

# SK2485 RS485 Transceivers

## General Description

The SK2485 is high-speed transceivers for RS-485 communication, which contain one driver and one receiver. The SK2485 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 SK2485 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.

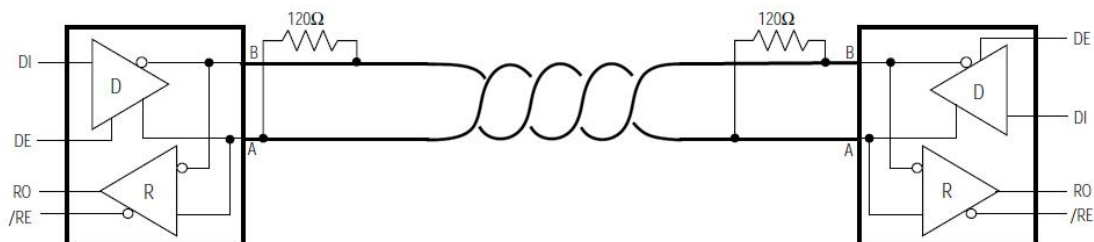
## Feature

- Fail-safe circuitry
- Low power consumption
- Up to 256 transceivers can be attached to the bus
- Maximum transmission rate: 10Mbps
- ESD:  $\geq \pm 15\text{kV}$
- SOP8 Package

## Applications

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

## Typical application circuit



## Absolute Maximum Ratings (TA=25°C)

Supply Voltage(VCC) .....	+7V	Receiver Input Voltage (A,B) .....	±13V
Operating voltage <sup>1</sup> .....	+3~5.5V	Receiver Output Voltage (RO) .....	-0.3~Vcc+0.3V
Control Input Voltage(/RE, DE).....	-0.3~Vcc+0.3V	Operating Temperature (TOPR) .....	-40°C~+85°C
Driver Input Voltage (DI) .....	-0.3~Vcc+0.3V	Storage Temperature (TSTG) .....	-65°C~+150°C
Driver Output Voltage (A,B) .....	±13V		

Note1: Recommended operating voltage is 5V, but can be compatible with 3V.

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

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Differential Driver Output (no load)	V <sub>OD1</sub>	R=27Ω, Figure 1		---	---	VCC	V
Differential Driver Output	V <sub>OD2</sub>			1.5	---	---	V
Change in Magnitude of Differential Output Voltage	ΔV <sub>OD</sub>			---	---	0.2	V
Driver Common-Mode Output Voltage	V <sub>OC</sub>			1.0	---	3.0	V
Change in Magnitude of Common-Mode Voltage <sup>2</sup>	ΔV <sub>OC</sub>			---	---	0.2	V
Input High Voltage	V <sub>IH</sub>	DE, DI, /RE		2.0	---	---	V
Input Low Voltage	V <sub>IL</sub>	DE, DI, /RE		---	---	0.8	V
DI Input Hysteresis	V <sub>HYS</sub>	---		---	100	---	mV
Driver Input Current (A And B)	I <sub>IN1</sub>	VIN=12V	DE=0V,	---	---	250	uA
		VIN=-7V	Vcc=5.0V	-150	---	---	uA
Driver Short-Circuit Output Current <sup>3</sup>	I <sub>OSD</sub>	A and B Short-Circuit		-100	---	100	mA
Receiver Differential Threshold Voltage	V <sub>TH</sub>	-7V≤V <sub>CM</sub> ≤12V		-200	-125	-50	mV
Receiver Input Hysteresis	ΔV <sub>TH</sub>	---		---	40	---	mV
Receiver Output High Voltage	V <sub>OH</sub>	I <sub>O</sub> =-8mA		VCC-1	---	---	V
Receiver Output Low Voltage	V <sub>OL</sub>	I <sub>O</sub> =8mA		---	---	0.4	V
Three-State Output Current at Receiver	I <sub>OZR</sub>	V <sub>O</sub> =1V		-1	---	1	μA
Receiver Input Resistance	R <sub>IN</sub>	-7V≤V <sub>CM</sub> ≤12V		96	---	---	KΩ
Receiver Output Short-Circuit Current	I <sub>OSR</sub>	0V≤V <sub>RO</sub> ≤VCC		±7	---	±100	mA
Supply Current	I <sub>CC</sub>	DE=VCC	No Load	---	700	1200	μA
		DE=GND	/RE=DI=VCC/G ND	---	600	1200	μA
Supply Current in Shutdown Mode	I <sub>SHDN</sub>	DE=GND, /RE=VCC, DI=VCC/GND		---	---	3	μA

## DC ELECTRICAL CHARACTERISTICS (VCC=3.0V, TA=25°C) <sup>1</sup>

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Differential Driver Output (no load)	V <sub>OD1</sub>	R=27Ω, Figure 1		---	---	VCC	V
Differential Driver Output	V <sub>OD2</sub>			0.9	---	---	V
Change in Magnitude of Differential Output Voltage	ΔV <sub>OD</sub>			---	---	0.2	V
Driver Common-Mode Output Voltage	V <sub>OC</sub>			1.0	---	3.0	V
Change in Magnitude of Common-Mode Voltage <sup>2</sup>	ΔV <sub>OC</sub>			---	---	0.2	V
Input High Voltage	V <sub>IH</sub>	DE, DI, /RE		1.5	---	---	V
Input Low Voltage	V <sub>IL</sub>	DE, DI, /RE		---	---	0.6	V
DI Input Hysteresis	V <sub>HYS</sub>	---		---	100	---	mV
Driver Input Current (A And B)	I <sub>IN1</sub>	VIN=12V	DE=0V, VCC=3V	---	---	150	uA
		VIN=-7V		-150	---	---	uA
Driver Short-Circuit Output Current <sup>3</sup>	I <sub>OSD</sub>	A and B Short-Circuit		-100	---	100	mA
Receiver Differential Threshold Voltage	V <sub>TH</sub>	-7V≤V <sub>CM</sub> ≤12V		-200	-125	-50	mV
Receiver Input Hysteresis	ΔV <sub>TH</sub>	---		---	40	---	mV
Receiver Output High Voltage	V <sub>OH</sub>	I <sub>O</sub> =-8mA		VCC-1	---	---	V
Receiver Output Low Voltage	V <sub>OL</sub>	I <sub>O</sub> =8mA		---	---	0.6	V
Three-State Output Current at Receiver	I <sub>OZR</sub>	Vo=1V		-1	---	1	μA
Receiver Input Resistance	R <sub>IN</sub>	-7V≤V <sub>CM</sub> ≤12V		96	---	---	KΩ
Receiver Output Short-Circuit Current	I <sub>OSR</sub>	0V≤V <sub>RO</sub> ≤VCC		±7	---	±100	mA
Supply Current	I <sub>CC</sub>	DE=VCC	No Load /RE=DI=VCC/G ND	---	---	1000	μA
		DE=GND		---	---	1000	μA
Supply Current in Shutdown Mode	I <sub>SHDN</sub>	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 Fall Time	$t_R, t_F$	Figure 3 and 5, $R_{DIFF}=54\Omega$ $C_{L1}=C_{L2}=100pF$	---	30	---	ns
Driver Input to Output	$t_{PLH}, t_{PHL}$		---	30	60	ns
Driver Output Skew $ T_{DPLH} - T_{DPHL} $	$t_{SKEW}$		---	---	20	ns
Driver Enable time	$t_{LZ}, t_{HZ}$	Figure 4 and 6, $C_L=100pF$ (Receiver enabled)	---	---	70	ns
Driver Enable time	$t_{LZ(SHDN)}, t_{HZ(SHDN)}$	Figure 4 and 6, $C_L=100pF$ (Receiver disabled)	---	1400	3000	ns
Driver disable time	$t_{LZ}, t_{ZL}$	Figure 4 and 6, $C_L=100pF$	---	---	70	ns
Maximum Data Rate	$F_{MAX}$	---	10	---	---	Mbps
Receiver Rise or Fall Time	$t_R, t_F$	Figure 7	---	20	---	ns
Receiver propagation delay time	$t_{PLH}, t_{PHL}$		---	90	250	ns
$ T_{RPLH} - T_{RPHL} $ Differential Receiver Skew	$t_{SKD}$		---	30	---	ns
Receiver enable time	$t_{ZL}, t_{ZH}$	Figure 2 and 8, $C_{RL}=15pF$ (Driver enabled)	---	30	70	ns
Receiver enable time	$t_{ZL(SHDN)}, t_{ZH(SHDN)}$	Figure 2 and 8, $C_{RL}=15pF$ (Driver disabled)	---	1400	3000	ns
Receiver disable time	$t_{LZ}, t_{HZ}$	Figure 2 and 8, $C_{RL}=15pF$	---	30	70	ns
Time to Shutdown	$t_{SHDN}$	---	---	200	600	ns

## SWITCHING CHARACTERISTICS (V<sub>CC</sub>=3.0V, T<sub>A</sub>=25°C)

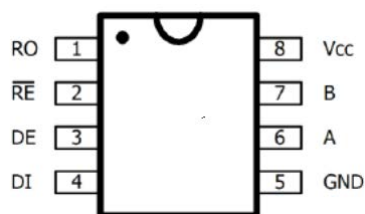
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Driver Rise or Fall Time	t <sub>R</sub> , t <sub>F</sub>	Figure 3 and 5, R <sub>DIFF</sub> =54Ω C <sub>L1</sub> =C <sub>L2</sub> =100pF	---	30	---	ns
Driver Input to Output	t <sub>PLH</sub> , t <sub>PHL</sub>		---	30	60	ns
Driver Output Skew  T <sub>DPLH</sub> - T <sub>DPHL</sub>	t <sub>SKEW</sub>		---	---	20	ns
Driver Enable time	t <sub>LZ</sub> , t <sub>HZ</sub>	Figure 4 and 6, C <sub>L</sub> =100pF (Receiver enabled)	---	---	70	ns
Driver Enable time	t <sub>LZ(SHDN)</sub> , t <sub>HZ(SHDN)</sub>	Figure 4 and 6, C <sub>L</sub> =100pF (Receiver disabled)	---	1600	3000	ns
Driver disable time	t <sub>LZ</sub> , t <sub>ZL</sub>	Figure 4 and 6, C <sub>L</sub> =100pF	---	---	70	ns
Maximum Data Rate	F <sub>MAX</sub>	---	10	---	---	Mbps
Receiver Rise or Fall Time	t <sub>R</sub> , t <sub>F</sub>	Figure 7	---	20	---	ns
Receiver propagation delay time	t <sub>PLH</sub> , t <sub>PHL</sub>		---	90	250	ns
T <sub>RPLH</sub> -T <sub>RPHL</sub>   Differential Receiver Skew	t <sub>SKD</sub>		---	30	---	ns
Receiver enable time	t <sub>ZL</sub> , t <sub>ZH</sub>	Figure 2 and 8, C <sub>RL</sub> =15pF (Driver enabled)	---	25	70	ns
Receiver enable time	t <sub>ZL(SHDN)</sub> , t <sub>ZH(SHDN)</sub>	Figure 2 and 8, C <sub>RL</sub> =15pF (Driver disabled)	---	1600	3000	ns
Receiver disable time	t <sub>LZ</sub> , t <sub>HZ</sub>	Figure 2 and 8, C <sub>RL</sub> =15pF	---	30	70	ns
Time to Shutdown	t <sub>SHDN</sub>	---	---	230	800	ns

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

Note 2: ΔV<sub>OD</sub> and ΔV<sub>OC</sub> are the changes in V<sub>OD</sub> and V<sub>OC</sub>, respectively, when the DI input changes state.

Note 3: Maximum current level applies to peak current just prior to foldback-current limiting; minimum current level applies during current limiting.

## Pin Assignment



SOP8

## Pin Description

PIN	NAME	FUNCTION
1	RO	Receiver Output, When RE is low and if A - B $\geq$ -50mV, RO will be high; if A - B $\leq$ -200mV, 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 Enable. Drive 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, a low 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	$\geq$ -0.05V	1
0	X	$\leq$ -0.2V	0
0	X	Open/shorted	1
1	1	X	High-Z
1	0	X	Shutdown

## Test circuit

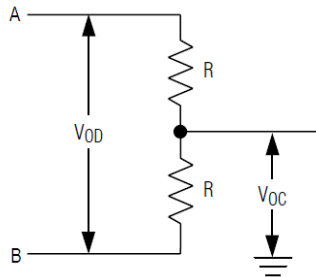


Figure 1. Driver DC Test Load

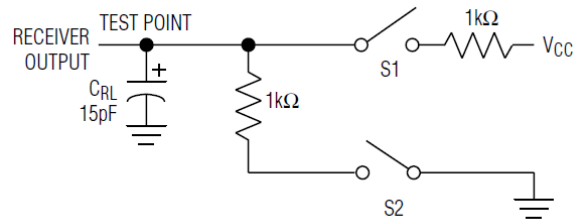


Figure 2. Receiver Enable/Disable Timing Test Load

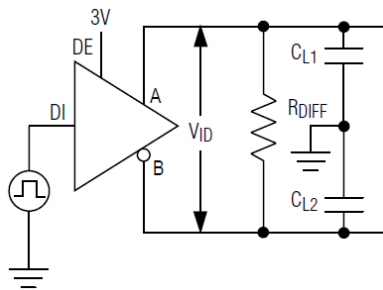


Figure 3. Driver Timing Test Circuit

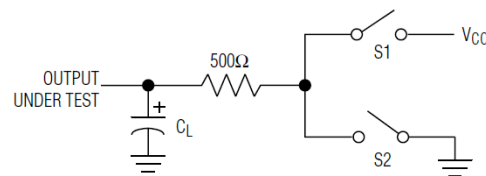


Figure 4. Driver Enable/Disable Timing Test Load

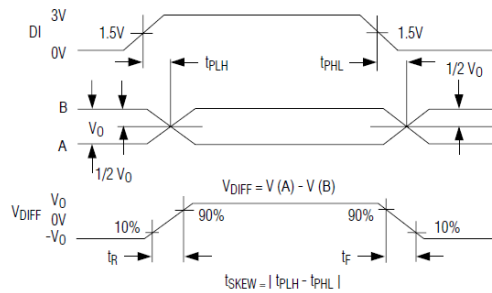


Figure 5. Driver Propagation Delays

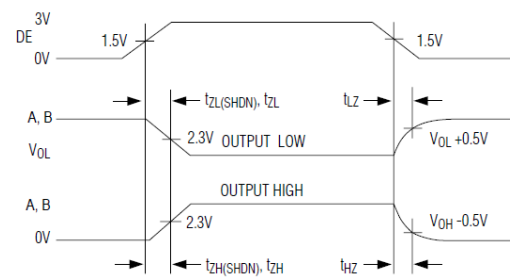


Figure 6. Driver Enable and Disable Times

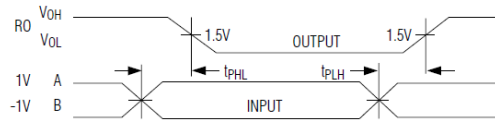


Figure 7. Receiver Propagation Delays

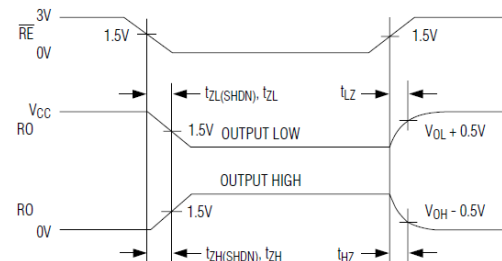
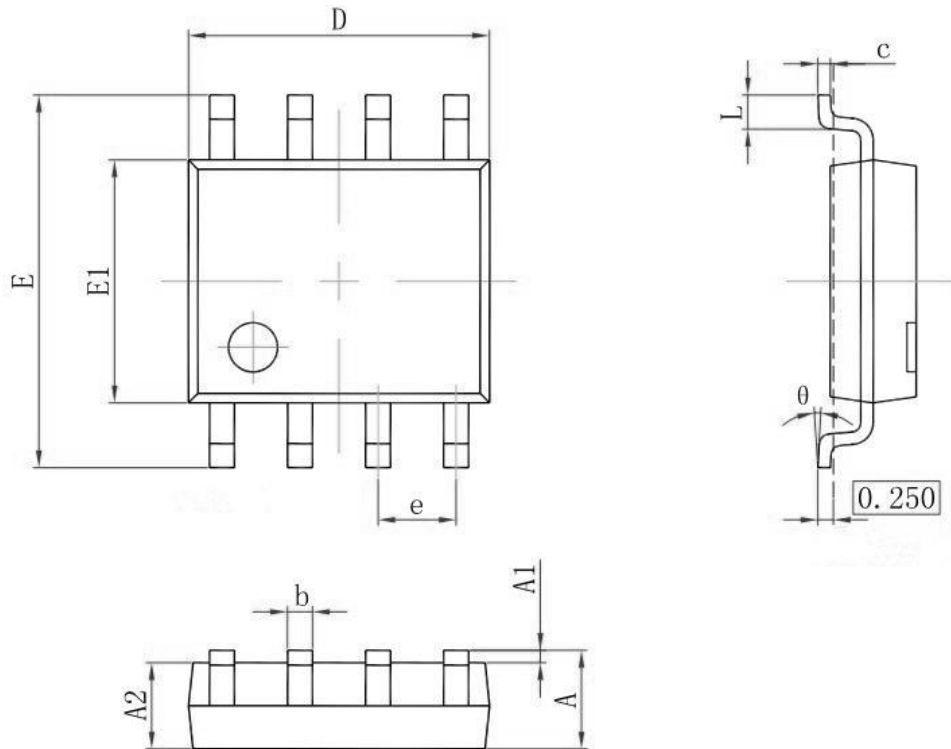


Figure 8. Receiver Enable and Disable Times

## Package Information: SOP8



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	0.031
$\theta$	0°	8°	0°	8°



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