

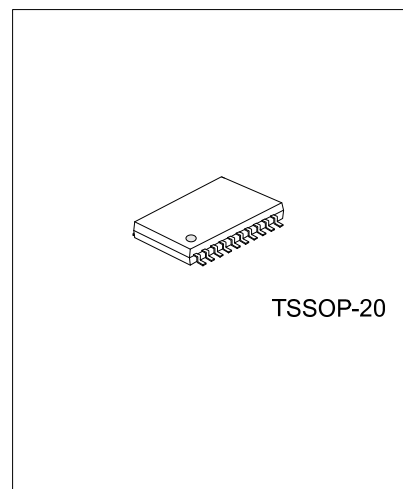


UT3223

Preliminary

CMOS IC

+3.0V TO +5.5V POWER SUPPLY,
250KBPS, MULTICHANNEL
RS-232 LINE
DRIVERS/RECEIVERS



■ DESCRIPTION

The UTC **UT3223** consists of 2 drivers and 2 receivers. It meets EIA/TIA-232 and V.28/V.24 specifications, it is 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 250kbps provides compatibility with popular software for communicating with PCs.

The UTC **UT3223** achieves 1μA supply current in shutdown condition. When the **UT3223** doesn't detect a valid signal level on its receiver inputs, the on-board power supply and drivers will shutdown, and when a valid level is applied to any RS-232 receiver input, then the system turns on again. Therefore, the system saves power without changes to the existing BIOS or operating system.

The UTC **UT3223** 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

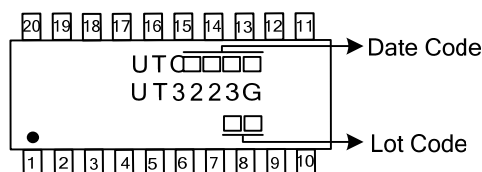
- * Operates With 3.0V~5.5V Power Supply
- * Two Drivers and Two Receivers
- * Operates Up To 250 kbps
- * Designed to Transmit at a Data Rate of 250 kbps
- * Low Standby Current (1μA Typical)
- * External Capacitors (4*0.1μF)
- * Accepts 5.0V Logic Input With 3.3V Supply
- * Serial-Mouse Drivability
- * Exceeds ±8KV ESD Protection(HBM) for RS-232 I/O Pins

■ ORDERING INFORMATION

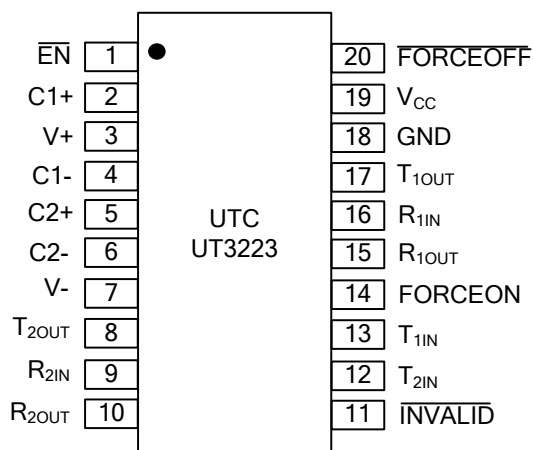
Ordering Number	Package	Packing
UT3223G-P20-R	TSSOP-20	Tape Reel

UT3223G-P20-R	
(1)Packing Type	(1) R: Tape Reel
(2)Package Type	(2) P20: TSSOP-20
(3)Green Package	(3) G: Halogen Free and Lead Free

MARKING



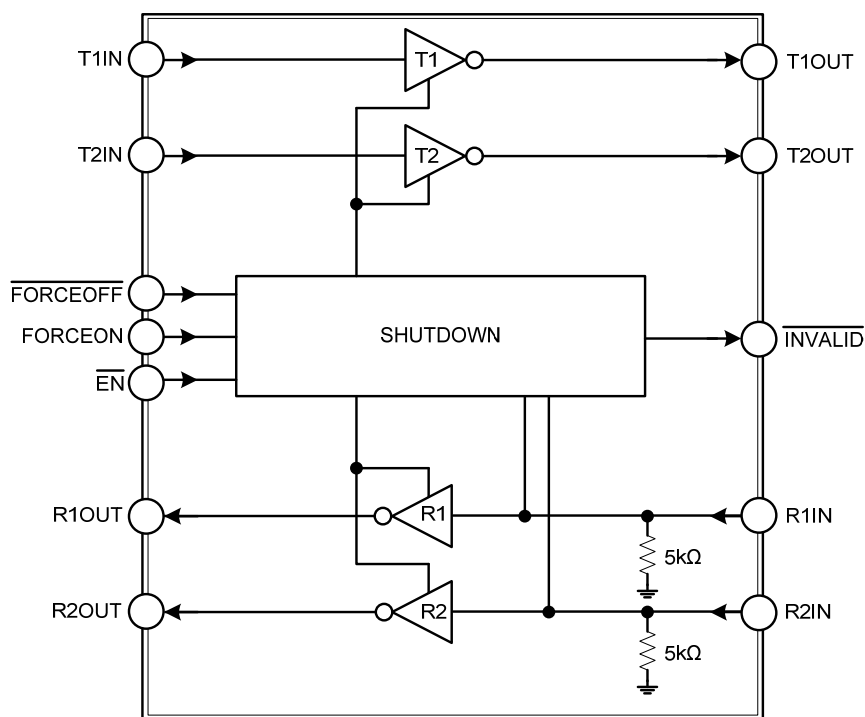
PIN CONFIGURATION



PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	$\overline{\text{EN}}$	Receiver Enable Control. Drive low for normal operation. Drive high to force the receiver outputs (R_OUT) into a high-impedance state.
2	C1+	Positive terminal of the voltage doubler charge-pump capacitor.
3	V+	+5.5V generated by the charge pump.
4	C1-	Negative terminal of the voltage doubler charge-pump capacitor.
5	C2+	Positive terminal of inverting charge-pump capacitor.
6	C2-	Negative terminal of inverting charge-pump capacitor.
7	V-	-5.5V generated by the charge pump.
8	T _{2OUT}	RS-232 Transmitter 2 Output.
9	R _{2IN}	RS-232 Receiver 2 Input.
10	R _{2OUT}	TTL/CMOS Receiver 2 Output.
11	$\overline{\text{INVALID}}$	Output of the valid signal detector. Indicates if a valid RS-232 level is present on receiver inputs logic "1".
12	T _{2IN}	TTL/CMOS Transmitter 2 Input.
13	T _{1IN}	TTL/CMOS Transmitter 1 Input.
14	FORCEON	Drive high to override automatic circuitry keeping transmitters on ($\overline{\text{FORCEOFF}}$ must be high) (Table 2).
15	R _{1OUT}	TTL/CMOS Receiver 1 Output.
16	R _{1IN}	RS-232 Receiver 1 Input.
17	T _{1OUT}	RS-232 Transmitter 1 Output.
18	GND	Ground.
19	V _{CC}	+3.0V ~ +5.5V Supply Voltage.
20	$\overline{\text{FORCEOFF}}$	Drive low to shut down transmitters and on-board power supply. This over-rides all automatic circuitry and FORCEON (Table 2).

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING

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

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

($V_{CC}=+3.0\text{V}\sim+5.5\text{V}$, $C1\sim C4=0.1\mu\text{F}$ (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	All R _{IN} open, FORCEOFF =V _{CC} , FORCEON=GND		1.0	10	μA
				FORCEOFF =GND, All R _{IN} =GND		1.0	10	μA
Supply Current, Shutdown Disabled		I _{CC}		FORCEON= FORCEOFF =V _{CC} , no load		0.3	1.0	mA
LOGIC INPUTS								
Input Logic Threshold	Low	V _{LGL}	EN ,T_IN, FORCEON, FORCEOFF				0.8	V
	High	V _{LGH}	EN ,T_IN, EN, FORCEON, FORCEOFF	V _{CC} = 3.3V V _{CC} = 5.0V	2.0 2.4			V
Input Leakage Current		I _{IN(LK)}	T_IN, EN , FORCEON, FORCEOFF			±0.01	±1.0	μA
RECEIVER OUTPUTS								
Output Leakage Current		I _{ROUT(LK)}	Receivers disabled			±0.05	±10	μA
Output Voltage	Low	V _{ROUTL}	I _{OUT} = 1.6mA				0.4	V
	High	V _{ROUTH}	I _{OUT} = -1.0mA		V _{CC} - 0.6V _{CC} - 0.1			V
AUTOSHUTDOWN (FORCEON=GND, FORCEOFF =V _{CC})								
Receiver Input Thresholds to Transmitters	Enabled	V _{R(EN)}	Fig.1	Positive threshold			2.7	V
				Negative threshold	-2.7			
	Disabled	V _{R(DIS)}	1μA supply current, Fig.1		-0.3		0.3	V
INVALID Output Voltage	Low	V _{INVL}	I _{OUT} =1.6mA				0.4	V
	High	V _{INVH}	I _{OUT} =-1.0mA		V _{CC} - 0.6			V
Receiver Threshold to Transmitters Enabled		t _{WU}	Fig.2			100		μs

■ ELECTRICAL CHARACTERISTICS(Cont.)

(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
Receiver Positive or Negative Threshold to INVALID	High	t _{INVH}	Fig.2			1.0		μs
	Low	t _{INVL}				30		μs
RECEIVER INPUTS								
Input Voltage Range		V _{RR}			-25		25	V
Input Threshold Low		V _{RINL}	T _A =25°C	V _{CC} =3.3V	0.6	1.2		V
				V _{CC} =5.0V	0.8	1.5		
Input Threshold High		V _{RINH}	T _A =25°C	V _{CC} =3.3V		1.5	2.4	V
				V _{CC} =5.0V		1.8	2.4	
Input Hysteresis		V _{RINHYS}				0.5		V
Input Resistance		V _{RINRES}	T _A =25°C		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}				±35	±60	mA
Output Leakage Current		I _{TOUT(LK)}	V _{CC} =3.0V~5.0V, V _{OUT} =±12V, Transmitters disabled				±25	μA
TIMING CHARACTERISTICS								
Maximum Data Rate		DR	R _L =3kΩ, C _L =1000pF, one transmitter switching		250			kbps
Receiver Propagation Delay		t _{PHL}	Receiver input to receiver output, C _L =150pF			0.15		μs
		t _{PLH}				0.15		
Receiver Output Time	Enable	t _{R(EN)}	Normal operation			200		ns
	Disable	t _{R(DIS)}				200		ns
Transmitter Skew		t _{TS}	t _{PHL} – t _{PLH}			100		ns
Receiver Skew		t _{RS}	t _{PHL} – t _{PLH}			50		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 =220pF~1000pF	5		35	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 **UT3223** 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 **UT3223**'s transmitters are inverting level translators that convert CMOS-logic levels to 5.0V EIA/TIA-232 levels. They guarantee a 250kbps data rate with worst-case loads of 3k Ω in parallel with 1000pF, providing compatibility with PC-to-PC communication software.

Transmitters can be paralleled to drive multiple receivers or mouse. When $\overline{\text{FORCEOFF}}$ is driven to ground, or shutdown circuitry senses invalid voltage levels at all receiver inputs, the transmitters are disabled and the outputs are forced into a high-impedance state.

RS-232 Receivers

The UTC **UT3223**'s receivers convert RS-232 signals to CMOS-logic output levels. All receivers have one inverting three-state output. In shutdown or in autoshutdown, the **UT3223**'s receivers are active. Drive $\overline{\text{EN}}$ high to place the receiver in a high-impedance state.

Table 1. $\overline{\text{EN}}$ Control Truth Table

$\overline{\text{EN}}$	R_OUT
0	Active
1	High-Z

Shutdown Function

A 1 μ A supply current is achieved with shutdown feature, which operates when FORCEON is low and $\overline{\text{FORCEOFF}}$ is high. When the UTC **UT3223** senses no valid signal levels on all receiver inputs for 30 μ s, the on-board power supply and drivers are shut off, reducing supply current to 1 μ A. This occurs if the RS-232 cable is disconnected or the connected peripheral transmitters are turned off. The system turns on again when a valid level is applied to any RS-232 receiver input. As a result, the system saves power without changes to the existing BIOS or operating system. $\overline{\text{INVALID}}$ indicates the receiver inputs' condition, when using shutdown function, the $\overline{\text{INVALID}}$ output is high when the device is on and low when the device is shut down.

Table 2. Shutdown Logic Control Truth Table

OPERATION STATUS	$\overline{\text{FORCEOFF}}$ INPUT	FORCEON INPUT	$\overline{\text{INVALID}}$ OUTPUT	T_OUT
Normal Operation (Forced On)	H	H	X	Active
Normal Operation (AutoShutdown)	H	L	H	Active
Normal Operation (AutoShutdown)	H	L	L	High-Z
Shutdown (Forced Off)	L	X	X	High-Z

■ DETAILED DESCRIPTION(Cont.)

Table 2 summarizes the UTC **UT3223** operating modes. $\overline{\text{FORCEON}}$ and $\overline{\text{FORCEOFF}}$ override the automatic circuitry and force the transceiver into its normal operating state or into its low-power standby state. When neither control is asserted, the IC selects between these states automatically based on receiver input levels.

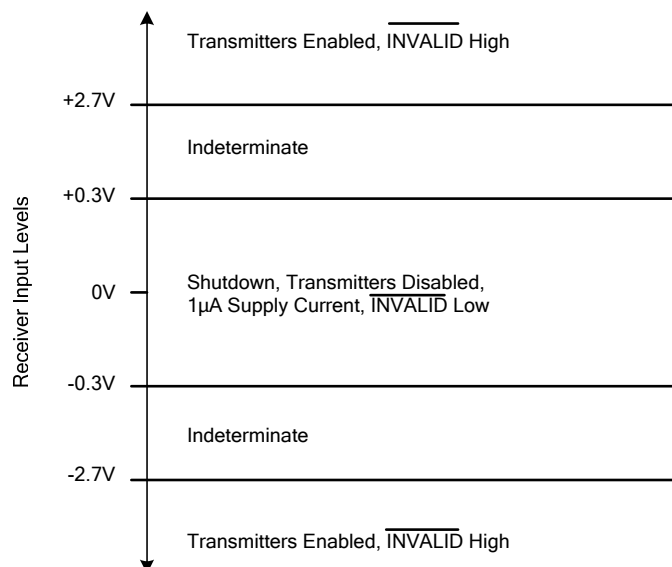


Fig.1 Shutdown Input Levels

When shutdown, the UTC **UT3223**'s charge pumps are turned off, V_+ decays to V_{CC} , V_- decays to ground, the transmitter outputs are disabled (high impedance). The time required to exit shutdown is typically 100µs.

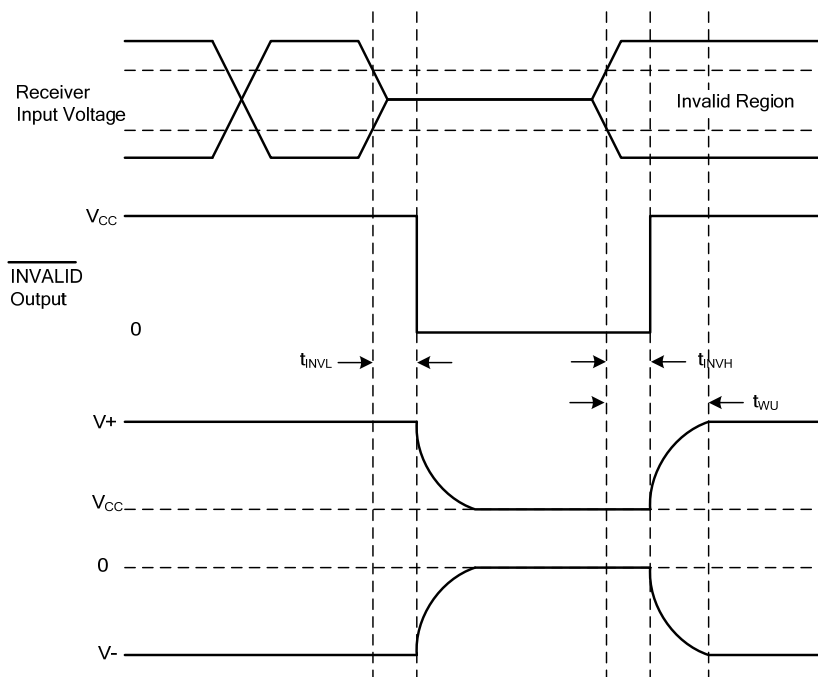


Fig.2 Shutdown Input Timing

TYPICAL APPLICATION CIRCUIT

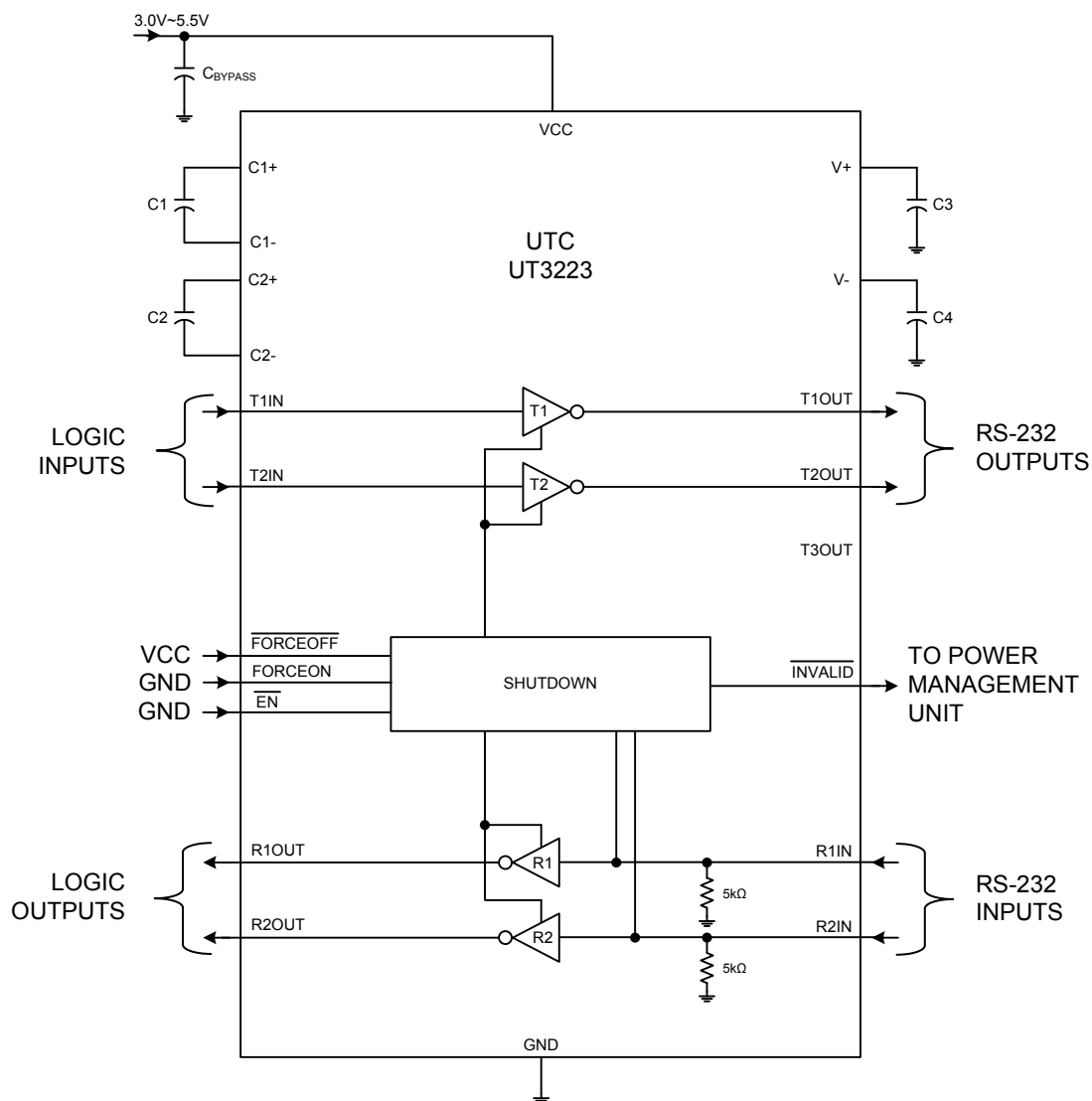


Fig.3 Application Circuit

Table 3. 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

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