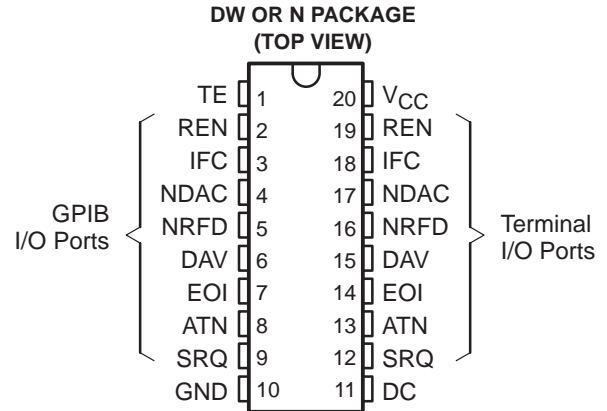


SN75ALS161

OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

SLLS019F – JUNE 1986 – REVISED JULY 2004

- Suitable for IEEE Standard 488-1978 (GPIB)
- 8-Channel Bidirectional Transceivers
- Designed to Implement Control Bus Interface
- Designed for Single Controller
- High-Speed Advanced Low-Power Schottky Circuitry
- Low Power Dissipation . . . 46 mW Max Per Channel
- Fast Propagation Times . . . 20 ns Max
- High-Impedance pnp Inputs
- Receiver Hysteresis . . . 650 mV Typ
- Bus-Terminating Resistors Provided on Driver Outputs
- No Loading of Bus When Device Is Powered Down ($V_{CC} = 0$)
- Power-Up/Power-Down Protection (Glitch Free)



description/ordering information

The SN75ALS161 eight-channel general-purpose interface bus transceivers are high-speed, advanced low-power Schottky-process devices designed to provide the bus-management and data-transfer signals between operating units of a single-controller instrumentation system. When combined with the SN75ALS160 octal bus transceivers, this device provides a complete 16-wire interface for the IEEE 488 bus.

The SN75ALS161 device features eight driver-receiver pairs connected in a front-to-back configuration to form input/output (I/O) ports at both the bus and terminal sides. The direction of data through these driver-receiver pairs is determined by the direction-control (DC) and talk-enable (TE) signals.

The driver outputs general-purpose interface bus (GPIB I/O ports) feature active bus-terminating resistor circuits designed to provide a high impedance to the bus when $V_{CC} = 0$. The drivers are designed to handle sink-current loads up to 48 mA. Each receiver features pnp transistor inputs for high input impedance and hysteresis of 400 mV on the commercial part, and 250 mV on the military part, minimum, for increased noise immunity. All receivers have 3-state outputs, to present a high impedance to the terminal when disabled.

The SN75ALS161 is characterized for operation from 0°C to 70°C.

CHANNEL-IDENTIFICATION TABLE

| NAME | IDENTITY | CLASS |
|------|--------------------|----------------|
| DC | Direction Control | Control |
| TE | Talk Enable | |
| ATN | Attention | Bus Management |
| SRQ | Service Request | |
| REN | Remote Enable | |
| IFC | Interface Clear | |
| EOI | End or Identify | Data Transfer |
| DAV | Data Valid | |
| NDAC | Not Data Accepted | |
| NRFD | Not Ready for Data | |

ORDERING INFORMATION

| TA | PACKAGE† | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|-------------|-----------|--------------|-----------------------|------------------|
| 0°C to 70°C | PDIP (N) | Tube of 20 | SN75ALS161N | SN75ALS161N |
| | | Tube of 25 | SN75ALS161DW | 75ALS161 |
| | SOIC (DW) | Reel of 2000 | SN75ALS161DWR | |

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at 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.

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

**TEXAS
INSTRUMENTS**

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SN75ALS161

OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

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FUNCTION TABLE
RECEIVE/TRANSMIT

| CONTROLS | | | BUS-MANAGEMENT CHANNELS | | | | DATA-TRANSFER CHANNELS | | | |
|----------|----|------------------|-------------------------|-----|-----|-----|------------------------|--------------------|------|------|
| DC | TE | ATN [†] | ATN [†] | SRQ | REN | IFC | EOI | DAV | NDAC | NRFD |
| | | | (CONTROLLED BY DC) | | | | | (CONTROLLED BY TE) | | |
| H | H | H | R | T | R | R | T | T | R | R |
| H | H | L | | | | | R | | | |
| L | L | H | T | R | T | T | R | R | T | T |
| L | L | L | | | | | T | | | |
| H | L | X | R | T | R | R | R | R | T | T |
| L | H | X | T | R | T | T | T | T | R | R |

H = high level, L = low level, R = receive, T = transmit, X = irrelevant

Direction of data transmission is from the terminal side to the bus side, and the direction of data receiving is from the bus side to the terminal side.

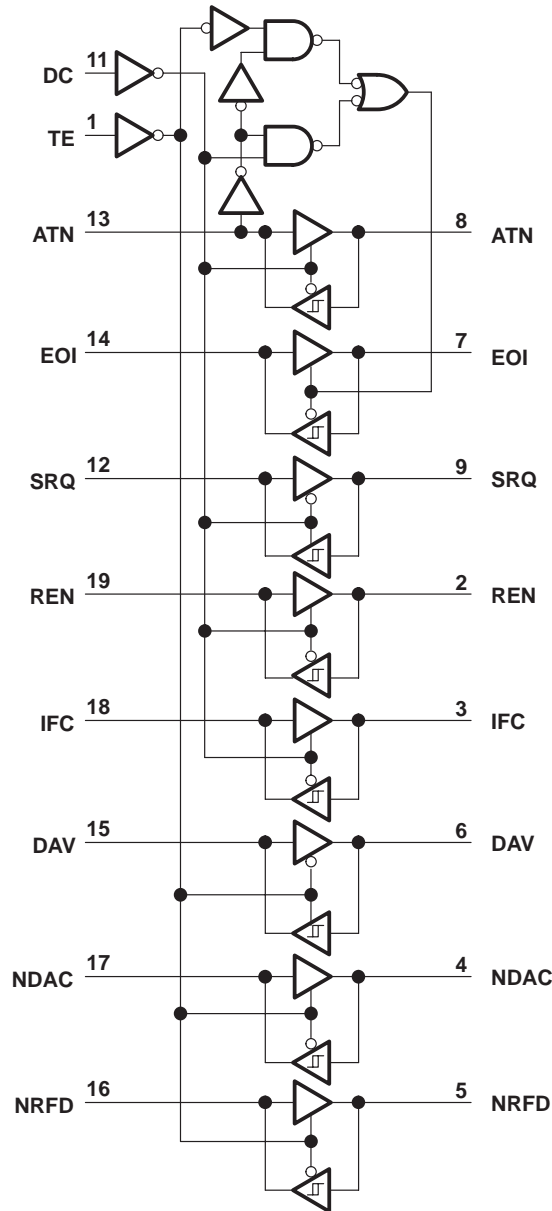
Data transfer is noninverting in both directions.

[†] ATN is a normal transceiver channel that functions additionally as an internal direction control or talk enable for EOI whenever the DC and TE inputs are in the same state. When DC and TE are in opposite states, the ATN channel functions as an independent transceiver only.

SN75ALS161 OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

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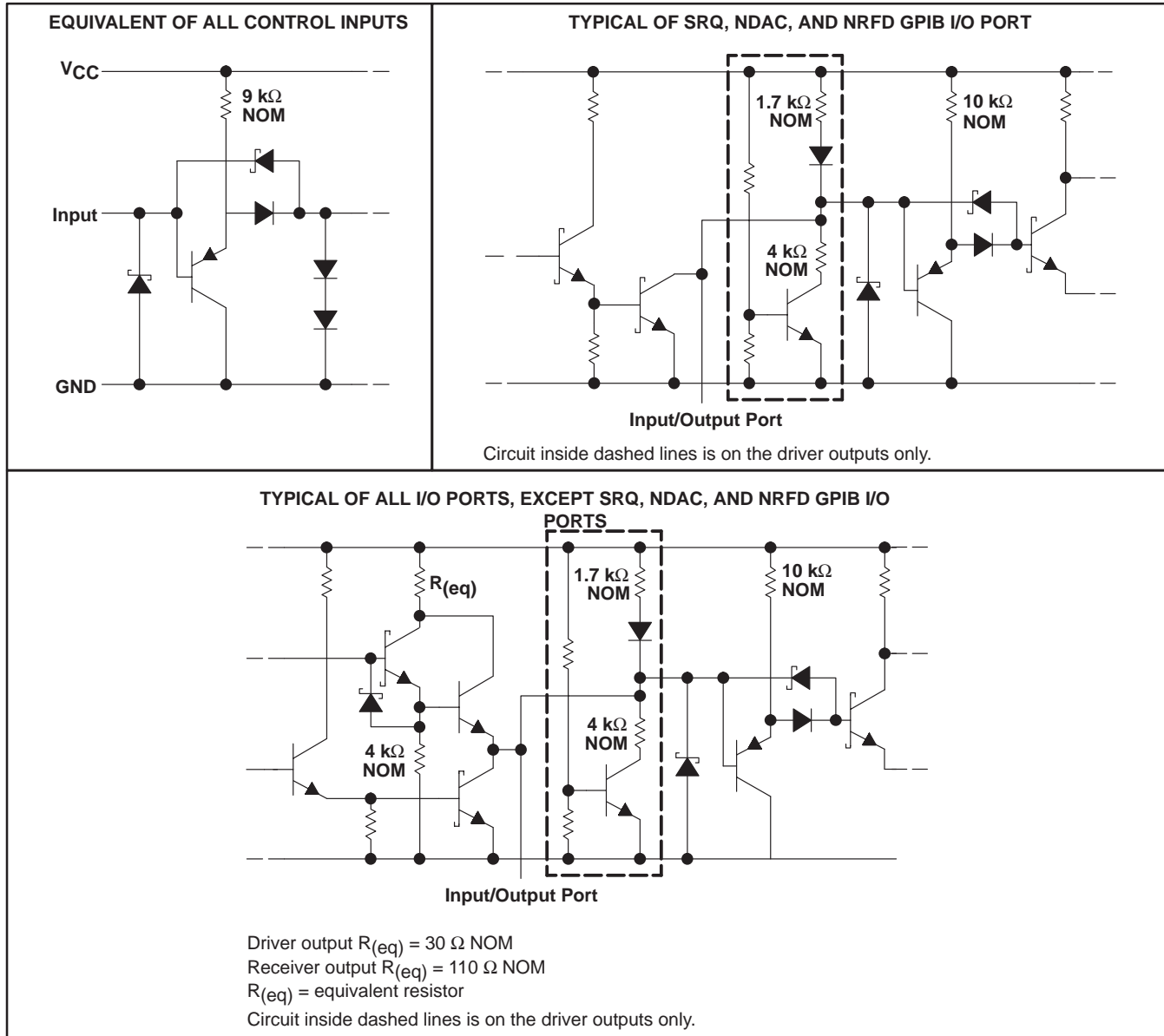
logic diagram (positive logic)



SN75ALS161 OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

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schematics of inputs and outputs



SN75ALS161

OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

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

| | |
|--|----------------|
| Supply voltage, V_{CC} (see Note 1) | 7 V |
| Input voltage, V_I | 5.5 V |
| Low-level driver output current, I_{OL} | 100 mA |
| Package thermal impedance, θ_{JA} (see Notes 2 and 3): DW package | 58°C/W |
| N package | 69°C/W |
| Operating virtual junction temperature, T_J | 150°C |
| Storage temperature range, T_{Stg} | –65°C 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.

- NOTES: 1. All voltage values are with respect to network ground terminal.
 2. Maximum power dissipation is a function of $T_{J(max)}$, θ_{JA} , and T_A . The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_{J(max)} - T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
 3. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions

| | | MIN | NOM | MAX | UNIT |
|----------|--------------------------------|-------------------------------|-----|-------|------|
| V_{CC} | Supply voltage | 4.75 | 5 | 5.25 | V |
| V_{IH} | High-level input voltage | 2 | | | V |
| V_{IL} | Low-level input voltage | | | 0.8 | V |
| I_{OH} | High-level output current | Bus ports with pullups active | | – 5.2 | mA |
| | | Terminal ports | | – 800 | μA |
| I_{OL} | Low-level output current | Bus ports | | 48 | mA |
| | | Terminal ports | | 16 | |
| T_A | Operating free-air temperature | 0 | | 70 | °C |



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OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

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electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS† | | MIN | TYP‡ | MAX | UNIT | | |
|-----------|--|--|--|---|------|------|------|---------------|---------------|
| V_{IK} | Input clamp voltage | $I_I = -18 \text{ mA}$ | | -0.8 | -1.5 | | V | | |
| V_{hys} | Hysteresis voltage ($V_{IT+} - V_{IT-}$) | Bus | | 0.4 | 0.65 | | V | | |
| $V_{OH}§$ | High-level output voltage | Terminal | $I_{OH} = -800 \mu\text{A}$, $V_{CC} = \text{MIN}$ | $T_A = 25^\circ\text{C}$ and MAX | | 2.7 | 3.5 | V | |
| | | | | $T_A = \text{MIN}$ | | 2.7 | 3.5 | | |
| | | Bus | $I_{OH} = -5.2 \text{ mA}$, $V_{CC} = \text{MIN}$ | $T_A = 25^\circ\text{C}$ and MAX | | 2.2 | | | |
| | | | | $T_A = \text{MIN}$ | | 2.2 | | | |
| V_{OL} | Low-level output voltage | Terminal | $I_{OL} = 16 \text{ mA}$, $V_{CC} = \text{MIN}$ | | | 0.3 | 0.5 | V | |
| | | Bus | $I_{OL} = 48 \text{ mA}$, $V_{CC} = \text{MIN}$ | | | 0.35 | 0.5 | | |
| I_I | Input current at maximum input voltage | Terminal | $V_I = 5.5 \text{ V}$, $V_{CC} = \text{MAX}$ | | | 0.2 | 100 | μA | |
| I_{IH} | High-level input current | Terminal and control inputs | $V_I = 2.7 \text{ V}$, $V_{CC} = \text{MAX}$ | | | 0.1 | 20 | μA | |
| $V_{I/O}$ | Voltage at GPIB I/O port | $I_I(\text{bus}) = 0$ | | 2.5 | 3 | 3.7 | V | | |
| | | $I_I(\text{bus}) = 0$ | | 2.5 | 3 | 3.7 | | | |
| | | $I_I(\text{bus}) = -12 \text{ mA}$ | | | | -1.5 | | | |
| I_{IL} | Low-level input current | Terminal and control inputs | $V_I = 0.5 \text{ V}$, $V_{CC} = \text{MAX}$ | | | -10 | -100 | μA | |
| $I_{I/O}$ | Current into GPIB I/O port | Power on | $V_I(\text{bus}) = -1.5 \text{ V to } 0.4 \text{ V}$ | | -1.3 | | mA | | |
| | | | $V_I(\text{bus}) = 0.4 \text{ V to } 2.5 \text{ V}$ | | 0 | | | -3.2 | |
| | | | $V_I(\text{bus}) = 2.5 \text{ V to } 3.7 \text{ V}$ | | | | | 2.5 | -3.2 |
| | | | $V_I(\text{bus}) = 3.7 \text{ V to } 5 \text{ V}$ | | 0 | | | 2.5 | |
| | | | $V_I(\text{bus}) = 5 \text{ V to } 5.5 \text{ V}$ | | 0.7 | | | 2.5 | |
| | | Power off | $V_{CC} = 0$ | $V_I(\text{bus}) = 0 \text{ to } 2.5 \text{ V}$ | | | | 40 | μA |
| $I_{OS}§$ | Short-circuit output current | Terminal | $V_{CC} = \text{MAX}$ | | -15 | -35 | -75 | mA | |
| | | Bus | $V_{CC} = \text{MAX}$ | | -25 | -50 | -125 | | |
| I_{CC} | Supply current | No load, TE and DC low, $V_{CC} = \text{MAX}$ | | | | 55 | 75 | mA | |
| $C_{I/O}$ | GPIB I/O port capacitance | $V_{CC} = 0 \text{ to } 5 \text{ V}$, $V_{I/O} = 0 \text{ to } 2 \text{ V}$, $f = 1 \text{ MHz}$ | | | | 30 | pF | | |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$.

§ V_{OH} and I_{OS} apply to 3-state outputs only.



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switching characteristics over recommended operating free-air temperature range, $V_{CC} = 5\text{ V}$

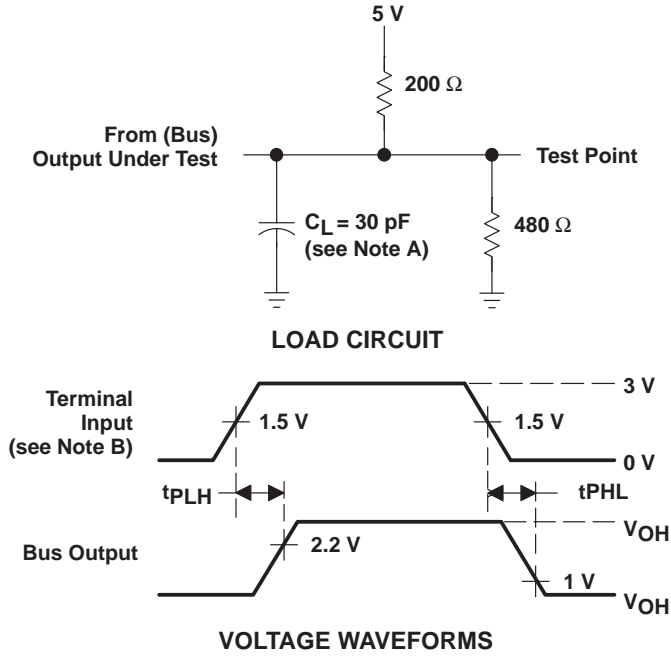
| PARAMETER | | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | MIN | TYP† | MAX | UNIT |
|-----------|---|--------------|-----------------------------------|--|-----|------|-----|------|
| t_{PLH} | Propagation delay time, low- to high-level output | Terminal | Bus | $C_L = 30\text{ pF}$, See Figure 1 | | 10 | 20 | ns |
| t_{PHL} | Propagation delay time, high- to low-level output | | | | | 12 | 20 | |
| t_{PLH} | Propagation delay time, low- to high-level output | Bus | Terminal | $C_L = 30\text{ pF}$, See Figure 2 | | 5 | 10 | ns |
| t_{PHL} | Propagation delay time, high- to low-level output | | | | | 7 | 14 | |
| t_{PZH} | Output enable time to high level | TE or DC | Bus (ATN, EOI, REN, IFC, and DAV) | $C_L = 15\text{ pF}$, See Figure 3 | | | 30 | ns |
| t_{PHZ} | Output disable time from high level | | | | | | 20 | |
| t_{PZL} | Output enable time to low level | | | | | | 45 | |
| t_{PLZ} | Output disable time from low level | | | | | | 20 | |
| t_{PZH} | Output enable time to high level | TE or DC | Terminal | $C_L = 15\text{ pF}$, See Figure 4 | | | 30 | ns |
| t_{PHZ} | Output disable time from high level | | | | | | 25 | |
| t_{PZL} | Output enable time to low level | | | | | | 30 | |
| t_{PLZ} | Output disable time from low level | | | | | | 25 | |

† All typical values are at $T_A = 25^\circ\text{C}$.

SN75ALS161 OCTAL GENERAL-PURPOSE INTERFACE BUS TRANSCEIVERS

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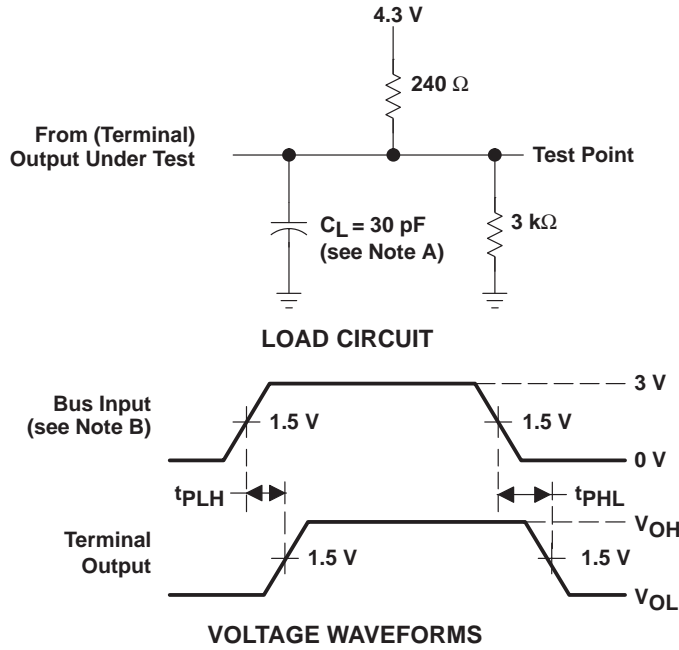
PARAMETER MEASUREMENT INFORMATION



- NOTES: A. C_L includes probe and jig capacitance.
 B. The input pulse is supplied by a generator having the following characteristics: $PRR \leq 1$ MHz, 50% duty cycle, $t_r \leq 6$ ns, $t_f \leq 6$ ns, $Z_O = 50 \Omega$.

Figure 1. Terminal-to-Bus Load Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION



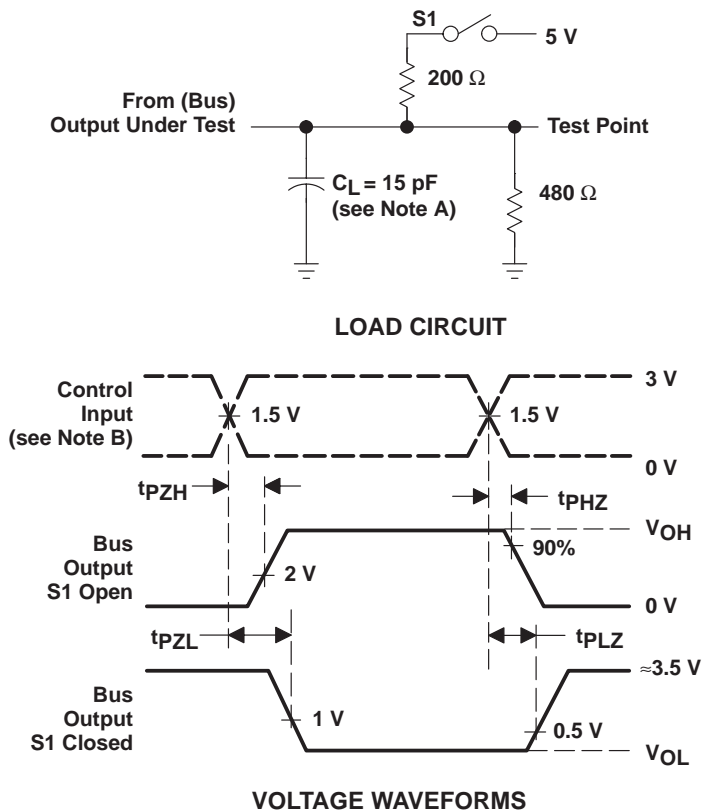
- NOTES: A. C_L includes probe and jig capacitance.
 B. The input pulse is supplied by a generator having the following characteristics: $PRR \leq 1 \text{ MHz}$, 50% duty cycle, $t_r \leq 6 \text{ ns}$, $t_f \leq 6 \text{ ns}$, $Z_O = 50 \Omega$.

Figure 2. Bus-to-Terminal Load Circuit and Voltage Waveforms

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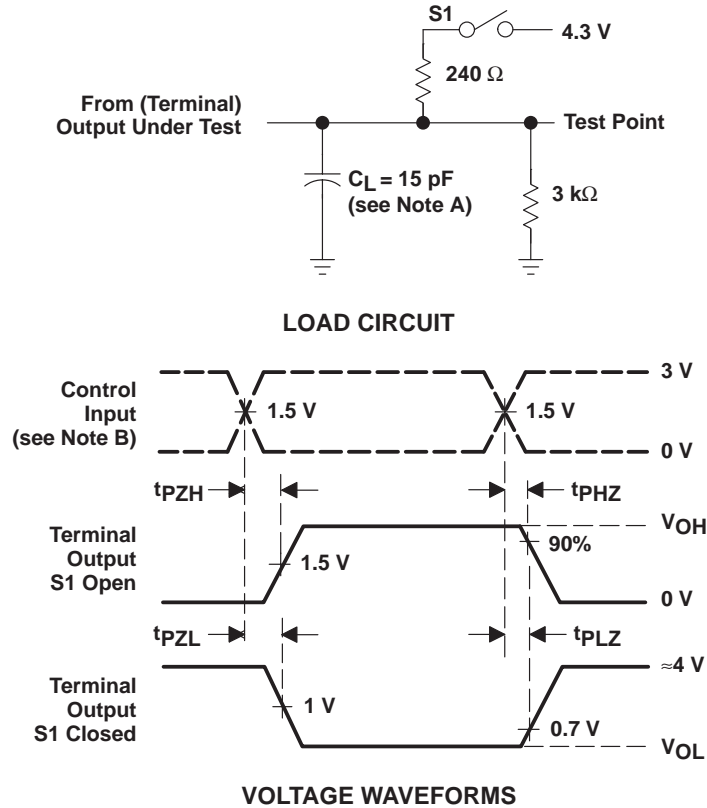
PARAMETER MEASUREMENT INFORMATION



- NOTES: A. C_L includes probe and jig capacitance.
 B. The input pulse is supplied by a generator having the following characteristics: PRR ≤ 1 MHz, 50% duty cycle, t_r ≤ 6 ns, t_f ≤ 6 ns, Z_O = 50 Ω.

Figure 3. Bus Load Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION



- NOTES: A. C_L includes probe and jig capacitance.
 B. The input pulse is supplied by a generator having the following characteristics: PRR ≤ 1 MHz, 50% duty cycle, t_r ≤ 6 ns, t_f ≤ 6 ns, Z_O = 50 Ω.

Figure 4. Terminal Load Circuit and Voltage Waveforms

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TYPICAL CHARACTERISTICS†

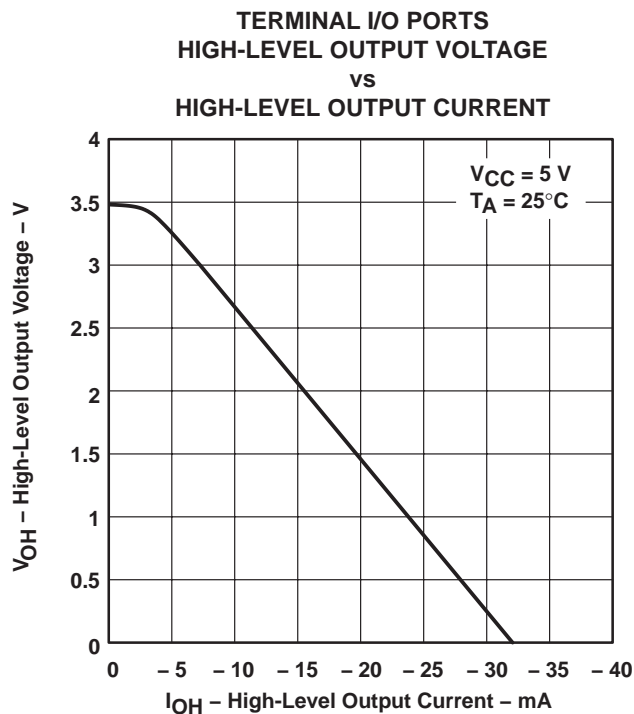


Figure 5

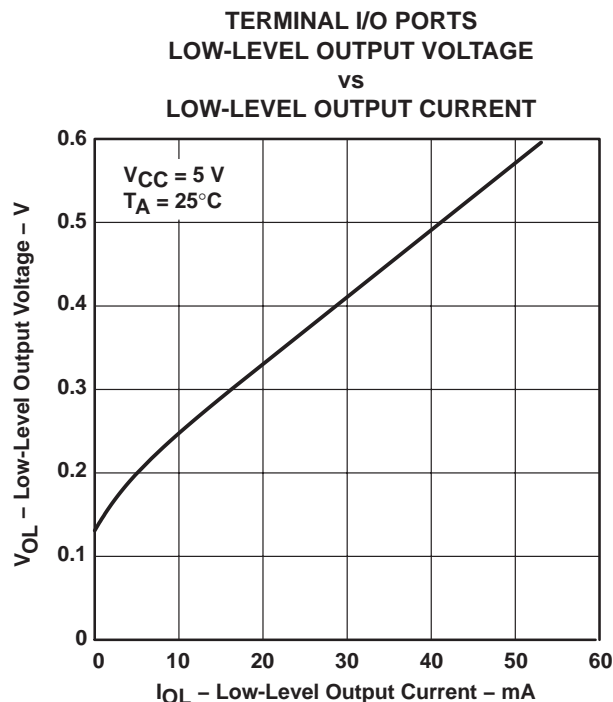


Figure 6

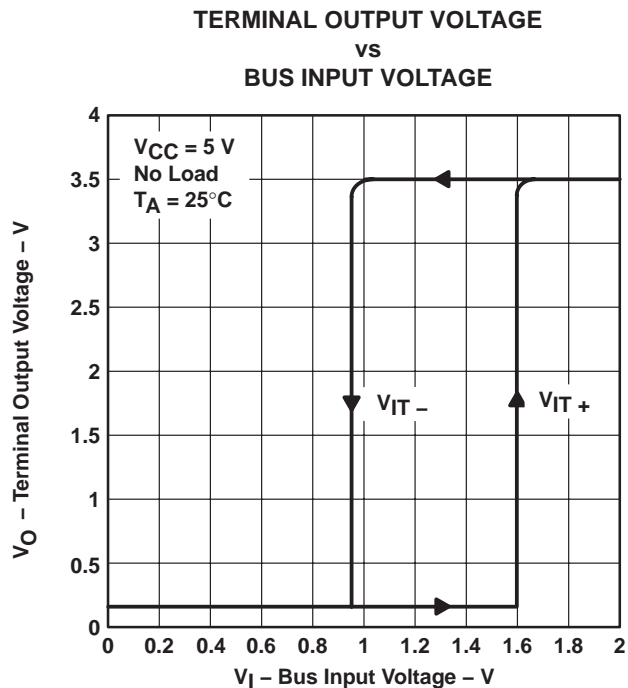


Figure 7

† Operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.

TYPICAL CHARACTERISTICS†

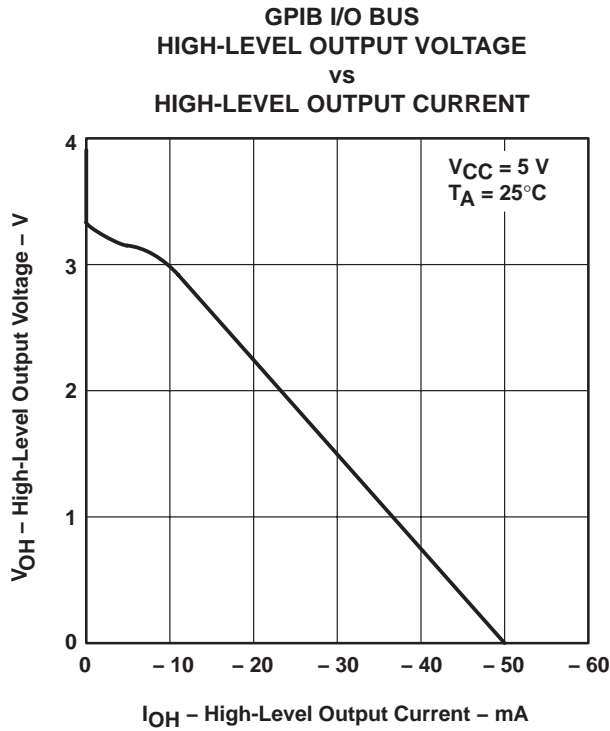


Figure 8

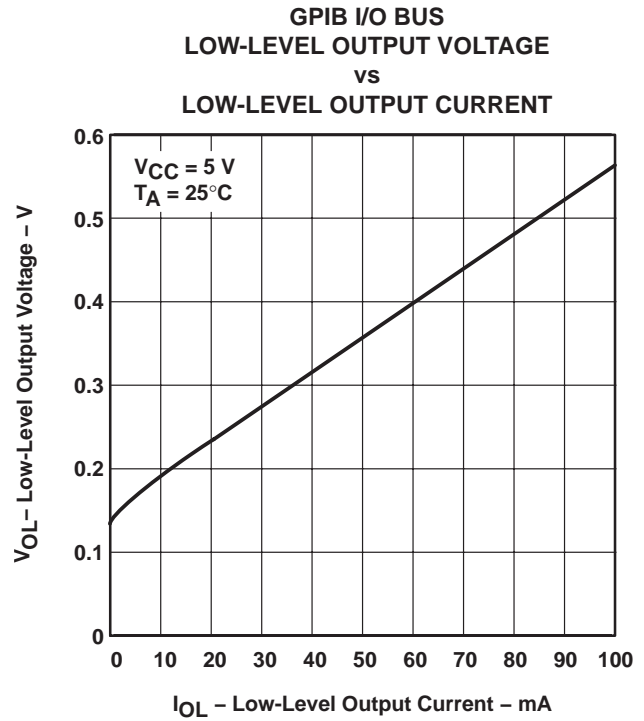


Figure 9

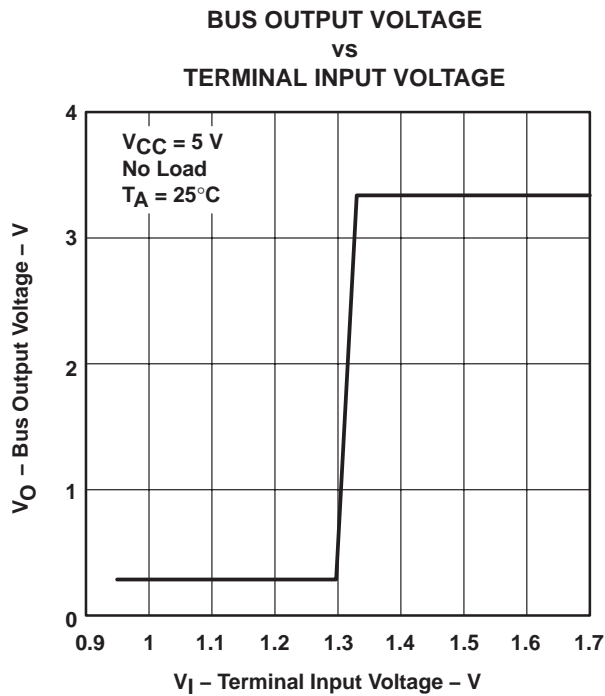


Figure 10

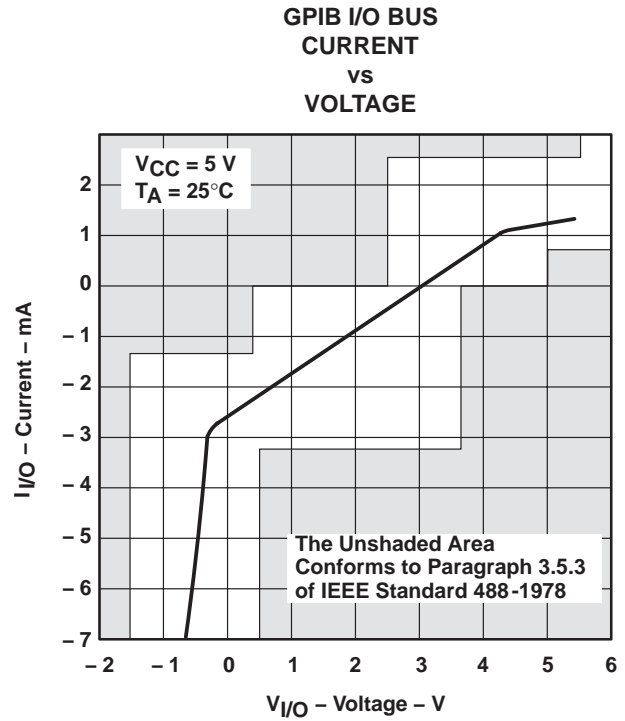


Figure 11

† Operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.

PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|---------------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| SN75ALS161DW | ACTIVE | SOIC | DW | 20 | 25 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 75ALS161 | Samples |
| SN75ALS161DWE4 | ACTIVE | SOIC | DW | 20 | 25 | TBD | Call TI | Call TI | 0 to 70 | | Samples |
| SN75ALS161DWG4 | ACTIVE | SOIC | DW | 20 | 25 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 75ALS161 | Samples |
| SN75ALS161DWR | ACTIVE | SOIC | DW | 20 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 75ALS161 | Samples |
| SN75ALS161N | ACTIVE | PDIP | N | 20 | 20 | RoHS & Non-Green | NIPDAU | N / A for Pkg Type | 0 to 70 | SN75ALS161N | 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.

OBSELETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(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 finish/Ball material - Orderable Devices 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.

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OTHER QUALIFIED VERSIONS OF SN75ALS161 :

- Military : [SN55ALS161](#)

NOTE: Qualified Version Definitions:

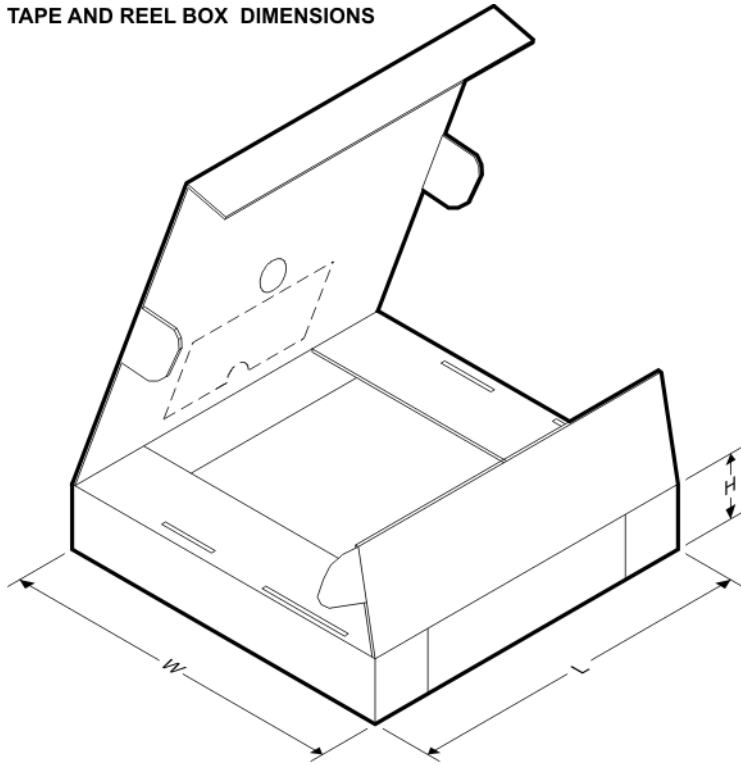
- Military - QML certified for Military and Defense Applications

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 |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN75ALS161DWR | SOIC | DW | 20 | 2000 | 330.0 | 24.4 | 10.8 | 13.3 | 2.7 | 12.0 | 24.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN75ALS161DWR | SOIC | DW | 20 | 2000 | 350.0 | 350.0 | 43.0 |

TUBE


*All dimensions are nominal

| Device | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|----------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| SN75ALS161DW | DW | SOIC | 20 | 25 | 506.98 | 12.7 | 4826 | 6.6 |
| SN75ALS161DWE4 | DW | SOIC | 20 | 25 | 506.98 | 12.7 | 4826 | 6.6 |
| SN75ALS161DWG4 | DW | SOIC | 20 | 25 | 506.98 | 12.7 | 4826 | 6.6 |
| SN75ALS161N | N | PDIP | 20 | 20 | 506 | 13.97 | 11230 | 4.32 |

DW0020A



PACKAGE OUTLINE

SOIC - 2.65 mm max height

SOIC



4220724/A 05/2016

NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm per side.
5. Reference JEDEC registration MS-013.

EXAMPLE BOARD LAYOUT

DW0020A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE
SCALE:6X



SOLDER MASK DETAILS

4220724/A 05/2016

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

DW0020A

SOIC - 2.65 mm max height

SOIC



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:6X

4220724/A 05/2016

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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