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应用指南 AN-3002

低电流输入电路概念 6N138/139 系列

引言

光耦合与 LED 技术的进步催生了 6N139。这种独特的光耦合器采用 500 微安的 LED 输入电流规格，开启了许多有趣的设计之门。除明显的、已经多篇文章论述的由 CMOS 电路直接驱动的功能外，还可考虑通过 6N139 实现信号检测、瞬态检测、矩阵和无负载线路接收。以下是一些能够激发设计人员兴趣的电路概念。

信号检测

通过 6N139 的输入可以轻松、直接地检测到噪声、尖峰或振荡，如图 1 电路所示。

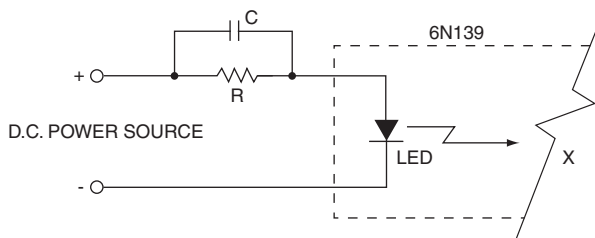


图 1. 用于信号检测的 6N139 输入电路

若要检测直流电源不良信号，请采用：

$$R = \frac{\text{Power supply voltage} - 1.5 \text{ volts}}{50 \text{ microamperes}}$$

C = 向 LED 中注入 500 微安

X = 可以继续连接的门锁或非门锁输出电路

LED = 6N139 的输入二极管

为 LED 提供 50 微安的正向电流，以将 LED 电容充电至 VF 电平。这样，LED 不会造成其输出电路导通，但预备将很快导通。“直流电源”上的任何噪声或振荡都由形成通过 LED 的信号“C”进行耦合。即使非常小的无用信号，都可能导致 LED 正向电流发生较大的变化。一旦 LED 的正向电流等于或超过 500 微安，输出电路将导通，这表明存在无用信号。

瞬态检测

通过图 2 中的电路很容易检测是否存在波形。

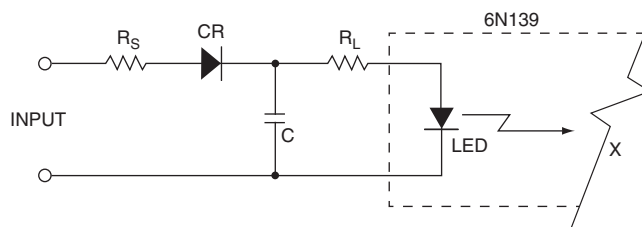


图 2. 脉冲或波形检测电路

若要检测是否存在有用信号、脉冲或波形，请采用：

CR = 硅二极管

$$R_L = \frac{(\text{Positive } V_{pk. \text{ of input}}) - 2.5 \text{ volts}}{1 \text{ milliampere}}$$

$$C_{min} = \frac{\text{Pulse interval of } 1/f}{R_L}$$

$$R_{Smax} = \frac{\text{Pulse width or } 1/4f}{5C}$$

X = 可以继续连接的非门锁输出电路

LED = 6N139 的输入二极管

f = 频率

示例：

图 3 显示需要存在的有用脉冲序列。

产生的能够维持输出电路导通的 LED 正向电流为合理设计的结果。

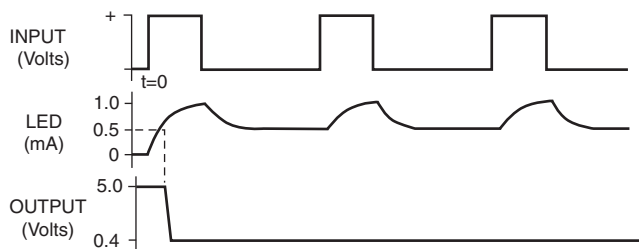


图 3. 脉冲序列波形

图 4 显示所需的正弦波形。产生的能够维持输出电路导通的 LED 正向电流为合理设计的结果。

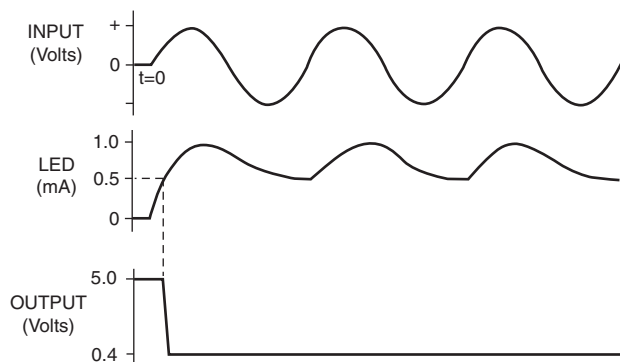


图 4. 正弦波形

矩阵光耦

利用 6N139 的低输入 LED 电流优势, 现在能够驱动只包含一个 TTL 输出的矩阵, 如图 5 所示。

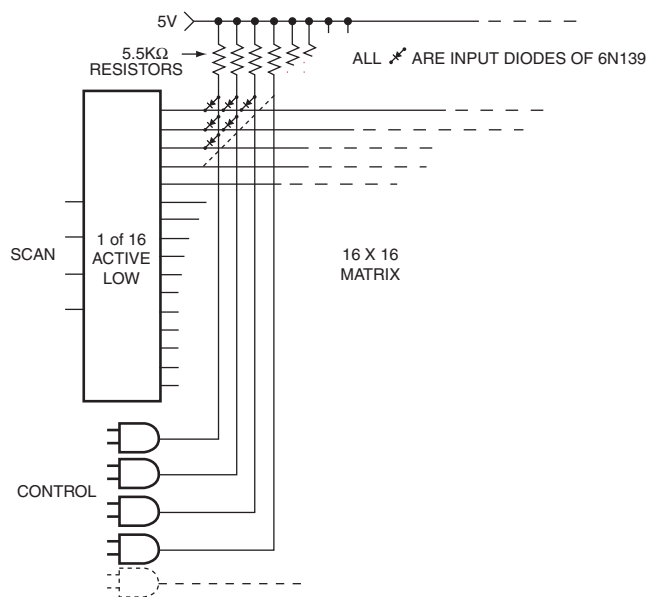


图 5. 矩阵的光耦合输出

非负载线路接收器

对于虚拟非负载, 6N139 与图 6 中的差分放大器电路兼容。

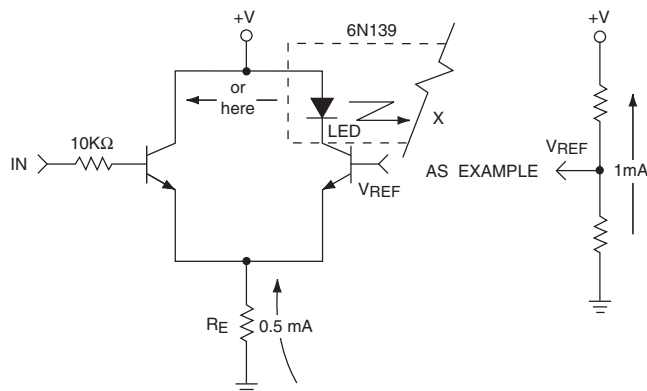


图 6. 差分放大器驱动

对于虚拟空载光隔离器电路, 采用:

X = 可继续连接的非门锁输出电路

LED = 6N139 的输入二极管

“IN” 电流要求小于 20 微安。

例如：

若“V_{REF}”为+1.4 V且R_E为1.2 K Ω，电路对于TTL“0”和“1”电平反应良好。即，若“IN”为“0”，LED电流导致输出电路导通。相反地，若“IN”为“1”，将不存在LED电流。注意，LED所串联的集电极决定“IN”为“0”或“1”时的LED电流通过。

6N139 输出电路

下面是 6N139 输出电路的两个示例。一个是开锁电路（图 7），另一个是非开锁电路（图 8），它们都能够直接驱动 TTL 栅极。

参见图 7，假设“RESET”已被某瞬时接地启动，并且未接收任何输入信号，所有晶体管显示为非导通状态（输出高电平，“1”）。一个输入信号的到达将导通所有晶体管。（输出低电平，“0”）。由输出晶体管导通的 PNP 晶体管，将转而闭锁同一输出晶体管，直至“RESET”后才会再次被启动。

在图 8 中, 由于没有接收任何信号, 输入晶体管处于非导通状态。输出晶体管少量导通。由于存在 $4.7\text{ M}\Omega$ 的电阻, 因此该少量导通不会将“输出”变为“0”电平。少量导通的目的是减少导通延时。接收到一个信号后, 输入和输出晶体管都被导通, 导致“输出”变为逻辑“0”状态。 $4.7\text{ M}\Omega$ 的电阻现在用于减少输出晶体管的关断时间。

若您尚未仔细阅读 6N139 规格数据表，可能无法完全了解飞兆半导体光耦合器的电流性能。

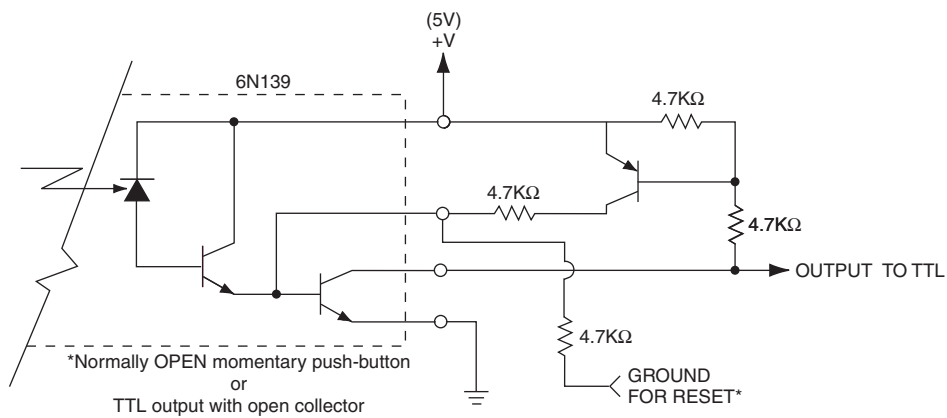


图 7. 6N139 的门锁输出电路

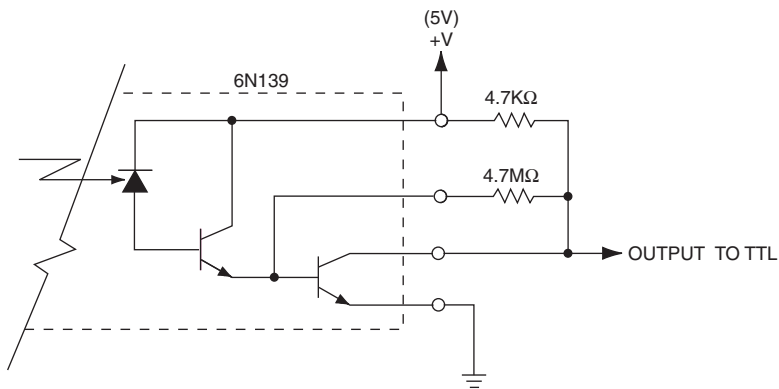


图 8. 6N139 的非门锁输出电路

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