

# **Fusion USB DVT Report**

## **April 2008**



## Document Revision History <sup>1</sup>

REV No.	Revision date	Revised by	Changes include
A1	4/22/2008	Ealasaid A. Haas	Original document

1. Update the revision number on the cover page.

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# 1.0 Overview

The contents of this binder are authorized for **EXTERNAL** use.

This report contains the DVT test results and relevant specifications for the USB components of the Fusion DVR.

The tests were conducted on the TiVo premises.

TiVo Model Number: TCD652160

Project: Fusion

## **2.0 Specifications Diagram**

This section contains the Fusion Ethernet, USB; Base SATA Connector Specifications Diagram

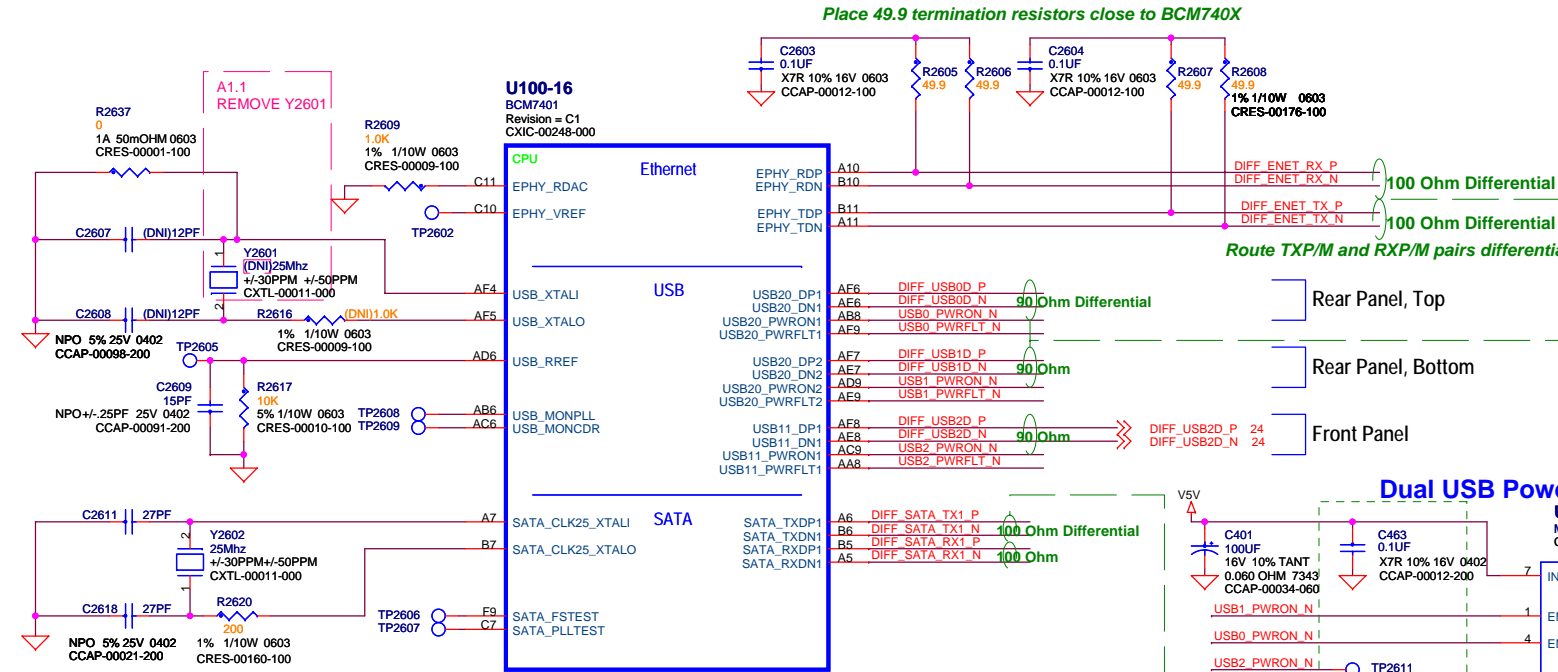
P1.05 25Dec2006  
- Add Transient Suppressor, D42 to Ethernet and D41 to USB differential data pairs

P1.06 30Dec2006  
- Delete Transient Suppressors, D42 to Ethernet and D41 to USB differential data pairs  
- Change C2611 and C2618 From CCAP-00006-100 to CCAP-00006-200 to combine line item with tuner use  
- Change C463 from CCAP-00012-000 to CCAP-00012-200 to eliminate single instance of 0805 package.  
- Change C2609 From CCAP-00091-100 to CCAP-00091-200 to combine line item.

- Change C2607 and C2608 From CCAP-00098-100 to CCAP-00098-200 to combine line item.  
P1.06: - Change C401 100uF, 150mOhm, CCAP-00111-000 to 100uF, 60mOhm, CCAP-00034-060 to combine 100uF TANT line item  
P1.064: - [BOM ONLY] Change C2611 and C2618 From 22pF CCAP-00006-200 to 27pF CCAP00021-000 for minimum in-circuit frequency ppm error, 25MHz SATA crystal Y2602.

C1 22Feb07 - 16 [BOM ONLY] (DNI) CN1  
D01 07Mar07 - 16 Change SATA Connector CN1 From Thru-hole CCON-00067-000 to SMT CCON-00089-000  
D1 22Mar07 - 16 Change SATA Connector CN1 From Tyco to Molex

## Ethernet, USB, SATA Controllers



## 3.0 Drop/Droop Test

### 3.1 Fusion Drop/Droop Test Results

Test Summary	
Unit under test	
Tested S/N	
Test date(s)	4/23/2008
Test location	TiVo, Inc.
Test Engineer	Dennis Del Carlo
Conclusion	Pass

Fusion Drop/Droop Test  
Fusion TSN 652 0001-8046-6A60

Test Equipment  
Tektronix TDSUSBF 071-1063-00  
Multimeter Fluke Model 87

**MEASURE AT Fusion Output**

1. Set Load 1 Switch of TDSUSBF to center off, set Load 3 Switch to center off. (Off, no load)
2. Connect Fusion USB port to J1, with 1 meter USB cable.
3. Connect Fusion USB port to J2, with 1 meter USB cable
4. Measure VBUS at J1 and J2, no load; record as No Load Voltage.
5. Switch Load 1 and Load 3 to 500mA load position.
6. Measure VBUS at J1 and J2 each with 500mA load switched on; record as Load Voltage.

	Lower	Upper
No Load Voltage	4.96	4.96
Load Voltage 500 ma	4.77	4.77
VBUS Droop at 500ma	0.190	0.190
Pass / Fail	Pass	Pass



## 4.0 Droop Test

### 4.1 Bus-Powered Droop Test Results in Tek format

Test Summary	
Unit under test	
Tested S/N	
Test date(s)	4/22/2008
Test location	TiVo, Inc.
Test Engineer	
Conclusion	Pass

## Bus-Powered Droop Test Results in Tek format

**Device ID:** TSN 652-0001-8046-6A60

**Device Description:** High Speed , DVR MODEL TCD652160.

**Date:** Wed Apr 23 14:19:14 PDT 2008

**Droop Test Result:** **Pass**

Measurement Name	Measured Droop Voltage	USB Limits	Status
Droop Test	28.000mV	< 330mV	Pass

**Droop value measured at:** Port 1 of HUT



*TDSUSB2 software version: 1.9.1*

## 5.0 Inrush Test

### 5.1 Inrush Test Results in Tek format

Test Summary	
Unit under test	
Tested S/N	
Test date(s)	1/15/2008
Test location	TiVo, Inc.
Test Engineer	
Conclusion	Pass

## Inrush Test Results in Tek format

**Device ID:**fsfe\_001

**Device Description:**Full Speed , Dummy Device.

**Date:**Tue Jan 15 14:16:56 PST 2008

**Inrush Test Result:** **Pass**

Measurement Name	Charge	Capacitance	USB Limits	Waiver Limits	Status
Inrush Test	4.440960u C	906.3183n F	<49.0000 0u C	<196.000 0u C	Pass



*TDSUSB2 software version: 1.9.1*

## 6.0 Full Speed Signal Quality Test

### 6.1 Signal Quality Test Results in Tek format

Test Summary	
Unit under test	TCD652160
Tested S/N	
Test date(s)	12/20/2007
Test location	TiVo, Inc.
Test Engineer	Dennis Del Carlo
Conclusion	<a href="#">Pass</a>

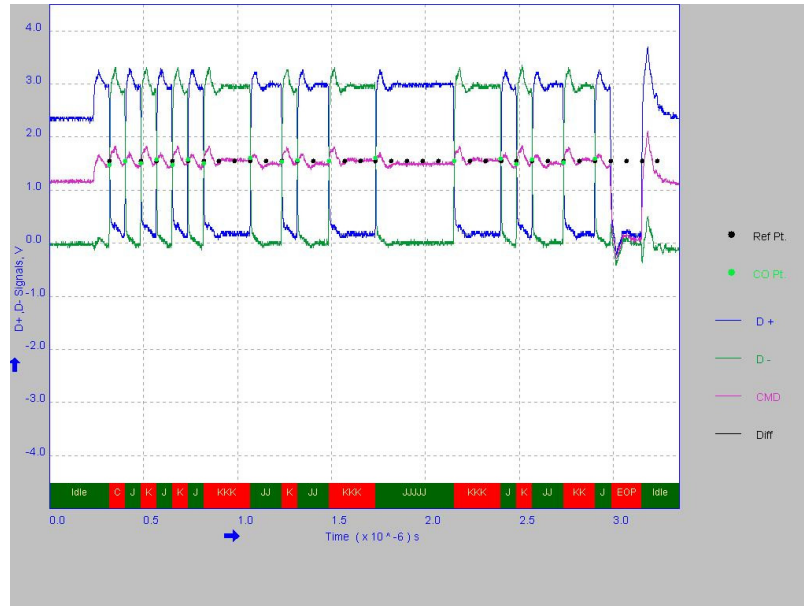
## Signal Quality Test Results in Tek format

**Device ID:**fsfe\_001

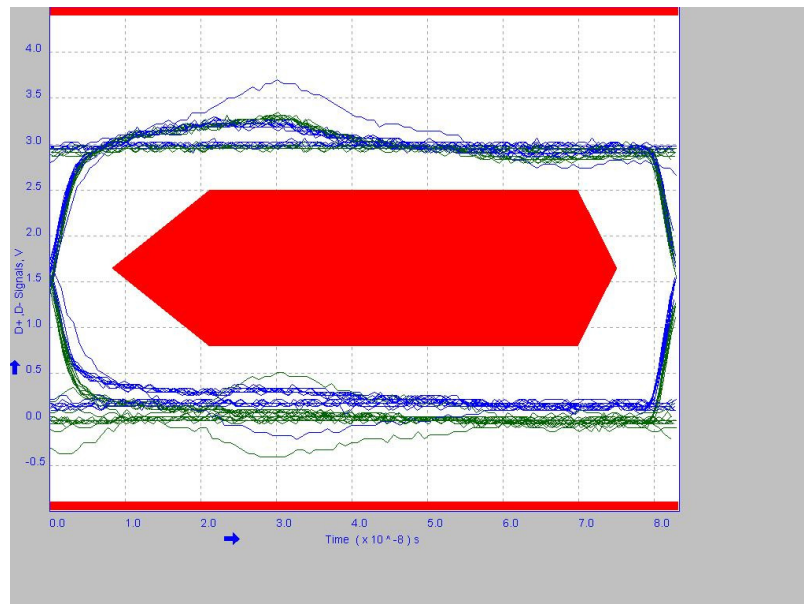
**Device Description:** Full Speed, Far End Device, Up Stream Testing, Tier 6, Dummy Device.

**Date:** Thu Dec 20 15:14:26 PST 2007

**Overall Result: Pass** 



### Waveform Plot



### Eye Diagram

Results based on USB-IF / Waiver Limits :

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
------------------	---------	---------	------	-------	--------------------	-----	------------	--------

Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	11.91556Mbps	12.08993Mbps	12.00219Mbps	0.0000bps	55.78330kbps	12.00285Mbps	31	Pass
Crossover Voltage	1.470407 V	1.606011 V	1.544779 V	135.6043mV	44.19866mV	1.545376 V	18	Pass
EOP Width	-	-	166.0977ns	-	-	-	1	Pass
Consecutive Jitter	-488.8744ps	476.7385ps	0.0000s	965.6129ps	278.4314ps	270.1181ps	17	Pass
Paired JK Jitter	-139.9193ps	86.80902ps	-57.23172ps	226.7283ps	76.24811ps	91.44683ps	8	Pass
Paired KJ Jitter	-145.6585ps	19.11635ps	-51.57139ps	164.7749ps	53.62642ps	71.58613ps	7	Pass

Additional Information :

Rise Time: Min: 7.2213ns Max: 8.0240ns Mean: 7.6676ns Std: 273.02ps RMS: 7.6718ns Population: 8

Fall Time: Min: 7.3805ns Max: 7.9602ns Mean: 7.6497ns Std: 158.11ps RMS: 7.6512ns Population: 9

\* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).



TDSUSB2 software version: 1.9.1

## 7.0 High Speed Signal Quality Test

### 7.1 Signal Quality Test Results in Tek format

Test Summary	
Unit under test	
Tested S/N	
Test date(s)	12/20/2007
Test location	TiVo, Inc.
Test Engineer	
Conclusion	Pass



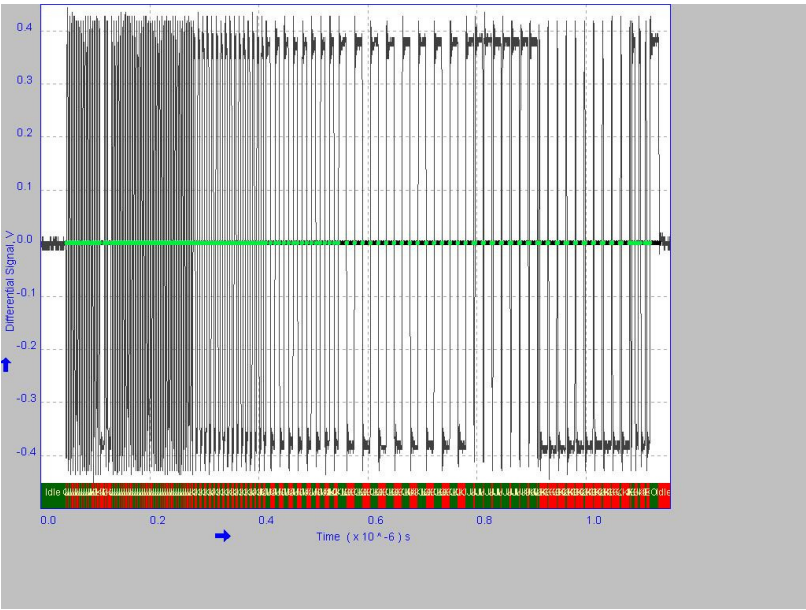
# Signal Quality Test Results in Tek format

Device ID:fsfe\_001

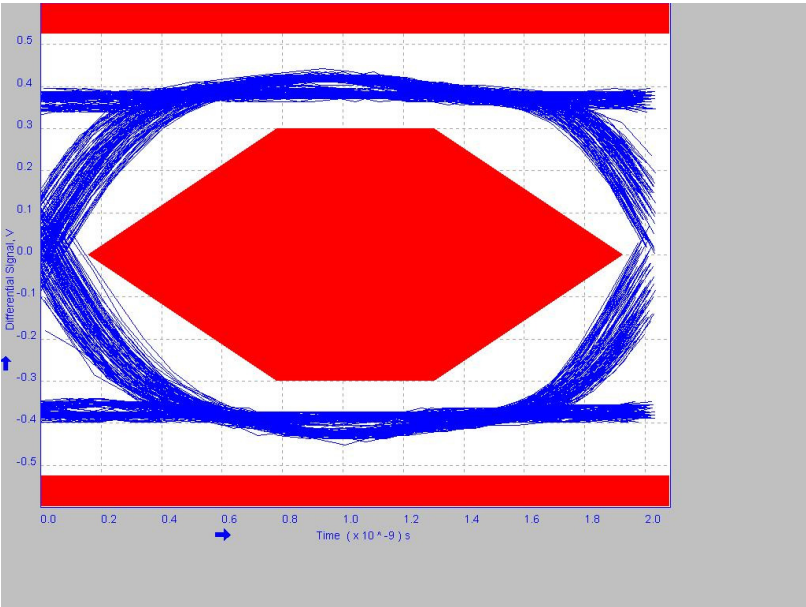
Device Description:High Speed, Near End Device, Up Stream Testing, Tier 1, Dummy Device.

Date: Thu Dec 20 15:00:29 PST 2007

Overall Result:Pass\*



Waveform Plot



Eye Diagram

Results based on USB-IF / Waiver Limits :

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
------------------	---------	---------	------	-------	--------------------	-----	------------	--------

Monotonic Property	-	-	-	-	-	-	0	Pass
Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	459.4871Mbps	499.6538Mbps	479.9329Mbps	0.0000bps	9.160196Mbps	480.1691Mbps	513	Pass
EOP Width	-	-	16.56090ns	-	-	-	1	Pass
EOP Width (Bits)	-	-	7.948123	-	-	-	1	Pass
Rise Time	659.9592ps	803.2581ps	726.3759ps	143.2989ps	42.27301ps	727.5935ps	107	Pass
Fall Time	691.0569ps	826.2003ps	773.4787ps	135.1434ps	27.04750ps	773.9470ps	107	Pass

Monotonicity test is performed on the test limits of 15.0% and 85.0%.

Additional Information :

Consecutive Jitter range : -129.0ps to 148.7ps RMS Jitter 57.44ps

KJ Paired Jitter range : -64.00ps to 54.17ps RMS Jitter 24.27ps

JK Paired Jitter range : -53.36ps to 55.96ps RMS Jitter 24.56ps

\*The Overall Result for this test is **Pass**, because one or more individual status of the measurements is **Pass**. For this test, the recommended configuration for USB2 testing (as per USB-IF) is on Tier 1.



TDSUSB2 software version: 1.9.1

## 8.0 Low Speed Signal Quality Test

### 8.1 Signal Quality Test Results in Tek format

Test Summary	
Unit under test	
Tested S/N	
Test date(s)	12/20/2007
Test location	TiVo, Inc.
Test Engineer	
Conclusion	Pass

Measurement Name	Minimum	Maximum	Mean	pk-pk	Standard Deviation	RMS	Population	Status
------------------	---------	---------	------	-------	--------------------	-----	------------	--------

Eye Diagram Test	-	-	-	-	-	-	-	Pass
Signal Rate	1.492834Mbps	1.508246Mbps	1.500037Mbps	0.0000bps	4.126709kbps	1.499968Mbps	30	Pass
Crossover Voltage	1.667506 V	1.839996 V	1.759122 V	172.4896mV	50.07425mV	1.759804 V	23	Pass
EOP Width	-	-	1.331282us	-	-	-	1	Pass
Consecutive Jitter	-2.160031ns	2.062411ns	0.0000s	4.222442ns	1.266140ns	1.237029ns	22	Pass
Paired JK Jitter	-1.811237ns	3.242755ns	-89.42197ps	5.053992ns	1.580994ns	1.502526ns	10	Pass
Paired KJ Jitter	-2.852340ns	1.033740ns	-87.18670ps	3.886080ns	1.074808ns	1.023373ns	10	Pass
Rise Time	98.18807ns	105.9743ns	102.3523ns	7.786188ns	2.327476ns	102.3764ns	11	Pass
Fall Time	98.40769ns	106.4920ns	103.5255ns	8.084334ns	2.435308ns	103.5515ns	11	Pass

\* The Overall Result for this test is **Pass**, because individual status of the measurements is **Pass** and it is performed on Tier 6 (as per USB-IF).



TDSUSB2 software version: 1.9.1

## 9.0 High Speed Chirp Test

### 9.1 High Speed Chirp-Test Results in Tek format

Test Summary	
Unit under test	
Tested S/N	
Test date(s)	12/20/2007
Test location	TiVo, Inc.
Test Engineer	
Conclusion	Pass

## Chirp-Test Results in Tek format

**Device ID:**fsfe\_001

**Device Description:**High Speed , Host EL\_33,EL\_34 Testing , Dummy Device.

**Date:**Thu Dec 20 17:42:48 PST 2007

**Chirp Test Result:** Pass

Measurement Name	Measurement Value	USB Limits	Status
Chirp Response Time	92.40000uS	Time =100.0000uS	Pass
Chirp-K&J Duration	49.20008uS & 50.80270uS	40.00000uS to 60.00000uS	Pass



*TDSUSB2 software version: 1.9.1*