

FIN1102 LVDS 2 Port High Speed Repeater

General Description

This 2 port repeater is designed for high speed interconnects utilizing Low Voltage Differential Signaling (LVDS) technology. The FIN1102 accepts and outputs LVDS levels with a typical differential output swing of 330 mV which provides low EMI at ultra low power dissipation even at high frequencies. The FIN1102 provides a V_{BB} reference for AC coupling on the inputs. In addition the FIN1102 can also directly accept LVPECL, HSTL, and SSTL-2 for translation to LVDS.

Features

- Greater than 800 Mbps full differential path
- 3.3V power supply operation
- 3.5 ps maximum random jitter and 135 ps maximum deterministic jitter
- Wide rail-to-rail common mode range
- LVDS receiver inputs accept LVPECL, HSTL, and SSTL-2 directly
- Ultra low power consumption
- 20 ps typical channel-to-channel skew
- Power off protection
- > 7 kV HBM ESD Protection
- Meets or exceeds the TIA/EIA-644-A LVDS standard
- 14-lead TSSOP package saves space
- Open circuit fail safe protection
- V_{BB} reference output

Ordering Code:

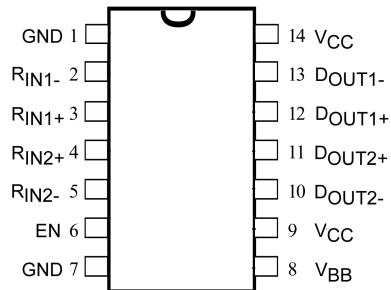
| Order Number | Package Number | Package Description |
|--------------|----------------|---|
| FIN1102MTC | MTC14 | 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide |

Devices also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.

Pin Descriptions

| Pin Name | Description |
|---------------------------|----------------------------------|
| R_{IN1+} , R_{IN2+} | Non-inverting LVDS Input |
| R_{IN1-} , R_{IN2-} | Inverting LVDS Input |
| D_{OUT1+} , D_{OUT2+} | Non-inverting Driver Output |
| D_{OUT1-} , D_{OUT2-} | Inverting Driver Output |
| EN | Driver Enable Pin for All Output |
| V_{CC} | Power Supply |
| GND | Ground |
| V_{BB} | Reference Voltage Output |

Connection Diagram

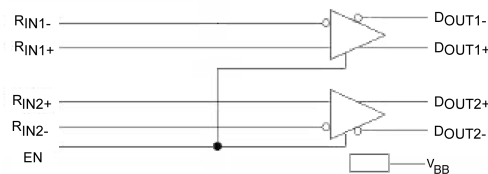


Function Table

| EN | Inputs | | Outputs | |
|----|----------------|-----------|------------|------------|
| | D_{IN+} | D_{IN-} | D_{OUT+} | D_{OUT-} |
| H | H | L | H | L |
| H | L | H | L | H |
| H | Fail Safe Case | | H | L |
| L | X | X | Z | Z |

H = HIGH Logic Level
L = LOW Logic Level
X = Don't Care
Z = High Impedance

Functional Diagram



Absolute Maximum Ratings (Note 1)

| | |
|---|------------------|
| Supply Voltage (V_{CC}) | -0.5V to +4.6V |
| LVDS DC Input Voltage (V_{IN}) | -0.5V to +4.6V |
| LVDS DC Output Voltage (V_{OUT}) | -0.5V to +4.6V |
| Driver Short Circuit Current (I_{OSD}) | Continuous 10 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 |
| ESD (Human Body Model) | 7000V |
| ESD (Machine Model) | 300V |

Recommended Operating Conditions

| | |
|--|---|
| Supply Voltage (V_{CC}) | 3.0V to 3.6V |
| Magnitude of Differential Voltage ($ V_{ID} $) | 100 mV to V_{CC} |
| Common Mode Voltage Range (V_{IC}) | (0V + $ V_{ID} /2$) to ($V_{CC} - V_{ID} /2$) |
| Operating Temperature (T_A) | -40°C to +85°C |

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

| Symbol | Parameter | Test Conditions | Min | Typ (Note 2) | Max | Units |
|-----------------|---|---|-------------------|--------------|-------------------------|---------|
| V_{TH} | Differential Input Threshold HIGH | See Figure 1; $V_{IC} = +0.05V, +1.2V, \text{ or } V_{CC} - 0.05V$ | | | 100 | mV |
| V_{TL} | Differential Input Threshold LOW | See Figure 1; $V_{IC} = +0.05V, +1.2V, \text{ or } V_{CC} - 0.05V$ | -100 | | | mV |
| V_{IH} | Input HIGH Voltage (EN) | | 2.0 | | V_{CC} | V |
| V_{IL} | Input LOW Voltage (EN) | | GND | | 0.8 | V |
| V_{OD} | Output Differential Voltage | | 250 | 330 | 450 | mV |
| ΔV_{OD} | V_{OD} Magnitude Change from Differential LOW-to-HIGH | $R_L = 100 \Omega$, Driver Enabled, | | | 25 | mV |
| V_{OS} | Offset Voltage | See Figure 2 | 1.125 | 1.23 | 1.375 | V |
| ΔV_{OS} | Offset Magnitude Change from Differential LOW-to-HIGH | | | | 25 | mV |
| I_{OS} | Short Circuit Output Current | $D_{OUT+} = 0V$ and $D_{OUT-} = 0V$, Driver Enabled $V_{OD} = 0V$, Driver Enabled | | -3.4 | -6 | mA |
| I_{IN} | Input Current (EN, D_{INx+} , D_{INx-}) | $V_{IN} = 0V$ to V_{CC} . Other Input = V_{CC} or 0V (for Differential Inputs) | | | ± 20 | μA |
| I_{OFF} | Power Off Input or Output Current | $V_{CC} = 0V$, V_{IN} or $V_{OUT} = 0V$ to 3.6V | | | ± 20 | μA |
| I_{CCZ} | Disabled Power Supply Current | Drivers Disabled | | 4 | 7 | mA |
| I_{CC} | Power Supply Current | Drivers Enabled, Any Valid Input Condition | | 16.7 | 23 | mA |
| I_{OZ} | Disabled Output Leakage Current | Driver Disabled, $D_{OUT+} = 0V$ to 3.6V or $D_{OUT-} = 0V$ to 3.6V | | | ± 20 | μA |
| V_{IC} | Common Mode Voltage Range | $ V_{ID} = 100 \text{ mV}$ to V_{CC} | $0V + V_{ID} /2$ | | $V_{CC} - (V_{ID} /2)$ | V |
| C_{IN} | Input Capacitance | Enable Input | | 2.5 | | pF |
| | | LVDS Input | | 2.1 | | |
| C_{OUT} | Output Capacitance | | | 2.8 | | pF |
| V_{BB} | Output Reference Voltage | $V_{CC} = 3.3V$, $I_{BB} = 0$ to $-275 \mu A$ | 1.125 | 1.2 | 1.375 | V |

Note 2: All typical values are at $T_A = 25^\circ C$ 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_{PLHD} | Differential Output Propagation Delay LOW-to-HIGH | $R_L = 100 \Omega, C_L = 5 \text{ pF},$ $ V_{ID} = 200 \text{ mV to } 450 \text{ mV},$ $V_{IC} = V_{ID} /2 \text{ to } V_{CC} - (V_{ID} /2),$ Duty Cycle = 50%, See Figure 3 and Figure 4 | 0.75 | 1.1 | 1.75 | ns |
| t_{PHLD} | Differential Output Propagation Delay HIGH-to-LOW | | 0.75 | 1.1 | 1.75 | ns |
| t_{TLHD} | Differential Output Rise Time (20% to 80%) | | 0.29 | 0.4 | 0.58 | ns |
| t_{THLD} | Differential Output Fall Time (80% to 20%) | | 0.29 | 0.4 | 0.58 | ns |
| $t_{SK(P)}$ | Pulse Skew $ t_{PLH} - t_{PHL} $ | | | 0.02 | 0.2 | ns |
| $t_{SK(LH)}$ | Channel-to-Channel Skew (Note 4) | | | 0.02 | 0.15 | ns |
| $t_{SK(HL)}$ | | | | 0.02 | | ns |
| $t_{SK(PP)}$ | Part-to-Part Skew (Note 5) | | | | 0.5 | ns |
| f_{MAX} | Maximum Frequency (Note 6)(Note 7) | | | 400 | 800 | MHz |
| t_{PZH} | Differential Output Enable Time from Z to HIGH | | $R_L = 100 \Omega, C_L = 5 \text{ pF},$ See Figure 5 and Figure 6 | | 2.3 | 5 |
| t_{PZL} | Differential Output Enable Time from Z to LOW | | | 2.5 | 5 | ns |
| t_{PHZ} | Differential Output Disable Time from HIGH to Z | | | 1.6 | 5 | ns |
| t_{PLZ} | Differential Output Disable Time from LOW to Z | | | 1.9 | 5 | ns |
| t_{DJ} | LVDS Data Jitter, Deterministic | $ V_{ID} = 300 \text{ mV}, \text{ PRBS} = 2^{23} - 1,$ $V_{IC} = 1.2\text{V at } 800 \text{ Mbps}$ | | 85 | 135 | ps |
| t_{RJ} | LVDS Clock Jitter, Random (RMS) | $ V_{ID} = 300 \text{ mV},$ $V_{IC} = 1.2\text{V at } 400 \text{ MHz}$ | | 2.1 | 3.5 | ps |

Note 3: All typical values are at $T_A = 25^\circ\text{C}$ and with $V_{CC} = 3.3\text{V}, V_{ID} = 300 \text{ mV}, V_{IC} = 1.2\text{V}$, unless otherwise specified.

Note 4: $t_{SK(LH)}, t_{SK(HL)}$ is the skew between specified outputs of a single device when the outputs have identical loads and are switching in the same direction.

Note 5: $t_{SK(PP)}$ is the magnitude of the difference in differential propagation delay times between identical channels 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 6: Passing criteria for maximum frequency is the output $V_{OD} > 200 \text{ mV}$ and the duty cycle is 45% to 55% with all channels switching.

Note 7: Output loading is transmission line environment only; C_L is $< 1 \text{ pF}$ of stray test fixture capacitance.

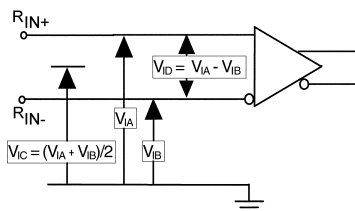


FIGURE 1. Differential Receiver Voltage Definitions and Propagation and Transition Time Test Circuit

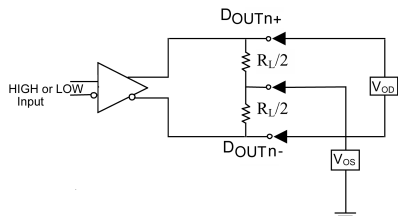
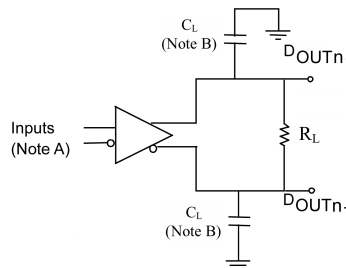


FIGURE 2. Differential Driver DC Test Circuit



Note A: All LVDS input pulses have frequency = 10 MHz, t_R or $t_F < 0.5 \text{ ns}$

Note B: C_L includes all probe and test fixture capacitances

FIGURE 3. Differential Driver Propagation Delay and Transition Time Test Circuit

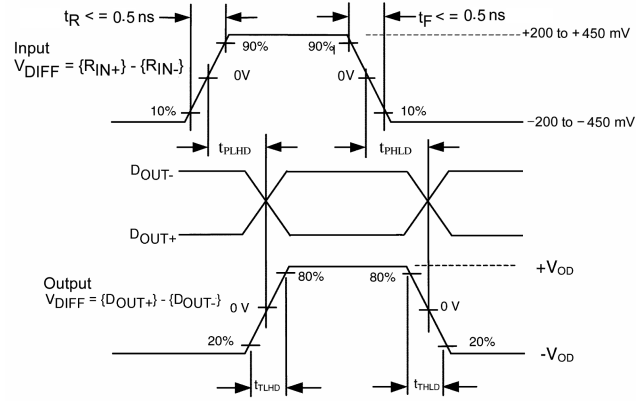
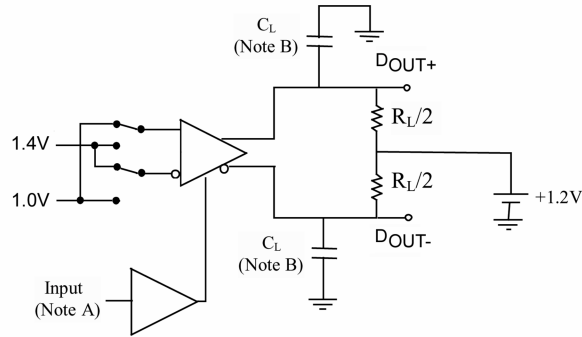


FIGURE 4. AC Waveform



Note A: All input pulses have frequency = 10MHz, t_R or $t_F \le 2 \text{ ns}$
 Note B: C_L includes all probe and test fixture capacitances

FIGURE 5. Differential Driver Enable and Disable Circuit

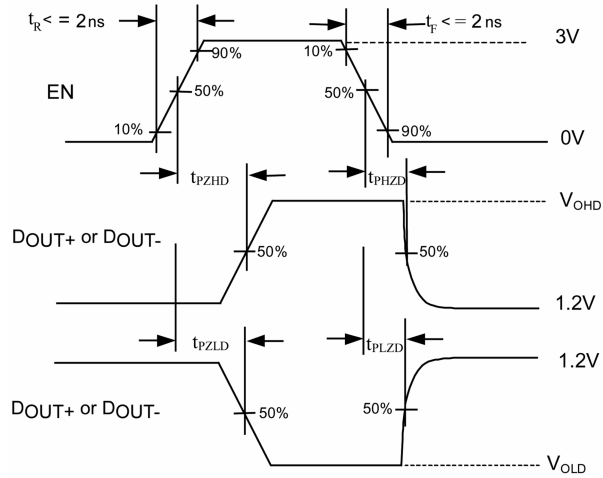
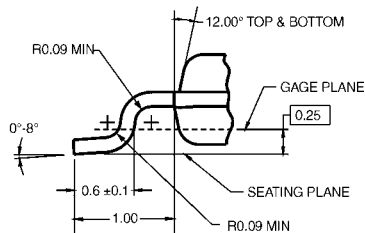
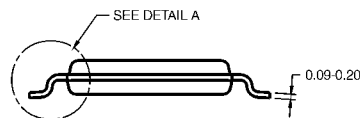
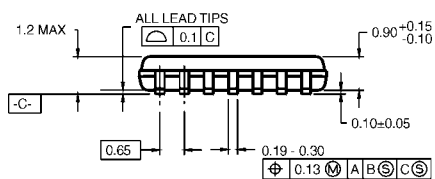
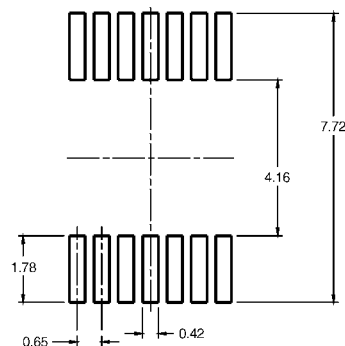
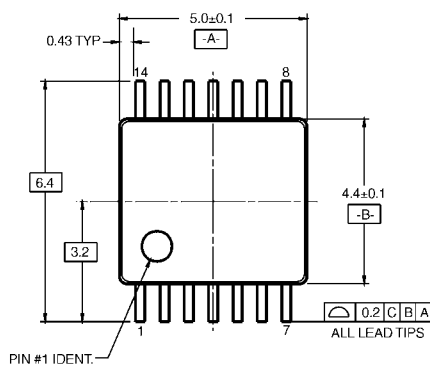


FIGURE 6. Enable and Disable AC Waveforms



- NOTES:
- CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6, DATE 7/93.
 - DIMENSIONS ARE IN MILLIMETERS.
 - DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
 - DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

MTC14RevC3

DETAIL A

**14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
Package Number MTC14**

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