# IDT™ 89EBP0504UB USB3.0 Evaluation Board Manual

(Evaluation Board: 18-701-000)

March 2011

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## Introduction

The 89HP0504UB 5Gbps Signal Repeater (also referred to as P0504UB in this manual) is a member of the IDT Signal Integrity Products family. It is a 4-channel repeater that supports 2 bidirectional USB3.0 channel. The main function of a signal repeater is to extend the reach of USB3.0 signals over a board trace or a cable far beyond that which can be achieved natively by a USB3.0 device.

The 89EBP0504UB (EBP0504UB) evaluation board provides an evaluation platform for the P0504UB signal repeater. The evaluation board provided by IDT can be configured to test the functionality of the P0504UB device in a wide variety of system topologies.

## Board Features

### Hardware

- P0504UB Signal Repeater for USB 3.0
  - Single P0504UB device enabling 2 bidirectional USB3.0 channels on a single board
  - USB3.0 connector on each side of the board allows USB3.0 cables plugs into Host and Target devices.
  - Additional USB-SMA breakout cards can be provided upon request for testing purposes.
- Numerous user-selectable configurations set using onboard jumpers and DIP-switches
  - Channel selection
  - Device power down
  - Receiver equalization
  - Transmitter swing

## Revision History

March 18, 2011: Initial publication of evaluation board manual.

Notes

# Installation of the EBP0504UB USB3.0 Evaluation Board

Notes

## EBP0504UB Installation

This chapter discusses the steps required to configure and install the EBP0504UB evaluation board. All available DIP switches and jumper configurations are explained in detail.

The primary installation steps are:

1. Configure jumper/switch options suitable for the evaluation or application requirements.
2. Connect the USB3.0 cable between the Host and EBP0504UB. Connect the USB3.0 cable between the EBP0504UB and the USB3.0 device, such as an external USB3.0 storage drive.

The EBP0504UB board is typically shipped with all jumpers and switches configured to their default settings. In most cases, the board does not require further modification or setup.

For technical support, please visit the IDT website and fill out the Technical Support Request form at http://www.idt.com/?app=TechSupport&prodFamily=signal%20integrity%20products.

## Hardware Description

The IDT 89HP0504UB is a 5Gbps Repeater IC that reconditions high-speed serial data streams. The 89HP0504UB contains four half-duplex data lanes, where each half-duplex lane consists of a differential equalizer, as well as a transmit driver that includes de-emphasis.

The EBP0504UB consists of single P0504UB device.

Basic requirements for the board to run are:

- USB3.0 Host Controller.
- USB3.0 Target.

### External Power Source

External power is supplied to the EBP0504UB board through a 15-pin SATA power connector (J7). The external power supply provides +3.3V to the EBP0504UB as described in Table 2.1. The +12V and +5V are unused. Please do not use adapters that can convert a 4-pin Molex connector to a SATA power connector because the 4-pin Molex connectors do not provide +3.3V power, these adapters provide only +5V and +12V power and leave the +3.3V lines unconnected.

| Pin | Signal |
|---|---|
| 1 | 3.3V |
| 2 | 3.3V |
| 3 | 3.3V |
| 4 | GND |
| 5 | GND |
| 6 | GND |
| 7 | 5V |
| 8 | 5V |

Table 2.1 External Power Connector — J7 (Part 1 of 2)

Notes

| Pin | Signal |
|---|---|
| 9 | 5V |
| 10 | GND |
| 11 | SPIN-UP |
| 12 | GND |
| 13 | 12V |
| 14 | 12V |
| 15 | 12V |

Table 2.1 External Power Connector — J7 (Part 2 of 2)

### 1.2V Voltage Regulator

A 3.3V to 1.2V voltage regulator (VR2) provides the 1.2V supply voltage (VDD) to the P0504UB.

## Boot Configuration Vector

A boot configuration vector consisting of the signals listed in Table 2.2 is sampled by the P0504UB during power-on. The boot configuration vector defines the essential parameters for repeater operation and is set using DIP switches S2 as defined in Table 2.2.

| Signal | Description |
|---|---|
| S2[0]: CHSEL | Channel Transfer Mode.<br>CHSEL — Setting<br>VSS — Multi-cast mode<br>Open — Direct-connect mode (default)<br>VDD — Cross-connect mode |
| S2[1]: A[0]RXEQ<br>S2[2]: A[1]RXEQ | Receiver Equalization.<br>Programming of channel A0 via pin is shown below. To program channel A1, use pin for that channel.<br>A0RXEQ — Setting<br>VSS — 2dB<br>Open — 6dB (Default)<br>VDD — 14dB |
| S2[3]: B[0]RXEQ<br>S2[4]: B[1]RXEQ | Receiver Equalization.<br>Programming of channel B0 via pin is shown below. To program channel B1, use pin for that channel.<br>B0RXEQ — Setting<br>VSS — 2dB<br>Open — 6dB (Default)<br>VDD — 14dB |

Table 2.2 Boot Configuration Vector Signals (Part 1 of 2)

Notes

| Signal | Description |
|---|---|
| S2[5]: A[0]TXSW<br>S2[6]: A[1]TXSW | Transmitter Voltage Swing (pk-pk).<br>Programming of channel A0 via pin is shown below. To program channel A1, use pin for that channel.<br>A0TXSW — Swing — De-Emphasis<br>VSS — 0.5Vdiff-pkpk — 0dB<br>Open — 0.8Vdiff-pkpk (Default) — -3.5dB<br>VDD — 0.95Vdiff-pkpk — -6.5dB |
| S2[7]: B[0]TXSW<br>S2[8]: B[1]TXSW | Transmitter Voltage Swing (pk-pk).<br>Programming of channel B0 via pin is shown below. To program channel B1, use pin for that channel.<br>B0TXSW — Swing — De-Emphasis<br>VSS — 0.5Vdiff-pkpk — 0dB<br>Open — 0.8Vdiff-pkpk (Default) — -3.5dB<br>VDD — 0.95Vdiff-pkpk — -6.5dB |
| S2[9]: PDB | Power-down Enable.<br>PDB — Setting<br>VSS — Powerdown IC. RX terminations are in Hi-Z, TX is disabled<br>VDD — Normal operation (internal 11K ohm minimum pull-up applied) |

Table 2.2 Boot Configuration Vector Signals (Part 2 of 2)

For the pin list in Table 2.2, two 3-level input pins will have four bit outputs. The 3-level input can be mapped to hexadecimal notation as shown in Table 2.3.

| Example [1:0] Input Voltage (VSS, VMI,VDD) | Example[3:0] Hexadecimal Notation |
|---|---|
| VSS, VSS | 4'h0 (0000) |
| VSS, VMI | 4'h1 (0001) |
| VSS, VDD | 4'h3 (0011) |
| VMI, VSS | 4'h4 (0100) |
| VMI, VMI | 4'h5 (0101) |
| VMI, VDD | 4'h7 (0111) |
| VDD, VSS | 4'hC (1100) |
| VDD, VMI | 4'hD (1101) |
| VDD, VDD | 4'hF (1111) |

Table 2.3 Two Bit 3-Level Input Hexadecimal Notation

Notes

## LEDs

There are LED indicators on the EBP0504UB which convey status feedback. A description of each is provided in Table 2.4.

| Location | Color | Definition |
|---|---|---|
| DS3 | Green | 3.3V Power Indicator |
| DS4 | Green | 1.2V Power Indicator |

Table 2.4 LED Indicators

## USB 3.0 Connectors

The P0504UB repeater has no special orientation requirements with respect to the host controller or target device. USB connectors J18, J19, J20, and J21 can be attached via cable to either the host or target device. The channel/trace length between the P0504UB and J19 is 18 inches which is intended to model a typical PC environment. It is important, however, to properly set the receiver equalization and transmitter settings based on the cable/channel length being used.

Notes

## EBP0504UB Board Figures

The top and bottom views of the board are shown in Figures 2.1 and 2.2 respectively.

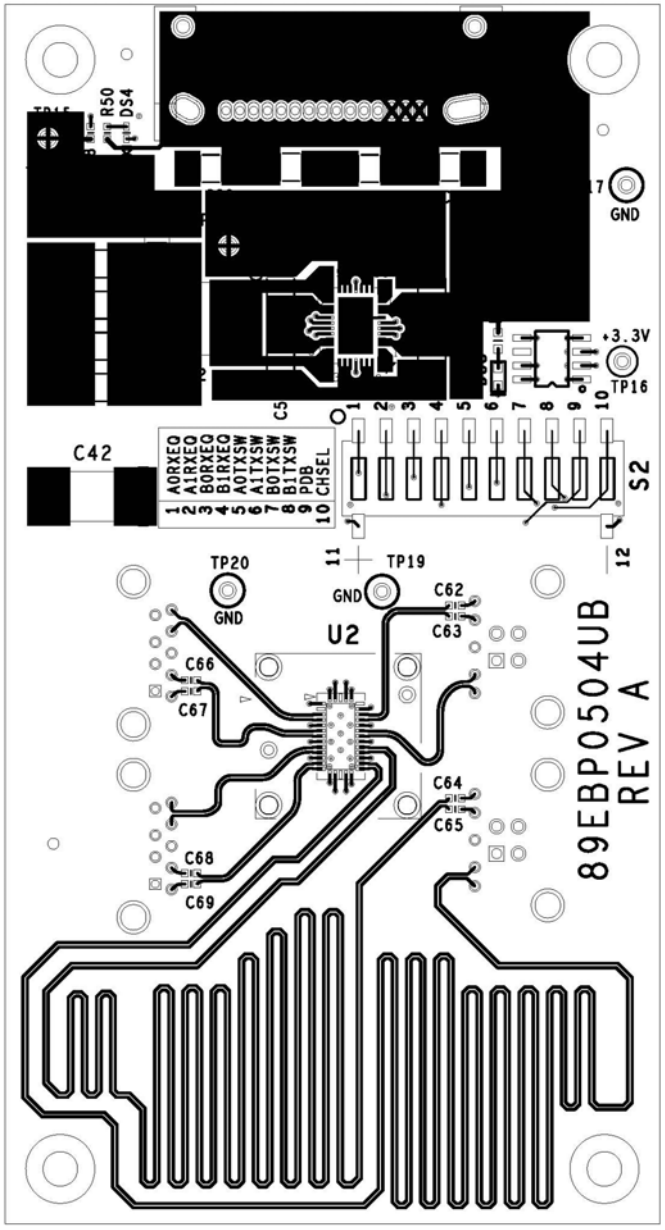


Figure 2.1 EBP0504UB Board Topside Figure

Notes

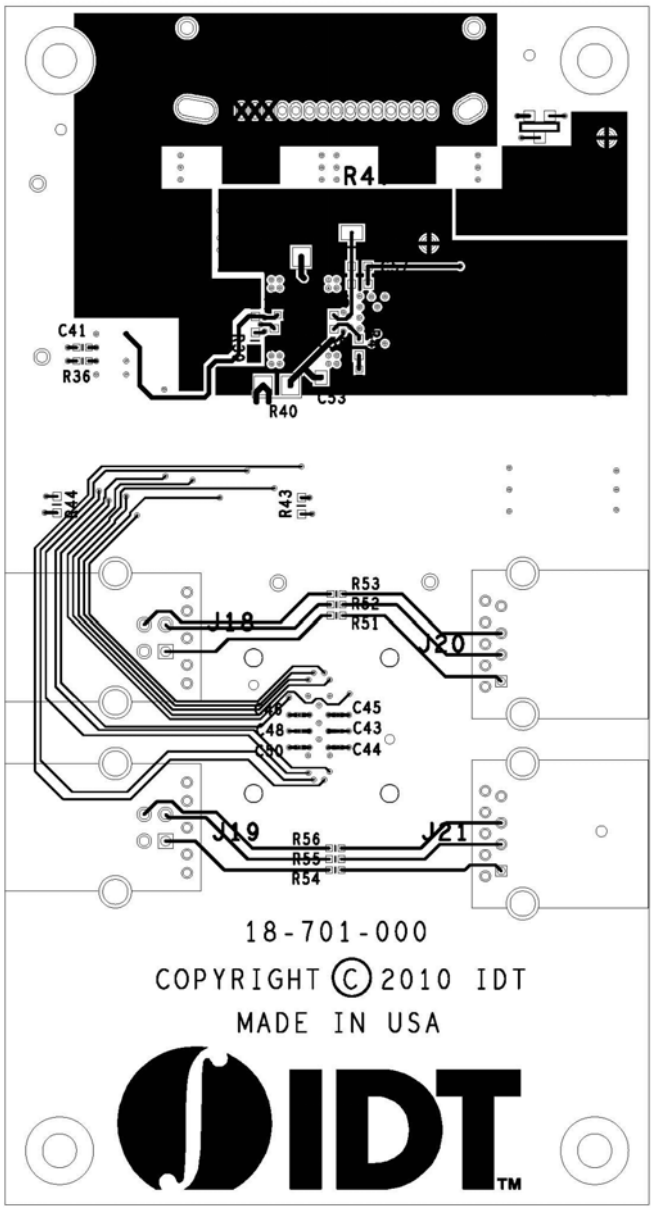


Figure 2.2 EBP0504UB Board Bottom Figure

# Schematics

Notes

## Schematics

| REVISIONS | | | | |
|---|---|---|---|---|
| DCN | REV | DESCRIPTION | DATE | CHANGE BY |
| | A | INITIAL RELEASE | 2010-06-30 | K. LEUNG |
| | | | | |
| | | | | |
| | | | | |

# IDT 89HP0504UB USB 3.0 EVALUATION BOARD

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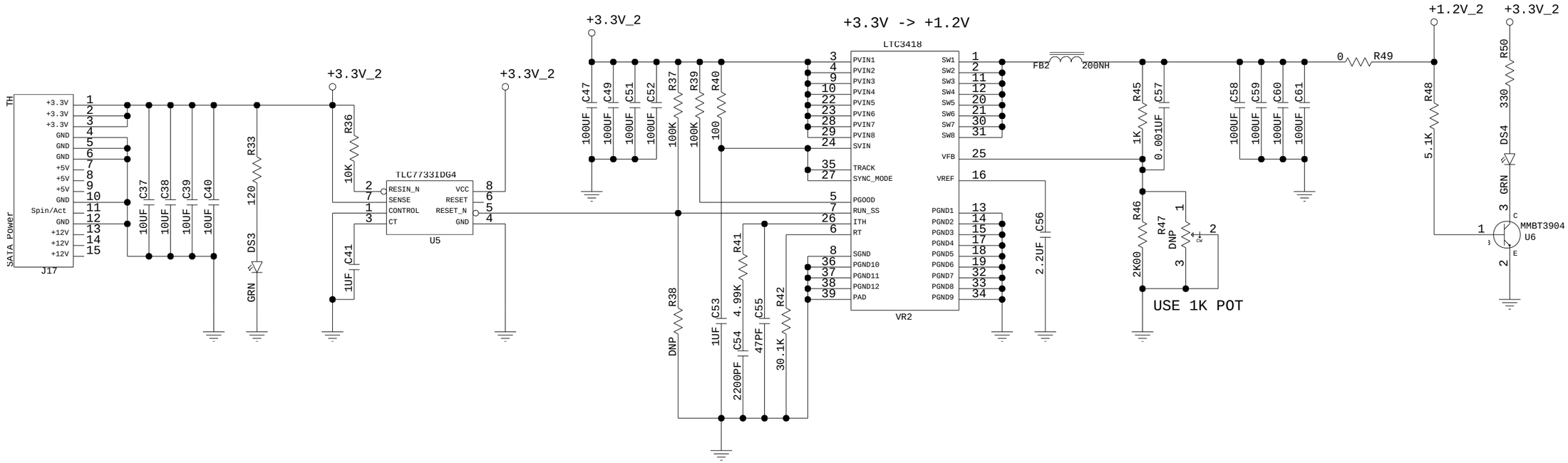
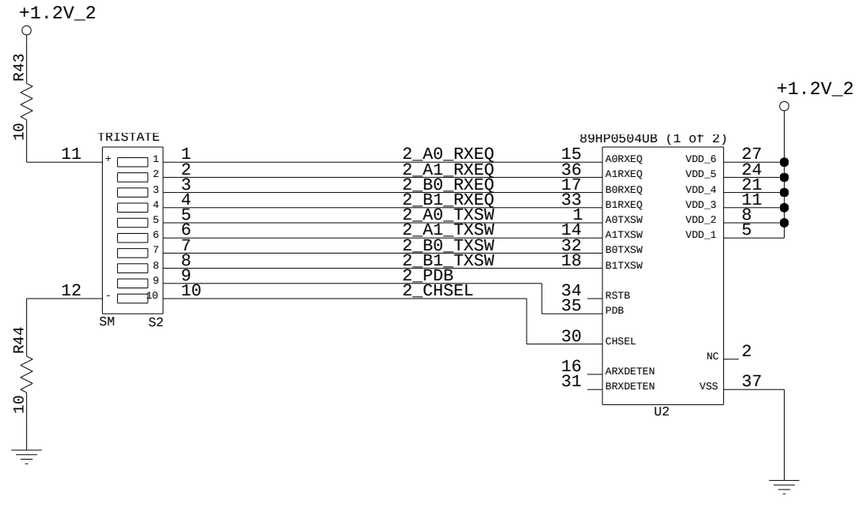
TITLE: 89EBP0504UB Eval Board

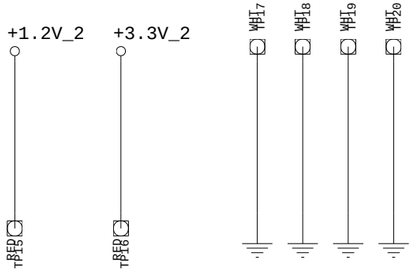
| SIZE | DRAWING NO. | FAB P/N | REV. |
|---|---|---|---|
| B | P0504U-USB3-EB-001 | 18-701-000 | A |

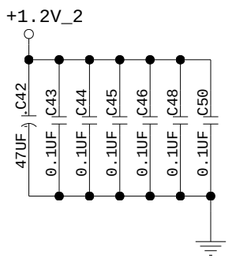
| AUTHOR | CHECKED BY |
|---|---|
| K. Leung | D. Huang |

Wed Jun 30 01:35:38 2010

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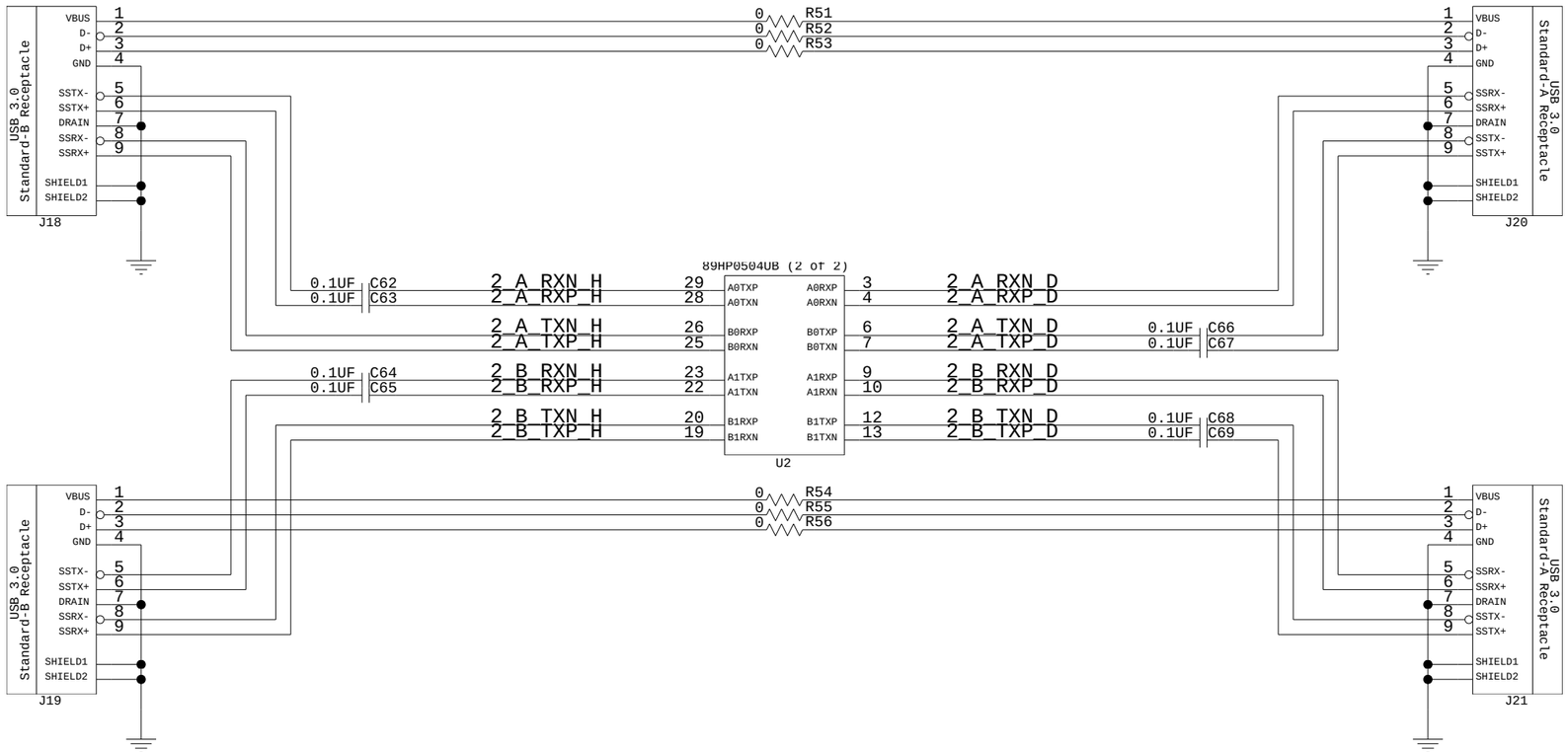
TITLE 89EBP0504U(B) Eval Board

# 89HP0504UB, POWER

| SIZE | DRAWING NO. | FAB P/N | REV. |
|---|---|---|---|
| B | P0504U-USB3-EB-001 | 18-701-000 | A |

| AUTHOR | CHECKED BY |
|---|---|
| K. Leung | D. Huang |

Wed Jun 30 01:37:39 2010 SHEET 5 OF 7




18" TRACE BETWEEN J19 AND U2

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TITLE 89EBP0504U(B) Eval Board

# 89HP0504UB, USB CONNECTORS

| SIZE | DRAWING NO. | FAB P/N | REV. |
|---|---|---|---|
| B | P0504U-USB3-EB-001 | 18-701-000 | A |

| AUTHOR | CHECKED BY |
|---|---|
| K. Leung | D. Huang |

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