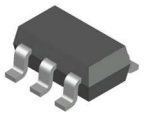
# LVDS 1-Bit, High-Speed Differential Reciever

# FIN1002



SOT−23, 5 Lead
CASE 527AH

## Description

This single receiver is designed for high−speed interconnects utilizing Low Voltage Differential Signaling (LVDS) technology. The receiver translates LVDS levels, with a typical differential input threshold of 100 mV, to LVTTL signal levels. LVDS provides low EMI at ultra low power dissipation even at high frequencies. This device is ideal for high−speed transfer of clock or data. The FIN1002 can be paired with its companion driver, the FIN1001, or with any other LVDS driver.

## Features

- Greater than 400 Mbs Data Rate
- 3.3 V Power Supply Operation
- 0.4 ns Maximum Pulse Skew
- 2.5 ns Maximum Propagation Delay
- Bus Pin ESD (HBM) Protection Exceeds 10 kV
- Power−Off, Over−voltage Tolerant Input and Output
- Fail−safe Protection for open−circuit and Non−driven, Shorted, or Terminated Conditions
- High−impedance Output at $V_{CC}$ < 1.5 V
- Meets or exceeds TIA/EIA−644 LVDS Standard
- 5−Lead SOT23 Package Saves Space

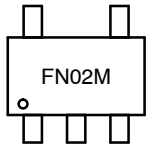
## PIN DEFINITIONS

| Pin No. | Function | Description |
|---|---|---|
| 1 | $V_{CC}$ | Power Supply |
| 2 | GND | Ground for the IC |
| 3 | $R_{IN+}$ | Non−inverting Driver Input |
| 4 | $R_{IN−}$ | Inverting Driver Input |
| 5 | $R_{OUT}$ | LVTTL Data Output |

## FUNCTION TABLE

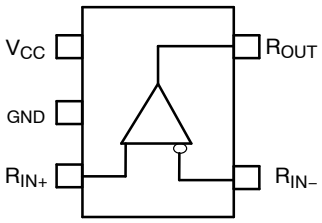
| Inputs | | Outputs |
|---|---|---|
| $R_{IN+}$ | $R_{IN-}$ | $R_{OUT}$ |
| LOW | HIGH | LOW |
| HIGH | LOW | HIGH |
| Fail−Safe Condition (Open, Shorted, Terminated) | | HIGH |

## MARKING DIAGRAM



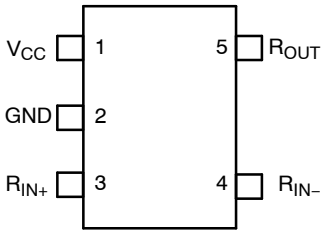

FN02 = Specific Device Code
M = Date Code

## CONNECTION DIAGRAM




(Top View)

## PIN CONFIGURATION




## ORDERING INFORMATION

See detailed ordering and shipping information on page 7 of this data sheet.

**ABSOLUTE MAXIMUM RATINGS**

| Symbol | Parameter | | | Min. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | | | −0.5 | 4.6 | V |
| $R_{IN+}$ / $R_{IN-}$ | Input Voltage | | | −0.5 | 4.6 | V |
| $D_{OUT}$ | DC Output Voltage | | | −0.5 | 6.0 | V |
| $I_O$ | Output Current | | | | 16 | mA |
| $T_{STG}$ | Storage Temperature Range | | | −65 | +150 | °C |
| $T_J$ | Maximum Junction Temperature | | | | +150 | °C |
| $T_L$ | Lead Temperature, Soldering, 10 Seconds | | | | +260 | °C |
| ESD | Electrostatic Discharge | Human Body Model | All Pins | | 8 | kV |
| | | | LVDS Pins to GND | | 10 | |
| | | Machine Model | | | 400 | V |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

**RECOMMENDED OPERATING RANGES**

| Symbol | Parameter | Min. | Max. | Unit |
|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | 3.0 | 3.6 | V |
| $V_{IN}$ | Input Voltage | 0 | $V_{CC}$ | V |
| $V_{ID}$ | Magnitude of Differential Voltage | 100 | $V_{CC}$ | mV |
| $V_{IC}$ | Common−mode Input Voltage | $0 + \|V_{ID}\| / 2$ | $2.4 - \|V_{ID}\| / 2$ | V |
| $T_A$ | Operating Temperature | −40 | +125 | °C |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

**DC ELECTRICAL CHARACTERISTICS** (Note 1)

All min. and max. values are guaranteed at $T_A$ = −40 to +125°C. All typical values are at $T_A$ = 25°C and with $V_{CC}$ = 3.3 V, unless otherwise specified.

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{TH}$ | Differential Input Threshold HIGH | $V_{IC}$ = +0.05 V, 1.2 V, or 2.35 V (Figure 1) | | | 100 | mV |
| $V_{TL}$ | Differential Input Threshold LOW | $V_{IC}$ = +0.05 V, 1.2 V, or 2.35 V (Figure 1) | −100 | | | mV |
| $I_{IN}$ | Input Current | $V_{IN}$ = 0 V or $V_{CC}$ | | | ±20 | μA |
| $I_{I(OFF)}$ | Power−OFF Input Current | $V_{CC}$ = 0 V, $V_{IN}$ = 0 V or 3.6 V | | | ±20 | μA |
| $V_{OH}$ | Output HIGH Voltage | $I_{OH}$ = −100 μA | $V_{CC}$ − 0.2 | 3.3 | | V |
| | | $I_{OH}$ = −8 mA | 2.4 | 3.1 | | |
| $V_{OL}$ | Output LOW Voltage | $I_{OH}$ = 100 μA | | 0 | 0.2 | V |
| | | $I_{OL}$ = 8 mA | | 0.16 | 0.50 | |
| $V_{IK}$ | Input Clamp Voltage | $I_{IK}$ = −18 mA | −1.5 | 0.8 | | V |
| $I_{CC}$ | Power Supply Current | ($R_{IN+}$ = 1 V and $R_{IN-}$ = 1.4 V) or ($R_{IN+}$ = 1.4 V and $R_{IN-}$ = 1 V) | | 4 | 7 | mA |
| $C_{IN}$ | Input Capacitance | $V_{CC}$ = 3.3 V | | 2.3 | | pF |
| $C_{OUT}$ | Output Capacitance | $V_{CC}$ = 0 V | | 2.8 | | pF |

1. Not production tested across the full temperature range.

## AC ELECTRICAL CHARACTERISTICS

All min. and max. values are guaranteed at $T_A$ = −40 to +85°C. All typical values are at $T_A$ = 25°C and with $V_{CC}$ = 3.3 V, unless otherwise specified.
$|V_{ID}|$ = 400 mV, $C_L$ = 10 pF. See Figure 1 and Figure 2.

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{PLH}$ | Propagation Delay | LOW to HIGH | 0.9 | 1.5 | 2.5 | ns |
| $t_{PHL}$ | Propagation Delay | HIGH to LOW | 0.9 | 1.5 | 2.5 | ns |
| $t_{TLH}$ | Output Rise Time | 20% to 80% | | 0.6 | | ns |
| $t_{THL}$ | Output Fall Time | 80% to 20% | | 0.5 | | ns |
| $t_{SK(p)}$ | Pulse Skew | $\|t_{PLH} - t_{PHL}\|$ | | 0.02 | 0.4 | ns |
| $t_{SK(PP)}$ | Part−to−Part Skew (Note 2) | | | | 1.0 | ns |

2. $t_{SK(PP)}$ is the magnitude of the difference in propagation delay times between any specified terminals of two devices switching in the same direction (either LOW−to−HIGH or HIGH−to−LOW) when both devices operate with the same supply voltage, same temperature, and have identical test circuits.

## TEST DIAGRAMS

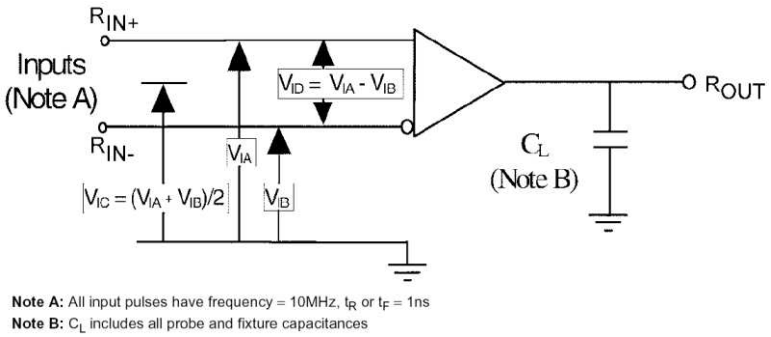



**Figure 1. Differential Receiver Voltage Definitions and Propagation Delay and Transition Time Test Circuit**

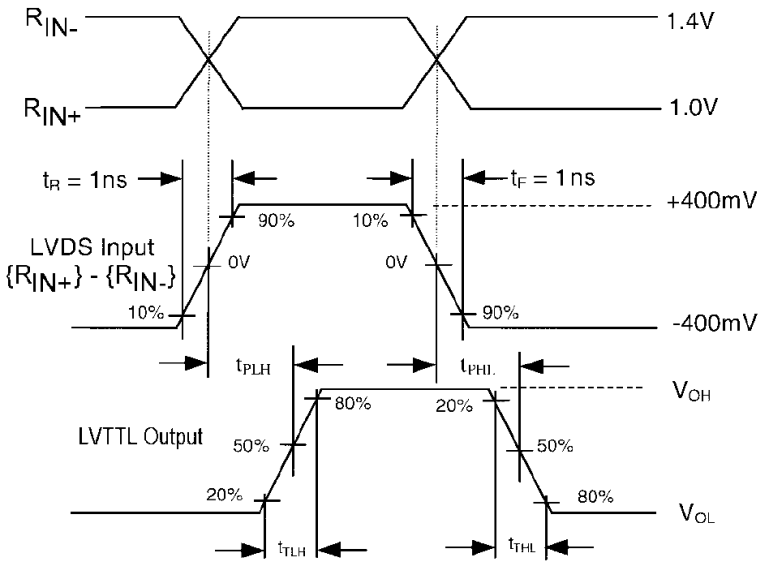



**Figure 2. LVDS Input to LVTTL Output AC Waveforms**

## TYPICAL CHARACTERISTICS

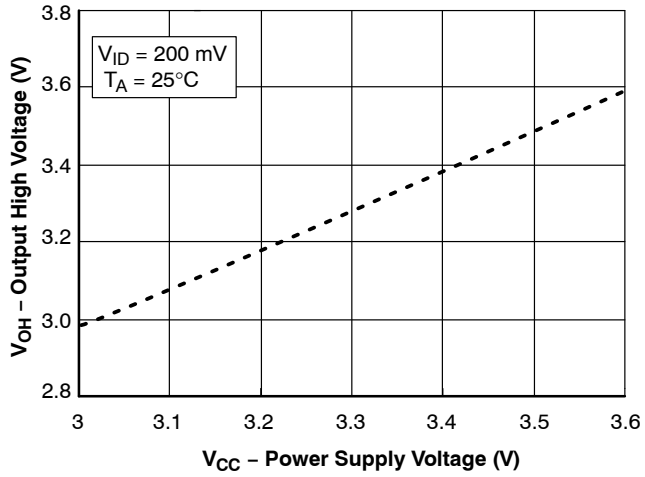



**Figure 3. Output High Voltage vs. Power Supply Voltage**

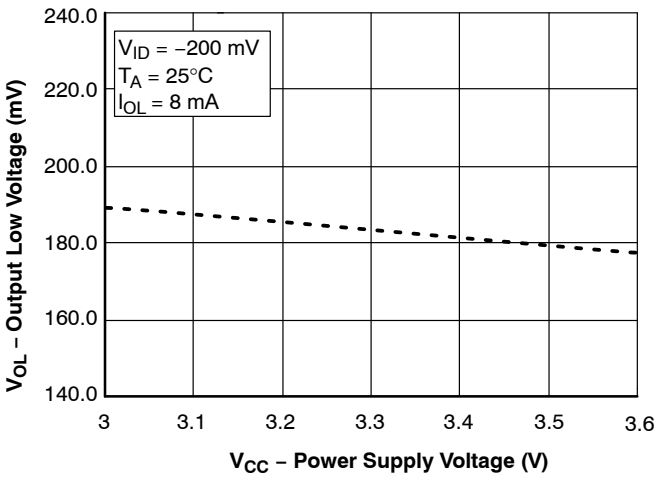



**Figure 4. Output Low Voltage vs. Power Supply Voltage**

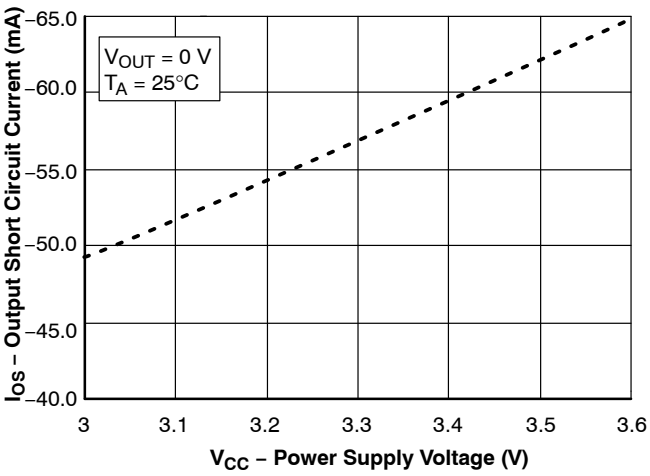



**Figure 5. Output Short Circuit Current vs. Power Supply Voltage**

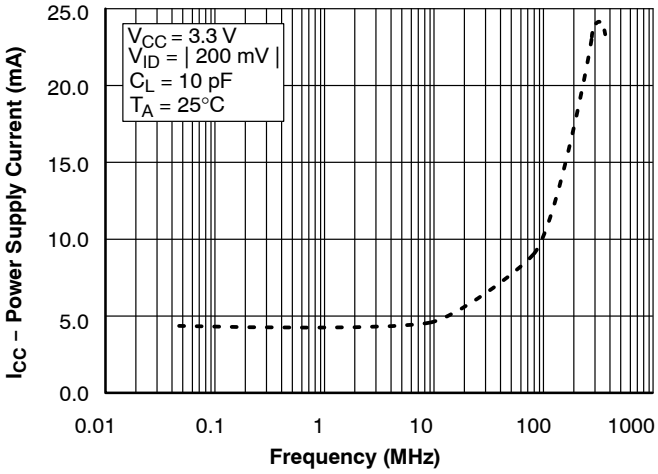



**Figure 6. Power Supply Current vs. Frequency**

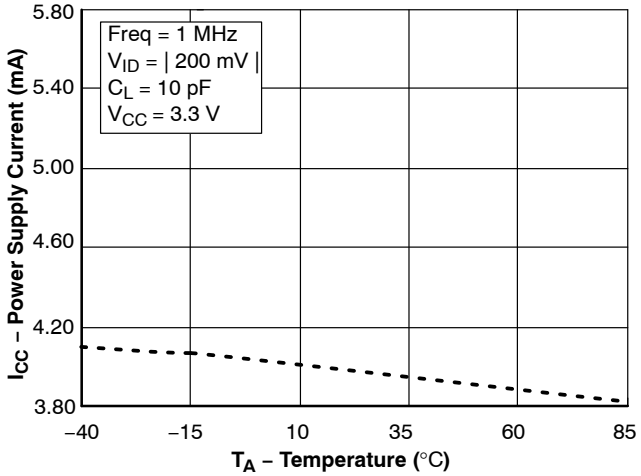



**Figure 7. Power Supply Current vs. Ambient Temperature**

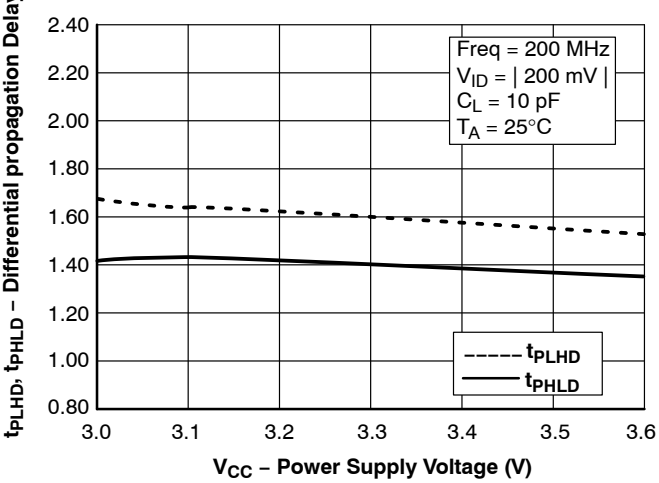



**Figure 8. Differential Propagation Delay Power Supply Voltage**

## TYPICAL CHARACTERISTICS (continued)

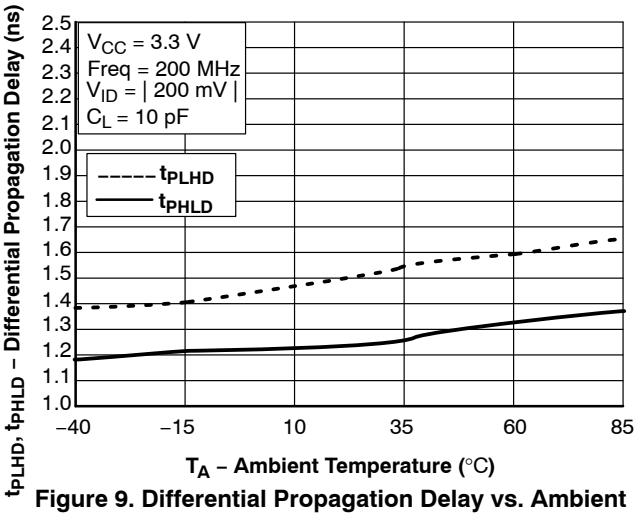



**Figure 9. Differential Propagation Delay vs. Ambient Temperature**

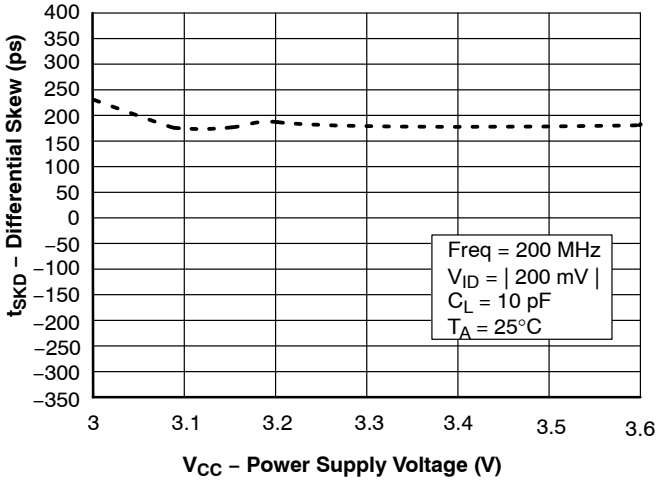



**Figure 10. Differential Skew vs. Power Supply Voltage**

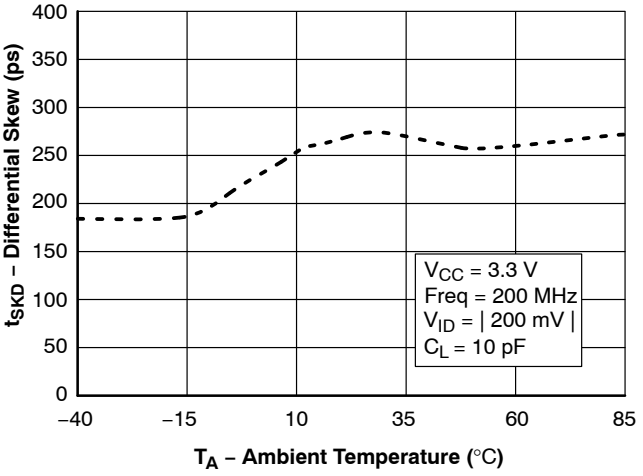



**Figure 11. Differential Skew vs. Ambient Temperature**

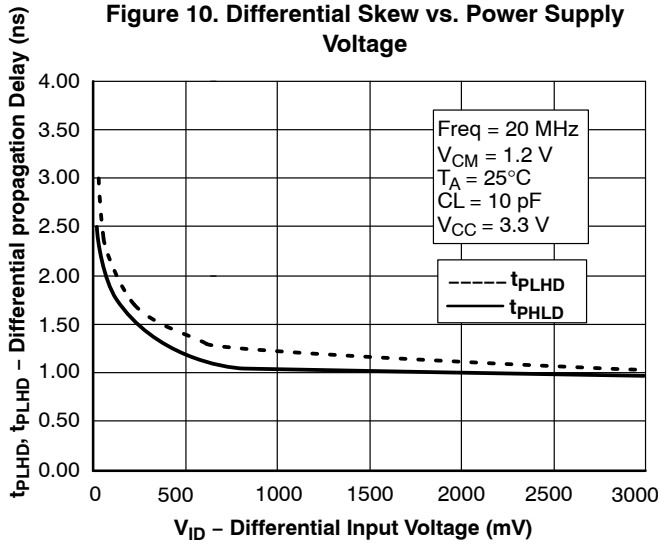



**Figure 12. Differential Propagation Delay vs. Differential Input Voltage**

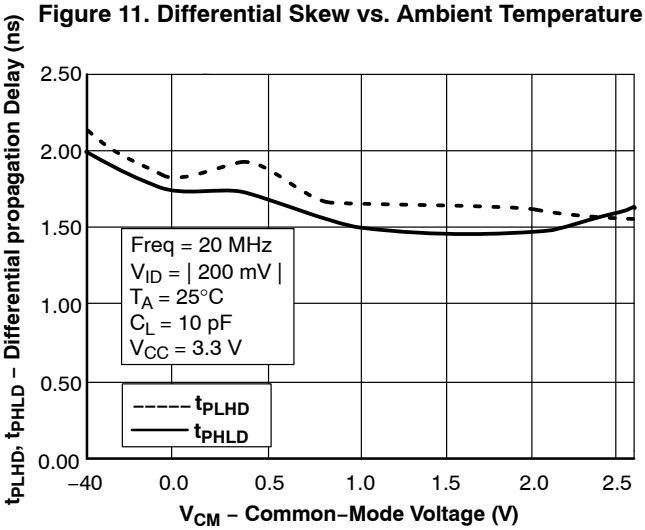



**Figure 13. Differential Propagation Delay vs. Common–Mode Voltage**

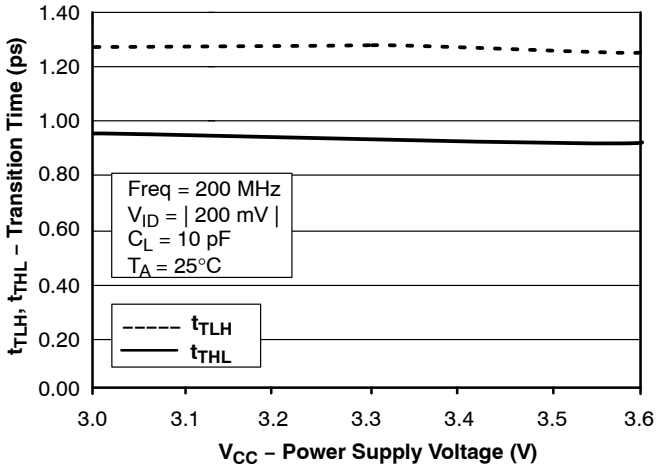



**Figure 14. Transition Time vs. Power Supply Voltage**

## TYPICAL CHARACTERISTICS (continued)

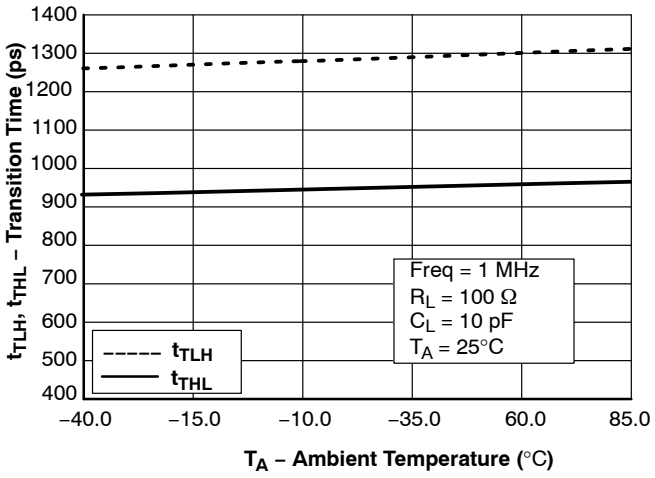



**Figure 15. Transition Time vs. Ambient Temperature**

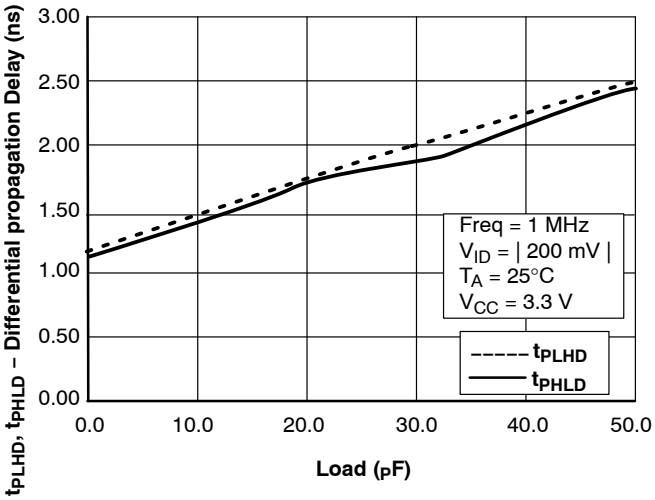



**Figure 16. Differential Propagation Delay vs. Load**

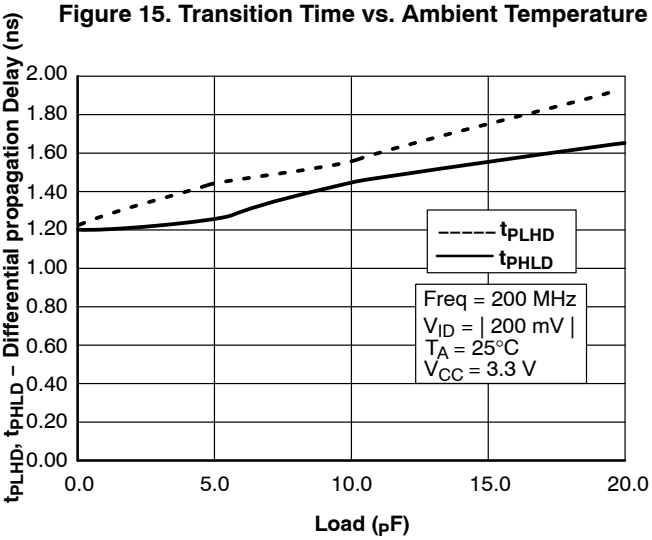



**Figure 17. Differential Propagation Delay vs. Load**

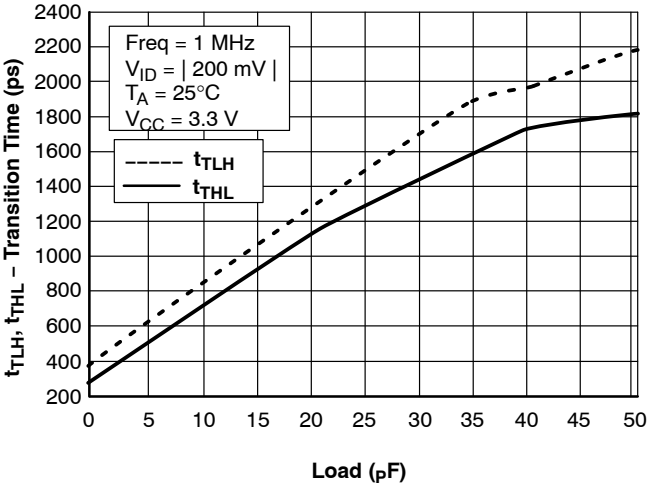



**Figure 18. Transition Time vs. Load**

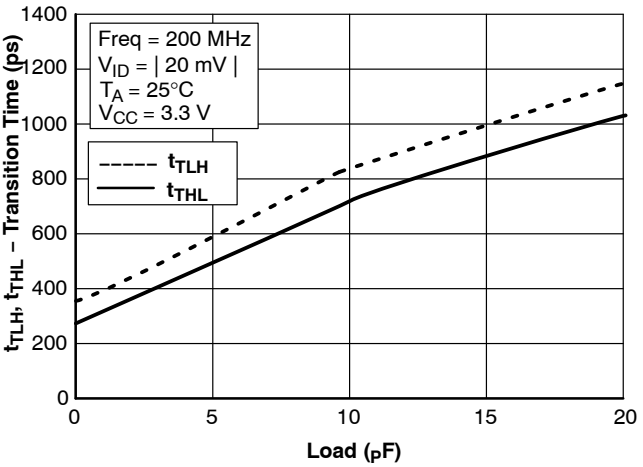



**Figure 19. Transition Time vs. Load**

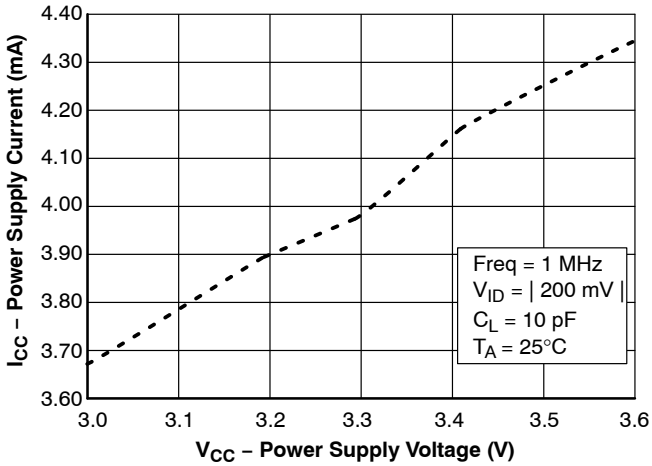



**Figure 20. Power Supply Current vs. Power Supply Voltage**

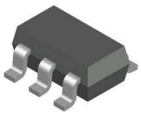
## ORDERING INFORMATION

| Product Number | Package | Shipping† |
|---|---|---|
| FIN1002M5X | 5 Lead SOT23, JEDEC MO−178, 1.6 mm (Pb−Free) | 3000 / Tape and Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

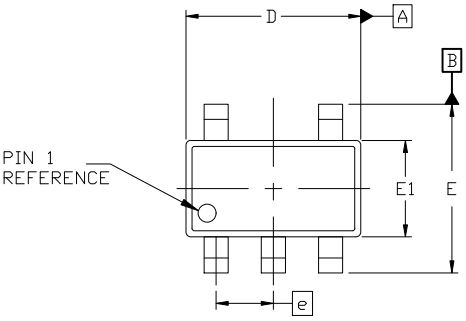
# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS

ON Semiconductor®

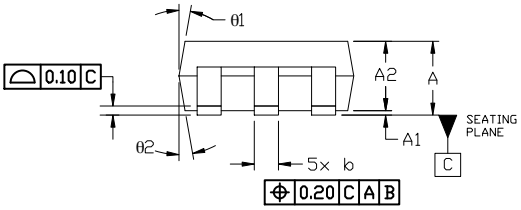


**SOT−23, 5 Lead**
CASE 527AH
ISSUE A

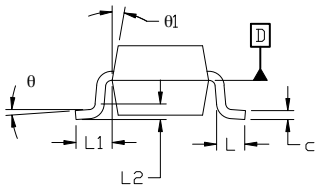
DATE 09 JUN 2021




TOP VIEW



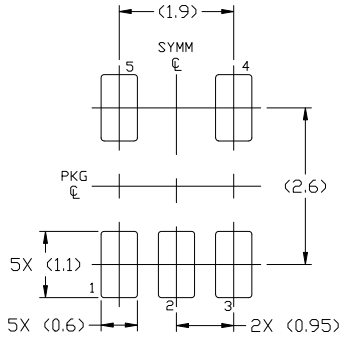

SIDE VIEW




END VIEW

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 19894
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.25 PER SIDE. D AND E1 DIMENSIONS ARE DETERMINED AT DATUM D.
5. DIMENSION 'b' DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08mm TOTAL IN EXCESS OF THE 'b' DIMENSION AT MAXIMUM MATERIAL CONDITION. MINIMUM SPACE BETWEEN PROTRUSION AND AN ADJACENT LEAD SHALL NOT BE LESS THAN 0.07mm.

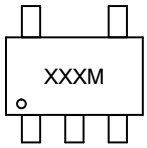
| | MILLIMETERS | | |
|---|---|---|---|
| DIM | MIN. | NOM. | MAX. |
| A | 0.90 | — | 1.45 |
| A1 | 0.00 | — | 0.15 |
| A2 | 0.90 | 1.15 | 1.30 |
| b | 0.30 | — | 0.50 |
| c | 0.08 | — | 0.22 |
| D | 2.90 BSC | | |
| E | 2.80 BSC | | |
| E1 | 1.60 BSC | | |
| e | 0.95 BSC | | |
| L | 0.30 | 0.45 | 0.60 |
| L1 | 0.60 REF | | |
| L2 | 0.25 REF | | |
| θ | 0° | 4° | 8° |
| θ1 | 0° | 10° | 15° |
| θ2 | 0° | 10° | 15° |




**RECOMMENDED MOUNTING FOOTPRINT**

For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

**GENERIC MARKING DIAGRAM***




XXX = Specific Device Code
M = Date Code

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

| | | |
|---|---|---|
| **DOCUMENT NUMBER:** | **98AON34320E** | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| **DESCRIPTION:** | **SOT−23, 5 LEAD** | **PAGE 1 OF 1** |

## ADDITIONAL INFORMATION

**TECHNICAL PUBLICATIONS**:
**Technical Library:** www.onsemi.com/design/resources/technical−documentation
**onsemi Website:** www.onsemi.com

**ONLINE SUPPORT**: www.onsemi.com/support
**For additional information, please contact your local Sales Representative at**
www.onsemi.com/support/sales