

## FIN1048

### 3.3V LVDS 4-Bit Flow-Through High Speed Differential Receiver

#### General Description

This quad receiver is designed for high speed interconnect utilizing Low Voltage Differential Signaling (LVDS) technology. The receiver translates LVDS levels, with a typical differential input threshold of 100mV, to LVTTTL 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.

The FIN1048 can be paired with its companion driver, the FIN1047, or any other LVDS driver.

#### Features

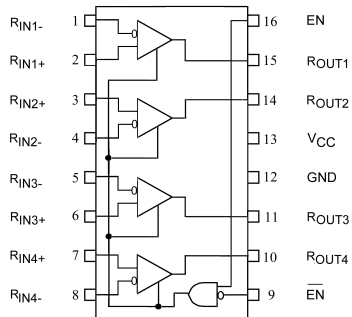
- Greater than 400Mbps data rate
- Flow-through pinout simplifies PCB layout
- 3.3V power supply operation
- 0.4ns maximum differential pulse skew
- 2.5ns maximum propagation delay
- Low power dissipation
- Power-Off protection
- Fail safe protection for open-circuit, shorted and terminated conditions
- Meets or exceeds the TIA/EIA-644 LVDS standard
- Pin compatible with equivalent RS-422 and LVPECL devices
- 16-Lead SOIC and TSSOP packages save space

#### Ordering Code:

Order Number	Package Number	Package Description
FIN1048M	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
FIN1048MTC	MTC16	16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

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

#### Connection Diagram



#### Pin Descriptions

Pin Name	Description
ROUT1+, ROUT2+, ROUT3+, ROUT4+	LVTTTL Data Outputs
RIN1+, RIN2+, RIN3+, RIN4+	Non-Inverting LVDS Inputs
RIN1-, RIN2-, RIN3-, RIN4-	Inverting LVDS Inputs
EN	Driver Enable Pin
EN-bar	Inverting Driver Enable Pin
VCC	Power Supply
GND	Ground

#### Function Table

Inputs				Outputs
EN	EN-bar	RIN+	ROUT-	ROUT
H	L or Open	H	L	H
H	L or Open	L	H	L
H	L or Open	Fail Safe Condition		H
X	H	X	X	Z
L or Open	X	X	X	Z

H = HIGH Logic Level    L = LOW Logic Level    X = Don't Care  
Z = High Impedance    Fail Safe = Open, Shorted, Terminated

**Absolute Maximum Ratings**(Note 1)

Supply Voltage ( $V_{CC}$ )	-0.5V to +4.6V
DC Input Voltage ( $V_{IN}$ )	-0.5V to +4.6V
DC Input Voltage ( $V_{OUT}$ )	-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
ESD (Human Body Model)	$\geq 10,000V$
ESD (Machine Model)	$\geq 450V$

**Recommended Operating Conditions**

Supply Voltage ( $V_{CC}$ )	3.0V to 3.6V
Magnitude of Differential Voltage ( $ V_{ID} $ )	100mV to $V_{CC}$
Common-Mode Input Voltage ( $V_{IC}$ )	0.05V to 2.35V
Input Voltage ( $V_{IN}$ )	0 to $V_{CC}$
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**

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 and Table 1			100	mV
$V_{TL}$	Differential Input Threshold LOW	See Figure 1 and Table 1	-100			mV
$I_{IN}$	Input Current	$V_{IN} = 0V$ or $V_{CC}$			$\pm 20$	$\mu A$
$I_{I(OFF)}$	Power-Off Input Current	$V_{CC} = 0V$ , $V_{IN} = 0V$ or 3.6V			$\pm 20$	$\mu A$
$V_{IH}$	Input High Voltage (EN or $\overline{EN}$ )		2.0		$V_{CC} + 1.0$	V
$V_{IL}$	Input Low Voltage (EN or $\overline{EN}$ )		GND		0.8	V
$V_{OH}$	Output HIGH Voltage	$I_{OH} = -100 \mu A$	$V_{CC} - 0.2$			V
		$I_{OH} = -8 mA$	2.4			
$V_{OL}$	Output LOW Voltage	$I_{OH} = 100 \mu A$			0.2	V
		$I_{OL} = 8 mA$			0.5	
$I_{OZ}$	Disabled Output Leakage Current	EN = 0.8 and $\overline{EN} = 2V$ , $V_{OUT} = 3.6V$ or 0V			$\pm 20$	$\mu A$
$V_{IK}$	Input Clamp Voltage	$I_{IK} = -18 mA$	-1.5			V
$I_{CCZ}$	Disabled Power Supply Current	Receiver Disabled			5	mA
$I_{CC}$	Power Supply Current	Receiver Enabled, ( $R_{IN+} = 1V$ and $R_{IN-} = 1.4V$ ) or ( $R_{IN+} = 1.4V$ and $R_{IN-} = 1V$ )			15	mA
$C_{IN}$	Input Capacitance			3.5		pF
$C_{OUT}$	Output Capacitance			6		pF

**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

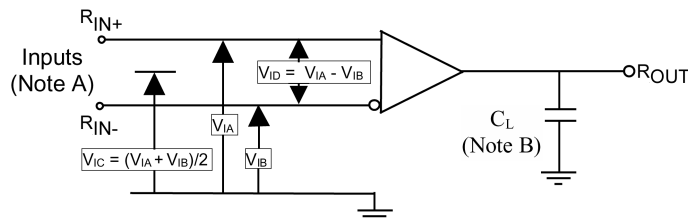
Symbol	Parameter	Test Conditions	Min	Typ (Note 3)	Max	Units	
$t_{PLH}$	Propagation Delay LOW-to-HIGH	$ V_{ID}  = 400\text{ mV}$ , $C_L = 10\text{ pF}$ , $R_L = 1\text{ k}\Omega$ See Figure 1 and Figure 2	1.0		2.5	ns	
$t_{PHL}$	Propagation Delay HIGH-to-LOW		1.0		2.5	ns	
$t_{TLH}$	Output Rise Time (20% to 80%)		0.7	1.2	ns		
$t_{THL}$	Output Fall Time (80% to 20%)		0.7	1.2	ns		
$t_{SK(P)}$	Pulse Skew $ t_{PLH} - t_{PHL} $				0.4	ns	
$t_{SK(LH)}$	Channel-to-Channel Skew (Note 4)				0.3	ns	
$t_{SK(HL)}$							
$t_{SK(PP)}$	Part-to-Part Skew (Note 5)				1.0	ns	
$f_{MAX}$	Maximum Operating Frequency (Note 6)		$R_L = 1\text{ k}\Omega$ , $C_L = 10\text{ pF}$ , see Figure 1 and Figure 2	200	375		MHz
$t_{ZH}$	LVTTTL Output Enable Time from Z to HIGH		$R_L = 1\text{ k}\Omega$ , $C_L = 10\text{ pF}$ , See Figure 3			6.0	ns
$t_{ZL}$	LVTTTL Output Enable Time from Z to LOW				6.0	ns	
$t_{HZ}$	LVTTTL Output Disable Time from HIGH to Z				6.0	ns	
$t_{LZ}$	LVTTTL Output Disable Time from LOW to Z				6.0	ns	

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

**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:**  $f_{MAX}$  Criteria: Input  $t_R = t_F < 1\text{ ns}$ ,  $V_{ID} = 300\text{ mV}$ , (1.05V to 1.35V pp), 50% duty cycle; Output duty cycle 40% to 60%,  $V_{OL} < 0.5\text{V}$ ,  $V_{OH} > 2.4\text{V}$ . All channels switching in phase.



**Note A:** All differential input pulses have frequency = 10MHz,  $t_R$  or  $t_F = 1\text{ ns}$

**Note B:**  $C_L$  includes all probe and jig capacitances

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

**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

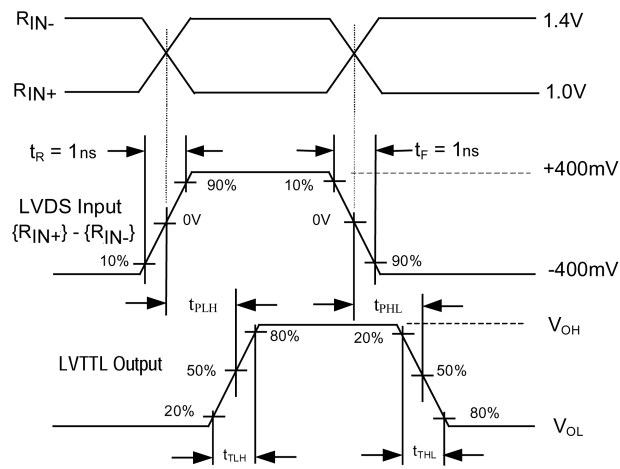
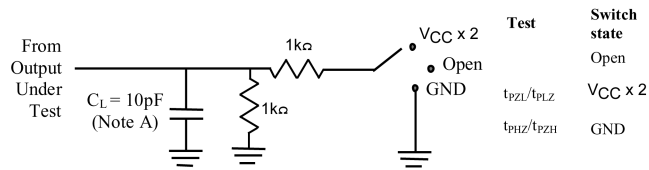


FIGURE 2. LVDS Input to LVTTTL Output AC Waveforms

Test Circuit for LVTTTL Outputs



Voltage Waveforms Enable and Disable Times

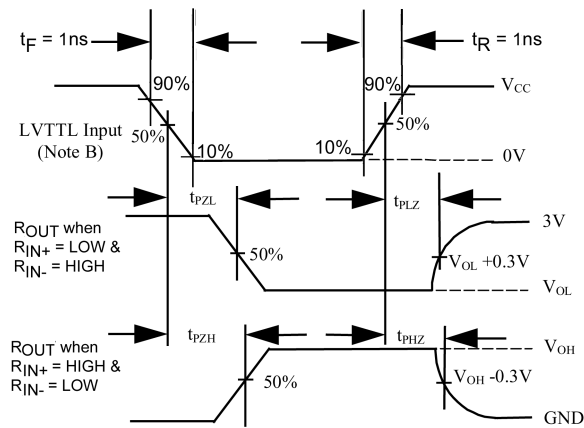


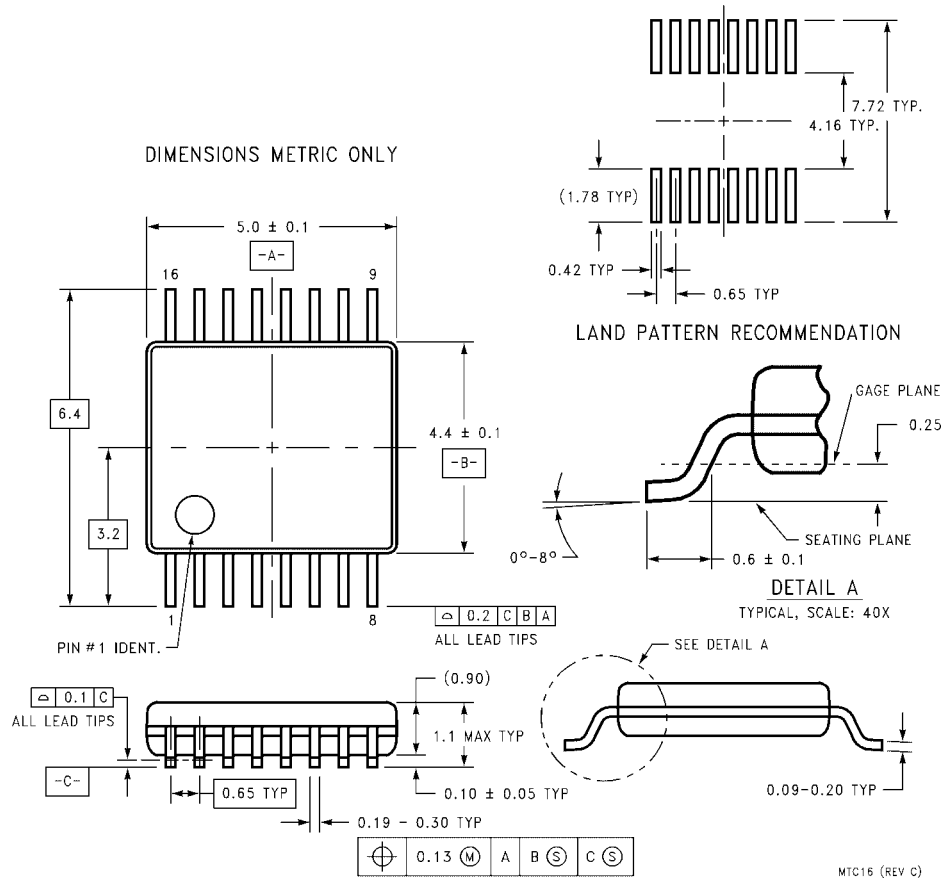
FIGURE 3. LVTTTL Outputs Test Circuit and AC Waveforms

**Physical Dimensions** inches (millimeters) unless otherwise noted



**16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow Package Number M16A**

**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



**16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide  
Package Number MTC16**

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