# TUSB544 Active Cable EVM

The TUSB544 is a *Video Electronics Standards Association* (VESA) USB Type-C™ *Alternate Mode* (Alt Mode) re-driving switch supporting data rates up to 5Gbps for a downstream facing port (Host) or upstream facing port (Device). This guide describes how to bring up the EVM and includes schematics that can be used as reference for the cable implementations with the TUSB544 device.

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# 1 TUSB544RNQEVM

Figure 1 illustrates the *TUSB544 Active Cable* EVM.

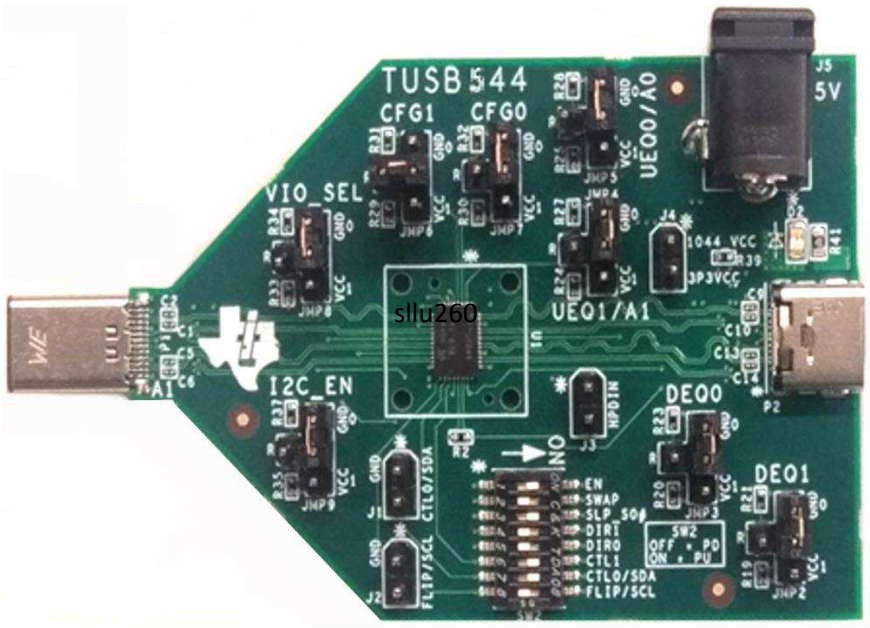


**Figure 1. TUSB544 EVM**

The TUSB544RNQEVM can be used with a DFP or UFP USB Type-C source or device to evaluate the USB Type-C implementation. Figure 2 is a typical test set-up.

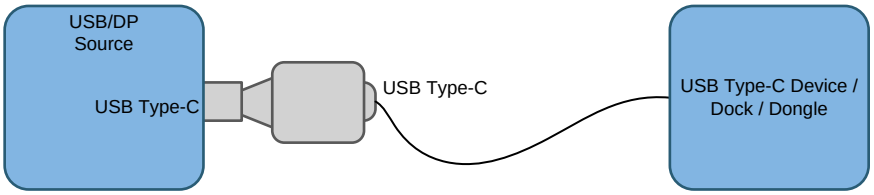


**Figure 2. TUSB544 System Example**


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# 2 TUSB544RNQEVM Configuration

This section provides the configuration options available in the TUSB544RNQEVM.

## 2.1 TUSB544 EVM Default Jumper and Switch Configuration

The following headers are provided for TUSB544 configuration by default, configuration settings may need to be optimized depending on the amount of loss of each channel in the system.

**Table 1. TUSB544 Configuration Pins**

| Reference Designator | JMP Control | Configuration |
|---|---|---|
| J1 | CTL0/SDA | No Connect |
| J2 | FLIP/SCL | No Connect |
| J3 | HPDIN | No Connect |
| J4 | VCC Isolate | No Connect |
| JMP2 | DEQ1 | SHUNT on pin 1-2 (GND) |
| JMP3 | DEQ0 | SHUNT on pin 1-2 (GND) |
| JMP4 | UEQ1/A1 | SHUNT on pin 1-2 (GND) |
| JMP5 | UEQ0/A0 | SHUNT on pin 1-2 (GND) |
| JMP6 | CFG1 | SHUNT on pin 2–4 (20K PD) |
| JMP7 | CFG0 | SHUNT on pin 1-2 (GND) |
| JMP8 | VIO_SEL | SHUNT on pin 1-2 (GND) |
| JMP9 | I2C_EN | SHUNT on pin 1-2 (GND) |

**Table 2. Switch Configuration**

| SW1 Position | Control Signal | Configuration |
|---|---|---|
| 1 | EN | ON |
| 2 | SWAP | OFF |
| 3 | SLP_S0# | ON |
| 4 | DIR1 | OFF |
| 5 | DIR0 | OFF |
| 6 | CTL1 | ON |
| 7 | CTL0/SDA | ON |
| 8 | FLIP/SCL | OFF |

## 2.2 TUSB544 EQ Control

Each of the TUSB544 receiver lanes has individual controls for receiver equalization. Table 3 through Table 5 detail the gain values for each available combination for Downstream, Upstream and all DisplayPort configurations.

**Table 3. Config Pin Level Definitions**

| Level | Settings |
|---|---|
| 0 | Option 1: Tie 1 kΩ, 5% to GND<br>Option 2: Tie directly to GND |
| R | Tie 20 kΩ, 5% to GND |
| F | Float (leave pin open) |
| 1 | Option 1: Tie 1 kΩ, 5% to VCC<br>Option 2: Tie directly to VCC |


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**Table 4. USB 3.1 EQ Settings**

| USB3.1 Downstream Facing Ports | | | | USB3.1 Upstream Facing Port | | |
|---|---|---|---|---|---|---|
| DEQ1 Pin Level | DEQ0 Pin Level | EQ Gain at 5 GHz (dB) | | UEQ1 Pin Level | UEQ0 Pin Level | EQ Gain at 5 GHz (dB) |
| 0 | 0 | 0 | | 0 | 0 | 0 |
| 0 | R | 1 | | 0 | R | 1 |
| 0 | F | 2 | | 0 | F | 2 |
| 0 | 1 | 3 | | 0 | 1 | 3 |
| R | 0 | 4 | | R | 0 | 4 |
| R | R | 5 | | R | R | 5 |
| R | F | 6 | | R | F | 6 |
| R | 1 | 7 | | R | 1 | 7 |
| F | 0 | 8 | | F | 0 | 8 |
| F | R | 9 | | F | R | 9 |
| F | F | 10 | | F | F | 10 |
| F | 1 | 11 | | F | 1 | 11 |
| 1 | 0 | 12 | | 1 | 0 | 12 |
| 1 | R | 13 | | 1 | R | 13 |
| 1 | F | 14 | | 1 | F | 14 |
| 1 | 1 | 15 | | 1 | 1 | 15 |

**Table 5. VOD Linear Range and DC Gain**

| VOD Linear Range and DC Gain | | | | | | |
|---|---|---|---|---|---|---|
| Setting | CFG1 Pin Level | CFG0 Pin Level | DS DC Gain (dB) | US DC Gain (dB) | DS VOD (mVpp) | US VOD (mVpp) |
| 1 | 0 | 0 | +1 | 0 | 900 | 900 |
| 2 | 0 | R | 0 | +1 | 900 | 900 |
| 3 | 0 | F | 0 | 0 | 900 | 900 |
| 4 | 0 | 1 | +1 | +1 | 900 | 900 |
| 5 | R | 0 | 0 | 0 | 1100 | 1100 |
| 6 | R | R | +1 | 0 | 1100 | 1100 |
| 7 | R | F | 0 | +1 | 1100 | 1100 |
| 8 | R | 1 | +2 | +2 | 1100 | 1100 |
| 9 | F | 0 | –1 | –1 | 1300 | 1300 |
| 10 | F | R | +2.5 | +2.5 | 1300 | 1300 |
| 11 | F | F | 0 | 0 | 1300 | 1300 |
| 12 | F | 1 | +1 | +1 | 1300 | 1300 |
| 13 | 1 | 0 | –1 | 0 | 1300 | 1300 |
| 14 | 1 | R | 0 | –1 | 1300 | 1300 |
| 15 | 1 | F | 0 | +1 | 1300 | 1300 |
| 16 | 1 | 1 | +1 | 0 | 1300 | 1300 |

## 2.3 Power

The EVM is designed to operate off of the VBUS from a USB host connected via the USB Type-C plug connector. Apply no external power via J4 unless standalone operation is desired.

If testing DisplayPort only, or if bypassing VBUS power, the EVM must be powered via J4 (5 V, 1-A input).


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## 3 TUSB544RNQEVM Schematics

Figure 3 through Figure 6 illustrate the EVM block diagram and schematics.

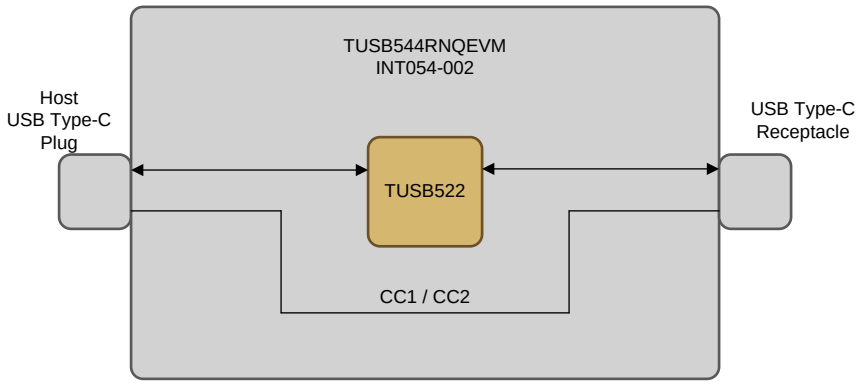


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**Figure 3. TUSB544RNQEVM Block Diagram**


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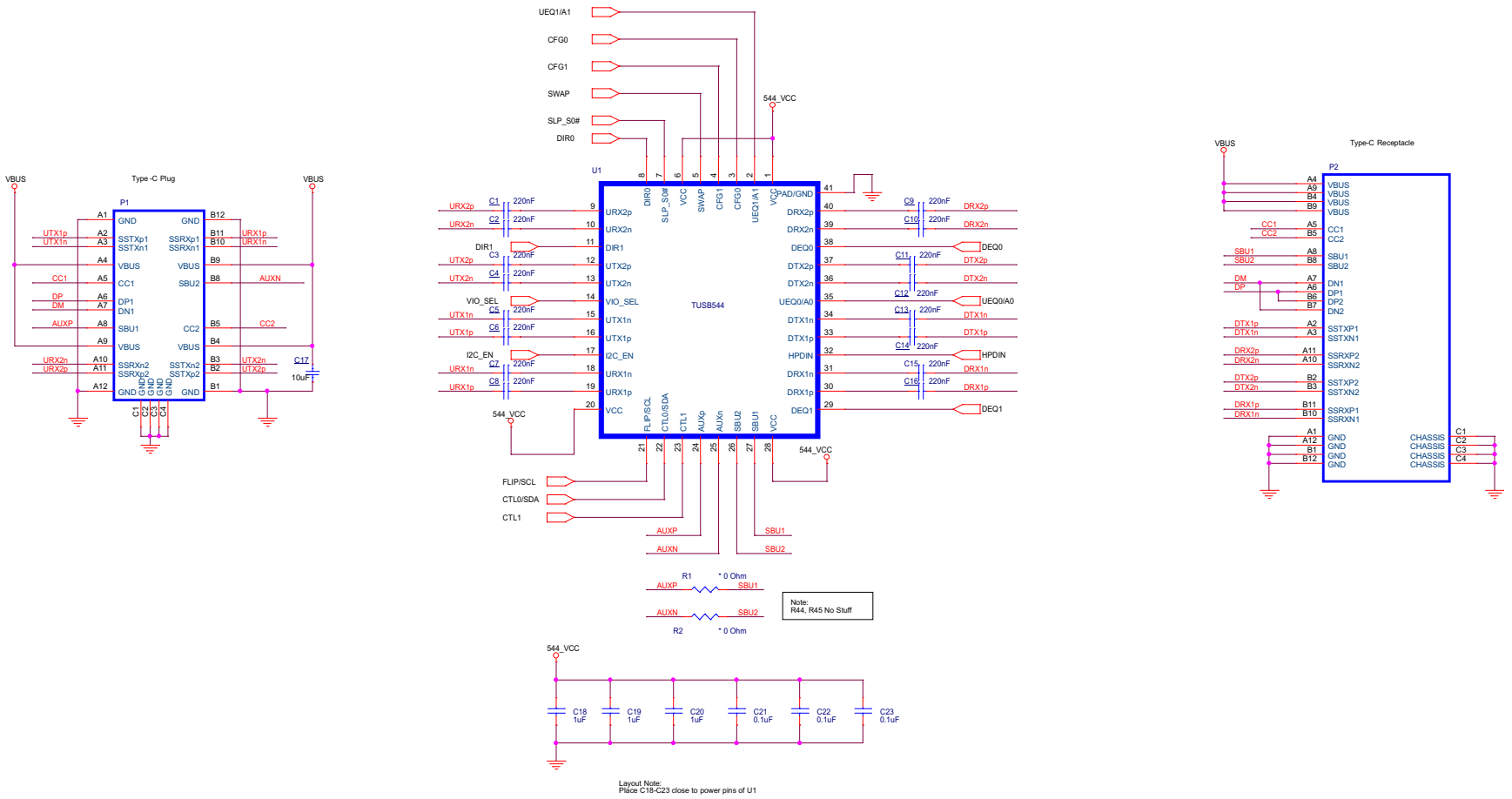


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**Figure 4. TUSB544RNQEVM Schematic (Page 1)**



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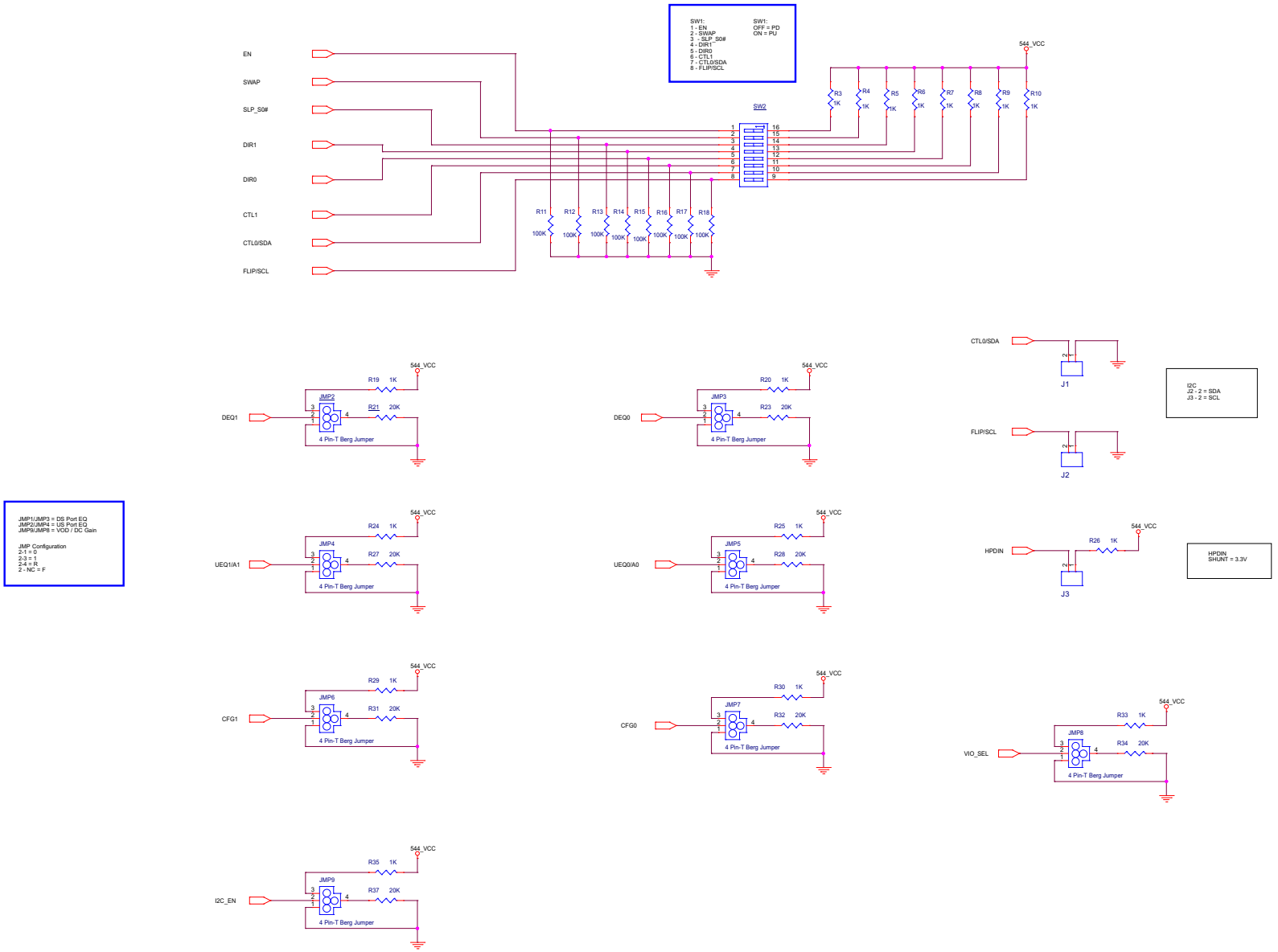


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**Figure 5. TUSB544RNQEVM Schematic (Page 2)**



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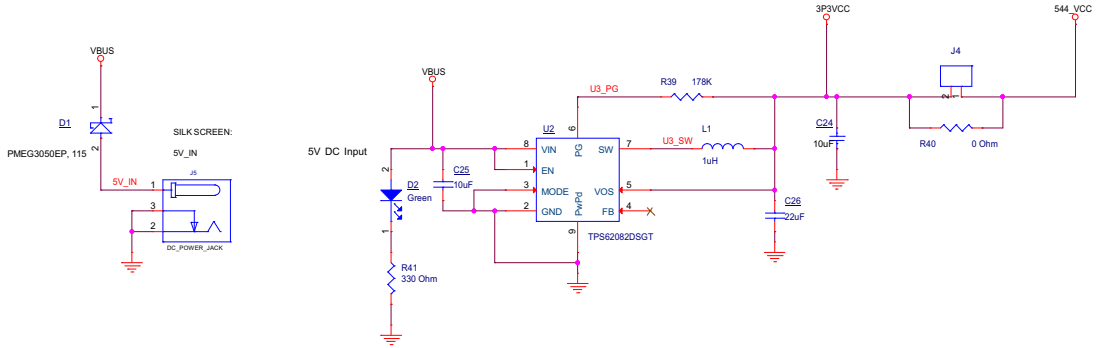


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**Figure 6. TUSB544RNQEVM Schematic (Page 3)**



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# 4 Bill of Materials

Table 6 lists the TUSB544RNQEVM bill of materials (BOM).

**Table 6. TUSB544 Bill of Materials**

| Item | Quantity | Reference | Value |
|---|---|---|---|
| 1 | 16 | C1,C2,C3,C4,C5,C6,C7,C8,C9,C10,C11,C12,C13,C14,C15,C16 | 220nF |
| 2 | 3 | C17,C24,C25 | 10uF |
| 3 | 3 | C18,C19,C20 | 1uF |
| 4 | 3 | C21,C22,C23 | 0.1uF |
| 5 | 1 | C26 | 22uF |
| 6 | 1 | D1 | SCHOTTKY |
| 7 | 1 | D2 | Green |
| 8 | 8 | JMP2,JMP3,JMP4,JMP5,JMP6,JMP7,JMP8,JMP9 | 4 Pin-T Berg Jumper |
| 9 | 4 | J1,J2,J3,J4 | CON02 |
| 10 | 1 | J5 | DC_PWR_JACK |
| 11 | 1 | L1 | 1uH |
| 12 | 1 | P1 | Wurth 632712000021 |
| 13 | 1 | P2 | JAE DX07S024JJ2 |
| 14 | 2 | R1,R2 | 0 Ohm |
| 15 | 17 | R3,R4,R5,R6,R7,R8,R9,R10,R19,R20,R24,R25,R26,R29,R30,R33,R35 | 1K |
| 16 | 8 | R11,R12,R13,R14,R15,R16,R17,R18 | 100K |
| 17 | 8 | R21,R23,R27,R28,R31,R32,R34,R37 | 20K |
| 18 | 1 | R39 | 178K |
| 19 | 1 | R40 | 0 Ohm |
| 20 | 1 | R41 | 330 Ohm |
| 21 | 1 | SW2 | 8-POS 50-MIL SMT |
| 22 | 1 | U1 | TUSB544 |
| 23 | 1 | U2 | TPS62082DSGT |


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- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

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3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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