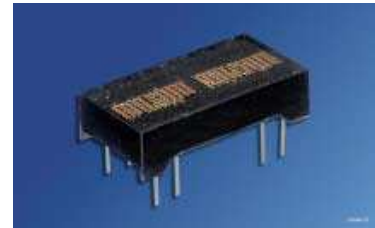


# Vertical Format 0.123" 4-Character 5x5 Dot Matrix Serial Input Dot Addressable Intelligent Display® Devices

**Lead (Pb) Free Product - RoHS Compliant**

|                              |                 |
|------------------------------|-----------------|
| <b>Standard Red</b>          | <b>SCDV5540</b> |
| <b>Yellow</b>                | <b>SCDV5541</b> |
| <b>Super-red</b>             | <b>SCDV5542</b> |
| <b>Green</b>                 | <b>SCDV5543</b> |
| <b>High Efficiency Green</b> | <b>SCDV5544</b> |



## DESCRIPTION

The SCDV5540 (Red), SCDV5541 (Yellow), SCDV5542 (Super-red), SCDV5543 (Green), and SCDV5544 (High Efficiency Green) are four digit, dot addressable 5 x 5 dot matrix, serial input, alphanumeric Intelligent Display devices in a vertical format. The four digits are packaged in a rugged, high quality, optically transparent, plastic 14 pin DIP with 7.62 mm (0.3") pin spacing.

The on-board CMOS has a 100 bit RAM, one bit associated with one LED, each to generate User Defined Characters. In Power Down Mode, quiescent current is  $< 50 \mu\text{A}$ .

The SCDV554X is designed for work with the serial port of most common microprocessors. Data is transferred into the display through the Serial Data Input (DATA), clocked by the Serial Data Clock (SDCLK), and enabled by the Load Input (LOAD).

The Clock I/O (CLK I/O) and Clock Select ( $\overline{\text{CLKSEL}}$ ) pins offer the user the capability to supply a high speed external multiplex clock. This feature can minimize audio in-band interference for portable communication equipment or eliminate the visual synchronization effects found in high vibration environments such as avionics equipment.

## FEATURES

- Vertical Format, Four 3.12 mm (0.123") 5 x 5 Dot Matrix Characters in Red, Yellow, Super-red, Green, or High Efficiency Green
- Optimum Display Surface Efficiency (display area to package ratio)
- High Speed Data Input Rate: 5.0 MHz
- ROMless Serial Input, Dot Addressable Display Ideal for User Defined Characters
- Built-in Decoders, Multiplexers and LED Drivers
- Readable from 1.8 meters (6.0 Feet)
- Wide Viewing Angle, X Axis  $\pm 55^\circ$ , Y Axis  $\pm 55^\circ$
- Attributes:
  - 100 Bit RAM for User Defined Characters
  - Eight Dimming Levels
  - Power Down Model ( $< 250 \mu\text{W}$ )
  - Hardware/Software Clear Functions
  - Lamp Test
  - Internal or External Clock
- 3.3 V Capability

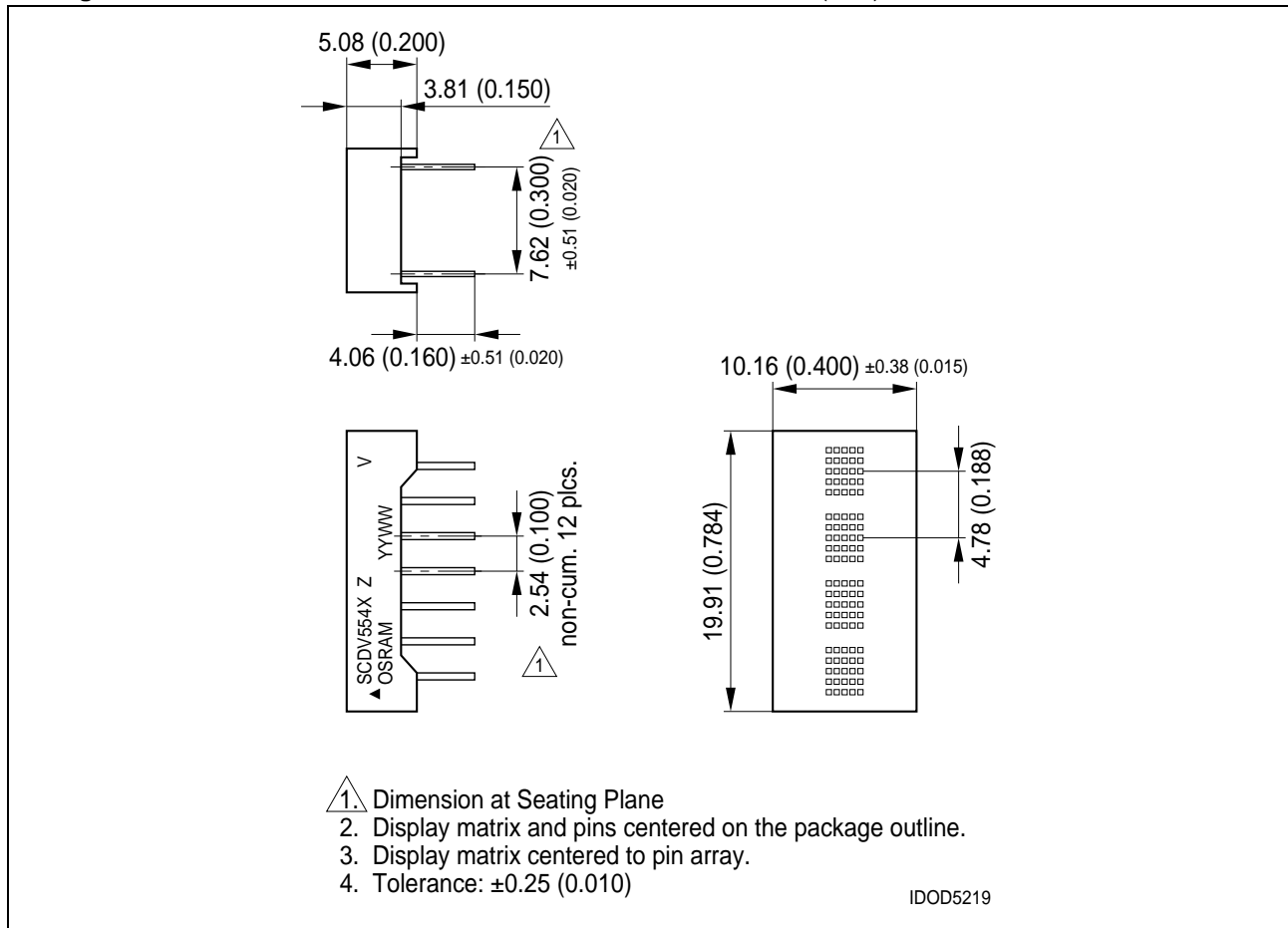
# SCDV5540, SCDV5541, SCDV5542, SCDV5543, SCDV5544

## Ordering Information

| Type     | Color of Emission     | Character Height mm (inch) | Ordering Code |
|----------|-----------------------|----------------------------|---------------|
| SCDV5540 | standard red          | 3.2 (0.123)                | Q68000A8890   |
| SCDV5541 | yellow                |                            | Q68000A8891   |
| SCDV5542 | super-red             |                            | Q68000A8892   |
| SCDV5543 | green                 |                            | Q68000A8893   |
| SCDV5544 | high efficiency green |                            | Q68000A8894   |

## Package Outlines

Dimensions in mm (inch)



# SCDV5540, SCDV5541, SCDV5542, SCDV5543, SCDV5544

## Maximum Ratings

| Parameter   | Symbol    | Value                  | Unit |
|---|-----------|------------------------|------|
| Operating temperature range   | $T_{op}$  | - 40 ... + 85          | °C   |
| Storage temperature range   | $T_{stg}$ | - 40 ... + 100         | °C   |
| DC Supply Voltage   | $V_{CC}$  | -0.5 to + 7.0          | V    |
| Input Voltage Levels Relative to GND                                    |           | -0.5 to $V_{CC} + 0.5$ | V    |
| Solder Temperature<br>1.59 mm (0.063") below seating plane, $t < 5.0$ s | $T_S$     | 260                    | °C   |
| Relative Humidity   |           | 85                     | %    |
| ESD (100 pF, 1.5 kΩ)  | $V_Z$     | 2.0                    | kV   |
| Input Current   |           | ± 100                  | mA   |
| Maximum Number of LEDs on at 100% Brightness                            |           | 64                     |      |
| Maximum Power Dissipation   |           | 0.65                   | W    |

## Optical Characteristics at 25°C

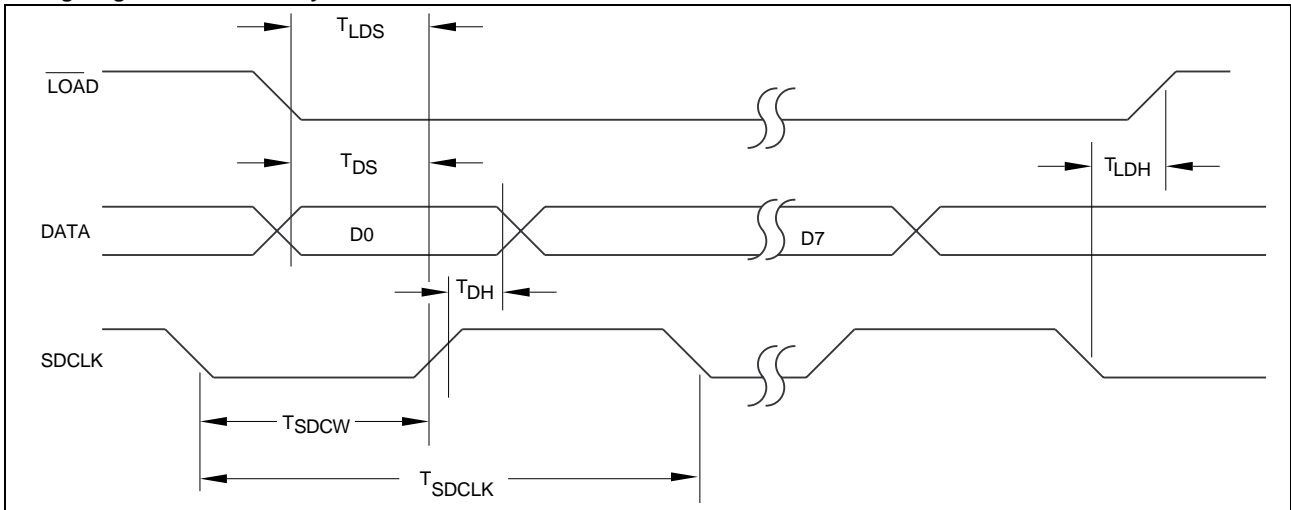
( $V_{CC}$ =5.0 V at 100% brightness level, viewing angle: X axis ± 55°, Y axis ± 65 °)

| Description                                      | Symbol           | Values          |                    |                       |                   |                                   | Unit |
|--|------------------|-----------------|--------------------|-----------------------|-------------------|-----------------------------------|------|
|  |                  | Red<br>SCDV5540 | Yellow<br>SCDV5541 | Super-red<br>SCDV5542 | Green<br>SCDV5543 | High Efficiency Green<br>SCDV5544 |      |
| Luminous Intensity (min.)                        | $I_V$            | 0.48            | 1.80               | 1.80                  | 1.80              | 2.10                              | mcd  |
| Character Average (#displayed all digits) (typ.) |                  | 1.80            | 5.40               | 5.40                  | 5.40              | 6.40                              | mdc  |
| Peak Wavelength (typ.)                           | $\lambda_{peak}$ | 665             | 583                | 630                   | 565               | 568                               | nm   |
| Dominant Wavelength (typ.)                       | $\lambda_{dom}$  | 639             | 585                | 620                   | 570               | 574                               | nm   |

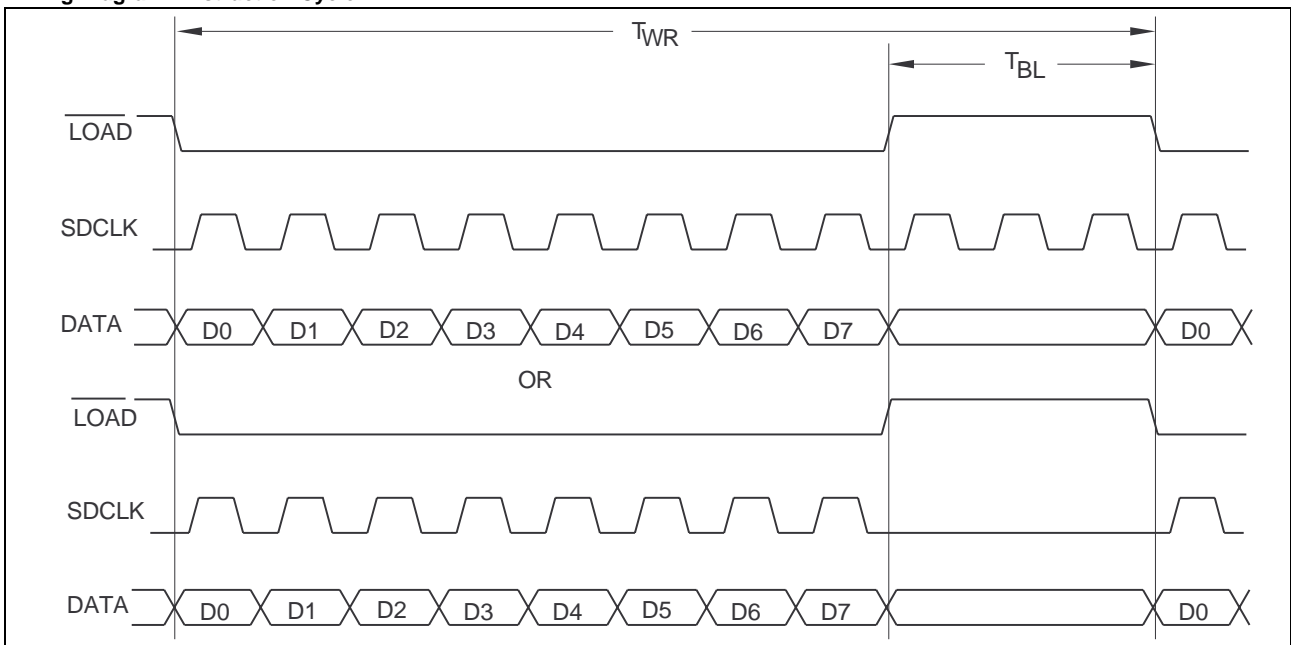
### Notes:

1. Dot to dot intensity matching at 100% brightness is 1.8:1.
2. Displays are binned for hue at 2.0 nm intervals.
3. Displays within a given intensity category have an intensity matching of 1.5:1 (max.).

Timing Diagram - Data Write Cycle



Timing Diagram - Instruction Cycle



**Switching Specifications**

(over operating temperature range and  $V_{CC}=4.5\text{ V}$  to  $5.5\text{ V}$ )

| Symbol    | Description        | Min. | Units | Symbol      | Description      | Min. | Units         |
|-----------|--------------------|------|-------|-------------|------------------|------|---------------|
| $T_{RC}$  | Reset Active Time  | 600  | ns    | $T_{SDCLK}$ | Clock Period     | 200  | ns            |
| $T_{LDS}$ | Load Setup Time    | 40   | ns    | $T_{SDCW}$  | Clock Width      | 70   | ns            |
| $T_{DS}$  | Data Setup Time    | 40   | ns    | $T_{LDH}$   | Load Hold Time   | 0    | ns            |
| $T_{DH}$  | Data Hold Time     | 20   | ns    | $T_{WR}$    | Total Write Time | 2.2  | $\mu\text{s}$ |
| $T_{BL}$  | Time Between Loads | 600  | ns    |             |                  |      |               |

Note:

SDCLK duty cycle = 30% Min. and 50% Max.

# SCDV5540, SCDV5541, SCDV5542, SCDV5543, SCDV5544

## Electrical Characteristics at 25°C

| Parameter                                | Min. | Typ. | Max. | Units          | Conditions   |
|--|------|------|------|----------------|--|
| $V_{CC}$                                 | 4.5  | 5.0  | 5.5  | V              | —  |
| $I_{CC}$ (Pwr Dwn Mode) <sup>4)</sup>    | —    | —    | 50   | $\mu$ A        | $V_{CC}=5.0$ V, all inputs=0 V or $V_{CC}$                               |
| $I_{CC}$ 4 digits<br>16 dots/character   | —    | 100  | 140  | mA             | $V_{CC}=5.0$ V, “#” displayed in all 4 digits at 100% brightness at 25°C |
| $I_{IL}$ Input current                   | —    | —    | -10  | $\mu$ A        | $V_{CC}=5.0$ V, $V_{IN}=0$ (all inputs)                                  |
| $I_{IH}$ Input current                   | —    | —    | 10   | $\mu$ A        | $V_{CC}=V_{IN}=5.0$ V (all inputs)                                       |
| $V_{IH}$                                 | 3.5  | —    | —    | V              | $V_{CC}=4.5$ V to 5.5 V  |
| $V_{IL}$                                 | —    | —    | 1.5  | V              | $V_{CC}=4.5$ V to 5.5 V  |
| $I_{OH}$ (CLK I/O)                       | —    | -8.9 | —    | mA             | $V_{CC}=4.5$ V, $V_{OH}=2.4$ V   |
| $I_{OL}$ (CLK I/O)                       | —    | 1.6  | —    | mA             | $V_{CC}=4.5$ V, $V_{OL}=0.4$ V   |
| $\theta_{J-pin}$                         | —    | —    | 64   | $^{\circ}$ C/W | —  |
| $F_{ext}$ External Clock Input Frequency | 120  | —    | 347  | kHz            | $V_{CC}=5.0$ V, $\overline{CLKSEL}=0$                                    |
| $F_{osc}$ Internal Clock Input Frequency | 120  | —    | 347  | kHz            | $V_{CC}=5.0$ V, $\overline{CLKSEL}=1.0$                                  |
| Clock I/O Bus Loading                    | —    | —    | 240  | pF             | —  |
| Clock Out Rise Time                      | —    | —    | 500  | ns             | $V_{CC}=4.5$ V, $V_{OH}=2.4$ V   |
| Clock Out Fall Time                      | —    | —    | 500  | ns             | $V_{CC}=4.5$ V, $V_{OH}=0.4$ V   |
| FM, Digit                                | 375  | 768  | 1086 | Hz             | —  |

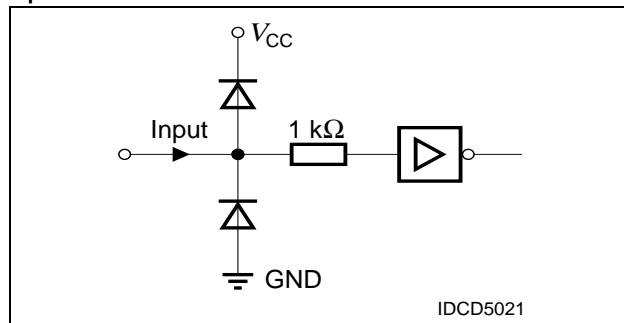
### Notes:

- 1) Contact Osram OS for 3.3 Volt operation.
- 2) Unused inputs must be tied high.
- 3) Peak current  $\frac{5}{3} \times I_{CC}$ .
- 4) External oscillator must be stopped if being used to maintain an  $I_{CC} < 50 \mu$ A.

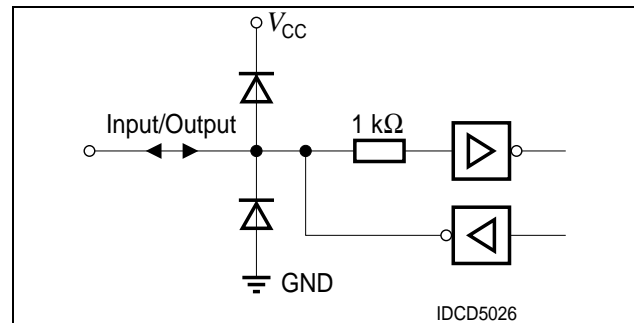
### Input/Output Circuits

Figures „Inputs“ and „Clock I/O“ show the input and output resistor/diode networks used for ESD protection and to eliminate substrate latch-up caused by input voltage over/under shoot.

#### Inputs

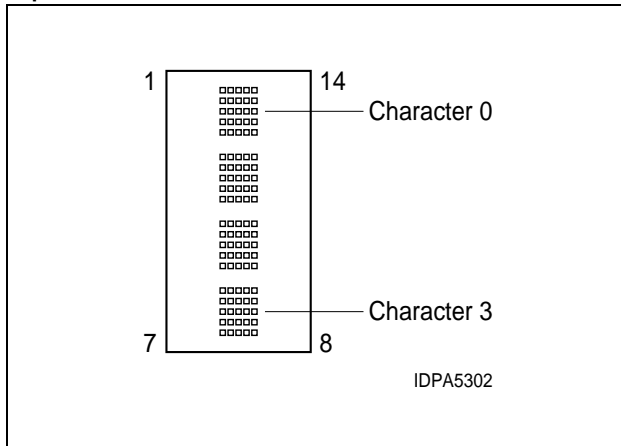


#### Clock I/O



# SCDV5540, SCDV5541, SCDV5542, SCDV5543, SCDV5544

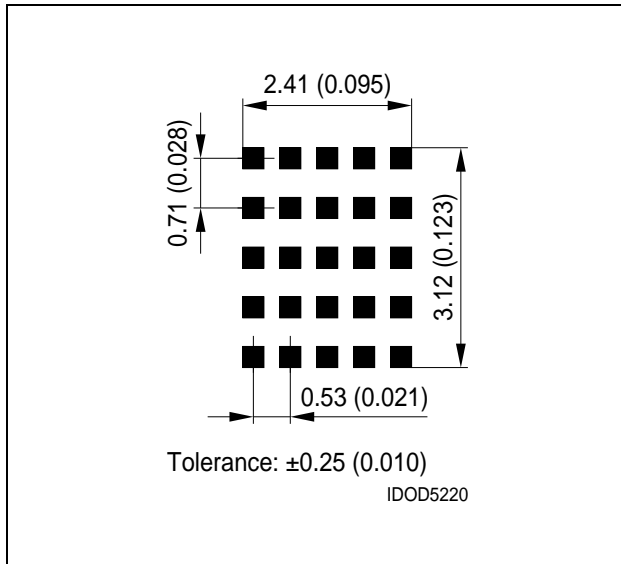
## Top View



## Pin Assignment

| Pin | Function                 | Pin | Function                   |
|-----|--------------------------|-----|----------------------------|
| 1   | SDCLK                    | 14  | GND                        |
| 2   | $\overline{\text{LOAD}}$ | 13  | DATA                       |
| 3   | NP                       | 12  | $V_{CC}$                   |
| 4   | NP                       | 11  | $V_{CC}$                   |
| 5   | NP                       | 10  | $V_{CC}$                   |
| 6   | $\overline{\text{RST}}$  | 9   | $\overline{\text{CLKSEL}}$ |
| 7   | GND                      | 8   | CLK I/O                    |

## Dot Matrix Format



## Pin Definitions

| Pin | Function                   | Definitions   |
|-----|----------------------------|---|
| 1   | SDCLK                      | Loads data into the 8-bit serial data register on a low to high transition.   |
| 2   | $\overline{\text{LOAD}}$   | Low input enables data clocking into 8-bit serial shift register. When $\overline{\text{LOAD}}$ goes high, the contents of 8-bit serial Shift Register will be decoded.   |
| 3   | NP                         | No pin  |
| 4   | NP                         | No pin  |
| 5   | NP                         | No pin  |
| 6   | $\overline{\text{RST}}$    | Asynchronous input, when low will clear the Multiplex Counter, User RAM and Data Register. Control Word Register is set to 100% brightness and the Address Register is set to select Digit 0. The display is blanked. |
| 7   | GND                        | Power supply ground   |
| 8   | CLK I/O                    | Outputs master clock or inputs external clock.  |
| 9   | $\overline{\text{CLKSEL}}$ | H=internal clock, L=external clock  |
| 10  | $V_{CC}$                   | Power supply  |
| 11  | $V_{CC}$                   | Power supply  |
| 12  | $V_{CC}$                   | Power supply  |
| 13  | DATA                       | Serial data input   |
| 14  | GND                        | Power supply ground   |

## Display Column and Row Format

|       | C0 | C1 | C2 | C3 | C4 |
|-------|----|----|----|----|----|
| Row 0 | 1  | 1  | 1  | 1  | 1  |
| Row 1 | 0  | 0  | 1  | 0  | 0  |
| Row 2 | 0  | 0  | 1  | 0  | 0  |
| Row 3 | 0  | 0  | 1  | 0  | 0  |
| Row 4 | 0  | 0  | 1  | 0  | 0  |

1= Display dot „ON“  
0=Display dot „OFF“

## Column Data Ranges

|       |            |
|-------|------------|
| Row 0 | 00H to 1FH |
| Row 1 | 20H to 3FH |
| Row 2 | 40H to 5FH |
| Row 3 | 60H to 7FH |
| Row 4 | 80H to 9FH |

# SCDV5540, SCDV5541, SCDV5542, SCDV5543, SCDV5544

## Operation of the SCDV554X

The SCDV554X display consists of a CMOS IC containing control logic and drivers for four 5 x 5 characters. These components are assembled in a compact plastic package.

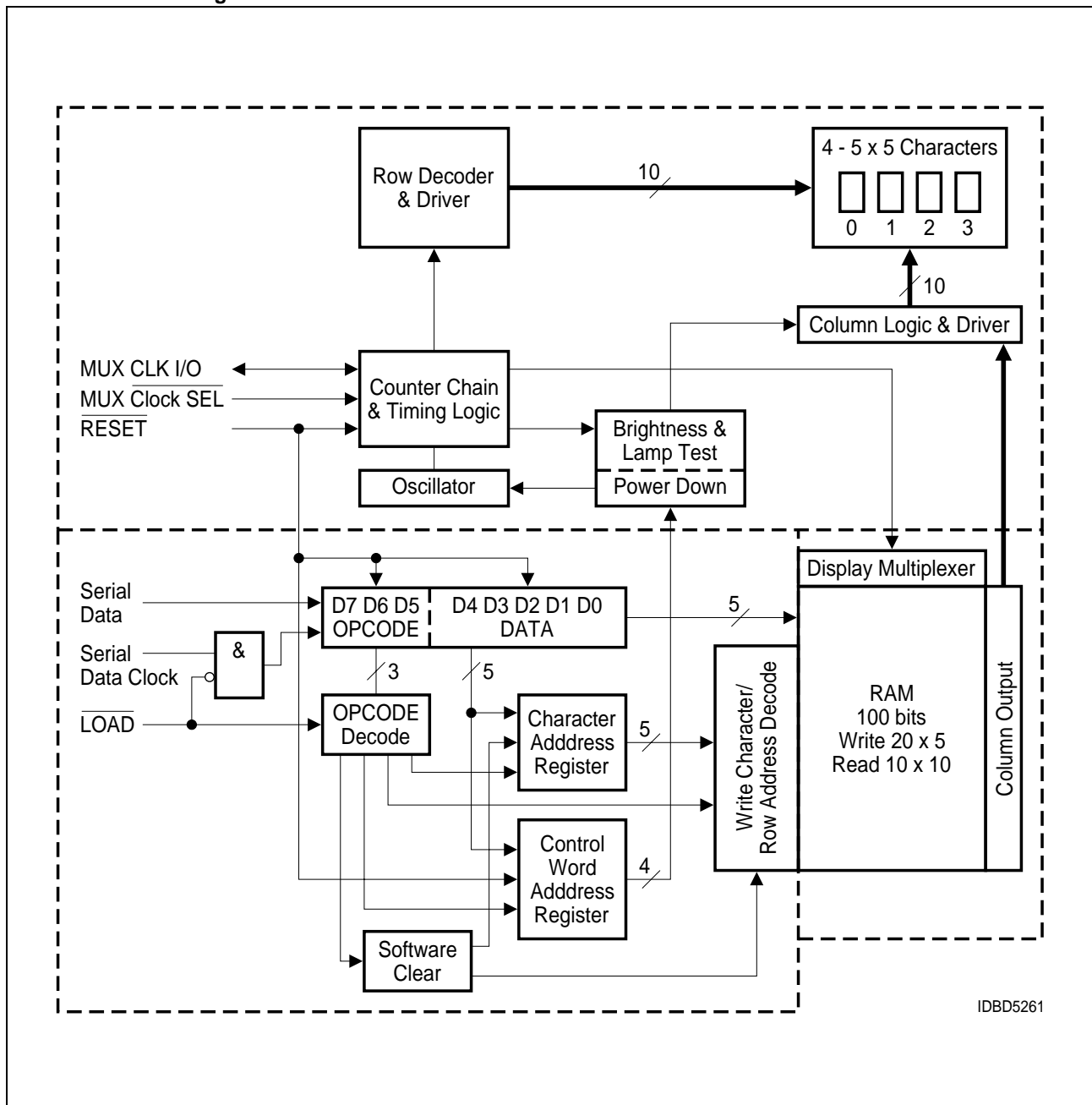
Individual LED dot addressability allows the user great freedom in creating special characters or mini-icons. The User Definable Character Set Examples illustrate 200 different character and symbol possibilities.

The use of a serial data interface provides a highly efficient inter-

connection between the display and the mother board. The SCDV554X requires only 4 lines as compared to 15 for an equivalent four character parallel input part.

The on-board CMOS IC is the electronic heart of the display. The IC accepts decoded serial data, which is stored in the internal RAM. Asynchronously the RAM is read by the character multiplexer at a strobe rate that results in a flicker free display. Figure „SCDV554X Block Diagram“ (page 7) shows the three functional areas of the IC. These include: the input serial data register and control logic, a 100 bits two port RAM, and an internal multiplexer/display driver.

## SCDV554X Block Diagram



The following explains how to format the serial data to be loaded into the display. The user supplies a string of bit mapped decoded characters. The contents of this string is shown in Figure „Loading Serial Character Data a“ (page 8). Figure „Loading Serial Character Data b“ (page 8) shows that each character consist of six 8 bit words. The first word encodes the display character location and the succeeding five bytes are row data. The row data represents the status (On, Off) of individual column LEDs. Figure „Loading Serial Character Data c“ (page 8) shows that each 8 bit word is formatted to include a three bit Operational Code (OPCODE) defined by bits D7–D5 and five bits (D4–D0) representing Column Data, Character Address, or Control Word Data.

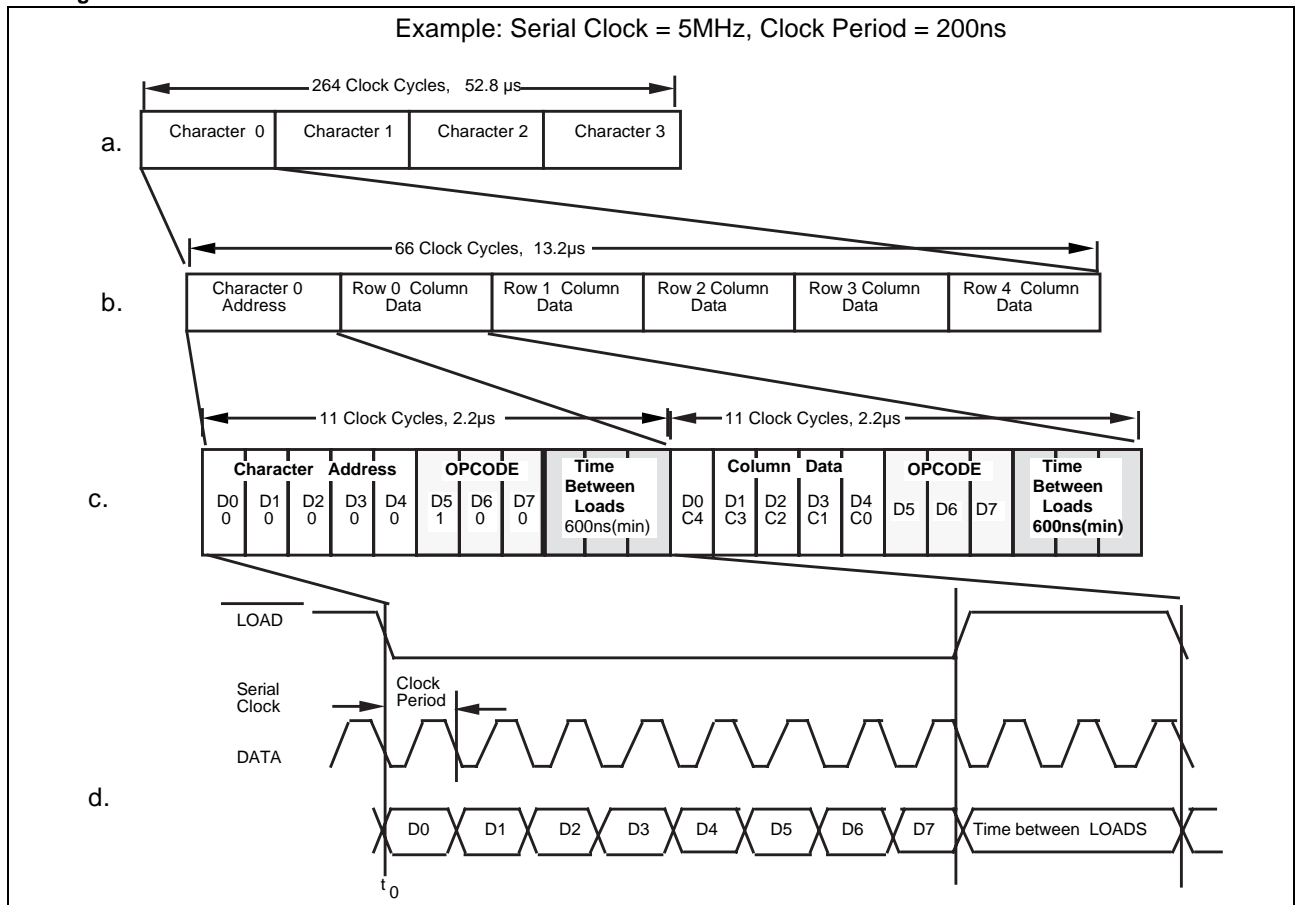
Figure „Loading Serial Character Data d“ (page 8) shows the sequence for loading the bytes of data. Bringing the LOAD line low enables the serial register to accept data. The shift action occurs on the low to high transition of the serial data clock (SDCLK). The least significant bit (D0) is loaded first. After eight clock pulses the LOAD line is brought high. With this transition the OPCODE is decoded. The decoded OPCODE directs D4–D0 to be latched in the Character Address register, stored in the RAM as Column data, or latched in the Control Word register. The control IC requires a minimum 600 ns delay between successive byte loads. As indicated in Figure „Loading Serial Character Data a“ (page 8), a total of 264 bits of data are required to load all eight characters into the display.

The Character Address Register bits, D4–D0 (Table „Load Character Address“ (page 9) and Row Address Register bits, D7–D5 (Table „Load Column Data“ (page 9)) direct the Column Data bits, D4–D0 (Table „Load Column Data“ (page 9)) to specific RAM location. Table „Character ‘D’“ (page 8) shows the Row Address for the example character “D.” Column data is written and read asynchronously from the 200 bit RAM. Once loaded the internal oscillator and character multiplexer reads the data from the RAM. These characters are row strobed with column data as shown in Figures „Row and Column Location“ (page 9) and „Row Strobing“ (page 10). The character strobe rate is determined by the internal or user supplied external MUX Clock and the IC’s ÷320 counter.

Character “D”

|       | Op code |    |    | Column Data |          |          |          |          | Hex |
|-------|---------|----|----|-------------|----------|----------|----------|----------|-----|
|       | D7      | D6 | D5 | D4<br>C0    | D3<br>C1 | D2<br>C2 | D1<br>C3 | D0<br>C4 |     |
| Row 0 | 0       | 0  | 0  | 1           | 1        | 1        | 1        | 0        | 1E  |
| Row 1 | 0       | 0  | 1  | 1           | 0        | 0        | 0        | 1        | 31  |
| Row 2 | 0       | 1  | 0  | 1           | 0        | 0        | 0        | 1        | 51  |
| Row 3 | 0       | 1  | 1  | 1           | 0        | 0        | 0        | 1        | 71  |
| Row 4 | 1       | 0  | 0  | 1           | 1        | 1        | 1        | 0        | 9E  |

Loading Serial Character Data





## Load Character Address

| Op code<br>D7 D6 D5 | Character Address<br>D4 D3 D2 D1 D0 | Hex | Operation Load |
|---------------------|-------------------------------------|-----|----------------|
| 1 0 1               | 0 0 0 0 0                           | A0  | Character 0    |
| 1 0 1               | 0 0 0 0 1                           | A1  | Character 1    |
| 1 0 1               | 0 0 0 1 0                           | A2  | Character 2    |
| 1 0 1               | 0 0 0 1 1                           | A3  | Character 3    |

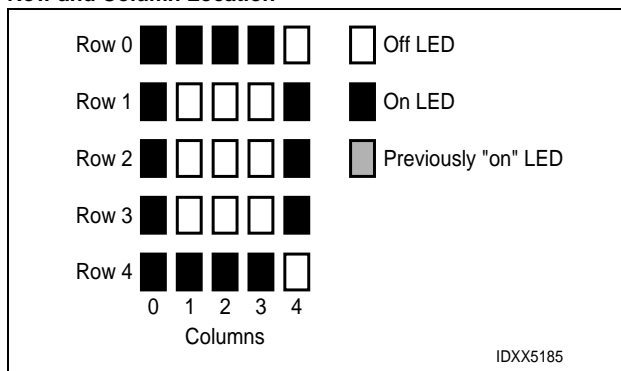
## Load Column Data

| Op code<br>D7 D6 D5 | Column Data<br>D4 D3 D2 D1 D0 | Operation Load |
|---------------------|-------------------------------|----------------|
| 0 0 0               | C0 C1 C2 C3 C4                | Row 0          |
| 0 0 1               | C0 C1 C2 C3 C4                | Row 1          |
| 0 1 0               | C0 C1 C2 C3 C4                | Row 2          |
| 0 1 1               | C0 C1 C2 C3 C4                | Row 3          |
| 1 0 0               | C0 C1 C2 C3 C4                | Row 4          |

The user can activate four Control functions. These include: LED Brightness Level, Lamp Test, IC Power Down, or Display Clear. OPCODEs and five bit words are used to initiate these functions. The OPCODEs and Control Words for the Character Address and Loading Column Data are shown in Tables „Load Character Address“ (page 9) and „Load Column Data“ (page 9).

The user can select seven specific LED brightness levels, Table „Display Brightness“ (page 9). These brightness levels (in percentages of full brightness of the display) include: 100% (F0<sub>HEX</sub>), 53% (F1<sub>HEX</sub>), 40% (F2<sub>HEX</sub>), 27% (F3<sub>HEX</sub>), 20% (F4<sub>HEX</sub>), 13% (F5<sub>HEX</sub>), and 6.6% (F6<sub>HEX</sub>). The brightness levels are controlled by changing the duty factor of the row strobe pulse.

## Row and Column Location



## Display Brightness

| Op code<br>D7 D6 D5 | Control Word<br>D4 D3 D2 D1 D0 | Hex | Operation Level |
|---------------------|--------------------------------|-----|-----------------|
| 1 1 1               | 1 0 0 0 0                      | F0  | 100%            |
| 1 1 1               | 1 0 0 0 1                      | F1  | 53%             |
| 1 1 1               | 1 0 0 1 0                      | F2  | 40%             |
| 1 1 1               | 1 0 0 1 1                      | F3  | 27%             |
| 1 1 1               | 1 0 1 0 0                      | F4  | 20%             |
| 1 1 1               | 1 0 1 0 1                      | F5  | 13%             |
| 1 1 1               | 1 0 1 1 0                      | F6  | 6.6%            |

The SCDV554X offers a unique Display Power Down feature which reduces  $I_{CC}$  to less than 50  $\mu$ A. When FF<sub>HEX</sub> is loaded, as shown in Table „Power Down“ (page 9), the display is set to 0% brightness and the internal multiplex clock is stopped. When in the Power Down mode data may still be written into the RAM. The display is reactivated by loading a new Brightness Level Control Word into the display.

## Power Down

| Op code<br>D7 D6 D5 | Control Word<br>D4 D3 D2 D1 D0 | Hex | Operation Level |
|---------------------|--------------------------------|-----|-----------------|
| 1 1 1               | 1 1 1 1 1                      | FF  | 0% brightness   |

The Lamp Test is enabled by loading F8<sub>HEX</sub>, Table „Lamp Test“ (page 9), into the serial shift register. This Control Word sets all of the LEDs to a 53% brightness level. Operation of the Lamp Test has no affect on the RAM and is cleared by loading a Brightness Control Word.

## Lamp Test

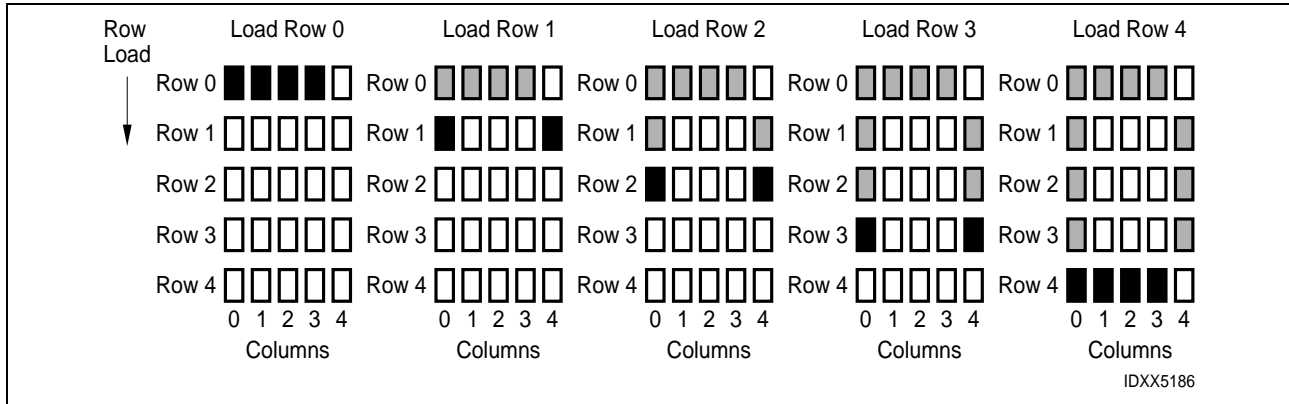
| Op code<br>D7 D6 D5 | Control Word<br>D4 D3 D2 D1 D0 | Hex | Operation Level |
|---------------------|--------------------------------|-----|-----------------|
| 1 1 1               | 1 0 B B B                      |     | Lamp Test (OFF) |
| 1 1 1               | 1 1 0 0 0                      | F8  | Lamp Test (OFF) |

The Software Clear (C0<sub>HEX</sub>), given in Table „Software Clear“ (page 9), clears the Address Register and the RAM. The display is blanked and the Character Address Register will be set to Character 0. The internal counter and the Control Word Register are unaffected. The Software Clear will remain active until the next data input cycle is initiated.

## Software Clear

| Op code<br>D7 D6 D5 | Control Word<br>D4 D3 D2 D1 D0 | Hex | Operation Level |
|---------------------|--------------------------------|-----|-----------------|
| 1 1 0               | 0 0 0 0 0                      | C0  | CLEAR           |

## Row Strobing



### Multiplexer and Display Driver

The four characters are row multiplexed with RAM resident column data. The strobe rate is established by the internal or external MUX Clock rate. The MUX Clock frequency is divided by a 320 counter chain. This results in a typical strobe rate of 750 Hz. By pulling the Clock SEL line low, the display can be operated from an external MUX Clock. The external clock is attached to the CLK I/O connection (pin 8). The maximum external MUX Clock frequency should be limited to 1.0 MHz.

An asynchronous hardware Reset Pin is also provided. Bringing this pin low will clear the Character Address Register, Control Word Register, RAM, and blanks the display. This action leaves the display set at Character Address 0, and the Brightness Level set at 100%.

### Electrical & Mechanical Considerations

#### Interconnect Considerations

Optimum product performance can be had when the following electrical and mechanical recommendations are adopted. The SCDV554X's IC is constructed in a high speed CMOS process, consequently high speed noise on the SERIAL DATA, SERIAL DATA CLOCK,  $\overline{\text{LOAD}}$  and  $\overline{\text{RESET}}$  lines may cause incorrect data to be written into the serial shift register. Adhere to transmission line termination procedures when using fast line drivers and long cables (> 10 cm).

Good digital grounds (pins 7 and 14) and power supply decoupling (pins 10, 11 and 12) will insure that  $I_{CC}$  (< 400 mA peak) switching currents do not generate localized ground bounce. Therefore it is recommended that each display package use a 0.1  $\mu\text{F}$  and 20  $\mu\text{F}$  capacitor between  $V_{CC}$  and ground.

When the internal MUX Clock is being used connect the  $\overline{\text{CLKSEL}}$  pin to  $V_{CC}$ . In those applications where  $\overline{\text{RESET}}$  will not be connected to the system's reset control, it is recommended that this pin be connected to the center node of a series 0.1  $\mu\text{F}$  and 100 k $\Omega$  RC network. Thus upon initial power up the  $\overline{\text{RESET}}$  will be held low for 10 ms allowing adequate time for the system power supply to stabilize.

### ESD Protection

The input protection structure of the SCDV554X provides significant protection against ESD damage. It is capable of withstanding discharges greater than 2.0 kV. Take all the standard precautions, normal for CMOS components. These include properly grounding personnel, tools, tables, and transport carriers that come in contact with unshielded parts. If these conditions are not, or cannot be met, keep the leads of the device shorted together or the parts in anti-static packaging.

### Soldering Considerations

The SCDV554X can be hand soldered with SN63 solder using a grounded iron set to 260°C.

Wave soldering is also possible following these conditions: Pre-heat that does not exceed 93°C on the solder side of the PC board or a package surface temperature of 85°C. Water soluble organic acid flux (except carboxylic acid) or rosin-based RMA flux without alcohol can be used.

Wave temperature of 245°C  $\pm$  5°C with a dwell between 1.5 sec. to 3.0 sec. Exposure to the wave should not exceed temperatures above 260°C for five seconds at 1.59 mm (0.063") below the seating plane. The packages should not be immersed in the wave.

### Post Solder Cleaning Procedures

The least offensive cleaning solution is hot D.I. water (60°C) for less than 15 minutes. Addition of mild saponifiers is acceptable. Do not use commercial dishwasher detergents.

For faster cleaning, solvents may be used. Exercise care in choosing solvents as some may chemically attack the nylon package. For further information refer to Appnotes 18 and 19 at [www.osram-os.com](http://www.osram-os.com)

An alternative to soldering and cleaning the display modules is to use sockets. Naturally, 14 pin DIP sockets 7.62 mm (0.300") wide with 2.54 mm (0.100") centers work well for single displays. Multiple display assemblies are best handled by longer SIP sockets or DIP sockets when available for uniform package alignment. Socket manufacturers are Aries Electronics, Inc., Frenchtown, NJ; Garry Manufacturing, New Brunswick, NJ; Robinson-Nugent, New Albany, IN; and Samtec Electronic Hardware, New Albany, IN.

For further information refer to Appnote 22 at [www.osram-os.com](http://www.osram-os.com)



# SCDV5540, SCDV5541, SCDV5542, SCDV5543, SCDV5544

## Microprocessor Interface

The microprocessor interface is through the serial port, SPI port or one out of eight data bits on the eight bit parallel port and also control lines  $\overline{SDCLK}$  and  $\overline{LOAD}$ .

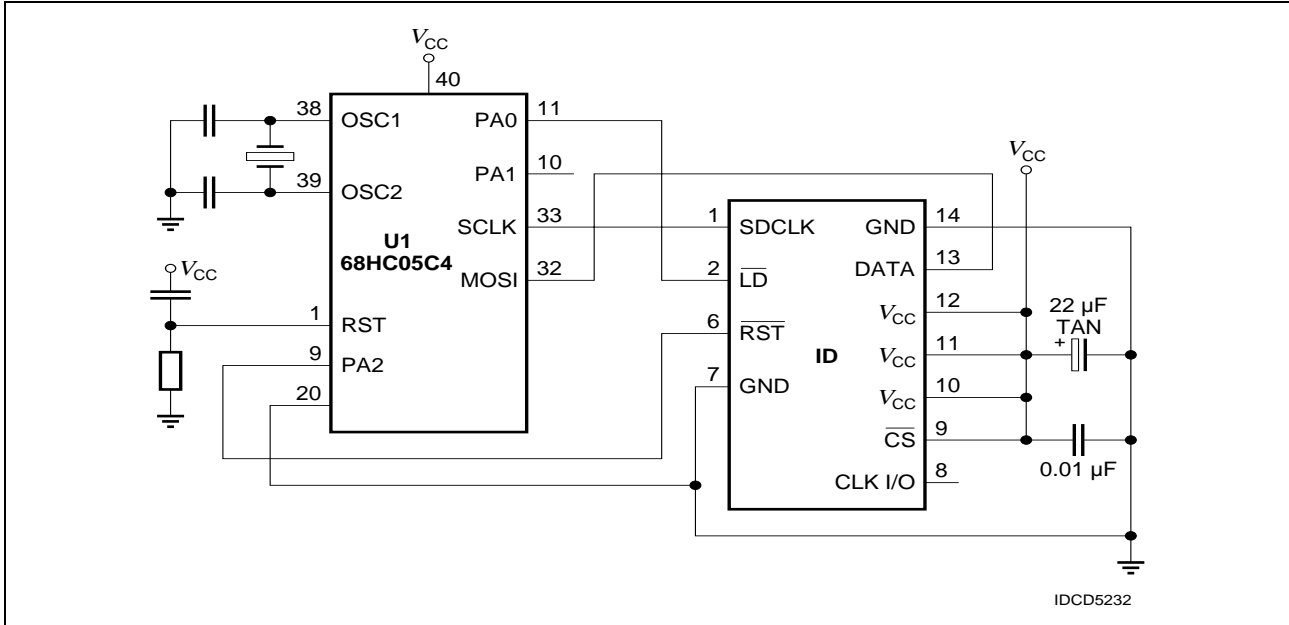
## Power Up Sequence

Upon power up display will come on at random. Thus the display should be reset at power-up. The reset will set the Address Register to Digit 0, User RAM is set to 0 (display blank) the Control Word is set to 0 (100% brightness with Lamp Test off) and the internal counters are reset.

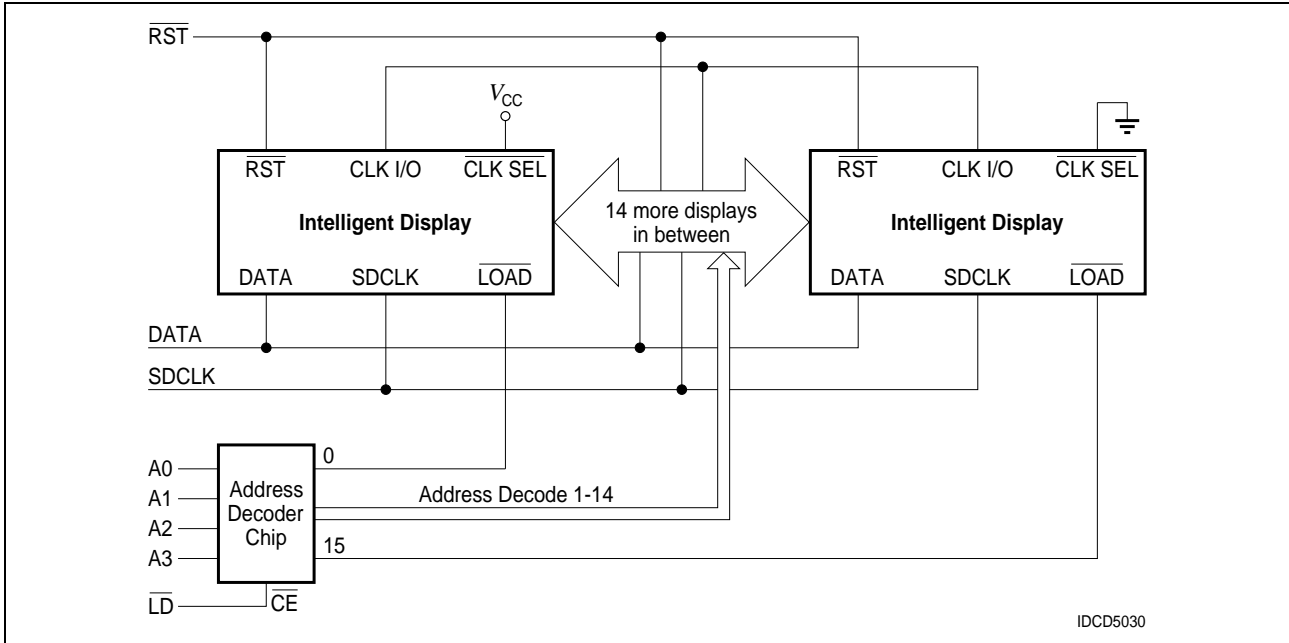
## Cascading Multiple Displays

Multiple displays can be cascaded using the  $\overline{CLKSEL}$  and CLK I/O pins as shown below. The display designated as the Master Clock source should have its  $\overline{CLKSEL}$  pin tied high and the slaves should have their  $\overline{CLKSEL}$  pins tied low. All CLK I/O pins should be tied together. One display CLK I/O can drive 15 slave CLK I/Os. Use  $\overline{RST}$  to synchronize all display counters.

## SCDV554X Interface with Motorola 68HC05C4 Microprocessor (using SPI port)



## Cascading Multiple Displays



# SCDV5540, SCDV5541, SCDV5542, SCDV5543, SCDV5544

## Loading Data Into the Display

Use following procedure to load data into the display:

1. Power up the display.
2. Bring  $\overline{RST}$  low (600 ns duration minimum) to clear the Multiplex Counter, Address Register, Control Word Register, User Ram and Data Register. The display will be blank. Display brightness is set to 100%.
3. If a different brightness is desired, load the proper brightness opcode into the Control Word Register.
4. Load the Digit Address into the display.
5. Load display row and column data for the selected digit.
6. Repeat steps 4 and 5 for all digits.

## Data Contents for the Display in a Vertical Format „↑AB↓“

| Step         | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Function          |
|--------------|----|----|----|----|----|----|----|----|-------------------|
| A            | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | CLEAR             |
| B (optional) | 1  | 1  | 1  | 1  | 0  | B  | B  | B  | BRIGHTNESS SELECT |
| 1            | 1  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | DIGIT D0 SELECT   |
| 2            | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | ROW 0 D0 (↑)      |
| 3            | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 0  | ROW 1 D0 (↑)      |
| 4            | 0  | 1  | 0  | 1  | 0  | 1  | 0  | 1  | ROW 2 D0 (↑)      |
| 5            | 0  | 1  | 1  | 0  | 0  | 1  | 0  | 0  | ROW 3 D0 (↑)      |
| 6            | 1  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | ROW 4 D0 (↑)      |
| 7            | 1  | 0  | 1  | 0  | 0  | 0  | 0  | 1  | DIGIT D1 SELECT   |
| 8            | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | ROW 0 D1 (A)      |
| 9            | 0  | 0  | 1  | 0  | 1  | 0  | 1  | 0  | ROW 1 D1 (A)      |
| 10           | 0  | 1  | 0  | 1  | 1  | 1  | 1  | 1  | ROW 2 D1 (A)      |
| 11           | 0  | 1  | 1  | 1  | 0  | 0  | 0  | 1  | ROW 3 D1 (A)      |
| 12           | 1  | 0  | 0  | 1  | 0  | 0  | 0  | 1  | ROW 4 D1 (A)      |
| 13           | 1  | 0  | 1  | 0  | 0  | 0  | 1  | 0  | DIGIT D2 SELECT   |
| 14           | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 0  | ROW 0 D2 (B)      |
| 15           | 0  | 0  | 1  | 0  | 1  | 0  | 0  | 1  | ROW 1 D2 (B)      |
| 16           | 0  | 1  | 0  | 0  | 1  | 1  | 1  | 0  | ROW 2 D2 (B)      |
| 17           | 0  | 1  | 1  | 0  | 1  | 0  | 0  | 1  | ROW 3 D2 (B)      |
| 18           | 1  | 0  | 0  | 1  | 1  | 1  | 1  | 0  | ROW 4 D2 (B)      |
| 19           | 1  | 0  | 1  | 0  | 0  | 0  | 1  | 1  | DIGIT D3 SELECT   |
| 20           | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | ROW 0 D3 (↓)      |
| 21           | 0  | 0  | 1  | 0  | 0  | 1  | 0  | 0  | ROW 1 D3 (↓)      |
| 22           | 0  | 1  | 0  | 1  | 0  | 1  | 0  | 1  | ROW 2 D3 (↓)      |
| 23           | 0  | 1  | 1  | 0  | 1  | 1  | 1  | 0  | ROW 3 D3 (↓)      |
| 24           | 1  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | ROW 4 D3 (↓)      |

Note:

If the display is already reset at Power Up, there is no need for Software Clear.

# SCDV5540, SCDV5541, SCDV5542, SCDV5543, SCDV5544

## User Definable Character Set Examples\*

### Upper and Lower Case Alphabets

| HEX CODE |         | HEX CODE |         | HEX CODE |         | HEX CODE |         | HEX CODE |         | HEX CODE |         | HEX CODE |         | HEX CODE |         |
|----------|---------|----------|---------|----------|---------|----------|---------|----------|---------|----------|---------|----------|---------|----------|---------|
| 04       | ■       | 1E       | ■ ■ ■ ■ | 0F       | ■ ■ ■ ■ | 1E       | ■ ■ ■ ■ | 1F       | ■ ■ ■ ■ | 1F       | ■ ■ ■ ■ | 0F       | ■ ■ ■ ■ | 11       | ■ ■ ■ ■ |
| 2A       | ■ ■ ■ ■ | 29       | ■ ■ ■ ■ | 30       | ■ ■ ■ ■ | 29       | ■ ■ ■ ■ | 30       | ■ ■ ■ ■ | 30       | ■ ■ ■ ■ | 30       | ■ ■ ■ ■ | 31       | ■ ■ ■ ■ |
| 5F       | ■ ■ ■ ■ | 4E       | ■ ■ ■ ■ | 50       | ■ ■ ■ ■ | 49       | ■ ■ ■ ■ | 5E       | ■ ■ ■ ■ | 5E       | ■ ■ ■ ■ | 53       | ■ ■ ■ ■ | 5F       | ■ ■ ■ ■ |
| 71       | ■ ■ ■ ■ | 69       | ■ ■ ■ ■ | 70       | ■ ■ ■ ■ | 69       | ■ ■ ■ ■ | 70       | ■ ■ ■ ■ | 70       | ■ ■ ■ ■ | 71       | ■ ■ ■ ■ | 71       | ■ ■ ■ ■ |
| 91       | ■ ■ ■ ■ | 9E       | ■ ■ ■ ■ | 8F       | ■ ■ ■ ■ | 9E       | ■ ■ ■ ■ | 9F       | ■ ■ ■ ■ | 90       | ■ ■ ■ ■ | 8F       | ■ ■ ■ ■ | 91       | ■ ■ ■ ■ |
| 01       | ■ ■ ■ ■ | 13       | ■ ■ ■ ■ | 10       | ■ ■ ■ ■ | 11       | ■ ■ ■ ■ | 11       | ■ ■ ■ ■ | 0E       | ■ ■ ■ ■ | 1E       | ■ ■ ■ ■ | 0C       | ■ ■ ■ ■ |
| 21       | ■ ■ ■ ■ | 34       | ■ ■ ■ ■ | 30       | ■ ■ ■ ■ | 3B       | ■ ■ ■ ■ | 39       | ■ ■ ■ ■ | 31       | ■ ■ ■ ■ | 31       | ■ ■ ■ ■ | 32       | ■ ■ ■ ■ |
| 41       | ■ ■ ■ ■ | 58       | ■ ■ ■ ■ | 50       | ■ ■ ■ ■ | 55       | ■ ■ ■ ■ | 55       | ■ ■ ■ ■ | 51       | ■ ■ ■ ■ | 5E       | ■ ■ ■ ■ | 5E       | ■ ■ ■ ■ |
| 71       | ■ ■ ■ ■ | 74       | ■ ■ ■ ■ | 70       | ■ ■ ■ ■ | 71       | ■ ■ ■ ■ | 73       | ■ ■ ■ ■ | 71       | ■ ■ ■ ■ | 70       | ■ ■ ■ ■ | 72       | ■ ■ ■ ■ |
| 8E       | ■ ■ ■ ■ | 93       | ■ ■ ■ ■ | 9F       | ■ ■ ■ ■ | 91       | ■ ■ ■ ■ | 91       | ■ ■ ■ ■ | 8E       | ■ ■ ■ ■ | 90       | ■ ■ ■ ■ | 8D       | ■ ■ ■ ■ |
| 0F       | ■ ■ ■ ■ | 1F       | ■ ■ ■ ■ | 11       | ■ ■ ■ ■ | 11       | ■ ■ ■ ■ | 11       | ■ ■ ■ ■ | 11       | ■ ■ ■ ■ | 11       | ■ ■ ■ ■ | 1F       | ■ ■ ■ ■ |
| 30       | ■ ■ ■ ■ | 24       | ■ ■ ■ ■ | 31       | ■ ■ ■ ■ | 31       | ■ ■ ■ ■ | 31       | ■ ■ ■ ■ | 2A       | ■ ■ ■ ■ | 2A       | ■ ■ ■ ■ | 22       | ■ ■ ■ ■ |
| 4E       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ | 51       | ■ ■ ■ ■ | 51       | ■ ■ ■ ■ | 55       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ |
| 61       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 71       | ■ ■ ■ ■ | 6A       | ■ ■ ■ ■ | 7B       | ■ ■ ■ ■ | 6A       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 68       | ■ ■ ■ ■ |
| 9E       | ■ ■ ■ ■ | 84       | ■ ■ ■ ■ | 8E       | ■ ■ ■ ■ | 84       | ■ ■ ■ ■ | 91       | ■ ■ ■ ■ | 91       | ■ ■ ■ ■ | 84       | ■ ■ ■ ■ | 9F       | ■ ■ ■ ■ |
| 00       | ■ ■ ■ ■ | 10       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 01       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 04       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 10       | ■ ■ ■ ■ |
| 2E       | ■ ■ ■ ■ | 30       | ■ ■ ■ ■ | 2F       | ■ ■ ■ ■ | 21       | ■ ■ ■ ■ | 2E       | ■ ■ ■ ■ | 2A       | ■ ■ ■ ■ | 2F       | ■ ■ ■ ■ | 30       | ■ ■ ■ ■ |
| 52       | ■ ■ ■ ■ | 5E       | ■ ■ ■ ■ | 50       | ■ ■ ■ ■ | 4F       | ■ ■ ■ ■ | 5F       | ■ ■ ■ ■ | 48       | ■ ■ ■ ■ | 50       | ■ ■ ■ ■ | 56       | ■ ■ ■ ■ |
| 72       | ■ ■ ■ ■ | 71       | ■ ■ ■ ■ | 70       | ■ ■ ■ ■ | 71       | ■ ■ ■ ■ | 70       | ■ ■ ■ ■ | 7C       | ■ ■ ■ ■ | 73       | ■ ■ ■ ■ | 79       | ■ ■ ■ ■ |
| 8D       | ■ ■ ■ ■ | 9E       | ■ ■ ■ ■ | 8F       | ■ ■ ■ ■ | 8F       | ■ ■ ■ ■ | 8E       | ■ ■ ■ ■ | 88       | ■ ■ ■ ■ | 8F       | ■ ■ ■ ■ | 91       | ■ ■ ■ ■ |
| 00       | ■ ■ ■ ■ | 10       | ■ ■ ■ ■ | 0C       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ |
| 26       | ■ ■ ■ ■ | 30       | ■ ■ ■ ■ | 24       | ■ ■ ■ ■ | 2A       | ■ ■ ■ ■ | 36       | ■ ■ ■ ■ | 2E       | ■ ■ ■ ■ | 3E       | ■ ■ ■ ■ | 2F       | ■ ■ ■ ■ |
| 42       | ■ ■ ■ ■ | 56       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ | 55       | ■ ■ ■ ■ | 59       | ■ ■ ■ ■ | 51       | ■ ■ ■ ■ | 51       | ■ ■ ■ ■ | 51       | ■ ■ ■ ■ |
| 72       | ■ ■ ■ ■ | 78       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 71       | ■ ■ ■ ■ | 71       | ■ ■ ■ ■ | 71       | ■ ■ ■ ■ | 7E       | ■ ■ ■ ■ | 6F       | ■ ■ ■ ■ |
| 8C       | ■ ■ ■ ■ | 96       | ■ ■ ■ ■ | 8E       | ■ ■ ■ ■ | 91       | ■ ■ ■ ■ | 91       | ■ ■ ■ ■ | 8E       | ■ ■ ■ ■ | 90       | ■ ■ ■ ■ | 81       | ■ ■ ■ ■ |
| 00       | ■ ■ ■ ■ | 08       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ |
| 23       | ■ ■ ■ ■ | 3C       | ■ ■ ■ ■ | 32       | ■ ■ ■ ■ | 31       | ■ ■ ■ ■ | 31       | ■ ■ ■ ■ | 32       | ■ ■ ■ ■ | 31       | ■ ■ ■ ■ | 3E       | ■ ■ ■ ■ |
| 44       | ■ ■ ■ ■ | 48       | ■ ■ ■ ■ | 52       | ■ ■ ■ ■ | 51       | ■ ■ ■ ■ | 55       | ■ ■ ■ ■ | 4C       | ■ ■ ■ ■ | 4A       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ |
| 62       | ■ ■ ■ ■ | 6A       | ■ ■ ■ ■ | 72       | ■ ■ ■ ■ | 6A       | ■ ■ ■ ■ | 7B       | ■ ■ ■ ■ | 6C       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 68       | ■ ■ ■ ■ |
| 8C       | ■ ■ ■ ■ | 84       | ■ ■ ■ ■ | 8D       | ■ ■ ■ ■ | 84       | ■ ■ ■ ■ | 91       | ■ ■ ■ ■ | 92       | ■ ■ ■ ■ | 98       | ■ ■ ■ ■ | 9E       | ■ ■ ■ ■ |

IDCS5089

### Numerals and Punctuation

| HEX CODE |         | HEX CODE |         | HEX CODE |         | HEX CODE |         | HEX CODE |         | HEX CODE |         | HEX CODE |         | HEX CODE |         |
|----------|---------|----------|---------|----------|---------|----------|---------|----------|---------|----------|---------|----------|---------|----------|---------|
| 0E       | ■ ■ ■ ■ | 04       | ■ ■ ■ ■ | 1E       | ■ ■ ■ ■ | 1E       | ■ ■ ■ ■ | 06       | ■ ■ ■ ■ | 1F       | ■ ■ ■ ■ | 06       | ■ ■ ■ ■ | 1F       | ■ ■ ■ ■ |
| 33       | ■ ■ ■ ■ | 2C       | ■ ■ ■ ■ | 21       | ■ ■ ■ ■ | 21       | ■ ■ ■ ■ | 2A       | ■ ■ ■ ■ | 30       | ■ ■ ■ ■ | 28       | ■ ■ ■ ■ | 22       | ■ ■ ■ ■ |
| 55       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ | 46       | ■ ■ ■ ■ | 4E       | ■ ■ ■ ■ | 5F       | ■ ■ ■ ■ | 5E       | ■ ■ ■ ■ | 5E       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ |
| 79       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 68       | ■ ■ ■ ■ | 61       | ■ ■ ■ ■ | 62       | ■ ■ ■ ■ | 61       | ■ ■ ■ ■ | 71       | ■ ■ ■ ■ | 68       | ■ ■ ■ ■ |
| 8E       | ■ ■ ■ ■ | 8E       | ■ ■ ■ ■ | 9F       | ■ ■ ■ ■ | 9E       | ■ ■ ■ ■ | 82       | ■ ■ ■ ■ | 9E       | ■ ■ ■ ■ | 8E       | ■ ■ ■ ■ | 88       | ■ ■ ■ ■ |
| 0E       | ■ ■ ■ ■ | 0A       | ■ ■ ■ ■ | 0F       | ■ ■ ■ ■ | 06       | ■ ■ ■ ■ | 19       | ■ ■ ■ ■ | 08       | ■ ■ ■ ■ | 0C       | ■ ■ ■ ■ | 02       | ■ ■ ■ ■ |
| 31       | ■ ■ ■ ■ | 3F       | ■ ■ ■ ■ | 34       | ■ ■ ■ ■ | 29       | ■ ■ ■ ■ | 3A       | ■ ■ ■ ■ | 34       | ■ ■ ■ ■ | 2C       | ■ ■ ■ ■ | 24       | ■ ■ ■ ■ |
| 4F       | ■ ■ ■ ■ | 4A       | ■ ■ ■ ■ | 4E       | ■ ■ ■ ■ | 5C       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ | 4D       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ |
| 62       | ■ ■ ■ ■ | 7F       | ■ ■ ■ ■ | 65       | ■ ■ ■ ■ | 68       | ■ ■ ■ ■ | 6B       | ■ ■ ■ ■ | 72       | ■ ■ ■ ■ | 68       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ |
| 8C       | ■ ■ ■ ■ | 8A       | ■ ■ ■ ■ | 9E       | ■ ■ ■ ■ | 9F       | ■ ■ ■ ■ | 93       | ■ ■ ■ ■ | 8D       | ■ ■ ■ ■ | 80       | ■ ■ ■ ■ | 82       | ■ ■ ■ ■ |
| 0C       | ■ ■ ■ ■ | 04       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 01       | ■ ■ ■ ■ | 04       | ■ ■ ■ ■ | 0A       | ■ ■ ■ ■ |
| 2C       | ■ ■ ■ ■ | 24       | ■ ■ ■ ■ | 2C       | ■ ■ ■ ■ | 20       | ■ ■ ■ ■ | 20       | ■ ■ ■ ■ | 22       | ■ ■ ■ ■ | 24       | ■ ■ ■ ■ | 2A       | ■ ■ ■ ■ |
| 48       | ■ ■ ■ ■ | 5F       | ■ ■ ■ ■ | 4C       | ■ ■ ■ ■ | 5F       | ■ ■ ■ ■ | 40       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ | 40       | ■ ■ ■ ■ |
| 64       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 60       | ■ ■ ■ ■ | 6C       | ■ ■ ■ ■ | 68       | ■ ■ ■ ■ | 60       | ■ ■ ■ ■ | 60       | ■ ■ ■ ■ |
| 80       | ■ ■ ■ ■ | 84       | ■ ■ ■ ■ | 88       | ■ ■ ■ ■ | 80       | ■ ■ ■ ■ | 8C       | ■ ■ ■ ■ | 90       | ■ ■ ■ ■ | 84       | ■ ■ ■ ■ | 80       | ■ ■ ■ ■ |
| 10       | ■ ■ ■ ■ | 1C       | ■ ■ ■ ■ | 0E       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 0C       | ■ ■ ■ ■ | 0C       | ■ ■ ■ ■ | 02       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ |
| 28       | ■ ■ ■ ■ | 24       | ■ ■ ■ ■ | 35       | ■ ■ ■ ■ | 20       | ■ ■ ■ ■ | 2C       | ■ ■ ■ ■ | 20       | ■ ■ ■ ■ | 24       | ■ ■ ■ ■ | 3F       | ■ ■ ■ ■ |
| 44       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ | 57       | ■ ■ ■ ■ | 40       | ■ ■ ■ ■ | 40       | ■ ■ ■ ■ | 4C       | ■ ■ ■ ■ | 48       | ■ ■ ■ ■ | 42       | ■ ■ ■ ■ |
| 62       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 70       | ■ ■ ■ ■ | 60       | ■ ■ ■ ■ | 6C       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 7F       | ■ ■ ■ ■ |
| 81       | ■ ■ ■ ■ | 9C       | ■ ■ ■ ■ | 8E       | ■ ■ ■ ■ | 9F       | ■ ■ ■ ■ | 8C       | ■ ■ ■ ■ | 88       | ■ ■ ■ ■ | 82       | ■ ■ ■ ■ | 80       | ■ ■ ■ ■ |
| 0E       | ■ ■ ■ ■ | 06       | ■ ■ ■ ■ | 0C       | ■ ■ ■ ■ | 04       | ■ ■ ■ ■ | 11       | ■ ■ ■ ■ | 15       | ■ ■ ■ ■ | 04       | ■ ■ ■ ■ | 08       | ■ ■ ■ ■ |
| 31       | ■ ■ ■ ■ | 24       | ■ ■ ■ ■ | 24       | ■ ■ ■ ■ | 24       | ■ ■ ■ ■ | 2A       | ■ ■ ■ ■ | 2E       | ■ ■ ■ ■ | 2A       | ■ ■ ■ ■ | 35       | ■ ■ ■ ■ |
| 42       | ■ ■ ■ ■ | 48       | ■ ■ ■ ■ | 42       | ■ ■ ■ ■ | 40       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ | 5F       | ■ ■ ■ ■ | 51       | ■ ■ ■ ■ | 42       | ■ ■ ■ ■ |
| 64       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 6E       | ■ ■ ■ ■ | 6E       | ■ ■ ■ ■ | 60       | ■ ■ ■ ■ | 60       | ■ ■ ■ ■ |
| 88       | ■ ■ ■ ■ | 86       | ■ ■ ■ ■ | 8C       | ■ ■ ■ ■ | 84       | ■ ■ ■ ■ | 84       | ■ ■ ■ ■ | 95       | ■ ■ ■ ■ | 80       | ■ ■ ■ ■ | 80       | ■ ■ ■ ■ |

IDCS5090

\*CAUTION: No more than 128 LEDs "on" at one time at 100% brightness.

# SCDV5540, SCDV5541, SCDV5542, SCDV5543, SCDV5544

## User Definable Character Set Examples\* (continued)

### Scientific Notations, etc.

| HEX CODE |         | HEX CODE |         | HEX CODE |         | HEX CODE |         | HEX CODE |         | HEX CODE |         | HEX CODE |         | HEX CODE |         | HEX CODE |         |
|----------|---------|----------|---------|----------|---------|----------|---------|----------|---------|----------|---------|----------|---------|----------|---------|----------|---------|
| 06       | ■ ■     | 04       | ■       | 1F       | ■ ■ ■ ■ | 1F       | ■ ■ ■ ■ | 0E       | ■ ■     | 0D       | ■ ■ ■ ■ | 0C       | ■ ■     | 0E       | ■ ■     | 00       | ■       |
| 2E       | ■ ■ ■ ■ | 24       | ■ ■     | 20       | ■ ■ ■ ■ | 20       | ■ ■ ■ ■ | 32       | ■ ■ ■ ■ | 32       | ■ ■ ■ ■ | 32       | ■ ■ ■ ■ | 24       | ■ ■     | 24       | ■ ■     |
| 5E       | ■ ■ ■ ■ | 48       | ■ ■ ■ ■ | 59       | ■ ■ ■ ■ | 56       | ■ ■ ■ ■ | 4A       | ■ ■     | 52       | ■ ■ ■ ■ | 56       | ■ ■ ■ ■ | 4E       | ■ ■ ■ ■ | 4A       | ■ ■ ■ ■ |
| 6E       | ■ ■ ■ ■ | 71       | ■ ■ ■ ■ | 75       | ■ ■ ■ ■ | 79       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 72       | ■ ■ ■ ■ | 71       | ■ ■ ■ ■ | 71       | ■ ■ ■ ■ | 71       | ■ ■ ■ ■ |
| 86       | ■ ■ ■ ■ | 8E       | ■ ■ ■ ■ | 93       | ■ ■ ■ ■ | 91       | ■ ■ ■ ■ | 8A       | ■ ■     | 8D       | ■ ■ ■ ■ | 96       | ■ ■ ■ ■ | 8E       | ■ ■ ■ ■ | 9F       | ■ ■ ■ ■ |
| 10       | ■       | 0E       | ■ ■ ■ ■ | 10       | ■       | 09       | ■ ■ ■ ■ | 01       | ■ ■ ■ ■ | 04       | ■ ■ ■ ■ | 0E       | ■ ■ ■ ■ | 01       | ■ ■ ■ ■ | 0F       | ■ ■ ■ ■ |
| 3C       | ■ ■ ■ ■ | 31       | ■ ■ ■ ■ | 28       | ■ ■ ■ ■ | 29       | ■ ■ ■ ■ | 2E       | ■ ■ ■ ■ | 2E       | ■ ■ ■ ■ | 31       | ■ ■ ■ ■ | 2E       | ■ ■ ■ ■ | 32       | ■ ■ ■ ■ |
| 52       | ■ ■ ■ ■ | 5F       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ | 49       | ■ ■ ■ ■ | 54       | ■ ■ ■ ■ | 55       | ■ ■ ■ ■ | 51       | ■ ■ ■ ■ | 5A       | ■ ■ ■ ■ | 52       | ■ ■ ■ ■ |
| 72       | ■ ■ ■ ■ | 71       | ■ ■ ■ ■ | 6A       | ■ ■ ■ ■ | 6E       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 6E       | ■ ■ ■ ■ | 6A       | ■ ■ ■ ■ | 6A       | ■ ■ ■ ■ | 72       | ■ ■ ■ ■ |
| 81       | ■ ■ ■ ■ | 8E       | ■ ■ ■ ■ | 91       | ■ ■ ■ ■ | 90       | ■ ■ ■ ■ | 84       | ■ ■ ■ ■ | 84       | ■ ■ ■ ■ | 9B       | ■ ■ ■ ■ | 8A       | ■ ■ ■ ■ | 8C       | ■ ■ ■ ■ |
| 1F       | ■ ■ ■ ■ | 18       | ■ ■ ■ ■ | 1C       | ■ ■ ■ ■ | 12       | ■ ■ ■ ■ | 06       | ■ ■ ■ ■ | 07       | ■ ■ ■ ■ | 1C       | ■ ■ ■ ■ | 0F       | ■ ■ ■ ■ | 04       | ■ ■ ■ ■ |
| 28       | ■ ■ ■ ■ | 24       | ■ ■ ■ ■ | 28       | ■ ■ ■ ■ | 36       | ■ ■ ■ ■ | 21       | ■ ■ ■ ■ | 22       | ■ ■ ■ ■ | 34       | ■ ■ ■ ■ | 28       | ■ ■ ■ ■ | 2E       | ■ ■ ■ ■ |
| 44       | ■ ■ ■ ■ | 48       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ | 5A       | ■ ■ ■ ■ | 5A       | ■ ■ ■ ■ | 59       | ■ ■ ■ ■ | 5C       | ■ ■ ■ ■ | 48       | ■ ■ ■ ■ | 5F       | ■ ■ ■ ■ |
| 68       | ■ ■ ■ ■ | 7C       | ■ ■ ■ ■ | 78       | ■ ■ ■ ■ | 67       | ■ ■ ■ ■ | 67       | ■ ■ ■ ■ | 66       | ■ ■ ■ ■ | 60       | ■ ■ ■ ■ | 78       | ■ ■ ■ ■ | 6E       | ■ ■ ■ ■ |
| 9F       | ■ ■ ■ ■ | 80       | ■ ■ ■ ■ | 80       | ■ ■ ■ ■ | 80       | ■ ■ ■ ■ | 80       | ■ ■ ■ ■ | 80       | ■ ■ ■ ■ | 80       | ■ ■ ■ ■ | 88       | ■ ■ ■ ■ | 80       | ■ ■ ■ ■ |
| 00       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 0E       | ■ ■ ■ ■ | 04       | ■ ■ ■ ■ | 04       | ■ ■ ■ ■ | 0E       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 04       | ■ ■ ■ ■ | 04       | ■ ■ ■ ■ |
| 24       | ■ ■ ■ ■ | 2E       | ■ ■ ■ ■ | 3F       | ■ ■ ■ ■ | 3E       | ■ ■ ■ ■ | 2F       | ■ ■ ■ ■ | 2E       | ■ ■ ■ ■ | 3F       | ■ ■ ■ ■ | 2E       | ■ ■ ■ ■ | 24       | ■ ■ ■ ■ |
| 4E       | ■ ■ ■ ■ | 5F       | ■ ■ ■ ■ | 4E       | ■ ■ ■ ■ | 5F       | ■ ■ ■ ■ | 5F       | ■ ■ ■ ■ | 4E       | ■ ■ ■ ■ | 5F       | ■ ■ ■ ■ | 55       | ■ ■ ■ ■ | 55       | ■ ■ ■ ■ |
| 7F       | ■ ■ ■ ■ | 6E       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 7E       | ■ ■ ■ ■ | 6F       | ■ ■ ■ ■ | 6E       | ■ ■ ■ ■ | 7F       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 6E       | ■ ■ ■ ■ |
| 8E       | ■ ■ ■ ■ | 84       | ■ ■ ■ ■ | 80       | ■ ■ ■ ■ | 84       | ■ ■ ■ ■ | 84       | ■ ■ ■ ■ | 8E       | ■ ■ ■ ■ | 80       | ■ ■ ■ ■ | 84       | ■ ■ ■ ■ | 84       | ■ ■ ■ ■ |
| 04       | ■ ■ ■ ■ | 04       | ■ ■ ■ ■ | 1F       | ■ ■ ■ ■ | 08       | ■ ■ ■ ■ | 0A       | ■ ■ ■ ■ | 15       | ■ ■ ■ ■ | 1F       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 0E       | ■ ■ ■ ■ |
| 22       | ■ ■ ■ ■ | 28       | ■ ■ ■ ■ | 31       | ■ ■ ■ ■ | 2C       | ■ ■ ■ ■ | 35       | ■ ■ ■ ■ | 2A       | ■ ■ ■ ■ | 35       | ■ ■ ■ ■ | 3F       | ■ ■ ■ ■ | 3F       | ■ ■ ■ ■ |
| 5F       | ■ ■ ■ ■ | 5F       | ■ ■ ■ ■ | 51       | ■ ■ ■ ■ | 4A       | ■ ■ ■ ■ | 4A       | ■ ■ ■ ■ | 55       | ■ ■ ■ ■ | 5F       | ■ ■ ■ ■ | 5F       | ■ ■ ■ ■ | 58       | ■ ■ ■ ■ |
| 62       | ■ ■ ■ ■ | 68       | ■ ■ ■ ■ | 71       | ■ ■ ■ ■ | 78       | ■ ■ ■ ■ | 75       | ■ ■ ■ ■ | 6A       | ■ ■ ■ ■ | 75       | ■ ■ ■ ■ | 7C       | ■ ■ ■ ■ | 7F       | ■ ■ ■ ■ |
| 84       | ■ ■ ■ ■ | 84       | ■ ■ ■ ■ | 9F       | ■ ■ ■ ■ | 98       | ■ ■ ■ ■ | 8A       | ■ ■ ■ ■ | 95       | ■ ■ ■ ■ | 9F       | ■ ■ ■ ■ | 80       | ■ ■ ■ ■ | 8E       | ■ ■ ■ ■ |
| 00       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 0C       | ■ ■ ■ ■ | 15       | ■ ■ ■ ■ |          |         |          |         |
| 27       | ■ ■ ■ ■ | 3C       | ■ ■ ■ ■ | 20       | ■ ■ ■ ■ | 20       | ■ ■ ■ ■ | 20       | ■ ■ ■ ■ | 23       | ■ ■ ■ ■ | 2E       | ■ ■ ■ ■ |          |         |          |         |
| 4F       | ■ ■ ■ ■ | 5F       | ■ ■ ■ ■ | 40       | ■ ■ ■ ■ | 40       | ■ ■ ■ ■ | 5F       | ■ ■ ■ ■ | 5C       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ |          |         |          |         |
| 78       | ■ ■ ■ ■ | 63       | ■ ■ ■ ■ | 60       | ■ ■ ■ ■ | 67       | ■ ■ ■ ■ | 7F       | ■ ■ ■ ■ | 7C       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ |          |         |          |         |
| 9C       | ■ ■ ■ ■ | 87       | ■ ■ ■ ■ | 83       | ■ ■ ■ ■ | 9F       | ■ ■ ■ ■ | 9F       | ■ ■ ■ ■ | 9C       | ■ ■ ■ ■ | 84       | ■ ■ ■ ■ |          |         |          |         |

IDCS5091

### Foreign Characters

| HEX CODE |         | HEX CODE |         | HEX CODE |         | HEX CODE |         | HEX CODE |         | HEX CODE |         | HEX CODE |         | HEX CODE |         | HEX CODE |         |
|----------|---------|----------|---------|----------|---------|----------|---------|----------|---------|----------|---------|----------|---------|----------|---------|----------|---------|
| 1F       | ■ ■ ■ ■ | 1F       | ■ ■ ■ ■ | 01       | ■ ■ ■ ■ | 04       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 02       | ■ ■ ■ ■ | 08       | ■ ■ ■ ■ | 1F       | ■ ■ ■ ■ | 02       | ■ ■ ■ ■ |
| 21       | ■ ■ ■ ■ | 21       | ■ ■ ■ ■ | 22       | ■ ■ ■ ■ | 3F       | ■ ■ ■ ■ | 3F       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ | 49       | ■ ■ ■ ■ | 45       | ■ ■ ■ ■ | 3F       | ■ ■ ■ ■ |
| 5F       | ■ ■ ■ ■ | 46       | ■ ■ ■ ■ | 46       | ■ ■ ■ ■ | 51       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ | 46       | ■ ■ ■ ■ | 49       | ■ ■ ■ ■ | 45       | ■ ■ ■ ■ | 51       | ■ ■ ■ ■ |
| 62       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 6A       | ■ ■ ■ ■ | 61       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 6A       | ■ ■ ■ ■ | 6A       | ■ ■ ■ ■ | 67       | ■ ■ ■ ■ | 62       | ■ ■ ■ ■ |
| 84       | ■ ■ ■ ■ | 88       | ■ ■ ■ ■ | 82       | ■ ■ ■ ■ | 86       | ■ ■ ■ ■ | 9F       | ■ ■ ■ ■ | 92       | ■ ■ ■ ■ | 88       | ■ ■ ■ ■ | 8C       | ■ ■ ■ ■ | 8C       | ■ ■ ■ ■ |
| 08       | ■ ■ ■ ■ | 04       | ■ ■ ■ ■ | 0F       | ■ ■ ■ ■ | 08       | ■ ■ ■ ■ | 0F       | ■ ■ ■ ■ | 0A       | ■ ■ ■ ■ | 19       | ■ ■ ■ ■ | 0F       | ■ ■ ■ ■ | 01       | ■ ■ ■ ■ |
| 3F       | ■ ■ ■ ■ | 3F       | ■ ■ ■ ■ | 29       | ■ ■ ■ ■ | 2F       | ■ ■ ■ ■ | 21       | ■ ■ ■ ■ | 3F       | ■ ■ ■ ■ | 21       | ■ ■ ■ ■ | 29       | ■ ■ ■ ■ | 3E       | ■ ■ ■ ■ |
| 49       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ | 51       | ■ ■ ■ ■ | 52       | ■ ■ ■ ■ | 41       | ■ ■ ■ ■ | 4A       | ■ ■ ■ ■ | 59       | ■ ■ ■ ■ | 42       | ■ ■ ■ ■ | 42       | ■ ■ ■ ■ |
| 69       | ■ ■ ■ ■ | 7F       | ■ ■ ■ ■ | 62       | ■ ■ ■ ■ | 62       | ■ ■ ■ ■ | 61       | ■ ■ ■ ■ | 62       | ■ ■ ■ ■ | 62       | ■ ■ ■ ■ | 63       | ■ ■ ■ ■ | 7F       | ■ ■ ■ ■ |
| 92       | ■ ■ ■ ■ | 84       | ■ ■ ■ ■ | 8C       | ■ ■ ■ ■ | 82       | ■ ■ ■ ■ | 9F       | ■ ■ ■ ■ | 8C       | ■ ■ ■ ■ | 9C       | ■ ■ ■ ■ | 8C       | ■ ■ ■ ■ | 86       | ■ ■ ■ ■ |
| 15       | ■ ■ ■ ■ | 0E       | ■ ■ ■ ■ | 08       | ■ ■ ■ ■ | 04       | ■ ■ ■ ■ | 0E       | ■ ■ ■ ■ | 1F       | ■ ■ ■ ■ | 04       | ■ ■ ■ ■ | 04       | ■ ■ ■ ■ | 04       | ■ ■ ■ ■ |
| 35       | ■ ■ ■ ■ | 20       | ■ ■ ■ ■ | 28       | ■ ■ ■ ■ | 3F       | ■ ■ ■ ■ | 20       | ■ ■ ■ ■ | 21       | ■ ■ ■ ■ | 3E       | ■ ■ ■ ■ | 24       | ■ ■ ■ ■ | 22       | ■ ■ ■ ■ |
| 55       | ■ ■ ■ ■ | 5F       | ■ ■ ■ ■ | 4C       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ | 40       | ■ ■ ■ ■ | 4A       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ | 44       | ■ ■ ■ ■ | 51       | ■ ■ ■ ■ |
| 62       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 6A       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 60       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 6E       | ■ ■ ■ ■ | 68       | ■ ■ ■ ■ | 71       | ■ ■ ■ ■ |
| 8C       | ■ ■ ■ ■ | 98       | ■ ■ ■ ■ | 90       | ■ ■ ■ ■ | 98       | ■ ■ ■ ■ | 9F       | ■ ■ ■ ■ | 9A       | ■ ■ ■ ■ | 95       | ■ ■ ■ ■ | 90       | ■ ■ ■ ■ | 91       | ■ ■ ■ ■ |
| 10       | ■ ■ ■ ■ | 1F       | ■ ■ ■ ■ | 0E       | ■ ■ ■ ■ | 04       | ■ ■ ■ ■ | 01       | ■ ■ ■ ■ | 1F       | ■ ■ ■ ■ | 1E       | ■ ■ ■ ■ | 1F       | ■ ■ ■ ■ | 0E       | ■ ■ ■ ■ |
| 3F       | ■ ■ ■ ■ | 21       | ■ ■ ■ ■ | 20       | ■ ■ ■ ■ | 28       | ■ ■ ■ ■ | 21       | ■ ■ ■ ■ | 28       | ■ ■ ■ ■ | 22       | ■ ■ ■ ■ | 21       | ■ ■ ■ ■ | 20       | ■ ■ ■ ■ |
| 50       | ■ ■ ■ ■ | 41       | ■ ■ ■ ■ | 4E       | ■ ■ ■ ■ | 51       | ■ ■ ■ ■ | 4A       | ■ ■ ■ ■ | 5F       | ■ ■ ■ ■ | 42       | ■ ■ ■ ■ | 5F       | ■ ■ ■ ■ | 5F       | ■ ■ ■ ■ |
| 70       | ■ ■ ■ ■ | 62       | ■ ■ ■ ■ | 60       | ■ ■ ■ ■ | 7F       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 68       | ■ ■ ■ ■ | 62       | ■ ■ ■ ■ | 61       | ■ ■ ■ ■ | 61       | ■ ■ ■ ■ |
| 8F       | ■ ■ ■ ■ | 8C       | ■ ■ ■ ■ | 8F       | ■ ■ ■ ■ | 81       | ■ ■ ■ ■ | 8A       | ■ ■ ■ ■ | 87       | ■ ■ ■ ■ | 9F       | ■ ■ ■ ■ | 9F       | ■ ■ ■ ■ | 8E       | ■ ■ ■ ■ |
| 12       | ■ ■ ■ ■ | 04       | ■ ■ ■ ■ | 1E       | ■ ■ ■ ■ | 0F       | ■ ■ ■ ■ | 0F       | ■ ■ ■ ■ | 0F       | ■ ■ ■ ■ | 0F       | ■ ■ ■ ■ | 00       | ■ ■ ■ ■ | 08       | ■ ■ ■ ■ |
| 32       | ■ ■ ■ ■ | 34       | ■ ■ ■ ■ | 25       | ■ ■ ■ ■ | 34       | ■ ■ ■ ■ | 30       | ■ ■ ■ ■ | 33       | ■ ■ ■ ■ | 34       | ■ ■ ■ ■ | 2A       | ■ ■ ■ ■ | 24       | ■ ■ ■ ■ |
| 52       | ■ ■ ■ ■ | 54       | ■ ■ ■ ■ | 4F       | ■ ■ ■ ■ | 5F       | ■ ■ ■ ■ | 4F       | ■ ■ ■ ■ | 55       | ■ ■ ■ ■ | 57       | ■ ■ ■ ■ | 5F       | ■ ■ ■ ■ | 4E       | ■ ■ ■ ■ |
| 64       | ■ ■ ■ ■ | 75       | ■ ■ ■ ■ | 74       | ■ ■ ■ ■ | 74       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 79       | ■ ■ ■ ■ | 74       | ■ ■ ■ ■ | 74       | ■ ■ ■ ■ | 72       | ■ ■ ■ ■ |
| 88       | ■ ■ ■ ■ | 96       | ■ ■ ■ ■ | 8F       | ■ ■ ■ ■ | 97       | ■ ■ ■ ■ | 98       | ■ ■ ■ ■ | 9E       | ■ ■ ■ ■ | 8F       | ■ ■ ■ ■ | 88       | ■ ■ ■ ■ | 8F       | ■ ■ ■ ■ |
| 0A       | ■ ■ ■ ■ | 02       | ■ ■ ■ ■ | 04       | ■ ■ ■ ■ | 0A       | ■ ■ ■ ■ | 08       | ■ ■ ■ ■ | 02       | ■ ■ ■ ■ | 04       | ■ ■ ■ ■ |          |         |          |         |
| 2E       | ■ ■ ■ ■ | 24       | ■ ■ ■ ■ | 2A       | ■ ■ ■ ■ | 24       | ■ ■ ■ ■ | 24       | ■ ■ ■ ■ | 24       | ■ ■ ■ ■ | 2A       | ■ ■ ■ ■ |          |         |          |         |
| 51       | ■ ■ ■ ■ | 4C       | ■ ■ ■ ■ | 4E       | ■ ■ ■ ■ | 52       | ■ ■ ■ ■ | 51       | ■ ■ ■ ■ | 51       | ■ ■ ■ ■ | 51       | ■ ■ ■ ■ |          |         |          |         |
| 7F       | ■ ■ ■ ■ | 64       | ■ ■ ■ ■ | 71       | ■ ■ ■ ■ | 7A       | ■ ■ ■ ■ | 71       | ■ ■ ■ ■ | 71       | ■ ■ ■ ■ | 71       | ■ ■ ■ ■ |          |         |          |         |
| 91       | ■ ■ ■ ■ | 8E       | ■ ■ ■ ■ | 8E       | ■ ■ ■ ■ | 96       | ■ ■ ■ ■ | 8E       | ■ ■ ■ ■ | 8E       | ■ ■ ■ ■ | 8E       | ■ ■ ■ ■ |          |         |          |         |

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\*CAUTION: No more than 128 LEDs "on" at one time at 100% brightness.

Revision History: 2006-01-23

Previous Version: 2005-01-10

| Page | Subjects (major changes since last revision) | Date of change |
|------|--|----------------|
| all  | Lead free device                             | 2006-01-23     |
|      |  |                |
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- <sup>1)</sup> A critical component is a component used in a life-support device or system whose failure can reasonably be expected to cause the failure of that life-support device or system, or to affect its safety or the effectiveness of that device or system.
- <sup>2)</sup> Life support devices or systems are intended (a) to be implanted in the human body, or (b) to support and/or maintain and sustain human life. If they fail, it is reasonable to assume that the health and the life of the user may be endangered.