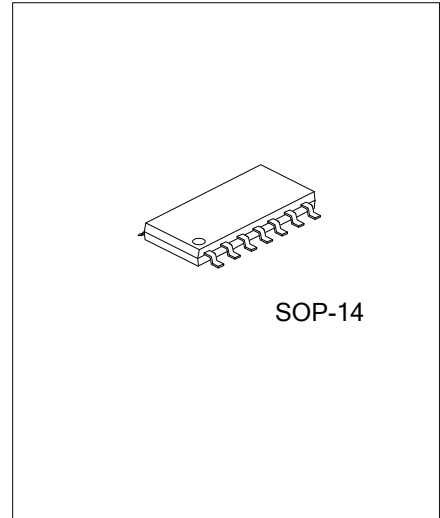# UNISONIC TECHNOLOGIES CO., LTD

UVXS0104

CMOS IC

4-BIT BIDIRECTIONAL VOLTAGE-LEVEL TRANSLATOR FOR OPEN-DRAIN AND PUSH-PULL APPLICATIONS

SOP-14

■ **DESCRIPTION**

The UTC **UVXS0104** is a 4-bit non-inverting bidirectional voltage-level translator. The UTC **UVXS0104** separates A ports with B ports, and both ports are configurable power-supply rails, with the A ports supporting operating voltages from 1.65V to 3.6V, and the B ports supporting operating voltages from 2.3V to 5.5V. This allows the support of both lower and higher logic signal levels while providing bidirectional translation capabilities between any of the 1.8V, 2.5V, 3.3V, and 5V voltage nodes.

All I/Os of the UTC **UVXS0104** are placed in the high-impedance state when the output-enable (OE) input is low, The UTC **UVXS0104** is designed so that the OE input circuit is supplied by V_{CCA}. So, to ensure the high-impedance state during power up or power down, OE should be tied to GND through a pull-down resistor; the minimum value of the resistor is determined by the current-sourcing capability of the driver.
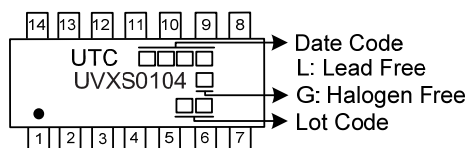
■ **FEATURES**

* Maximum Data Rates
   24 Mbps (Push Pull)
   2 Mbps (Open Drain)
* 1.65V~3.6V on A ports and 2.3V~5.5V on B ports ($V_{CCA} \leq V_{CCB}$)
* No Direction-Control Signal Needed
* No Power-Supply Sequencing Required: -V_{CCA} or V_{CCB} Can Be Ramped First
* I_{off} Supports Partial-Power-Down Mode Operation

■ **ORDERING INFORMATION**

Ordering Number		Package	Packing
Lead Free	Halogen Free		
UVXS0104L-S14-R	UVXS0104G-S14-R	SOP-14	Tape Reel

UVXS0104G-S14-R

- (1)Packing Type
- (2)Package Type
- (3)Green Package

(1) R: Tape Reel

(2) S14: SOP-14

(3) G: Halogen Free and Lead Free, L: Lead Free

■ **MARKING**

- Date Code
- L: Lead Free
- G: Halogen Free
- Lot Code

■ **PIN CONFIGURATION**

V_{CCA}	1	14 V_{CCB}
A1	2	13 B1
A2	3	12 B2
A3	4	11 B3
A4	5	10 B4
NC	6	9 NC
GND	7	8 OE
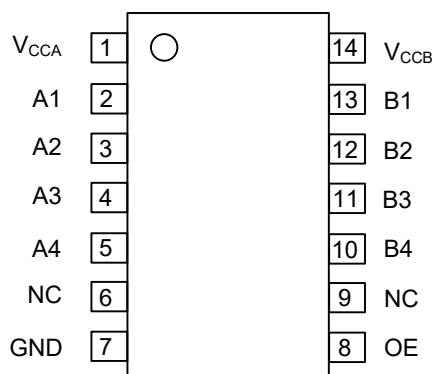
■ **PIN DESCRIPTION**

PIN NO.	PIN NAME	DESCRIPTION
1	V_{CCA}	A-port supply voltage. $1.65V \leq V_{CCA} \leq 3.6V$ and $V_{CCA} \leq V_{CCB}$.
2	A1	Input/output A1. Referenced to V_{CCA}.
3	A2	Input/output A2. Referenced to V_{CCA}.
4	A3	Input/output A3. Referenced to V_{CCA}.
5	A4	Input/output A4. Referenced to V_{CCA}.
6	NC	No internal connection
7	GND	Ground
8	OE	3-state output-mode enable. Pull OE low to place all outputs in 3-state mode. Referenced to V_{CCA}.
9	NC	No internal connection
10	B4	Input/output B4. Referenced to V_{CCB}.
11	B3	Input/output B3. Referenced to V_{CCB}.
12	B2	Input/output B2. Referenced to V_{CCB}.
13	B1	Input/output B1. Referenced to V_{CCB}.
14	V_{CCB}	B-port supply voltage. $2.3V \leq V_{CCB} \leq 5.5V$.

◼ BLOCK DIAGRAM
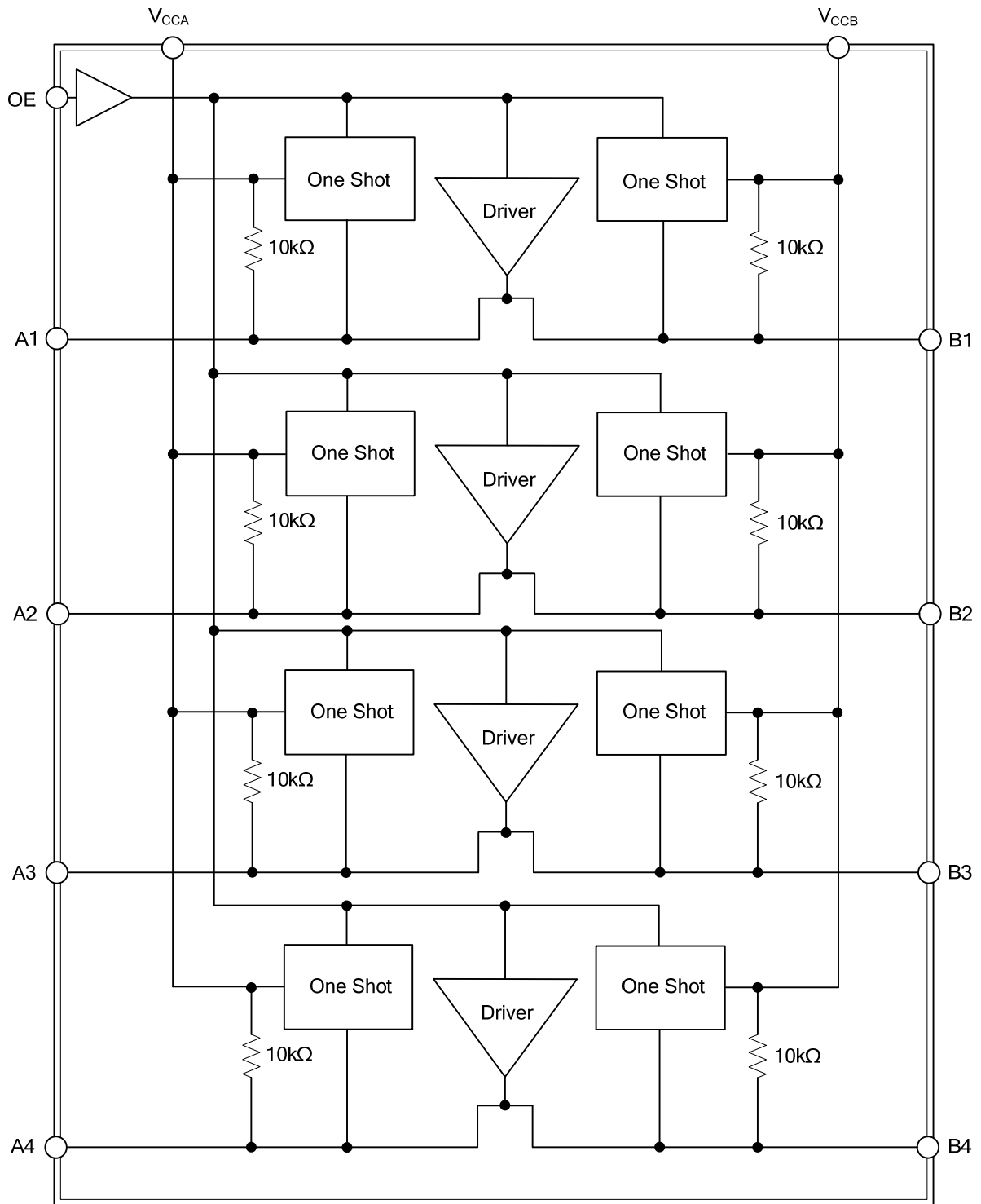
■ **ABSOLUTE MAXIMUM RATING (NOTE 1)**

PARAMETER		SYMBOL	RATINGS	UNIT
Supply Voltage Range		V_{CCA}	-0.5 ~ 4.6	V
Supply Voltage Range		V_{CCB}	-0.5 ~ 6.5	V
Input Voltage Range (Note 2)	A port	V_I	-0.5 ~ 4.6	V
	B port		-0.5 ~ 6.5	
Voltage Range Applied To Any Output In The High-Impedance Or Power-Off State (Note 2)	A port	V_O	-0.5 ~ 4.6	V
	B port		-0.5 ~ 6.5	
Voltage Range Applied To Any Output In The High Or Low State (Note 2, 3)	A port	V_O	-0.5 ~ V_{CCA}+0.5	V
	B port		-0.5 ~ V_{CCB}+0.5	
Input Clamp Current	V_I<0	I_{IK}	-50	mA
Output Clamp Current	V_O<0	I_{OK}	-50	mA
Continuous Output Current		I_O	±50	mA
Continuous Current Through V_{CCA}, V_{CCB}, or GND		I_{CC} / I_{GND}	±100	mA
Junction Temperature		T_J	+150	°C
Storage Temperature		T_{STG}	-65 ~ +150	°C

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

       2. The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.

       3. The value of V_{CCA} and V_{CCB} are provided in the recommended operating conditions table.

■ **RECOMMENDED OPERATING CONDITIONS**

V_{CCI} is the supply voltage associated with the input port. V_{CCO} is the supply voltage associated with the output port.

PARAMETER			SYMBOL	RATINGS	UNIT
Supply Voltage (Note 1)			V_{CCA}	1.65 ~ 3.6	V
Supply Voltage (Note 1)			V_{CCB}	2.3 ~ 5.5	V
High-Level Input Voltage	A-Port I/Os	V_{CCA}=1.65V ~ 1.95V, V_{CCB}=2.3 ~ 5.5V	V_{IH}	V_{CCI} - 0.2 ~ V_{CCI}	V
		V_{CCA}=2.3V ~ 3.6V, V_{CCB}=2.3 ~ 5.5V		V_{CCI} - 0.4 ~ V_{CCI}	
	B-Port I/Os	V_{CCA}=1.65V ~ 3.6V, V_{CCB}=2.3 ~ 5.5V		V_{CCI} - 0.4 ~ V_{CCI}	
	OE Input	V_{CCA}=1.65V ~ 3.6V, V_{CCB}=2.3 ~ 5.5V		V_{CCA}×0.65 ~ 5.5	
Low-Level Input Voltage	A-Port I/Os	V_{CCA}=1.65V ~ 3.6V, V_{CCB}=2.3 ~ 5.5V	V_{IL}	0 ~ 0.15	V
	B-Port I/Os	V_{CCA}=1.65V ~ 3.6V, V_{CCB}=2.3 ~ 5.5V		0 ~ 0.15	
	OE Input	V_{CCA}=1.65V ~ 3.6V, V_{CCB}=2.3 ~ 5.5V		0 ~ V_{CCA}×0.35	
Input Transition Rise Or Fall Rate	A-Port I/Os Push-Pull Driving	V_{CCA}=1.65V ~ 3.6V, V_{CCB}=2.3 ~ 5.5V	Δt/Δv	10	ns/V
	B-Port I/Os Push-Pull Driving	V_{CCA}=1.65V ~ 3.6V, V_{CCB}=2.3 ~ 5.5V		10	
	Control Input	V_{CCA}=1.65V ~ 3.6V, V_{CCB}=2.3 ~ 5.5V		10	
Operating Free-Air Temperature			T_A	-40 ~ +125	°C

Note: 1. V_{CCA} must be less than or equal to V_{CCB}, and V_{CCA} must not exceed 3.6V.

■ **ELECTRICAL CHARACTERISTICS (Note 1, 2, 3)** (T_A=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Port A Output High Voltage	V_{OHA}	I_{OH}=-20µA, V_{IB}≥V_{CCB}-0.4V V_{CCA}=1.65V~3.6V, V_{CCB}=2.3V~5.5V		V_{CCA} ×0.8			V
Port A Output Low Voltage	V_{OLA}	I_{OL}=1mA, V_{IB}≤0.15V V_{CCA}=1.65V~3.6V, V_{CCB}=2.3V~5.5V				0.4	V
Port B Output High Voltage	V_{OHB}	I_{OH} =-20µA, V_{IA} ≥ V_{CCA} - 0.2V V_{CCA}=1.65V~3.6V, V_{CCB}=2.3V~5.5V		V_{CCB} ×0.8			V
Port B Output Low Voltage	V_{OLB}	I_{OL}=1mA, V_{IA}≤0.15V V_{CCA}=1.65V~3.6V, V_{CCB}=2.3V~5.5V				0.4	V
Input Leakage Current	I_I	OE: V_I = V_{CCI} or GND, V_{CCA}=1.65V~3.6V, V_{CCB}=2.3V~5.5V				±1	µA
High-Impedance State Output Current	I_{OZ}	A or B port: OE = V_{IL} V_{CCA}=1.65V~3.6V, V_{CCB}=2.3V~5.5V				±1	µA
V_{CCA} Supply Current	I_{CCA}	V_I=V_O=Open, I_O=0	V_{CCA}=1.65V~V_{CCB} V_{CCB}=2.3V~5.5V			2.4	µA
			V_{CCA}=3.6V V_{CCB}=0V			2.2	µA
			V_{CCA}=0V V_{CCB}=5.5V			-1	µA
V_{CCB} Supply Current	I_{CCB}	V_I=V_O=Open, I_O=0	V_{CCA}=1.65V~V_{CCB} V_{CCB}=2.3V~5.5V			12	µA
			V_{CCA}=3.6V V_{CCB}=0V			-1	µA
			V_{CCA}=0V V_{CCB}=5.5V			1	µA
Combined Supply Current	I_{CCA}+I_{CCB}	V_I=V_O=Open, I_O=0	V_{CCA}=1.65V~V_{CCB} V_{CCB}=2.3V~5.5V			14.4	µA
Input Capacitance	C_I	OE	V_{CCA}=3.3V V_{CCB}=3.3V		2.5		pF
Input-to-Output Internal Capacitance	C_{IO}	A port	V_{CCA}=3.3V V_{CCB}=3.3V		5		pF
		B port	V_{CCA}=3.3V V_{CCB}=3.3V		12		pF

Notes: 1. V_{CCI} is the V_{CC} associated with the input port.
　　　 2. V_{CCO} is the V_{CC} associated with the output port.
　　　 3. V_{CCA} must be less than or equal to V_{CCB}, and V_{CCA} must not exceed 3.6V.

■ **TIMING REQUIREMENTS** (T_A=25°C, unless otherwise specified)

V_{CCA}=1.8V±0.15V

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Push-Pull Driving	Data Rate	V_{CCB}=2.5V±0.2V			24	Mbps
		V_{CCB}=3.3V±0.3V			24	Mbps
		V_{CCB}=5V±0.5V			24	Mbps
Open-Drain Driving		V_{CCB}=2.5V±0.2V			2	Mbps
		V_{CCB}=3.3V±0.3V			2	Mbps
		V_{CCB}=5V±0.5V			2	Mbps
Push-Pull Driving (Data Inputs)	Pulse Duration	V_{CCB}=2.5V±0.2V	41			ns
		V_{CCB}=3.3V±0.3V	41			ns
		V_{CCB}=5V±0.5V	41			ns
Open-Drain Driving (Data Inputs)		V_{CCB}=2.5V±0.2V	500			ns
		V_{CCB}=3.3V±0.3V	500			ns
		V_{CCB}=5V±0.5V	500			ns

V_{CCA}=2.5V±0.2V

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Push-Pull Driving	Data Rate	V_{CCB}=2.5V±0.2V			24	Mbps
		V_{CCB}=3.3V±0.3V			24	Mbps
		V_{CCB}=5V±0.5V			24	Mbps
Open-Drain Driving		V_{CCB}=2.5V±0.2V			2	Mbps
		V_{CCB}=3.3V±0.3V			2	Mbps
		V_{CCB}=5V±0.5V			2	Mbps
Push-Pull Driving (Data Inputs)	Pulse Duration	V_{CCB}=2.5V±0.2V	41			ns
		V_{CCB}=3.3V±0.3V	41			ns
		V_{CCB}=5V±0.5V	41			ns
Open-Drain Driving (Data Inputs)		V_{CCB}=2.5V±0.2V	500			ns
		V_{CCB}=3.3V±0.3V	500			ns
		V_{CCB}=5V±0.5V	500			ns

V_{CCA}=3.3V±0.3V

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Push-Pull Driving	Data Rate	V_{CCB}=3.3V±0.3V			24	Mbps
		V_{CCB}=5V±0.5V			24	Mbps
Open-Drain Driving		V_{CCB}=3.3V±0.3V			2	Mbps
		V_{CCB}=5V±0.5V			2	Mbps
Push-Pull Driving (Data Inputs)	Pulse Duration	V_{CCB}=3.3V±0.3V	41			ns
		V_{CCB}=5V±0.5V	41			ns
Open-Drain Driving (Data Inputs)		V_{CCB}=3.3V±0.3V	500			ns
		V_{CCB}=5V±0.5V	500			ns

UVXS0104   **Preliminary**   *CMOS IC*

■ **SWITCHING CHARACTERISTICS** (T_A=25°C, unless otherwise specified)

V_{CCA}=1.8V±0.15V

PARAMETER	SYMBOL	TEST CONDITIONS	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Propagation Delay Time High to Low Output (A to B)	t_{PHL}	Push-pull driving	V_{CCB}=2.5V±0.2V			7.6	ns
			V_{CCB}=3.3V±0.3V			7.7	ns
			V_{CCB}=5V±0.5V			8.8	ns
		Open-drain driving	V_{CCB}=2.5V±0.2V	1		11.8	ns
			V_{CCB}=3.3V±0.3V	1		12.6	ns
			V_{CCB}=5V±0.5V	1		13	ns
Propagation Delay Time Low to High Output (A to B)	t_{PLH}	Push-pull driving	V_{CCB}=2.5V±0.2V			8.8	ns
			V_{CCB}=3.3V±0.3V			8.8	ns
			V_{CCB}=5V±0.5V			9	ns
		Open-drain driving	V_{CCB}=2.5V±0.2V	40		270	ns
			V_{CCB}=3.3V±0.3V	30		215	ns
			V_{CCB}=5V±0.5V	20		205	ns
Propagation Delay Time High to Low Output (B to A)	t_{PHL}	Push-pull driving	V_{CCB}=2.5V±0.2V			7.4	ns
			V_{CCB}=3.3V±0.3V			7.5	ns
			V_{CCB}=5V±0.5V			7.7	ns
		Open-drain driving	V_{CCB}=2.5V±0.2V	1		8.3	ns
			V_{CCB}=3.3V±0.3V	1		7.4	ns
			V_{CCB}=5V±0.5V	1		7.0	ns
Propagation Delay Time Low to High Output (B to A)	t_{PLH}	Push-pull driving	V_{CCB}=2.5V±0.2V			8.3	ns
			V_{CCB}=3.3V±0.3V			7.5	ns
			V_{CCB}=5V±0.5V			3.5	ns
		Open-drain driving	V_{CCB}=2.5V±0.2V	40		185	ns
			V_{CCB}=3.3V±0.3V	30		150	ns
			V_{CCB}=5V±0.5V	20		110	ns
Enable Time	t_{en}	OE to A or B	V_{CCB}=2.5V±0.2V			200	ns
			V_{CCB}=3.3V±0.3V			200	ns
			V_{CCB}=5V±0.5V			200	ns
Disable Time	t_{dis}	OE to A or B	V_{CCB}=2.5V±0.2V			60	ns
			V_{CCB}=3.3V±0.3V			50	ns
			V_{CCB}=5V±0.5V			45	ns
Input Rise Time (A port rise time)	t_{rA}	Push-pull driving	V_{CCB}=2.5V±0.2V	3.2		9.5	ns
			V_{CCB}=3.3V±0.3V	2.3		9.3	ns
			V_{CCB}=5V±0.5V	2.0		7.6	ns
		Open-drain driving	V_{CCB}=2.5V±0.2V	38		165	ns
			V_{CCB}=3.3V±0.3V	30		132	ns
			V_{CCB}=5V±0.5V	22		95	ns
Input Rise Time (B port rise time)	t_{rB}	Push-pull driving	V_{CCB}=2.5V±0.2V	4		10.8	ns
			V_{CCB}=3.3V±0.3V	2.7		9.1	ns
			V_{CCB}=5V±0.5V	2.7		7.6	ns
		Open-drain driving	V_{CCB}=2.5V±0.2V	34		145	ns
			V_{CCB}=3.3V±0.3V	23		106	ns
			V_{CCB}=5V±0.5V	10		58	ns
Input Fall Time (A port fall time)	t_{fA}	Push-pull driving	V_{CCB}=2.5V±0.2V	2		5.9	ns
			V_{CCB}=3.3V±0.3V	1.9		6.0	ns
			V_{CCB}=5V±0.5V	1.7		13.3	ns
		Open-drain driving	V_{CCB}=2.5V±0.2V	4.4		6.9	ns
			V_{CCB}=3.3V±0.3V	4.3		6.4	ns
			V_{CCB}=5V±0.5V	4.2		6.1	ns

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QW-R140-049.a

■ **SWITCHING CHARACTERISTICS (Cont.)**

PARAMETER	SYMBOL	TEST CONDITIONS	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Fall Time (B port fall time)	t_{fB}	Push-pull driving	V_{CCB}=2.5V±0.2V	2.9		7.6	ns
			V_{CCB}=3.3V±0.3V	2.8		7.5	ns
			V_{CCB}=5V±0.5V	2.8		8.8	ns
		Open-drain driving	V_{CCB}=2.5V±0.2V	6.9		13.8	ns
			V_{CCB}=3.3V±0.3V	7.5		16.2	ns
			V_{CCB}=5V±0.5V	7.0		16.2	ns
Skew (Time), Output	$t_{SK(O)}$	Channel -to- channel skew	V_{CCB}=2.5V±0.2V			1	ns
			V_{CCB}=3.3V±0.3V			1	ns
			V_{CCB}=5V±0.5V			1	ns
Maximum data rate	f_{data}	Push-pull driving	V_{CCB}=2.5V±0.2V	24			Mbps
			V_{CCB}=3.3V±0.3V	24			Mbps
			V_{CCB}=5V±0.5V	24			Mbps
		Open-drain driving	V_{CCB}=2.5V±0.2V	2			Mbps
			V_{CCB}=3.3V±0.3V	2			Mbps
			V_{CCB}=5V±0.5V	2			Mbps

V_{CCA}=2.5V±0.2V

PARAMETER	SYMBOL	TEST CONDITIONS	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Propagation Delay Time High to Low Output (A to B)	t_{PHL}	Push-pull driving	V_{CCB}=2.5V±0.2V			5.2	ns
			V_{CCB}=3.3V±0.3V			5.3	ns
			V_{CCB}=5V±0.5V			5.4	ns
		Open-drain driving	V_{CCB}=2.5V±0.2V	1		9.3	ns
			V_{CCB}=3.3V±0.3V	1		9.0	ns
			V_{CCB}=5V±0.5V	1		8.8	ns
Propagation Delay Time Low to High Output (A to B)	t_{PLH}	Push-pull driving	V_{CCB}=2.5V±0.2V			6.5	ns
			V_{CCB}=3.3V±0.3V			7.1	ns
			V_{CCB}=5V±0.5V			7.4	ns
		Open-drain driving	V_{CCB}=2.5V±0.2V	40		260	ns
			V_{CCB}=3.3V±0.3V	30		210	ns
			V_{CCB}=5V±0.5V	20		200	ns
Propagation Delay Time High to Low Output (B to A)	t_{PHL}	Push-pull driving	V_{CCB}=2.5V±0.2V			5.0	ns
			V_{CCB}=3.3V±0.3V			5.6	ns
			V_{CCB}=5V±0.5V			6.3	ns
		Open-drain driving	V_{CCB}=2.5V±0.2V	1		7.7	ns
			V_{CCB}=3.3V±0.3V	1		7.2	ns
			V_{CCB}=5V±0.5V	1		7.0	ns
Propagation Delay Time Low to High Output (B to A)	t_{PLH}	Push-pull driving	V_{CCB}=2.5V±0.2V			5.5	ns
			V_{CCB}=3.3V±0.3V			4.6	ns
			V_{CCB}=5V±0.5V			3.7	ns
		Open-drain driving	V_{CCB}=2.5V±0.2V	40		180	ns
			V_{CCB}=3.3V±0.3V	30		150	ns
			V_{CCB}=5V±0.5V	20		110	ns
Enable Time	t_{en}	OE to A or B	V_{CCB}=2.5V±0.2V			200	ns
			V_{CCB}=3.3V±0.3V			200	ns
			V_{CCB}=5V±0.5V			200	ns
Disable Time	t_{dis}	OE to A or B	V_{CCB}=2.5V±0.2V			60	ns
			V_{CCB}=3.3V±0.3V			50	ns
			V_{CCB}=5V±0.5V			45	ns

■ **SWITCHING CHARACTERISTICS (Cont.)**

PARAMETER	SYMBOL	TEST CONDITIONS	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Rise Time (A port rise time)	t_{rA}	Push-pull driving	V_{CCB}=2.5V±0.2V	2.8		7.4	ns
			V_{CCB}=3.3V±0.3V	2.6		6.6	ns
			V_{CCB}=5V±0.5V	1.8		5.6	ns
		Open-drain driving	V_{CCB}=2.5V±0.2V	34		149	ns
			V_{CCB}=3.3V±0.3V	28		121	ns
			V_{CCB}=5V±0.5V	24		89	ns
Input Rise Time (B port rise time)	t_{rB}	Push-pull driving	V_{CCB}=2.5V±0.2V	3.2		8.3	ns
			V_{CCB}=3.3V±0.3V	2.9		7.2	ns
			V_{CCB}=5V±0.5V	2.4		6.1	ns
		Open-drain driving	V_{CCB}=2.5V±0.2V	35		151	ns
			V_{CCB}=3.3V±0.3V	24		112	ns
			V_{CCB}=5V±0.5V	12		64	ns
Input Fall Time (A port fall time)	t_{fA}	Push-pull driving	V_{CCB}=2.5V±0.2V	1.9		5.7	ns
			V_{CCB}=3.3V±0.3V	1.9		5.5	ns
			V_{CCB}=5V±0.5V	1.8		5.3	ns
		Open-drain driving	V_{CCB}=2.5V±0.2V	4.4		6.9	ns
			V_{CCB}=3.3V±0.3V	4.3		6.2	ns
			V_{CCB}=5V±0.5V	4.2		5.8	ns
Input Fall Time (B port fall time)	t_{fB}	Push-pull driving	$V_{CCB2.6}$=2.5V±0.2V	2.2		7.8	ns
			V_{CCB}=3.3V±0.3V	2.4		6.7	ns
			V_{CCB}=5V±0.5V	2.6		6.6	ns
		Open-drain driving	V_{CCB}=2.5V±0.2V	5.1		8.8	ns
			V_{CCB}=3.3V±0.3V	5.4		9.4	ns
			V_{CCB}=5V±0.5V	5.4		10.4	ns
Skew (Time), Output	$t_{SK(O)}$	Channel -to- channel skew	V_{CCB}=2.5V±0.2V			1	ns
			V_{CCB}=3.3V±0.3V			1	ns
			V_{CCB}=5V±0.5V			1	ns
Maximum data rate	f_{data}	Push-pull driving	V_{CCB}=2.5V±0.2V	24			Mbps
			V_{CCB}=3.3V±0.3V	24			Mbps
			V_{CCB}=5V±0.5V	24			Mbps
		Open-drain driving	V_{CCB}=2.5V±0.2V	2			Mbps
			V_{CCB}=3.3V±0.3V	2			Mbps
			V_{CCB}=5V±0.5V	2			Mbps

■ **SWITCHING CHARACTERISTICS (Cont.)**

V_{CCA}=3.3V±0.3V

PARAMETER	SYMBOL	TEST CONDITIONS	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Propagation Delay Time High to Low Output (A to B)	t_{PHL}	Push-pull driving	V_{CCB}=3.3V±0.3V			4.4	ns
			V_{CCB}=5V±0.5V			5.1	ns
		Open-drain driving	V_{CCB}=3.3V±0.3V	1		6.2	ns
			V_{CCB}=5V±0.5V	1		6.6	ns
Propagation Delay Time Low to High Output (A to B)	t_{PLH}	Push-pull driving	V_{CCB}=3.3V±0.3V			6.2	ns
			V_{CCB}=5V±0.5V			6.4	ns
		Open-drain driving	V_{CCB}=3.3V±0.3V	30		210	ns
			V_{CCB}=5V±0.5V	20		175	ns
Propagation Delay Time High to Low Output (B to A)	t_{PHL}	Push-pull driving	V_{CCB}=3.3V±0.3V			4.5	ns
			V_{CCB}=5V±0.5V			5.3	ns
		Open-drain driving	V_{CCB}=3.3V±0.3V	1		135	ns
			V_{CCB}=5V±0.5V	1		105	ns
Propagation Delay Time Low to High Output (B to A)	t_{PLH}	Push-pull driving	V_{CCB}=3.3V±0.3V			4.5	ns
			V_{CCB}=5V±0.5V			4.6	ns
		Open-drain driving	V_{CCB}=3.3V±0.3V	1		145	ns
			V_{CCB}=5V±0.5V	1		115	ns
Enable Time	t_{en}	OE to A or B	V_{CCB}=3.3V±0.3V			200	ns
			V_{CCB}=5V±0.5V			200	ns
Disable Time	t_{dis}	OE to A or B	V_{CCB}=3.3V±0.3V			50	ns
			V_{CCB}=5V±0.5V			45	ns
Input Rise Time (A port rise time)	t_{rA}	Push-pull driving	V_{CCB}=3.3V±0.3V	2.3		5.6	ns
			V_{CCB}=5V±0.5V	1.9		4.8	ns
		Open-drain driving	V_{CCB}=3.3V±0.3V	25		116	ns
			V_{CCB}=5V±0.5V	19		85	ns
Input Rise Time (B port rise time)	t_{rB}	Push-pull driving	V_{CCB}=3.3V±0.3V	2.5		6.4	ns
			V_{CCB}=5V±0.5V	2.1		7.4	ns
		Open-drain driving	V_{CCB}=3.3V±0.3V	26		116	ns
			V_{CCB}=5V±0.5V	26		116	ns
Input Fall Time (A port fall time)	t_{fA}	Push-pull driving	V_{CCB}=3.3V±0.3V	2		5.4	ns
			V_{CCB}=5V±0.5V	1.9		5.0	ns
		Open-drain driving	V_{CCB}=3.3V±0.3V	4.3		6.1	ns
			V_{CCB}=5V±0.5V	4.2		5.7	ns
Input Fall Time (B port fall time)	t_{fB}	Push-pull driving	V_{CCB}=3.3V±0.3V	2.3		7.4	ns
			V_{CCB}=5V±0.5V	2.4		7.6	ns
		Open-drain driving	V_{CCB}=3.3V±0.3V	5		7.6	ns
			V_{CCB}=5V±0.5V	4.8		8.3	ns
Skew (Time), Output	$t_{SK(O)}$	Channel -to- channel skew	V_{CCB}=3.3V±0.3V			1	ns
			V_{CCB}=5V±0.5V			1	ns
Maximum data rate	f_{data}	Push-pull driving	V_{CCB}=3.3V±0.3V	24			Mbps
			V_{CCB}=5V±0.5V	24			Mbps
		Open-drain driving	V_{CCB}=3.3V±0.3V	2			Mbps
			V_{CCB}=5V±0.5V	2			Mbps

■ **TYPICAL APPLICATION CIRCUIT**