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# 7545 群

## 振荡控制

### 1. 要点

本篇资料举例介绍了 7545 群单片机的振荡控制。

### 2. 说明

该应用说明适用于以下单片机：
适用单片机： 7545 群

## 3. 内容

7545 群单片机可设定停止 CPU 工作，CPU 在等待状态以低功耗为目的使用时，有以下两种模式：

- 通过 STP 指令执行的停止模式
- 通过 WIT 指令执行的等待模式

## 3.1 停止模式

通过执行 STP 指令，单片机进入停止模式。在停止模式中，时钟（XIN-XOUT）停振，内部时钟ϕ停止在“H”状态。CPU 及其外围功能均停止工作，单片机功耗降低。

### 3.1.1 停止模式的状态

停止模式的状态如表 3.1 所示。

表 3.1 停止模式的状态

| 项目 | 功能 | 管脚 |
|---|---|---|
| 晶振 | 停止 | XIN 和 XOUT 停止在“H”状态 |
| CPU | 停止 | - |
| 内部时钟ϕ | 停止在“H”状态 | - |
| 输入/输出端口<br>P0, P2, P3, P42 | 输入/输出端口维持在执行 STP 指令前的状态 | 执行 STP 指令后输入/输出端口保持以前输入状态或者输出电平不变 |
| 定时器 | 停止（定时器 1，2，3） | - |
| 监视定时器 | 停止 | - |
| RAM | RAM1 保持(1)，RAM2 保持(2) | - |
| CPU 寄存器和 SFR | 保持(3) | - |
| 低电压检测电路 | 停止(4) | - |

注：1. 当电源电压 VCC 大于 RAM1 保持电压的情况下。
2. 当 VDDR 供电电压大于 RAM2 保持电压的情况下。
3. 当电源电压 VCC 大于 RAM1 保持电压的情况下。但是在 RESET 输入复位的情况下，CPU 寄存器和 SFR 将被初始化。
4. 在执行 STP 指令时，低电压检测电路的功能被停止，降低消耗电流。

- 降低功耗的例子
  - ✧ 输入端口：保持输入端口“H”或“L”电平不变化
  - ✧ 输出端口：保持不产生电流所需要的电平不变化

例如：对于一个需要用“L”电平驱动 LED 发光的端口，为了降低功耗，在进入停止模式前需要将驱动 LED 的端口设置成“H”电平。

### 3.1.2 从停止模式返回

产生有效的外部中断请求或者通过复位(1)均可以使单片机从停止模式返回。产生中断请求和输入复位信号这两种方式使单片机从停止模式返回是不相同的。

- 通过中断从停止模式返回

  如果在停止模式中接受有效的中断请求(2)，那么单片机将从停止模式返回，陶瓷谐振器开始振荡。由于在使用陶瓷振荡等时，启动振荡需要时间的缘故，因此必须设定符合使用的谐振器的振荡稳定时间的等待时间。单片机通过外部中断从停止模式返回时，预定标器 1（PRE1）和定时器 1（T1）产生振荡稳定等待时间(3)。当定时器 1（T1）下溢后，稳定等待时间结束并且开始提供内部时钟ϕ，此时接受相应中断请求并且执行中断程序。监视定时器在停止模式不运行，但是在等待模式时运行。监视定时器虽然在停止模式时不运行，但是在 STP 指令解除后的振荡稳定时间内运行，所以为了在此时间内不发生下溢，必须在执行 STP 指令前对监视定时器控制寄存器（地址 $0039_{16}$）进行写操作。

  图 3.1 所示为使用 INT0 中断从停止模式返回的操作实例。在解除 STP 状态时，为了能接受中断，必须在执行 STP 指令前，先将所对应的中断允许位置“1”。

注：

1. 关于复位，是以复位管脚的“L”输入为例的。
2. 能够使用从停止模式返回的中断资源如下所示。在执行 STP 指令前请先将所对应的中断允许位置“1”。
   - ✧ INT0，INT1
   - ✧ 键输入中断（键唤醒）
3. 当振荡稳定时间设定位置“0”时（寄存器 MISRG 的 0 位（地址 $0038_{16}$）），定时器 1 被自动设定成“$03_{16}$”，预定标器 1 被自动设定成“$FF_{16}$”。当振荡稳定时间设定位置“1”时，请按照以下说明在执行 STP 指令前设置定时器 1 和预标定器 1。
   - ✧ 预定标器 1 和定时器 1：等待时间

     按照下列范围设置等待时间：

     谐振器振荡稳定时间 < 等待时间 < 监视定时器下溢时间
   - ✧ 定时器 1 中断允许位置“0”（禁止中断）
   - ✧ 定时器 1 计数停止位置“0”（开始计数）

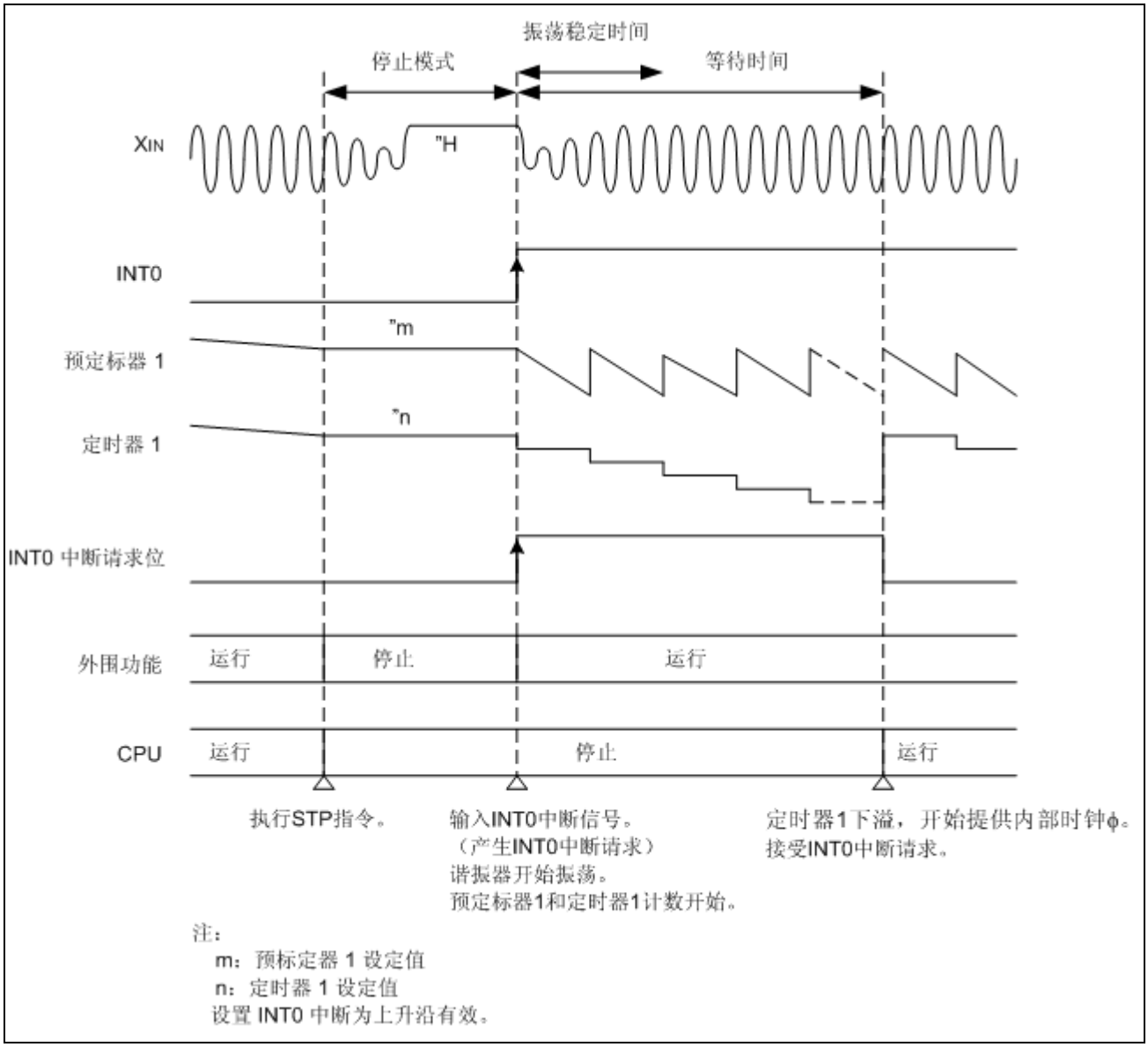


图 3.1　使用 INT0 中断从停止模式返回

- 通过复位从停止模式返回

在停止模式中由 RESET 管脚输入“L”电平，单片机将从停止模式返回。所有的输入/输出端口都初始化成输入模式，时钟（XIN-XOUT）开始振荡。由于在陶瓷谐振器起振初期振荡不稳定，因此需要一定的时间来等待陶瓷谐振器的稳定振荡（振荡稳定时间）。保持 RESET 管脚输入“L”电平直到振荡稳定为止。在 RESET 管脚输入“L”电平并保持时间为 2μs 或 2μs 以上时，发生内部复位，单片机按照复位时序开始工作。

## 3.2 等待模式

通过执行 WIT 指令，单片机进入等待模式。在等待模式中，谐振器维持振荡状态，内部时钟ϕ停止在“H”状态。CPU 及其外围功能均正常工作。

### 3.2.1 等待模式的状态

等待模式的状态如表 3.2 所示。

表 3.2 等待模式的状态

| 项目 | 等待模式的状态 |
|---|---|
| 晶振 | 运行 |
| CPU | 停止 |
| 内部时钟ϕ | 停止在“H”状态 |
| 输入/输出端口<br>P0, P2, P3, P4$_2$ | 执行 WIT 指令时保持输入端口状态或者输出电平 |
| 定时器 | 运行 |
| 监视定时器 | 运行 |
| RAM | RAM1 保持，RAM2 保持 |
| CPU 寄存器和 SFR | 保持(1) |
| 低电压检测电路 | 运行(2) |

注：1. 一些 SFR 会随着外围功能的运行而变化。但是在 RESET 输入复位的情况下，CPU 寄存器和 SFR 将被初始化。

2. 将内部 QzROM 的功能设定 ROM 数据（地址 FFDA$_{16}$）的 bit 4 设定为“1”，使能低电压检测电路的运行。

### 3.2.2 从等待模式返回

产生有效的中断请求或者通过复位(1)均可以使单片机从等待模式返回。产生中断请求和输入复位信号这两种方式使单片机从等待模式返回是不相同的。

- 通过中断从等待模式返回
  如果在等待模式中接受有效的中断请求(2)，那么单片机将从等待模式返回，并且开始向 CPU 提供内部时钟ϕ，接受相应的中断请求并且执行中断程序。监视定时器在等待模式时运行，因此需要对监视定时器控制寄存器进行写操作来防止监视定时器下溢。
  图 3.2 所示为使用 INT0 中断从等待模式返回的操作实例。

注：
1. 关于复位，是以复位管脚的“L”输入为例的
2. 所有的中断资源都能够使单片机从停止模式返回。在执行 WIT 指令前请先将所对应的中断允许位置“1”。

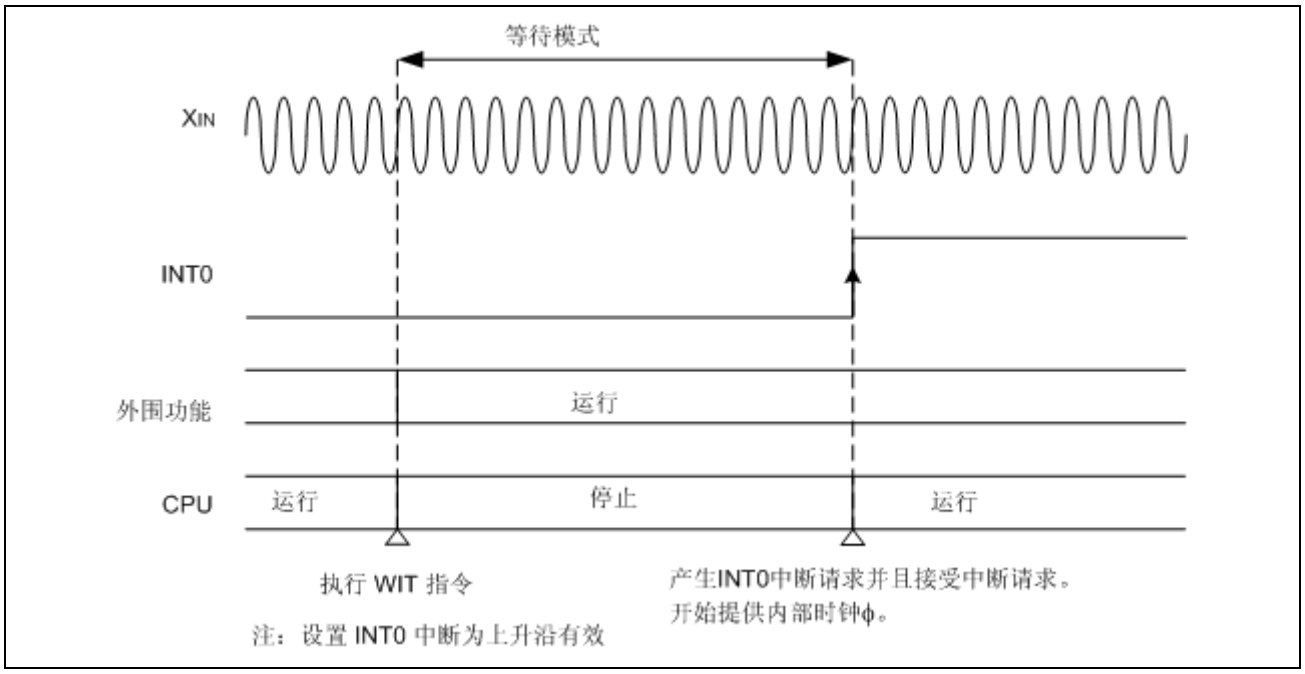


图 3.2 使用 INT0 中断从等待模式返回

- 通过复位从等待模式返回
  在等待模式中由 RESET 管脚输入“L”电平，单片机将从等待模式返回。所有的输入/输出端口都初始化成输入模式，时钟（XIN-XOUT）继续振荡。在 RESET 管脚输入“L”电平并保持时间为 2μs 或 2μs 以上时，发生内部复位，单片机按照复位时序开始工作。

## 4. 参考文献

数据手册
7545 群硬件手册
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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。
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