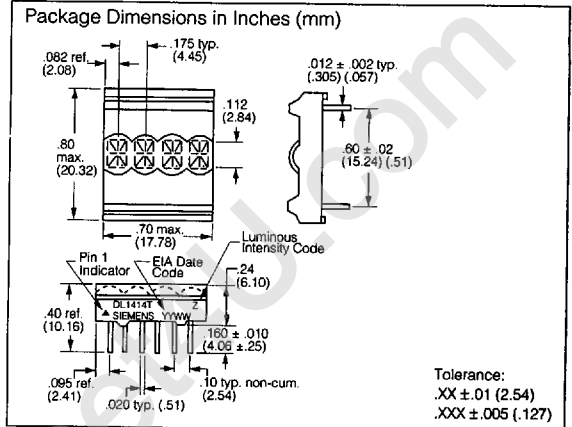
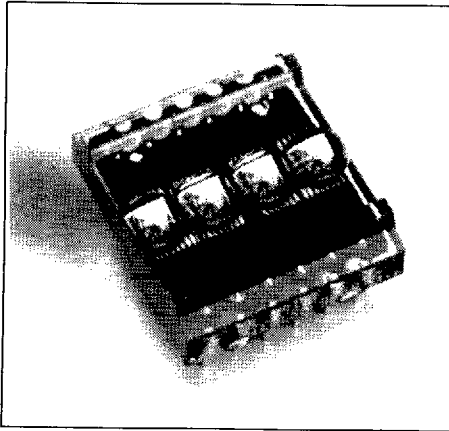


SIEMENS

DL1414T

.112" Red, 4-Character 16 Segment Plus Decimal Alphanumeric Intelligent Display® With Memory/Decoder/Driver



FEATURES

- 0.112" High, Magnified Monolithic Character
- Wide Viewing Angle, X Axis $\pm 40^\circ$, Y Axis $\pm 55^\circ$
- Close Vertical Row Spacing, .800" Centers
- Rugged Solid Plastic Encapsulated Package
- Fast Access Time, 110 ns at 25° C
- Compact Size for Hand Held Equipment
- Built-in Memory
- Built-in Character Generator
- Built-in Multiplex and LED Drive Circuitry
- Direct Access to Each Digit Independently and Asynchronously
- TTL Compatible, 5 Volt Power
- 17th Segment for Improved Punctuation Marks
- Low Power Consumption, Typically 10 mA per Character
- Intensity Coded for Display Uniformity
- Extended Operating Temperature Range: -40°C to +85°C
- End Stackable, 4 Character Package
- 100% Burned in and Tested
- Superior ESD Immunity

DESCRIPTION

The DL1414T is a four digit display module with 16 bar segments plus a decimal and a built-in CMOS integrated circuit.

The integrated circuit contains memory, ASCII character generator, LED multiplexing and drive circuitry. Inputs are TTL compatible. A single 5-volt power supply is required. Data entry is asynchronous and random access. A display system can be built using any number of DL1414Ts since each digit in any DL1414T can be addressed independently and will continue to display the character last stored until replaced by another.

Loading data into the DL1414T is straightforward. The desired data code (D0-D6 and digit address (A0, A1) is presented in parallel and held stable during a write cycle. Data entry may be asynchronous and in random order. (Digit 0 is defined as right hand digit with A1 = A0 = 0 = low).

System interconnection is very straightforward. The least significant two address bits (A0 A1) are normally connected to the like named inputs of all DL1414Ts in the system. Data lines are connected to all DL1414Ts directly and in parallel. Multiple DL1414T systems usually use an external one-of-N decoder chip. The "write" pulse is connected to the CE of the decoder. A 3-to-8 line decoder/multiplexer (74138) or a 4-to-16 line decoder/multiplexer (74154) are possible choices. All higher-order address bits (above A1) become inputs to the decoder.

All product are 100% burned-in and tested, then subjected to out-going AQL's of 0.25% for brightness matching, visual alignment and dimensions, 0.065% for electrical and functional.

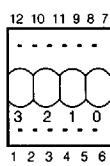
Important: Refer to Appnote 18, "Using and Handling Intelligent Displays." Since this is a CMOS device, normal precautions should be taken to avoid static damage.

See Appnote 15 for applications information.

Maximum Ratings

Supply Voltage, V_{CC} -0.5 to +7.0 Vdc
 Voltage, Any Pin Respect to GND -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, .063" (1.59mm) below Seating Plane, t<5 sec. 260°C
 Relative Humidity (non condensing) at 85°C 85%

Top View

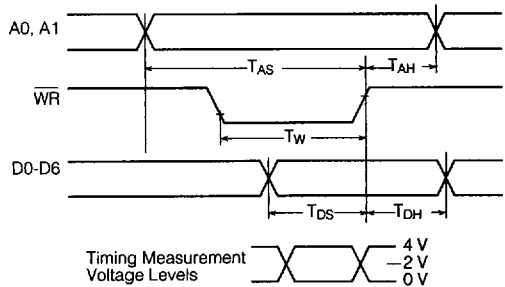


| Pin | Function |
|-----|---------------------|
| 1 | D5 Data Input |
| 2 | D4 Data Input |
| 3 | WR Write |
| 4 | A1 Digit Select |
| 5 | A0 Digit Select |
| 6 | V_{CC} |
| 7 | GND |
| 8 | D0 Data Input (LSB) |
| 9 | D1 Data Input |
| 10 | D2 Data Input |
| 11 | D3 Data Input |
| 12 | D6 Data Input (MSB) |

Optical Characteristics at 25°C

Spectral Peak Wavelength 660 nm typ.
 Viewing Angle (off normal axis)
 Horizontal ±40°
 Vertical ±55°
 Magnified Digit Size 0.112" X 0.085"
 Time Averaged Luminous Intensity (100% brightness, 0.40 mcd/digit min.
 8 Segments/Digit, $V_{CC} = 5$ V 0.75 mcd/digit typ.
 LED to LED Intensity Matching 1.8:1.0 max.
 Device to Device Intensity Matching (one bin) 1.5:1.0 max.
 Bin to Bin Intensity Matching 1.9:1.0 max.

Timing Characteristics — Write Cycle Waveforms



DC Characteristics

| Parameter | -40°C | | | +25°C | | | +85°C | | | Units | Conditions |
|--|-------|------|------|-------|------|------|-------|------|------|-------|---------------------------------------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. | Min. | Typ. | Max. | | |
| I_{CC} 4 Digits on 10 segments/digit | | 60 | 75 | | 50 | 65 | | 40 | 55 | mA | $V_{CC} = 5$ V |
| I_{CC} Blank | | 1.5 | 3.5 | | 1.0 | 2.7 | | 0.5 | 2.0 | mA | $V_{CC} = WR = 5$ V $V_{IN} = 0$ V |
| I_{IL} (all inputs) | | 60 | 120 | | 55 | 100 | | 30 | 70 | μA | $V_{IN} = 0.8$ V $V_{CC} = 5$ V |
| V_{IH} | 2.0 | | | 2.0 | | | 2.0 | | | V | $V_{CC} = 5$ V ± 0.5 V |
| V_{IL} | | | 0.8 | | | 0.8 | | | 0.8 | V | $V_{CC} = 5$ V ± 0.5 V |

AC Characteristics Guaranteed Minimum Timing Parameters at 4.5 V ≤ V_{CC} ≤ 5.5 V

| Parameter | Symbol | -40°C | +25°C (ns) | +85°C (ns) |
|----------------------------|-----------|-------|------------|------------|
| Address Set Up Time | T_{AS} | 10 | 10 | 10 |
| Address Hold Time | T_{AH} | 20 | 30 | 40 |
| Write Time | T_W | 60 | 70 | 90 |
| Data Set Up Time | T_{DS} | 20 | 30 | 50 |
| Data Hold Time | T_{DH} | 20 | 30 | 40 |
| Access Time ⁽²⁾ | T_{ACC} | 90 | 110 | 140 |

Notes: 1. Access time $T_{ACC} = T_{AS} + T_W + T_{DH}$
 2. Digit multiplex frequency may vary from 200 Hz to 800 KHz.



Loading Data State Table

| WR | A1 | A0 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Digit | | | |
|----|----|----|---------------------------|----|----|----|----|----|-------------------|-------|---|---|---|
| | | | | | | | | | | 3 | 2 | 1 | 0 |
| H | | | previously loaded display | | | | | | G | R | E | Y | |
| L | L | L | H | L | L | L | H | L | H | G | R | E | E |
| L | L | H | H | L | H | L | H | L | H | G | R | U | E |
| L | H | L | H | L | L | H | H | L | L | G | L | U | E |
| L | H | H | H | L | L | L | L | H | L | B | L | U | E |
| L | L | H | H | L | L | L | H | L | H | B | L | E | E |
| L | L | L | H | L | H | L | H | H | H | B | L | E | W |
| L | X | X | see character code | | | | | | see character set | | | | |

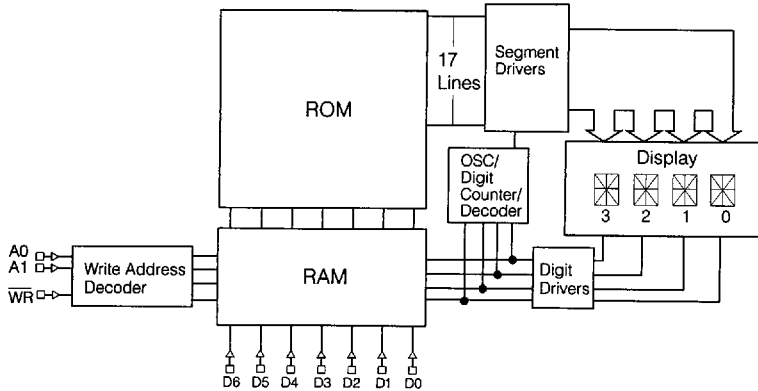
X = don't care

Character Set

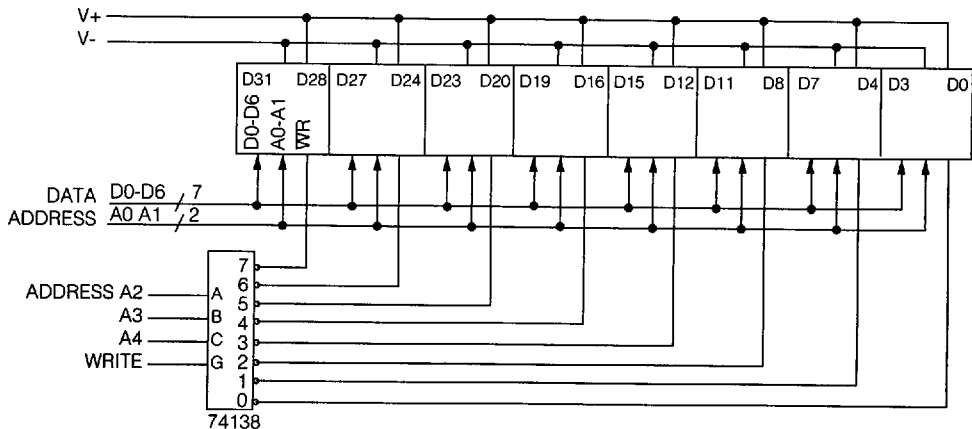
| D6 | D5 | D4 | D3 | D0 | L | H | L | H | L | H | L | H |
|----|----|----|----|----|---|---|---|----|---|----|---|----|
| | | | | D1 | L | L | H | H | L | L | H | H |
| | | | | D2 | L | L | L | L | H | H | H | H |
| L | H | L | L | | ! | " | # | \$ | % | & | ' | |
| L | H | L | H | | < | > | * | + | , | -- | . | / |
| L | H | H | L | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| L | H | H | H | | 8 | 9 | - | / | ∠ | = | Δ | ? |
| H | L | L | L | | a | A | B | C | D | E | F | G |
| H | L | L | H | | H | I | J | K | L | M | N | O |
| H | L | H | L | | P | Q | R | S | T | U | V | W |
| H | L | H | H | | X | Y | Z | [| \ |] | ^ | .. |

All other input codes display "blank"

Block Diagram



Typical Interconnection for 32 Digits



Design Considerations

For details on design and applications of the DL1414T using standard bus configurations in multiple display systems, or parallel I/O devices, such as the 8255 with an 8080 or memory mapped addressing on processors such as the 8080, Z80, 6502, 8748, or 6800, refer to Appnote 15 in the current Siemens Optoelectronic Data Book.

ELECTRICAL AND MECHANICAL CONSIDERATIONS

Voltage Transient Suppression

We strongly recommend that the same power supply be used for the display and the components that interface with the display to avoid logic inputs higher than V_{CC} . Additionally, the LEDs may cause transients in the power supply line while they change display states. The common practice is to place .01 μ F capacitors close to the displays across V_{CC} and GND, one for each display, and one 10 μ F capacitor for every second display.

ESD Protection

The metal gate CMOS IC of the DL1414T is extremely immune to ESD damage. However, users of these devices are encouraged to 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. Where 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 DL1414T 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 resin-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 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. Maximum exposure should not exceed two minutes at elevated temperatures. Acceptable solvents are TF (trichlorotrifluoroethane), TA, 111 Trichloroethane, and unheated acetone.

Note: Acceptable commercial solvents are: Basic TF, Arklone P, Genesolve D, Blaco-tron TF, Freon TA, Genesolve DA, and Blaco-tron TA.

Unacceptable solvents contain alcohol, methanol, methylene chloride, ethanol, TP35, TCM, TMC, TMS+, TE, or TES. Since many commercial mixtures exist, contact a solvent vendor for chemical composition information. Some major solvent manufacturers are: Allied Chemical

Corporation, Specialty Chemical Division, Morristown, NJ; Baron-Blakeslee, Chicago, IL; Dow Chemical, Midland, MI; E.I. DuPont de Nemours & Co., Wilmington, DE.

For further information refer to Appnotes 18 and 19 in the current Siemens Optoelectronic Data Book.

An alternative to soldering and cleaning the display modules is to use sockets. Eighteen pin DIP sockets .600" 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. 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 in the current Siemens Optoelectronic Data Book.

Optical Considerations

The .112" high characters of the DL1414T gives readability up to eight feet. The user can build a display that enhances readability over this distance by proper filter selection.

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. Remember to 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 DL1414T is a standard red display and should be matched with long wavelength pass filter in the 600 nm to 620 nm range. For displays of multiple colors, neutral density grey filters offer the best compromise.

Additional contrast enhancement can be 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. 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.

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.

Refer to Siemens Appnote 23 for further information.