

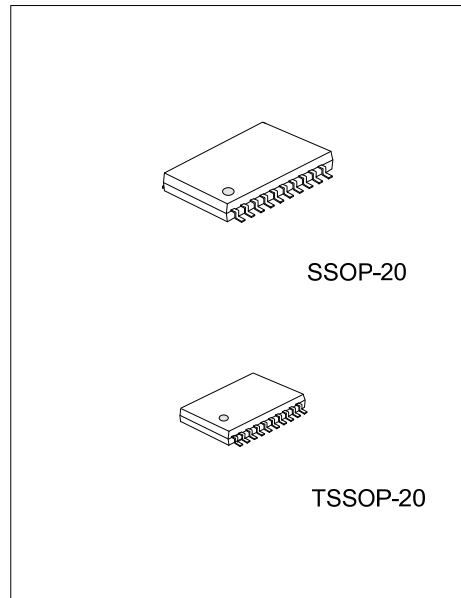


## UT3223

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 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

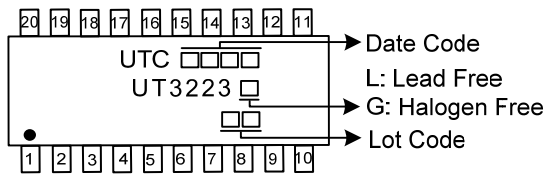
- \* Operates With 3.0V~5.5V Power Supply
- \* Two Drivers and Two Receivers
- \* Operates Up To 250 kbps
- \* Designed to Transmit at a Data Rate of 250 kbps
- \* Low Standby Current (1μA Typical)
- \* External Capacitors (4\*0.1μF)
- \* Accepts 5.0V Logic Input With 3.3V Supply
- \* Serial-Mouse Drivability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

#### ORDERING INFORMATION

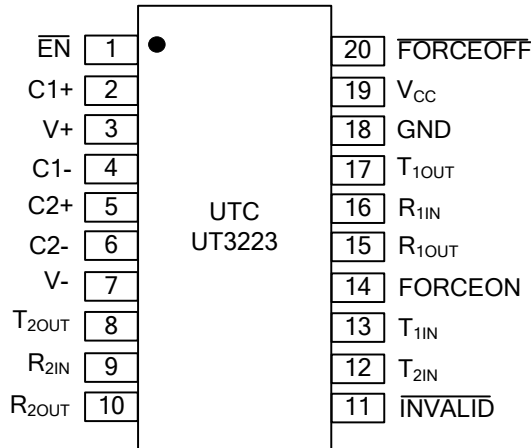
Ordering Number		Package	Packing
Lead Free	Halogen Free		
UT3223L-R20-R	UT3223G-R20-R	SSOP-20	Tape Reel
UT3223L-P20-R	UT3223G-P20-R	TSSOP-20	Tape Reel

<p>UT3223G-R20-R</p> <ul style="list-style-type: none"> <li>(1)Packing Type</li> <li>(2)Package Type</li> <li>(3)Green Package</li> </ul>	<ul style="list-style-type: none"> <li>(1) R: Tape Reel</li> <li>(2) R20: SSOP-20, P20: TSSOP-20</li> <li>(3) G: Halogen-Free and Lead Free, L: Lead Free</li> </ul>
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### MARKING



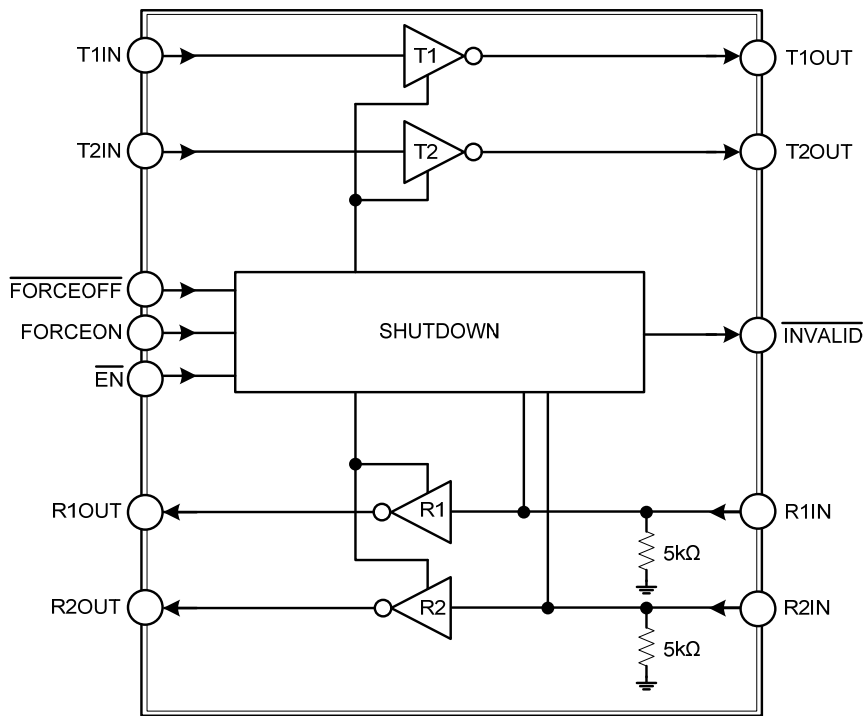
### PIN CONFIGURATION



### 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 <sub>2OUT</sub>	RS-232 Transmitter 2 Output.
9	R <sub>2IN</sub>	RS-232 Receiver 2 Input.
10	R <sub>2OUT</sub>	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 <sub>2IN</sub>	TTL/CMOS Transmitter 2 Input.
13	T <sub>1IN</sub>	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 <sub>1OUT</sub>	TTL/CMOS Receiver 1 Output.
16	R <sub>1IN</sub>	RS-232 Receiver 1 Input.
17	T <sub>1OUT</sub>	RS-232 Transmitter 1 Output.
18	GND	Ground.
19	V <sub>CC</sub>	+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



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### ■ ABSOLUTE MAXIMUM RATING

PARAMETER		SYMBOL	RATINGS	UNIT
V <sub>CC</sub>		V <sub>CC</sub>	-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 <sub>PUMP</sub>	+13.0	V
Input Voltages	T_IN, $\overline{\text{FORCEOFF}}$ , $\overline{\text{FORCEON}}$ , $\overline{\text{EN}}$	V <sub>IN</sub>	-0.3 ~ +6.0	V
	R_IN		±25	V
Output Voltages	T_OUT	V <sub>OUT</sub>	±13.2	V
	R_OUT, $\overline{\text{INVALID}}$		-0.3 ~ (V <sub>CC</sub> +0.3)	V
Short-Circuit Duration	T_OUT	SC	Continuous	
Power Dissipation(T <sub>A</sub> =25°C)		P <sub>D</sub>	870	mW
Operating Temperature		T <sub>OPR</sub>	-40 ~ +85	°C
Storage Temperature		T <sub>STG</sub>	-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<sub>CC</sub>=+3.0V~+5.5V, C1~C4=0.1μF (Note 2), T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>DC CHARACTERISTICS</b>							
Supply Current, Shutdown	I <sub>SHDN</sub>	V <sub>CC</sub> =3.3V or 5.0V, T <sub>A</sub> = 25°C	All R_IN open, $\overline{\text{FORCEOFF}} = \text{V}_{\text{CC}}$ , $\overline{\text{FORCEON}} = \text{GND}$		1.0	10	μA
			$\overline{\text{FORCEOFF}} = \text{GND}$ , All R_IN=GND		1.0	10	μA
Supply Current, Shutdown Disabled	I <sub>CC</sub>		$\overline{\text{FORCEON}} = \overline{\text{FORCEOFF}} = \text{V}_{\text{CC}}$ , no load		0.3	1.0	mA
<b>LOGIC INPUTS</b>							
Input Logic Threshold	Low	V <sub>LGL</sub>	$\overline{\text{EN}}$ , T_IN, FORCEON, $\overline{\text{FORCEOFF}}$			0.8	V
	High	V <sub>LGH</sub>	$\overline{\text{EN}}$ , T_IN, EN, FORCEON, $\overline{\text{FORCEOFF}}$	V <sub>CC</sub> = 3.3V V <sub>CC</sub> = 5.0V	2.0 2.4		V
Input Leakage Current	I <sub>IN(LK)</sub>		T_IN, $\overline{\text{EN}}$ , FORCEON, $\overline{\text{FORCEOFF}}$		±0.01	±1.0	μA
<b>RECEIVER OUTPUTS</b>							
Output Leakage Current	I <sub>ROUT(LK)</sub>		Receivers disabled		±0.05	±10	μA
Output Voltage	Low	V <sub>ROUTL</sub>	I <sub>OUT</sub> = 1.6mA			0.4	V
	High	V <sub>ROUTH</sub>	I <sub>OUT</sub> = -1.0mA	V <sub>CC</sub> - 0.6	V <sub>CC</sub> - 0.1		V
<b>AUTOSHUTDOWN</b> (FORCEON=GND, $\overline{\text{FORCEOFF}} = \text{V}_{\text{CC}}$ )							
Receiver Input Thresholds to Transmitters	Enabled	V <sub>R(EN)</sub>	Fig.1	Positive threshold		2.7	V
	Disabled	V <sub>R(DIS)</sub>	1μA supply current, Fig.1	Negative threshold	-2.7		
$\overline{\text{INVALID}}$ Output Voltage	Low	V <sub>INVL</sub>	I <sub>OUT</sub> =1.6mA		-0.3	0.3	V
	High	V <sub>INVH</sub>	I <sub>OUT</sub> =-1.0mA		V <sub>CC</sub> - 0.6		V
Receiver Threshold to Transmitters Enabled	t <sub>WU</sub>		Fig.2		100		μs

■ ELECTRICAL CHARACTERISTICS(Cont.)

(V<sub>CC</sub>=+3.0V~+5.5V, C1~C4=0.1μF (Note 2), T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, Unless Otherwise Specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
Receiver Positive or Negative Threshold to INVALID	High	t <sub>INVH</sub>	Fig.2		1.0		μs	
	Low	t <sub>INVL</sub>			30		μs	
<b>RECEIVER INPUTS</b>								
Input Voltage Range		V <sub>RR</sub>		-25		25	V	
Input Threshold Low		V <sub>RINL</sub>	T <sub>A</sub> =25°C	V <sub>CC</sub> =3.3V	0.6	1.2	V	
				V <sub>CC</sub> =5.0V	0.8	1.5		
Input Threshold High		V <sub>RINH</sub>	T <sub>A</sub> =25°C	V <sub>CC</sub> =3.3V		1.5	2.4	V
				V <sub>CC</sub> =5.0V		1.8	2.7	
Input Hysteresis		V <sub>RINHYS</sub>			0.5		V	
Input Resistance		V <sub>RINRES</sub>	T <sub>A</sub> =25°C	3	5	7	kΩ	
<b>TRANSMITTER OUTPUTS</b>								
Output Voltage Swing		V <sub>TOUTSW</sub>	All transmitter outputs loaded with 3kΩ to ground	±5.0	±5.4		V	
Output Resistance		V <sub>TOUTRES</sub>	V <sub>CC</sub> = V+=V-=0V, Transmitter output=±2V	300	10M		Ω	
Output Short-Circuit Current		I <sub>TSC</sub>			±35	±60	mA	
Output Leakage Current		I <sub>TOUT(LK)</sub>	V <sub>CC</sub> =3.0V~5.0V, V <sub>OUT</sub> =±12V, Transmitters disabled			±25	μA	
<b>TIMING CHARACTERISTICS</b>								
Maximum Data Rate		DR	R <sub>L</sub> =3kΩ, C <sub>L</sub> =1000pF, one transmitter switching	250			kbps	
Receiver Propagation Delay		t <sub>PHL</sub>	Receiver input to receiver output, C <sub>L</sub> =150pF		0.15		μs	
		t <sub>PLH</sub>			0.15			
Receiver Output Time	Enable	t <sub>R(EN)</sub>	Normal operation		200		ns	
	Disable	t <sub>R(DIS)</sub>			200			
Transmitter Skew		t <sub>TS</sub>	t <sub>PHL</sub> - t <sub>PLH</sub>		100		ns	
Receiver Skew		t <sub>RS</sub>	t <sub>PHL</sub> - t <sub>PLH</sub>		50		ns	
Transition-Region Slew Rate		SR	V <sub>CC</sub> =3.3V, T <sub>A</sub> =25°C, R <sub>L</sub> =3kΩ~7kΩ, measured from +3V ~ -3V or -3V~+3V	C <sub>L</sub> =220pF~1000pF	5	35	V/μs	

Notes: 1. Typical values are at T<sub>A</sub>=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 $\Omega$  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 autosutdown, 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 $\mu$ 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 $\mu$ s, the on-board power supply and drivers are shut off, reducing supply current to 1 $\mu$ 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. FORCEON and 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.

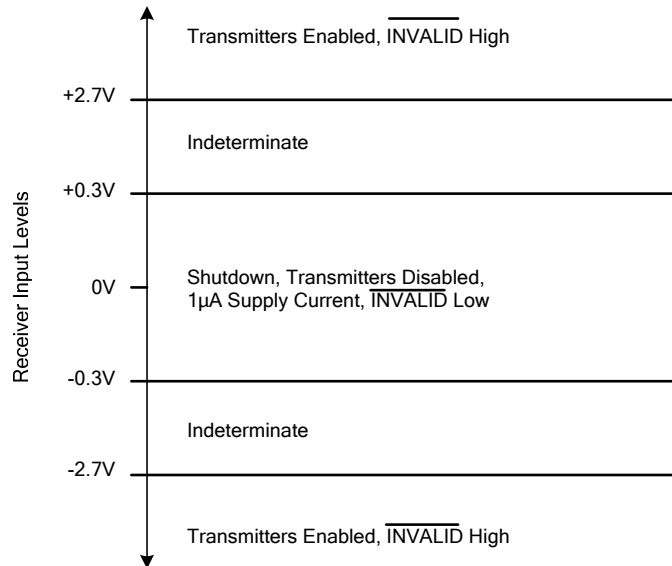


Fig.1 Shutdown Input Levels

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

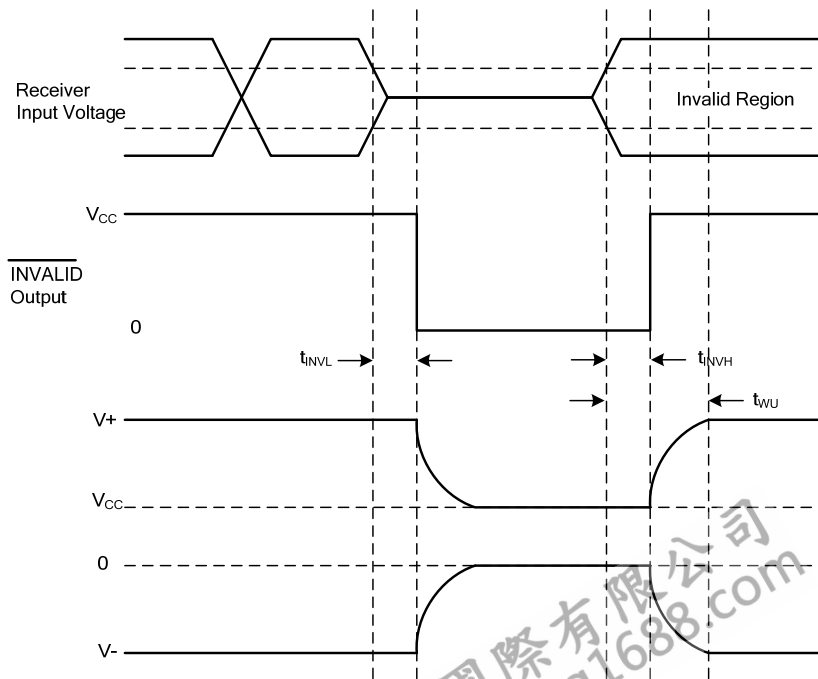


Fig.2 Shutdown Input Timing

■ TYPICAL APPLICATION CIRCUIT

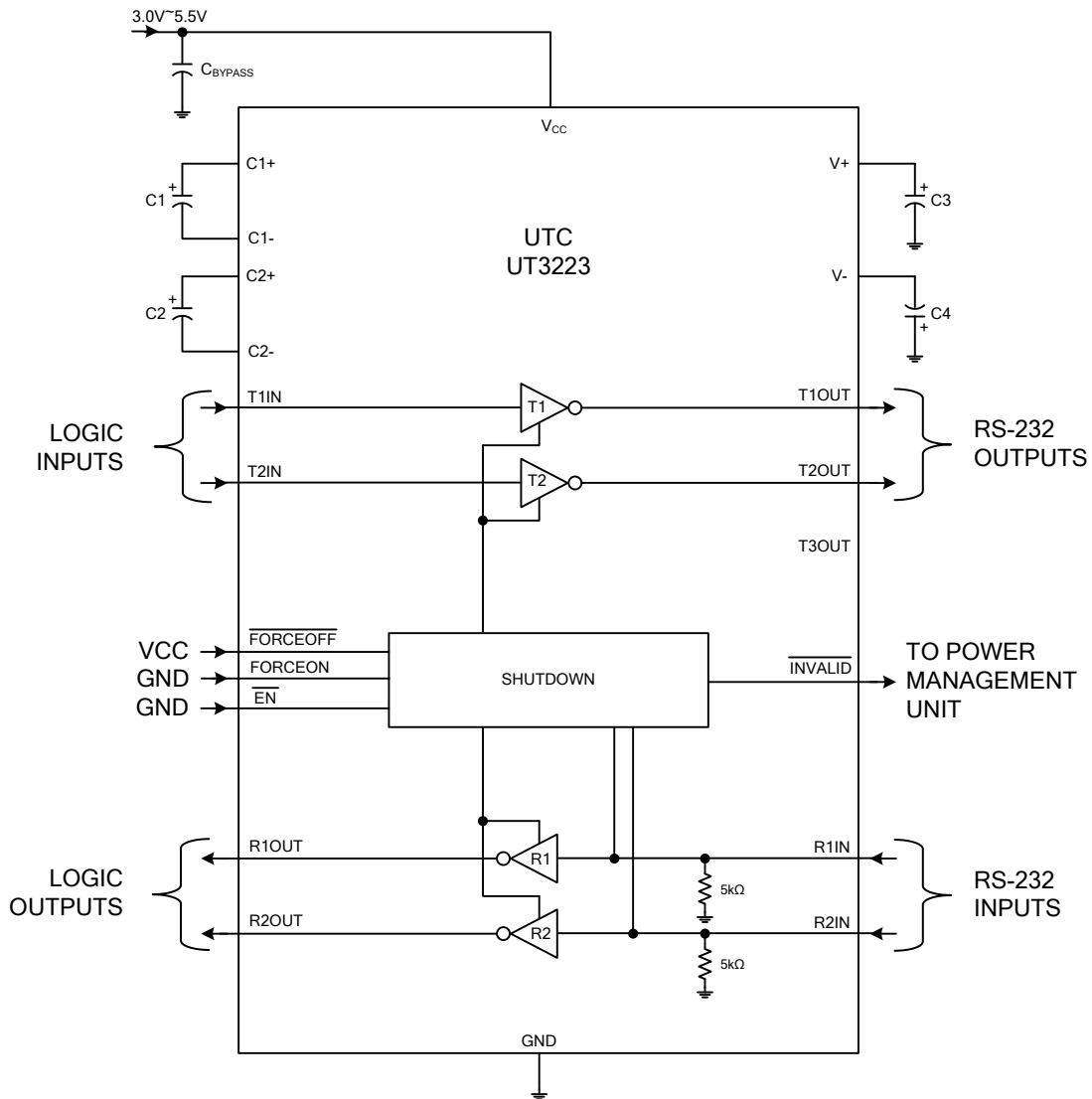


Fig.3 Application Circuit

Table 3. Required Capacitor Value

V <sub>CC</sub> (V)	C1 (μF)	C2, C3, C4 (μF)	C <sub>BYPASS</sub> (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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