MAX485ESA是一款应用于RS485和RS422通信系统的收发器芯片，传输和接收数据的传输速率可达2.5Mbps 。MAX485ESA是半双工通信的RS485接口芯片，有驱动使能（DE ）和接收使能/RE控制引脚。

MAX485ESA的接收器设计为1/4单位负载输入阻抗，总线上可以挂接128个负载。

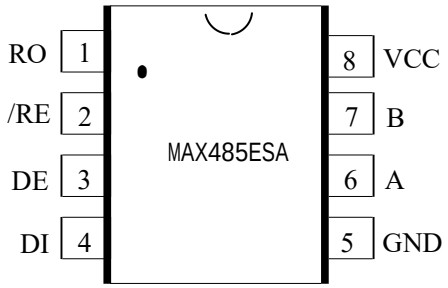
产品特点

- 三态输出
- 半双工通信
- A、B 端短路保护
- SOP8封装

产品应用

- 低功耗 RS485&RS422 接收器
- 电表、水表、燃气表
- 电平转换
- 门禁、安防系统
- 防电磁干扰(EMI)的收发器
- 工控局域网

产品封装



产品信息

型号	封装	最小包装	温度范围
MAX485ESA	SOP8	2500	0°C---85°C

引脚	引脚定义	功能描述
1	RO	接收器输出: 当 /RE 为低电平时， 若(A - B) ≥ 200mV, 则RO 输出为高电平; 若(A - B) ≤ -200mV, 则RO输出为低电平。
2	/RE	接收器使能控制:/RE为低电平时接收器功能有效;/RE为高电平时接收器功能禁止。
3	DE	发送器是能控制:DE 为高电平时发送器功能有效; DE为低电平时发送器功能禁止
4	DI	发送器输入: 当 DE为高电平, DI 输入为低电平时， A 输出低电平，B输出高电平；相反DI 输入为高电平时， A 输出高电平， B输出地电平
5	GND	接地
6	A	接收器同相输入和发送器反向输出
7	B	接收器反相输入和发送器反向输出
8	VCC	电源引脚: 一般接5V电源

名称	信号参数	范围	单位
电源电压	Vcc	-0.3 to 8.0	V
控制输入信号电压	/RE, DE	-0.3 to (Vcc+ 0.3)	V
接收器输入信号电压	A, B	±13	V
接收器输出电压	RO	-0.3 to (Vcc+ 0.3)	V
发送器输出电压	A, B	±13	V
发送器输入电压	DI	-0.3 to (Vcc+ 0.3)	V
工作温度	T_{OP}	0 to +85	ºC
储存温度	T_{STO}	-65 to +150	ºC

名称	信号参数	最小	典型	最大	单位
电源电压	Vcc	3		5.5	V
控制输入信号高电压	/RE, DE, DI	2			V
控制输入信号低电压	/RE, DE, DI			0.8	V
接收器输入信号电压	A, B			±12	V
工作温度		0 to +85			ºC

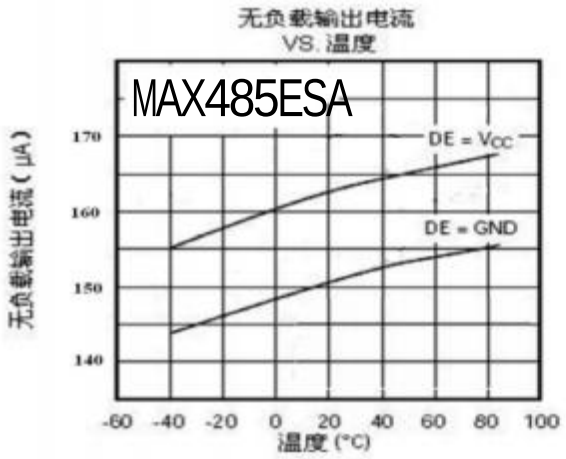
(注释： 若无另外说明，VCC=5V, TA=25°C)

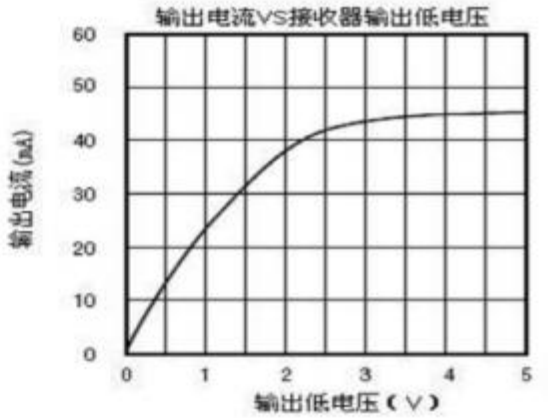
参数	名称	测试条件		最小	典型	最大	单位
发送器							
差分信号输出	V_{OD1}	无负载				5	V
差分信号输出	V_{OD2}	Fig. 1, R_L= 27Ω		1.5			V
差分信号输出变化幅度	ΔV_{OD}	Fig. 1, R_L= 27Ω				0.2	V
共模输出电压	V_{OC}	Fig. 1, R_L= 27Ω				3	V
共模电压输出变化幅度	ΔV_{OC}	Fig. 1, R_L= 27Ω				0.2	V
输入信号高电平	V_{IH}	DE, DI, REB		2.0			V
输入信号低电平	V_{IL}	DE, DI, REB				0.8	V
控制引脚输入电流	I_{IN1}	DE, DI, REB				±2	μA
A/B引脚输入电流	I_{IN2}	DE=0, Vcc=0V or 5.25V	V_{IN}=12V			1.0	mA
			V_{IN}=-7V			-0.8	
输出短路电流	I_{OSD}	-7V ＞ V_{OUT} ＞ 12V		-250		250	mA
接收器							
接收器差分信号阈值电压	V_{TH}			-200		200	mV
接收器输入迟滞	ΔV_{TH}				30		mV
接收器输出高电平	V_{OH}	Io= -4mA, VID= 200mV		Vcc- 1.5			V
接收器输出低电平	V_{OL}	Io= 4mA, VID= -200mV				0.4	V
接收器三态输出电流	I_{OZR}	0.4V ＞ V_{CM} ＞ 2.4V				±1	μA
接收器输入阻抗	R_{IN}	-7V ＞ V_{CM} ＞ +12V		32			kΩ
接收器短路电流	I_{OSR}	Fig. 6, 0V ＞ V_{RO} ＞ Vcc		±7		±95	mA
供电电流							
供电电流	Icc	无负载, /RE=GND, DI= Vcc or GND.	DE= Vcc		155	900	μA
			DE= GND		160	600	μA

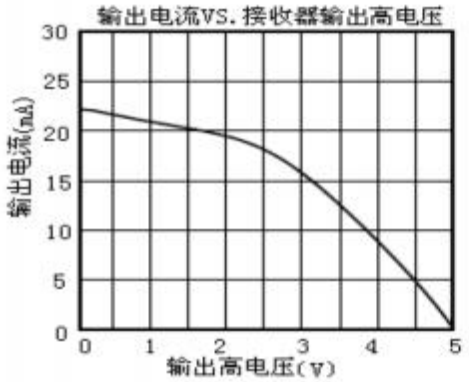
注释： 1、进入器件的电流为正，流出器件的电流为负

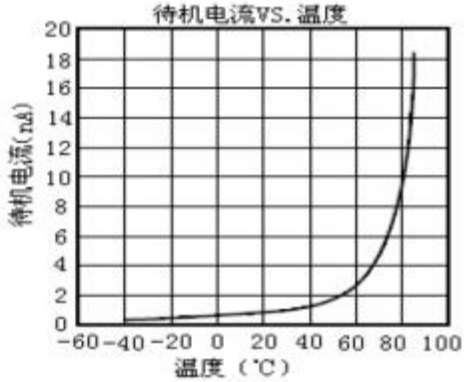
（若无另外说明VCC=5V, TA=25℃ ）

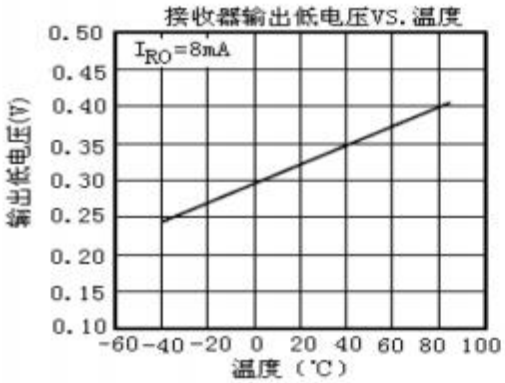
参数	名称	测试条件	最小	典型	最大	单位
驱动器输入到输出 t_{DPLH}– t_{DH}	t_{DSKEW}	图5和7, R_{DIFF}=54Ω, C_{L1}=C_{L2}= 100pF			100	ns
驱动器上升或下降时间	t_{DF}, t_{DR}	图5和7, R_{DIFF}=54Ω, C_{L1}=C_{L2}= 100pF	200	530	750	ns
传输 速率	f_{Data}				2.5	Mbps
驱动器使能到输出低	t_{DZL}	图6和8, C_{DL}= 100pF, S1 关闭			2500	ns
驱动器使能到输出高	t_{DZH}	图6和8, C_{DL}= 100pF, S2 关闭			2500	ns
从低到驱动器无效	t_{DLZ}	图6和8, C_{DL}= 15pF, S1 关闭			100	ns
从高到驱动器无效	t_{DHZ}	图6和8, C_{DL}= 15pF, S2 关闭			100	ns
接收器输入到输出	t_{RPLH}, t_{RPHL}	图9和11, V_{ID} ≥2.0V; V_{ID} ≤ 15ns的上升和下降时间		120	200	ns
t_{RPLH}– t_{RPH}	t_{RSKD}	图9和11, V_{ID} ≥2.0V; V_{ID} ≤ 15ns 的上升和下降时间		5	30	ns
接收器使能到输出低	t_{RZL}	图4和10, C_{RL}= 15pF, S1 关闭		20	50	ns
接收器使能到输出高	t_{RZH}	图4和10, C_{RL}= 15pF, S2 关闭		20	50	ns
接收器从低到无效时间	t_{RLZ}	图4和10, C_{RL}= 15pF, S1 关闭		20	50	ns
接收器从高到无效时间	t_{RHZ}	图4和10, C_{RL}= 15pF, S2 关闭		20	50	ns

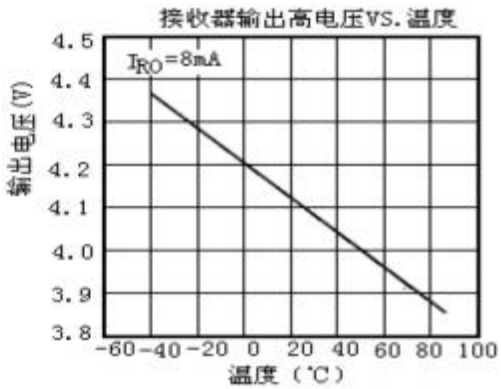

无负载输出电流
VS. 温度
MAX485ESA
DE = Vcc
DE = GND
无负载输出电流（μA）
温度（°C）

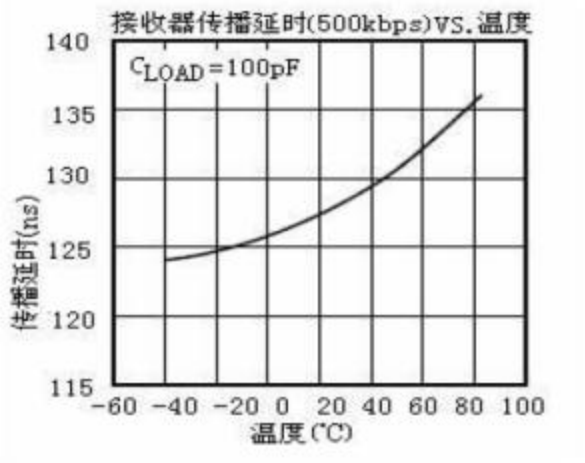

输出电流VS接收器输出低电压
输出电流(mA)
输出低电压（V）

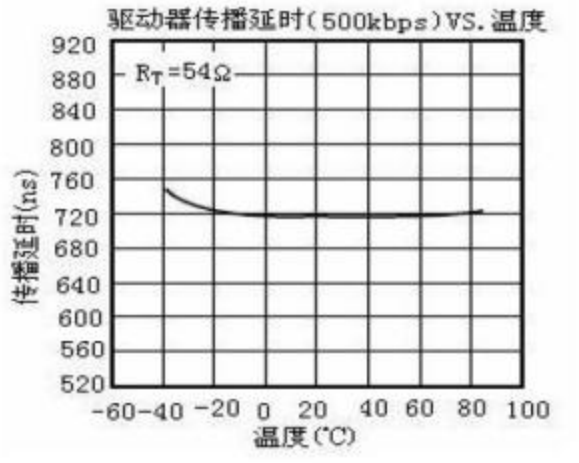

输出电流VS. 接收器输出高电压
输出电流(mA)
输出高电压(V)

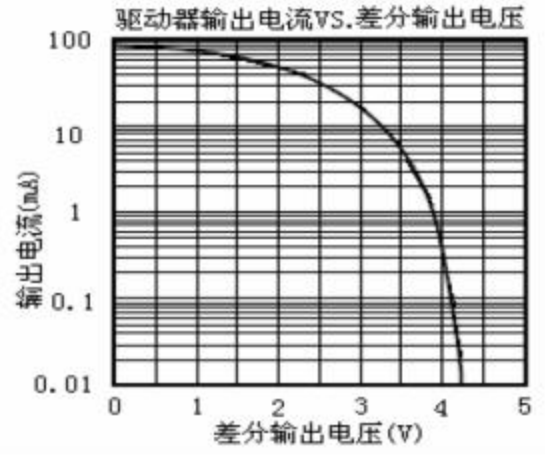

待机电流VS. 温度
待机电流(nA)
温度（°C）

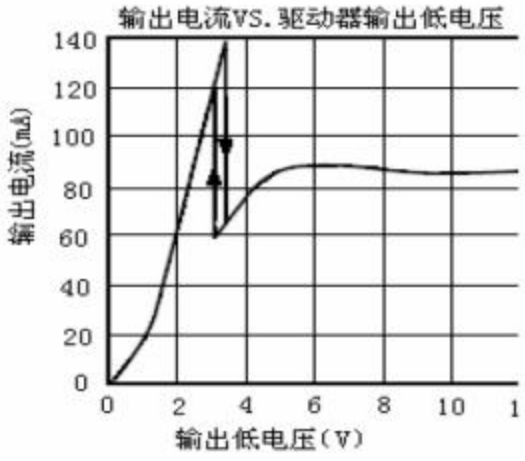

接收器输出低电压VS. 温度
IRO=8mA
输出低电压(V)
温度（°C）

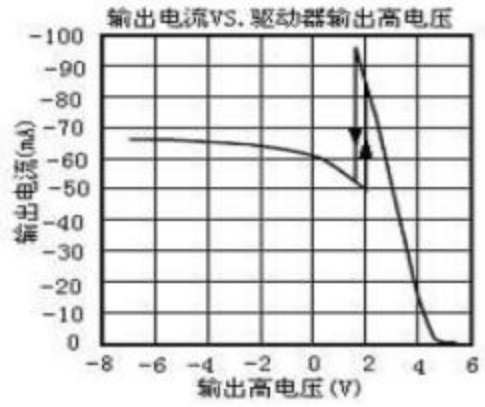

接收器输出高电压VS. 温度
IRO=8mA
输出电压(V)
温度（°C）

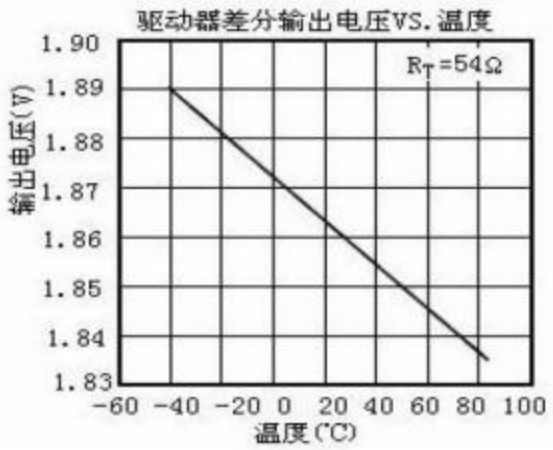

接收器传播延时(500kbps)VS.温度
C_{LOAD}=100pF
传播延时(ns)
140
135
130
125
120
115
-60 -40 -20 0 20 40 60 80 100
温度(℃)


驱动器传播延时(500kbps)VS.温度
R_T=54Ω
传播延时(ns)
920
880
840
800
760
720
680
640
600
560
520
-60-40 -20 0 20 40 60 80 100
温度(℃)


驱动器输出电流VS.差分输出电压
输出电流(mA)
100
10
1
0.1
0.01
0 1 2 3 4 5
差分输出电压(V)


输出电流VS.驱动器输出低电压
输出电流(mA)
140
120
100
80
60
40
20
0
0 2 4 6 8 10 1
输出低电压(V)


输出电流VS.驱动器输出高电压
输出电流(mA)
-100
-90
-80
-70
-60
-50
-40
-30
-20
-10
0
-8 -6 -4 -2 0 2 4 6
输出高电压(V)


驱动器差分输出电压VS.温度
R_T=54Ω
输出电压(V)
1.90
1.89
1.88
1.87
1.86
1.85
1.84
1.83
-60 -40 -20 0 20 40 60 80 100
温度(℃)

TRANSMITTING				
INPUTS			OUTPUTS	
/ RE	DE	DI	A	B
X	1	0	0	1
X	1	1	1	0
X	0	X	高阻	高阻

RECEIVING			
INPUTS			OUTPUTS
/RE	DE	A - B	RO
0	0	A 0.2V	1
0	0	≤ −0.2V	0
0	0	Open/ Shorted	不确定状态
1	0	X	高阻

X=任意状态

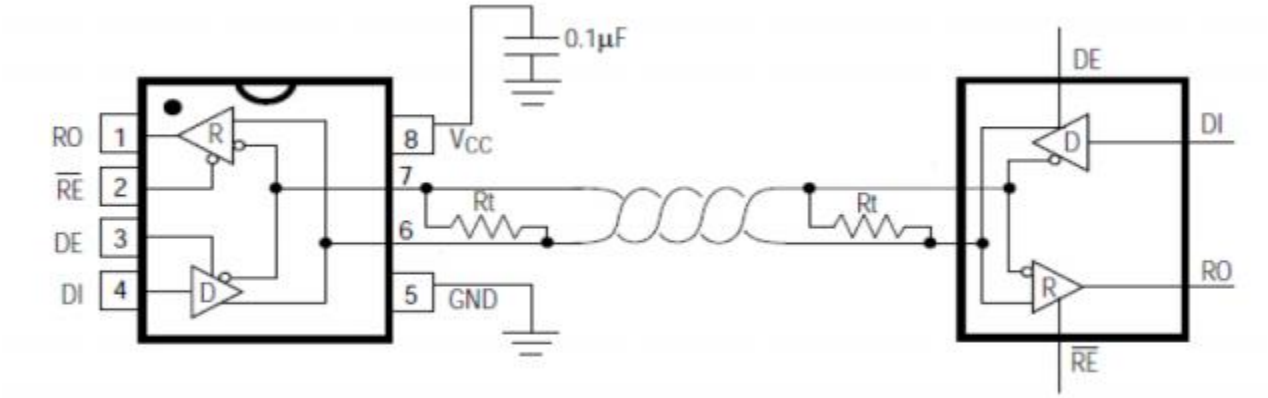


图 1：MAX485ESA典型半双工应用电路

1.简述

用于 RS485/RS422 通信的 MAX485ESA高速收发器包含一个驱动器和接收器。 MAX485ESA 具有低摆率驱动器，能够减小 EMI 和由于不恰电缆端接所引起的反射，实现高达2.5Mbps 的数据传输。

2.接收器输入滤波

MAX485ESA的接收器出来具有输入滞后外，还包括输入滤波功能。此滤波功能提高了上升和下降缓慢的差分信号的噪声抑制能力。滤波器使接收器传输延时增加25%。

3.失效保护的应用

MAX485ESA内部没有失效保护电路， 需要注意的是当A/B端的差分信号介于0.2V和-0.2V之间时(-200mV≤A-B≤200mV)，接收器的输出状态不确定。在接收器输入开路时(RS485总线空闲时)， 需要在A口加上拉电阻来确保接收器 RO为高电平。

4.总线上挂接 128 个收发器

MAX485ESA收发器的接收端具有 1/8 单位负载输入阻抗 (128KΩ),允许 128 个收发器并行挂接在同一通信总线上。

5.降低 EMI 和反射

MAX485ESA的低摆率驱动器可以减小 EMI,并降低由不恰当的终端匹配电缆引起的反射，图11显示了高频谐波元件在幅度上要低于一般情况，驱动器上升沿的时间与终端的长度有关，下面的方程式表示其关系： Length=t RISE/(10 x 1.5ns/ft) t RISE 是驱动器上升沿的时间。

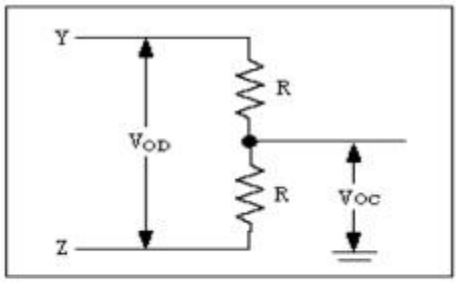


图 2:驱动器 DC 测试负载

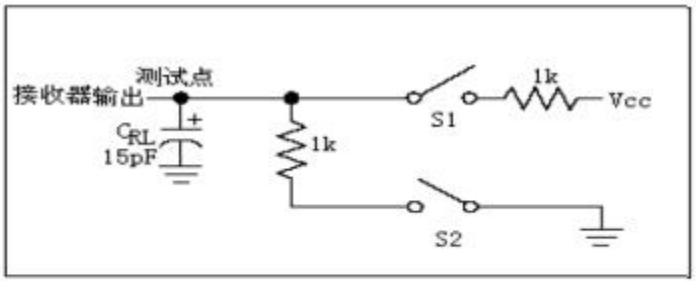


图 3:接收器使能/无效定时测试负载

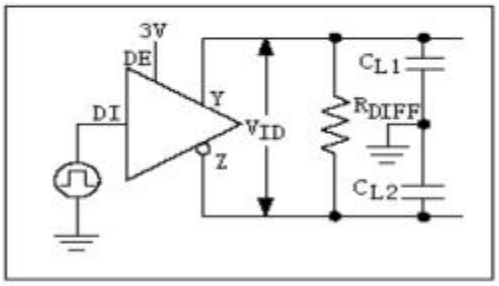


图 4:驱动器定时测试负载

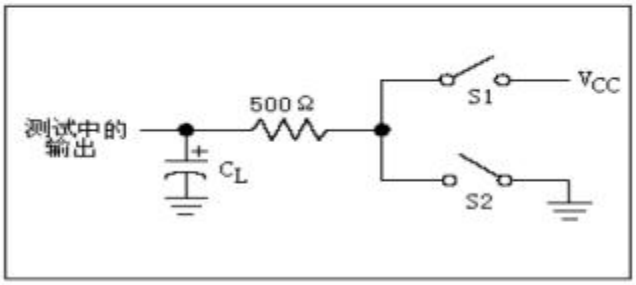


图 5:驱动器使能/无效定时测试负载

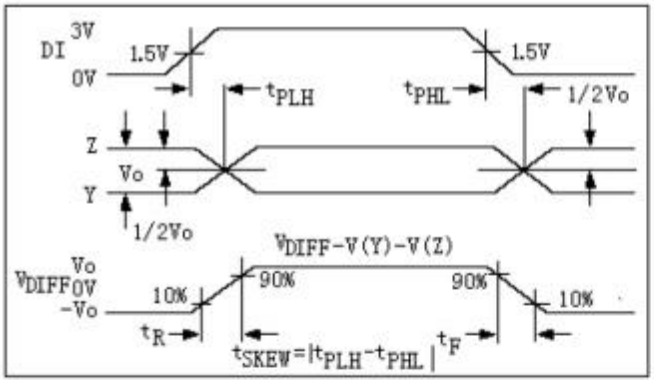


图 6:驱动器传播延时

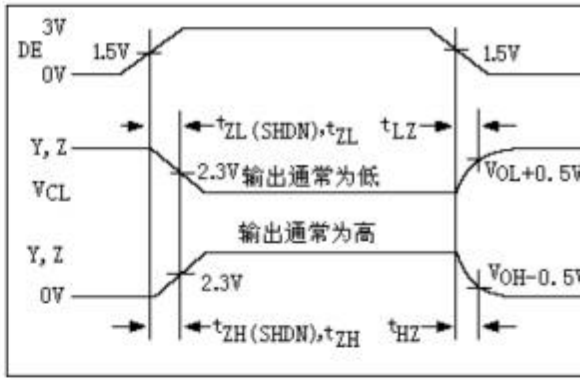


图 7:驱动器使能和无效时间

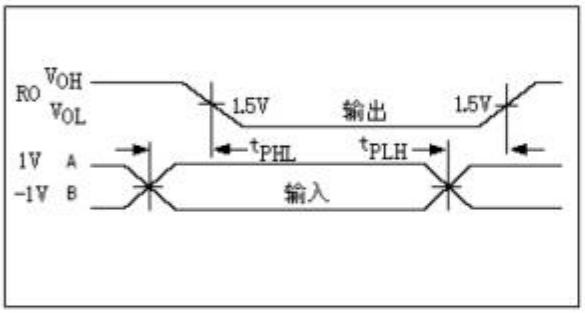


图 8:接收器传播延时

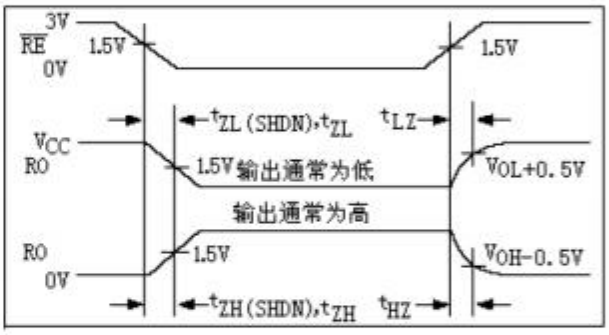


图 9:接收器使能和无效时间

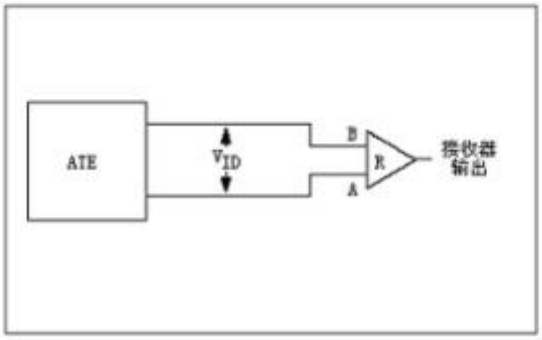


图 10:接收器传播延时测试电路

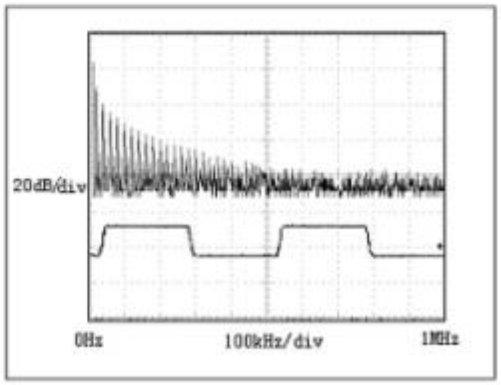


图 11:传输 20kHz 信号时MAX485ESA驱动器输出波形和 FFT 图

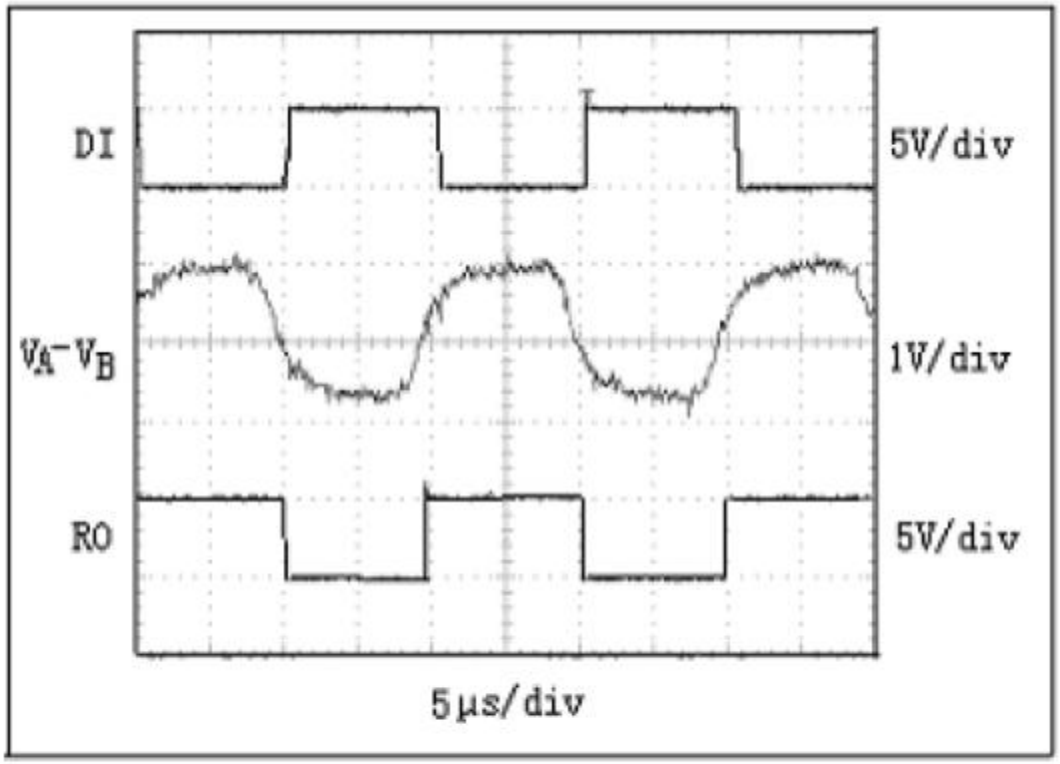


图 12:在 50kHz 时驱动 4000 英尺的电缆

MAX485ESA系统差分电压线性转发器

6.驱动器输出保护

通过两种机制避免故障或总线冲突引起输出电流过大和功耗过高。第一，输出级折返式限流，在整个共模电压范围(参考典型工作特性)内提供快速短路保护。第二，热关断电路，当管芯温度超过典型值时，强制驱动器输出进入高阻状态。

7.典型应用

收发器设计用于多点总线传输线上的双向数据通信。图 13 显示了典型的网络应用电路。这些器件也能用作电缆长于 4000 英尺的线性转发器，如图 12 。为减小反射，应当在传输线两端以其特性阻抗进行终端匹配，主干线以外的分支连线长度应尽可能短。

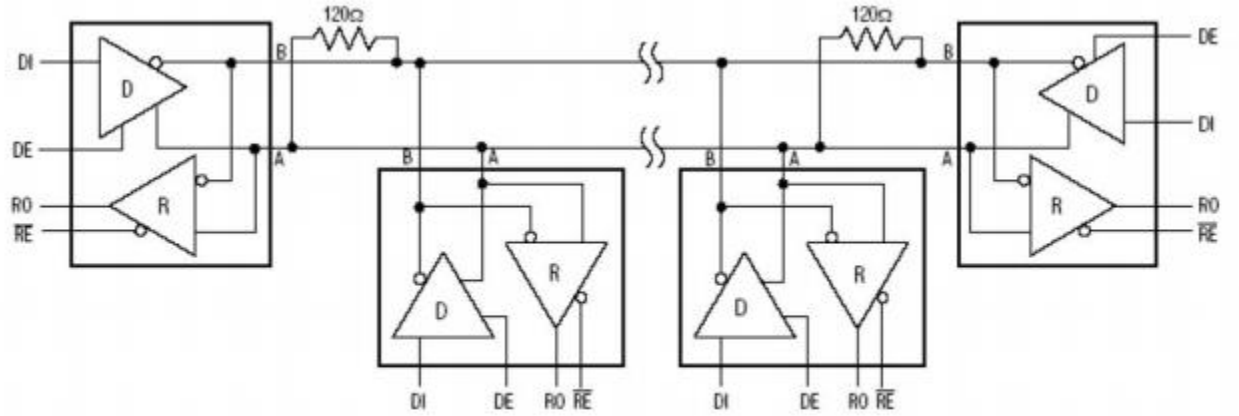


图13:典型半双工RS-485网络

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