



UT3227

Preliminary

CMOS IC

+3.0V TO +5.5V POWER SUPPLY, 1MBPS, RS-232 LINE DRIVER/RECEIVER

DESCRIPTION

The UTC **UT3227** 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 1Mbps for high speed applications such as communicating with ISDN modems.

The UTC **UT3227** achieves 1µA supply current in shutdown condition. The UTC **UT3227** automatically enter a low-power shutdown mode when the RS-232 cable is disconnected or the transmitters of the connected peripherals are inactive, and the UART driving the transmitter inputs is inactive for more than 30 seconds. The UTC **UT3227** turn on again when they sense a valid transition at any transmitter or receiver input.

The UTC **UT3227** 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.

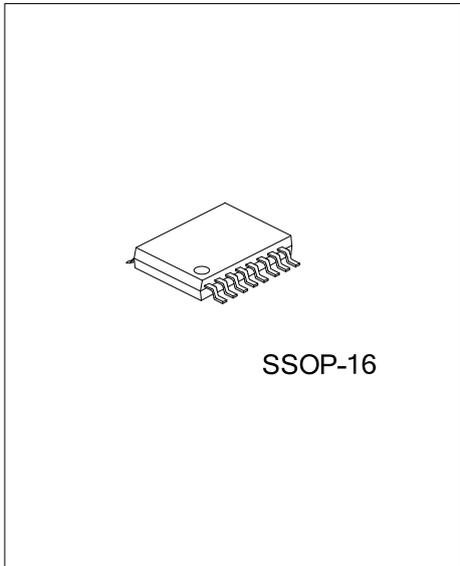
FEATURES

- * Operates With 3.0V to 5.5V Power Supply
- * One Driver and one Receiver
- * Operates Up To 1Mbps
- * Designed to Transmit at a Data Rate of 1Mbps
- * 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

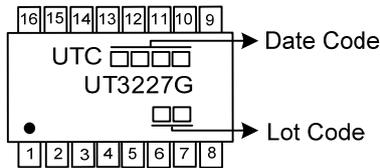
ORDERING INFORMATION

Ordering Number	Package	Packing
UT3227G-R16-R	SSOP-16	Tape Reel

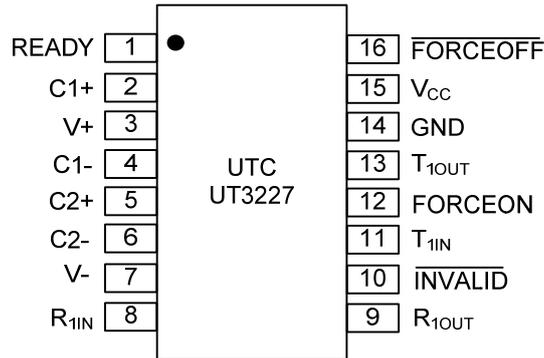
<p>UT3227G-R16-R</p> <p>(1)Packing Type (2)Package Type (3)Green Package</p>	<p>(1) R: Tape Reel (2) R16: SSOP-16 (3) G: Halogen Free and Lead Free</p>
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MARKING



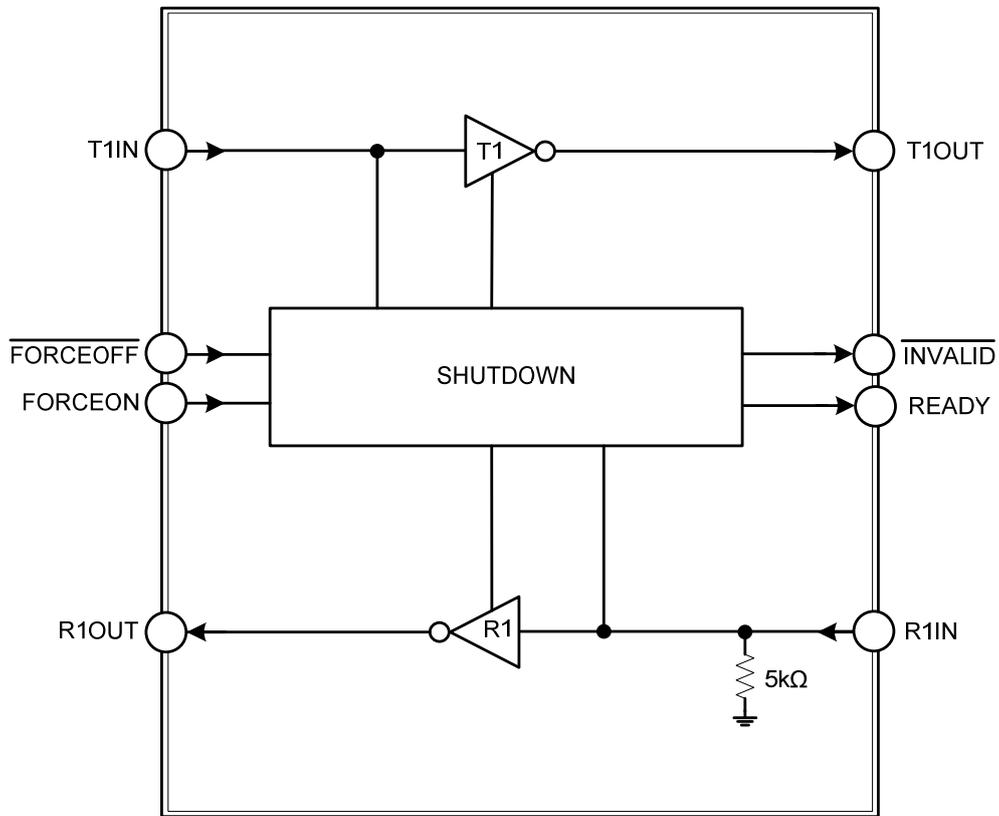
PIN CONFIGURATION



PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	READY	Ready to Transmit Output, Active High. READY is enabled high when V- goes below -4V and the device is ready to transmit.
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	R _{1IN}	RS-232 Receiver Input.
9	R _{1OUT}	TTL/CMOS Receiver Output.
10	INVALID	Output of the valid signal detector. Indicates if a valid RS-232 level is present on receiver inputs logic "1".
11	T _{1IN}	TTL/CMOS Transmitter Input.
12	FORCEON	Drive high to override automatic circuitry keeping transmitters on ($\overline{\text{FORCEOFF}}$ must be high) (Table 2).
13	T _{1OUT}	RS-232 Transmitter Output.
14	GND	Ground.
15	V _{CC}	+3.0V ~ +5.5V Supply Voltage.
16	$\overline{\text{FORCEOFF}}$	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}	+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	T1IN, FORCEOFF, FORCEON	V _{IN}	+6.0	V
	R1IN		±25	V
Output Voltages	T1OUT	V _{OUT}	±13.2	V
	R1OUT, INVALID, READY		V _{CC}	V
Short-Circuit Duration	T1OUT	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	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	2.0	mA	
LOGIC INPUTS								
Input Logic Threshold	Low	V _{LGL}	T1IN, FORCEON, FORCEOFF			0.8	V	
	High	V _{LGH}	T1IN, FORCEON, FORCEOFF	V _{CC} = 3.3V V _{CC} = 5.0V	2.0 2.4		V	
Input Leakage Current		I _{IN(LK)}	T1IN, 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 _{ROU_TL}	I _{OUT} = 1.6mA			0.4	V	
	High	V _{ROU_TH}	I _{OUT} = -1.0mA	V _{CC} - 0.6	V _{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	
	Disabled	V _{R(DIS)}	1µA supply current, Fig.1	Negative threshold	-2.7		V	
INVALID, READY 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 or Transmitter Edge to Transmitters Enabled		t _{WU}	Fig.2		100		µs	
Receiver or Transmitter Edge to Transmitters Shutdown		t _{AUTOSHDN}	Fig.2		15	30	60	s

■ 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} =0 or 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	
			V _{CC} =3.0V to 4.5V, R _L =3kΩ, C _L =250pF, one transmitter switching	1000			kbps	
			V _{CC} =4.5V to 5.5V, R _L =3kΩ, C _L =250pF, one transmitter switching	1000			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	Normal operation		200		ns	
		Disable			200			
Transmitter Skew		t _{TS}	t _{PHL} - t _{PLH}		25		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 =150pF~1000pF	10	150	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 **UT3227** 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 **UT3227**'s transmitter is inverting level translators that convert CMOS-logic levels to 5.0V EIA/TIA-232 levels. They guarantee a 1Mbps data rate with worst-case loads of 3k Ω in parallel with 1000pF, providing compatibility with PC-to-PC communication software.

Transmitter 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 receiver input, the transmitter is disabled and the output are forced into a high-impedance state.

RS-232 Receiver

The UTC **UT3227**'s receiver convert RS-232 signals to CMOS-logic output levels. The receiver has one inverting three-state output. In shutdown or in autosutdown, the **UT3227**'s receiver is active.

The UTC **UT3227** features an $\overline{\text{INVALID}}$ output that is enabled low when no valid RS-232 voltage levels have been detected on receiver input. Because $\overline{\text{INVALID}}$ indicates the receiver input's condition, it is independent of FORCEON and FORCEOFF states

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

RS-232 SIGNAL PRESENT AT RECEIVER INPUT	$\overline{\text{INVALID}}$ OUTPUT
YES	High
NO	Low

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 **UT3227** do not sense a valid signal transition on any receiver and transmitter input for 30sec, the on-board charge pumps are shutdown, 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 transition is applied to any RS-232 receiver or transmitter input (Table 2). 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	Valid signal at Transmitter or Receiver	T1OUT
Normal Operation (AutoShutdown Disable)	H	H	X	Active
Normal Operation (AutoShutdown)	H	L	YES	Active
Normal Operation (AutoShutdown)	H	L	NO	High-Z
Shutdown	L	X	X	High-Z

■ DETAILED DESCRIPTION (Cont.)

Figure 1 depicts valid and invalid RS-232 receiver voltage levels. INVALID indicates the receiver input's condition, and is independent of FORCEON and FORCEOFF states.

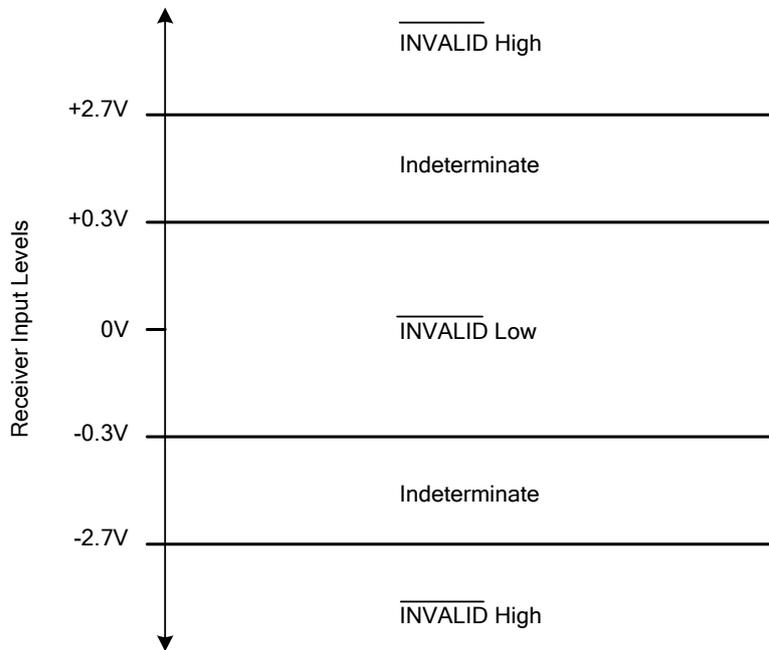


Fig.1 Shutdown Input Levels

When shutdown, the UTC **UT3227**'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 100μs.

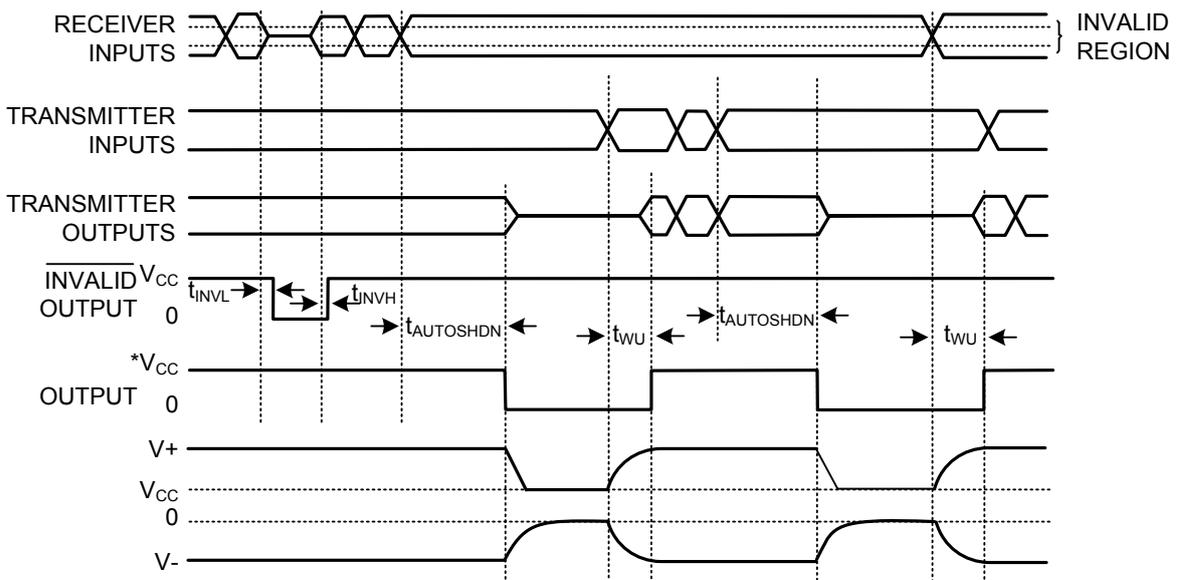


Fig.2 Shutdown Input Timing

■ TYPICAL APPLICATION CIRCUIT

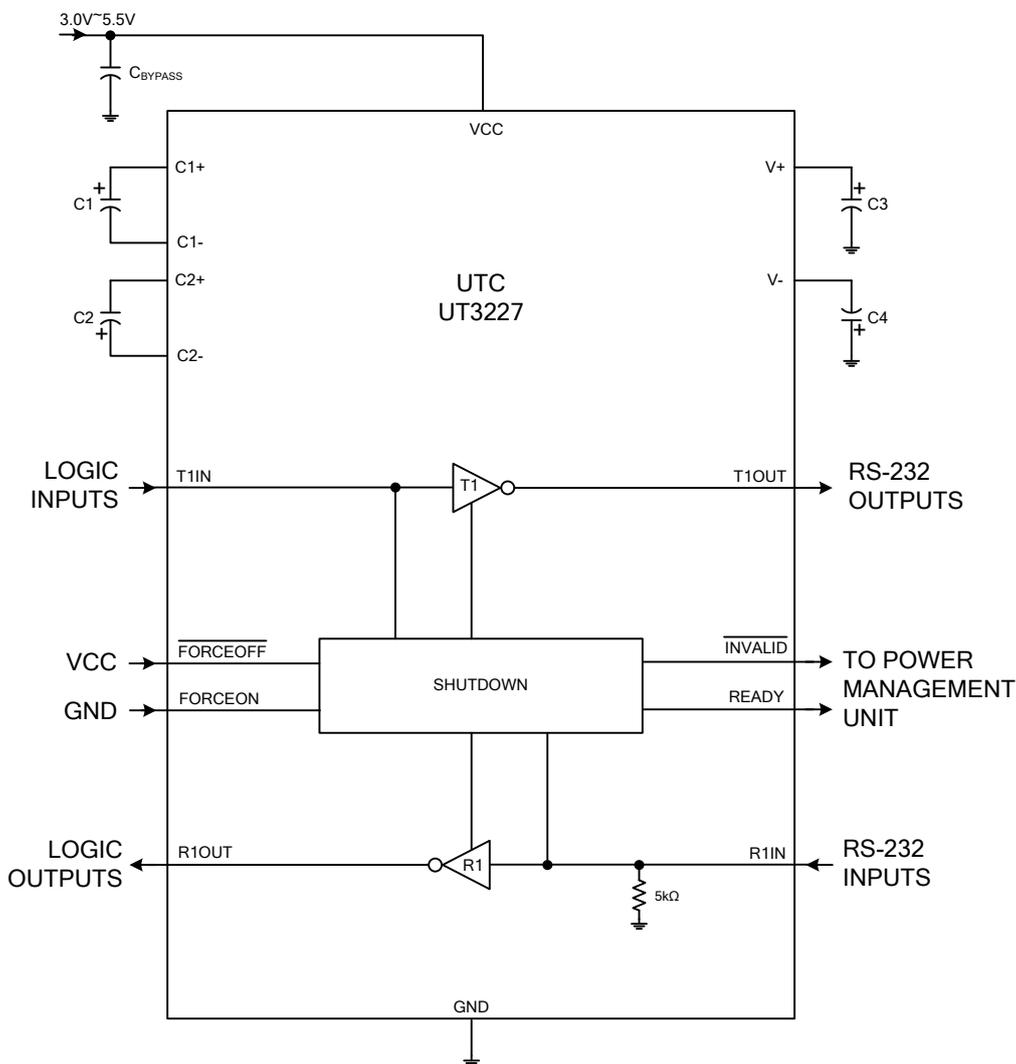


Fig.3 Application Circuit

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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