

# RS-485 Shield Module for Arduino

## FEATURES

- RS-485 Arduino Shield Module
- Data Rate: 5Mbps
- Recommended Vcc Voltage: DC 5.0V
- 16 digital IO port (including a I2C interface)
- 6 analog IO port and power
- Operation/programming mode switch
- Transceiver indicating LED
- Reset button
- Compatible with Arduino Uno

## APPLICATIONS

- Arduino Board

## DESCRIPTION

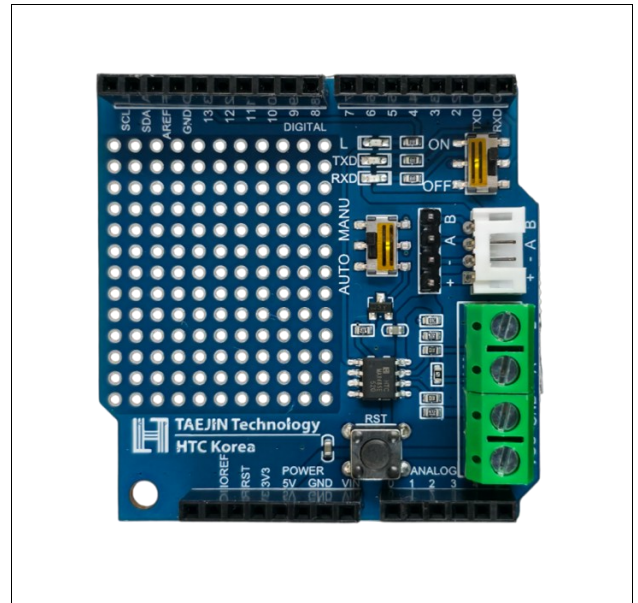
The RS-485 Arduino Shield Module converts UART/Serial protocol to the RS485 protocol. This RS485 board allows Arduino talk to industrial devices.

## APPLICATION GUIDE

Integrated a standard RS485 port, a mini RS485 port, RS485 headers Provide the welding areas to make full use of the free space. Switch between automatic mode and manual transmission mode, which expands the scope of application.

Besides Tx/Rx interface, there is a switch to block/disable this shield, when Arduino needs to be programmed.

Long pins on the back adapt to most Arduino controllers.

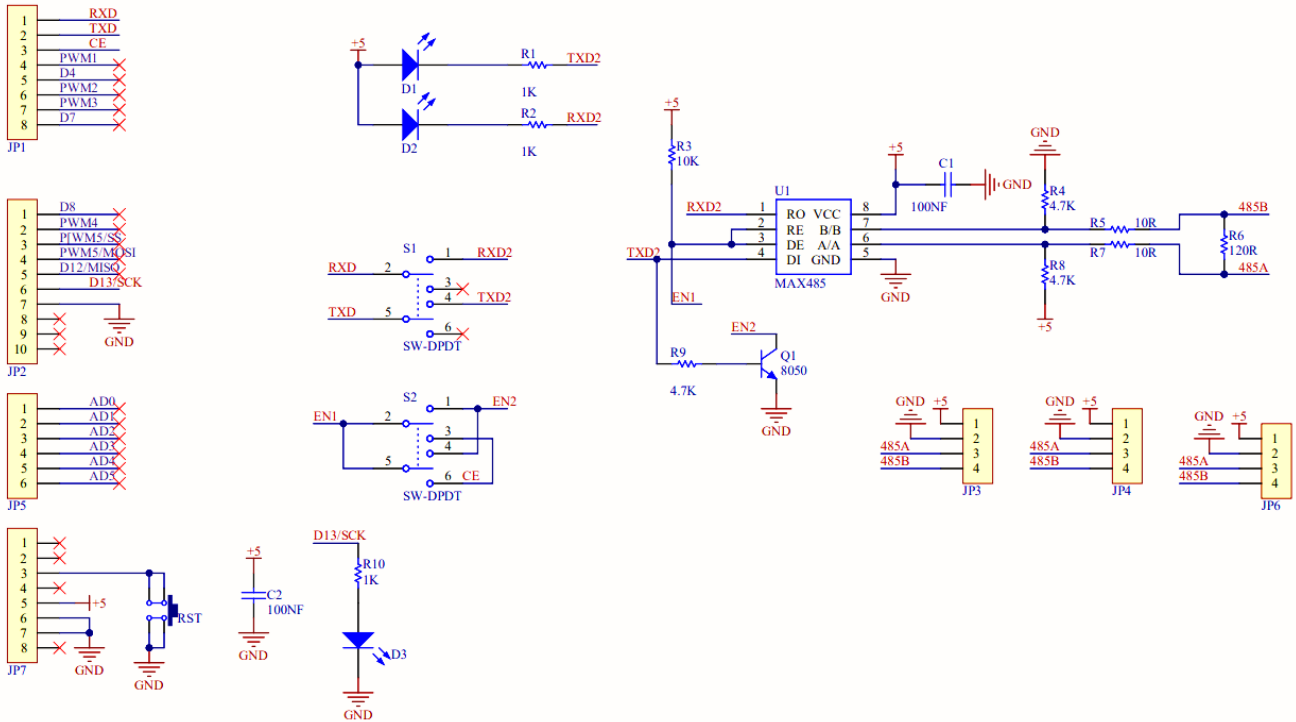


## ORDERING INFORMATION

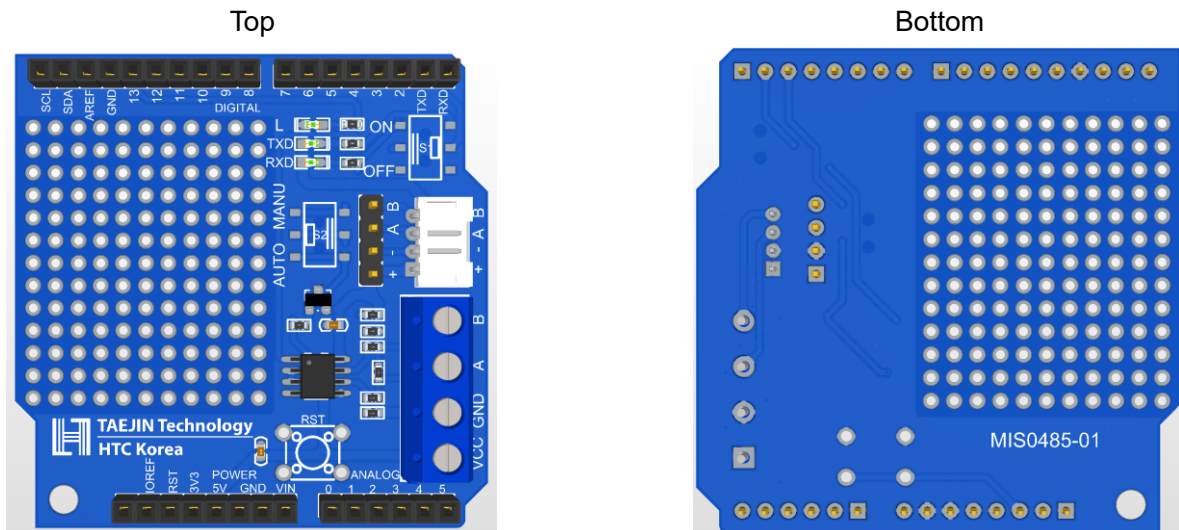
Part Number	MIS0485-01
Device	RS-485 Arduino Shield Module
Package	Assembled Module (54mm X 53mm)

# RS-485 Shield Module for Arduino

## SCHEMATICS



## LAYOUT

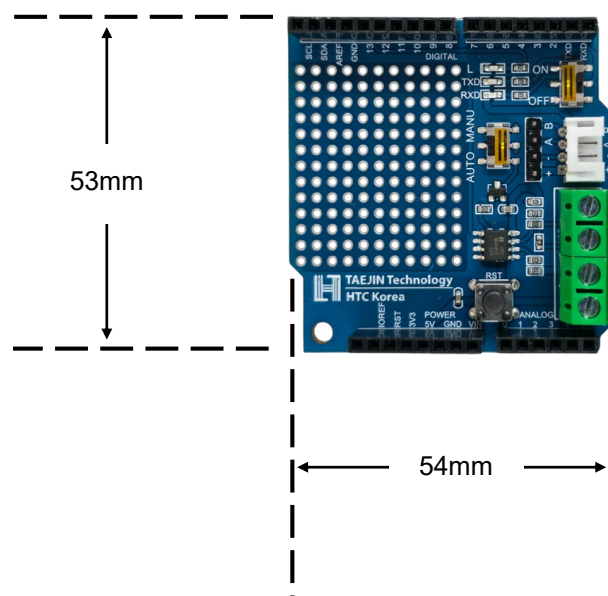


# RS-485 Shield Module for Arduino

## PARTS LIST

Name	Description	P/N	Qty.	Distributor
PCB	Printed Circuit Board	FR4 Lead-Free PCB	1	TAEJIN
IC	MAX485ED	MAX485ED, SOP-8	1	TAEJIN
Connector	Wire to Board Connector	KF301 / 4P, 5.08mm	1	Generic
Switch	Reset Switch	Tact Switch 6*6*5mm	1	Generic
Switch	Slide Switch	Slide Switch 7.2*3.5mm	2	Generic
Pin Header	1*4 / 2.54mm pitch	Male Pin Header	1	Generic
Pin Header	1*10 / 2.54mm pitch	Female Pin Header	1	Generic
Pin Header	1*8 / 2.54mm pitch	Female Pin Header	2	Generic
Pin Header	1*6 / 2.54mm pitch	Female Pin Header	1	Generic
Connector	Angle Type Connector	4P, 2.0mm	1	Generic
Resistor	10KΩ Resistor	10KΩ 1% Resistor, 1608(0603)	1	Generic
Resistor	1KΩ Resistor	1KΩ 1% Resistor, 1608(0603)	3	Generic
Resistor	4.7KΩ Resistor	4.7KΩ 1% Resistor, 1608(0603)	3	Generic
Resistor	10Ω Resistor	10Ω 1% Resistor, 1608(0603)	2	Generic
Resistor	120Ω Resistor	120Ω 1% Resistor, 1608(0603)	1	Generic
Capacitor	100nF / 16V Capacitor	100nF / 25V Capacitor, 1608(0603)	2	Generic
Transistor	NPN Transistor	S8050, SOT-23-3 25V/0.5A NPN	1	Generic
LED	LED for Indicator	LED, Green	3	Generic

## SIZE INFORMATION

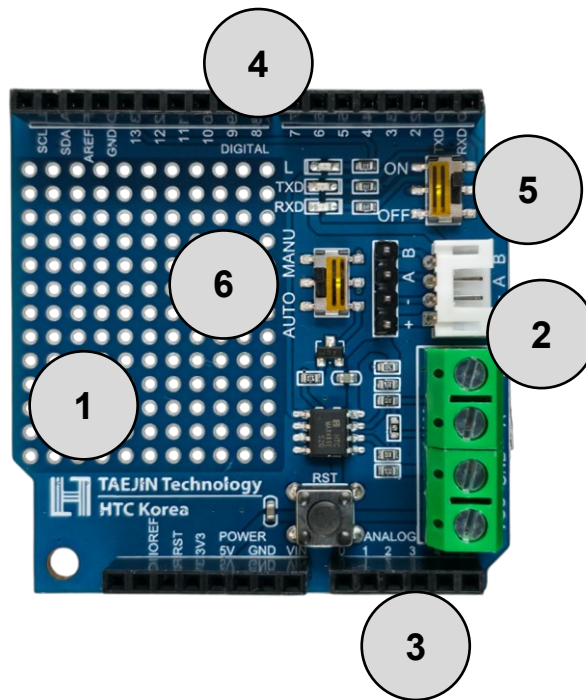


# RS-485 Shield Module for Arduino

## PRODUCT IMAGE



## I/O PORT CONFIGURATION AND DESCRIPTION



Designator	Port Name & Port Description
1	Weldable Area
2	RS485 Pins / Mini RS485 Interface
3	Analog Pins
4	Digital Pins
5	Operation / Programming Mode Switch
6	Automatic / Manual Transceiver Mode Switch

# RS-485 Shield Module for Arduino

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## REVISION NOTICE

The description in this datasheet is subject to change without any notice to describe its electrical characteristics properly.

# Low-Power, Slew-Rate-Limited RS-485/RS-422 Transceivers **MAX485**

## DESCRIPTION

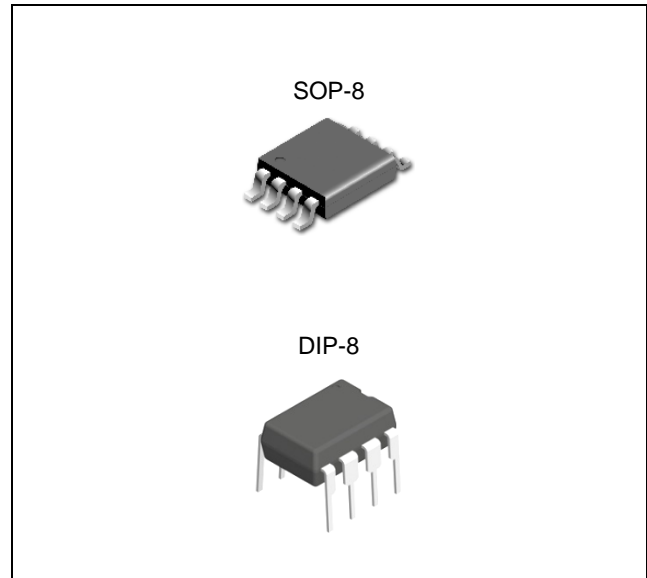
The MAX485 is a half-duplex transceiver that meets the specifications of RS-485 and RS-422. Its BiCMOS design allows low power operation without sacrificing performance. The MAX485 meets the requirements of the RS-485 and RS-422 protocols up to 5Mbps underload. The ESD tolerance is more than  $\pm 8\text{kV}$  for both Human Body Model and  $\pm 15\text{kV}$  for IEC61000-4-2 Air Discharge Method on this device.

## FEATURES

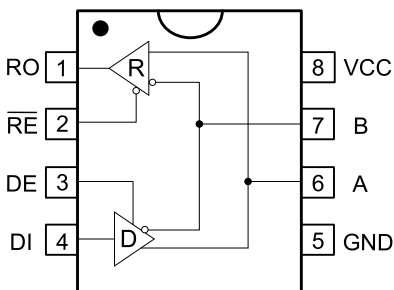
- Single +5V Supply
- Low Power BiCMOS
- Driver/Receiver Enable for Multi-Drop Configurations
- Half-Duplex Versions Available
- Data rate: 5 Mbps
- ESD Specifications
  - $\pm 15\text{kV}$  IEC61000-4-2 Air Discharge
  - $\pm 8\text{kV}$  Human Body Model

## APPLICATIONS

- Low Power RS-485 Systems
- DTE-DCE Interface
- Packet Switching
- Local Area Networks
- Data Concentration
- Data Multiplexers
- Integrated Services Digital Network (ISDN)



## PIN CONFIGURATION AND LOGIC DIAGRAM



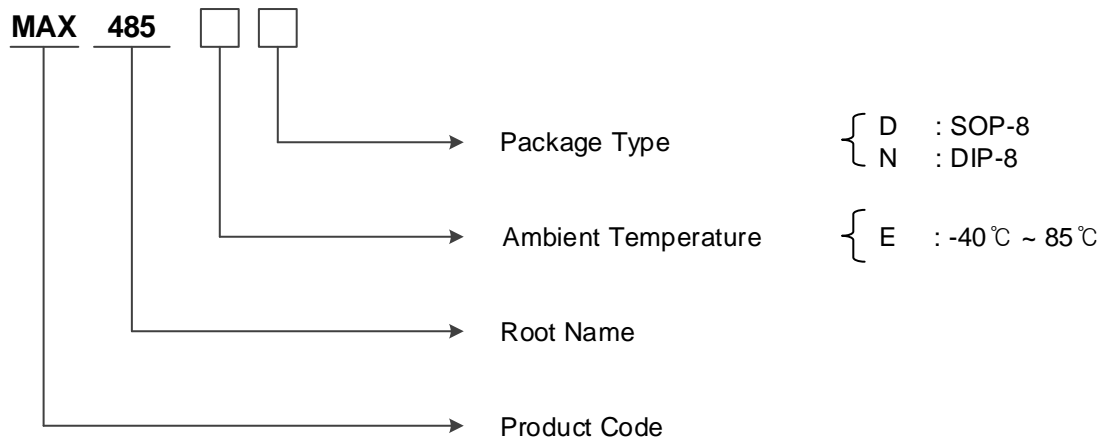
## TRUTH TABLE

Transmission				
Inputs			Outputs	
$\overline{\text{RE}}$	DE	DI	A	B
X	1	1	1	0
X	1	0	0	1
0	0	X	Z	Z
1	0	X	Z	Z
Receiver				
Inputs			Outputs	
$\overline{\text{RE}}$	DE	A-B	RO	
0	0	$\geq +0.2\text{V}$	1	
0	0	$\leq -0.2\text{V}$	0	
0	0	Open	1	
1	0	X	Z	

# Low-Power, Slew-Rate-Limited RS-485/RS-422 Transceivers **MAX485**

## ORDERING INFORMATION

Package	Oder No.	Description	Marking	Compliance	Status
SOP-8	MAX485ED	RS-485/RS-422 Transceivers	MAX485E	RoHS, Green	Active
DIP-8	MAX485EN	RS-485/RS-422 Transceivers	MAX485E	RoHS, Green	Active



# Low-Power, Slew-Rate-Limited RS-485/RS-422 Transceivers MAX485

## ABSOLUTE MAXIMUM RATINGS

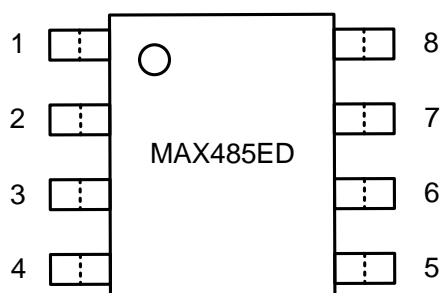
Characteristic	Symbol	Min	Max	Unit
Supply Voltage	$V_{CC}$		7	V
Control Input Voltage	$V_{DE}, V_{RE}$	-0.3	$V_{CC} + 0.5$	V
Driver Input Voltage	$V_{DI}$	-0.3	$V_{CC} + 0.5$	V
Driver Output Voltage	A, B	-15	15	V
Receiver Input Voltage	A, B	-15	15	V
Receiver Output Voltage	$V_{RO}$	-0.3	$V_{CC} + 0.5$	V
Junction Temperature	$T_J$	-40	125	°C
Storage Temperature Range	$T_{STG}$	-65	150	°C

## RECOMMENDED OPERATING CONDITIONS

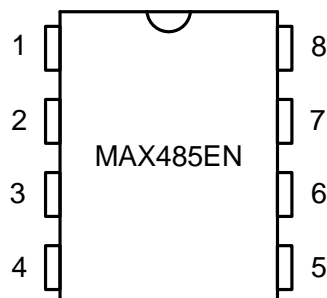
Characteristic	Symbol	Min	Max	Unit
Supply Voltage	$V_{CC}$	4.75	5.25	V
Operating Ambient Temperature Ranges	$T_A$	-40	85	°C

# Low-Power, Slew-Rate-Limited RS-485/RS-422 Transceivers **MAX485**

## PIN CONFIGURATION



SOP-8



DIP-8

## PIN DESCRIPTION

Pin No.	SOP-8 / DIP-8 PKG	
	Name	Function
1	RO	Receiver Output
2	$\overline{\text{RE}}$	Receiver Output Enable Active Low
3	DE	Driver Output Enable Active High
4	DI	Driver Input
5	GND	Ground
6	A	Non-inverting Driver Output and Receiver Input
7	B	Inverting Driver Output and Receiver Input
8	V <sub>CC</sub>	Power Supply: 4.75V to 5.25V

# Low-Power, Slew-Rate-Limited RS-485/RS-422 Transceivers **MAX485**

## ELECTRICAL CHARACTERISTICS

Unless otherwise specified:  $V_{CC} = 5V \pm 5\%$ ,  $T_A = T_{MIN}$  to  $T_{MAX}$

PARAMETER	Symbol	CONDITIONS	MIN	TYP	MAX	UNITS
<b>DRIVER DC Characteristics</b>						
Differential Driver Output (no load)	$V_{OD1}$	$R_L = \infty$ , Figure 1	GND		$V_{CC}$	V
Differential Driver Output (with load)	$V_{OD2}$	$R_L = 50\Omega$ (RS-422), Figure 1	2		$V_{CC}$	V
		$R_L = 27\Omega$ (RS-485), Figure 1	1.5		$V_{CC}$	
Change in Magnitude of Driver Differential Output Voltage for Complementary Output States	$\Delta V_{OD}$	$R_L = 27\Omega$ or $50\Omega$ , Figure 1			0.2	V
Driver Common-Mode Output Voltage	$V_{OC}$	$R_L = 27\Omega$ or $50\Omega$ , Figure 1			3	V
Change in Magnitude of Driver Common-Mode Output Voltage for Complementary Output States	$\Delta V_{OC}$	$R = 27\Omega$ or $50\Omega$ , Figure 1			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*			$\pm 10$	$\mu A$
<b>Driver Short Circuit Current</b>						
Driver Short-Circuit Current, $V_O = \text{High}$	$I_{OSD1}$	$-7V \leq V_O \leq 12V$			$\pm 250$	mA
Driver Short-Circuit Current, $V_O = \text{Low}$	$I_{OSD2}$	$-7V \leq V_O \leq 12V$			$\pm 250$	mA
<b>DRIVER AC Characteristics</b>						
Max. Transmission Rate	$f_{MAX}$		5			Mbps
Driver Input to Output	$t_{DPLH}$	Figure 3 & 5 $R_L = 54\Omega$ , $C_{L1} = C_{L2} = 100pF$		30	60	ns
	$t_{DPHL}$			30	60	ns
Driver Output Skew to Output	$t_{SKEW}$			5	10	ns
Driver Rise or Fall Time	$t_r, t_f$			15	40	ns
Driver Enable to Output High	$t_{ZH}$		$S_2$ closed		40	70
Driver Enable to Output Low	$t_{ZL}$	$S_1$ closed		40	70	ns
Driver Disable Time from Low	$t_{HZ}$	$C_L = 100pF$ , $S_2$ closed		40	70	ns
Driver Disable Time from High	$t_{LZ}$	$C_L = 100pF$ , $S_1$ closed		40	70	ns
<b>RECEIVER DC Characteristics</b>						
Receiver Differential Threshold Voltage	$V_{TH}$	$-7V \leq V_{CM} \leq 12V$	-0.2		0.2	V
Receiver Input Hysteresis	$\Delta V_{TH}$	$V_{CM} = 0V$		20		mV
Receiver Output High Voltage	$V_{OH}$	$I_O = -4mA$ , $V_{ID} = +200mV$	3.5			V
Receiver Output Low Voltage	$V_{OL}$	$I_O = +4mA$ , $V_{ID} = -200mV$			0.4	V
Three-State (High Impedance) Output Current at Receiver	$I_{OZR}$	$0.4V \leq V_O \leq 2.4V$ , $RE^* = 5V$			$\pm 1$	$\mu A$
Receiver Input Resistance	$R_{IN}$	$-7V \leq V_{CM} \leq 12V$	12	15		$k\Omega$
Input Current (A, B)	$I_{IN2}$	$DE = 0V$ , $V_{CC} = 0V$ or $5.25V$	$V_{IN} = 12V$		1.0	mA
			$V_{IN} = -7V$		-0.8	
Receiver Short-Circuit Current	$I_{OSR}$	$0V \leq V_O \leq V_{CC}$	7		95	mA

## Low-Power, Slew-Rate-Limited RS-485/RS-422 Transceivers **MAX485**

RECEIVER AC Characteristics							
Receiver Input to Output	t <sub>PLH</sub>	Figure 2 & 7 S <sub>1</sub> , S <sub>2</sub> open C <sub>L</sub> = 15pF		20	45	100	ns
	t <sub>PHL</sub>			20	45	100	ns
t <sub>PLH</sub> - t <sub>PHL</sub>   Differential Receiver Skew	t <sub>SKD</sub>					13	
Receiver Enable to Output Low	t <sub>ZL</sub>	Figure 2 & 8 C <sub>L</sub> = 15pF	S <sub>1</sub> closed		45	70	ns
Receiver Enable to Output High	t <sub>ZH</sub>		S <sub>2</sub> closed		45	70	ns
Receiver Disable Time from Low	t <sub>LZ</sub>		S <sub>1</sub> closed		45	70	ns
Receiver Disable Time from High	t <sub>HZ</sub>		S <sub>2</sub> closed		45	70	ns
Supply Current							
No-Load Supply Current	I <sub>CC</sub>	RE = 0V or V <sub>CC</sub>	DE=V <sub>CC</sub>		900		uA
			DE=0V		600		

TEST CIRCUITS

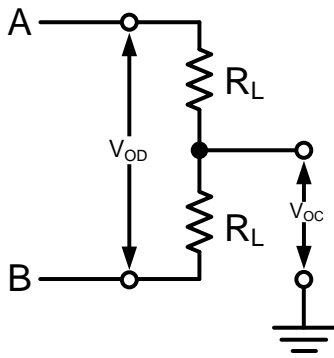


Figure 1.

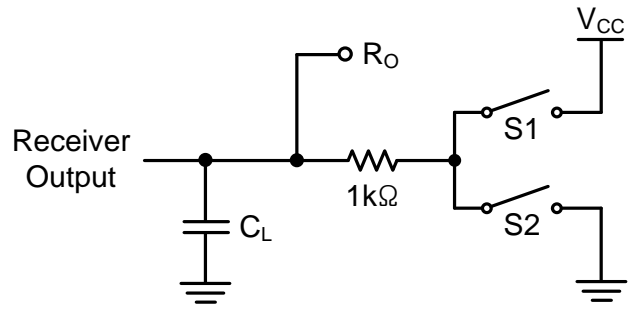


Figure 2.

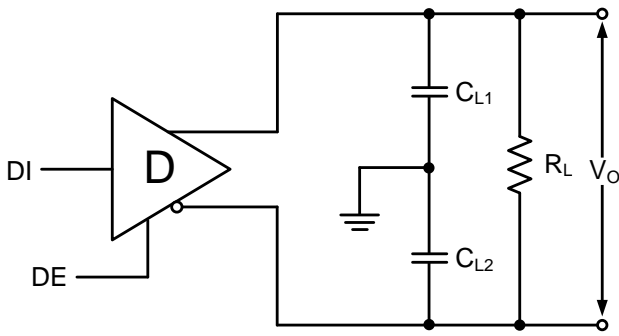


Figure 3.

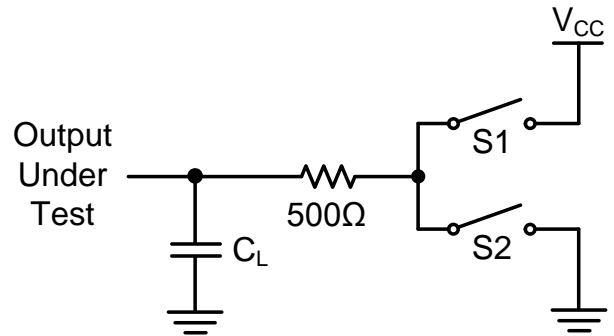


Figure 4.

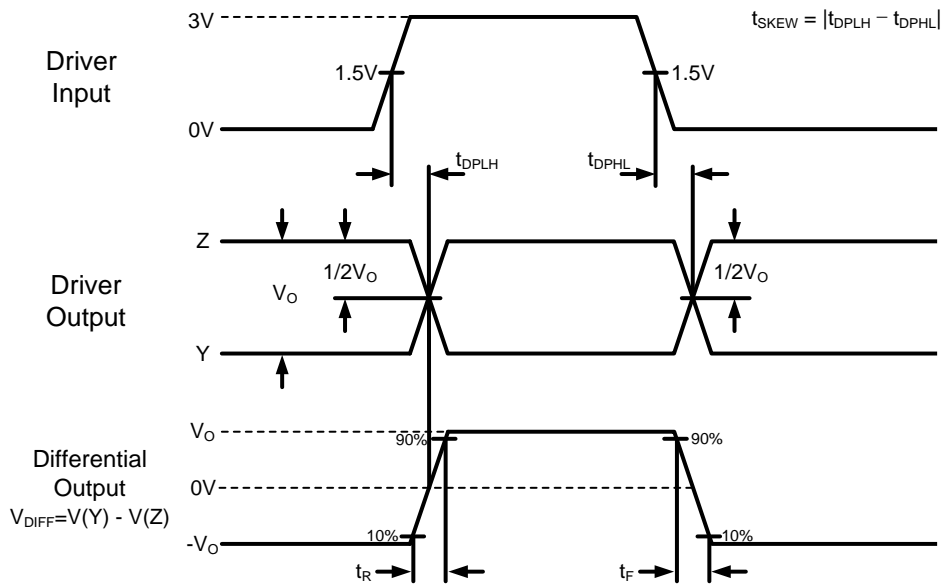


Figure 5.

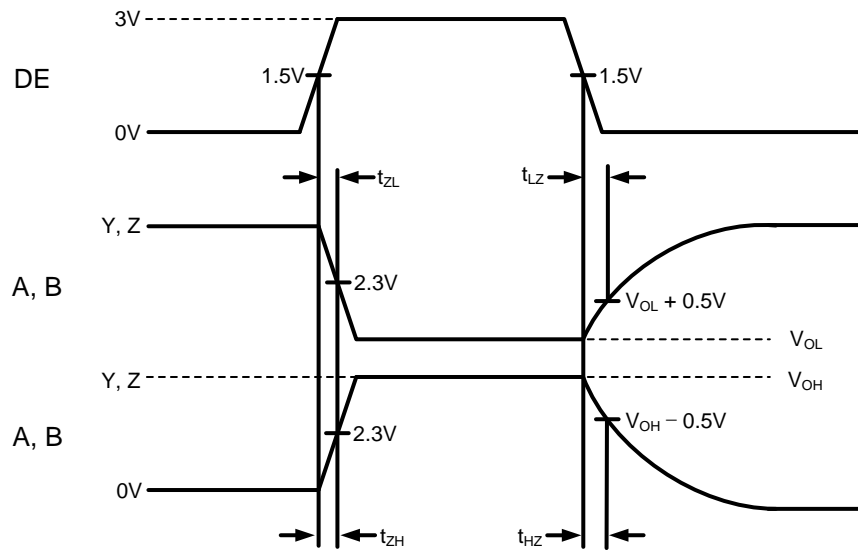


Figure 6.

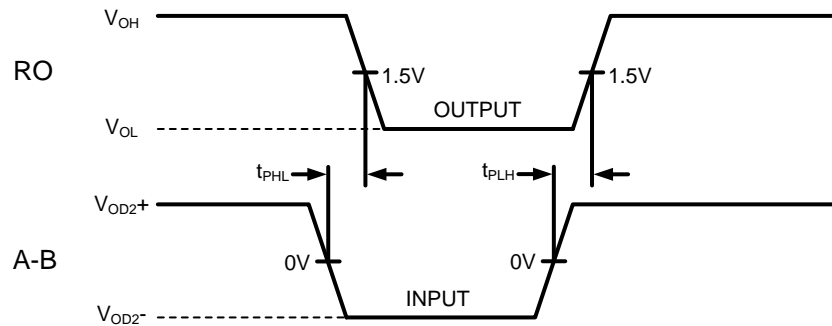


Figure 7.

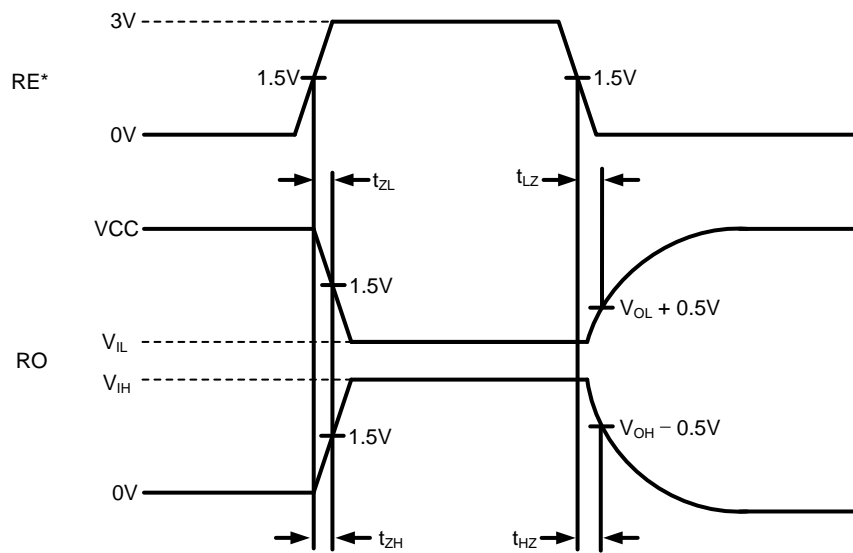


Figure 8.

## APPLICATION INFORMATION

### FUNCTIONAL DESCRIPTION

The MAX485 is half-duplex differential transceiver that meets the requirements of RS-485 and RS-422. The RS-485 standard is ideal for multi-drop applications and for long-distance interfaces. RS-485 allows up to 32 drivers and 32 receivers to be connected to a data bus, making it an ideal choice for multi-drop applications. Since the cabling can be as long as 4,000 feet, RS-485 transceivers are equipped with a wide (-7V to +12V) common mode range to accommodate ground potential differences. Because RS-485 is a differential interface, data is virtually immune to noise in the transmission line.

### DRIVERS

The driver outputs of the MAX485 are differential outputs meeting the RS-485 and RS-422 standards. The typical voltage output swing with no load will be 0 Volts to +5 Volts. With worst case loading of 54 $\Omega$  across the differential outputs, the drivers can maintain greater than 1.5V voltage levels. The drivers of the MAX485 have an enable control line which is active HIGH. A logic HIGH on DE (pin 3) will enable the differential driver outputs. A logic LOW on the DE(pin 3) will tri-state the driver output. The transmitters of the MAX485 will operate up to at least 5Mbps.

### RECEIVERS

The MAX485 receiver has differential inputs with an input sensitivity as low as  $\pm 200\text{mV}$ . Input impedance of the receivers is typically 15k $\Omega$  (12k $\Omega$  minimum). A wide common mode range of -7V to +12V allows for large ground potential differences between systems. The receivers of the MAX485 have a tri-state enable control pin. A logic LOW on RE\* (pin 2) will enable the receiver, a logic HIGH on RE\*(pin 2) will disable the receiver. The receiver for the MAX485 will operate up to at least 5Mbps. The receiver is equipped with the fail-safe feature. Fail-safe guarantees that the receiver output will be in a HIGH state when the input is left unconnected.

# **Low-Power, Slew-Rate-Limited RS-485/RS-422 Transceivers MAX485**

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