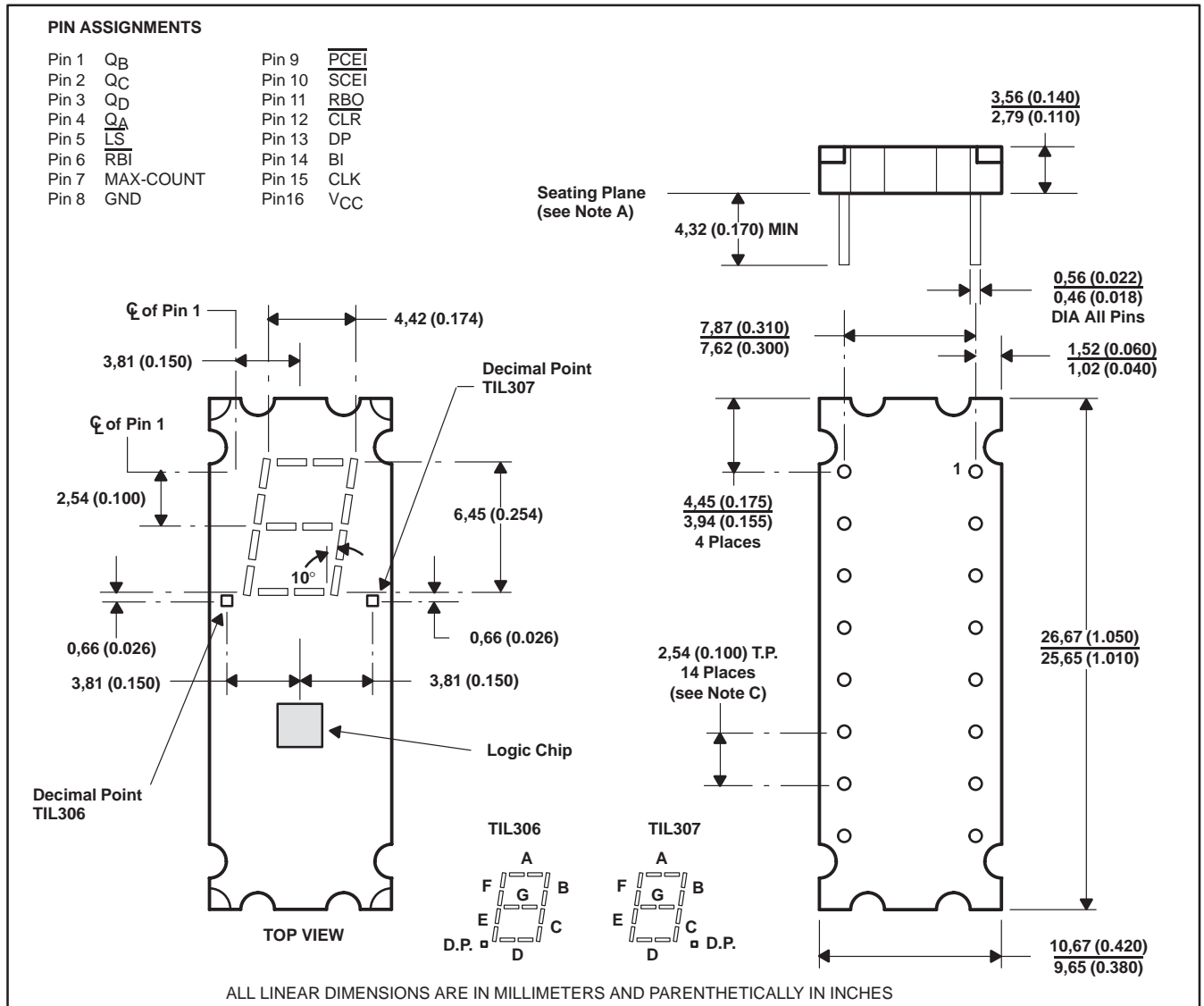


SOLID-STATE DISPLAYS WITH INTEGRAL TTL MSI CIRCUIT CHIP FOR USE IN ALL SYSTEMS WHERE THE DATA TO BE DISPLAYED IS THE PULSE COUNT

- 6,9-mm (0.270-Inch) Character Height
- High Luminous Intensity
- TIL306 Has Left Decimal
- TIL307 Has Right Decimal
- Easy System Interface
- Wide Viewing Angle
- Internal TTL MSI Chip and Counter, Latch, Decoder, and Driver
- Constant-Current Drive for Light-Emitting Diodes

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 11,43-mm (0.450-inch) centers.

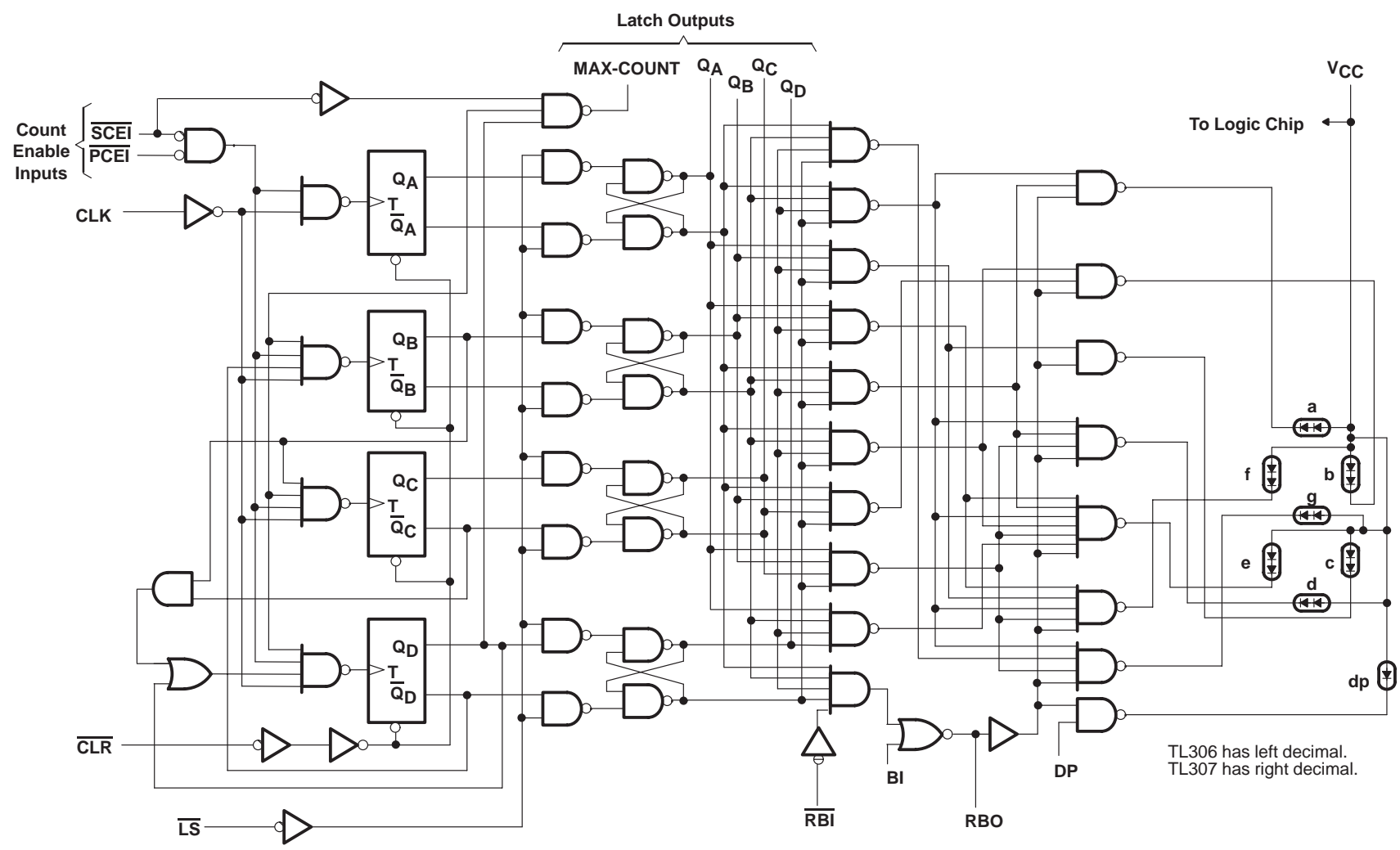


- NOTES: A. Lead dimensions are not controlled above the seating plane.
 B. Centerlines of character segments and decimal points are shown as dashed lines. Associated dimensions are nominal.
 C. The true-position pin spacing is 2,54 mm (0.100 inch) between centerlines. Each centerline is located with 0,26 mm (0.010 inch) of its true longitudinal position relative to pins 1 and 16.

TL306, TL307 NUMERIC DISPLAYS WITH LOGIC

SLS001-D1034, JUNE 1982-REVISED SEPTEMBER 1992

logic diagram



TL306 has left decimal.
TL307 has right decimal.

Synchronous BCD counter, 4-bit latch, decoder/driver, seven-segment LED display with decimal point

description

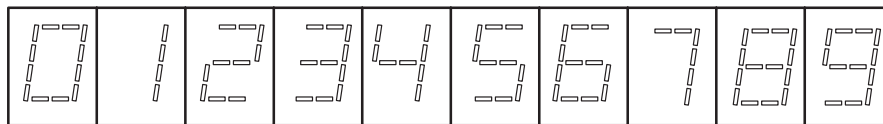
These internally-driven seven-segment light-emitting-diode (LED) displays contain a BCD counter, a four-bit latch, and a decoder/LED driver in a single 16-pin package. A description of the functions of the inputs and outputs of these devices are in the terminal function table.

The TTL MSI circuits contain the equivalent of 86 gates on a single chip. Logic inputs and outputs are completely TTL/DTL compatible. The buffered inputs are implemented with relatively large resistors in series with the bases of the input transistors to lower drive-current requirements to one-half of that required for a standard Series 54/74 TTL input. The serial-carry input, actually two internal loads, is rated as one standard series 54/74 load.

The logic outputs, except RBO, are active pullup, and the latch outputs Q_A , Q_B , Q_C , and Q_D are each capable of driving three standard Series 54/74 loads at a low logic level or six loads at a high logic level while the maximum-count output is capable of driving five Series 54/74 loads at a low logic level or ten loads at a high logic level. The RBO node with passive pull-up serves as a ripple-blanking output with the capability to drive three Series 54/74 loads.

The LED driver outputs are designed specifically to maintain a relatively constant on-level current of approximately 7 mA through each LED segment and decimal point. All inputs are diode clamped to minimize transmission-line effects, thereby simplifying system design. Maximum clock frequency is typically 18 MHz and power dissipation is typically 600 mW with all segments on.

The display format is as follows:



The displays may be interconnected to produce an n-digit display with the following features:

- Ripple-blanking input and output for blanking leading or trailing zeroes
- Floating-decimal-point logic capability
- Overriding blanking for suppressing entire display or pulse modulation of LED brightness
- Dual count-enable inputs for parallel lookahead and serial ripple logic to build high-speed fully synchronous, multidigit counter systems with no external logic, minimizing total propagation delay from the clock to the last latch output
- Provision for ripple-count cascading between packages
- Positive-edge-triggered synchronous BCD counter
- Parallel BCD data outputs available to drive logic processors or remote slaved displays simultaneously with data being displayed
- Latch strobe input allows counter to operate while a previous data point is displayed
- Reset-to-zero capability with clear input.

TIL306, TIL307 NUMERIC DISPLAYS WITH LOGIC

SLBS001 – D1034, JUNE 1982 – REVISED SEPTEMBER 1992

Terminal Functions

PIN NAME	NO.	DESCRIPTION
BLANKING Input (BI)	14	When high, will blank (turn off) the entire display and force RBO low. Must be low for normal display. May be pulsed to implement intensity control of the display.
CLEAR Input (CLR)	12	When low, resets and holds counter at 0. Must be high for normal counting.
CLOCK Input (CLK)	15	Each positive-going transition will increment the counter provided that the circuit is in the normal counting mode (serial and parallel count enable inputs low, clear input high).
DECIMAL POINT Input (DP)	13	Must be high to display decimal point. The decimal point is not displayed when this input is low or when the display is blanked.
LATCH Outputs (QA, QB, QC, QD)	4, 1, 2, 3	The BCD data that drives the decoder can be stored in the 4-bit latch and is available at these outputs for driving other logic and/or processors. The binary weights of the outputs are: QA = 1, QB = 2, QC = 4, QD = 8.
LATCH STROBE Input (LS)	5	When low, data in latches follow the data in the counter. When high, the data in the latches are held constant, and the counter may be operated independently.
MAX-COUNT Output	7	Will go low when the counter is at 9 and serial count enable input is low. Will return high when the counter changes to 0 and will remain high during counts 1 through 8. Will remain high (inhibited) as long as serial count enable input is high.
PARALLEL Count Enable Input (PCEI)	9	Must be low for normal counting mode. When high, counter will be inhibited. Logic level must not be changed when the clock is low.
RIPPLE-BLANKING Input (RBI)	6	When the data in the latches is BCD 0, a low input will blank the entire display and force the RBO low. This input has no effect if the data in the latches is other than 0.
RIPPLE-BLANKING Output (RBO)	11	Supplies ripple-blanking information for the ripple-blanking input of the next decade. Provides a low if BI is high, or if RBI is low and the data in the latches is BCD 0; otherwise, this output is high. This pin has a resistive pullup circuit suitable for performing a wire-AND function with any open-collector output. Whenever this pin is low, the entire display will be blanked; therefore, this pin may be used as an active-low blanking input.
SERIAL Count Enable Input (SCEI)	10	Must be low for normal counting mode, also must be low to enable maximum count output to go low. When high, counter will be inhibited and maximum count output will be driven high. Logic level must not be changed when the clock is low.

absolute maximum ratings over operating case temperature range (unless otherwise noted)

Supply voltage, V _{CC} (see Note 1): Continuous	5.5 V
Nonrepetitive peak, t _w ≤ 100 ms	7 V
Input voltage (see Note 1)	5.5 V
Operating case temperature range, T _C (see Note 2)	0°C to 85°C
Storage temperature range	-25°C to 85°C

- NOTES: 1. Voltage values are with respect to network 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}			4.75	5	5.25	V
Normalized fan-out from each output, N (to Series 54/74 integrated circuits)	Low logic level	Q_A, Q_B, Q_C, Q_D, RBO			3	
		MAX-COUNT Output			5	
	High logic level	RBO			3	
		Q_A, Q_B, Q_C, Q_D			6	
		MAX-COUNT Output			10	
Clock pulse duration, $t_w(\text{clock})$		High logic level	25		ns	
		Low logic level	55			
Clear pulse duration, $t_w(\text{clear})$			25		ns	
Latch strobe pulse duration, $t_w(\text{latch strobe})$			45		ns	
Setup time, t_{su}	PCEI/SCEI \uparrow before CLOCK \uparrow		30		ns	
	CLEAR \uparrow before CLOCK \uparrow		60			
Operating case temperature, T_C			0		70	$^{\circ}\text{C}$

electrical characteristics at 25 $^{\circ}\text{C}$ case temperature

PARAMETER		TEST CONDITIONS	MIN	TYP \dagger	MAX	UNIT		
V_{IH}	High-level input voltage		2			V		
V_{IL}	Low-level input voltage				0.8	V		
V_{IK}	Input clamp voltage	$V_{CC} = 4.75\text{ V}, I_I = -12\text{ mA}$			-1.5	V		
V_{OH}	High-level output voltage	RBO	$V_{CC} = 4.75\text{ V}, I_{OH} = -120\text{ }\mu\text{A}$	2.4		V		
		Q_A, Q_B, Q_C, Q_D	$V_{CC} = 4.75\text{ V}, I_{OH} = -240\text{ }\mu\text{A}$					
		MAX-COUNT Output	$V_{CC} = 4.75\text{ V}, I_{OH} = -400\text{ }\mu\text{A}$					
V_{OL}	Low-level output voltage (see Note 3)	Q_A, Q_B, Q_C, Q_D, RBO	$V_{CC} = 4.75\text{ V}, I_{OL} = 4.8\text{ mA}$		0.4	V		
		MAX-COUNT Output	$V_{CC} = 4.75\text{ V}, I_{OL} = 8\text{ mA}$					
I_I	Input current at maximum input voltage	$V_{CC} = 5.25\text{ V}, V_I = 5.5\text{ V}$			1	mA		
I_{IH}	High-level input current	SCEI	$V_{CC} = 5.25\text{ V}, V_I = 2.4\text{ V}$			40		
		RBO node				-0.12	-0.5	mA
		Other inputs					20	μA
I_{IL}	Low-level input current	SCEI	$V_{CC} = 5.25\text{ V}, V_I = 0.4\text{ V}$			-1.6		
		RBO node				-1.5	-2.4	mA
		Other inputs					-0.8	
I_{OS}	Short-circuit output current	Q_A, Q_B, Q_C, Q_D	$V_{CC} = 5.25\text{ V}$			-9		
		MAX-COUNT Output				-15	-55	mA
I_{CC}	Supply current	$V_{CC} = 5.25\text{ V},$ See Note 4		120	200	mA		
I_v	Luminous intensity (see Note 5)	Figure B	$V_{CC} = 5\text{ V}$			700		
		DP Input				40	70	μcd
λ_p	Wavelength at peak emission	$V_{CC} = 5\text{ V},$ See Note 4		660		nm		
$\Delta\lambda$	Spectral bandwidth	$V_{CC} = 5\text{ V},$ See Note 4		20		nm		

\dagger All typical values are at $V_{CC} = 5\text{ V}$.

NOTES: 3. This parameter is measured with the display blanked ($BI = 5\text{ V}$).

4. These parameters are measured with all LED segments and the decimal point on.

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

TIL306, TIL307 NUMERIC DISPLAYS WITH LOGIC

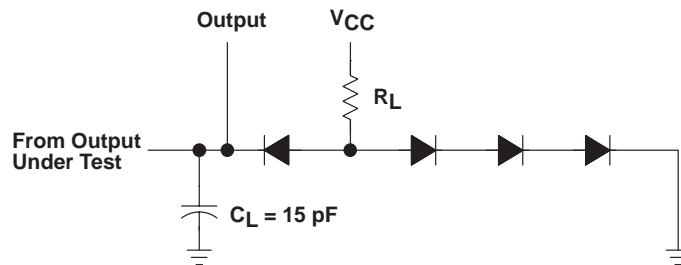
SLBS001 – D1034, JUNE 1982 – REVISED SEPTEMBER 1992

switching characteristics, $V_{CC} = 5\text{ V}$, $T_C = 25^\circ\text{C}$

PARAMETER†	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
f_{\max}				12	18		MHz	
t_{PLH}	SERIAL lookahead	MAX-COUNT Output	$C_L = 15\text{ pF}$, $R_L = 560\ \Omega$, See Figure 1		12		ns	
t_{PHL}					23			
t_{PLH}	CLK Input	MAX-COUNT Output			26		ns	
t_{PHL}					29			
t_{PLH}	CLK Input	Q_A, Q_B, Q_C, Q_D		$C_L = 15\text{ pF}$, $R_L = 1.2\text{ k}\Omega$, See Figure 1		28		ns
t_{PHL}						38		
t_{PHL}	CLR Input	Q_A, Q_B, Q_C, Q_D			57		ns	

† f_{\max} ≡ Maximum clock frequency
 t_{PLH} ≡ Propagation delay time, low-to-high-level output
 t_{PHL} ≡ Propagation delay time, high-to-low-level output

PARAMETER MEASUREMENT INFORMATION



NOTES: A. C_L includes probe and jig capacitance.
 B. All diodes are 1N3064.

Figure 1. Load Circuit

TYPICAL CHARACTERISTICS

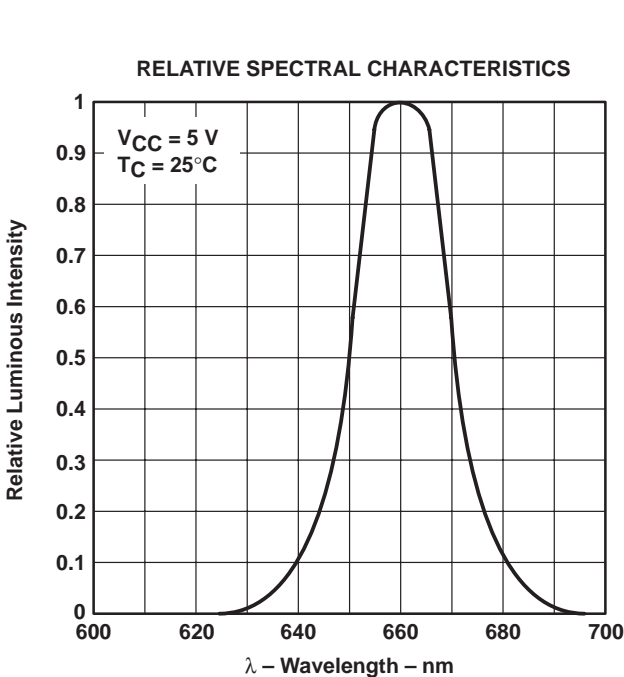


Figure 2

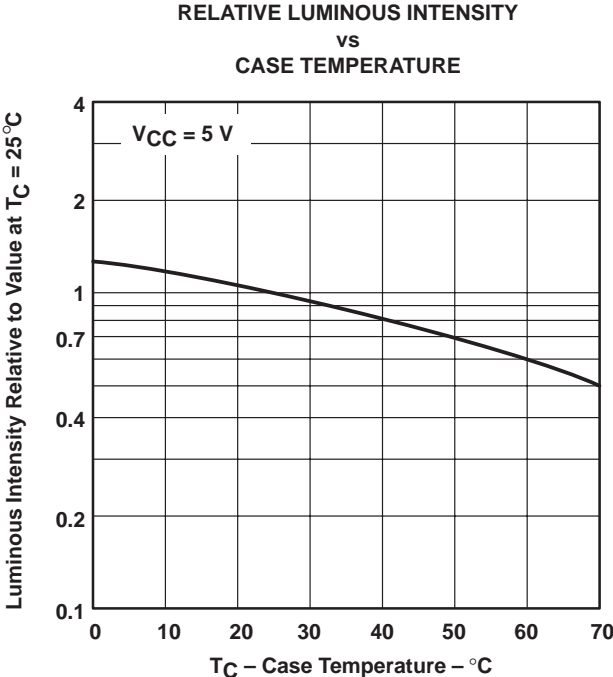


Figure 3

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
TIL306	OBSOLETE			16		TBD	Call TI	Call TI
TIL307	OBSOLETE			16		TBD	Call TI	Call TI
TIL307	OBSOLETE			16		TBD	Call TI	Call TI
TIL307	OBSOLETE			16		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.

Important Information and Disclaimer:The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265