

2.5Mbps Half-duplex RS485/RS422 Transceiver

UN485CUA

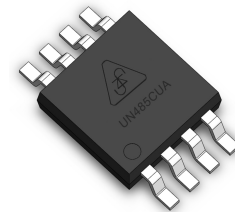
Features

- ◆ 5V Power Supply, Half-duplex;
- ◆ allows up to 32 transceivers on the bus;
- ◆ Short-circuit protection;
- ◆ Thermal shutdown protection;
- ◆ Low-Current Shutdown Mode;
- ◆ Hot-Swap Input Structures on DE and /RE;
- ◆ True Fail-Safe Receiver;
- ◆ Excellent noise immunity;
- ◆ Integrated transient voltage suppression;
- ◆ 2.5Mbps in Electrically Noisy Environments;

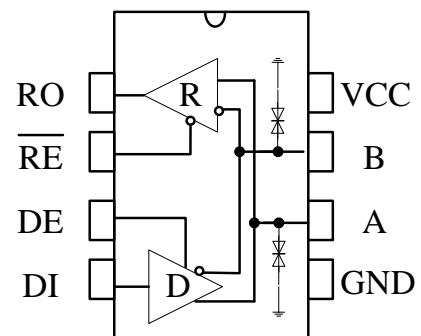
Applications

- ◆ Industrial control automation;
- ◆ Security system;
- ◆ instruments and meters;
- ◆ Road traffic control automation;
- ◆ Bas;
- ◆ Scene lighting control system;
- ◆ Level converter;

Configuration



Functional Block



General Description

UN485CUA is a 5V power supply, half-duplex, low power, high speed RS485/422 Transceiver. UN485CUA Fully meets the TIA/EIA-485 standard.

UN485CUA includes a driver and a receiver, both of which can be independently enabled and disabled. When both are disabled, the driver and receiver outputs are high-impedance state. UN485CUA allows up to 32 Transceiver on the bus. The UN485CUA features reduced slew-rate drives that minimize EMI and reduce reflections caused by improperly terminated cables, allowing error-free data transmission up to 2.5Mbps.

UN485CUA operates under the supply voltage of 4.75V to 5.25V. UN485CUA is a true fail-safe Transceiver. UN485CUA also has the function of thermal shutdown protection, current limiting protection, overvoltage protection, DE and /RE control port input features such as hot-swappable.

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Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Supply Voltage	VCC	+7	V
CTR Port	/RE, DE, DI	-0.3~VCC+0.3	V
Driver Output Voltage	A, B	-7~13	V
Receiver Output Voltage	RO	-0.3~VCC+0.3	V
Temperature Range		-40~85	°C
Storage Temperature Range		-60~150	°C
Soldering Temperature(reflow)		300	°C
Continuous Power Dissipation		400	mW

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Pin Description

Pin Number	Pin Name	Function
1	RO	Receiver Output. When enabled, if $A-B \geq -10$ mV, then RO = high. If $A-B \leq -200$ mV, then RO = low.
2	/RE	Receiver Output Enable. A low level enables the RO; a high level places it in a high impedance state.
3	DE	Driver Output Enable. A high level enables the driver differential outputs, Pin A and Pin B; a low level places the driver in a high impedance state.
4	DI	Driver Input. When the driver is enabled, a logic low on DI forces Pin A low and Pin B high; a logic high on DI forces Pin A high and Pin B low.
5	GND	Ground Connection (0 V).
6	A	No inverting Receiver Input A/Driver Output A.
7	B	Inverting Receiver Input B/Driver Output B.
8	VCC	Power Supply

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DC Electrical Characteristics Of Driver

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Differential Driver Output(no load)	V_{OD1}			5		V
Differential Driver Output	V_{OD2}	Fig 2, $R_L = 27 \Omega$	1.5		VCC	V
		Fig 2, $R_L = 50 \Omega$	2		VCC	V
Change in Magnitude of Differential Output Voltage (NOTE1)	ΔV_{OD}	Fig 2, $R_L = 27 \Omega$			0.2	V
Driver Common-Mode Output Voltage	V_{OC}	Fig 2, $R_L = 27 \Omega$			3	V
Change In Magnitude of Common-Mode Voltage (NOTE1)	ΔV_{OC}	Fig 2, $R_L = 27 \Omega$			0.2	V
Input High Voltage	V_{IH}	DE, DI, /RE	2.0			V
Input Low Voltage	V_{IL}	DE, DI, /RE			0.8	V
Input Current	I_{IN1}	DE, DI, /RE	-2		2	μA
Driver Short-Circuit Output Current (short to high)	I_{OSD1}	Short to 0V~12V	35		250	mA
Driver Short-Circuit Output Current (short to low)	I_{OSD2}	Short to -7V~0V	-250		-35	mA
Thermal-Shutdown Threshold				150		$^{\circ}C$
Thermal-Shutdown Hysteresis				20		$^{\circ}C$

(If no special situation occurs, $V_{CC}=5V \pm 10\%$, $Temp=T_{MIN} \sim T_{MAX}$, typically $V_{CC}=+5V$, $Temp=25^{\circ}C$)

NOTE1: ΔV_{OD} and ΔV_{OC} are the changes in V_{OD} and V_{OC} , respectively, when the DI input changes state.

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DC Electrical Characteristics Of Receiver

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Input Current (A, B)	I_{IN2}	DE = 0 V, VCC=0 or 5V $V_{IN} = 12$ V			1.0	mA
		DE = 0 V, VCC=0 or 5V $V_{IN} = -7$ V	0.8			mA
Positive-going input threshold voltage	V_{IT+}	$-7V \leq V_{CM} \leq 12V$			-10	mV
Negative-going input threshold voltage	V_{IT-}	$-7V \leq V_{CM} \leq 12V$	-200			mV
Receiver Input Hysteresis	V_{HYS}	$-7V \leq V_{CM} \leq 12V$		30		mV
RO Output-High Voltage	V_{OH}	$I_{OUT} = -4mA$, $V_{ID} = +200$ mV	3.5			V
RO Output-Low Voltage	V_{OL}	$I_{OUT} = +4mA$, $V_{ID} = -200$ mV			0.4	V
Three-State Output Current at Receiver	I_{OZR}	0.4 V < V_O < 2.4 V			± 1	μA
Receiver Input Resistance	R_{IN}	$-7V \leq V_{CM} \leq 12V$	12			k Ω
Receiver Output Short-Circuit	I_{OSR}	0 V $\leq V_O \leq V_{CC}$	± 7		± 95	mA

(If no special situation occurs, $V_{CC}=5V \pm 10\%$, $Temp=T_{MIN} \sim T_{MAX}$, typically $V_{CC}=+5V$, $Temp=25^{\circ}C$)

Supply Current

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Supply Current	I_{CC1}	/RE=0V or VCC, DE = 0 V		200	500	μA
	I_{CC2}	/RE=VCC, DE=VCC		300	600	μA
Supply Current in Shutdown Mode	I_{SHDN}	/RE=VCC, DE=0V		0.5	10	μA

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Switching Characteristics Of Driver

Parameter	Symbol	Conditions	Min	Typ	Max	Units	
Driver Propagation Delay (low to high)	t_{DPLH}	$R_{DIFF} = 54 \Omega$, $C_{L1}=C_{L2}=100pF$ (Fig 3,4)		60		ns	
Driver Propagation Delay (high to low)	t_{DPHL}			60		ns	
$ t_{DPLH} - t_{DPHL} $	t_{SKEW1}				5	± 10	ns
Driver Differential Output Rise or Fall Time	t_{DR}, t_{DF}				40		ns
Driver Enable to Output High	t_{DZH}	$C_L = 100 pF$, S1 closed (Fig 5,6)			70	ns	
Driver Enable to Output Low	t_{DZL}				70	ns	
Driver Disable Time from Low	t_{DLZ}	$C_L = 15 pF$, S2 closed (Fig 5,6)			70	ns	
Driver Disable Time from High	t_{DHZ}				70	ns	

Switching Characteristics Of Receiver

Parameter	Symbol	Conditions	Min	Typ	Max	Units	
Receiver Propagation Delay (low to high)	t_{RPLH}	Fig 7 and 8 $V_{ID} \geq 2.0V$; Rise and fall time $V_{ID} \leq 15ns$		50	200	ns	
Receiver Propagation Delay (high to low)	t_{RPHL}				50	200	ns
$ t_{RPLH} - t_{RPHL} $	T_{skew2}				13	15	ns
Receiver Enable to Output Low	t_{RZL}	$C_L = 100 pF$, S1 closed (Fig 9,10)		20	50	ns	
Receiver Enable to Output High	t_{RZH}	$C_L = 100 pF$, S2 closed (Fig 9,10)		20	50	ns	
Receiver Disable Time from Low	t_{RLZ}	$C_L = 100 pF$, S1 closed (Fig 9,10)		20	50	ns	
Receiver Disable Time from High	t_{RHZ}	$C_L = 100 pF$, S2 closed (Fig 9,10)		20	50	ns	

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Function Tables

Transmitting

CTR		Inputs	Outputs	
/RE	DE	DI	A	B
X	1	1	H	L
X	1	0	L	H
0	0	X	Z	Z
1	0	X	Z(shutdown)	

X: Don't care; Z: high impedance.

Receiving

CTR		Inputs	Outputs
/RE	DE	A-B	RO
0	X	$\geq -10\text{mV}$	H
0	X	$\leq -200\text{mV}$	L
0	X	Open/shorted	H
1	X	X	Z

X: Don't care; Z: high impedance.

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Test Circuit

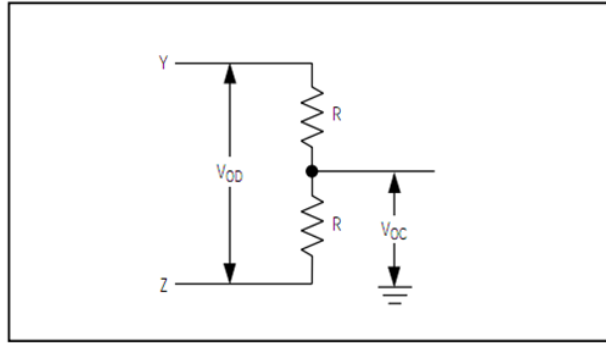


Fig 2 Driver DC Test Load

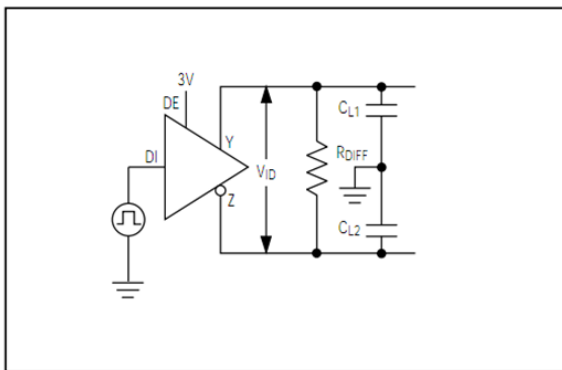


Fig 3 Driver Timing Test Circuit

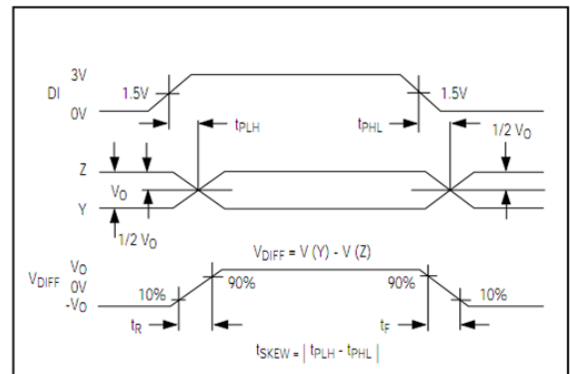


Fig 4 Driver Propagation Delays

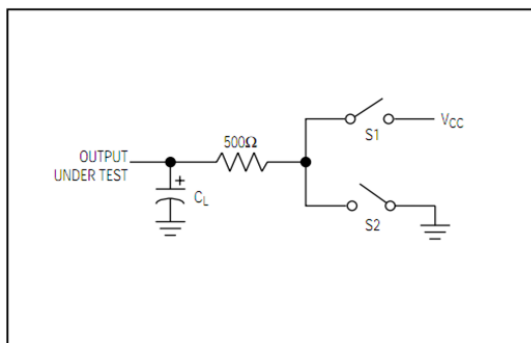


Fig 5 Driver Enable/Disable Timing Test Load

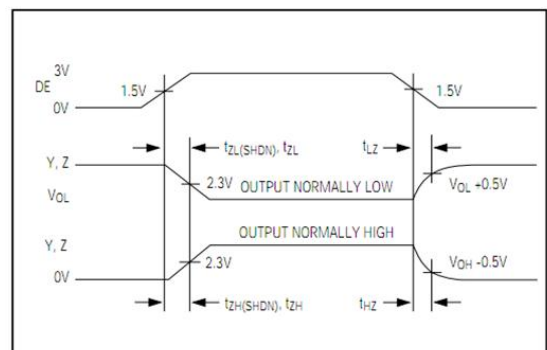


Fig 6 Driver Enable and Disable Times

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Test Circuit

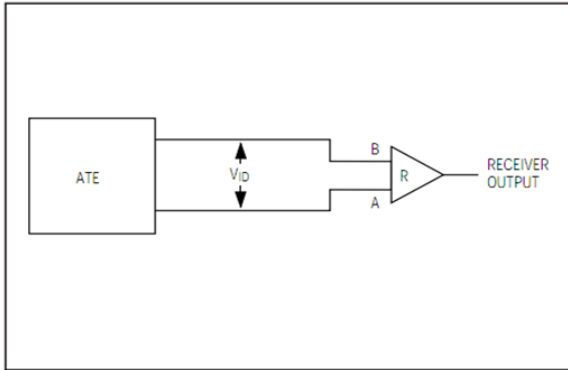


Fig 7 Receiver Propagation Delay Test Circuit

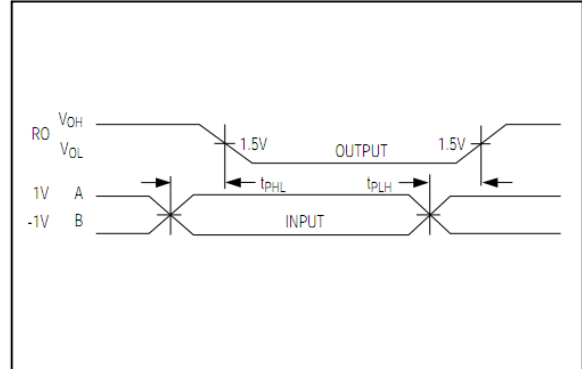


Fig 8 Receiver Propagation Delays

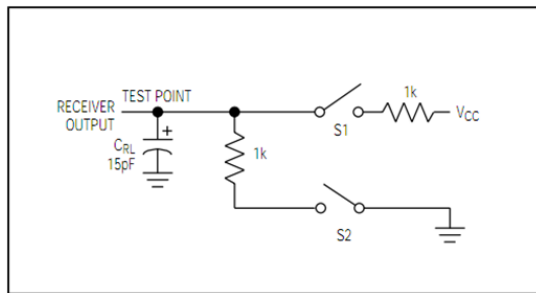


Fig 9 Receiver Enable/Disable Timing Test Load

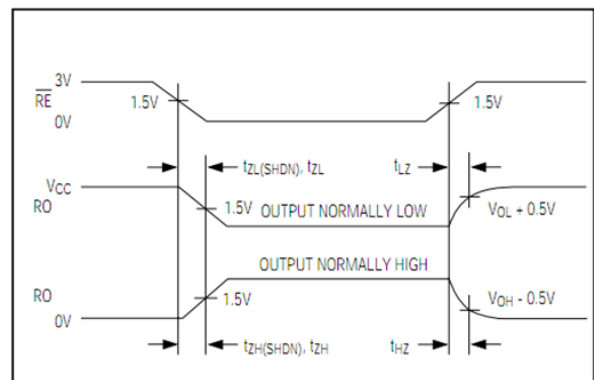


Fig 10 Receiver Enable and Disable Times

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Summary

1 Description

UN485CUA, including a driver and a receiver, is a half-duplex high-speed transceivers for RS-485 / RS-422 communications. UN485CUA features fail-safe, overvoltage protection, overcurrent protection, thermal protection, and allows / RE, DE hot-swappable.

The UN485CUA allows an error-free data transmission up to 2.5Mbps.

2 Fail Safe

When the receiver inputs are shorted or open, or when they are connected to a terminated transmission line with all drivers disabled, UN485CUA guarantees a logic-high receiver output. This is done by the receiver input thresholds are set between -10mV and -200mV. If the differential receiver input voltage (A-B) $\geq -10\text{mV}$, RO is logic high; if the voltage (A-B) $\leq -200\text{mV}$, RO is logic low. When attached to the terminal all transmitters on the bus are disabled, the receiver differential input voltage is pulled to 0V by the termination resistor. With the receiver threshold of the UN485CUA, this results in a logic-high with a 10mV minimum noise margin. The -10mV to -200mV threshold complies with the $\pm 200\text{mV}$ EIA/TIA-485 standard.

3 Connecting 32 Transceivers on one Bus

The standard UN485CUA receiver input impedance is guaranteed $>12\text{k}\Omega$, the standard driver can drive up to 32 unit loads. These devices can be any combination, or in combination with other RS-485 transceiver combination, as long as the total load does not load more than 32 units, can be connected on the same bus.

4 Drive Output Protection

Through two mechanisms to avoid failure or a bus contention causes power consumption is too high. First, in the entire common Mode voltage range, overcurrent protection circuit provides a fast short protection. Second, when the die temperature exceeds 150°C , driver output is forced into a high impedance state by the thermal shutdown circuit.

5 Typical Application

UN485CUA transceiver is designed for multi-point bi-directional data communication bus transmission lines. Figure 11 shows a typical network application circuit. These devices can also be used as a cable longer than 4,000 feet of line repeater, to reduce the reflection, the transmission line should be in its ends terminated in its characteristic impedance, and stub lengths off the main line should be as short as possible.

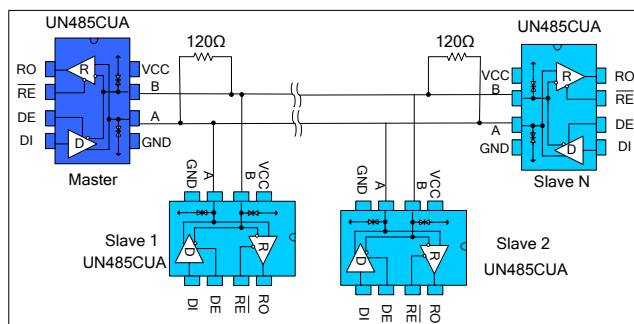
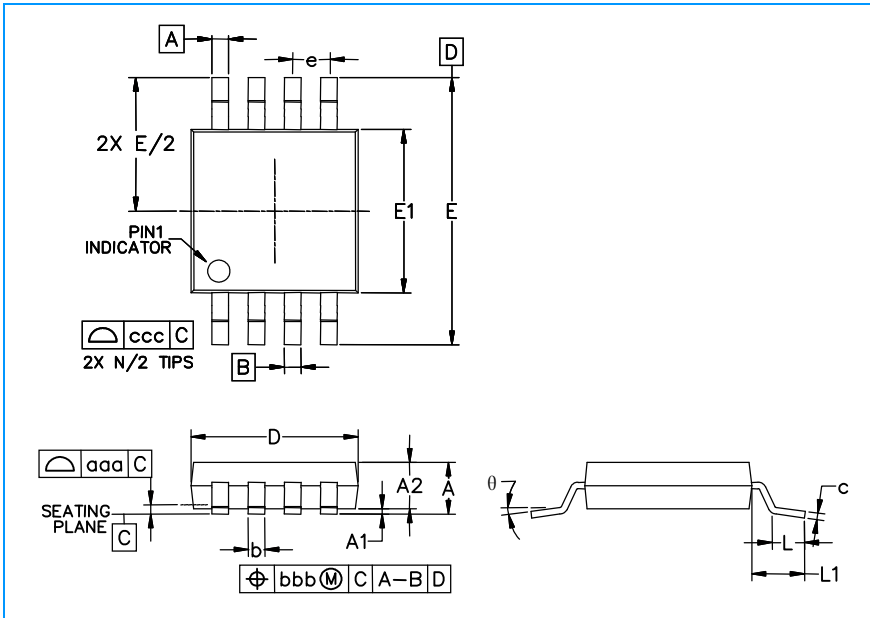


Fig11 Backbone cable type RS485 communications network

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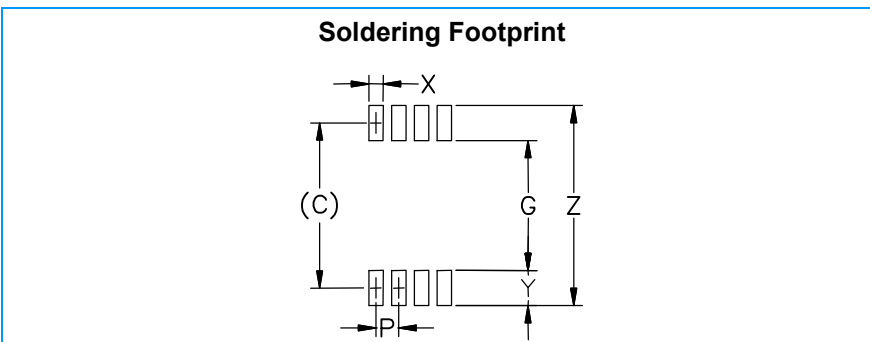
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Package Outline



Symbol	Inches			Millimeters		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	0.043	-	-	1.10
A1	0.000	-	0.004	0.00	-	0.10
A2	0.030	0.033	0.037	0.75	0.85	0.95
b	0.009	0.012	0.015	0.22	0.30	0.38
c	0.005	0.006	0.009	0.13	0.15	0.23
D	0.118 BSC			3.00 BSC		
E1	0.118 BSC			3.00 BSC		
E	0.193 BSC			4.90 BSC		
e	0.026 BSC			0.65 BSC		
L	0.016	0.021	0.026	0.40	0.53	0.66
L1	0.037 REF			0.95 REF		
N	8			8		
θ	0°	-	8°	0°	-	8°
aaa	0.004			0.10		
bbb	0.003			0.08		
ccc	0.010			0.25		

Pad size



Symbol	Inches	Millimeters
C	0.1890	4.80
G	0.1448	3.78
P	0.026	0.65
X	0.0161	0.41
Y	0.0402	1.02
Z	0.2291	5.82

Part	Temp Range	Pin-Package	Quantity
UN485CUA	-40°C~85°C	MSOP-8	2500pcs