
1000kbps, Single Supply RS-232 Transceivers**UM3232UEESE SOP16
UM3232UEEUE TSSOP16****1 Description**

The charge pump and four small external capacitors allow operation from a single 3.0V to 5.5V supply. The UM3232U has two drivers/two receivers. The device features low power consumption, high data-rate capability and enhanced ESD protection. The ESD rating of all transmitter outputs and receiver inputs is $\pm 8\text{kV}$ for human body mode. The logic I/O pins are protected to $\pm 2\text{kV}$ for human body mode.

Small footprint, low profile package and the use of small $0.1\mu\text{F}$ capacitors ensure board space savings as well. The device operates at data signaling rates up to 1000 kbps. The device is fully compatible with 3.3V-only systems, mixed 3.3V and 5.0V systems and 5.0V-only systems.

2 Applications

- Industrial Automation Equipments
- Battery-Powered Equipments
- Hand-Held Equipments
- POS Terminals

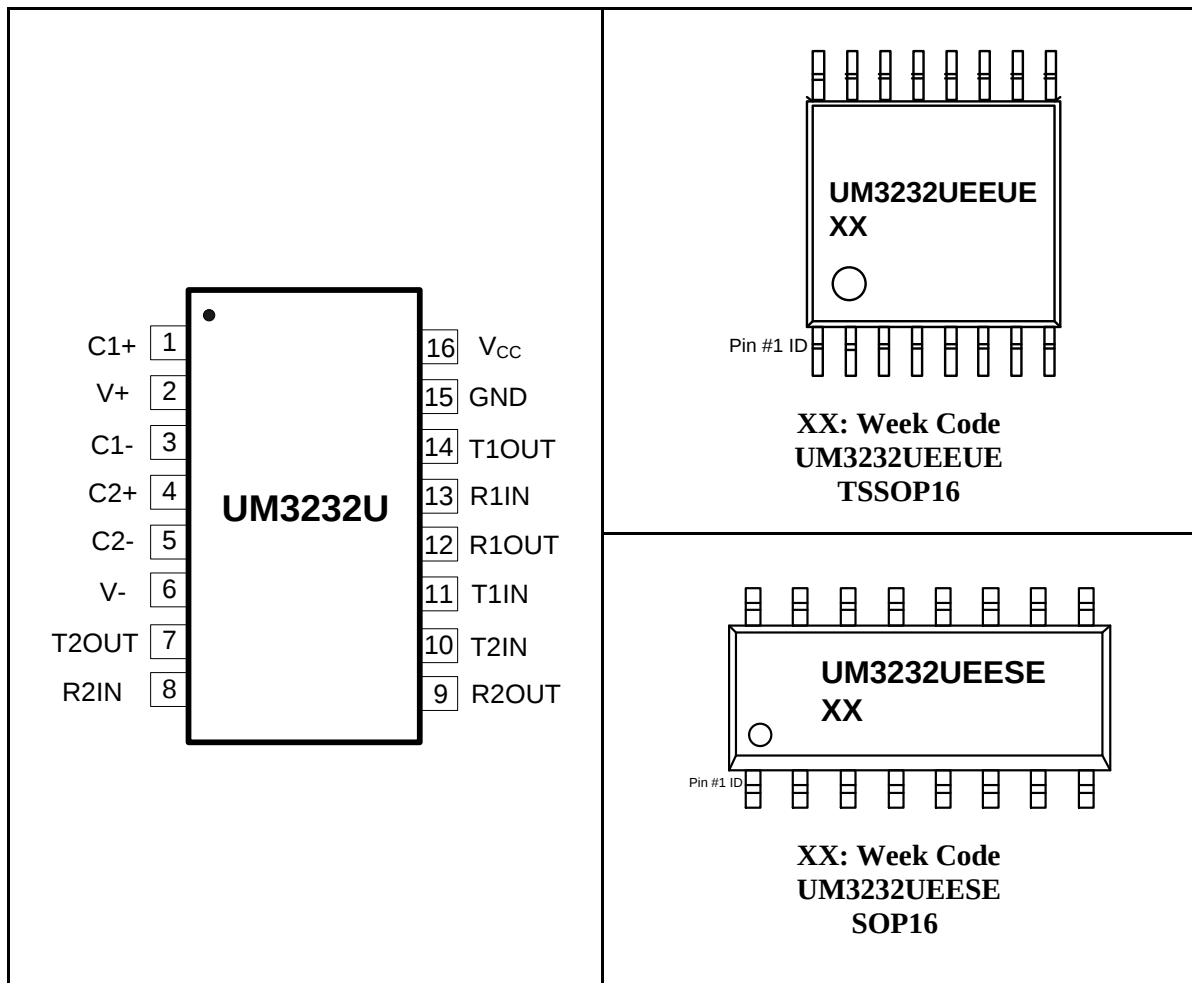
3 Features

- Meets True EIA/TIA-232-F Standards from a +3.0V to +5.5V Power Supply
- Meets EIA/TIA-562 Levels of $\pm 3.7\text{V}$ with Supply Voltages as Low as 2.7V
- Enhanced ESD Specifications:
 - $\pm 8\text{kV}$ Human Body Mode
- 1000kbps Minimum Transmission Rate
- Guaranteed $150\text{V}/\mu\text{s}$ Max Slew Rate
- Latch-Up Performance Exceeds 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



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 $+5.5V$, $C1-C4=0.1\mu F$, $T_A=T_{MIN}$ to T_{MAX} , unless otherwise noted. Typical values are at $T_A=25^\circ C$)

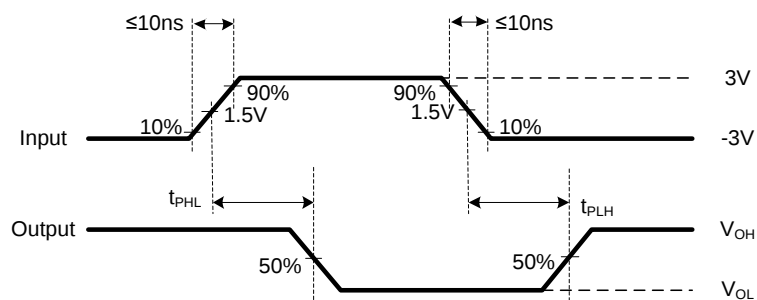
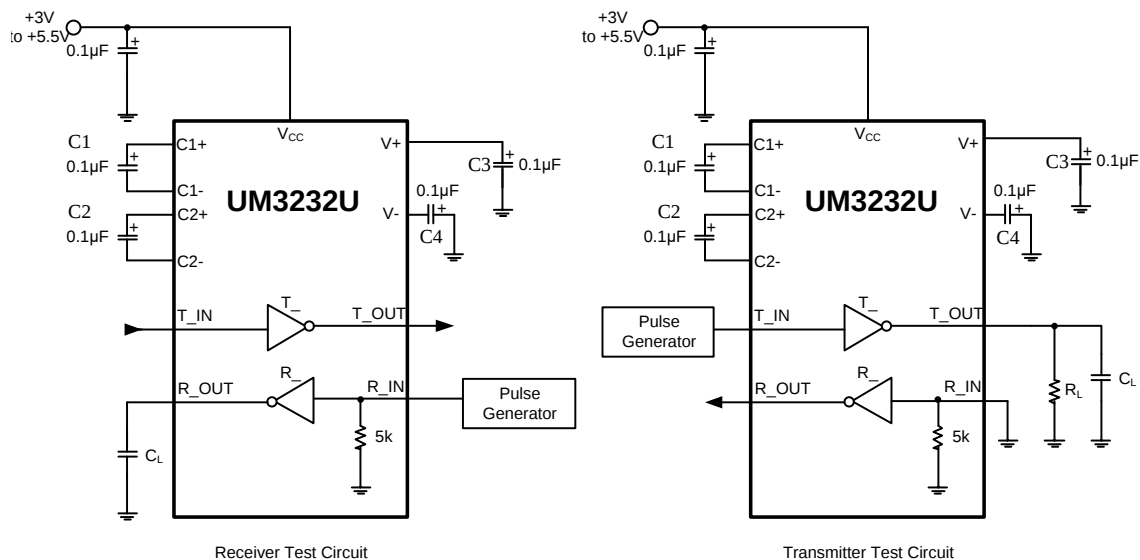
Parameter	Symbol	Conditions		Min	Typ	Max	Unit
DC CHARACTERISTICS (V _{CC} =+3.3V or +5V, T _A =25 °C)							
V _{CC} Supply Current	I _{CC}	No Load				1.5	mA
LOGIC INPUTS							
Input Leakage Current		T _{IN}				±1	µA
Input Threshold Low	V _{IL}	T _{IN}	V _{CC} =3.3V			0.8	V
			V _{CC} =5.0V			0.8	
Input 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 °C		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)

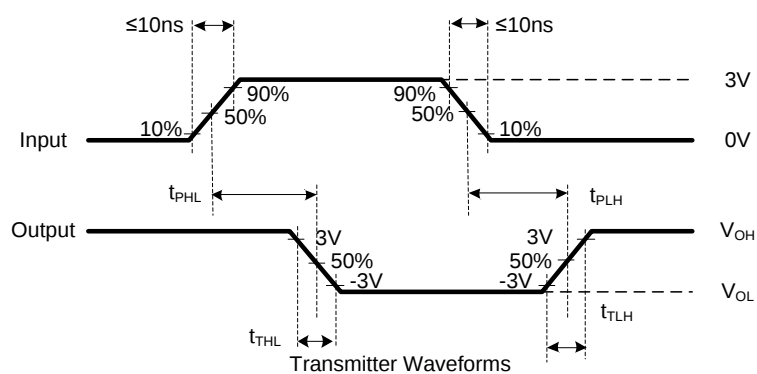
($V_{CC}=+3.0V$ to $+5.5V$, $C1-C4=0.1\mu F$, $T_A=T_{MIN}$ to T_{MAX} , unless otherwise noted. Typical values are at $T_A=25^\circ C$)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
TIMING CHARACTERISTICS						
Maximum Data Rate		$R_L=3k\Omega$, $C_L=250pF$, one Transmitter Switching see Figure 7-1	1000			kbps
Transmitter Skew	$ t_{PHL}-t_{PLH} $			25		ns
Transition-Region Slew Rate	SR(tr)	$T_A=+25^\circ C$, $V_{CC}=3.3V$, $R_L=3k\Omega$ to $7k\Omega$, $C_L=150pF$ 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		150		ns
Receiver Skew	$ t_{PHL}-t_{PLH} $	All Parts, Normal Operation		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 0.1 μ F 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 (3k Ω 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 ± 25 V while presenting the required 3k Ω to 7k Ω 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: ± 8 kV using the Human Body Model. The logic pins are characterized for protection to the following limit: ± 2 kV 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

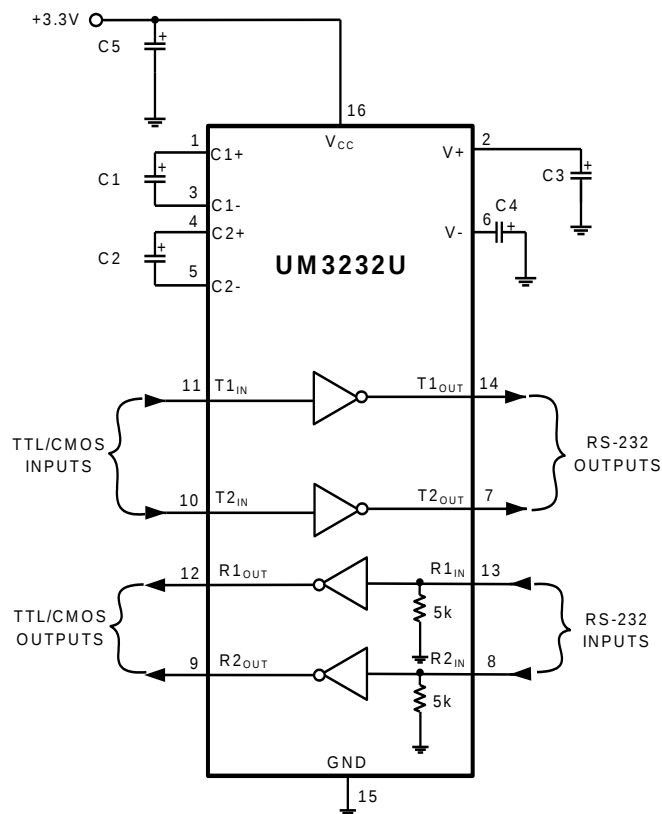


Figure 9-1

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 $0.1\mu\text{F}$ 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.

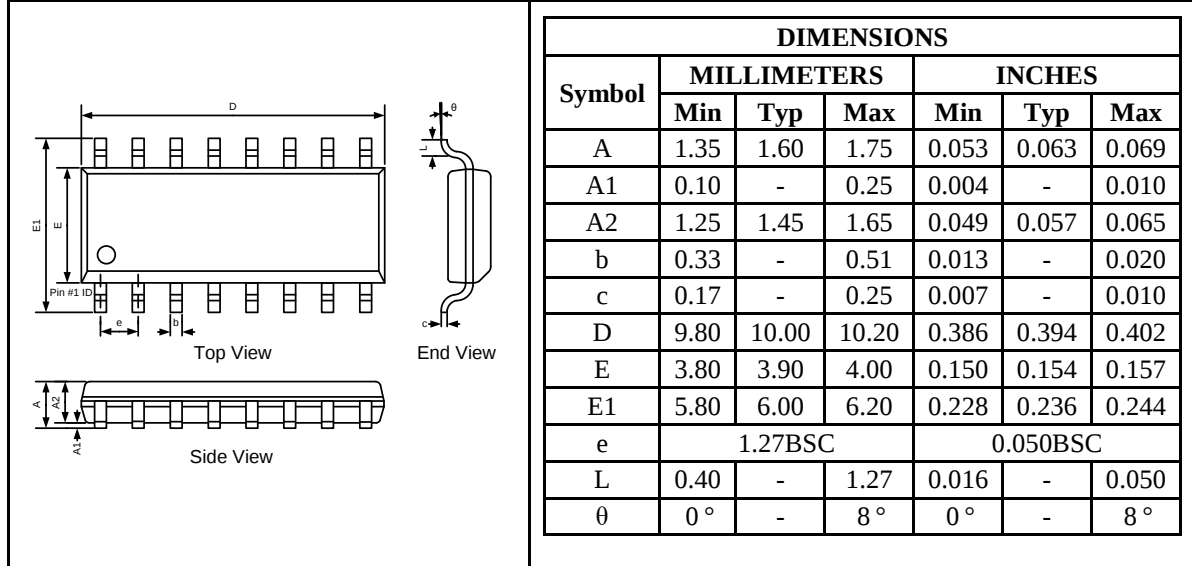
9.4 Interconnection with 3.3V and 5V Logic

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

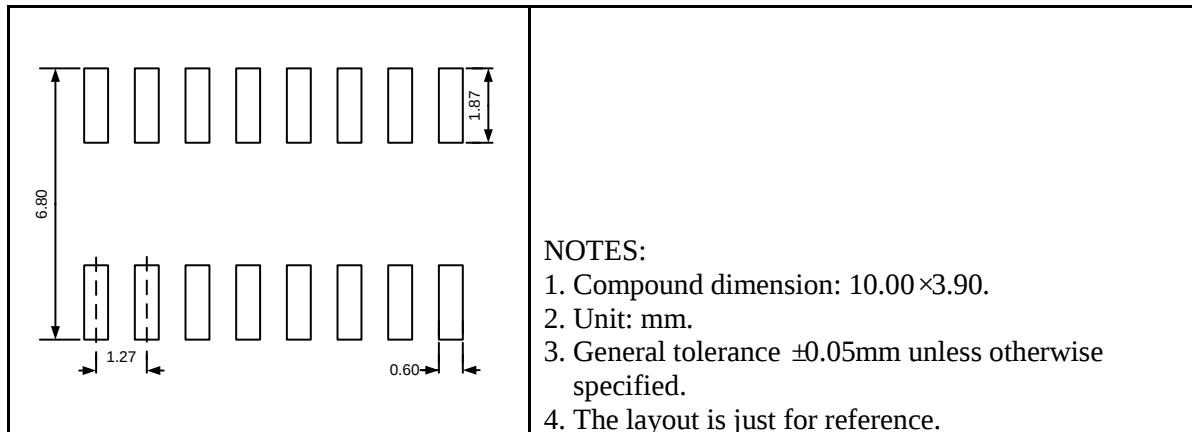
Package Information

SOP16

Outline Drawing

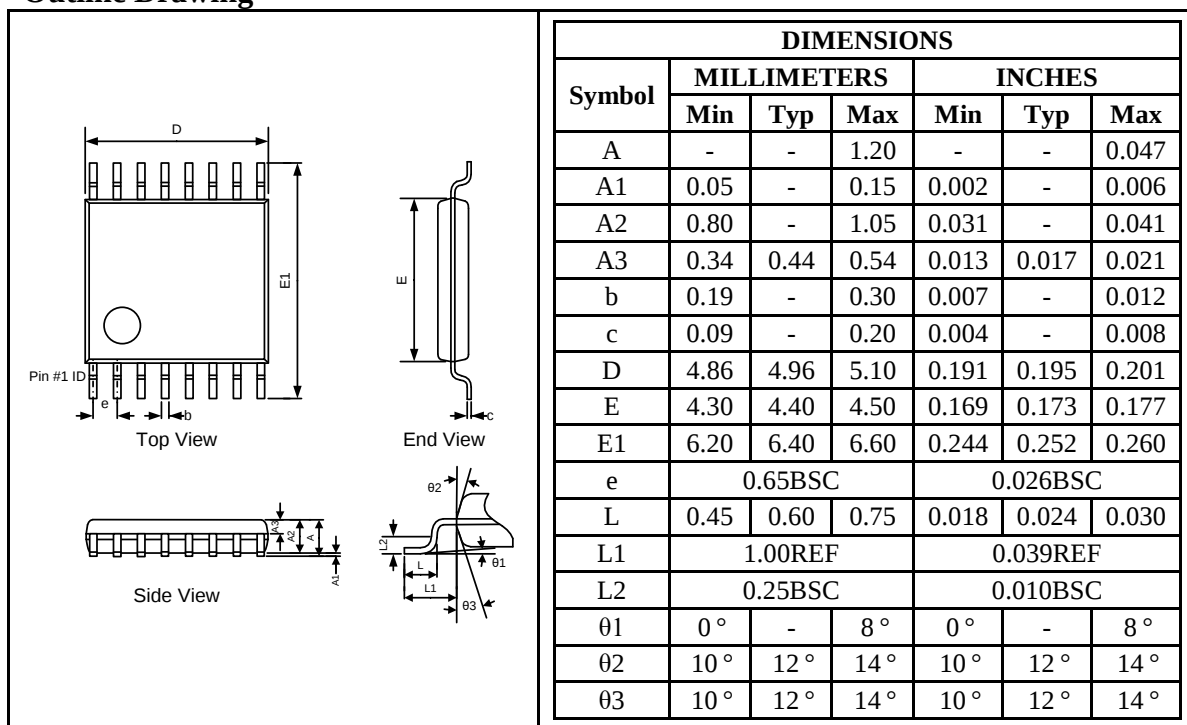


Land Pattern

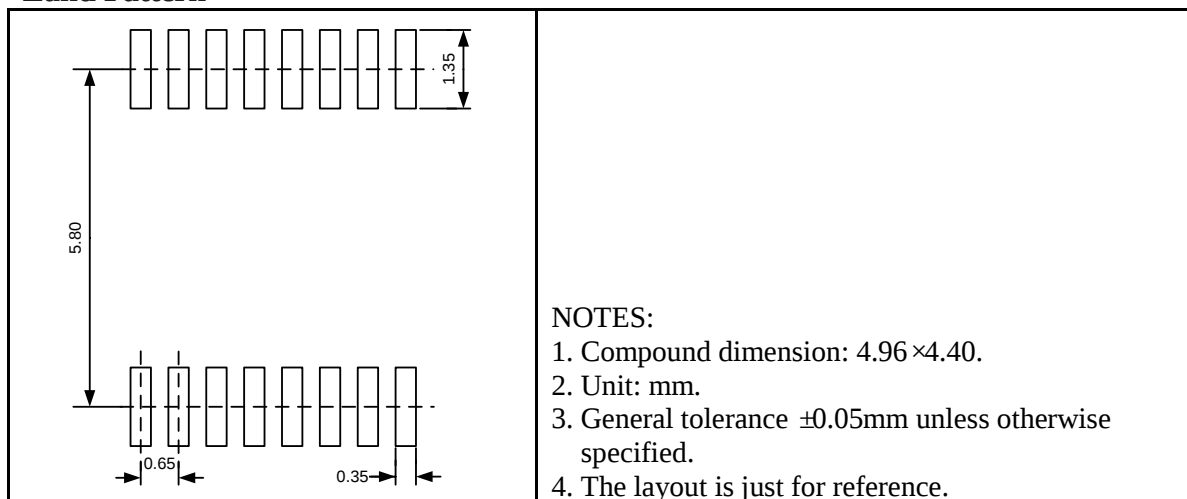


TSSOP16

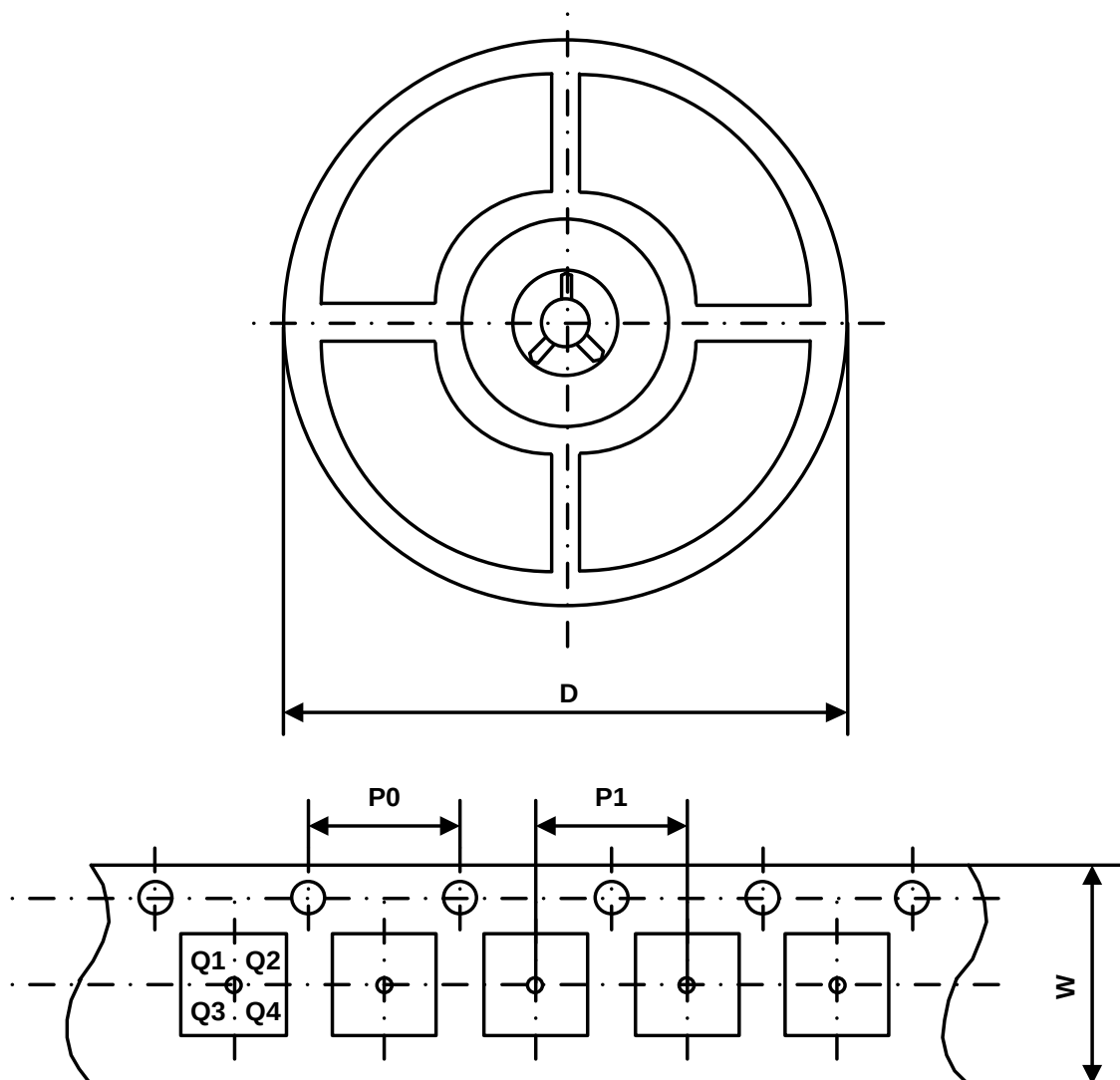
Outline Drawing



Land Pattern



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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