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2010年4月1日
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H8/300L SLP 系列

振荡稳定时间的设定

要点

说明关于时钟稳定前的 CPU 和外围功能待机时间（振荡稳定时间）的设定方法。

动作确认器件

H8/38024

目录

1. 使用功能的说明

在通过特定的中断解除待机模式、时钟模式并转移到激活模式的情况下，指定时钟稳定前的 CPU 和外围功能的待机时间。必须根据工作频率指定长于振荡稳定时间的待机时间。

1.1 待机时间的设定

通过设定系统控制寄存器 1（SYSCR1）的待机定时器选择 2～0（STS2～STS0），进行待机时间的设定。

1.2 STS2～STS0 的说明

SYSCR1 的 STS2～STS0 的说明如**表 1** 所示。

表 1　STS2～STS0 的说明

SYSCR1			说明
位 6	位 5	位 4	
STS2	STS1	STS0	
0	0	0	待机时间 = 8,192 个状态　（初始状态）
0	0	1	待机时间 = 16,384 个状态
0	1	0	待机时间 = 1,024 个状态
0	1	1	待机时间 = 2,048 个状态
1	0	0	待机时间 = 4,096 个状态
1	0	1	待机时间 = 2 个状态　（外部时钟输入模式）
1	1	0	待机时间 = 8 个状态
1	1	1	待机时间 = 16 个状态

【注】 在输入外部时钟的情况下，必须在进行模式转移前将待机定时器选择设定为外部时钟输入模式。另外，在不使用外部时钟的情况下，不要设定为外部时钟输入模式。

1.3 晶体振荡时的工作频率和振荡稳定时间

对于工作频率和 STS2～STS0 设定值的待机时间如**表 2** 所示。设定 STS2～STS0，使待机时间长于振荡稳定时间。

表 2　工作频率和振荡稳定时间

（单位：ms）

STS2	STS1	STS0	待机时间	5MHz	2MHz
0	0	0	8,192 个状态	1.638	4.1
0	0	1	16,384 个状态	3.277	8.2
0	1	0	1,024 个状态	0.205	0.512
0	1	1	2,048 个状态	0.410	1.024
1	0	0	4,096 个状态	0.819	2.048
1	0	1	2 个状态　（禁止使用）	0.0004	0.001
1	1	0	8 个状态	0.0002	0.004
1	1	1	16 个状态	0.003	0.008

1.4 外部时钟的情况

建议使用 STS2="1"、STS1="0"、STS0="1"的设定。也能使用其他的设定，但是对于 STS2="1"、STS1="0"、STS0="1"以外的设定，有可能在待机时间结束之前开始运行。

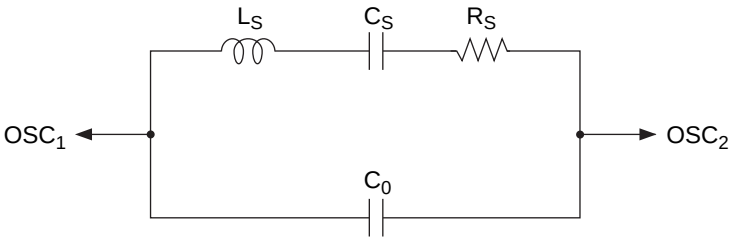
1.5 振荡稳定时间

振荡稳定时间的 AC 特性如**表 3** 所示。

表 3　振荡稳定时间的 AC 特性

项目	符号	适用管脚	测量条件	标准值			单位	参照图
				min.	typ.	max.		
振荡稳定时间	trc	OSC1、OSC2	图 1 的情况 VCC=2.2～5.5V	—	20	45	μs	图 1
			上述以外	—	—	50	ms	
振荡稳定时间	trc	X1、X2	VCC=2.7～5.5V	—	—	2.0	s	—
			VCC=2.2～5.5V	—	—	10.0	s	—

（包含 V_{CC}=1.8～5.5V、AV_{CC}=1.8～5.5V、V_{SS}=AV_{SS}=0.0V、Ta=-20～+75℃、子激活模式）



晶体振荡器的参数

频率 (MHz)	4.193
R_S (max)	100 Ω
C_0 (max)	16 pF

陶瓷振荡器的参数

频率 (MHz)	4
R_S (max)	8.8 Ω
C_0 (max)	36 pF

图 1　谐振器的等效电路

1.6 振荡稳定时间的设定例

（1）功能

从激活（高速）模式转移到时钟模式，在等待 250ms 后通过定时器 A 中断解除时钟模式，转移到激活（高速）模式。从时钟模式转移到激活（高速）模式时，将时钟稳定前的 CPU 和外围功能的待机时间设定为 8 个状态。

（2）注意事项

本设定例子中，在通过定时器 A 中断解除时钟模式时，禁止定时器 A 中断处理中的定时器 A 中断请求。所以，在从激活（高速）模式转移到时钟模式、然后通过定时器 A 中断解除时钟模式并且转移到激活（高速）模式时结束。

（3）时钟模式

（a） 向时钟模式的转移

在激活模式、子激活模式中，当系统控制寄存器 1（SYSCR1）的软件待机（SSBY）为"1"，并且定时器模式寄存器 A（TMA）的内部时钟选择 3（TMA3）为"1"时，如果执行 SLEEP 指令就转移到时钟模式。在时钟模式中，定时器 A、定时器 F、定时器 G、异步事件计数器和 LCD（可选择运行/停止）以外的内部外围功能停止运行。只要供给规定的电压，就保持 CPU 和一部分内部外围功能的内部寄存器、内部 RAM 的内容，并且 I/O 端口保持转移前的状态。

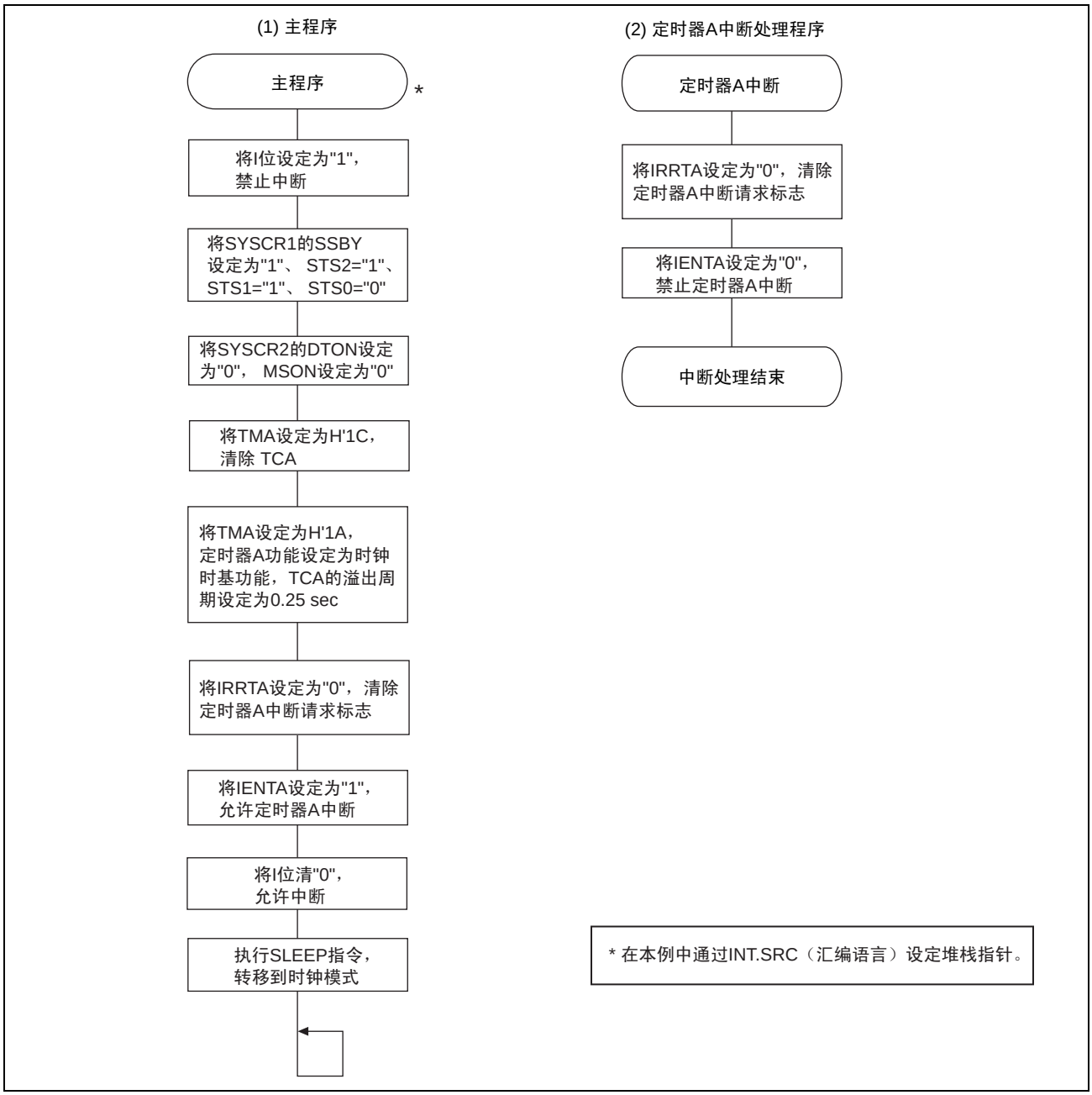
（b） 时钟模式的解除

通过中断（IRQ_0、WKP_7～WKP_0、定时器 A、定时器 F、定时器 G）和 $\overline{RES}$ 管脚的输入进行时钟模式的解除。

通过中断进行解除时，如果发生中断就解除时钟模式。通过 SYSCR1 的低速 ON 标志（LSON）和系统控制寄存器 2（SYSCR2）的中速 ON 标志（MSON）的组合，在 LSON="0"并且 MSON="0"时，转移到激活（高速）模式；在 LSON="0"并且 MSON="1"时，转移到激活（中速）模式；在 LSON="1"时，转移到子激活模式。转移到激活模式时，在经过由 SYSCR1 的 STS2～STS0 设定的时间后给整个 LSI 提供稳定的时钟，开始中断异常处理。而且，在 CCR 的 I 位为"1"或者根据中断允许寄存器禁止接受相应中断的情况下，不解除时钟模式。

通过 $\overline{RES}$ 管脚进行解除时，如果将 $\overline{RES}$ 管脚设定为"Low"电平，系统时钟就开始振荡。如果在经过振荡稳定时间后将 $\overline{RES}$ 管脚设定为"High"电平，CPU 就开始复位异常处理。而且，在系统时钟开始振荡的同时给整个 LSI 提供系统时钟。$\overline{RES}$ 管脚必须保持"Low"电平，直到系统时钟的振荡稳定为止。

2. 流程图


(1) 主程序
主程序
*
将I位设定为"1"，
禁止中断
将SYSCR1的SSBY
设定为"1"、 STS2="1"、
STS1="1"、 STS0="0"
将SYSCR2的DTON设定
为"0"， MSON设定为"0"
将TMA设定为H'1C，
清除 TCA
将TMA设定为H'1A，
定时器A功能设定为时钟
时基功能，TCA的溢出周
期设定为0.25 sec
将IRRTA设定为"0"，清除
定时器A中断请求标志
将IENTA设定为"1"，
允许定时器A中断
将I位清"0"，
允许中断
执行SLEEP指令，
转移到时钟模式
(2) 定时器A中断处理程序
定时器A中断
将IRRTA设定为"0"，清除
定时器A中断请求标志
将IENTA设定为"0"，
禁止定时器A中断
中断处理结束
* 在本例中通过INT.SRC（汇编语言）设定堆栈指针。

3. 程序清单

3.1 INIT.SRC（程序清单）

```
      .EXPORT   _INIT
      .IMPORT   _main
  ;
      .SECTION  P,CODE
  _INIT:
      MOV.W     #H'FF80,R7
      LDC.B     #B'10000000,CCR
      JMP       @_main
  ;
      .END
```

```
/************************************************************/
/*                                                          */
/*  H8/300L Super Low Power Series                          */
/*     -H8/38024 Series-                                    */
/*  Application Note                                        */
/*                                                          */
/*  'Oscillator Settling Time -8 States'                    */
/*                                                          */
/*  Function                                                */
/*  : Oscillator Settling Time                              */
/*                                                          */
/*  External Clock : 0.8KHz                                 */
/*  Internal Clock : 0.4KHz                                 */
/*  Sub Clock      : 32.768kHz                              */
/*                                                          */
/************************************************************/

#include    <machine.h>

/************************************************************/
/*  Symbol Definition                                       */
/************************************************************/
struct BIT {
    unsigned char   b7:1;       /* bit7 */
    unsigned char   b6:1;       /* bit6 */
    unsigned char   b5:1;       /* bit5 */
    unsigned char   b4:1;       /* bit4 */
    unsigned char   b3:1;       /* bit3 */
    unsigned char   b2:1;       /* bit2 */
    unsigned char   b1:1;       /* bit1 */
    unsigned char   b0:1;       /* bit0 */
};

#define     TMA         *(volatile unsigned char *)0xFFB0   /* Timer Mode Register A          */
#define     TCA         *(volatile unsigned char *)0xFFB1   /* Timer Counter A               */
#define     SYSCR1      *(volatile unsigned char *)0xFFF0   /* System Control Register 1       */
#define     SYSCR1_BIT  (*(struct BIT *)0xFFF0)           /* System Control Register 1       */
#define     SSBY        SYSCR1_BIT.b7                   /* Software Standby              */
#define     STS2        SYSCR1_BIT.b6                   /* Standby Timer Select 2         */
#define     STS1        SYSCR1_BIT.b5                   /* Standby Timer Select 1         */
#define     STS0        SYSCR1_BIT.b4                   /* Standby Timer Select 0         */
#define     LSON        SYSCR1_BIT.b3                   /* Low Speed On Flag             */
#define     MA1         SYSCR1_BIT.b1                   /* Active Mode Clock Select 1      */
```

```
#define    MA0       SYSCR1_BIT.b0                  /* Active Mode Clock Select 0      */
#define    SYSCR2     *(volatile unsigned char *)0xFFF1   /* System Control Register 2       */
#define    SYSCR2_BIT  (*(struct BIT *)0xFFF1)           /* System Control Register 2       */
#define    NESEL      SYSCR2_BIT.b4         /* Noise Elimination Sampling Frequency Select  */
#define    DTON       SYSCR2_BIT.b3                   /* Direct Transfer On Flag         */
#define    MSON       SYSCR2_BIT.b2                   /* Middle Speed On Flag           */
#define    SA1        SYSCR2_BIT.b1                   /* Subactive Mode Clock Select 1    */
#define    SA0        SYSCR2_BIT.b0                   /* Subactive Mode Clock Select 0    */
#define    IENR1_BIT   (*(struct BIT *)0xFFF3)           /* Interrupt Enable Register 1     */
#define    IENTA      IENR1_BIT.b7                    /* Timer A Interrupt Enable        */
#define    IRR1_BIT    (*(struct BIT *)0xFFF6)           /* Interrupt Request Register 1    */
#define    IRRTA      IRR1_BIT.b7                     /* Timer A Interrupt Request Flag   */

#pragma interrupt   (taint)
/************************************************************/
/*  Function define                                         */
/************************************************************/
extern void INIT ( void );                              /* SP Set                       */
void       main ( void );
void       taint ( void );

/************************************************************/
/*  Vector Address                                          */
/************************************************************/
#pragma section    V1                                   /* VECTOR SECTOIN SET            */
void (*const VEC_TBL1[])(void) = {
   INIT                                              /* 00 Reset                     */
};
#pragma section    V2                                   /* VECTOR SECTOIN SET            */
void (*const VEC_TBL2[])(void) = {
   taint                                             /* 16 timer A  Interrupt          */
};

#pragma section                                         /* P                            */
/************************************************************/
/*  Main Program                                            */
/************************************************************/
void   main ( void )
{
   set_imask_ccr(1);                            /* Interrupt Disable                   */

   SYSCR1 = 0xE7;                               /* Set SYSCR1    */
   SYSCR2 = 0xE0;                               /* Set SYSCR2    */

   TMA = 0x1C;                                 /* Initialize TCA                      */
   TMA = 0x1A;                                 /* Initialize TCA Overflow Period        */
   IRRTA = 0;                                  /* Clear IRRTA                        */
   IENTA = 1;                                  /* Timer A Interrupt Enable             */

   set_imask_ccr(0);                            /* Interrupt Enable                    */

   sleep();                                    /* Transition to Sleep Mode             */

   while(1){
      ;
   }
}
```

```
/*********************************************************/
/*  Timer A Interrupt                                    */
/*********************************************************/
void    taint ( void )
{
   IRRTA = 0;                                    /* Clear IRRTA                  */
   IENTA = 0;
}
```

连接地址指定

段名	地址
CV1	H'0000
CV2	H'0016
P	H'0100
B	H'FB80

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