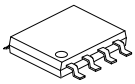
FAIL-SAFE, 1.0MBPS, RS-485 / RS-422 TRANSCEIVERS WITH ±15KV ESD-PROTECTED



SOP-8

■ DESCRIPTION

The UTC **UTRS3088** is a half-duplex transceiver designed for RS-485 data bus network, which contains one transmitter and one receiver. The UTC **UTRS3088** features a fail-safe receiver, which guarantees the receiver to output high when the receiver inputs are open, short or idle.

The UTC **UTRS3088** also features a hot-swap glitch free protection circuits which guarantee outputs of both the transmitter and the receiver in a high impedance state during the power up period. So that the large short current from power to ground will be disable by glitch free function, which will save the power and enhance the efficiency of the power up.

The UTC **UTRS3088** is optimized for signal rates up to 1.0Mbps with differential voltage of 2.3V. The UTC **UTRS3088** also has the thermal shutdown function when the temperature is over 150℃ and the protection of the current limitation in the transmitter to protect the itself from the damage by the system-fault conditions during normal operation.

■ FEATURES

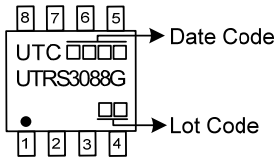
* Meet the requirements of the EIA/TIA-485 standards.
* 5.0V single power supply.
* 1μA low-current shutdown mode.
* HBM ±15kV ESD protection.
* True fail-safe receiver while maintaining EIA/TIA-485 compatibility.
* Hot-Swap glitch free protection on control inputs.
* Up to 256 transceivers on the bus.
* Maximum baud rate up to 1.0Mbps.
* Transmitter short circuit current limit.
* Thermal shutdown for overload protection.

■ ORDERING INFORMATION

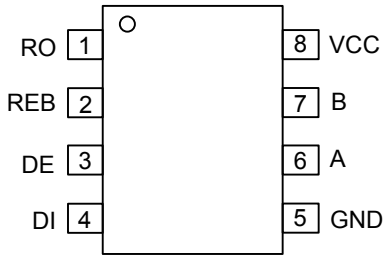
Ordering Number	Package	Packing
UTRS3088G-S08-R	SOP-8	Tape Reel

UTRS3088G-S08-R (1)Packing Type (2)Package Type (3)Green Package	(1) R: Tape Reel (2) S08: SOP-8 (3) G: Halogen Free and Lead Free

■ MARKING



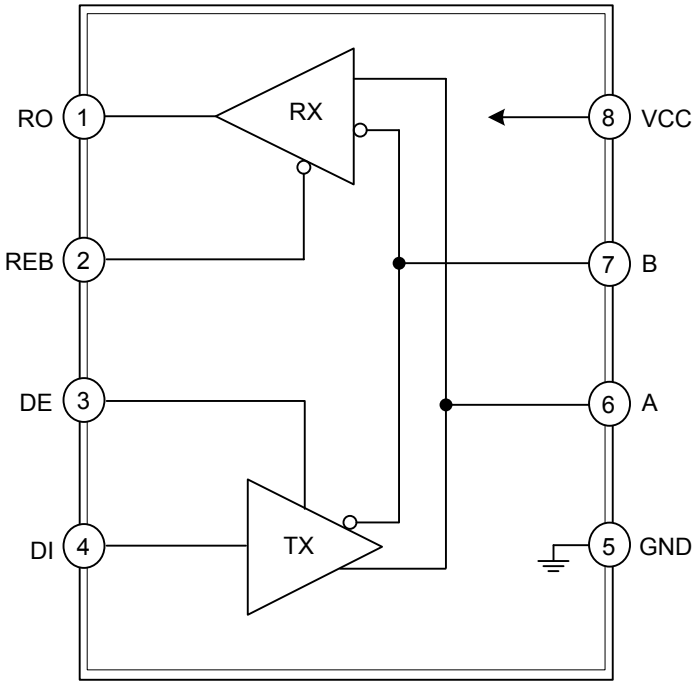
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	RO	Receiver Output: When REB is low and if (A-B) ≥ -50mV, RO is high; if (A-B) ≤ -200mV, RO is low.
2	REB	Receiver Output Enable: REB is low to enable the Receiver; REB is high to disable the Receiver.
3	DE	Transmitter Output Enable: DE is high to enable the transmitter; DE is low to disable the transmitter.
4	DI	Transmitter Input: When DE is high, a low on DI forces A output low and B output high. Similarly, a high on DI forces A output high and B output low.
5	GND	Ground pin. Must be connected to 0V.
6	A	Non-inverting Receiver Input and Non-inverting Transmitter Output
7	B	Inverting Receiver Input and Inverting Transmitter Output
8	VCC	Power Supply Input 5.0V.

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
Power Supply V_{CC}	V_{CC}	-0.3~8.0	V
Control Input Voltage	REB, DE	-0.3~ (V_{CC}+0.3)	V
Receiver Input Voltage	A, B	±13	V
Receiver Output Voltage	RO	-0.3~ (V_{CC}+0.3)	V
Transmitter Output Voltage	A, B	±13	V
Transmitter Input	DI	-0.3~ (V_{CC}+0.3)	V
Operating Temperature	T_{OP}	-40~+85	°C
Storage Temperature	T_{STG}	-65~+150	°C

Note: 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.

■ DC ELECTRICAL CHARACTERISTICS

(V_{CC}=5.0V ±5% with T_A= T_{MIN} to T_{MAX}, , unless otherwise specified. Typical values are at V_{CC}=5.0V and T_{AMB}=25°C.)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
TRANSMITTER							
Differential Transmitter Output	V_{OD1}	No Load				5.0	V
Differential Transmitter Output	V_{OD2}	Fig.1, R_L=27Ω		1.5			V
Change in Magnitude of Differential Output Voltage	ΔV_{OD}	Fig.1, R_L=27Ω				0.2	V
Transmitter Common- Mode Output Voltage	V_{OC}	Fig.1, R_L=27Ω				3.0	V
Change in Magnitude of Common- Mode Voltage	ΔV_{OC}	Fig.1, R_L=27Ω				0.2	V
Input High Voltage	V_{IH}	DE, DI, REB		2.0			V
Input Low Voltage	V_{IL}	DE, DI, REB				0.8	V
Input Current	I_{IN1}	DI				±1	μA
Input Current	I_{IN2}	DE, REB				±50	μA
DI Input Hysteresis	V_{HYS}				100		mV
Input Current (A and B)	I_{IN3}	DE=GND, VCC=GND or 5.25V	V_{IN}=12V			125	μA
			V_{IN}=-7V			-75	μA
Transmitter Short-Circuit Output Current	I_{OS}	-7V≤V_{OUT}≤V_{CC}		-250			mA
		0V≤V_{OUT}≤12V				250	mA
RECEIVER							
Receiver Differential Threshold Voltage	V_{TH}	-7V≤V_{CM}≤+12V		-200	-125	-50	mV
Receiver Input Hysteresis	ΔV_{TH}				25		mV
Receiver Output High Voltage	V_{OH}	I_O=-4mA, V_{ID}=-50mV		V_{CC}-1.5			V
Receiver Output Low Voltage	V_{OL}	I_O=4mA, V_{ID}=-200mV				0.5	V
Three- State Output Current at Receiver	I_{OZR}	0.4V≤V_{CM}≤2.4V				±1	μA
Receiver Input Resistance	R_{IN}	-7V≤V_{CM}≤+12V		96			kΩ
Receiver Output Short-Circuit Current	I_{OSR}	Fig.6 , 0V≤V_{RO}≤VCC		±7		±95	mA
SUPPLY CURRENT							
Supply Current	I_{CC}	No Load, REB=GND, DI=VCC or GND.	DE=V_{CC}		420	600	μA
			DE=GND		320	500	μA
Supply Current in Shutdown Mode	I_{SHDN}	REB=V_{CC}, DE=GND			1.0	15	μA

■ SWITCHING CHARACTERISTICS

(V_{CC}=5.0V ±5% with T_A= T_{MIN} to T_{MAX}, unless otherwise specified. Typical values are at V_{CC}=5.0V and T_{AMB}=25°C.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Transmitter Input to Output	t_{DPLH}, t_{DPHL}	Fig.2 and 7, R_{DIFF}=54Ω, C_{L1}=C_{L2}= 100pF		70	200	ns
Transmitter Output Skew | t_{DPLH} - t_{DPHL} |	t_{DSKEW}	Fig.2 and 7, R_{DIFF}=54Ω, C_{L1}=C_{L2}= 100pF		10		ns
Transmitter Rise or Fall Time	t_{DF}, t_{DR}	Fig.2 and 7, R_{DIFF}=54Ω, C_{L1}=C_{L2}= 100pF		40	150	ns
Maximum Data Rate	f_{MAX}			1.0		Mbps
Transmitter Enable to Output Low	t_{DZL}	Fig.4 and 8, C_{DL}=100pF, S1 Closed			150	ns
Transmitter Enable to Output High	t_{DZH}	Fig.4 and 8, C_{DL}=100pF, S2 Closed			150	ns
Transmitter Disable Time from Low	t_{DLZ}	Fig.4 and 8, C_{DL}=15pF, S1 Closed			150	ns
Transmitter Disable Time from High	t_{DHZ}	Fig.4 and 8, C_{DL}=15pF, S2 Closed			150	ns
Receiver Input to Output	t_{RPLH}, t_{RPHL}	Fig.5 and 9 , $\|V_{ID}\|$≥2.0V; Rise and Fall Time of V_{ID}≤15ns		900	1200	ns
| t_{RPLH} – t_{RPHL} | Different Receiver Skew	t_{RSKD}	Fig.5 and 9 , $\|V_{ID}\|$≥2.0V; Rise and Fall Time of V_{ID}≤15ns		10		ns
Receiver Enable to Output Low	t_{RZL}	Fig.3 and 10, C_{RL}=100pF, S1 Closed		60	150	ns
Receiver Enable to Output High	t_{RZH}	Fig.3 and 10, C_{RL}=100pF, S2 Closed		60	150	ns
Receiver Disable Time from Low	t_{RLZ}	Fig.3 and 10, C_{RL}=100pF, S1 Closed		60	150	ns
Receiver Disable Time from High	t_{RHZ}	Fig.3 and 10, C_{RL}=100pF, S2 Closed		60	150	ns
Time to Shutdown	t_{SHDN}			500	1000	ns
Transmitter Enable from Shutdown to Output Low	$t_{DZL(SHDN)}$	Fig.4 and 8, C_{DL}=15pF, S1 Closed			2500	ns
Transmitter Enable from Shutdown to Output High	$t_{DZH(SHDN)}$	Fig.4 and 8, C_{DL}=15pF, S2 Closed			2500	ns
Receiver Enable from Shutdown to Output Low	$t_{RZL(SHDN)}$	Fig.3 and 10, C_{RL}=100pF, S1 Closed			3500	ns
Receiver Enable from Shutdown to Output High	$t_{RZH(SHDN)}$	Fig.3 and 10, C_{RL}=100pF, S2 Closed			3500	ns

■ FUNCTION TABLE

Table 1 TRANSMITTING

INPUTS			OUTPUTS	
REB	DE	DI	A	B
X	1	0	0	1
X	1	1	1	0
0	0	X	High-Z	High-Z
1	0	X	Shutdown	

Table 2 RECEIVING

INPUTS			OUTPUTS
REB	DE	A-B	RO
0	X	≥-0.05V	1
0	X	≤-0.2V	0
0	X	Open/Shorted	1
1	1	X	High-Z
1	0	Shutdown	

X = Don't care

Shutdown mode, driver and receiver outputs high impedance

■ TEST CIRCUIT

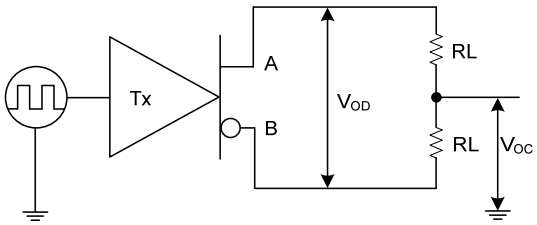


Fig. 1 Transmitter DC Test Circuit

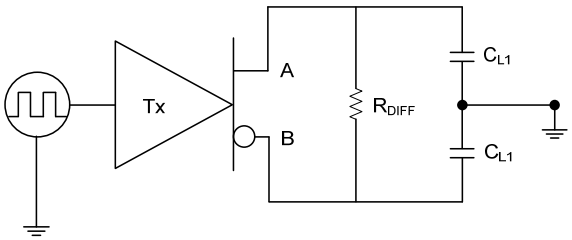


Fig. 2 Transmitter Timing Test Circuit

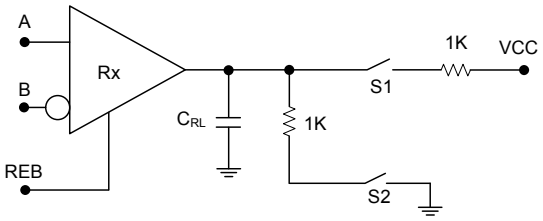


Fig. 3 Receiver Enable/Disable Timing Test Circuit

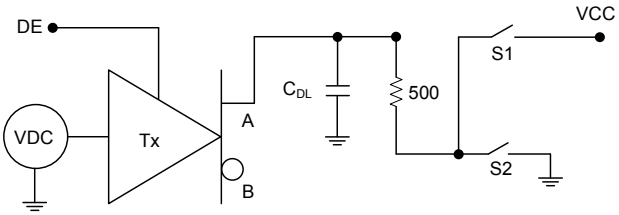


Fig. 4 Transmitter Enable/Disable Timing Test Circuit

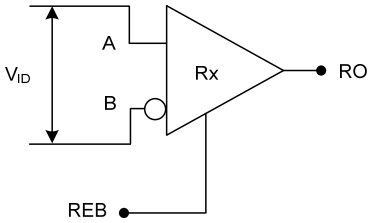


Fig. 5 Receiver Timing Test Circuit

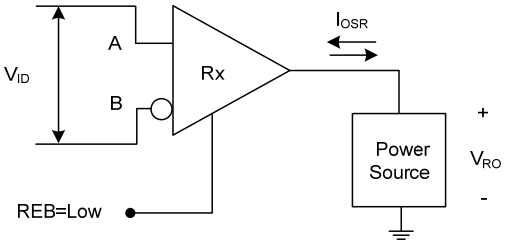


Fig. 6 Receiver Output Short Circuit

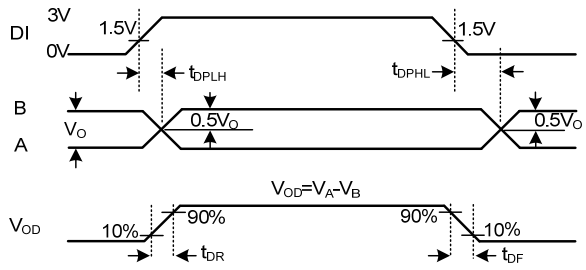


Fig. 7 Transmitter Propagation Delays

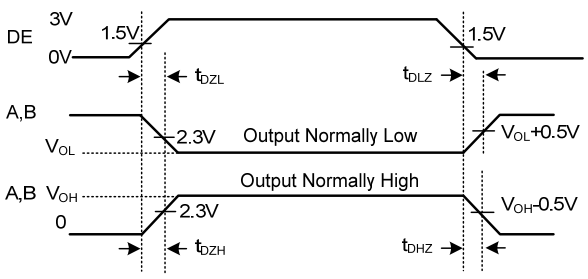


Fig. 8 Transmitter Enable and Disable Times

■ TEST CIRCUIT (Cont.)

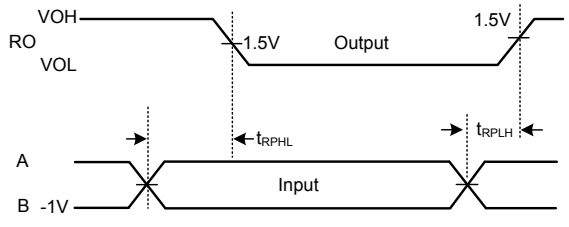


Fig. 9 Receiver Propagation Delays

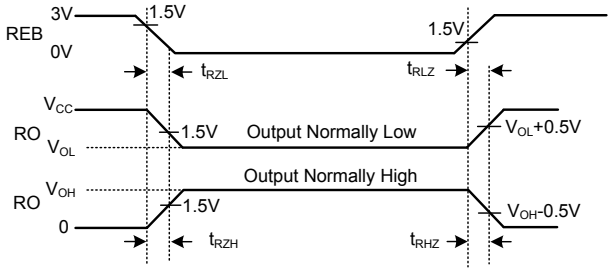


Fig. 10 Receiver Enable and Disable Times