

# The DLO4135/DLG4137 5 x 7 Dot Matrix Intelligent Display<sup>®</sup> Appnote 28

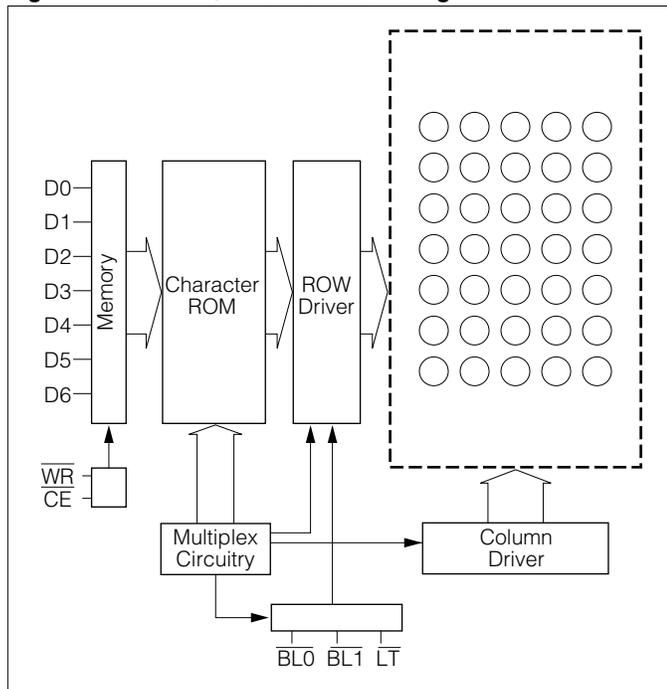
This application note is intended to serve as a design and application guide for users of the DLO4135 and DLG4137 OSRAM Intelligent Displays. This appnote covers device electrical description, operation, general circuit design considerations, and interfacing to microprocessors.

## Electrical Description

The DLO4135/DLG4137 Intelligent Alphanumeric 5x7 Dot Matrix Display contains memory, character generator, multiplexing circuits, and drivers built into a single package.

Figure 1 is a block diagram of DLO4135/DLG4137. The unit consists of 35 LED die arranged in a 5x7 pattern and a single CMOS integrated circuit chip. The IC chip contains the column drivers, row drivers, 128 character generator ROM, memory, multiplex and blanking circuitry.

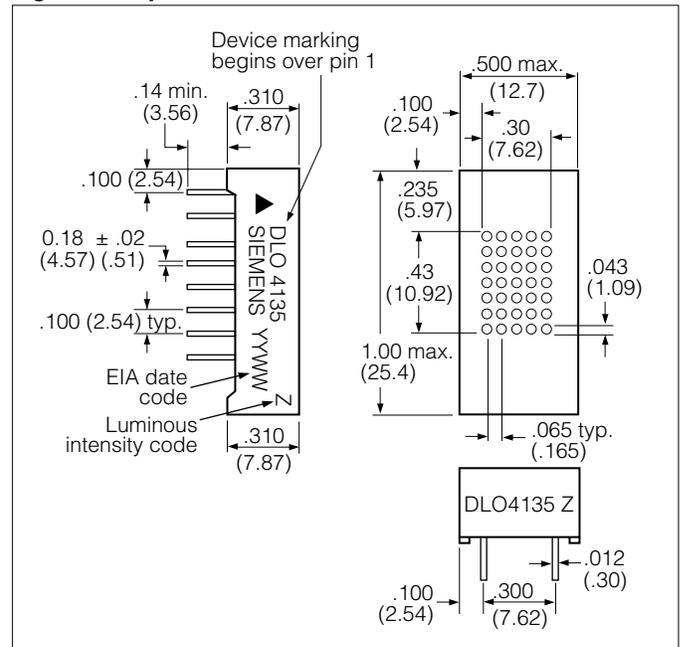
**Figure 1. DLO4135/DLG4137 block diagram**



Thirty-five dots form a 0.30 x 0.43 inch overall character size in a .500 x 1.00 inch dual-in-line package. The  $\pm 50$  degree wide viewing angle complements the display and is the ideal display

for industrial control applications. Display construction is filled reflector type with the integrated circuit in the back also filled with IC-grade epoxy. This results in a very rugged part which is resistant to moisture, shock and vibration.

**Figure 2. Physical dimensions in inches (mm)**



**Table 1. DLO4135/DLG4137 pin functions**

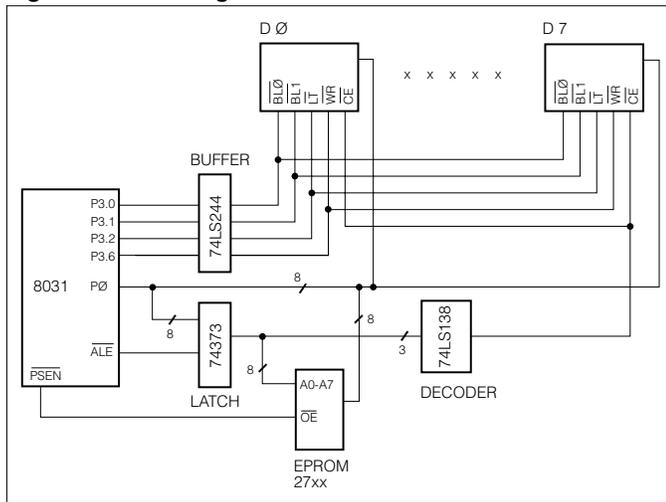
Pin	Function	Pin	Function
1	$\overline{LT}$ Lamp Test	9	D0 data LSB
2	$\overline{WR}$ Write	10	D1 data
3	$\overline{BL1}$ Brightness	11	D2 data
4	$\overline{BL0}$ Brightness	12	D3 data
5	No Pin	13	D4 data
6	No Pin	14	D5 data
7	$\overline{CE}$ Chip Enable	15	D6 data MSB
8	GND	16	+V <sub>CC</sub>



If small wire cables are used, good engineering practice is to calculate the wire resistance of the ground and the +5 volt wires. More than 0.2 volt drop (at 100 ma per digit) should be avoided, since this loss is in addition to any inaccuracies or load regulation of the power supply.

The 5 volt power supply for the DLO4135/DLG4137 should be the same one supplying the  $V_{CC}$  to all logic devices. If a separate power supply must be used, then local buffers should be used on all the inputs. These buffers should be powered from the display power supply. This precaution is to avoid line transients or any logic signals to be higher than  $V_{CC}$  during power up.

**Figure 5. Block diagram of the Intel 8031 controller**



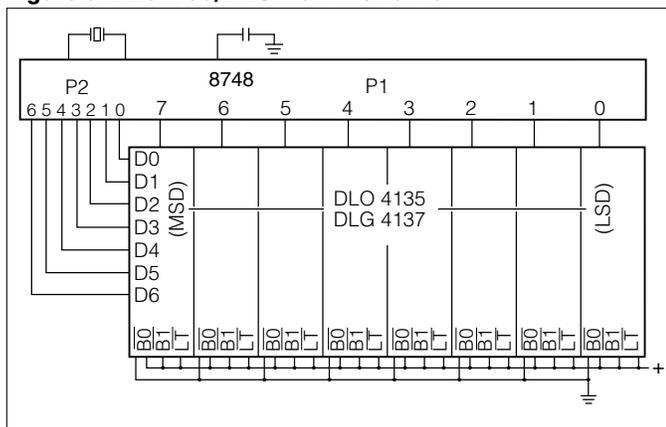
### Interfacing

For an eight digit display using the DLO4135/DLG4137, interfacing to a single chip microprocessor such as the 8748, is easy and straight forward. One approach may be to dedicate one port for the seven data signals and another 8-bit port for the write signals. The schematic is shown in Figure 6.

### I/O or Memory Mapped System

For a memory mapped system using a processor such as the 8080 or 8085, the interfacing is also straight-forward. Each display is treated as a memory location with its own address, like another I/O or RAM location. See Figure 7.

**Figure 6. DLO4135/DLG4137 with 8748**



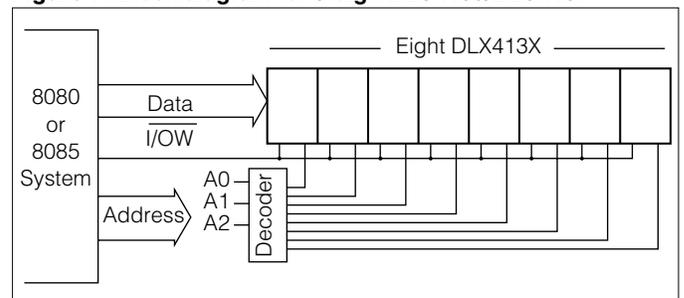
### Subroutine to Load an 8-digit Display using the DLO4135/DLG4137

```

; DATA IN RAM 10H-17H
; (MSD-LSD)
INIT   ORL   P1,#0FFH ; PORT 1 ALL HIGH (WRITE)
        ORL   P2,#00H ; PORT 2 ALL LOW (DATA)
        MOV   R1,#0FH ; RAM ADDRESS—1
        MOV   R2,#0FEH ; WRITE PULSE
        MOV   R3,#08H ; COUNTER
START: INC   R1 ; INCREMENT RAM POINTER
DATA:  MOV   A,@R1 ; FETCH DATA FROM RAM
        OUTL  P2,A ; LOAD PORT 2
        MOV   A,R2 ; RECALL WRITE
        RR    A ; SHIFT A TO NEXT WRITE
        MOV   R2,A ; SAVE WRITE
WRITE:  OUTL  P1,A ; SEND WRITE PULSE
        MOV   A,#0FFH ; WAIT
        OUTL  P1,A ; RESET WRITE PULSE
        DJNZ  R3,START ; LOAD COMPLETE?
        RET   ; RETURN TO MAIN PROGRAM

```

**Figure 7. Block diagram for 8-digit DLO4135/DLG4137**



### Routine for an 8-Digit Display using the DLO4135/DLG4137 and 8085 or 8080 Microprocessor

```

; DATA TO BE DISPLAYED IS IN
; A0 (LSD) THRU A7 (MSD)
;
; DISPLAY ADDRESS C00X
; LSD IS RIGHT MOST DIGIT
;
; DOES NOT SAVE REG A,B,H,L,D,E
;
DADD   EQU   0A000H ; DATA ADDRESS LOCATION
DPAD   EQU   0C000H ; DISPLAY ADDRESS
                     LOCATION
LEN    EQU   08H ; DISPLAY LENGTH
;
ORG    100H
;
DISP:  LXI   H,DADD ; LOAD DATA ADDRESS
        LXI   D,DPAD ; LOAD DISPLAY ADDRESS
        MVI   B,LEN ; LOAD DISPLAY LENGTH
DISP1: MOV   A,M ; GET DATA
        XCHG ; XCHG H/L & D/E
        MOV   M,A ; LOAD DISPLAY FROM REG A
        XCHG ; RESTORE H/L & D/E
        INX   D ; INCREMENT DISPLAY ADDRESS
        INX   H ; INCREMENT DATA ADDRESS
        DCR   B ; DECREMENT LENGTH COUNTER
        JNZ  DISP1 ; END OF DISPLAY?
        RET   ; RETURN TO MAIN PROGRAM

```

## Conclusion

Note that although other manufacturers' products are used in the examples, this application note does not imply specific endorsement, or warranty of other manufacturer's products by OSRAM. The interface schemes shown demonstrate the simplicity of using the DLO4135/DLG4137 dot matrix Intelligent Dis-

play. Slight timing differences may be encountered for various microprocessors, but can be resolved using similar methods as those used when using interfacing microprocessors with various RAMs. The techniques used in the examples were shown for their generality. The user will undoubtedly invent other schemes to optimize his particular system to its requirements.

## Program Listing

```
1          ; BY DAN WATSON
2          ; TO DO LAMP TEST, SET 100% BRIGHTNESS
3          ; AND WRITE 'SIEMENS*'
4
5          ; P3.0 = BLO\
6          ; P3.1 = BL1\
7          ; P3.2 = LT\
8          ; P3.6 = WR\
9
10         ; RO = DIGIT ADDRESS ( CHIP ENABLES – CE\ )
11         ; R1 = DIGIT COUNTER
12         ; R7 = R6 = R5 = WAIT REGISTERS
13
14         .ORG 00H
15         0000          02 00 03          INIT:JMP BEGIN
16         0003          12 00 24          BEGIN:CALL WAIT1          ; DELAY FOR uC TO STABILIZE
17         0006          75 B0 00          MOV P3,#00H          ; LAMP TEST
18         0009          12 00 24          CALL WAIT1          ; DISPLAY LT\ FOR A WHILE
19         000C          75 B0 07          MOV P3,#07H          ; SET ALL 8 DISPLAYS TO 100% BRT
20         000F          00
21         0010          00          NOP
22         0011          78 00          MOV R0,#00H          ; DIGIT 7 ADDRESS
23         0013          79 08          MOV R1,#08H          ; 8 DIGIT COUNTER
24         0015          74 00          MOV A,#00H          ; CLEAR ACC.
25         0017          90 00 37          MOV DPTR,#TEXT          ; ADDRESS OF THE MESSAGE
26         001A          93          WRT:MOVC A,@A+DPTR          ; LOAD FIRST CHAR. INTO THE ACC.
27         001B          F2          MOVX @R0,A          ; DIGIT ADDRESS AND DATA WRITE
28         001C          A3          INC DPTR          ; NEXT CHARACTER ADDRESS
29         001D          08          INC R0          ; NEXT DIGIT (6) ADDRESS
30         001E          E4          CLR A
31         001F          D9 F9          DJNZ R1,WRT          ; WRITE ALL 8 CHAR.
32         0021          00          GO:NOP
33         0022          01 21          JMP GO          ; MESSAGE ALWAYS ON
34         0024
35         0024
36         0024          7F 88          WAIT1:MOV R7,#88H          ; DELAY LOOPS
37         0026          00          NOP
38         0027          7E FF          WAIT2:MOV R6,#FFH
39         0029          00          NOP
40         002A          7D FF          WAIT3:MOV R5,#FFH
41         002C          00          NOP
42         002D          DD FE          DJNZ R5,$
43         002F          00          NOP
44         0030          DE F8          DJNZ R6,WAIT3
45         0032          00          NOP
46         0033          DF F2          DJNZ R7,WAIT2
47         0035          00          NOP
48         0036          22          RET
49
50         0037          53 49 45 4D 45          TEXT:DB 'SIEMENS*'
51         003C          4E 53 2A
52         003F          .END
```