具备可配置电压转换和三态输出的 2 位双电源总线收发器

UM3602V8 *VSSOP8*

描述

UM3602 是一款双电源、2 位同向总线收发器。该器件经过优化，可在V_{CCA}/V_{CCB}设置为 1.65V至5.5V 的范围内正常运行。A 端口旨在 跟踪 V_{CCA}，V_{CCA} 电源电压为 1.65V 至 5.5V。B 端口旨在跟踪 V_{CCB}，V_{CCB} 电源电压为 1.65V 至 5.5V。因此可在 1.8V、2.5V 、 3.3V 和 5.5V 电压节点之间进行通用的低电压双向转换。

UM3602 旨在实现两条数据总线间的异步通信。方向控制 (DIR) 输入的逻辑电平将会激活 B 端口或 A 端口输出。当 B 端口输出被激活时，此器件将数据从 A 总线发送到 B 总线，而当 A 端口输出被激活时，此器件将数据从 B 总线发送到 A 总线。A 端口和 B 端口上的输入电路一直处于激活状态并且必须施加一个逻辑高或低电平，从而防止过大的 I_{CC} 和 I_{CCZ}。

UM3602 旨在通过 V_{CCA} 对 DIR 输入供电。

UM3602V8 采用 VSSOP8 封装。

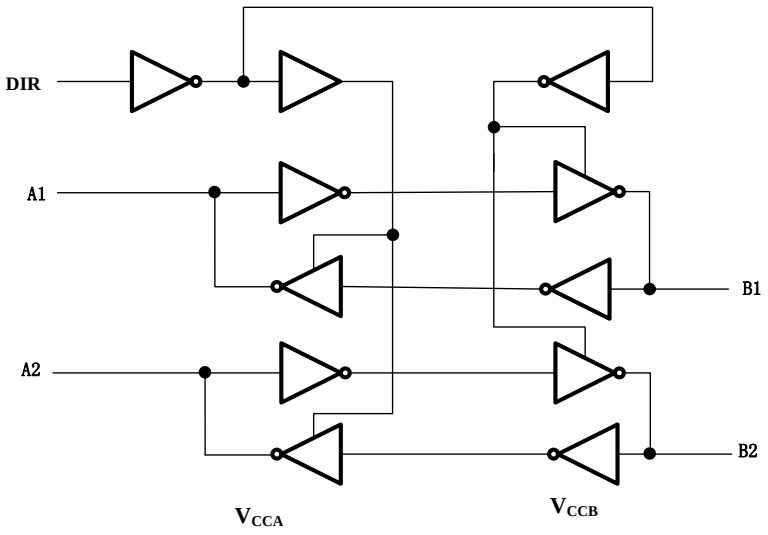
应用

- 个人电子产品
- 工业
- 企业
- 电信

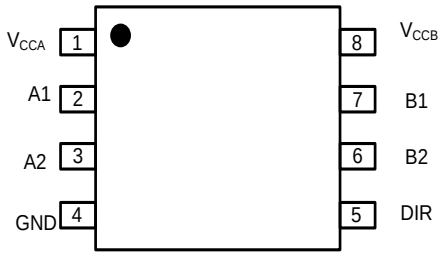
特性

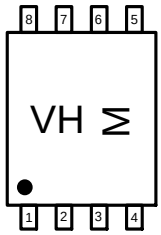
- 控制输入V_{IH}/V_{IL}电平以V_{CCA}电压为基准
- V_{CC}隔离特性-如果任何一个V_{CC}输入接地(GND)，所有输出均处于高阻抗状态
- 完全可配置的双轨设计，支持各个端口在1.65V至5.5V的整个电源电压范围内运行
- 低功耗，I_{CC}最大为 10μA
- 3.3 V 时输出驱动能力为 ±24-mA
- 采用 VSSOP8 封装
- 最大数据传输速率
  150 Mbps(V_{CCA}<3.3 V 或 V_{CCB}<3.3 V)
  220 Mbps(V_{CCA}≥3.3 V 且 V_{CCB}≥3.3 V)

Logic Diagram (Positive Logic)



Pin Configurations





M:Month Code
UM3602V8
VSSOP8

Pin Descriptions

Pin No.	Pin Name	Function
1	V_{CCA}	A-port supply voltage. 1.65 V ≤ V_{CCA} ≤ 5.5 V.
2	A1	Input/output A1. Referenced to V_{CCA}
3	A2	Input/output A2. Referenced to V_{CCA}
4	GND	Ground.
5	DIR	Direction-control signal.
6	B2	Input/output B2. Referenced to $V_{CCB.}$
7	B1	Input/output B1. Referenced to V_{CCB}
8	V_{CCB}	B-port supply voltage. 1.65 V ≤V_{CCB} ≤ 5.5 V.

Ordering Information

Part Number	Marking	Package Type	Shipping Qty
UM3602V8	VH	VSSOP8	3000pcs/7Inch Tape&Reel

Absolute Maximum Ratings (Note 1)

Over operating free-air temperature range (unless otherwise noted)

Symbol	Parameter		Value	Unit
V_{CCA}	Supply Voltage Range		-0.5 to +6.5	V
V_{CCB}	Supply Voltage Range		-0.5 to +6.5	V
V_I	Input Voltage Range (Note 2)	A ports	-0.5 to +6.5	V
		B ports	-0.5 to +6.5	
V_O	Voltage Range Applied to Any Output in the High-Impedance or Power-Off State (Note 2)	A ports	-0.5 to +6.5	V
		B ports	-0.5 to +6.5	
V_O	Voltage Range Applied to Any Output in the High or Low State (Note 2, 3)	A ports	-0.5 to (V_{CCA}+0.5)	V
		B ports	-0.5 to (V_{CCB}+0.5)	
I_{IK}	Input Clamp Current	V_I<0	-50	mA
I_{OK}	Output Clamp Current	V_O<0	-50	mA
I_O	Continuous Output Current		±50	mA
	Continuous Current through V_{CCA}, V_{CCB}, or GND		±100	mA
θ_{JA}	Package Thermal Impedance		329.4	℃/W
T_{OP}	Operating Temperature Range		-40 to +125	℃
T_{STG}	Storage Temperature Range		-65 to +150	℃
T_J	Junction Temperature		-40 to +125	℃

Note 1: Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

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

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

ESD Rating

Symbol	Parameter	Value	Unit
ESD Protection	Human body model (HBM)	±4000	V

Recommended Operating Conditions (Note 1, 2,3,4)

Symbol	Parameter		V_{CCI}	V_{CCO}	Min	Max	Unit
V_{CCA}	Supply Voltage				1.65	5.5	V
V_{CCB}					1.65	5.5	
V_{IH}	High Level Input Voltage	Data Inputs(5)	1.65 V to 1.95 V		V_{CCI}×0.65		V
			2.3 V to 2.7 V		1.7		
			3 V to 3.6 V		2		
			4.5 V to 5.5 V		V_{CCI}×0.7		
V_{IL}	Low Level Input Voltage	Data Inputs(5)	1.65 V to 1.95 V			V_{CCI}×0.35	V
			2.3 V to 2.7 V			0.7	
			3 V to 3.6 V			0.8	
			4.5 V to 5.5 V			V_{CCI}×0.3	
V_{IH}	High Level Input Voltage	Control inputs (referenced to V_{CCA})(6)	1.65 V to 1.95 V		V_{CCI}×0.65		V
			2.3 V to 2.7 V		1.7		
			3 V to 3.6 V		2		
			4.5 V to 5.5 V		V_{CCI}×0.7		
V_{IL}	Low Level Input Voltage	Control inputs (referenced to V_{CCA})(6)	1.65 V to 1.95 V			V_{CCI}×0.35	V
			2.3 V to 2.7 V			0.7	
			3 V to 3.6 V			0.8	
			4.5 V to 5.5 V			V_{CCI}×0.3	
V_I	Input voltage	Control Inputs			0	5.5	V
$V_{I/O}$	Input/output voltage	Active state			0	V_{CCO}	V
		Three-State			0	5.5	
I_{OH}	High-level output current			1.65 V to 1.95 V		-4	mA
				2.3 V to 2.7 V		-8	
				3 V to 3.6 V		-24	
				4.5 V to 5.5 V		-32	
I_{OL}	Low-level output current			1.65 V to 1.95 V		4	mA
				2.3 V to 2.7 V		8	
				3 V to 3.6 V		24	
				4.5 V to 5.5 V		32	
Δt/ΔV	Input Transition Rise or Fall Time	Data Inputs	1.65 V to 1.95 V			20	ns/V
			2.3 V to 2.7 V			20	
			3 V to 3.6 V			10	
			4.5 V to 5.5 V			5	

Note 1:V_{CCI} is the V_{CC} associated with the data input port.
Note 2: V_{CCO} is the V_{CC} associated with the output port.
Note 3: All unused or driven (floating) data inputs (I/Os) of the device must be held at logic HIGH or LOW (preferably V_{CCI} or GND) to ensure proper device operation and minimize power.
Note 4: All unused control inputs must be held at V_{CCA} or GND to ensure proper device operation and minimize power comsumption.
Note 5: For V_{CCI} values not specified in the data sheet, V_{IH} min = V_{CCI} × 0.7 V, V_{IL} max = V_{CCI} × 0.3 V.
Note 6: For V_{CCA} values not specified in the data sheet, V_{IH} min = V_{CCA} × 0.7 V, V_{IL} max = V_{CCA} × 0.3 V.

Electrical Characteristics (Note 1, 2)

Over recommended operating free-air temperature range (unless otherwise noted)

Parameter		Test Conditions	V_{CCA}	V_{CCB}	T_A=25℃	-40℃ to 125℃	Unit
					Typ Max	Min Max	
V_{OH}		I_{OH}=-100μA, V_I=V_{IH}	1.65V to 4.5V	1.65V to 4.5V		V_{CCO}-0.1	V
		I_{OH}=-4mA, V_I=V_{IH}	1.65V	1.65V		1.2	
		I_{OH}=-8mA, V_I=V_{IH}	2.3V	2.3V		1.9	
		I_{OH}=-24mA, V_I=V_{IH}	3V	3V		2.4	
		I_{OH}=-32mA, V_I=V_{IH}	4.5V	4.5V		3.8	
V_{OL}		I_{OL}=100μA, V_I=V_{IL}	1.65V to 4.5V	1.65V to 4.5V		0.1	V
		I_{OL}=4mA, V_I=V_{IL}	1.65V	1.65V		0.45	
		I_{OL}=8mA, V_I=V_{IL}	2.3V	2.3V		0.3	
		I_{OL}=24mA, V_I=V_{IL}	3V	3V		0.55	
		I_{OL}=32mA, V_I=V_{IL}	4.5V	4.5V		0.55	
I_I	DIR	V_I = V_{CCA} or GND	1.65V to 5.5V	1.65V to 5.5V	±1	±2	μA
I_{off}	A or B Port	V_I or V_O = 0 to 5.5 V	0V	0V to 5.5V	±1	±9	μA
			0V to 5.5V	0V	±1	±9	
I_{OZ}	A or B Port	V_O = V_{CCO} or GND	1.65V to 5.5V	1.65V to 5.5V	±1	±9	μA
I_{CCA}		V_I=V_{CCI} or GND I_O=0	1.65V to 5.5V	1.65 V to 5.5 V		4	μA
			5 V	0 V		2	
			0 V	5 V		-12	
I_{CCB}		V_I=V_{CCI} or GND I_O=0	1.65V to 5.5V	1.65 V to 5.5 V		4	μA
			5 V	0 V		-12	
			0 V	5 V		2	
I_{CCA}+I_{CCB}		V_I=V_{CCI} or GND I_O=0	1.65V to 5.5V	1.65V to 5.5V		4	μA
ΔI_{CCA}	A port	One A port at V_{CCA} – 0.6 V, DIR at V_{CCA}, B port = open	3V to 5.5V	3V to 5.5V		50	μA
	DIR	DIR at V_{CCA} – 0.6 V, B port = open, A port at V_{CCA} or GND				50	
ΔI_{CCB}	B port	One B port at V_{CCB} – 0.6 V, DIR at GND, A port = open	3V to 5.5V	3V to 5.5V		50	μA
C_i	DIR	V_I=V_{CCI} or GND	3.3V	3.3V	2.5		pF
C_{iO}	A or B Port	V_O = $V_{CCA/B}$ or GND	3.3V	3.3V	6		pF

Note 1: V_{CCI} is the supply voltage associated with the input port.

Note 2: V_{CCO} is the supply voltage associated with the output port.

Switching Characteristics

Over recommended operating free-air temperature range, V_{CCA}= 1.8V ±0.15V (unless otherwise noted)

Parameter	From (Input)	To (Output)	V_{CCB}=1.8V ±0.15V		V_{CCB}=2.5V ±0.2 V		V_{CCB}=3.3 ±0.3V		V_{CCB}=5V ±0.5V		Unit
			Min	Max	Min	Max	Min	Max	Min	Max	
t_{PLH}	A	B	3	21.7	2.2	14.3	1.7	12.3	1.4	11.2	ns
t_{PHL}			2.8	28.3	2.2	12.5	1.8	11.1	1.7	11	
t_{PLH}	B	A	3	21.7	2.3	20	2.1	19.5	1.9	19.1	ns
t_{PHL}			2.8	18.3	2.1	16.9	2	16.6	1.8	16.2	
t_{PHZ}	DIR	A	10.6	34.9	9.3	34.5	8.6	34.5	10.7	33.3	ns
t_{PLZ}			7.3	23.7	7.5	23.6	7.5	23.5	7	23.4	
t_{PHZ}	DIR	B	7.1	31.9	6.9	18.9	6.5	15.3	4.1	12.6	ns
t_{PLZ}			6.5	23.5	6.5	16.6	4.3	13.7	2.1	11.1	
t_{PZH}	DIR	A		45.2		36.6		33.2		30.2	ns
t_{PZL}				50.2		35.8		31.9		28.8	
t_{PZH}	DIR	B		45.4		37.9		35.8		34.6	ns
t_{PZL}				53.2		47		45.6		44.3	

Switching Characteristics

Over recommended operating free-air temperature range, V_{CCA}= 2.5V ±0.2V (unless otherwise noted)

Parameter	From (Input)	To (Output)	V_{CCB}=1.8V ±0.15V		V_{CCB}=2.5V ±0.2 V		V_{CCB}=3.3 ±0.3V		V_{CCB}=5V ±0.5V		Unit
			Min	Max	Min	Max	Min	Max	Min	Max	
t_{PLH}	A	B	2.3	20	1.5	12.5	1.3	10.4	1.1	9.1	ns
t_{PHL}			2.1	16.9	1.4	11.5	1.3	9.4	0.9	8.6	
t_{PLH}	B	A	2.2	14.3	1.5	12.5	1.4	12	1	11.5	ns
t_{PHL}			2.2	12.5	1.4	11.5	1.3	11	0.9	10.2	
t_{PHZ}	DIR	A	6.6	21.1	7.1	20.8	6.8	20.8	5.2	20.5	ns
t_{PLZ}			5.3	16.6	5.2	16.5	4.9	16.3	4.8	16.3	
t_{PHZ}	DIR	B	6.2	31.9	5.3	17.9	5.8	14.5	3.5	11.6	ns
t_{PLZ}			5.8	22.9	5.5	15.2	3.6	12.9	1.4	11.2	
t_{PZH}	DIR	A		37.2		27.7		24.9		21.7	ns
t_{PZL}				44.4		29.4		25.5		21.8	
t_{PZH}	DIR	B		28.6		29		26.7		25.4	ns
t_{PZL}				38		32.3		30.2		29.1	

Switching Characteristics

Over recommended operating free-air temperature range, V_{CCA}= 3.3V ±0.3V (unless otherwise noted)

Parameter	From (Input)	To (Output)	V_{CCB}=1.8V ±0.15V		V_{CCB}=2.5V ±0.2 V		V_{CCB}=3.3 ±0.3V		V_{CCB}=5V ±0.5V		Unit
			Min	Max	Min	Max	Min	Max	Min	Max	
t_{PLH}	A	B	2.1	19.5	1.4	12	0.7	9.6	0.7	8.4	ns
t_{PHL}			2	16.6	1.3	11	0.8	9	0.7	8	
t_{PLH}	B	A	1.7	12.3	1.3	10.4	0.7	9.8	0.6	9.4	ns
t_{PHL}			1.8	11.1	1.3	9.4	0.8	9	0.7	8.5	
t_{PHZ}	DIR	A	5	14.9	5.1	14.8	5	14.8	5	14.4	ns
t_{PLZ}			3.4	12.4	3.7	12.4	3.9	12.1	3.3	11.8	
t_{PHZ}	DIR	B	5.0	31.3	5.0	17.7	4.9	14.4	2.9	11.4	ns
t_{PLZ}			5.6	21.7	5.6	15.3	4.3	12.3	1	9.6	
t_{PZH}	DIR	A		34		25.7		22.1		19	ns
t_{PZL}				42.4		27.1		23.4		19.9	
t_{PZH}	DIR	B		31.9		24.4		21.9		20.2	ns
t_{PZL}				31.5		25.8		23.8		22.4	

Switching Characteristics

Over recommended operating free-air temperature range, V_{CCA}= 5V ±0.5V (unless otherwise noted)

Parameter	From (Input)	To (Output)	V_{CCB}=1.8V ±0.15V		V_{CCB}=2.5V ±0.2 V		V_{CCB}=3.3 ±0.3V		V_{CCB}=5V ±0.5V		Unit
			Min	Max	Min	Max	Min	Max	Min	Max	
t_{PLH}	A	B	1.9	19.1	1	11.5	0.6	9.4	0.5	7.9	ns
t_{PHL}			1.8	16.2	0.9	10.2	0.7	8.5	0.5	7.5	
t_{PLH}	B	A	1.4	11.2	1	9.1	0.7	8.4	0.5	7.9	ns
t_{PHL}			1.7	11	0.9	8.6	0.7	8	0.5	7.5	
t_{PHZ}	DIR	A	2.9	12.2	2.9	11.9	2.8	11.9	2.2	11.8	ns
t_{PLZ}			1.4	10.9	1.3	10.7	0.7	10.7	0.7	10.6	
t_{PHZ}	DIR	B	4.5	30.1	4.3	17.9	4.3	14.1	1.3	11.3	ns
t_{PLZ}			5.9	20.9	5	15	4	11.7	1	9.6	
t_{PZH}	DIR	A		32.1		24.1		20.1		18.5	ns
t_{PZL}				41.1		26.5		22.1		18.8	
t_{PZH}	DIR	B		30		22.2		20.1		18.5	ns
t_{PZL}				28.4		22.1		22.4		19.3	

Operating Characteristics

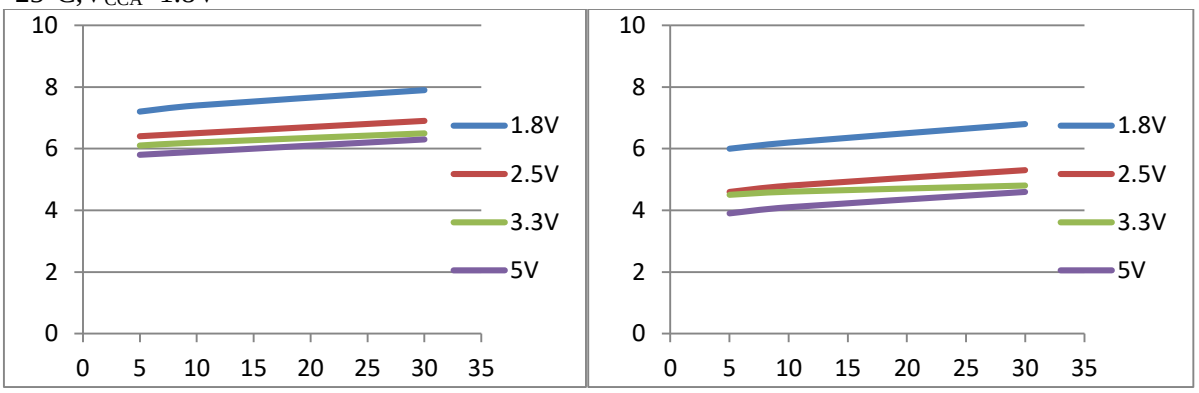
T_A=25°C

Parameter		Test Conditions	V_{CCA}= V_{CCB} =1.8V	V_{CCA}= V_{CCB} =2.5V	V_{CCA}= V_{CCB} =3.3V	V_{CCA}= V_{CCB} =5V	Unit
			TYP	TYP	TYP	TYP	
C_{pdA} (1)	A-port input, B-port output	C_L = 0, f = 10 MHz, tr = tf = 1 ns	3	4	4	4	pF
	B-port input, A-port output		18	19	20	21	
C_{pdB} (1)	A-port input, B-port output		18	19	20	21	
	B-port input, A-port output		3	4	4	4	

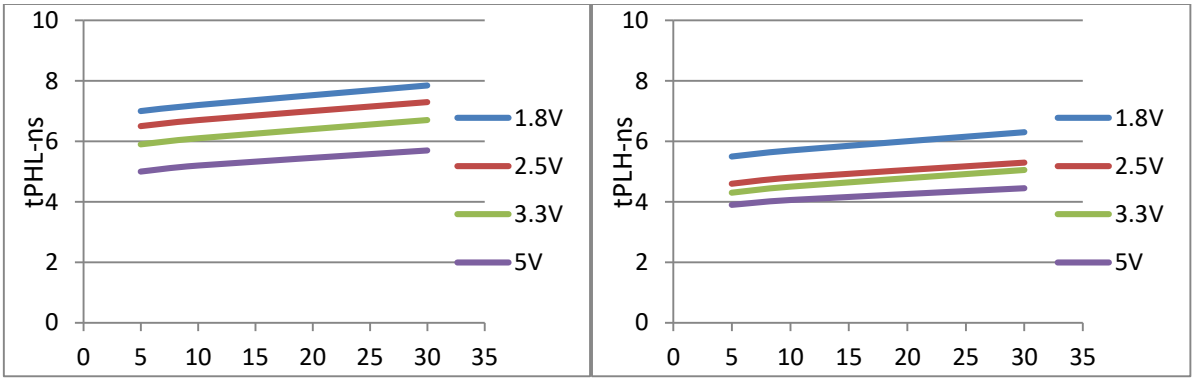
(1) Power dissipation capacitance per transceiver

Typical Characteristics

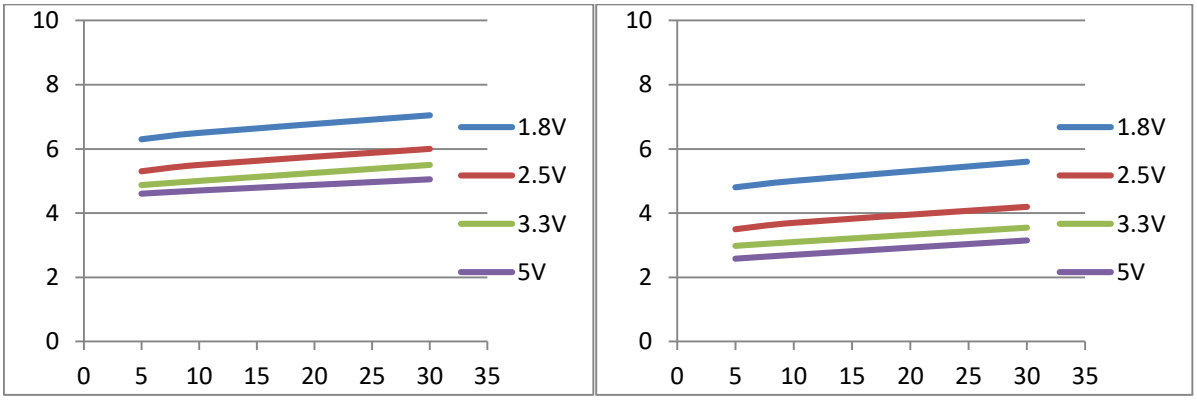
Typical Propagation Delay (A to B) vs Load Capacitance
T_A=25℃,V_{CCA}=1.8V



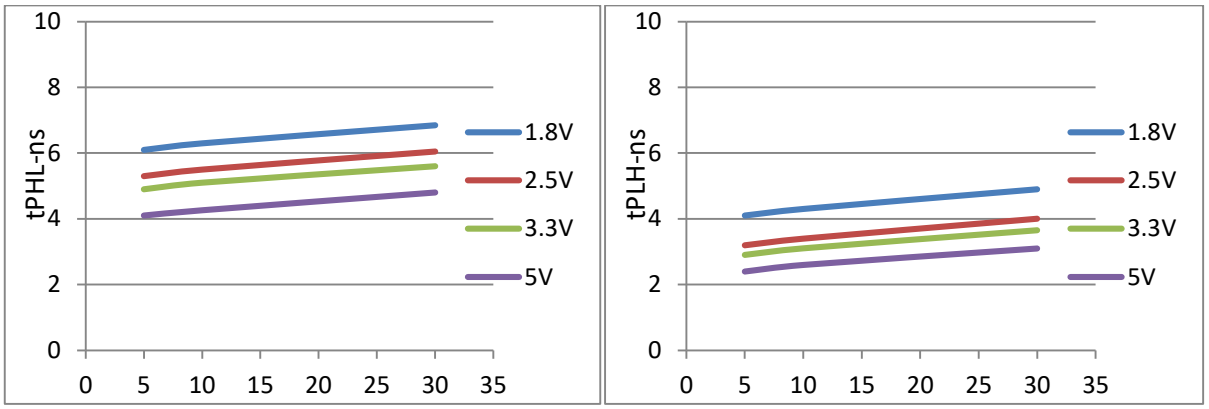
Typical Propagation Delay (B to A) vs Load Capacitance
T_A=25℃,V_{CCA}=1.8V



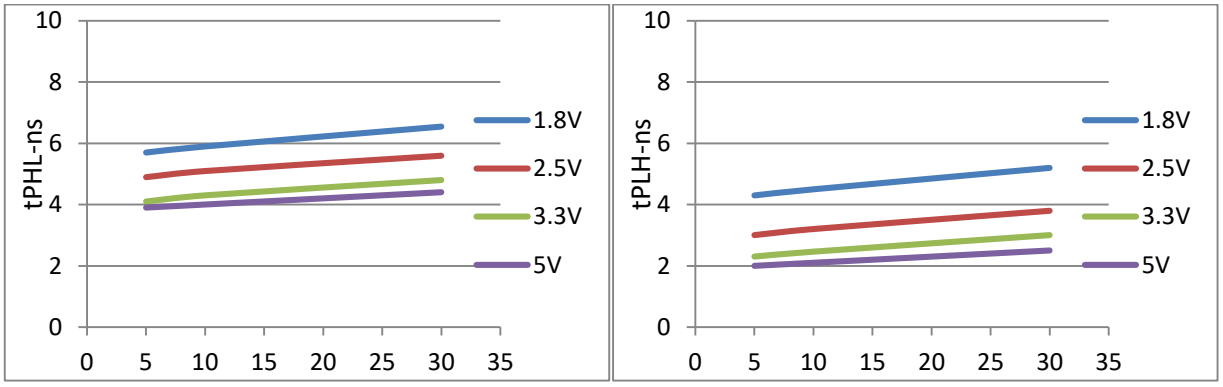
Typical Propagation Delay (A to B) vs Load Capacitance
T_A=25℃,V_{CCA}=2.5V



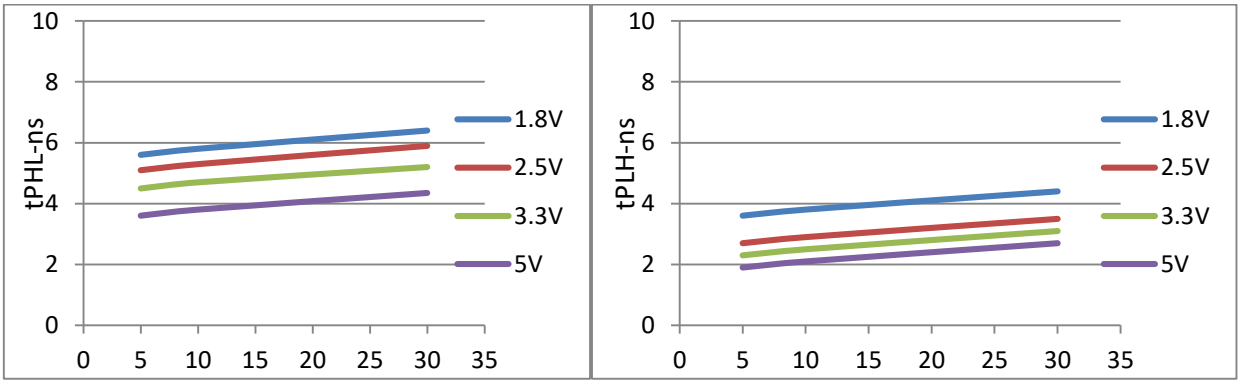
Typical Propagation Delay (B to A) vs Load Capacitance
T_A=25℃,V_{CCA}=2.5V



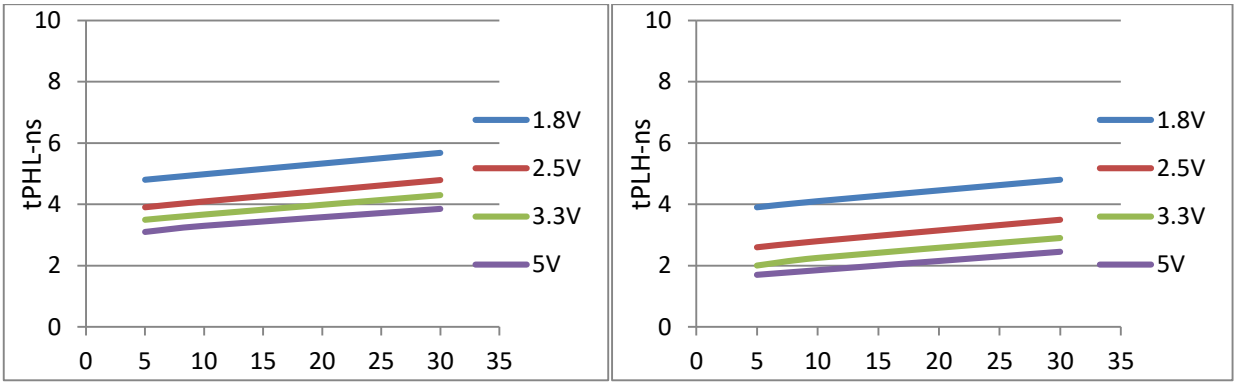
Typical Propagation Delay (A to B) vs Load Capacitance
T_A=25℃,V_{CCA}=3.3V



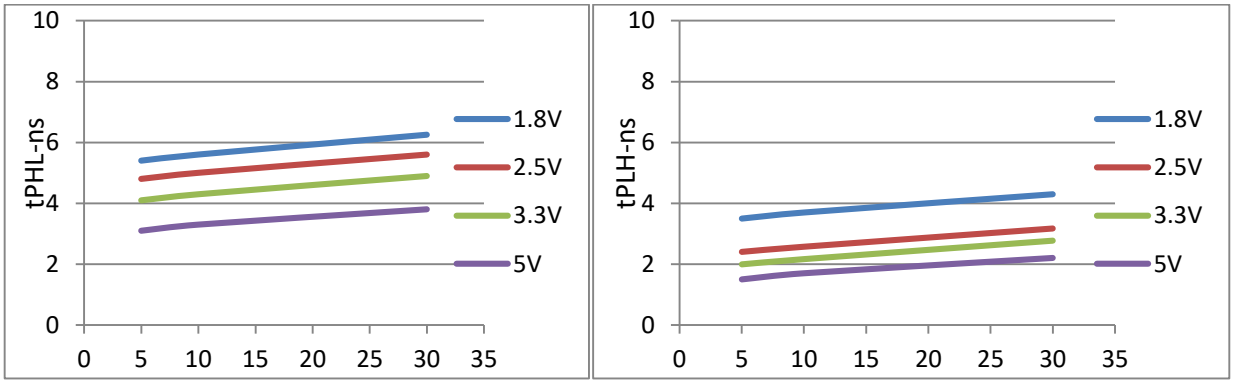
Typical Propagation Delay (B to A) vs Load Capacitance
T_A=25℃,V_{CCA}=3.3V



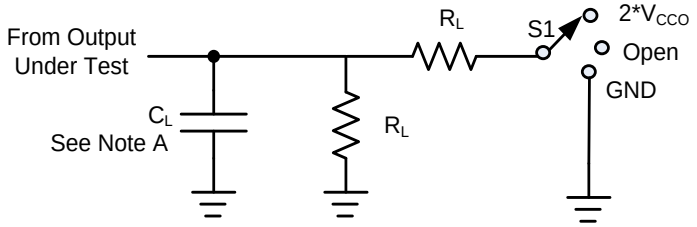
Typical Propagation Delay (A to B) vs Load Capacitance
T_A=25 ℃,V_{CCA}=5V



Typical Propagation Delay (B to A) vs Load Capacitance
T_A=25 ℃,V_{CCA}=5V



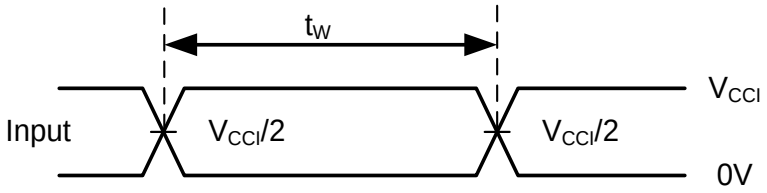
Parameter Measurement Information



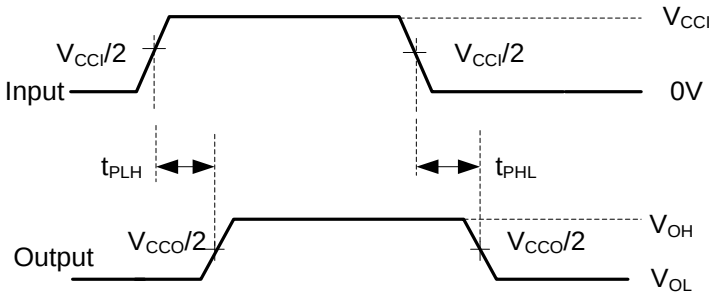
TEST	S1
t_{pd}	Open
t_{PLZ}/t_{PZL}	$2 \times V_{CCO}$
t_{PHZ}/t_{PZH}	GND

Load Current

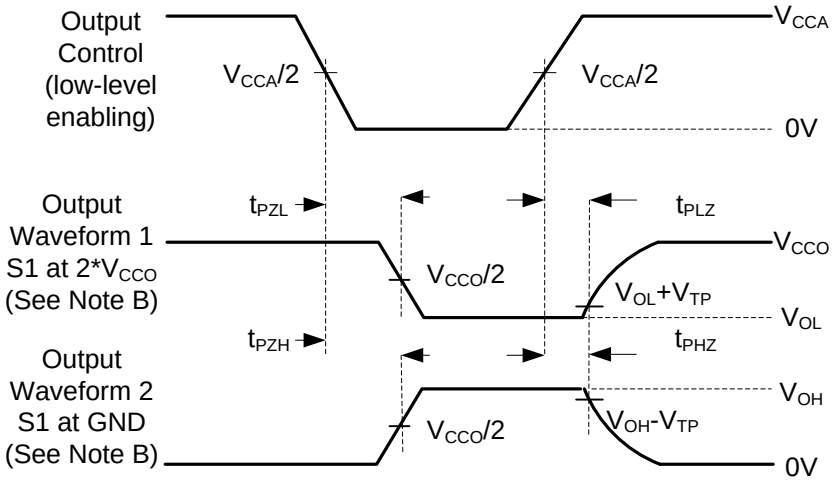
V_{CCO}	C_L	R_L	V_{TP}
1.8 V ±0.15 V	15PF	2kΩ	0.15V
2.5V ±0.2V	15PF	2kΩ	0.15V
3.3V ±0.3V	15PF	2kΩ	0.3V
5V ±0.5V	15PF	2kΩ	0.3V



VOLTAGE WAVEFORMS PULSE DURATION



VOLTAGE WAVEFORMS PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS ENABLE AND DISABLE TIMES

NOTES:

A. C_L includes probe and jig capacitance.

B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.

C. All input pulses are supplied by generators having the following characteristics: PRR≤10 MHz, Z_O = 50Ω, dv/dt≥1V/ns.

D. The outputs are measured one at a time, with one transition per measurement.

E. t_{PLZ} and t_{PHZ} are the same as t_{dis}.

F. t_{PZL} and t_{PZH} are the same as t_{en}.

G. t_{PLH} and t_{PHL} are the same as t_{pd}.

H. V_{CCI} is the V_{CC} associated with the input port.

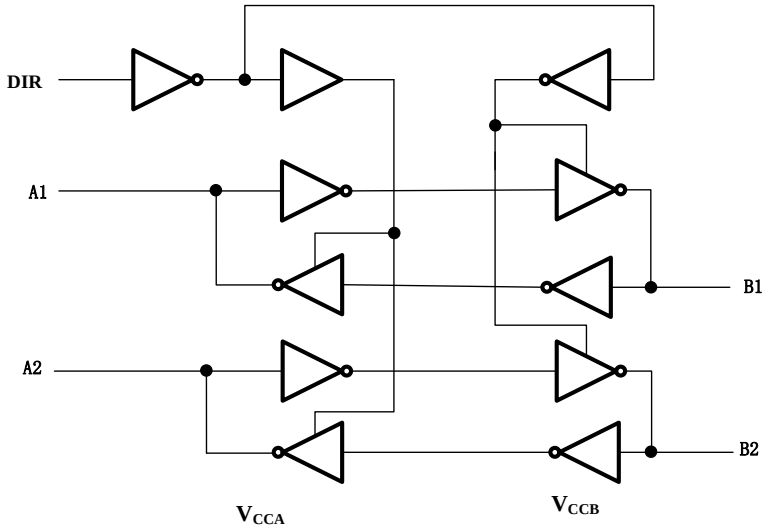
I. V_{CCO} is the V_{CC} associated with the output port.

J. All parameters and waveforms are not applicable to all devices.

Detailed Description

The UM3602 is an dual-bit, dual supply non-inverting bus transceiver. Pin A and direction control pin are support by V_{CCA} and pin B is support by V_{CCB}. The A port is able to accept I/O voltages ranging from 1.65 V to 5.5 V, while the B port can accept I/O voltages from 1.65 V to 5.5 V. The high on DIR allows data transmission from A to B and a low on DIR allows data transmission from B to A.

Functional Block Diagram



Logic Diagram (Positive Logic)

Feature Description

Fully Configurable Dual-Rail Design Allows Each Port to Operate Over the Full 1.65V to 5.5V Power-Supply Range

Both V_{CCA} and V_{CCB} can be supplied at any voltage between 1.65V and 5.5V making the device suitable for translating between any of the voltage nodes (1.8V, 2.5V, 3.3V and 5V).

I_{off} Supports Partial-Power-Down Mode Operation

I_{off} prevents backflow current by disabling I/O output circuits when device is in partial-power-down mode.

Device Functional Modes

The UM3602 is bus transceiver that can operate from 1.65V to 5.5V (V_{CCA}) and 1.65V to 5.5V (V_{CCB}). The signal translation between 1.65V and 5.5V requires direction control and output enable control. When DIR is high, data transmission is from A to B. When DIR is low, data transmission is from B to A.

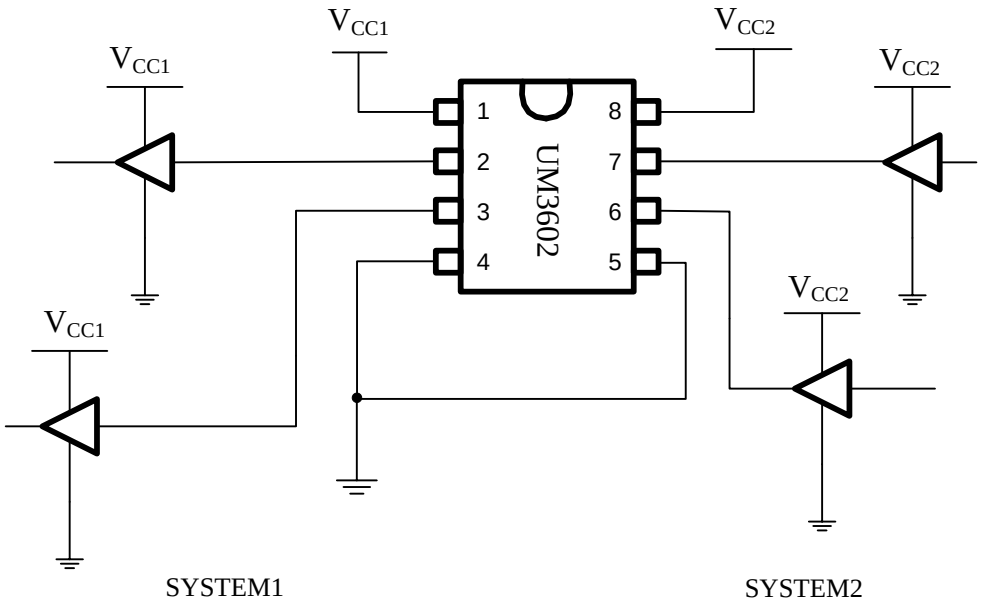
Table 1. Function Table(1)
(Each Transceiver)

INPUTS DIR	OPERATION
L	B data to A bus
H	A data to B bus

(1) Input circuits of the data I/Os are always active.

Application Information

The UM3602 device can be used in level-translation applications for interfacing devices or systems operating at different interface voltages with one another. The maximum output current can be up to 32 mA when device is powered by 5.5 V.

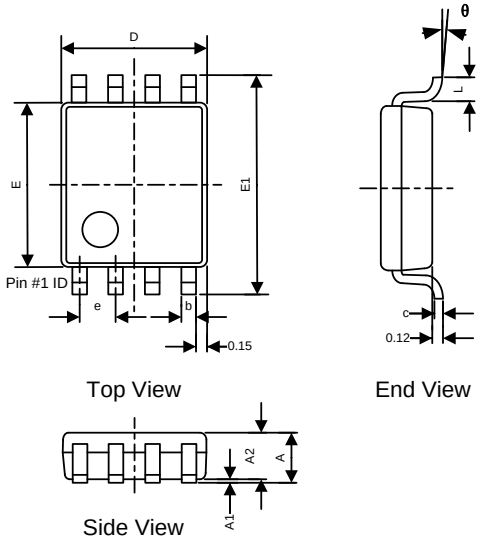


Typical Application Circuit

Package Information

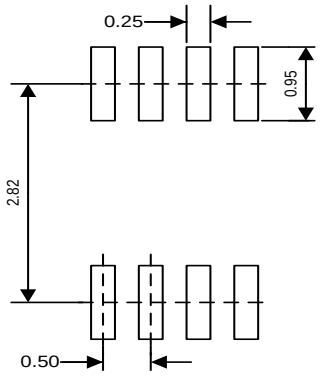
UM3602V8 VSSOP8

Outline Drawing



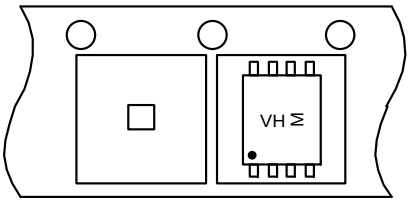
DIMENSIONS						
Symbol	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	0.60	0.75	0.90	0.023	0.029	0.035
A1	0.00	0.05	0.10	0.000	0.002	0.004
A2	0.60	0.70	0.80	0.023	0.027	0.031
b	0.17	-	0.27	0.007	-	0.011
c	0.08	-	0.23	0.003	-	0.009
D	1.90	2.00	2.10	0.075	0.079	0.083
E	2.20	2.30	2.40	0.086	0.090	0.094
E1	3.00	3.10	3.20	0.118	0.122	0.126
e	0.50BSC			0.020BSC		
L	0.20	0.28	0.35	0.008	0.011	0.014
θ	0°	3°	6°	0°	3°	6°

Land Pattern

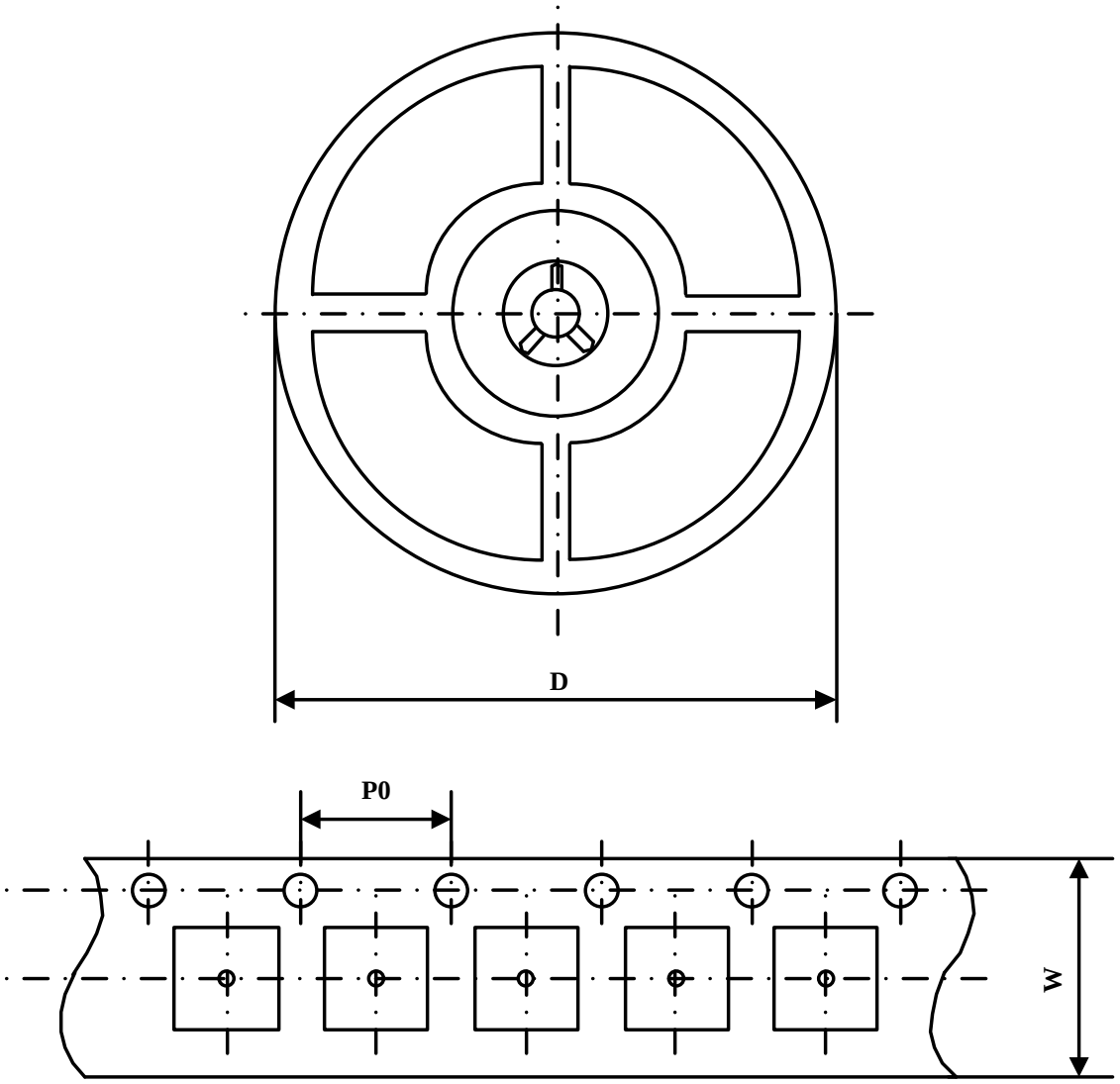


NOTES:
1. Compound dimension: 2.00×2.30;
2. Unit: mm;
3. General tolerance ±0.05mm unless otherwise specified;
4. The layout is just for reference.

Tape and Reel Orientation



Packing Information



Part Number	Package Type	Carrier Width(W)	Pitch(P0)	Reel Size(D)
UM3602V8	VSSOP8	8 mm	4 mm	180 mm

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