在自动化密集的的场合会有很多被控元件如继电器，微型电机，风机，电磁阀，空调，水处理等元件及设备，这些设备通常由 CPU 所集中控制，由于控制系统不能直接驱动被控元件，这需要由功率电路来扩展输出电流以满足被控元件的电流，电压。ULN2XXXX 高压大电流达林顿晶体管阵列系列产品就属于这类可控大功率器件，由于这类器件功能强、应用范围语广。因此，许多公司都生产高压大电流达林顿晶体管阵列产品，从而形成了各种系列产品。

原理：LN2003 也是一个 7 路反向器电路，即当输入端为高电平时 ULN2003 输出端为低电平，当输入端为低电平时 ULN2003 输出端为高电平，继电器得电吸合。如图九所示

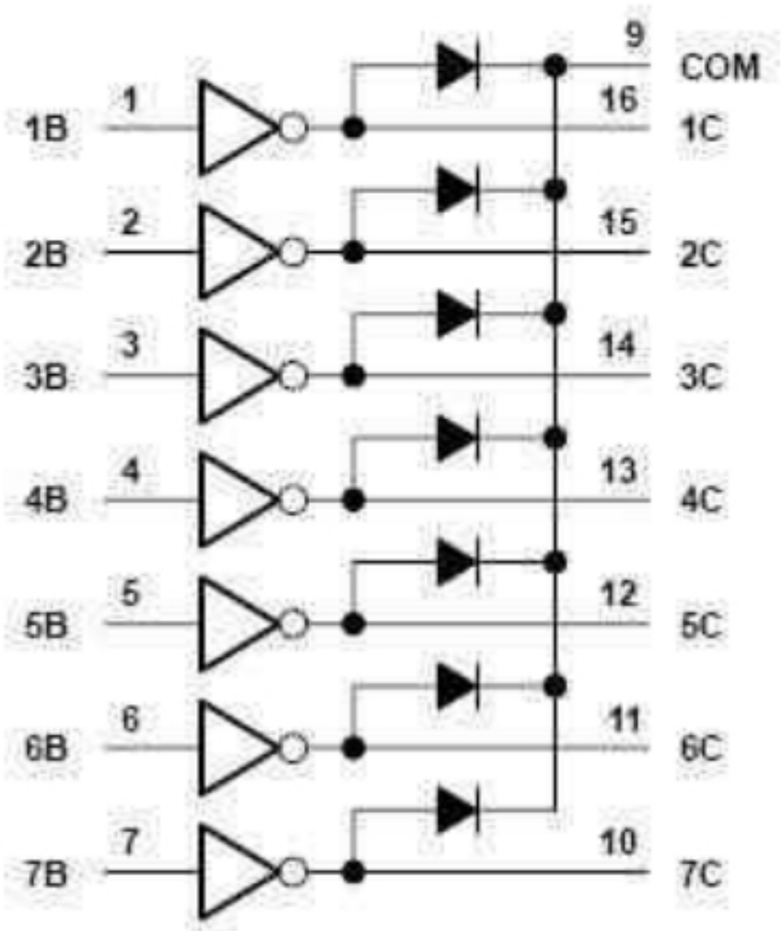
功能特点：

高电压输出 50V

输出钳位二极管

输入兼容各种类型的逻辑电路

应用继电器驱动器



ULN200X 逻辑图

DISSIPATION RATING TABLE 耗散评级表

PACKAGE 封装	TA=25℃ POWER RATING 额定功率	DERATING FACTOR ABOVE 功耗系数 TA=25℃	TA=85℃ POWE RATING 额定功率
D	950 mW	7.6 mW/℃	494 mW
N	1150 mW	9.2 mW/℃	598 mW

electrical characteristics, 电气特性(除非另有说明)TA = 25℃ (unless otherwise noted)

PARAMETER 参数		测试图	TEST CONDITIONS 测试条件	ULN2001A			ULN2	
				最小	典型	最大	最小	典型
VI(on)	On-state input voltage 输入电压	6	VCE=2V, IC =300mA					
VCE(sat)	Collector-emitter saturation voltage 集电极	5	II=250μA,IC=100mA		0.9	1.1		0.9
			II=350μA, IC=200mA		1	1.3		1

	-发射极饱和电压		II=500μA, IC=350mA		1.2	1.6		1.2	1.6	
VF	Clamp forward voltage 正向钳位电压	8	IF = 350mA		1.7	2		1.7	2	V
ICEX	Collector cutoff current 集电极截止电流	1	VCE = 50V, II = 0			50			50	μA
		2	VCE=50V,TA=70℃	II=0		100			100	
				VI=6V					500	
II(off)	Off state input current 关闭状态下输入电流	3	VCE=50V,TA=70℃ IC=500μA,		50	65		50	65	μA
II	Input current 输入电流	4	VI = 17 V					0.82	1.25	mA
IR	Clamp reverse current 反向钳位电流	7	VR=50V, TA=70℃			100			100	μA
			VR = 50 V			50			50	
hFE	Static forward-current transfer ratio 静态正向电流传输比	5	VCE=2V, IC =350mA		1000					
Ci	Input capacitance 输入电容		VI = 0, f = 1MHz			15	25		15	25	pF

electrical characteristics, 电气特性(除非另有说明)TA = 25℃ (unless otherwise noted)

PARAMETER 参数		测试图	TEST CONDITIONS 测试条件		ULN2003A			ULI	
					最小	典型	最大	最小	
VI(on)	On state input voltage 输入电压	66	VCE=2V	IC=125mA					
				IC=200mA			2.4		
				IC=250mA			2.7		
				IC=275mA					
				IC=300mA			3		
				IC=350mA					
VCE(sat)	ittCollector-emitter saturation voltage 集电极发射极饱和电压	5	II = 250μA, IC=100mA			0.9	1.1		
			II = 350μA, IC =200mA			1	1.3		
			II = 500μA, IC=350mA			1.2	1.6		
ICEX	Collector cutoff current 集电极截止电流	1	VCE = 50V, II = 0				50		
		22	VCE=50V,TA=70℃	II = 0			100		
				VI = 1V					
VF	Clamp forward voltage 正向钳位电压	8	IF = 350mA			1.7	2		
II(off)	Off state input current 关闭状态下输入电流	33	VCE = 50 V, CE , TA = 70℃ IC = 500μA		50	65		50	
II	Input current 输入	4	VI = 3.85 V			0.93	1.35		

	电流		VI = 5 V					0.35	0.5	
			VI = 12 V					1	1.45	
IR	Clamp reverse current 反向钳位电流	77	VR = 50 V			50			50	μA
			VR = 50 V, TA = 70℃			100			100	
Ci	Input capacitance 输入电容		VI = 0, f =1MHz		15	25		15	25	pF

electrical characteristics, 电气特性(除非另有说明)TA = 25℃ (unless otherwise noted)

PARAMETER 参数		测试图	TEST CONDITIONS 测试条件		ULQ2003A			ULQ2	
					最小	典型	最大	最小	典
VI(on)	On state input voltage 输入电压	6	VCE=2V	IC=125mA					
				IC=200mA			2.7		
				IC=250mA			2.9		
				IC=275mA					
				IC=300mA			3		
				IC=350mA					
VCE(sat)	ittCollector-emitter saturation voltage 集电极发射极饱和电压	5	II = 250μA, IC=100mA			0.9	1.1		0
			II = 350μA, IC =200mA			1	1.3		1
			II = 500μA, IC=350mA			1.2	1.6		1
ICEX	Collector cutoff current 集电极截止电流	1	VCE = 50V, II = 0				50		
		22	VCE=50V	II = 0			100		
				VI = 1V					
VF	Clamp forward voltage 正向钳位电压	8	IF =350mA			1.7	2		1
II(off)	Off state input current 关闭状态下输入电流	3	VCE =50V, IC=500μA		30	65		50	6
II	Input current 输入电流	4	VI = 3.85V			0.93	1.35		
			VI = 5V						0
			VI = 12V						1
IR	Clamp reverse current 反向钳位电流	7	VR = 50V TA =25℃				100		
			VR = 50V				100		
Ci	Input capacitance 输入电容		VI = 0, f=1MHz			15	25		1

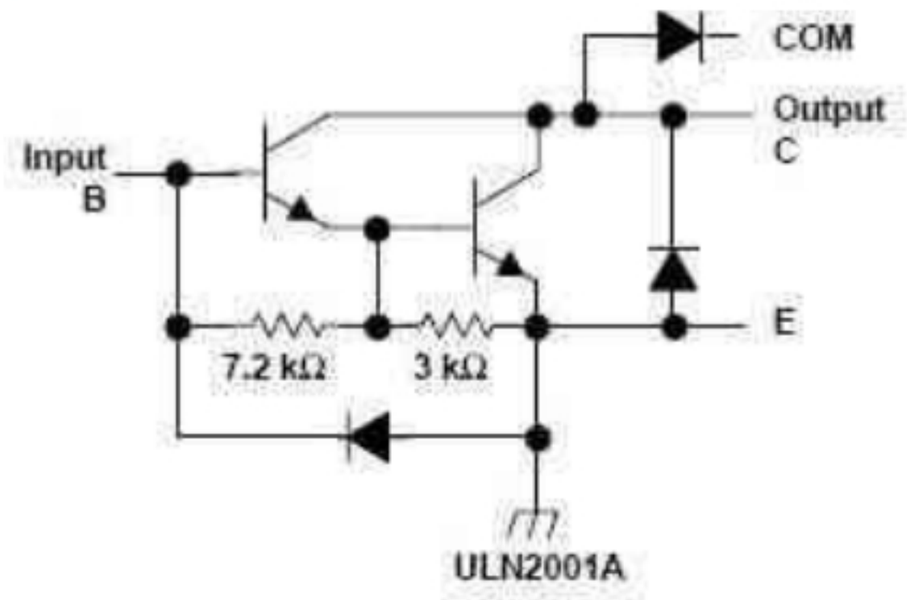
switching characteristics, 开关特性 TA = 25℃

PARAMETER 参数		TEST CONDITIONS 测试条件	ULN2001A,ULN2 ULN2003A,ULN2	
			最小	典型
tPLH	Propagation delay time, low- to high-level output 传播延迟时间，从低到高输出	See Figure 9		0.25

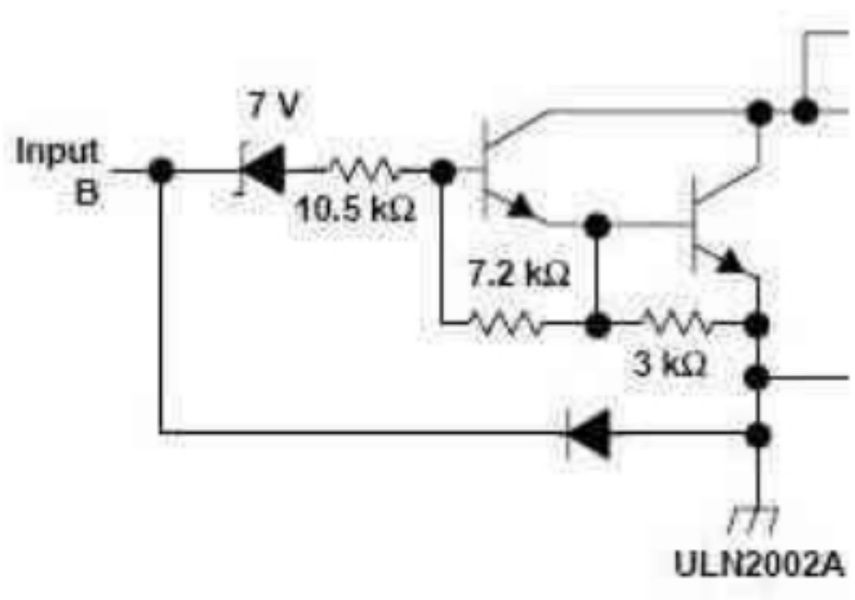
tPHL	Propagation delay time, high-to low-level output 传播延迟时间，从高到低输出	See Figure 9		0.25	1	μs
VOH	High-level output voltage after switching 输出高电平电压	VS=50V, IO≈300mA, See Figure 10	VS–20			mV

switching characteristics over recommended operating conditions (unless otherwise noted)开关特性的建议运行条件（除非另有说明）

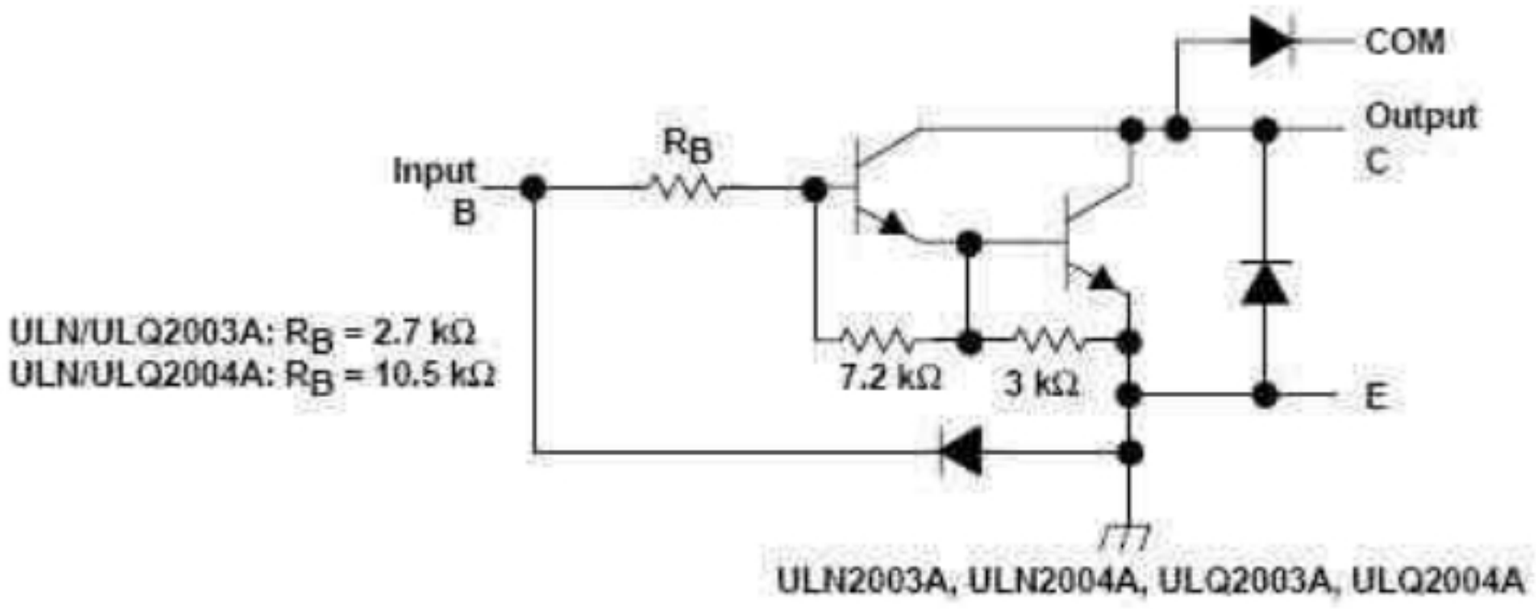
PARAMETER 参数		TEST CONDITIONS 测试条件	ULQ2003A,ULQ200		
			最小	典型	最大
tPLH	Propagation delay time, low- to high-level output 传播延迟时间，从低到高输出	See Figure 9		1	10
tPHL	Propagation delay time, high-to low-level output 传播延迟时间，从高到低输出	See Figure 9		1	10
VOH	High-level output voltage after switching 输出高电平电压	VS=50V, IO≈300mA, See Figure 10	VS–500		



图一 ULN2001A 内部电路图



图二 ULN2002A 内部电路图



图三 ULN2003A ULN2004A ULQ2003A ULQ2004A 内部电路图

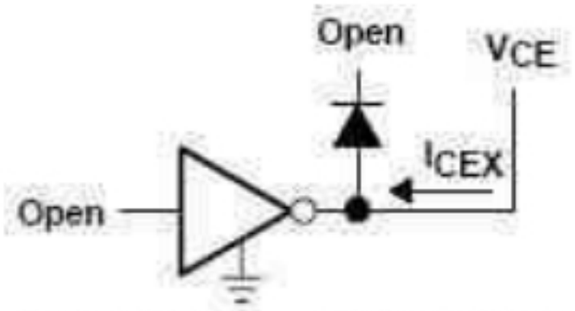


Figure 1. I_{CEX} Test Circuit

图 1 ICEX 测试电路

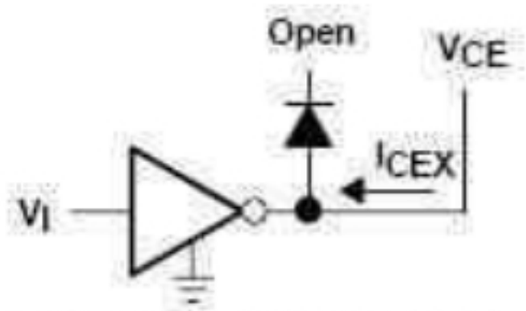


Figure 2. I_{CEX} Test Circuit

图 2　ICEX 测试电路

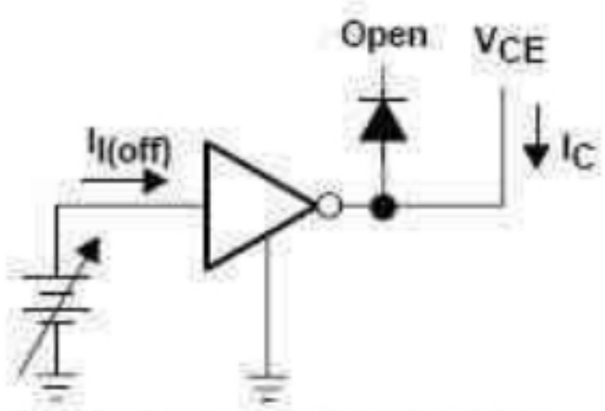


Figure 3. $I_{I(off)}$ Test Circuit

图 3 ICEX 测试电路

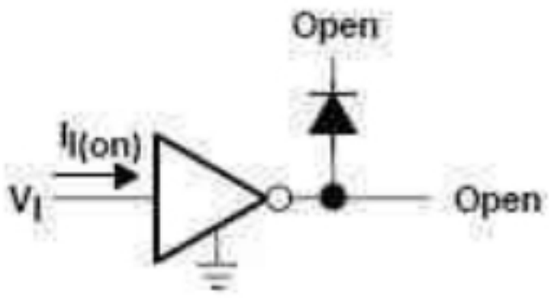
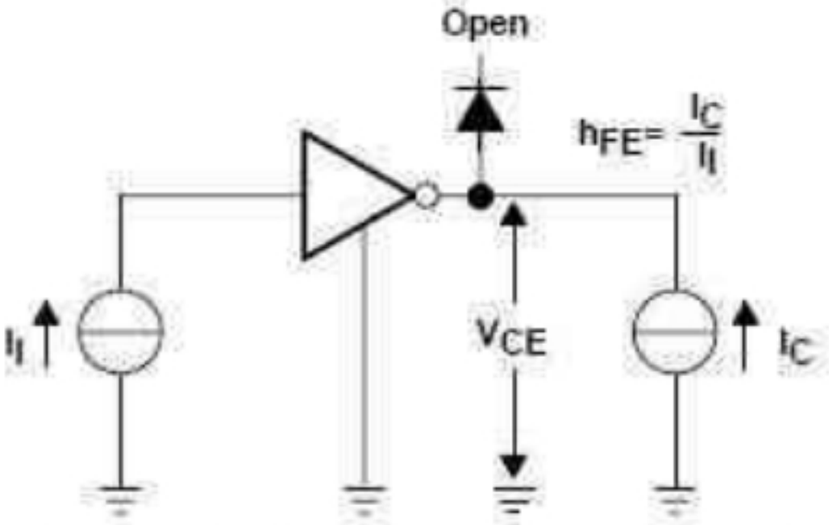


Figure 4. I_I Test Circuit

图 4ICEX 测试电路



NOTE: I_I is fixed for measuring $V_{CE(sat)}$, variable for measuring h_{FE}.

Figure 5. h_{FE}, $V_{CE(sat)}$ Test Circuit

图 5　hFE, VCE(sat)测试电路

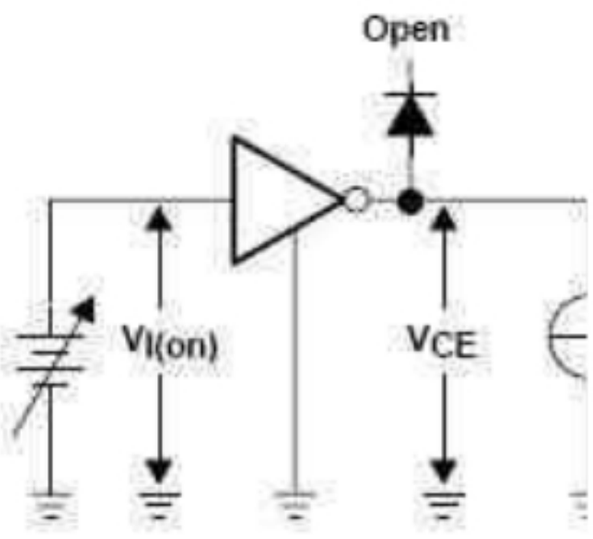


Figure 6. $V_{I(on)}$ Test Circuit

图 6 VI(on) 测试电路

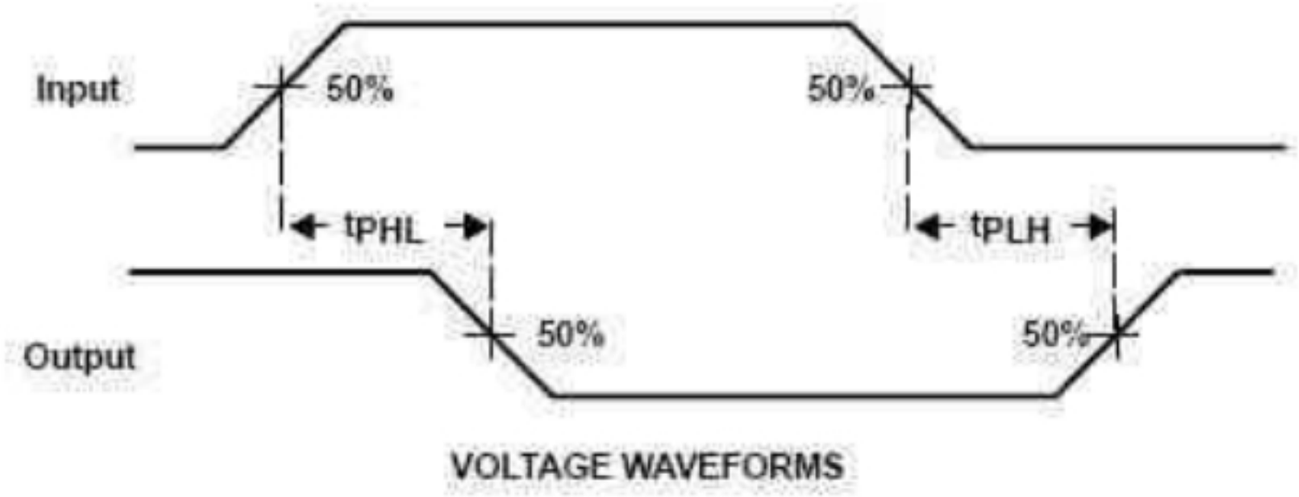
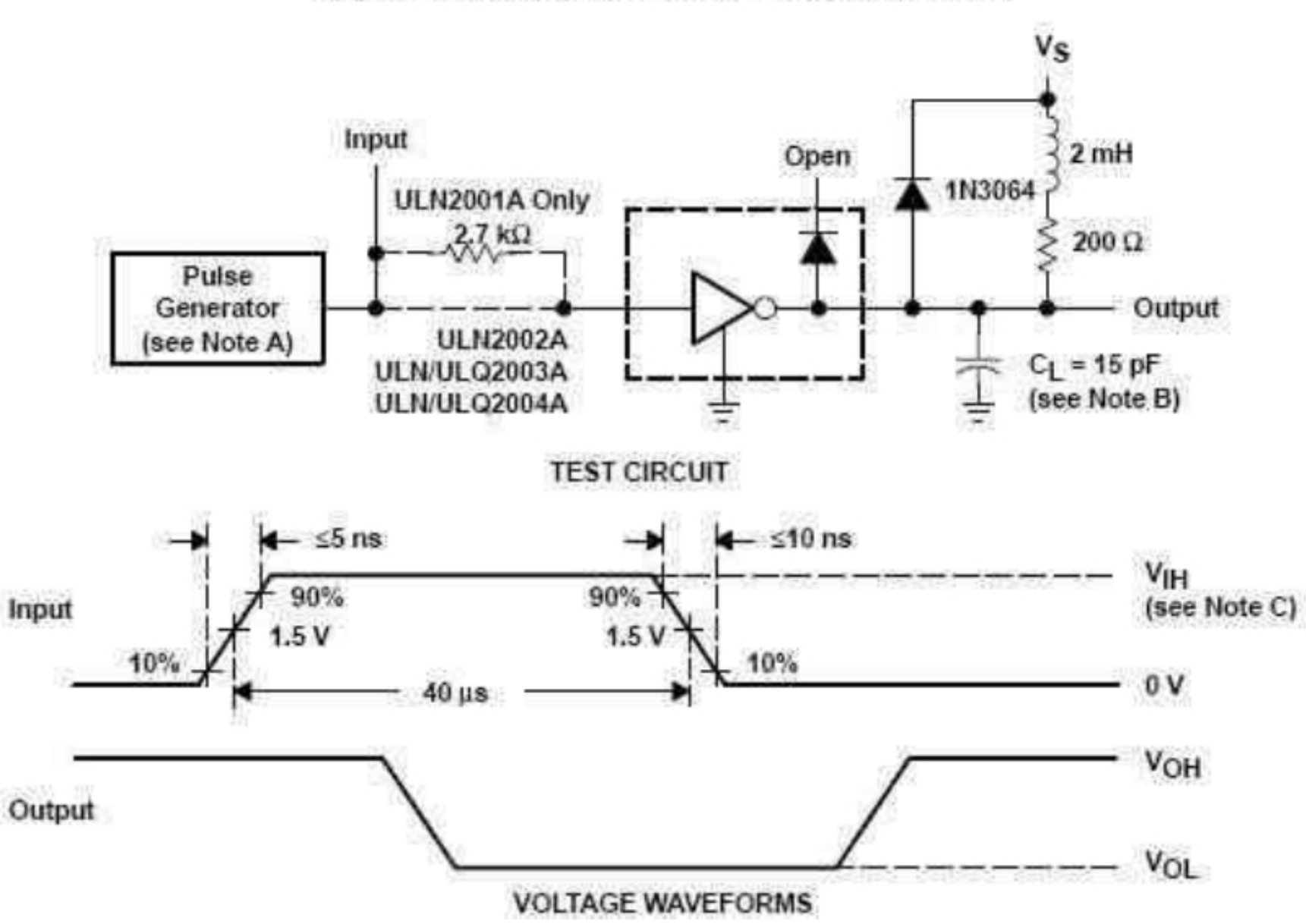
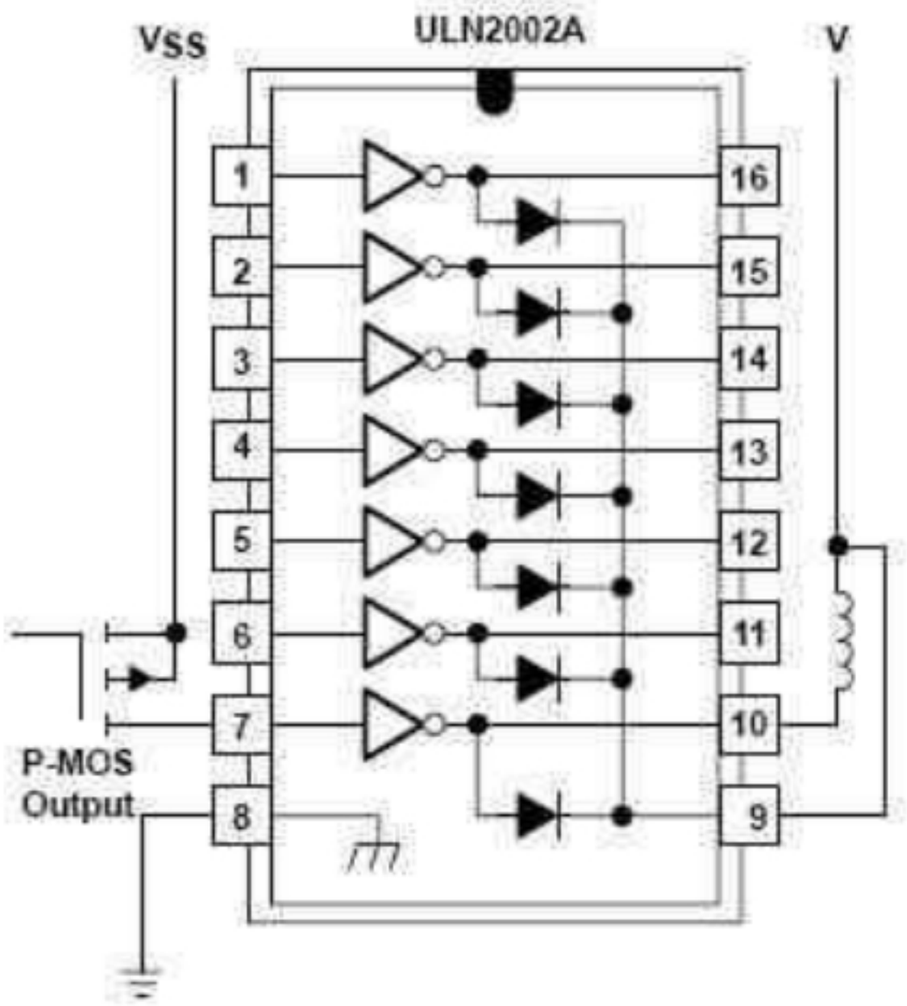


Figure 9. Propagation Delay-Time Waveforms

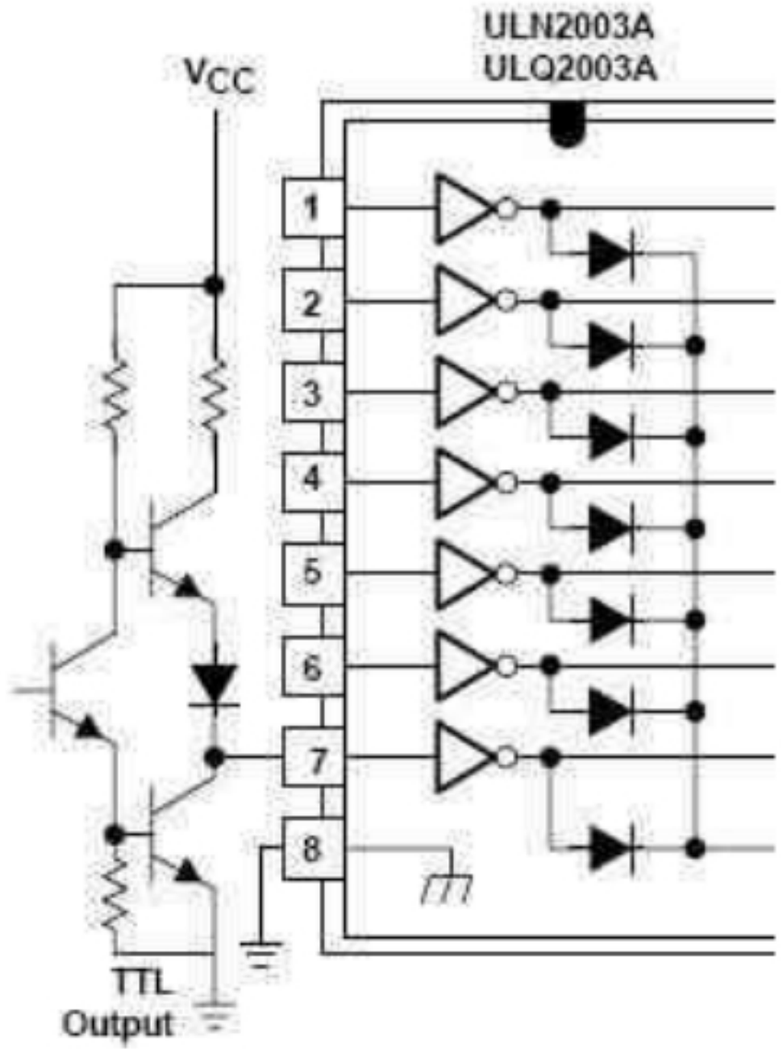


图四 参数测量信息

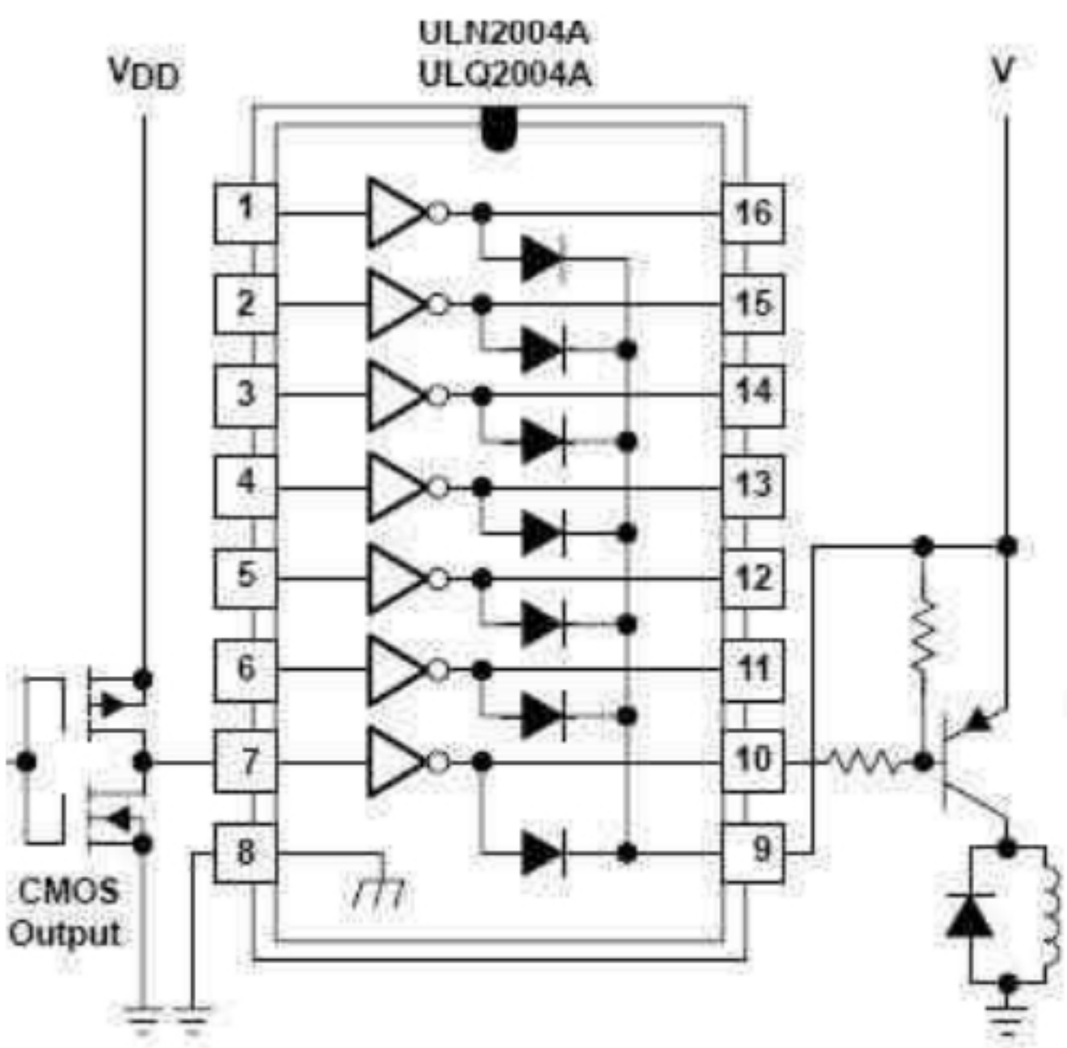
应用电路：



图五 MOS 管加载到输入端

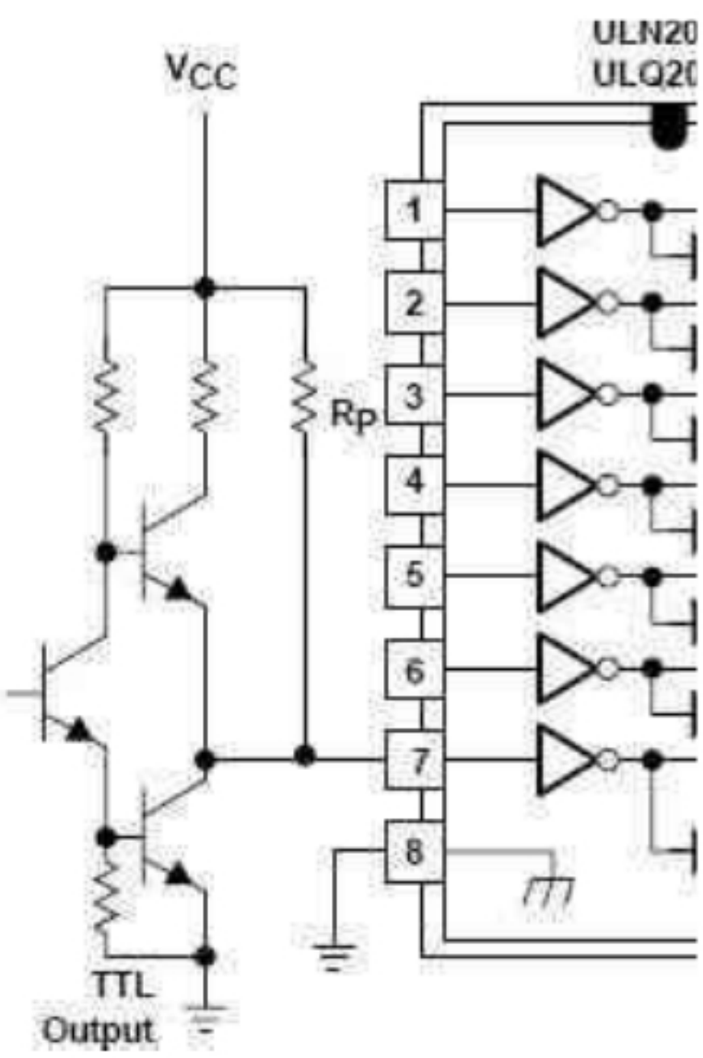


图六　TTL 电路到输入端

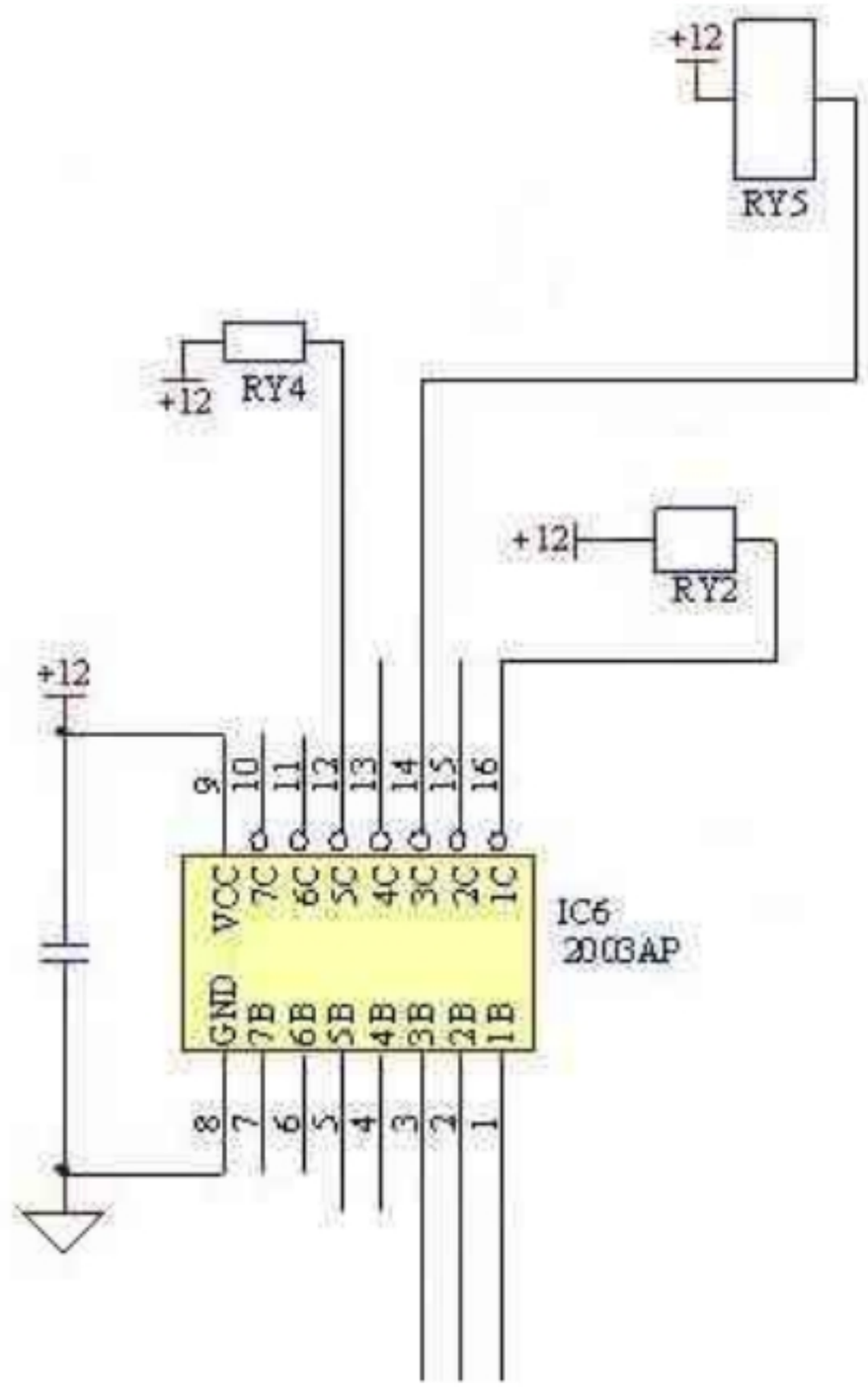


图七 冲区高电流负载

驱动电流



图八　使用上拉电阻提高



图九 实际应用的 UL2003 电路图

absolute maximum ratings at=25℃ free-air temperature (unless otherwise noted)† 绝对最大额定值 at=25℃		
Collector-emitter voltage 集电极-发射极电压		50 V
Clamp diode reverse voltage 钳位二极管的反向电压（见注 1 ）		50 V
Input voltage, VI (see Note 1) 输入电压		30 V
Peak collector current (see Figures 14 and 15)峰值集电极电流		500 mA
Output clamp current, IOK .输出钳位电流		500 mA
Total emitter-terminal current 共发射极端子电流		–2.5 A
Continuous total power dissipation . 连续总功耗		See Dissipation Rating Table
Package thermal impedance, θJA 封装热阻(see Note 2):	D package	73℃/W
	N package	67℃/W
	NS package	64℃/W
Operating free-air temperature range, TA 自由空气的温度范围内	ULN200xA	–20℃ to 70℃
	ULQ200xA	–40℃ to 85℃
Lead temperature 1.6mm(1/16inch)from case for 10 seconds		260℃
Storage temperature range, Tstg 储存温度范围		–65℃ to 150℃