支持1.65V至5V IO口、1.8V低电源供电、双通道、RS-232收发器

UM3122EEQA

描述

UM3122EEQA是一款具有双驱动器、双接收器的RS-232接口器件，配有独立逻辑供电引脚以支持混合电压运行。所有RS-232输入和输出引脚能够耐受±15kV IEC61000-4-2空气间隙放电、±8kV IEC61000-4-2接触放电和±8kV人体放电模型。电荷泵需要使用5个0.1μF小电容，以便器件能够在电源电压低至1.8V时运行。UM3122EEQA能够以高达1000kbps的数据速率运行，同时保持与RS-232相兼容的输出水平。

UM3122EEQA具有一个独特的V_L引脚，可实现在混合逻辑电压系统内运行。可通过V_L引脚设定驱动器输入(D_{IN})和接收器输出(R_{OUT})逻辑电平。当连接低电压微控制器或通用异步收发器(UART)时，不再需要使用附加电压电平转换器。该器件具备"自动省电增强"(Auto Powerdown Plus)功能，如果连续30秒未收发任何数据，则自动进入低功耗模式。该功能使得该器件备受电池供电类应用或其他功率敏感型应用的青睐。

应用

- 远程射频单元 (RRU)
- 基带装置 (BBU)
- POS机
- 诊断和数据传输
- 电池供电类设备

特性

- 扩展 V_{CC}工作节点：1.8V、3.3V 或 5.0V 独特的三倍频器电荷泵架构，支持1.8V低压供电，同时兼容3.3V和5V供电
- 集成电平转换功能，连接低电压 MCU 时无需使用外部电源或附加电平转换器
- R_{IN}输入和D_{OUT}输出端的增强型ESD保护
  ±15kV IEC 61000-4-2 空气间隙放电
  ±8kV IEC 61000-4-2 接触放电
  ±8kV 人体放电模型
- 数据速率指定为 1000Kbps
- 自动断电增强特性
- 关断电源电流低至0.5μA
- 满足甚至超过 RS-232 接口的兼容性要求

UM3122EEQA

Ordering Information

Part Number	Temp. Range	Marking Code	Package Type	Shipping Qty
UM3122EEQA	-40 ℃ to +105 ℃	3122E	QFN24 4.0×4.0	3000pcs/13Inch Tape & Reel

Pin Configurations

Top View

XX: Week Code
UM3122EEQA
QFN24 4.0×4.0
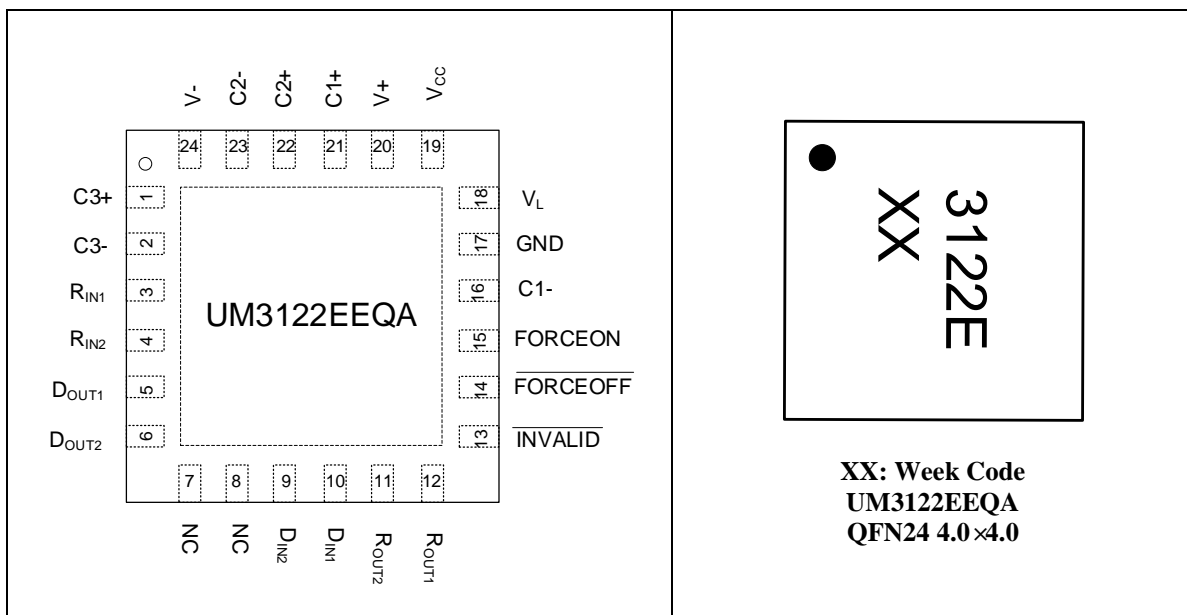
Pin Description

Pin No.	Pin Name	Function
1	C3+	Positive terminal of voltage-tripler charge-pump capacitor (Not needed for V_{CC} 3V to 5.5V)
2	C3-	Negative terminal of voltage-tripler charge-pump capacitor (Not needed for V_{CC} 3V to 5.5V)
3	R_{IN1}	RS-232 Receiver Input
4	R_{IN2}	RS-232 Receiver Input
5	D_{OUT1}	RS-232 Driver Output
6	D_{OUT2}	RS-232 Driver Output
7	NC	Factory pin, can be unconnected or connected to GND
8	NC	Factory pin, can be unconnected or connected to GND
9	D_{IN2}	RS-232 Driver Input
10	D_{IN1}	RS-232 Driver Input
11	R_{OUT2}	RS-232 Receiver Output
12	R_{OUT1}	RS-232 Receiver Output
13	$\overline{INVALID}$	Invalid Output Pin
14	$\overline{FORCEOFF}$	Auto Powerdown Control input (Refer to Truth Table)
15	FORCEON	Auto Powerdown Control input (Refer to Truth Table)
16	C1-	Negative terminal of voltage-doubler charge-pump capacitors (required)
17	GND	Ground
18	V_L	Logic-level supply. All CMOS inputs (D_{IN}) and outputs (R_{OUT}) are referenced to this supply
19	V_{CC}	1.8V or 3V to 5V Supply Voltage Input
20	V_+	Positive charge pump storage capacitor (required)
21	C1+	Positive terminal of voltage-doubler charge-pump capacitor (required)
22	C2+	Positive terminal of voltage-doubler charge-pump capacitor (required)
23	C2-	Negative terminal of voltage-doubler charge-pump capacitors (required)
24	V-	Negative charge pump storage capacitor (required)

Absolute Maximum Ratings（Note1）

Symbol	Parameter	Value	Unit
V_{CC}	Charge pump power supply	-0.3 to +6	V
V_L	Logic Power Supply	-0.3 to +6	V
V_+	Positive storage capacitor voltage$_+$	-0.3 to +7	V
V_-	Negative storage capacitor voltage	-7 to +0.3	V
D_{IN}	Voltage on D_{IN}	-0.3 to (V_L +0.3)	V
R_{IN}	(0Ω series resistance)	±20	V
	(≥250Ω series resistance)	±25	
D_{OUT}	Output voltage	V_- -0.3 to V_+ + 0.3	V
R_{OUT}	Output voltage	-0.3 to (V_L+0.3)	V
$V_+ + \|V_-\|$ (Note2)		13	
$\overline{FORCEOFF}$	Input voltage	-0.3 to +6	V
FORCEON	Input voltage	-0.3 to +6	V
T_J	Junction temperature	150	℃
T_{stg}	Storage temperature range	-65 to 150	℃

Note1:   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 in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Note2: V_+ and V_- can have maximum magnitudes of 7V, but their absolute difference cannot exceed 13V.

Thermal Characteristics

Symbol	Thermal Metric	Value	Unit
θ_{JA}	Junction-to-ambient thermal resistance	34.2	℃/W
θ_{JC}	Junction-to-case thermal resistance	27.2	

UM3122EEQA

Recommended Operating Conditions

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Charge pump power supply	V_{CC}	Tripler Mode	1.65	1.8	2	V
		Doubler Mode	3	3.3	3.6	
			4.5	5	5.5	
Logic power supply	V_L		1.65		V_{CC}	V
RS-232 Receiver interface	R_{IN}		-15		15	V
RS-232 Transmitter interface	D_{OUT}		-7		7	V
GPIO Input logic threshold low （D_{IN} , $\overline{FORCEOFF}$, FORCEON）	V_{IL}	$V_L = 5.0$ V	0		1.7	V
		$V_L = 3.3$V	0		1.1	
		$V_L = 1.8$ V	0		0.6	
GPIO Input logic threshold high （D_{IN}, $\overline{FORCEOFF}$, FORCEON）	V_{IH}	$V_L = 5.0$V	3.3		V_L	V
		$V_L = 3.3$V	2.2		V_L	
		$V_L = 1.8$V	1.2		V_L	
R_{OUT} disabled	V_{OZ}	$\overline{FORCEOFF}$ = 0V	0		V_L	V
Operating temperature			–40		105	℃

Electrical Characteristics

$V_{CC} = V_L = (1.65 \text{ V to } 2.0 \text{ V})$ & $(3.0\text{V to } 5.5\text{V})$, $T_A = -40\text{°C to } 105\text{°C}$ (unless otherwise noted).
Typical data is $T_A = 25\text{°C}$, $V_{CC} = V_L = 3.3\text{V}$ (unless otherwise noted).

Parameter	Symbol	Condition			Min	Typ	Max	Unit
Power and Status Electrical Characteristics								
Static	$I_{CC\,(static)}$	D_{IN1} = GND or V_L; D_{IN2} = GND or V_L, $\overline{\text{FORCEOFF}}$ = V_L FORCEON = V_L	No load	V_{CC} = 1.65V to 2.0V		1.0	1.9	mA
				V_{CC} = 3.0V to 3.6V		0.7	1.4	
				V_{CC} = 4.5V to 5.5V		0.8	1.9	
off	$I_{CC\,(off)}$	$\overline{\text{FORCEOFF}}$ = GND				0.4	10	μA
R_{IN} positive voltage threshold for $\overline{\text{INVALID}}$ output change	V_{IT+}	$R_{IN1} = R_{IN2}$			0.3		2.4	V
R_{IN} negative voltage threshold for $\overline{\text{INVALID}}$ output change	V_{IT-}				-2.4		-0.3	
$\overline{\text{INVALID}}$ high-level output voltage	V_{OH}	I_{OH} = -1 mA, FORCEON = GND, $\overline{\text{FORCEOFF}}$ = V_L			V_L-0.4	V_L-0.08	V_L	V
$\overline{\text{INVALID}}$ low-level output voltage	V_{OL}	I_{OL} = 1.6 mA, FORCEON = GND, $\overline{\text{FORCEOFF}}$ = V_L			0	0.06	0.4	V
Driver Electrical Characteristics								
Output voltage swing	V_{OUT}	All driver outputs loaded with 3 kΩ to ground C3 = 100 nF, V_{CC}= 1.8 V			±4.25	±4.7		V
		All driver outputs loaded with 3 kΩ to ground C3 = 0 F, V_{CC}= 3.3 V or 5 V			±5	±5.4		
Output short-circuit	Ios	V_{DOUT} = 0					±60	mA
Input leakage current		D_{IN} = GND to V_L; $\overline{\text{FORCEOFF}}$ = GND to V_L; FORCEON = GND to V_L				0	±10	μA

Electrical Characteristics （continued）

$V_{CC} = V_L = (1.65\ V\ to\ 2.0\ V)\ \&\ (3.0V\ to\ 5.5V)$, $T_A = -40\ ℃\ to\ 105\ ℃$ (unless otherwise noted).
Typical data is $T_A = 25\ ℃$, $V_{CC} = V_L = 3.3V$ (unless otherwise noted).

Receiver Electrical Characteristics							
Parameter	**Symbol**	**Condition**		**Min**	**Typ**	**Max**	**Unit**
Output leakage current	I_{off}	R_{OUT}, receives disabled			±0.01	±10	μA
Output voltage low	V_{OL}	I_{out}=2.0mA			0.04	0.3	V
Output voltage high	V_{OH}	I_{out}= -2.0mA		V_L-0.3	V_L-0.04		V
Input threshold low	V_{IT-}	T_A=25°C	V_L=5	0.8	1.5		V
			V_L=3.3V	0.7	1.1		
			V_L=1.8V	0.6	0.7		
Input threshold high	V_{IT+}	T_A=25°C	V_L=5V		2.0	2.4	V
			V_L=3.3V		1.5	2.4	
			V_L=1.8V		0.9	1.4	
Input hysteresis	V_{hys}	T_A=25°C	V_L=5V		0.45		V
			V_L=3.3V		0.35		
			V_L=1.8V		0.26		
Input resistance		T_A= -40 to 105 °C		3	5	7	kΩ
Driver Switching Characteristics							
Maximum data rate		R_L = 3 kΩ, C_L = 500 pF (one driver)		1000			kbps
		R_L = 3 kΩ, C_L = 1000 pF (one driver)		500			
Time-to-exit powerdown		$|V_{DOUT}| > 3.7\ V$			30	150	μs
Driver skew (Note1)	$|t_{PHL} - t_{PLH}|$	R_L = 3 kΩ		0	50	100	ns
Transition-Region slew rate		R_L = 3 kΩ to 7 kΩ, T_A = 25 ℃ Measured from 3 V to –3V or –3 V to 3 V	V_{CC} = 1.8V, C_L = 200 pF		33		V/μs
			V_{CC} = 1.8V, C_L = 1000pF		25		
			V_{CC} = 3.3 V, C_L = 200 pF		38		
			V_{CC} = 3.3 V, C_L = 1000pF		28		
			V_{CC} = 5 V, C_L = 200 pF		41		
			V_{CC} = 5 V, C_L= 1000 pF		30		

Electrical Characteristics （continued）

$V_{CC} = V_L = (1.65\ V$ to $2.0\ V) \& (3.0V$ to $5.5V)$, $T_A = -40\ ℃$ to $105\ ℃$ (unless otherwise noted).
Typical data is $T_A = 25\ ℃$, $V_{CC} = V_L = 3.3V$(unless otherwise noted).

Receiver Switching Characteristics						
Parameter	**Symbol**	**Condition**	**Min**	**Typ**	**Max**	**Unit**
Receiver propagation delay, high to low	t_{PHL}	Receiver input to receiver output $C_L = 150\ pF$		0.15	0.4	μs
Receiver propagation delay, low to high	t_{PLH}			0.15	0.4	μs
Receiver skew	$t_{PHL} - t_{PLH}$			50	300	ns
Receiver output enable time	t_{en}	From $\overline{FORCEOFF}$ to $R_{OUT} = V_L/2$ $C_L = 150\ pF$, $R_L = 3\ kΩ$		200	400	ns
Receiver output disable time	t_{dis}			200	400	ns
Power and Status Switching Characteristics						
Propagation delay time, low to high level output	t_{valid}			1		μs
Propagation delay time, high to low level output	$t_{invalid}$			30		μs
Receiver or driver edge to auto powerdown plus	t_{dis}		15	30	60	s
ESD						
Electrostatic discharge	$V_{(ESD)}$	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins (Note2)	All pins except RS-232 bus	±2000		V
			RS-232 bus pins	±8000		
		IEC 61000-4-2 Air-Gap Discharge	RS-232 bus pins	±15000		
		IEC 61000-4-2 Contact Discharge		±8000		

Note1： Driver skew is measured at the driver zero crosspoint.
Note2： JEDEC document JEP155 states that 500V HBM allows safe manufacturing with a standard ESD control process.
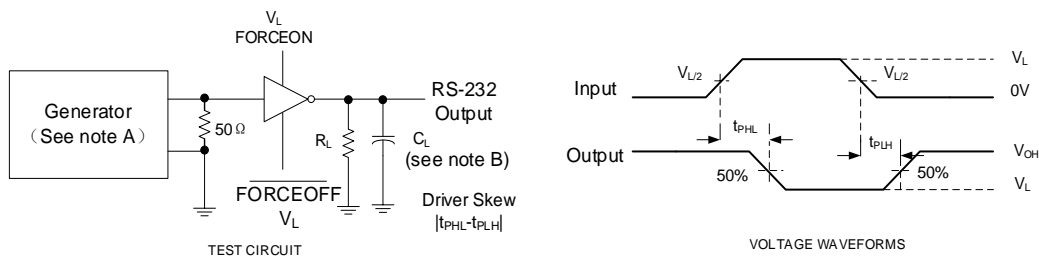
Parameter Measurement Information
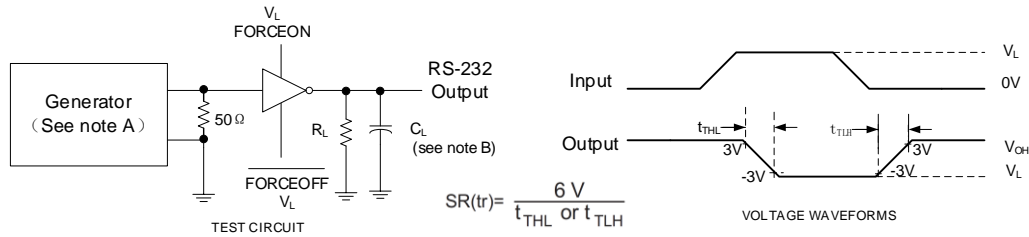
Notes: A. The pulse generator has the following characteristics: PRR = 1000 kbit/s, $Z_O = 50\Omega$, 50% duty cycle, $t_r \leq 10$ ns, $t_f \leq 10$ ns.
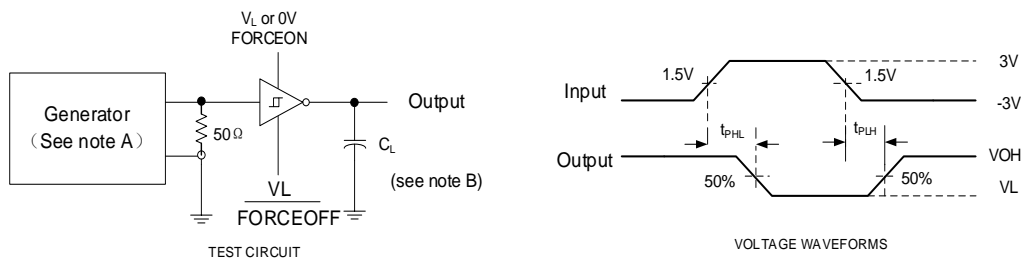
B. C_L includes probe and jig capacitance.

Figure 1. Driver Slew Rate

Notes: A. The pulse generator has the following characteristics: PRR = 1000 kbit/s, $Z_O = 50\Omega$, 50% duty cycle, $t_r \leq 10$ ns, $t_f \leq 10$ ns.

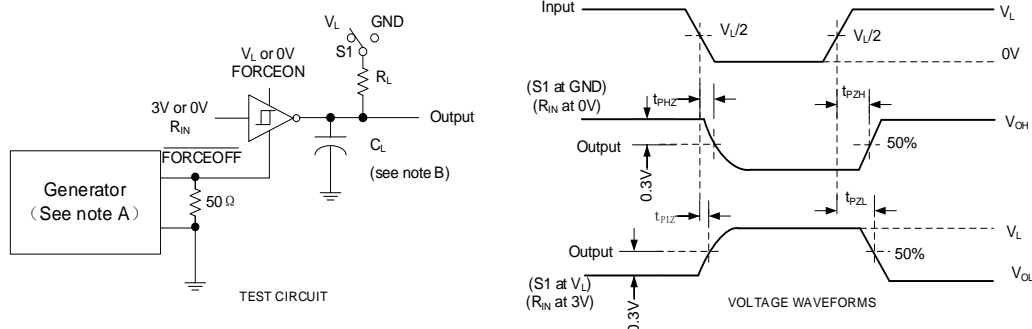B. C_L includes probe and jig capacitance.

Figure 2. Driver Pulse Skew

Notes: A. The pulse generator has the following characteristics: $Z_O = 50\Omega$, 50% duty cycle, $t_r \leq 10$ ns, $t_f \leq 10$ ns.

B. C_L includes probe and jig capacitance.

Figure 3. Receiver Propagation Delay Times
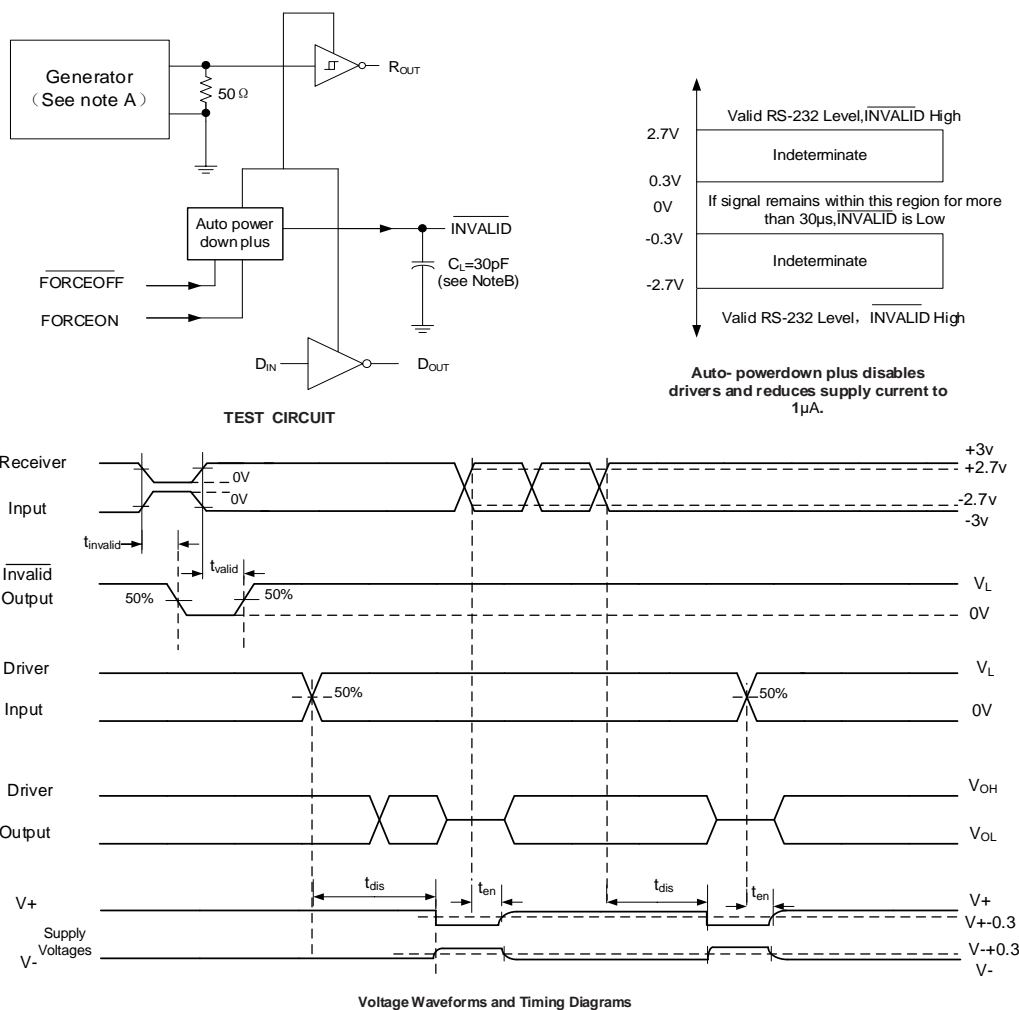
Parameter Measurement Information （continued）

TEST CIRCUIT

VOLTAGE WAVEFORMS

Note：A. The pulse generator has the following characteristics: $Z_O = 50\Omega$, 50% duty cycle, $t_r \leqslant 10$ ns, $t_f \leqslant 10$ ns.

B. C_L includes probe and jig capacitance.

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

D. t_{PLZ} and t_{PHZ} are the same as t_{en}.

Figure 4. Receiver Enable and Disable Times

TEST CIRCUIT

Auto- powerdown plus disables drivers and reduces supply current to 1µA.

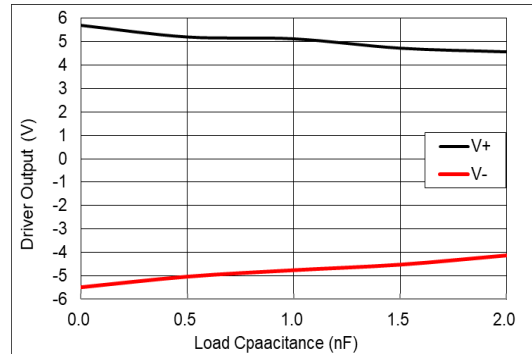Voltage Waveforms and Timing Diagrams

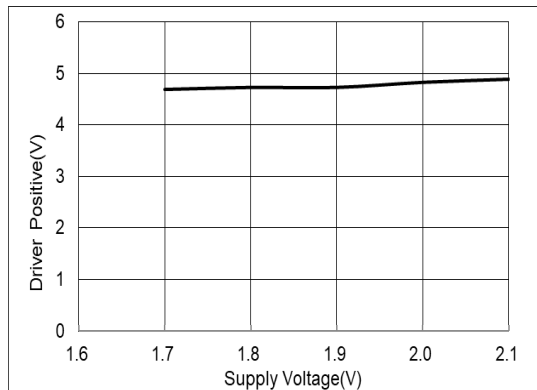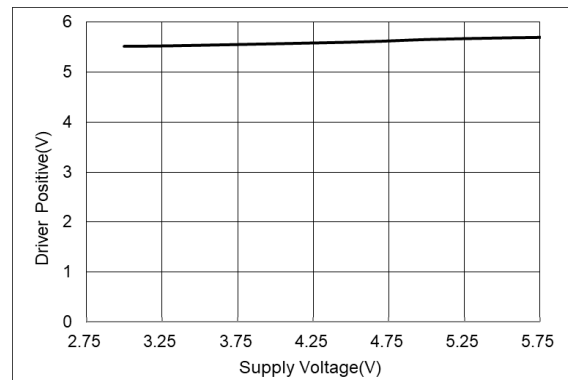**Figure 5. INVALID Propagation-Delay Times and Supply-Enabling Time**

Typical Characteristics
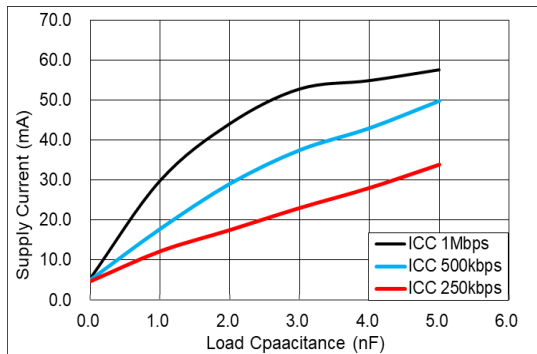
Figure 6. Supply Current vs Load Capacitance
V_{CC}=3.3V, V_L=1.8V, R_{LOAD}=3kΩ, CH2=32kbps

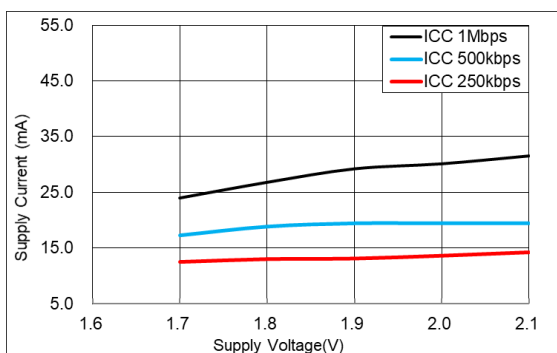**Figure 7. Driver Output vs Load Capacitance**
V_{CC}=3.3V, V_L=1.8V, R_{LOAD}=3kΩ, CH1=1Mbps, CH2=32kbps

Figure 8. Driver Positive vs Supply Voltage (Tripler Mode)
1Mbps, R_{LOAD}=3kΩ, C_{LOAD}=560pF

Figure 9. Driver Positive vs Supply Voltage (Doubler Mode)
1Mbps, R_{LOAD}=3kΩ, C_{LOAD}=560pF

Figure 10. Supply Current vs Supply Voltage (Tripler Mode)
V_L=1.8V, R_{LOAD}=3kΩ, C_{LOAD}=1nF, CH2=32kbps
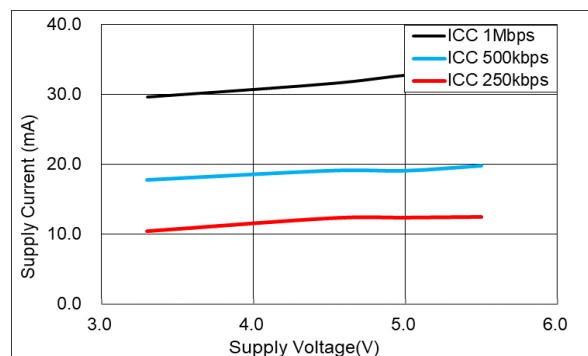
Figure 11. Supply Current vs Supply Voltage (Tripler Mode)
V_L=1.8V, R_{LOAD}=3kΩ, C_{LOAD}=1nF, CH2=32kbps

Detailed Description

Overview

The UM3122EEQA is an upgrade to standard RS-232 transceivers, offering compatibility with modern system needs like 1.8V GPIO capability, enhanced ESD & ultralow stand-by current. The majority of RS-232 transceivers with 1.8V GPIO compatibility require a logic supply pin for the I/O translation, in addition to a minimum 3.3V V_{CC} for all of the other active circuitry on the chip. Unlike these transceivers, UM3122EEQA can operate with both V_L and V_{CC} equal to 1.8V. When V_{CC}=3.0V to 5.5V, the charge pump will sense V_{CC} and switch to doubler mode. C1 & C2 are the necessary flying capacitors, C3 is not needed, and the charge pump outputs V_+ & V_- will regulate to ~+/-5.4V. When V_{CC}=1.65V to 2.0V, the charge pump will sense V_{CC} and switch to tripler mode. C1, C2&C3 are all necessary, and the charge pump outputs V_+ & V_- will regulate to ~+/-2.65*V_{CC} from V_{CC}=1.65V to 2.0V.

With many modern applications expanding into products that use UM3122EEQA as a backup communication protocol, itis important for the transceiver to have efficient standby operation. In order to accommodate this, Auto Powerdown Plus has been integrated to shut-off all active circuitry, allowing UM3122EEQA to achieve an I_{off} of 1uA.

In order to comply with common interface system needs and environments, the RS-232 receive and transmit I/O pins comply with IEC 61000-4-2 ratings.
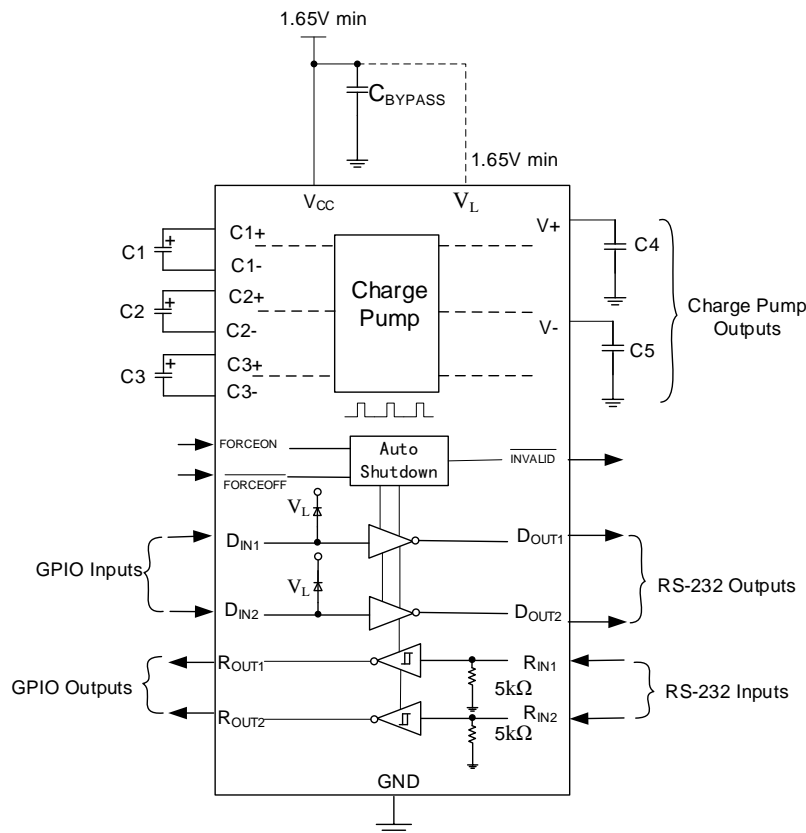
Detailed Functional Block Diagram

Figure 12. Schematic

Feature Description

Charge Pump

The internal power supply consists of a regulated auto-sensing charge pump that provides RS-232 compatible output voltages, over the 1.65V to 2.0V and 3.0V to 5.5V V_{CC} ranges. The charge pump operates in two modes to efficiently accommodate low voltage (1.8V) and higher voltage (3.3V & 5.0V) supplies.

Doubler Mode: The charge pump requires two flying capacitors (C1, C2) and reservoir capacitors (C4, C5) to generate the V_+ and V- supplies of approximately ±5.4V when V_{CC} is greater than 3 V. When V_{CC} is >2.9V, UM3122EEQA will sense the supply voltage level and switch the charge pump to a doubler. Hence, no need for a third flying capacitor. C3+&C3- pins can be left open for proper operation. If a capacitor is placed between C3+&C3-, the charge pump will ignore this capacitor and still behave as a doubler. For capacitor choice recommendations, please refer to Capacitor Selection Table.

Tripler Mode: The charge pump requires three flying capacitors (C1, C2&C3) and reservoir capacitors (C4, C5) to generate the V_+ and V- supplies of approximately $\pm 2.65 * V_{CC}$ when V_{CC} is greater than 1.65V. When V_{CC} is < 2.1V, UM3122EEQA will sense the supply voltage level and switch the charge pump to a tripler.

Drivers

The drivers are inverting level transmitters that convert TTL or CMOS logic levels to RS-232 levels. For V_{CC} =3.0V to 5.0V, the RS-232 output voltage swing is typically ±5.4V fully loaded and ±5 V minimum fully loaded. For V_{CC} = 1.8V, the RS-232 output voltage swing is typically ±4.7V fully loaded and ±4.25V minimum fully loaded. The driver outputs are protected against indefinite short-circuits to ground without degradation in reliability. These drivers are compatible with RS-232 logic levels and all previous RS-232 versions. Unused driver inputs should be connected to GND or $V_{CC.}$

Receivers

The receivers convert EIA/TIA-232 levels to TTL or CMOS logic output levels. Receivers have an inverting output that can be disabled by using the $\overline{\text{FORCEOFF}}$ pin. Receivers remain active when the Auto Powerdown Plus circuitry autonomously enters a low power state. See Auto Powerdown Plus for more information on the Auto Powerdown mode. If the $\overline{\text{FORCEOFF}}$ pin is manually set low, the receivers will be disabled and put into 3-state mode. In either of these Powerdown modes, the device will typically consume about 0.5 uA. The truth table logic of the UM3122EEQA driver and receiver outputs can be found in Device Functional Modes. Since receiver input is usually from a transmission line where long cable lengths and system interference can degrade the signal, the inputs have a typical hysteresis margin of 300 mV. This ensures that the receiver is virtually immune to noisy transmission lines. Should an input be left unconnected, an internal 5kΩ pull-down resistor to ground will commit the output of the receiver to a HIGH state.

Auto Powerdown Plus

Powerdown is engaged in two separate cases: automatically, when no activity has occurred for a period of time, and manually, using the $\overline{\text{FORCEOFF}}$ device pin.

Automatic Powerdown: Auto Powerdown Plus is enabled when FORCEON is set LOW and

$\overline{\text{FORCEOFF}}$ is set HIGH. Using UM3122EEQA's integrated edge detection circuitry and timer, the device can sense when there is no activity on the driver or receiver inputs for 30 seconds. When this condition is sensed by the device, it automatically shuts the charge pump off, reducing supply current to 0.5μA. When a valid transition is sensed on one of the driver or receiver inputs, the charge pump turns back on and UM3122EEQA exits powerdown. The typical time to exit powerdown is typically in 30 us, but can be as long as 150 us. As a result, the system saves power without requiring any software control. Device Functional Modes summarizes the operating modes in truth table form. While in the low power mode with Automatic Powerdown enabled ($\overline{\text{FORCEOFF}}$ = HIGH and FORCEON = LOW), the receiver inputs are still enabled.

Manual Powerdown：

The device can be manually powered down by externally setting $\overline{\text{FORCEOFF}}$ pin to low logic level. Both the drivers and receivers will be powered off. Device Functional Modes summarizes the operating modes in truth table form.

Forced On： If the $\overline{\text{FORCEOFF}}$ and FORCEON pins are both set HIGH, the device will power on with Auto Powerdown Plus disabled. Both the drivers and receiver will be active regardless of inactivity. Because Powerdown is autonomous, FORCEON can be used ensure drivers are ready for new data transmission if the time since last transmission (or receive data) was more than 15 seconds. Device Functional Modes summarizes the operating modes in truth table form.

Device Functional Modes
Each Driver (Note1)

Inputs				Outputs	
D_{IN}	FORCEON	$\overline{\text{FORCEOFF}}$	Time elapsed since last R_{IN} or D_{IN} transition	D_{OUT}	Driver status
X	X	L	X	Z	Powered off
L	H	H	X	H	Normal operation with auto-powerdown plus disabled
H	H	H	X	L	Normal operation with auto-powerdown plus disabled
L	L	H	<30s	H	Normal operation with auto-powerdown plus enabled
H	L	H	<30s	L	Normal operation with auto-powerdown plus enabled
L	L	H	>30s	Z	Normal operation with auto-powerdown plus feature
H	L	H	>30s	Z	Normal operation with auto-powerdown plus feature

Note1：H = high level, L = low level, X = irrelevant, Z = high impedance (off), 30s is typical inactivity time.

Each Receiver (Note1)

Inputs			Outputs	
R_{IN}	$\overline{FORCEOFF}$	Time elapsed since last R_{IN} or D_{IN} transition	R_{OUT}	Receiver status
X	L	X	Z	Powered off
L	H	X	H	Normal operation with auto-powerdown plus disabled
H	H	X	L	
Open	H	X	H	Normal operation with auto-powerdown plus enabled

Note1：H = high level, L = low level, X = irrelevant, Z = high impedance (off), Open = input disconnected or connected driver off.

$\overline{Invalid}$ **Status Truth (Note1)**

Inputs				Outputs
R_{IN1}, R_{IN2}	FORCEON	$\overline{FORCEOFF}$	Time elapsed since last R_{IN} or D_{IN} transition	$\overline{Invalid}$
Any L or H	X	X	X	H
All Open	X	X	X	L

Note1：H = high level, L = low level, X = irrelevant, Z = high impedance (off), 30s is typical inactivity time.

Applications Information

UM3122EEQA is used to communicate between two electrical units on separate PCBs across cables <40 ft. Common UM3122EEQA cables are RJ45, DB9 & DB25.Typical 1.8V Application is shown in the figure below.
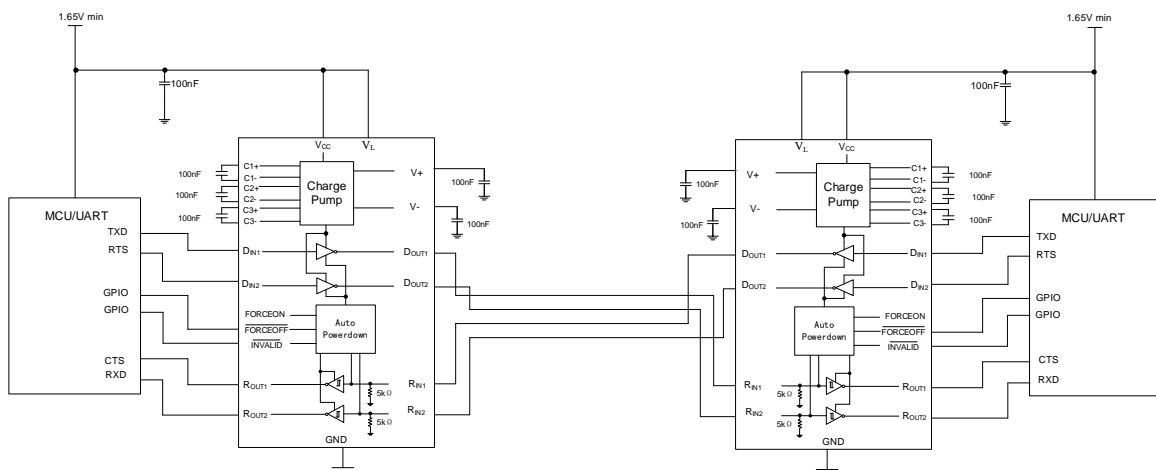

Figure 13. Typical 1.8V Application

Data-Rate and Cable Length

RS-232 intended is for short range data transmission. The rise time for RS-232 driver edges is slow enough that the data cable appears as a capacitor instead of a transmission line impedance. The elapsed time for one bit of data far exceeds the transit time of any practical RS-232 cable length. The capacitance of the cable is the limiting factor. Therefore，the capacitance per foot (or meter) of the cable is important if long data cables are used. Capacitance slows the rise and fall time of the signal. For low data rates, the delay is insignificant. However, high data rates will have reduced percentage of time that the output is at V_{OL} or V_{OH} and more time in the transitions.

The timing of the UART (universal asynchronous receiver/transmitter) must sample the signal at the right time to coincide with V_{OL} and V_{OH} plateaus. At some point data reliability will be impacted. There are no hard limits for cable capacitance and data rate.
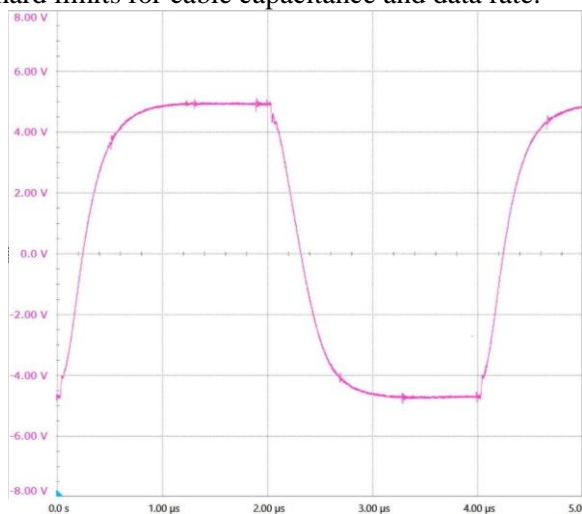
Figure 14. Typical Waveform with Capacitive Load

V_{CC} = 3.3 V, R_{LOAD} = 3 kΩ, Date Rate = 500kbps，C=2nF

The maximum cable length depends on the cable used (pf/ft), data rate, timing of receiving UART, system tolerance to data errors.

Capacitor Selection

The capacitor type used for C1–C5 is not critical for proper operation; polarized or non-polarized capacitors can be used, though lower ESR capacitors are preferred. The charge pump requires 0.1 μF capacitors for V_{CC} =1.8V or V_{CC} = 3.3V operation. For other supply voltages, see the Capacitor Selection Table for required capacitor values. Do not use values smaller than those listed in Capacitor Selection Table. Increasing the capacitor values, except for C1, reduces ripple on the transmitter outputs and slightly reduces power consumption. C2, C3, C4 and C5 can be increased without changing C1's value. However, do not increase C1 without also increasing the values of C2, C3, C4, C5, $C_{BYPASS1}$, and $C_{BYPASS2}$ to maintain the proper ratios (C1 to the other capacitors). When using the minimum required capacitor values, make sure the capacitor value does not degrade excessively with temperature. If in doubt, use capacitors with a larger nominal value. The capacitor's equivalent series resistance (ESR) usually increases at low temperatures.

For best charge pump efficiency locate the charge pump and bypass capacitors as close as possible to the IC. Surface mount capacitors are best for this purpose. Using capacitors with lower equivalent series resistance (ESR) and self-inductance, along with minimizing parasitic PCB trace inductance will optimize charge pump operation. Designers are also advised to consider that capacitor values may shift over time and operating temperature.

Capacitor Selection Table

$V_{CC} = V_L$	C1 Capacitor Value	C2 Capacitor Value	C3 Capacitor Value	C4 Capacitor Value	C5 Capacitor Value
1.65 V to 2 V （Note1）	100 nF				
3.0 V to 3.6 V （Note1）	100 nF		100 nF or open	100nF	
4.5 V to 5.5 V （Note1）	47 nF	330 nF	100 nF or open	330nF	
3 V to 5.5 V （Note2）	47 nF	470 nF	100 nF or open	470nF	

Note1：For optimized performance, we recommend using these configurations.

Note2：For applications where the V_{CC} variation is larger, this configuration is acceptable.

Application Curves
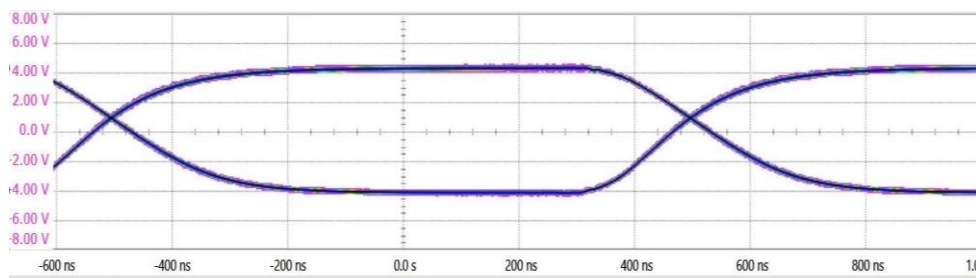
Figure 14.1 Mbps Eye Diagram, 2 V/div, 200 ns/ div
V_{CC} = 1.8 V, C_{LOAD} = 500 pF, R_{LOAD} = 3 kΩ

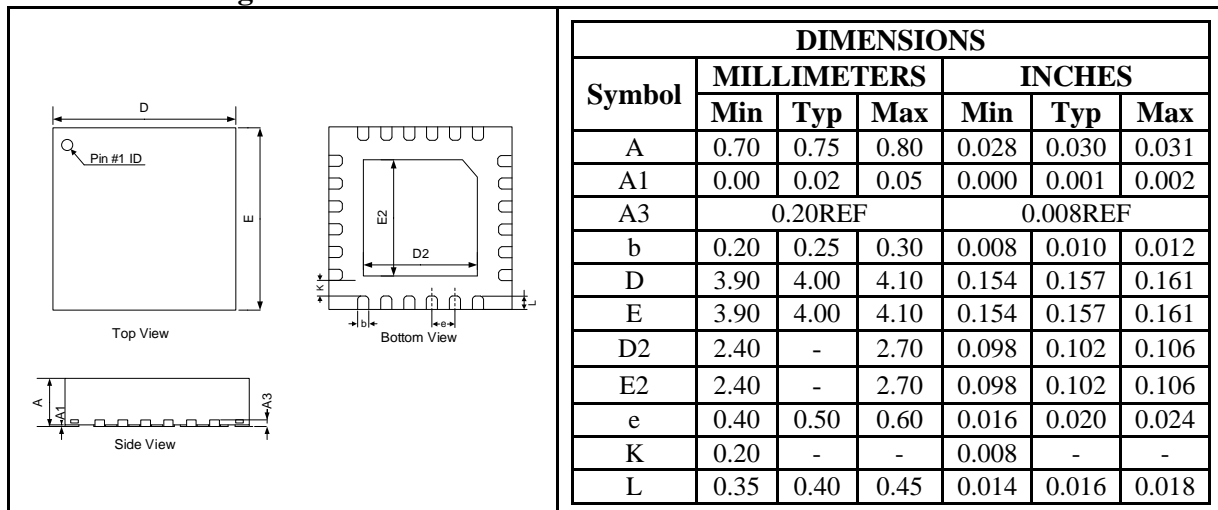## Power Supply Recommendations

In most circumstances, a 0.1μF V_{CC} bypass capacitor and a 1μF V_L bypass capacitor are adequate. In applications that are sensitive to power-supply noise, use larger value V_{CC} bypass capacitor. There is no maximum limit for bypass capacitor. Place bypass capacitors as close to the IC as possible. It is not recommended to use this device when V_{CC} is powered and V_L = 0 V or floating for an extended period of time because operation is undefined. V_{CC} and V_L must be powered to guarantee charge pump operation. Also, to achieve full functionality as described in Specifications, it is recommended to not use a higher voltage on V_L than V_{CC}. Full functionality can be achieved when V_{CC} is greater than or equal to V_L.
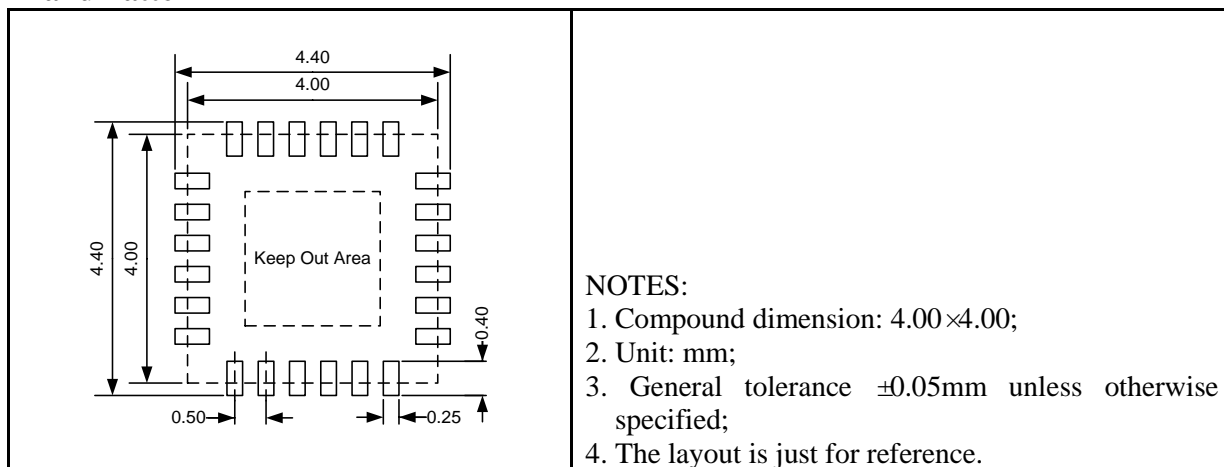
UM3122EEQA

Package Information

UM3122EEQA: QFN24 4.0 × 4.0

Outline Drawing

Symbol	DIMENSIONS					
	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	0.70	0.75	0.80	0.028	0.030	0.031
A1	0.00	0.02	0.05	0.000	0.001	0.002
A3	0.20REF			0.008REF		
b	0.20	0.25	0.30	0.008	0.010	0.012
D	3.90	4.00	4.10	0.154	0.157	0.161
E	3.90	4.00	4.10	0.154	0.157	0.161
D2	2.40	-	2.70	0.098	0.102	0.106
E2	2.40	-	2.70	0.098	0.102	0.106
e	0.40	0.50	0.60	0.016	0.020	0.024
K	0.20	-	-	0.008	-	-
L	0.35	0.40	0.45	0.014	0.016	0.018

Land Pattern

NOTES:
1. Compound dimension: 4.00×4.00;
2. Unit: mm;
3. General tolerance ±0.05mm unless otherwise specified;
4. The layout is just for reference.

Tape and Reel Orientation

GREEN COMPLIANCE

Union Semiconductor is committed to environmental excellence in all aspects of its operations including meeting or exceeding regulatory requirements with respect to the use of hazardous substances. Numerous successful programs have been implemented to reduce the use of hazardous substances and/or emissions.

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