# UMW SP485EN

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

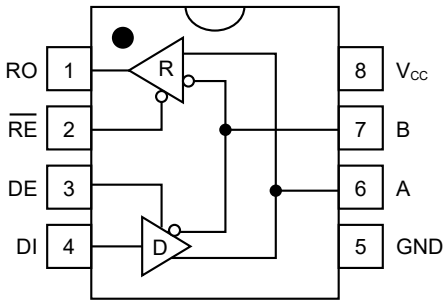
## 1.Description

The SP485 is low-power transceivers for RS-485 and RS- 422 communication. IC contains one driver and one receiver. The driver slew rates of the SP485 is not limited, allowing them to transmit up to 2.5Mbps. These transceivers draw between 120μA and 900μA 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 SP485 is designed for half-duplex applications.

## 2.Features

- Low Quiescent Current: 900μA
- -7V to +13V 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

## 3.Pinning Information




**SOP-8**

## 4.Absolute Maximum Ratings

| Parameter | Symbol | Value |
|---|---|---|
| Supply Voltage | $V_{CC}$ | 7V |
| 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 | -7V to +13V |
| Receiver Input Voltage (A, B) | A, B | -7V to +13V |
| 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 |
| Operating Temperature Ranges | | -40°C to +105°C |
| Storage Temperature Range | | -65°C to +160°C |
| Lead Temperature (soldering, 10sec) | | 300°C |

## 5.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 (noload) | $V_{OD1}$ | | | | | 5 | V |
| Differential Driver Output (with load) | $V_{OD2}$ | R=50Ω (RS-422) | | 2 | | | V |
| | | R=27Ω (RS-485), Figure 4 | | 1.5 | | 5 | V |
| Change in Magnitude of Driver Differential Output Voltage for Complementary Output States | $\Delta V_{OD}$ | 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 | $\Delta V_{OD}$ | R=27Ω or 50Ω, Figure 4 | | | | 0.2 | V |
| Input High Voltage | $V_{IH}$ | DE, DI, $\overline{RE}$ | | 2 | | | 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 | mA |
| | | $V_{CC}$=0V or 5.25V | $V_{IN}$=-7V | | | -0.8 | mA |
| Receiver Differential Threshold Voltage | $V_{TH}$ | -7V≤$V_{CM}$≤12V | | -0.2 | | 0.2 | V |
| Receiver Input Hysteresis | $\Delta V_{TH}$ | $V_{CM}$=0V | | | 70 | | mV |
| Receiver Output High Voltage | $V_{OH}$ | $I_O$=-4mA, VID=200mV | | 3.5 | | | V |
| Receiver Output Low Voltage | $V_{OL}$ | $I_O$=4mA, VID=-200mV | | | | 0.4 | V |
| Three-State (high impedance) Output Current at Receiver | $I_{OZR}$ | 0.4V≤$V_O$≤2.4V | | | | ±1 | μA |
| Receiver Input Resistance | $R_{IN}$ | -7V≤$V_{CM}$≤12V | | 12 | | | kΩ |
| SP485 | | No Load: RE, DI=0V or $V_{CC}$ DE=$V_{CC}$ | | | 900 | | μA |
| | | No Load: RE=0V, DI=0V or 5V DE=0V | | | 900 | | μA |

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Driver Short-Circuit Current, $V_O$=High | $I_{OSD1}$ | -7V≤$V_O$≤12V (Note 4) | 35 | | 250 | mA |
| Driver Short-Circuit Current, $V_O$=LOW | $I_{OSD2}$ | -7V≤$V_O$≤12V (Note 4) | 35 | | 250 | mA |
| Receiver Short-Circuit Current | $I_{OSR}$ | 0V≤$V_O$≤$V_{CC}$ | 7 | | 95 | mA |

## 6.Switching 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 |
|---|---|---|---|---|---|---|
| Driver Input to Output | $t_{PLH}$ | $R_{DIFF}$=54Ω | 10 | 30 | 60 | ns |
| | $t_{PHL}$ | $C_{L1}$=$C_{L2}$=100pF | 10 | 30 | 60 | ns |
| Driver Output Skew to Qutput | $t_{SKEW}$ | $R_{DIFF}$=54Ω, $C_{L1}$=$C_{L2}$=100pF | | 5 | 10 | ns |
| Driver Enable to Qutput 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 |
| \|tPLH -tPHL\| Differential | $t_{SKD}$ | $R_{DIFF}$=54Ω | | 13 | | ns |
| Receiver Skew | | $C_{L1}$=$C_{L2}$=100pF | | 10 | | 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 |

## 7.Operation Timing Diagrams of SP485

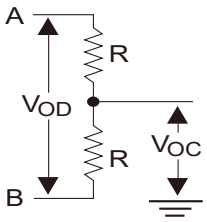



Figure 2. DC test load of the drive

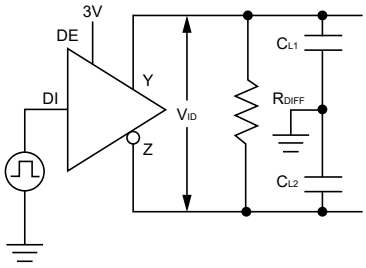



Figure 3. Drive timing test circuit

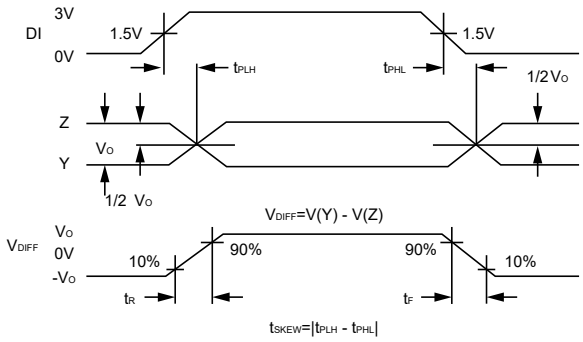



Figure 4. Drive propagation delay

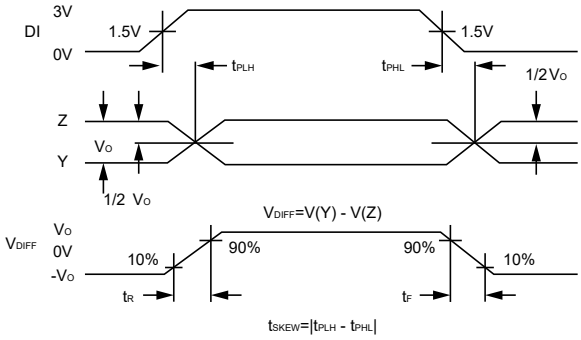



Figure 5. Drive enable/disable timing sequence

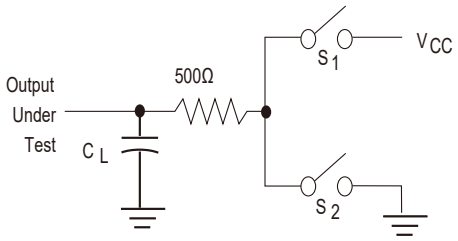



Figure 6. Drive enable/disable timing test circuit

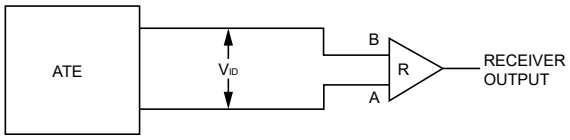



Figure 7. Receiver propagation delay test circuit

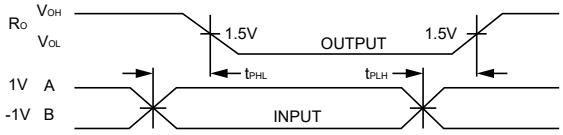



Figure 8. Receiver propagation delay timing

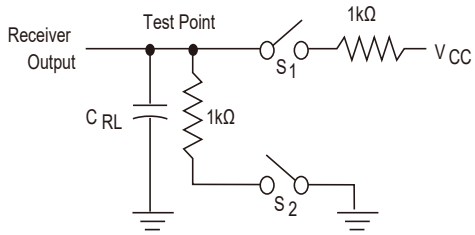



Figure 9. Receiver Enable/Disable Timing Test Circuit

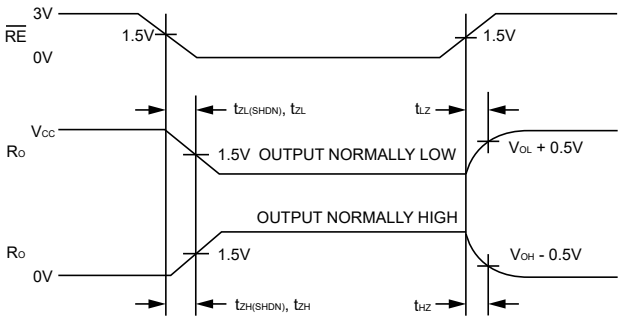



Figure 10. Receiver enable and disable timing sequence

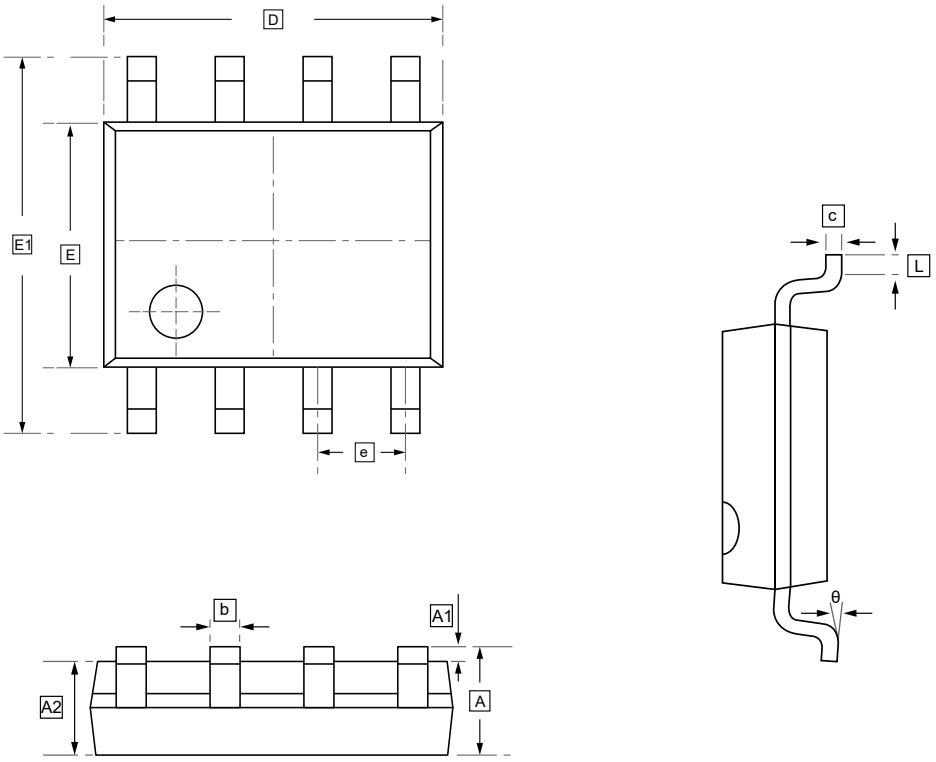
## 8.Table of SP485 Operation

| Transmission | | | | | Receipt | | | |
|---|---|---|---|---|---|---|---|---|
| Inputs | | | Outputs X | | Inputs | | | Outputs |
| $\overline{RE}$ | DE | DI | B | A | $\overline{RE}$ | DE | A-B | RO |
| X | 1 | 1 | 0 | 1 | 0 | 0 | +0.2V | 1 |
| X | 1 | 0 | 1 | 0 | 0 | 0 | -0.2V | 0 |
| 0 | 0 | X | Z | Z | 0 | 0 | open | 1 |
| 1 | 0 | X | Z | Z | 1 | 1 | X | Z |

X-don't care

Z-high resistance

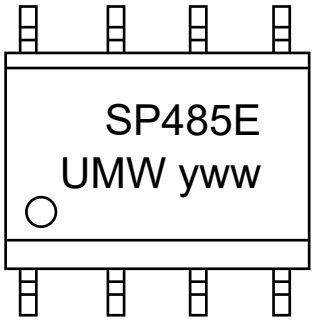
## 9.SOP-8 Package Outline Dimensions




**DIMENSIONS (mm are the original dimensions)**

| Symbol | A | A1 | A2 | b | c | D | E | E1 | e | L | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Min** | 1.350 | 0.000 | 1.350 | 0.330 | 0.170 | 4.700 | 3.800 | 5.800 | 1.270 | 0.400 | 0° |
| **Max** | 1.750 | 0.100 | 1.550 | 0.510 | 0.250 | 5.100 | 4.000 | 6.200 | BSC | 1.270 | 8° |

## 10.Ordering Information




yww: Batch Code

| Order Code | Package | Base QTY | Delivery Mode |
|---|---|---|---|
| UMW SP485EN | SOP-8 | 2500 | Tape and reel |

## 11.Disclaimer

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