EVM User's Guide: DP83TD535EVM
DP83TD535 Evaluation Module

TEXAS INSTRUMENTS

Description

The DP83TD53x-Q1 is a 10BASE-T1S transceiver that is compliant with the IEEE802.3cg specification. The device supports 10Mbps multi-drop or point-to-point half-duplex communication over an unshielded twisted pair with a common mode tolerance of ±40V. The device communicates to the host over the OA-3 pin interface.

The DP83TD53x-Q1 allows for efficient system-level battery current consumption by supporting TC10 wake and sleep requirements. This allows a low-current sleep state in which power is gated to system components by DP83TD535-Q1. When a wake-up event is detected, the DP83TD535-Q1 initiates system start-up by driving INH high.

Get Started

1. Configure the board headers for desired power configuration or MDI termination.
2. Connect the DP83TD535EVM to the MCU board using the 3-pin interface.
3. For any issues, reach out on the TI E2E™ forums.

Features

- DP83TD535, IEEE802.3cg, and 10BASE-T1S compliant
- 10BASE-T1S interface through Rosenberger MTD® Daisy-Chain adapter and cabling
- Status LEDs for VBAT/VCC/VDDIO power rails
- Variable I/O voltage range: 1.8V, 2.5V, and 3.3V
- Configurable MDI termination through jumpers for device to act as the End Node or Drop Node
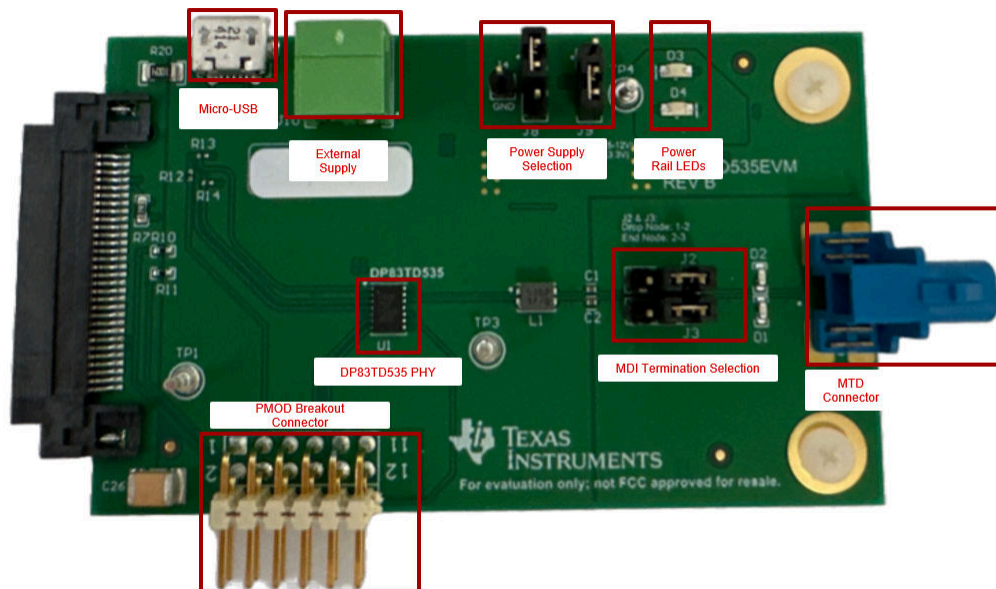
DP83TD535EVM Key Interfaces

1 Evaluation Module Overview

1.1 Introduction

DP83TD535EVM supports 10Mbps half-duplex speed and is IEEE 802.3cg and 10BASE-T1S compliant. The EVM provides on-board interface options to connect to the SMI bus and access PHY registers with an external MCU, such as MSP430F5529 LaunchPad™ and USB-2-MDIO GUI. Power the EVM by using an external 5V-12V power supply, or through a microUSB cable. On-board TC10 and OA-3pin interface options are provided to communicate with the PHY through a compatible SoC.

This document discusses how to properly operate and configure the DP83TD535EVM. The document also include the best layout practices, schematic files, and Bill of Materials.

1.2 Kit Contents

The DP83TD535EVM kit includes with the following:
- DP83TD535EVM
- 1x Untwiste Pair Cable (LAQ-116-1000Z-Z)

Not supplied:
- Micro-USB cable
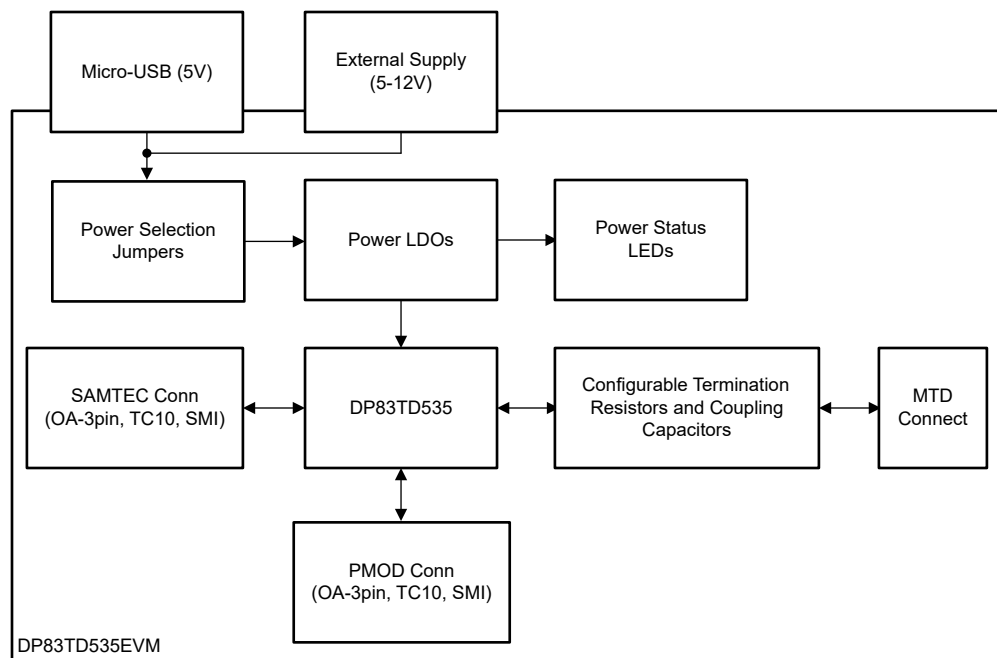- Rosenberger multidrop connector (E7C10T-900X5Z)

1.3 Specification

Figure 1-1. DP83TD535EVM Block Diagram

2 Hardware

2.1 Setup

2.1.1 Board Setup Out of Box

Follow these quick set up instructions for the DP83TD535EVM:

- Populate jumpers J8 at pins 1-2
- Populate jumpers J9 at pins 2-3
- Configure J2 and J3 jumper to Drop Node or End Node
  - Drop Node: Connect pin 1 to 2
  - End Node: Connect pin 2 to 3
- Connect external host to TX/RX/ED pins of J7
- Connect micro-USB to J14 for 5V supply

2.1.2 Power Supply Selection

2.1.2.1 USB Power Supply Option

DP838TD535 block powered by USB.
- Populate jumpers J8 at pins 1-2
- Populate jumpers J9 at pins 2-3
- Connect micro-USB to J11 for 5V supply

2.1.2.2 External Power Supply Operation

- DP83TD535EVM External Power
  - Populate jumpers J8 and J9 at pins 2-3
  - Supply 5-12V on J10 (pin 2 = GND)

2.1.2.3 VDDIO Rail Selection

By default, DP83TD535EVM operates at 3.3V for the VDDIO rail. For VDDIO operation at 2.5V or 1.8V, follow the resistor modifications below:
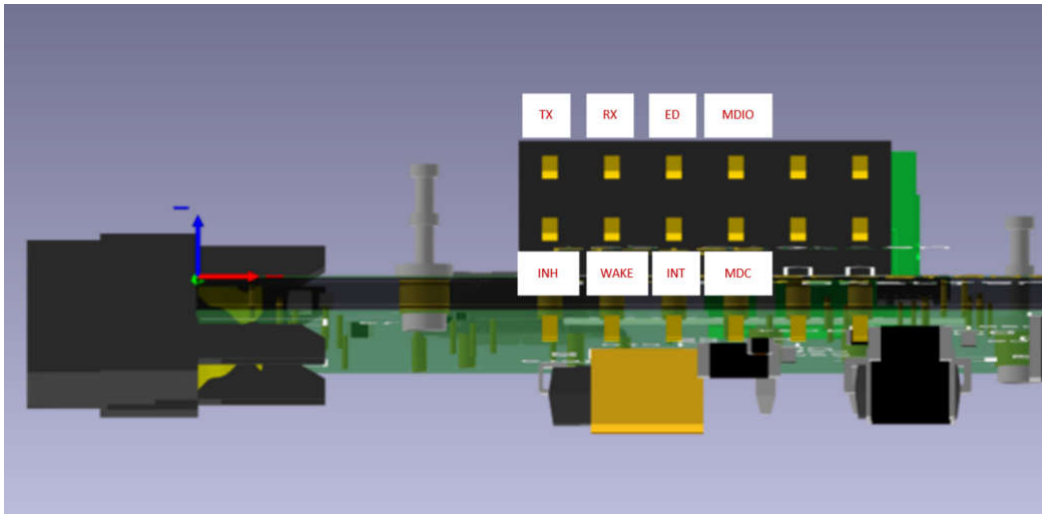
Table 2-1. VDDIO Selection

VDDIO Rail	R15	R17	R18
3.3V	0Ω	DNP	N/A
2.5V	DNP	0Ω	2.87kΩ
1.8V	DNP	0Ω	1.78kΩ

2.1.3 Interface Connections

2.1.3.1 PMOD Interface Connections

The PMOD breakout connector J7 provides access to the OA-3pin (TX/RX/ED), SMI (MDC/MDIO), and TC10 (WAKE/INH) interfaces:

The external host supporting OA-3pin connects to TX/RX/ED pins, driving the TX pin with RESET pulse on or before PHY power-up to activate DP83TD535 transmit mode.

2.1.3.2 MDI Interface Connection

Rosenberger's Daisy-Chain Adapter (E7C10T-900X5Y) and MTD cabling is used to connect to the PHY MDI interface on J1. If this cable assembly cannot be sourced, the MDI can also connect to any single-pair Ethernet cable direct to the pins in J1, or to pin 2 of J2 (Line+) and J3 (Line-).

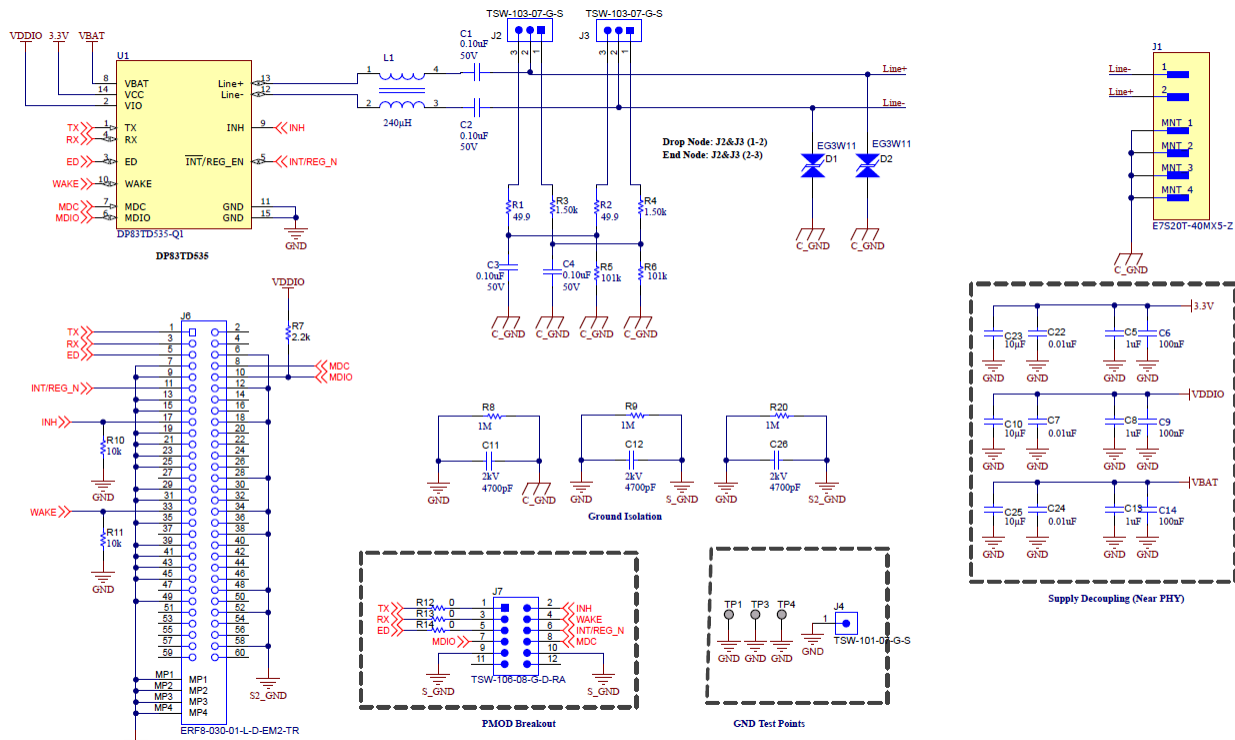# 3 Hardware Design Files

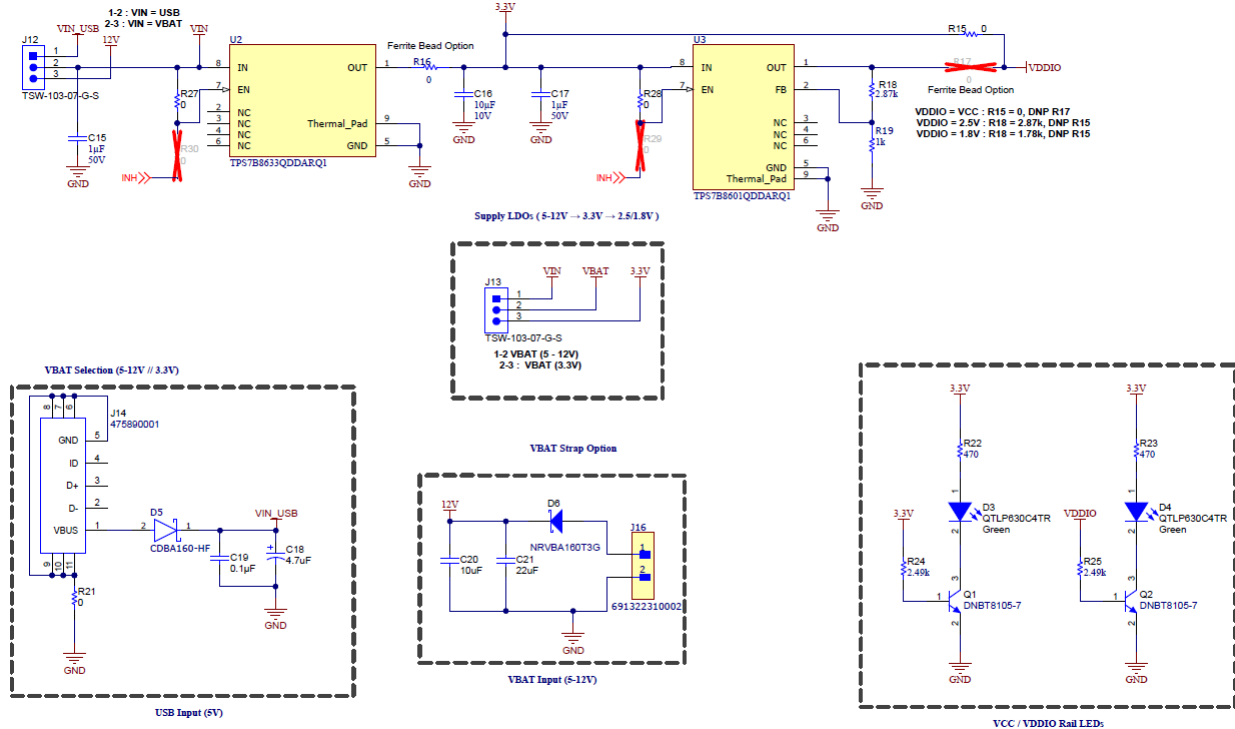## 3.1 Schematics

Figure 3-1. DP83TD535EVM Main Schematic Block

Figure 3-2. DP83TD535EVM Power Block
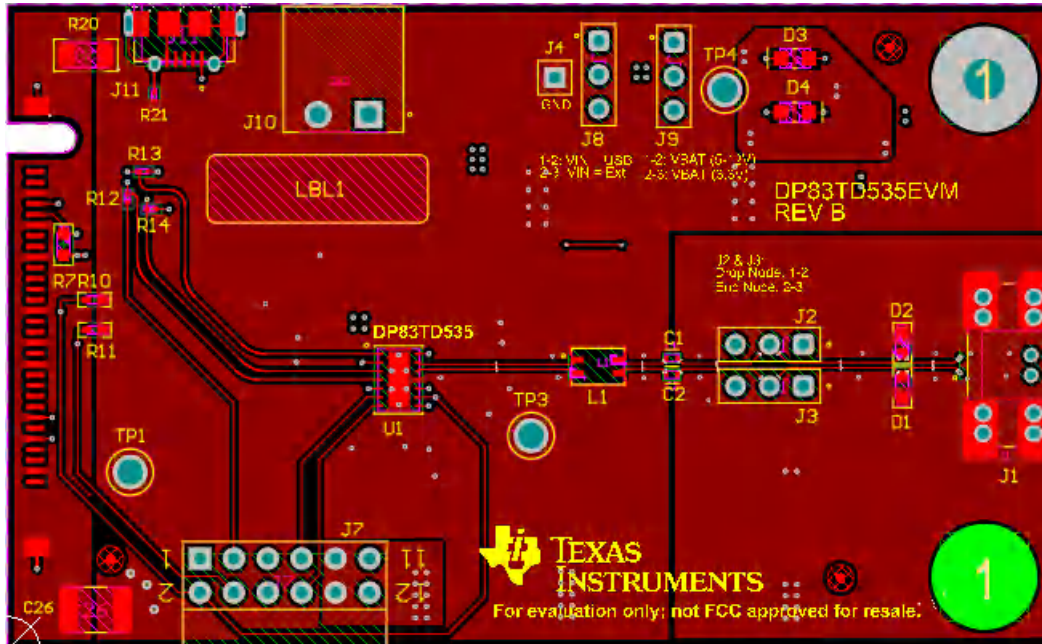
3.2 PCB Layouts
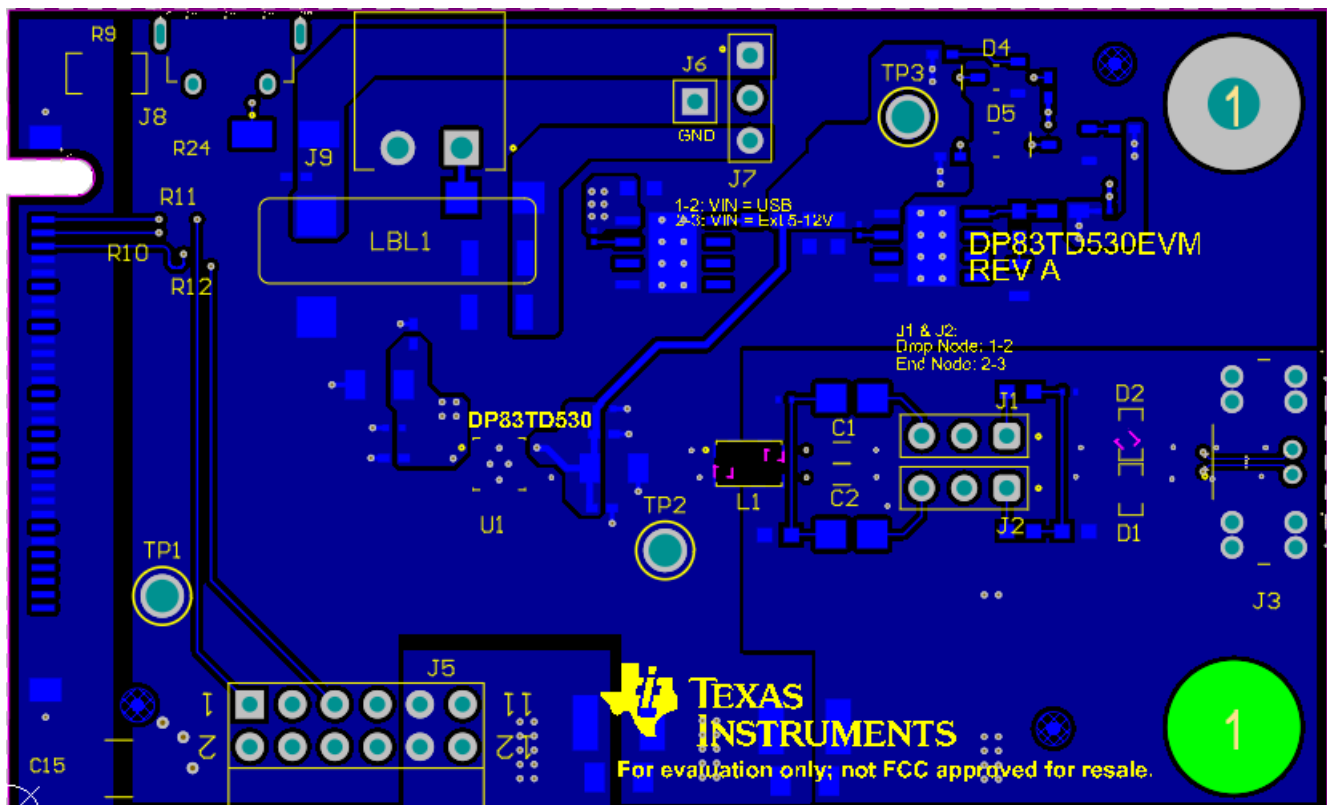

Figure 3-3. Top Layer

Figure 3-4. Bottom Layer

3.3 Bill of Materials (BOM)

Item #	Designator	Quantity	Value	Part #	Manufacturer	Description	Package Reference
1	!PCB	1		DP83TD535EVM	Any	Printed Circuit Board	
2	C1, C2, C3, C4	4	100nF	GRM155R71H104KE14D	Murata	Chip Multilayer Ceramic Capacitors for General Purpose, 0402, 0.10uF, X7R, 15%, 10%, 50V	0402
3	C5, C8, C13	3	1uF	GRM155R6YA105KE11D	MuRata	CAP, CERM, 1uF, 35V, +/- 10%, X5R, 0402	0402
4	C6, C9, C14	3	100nF	CC0402KRX5R6BB104	YAGEO	0402 0.1uF 10V ±10% Tolerance X5R SMT Multilayer Ceramic Capacitor	0402
5	C7, C22, C24	3	0.01uF	CGA2B3X7R1H103K050BB	TDK	CAP, CERM, 0.01uF, 50V, +/- 10%, X7R, AEC-Q200 Grade 1, 0402	0402
6	C10, C23, C25	3	10uF	GRM31CR71E106MA12L	MuRata	CAP, CERM, 10 µF, 25V,+/- 20%, X7R, AEC-Q200 Grade 1, 1206	1206
7	C11, C12	2	4700pF	1812GC472KAT1A	AVX	CAP, CERM, 4700pF, 2000V, +/- 10%, X7R, 1812	1812
8	C15, C17	2	1uF	UMK107AB7105KA-T	Taiyo Yuden	CAP, CERM, 1uF, 50V, +/- 10%, X7R, 0603	0603
9	C16	1	10uF	GRM188Z71A106MA73D	MuRata	CAP, CERM, 10uF, 10V, +/- 20%, X7R, 0603	0603
10	C18	1	4.7uF	293D475X9035D2TE3	Vishay-Sprague	CAP, TA, 4.7uF, 35V, +/- 10%, 1.3ohm, SMD	7343-31
11	C19	1	0.1uF	C0402C104K8RACTU	Kemet	CAP, CERM, 0.1 µF, 10V,+/- 10%, X7R, 0402	0402
12	C20	1	10uF	CGA6P1X7R1E106M250AC	TDK	CAP, CERM, 10uF, 25V, +/- 20%, X7R, AEC-Q200 Grade 1, 1210	1210
13	C21	1	22uF	CGA6P1X7R1C226M250AC	TDK	CAP, CERM, 22uF, 16V, +/- 20%, X7R, AEC-Q200 Grade 1, 1210	1210
14	D1, D2	2		EZA-EG3W11AV	Panasonic	Diode, TVS, Bi, AEC-Q101, 0603	0603
15	D3, D4	2	Green	QTLP630C4TR	Everlight	LED, Green, SMD	2x1.25mm
16	D5	1		CDBA160-HF	Comchip Technology	Diode Schottky 60V 1A Surface Mount DO-214AC (SMA)	SMA
17	D6	1	60V	NRVBA160T3G	ON Semiconductor	Diode, Schottky, 60V, 1A, AEC-Q101, SMA	SMA
18	FID4, FID5, FID6	3		N/A	N/A	Fiducial mark. There is nothing to buy or mount.	N/A
19	H1, H2	2		NY PMS 440 0025 PH	B&F Fastener Supply	Machine Screw, Round, #4-40x 1/4, Nylon, Philips panhead	Screw

Item #	Designator	Quantity	Value	Part #	Manufacturer	Description	Package Reference
20	H3, H5	2		1902C	Keystone	Standoff, Hex, 0.5"L #4-40 Nylon	Standoff
21	J1	1		E7S20T-40MX5Z	Rosenberger	MTD® right angle plug PCB	CONN_MTD2
22	J2, J3, J12, J13, J15	5		TSW-103-07G-S	Samtec	Header, 100mil, 3x1, Gold, TH	3x1 Header
23	J6	1		ERF8-030-01L-D-EM2-TR	Samtec	Receptacle, 0.8mm, 30x2, Gold, Edge Mount	Receptacle, 0.8mm, 30x2, Edge Mount
24	J7	1		TSW-106-08G-D-RA	Samtec	Header, 100mil, 6x2, Gold, R/A, TH	6x2 R/A Header
25	J14	1		475890001	Molex	Connector, Receptacle, Micro-USB Type AB, R/A, Bottom Mount SMT	5.6x2.5x8.2mm
26	J16	1		691322310002	Wurth Electronics		CONN_TERM_BLOCK_HDR2
27	L1	1		ACT1210E-241-2P-TL00	TDK	Common Mode Filters / Chokes, L=240µH, L x W x T :	SMD4
28	LBL1	1		THT-14-423-10	Brady	Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650x 0.200 inch
29	Q1, Q2	2	60V	DNBT8105-7	Diodes Inc.	Transistor, NPN, 60V, 1A, AEC-Q101, SOT-23	SOT-23
30	R1, R2	2	49.9	PHP01206E49R9BST5	Vishay Thin Film	Res Thin Film 1206 49.9 Ohm 0.1% 1W ±25ppm/C Pad SMD T/R	1206
31	R3, R4	2	1.50k	RT0603BRD071K5L	Yageo America	RES, 1.50k, 0.1%, 0.1W, 0603	0603
32	R5, R6	2	101k	RT0603DRE07101KL	Yageo America	RES, 101k, 0.5%, 0.1W, 0603	0603
33	R7	1	2.2k	ERJ-3GEYJ222V	Panasonic	RES, 2.2k, 5%, 0.1W, AEC-Q200 Grade 0, 0603	0603
34	R8, R9	2	1.0Meg	RC1206FR-071ML	Yageo America	RES 1M OHM 1% 1/4W 1206	1206
35	R10, R11, R20	3	50	FC0402E50R0BTBST1	Vishay Thin Film	RES, 50, 0.1%, 0.5W, 0402	0402
36	R12, R13, R14, R15, R27, R28	6	0	CRCW02010000Z0ED	Vishay-Dale	RES, 0, 5%, 0.05W, 0201	0201
37	R16	1	0	HCJ0603ZT0R00	Stackpole Electronics	RES 0 OHM JUMPER 1/4W 0603	0603
38	R18	1	2.87k	RG1608P-2871B-T5	Susumu Co Ltd	RES, 2.87k, 0.1%, 0.1W, 0603	0603

Item #	Designator	Quantity	Value	Part #	Manufacturer	Description	Package Reference
39	R19	1		TNPU08051K00BZEN00	Vishay Dale	1 kOhms ±0.1% 0.125W, 1/8W Chip Resistor 0805 (2012 Metric) Anti-Sulfur, Automotive AEC-Q200, Moisture Resistant Thin Film	0805
40	R21	1	98.8	RT0603BRD0798R8L	Yageo America	RES, 98.8, 0.1%, 0.1W, 0603	0603
41	R22, R23	2	470	CRCW0402470RJNED	Vishay-Dale	RES, 470, 5%, 0.063W, AEC-Q200 Grade 0, 0402	0402
42	R24, R25	2	2.49k	CRCW04022K49FKED	Vishay-Dale	RES, 2.49k, 1%, 0.063W, AEC-Q200 Grade 0, 0402	0402
43	R26	1	33	CRCW040233R0JNED	Vishay-Dale	RES, 33, 5%, 0.063W, AEC-Q200 Grade 0, 0402	0402
44	TP1, TP2, TP3, TP4	4		1573-2	Keystone	Terminal, Turret, TH, Double	Keystone1573-2
45	U1	1		DP83TD535-Q1	Texas Instruments	DP83TD535-Q1	VSON14
46	U2	1		TPS7B8633QDDARQ1	Texas Instruments	Automotive 500mA, 40V, ultra-low-IQ, low-dropout (LDO) linear regulator with power good 8-SO PowerPAD -40 to 150	SO8
47	U3	1		TPS7B8601QDDARQ1	Texas Instruments	450mA, wide VIN, low IQ, adjustable output, low-dropout regulator	SOIC8
48	FID1, FID2, FID3	0		N/A	N/A	Fiducial mark. There is nothing to buy or mount.	N/A
49	R29, R30	0	0	CRCW02010000Z0ED	Vishay-Dale	RES, 0, 5%, 0.05W, 0201	0201

4 Additional Information

4.1 Trademarks

E2E™ and LaunchPad™ are trademarks of Texas Instruments.

Rosenberger MTD® is a registered trademark of Rosenberger Hochfrequenztechnik GmbH & Co. KG.

All trademarks are the property of their respective owners.

4.2 Terminology

ED	Energy Detect
MTD	Modular Twisted Pair
MAC	Media Access Controller
MDC	Management Data Clock
MDIO	Management Data I/O
OA-3pin	Open Alliance 3-pin Interface
PHY	Physical Layer Transceiver
SMI	Serial Management Interface
VBAT	Battery Supply Rail
VCC	Analog Supply Rail
VDDIO	Digital Supply Rail

4.3 Third-Party Products Disclaimer

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   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.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けて

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措置を取っていただく必要がありますのでご注意ください。

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。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。 上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。 日本テキサス・イ

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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

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.

    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.

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