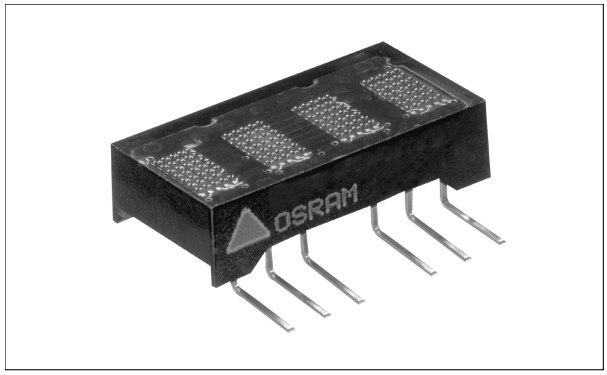
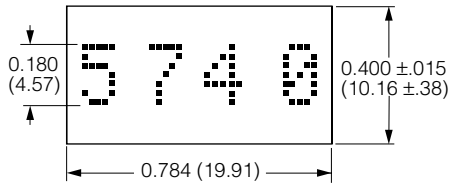
# OSRAM

## STANDARD RED SCE5740
## YELLOW SCE5741
## HIGH EFFICIENCY RED SCE5742
## GREEN SCE5743
## HIGH EFFICIENCY GREEN SCE5744
## ORANGE SCE5745

### 0.180" 4-Character 5 x 7 Dot Matrix Serial Input Dot Addressable Intelligent Display® Devices




Dimensions in Inches (mm)




**ALSO AVAILABLE WITH OPTIONS**
**(see pages 14 and 15)**

- **SCE574xP-SIP**
- **SCE574xQ-SIP with right angle bends**

**FEATURES**

- **Four 0.180" (4.57 mm) 5 x 7 Dot Matrix Characters in Red, Yellow, High Efficiency Red, Green, High Efficiency Green, Orange**
- **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**
- **Wide Viewing Angle, X Axis ±55°, Y Axis ±55°**

**ATTRIBUTES**

- **140 Bit RAM for User Defined Characters**
- **Eight Dimming Levels plus eight fine dimming levels.**
- **Power Down Model (<250 mW)**
- **Hardware/Software Clear Functions**
- **External Clock-SCE574x only**

**DESCRIPTION**

The SCE574x is a four digit, dot addressable 5 x 7 dot matrix, serial input, alphanumeric Intelligent Display device. The four digits are packaged in a rugged, high quality, optically transparent, plastic 14 pin DIP with 0.1" pin spacing.

The SCE574xP is a SIP version of SCE574x. The SCE574xQ is also a SIP version of the SCE574x but the leads are at right angles to the package so that the part can be mounted vertically. The SIP version parts have only 7 pins. The SIP parts do not have the option of using an external clock. All the electrical descriptions for the SCE574x apply to the SIP versions except the allusions to the external clock.

The on-Board CMOS has a 140 bit RAM, one bit associated with one LED, each to generate User Defined Characters. In Power Down Mode, quiescent current is <50 μA.

The SCE574x 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 SCE574x 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 avionic equipment.

(Description continued on next page)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**DESCRIPTION** (continued)

A divide by 16 prescalar is built into the part and can be accessed by software to reduce the multiplex frequency if a high speed external clock is used.

**Maximum Ratings**

DC Supply Voltage ..... –0.5 to +7.0 Vdc
Input Voltage Levels Relative
to Ground ..... –0.5 to $V_{CC}$ +0.5 Vdc
Operating Temperature ..... –40°C to +85°C
Storage Temperature ..... –40°C to +100°C
Maximum Solder Temperature 0.063"
below Seating Plane, t<5.0 s ..... 260°C
Relative Humidity at 85°C ..... 85%
Maximum Number of LEDs at 100% Brightness ..... 64
Maximum Power Dissipation ..... 0.6 W
ESD (100 pF, 1.5 kW) ..... 2.0 kV
Maximum Input Current ..... 130 mA

**Electrical Characteristics** (over operating temperature)

| Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|
| $V_{CC}$ | 4.5 | 5.0 | 5.5 | V | — |
| $I_{CC}$ (Power Down)[1][2] | — | — | 50 | µA | $V_{CC}$=5.0 V, all inputs=0 V or $V_{CC}$ |
| $I_{CC}$ 4 digits 20 dots/character[3] | 90 | 115 | 130 | mA | $V_{CC}$=5.0 V, "#" displayed in all 4 digits at 100% brightness at 25°C |
| $I_{IL}$ Input current | — | — | –10 | µA | $V_{CC}$=5.0 V, $V_{IN}$=0 (all inputs) |
| $I_{IH}$ Input current | _ | — | 10 | µA | $V_{CC}$=$V_{IN}$=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 |
| Row Multiplex Rate | 375 | 768 | 1086 | Hz | — |
| $\theta_{JC\text{-}pin}$ | — | — | 45 | °C/W | — |

Notes:
1) Unused inputs must be tied high.
2) External oscillator must be stopped.
3) Peak current $^5/_3$ x $I_{CC}$.

**Electrical Characteristics for SCE574x only**

| Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|
| $I_{OH}$ (CLK I/O) | — | –28 | — | mA | $V_{CC}$=4.5 V, $V_{OH}$=2.4 V |
| $I_{OL}$ (CLK I/O) | — | 23 | — | mA | $V_{CC}$=4.5 V, $V_{OL}$=0.4 V |
| $F_{ext}$ External Clock Input Frequency | 120 | — | 3 | MHz | $V_{CC}$=5.0 V, $\overline{\text{CLKSEL}}$=0 |
| $F_{osc}$ Internal Clock Input Frequency | 120 | — | 347 | kHz | $V_{CC}$=5.0 V, $\overline{\text{CLKSEL}}$=1 |
| 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 |

**Optical Characteristics at 25°C**
($V_{CC}$=5.0 V at 100% brightness level, viewing angle: X axis ±55°, Y axis ±65°)

**Red SCE5740**

| Description | Sym. | Min. | Typ. | Units |
|---|---|---|---|---|
| Luminous Intensity | $I_V$ | 30 | 60 | µcd/dot |
| Peak Wavelength | $\lambda_{peak}$ | — | 655 | nm |
| Dominant Wavelength | $\lambda_{dom}$ | — | 639 | nm |

**Yellow SCE5741**

| Description | Sym. | Min. | Typ. | Units |
|---|---|---|---|---|
| Luminous Intensity | $I_V$ | 60 | 150 | µcd/dot |
| Peak Wavelength | $\lambda_{peak}$ | — | 583 | nm |
| Dominant Wavelength | $\lambda_{dom}$ | — | 585 | nm |

**High Efficiency Red SCE5742**

| Description | Sym. | Min. | Typ. | Units |
|---|---|---|---|---|
| Luminous Intensity | $I_V$ | 60 | 150 | µcd/dot |
| Peak Wavelength | $\lambda_{peak}$ | — | 630 | nm |
| Dominant Wavelength | $\lambda_{dom}$ | — | 620 | nm |

**Green SCE5743**

| Description | Sym. | Min. | Typ. | Units |
|---|---|---|---|---|
| Luminous Intensity | $I_V$ | 60 | 150 | µcd/dot |
| Peak Wavelength | $\lambda_{peak}$ | — | 565 | nm |
| Dominant Wavelength | $\lambda_{dom}$ | — | 573 | nm |

**High Efficiency Green SCE5744**

| Description | Sym. | Min. | Typ. | Units |
|---|---|---|---|---|
| Luminous Intensity | $I_V$ | 80 | 180 | µcd/dot |
| Peak Wavelength | $\lambda_{peak}$ | — | 568 | nm |
| Dominant Wavelength | $\lambda_{dom}$ | — | 574 | nm |

**Orange SCE5745**

| Description | Sym. | Min. | Typ. | Units |
|---|---|---|---|---|
| Luminous Intensity | $I_V$ | 60 | 150 | µcd/dot |
| Peak Wavelength | $\lambda_{peak}$ | — | 605 | nm |
| Dominant Wavelength | $\lambda_{dom}$ | — | 610 | nm |

Notes:

1. Dot to dot intensity matching at 100% brightness is 1.8:1.
2. Displays within a given intensity category have an intensity matching of 1.5:1 (max.)

**Switching Specifications**
(over operating temperature range and $V_{CC}$=4.5 V to 5.5 V)

| Symbol | Description | Min. | Units |
|---|---|---|---|
| $T_{RC}$ | Reset Active Time | 600 | ns |
| $T_{LDS}$ | Load Setup Time | 50 | ns |
| $T_{DS}$ | Data Setup Time | 50 | ns |
| $T_{SDCLK}$ | Clock Period | 200 | ns |
| $T_{SDCW}$ | Clock Width | 70 | ns |
| $T_{LDH}$ | Load Hold Time | 0 | ns |
| $T_{DH}$ | Data Hold Time | 25 | ns |
| $T_{WR}$ | Total Write Time | 2.2 | µs |
| $T_{BL}$ | Time Between Loads | 600 | ns |

Note:

$T_{SDCW}$ is the minimum time the SDCLK may be low or high. The SDCLK period must be a minimum of 200 ns.

**Figure 1. Timing Diagram—Data Write Cycle**

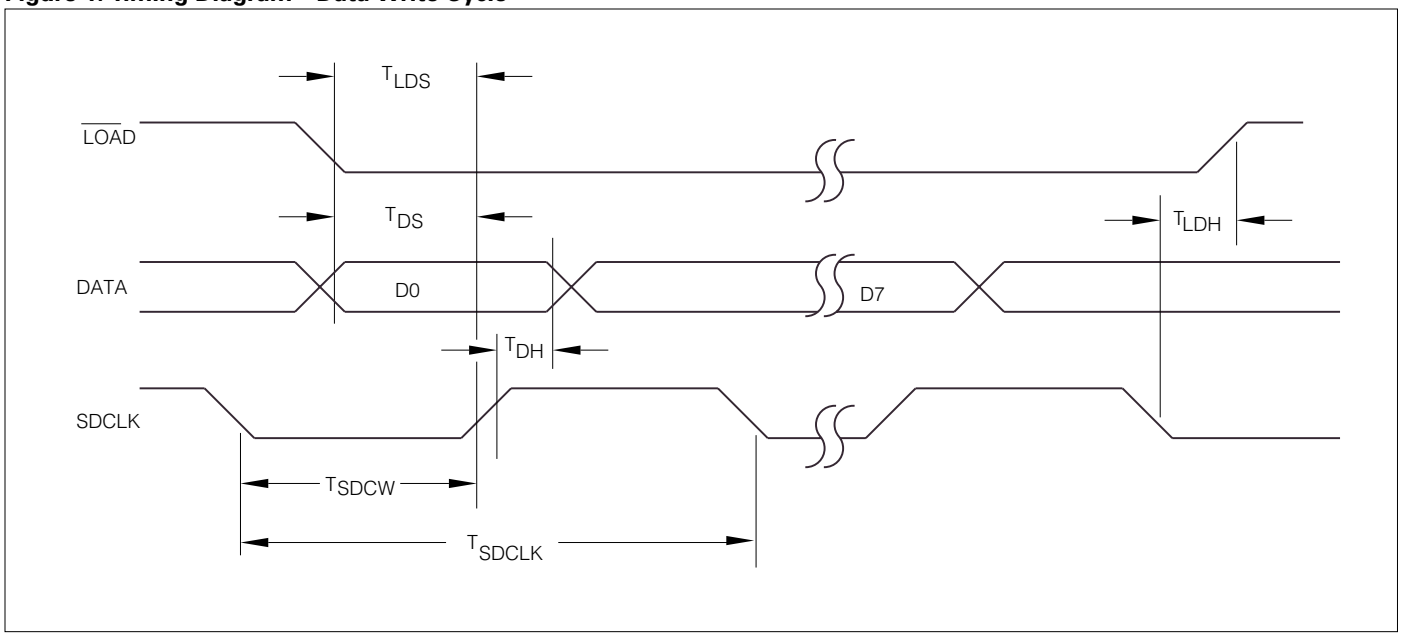
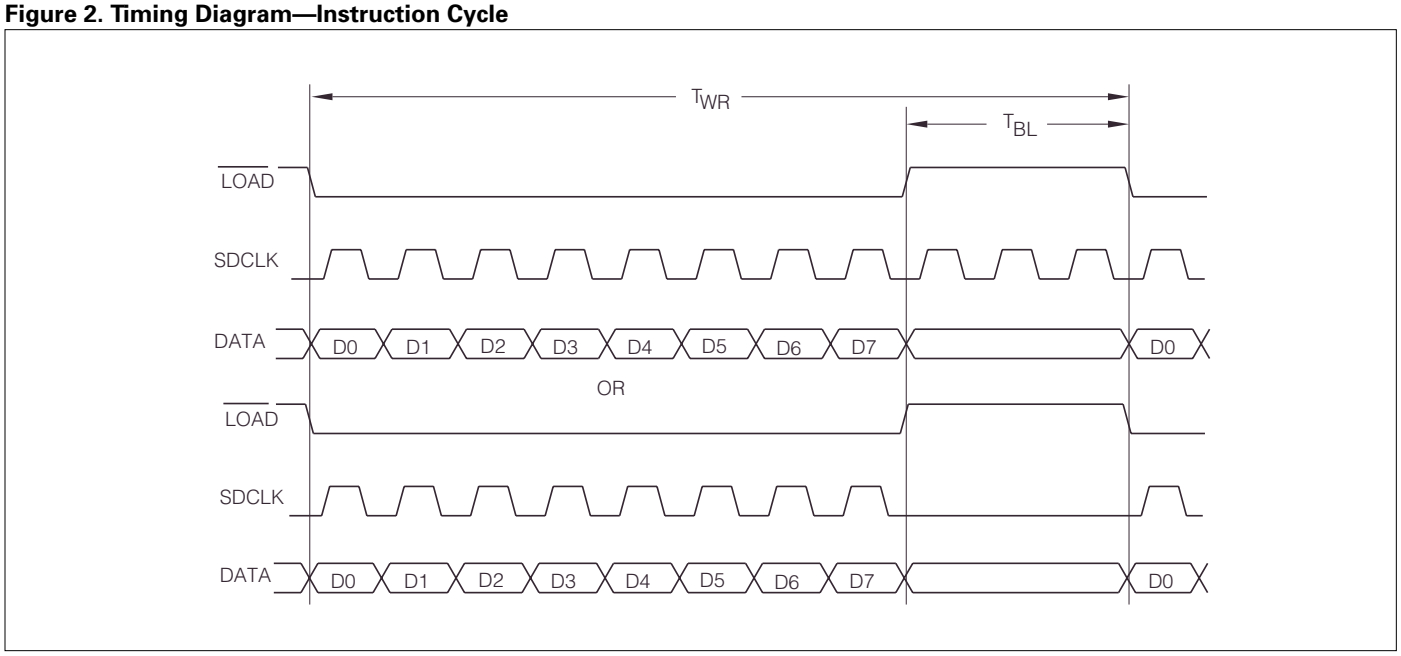



**Figure 2. Timing Diagram—Instruction Cycle**



**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 |
| Row 5 | 0 | 0 | 1 | 0 | 0 |
| Row 6 | 0 | 0 | 1 | 0 | 0 |

**Column Data Ranges**

| | | | |
|---|---|---|---|
| **Row 0** | 00H to 1FH | **Row 4** | 00H to LFH |
| **Row 1** | 00H to LFH | **Row 5** | 00H to LFH |
| **Row 2** | 00H to LFH | **Row 6** | 00H to LFH |
| **Row 3** | 00H to LFH | | |

**Input/Output Circuits**

Figures 3 and 4 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.

**Figure 3. Inputs**

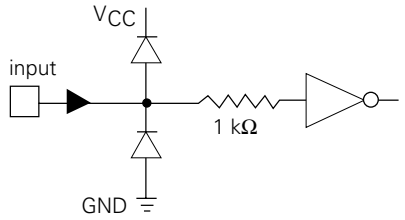



**Figure 4. Clock I/O (SCE574x only).**

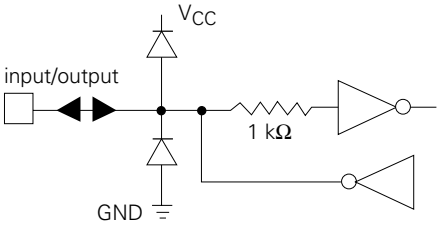
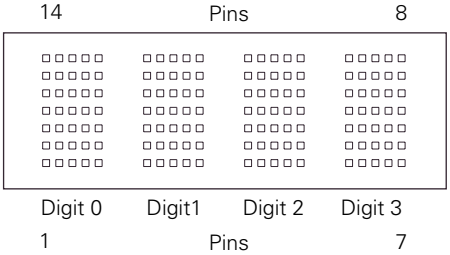


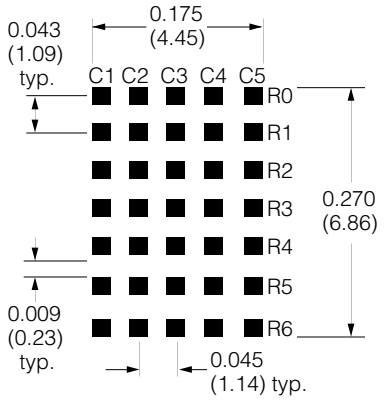

**Figure 5. Top View**




**Pin Assignment**

| Pin | Function | Pin | Function |
|---|---|---|---|
| 1 | $V_{CC}$ | 6 | $\overline{\text{RESET}}$ |
| 2 | $\overline{\text{Load}}$ | 7 | GROUND |
| 3 | $\overline{\text{Data}}$ | 8 | CLK I/O |
| 4 | no connection | 9 –13 | No Pins |
| 5 | $\overline{\text{SDCLK}}$ | 14 | CLK SELECT |

**Figure 6. Dot Matrix Format**

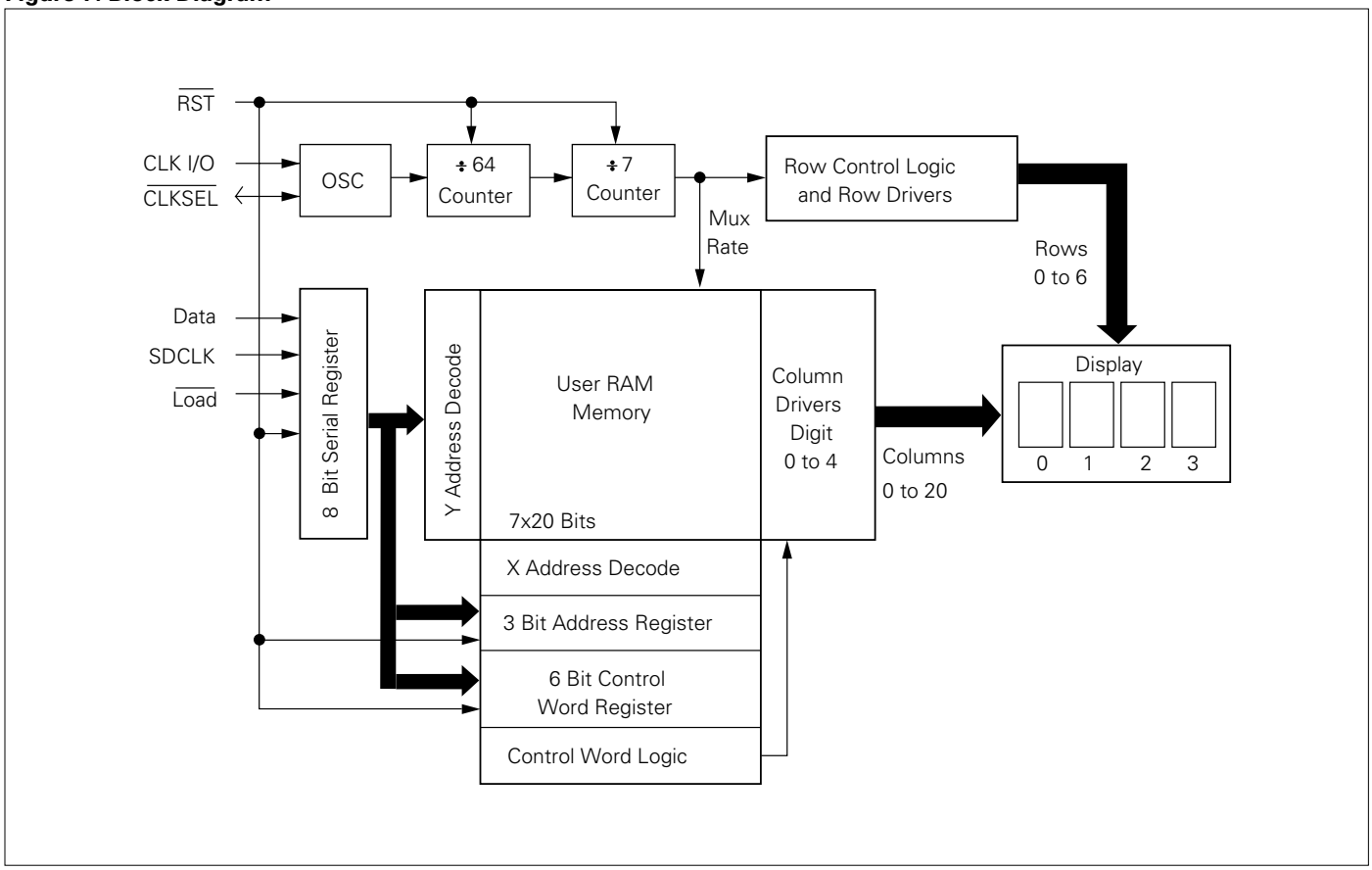



Dimensions in inches (mm)
Tolerance:.XXX ±.010 (.25)

**Pin Definitions**

| Pin | Function | Definitions |
|---|---|---|
| 1 | $V_{CC}$ | Power supply |
| 2 | $\overline{\text{LOAD}}$ | Low input enables data clocking into 8-bit serial shift register. When load goes high, the contents of 8-bit serial shift register will be decoded. |
| 3 | DATA | Serial input data |
| 4 | N/C | — |
| 5 | SDCLK | For loading data into the 8-bit serial data register |
| 6 | $\overline{\text{RST}}$ | Asynchronous input, when low clears the multiplex counter, address register, control word register, user RAM and data register. Control word register is set to 100% brightness. The display will be blank. |
| 7 | GND | Supply ground |
| 8 | CLK I/O | Outputs Master Clock or inputs External Clock |
| 9–13 | No Pins | — |
| 14 | CLKSEL | High=Internal Clock (Master) Low=External Clock (Slave) |

**Figure 7. Block Diagram**




**Operation of the SCE574x**

The SCE574x display consists of a CMOS IC containing control logic and drivers for four 5 x 7 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 serial data interface provides a highly efficient interconnection between the display and the mother board. The SCE574x requires only three lines as compared to 14 lines 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 7 shows the three functional areas of the IC. These include: the input serial data register and control logic, a 140 bits two port RAM, and an internal multiplexer/display driver.

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 8a. Figure 8b shows that each character consist of eight 8 bit words. The first word encodes the display character location and the succeeding seven bytes are row data. The row data represents the status (On, Off) of individual column LEDs. Figure 8c shows that each 8 bit word is formatted to represent Character Address, or Column Data.

Figure 8d shows the sequence for loading the bytes of data. Bringing the $\overline{\text{LOAD}}$ 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 $\overline{\text{LOAD}}$ 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.

**Figure 8. Loading Serial Character Data**

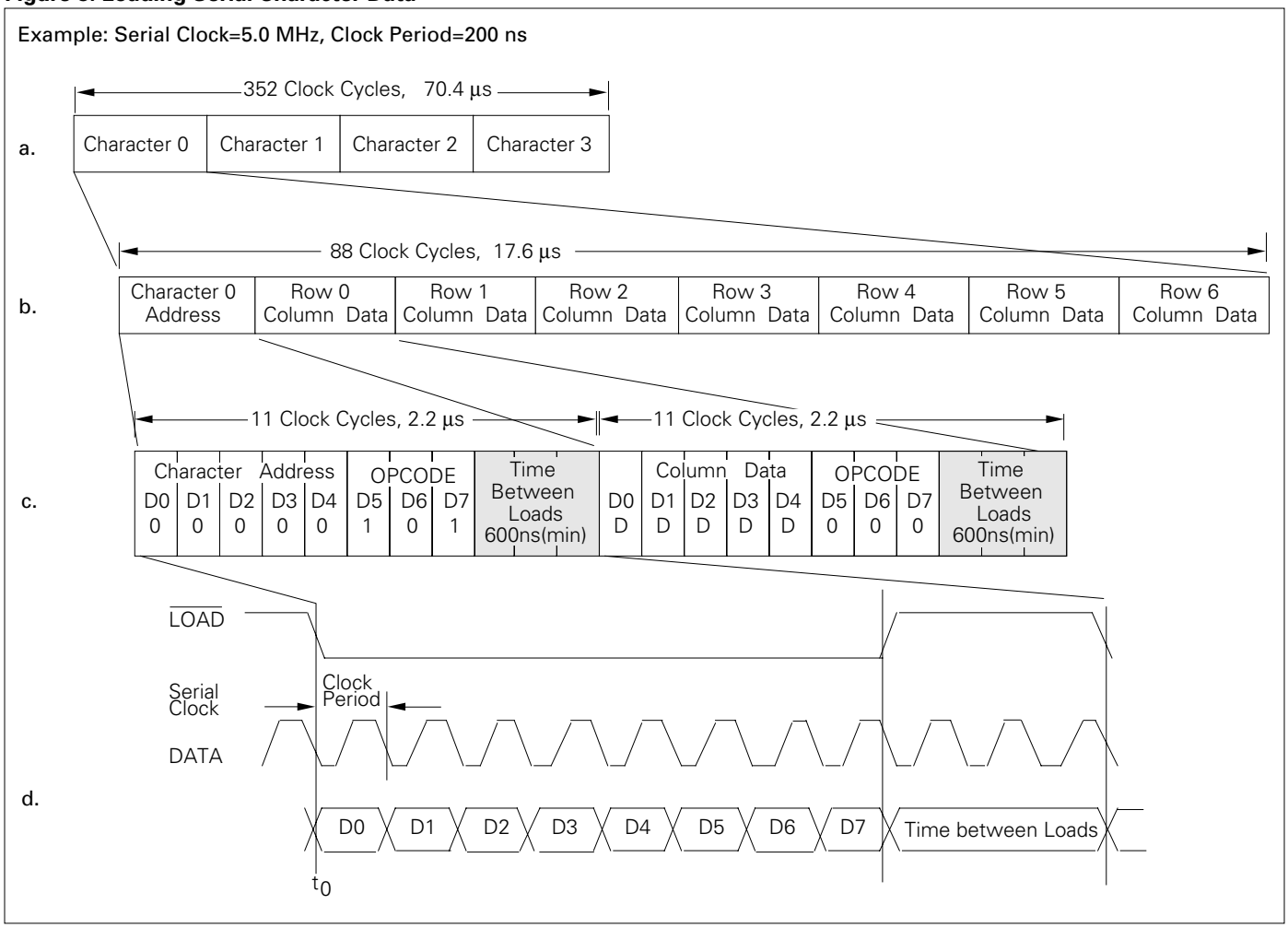



Table 1 shows the Row Address for the example character "D." Column data is written and read asynchronously from the 140 bit RAM. Once loaded the internal oscillator and character multiplexer reads the data from the RAM. These characters are row strobed with column data as shown in Figures 9 and 10. The character strobe rate is determined by the internal or user supplied external MUX Clock, the IC's counter and the prescaler.

**Figure 9. Row and Column Locations for a Character "D"**

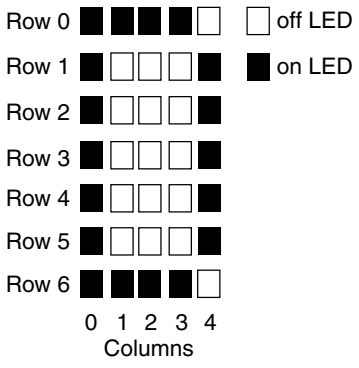
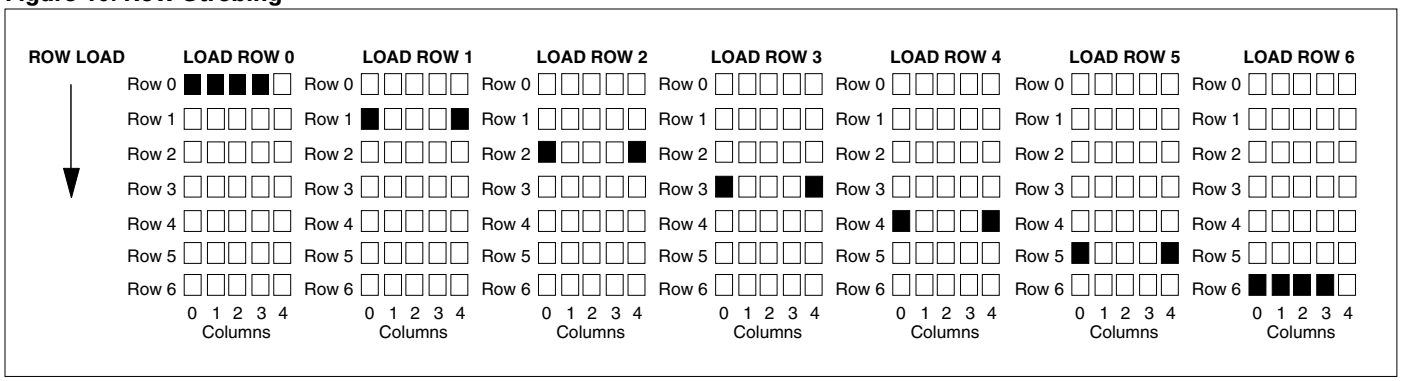



**Table 1. Character "D"**

| | Op code D7 D6 D5 | Column Data D4 C0 D3 C1 D2 C2 D1 C3 D0 C4 | Hex |
|---|---|---|---|
| Row 0 | 0 0 0 | 1 1 1 1 0 | 1E |
| Row 1 | 0 0 0 | 1 0 0 0 1 | 11 |
| Row 2 | 0 0 0 | 1 0 0 0 1 | 11 |
| Row 3 | 0 0 0 | 1 0 0 0 1 | 11 |
| Row 4 | 0 0 0 | 1 0 0 0 1 | 11 |
| Row 5 | 0 0 0 | 1 0 0 0 1 | 11 |
| Row 6 | 0 0 0 | 1 1 1 1 0 | 1E |

**Figure 10. 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 448 counter chain. This results in a typical strobe rate of 768 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 3 MHz.

When a high speed external clock is used the frequency can be further divided down by 16 by using the built in prescaler. In the control word format data bit D4 is set high (D4=1). It is not recommended to use the prescaler with the internal clock.

An asynchronous hardware Reset (pin 6) 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%.

The user can activate four Control functions. These include: LED Brightness Level, IC Power Down, Prescaler, or Display Clear. OPCODEs and six 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 2 and 3.

**Basic Instruction Set**

| Instruction | Opcode | Address/Data | | | | | Comments |
|---|---|---|---|---|---|---|---|
| LCD | 000 | D4 | D3 | D2 | D1 | D0 | Load Column Data |
| LDA | 101 | X | X | A2 | A1 | A0 | Load Digit Address |
| SCL | 110 | PS | B3 | B2 | B1 | B0 | Software Clear |
| LCWD | 111 | PS | B3 | B2 | B1 | B0 | Load Control Word Data |

**Control Word Register:**

The Control Word is a 5 bit write only register which controls the display attributes. Below are the truth tables which defines each bit in the Control Word Register and a description of their functions.

**Control Word Format**

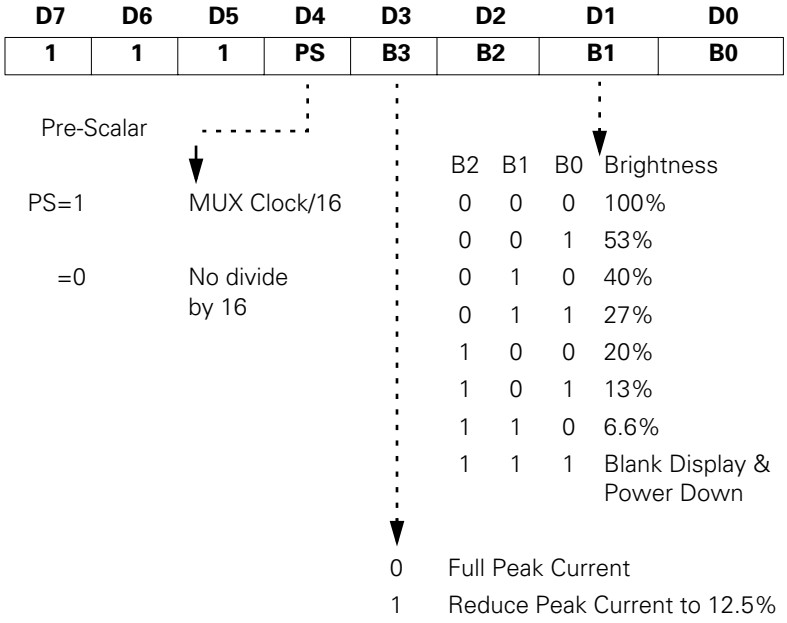



**Table 2. Load Character Address**

| Op code D7 | D6 | D5 | Character Address 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 |

**Table 3. Load Column Data**

| Op code D7 | D6 | D5 | Column Data D4 | D3 | D2 | D1 | D0 | Operation Load |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | C0 | C1 | C2 | C3 | C4 | Row 0 |
| 0 | 0 | 0 | C0 | C1 | C2 | C3 | C4 | Row 1 |
| 0 | 0 | 0 | C0 | C1 | C2 | C3 | C4 | Row 2 |
| 0 | 0 | 0 | C0 | C1 | C2 | C3 | C4 | Row 3 |
| 0 | 0 | 0 | C0 | C1 | C2 | C3 | C4 | Row 4 |
| 0 | 0 | 0 | C0 | C1 | C2 | C3 | C4 | Row 5 |
| 0 | 0 | 0 | C0 | C1 | C2 | C3 | C4 | Row 6 |

The user can select eight specific LED brightness levels (Table 4) by changing the peak current driving the LEDs. The peak current is varied by varying the ON time of the row drivers. Note that data line 3 is low (logic 0).

If dimming is required with finer control between 12.5% brightness and 0.0% brightness, data line 3 can be set high (logic 1). The 12.5% peak current is now the brightness reference (100%-E8) for further dimming and as shown in Table 5 eight levels of dimming are provided. For example the hex code EC in Table 5 will provide a brightness level 29% lower than the 12.5% brightness level.

**Table 4. Display Brightness**

| Op code | | | Control Word | | | | | Hex | Brightness Level |
|---|---|---|---|---|---|---|---|---|---|
| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | | |
| 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | E0 | 100% |
| 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | E1 | 53% |
| 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | E2 | 40% |
| 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | E3 | 27% |
| 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | E4 | 20% |
| 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | E5 | 13% |
| 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | E6 | 6.6% |
| 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | E7 | 0.0% |

**Table 5. Display Brightness**

| Op code | | | Control Word | | | | | Hex | Brightness Level |
|---|---|---|---|---|---|---|---|---|---|
| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | | |
| 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | E8 | 100% |
| 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | E9 | 53% |
| 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | EA | 40% |
| 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | EB | 27% |
| 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | EC | 20% |
| 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | ED | 13% |
| 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | EE | 6.6% |
| 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | EF | 0.0% |

The SCE574x offers a unique Display Power Down feature which reduces $I_{CC}$ to less than 50 µA. When $EF_{HEX}$ is loaded (Table 6) the display is set to 0% brightness. 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.

**Table 6. Power Down**

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

The Software Clear ($C0_{HEX}$), given in Table 7, 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.

**Table 7. Software Clear**

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

## Electrical and Mechanical Considerations

### Thermal Considerations

Optimum product performance can be had when the following electrical and mechanical recommendations are adopted. The IC is constructed in a high speed CMOS process, consequently 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 ground and power supply decoupling 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 µF and 0 µF 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, µF and 100 kΩ 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 SCE574x 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 SCE574x can be hand soldered with SN63 solder using a grounded iron set to 260°C.

Wave soldering is also possible following these conditions: Preheat 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 ±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 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.

An alternative to soldering and cleaning the display modules is to use sockets. Naturally, 14 pin DIP sockets .300" wide with .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.

## Optical Considerations

The 0.180" high character of the SCE574x gives readability up to five feet. Proper filter selection enhances readability over this distance.

Using filters emphasizes the contrast ratio between a lit LED and the character background. This will increase the discrimination of different characters. The only limitation is cost. Take into consideration the ambient lighting environment for the best cost/benefit ratio for filters.

Incandescent (with almost no green) or fluorescent (with almost no red) lights do not have the flat spectral response of sunlight. Plastic band-pass filters are an inexpensive and effective way to strengthen contrast ratios. The SCE5740 is a red display and should be used with long wavelength pass filter having a sharp cut-off in the 600 nm to 620 nm range. The SCE5742 is a high efficiency red display and should be used with long wavelength pass filter having a sharp cut-off in the 570 nm to 600 nm range. The SCE5744 is a high efficiency green display and should be used with long wavelength pass filter that peaks at 565 nm.

Additional contrast enhancement is gained by shading the displays. Plastic band-pass filters with built-in louvers offer the next step up in contrast improvement. Plastic filters can be improved further with anti-reflective coatings to reduce glare.

Optimal filter enhancements are gained by using circular polarized, anti-reflective, band-pass filters. The circular polarizing further enhances contrast by reducing the light that travels through the filter and reflects back off the display to less than 1%.

Several filter manufacturers supply quality filter materials. Some of them are: Panelgraphic Corporation, W. Caldwell, NJ; SGL Homalite, Wilmington, DE; 3M Company, Visual Products Division, St. Paul, MN; Polaroid Corporation, Polarizer Division, Cambridge, MA; Marks Polarized Corporation, Deer Park, NY, Hoya Optics, Inc., Fremont, CA.One last note on mounting filters: recessing displays and bezel assemblies is an inexpensive way to provide a shading effect in overhead lighting situations. Several Bezel manufacturers are: R.M.F. Products, Batavia, IL; Nobex Components, Griffith Plastic Corp., Burlingame, CA; Photo Chemical Products of California, Santa Monica, CA; I.E.E.-Atlas, Van Nuys, CA. The trade-off is fuzzy characters. Mounting the filters close to the display reduces this effect. Take care not to overheat the plastic filter by allowing for proper air flow.

### 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 $\overline{\text{SDCLK}}$ and $\overline{\text{LOAD}}$.

### 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) and the internal counters are reset.

**Figure 11. Display Interface to Siemens/Intel 8031 Microprocessor** (using serial port in mode 0)

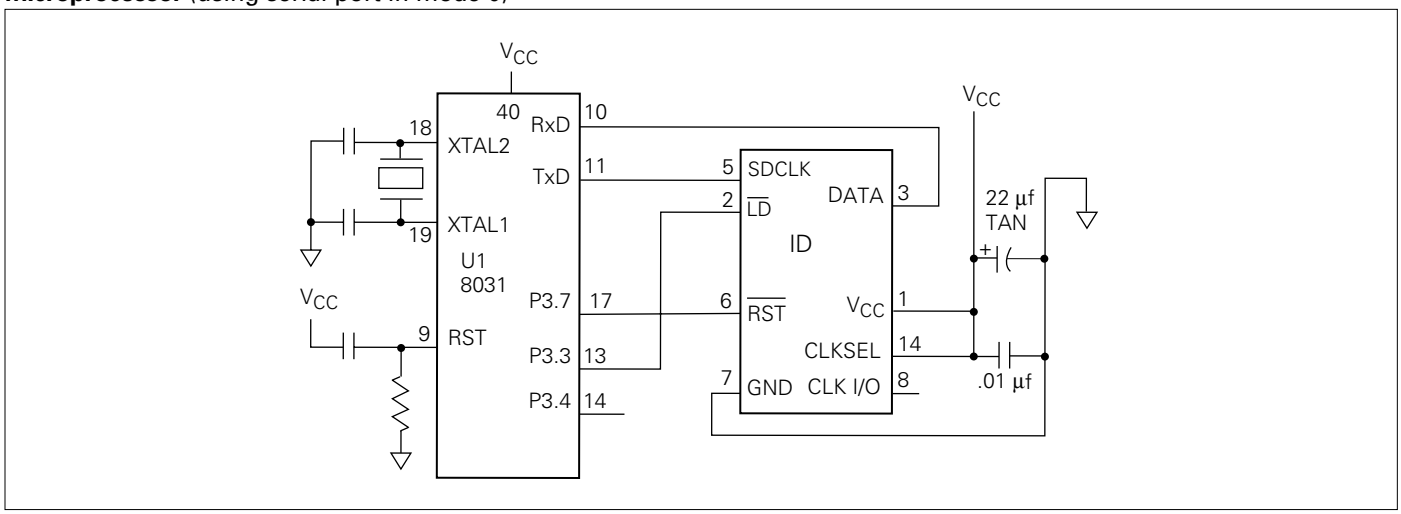



**Figure 12. Display Interface to Siemens/Intel 8031 Microprocessor** (using one bit of parallel port as serial port)

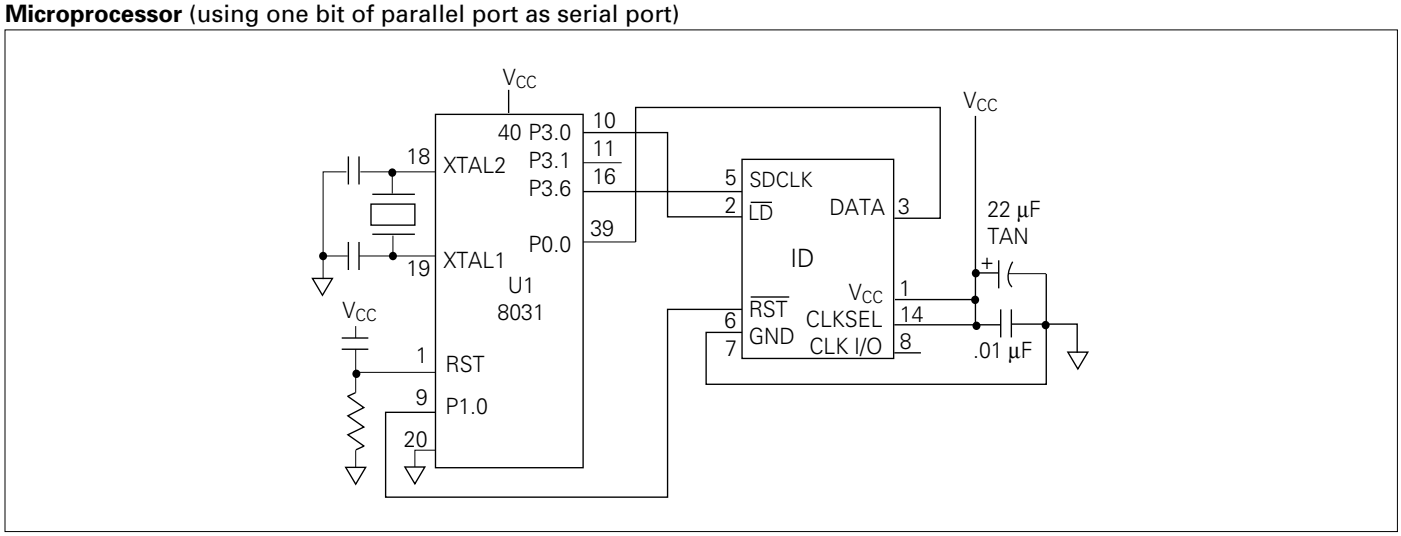



**Figure 13. Display Interface with Motorola 68HC05C4 Microprocessor** (using SPI port)

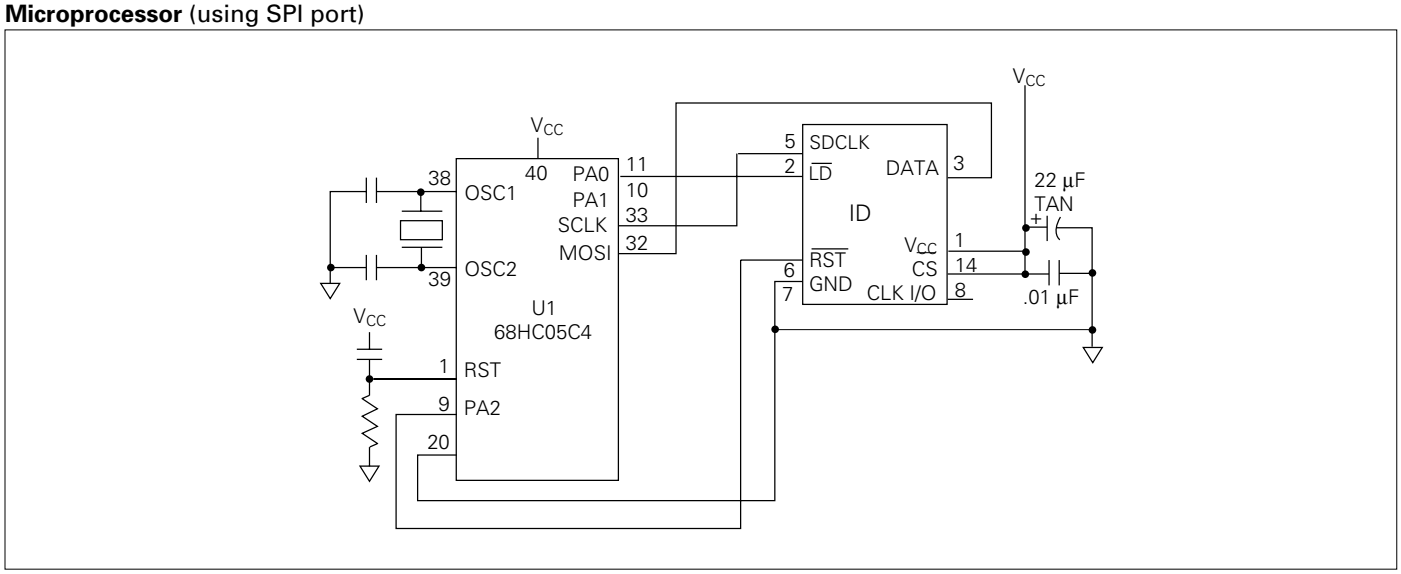
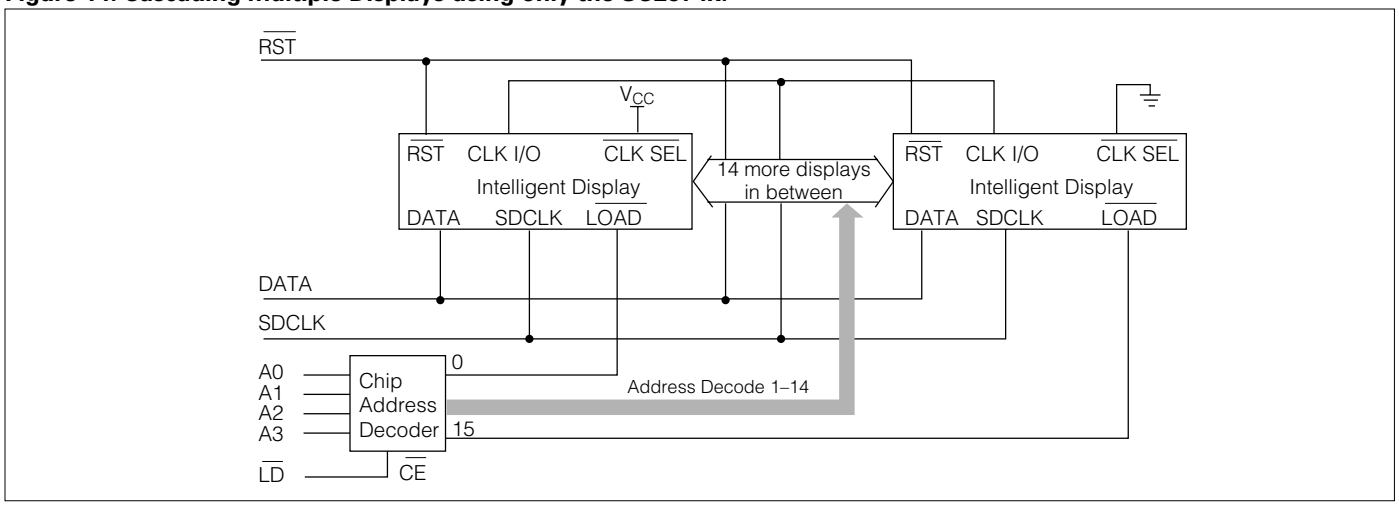


**Figure 14. Cascading Multiple Displays using only the SCE574x.**




Multiple displays can be cascaded using the $\overline{\text{CLK SEL}}$ and CLK I/O pins (Figure 14). The display designated as the MasterClock source should have its $\overline{\text{CLK SEL}}$ pin tied high and the slaves should have their $\overline{\text{CLK SEL}}$ 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 $\overline{\text{RST}}$ to synchronize all display counters.

### Loading Data into the Display

Use following procedure to load data into the display:

1. Power up the display.
2. Bring $\overline{\text{RST}}$ 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 Word "ABCD"

| 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 | 0 | 0 | 0 | 0 | 0 | 100% BRIGHTNESS |
| 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | DIGIT D0 SELECT |
| 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | ROW 0 (A) |
| 3 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | ROW 1 (A) |
| 4 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | ROW 2 (A) |
| 5 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | ROW 3 (A) |
| 6 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | ROW 4 (A) |
| 7 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | ROW 5 (A) |
| 8 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | ROW 6 (A) |
| 9 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | DIGIT D1 SELECT |
| 10 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | ROW 0 (B) |
| 11 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | ROW 1 (B) |
| 12 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | ROW 2 (B) |
| 13 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | ROW 3 (B) |
| 14 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | ROW 4 (B) |
| 15 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | ROW 5 (B) |
| 16 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | ROW 6 (B) |
| 17 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | DIGIT D2 SELECT |
| 18 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | ROW 0 (C) |
| 19 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | ROW 1 (C) |
| 20 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | ROW 2 (C) |
| 21 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | ROW 3 (C) |
| 22 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | ROW 4 (C) |
| 23 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | ROW 5 (C) |
| 24 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | ROW 6 (C) |
| 25 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | DIGIT D3 SELECT |
| 26 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | ROW 0 (D) |
| 27 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | ROW 1 (D) |
| 28 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | ROW 2 (D) |
| 29 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | ROW 3 (D) |
| 30 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | ROW 4 (D) |
| 31 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | ROW 5 (D) |
| 32 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | ROW 6 (D) |

**Figure 15. Detail Drawing of SCE574x**

Dimensions in Inches (mm)

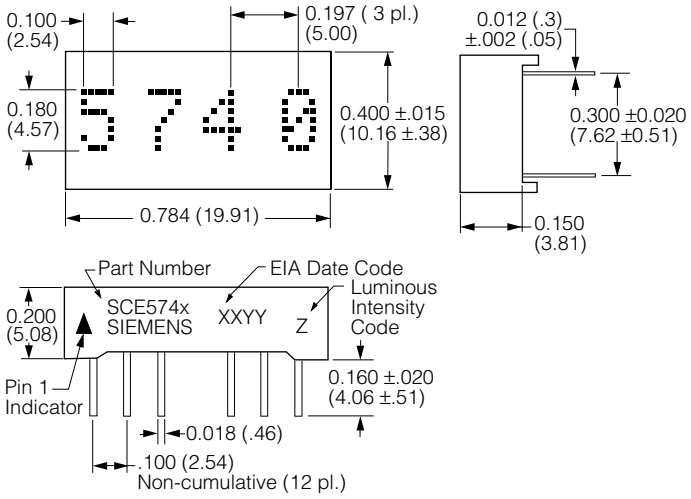



**Table 8. Pin Functions for SCE574x**

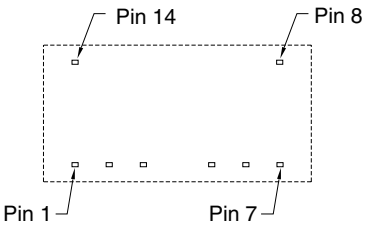
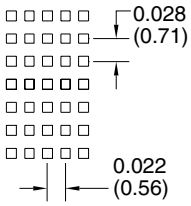
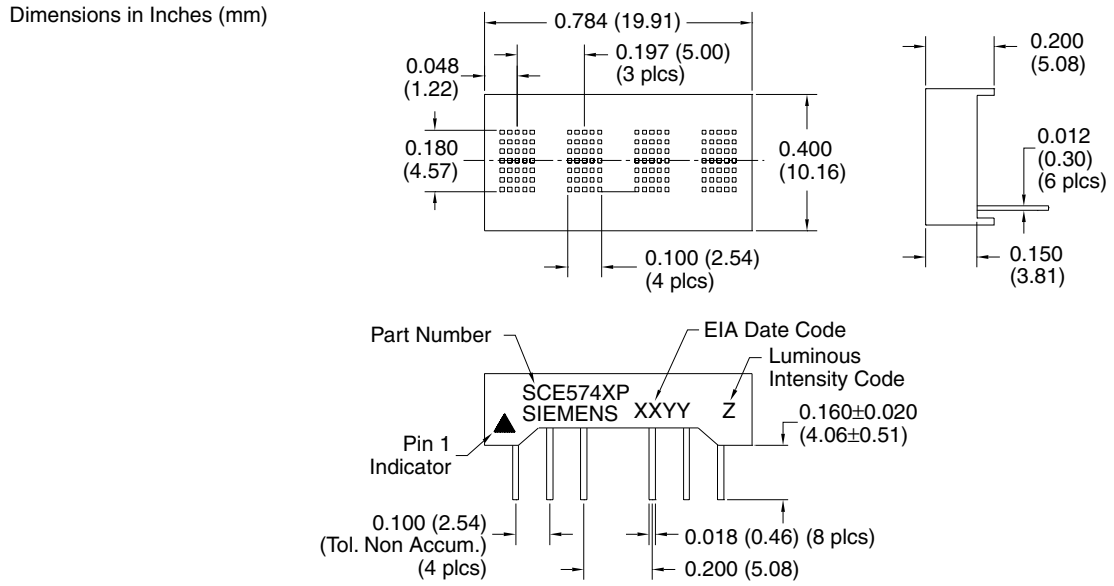
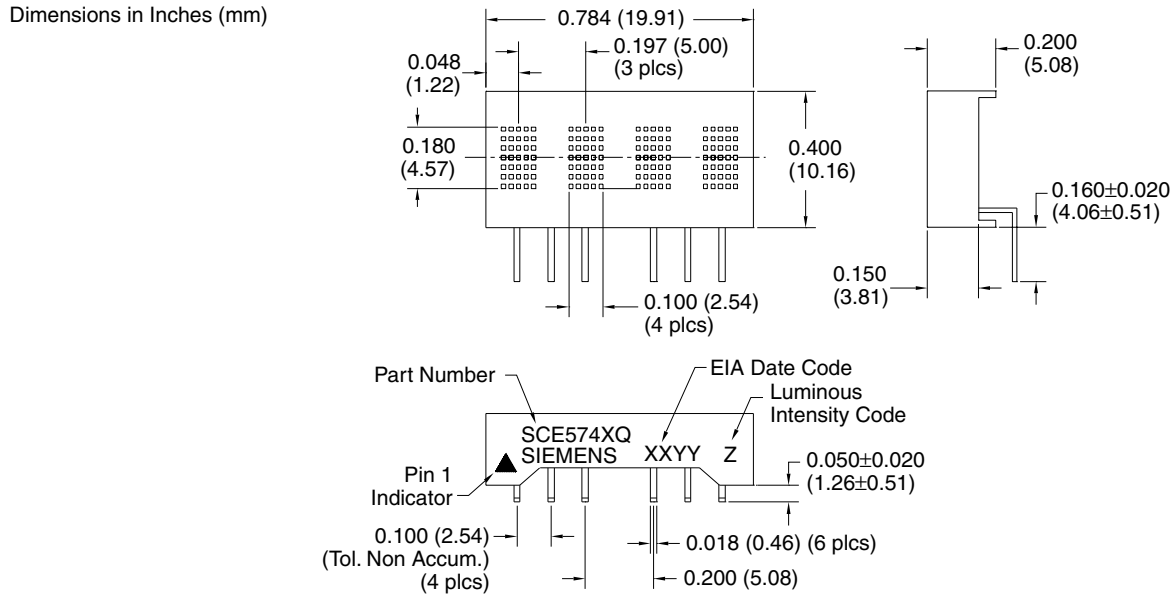
| Pin # | Function | Pin # | Function | Top View | Typical Character |
|---|---|---|---|---|---|
| 1 | $V_{CC}$ | 6 | $\overline{\text{RESET}}$ |  |  |
| 2 | $\overline{\text{Load}}$ | 7 | GROUND | | |
| 3 | $\overline{\text{Data}}$ | 8 | CLK I/O | | |
| 4 | No Pin | 9—13 | No Pins | | |
| 5 | $\overline{\text{SDCLK}}$ | 14 | CLK SELECT | | |

**Figure 16. Detail Drawing of SCE574xP (SIP configuration)**



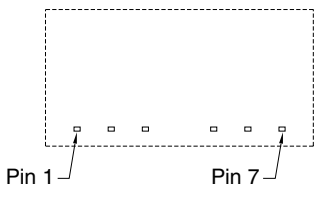
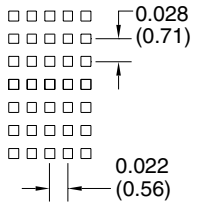

Note: Unless otherwise specified, tolerance on dimensions is ±.010 in. (0.25 mm)

**Figure 17. Detail Drawing of SCE574xQ (SIP configuration with right angle bend)**




Note: Unless otherwise specified, tolerance on dimensions is ±.010 in. (0.25 mm)

**Table 9. Pin Functions for SCE574xP and SCE574xQ**

| Pin # | Function | Top View | Typical Character |
|---|---|---|---|
| 1 | $V_{CC}$ |  |  |
| 2 | Load | | |
| 3 | Data | | |
| 4 | No Pin | | |
| 5 | SDCLK | | |
| 6 | RESET | | |
| 7 | GND | | |