

UM3222E,UM3232E***High ESD-Protected, Low Power,
3.3V to 5.5V, True RS-232 Transceivers******General Description***

The UM3222E/UM3232E are dual driver, dual receiver RS-232 transceiver solutions intended for portable or hand-held applications, features low power consumption, high data-rate capabilities, and enhanced ESD protection. The ESD tolerance of the UM3222E/3232E devices is over $\pm 15\text{kV}$ for both human body model and IEC1000-4-2 air discharge test methods.

A low-dropout transmitter output stage delivers true RS-232 performance from a +3.0V to +5.5V power supply, using an internal dual charge pump. The charge pump requires only four small 0.1 μF capacitors for operation from a +3.3V supply. Each device guarantees operation at data rates of 250kbps while maintaining RS-232 output levels.

The UM3222E features a 1 μA shutdown mode that reduces power consumption in battery-powered portable systems. Its receivers remain active in shutdown mode, allowing monitoring of external devices while consuming only 1 μA of supply current.

Applications

Notebook, Sub notebook, and Palmtop Computers
Battery-Powered / Hand-Held Equipment
POS terminal / Intelligent Network Switch
DMM / Printers
Smart Phones
xDSL Modems

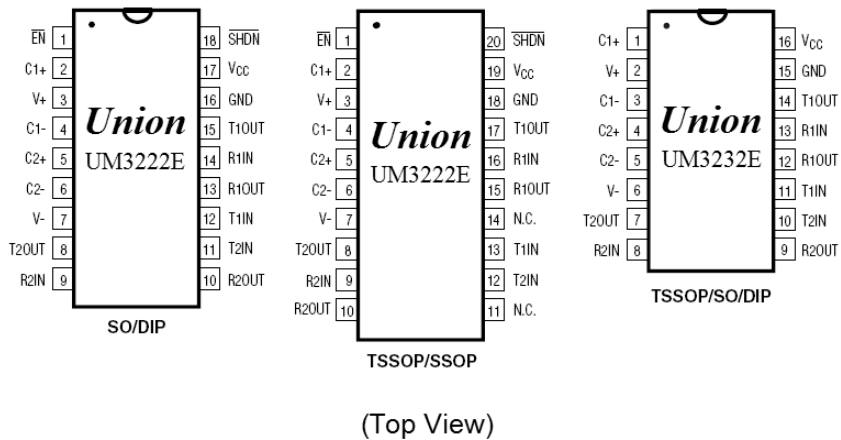
Features

Meets true EIA/TIA-232-F Standards from a +3.0V to +5.5V power supply
Interoperable with EIA/TIA - 232 and adheres to EIA/TIA - 562
1 μA Low-Power Shutdown (UM3222E)
Enhanced ESD Specifications:
 15kV Human Body Model
 15kV IEC1000-4-2 Air Discharge
 8kV IEC1000-4-2 Contact Discharge
250 kbps Minimum Transmission Rate
Ideal for Handheld, Battery Operated Applications
Latch up Free
Guaranteed 30V/ μs Max Slew Rate
BiCMOS Technology

Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE
UM3222EEUP	-40°C to +85°C	20 TSSOP
UM3222EEAP	-40°C to +85°C	20 SSOP
UM3222EEPN	-40°C to +85°C	20 Plastic DIP
UM3232EEUE	-40°C to +85°C	16 TSSOP
UM3232EESE	-40°C to +85°C	16 Narrow SO
UM3232EEPE	-40°C to +85°C	16 Plastic DIP

Pin Configurations



Selector Guide

PART NUMBER	POWER SUPPLY VOLTAGE	No. of DRIVER	No. of RECEIVER	LOW POWER MODE	GUARANTEED DATA RATE (kbps)
UM3222E	3.0 to 5.5	2	2	YES	250
UM3232E	3.0 to 5.5	2	2	NO	250

Absolute Maximum Ratings

V _{CC}	-0.3V to +6V	Short-Circuit Duration, T _{OUT}	Continuous
V ₊	- 0.3V to +7V	Continuous Power Dissipation (TA = +70°C)	
V ₋	+0.3V to-7V	16-Pin Plastic DIP (derate 10.53mW/°C above +70°C)	842mW
Input Voltages		16-Pin Narrow SO (derate 8.70mW/°C above +70°C)	696mW
T _{IN}	-0.3V to +6V	Operating Temperature Ranges	
R _{IN}	±25V	UM3232E.....	-40°C to +85°C
Output Voltages		Storage Temperature Range.....	-65°C to +165°C
T _{OUT}	±13.2V	Lead Temperature (soldering, 10sec)	+300°C
R _{OUT}	-0.3V to (V _{CC} + 0.3V)		

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.

Electrical Characteristics(V_{CC} = +3V to +5.5V, C1-C4 = 0.1μF, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.)

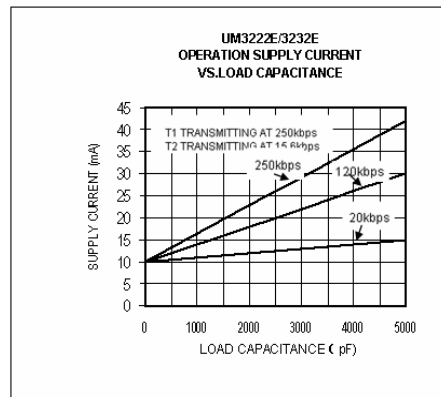
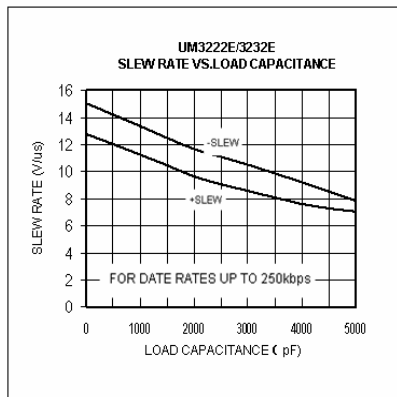
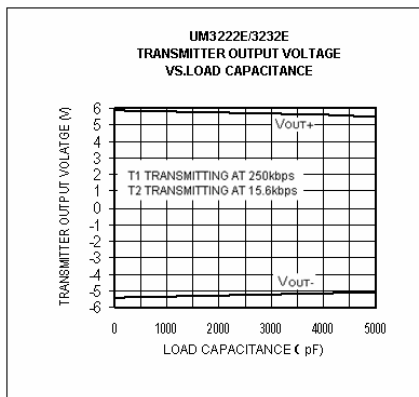
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC CHARACTERISTICS (V_{CC} = +3.3V OR +5.5V, T_A = +25°C)						
V _{CC} Supply Current	I _{CC}	/SHDN = V _{CC} , No Load, T _A = +25°C		0.3	2	mA
Shutdown Supply Current	I _{SHDN}	/SHDN = GND, No Load, T _A = +25°C		1	10	μA
LOGIC						
Input Leakage Current		T _{IN} , /SHDN, /EN			±1	μA
Input Threshold Low	V _{IL}	T _{IN} , /SHDN, /EN			0.8	V
Input Threshold High	V _{IH}	T _{IN} , /SHDN, /EN	2.0			V
Output Voltage Low	V _{OH}	R _{OUT} ; IO _{UT} = 3.2mA			0.4	V
Output Voltage High	V _{OL}	R _{OUT} ; IO _{UT} = -1.0mA	V _{CC} -0.6	V _{CC} -0.1		V
EIA/TIA-232E RECEIVER INPUTS						
Input Voltage Range			-25		25	V
Input Threshold Low		T _A = +25°C, V _{CC} = 3.3V	0.6	1.1		V
Input Threshold High		T _A = +25°C, V _{CC} = 3.3V		1.5	2.4	V
Input Hysteresis		V _{CC} = 3.3V	0.1		0.2	V
Input Resistance		T _A = +25°C, V _{CC} = 3.3V	3	5	7	kΩ
EIA/TIA-232E TRANSMITTER OUTPUTS						
Output Voltage Swing		All drivers loaded with 3kΩ to ground	±5	±5.4		V
Output Resistance			300	500		Ω
Output Short Circuit Current					±60	mA
TIMING CHARACTERISTICS						
Maximum Data Rate		RL = 3 kΩ to 7 kΩ, CL = 50pF to 1000pF, one transmitter switching	250			kbps
Receiver Propagation Delay	t _{PLHR} , t _{PHLR}	CL = 150pF		0.15		μs
Transmitter Propagation Delay	t _{PLHT} , t _{PHLT}	RL = 3 kΩ, CL = 2500pF, all transmitters loaded		0.1		μs
Transition-Region Slew rate		T _A = +25°C, V _{CC} = 3.3V RL = 3 kΩ to 7 kΩ, CL = 50pF to 1000pF, measured from -3V to +3V or +3V to -3V,	3	6	30	V/μs
ESD & LATCH UP PERFORMANCE						
ESD Protection Voltage		Human Body Model		±15		kV
		IEC1000-4-2, Contact Discharge		±8		kV
		IEC1000-4-2, Air-Gap Discharge		±15		kV
Latch up Performance			±200		mA	

Pin Descriptions

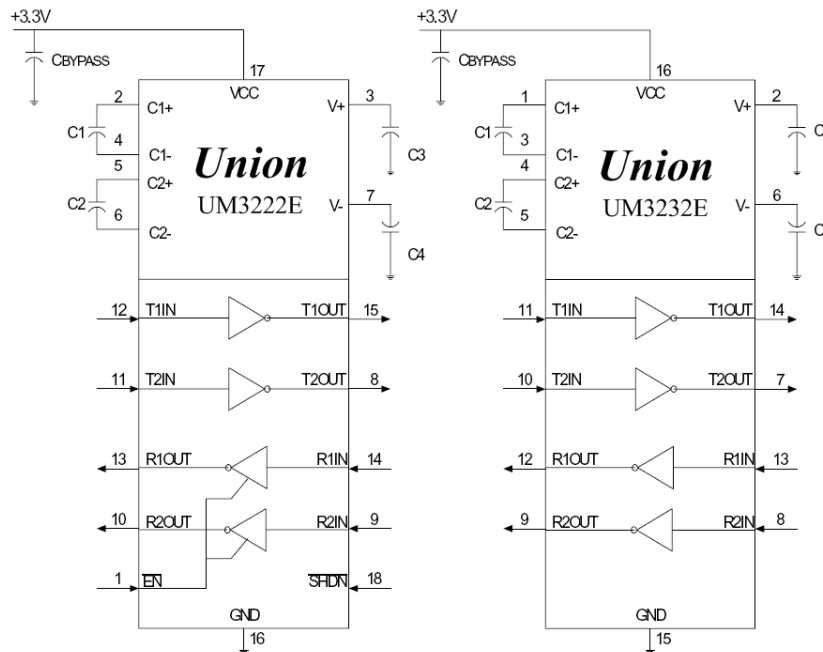
PIN				NAME	FUNCTION
UM3222E		UM3232E			
SO/DIP	TSSOP/SSOP	SO/DIP/SSOP	TSSOP		
1	1	—	—	/EN	Receiver Enable. Active low.
2	2	1	2	C1+	Positive Terminal of Voltage-Doubler Charge-Pump Capacitor
3	3	2	3	V+	+5.5V Generated by the Charge Pump
4	4	3	4	C1-	Negative Terminal of Voltage-Doubler Charge-Pump Capacitor
5	5	4	5	C2+	Positive Terminal of Inverting Charge-Pump Capacitor
6	6	5	6	C2-	Negative Terminal of Inverting Charge-Pump Capacitor
7	7	6	7	V-	-5.5V Generated by the Charge Pump
8, 15	8, 17	7, 14	8, 17	T_OUT	RS-232 Transmitter Outputs
9, 14	9, 16	8, 13	9, 16	R_IN	RS-232 Receiver Inputs
10, 13	10, 15	9, 12	12, 15	R_OUT	TTL/CMOS Receiver Outputs
11, 12	12, 13	10, 11	13, 14	T_IN	TTL/CMOS Transmitter Inputs
16	18	15	18	GND	Ground
17	19	16	19	VCC	+3.0V to +5.5V Supply Voltage
18	20	—	—	/SHDN	Shutdown Control. Active low.

Typical Operating Characteristics

($V_{CC} = +3V$ to $+5.5V$, $C1-C4 = 0.1\mu F$, $T_A = T_{MIN}$ to T_{MAX} , unless otherwise noted. Typical values are at $T_A = +25^\circ C$.)



Typical Operating Circuits



Detailed Description

Dual Charge-Pump Voltage Converter

The UM3222E/UM3232Es' internal power supply consists of a regulated dual charge pump that provides output voltages of +5.5V (doubling charge pump) and -5.5V (inverting charge pump) over the +3.0V to +5.5V VCC range. The charge pump operates in discontinuous mode; if the output voltages are less than 5.5V, the charge pump is enabled, and if the output voltages exceed 5.5V, the charge pump is disabled. Each charge pump requires a flying capacitor (C1, C2) and a storage capacitor (C3, C4) to generate the V+ and V- supplies.

RS-232 Transmitters

The transmitters are inverting level translators that convert TTL/CMOS-logic levels to $\pm 5V$ EIA/TIA-232 compliant levels. The UM3222E/UM3232E transmitters guarantee a 250kbps data rate with worst-case loads of $3K\Omega$ parallel with 1000pF. Transmitters can be paralleled to drive multiple receivers. The UM3222E transmitters are disabled and the outputs are forced into a high-impedance state when the device is in shutdown mode (/SHDN = GND). The UM3222E/UM3232E permits the outputs to be driven up to $\pm 12V$ in shutdown.

RS-232 Receivers

The receivers convert RS-232 signals to CMOS-logic output levels. The UM3222E receivers have inverting three-state outputs. Drive /EN high to place the receiver(s) into a high impedance state. Receivers can be either active or inactive in shutdown.

UM3222E

Supply current falls to less than $1\mu A$ in shutdown mode (/SHDN = GND). When shutdown, the device's charge pumps are shut off, V+ is pulled down to VCC, V- is pulled to ground, and the transmitter outputs are disabled (high impedance). The time required to recover from shutdown is typically $100\mu s$. Connect /SHDN to VCC if shutdown mode is not used.

±15kV ESD Protection

ESD-protection structures are incorporated to protect against electrostatic discharges encountered during handling and assembly. The driver outputs and receiver inputs of the UM3222E/UM3232E have extra protection against static electricity. 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 for the UM3222E/UM3232E are characterized for protection to the following limits:

±15kV using the Human Body Model

±8kV using the Contact Discharge method specified in IEC 1000-4-2

±15kV using the Air-Gap Discharge method specified in IEC 1000-4-2.

Applications Information***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 0.1 μ F capacitors for 3.3V operation. Increasing the capacitor values (e.g., by a factor of 2) reduces ripple 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 ripple on V+ and V- output voltages.

Power-Supply Decoupling

In most circumstances, a 0.1 μ F VCC 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 as close to the IC as possible.

Operation Down to 2.7V

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

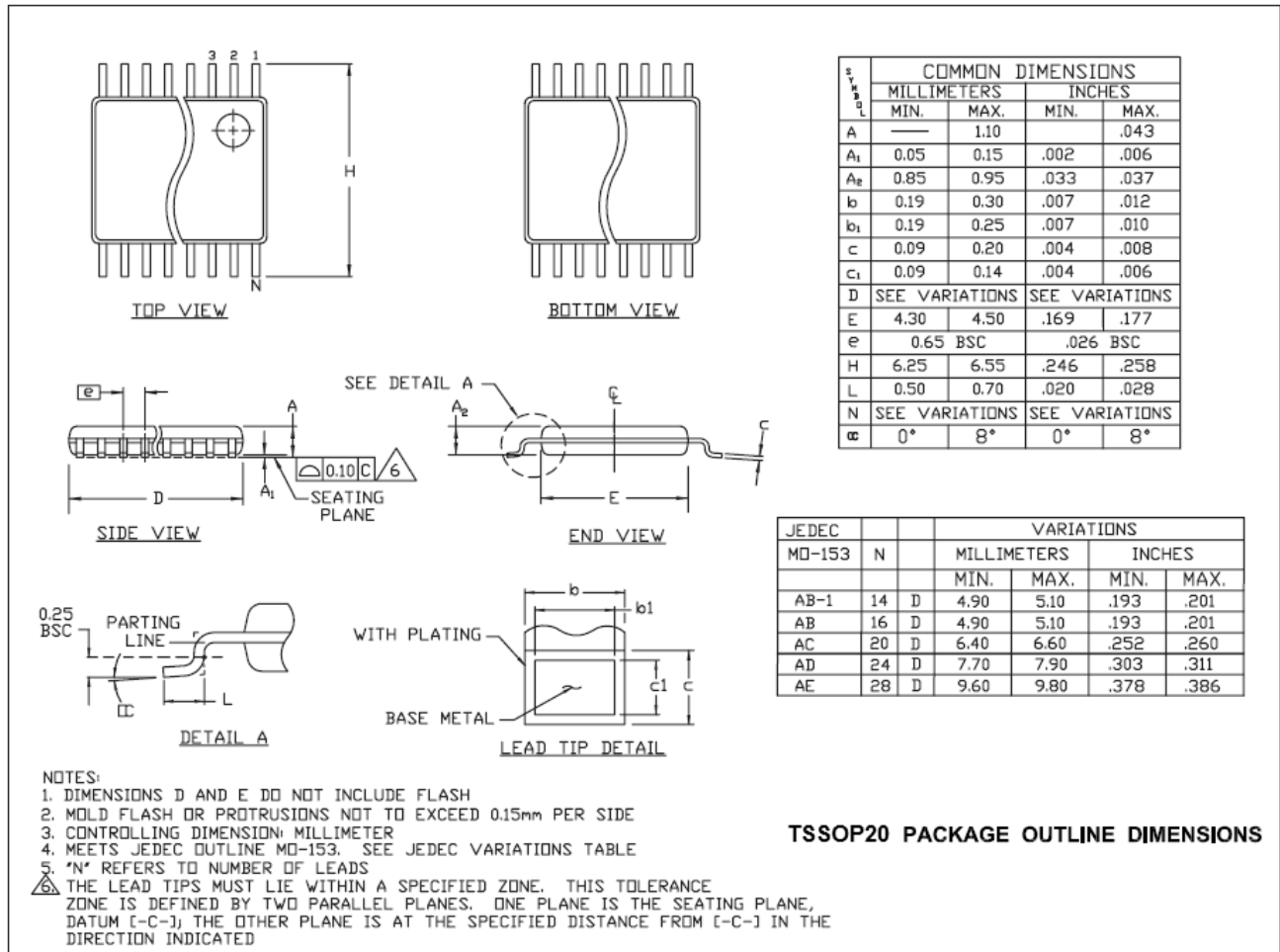
Transmitter Outputs Recovering from Shutdown

When UM3222E's two transmitter outputs were recovering from shutdown mode, the two transmitter outputs are shown going to opposite RS-232 levels (one transmitter input is high; the other is low) as they become active. Each transmitter is loaded with 3K resistor in parallel with 2500pF. The transmitter outputs display no ringing or undesirable transients as they come out of shutdown. Note that the transmitters are enabled only when the magnitude of V- exceeds approximately -3.0V.

Interconnection with 3V and 5V Logic

The UM3222E/UM3232E can directly interface with various 3V and 5V logic families, including ACT and HCT CMOS.

Package Information



TSSOP20 PACKAGE OUTLINE DIMENSIONS

