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FAIRCHILD SEMICONDUCTOR®

August 2008



# FIN1028 — 3.3V LVDS 2-Bit High-Speed Differential Receiver

## Features

- Greater than 400Mbs Data Rate
- Power Supply Operation: 3.3V
- Maximum Differential Pulse Skew: 0.4ns
- Maximum Propagation Delay: 2.5ns
- Low-Power Dissipation
- Power-Off Protection
- Fail-Safe Protection for Open-Circuit, Shorted, and Terminated Conditions
- Meets or Exceeds the TIA/EIA-644 LVDS Standard
- Flow-through Pinout Simplifies PCB Layout

## Description

This dual 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 100mV, 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 and data signals.

The FIN1028 can be paired with its companion driver, the FIN1027, or any other LVDS driver.

## Ordering Information

| Part Number | Operating Temperature Range | Eco Status | Package | Packing Method |
|---|---|---|---|---|
| FIN1028M | -40 to +85°C | RoHS | 8-Lead Small Outline Package (SOIC) JEDEC MS-012, 0.150 inch Narrow | Trays |
| FIN1028MX | -40 to +85°C | RoHS | 8-Lead Small Outline Package (SOIC) JEDEC MS-012, 0.150 inch Narrow | Tape and Reel |

*For Fairchild's definition of "green" Eco Status, please visit: http://www.fairchildsemi.com/company/green/rohs_green.html.*

## Pin Configuration

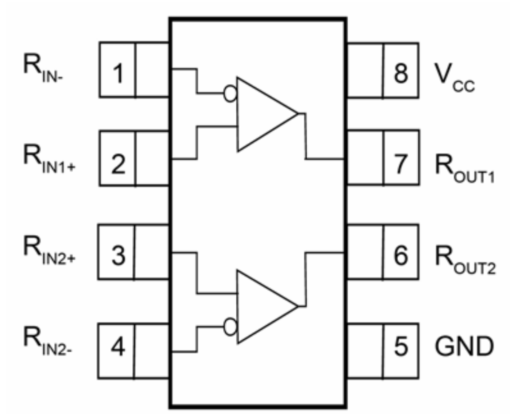


**Figure 1. SOIC Pin Assignments (Top View)**

## Pin Definitions

| Pin # | Name | Description |
|---|---|---|
| 1 | $R_{IN1-}$ | Inverting LVDS Input |
| 2 | $R_{IN1+}$ | Non-Inverting LVDS Input |
| 3 | $R_{IN2+}$ | Non-Inverting LVDS Input |
| 4 | $R_{IN2-}$ | Inverting LVDS Input |
| 5 | GND | Ground |
| 6 | $R_{OUT2}$ | LVTTL Data Output |
| 7 | $R_{OUT1}$ | LVTTL Data Output |
| 8 | $V_{CC}$ | Power Supply |

## Function Table

| Inputs | | Outputs |
|---|---|---|
| **$R_{IN+}$** | **$R_{IN-}$** | **$R_{OUT}$** |
| LOW | HIGH | LOW |
| HIGH | LOW | HIGH |
| Fail-Safe Conditions[1] | | HIGH |

**Note:**
1. Fail-safe=open, shorted, terminated.

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

| Symbol | Parameter | Min. | Max. | Unit |
|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | -0.5 | 4.6 | V |
| $R_{INx+}$, $R_{INx-}$ | DC Input Voltage | -0.5 | 4.7 | V |
| $R_{OUTx}$ | DC Output Voltage | -0.5 | 6.0 | V |
| $I_O$ | DC 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 | Human Body Model, JESD22-A114 | | ≥6500 | V |
| | Machine Model, JESD22-A115 | | ≥300 | |

## Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings.

| 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 | 0.05 | 2.35 | V |
| $T_A$ | Operating Temperature | -40 | +85 | °C |

## DC Electrical Characteristics

Typical values are at $T_A$=25°C and with $V_{CC}$=3.3V. Over-supply voltage and operating temperature ranges, unless otherwise noted.

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $V_{TH}$ | Differential Input Threshold HIGH | Figure 2, Table 1 | | | 100 | mV |
| $V_{TL}$ | Differential Input Threshold LOW | Figure 2, Table 1 | -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 | $I_{OH}$=-100µA | $V_{CC}$-0.2 | | | V |
| | | $I_{OH}$=-8mA | 2.4 | | | |
| $V_{OL}$ | Output LOW Voltage | $I_{OL}$=100µA | | | 0.2 | V |
| | | $I_{OL}$=8mA | | | 0.5 | |
| $V_{IK}$ | Input Clamp Voltage | $I_{IK}$=-18mA | -1.5 | | | V |
| $I_{CC}$ | Power Supply Current | $R_{IN+}$=1V and $R_{IN-}$=1.4V or $R_{IN+}$=1.4V and $R_{IN-}$=1V | | | 9 | mA |
| $C_{IN}$ | Input Capacitance | | | 4 | | pF |
| $C_{OUT}$ | Output Capacitance | | | 6 | | pF |

## DC Electrical Characteristics

Typical values are at $T_A$=25°C and with $V_{CC}$=3.3V. Over-supply voltage and operating temperature ranges, unless otherwise noted.

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $t_{PLH}$ | Differential Propagation Delay, LOW-to-HIGH | $\lvert V_{ID} \rvert$=400mV, $C_L$=10pF Figure 2, Figure 3 | 0.9 | | 2.5 | ns |
| $t_{PHL}$ | Differential Propagation Delay, HIGH-to-LOW | | 0.9 | | 2.5 | ns |
| $t_{TLH}$ | Output Rise Time (20% to 80%) | | | 0.5 | | ns |
| $t_{THL}$ | Output Fall Time (80% to 20%) | | | 0.5 | | ns |
| $t_{SK(P)}$ | Pulse Skew $\lvert t_{PLH} - t_{PHL} \rvert$ | | | | 0.4 | ns |
| $t_{SK(LH)}$, $t_{SK(HL)}$ | Channel-to-Channel Skew[2] | | | | 0.3 | ns |
| $t_{SK(PP)}$ | Part-to-Part Skew[3] | | | | 1.0 | ns |

**Notes:**

2. $t_{SK(LH)}$, $t_{SK(HL)}$ is the skew between specified outputs of a single device when the outputs have identical loads and are switching in the same direction.
3. $t_{SK(PP)}$ 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.

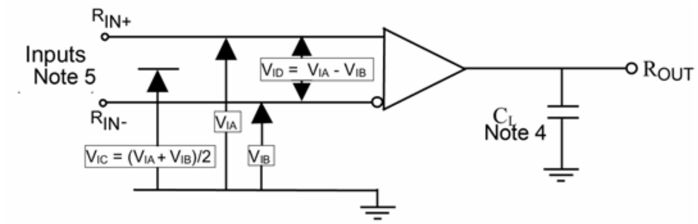


**Figure 2. Differential Driver Propagation Delay and Transition Time Test Circuit**

**Notes:**

4. $C_L$ includes all probe and fixture capacitances.
5. All input pulses have frequency = 10MHz, $t_R$ or $t_F$=1ns.

**Table 1. Receiver Minimum and Maximum Input Threshold Test Voltages**

| Applied Voltages (V) | | Resulting Differential Input Voltage (mV) | Resulting Common Mode Input Voltage (V) |
|---|---|---|---|
| $V_{IA}$ | $V_{IB}$ | $V_{ID}$ | $V_{IC}$ |
| 1.25 | 1.15 | 100 | 1.2 |
| 1.15 | 1.25 | -100 | 1.2 |
| 2.4 | 2.3 | 100 | 2.35 |
| 2.3 | 2.4 | -100 | 2.35 |
| 0.1 | 0 | 100 | 0.05 |
| 0 | 0.1 | -100 | 0.05 |
| 1.5 | 0.9 | 600 | 1.2 |
| 0.9 | 1.5 | -600 | 1.2 |
| 2.4 | 1.8 | 600 | 2.1 |
| 1.8 | 2.4 | -600 | 2.1 |
| 0.6 | 0 | 600 | 0.3 |
| 0 | 0.6 | -600 | 0.3 |

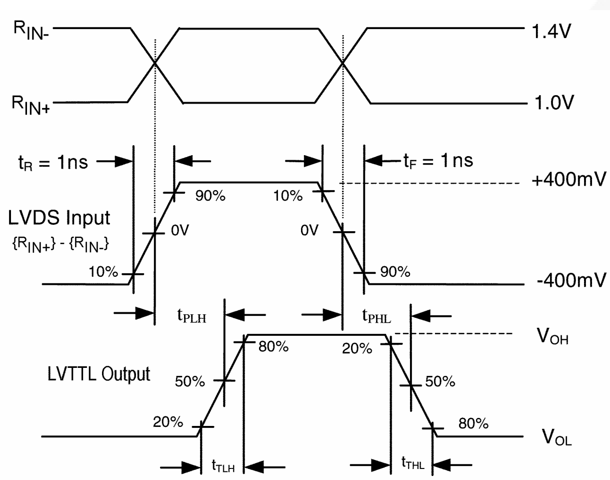


**Figure 3. AC Waveforms**

## Typical Performance Characteristics

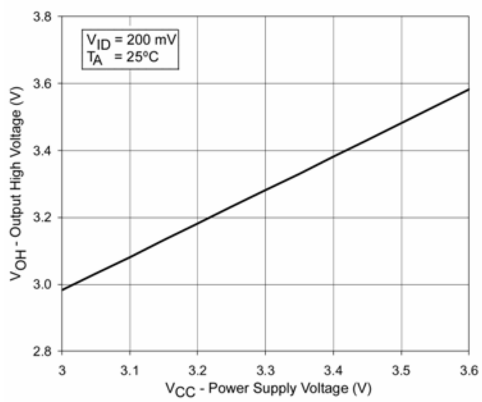


**Figure 4. Output High Voltage vs. Power Supply Voltage**

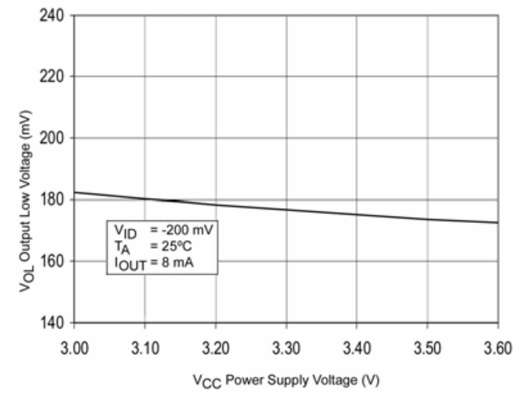


**Figure 5. Output Low Voltage vs. Power Supply Voltage**

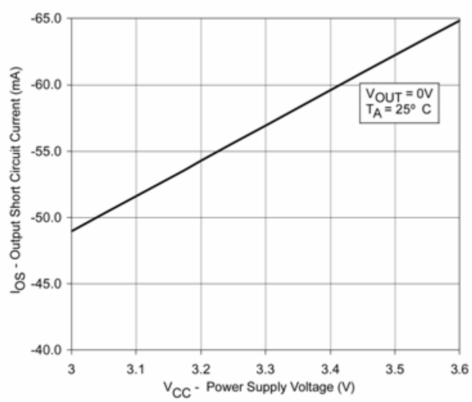


**Figure 6. Output Short Circuit Current vs. Power Supply Voltage**

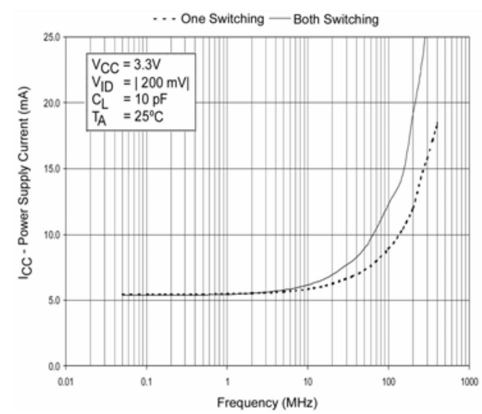


**Figure 7. Power Supply Current vs. Frequency**

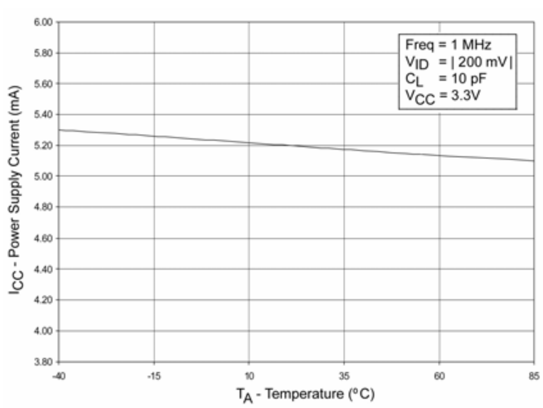


**Figure 8. Power Supply Current vs. Ambient Temperature**

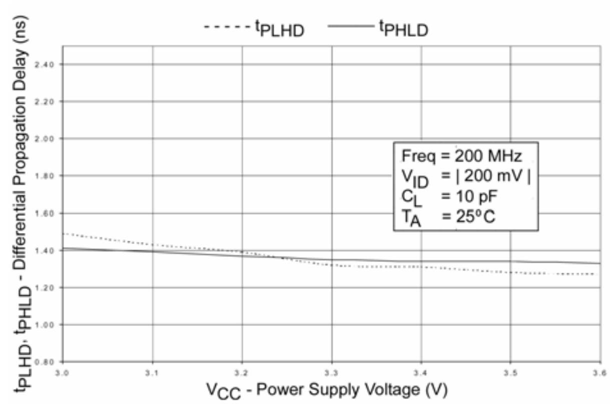


**Figure 9. Differential Propagation Delay vs. Power Supply Voltage**

## Typical Performance Characteristics (Continued)

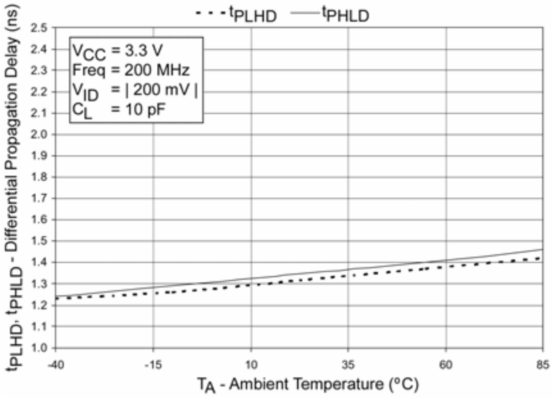


**Figure 10. Differential Propagation Delay vs. Ambient Temperature**

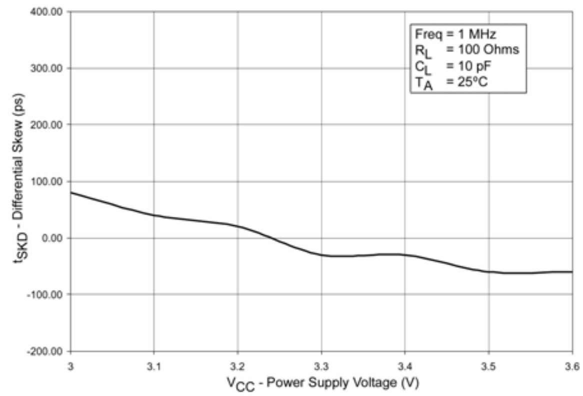


**Figure 11. Differential Skew ($t_{PLH}$-$t_{PHL}$) vs. Power Supply Voltage**

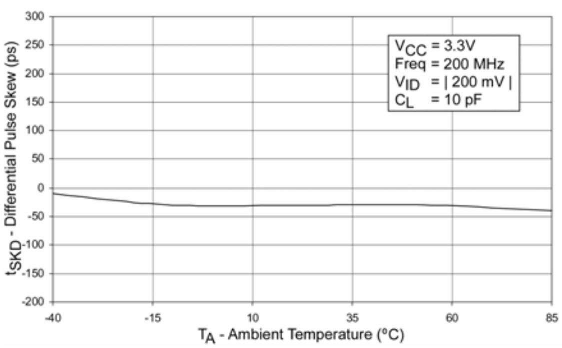


**Figure 12. Differential Skew ($t_{PHL}$-$t_{PHL}$) vs. Ambient Temperature**

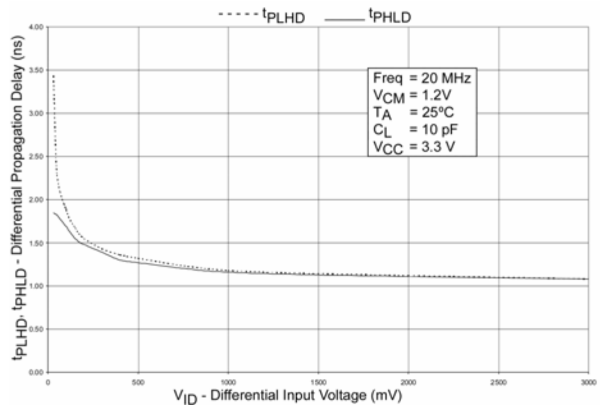


**Figure 13. Differential Propagation Delay vs. Differential Input Voltage**

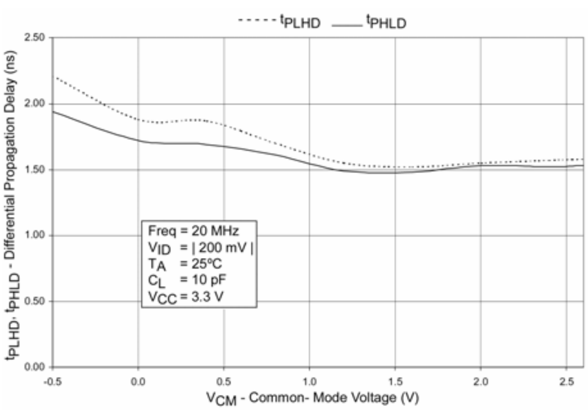


**Figure 14. Differential Propagation Delay vs. Common-Mode Voltage**

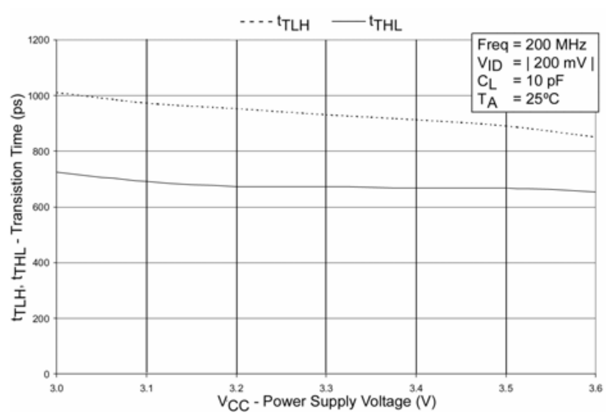


**Figure 15. Transition Time vs. Power Supply Voltage**

## Typical Performance Characteristics (Continued)

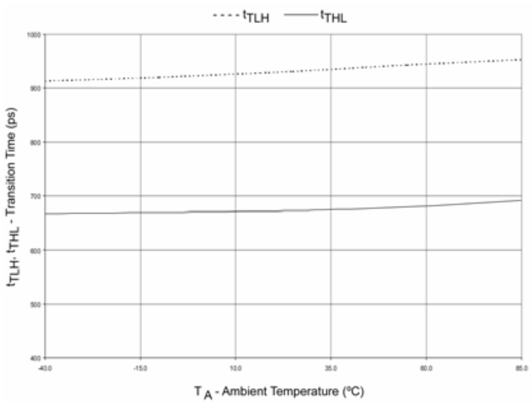


**Figure 16. Transition Time vs. Ambient Temperature**

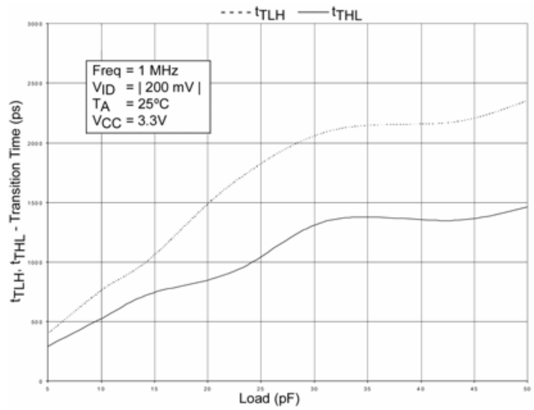


**Figure 17. Differential Propagation Delay vs. Load**

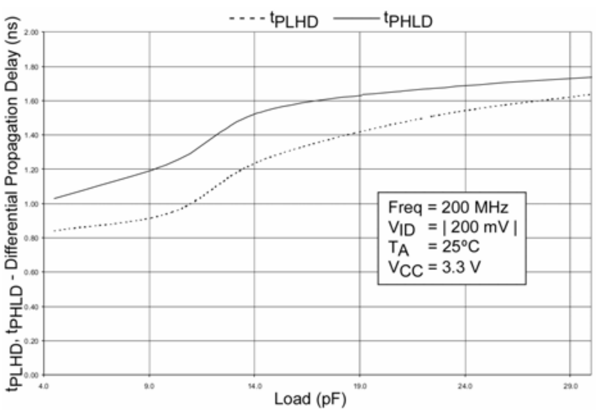


**Figure 18. Differential Propagation Delay vs. Load**

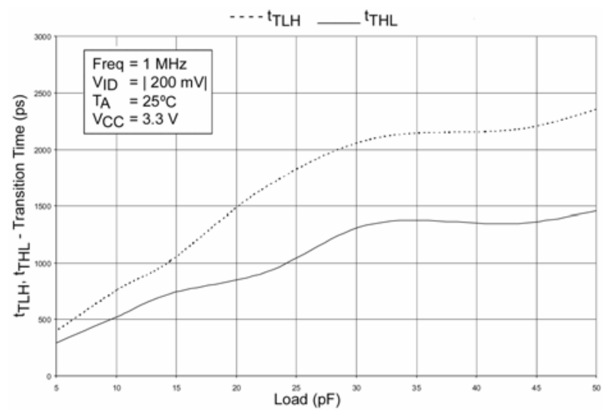


**Figure 19. Transition Time vs. Load**

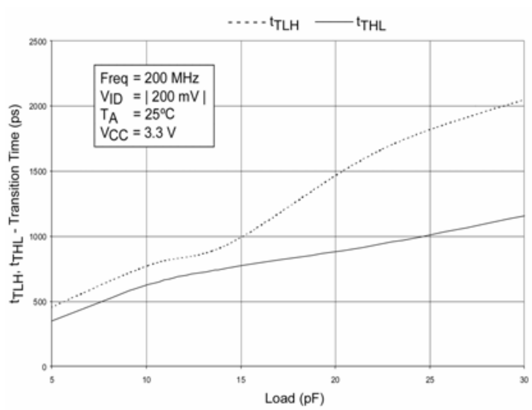


**Figure 20. Transition Time vs. Load**

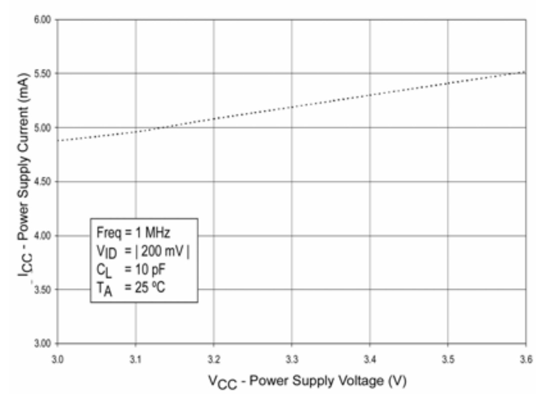


**Figure 21. Power Supply Current vs. Power Supply Voltage**

## Physical Dimensions

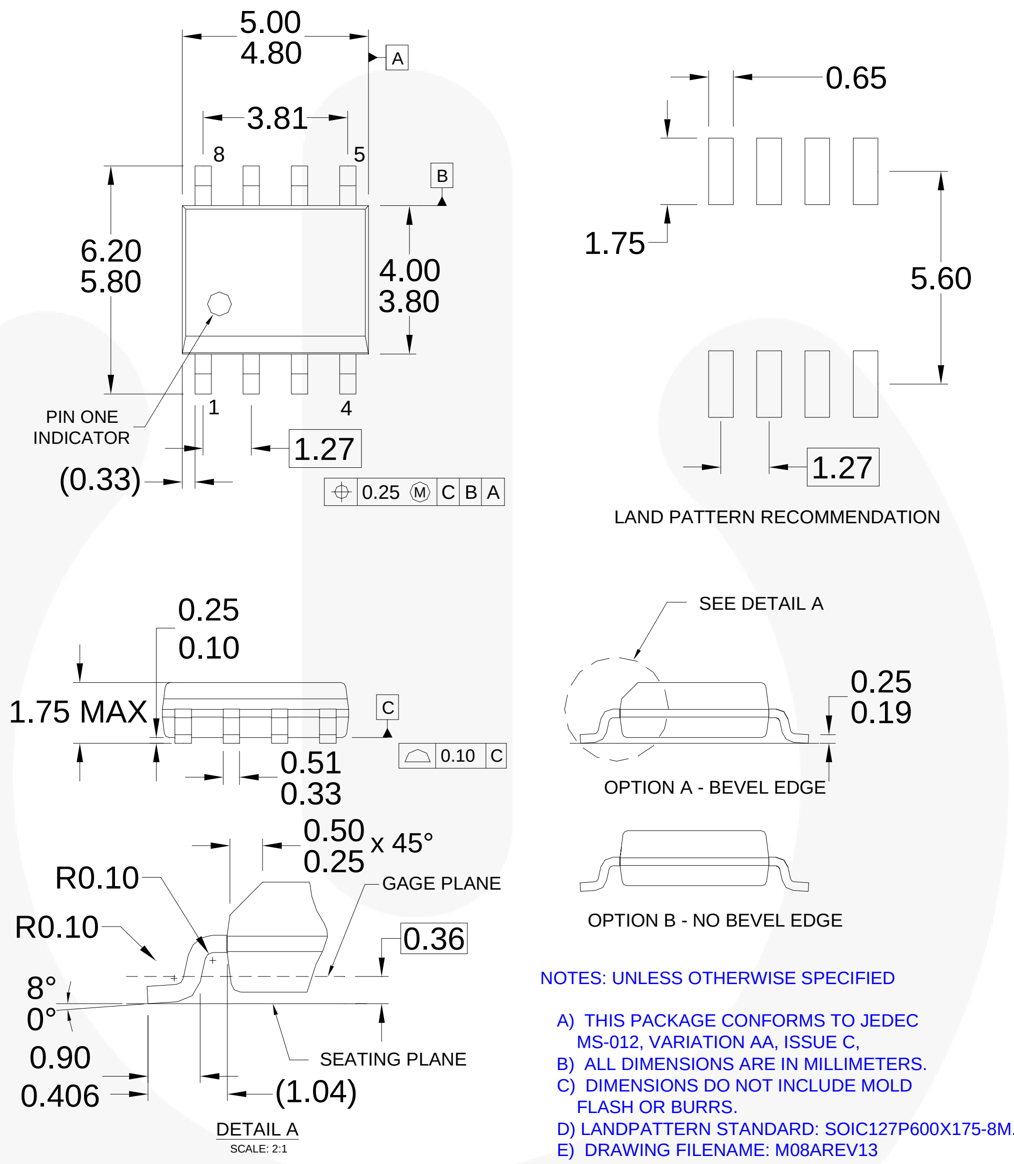


**Figure 22. 8-Lead, Small Outline Package (SOIC), JEDEC MS-012, 0.150-inch, Narrow Body**

***Click here for tape and reel specifications, available at:***

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Rev. I35

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