

## 十四位二进制串行计数器

### 概述

CD4060 包含一个振荡器和一组十四位二进制串行计数器。振荡器的结构可以是 RC 或晶振电路。Reset 为高电平时，计数器清零且振荡器使用无效，所有的计数器位均为主从触发器。在 CP1（和 CP0）的下降沿计数器以二进制进行计数，在时钟脉冲线上使用施密特触发器对时钟上升和下降时间无限制。

CD4060 提供了 16 引线多层陶瓷双列直插（D）、熔封陶瓷双列直插（J）、塑料双列直插（P）和陶瓷片状载体（C）4 种封装形式。

### 主要特点

- 高达18V的电源（极限）
- 公共复位RESET

- 15V时输入可达12MHz
- 可全静态的工作
- 缓冲输入和输出
- 施密特触发输入脉冲
- 标准化，对称的输出特性
- 5V，10V，15V三个等级

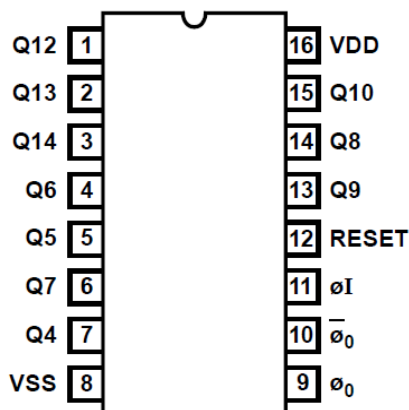
### 振荡器特点

- RC或晶体振荡器配置
- 在15V时，RC振荡器可达690kHz的频率

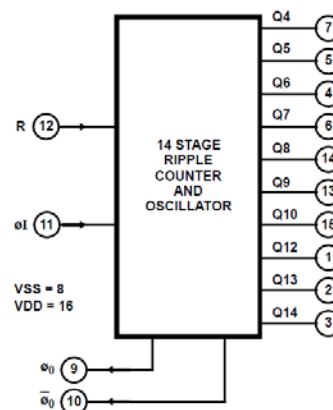
### 应用

- 控制计数
- 定时器
- 分频器
- 时延电路

### 引脚排列图



### 功能框图



### 极限值 (Ta=25℃)

| 参数名称 | 符号   | 数值               | 单位 |
|------|------|------------------|----|
| 电源电压 | Vdd  | -0.5 to +17      | V  |
| 工作电流 | Idd  | ±10              | mA |
| 输入电压 | VPOL | -0.5 to VDD +0.5 | V  |
| 工作温度 | Topr | -10 to +85       | ℃  |
| 贮存温度 | Tstg | -55 to +150      | ℃  |

### 电气参数特性(若无其它规定: Ta = 25℃)

| 参数                                                    | 符号    | 测试条件 (NOTE 1)                      |           | TEMPERATURE<br>( ° C ) | 规范          |             | 单位 |
|-------------------------------------------------------|-------|------------------------------------|-----------|------------------------|-------------|-------------|----|
|                                                       |       |                                    |           |                        | MIN         | MAX         |    |
| Supply Current                                        | IDD   | VDD = 15V, VIN = VDD or GND        |           | +25                    | –           | 15          | uA |
| Input Leakage Current                                 | IIL   | VIN = VDD or GND                   | VDD = 15V | +25                    | –1          | –           | uA |
| Input Leakage Current                                 | IIH   | VIN = VDD or GND                   | VDD = 15V | +25                    | –           | 1           | uA |
| Output Voltage                                        | VOL15 | VDD = 15V, No Load                 |           | +25                    | –           | 50          | mV |
| Output Voltage                                        | VOH15 | VDD = 15V, No Load (Note 3)        |           | +25                    | 14.95       | –           | V  |
| Output Current<br>(Sink) (Excluding pins 9 & 10)      | IOL5  | VDD = 5V, VOUT = 0.4V              |           | +25                    | 0.53        | –           | mA |
|                                                       | IOL10 | VDD = 10V, VOUT = 0.5V             |           | +25                    | 1.4         | –           | mA |
|                                                       | IOL15 | VDD = 15V, VOUT = 1.5V             |           | +25                    | 3.5         | –           | mA |
| Output Current<br>(Source)<br>(Excluding pins 9 & 10) | IOH5A | VDD = 5V, VOUT = 4.6V              |           | +25                    | –           | –0.53       | mA |
|                                                       | IOH5B | VDD = 5V, VOUT = 2.5V              |           | +25                    | –           | –1.8        | mA |
|                                                       | IOH10 | VDD = 10V, VOUT = 9.5V             |           | +25                    | –           | –1.4        | mA |
|                                                       | IOH15 | VDD = 15V, VOUT = 13.5V            |           | +25                    | –           | –3.5        | mA |
| N Threshold Voltage                                   | VNTH  | VDD = 10V, ISS = –10uA             |           | +25                    | –2.8        | –0.7        | V  |
| P Threshold Voltage                                   | VPTH  | VSS = 0V, IDD = 10uA               |           | +25                    | 0.7         | 2.8         | V  |
| Functional                                            | F     | VDD = 2.8V, VIN = VDD or GND       |           | +25                    | VOH > VDD/2 | VOL < VDD/2 | V  |
|                                                       |       | VDD = 18V, VIN = VDD or GND        |           |                        |             |             |    |
|                                                       |       | VDD = 3V, VIN = VDD or GND         |           |                        |             |             |    |
| Input Voltage Low (Note 2)                            | VIL   | VDD = 5V, VOH > 4.5V, VOL < 0.5V   |           | +25                    | –           | 1.5         | V  |
| Input Voltage High (Note 2)                           | VIH   | VDD = 5V, VOH > 4.5V, VOL < 0.5V   |           | +25                    | 3.5         | –           | V  |
| Input Voltage Low (Note 2)                            | VIL   | VDD = 15V, VOH > 13.5V, VOL < 1.5V |           | +25                    | –           | 4           | V  |
| Input Voltage High (Note 2)                           | VIH   | VDD = 15V, VOH > 13.5V, VOL < 1.5V |           | +25                    | 11          | –           | V  |

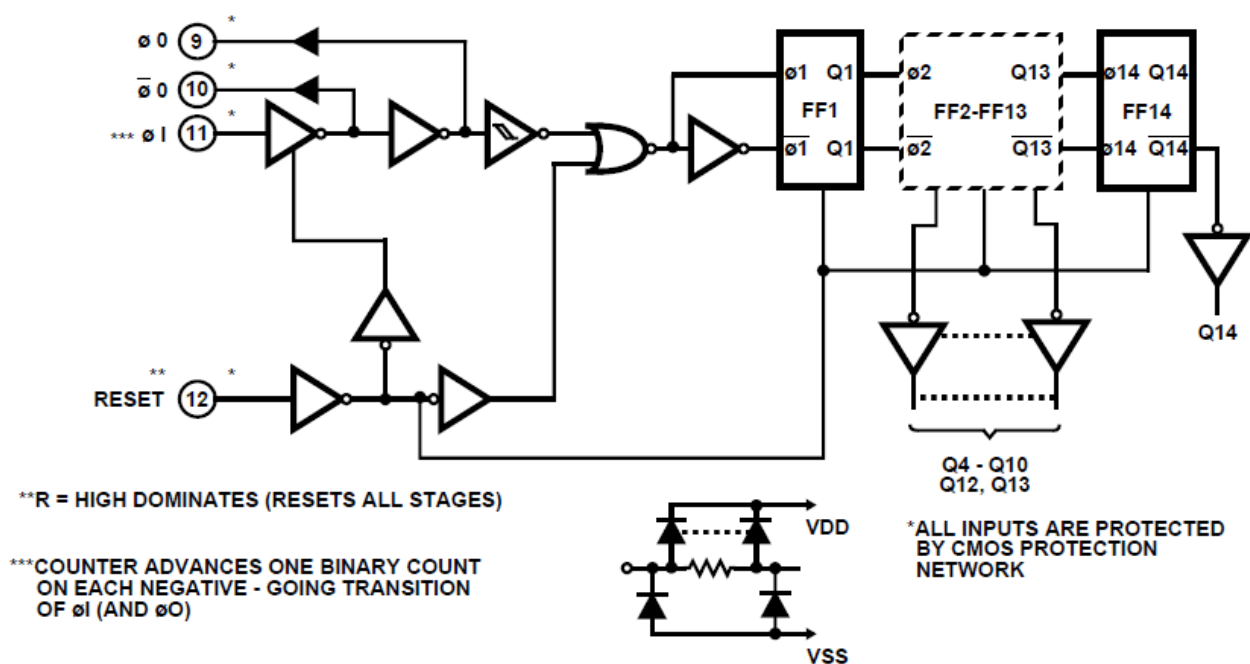
Notes: 1. All voltages referenced to device GND, 100% testing being implemented.

2. Go/No Go test with limits applied to inputs.

3. For accuracy, voltage is measured differentially to VDD. Limitis 0.050V max.

| 参数                                              | 符号                                  | 测试条件 (NOTE 1)                 | TEMPERATURE<br>(° C) | 规范      |            | 单位         |
|-------------------------------------------------|-------------------------------------|-------------------------------|----------------------|---------|------------|------------|
|                                                 |                                     |                               |                      | MIN     | MAX        |            |
| Drive Current at Pin<br>9<br>Oscillator Design  | IOL                                 | VDD = 5V, VO = .4V            | +25                  | 0.16    | —          | mA         |
|                                                 |                                     | VDD = 10V, VO = .5V           | +25                  | 0.42    | —          | mA         |
|                                                 |                                     | VDD = 15V, VO = 1.5V          | +25                  | -1.0    | —          | mA         |
| Drive Current at Pin<br>9<br>Oscillator Design  | IOH                                 | VDD = 5V                      | +25                  | —       | -.16       | mA         |
|                                                 |                                     | VDD = 10V                     | +25                  | —       | -.42       | mA         |
|                                                 |                                     | VDD = 15V                     | +25                  | —       | 1.0        | mA         |
| Propagation Delay<br>Input Pulse $\phi$ I to Q4 | TPHL1<br>TPLH1                      | VDD = 10V<br>VDD = 15V        | +25<br>+25           | —<br>—  | 300<br>200 | ns<br>ns   |
| Propagation Delay<br>QN to QN + 1               | TPHL2<br>TPLH2                      | VDD = 10V<br>VDD = 15V        | +25<br>+25           | —<br>—  | 100<br>80  | ns<br>ns   |
|                                                 |                                     | VDD = 10V<br>VDD = 15V        | +25<br>+25           | —<br>—  | 160<br>100 | ns<br>ns   |
| Propagation Delay<br>RESET                      | TPHL3                               | VDD = 10V<br>VDD = 15V        | +25<br>+25           | —<br>—  | 100<br>80  | ns<br>ns   |
|                                                 |                                     | VDD = 10V<br>VDD = 15V        | +25<br>+25           | —<br>—  | 100<br>80  | ns<br>ns   |
| Transition Time                                 | TTHL TTLH                           | VDD = 10V<br>VDD = 15V        | +25<br>+25           | —<br>—  | 100<br>80  | ns<br>ns   |
|                                                 |                                     | VDD = 10V<br>VDD = 15V        | +25<br>+25           | 8<br>12 | —<br>—     | MHz<br>MHz |
| Maximum Input Pulse<br>Frequency                | F $\phi$ I                          | VDD = 5V                      | +25                  | —       | 120        | ns         |
|                                                 |                                     | VDD = 10V                     | +25                  | —       | 60         | ns         |
|                                                 |                                     | VDD = 15V                     | +25                  | —       | 40         | ns         |
| Minimum RESET Pulse<br>Width                    | TW                                  | VDD = 5V                      | +25                  | —       | 100        | ns         |
|                                                 |                                     | VDD = 10V                     | +25                  | —       | 40         | ns         |
|                                                 |                                     | VDD = 15V                     | +25                  | —       | 30         | ns         |
| Minimum Input Pulse<br>Width<br>F = 100kHz      | TW                                  | VDD = 5V                      | +25                  | —       | 100        | ns         |
|                                                 |                                     | VDD = 10V                     | +25                  | —       | 40         | ns         |
|                                                 |                                     | VDD = 15V                     | +25                  | —       | 30         | ns         |
| RC Operation RX Max                             | RX                                  | VDD = 5V, CX = 10 F           | +25                  | —       | 20         | M $\Omega$ |
|                                                 |                                     | VDD = 10V, CX = 50 F          | +25                  | —       | 20         | M $\Omega$ |
|                                                 |                                     | VDD = 15V, CX = 10 F          | +25                  | —       | 10         | M $\Omega$ |
| RC Operation CX Max                             | CX                                  | VDD = 5V, RX = 500k $\Omega$  | +25                  | —       | 1000       | F          |
|                                                 |                                     | VDD = 10V, RX = 300k $\Omega$ | +25                  | —       | 50         | F          |
|                                                 |                                     | VDD = 15V, RX = 300k $\Omega$ | +25                  | —       | 50         | F          |
| Maximum Oscillator<br>Frequency (Note 4)        | RX = 5k $\Omega$<br>CX = 15pF       | VDD = 10V                     | +25                  | 530     | 810        | ns         |
|                                                 |                                     | VDD = 15V                     | +25                  | 690     | 940        | ns         |
| RC Operation<br>Variation of<br>Frequency       | CX = 200pF<br>RS = 560K<br>RX = 50k | VDD = 5V                      | +25                  | 18      | 25         | kHz        |
|                                                 |                                     | VDD = 10V                     | +25                  | 20      | 26         | kHz        |
|                                                 |                                     | VDD = 15V                     | +25                  | 21.1    | 27         | kHz        |
| Variation of<br>Frequency with                  | CX = 200pF<br>RS = 560K             | 5V to 10V                     | +25                  | —       | 2          | kHz        |
|                                                 |                                     | 10V to 15V                    | +25                  | —       | 1          | kHz        |
| Input Capacitance                               | CIN                                 | Any Input                     | +25                  | —       | 7.5        | pF         |

## 内部框图



## 特性曲线

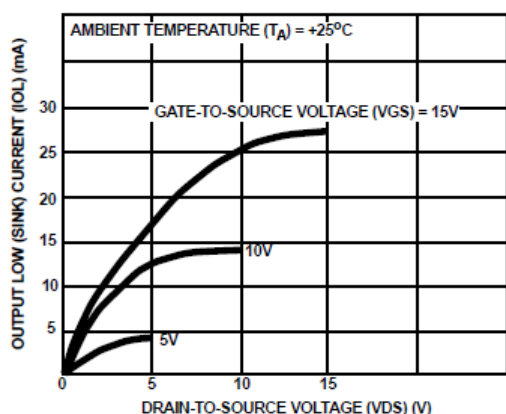


FIGURE 1. TYPICAL N-CHANNEL OUTPUT LOW SINK CURRENT CHARACTERISTICS

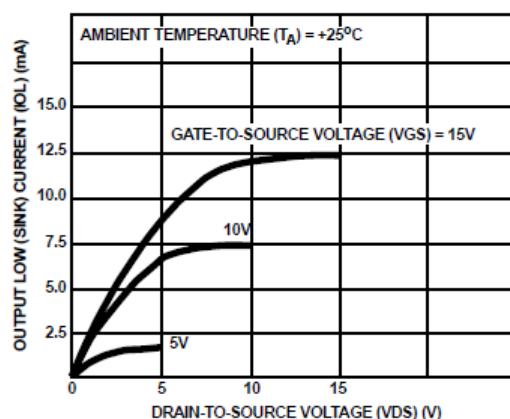


FIGURE 2. MINIMUM N-CHANNEL OUTPUT LOW (SINK) CURRENT CHARACTERISTICS

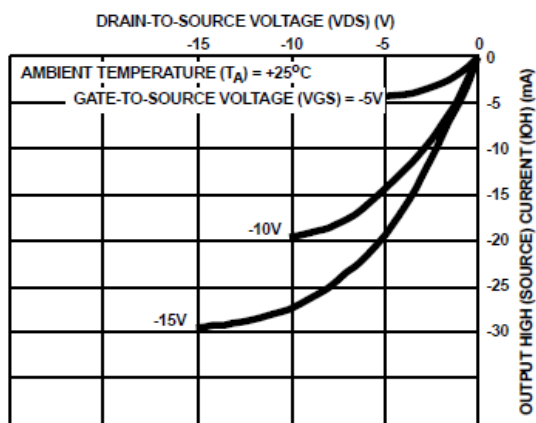


FIGURE 3. TYPICAL P-CHANNEL OUTPUT HIGH (SOURCE) CURRENT CHARACTERISTICS

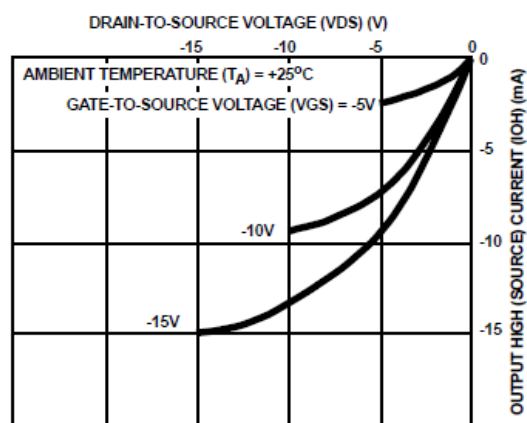


FIGURE 4. MINIMUM P-CHANNEL OUTPUT HIGH (SOURCE) CURRENT CHARACTERISTICS

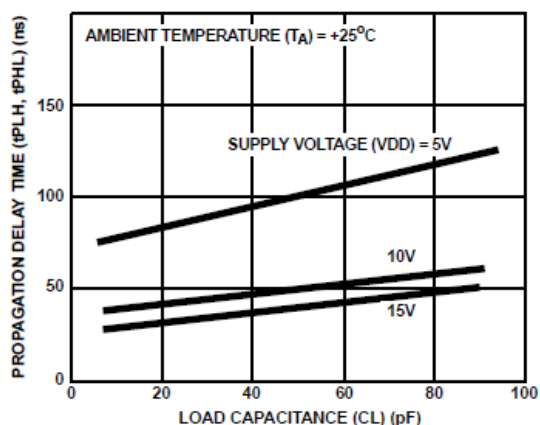


FIGURE 5. TYPICAL PROPAGATION DELAY TIME (Q<sub>N</sub> TO Q<sub>N+1</sub>) AS A FUNCTION OF LOAD CAPACITANCE

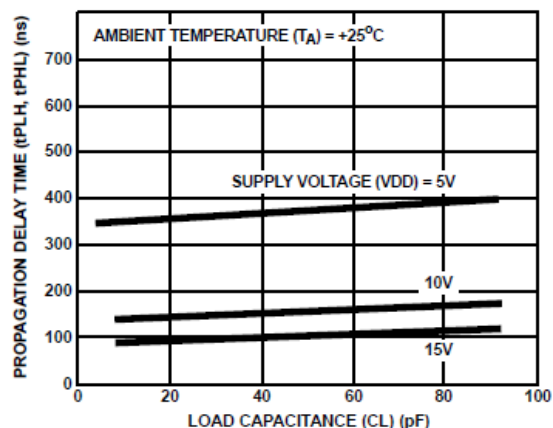


FIGURE 6. TYPICAL PROPAGATION DELAY TIME (Ø1 TO Q4 OUTPUT) AS A FUNCTION OF LOAD CAPACITANCE

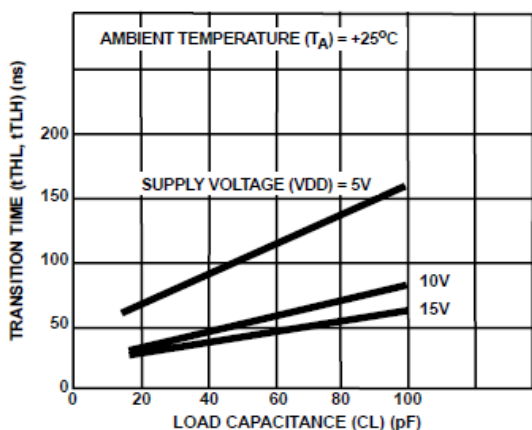


FIGURE 7. TYPICAL TRANSITION TIME AS A FUNCTION OF LOAD CAPACITANCE

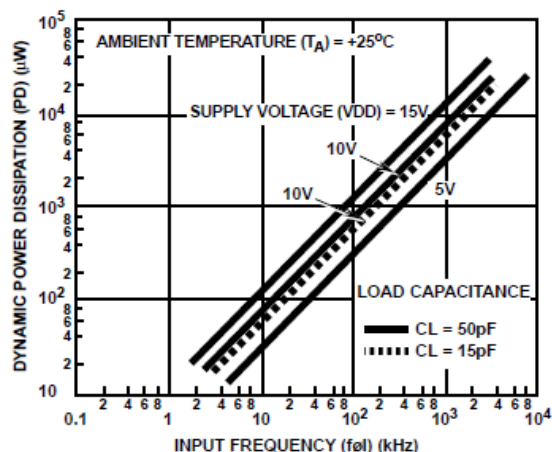


FIGURE 8. TYPICAL DYNAMIC POWER DISSIPATION AS A FUNCTION OF INPUT FREQUENCY

## 测试电路

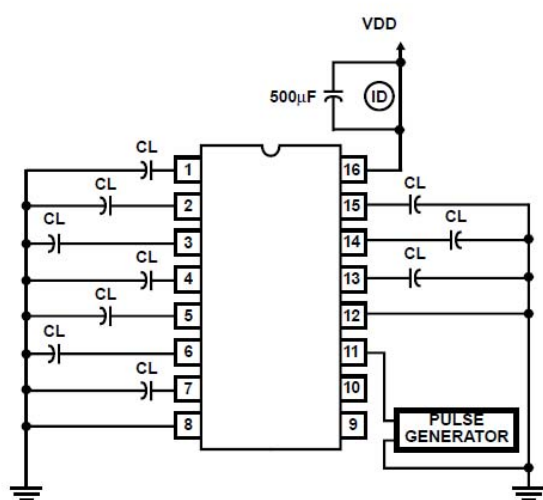


FIGURE 9. DYNAMIC POWER DISSIPATION TEST CIRCUIT

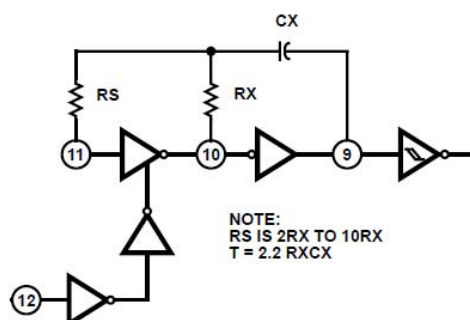
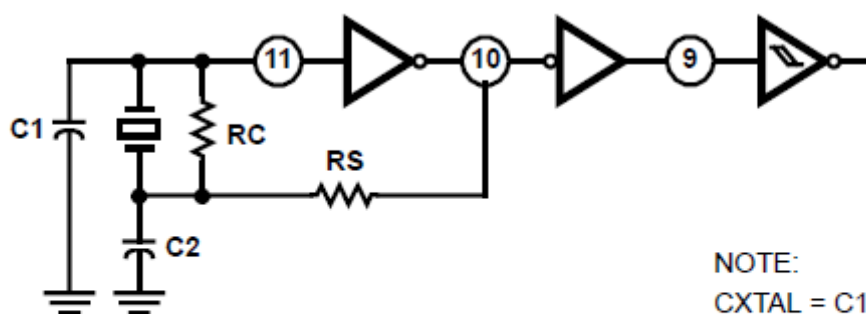


FIGURE 10. TYPICAL RC CIRCUIT



NOTE:  
 $C_{XTAL} = C1 + C2 + C_{STRAY}$   
 RC = Broader frequency response  
 RS = Current limiting

FIGURE 11. TYPICAL CRYSTAL CIRCUIT

## 封装信息

