

2.5 V or 3.3 V, 200 MHz, 1:18 Clock Distribution Buffer

Features

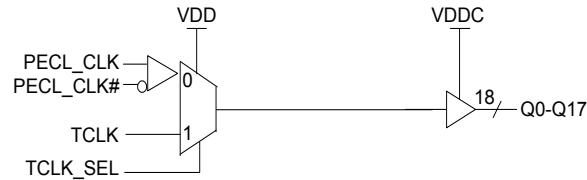
- 200 MHz clock support
- LVPECL or LVCMOS/LVTTL clock input
- LVCMOS/LVTTL compatible inputs
- 18 clock outputs: drive up to 36 clock lines
- 60 ps typical output-to-output skew
- Dual or single supply operation:
 - 3.3 V core and 3.3 V outputs
 - 3.3 V core and 2.5 V outputs
 - 2.5 V core and 2.5 V outputs
- Pin compatible with MPC940L, MPC9109
- Available in Commercial and Industrial temperature
- 32-pin TQFP package

Functional Description

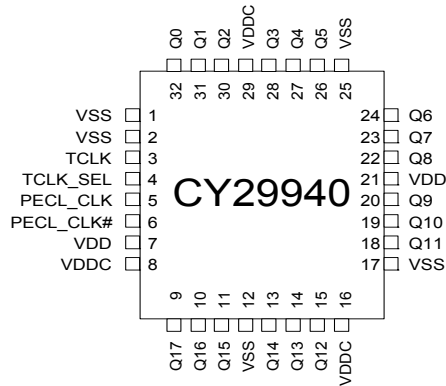
The CY29940 is a low-voltage 200 MHz clock distribution buffer with the capability to select either a differential LVPECL or a LVCMOS/LVTTL compatible input clock. The two clock sources can be used to provide for a test clock as well as the primary system clock. All other control inputs are LVCMOS/LVTTL compatible. The eighteen outputs are 2.5 V or 3.3 V LVCMOS/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 1:36. Low output-to-output skews make the CY29940 an ideal clock distribution buffer for nested clock trees in the most demanding of synchronous systems.

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

Block Diagram



Pin Configuration



Pin Description

Pin	Name	PWR	I/O [1]	Description
5	PECL_CLK		I, PU	PECL input clock
6	PECL_CLK#		I, PD	PECL input clock
3	TCLK		I, PD	External reference/test clock input
9, 10, 11, 13, 14, 15, 18, 19, 20, 22, 23, 24, 26, 27, 28, 30, 31, 32	Q(17:0)	VDDC	O	Clock outputs
4	TCLK_SEL		I, PD	Clock Select Input. When LOW, PECL clock is selected and when HIGH TCLK is selected.
8, 16, 29	VDDC			3.3 V or 2.5 V power supply for output clock buffers
7, 21	VDD			3.3 V or 2.5 V power supply
1, 2, 12, 17, 25	VSS			Common ground

Note

1. PD = Internal Pull-Down, PU = Internal Pull-up

Maximum Ratings

Exceeding the maximum ratings^[2] may impair 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

$V_{DD} = 3.3$ V ± 5% or 2.5 V ± 5%, $V_{DDC} = 3.3$ V ± 5% or 2.5 V ± 5%, $T_A = -40$ °C to +85 °C

Parameter ^[2]	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]		–	–	-200	µA
I_{IH}	Input high current ^[3]		–	–	200	µA
V_{PP}	Peak-to-peak input voltage PECL_CLK		500	–	1000	mV
V_{CMR}	Common mode range ^[4] PECL_CLK	$V_{DD} = 3.3$ V	$V_{DD} - 1.4$	–	$V_{DD} - 0.6$	V
		$V_{DD} = 2.5$ V	$V_{DD} - 1.0$	–	$V_{DD} - 0.6$	V
V_{OL}	Output low voltage ^[5, 6, 7]	$I_{OL} = 20$ mA	–	–	0.5	V
V_{OH}	Output high voltage ^[5, 6, 7]	$I_{OH} = -20$ mA, $V_{DDC} = 3.3$ V	2.4	–	–	V
		$I_{OH} = -20$ mA, $V_{DDC} = 2.5$ V	1.8	–	–	V
I_{DDQ}	Quiescent supply current		–	5	7	mA
I_{DD}	Dynamic supply current	$V_{DD} = 3.3$ V, Outputs at 150 MHz, $C_L = 15$ pF	–	285	–	mA
		$V_{DD} = 3.3$ V, Outputs at 200 MHz, $C_L = 15$ pF	–	335	–	
		$V_{DD} = 2.5$ V, Outputs at 150 MHz, $C_L = 15$ pF	–	200	–	
		$V_{DD} = 2.5$ V, Outputs at 200 MHz, $C_L = 15$ pF	–	240	–	
Z_{out}	Output impedance	$V_{DD} = 3.3$ V	8	12	16	Ω
		$V_{DD} = 2.5$ V	10	15	20	
C_{in}	Input capacitance		–	4	–	pF

Thermal Resistance

Parameter ^[8]	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.	67	°C/W
θ_{JC}	Thermal resistance (junction to case)		28	°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.
- The V_{CMR} is the difference from the most positive side of the differential input signal. Normal operation is obtained when the "High" input is within the V_{CMR} range and the input lies within the V_{PP} specification. Driving series or parallel terminated 50 Ω (or 50 Ω to $V_{DD}/2$) transmission lines
- Outputs driving 50 Ω transmission lines.
- See Figure 1 on page 5 and Figure 2 on page 5.
- 50% input duty cycle.
- These parameters are guaranteed by design and are not tested.

AC Parameters^[9]
 $V_{DD} = 3.3\text{ V} \pm 5\%$ or $2.5\text{ V} \pm 5\%$, $V_{DDC} = 3.3\text{ V} \pm 5\%$ or $2.5\text{ V} \pm 5\%$, $T_A = -40\text{ }^\circ\text{C}$ to $+85\text{ }^\circ\text{C}$

Parameter	Description	Conditions	Min	Typ	Max	Unit	
F_{max}	Input frequency		–	–	200	MHz	
t_{PD}	PECL_CLK to Q Delay ^[10, 11, 12] $\leq 150\text{ MHz}$	$V_{DD} = 3.3\text{ V}, 85\text{ }^\circ\text{C}$	t_{PHL}	2.0	–	3.2	ns
			t_{PLH}	2.1	–	3.4	
		$V_{DD} = 3.3\text{ V}, 70\text{ }^\circ\text{C}$	t_{PHL}	1.9	–	3.1	
			t_{PLH}	2.0	–	3.2	
		$V_{DD} = 2.5\text{ V}, 85\text{ }^\circ\text{C}$	t_{PHL}	2.5	–	5.2	
			t_{PLH}	2.6	–	5	
		$V_{DD} = 2.5\text{ V}, 70\text{ }^\circ\text{C}$	t_{PHL}	2.5	–	5	
			t_{PLH}	2.6	–	5	
t_{PD}	LVCMOS to Q Delay ^[10, 11, 12] $\leq 150\text{ MHz}$	$V_{DD} = 3.3\text{ V}, 85\text{ }^\circ\text{C}$	t_{PHL}	1.9	–	3	ns
			t_{PLH}	2.0	–	3.2	
		$V_{DD} = 3.3\text{ V}, 70\text{ }^\circ\text{C}$	t_{PHL}	1.8	–	2.9	
			t_{PLH}	1.8	–	3.1	
		$V_{DD} = 2.5\text{ V}, 85\text{ }^\circ\text{C}$	t_{PHL}	2.5	–	4	
			t_{PLH}	2.5	–	4	
		$V_{DD} = 2.5\text{ V}, 70\text{ }^\circ\text{C}$	t_{PHL}	2.3	–	3.8	
			t_{PLH}	2.3	–	3.8	
t_J	Total jitter	$V_{DD} = 3.3\text{ V @ }150\text{ MHz}$	–	–	10	ps	
F_{outDC}	Output duty cycle ^[10, 11, 13]	$F_{CLK} < 134\text{ MHz}$	–	–	55	%	
		$F_{CLK} > 134\text{ MHz}$	–	–	60		
T_{skew}	Output-to-output skew ^[10, 11]	$V_{DD} = 3.3\text{ V}$	–	60	150	ps	
		$V_{DD} = 2.5\text{ V}$	–	–	200		
$T_{skew(PP)}$	Part-to-part skew ^[14]	PECL, $V_{DDC} = 3.3\text{ V}$	–	–	1.4	ns	
		PECL, $V_{DDC} = 2.5\text{ V}$	–	–	2.2		
$T_{skew(PP)}$	Part-to-part skew ^[14]	TCLK, $V_{DDC} = 3.3\text{ V}$	–	–	1.2	ns	
		TCLK, $V_{DDC} = 2.5\text{ V}$	–	–	1.7		
$T_{skew(PP)}$	Part-to-part skew ^[15]	PECL_CLK	–	–	850	ps	
		TCLK	–	–	750		
t_R/t_F	Output clocks rise/fall time ^[10, 11]	0.7 V to 2.0 V, $V_{DDC} = 3.3\text{ V}$	0.3	–	1.1	ns	
		0.5 V to 1.8 V, $V_{DDC} = 2.5\text{ V}$	0.3	–	1.2		

Notes

9. Parameters are guaranteed by design and characterization. Not 100% tested in production. All parameters specified with loaded outputs.
10. Outputs driving $50\ \Omega$ transmission lines.
11. See [Figure 1 on page 5](#) and [Figure 2 on page 5](#).
12. Parameters tested @ 150 MHz.
13. 50% input duty cycle.
14. Across temperature and voltage ranges, includes output skew.
15. For a specific temperature and voltage, includes output skew.

Figure 1. LVCMOS_CLK CY29940 Test Reference for $V_{CC} = 3.3\text{ V}$ and $V_{CC} = 2.5\text{ V}$

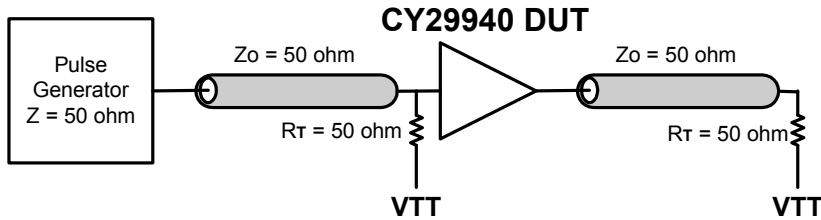


Figure 2. PECL_CLK CY29940 Test Reference for $V_{CC} = 3.3\text{ V}$ and $V_{CC} = 2.5\text{ V}$

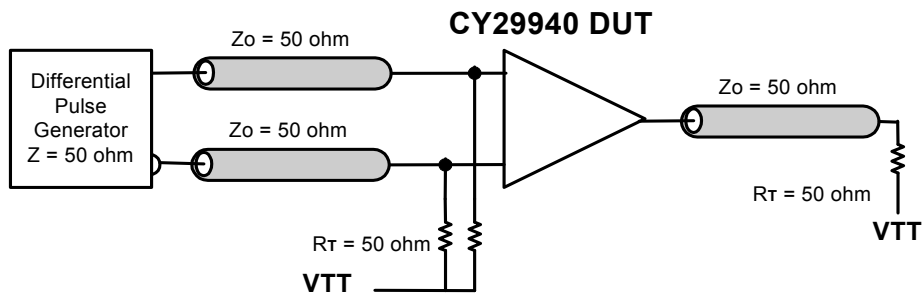


Figure 3. Propagation Delay (TPD) Test Reference

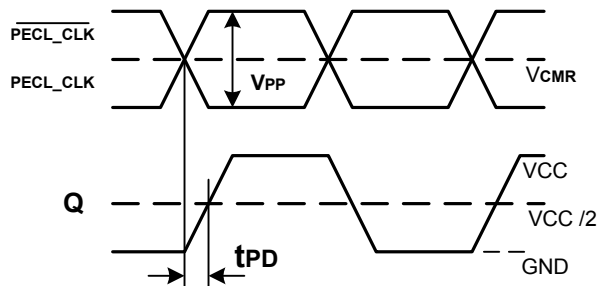


Figure 4. LVCMOS Propagation Delay (TPD) Test Reference

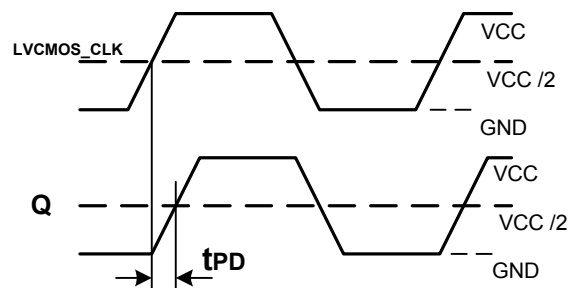


Figure 5. Output Duty Cycle (FoutDC)

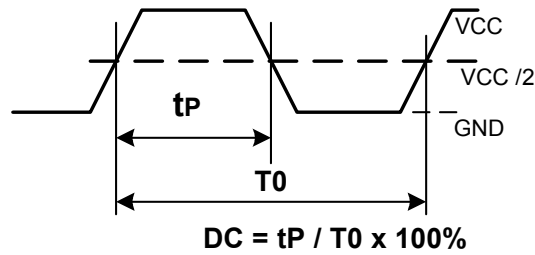
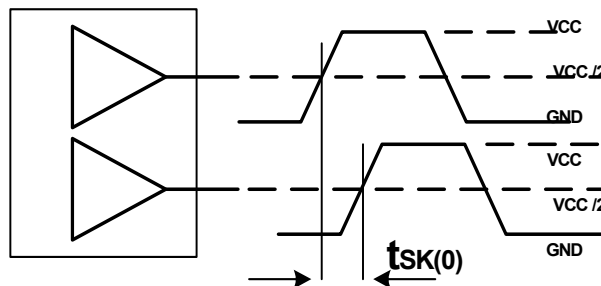


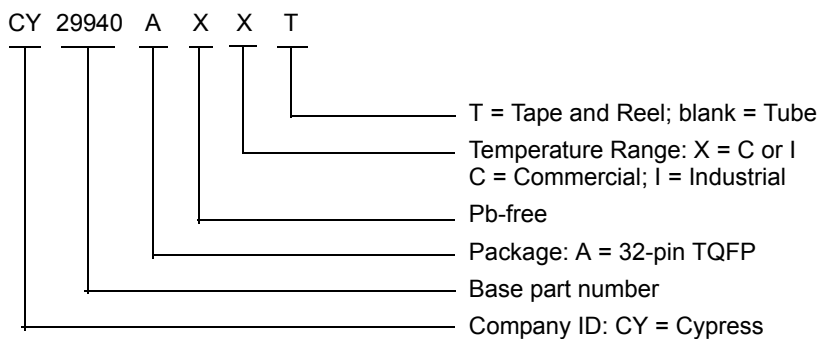
Figure 6. Output-to-Output Skew tsk(0)



Ordering Information

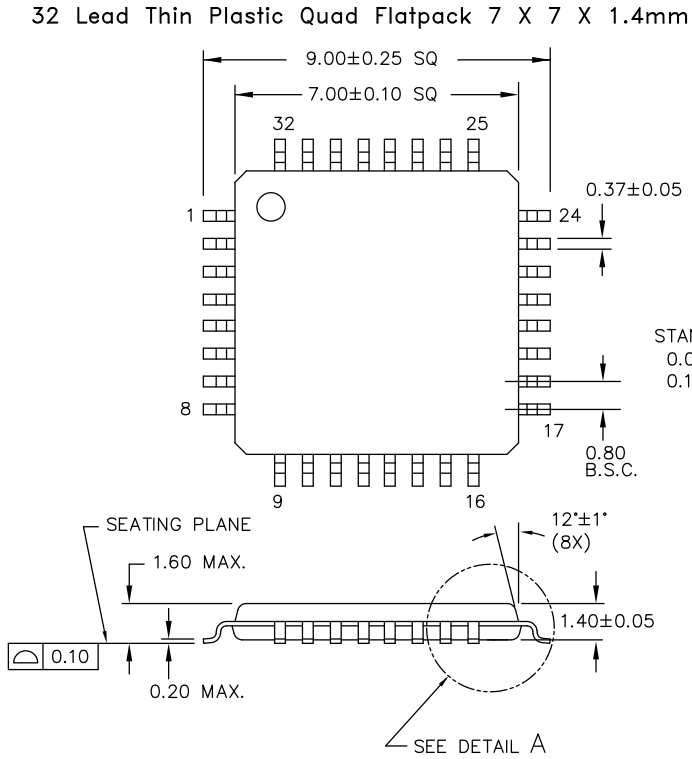
Part Number	Package Type	Production Flow
Pb-free		
CY29940AXI	32-pin TQFP	Industrial, -40 °C to +85 °C
CY29940AXIT	32-pin TQFP – Tape and Reel	Industrial, -40 °C to +85 °C
CY29940AXC	32-pin TQFP	Commercial, 0 °C to 70 °C
CY29940AXCT	32-pin TQFP – Tape and Reel	Commercial, 0 °C to 70 °C

Ordering Code Definitions

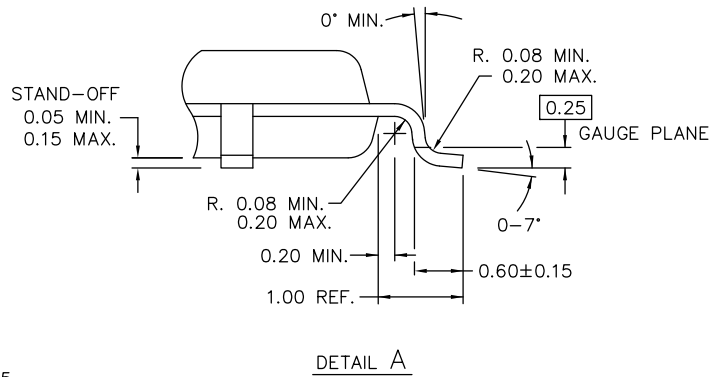


Package Drawing and Dimensions

Figure 7. 32-pin TQFP 7 × 7 × 1.4 mm A32.14



DIMENSIONS ARE IN MILLIMETERS
PKG WEIGHT: REFER TO PMDD SPEC



51-85088 *E

Acronyms

Acronym	Description
ESD	electrostatic discharge
I/O	input/output
TQFP	thin quad flat package
LVC MOS	low voltage complementary metal oxide semiconductor
LVPECL	low-voltage positive emitter-coupled logic
LVTTL	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: CY29940, 2.5 V or 3.3 V, 200 MHz, 1:18 Clock Distribution Buffer				
Document Number: 38-07283				
Rev.	ECN No.	Issue Date	Orig. of Change	Description of Change
**	111094	02/01/02	BRK	New data sheet
*A	116776	08/15/02	HWT	Incorporate results of final characterization using corporate methods, added output impedance on page 3 and added output duty cycle on page 4. Updated Ordering Information : Add commercial temperature range part numbers.
*B	122875	12/21/02	RBI	Add power up requirements to maximum rating information
*C	448379	See ECN	RGL	Add typical value for output-to-output skew Updated Ordering Information : Added Lead-free devices.
*D	2899304	03/25/10	BASH / KVM	Updated Ordering Information : Removed inactive parts. Updated Package Drawing and Dimensions .
*E	3254185	05/11/2011	CXQ	Added Ordering Code Definitions . Added Acronyms and Units of Measure . Updated to new template.
*F	3548252	03/12/2012	PURU	Changed LQFP to TQFP throughout document.
*G	4586288	12/03/2014	PURU	Updated Functional Description : Added "For a complete list of related documentation, click here ." at the end. Updated Package Drawing and Dimensions : Updated Figure 7 (spec 51-85088 – Changed revision from *D to *E).
*H	4787038	06/04/2015	TAVA	Updated to new template. Completing Sunset Review.
*I	5258862	05/04/2016	PSR	Added Thermal Resistance . Updated to new template. Completing Sunset Review.
*J	5973872	11/22/2017	AESATMP8	Updated logo and Copyright.

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