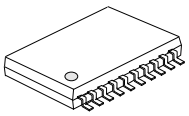
8-BIT BIDIRECTIONAL LEVEL-SHIFTING AND VOLTAGE TRANSLATOR WITH AUTO-DIRECTION SENSING



TSSOP-20

■ DESCRIPTION

This 8-bit noninverting translator uses two separate configurable power-supply rails. The A port is designed to V_{CCA}. V_{CCA} accepts any supply voltage from 1.2V to 3.6V. The B port is designed to V_{CCB}. V_{CCB} accepts any supply voltage from 1.65V to 5.5V.

The **UTXB0108** is designed so that the OE input circuit is supplied by V_{CCA}. When the output-enable (OE) input is low, all outputs are placed in the high-impedance state.

This device is fully specified for partial-power-down applications using I_{OFF}. The I_{OFF} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

■ FEATURES

* 1.2V to 3.6V on A port and 1.65V to 5.5V on B Port ($V_{CCA} \leq V_{CCB}$)
* V_{CC} Isolation Feature – If Either V_{CC} Input Is at GND, All Outputs Are in the High-Impedance State
* OE Input Circuit Referenced to V_{CCA}
* Low Power Consumption, 4μA Max. I_{CC}
* I_{OFF} Supports Partial-Power-Down Mode Operation

■ APPLICATION

* Handset
* Smartphone
* Tablet
* Desktop PC

■ ORDERING INFORMATION

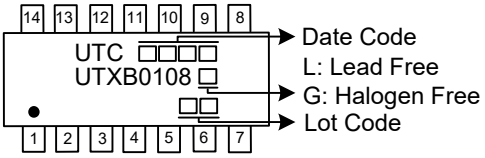
Ordering Number		Package	Packing
Lead Free	Halogen Free		
UTXB0108L-P20-R	UTXB0108G-P20-R	TSSOP-20	Tape Reel

UTXB0108G-P20-R

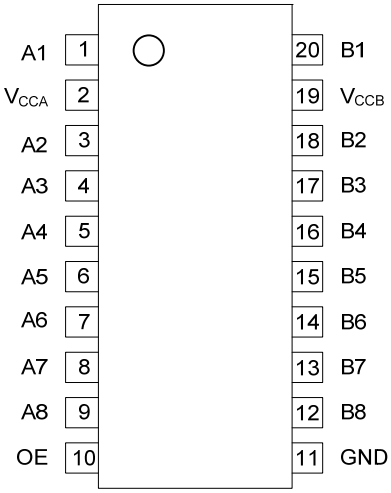
(1)Packing Type
(2) Package Type
(3) Green Package

(1) R: Tape Reel
(2) P20: TSSOP-20
(3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING



■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	I/O	DESCRIPTION
1	A1	I/O	Input/output A1. Referenced to V_{CCA}
2	V_{CCA}		A-Port supply voltage.1.2V ≤ V_{CCA} ≤ 3.6V and V_{CCA} ≤ V_{CCB}
3	A2	I/O	Input/output A2. Referenced to V_{CCA}
4	A3	I/O	Input/output A3. Referenced to V_{CCA}
5	A4	I/O	Input/output A4. Referenced to V_{CCA}
6	A5	I/O	Input/output A5. Referenced to V_{CCA}
7	A6	I/O	Input/output A6. Referenced to V_{CCA}
8	A7	I/O	Input/output A7. Referenced to V_{CCA}
9	A8	I/O	Input/output A8. Referenced to V_{CCA}
10	OE	I	Output enable. Pull OE low to place all outputs in 3-state mode. Referenced to V_{CCA}.
11	GND		Ground
12	B8	I/O	Input/output B8. Referenced to V_{CCB}
13	B7	I/O	Input/output B7. Referenced to V_{CCB}
14	B6	I/O	Input/output B6. Referenced to V_{CCB}
15	B5	I/O	Input/output B5. Referenced to V_{CCB}
16	B4	I/O	Input/output B4. Referenced to V_{CCB}
17	B3	I/O	Input/output B3. Referenced to V_{CCB}
18	B2	I/O	Input/output B2. Referenced to V_{CCB}
19	V_{CCB}		B-Port supply voltage.1.65V ≤ V_{CCB} ≤ 5.5V
20	B1	I/O	Input/output B1. Referenced to V_{CCB}

Note: I=Input, I/O=Input and Output

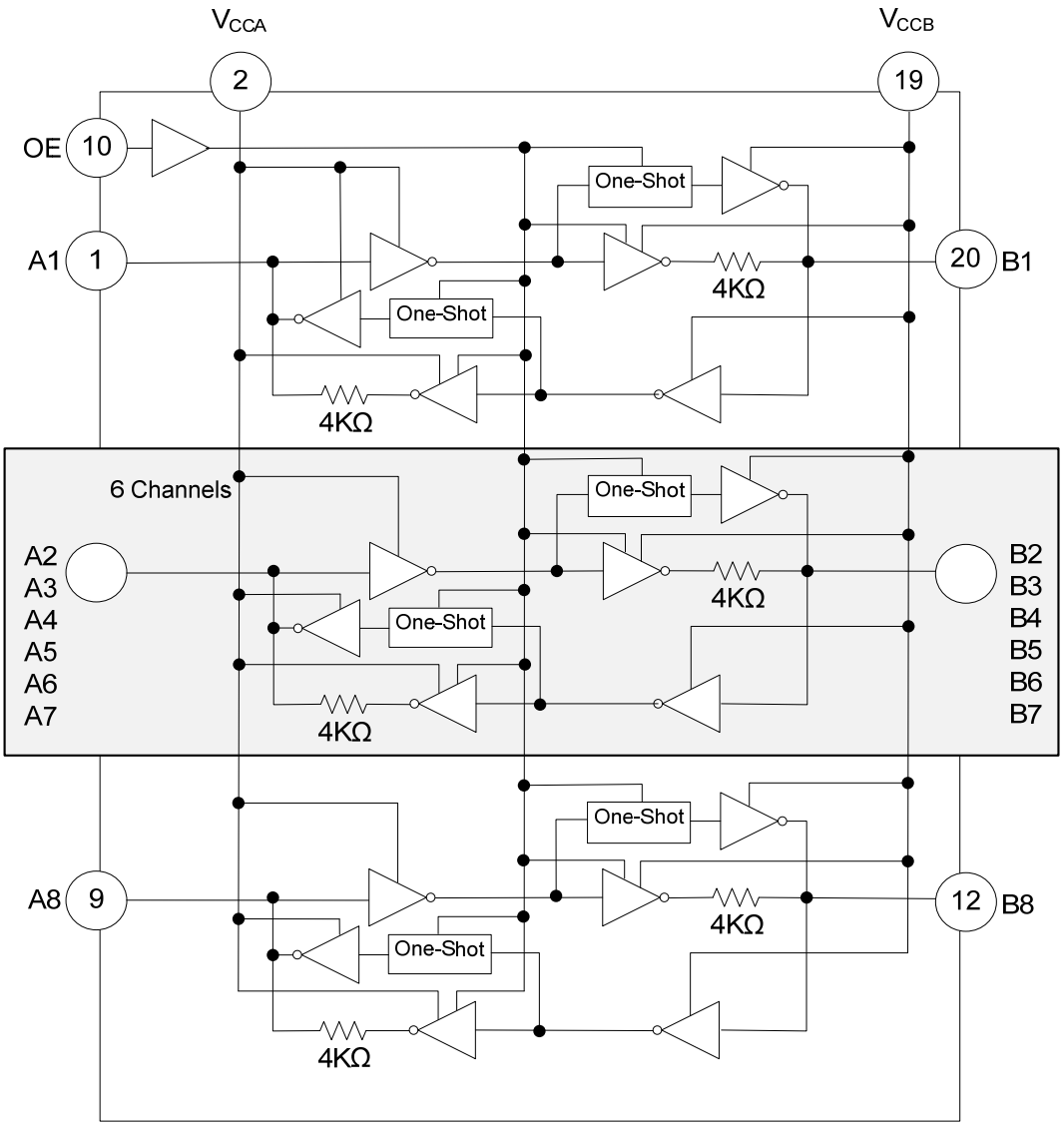
■ FUNCTION TABLE

SUPPLY VOLTAGE		INPUTS	INPUTS/OUTPUT	
V_{CCA}	V_{CCB}	OE	An	Bn
1.2V ~ V_{CCB}	1.65V ~ 5.5V	L	Z	Z
1.2V ~ V_{CCB}	1.65V ~ 5.5V	H	Input or Output	Output or Input
GND (Note 2)	GND (Note 2)	X	Z	Z

Notes: 1. H = High voltage level；L = Low voltage level；Z : High impedance OFF-state；X = Don't care.

2. When either V_{CCA} or V_{CCB} is at GND level, the device goes into Power-down mode.

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING (T_A=25°C, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Supply voltage		V_{CCA}	-0.5 ~ 4.6	V
Supply voltage		V_{CCB}	-0.5 ~ 6.5	V
Input voltage	A Port	V_{IN}	-0.5 ~ 4.6	V
	B port		-0.5 ~ 6.5	V
Voltage range applied to any output in the high-impedance or power-off state	A port	V_{OUT}	-0.5 ~ 4.6	V
	B Port		-0.5 ~ 6.5	V
Voltage range applied to any output in the high or low state	A Port	V_{OUT}	-0.5 ~ V_{CCA}+0.5	V
	B Port		-0.5 ~ V_{CCB}+0.5	V
Input clamp current	V_{IN}<0	I_{IK}	-50	mA
Output clamp current	V_{OUT}<0	I_{OK}	-50	mA
Continuous output current		I_{OUT}	±50	mA
Continuous current through V_{CCA}, V_{CCB}, or GND		I_{CC} / I_{GND}	±100	mA
Storage Temperature		T_{STG}	-65 ~ +150	°C

Note: 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.

■ RECOMMENDED OPERATING CONDITIONS (T_A=25°C, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Supply Voltage		V_{CCA}			1.2		3.6	V
Supply Voltage		V_{CCB}			1.65		5.5	V
Input Voltage		V_{IN}			0		V_{CCI}	V
Output Voltage	A Port Inputs	V_{OUT}	V_{CCA}=1.2V~3.6V, V_{CCB}=1.65V~5.5V		0		3.6	V
	B Port Inputs				0		5.5	V
High-Level Input Voltage	Data Inputs	V_{IH}	V_{CCA}=1.2V~3.6V, V_{CCB}=1.65V~5.5V		V_{CCI} ×0.65 (Note 3)		V_{CCI}	V
	OE				V_{CCA} ×0.65		5.5	V
Low-Level Input Voltage	Data Inputs	V_{IL}	V_{CCA}=1.2V~3.6V, V_{CCB}=1.65V~5.5V		0		V_{CCI} ×0.35 (Note 3)	V
	OE				0		V_{CCA} ×0.35	V
Input Transition Rise or Fall Rate	A Port Inputs	Δt/Δv	V_{CCA}=1.2V~3.6V	V_{CCB}=1.65V~5.5V			40	ns/V
	B Port Inputs			V_{CCB}=1.65V~3.6V			40	ns/V
				V_{CCB}=4.5V~5.5V			30	ns/V
Operating Temperature		T_A			-40		+85	°C

Notes: 1. The A and B sides of an unused data I/O pair must be held in the same state, i.e., both at V_{CCI} or both at GND.
2. V_{CCA} must be less than or equal to V_{CCB} and must not exceed 3.6V.
3. V_{CCI} is the supply voltage associated with the input port.

■ ELECTRICAL CHARACTERISTICS (T_A=-25°C, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Port A Output High Voltage		V_{OHA}	V_{CCA}=1.2V, I_{OH}=-20μA			1.1		V
			V_{CCA}=1.4~3.6V, I_{OH}=-20μA		V_{CCA} -0.4			V
Port A Output Low Voltage		V_{OLA}	V_{CCA}=1.2V, I_{OL}=20μA			0.3		V
			V_{CCA}=1.4V~3.6V, I_{OL}=20μA				0.4	V
Port B Output High Voltage		V_{OHB}	V_{CCB}=1.65V~5.5V, I_{OH}=-20μA		V_{CCB} -0.4			V
Port B Output Low Voltage		V_{OLB}	V_{CCB}=1.65V~5.5V, I_{OL}=20μA				0.4	V
Input Leakage Current	OE	$I_{I(LEAK)}$	V_{CCA}=1.2V~3.6V, V_{CCB}=1.65V~5.5V				±1	μA
Power OFF Leakage Current	A Port	I_{OFF}	V_{CCA}=0V, V_{CCB}=0V~5.5V				±1	μA
	B Port		V_{CCA}=0V~3.6V, V_{CCB}=0V				±1	μA
High-Impedance State Output Current	A or B Port	I_{OZ}	V_{CCA}=1.2V~3.6V, V_{CCB}=1.65V~5.5V, OE=GND				±1	μA
Quiescent Supply Current		I_{CCA}	V_I=V_{CCI} or GND I_O=0A	V_{CCA}=1.2V, V_{CCB}=1.65V~5.5V		0.06		μA
				V_{CCA}=1.4V~3.6V, V_{CCB}=1.65V~5.5V			5	μA
				V_{CCA}=3.6V, V_{CCB}=0V			2	μA
				V_{CCA}=0V, V_{CCB}=5.5V			-2	μA
		I_{CCB}		V_{CCA}=1.2V, V_{CCB}=1.65V~5.5V		3.4		μA
				V_{CCA}=1.4V~3.6V, V_{CCB}=1.65V~5.5V			5	μA
				V_{CCA}=3.6V, V_{CCB}=0V			-2	μA
				V_{CCA}=0V, V_{CCB}=5.5V			2	μA
		I_{CCA}+I_{CCB}		V_{CCA}=1.2V, V_{CCB}=1.65V~5.5V		3.5		μA
				V_{CCA}=1.4V~3.6V, V_{CCB}=1.65V~5.5V			10	μA
		I_{CCZA}		V_{CCA}=1.2V, V_{CCB}=1.65V~5.5V OE=GND		0.05		μA
				V_{CCA}=1.2V, V_{CCB}=1.4V~3.6V OE=GND			5	μA
		I_{CCZB}		V_{CCA}=1.2V, V_{CCB}=1.65V~5.5V OE=GND		3.3		μA
				V_{CCA}=1.4V~3.6V, V_{CCB}=1.65V~5.5V OE=GND			5	μA
Input Capacitance	OE	C_{IN}	V_{CCA}=1.2V~3.6V, V_{CCB}=1.65V~5.5V			5		pF
Output Capacitance	A Port	C_{IO}				5		pF
	B Port					8		pF

Notes: 1. V_{CCI} is the supply voltage associated with the input port.
2. V_{CCO} is the supply voltage associated with the output port.

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

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Propagation Delay From Input (A) to Output (B)	t_{PD}	V_{CCA}=1.2V	V_{CCB}=1.8V		9.5		ns
			V_{CCB}=2.5V		7.9		ns
			V_{CCB}=3.3V		7.6		ns
			V_{CCB}=5V		8.5		ns
		V_{CCA}=1.5V±0.1V	V_{CCB}=1.8V±0.15V	1.4		12.9	ns
			V_{CCB}=2.5V±0.2V	1.2		10.1	ns
			V_{CCB}=3.3V±0.3V	1.1		10	ns
			V_{CCB}=5V±0.5V	0.8		9.9	ns
		V_{CCA}=1.8V±0.15V	V_{CCB}=1.8V±0.15V	1.6		11	ns
			V_{CCB}=2.5V±0.2V	1.4		7.7	ns
			V_{CCB}=3.3V±0.3V	1.3		6.8	ns
			V_{CCB}=5V±0.5V	1.2		6.5	ns
		V_{CCA}=2.5V±0.2V	V_{CCB}=2.5V±0.2V	1.1		6.4	ns
			V_{CCB}=3.3V±0.3V	1.0		5.3	ns
			V_{CCB}=5V±0.5V	0.9		4.7	ns
		V_{CCA}=3.3V±0.3V	V_{CCB}=3.3V±0.3V	0.9		4.9	ns
			V_{CCB}=5V±0.5V	0.8		4.0	ns
Propagation Delay From Input (B) to Output (A)		V_{CCA}=1.2V	V_{CCB}=1.8V		9.2		ns
			V_{CCB}=2.5V		8.8		ns
			V_{CCB}=3.3V		8.4		ns
			V_{CCB}=5V		8.0		ns
		V_{CCA}=1.5V±0.1V	V_{CCB}=1.8V±0.15V	0.9		14.2	ns
			V_{CCB}=2.5V±0.2V	0.7		12	ns
			V_{CCB}=3.3V±0.3V	0.4		11.7	ns
			V_{CCB}=5V±0.5V	0.3		13.7	ns
		V_{CCA}=1.8V±0.15V	V_{CCB}=1.8V±0.15V	1.5		12	ns
			V_{CCB}=2.5V±0.2V	1.2		8.4	ns
			V_{CCB}=3.3V±0.3V	0.8		7.6	ns
			V_{CCB}=5V±0.5V	0.5		7.1	ns
		V_{CCA}=2.5V±0.2V	V_{CCB}=2.5V±0.2V	1.0		7.0	ns
			V_{CCB}=3.3V±0.3V	0.6		5.6	ns
			V_{CCB}=5V±0.5V	0.3		4.4	ns
		V_{CCA}=3.3V±0.3V	V_{CCB}=3.3V±0.3V	0.5		5.4	ns
			V_{CCB}=5V±0.5V	0.2		4.0	ns
Enable Time From Input (OE) to Output (A or B)	t_{en}	V_{CCA}=1.2V	V_{CCB}=1.8V		150		ns
			V_{CCB}=2.5V		150		ns
			V_{CCB}=3.3V		150		ns
			V_{CCB}=5V		150		ns
		V_{CCA}=1.5V±0.1V	V_{CCB}=1.8V±0.15V			1	μs
			V_{CCB}=2.5V±0.2V			1	μs
			V_{CCB}=3.3V±0.3V			1	μs
			V_{CCB}=5V±0.5V			1	μs
		V_{CCA}=1.8V±0.15V	V_{CCB}=1.8V±0.15V			1	μs
			V_{CCB}=2.5V±0.2V			1	μs
			V_{CCB}=3.3V±0.3V			1	μs
			V_{CCB}=5V±0.5V			1	μs
		V_{CCA}=2.5V±0.2V	V_{CCB}=2.5V±0.2V			1	μs
			V_{CCB}=3.3V±0.3V			1	μs
			V_{CCB}=5V±0.5V			1	μs
		V_{CCA}=3.3V±0.3V	V_{CCB}=3.3V±0.3V			1	μs
			V_{CCB}=5V±0.5V			1	μs

■ SWITCHING CHARACTERISTICS (Cont.)

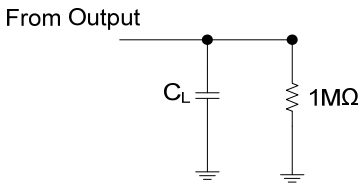
PARAMETER		SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Disable Time From Input (OE) to Output (A)		t_{dis}	V_{CCA}=1.2V	V_{CCB}=1.8V		160		ns
				V_{CCB}=2.5V		150		ns
				V_{CCB}=3.3V		140		ns
				V_{CCB}=5V		130		ns
			V_{CCA}=1.5V±0.1V	V_{CCB}=1.8V±0.15V			320	ns
				V_{CCB}=2.5V±0.2V			260	ns
				V_{CCB}=3.3V±0.3V			260	ns
				V_{CCB}=5V±0.5V			260	ns
			V_{CCA}=1.8V±0.15V	V_{CCB}=1.8V±0.15V			260	ns
				V_{CCB}=2.5V±0.2V			230	ns
				V_{CCB}=3.3V±0.3V			230	ns
				V_{CCB}=5V±0.5V			230	ns
			V_{CCA}=2.5V±0.2V	V_{CCB}=2.5V±0.2V			200	ns
				V_{CCB}=3.3V±0.3V			200	ns
				V_{CCB}=5V±0.5V			200	ns
			V_{CCA}=3.3V±0.3V	V_{CCB}=3.3V±0.3V			200	ns
				V_{CCB}=5V±0.5V			200	ns
Disable Time From Input (OE) to Output (B)			V_{CCA}=1.2V	V_{CCB}=1.8V		160		ns
				V_{CCB}=2.5V		150		ns
				V_{CCB}=3.3V		150		ns
				V_{CCB}=5V		130		ns
			V_{CCA}=1.5V±0.1V	V_{CCB}=1.8V±0.15V			200	ns
				V_{CCB}=2.5V±0.2V			200	ns
				V_{CCB}=3.3V±0.3V			200	ns
				V_{CCB}=5V±0.5V			200	ns
			V_{CCA}=1.8V±0.15V	V_{CCB}=1.8V±0.15V			200	ns
				V_{CCB}=2.5V±0.2V			200	ns
				V_{CCB}=3.3V±0.3V			200	ns
				V_{CCB}=5V±0.5V			200	ns
			V_{CCA}=2.5V±0.2V	V_{CCB}=2.5V±0.2V			200	ns
				V_{CCB}=3.3V±0.3V			200	ns
				V_{CCB}=5V±0.5V			200	ns
			V_{CCA}=3.3V±0.3V	V_{CCB}=3.3V±0.3V			200	ns
				V_{CCB}=5V±0.5V			200	ns
Rise and Fall Time	A Port Rise And Fall Times	t_{rA}, t_{fA}	V_{CCA}=1.2V	V_{CCB}=1.8V		4.1		ns
				V_{CCB}=2.5V		4.4		ns
				V_{CCB}=3.3V		4.1		ns
				V_{CCB}=5V		3.9		ns
			V_{CCA}=1.5V±0.1V	V_{CCB}=1.8V±0.15V	0.8		6.5	ns
				V_{CCB}=2.5V±0.2V	0.8		6.3	ns
				V_{CCB}=3.3V±0.3V	0.8		6.3	ns
				V_{CCB}=5V±0.5V	0.8		6.3	ns
			V_{CCA}=1.8V±0.15V	V_{CCB}=1.8V±0.15V	0.7		5.1	ns
				V_{CCB}=2.5V±0.2V	0.7		5.0	ns
				V_{CCB}=3.3V±0.3V	1.0		5.0	ns
				V_{CCB}=5V±0.5V	0.7		5.0	ns
			V_{CCA}=2.5V±0.2V	V_{CCB}=2.5V±0.2V	0.8		3.6	ns
				V_{CCB}=3.3V±0.3V	0.6		3.6	ns
				V_{CCB}=5V±0.5V	0.5		3.5	ns
			V_{CCA}=3.3V±0.3V	V_{CCB}=3.3V±0.3V	0.5		3.0	ns
				V_{CCB}=5V±0.5V	0.5		3.0	ns

■ SWITCHING CHARACTERISTICS (Cont.)

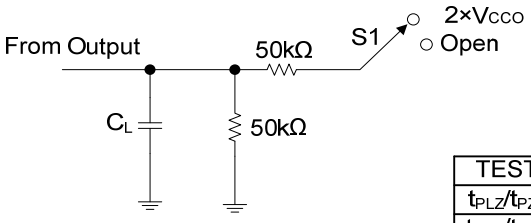
PARAMETER		SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Rise and Fall Time	B Port Rise And Fall Times	t_{rB}, t_{fB}	V_{CCA}=1.2V	V_{CCB}=1.8V		5.0		ns
				V_{CCB}=2.5V		5.0		ns
				V_{CCB}=3.3V		5.1		ns
				V_{CCB}=5V		5.1		ns
			V_{CCA}=1.5V±0.1V	V_{CCB}=1.8V±0.15V	1.0		7.3	ns
				V_{CCB}=2.5V±0.2V	0.7		4.9	ns
				V_{CCB}=3.3V±0.3V	0.7		4.6	ns
				V_{CCB}=5V±0.5V	0.6		4.6	ns
			V_{CCA}=1.8V±0.15V	V_{CCB}=1.8V±0.15V	1.0		7.3	ns
				V_{CCB}=2.5V±0.2V	0.7		5.0	ns
				V_{CCB}=3.3V±0.3V	0.7		3.9	ns
				V_{CCB}=5V±0.5V	0.6		3.8	ns
			V_{CCA}=2.5V±0.2V	V_{CCB}=2.5V±0.2V	0.6		4.9	ns
				V_{CCB}=3.3V±0.3V	0.7		3.9	ns
				V_{CCB}=5V±0.5V	0.6		3.2	ns
			V_{CCA}=3.3V±0.3V	V_{CCB}=3.3V±0.3V	0.7		3.9	ns
				V_{CCB}=5V±0.5V	0.6		3.2	ns
Data Rate		f_{data}	V_{CCA}=1.2V, V_{CCB}=1.8V~5V			20		Mbps
			V_{CCA}=1.5V±0.1V, V_{CCB}=1.65V~5.5V				50	Mbps
			V_{CCA}=1.8V±0.15V	V_{CCB}=1.8V±0.15V			52	Mbps
				V_{CCB}=2.3V~5.5V			60	Mbps
			V_{CCA}=2.5V±0.2V	V_{CCB}=2.5V±0.2V			70	Mbps
				V_{CCB}=3V~5.5V			100	Mbps
			V_{CCA}=3.3V±0.3V	V_{CCB}=3V~5.5V			100	Mbps
Pulse Duration	Data Inputs	t_W	V_{CCA}=1.2V, V_{CCB}=1.8V~5V			50		ns
			V_{CCA}=1.5V±0.1V, V_{CCB}=1.65V~5.5V		20			ns
			V_{CCA}=1.8V±0.15V	V_{CCB}=1.8V±0.15V	19			ns
				V_{CCB}=2.3V~5.5V	17			ns
			V_{CCA}=2.5V±0.2V	V_{CCB}=2.5V±0.2V	14			ns
				V_{CCB}=3V~5.5V	10			ns
			V_{CCA}=3.3V±0.3V	V_{CCB}=3V~5.5V	10			ns

■ TEST CIRCUIT AND WAVEFORMS

Load Circuit

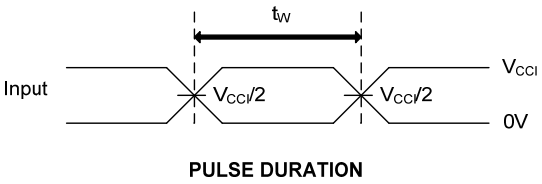


MAX DATA RATE, PULSE DURATION PROPAGATION DELAY OUTPUT RISE AND FALL TIME MEASUREMENT

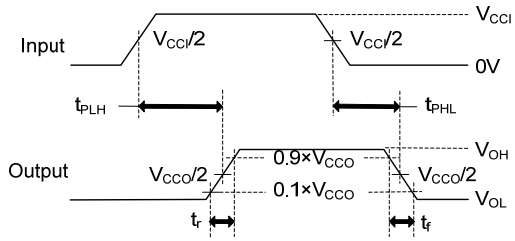


TEST	S1
t_{PLZ}/t_{PZL}	2×Vcco
t_{PHZ}/t_{PZH}	Open

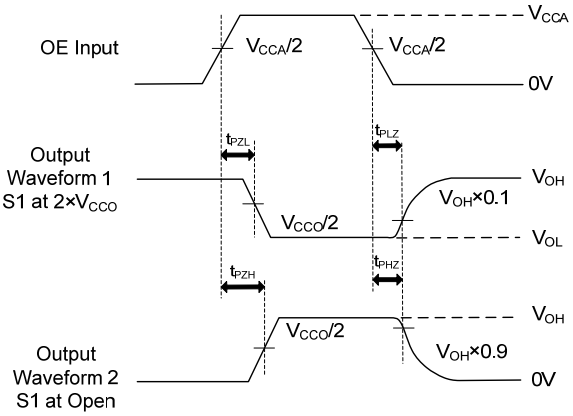
ENABLE/DISABLE TIME MEASUREMENT



PULSE DURATION



PROPAGATION DELAY TIMES



ENABLE AND DISABLE TIMES

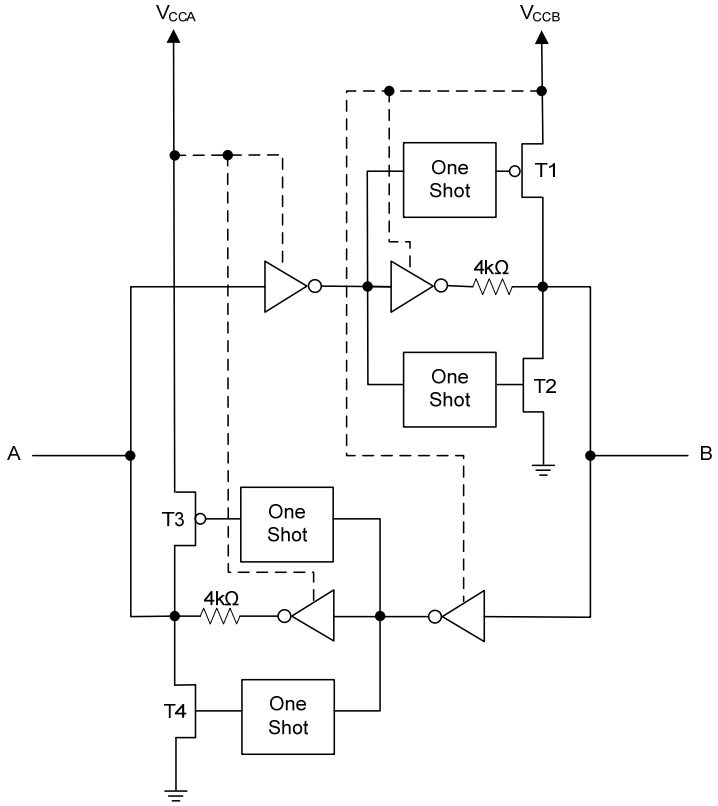
Notes: 1. C_L includes probe and jig capacitance.
2. The outputs are measured one at a time, with one transition per measurement.
3. t_{PLH} and t_{PHL} are the same as t_{PD}.
4. V_{CCI} is the V_{CC} associated with the input port.
5. V_{CCO} is the V_{CC} associated with the output port.
6. All parameters and waveforms are not applicable to all devices.

■ DETAILED DESCRIPTION

Overview

The **UTXB0108** device is a 8-bit, directionless voltage-level translator specifically designed for translating logic voltage levels. The A port is able to accept I/O voltages from 1.2V to 3.6V, while the B port can accept I/O voltages from 1.65V to 5.5V.

This device can only translate push-pull CMOS logic outputs. If for open-drain signal translation, please refer to UTC's UTXS010X products.



■ DETAILED DESCRIPTION (Cont.)

Power-Up

During operation, ensure that $V_{CCA} \leqslant V_{CCB}$ at all times. During power-up sequencing, $V_{CCA} \geqslant V_{CCB}$ does not damage the device, so any power supply can be ramped up first. The **UTXB0108** has circuitry that disables all output ports when either V_{CC} is switched off ($V_{CCA/B}$=0V).

Enable and Disable

The **UTXB0108** has an OE input that is used to disable the device by setting OE = LOW, which places all I/Os in the high-impedance (Hi-Z) state. The disable time (t_{dis}) indicates the delay between when OE goes low and when the outputs actually get disabled (Hi-Z). The enable time (t_{en}) indicates the amount of time the user must allow for the one-shot circuitry to become operational after OE is taken high.

Device Functional Modes

The **UTXB0108** device has two functional modes, enabled and disabled. To disable the device, the OE =LOW, which places all I/Os in a high impedance state. When the OE = HIGH, it will enable the device.

■ TYPICAL APPLICATION CIRCUIT