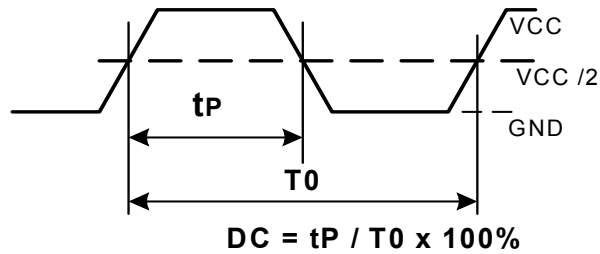
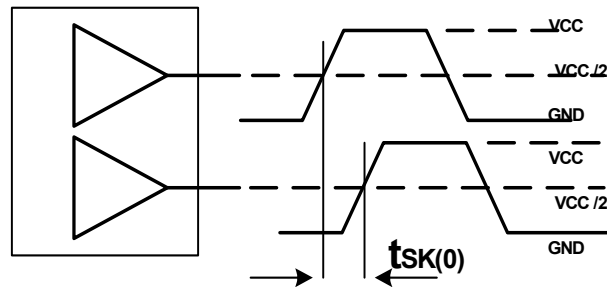


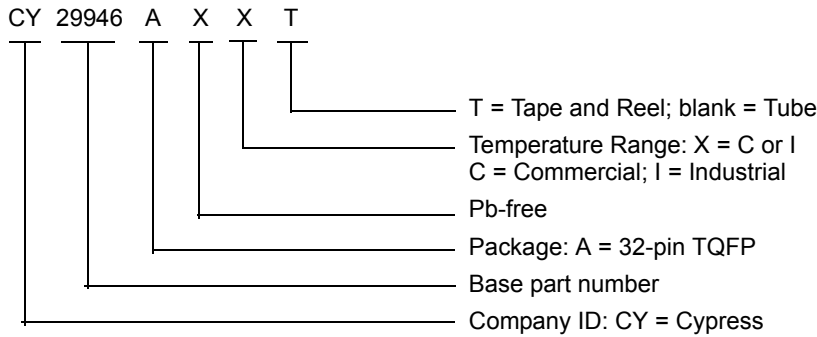
Figure 4. Output-to-Output Skew $t_{sk(0)}$



Ordering Information

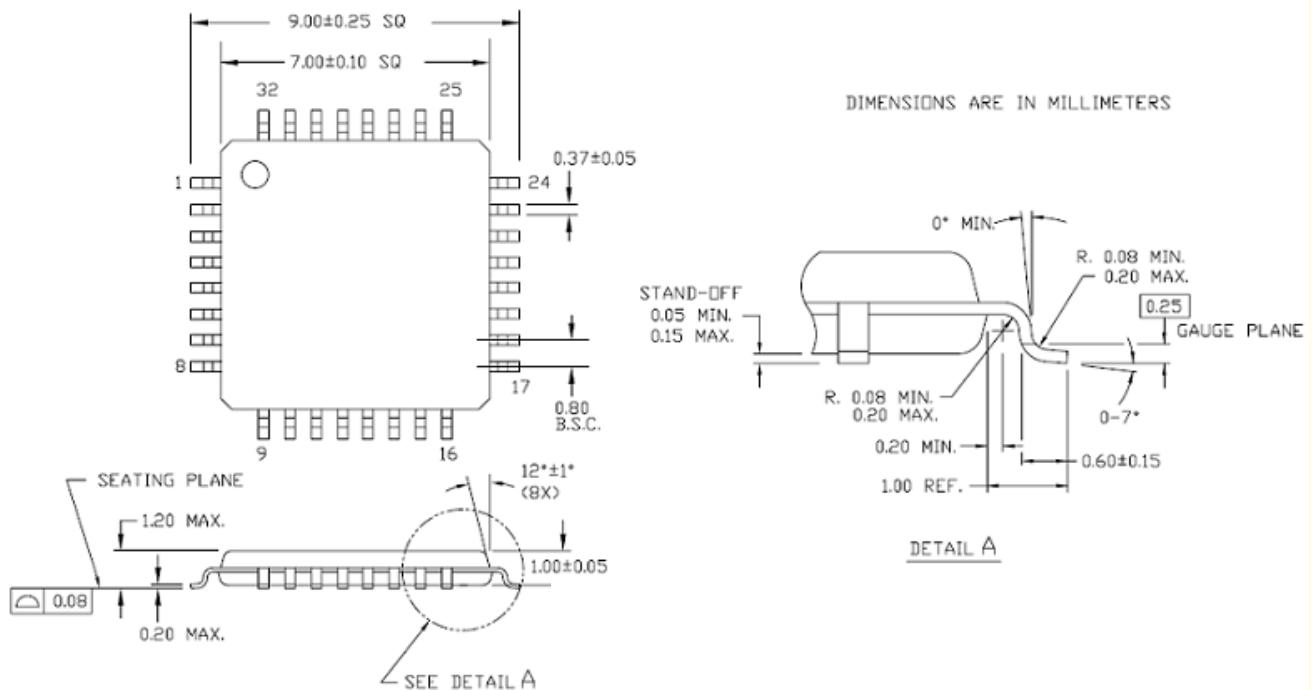
Part Number	Package Type	Production Flow
CY29946AXC	32-pin TQFP	Commercial, 0 °C to +70 °C
CY29946AXCT	32-pin TQFP – Tape and Reel	Commercial, 0 °C to +70 °C
CY29946AXI	32-pin TQFP	Industrial, -40 °C to +85 °C
CY29946AXIT	32-pin TQFP – Tape and Reel	Industrial, -40 °C to +85 °C

Ordering Code Definitions



Package Drawing and Dimensions

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



51-85063 °C

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	kilo Volts
MHz	Mega Hertz
µA	micro Amperes
mA	milli Amperes
mm	milli meter
mV	milli Volts
ns	nano seconds
Ω	ohms
%	percent
pF	pico Farad
ps	pico seconds
V	Volts
W	Watts

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.	Issue Date	Orig. of Change	Description of Change
**	111097	02/07/02	BRK	New data sheet
*A	116780	08/15/02	HWT	Added the commercial temperature range in the Ordering Information
*B	122878	12/22/02	RBI	Added power-up requirements to Maximum Ratings
*C	130007	10/15/03	RGL	Fixed the block diagram. Fixed the MK/OE# description in the pin description table.
*D	131375	11/21/03	RGL	Updated document history page (revision *C) to reflect changes that were not listed.
*E	221587	See ECN	RGL	Minor Change: Moved up the word Block Diagram in the first page.
*F	2899714	03/26/10	BRIJ/CXQ	Removed inactive parts from the ordering table. Updated package diagram
*G	3254185	05/11/2011	CXQ	Added Ordering Code Definitions . Added Acronyms and Units of Measure . Updated in new template.

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