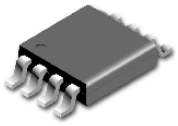
Low-Power, Slew-Rate-Limited RS-485/RS-422 Transceivers MAX485

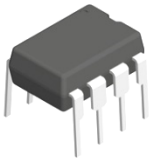
DESCRIPTION

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 ±8kV for both Human Body Model and ±15kV for IEC61000-4-2 Air Discharge Method on this device.

SOP-8



DIP-8



FEATURES

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

APPLICATIONS

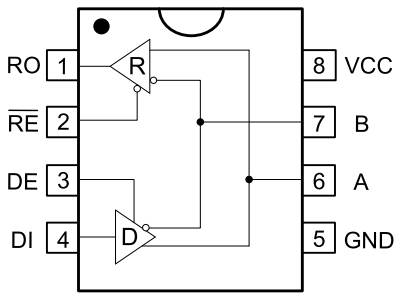
- Low Power RS-485 Systems
- DTE-DCE Interface
- Packet Switching
- Local Area Networks
- Data Concentration
- Data Multiplexers
- Integrated Services Digital Network (ISDN)

TRUTH TABLE

Transmission				
Inputs			Outputs	
$\overline{RE}$	DE	DI	A	B
X	1	1	1	0
X	1	0	0	1
0	0	X	Z	Z
1	0	X	Z	Z

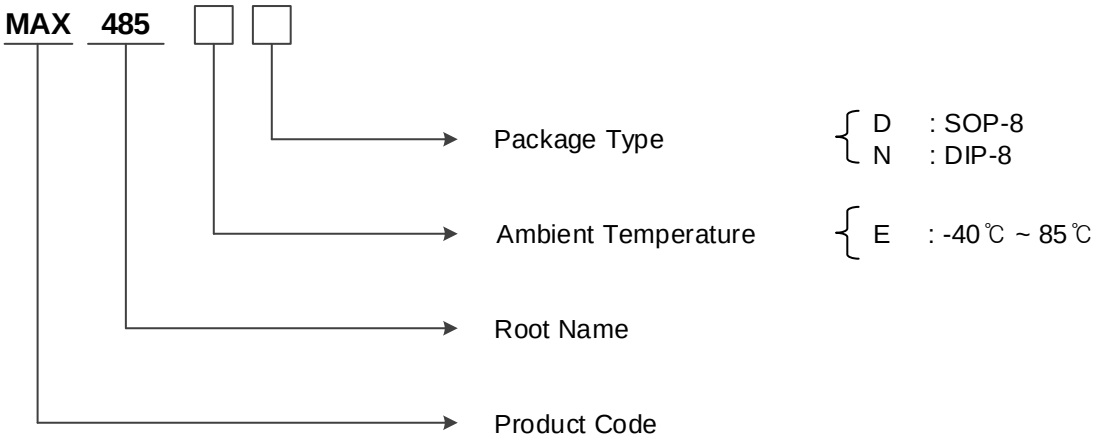
Receiver			
Inputs			Outputs
$\overline{RE}$	DE	A-B	RO
0	0	≥ +0.2V	1
0	0	≤ -0.2V	0
0	0	Open	1
1	0	X	Z

PIN CONFIGRUATION AND LOGIC DIAGRAM



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



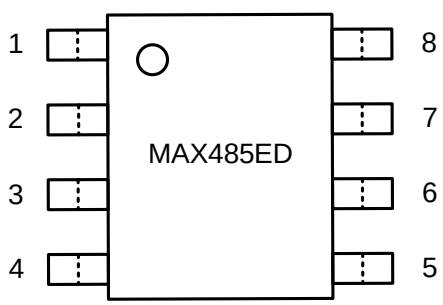
ABSOLUTE MAXIMUM RATINGS

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

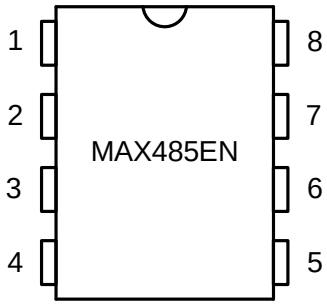
RECOMMENDED OPERATING CONDITIONS

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

PIN CONFIGURATION



SOP-8



DIP-8

PIN DESCRIPTION

Pin No.	SOP-8 / DIP-8 PKG	
	Name	**Function**
1	RO	Receiver Output
2	$\overline{RE}$	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

ELECTRICAL CHARACTERISTICS

Unless otherwise specified: V_{CC} = 5V ± 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 = ∞, Figure 1		GND		V_{CC}	V
Differential Driver Output (with load)	V_{OD2}	R_L = 50Ω (RS-422), Figure 1		2		V_{CC}	V
		R_L = 27Ω (RS-485), Figure 1		1.5		V_{CC}	
Change in Magnitude of Driver Differential Output Voltage for Complementary Output States	ΔV_{OD}	R_L = 27Ω or 50Ω, Figure 1				0.2	V
Driver Common-Mode Output Voltage	V_{OC}	R_L = 27Ω or 50Ω, Figure 1				3	V
Change in Magnitude of Driver Common-Mode Output Voltage for Complementary Output States	ΔV_{OC}	R = 27Ω 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	uA
Driver Short Circuit Current							
Driver Short-Circuit Current, V_O = High	I_{OSD1}	-7V ≤ V_O ≤ 12V				±250	mA
Driver Short-Circuit Current, V_O = Low	I_{OSD2}	-7V ≤ V_O ≤ 12V				±250	mA
DRIVER AC Characteristics							
Max. Transmission Rate	f_{MAX}			5			Mbps
Driver Input to Output	t_{DPLH}	Figure 3 & 5 R_L = 54Ω, 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	ns
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 ≤ V_{CM} ≤ 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 ≤ V_O ≤ 2.4V, RE* = 5V				±1	uA
Receiver Input Resistance	R_{IN}	-7V ≤ V_{CM} ≤ 12V		12	15		kΩ
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 ≤ V_O ≤ V_{CC}		7		95	mA

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
| tPLH - tPHL | Differential Receiver Skew	t_{SKD}				13		ns
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

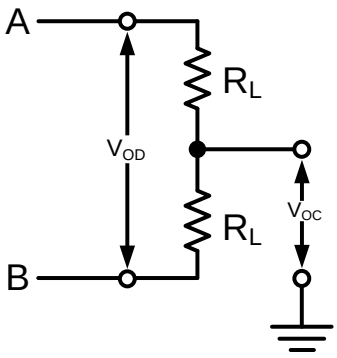


Figure1.

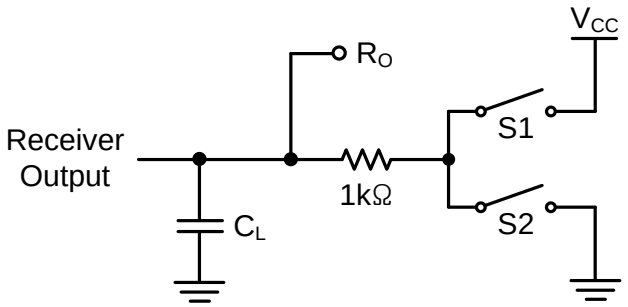


Figure 2.

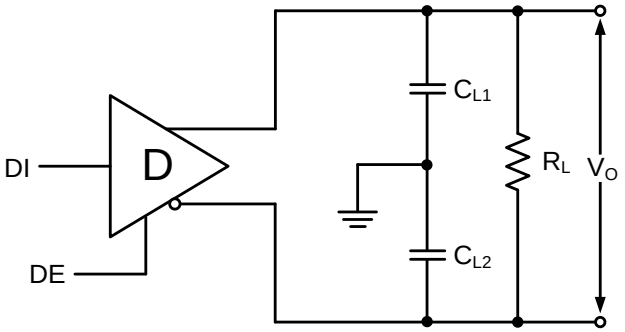


Figure 3.

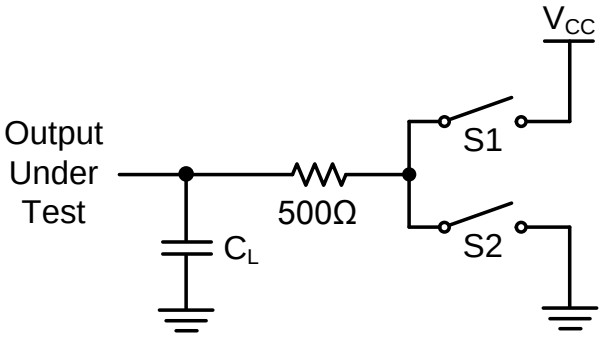


Figure 4.

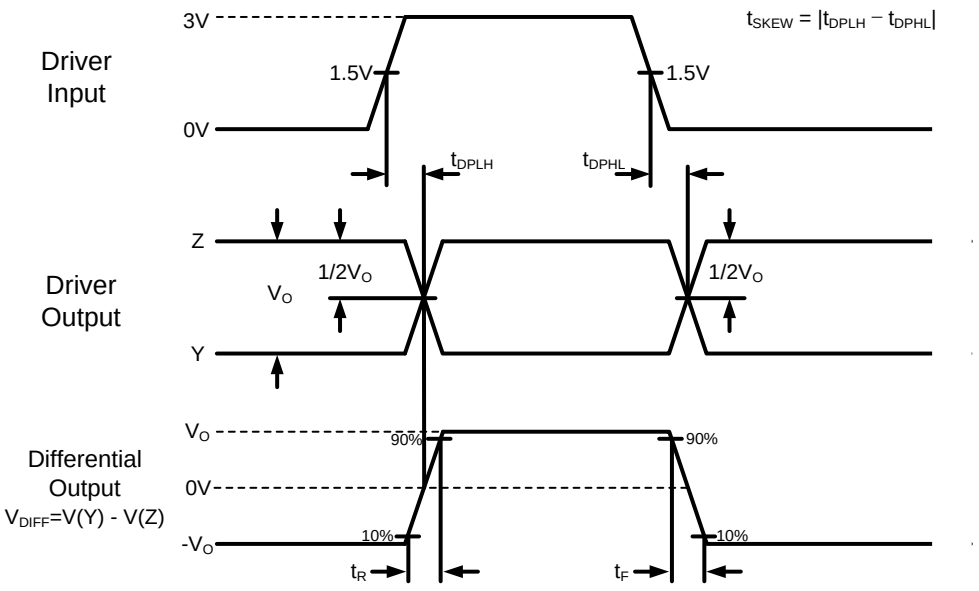


Figure 5.

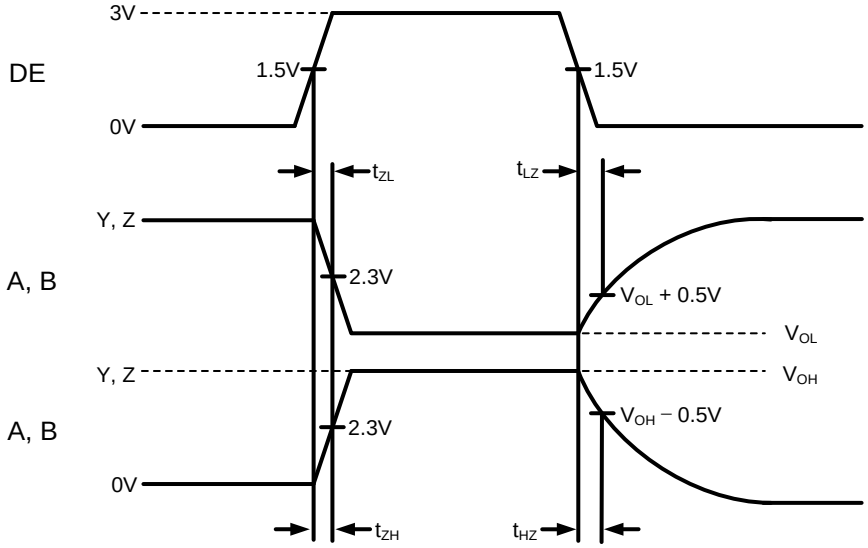


Figure 6.

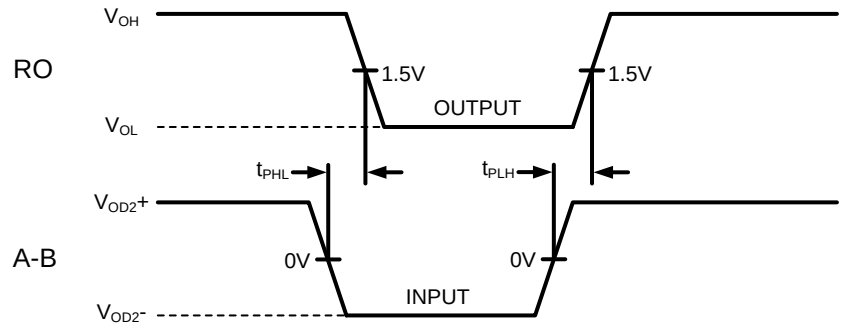


Figure 7.

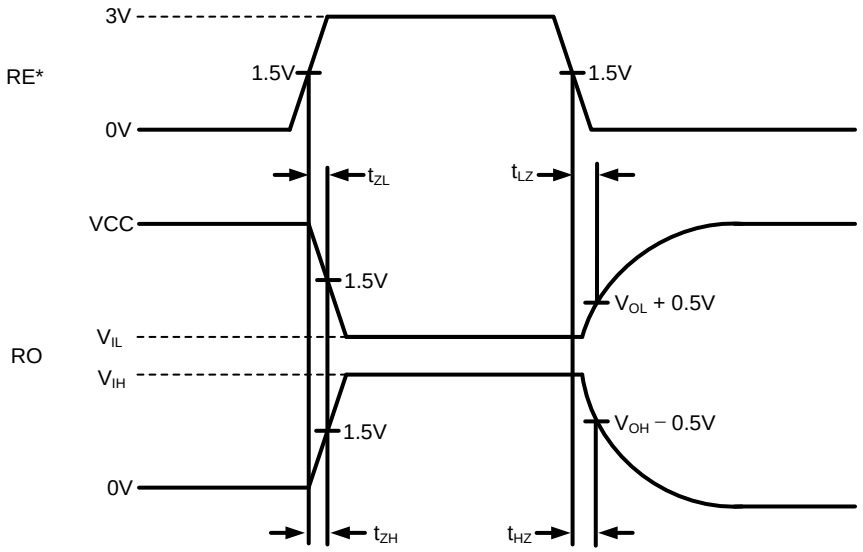


Figure 8.

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 54Ω 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 ±200mV. Input impedance of the receivers is typically 15kΩ (12kΩ 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.

REVISION NOTICE

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