Texas Optoelectronics, Inc.

4N56 Hexadecimal Display With Logic

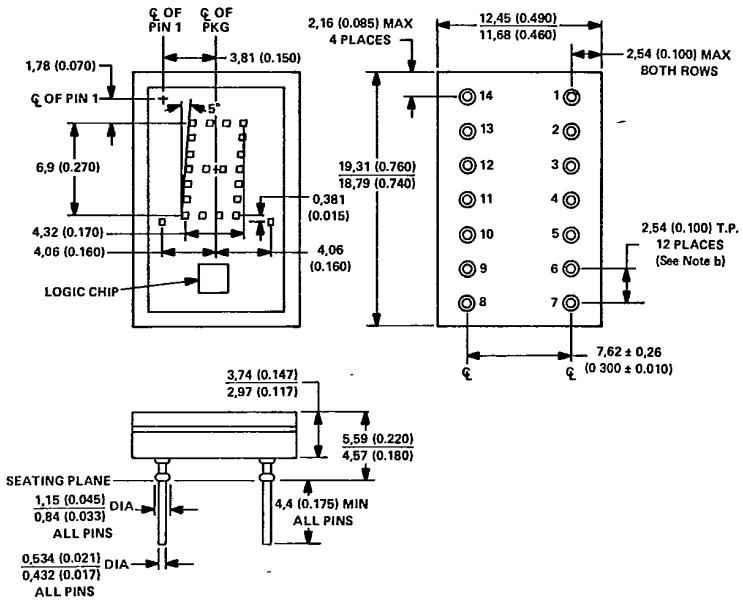
T-41-37

HERMETICALLY SEALED SOLID-STATE HEXADECIMAL DISPLAY WITH INTEGRAL TTL CIRCUIT TO ACCEPT, STORE, AND DISPLAY 4-BIT BINARY DATA

- **Available with Screening in Accordance with MIL-D-87157, 4N56-TXV**
- 7,62-mm (0.300-Inch) Character Height
- Left- and Right-Hand Decimals
- Separate LED and Logic Power Supplies May Be Used
- Easy System Interface
- Wide Viewing Angle
- Internal TTL MSI Chip with Latch, Decoder, and Driver
- Operates from 5-Volt or 6-Volt Supply
- Constant-Current Drive for Hexadecimal Characters
- Withstands Severe Environmental Conditions

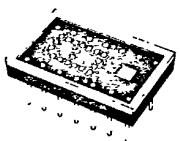
*mechanical data

The display and TTL MSI chip are mounted on a ceramic header, which is then hermetically sealed to a glass window. Multiple displays may be mounted on 12,7-mm (0.500-inch) centers.



PIN 1 LED SUPPLY VOLTAGE
PIN 2 LATCH DATA INPUT B
PIN 3 LATCH DATA INPUT A
PIN 4 LEFT DECIMAL POINT CATHODE
PIN 5 NO INTERNAL CONNECTION
PIN 6 LATCH STROBE INPUT
PIN 7 COMMON GROUND
PIN 8 BLANKING INPUT
PIN 9 NO INTERNAL CONNECTION
PIN 10 RIGHT DECIMAL POINT CATHODE
PIN 11 NO INTERNAL CONNECTION
PIN 12 LATCH DATA INPUT D
PIN 13 LATCH DATA INPUT C
PIN 14 LOGIC SUPPLY VOLTAGE, V_{CC}

NOTES: a. The true-position pin spacing is 2,54 mm (0.100 inch) between centerlines. Each pin centerline is located within 0,26 mm (0.010 inch) of its true longitudinal position relative to pins 1 and 14.
b. Lead dimensions are not controlled above the seating plane.
c. Dimensions associated with position of LED's are between centerlines and are nominal.
d. All dimensions are in millimeters and parenthetically in inches.



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*JEDEC registered data. This data sheet contains all applicable registered data in effect at the time of publication.

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*description

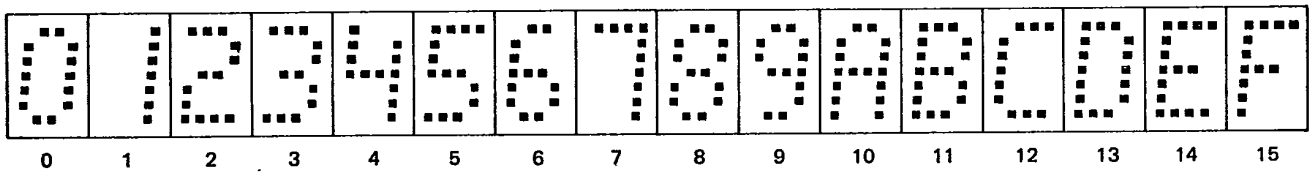
This hexadecimal display contains a four-bit latch, decoder, driver, and 4 X 7 light-emitting-diode (LED) character with two externally driven decimal points in a 14-pin package. A description of the functions of the inputs of this device follows.

FUNCTION	PIN NO.	DESCRIPTION
LATCH STROBE INPUT	6	When low, the data in the latches follow the data on the latch data inputs. When high, the data in the latches will not change. If the display is blanked and then restored while the enable input is high, the previous character will again be displayed.
BLANKING INPUT	8	When high, the display is blanked regardless of the levels of the other inputs. When low, a character is displayed as determined by the data in the latches. The blanking input may be pulsed for intensity modulation.
LATCH DATA INPUTS (A, B, C, D)	3, 2, 13, 12	Data on these inputs are entered into the latches when the enable input is low. The binary weights of these inputs are A = 1, B = 2, C = 4, D = 8.
DECIMAL POINT CATHODES	4, 10	These LEDs are not connected to the logic chip. If a decimal point is used, an external resistor or other current-limiting mechanism must be connected in series with it.
LED SUPPLY	1	This connection permits the user to save on regulated V_{CC} current by using a separate LED supply, or it may be externally connected to the logic supply (V_{CC}).
LOGIC SUPPLY (V_{CC})	14	Separate V_{CC} connection for the logic chip.
COMMON GROUND	7	This is the negative terminal for all logic and LED currents except for the decimal points.

The LED driver outputs are designed to maintain a relatively constant on-level current of approximately five milliamperes through each of the LED's forming the hexadecimal character. This current is virtually independent of the LED supply voltage within the recommended operating conditions. Drive current varies with changes in logic supply voltage resulting in a change in luminous intensity as shown in Figure 2. The decimal point anodes are connected to the LED supply; the cathodes are connected to external pins. Since there is no current limiting built into the decimal point circuits, this must be provided externally if the decimal points are used.

The TTL MSI chip is specially designed with a wider supply voltage range than standard Series 54/74 circuits so that it will operate from either a five-volt or a six-volt power supply.

The resultant displays for the values of the binary data in the latches are as shown below.



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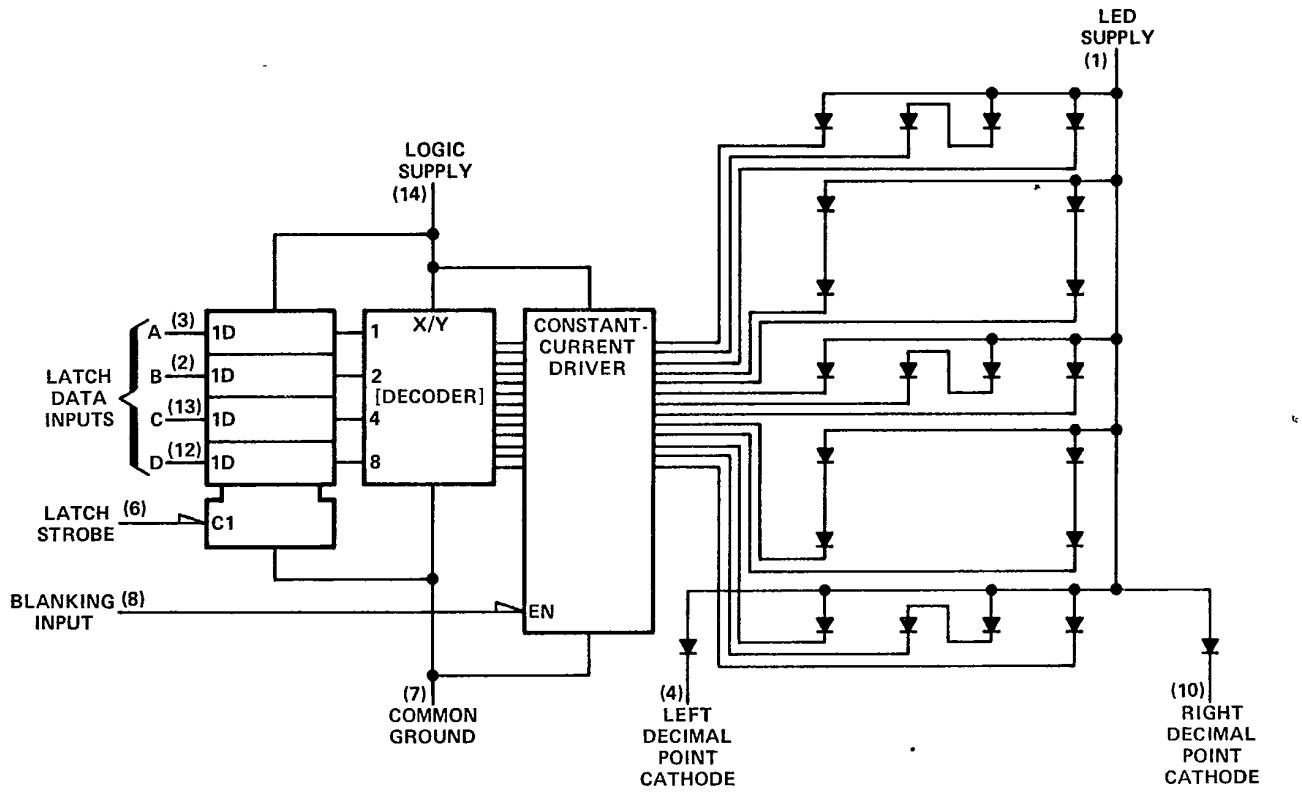
*functional block diagram



*absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Logic Supply Voltage, V_{CC} (See Note 1)	7 V
LED Supply Voltage (See Note 1)	7 V
Input Voltage (Pins 2, 3, 6, 8, 12, 13; See Note 1)	5.5 V
Decimal Point Current (See Note 4)	20 mA
Operating Free-Air Temperature Range	−55°C to 100°C
Storage Temperature Range	−65°C to 125°C

NOTE 1: Voltage values are with respect to common ground terminal.

*recommended operating conditions

	MIN	NOM	MAX	UNIT
Logic Supply Voltage, V_{CC}	4.5	5	6.5	V
LED Supply Voltage, V_{LED}	4	5	7	V
High-Level Input Voltage, V_{IH}	2			V
Low-Level Input Voltage, V_{IL}			0.8	V
Decimal Point Current, $I_{F(DP)}$ (See Note 4)		5		mA
Latch Strobe Pulse Duration, t_w	40			ns
Data Setup Time Before Latch Strobe Goes High, t_{su}	50			ns
Data Hold Time After Latch Strobe Goes High, t_h	40			ns

NOTES: 2. The minimum setup time is the interval immediately preceding the positive-going transition of the latch strobe input during which interval the data to be displayed must be maintained at the latch data inputs to ensure its recognition.
3. The minimum hold time is the interval immediately following the positive-going transition of the latch strobe input during which interval the data to be displayed must be maintained at the latch data inputs to ensure its continued recognition.
4. Derate linearly to 100°C free air temperature at the rate of .2mA/°C.

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*operating characteristics at 25°C free-air temperature

PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
I_V	Luminous Intensity (See Note 4)	Average Per Character LED	V_{CC} = 5 V, V_{LED} = 5 V, See Note 5	35	100		µcd
		Each decimal	$I_{F(DP)}$ = 5 mA	35	100		µcd
λ_p	Wavelength at Peak Emission		V_{CC} = 5 V, V_{LED} = 5 V, $I_{F(DP)}$ = 5 mA, See Note 6	640	660	680	nm
$\Delta\lambda$	Spectral Bandwidth				20		nm
V_{IK}	Input Clamp Voltage		V_{CC} = 4.75 V, I_I = 12 mA			1.5	V
I_I	Input Current at Maximum Input Voltage		V_{CC} = 5.5 V, V_I = 5.5 V			1	mA
I_{IH}	High-Level Input Current		V_{CC} = 5.5 V, V_I = 2.4 V			40	µA
I_{IL}	Low-Level Input Current		V_{CC} = 5.5 V, V_I = 0.4 V			1.6	mA
I_{CC}	Logic Supply Current		V_{CC} = 5.5 V, V_{LED} = 5.5 V, $I_{F(DP)}$ = 5 mA, All inputs at 0 V		60	90	mA
I_{LED}	LED Supply Current				45	90	mA

NOTES: 4. Luminous intensity is measured with a light sensor and filter combination that approximates the CIE (International Commission on Illumination) eye-response curve.

5. This parameter is measured with A displayed, then again with E displayed.

6. These parameters are measured with B displayed.

*JEDEC registered data.

4N56-TXV 100% processing tests

100% processing tests in accordance with MIL-D-87157 for 4N56-TXV (General Military Specification for Visible Displays)

EXAMINATION OR TEST	MIL-STD-750 METHOD	CONDITIONS
Internal Visual	2072	50X Maginfication max
High Temp Storage	1032	T_A = 125°C, t = 24 hrs min
Temperature Cycling	1051	-65 to +125°C, 20 cycles
Constant Acceleration	2006	10KG's, Y_1 orientation
Hermetic Seal	1071	Condition G or H, 3 atm max pressure, Q = 5 x 10^{-8} max Condition C or D, 30 psi max pressure
Burn-In		MIL-STD-883 Method 1015 V_{CC} = V_{LED} = 7V, I_F (DP) = 20 mA, T_A = 25°C, t = 160 hrs min
Final Electrical Test		Device Data Sheet, PDA = 10%
External Visual		MIL-STD-883 Method 2009

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TYPICAL CHARACTERISTICS

RELATIVE SPECTRAL CHARACTERISTICS

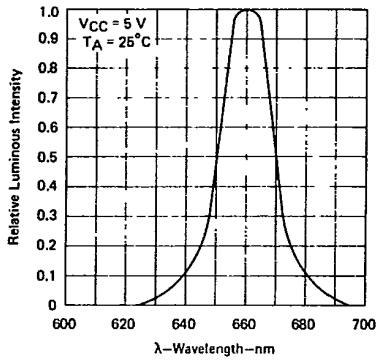

FIGURE 1

RELATIVE LUMINOUS INTENSITY
vs
LOGIC SUPPLY VOLTAGE

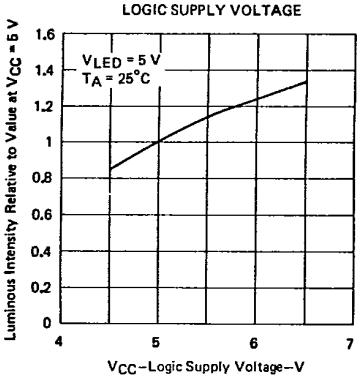

FIGURE 2

RELATIVE LUMINOUS INTENSITY
vs
FREE-AIR TEMPERATURE

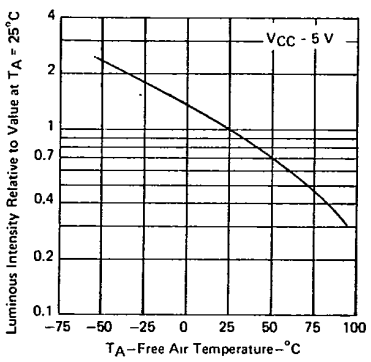

FIGURE 3

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