

SIEMENS

Serial Intelligent Display[®] Device Appnote 29

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This application note describes a method of obtaining a serial input display with a selected number of digits using an 8051/8031 microprocessor and DL2416 Intelligent Displays. The DL2416 has been used only as an example for this Appnote; other Intelligent Displays can be used instead.

Introduction

A parallel bus configuration is frequently used to transfer data to a microprocessor when it is used on a single card system. However, if the system is not physically small in number of chips or has multiple cards, data handling becomes cumbersome and costly. For long distances, serial communications over a two or four wire links is desirable and is economically attractive. However, the trade-off between cost and speed has to be considered by the designer.

Description

The DL2416 Intelligent Display is a 0.160" four character, 17 segment, LED display module with on-board memory, character generator, multiplexer and display drivers integrated into a custom integrated circuit. This eliminates the necessity to design external circuitry normally required to drive a multiplexed display. Using these important attributes of the Intelligent Display, the designer now only has to provide for interfacing, which is a seven-bit ASCII parallel code, a two-bit address, and a write signal. The procedure for writing these commands is similar to those used for an external Random Access Memory.

The serial/parallel and parallel/serial conversion is normally accomplished by using a UART (Universal Asynchronous Receiver/Transmitter) or a USART (Universal Synchronous/Asynchronous Receiver/Transmitter). The 8031 is a very attractive microcontroller to use in this application because it has an integral UART. This integral UART provides the designer with the means for controlling the conversion of serial into parallel information or vice-versa. The 8031 has more RAM than the popular 8048, but the operation and instruction sets are very similar. Refer to a 8031 data sheet for a complete description of the product.

Circuit Description

The block diagrams of the 8031 (Figure 1) and the DL2416 (Figure 2) show the internal structure of these devices. By combining the DL2416, an easy to use peripheral device in a parallel system, and the 8031 results in a low cost, simple serial display system. A 32-digit system can be built using an 8031 microprocessor, an 8212 or equivalent latch, a 2716 EPROM, and a 75189 IC for interfacing to 20 mA or RS232 input lines. Buffers were added to minimize the long cable noise spikes and interface loading on the bus. See Figure 3 for system schematic.

Software Considerations

This system, as described, is set up to receive data only at 100 baud rate. Additional software is required for transmit routine. For a given data rate and (data format is start bit, 9-data bits and a stop bit) three sections of software and possibly a special crystal oscillator frequency may be required for a given transmit rate. On power-up or reset, the serial port and timer control words must be initialized.

Special control functions have been included in this program as follows:

- Power Up
- Return
- Backspace
- Line Feed

See Program Listing on last page of appnote.

Conclusion

This Application Note has introduced the ease of interfacing the DL2416 to any microprocessor. By combining the DL2416 and the 8031, difficulties usually associated with serial conversion using software and its attendant timing problems can be easily overcome.

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Figure 1. 8031 block diagram

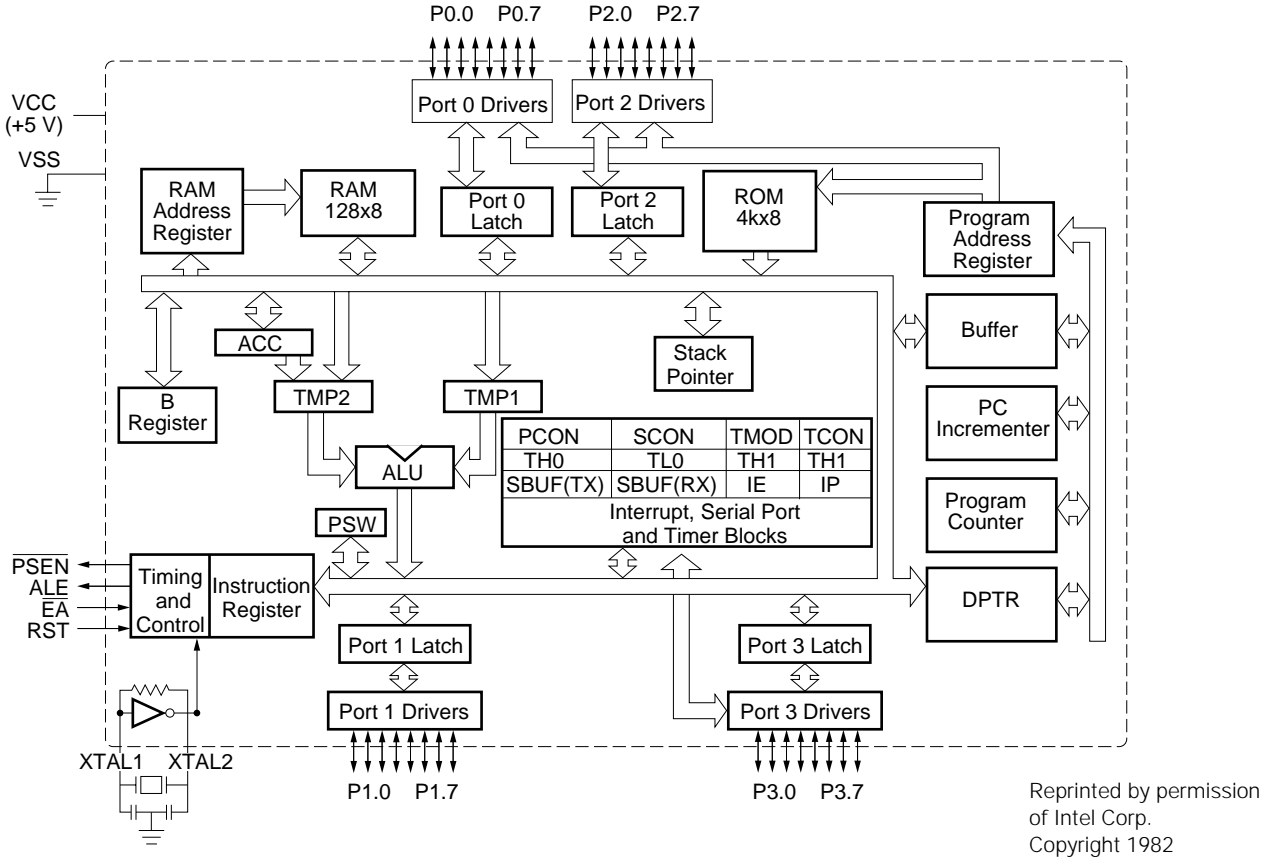


Figure 2. DL2416 internal block diagram

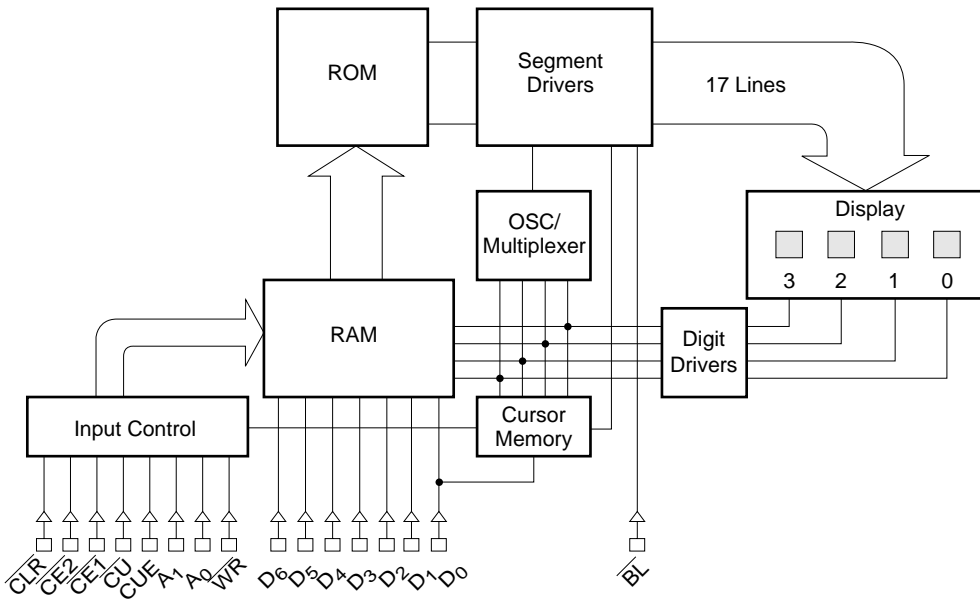


Figure 3. System schematic

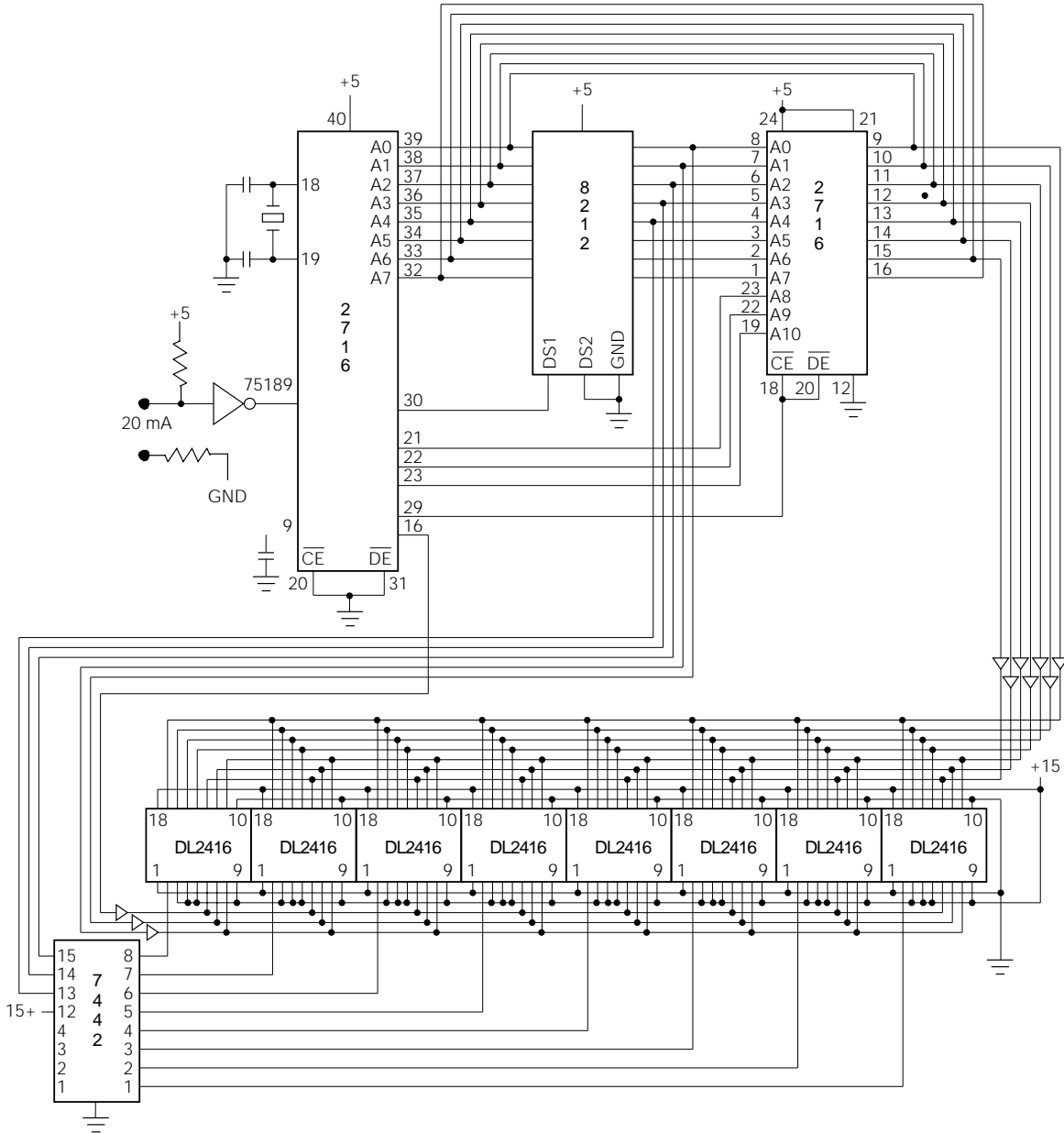
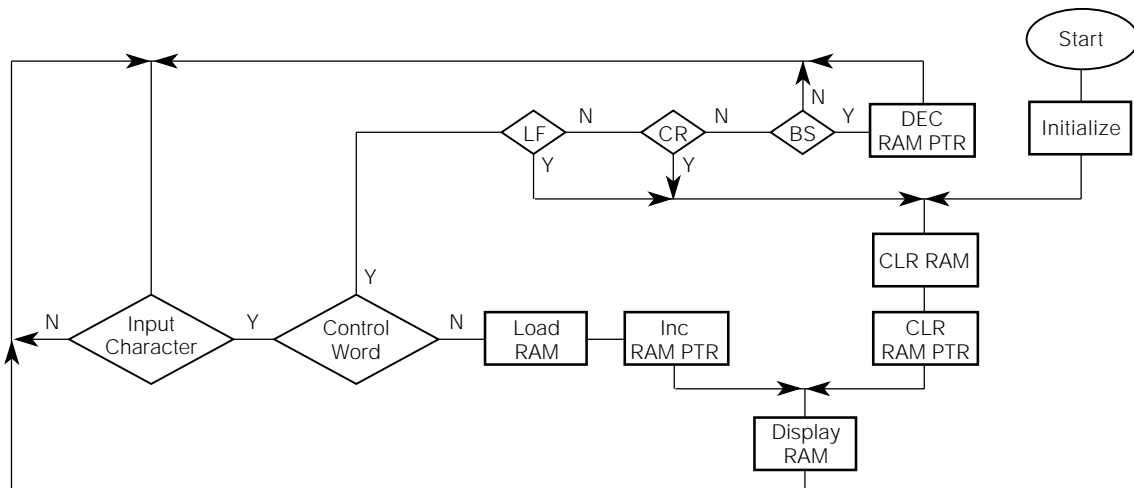


Figure 4. Serial IDA flow chart



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                                ;SERIAL IDA USING 8031 UP
                                ;AND IEA2416-32

0000 020040          ORG      0000H
                                LJMP   INIT
0003 32             ORG      0003H          ;EXTERNAL INTERRUPT 0
                                RTI
000B 32             ORG      000BH          ;TIMER 0 OVERFLOW
                                RTI
0013 32             ORG      0013H          ;EXTERNAL INTERRUPT 1
                                RTI
001B 32             ORG      001BH          ;TIMER 1 OVERFLOW
                                RTI
0023 32             ORG      0023H          ;SERIAL I/O INTERRUPT
                                RTI

                                ;SETUP SERIAL PORT
                                ;9 BIT UART MODE 3
                                ;SET TIMER

0040 75A800      INIT:  ORG      0040H
                                MOV      IE,#00H          ;ENABLE INTERRUPTS
0043 758922      MOV      TMODE,#22H        ;TIMER 0 & 1 AUTO RELOAD
0046 758D72      MOV      TH1,#72H          ;RELOAD FOR 110
0049 759870      MOV      SCON,#70H        ;MODE 3 RCV
004C D28E        SETB      #8EH          ;TIMER 1 ON

004E 7920      CLRAM:  MOV      R1,#RAM          ;RAM INITIAL ADDRESS
0050 E4         CLR      A
0051 7B20      MOV      R3,#CNTR          ;LOAD # OF DIGITS
0053 F7         CLR1:  MOV      @R1,A          ;LOAD RAM
0054 09         INC      R1
0055 DBFC      DJNZ     R3,CLR1
0057 7820      MOV      R0,#RAM          ;SET RAM INPUT PNTR TO INITIAL

0059 7B20      DISPRM: MOV      R3,#CNTR          ;R3=COUNTER
005B 900000    MOV      DPTR,#DSPTR        ;DPTR=DISPLAY POINTER
005E 793F      MOV      R1,#RAM          ;R1=RAM DISPLAY POINTER+LENGTH
0060 E7         DISP1: MOV      A,@R1          ;FETCH DATA FROM RAM
0061 F0         MOVX    @DPTR,A          ;LOAD DISPLAY
0062 19         DEC      R1
0063 A3         INC      DPTR
0064 DBFA      DJNZ     R3,DISP1

0066 3098FD    SERIN:  JNB      RI,SERIN          ;WAIT UNTIL AN INPUT
0069 C298      CLR      RI
006B E599      MOV      A,SBUF

                                ;CHECK FOR CONTROL WORDS
                                ;SAVE A
006D FC        CNTLWD: MOV      R4,A
006E 2460      ADD      A,#060H
0070 4013      JC       LDATA          ;JUMP IF DATA
0072 EC        MOV      A,R4
0073 2473      ADD      A,#073H
0075 40D7      JC:      CLRAM          ;CR
0077 EC        MOV      A,R4
0078 2476      ADD      A,#076H
007A 40D2      JC       CLRAM          ;LF
007C EC        MOV      A,R4
007D 2478      ADD      A,#078H
007F 50E5      JNC      SERIN          ;OTHER CONTROL
0081 18        DEC      R0
0082 020066    AJMP     SERIN          ;BS

0085 EC        LDATA:  MOV      A,R4
0086 F6        MOV      @R0,A          ;LOAD RAM
0087 08        INC      R0
0088 E8        MOV      A,R0
0089 24C0      ADD      A,#0C0H
008B 5002      JNC      LDAT1
008D 7820      MOV      R0,#RAM
008F 020059    LDAT1:  AJMP     DISPRM

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END

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