1000kbps、单电源供电 RS-232 收发器

UM3232UEESE *SOP16*
UM3232UEEUE *TSSOP16*

1 描述

UM3232U具有电荷泵电路，四个小型外部电容允许使用3.0V至5.5V单电源运行。UM3232U具有两个驱动器和两个接收器。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±8kV。逻辑I/O引脚能够耐受±2kV 人体放电模式。

UM3232U 具备小占板面积和扁平封装，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 1000kbps。该器件完全兼容 3.3V 系统、3.3V 和 5.0V 混合系统以及 5.0V 系统。

2 应用

- 工业自动化设备
- 电池供电设备
- 手持设备
- POS 终端

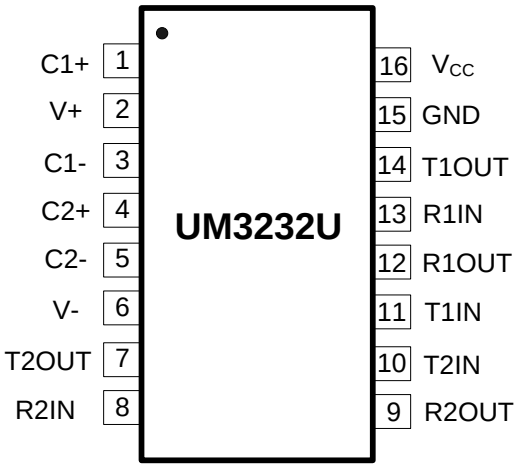
3 特性

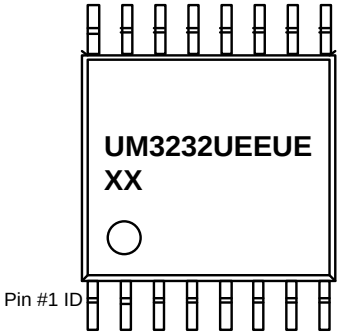
- 通过+3.0V至+5.5V电源供电，符合真正的EIA/TIA-232-F标准
- 在电源电压低至2.7V时，能满足EIA/TIA-562标准的±3.7V信号电平
- 增强ESD规格:
  - ±8kV 人体放电模型
- 1000kbps 最低传输速率
- 保证150V/μs最大压摆率
- 闩锁性能(Latch-Up)超过200mA

4 Ordering Information

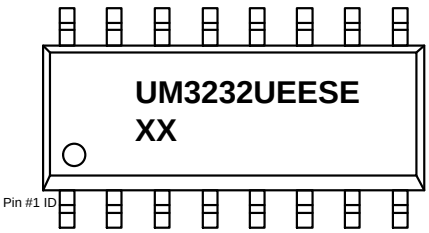
Part Number	Temp. Range	Package Type	Shipping Qty
UM3232UEESE	-40℃ to +105℃	SOP16	2500pcs/13 Inch Tape & Reel
UM3232UEEUE	-40℃ to +105℃	TSSOP16	3000pcs/13 Inch Tape & Reel

5 Pin Configuration and Function





XX: Week Code
UM3232UEEUE
TSSOP16



XX: Week Code
UM3232UEESE
SOP16

5 Pin Configuration and Function (continued)

Table 5-1. Pin Functions

Pin No.	Pin Name	Function
1	C1+	Positive Terminals of Voltage-Doubler Charge Pump Capacitor.
2	V+	Positive Voltage Generated by the Charge Pump.
3	C1-	Negative Terminals of Voltage-Doubler Charge Pump Capacitor.
4	C2+	Positive Terminals of Inverting Charge Pump Capacitor.
5	C2-	Negative Terminals of Inverting Charge Pump Capacitor.
6	V-	Negative Voltage Generated by the Charge Pump.
7, 14	T_OUT	RS-232 Driver Outputs.
8, 13	R_IN	RS-232 Receiver Inputs.
9, 12	R_OUT	RS-232 Receiver Outputs.
10, 11	T_IN	RS-232 Driver Inputs.
15	GND	Ground.
16	V_{CC}	+3.0V to +5.5V Supply Voltage Input.

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
T_IN	Voltage on T_IN	-0.3 to (V_{CC}+0.3)	V
R_IN	Voltage on R_IN	±25	V
T_OUT	Voltage on T_OUT	(V_--0.3) to (V_++0.3)	V
R_OUT	Voltage on R_OUT	-0.3 to (V_{CC}+0.3)	V
T_A	Operating Temperature Range	-40 to +105	℃
T_{STG}	Storage Temperature Range	-65 to +150	℃
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℃)

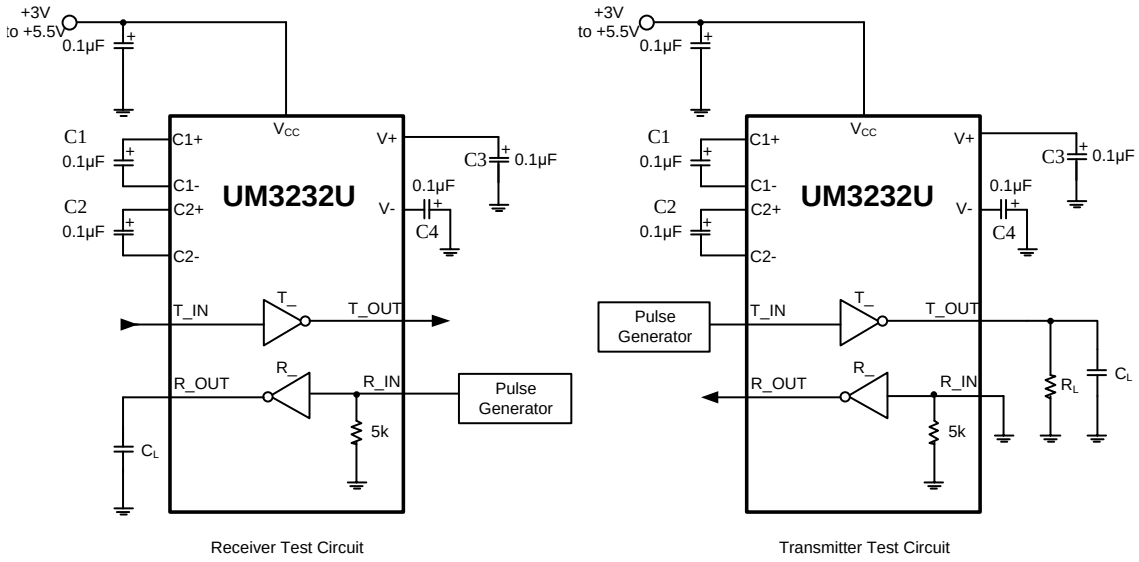
Parameter	Symbol	Conditions		Min	Typ	Max	Unit
DC CHARACTERISTICS (V_{CC}=+3.3V or +5V, T_A=25℃)							
V_{CC} Supply Current	I_{CC}	No Load				1.5	mA
LOGIC INPUTS							
Input Leakage Current		T_IN				±1	μA
Input Threshold Low	V_{IL}	T_IN	V_{CC}=3.3V			0.8	V
			V_{CC}=5.0V			0.8	
Input Threshold High	V_{IH}	T_IN	V_{CC}=3.3V	2			V
			V_{CC}=5.0V	2.4			
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				0.4	V
		V_{CC}=5.0V, I_{OUT}=1.6mA				0.4	
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				-25		25	V
Input Threshold Low			V_{CC}=3.3V	0.8	1.15		V
			V_{CC}=5.0V	0.8	1.55		
Input Threshold High			V_{CC}=3.3V		1.35	2.4	V
			V_{CC}=5.0V		1.75	2.4	
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

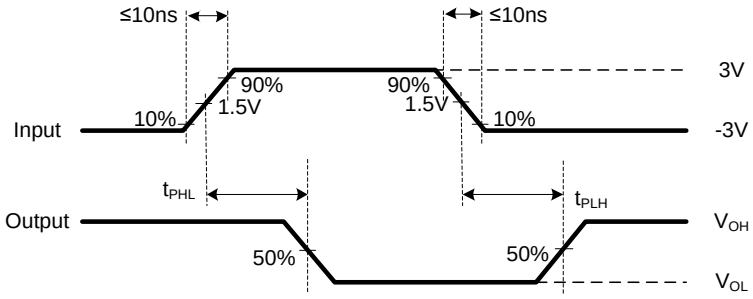
6.2 Electrical Characteristics (continued)

(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℃)

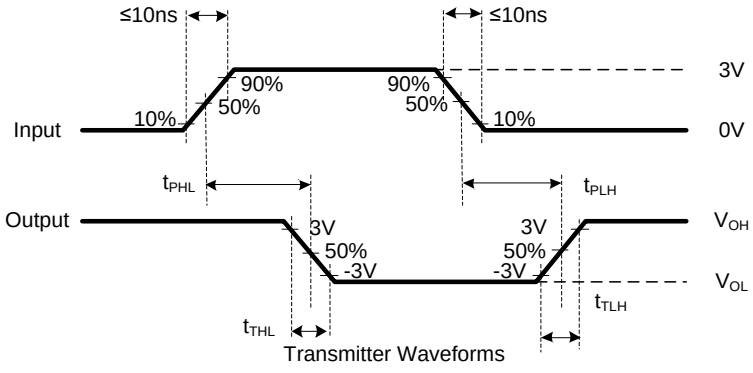
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
TIMING CHARACTERISTICS						
Maximum Data Rate		R_L= 3kΩ,C_L= 250pF, one Transmitter Switching see Figure 7-1	1000			kbps
Transmitter Skew	$\|t_{PHL}-t_{PLH}\|$			25		ns
Transition-Region Slew Rate	SR(tr)	T_A=+25℃, V_{CC}=3.3V, R_L=3kΩ to 7kΩ, C_L=150pF to 1000pF, Measured from -3V to +3V or +3V to -3V, see Figure 7-1	18		150	V/μs
Receiver Propagation Delay	t_{PLH}, t_{PHL}	C_L=150pF, see Figure 7-1 / All Parts, Normal Operation		150		ns
Receiver Skew	$\|t_{PHL}-t_{PLH}\|$			50		ns
ESD AND LATCH UP PERFORMANCE						
R_IN, T_OUT ESD-Protection Voltage		Human Body Model		±8		kV
Logic Pin ESD-Protection Voltage		Human Body Model		±2		kV
Latch Up Performance		JEDEC Standard No.78D		±200		mA

7 Parameter Measurement Information





Receiver Waveforms



Transmitter Waveforms

Figure 7-1

8 Detailed Description

8.1 Dual Charge-Pump Voltage Converter

The UM3232U'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 9-1).

8.2 RS-232 Transmitters

The transmitters are inverting level translators that translate TTL/CMOS inputs to EIA/TIA-232 output levels. All UM3232U transmitters guarantee a 1000kbps data rate for full load conditions (3kΩ and 250pF). Transmitters can be paralleled to drive multiple receivers. When T_IN is not driven, the UM3232U's T_IN logic level is on hold.

8.3 RS-232 Receivers

The receivers convert RS-232 signals to CMOS output levels and accept inputs up to ±25V while presenting the required 3kΩ to 7kΩ input impedance.

8.4 Transient Protection

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 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: ±8kV using the Human Body Model. The logic pins are characterized for protection to the following limit: ±2kV using the Human Body Model. What's more, it's recommended that select the appropriate TVS to enhance ESD protection when the UM3232U communicates in rugged industrial environments.

9 Application Information

9.1 Typical Operating Circuits

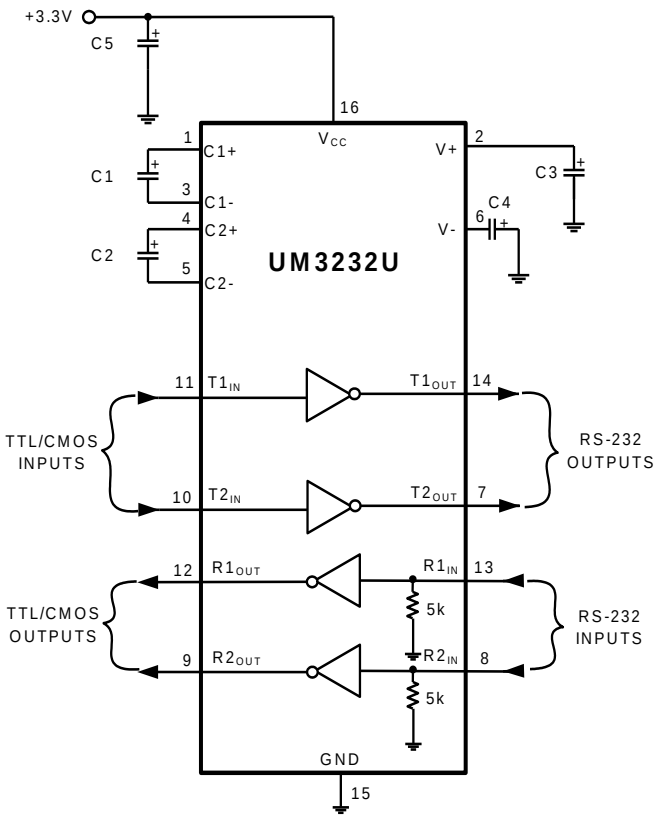


Figure 9-1

9.2 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 UM3232U**
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

9.3 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.

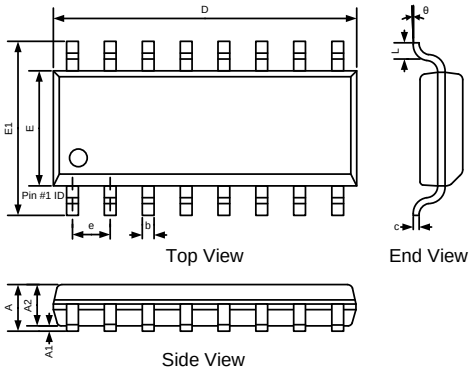
9.4 Interconnection with 3.3V and 5V Logic

The UM3232U can directly interface with various 3.3V and 5V logic families, including ACT and HCT CMOS.

Package Information

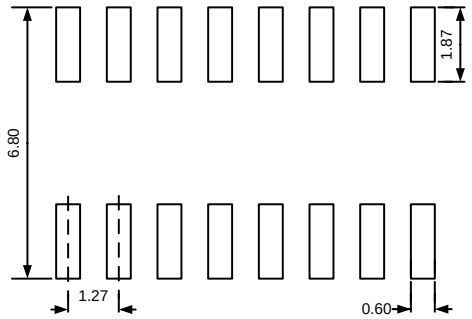
SOP16

Outline Drawing



Symbol	DIMENSIONS					
	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	1.35	1.60	1.75	0.053	0.063	0.069
A1	0.10	-	0.25	0.004	-	0.010
A2	1.25	1.45	1.65	0.049	0.057	0.065
b	0.33	-	0.51	0.013	-	0.020
c	0.17	-	0.25	0.007	-	0.010
D	9.80	10.00	10.20	0.386	0.394	0.402
E	3.80	3.90	4.00	0.150	0.154	0.157
E1	5.80	6.00	6.20	0.228	0.236	0.244
e	1.27BSC			0.050BSC		
L	0.40	-	1.27	0.016	-	0.050
θ	0 °	-	8 °	0 °	-	8 °

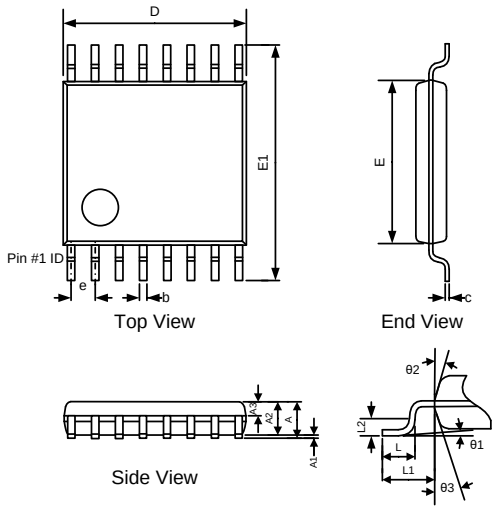
Land Pattern



NOTES:
1. Compound dimension: 10.00×3.90.
2. Unit: mm.
3. General tolerance ±0.05mm unless otherwise specified.
4. The layout is just for reference.

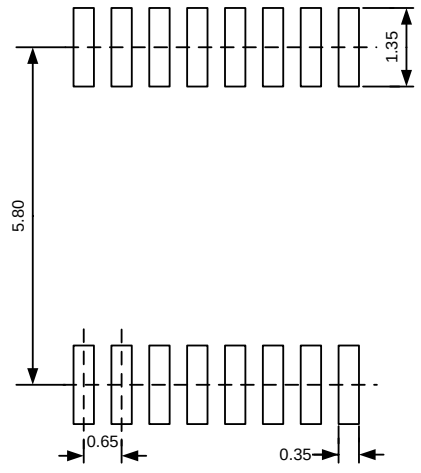
TSSOP16

Outline Drawing



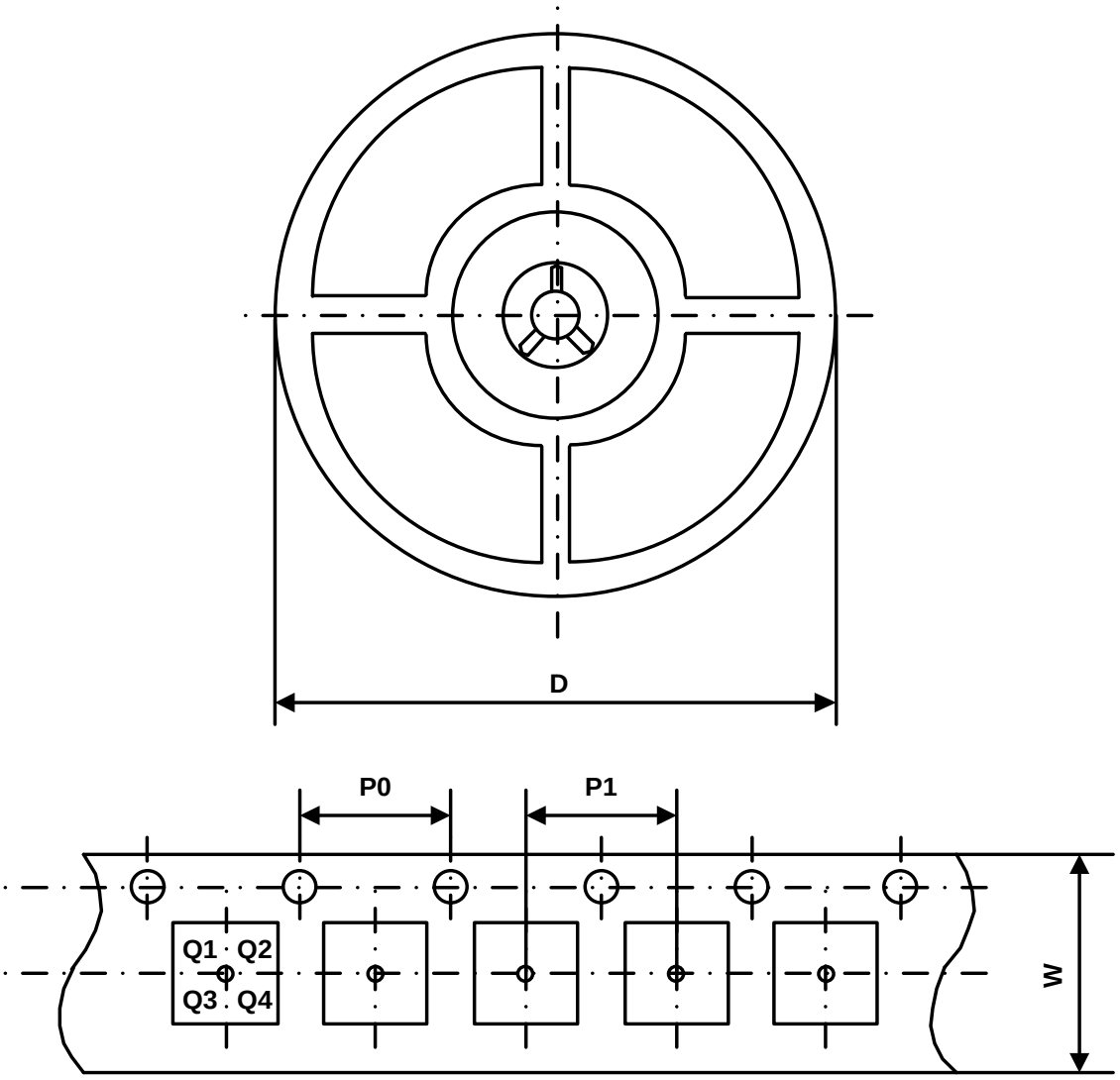
DIMENSIONS						
Symbol	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	-	-	1.20	-	-	0.047
A1	0.05	-	0.15	0.002	-	0.006
A2	0.80	-	1.05	0.031	-	0.041
A3	0.34	0.44	0.54	0.013	0.017	0.021
b	0.19	-	0.30	0.007	-	0.012
c	0.09	-	0.20	0.004	-	0.008
D	4.86	4.96	5.10	0.191	0.195	0.201
E	4.30	4.40	4.50	0.169	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.

Packing Information



Part Number	Package Type	Carrier Width (W)	Pitch (P0)	Pitch (P1)	Reel Size (D)	PIN 1 Quadrant
UM3232UEESE	SOP16	16 mm	4 mm	8 mm	330 mm	Q1
UM3232UEEUE	TSSOP16	16 mm	4 mm	8 mm	330 mm	Q1

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