FAIRCHILD SEMICONDUCTOR®

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FIN1104
LVDS 4 Port High Speed Repeater

General Description

This 4 port repeater is designed for high speed interconnects utilizing Low Voltage Differential Signaling (LVDS) technology. The FIN1104 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 FIN1104 provides a V_{BB} reference for AC coupling on the inputs. In addition the FIN1104 can directly accept LVPECL, HSTL, and SSTL-2 for translation to LVDS.

Features

- Greater than 800 Mbps data rate
- 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
- > 7.5 kV HBM ESD Protection
- Meets or exceeds the TIA/EIA-644-A LVDS standard
- Available in space saving 24-Lead TSSOP package
- Open circuit fail safe protection
- V_{BB} reference output

Ordering Code:

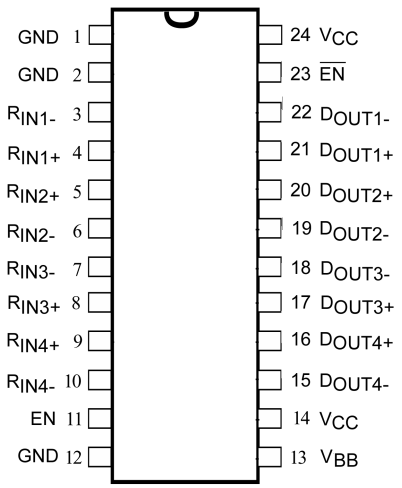
Order Number	Package Number	Package Description
FIN1104MTC	MTC24	24-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

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+}, R_{IN3+}, R_{IN4+}	Non-inverting LVDS Input
R_{IN1-}, R_{IN2-}, R_{IN3-}, R_{IN4-}	Inverting LVDS Input
D_{OUT1+}, D_{OUT2+}, D_{OUT3+}, D_{OUT4+}	Non-inverting Driver Output
D_{OUT1-}, D_{OUT2-}, D_{OUT3-}, D_{OUT4-}	Inverting Driver Output
EN	Driver Enable Pin for All Output
$\overline{EN}$	Inverting Driver Enable Pin for all Outputs
V_{CC}	Power Supply
GND	Ground
V_{BB}	Reference Voltage Output

Connection Diagram



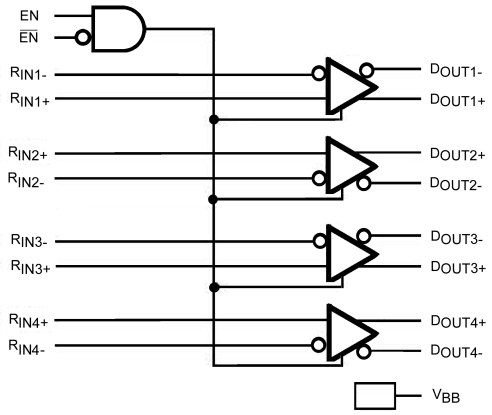
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Function Table

Inputs				Outputs	
EN	**$\overline{EN}$**	**D_{IN+}**	**D_{IN-}**	**D_{OUT+}**	**D_{OUT-}**
H	L	H	L	H	L
H	L	L	H	L	H
H	L	Fail Safe Case		H	L
X	H	X	X	Z	Z
L	X	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)	7500V
ESD (Machine Model)	400V

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, or V_{CC} − 0.05V				100	mV
V_{TL}	Differential Input Threshold LOW	See Figure 1; V_{IC} = +0.05V, +1.2V, or V_{CC} − 0.05V		−100			mV
V_{IH}	Input HIGH Voltage (EN or $\overline{EN}$)			2.0		V_{CC}	V
V_{IL}	Input LOW Voltage (EN or $\overline{EN}$)			GND		0.8	V
V_{OD}	Output Differential Voltage	R_L = 100 Ω, Driver Enabled, See Figure 2		250	330	450	mV
ΔV_{OD}	V_{OD} Magnitude Change from Differential LOW-to-HIGH					25	mV
V_{OS}	Offset Voltage			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			−3.4	−6	mA
		V_{OD} = 0V, Driver Enabled			±3.4	±6	mA
I_{IN}	Input Current (EN, $\overline{EN}$, 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			5.4	11	mA
I_{CC}	Power Supply Current	Drivers Enabled, Any Valid Input Condition			30.4	41	mA
I_{OZ}	Disabled Output Leakage Current	Driver Disabled, D_{OUT+} = 0V to 3.6V or D_{OUT-} = 0V to3.6V				±20	µA
V_{IC}	Common Mode Voltage Range	$\|V_{ID}\|$ = 100 mV to V_{CC}		0V + $\|V_{ID}\|$/2		V_{CC} − ($\|V_{ID}\|$/2)	V
C_{IN}	Input Capacitance		Enable Input		2.6		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 µA		1.125	1.2	1.375	V

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_{PLHD}	Differential Output Propagation Delay LOW-to-HIGH	R_L = 100 Ω, C_L = 5 pF, V_{ID} = 200 mV to 450 mV, V_{IC} = $\|V_{ID}\|/2$ to V_{CC} − ($\|V_{ID}\|/2$), Duty Cycle = 50%, See Figure 1 and Figure 3	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
$t_{SK(LH)}$, $t_{SK(HL)}$	Channel-to-Channel Skew (Note 4)			0.02 0.02	0.15	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_{PZHD}	Differential Output Enable Time from Z to HIGH	R_L = 100 Ω, C_L = 5 pF, See Figure 2 and Figure 3		2.2	5	ns
t_{PZLD}	Differential Output Enable Time from Z to LOW			2.5	5	ns
t_{PHZD}	Differential Output Disable Time from HIGH to Z			1.8	5	ns
t_{PLZD}	Differential Output Disable Time from LOW to Z			2.1	5	ns
t_{DJ}	LVDS Data Jitter, Deterministic	V_{ID} = 300 mV, PRBS = 2^{23} - 1, V_{IC} = 1.2V at 800 Mbps		85	135	ps
t_{RJ}	LVDS Clock Jitter, Random (RMS)	V_{ID} = 300 mV, V_{IC} = 1.2V at 400 MHz		2.1	3.5	ps

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

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 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 6: Passing criteria for maximum frequency is the output V_{OD} > 200 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 pF of stray test fixture capacitance.

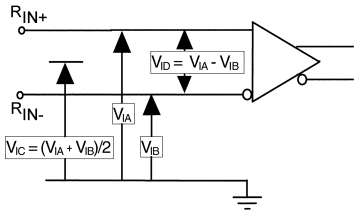


FIGURE 1. Differential Receiver Voltage Definitions and Propagation and Transition Time Test Circuit

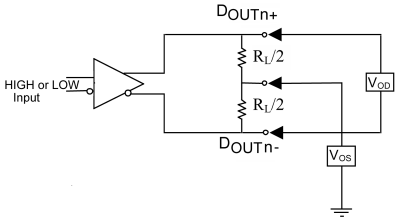
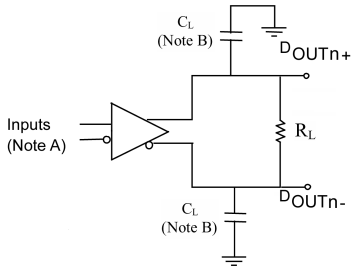


FIGURE 2. Differential Driver DC Test Circuit



Note A: All LVDS input pulses have frequency = 10 MHz, t_R or t_F < = 0.5 ns

Note B: C_L includes all probe and test fixture capacitances

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

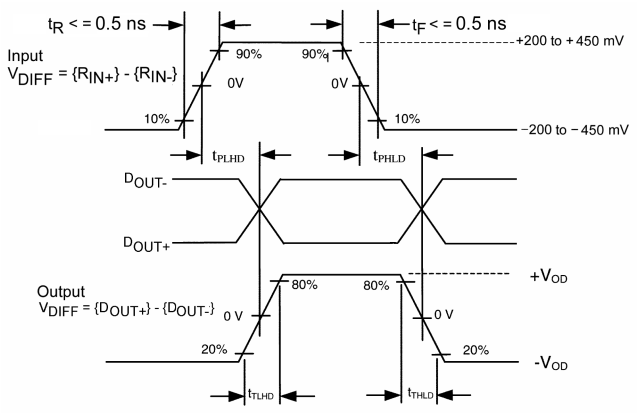
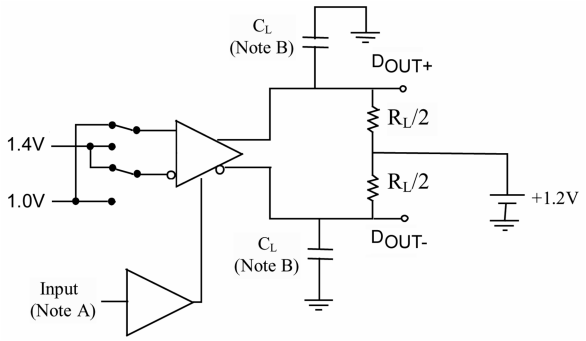


FIGURE 4. AC Waveform



Note A: All LVTTL input pulses have frequency = 10MHz, t_R or t_F < = 2 ns
Note B: C_L includes all probe and jig capacitances

FIGURE 5. Differential Driver Enable and Disable Circuit

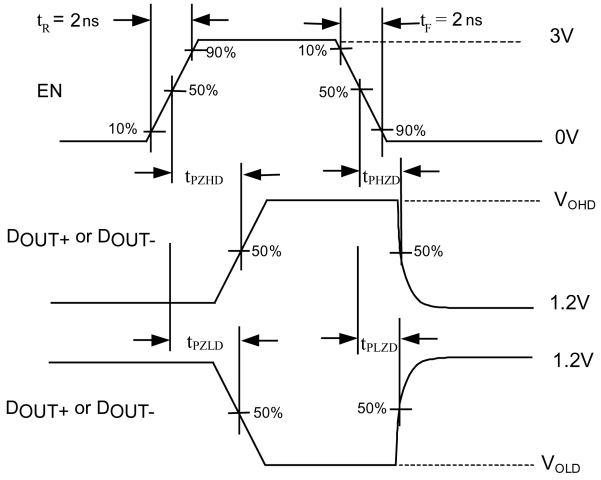
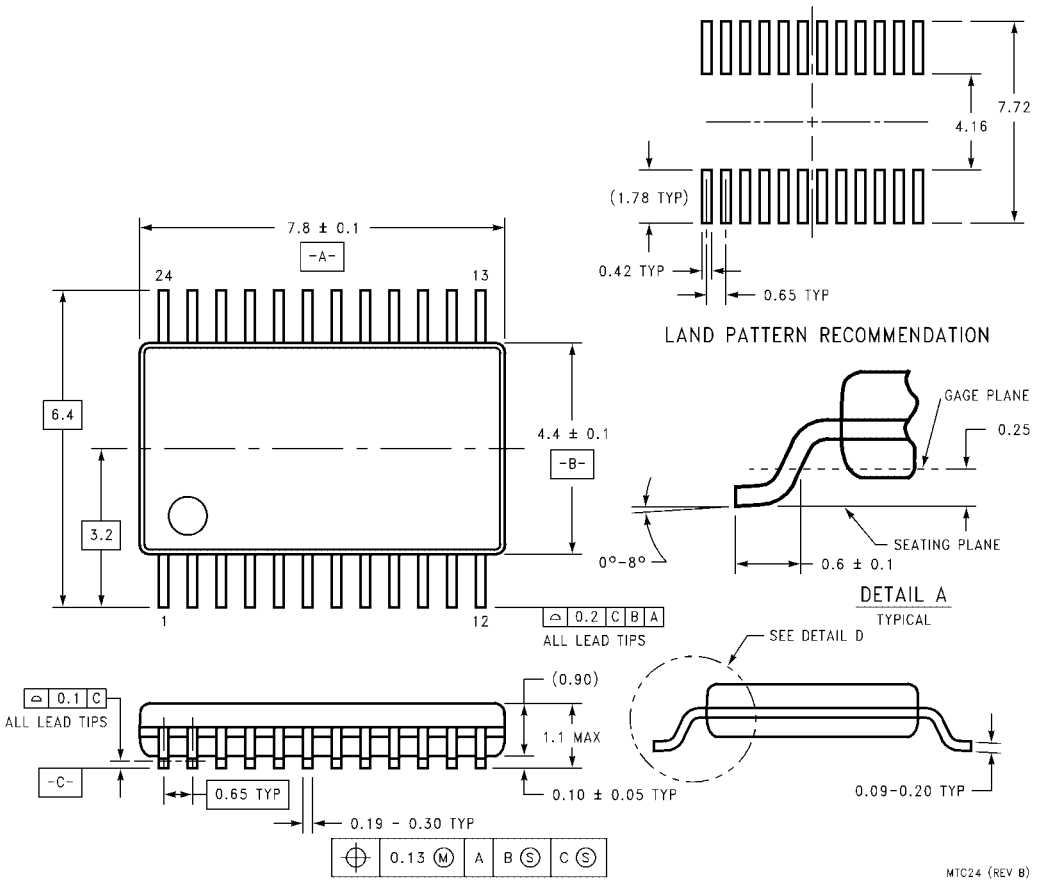


FIGURE 6. Enable and Disable AC Waveforms



24-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
Package Number MTC24

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