



CYPRESS

FastEdge™ Series  
CY2DP3110

# 1 of 2: 10 Differential Clock/Data Fanout Buffer

## Features

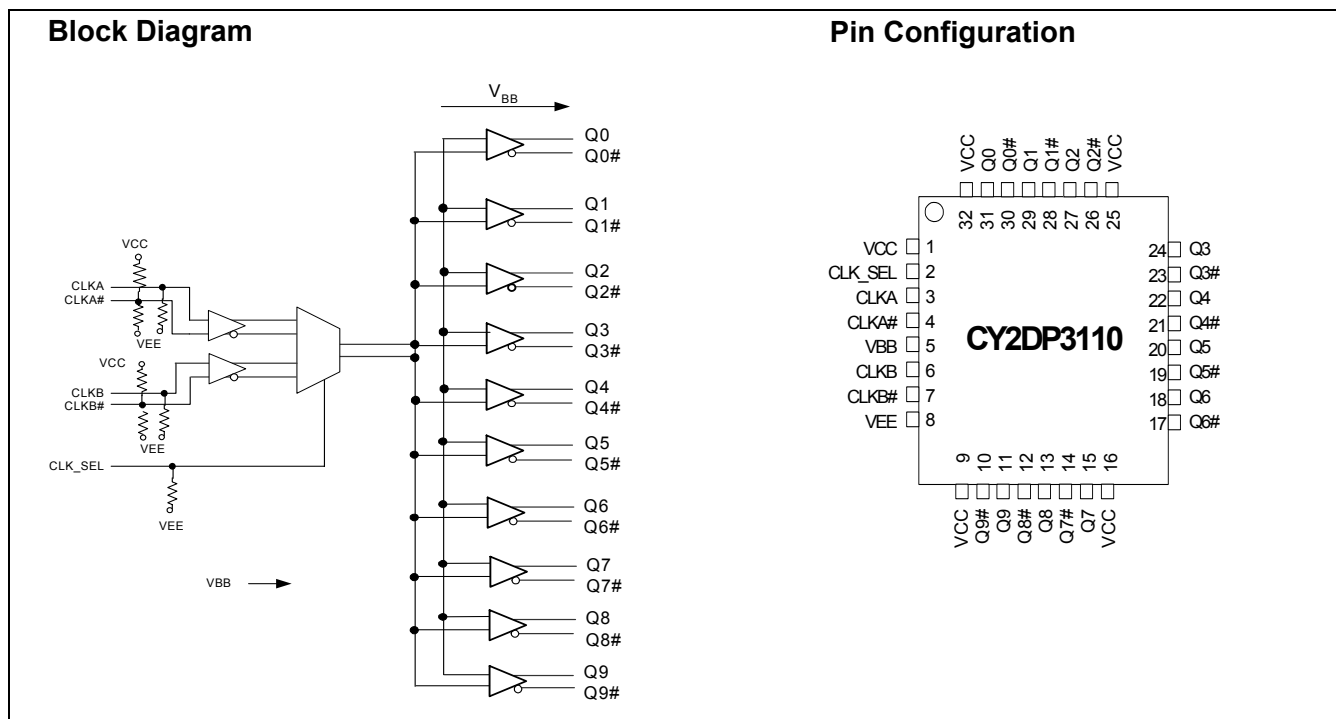
- Ten ECL/PECL differential outputs
- One ECL/PECL differential or single-ended inputs (CLKA)
- One HSTL differential or single-ended inputs (CLKB)
- Hot-swappable/-insertable
- 29 ps typical output-to-output skew
- 95 ps typical part-to-part skew
- 400 ps typical propagation delay
- 0.1 ps typical RMS phase jitter
- 1.5 GHz Operation (2.7 GHz maximum toggle frequency)
- PECL and HSTL mode supply range:  $V_{CC} = 2.5V \pm 5\%$  to  $3.3V \pm 5\%$  with  $V_{EE} = 0V$
- ECL mode supply range:  $V_{EE} = -2.5V \pm 5\%$  to  $-3.3V \pm 5\%$  with  $V_{CC} = 0V$
- Industrial temperature range:  $-40^{\circ}C$  to  $85^{\circ}C$
- 32-pin TQFP package
- Temperature compensation like 100K ECL
- Pin-compatible with MC100ES6111

## Functional Description

The CY2DP3110 is a low-skew, low propagation delay 2-to-10 differential fanout buffer targeted to meet the requirements of high-performance clock and data distribution applications. The device is implemented on SiGe technology and has a fully differential internal architecture that is optimized to achieve low signal skews at operating frequencies of up to 1.5 GHz.

The device features two differential input paths that are multiplexed internally. This mux is controlled by the CLK\_SEL pin. The CY2DP3110 may function not only as a differential clock buffer but also as a signal-level translator and fanout on HSTL single-ended signal to 10 ECL/PECL differential loads. An external bias pin, VBB, is provided for this purpose. In such an application, the VBB pin should be connected to either one of the CLKA# or CLKB# inputs and bypassed to ground via a 0.01- $\mu F$  capacitor. Traditionally, in ECL, it is used to provide the reference level to a receiving single-ended input that might have a different self-bias point.

Since the CY2DP3110 introduces negligible jitter to the timing budget, it is the ideal choice for distributing high frequency, high precision clocks across back-planes and boards in communication systems. Furthermore, advanced circuit design schemes, such as internal temperature compensation, ensure that the CY2DP3110 delivers consistent performance over various platforms



**Pin Definitions**<sup>[1, 2, 3]</sup>

Pin	Name	I/O	Type	Description
2	CLK_SEL	I,PD	ECL/PECL	<b>Input Clock Select.</b>
3	CLKA	I,PD <sup>[1]</sup>	ECL/PECL	<b>Differential Input Clocks.</b>
4	CLKA#	I,PD/PU	ECL/PECL	<b>Differential Input Clocks.</b>
5	VBB	O	Bias	<b>Reference Voltage Output.</b>
6	CLKB,	I,PD	HSTL	<b>Alternate Differential Input Clocks.</b>
7	CLKB#	I,PD/PU	HSTL	<b>Alternate Differential Input Clocks.</b>
8	VEE	-PWR	Power	<b>Negative Power Supply.</b>
1,9,16, 25,32	VCC	+PWR	Power	<b>Positive Power Supply.</b>
31,29,27,24,22,20,18, 15,13,11	Q(0:9)	O	ECL/PECL	<b>ECL/PECL Differential Output Clocks.</b>
30,28,26,23,21,19,17, 14,12,10	Q#(0:9)	O	ECL/PECL	<b>ECL/PECL Differential Output Clocks.</b>

**Table 1.**

Control	Operation
CLK_SEL	
0	CLKA, CLKA# input pair is active (Default condition with no connection to pin) CLKA can be driven with ECL- or PECL-compatible signals with respective power configurations
1	CLKB, CLKB# input pair is active. CLKB can be driven with HSTL compatible signals with respective power configurations

**Governing Agencies**

The following agencies provide specifications that apply to the CY2DP3110. The agency name and relevant specification is listed below in *Table 2*.

**Table 2.**

Agency Name	Specification
JEDEC	JESD 020B (MSL) JESD 8-6 (HSTL) JESD 51 (Theta JA) JESD 8-2 (ECL) JESD 65-B (skew,jitter)
Mil-Spec	883E Method 1012.1 (Thermal Theta JC)

**Notes:**

- In the I/O column, the following notation is used: I for Input, O for Output, PD for Pull-Down, PU for Pull-Up, and PWR for Power.
- In ECL mode (negative power supply mode),  $V_{EE}$  is either -3.3V or -2.5V and  $V_{CC}$  is connected to GND (0V). In PECL mode (positive power supply mode),  $V_{EE}$  is connected to GND (0V) and  $V_{CC}$  is either +3.3V or +2.5V. In both modes, the input and output levels are referenced to the most positive supply ( $V_{CC}$ ) and are between  $V_{CC}$  and  $V_{EE}$ .
- $V_{BB}$  is available for use for single-ended bias mode for |3.3V| supplies (not |2.5V|).

**Absolute Maximum Ratings**

Parameter	Description	Condition	Min.	Max.	Unit
V <sub>CC</sub>	Positive Supply Voltage	Non-Functional	-0.3	4.6	V
V <sub>EE</sub>	Negative Supply Voltage	Non-Functional	-4.6	0.3	V
T <sub>S</sub>	Temperature, Storage	Non-Functional	-65	+150	°C
T <sub>J</sub>	Temperature, Junction	Non-Functional		150	°C
ESD <sub>h</sub>	ESD Protection	Human Body Model		2000	V
M <sub>SL</sub>	Moisture Sensitivity Level			3	N.A.
Gate Count	Total Number of Used Gates	Assembled Die		50	gates

**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.

**Operating Conditions**

Parameter	Description	Condition	Min.	Max.	Unit
I <sub>BB</sub>	Output Reference Current	Relative to V <sub>BB</sub>		200	uA
LU <sub>I</sub>	Latch Up Immunity	Functional, typical		100	mA
T <sub>A</sub>	Temperature, Operating Ambient	Functional	-40	+85	°C
∅ <sub>Jc</sub>	Dissipation, Junction to Case	Functional		35 <sup>[4]</sup>	°C/W
∅ <sub>Ja</sub>	Dissipation, Junction to Ambient	Functional		76 <sup>[4]</sup>	°C/W
I <sub>EE</sub>	Maximum Quiescent Supply Current	V <sub>EE</sub> pin		130 <sup>[5]</sup>	mA
C <sub>IN</sub>	Input pin capacitance			3	pF
L <sub>IN</sub>	Pin Inductance			1	nH
V <sub>IN</sub>	Input Voltage	Relative to V <sub>CC</sub> <sup>[6]</sup>	-0.3	V <sub>CC</sub> + 0.3	V
V <sub>TT</sub>	Output Termination Voltage	Relative to V <sub>CC</sub> <sup>[6]</sup>		V <sub>CC</sub> - 2	V
V <sub>OUT</sub>	Output Voltage	Relative to V <sub>CC</sub> <sup>[6]</sup>	-0.3	V <sub>CC</sub> + 0.3	V
I <sub>IN</sub>	Input Current <sup>[7]</sup>	V <sub>IN</sub> = V <sub>IL</sub> , or V <sub>IN</sub> = V <sub>IH</sub>		150	uA

**PECL/HSTL DC Electrical Specifications**

Parameter	Description	Condition	Min.	Max.	Unit
V <sub>CC</sub>	Operating Voltage	2.5V ± 5%, V <sub>EE</sub> = 0.0V 3.3V ± 5%, V <sub>EE</sub> = 0.0V	2.375 3.135	2.625 3.465	V V
V <sub>CMR</sub>	PECL Input Differential Cross Point Voltage <sup>[8]</sup>	Differential operation	1.2	V <sub>CC</sub>	V
V <sub>X</sub>	HSTL Input Differential Crosspoint Voltage <sup>[9]</sup>	Standard Load Differential Operation	0.68	0.9	V
V <sub>OH</sub>	Output High Voltage	I <sub>OH</sub> = -30 mA <sup>[10]</sup>	V <sub>CC</sub> - 1.25	V <sub>CC</sub> - 0.7	V
V <sub>OL</sub>	Output Low Voltage V <sub>CC</sub> = 3.3V ± 5% V <sub>CC</sub> = 2.5V ± 5%	I <sub>OL</sub> = -5 mA <sup>[10]</sup>	V <sub>CC</sub> - 1.995 V <sub>CC</sub> - 1.995	V <sub>CC</sub> - 1.5 V <sub>CC</sub> - 1.3	V V
V <sub>IH</sub>	Input Voltage, High	Single-ended operation	V <sub>CC</sub> - 1.165	V <sub>CC</sub> - 0.880 <sup>[11]</sup>	V
V <sub>IL</sub>	Input Voltage, Low	Single-ended operation	V <sub>CC</sub> - 1.945 <sup>[11]</sup>	V <sub>CC</sub> - 1.625	V
V <sub>BB</sub> <sup>[3]</sup>	Output Reference Voltage	Relative to V <sub>CC</sub> <sup>[6]</sup>	V <sub>CC</sub> - 1.620	V <sub>CC</sub> - 1.220	V

**Notes:**

- Theta JA EIA JEDEC 51 test board conditions (typical value); Theta JC 883E Method 1012.1
- Power Calculation: V<sub>CC</sub> \* I<sub>EE</sub> + 0.5 (I<sub>OH</sub> + I<sub>OL</sub>) (V<sub>OH</sub> - V<sub>OL</sub>) (number of differential outputs used); I<sub>EE</sub> does not include current going off chip.
- where V<sub>CC</sub> is 3.3V±5% or 2.5V±5%.
- Inputs have internal pull-up/pull-down or biasing resistors which affect the input current.
- Refer to Figure 1.
- V<sub>X</sub>(AC) is the crosspoint of the differential HSTL input signal. Normal AC operation is obtained when the crosspoint is within the V<sub>X</sub>(AC) range and the input swing lies within the V<sub>DIF</sub>(AC) specification. Violation of V<sub>X</sub>(AC) or V<sub>DIF</sub>(AC) impacts the device propagation delay, device and part-to-part skew. Refer to Figure 2.
- Equivalent to a termination of 50Ω to V<sub>TT</sub>. I<sub>OHMIN</sub>=(V<sub>OHMIN</sub> - V<sub>TT</sub>)/50; I<sub>OHMAX</sub>=(V<sub>OHMAX</sub> - V<sub>TT</sub>)/50; I<sub>OLMIN</sub>=(V<sub>OLMIN</sub> - V<sub>TT</sub>)/50; I<sub>OLMAX</sub>=(V<sub>OLMAX</sub> - V<sub>TT</sub>)/50.
- V<sub>IL</sub> will operate down to V<sub>EE</sub>; V<sub>IH</sub> will operate up to V<sub>CC</sub>.

**ECL DC Electrical Specifications**

Parameter	Description	Condition	Min.	Max.	Unit
V <sub>EE</sub>	Negative Power Supply	-2.5V ± 5%, V <sub>CC</sub> = 0.0V -3.3V ± 5%, V <sub>CC</sub> = 0.0V	-2.625 -3.465	-2.375 -3.135	V
V <sub>CMR</sub>	ECL Input Differential Cross Point Voltage <sup>[8]</sup>	Differential operation	V <sub>EE</sub> + 1.2	0V	V
V <sub>OH</sub>	Output High Voltage	I <sub>OH</sub> = -30 mA <sup>[10]</sup>	-1.25	-0.7	V
V <sub>OL</sub>	Output Low Voltage V <sub>EE</sub> = -3.3V ± 5% V <sub>EE</sub> = -2.5V ± 5%	I <sub>OL</sub> = -5 mA <sup>[10]</sup>	-1.995 -1.995	-1.5 -1.3	V
V <sub>IH</sub>	Input Voltage, High	Single-ended operation	-1.165	-0.880 <sup>[11]</sup>	V
V <sub>IL</sub>	Input Voltage, Low	Single-ended operation	-1.945 <sup>[11]</sup>	-1.625	V
V <sub>BB</sub> <sup>[3]</sup>	Output Reference Voltage		-1.620	-1.220	V

**AC Electrical Specifications**

Parameter	Description	Condition	Min.	Typ.	Max.	Unit
V <sub>PP</sub>	PECL/ECL Differential Input Voltage <sup>[8]</sup>	Differential operation	0.1		1.3	V
V <sub>CMRO</sub>	Output Common Voltage Range (typ.)		V <sub>CC</sub> - 1.425			V
F <sub>CLK</sub>	Input Frequency	50% duty cycle Standard load	-		1.5	GHz
T <sub>PD</sub>	Propagation Delay CLKA or CLKB to Output pair <sup>[13]</sup>	PECL, ECL < 660 MHz HSTL < 1 GHz	280 280	400 400	650 750	ps ps
V <sub>DIF</sub>	HSTL Differential Input Voltage <sup>[12]</sup>	Duty Cycle Standard Load Differential Operation	0.4	-	1.9	V
V <sub>O</sub>	Output Voltage (peak-to-peak; see Figure 2)	< 1 GHz	0.375	-	-	V
tsk <sub>(O)</sub>	Output-to-output Skew	<660 MHz <sup>[13]</sup> , See Figure 3	-	29	50	ps
tsk <sub>(PP)</sub>	Part-to-Part Output Skew <sup>[13]</sup>		-	95	150	ps
t <sub>jit(per)</sub>	Output Period Jitter (peak) <sup>[14]</sup>	156.25 MHz <sup>[13]</sup>	-	7.2	15	ps
t <sub>jit(pn)</sub>	Output RMS Phase Jitter <sup>[13, 14]</sup> (See Figure 6)	156.25 MHz, 3.3V, broadband	-	0.165	-	ps
		156.25 MHz, 3.3V, filtered	-	0.151	-	ps
		312.5 MHz, 3.3V, broadband	-	0.141	-	ps
		312.5 MHz, 3.3V, filtered	-	0.107	-	ps
tsk <sub>(P)</sub>	Output Pulse Skew <sup>[15]</sup>	660 MHz <sup>[13]</sup> , See Figure 3	-	-	50	ps
T <sub>R</sub> , T <sub>F</sub>	Output Rise/Fall Time (see Figure 2)	50% duty cycle Differential 20% to 80%	0.08	-	0.3	ps

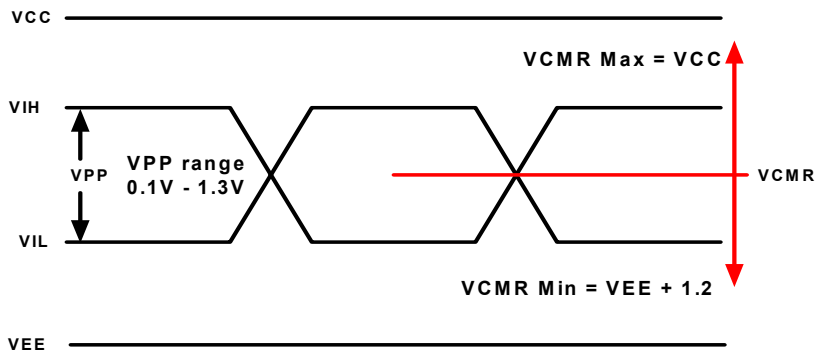
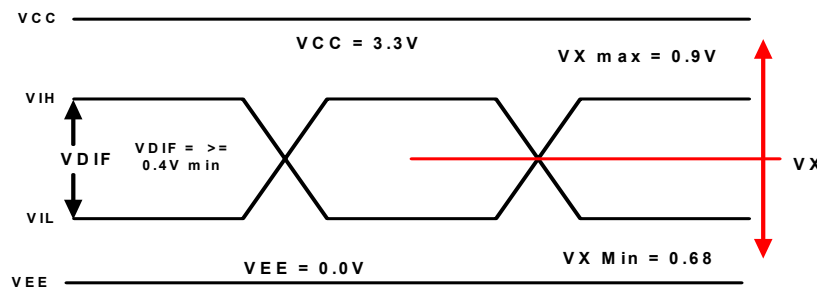
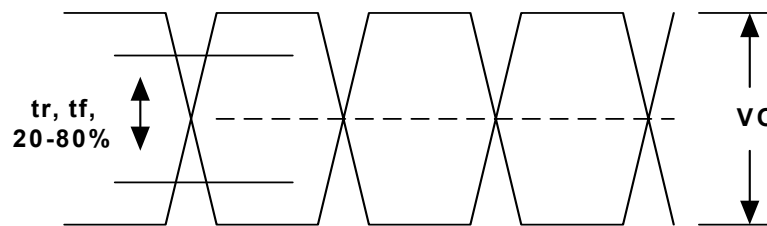
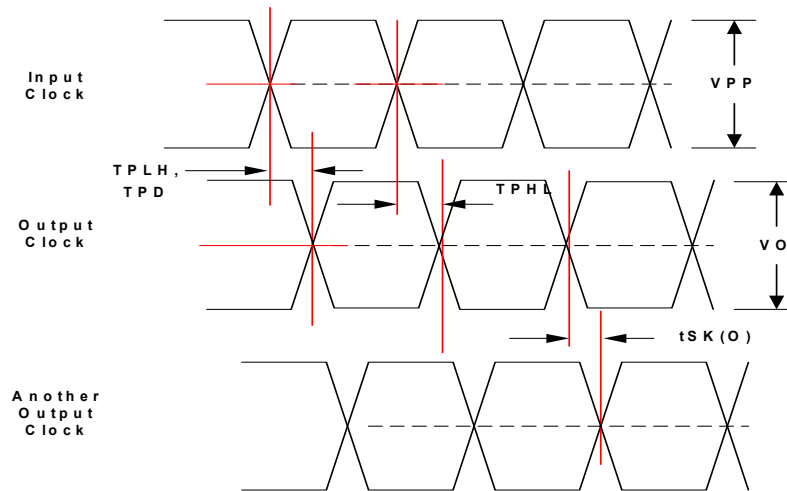
**Notes:**

12. V<sub>DIF</sub> (AC) is the minimum differential HSTL input voltage swing required to maintain AC characteristics including tkpd and device-to-device skew.

13. 50% duty cycle; standard load; differential operation.

14. Typical jitter measurements are taken at room temperature and nominal voltage. For further information regarding jitter, please refer to the Application note "Understanding Data sheet Jitter Specifications for Cypress Timing Products."

15. Output pulse skew is the absolute difference of the propagation delay times: | t<sub>PLH</sub> - t<sub>PHL</sub> |.

**Timing Definitions**

**Figure 1. PECL/ECL Input Waveform Definitions**

**Figure 2. HSTL Differential Input Waveform Definitions**

**Figure 3. ECL/LVPECL Output**

**Figure 4. Propagation Delay ( $T_{PD}$ ), output pulse skew ( $|t_{PLH}-t_{PHL}|$ ), and output-to-output skew ( $t_{SK(O)}$ ) for both CLKA or CLKB to Output Pair, PECL/ECL to PECL/ECL**

### Test Configuration

Standard test load using a differential pulse generator and differential measurement instrument.

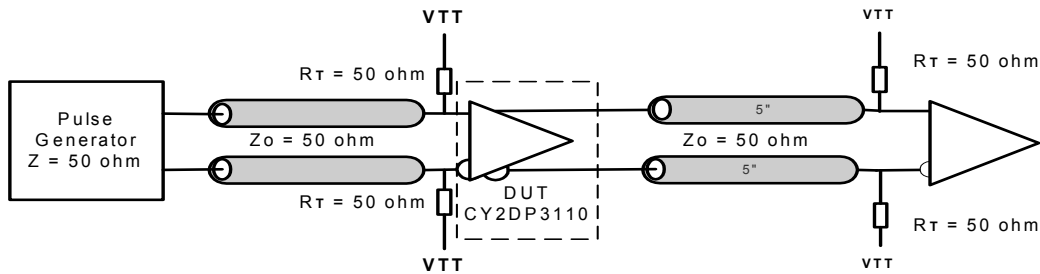


Figure 5. CY2DP3110 AC Test Reference

### Supplemental Parametric Information

**RMS Phase Jitter:** 0.151 ps typical @ 156.25 MHz, 10 GbE Filter (1.875 MHz – 20 MHz)  
0.165 ps typical @ 156.25 MHz, Broadband (Raw Data from 10 Hz – 20 MHz)

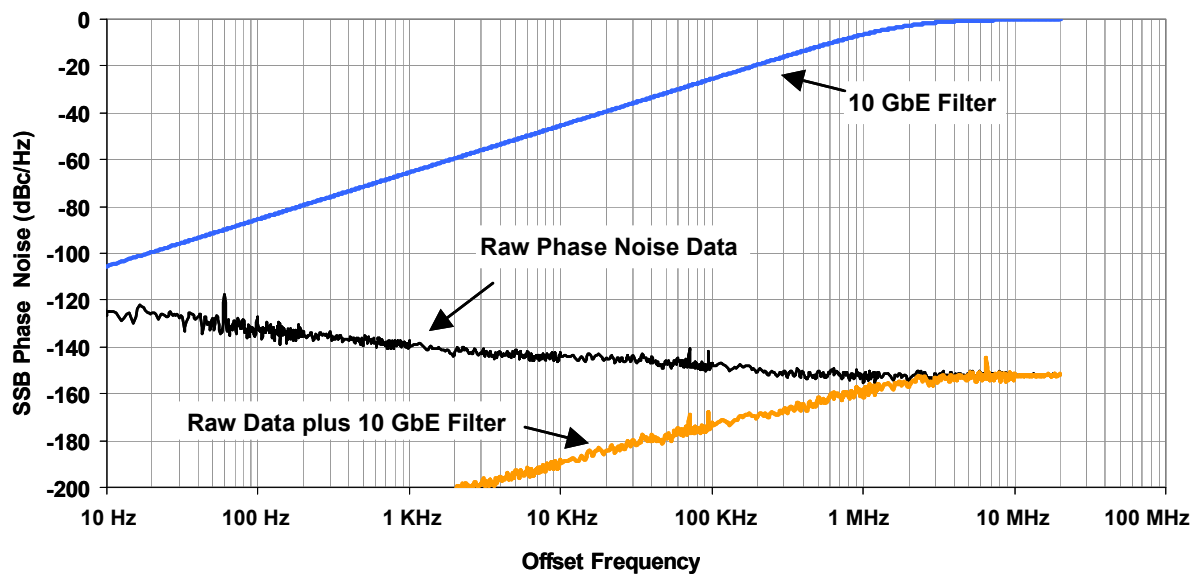
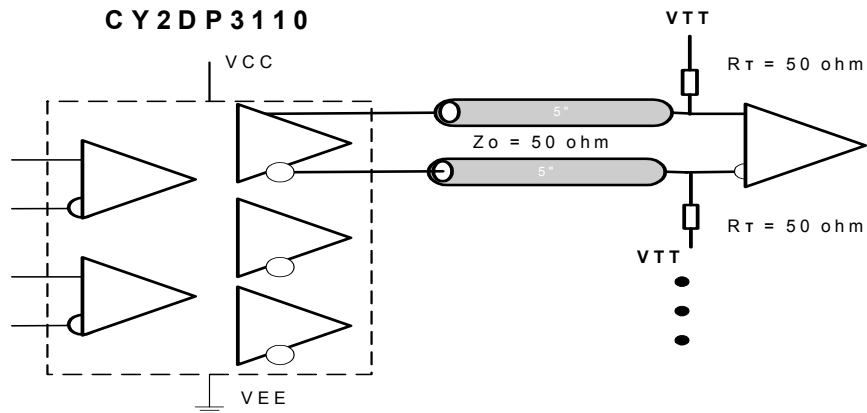
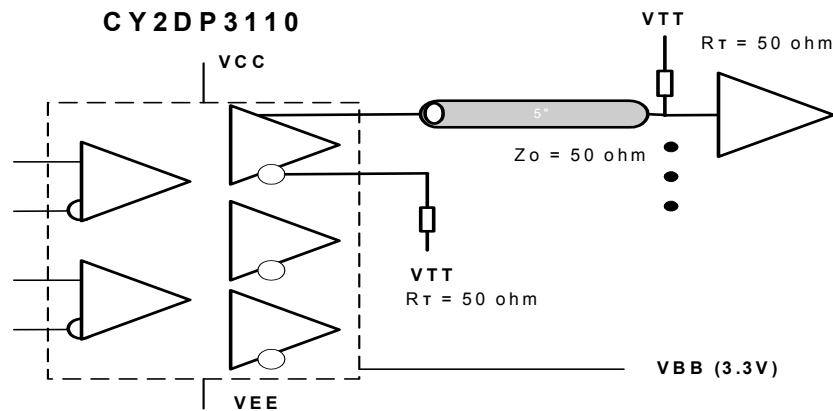
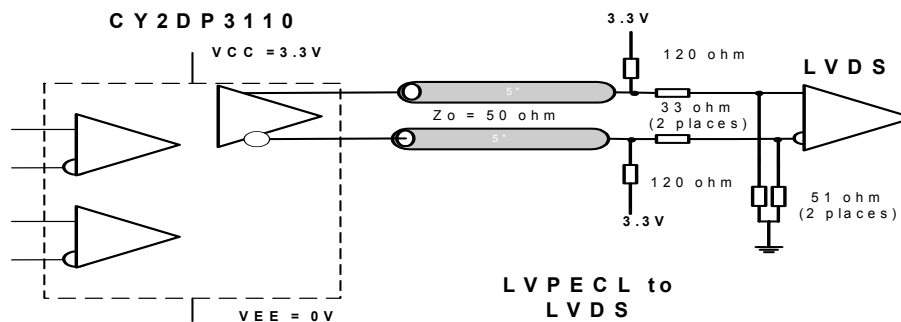
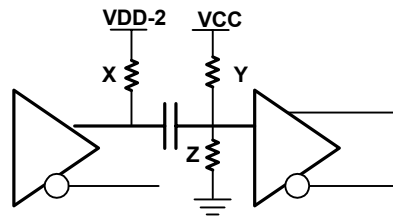


Figure 6. Typical Phase-noise Characteristics at 156.25 MHz, 3.3V, Room Temperature

**Applications Information**
**Termination Examples**

**Figure 7. Standard LVPECL – PECL Output Termination**

**Figure 8. Driving a PECL/ECL Single-ended Input**

**Figure 9. Low-voltage Positive Emitter-coupled Logic (LVPECL) to a Low-voltage Differential Signaling (LVDS) Interface**



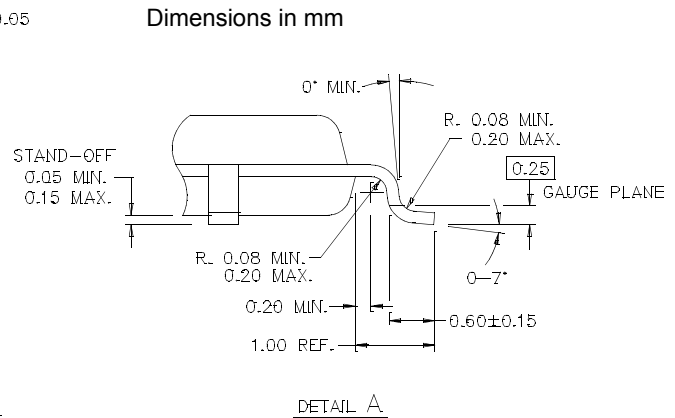
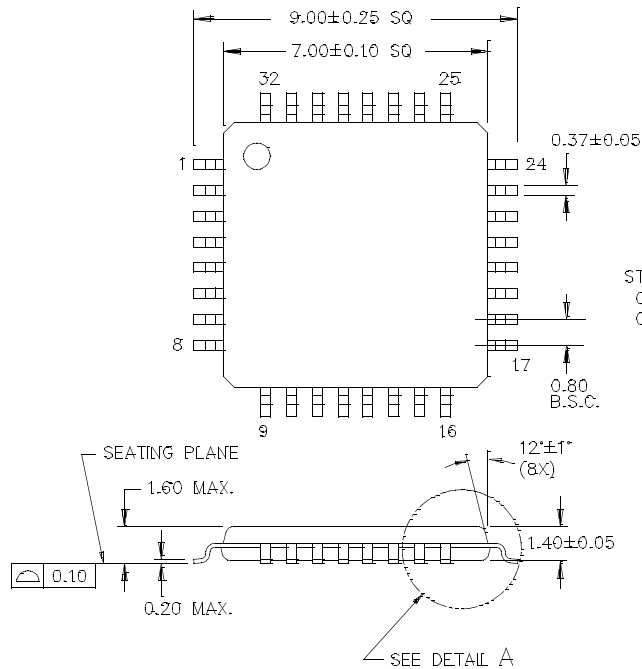
One output is shown for clarity

**Figure 10. Termination for LVPECL to HTSL interface for VCC=2.5V would use X=50 Ohms, Y=2300 Ohms, and Z=1000 Ohms. See application note titled, “PECL Translation, SAW Oscillators, and Specs” for other signalling standards and supplies.**

### Ordering Information

Part Number	Package Type	Product Flow
CY2DP3110AI	32-pin TQFP	Industrial, -40° to 85°C
CY2DP3110AIT	32-pin TQFP – Tape and Reel	Industrial, -40° to 85°C
<b>Lead-free</b>		
CY2DP3110AXI	32-pin TQFP	Industrial, -40° to 85°C
CY2DP3110AXIT	32-pin TQFP – Tape and Reel	Industrial, -40° to 85°C



**Package Drawing and Dimensions**
**32-Lead Thin Plastic Quad Flatpack 7 x 7 x 1.4 mm A32.14**


51-85088-B

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**Document History Page**

Document Title: CY2DP3110 FastEdge™ Series 1 of 2:10 Differential Clock/Data Fanout Buffer				
Document Number: 38-07469				
REV.	ECN NO.	Issue Date	Orig. of Change	Description of Change
**	121284	11/12/02	RGL	New Data Sheet
*A	126251	04/15/03	RGL	Added VBB in the block diagram Corrected specs that does not match EROS/IROS Changed V <sub>OHMIN</sub> in PECL Output table to V <sub>CC</sub> -1.2V Shifted table on ECL levels to match PECL Added power-up requirements to absolute maximum conditions Changed title (ComLink to FastEdge)
*B	127696	06/12/03	RGL	Changed operation value from 3.0 GHz to 1.5 GHz in features Modified Note 21: reduced swing value from up to 3 GHz to 2.2 GHz
*C	128731	08/04/03	RGL	Specified TTB value from TBD to 250 ps Specified Vo (pp) values from TBDs to 0.34 ps(min) at < 1.5 GHz, 0.30 ps (typ) at 2.2 GHz Changed Jitter value from 10 ps to 1 ps (intrinsic)
*D	130299	11/19/03	RGL	Corrected the "VCCO" to "VCC" in the Pin Configuration diagram.
*E	227708	See ECN	RGL/GGK	Changed the max. Dissipation, Junction to ambient from 100 to 70°C/W Added Junction Temperature(T <sub>J</sub> ) parameter of 150°C max Replaced I <sub>CC</sub> calculation with power calculation in the footnote
*F	229393	See ECN	RGL/GGK	Provided data for TBD's to match the device
*G	247626	See ECN	RGL/GGK	Changed V <sub>OH</sub> and V <sub>OL</sub> to match the Char Data
*H	381816	See ECN	RGL/GGK	Added Phase-noise information; Added typical information Added Lead-free devices
*I	392887	See ECN	RGL/GGK	Changed typical values for Output RMS Phase Jitter