

# TIL311, TIL311A HEXADECIMAL DISPLAY WITH LOGIC

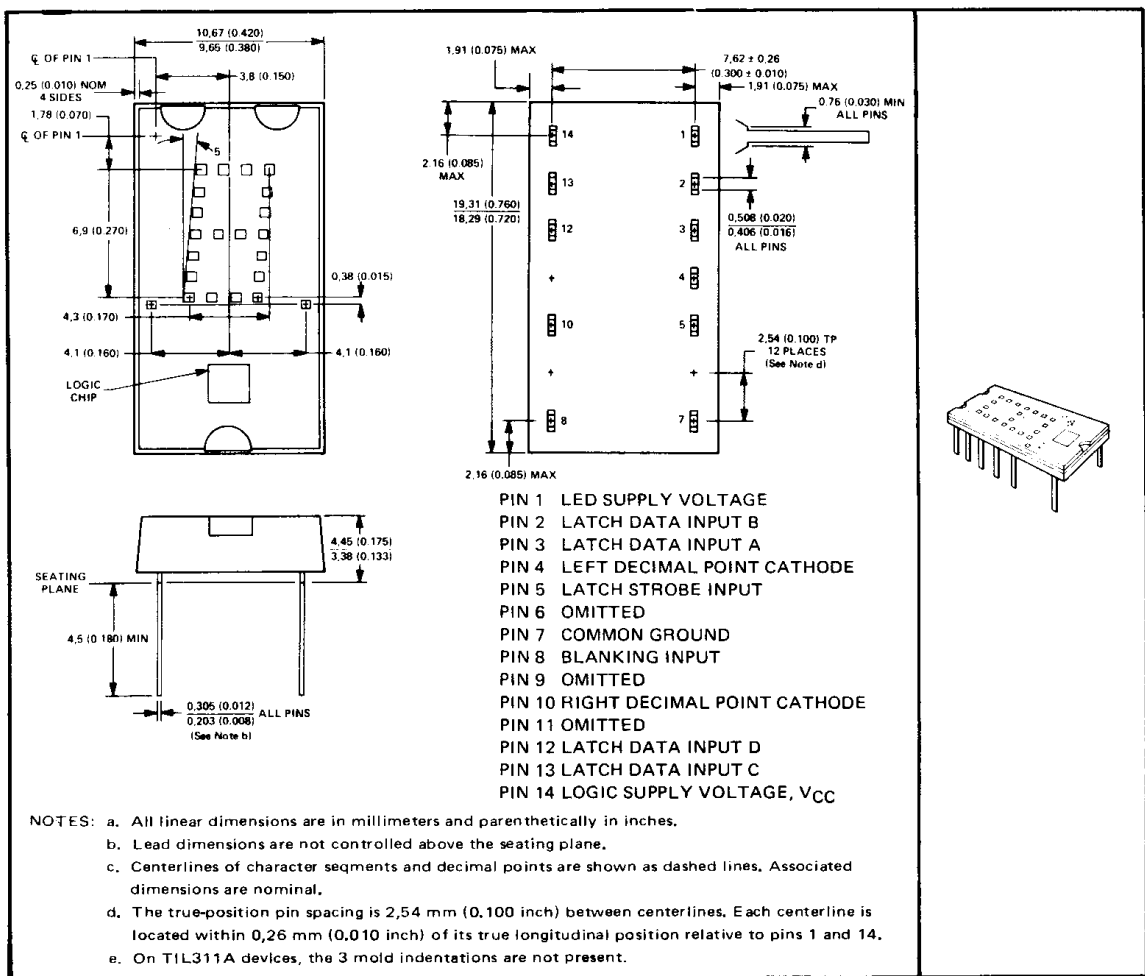
D1176, MARCH 1972—REVISED APRIL 1987

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

- 7,62-mm (0.300-Inch) Character Height
- High Brightness
- Left-and-Right-Hand Decimals
- Separate LED and Logic Power Supplies May Be Used
- Wide Viewing Angle
- Internal TTL MSI Chip with Latch, Decoder, and Driver
- Operates from 5-Volt Supply
- Constant-Current Drive for Hexadecimal Characters
- Easy System Interface

### mechanical data

These assemblies consist of display chips and a TTL MSI chip mounted on a header with either a red molded plastic body for the TIL311 or a red plastic cap for the TIL311A. Multiple displays may be mounted on 11,43-mm (0.450-inch) centers.



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# TIL311, TIL311A HEXADECIMAL DISPLAY WITH LOGIC

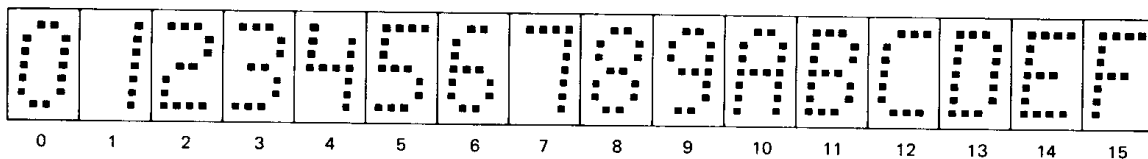
## description

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	5	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 slightly with changes in logic supply voltage resulting in a change in luminous intensity as shown in Figure 2. This change will not be noticeable to the eye. 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 resultant displays for the values of the binary data in the latches are as shown below.

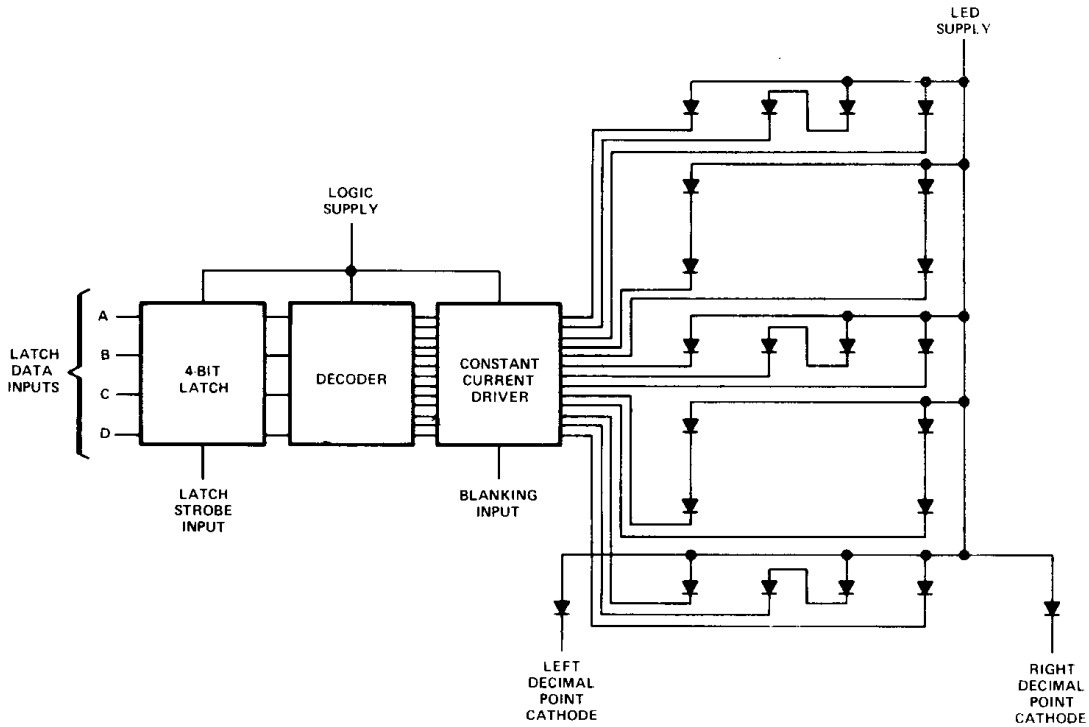


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functional block diagram



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**absolute maximum ratings over operating case 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, 5, 8, 12, 13; See Note 1)	5.5 V
Decimal Point Current	20 mA
Operating Case Temperature Range (See Note 2)	0°C to 85°C
Storage Temperature Range	-25°C to 85°C

- NOTES: 1. Voltage values are with respect to common ground terminal.  
 2. Case temperature is the surface temperature of the plastic measured directly over the integrated circuit. Forced-air cooling may be required to maintain this temperature.

**recommended operating conditions**

	MIN	NOM	MAX	UNIT
Logic Supply Voltage, $V_{CC}$	4.5	5	5.5	V
LED Supply Voltage, $V_{LED}$	4	5	5.5	V
Decimal Point Current, $I_{F(DP)}$		5		mA
Latch Strobe Pulse Duration, $t_w$	40			ns
Setup Time, $t_{su}$	50			ns
Hold Time, $t_h$	40			ns

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operating characteristics at 25°C case temperature

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT	
$I_V$	Luminous Intensity (See Note 3)	Average Per Character LED	$V_{CC} = 5 V,$	$V_{LED} = 5 V,$	35	100	$\mu cd$
		Each decimal	See Note 4		35	100	$\mu cd$
$\lambda_p$	Wavelength at Peak Emission	$V_{CC} = 5 V,$	$V_{LED} = 5 V,$	660		nm	
$\Delta\lambda$	Spectral Bandwidth	$I_F(DP) = 5 mA,$ See Note 5		20		nm	
$V_{IH}$	High-Level Input Voltage			2		V	
$V_{IL}$	Low-Level Input Voltage				0.8	V	
$V_{IK}$	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	$\mu A$
$I_{IL}$	Low-Level Input Current	$V_{CC} = 5.5 V,$ $V_I = 0.4 V$				-1.6	mA
$I_{CC}$	Logic Supply Current	$V_{CC} = 5.5 V,$ $V_{LED} = 5.5 V,$		60	90	mA	
$I_{LED}$	LED Supply Current	$I_F(DP) = 5 mA,$ All inputs at 0 V		45	90	mA	

NOTES: 3. Luminous intensity is measured with a light sensor and filter combination that approximates the CIE (International Commission on Illumination) eye-response curve.

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

5. These parameters are measured with **B** displayed.

## TYPICAL CHARACTERISTICS

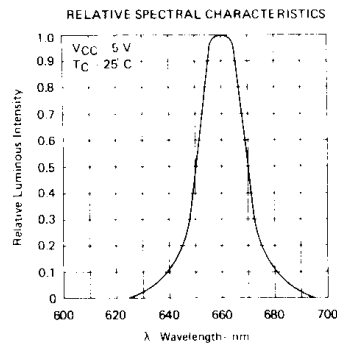


FIGURE 1

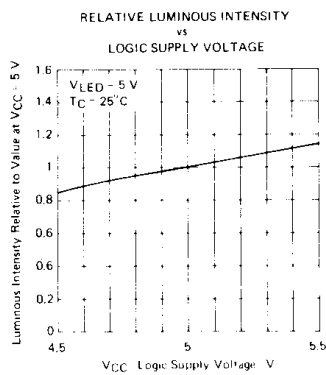


FIGURE 2

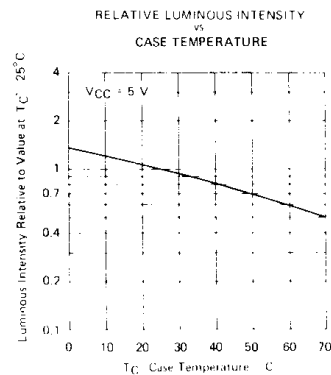


FIGURE 3

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