EN: This Datasheet is presented by the manufacturer.
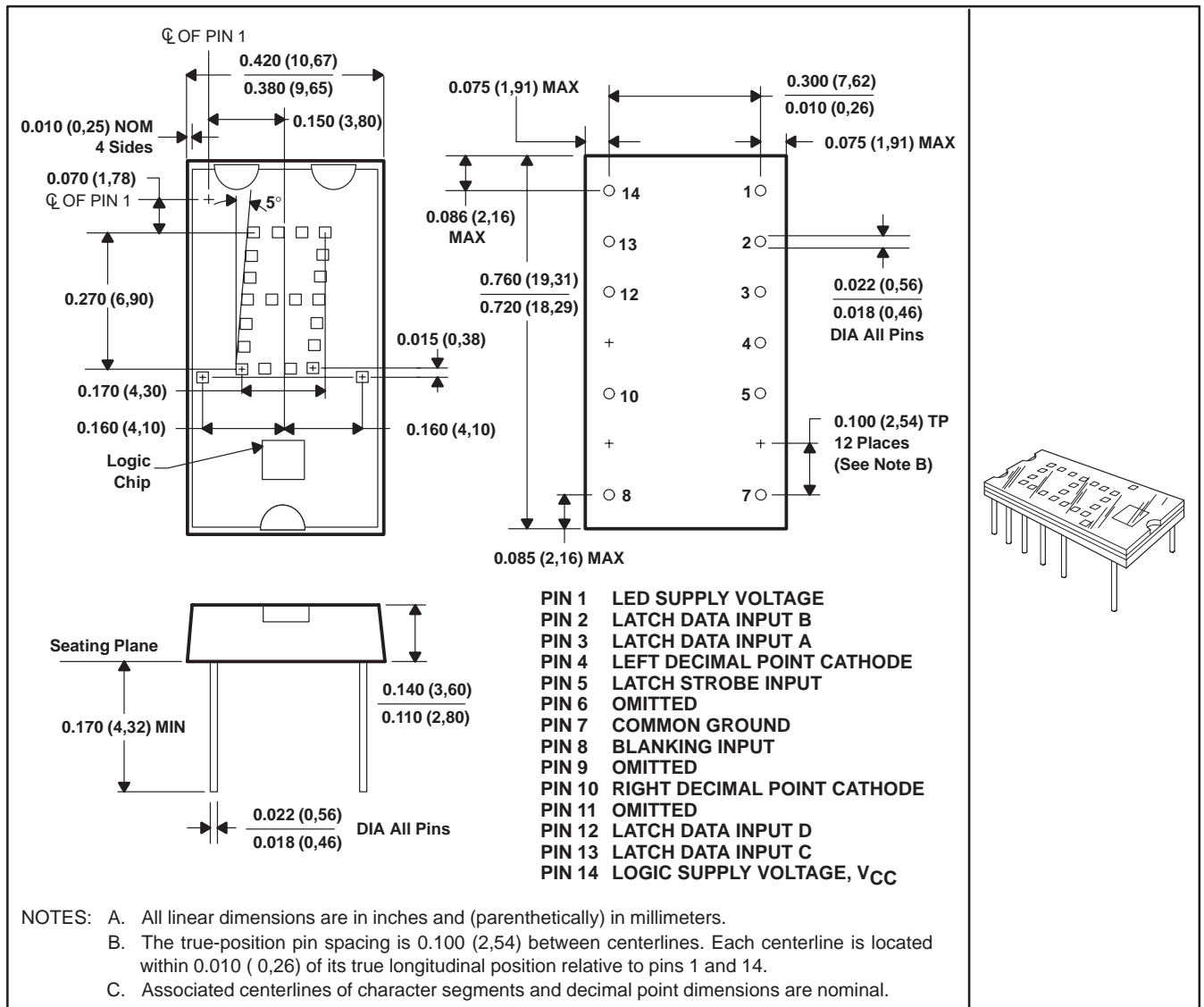
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SOLID-STATE HEXADECIMAL DISPLAY WITH INTEGRAL TTL CIRCUIT TO ACCEPT, STORE, AND DISPLAY 4-BIT BINARY DATA

- **0.300-Inch (7,62-mm) 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-V 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 a red molded plastic body. Multiple displays may be mounted on 0.450-inch (11,43-mm) 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   LATCH STROBE INPUT
PIN 6   OMITTED
PIN 7   COMMON GROUND
PIN 8   BLANKING INPUT
PIN 9   OMITTED
PIN 10   RIGHT DECIMAL POINT CATHODE
PIN 11   OMITTED
PIN 12   LATCH DATA INPUT D
PIN 13   LATCH DATA INPUT C
PIN 14   LOGIC SUPPLY VOLTAGE, V_{CC}

NOTES: A. All linear dimensions are in inches and (parenthetically) in millimeters.
B. The true-position pin spacing is 0.100 (2,54) between centerlines. Each centerline is located within 0.010 (0,26) of its true longitudinal position relative to pins 1 and 14.
C. Associated centerlines of character segments and decimal point dimensions are nominal.

TEXAS INSTRUMENTS

# TIL311
HEXADECIMAL DISPLAY WITH LOGIC

description

This hexadecimal display contains a four-bit latch, decoder, driver, and 4 × 7 light-emitting-diode (LED) character with two externally driven decimal points in a 14-pin package. A description of the input functions 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 VOLTAGE (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 5 mA through each LED that forms 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, limiting 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.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
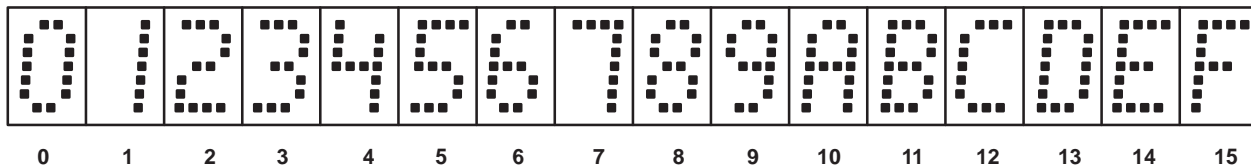
functional block diagram
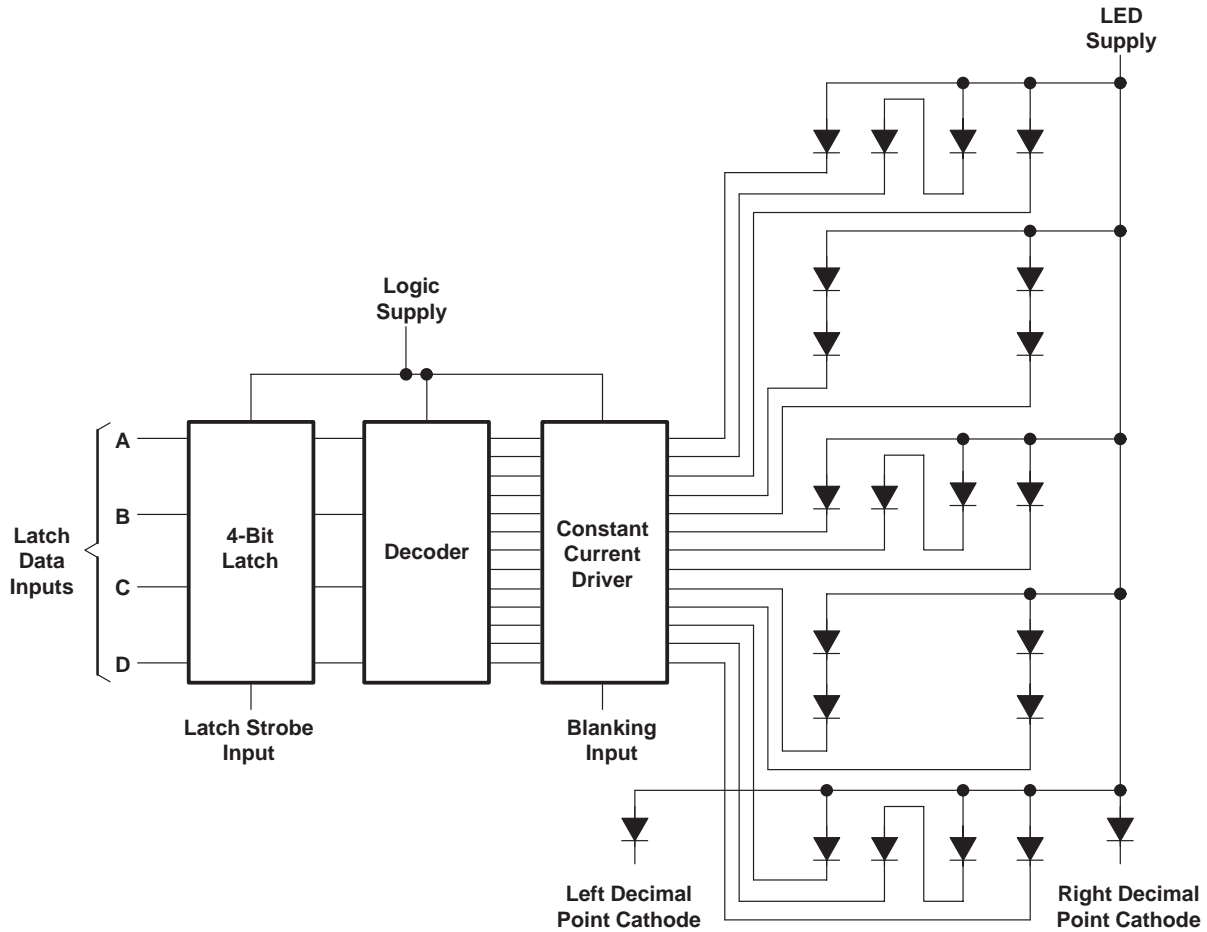
absolute maximum ratings over operating case temperature range (unless otherwise noted)

Supply voltage, V_{CC}, logic (see Note 1) .... 7 V
Supply voltage, LED (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
Supply voltage, V_{CC}, logic	4.5	5	5.5	V
Supply voltage, V_{LED}, LED	4	5	5.5	V
Decimal point current, $I_{F(DP)}$		5		mA
Pulse duration, t_W, latch strobe	40			ns
Setup time, t_{su}	50			ns
Hold time, t_h	40			ns

TIL311
HEXADECIMAL DISPLAY WITH LOGIC

operating characteristics at $T_A = 25°C$

PARAMETER			TEST CONDITIONS		MIN	TYP	MAX	UNIT
I_V	Luminous intensity (see Note 3)	Average per character LED	$V_{CC} = 5$ V, See Note 4	$V_{LED} = 5$ V,	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,		660		nm
$\Delta\lambda$	Spectral bandwidth		$I_{F(DP)} = 5$ mA,	See Note 5		20		nm
V_{IH}	High-level ilnput 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		$V_{CC} = 5.5$ 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}	Supply current, logic		$V_{CC} = 5.5$ V,	$V_{LED} = 5.5$ V,		60	90	mA
I_{LED}	Supply current, LED		$I_{F(DP)} = 5$ 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 ▯ displayed, then again with ▯ displayed.

5. These parameters are measured with ▯ displayed.

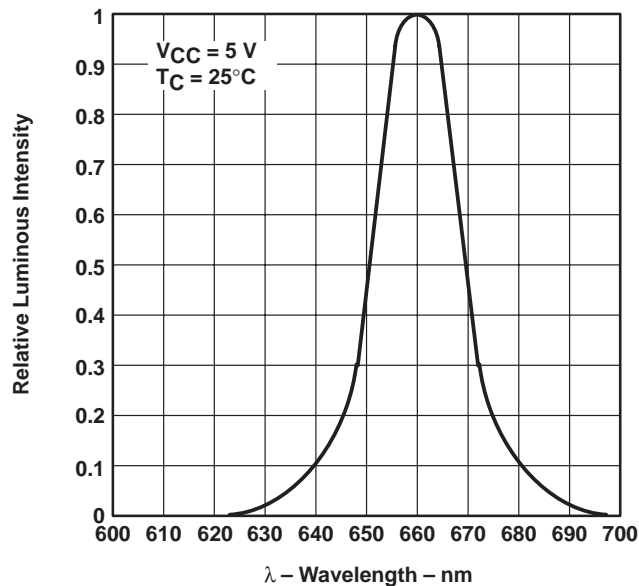## TYPICAL CHARACTERISTICS

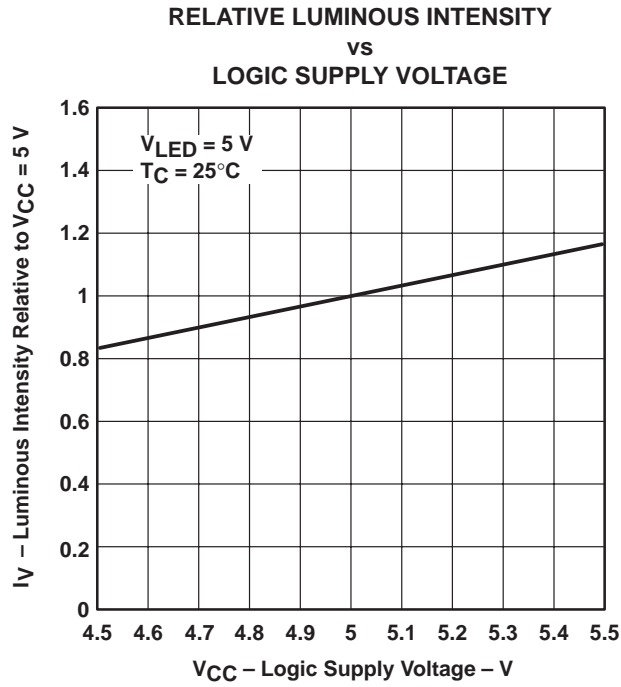### RELATIVE SPECTRAL CHARACTERISTIC
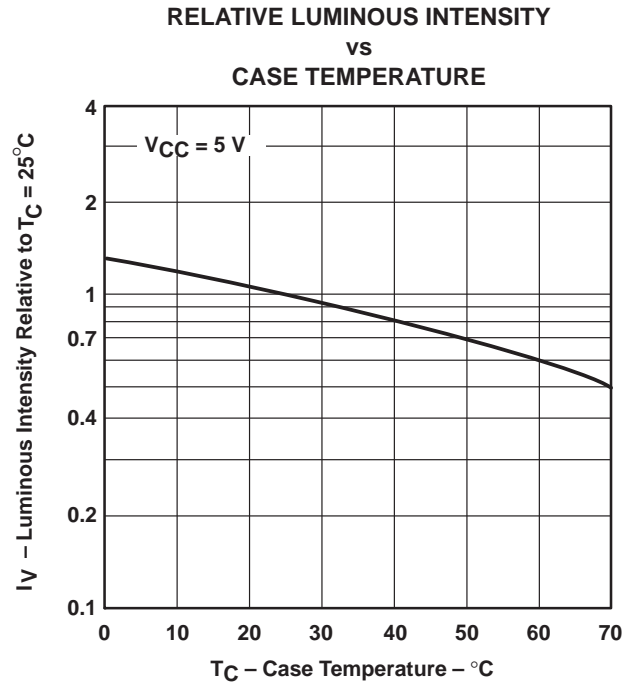

Figure 1

TYPICAL CHARACTERISTICS

RELATIVE LUMINOUS INTENSITY
vs
LOGIC SUPPLY VOLTAGE

Figure 2

RELATIVE LUMINOUS INTENSITY
vs
CASE TEMPERATURE

Figure 3

TEXAS
INSTRUMENTS

PACKAGING INFORMATION

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/Ball Finish	MSL Peak Temp [3]
TIL311	NRND			14		TBD	Call TI	Call TI

[1] The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

[2] Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

[3] MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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