

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

DESCRIPTION

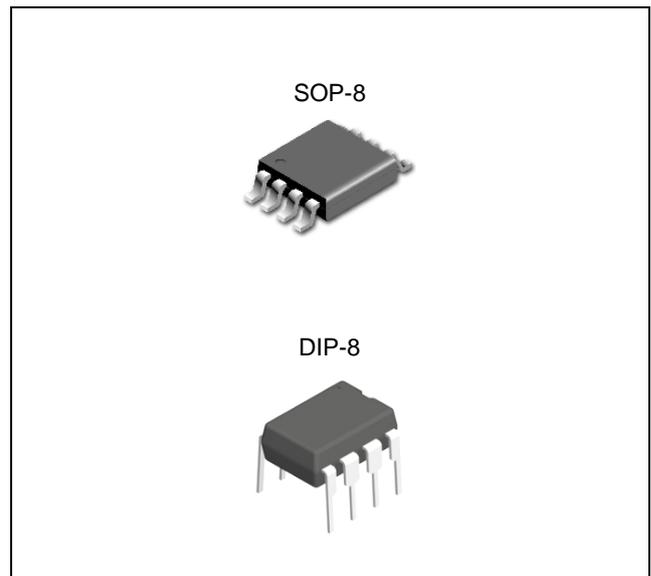
The MAX485 is a half-duplex transceiver that meets the specifications of RS-485 and RS-422. Its BiCMOS design allows low power operation without sacrificing performance. The MAX485 meets the requirements of the RS-485 and RS-422 protocols up to 5Mbps underload. The ESD tolerance is more than $\pm 8\text{kV}$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

FEATURES

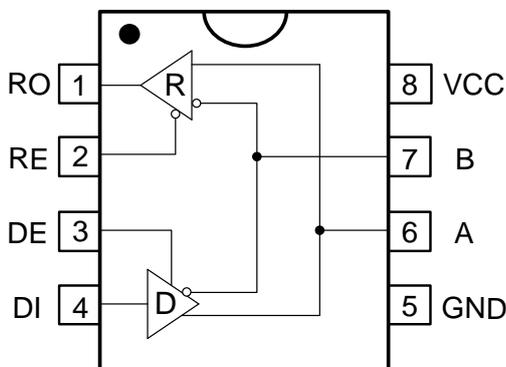
- Single +5V Supply
- Low Power BiCMOS
- Driver/Receiver Enable for Multi-Drop Configurations
- Half-Duplex Versions Available
- Data rate: 5 Mbps
- ESD Specifications
 - $\pm 15\text{kV}$ IEC61000-4-2 Air Discharge
 - $\pm 8\text{kV}$ Human Body Model

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



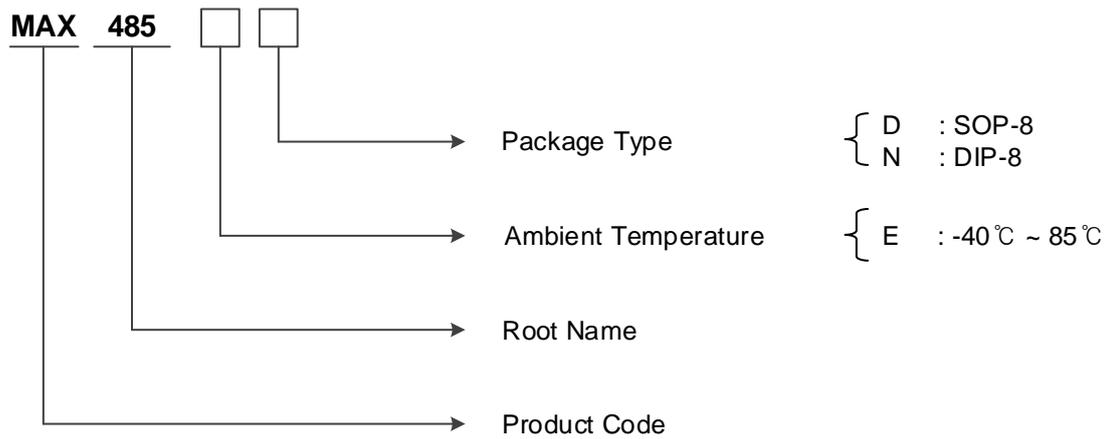
TRUTH TABLE

Transmission				
Inputs			Outputs	
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	
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	

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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



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ABSOLUTE MAXIMUM RATINGS

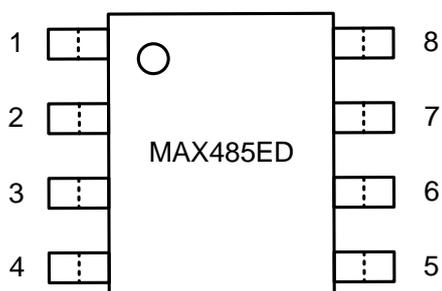
Characteristic	Symbol	Min	Max	Unit
Supply Voltage	V_{CC}		7	V
Control Input Voltage	V_{DE}, V_{RE}	-0.3	$V_{CC} + 0.5$	V
Driver Input Voltage	V_{DI}	-0.3	$V_{CC} + 0.5$	V
Driver Output Voltage	A, B	-15	15	V
Receiver Input Voltage	A, B	-15	15	V
Receiver Output Voltage	V_{RO}	-0.3	$V_{CC} + 0.5$	V
Junction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

RECOMMENDED OPERATING CONDITIONS

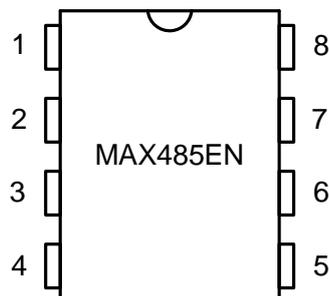
Characteristic	Symbol	Min	Max	Unit
Supply Voltage	V_{CC}	4.75	5.25	V
Operating Ambient Temperature Ranges	T_A	-40	85	°C

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PIN CONFIGURATION



SOP-8



DIP-8

PIN DESCRIPTION

Pin No.	SOP-8 / DIP-8 PKG	
	Name	Function
1	RO	Receiver Output
2	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 _{CC}	Power Supply: 4.75V to 5.25V

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ELECTRICAL CHARACTERISTICS

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

PARAMETER	Symbol	CONDITIONS	MIN	TYP	MAX	UNITS
DRIVER DC Characteristics						
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	ΔV_{OD}	$R_L = 27\Omega$ or 50Ω , Figure 1			0.2	V
Driver Common-Mode Output Voltage	V_{OC}	$R_L = 27\Omega$ or 50Ω , Figure 1			3	V
Change in Magnitude of Driver Common-Mode Output Voltage for Complementary Output States	ΔV_{OC}	$R = 27\Omega$ or 50Ω , 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*			± 10	μA
Driver Short Circuit Current						
Driver Short-Circuit Current, $V_O = \text{High}$	I_{OSD1}	$-7V \leq V_O \leq 12V$			± 250	mA
Driver Short-Circuit Current, $V_O = \text{Low}$	I_{OSD2}	$-7V \leq V_O \leq 12V$			± 250	mA
DRIVER AC Characteristics						
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}		Figure 4 & 6 $C_L = 100pF$	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}	S_2 closed		40	70	ns
Driver Disable Time from High	t_{LZ}	S_1 closed		40	70	ns
RECEIVER DC Characteristics						
Receiver Differential Threshold Voltage	V_{TH}	$-7V \leq V_{CM} \leq 12V$	-0.2		0.2	V
Receiver Input Hysteresis	ΔV_{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}	$0.4V \leq V_O \leq 2.4V$, $RE^* = 5V$			± 1	μA
Receiver Input Resistance	R_{IN}	$-7V \leq V_{CM} \leq 12V$	12	15		k Ω
Input Current (A, B)	I_{IN2}	$DE = 0V$	$V_{IN} = 12V$		1.0	mA
		$V_{CC} = 0V$ or $5.25V$	$V_{IN} = -7V$		-0.8	
Receiver Short-Circuit Current	I_{OSR}	$0V \leq V_O \leq V_{CC}$	7		95	mA

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

TEST CIRCUITS

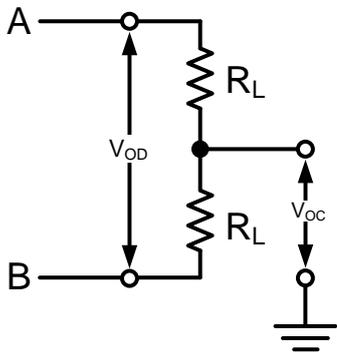


Figure 1.

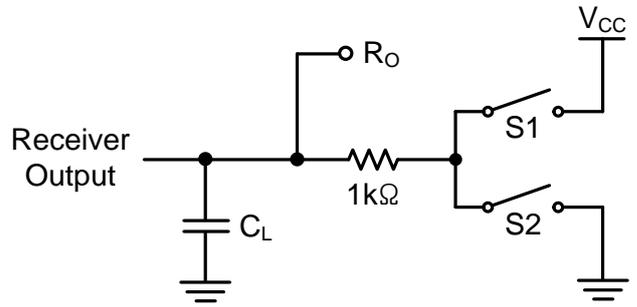


Figure 2.

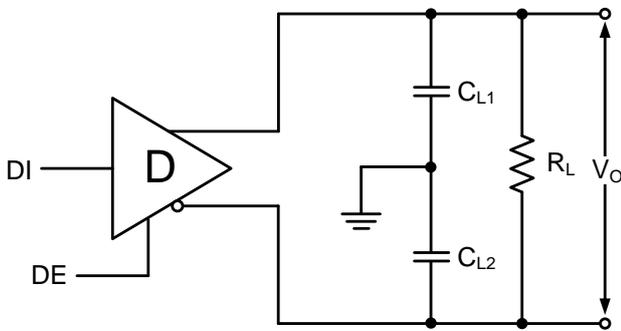


Figure 3.

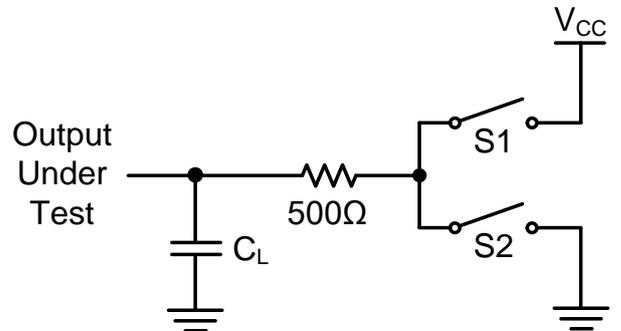


Figure 4.

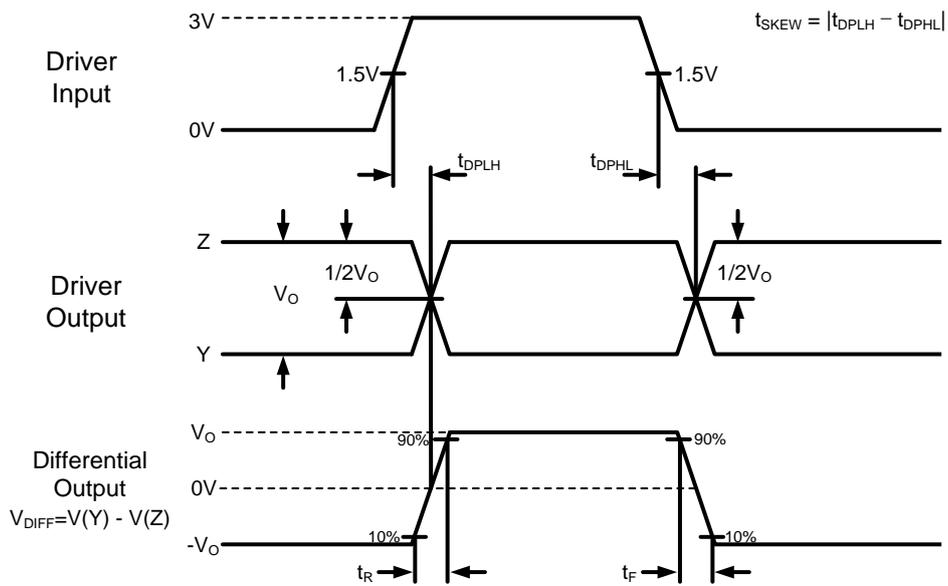


Figure 5.

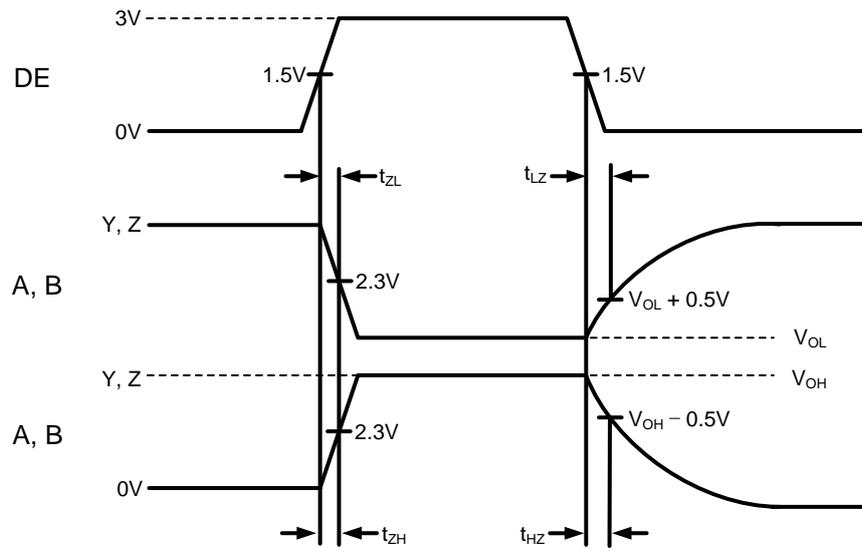


Figure 6.

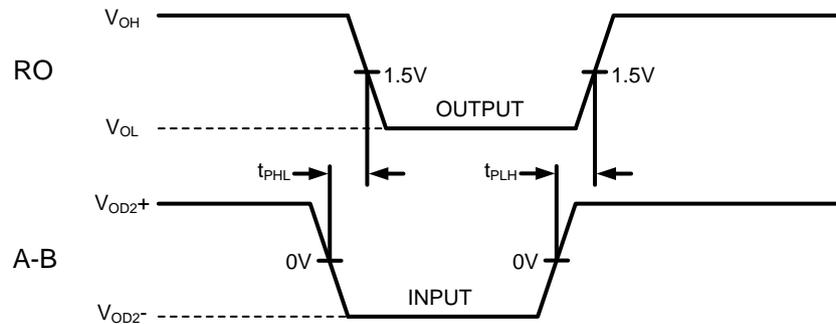


Figure 7.

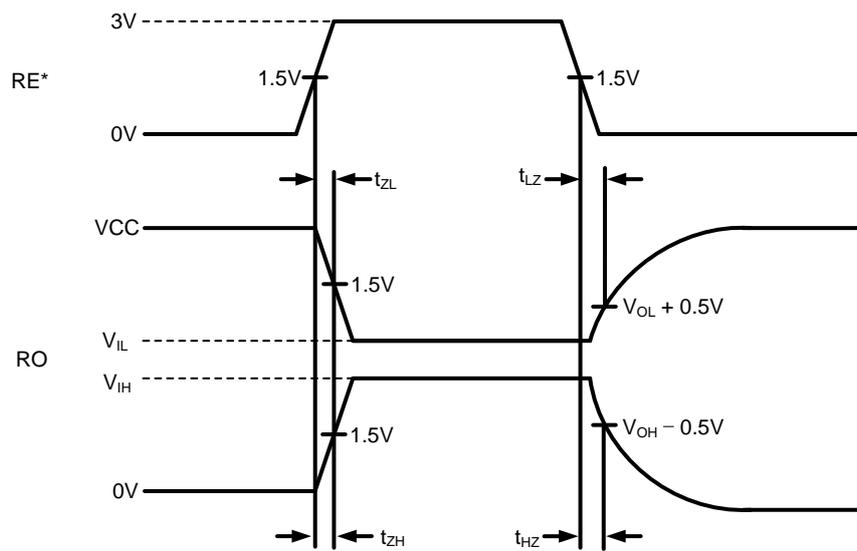


Figure 8.

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 Ω 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 Ω (12k Ω 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.

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REVISION NOTICE

The description in this datasheet can be revised without any notice to describe its electrical characteristics properly.