User's Guide

SNVU599A–February 2019–Revised October 2019

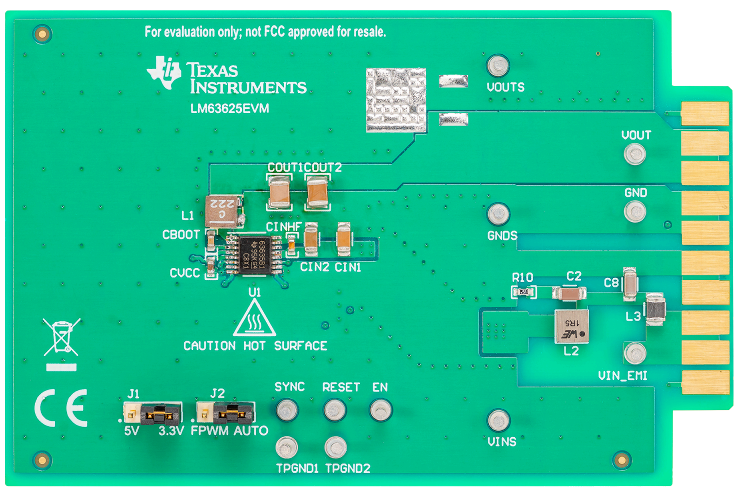
LM63625EVM EVM User's Guide

The Texas Instruments LM63625EVM evaluation module (EVM) helps designers evaluate the operation and performance of the LM63625-Q1 buck regulator. The LM63625-Q1 is a family of easy-to-use synchronous step-down DC/DC converters capable of driving up to 2.5 A of load current from an input voltage of 3.5 V to 36 V. The LM63625EVM features a selectable output voltage of 3.3 V or 5 V and a switching frequency of 2.1 MHz . See the *LM636x5-Q1 3.5-V to 36-V, 1.5-A, and 2.5-A Automotive Step-down Voltage Converter Data Sheet* for additional features, detailed description, and available options.

The EVM options are found in Table 1.

Table 1. Device and Package Configurations

EVM	DEVICE	FREQUENCY/OUTPUT CURRENT
LM63625EVM	LM63625DQPWPRQ1	2100 kHz / 2.5 A



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Trademarks

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1 Setup

This section describes the test points and connectors on the EVM and how to properly connect, set up, and use the LM63625EVM . Either the test points on the top of the board or the card edge connector can be used for connections. See Figure 1 for the top of board connections and Figure 2 for the card edge connections. The following lists the functions of the connections:

VIN_EMI— Input supply to EVM. Connect to a suitable input supply. See the *LM636x5-Q1 3.5-V to 36-V, 1.5-A, and 2.5-A Automotive Step-down Voltage Converter Data Sheet* for input supply requirements.

GND— System ground

VOUT— Output of EVM. Connect to desired load.

VOUTS— Output voltage sense connection (do not use for current; sense only)

VINS— Input voltage sense connection (do not use for current; sense only)

GNDS— Ground sense point for analog measurements (do not use for current; sense only)

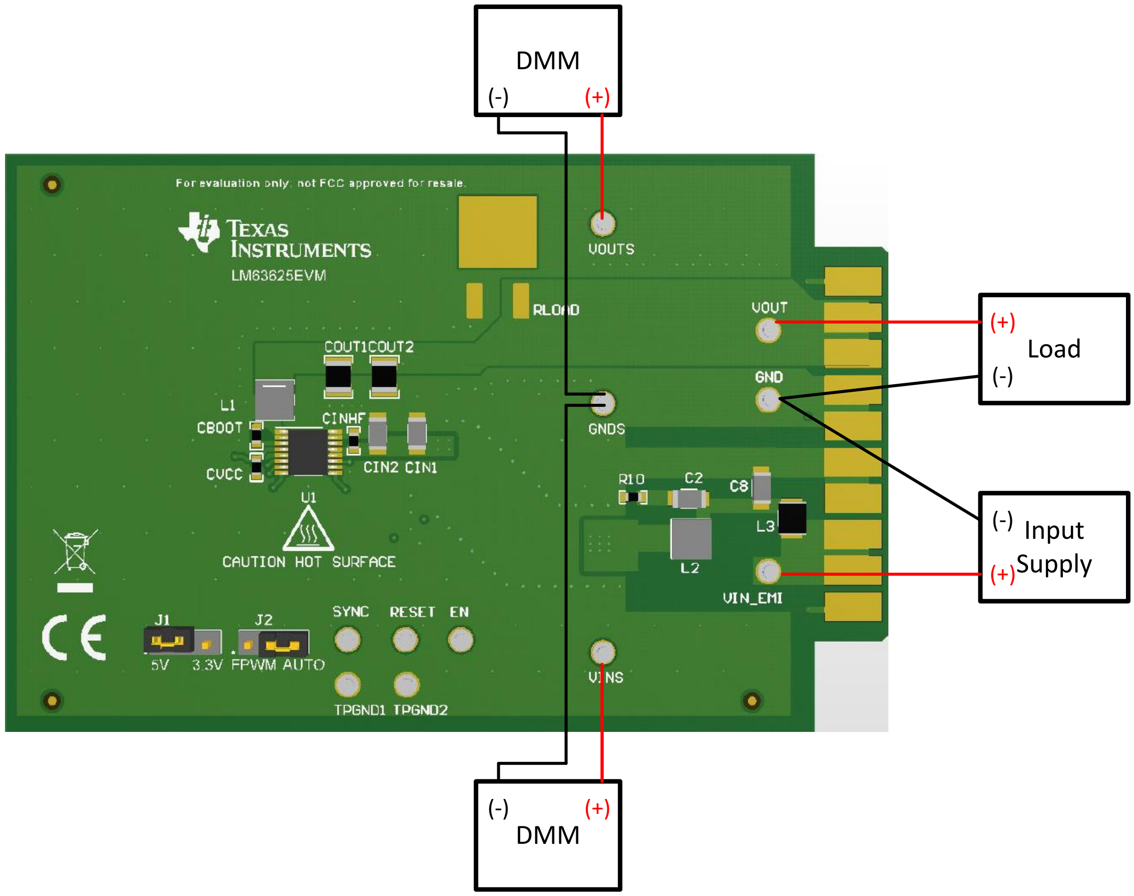


Figure 1. EVM Board Connections

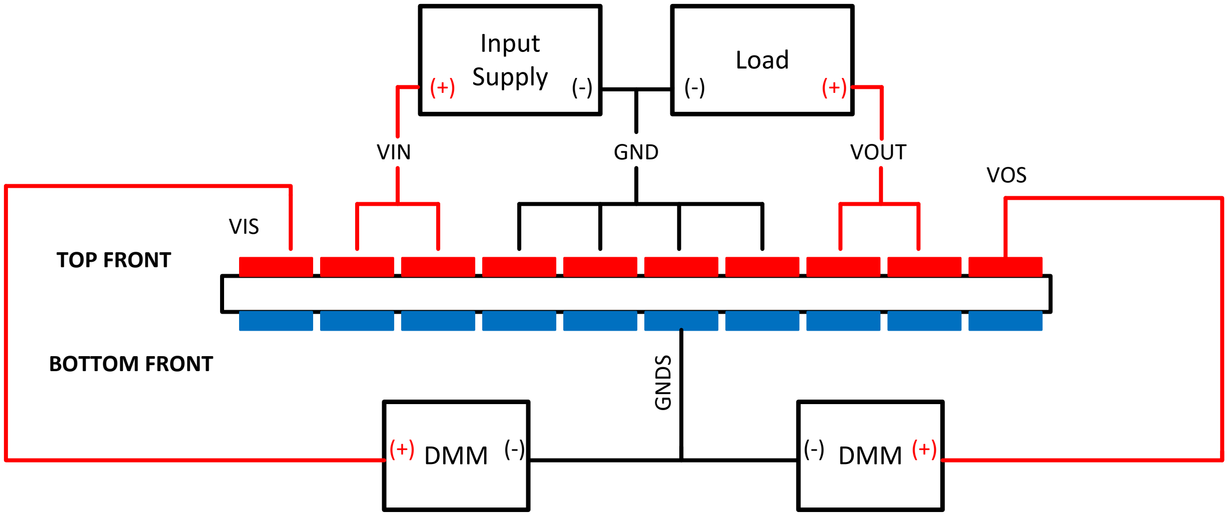


Figure 2. EVM Card Edge Connections

1.1 Jumpers

See Figure 3 for jumper locations.

- **J1** This jumper allows the VOUT_SEL pin input to be connected to either VCC or GND for a fixed output voltage selection of 3.3 V or 5 V, respectively. Alternatively, the jumper can be left open and a $R_{VOUTSEL}$ can be populated with 10 kΩ to have the part operate with an adjustable output voltage. See the *LM636x5-Q1 3.5-V to 36-V, 1.5-A, and 2.5-A Automotive Step-down Voltage Converter Data Sheet* for feedback resistor calculation.
- **J2** This jumper allows SYNC to be connected in this mode to either VCC or GND. When connected to VCC, the part operates in forced pulse width modulation (FPWM) mode and when the SYNC pin is connected to GND, the part operates in auto mode where pulse frequency modulation (PFM) is engaged.

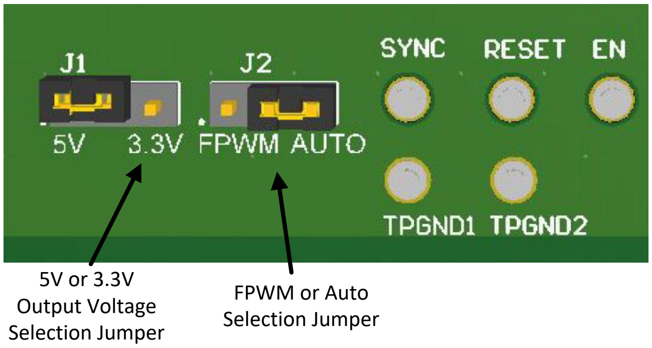


Figure 3. Jumper Locations

1.2 Test Points

- **VIN_EMI -** Input supply to EVM. Connect to a suitable input supply. See the *LM636x5-Q1 3.5-V to 36-V, 1.5-A, and 2.5-A Automotive Step-down Voltage Converter Data Sheet* for input supply requirements.
- **GND -** System power ground
- **VOUT -** Power output of EVM. Connect to desired load.
- **VOUTS -** Output voltage sense connection. Connect to DMM. It is also used for frequency response analyzer connection (do not use for current; sense only).
- **VINS -** Input voltage sense connection. Connect to DMM (do not use for current; sense only).
- **GNDS -** Ground sense point for analog measurements. Connect to DMM (do not use for current; sense only).
- **EN -** Connection for external EN logic input. Connect controlling logic to EN test point for external enable control.
- **RESET -** Connected to the RESET pin of the IC. It is used as a flag output. The reset function can be monitored at this test point. Pullup resistor, R_{PULLUP}, must be populated. A typical value for pullup resistor is 100 kΩ.
- **SYNC -** Connected to the SYNC pin of the IC. Connection to an external clock or synchronization signal enables the IC switching frequency to follow the synchronization signal.
- **TPGND1, TPGND2 -** System power ground
- **OPEN PADS -** Connection for frequency response analyzer (on bottom of board). See Figure 4.

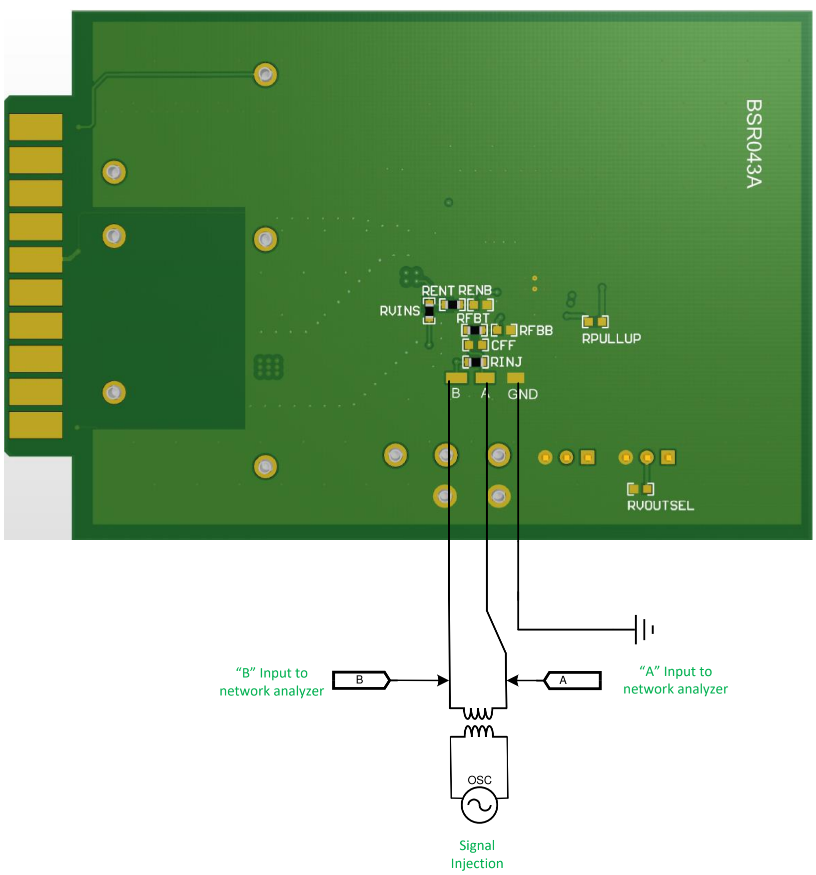


Figure 4. FRA Setup

2 Operation

Once the above connections are made and the appropriate jumpers are set, the EVM is ready to use. The EN pin is pulled up to VIN with a 100-kΩ resistor.

The output voltage of the EVM can be selected by the VOUT jumper to either 3.3 V or 5 V. Other values of output voltage can be programmed by removing the jumper on J1 before powering on the device and changing the value of R_{FBT} and R_{FBB} on the EVM. In addition, it is possible that the values of the inductor and the output capacitance need to be changed. See the *LM636x5-Q1 3.5-V to 36-V, 1.5-A, and 2.5-A Automotive Step-down Voltage Converter Data Sheet* for more information.

The EVM has been designed for maximum flexibility regarding component selection. This allows the user to place preferred components such as the inductor, the capacitors, or both, on the board and test the performance of the regulator. This way the power supply system can be tested before committing the design to production.

3 Performance Curves

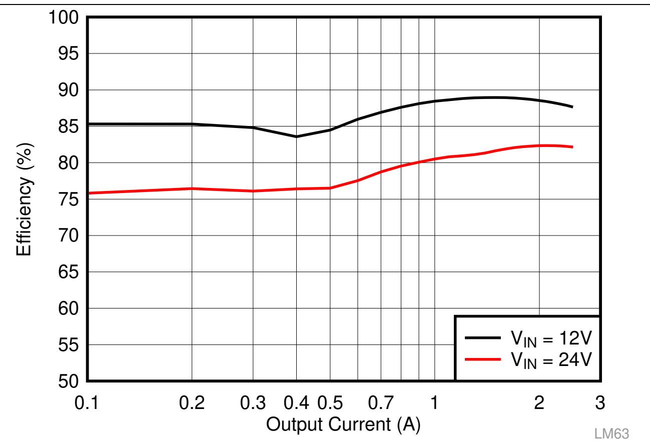


Figure 5. Efficiency Without Input Filter AUTO Mode, V_{OUT} = 3.3V, f_{SW} = 2.1 MHz

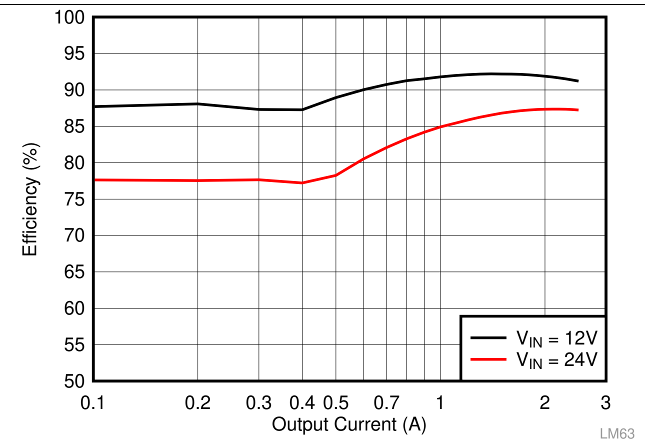


Figure 6. Efficiency Without Input Filter AUTO Mode, V_{OUT} = 5 V, f_{SW} = 2.1 MHz

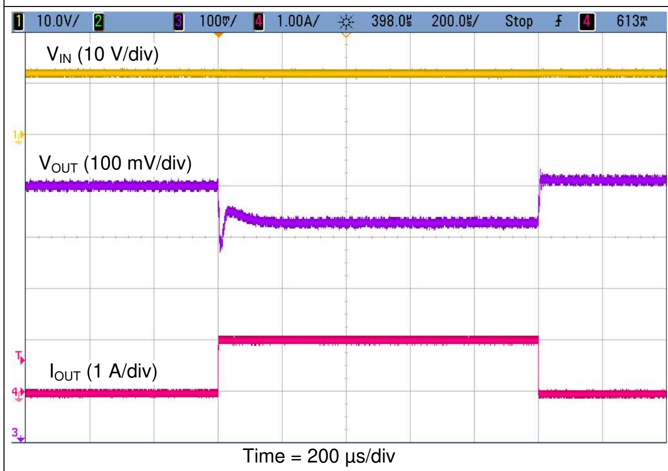


Figure 7. Load Transient 12 V_{IN}, 3.3 V_{OUT}, 0 A to 1 A, C_{OUT} = 2 × 22 µF , I_{OUT} Slew Rate = 1 A/µs

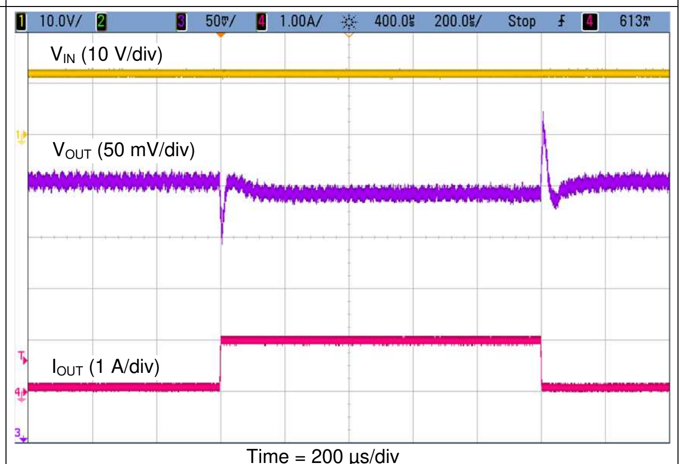
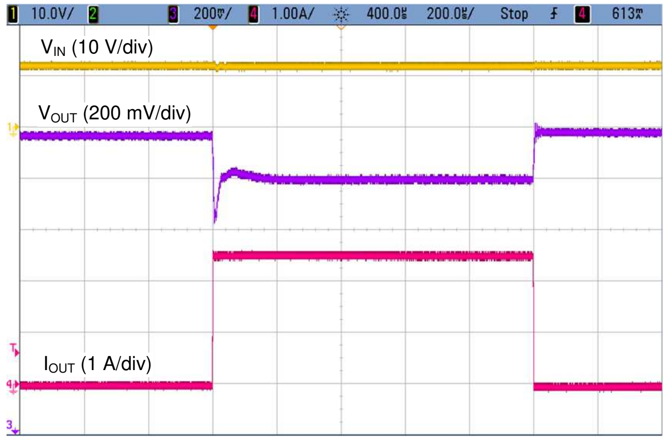
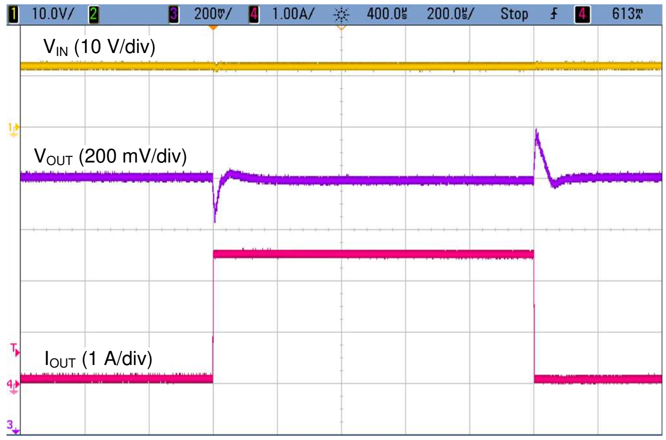


Figure 8. Load Transient 12 V_{IN}, 3.3 V_{OUT}, 0.1 A to 1 A, C_{OUT} = 2 × 22 µF, I_{OUT} Slew Rate = 1 A/µs



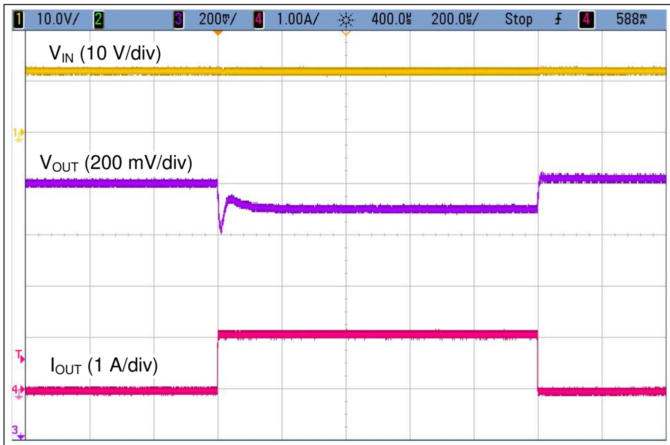
Time = 200 µs/div

Figure 9. Load Transient 12 V_{IN}, 3.3 V_{OUT}, 0 A to 2.5 A, C_{OUT} = 2 × 22 µF, I_{OUT} Slew Rate = 1 A/µs



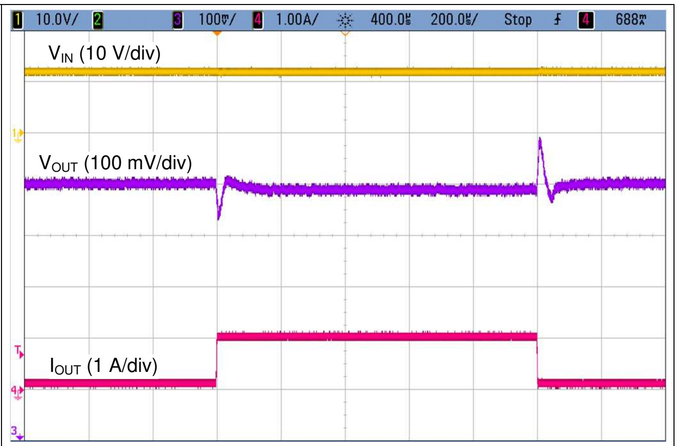
Time = 200 µs/div

Figure 10. Load Transient 2 V_{IN}, 3.3 V_{OUT}, 0.1 A to 2.5 A, C_{OUT} = 2 × 22 µF, I_{OUT} Slew Rate = 1 A/µs



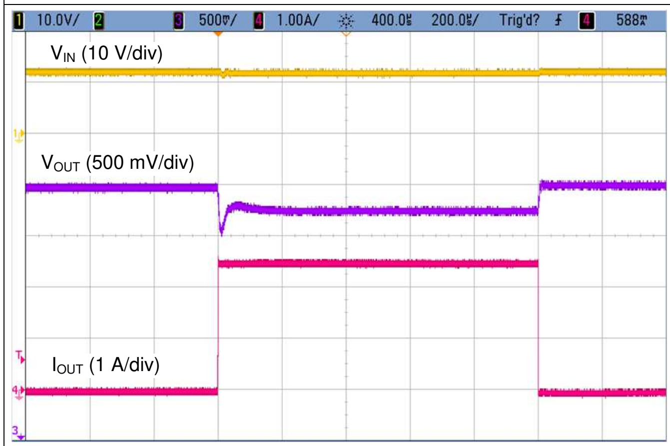
Time = 200 µs/div

Figure 11. Load Transient 12 V_{IN}, 5 V_{OUT}, 0 A to 1 A, C_{OUT} = 2 × 22 µF, I_{OUT} Slew Rate = 1 A/µs



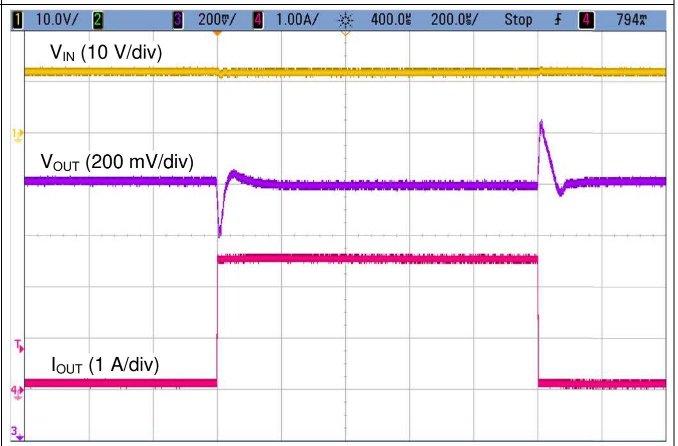
Time = 200 µs/div

Figure 12. Load Transient 2 V_{IN}, 5 V_{OUT}, 0.1 A to 1 A, C_{OUT} = 2 × 22 µF, I_{OUT} Slew Rate = 1 A/µs



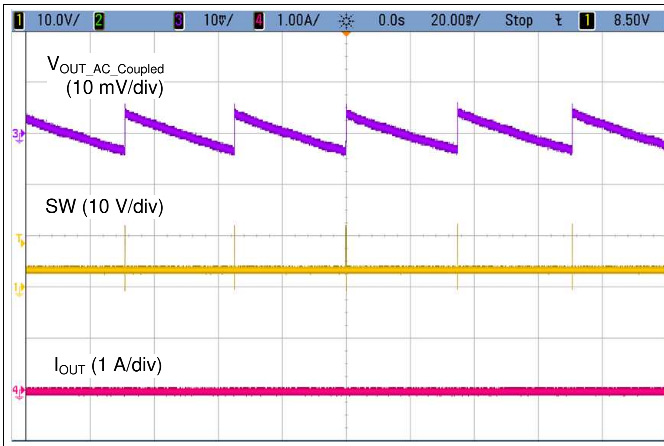
Time = 200 µs/div

Figure 13. Load Transient 12 V_{IN}, 5 V_{OUT}, 0 A to 2.5 A, C_{OUT} = 2 × 22 µF, I_{OUT} Slew Rate = 1 A/µs



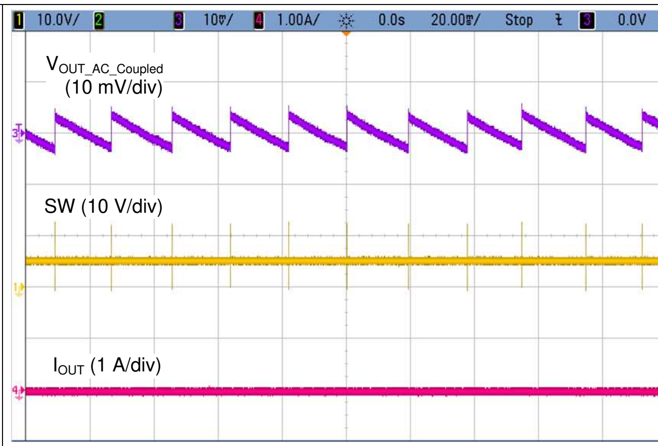
Time = 200 µs/div

Figure 14. Load Transient 2 V_{IN}, 5 V_{OUT}, 0.1 A to 2.5 A, C_{OUT} = 2 × 22 µF, I_{OUT} Slew Rate = 1 A/µs



Time = 20 ms/div

Figure 15. Output Voltage Ripple Auto Mode 2 V_{IN}, 3.3 V_{OUT}, 0 A



Time = 20 ms/div

Figure 16. Output Voltage Ripple Auto Mode 2 V_{IN}, 5 V_{OUT}, 0 A

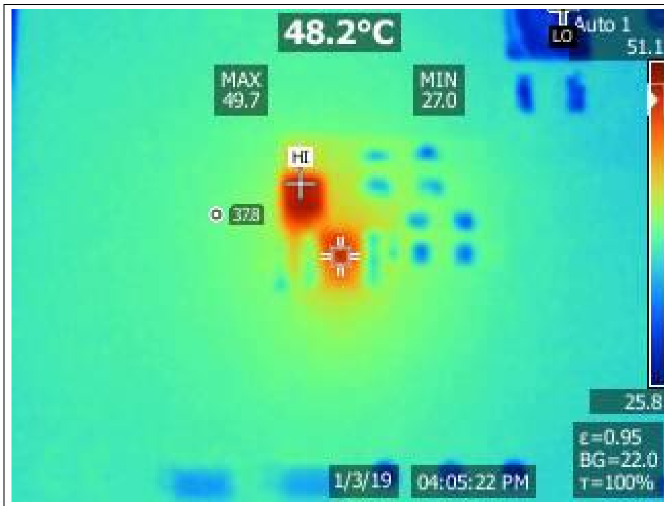


Figure 17. IC Temperature = 48.2°C 2 V_{IN}, 3.3 V_{OUT}, I_{OUT} = 2.5 A, f_{SW} = 2.1 MHz

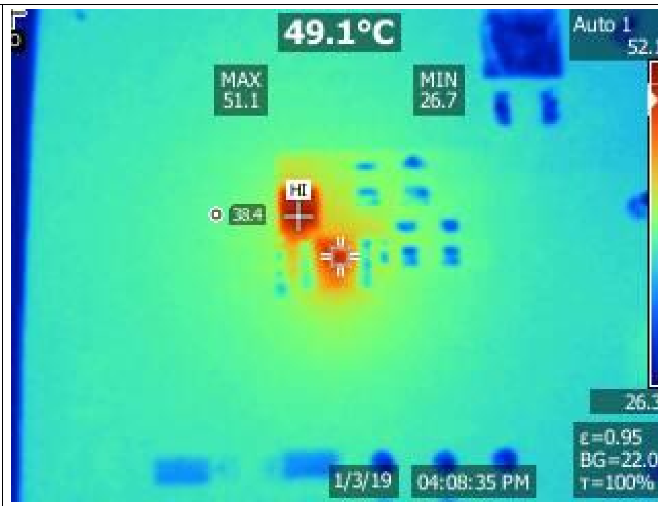


Figure 18. IC Temperature = 49.1°C 2 V_{IN}, 5 V_{OUT}, I_{OUT} = 2.5 A, f_{SW} = 2.1 MHz

4 Schematic

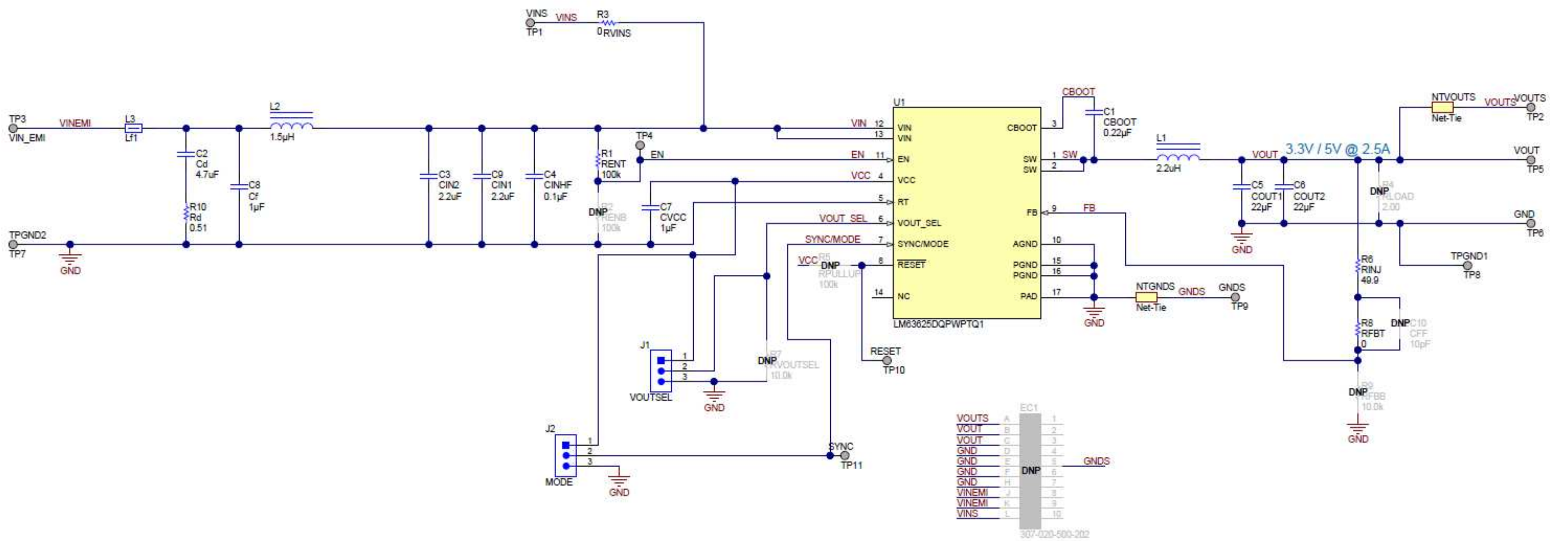


Figure 19. LM63625EVM Schematic

5 Board Layout

CAUTION

Caution Hot surface.
Contact may cause burns.
Do not touch.

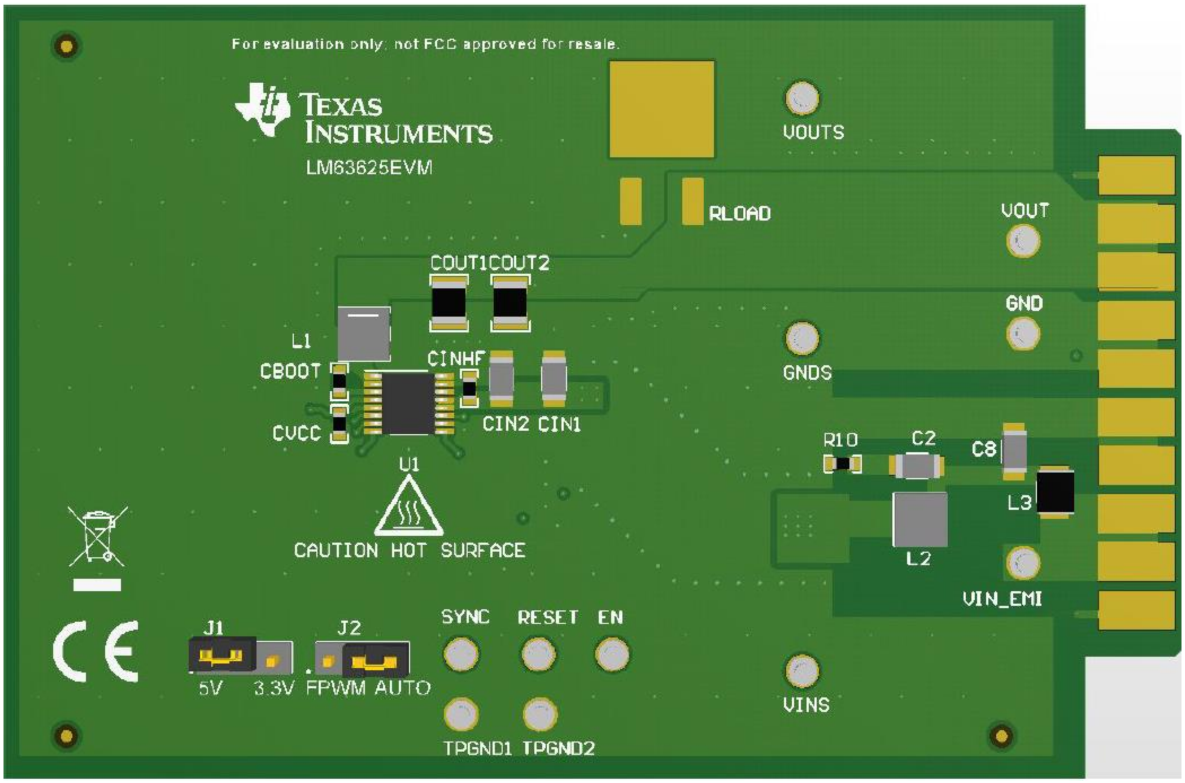


Figure 20. Top View of EVM

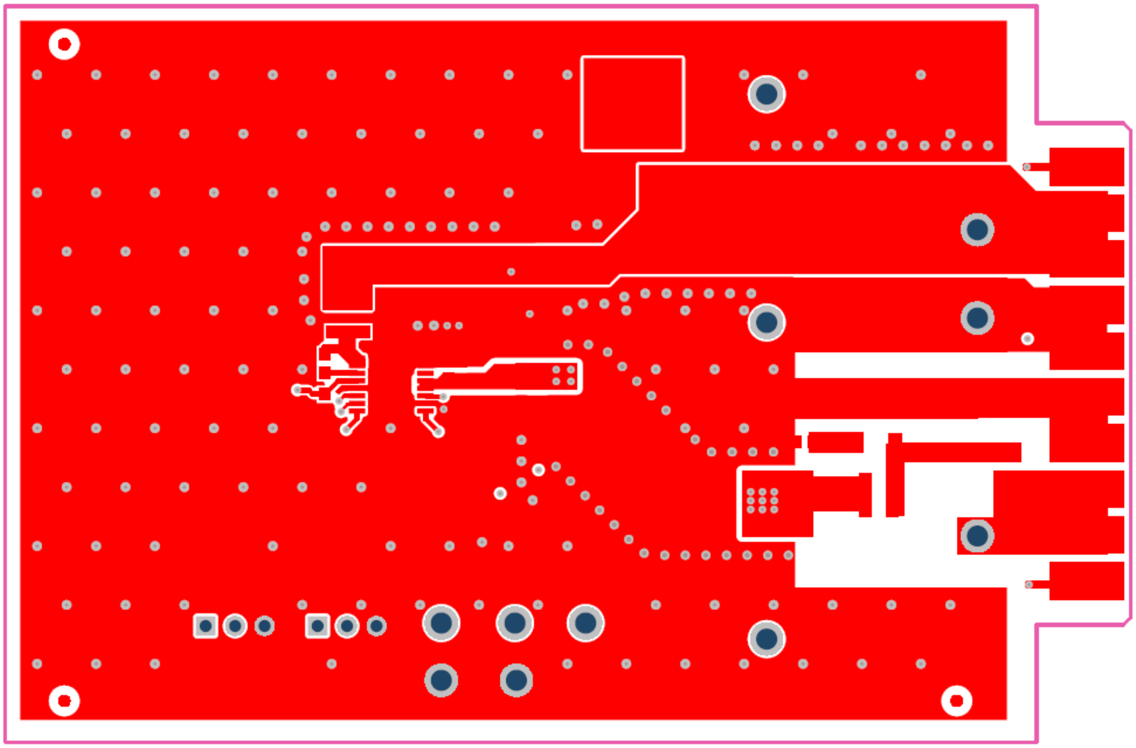


Figure 21. EVM Top Copper Layer

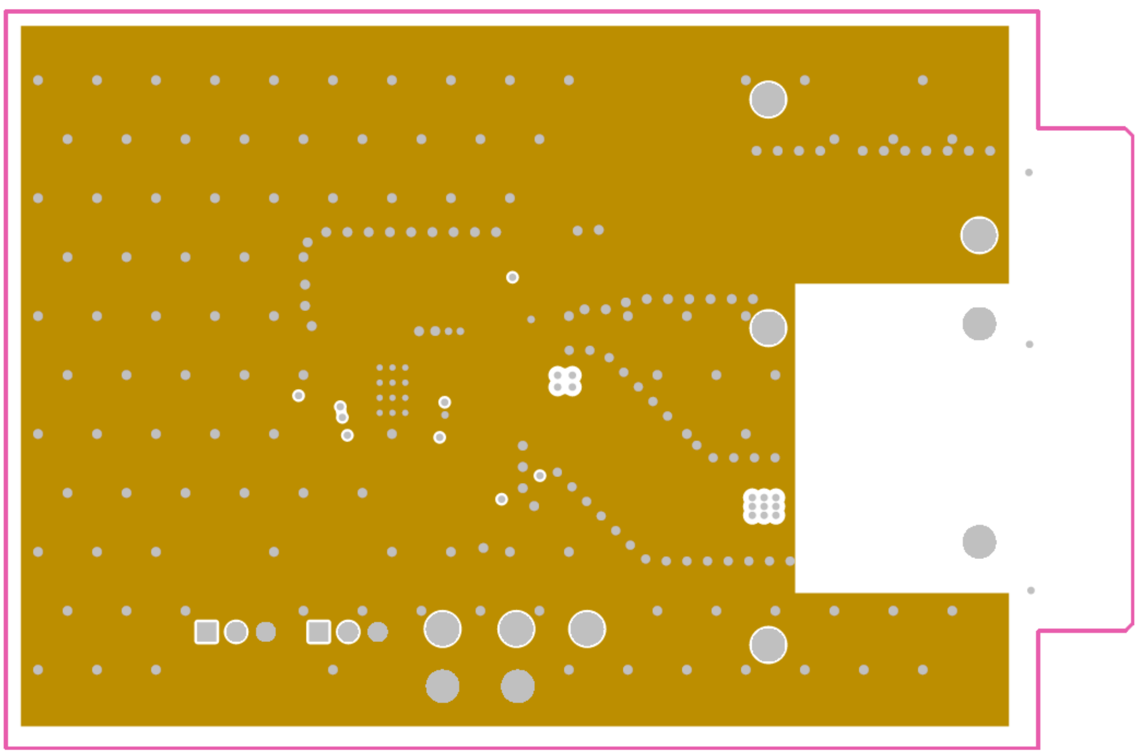


Figure 22. EVM Mid Layer One

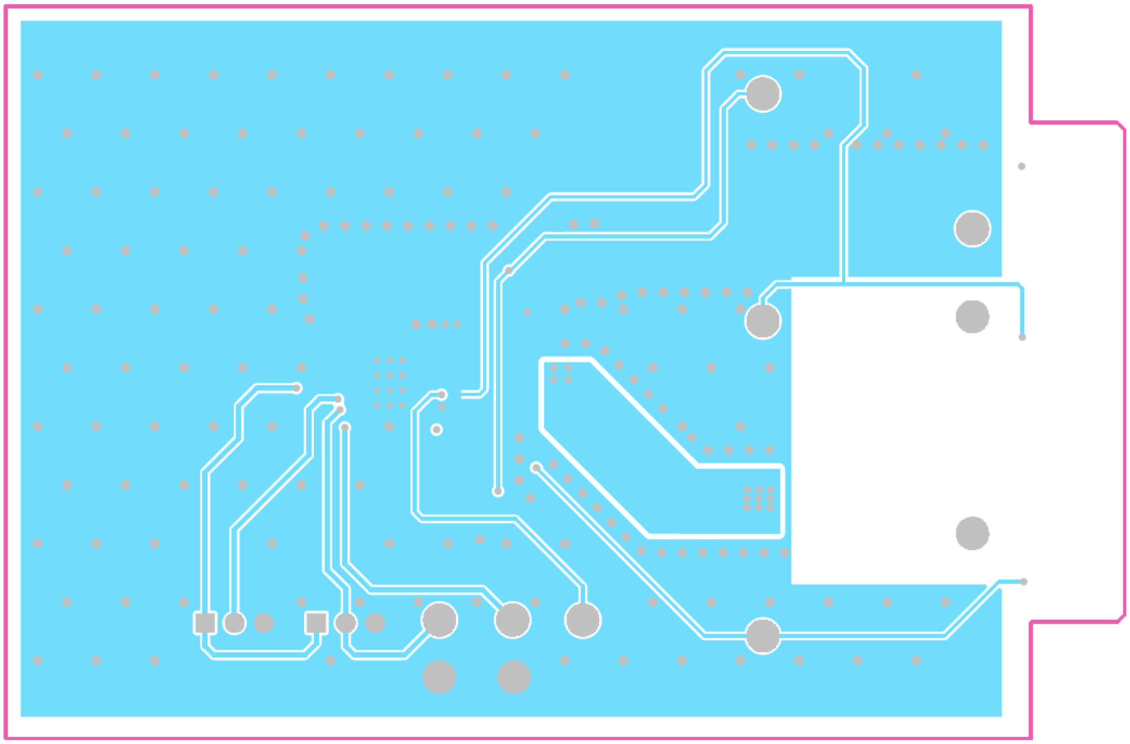


Figure 23. EVM Mid Layer Two

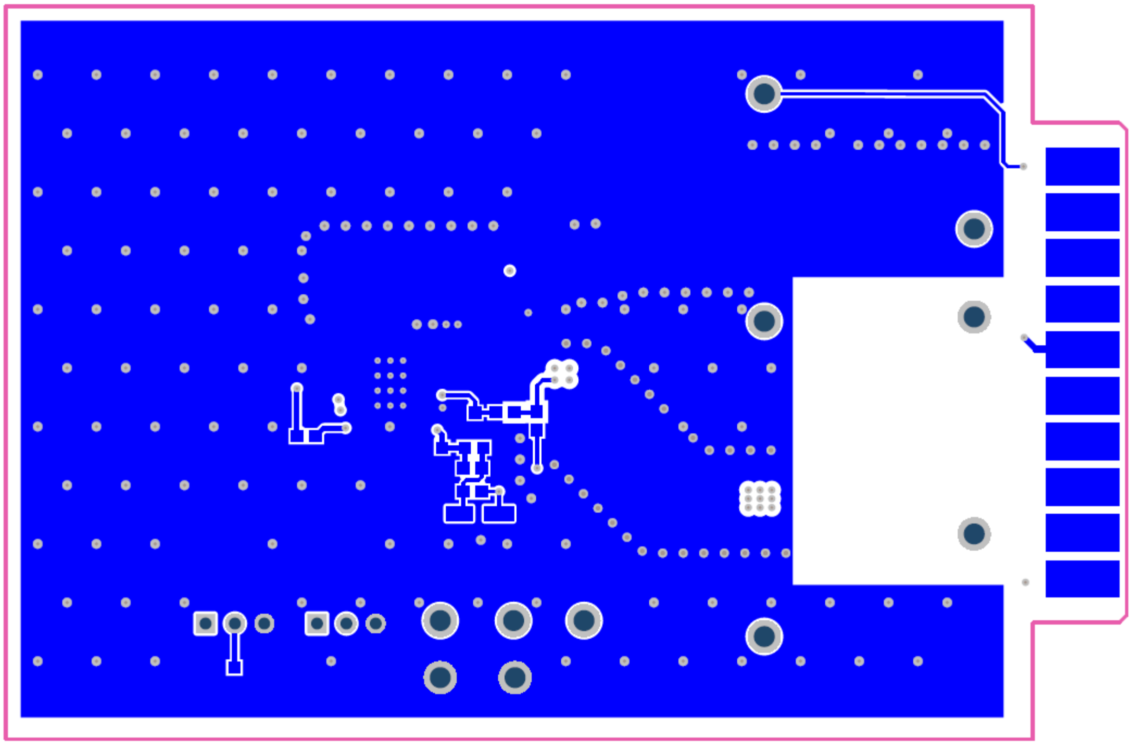


Figure 24. EVM Bottom Copper Layer

6 Bill of Materials

Table 2. BOM for LM63625EVM

DESIGNATOR	COMMENT	DESCRIPTION	MANUFACTURER	PART NUMBER	QUANTITY
C1	CBOOT	CAP, CERM, 0.22 µF, 16 V, ±10%, X7R, AEC-Q200 Grade 1, 0603	Samsung	CL10B224KO8VPNC	1
C2	Cd	CAP, CERM, 4.7 µF, 50 V, ±10%, X7R, 1206	TDK	C3216X7R1H475K160AC	1
C3, C9	CIN2, CIN1	CAP, CERM, 2.2 µF, 50 V, ±10%, X7R, AEC-Q200 Grade 1, 1206	MuRata	GCM31CR71H225KA55L	2
C4	CINHF	CAP, CERM, 0.1 µF, 50 V, ±10%, X7R, AEC-Q200 Grade 1, 0603	Kemet	C0603C104K5RACAUTO	1
C5, C6	COUT1, COUT2	CAP, CERM, 22 µF, 16 V, ±20%, X7R, AEC-Q200 Grade 1, 1210	Taiyo Yuden	EMK325B7226MMHT	2
C7	CVCC	CAP, CERM, 1 µF, 16 V, ±10%, X7R, AEC-Q200 Grade 1, 0603	Taiyo Yuden	EMK107B7105KAHT	1
C8	Cf	CAP, CERM, 1 µF, 50 V, ±10%, X7R, AEC-Q200 Grade 1, 1206	Taiyo Yuden	UMK316B7105KLHT	1
J1, J2	VOUTSEL, MODE	Header, 100 mil, 3x1, Gold, TH	Samtec	HTSW-103-07-G-S	2
L1	XAL4020-222MEB	Inductor, Shielded, Composite, 2.2 µH, 5.5 A, 0.04 Ω, SMD	Coilcraft	XAL4020-222MEB	1
L2	Lf2	Inductor, Shielded, Metal Composite, 1.5 µH, 5.8 A, 0.019 Ω, SMD	Wurth Elektronik	74438356015	1
L3	Lf1	Ferrite Bead, 600 Ω at 100 MHz, 3 A, 1210	Taiyo Yuden	FBMH3225HM601NT	1
R1	RENT	RES, 100 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	Vishay-Dale	CRCW0603100KFKEA	1
R3, R8	RVINS, RFBT	RES, 0, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	Stackpole Electronics Inc	RMCF0603ZT0R00	2
R6	RINJ	RES, 49.9, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	Vishay-Dale	CRCW060349R9FKEA	1
R10	Rd	RES, 0.51, 1%, 0.1 W, AEC-Q200 Grade 1, 0603	Panasonic	ERJ-3RQFR51V	1
SH-J1, SH-J2	SNT-100-BK-G	Shunt, 100 mil, Gold plated, Black	Samtec	SNT-100-BK-G	2
TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11	VINS, VOUTS, VIN_EMI, EN, VOUT, GND, TPGND2, TPGND1, GNDS, RESET, SYNC	Terminal, Turret, TH, Double	Keystone	1593-2	11
U1	LM63625DQPWPTQ1	3.5-V to 36-V, 2.5-A Synchronous Step-Down Voltage Regulator with Spread Spectrum, PWP0016D (TSSOP-16)	Texas Instruments	LM63625DQPWPTQ1	1
C10	CFF	CAP, CERM, 10 pF, 50 V, ±5%, C0G/NP0, 0603	MuRata	GRM1885C1H100JA01D	0
FID1, FID2, FID3	Fiducial	Fiducial mark. There is nothing to buy or mount.	N/A	N/A	0
R2, R5	RENB, RPULLUP	RES, 100 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	Vishay-Dale	CRCW0603100KFKEA	0
R4	RLOAD	RES, 2.00, 1%, 25 W, AEC-Q200 Grade 0, DPAK	Bourns	PWR163S-25-2R00F	0
R7, R9	RVOUTSEL, RFBB	RES, 10.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	Vishay-Dale	CRCW060310K0FKEA	0

Revision History

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

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• First public release	1
• Updated schematic	9