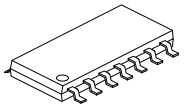
UTRS3080

CMOS IC

FAIL-SAFE, 500KBPS, RS-485 / RS-422 TRANSCEIVERS WITH ±12KV ESD-PROTECTED



SOP-14

■ DESCRIPTION

The UTC **UTRS3080** high-speed transceivers for RS-485/RS-422 communication contain one driver and one receiver. The device features fail-safe circuitry, which guarantees a logic-high receiver output when the receiver inputs are open or shorted. This means that the receiver output will be logic high if all transmitters on a terminated bus are disabled (high impedance). The UTC **UTRS3080** features reduced slew-rate drivers that minimize EMI and reduce reflections caused by improperly terminated cables, allowing error-free data transmission up to 500kbps.

The transceiver typically draws 375μA of supply current when unloaded or when fully loaded with the drivers disabled.

A device has a 1/8-unit-load receiver input impedance that allows up to 256 transceivers on the bus.

■ FEATURES

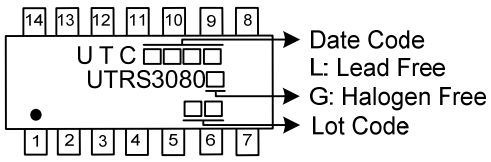
* True fail-safe receiver while maintaining EIA/TIA-485 compatibility
* Enhanced slew-rate limiting facilitates Error-Free data transmission
* 5.0V single power supply
* 1μA low-current shutdown mode
* Allow up to 256 transceivers on the Bus
* HBM ±12kV ESD protection for Drive / Receiver
* Driver short circuit current limit
* Thermal shutdown for overload protection

■ ORDERING INFORMATION

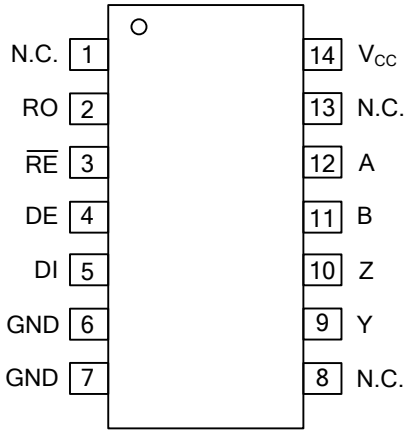
Ordering Number		Package	Packing
Lead Free	Halogen Free		
UTRS3080L-S14-R	UTRS3080G-S14-R	SOP-14	Tape Reel

UTRS3080G-S14-R (1)Packing Type (2)Package Type (3)Green Package	(1) R: Tape Reel (2) S14: SOP-14 (3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING



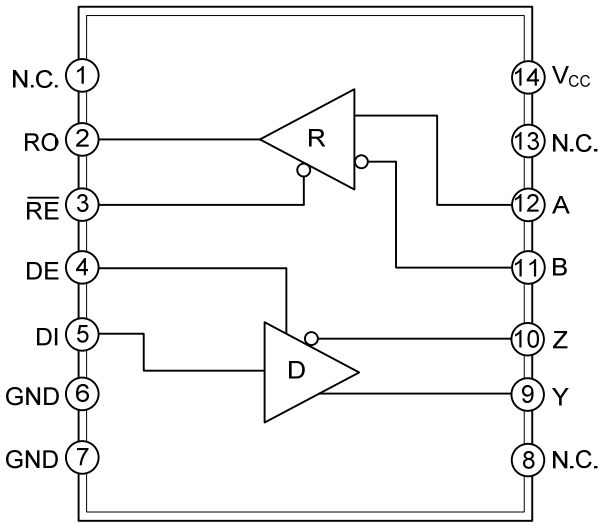
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1, 8, 13	N.C.	Not connected. Not internally connected.
2	RO	Receiver output. When $\overline{RE}$ is low and if A-B≥-20mV, RO will be high; if A-B≤ -300mV, RO will be low.
3	$\overline{RE}$	Receiver output enable. Drive $\overline{RE}$ low to enable RO; RO is high impedance when $\overline{RE}$ is high. Drive $\overline{RE}$ high and DE low to enter low-power shutdown mode.
4	DE	Driver output enable. Drive DE high to enable driver outputs. These outputs are high impedance when DE is low. Drive $\overline{RE}$ high and DE low to enter low-power shutdown mode.
5	DI	Driver input. With DE high, a low on DI forces non-inverting output low and inverting output high. Similarly, a high on DI forces non-inverting output high and inverting output low.
6, 7	GND	Ground
9	Y	Non-inverting driver output
10	Z	Inverting driver output
11	B	Inverting receiver input
12	A	Non-inverting receiver input
14	V_{CC}	Positive supply; 4.75V≤V_{CC}≤5.25V

■ BLOCK DIAGRAM



SSOP-14

■ ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V_{CC}	+7.0	V
Control Input Voltage ($\overline{RE}$, DE)		-0.3 ~ (V_{CC}+0.3)	V
Driver Input Voltage	DI	-0.3 ~ (V_{CC}+0.3)	V
Driver Output Voltage (A, B, Y, Z)		±13	V
Receiver Input Voltage (A, B)		±13	V
Receiver Input Voltage, Full Duplex (A, B)		±25	V
Receiver Output Voltage (RO)		-0.3 ~ (V_{CC}+0.3)	V
Continuous Power Dissipation (Derate 8.33mW/°C above +70°C)	P_D	667	mW
Lead Temperature (Soldering, 10s)	T_L	+300	°C
Operating Temperature Ranges	T_{OPR}	-40 ~ +85	°C
Storage Temperature Range	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%, T_A=T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V_{CC}=+5.0V and T_A=+25°C) (Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
DRIVER							
Differential Driver Output (No Load)	V_{OD1}	R_T=10kΩ				5.0	V
Differential Driver Output	V_{OD2}	Fig.1, R=50Ω (RS-422)		1.6			V
		Fig.1, R=27Ω (RS-485)		1.4			V
Change in Magnitude of Differential Output Voltage (Note 2)	ΔV_{OD}	Fig.1, R=50Ω or R=27Ω				0.2	V
Driver Common-Mode Output Voltage	V_{OC}	Fig.1, R=50Ω or R=27Ω				3.0	V
Change In Magnitude of Common-Mode Voltage (Note 2)	ΔV_{OC}	Fig.1, R=50Ω or R=27Ω				0.2	V
Input High Voltage	V_{IH1}	DE, DI, $\overline{RE}$		2.0			V
Input Low Voltage	V_{IL1}	DE, DI, $\overline{RE}$				0.8	V
DI Input Hysteresis	V_{HYS}				100		mV
Input Current	I_{IN1}	DE, DI, $\overline{RE}$				±2.0	μA
Input Current (A and B) Full Duplex	I_{IN4}	DE=GND, V_{CC}=GND or 5.25V	V_{IN}=12V			125	μA
			V_{IN}=-7V			-75	μA
Output Leakage (Y and Z) Full Duplex	I_O	DE=GND, V_{CC}=GND or 5.25V	V_{IN}=12V			125	μA
			V_{IN}=-7V	-100			μA
Driver Short-Circuit Output Current (Note 4)	V_{OD1}	-7V≤V_{OUT}≤V_{CC}		-250			mA
		0V≤V_{OUT}≤12V				250	mA
		0V≤V_{OUT}≤V_{CC}		±25			mA

■ DC ELECTRICAL CHARACTERISTICS (Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
RECEIVER							
Receiver Differential Threshold Voltage	V_{TH}	V_{CM}=+2.5V		-300		-20	mV
Receiver Input Hysteresis	ΔV_{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}=-300mV				0.4	V
Three-State Output Current at Receiver	I_{OZR}	0.4V≤V_O≤ 2.4V				±1.0	μA
Receiver Input Resistance	R_{IN}	-7V≤V_{CM}≤+12V		96			kΩ
Receiver Output Short-Circuit Current	I_{OSR}	0V≤V_{RO}≤V_{CC}		±7		±95	mA
SUPPLY CURRENT							
Supply Current	I_{CC}	No Load, $\overline{RE}$ =DI=GND or V_{CC}	DE=V_{CC}		430	900	μA
			DE=GND		375	600	μA
Supply Current in Shutdown Mode	I_{SHDN}	DE=GND, $V_{\overline{RE}}$ =V_{CC}			1.0	10	μA

Notes: 1. All currents into the device are positive; all currents out of the device are negative. All voltages are referred to device ground unless otherwise noted.

2. ΔV_{OD} and ΔV_{OC} are the changes in V_{OD} and V_{OC}, respectively, when the DI input changes state.
3. The SRL pin is internally biased to V_{CC}/ 2 by a 100kΩ/100kΩ resistor divider. It is guaranteed to be V_{CC}/ 2 if left unconnected.
4. Maximum current level applies to peak current just prior to foldback-current limiting; minimum current level applies during current limiting.

■ SWITCHING CHARACTERISTICS

(V_{CC}=+5.0V ±5%, 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
Driver Input to Output	t_{DPLH}	Fig.3 and 5, R_{DIFF}=54Ω, C_{L1}=C_{L2}=100pF		100		ns
	t_{DPHL}			100		ns
Driver Output Skew $\lvert t_{DPLH} - t_{DPHL} \rvert$	t_{DSKEW}	Fig.3 and 5, R_{DIFF}=54Ω, C_{L1}=C_{L2}=100pF		5	200	ns
Driver Rise or Fall Time	t_{DR}, t_{DF}	Fig.3 and 5, R_{DIFF}=54Ω, C_{L1}=C_{L2}=100pF		200		ns
Maximum Data Rate	f_{MAX}		500			kbps
Driver Enable to Output High	t_{DZH}	Fig.4 and 6, C_L=100pF, S2 Closed			3500	ns
Driver Enable to Output Low	t_{DZL}	Fig.4 and 6, C_L=100pF, S1 Closed			3500	ns
Driver Disable Time from Low	t_{DLZ}	Fig.4 and 6, C_L=15pF, S1 Closed			200	ns
Driver Disable Time from High	t_{DHZ}	Fig.4 and 6, C_L=15pF, S2 Closed			200	ns
Receiver Input to Output	t_{RPLH}, t_{RPHL}	Fig.7 and 9, $\lvert V_{ID} \rvert$≥2.0V; Rise and Fall Time of V_{ID}≤15ns		200		ns
$\lvert t_{RPLH} - t_{RPHL} \rvert$ Differential Receiver Skew	t_{RSKD}	Fig.7 and 9, $\lvert V_{ID} \rvert$≥2.0V; Rise and Fall Time of V_{ID}≤15ns		50		ns
Receiver Enable to Output Low	t_{RZL}	Fig.2 and 8, C_L=100pF, S1 Closed		50		ns
Receiver Enable to Output High	t_{RZH}	Fig.2 and 8, C_L=100pF, S2 Closed		50		ns
Receiver Disable Time from Low	t_{RLZ}	Fig.2 and 8, C_L=100pF, S1 Closed		50		ns
Receiver Disable Time from High	t_{RHZ}	Fig.2 and 8, C_L=100pF, S2 Closed		50		ns
Time to Shutdown	t_{SHDN}	Note 1		200		ns
Driver Enable from Shutdown to Output High	$t_{DZH(SHDN)}$	Fig. 4 and 6, C_L=15pF, S2 Closed			4500	ns
Driver Enable from Shutdown to Output Low	$t_{DZL(SHDN)}$	Fig.4 and 6, C_L=15pF, S1 Closed			4500	ns
Receiver Enable from Shutdown to Output High	$t_{RZH(SHDN)}$	Fig.4 and 6, C_L=100pF, S2 Closed			3500	ns
Receiver Enable from Shutdown to Output Low	$t_{RZL(SHDN)}$	Fig. 4 and 6, C_L=100pF, S1 Closed			3500	ns

Note: The device is put into shutdown by bringing $\overline{RE}$ high and DE low. If the enable inputs are in this state for less than 50ns, the device is guaranteed not to enter shutdown. If the enable inputs are in this state for at least 600ns, the device is guaranteed to have entered shutdown.

■ FUNCTION TABLE

Table 1 TRANSMITTING

INPUTS			OUTPUTS	
$\overline{RE}$	DE	DI	Z	Y
X	1	1	0	1
X	1	0	1	0
0	0	X	High-Z	High-Z
1	0	X	Shutdown	

Table 2 RECEIVING

INPUTS			OUTPUT
$\overline{RE}$	DE	A-B	RO
0	X	≥-0.02V	1
0	X	≤-0.3V	0
0	X	Open/Shorted	1
1	1	X	High-Z
1	0	X	Shutdown

X = Don't care

Shutdown mode, driver and receiver outputs high impedance

■ TEST CIRCUIT

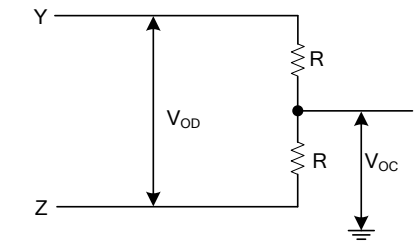


Fig. 1 Driver DC Test Circuit

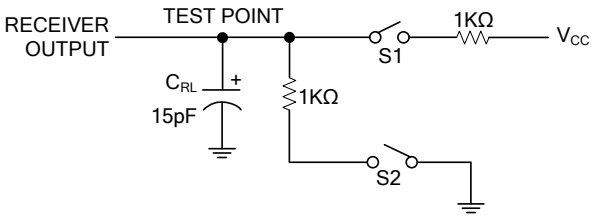


Fig. 2 Receiver Enable/Disable Timing Test Load

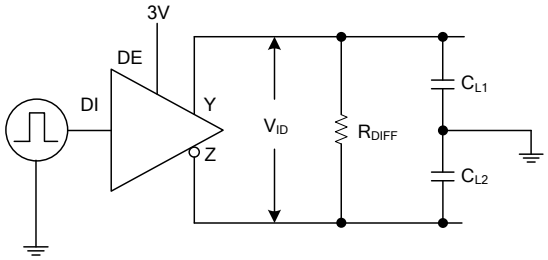


Fig. 3 Driver Timing Test Circuit

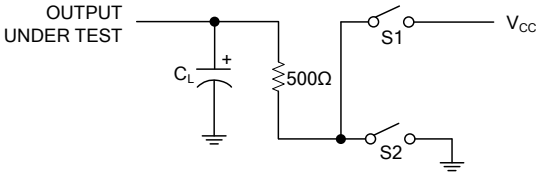


Fig. 4 Driver Enable/Disable Timing Test Load

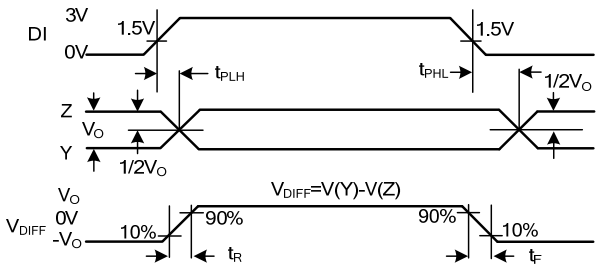


Fig. 5 Driver Propagation Delays

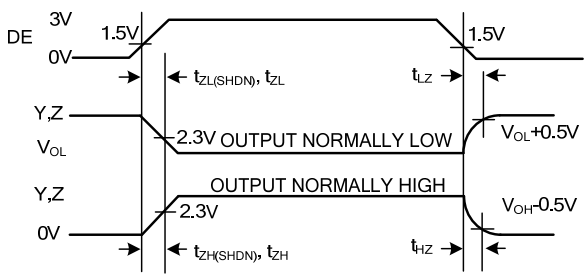


Fig. 6 Driver Enable and Disable Times

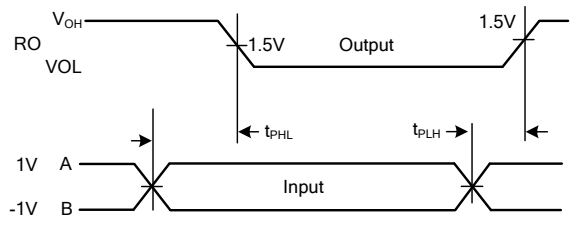


Fig. 7 Receiver Propagation Delays

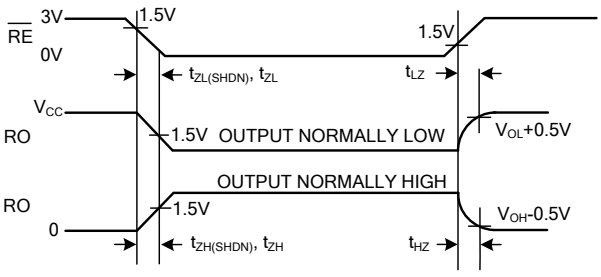


Fig. 8 Receiver Enable and Disable Times

■ TEST CIRCUIT (Cont.)

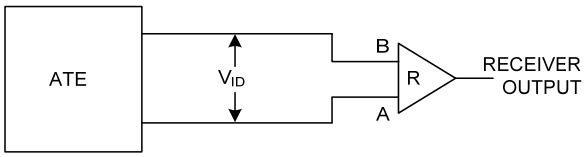


Fig. 9 Receiver Propagation Delay Test Circuit

■ TYPICAL APPLICATION CIRCUIT