3V to 5.5V, 2T/2R, 250kbps, RS-232 Transceivers

UM3232E ***DIP16/SOP16/SSOP16/TSSOP16***

1 Description

The UM3232E is 3.3V powered RS-232 transceivers intended for portable or hand-held applications. The UM3232E 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 ±16kV for human body mode and ±15kV for IEC61000-4-2 air discharge methods, and over ±8kV for IEC61000-4-2 contact discharge methods. The logic I/O pins are protected to ±2kV for human body mode.
Small footprint, low profile package and the use of small 0.1μF capacitors ensure board space savings as well. Data rates greater than 250kbps are guaranteed at worst case load conditions.

2 Applications

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

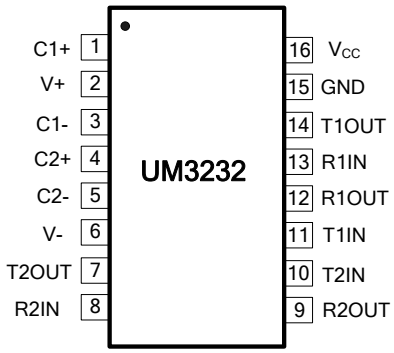
3 Features

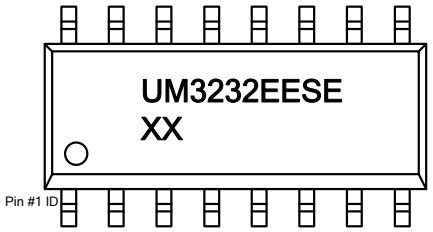
- Meets True EIA/TIA-232-F Standards from a +3.0V to +5.5V Power Supply
- Meets EIA/TIA-562 Levels of ±3.7V with Supply Voltages as Low as 2.7V
- Enhanced ESD Specifications:
  ±16kV Human Body Mode
  ±15kV IEC61000-4-2 Air Discharge Mode
  ±8kV IEC61000-4-2 Contact Discharge Mode
- 250kbps Minimum Transmission Rate
- Guaranteed 30V/μs Max Slew Rate
- Latch-Up Performance Exceeds 200mA

4 Ordering Information

Part Number	Temp. Range	Package Type	Shipping Qty
UM3232EESE	-40℃ to +85℃	SOP16	2500pcs/13 Inch Tape & Reel
UM3232EEPE	-40℃ to +85℃	DIP16	25pcs/Tube
UM3232EEUE	-40℃ to +85℃	TSSOP16	3000pcs/13 Inch Tape & Reel
UM3232EEAE	-40℃ to +85℃	SSOP16	2000pcs/13 Inch Tape & Reel

5 Pin Configuration and Function





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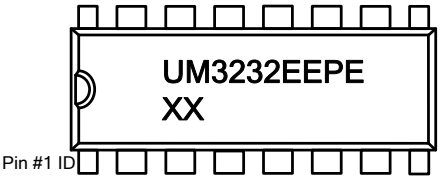
SOP16



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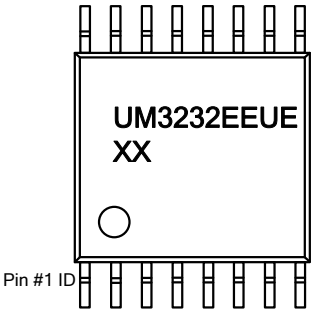

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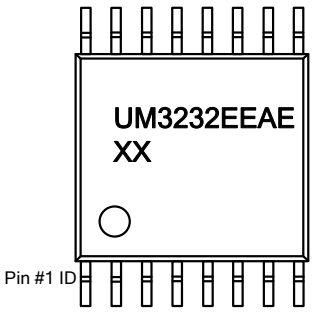
TSSOP16



XX: Week Code
UM3232EEAE
SSOP16

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		±30	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
	Short-Circuit Duration, T_OUT		Continuous	
P_D	Continuous Power Dissipation at T_A=70℃	SSOP16	775	mW
		SOP16	696	
		DIP16	842	
		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}	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	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	$\lvert t_{PHL}-t_{PLH} \rvert$					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	$\lvert t_{PHL}-t_{PLH} \rvert$					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			±16		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 UM3232E'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 Transmitters

The transmitters are inverting level translators that translate TTL/CMOS inputs to EIA/TIA-232 output levels. All transmitters guarantee a 250kbps data rate for full load conditions (3kΩ and 1000pF). Transmitters can be paralleled to drive multiple receivers. When T_IN is not driven, UM3232's T_IN logic level is on hold.

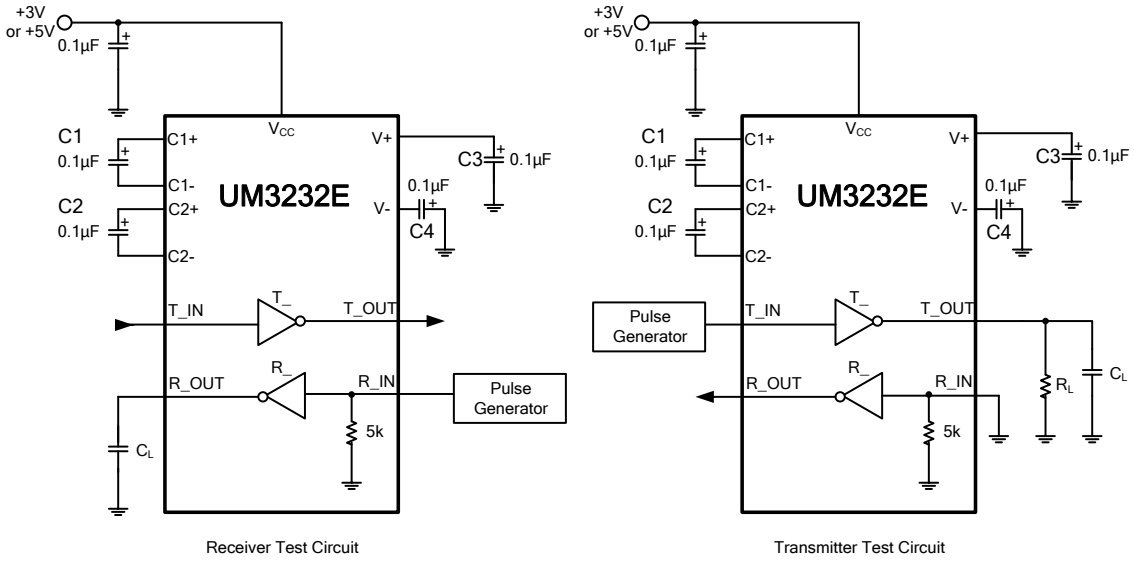
7.3 RS-232 Receivers

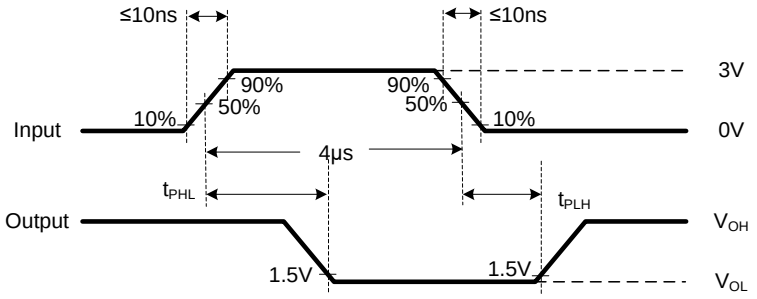
The receivers convert RS-232 signals to CMOS output levels and accept inputs up to ±30V while presenting the required 3kΩ to 7kΩ input impedance.

7.4 ESD Protection

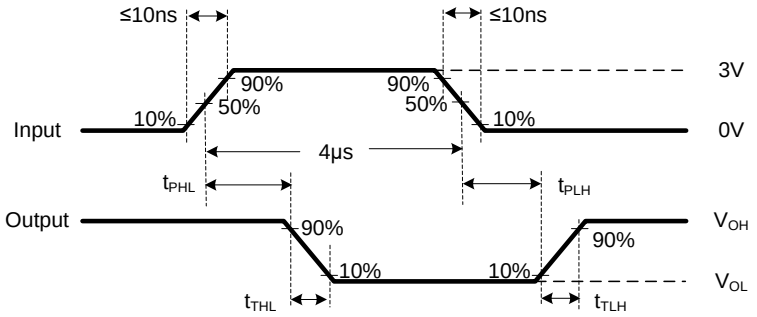
All pins on UM3232E include ESD protection structures, but the family incorporates advanced structures which allow the RS-232 pins (transmitter outputs and receiver inputs) to survive ESD events up to ±16kV. The RS-232 pins are particularly vulnerable to ESD damage because they are typically connected 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: ±16kV 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 Waveforms



Transmitter Waveforms

Figure 8-1

9 Typical Operating Circuits

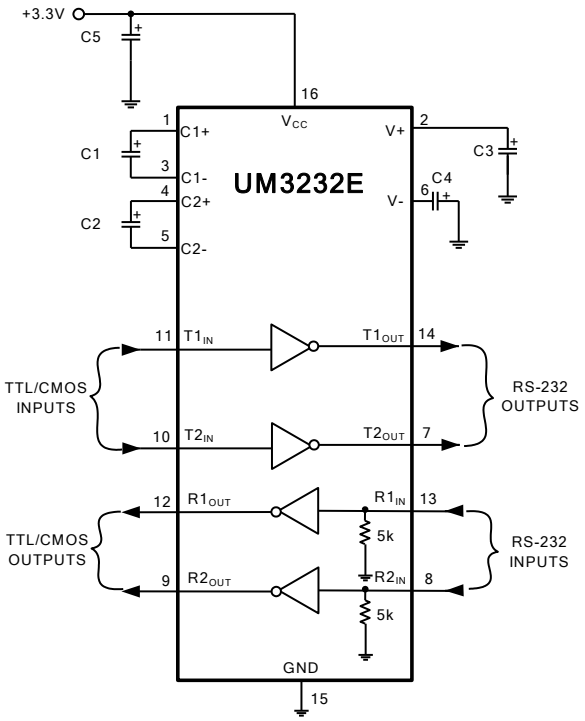
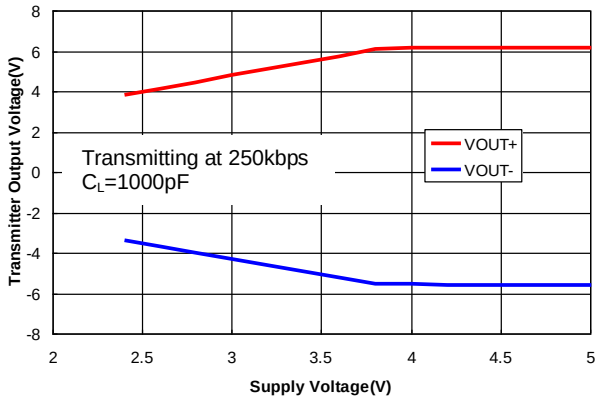


Figure 9-2

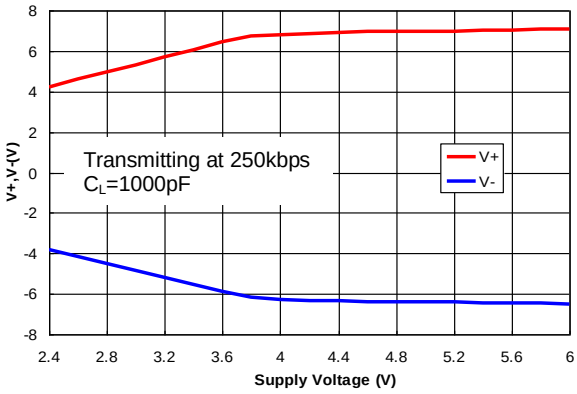
10 Typical Operating Characteristics

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

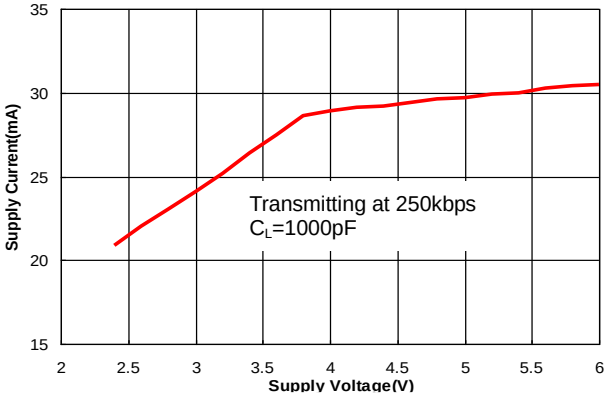
Transmitter Output Voltage vs. Supply Voltage



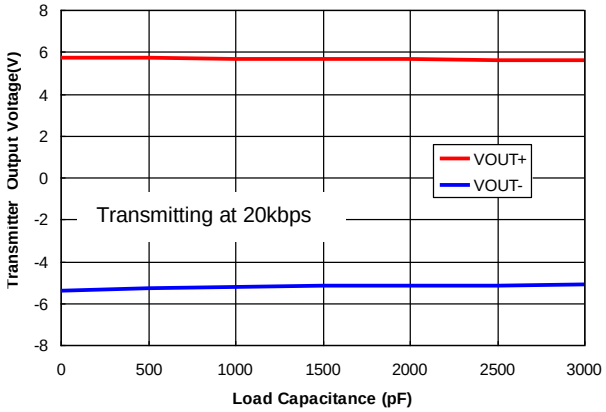
V+,V- vs. Supply Voltage



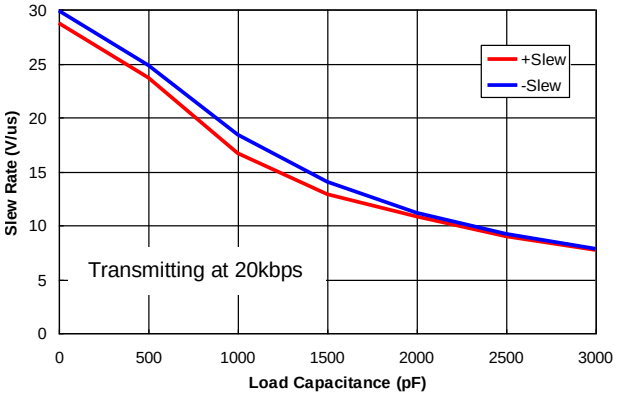
Supply Current vs.Supply Voltage



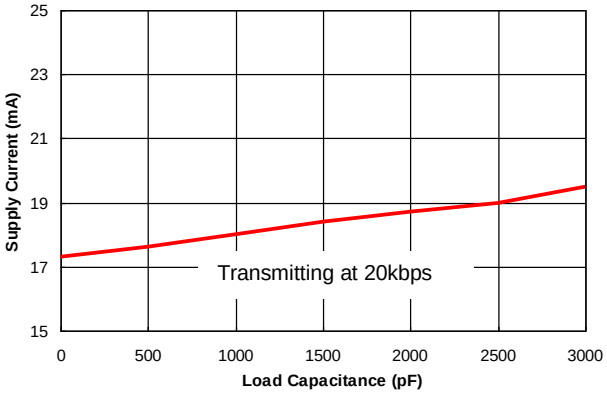
Transmitter Output Voltage vs. Load Capacitance



Slew Rate vs. Load Capacitance



Supply Current vs. Load Capacitance



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 UM3232E**
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.

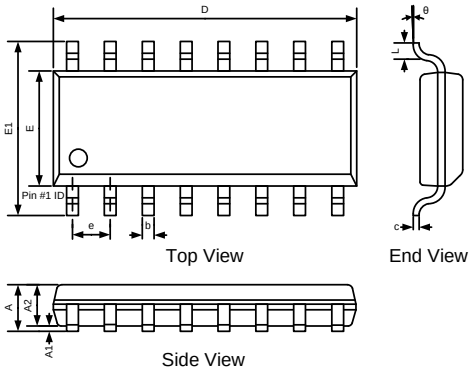
11.4 Interconnection with 3V and 5V Logic

The UM3232E can directly interface with various 3V and 5V logic families, including ACT and HCT CMOS.

Package Information

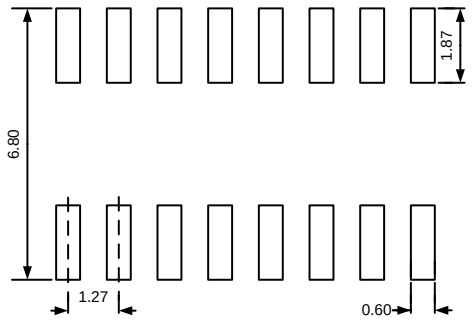
SOP16

Outline Drawing



DIMENSIONS						
Symbol	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 °

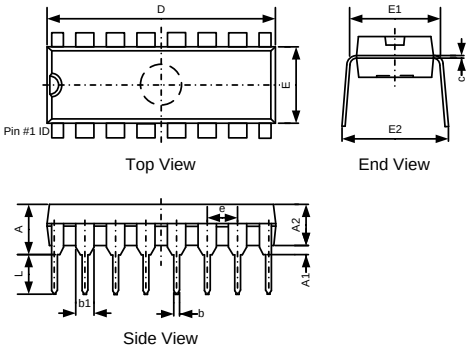
Land Pattern



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.

DIP16

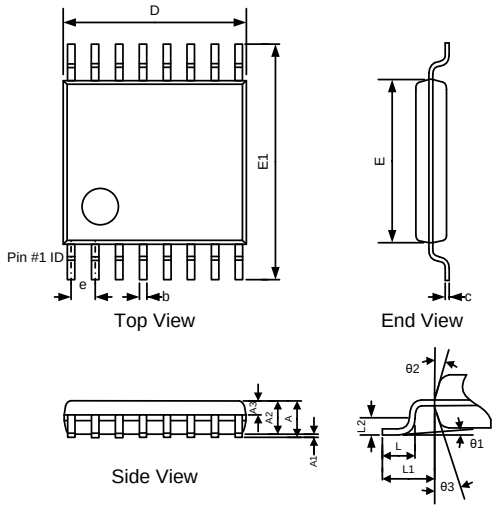
Outline Drawing



DIMENSIONS						
Symbol	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	3.71	4.01	4.31	0.146	0.158	0.170
A1	0.51	-	-	0.020	-	-
A2	3.20	3.40	3.60	0.126	0.134	0.142
b	0.38	0.48	0.57	0.015	0.019	0.022
b1	1.52BSC			0.060BSC		
c	0.20	0.28	0.36	0.008	0.011	0.014
D	18.80	19.00	19.20	0.740	0.748	0.756
E	6.20	6.40	6.60	0.244	0.252	0.260
E1	7.32	7.62	7.92	0.288	0.300	0.312
E2	8.40	8.70	9.00	0.331	0.343	0.354
e	2.54BSC			0.100BSC		
L	3.00	3.30	3.60	0.118	0.130	0.142

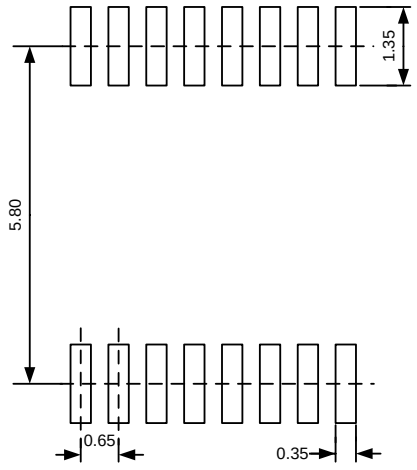
TSSOP16

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 °

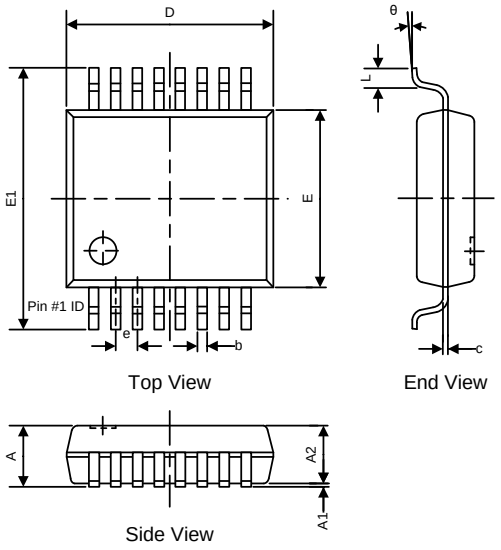
Land Pattern



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.

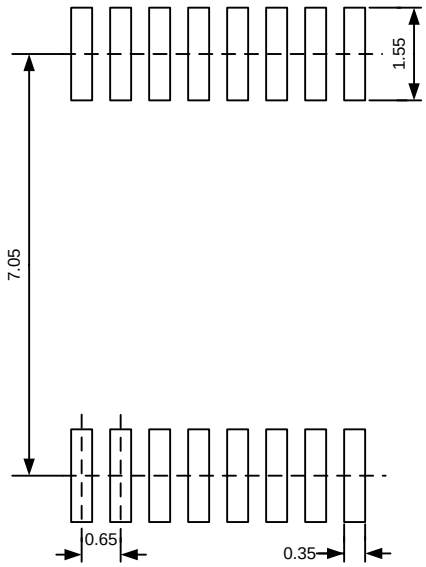
SSOP16

Outline Drawing



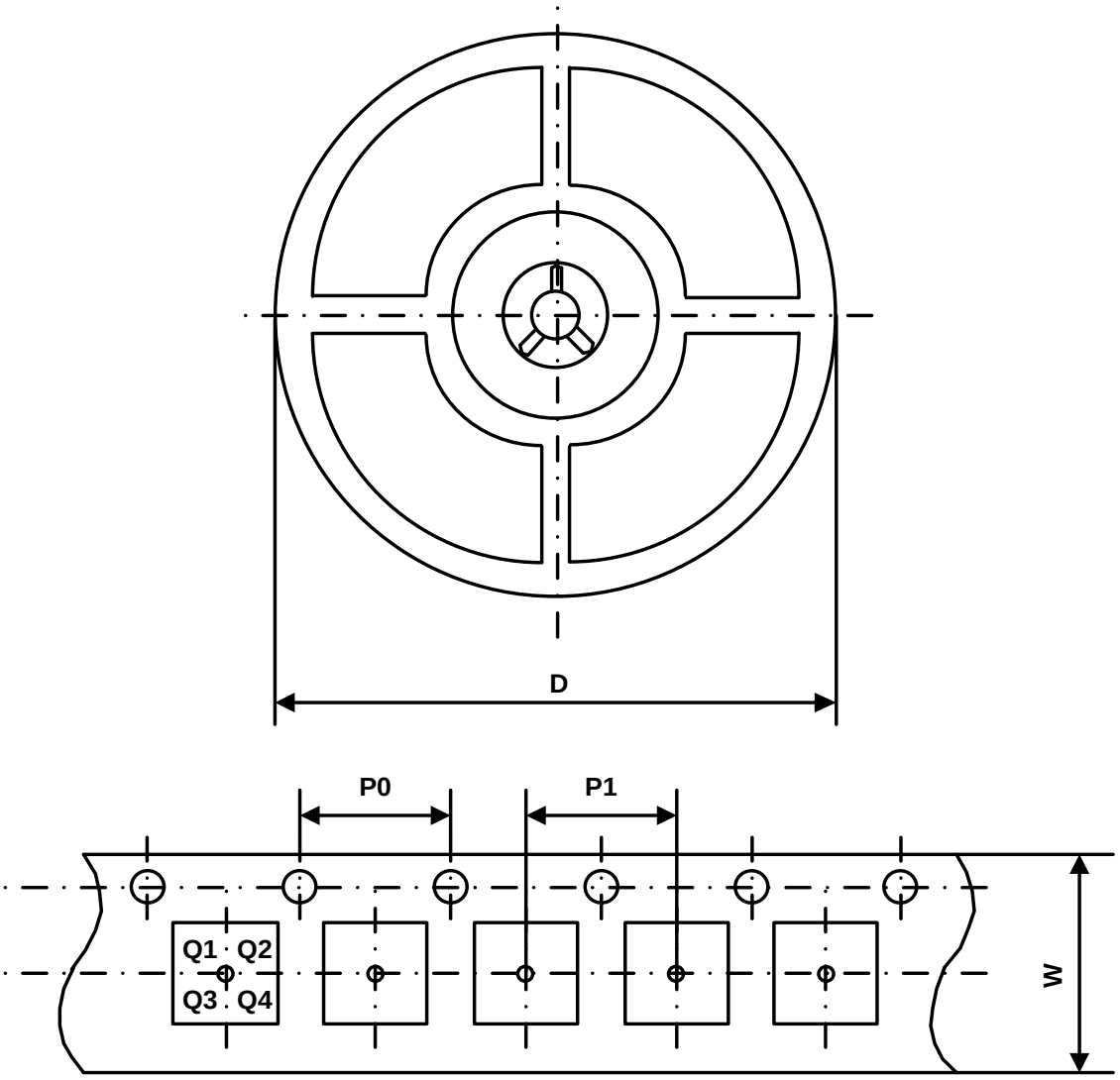
Symbol	DIMENSIONS					
	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	-	-	2.00	-	-	0.079
A1	0.05	-	-	0.002	-	-
A2	1.65	1.75	1.85	0.065	0.069	0.073
b	0.22	0.30	0.38	0.009	0.012	0.015
c	0.09	0.17	0.25	0.004	0.007	0.010
D	5.90	6.20	6.50	0.232	0.244	0.256
E	5.00	5.30	5.60	0.197	0.209	0.220
E1	7.40	7.80	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
UM3232EESE	SOP16	16 mm	4 mm	8 mm	330 mm	Q1
UM3232EEUE	TSSOP16	16 mm	4 mm	8 mm	330 mm	Q1
UM3232EEAE	SSOP16	16 mm	4 mm	12 mm	330 mm	Q1

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.
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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