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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-/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

## Functional Description

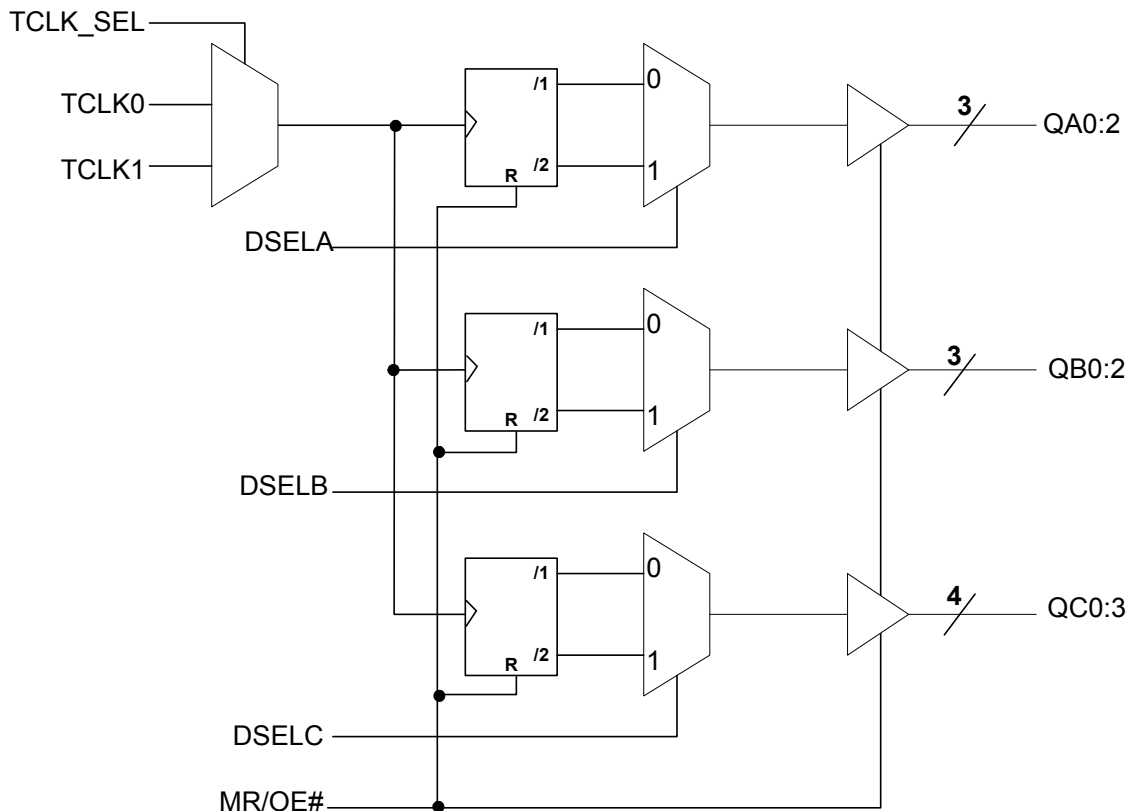
The CY29946 is a low-voltage 200-MHz clock distribution buffer with the capability to select one of two LVCMOS/LVTTTL compatible input clocks. These clock sources can be used to provide for test clocks as well as the primary system clocks. All other control inputs are LVCMOS/LVTTTL compatible. The 10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

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

## Block Diagram





### Absolute Maximum Conditions<sup>[2]</sup>

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

$V_{DD} = V_{DCC} = 3.3$  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 <sup>[3]</sup>		-	-	-100	µA
$I_{IH}$	Input High Current <sup>[3]</sup>		-	-	100	µA
$V_{OL}$	Output Low Voltage <sup>[4]</sup>	$I_{OL} = 20$ mA	-	-	0.4	V
$V_{OH}$	Output High Voltage <sup>[4]</sup>	$I_{OH} = -20$ 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, $C_L = 30$ pF	-	130	-	mA
		$V_{DD} = 3.3$ V, Outputs @ 160 MHz, $C_L = 30$ pF	-	225	-	
		$V_{DD} = 2.5$ V, Outputs @ 100 MHz, $C_L = 30$ pF	-	95	-	
		$V_{DD} = 2.5$ V, Outputs @ 160 MHz, $C_L = 30$ 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

### Thermal Resistance

Parameter <sup>[5]</sup>	Description	Test Conditions	32-pin TQFP	Unit
$\theta_{JA}$	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
$\theta_{JC}$	Thermal resistance (junction to case)		12	°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 50 Ω (or 50 Ω 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<sup>[6]</sup>

Parameter	Description	Conditions	Min	Typ	Max	Unit
$F_{\text{max}}$	Input Frequency <sup>[7]</sup>	$V_{DD} = 3.3\text{ V}$	–	–	200	MHz
		$V_{DD} = 2.5\text{ V}$	–	–	170	
$T_{\text{pd}}$	TTL_CLK To Q Delay <sup>[7]</sup>		5.0	–	11.5	ns
$F_{\text{outDC}}$	Output Duty Cycle <sup>[7, 8]</sup>	Measured at $V_{DD}/2$	45	–	55	%
$t_{\text{pZL}}, t_{\text{pZH}}$	Output enable time (all outputs)		2	–	10	ns
$t_{\text{pLZ}}, t_{\text{pHZ}}$	Output disable time (all outputs)		2	–	10	ns
$T_{\text{skew}}$	Output-to-Output Skew <sup>[7, 9]</sup>		–	150	250	ps
$T_{\text{skew(pp)}}$	Part-to-Part Skew <sup>[10]</sup>		–	2.0	4.5	ns
$T_{\text{r}}/T_{\text{f}}$	Output Clocks Rise/Fall Time <sup>[9]</sup>	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  $50\Omega$  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  $V_{CC} = 2.5\text{ V}$

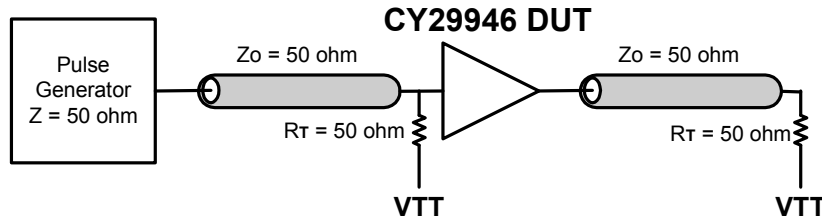


Figure 2. LVCMOS Propagation Delay ( $T_{PD}$ ) Test Reference

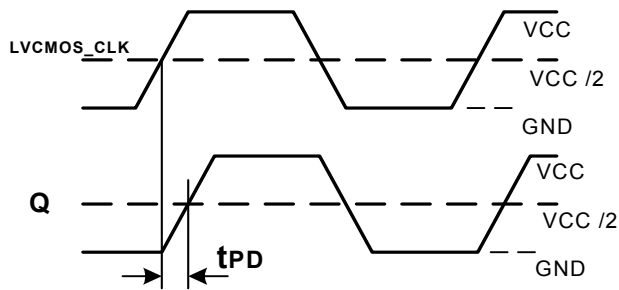


Figure 3. Output Duty Cycle ( $F_{outDC}$ )

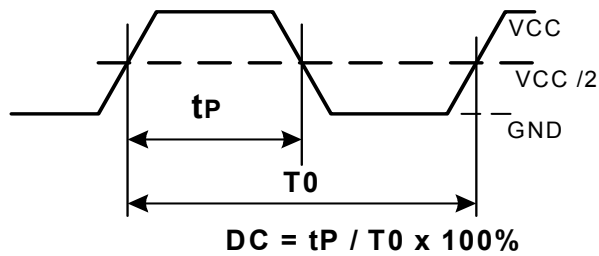
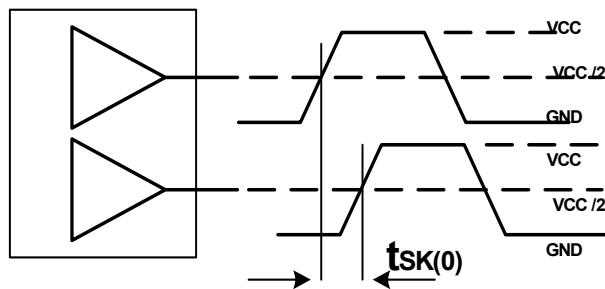


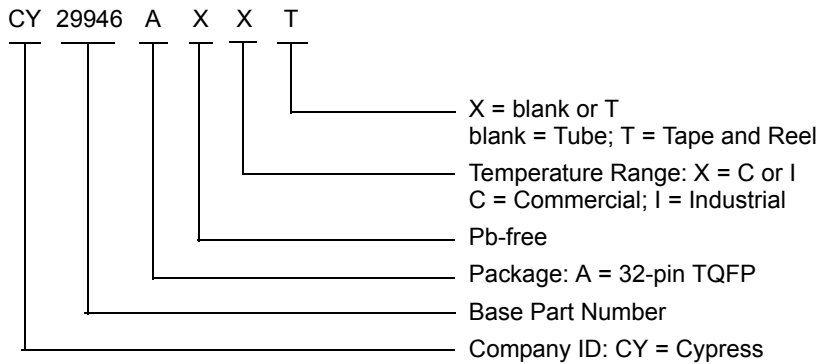
Figure 4. Output-to-Output Skew  $t_{sk(0)}$



### Ordering Information

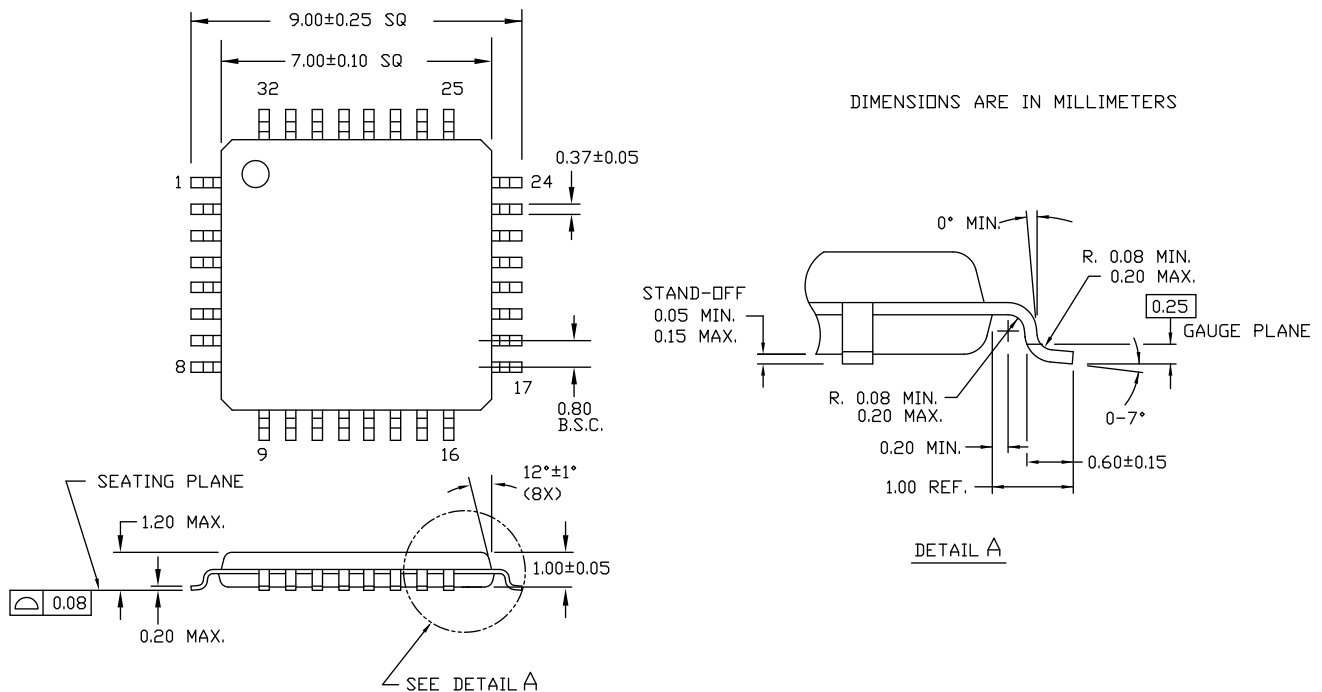
Part Number	Package Type	Production Flow
CY29946AXC	32-pin TQFP	Commercial, 0 °C to +70 °C
CY29946AXCT	32-pin TQFP – Tape and Reel	Commercial, 0 °C to +70 °C
CY29946AXI	32-pin TQFP	Industrial, –40 °C to +85 °C
CY29946AXIT	32-pin TQFP – Tape and Reel	Industrial, –40 °C to +85 °C

### Ordering Code Definitions



### Package Drawing and Dimensions

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



51-85063 \*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.	Orig. of Change	Issue Date	Description of Change
**	111097	BRK	02/07/02	New data sheet.
*A	116780	HWT	08/15/02	Added the commercial temperature range in the Ordering Information
*B	122878	RBI	12/22/02	Added power-up requirements to Maximum Ratings
*C	130007	RGL	10/15/03	Fixed the block diagram. Fixed the MK/OE# description in the pin description table.
*D	131375	RGL	11/21/03	Updated document history page (revision *C) to reflect changes that were not listed.
*E	221587	RGL	See ECN	Minor Change: Moved up the word Block Diagram in the first page.
*F	2899714	BRIJ / CXQ	03/26/10	Updated <a href="#">Ordering Information</a> : Updated part numbers. Updated <a href="#">Package Drawing and Dimensions</a> .
*G	3254185	CXQ	05/11/2011	Added <a href="#">Ordering Code Definitions</a> . Added <a href="#">Acronyms and Units of Measure</a> . Updated to new template.
*H	4389717	XHT	05/30/2014	Updated <a href="#">Package Drawing and Dimensions</a> : spec 51-85063 – Changed revision from *C to *D. Completing Sunset Review.
*I	4586288	XHT	12/03/2014	Updated <a href="#">Functional Description</a> : Added “For a complete list of related documentation, <a href="#">click here</a> .” at the end.
*J	5270507	PSR	05/13/2016	Added <a href="#">Thermal Resistance</a> . Updated <a href="#">Package Drawing and Dimensions</a> : spec 51-85063 – Changed revision from *D to *E. Updated to new template.
*K	5754145	XHT	05/29/2017	Updated to new template. Completing Sunset Review.

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