

# SP485EEN

## DATASHEET

### Specification Revision History:

Version	Date	Description
V1.0	2019/03	New
V1.1	2021/08	Modify Ordering Information
V1.2	2025/02	Modify Ordering Information
V1.3	2025/03	Add application precautions and overall typesetting.

## General Description

The SP485 is high-speed transceivers for RS-SP485 communication, which contain one driver and one receiver. The SP485 feature fail-safe circuitry, which guarantees a logic-high receiver output when the receiver inputs are open or shorted. This means that the receiver output will be a logic high if all transmitters on a terminated bus are disabled (high impedance). The SP485 driver slew rates are not limited, making transmit speeds up to 10Mbps possible. And this device has a 1/8-unit-load receiver input impedance that allows up to 256 transceivers on the bus.

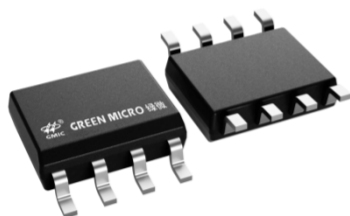
## Features

- Fail-safe circuitry
- Low power consumption
- Up to 256 transceivers can be attached to the bus
- Maximum transmission rate: 10Mbps(Vcc=5V)
- ESD:  $\geq \pm 15KV$
- SOP8 Package

## Applications

- RS-485 Communications
- Level Translators
- Security Equipment
- Industrial Control Equipment
- Watt-hour meter

## The appearance of the product



SOP-8

## Ordering Information

Product Model	Package Type	Marking	Packing	Packing Qty
SP485EEN(GMIC)	SOP-8	SP485 276	REEL	2500PCS/REEL

## ABSOLUTE MAXIMUM RATINGS

Supply Voltage(VCC).....7V	Receiver Input Voltage(A,B) .....±13V	Output
Operating voltage.....3-5.5V	Receiver Voltage(RO).....-0.3~VCC+0.3V	
Control Input Voltage(RE,DE).....0.3~Vcc+0.3V	Operating Temperature (TOPR).....-40°C+85°C	
DriverInput Voltage(DI).....-0.3~Vcc+0.3V	Storage Temperature(TSTG).....65°C~+150°C	
Driver Output Voltage(A,B).....±13V		

Note 1:Recommended operating voltage is 5V,but can be compatible with 3V.If using a 3Vor3.3Vsupply voltage,please reduce the transmission rate.

## DC ELECTRICAL CHARACTERISTICS (VCC=5.0V,TA=25°C) 1

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Difeential Driver Output(no load)	$V_{OD1}$	R=27Ω,Figure 1		---	---	VCC	V
Differential Driver Output	$V_{OD2}$			1.5	--	-	V
Change in Magnitude of Differential Output Voltage	$\Delta V_{OD}$			--	--	0.2	V
Driver Common-Mode Output Voltage	$V_{OC}$			1.0	-	3.0	V
Change in Magnitude of Common-Mode Voltage <sup>2</sup>	$\Delta V_{OC}$			---	--	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
DI Input Hysteresis	$V_{HYS}$	--			100	-	mV
Driver Input Current(A AndB)	$I_{NI1}$	VIN=12V	DE=0V, Voc=5.0V	---	--	250	uA
		VIN=-7V		-150	-	-	uA
Driver Short-Circuit Output Current	$I_{OSD}$	A and B Short-Circuit		-100	-	100	mA
Receiver Differential Threshold Voltage	$V_{TH}$	$-7V \leq V_{CM} \leq 12V$		-200	-125	-50	mV
Receiver Input Hysteresis	$\Delta V_{TH}$	---		--	40	---	mV
Receiver Output High Voltage	$V_{OH}$	$I_o = -8mA$		VCC-1	---	-	V
Receiver Output Low Voltage	$V_{OL}$	$I_o = 8mA$		---	-	0.4	V
Three-State Output Current at Receiver	$I_{OZ}$	$V_o = 1V$		-1	--	1	μA
Receiver Input Resistance	$R_{IN}$	$-7V \leq V_c \leq 12V$		96	-	-	KΩ
Receiver Output Short-Circuit Current	$I_{OSR}$	$0V \leq V_{Ro} \leq VCC$		±7	--	±100	mA
Supply Current	$I_{CC}$	DE=VCC	No Load /RE=DI=VCC/GND	---	700	1200	pA
		DE=GND		---	600	1200	μA
Supply Current in Shutdown Mode	$I_{SHDN}$	DE=GND,/RE=VCC, DI=VCC/GND		--	---	3	μA

**DC ELECTRICAL CHARACTERISTICS** (VCC=3.0V,TA=25°C)1

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Differential Driver Output(no load)	$V_{OD1}$	R=27Ω,Figure 1		--	—	VCC	V
Differential Driver Outputt	$V_{OD2}$			0.9	--	—	V
Change in Magnitude of Differential Output Voltage	$\Delta V_{OD}$			---	-	0.2	V
Driver Common-Mode Output Voltage	$V_{OC}$			1.0	-	3.0	V
Change in Magnitude of Common-Mode Voltage <sup>2</sup>	$\Delta V_{OC}$			---	-	0.2	V
Input High Voltage	$V_{IH}$	DE,DI,/RE		1.5	-	---	V
Input Low Voltage	$V_{IL}$	DE,DI,/RE		---	-	0.6	V
DI Input Hysteresis	$V_{HYS}$	---			100	---	mV
Driver Input Current(A AndB)	$I_{NI1}$	VIN=12V	DE=0V, Vcc=3V	---	-	150	uA
		VIN=-7V		-150	--	--	UA
Driver Short-Circuit Output Current <sup>3</sup>	$I_{OSD}$	A and B Short-Circuit		-100	---	100	mA
Receiver Differential Threshold Voltage	$V_{TH}$	$-7V \leq V_{CM} \leq 12V$		-200	-	200	mV
Receiver Input Hysteresis	$\Delta V_{TH}$	---		--	40	--	mV
Receiver Output High Voltage	$V_{OH}$	$I_o=-8mA$		VCC-1	-	--	V
Receiver Output Low Voltage	$V_{OL}$	$I_o=8mA$		---	-	0.6	V
Three-State Output Current at Receiver	$I_{OZ}$	Vo=1V		-1	-	1	μA
Receiver Input Resistance	$R_{IN}$	$-7V \leq V_{CM} \leq 12V$		96	-	-	KΩ
Receiver Output Short-Circuit Current	$I_{OSR}$	$0V \leq V_{RO} \leq VCC$		±7	--	±100	mA
Supply Current	$I_{CC}$	DE=VCC	No Load /RE=DI=VCC/GND	---	-	1000	μA
		DE=GND		---	--	1000	pA
Supply Current in Shutdown Mode	$I_{SHDN}$	DE=GND,/RE=VCC, DI=VCC/GND		--	--	3	μA

**SWITCHING CHARACTERISTICS**(VCC=5.0V,TA=25°C)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Driver Rise or FallTime	$t_R, t_F$	Figure3 and5, $R_{DIFF}=54\Omega$ $C_{L1}=C_{L2}=100pF$		30	---	ns
Driver Input to Output	$t_{PLH}, t_{PHL}$		--	30	60	ns
Driver Output Skew TDPLH-ToPLI	$t_{SKEW}$		--	--	20	ns
Driver Enable time	$t_{LZ}, t_{HZ}$	Figure4 and6, $C_L=100pF$ (Receiver enabled)	--	--	70	ns
Driver Enable time	$t_{LZ(SHDN)}, t_{HZ(SHDN)}$	Figure4 and6, $C_L=100pF$ (Receiver disabled)	--	1400	3000	ns
Driver disable time	$t_{LZ}, t_{ZL}$	Figure4 and6, $C_L=100pF$	--	--	70	ns
Maximum Data Rate	$F_{MAX}$	---	10	--	--	Mbps
Receiver Rise or Fall Time	$t_R, t_F$	Figure7	--	20	--	ns
Receiver propagation delay time	$t_{PLH}, t_{PHL}$		--	90	250	ns
TRPuH-TRPHLI Differential Receiver Skew	$t_{SKD}$		--	30	---	ns
Receiver enable time	$t_{ZL}, t_{ZH}$	Figure2 and8, $C_{RL}=15pF$ (Driver enabled)	--	30	70	ns
Receiver enable time	$t_{ZL(SHDN)}, t_{ZH(SHDN)}$	Figure2 and8, $C_{RL}=15pF$ (Driver disabled)	--	1400	3000	ns
Receiver disable time	$t_{LZ}, t_{HZ}$	Figure2 and8, $C_{RL}=15pF$	--	30	70	ns
Time to Shutdown	$t_{SHDN}$	---	--	200	600	ns

**SWITCHING CHARACTERISTICS** (VCC=3.0V,TA=25°C)

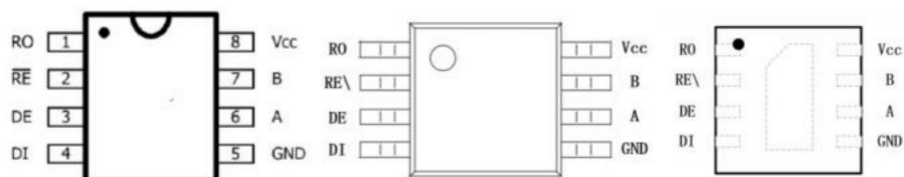
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Driver Rise or FallTime	$t_R, t_F$	Figure3 and5, $R_{DIFF}=54\Omega$ $C_{L1}=C_{L2}=100pF$		30	—	ns
Driver Input to Output	$t_{PLH}, t_{PHL}$		--	30	60	ns
Driver Output Skew TDPLH-ToPLI	$t_{SKEW}$		--	--	20	ns
Driver Enable time	$t_{LZ}, t_{HZ}$	Figure4 and6, $C_L=100pF$ (Receiver enabled)	--	--	70	ns
Driver Enable time	$t_{LZ(SHDN)}, t_{HZ(SHDN)}$	Figure4 and6, $C_L=100pF$ (Receiver disabled)	--	1600	3000	ns
Driver disable time	$t_{LZ}, t_{ZL}$	Figure4 and6, $C_L=100pF$	--	--	70	ns
Maximum Data Rate	$F_{MAX}$	---	10	--	--	Mbps
Receiver Rise or Fall Time	$t_R, t_F$	Figure7	--	20	--	ns
Receiver propagation delay time	$t_{PLH}, t_{PHL}$		--	90	250	ns
TRPuH-TRPHLI Differential Receiver Skew	$t_{SKD}$		--	30	---	ns
Receiver enable time	$t_{ZL}, t_{ZH}$	Figure2 and8, $C_{RL}=15pF$ (Driver enabled)	--	25	70	ns
Receiver enable time	$t_{ZL(SHDN)}, t_{ZH(SHDN)}$	Figure2 and8, $C_{RL}=15pF$ (Driver disabled)	--	1600	3000	ns
Receiver disable time	$t_{LZ}, t_{HZ}$	Figure2 and8, $C_{RL}=15pF$	--	30	70	ns
Time to Shutdown	$t_{SHDN}$	---	--	230	800	ns

Note 1:All currents into the device are positive;all urents out of the device are negative.All voltages are referred to device ground unless otherwise noted.

Note 2: $\Delta V_{OD}$  and  $\Delta V_{OC}$  are the changes in  $V_{OD}$  and  $V_{OC}$  respectively,when the DI input changes state.

Note 3:Maximum curent levelapplies to peak current just prior to foldback-curent imiting;minimum curent levelapplies during curent limiting.

## Pin Assignment



SOP8 MSOP8 DFN3\*3-8

## Pin Description

PIN	NAME	FUNCTION
1	RO	Receiver Output,When RE is low and if $A-B \geq -50\text{mV}$ ,RO will be high;if $A-B \leq -200\text{mV}$ ,RO will be low.
2	/RE	Receiver Output Enable.Drive RE low to enable RO;RO is high impedance when RE is high.Drive RE high and DE low to enter low-power shutdown mode.
3	DE	Driver Output EnableDrive DE high to enable driver outputs.These outputs are high impedance when DE is low.Drive RE high and DE low to enter low-power shutdown mode.
4	DI	Driver Input.With DE high,alow on DI forces noninverting output low and inverting output high.
5	GND	Ground
6	A	Noninverting Receiver Input and Noninverting Driver Output
7	B	Inverting Receiver Input and Inverting Driver Output
8	VCC	Positive Supply

## Function Tables

### ● TRANSMITTING

INPUTS			OUTPUTS	
/RE	DE	DI	A	B
X	1	1	1	0
X	1	0	0	1
0	0	X	High-Z	High-Z
1	0	X	Shutdown	

### ● RECEIVING

INPUTS			OUTPUT
/RE	DE	A-B	RO
0	X	$\geq -0.05\text{V}$	1
0	X	$\leq -0.2\text{V}$	0
0	X	Open/shorted	1
1	1	X	High-Z
1	0	X	Shutdown

### Test circuit

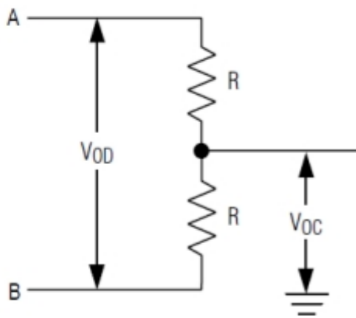


Figure 1. Driver DC Test Load

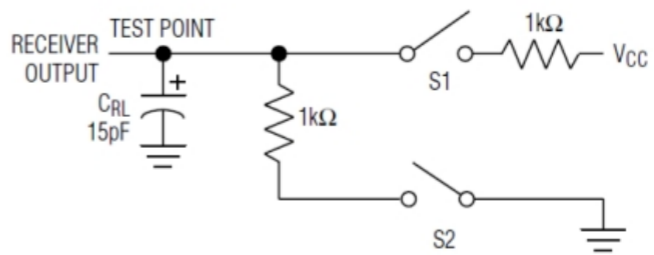


Figure 2. Receiver Enable/Disable Timing Test Load

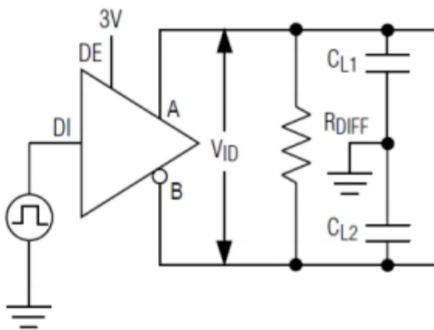


Figure 3. Driver Timing Test Circuit

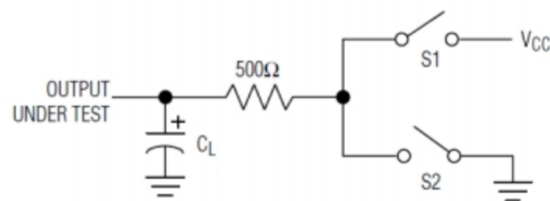


Figure 4. Driver Enable/Disable Timing Test Load

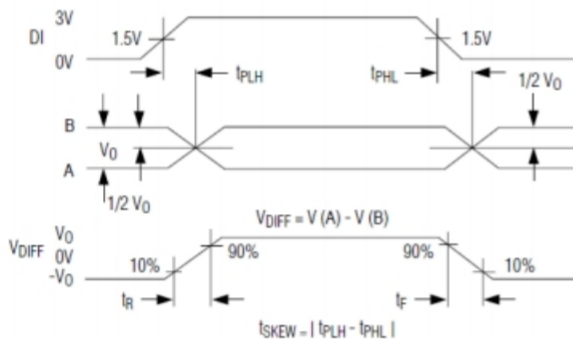


Figure 5. Driver Propagation Delays

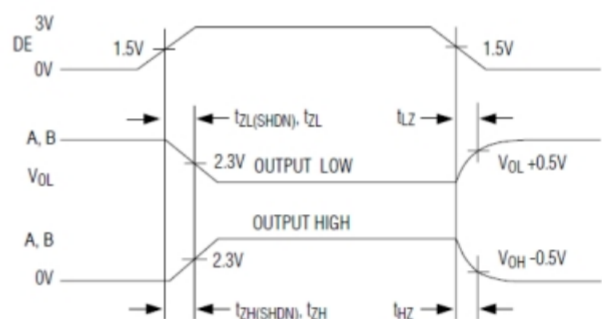


Figure 6. Driver Enable and Disable Times

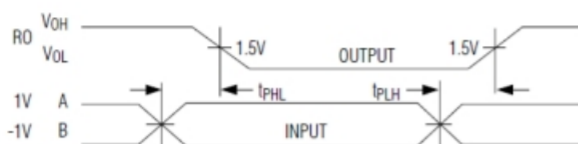


Figure 7. Receiver Propagation Delays

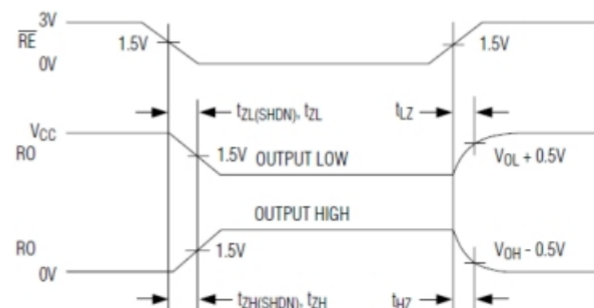
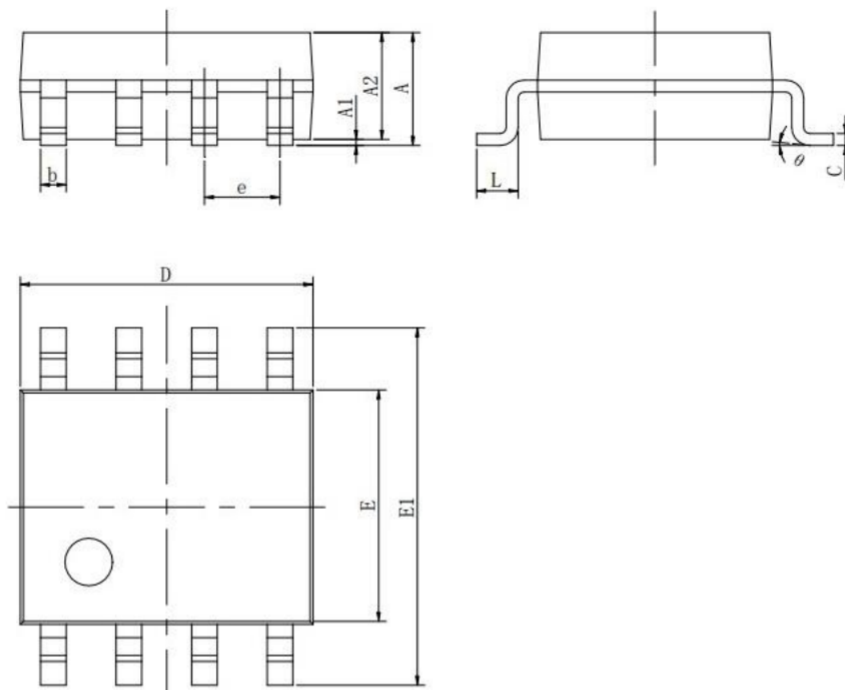


Figure 8. Receiver Enable and Disable Times

Outline Dimensions

SOP-8

Unit : mm



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.800	0.053	0.071
A1	0.050	0.250	0.004	0.010
A2	1.250	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
C	0.170	0.250	0.006	0.010
D	4.780	5.000	0.185	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
theta	0°	8°	0°	8°

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