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

UM3232QCG ***QFN16 3.0×3.0***

1 Description

The UM3232QCG is 3V-5.5V powered RS-232 transceiver intended for portable or hand-held applications. The UM3232QCG 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 ±8kV for human body mode, and ±8kV for IEC61000-4-2 contact discharge methods. The logic I/O pins are protected to ±2kV for human body mode.

The UM3232QCG is available in small QFN16 3.0×3.0 package. The space-saving package and the use of small 0.1μF capacitors facilitate the PCB layout. Data rates greater than 250kbps are guaranteed at worst case load conditions. This family is fully compatible with 3.3V-only systems, mixed 3.3V and 5.0V systems and 5.0V-only systems.

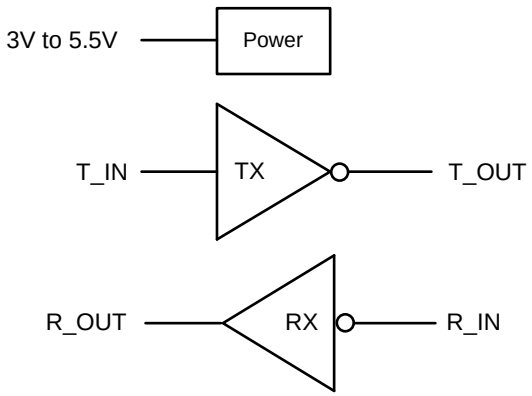
2 Features

- Meets True EIA/TIA-232-F Standards from 3.0V to 5.5V Power Supply
- 250kbps Minimum Transmission Rate
- External capacitors: 4 × 0.1 μF
- Enhanced ESD Specifications:
  - ±8kV Human Body Mode
  - ±8kV IEC61000-4-2 Contact Discharge Mode
- Extended ambient temperature range: -40°C to 125°C
- Guaranteed 30V/μs Max Slew Rate
- Latch-Up Performance Exceeds ±200mA

3 Applications

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

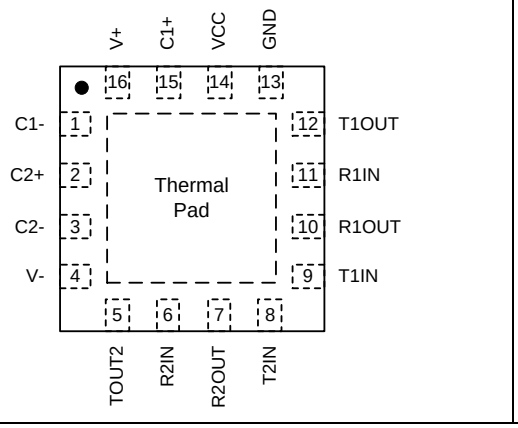
4 Simplified Schematic

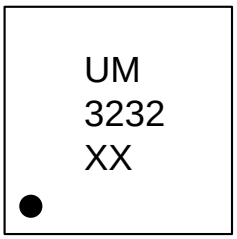


5 Ordering Information

Part Number	Mark Code	Package Type	Shipping Qty
UM3232QCG	UM3232	QFN16 3.0×3.0	3000pcs/13 Inch Tape & Reel

6 Pin Configuration and Function





XX: Week Code
UM3232QCG
QFN16 3.0×3.0

Table 6-1. Pin Functions

Pin No.	Pin Name	Function
1	C1-	Negative Terminals of Voltage-Doubler Charge Pump Capacitor
2	C2+	Positive Terminals of Inverting Charge Pump Capacitor
3	C2-	Negative Terminals of Inverting Charge Pump Capacitor
4	V-	Negative Voltage Generated by the Charge Pump
5	T2OUT	RS-232 Driver Output T2OUT
6	R2IN	RS-232 Receiver Input R2IN
7	R2OUT	RS-232 Receiver Output R2OUT
8	T2IN	RS-232 Driver Input T2IN
9	T1IN	RS-232 Driver Input T1IN
10	R1OUT	RS-232 Receiver Output R1OUT
11	R1IN	RS-232 Receiver Input R1IN
12	T1OUT	RS-232 Driver Output T1OUT
13	GND	Ground
14	VCC	+3.0V to +5.5V Supply Voltage Input
15	C1+	Positive Terminals of Voltage-Doubler Charge Pump Capacitor
16	V+	Positive Voltage Generated by the Charge Pump
-	Thermal Pad	Thermal Pad for QFN16 3.0×3.0 package. It should be soldered to PCB board and connected to GND.

7 Specifications

7.1 Absolute Maximum Ratings (Note 1)

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	Supply Voltage on V_{CC}	V_{CC} to GND	-0.3	6	V
V+	Voltage on V_+	V+ to GND	-0.3	7.5	V
V-	Voltage on V_-	V- to GND	-7.5	0.3	V
V_I	Input voltage	T_IN to GND	-0.3	6	V
		R_IN to GND	-25	25	V
V_O	Output voltage	T_OUT to GND	-13.2	13.2	V
		R_OUT to GND	-0.3	V_{CC}+0.3	V
V_{ESD}	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001	T_OUT, R_IN pins	-8	8	kV
	Contact discharge, per IEC 61000-4-2	T_OUT, R_IN pins	-8	8	kV
T_{STG}	Storage temperature		-65	150	℃

Note 1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

7.2 Recommended Operating Conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	Bus supply voltage		3		5.5	V
DR	Data rate				250	kbps
T_A	Operating ambient temperature		-40		125	℃

7.3 Electrical Characteristics(Static)

V_{CC} = 3V to 5.5V, T_A = -40℃ to 125℃, unless otherwise noted. All typical values are at T_A = 25°C.

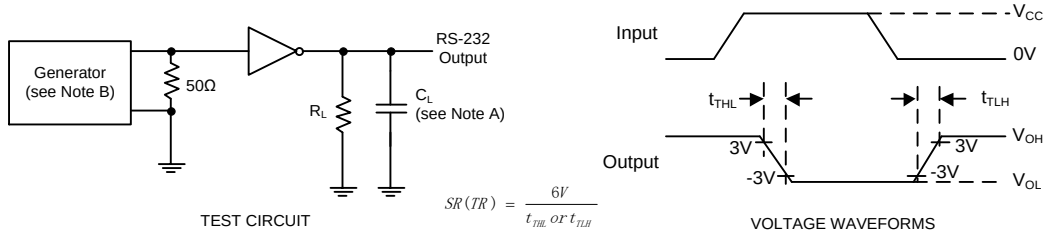
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Supply						
I_{CC}	V_{CC} Supply Current	No load, T_IN = V_{CC} or GND		0.6	2.5	mA
Logic inputs and receiver output						
V_{IT+}	Input high voltage on T_IN pins	V_{CC} = 3.3V	2.0			V
		V_{CC} = 5V	2.4			
V_{IT-}	Input low voltage on T_IN pins	V_{CC} = 3.3V			0.8	V
		V_{CC} = 5V			0.8	
I_I	Input leakage current	V_{IN}= 0V to V_{CC}, T_IN pins		±0.1	±1	μA
V_{OH}	High-level output voltage	I_{OUT} = -1 mA	V_{CC}-0.6			V
V_{OL}	Low-level output voltage	I_{OUT} = 1.6 mA			0.4	V
Driver output						
V_{OUT}	Output voltage swing	Driver output loaded with 3kΩ to GND	±5.0			V
I_{OS}	Output short-circuit current	V_{OUT} = 0V			±60	mA
I_{OL}	Output leakage current	V_{CC} = 0V, V_{OUT} = ±12V			±25	μA
Receiver input						
V_{IN}	Input voltage range		-25		25	V
V_{IT+}	Positive-going input threshold voltage	V_{CC} = 3.3V		1.5	2	V
		V_{CC} = 5V		2	2.4	V
V_{IT-}	Negative-going input threshold voltage	V_{CC} = 3.3V	0.8	1.15		V
		V_{CC} = 5V	0.8	1.7		V
V_{HYS}	Input hysteresis (V_{IT+} – V_{IT-})			0.4		V
R_I	Input resistance		3	5	7	kΩ

7.4 Switching Characteristics

V_{CC} = 3V to 5.5V, T_A = -40℃ to 125℃, unless otherwise noted. All typical values are at T_A= 25°C.

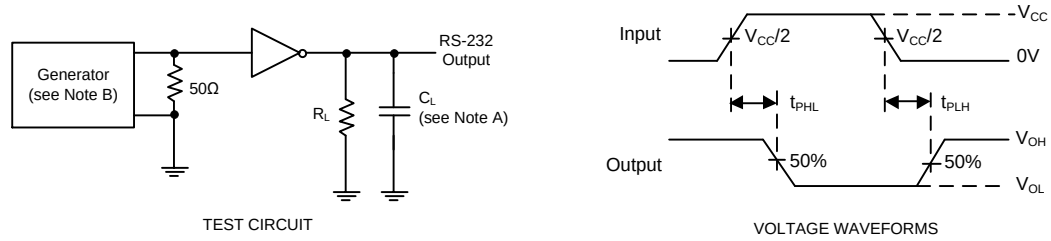
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Timing characteristics						
DR_{MAX}	Maximum data rate	R_L=3kΩ to 7kΩ,C_L=150pF to 1000pF,One Transmitter Switching	250			kbps
Receiver switching characteristics						
t_{PHL}, t_{PLH}	Receiver propagation delay	Receiver input to Receiver output, C_L=150pF, see Figure 8-3		0.23		μs
$t_{SK(P)}$	Receiver skew, $\|t_{PHL}-t_{PLH}\|$			0.09		μs
Transmitter switching characteristics						
t_{PHL}, t_{PLH}	Transmitter propagation delay	R_L=3kΩ, C_L=1000pF, see Figure 8-2		0.9		μs
$t_{SK(P)}$	Transmitter skew, $\|t_{PHL}-t_{PLH}\|$	R_L=3kΩ to 7kΩ, C_L=150pF to 1000pF		0.23		μs
SR_{TR}	Transition-region slew rate	T_A=+25°C, V_{CC}=3.3V, R_L=3kΩ to 7kΩ, C_L=150pF to 2500pF, Measured from -3V to +3V or +3V to -3V, see Figure 8-1	4		30	V/μs

8 Parameter Measurement Information



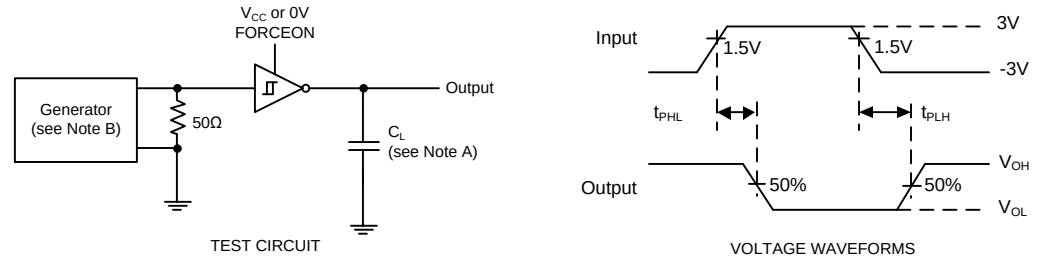
NOTES: A. C_L includes probe and jig capacitance.
B. The pulse generator has the following characteristics: Z_O=50Ω, 50% duty cycle, t_r≤10ns, t_f≤10ns.

Figure 8-1. Transmitter Slew Rate



NOTES: A. C_L includes probe and jig capacitance.
B. The pulse generator has the following characteristics: PRR=250kbit/s, Z_O=50Ω, 50% duty cycle, t_r≤10ns, t_f≤10ns.

Figure 8-2. Transmitter Pulse Skew



NOTES: A. C_L includes probe and jig capacitance.
B. The pulse generator has the following characteristics: Z_O=50Ω, 50% duty cycle, t_r≤10ns, t_f≤10ns.

Figure 8-3. Receiver Propagation Delay Times

9 Detailed Description

9.1 Overview

The UM3232QCG is 3V-5.5V powered RS-232 transceiver intended for portable or hand-held applications. The UM3232QCG 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 ±8kV for human body mode, and ±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. This family is fully compatible with 3.3V-only systems, mixed 3.3V and 5.0V systems and 5.0V-only systems.

9.2 Functional Block Diagram

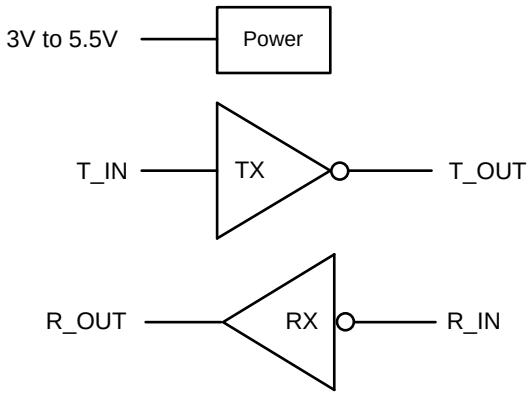


Figure 9-1. UM3232QCG Block Diagram

9.3 Feature Description

9.3.1 Power

A charge pump with four external capacitors enables the power block to boost, invert, and regulate the voltage present at the V+ and V- pins.

9.3.2 RS-232 Transmitters

The transmitters are inverting level translators that translate CMOS inputs to EIA/TIA-232 output levels. All UM3232QCG's transmitters guarantee a 250kbps data rate for full load conditions (3kΩ and 1000pF). Transmitters can be paralleled to drive multiple receivers.

9.3.3 RS-232 Receivers

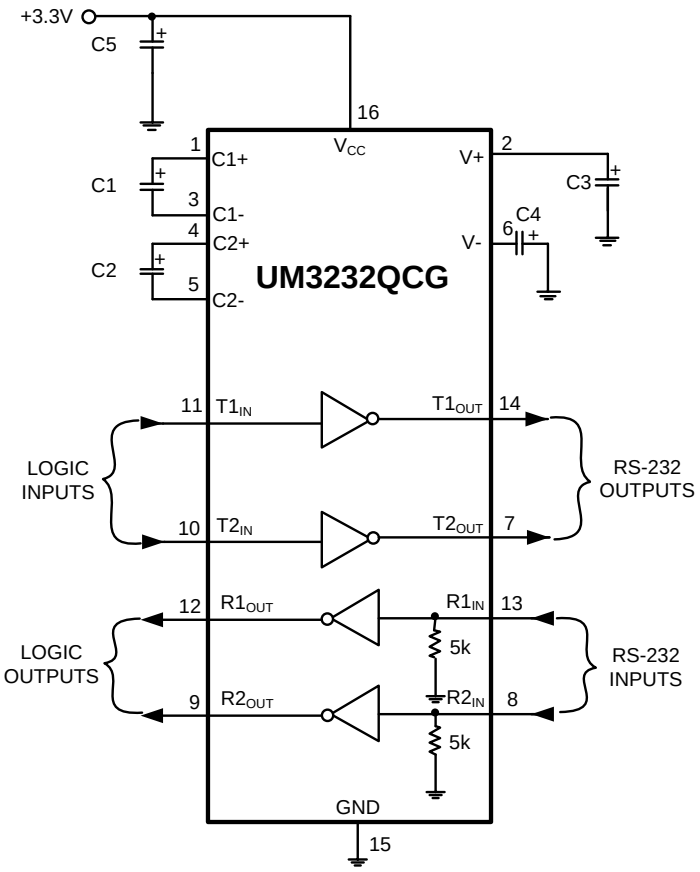
The receivers convert RS-232 signals to CMOS output levels and accept inputs up to ±25V while presenting the required 3kΩ to 7kΩ input impedance.

10 Application and Implementation

10.1 Application Information

Add capacitors per the Typical Operating Circuit and Capacitor Values to ensure proper operation.

10.2 Typical Application



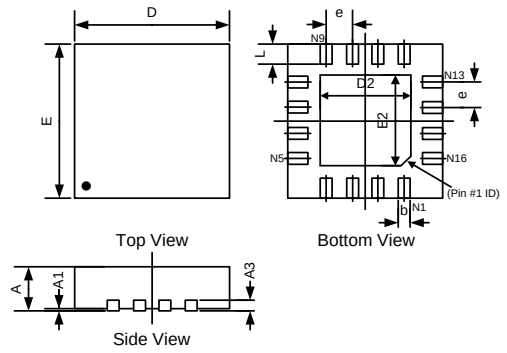
V_{CC}	C1 (µF)	C2, C3 and C4 (µF)
3.3 V ± 0.3 V	0.1	0.1
5 V ± 0.5 V	0.047	0.33
3 V to 5.5 V	0.1	all = 0.47 or all = 0.1

Figure 10-1. Typical Operating Circuit and Capacitor Values

11 Package Information

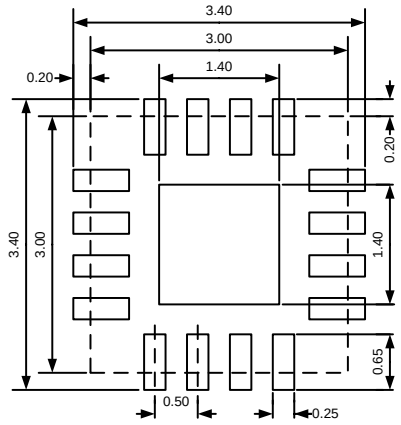
QFN16 3.0×3.0

Outline Drawing



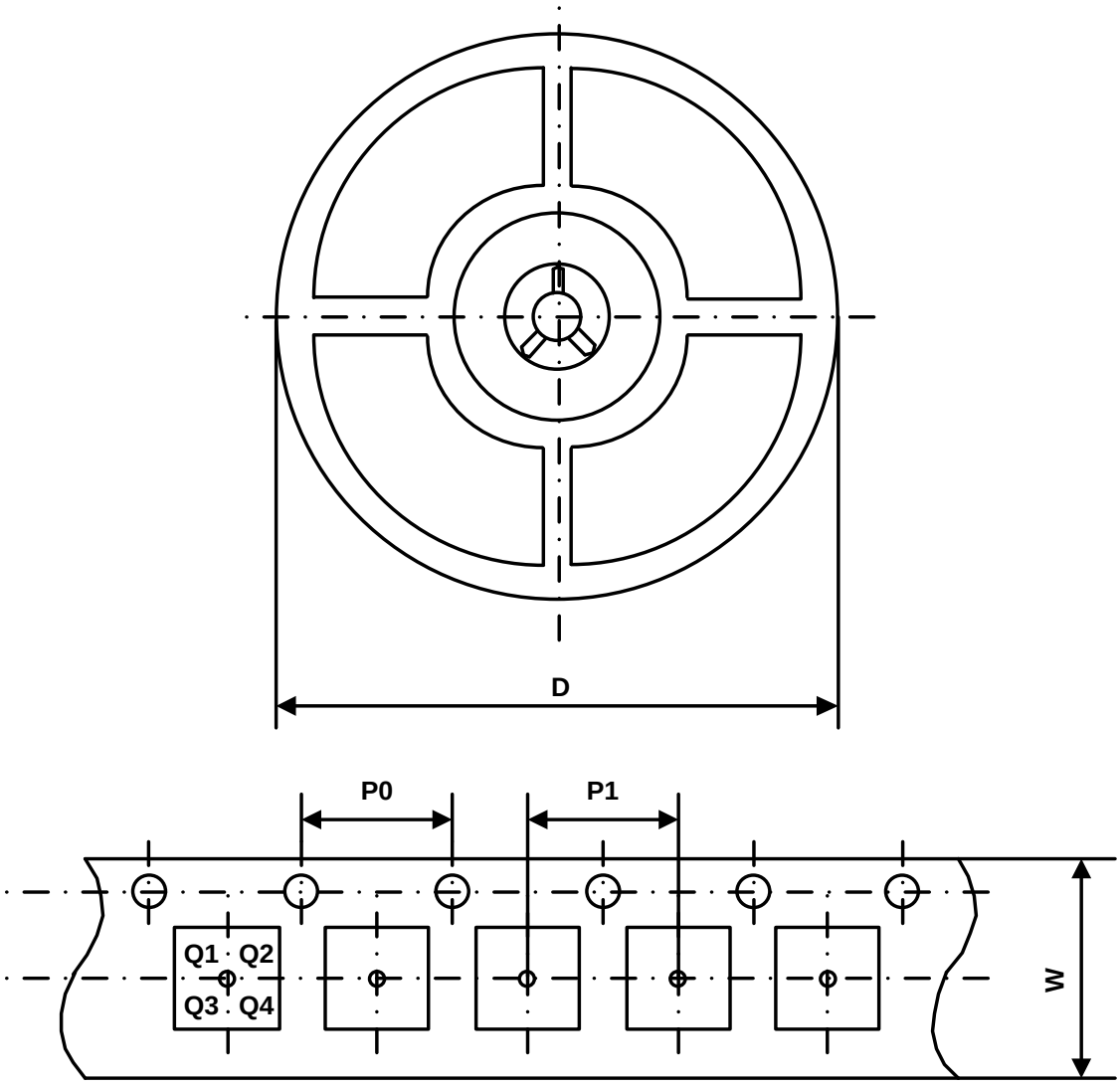
DIMENSIONS						
Symbol	MILLIMETERS			INCHES		
	Min	Typ	Max	Min	Typ	Max
A	0.55	-	0.80	0.022	-	0.031
A1	0.00	-	0.05	0.000	-	0.002
A3	0.20REF			0.008REF		
b	0.18	-	0.30	0.007	-	0.012
D	2.90	3.00	3.10	0.114	0.118	0.122
D2	1.55	-	1.86	0.061	-	0.073
E	2.90	3.00	3.10	0.114	0.118	0.122
E2	1.55	-	1.86	0.061	-	0.073
e	0.50TYP			0.020TYP		
L	0.25	0.40	0.55	0.010	0.016	0.022

Land Pattern



NOTES:
1. Unit: mm;
2. General tolerance ±0.05mm unless otherwise specified;
3. The layout is just for reference.

12 Packing Information



Part Number	Package Type	Carrier Width (W)	Pitch (P0)	Pitch (P1)	Reel Size (D)	PIN 1 Quadrant
UM3232QCG	QFN16 3.0×3.0	12 mm	4 mm	8 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:
https://www.union-ic.com/Quality.html

IMPORTANT NOTICE

The information in this document has been carefully reviewed and is believed to be accurate. Nonetheless, this document is subject to change without notice. Union assumes no responsibility for any inaccuracies that may be contained in this document, and makes no commitment to update or to keep current the contained information, or to notify a person or organization of any update. Union reserves the right to make changes, at any time, in order to improve reliability, function or design and to attempt to supply the best product possible.