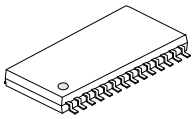
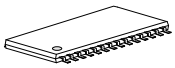
UT213 *CMOS IC*

+3.0V TO +5.5V POWER SUPPLY, 120KBPS, MULTICHANNAEL RS-232 LINE DRIVERS/RECEIVERS



SOP-28



SSOP-28

■ DESCRIPTION

The UTC **UT213** consists of 4 drivers and 5 receivers. It meets EIA/TIA-232 and V.28/V.24 specifications, it intended for notebook computer applications. A high-efficiency, dual charge-pumps power supply and a low-dropout transmitter combine to deliver true RS-232 performance from a single +3.0V~+5.5V power supply. A guaranteed data rate of 120kbps provides compatibility with popular software for communicating with PCs.

The UTC **UT213** has an active-low shutdown and an active-high receiver enable control. Two receivers of the UTC 213 are active, allowing the ring indicator(RI)to be monitored easily using only 75uW power.

The UTC **UT213** requires only 0.1µF capacitors in 3.3V operation, and can operate from input voltages ranging from +3.0V ~+5.5V. It is ideal for 3.3V-only systems, 5.0V-only systems, or mixed 3.3V and 5.0V systems that require true RS-232 performance.

■ FEATURES

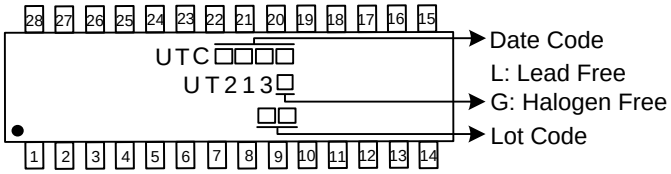
* Operates With 3.0V~5.5V Power Supply
* Four Drivers and Five Receivers
* Operates Up To 120 kbps
* Designed to Transmit at a Data Rate of 120 kbps
* Low Standby Current (15µA Typical)
* External Capacitors (4*0.1µF)
* Accepts 5.0V Logic Input With 3.3V Supply
* Serial-Mouse Drivability
* Exceeds ±8KV ESD Protection(HBM) for RS-232 I/O Pins

■ ORDERING INFORMATION

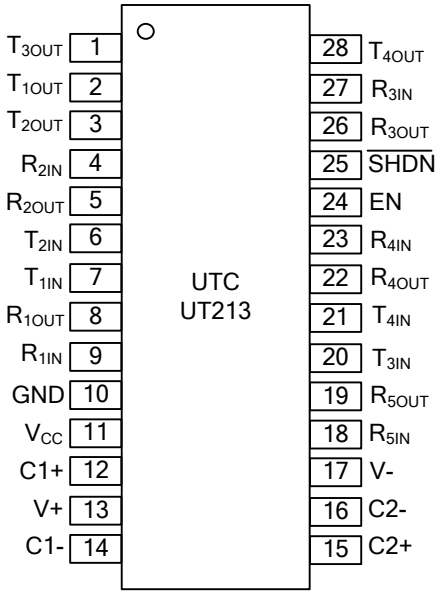
Ordering Number		Package	Packing
Lead Free	Halogen Free		
UT213G-S28-R	UT213G-S28-R	SOP-28	Tape Reel
UT213G-R28-R	UT213G-R28-R	SSOP-28	Tape Reel

UT213G-S28-R (1)Packing Type (2)Package Type (3)Green Package	(1) R: Tape Reel (2) S28: SOP-28, R28: SSOP-28 (3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING



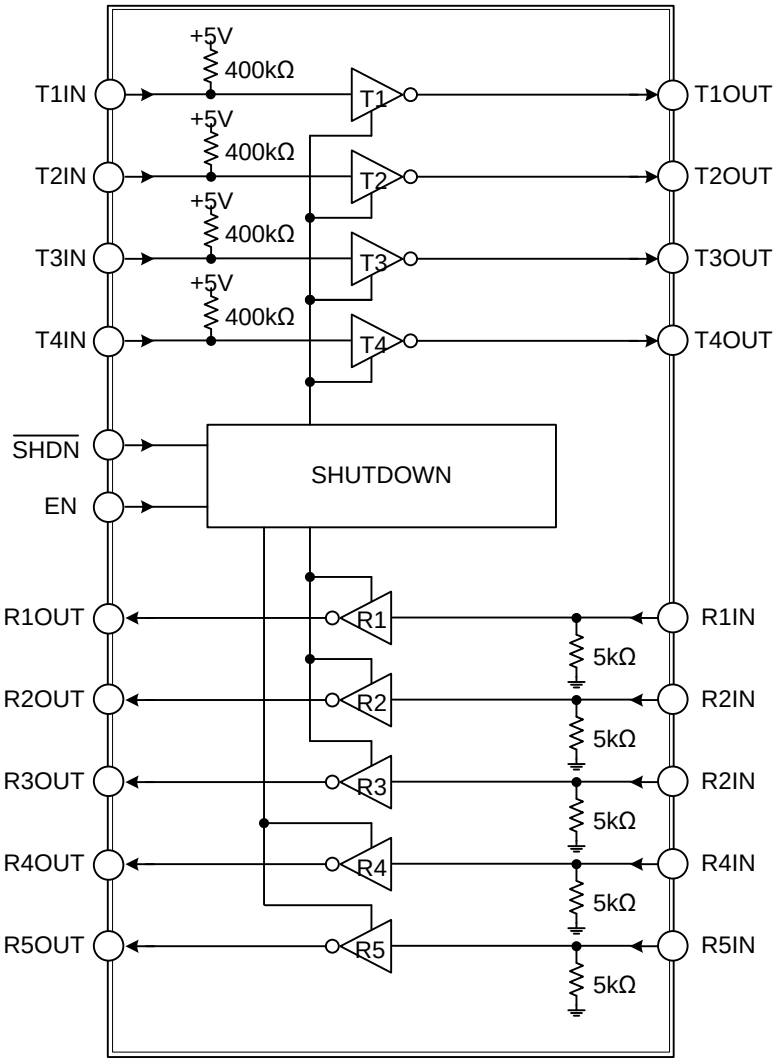
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1, 2, 3, 28	T_{XOUT}	RS-232 Transmitter Outputs
4, 9, 27	R_{1IN} ~ R_{3IN}	RS-232 Receiver Inputs
5, 8, 26	R_{1OUT} ~ R_{3OUT}	TTL/CMOS Receiver Outputs
6, 7, 20, 21	T_{XIN}	TTL/CMOS Transmitter Inputs
10	GND	Ground
11	V_{CC}	+3.0V ~ +5.5V Supply Voltage
12	C1+	Positive terminal of the voltage doubler charge-pump capacitor
13	V+	+5.5V generated by the charge pump
14	C1-	Negative terminal of the voltage doubler charge-pump capacitor
15	C2+	Positive terminal of inverting charge-pump capacitor
16	C2-	Negative terminal of inverting charge-pump capacitor
17	V-	-5.5V generated by the charge pump
18, 23	R_{4IN} ~ R_{5IN}	RS-232 Receiver Inputs (Active in shutdown)
19, 22	R_{4OUT} ~ R_{5OUT}	TTL/CMOS Receiver Outputs (Active in shutdown)
24	EN	Active high enable control
25	$\overline{SHDN}$	Active low shutdown control

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING

PARAMETER		SYMBOL	RATINGS	UNIT
V_{CC}		V_{CC}	+6.0	V
V+ (Note 2)		V+	+7.0	V
V- (Note 2)		V-	-7.0	V
V+ +|V-| (Note 2)		V_{PUMP}	+13.0	V
Input Voltages	T_IN, $\overline{SHDN}$, EN	V_{IN}	-0.3 ~ +6.0	V
	R_IN		±25	V
Output Voltages	T_OUT	V_{OUT}	±13.2	V
	R_OUT,		-0.3 ~ (V_{CC}+0.3)	V
Short-Circuit Duration	T_OUT	SC	Continuous	
Power Dissipation(T_A=25°C)		P_D	870	mW
Operating Temperature		T_{OPR}	-40 ~ +85	°C
Storage Temperature		T_{STG}	-65 ~ +150	°C

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. V+ and V- can have maximum magnitudes of 7.0V, but their absolute difference cannot exceed 13.0V.

■ ELECTRICAL CHARACTERISTICS

(V_{CC}=+3.0V~+5.5V, C1~C4=0.1μF (Note 2), T_A = T_{MIN} to T_{MAX}, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
DC CHARACTERISTICS								
Supply Current, Shutdown		I_{SHDN}	V_{CC}=3.3V or 5.0V, T_A= 25°C	$\overline{SHDN}$=0V, EN=0V or V_{CC}		15	50	μA
V_{CC} Supply Current		I_{CC}		$\overline{SHDN}$=V_{CC}, EN=0V or V_{CC}		11	20	mA
LOGIC INPUTS								
Input Logic Threshold	Low	V_{LGL}	T_IN, $\overline{SHDN}$, EN				0.8	V
	High	V_{LGH}	T_IN, $\overline{SHDN}$, EN	V_{CC} = 3.3V	2.0			V
				V_{CC} = 5.0V	2.4			
Logic Pullup Current		I_{Pullup}	T_IN=0V			15	200	μA
RECEIVER OUTPUTS								
Output Leakage Current		$I_{ROUT(LK)}$	EN=0V,0V≤ROUT≤V_{CC}			0.05	±10	μA
Output Voltage	Low	V_{ROUTL}	I_{OUT} = 1.6mA				0.4	V
	High	V_{ROUTH}	I_{OUT} = -1.0mA		3.5			V
RECEIVER INPUTS								
Input Voltage Range		V_{RR}			-30		30	V
Input Threshold Low		V_{RINL}	T_A=25°C V_{CC}=5.0V	Active mode	0.8	1.2		V
				Shutdown mode R4,R5	0.6	1.5		
Input Threshold High		V_{RINH}	T_A=25°C V_{CC}=5.0V	Active mode		1.7	2.4	V
				Shutdown mode R4,R5		1.5	2.4	
Input Hysteresis		V_{RINHYS}	V_{CC}=5.0V,no Hysteresis in shutdown		0.2	0.5	1.0	V
Input Resistance		V_{RINRES}	T_A=25°C,V_{CC}=5.0V		3	5	7	kΩ
TRANSMITTER OUTPUTS								
Output Voltage Swing		V_{TOUTSW}	All transmitter outputs loaded with 3kΩ to ground		±5.0	±5.4		V
Output Resistance		$V_{TOUTRES}$	V_{CC}= V+=V-=0V, Transmitter output=±2V		300	10M		Ω
Output Short-Circuit Current		I_{TSC}				±10	±60	mA
Output Leakage Current		$I_{TOUT(L)}$	V_{CC}=3.0V~5.0V, V_{OUT}=±12V, Transmitters disabled				±25	μA

■ ELECTRICAL CHARACTERISTICS (Cont.)

PARAMETER		SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
TIMING CHARACTERISTICS								
Maximum Data Rate		DR	V_{CC}=5V, R_L=3kΩ to 7kΩ C_L=50pf to 1000pF one transmitter switching		120			kbps
Receiver Propagation Delay		T_{DR1}	$\overline{SHDN}$=0V,R4,R5			4	40	µs
		T_{DR2}	$\overline{SHDN}$=V_{CC}			0.5	10	
Receiver Output Time	Enable	$t_{R(EN)}$	Normal operation			600		ns
	Disable	$t_{R(DIS)}$				200		ns
Transmitter Skew		t_{TS}	$\lvert t_{PHL} - t_{PLH} \rvert$			300		ns
Transition-Region Slew Rate		SR	V_{CC}=3.3V, T_A=25°C, R_L=3kΩ~7kΩ, measured from +3V ~ -3V or -3V~+3V	C_L=50pF~2500pF		15		V/µs

Notes: 1. Typical values are at T_A=25°C.

2. C1~C4=0.1µF, measured at 3.3V±10%. C1=0.047µF, C2~C4=0.33µF, measured at 5.0V ±10%.

■ DETAILED DESCRIPTION

Charge-Pump Voltage Converter

The UTC **UT213** consists of a regulated dual charge pumps that provide output voltages of +5.5V and -5.5V, regardless of the input voltage (V_{CC}) changing from +3.0V to +5.5V.

The charge pumps operate in a discontinuous mode: if the output voltages are less than 5.5V, the charge pumps are enabled; if the output voltages exceed 5.5V, the charge pumps are disabled.

Each charge pump requires a flying capacitor (C1, C2) and a reservoir capacitor (C3, C4) to generate the V+ and V- supplies, refer to application circuit.

RS-232 Transmitters

UTC **UT213**'s transmitters are inverting level translators that convert CMOS-logic levels to 5.0V EIA/TIA-232 levels. They guarantee a 120kbps data rate with worst-case loads of 3kΩ in parallel with 1000pF, providing compatibility with PC-to-PC communication software.

Input thresholds are both CMOS and TTL compatible. The inputs of unused drivers can be left unconnected since 400kΩ pullup resistors to V_{CC} are included on-chip. Since all drivers invert, the pullup resistors force the outputs of unused drivers low. The input pullup resistors typically source 15μA; therefore, the driver inputs should be driven high or open circuited to minimize power-supply current in shutdown mode.

RS-232 Receivers

The UTC **UT213**'s receivers convert RS-232 signals to CMOS logic output levels. Receiver outputs are inverting, maintaining compatibility with driver outputs. The guaranteed receiver input thresholds of +0.8V and +2.4V are significantly tighter than the Q3.0V threshold required by the EIA/TIA-232E specification. This allows receiver inputs to respond to TTL/CMOS logic levels and improves noise margin for RS-232 levels.

Receiver inputs have approximately +0.5V hysteresis. This provides clean output transitions, even with slow rise and fall time input signals with moderate amounts of noise and ringing. In shutdown, the UTC **UT213**'s receivers R4 and R5 have no hysteresis.

During normal operation, the UTC **UT213**'s receiver propagation delay is typically 1us. When entering shutdown with receivers active, R4 and R5 are not valid until 80Fs after SHDN is driven low. In shutdown mode, propagation delays increase to 4us for a high-to-low or a low-to-high transition.

Shutdown Function

In shutdown mode, the UTC **UT213**'s charge pumps are turned off, V+ is pulled down to V_{CC}, V- is pulled to ground, and the transmitter outputs are disabled. This reduces supply current typically to 15μA. The time required to exit shutdown is 1ms, All receivers except R4 and R5 on the UTC **UT213** are put into a high-impedance state in shutdown mode. The UTC **UT213**'s R4 and R5 receivers still function in shutdown mode. These two receivers are useful for monitoring external activity while maintaining minimal power consumption.

The enable control is used to put the receiver outputs into a high-impedance state, so that the receivers can be connected directly to a three-state bus. It has no effect on the RS-232 drivers or on the charge pumps.

Table 1. Shutdown Logic Control Truth Table

$\overline{SHDN}$	EN	OPERATION STATUS	TRANSMITTERS T1–T4	R1, R2, R3	R4, R5
0	0	Shutdown	High-Z	High-Z	High-Z
0	1	Shutdown	High-Z	High-Z	Active*
1	0	Normal operation	Active	High-Z	High-Z
1	1	Normal operation	Active	Active	Active

* Active with reduced performance.

■ TYPICAL APPLICATION CIRCUIT

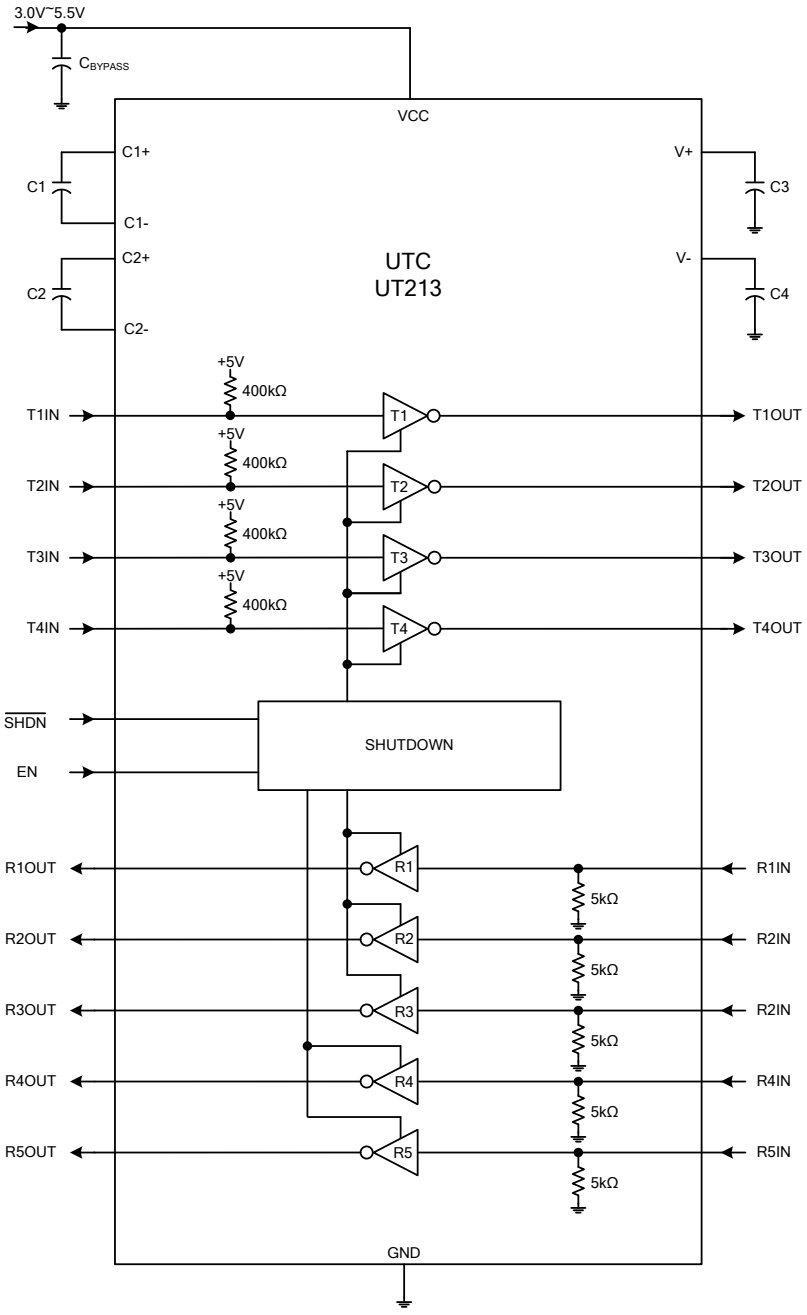


Table 2. Required Capacitor Value

V_{CC} (V)	C1 (μF)	C2, C3, C4 (μF)	C_{BYPASS} (μF)
3.0~3.6	0.22	0.22	0.22
3.15~3.6	0.1	0.1	0.1
4.5~5.5	0.047	0.33	0.047
3.0~5.5	0.22	1.0	0.22