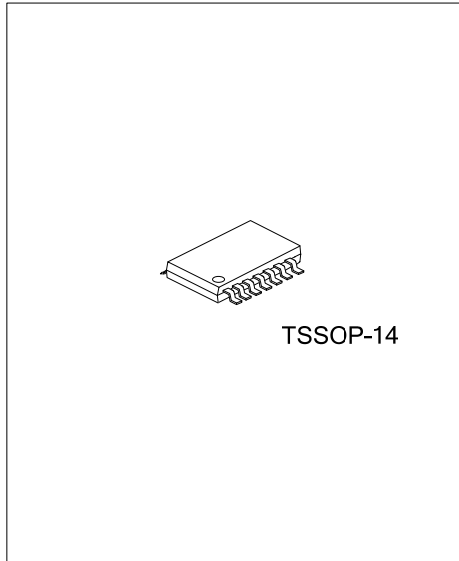




### 4-BIT BIDIRECTIONAL VOLTAGE-LEVEL TRANSLATOR WITH AUTOMATIC DIRECTION SENSING



#### DESCRIPTION

The UTC **UTXB0104** is 4-bit non-inverting 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 State 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. 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.

The **UTC UTXB0104** is designed so that the OE input circuit is supplied by  $V_{CCA}$ .

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

#### FEATURES

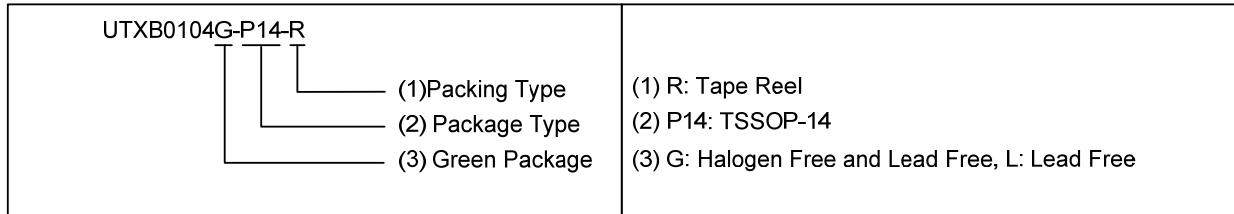
- \* 1.2V to 3.6V on A Port and 1.65V to 5.5V on B Port ( $V_{CCA} \leq V_{CCB}$ )
- \*  $V_{CC}$  Isolation Feature – If Either  $V_{CC}$  Input Is at GND, All Outputs Are in the High-Impedance State
- \* OE Input Circuit Referenced to  $V_{CCA}$
- \* Low Power Consumption, 5 $\mu$ A Max  $I_{CC}$
- \*  $I_{OFF}$  Supports Partial-Power-Down Mode Operation

#### APPLICATION

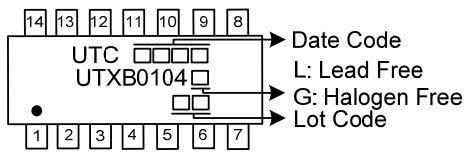
- \* Headset
- \* Smartphone
- \* Tablet
- \* Desktop PC

### ■ ORDERING INFORMATION

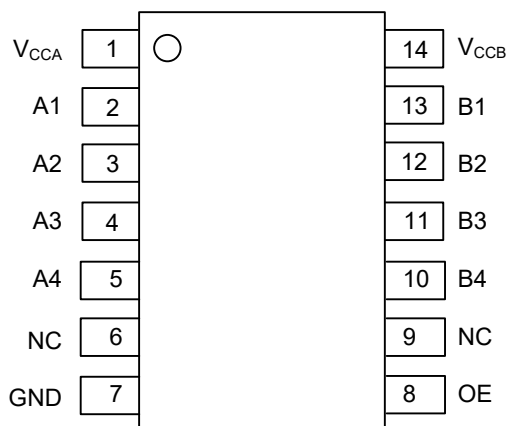
Ordering Number		Package	Packing
Lead Free	Halogen Free		
UTXB0104L-P14-R	UTXB0104G-P14-R	TSSOP-14	Tape Reel



### ■ MARKING



### ■ PIN CONFIGURATION



### ■ PIN DESCRIPTION

PIN NO.	PIN NAME	I/O	DESCRIPTION
1	V <sub>CCA</sub>		A-port supply voltage $1.2V \leq V_{CCA} \leq 3.6V$ and $V_{CCA} \leq V_{CCB}$ .
2	A1	I/O	Input/output A1. Referenced to V <sub>CCA</sub>
3	A2	I/O	Input/output A2. Referenced to V <sub>CCA</sub>
4	A3	I/O	Input/output A3. Referenced to V <sub>CCA</sub>
5	A4	I/O	Input/output A4. Referenced to V <sub>CCA</sub>
6	NC		No connection. Not internally connected.
7	GND		Ground
8	OE	I	3-state output-mode enable. Pull OE low to place all outputs in 3-state mode. Referenced to V <sub>CCA</sub>
9	NC		No connection. Not internally connected.
10	B4	I/O	Input/output B4. Referenced to V <sub>CCB</sub>
11	B3	I/O	Input/output B3. Referenced to V <sub>CCB</sub>
12	B2	I/O	Input/output B2. Referenced to V <sub>CCB</sub>
13	B1	I/O	Input/output B1. Referenced to V <sub>CCB</sub>
14	V <sub>CCB</sub>		B-port supply voltage $1.65V \leq V_{CCB} \leq 5.5V$

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

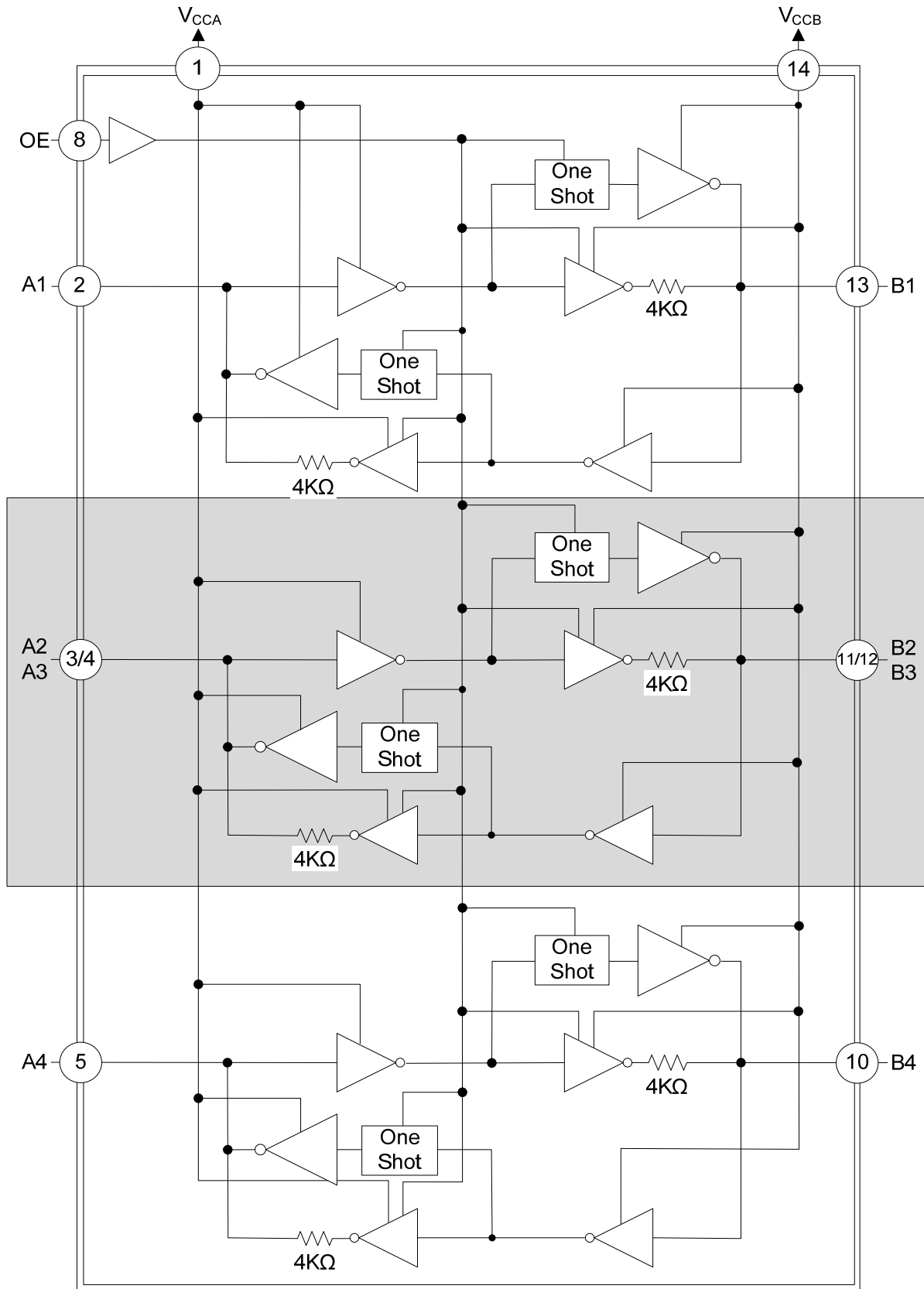
### ■ FUNCTION TABLE

SUPPLY VOLTAGE		INPUTS	INPUTS/OUTPUT	
V <sub>CCA</sub>	V <sub>CCB</sub>	OE	A <sub>n</sub>	B <sub>n</sub>
1.2V ~ V <sub>CCB</sub>	1.65V ~ 5.5V	L	Z	Z
1.2V ~ V <sub>CCB</sub>	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<sub>CCA</sub> or V<sub>CCB</sub> 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	$V_{OUT}$	$V_{CCA}=1.2V\sim 3.6V$ , $V_{CCB}=1.65V\sim 5.5V$	0		3.6	V
	B Port		$V_{CCA}=1.2V\sim 3.6V$ , $V_{CCB}=1.65V\sim 5.5V$	0		5.5	V
High-Level Input Voltage	Data Inputs	$V_{IH}$	$V_{CCA}=1.2V\sim 3.6V$ , $V_{CCB}=1.65V\sim 5.5V$	$V_{CCI}$ ×0.65 (Note 3)		$V_{CCI}$	V
	OE			$V_{CCA}$ ×0.65		5.5	V
Low-Level Input Voltage	Data Inputs	$V_{IL}$	$V_{CCA}=1.2V\sim 3.6V$ , $V_{CCB}=1.65V\sim 5.5V$	0		$V_{CCI}$ ×0.35 (Note 3)	V
	OE			0		$V_{CCA}$ ×0.35	V
Input Transition Rise or Fall Rate	A Port Inputs	$\Delta t/\Delta v$	$V_{CCA}=1.2V\sim 3.6V$	$V_{CCB}=1.65V\sim 5.5V$		40	ns/V
	B Port Inputs			$V_{CCB}=1.65V\sim 3.6V$		40	ns/V
				$V_{CCB}=4.5V\sim 5.5V$		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		$V_{OHA}$	$V_{CCA}=1.2V, I_{OH}=-20\mu A$		1.1		V
			$V_{CCB}=1.4V\sim 3.6V, I_{OH}=-20\mu A$	$V_{CCA}$ -0.4			V
Port A Output Low Voltage		$V_{OLA}$	$V_{CCA}=1.2V, I_{OL}=20\mu A$		0.3		V
			$V_{CCB}=1.4V\sim 3.6V, I_{OL}=20\mu A$			0.4	V
Port B Output High Voltage		$V_{OHB}$	$V_{CCB}=1.65V\sim 5.5V, I_{OH}=-20\mu A$	$V_{CCB}$ -0.4			V
Port B Output Low Voltage		$V_{OLB}$	$V_{CCB}=1.65V\sim 5.5V, I_{OL}=20\mu A$			0.4	V
Input Leakage Current	OE	$I_{I(LEAK)}$	$V_I=V_{CCI}$ or GND, $V_{CCA}=1.2V\sim 3.6V,$ $V_{CCB}=1.65V\sim 5.5V$			$\pm 1$	$\mu A$
Power OFF Leakage Current	A Port	$I_{OFF}$	$V_I$ or $V_{OUT}=0\sim 3.6V, V_{CCA}=0V,$ $V_{CCB}=0V\sim 5.5V$			$\pm 1$	$\mu A$
	B Port		$V_I$ or $V_{OUT}=0\sim 5.5V,$ $V_{CCA}=0V\sim 3.6V, V_{CCB}=0V$			$\pm 1$	$\mu A$
High-Impedance State Output Current	A or B Port	$I_{OZ}$	$V_{CCA}=1.2V\sim 3.6V,$ $V_{CCB}=1.65V\sim 5.5V, OE=GND$			$\pm 1$	$\mu A$
Quiescent Supply Current		$I_{CCA}$	$V_I=V_{CCI}$ or GND $I_O=0A$	$V_{CCA}=1.2V,$ $V_{CCB}=1.65V\sim 5.5V$		0.06	$\mu A$
				$V_{CCA}=1.4V\sim 3.6V,$ $V_{CCB}=1.65V\sim 5.5V$		5	$\mu A$
				$V_{CCA}=3.6V, V_{CCB}=0V$		2	$\mu A$
				$V_{CCA}=0V, V_{CCB}=5.5V$		-2	$\mu A$
		$I_{CCB}$		$V_{CCA}=1.2V,$ $V_{CCB}=1.65V\sim 5.5V$		3.4	$\mu A$
				$V_{CCA}=1.4V\sim 3.6V,$ $V_{CCB}=1.65V\sim 5.5V$		5	$\mu A$
				$V_{CCA}=3.6V, V_{CCB}=0V$		-2	$\mu A$
				$V_{CCA}=0V, V_{CCB}=5.5V$		2	$\mu A$
		$I_{CCA}+I_{CCB}$		$V_{CCA}=1.2V,$ $V_{CCB}=1.65V\sim 5.5V$		3.5	$\mu A$
				$V_{CCA}=1.4V\sim 3.6V,$ $V_{CCB}=1.65V\sim 5.5V$		10	$\mu A$
		$I_{CCZA}$		$V_{CCA}=1.2V,$ $V_{CCB}=1.65V\sim 5.5V$ OE=GND		0.05	$\mu A$
				$V_{CCA}=1.4V\sim 3.6V,$ $V_{CCB}=1.65V\sim 5.5V$ OE=GND		5	$\mu A$
$V_{CCA}=1.2V,$ $V_{CCB}=1.65V\sim 5.5V$ OE=GND			3.3	$\mu A$			
$V_{CCA}=1.4V\sim 3.6V,$ $V_{CCB}=1.65V\sim 5.5V$ OE=GND			5	$\mu A$			
Input Capacitance	OE	$C_{IN}$		3		pF	
Output Capacitance	A Port	$C_{IO}$	$V_{CCA}=1.2V\sim 3.6V,$ $V_{CCB}=1.65V\sim 5.5V$		5		pF
	B Port				11		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.  
 3.  $V_{CCA}$  must be less than or equal to  $V_{CCB}$ , and  $V_{CCA}$  must not exceed 3.6V.

■ SWITCHING CHARACTERISTICS (Unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT			
Propagation Delay From Input (A) to Output (B)	t <sub>PD</sub>	V <sub>CCA</sub> =1.2V	V <sub>CCB</sub> =1.8V		8.9	ns			
			V <sub>CCB</sub> =2.5V		7.7	ns			
			V <sub>CCB</sub> =3.3V		7.3	ns			
			V <sub>CCB</sub> =5V		7.5	ns			
		V <sub>CCA</sub> =1.5V±0.1V	V <sub>CCB</sub> =1.8V±0.15V	1.4		14.4	ns		
			V <sub>CCB</sub> =2.5V±0.2V	1.2		11.6	ns		
			V <sub>CCB</sub> =3.3V±0.3V	1.1		11.5	ns		
			V <sub>CCB</sub> =5V±0.5V	0.8		11.4	ns		
		V <sub>CCA</sub> =1.8V±0.15V	V <sub>CCB</sub> =1.8V±0.15V	1.6		12	ns		
			V <sub>CCB</sub> =2.5V±0.2V	1.4		8.7	ns		
			V <sub>CCB</sub> =3.3V±0.3V	1.3		7.8	ns		
			V <sub>CCB</sub> =5V±0.5V	1.2		7.5	ns		
		V <sub>CCA</sub> =2.5V±0.2V	V <sub>CCB</sub> =2.5V±0.2V	1.1		7	ns		
			V <sub>CCB</sub> =3.3V±0.3V	1.0		5.9	ns		
			V <sub>CCB</sub> =5V±0.5V	0.9		5.4	ns		
		V <sub>CCA</sub> =3.3V±0.3V	V <sub>CCB</sub> =3.3V±0.3V	0.9		5.2	ns		
			V <sub>CCB</sub> =5V±0.5V	0.8		4.5	ns		
		Propagation Delay From Input (B) to Output (A)	t <sub>PD</sub>	V <sub>CCA</sub> =1.2V	V <sub>CCB</sub> =1.8V		9.4	ns	
					V <sub>CCB</sub> =2.5V		8.4	ns	
					V <sub>CCB</sub> =3.3V		8.0	ns	
					V <sub>CCB</sub> =5V		8.8	ns	
				V <sub>CCA</sub> =1.5V±0.1V	V <sub>CCB</sub> =1.8V±0.15V	1.4		15.7	ns
					V <sub>CCB</sub> =2.5V±0.2V	1.2		13.5	ns
					V <sub>CCB</sub> =3.3V±0.3V	1.1		13.2	ns
V <sub>CCB</sub> =5V±0.5V	0.8					15.2	ns		
V <sub>CCA</sub> =1.8V±0.15V	V <sub>CCB</sub> =1.8V±0.15V			1.6		13	ns		
	V <sub>CCB</sub> =2.5V±0.2V			1.4		9.4	ns		
	V <sub>CCB</sub> =3.3V±0.3V			1.3		8.6	ns		
	V <sub>CCB</sub> =5V±0.5V			1.2		8.1	ns		
V <sub>CCA</sub> =2.5V±0.2V	V <sub>CCB</sub> =2.5V±0.2V			1.1		7.3	ns		
	V <sub>CCB</sub> =3.3V±0.3V			1.0		5.8	ns		
	V <sub>CCB</sub> =5V±0.5V			0.9		5.1	ns		
V <sub>CCA</sub> =3.3V±0.3V	V <sub>CCB</sub> =3.3V±0.3V			1.0		5.4	ns		
	V <sub>CCB</sub> =5V±0.5V			0.9		4.3	ns		
Enable Time From Input (OE) to Output (A or B)	t <sub>en</sub>			V <sub>CCA</sub> =1.2V	V <sub>CCB</sub> =1.8V		1	μs	
					V <sub>CCB</sub> =2.5V		1	μs	
					V <sub>CCB</sub> =3.3V		1	μs	
					V <sub>CCB</sub> =5V		1	μs	
				V <sub>CCA</sub> =1.5V±0.1V	V <sub>CCB</sub> =1.8V±0.15V			1	μs
					V <sub>CCB</sub> =2.5V±0.2V			1	μs
					V <sub>CCB</sub> =3.3V±0.3V			1	μs
		V <sub>CCB</sub> =5V±0.5V				1	μs		
		V <sub>CCA</sub> =1.8V±0.15V	V <sub>CCB</sub> =1.8V±0.15V			1	μs		
			V <sub>CCB</sub> =2.5V±0.2V			1	μs		
			V <sub>CCB</sub> =3.3V±0.3V			1	μs		
			V <sub>CCB</sub> =5V±0.5V			1	μs		
		V <sub>CCA</sub> =2.5V±0.2V	V <sub>CCB</sub> =2.5V±0.2V			1	μs		
			V <sub>CCB</sub> =3.3V±0.3V			1	μs		
			V <sub>CCB</sub> =5V±0.5V			1	μs		
		V <sub>CCA</sub> =3.3V±0.3V	V <sub>CCB</sub> =3.3V±0.3V			1	μs		
			V <sub>CCB</sub> =5V±0.5V			1	μs		

■ SWITCHING CHARACTERISTICS (Cont.)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT				
Disable Time From Input (OE) to Output (A)		$t_{dis}$	$V_{CCA}=1.2V$	$V_{CCB}=1.8V$		18	ns				
				$V_{CCB}=2.5V$		15	ns				
				$V_{CCB}=3.3V$		14	ns				
				$V_{CCB}=5V$		14	ns				
			$V_{CCA}=1.5V\pm 0.1V$	$V_{CCB}=1.8V\pm 0.15V$	5.9		31	ns			
				$V_{CCB}=2.5V\pm 0.2V$	5.7		25.9	ns			
				$V_{CCB}=3.3V\pm 0.3V$	5.6		23	ns			
				$V_{CCB}=5V\pm 0.5V$	5.7		22.4	ns			
			$V_{CCA}=1.8V\pm 0.15V$	$V_{CCB}=1.8V\pm 0.15V$	5.9		31	ns			
				$V_{CCB}=2.5V\pm 0.2V$	5.1		21.3	ns			
				$V_{CCB}=3.3V\pm 0.3V$	5.0		19.3	ns			
				$V_{CCB}=5V\pm 0.5V$	5.0		17.4	ns			
			$V_{CCA}=2.5V\pm 0.2V$	$V_{CCB}=2.5V\pm 0.2V$	5.1		21.3	ns			
				$V_{CCB}=3.3V\pm 0.3V$	4.6		15.2	ns			
				$V_{CCB}=5V\pm 0.5V$	4.6		13.2	ns			
			$V_{CCA}=3.3V\pm 0.3V$	$V_{CCB}=3.3V\pm 0.3V$	4.6		15.2	ns			
				$V_{CCB}=5V\pm 0.5V$	4.3		12.1	ns			
			Disable Time From Input (OE) to Output (B)		$t_{dis}$	$V_{CCA}=1.2V$	$V_{CCB}=1.8V$		20	ns	
							$V_{CCB}=2.5V$		17	ns	
							$V_{CCB}=3.3V$		16	ns	
							$V_{CCB}=5V$		16	ns	
						$V_{CCA}=1.5V\pm 0.1V$	$V_{CCB}=1.8V\pm 0.15V$	5.4		30.3	ns
							$V_{CCB}=2.5V\pm 0.2V$	4.9		22.8	ns
							$V_{CCB}=3.3V\pm 0.3V$	4.8		20	ns
$V_{CCB}=5V\pm 0.5V$	4.9						19.5	ns			
$V_{CCA}=1.8V\pm 0.15V$	$V_{CCB}=1.8V\pm 0.15V$	5.4					30.3	ns			
	$V_{CCB}=2.5V\pm 0.2V$	4.4					20.8	ns			
	$V_{CCB}=3.3V\pm 0.3V$	4.2					17.9	ns			
	$V_{CCB}=5V\pm 0.5V$	4.3					16.3	ns			
$V_{CCA}=2.5V\pm 0.2V$	$V_{CCB}=2.5V\pm 0.2V$	4.4					20.8	ns			
	$V_{CCB}=3.3V\pm 0.3V$	3.8					16	ns			
	$V_{CCB}=5V\pm 0.5V$	3.9					13.9	ns			
$V_{CCA}=3.3V\pm 0.3V$	$V_{CCB}=3.3V\pm 0.3V$	3.8					16	ns			
	$V_{CCB}=5V\pm 0.5V$	3.4					13.2	ns			
Rise and Fall Time A Port Rise And Fall Times		$t_{rA}, t_{fA}$				$V_{CCA}=1.2V$	$V_{CCB}=1.8V$		4.2	ns	
							$V_{CCB}=2.5V$		4.2	ns	
							$V_{CCB}=3.3V$		4.2	ns	
							$V_{CCB}=5V$		4.2	ns	
						$V_{CCA}=1.5V\pm 0.1V$	$V_{CCB}=1.8V\pm 0.15V$	1.4		5.1	ns
							$V_{CCB}=2.5V\pm 0.2V$	1.4		5.1	ns
							$V_{CCB}=3.3V\pm 0.3V$	1.4		5.1	ns
			$V_{CCB}=5V\pm 0.5V$	1.4			5.1	ns			
			$V_{CCA}=1.8V\pm 0.15V$	$V_{CCB}=1.8V\pm 0.15V$	1.0		4.2	ns			
				$V_{CCB}=2.5V\pm 0.2V$	1.1		4.1	ns			
				$V_{CCB}=3.3V\pm 0.3V$	1.1		4.1	ns			
				$V_{CCB}=5V\pm 0.5V$	1.1		4.1	ns			
			$V_{CCA}=2.5V\pm 0.2V$	$V_{CCB}=2.5V\pm 0.2V$	0.8		3.0	ns			
				$V_{CCB}=3.3V\pm 0.3V$	0.8		3.0	ns			
				$V_{CCB}=5V\pm 0.5V$	0.8		3.0	ns			
			$V_{CCA}=3.3V\pm 0.3V$	$V_{CCB}=3.3V\pm 0.3V$	0.7		2.5	ns			
				$V_{CCB}=5V\pm 0.5V$	0.7		2.5	ns			

■ SWITCHING CHARACTERISTICS (Cont.)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
Rise and Fall Time	B Port Rise And Fall Times	$t_{rB}, t_{fB}$	$V_{CCA}=1.2V$	$V_{CCB}=1.8V$		2.1	ns	
				$V_{CCB}=2.5V$		1.5	ns	
				$V_{CCB}=3.3V$		1.2	ns	
				$V_{CCB}=5V$		1.1	ns	
			$V_{CCA}=1.5V\pm 0.1V$	$V_{CCB}=1.8V\pm 0.15V$	0.9		4.5	ns
				$V_{CCB}=2.5V\pm 0.2V$	0.6		3.2	ns
				$V_{CCB}=3.3V\pm 0.3V$	0.5		2.8	ns
				$V_{CCB}=5V\pm 0.5V$	0.4		2.7	ns
			$V_{CCA}=1.8V\pm 0.15V$	$V_{CCB}=1.8V\pm 0.15V$	0.9		3.8	ns
				$V_{CCB}=2.5V\pm 0.2V$	0.6		3.2	ns
				$V_{CCB}=3.3V\pm 0.3V$	0.5		2.8	ns
				$V_{CCB}=5V\pm 0.5V$	0.4		2.7	ns
			$V_{CCA}=2.5V\pm 0.2V$	$V_{CCB}=2.5V\pm 0.2V$	0.7		2.6	ns
				$V_{CCB}=3.3V\pm 0.3V$	0.5		2.8	ns
			$V_{CCA}=3.3V\pm 0.3V$	$V_{CCB}=3.3V\pm 0.3V$	0.5		2.1	ns
				$V_{CCB}=5V\pm 0.5V$	0.4		2.7	ns
Data Rate		$f_{data}$	$V_{CCA}=1.2V, V_{CCB}=1.8V\sim 5V$		20		Mbps	
			$V_{CCA}=1.5V\pm 0.1V, V_{CCB}=1.65V\sim 5.5V$			40	Mbps	
			$V_{CCA}=1.8V\pm 0.15V, V_{CCB}=1.65V\sim 5.5V$			60	Mbps	
			$V_{CCA}=2.5V\pm 0.2V, V_{CCB}=2.3V\sim 5.5V$			100	Mbps	
			$V_{CCA}=3.3V\pm 0.3V, V_{CCB}=3.0V\sim 5.5V$			100	Mbps	
Pulse Duration	Data Inputs	$t_w$	$V_{CCA}=1.2V, V_{CCB}=1.8V\sim 5V$		50		ns	
			$V_{CCA}=1.5V\pm 0.1V, V_{CCB}=1.65V\sim 5.5V$	25			ns	
			$V_{CCA}=1.8V\pm 0.15V, V_{CCB}=1.65V\sim 5.5V$	17			ns	
			$V_{CCA}=2.5V\pm 0.2V, V_{CCB}=2.3V\sim 5.5V$	10			ns	
			$V_{CCA}=3.3V\pm 0.3V, V_{CCB}=3.0V\sim 5.5V$	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 <sub>PDA</sub>	V <sub>CCA</sub> =1.2V V <sub>CCB</sub> =5V		7.8		pF					
			V <sub>CCA</sub> =1.2V V <sub>CCB</sub> =1.8V		10		pF					
			V <sub>CCA</sub> =1.5V V <sub>CCB</sub> =1.8V		9		pF					
			V <sub>CCA</sub> =1.8V V <sub>CCB</sub> =1.8V		8		pF					
			V <sub>CCA</sub> =2.5V V <sub>CCB</sub> =2.5V		8		pF					
			V <sub>CCA</sub> =2.5V V <sub>CCB</sub> =5V		8		pF					
	B Port Input A Port Output		C <sub>PDA</sub>	C <sub>L</sub> =0, f=10MHz t <sub>r</sub> =t <sub>f</sub> =1nS OE=V <sub>CCA</sub> (Output Enabled)	V <sub>CCA</sub> =3.3V V <sub>CCB</sub> =3.3~5V		9		pF			
					V <sub>CCA</sub> =1.2V V <sub>CCB</sub> =5V		12		pF			
					V <sub>CCA</sub> =1.2V V <sub>CCB</sub> =1.8V		11		pF			
					V <sub>CCA</sub> =1.5V V <sub>CCB</sub> =1.8V		11		pF			
					V <sub>CCA</sub> =1.8V V <sub>CCB</sub> =1.8V		11		pF			
					V <sub>CCA</sub> =2.5V V <sub>CCB</sub> =2.5V		11		pF			
					V <sub>CCA</sub> =2.5V V <sub>CCB</sub> =5V		11		pF			
					V <sub>CCA</sub> =3.3V V <sub>CCB</sub> =3.3~5V		11		pF			
					A Port Input B Port Output	C <sub>PDA</sub>	C <sub>L</sub> =0, f=10MHz t <sub>r</sub> =t <sub>f</sub> =1nS OE=GND (Output Disabled)	V <sub>CCA</sub> =1.2V V <sub>CCB</sub> =5V		0.01		pF
								V <sub>CCA</sub> =1.2V V <sub>CCB</sub> =1.8V		0.01		pF
								V <sub>CCA</sub> =1.5V V <sub>CCB</sub> =1.8V		0.01		pF
								V <sub>CCA</sub> =1.8V V <sub>CCB</sub> =1.8V		0.01		pF
	V <sub>CCA</sub> =2.5V V <sub>CCB</sub> =2.5V			0.01					pF			
	V <sub>CCA</sub> =2.5V V <sub>CCB</sub> =5V			0.01					pF			
	V <sub>CCA</sub> =3.3V V <sub>CCB</sub> =3.3~5V			0.01					pF			

■ OPERATING CHARACTERISTICS (Cont.)

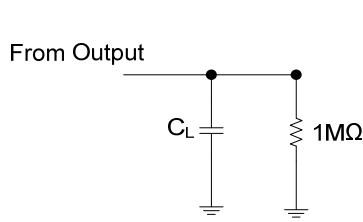
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Power Dissipation Capacitance	B Port Input A Port Output	C <sub>PDA</sub>	V <sub>CCA</sub> =1.2V V <sub>CCB</sub> =5V		0.01		pF
			V <sub>CCA</sub> =1.2V V <sub>CCB</sub> =1.8V		0.01		pF
			V <sub>CCA</sub> =1.5V V <sub>CCB</sub> =1.8V		0.01		pF
			V <sub>CCA</sub> =1.8V V <sub>CCB</sub> =1.8V		0.01		pF
			V <sub>CCA</sub> =2.5V V <sub>CCB</sub> =2.5V		0.01		pF
			V <sub>CCA</sub> =2.5V V <sub>CCB</sub> =5V		0.01		pF
			V <sub>CCA</sub> =3.3V V <sub>CCB</sub> =3.3~5V		0.01		pF
			A Port Input B Port Output	C <sub>PDB</sub>	V <sub>CCA</sub> =1.2V V <sub>CCB</sub> =5V		38.1
	V <sub>CCA</sub> =1.2V V <sub>CCB</sub> =1.8V				28		pF
	V <sub>CCA</sub> =1.5V V <sub>CCB</sub> =1.8V				28		pF
	V <sub>CCA</sub> =1.8V V <sub>CCB</sub> =1.8V				28		pF
	V <sub>CCA</sub> =2.5V V <sub>CCB</sub> =2.5V				29		pF
	V <sub>CCA</sub> =2.5V V <sub>CCB</sub> =5V				29		pF
	V <sub>CCA</sub> =3.3V V <sub>CCB</sub> =3.3~5V				29		pF
	B Port Input A Port Output	C <sub>PDB</sub>			V <sub>CCA</sub> =1.2V V <sub>CCB</sub> =5V		25.4
			V <sub>CCA</sub> =1.2V V <sub>CCB</sub> =1.8V		19		pF
			V <sub>CCA</sub> =1.5V V <sub>CCB</sub> =1.8V		18		pF
			V <sub>CCA</sub> =1.8V V <sub>CCB</sub> =1.8V		18		pF
			V <sub>CCA</sub> =2.5V V <sub>CCB</sub> =2.5V		19		pF
			V <sub>CCA</sub> =2.5V V <sub>CCB</sub> =5V		21		pF
			V <sub>CCA</sub> =3.3V V <sub>CCB</sub> =3.3~5V		22		pF

■ OPERATING CHARACTERISTICS (Cont.)

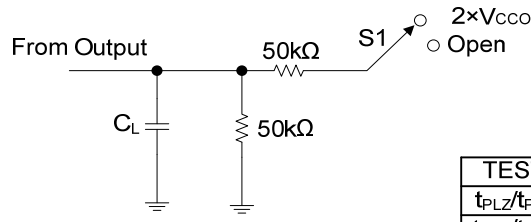
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
Power Dissipation Capacitance	A Port Input B Port Output	C <sub>PDB</sub>	V <sub>CCA</sub> =1.2V V <sub>CCB</sub> =5V		0.01		pF	
			V <sub>CCA</sub> =1.2V V <sub>CCB</sub> =1.8V		0.01		pF	
			V <sub>CCA</sub> =1.5V V <sub>CCB</sub> =1.8V		0.01		pF	
			V <sub>CCA</sub> =1.8V V <sub>CCB</sub> =1.8V		0.01		pF	
			V <sub>CCA</sub> =2.5V V <sub>CCB</sub> =2.5V		0.01		pF	
			V <sub>CCA</sub> =2.5V V <sub>CCB</sub> =5V		0.01		pF	
	B Port Input A Port Output		C <sub>L</sub> =0, f=10MHz t <sub>r</sub> =t <sub>f</sub> =1nS OE=GND (Output Disabled)	V <sub>CCA</sub> =3.3V V <sub>CCB</sub> =3.3~5V		0.03		pF
			V <sub>CCA</sub> =1.2V V <sub>CCB</sub> =5V		0.01		pF	
			V <sub>CCA</sub> =1.2V V <sub>CCB</sub> =1.8V		0.01		pF	
			V <sub>CCA</sub> =1.5V V <sub>CCB</sub> =1.8V		0.01		pF	
			V <sub>CCA</sub> =1.8V V <sub>CCB</sub> =1.8V		0.01		pF	
			V <sub>CCA</sub> =2.5V V <sub>CCB</sub> =2.5V		0.01		pF	
			V <sub>CCA</sub> =2.5V V <sub>CCB</sub> =5V		0.01		pF	
			V <sub>CCA</sub> =3.3V V <sub>CCB</sub> =3.3~5V		0.04		pF	

TEST CIRCUIT AND WAVEFORMS

Load Circuit

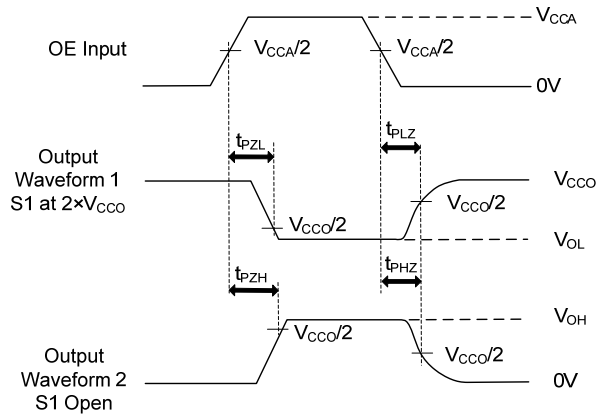
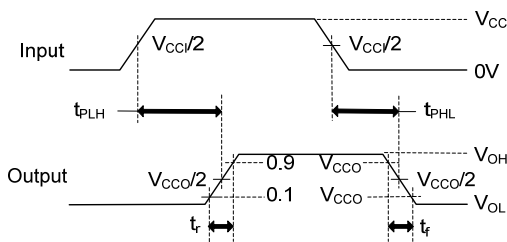
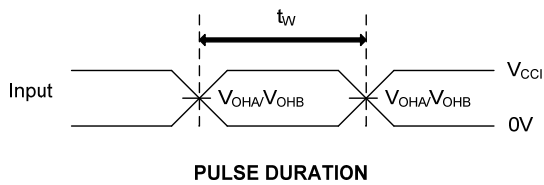


MAX DATA RATE, PULSE DURATION PROPAGATION DELAY OUTPUT RISE AND FALL TIME MEASUREMENT



ENABLE/DISABLE TIME MEASUREMENT

TEST	S1
$t_{PLZ}/t_{PZL}$	$2 \times V_{CCO}$
$t_{PHZ}/t_{PZH}$	Open



- 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.

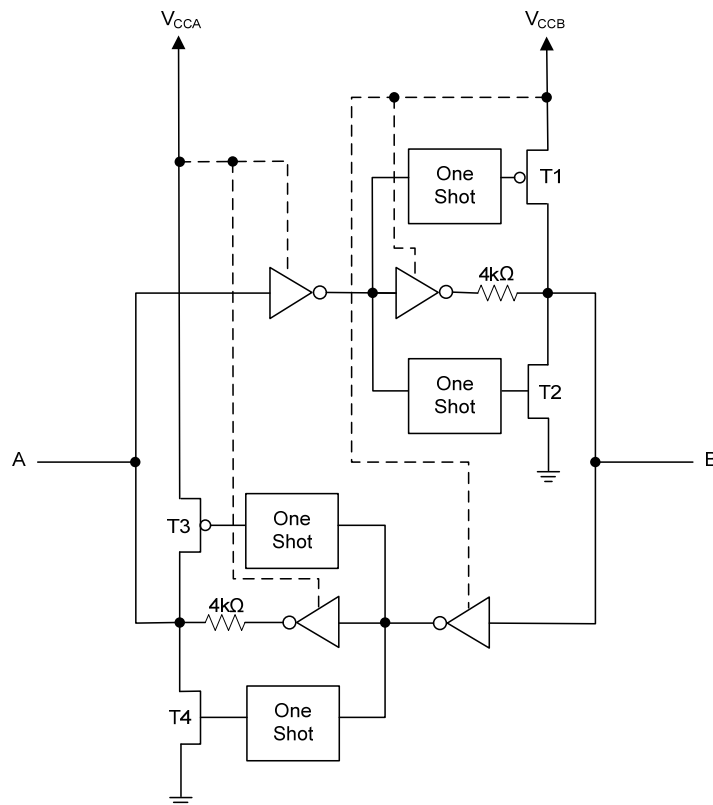
■ DETAILED DESCRIPTION

**Overview**

The **UTXB0104** device is a 4-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 the **UTC UTXS010X** products.

**Architecture**

The **UTXB0104** 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 **UTXB0104** 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.



**Figure 1. Architecture of UTXB0104 I/O Cell**

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<sub>CC0</sub> = 1.2V to 1.8V, 50Ω at V<sub>CC0</sub> = 1.8V to 3.3V, and 40Ω at V<sub>CC0</sub> = 3.3V to 5V.

**Enable and Disable**

The **UTXB0104** 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<sub>dis</sub>) indicates the delay between when OE goes low and when the outputs acutally get disabled (Hi-Z). The enable time (t<sub>en</sub>) indicates the amount of time the user must allow for the one-shot circuitry to become operational after OE is taken high.

## ■ DETAILED DESCRIPTION (Cont.)

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

The **UTXB0104** is designed to drive capacitive loads of up to 70pF. The output drivers of the **UTXB0104** have low dc drive strength. If pullup or pulldown resistors are connected externally to the data I/Os, their values must be kept higher than 50 k $\Omega$  to ensure that they do not contend with the output drivers of the **UTXB0104**. For the same reason, the **UTXB0104** should not be used in applications such as I<sup>2</sup>C 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.

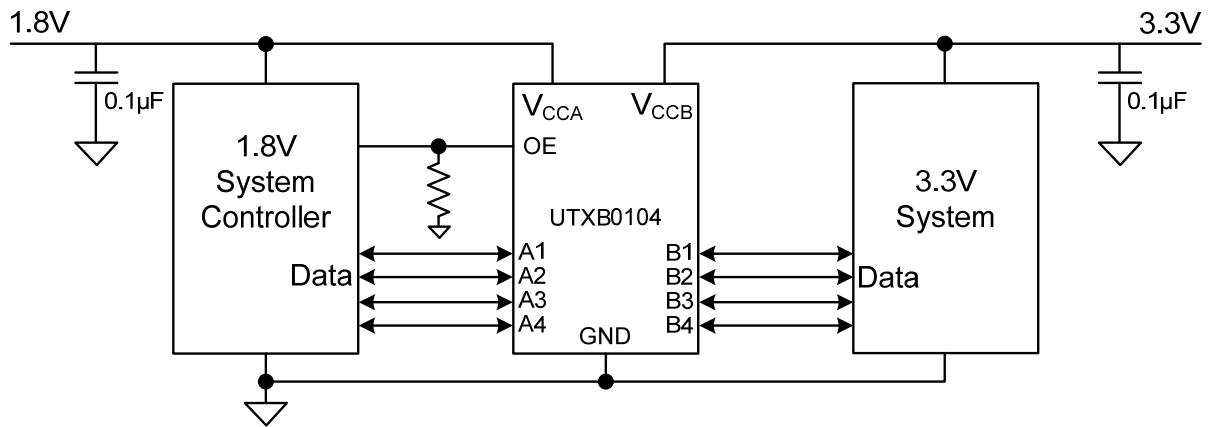
### Device Functional Modes

The **UTXB0104** 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.

### Power Supply Recommendations

During operation, ensure that  $V_{CCA} \leq V_{CCB}$  at all times. During power-up sequencing,  $V_{CCA} \geq V_{CCB}$  does not damage the device, so any power supply can be ramped up first. The **UTXB0104** has circuitry that disables all output ports when either  $V_{CC}$  is switched off ( $V_{CCA/B} = 0V$ ). The output-enable (OE) input circuit is designed so that it is supplied by  $V_{CCA}$  and when the (OE) input is low, all outputs are placed in the high-impedance state. To ensure the high-impedance state of the outputs during power up or power down, the OE input pin must be tied to GND through a pull-down resistor and must not be enabled until  $V_{CCA}$  and  $V_{CCB}$  are fully ramped and stable. The minimum value of the pull-down resistor to ground is determined by the current-sourcing capability of the driver.

■ TYPICAL APPLICATION CIRCUIT



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