VOSSEL

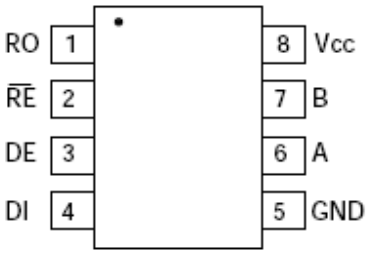
VS485

Low-Power, Slew-RateLimited RS-485 Transceivers

General Description

VS485 is low-power transceivers for RS-485 communication. Each part contains one driver and one receiver. The driver slew rate is not limited , allowing them to transmit up to 2.5 Mbps. (Reduced slew-rate drivers minimize EMI and reduce reflections caused by improperly terminated cables, thus allowing error-free data transmission up to 250kbps.) The transceivers draw between 120µg A and 50µ£gA 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. VS485 is designed for half-duplex applications.

Pin Configuration
VS485 (DIP 8/SO 8)



Pin Description

RO	Receiver Output
RE	Receiver Output Enable.
DE	Driver Output Enable.
DI	Driver Input.
V_{cc}	Positive Supply:
B	Inverting Receiver Input and Inverting Driver Output
A	Noninverting Receiver Input and Noninverting Driver Output
GND	Ground

Applicatons :

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

Applications Information

The VS485 is a half-duplex low-power transceivers for RS-485. It can transmit and receive at data rates up to 2.5Mbps. Driver Enable (DE) and Receiver Enable (RE) pins are included. When disabled, the driver and receiver outputs are high impedance.

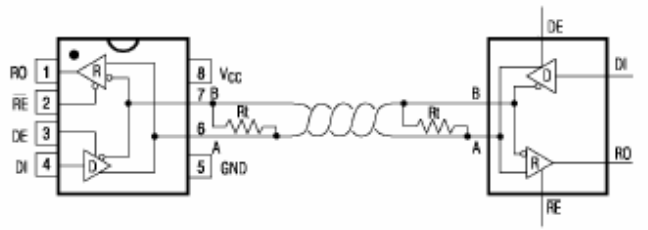
The 12k Ohms 1-unit load Input impedance of VS485 allows up to a total of 32 transceivers on a bus. VS485 sustains transient high-voltage to a range of ¡Ó15K. The ESD protection prevent the device from being damaged by static potential at the operating environment and peripherals, which is especially applicable for high speed I/O data-voice signal communications.

The VS485 provides the driver output protection. Excessive output current and power dissipation caused by faults or by bus contention are prevented by two mechanisms. A foldback current limit on the output stage provides immediate protection against short circuits over the whole common-mode voltage range. In addition, a thermal shutdown circuit forces the driver outputs into a high-impedance state if the die temperature rises excessively.

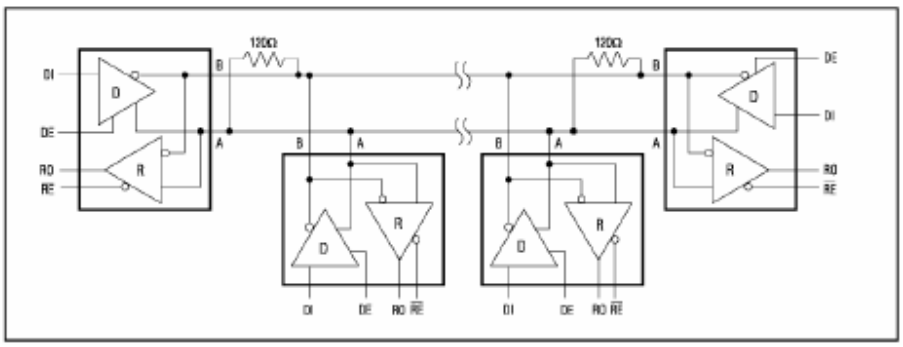
Many digital encoding schemes depend on the difference between the driver and receiver propagation delay times. For VS485, the difference in receiver delay times, $| t_{PLH} - t_{PHL} |$, is typically under 13ns; while the driver skew times are typically 5ns (10ns max).

The VS485 transceivers are designed for bidirectional data communications on multipoint bus transmission lines. The line length and data rate are complied with the RS485 Standard; covers up to 4000 feet & at max 2.5M bps.

Operation mode	DATA RATE (Mbps)	SLEW-RATE LIMITED	LOW-POWER SHUTDOWN	RECEIVER/DRIVER ENABLE	QUIESCENT CURRENT (μA)	*NUMBER OF TRANSMITTERS ON BUS*
HALF DUPLEX	***2.5***	***No***	***No***	***Yes***	***300***	***32***



TYPICAL OPERATING CIRCUIT SHOWN WITH DIP/SO PACKAGE.



Typical Half-Duplex RS-485 Network

Pin Description

01	RO	Receiver Output: If A > B by 200mV, RO will be high; If A < B by 200mV, RO will be low.
02	RE	Receiver Output Enable. RO is enabled when RE is low; RO is high impedance when RE is high.
03	DE	Driver Output Enable. 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 RE is low.
04	DI	Driver Input. A low on DI forces output Y low and output Z high. Similarly, a high on DI forces output Y high and output Z low.
05	GND	Ground
06	A	Non-inverting Receiver Input and Non-inverting Driver Output
07	B	Inverting Receiver Input and Inverting Driver Output
08	V_{cc}	Positive Supply: 4.75V ≦ Vcc ≦ 5.25V

Function Tables

Table 1. Transmitting

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

X = Don't care, High-Z = High impedance

Table 2. Receiving

INPUTS			OUTPUTS
RE	DE	A-B	RO
0	0	> +0.2V	1
0	0	< -0.2V	0
0	0	Inputs	1

X = Don't care, High-Z = High impedance

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{CC}) 12V
Control Input Voltage (RE , DE).....-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¢XC
8-Pin Plastic DIP (derate 9.09mW/¢XC above +70¢XC…;…..727mW
8-Pin SO (derate 5.88mW/¢XC above +70¢XC).....;....471mW
Operating Temperature Ranges
Commercial Grade…….....;.....0¢XC to +70
Industrial Grade…….....-40¢XC to +85U
Storage Temperature Range .....-65¢XC to +160
Lead Temperature (soldering, 10sec) .....+300¢X

Stresses beyond those listed under “§Absolute Maximum Rating”¡¨ may cause permanent damage to the device

DC ELECTRICAL CHARACTERISTICS

(V_{CC} = 5V ¡Ó5%, 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 = 27 Ω, Figure 4		2			V
Change in Magnitude of Driver Differential Output Voltage for Complementary Output States	$\triangle V_{OD}$	R = 27 Ω , Figure 4				0.2	V
Driver Common-Mode Output Voltage	V_{OC}	R = 27 Ω , Figure 4				3	V
Change in Magnitude of Driver Common-Mode Output Voltage for Complementary Output States	$\triangle V_{OD}$	R = 27 Ω , Figure 4				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
Input Current	I_{IN1}	DE, DI, RE				¡Ó	µg
Input Current (A, B)	I_{IN2}	DE = 0V; V_{CC} = 0V or 5.25V	V_{IN} = 12V			1.0	mA
			V_{IN} = -7V			-0.8	mA
Receiver Differential Threshold Voltage	V_{TH}	-7V ≦ V_{CM} ≦ 12V		-0.2		0.2	V
Receiver Input Hysteresis	$\triangle V_{TH}$	V_{CM} = 0V			70		mV
Receiver Output High Voltage	V_{OH}	I_O = -4mA, V_{ID} = 200mV		3.5			V
Receiver Output Low Voltage	V_{OL}	I_O = -4mA, V_{ID} = 200mV				0.4	V
Three-State (high impedance) Output Current at Receiver	I_{OZR}	0.4V ≦ V_O ≦ 2.4V				¡Ó	µg
Receiver Input Resistance	R_{IN}	-7V ≦ V_{CM} ≦ 12V		12			kΩ
No-Load Supply Current (Note 3)	I_{CC}	RE = 0V or V_{CC}	DE = V_{CC}		500	900	µg
			DE = 0V		300	500	µg
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 ≦ VCC		7		95	mA

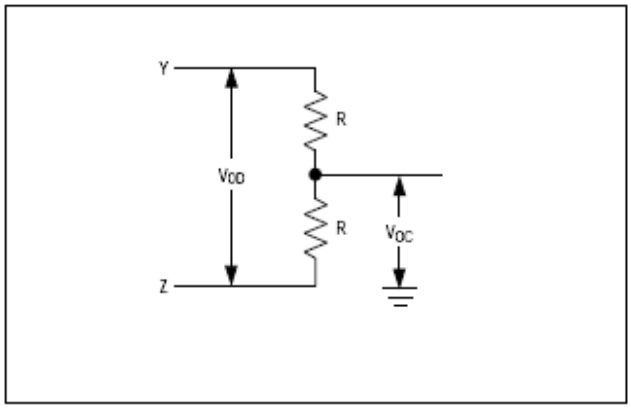


Figure 4. Driver DC Test Load

SWITCHING CHARACTERISTICS

(VCC = 5V ¡Ó5%, A = TMIN to TMAX, unless otherwise noted.) (Notes 1, 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Driver Input to Output	t_{PLH}	Figures 6 and 8, R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF	10	30	60	ns
	t_{PHL}		10	30	60	
Driver Output Skew to Output	t_{SKEW}	Figures 6 and 8, R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF		5	10	ns
Driver Rise or Fall Time	t_R, t_F	Figures 6 and 8, R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF	3	15	40	ns
Driver Enable to Output High	t_{ZH}	Figures 7 and 9, C_L = 100pF, S_2 closed		40	70	ns
Driver Enable to Output Low	t_{ZL}	Figures 7 and 9, C_L = 100pF, S_1 closed		40	70	ns
Driver Disable Time from Low	t_{LZ}	Figures 7 and 9, C_L = 15pF, S_1 closed		40	70	ns
Driver Disable Time from High	t_{HZ}	Figures 7 and 9, C_L = 15pF, S_2 closed		40	70	ns
Receiver Input to Output	t_{PLH}	Figures 6 and 10, R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF	20	90	200	ns
	t_{PHL}					
$\lvert t_{PLH} - t_{PHL} \rvert$ Differential Receiver Skew	t_{SKD}	Figures 6 and 10, R_{DIFF} = 54Ω, C_{L1} = C_{L2} = 100pF		13		ns
Receiver Enable to Output Low	t_{ZL}	Figures 5 and 11, C_{RL} = 15pF, S_1 closed		20	50	ns
Receiver Enable to Output High	t_{ZH}	Figures 5 and 11, C_{RL} = 15pF, S_2 closed		20	50	ns
Receiver Disable Time from Low	t_{LZ}	Figures 5 and 11, C_{RL} = 15pF, S_1 closed		20	50	ns
Receiver Disable Time from High	t_{HZ}	Figures 5 and 11, C_{RL} = 15pF, S_2 closed		20	50	ns
Maximum Data Rate	f_{MAX}	t_{PLH}, t_{PHL} < 50% of data period			2.5	Mbps

NOTES FOR ELECTRICAL/SWITCHING CHARACTERISTICS

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 VCC = 5V and TA = +25¢XC

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

Note 4: Applies to peak current.

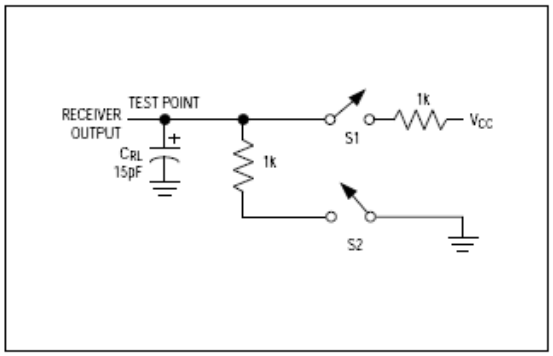


Figure 5. Receiver Timing Test Load

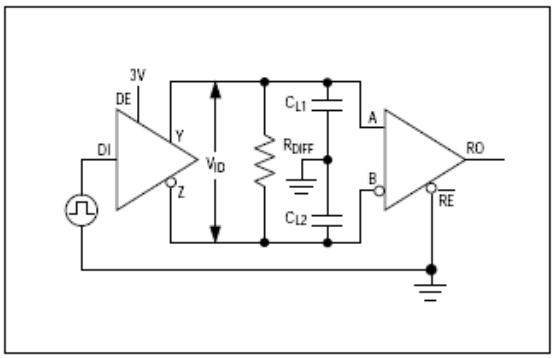


Figure 6. Driver/Receiver Timing Test Circuit

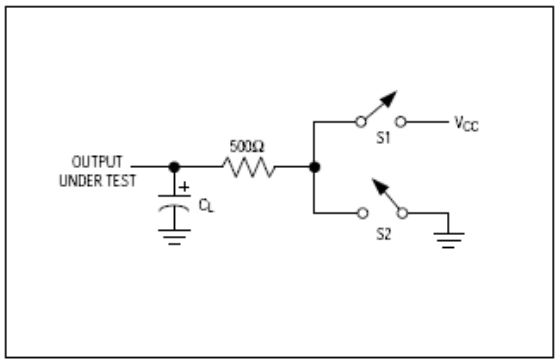


Figure 7. Driver Timing Test Load

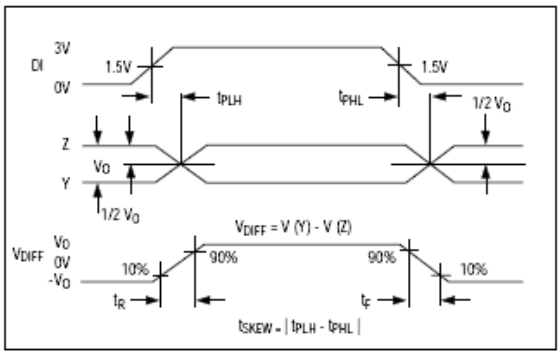


Figure 8. Driver Propagation Delays

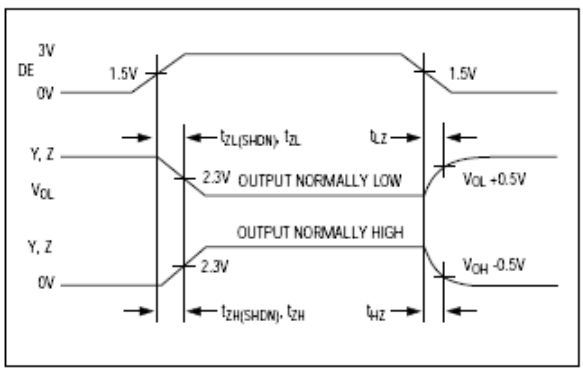


Figure 9. Driver Enable and Disable Times

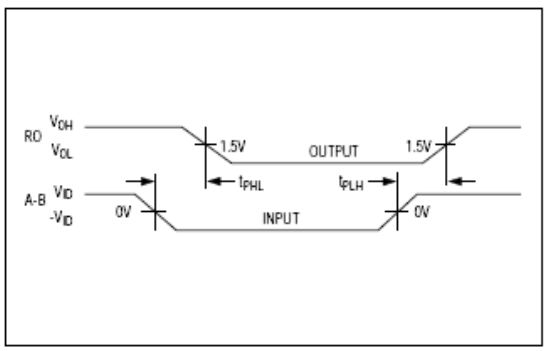


Figure 10. Receiver Propagation Delays

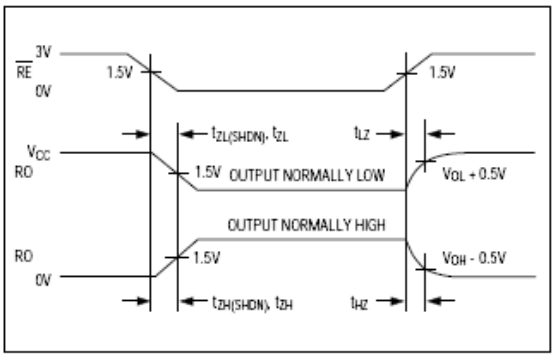
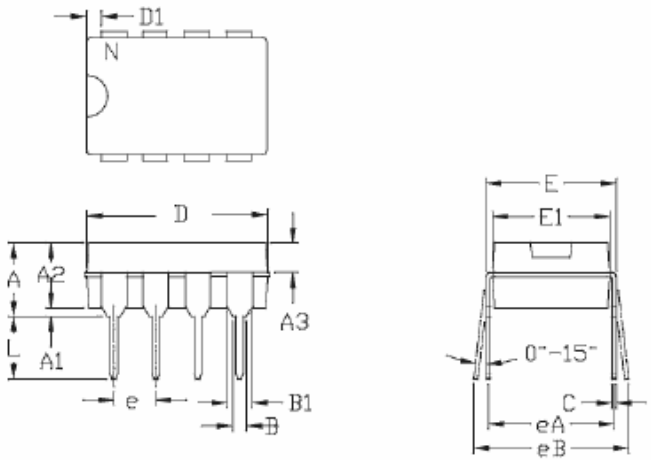


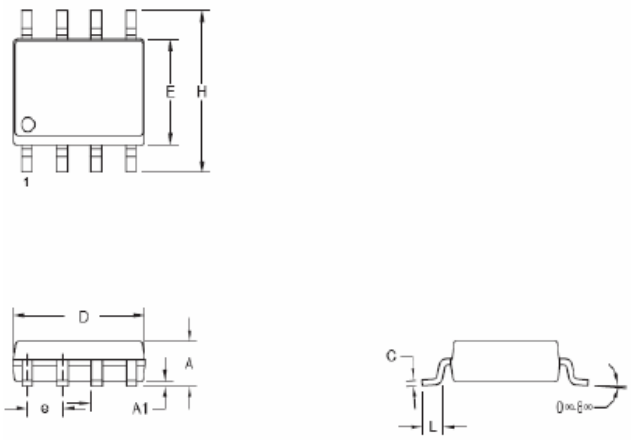
Figure 11. Receiver Enable and Disable Times

Package PDIP, .300”



	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	---	0.180	---	4.572
A1	0.015	---	0.38	---
A2	0.125	0.175	3.18	4.45
A3	0.055	0.080	1.40	2.03
B	0.015	0.022	0.381	0.56
B1	0.045	0.065	1.14	1.65
C	0.008	0.014	0.2	0.355
D1	0.005	0.080	0.13	2.03
E	0.300	0.325	7.62	8.26
E1	0.240	0.310	6.10	7.87
e	0.100 BSC.		2.54 BSC	
eA	0.300 BSC		7.62 BSC	
eB	0.4100 BSC		10.16BSC	
L	0.115	0.150	2.91	3.81

Package SOIC, .150”



	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.053	0.069	1.35	1.75
A1	0.004	0.010	0.10	0.25
B	0.014	0.019	0.35	0.49
C	0.007	0.010	0.19	0.25
e	0.050 BSC		1.27 BSC	
E	0.150	0.157	3.80	4.00
H	0.228	0.244	5.80	6.20
L	0.016	0.050	0.40	1.27