KDK350ADPTR-EVM

This user's guide is a quick reference to the features and options of the of the KDK350ADPTR-EVM. Topics include using the EVM, header pinout, backlight control, LCD interface control switches, and touchscreen interface.

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Trademarks

1 Board Overview

The KDK350ADPTR-EVM provides a physical adapter layer to interface the MSP432E411Y microcontroller (MCU) on the SimpleLink™ Ethernet MSP432E411Y MCU Evaluation Board (MSP432E411Y-BGAEVM) to a Kentec Display K350QVG-V2-F-04 LCD, including the LCD backlight driver. The KDK350ADPTR-EVM can be used as a reference for connecting other LCD modules to the MSP432E411Y-BGAEVM.

The Kentec Display K350QVG-V2-F-04 LCD is a 3.5-inch diagonal, 320-×240-pixel resolution, TFT module display that has LED backlighting and supports the i80 8-, 16-, or 18-bit interface and SPI. The display also includes an integrated resistive touch panel.

Figure 1 shows the KDK350ADPTR-EVM with key features highlighted.

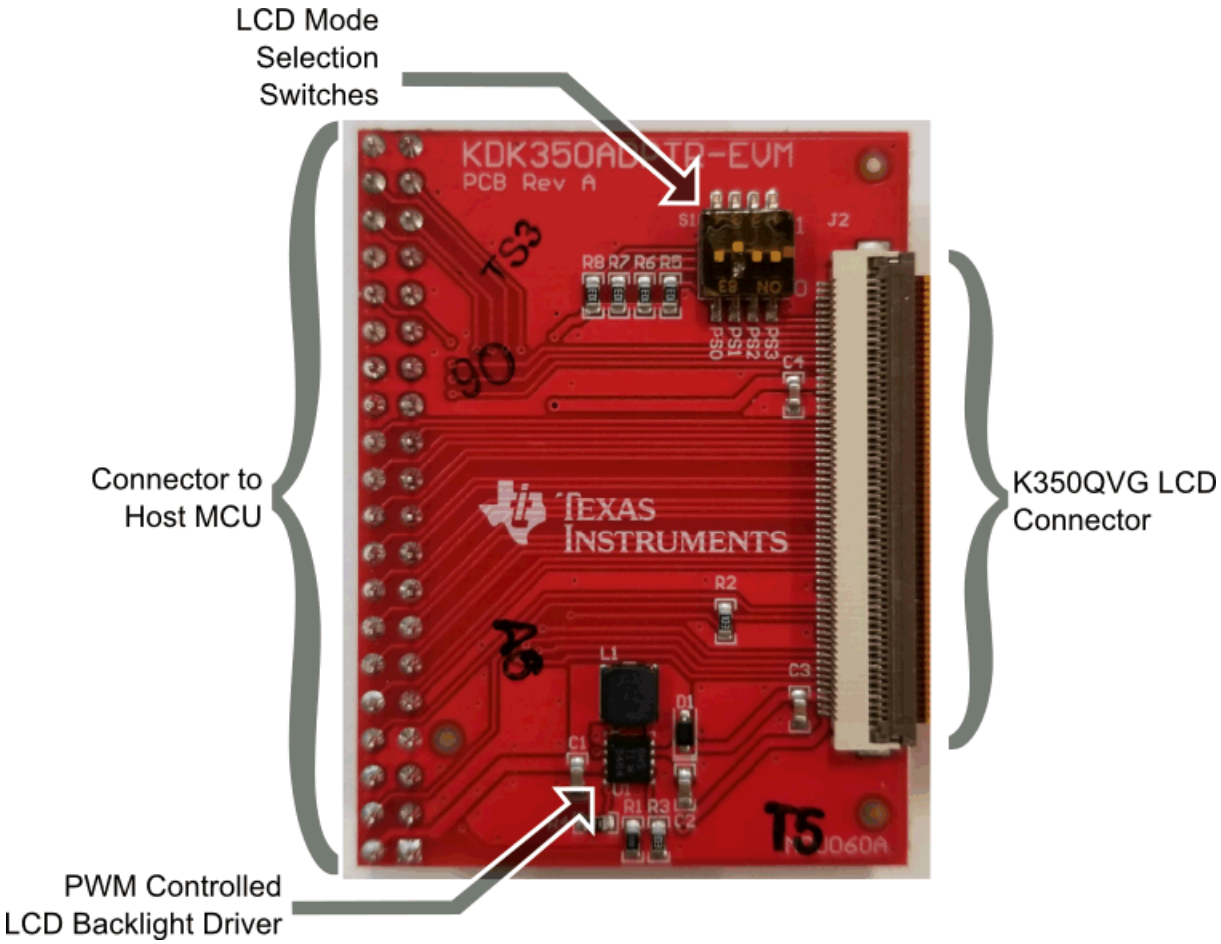

Figure 1. KDK350ADPTR-EVM LCD Evaluation Module

1.1 Using the KDK350ADPTR-EVM

The KDK350ADPTR-EVM is used with the MSP432E411Y-BGAEVM to showcase the 16-bit parallel LCD interface on the MSP432E411Y device. The SimpleLink MSP432E4 Software Development Kit (SDK) includes a graphics library example of the LCD capabilities of the MSP432E411Y MCU.

To use the KDK350ADPTR-EVM with an MSP432E411Y-BGAEVM and the graphics library example, follow these steps:

1. Connect the J1 female header on the KDK350ADPTR-EVM to the J9 male header on the MSP432E411Y-BGAEVM. Make sure to align all of the pins. Figure 2 shows how the LCD EVM connects to the BGA EVM.

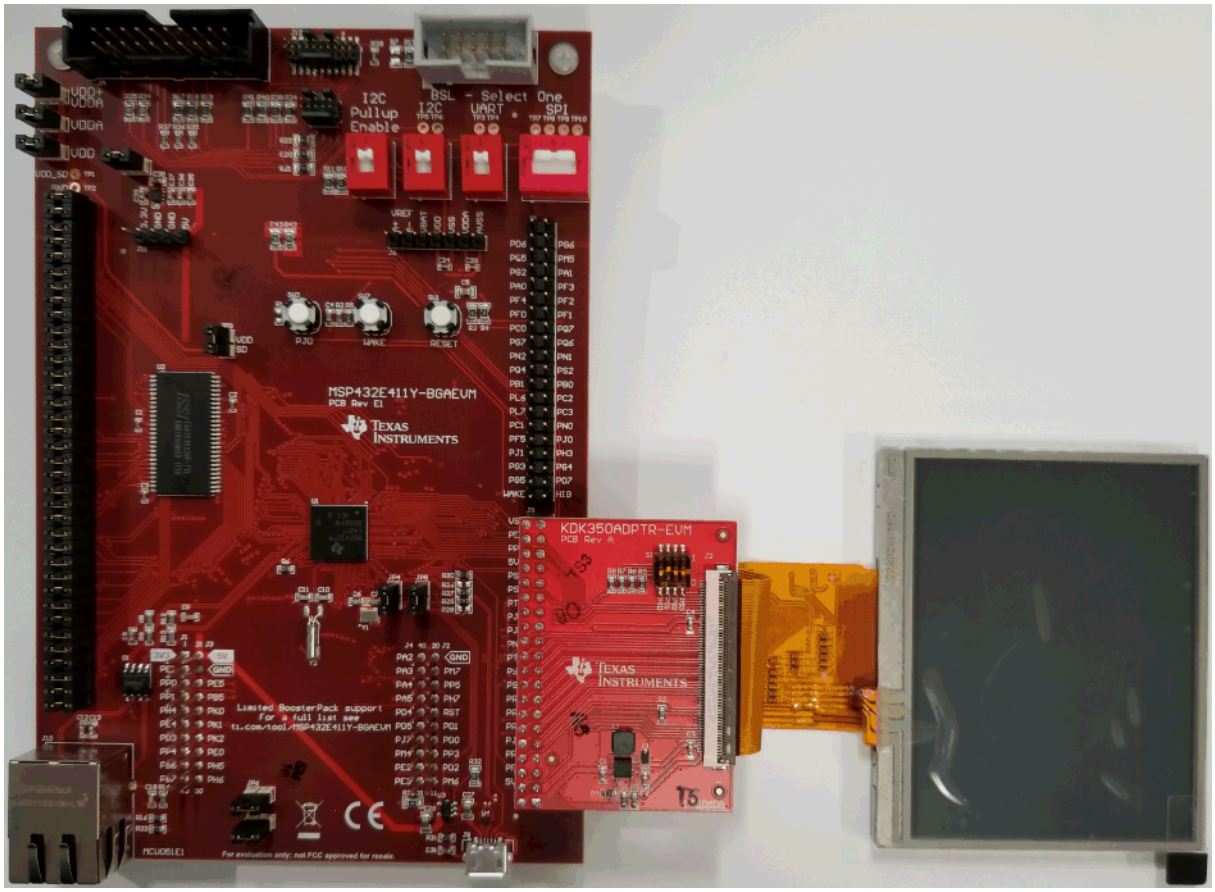

Figure 2. KDK350ADPTR-EVM Connected to MSP432E411Y-BGAEVM

2. Connect a debugger that supports Arm® based MCUs (such as an the XDS110 JTAG Debug Probe) to the PC and to the MSP432E411Y-BGAEVM.
3. Apply power to the MSP432E411Y-BGAEVM following the instructions in the MSP432E411Y-BGAEVM User's Guide.
4. Import the 'kentec_lcd' example project (/examples/nortos/MSP432E411Y_BGAEVM/grlib/kentec_lcd) into one of the supported IDEs and build the project.
5. Download and run the example.

2 KDK350ADPTR-EVM Pinouts and Features

2.1 LCD EVM Interface Header

The KDK350ADPTR-EVM uses header J1 on the bottom of the EVM to connect to a microcontroller or LCD driver. Table 1 lists the pinout for J1. All of the signals are on the K350QVG LCD except for the backlight PWM signal on pin 32. Table 2 lists the connections between the LCD at J2 and J1.

Table 1. J1 Pinout(1)

Signal	J1 Pin		Signal
3.3V	1	2	5V
DC	3	4	RESET
RD	5	6	WR
GND	7	8	CS
8080_D1	9	10	8080_D2
8080_D3	11	12	8080_D4
8080_D5	13	14	8080_D6
8080_D7	15	16	8080_D8
8080_D10	17	18	8080_D11
8080_D12	19	20	8080_D13
8080_D14	21	22	8080_D15
8080_D16	23	24	8080_D17
NC	25	26	NC
NC	27	28	NC
NC	29	30	NC
NC	31	32	Backlight PWM
3.3V	33	34	5V
XL	35	36	XR
YU	37	38	YD
GND	39	40	GND

(1) NC = no connection

Table 2. J2 Connections to J1(1)

J2 Pin	LCD Signal	J1 Pin	MSP432E411Y Signal
1	Backlight LED Cathode	N/A	N/A
2	Backlight LED Cathode	N/A	N/A
3	Backlight LED Anode	N/A	N/A
4	Backlight LED Anode	N/A	N/A
5	GND	7, 39, 40	GND
6	XR	36	PP6 – AIN23
7	YD	38	PE7 – AIN21
8	XL	35	PP7 – AIN22
9	YU	37	PE6 – AIN20
10	GND	7, 39,40	GND
11, 12 ,13	No Connection	N/A	N/A
14	RESET	4	LCDMCLK
15	CS	8	LCDAC
16	SPCLK	7, 39, 40	GND
17	SDA-SDI	7, 39, 40	GND
18, 19	No Connection	N/A	N/A

(1) N/A = not applicable

Table 2. J2 Connections to J1[(1)] (continued)

J2 Pin	LCD Signal	J1 Pin	MSP432E411Y Signal
20	D0	7, 39, 40	GND
21	D1	9	LCDDATA0
22	D2	10	LCDDATA1
23	D3	11	LCDDATA2
24	D4	12	LCDDATA3
25	D5	13	LCDDATA4
26, 27	No Connection	N/A	N/A
28	D6	14	LCDDATA5
29	D7	15	LCDDATA6
30	D8	16	LCDDATA7
31	D9	7, 39, 40	GND
32	D10	17	LCDDATA8
33	D11	18	LCDDATA9
34, 35	No Connection	N/A	N/A
36	D12	19	LCDDATA10
37	D13	20	LCDDATA11
38	D14	21	LCDDATA12
39	D15	22	LCDDATA13
40	D16	23	LCDDATA14
41	D17	24	LCDDATA15
42	HSYNC	7, 39, 40	GND
43	VSYNC	7, 39, 40	GND
44	DCLK	7, 39, 40	GND
45, 46, 47, 48	AVDD	1, 33	VDD
49	DC	3	LCDFP
50	RD	5	LCDCP
51	WR	6	LCDLP
52, 53, 54, 55	PS0, PS1, PS2, PS3	N/A	N/A
56	WSYNC	N/A	N/A
57	No Connection	N/A	N/A
58	OE	7, 39, 40	GND
59	GND	7, 39, 40	GND
60	GND	7, 39, 40	GND

2.2 LCD Backlight Control

The K350QVG-V2-F-04 LCD provides backlighting through six LEDs in a serial configuration which requires 19.2 V at 20 mA for full brightness. The backlight voltage is generated using a TI TPS61042 Switch Boost Converter. The TPS61042 allows PWM control over the backlight to adjust brightness using the Backlight PWM pin on J1 (pin 32). For full brightness, a logic "high" signal is applied to the Backlight PWM pin. For reduced brightness, a PWM signal between 100 Hz and 50 kHz is applied.

2.3 LCD Interface Control

The K350QVG-V2-F-04 LCD supports for multiple interface modes:

- 8-, 9-, 16-, or 18-bit 8080 parallel interface
- 6-, 9-, 16-, or 18-bit RGB interface with 3-wire SPI
- 3-wire SPI

The mode is selected by the PS3, PS2, PS1, and PS0 pins on the LCD. Table 3 lists the selection for each mode. Switch bank S1 on the KDK350ADPTR-EVM controls the PS3, PS2, PS1, and PS0 pins (see Figure 3). The silkscreen adjacent to S1 shows the signal that each switch controls and the position to generate a 1 or a 0. Figure 3 shows the switch configuration to use 8080 16-bit parallel interface.

Table 3. LCD Interface Selection

PS3	PS2	PS1	PS0	Interface
0	0	1	0	16-bit 8080 parallel interface
0	0	1	1	8-bit 8080 parallel interface
0	1	0	0	9-bit RGB and 3-wire SPI
0	1	0	1	16-bit RGB and 3-wire SPI
0	1	1	0	18-bit RGB and 3-wire SPI
0	1	1	1	6-bit RGB and 3-wire SPI
1	0	1	0	18-bit 8080 parallel interface
1	0	1	1	9-bit 8080 parallel interface
1	1	1	0	3-wire SPI

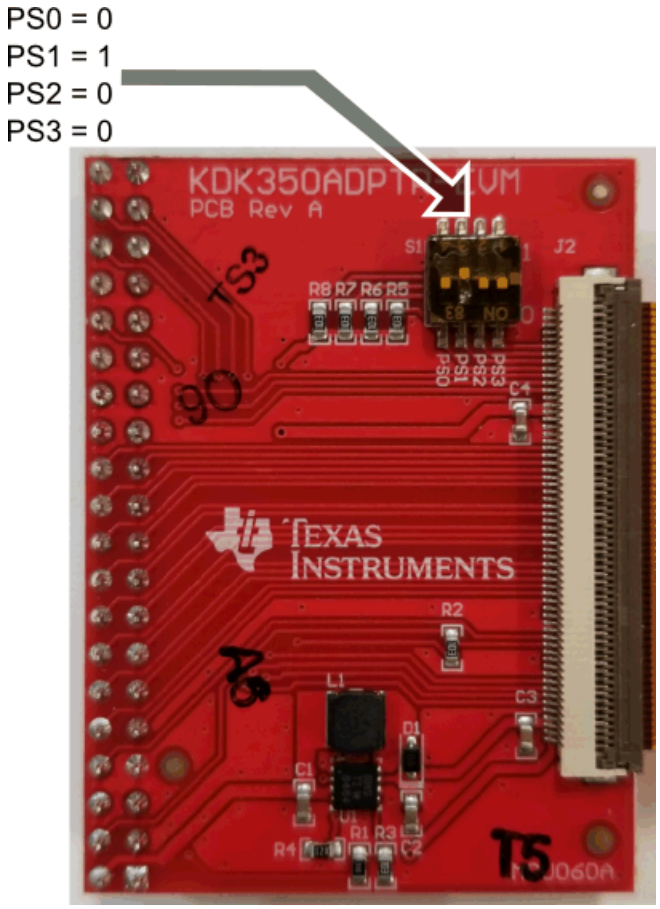

Figure 3. Switch Bank S1 Configured to Use 8080 16-Bit Interface

3 Software Development

3.1 Software Description

The SimpleLink MSP432E4 Software Development Kit (SDK) has examples and drivers for the KDK350ADPTR-EVM when used in conjunction with the MSP432E411Y-BGAEVM. The example projects draw to the LCD screen and use the touchscreen overlay. These examples are a starting point for the development of the final application for use on the MSP432E411Y-BGAEVM with KDK350ADPTR-EVM.

3.2 Source Code

The source code is provided as part of the SimpleLink MSP432E4 SDK.

3.3 Tool Options

The source code installation includes directories containing projects, makefiles, and binaries for the following tool-chains:

- IAR Embedded Workbench® for Arm IDE
- TI Code Composer Studio™ IDE for Arm
- TI GCC compiler

For detailed information on using the tools, see the documentation included in the tool chain installation or visit the website of the tool supplier.

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In compliance with the Article 33 provision of the EU REACH regulation, TI notifies you that this EVM includes components that contain at least one Substance of Very High Concern (SVHC) above 0.1%. These uses from Texas Instruments do not exceed 1 ton per year. Table 4 lists the SVHCs in this EVM.

Table 4. SVHC Use

Component Manufacturer	Component Part Number	SVHC Substance	SVHC CAS
Kentec Display	K350QVG-V2-F	2-(2H-benzotriazol-2-yl)-4,6-ditertpentylphenol (UV-328)	25973-55-1
Kentec Display	K350QVG-V2-F	Boric acid	10043-35-3, 11113-50-1
Kentec Display	K350QVG-V2-F	Disodium tetraborate, anhydrous	1303-96-4, 1330-43-4, 12179-04-03
Kentec Display	K350QVG-V2-F	Tetraboron disodium heptaoxide, hydrate	12267-73-1
Kentec Display	K350QVG-V2-F	Diboron trioxide	1303-86-2
Kentec Display	K350QVG-V2-F	Diarsenic pentaoxide	1303-28-2

5 Schematics

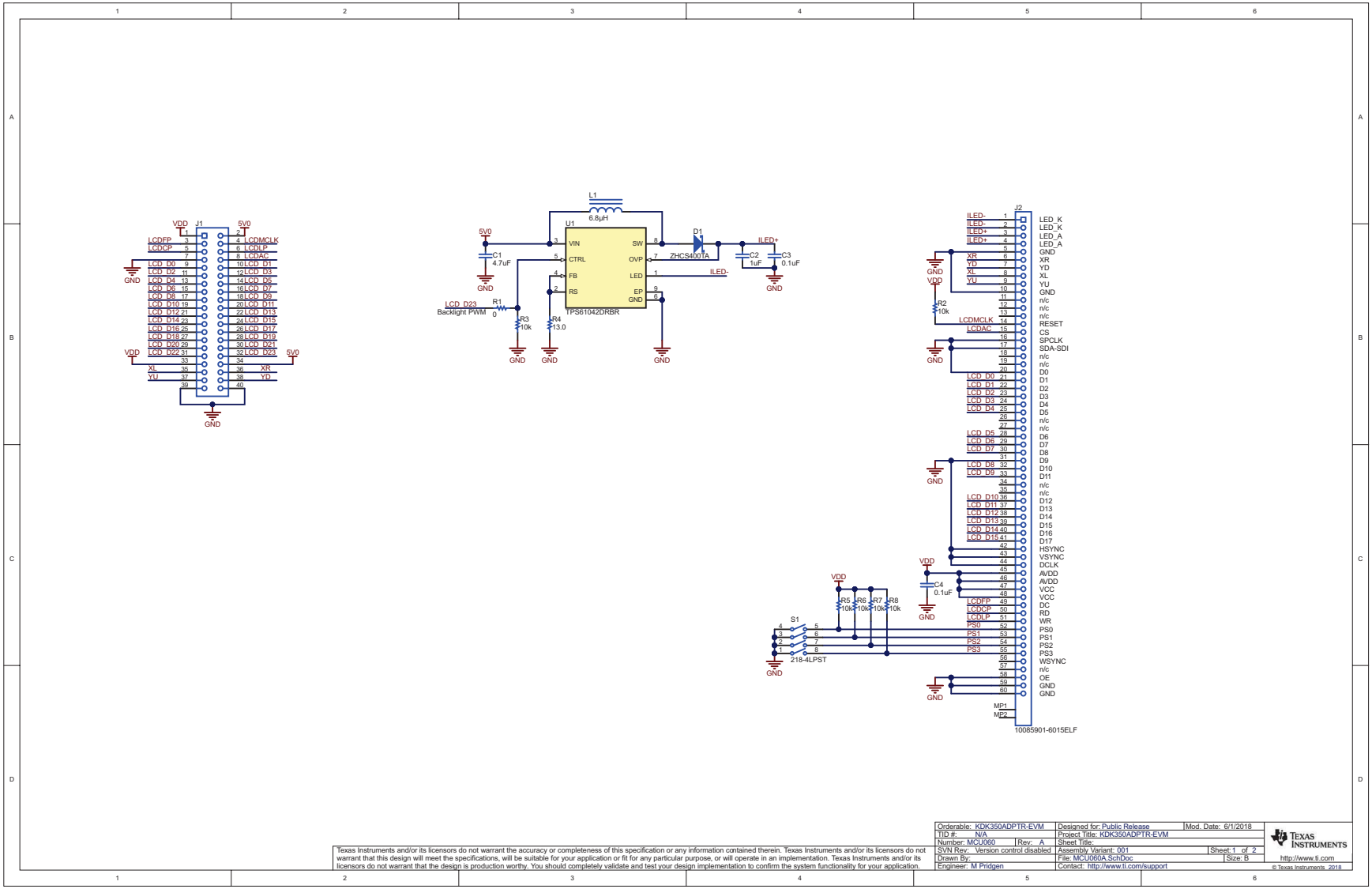

Figure 4. Schematics

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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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