具备3V至5.5V供电、1发/1收、250kbps、关断模式 RS-232收发器

UM3221EEAE *SSOP16*
UM3221EEUE *TSSOP16*

1 描述

UM3221E是3.3V供电的RS-232收发器，适用于便携式或手持式应用。UM3221E具有一个驱动器和一个接收器。该器件具有低功耗、高数据速率能力和增强型ESD保护功能。所有发射器输出和接收器输入的ESD额定值在人体放电模式下为±15kV，在IEC61000-4-2空气间隙放电下为±15kV，在IEC61000-4-2接触放电下超过±8kV。逻辑I/O引脚的ESD额定值在人体放电模式下为±2kV。

UM3221E 具备小占板面积和扁平封装的特点，并使用 0.1μF 电容，可节省电路板空间。在最大负载条件下，数据传输率大于 250kbps。

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2 应用

- 工业自动化设备
- 电池供电设备
- 手持设备
- POS 终端

3 特性

- 通过+3.0V至+5.5V电源供电，符合真正的EIA/TIA-232-F标准
- 符合 EIA/TIA-562 ±3.7V 的电平，电源电压低至 2.7 V
- 增强ESD规格：
  ±15kV 人体放电模型
  ±15kV IEC61000-4-2 空气间隙放电
  ±8kV IEC61000-4-2 接触放电
- 1μA 低功耗关断模式
- 250kbps 最低传输速率
- 保证30V/μs最大压摆率
- 闩锁性能(Latch-Up)超过200mA

4 订购信息

芯片型号	工作温度范围	封装类型	发货数量
UM3221EEAE	-40℃ to +85℃	SSOP16	2000pcs/13 Inch Tape & Reel
UM3221EEUE	-40℃ to +85℃	TSSOP16	3000pcs/13 Inch Tape & Reel

5 Pin Configuration and Function

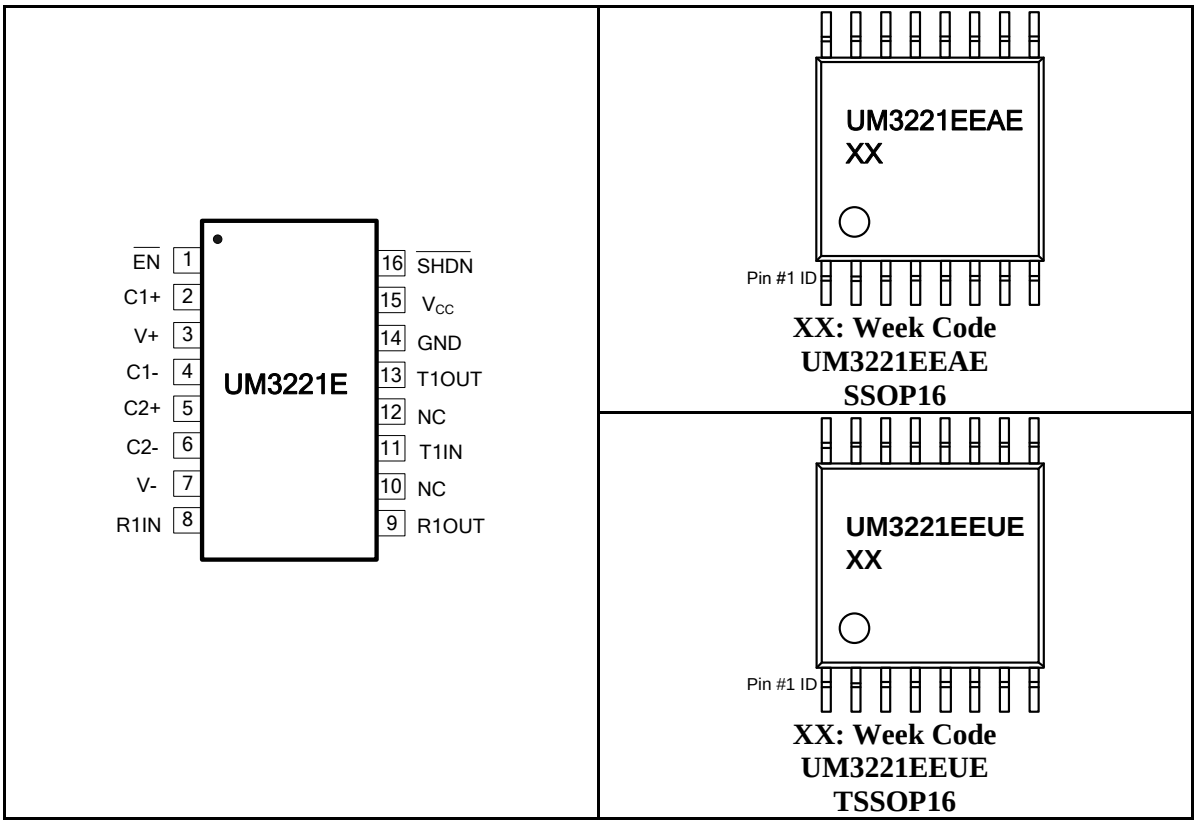


Table 5-1. Pin Functions

Pin No.	Pin Name	Function
1	$\overline{EN}$	Receiver Enable. Active low.
2	C1+	Positive Terminals of Voltage-Doubler Charge Pump Capacitor
3	V+	Positive Voltage Generated by the Charge Pump
4	C1-	Negative Terminals of Voltage-Doubler Charge Pump Capacitor
5	C2+	Positive Terminals of Inverting Charge Pump Capacitor
6	C2-	Negative Terminals of Inverting Charge Pump Capacitor
7	V-	Negative Voltage Generated by the Charge Pump
8	R1IN	RS-232 Receiver Input
9	R1OUT	RS-232 Receiver Output
10, 12	NC	Not connected
11	T1IN	RS-232 Driver Input
13	T1OUT	RS-232 Driver Output
14	GND	Ground
15	V_{CC}	+3.0V to +5.5V Supply Voltage Input
16	$\overline{SHDN}$	Shut off Pump Power and Transmitters. Active low.

6 Specifications

6.1 Absolute Maximum Ratings (Note 1)

Symbol	Parameter		Value	Unit
V_{CC}	Supply Voltage on V_{CC}		-0.3 to +6	V
V_+	Voltage on V_+		(V_{CC}-0.3) to +7.5	V
V_-	Voltage on V_-		-7.5 to +0.3	V
T1IN	Voltage on T1IN		-0.3 to (V_{CC}+0.3)	V
R1IN	Voltage on R1IN		±30	V
T1OUT	Voltage on T1OUT		(V_--0.3) to (V_++0.3)	V
R1OUT	Voltage on R1OUT		-0.3 to (V_{CC}+0.3)	V
	Short-Circuit Duration, T1OUT		Continuous	
P_D	Continuous Power Dissipation at T_A=70℃	SSOP16	775	mW
		TSSOP16	754	
T_A	Operating Temperature Range		-40 to +85	℃
T_{STG}	Storage Temperature Range		-65 to +165	℃
T_L	Lead Temperature for Soldering 10 Seconds		+260	℃

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

6.2 Electrical Characteristics

V_{CC}=+3.0V to +5.5V, C1- C4=0.1μF, T_A=T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A=25℃.

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
DC CHARACTERISTICS (V_{CC}=+3.3V or +5V, T_A=25℃)							
V_{CC} Supply Current	I_{CC}	$\overline{SHDN}$=V_{CC}, No Load				1.5	mA
Shutdown Supply Current	I_{SHDN}	$\overline{SHDN}$=GND				1	μA
LOGIC INPUTS							
Input Leakage Current		T1IN, $\overline{SHDN}$, $\overline{EN}$				±1	μA
Input Threshold Low	V_{IL}	T1IN, $\overline{SHDN}$, $\overline{EN}$	V_{CC}=3.3V			0.8	V
			V_{CC}=5.0V			0.8	
Input Threshold High	V_{IH}	T1IN, $\overline{SHDN}$, $\overline{EN}$	V_{CC}=3.3V	1.6			V
			V_{CC}=5.0V	2.2			
Transmitter Input Hysteresis		V_{CC}=3.3V			0.2		V
		V_{CC}=5.0V			0.15		
RECEIVER OUTPUTS							
Output Voltage Low	V_{OL}	V_{CC}=3.3V, I_{OUT}=1.6mA				0.8	V
		V_{CC}=5.0V, I_{OUT}=1.6mA				0.8	
Output Voltage High	V_{OH}	V_{CC}=3.3V, I_{OUT}=-1.0mA		2.8			V
		V_{CC}=5.0V, I_{OUT}=-1.0mA		4.4			
RECEIVER INPUTS							
Input Voltage Range				-30		30	V
Input Threshold Low		T_A=+25℃	V_{CC}=3.3V	0.8	1.15		V
			V_{CC}=5.0V	0.8	1.55		
Input Threshold High		T_A=+25℃	V_{CC}=3.3V		1.35	2	V
			V_{CC}=5.0V		1.75	2	
Input Hysteresis					0.2		V
Input Resistance		T_A=+25℃		3	5	7	kΩ
TRANSMITTER OUTPUTS							
Output Voltage Swing		All Drivers Loaded with 3kΩ to Ground		±5.0	±6.0		V
Output Short-Circuit Current		Short to V_{CC} , GND or Other TXD Pin	V_{CC}=3.3V		±30	±60	mA
			V_{CC}=5.0V		±40	±60	mA

Electrical Characteristics (Continued)

(V_{CC}=+3.0V to +5.5V, C1- C4=0.1μF, T_A=T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A=25℃)

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
TIMING CHARACTERISTICS							
Maximum Data Rate		R_L=3kΩ to 7kΩ, C_L=50pF to 1000pF, One Transmitter Switching			250		kbps
Receiver Propagation Delay	t_{PLH}, t_{PHL}	C_L=150pF, see Figure 8-1	All Parts, Normal Operation		0.15		μs
Receiver Skew	$\|t_{PHL}-t_{PLH}\|$					0.1	μs
Transmitter Propagation Delay	t_{PLH}, t_{PHL}	R_L=3kΩ, C_L=2500pF, All Transmitters Loaded, see Figure 8-1			0.9		μs
Transmitter Skew	$\|t_{PHL}-t_{PLH}\|$					0.1	μs
Transition-Region Slew Rate		T_A=+25℃, V_{CC}=3.3V, R_L=3kΩ to 7kΩ, C_L=50pF to 1000pF, Measured from -3V to +3V or +3V to -3V, see Figure 8-1		3	15	30	V/μs
ESD AND LATCH UP PERFORMANCE							
R_IN, T_OUT ESD-Protection Voltage		Human Body Model			±15		kV
		IEC61000-4-2, Contact Discharge			±8		
		IEC61000-4-2, Air-Gap Discharge			±15		
Logic Pin ESD-Protection Voltage		Human Body Model			±2		kV
Latch Up Performance		JEDEC Standard No.78D			±200		mA

7 Detailed Description

7.1 Dual Charge-Pump Voltage Converter

The UM3221E's internal power supply consists of a regulated dual charge pump and provides output the maxim voltages of +7V (doubling charge pump) and -7V (inverting charge pump) over the +3.0V to +5.5V V_{CC} range. The charge pump operates in discontinuous mode; if the output voltages are less than 7V, the charge pump is enabled, and if the output voltages exceed 7V, the charge pump is disabled. The charge pumps require only four small, external 0.1μF capacitors for the voltage doubler and inverter functions (see Figure 9-2).

7.2 RS-232 Transmitter

The transmitter is inverting level translator that translates TTL/CMOS inputs to EIA/TIA-232 output levels. The transmitter guarantees a 250kbps data rate for full load conditions (3kΩ and 1000pF). The transmitter can be paralleled to drive multiple receivers. When T1IN is not driven, UM3221 will keep logic high.

7.3 RS-232 Receiver

The receiver converts RS-232 signals to CMOS output levels and accepts inputs up to ±30V while presenting the required 3kΩ to 7kΩ input impedance. The UM3221E receiver has inverting three-state outputs. Drive $\overline{EN}$ high to place the receivers into a high impedance state. Receiver can be either active or inactive in shutdown state depending on $\overline{EN}$ status.

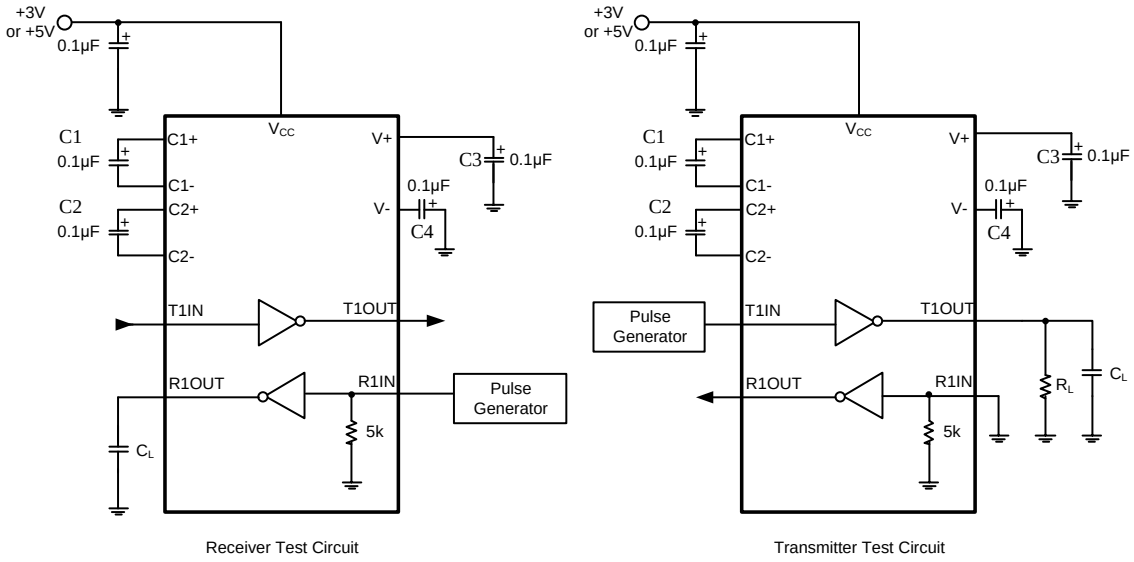
7.4 Shutdown Mode

Supply current falls to less than 1μA in shutdown mode ($\overline{SHDN}$ = GND). When shutdown, the device's charge pumps are shut off, V+ is pulled down to V_{CC}, V- is pulled to ground, and the transmitter outputs are disabled (high impedance). The time required to recover from shutdown is typically 100μs. Connect $\overline{SHDN}$ to V_{CC} if shutdown mode is not used. $\overline{SHDN}$ has no effect on R1OUT.

7.5 ESD Protection

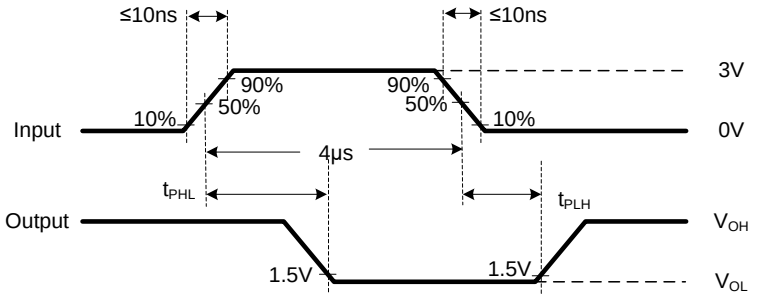
All pins on UM3221E include ESD protection structures, but the family incorporates advanced structures which allow the RS-232 pins (transmitter outputs and receiver inputs) to survive ESD events up to ±15kV. The RS-232 pins are particularly vulnerable to ESD damage because they are typically connected to an exposed port on the exterior of the finished product. The ESD structures withstand high ESD in all states: normal operation, shutdown and powered down. After an ESD event, circuits keep working without latch up. ESD protection can be tested in various ways; the transmitter outputs and receiver inputs are characterized for protection to the following limits: ±15kV using the Human Body Model, ±8kV using the Contact Discharge method specified in IEC61000-4-2, ±15kV using the Air-Gap Discharge method specified in IEC61000-4-2. The logic pins are characterized for protection to the following limit: ±2kV using the Human Body Model.

8 Parameter Measurement Information

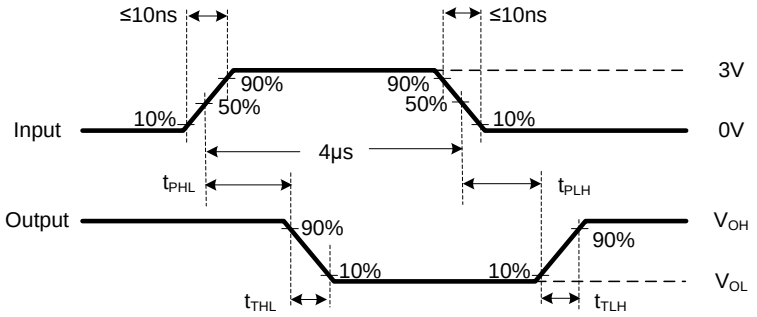


Receiver Test Circuit

Transmitter Test Circuit



Receiver Waveforms



Transmitter Waveforms

Figure 8-1

9 Typical Operating Circuits

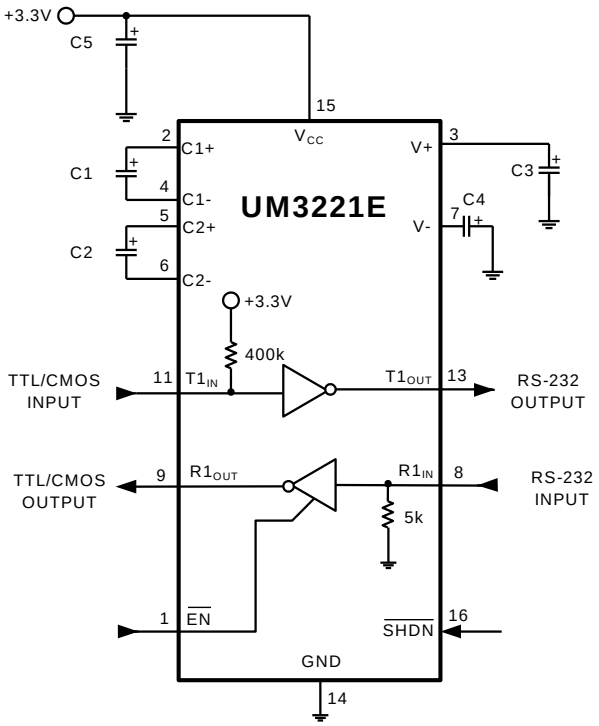
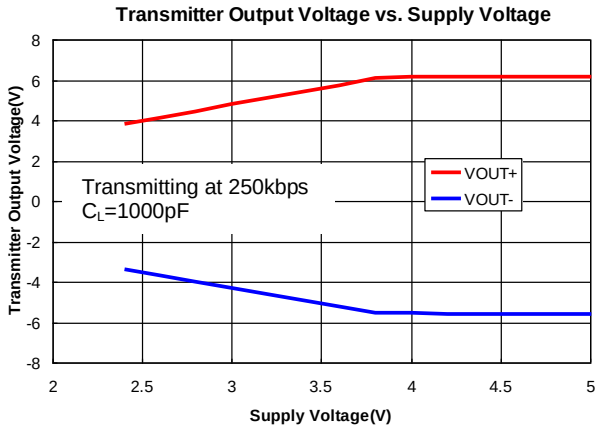
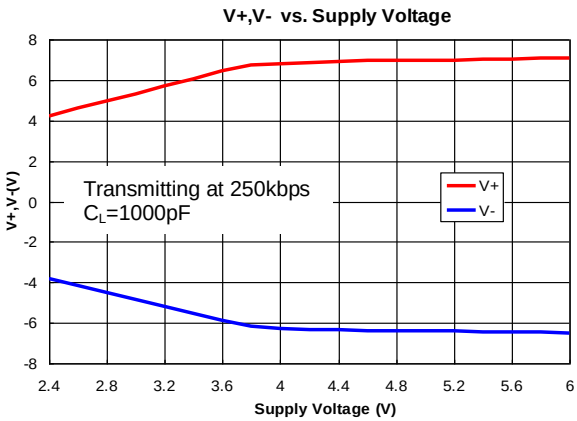


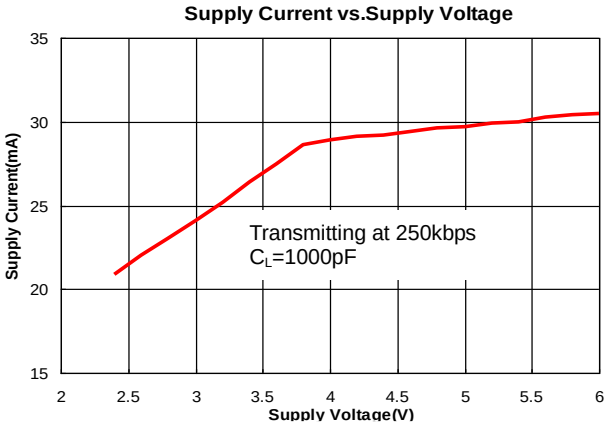
Figure 9-2

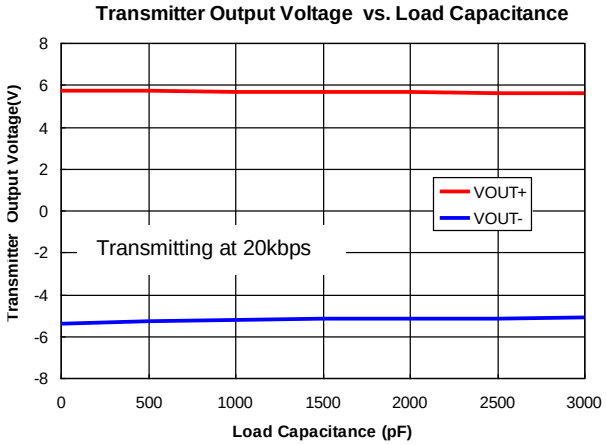
10 Typical Operating Characteristics

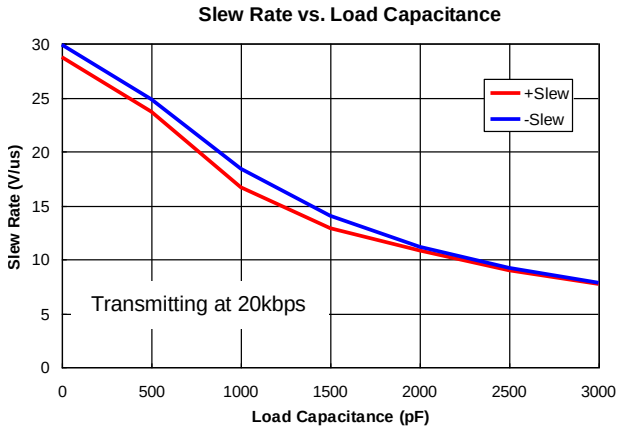
V_{CC}=+3.3V, 250kbps data rate, 0.1μF capacitors, all transmitters loaded with 3kΩ and C_L, T_A=25℃, unless otherwise noted.

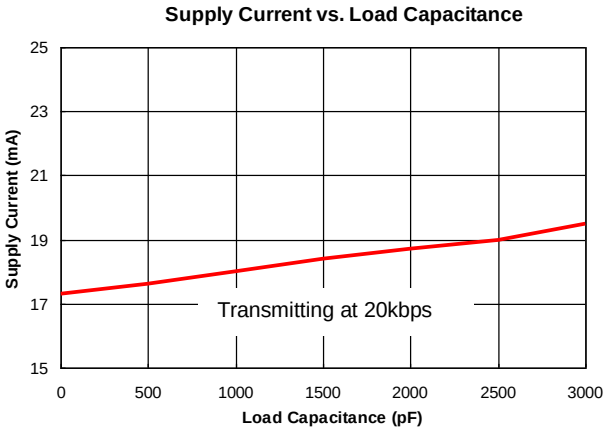












11 Applications Information

11.1 Capacitor Selection

The capacitor type used for C1–C4 is not critical for proper operation; polarized or non-polarized capacitors can be used. The charge pump requires 0.1μF capacitors for 3.3V operation. Increasing the capacitor values (e.g. by a factor of 2) reduces ripples on the transmitter outputs and slightly reduces power consumption. C2, C3 and C4 can be increased without changing C1's value. 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), which usually rises at low temperatures, influences the amount of ripples on V+ and V- output voltages.
The following table shows some recommended minimum required pump capacitor values for different input voltage ranges.

Minimum Required Pump Capacitor Value	
Input Voltage V_{CC}	**Charge Pump Capacitor Value for UM3221E**
2.7V to 3.6V	C1–C4=0.1μF
3.6V to 5.5V	C1–C4=0.47μF
2.7V to 5.5V	C1–C4=0.47μF

11.2 Power Supply Decoupling

In most circumstances, a 0.1μF V_{CC} bypass capacitor is adequate. In applications sensitive to power-supply noise, use a capacitor of the same value as charge pump capacitor C1. Connect bypass capacitors to the IC as close as possible.

11.3 Operation down to 2.7V

Transmitter outputs meet EIA/TIA-562 levels of ±3.7V with supply voltages as low as 2.7V.

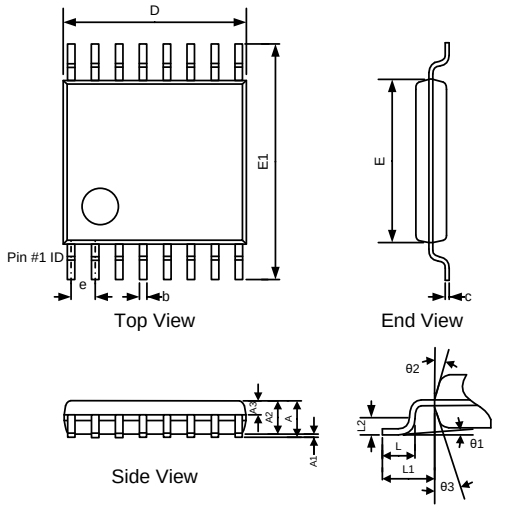
11.4 Interconnection with 3V and 5V Logic

The UM3221E can directly interface with various 3V and 5V logic families, including ACT and HCT CMOS.

Package Information

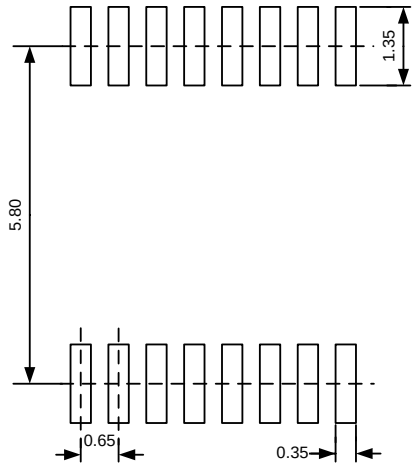
TSSOP16

Outline Drawing



Symbol	DIMENSIONS					
	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	4.86	4.96	5.10	0.191	0.195	0.201
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 °

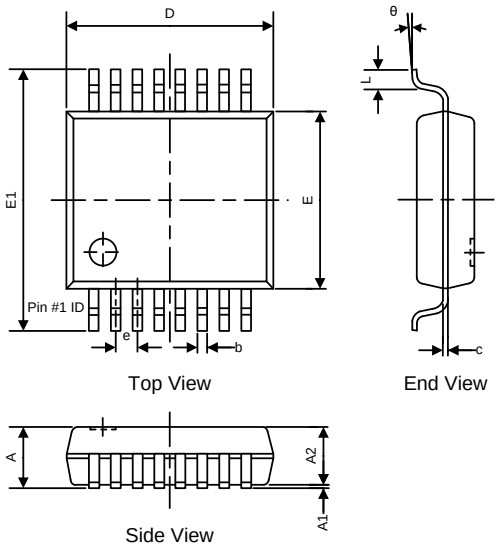
Land Pattern



NOTES:
1. Compound dimension: 4.96×4.40.
2. Unit: mm.
3. General tolerance ±0.05mm unless otherwise specified.
4. The layout is just for reference.

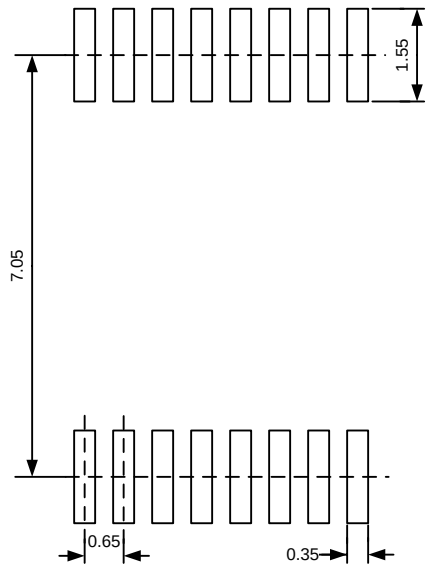
SSOP16

Outline Drawing



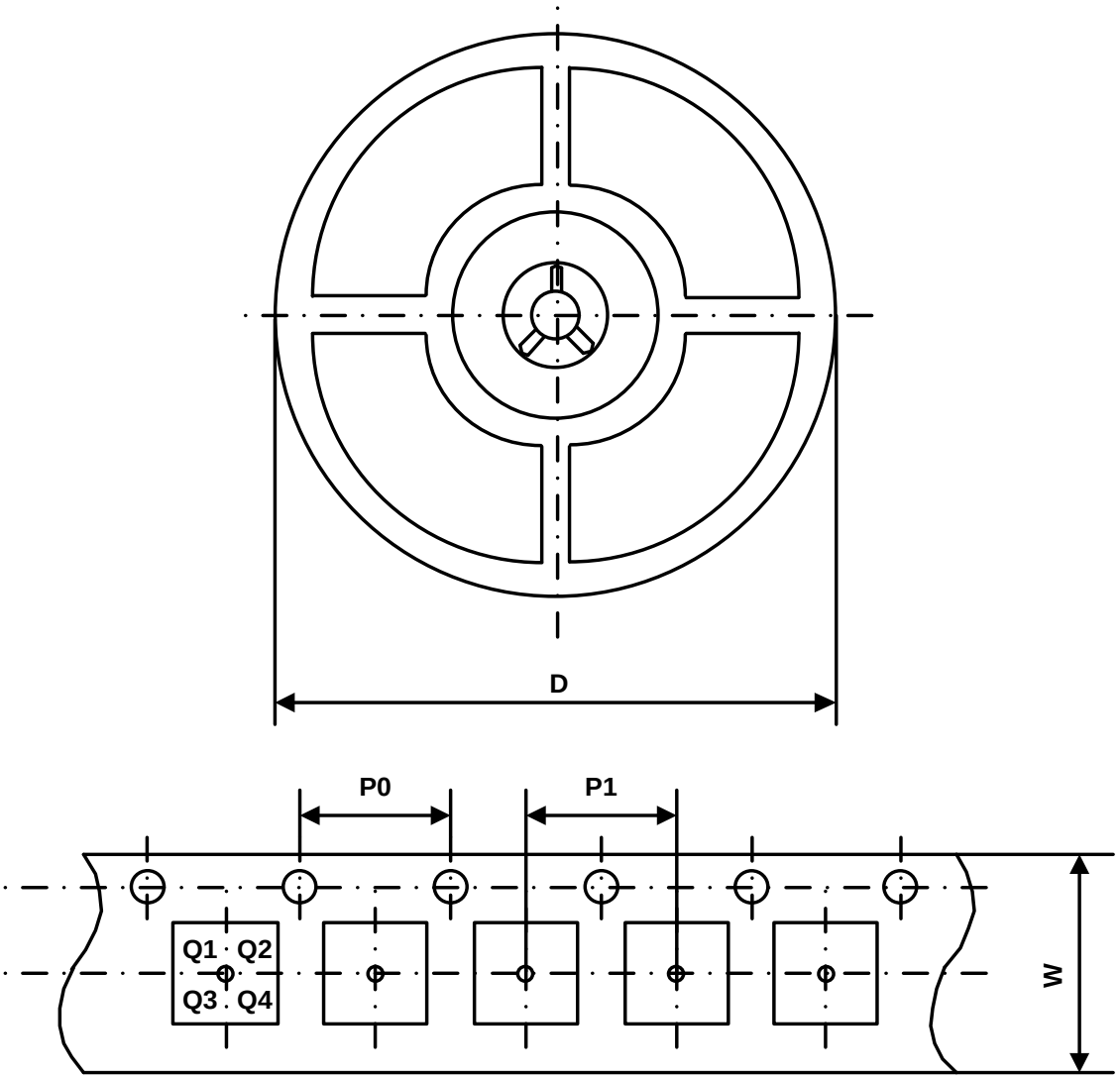
DIMENSIONS						
Symbol	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	-	-	2.00	-	-	0.079
A1	0.05	-	-	0.002	-	-
A2	1.65	1.75	1.85	0.065	0.069	0.073
b	0.22	0.30	0.38	0.009	0.012	0.015
c	0.09	0.17	0.25	0.004	0.007	0.010
D	5.90	6.20	6.50	0.232	0.244	0.256
E	5.00	5.30	5.60	0.197	0.209	0.220
E1	7.40	7.80	8.20	0.291	0.307	0.323
e	0.65BSC			0.026BSC		
L	0.55	0.75	0.95	0.022	0.030	0.037
θ	0 °	-	8 °	0 °	-	8 °

Land Pattern



NOTES:
1. Compound dimension: 6.20×5.30.
2. Unit: mm.
3. General tolerance ±0.05mm unless otherwise specified.
4. The layout is just for reference.

Packing Information



Part Number	Package Type	Carrier Width (W)	Pitch (P0)	Pitch (P1)	Reel Size (D)	PIN 1 Quadrant
UM3221EEAE	SSOP16	16 mm	4 mm	12 mm	330 mm	Q1
UM3221EEUE	TSSOP16	16 mm	4 mm	8 mm	330 mm	Q1

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