

# 1:4 Clock Fanout Buffer

## Features

- Low-voltage operation
- $V_{DD} = 3.3V$
- 1:4 fanout
- Single input configurable for LVDS, LVPECL, or LVTTTL
- Four differential pairs of LVPECL outputs
- Drives 50-ohm load
- Low input capacitance
- Less than 4 ns typical propagation delay
- 85 ps typical output-to-output skew
- Industrial versions available
- Available in TSSOP package

## Description

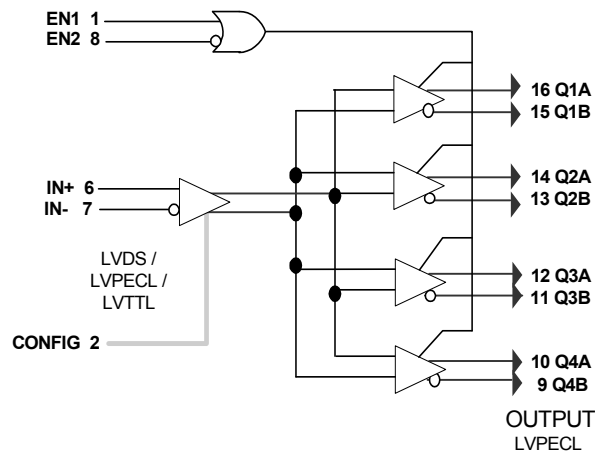
The Cypress CY2 series of network circuits are produced using advanced 0.35-micron CMOS technology, achieving the industry's fastest logic.

The Cypress CY2DP814 fanout buffer features a single LVDS- or a single LVPECL-compatible input and four LVPECL output pairs.

Designed for data communications clock management applications, the fanout from a single input reduces loading on the input clock.

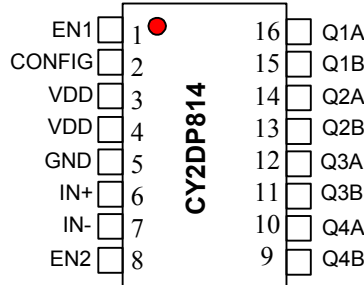
The CY2DP814 is ideal for both level translations from single-ended to LVPECL, and/or for the distribution of LVDS-based clock signals. The Cypress CY2DP814 has configurable input between logic families. The input can be selectable for an LVPECL, LVTTTL or LVDS signal, while the output drivers support LVPECL capable of driving 50-ohm lines.

## Logic Block Diagram



## Pin Configuration

Figure 1. 16-Pin TSSOP/SOIC



16 pin TSSOP / SOIC

## Pin Description

Pin Number	Pin Name	Pin Standard Interface	Description
6, 7	IN+, IN-	Configurable	<b>Differential input pair or single line.</b> LVPECL default. See CONFIG below.
2	CONFIG	LVTTL/LVCMOS	<b>Converts inputs</b> from the default LVPECL/LVDS (logic = 0) to LVTTL/LVCMOS (logic = 1). See <a href="#">Figure 6</a> and <a href="#">Figure 7</a> for additional information
1, 8	EN1, EN2	LVTTL/LVCMOS	<b>Enable/disable logic.</b> See Function Table below for details.
16, 15, 14, 13, 12, 11, 10, 9	Q1A, Q1B, Q2A, Q2B, Q3A, Q3B, Q4A, Q4B	LVPECL	<b>Differential outputs.</b>
3, 4	V <sub>DD</sub>	POWER	<b>Positive supply voltage.</b>
5	GND	POWER	<b>Ground.</b>

**Maximum Ratings**<sup>[1, 2]</sup>

Storage Temperature: ..... -65°C to +150°C  
 Ambient Temperature: ..... -40°C to +85°C  
 Supply Voltage to Ground Potential  
 (Inputs and V<sub>CC</sub> only) ..... -0.3V to 4.6V

Supply Voltage to Ground Potential

(Outputs only) ..... -0.3V to V<sub>DD</sub> + 0.3V  
 DC Input Voltage ..... -0.3V to V<sub>DD</sub> + 0.3V  
 DC Output Voltage ..... -0.3V to V<sub>DD</sub> + 0.9V  
 Power Dissipation ..... 0.75W

**Table 1. EN1 EN2 Function Table**

Enable Logic		Input		Outputs	
EN1	EN2	IN+	IN-	QnA	QnB
H	H	H	L	H	L
H	L	H	L	H	L
L	L	H	L	H	L
L	H	X	X	Z	Z

**Table 2. Input Receiver Configuration for Differential or LVTTTL/LVCMOS**

CONFIG Pin 2 Binary Value	Input Receiver Family	Input Receiver Type
1	LVTTTL in LVCMOS	Single ended, non-inverting, inverting, void of bias resistors.
0	LVDS	Low voltage differential signaling
	LVPECL	Low voltage pseudo (positive) emitter coupled logic

**Table 3. Function Control of the TTL Input Logic Used to Accept or Invert the Input Signal**

LVTTTL/LVCMOS INPUT LOGIC			
Input Condition	Input Logic	Output Logic Q pins	
Ground	IN- Pin 7		
	IN+ Pin 6	Input	True
V <sub>CC</sub>	IN- Pin 7		
	IN+ Pin 6	Input	Invert
Ground	IN+ Pin 6		
	IN- Pin 7	Input	Invert
V <sub>CC</sub>	IN+ Pin 6		
	IN- Pin 7	Input	True

**Table 4. Power Supply Characteristics**

Parameter	Description	Test Conditions	Min	Typ	Max	Unit
I <sub>CCD</sub>	Dynamic Power Supply Current	V <sub>DD</sub> = Max. Input toggling 50% Duty Cycle, Outputs Loaded		1.5	2.0	mA/MHz
I <sub>C</sub>	Total Power Supply Current	V <sub>DD</sub> = Max. Input toggling 50% Duty Cycle, Outputs Loaded, f <sub>L</sub> = 100 MHz		90	100	mA

**Table 5. DC Electrical Characteristics: 3.3V-LVDS Input**

Parameter	Description	Conditions	Min	Typ	Max	Unit
V <sub>ID</sub>	Magnitude of Differential Input Voltage		100		600	mV
V <sub>IC</sub>	Common-Mode of Differential Input Voltage  V <sub>ID</sub>   (min. and max.)		V <sub>ID</sub>   / 2	2.4– ( V <sub>ID</sub>   / 2)		V
I <sub>IH</sub>	Input High Current	V <sub>DD</sub> = Max. V <sub>IN</sub> = V <sub>DD</sub>		±10	±20	µA
I <sub>IL</sub>	Input Low Current	V <sub>DD</sub> = Max. V <sub>IN</sub> = V <sub>SS</sub>		±0	±20	µA
I <sub>I</sub>	Input High Current	V <sub>DD</sub> = Max., V <sub>IN</sub> = V <sub>DD</sub> (max.)			±20	µA

**Notes**

- Stresses greater than those listed under absolute maximum ratings may cause permanent damage to the device. This is intended to be a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operation sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
- 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.

**Table 6. DC Electrical Characteristics: 3.3V–LVPECL Input**

Parameter	Description	Condition		Min	Typ	Max	Unit
$ V_{ID} $	Differential Input Voltage p-p	Guaranteed Logic High Level		400		2600	mV
VCM	Common-mode Voltage			1650		2250	mV
$I_{IH}$	Input High Current	$V_{DD} = \text{Max.}$	$V_{IN} = V_{DD}$		$\pm 10$	$\pm 20$	$\mu\text{A}$
$I_{IL}$	Input Low Current	$V_{DD} = \text{Max.}$	$V_{IN} = V_{SS}$		$\pm 10$	$\pm 20$	$\mu\text{A}$
$I_I$	Input High Current	$V_{DD} = \text{Max.}, V_{IN} = V_{DD}(\text{max.})$				$\pm 20$	$\mu\text{A}$

**Table 7. DC Electrical Characteristics: 3.3V–LVTTTL/LVCMOS Input**

Parameter	Description	Condition		Min	Typ	Max	Unit
$V_{IH}$	Input High Voltage	Guaranteed Logic High Level		2			V
$V_{IL}$	Input Low Voltage	Guaranteed Logic Low Level				0.8	V
$I_{IH}$	Input High Current	$V_{DD} = \text{Max.}$	$V_{IN} = 2.7\text{V}$			1	$\mu\text{A}$
$I_{IL}$	Input Low Current	$V_{DD} = \text{Max.}$	$V_{IN} = 0.5\text{V}$			-1	$\mu\text{A}$
$I_I$	Input High Current	$V_{DD} = \text{Max.}, V_{IN} = V_{DD}(\text{max.})$				20	$\mu\text{A}$
$V_{IK}$	Clamp Diode Voltage	$V_{DD} = \text{Min.}, I_{IN} = -18\text{ mA}$			-0.7	-1.2	V
$V_H$	Input Hysteresis				80		mV

**Table 8. DC Electrical Characteristics: 3.3V–LVPECL Output**

Parameter	Description	Condition		Min	Typ	Max	Unit
$ V_{OD} $	Driver Differential Output Voltage p-p	$V_{DD} = \text{Min.}, V_{IN} = V_{IH} \text{ or } V_{IL}$	$RL = 50\text{ ohm}$	1000	-	3600	mV
$ V_{OC} $	Driver common-mode p-p	$V_{DD} = \text{Min.}, V_{IN} = V_{IH} \text{ or } V_{IL}$	$RL = 50\text{ ohm}$	-	-	226	mV
Rise Time	Differential 20% to 80%	CL-10 pF RL and CL to GND	$RL = 50\text{ ohm}$	300		800	ps
Fall Time							
$V_{OH}$	Output High Voltage	$V_{DD} = \text{Min.}, V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OH} = -12\text{ mA}$	2.1	-	3.0	V
$V_{OL}$	Output Low Voltage	User-defined (see Figure 1)		-	-		V
$I_{OS}$	Short Circuit Current	$V_{DD} = \text{Max.}, V_{OUT} = G_{ND}$		-125	-	-150	mA

**Table 9. AC Switching Characteristics @ 3.3V  $V_{DD} = 3.3\text{V} \pm 5\%$ , Temperature =  $-40^\circ\text{C}$  to  $+85^\circ\text{C}$** 

Parameter	Description	Conditions	Min	Typ	Max	Unit
<b>IN [+,-] to Q[A,B] Data &amp; Clock Speed</b>						
$t_{PLH}$	Propagation Delay—Low to High	$V_{OD} = 100\text{ mV}$	3	4	5	ns
$t_{PHL}$	Propagation Delay—High to Low		3	4	5	ns
$t_{PD}$	Propagation Delay		3	4	5	ns
<b>EN [1,2] to Q[A,B] Control Speed</b>						
$t_{PE}$	Enable (EN) to functional operation		-	-	6	ns
Tpd	Functional operation to Disable		-	-	5	ns
$t_{SK(0)}$	Output Skew: Skew between outputs of the same package (in phase)		-	0.085	0.2	ns
$t_{SK(p)}$	Pulse Skew: Skew between opposite transitions of the same output ( $t_{PHL} - t_{PLH}$ )		-	0.2	-	ns
$t_{SK(t)}$	Package Skew: Skew between outputs of different packages at the same power supply voltage, temperature and package type. Same input signal level and output load.	$V_{ID} = 100\text{ mV}$	-	-	1	ns

Figure 2. Differential PECL Output

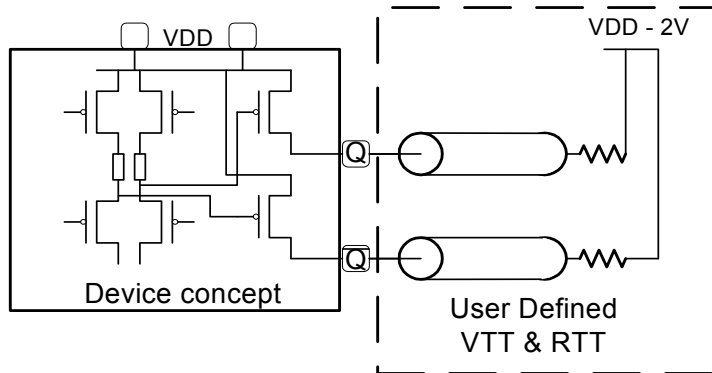
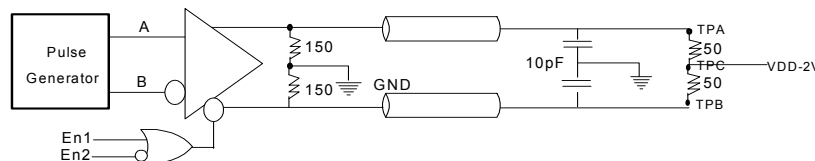


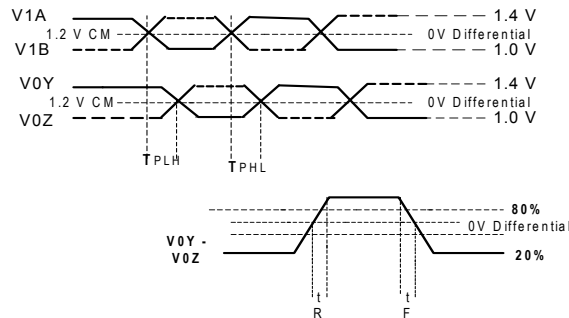
Table 10. High-frequency Parametrics

Parameter	Description	Conditions	Min	Typ	Max	Unit
Fmax	Maximum Frequency $V_{DD} = 3.3V$	50% Duty Cycle $tW(50-50)$ Standard Load Circuit			450	MHz
Fmax(20)	Maximum Frequency $V_{DD} = 3.3V$	20% Duty Cycle $tW(20-80)$ LVPECL Input $V_{in} = V_{IH}(Max.)/V_{IL}(Min.)$ $V_{out} = V_{OH}(Min.)/V_{OL}(Max.)$ (Limit)			175	MHz
TW	Minimum Pulse $V_{DD} = 3.3V$	LVPECL Input $V_{in} = V_{IH}(Max.)/V_{IL}(Min.)$ F = 100 MHz $V_{out} = V_{OH}(Min.)/V_{OL}(Max.)$ (Limit)	900			ps

Figure 3. Differential Receiver to Driver Propagation Delay and Driver Transition Time<sup>[3, 4, 5, 6, 7]</sup>



Standard Termination



Notes

3.  $R_L = 50 \text{ ohm} \pm 1\%$ ;  $Z_{line} = 50 \text{ ohm}$   $\theta = 0$ .
4.  $C_L$  includes instrumentation and fixture capacitance within 6 mm of the UT.
5. TPA and B are used for prop delay and rise/fall measurements.  $T_{PC}$  is used for  $V_{OC}$  measurements only and otherwise connected to  $V_{DD} - 2$ .
6. When measuring  $T_r/T_f$ ,  $t_{pd}$ ,  $V_{OD}$  point  $T_{PC}$  is held at  $V_{DD} - 2.0V$ .
7. LVCMOS/LVTTL single-ended input value. Ground either input: when on the B side, non-inversion takes place. If A side is grounded, the signal becomes the complement of the input on B side. See Table 3.

Figure 4. Test Circuit and Voltage Definitions for the Driver Common-mode Output Voltage<sup>[3, 4, 5, 7, 8]</sup>

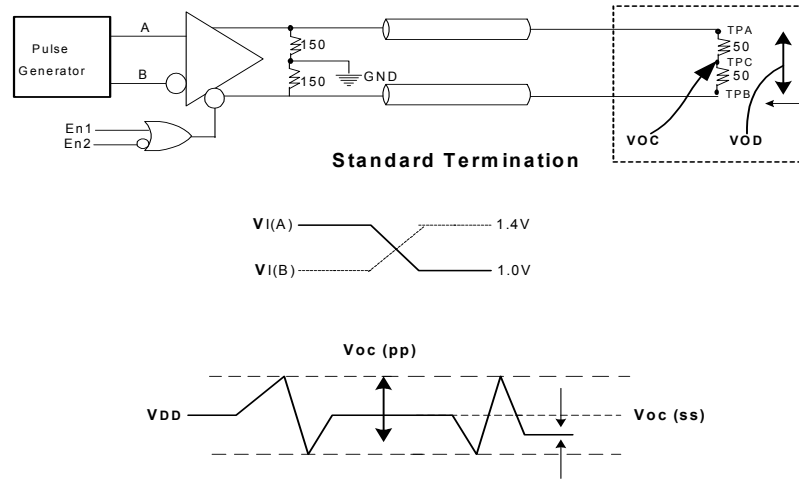


Figure 5. Test Circuit and Voltage Definitions for the Differential Output Signal<sup>[3, 4, 5, 6, 7]</sup>

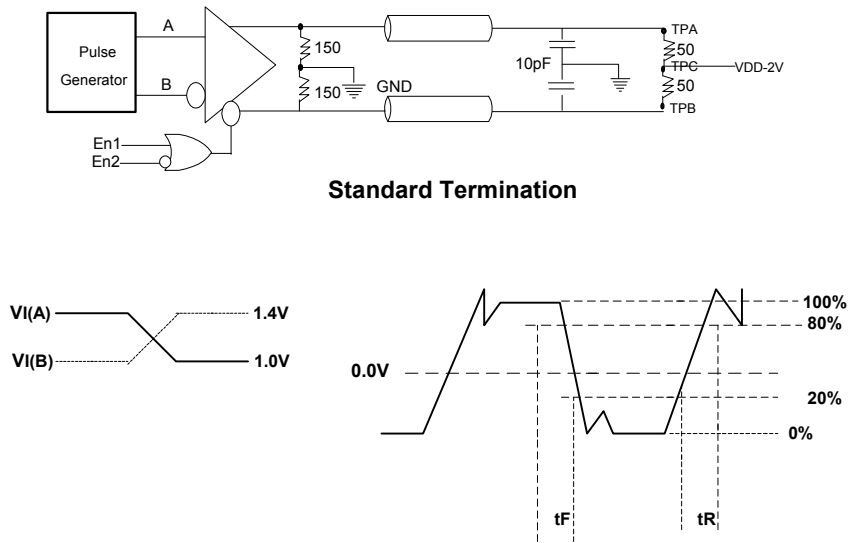


Figure 6. Test Circuit and Voltage Definitions for the Driver Common-Mode Output Voltage<sup>[3, 4, 5, 8, 9]</sup>

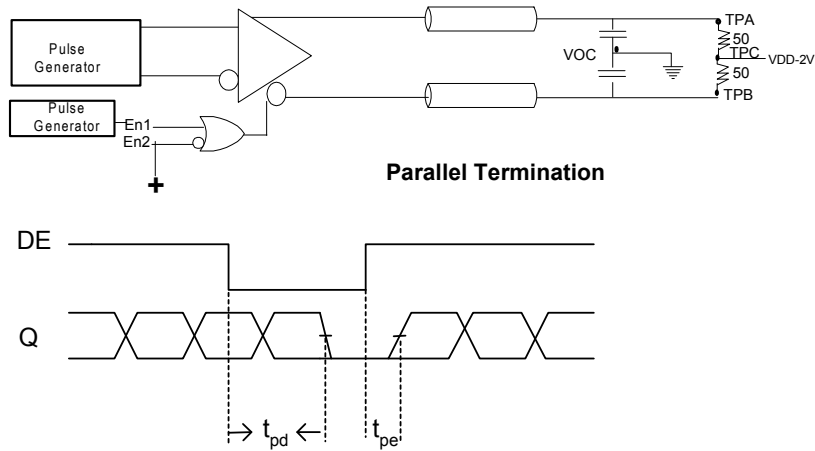


Figure 7. LVTTTL/LVCMOS

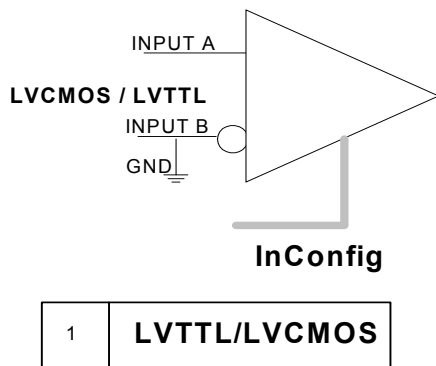
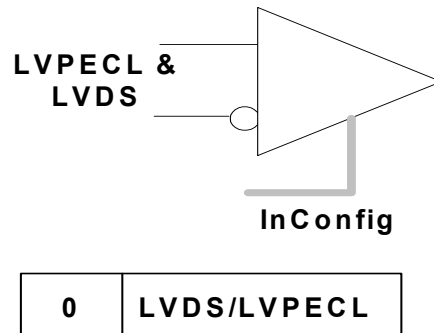


Figure 8. LVDS/LVPECL



## Ordering Information

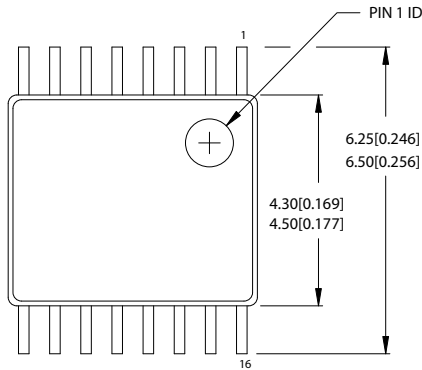
Part Number	Package Type	Product Flow
CY2DP814ZCT	16-pin TSSOP–Tape and Reel	Commercial, 0°C to 70 °C
<b>Pb free</b>		
CY2DP814ZXC	16-pin TSSOP	Commercial, 0°C to 70 °C
CY2DP814ZXCT	16-pin TSSOP–Tape and Reel	Commercial, 0°C to 70 °C
CY2DP814ZXI	16-pin TSSOP	Industrial, –40°C to 85 °C
CY2DP814ZXIT	16-pin TSSOP–Tape and Reel	Industrial, –40°C to 85 °C

### Notes

- $V_{OC}$  measurement requires equipment with a 3-dB bandwidth of at least 300 MHz.
- All input pulses are supplied by a frequency generator with the following characteristics:  $t_R$  and  $t_F \leq 1$  ns; pulse re-rate = 50 Mpps; pulse width =  $10 \pm 0.2$  ns.

## Package Drawing and Dimensions

Figure 9. 16-Pin TSSOP 4.40 mm Body Z16.173

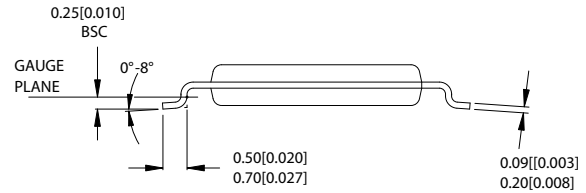
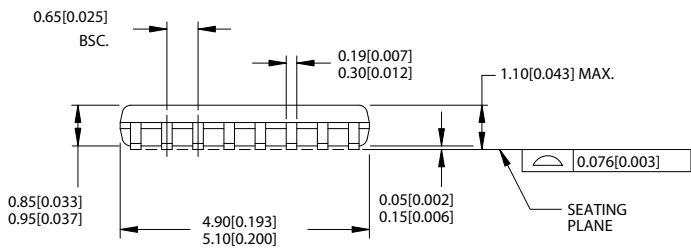


DIMENSIONS IN MM[INCHES] MIN.  
MAX.

REFERENCE JEDEC MO-153

PACKAGE WEIGHT 0.05 gms

PART #	
Z16.173	STANDARD PKG.
ZZ16.173	LEAD FREE PKG.



51-85091-\*A

**Note**

10. LVPECL or LVDS differential input value.



## Document History Page

Document Title: CY2DP814 1:4 Clock Fanout Buffer Document Number: 38-07060				
REV.	ECN No.	Submission Date	Orig. of Change	Description of Change
**	10785	06/07/01	IKA	Convert from IMI to Cypress
*A	115610	07/02/02	CTK	Range of VCM
*B	122746	12/15/02	RBI	Added power-up requirements to maximum ratings information.
*C	382376	See ECN	RGL	Added Lead-free device for TSSOP commercial Removed pruned parts Added typical values
*D	403374	See ECN	RGL	Added Lead-free for TSSOP Industrial
*E	2595534	10/23/08	CXQ	Removed CY2DP814ZC from the Ordering Information Updated template

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CAN 2.0b	<a href="http://psoc.cypress.com/can">psoc.cypress.com/can</a>
USB	<a href="http://psoc.cypress.com/usb">psoc.cypress.com/usb</a>

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