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## FIN1215 / FIN1216 / FIN1217/ FIN1218 LVDS 21-Bit Serializers / De-Serializers

### Features

- Low Power Consumption
- 20MHz to 85MHz Shift Clock Support
- 50% Duty Cycle on the Clock Output of Receiver
- ±1V Common-mode Range ~1.2V
- Narrow Bus Reduces Cable Size and Cost
- High Throughput: 1.785Gbps
- Up to 595Mbps per Channel
- Internal PLL with No External Components
- Compatible with TIA/EIA-644 Specification
- Offered in 48-lead TSSOP Packages


### Description

The FIN1217 and FIN1215 transform 21-bit wide parallel LVTTTL (Low-Voltage TTL) data into three serial LVDS (Low-Voltage Differential Signaling) data streams. A phase-locked transmit clock is transmitted in parallel with the data stream over a separate LVDS link. Every cycle of transmit clock, 21 bits of input LVTTTL data are sampled and transmitted.

The FIN1216 and FIN1218 receives and converts the three serial LVDS data streams back into 21 bits of LVTTTL data. Table 1 provides a matrix summary of the serializers and de-serializers available. For the FIN1217, at a transmit clock frequency of 85MHz, 21 bits of LVTTTL data are transmitted at a rate of 595Mbps per LVDS channel.

These chipsets solve EMI and cable size problems associated with wide and high-speed TTL interfaces.

### Ordering Information

Part Number	Operating Temperature Range	 Eco Status	Package	Packing Method
FIN1215MTDX	-40 to + 85°C	RoHS	48-Lead Thin Shrink Small Outline Package (TSSOP)	Tape and Reel
FIN1216MTDX				
FIN1217MTDX				
FIN1218MTDX (Preliminary)				

 For Fairchild's definition of Eco Status, please visit: [http://www.fairchildsemi.com/company/green/rohs\\_green.html](http://www.fairchildsemi.com/company/green/rohs_green.html).

## Block Diagrams

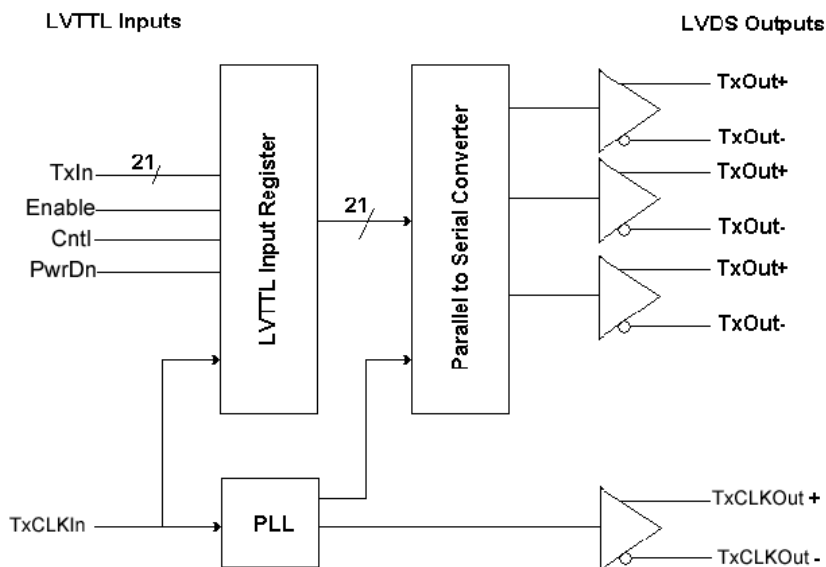


Figure 1. FIN1217 / FIN1215 Transmitter Functional Diagram

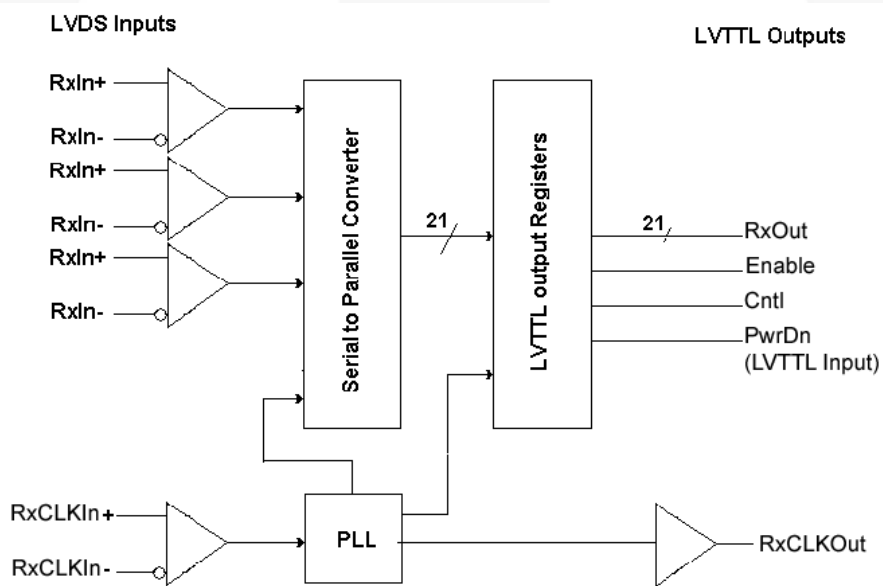


Figure 2. FIN1218 / FIN1216 Receiver Functional Diagram

Table 1. Serializers / De-Serializers Chip Matrix

Part	CLK Frequency	LVTTTL IN	LVDS OUT	LVDS IN	LVTTTL OUT	Package
FIN1215	66	21	3			48-Lead TSSOP
FIN1216	66			3	21	48-Lead TSSOP
FIN1217	85	21	3			48-Lead TSSOP
FIN1218	85			3	21	48-Lead TSSOP

## Transmitters

### Pin Configuration

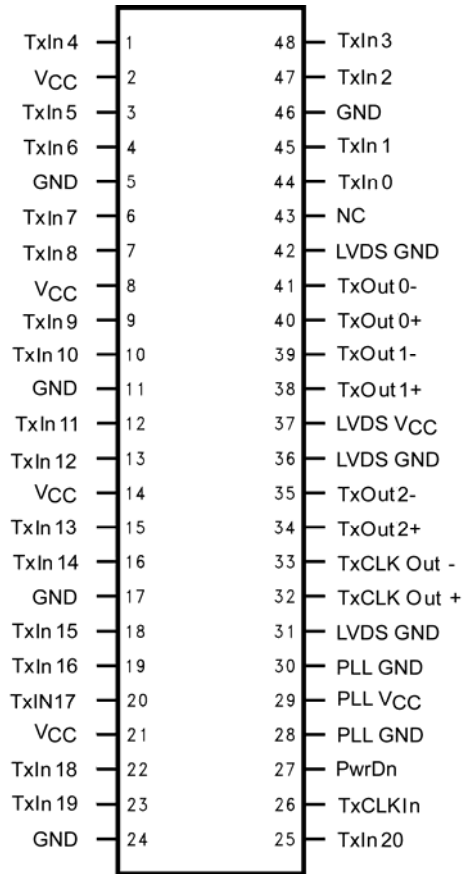


Figure 3. FIN1217 / FIN1215 (21:3 Transmitter)

### Pin Definitions

Pin Names	I/O Type	# of Pins	Description of Signals
TxIn	I	21	LVTTTL Level Inputs
TxCKLIn	I	1	LVTTTL Level Clock Input; the rising edge is for data strobe
TxOut+	O	3	Positive LVDS Differential Data Output
TxOut	O	3	Negative LVDS Differential Data Output
TxCLKOut+	O	1	Positive LVDS Differential Clock Output
TxCLKOut-	O	1	Negative LVDS Differential Clock Output
/PwrDn	I	1	LVTTTL Level Power-Down Input; assertion (LOW) puts the outputs in high-impedance state
PLL VCC	I	1	Power Supply Pin for LVDS Outputs
PLL GND	I	2	Ground Pins for PLL
LVDS VCC	I	1	Power Supply Pins for LVDS Outputs
LVDS GND	I	3	Ground Pin for LVDS Outputs
VCC	I	4	Power Supply Pins for LVTTTL Inputs
GND	I	5	Ground Pins for LVTTTL Inputs
NC			No Connect

## Receivers

### Pin Configuration

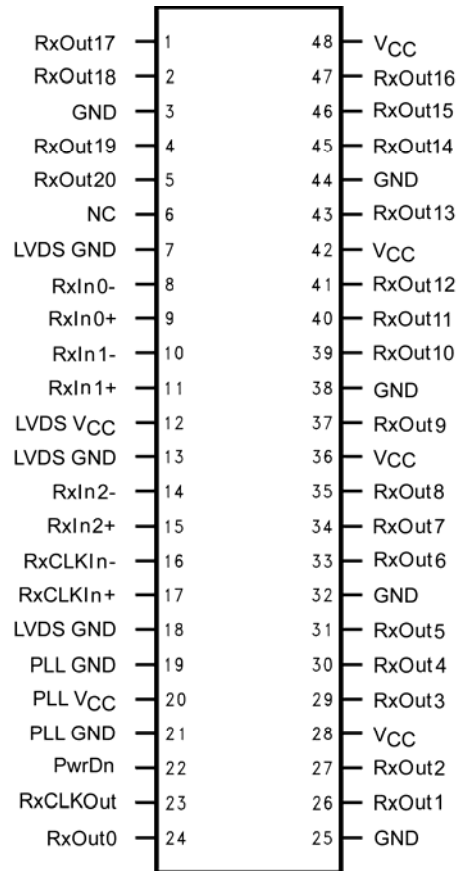


Figure 4. FIN1216 / FIN1218 (3:21 Receiver)

### Pin Definitions

Pin Names	I/O Type	# of Pins	Description of Signals
RxIn	I	3	Negative LVDS Differential Data Output
RxIn+	I	3	Positive LVDS Differential Data Output
RxCLKIn-	I	1	Negative LVDS Differential Clock Output
RxCLKIn+	I	1	Positive LVDS Differential Clock Output
RxOut-	O	21	LVTTL Level Data Outputs Goes HIGH for /PwrDn LOW
RxCLKOut	O	1	LVTTL Level Clock Output
/PwrDn	I	1	LVTTL Level Input; Refer to Transmitter and Receiver Power-up and Power-down Operation Truth Table
PLL V <sub>CC</sub>	I	1	Power Supply Pin for PLL
PLL GND	I	2	Ground Pins for PLL
LVDS V <sub>CC</sub>	I	1	Power Supply Pins for LVDS Inputs
LVDS GND	I	3	Ground Pin for LVDS Inputs
V <sub>CC</sub>	I	4	Power Supply Pins for LVTTL Outputs
GND	I	5	Ground Pins for LVTTL Outputs
NC			No Connect

## Truth Tables

### Transmitter

Inputs			Outputs	
TxIn	TxCLKIn	PwrDn <sup>(1)</sup>	TxOut±	TxCLKOut±
Active	Active	HIGH	LOW / HIGH	LOW / HIGH
Active	LOW / HIGH High Impedance	HIGH	LOW / HIGH	Don't Care <sup>(2)</sup>
Floating	Active	HIGH	LOW	LOW / HIGH
Floating	Floating	HIGH	LOW	Don't Care <sup>(2)</sup>
Don't Care	Don't Care	LOW	High Impedance	High Impedance

#### Notes:

1. The outputs of the transmitter or receiver remain in a high-impedance state until  $V_{CC}$  reaches 2V.
2. TxCLKOut± settles at a free running frequency when the part is powered up, PwrDn is HIGH and the TxCLKIn is a steady logic level LOW / HIGH / high-impedance.

### Receiver

Inputs			Outputs	
RxIn±	RxCLKIn±	/PwrDn <sup>(3)</sup>	RxOut	RxCLKOut
Active	Active	HIGH	LOW / HIGH	LOW / HIGH
Active	Failsafe Condition <sup>(4)</sup>	HIGH	Last Valid State	HIGH
Failsafe Condition <sup>(4)</sup>	Active	HIGH	HIGH	LOW / HIGH
Failsafe Condition <sup>(4)</sup>	Failsafe Condition <sup>(4)</sup>	HIGH	Last Valid State <sup>(5)</sup>	HIGH
Don't Care	Don't Care	LOW	LOW	HIGH

#### Notes:

3. The outputs of the transmitter or receiver remain in a high-impedance state until  $V_{CC}$  reaches 2V.
4. Failsafe condition is defined as the input being terminated and un-driven, shorted, or open.
5. If RxCLKIn± is removed prior to the RxIn± data being removed, RxOut is the last valid state. If RxIn± data is removed prior to RxCLKIn± being removed, RxOut is HIGH.

## 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
$V_{CC}$	Power Supply Voltage		-0.3	+4.6	V
$V_{TTL}$	TTL/CMOS Input/Output Voltage		-0.5	+4.6	V
$V_{LVDS}$	LVDS Input/Output Voltage		-0.3	+4.6	V
$I_{OSD}$	LVDS Output Short-Circuit Current			Continuous	
$T_{STG}$	Storage Temperature Range		-65	+150	°C
$T_J$	Maximum Junction Temperature, Soldering 4 seconds			+150	°C
$T_L$	Lead Temperature			+260	°C
ESD	Human Body Model, JESD22-A114 (1.5k $\Omega$ , 100pF)	LVDS I/O to Ground		10.0	kV
		All Pins (FIN1215, FIN1217)		6.5	
	Machine Model, JESD22-A115, 0 $\Omega$ , 200pF	FIN1215, FIN1217 Only		>400	V

## 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
$T_A$	Operating Temperature	-40	+85	°C
$V_{CCNPP}$	Maximum Supply Noise Voltage <sup>(6)</sup>		100	mV <sub>PP</sub>

**Note:**

- 100mV  $V_{CC}$  noise should be tested for frequency at least up to 2MHz. All the specifications should be met under such a noise level.

## Transmitter DC Electrical Characteristics

Typical values are at  $T_A=25^\circ\text{C}$  and with  $V_{CC}=3.3\text{V}$ ; minimum and maximum are at over supply voltages and operating temperatures ranges, unless otherwise specified.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units	
<b>Transmitter LVTTTL Input Characteristics</b>							
$V_{IH}$	Input High Voltage		2.0		$V_{CC}$	V	
$V_{IL}$	Input Low Voltage		GND		0.8	V	
$V_{IK}$	Input Clamp Voltage	$I_{IK}=-18\text{mA}$		-0.79	-1.50	V	
$I_{IN}$	Input Current	$V_{IN}=0.4\text{V to }4.6\text{V}$		1.8	10.0	$\mu\text{A}$	
		$V_{IN}=\text{GND}$	-10.0	0			
<b>Transmitter LVDS Output Characteristics<sup>(7)</sup></b>							
$V_{OD}$	Output Differential Voltage	$R_L=100\Omega$ , Figure 4	250		450	mV	
$\Delta V_{OD}$	$V_{OD}$ Magnitude Change from Differential LOW-to-HIGH				35	mV	
$V_{OS}$	Offset Voltage		1.125	1.250	1.375	V	
$\Delta V_{OS}$	Offset Magnitude Change from Differential LOW-to-HIGH			25		mV	
$I_{OS}$	Short-Circuit Output Current	$V_{OUT}=0\text{V}$		-3.5	-5.0	mA	
$I_{OZ}$	Disabled Output Leakage Current	$D_0=0\text{V to }4.6\text{V}$ , $/PwrDn=0\text{V}$		$\pm 1.0$	$\pm 10.0$	$\mu\text{A}$	
<b>Transmitter Supply Current</b>							
$I_{CCWT}$	21:3 Transmitter Power Supply Current for Worst-Case Pattern with Load <sup>(8,9)</sup>	$R_L=100\Omega$ , Figure 7	33MHz		28.0	46.2	mA
			40MHz		29.0	51.7	
			65MHz		34.0	57.2	
			85MHz <sup>(10)</sup>		39.0	62.7	
$I_{CCPDT}$	Powered-Down Supply Current	$/PwrDn=0.8\text{V}$		10.0	55.0	$\mu\text{A}$	

### Notes:

- Positive current values refer to the current flowing into device and negative values means current flowing out of pins. Voltages are referenced to ground unless otherwise specified (except  $\Delta V_{OD}$  and  $V_{OD}$ ).
- The power supply current for both transmitter and receiver can be different with the number of active I/O channels.
- The 16-grayscale test pattern tests device power consumption for a "typical" LCD display pattern. The test pattern approximates signal switching needed to produce groups of 16 vertical strips across the display.
- FIN1217 only.

## Transmitter AC Electrical Characteristics

Typical values are at over supply voltages and operating temperatures ranges, unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
t <sub>TCP</sub>	Transmit Clock Period	Figure 10	11.76	T	50.00	ns
t <sub>TCH</sub>	Transmit Clock (TxCLKIn) HIGH Time		0.35	0.50	0.65	T
t <sub>TCL</sub>	Transmit Clock LOW Time		0.35	0.50	0.65	T
t <sub>CLKT</sub>	TxCLKIn Transition Time (Rising and Falling)	10% to 90% Figure 11	1.0		6.0	ns
t <sub>JIT</sub>	TxCLKIn Cycle-to-Cycle Jitter				3.0	ns
t <sub>XIT</sub>	TxIn Transition Time		1.5		6.0	ns

### LVDS Transmitter Timing Characteristics

t <sub>TLH</sub>	Differential Output Rise Time (20% to 80%)	Figure 8		0.75	1.50	ns
t <sub>THL</sub>	Differential Output Fall Time (80% to 20%)			0.75	1.50	ns
t <sub>STC</sub>	TxIn Setup to TxCLNIn	Figure 10 f=85MHz FIN1217 only	2.5			ns
t <sub>HTC</sub>	TxIn Holds to TCLKIn		0			ns
t <sub>TPDD</sub>	Transmitter Power-Down Delay	Figure 17 <sup>(11)</sup>			100	ns
t <sub>TCCD</sub>	Transmitter Clock Input to Clock Output Delay	Figure 13 T <sub>A</sub> =25°C, V <sub>CC</sub> =3.3V	2.8	5.5	6.8	ns

### Transmitter Output Data Jitter (f=40 MHz)<sup>(12)</sup>

t <sub>TPPB0</sub>	Transmitter Output Pulse Position of Bit 0	Figure 20 $a = \frac{1}{f \times 7}$	-0.25	0	0.25	ns
t <sub>TPPB1</sub>	Transmitter Output Pulse Position of Bit 1		a-0.25	a	a+0.25	ns
t <sub>TPPB2</sub>	Transmitter Output Pulse Position of Bit 2		2a-0.25	2a	2a+0.25	ns
t <sub>TPPB3</sub>	Transmitter Output Pulse Position of Bit 3		3a-0.25	3a	3a+0.25	ns
t <sub>TPPB4</sub>	Transmitter Output Pulse Position of Bit 4		4a-0.25	4a	4a+0.25	ns
t <sub>TPPB5</sub>	Transmitter Output Pulse Position of Bit 5		5a-0.25	5a	5a+0.25	ns
t <sub>TPPB6</sub>	Transmitter Output Pulse Position of Bit 6		6a-0.25	6a	6a+0.25	ns

### Transmitter Output Data Jitter (f=65 MHz)<sup>(12)</sup>

t <sub>TPPB0</sub>	Transmitter Output Pulse Position of Bit 0	Figure 20 $a = \frac{1}{f \times 7}$	-0.2	0	0.2	ns
t <sub>TPPB1</sub>	Transmitter Output Pulse Position of Bit 1		a-0.2	a	a+0.2	ns
t <sub>TPPB2</sub>	Transmitter Output Pulse Position of Bit 2		2a-0.2	2a	2a+0.2	ns
t <sub>TPPB3</sub>	Transmitter Output Pulse Position of Bit 3		3a-0.2	3a	3a+0.2	ns
t <sub>TPPB4</sub>	Transmitter Output Pulse Position of Bit 4		4a-0.2	4a	4a+0.2	ns
t <sub>TPPB5</sub>	Transmitter Output Pulse Position of Bit 5		5a-0.2	5a	5a+0.2	ns
t <sub>TPPB6</sub>	Transmitter Output Pulse Position of Bit 6		6a-0.2	6a	6a+0.2	ns

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### Transmitter AC Electrical Characteristics (Continued)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
<b>Transmitter Output Data Jitter (f=85 MHz, FIN1217 only)<sup>(12)</sup></b>						
t <sub>TPPB0</sub>	Transmitter Output Pulse Position of Bit 0	Figure 20 $a = \frac{1}{f \times 7}$	-0.2	0	0.2	ns
t <sub>TPPB1</sub>	Transmitter Output Pulse Position of Bit 1		a-0.2	a	a+0.2	ns
t <sub>TPPB2</sub>	Transmitter Output Pulse Position of Bit 2		2a-0.2	2a	2a+0.2	ns
t <sub>TPPB3</sub>	Transmitter Output Pulse Position of Bit 3		3a-0.2	3a	3a+0.2	ns
t <sub>TPPB4</sub>	Transmitter Output Pulse Position of Bit 4		4a-0.2	4a	4a+0.2	ns
t <sub>TPPB5</sub>	Transmitter Output Pulse Position of Bit 5		5a-0.2	5a	5a+0.2	ns
t <sub>TPPB6</sub>	Transmitter Output Pulse Position of Bit 6		6a-0.2	6a	6a+0.2	ns
t <sub>JCC</sub>	Transmitter Clock Out Jitter, Cycle-to cycle Figure 23	f=40MHz		350	370	ps
		f=65MHz		210	230	
		f=85MHz FIN1217 only		110	150	
t <sub>TPLLS</sub>	Transmitter Phase Lock Loop Set Time <sup>(13)</sup>	Figure 15 <sup>(12)</sup>			10.0	ms

**Notes:**

11. Outputs of all transmitters stay in 3-STATE until power reaches 2V. Clock and data output begins to toggle 10ms after V<sub>CC</sub> reaches 3V and /PwrDn pin is above 1.5V.
12. This output data pulse position works for both transmitters with 21 TTL inputs, except the LVDS output bit mapping difference (see Figure 19). Figure 20 shows the skew between the first data bit and clock output. A two-bit cycle delay is guaranteed when the MSB is output from transmitter.
13. This jitter specification is based on the assumption that PLL has a reference clock with cycle-to-cycle input jitter of less than 2ns.

## Receiver DC Electrical Characteristics

Typical values are at  $T_A=25^\circ\text{C}$  and with  $V_{CC}=3.3\text{V}$ . Positive current values refer to the current flowing into device and negative values means current flowing out of pins. Voltages are referenced to ground unless otherwise specified (except  $\Delta V_{OD}$  and  $V_{OD}$ ). Minimum and maximum values are at over supply voltage and operating temperature ranges unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units	
<b>LVTTTL/CMOS DC Characteristics</b>							
$V_{IH}$	Input High Voltage		2.0		$V_{CC}$	V	
$V_{IL}$	Input Low Voltage		GND		0.8	V	
$V_{OH}$	Output High Voltage	$I_{OH}=-0.4\text{mA}$	2.7	3.3		V	
$V_{OL}$	Output Low Voltage	$I_{OL}=2\text{mA}$			0.3	V	
$V_{IK}$	Input Clamp Voltage	$I_{IK}=-18\text{mA}$			-1.5	V	
$I_{IN}$	Input Current	$V_{IN}=0\text{V}$ to 4.6V	-10		10	$\mu\text{A}$	
$I_{OFF}$	Input/Output Power-Off Leakage Current	$V_{CC}=0\text{V}$ , All LVTTTL Inputs/Outputs 0V to 4.6V			$\pm 10$	$\mu\text{A}$	
$I_{OS}$	Output Short-Circuit Current	$V_{OUT}=0\text{V}$		-60	-120	$\mu\text{A}$	
<b>Receiver LVDS Input Characteristics</b>							
$V_{TH}$	Differential Input Threshold HIGH	Figure 6, Table 2			100	mV	
$V_{TL}$	Differential Input Threshold LOW	Figure 6, Table 2	-100			mV	
$V_{ICM}$	Input Common Mode Range	Figure 6, Table 2	0.05		2.35	V	
$I_{IN}$	Input Current	$V_{IN}=2.4\text{V}$ , $V_{CC}=3.6\text{V}$ or 0V			$\pm 10.0$	$\mu\text{A}$	
		$V_{IN}=0\text{V}$ , $V_{CC}=3.6\text{V}$ or 0V			$\pm 10.0$		
<b>Receiver Supply Current</b>							
$I_{CCWR}$	3:21 Receiver Power Supply Current for Worst Case Pattern with Load <sup>(14)</sup>	$C_L=8\text{pF}$ , Figure 7	33MHz			66	mA
			40MHz		56	74	
			65MHz		75	102	
			85MHz <sup>(15)</sup>		92	125	
$I_{CCPDR}$	Powered Down Supply Current	/PwrDn=0.8V (RxOut stays LOW)		NA	400	$\mu\text{A}$	

### Notes:

14. The power supply current for the receiver can be different due to the number of active I/O channels.
15. 85MHz specification for FIN1218 only.

## Receiver AC Electrical Characteristics

Values are at over supply voltages and operating temperatures, unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
$t_{RCOL}$	RxCLKOut LOW Time	Figure 12 Rising Edge Strobe $f=40\text{MHz}$	10.0	11.0		ns
$t_{RCOH}$	RxCLKOut HIGH Time		10.0	12.2		ns
$t_{RSRC}$	RxOut Valid Prior to RxCLKOut		6.5	11.6		ns
$t_{RHRC}$	RxOut Valid After RxCLKOut		6.0	11.6		ns
$t_{RCOP}$	Receiver Clock Output (RxCLKOut) Period	Figure 12 Rising Edge Strobe $f=65\text{MHz}$	15.0	T	50.0	ns
$t_{RCOL}$	RxCLKOut LOW Time		5.0	7.8	9.0	ns
$t_{RCOH}$	RxCLKOut HIGH Time		5.0	7.3	9.0	ns
$t_{RSRC}$	RxOut Valid Prior to RxCLKOut		4.5	7.7		ns
$t_{RHRC}$	RxOut Valid After RxCLKOut	4.0	8.4		ns	
$t_{RCOP}$	Receiver Clock Output (RxCLKOut) Period	Figure 12 Rising Edge Strobe $f=85\text{MHz}$ FIN1218 only	11.76	T	50.00	ns
$t_{RCOL}$	RxCLKOut LOW Time		4.0	6.3	6.0	ns
$t_{RCOH}$	RxCLKOut HIGH Time		4.5	5.4	6.5	ns
$t_{RSRC}$	RxOut Valid Prior to RxCLKOut		3.5	6.3		ns
$t_{RHRC}$	RxOut Valid After RxCLKOut	3.5	6.5		ns	
$t_{ROLH}$	Output Rise Time (20% to 80%)	$C_L=8\text{pF}$ , Figure 9		2.2	5.0	ns
$t_{ROHL}$	Output Fall Time (80% to 20%)			2.1	5.0	ns
$t_{RCCD}$	Receiver Clock Input to Clock Output Delay	$T_A=25^\circ\text{C}$ , $V_{CC}=3.3\text{V}$ Figure 14 <small>(Error! Reference source not found.)</small>	3.5	6.9	7.5	ns
$t_{RPDD}$	Receiver Power-Down Delay	Figure 18			1.0	ms
$t_{RSPB0}$	Receiver Input Strobe Position of Bit 0	Figure 21 $f=40\text{MHz}$	1.00		2.15	ns
$t_{RSPB1}$	Receiver Input Strobe Position of Bit 1		4.5		5.8	ns
$t_{RSPB2}$	Receiver Input Strobe Position of Bit 2		8.10		9.15	ns
$t_{RSPB3}$	Receiver Input Strobe Position of Bit 3		11.6		12.6	ns
$t_{RSPB4}$	Receiver Input Strobe Position of Bit 4		15.1		16.3	ns
$t_{RSPB5}$	Receiver Input Strobe Position of Bit 5		18.8		19.9	ns
$t_{RSPB6}$	Receiver Input Strobe Position of Bit 6		22.5		23.6	ns

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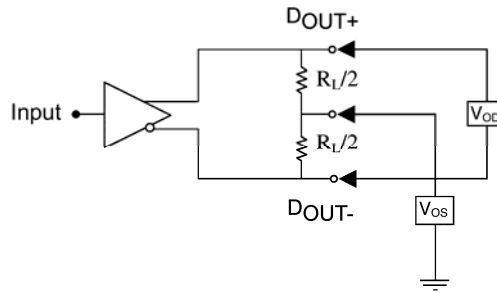
## Receiver AC Electrical Characteristics (Continued)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
t <sub>RSPB0</sub>	Receiver Input Strobe Position of Bit 0	Figure 21 f=65MHz	0.7		1.4	ns
t <sub>RSPB1</sub>	Receiver Input Strobe Position of Bit 1		2.9		3.6	ns
t <sub>RSPB2</sub>	Receiver Input Strobe Position of Bit 2		5.1		5.8	ns
t <sub>RSPB3</sub>	Receiver Input Strobe Position of Bit 3		7.3		8.0	ns
t <sub>RSPB4</sub>	Receiver Input Strobe Position of Bit 4		9.5		10.2	ns
t <sub>RSPB5</sub>	Receiver Input Strobe Position of Bit 5		11.7		12.4	ns
t <sub>RSPB6</sub>	Receiver Input Strobe Position of Bit 6		13.9		14.6	ns
t <sub>RSPB0</sub>	Receiver Input Strobe Position of Bit 0	Figure 21 f=85MHz FIN1218 only	0.49		1.19	ns
t <sub>RSPB1</sub>	Receiver Input Strobe Position of Bit 1		2.17		2.87	ns
t <sub>RSPB2</sub>	Receiver Input Strobe Position of Bit 2		3.85		4.55	ns
t <sub>RSPB3</sub>	Receiver Input Strobe Position of Bit 3		5.53		6.23	ns
t <sub>RSPB4</sub>	Receiver Input Strobe Position of Bit 4		7.21		7.91	ns
t <sub>RSPB5</sub>	Receiver Input Strobe Position of Bit 5		8.89		9.59	ns
t <sub>RSPB6</sub>	Receiver Input Strobe Position of Bit 6		10.57		11.27	ns
t <sub>RSKM</sub>	RxIn Skew Margin <sup>(Error! Reference source not found.)</sup>	f=40MHz, Figure 22	490			ps
		f=65MHz, Figure 22	400			
		f=85MHz FIN1218 only Figure 22	252			
t <sub>RPLLS</sub>	Receiver Phase Lock Loop Set Time	Figure 16			10.0	ms

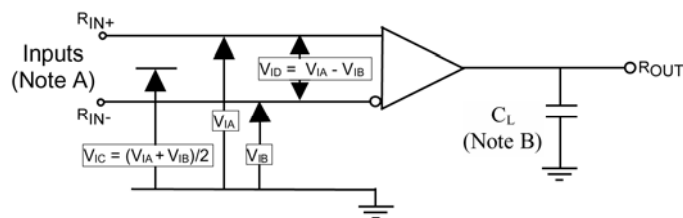
**Notes:**

16. Total channel latency from serializer to deserializer is  $(T + t_{TCCD}) + (2 \cdot T + t_{RCCD})$ .
17. Receiver skew margin is defined as the valid sampling window after considering potential setup/hold time and minimum/maximum bit position.

## Test Circuits



**Figure 5. Differential LVDS Output DC Test Circuit**



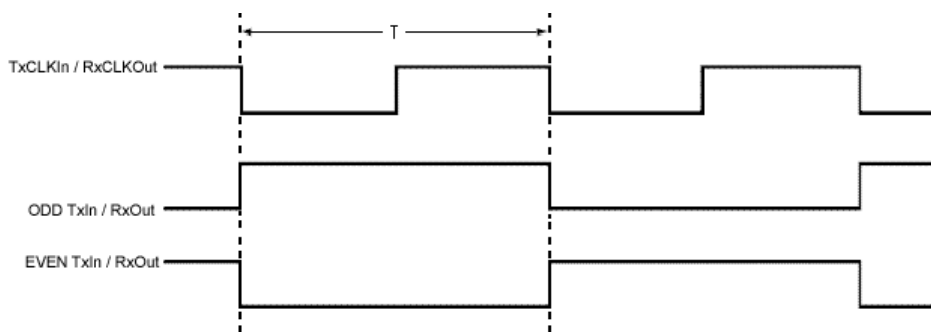
Notes: For all input pulses,  $t_R$  or  $t_F \leq 1\text{ns}$ .  
 $C_L$  includes all probe and jig capacitance.

**Figure 6. Differential Receiver Voltage Definitions, Propagation Delay, and Transition Time Test Circuit**

**Table 2. Receiver Minimum and Maximum Input Threshold Test Voltages**

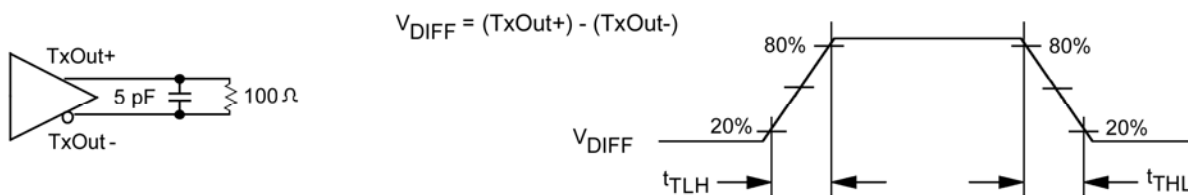
Applied Voltages (V)		Resulting Differential Input Voltage (mV)	Resulting Common Mode Input Voltage (V)
$V_{IA}$	$V_{IB}$	$V_{ID}$	$V_{IC}$
1.25	1.15	100	1.20
1.15	1.25	-100	1.20
2.40	2.30	100	2.35
2.30	2.40	-100	2.35
0.10	0	100	0.05
0	0.10	-100	0.05
1.50	0.90	600	1.20
0.90	1.50	-600	1.20
2.40	1.80	600	2.10
1.80	2.40	-600	2.10
0.60	0	600	0.30
0	0.60	-600	0.30

## AC Loadings and Waveforms



Note: The worst-case test pattern produces a maximum toggling of digital circuits, LVDS I/O and LVTTTL/CMOS I/O. Depending on the valid strobe edge of transmitter, the TxCLKIn can be either rising or falling edge data strobe.

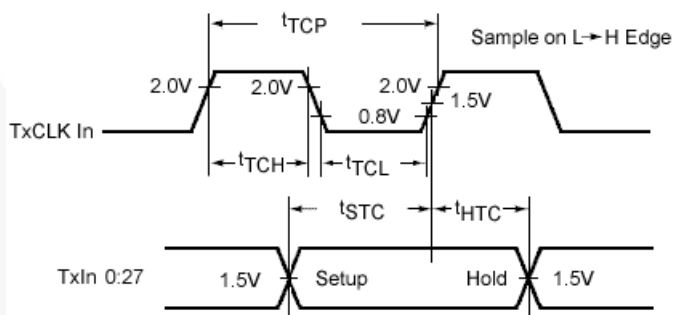
**Figure 7. Worst-Case Test Pattern**



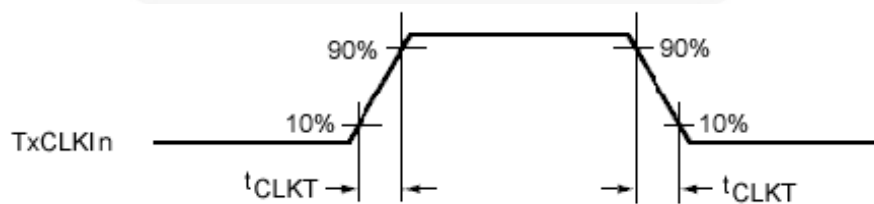
**Figure 8. Transmitter LVDS Output Load and Transition Times**



**Figure 9. Receiver LVTTTL/CMOS Output Load and Transition Times**



**Figure 10. Transmitter Set-up/Hold and HIGH/LOW Times (Rising Edge Strobe)**



**Figure 11. Transmitter Input Clock Transition Time**

AC Loadings and Waveforms (Continued)

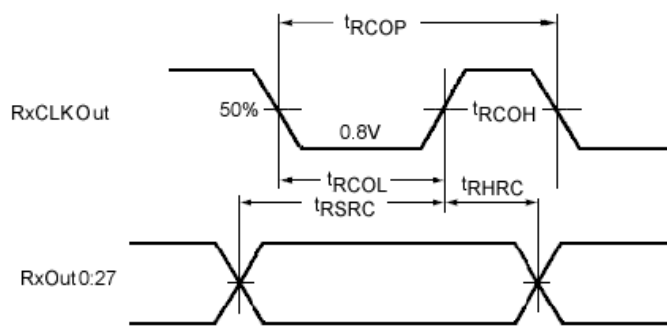


Figure 12. Receiver Set-up/Hold and HIGH/LOW Times

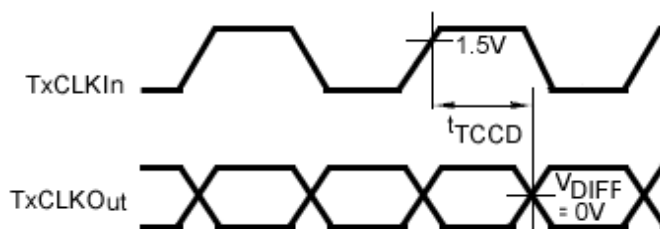


Figure 13. Transmitter Clock-In to Clock-Out Delay (Rising Edge Strobe)

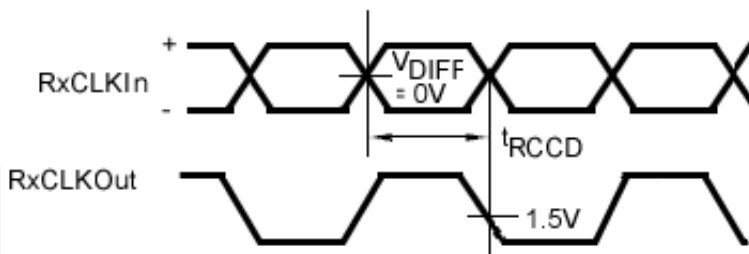


Figure 14. Receiver Clock-In to Clock-Out Delay (Rising Edge Strobe)

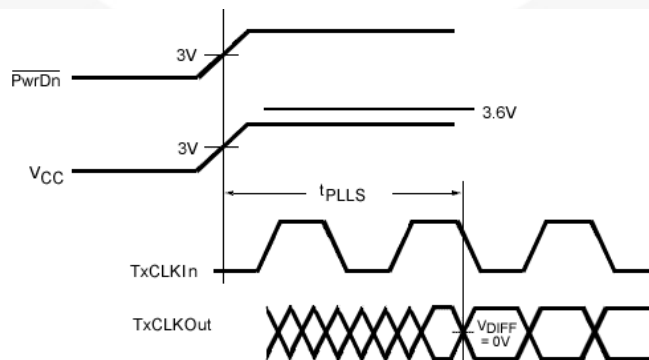


Figure 15. Transmitter Phase-Lock-Loop Set Time

AC Loadings and Waveforms (Continued)

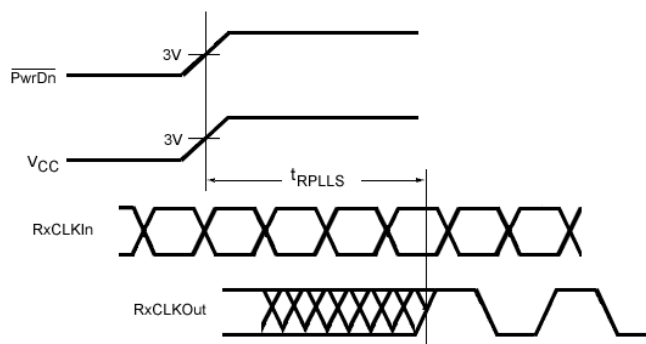


Figure 16. Receiver Phase Lock Loop Set Time

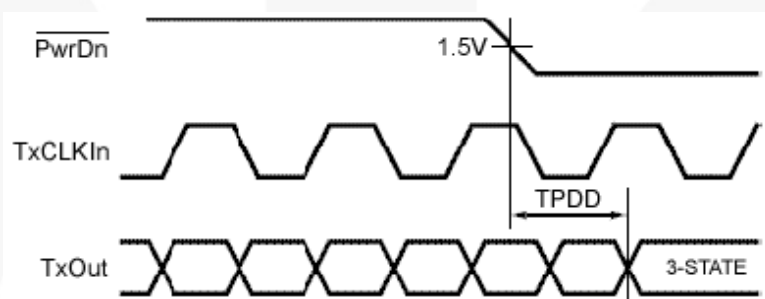


Figure 17. Transmitter Power-down Delay

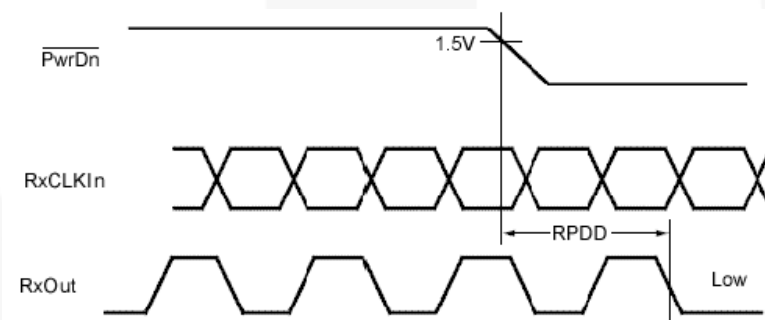
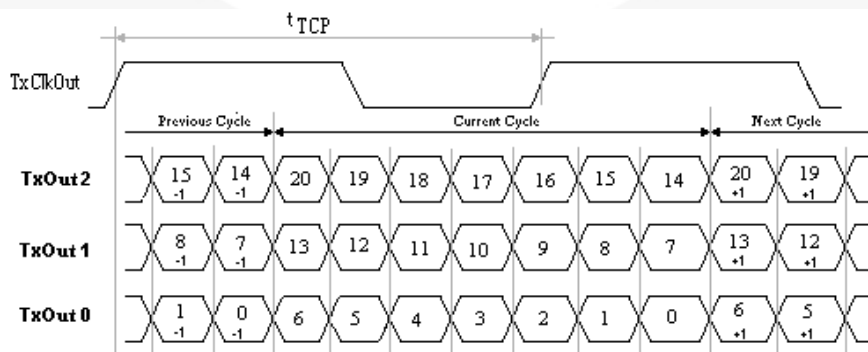


Figure 18. Receiver Power-down Delay



Note: This output date pulse position works for both transmitters with 21 TTL inputs, except the LVDS output bit mapping difference. Two-bit cycle delay is guaranteed with the MSB is output from transmitter.

Figure 19. Parallel LVTTL Inputs Mapped to Three Serial LVDS Outputs

AC Loadings and Waveforms (Continued)

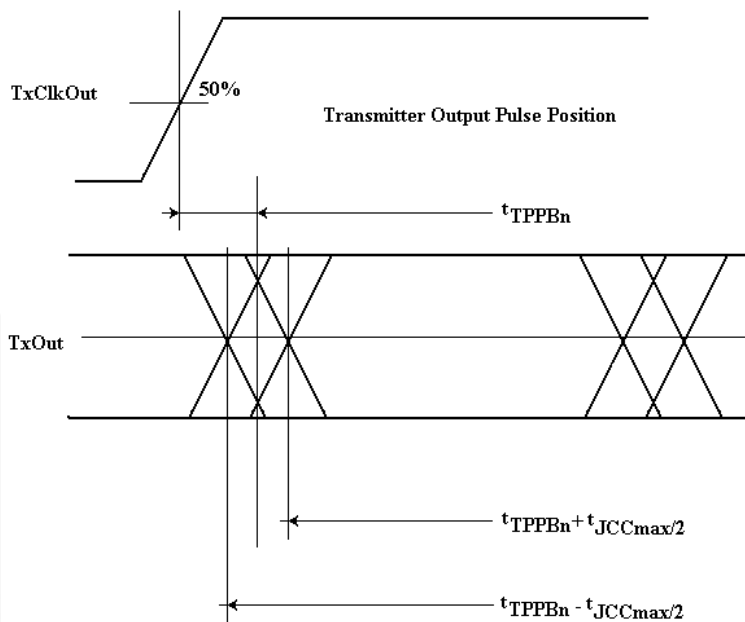


Figure 20. Transmitter Output Pulse Bit Position

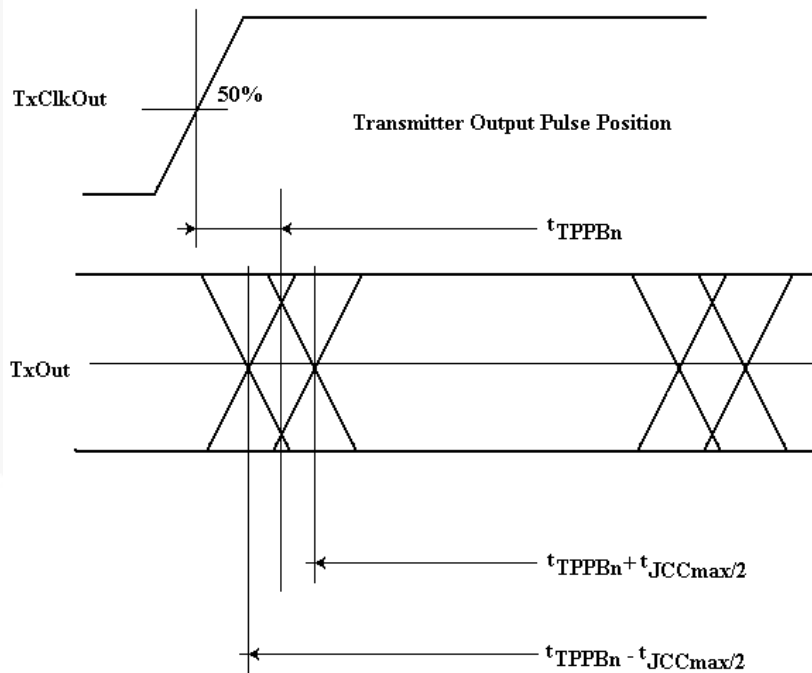
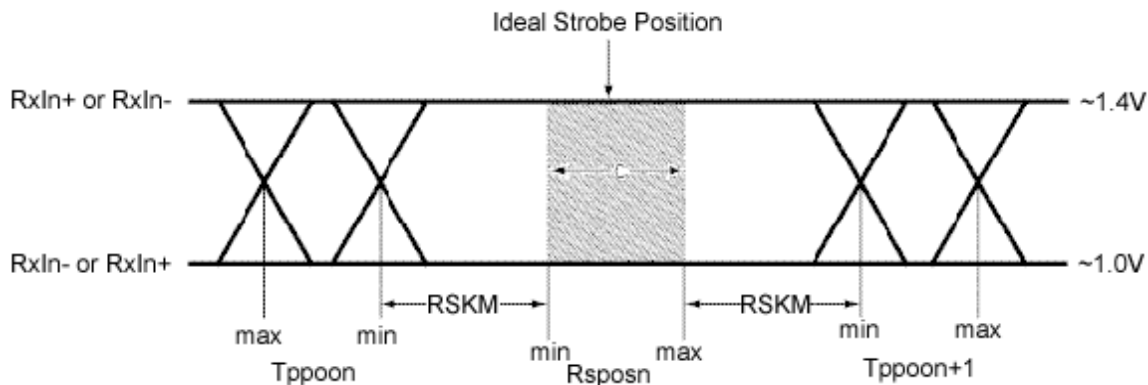


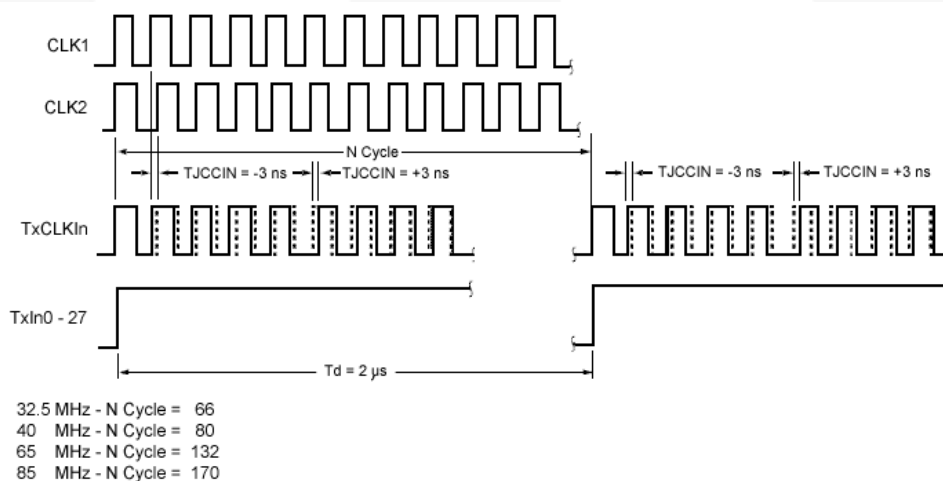
Figure 21. Receiver Strobe Bit Position

### AC Loadings and Waveforms (Continued)



Note:  $t_{RSKM}$  is the budget for the cable skew and source clock skew plus Inter-Symbol Interference (ISI). The minimum and maximum pulse position values are based on the bit position of each of the seven bits within the LVDS data stream across PVT (Process, Voltage Supply, and Temperature).

**Figure 22. Receiver LVDS Input Skew Margin**

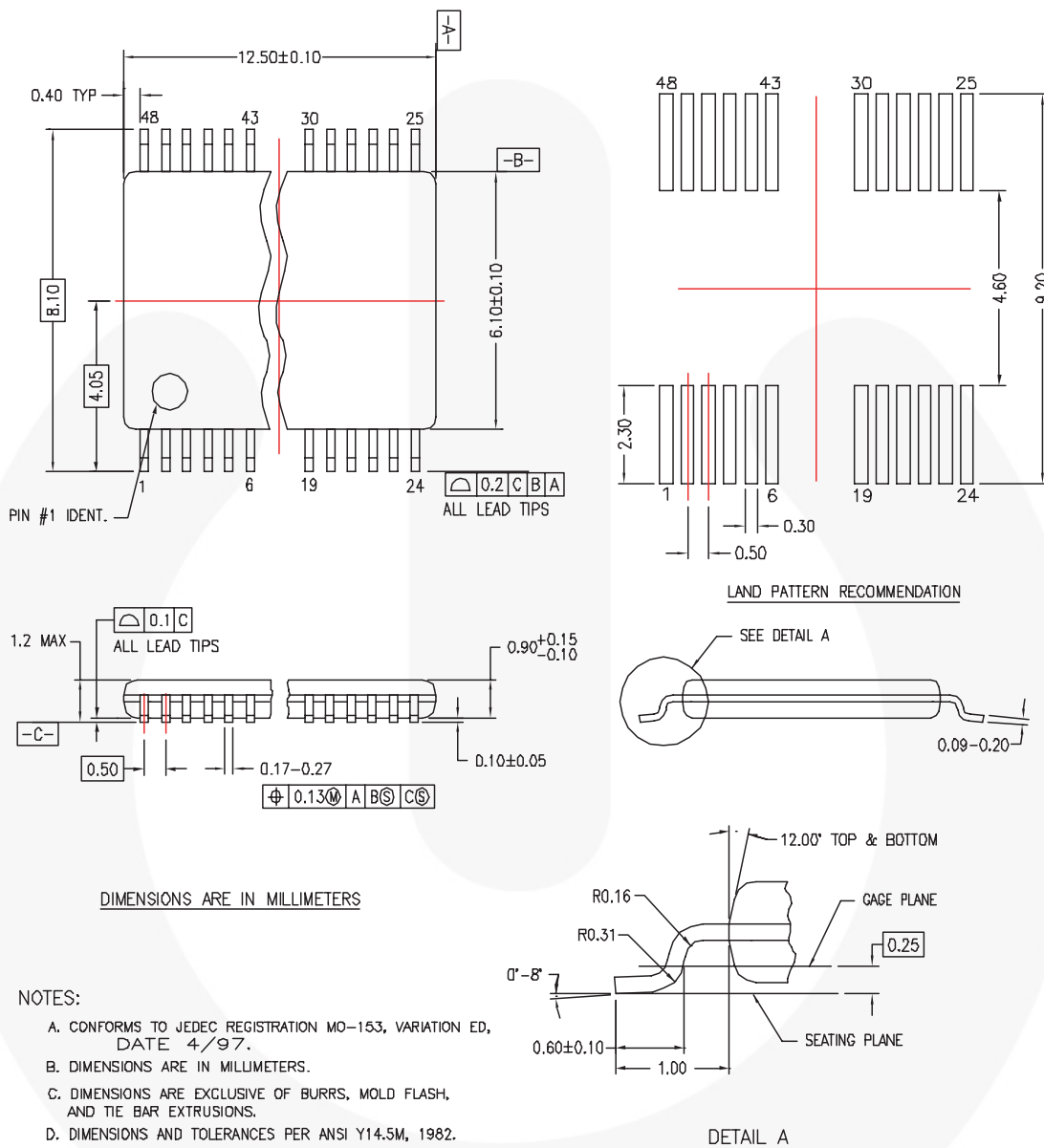


Note: This jitter pattern is used to test the jitter response (clock out) of the device over the power supply range with worst jitter  $\pm$ ns (cycle-to-cycle) clock input. The specific test methodology is as follows:

- Switching input data TxIn0 to TxIn20 at 0.5MHz and the input clock is shifted to left -3ns and to the right +3ns when data is HIGH (by switching between CLK1 and CLK2 in Figure 11).
- The  $\pm$ 3ns cycle-to-cycle input jitter is the static phase error between the two clock sources. Jumping between two clock sources to simulate the worst-case of clock edge jump (3ns) from graphical controllers. Cycle-to-cycle jitter at TxCLK out pin should be measured cross  $V_{CC}$  range with 100mV noise ( $V_{CC}$  noise frequency <2MHz).

**Figure 23. Jitter Pattern**

## Physical Dimensions



MTD48REVC

**Figure 24. 48-Lead Thin Shrink Small Outline Package (TSSOP)**

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