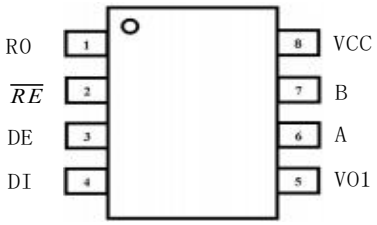
DESCRIPTION

The MAX3485EESA is a low power half duplex transceiver that meets the specifications of RS-485 and RS-422. IC contains one driver and one receiver. The driver slew rates is not limited, allowing them to transmit up to 10Mbps. These transceivers draw between 120μA and 500μA of supply current when unloaded or fully loaded with disabled drivers. All parts operate from a single 3.3V 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 ESD tolerance is more than ±8kV for both Human Body Model and ±15kV for IEC61000-4-2 Air Discharge Method on this device.

PIN CONFIGURATION

Pin 1
SOP-8
(SOIC-8)



FEATURES

- Operates from a Single 3.3V Supply
- Interoperable with +5.0V Logic
- −7V to 12V Common-Mode Input Voltage Range
- Three-State Outputs
- Driver/ Receiver Enable
- Half-Duplex Communication
- 1/8 Unit Load Allows Up To 256 Devices On The Bus
- Data Rate up to 10 Mbps
- Current-Limiting and Thermal Shutdown for Driver Overload Protection
- ESD Specifications
  - ±15kV IEC61000-4-2 Air Discharge
  - ±8kV Human Body Model

APPLICATIONS

- Low Power RS-485 Systems
- Telecommunications
- Packet Switching
- Industrial-Control Local Area Networks
- Data Concentration
- Data Multiplexers
- Integrated Services Digital Network (ISDN)

PIN DESCRIPTION

Pin No.	Pin Name	Pin 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/ Non-Inverting Receiver Input
7	B	Inverting Driver Output/ Inverting Receiver Input
8	VCC	Power Supply

ABSOLUTE MAXIMUM RATINGS (Note 1)

CHARACTERISTIC	SYMBOL	MIN.	MAX.	UNIT
Supply Voltage	V_{CC}	−0.3	6.0	V
Control Input Voltage	V_{RE}, V_{DE}	−0.3	6.0	V
Driver Input Voltage	V_{DI}	−0.3	6.0	V
Driver Output Voltage	V_A, V_B	−15	15	V
Receiver Input Voltage	V_A, V_B	−15	15	V
Receiver Output Voltage	V_{RO}	−0.3	V_{CC} + 0.3	V
Junction Temperature Range	T_J	−40	125	°C
Storage Temperature Range	T_{STG}	−65	150	°C

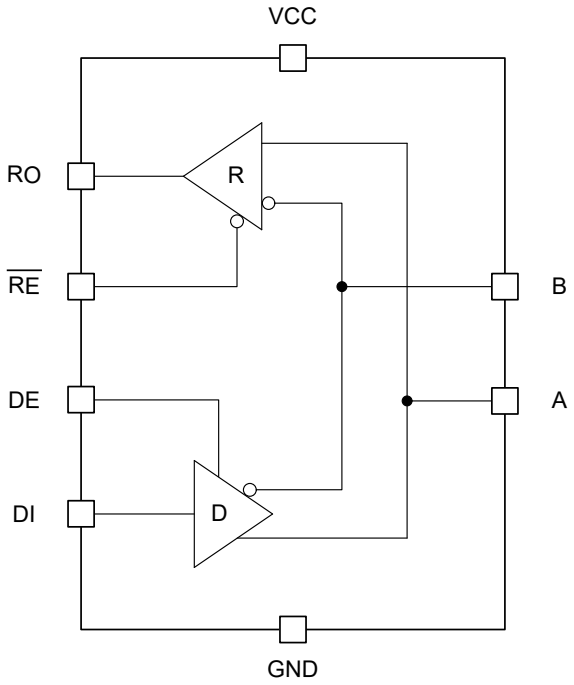
Note 1. Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS (Note 2)

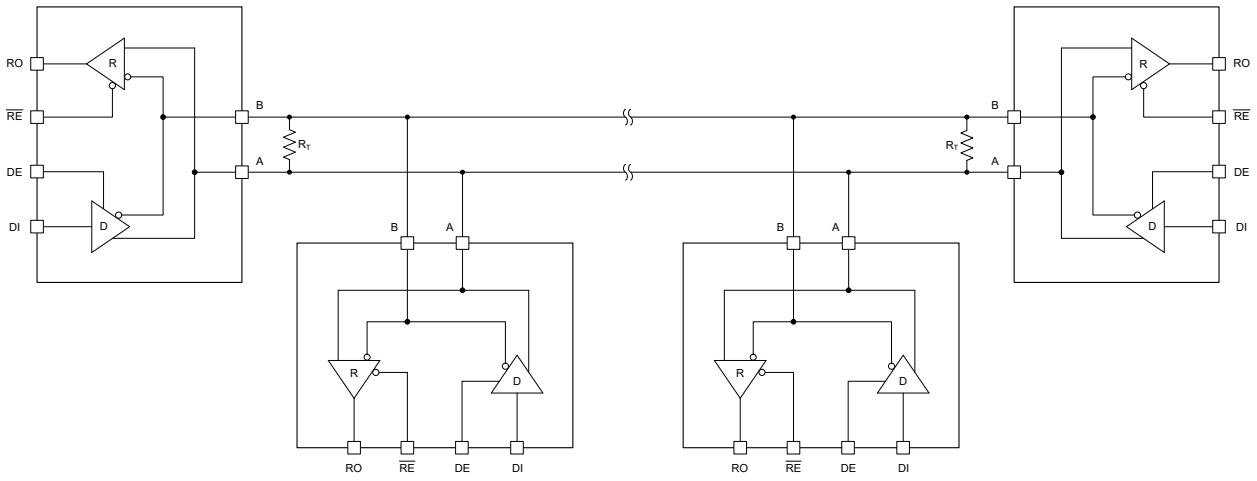
CHARACTERISTIC	SYMBOL	MIN.	MAX.	UNIT
Supply Voltage	V_{CC}	0	3.3 ± 5%	V
Ambient Temperature Range	T_A	−40	85	°C

Note 2. The device is not guaranteed to function outside its operating ratings.

BLOCK DIAGRAM



TYPICAL APPLICATION



< Typical RS-485 Network with Half-Duplex Transceivers >

DC ELECTRICAL CHARACTERISTICS

V_{CC} = 3.3V, T_A = 25°C, unless otherwise noted.

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Differential Output Voltage	V_{OD}	Unloaded, R_L = ∞, Figure 1		GND	-	V_{CC}	V
		With Load, R_L = 50Ω (RS-422), Figure 1		1	-	V_{CC}	
		With Load, R_L = 27Ω (RS-485), Figure 1		0.6	-	V_{CC}	
Change in Magnitude of Driver Differential Output Voltage for Complimentary States (NOTE 3)	ΔV_{OD}	R_L = 27Ω or R_L = 50Ω, Figure 1		-	-	0.2	V
Driver Common- Mode Output Voltage	V_{OC}	R_L = 27Ω or R_L = 50Ω, Figure 1		-	-	3.0	V
Input High Voltage	V_{IH}	DE, DI, $\overline{RE}$		2.0	-	-	V
Input Low Voltage	V_{IL}	DE, DI, $\overline{RE}$		-	-	0.6	V
Logic Input Current	I_{IN1}	DE, DI, $\overline{RE}$		-	-	±10	μA
Driver Short-Circuit Output Current	I_{OSD}	V_{OUT} = High or Low, −7V ≤ V_{OUT} ≤ 12V		-	-	±250	mA
Receiver Differential Input Threshold	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_{OUT} = −1.5mA, V_{ID} = 200mV, Figure 2		V_{CC}−0.4	-	-	V
Receiver Output Low Voltage	V_{OL}	I_{OUT} = 2.5mA, V_{ID} = 200mV, Figure 2		-	-	0.4	V
Three-State (High Impedance) Output Current at Receiver	I_{OZR}	0 ≤ V_{OUT} ≤ V_{CC}, $\overline{RE}$ = V_{CC}		-	-	±1.0	μA
Receiver Input Resistance	R_{IN}	−7V ≤ V_{CM} ≤ 12V		12	15	-	kΩ
Receiver Input Current (A, B)	I_{IN2}	DE = 0V, V_{CC} = 0V or 3.5V	V_{IN} = 12V	-	-	1.0	mA
			V_{IN} = −7V	-	-	−0.8	mA
Receiver Short Circuit Output Current	I_{OSR}	0V ≤ V_{OUTR} ≤ V_{CC}		7	-	60	mA
Supply Current	I_{CC}	No Load, DI = 0V or V_{CC}	DE = V_{CC}, $\overline{RE}$ = 0V or V_{CC}	-	425	2000	μA
			DE = 0V, $\overline{RE}$ = 0V	-	300	1500	

Note 3. ΔV_{OD} and ΔV_{OC} are the changes in V_{OD} and V_{OC}, respectively, when the DI input changes state.

AC ELECTRICAL CHARACTERISTICS

V_{CC} = 3.3V, T_A = 25°C, unless otherwise noted.

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Maximum Data Rate		DE = $\overline{RE}$ = V_{CC} or 0V	10	-	-	Mbps
Driver Differential Output Transition Time	t_{TD}	Figure 3	-	5	20	ns
Driver Input to Output Propagation Delay, Low-to-High Level	t_{PLH}	Figure 4	-	17	60	ns
Driver Input to Output Propagation Delay, High-to-Low Level	t_{PHL}	Figure 4	-	17	60	ns
Driver Propagation Delay Skew	t_{SKEW}	Figure 4, $\lvert t_{PLH} - t_{PHL} \rvert$	-	2	10	ns
Driver Output Enable Time to High	t_{PZH}	Figure 5	-	35	120	ns
Driver Output Enable Time to Low	t_{PZL}	Figure 6	-	30	120	ns
Driver Output Disable Time from High	t_{PHZ}	Figure 5	-	20	120	ns
Driver Output Disable Time from Low	t_{PLZ}	Figure 6	-	20	120	ns
Receiver Input to Output Propagation Delay, Low-to-High Level	t_{RPLH}	Figure 7	-	40	100	ns
Receiver Input to Output Propagation Delay, High-to-Low Level	t_{RPHL}	Figure 7	-	35	100	ns
Differential Receiver Propagation Delay Skew	t_{RSKEW}	Figure 7, $\lvert t_{RPLH} - t_{RPHL} \rvert$	-	4	-	ns
Receiver Output Enable Time to Low	t_{PRZL}	Figure 8	-	10	60	ns
Receiver Output Enable Time to High	t_{PRZH}	Figure 8	-	10	60	ns
Receiver Output Disable Time from Low	t_{PRLZ}	Figure 8	-	10	60	ns
Receiver Output Disable Time from High	t_{PRHZ}	Figure 8	-	10	60	ns

FUNCTION TABLE

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

Receiving			
Inputs			Output
$\overline{RE}$	DE	A − B	RO
0	0	≥ +0.2V	1
0	0	≤ −0.2V	0
0	0	Inputs Open	1
1	0	X	Z

X: Don't Care Z: High Impedance

PARAMETER MEASUREMENT INFORMATION

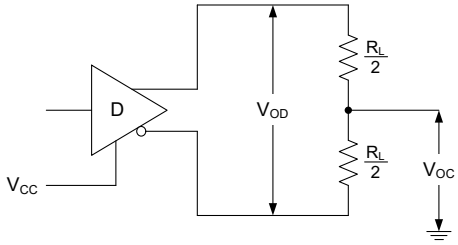


Fig. 1. Driver V_{OD} and V_{OC}

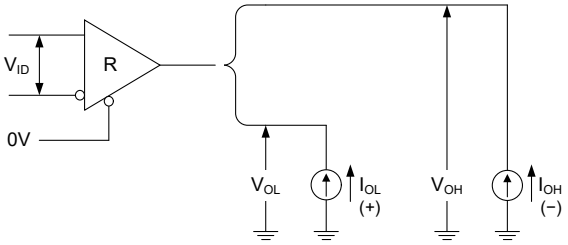
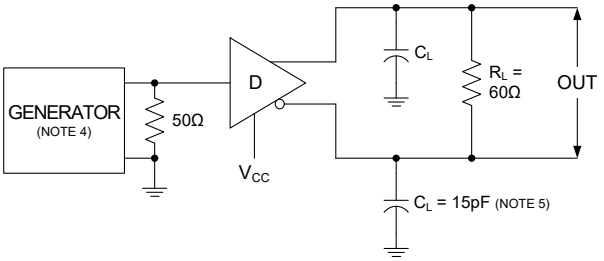


Fig. 2. Receiver V_{OH} and V_{OL}



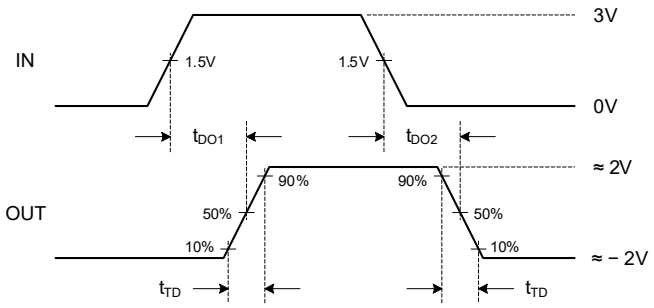
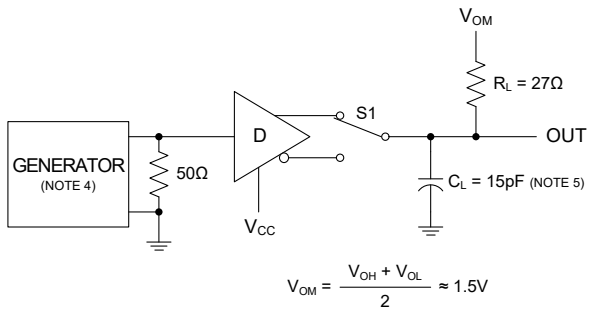


Fig. 3. Driver Differential Output Delay and Transition Times



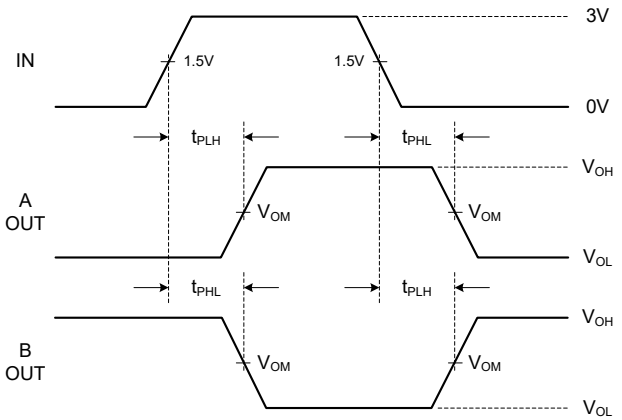


Fig. 4. Driver Propagation Delay

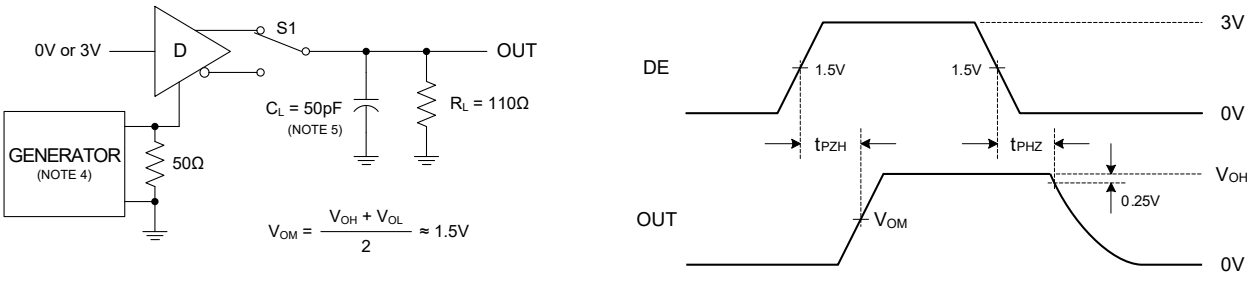


Fig. 5. Driver Enable and Disable Times, Output High

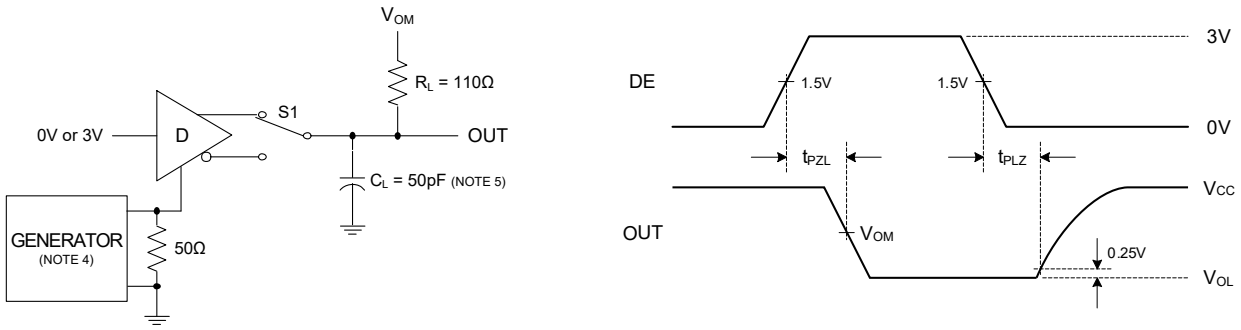


Fig. 6. Driver Enable and Disable Times, Output Low

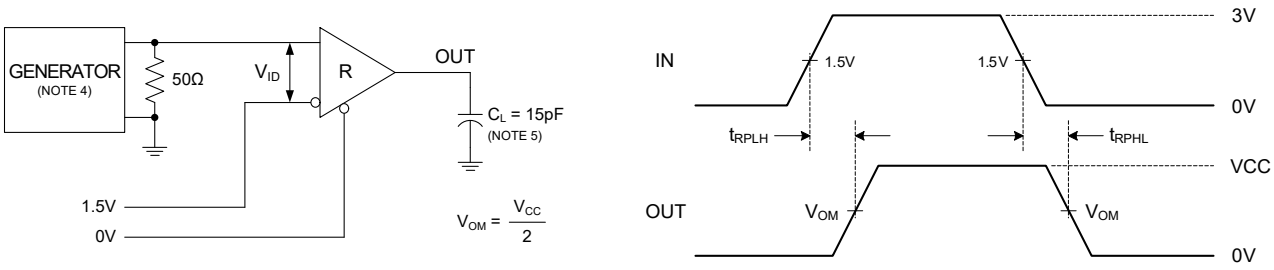


Fig. 7. Receiver Propagation Delay

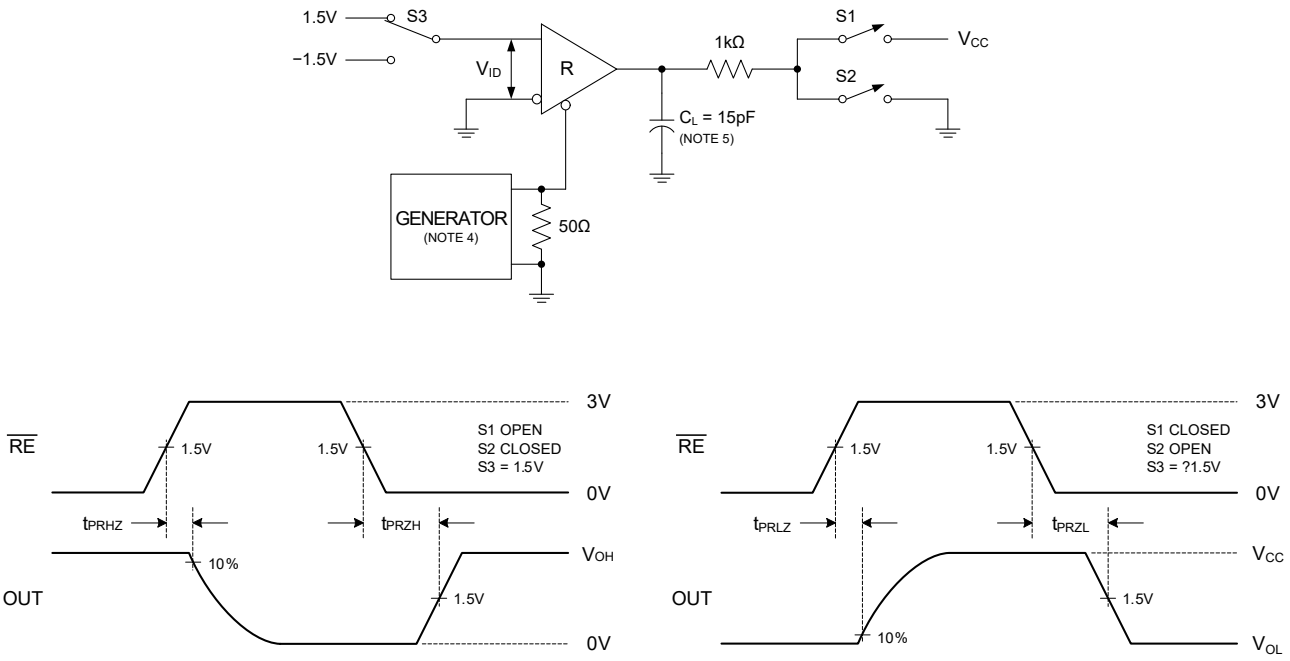


Fig. 8. Receiver Enable and Disable Times

Note 4. The input pulse is supplied by a generator with the following characteristics: PRR = 250kHz, 50% duty cycle, $t_r \le 6.0$ns, $Z_O = 50\Omega$.

Note 5. C_L includes probe and stray capacitance.

APPLICATION INFORMATION

Functional Description

The MAX3485EESA is 3.3V low power 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 common mode range of −7V to 12V to accommodate ground potential differences. Because RS-485 is a differential interface, data is virtually immune to noise in the transmission line.

Output Enable

The receiver output RO is enabled when $\overline{RE}$ is low. RO is high impedance when $\overline{RE}$ is high.
The driver outputs are enabled by bringing DE high. They are high impedance when DE is low. If the driver outputs are enabled, the parts function as line drivers. While they are high impedance, they function as line receivers if $\overline{RE}$ is low.

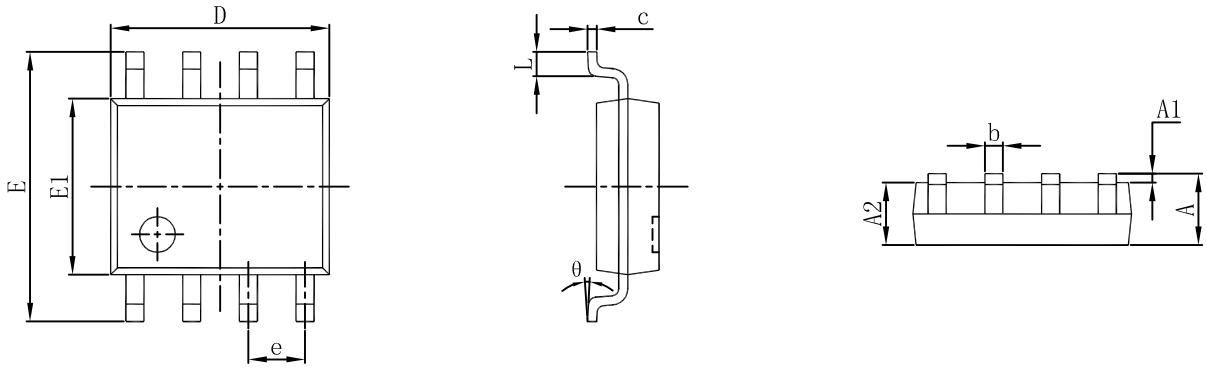
Driver

The driver outputs of the MAX3485EESA are differential outputs meeting the RS-485 and RS-422 standards. The typical voltage output swing with no load will be 0 Volts to 3.3 Volts. With worst case loading of 54Ω across the differential outputs, the driver can maintain greater than 1.5V levels. The driver of the MAX3485EESA has 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 DE (pin 3) will tri-state the driver outputs. The transmitter of the MAX3485EESA will operate up to 10Mbps.

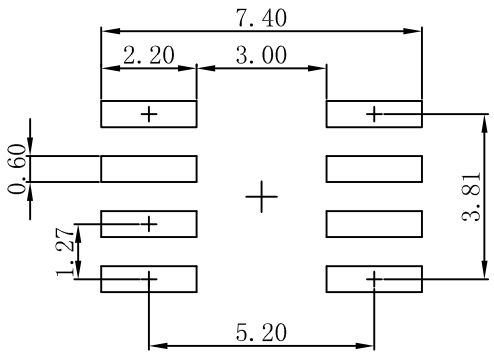
Receiver

The MAX3485EESA receiver has differential inputs with an input sensitivity as low as ±200mV. Input impedance of the receiver is typically 15kΩ (12kΩ minimum). A wide common mode range of −7V to +12V allows for large ground potential differences between systems. The receiver of the MAX3485EESA has a tri-state enable control pin. A logic lowon $\overline{RE}$(pin 2) will enable the receiver, a logic high on $\overline{RE}$ (pin 2)will disable the receiver. The receiver for the MAX3485EESA will operate up to 10Mbps. The
receiver is equipped with the fail-safe feature. Fail-safe feature guarantees that the receiver output will be in a high state when the input is left unconnected.

SOP-8(SOIC-8) Package Outline Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	**Max**	**Min**	**Max**
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.800	5.000	0.189	0.197
e	1.270 (BSC)		0.050 (BSC)	
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°



Note:
1.Controlling dimension:in millimeters.
2.General tolerance:± 0.05mm.
3.The pad layout is for reference purposes only.

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