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Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



**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

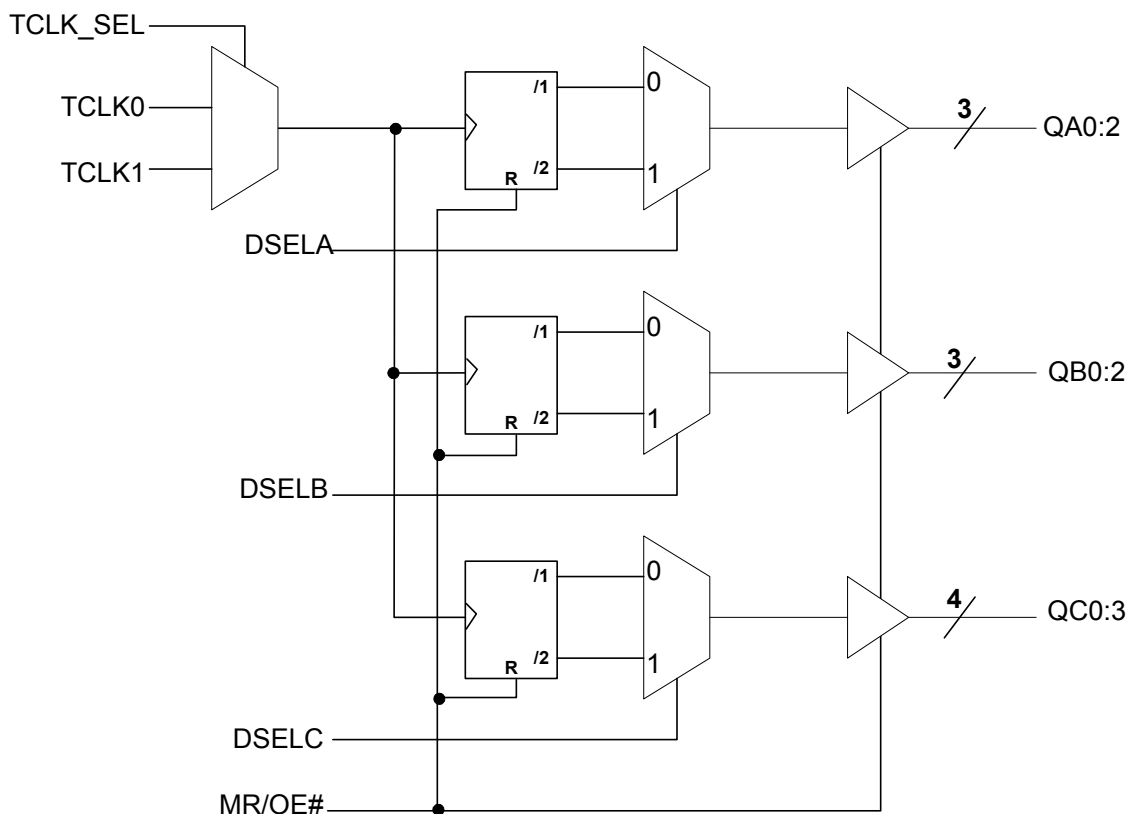
The CY29946 is a low-voltage 200-MHz clock distribution buffer with the capability to select one of two LVCMOS/LVTTTL compatible input clocks. These clock sources can be used to provide for test clocks as well as the primary system clocks. All other control inputs are LVCMOS/LVTTTL compatible. The 10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

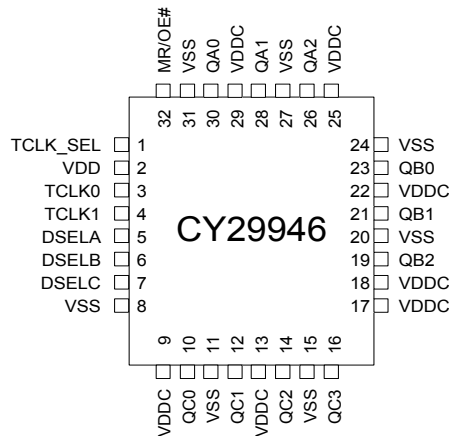
The CY29946 outputs can also be three-stated via MR/OE# input. When MR/OE# is set HIGH, it resets the internal flip-flops and three-states the outputs.

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

Block Diagram



Pin Configuration



Pin Description

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

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 ± 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]		–	–	100	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	–	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

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

- 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^[6]

Parameter	Description	Conditions	Min	Typ	Max	Unit
F _{max}	Input Frequency ^[7]	V _{DD} = 3.3 V	–	–	200	MHz
		V _{DD} = 2.5 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 _{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 V	0.10	–	1.0	ns
		0.6 V to 1.8 V, V _{DD} = 2.5 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 $V_{CC} = 2.5\text{ V}$

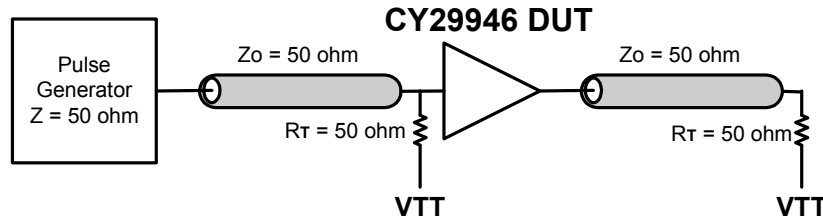


Figure 2. LVCMOS Propagation Delay (T_{PD}) Test Reference

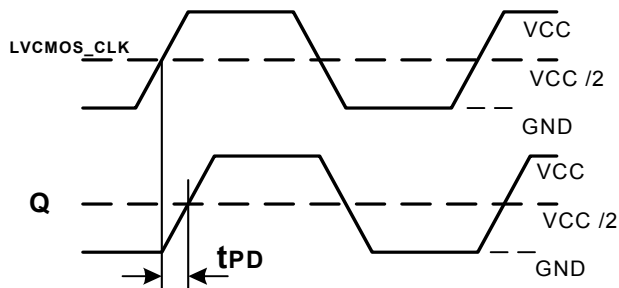


Figure 3. Output Duty Cycle (F_{outDC})

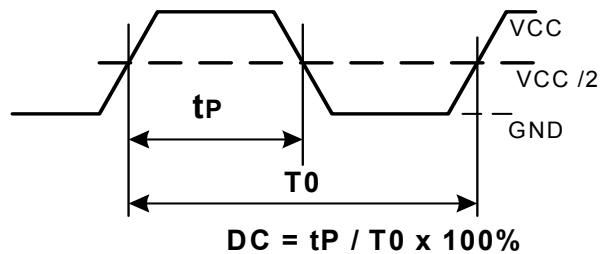
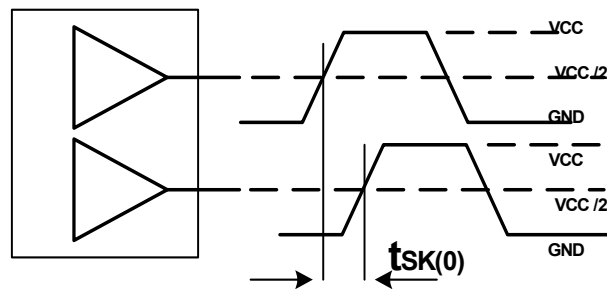


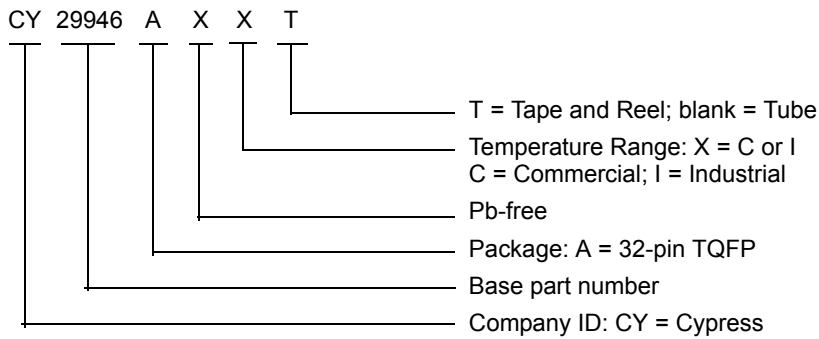
Figure 4. Output-to-Output Skew $t_{sk(0)}$



Ordering Information

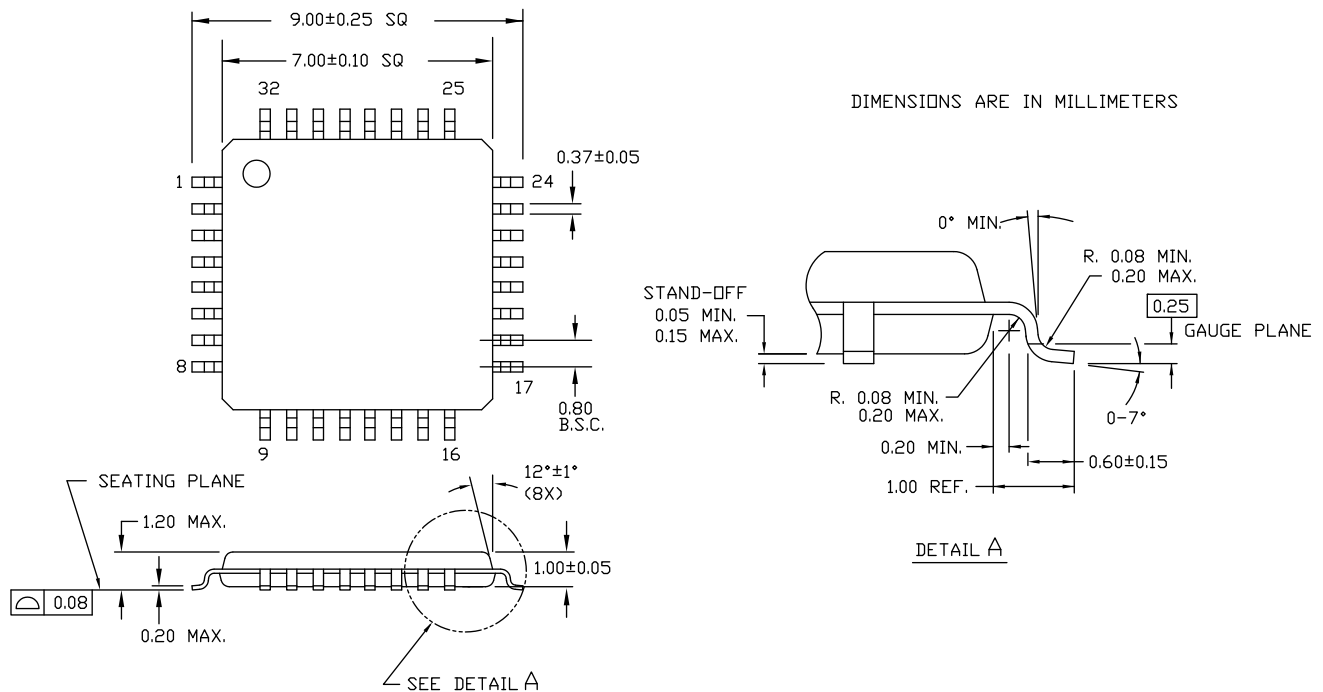
Part Number	Package Type	Production Flow
CY29946AXC	32-pin TQFP	Commercial, 0 °C to +70 °C
CY29946AXCT	32-pin TQFP – Tape and Reel	Commercial, 0 °C to +70 °C
CY29946AXI	32-pin TQFP	Industrial, -40 °C to +85 °C
CY29946AXIT	32-pin TQFP – Tape and Reel	Industrial, -40 °C to +85 °C

Ordering Code Definitions



Package Drawing and Dimensions

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



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.	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 to new template.
*H	4389717	05/30/2014	XHT	Updated Package Drawing and Dimensions : spec 51-85063 – Changed revision from *C to *D. Completing Sunset Review.
*I	4586288	12/03/2014	XHT	Updated Functional Description : Added “For a complete list of related documentation, click here .” at the end.
*J	5270507	05/13/2016	PSR	Added Thermal Resistance . Updated Package Drawing and Dimensions : spec 51-85063 – Changed revision from *D to *E. Updated to new template.

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