FAIRCHILD SEMICONDUCTOR™

February 2002
Revised February 2002

# FIN1002
# LVDS 1-Bit High Speed Differential Receiver

## General 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 400Mbs data rate
- 3.3V power supply operation
- 0.4ns maximum pulse skew
- 2.5ns maximum propagation delay
- Bus pin ESD (HBM) protection exceeds 10kV
- 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 $V_{CC}$ < 1.5V
- Meets or exceeds the TIA/EIA-644 LVDS standard
- 5-Lead SOT23 package saves space

## Ordering Code:

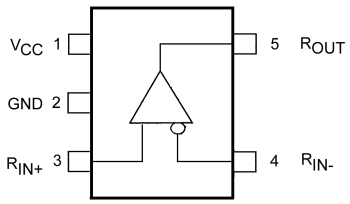
| Order Number | Package Number | Package Description |
|---|---|---|
| FIN1002M5 | MA05B | 5-Lead SOT23, JEDEC MO-178, 1.6mm [250 Units on Tape and Reel] |
| FIN1002M5X | MA05B | 5-Lead SOT23, JEDEC MO-178, 1.6mm [3000 Units on Tape and Reel] |

## Pin Descriptions

| Pin Name | Description |
|---|---|
| $R_{OUT}$ | LVTTL Data Output |
| $R_{IN+}$ | Non-inverting Driver Input |
| $R_{IN-}$ | Inverting Driver Input |
| $V_{CC}$ | Power Supply |
| GND | Ground |
| NC | No Connect |

## Connection Diagram

**Pin Assignment for SOT package**




**Top View**

## Function Table

| Input | | Outputs |
|---|---|---|
| $R_{IN+}$ | $R_{IN-}$ | $R_{OUT}$ |
| L | H | L |
| H | L | H |
| Fail Safe Condition | | H |

H = HIGH Logic Level
L = LOW Logic Level
Fail Safe = Open, Shorted, Terminated

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## Absolute Maximum Ratings(Note 1)

| | |
|---|---|
| Supply Voltage ($V_{CC}$) | −0.5V to +4.6V |
| DC Input Voltage ($R_{IN+}$, $R_{IN-}$) | −0.5V to +4.6V |
| DC Output Voltage ($D_{OUT}$) | −0.5V to +6V |
| DC Output Current ($I_O$) | 16 mA |
| Storage Temperature Range ($T_{STG}$) | −65°C to +150°C |
| Max Junction Temperature ($T_J$) | 150°C |
| Lead Temperature ($T_L$) | |
| (Soldering, 10 seconds) | 260°C |

## Recommended Operating Conditions

| | |
|---|---|
| Supply Voltage ($V_{CC}$) | 3.0V to 3.6V |
| Input Voltage ($V_{IN}$) | 0 to $V_{CC}$ |
| Magnitude of Differential | |
| Voltage ($\|V_{ID}\|$) | 100mV to $V_{CC}$ |
| Common-mode Input | |
| Voltage ($V_{IC}$) | (0V + $\|V_{ID}\|$ /2) to (2.4 − $\|V_{ID}\|$/2) |
| Operating Temperature ($T_A$) | −40°C to +85°C |
| ESD (Human Body Model) | |
| All Pins | 8kV |
| LVDS pins to GND | 10kV |
| ESD (Machine Model) | 400V |

**Note 1:** The "Absolute Maximum Ratings": are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature and output/input loading variables. Fairchild does not recommend operation of circuits outside databook specification.

## DC Electrical Characteristics

Over supply voltage and operating temperature ranges, unless otherwise specified

| Symbol | Parameter | Test Conditions | Min | Typ (Note 2) | Max | Units |
|---|---|---|---|---|---|---|
| $V_{TH}$ | Differential Input Threshold HIGH | See Figure 1; $V_{IC}$ = +0.05V, 1.2V, or 2.35V | | | 100 | mV |
| $V_{TL}$ | Differential Input Threshold LOW | See Figure 1; $V_{IC}$ = +0.05V, 1.2V, or 2.35V | −100 | | | mV |
| $I_{IN}$ | Input Current | $V_{IN}$ = 0V or $V_{CC}$ | | | ±20 | µA |
| $I_{I(OFF)}$ | Power-OFF Input Current | $V_{CC}$ = 0V, $V_{IN}$ = 0V or 3.6V | | | ±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 | 0.2 | V |
| | | $I_{OL}$ = 8 mA | | 0.16 | 0.5 | |
| $V_{IK}$ | Input Clamp Voltage | $I_{IK}$ = −18 mA | −1.5 | 0.8 | | V |
| $I_{CC}$ | Power Supply Current | ($R_{IN+}$ = 1V and $R_{IN-}$ = 1.4V), or ($R_{IN+}$ = 1.4V and $R_{IN-}$ = 1V) | | 4 | 7 | mA |
| $C_{IN}$ | Input Capacitance | $V_{CC}$ = 3.3V | | 2.3 | | pF |
| $C_{OUT}$ | Output Capacitance | $V_{CC}$ = 0V | | 2.8 | | pF |

**Note 2:** All typical values are at $T_A$ = 25°C and with $V_{CC}$ = 3.3V.

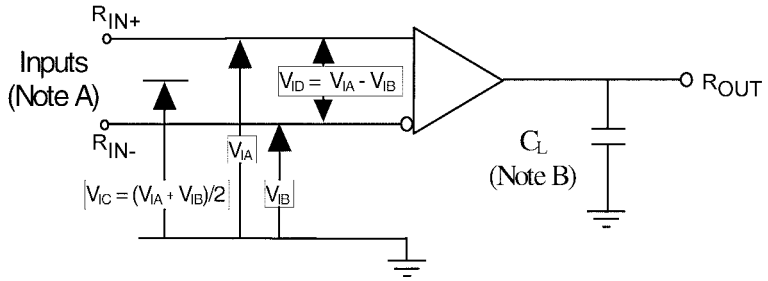
## AC Electrical Characteristics

Over supply voltage and operating temperature ranges, unless otherwise specified

| Symbol | Parameter | Test Conditions | Min | Typ (Note 3) | Max | Units |
|---|---|---|---|---|---|---|
| $t_{PLH}$ | Propagation Delay LOW-to-HIGH | $\|V_{ID}\|$ = 400 mV, $C_L$ = 10 pF See Figure 1 and Figure 2 | 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 4) | | | | 1.0 | ns |

**Note 3:** All typical values are at $T_A$ = 25°C and with $V_{CC}$ = 3.3V.

**Note 4:** $t_{SK(PP)}$ 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.




**Note A:** All input pulses have frequency = 10MHz, $t_R$ or $t_F$ = 1ns
**Note B:** $C_L$ includes all probe and fixture capacitances

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

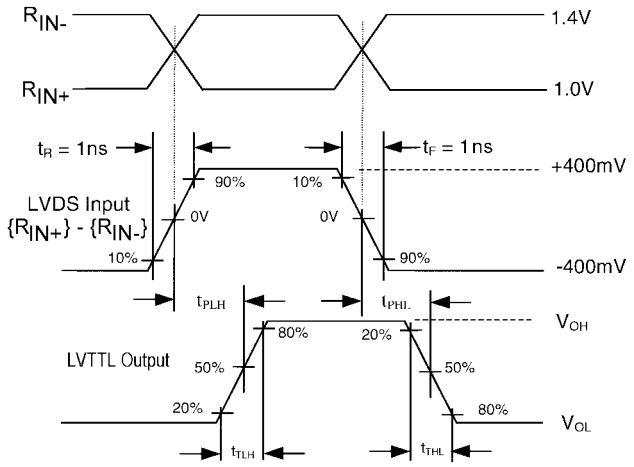



**FIGURE 2. LVDS Input to LVTTL Output AC Waveforms**

## DC / AC Typical Performance Curves

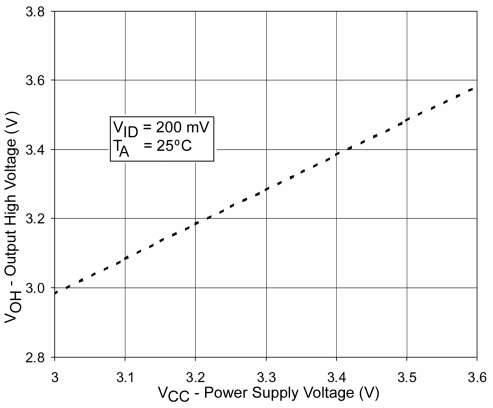



**FIGURE 3. Output High Voltage vs. Power Supply Voltage**

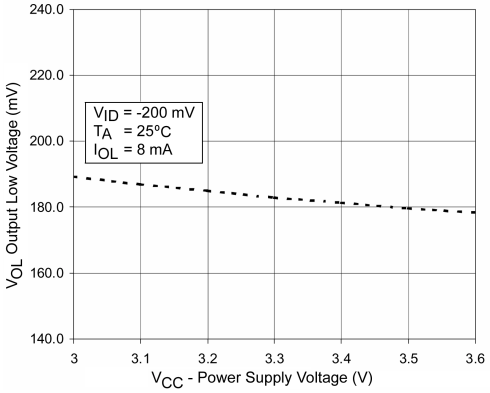



**FIGURE 4. Output Low Voltage vs. Power Supply Voltage**

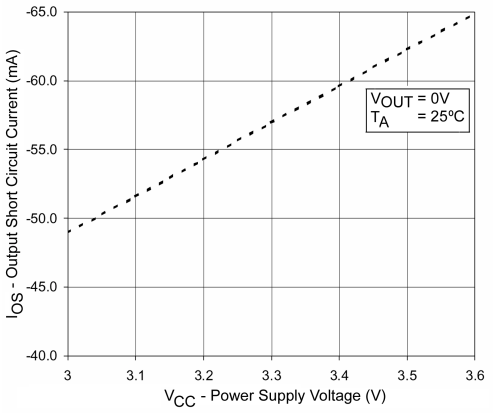



**FIGURE 5. Output Short Circuit Current vs. Power Supply Voltage**

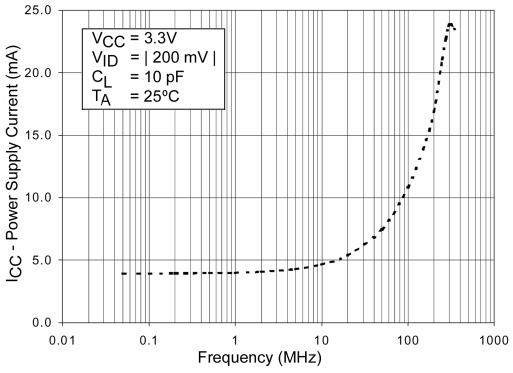



**FIGURE 6. Power Supply Current vs. Frequency**

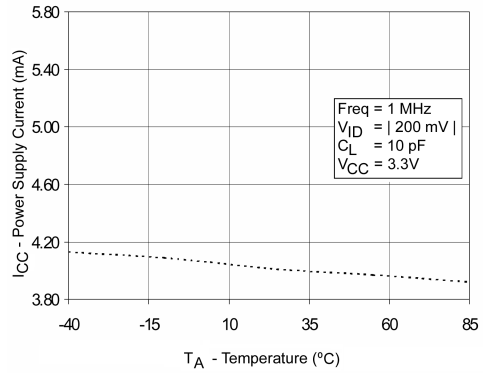



**FIGURE 7. Power Supply Current vs. Ambient Temperature**

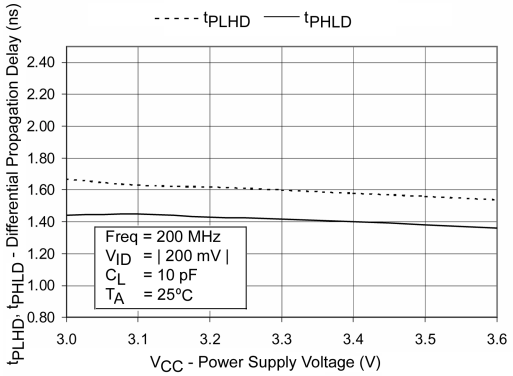



**FIGURE 8. Differential Propagation Delay Power Supply Voltage**

## DC / AC Typical Performance Curves (Continued)

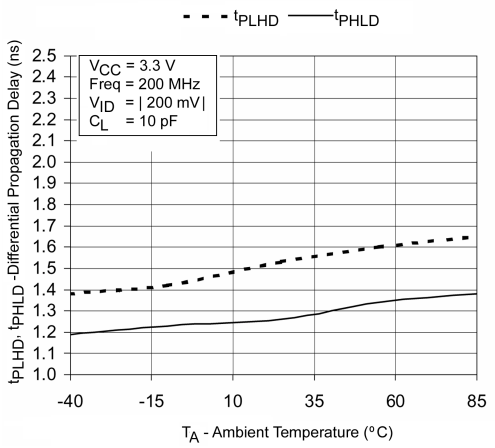



**FIGURE 9. Differential Propagation Delay vs. Ambient Temperature**

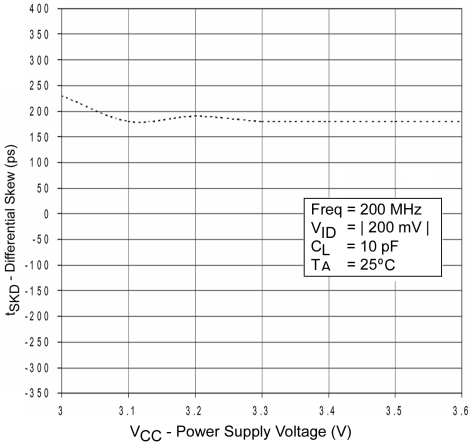



**FIGURE 10. Differential Skew vs. Power Supply Voltage**

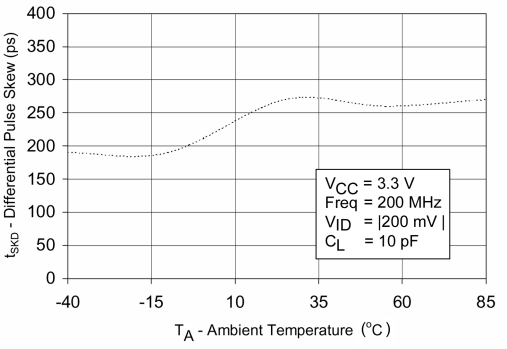



**FIGURE 11. Differential Skew vs. Ambient Temperature**

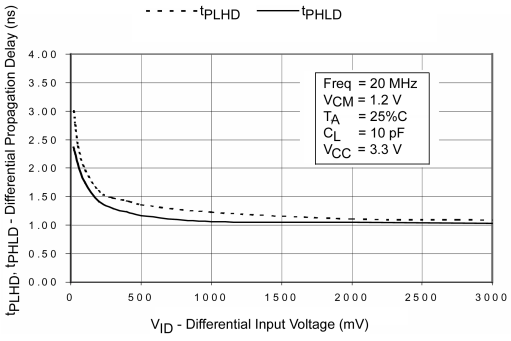



**FIGURE 12. Differential Propagation Delay vs. Differential Input Voltage**

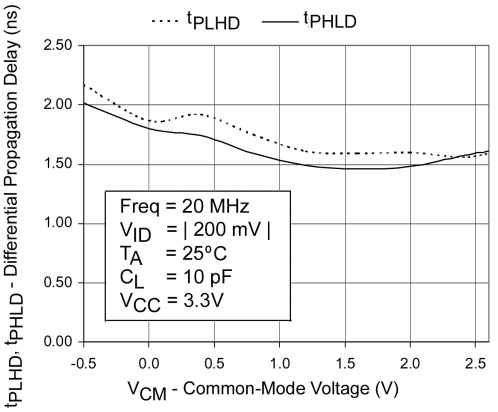



**FIGURE 13. Differential Propagation Delay vs. Common-Mode Voltage**

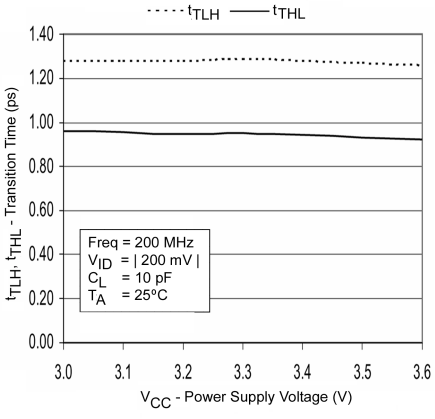



**FIGURE 14. Transition Time vs. Power Supply Voltage**

## DC / AC Typical Performance Curves (Continued)

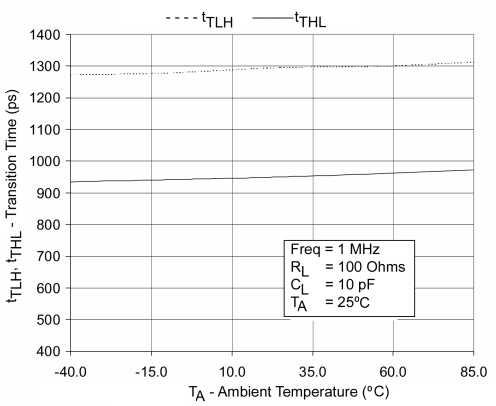



**FIGURE 15. Transition Time vs. Ambient Temperature**

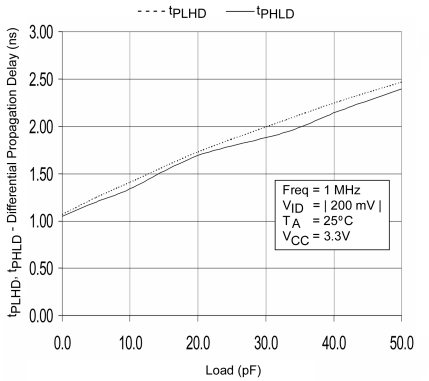



**FIGURE 16. Differential Propagation Delay vs. Load**

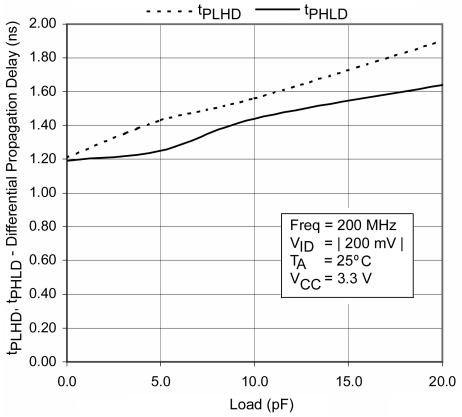



**FIGURE 17. Differential Propagation Delay vs. Load**

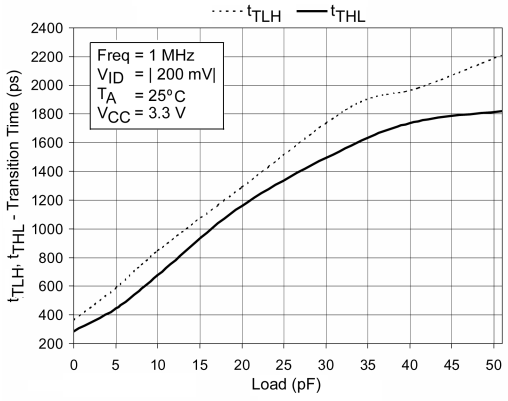



**FIGURE 18. Transition Time vs. Load**

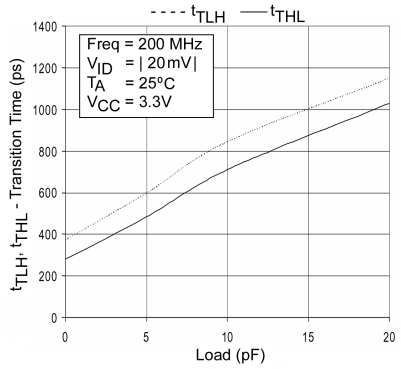



**FIGURE 19. Transition Time vs. Load**

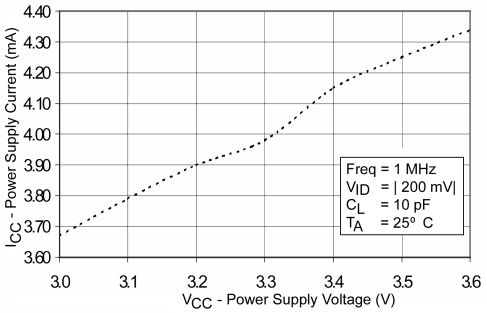
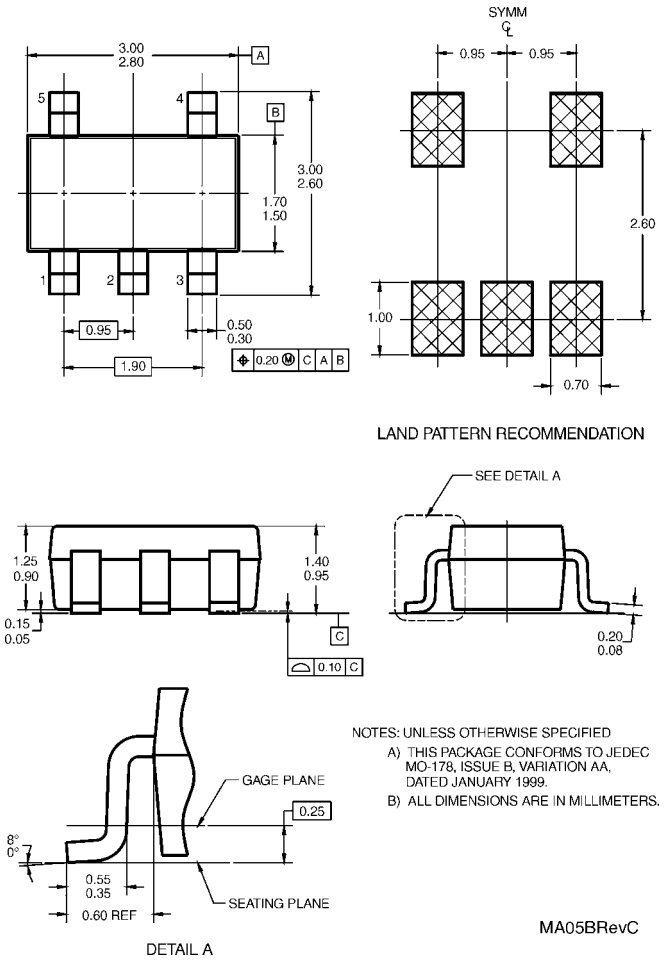



**FIGURE 20. Power Supply Current vs. Power Supply Voltage**

## Physical Dimensions inches (millimeters) unless otherwise noted




**5-Lead SOT23, JEDEC MO-178, 1.6mm**
**Package Number MA05B**

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