

User's Guide

DP83826EVM



ABSTRACT

This User's Guide discusses how to properly operate and configure the DP83826EVM.

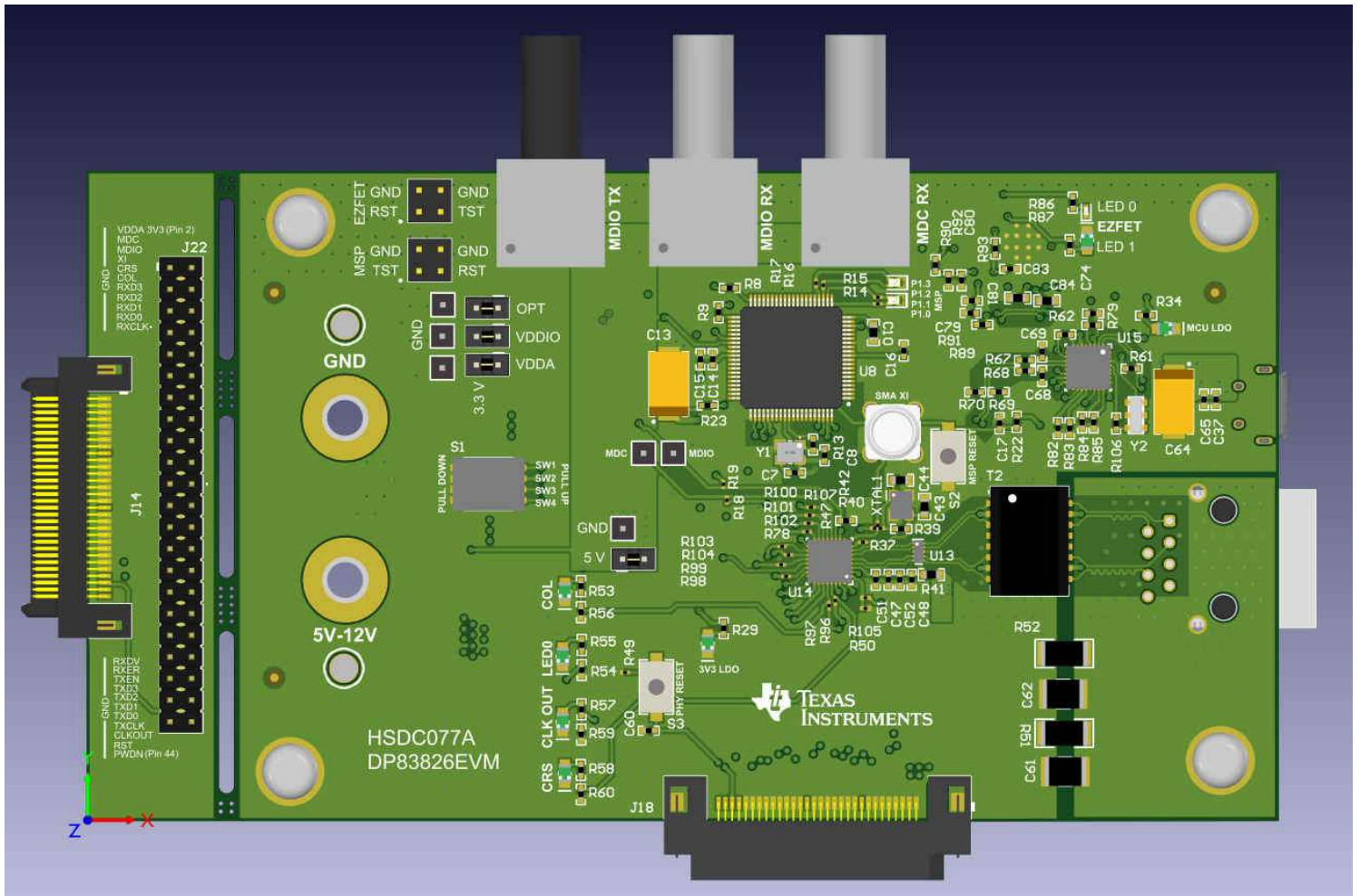


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Trademarks

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1 Definitions

Table 1-1. Terminology

ACRONYM	DEFINITION
PHY	Physical Layer Transceiver
MAC	Media Access Controller
SMI	Serial Management Interface
MDIO	Management Data I/O
MDC	Management Data Clock
MII	Media Independent Interface
RMII	Reduced Media Independent Interface
SFD	Start-of-Frame Detection
VDDA	Analog Core Supply Rail
VDDIO	Digital Supply Rail
PD	Pulldown
PU	Pullup
MCU	Microcontroller
PMD	Physical Medium Dependent
PRBS	Pseudo Random Binary Sequence

2 Introduction

The DP83826 is a low latency, deterministic, and low power Ethernet Physical Layer transceiver with integrated PMD sublayers to support both 10BASE-T_e and 100BASE-TX Ethernet protocols. The DP83826 interfaces directly to twisted pair media via an external transformer and offers integrated cable diagnostic tools, built-in self-test and loopback capabilities for ease of use. It interfaces to the MAC layer through a Media Independent Interface (MII) or a Reduced MII (RMII) both in Master and Slave mode. The 50 MHz clock in RMII Master mode is synchronized to the MDI derived clock to improve the system's jitter. The DP83826EVM will demonstrate all features of DP83826. The EVM supports 10BASE-T_e and 100BASE-TX Ethernet protocols. The EVM includes connections to use the DP83826 MII and RMII pins through header pins.

Note

TI is transitioning to use more inclusive terminology. Some language may be different than what you would expect to see for certain technology areas.

2.1 Key Features

- 100Base-TX, 10Base-T_e with Auto-Negotiation and Force 100M Mode
- Onboard Clock
- Output Clock
- Onboard MSP430F5529 for easy MDIO Register Access
- Onboard MSP430F5528 for flashing firmware
- LDO and External Power Supply Options
- Status LEDs
- 100BASE-TX Data Transfer Over 150 Meters CAT5 Cable
- Fiber Optic transceivers option for MDIO/MDC
- EMI/EMC Compliance Testing Completed:
 - CISPR 22 Radiated Emissions Class B
 - CISPR 22 Conducted Emissions Class B
 - IEC 61000-4-2 ESD: ± 8 kV contact, ± 15 kV air
 - IEC 61000-4-4 EFT: ± 4 kV @ 5 kHz, 100 kHz

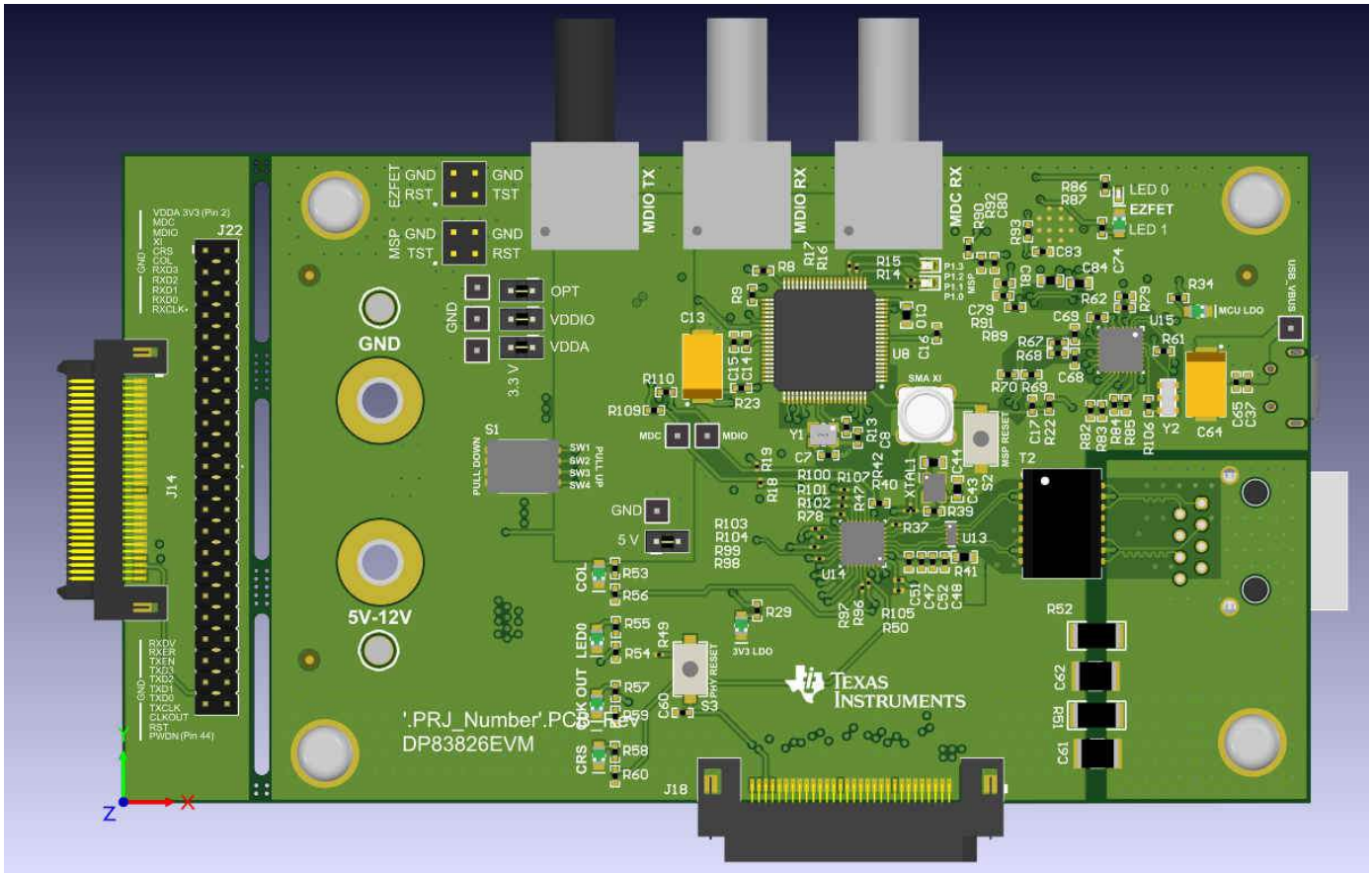


Figure 2-1. DP83826EVM – Top Side

Layer (1 Tipped)
 43mil Hotspot Snap (All Layers): 10mil

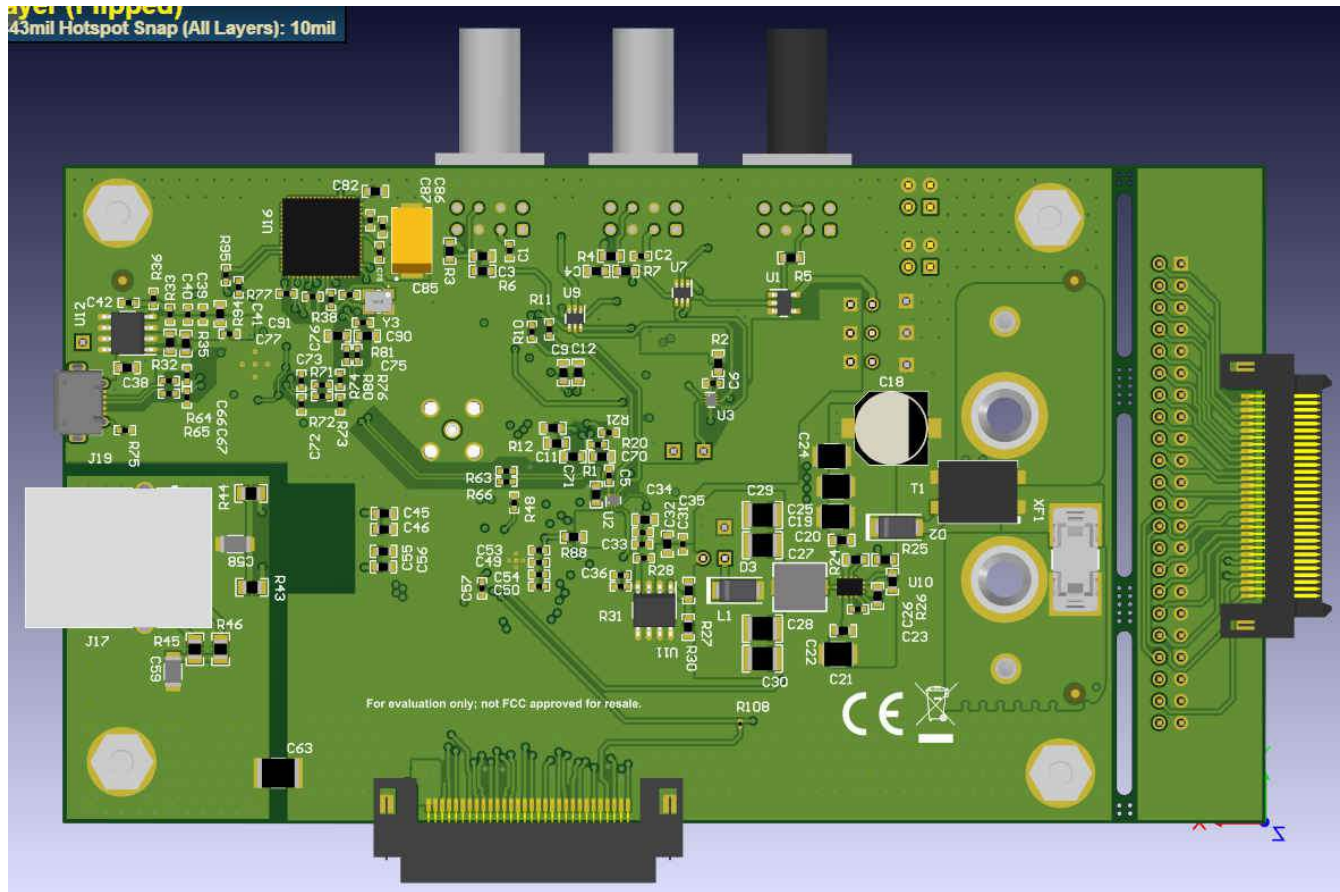


Figure 2-2. DP83826EVM – Bottom Side

2.2 Operation – Quick Setup

2.2.1 Power Supply

The DP83826EVM power is supplied by the 5-12V input connection in [Figure 2-3](#). Single supply operation uses on-board LDOs to generate the voltages required for operating various sections of the EVM. Power can also be supplied externally to individual voltage rails. The micro-USB supplies power to the on-board LDOs that power all microcontroller related components.

Note

Before supplying power at the 5-12V input, ensure the correct shunts are added to the appropriate headers to properly operate the on-board LDOs as seen in [Figure 2-4](#).

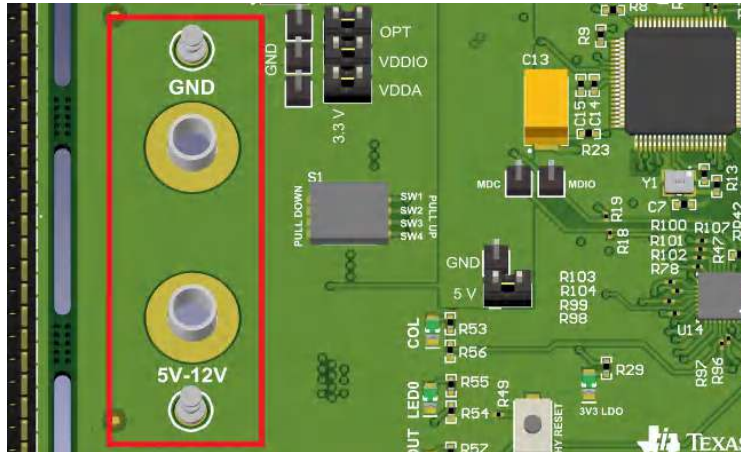


Figure 2-3. DP83826EVM Power Headers

2.2.2 Power Inputs

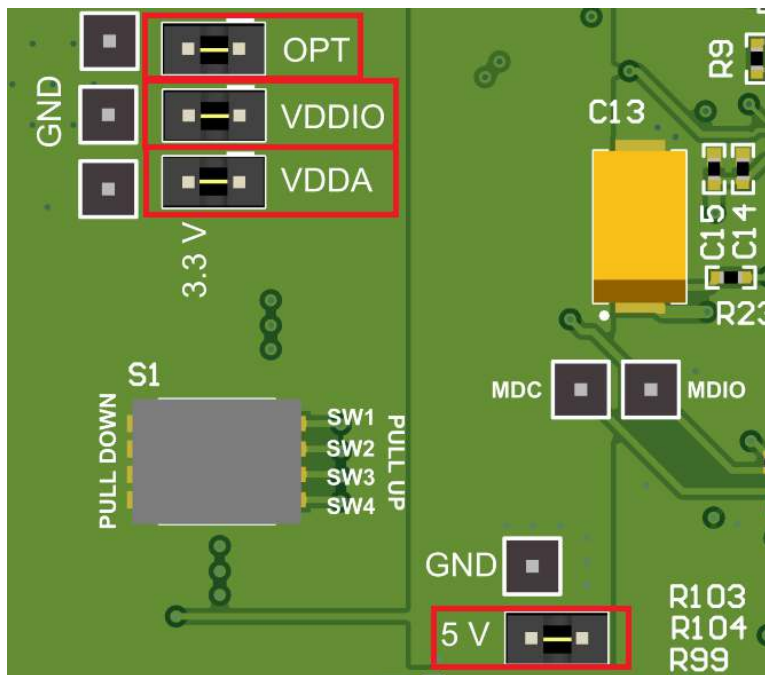
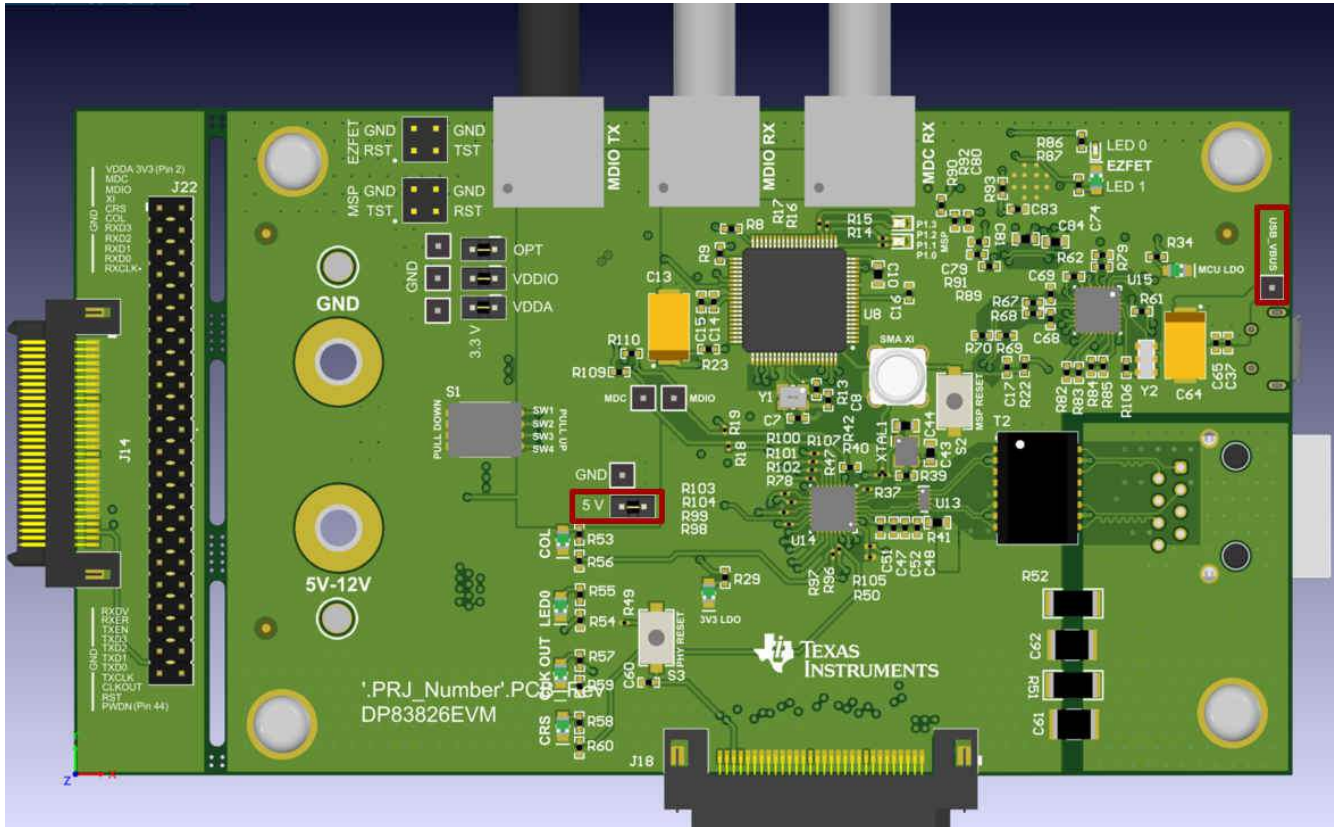


Figure 2-4. DP83826EVM Power Inputs

In the case the user would like to power the EVM from external sources, J7, J8, and J9, VDDA, VDDIO and the fiber optic transceivers respectively, can be removed and supplied power at pin 2 for all three jumpers. J23 (5V jumper) is used to supply LDO and PHY using an external 5V power supply. MSP is powered through USB.

DP83826EVM USB Power Input



Remove the J23 jumper (5V jumper) and connect the right hand side pin to USB_VBUS using two female connector. After connection, PHY and MSP can be power up through USB without any external power supply required.

2.2.3 Software

The on-board MSP430 comes pre-programmed and ready to use. When using this EVM for the first time on a Windows 7 (or above) PC, MSP430 drivers and USB-2-MDIO software utility will have to be installed. USB-2-MDIO software can be used for accessing the PHY's registers. In the case where an external MSP430 or EZFET is needed, the user may simply connect the TST and RST pins of their device to the DP83826EVM.

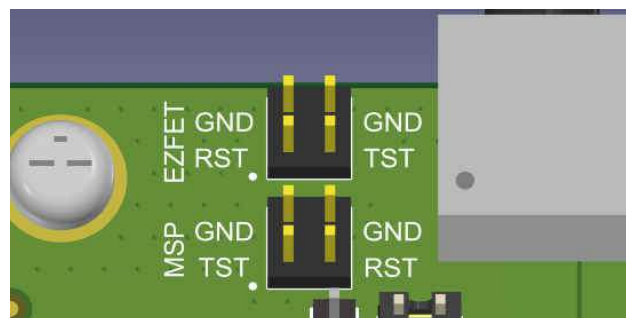


Figure 2-5. DP83826EVM External MSP Connection

2.2.3.1 MSP430 Driver

Install the latest MSP430 drive from this website: http://software-dl.ti.com/msp430/msp430_public_sw/mcu/msp430/MSP430_FET_Drivers/latest/index_FDS.html.

2.2.3.2 USB-2-MDIO Software

Download the software from <http://www.ti.com/tool/usb-2-mdio> .

The webpage also contains the User's Guide for installing and using the software. Because the MSP430 is on-board the DP83826EVM, it is not necessary to purchase a separate MSP430 Launchpad kit and connect to the PHY using wires.

In the case the on-board MSP430 cannot be used for some reason, MDIO and MDC pins are also broken out on J1 and J2 pins, respectively. Users can connect an MSP430 launchpad or their own MDIO-MDC utility on J1 and J2 to access the PHY.

3 Board Setup Details

3.1 Block Diagram

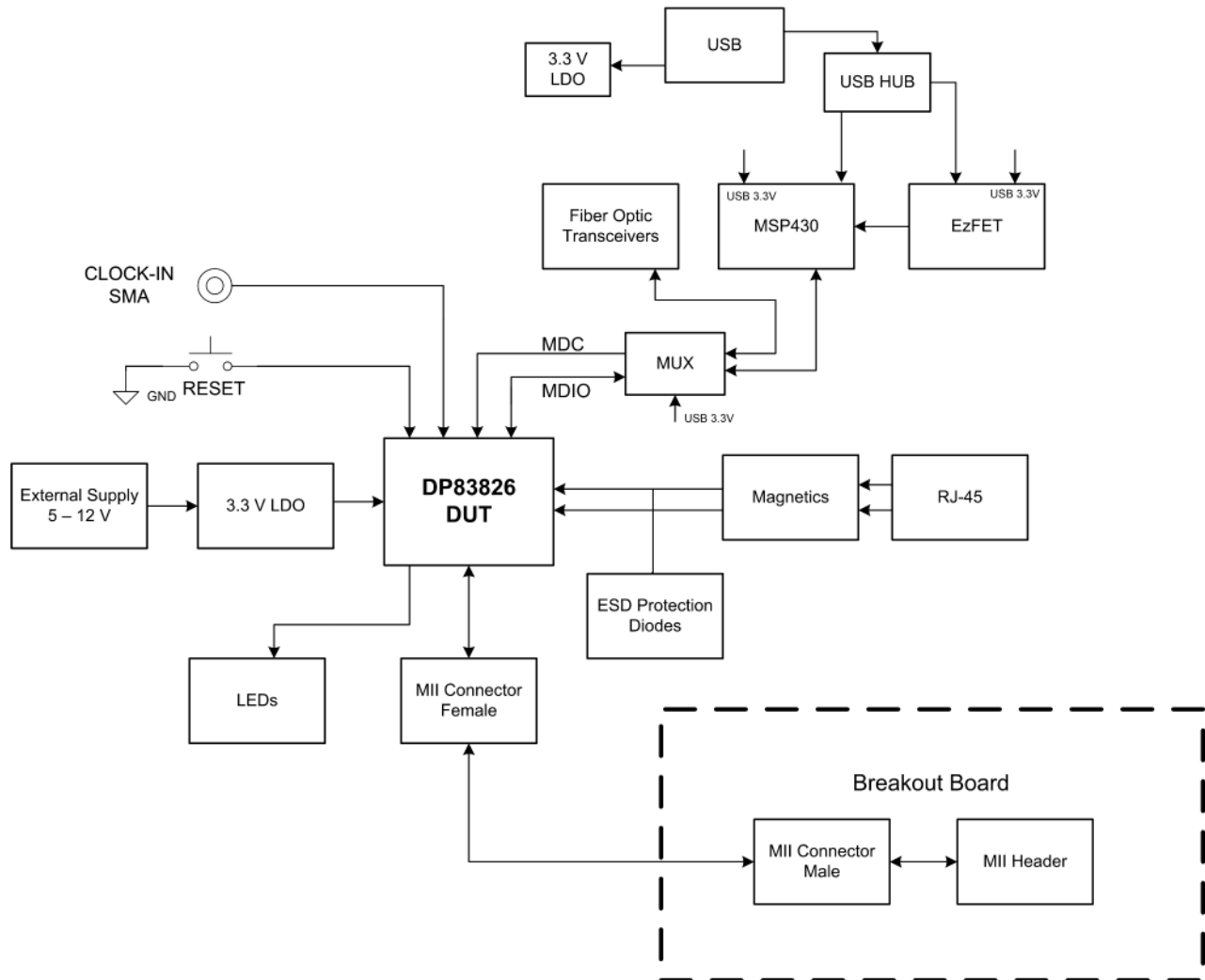


Figure 3-1. DP83826EVM Block Diagram

3.2 EVM High Level Summary

Table 3-1. DP83826EVM Applications

NO.	TEST CASES	APPLICATIONS	HOW TO USE
1	MII/RMII to Copper	Run traffic between MII/RMII and Copper.	Connect to DP83826 EVM or MAC System using Header pins.
		Perform IEEE and UNH compliance testing	Using onboard MSP430 and software.
		Run EMI/EMC Test on EVM	Use internal PRBS and loopback. Onboard MSP430 can be used for register access.
		Measure Power Dissipation	Connect external power supplies.
		External MAC loopback	Connect external MAC to headers and use MAC loopback register settings
		50MHz output clock	Optional Clock out SMA
2	Loopback	Data received by the PHY can be looped back through the interface without needing a MAC.	Use onboard MSP430 to enable loopback.
3	Repeater Mode	RMII back to back as range extender.	Two EVMs can be connected back to back using custom header cable.
4	Low Power modes	Demonstrate EEE	Use onboard MSP430 to enable EEE.
		Demonstrate Sleep and Power down mode	Use onboard MSP430 to activate low power mode

4 Configurations Options

4.1 MDIO Register Access

To update or read the registers of the device, the user can simply connect the DP83826EVM to a computer and use the USB-2-MDIO software. The EVM is designed to easily enable and test strap functionality through software instead without the need to modify the board and hardware. This allows for simple hardware and software support for those that do not have MDIO communication capability. The register map used for the DP83826EVM can be found in section 8.7 of the DP83826E Datasheet.

More information on how to access the DP83826 MDIO status and control registers can be found in the [USB-2-MDIO Software User's Guide](#) .

5 EMI Results

This section provides details of the EMI tests performed and its results.

Table 5-1. DP83826EVM EMI Tests Performed

TEST	STANDARD	TEST LEVEL	RESULT
Radiated Emissions 100M MII	CISPR 22	Class B	Below Limit Levels
Radiated Emissions 100M RMII Master			
Conducted Emissions 100M MII			
Conducted Emissions 100M RMII Master			

5.1 Setup

Below are a simple diagram and photo outlining the setup of the DP83826EVM in a 10m anechoic chamber.

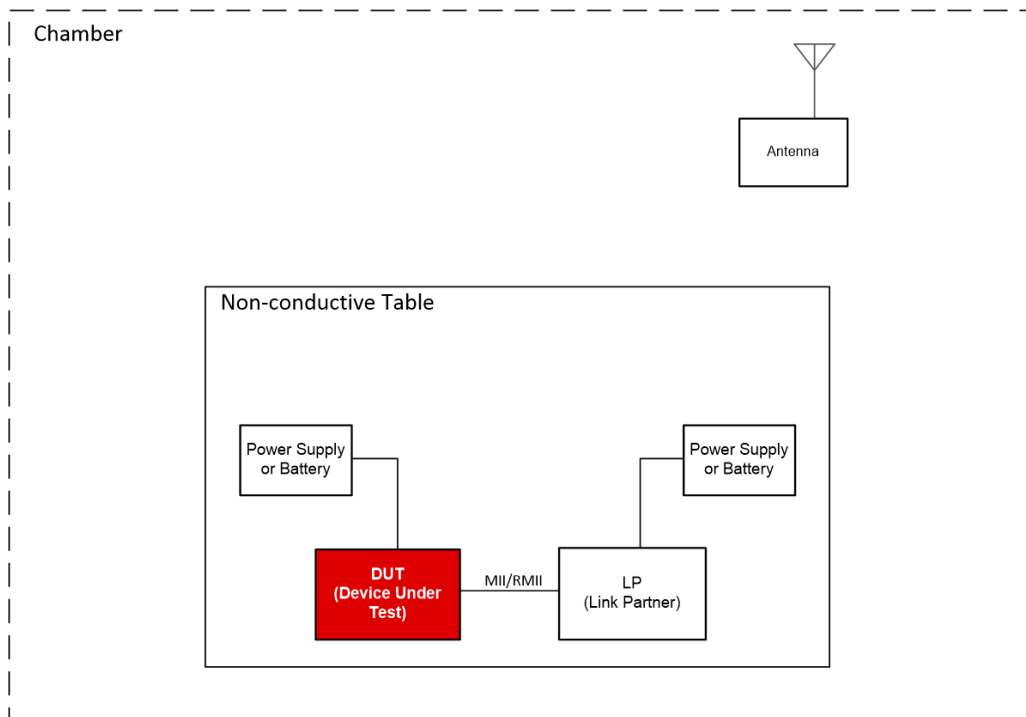


Figure 5-1. Block Diagram Setup for EMI Testing



Figure 5-2. EMI Testing Setup in Chamber

5.2 Results

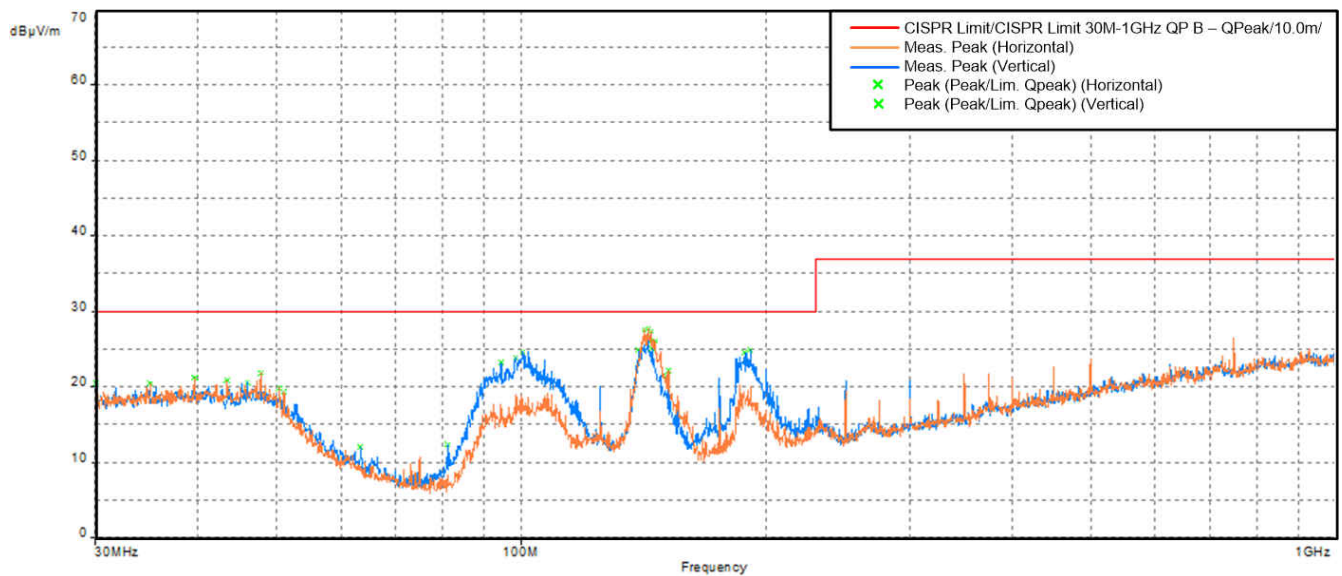


Figure 5-3. Radiated Emissions 100M MII

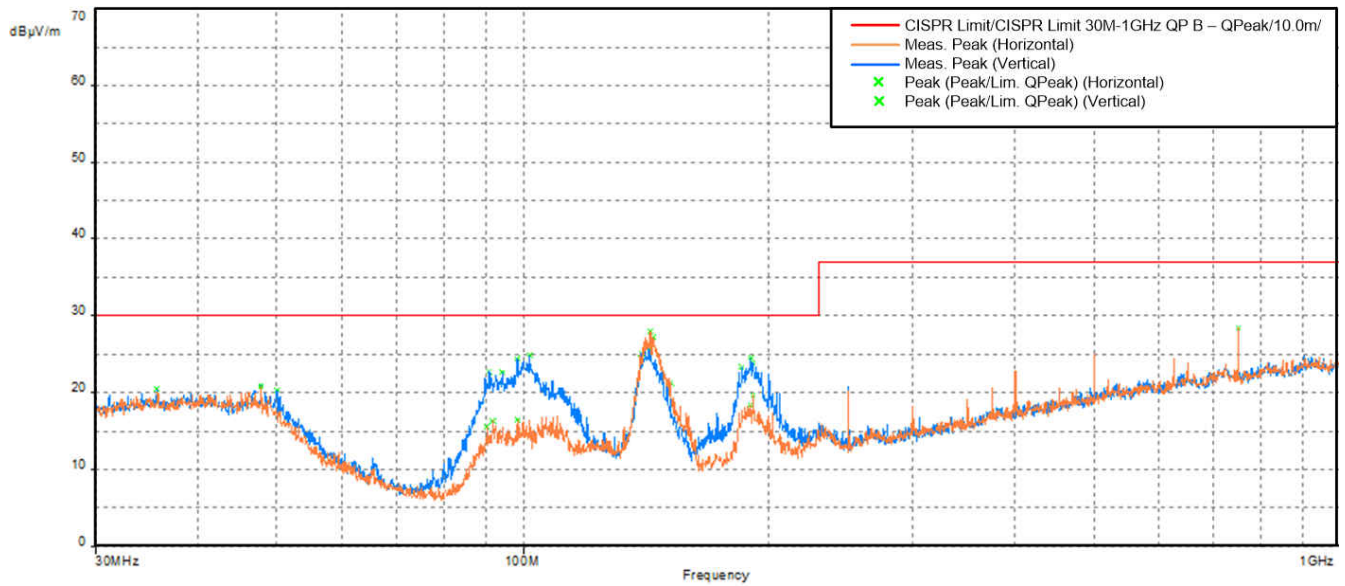


Figure 5-4. Radiated Emissions 100M RMII Master

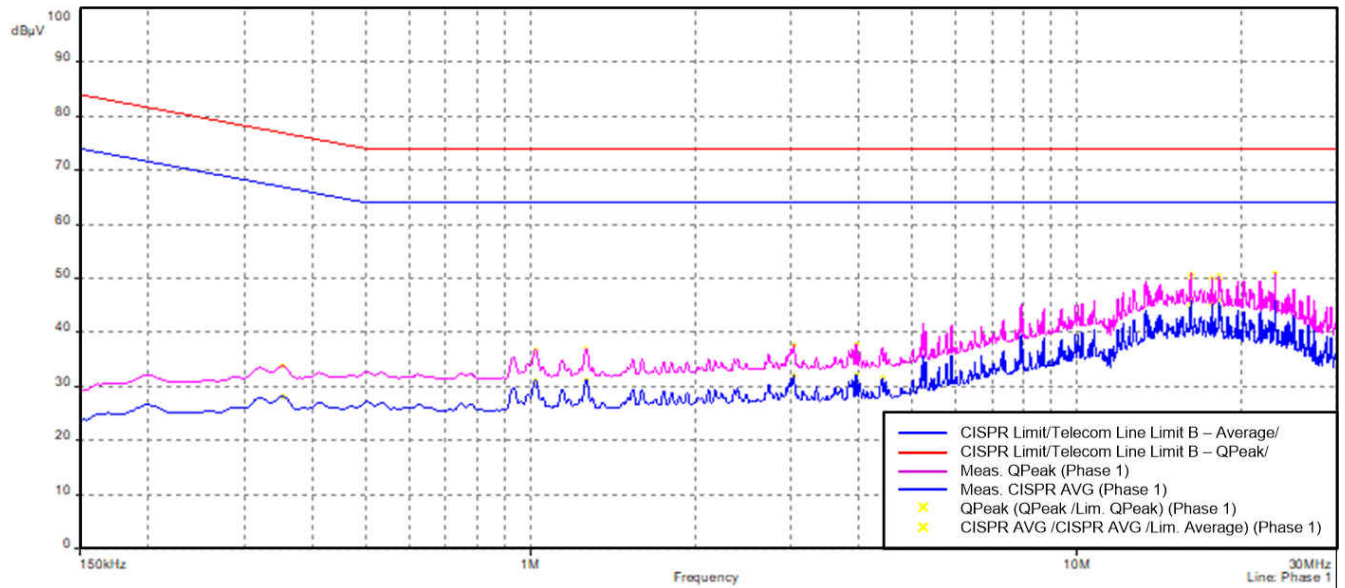


Figure 5-5. Conducted Emissions 100M MII

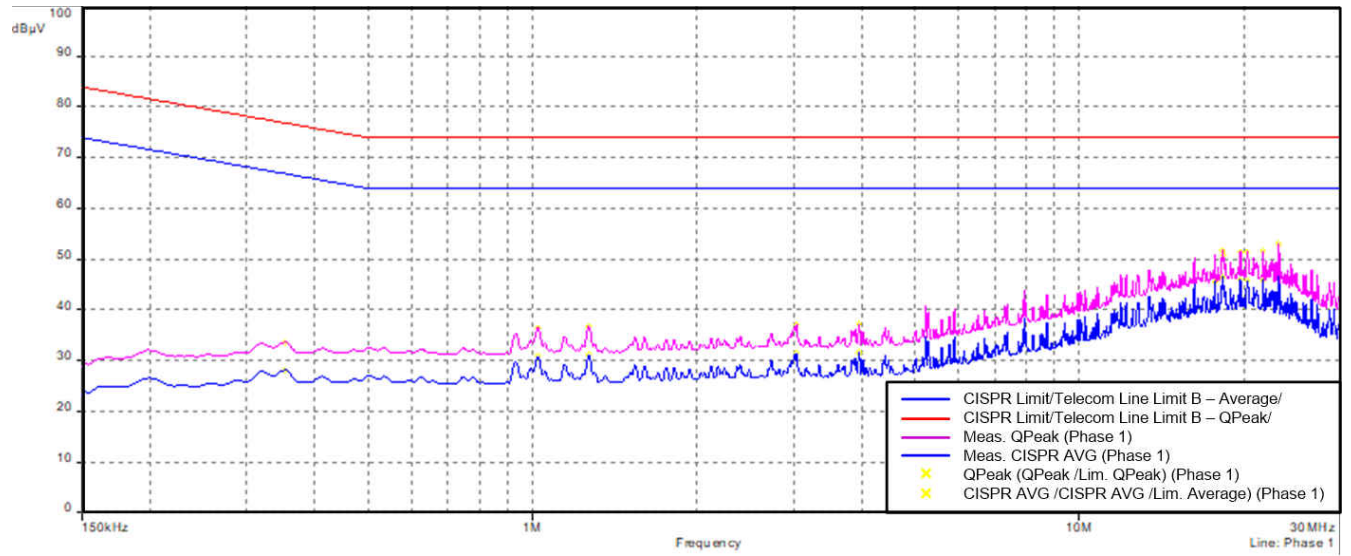


Figure 5-6. Conducted Emissions 100M RMII Master

6 DP83826EVM Schematics

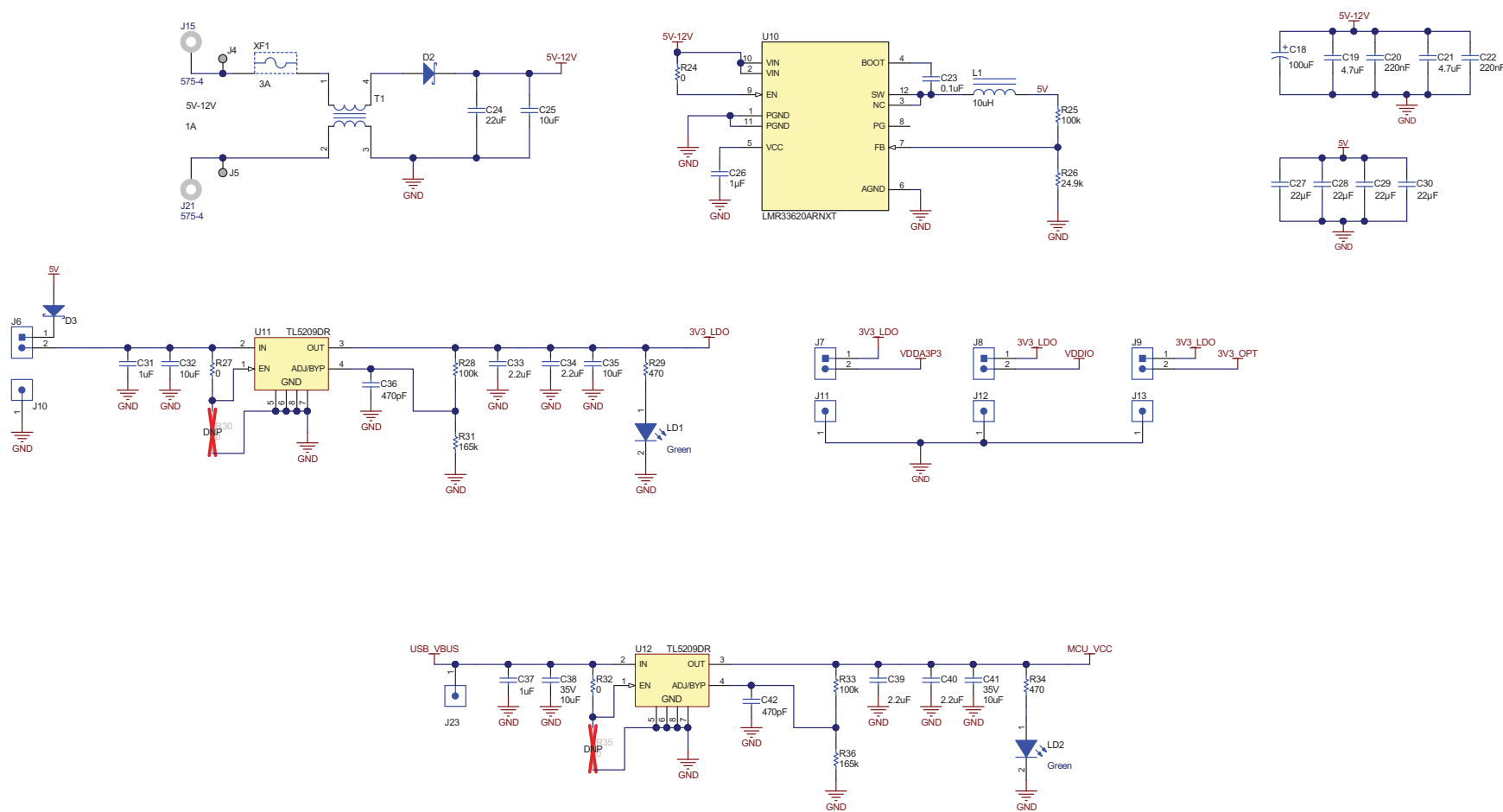


Figure 6-1. DP83826EVM Power Schematic

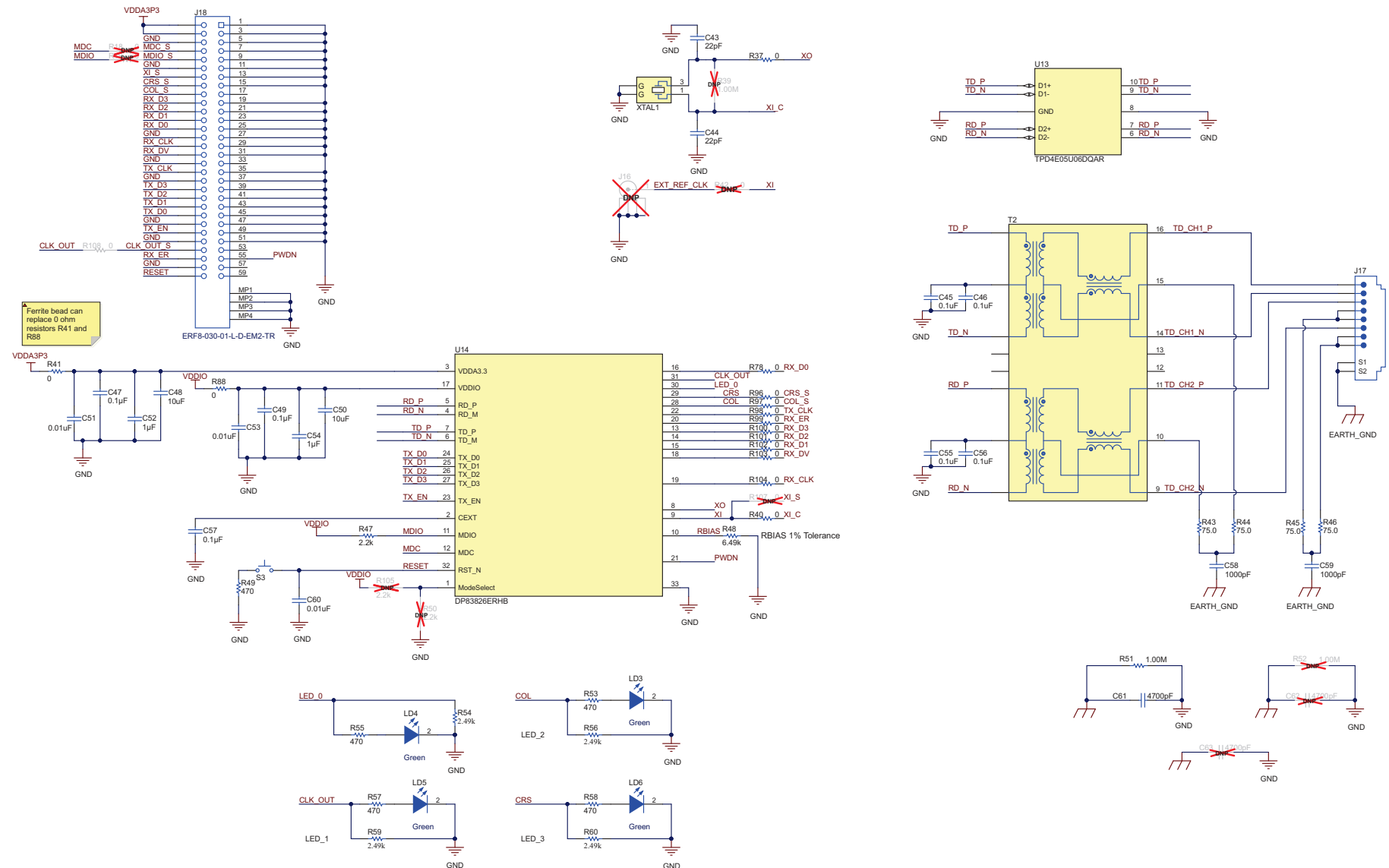


Figure 6-2. DP83826EVM Main Schematic

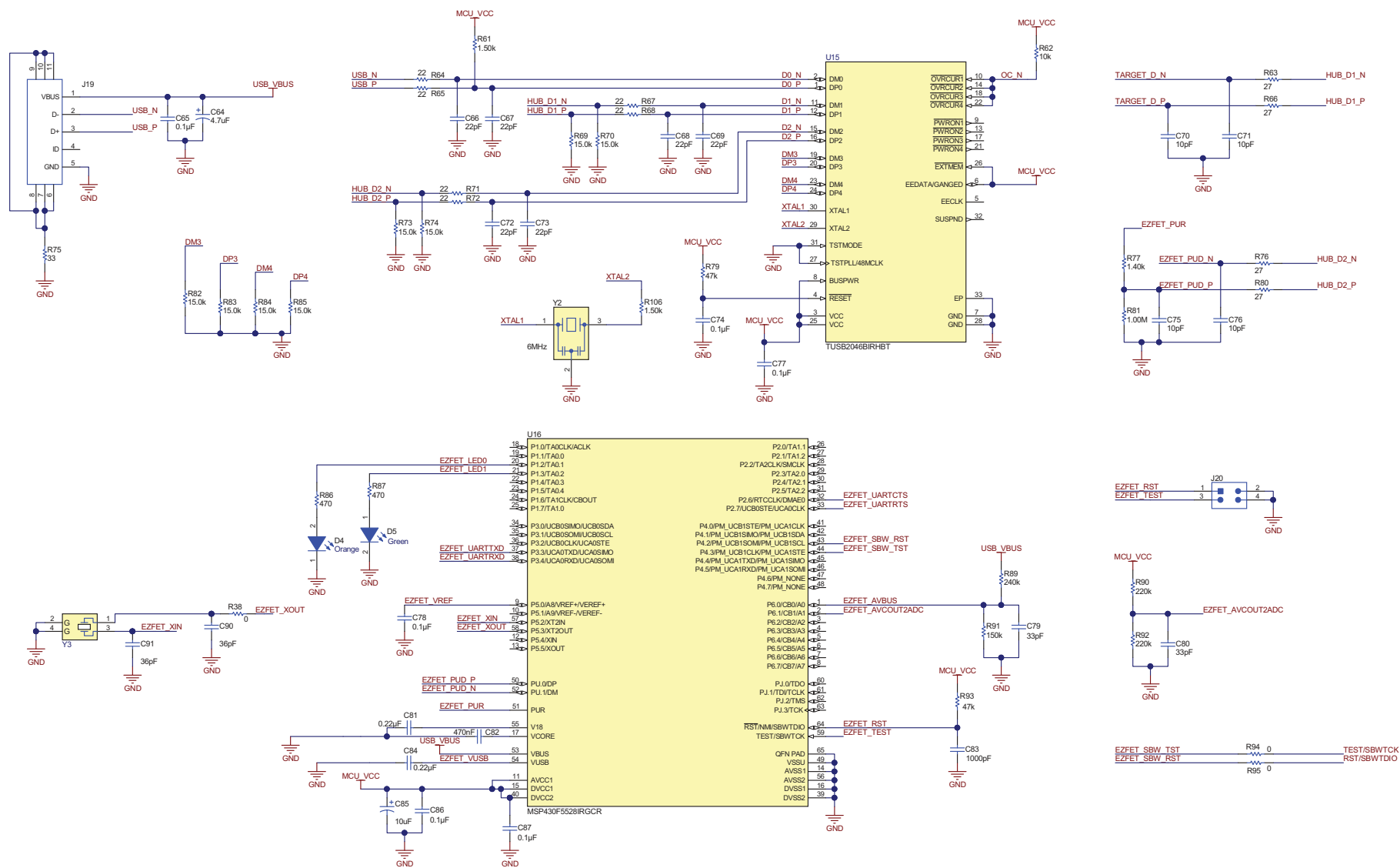


Figure 6-3. DP83826EVM USB HUB and EZFET Schematic

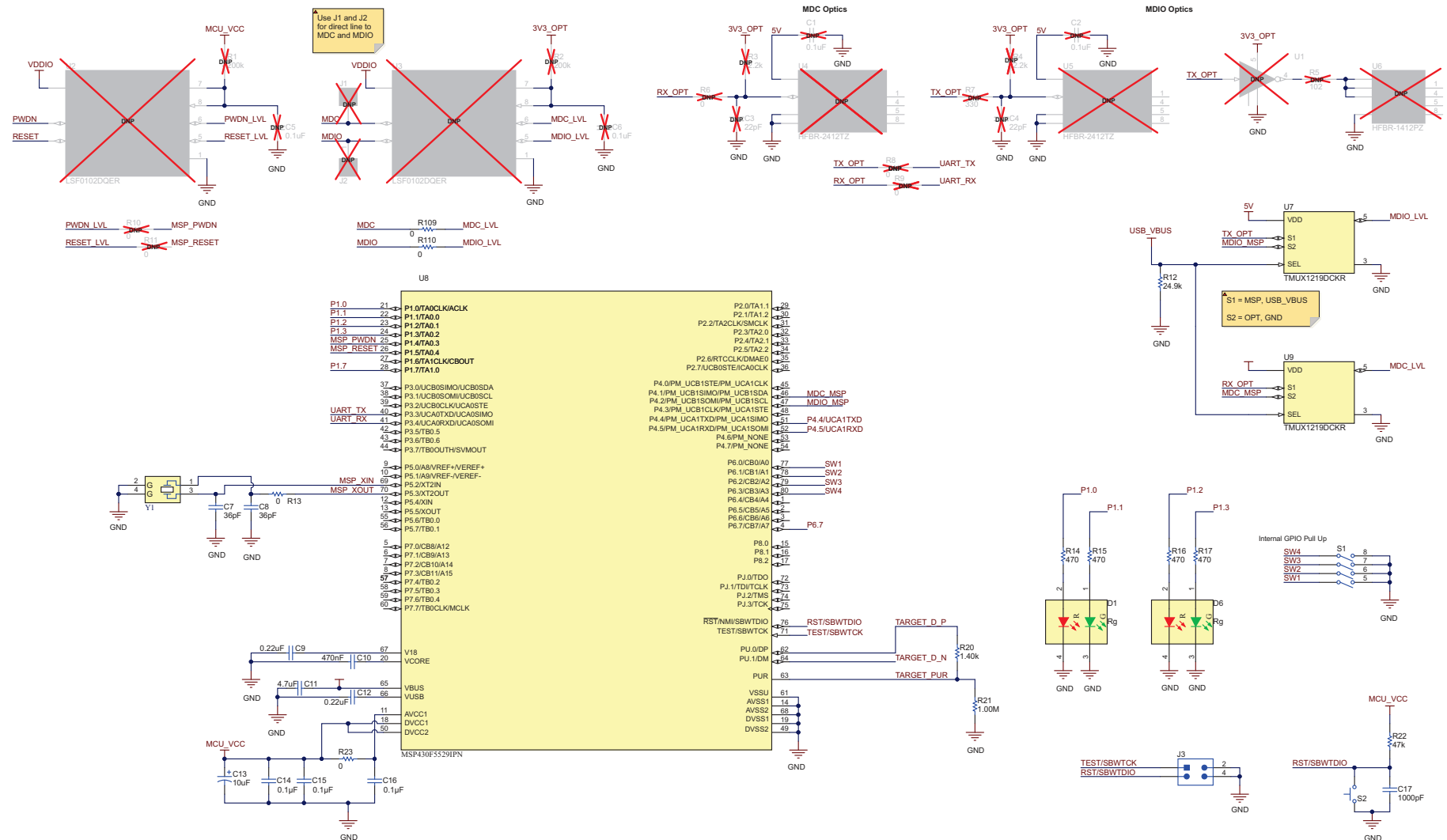


Figure 6-4. DP83826EVM MSP430 and SMI Schematic

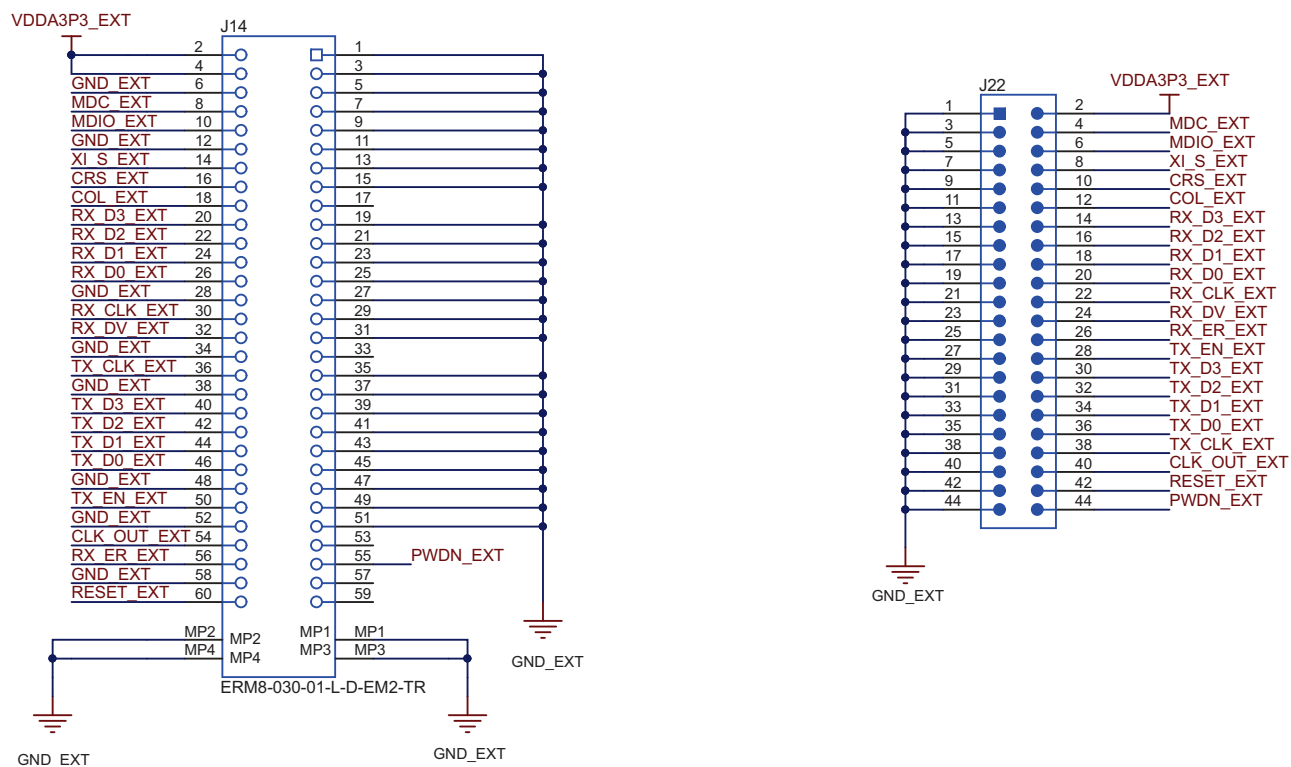


Figure 6-5. DP83826EVM Breakout Board Schematic

7 DP83826EVM BOM

Table 7-1. DP83826EVM BOM

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
!PCB1	1		Printed Circuit Board		HSDC077	Any
C7, C8, C90, C91	4	36pF	CAP, CERM, 36 pF, 50 V,+/- 5%, C0G/NPO, 0402	0402	CL05C360JB5NNNC	Samsung Electro-Mechanics
C9, C12	2	0.22uF	CAP, CERM, 0.22 uF, 16 V, +80/-20%, Y5V, 0603	0603	C0603C224Z4VACTU	Kemet
C10	1	0.47uF	CAP, CERM, 0.47 uF, 16 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	GCM188R71C474KA55D	MuRata
C11	1	4.7uF	CAP, CERM, 4.7 uF, 35 V, +/- 10%, X5R, 0603	0603	C1608X5R1V475K080AC	TDK
C13, C85	2	10uF	CAP, TA, 10 uF, 35 V, +/- 10%, 0.125 ohm, SMD	7343-31	TPSD106K035R0125	AVX
C14, C15, C16, C47, C49, C57, C65	7	0.1uF	CAP, CERM, 0.1 uF, 10 V,+/- 10%, X7R, 0402	0402	C0402C104K8RACTU	Kemet
C17, C83	2	1000pF	CAP, CERM, 1000 pF, 50 V, +/- 5%, C0G/NPO, 0402	0402	C1005NP01H102J050BA	TDK
C18	1	100uF	CAP, AL, 100 uF, 50 V, +/- 20%, SMD	HA0	EMVE500ADA101MH A0G	Chemi-Con
C19, C21	2	4.7uF	CAP, CERM, 4.7 uF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 1210	1210	CGA6P3X7R1H475K250AB	TDK
C20, C22	2	0.22uF	CAP, CERM, 0.22 uF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	CGA3E3X7R1H224K080AB	TDK
C23	1	0.1uF	CAP, CERM, 0.1 uF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0402	0402	GCM155R71H104KE02D	MuRata
C24	1	22uF	CAP, CERM, 22 uF, 16 V, +/- 20%, X7R, AEC-Q200 Grade 1, 1210	1210	CGA6P1X7R1C226M250AC	TDK
C25	1	10uF	CAP, CERM, 10 uF, 25 V, +/- 20%, X7R, AEC-Q200 Grade 1, 1210	1210	CGA6P1X7R1E106M250AC	TDK
C26	1	1uF	CAP, CERM, 1 uF, 35 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	CGA3E1X7R1V105K080AC	TDK
C27, C28, C29, C30	4	22uF	CAP, CERM, 22 uF, 25 V,+/- 10%, X7R, AEC-Q200 Grade 1, 1210	1210	TMK325B7226KMHP	Taiyo Yuden
C31, C37	2	1uF	CAP, CERM, 1 uF, 35 V, +/- 20%, X5R, 0402	0402	GRM155R6YA105ME11D	MuRata
C32, C35, C38, C41	4	10uF	CAP, CERM, 10 uF, 35 V, +/- 20%, X5R, 0603	0603	GRM188R6YA106MA73D	Murata
C33, C34, C39, C40	4	2.2uF	CAP, CERM, 2.2 uF, 16 V, +/- 10%, X6S, 0402	0402	GRM155C81C225KE11D	MuRata

Table 7-1. DP83826EVM BOM (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
C36, C42	2	470pF	CAP, CERM, 470 pF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0402	0402	GCM155R71H471KA37D	MuRata
C43, C44	2	22pF	CAP, CERM, 22 pF, 50 V, +/- 5%, C0G/NPO, AEC-Q200 Grade 1, 0603	0603	CGA3E2C0G1H220J080AA	TDK
C45, C46, C55, C56	4	0.1uF	CAP, CERM, 0.1 uF, 10 V, +/- 10%, X7R, 0603	0603	C0603C104K8RACTU	Kemet
C48, C50	2	10uF	CAP, CERM, 10 uF, 6.3 V, +/- 20%, X5R, 0402	0402	CL05A106MQ5NUNC	Samsung Electro-Mechanics
C51, C53, C60	3	0.01uF	CAP, CERM, 0.01 uF, 16 V, +/- 10%, X7R, 0402	0402	885012205031	Würth Elektronik
C52, C54	2	1uF	CAP, CERM, 1 uF, 10 V, +/- 20%, X5R, 0402	0402	CC0402MRX5R6BB105	Yageo America
C58, C59	2	1000pF	CAP, CERM, 1000 pF, 2000 V, +/- 10%, X7R, AEC-Q200 Grade 1, 1206	1206	C1206C102KGRACAU TO	Kemet
C61	1	4700pF	CAP, CERM, 4700 pF, 2000 V, +/- 10%, X7R, 1812	1812	1812GC472KAT1A	AVX
C64	1	4.7uF	CAP, TA, 4.7 uF, 35 V, +/- 10%, 1.3 ohm, SMD	7343-31	293D475X9035D2TE3	Vishay-Sprague
C66, C67, C68, C69, C72, C73	6	22pF	CAP, CERM, 22 pF, 50 V, +/- 5%, C0G/NPO, 0402	0402	C1005NP01H220J050BA	TDK
C70, C71, C75, C76	4	10pF	CAP, CERM, 10 pF, 50 V, +/- 5%, C0G/NPO, 0603	0603	CGA3E2NP01H100D080AA	TDK
C74, C77, C78, C86, C87	5	0.1uF	CAP, CERM, 0.1 uF, 16 V, +/- 10%, X7R, 0402	0402	CL05B104KO5NNNC	Walsin
C79, C80	2	33pF	CAP, CERM, 33 pF, 50 V, +/- 5%, C0G/NPO, AEC-Q200 Grade 1, 0402	0402	GCM1555C1H330JA16D	MuRata
C81, C84	2	0.22uF	CAP, CERM, 0.22 uF, 50 V, +/- 10%, X5R, 0603	0603	CL10A224KB8NNNC	Samsung Electro-Mechanics
C82	1	0.47uF	CAP, CERM, 0.47 uF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	CGA3E3X7R1H474K080AB	TDK
D1, D6	2	Rg	LED, Rg, SMD	1.6x0.8mm	HSMF-C165	Avago
D2, D3	2	60V	Diode, Schottky, 60 V, 1 A, AEC-Q101, SMA	SMA	NRVBA160T3G	ON Semiconductor
D4	1	Orange	LED, Orange, SMD	1x0.5mm	APHHS1005SECK	Kingbright
D5, LD1, LD2, LD3, LD4, LD5, LD6	7	Green	LED, Green, SMD	2x1.25mm	QTLTP630C4TR	Everlight
F1	1		Fuse, 3 A, 63VAC/VDC, SMD	7.4x3.1mm	3402.0014.11	Schurter
H1, H2, H3, H4	4		Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	Screw	NY PMS 440 0025 PH	B&F Fastener Supply

Table 7-1. DP83826EVM BOM (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
H5, H6, H7, H8	4		Standoff, Hex, 1"L #4-40 Nylon	Standoff	1902E	Keystone
J3, J20	2		Header, 100mil, 2x2, Gold, TH	2x2 Header	TSW-102-07-G-D	Samtec
J4, J5	2		Terminal, Turret, TH, Double	Keystone1502-2	1502-2	Keystone
J6, J7, J8, J9	4		Header, 100mil, 2x1, Tin, TH	Header, 2 PIN, 100mil, Tin	PEC02SAAN	Sullins Connector Solutions
J10, J11, J12, J13, J23	5		Header, 1x1, Tin, TH	Header, 1x1	PEC01SAAN	Sullins Connector Solutions
J14	1		Receptacle, 0.8mm, 30x2, Tin, Edge mount	Receptacle, 0.8mm, 30x2, Edge mount	ERM8-030-01-L-D-EM2-TR	Samtec
J15, J21	2		Standard Banana Jack, Uninsulated, 5.5mm	Keystone_575-4	575-4	Keystone
J17	1		RJ45, 1.27mm, R/A, Gold, TH	RJ-45, 1.27mm, R/A, TH	SS-7188S-A-NF	Stewart Connector
J18	1		Receptacle, 0.8mm, 30x2, Gold, Edge Mount	Receptacle, 0.8mm, 30x2, Edge Mount	ERF8-030-01-L-D-EM2-TR	Samtec
J19	1		Connector, Receptacle, Micro-USB Type AB, R/A, Bottom Mount SMT	5.6x2.5x8.2mm	475890001	Molex
J22	1		Header, 2.54mm, 22x2, Gold, TH	Header, 2.54mm, 22x2, TH	TSW-122-07-G-D	Samtec
L1	1	10uH	Inductor, Shielded, Ferrite, 10 uH, 2.75 A, 0.128 ohm, SMD	Inductor, 5.7x2.8x5.2mm	SRP5030T-100M	Bourns
R12, R26	2	24.9k	RES, 24.9 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060324K9FKEA	Vishay-Dale
R13, R23	2	0	RES, 0, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04020000Z0ED	Vishay-Dale
R14, R15, R16, R17, R49	5	470	RES, 470, 5%, 0.05 W, 0201	0201	RC0201JR-07470RL	Yageo America
R20, R77	2	1.40k	RES, 1.40 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04021K40FKED	Vishay-Dale
R21, R81	2	1.00Meg	RES, 1.00 M, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04021M00FKE D	Vishay-Dale
R22, R79, R93	3	47k	RES, 47 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040247K0JNED	Vishay-Dale
R24	1	0	RES, 0, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	RMCF0603ZT0R00	Stackpole Electronics Inc
R25	1	100k	RES, 100 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW0603100KFKEA	Vishay-Dale
R27, R32	2	0	RES, 0, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	ERJ-3GEY0R00V	Panasonic

Table 7-1. DP83826EVM BOM (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
R28, R33	2	100k	RES, 100 k, 0.5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402100KDHE DP	Vishay-Dale
R29, R34, R53, R55, R57, R58, R86, R87	8	470	RES, 470, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402470RJNED	Vishay-Dale
R31, R36	2	165k	RES, 165 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402165KFKED	Vishay-Dale
R37, R40, R78, R96, R97, R98, R99, R100, R101, R102, R103, R104	12	0	RES, 0, 5%, 0.05 W, 0201	0201	CRCW02010000Z0ED	Vishay-Dale
R38, R94, R95	3	0	RES, 0, 5%, 0.063 W, 0402	0402	RC0402JR-070RL	Yageo America
R41, R88	2	0	RES, 0, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06030000Z0EA	Vishay-Dale
R43, R44, R45, R46	4	75.0	RES, 75.0, 1%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	CRCW080575R0FKEA	Vishay-Dale
R47	1	2.2k	RES, 2.2 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04022K20JNED	Vishay-Dale
R48	1	6.49k	RES, 6.49 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04026K49FKED	Vishay-Dale
R51	1	1.00Meg	RES, 1.00 M, 1%, 1 W, 2010	2010	HVCB2010FKC1M00	Stackpole Electronics Inc
R54, R56, R59, R60	4	2.49k	RES, 2.49 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04022K49FKED	Vishay-Dale
R61, R106	2	1.50k	RES, 1.50 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04021K50FKED	Vishay-Dale
R62	1	10k	RES, 10 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040210K0JNED	Vishay-Dale
R63, R66, R76, R80	4	27	RES, 27, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040227R0JNED	Vishay-Dale
R64, R65, R67, R68, R71, R72	6	22	RES, 22, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040222R0JNED	Vishay-Dale
R69, R70, R73, R74, R82, R83, R84, R85	8	15.0k	RES, 15.0 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040215K0FKED	Vishay-Dale
R75	1	33	RES, 33, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040233R0JNED	Vishay-Dale
R89	1	240k	RES, 240 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402240KJNED	Vishay-Dale
R90, R92	2	220k	RES, 220 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402220KJNED	Vishay-Dale
R91	1	150k	RES, 150 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402150KJNED	Vishay-Dale

Table 7-1. DP83826EVM BOM (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
R109, R110	2	0	RES, 0, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	0402	ERJ-2GE0R00X	Panasonic
S1	1		Switch, Slide, SPST 4 poles, SMT	SW, SMT Half Pitch 4SPST, 5.8x2.7x6.25 mm	218-4LPST	CTS Electrocomponents
S2, S3	2		Switch, Normally open, 2.3N force, 200k operations, SMD	KSR	KSR221GLFS	C&K Components
SH-J1, SH-J2, SH-J3, SH-J4	4		Single Operation 2.54mm Pitch Open Top Jumper Socket	Single Operation 2.54mm Pitch Open Top Jumper Socket	M7582-05	Harwin
T1	1		Coupled inductor, 5 A, 0.01 ohm, SMD	9x7mm	ACM9070-701-2PL-TL01	TDK
T2	1	350uH	Transformer, 350 uH, SMT	12.7x9.09mm	HX1188FNLT	Pulse Engineering
U8	1		25 MHz Mixed Signal Microcontroller with 128 KB Flash, 8192 B SRAM and 63 GPIOs, -40 to 85 degC, 80-pin QFP (PN), Green (RoHS & no Sb/Br)	PN0080A	MSP430F5529IPN	Texas Instruments
U10	1		3.8-V to 36-V 2-A Synchronous Step-Down Voltage Regulator, RNX0012B (VQFN-HR-12)	RNX0012B	LMR33620ARNXT	Texas Instruments
U11, U12	2		Single Output Low Noise LDO, 500 mA, Adjustable 1.3 to 6.5 V Output, 2.5 to 16 V Input, 8-pin SOIC (D), -40 to 125 degC, Green (RoHS & no Sb/Br)	D0008A	TL5209DR	Texas Instruments
U13	1		4-Channel Ultra-Low-Capacitance IEC ESD Protection Diode, DQA0010A (USON-10)	DQA0010A	TPD4E05U06DQAR	Texas Instruments
U14	1		DP83826ERHB, RHB0032M (VQFN-32)	RHB0032M	DP83826ERHB	Texas Instruments
U15	1		4-Port Full-Speed USB Hub, 3.3V, -40 to 85 degC, 32-Pin QFN (RHB), Green (RoHS & no Sb/Br)	RHB0032E	TUSB2046BIRHBT	Texas Instruments
U16	1		16-Bit Ultra-Low-Power Microcontroller, 128KB Flash, 8KB RAM, USB, 12Bit ADC, 2 USCIs, 32Bit HW MPY, RGC0064B (VQFN-64)	RGC0064B	MSP430F5528IRGCR	Texas Instruments
XF1	1		FUSE HLDR CARTRIDGE 125V 5A SMD	12x5.2mm	0031.7701.11	Schurter
XTAL1	1		Crystal, 25 MHz, 20 ppm, AEC-Q200 Grade 1, SMD	2.5x3.2mm	ECS-250-12-33Q-JES-TR	ECS Inc.
Y1, Y3	2		Crystal, 24 MHz, 20pF, SMD	3.2x2.5mm	ECS-240-20-33-DU-TR	ECS Inc.
Y2	1		Resonator, 6 MHz, 15pF SMD	4.5x1.2x2 mm	CSTCR6M00G53Z-R0	MuRata

Table 7-1. DP83826EVM BOM (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
C1, C2, C5, C6	0	0.1uF	CAP, CERM, 0.1 uF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0402	0402	GCM155R71H104KE02D	MuRata
C3, C4	0	22pF	CAP, CERM, 22 pF, 50 V, +/- 5%, COG/NP0, AEC-Q200 Grade 1, 0603	0603	CGA3E2C0G1H220J080AA	TDK
C62, C63	0	4700pF	CAP, CERM, 4700 pF, 2000 V, +/- 10%, X7R, 1812	1812	1812GC472KAT1A	AVX
FID1, FID2, FID3, FID4, FID5, FID6	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A
J1, J2	0		Header, 1x1, Tin, TH	Header, 1x1	PEC01SAAN	Sullins Connector Solutions
J16	0		SMA Straight PCB Socket Die Cast, 50 Ohm, TH	SMA Straight PCB Socket Die Cast, TH	5-1814832-1	TE Connectivity
R1, R2	0	200k	RES, 200 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW0603200KJNEA	Vishay-Dale
R3, R4	0	2.2k	RES, 2.2 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	ERJ-3GEYJ222V	Panasonic
R5	0	102	RES, 102, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW0603102RFKEA	Vishay-Dale
R6, R30, R35	0	0	RES, 0, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	ERJ-3GEY0R00V	Panasonic
R7	0	330	RES, 330, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW0603330RJNEA	Vishay-Dale
R8, R9, R10, R11	0	0	RES, 0, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	0402	ERJ-2GE0R00X	Panasonic
R18, R19, R42, R107, R108	0	0	RES, 0, 5%, 0.05 W, 0201	0201	CRCW02010000Z0ED	Vishay-Dale
R39	0	1.00Meg	RES, 1.00 M, 1%, 0.063 W, 0402	0402	RC0402FR-071ML	Yageo America
R50, R105	0	2.2k	RES, 2.2 k, 5%, 0.05 W, 0201	0201	CRCW02012K20JNED	Vishay-Dale
R52	0	1.00Meg	RES, 1.00 M, 1%, 1 W, 2010	2010	HVCB2010FKC1M00	Stackpole Electronics Inc
U1	0		Automotive Catalog Single Inverter, DBV0005A, LARGE T&R	DBV0005A	SN74LVC1G04QDBVRQ1	Texas Instruments
U2, U3	0		Dual Bidirectional Multi-Voltage Level Translator, DQE0008A (X2SON-8)	DQE0008A	LSF0102DQER	Texas Instruments
U4, U5	0		Fiber Optic Receiver 5MBd, TH	12.7x27.2mm	HFBR-2412TZ	Broadcom Limited
U6	0		Fiber Optic Transmitter 820nm, TH	12.7x27.2mm	HFBR-1412PZ	Broadcom Limited

8 Revision History

Changes from Revision * (December 2019) to Revision A (June 2023)	Page
• Updated the numbering format for tables, figures, and cross-references throughout the document.....	1
• Update users guide on how to power the PHY using just the USB connection as well as the external power supply.....	7

STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.
 - 1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM ("Software") shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software
 - 1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.
2. *Limited Warranty and Related Remedies/Disclaimers:*
 - 2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.
 - 2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.
 - 2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

WARNING

Evaluation Kits are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.

User shall operate the Evaluation Kit within TI's recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI's recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI's instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGRADATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

3 Regulatory Notices:

3.1 United States

3.1.1 Notice applicable to EVMs not FCC-Approved:

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

3.1.2 For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:

CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- 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.

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

3.3 Japan

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。

<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html>

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
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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1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

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3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_02.page

電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。 <https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-for-power-line-communication.html>

3.4 European Union

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive):*

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

-
- 4 *EVM Use Restrictions and Warnings:*
- 4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.
- 4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.
- 4.3 *Safety-Related Warnings and Restrictions:*
- 4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user 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, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.
- 4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.
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9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

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