USB 2.0/3.0 Droop/Drop Test Fixture

April 23, 2013

Revision 1.2
PACKAGE CONTENTS

The USB-IF 2.0/3.0 Droop/Drop Test Fixture should come with the following:

- Qty. 1 - USB 2.0/3.0 Droop Drop Fixture
- Qty. 1 - 5V Power Supply
- Qty. 8 - 1-meter USB 3.0 cables
- Qty. 1 - 4-inch USB 3.0 cable

Please examine package contents upon receiving your fixture kit for these items.
HARDWARE

The USB-IF 2.0/3.0 Droop/Drop Fixture provides the following ports:

- 8 load ports
- 1 droop port
- 1 non-loaded port.

The load ports are configurable in two sections of 4 ports to draw USB 2.0 or 3.0 maximum current levels for high powered devices. In addition ports 1-4 can be configured to draw 1-unit load of current representing a low-power or non-configured device for use when testing a bus-powered hub. The value of the load is set with the Mode Switches. The “up” position sets the ports to 3.0 mode, the “down” position sets the ports to 2.0 mode. The left-most switch can be used to set Ports 1-4 into Low-Power mode by putting it into the “down” position. Figure 1 and Figure 2 detail locations of these interfaces.
<table>
<thead>
<tr>
<th>Switch Mode</th>
<th>Current Draw per Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.0</td>
<td>900mA</td>
</tr>
<tr>
<td>2.0</td>
<td>500mA</td>
</tr>
<tr>
<td>3.0 Low-Power</td>
<td>150mA</td>
</tr>
<tr>
<td>2.0 Low-Power</td>
<td>100mA</td>
</tr>
</tbody>
</table>

Table 1: Current Draw Levels
DROP TEST

The Drop Test determines whether or not a host or hub port can provide the minimum required V-Bus level when all ports are fully loaded. It also determines that the V-Bus voltage does not exceed the maximum requirements determined by the USB Specification. Table 2 provides the limits on voltage levels for USB 2.0 and 3.0 host or hub ports in both loaded and non-loaded configurations.

<table>
<thead>
<tr>
<th>Downstream Port Under Test</th>
<th>Load (mA)</th>
<th>Vbus Min (V)</th>
<th>V-Bus Max (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.0 Host/Self-Powered Hub</td>
<td>900</td>
<td>4.45</td>
<td>5.25</td>
</tr>
<tr>
<td>3.0/2.0 Host/Self-Powered Hub</td>
<td>500</td>
<td>4.75</td>
<td>5.25</td>
</tr>
<tr>
<td>2.0 Bus-Powered Hub*</td>
<td>100</td>
<td>4.4</td>
<td>5.25</td>
</tr>
<tr>
<td>Not Loaded Host/Hub</td>
<td>0</td>
<td>4.75</td>
<td>5.25</td>
</tr>
</tbody>
</table>

Table 2: Drop Level Extrema

*Should be tested on host system with known good power supply

A system with both USB 2.0 and 3.0 ports must be tested with all ports loaded simultaneously to the appropriate levels. Also for end product hosts/hubs the power supply used during the testing should be the same as that which will be provided to consumers in the market if applicable.

Note: Both 2.0 and 3.0 load conditions should be tested on USB 3.0 ports and the levels should be within the bounds defined in Table 2.

Note: The cumulative load produced on the USB ports should not exceed 5A. Hence when testing voltage drop it may not be necessary to load all ports if the sum of all currents is greater than 5 A.

If a host has more than 5 USB 3.0 ports it is necessary to adjust the loads in order to draw close to 5A. Loading 4 ports to USB 3.0 levels and 2 ports to USB 2.0 levels will provide a total of 4.6A. An additional Low-Power load must be added to the total (refer to Table 1 for 2.0/3.0 Low-Power load definitions) to account for the unconfigured current draw of the droop port, resulting in either 4.7A or 4.75A total load. This is as close as possible to the 5A maximum this fixture can provide while still fully loading many of the 3.0 ports.

1. Non-Loaded Port Test

Measure the unloaded voltage of each port under test and check the value against that of the unloaded value in Table 2. If the voltage is beyond the table limits the host or hub fails the test.
2. Loaded Port Test

Attach all host or hub ports to load ports as shown in Figure 4. Set the correct load setting with the mode switches. Measure the loaded voltage of each port under test and check the value against that of the loaded value in Table 2. If the voltage is beyond the table limits the Host or Hub fails the test.
**DROOP TEST**

The Droop Test measures the amount of voltage droop a loaded port produces on its V-Bus line when a device is connected or resumed from an adjacent port. Both USB 2.0 and USB 3.0 specify a maximum droop voltage of 330mV.

### 1. Droop Test

Attach one host or hub port to the Droop Port and attach all remaining ports to load ports as shown in Figure 5. Set the correct load setting with the mode switches. Using passive, single ended probes attach oscilloscope Channel 1 to the OSC node and Channel 2 to the port under test node.

- Set Channel 1 to 2V/div
- Set Channel 2 to < 1V/div
- Set Timebase to 25uS/div
- Set Trigger to “normal” and “rising edge” for Channel 1
- Set Acquire Mode to Average(16)

Acquire at least 16 captures of the voltage droop for proper averaging. Using the oscilloscope cursors measure the difference from Channel 2 voltage level before the trigger to the lowest droop point. If this value exceeds 330mV the test fails.

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**Note:** Be sure to only begin measuring once everything is set up and operating. This will prevent unrelated signals from being included in the averaged waveform.

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**Figure 5: Droop Test Topology**