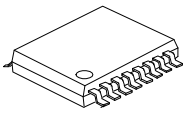
6-BIT BIDIRECTIONAL LEVEL-SHIFTING AND VOLTAGE TRANSLATOR WITH AUTO-DIRECTION SENSING



TSSOP-16

■ DESCRIPTION

This 6-bit noninverting translator uses two separate configurable power-supply rails. The A port is designed to track V_{CCA}. V_{CCA} accepts any supply voltage from 1.2V to 3.6V. The B port is designed to track V_{CCB}. V_{CCB} accepts any supply voltage from 1.65V to 5.5V. This allows for universal low-voltage bidirectional translation between any of the 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, and 5V voltage nodes. V_{CCA} should not exceed V_{CCB}.

When the output-enable(OE) input is low, all outputs are placed in the high-impedance state.

The **UTXB0106** is designed so that the OE input circuit is supplied by V_{CCA}.

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.

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

* 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

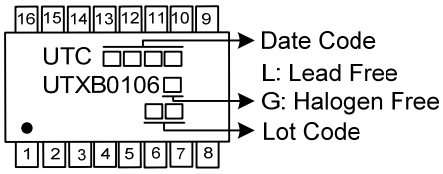
* Handset
* Smartphone
* Tablet
* Desktop PC

■ ORDERING INFORMATION

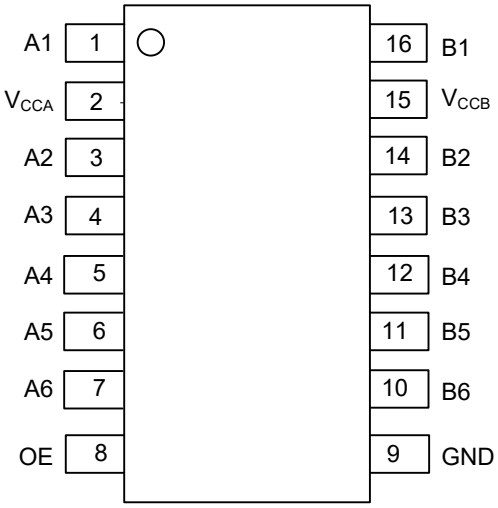
Ordering Number		Package	Packing
Lead Free	Halogen Free		
UTXB0106L-P16-R	UTXB0106G-P16-R	TSSOP-16	Tape Reel

UTXB0106G-P16-R (1)Packing Type (2) Package Type (3) Green Package	(1) R: Tape Reel (2) P16: TSSOP-16 (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	OE	I	Output Enable. Pull OE low to place all outputs in 3-state mode. Referenced to V_{CCA}
9	GND		Ground
10	B6	I/O	Input/output B6. Referenced to V_{CCB}
11	B5	I/O	Input/output B5. Referenced to V_{CCB}
12	B4	I/O	Input/output B4. Referenced to V_{CCB}
13	B3	I/O	Input/output B3. Referenced to V_{CCB}
14	B2	I/O	Input/output B2. Referenced to V_{CCB}
15	V_{CCB}		B-Port supply voltage 1.65 V ≤ V_{CCB} ≤ 5.5 V
16	B1	I/O	Input/output B1. Referenced to V_{CCB}

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

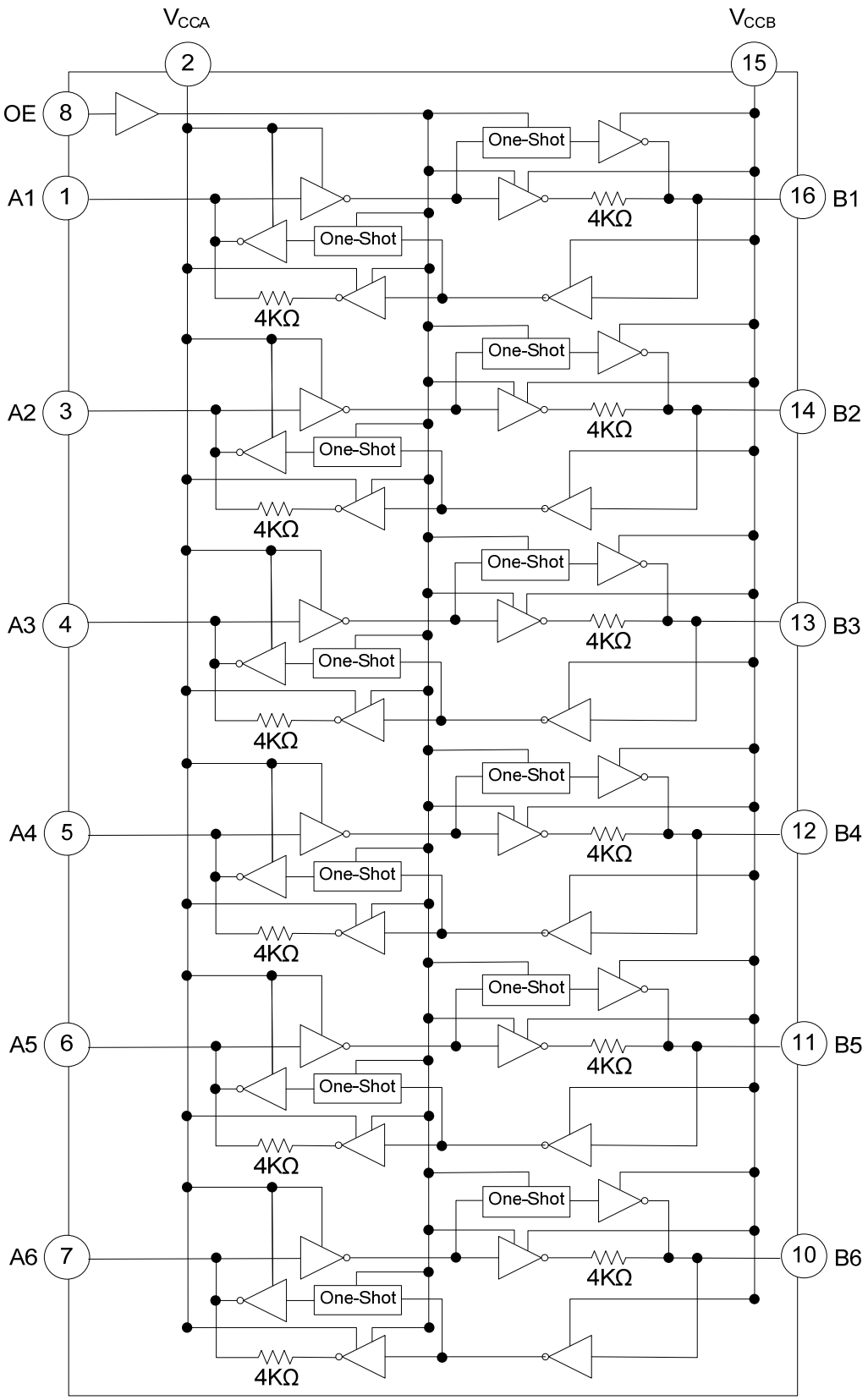
■ FUNCTION TABLE

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 (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 (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		+125	°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 (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}=1.2V, V_{CCB}=1.4V~3.6V 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 (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		1		μs
			V_{CCB}=2.5V		1		μs
			V_{CCB}=3.3V		1		μs
			V_{CCB}=5V		1		μs
		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		20		ns
				V_{CCB}=2.5V		17		ns
				V_{CCB}=3.3V		17		ns
				V_{CCB}=5V		18		ns
			V_{CCA}=1.5V±0.1V	V_{CCB}=1.8V±0.15V	6.6		33	ns
				V_{CCB}=2.5V±0.2V	6.4		25.3	ns
				V_{CCB}=3.3V±0.3V	6.1		23.1	ns
				V_{CCB}=5V±0.5V	5.9		24.6	ns
			V_{CCA}=1.8V±0.15V	V_{CCB}=1.8V±0.15V	5.9		26.7	ns
				V_{CCB}=2.5V±0.2V	5.6		21.6	ns
				V_{CCB}=3.3V±0.3V	5.4		18.9	ns
				V_{CCB}=5V±0.5V	4.8		18.7	ns
			V_{CCA}=2.5V±0.2V	V_{CCB}=2.5V±0.2V	5.0		16.9	ns
				V_{CCB}=3.3V±0.3V	4.9		15	ns
				V_{CCB}=5V±0.5V	4.5		13.8	ns
			V_{CCA}=3.3V±0.3V	V_{CCB}=3.3V±0.3V	4.5		13.9	ns
				V_{CCB}=5V±0.5V	4.1		12.4	ns
Disable Time From Input (OE) to Output (B)			V_{CCA}=1.2V	V_{CCB}=1.8V		20		ns
				V_{CCB}=2.5V		16		ns
				V_{CCB}=3.3V		15		ns
				V_{CCB}=5V		15		ns
			V_{CCA}=1.5V±0.1V	V_{CCB}=1.8V±0.15V	6.6		35.6	ns
				V_{CCB}=2.5V±0.2V	5.8		25.6	ns
				V_{CCB}=3.3V±0.3V	5.5		22.1	ns
				V_{CCB}=5V±0.5V	5.6		20.6	ns
			V_{CCA}=1.8V±0.15V	V_{CCB}=1.8V±0.15V	6.1		33.9	ns
				V_{CCB}=2.5V±0.2V	5.2		23.7	ns
				V_{CCB}=3.3V±0.3V	5.0		19.9	ns
				V_{CCB}=5V±0.5V	5.0		17.6	ns
			V_{CCA}=2.5V±0.2V	V_{CCB}=2.5V±0.2V	4.8		21.8	ns
				V_{CCB}=3.3V±0.3V	4.5		17.9	ns
				V_{CCB}=5V±0.5V	4.4		15.2	ns
			V_{CCA}=3.3V±0.3V	V_{CCB}=3.3V±0.3V	4.1		17.3	ns
				V_{CCB}=5V±0.5V	4.0		14.4	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

■ OPERATING CHARACTERISTICS (Unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Power Dissipation Capacitance	A Port Input B Port Output	C_{PDA}	C_L=0, f=10MHz t_r=t_f=1nS OE=V_{CCA} (Output Enabled)	V_{CCA}=1.2V V_{CCB}=5V		9.0		pF
				V_{CCA}=1.2V V_{CCB}=1.8V		8.0		pF
				V_{CCA}=1.5V V_{CCB}=1.8V		7.0		pF
				V_{CCA}=1.8V V_{CCB}=1.8V		7.0		pF
				V_{CCA}=2.5V V_{CCB}=2.5V		7.0		pF
				V_{CCA}=2.5V V_{CCB}=5V		7.0		pF
				V_{CCA}=3.3V V_{CCB}=3.3~5V		7.0		pF
	B Port Input A Port Output			V_{CCA}=1.2V V_{CCB}=5V		12		pF
				V_{CCA}=1.2V V_{CCB}=1.8V		11		pF
				V_{CCA}=1.5V V_{CCB}=1.8V		11		pF
				V_{CCA}=1.8V V_{CCB}=1.8V		11		pF
				V_{CCA}=2.5V V_{CCB}=2.5V		11		pF
				V_{CCA}=2.5V V_{CCB}=5V		11		pF
				V_{CCA}=3.3V V_{CCB}=3.3~5V		11		pF
Power Dissipation Capacitance	A Port Input B Port Output		C_L=0, f=10MHz t_r=t_f=1nS OE=GND (Output Disabled)	V_{CCA}=1.2V V_{CCB}=5V		0.01		pF
				V_{CCA}=1.2V V_{CCB}=1.8V		0.01		pF
				V_{CCA}=1.5V V_{CCB}=1.8V		0.01		pF
				V_{CCA}=1.8V V_{CCB}=1.8V		0.01		pF
				V_{CCA}=2.5V V_{CCB}=2.5V		0.01		pF
				V_{CCA}=2.5V V_{CCB}=5V		0.01		pF
				V_{CCA}=3.3V V_{CCB}=3.3~5V		0.01		pF

■ OPERATING CHARACTERISTICS (Cont.)

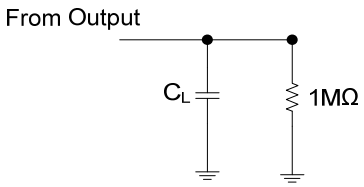
PARAMETER		SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Power Dissipation Capacitance	B Port Input A Port Output	C_{PDA}	C_L=0, f=10MHz t_r=t_f=1nS OE=GND (Output Disabled)	V_{CCA}=1.2V V_{CCB}=5V		0.01		pF
				V_{CCA}=1.2V V_{CCB}=1.8V		0.01		pF
				V_{CCA}=1.5V V_{CCB}=1.8V		0.01		pF
				V_{CCA}=1.8V V_{CCB}=1.8V		0.01		pF
				V_{CCA}=2.5V V_{CCB}=2.5V		0.01		pF
				V_{CCA}=2.5V V_{CCB}=5V		0.01		pF
				V_{CCA}=3.3V V_{CCB}=3.3~5V		0.01		pF
	A Port Input B Port Output	C_{PDB}	C_L=0, f=10MHz t_r=t_f=1nS OE=V_{CCA} (Output Enabled)	V_{CCA}=1.2V V_{CCB}=5V		35		pF
				V_{CCA}=1.2V V_{CCB}=1.8V		26		pF
				V_{CCA}=1.5V V_{CCB}=1.8V		27		pF
				V_{CCA}=1.8V V_{CCB}=1.8V		27		pF
				V_{CCA}=2.5V V_{CCB}=2.5V		27		pF
				V_{CCA}=2.5V V_{CCB}=5V		27		pF
				V_{CCA}=3.3V V_{CCB}=3.3~5V		28		pF
	B Port Input A Port Output			V_{CCA}=1.2V V_{CCB}=5V		26		pF
				V_{CCA}=1.2V V_{CCB}=1.8V		19		pF
				V_{CCA}=1.5V V_{CCB}=1.8V		18		pF
				V_{CCA}=1.8V V_{CCB}=1.8V		18		pF
				V_{CCA}=2.5V V_{CCB}=2.5V		18		pF
				V_{CCA}=2.5V V_{CCB}=5V		20		pF
				V_{CCA}=3.3V V_{CCB}=3.3~5V		21		pF

■ OPERATING CHARACTERISTICS (Cont.)

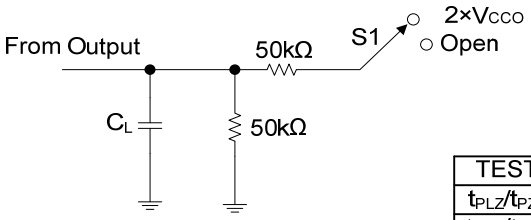
PARAMETER		SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Power Dissipation Capacitance	A Port Input B Port Output	C_{PDB}	C_L=0, f=10MHz t_r=t_f=1nS OE=GND (Output Disabled)	V_{CCA}=1.2V V_{CCB}=5V		0.01		pF
				V_{CCA}=1.2V V_{CCB}=1.8V		0.01		pF
				V_{CCA}=1.5V V_{CCB}=1.8V		0.01		pF
				V_{CCA}=1.8V V_{CCB}=1.8V		0.01		pF
				V_{CCA}=2.5V V_{CCB}=2.5V		0.01		pF
				V_{CCA}=2.5V V_{CCB}=5V		0.01		pF
				V_{CCA}=3.3V V_{CCB}=3.3~5V		0.03		pF
	B Port Input A Port Output			V_{CCA}=1.2V V_{CCB}=5V		0.01		pF
				V_{CCA}=1.2V V_{CCB}=1.8V		0.01		pF
				V_{CCA}=1.5V V_{CCB}=1.8V		0.01		pF
				V_{CCA}=1.8V V_{CCB}=1.8V		0.01		pF
				V_{CCA}=2.5V V_{CCB}=2.5V		0.01		pF
				V_{CCA}=2.5V V_{CCB}=5V		0.01		pF
				V_{CCA}=3.3V V_{CCB}=3.3~5V		0.03		pF

■ TEST CIRCUIT AND WAVEFORMS

Load Circuit

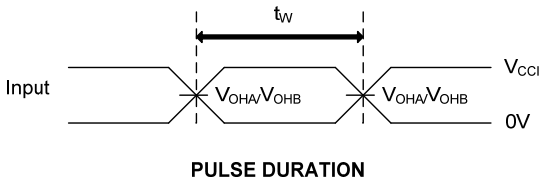


MAX DATA RATE, PULSE DURATION PROPAGATION DELAY OUTPUT RISE AND FALL TIME MEASUREMENT

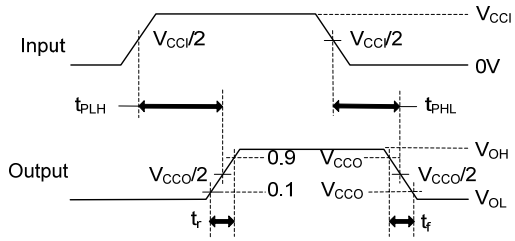


TEST	S1
t_{PLZ}/t_{PZL}	2×V_{CCO}
t_{PHZ}/t_{PZH}	Open

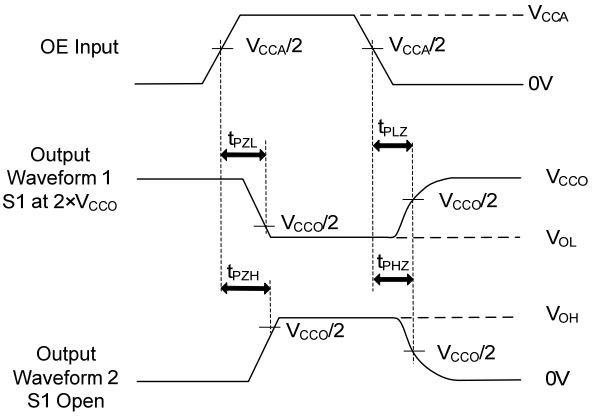
ENABLE/DISABLE TIME MEASUREMENT



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 **UTXB0106** device is a 6-bit, directionless voltage-level translator specifically designed for translating logic voltage levels. The A port is able to accept I/O voltages ranging from 1.2V to 3.6V, while the B port can accept I/O voltages from 1.65V to 5.5V. The device is a buffered architecture with edge-rate accelerators (one-shots)

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

Architecture

The **UTXB0106** architecture (see Figure 1) does not require a direction-control signal to control the direction of data flow from A to B or from B to A. In a dc state, the output drivers of the **UTXB0106** can maintain a high or low, but are designed to be weak, so that they can be overdriven by an external driver when data on the bus starts flowing the opposite direction.

The output one-shots detect rising or falling edges on the A or B ports. During a rising edge, the one-shot turns on the PMOS transistors (T1, T3) for a short duration, which speeds up the low-to-high transition. Similarly, during a falling edge, the one-shot turns on the NMOS transistors (T2, T4) for a short duration, which speeds up the high-to-low transition. The typical output impedance during output transition is 70Ω at V_{CCO} = 1.2V to 1.8V, 50Ω at V_{CCO}=1.8V to 3.3V, and 40Ω at V_{CCO}=3.3V to 5V.

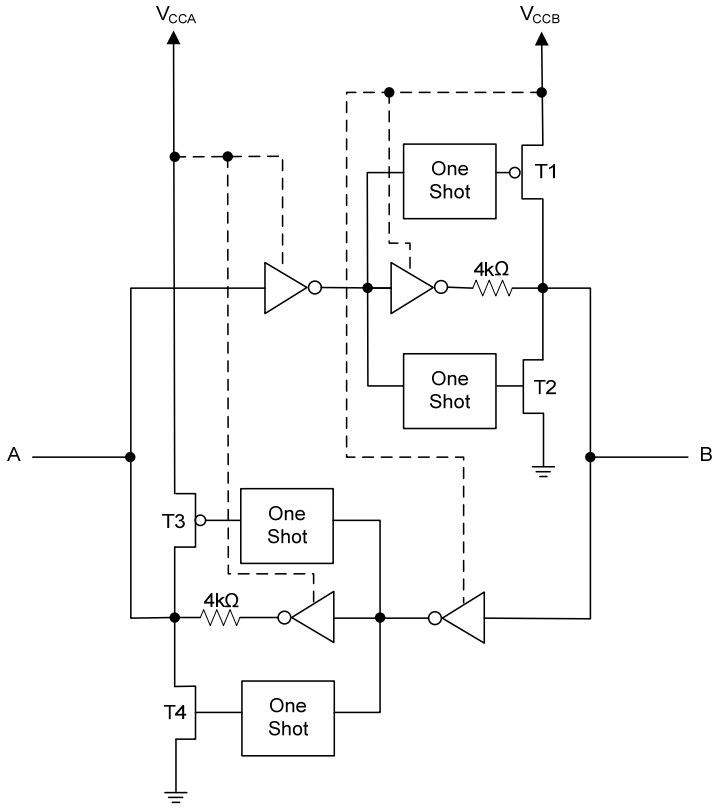


Figure 1. Architecture of UTXB0106 I/O Cell

■ 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 **UTXB0106** has circuitry that disables all output ports when either V_{CC} is switched off ($V_{CCA/B}$=0V).

Output Load Considerations

Recommends careful PCB layout practices with short PCB trace lengths to avoid excessive capacitive loading and to ensure that proper O.S. triggering takes place. PCB signal trace-lengths should be kept short enough such that the round trip delay of any reflection is less than the one-shot duration. This improves signal integrity by ensuring that any reflection sees a low impedance at the driver. The O.S. circuits have been designed to stay on for approximately 10ns. The maximum capacitance of the lumped load that can be driven also depends directly on the one-shot duration. With very heavy capacitive loads, the one-shot can time-out before the signal is driven fully to the positive rail. The O.S. duration has been set to best optimize trade-offs between dynamic ICC, load driving capability, and maximum bit-rate considerations. Both PCB trace length and connectors add to the capacitance that the **UTXB0106** output sees, so it is recommended that this lumped-load capacitance be considered to avoid O.S. retriggering, bus contention, output signal oscillations, or other adverse system-level affects.

Enable and Disable

The **UTXB0106** 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.

Pull-up or Pull-down Resistors on I/O Lines

The **UTXB0106** is designed to drive capacitive loads of up to 70pF. The output drivers of the **UTXB0106** have low dc drive strength. If pull-up or pull-down resistors are connected externally to the data I/Os, their values must be kept higher than 50kΩ to ensure that they do not contend with the output drivers of the **UTXB0106**.

For the same reason, the **UTXB0106** should not be used in applications such as I^2C or 1-Wire where an open-drain driver is connected on the bidirectional data I/O. For these applications, use a device from the UTC UTXS01xx series of level translators.

Device Functional Modes

The **UTXB0106** device has two functional modes, enabled and disabled. To disable the device, set the OE input to low, which places all I/Os in a high impedance state. Setting the OE input to high will enable the device.

■ TYPICAL APPLICATION CIRCUIT