TEXAS INSTRUMENTS

TUSB3210 Keyboard Evaluation Board

User's Guide

June 2003

MSP USB

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EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 4 V to 6 V and the output voltage range of 3 V and 3.6 V.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than 50°C. The EVM is designed to operate properly with certain components above 50°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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Preface

Read This First

About This Manual

This user's guide describes the setup and operation of the TUSB3210 keyboard evaluation board. There are two revisions of the evaluation board: Rev 2 and Rev 3. They will be used as designators to differentiate between the PCBs. Familiarity with universal serial bus (USB) protocol and common laboratory testing equipment is required and assumed throughout this user's guide.

How to Use This Manual

This document contains the following chapters:

- Chapter 1—Hardware and Software Required
- Chapter 2—EVM Operation

Related Documentation From Texas Instruments

- TUSB3210 Literature No. SLLS466
- TPS76333 Literature No. SLVS181
- TPS2042 Literature No. SLVS173
- MAX232 Literature No. SLLS047

These files are available from Texas Instruments and can be downloaded from www.ti.com.

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Chapter 1

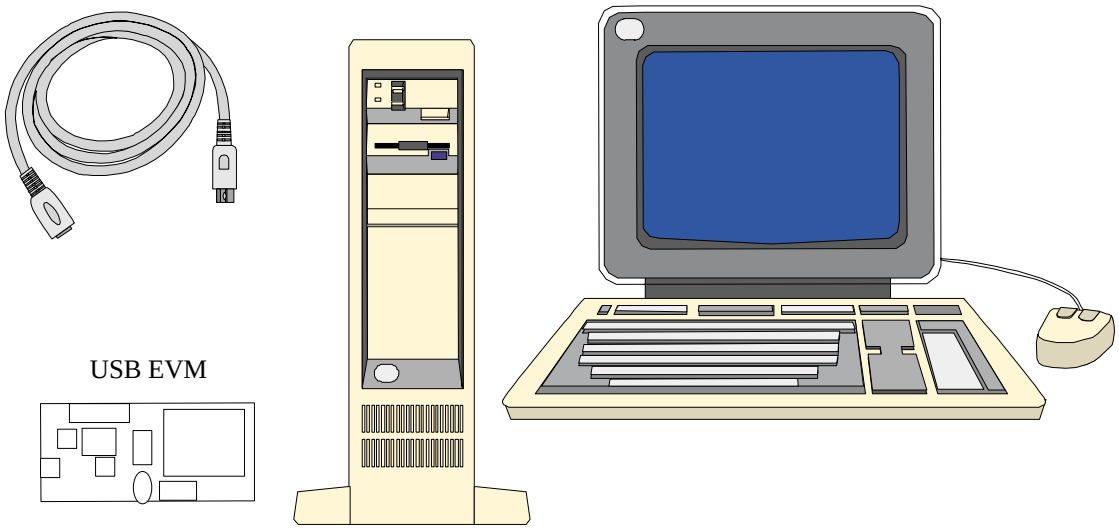
Hardware and Software Required

The TUSB3210 keyboard EVM is designed for use with a personal computer running a USB-enabled operating system. The PC must be USB 1.1 specification compliant. This implies that the BIOS, chipsets, and operating system are all USB 1.1 specification compliant. If the BIOS is not specification compliant, the system may not boot when USB devices are connected at power up and the EVM may not function in DOS mode. Note that an ac/dc power supply is optional equipment (but included) since the EVM functions in bus-powered mode.

Topic **Page**

1.1 Equipment

Figure 1–1. TUSB3210 Evaluation Hardware Equipment



1.2 Hardware Overview

The TUSB3210 keyboard EVM hardware platform is four inches wide by eight inches long. Throughout this document, text inside of parenthesis (ex.) denotes reference designators found on the TUSB3210 keyboard EVM. See Figure 1–2 for a photograph of the EVM. All jumpers and jumper blocks are installed with the factory settings. See Table 2–2, *Jumpers and Switches*, for a description of settings, and then make any required adjustments before using the EVM.

The TUSB3210 keyboard EVM is designed to allow great flexibility in evaluation while being very easy and practical to use. The EVM is designed to run on a 12-MHz crystal and uses an I^2C EEPROM. The EVM is set up for bus-powered operation with the use of a voltage regulator. The UART port and LEDs (D7 and D8) are disabled.

The firmware installed at the factory in the EEPROM allows switches S1–S9 to function as digits 1–9, and switches S10 through S26 to function as characters A–Z, very similar to a QWERTY keyboard. This is a reference firmware and its source code is available to developers. The RS-232 port is available for monitoring 8052 MCU activity. The port uses a one-to-one cable and does not function properly if a null-modem cable is used.

Several test points have been added to the EVM for probing. The upstream B-type connector has test points on the differential-pair lines. The I^2C port can also be probed on the EEPROM.

Carefully review all setting changes prior to powering the EVM, as improper use could result in damage to some of the EVM components.

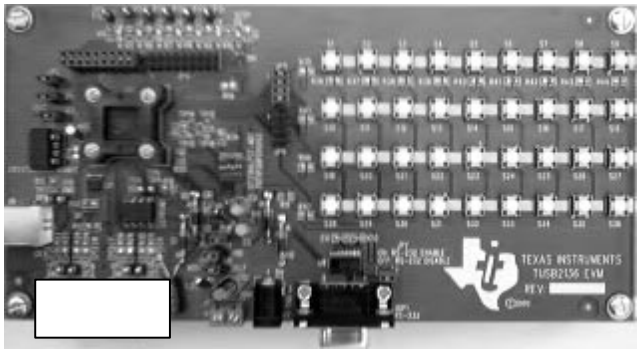
Of the 32 GPIOs, 26 have break out connectors and it is possible to build a cable to interface to other hardware for evaluation instead of using the button

array provided. Users are responsible for developing their own application firmware for the target hardware device. Six LEDs provide quick feedback during firmware debugging or for status information. One LED (D9) is fixed to provide power and suspend status of the TUSB3210 device. A USB cable must be plugged into the hub of the PC and connected to the TUSB3210 EVM type-B connector (U6).

There are two versions of the EVM board, Rev. 2 and Rev. 3. Owners of the Rev. 2 board must note that the board has been modified by changing JP7 power to DVCC_3.3 to correct a reliability issue that exists on the Rev. 2 board.

Figure 1–2. TUSB3210 Evaluation Board

(A)



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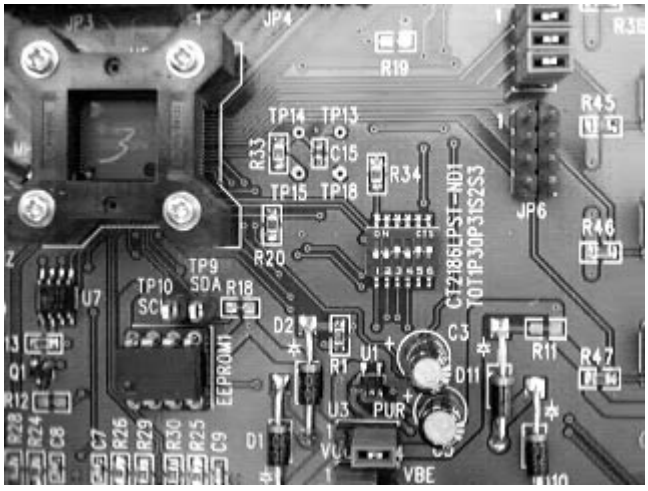


1.3 Bill of Materials of Rev. 2 Board

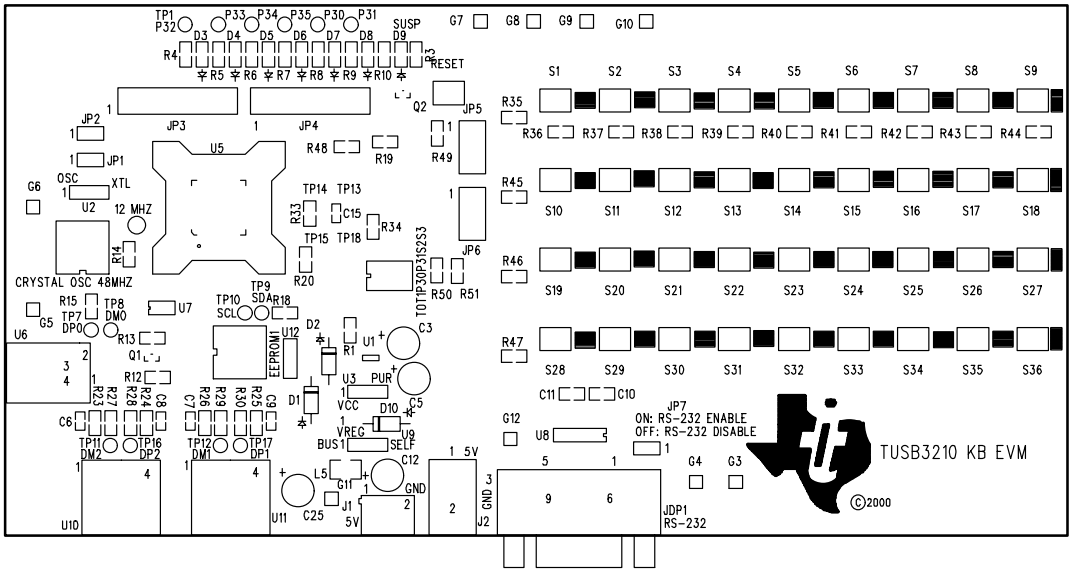
Item	Quantity	Reference	Part
1	2	C1, C2	33 pF
2	1	C3	4.7 µF
3	11	C4, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24	0.1 µF
4	3	C5, C12, C25	10 µF
5	4	C10, C11, C13, C14	1 µF
6	7	D3, D4, D5, D6, D7, D8, D9	Light-emitting diode
7	10	G3, G4, G5, G6, G7, G8, G9, G10, G11, G12	CON1
8	1	JDP1	DB 9-F (1-2-1 cable only)
9	3	JP1, JP2, JP7	Jumper
10	2	JP3, JP4	Header 9×2
11	2	JP5, JP6	Header 4×2
12	1	J1	Terminal block
13	1	J2	AC adaptor 5 Vdc
14	2	L6, L5	Ferrite
15	1	PROM1	Dip socket
16	1	Q1	NPN transistor, 2N2222A
17	1	Q2	PNP transistor
18	1	RESET	Pushbutton switch
19	6	R1, R12, R14, R18, R19, R48	Resistor, 0 Ω
20	2	R2, R23	Resistor, 100 kΩ
21	8	R3, R4, R5, R6, R7, R8, R9, R10	Resistor, 510 Ω
22	1	R13	Resistor, 10 kΩ
23	1	R15	Resistor, 1.5 kΩ
24	2	R17, R16	Resistor, 30 Ω
25	2	R20, R33	Resistor, 200 kΩ
26	3	R21, R22, R34	Resistor, 1 kΩ
27	2	R32, R31	Resistor, 20 kΩ
28	13	R35, R36, R37, R38, R39, R40, R41, R42, R43, R44, R45, R46, R47	Resistor, 50 kΩ
29	1	R49	Resistor, 10 Ω
30	2	R51, R50	Resistor, 30 kΩ
31	1	SW1	Dip switch
32	1	S1	Key switch (P8007S-ND)
33	35	S2, S3, S4, S5, S6, S7, S8, S9, S10, S11, S12, S13, S14, S15, S16, S17, S18, S19, S20, S21, S22, S23, S24, S25, S26, S27, S28, S29, S30, S31, S32, S33, S34, S35, S36	Key switch
34	14	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP13, TP14, TP15, TP18	Test point
35	1	U1	TPS76333DBV
36	4	U2, U3, U9, U12	JP(3)
37	1	U5	USB controller, TUSB3210
38	1	U6	Type B USB-shield
39	1	U8	MAX232
40	1	Y1	SE1122-ND
41	1	12 MHz	SE3409-ND

1.4 Bill of Materials of Rev. 3 Board

Item	Quantity	Reference	Part
1	2	C1, C2	33 pF
2	1	C3	4.7 µF
3	10	C4, C16, C17, C18, C19, C20, C21, C22, C23, C24	0.1 µF
4	3	C5, C12, C25	10 µF
5	4	C10, C11, C13, C14	1 µF
6	1	C15	1 µF
7	7	D3, D4, D5, D6, D7, D8, D9	LED
8	10	G3, G4, G5, G6, G7, G8, G9, G10, G11, G12	CON1
9	1	JDP1	DB 9-F (1-2-1 cable only)
10	3	JP1, JP2, JP7	Jumper
11	2	JP3, JP4	Header 9X2
12	2	JP5, JP6	Header 4X2
13	1	J1	Terminal block
14	1	J2	AC adaptor, 5-V DC
15	2	L6, L5	Ferrite
16	1	PROM1	DIP socket
17	1	Q1	2N2222A
18	1	Q2	PNP
19	1	RESET	Switch, pushbutton
20	5	R1, R12, R14, R18, R19	Resistor, 0 Ω
21	1	R2	Resistor, 100 kΩ
22	8	R3, R4, R5, R6, R7, R8, R9, R10	Resistor, 510 Ω
23	1	R13	Resistor, 10 kΩ
24	1	R15	Resistor, 1.5 kΩ
25	2	R17, R16	Resistor, 30 Ω
26	2	R20, R33	Resistor, 200 kΩ
27	3	R21, R22, R34	Resistor, 1 kΩ
29	4	R35, R45, R46, R47	Resistor, 50 kΩ
30	1	R49	Resistor, 10 Ω
31	2	R51, R50	Resistor, 30 kΩ
32	1	R52	Resistor, 100 kΩ
33	1	SW1	DIP switch
34	1	S1	Key switch (P8007S-ND)
35	35	S2, S3, S4, S5, S6, S7, S8, S9, S10, S11, S12, S13, S14, S15, S16, S17, S18, S19, S20, S21, S22, S23, S24, S25, S26, S27, S28, S29, S30, S31, S32, S33, S34, S35, S36	Key switch
36	10	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10	Test point R
37	4	TP13, TP14, TP15, TP18	Test point R
38	1	U1	TPS76333DBV
39	4	U2, U3, U9, U12	JP(3)
40	1	U5	TUSB3210
41	1	U6	Type B USB-Shield
42	1	U8	MAX232
43	1	Y1	SE1122-ND

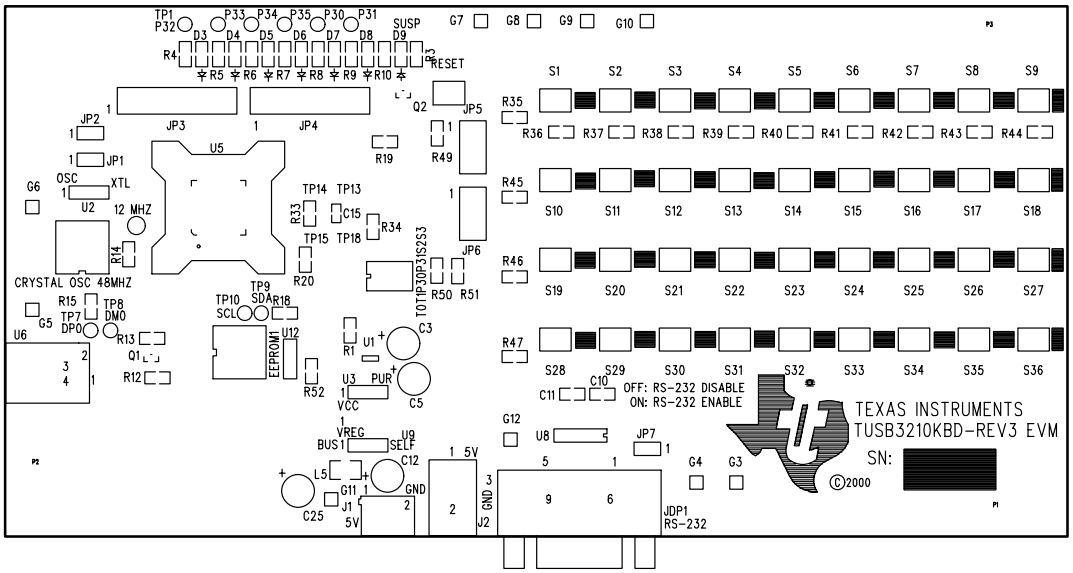
Item	Quantity	Reference	Part
44	1	12MHz	SE3409-ND
45	9	JP3	Jumper
46	4	JP5	Jumper
47	1	U2	Jumper
48	1	U12	Jumper
49	1	U3	Jumper
50	1	U9	Jumper

Figure 1–3. TUSB3210 Keyboard Evaluation Board Rev. 2—Silkscreen



TOP SILKSCREEN

Figure 1–4. TUSB3210 Keyboard Evaluation Board Rev. 3—Silkscreen



TOP SILKSCREEN

1.5 Differences Between Rev 2 and Rev 3

Relative to Rev 2, the following changes have been made to the design to generate Rev 3:

- Removed the resistor between the TEST2 pin of the TUSB3210 and ground
- Changed the connection point of JP7 pin 1 from PWR to DVCC_3.3
- Removed the hub-related components from the board

1.6 Schematic Diagrams

The complete schematic diagrams of the TUSB3210 keyboard evaluation boards are presented at the end of this document.

Chapter 2

EVM Operation

This chapter describes the operation of the 3210EVM.

Topic **Page**

2.1 TUSB3210 Setup

The 3210EVM is designed to allow evaluation of the keyboard controller. The jumpers provide flexibility to configure the EVM to various modes for evaluation purposes. Note that some modes require additional components not included with the EVM kit. The EVM comes in a default configuration that requires no additional components on the EVM. A full description of the TUSB3210 device is specified in the data manual. The PC should be running on a USB 1.1 operating system version or higher. Configure the EVM, when required, based on desired settings specified later in this section. Use a standard USB cable to connect the 3210EVM platform to a downstream port of the PC or to a USB HUB tier. This completes the setup of the 3210EVM.

2.2 Interfaces and USB Port

The EVM uses a standard type-B connector for the upstream port. An I^2C serial interface is provided to access an EEPROM. A UART port is embedded in the microcontroller and may be connected to the RS-232 port on the EVM. See jumper settings for more details. Of the 32 GPIOs, 26 are broken out for possible use in other applications.

2.3 Power Supplies

The TUSB3210 keyboard EVM requires a single positive 5-V supply for operation. There are three options for supplying power to the EVM: a switching 5-V dc power supply plugged into J2, a straight 5-V dc source connected to J1, and 5 V dc supplied by the USB cable. The EVM may fail to operate properly with less power. An onboard low-dropout regulator is used to generate a 3.3-V supply from the 5-V external supply. The red LED (D9) is on when the platform is powered. See also the *Jumpers and Switches* section.

2.4 Light Emitting Diodes (LEDs)

Several onboard LEDs are provided on the EVM for quick and easy evaluation. A set of six green LEDs connected to P3.0 through P3.5 are available. The factory code, provided with the EVM by default, uses only three of the LEDs as keyboard status indicators for CapsLock, ScrollLock, and NumLock. The other three are not used. However, all six may be used for general purposes in any code written for the TUSB2136.

Table 2–1. LED Description

LED	LED Description
D3–D8	Green LED on indicates corresponding GPIO pin is low (when D9 on) Green LED off indicates corresponding GPIO pin is high (when D9 on)
D9	Red LED on indicates that the EVM is powered on and not suspended Red LED off indicates that the EVM is powered off or suspended

2.5 Jumpers and Switches

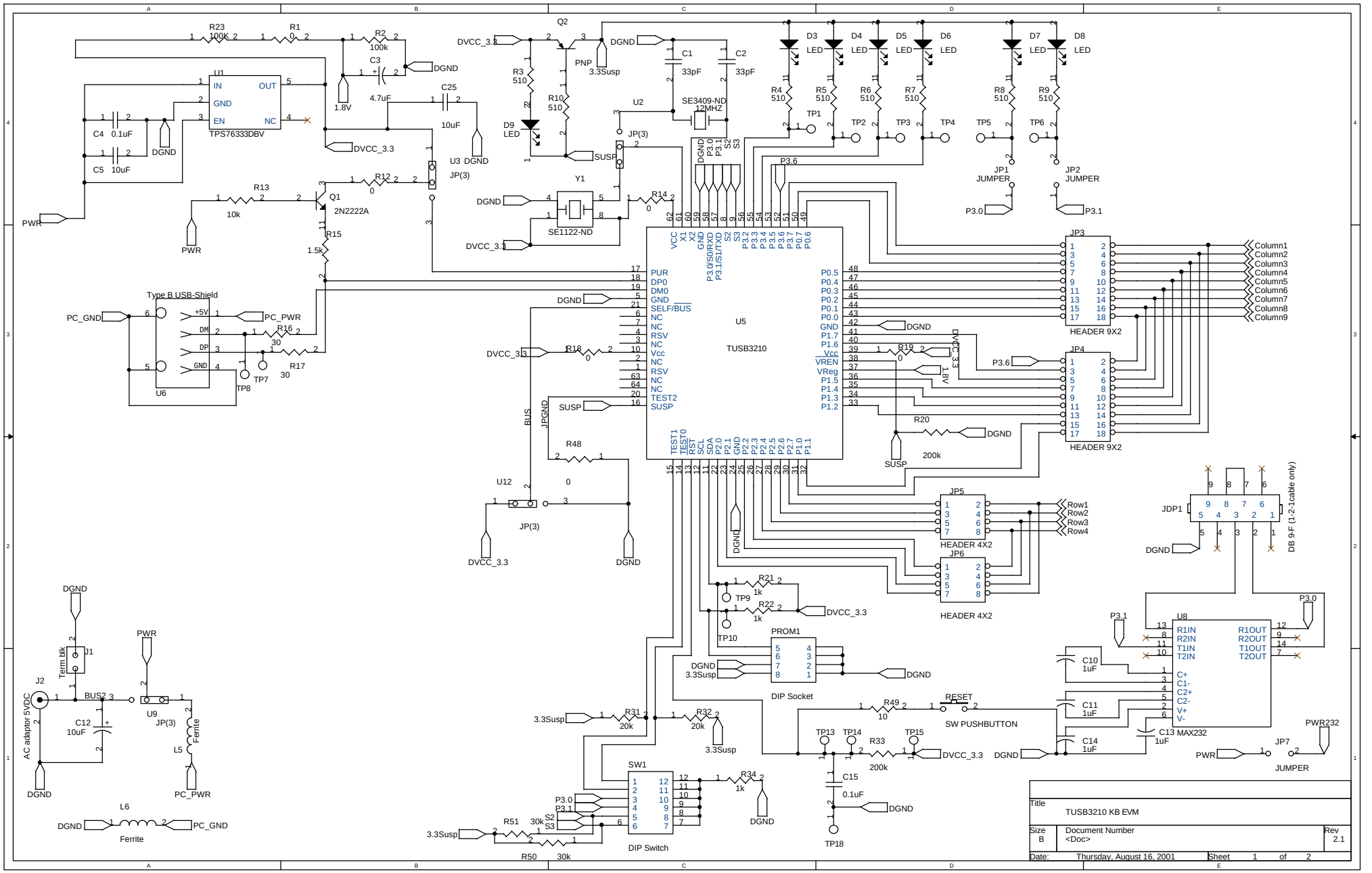
Table 2–2 is provided to help set up and configure the EVM platform jumpers to the desired mode of operation. The EVM may use either a 48-MHz crystal oscillator or a 12-MHz crystal oscillator; this is selectable by U2. The EVM can download firmware code from the PC through a loading program (which may or may not be supplied with your EVM) or from an EEPROM. If loading firmware from a PC through a loading program, U3 must be set to position 2–3; otherwise it may be set to either position. A 5-V power source may be supplied from an external source or from the USB cable. If supplied from an external source, U9 must be set to position 2–3; if supplied from the USB cable, set U9 to position 1–2. U12 must be set in accordance with U9 for proper descriptor reporting (Rev 2). The 5-V source is used to generate 3.3 V either from a voltage regulator or through a diode-resistor network (Rev 1 only). U4 is used to select the corresponding option (Rev 1 only). An LDO regulator generates 3.3 V from the 5-V source on Rev 2. JP1 and JP2 are used to connect P3.0 and P3.1 to D7 and D8, respectively. This should only be done when not using the MCU's UART, or when S0 and S1 are not set to GND for VID/PID selection.

Table 2–2. Jumpers and Switches

Jumper/Switch	Jumper/Switch Description
U2	Position 1–2: crystal oscillator source; position 2–3: crystal clock source
U3	Position 1–2: speed sense always on; position 2–3: speed sense use PUR control
U4	Position 1–2: 3.3-V voltage regulator; position 2–3: 3.3-V Vbe generated (Rev 1)
U9	Position 1–2: 5-V bus power supply; position 2–3: 5-V dc or 5-V switching supply
U12	Position 1–2: self powered device; position 2–3: bus power device (Rev 2)
JP1	Position 1–2 on: connect P3.0 to D7; position 1–2 off: disconnect P3.0 from D7
JP2	Position 1–2 on: connect P3.1 to D8; position 1–2 off: disconnect P3.1 from D8
JP7	Position 1–2 on : enable RS–232 port; position 1–2 off: disable RS–232 port
T0–T1	00: 48-MHz mode; 11: 12-MHz mode (must also set U2); other combinations reserved
S0–S3	Pins are read only at power up and stored in VIDSTA register

2.6 EEPROM

The EEPROM is used to provide application-specific firmware. The TUSB3210 automatically reads the EEPROM at power up via the I^2C bus. A header must be added to the application firmware before loading into the EEPROM. This header format is specified in the boot code document provided with the device. The header may be generated for you automatically with the I^2C header generation utility software provided with the device.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TUSB3210
U1
TPS76333DBV
Q1
2N2222A
Q2
PNP
U2
SE3409-ND
12MHZ
Y1
SE1122-ND
U6
Type B USB-Shield
U12
PROM1
DIP Socket
SW1
DIP Switch
SW PUSHBUTTON
U8
MAX232
U9
JP1
JUMPER
JP2
JUMPER
JP3
HEADER 9X2
JP4
HEADER 9X2
JP5
HEADER 4X2
JP6
HEADER 4X2
JDP1
DB 9-F (1-2-cable only)
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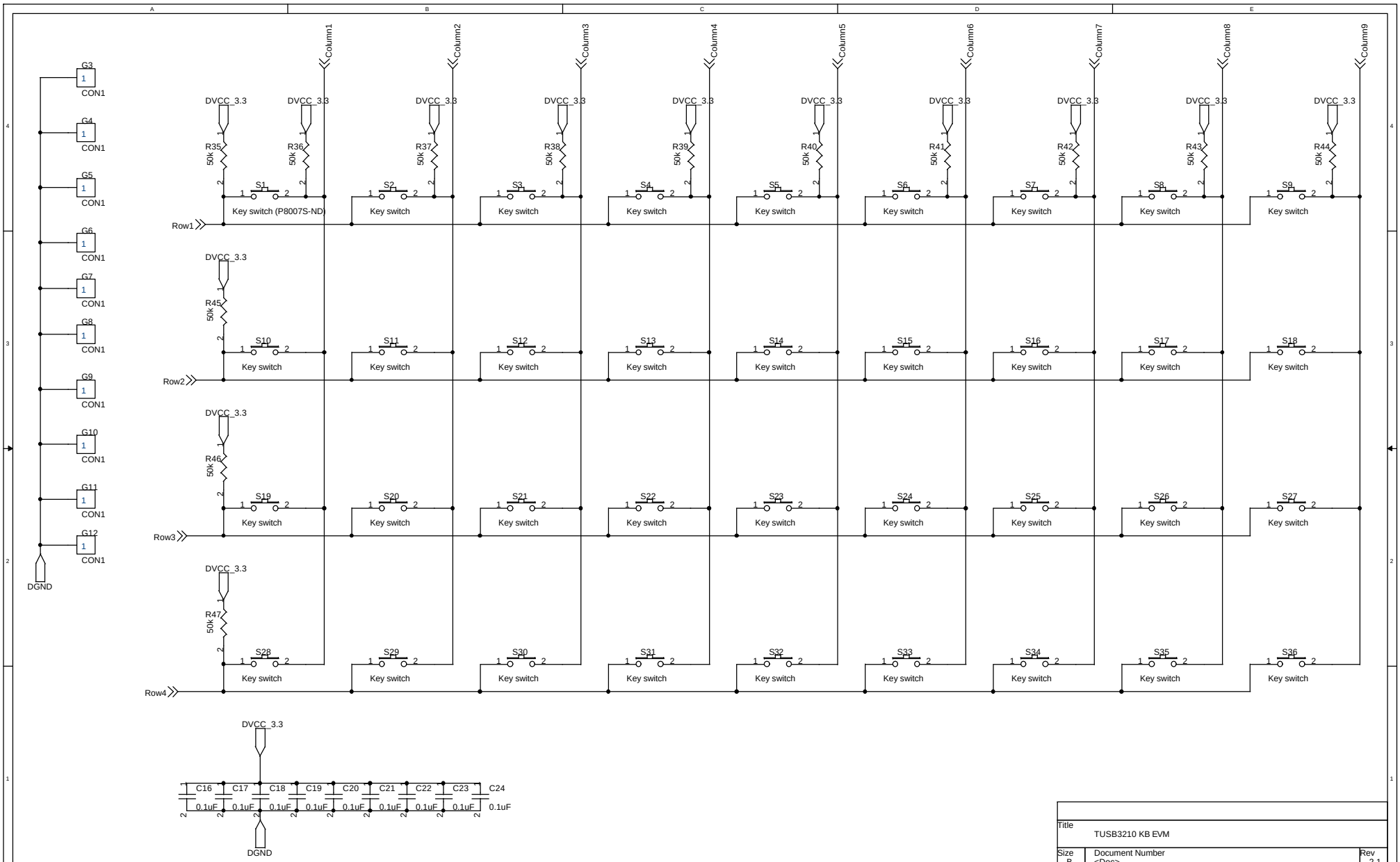
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G9
G10
G11
G12
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Column4
Column5
Column6
Column7
Column8
Column9
DVCC_3.3
R35
R36
R37
R38
R39
R40
R41
R42
R43
R44
R45
R46
R47
50k
S1
S2
S3
S4
S5
S6
S7
S8
S9
S10
S11
S12
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S34
S35
S36
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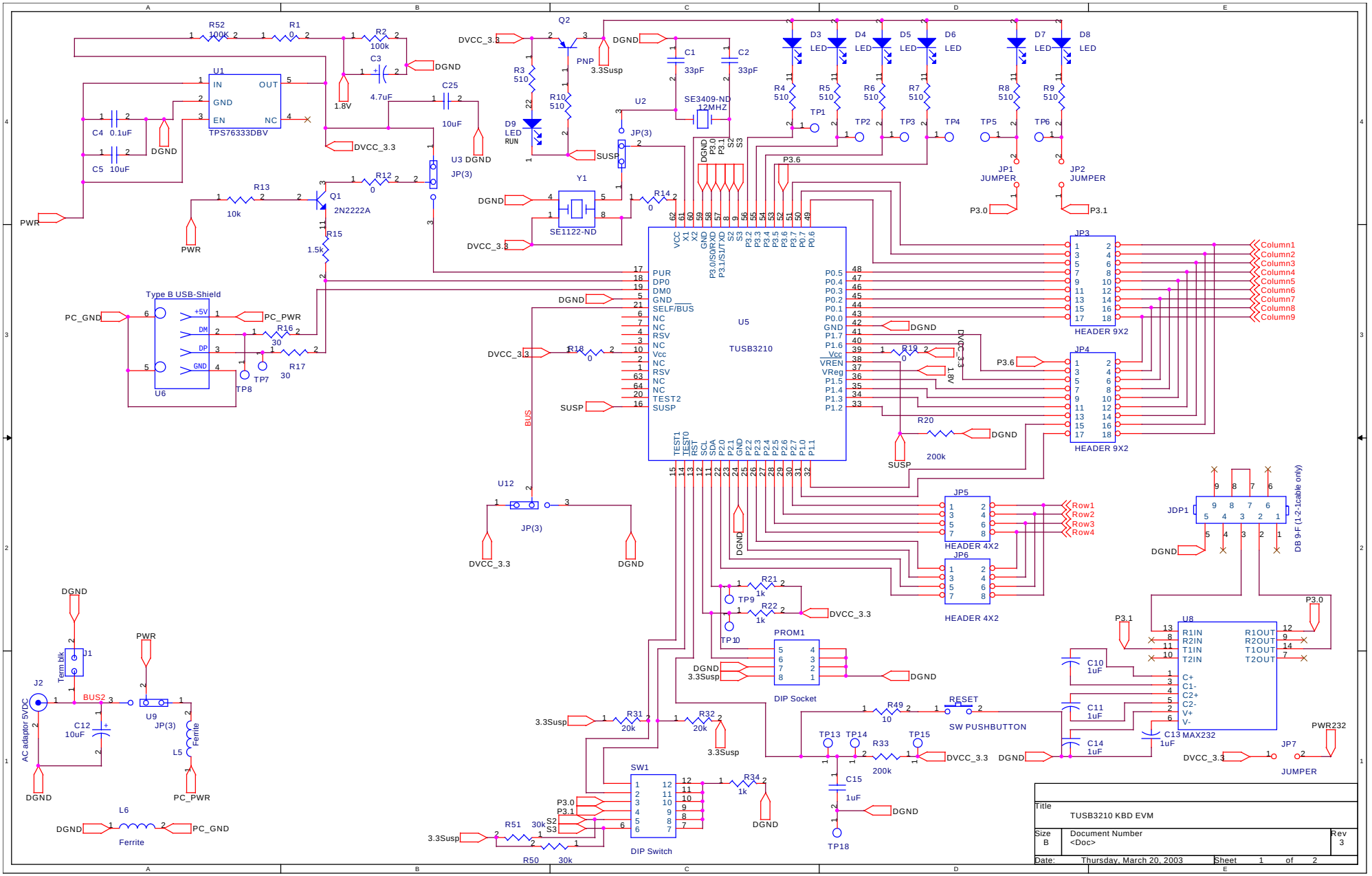

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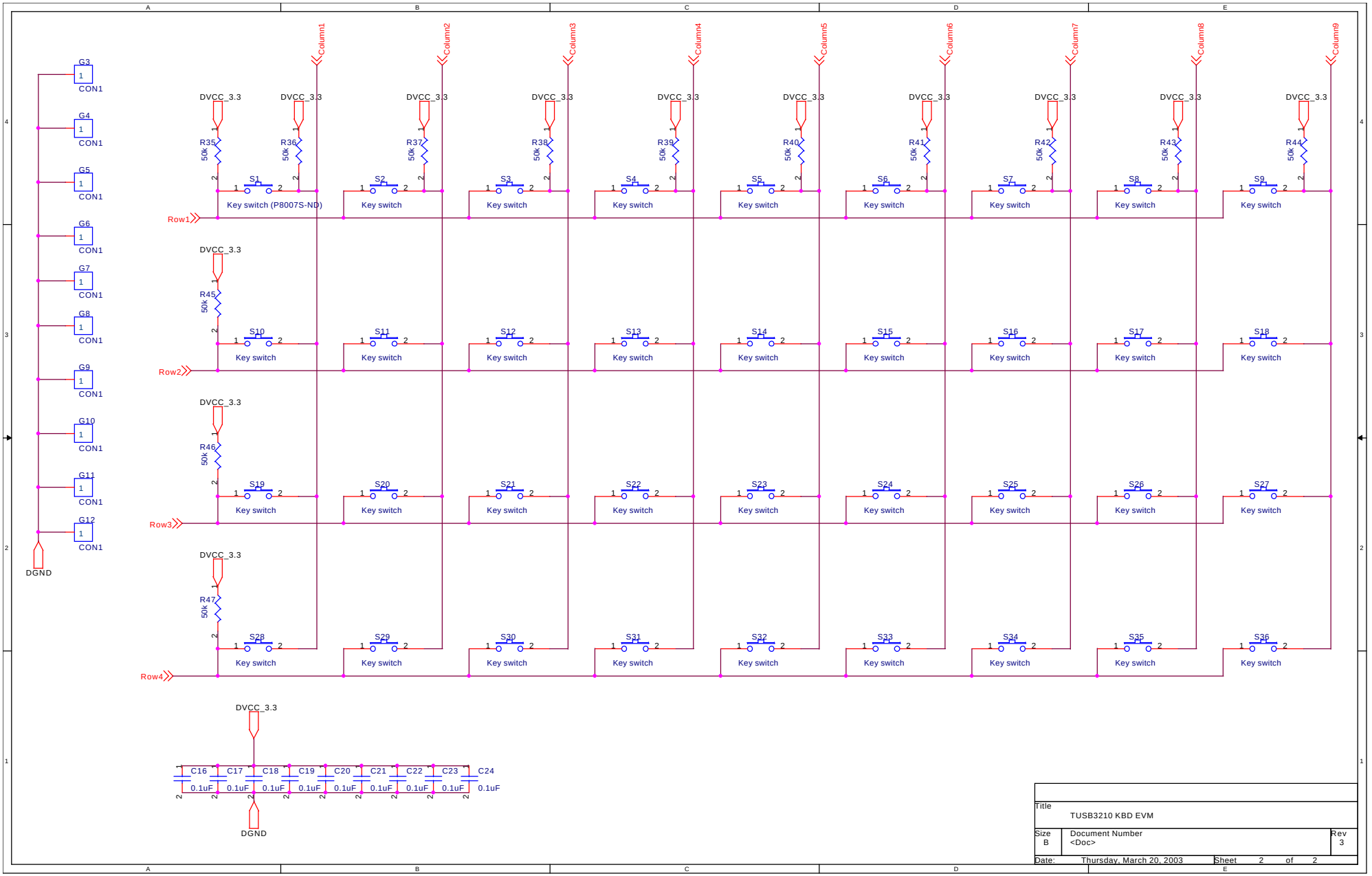
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G5
G6
G7
G8
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G10
G11
G12
CON1
DGND
Column1
Column2
Column3
Column4
Column5
Column6
Column7
Column8
Column9
DVCC_3.3
R35
R36
R37
R38
R39
R40
R41
R42
R43
R44
R45
R46
R47
50k
S1
S2
S3
S4
S5
S6
S7
S8
S9
S10
S11
S12
S13
S14
S15
S16
S17
S18
S19
S20
S21
S22
S23
S24
S25
S26
S27
S28
S29
S30
S31
S32
S33
S34
S35
S36
Key switch (P8007S-ND)
Key switch
Row1
Row2
Row3
Row4
C16
C17
C18
C19
C20
C21
C22
C23
C24
0.1uF
Title
TUSB3210 KBD EVM
Size
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Document Number
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Rev
3
Date:
Thursday, March 20, 2003
Sheet
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