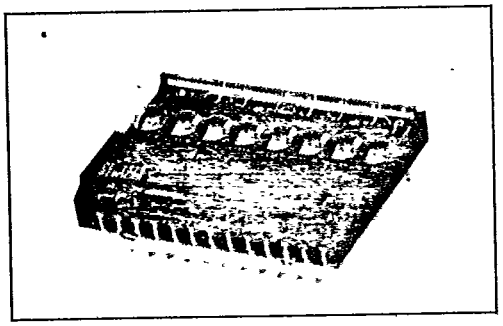
SIEMENS

DL 1814

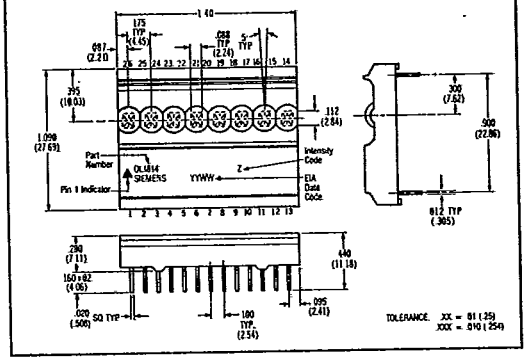
.112″ Red, 8-Digit 17-Segment ALPHANUMERIC Intelligent Display® With Memory/Decoder/Driver

T-41-37

Intelligent Display Devices



Package Dimensions in Inches (mm)



FEATURES

- **0.112″ × 0.088″ Magnified Monolithic Character**
- **Rugged Solid Plastic Encapsulated Package**
- **Wide Viewing Angle ±40°, Both Axis**
- **Compact Size for Hand Held Equipment**
- **Fast Access Time, 525 ns**
- **Full Integrated CMOS Drive Electronics**
- **Direct Access to each Digit Independently & Asynchronously**
- **TTL Compatible, 5 Volt Power**
- **17th Segment for Improved Punctuation Marks**
- **Low Power Consumption, Typically 10 mA per Character**
- **Display Blank Function**
- **End-Stackable, Eight Character Package**
- **Intensity Coded for Display Uniformity**
- **100% Burned In and Tested**
- **Extended Operating Temperature Range: −40°C to +85°C**

DESCRIPTION

The DL 1814 is an 8-digit module. Each digit has 16 segments plus a decimal segment and a built-in CMOS integrated circuit.

The integrated circuit contains memory, ASCII character generator, and 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 DL 1814's since each character in any DL 1814 can be addressed independently and will continue to display the character last written until it is replaced by another.

All products are 100% burned-in and tested, then subjected to out-going AQL's of .25% for brightness matching, visual alignment and dimensions, .065% for electrical and functional.

Maximum Ratings

Supply Voltage V_{CC}	−0.5 V to +6.0 Vdc
Voltage, Any Pin Respect to GND	−0.5 V to (V_{CC} +0.5) Vdc
Operating Temperature	−40°C to +85°C
Storage Temperature	−40°C to +100°C
Relative Humidity (non condensing) @85°C	85%
Maximum Solder Temperature, 1.59 mm (0.063″) below Seating Plane, t<5 sec	260°C
ESD (MIL-STD-883, method 3015)	V_Z=3 KV

Optical Characteristics

Spectral Peak Wavelength	660 nm typ.
Magnified digit size	0.112″×0.088″
Time Averaged Luminous Intensity	0.2 mcd/digit min.
(100% brightness, 8 segments/digit, V_{CC}=5 V)	0.5 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.
Viewing Angle (off normal axis)	
Horizontal	±40°
Vertical	±40°

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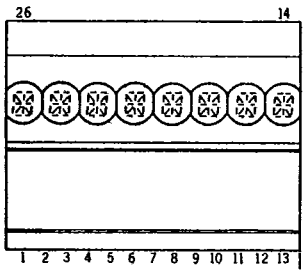
TOP VIEW



Pin		Function	Pin	Function
1	D0	Data input	14	$\overline{BL}$ (Blank)
2	D1	Data input	15	NO PIN
3	D2	Data input	16	NO PIN
4	D3	Data input	17	NO PIN
5	D4	Data input	18	NO PIN
6	D5	Data input	19	NO PIN
7	D6	Data input	20	NO PIN
8	GND		21	NO PIN
9	A0	Address	22	NO PIN
10	A1	Address	23	NO PIN
11	A2	Address	24	NO PIN
12	$\overline{WR}$	Write	25	NO PIN
13	VCC		26	$\overline{CE}$ (Chip Enable)

DC CHARACTERISTICS

Parameter	−40°C			+25°C			+85°C			Units	Conditions
	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.		
I_{CC}[1] 8 Digits on 10 segments/digit		130	156		100	120		85	102	mA	V_{CC}=5 V
I_{CC} Blank[1]		2.5	5.0		2.0	3.5		1.5	2.0	mA	V_{CC}=5 V, $\overline{BL}$=0.8 V
I_{IL} (all inputs)		75	110		55	80		40	55	μA	V_{IN}=0.8 V, V_{CC}=5 V
V_{IH}	2.7			2.7			2.7			V	V_{CC}=5 V±0.5 V
V_{IL}			0.8			0.8			0.8	V	V_{CC}=5 V±0.5 V

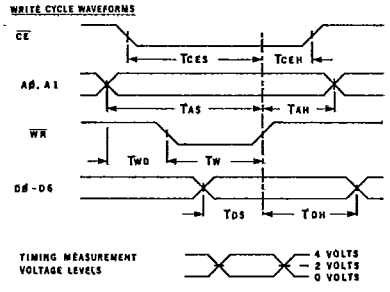
Notes: 1. Measured at 5 sec.

AC CHARACTERISTICS Guaranteed Minimum Timing Parameters @V_{CC}=4.5 V

Parameter	Symbol	−40°C (ns)	+25°C (ns)	+85°C (ns)
Chip Enable Set Up Time	T_{CES}	300	450	550
Address Set Up Time	T_{AS}	300	450	575
Chip Enable Hold Time	T_{CEH}	50	75	100
Address Hold Time	T_{AH}	50	75	100
Write Delay Time	T_{WD}	100	150	200
Write Time	T_W	200	300	450
Data Set Up Time	T_{DS}	150	250	350
Data Hold Time	T_{DH}	50	75	100
Access Time	T_{ACC}	350	525	675

Notes:
1. "Off Axis Viewing Angle" is here defined as. "the minimum angle in any direction from the normal to the display surface at which any part of any segment in the display is not visible.
2. This display contains a CMOS integrated circuit. Normal CMOS handling precautions should be taken to avoid damage due to high static voltages or electric fields. See Appnote 18.
3. Unused inputs must be tied to an appropriate logic voltage level (either V+ or V−).
4. **Warning:** Do not use solvents containing alcohol.
5. V_{CC}=5.0 VDC ±10%.
6. Access time is defined as $T_{AS}+T_{DH}$ (sum of address set up and data hold time)
7. V_{CC}=4.5 V, worst case for all timing parameters.

TIMING CHARACTERISTICS



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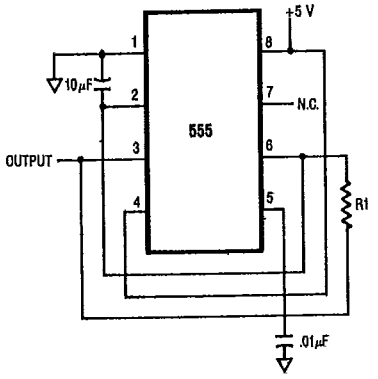
DISPLAY BLANKING

Blanking the display may be accomplished by loading a blank or space into each digit of the display or by using the ($\overline{BL}$) display blank input.

Setting the ($\overline{BL}$) input low does not affect the contents of either data. A flashing display can be realized by pulsing ($\overline{BL}$).

A flashing circuit can easily be constructed using a 555 astable multivibrator. Figure 1 illustrates a circuit in which varying R1 (100K~10K) will have a flash rate of 1 Hz~10 Hz.

FIGURE 1. FLASHING CIRCUIT FOR DL 1814 USING A 555

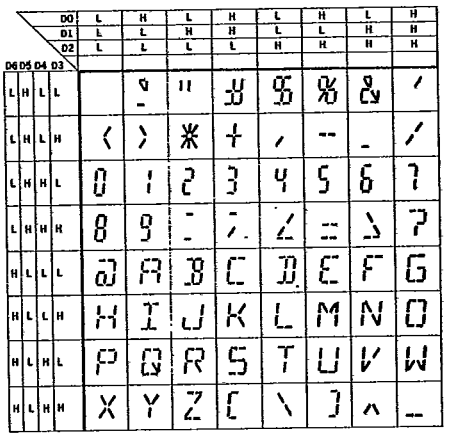


LOADING DATA

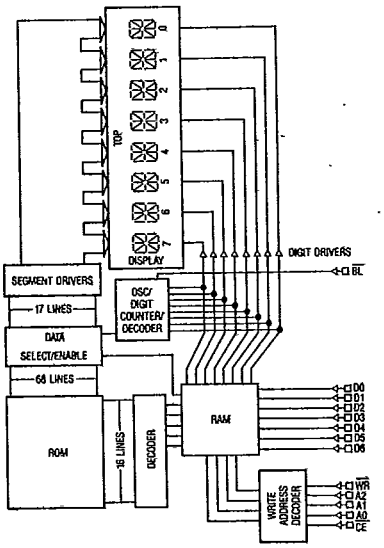
Loading data into the DL1814 is straightforward. The desired data and chip enable should be present and stable during a write pulse. No synchronization is necessary, and each character will continue to be displayed until it is replaced with another. Multiple displays will require an external decoder IC connected to the chip enable input.

Setting the chip enables $\overline{CE}$ to its true state will enable data loading. The desired data code (D0-D6) and digit address (A_0, A_1, A_2) must be held stable during the write cycle for storing new data. Data entry may be asynchronous and random. (Digit 0 is defined as right hand digit with (A_2=A_1=A_0=0.)

CHARACTER SET



BLOCK DIAGRAM



TYPICAL LOADING DATA STATE TABLE

$\overline{BL}$	$\overline{CE}$	$\overline{WR}$	A2	A1	A0	D6	D5	D4	D3	D2	D1	D0	DIGIT 7	6	5	4	3	2	1	0
H	X	H	X	X	X	PREVIOUSLY LOADED DISPLAY							S	I	E	M	E	N	S	
H	H	X	X	X	X	X	X	X	X	X	X	X	S	I	E	M	E	N	S	
H	L	L	L	L	L	H	L	L	L	H	L	H	S	I	E	M	E	N	S	E
H	L	L	L	L	H	H	L	H	L	H	L	H	S	I	E	M	E	N	N	E
H	L	L	L	H	L	H	L	L	H	H	L	L	S	I	E	M	E	N	L	E
H	L	L	L	H	H	H	L	L	L	L	H	L	S	I	E	M	B	L	U	E
H	L	L	H	L	L	H	L	L	L	H	L	H	S	I	E	E	B	L	U	E
H	L	L	H	L	H	H	L	H	L	H	L	L	S	I	U	E	B	L	U	E
H	L	L	H	H	L	H	L	L	H	H	L	L	S	L	U	E	B	L	U	E
H	L	L	H	H	H	H	L	L	L	L	H	L	B	L	U	E	B	L	U	E
L	X	H	X	X	X	BLANK DISPLAY														
H	L	L	L	H	H	H	L	L	L	H	H	H	B	L	U	E	G	L	U	E
H	L	L	X	X	X	SEE CHARACTER CODE							SEE CHARACTER SET							

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ELECTRICAL AND MECHANICAL CONSIDERATIONS

VOLTAGE TRANSIENT SUPPRESSION

It is highly recommended that the display and the components that interface with the display be powered by the same supply to avoid logic inputs higher than V_{CC}. Additionally, the LEDs may cause transients in the power supply line while they change display states. Common practice is to place .01 μF capacitors close to the displays across V_{CC} and GND, one for each display, and one 10 μF capacitor for every second display.

ESD PROTECTION

The metal gate CMOS IC of the DL 1814 is extremely immune to ESD damage. It is capable of withstanding discharges greater than 3 KV. 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 un-shielded 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 DL 1814 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 ±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 5 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. Care should be exercised in choosing these 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.

Unacceptable solvents contain alcohol, methanol, methylene chloride, ethanol, TP35, TCM, TMC, TMS+, TE, and TES. Since many commercial mixtures exist, you should contact your 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. Naturally, 26 pin DIP sockets .960" 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 T-41-37

The .112" high characters of the DL 1814 allow readability up to six feet. Proper filter selection will allow the user to build a display that can be utilized over this distance.

Filters allow the user to enhance the contrast ratio between a lit LED and the character background. This will maximize discrimination of different characters as perceived by the display user. The only limitation is cost. The cost/benefit ratio for filters can be maximized to the user's benefit by first considering the ambient lighting environment.

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 inexpensive and effective in optimizing contrast ratios. The DL 1814 is a standard red display and should be matched with a long wavelength pass filter in the 600 nm to 620 nm range. For display systems of multiple colors (using other Siemens' displays), neutral density grey filters offer the best compromise.

Additional contrast enhancement can be gained through shading the displays. Plastic band-pass filters with built-in louvers offer the "next step up" in contrast improvement. Plastic filters can be further improved with anti-reflective coatings to reduce glare. The trade-off is "fuzzy" characters. Mounting the filters close to the display reduces this effect. Care should be taken not to overheat the plastic filters by allowing for proper air flow.

Optimal filter enhancements for any condition can be gained through the use of 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 display 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.