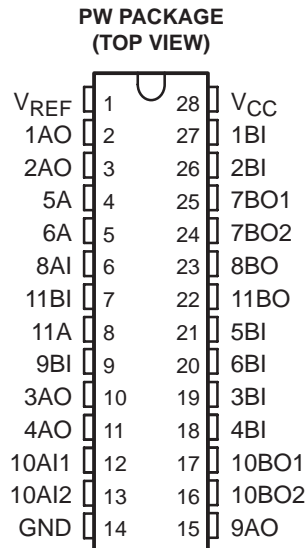


- Operates as GTL-/GTL/GTL+ to LVTTTL or LVTTTL to GTL-/GTL/GTL+ Translator
- Series Termination on TTL Outputs of 30  $\Omega$
- Latch-Up Testing to JEDEC Standard JESD 78 Exceeds 500 mA
- ESD Performance Tested Per JESD 22
  - 2000-V Human-Body Model (A114-B, Class II)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)



## description

The SN74GTL2006 is a 13-bit translator to interface between the 3.3-V LVTTTL chipset 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 NUMBER	SYMBOL	NAME AND FUNCTION
1	V <sub>REF</sub>	GTL reference voltage
2–6, 8, 10–13, 15	nAn	Data inputs/outputs (LVTTTL)
7, 9, 16, 17–27	nBn	Data inputs/outputs (GTL-/GTL/GTL+)
14	GND	Ground (0 V)
28	V <sub>CC</sub>	Positive supply voltage

## ORDERING INFORMATION

T <sub>A</sub>	PACKAGE†	ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	TSSOP – PW	Tube	SN74GTL2006PW
		Tape and reel	SN74GTL2006PWR

† 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).



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# SN74GTL2006

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

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### Function Tables

INPUTS 1BI/2BI/3BI/4BI/9BI	OUTPUTS 1AO/2AO/3AO/4AO/9AO
L	L
H	H

INPUT 8AI	OUTPUT 8BO
L	L
H	H

INPUTS		OUTPUTS
10AI1/10AI2	9BI	10BO1/10BO2
L	L	L
L	H	L
H	L	L
H	H	H

INPUTS 5BI/6BI	INPUTS/OUTPUTS 5A/6A (OPEN DRAIN)	OUTPUTS 7BO1/7BO2
L	L	H <sup>†</sup>
H	L <sup>‡</sup>	L
H	H	H

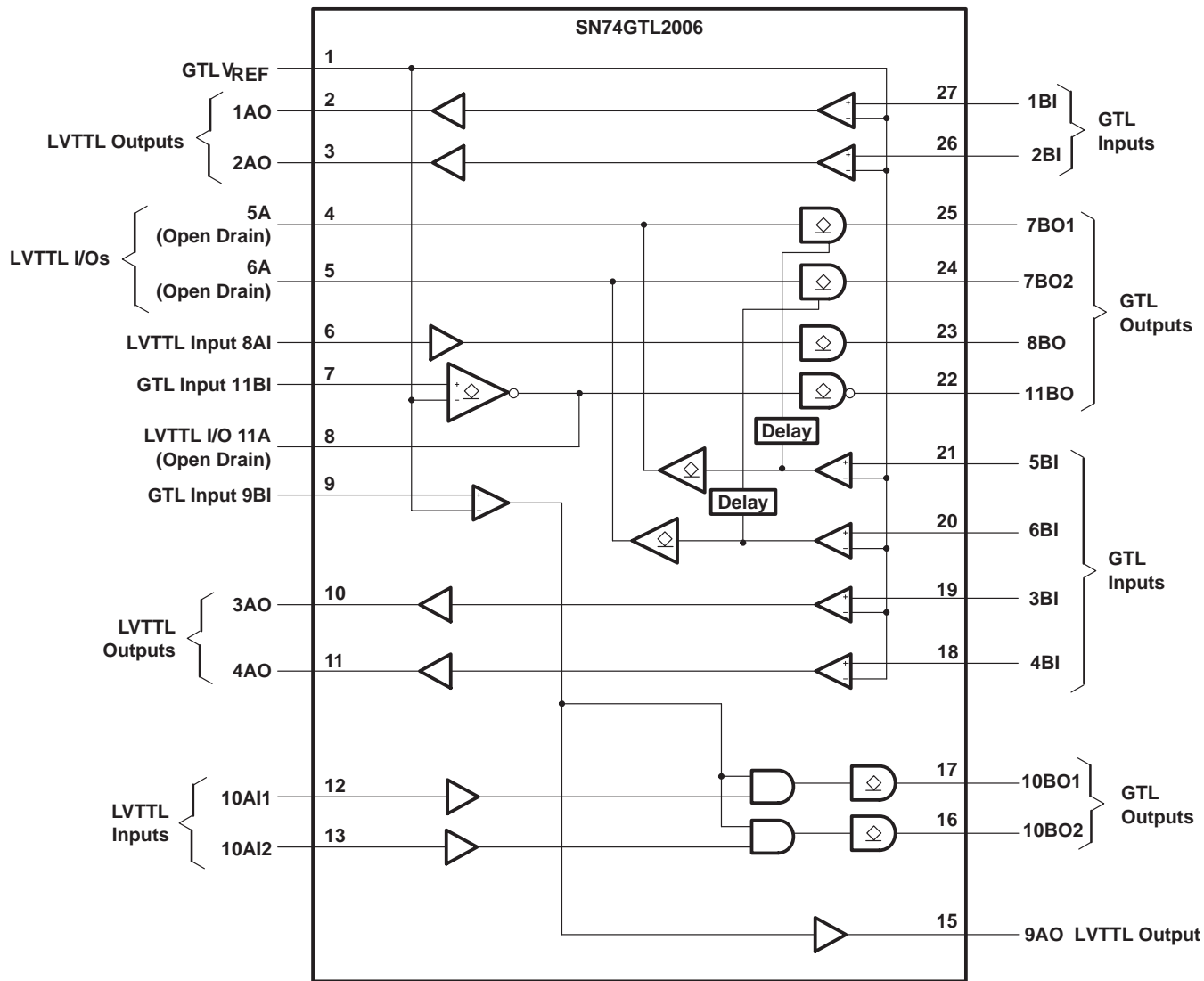
<sup>†</sup> The enable on 7BO1/7BO2 includes a delay that prevents a transient condition (when 5BI/6BI goes from low to high, and the low to high on 5A/6A lags up to 100 ns) from causing a low glitch on the 7BO1/7BO2 outputs.

<sup>‡</sup> Open-drain input/output terminal is driven to a logic-low state by an external driver.

INPUT 11BI	INPUT/OUTPUT 11A (OPEN DRAIN)	OUTPUT 11BO
L	H	L
L	L <sup>‡</sup>	H
H	L	H

<sup>‡</sup> Open-drain input/output terminal is driven to a logic-low state by an external driver.

logic symbol



NOTE A: 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.

# SN74GTL2006

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

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### absolute maximum ratings over operating free-air temperature (unless otherwise noted)†‡

Supply voltage range, $V_{CC}$	–0.5 to 4.6 V
Input voltage range, $V_I$ (see Note 2): A port (LVTTTL)	–0.5 to 4.6 V
B port (GTL)	–0.5 to 4.6 V
Output voltage range, $V_O$ (output in OFF or HIGH state)(see Note 2): A port	–0.5 to 4.6 V
B port	–0.5 to 4.6 V
Input diode current, $I_{IK}$ ( $V_I < 0$ )	–50 mA
Output diode current, $I_{OK}$ ( $V_O < 0$ )	–50 mA
Current into any output in the LOW state: A port	32 mA
B port	30 mA
Current into any output in the HIGH state, A port	–32 mA
Storage temperature range, $T_{stg}$	–60 to 150°C

† 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.

‡ Voltages are referenced to GND (ground = 0 V).

- NOTES: 1. 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.
2. The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.

### recommended operating conditions

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



**electrical characteristics over recommended operating conditions**

PARAMETER		TEST CONDITIONS		-40°C TO 85°C			UNIT
				MIN	TYP†	MAX	
V <sub>OH</sub> ‡	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> ‡	A port	V <sub>CC</sub> = 3 V, I <sub>OL</sub> = 16 mA					0.8
	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
			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
ΔI <sub>CC</sub> §	A port or control inputs	V <sub>CC</sub> = 3.6 V,	V <sub>I</sub> = V <sub>CC</sub> - 0.6 V				500
C <sub>IO</sub>	A port	V <sub>O</sub> = 3 V or 0,	V <sub>O</sub> = 3 V or 0				5
	B port	V <sub>O</sub> = V <sub>TT</sub> or 0,	V <sub>O</sub> = V <sub>TT</sub> or 0				4

† All typical values are measured at V<sub>CC</sub> = 3.3 V and T<sub>A</sub> = 25°C.

‡ The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

§ This is the increase in supply current for each input that is at the specified LVTTTL voltage, rather than V<sub>CC</sub> or GND.

**switching characteristics over recommended operating free-air temperature range**

PARAMETER		WAVEFORM	GTL-			GTL			GTL+			UNIT
			V <sub>CC</sub> = 3.3 V ± 0.3 V, V <sub>REF</sub> = 0.6 V			V <sub>CC</sub> = 3.3 V ± 0.3 V, V <sub>REF</sub> = 0.8 V			V <sub>CC</sub> = 3.3 V ± 0.3 V, V <sub>REF</sub> = 1 V			
			MIN	TYP†	MAX	MIN	TYP†	MAX	MIN	TYP†	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>	Bn to An	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> ¶			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>	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	

† All typical values are measured at V<sub>CC</sub> = 3.3 V and T<sub>A</sub> = 25°C.

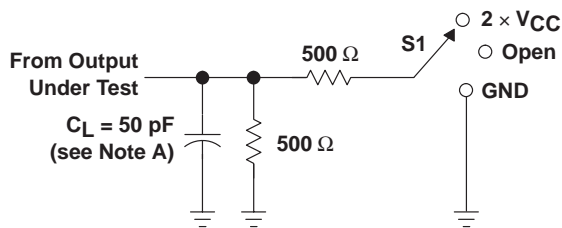
¶ Includes ~7.6-ns RC rise time of test-load pullup on 11-A, 1.5-kΩ pullup, and 21-pF load on 11 A has approximately 23-ns RC rise time.

# SN74GTL2006 13-BIT GTL-/GTL/GTL+ TO LVTTTL TRANSLATOR

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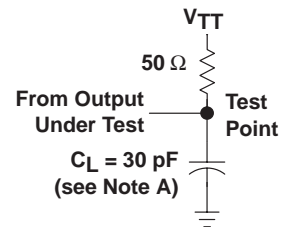
## PARAMETER MEASUREMENT INFORMATION

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

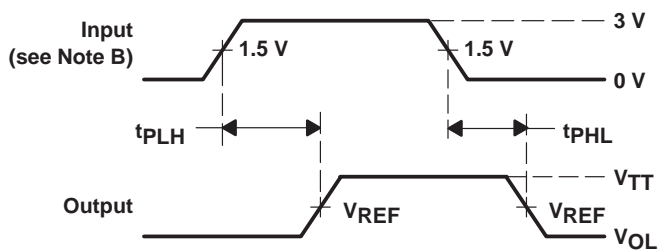


LOAD CIRCUIT FOR A OUTPUTS

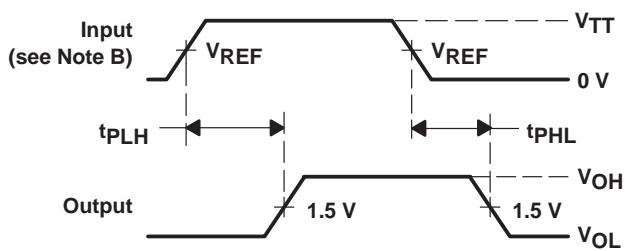
TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$2 \times V_{CC}$



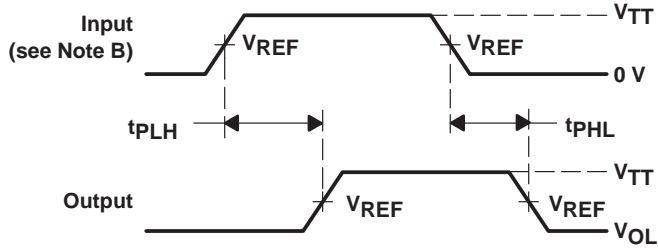
LOAD CIRCUIT FOR B OUTPUTS



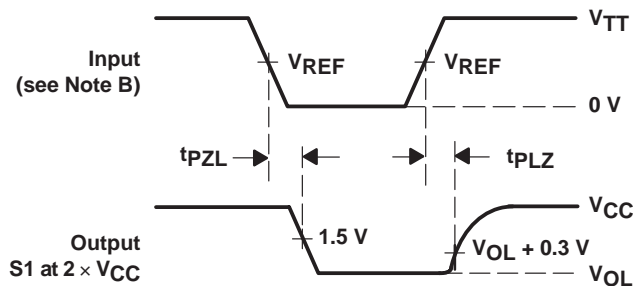
VOLTAGE WAVEFORM 1  
PROPAGATION DELAY TIMES  
(A port to B port)<sup>†</sup>



VOLTAGE WAVEFORM 2  
PROPAGATION DELAY TIMES  
(B port to A port)<sup>†</sup>



VOLTAGE WAVEFORM 3  
PROPAGATION DELAY TIMES  
(B port to B port)<sup>†</sup>



VOLTAGE WAVEFORM 4  
PROPAGATION DELAY TIMES  
(B port to A (I/O) port)<sup>†</sup>

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

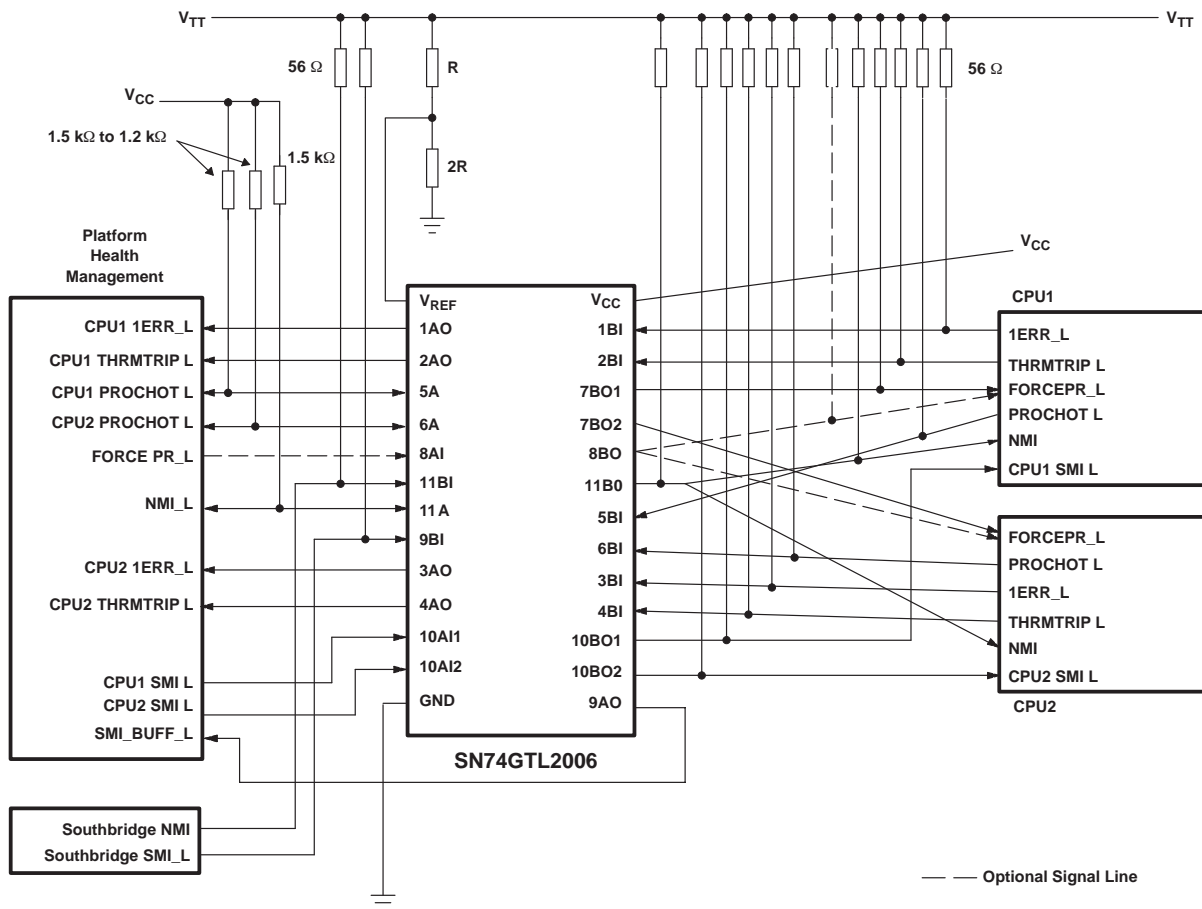
NOTES: A.  $C_L$  includes probe and jig capacitance.

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 SN74GTL2006 LVTTL inputs, specifically 10AI1 and 10AI2, when the device 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 LVTTL inputs high impedance when the device is powered down, and will there be any leakage?

**Answer 1:** When the device is powered down, the LVTTL 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 LVTTL inputs have the same powered-down characteristic?

**Answer 2:** Yes

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

**Answer 3:** The open-drain outputs, both GTL and LVTTL, 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 LVTTL totem-pole outputs, however, are not open-drain type outputs, and there will be current flow on these pins if they are pulled high when  $V_{DD}$  is at ground.

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74GTL2006PWR	ACTIVE	TSSOP	PW	28	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	GK2006	Samples

(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), 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)

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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## TAPE AND REEL INFORMATION



### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



\*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
SN74GTL2006PWR	TSSOP	PW	28	2000	330.0	16.4	6.9	10.2	1.8	12.0	16.0	Q1

**TAPE AND REEL BOX DIMENSIONS**

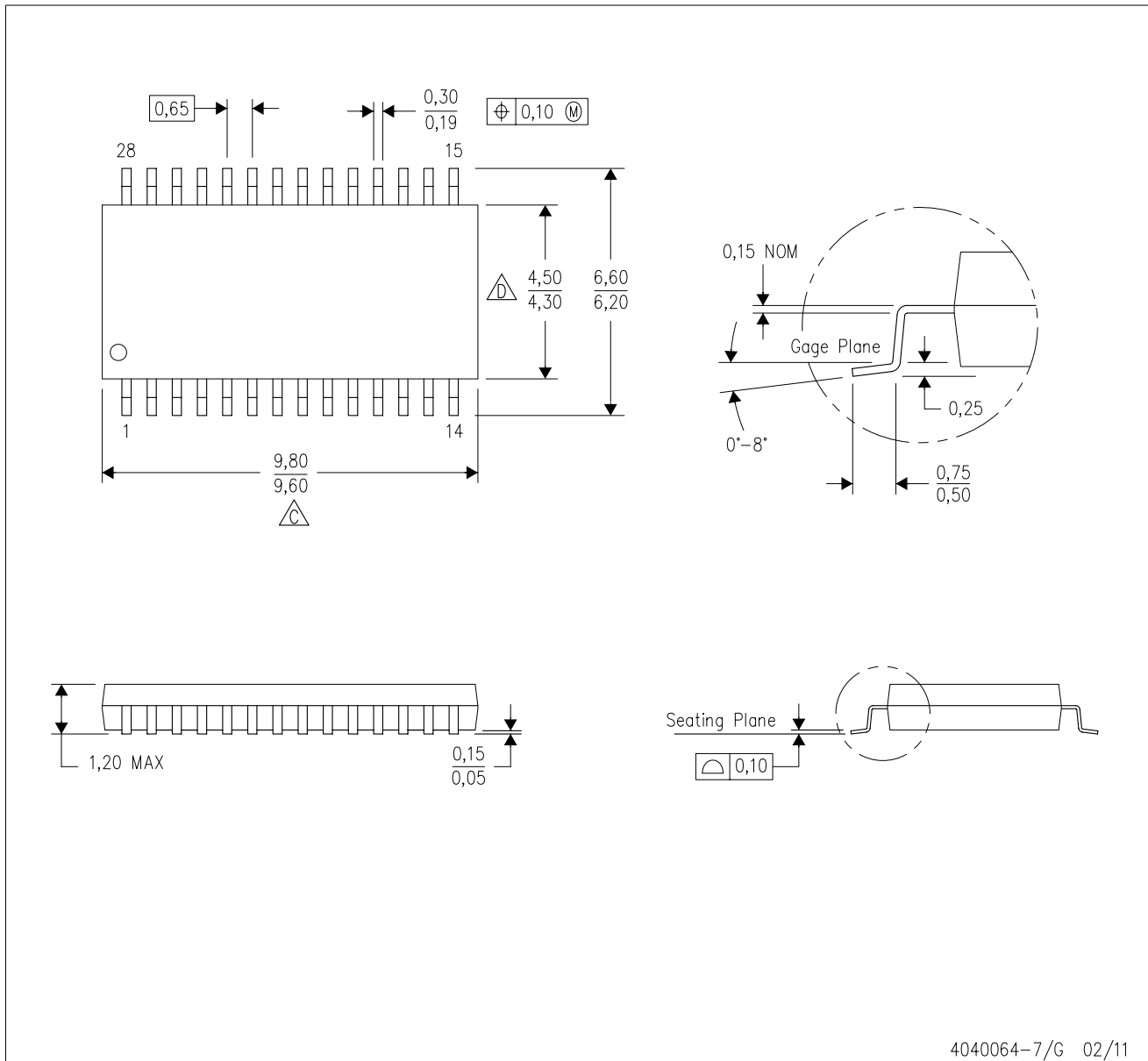


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74GTL2006PWR	TSSOP	PW	28	2000	367.0	367.0	38.0

PW (R-PDSO-G28)

PLASTIC SMALL OUTLINE

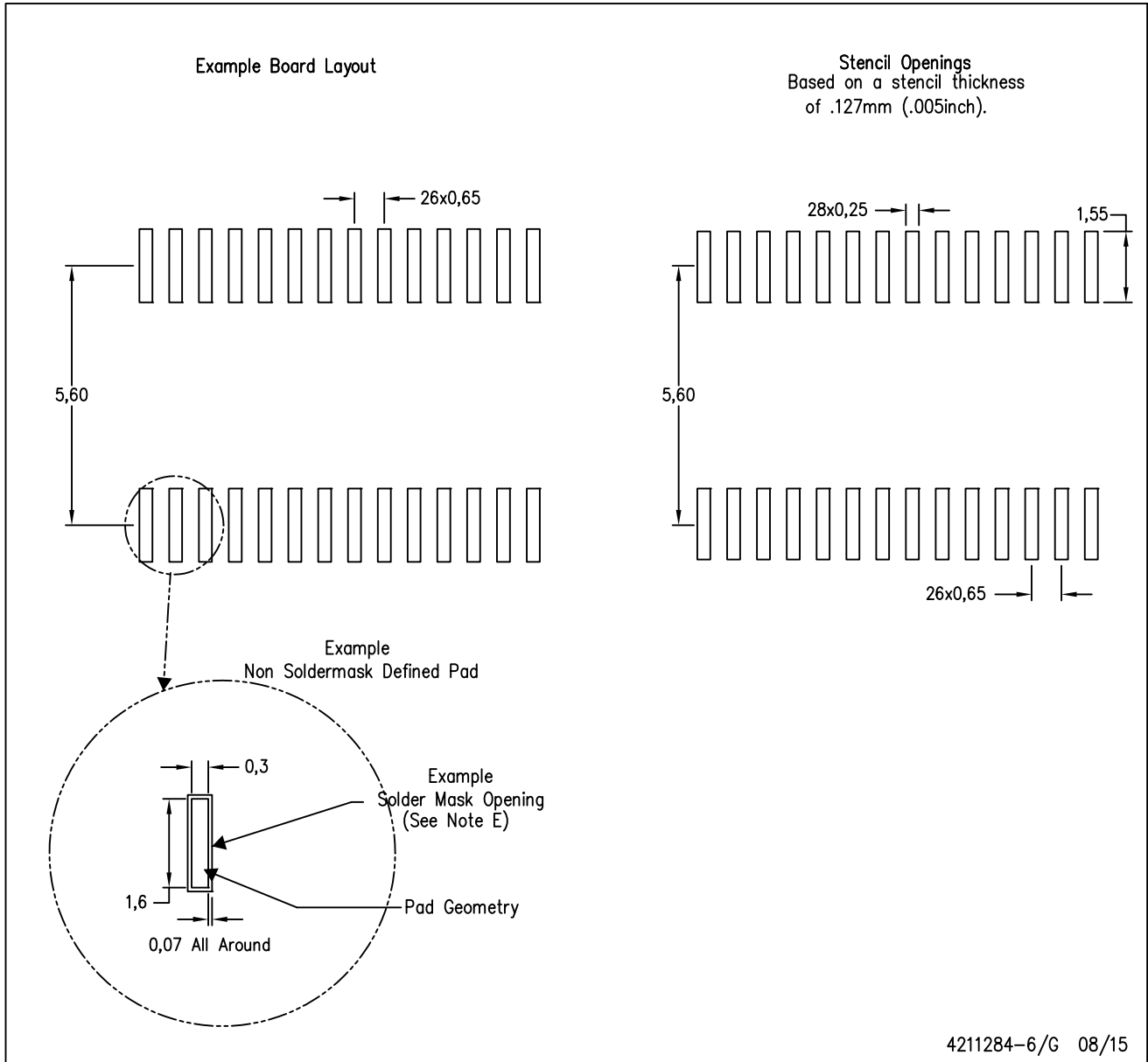


4040064-7/G 02/11

- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
  - E. Falls within JEDEC MO-153

PW (R-PDSO-G28)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate design.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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