WIRELESS CHARGING

User Guide

TSDMTX-5V-EVM
Dual-Mode (Qi and PMA) Transmitter

Introduction

The Semtech TSDMTX-5V-EVM is an evaluation platform for test and experimentation of a wireless charging transmitter based on the Semtech TS80000 Wireless Power Transmitter Controller, TS61001 Full-Bridge FET Driver, and TS31023 Linear Regulator. This evaluation module provides a complete system solution for both Qi and PMA standards of power transmission, making this transmitter an ideal platform for powering the majority of wireless receivers in use today.

Objectives

The objective of this User Guide is to provide a fast, easy and thorough method to experiment with and evaluate the Semtech solutions for wireless charging systems. Sufficient information is provided to support the engineer in all aspects of adding wireless charging support to their products. Semtech offers a range of solutions to meet the needs of a wide range of system developers. Developers are provided with all the information on how this EVM was built as a starting point for their own designs using the TS80000 and other Semtech components.

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Wireless Charging Concepts

Wireless power transfer is, essentially, a transformer. Power is provided to a primary coil which produces an electromagnetic (EM) field. In this field, a secondary coil is placed. The EM field induces a current into the secondary coil, providing power to whatever it is connected to.

However, unlike a conventional power transformer that operates at line frequencies and requires an iron core for efficiency, wireless power systems are designed to operate in the 100 kHz range, and thus can perform efficiently with an air core. As such, the primary and secondary windings, if closely spaced, can be in separate devices, the primary being part of a transmitter and the secondary within a receiver. This implementation can also be described as a radio broadcast process, and as such, these transformer coils can also be seen as antennas with equal validity, and the two terms will be used interchangeably in this text.
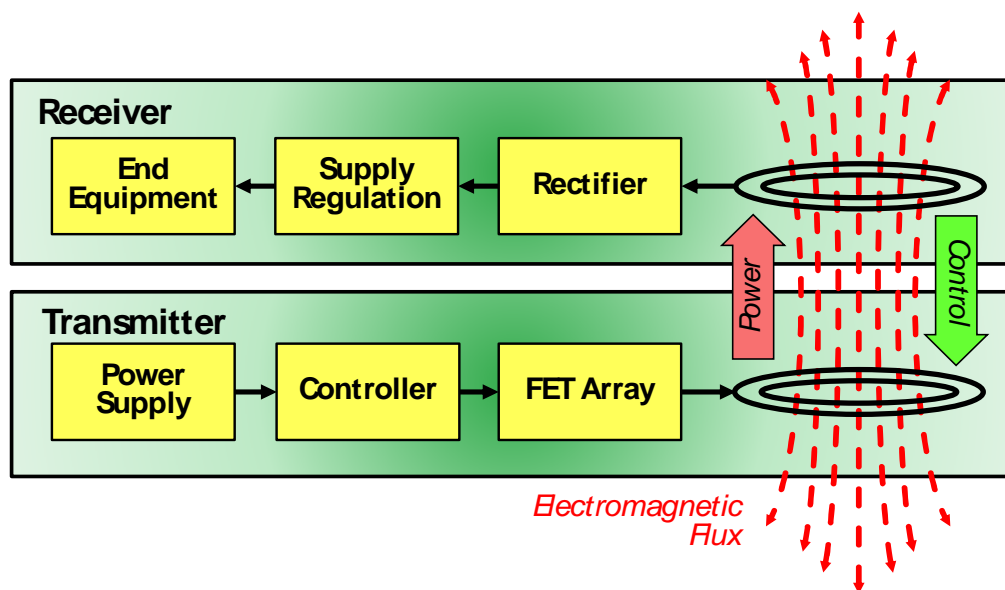
Wireless power systems differ in another major aspect from conventional transformers, in that they are intelligently managed. A transmitter will only provide power when a receiver is present, and only produce the amount of power requested by the receiver. In addition, the system is capable of recognizing when the electromagnetic field has been interrupted by an unintended element, a 'foreign object', and will shut down the transfer to prevent any significant amount of power being absorbed by anything but a proper receiver. The intelligent management of the wireless power transmission process is achieved though the programming of the TS80000, which first searches for a receiver. Once found, the receiver informs the transmitter of its power requirements, and transmission begins. The system then verifies the right amount of power is being sent, and that none is being lost to foreign objects. The receiver will continually provide ongoing requests for power to maintain the transaction. If the requests cease, the transaction terminates. Via this protocol, even complex charging patterns can be supported, as the transmitter can provide varying amounts of power at different times, as requested by the receiver. Should the receiver require no further power, such as when a battery charge is completed, it can request no further power be sent, and the transmitter will reduce its output accordingly.

Wireless power systems have been broken into three basic power categories. "Wearable" devices, such as headsets, wrist-band devices, medical sensors, and so forth - all operate in the low power range, up to 5 watts. Medium power devices, in the 5- to 15-watt range, include most handheld devices, such as cell phones, tablets, and medical electronics. High power wireless systems are intended to support devices such as power tools, radio controlled ("RC") devices such as drones, and other equipment requiring 15 to 100 watts of power.

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Product Description

The TSDMTX-5V-EVM Evaluation Module is a ready-to-use demonstration platform allowing testing of up to 5 watts of wireless power transmission compliant with the dominant industry standards – Qi and PMA.

The transmitter may be coupled with any Qi or PMA receiver module to form a complete wireless power transmission system. For the system designer, a likely choice might be the complementary Semtech TSDMRX-5W-EVM, which can allow a variety of experiments to easily be performed in order to learn more about the behavior of the system.

There are a number of other Semtech Receiver EVMs that support different power levels and output voltages, any of which can be used as all support the Qi and/or PMA standard and therefore are compatible with the TSDMTX-5V-EVM transmitter.

In addition, the evaluator can also use any existing Qi or PMA compliant product, though the limited access these devices offer may make the range of experiments that can be performed more limited.

Those who wish to develop their own board, or integrate this functionality into an existing system can use the EVM as a starting point for their design, as it demonstrates a working model from which to proceed. Toward this end, all documentation for the EVM is provided to make the process as efficient as possible.

The key technology in the EVM is the Semtech TS80000 integrated circuit, which controls the system and implements the Qi and PMA protocols. Developers can vary the supporting componentry to meet their goals as desired.

In this user guide, an introduction will be provided to the evaluator for how to use the EVM for wireless power transmission as well as how the TSDMRX-5W-EVM can be used in conjunction with it.

Once the system is set up and working, a selection of tests and activities will be described that the evaluator can choose to perform.

LED Behavior

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The red and green LEDs on the EVM let the user know what the transmitter is doing as it operates. As seen in the diagram below, when power is applied, the transmitter initializes as indicated by the green LED lighting for about a half second. Next, as the transmitter searches for a nearby receiver, no LED is lit, keeping power to a minimum in this standby state. When a receiver is located the transmitter receives instructions on the upcoming transaction to perform. Power is then transmitted and the green LED flashes each second indicating an ongoing charging event. During charging, if a foreign object is detected, charging is aborted and the red LED will flash each second indicating the fault detected, and will continue to do so until the receiver is removed from the target zone. Similarly, any other detected error will also abort the charging process, indicated by a steady red LED that remains lit until the receiver is taken away. Error conditions include communication errors between receiver and transmitter, and detection of excess voltage, current, power, or temperature on the receiver or transmitter. Absent an error, charging continues until the receiver indicates no further power is required, usually when an attached battery is fully recharged. At this point, the transmitter enters the charge complete state, as indicated by the green LED being lit steadily, which it continues to do until the receiver is removed from the transmitter. Whenever the receiver is removed from the target area, the transmitter returns to the standby state, searching for another transaction to begin.

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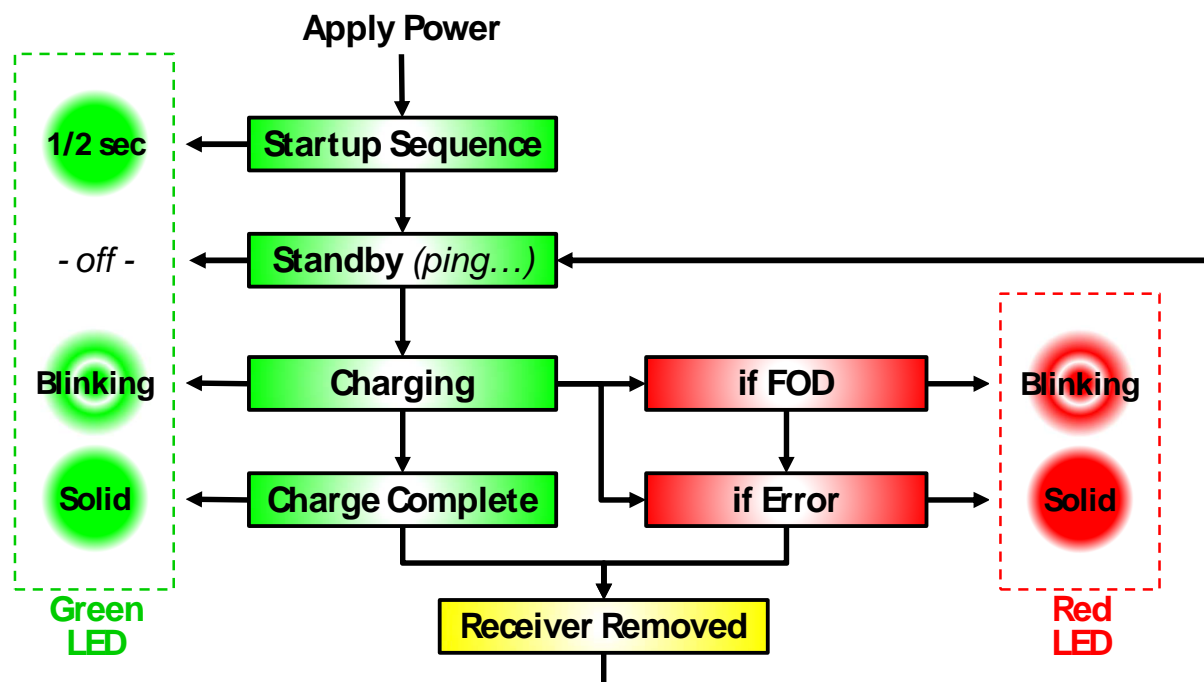
Standard Use

The TSDMTX-5V-EVM is easy to set up and use. Connect a USB cable from any USB port capable of driving up to 1 amp (most PCs will suffice) to the USB port on the EVM. On application of power, the green LED should light for about a second and then turn off. *Note: you can also apply power via the J5 port from an external 5 volt power supply (not included with the EVM kit), but not when the USB cable is in use.*

At this point, the EVM is ready to transmit power. A few times each second, the transmitter emits a 'ping' of energy in search of a compliant receiver in range.

When in range, the receiver is powered by the ping sufficiently to be able to announce its presence to the transmitter, and a transaction begins. The transmitter provides a small amount of power to the newly discovered receiver, so it can tell the transmitter what its power requirements are.

At the completion of the handshake, the transmitter begins providing the requested power, indicated by a blinking green LED. During power transfer, the receiver continuously communicates with the transmitter, actively directing the process. In this way, it is assured that power is only sent when and how it is required by an available and desirous receiver – and in the way that is compatible to the requirements of the receiver. If required, a receiver can actively increase or decrease its power request, and the transmitter will act accordingly. As such, equipment with complex charging requirements can be precisely supported and only the desired amount of power is provided.

Once charging is completed, the LED stops blinking and displays a steady green 'completed' state. If at any time an error is detected, the red LED is lit and transmission is halted. To restart, the receiver must be removed from the range of the transmitter and returned to the target zone to start a new transaction.

Productized Receiver Test

If you have a product that is Qi or PMA compliant, simply place it on the circular target of the black plastic antenna cover. The transmitter should demonstrate the above actions, and the device receiving power should indicate it is taking a charge in whatever manner its users guide states. You can also perform foreign object detection (FOD) by following the steps in the "FOD Testing" section below.

EVM Receiver Tests

Additional testing can be performed with the use of an EVM receiver module. There are a number of Semtech Receiver EVMs that support different power levels and output voltages, any of which can be used, as all support the Qi and/or PMA standard and therefore are compatible with the TSDMTX-5V-EVM transmitter. In this User Guide, the TSDMRX-5V-EVM has been selected as the receiver to experiment with. Other Semtech receiver EVMs may be used instead in a similar manner; refer to the user guide for the selected receiver for details specific to the selected device.

In order to use the TSDMRX-5V-EVM as a target receiver, simply place the receiver over the target circle on the transmitter EVM module. You should see the LEDs on each EVM turn green, indicating a transaction has been established. The EVM's purpose is to receive power; next you can decide what to deliver that power to.

The user has a number of possible options to choose from. The optimal load to select would be a Programmable DC Electronic Load. A 'load box' can easily be set to draw a selected current or power at the turn of a knob, making them very flexible and easy to use in observing power supply operation in general. If a load box is not available, a power resistor decade box is nearly as convenient, as it can easily be set to any desired resistance to simulate a range of load conditions. In either case, be sure the test load is rated for at least the amount of power being tested. If need be, a selection of power resistors

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could be used as test loads, though without the ease of modification of the prior options. Finally, any device that uses a 5 volt input up to 5 watts of power can be used as a test load should that be desired.

Whatever load is selected, wires must be run from the VOUT+ and VOUT- pins of the receiver EVM to the selected test load, as per the illustration below. Once the load is added, the receiver EVM can be used to perform a variety of tests. Alternately, power can be drawn from the VBUS and GND lines of the USB port if desired.
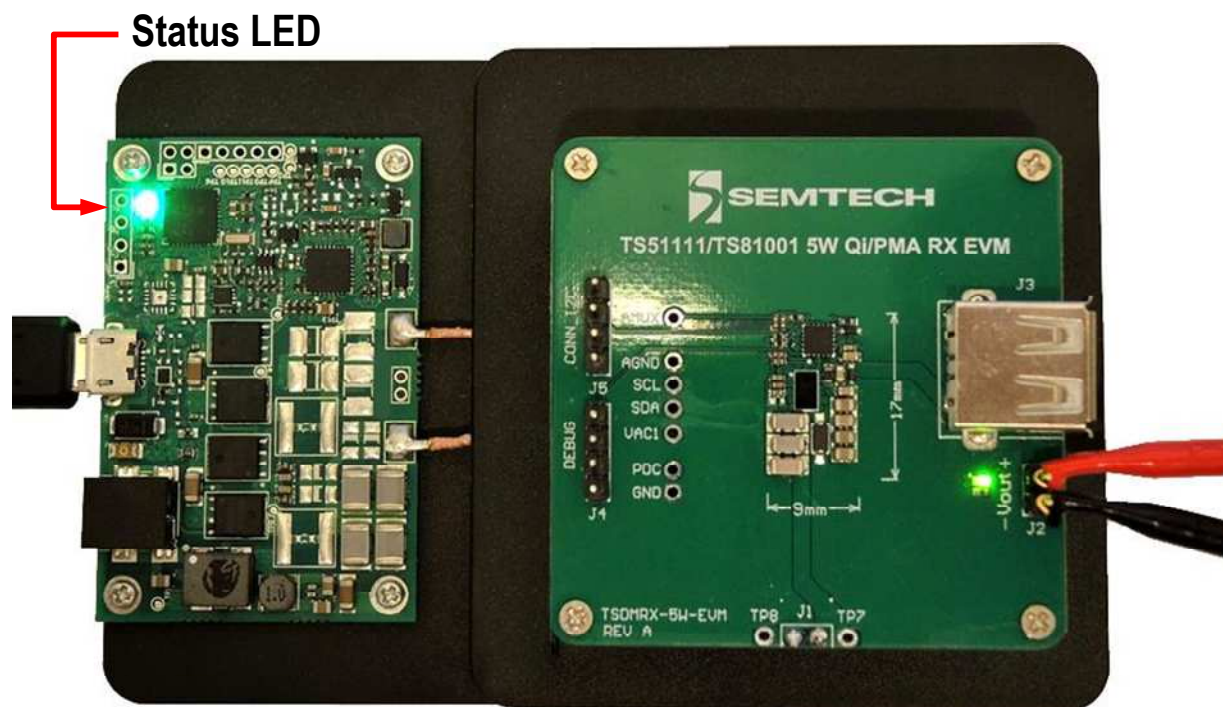
Connect a DC voltmeter across the VOUT+ and VOUT- pins to monitor the voltage being output to the load, and a DC ammeter in series with the VOUT+ line. Set levels to allow for up to 10 volts and 2 amps to be observed.

With no load selected, place the receiver on the center of the transmitter target circle. Once transmission begins, you should observe approximately 5 volts and 0 amperes on the meters.

Apply a variety of loads to observe performance at 1, 2, and 5 watt levels. Voltage should remain nearly constant, and current should follow the P=V*I relationship. Experiment with the maximum power that can be drawn before the receiver detects an overload and cuts off power. You should be able to observe on a minor overload, the receiver will attempt to restore power by retesting the load intermittently. In the case of a major overload, the transmitter may register an error, as indicated by a red LED on the transmitter, which will halt further activity until the receiver is removed from the target area for several seconds before being returned to start a new transaction.

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Observe Coil Signals

The following information is not required in order to use the EVM, as what can be observed below is entirely managed by the Semtech TS80000 Wireless Controller. However, it allows the observer an opportunity to see how the receiver and transmitter actively manage the wireless power process.

If you wish to observe the intrinsic wireless process, place an oscilloscope probe on one antenna lead, with the probe ground run to the board ground (one of the fastener screws will suffice). Be sure the scope can handle signals up to 100 volts. While the EVM power supply is only 5 volts, the antenna is part of a resonant circuit where considerably higher voltages are developed.

To observe the search ping, apply power to the transmitter and remove the receiver from the target zone. The scope should display a 'chirp' of 0.5 to 1mSec in duration with an initial peak of 10 to 20 volts. The frequency within the envelope of the chirp is in the 100-150 kHz range, which is the normal range of Qi and PMA systems.

Next, place the receiver on the transmitter target. With the scope set to 0.5 to 1 uSec and 10 to 20 volts per division, you should observe a signal that is a composite of the sinusoidal power signal with a digital 'notch' in the sinewave which is produced by the communication between the receiver and transmitter. Note as you vary the load and the location of the receiver on the target that the amplitude and frequency of the coil signal changes. The greater the load, the more signal is sent to transfer the power required by the load. Similarly, the less well coupled the receiver antenna is to the transmitter coil, the more power must be sent to compensate for the inefficient misalignment. You may note voltages near 140 volts peak-to-peak in the most demanding conditions.

Measure Efficiency

By measuring the power from the receiver's VOUT+ and VOUT- pins in comparison to the power entering the transmitter EVM, you can determine the efficiency of the power transfer through the system. The diagram below, for EVMs similar to those used here, demonstrates efficiency is a function of output current, and runs about 75% beyond the mid-power point, assuring good efficiency and minimal heat dissipation concerns.

Load vs Efficiency
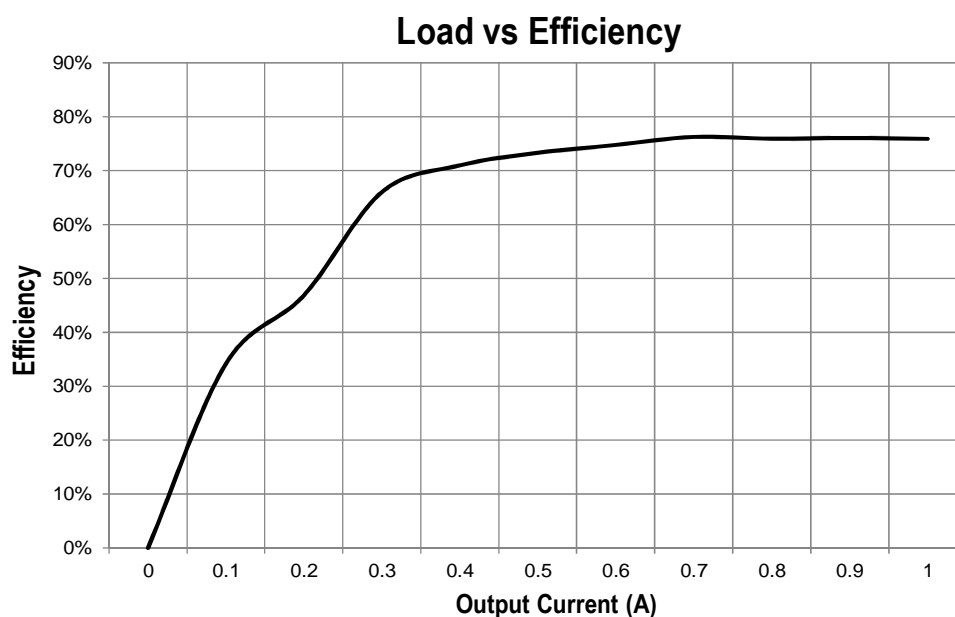
Firmware Management

The EVM is shipped with the most current release of the firmware at the time it was manufactured. As the standard evolves, or enhancements are made to the board performance, updates to the firmware will be available via your Semtech FAE.

A small utility "FW_FLASH" allows you install the latest firmware to your board, and also to interrogate the board as to which version of the firmware is currently installed. FW_FLASH is also available via your Semtech FAE.

Once obtained, install FW_FLASH to any desired location on your computer. If you wish to obtain the latest firmware, obtain and install it as well.

Let Windows install an EVM Driver on your PC

- Connect a USB cable between the EVM and your PC.
- Apply power to the EVM.
- Wait for windows to indicate that it has finished loading a driver for the EVM, then unplug the EVM.
- *Note: you do not need to locate a special driver for this process. Windows will select one of its own. This operation only needs to be performed once on a given PC.*

Determine the EVM Flash Revision

- To set up the EVM hardware correctly for the flash utility, start with an unpowered EVM.
- Double click on the FW_FLASH icon on your computer.
- FW_FLASH will open a window on your PC.
- Connect a USB cable between the EVM and your PC, which applies power and initiates the USB connection.
- The revision number of the flash firmware found on the EVM will be displayed in the FW_FLASH window.
- Close the window when you are done reviewing this information.

Updating the EVM Flash Revision

- Begin with an unpowered EVM.
- Drag the firmware file to send to the EVM onto the FW_FLASH icon.
- FW_FLASH will open a window on your PC.
- Connect the USB cable between the PC and the EVM.
- In the FW_FLASH window, the utility will indicate the progress of the flash update.
  In just a few seconds should indicate the update has been completed.
- Close the window when you are done reviewing this information.

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FOD Test

In a production device, FOD testing is an important feature, in that the transmission process is constantly inspected for the introduction of extraneous materials in the target area that could absorb the transmitted energy and become hot. When Foreign Objects are Detected ("FOD"), the TS80000 shuts down power transmission as a safety precaution, and indicates the detected problem by blinking the red status LED.

This process is bypassed in the receiver EVM, however, in order to allow engineers to test different antennas and make other hardware modifications without triggering the FOD protocols and complicating the testing process. When such hardware changes are made, the parameters of the feedback measurements change, which the FOD protocol would perceive as a foreign object in the field, and cause the system to shut down.

In order to test the FOD protocols, the experimenter can use as a receiver any Qi certified cell phone. Examples of these are the Samsung Galaxy S6, Samsung Galaxy Edge, Samsung Galaxy Note+, various LG and Google Nexus phones, and, some models of the Nokia Lumia. A more extensive list can be found at:

http://www.wirelesspowerconsortium.com/products/?brand_name=&product_name=&type_number=&product_type=2&compliant_automotive=&sort=&direction=asc

Experiments can be run on foreign objects on receivers with and without FOD management enabled to observe the differences. With FOD disabled, the metal object in the field will absorb some of the transmitted energy and become warm. Using a FOD-enabled production device, power transmission will be aborted when any significant interference in power transfer has been detected.

Once a FOD abort takes place, the transaction is terminated, as indicated by a blinking red LED. To restart power transmission, the receiver must be removed from the target area and a new transaction must be initiated. If the FOD is still present, the transaction will fail again, and continue to do so until the FOD is removed from the target area.

Based on prior information and experiments, what should be expected if FOD is introduced in the target area of an EVM that is not currently in a power transmission transaction? Why?

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Documentation

The following sections document the hardware design of the TSDMTX-5V-EVM. This information can be used to better understand the functionality of the design, as well as assist in creating your own hardware solution based on this design

A. Block Diagram

The TSDMTX-5V-EVM may be divided into a number of sub-blocks as show in the diagram below:
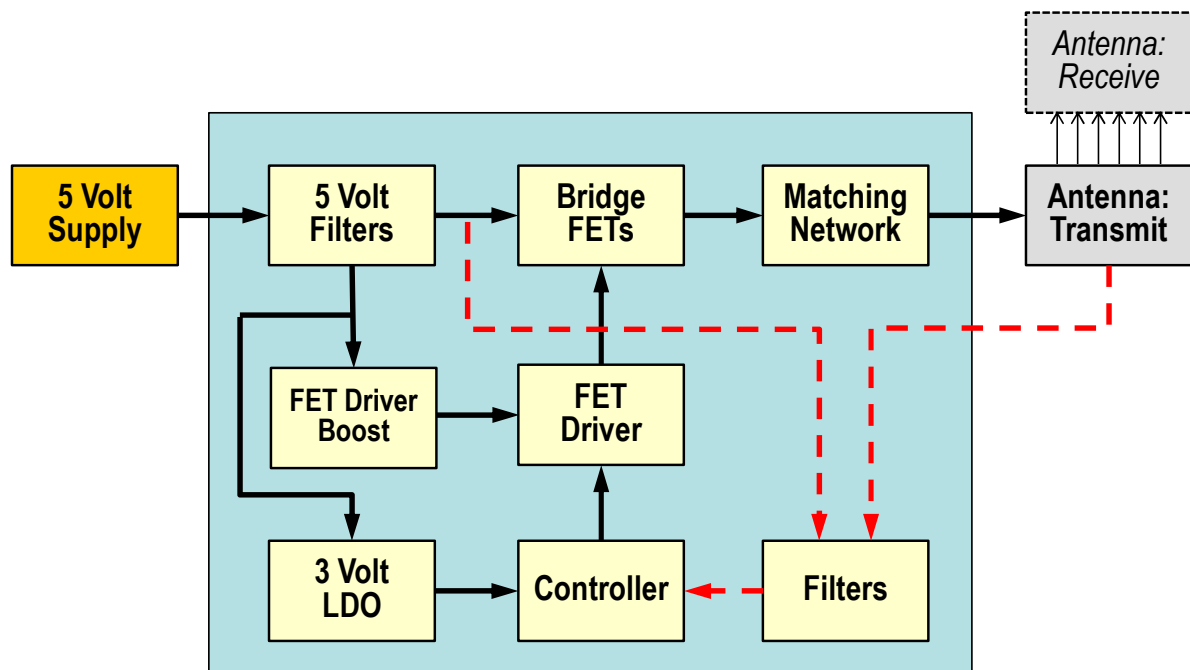
5 Volt Filters - smooths the 5 volt input supply

FET Driver Boost - raises the 5 volt input above 6 volts for the FET drivers

Controller - based on the TS80000 Wireless Power Controller. Includes I/O: USB, I2C, Temp Sensor, LED display

FET Driver - based on the TS61001 Full-bridge FET Driver, powers the FETs based on inputs from controller

Bridge FETs - gates drive power from the 5v supply to drive the resonant tank circuit (antenna)

Matching Network - array of capacitors to create the resonant tank along with the antenna

Antenna: Transmit - acts as the primary of an air-core transformer in conjunction with the receiver antenna

Filters - adapt the antenna and drive values for use as feedback input to the controller

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B. Schematic

Below are the schematics for the TSDMTX-5V-EVM. Annotation has been added to indicate which part of the block diagram each component is a member of:

Controller
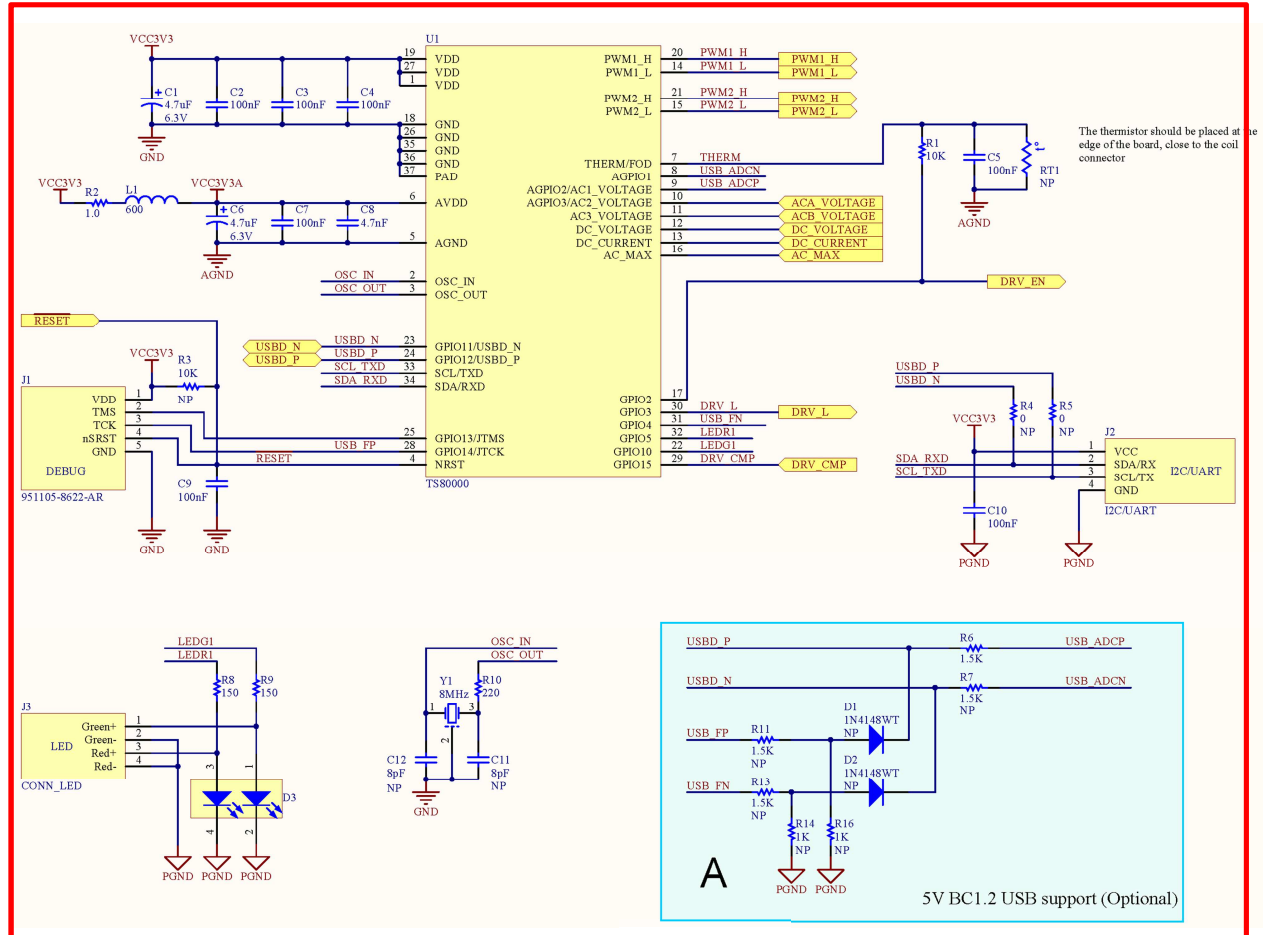
9v Filter
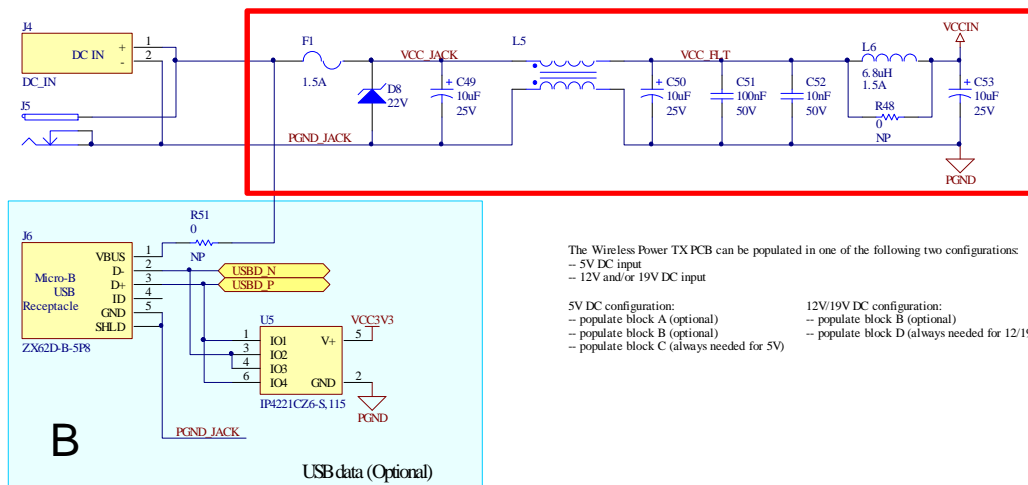
The Wireless Power TX PCB can be populated in one of the following two configurations:
-- 5V DC input
-- 12V and/or 19V DC input

5V DC configuration:
-- populate block A (optional)
-- populate block B (optional)
-- populate block C (always needed for 5V)

12V/19V DC configuration:
-- populate block B (optional)
-- populate block D (always needed for 12/19V)

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C

5V support

VCC5V VCCIN VCC5V

C57 10uF 10V L7 33 uH 0.37A R52 0 NP

PGND

D9 B0540W-7-F

VCCDRV

DRV_L Q5 2N7002

R55 100K

R54 75K

C61 10uF 16V

R61 10K

C62 33pF

DRV_VOLTAGE

PGND PGND PGND PGND PGND

VCC5V U4 VCC3V3 3.0V

INPUT OUTPUT 2 R47 15K

R46 10K

C55 100nF 50V

ENABLE FB 6 R50 10K

R49 75K

GND PAD

TS31023

GND GND GND

Place close to the MCU 4.7uF decoupling capacitor.

VCCIN

C14 22uF 25V R19 0.020 0.1W

TIE1 Net Tie
TIE2 Net Tie

R17 1.0 U2 VCC3V3A

IN+ OUT 6 R18 1K

C13 100nF

R20 1.0 IN- REF GND

INA199A2

C15 10nF C16 100nF

AGND

DC_CURRENT DC_CURRENT

PGND

VBRIDGE

C17 100nF 50V C18 22u 25V

R21 75K DC_VOLTAGE DC_VOLTAGE

R23 10K

C19 4.7nF

AGND AGND

R22 10K

PGND

U3

DRV_EN DRV_EN

SLEEP
PGOOD
SDATA
SCLK

VB1 28

HO1 2

R24 0 C23 NP VBRIDGE
C24 NP
C20 NP
C21 NP

L2 2.2uH 4.2A NP

ACA ACA_VOLTAGE

VCC3V3A VCC3V3

COILB C25 4.7nF 200V NP R28 200K NP R12 14K NP D4 BAT54SW-7-F NP

R15 14K

C26 33pF NP

AGND AGND AGND

PWM1_H
PWM1_L
PWM2_H
PWM2_L

HS1ON
LS1ON
HS2ON
LS2ON

VS1 1

LO1 3

SW1

R27 2.0

C22 47nF

Q1 BSC120N03MS G
Q2 BSC120N03MS G

C27 2.7nF 50V

PGND

R30 10K R31 10K R32 10K R33 10K

PGND

COMPP
COMPN
COMPOUT

21
20
19

AMPP
AMPN
AMPOUT

24
22
23

C35 47nF 250V
C38 47nF 250V
C39 NP
C40 NP

Antenna

COILA
L3 TX Inductor 24uH
COILB

ACB ACB_VOLTAGE

VCC3V3A VCC3V3

COILB C34 4.7nF 200V R38 200K R56 14K D5 BAT54SW-7-F
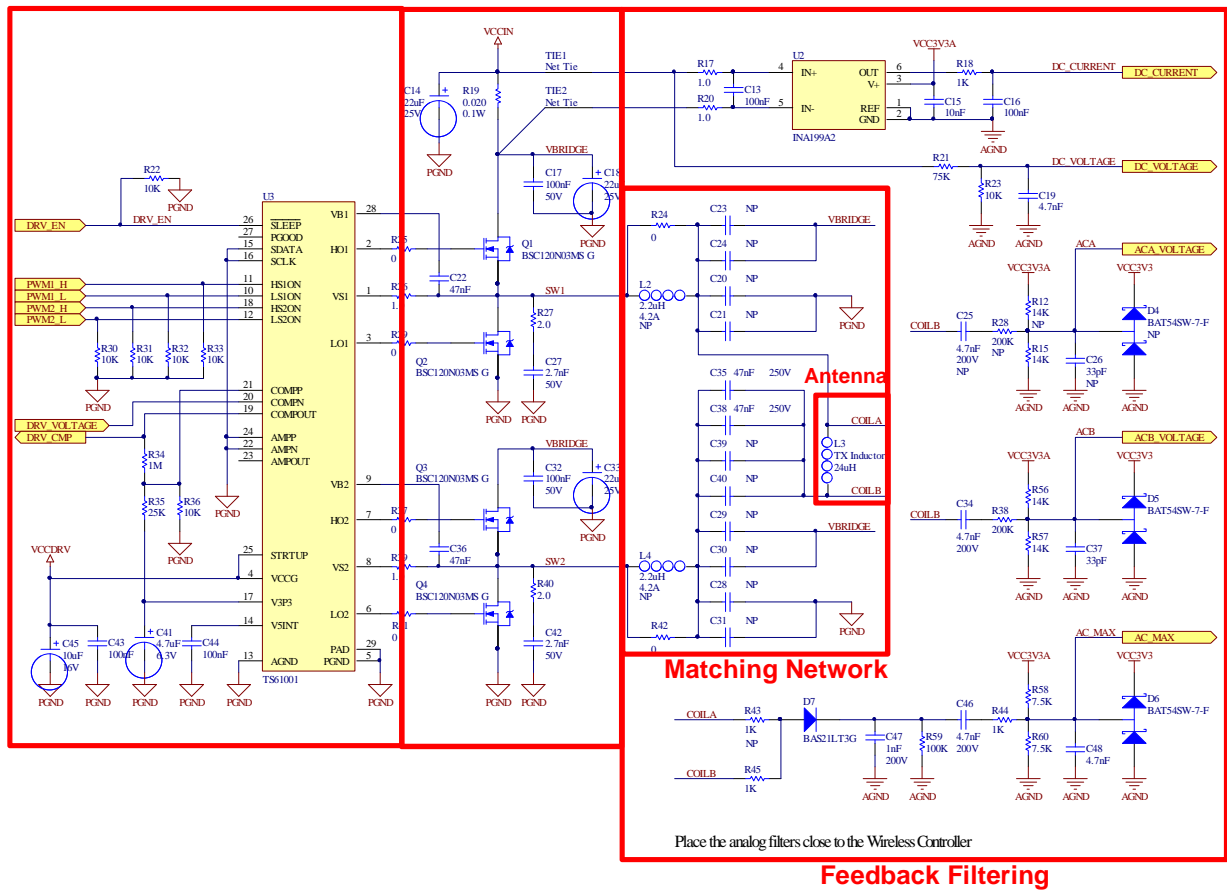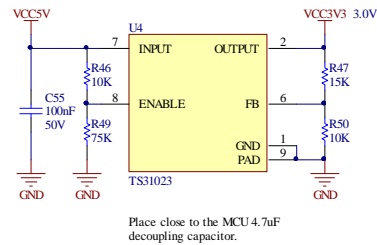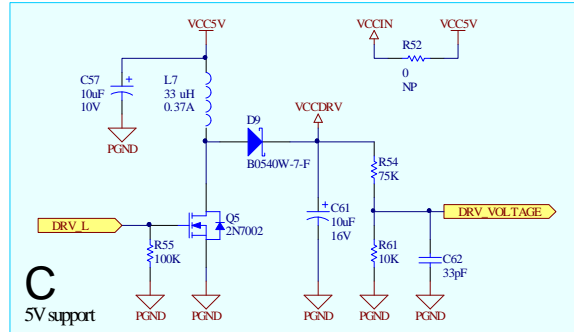
R57 14K

C37 33pF

AGND AGND AGND

DRV_VOLTAGE
DRV_CMP

R34 1M

R35 25K R36 10K

PGND

VB2 9

HO2 7

Q3 BSC120N03MS G

C32 100nF 50V C33 22u 25V

VBRIDGE

PGND

Matching Network

C29 NP
C30 NP
C28 NP
C31 NP

L4 2.2uH 4.2A NP

R42 0

VBRIDGE

PGND

VCCDRV

STRTUP 25

VCCG 4

V3P3 17

V5INT

VS2 8

LO2 6

SW2

R40 2.0

C36 47nF

Q4 BSC120N03MS G

C42 2.7nF 50V

AC_MAX AC_MAX

VCC3V3A VCC3V3

R58 7.5K D6 BAT54SW-7-F

R60 7.5K

C48 4.7nF

AGND AGND AGND

C45 10uF 16V C43 100nF C41 4.7uF 3V C44 100nF

PAD PGND 29
AGND 13

TS61001

PGND PGND PGND PGND PGND PGND PGND

COILA R43 1K NP

D7 BAS21LT3G

C47 1nF 200V R59 100K C46 4.7nF 200V R44 1K

COILB R45 1K

AGND AGND AGND AGND AGND

Place the analog filters close to the Wireless Controller

Feedback Filtering

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C. Bill Of Materials "BOM"

Below is a listing of the parts used in the TSDMTX-5V-EVM. An excel spreadsheet file with this information is available on the Semtech website as an added convenience.

	Designator	Value	Detail	Manufacturer	Qty
1	C1, C6, C41	4.7uF/6.3V	JMK107BJ475KA-T	Tayio Yuden	3
2	C14, C18, C33	22uF/25V	TMK316BBJ226ML-T	Taiyo Yuden	3
3	C15	10nF/50V	GRM155R71H103KA88D	Murata	1
4	C17, C32, C51, C55	100nF/50V	GRM155R61H104KA01D	Murata	4
5	C2-5, C7, C9, C10, 13,C16, C43-44	100nF/10V	GRM155R61A104KA01D	Murata	11
6	C22, C36	47nF/25V	GRM188R71E473KA01D	Murata	2
7	C27, C42	2.7nF/50V	CC0603KRX7R9BB272	Yageo	2
8	C34	4.7nF/200V	C1608X7S2A473K	TDK	1
9	C35, C38-40	100nF/50V	C3225C0G2E104J250AA	TDK	4
10	C37, C62	33pF/16V	C0402C0G1C330J020BC	TDK	2
11	C45	10uF/16V	C2012X5R1E106K085AC	TDK	1
12	C46	4.7nF/200V	C1608X7S2A473K	TDK	1
13	C47	1nF/200V	GRM188R72E102KW07D	Murata	1
14	C49, C50, C53,C54	10uF/25V	C2012X5R1C106K085AC	TDK	4
15	C52	10nF/50V	C1608X7R1H103K080AA	TDK	1
16	C57,C61	10uF/16V	C1608X5R1C106M080AB	TDK	2
17	C8, C19, C48	4.7nF/10V	C0402X5R1A103K020BC	TDK	3
18	D3		APHB1608ZGSURKC	Kingbright	1
19	D5, D6		BAT54SW-7-F	Zetex	2
20	D7		BAS21LT3G	ON Semiconductor	1
21	D8	22V	SMAJ22A	Bourns	1
22	D9		B0540W-7-F	Zetex	1
23	F1	1.5A	CQ12PF	CONQUER	1
24	J5		PJ-014DH-SMT	CUI	1
25	J6		ZX62D-B-5P8	Hirose	1
26	L1	600	BLM18AG601SN1D	Murata	1
27	L3	6.3uH	WT-505090-10K2-A11-G	TDK	1
28	L5		IND_CHOKE_TAI_TECH	Common Mode Choke	1
29	L6	6.8uH/1.5A	IFSC1515AHER6R8M01	Vishay	1
30	L7	33 Uh/0.37A	NR3015T330M	Tayio Yuden	1
31	Q1, Q2, Q3, Q4		BSC120N03MS G	Infineon	4
32	Q5		2N7002LT3G	On Semiconductor	1
33	R1, R46, R22-23, R30-33, R36, R50, R61	10K	RC0402FR-0710KL		11
34	R10	220	10K/1% 0402		1
35	R15,R56,R57	14K	14K/1% 0402		3
36	R2,R17, R20, R26, R39	1	RC0402FR-071RL		5
37	R18, R44, R45	1K	1K/1% 0402		3
38	R19	0.020/0.1W	0.02/1% 0603	Vishay	1
39	R21, R49, R54	75K	75K/1% 0402		3
40	R3,R24, R25, R29, R37, R41, R51,R52,R42	0	0K/1% 0402		9
41	R27, R40	2	2.0/1% 0402		2
42	R34	1M	1M/1% 0402		1

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|	Designator	Value	Detail	Manufacturer	Qty
43	R35	25K	25K/1% 0402		1
44	R38	200K	200K/1% 0402		1
45	R47	15K	15K/1% 0402		1
46	R55, R59	100K	200K/1% 0402		2
47	R58, R60	7.5K	7.5K/1% 0402		2
48	R6	1.5K	1.5K/1% 0402		1
49	R8, R9	150	RC0402FR-07150RL		2
50	U1	IC	TS80000	Semtech	1
51	U2	IC	INA199A1DCKR	TI	1
52	U3	IC	TS61001	Semtech	1
53	U4	IC	TS31023	Semtech	1
54	U5	IC	IP4221CZ6-S,115	NXP	1
55	Y1	8MHz	CSTCE8M00G55-R0	Murata	1

D. Board Layout

The diagram below shows the locations of the components used in the TSDMTX-5V-EVM PCB.

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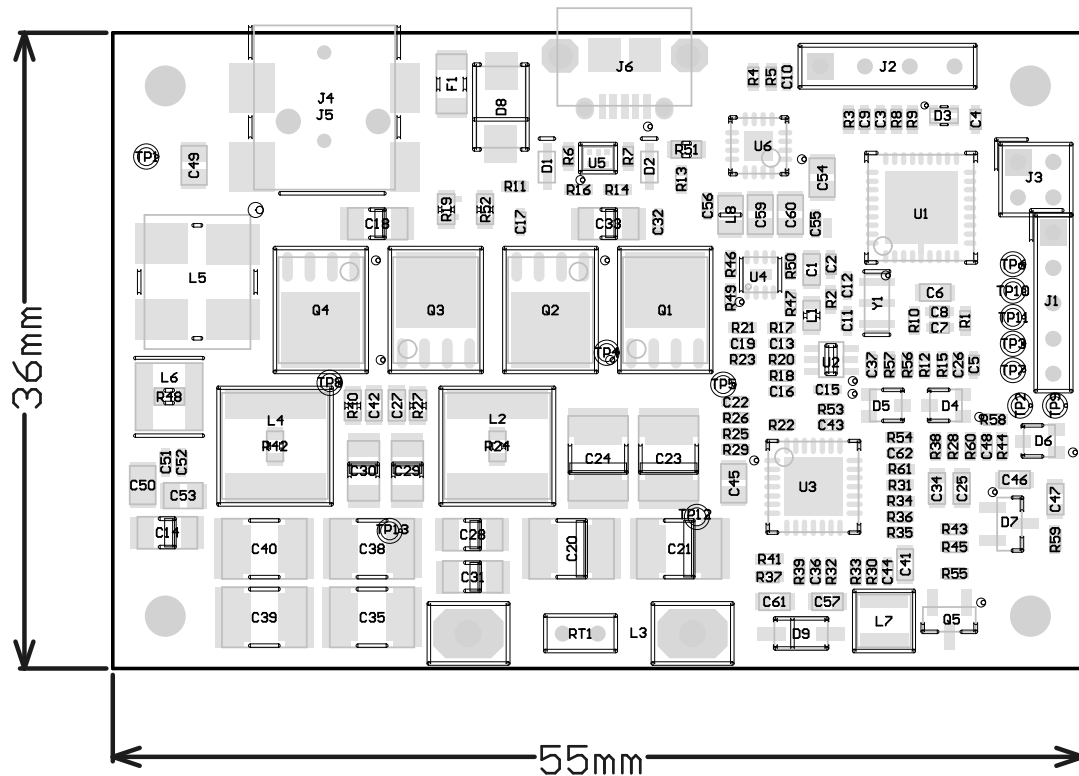
E. Board Layers

The TSDMTX-5V-EVM PCB is based on a four layer design as shown below. The ground plane in layer two is recommended to reduce noise and signal crosstalk. The EVM placed all components on the top of the board for easier evaluation of the system. End product versions of this design can be made significantly smaller by distributing components on both sides of the board. The Gerber files for this artwork can be downloaded from the Semtech web page.

Top Layer
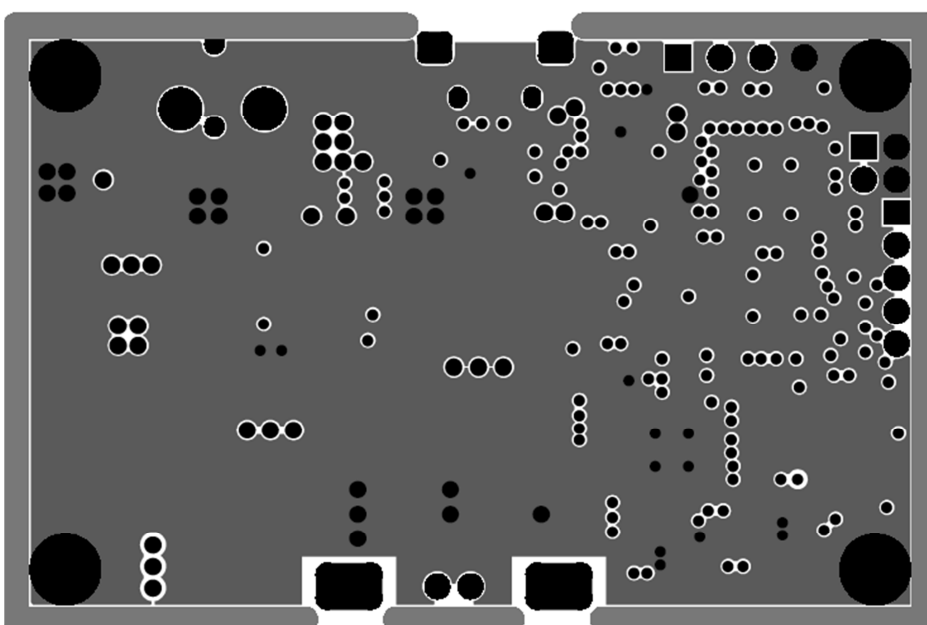

Ground Plane

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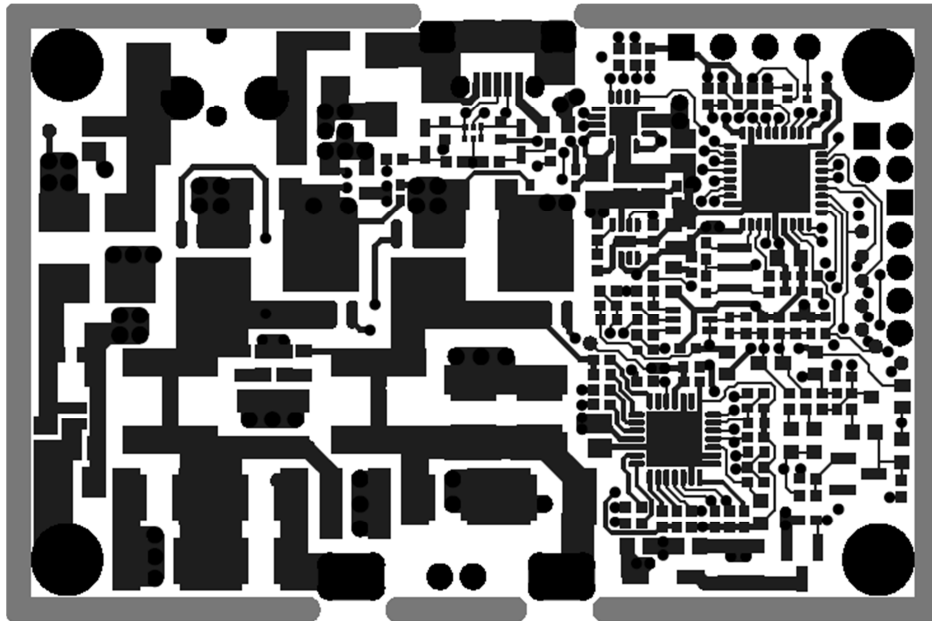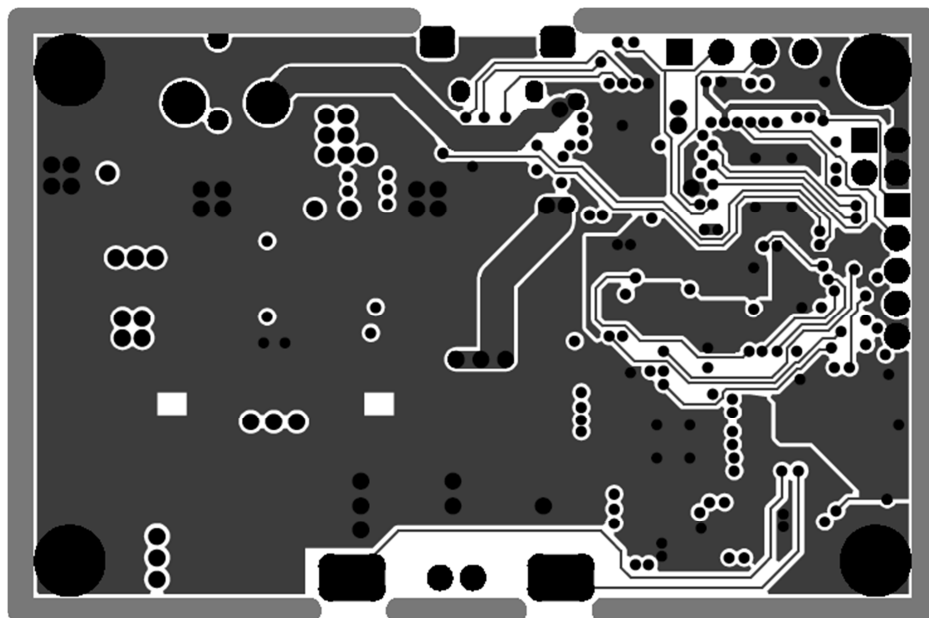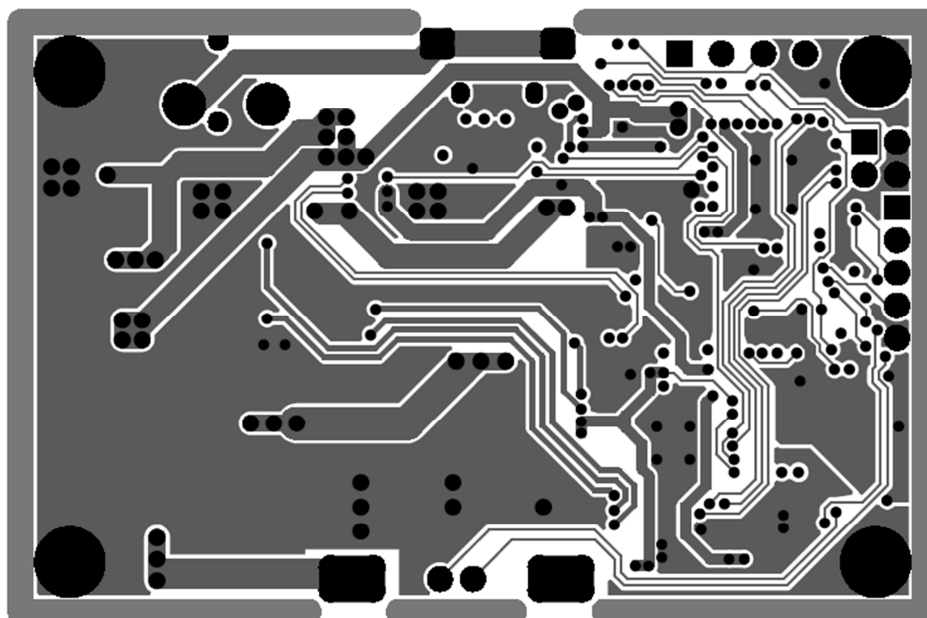
Signal Layer

Bottom Layer

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FAQs

Q: What output voltage is provided by the TSDMTX-5V-EVM system?

A: It depends on which receiver is being used. For the TSDMRX-5V-EVM, the output would be 5 volts.

Q: Where can I find more information on the Qi and PMA standards?

A: There are a number of websites that address this subject. A good starting point for Qi would be: http://www.wirelesspowerconsortium.com/technology/how-it-works.html.
PMA, which is now joined with A4WP, is now called AirFuel. Information on them can be found at: http://www.airfuel.org/technologies/inductive.

Q: Does the EVM part number represent something in particular?

A: Yes. The part number is broken into a prefix, main body, and suffix, separated by dashes. The prefix is comprised of three two letter groupings that each help define the product represented. As such, the part number can be read as follows:

Prefix characters:

1+2 = Company :	TS = Triune/Semtech	
3+4 = Environment :	DM = Dual Mode	WI = Wearable Infrastructure
5+6 = Type :	TX = Transmit	RX = Receive

Mid-section = Device Voltage or Wattage

Suffix = Equipment type:
EVM = Evaluation Module
MOD = Production Module

Therefore, the TSDMTX-5V-EVM is a Dual Mode, 5 volt Transmitter Evaluation Module provided by Semtech.

Q: What if my questions weren't answered here?

A: Go to the Semtech website as described on the next page. An updated FAQ for the TSDMTX-19V1-EVM is maintained there and may contain the answers you're looking for. Your local Semtech FAE can also assist in answering your questions.

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Next Steps

For more information on Wireless Power, go to the Semtech webpage at:

https://www.semtech.com/power-management/wireless-charging-ics/

You may also scan the bar code to the right to go to the above web page:

There you can find the downloadable copies of the schematic, BOM, and board artwork, as well as additional information on how to obtain Semtech wireless power products, from the chip level all the way to complete board modules, as your needs require.

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http://moschip.ru/get-element

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