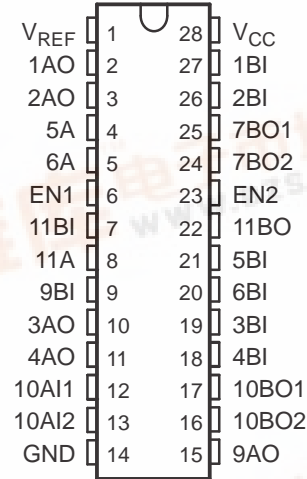


## FEATURES

- Operates as a GTL-/GTL/GTL+ to LVTTL or LVTTL to GTL-/GTL/GTL+ Translator
- Series Termination on TTL Output of 30  $\Omega$
- Latch-Up Testing Done to JEDEC Standard JESD 78
- ESD Performance Tested Per JESD 22
  - 2000-V Human-Body Model (A114-B, Class II)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

PW PACKAGE  
(TOP VIEW)



## DESCRIPTION/ORDERING INFORMATION

The SN74GTL2107 is a 12-bit translator that interfaces between the 3.3-V LVTTL chip set I/O and the Xeon™ processor GTL-/GTL/GTL+ I/O. The device is designed for platform health management in dual-processor applications.

### PIN DESCRIPTION

| PIN NO.                | SYMBOL     | NAME AND FUNCTION   |
|------------------------|------------|---|
| 1                      | $V_{REF}$  | GTL reference voltage   |
| 2–6, 8, 10–13, 15, 23  | ENn<br>nAn | Data and enable inputs/outputs (LVTTL) on all inputs and pin 15 output. Remaining outputs are open drain. |
| 7, 9, 16, 17–22, 24–27 | nBn        | Data inputs/outputs (GTL-/GTL/GTL+)   |
| 14                     | GND        | Ground (0 V)  |
| 28                     | $V_{CC}$   | Positive supply voltage   |

### ORDERING INFORMATION

| $T_A$         | PACKAGE <sup>(1)</sup> |               | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---------------|------------------------|---------------|-----------------------|------------------|
| –40°C to 85°C | TSSOP – PW             | Tube          | SN74GTL2107PW         | GK2107           |
|               |                        | Tape and reel | SN74GTL2107PWR        |                  |

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

Xeon is a trademark of Intel Corporation.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of the Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

Copyright © 2006, Texas Instruments Incorporated



# SN74GTL2107

## 12-BIT GTL-/GTL/GTL+ TO LVTTTL TRANSLATOR

SC116689-01 JULY 2006  
[查看“SN74GTL2107”供应商](#)

**FUNCTION TABLES<sup>(1)</sup>**

| INPUTS |         | OUTPUT<br>1AO/2AO<br>(OPEN DRAIN) |
|--------|---------|-----------------------------------|
| EN1    | 1BI/2BI |                                   |
| H      | L       | L                                 |
| H      | H       | H                                 |
| L      | X       | H                                 |

(1) H = High voltage level, L = Low voltage level

| INPUTS |         | OUTPUT<br>3AO/4AO<br>(OPEN DRAIN) |
|--------|---------|-----------------------------------|
| EN2    | 3BI/4BI |                                   |
| H      | L       | L                                 |
| H      | H       | H                                 |
| L      | X       | H                                 |

| INPUT<br>9BI | OUTPUT<br>9AO |
|--------------|---------------|
| L            | L             |
| H            | H             |

| INPUTS      |     | OUTPUT<br>10BO1/10BO2 |
|-------------|-----|-----------------------|
| 10AI1/10AI2 | 9BI |                       |
| L           | L   | L                     |
| L           | H   | L                     |
| H           | L   | L                     |
| H           | H   | H                     |

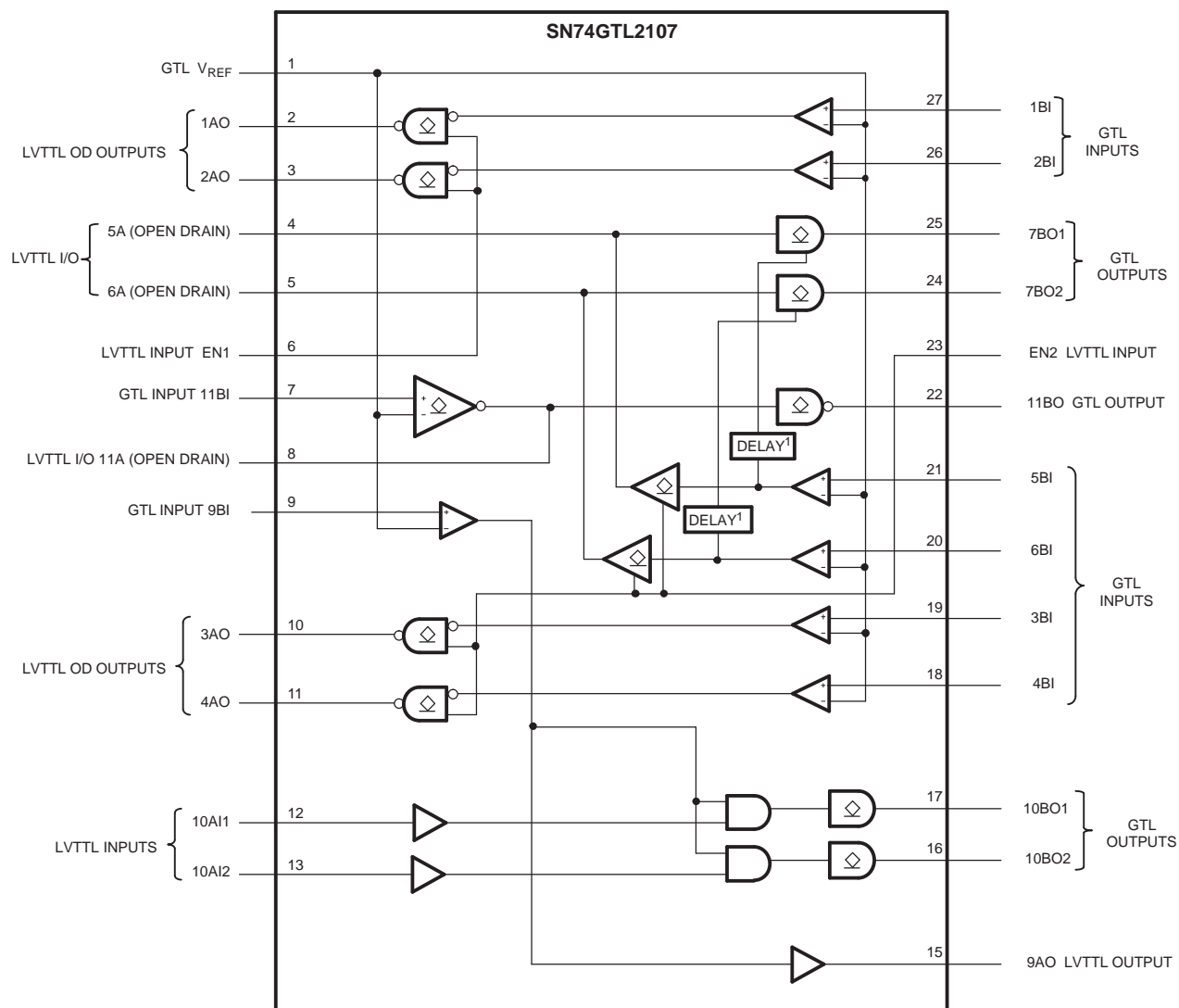
| INPUTS |         | INPUT/OUTPUT<br>5A/6A<br>(OPEN DRAIN) | OUTPUT<br>7BO1/7BO2 |
|--------|---------|---------------------------------------|---------------------|
| EN2    | 5BI/6BI |                                       |                     |
| H      | L       | L                                     | H <sup>(1)</sup>    |
| H      | H       | L <sup>(2)</sup>                      | L                   |
| H      | H       | H                                     | H                   |
| L      | H       | L <sup>(2)</sup>                      | L                   |
| L      | H       | H                                     | H                   |
| L      | L       | H                                     | H                   |
| L      | L       | L <sup>(2)</sup>                      | H                   |

- (1) The enable on 7BO1/7BO2 includes a delay that prevents a transient condition (where 5BI/6BI goes from low to high, and the low to high on 5A/6A lags up to 100 ns) from causing a low glitch on the 7BO1/7BO2 outputs.
- (2) Open-drain input/output terminal is driven to a logic-low state by an external driver.

| INPUT<br>11BI | INPUT/OUTPUT<br>11A<br>(OPEN DRAIN) | OUTPUT<br>11BO |
|---------------|-------------------------------------|----------------|
| L             | H                                   | L              |
| L             | L <sup>(1)</sup>                    | H              |
| H             | L                                   | H              |

- (1) Open-drain input/output terminal is driven to a logic-low state by an external driver.

LOGIC SYMBOL



- (1) The enable on 7BO1/7BO2 includes a delay that prevents a transient condition (where 5BI/6BI go from low to high, and the low to high on 5A/6A lags up to 100 ns) from causing a low glitch on the 7BO1/7BO2 outputs.

# SN74GTL2107

## 12-BIT GTL-/GTL/GTL+ TO LVTTTL TRANSLATOR

SCS5639-00174066 查询"SN74GTL2107"供应商

### Absolute Maximum Ratings<sup>(1)(2)</sup>

over operating free-air temperature range (unless otherwise noted)

|               |   |                 | MIN  | MAX | UNIT |
|---------------|---|-----------------|------|-----|------|
| $V_{CC}$      | Supply voltage range  |                 | -0.5 | 4.6 | V    |
| $V_I$         | Input voltage range <sup>(3)</sup>                                | A port (LVTTTL) | -0.5 | 4.6 | V    |
|               |   | B port (GTL)    | -0.5 | 4.6 |      |
| $V_O$         | Output voltage range (output in OFF or HIGH state) <sup>(3)</sup> | A port          | -0.5 | 4.6 | V    |
|               |   | B port          | -0.5 | 4.6 |      |
| $I_{IK}$      | Input diode current   | $V_I < 0$       |      | -50 | mA   |
| $I_{OK}$      | Output diode current  | $V_O < 0$       |      | -50 | mA   |
|               | Current into any output in the LOW state                          | A port          |      | 32  | mA   |
|               |   | B port          |      | 30  |      |
|               | Current into any output in the HIGH state                         | A port          |      | -32 | mA   |
|               |   |                 |      |     |      |
| $\theta_{JA}$ | Package thermal impedance <sup>(4)</sup>                          |                 |      | 62  | °C/W |
| $T_{stg}$     | Storage temperature range   |                 | -60  | 150 | °C   |

- (1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) Voltages are referenced to GND (ground = 0 V).
- (3) The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.
- (4) The performance capability of a high-performance integrated circuit, in conjunction with its thermal environment, can create junction temperatures that are detrimental to reliability. The maximum junction temperature of this integrated circuit should not exceed 150°C.

### Recommended Operating Conditions

|                  |                                |         | MIN                      | NOM                 | MAX  | UNIT |    |
|------------------|--------------------------------|---------|--------------------------|---------------------|------|------|----|
| V <sub>CC</sub>  | Supply voltage                 |         | 3                        | 3.3                 | 3.6  | V    |    |
| V <sub>TT</sub>  | Termination voltage            | GTL−    | 0.85                     | 0.9                 | 0.95 | V    |    |
|                  |                                | GTL     | 1.14                     | 1.2                 | 1.26 |      |    |
|                  |                                | GTL+    | 1.35                     | 1.5                 | 1.65 |      |    |
| V <sub>REF</sub> | Reference voltage              | Overall | 0.5                      | 2/3 V <sub>TT</sub> | 1.8  | V    |    |
|                  |                                | GTL−    | 0.5                      | 0.6                 | 0.63 |      |    |
|                  |                                | GTL     | 0.76                     | 0.8                 | 0.84 |      |    |
|                  |                                | GTL+    | 0.87                     | 1                   | 1.1  |      |    |
| V <sub>I</sub>   | Input voltage                  | A port  | 0                        | 3.3                 | 3.6  | V    |    |
|                  |                                | B port  | 0                        | V <sub>TT</sub>     | 3.6  |      |    |
| V <sub>IH</sub>  | High-level input voltage       | A port  | 2                        |                     |      | V    |    |
|                  |                                | B port  | V <sub>REF</sub> + 50 mV |                     |      |      |    |
| V <sub>IL</sub>  | Low-level input voltage        | A port  | 0.8                      |                     |      | V    |    |
|                  |                                | B port  | V <sub>REF</sub> − 50 mV |                     |      |      |    |
| I <sub>OH</sub>  | High-level output current      | A port  | −16                      |                     |      | mA   |    |
| I <sub>OL</sub>  | Low-level output current       | A port  | 16                       |                     |      | mA   |    |
|                  |                                | B port  | 15                       |                     |      |      |    |
| T <sub>A</sub>   | Operating free-air temperature |         | −40                      |                     |      | 85   | °C |

## Electrical Characteristics

over recommended operating conditions

| PARAMETER                       |                          | TEST CONDITIONS  | –40°C to 85°C         |                    |     | UNIT |
|---------------------------------|--------------------------|--|-----------------------|--------------------|-----|------|
|                                 |                          |  | MIN                   | TYP <sup>(1)</sup> | MAX |      |
| V <sub>OH</sub> <sup>(2)</sup>  | A port                   | V <sub>CC</sub> = 3 V to 3.6 V, I <sub>OH</sub> = –100 μA                            | V <sub>CC</sub> – 0.2 |                    |     | V    |
|                                 |                          | V <sub>CC</sub> = 3 V, I <sub>OH</sub> = –16 mA                                      | 2.1                   |                    |     |      |
| V <sub>OL</sub> <sup>(2)</sup>  | A port                   | V <sub>CC</sub> = 3 V, I <sub>OL</sub> = 16 mA                                       | 0.8                   |                    |     | V    |
|                                 | B port                   | V <sub>CC</sub> = 3 V, I <sub>OL</sub> = 15 mA                                       | 0.4                   |                    |     |      |
| I <sub>I</sub>                  | A port                   | V <sub>CC</sub> = 3.6 V, V <sub>I</sub> = V <sub>CC</sub>                            | ±1                    |                    |     | μA   |
|                                 |                          | V <sub>CC</sub> = 3.6, V <sub>I</sub> = 0 V  | ±1                    |                    |     |      |
|                                 | B port                   | V <sub>CC</sub> = 3.6 V, V <sub>I</sub> = V <sub>TT</sub> or GND                     | ±1                    |                    |     |      |
| I <sub>CC</sub>                 | A or B port              | V <sub>CC</sub> = 3.6 V, V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0 | 12                    |                    |     | mA   |
| ΔI <sub>CC</sub> <sup>(3)</sup> | A port or control inputs | V <sub>CC</sub> = 3.6 V, V <sub>I</sub> = V <sub>CC</sub> – 0.6 V                    | 500                   |                    |     | μA   |
| C <sub>IO</sub>                 | A port                   | V <sub>O</sub> = 3 V or 0  | 5                     |                    |     | pF   |
|                                 | B port                   | V <sub>O</sub> = V <sub>TT</sub> or 0  | 4                     |                    |     |      |

(1) All typical values are at  $V_{CC} = 3.3\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

(2) The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

(3) This is the increase in supply current for each input that is at the specified LVTTTL voltage, rather than  $V_{CC}$  or GND.

## Switching Characteristics

over recommended operating free-air temperature range

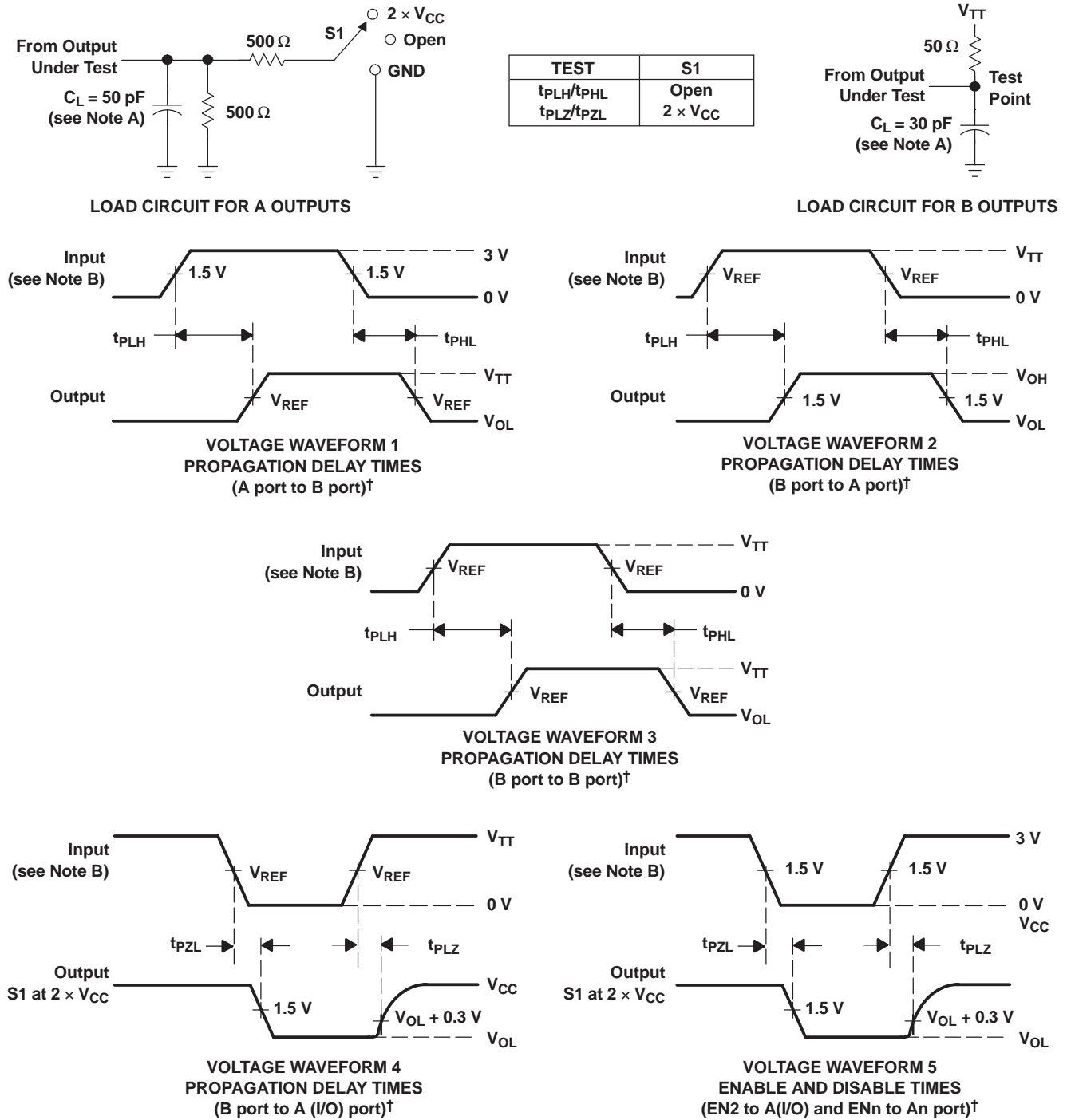
| PARAMETER                       |                 | WAVEFORM | GTL–   |                    |     | GTL  |                    |     | GTL+   |                    |     | UNIT |
|---------------------------------|-----------------|----------|--|--------------------|-----|--|--------------------|-----|--|--------------------|-----|------|
|                                 |                 |          | $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$<br>$V_{REF} = 0.6\text{ V}$ |                    |     | $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$<br>$V_{REF} = 0.8\text{ V}$ |                    |     | $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$<br>$V_{REF} = 1\text{ V}$ |                    |     |      |
|                                 |                 |          | MIN  | TYP <sup>(1)</sup> | MAX | MIN  | TYP <sup>(1)</sup> | MAX | MIN  | TYP <sup>(1)</sup> | MAX |      |
| t <sub>PLH</sub>                | An to Bn        | 1        | 2  | 4                  | 8   | 2  | 4                  | 8   | 2  | 4                  | 8   | ns   |
| t <sub>PHL</sub>                |                 |          | 2  | 5.5                | 10  | 2  | 5.5                | 10  | 2  | 5.5                | 10  |      |
| t <sub>PLH</sub>                | 9BI to 9AO      | 2        | 2  | 5.5                | 10  | 2  | 5.5                | 10  | 2  | 5.5                | 10  | ns   |
| t <sub>PHL</sub>                |                 |          | 2  | 5.5                | 10  | 2  | 5.5                | 10  | 2  | 5.5                | 10  |      |
| t <sub>PLH</sub>                | 9BI to 10BOn    | 3        | 2  | 6                  | 11  | 2  | 6                  | 11  | 2  | 6                  | 11  | ns   |
| t <sub>PHL</sub>                |                 |          | 2  | 6                  | 11  | 2  | 6                  | 11  | 2  | 6                  | 11  |      |
| t <sub>PLH</sub>                | 11BI to 11BO    | 3        | 2  | 8                  | 13  | 2  | 8                  | 13  | 2  | 8                  | 13  | ns   |
| t <sub>PHL</sub> <sup>(2)</sup> |                 |          | 2  | 14                 | 21  | 2  | 14                 | 21  | 2  | 14                 | 21  |      |
| t <sub>PLH</sub>                | Bn to Bn        | 3        | 4  | 7                  | 11  | 4  | 7                  | 11  | 4  | 7                  | 11  | ns   |
| t <sub>PHL</sub>                |                 |          | 120  | 205                | 350 | 120  | 205                | 350 | 120  | 205                | 350 |      |
| t <sub>PLZ</sub>                | ENn to An       | 5        | 1  | 3                  | 7   | 1  | 3                  | 7   | 1  | 3                  | 7   | ns   |
| t <sub>PZL</sub>                |                 |          | 1  | 3                  | 7   | 1  | 3                  | 7   | 1  | 3                  | 7   |      |
| t <sub>PLZ</sub>                | Bn to An (I/O)  | 4        | 2  | 5                  | 10  | 2  | 5                  | 10  | 2  | 5                  | 10  | ns   |
| t <sub>PZL</sub>                |                 |          | 2  | 5                  | 10  | 2  | 5                  | 10  | 2  | 5                  | 10  |      |
| t <sub>PLZ</sub>                | Bn to An        | 4        | 2  | 5                  | 10  | 2  | 5                  | 10  | 2  | 5                  | 10  | ns   |
| t <sub>PZL</sub>                |                 |          | 2  | 5                  | 10  | 2  | 5                  | 10  | 2  | 5                  | 10  |      |
| t <sub>PLZ</sub>                | EN2 to An (I/O) | 5        | 1  | 3                  | 7   | 1  | 3                  | 7   | 1  | 3                  | 7   | ns   |
| t <sub>PZL</sub>                |                 |          | 1  | 3                  | 7   | 1  | 3                  | 7   | 1  | 3                  | 7   |      |

(1) All typical values are measured at  $V_{CC} = 3.3\text{ V}$  and  $T_A = 25^\circ\text{C}$ .

(2) Includes –7.6-ns RC rise time of test-load pullup on 11 A, 1.5-k $\Omega$  pullup, and 21-pF load on 11 A has approximately 23-ns RC rise time.

# PARAMETER MEASUREMENT INFORMATION

$V_{TT} = 1.2 \text{ V}$ ,  $V_{REF} = 0.8 \text{ V}$  for GTL and  $V_{TT} = 1.5 \text{ V}$ ,  $V_{REF} = 1 \text{ V}$  for GTL+



<sup>†</sup> All control inputs are LVTTTL levels.

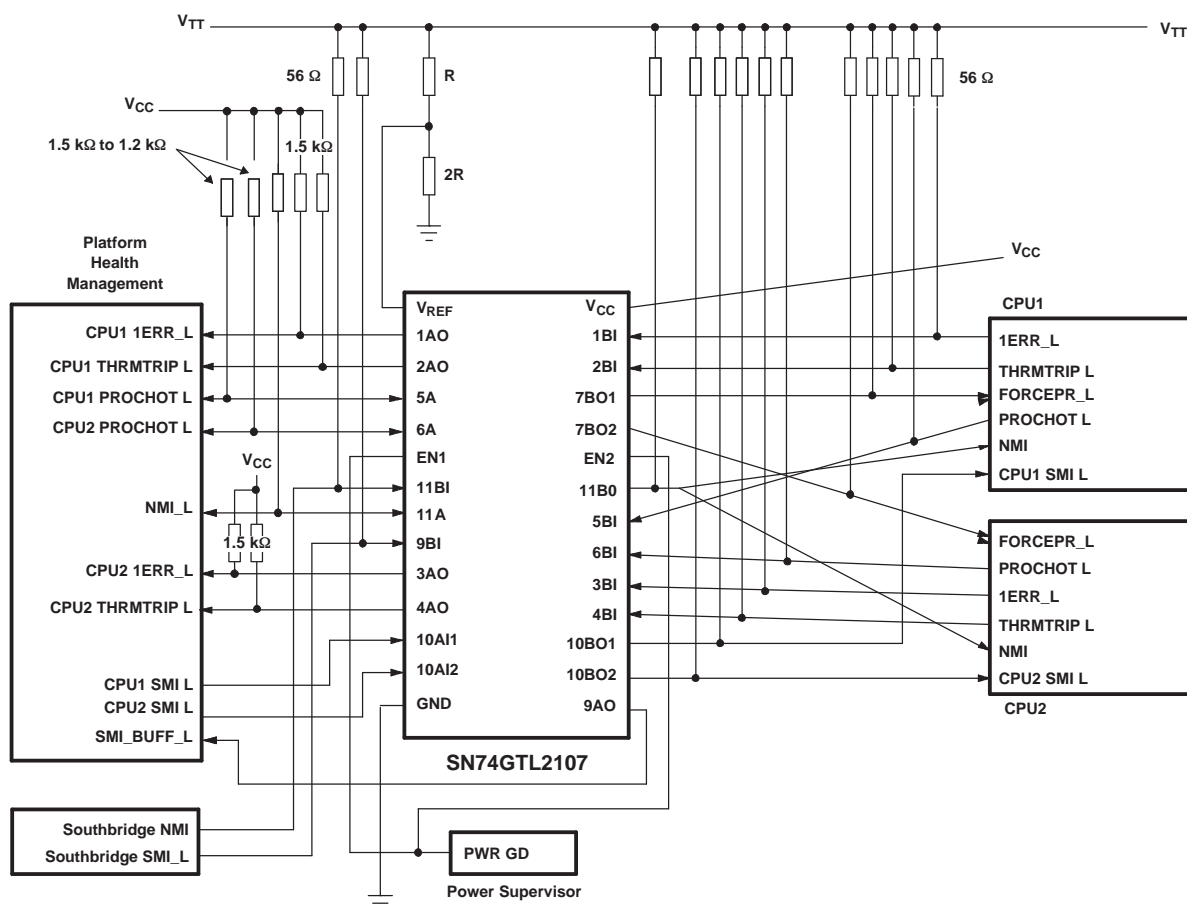
NOTES: A.  $C_L$  includes probe and jig capacitance.

B. All input pulses are supplied by generators having the following characteristics: PRR  $\leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5 \text{ ns}$ ,  $t_f \leq 2.5 \text{ ns}$ .

C. The outputs are measured one at a time, with one transition per measurement.

Figure 1. Load Circuits and Voltage Waveforms

## APPLICATION INFORMATION



### Frequently Asked Questions

**Question 1:** On the SN74GTL2107 LVTTTL input, specifically 10AI1 and 10AI2, when the SN74GTL2107 is powered down, these inputs may be pulled up to 3.3 V, and we want to ensure that there is no leakage path to the power rail under this condition. Are the LVTTTL inputs high impedance when the device is powered down, and will there be any leakage?

**Answer 1:** When the device is powered down, the LVTTTL inputs are in a high-impedance state and do not leak to  $V_{DD}$  if they are pulled high while the device is powered down.

**Question 2:** Do all the LVTTTL inputs have the same powered-down characteristic?

**Answer 2:** Yes

**Question 3:** What is the condition of the other GTL I/O and LVTTTL output pins when the device is powered down?

**Answer 3:** The open-drain outputs, both GTL and LVTTTL, do not leak to the power supply if they are pulled high while the device is powered down. The GTL inputs also do not leak to the power supply under the same conditions. The LVTTTL totem-pole outputs, however, are not open-drain type outputs, and there is current flow on these pins if they are pulled high when  $V_{DD}$  is at ground.

**PACKAGING INFORMATION**

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| SN74GTL2107PW    | ACTIVE                | TSSOP        | PW              | 28   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74GTL2107PWG4  | ACTIVE                | TSSOP        | PW              | 28   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74GTL2107PWR   | ACTIVE                | TSSOP        | PW              | 28   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74GTL2107PWRG4 | ACTIVE                | TSSOP        | PW              | 28   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |

<sup>(1)</sup> 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.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), 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.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**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)

<sup>(3)</sup> 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.



## TAPE AND REEL INFORMATION



\*All dimensions are nominal

| Device         | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74GTL2107PWR | TSSOP        | PW              | 28   | 2000 | 330.0              | 16.4               | 7.1     | 10.4    | 1.6     | 12.0    | 16.0   | Q1            |

**TAPE AND REEL BOX DIMENSIONS**



\*All dimensions are nominal

| Device         | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74GTL2107PWR | TSSOP        | PW              | 28   | 2000 | 346.0       | 346.0      | 33.0        |

[查询"SN74GTL2107"供应商](#)

MTSS001C – JANUARY 1995 – REVISED FEBRUARY 1999

PW (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
B. This drawing is subject to change without notice.  
C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
D. Falls within JEDEC MO-153

## 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 TI 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. Information of third parties may be subject to additional restrictions.

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.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

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

### Products

|                             |  |
|-----------------------------|--|
| Amplifiers                  | <a href="http://amplifier.ti.com">amplifier.ti.com</a>             |
| Data Converters             | <a href="http://dataconverter.ti.com">dataconverter.ti.com</a>     |
| DSP                         | <a href="http://dsp.ti.com">dsp.ti.com</a>                         |
| Clocks and Timers           | <a href="http://www.ti.com/clocks">www.ti.com/clocks</a>           |
| Interface                   | <a href="http://interface.ti.com">interface.ti.com</a>             |
| Logic                       | <a href="http://logic.ti.com">logic.ti.com</a>                     |
| Power Mgmt                  | <a href="http://power.ti.com">power.ti.com</a>                     |
| Microcontrollers            | <a href="http://microcontroller.ti.com">microcontroller.ti.com</a> |
| RFID                        | <a href="http://www.ti-rfid.com">www.ti-rfid.com</a>               |
| RF/IF and ZigBee® Solutions | <a href="http://www.ti.com/lprf">www.ti.com/lprf</a>               |

### Applications

|                    |  |
|--------------------|--|
| Audio              | <a href="http://www.ti.com/audio">www.ti.com/audio</a>                   |
| Automotive         | <a href="http://www.ti.com/automotive">www.ti.com/automotive</a>         |
| Broadband          | <a href="http://www.ti.com/broadband">www.ti.com/broadband</a>           |
| Digital Control    | <a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a> |
| Medical            | <a href="http://www.ti.com/medical">www.ti.com/medical</a>               |
| Military           | <a href="http://www.ti.com/military">www.ti.com/military</a>             |
| Optical Networking | <a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a> |
| Security           | <a href="http://www.ti.com/security">www.ti.com/security</a>             |
| Telephony          | <a href="http://www.ti.com/telephony">www.ti.com/telephony</a>           |
| Video & Imaging    | <a href="http://www.ti.com/video">www.ti.com/video</a>                   |
| Wireless           | <a href="http://www.ti.com/wireless">www.ti.com/wireless</a>             |