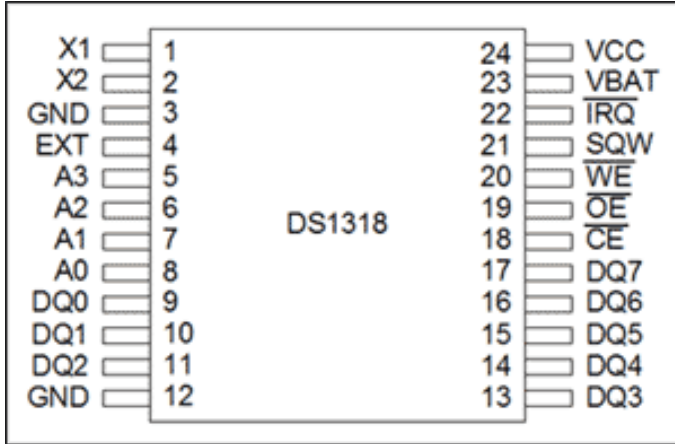


APPLICATION NOTE 3721

Interfacing the DS1318 with an 8051-type Microcontroller

Abstract: This note demonstrates an application that counts the passage of days using the DS1318 Elapsed-Time Counter. The software example includes basic operating routines. A schematic of the application circuit is included.

DS1318 Pin Assignment



Counter Overview

This application note demonstrates how to use the [DS1318](#) Elapsed-Time Counter. The DS1318 has a 44-bit counter that increments once every 244µs. The 44-bit counter is accessed through six 8-bit registers (**Figure 1**).

ADDRESS	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	FUNCTION	RANGE
00H	SS3	SS2	SS1	SS0	0	0	0	SQWS	Sub-Seconds0	00-F0h
01H	SS11	SS10	SS9	SS8	SS7	SS6	SS5	SS4	Sub-Seconds1	00-FFh
02H	S7	S6	S5	S4	S3	S2	S1	S0	Seconds0	00-FFh
03H	S15	S14	S13	S12	S11	S10	S9	S8	Seconds1	00-FFh
04H	S23	S22	S21	S20	S19	S18	S17	S16	Seconds2	00-FFh
05H	S31	S30	S29	S28	S27	S26	S25	S24	Seconds3	00-FFh

Figure 1. DS1318 44-bit counter configuration.

Conceptually, the 44-bit counter can be broken into a 12-bit sub-second counter and a 32-bit counter that increments once per second (**Figure 2**). If sub-second resolution is not required, only the 32-bit second counter registers can be accessed.

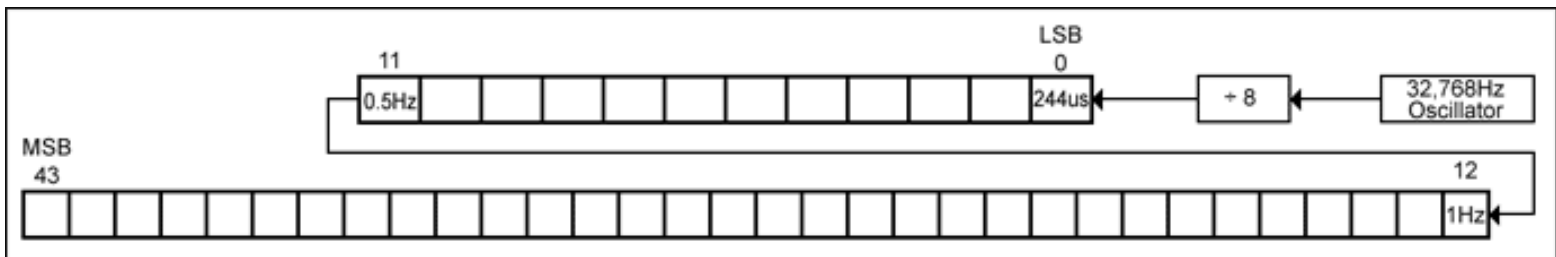


Figure 2. The 12-bit sub-second and 32-bit second counters.

In the example for this application note, a software routine reads the 32-bit seconds counter continuously, and outputs the time and

date in ASCII format through a UART on an 8051 microcontroller (μC) on each once-per-second change. The time and date value is based upon the elapsed time, in seconds, from January 1, 1970 00:00:00. A value of 00000000h would be January 1, 1970 00:00:00. A value of 42C924C0h corresponds to 2005/7/4 12:00:00.

Another routine configures the device's periodic interrupt to a 1Hz rate. Each time an interrupt occurs, an interrupt handling routine reads the counter data, converts the data to a time and date format, and outputs the data in ASCII through the UART.

Additional routines are possible. In other examples the DS1318 could: take user inputs to write data to a single register; take time and date information from the user and convert it to elapsed time in seconds from January 1, 1970; write the value to the counter. Another routine reads all the DS1318 registers and outputs them in hexadecimal format.

Operation

The hardware example in this application note places the DS1318 into the μC 's data memory space. The μC accesses the DS1318's registers by reading and writing the appropriate data-memory locations.

A low-voltage 8051-compatible microcontroller, the DS80C323, is used in this example. User inputs and data outputs from the program are passed to the μC through an RS-232 interface from a terminal emulator program on a PC. More information about the [DS80C323](#) microcontroller used in this application note can be found on our website.

The software is shown in the Program Listing, **Figure 3**. A schematic of the circuit is shown in **Figure 4**.

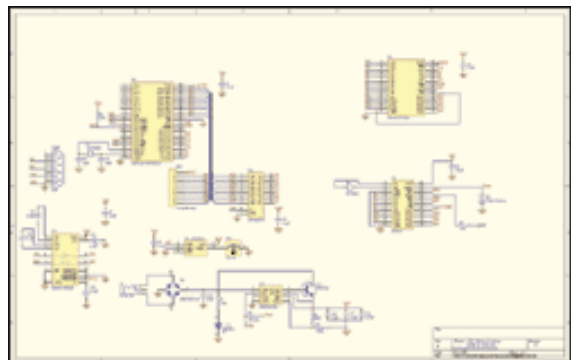
```
Figure 3. Program Listing /
*****
/* DS1318M.c program, use on the DS1318 app note board */
/*****
#include <stdio.h> /* Prototypes for I/O functions */
#include <DS5000.h> /* Register declarations for DS5000 */
#include <ds1318.h> /* needed to define data addresses */
/***** Defines *****/
#define SEC1 0x0000
#define SEC2 0x0001
#define SEC3 0x0002
#define SEC4 0x0003
#define SEC5 0x0004
#define SEC6 0x0005
#define SEC7 0x0006
#define SEC8 0x0007
#define SEC9 0x0008
#define SEC10 0x0009
#define SEC11 0x000A
#define SEC12 0x000B
#define SEC13 0x000C
#define SEC14 0x000D
#define SEC15 0x000E
#define SEC16 0x000F
#define SEC17 0x0010
#define SEC18 0x0011
#define SEC19 0x0012
#define SEC20 0x0013
#define SEC21 0x0014
#define SEC22 0x0015
#define SEC23 0x0016
#define SEC24 0x0017
#define SEC25 0x0018
#define SEC26 0x0019
#define SEC27 0x001A
#define SEC28 0x001B
#define SEC29 0x001C
#define SEC30 0x001D
#define SEC31 0x001E
#define SEC32 0x001F
#define SEC33 0x0020
#define SEC34 0x0021
#define SEC35 0x0022
#define SEC36 0x0023
#define SEC37 0x0024
#define SEC38 0x0025
#define SEC39 0x0026
#define SEC40 0x0027
#define SEC41 0x0028
#define SEC42 0x0029
#define SEC43 0x002A
#define SEC44 0x002B
#define SEC45 0x002C
#define SEC46 0x002D
#define SEC47 0x002E
#define SEC48 0x002F
#define SEC49 0x0030
#define SEC50 0x0031
#define SEC51 0x0032
#define SEC52 0x0033
#define SEC53 0x0034
#define SEC54 0x0035
#define SEC55 0x0036
#define SEC56 0x0037
#define SEC57 0x0038
#define SEC58 0x0039
#define SEC59 0x003A
#define SEC60 0x003B
#define SEC61 0x003C
#define SEC62 0x003D
#define SEC63 0x003E
#define SEC64 0x003F
#define SEC65 0x0040
#define SEC66 0x0041
#define SEC67 0x0042
#define SEC68 0x0043
#define SEC69 0x0044
#define SEC70 0x0045
#define SEC71 0x0046
#define SEC72 0x0047
#define SEC73 0x0048
#define SEC74 0x0049
#define SEC75 0x004A
#define SEC76 0x004B
#define SEC77 0x004C
#define SEC78 0x004D
#define SEC79 0x004E
#define SEC80 0x004F
#define SEC81 0x0050
#define SEC82 0x0051
#define SEC83 0x0052
#define SEC84 0x0053
#define SEC85 0x0054
#define SEC86 0x0055
#define SEC87 0x0056
#define SEC88 0x0057
#define SEC89 0x0058
#define SEC90 0x0059
#define SEC91 0x005A
#define SEC92 0x005B
#define SEC93 0x005C
#define SEC94 0x005D
#define SEC95 0x005E
#define SEC96 0x005F
#define SEC97 0x0060
#define SEC98 0x0061
#define SEC99 0x0062
#define SEC100 0x0063
#define SEC101 0x0064
#define SEC102 0x0065
#define SEC103 0x0066
#define SEC104 0x0067
#define SEC105 0x0068
#define SEC106 0x0069
#define SEC107 0x006A
#define SEC108 0x006B
#define SEC109 0x006C
#define SEC110 0x006D
#define SEC111 0x006E
#define SEC112 0x006F
#define SEC113 0x0070
#define SEC114 0x0071
#define SEC115 0x0072
#define SEC116 0x0073
#define SEC117 0x0074
#define SEC118 0x0075
#define SEC119 0x0076
#define SEC120 0x0077
#define SEC121 0x0078
#define SEC122 0x0079
#define SEC123 0x007A
#define SEC124 0x007B
#define SEC125 0x007C
#define SEC126 0x007D
#define SEC127 0x007E
#define SEC128 0x007F
#define SEC129 0x0080
#define SEC130 0x0081
#define SEC131 0x0082
#define SEC132 0x0083
#define SEC133 0x0084
#define SEC134 0x0085
#define SEC135 0x0086
#define SEC136 0x0087
#define SEC137 0x0088
#define SEC138 0x0089
#define SEC139 0x008A
#define SEC140 0x008B
#define SEC141 0x008C
#define SEC142 0x008D
#define SEC143 0x008E
#define SEC144 0x008F
#define SEC145 0x0090
#define SEC146 0x0091
#define SEC147 0x0092
#define SEC148 0x0093
#define SEC149 0x0094
#define SEC150 0x0095
#define SEC151 0x0096
#define SEC152 0x0097
#define SEC153 0x0098
#define SEC154 0x0099
#define SEC155 0x009A
#define SEC156 0x009B
#define SEC157 0x009C
#define SEC158 0x009D
#define SEC159 0x009E
#define SEC160 0x009F
#define SEC161 0x00A0
#define SEC162 0x00A1
#define SEC163 0x00A2
#define SEC164 0x00A3
#define SEC165 0x00A4
#define SEC166 0x00A5
#define SEC167 0x00A6
#define SEC168 0x00A7
#define SEC169 0x00A8
#define SEC170 0x00A9
#define SEC171 0x00AA
#define SEC172 0x00AB
#define SEC173 0x00AC
#define SEC174 0x00AD
#define SEC175 0x00AE
#define SEC176 0x00AF
#define SEC177 0x00B0
#define SEC178 0x00B1
#define SEC179 0x00B2
#define SEC180 0x00B3
#define SEC181 0x00B4
#define SEC182 0x00B5
#define SEC183 0x00B6
#define SEC184 0x00B7
#define SEC185 0x00B8
#define SEC186 0x00B9
#define SEC187 0x00BA
#define SEC188 0x00BB
#define SEC189 0x00BC
#define SEC190 0x00BD
#define SEC191 0x00BE
#define SEC192 0x00BF
#define SEC193 0x00C0
#define SEC194 0x00C1
#define SEC195 0x00C2
#define SEC196 0x00C3
#define SEC197 0x00C4
#define SEC198 0x00C5
#define SEC199 0x00C6
#define SEC200 0x00C7
#define SEC201 0x00C8
#define SEC202 0x00C9
#define SEC203 0x00CA
#define SEC204 0x00CB
#define SEC205 0x00CC
#define SEC206 0x00CD
#define SEC207 0x00CE
#define SEC208 0x00CF
#define SEC209 0x00D0
#define SEC210 0x00D1
#define SEC211 0x00D2
#define SEC212 0x00D3
#define SEC213 0x00D4
#define SEC214 0x00D5
#define SEC215 0x00D6
#define SEC216 0x00D7
#define SEC217 0x00D8
#define SEC218 0x00D9
#define SEC219 0x00DA
#define SEC220 0x00DB
#define SEC221 0x00DC
#define SEC222 0x00DD
#define SEC223 0x00DE
#define SEC224 0x00DF
#define SEC225 0x00E0
#define SEC226 0x00E1
#define SEC227 0x00E2
#define SEC228 0x00E3
#define SEC229 0x00E4
#define SEC230 0x00E5
#define SEC231 0x00E6
#define SEC232 0x00E7
#define SEC233 0x00E8
#define SEC234 0x00E9
#define SEC235 0x00EA
#define SEC236 0x00EB
#define SEC237 0x00EC
#define SEC238 0x00ED
#define SEC239 0x00EE
#define SEC240 0x00EF
#define SEC241 0x00F0
#define SEC242 0x00F1
#define SEC243 0x00F2
#define SEC244 0x00F3
#define SEC245 0x00F4
#define SEC246 0x00F5
#define SEC247 0x00F6
#define SEC248 0x00F7
#define SEC249 0x00F8
#define SEC250 0x00F9
#define SEC251 0x00FA
#define SEC252 0x00FB
#define SEC253 0x00FC
#define SEC254 0x00FD
#define SEC255 0x00FE
#define SEC256 0x00FF
/***** bit definitions *****/
/***** Global Variables *****/
uchar int_flg = 0;
/***** Function Prototypes *****/
void init_etc();
void writbyte();
void readregs();
void disp_clk_regs();
void disp_clk_regs_hex();
void binddate();
unsigned long date2bin(uchar, uchar, uchar, uchar, uchar, uchar);
void external_int(void);

void init_etc() /* ----- set the time and date ----- */
/* Note: NO error checking is done on the user entries! */
{
  uchar yrs, mon, dt, hrs, min, sec;
  unsigned long y;

  printf("\nEnter the year (1970-2099): ");
  scanf("%d", &y);
  printf("\nEnter the month (1-12): ");
  scanf("%d", &mon);
  printf("\nEnter the date (1-31): ");
  scanf("%d", &dt);
  printf("\nEnter the hour (0-23): ");
  scanf("%d", &hrs);
  printf("\nEnter the minute (0-59): ");
  scanf("%d", &min);
  printf("\nEnter the second (0-59): ");
  scanf("%d", &sec);
}
```

[Download](#) (TXT, 7K)

Figure 3. Program listing.



[More Detailed Image](#) (PDF, 30K)

Figure 4. Circuit schematic.

Application Note 3721: www.maxim-ic.com/an3721

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