DEMO MANUAL DC126
High Speed Line Receiver Demo Board

LTC 1520
50Mbps Precision Quad Line Receiver

DESCRIPTION

Demonstration Circuit DC126 highlights some of the key characteristics of the LTC\textsuperscript{®} 1520 line receiver. The LTC1520 is a high speed, precision timing, differential line receiver that can operate at data rates as high as 50Mbps. A unique architecture provides very stable propagation delays and low skew (both same-channel and channel-to-channel) over a wide input common mode range. The device operates from a single 5V supply and is designed for use in network backplanes, high speed computer buses and other applications that require precision delay between channels. LTC and LT are registered trademarks of Linear Technology Corporation.

PERFORMANCE SUMMARY

Operating temperature range 0\(^\circ\)C to 70\(^\circ\)C, \(V_{DD} = 5V\), unless otherwise specified.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Common Mode Range</td>
<td>−0.2</td>
<td>(V_{DD} + 0.2)</td>
<td>(V)</td>
<td></td>
</tr>
<tr>
<td>Input-Output Propagation Delay</td>
<td>15</td>
<td>18</td>
<td>21</td>
<td>ns</td>
</tr>
<tr>
<td>(</td>
<td>t_{LH} - t_{HL}</td>
<td>) Skew</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Channel-to-Channel Skew</td>
<td>0.4</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
</tbody>
</table>

TYPICAL PERFORMANCE CHARACTERISTICS AND BOARD PHOTO

Propagation Delay Guaranteed to Fall Within Shaded Area (±3ns)

![Propagation Delay Graph](LTC1520 TA02)

![Board Photo](LTC1520 BD PHOTO)
Figure 1. Demo Board Schematic

PARTS LIST

<table>
<thead>
<tr>
<th>REFERENCE DESIGNATOR</th>
<th>QUANTITY</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
<th>VENDOR</th>
<th>TELEPHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1, C3, C9</td>
<td>3</td>
<td>TAJB106M010R</td>
<td>10μF 10V 20% Tantalum Capacitor</td>
<td>AVX</td>
<td>(207) 282-5111</td>
</tr>
<tr>
<td>C2, C4 to C8</td>
<td>6</td>
<td>08055C103MAT1A</td>
<td>0.01μF 50V 20% X7R Capacitor</td>
<td>AVX</td>
<td>(803) 946-0362</td>
</tr>
<tr>
<td>J1</td>
<td>1</td>
<td>112404</td>
<td>BNC 50Ω Connector</td>
<td>Connex</td>
<td>(805) 378-6464</td>
</tr>
<tr>
<td>R1, R3</td>
<td>2</td>
<td>CR21-121J-T</td>
<td>120Ω 1/10W 5% Chip Resistor</td>
<td>AVX</td>
<td>(803) 946-0524</td>
</tr>
<tr>
<td>R2</td>
<td>1</td>
<td>CR21-510J-T</td>
<td>51Ω 1/10W 5% Chip Resistor</td>
<td>AVX</td>
<td>(803) 946-0524</td>
</tr>
<tr>
<td>TP1 to TP6</td>
<td>6</td>
<td>131-4353-00</td>
<td>5mm Scope Probe Test Point</td>
<td>Tektronix</td>
<td>(800) 835-9433</td>
</tr>
<tr>
<td>U1</td>
<td>1</td>
<td>LTC1520CS</td>
<td>Quad Line Receiver SO-16 IC</td>
<td>LTC</td>
<td>(408) 432-1900</td>
</tr>
<tr>
<td>U2</td>
<td>1</td>
<td>MC10116FNR1</td>
<td>Triple Line Receiver PLCC-20 IC</td>
<td>Motorola</td>
<td>(602) 655-3005</td>
</tr>
<tr>
<td>U3</td>
<td>1</td>
<td>MC74ACT04DR1</td>
<td>Hex Inverter SO-14 IC</td>
<td>Motorola</td>
<td>(602) 655-3005</td>
</tr>
</tbody>
</table>
OPERATION

DC126 highlights the excellent propagation delay characteristics of the LTC1520 line receiver. Receivers A and B are driven differentially by the MC10116 PECL device. Because the inputs to these two receivers are the same, probing the two receiver outputs simultaneously will show channel-to-channel skew. Receiver C is driven by a CMOS inverter. Note that the negative input of Receiver C is not driven externally; it is internally self-biased to 3.3V. The 0.01µF C6 bypass capacitor is recommended for maximum frequency operation. Receiver D has both inputs brought out for the user to test some of the other features of the LTC1520, such as rail-to-rail input common mode, Hot Swap™ capable inputs which may be overdriven to ±10V and high input resistance (>18k, even when unpowered).

Equipment

In order to accurately measure the subnanosecond skews of the LTC1520, it is necessary to use high bandwidth equipment:

- 500MHz scope with high frequency FET probes
- ~3ns input rise/fall times input square wave (J1)

Receiver Skew

Connect DRVP to RCVP. Connect DRVN to RCVN. Make sure you use two small wires of equal length to make the connection. When a signal (square wave) is input to J1, OUT1 and OUT2 receiver outputs will show a 0.4ns typical skew. The FET probes must be inserted into the probe sockets; do not use the probe ground clips. This allows good grounding of the FET probes.

Twisted-Pair Connection

The LTC1520 can be used to receive high speed data over twisted-pair lines. One end of the twisted pair should be connected between DRVP and DRVN. The other end of the twisted pair should be terminated by a 120Ω resistor and connected between RCVP and RCVN. DC126 allows up to 50Mbps operation with a 100ft section of Category 5 twisted-pair wire. Longer wire will result in a lower maximum frequency.

Propagation Delay Measurement

Measure propagation delay by inserting one probe at RCVP and another at OUT1. Measure from the 50% point of the AC portion of the input to the 50% point of the AC portion of the output. Note that if the FET probes are not used, the probe capacitance may exceed 15pF, which will slightly increase the propagation delay (see the LTC1520 data sheet).

Single-Ended Operation

Receiver C is set up for single-ended operation. Its positive input is driven by a high speed CMOS hex inverter output. The negative input is connected only to a bypass capacitor, which is needed only during maximum frequency operation. The receiver inputs of the LTC1520 have an open-circuit voltage of 3.3V with a 5V supply, and a minimum input resistance of 18k. This configuration is useful for minimizing the number of routed lines on your PC board.

Uncommitted Receiver

The inputs to Receiver D have been left unconnected. This allows the user to test some of the other features of the LTC1520.

Temperature Stability

The LTC1520 is designed for superior temperature performance (see the data sheet). Make connections as described in the “Receiver Skew” section. Measure the propagation delay. Heat up/cool down the device. Remeasure the propagation delay. The propagation delay should change by less than ±1ns over the commercial temperature range.

Hot Swap is a trademark of Linear Technology Corporation.
PCB LAYOUT AND FILM

Component Side Silkscreen

Component Side

Component Side Solder Mask

Paste Mask Top

Solder Side

Solder Side Solder Mask

PC FAB DRAWING

NOTES: (UNLESS OTHERWISE SPECIFIED)
1. ALL DIMENSIONS ARE IN INCHES ±0.003
2. FINISHED MATERIAL IS FR4, 0.062 THICK, 2 OZ COPPER, 2 LAYERS
3. FINISHED HOLE SIZES ARE +0.003/–0
4. PLATED HOLE WALL THICKNESS IS 0.001 MINIMUM
5. SOLDER MASK BOTH SIDES USING GREEN SR1020 OR EQUIVALENT
6. SILKSCREEN WHITE NONCONDUCTIVE INK COMPONENT SIDE

SIZE	 QTY	 SYM	 PLTD
0.015	 18	 A	 Yes
0.026	 9	 B	 Yes
0.035	 18	 C	 Yes
0.052	 5	 D	 Yes
0.070	 2	 E	 No
0.090	 6	 F	 Yes
0.150

Component Side Silkscreen

Component Side

Component Side Solder Mask

Paste Mask Top

Solder Side

Solder Side Solder Mask