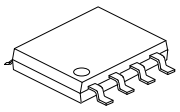
FAIL-SAFE, 500KBPS, RS-485 / RS-422 TRANSCEIVERS WITH ±15KV ESD-PROTECTED



SOP-8

■ DESCRIPTION

The UTC **UTRS458** is a Polarity-Free half-duplex transceiver designed for RS-485 data bus network, which contains one transmitter and one receiver. The UTC **UTRS458** features a fail-safe receiver, which guarantees the receiver to output high when the receiver inputs are open, short or idle.

The UTC **UTRS458** can automatically detect the polarity for A and B pins when pull-high for A and pull-low for B have been designed on the RS485 bus. The detection function is real-time monitored the bus polarity without any data flow on the RS485 bus.

The UTC **UTRS458** 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 **UTRS458** is optimized for signal rates up to 500Kbps with differential voltage of 2.3V. The UTC **UTRS458** also has the thermal shutdown function when the temperature is over 150°C 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 500Kbps.
* Transmitter short circuit current limit.
* Thermal shutdown for overload protection.
* Polarity-Free for RS485 bus pins.

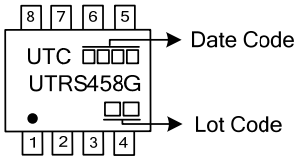
■ ORDERING INFORMATION

Ordering Number	Package	Packing
UTRS458G-S08-R	SOP-8	Tape Reel

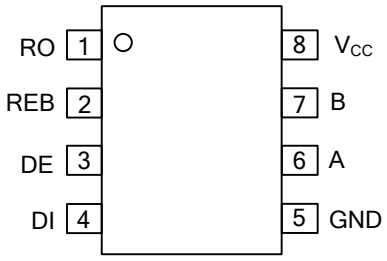
UTRS458G-S08-R

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

■ MARKING



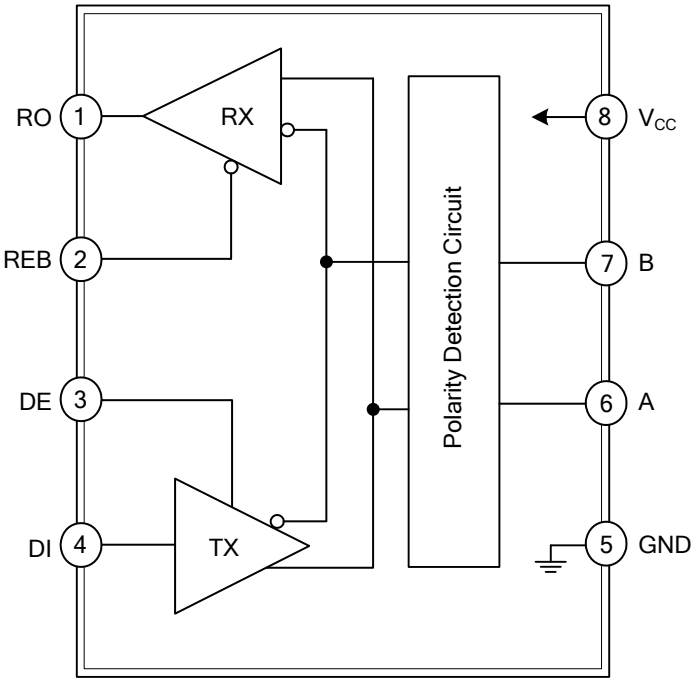
■ PIN CONFIGURATION



■ 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) ≤ -250mV, 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 An output low and B output high. Similarly, a high on DI forces An 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	V_{CC}	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 only stress ratings and it is not implied for functional device operation. Absolute maximum ratings are the values beyond which the device will be damaged permanently.

■ DC ELECTRICAL CHARACTERISTICS

(V_{CC}=5.0V ±5% with T_A=T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V_{CC}=5.0V and T_A=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, V_{CC}=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		-280	-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=V_{CC} 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	10	μA

■ SWITCHING CHARACTERISTICS

(V_{CC}=5.0V ±5% with T_A=T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V_{CC}=5.0V and T_A=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	50	720	900	ns
Transmitter Output Skew | t_{DPLH} - t_{DPHL} |	t_{DSKEW}	Fig.2 and 7, R_{DIFF}=54Ω, C_{L1}=C_{L2}= 100pF		3	±100	ns
Transmitter Rise or Fall Time	t_{DF}, t_{DR}	Fig.2 and 7, R_{DIFF}=54Ω, C_{L1}=C_{L2}= 100pF		530	750	ns
Maximum Data Rate	f_{MAX}		500			Kbps
Transmitter Enable to Output Low	t_{DZL}	Fig.4 and 8, C_{DL}=100pF, S1 Closed			2500	ns
Transmitter Enable to Output High	t_{DZH}	Fig.4 and 8, C_{DL}=100pF, S2 Closed			2500	ns
Transmitter Disable Time from Low	t_{DLZ}	Fig.4 and 8, C_{DL}=15pF, S1 Closed			300	ns
Transmitter Disable Time from High	t_{DHZ}	Fig.4 and 8, C_{DL}=15pF, S2 Closed			500	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			1500	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			500	ns
Receiver Enable to Output Low	t_{RZL}	Fig.3 and 10, C_{RL}=100pF, S1 Closed		50		ns
Receiver Enable to Output High	t_{RZH}	Fig.3 and 10, C_{RL}=100pF, S2 Closed		50		ns
Receiver Disable Time from Low	t_{RLZ}	Fig.3 and 10, C_{RL}=100pF, S1 Closed		50		ns
Receiver Disable Time from High	t_{RHZ}	Fig.3 and 10, C_{RL}=100pF, S2 Closed		50		ns
Time to Shutdown	t_{SHDN}			200		ns
Transmitter Enable from Shutdown to Output Low	$t_{DZL(SHDN)}$	Fig.4 and 8, C_{DL}=15pF, S1 Closed		3000		ns
Transmitter Enable from Shutdown to Output High	$t_{DZH(SHDN)}$	Fig.4 and 8, C_{DL}=15pF, S2 Closed		3000		ns
Receiver Enable from Shutdown to Output Low	$t_{RZL(SHDN)}$	Fig.3 and 10, C_{RL}=100pF, S1 Closed		200		ns
Receiver Enable from Shutdown to Output High	$t_{RZH(SHDN)}$	Fig.3 and 10, C_{RL}=100pF, S2 Closed		200		ns

■ FUNCTION TABLE

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	

RECEIVING

INPUTS			OUTPUT
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, transmitter and receiver outputs high impedance

■ TEST CIRCUIT

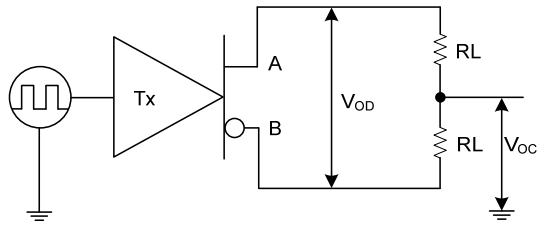


Fig. 1 Transmitter DC Test Circuit

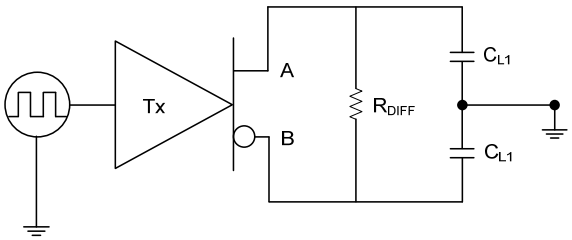


Fig. 2 Transmitter Timing Test Circuit

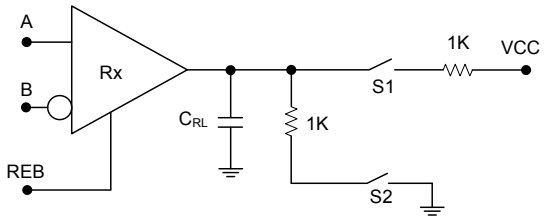


Fig. 3 Receiver Enable/Disable Timing Test Circuit

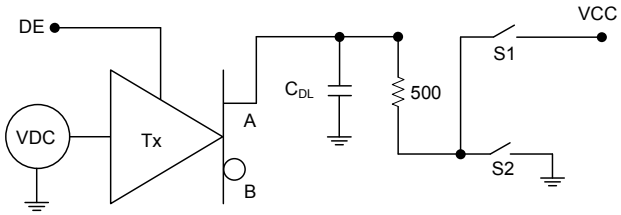


Fig. 4 Transmitter Enable/Disable Timing Test Circuit

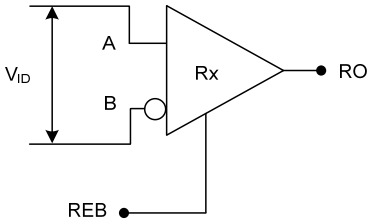


Fig. 5 Receiver Timing Test Circuit

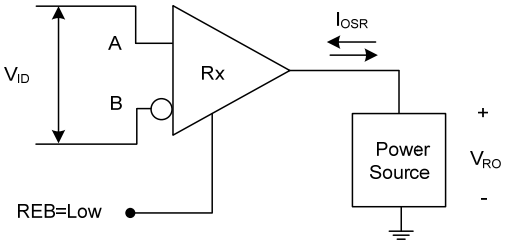


Fig. 6 Receiver Output Short Circuit

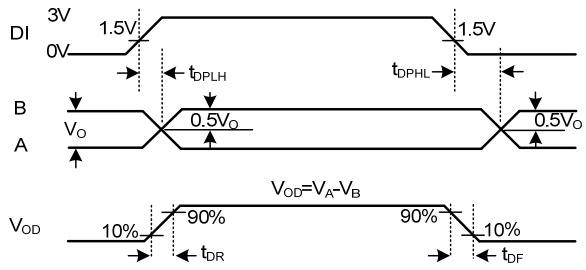


Fig. 7 Transmitter Propagation Delays

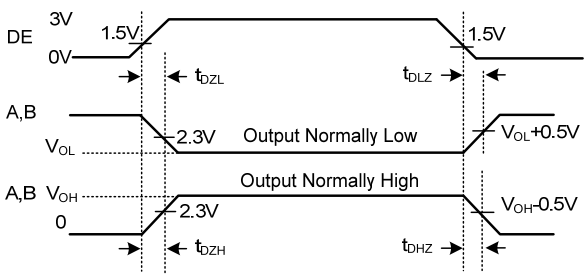


Fig. 8 Transmitter Enable and Disable Times

■ TEST CIRCUIT (Cont.)

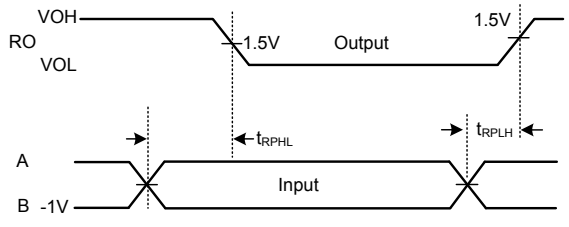


Fig. 9 Receiver Propagation Delays

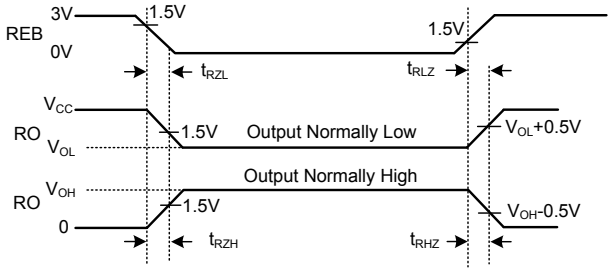


Fig. 10 Receiver Enable and Disable Times