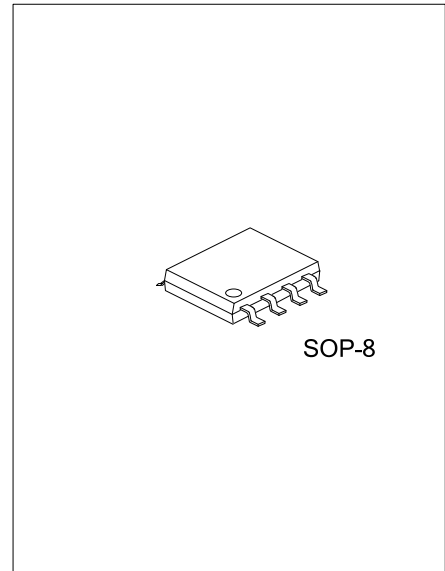




## UTRS458

CMOS IC

### POLARITY FREE, FAIL-SAFE, 500KBPS, RS-485 / RS-422 TRANSCEIVERS WITH $\pm 12KV$ ESD-PROTECTED



#### 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 disabled 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

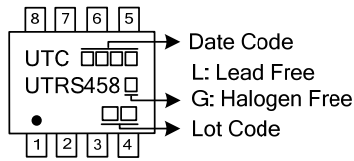
- \* Meet the requirements of the EIA/TIA-485 standards.
- \* 5.0V single power supply.
- \* 1 $\mu$ A low-current shutdown mode.
- \* HBM  $\pm 12kV$  ESD protection.
- \* True fail-safe receiver while maintaining EIA/TIA-485 compatibility.
- \* Hot-swap glitch free protection on control inputs.
- \* 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

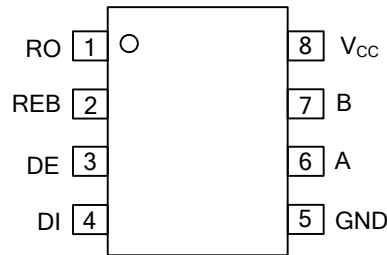
Ordering Number		Package	Packing
Lead Free	Halogen Free		
UTRS458L-S08-R	UTRS458G-S08-R	SOP-8	Tape Reel

<p>UTRS458G-S08-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) S08: SOP-8</li> <li>(3) G: Halogen Free and Lead Free, L: Lead Free</li> </ul>
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■ MARKING



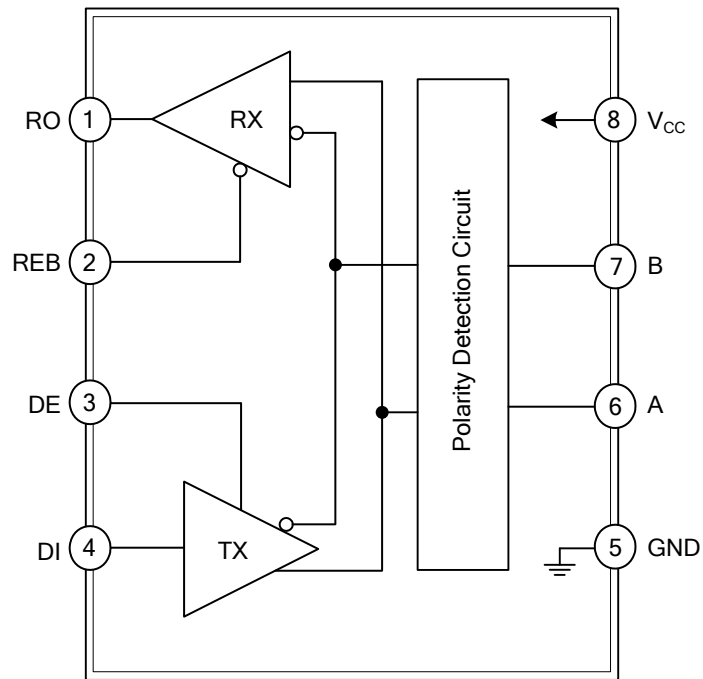
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	RO	Receiver output.
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 <sub>CC</sub>	Power supply Input 5.0V.

■ BLOCK DIAGRAM



## ■ ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
Power Supply $V_{CC}$	$V_{CC}$	-0.3 ~ 7.0	V
Control Input Voltage	REB, DE	-0.3 ~ $V_{CC}$	V
Receiver Input Voltage	A, B	$\pm 12.5$	V
Receiver Output Voltage	RO	-0.3 ~ $V_{CC}$	V
Transmitter Output Voltage	A, B	$\pm 12.5$	V
Transmitter Input	DI	-0.3 ~ $V_{CC}$	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

( $V_{CC}=5.0V \pm 5\%$  with  $T_A=T_{MIN}$  to  $T_{MAX}$ , unless otherwise noted. Typical values are at  $V_{CC}=5.0V$  and  $T_A=25^\circ C$ )

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
<b>TRANSMITTER</b>							
Differential Transmitter Output	$V_{OD1}$	No Load			5.0	V	
Differential Transmitter Output	$V_{OD2}$	Fig.1, $R_L=27\Omega$	1.5			V	
Change in Magnitude of Differential Output Voltage	$\Delta V_{OD}$	Fig.1, $R_L=27\Omega$			0.2	V	
Transmitter Common- Mode Output Voltage	$V_{OC}$	Fig.1, $R_L=27\Omega$			3.0	V	
Change in Magnitude of Common- Mode Voltage	$\Delta V_{OC}$	Fig.1, $R_L=27\Omega$			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			$\pm 2.0$	$\mu A$	
Input Current	$I_{IN2}$	DE, REB			$\pm 50$	$\mu A$	
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	$\mu A$	
			$V_{IN}=-7V$		-75	$\mu A$	
Transmitter Short-Circuit Output Current	$I_{OS}$	$-7V \leq V_{OUT} \leq V_{CC}$	-250			mA	
		$0V \leq V_{OUT} \leq 12V$			250	mA	
<b>RECEIVER</b>							
Receiver Differential Threshold Voltage	$V_{TH}$	$V_{CM}=+2.5V$	-200		-20	mV	
Receiver Input Hysteresis	$\Delta V_{TH}$			25		mV	
Receiver Output High Voltage	$V_{OH}$	$I_O=-4mA, V_{ID}=-20mV$	$V_{CC}-1.5$			V	
Receiver Output Low Voltage	$V_{OL}$	$I_O=4mA, V_{ID}=-200mV$			0.5	V	
Three- State Output Current at Receiver	$I_{OZR}$	$0.4V \leq V_{CM} \leq 2.4V$			$\pm 1.0$	$\mu A$	
Receiver Input Resistance	$R_{IN}$	$-7V \leq V_{CM} \leq +12V$	96			k $\Omega$	
Receiver Output Short-Circuit Current	$I_{OSR}$	Fig.6, $0V \leq V_{RO} \leq V_{CC}$	$\pm 7$		$\pm 95$	mA	
<b>SUPPLY CURRENT</b>							
Supply Current	$I_{CC}$	No Load, REB=GND, DI= $V_{CC}$ or GND.	DE= $V_{CC}$		420	900	$\mu A$
			DE=GND		320	600	$\mu A$
Supply Current in Shutdown Mode	$I_{SHDN}$	REB= $V_{CC}$ , DE=GND		1.0	10	$\mu A$	

## ■ SWITCHING CHARACTERISTICS

( $V_{CC}=5.0V \pm 5\%$  with  $T_A=T_{MIN}$  to  $T_{MAX}$ , unless otherwise noted. Typical values are at  $V_{CC}=5.0V$  and  $T_A=25^\circ C$ )

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Transmitter Input to Output	$t_{DPLH}, t_{DPHL}$	Fig.2 and 7, $R_{DIFF}=54\Omega, C_{L1}=C_{L2}= 100pF$		720	900	ns
Transmitter Output Skew $ t_{DPLH} - t_{DPHL} $	$t_{DSKEW}$	Fig.2 and 7, $R_{DIFF}=54\Omega, C_{L1}=C_{L2}= 100pF$		10		ns
Transmitter Rise or Fall Time	$t_{DF}, t_{DR}$	Fig.2 and 7, $R_{DIFF}=54\Omega, C_{L1}=C_{L2}= 100pF$		15	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			500	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} \geq 2.0V$ ; Rise and Fall Time of $V_{ID}\leq 15ns$		200		ns
$ t_{RPLH} - t_{RPHL} $ Different Receiver Skew	$t_{RSKD}$	Fig.5 and 9, $ V_{ID} \geq 2.0V$ ; Rise and Fall Time of $V_{ID}\leq 15ns$		100		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			4500	ns
Transmitter Enable from Shutdown to Output High	$t_{DZH(SHDN)}$	Fig.4 and 8, $C_{DL}=15pF, S2$ Closed			4500	ns
Receiver Enable from Shutdown to Output Low	$t_{RZL(SHDN)}$	Fig.3 and 10, $C_{RL}=100pF, S1$ Closed			4500	ns
Receiver Enable from Shutdown to Output High	$t_{RZH(SHDN)}$	Fig.3 and 10, $C_{RL}=100pF, S2$ Closed			4500	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	$\geq -0.02V$	1
0	X	$\leq -0.2V$	0
0	X	Open/Shorted	1
1	1	X	High-Z
1	0	X	Shutdown

X = Don't care

Shutdown mode, transmitter and receiver outputs high impedance

## ■ TEST CIRCUIT

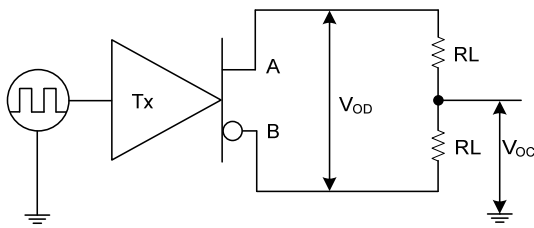


Fig. 1 Transmitter DC Test Circuit

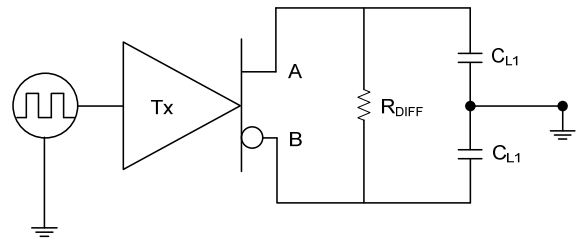


Fig. 2 Transmitter Timing Test Circuit

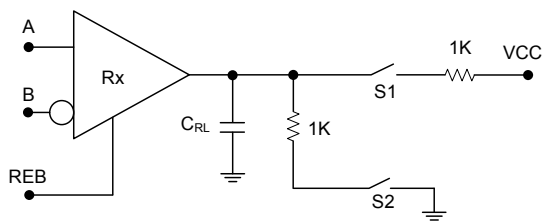


Fig. 3 Receiver Enable/Disable Timing Test Circuit

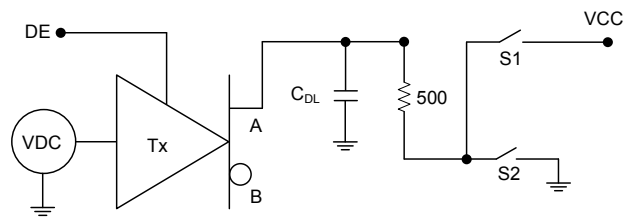


Fig. 4 Transmitter Enable/Disable Timing Test Circuit

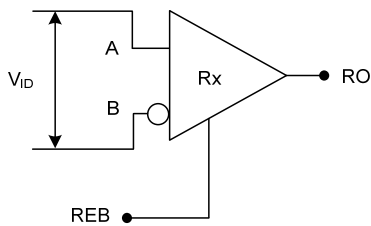


Fig. 5 Receiver Timing Test Circuit

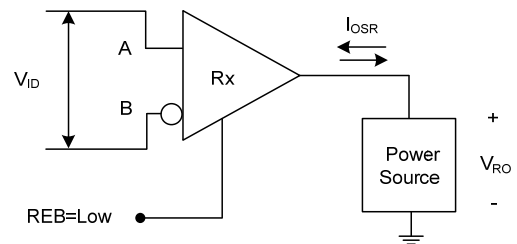


Fig. 6 Receiver Output Short Circuit

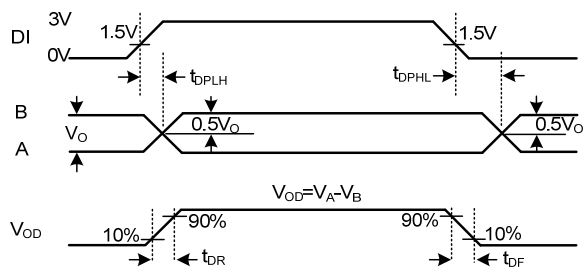


Fig. 7 Transmitter Propagation Delays

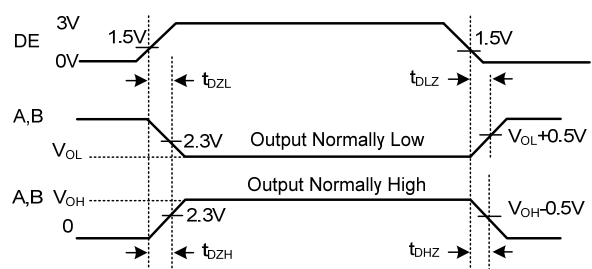


Fig. 8 Transmitter Enable and Disable Times

■ TEST CIRCUIT (Cont.)

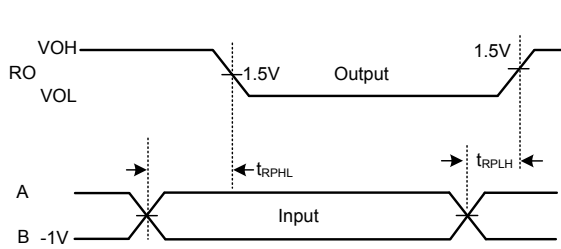


Fig. 9 Receiver Propagation Delays

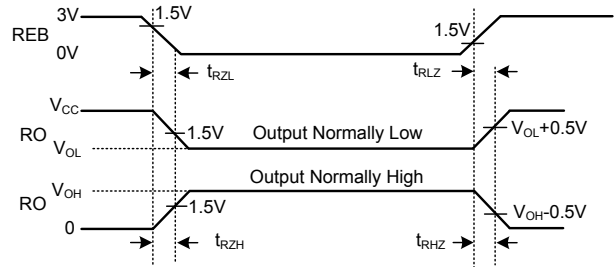


Fig. 10 Receiver Enable and Disable Times

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