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

DESCRIPTION

The MAX485 is low-power transceivers for RS-485 and RS-422 communication. IC contains one driver and one receiver.

The driver slew rates of the MAX485 is not limited, allowing them to transmit up to 2.5Mbps.

These transceivers draw between 120µA and 500µA of supply current when unloaded or fully loaded with disabled drivers. All parts operate from a single 5V supply. Drivers are short-circuit current limited and are protected against excessive power dissipation by thermal shutdown circuitry that places the driver outputs into a high-impedance state.

The receiver input has a fail-safe feature that guarantees a logic-high output if the input is open circuit. The MAX485 is designed for half-duplex applications

FEATURES

- Low Quiescent Current: 300µA
- -7V to +12V Common-Mode Input Voltage Range
- Three-State Outputs
- 30ns Propagation Delays, 5ns Skew
- Full-Duplex and Half-Duplex Versions Available
- Operate from a Single 5V Supply
- Allows up to 32 Transceivers on the Bus
- Data rate: 2,5 Mbps
- Current-Limiting and Thermal Shutdown for Driver Overload Protection

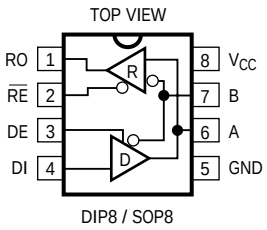
APPLICATIONS

- Low-Power RS-485 Transceivers
- Low-Power RS-422 Transceivers
- Level Translators
- Transceivers for EMI-Sensitive Applications
- Industrial-Control Local Area Networks

ORDERING INFORMATION

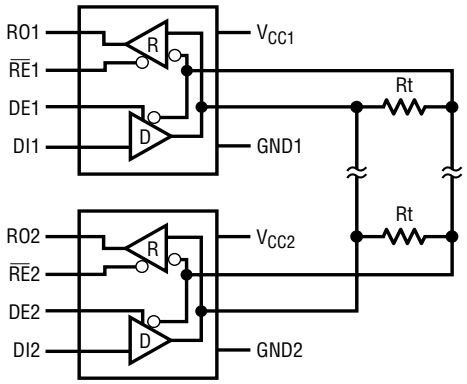
PART NO.	Temp. Range (°C)	Package
MAX485CPA	0 to 70	8 Pin DIP
MAX485CSA	0 to 70	8 Pin SOP
MAX485EPA	-40 to 85	8 Pin DIP
MAX485ESA	-40 to 85	8 Pin SOP

PINOUT



DIP8 / SOP8

TYPICAL APPLICATION



PIN DESCRIPTIONS

Pin No.	PIN NAME	DESCRIPTION
01	RO	Receiver Output. If the receiver output is enabled(RE low), then if A > B by 200mV, RO will be high. If A < B by 200mV, then RO will be low.
02	$\overline{RE}$	Receiver Output Enable. A low enables the receiver output, RO. A high input forces the receiver output into a high impedance state.
03	DE	Driver Outputs Enable. A high on DE enables the driver output. A and B, and the chip will function as a line driver. A low input will force the driver outputs into a high impedance state and the chip will function as a line receiver.
04	DI	Driver Input. If the driver outputs are enabled (DE high), then a low on DI forces the outputs A low and B high. A high on DI with the driver outputs enabled will force A high and B low.
05	GND	Ground Connection.
06	A	Driver Output/Receiver Input.
07	B	Driver Output/Receiver Input.
08	Vcc	Positive Supply; 4.75 < Vcc < 5.25.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{CC}) ……..12V
Control Input Voltage……....-0.5V to (V_{CC} +0.5V)
Driver Input Voltage (DI)……-0.5V to (V_{CC} +0.5V)
Driver Output Voltage (A, B)…….... -8V to +12.5V
Receiver Input Voltage (A, B)…… -8V to +12.5V
Receiver Output Voltage (RO)……..-0.5V to (V_{CC} +0.5V)
Continuous Power Dissipation…… (T_A= +70°C)
8-Pin Plastic DIP (derate 9.09mW/°C above +70°C) ……..727mW
8-Pin SO (derate 5.88mW/°C above +70°C) ……471mW
Storage Temperature Range……-65°C to +160°C
Lead Temperature (soldering, 10sec)…… +300°C

DC ELECTRICAL CHARACTERISTICS

(V_{CC} = 5V ±5%, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.) (Notes 1, 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Differential Driver Output (no load)	V_{OD1}					5	V
Differential Driver Output (with load)	V_{OD2}	R = 50Ω (RS-422)		2			V
		R = 27Ω (RS-485), Figure 4		1.5		5	
Change in Magnitude of Driver Differential Output Voltage for Complementary Output States	ΔV_{OD}	R = 27Ω or 50Ω, Figure 4				0.2	V
Driver Common-Mode Output Voltage	V_{OC}	R = 27Ω or 50Ω, Figure 4				3	V
Change in Magnitude of Driver Common-Mode Output Voltage for Complementary Output States	ΔV_{OD}	R = 27Ω or 50Ω, Figure 4				0.2	V
Input High Voltage	V_{IH}	DE, DI, $\overline{RE}$		2.0			V
Input Low Voltage	V_{IL}	DE, DI, $\overline{RE}$				0.8	V
Input Current	I_{IN1}	DE, DI, $\overline{RE}$				±2	µA
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 Differential Threshold Voltage	V_{TH}	-7V ≤ V_{CM} ≤12V		-0.2		0.2	V
Receiver Input Hysteresis	ΔV_{TH}	VCM = 0V			70		mV
Receiver Output High Voltage	V_{OH}	IO = -4mA, V_{ID} = 200mV		3.5			V
Receiver Output Low Voltage	V_{OL}	IO = 4mA, VID = -200mV				0.4	V

DC ELECTRICAL CHARACTERISTICS (continued)

(VCC = 5V ±5%, TA = TMIN to TMAX, unless otherwise noted.) (Notes 1, 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Three-State (high impedance) Output Current at Receiver	I_{OZR}	$0.4V \le V_O \le 2.4V$				±1	µA
Receiver Input Resistance	R_{IN}	$-7V \le V_{CM} \le 12V$		12			kΩ
No-Load Supply Current (Note 3)	I_{CC}	$\overline{RE}$ = 0V or V_{CC}	DE = V_{CC}		500	900	
			DE = 0V		300	500	µA
Driver Short-Circuit Current, V_O = High	I_{OSD1}	$-7V \le V_O \le 12V$ (Note 4)		35		250	mA
Driver Short-Circuit Current, V_O = Low	I_{OSD2}	$-7V \le V_O \le 12V$ (Note 4)		35		250	mA
Receiver Short-Circuit Current	I_{OSR}	$0V \le V_O \le V_{CC}$		7		95	mA

SWITCHING CHARACTERISTICS

(VCC = 5V ±5%, TA = TMIN to TMAX, unless otherwise noted.) (Notes 1, 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Driver Input to Output	t_{PLH}	R_{DIFF} = 54Ω	10	30	60	ns
	t_{PHL}	$C_{L1} = C_{L2}$ = 100pF	10	30	60	
Driver Output Skew to Output	t_{SKEW}	R_{DIFF} = 54Ω, $C_{L1} = C_{L2}$ = 100pF		5	10	ns
Driver Enable to Output High	t_{ZH}	C_L= 100pF, S2 closed		40	70	ns
Driver Enable to Output Low	t_{ZL}	C_L= 100pF, S1 closed		40	70	ns
Driver Disable Time from Low	t_{LZ}	C_L= 15pF, S1 closed		40	70	ns
Driver Disable Time from High	t_{HZ}	C_L= 15pF, S2 closed		40	70	ns
$\lvert t_{PLH} - t_{PHL} \rvert$ Differential Receiver Skew	t_{SKD}	R_{DIFF} = 54Ω		13		ns
Receiver Enable to Output Low	t_{ZL}	C_{RL} = 15pF, S1 closed		20	50	ns
Receiver Enable to Output High	t_{ZH}	C_{RL} = 15pF, S2 closed		20	50	ns
Receiver Disable Time from Low	t_{LZ}	C_{RL} = 15pF, S1 closed		20	50	ns
Receiver Disable Time from High	t_{HZ}	C_{RL} = 15pF, S2 closed		20	50	ns
Maximum Data Rate	f_{MAX}		2.5			Mbps

Note 1: All currents into device pins are positive; all currents out of device pins are negative. All voltages are referenced to device ground unless otherwise specified.

Note 2: All typical specifications are given for V_{CC} = 5V and T_A = +25°C.

Note 3: Supply current specification is valid for loaded transmitters when DE = 0V.

Note 4: Applies to peak current. See *Typical Operating Characteristics.*

TESTING CIRCUITS

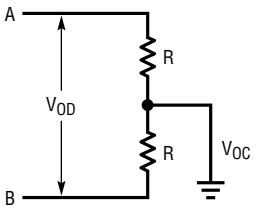


Figure 1. Driver DC Test Load

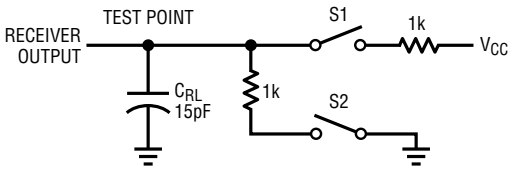


Figure 2. Receiver Timing Test Load

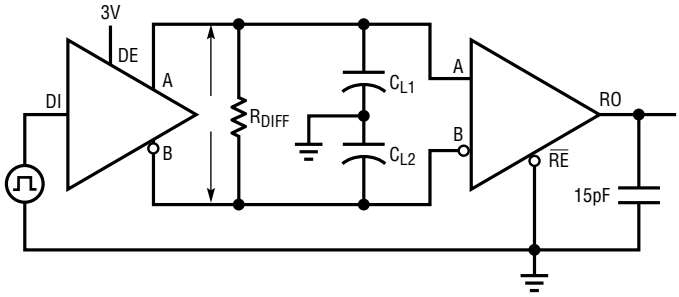


Figure 3. Driver/Receiver Timing Test Circuit

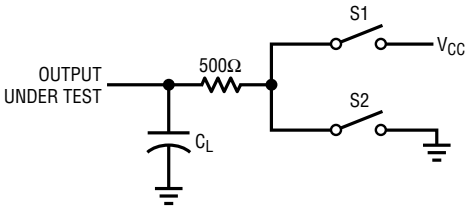


Figure 4. Driver Timing Test Load #2

SWITCHING TIME WAVEFORMS

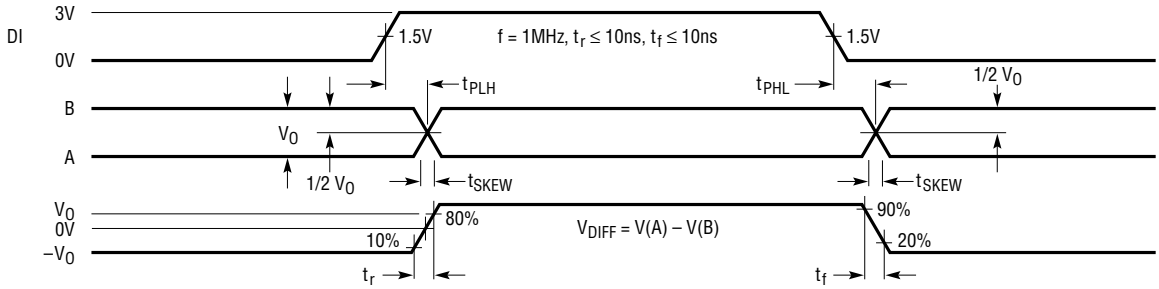


Figure 5. Driver Propagation Delays

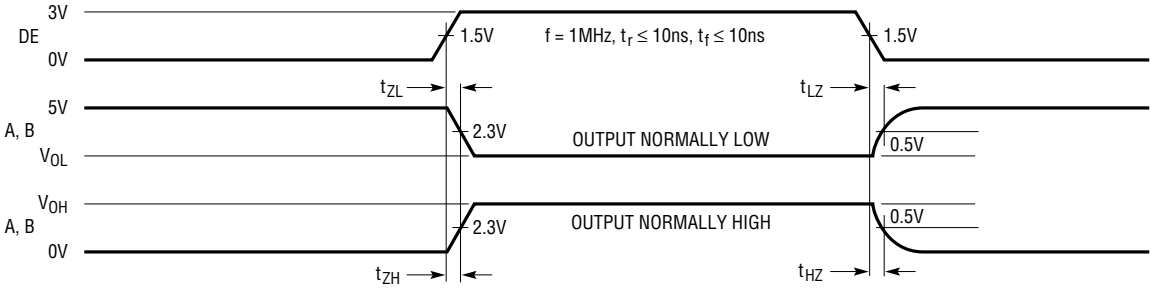


Figure 6. Driver Enable and Disable Times

SWITCHING TIME WAVEFORMS

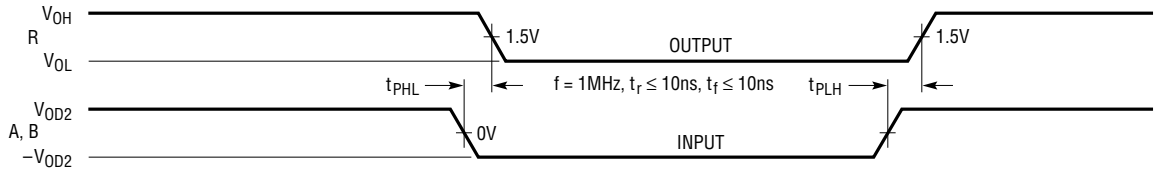


Figure 7. Receiver Propagation Delays

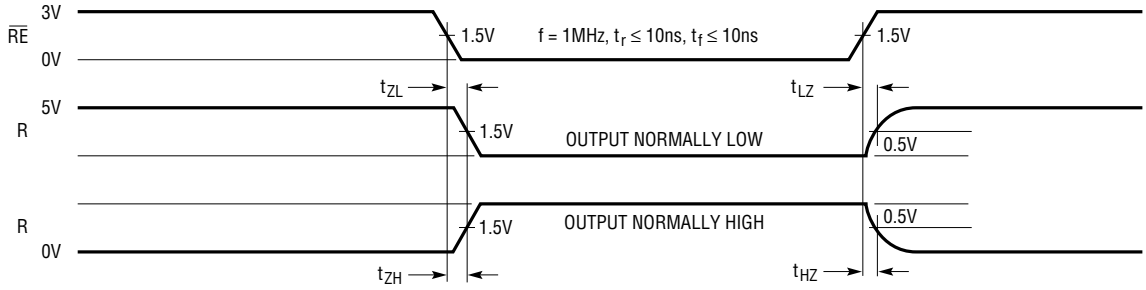


Figure 8. Receiver Enable and Disable Times

FUNCTION TABLES

Transmitting

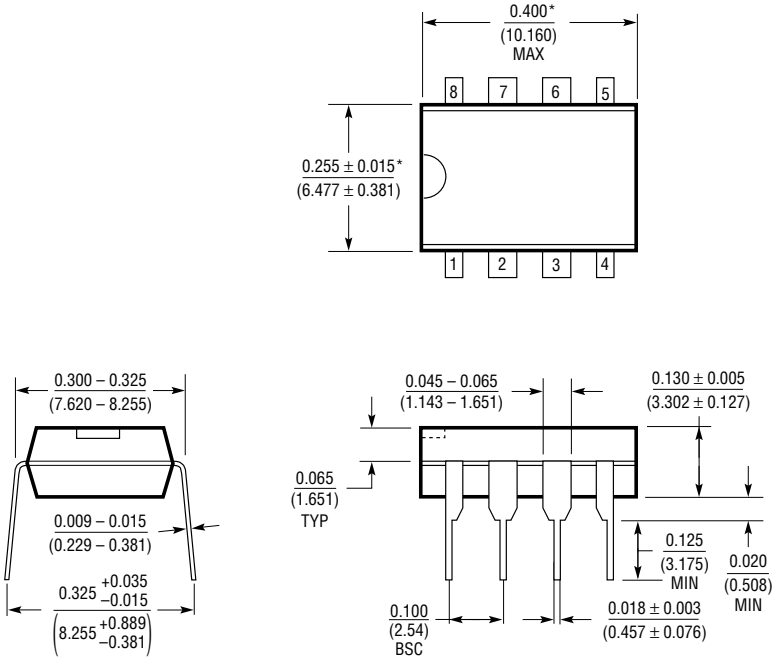
INPUTS			LINE CONDITION	OUTPUTS	
$\overline{RE}$	DE	DI		B	A
X	1	1	No Fault	0	1
X	1	0	No Fault	1	0
X	0	X	X	Z	Z
X	1	X	Fault	Z	Z

Receiving

INPUTS			OUTPUTS
$\overline{RE}$	DE	A – B	R
0	0	≥0.2V	1
0	0	≤–0.2V	0
0	0	Inputs Open	1
1	0	X	Z

PACKAGE

DIP8 Package
(Narrow .300 Inch)



SOP8 Package
(Narrow .150 Inch)