User's Guide

DP83825 Evaluation Module

ABSTRACT

This user's guide details how to properly operate and configure the DP83825EVM.

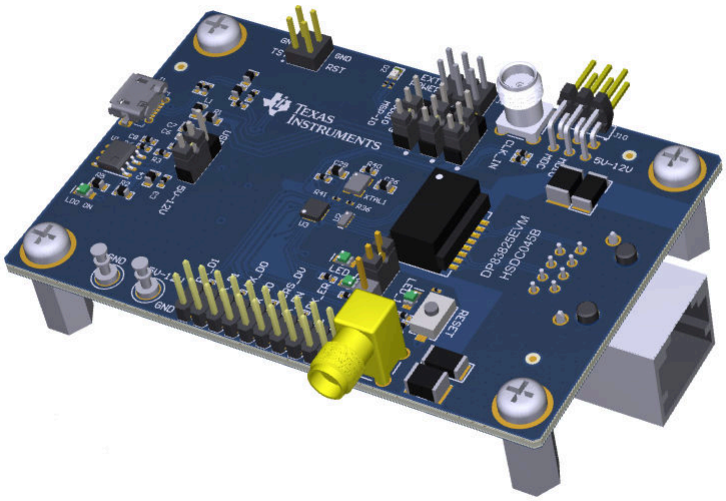

Table of Contents

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
RGMII	Reduced Gigabit Media Independent Interface
SFD	Start-of-Frame Detection
VDDA	Analog Core Supply Rail
VDDIO	Digital Supply Rail
PD	Pulldown
PU	Pullup
MC	Microcontroller

2 Introduction

The DP83825 is an ultra small form factor, very low power Ethernet Physical Layer transceiver with integrated PMD sublayers to support 10BASE-Te, 100BASE-TX Ethernet protocols. The DP83825 interfaces directly to twisted pair media via an external transformer. The DP83825 interfaces to the MAC layer through Reduced MII (RMII) both in Master and Slave mode. The 50 MHz clock in RMII Master mode is synchronized to MDI derived clock to improve the jitter in the system. The DP83825EVM demonstrates all features of DP83825 and supports 10BASE-Te and 100BASE-TX Ethernet protocols.

2.1 Key Features

- 100Base-TX, 10Base-Te
- RMII Onboard Clock
- Output Clock
- Onboard MSP430F5529 for easy MDIO Register Access
- LDO and External Power Supply Options
- Status LEDs
- Variable I/O Voltage Range: 1.8-V and 3.3-V
- Bootstraps for Hardware Configuration
- 100BASE-TX Data Transfer Over 150 Meters CAT5 Cable

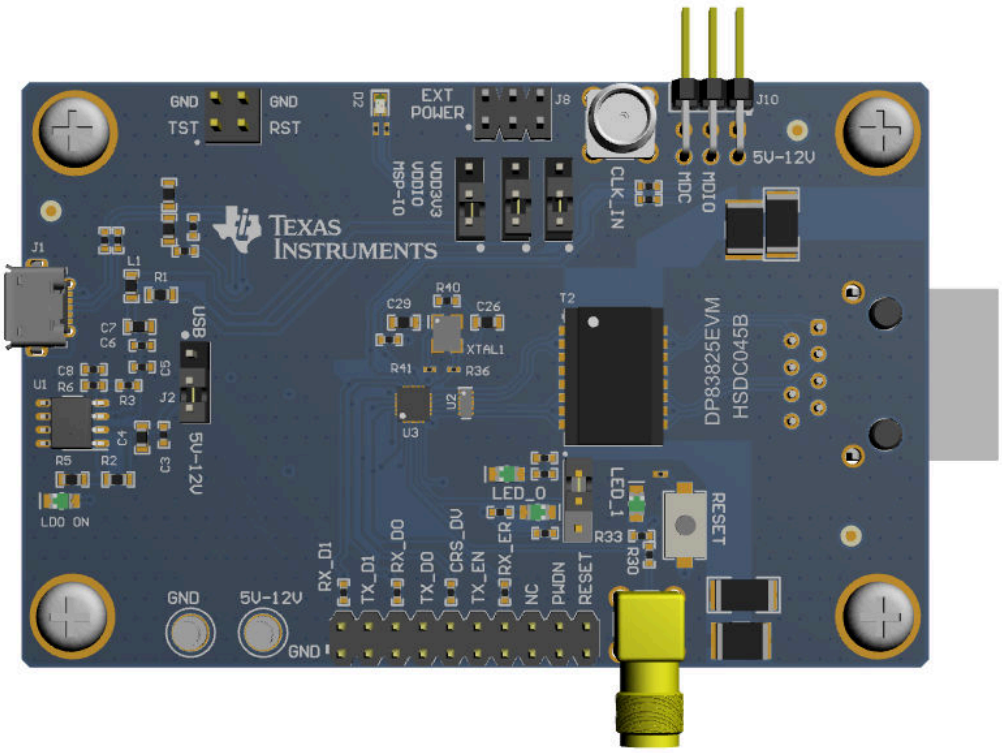

Figure 2-1. DP83825EVM - Top Side

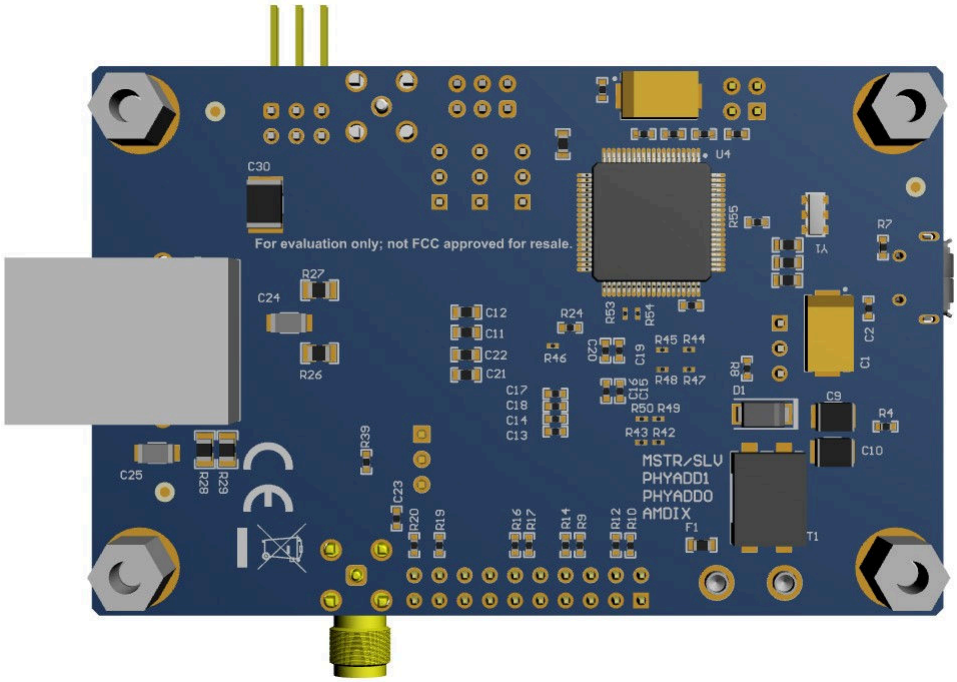

Figure 2-2. DP83825EVM - Bottom Side

2.2 Operation – Quick Setup

2.2.1 Power Supply

The EVM can be supplied power via multiple options. Single supply operation uses on-board LDOs to generate the voltages required for operating various sections of the EVM (PHY, MSP430 etc). Power can also be supplied externally to individual voltage rails.

2.2.2 LDO Supply

The EVM can be used in LDO operation by providing power by using power supply turrets or USB connector. The following jumper connections need to be connected to configure the board for LDO operation.

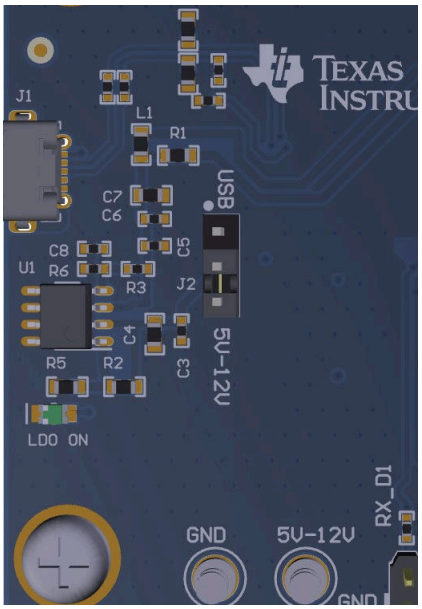

Figure 2-3. LDO Operation

- For Turret, connect jumper to position 2-3 on J2 connector (pictured) as shown in Figure 2-3 and supply power through ‘5V-12V’ and ‘GND’ turrets.
- For USB power, connect jumper to position 1-2 on J2 connector as shown in Figure 2-3 and supply power through J1 USB connector.
- On the VDD3V3, VDDIO, and MSP-IO connections, make sure that the jumpers are populated on position 1-2 for all three connectors shown in Figure 2-4.

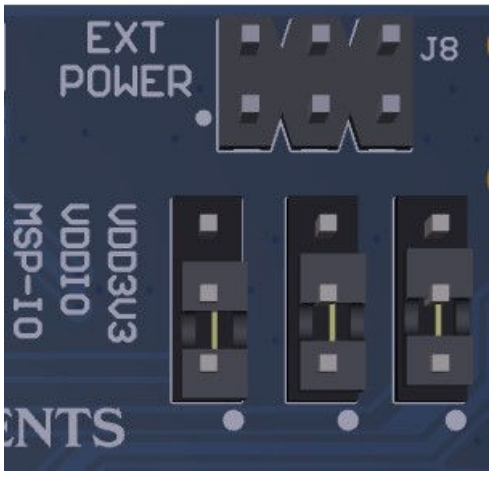

Figure 2-4. Supply Selection Jumpers - LDO

2.2.3 External Supply

DP83825EVM provides the option to power individual voltage rails from external power source giving customers more flexibility with EVM testing. ‘VDD3V3’, ‘VDDIO’, and ‘MSP-IO’ connectors shown above are used to switch individual rails from LDO source to External source. Connect jumper between pin 2-3 to switch from LDO supply to External power source. Then supply power through corresponding pin on J8.

Note

Jumpers in Figure 2-5 are in position 1-2. For external use, switch to position 2-3.

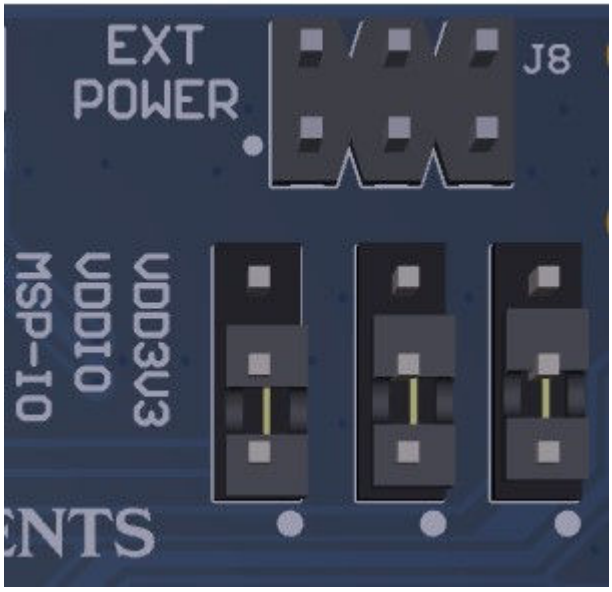

Figure 2-5. Supply Selection - LDO

For example: If VDD3V3 needs to be supplied externally, then switch the jumper on VDD3V3 connector from position 1-2 to 2-3. Then supply 3.3V external power through pin 5 on J8.

2.2.4 EVM High Level Summary

Table 2-1. EVM Applications

NO.	DP83825 MODE	APPLICATIONS	HOW TO USE
1	RMII to Copper	Run traffic between RMII and Copper.	Connect to DP83822 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. MSP430 launchpad 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
		50 MHz output clock	Optional Clock out SMA
2	RMII Loopback	Data received by the PHY can be looped back through the RMII interface without needing a MAC.	Use jumpers to connect TXD0->RXD0, TXD1->RXD1, and TXEN->RXDV.
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	Straps to enable EEE.
		Demonstrate Sleep and Power down mode	Use MSP430 launchpad to activate low power mode

3 Configurations Options

3.1 Strap Options

All straps are only two level straps in DP83825. DP83825 contains internal pull down resistors on the strap pins. The EVM takes advantage of this feature and has only pull up resistors on the board. When DP83825 strap pins are using internal pull down the corresponding pin is strapped to ‘0’ and when the strap pin has an external pull up resistor connected, the corresponding pin is strapped to ‘1’. Resistors R43, R45, R48, R50, needs to be installed to be used as pull up strap connectors (can be found on the back side of the board). When any strap pin needs to be strapped to ‘0’ on the EVM, disconnect the corresponding resistor. When a strap pin needs to be strapped to ‘1’, populate the corresponding resistor.

Table 3-1. Strap Value

STRAP VALUE	'1'	'0'
Resistor Pull Up	2.49 kΩ	Open
Resistor Pull Down	Open	2.49 kΩ (optional)

The LED_0 pin also has a strap. Because LED pins have automatic polarity, separate LEDs are used on the EVM depending on LED_0 pin being strapped high or low. In position 1-2 LED_0 is pulled low (0) and in position 2-3 LED_0 is pulled high (1).

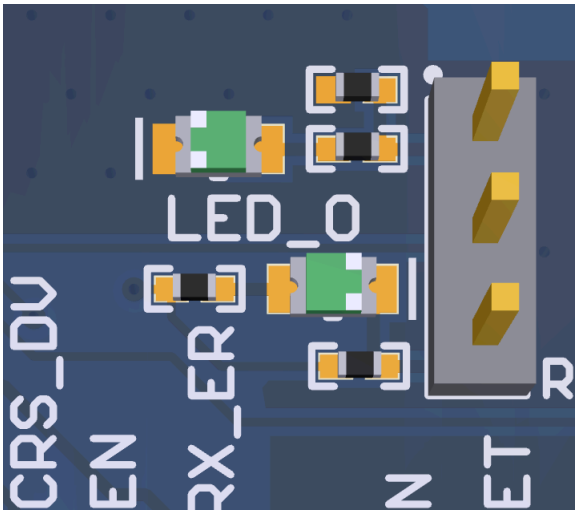

Figure 3-1. LED_0 Strap

Table 3-2. Strap Options Table

PIN NAME	STRAP NAME	PIN NO	DEFAULT	VALUE	DESCRIPTION
LED_0	ANEG_DIS	4	0	0	Enable Auto negotiation
				1	Disable Auto negotiation
RX_D1	RMII_MAS	17	0	0	RMII Master Mode
				1	RMII Slave Mode
RX_D0	PHY_AD[0]	18	0	0	PHY_AD[0] = 0
				1	PHY_AD[0] = 1
CRS_DV	PHY_AD[1]	20	0	0	PHY_AD[1] = 0
				1	PHY_AD[1] = 1
RX_ER	AMDIX_DIS	22	0	0	AMDIX Enabled
				1	AMDIX Disabled

4 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 USB2MDIO software utility has to be installed. USB2MDIO software can be used for accessing registers.

4.1 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.

4.2 USB2MDIO Software

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

The web-page also contains the user's guide for installing and using the software. Since MSP430 is on board the EVM, purchasing a separate MSP430 Launchpad kit to connect to the PHY using wires is not required. The entire EVM can be powered and controlled via USB connector. MSP430 and USB2MDIO utility can be used even when power is not supplied via USB.

In case the onboard MSP430 cannot be used due to some reason, MDIO and MDC pins are also broken out on J10 connector. Customers can connect a MSP430 launchpad or their own MDIO-MDC utility on J10 to access the PHY registers.

5 Board Setup Details

5.1 Block Diagram

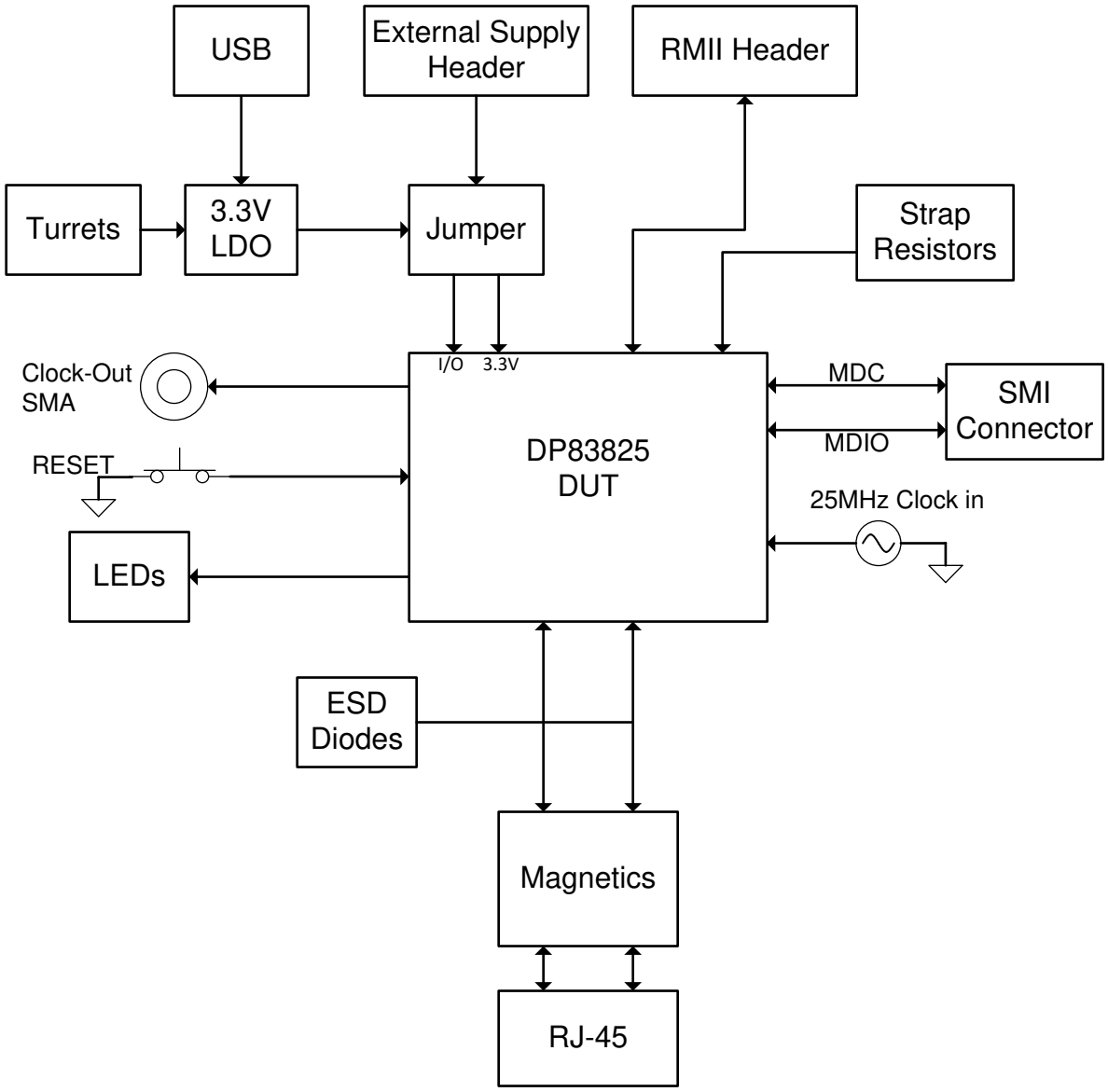

Figure 5-1. DP83825EVM Block Diagram

5.2 Schematics

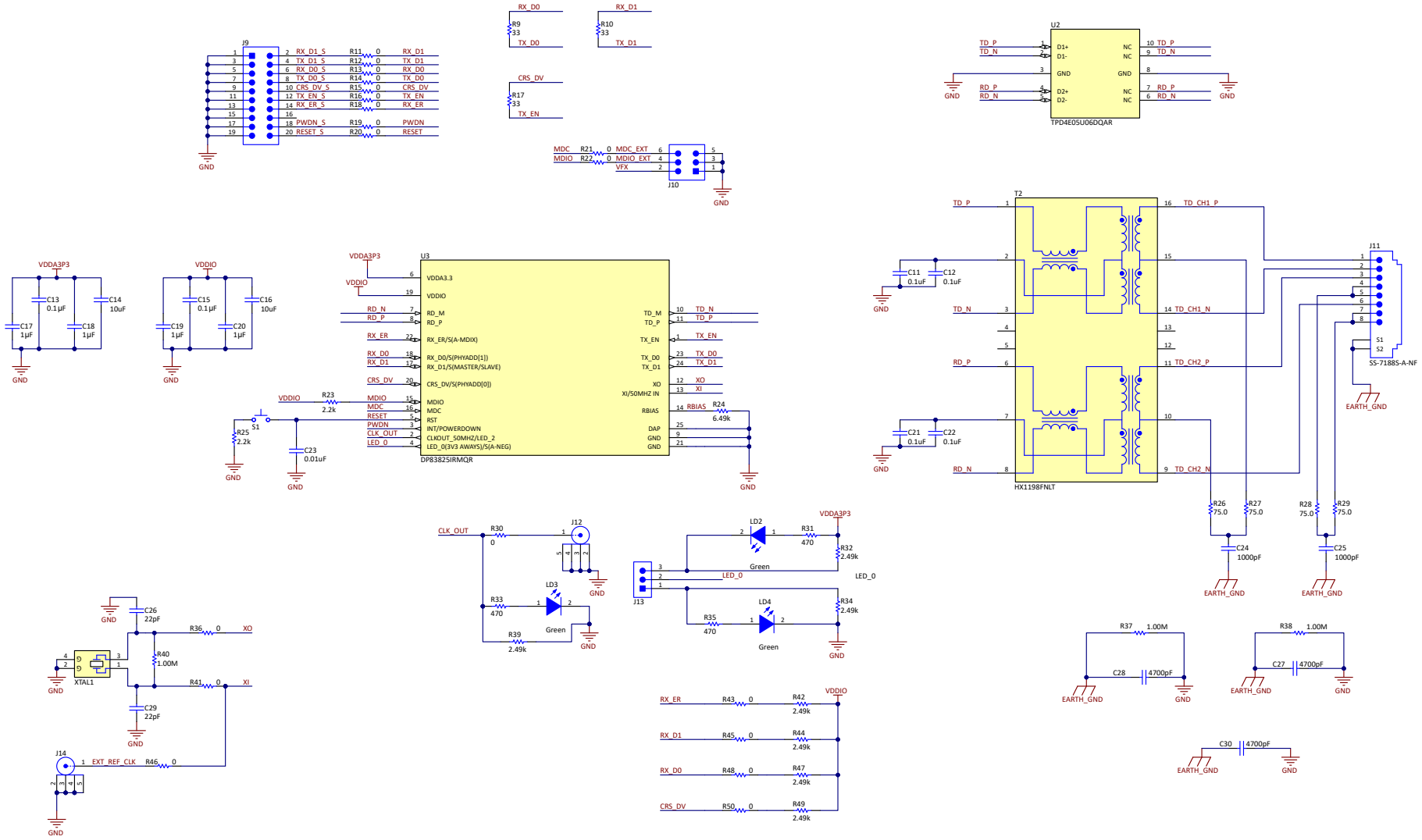

Figure 5-2. Schematic Page 1

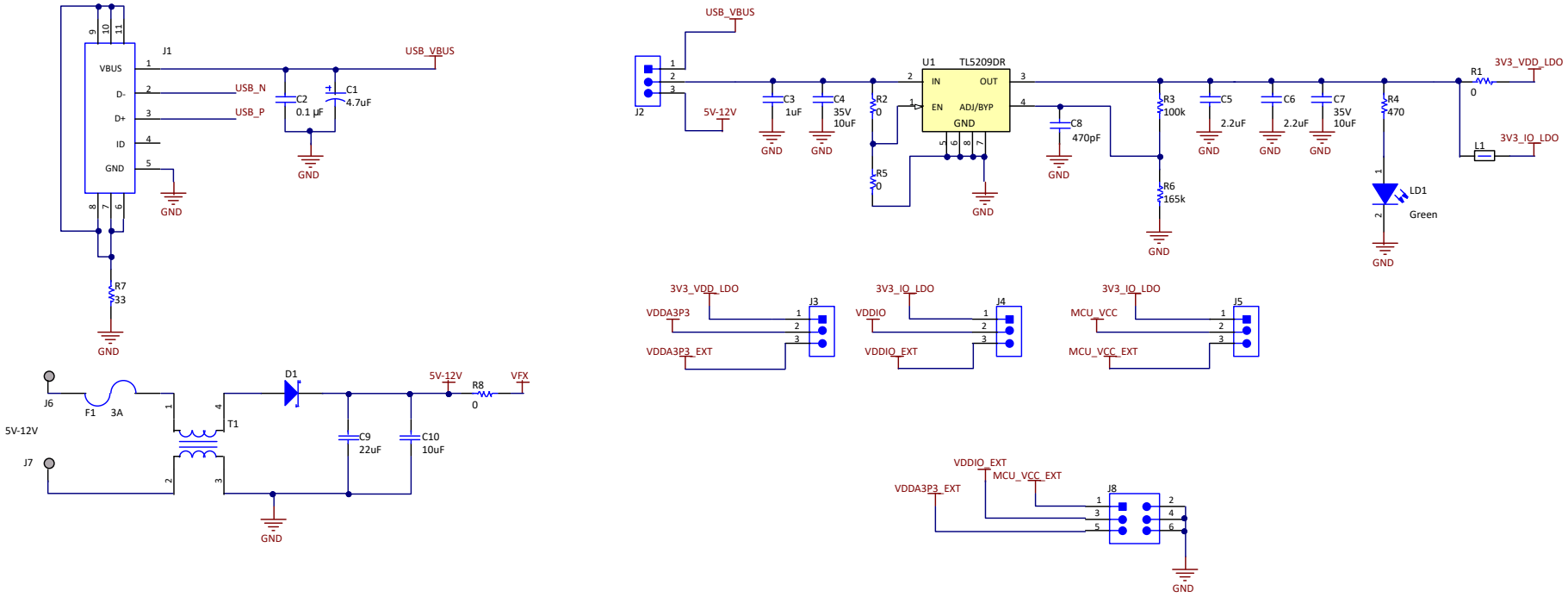

Figure 5-3. Schematic Page 2

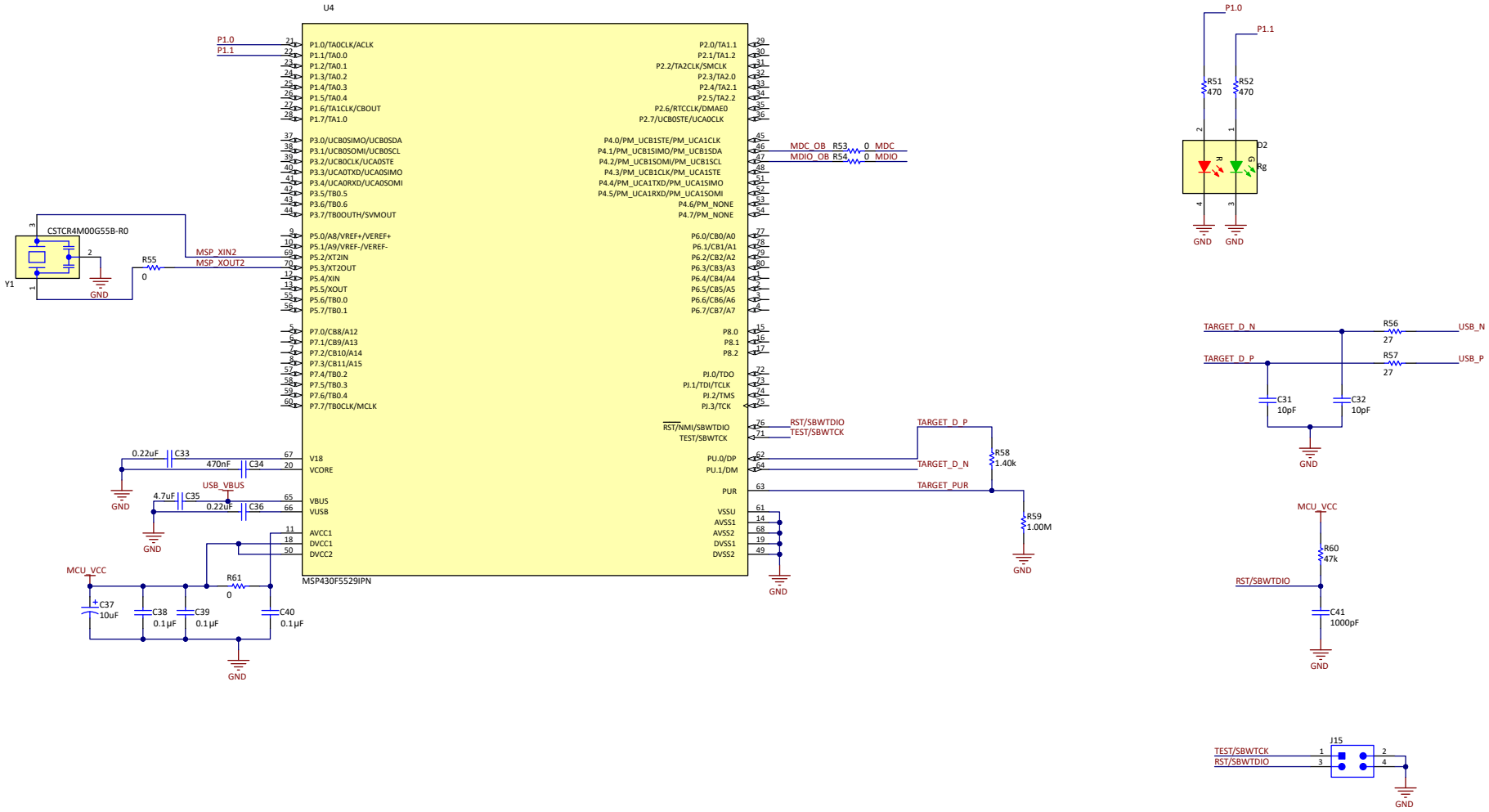

Figure 5-4. Schematic Page 3

6 Bill of Materials

Table 6-1. Bill of Materials

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
!PCB1	1		Printed Circuit Board		HSDC045	Any		
C1	1	4.7 uF	CAP, TA, 4.7 uF, 35 V, +/- 10%, 1.3 ohm, SMD	7343-31	293D475X9035D2TE3	Vishay-Sprague		
C2, C13, C15, C38, C39, C40	6	0.1 uF	CAP, CERM, 0.1 µF, 10 V,+/- 10%, X7R, 0402	402	C0402C104K8RACTU	Kemet		
C3	1	1 uF	CAP, CERM, 1 uF, 35 V, +/- 20%, X5R, 0402	402	GRM155R6YA105ME11D	MuRata		
C4, C7	2	10 uF	CAP, CERM, 10 uF, 35 V, +/- 20%, X5R, 0603	603	GRM188R6YA106MA73D	Murata		
C5, C6	2	2.2 uF	CAP, CERM, 2.2 uF, 16 V, +/- 10%, X6S, 0402	402	GRM155C81C225KE11D	MuRata		
C8	1	470 pF	CAP, CERM, 470 pF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0402	402	GCM155R71H471KA37D	MuRata		
C9	1	22 uF	CAP, CERM, 22 uF, 16 V, +/- 20%, X7R, AEC-Q200 Grade 1, 1210	1210	CGA6P1X7R1C226M250AC	TDK		
C10	1	10 uF	CAP, CERM, 10 uF, 25 V, +/- 20%, X7R, AEC-Q200 Grade 1, 1210	1210	CGA6P1X7R1E106M250AC	TDK		
C11, C12, C21, C22	4	0.1 uF	CAP, CERM, 0.1 uF, 10 V, +/- 10%, X7R, 0603	603	C0603C104K8RACTU	Kemet		
C17, C19	2	1 uF	CAP, CERM, 1 µF, 10 V,+/- 20%, X5R, 0402	402	CC0402MRX5R6BB105	Yageo America		
C23	1	0.01 uF	CAP, CERM, 0.01 uF, 16 V, +/- 10%, X7R, 0402	402	8.85012E+11	Wurth Elektronik		
C24, C25	2	1000 pF	CAP, CERM, 1000 pF, 2000 V, +/- 10%, X7R, AEC-Q200 Grade 1, 1206	1206	C1206C102KGRACAUTO	Kemet		
C26, C29	2	22 pF	CAP, CERM, 22 pF, 50 V, +/- 5%, C0G/NP0, AEC-Q200 Grade 1, 0603	603	CGA3E2C0G1H220J080AA	TDK		
C28	1	4700 pF	CAP, CERM, 4700 pF, 2000 V, +/- 10%, X7R, 1812	1812	1812GC472KAT1A	AVX		
C31, C32	2	10 pF	CAP, CERM, 10 pF, 50 V, +/- 5%, C0G/NP0, 0603	603	CGA3E2NP01H100D080AA	TDK		
C33, C36	2	0.22 uF	CAP, CERM, 0.22 uF, 16 V, +80/-20%, Y5V, 0603	603	C0603C224Z4VACTU	Kemet		

Table 6-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
C34	1	0.47 uF	CAP, CERM, 0.47 uF, 16 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	603	GCM188R71C474KA55D	MuRata		
C35	1	4.7 uF	CAP, CERM, 4.7 uF, 35 V, +/- 10%, X5R, 0603	603	C1608X5R1V475K080AC	TDK		
C37	1	10 uF	CAP, TA, 10 uF, 35 V, +/- 10%, 0.125 ohm, SMD	7343-31	TPSD106K035R0125	AVX		
C41	1	1000 pF	CAP, CERM, 1000 pF, 50 V, +/- 5%, C0G/NP0, 0402	402	C1005NP01H102J050BA	TDK		
D1	1	60 V	Diode, Schottky, 60 V, 1 A, AEC-Q101, SMA	SMA	NRVBA160T3G	ON Semiconductor		
D2	1	Rg	LED, Rg, SMD	1.6x0.8mm	HSMF-C165	Avago		
F1	1		Fuse, 3 A, 32 VDC, SMD	603	F0603E3R00FSTR	AVX		
J1	1		Connector, Receptacle, Micro-USB Type AB, R/A, Bottom Mount SMT	5.6x2.5x8.2mm	475890001	Molex		
J2, J3, J4, J5	4		Header, 100mil, 3x1, Tin, TH	Header, 3 PIN, 100mil, Tin	PEC03SAAN	Sullins Connector Solutions		
J6, J7	2		Terminal, Turret, TH, Double	Keystone1502-2	1502-2	Keystone		
J8	1		Header, 100mil, 3x2, Tin, TH	Header, 100mil, 3x2, TH	5-146254-3	TE Connectivity		
J9	1		Header, 2.54mm, 10x2, Gold, TH	Header, 2.54mm, 10x2, TH	PRPC010DAAN-RC	Sullins Connector Solutions		
J10	1		Header, 2.54mm, 3x2, Gold, R/A, TH	Header, 2.54mm, 3x2, R/A, TH	90122-0763	Molex		
J11	1		RJ45, 1.27mm, R/A, Gold, TH	RJ-45, 1.27mm, R/A, TH	SS-7188S-A-NF	Stewart Connector		
J13	1		Header, 100mil, 3x1, Gold, TH	Header, 100mil, 3x1, TH	HTSW-103-07-G-S	Samtec		
J15	1		Header, 100mil, 2x2, Gold, TH	2x2 Header	TSW-102-07-G-D	Samtec		
L1	1	1000 Ω	Ferrite Bead, 1000 ohm @ 100 MHz, 0.4 A, 0603	603	BLM18AG102SN1D	MuRata		
LD1, LD2, LD3, LD4	4	Green	LED, Green, SMD	2x1.25mm	QTLP630C4TR	Everlight		
R1, R2	2	0 Ω	RES, 0, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	603	ERJ-3GEY0R00V	Panasonic		
R3	1	100 kΩ	RES, 100 k, 0.5%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW0402100KDHEDP	Vishay-Dale		

Table 6-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
R4, R31, R35	3	470 Ω	RES, 470, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW0402470RJNED	Vishay-Dale		
R6	1	165 kΩ	RES, 165 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW0402165KFKED	Vishay-Dale		
R7, R9, R10, R17	4	33 Ω	RES, 33, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040233R0JNED	Vishay-Dale		
R8	1	0 Ω	RES, 0, 5%, 0.063 W, 0402	402	MCR01MZPJ000	Rohm		
R19, R20, R21, R22, R30, R55, R61	7	0 Ω	RES, 0, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04020000Z0ED	Vishay-Dale		
R23	1	2.2 kΩ	RES, 2.2 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04022K20JNED	Vishay-Dale		
R24	1	6.49 kΩ	RES, 6.49 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04026K49FKED	Vishay-Dale		
R25	1	2.2 kΩ	RES, 2.2 k, 5%, 0.05 W, 0201	201	CRCW02012K20JNED	Vishay-Dale		
R26, R27, R28, R29	4	75 Ω	RES, 75.0, 1%, 0.125 W, AEC-Q200 Grade 0, 0805	805	CRCW080575R0FKEA	Vishay-Dale		
R32, R34	2	2.49 kΩ	RES, 2.49 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04022K49FKED	Vishay-Dale		
R36, R41, R53, R54	4	0 Ω	RES, 0, 5%, 0.05 W, 0201	201	CRCW02010000Z0ED	Vishay-Dale		
R37	1	1.00 MΩ	RES, 1.00 M, 1%, 1 W, 2010	2010	HVCB2010FKC1M00	Stackpole Electronics Inc		
R42, R44, R47, R49	4	2.49 kΩ	RES, 2.49 k, 1%, 0.05 W, 0201	201	RC0201FR-072K49L	Yageo America		
R51, R52	2	470 Ω	RES, 470, 5%, 0.05 W, 0201	201	RC0201JR-07470RL	Yageo America		
R56, R57	2	27 Ω	RES, 27, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040227R0JNED	Vishay-Dale		
R58	1	1.40 kΩ	RES, 1.40 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04021K40FKED	Vishay-Dale		
R59	1	1.00 MΩ	RES, 1.00 M, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04021M00FKED	Vishay-Dale		
R60	1	47 kΩ	RES, 47 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW040247K0JNED	Vishay-Dale		
S1	1		Switch, Normally open, 2.3N force, 200k operations, SMD	KSR	KSR221GLFS	C&K Components		

Table 6-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
SH-J1, SH-J2, SH-J3, SH-J4, SH-J5	5		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	HX1198FNLT	Pulse Engineering		
U1	1		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		
U2	1		4-Channel Ultra-Low-Capacitance IEC ESD Protection Diode, DQA0010A (USON-10)	DQA0010A	TPD4E05U06DQAR	Texas Instruments		Texas Instruments
U3	1		DP83825IRMQR, RMQ0024A (WQFN-24)	RMQ0024A	DP83825IRMQR	Texas Instruments	DP83825IRMQT	Texas Instruments
U4	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		
XTAL1	1		Crystal, 25 MHz, 20 ppm, AEC-Q200 Grade 1, SMD	2.5x3.2mm	ECS-250-12-33Q-JES-TR	ECS Inc.		
Y1	1		Resonator, 4 MHz, 39 pF, AEC-Q200 Grade 1, SMD	4.5x1.2x2 mm	CSTCR4M00G55B-R0	MuRata		
C14, C16	0	10 uF	CAP, CERM, 10 uF, 6.3 V, +/- 20%, X5R, 0402	402	GRM155R60J106ME11	MuRata		
C18, C20	0	1 uF	CAP, CERM, 1 µF, 10 V,+/- 20%, X5R, 0402	402	CC0402MRX5R6BB105	Yageo America		
C27, C30	0	4700 pF	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		
H1, H2, H3, H4	0		Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	Screw	NY PMS 440 0025 PH	B&F Fastener Supply		
H5, H6, H7, H8	0		Standoff, Hex, 0.5"L #4-40 Nylon	Standoff	1902C	Keystone		
J12	0		JACK, SMA, 50 Ohm, Gold, R/A, TH	SMA Jack, 50 Ohm, R/A, TH	5-1814400-1	TE Connectivity		

Table 6-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
J14	0		SMA Straight PCB Socket Die Cast, 50 Ohm, TH	SMA Straight PCB Socket Die Cast, TH	5-1814832-1	TE Connectivity		
R5	0	0	RES, 0, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	603	ERJ-3GEY0R00V	Panasonic		
R11, R12, R13, R14, R15, R16, R18	0	0	RES, 0, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04020000Z0ED	Vishay-Dale		
R33	0	470 Ω	RES, 470, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW0402470RJNED	Vishay-Dale		
R38	0	1.00 MΩ	RES, 1.00 M, 1%, 1 W, 2010	2010	HVCB2010FKC1M00	Stackpole Electronics Inc		
R39	0	2.49 kΩ	RES, 2.49 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	CRCW04022K49FKED	Vishay-Dale		
R40	0	1.00 MΩ	RES, 1.00 M, 1%, 0.063 W, 0402	402	RC0402FR-071ML	Yageo America		
R43, R45, R46, R48, R50	0 Ω	0	RES, 0, 5%, 0.05 W, 0201	201	CRCW02010000Z0ED	Vishay-Dale		

7 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision * (December 2018) to Revision A (December 2023)	Page
• Updated EVM board image	1
• Deleted REACH compliance section	2
• Updated board images	2
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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 DEGREDATION 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/lsds/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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2. 実験局の免許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/lsds/ti_ja/general/eStore/notice_02.page

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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.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

6. *Disclaimers:*

6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY MATERIALS PROVIDED WITH THE EVM (INCLUDING, BUT NOT LIMITED TO, REFERENCE DESIGNS AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY EPIDEMIC FAILURE WARRANTY OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.

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7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS LICENSORS AND THEIR REPRESENTATIVES HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES, EXPENSES, COSTS AND LIABILITIES (COLLECTIVELY, "CLAIMS") ARISING OUT OF OR IN CONNECTION WITH ANY HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.

8. *Limitations on Damages and Liability:*

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   8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY USE OF AN EVM PROVIDED HEREUNDER, INCLUDING FROM ANY WARRANTY, INDEMITY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS, , EXCEED THE TOTAL AMOUNT PAID TO TI BY USER FOR THE PARTICULAR EVM(S) AT ISSUE DURING THE PRIOR TWELVE (12) MONTHS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

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.

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