

AN-2298 LM8335 Evaluation Module (EVM)

1 Introduction

The Texas Instruments LM8335EVM evaluation module (EVM), [Figure 1](#), helps designers evaluate the operation and performance of the LM8335 MIPI RFFE to General Purpose Output (GPO) Expander. The EVM contains a USB to MIPI RFFE converter (MSP430F5510), three LDOs, a 74LVC8T245 buffer for self-test, and the LM8335 (see [Table 1](#)).

Table 1. Device and Package Configurations

Converter	IC	Package
U1	LM8335	DSBGA-16
U2	MSP430F5510	48VQFN
U3	74LVC8T245PWRE4	PW024
U4	LP2980AIM5-3.3/NOPB	SOT23
U5	LP5990	DSBGA-4
U6	LP5990	

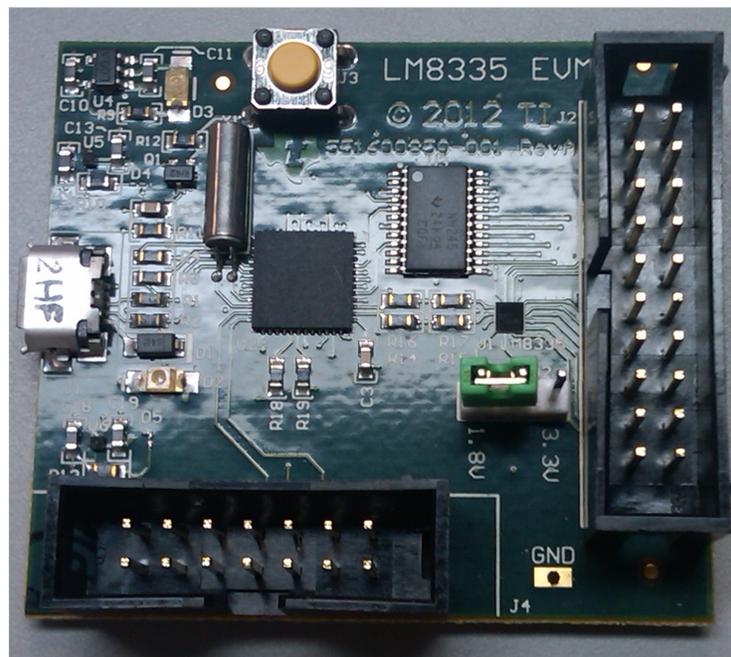


Figure 1. LM8335EVM

2 LM8335 EVM Setup

This section describes the jumpers and connectors on the EVM as well and how to properly connect, set up and test the LM8335EVM Evaluation Board.

2.1 Input/Output Connector Description

- **J1 – Input** is the USB input connector. This connector provides USB data communication, 5V Power In, and ground (GND) connection.
- **J2 – Input/Output** is the MIPI RFFE input/output and GPO output connector. This connector provides MIPI RFFE communication to an external device and access to the LM8335 GPO outputs.
- **J4 – Input/Output** is the connector used to program the MSP430. This connector uses the standard interface for programming the MSP430 using the MSP-FET430UIF Debug-Interface Tool.
- **VDDIO2 – VDDIO Select** is the jumper used to select the VDDIO voltage used by the LM8335.

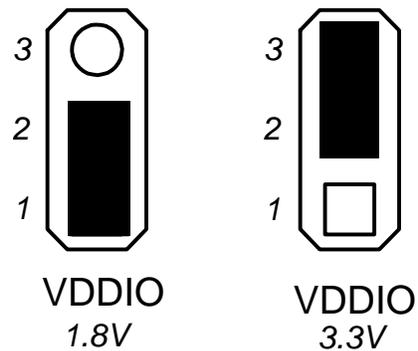


Figure 2. LPM Jumper Settings

2.2 Setup

For proper operation of the LM8335, the VDDIO2 jumper should be properly configured. The recommended setting, using shorting blocks: VDDIO to 1.8V

2.3 Operation

The LM8335EVM evaluation board is powered by the USB interface, no external supply is required. Connect the micro-USB type B cable to the LM8335EVM and to the PC. Launch the LM8335EVM GUI to access the features on the evaluation board.

3 Board Layout

The LM8335 GPO output pins can be accessed via the J2 connector. Additionally the LM8335 EVM can be used to communicate with additional devices that comply with the MIPI RFFE specification using the 20-pin connector J2. Note that the cable required to communicate with an external MIPI RFFE device is not included. The connector J4 is provided only for initial programming of the MSP430 and should not be used by the customer.

4 LM8335 Evaluation Board

The LM8335EVM supports the MIPI RFFE register 0 write, register write, register read, extended register write, extended register read, extended register write long and extended register read long command sequences at 400 Khz SCLK rate.

5 LM8335 GUI

The LM8335EVM GUI will initially start with all access disabled with the exception of the Open button (refer to [Figure 3](#)). Clicking this button will initialize the USB interface between the PC and the LM8335EVM. When the USB connection is successfully opened the Serial: and Firmware Revision: fields will be populated with the LM8335EVM values (refer to [Figure 4](#)). If the LM8335EVM is not recognized by the PC the Serial: and Firmware Revision: fields will be populated with the word Error (refer to [Figure 5](#)).

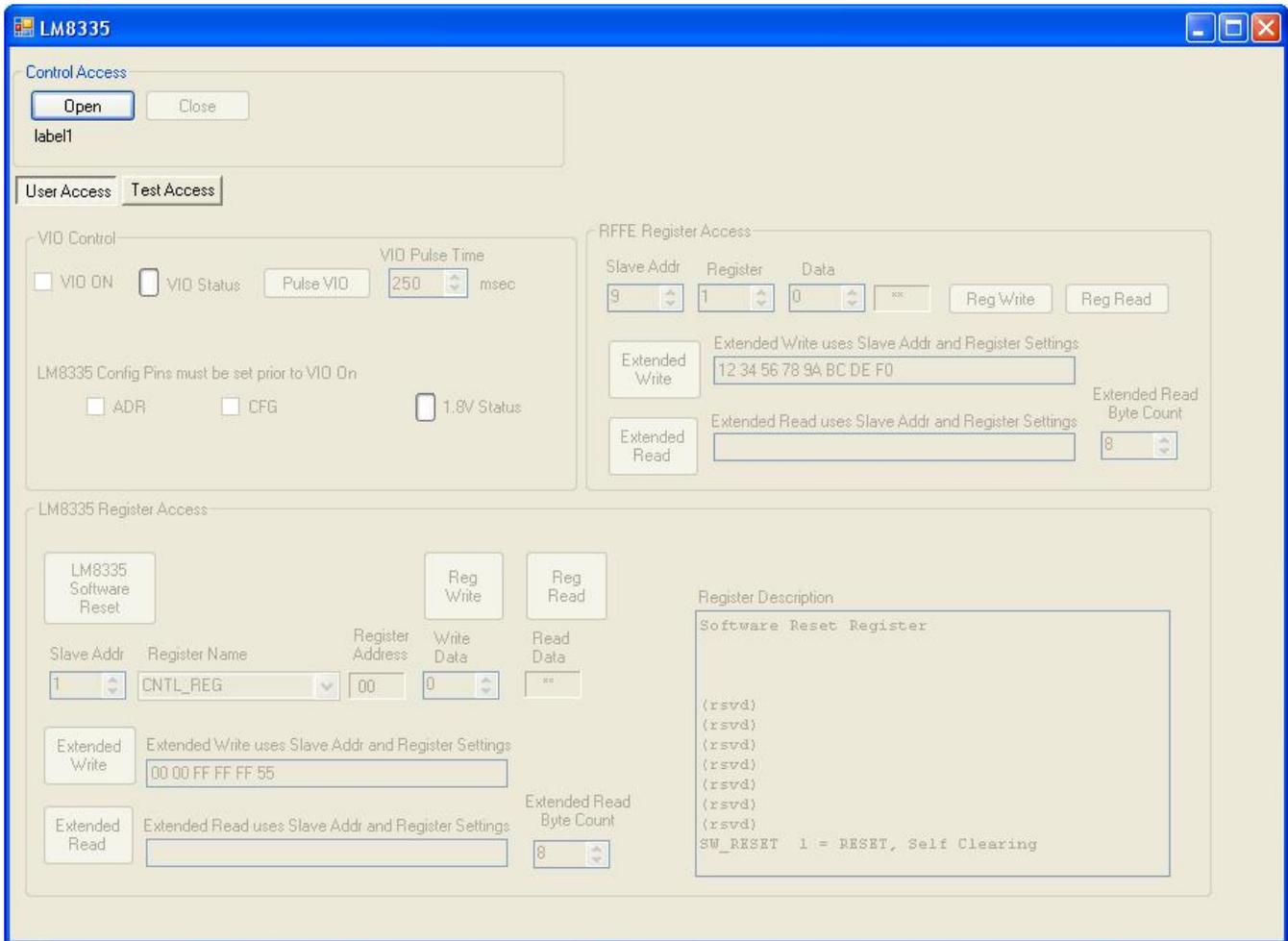


Figure 3. LM8335EVM GUI Initial Screen

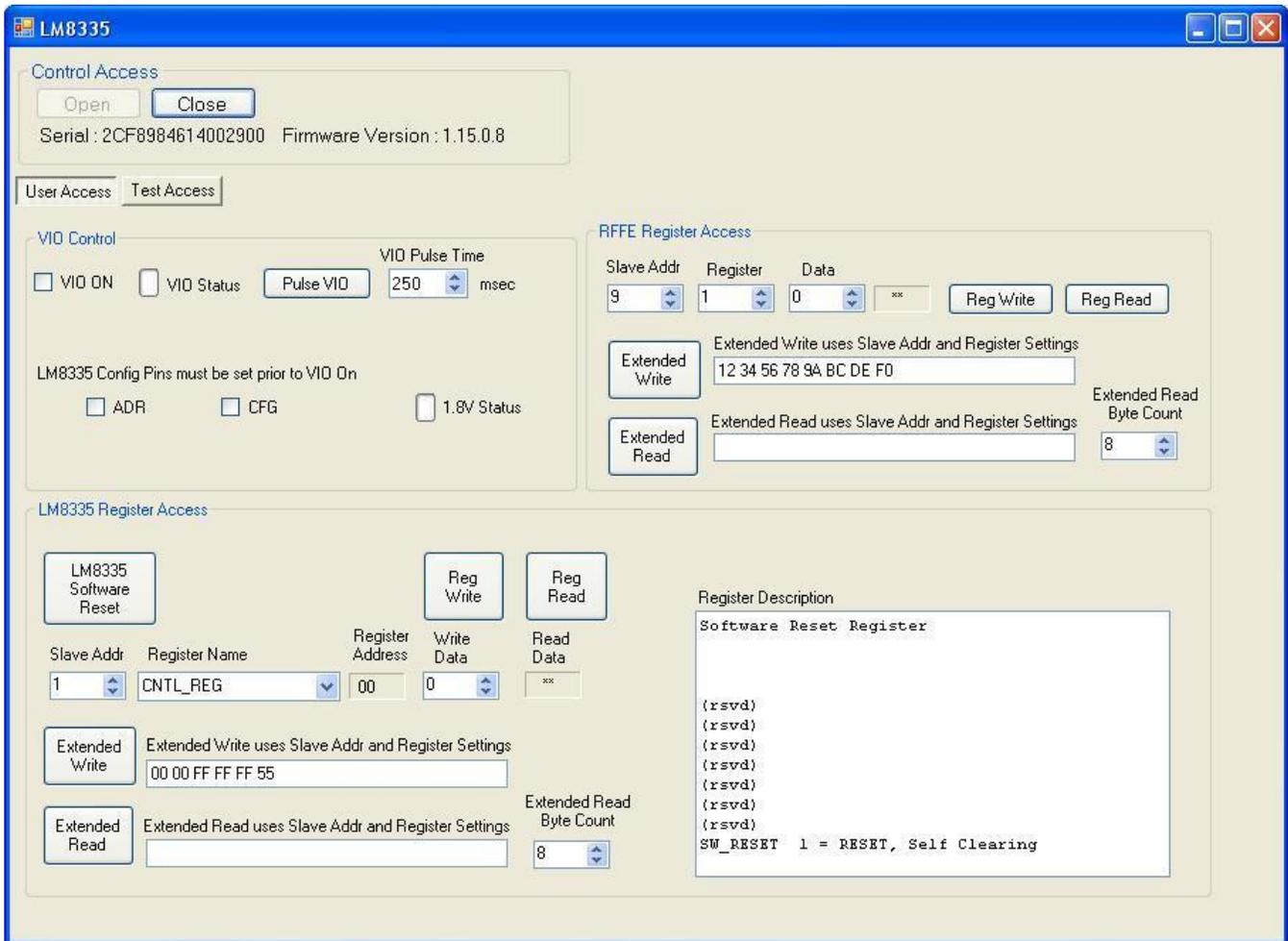


Figure 4. LM8335EVM Open Successful Screen

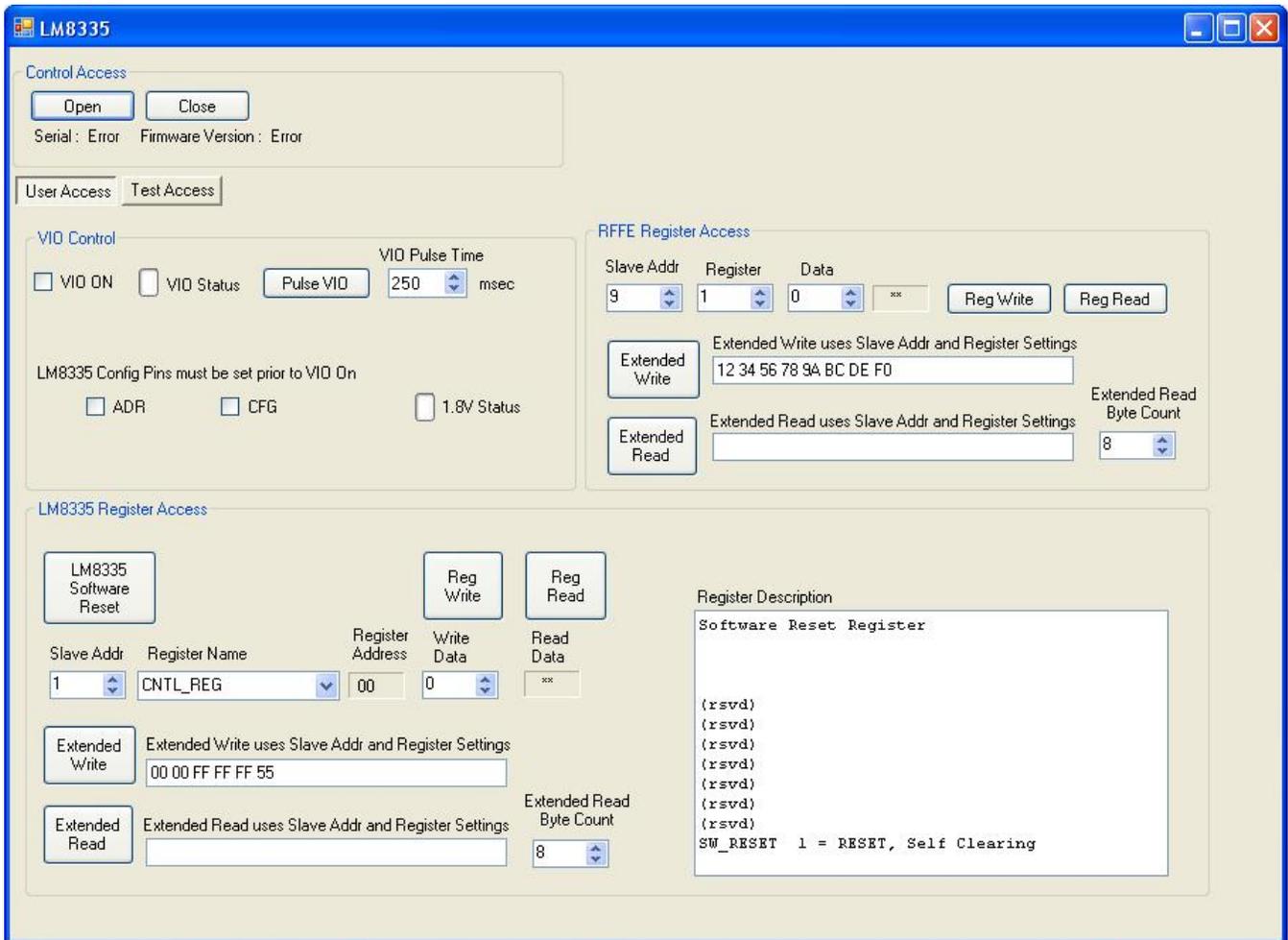


Figure 5. LM8335EVM Open Error Screen

The LM8335EVM GUI provides user access and LM8335 self-test access.

5.1 User Access Tab

The User Access tab (refer to [Figure 4](#)) is partitioned into 4 sections:

1. Control Access: this section establishes USB communication to the LM8335EVM.
2. VIO Control: this section is used set the LM8335 ADR and CFG pin starts, turn VIO on, turn VIO off, pulse VIO and provides the VIO and 1.8V status indicators.
3. LM8335 Register Access: this section is used to access the LM8335 registers 4).
4. MIPI RFFE Register Access: this section can be used to access an external MIPI RFFE device.

The normal sequence to access the LM8335EVM is:

1. Click the Open button and verify the USB interface was successfully established.
2. Select the desired state of the ADR and CFG inputs (no check = low, check = high).
 - Note: the state of the ADR input automatically sets the Slave Addr field in the LM8335 Register Access section of the LM8335EVM GUI.
3. Click the VIO ON checkbox.
4. Perform the desired register write/read operation using the Register Name & Write Data dialog along with the Reg Write and Reg Read buttons.

The MIPI RFFE Register Write and Read access is performed as:

1. The LM8335 register is selected via the Register Name select box in the LM8335 Register Access section of the LM8335EVM GUI.
2. Clicking the Reg Write button will perform a single register write to the selected Register Name with the data contained in the Write Data box.
3. Clicking the Reg Read button will perform a single register read from the selected Register Name and place the value in the Read Data status box.

The MIPI RFFE Extended Register Write and Read access is performed as:

1. Clicking the Extended Write button will write the data contained in the text line adjacent to the Extended Write button starting at the selected Register Name address. (Note the data entered in the text line is hexadecimal format with a single space between bytes as illustrated by the default data pattern: 00 00 FF FF FF 55).
2. When performing the Extended Read command the number of bytes needs to be entered in the Extended Read Byte Count field prior to clicking the Extended Read button. The data is read starting at the address indicated by the Register Name dialog and is placed in the text line adjacent to the Extended Read button.

The MIPI RFFE access to an external MIPI RFFE device is performed in a similar manner using the MIPI RFFE Register Access section of the LM8335EVM GUI.

5.2 Test Access Tab

The Test Access tab (refer to [Figure 6](#)) is partitioned into 2 sections:

1. LM8335 GPO Readback: this section is used to verify the LM8335 GPO outputs. Clicking the Read GPO button will perform a walking one test of the LM8335 GPOs. The test starts with the value of 1 (GPO0) and advances to 80 (GPO7). The test will wrap from 80 back to 1 and can be repeated indefinitely by continuing to click the Read GPO button.
2. GPO Toggle Test: this section will cause the LM8335 to toggle between the values 0x55 and 0xAA for the number of times entered in the Loop Count box after the GPO Toggle Test checkbox is clicked.

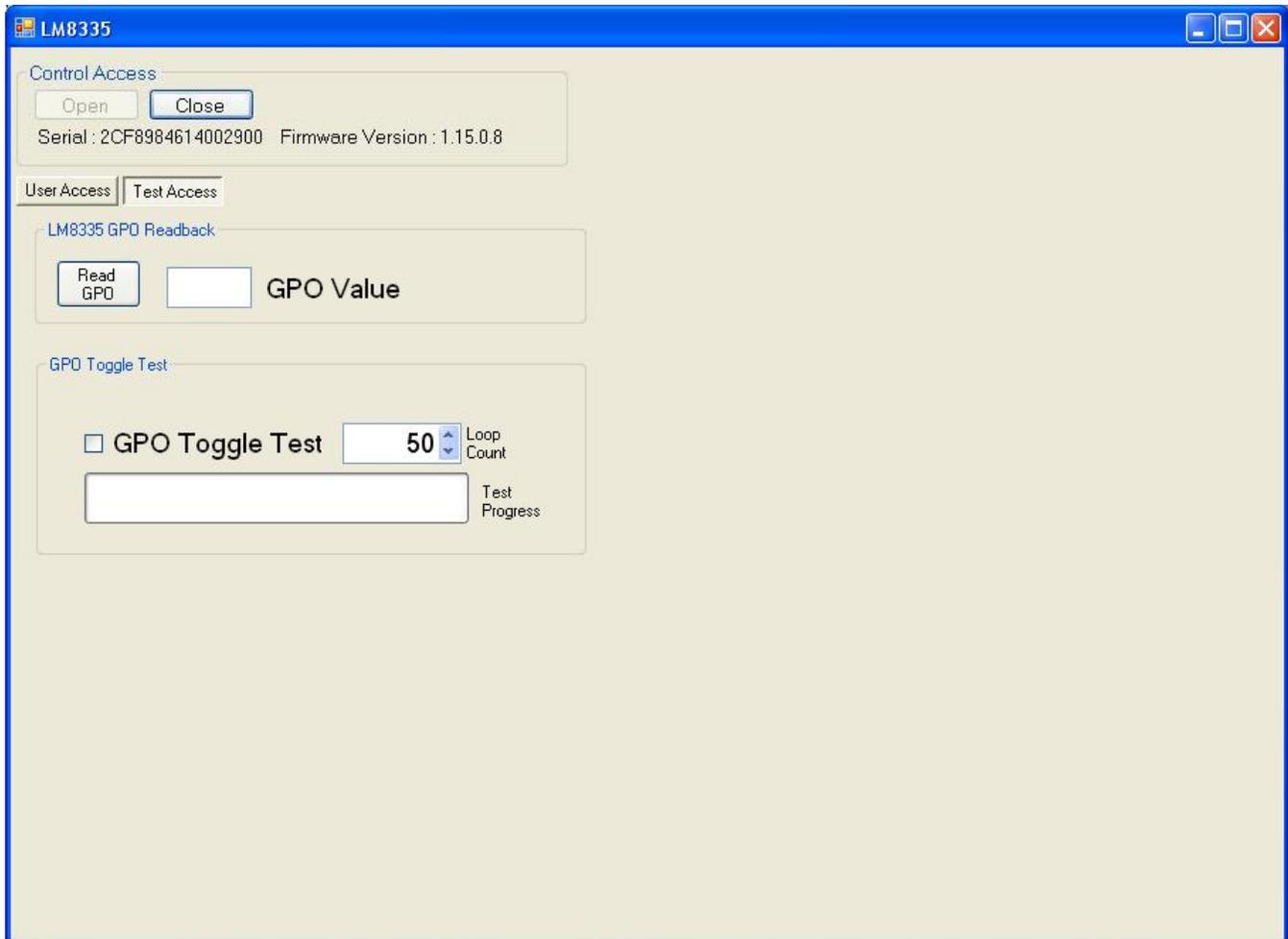


Figure 6. Test Access Tab

6 LM8335 EVM Layout

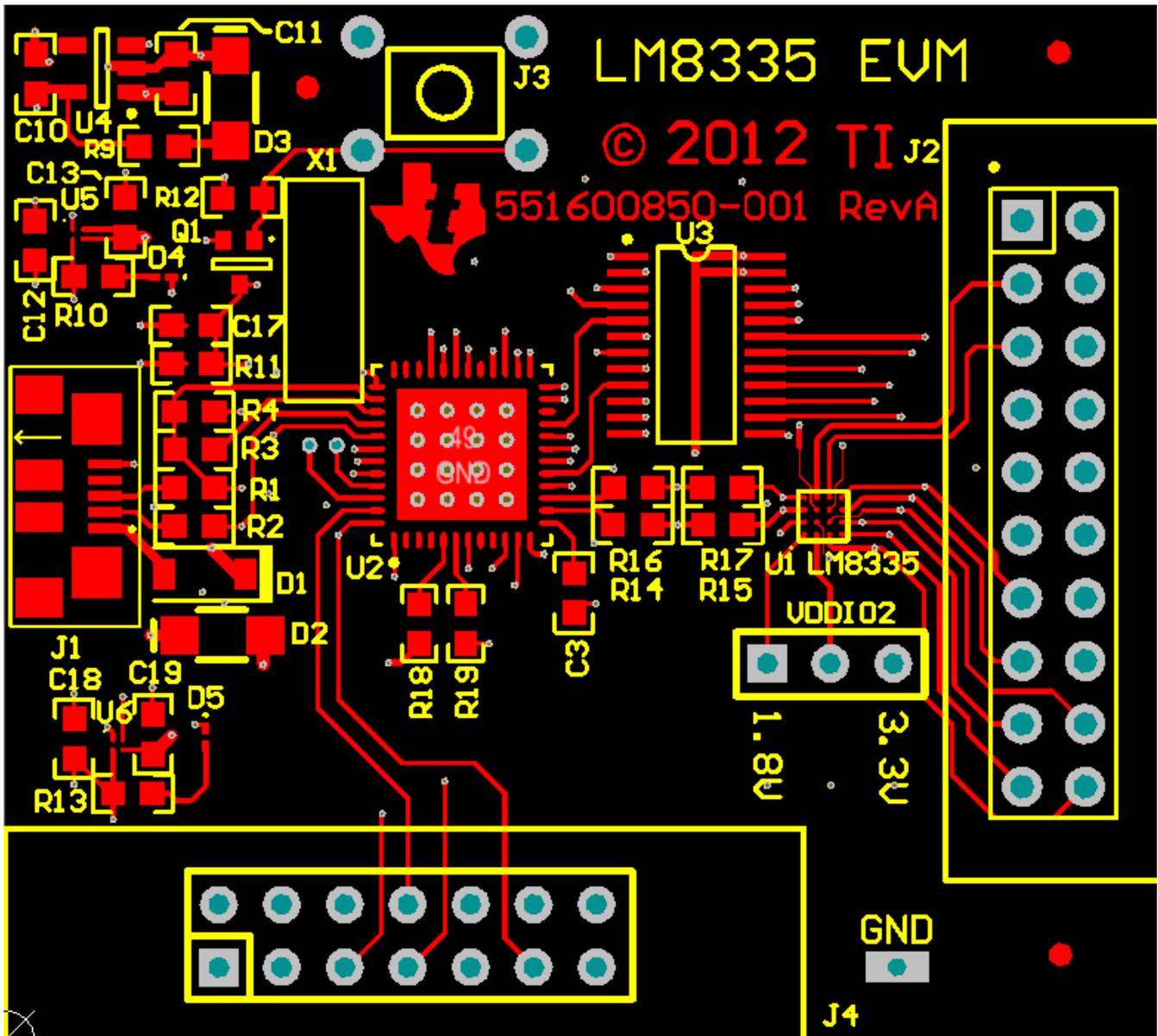


Figure 7. Top Assembly Layer

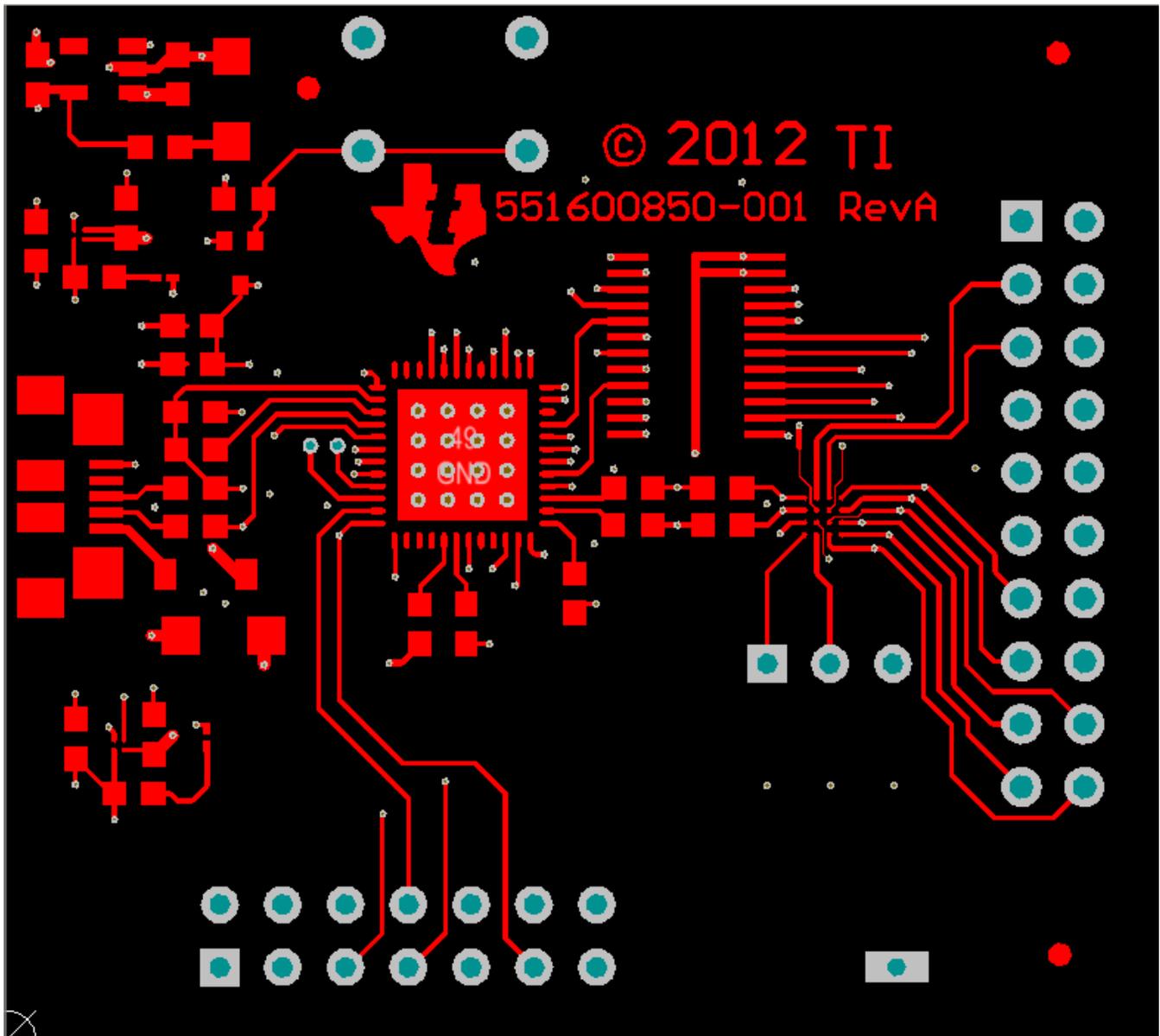


Figure 8. Top Layer Routing

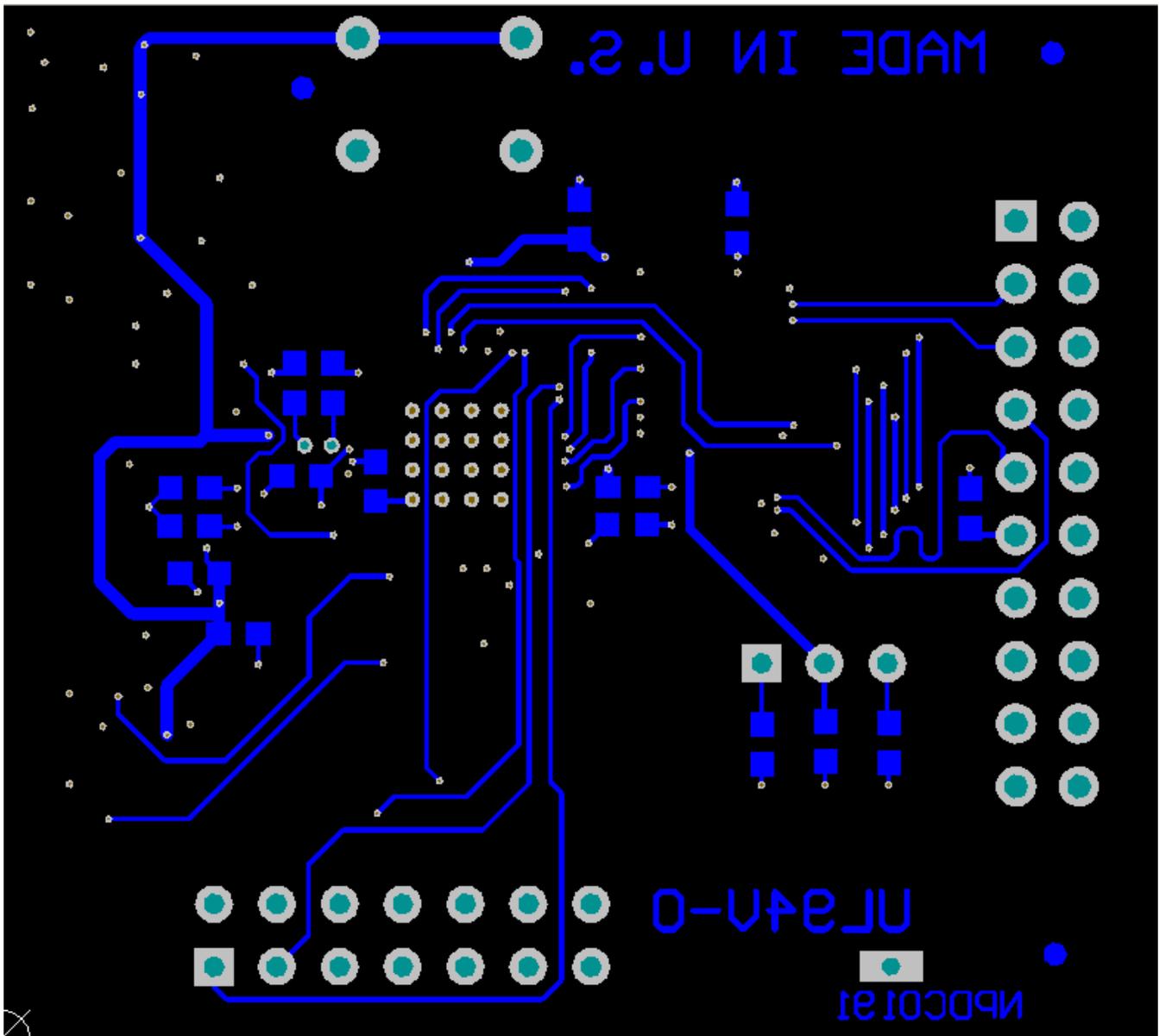


Figure 9. Bottom Layer Routing

7 LM8335 Bill of Materials

Qty	Designator	Description	Part Number	Footprint
2	C1, C5	CAP, CERM, 20 pF, 50V, ±5%, C0G/NP0, 0603	GRM1885C1H200JA01D	603
1	C2	CAP, CERM, 0.22 µF, 25V, ±10%, X5R, 0603	06033D224KAT2A	603
2	C3, C4	CAP, CERM, 0.4 7µF, 16V, ±10%, X7R, 0603	C0603C474K4RACTU	603
2	C6, C7	CAP, CERM, 10 pF, 50V, ±5%, C0G/NP0, 0603	06035A100JAT2A	603
1	C8	CAP, CERM, 4.7 µF, 10V, ±10%, X5R, 0603	C0603C475K8PACTU	603
1	C9	CAP, CERM, 2.2 µF, 10V, ±10%, X5R, 0603	C0603C225K8PACTU	603
6	C10, C11, C12, C13, C18, C19	CAP, CERM, 1 µF, 10V, ±10%, X5R, 0603	C0603C105K8PACTU	603
5	C14, C15, C16, C22, C23	CAP, CERM, 0.1 µF, 16V, ±5%, X7R, 0603	0603YC104JAT2A	603
1	C17	CAP, CERM, 1000 pF, 16V, ±10%, X7R, 0603	GRM188R71C102KA01D	603
2	C20, C21	CAP, CERM, 6.8 pF, 50V, ±4%, C0G/NP0, 0603	06035A6R8CAT2A	603
1	D1	Diode, Schottky, 40V, 0.35A, SOD-123	SD103AW-7-F	SOD-123
2	D2, D3	LED 3X1.5MM 568NM GN WTR CLR SMD	APL3015SGC-F01	1206L DIODE
1	J1	CONN RCPT MICRO USB B SMD R/A	ZX62R-B-5P	ZX62R-B-5P
1	J2	CONN HEADER 20POS DL STR GOLD	30320-6002HB	TSW-110-07-G-D
1	J3	SWITCH TACT 6MM MOM 150GF	B3F-1002	B3F-1002
1	J4	CONN HEADER 14POS DL STR GOLD	30314-6002HB	IDC14nat
1	Q1	MOSFET N-CH 30V 900 mA SOT323-3	SI1304BDL-T1-E3	SC-70-3-VISHAY
2	R1, R2	RES, 27Ω, 5%, 0.1W, 0603	CRCW060327R0JNEA	603
1	R3, R18, R19	RES, 1.40 kΩ, 1%, 0.1W, 0603	CRCW06031K40FKEA	603
1	R4	RES, 1.0MegΩ, 5%, 0.1W, 0603	CRCW06031M00JNEA	603
1	R5	RES, 280Ω, 1%, 0.1W, 0603	CRCW0603280RFKEA	603
1	R9	RES, 110Ω, 1%, 0.1W, 0603	CRCW0603110RFKEA	603
2	R10, R13	RES, 91Ω, 5%, 0.1W, 0603	CRCW060391R0JNEA	603
1	R11	RES, 47 kΩ, 5%, 0.1W, 0603	CRCW060347K0JNEA	603
1	R12	RES, 100 kΩ, 1%, 0.1W, 0603	CRCW0603100KFKEA	603
4	R14, R15, R16, R17	RES, 49.9Ω, 1%, 0.1W, 0603	CRCW060349R9FKEA	603
1	U1	LM8335 supplied by Texas Instruments	LM8335	DSBGA-16
1	U2	IC RF RCVR MSP430 48VQFN	MSP430F5510IRGZR	S-PVQFN-N48
1	U3	IC 74LVC8T245PWR	IC 74LVC8T245PWR	
1	U4	Micropower 50 mA Low Dropout 5-pin SOT23	LP2980AIM5-3.3/NOPB	TMD04CEA
2	U5, U6	Micropower 200 mA Low Dropout	LP5990TM-1.8/NOPB	TMD04CEA
1	VDDIO2	Narrow Base Post HJeaders, .100	3-644695-3	IDC3_INLINE
1	X1	Crystal 8 Mhz	CA-301 8.0000M-C:PBFREE	CA-301

8 LM8335 EVM Schematic

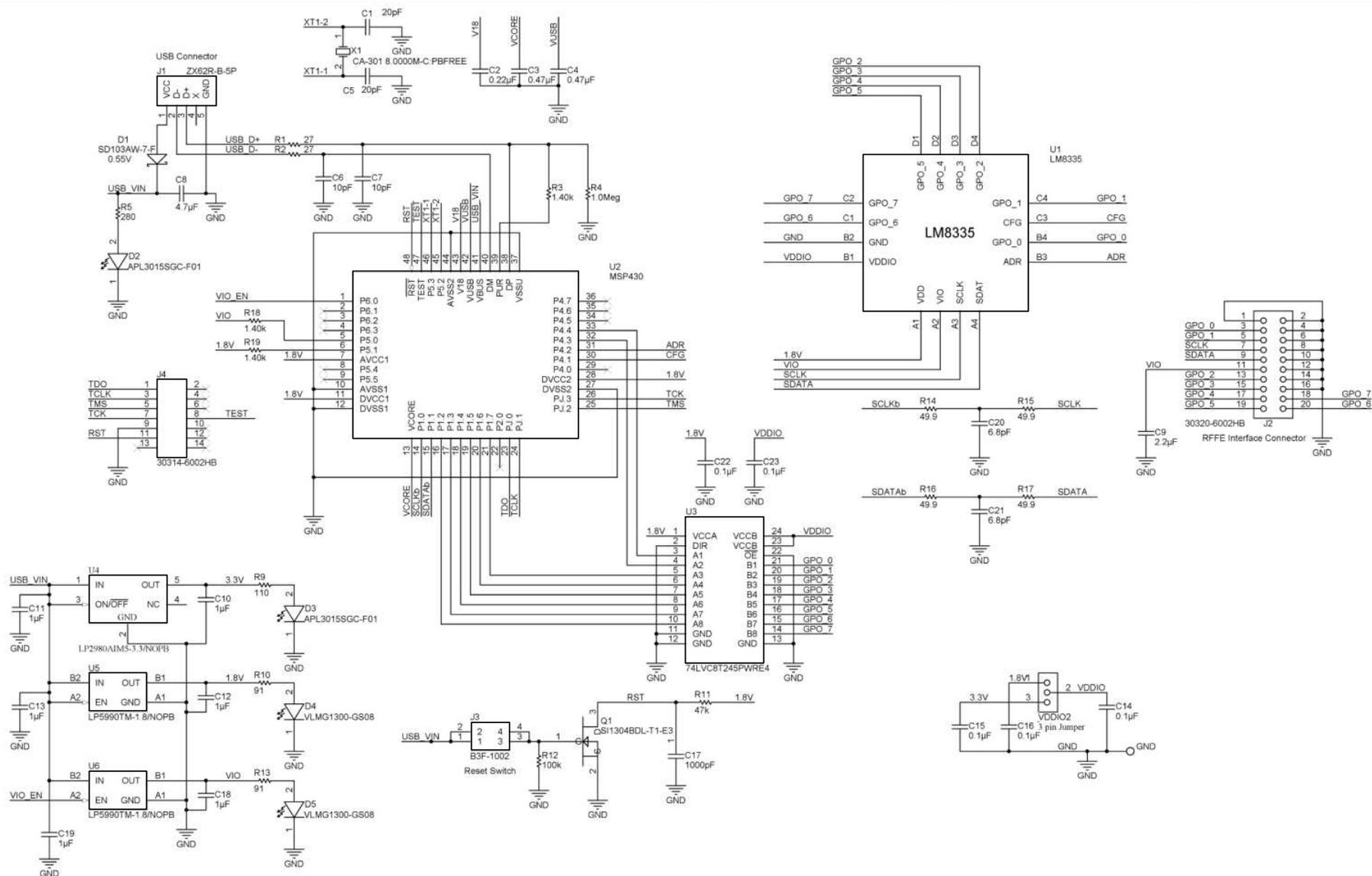


Figure 10. LM8335 EVM Schematic

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