

带自动方向感应和 $\pm 7\text{kV}$ ESD保护的 8 位 双向电压电平转换器

UM3308/UM3308H CSP20 2.4×1.9

UM3308UK TSSOP20

UM3308QA QFN20 4.5×3.5

UM3308QB QFN20 3.0×3.0

描述

UM3308是一款带自动方向感应和 $\pm 7\text{kV}$ ESD保护的8通道电平转换器。这个8通道同相转换器使用两个独立的可配置电源轨。A端口设计用于跟踪 V_{CCA} 。 V_{CCA} 支持从1.2V到3.6V范围内的任意电源电压。B端口设计用于跟踪 V_{CCB} 。 V_{CCB} 支持从1.65V到5.5V范围内的任意电源电压。这使得该器件可在1.2V、1.5V、1.8V、2.5V、3.3V和5V电压节点之间任意进行通用低压双向转换。所有I/O端口都具有自动感应功能，因此无需方向控制引脚，非常适合在低电压ASIC/PLD和较高电压系统间的数据传输。

UM3308在整个指定的工作电压范围内能保证以20Mbps的数据速率工作。在特定电压域内，更高的数据速率可达100Mbps。

当输出使能端(OE)输入为低电平时，所有输出都被置于高阻态。UM3308旨在由 V_{CCA} 为OE输入电路供电。为确保在上电或掉电期间均处于高阻抗状态，必须将OE通过下拉电阻接地。驱动器的拉电流能力决定该电阻的最小值。

UM3308 和 UUM3308H 都采用 CSP20 2.4×1.9 BGA 封装，而 UM3308H 特别采用晶圆背面涂覆工艺，最大限度地降低了芯片破损风险。UM3308UK 采用 TSSOP20 封装，UM3308QA 采用 QFN20 4.5×3.5 封装，UM3308QB 采用 QFN20 3.0×3.0 封装。

应用

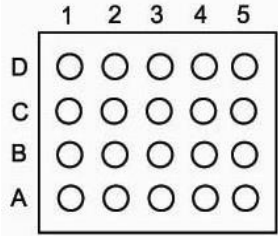
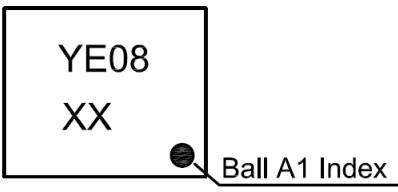
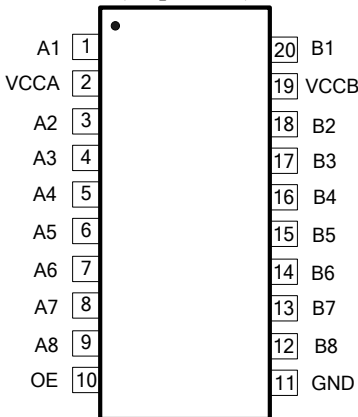
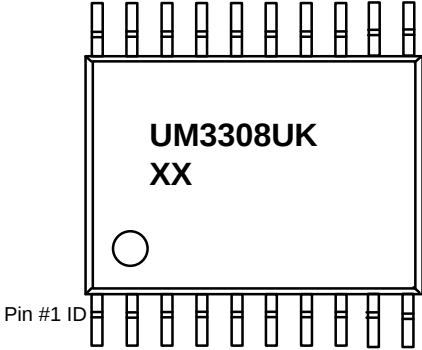
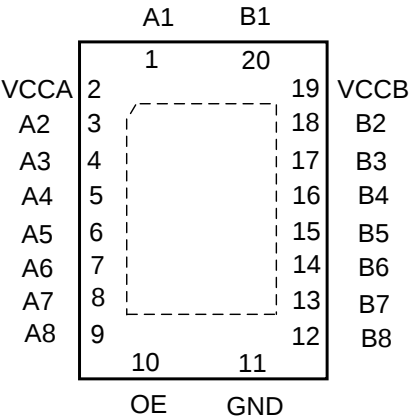
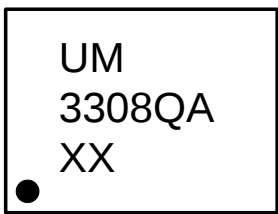
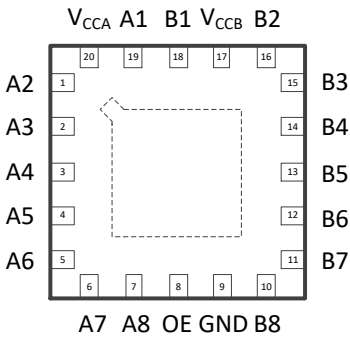
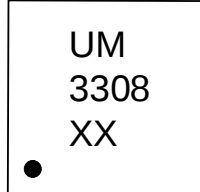
- 低电压ASIC电平转换
- 手机卡
- 便携式POS设备
- 便携式通信设备
- 低成本串行接口
- 蜂窝电话
- GPS
- 电信设备

特性

- A端口输入电压范围为1.2V至3.6V
B端口输入电压范围为1.65V至5.5V
($V_{CCA} \leq V_{CCB}$)
- V_{CC} 隔离特性--如果任何一个 V_{CC} 输入在接地(GND)上，所有输出呈高阻态
- 以 V_{CCA} 为基准的输出使能(OE)输入电路
- 低功耗
- 闩锁性能(Latch-Up)超过100mA
- B端口提供 $\pm 7\text{kV}$ ESD保护

Pin Configurations

Top View

(Bottom View) 	 XX: Date Code UM3308/UM3308H CSP20 2.4×1.9
(Top View) 	 XX: Week Code UM3308UK TSSOP20
(Top View) 	 XX: Week Code UM3308QA QFN20 4.5×3.5
(Top View) 	 XX: Week Code UM3308QB QFN20 3.0×3.0

Ball Mapping for UM3308/UM3308H

	5	4	3	2	1
D	B8	B6	B4	B2	V _{CCB}
C	GND	B7	B5	B3	B1
B	OE	A7	A5	A3	A1
A	A8	A6	A4	A2	V _{CCA}

Transparent Top View

Pin Description

Pin Name	Function
A1	Input/Output 1. Referenced to V _{CCA}
V _{CCA}	A-Port Supply Voltage. $1.1V \leq V_{CCA} \leq 3.6V$ and $V_{CCA} \leq V_{CCB}$
A2	Input/Output 2. Referenced to V _{CCA}
A3	Input/Output 3. Referenced to V _{CCA}
A4	Input/Output 4. Referenced to V _{CCA}
A5	Input/Output 5. Referenced to V _{CCA}
A6	Input/Output 6. Referenced to V _{CCA}
A7	Input/Output 7. Referenced to V _{CCA}
A8	Input/Output 8. Referenced to V _{CCA}
OE	3-State Output Enable. Pull OE low to place all outputs in 3-state mode. Referenced to V _{CCA}
GND	Ground
B8	Input/Output 8. Referenced to V _{CCB}
B7	Input/Output 7. Referenced to V _{CCB}
B6	Input/Output 6. Referenced to V _{CCB}
B5	Input/Output 5. Referenced to V _{CCB}
B4	Input/Output 4. Referenced to V _{CCB}
B3	Input/Output 3. Referenced to V _{CCB}
B2	Input/Output 2. Referenced to V _{CCB}
V _{CCB}	B-Port Supply Voltage. $1.65V \leq V_{CCB} \leq 5.5V$
B1	Input/Output 1. Referenced to V _{CCB}

Ordering Information

Part Number	Packaging Type	Marking Code	Shipping Qty
UM3308	CSP20 2.4×1.9	YE08	3000pcs/7Inch Tape & Reel
UM3308H			
UM3308UK	TSSOP20	UM3308UK	3000pcs/13Inch Tape & Reel
UM3308QA	QFN20 4.5×3.5	UM3308QA	3000pcs/13Inch Tape & Reel
UM3308QB	QFN20 3.0×3.0	UM3308QB	3000pcs/13Inch 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 +4.5	V
V_{CCB}	Supply Voltage Range		-0.5 to +6.5	V
V_I	Input Voltage Range (Note 2)	A ports	-0.5 to +4.5	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 +4.5	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
T_{OP}	Operating Temperature Range		-40 to +85	°C
T_{STG}	Storage Temperature Range		-65 to +150	°C

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.

Recommended Operating Conditions (Note 1, 2)

Symbol	Parameter		V_{CCA}	V_{CCB}	Min	Max	Unit
V_{CCA}	Supply Voltage				1.2	3.6	V
V_{CCB}					1.65	5.5	V
V_{IH}	High Level Input Voltage	Data Inputs	1.2V to 3.6V	1.65V to 5.5V	$V_{CCI} \times 0.65$ (Note 3)	V_{CCI}	V
		OE	1.2V to 3.6V	1.65V to 5.5V	$V_{CCA} \times 0.65$	5.5	V
V_{IL}	Low Level Input Voltage	Data Inputs	1.2V to 5.5V	1.65V to 5.5V	0	$V_{CCI} \times 0.35$	V
		OE	1.2V to 3.6V	1.65V to 5.5V	0	$V_{CCA} \times 0.35$	V
$\Delta t / \Delta V$	Input Transition Rise or Fall Time	A-Port Inputs	1.2V to 3.6V	1.65V to 5.5V		40	ns/V
		B-Port Inputs	1.2V to 3.6V	1.65V to 3.6V		40	
				4.5V to 5.5V		30	

Note 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.

Note 2: V_{CCA} must be less than or equal to V_{CCB} and must not exceed 3.6 V.

Note 3: V_{CCI} is the supply voltage associated with the input port.

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 °C		-40 °C to 85 °C		Unit
				Typ	Max	Min	Max	
V _{OHA}	I _{OH} =-20μA	1.2V		1.1				V
		1.4V to 3.6V				V _{CCA} -0.4		
V _{OLA}	I _{OL} =20μA	1.2V		0.3				V
		1.4V to 3.6V					0.4	
V _{OHB}	I _{OH} =-20μA		1.65V to 5.5V			V _{CCB} -0.4		V
V _{OLB}	I _{OL} =20μA		1.65V to 5.5V				0.4	V
I _I	OE	1.2V to 3.6V	1.65V to 5.5V	±1		±2		μA
I _{off}	A Port	0V	0V to 5.5V	±1		±2		μA
	B Port	0V to 3.6V	0V	±1		±2		
I _{OZ}	A or B Port	OE=GND	1.2V to 3.6V	1.65V to 5.5V	±1		±2	μA
I _{CCA}	V _I =V _{CCI} or GND I _O =0	1.2V	1.65V to 5.5V	0.06				μA
		1.4V to 3.6V	1.65V to 5.5V			5		
		3.6V	0V			2		
		0V	5.5V			-2		
I _{CCB}	V _I =V _{CCI} or GND I _O =0	1.2V	1.65V to 5.5V	3.5				μA
		1.4V to 3.6V	1.65V to 5.5V			5		
		3.6V	0V			-2		
		0V	5.5V			2		
I _{CCA} +I _{CCB}	V _I =V _{CCI} or GND I _O =0	1.2V	1.65V to 5.5V	3.5				μA
		1.4V to 3.6V	1.65V to 5.5V			10		
I _{CCZA}	V _I =V _{CCI} or GND I _O =0, OE=GND	1.2V	1.65V to 5.5V	0.05				μA
		1.4V to 3.6V	1.65V to 5.5V			5		
I _{CCZB}	V _I =V _{CCI} or GND I _O =0, OE=GND	1.2V	1.65V to 5.5V	3.5				μA
		1.4V to 3.6V	1.65V to 5.5V			5		
C _i	OE	1.2V to 3.6V	1.65V to 5.5V	5		5.5		pF
C _{iO}	A Port	1.2V to 3.6V	1.65V to 5.5V	5		6.5		pF
	B Port			8		10		

 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

$T_A = +25^\circ\text{C}$, $V_{CCA} = 1.2\text{V}$

Parameter	From (Input)	To (Output)	$V_{CCB}=1.8\text{V}$	$V_{CCB}=2.5\text{V}$	$V_{CCB}=3.3\text{V}$	$V_{CCB}=5\text{V}$	Unit
			Typ	Typ	Typ	Typ	
t_{pd}	A	B	7	6	5.3	5.5	ns
	B	A	7.5	6.5	6	6	
t_{en}	OE	A	1	1	1	1	μs
		B	1	1	1	1	
t_{dis}	OE	A	18	16	14	14	ns
		B	19	17	15	15	
t_{rA}, t_{fA}	A Port Rise and Fall Time		5	5	5	5	ns
t_{rB}, t_{fB}	B Port Rise and Fall Time		2.5	1.5	1.2	1	ns
$t_{SK(O)}$	Channel-to-Channel		0.5	0.5	0.5	1.5	ns
Max Data Rate			20	20	20	20	Mbps

Switching Characteristics

Over recommended operating free-air temperature range, $V_{CCA}=1.5\text{V}\pm 0.1\text{V}$ (unless otherwise noted)

Parameter	From (Input)	To (Output)	$V_{CCB}=1.8\text{V}\pm 0.15\text{V}$		$V_{CCB}=2.5\text{V}\pm 0.2\text{V}$		$V_{CCB}=3.3\text{V}\pm 0.3\text{V}$		$V_{CCB}=5\text{V}\pm 0.5\text{V}$		Unit
			Min	Max	Min	Max	Min	Max	Min	Max	
t_{pd}	A	B	2	15	1.2	11	1.1	10	1	10	ns
	B	A	1	15	0.9	12	0.5	12	0.3	13	
t_{en}	OE	A		1		1		1		1	μs
		B		1		1		1		1	
t_{dis}	OE	A	6	30	5.5	28	5.5	25	5.5	23	ns
		B	5.5	30	5	25	5	20	5	20	
t_{rA}, t_{fA}	A Port Rise and Fall Time		1.5	5.0	1.5	5.0	1.5	5.0	1.5	5.0	ns
t_{rB}, t_{fB}	B Port Rise and Fall Time		0.9	4.5	0.6	3.5	0.5	3	0.4	2.5	ns
$t_{SK(O)}$	Channel-to-Channel			0.5		0.5		0.5		0.5	ns
Max Data Rate			40		40		40		40		Mbps

Switching Characteristics

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

Parameter	From (Input)	To (Output)	$V_{CCB}=1.8V \pm 0.15V$		$V_{CCB}=2.5V \pm 0.2V$		$V_{CCB}=3.3V \pm 0.3V$		$V_{CCB}=5V \pm 0.5V$		Unit
			Min	Max	Min	Max	Min	Max	Min	Max	
t_{pd}	A	B	1.6	10	1.4	9	1.3	7	1.2	6.5	ns
	B	A	1.5	12	1.3	8.5	1	8	0.9	8	
t_{en}	OE	A		1		1		1		1	μs
		B		1		1		1		1	
t_{dis}	OE	A	6	34	5.5	23	5	20	5	17.6	ns
		B	5.5	33	4.5	22	4.2	16.8	4.4	16.3	
t_{rA}, t_{fA}	A Port Rise and Fall Time		1	4.2	1.1	4.0	1.1	4.0	1.1	4.0	ns
t_{rB}, t_{fB}	B Port Rise and Fall Time		0.9	4	0.6	3.2	0.5	2.8	0.4	2.8	ns
$t_{SK(O)}$	Channel-to-Channel			0.5		0.5		0.5		0.5	ns
Max Data Rate			60		60		60		60		Mbps

Switching Characteristics

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

Parameter	From (Input)	To (Output)	$V_{CCB}=2.5V \pm 0.2V$		$V_{CCB}=3.3V \pm 0.3V$		$V_{CCB}=5V \pm 0.5V$		Unit
			Min	Max	Min	Max	Min	Max	
t_{pd}	A	B	1.1	6.5	1	5.2	0.9	5	ns
	B	A	1.2	6.6	1.1	5.1	0.9	4.4	
t_{en}	OE	A		1		1		1	μs
		B		1		1		1	
t_{dis}	OE	A	5.0	23	4.6	15.2	4.6	13	ns
		B	4.4	22	3.8	16	3.9	13.3	
t_{rA}, t_{fA}	A Port Rise and Fall Time		0.8	3	0.8	3	0.8	3	ns
t_{rB}, t_{fB}	B Port Rise and Fall Time		0.7	2.7	0.5	2.8	0.4	2.7	ns
$t_{SK(O)}$	Channel-to-Channel			0.5		0.5		0.5	ns
Max Data Rate			100		100		100		Mbps

Switching Characteristics

Over recommended operating free-air temperature range, $V_{CCA}=3.3V\pm0.3V$ (unless otherwise noted)

Parameter	From (Input)	To (Output)	$V_{CCB}=3.3V\pm0.3V$		$V_{CCB}=5V\pm0.5V$		Unit
			Min	Max	Min	Max	
t_{pd}	A	B	0.9	5	0.8	4	ns
	B	A	1	5.1	0.9	4	
t_{en}	OE	A		1		1	μs
		B		1		1	
t_{dis}	OE	A	5	15	4	13	ns
		B	4	16	3.4	13.8	
t_{rA}, t_{fA}	A Port Rise and Fall Time		0.7	2.5	0.7	2.5	ns
t_{rB}, t_{fB}	B Port Rise and Fall Time		0.5	2.1	0.4	2.8	ns
$t_{SK(O)}$	Channel-to-Channel			0.5		0.5	ns
Max Data Rate			100		100		Mbps

Applications Information

UM3308/UM3308H/UM3308UK/UM3308QA/UM3308QB ESD protected level translator provides level shifting necessary to allow data transfer in a multi-voltage system. Externally applied voltages, V_{CCA} and V_{CCB} set the logic levels on either side of device. A high voltage signal present on V_{CCA} side of the device appears as a high voltage logic signal on the V_{CCB} side of the device, and vice-versa.

Block Diagram

The UM3308/UM3308H/UM3308UK/UM3308QA/UM3308QB (block diagram 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 UM3308/UM3308H/UM3308UK/UM3308QA/UM3308QB 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 to the opposite direction.

The output one shot detects 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.

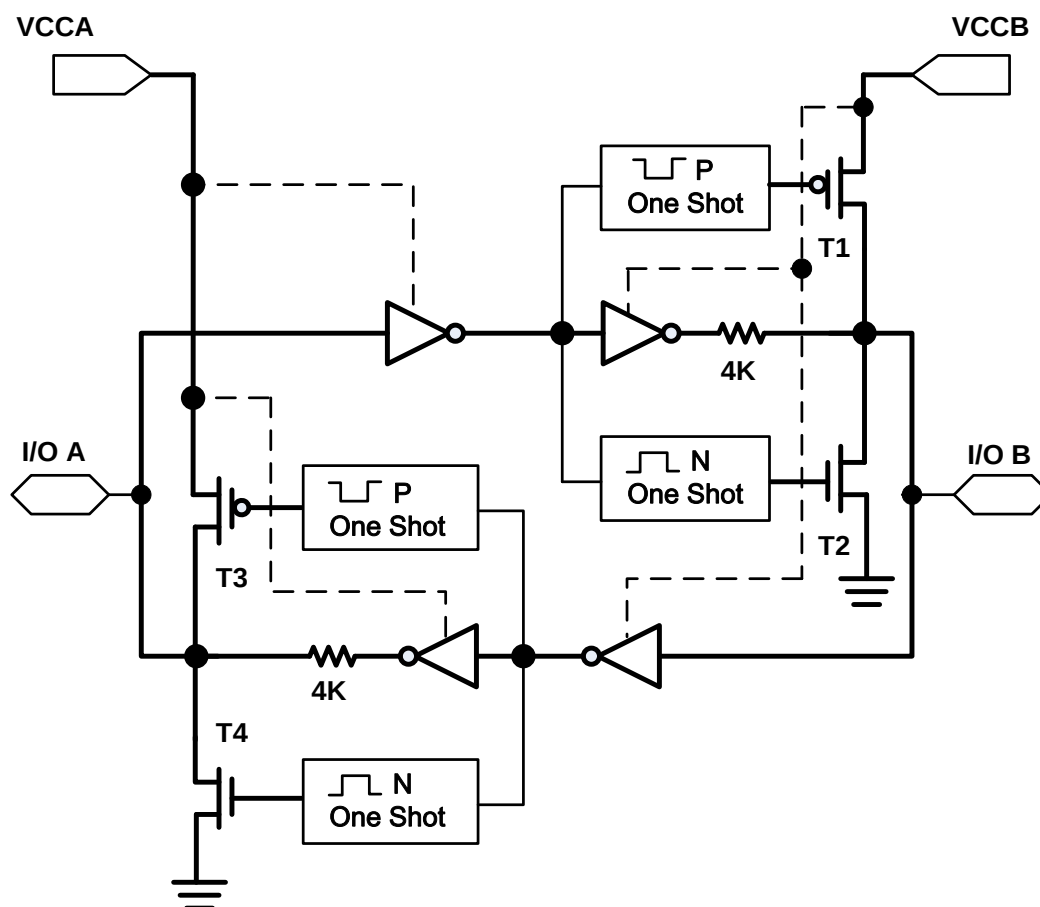
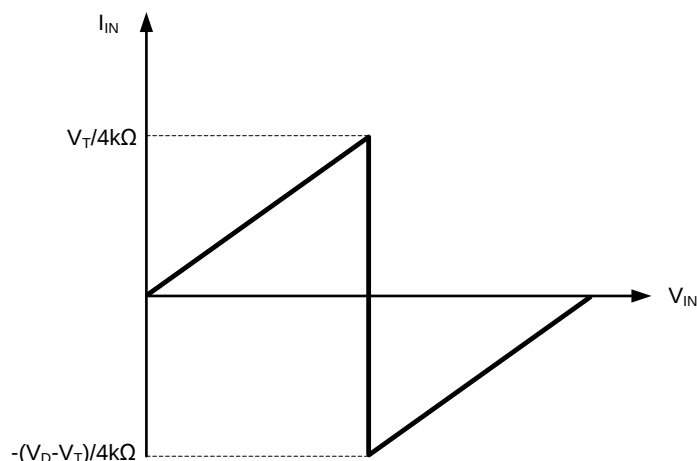


Figure 1 Block Diagram of UM3308/UM3308H/UM3308UK/UM3308QA/UM3308QB I/O Cell

Input Driver Requirements

Typical I_{IN} vs V_{IN} characteristics of the UM3308/UM3308H/UM3308UK/UM3308QA/UM3308QB are shown in Figure 2. For proper operation, the device driving the data I/Os of the UM3308/UM3308H/UM3308UK/UM3308QA/UM3308QB must have driven strength of at least $\pm 2\text{mA}$.



A: V_T is the input threshold voltage of the UM3308/UM3308H/UM3308UK/UM3308QA/UM3308QB (typical $V_{CC}/2$).

B: V_D is the supply voltage of the external driver.

Figure 2 Typical I_{IN} vs. V_{IN} Curve

Power Up

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 UM3308/UM3308H/UM3308UK/UM3308QA/UM3308QB has circuitry that disables all output ports when either V_{CC} is switched off ($V_{CCA/B} = 0\text{ V}$).

Enable and Disable

The UM3308/UM3308H/UM3308UK/UM3308QA/UM3308QB 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 UM3308/UM3308H/UM3308UK/UM3308QA/UM3308QB is designed to drive capacitive loads of up to 50pF. The output drivers of the UM3308/UM3308H/UM3308UK/UM3308QA/UM3308QB 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 UM3308/UM3308H/UM3308UK/UM3308QA/UM3308QB.

For the same reason, the UM3308/UM3308H/UM3308UK/UM3308QA/UM3308QB should not be used in applications such as I²C or 1-Wire where an open-drain driver is connected on the bidirectional data I/O.

Typical Operating Circuit

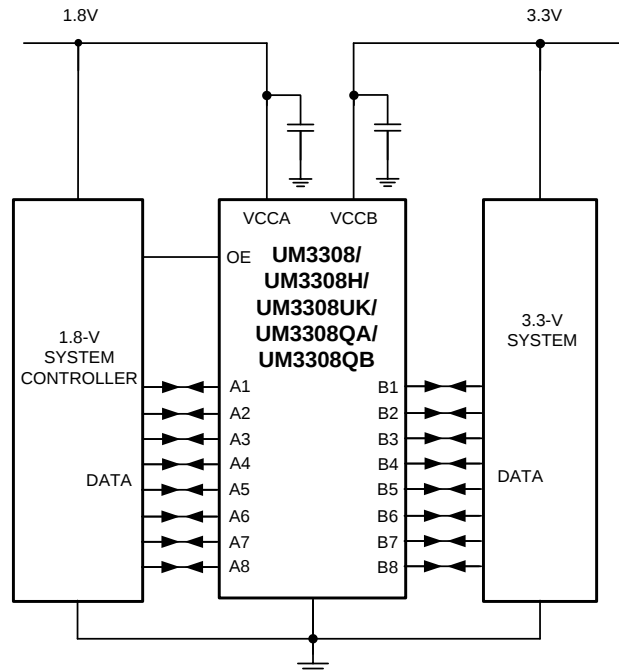
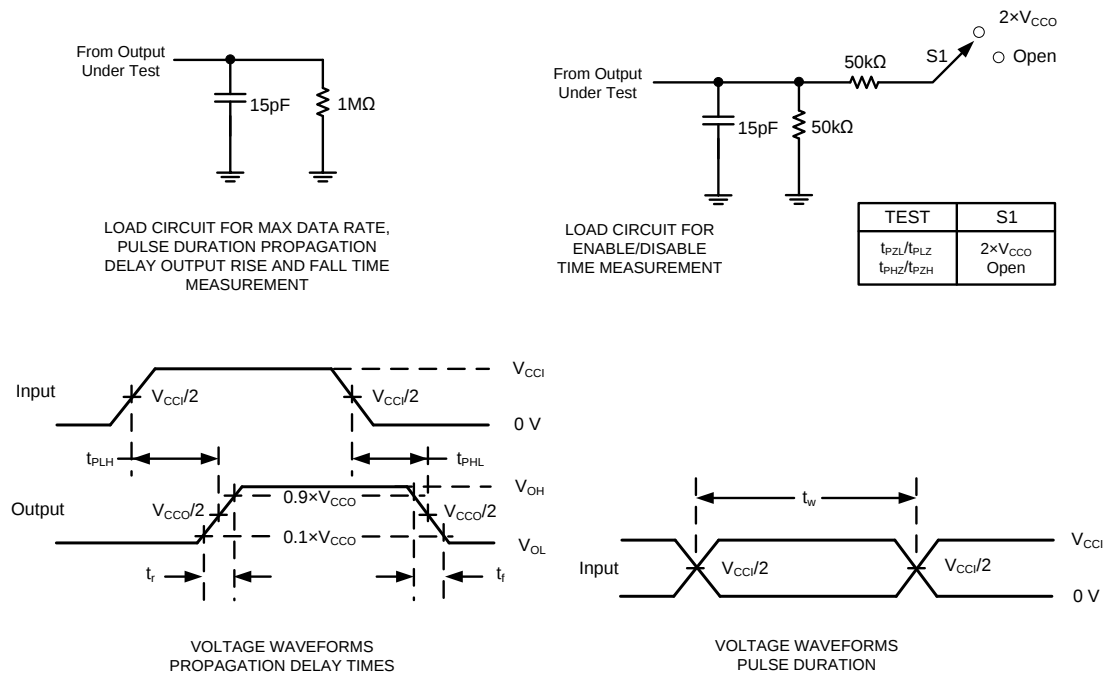


Figure 3 Typical Operating Circuit

Test Circuits



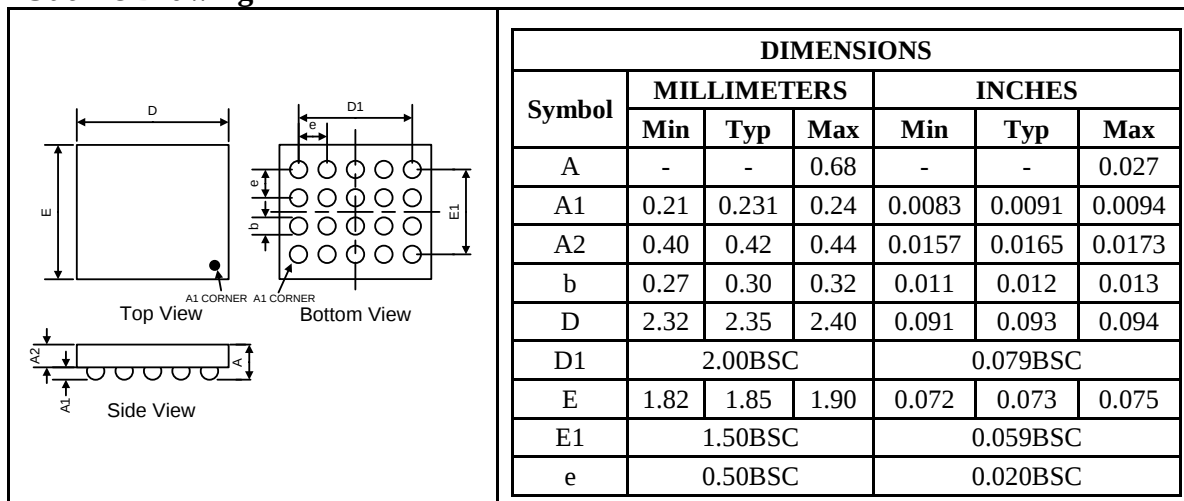
- A. C_L includes probe and jig capacitance.
 B. All input pulses are supplied by generators having the following characteristics: $PRR \leq 10\text{MHz}$, $Z_o = 50\Omega$, $dv/dt \geq 1\text{V/ns}$.
 C. The outputs are measured one at a time, with one transition per measurement.
 D. t_{PLH} and t_{PHL} are the same as t_{pd} .
 E. V_{CCI} is the V_{CC} associated with the input port.
 F. V_{CCO} is the V_{CC} associated with the output port.
 G. All parameters and waveforms are not applicable to all devices.

Figure 4 Load Circuits and Voltage Waveforms

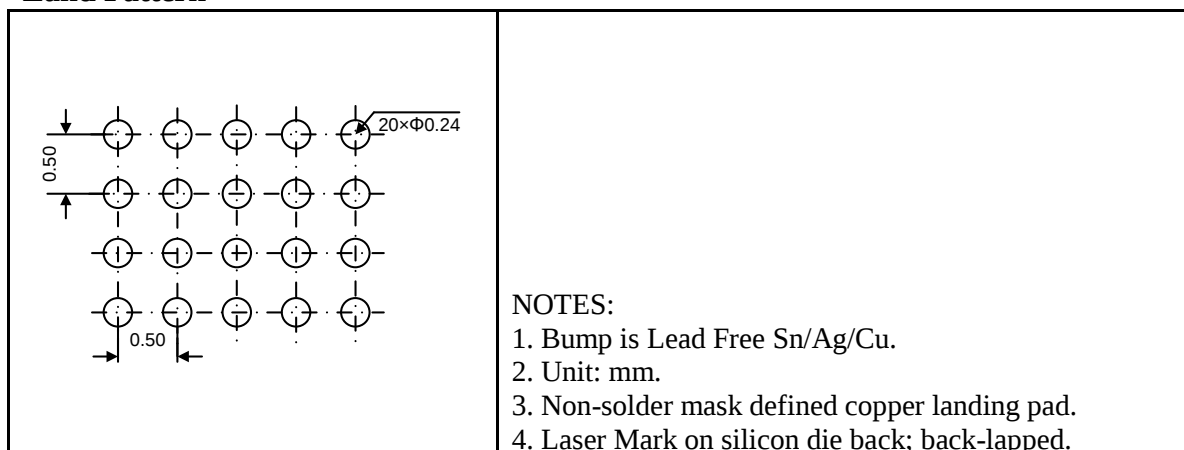
Package Information

UM3308/UM3308H: CSP20 2.4×1.9

Outline Drawing



Land Pattern



Tape and Reel Orientation

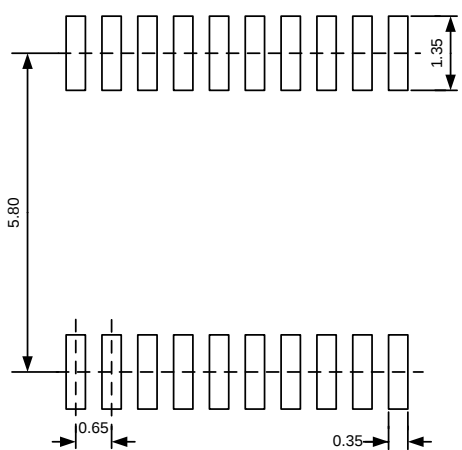


UM3308UK TSSOP20

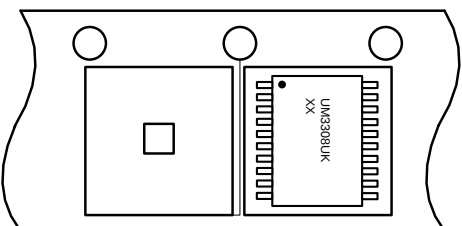
Outline Drawing

DIMENSIONS						
Symbol	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	-	-	1.20	-	-	0.047
A1	0.05	-	0.15	0.002	-	0.006
A2	0.80	-	1.05	0.031	-	0.041
A3	0.34	0.44	0.54	0.013	0.017	0.021
b	0.19	-	0.30	0.007	-	0.012
c	0.09	-	0.20	0.004	-	0.008
D	6.40	6.50	6.60	0.252	0.256	0.260
E	4.30	4.40	4.50	0.169	0.173	0.177
E1	6.20	6.40	6.60	0.244	0.252	0.260
e	0.65BSC			0.026BSC		
L	0.45	0.60	0.75	0.018	0.024	0.030
L1	1.00REF			0.039REF		
L2	0.25BSC			0.010BSC		
θ1	0°	-	8°	0°	-	8°
θ2	10°	12°	14°	10°	12°	14°
θ3	10°	12°	14°	10°	12°	14°

Land Pattern

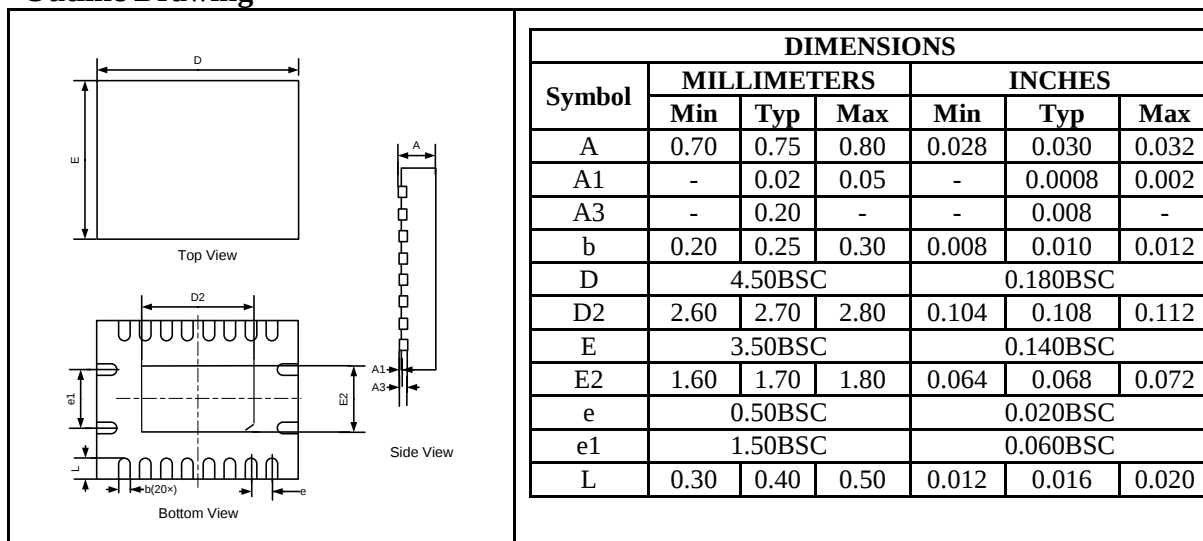
	NOTES: 1. Compound dimension: 6.50×4.40. 2. Unit: mm. 3. General tolerance $\pm 0.05\text{mm}$ unless otherwise specified. 4. The layout is just for reference.
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Tape and Reel Orientation

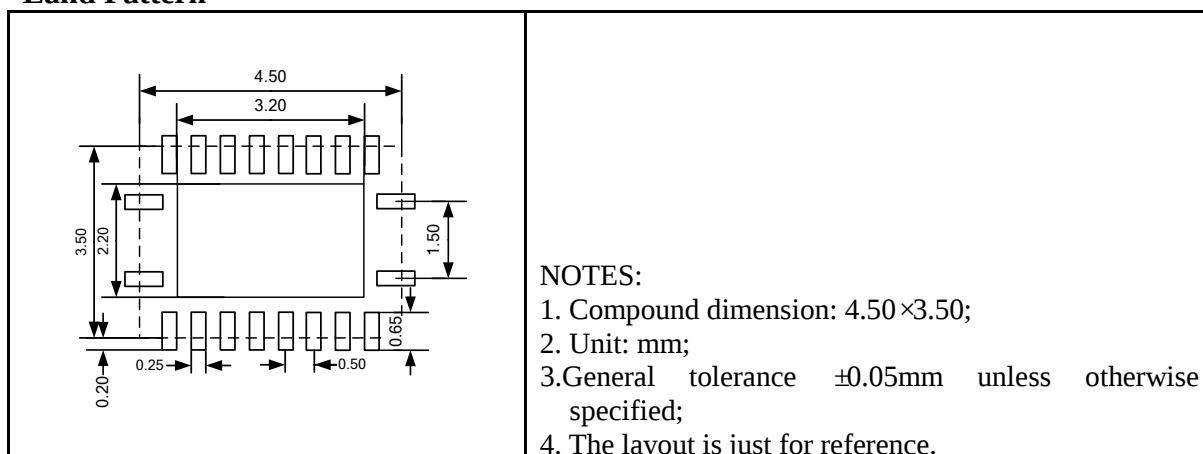


UM3308QA QFN20 4.5×3.5

Outline Drawing



Land Pattern



Tape and Reel Orientation

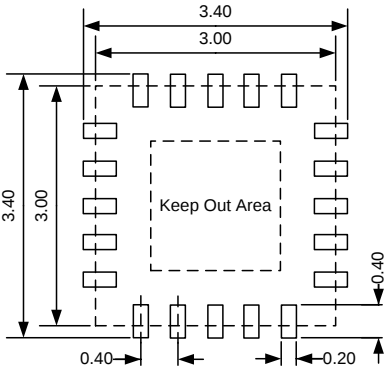


UM3308QB QFN20 3.0×3.0

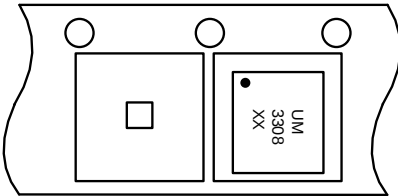
Outline Drawing

DIMENSIONS						
Symbol	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	0.70	0.75	0.80	0.028	0.030	0.032
A1	0	0.02	0.05	0	0.001	0.002
A3	0.20REF			0.008REF		
D	2.90	3.00	3.10	0.116	0.120	0.124
E	2.90	3.00	3.10	0.116	0.120	0.124
D1	1.40	1.50	1.60	0.056	0.060	0.064
E1	1.40	1.50	1.60	0.056	0.060	0.064
K	0.20MIN			0.008MIN		
b	0.15	0.20	0.25	0.006	0.008	0.010
e	0.40TYP			0.016TYP		
L	0.32	-	0.48	0.013	-	0.019

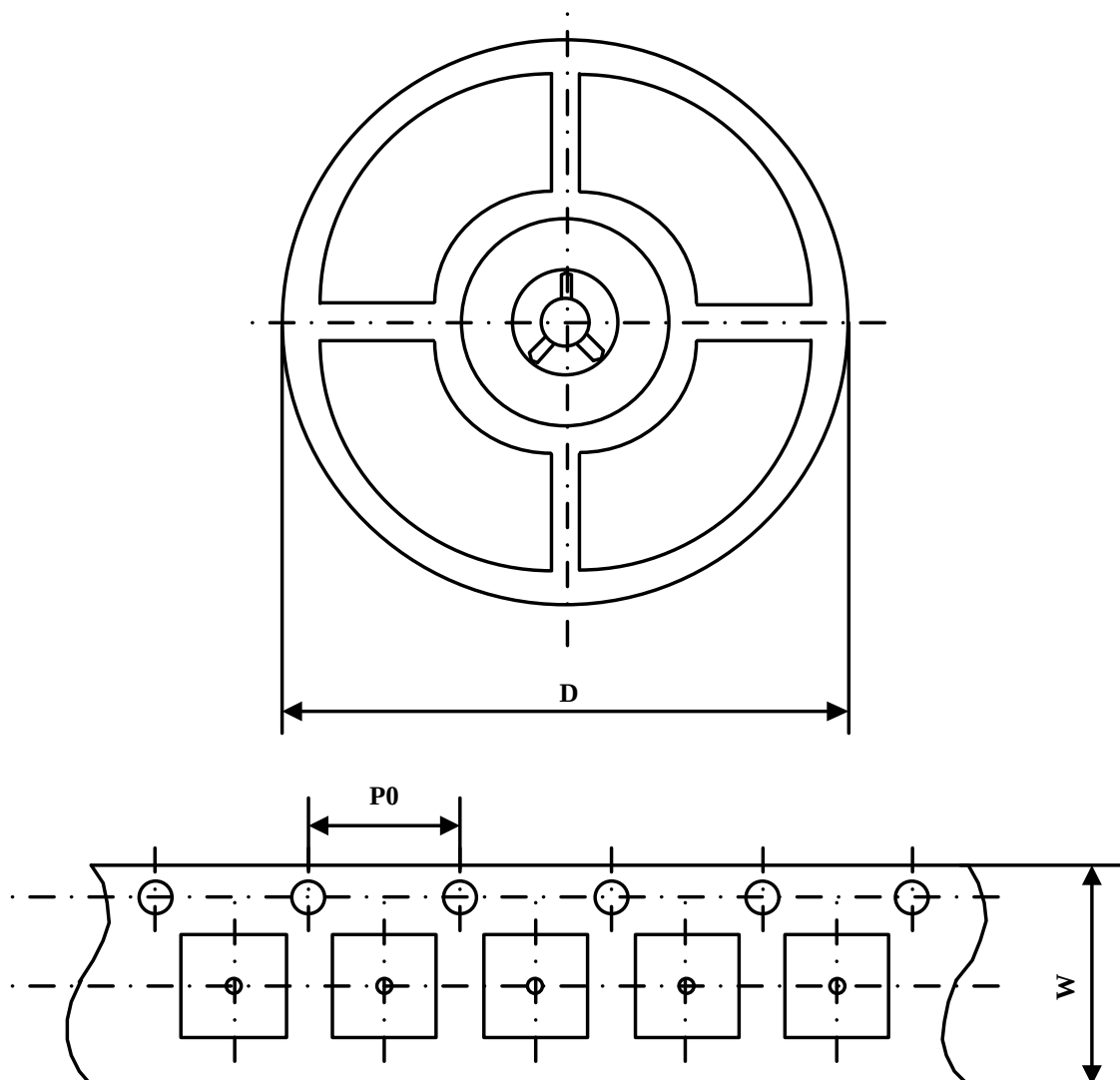
Land Pattern

	NOTES: 1. Compound dimension: 3.0×3.0; 2. Unit: mm; 3. General tolerance $\pm 0.05\text{mm}$ unless otherwise specified; 4. The layout is just for reference.
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Tape and Reel Orientation



Packing Information



Part Number	Package Type	Carrier Width(W)	Pitch(P0)	Reel Size(D)
UM3308	CSP20 2.4×1.9	8 mm	4 mm	180 mm
UM3308H	CSP20 2.4×1.9	8 mm	4 mm	180 mm
UM3308UK	TSSOP20	16 mm	4 mm	330 mm
UM3308QA	QFN20 4.5×3.5	12 mm	4 mm	330 mm
UM3308QB	QFN20 3.0×3.0	12 mm	4 mm	330 mm

GREEN COMPLIANCE

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All Union components are compliant with the RoHS directive, which helps to support customers in their compliance with environmental directives. For more green compliance information, please visit:

http://www.union-ic.com/index.aspx?cat_code=RoHSDeclaration

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