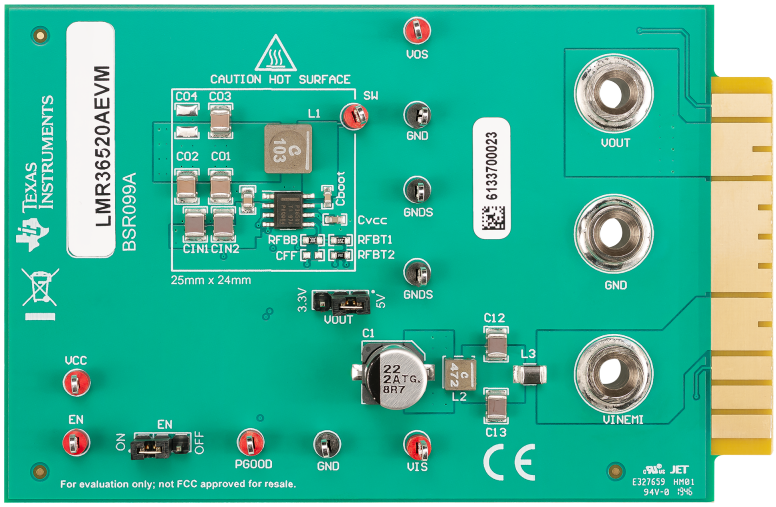
LMR36520AEVM User's Guide

The Texas Instruments LMR36520 EVM evaluation module (EVM) helps designers evaluate the operation and performance of the LMR36520 buck regulator. The LMR36520 is a family of easy-to-use synchronous step-down DC/DC converters capable of driving up to 2 A of load current from an input voltage of 4.2 V to 65 V. The LMR36520 EVM features a selectable output voltage of 3.3 V or 5 V and a switching frequency of 400 kHz. See the *LMR36520 4.2-V to 60-V, 1.5-A Ultra-small Synchronous Step-down Converter Data Sheet* for additional features, detailed description, and available options.

Table 1 shows the EVM options.

Table 1. Device and Package Configurations

EVM	DEVICE	FREQUENCY / OUTPUT CURRENT
LMR36520AEVM	LMR36520ADDAR	400 kHz / 2A



Contents

1 Setup 3
2 Operation 5
3 Schematic 7
4 Board Layout 8
5 Bill of Materials 10

List of Figures

1 EVM Board Connections 3
2 EVM Card Edge Connections 4
3 Jumper Locations 4
4 Frequency Response Analyzer Setup 5
5 LMR36520AEVM Schematic 7
6 Top View of EVM 8
7 EVM Top Copper Layer 8

Copyright © 2020, Texas Instruments Incorporated

8 EVM Mid-Layer One 8
9 EVM Mid-Layer Two 9
10 EVM Bottom Copper Layer 9

List of Tables

1 Device and Package Configurations 1
2 BOM for LMR36520AEVM 10

Trademarks

All trademarks are the property of their respective owners.

Copyright © 2020, Texas Instruments Incorporated

1 Setup

This section describes the test points and connectors on the EVM and how to properly connect, set up, and use the LMR36520AEVM. Either the banana jacks and test points on the top of the board can be used for connections, or the card edge connector can be used. 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:

- **VINEMI -** Input supply to EVM with an EMI filter. Connect to a suitable input supply. See the *LMR36520 4.2-V to 60-V, 1.5-A Ultra-small Synchronous Step-down Converter Data Sheet* for input supply requirements.
- **GND -** System ground
- **VOUT -** Output of EVM. Connect to the desired load.
- **VOS -** Output voltage sense connection
- **VIS -** Input voltage sense connection
- **GNDS -** Ground sense point for analog measurements

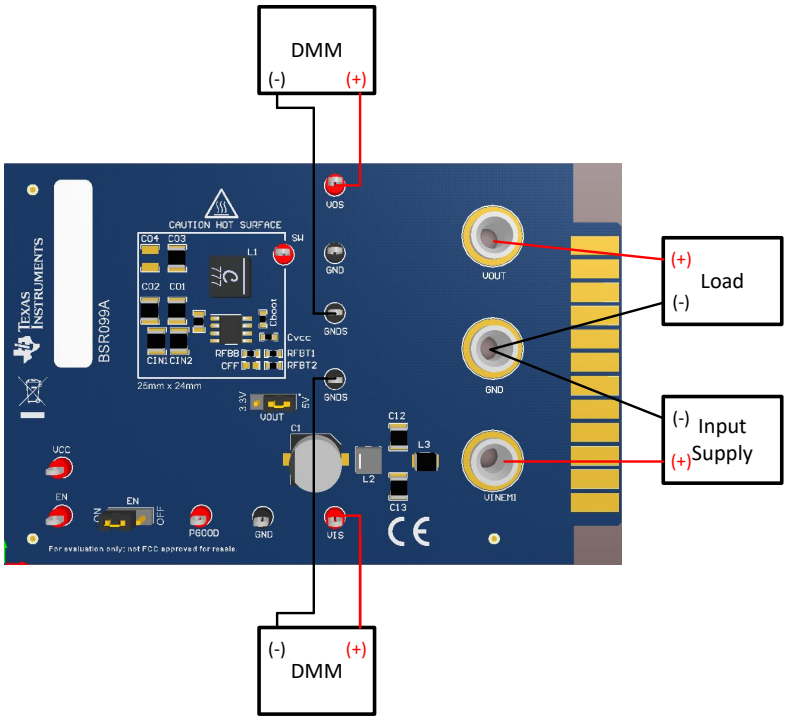


Figure 1. EVM Board Connections

Copyright © 2020, Texas Instruments Incorporated

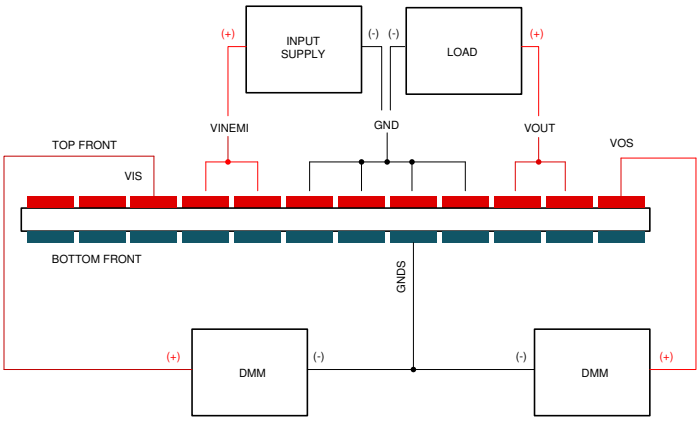


Figure 2. EVM Card Edge Connections

1.1 Jumpers

See Figure 3 for jumper locations.

- **EN -** This jumper allows the EN input to be connected to either ground (OFF) or VIN (ON). Remove this jumper to allow an external logic signal to control the EN function.
- **VOUT -** This jumper is used to select one of the two pre-defined output voltages. The "3.3 V" position provides a 3.3 V output while the "5 V" position provides a 5 V output.

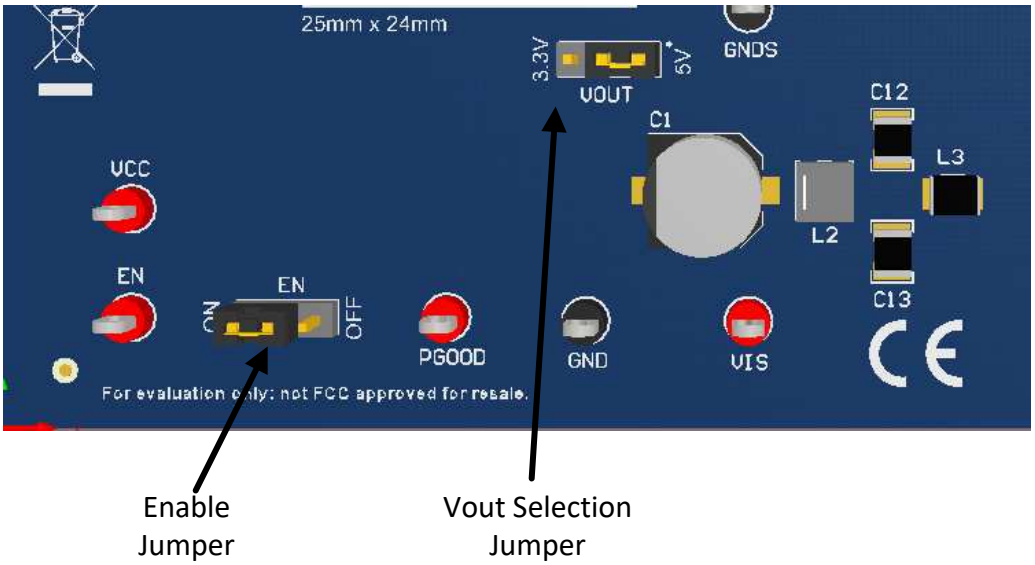


Figure 3. Jumper Locations

1.2 Test Points

- **VINEMI -** Input supply to EVM with an EMI filter. Connect to a suitable input supply. See the *LMR36520 4.2-V to 60-V, 1.5-A Ultra-small Synchronous Step-down Converter Data Sheet* for input supply requirements.
- **GND -** System power ground
- **VOUT -** Power output of EVM. Connect to the desired load.
- **VOS -** Output voltage sense connection; connect to DMM. VOS is also used for frequency response analyzer connection.

Copyright © 2020, Texas Instruments Incorporated

- **VIS -** Input voltage sense connection; connect to DMM.
- **GNDS -** Ground sense point for analog measurements; connect to DMM.
- **VCC -** Test point to measure internal VCC of device; approximately 5 V. On-board PGOOD pullup resistor is connected to VCC.
- **EN -** Connection for external EN logic input. Remove EN jumper and connect controlling logic to EN test point for external enable control.
- **PGOOD -** Power-good flag output. This test point is connected to VCC through a 20 kΩ resistor. The power good function can be monitored at this test point.
- **A -** Connection for frequency response analyzer (on bottom of board). See Figure 4.

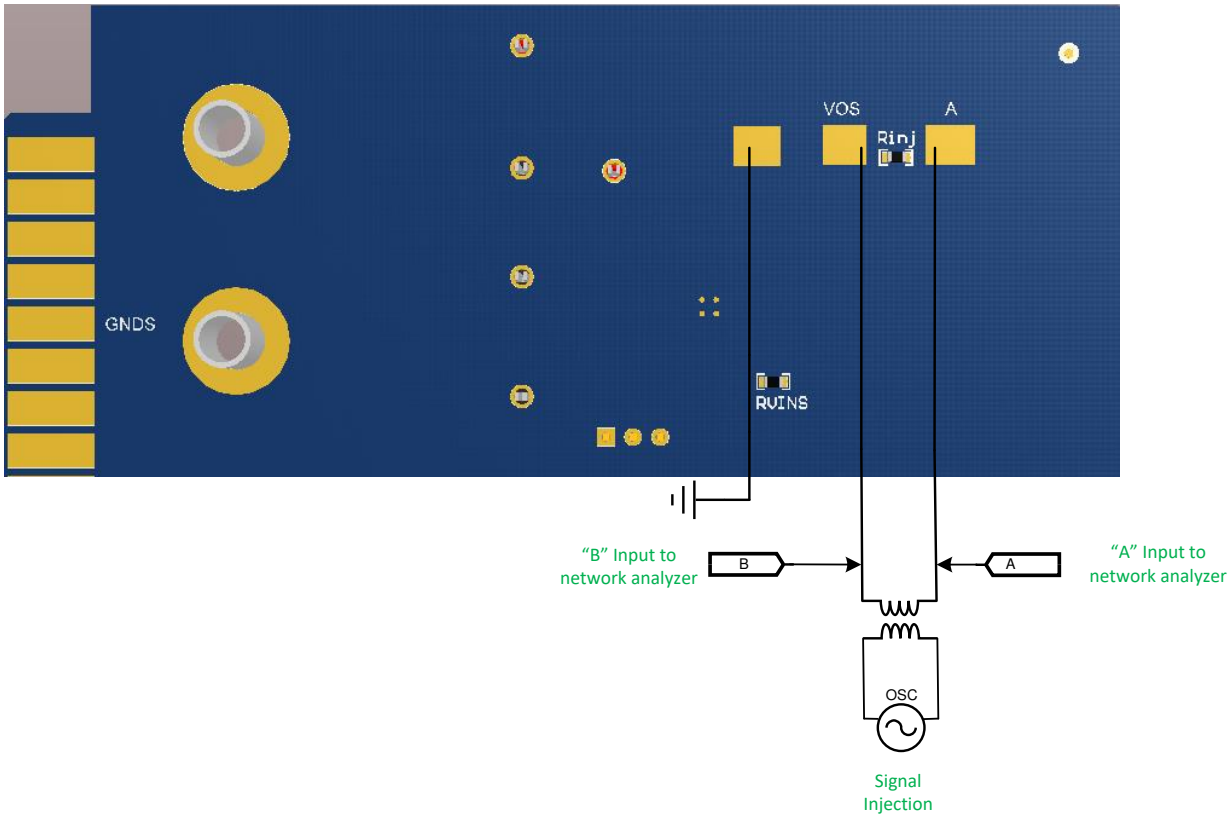


Figure 4. Frequency Response Analyzer Setup

2 Operation

Once the above connections are made and the appropriate jumpers are set, the EVM is ready for use. If external control of the EN input is desired, remove the EN jumper, and apply the external signal to the EN test point and GND. The PGOOD output is pulled up to VCC through a 20-kΩ resistor. This way, the PGOOD signal swings from 0 V to about 5 V to indicate when the output voltage is either outside or inside of the PGOOD window, respectively. If an external pullup and supply is desired for the PGOOD function, remove the 20-kΩ resistor, and pull the PGOOD test point up to the desired voltage through an appropriate resistance. See the *LMR36520 4.2-V to 60-V, 1.5-A Ultra-small Synchronous Step-down Converter Data Sheet* for more details.

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 changing the value of R_{FBB} on the EVM. In addition, the values of the inductor and the output capacitance can also need to be changed. See the *LMR36520 4.2-V to 60-V, 1.5-A Ultra-small Synchronous Step-down Converter Data Sheet* for more information.

Copyright © 2020, Texas Instruments Incorporated

The EVM has been designed for maximum flexibility regarding component selection. This allows you to place preferred components, such as the inductor and capacitors, 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.

Copyright © 2020, Texas Instruments Incorporated

3 Schematic

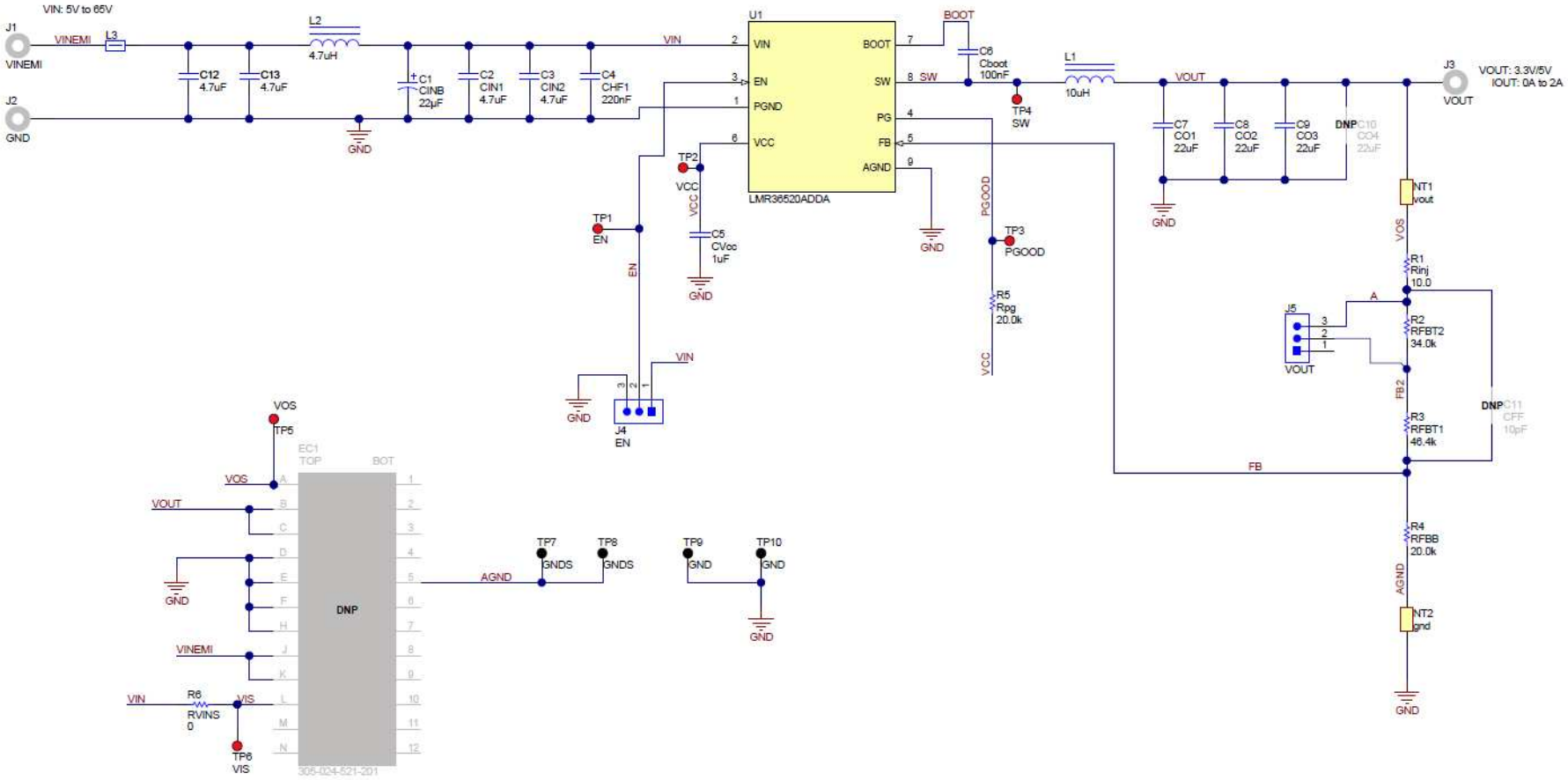


Figure 5. LMR36520AEVM Schematic

Copyright © 2020, Texas Instruments Incorporated

4 Board Layout

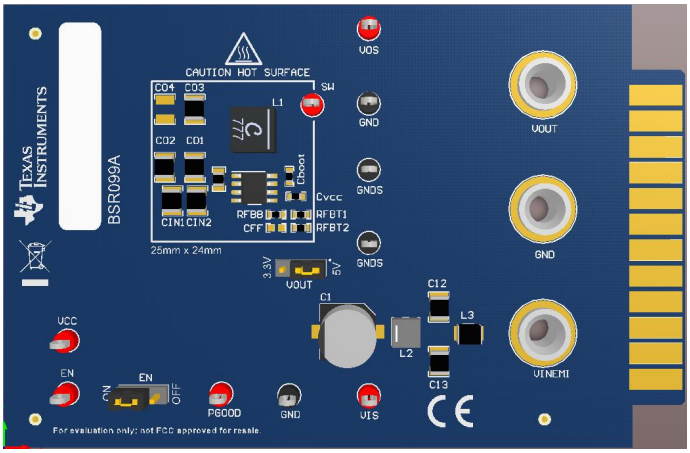


Figure 6. Top View of EVM

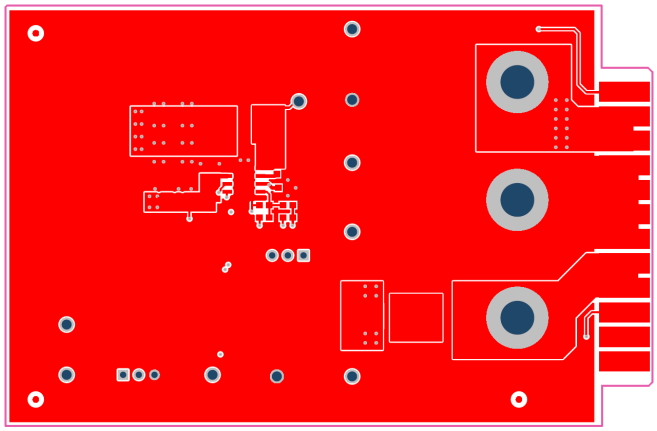


Figure 7. EVM Top Copper Layer

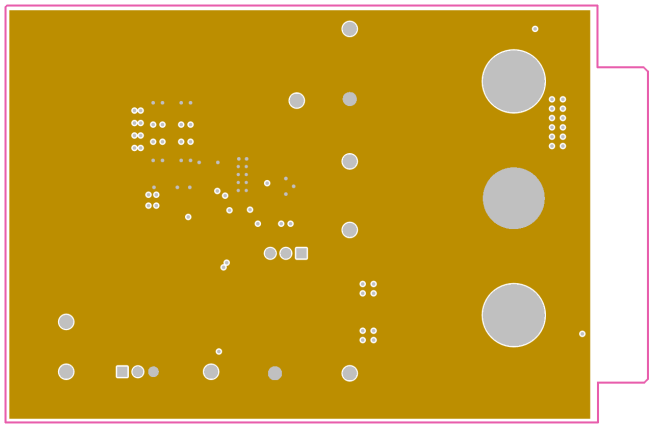


Figure 8. EVM Mid-Layer One

Copyright © 2020, Texas Instruments Incorporated

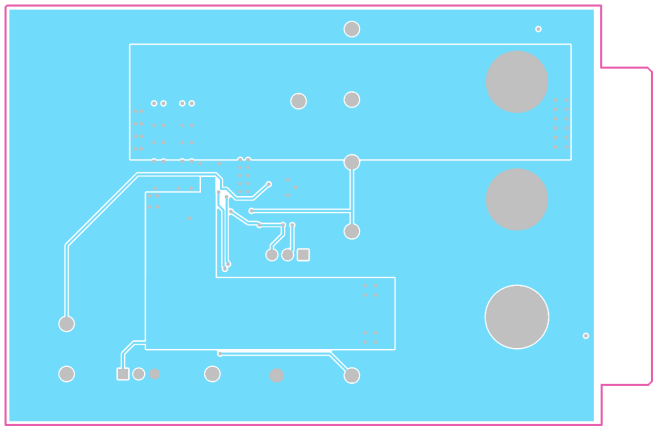


Figure 9. EVM Mid-Layer Two

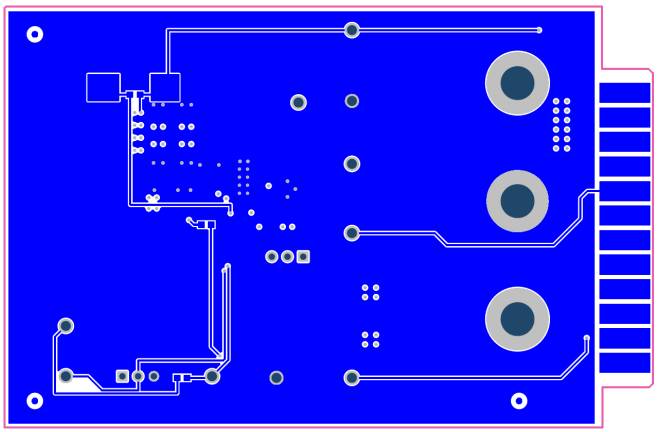


Figure 10. EVM Bottom Copper Layer

Copyright © 2020, Texas Instruments Incorporated

5 Bill of Materials

Table 2. BOM for LMR36520AEVM

DESIGNATOR	COMMENT	DESCRIPTION	MANUFACTURER	PART NUMBER	QUANTITY
C1	CINB	CAP, AL, 22 µF, 100 V, ±20%, 1.3 Ω, AEC-Q200 Grade 1, SMD	Panasonic	EEETG2A220UP	1
C2, C3, C12, C13	CIN1, CIN2, C12, C13	CAP, CERM, 4.7 µF, 100 V, ±10%, X7S, AEC-Q200 Grade 1, 1210	TDK	CGA6M3X7S2A475K200AB	4
C4	CHF1	CAP, CERM, 0.22 µF, 100 V, ±10%, X7R, 0805	MuRata	GRM21AR72A224KAC5L	1
C5	CVcc	CAP, CERM, 1 µF, 25 V, ±10%, X5R, 0603	TDK	C1608X5R1E105K080AC	1
C6	Cboot	CAP, CERM, 0.1 µF, 25 V, ±10%, X7R, 0603	AVX	06033C104KAT2A	1
C7, C8, C9, C10	CO1, CO2, CO3, CO4	CAP, CERM, 22 µF, 25 V, ±10%, X5R, 1210	Samsung Electro-Mechanics	CL32A226KAJNNNE	4
C11	CFF	CAP, CERM, 10 pF, 50 V, ±5%, C0G/NP0, 0603	MuRata	GRM1885C1H100JA01D	0
FID1, FID2, FID3, FID4, FID5, FID6	Fiducial	Fiducial mark. There is nothing to buy or mount.	N/A	N/A	0
J1, J2, J3	VINEMI, GND, VOUT	Standard Banana Jack, Uninsulated, 8.9 mm	Keystone	575-8	3
J4, J5	EN, VOUT	Header, 100 mil, 3x1, Gold, TH	Samtec	HTSW-103-07-G-S	2
L1	XAL6060-103MEB	Inductor, Shielded, Composite, 10 µH, 7 A, 0.02982 Ω, AEC-Q200 Grade 1, SMD	Coilcraft	XAL6060-103MEB	1
L2	XAL4030-472MEB	Inductor, Shielded, Composite, 4.7 µH, 4.5 A, 0.0401 Ω, SMD	Coilcraft	XAL4030-472MEB	1
L3	FBMH3225HM601NT	Ferrite Bead, 600 Ω at 100 MHz, 3 A, 1210	Taiyo Yuden	FBMH3225HM601NT	1
LBL1	THT-13-457-10		Brady	THT-13-457-10	1
R1	Rinj	RES, 10.0, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	Vishay-Dale	CRCW060310R0FKEA	1
R2	RFBT2	RES, 34.0 k, 1%, 0.1 W, 0603	Yageo	RC0603FR-0734KL	1
R3	RFBT1	RES, 46.4 k, 1%, 0.1 W, 0603	Yageo	RC0603FR-0746K4L	1
R4, R5	RFBB, Rpg	RES, 20.0 k, 1%, 0.1 W, 0603	Yageo	RC0603FR-0720KL	2
R6	RVINS	RES, 0, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	Vishay-Dale	CRCW06030000Z0EA	1
SH-J1, SH-J2	EN, VOUT	Shunt, 100 mil, Gold-plated, Black	Samtec	SNT-100-BK-G	2
TP1, TP2, TP3, TP4, TP5, TP6	EN, VCC, PGOOD, SW, VOS, VIS	Test Point, Multipurpose, Red, TH	Keystone	5010	6
TP7, TP8, TP9, TP10	GNDS, GNDS, GND, GND	Test Point, Multipurpose, Black, TH	Keystone	5011	4
U1	LMR36520ADDAR	SIMPLE SWITCHER(R) 4.2 V to 65 V Synchronous Step-Down Converter, DDA0008J (HSOIC-8)	Texas Instruments	LMR36520ADDAR	1

Copyright © 2020, Texas Instruments Incorporated

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI’s products are provided subject to TI’s Terms of Sale (www.ti.com/legal/termsofsale.html) or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI’s provision of these resources does not expand or otherwise alter TI’s applicable warranties or warranty disclaimers for TI products.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2020, Texas Instruments Incorporated