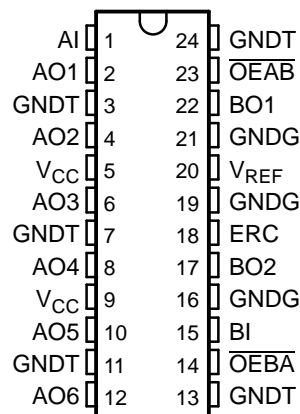


FEATURES

- **OEC™ Circuitry Improves Signal Integrity and Reduces Electromagnetic Interference**
- **Bidirectional Interface Between GTLP Signal Levels and LVTTL Logic Levels**
- **GTLP-to-LVTTL 1-to-6 Fanout Driver**
- **LVTTL-to-GTLP 1-to-2 Fanout Driver**
- **LVTTL Interfaces Are 5-V Tolerant**
- **Medium-Drive GTLP Outputs (50 mA)**
- **Reduced-Drive LVTTL Outputs (–12 mA/12 mA)**
- **Variable Edge-Rate Control (ERC) Input Selects GTLP Rise and Fall Times for Optimal Data-Transfer Rate and Signal Integrity in Distributed Loads**
- **I_{off} and Power-Up 3-State Support Hot Insertion**
- **Distributed V_{CC} and GND Pins Minimize High-Speed Switching Noise**
- **Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II**
- **ESD Protection Exceeds JESD 22**
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)
 - 1000-V Charged-Device Model (C101)

DGV, DW, OR PW PACKAGE
(TOP VIEW)



DESCRIPTION/ORDERING INFORMATION

The SN74GTLP817 is a medium-drive fanout driver that provides LVTTL-to-GTLP and GTLP-to-LVTTL signal-level translation. The device provides a high-speed interface between cards operating at LVTTL logic levels and a backplane operating at GTLP signal levels. High-speed (about three times faster than standard TTL or LVTTL) backplane operation is a direct result of GTLP reduced output swing (<1 V), reduced input threshold levels, improved differential input, and OEC™ circuitry. The improved GTLP OEC circuitry minimizes bus settling time and has been designed and tested using several backplane models. The medium drive allows incident-wave switching in heavily loaded backplanes with equivalent load impedance down to 19 Ω. BO1 and BO2 can be tied together to drive an equivalent load impedance down to 11 Ω.

GTLP is the Texas Instruments (TI™) derivative of the Gunning Transceiver Logic (GTL) JEDEC standard JESD 8-3. The ac specification of the SN74GTLP817 is given only at the preferred higher noise-margin GTLP, but the user has the flexibility of using this device at either GTL (V_{TT} = 1.2 V and V_{REF} = 0.8 V) or GTLP (V_{TT} = 1.5 V and V_{REF} = 1 V) signal levels.

Normally, the B port operates at GTLP signal levels. The A-port and control inputs operate at LVTTL logic levels, but are 5-V tolerant and are compatible with TTL and 5-V CMOS inputs. V_{REF} is the B-port differential input reference voltage.

GNDT is the TTL output ground, while GNDG is the GTLP output ground, and both may be separated from each other for a quieter device.



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SN74GTLP817

GTLP-TO-LVTTL 1-TO-6 FANOUT DRIVER

SCES285E–OCTOBER 1999–REVISED APRIL 2005

DESCRIPTION/ORDERING INFORMATION (CONTINUED)

This device is fully specified for hot-insertion applications using I_{off} and power-up 3-state. The I_{off} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down. The power-up 3-state circuitry places the outputs in the high-impedance state during power up and power down, which prevents driver conflict.

This device features adjustable edge-rate control (ERC). Changing the ERC input voltage between GND and V_{CC} adjusts the B-port output rise and fall times. This allows the designer to optimize system data-transfer rate and signal integrity to the backplane load. ERC automatically is selected to the same speed as alternate source 1-to-6 fanout drivers that use pin 18 for 3.3-V or 5-V V_{CC} .

When V_{CC} is between 0 and 1.5 V, the device is in the high-impedance state during power up or power down. However, to ensure the high-impedance state above 1.5 V, the output-enable (\overline{OE}) input should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

ORDERING INFORMATION

| T_A | PACKAGE ⁽¹⁾ | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---------------|------------------------|---------------|-----------------------|------------------|
| –40°C to 85°C | SOIC – DW | Tube | SN74GTLP817DW | GTLP817 |
| | | Tape and reel | SN74GTLP817DWR | |
| | TSSOP – PW | Tape and reel | SN74GTLP817PWR | GT817 |
| | TVSOP – DGV | Tape and reel | SN74GTLP817DGVR | GT817 |

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

FUNCTIONAL DESCRIPTION

The SN74GTLP817 is a fanout driver providing LVTTL-to-GTLP translation and GTLP-to-LVTTL translation in the same package.

The LVTTL-to-GTLP direction is a 1-to-2 fanout driver with a single output enable (\overline{OEAB}).

The GTLP-to-LVTTL direction is a 1-to-6 fanout driver with a single output enable (\overline{OEBA}).

Data polarity is inverting for both directions.

FUNCTION TABLES

OUTPUT CONTROL (A TO B)

| INPUTS | | OUTPUT BOn | MODE |
|--------|-------------------|---------------|----------------------|
| AI | \overline{OEAB} | | |
| X | H | Z | Isolation |
| H | L | L | Inverted transparent |
| L | L | H | |

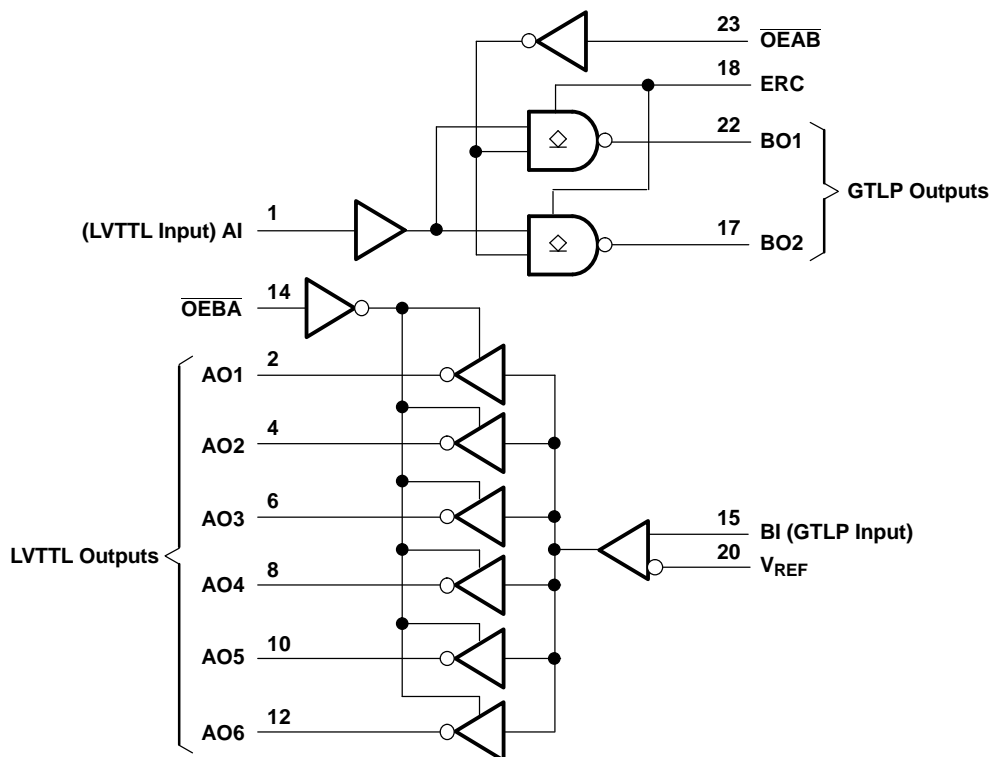
OUTPUT CONTROL (B TO A)

| INPUTS | | OUTPUT AOn | MODE |
|--------|-------------------|---------------|----------------------|
| BI | \overline{OEBA} | | |
| X | H | Z | Isolation |
| H | L | L | Inverted transparent |
| L | L | H | |

B-PORT EDGE-RATE CONTROL (ERC)

| INPUT ERC | | OUTPUT B-PORT EDGE RATE |
|----------------|--------------------|-------------------------------|
| LOGIC LEVEL | NOMINAL VOLTAGE | |
| H | V_{CC} | Slow |
| L | GND | Fast |

LOGIC DIAGRAM (POSITIVE LOGIC)



SN74GTLP817

GTLP-TO-LVTTL 1-TO-6 FANOUT DRIVER

SCES285E–OCTOBER 1999–REVISED APRIL 2005

Absolute Maximum Ratings⁽¹⁾

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

| | | | MIN | MAX | UNIT |
|-------------------------|---------------------------------------------------------------------------------------------|----------------------------|------|------|------|
| V_{CC} | Supply voltage range | | –0.5 | 4.6 | V |
| $ V_{GNDG} - V_{GNDT} $ | Ground dc voltage difference | | | 0.3 | V |
| V_I | Input voltage range ⁽²⁾ | AI port and control inputs | –0.5 | 7 | V |
| | | BI port and V_{REF} | –0.5 | 4.6 | |
| V_O | Voltage range applied to any output in the high-impedance or power-off state ⁽²⁾ | AO port | –0.5 | 7 | V |
| | | BO port | –0.5 | 4.6 | |
| I_O | Current into any output in the low state | AO port | | 24 | mA |
| | | BO port | | 100 | |
| I_O | Current into any A output in the high state ⁽³⁾ | | | 24 | mA |
| | Continuous current through each V_{CC} or GND | | | ±100 | mA |
| I_{IK} | Input clamp current | $V_I < 0$ | | –50 | mA |
| I_{OK} | Output clamp current | $V_O < 0$ | | –50 | mA |
| θ_{JA} | Package thermal impedance ⁽⁴⁾ | DGV package | | 86 | °C/W |
| | | DW package | | 46 | |
| | | PW package | | 88 | |
| T_{stg} | Storage temperature range | | –65 | 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) The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- (3) This current flows only when the output is in the high state and $V_O > V_{CC}$.
- (4) The package thermal impedance is calculated in accordance with JESD 51-7.

Recommended Operating Conditions ⁽¹⁾⁽²⁾⁽³⁾⁽⁴⁾

| | | | MIN | NOM | MAX | UNIT |
|---------------------|------------------------------------|---------------------|-------------------------|-----------------|------|------|
| V _{CC} | Supply voltage | | 3.15 | 3.3 | 3.45 | V |
| V _{TT} | Termination voltage | GTL | 1.14 | 1.2 | 1.26 | V |
| | | GTLP | 1.35 | 1.5 | 1.65 | |
| V _{REF} | Reference voltage | GTL | 0.74 | 0.8 | 0.87 | V |
| | | GTLP | 0.87 | 1 | 1.1 | |
| V _I | Input voltage | BI | V _{TT} | | | V |
| | | AI, \overline{OE} | V _{CC} 5.5 | | | |
| V _{IH} | High-level input voltage | BI | V _{REF} + 0.05 | | | V |
| | | ERC | V _{CC} − 0.6 | V _{CC} | 5.5 | |
| | | AI, \overline{OE} | 2 | | | |
| V _{IL} | Low-level input voltage | BI | V _{REF} − 0.05 | | | V |
| | | ERC | GND 0.6 | | | |
| | | AI, \overline{OE} | 0.8 | | | |
| I _{IK} | Input clamp current | | | | −18 | mA |
| I _{OH} | High-level output current | AO port | | | −12 | mA |
| I _{OL} | Low-level output current | AO port | | | 12 | mA |
| | | BO port | | | 50 | |
| Δt/Δv | Input transition rise or fall rate | Outputs enabled | | | 10 | ns/V |
| Δt/ΔV _{CC} | Power-up ramp rate | | 20 | | | μs/V |
| T _A | Operating free-air temperature | | −40 | | 85 | °C |

- (1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.
- (2) Normal connection sequence is GND first and $V_{CC} = 3.3$ V, I/O, control inputs, V_{TT} , V_{REF} (any order) last.
- (3) V_{TT} and R_{TT} can be adjusted to accommodate backplane impedances if the dc recommended I_{OL} ratings are not exceeded.
- (4) V_{REF} can be adjusted to optimize noise margins, but normally is two-thirds V_{TT} .

Electrical Characteristics

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

| PARAMETER | | TEST CONDITIONS | | MIN | TYP ⁽¹⁾ | MAX | UNIT |
|-----------------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-----|--------------------|----------------|---------------|
| V_{IK} | | $V_{CC} = 3.15\text{ V}$, | $I_I = -18\text{ mA}$ | | | -1.2 | V |
| V_{OH} | AO port | $V_{CC} = 3.15\text{ V to } 3.45\text{ V}$, | $I_{OH} = -100\text{ }\mu\text{A}$ | | | $V_{CC} - 0.2$ | V |
| | | | $I_{OH} = -100\text{ }\mu\text{A}$ | | | $V_{CC} - 0.2$ | |
| | | $V_{CC} = 3.15\text{ V}$ | $I_{OH} = -6\text{ mA}$ | | | 2.4 | |
| | | | $I_{OH} = -12\text{ mA}$ | | | 2.2 | |
| V_{OL} | AO port | $V_{CC} = 3.15\text{ V to } 3.45\text{ V}$, | $I_{OL} = 100\text{ }\mu\text{A}$ | | | 0.2 | V |
| | | | $I_{OL} = 100\text{ }\mu\text{A}$ | | | 0.2 | |
| | | $V_{CC} = 3.15\text{ V}$ | $I_{OL} = 6\text{ mA}$ | | | 0.4 | |
| | | | $I_{OL} = 12\text{ mA}$ | | | 0.5 | |
| | BO port | $V_{CC} = 3.15\text{ V}$ | $I_{OL} = 100\text{ }\mu\text{A}$ | | | 0.2 | |
| | | | $I_{OL} = 40\text{ mA}$ | | | 0.5 | |
| | | | $I_{OL} = 50\text{ mA}$ | | | 0.55 | |
| I_I | BI, AI, \overline{OE} , ERC | $V_{CC} = 3.45\text{ V}$, | $V_I = 0\text{ or } 5.5\text{ V}$ | | | ± 5 | μA |
| I_{OZH} | AO port | $V_{CC} = 3.45\text{ V}$ | $V_O = V_{CC}$ | | | 10 | μA |
| | BO port | | $V_O = 1.5\text{ V}$ | | | 5 | |
| I_{OZL} | AO port | $V_{CC} = 3.45\text{ V}$ | $V_O = \text{GND}$ | | | -10 | μA |
| | BO port | | $V_O = 5.5\text{ V}$ | | | -5 | |
| I_{CC} | AO or BO port | $V_{CC} = 3.45\text{ V}$, $I_O = 0$, V_I (AI or control input) = V_{CC} or GND, V_I (BI input) = V_{TT} or GND | Outputs high | | | 10 | mA |
| | | | Outputs low | | | 10 | |
| | | | Outputs disabled | | | 10 | |
| $\Delta I_{CC}^{(2)}$ | AI, \overline{OE} | $V_{CC} = 3.45\text{ V}$, One A-port or control input at $V_{CC} - 0.6\text{ V}$, Other A-port or control inputs at V_{CC} or GND | | | | 1 | mA |
| C_i | AI, \overline{OE} , ERC | $V_I = V_{CC}$ or 0 | | | 4 | 4.4 | pF |
| | BI | $V_I = V_{TT}$ or 0 | | | 3.5 | 3.9 | |
| C_o | AO port | $V_O = V_{CC}$ or 0 | | | 4 | 4.5 | pF |
| | BO port | $V_O = V_{TT}$ or 0 | | | 5 | 5.4 | |

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

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

Hot-Insertion Specifications for A Port

over recommended operating free-air temperature range

| PARAMETER | TEST CONDITIONS | | | MIN | MAX | UNIT |
|------------|----------------------------------------|--------------------------------------------|---------------------|-----|----------|---------------|
| I_{off} | $V_{CC} = 0$, | V_I or $V_O = 0\text{ to } 5.5\text{ V}$ | | | 10 | μA |
| I_{OZPU} | $V_{CC} = 0\text{ to } 1.5\text{ V}$, | $V_O = 0.5\text{ V to } 3\text{ V}$, | $\overline{OE} = 0$ | | ± 30 | μA |
| I_{OZPD} | $V_{CC} = 1.5\text{ V to } 0$, | $V_O = 0.5\text{ V to } 3\text{ V}$, | $\overline{OE} = 0$ | | ± 30 | μA |

Hot-Insertion Specifications for B Port

over recommended operating free-air temperature range

| PARAMETER | TEST CONDITIONS | | | MIN | MAX | UNIT |
|------------|----------------------------------------|--------------------------------------------|---------------------|-----|----------|---------------|
| I_{off} | $V_{CC} = 0$, | V_I or $V_O = 0\text{ to } 1.5\text{ V}$ | | | 10 | μA |
| I_{OZPU} | $V_{CC} = 0\text{ to } 1.5\text{ V}$, | $V_O = 0.5\text{ V to } 1.5\text{ V}$, | $\overline{OE} = 0$ | | ± 30 | μA |
| I_{OZPD} | $V_{CC} = 1.5\text{ V to } 0$, | $V_O = 0.5\text{ V to } 1.5\text{ V}$, | $\overline{OE} = 0$ | | ± 30 | μA |

Switching Characteristics

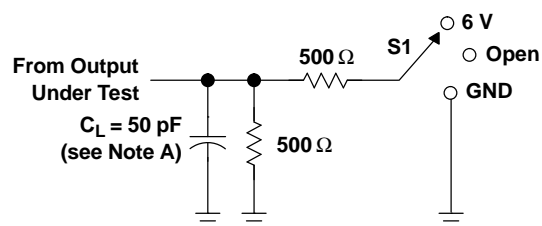
over recommended ranges of supply voltage and operating free-air temperature,
 $V_{TT} = 1.5\text{ V}$ and $V_{REF} = 1\text{ V}$ for GTLP (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | EDGE RATE ⁽¹⁾ | MIN | TYP ⁽²⁾ | MAX | UNIT |
|------------------|-----------------------------------|----------------|--------------------------|-----|--------------------|-----|------|
| t _{PLH} | AI | BO | Slow | 3 | | 6 | ns |
| t _{PHL} | | | | 1.8 | | 4.7 | |
| t _{PLH} | AI | BO | Fast | 2 | | 5 | ns |
| t _{PHL} | | | | 1.5 | | 4.2 | |
| t _{en} | \overline{OEAB} | BO | Slow | 3 | | 6.1 | ns |
| t _{dis} | | | | 2 | | 4.7 | |
| t _{en} | \overline{OEAB} | BO | Fast | 2.1 | | 6 | ns |
| t _{dis} | | | | 1.5 | | 4.7 | |
| t _r | Rise time, B outputs (20% to 80%) | | Slow | 2.5 | | | ns |
| | | | Fast | 1.4 | | | |
| t _f | Fall time, B outputs (80% to 20%) | | Slow | 1.7 | | | ns |
| | | | Fast | 1 | | | |
| t _{PLH} | BI | AO | | 2.3 | | 6 | ns |
| t _{PHL} | | | | 1.9 | | 4.7 | |
| t _{en} | \overline{OEBA} | AO | | 1.1 | | 6.3 | ns |
| t _{dis} | | | | 1.2 | | 5 | |

(1) Slow (ERC = V_{CC}) and Fast (ERC = GND)

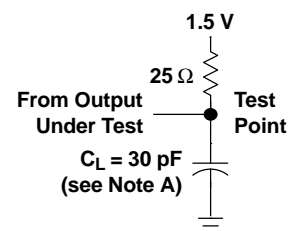
(2) All typical values are at $V_{CC} = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$.

PARAMETER MEASUREMENT INFORMATION

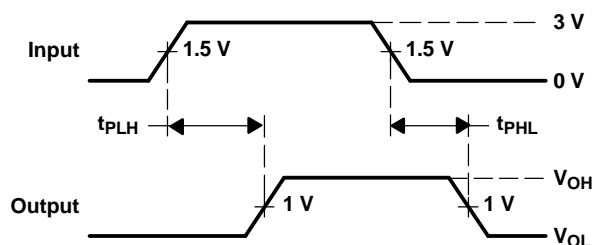


LOAD CIRCUIT FOR AO PORTS

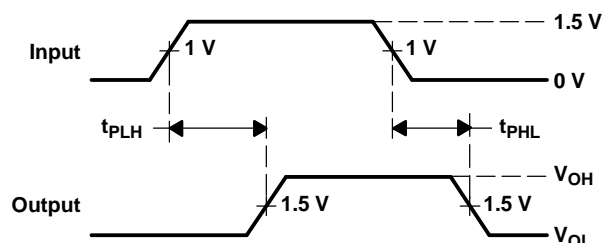
| TEST | S1 |
|-------------------|------|
| t_{PLH}/t_{PHL} | Open |
| t_{PLZ}/t_{PZL} | 6 V |
| t_{PHZ}/t_{PZH} | GND |



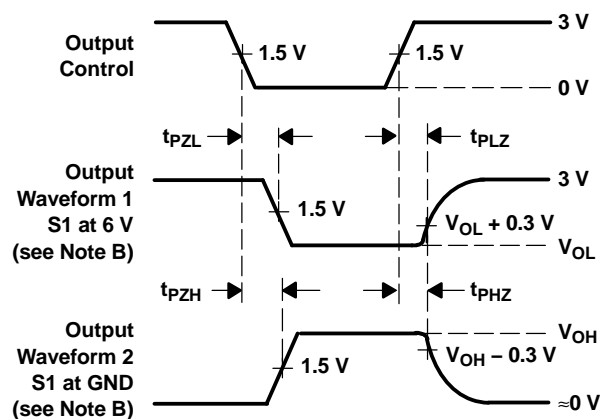
LOAD CIRCUIT FOR BO PORTS



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
(AI to BO port)



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
(BI to AO port)



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
(AO ports)

- NOTES: A. C_L includes probe and jig capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
C. All input pulses are supplied by generators having the following characteristics: PRR $\approx 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \approx 2 \text{ ns}$, $t_f \approx 2 \text{ ns}$.
D. The outputs are measured one at a time, with one transition per measurement.

Figure 1. Load Circuits and Voltage Waveforms

Distributed-Load Backplane Switching Characteristics

The preceding switching characteristics table shows the switching characteristics of the device into a lumped load (Figure 1). However, the designer's backplane application probably is a distributed load. The physical representation is shown in Figure 2. This backplane, or distributed load, can be approximated closely to a resistor inductance capacitance (RLC) circuit, as shown in Figure 3. This device has been designed for optimum performance in this RLC circuit. The following switching characteristics table shows the switching characteristics of the device into the RLC load, to help the designer better understand the performance of the GTLP device in this typical backplane. See www.ti.com/sc/gtlp for more information.

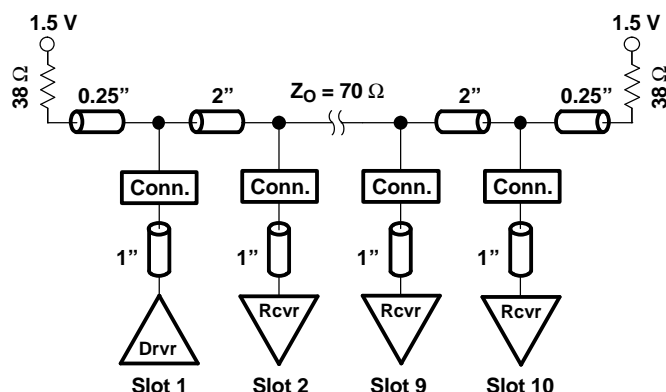


Figure 2. Medium-Drive Test Backplane

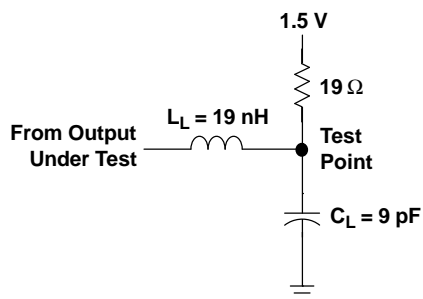


Figure 3. Medium-Drive RLC Network

SN74GTLP817

GTLP-TO-LVTTL 1-TO-6 FANOUT DRIVER

SCES285E—OCTOBER 1999—REVISED APRIL 2005

Switching Characteristics

over recommended ranges of supply voltage and operating free-air temperature,
 $V_{TT} = 1.5\text{ V}$ and $V_{REF} = 1\text{ V}$ for GTLP (see Figure 3)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | EDGE RATE ⁽¹⁾ | TYP ⁽²⁾ | UNIT |
|------------------|-----------------------------------|----------------|--------------------------|--------------------|------|
| t _{PLH} | AI | BO | Slow | 4.4 | ns |
| t _{PHL} | | | | 4.4 | |
| t _{PLH} | AI | BO | Fast | 3.2 | ns |
| t _{PHL} | | | | 3.2 | |
| t _{en} | \overline{OEAB} | BO | Slow | 4 | ns |
| t _{dis} | | | | 4.4 | |
| t _{en} | \overline{OEAB} | BO | Fast | 2.9 | ns |
| t _{dis} | | | | 3.1 | |
| t _r | Rise time, B outputs (20% to 80%) | | Slow | 1.8 | ns |
| | | | Fast | 1 | |
| t _f | Fall time, B outputs (80% to 20%) | | Slow | 2 | ns |
| | | | Fast | 1.6 | |

(1) Slow (ERC = V_{CC}) and Fast (ERC = GND)

(2) All typical values are at $V_{CC} = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$. All values are derived from TI-SPICE models.

PACKAGING INFORMATION

| Orderable part number | Status (1) | Material type (2) | Package Pins | Package qty Carrier | RoHS (3) | Lead finish/ Ball material (4) | MSL rating/ Peak reflow (5) | Op temp (°C) | Part marking (6) |
|------------------------------|---------------|----------------------|-----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| SN74GTL817PW | Active | Production | TSSOP (PW) 24 | 60 TUBE | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | GT817 |

⁽¹⁾ **Status:** For more details on status, see our [product life cycle](#).

⁽²⁾ **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

⁽³⁾ **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

⁽⁴⁾ **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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TUBE



*All dimensions are nominal

| Device | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|---------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| SN74GTLP817PW | PW | TSSOP | 24 | 60 | 530 | 10.2 | 3600 | 3.5 |

EXAMPLE BOARD LAYOUT

PW0024A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



SOLDER MASK DETAILS

4220208/A 02/2017

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

PW0024A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220208/A 02/2017

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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