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瑞萨电子公司网址：<http://www.renesas.com>

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【发行】瑞萨电子公司（<http://www.renesas.com>）

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TTL

瑞萨TTL集成电路概要

1. 低功耗肖特基TTL电路的特点

通过用SBD减少累积时间和提高工艺技术，大幅度地改善了TTL电路的速度和总功耗等性能指标。

HD74LS系列达到了和标准TTL系列一样的速度，并通过降低功耗来提高性能指标，其结果是：每个门的传播延迟时间为10ns，功耗为2mW。HD74LS系列的基本门电路如图1所示。

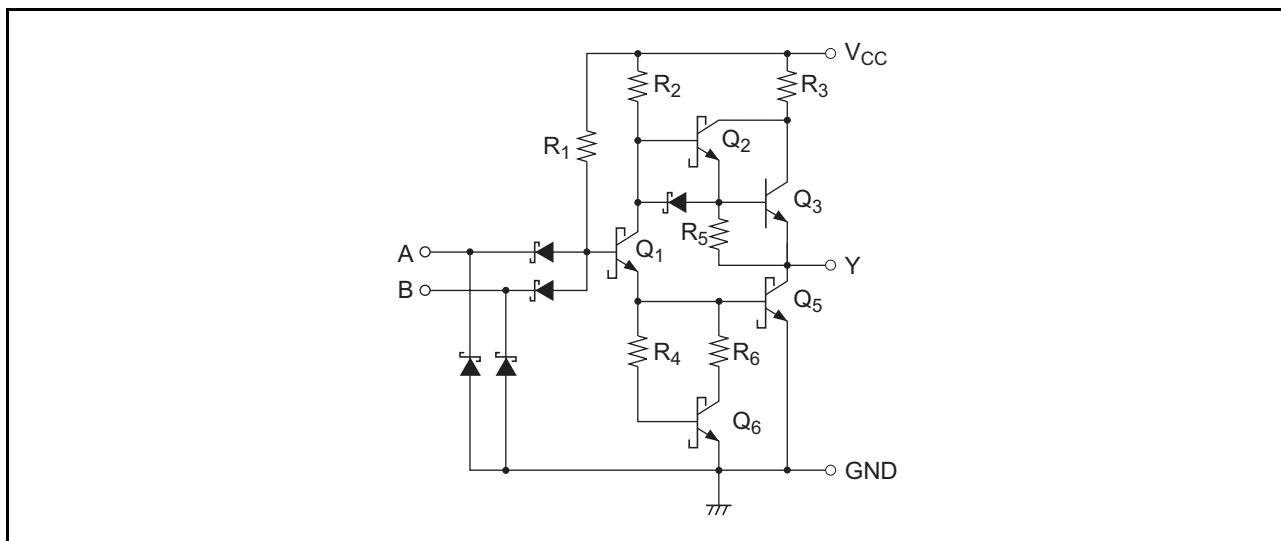


图1 HD74LS系列的基本电路

此输入电路不是采用以前TTL电路所使用的多发射极结构，而大部分是采用了SBD（肖特基二极管）结构。与多发射极输入结构相比，此结构至少提高了2倍的输入耐压，其优点是能将未使用的引脚直接连接到V_{CC}引脚。但是，如果输入数增加，有可能因连接二极管阳极的衬底电容增加而导致速度（尤其是t_{PHL}）的降低（但是，MSI等的内部门电路采用了多发射极结构）。

另一方面，虽然通过高电阻来降低功耗，但是使用以前的集成电路技术，当电阻值变大时，电阻所占的面积也变大，所以不能节省费用。HD74LS系列导入了离子注入技术，能在高电阻部分以高精度形成高面积电阻率的区域，因而提高了集成度。所以说，低功耗肖特基TTL在MSI或者LSI中更能发挥其特点。

2. 瑞萨TTL HD74LS系列的特点

瑞萨提供低功耗SBD TTL HD74LS系列，可根据系统设计者的各种要求选择这些系列。下面叙述瑞萨TTL系列的一般特点。

- (1) 可根据系统要求自由选择
因为各系列完全兼容，所以可在中速~高速范围内自由选择。
- (2) 电路功能的种类丰富
各系列有门系列、触发器系列和MSI，品种繁多。
- (3) 输入引脚内置钳位二极管
为了防止因反射等引起的误动作，输入引脚内置了钳位二极管，所以不需要考虑终端等的阻抗耦合。
- (4) 工作温度范围广
充分考虑国内的环境条件，将瑞萨TTL的工作温度确保在-20°C~+75°C范围内。
- (5) 可靠性高
以“内建可靠性”为基本原则，充分发挥多年的经验和技術以确保其可靠性。
- (6) 具有兼容性
在功能、特性、引脚排列、品名等方面和国际标准系列的SN74LS系列完全兼容。

(7) 能连接其他系统

确保全系列产品的电源电压为 $5V \pm 5\%$ ，并能直接或者通过专用电路连接 DTL 电路、MOS 电路、其他显示元件和信号线等。

3. TTL 集成电路的术语和符号

3.1 电特性和推荐工作条件



(1) 直流特性

符号	术语	说明
V_{IH}	“H”电平输入电压	保证逻辑元件在某规格内正常工作的“H”电平输入电压。
V_{IL}	“L”电平输入电压	保证逻辑元件在某规格内正常工作的“L”电平输入电压。
V_{OL}	“L”电平输出电压	在使输出引脚为“L”电平的输入条件下，规定的输出电流 I_{OL} （例如，假定最大扇出时的最大流入电流）流入输出引脚时的输出电压。
V_{OH}	“H”电平输出电压	在使输出引脚为“H”电平的输入条件下，规定的输出电流 I_{OH} （例如，假定最大扇出时的最大流入电流）从输出引脚流出时的输出电压。
V_{T^+}	正向输入的阈值电压	在使输入电平从低于反向输入阈值电压 V_{T^-} 的电压电平上升的情况下，逻辑元件的工作发生变化时的输入电压。
V_{T^-}	反向输入的阈值电压	在使输入电平从高于正向输入阈值电压 V_{T^+} 的电压电平下降的情况下，逻辑元件的工作发生变化时的输入电压。
$V_{O(on)}$	ON 状态的输出电压	在使输出引脚进入 ON 状态的输入条件下，规定的输出电流的输出引脚电压（此特性是针对内部无上拉元件的输出引脚而规定的）。
$V_{O(off)}$	OFF 状态的输出电压	在使输出引脚进入 OFF 状态的输入条件下，规定的输出电流的输出引脚电压（此特性是针对内部无上拉元件的输出引脚和三态输出引脚而规定的）。
V_{IK}	输入钳位电压	从输入引脚引出规定的电流时的输入电压（此项是针对有钳位二极管的输入引脚而规定的）。
I_{IH}	“H”电平输入电流	给输入引脚外加规定的“H”电平电压时，流入的输入电流。
I_{IL}	“L”电平输入电流	给输入引脚外加规定的“L”电平电压时，流出的输入电流。
I_{OH}	“H”电平输出电流	在输出引脚为规定的“H”电平输出电压 V_{OH} 时，流出的输出电流。
$I_{O(off)}$	OFF 状态的输出电流	在使输出引脚进入 OFF 状态的输入条件下，输出引脚为规定的输出电压时流入的输出电流（此项是针对驱动非逻辑电路元件的集电极开路输出而规定的）。
I_{oz}	OFF 状态的输出电流（高阻抗）	为了使三态输出元件的输出引脚进入高阻抗状态而设定了输入条件时，流入输出引脚的电流。
I_{os}	输出短路电流	在使输出引脚为“H”电平的输入条件下，将输出引脚短路时流出的电流（即使在有多个输出引脚时，也不能同时将 2 个或 2 个以上的输出引脚短路）。
I_i	输入电流	给输入引脚外加规定的最大输入电压时，流入的输入电流。
I_{CCH}	输出“H”电平时的电源电流	全部输出引脚都为“H”电平状态时，流入电源引脚（ V_{CC} ）的电流。
I_{CCL}	输出“L”电平时的电源电流	全部输出引脚都为“L”电平状态时，流入电源引脚（ V_{CC} ）的电流。
I_{CC}	电源电流	在规定的输入/输出条件下，流入电源引脚（ V_{CC} ）的电流。
I_{T^+}	正向输入的阈值电流	给输入引脚外加阈值电压 V_{T^+} 时，流出的输入电流。
I_{T^-}	反向输入的阈值电流	给输入引脚外加阈值电压 V_{T^-} 时，流出的输入电流。

(2) 交流特性

符号	术语	说明
f_{\max}	最高时钟频率	要通过时钟脉冲使输出状态发生变化而设定了输入/输出条件时，按照规定的顺序，能维持稳定的输出逻辑电平变化的最高时钟重复频率。
t_{TLH}	上升（过渡）时间	在从定义的“L”电平变为定义的“H”电平的过渡期间，波形从规定的“L”电平变为规定的“H”电平的时间。
t_{THL}	下降（过渡）时间	在从定义的“H”电平变为定义的“L”电平的过渡期间，波形从规定的“H”电平变为规定的“L”电平的时间。
t_{PLH}	输出上升沿的传播延迟时间	当输出引脚从“L”电平变为“H”电平时，在规定的负载条件下，输入和输出电压波形在规定的电压电平之间的延迟时间。
t_{PHL}	输出下降沿的传播延迟时间	当输出引脚从“H”电平变为“L”电平时，在规定的负载条件下，输入和输出电压波形在规定的电压电平之间的延迟时间。
t_{HZ}	三态输出的禁止时间（“H”电平）	当三态输出引脚从“H”电平变为高阻抗状态时，在规定的负载条件下，输入和输出电压波形在规定的电压电平之间的延迟时间。
t_{LZ}	三态输出的禁止时间（“L”电平）	当三态输出引脚从“L”电平变为高阻抗状态时，在规定的负载条件下，输入和输出电压波形在规定的电压电平之间的延迟时间。
t_{ZH}	三态输出的允许时间（“H”电平）	当三态输出引脚从高阻抗状态变为“H”电平时，在规定的负载条件下，输入和输出电压波形在规定的电压电平之间的延迟时间。
t_{ZL}	三态输出的允许时间（“L”电平）	当三态输出引脚从高阻抗状态变为“L”电平时，在规定的负载条件下，输入和输出电压波形在规定的电压电平之间的延迟时间。
t_w	脉宽	脉冲波形前后端在规定的电平之间的时间。
t_h	保持时间	在其他相关的输入引脚（例如，时钟输入）发生变化后，必须对规定的输入引脚保持信号的时间。
t_{su}	准备时间	在其他相关的输入引脚（例如，时钟输入）发生变化前，必须对规定的输入引脚外加并维持信号的时间。
t_{release}	释放时间	从对规定的输入引脚解除信号后，到能改变其他相关的输入引脚（例如，时钟输入）的时间。

3.2 功能表

符号	说明
H	High (高) 电平 (稳定) (在文章中记为 “H” 或者H电平)
L	Low (低) 电平 (稳定) (在文章中记为 “L” 或者L电平)
↑	从L电平变为H电平
↓	从H电平变为L电平
×	H或者L均可
Z	三态输出引脚处于OFF状态 (高阻抗)
a....h	A~H各输入引脚的稳定状态的输入电平
Q ₀	确立输入条件前的Q电平
$\overline{Q_0}$	Q ₀ 的补码
Q _n	在发生最新有效变化 (↑或者↓) 前的Q电平
	1个 “H” 电平的脉冲
	1个 “L” 电平的脉冲
TOGGLE	各输出引脚随着输入引脚的有效变化 (↑或者↓) 而变为前一个状态的补码

修订记录

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		页	修订处
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7. 本资料中所记载的产品并非针对万一出现故障或是错误运行就会威胁到人的生命或给人体带来危害的机器、系统(如各种安全装置或者运输交通用的、医疗、燃烧控制、航天器械、核能、海底中继用的机器和系统等)而设计和制造的,特别是对于品质和可靠性要求极高的机器和系统等(将本公司指定用于汽车方面的产品用于汽车时除外)。如果要用于上述的目的,请务必事先向本公司的营业窗口咨询。另外,对于用于上述目的而造成的损失等,本公司概不负责。
8. 除上述第7项内容外,不能将本资料中记载的产品用于以下用途。如果用于以下用途而造成的损失,本公司概不负责。
 - 1) 生命维持装置。
 - 2) 植埋于人体使用的装置。
 - 3) 用于治疗(切除患处、给药等)的装置。
 - 4) 其他直接影响到人的生命的装置。
9. 在使用本资料所记载的产品时,对于最大额定值、工作电源电压的范围、放热特性、安装条件及其他条件请在本公司规定的保证范围内使用。如果超出了本公司规定的保证范围使用时,对于由此而造成的故障和出现的事故,本公司将不承担任何责任。
10. 本公司一直致力于提高产品的质量和可靠性,但一般来说,半导体产品总会以一定的概率发生故障、或者由于使用条件不同而出现错误运行等。为了避免因本公司的产品发生故障或者错误运行而导致人身事故和火灾或造成社会性的损失,希望客户能自行负责进行冗余设计、采取延烧对策及进行防止错误运行等的安全设计(包括硬件和软件两方面的设计)以及老化处理等,这是作为机器和系统的出厂保证。特别是单片机的软件,由于单独进行验证很困难,所以要求在顾客制造的最终的机器及系统上进行安全检验工作。
11. 如果把本资料所记载的产品从其载体设备上卸下,有可能造成婴儿误吞的危险。顾客在将本公司产品安装到顾客的设备上时,请顾客自行负责将本公司产品设置为不容易剥落的安全设计。如果从顾客的设备上剥落而造成事故时,本公司将不承担任何责任。
12. 在未得到本公司的事先书面认可时,不可将本资料的一部分或者全部转载或者复制。
13. 如果需要了解关于本资料的详细内容,或者有其他关心的问题,请向本公司的营业窗口咨询。