

UT3221/E

+3.0V TO +5.5V POWER SUPPLY, 250KBPS, MULTICHANNAEL RS-232 LINE DRIVER/RECEIVER

DESCRIPTION

The UTC **UT3221/E** consists of 1 driver and 1 receiver. 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 250kbps provides compatibility with popular software for communicating with PCs.

The UTC **UT3221/E** achieves 1μ A supply current in shutdown condition. When the **UT3221/E** doesn't detect a valid signal level on its receiver input, the on-board power supply and driver will shutdown, and when a valid level is applied to 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 **UT3221/E** requires only 0.1μ F 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 to 5.5V Power Supply
- * One Driver and One Receiver
- * Operates Up To 250 kbps
- * Designed to Transmit at a Data Rate of 250 kbps
- * Low Standby Current (1µA Typical)

ORDERING INFORMATION

- * 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	Number	Deskere	Packing	
Lead Free	Halogen Free	Раскаде		
UT3221L-R16N-R	UT3221G-R16N-R	SSOP-16N	Tape Reel	
UT3221L-P16-R	UT3221G-P16-R	TSSOP-16	Tape Reel	
UT3221EL-R16N-R	UT3221EG-R16N-R	SSOP-16N	Tape Reel	
UT3221EL-P16-R	UT3221EG-P16-R	TSSOP-16	Tape Reel	





MARKING

UT3221	UT3221E			
16 15 14 13 12 11 10 9 UTC 0 0 0 0 0 0 UTC 0 0 0 0 0 0 UT3221□ > G: Halogen Free 0 0 0 0 0 0 0 0 0 0 1 2 3 4 5 6 7 8 0 0	16 13 12 11 10 9 UTC □□□□□ → Date Code UT3221E → C: Lead Free UT3221E → G: Halogen Free ● □□□ → Lot Code 1 2 3 4 5 6 7 8			

■ PIN CONFIGURATION



PIN DESCRIPTION

PIN NO.			DECODIDION	
UT3221	UT3221E	PIN NAME	DESCRIPTION	
1	1	ĒN	Receiver Enable Control. Drive low for normal operation. Drive high to	
2	2	C1+	Positive terminal of the voltage doubler charge nump capacitor	
3	3		+5.5V generated by the charge nump	
1	3	C1-	Negative terminal of the voltage doubler charge nump capacitor	
5	5	C2+	Positive terminal of inverting charge nump capacitor	
6	6	C2+	Nogetive terminal of inverting charge pump capacitor.	
7	7	V	5.5V generated by the charge nump	
0	0	V-	-5.5V generated by the charge pump.	
0	0	R 1IN	TTL/CMOS Receiver 1 Output	
9	9	R10UT	Output of the valid simple detector, Indiantes if a valid DC 222 level is	
10	-	INVALID	present on receiver input logic "1"	
11	11	T _{1IN}	TTL/CMOS Transmitter 1 Input.	
12	-	FORCEON	Drive high to override automatic circuitry keeping transmitter on (FORCEOFF must be high) (Table 2).	
13	13	T _{10UT}	RS-232 Transmitter 1 Output.	
14	14	GND	Ground.	
15	15	Vcc	+3.0V ~ +5.5V Supply Voltage.	
16	-	FORCEOFF	Drive low to shut down transmitter and on-board power supply. This over-rides all automatic circuitry and FORCEON (Table 2).	
-	10, 12	NC	No connect	
-	16	FORCEOFF	Shut off Pump Power and Transmitters. Active low.	



BLOCK DIAGRAM



UT3221



UT3221E



■ ABSOLUTE MAXIMUM RATING

PARAM	ETER	SYMBOL	RATINGS	UNIT
Vcc		Vcc	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	$T_IN, \overline{FORCEOFF}, FORCEON, \overline{EN}$	V _{IN}	6.0	V
	R_IN		±25	V
T_OUT			±13.2	V
Output Voltages	R_OUT, INVALID	Vout	-0.3 ~ (V _{CC} +0.3)	V
Short-Circuit Duration T_OUT		SC	Continuous	
Power Dissipation(T _A =25°C)		PD	680	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

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

PARAMETEI	۲	SYMBOL	TEST CONDITIONS		ONDITIC	MIN	TYP	MAX	UNIT	
DC CHARACTERISTI	CS									
Supply Current, Shutdown				All R_IN FORCE	All R_IN open, FORCEOFF =V _{CC} , FORCEON=GND			1.0	10	μA
		ISHDN	V _{CC} =3.3V or 5.0V, T _A = 25°C	FORCE All R_IN (FORCE	FORCEOFF =GND, All R_IN=GND (FORCEOFF =GND.UT3221F)			1.0	10	μA
Supply Current, Shutdown Disabled		lcc	FORCEON= FORCEOFF = V_{CC} , no load (FORCEOFF = V_{CC} ,UT3221E)			0.3	1.0	mA		
LOGIC INPUTS										
	Low	V_{LGL}	EN ,T_IN, FORCEON, FORCEOFF				0.8	V		
Input Logic Threshold			EN ,T IN, EN, FORCEON, Vcc = 3.3V		2.0			.,		
	Hign	IIGN VLGH	FORCEOFF Vcc = 5.0V		2.4			V		
Input Leakage Current		IIN(LK)	T_IN, EN, FORCEON, FORCEOFF			±0.01	±1.0	μA		
RECEIVER OUTPUT										
Output Leakage Current		I _{ROUT(LK)}	Receiver disabled			±0.05	±10	μA		
	Low	VROUTL	I _{ОUT} = 1.6n	nA					0.4	V
Oulput voltage	High	VROUTH	I _{OUT} = -1.0mA		V _{CC} - 0.6	V _{CC} - 0.1		V		
AUTOSHUTDOWN (FORCEON=GND, FORCEOFF =Vcc, UT3221)										
Receiver Input	Enabled	V _{R(EN)}	Fig.1		Positive Negative	threshold threshold	-27		2.7	V
Transmitter	Disabled		1uA supply	v current	. Fia.1		-0.3		0.3	V
	Low	VINVL	Iout=1.6mA				0.4	V		
Voltage	High	VINVH	I _{OUT} =-1.0mA		Vcc - 0.6			V		
Receiver Threshold to Transmitter Enabled		twu	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)

1 55		<u> </u>	((((()))))	-	1			
PARAMETER		SYMBOL	TEST CON	DITIONS	MIN	TYP	MAX	UNIT
Receiver Positive or	High	t _{IN∨H}				1.0		μs
Negative Threshold to	Low	tinvl	Fig.2			30		us
								•
		\/			25	1	25	V
Input voltage Range		V RR		V 0.0V/	-25	1.0	25	v
Input Threshold Low		V _{RINL}	T _A =25°C	$V_{CC}=3.3V$	0.6	1.2		V
				V(0.0	1.5	24	
Input Threshold High		V _{RINH}	T _A =25°C	$V_{CC} = 5.3V$		1.0	2.4	V
Input Hysteresis				VCC-3.0V		0.5	2.4	V
Input Resistance			T₄=25°C		3	5	7	k0
	г	V RINKES	TA-20 0		0	Ū	'	1132
Output Voltage Swing VTOUTSW The transmitter output loaded with		t loaded with 3 kΩ to	±5.0	±5.4		v		
Jutput Resistance $V_{TOUTRES}$ V_{CC} = V+=V-=0V, Transmitter output=±2V		300	10M		Ω			
Output Short-Circuit Curr	ent	I _{TSC}				±35	±60	mA
Output Leakage Current		Itout(lk)	Vcc=3.0V~5.0V, Vouт=±12V, Transmitter disabled				±25	μA
TIMING CHARACTERIS	TICS	•						
Maximum Data Rate		DR	R∟=3kΩ, C∟=1000pF switching	, one transmitter	250			kbps
		t _{PHL}	Receiver input to	receiver output,		0.15		
Receiver Propagation De	lay	t PLH	C∟=150pF			0.15		μs
	Enable	t _{R(EN)}				200		ns
Receiver Output Time	Disable	t _{R(DIS)}	Normal operation			200		ns
Transmitter Skew		tтs	tphl — tplh			100		ns
Receiver Skew		t _{RS}	tphl – tplh			50		ns
Transition-Region Slew F	Rate	SR	$V_{CC}=3.3V, T_A=25^{\circ}C,$ $R_L=3k\Omega\sim7k\Omega,$ measured from +3V $\sim -3V$ or -3V \sim +3V	C∟=150pF~1000pF	4		35	V/µs

Notes: 1. Typical values are at $T_A=25^{\circ}C$.

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



DETAILED DESCRIPTION

Charge-Pump Voltage Converter

The UTC **UT3221/E** 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 Transmitter

UTC **UT3221/E**'s transmitter is 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 $3k\Omega$ in parallel with 1000pF, providing compatibility with PC-to-PC communication software.

Transmitter can be paralleled to drive multiple receiver or mouse. When FORCEOFF is driven to ground, or shutdown circuitry senses invalid voltage levels at the receiver input, the transmitter is disabled and the output is forced into a high-impedance state.

RS-232 Receiver

The UTC **UT3221/E**'s receiver convert RS-232 signals to CMOS-logic output levels. The receiver has one inverting three-state output. In shutdown or in autoshutdown, the **UT3221/E**'s receiver is active. Drive \overline{EN} high to place the receiver in a high-impedance state.

	Table 1.	ΕN	Control	Truth	Table
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ĒN	R_OUT
0	Active
1	High-Z

Shutdown Function(UT3221E)

Supply current falls to less than 1µA in shutdown mode ($\overline{\text{FORCEOFF}}$ = 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). Connect $\overline{\text{FORCEOFF}}$ to VCC if shutdown mode is not used. $\overline{\text{FORCEOFF}}$ has no effect on R_OUT.

Shutdown Function(UT3221)

A 1 μ A supply current is achieved with shutdown feature, which operates when FORCEON is low and FORCEOFF is high. When the UTC **UT3221** senses no valid signal levels on the receiver input for 30 μ s, the on-board power supply and driver is shut off, reducing supply current to 1 μ A. This occurs if the RS-232 cable is disconnected or the connected peripheral transmitter is turned off. The system turns on again when a valid level is applied to RS-232 receiver input. As a result, the system saves power without changes to the existing BIOS or operating system. INVALID indicates the receiver input' condition, when using shutdown function, the INVALID output is high when the device is on and low when the device is shut down.

OPERATION STATUS	FORCEOFF	FORCEON INPUT	INVALID OUTPUT	T_OUT
Normal Operation (Forced On)	Н	Н	Х	Active
Normal Operation (AutoShutdown)	Н	L	Н	Active
Normal Operation (AutoShutdown)	Н	L	L	High-Z
Shutdown (Forced Off)	L	Х	Х	High-Z

Table 2. Shutdown Logic Control Truth Table



■ DETAILED DESCRIPTION (Cont.)

Table 2 summarizes the UTC **UT3221** operating modes. FORCEON and FORCEOFF override the automatic circuitry and force the transmitter 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 **UT3221**'s charge pumps are turned off, V+ decays to V_{CC} , V- decays to ground, the transmitter output is disabled (high impedance). The time required to exit shutdown is typically 100 μ s.







TYPICAL APPLICATION CIRCUIT





TYPICAL APPLICATION CIRCUIT (Cont.)



Fig.3 Application Circuit

Vcc (V)	C1 (µF)	C2, C3, C4 (µF)	CBYPASS (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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