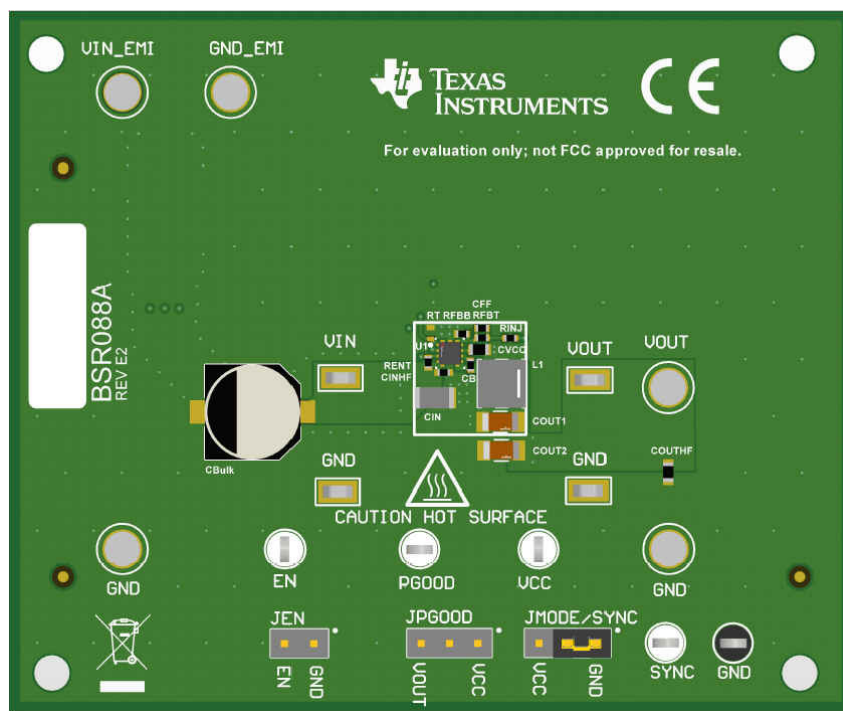


**LMR43620-Q1 EVM User's Guide****ABSTRACT**

The Texas Instruments LMR43620MQ3EVM-2M evaluation module (EVM) helps designers evaluate the operation and performance of the LMR43620-Q1 wide-input buck converter. The LMR43620-Q1 is an easy-to-use synchronous step-down voltage converter capable of driving up to 2 A of load current from an input voltage of up to 36 V. The LMR43620MQ3EVM-2M features an output voltage of 3.3 V and a switching frequency of 2.2 MHz. See the data sheet for additional features, detailed descriptions, and available options.

**Table 1-1. Device and Package Configurations**

| EVM               | U1                | FREQUENCY | SPREAD SPECTRUM | CURRENT | PIN 1 TRIM |
|-------------------|-------------------|-----------|-----------------|---------|------------|
| LMR43620MQ3EVM-2M | LMR43620MSC3RPEQ1 | 2200 kHz  | Enabled         | 2 A     | MODE/SYNC  |

**Figure 1-1. LMR43620MQ3EVM-2M Board****Table of Contents**

|                                    |           |
|------------------------------------|-----------|
| <b>1 Setup</b>                     | <b>3</b>  |
| 1.1 Test Points                    | 3         |
| 1.2 Jumpers                        | 4         |
| <b>2 Operation</b>                 | <b>5</b>  |
| 2.1 Quick Start                    | 5         |
| <b>3 Schematic</b>                 | <b>6</b>  |
| <b>4 Board Layout</b>              | <b>7</b>  |
| <b>5 Bill of Materials</b>         | <b>10</b> |
| <b>6 Test Results</b>              | <b>12</b> |
| 6.1 LMR43620MQ3EVM-2M Test Results | 12        |

|                                 |           |
|---------------------------------|-----------|
| <b>7 Revision History</b> ..... | <b>14</b> |
|---------------------------------|-----------|

## List of Figures

|                                                                                                                                                                                                    |    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Figure 1-1. LMR43620MQ3EVM-2M Board.....                                                                                                                                                           | 1  |
| Figure 1-1. EVM Board Connections.....                                                                                                                                                             | 3  |
| Figure 1-2. Jumper Locations.....                                                                                                                                                                  | 4  |
| Figure 3-1. LMR43620MQ3EVM -2M Schematic.....                                                                                                                                                      | 6  |
| Figure 4-1. Top View of EVM.....                                                                                                                                                                   | 7  |
| Figure 4-2. EVM Top Copper Layer.....                                                                                                                                                              | 7  |
| Figure 4-3. Mid-Layer One.....                                                                                                                                                                     | 8  |
| Figure 4-4. Mid-Layer Two.....                                                                                                                                                                     | 8  |
| Figure 4-5. EVM Bottom Copper Layer.....                                                                                                                                                           | 9  |
| Figure 6-1. 3.3 V <sub>OUT</sub> , 2.2-MHz Efficiency.....                                                                                                                                         | 12 |
| Figure 6-2. 3.3 V <sub>OUT</sub> , 2.2-MHz Load Regulation.....                                                                                                                                    | 12 |
| Figure 6-3. 3.3 V <sub>OUT</sub> , Light Load Efficiency.....                                                                                                                                      | 12 |
| Figure 6-4. Input Current vs Load Current for 3.3 V <sub>OUT</sub> .....                                                                                                                           | 12 |
| Figure 6-5. Load Transient 12 V <sub>IN</sub> , 3.3 V <sub>OUT</sub> , I <sub>OUT</sub> = 0 A to 1 A, Slew Rate = 1 A/μs (FPWM).....                                                               | 12 |
| Figure 6-6. Load Transient 12 V <sub>IN</sub> , 3.3 V <sub>OUT</sub> , I <sub>OUT</sub> = 0 A to 1 A, Slew Rate = 1 A/μs (AUTO).....                                                               | 12 |
| Figure 6-7. Load Transient 12 V <sub>IN</sub> , 3.3 V <sub>OUT</sub> , I <sub>OUT</sub> = 0.5 A to 1.5 A, Slew Rate = 1 A/μs (FPWM).....                                                           | 13 |
| Figure 6-8. Load Transient 12 V <sub>IN</sub> , 3.3 V <sub>OUT</sub> , I <sub>OUT</sub> = 0 A to 2 A, Slew Rate = 1 A/μs (AUTO).....                                                               | 13 |
| Figure 6-9. Output Ripple at 12 V <sub>IN</sub> , 3.3 V <sub>OUT</sub> (Fixed), 2-A Load.....                                                                                                      | 13 |
| Figure 6-10. Output Ripple at 12 V <sub>IN</sub> , 3.3 V <sub>OUT</sub> (Fixed), No Load.....                                                                                                      | 13 |
| Figure 6-11. Thermal Capture, 12 V <sub>IN</sub> , 3.3 V <sub>OUT</sub> , 2-A Load, 2.2 MHz, Θ <sub>JA</sub> ≅ 46°C/W.....                                                                         | 13 |
| Figure 6-12. LMR43620MQ3EVM-2M Low Frequency Conducted EMI Results<br>13.5 V <sub>IN</sub> , 3.3 V <sub>OUT</sub> , I <sub>OUT</sub> = ..... 2 A<br>(Blue-Average Scan and Yellow-Peak Scan).....  | 14 |
| Figure 6-13. LMR43620MQ3EVM-2M High Frequency Conducted EMI Results<br>13.5 V <sub>IN</sub> , 3.3 V <sub>OUT</sub> , I <sub>OUT</sub> = ..... 2 A<br>(Blue-Average Scan and Yellow-Peak Scan)..... | 14 |

## List of Tables

|                                                   |    |
|---------------------------------------------------|----|
| Table 1-1. Device and Package Configurations..... | 1  |
| Table 5-1. Bill of Materials.....                 | 10 |

## 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 LMR43620-Q1 EVM.

### 1.1 Test Points

The test points on the board can be used for connecting to the input of a power supply and output load for the EVM. See [Figure 1-1](#) for typical test setup. The functions of the test points connections are:

- **VIN\_EMI** — Input supply to EVM including an EMI filter. Connect to a suitable input supply. Connect at this point for EMI test.
- **GND\_EMI** — Ground connection for the input supply
- **VIN** — Input supply to the IC. Can be connected to DMM to measure input voltage after EMI filter.
- **VOUT** — Output voltage test point of EVM. Can be connected to a desired load.
- **GND** — Ground test points
- **EN** — This test point is connected to the EN pin. By default, there is a pullup resistor, R1 (RENT), to VIN to enable the IC.
- **PGOOD** — This test point is connected to the PGOOD pin from the IC. Can be tied to an external supply through a pullup resistor or left open.
- **SYNC** — In a **MODE/SYNC** trim part, this test point is connected to the SYNC pin of the IC. This test point can also be connected to an external clock to synchronize the IC. Make sure R9 (RJM) is installed and R8 (RSYNC) is not installed when applying a sync clock input.

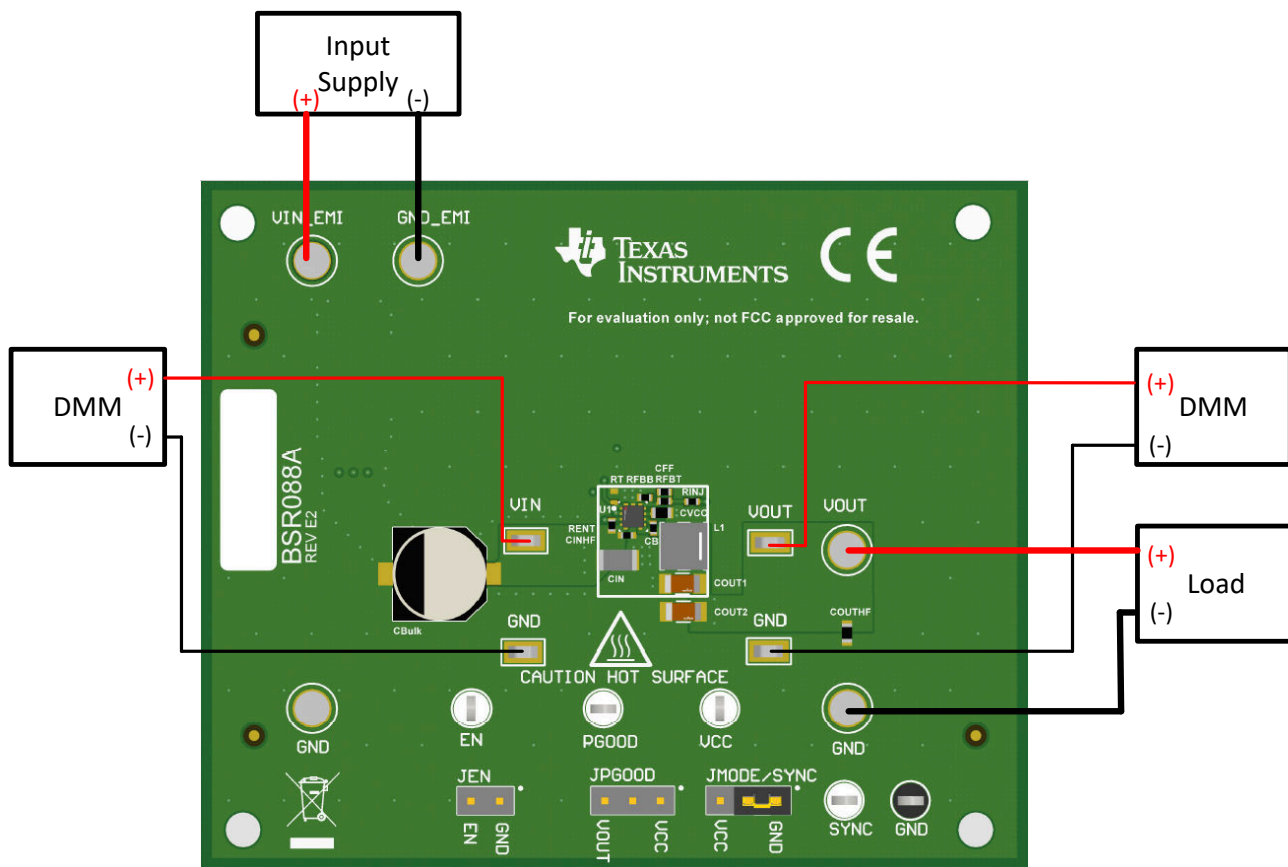


Figure 1-1. EVM Board Connections

## 1.2 Jumpers

See [Figure 1-2](#) for jumper locations.

- **JEN** — This jumper allows the ENABLE input to be connected to GND in order to disable the IC. By default, this jumper is left open since there is a pullup resistor, R2 (RENT), to VIN to enable the IC.
- **JPGOOD** — Use this jumper to select how the PGOOD pin is connected. A jumper can be used to connect pin 2 and 3. In this configuration, the PGOOD pin will be pulled up to VOUT through R7 (RPGOOD) with a value of 100 k $\Omega$ . When connecting the jumper between pin 1 and 2, the PGOOD pin will be pulled up to VCC through R7 (RPGOOD) with a value of 100 k $\Omega$ . By default, this jumper is not populated.
- **JMODE/SYNC** — Use this jumper to select the mode of operation in a *MODE/SYNC* trim part. Connecting a jumper between pin 1 and 2 sets the IC operation to PFM (pulse frequency modulation) mode for a higher efficiency at light load. A jumper between pin 2 and pin 3 causes the IC to operate in FPWM (forced pulse width modulation) mode. By default, the jumper is connected between pin 1 and 2. Pin 1 is indicated by the dot on the PCB.

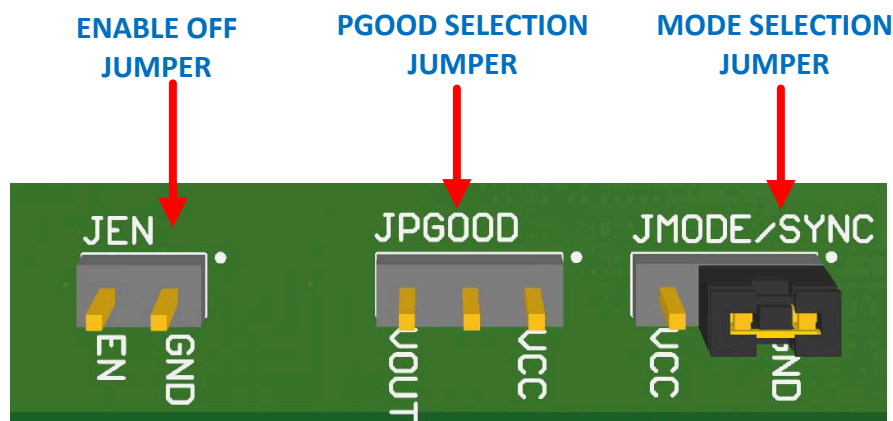


Figure 1-2. Jumper Locations

## 2 Operation

### 2.1 Quick Start

1. Connect the voltage supply between the VIN\_EMI and GND\_EMI supply connections.
2. Connect the load between the VOUT and GND test points.
3. Set the supply voltage at an appropriate level between 3.5 V to 36 V. Set the current limit of the supply to an appropriate level.
4. Turn on the power supply. With the default configuration, the EVM powers up and provides  $V_{OUT} = 3.3\text{ V}$ .
5. Monitor the output voltage. The maximum load current is rated at 2 A with the LMR43620-Q1 device.

### 3 Schematic

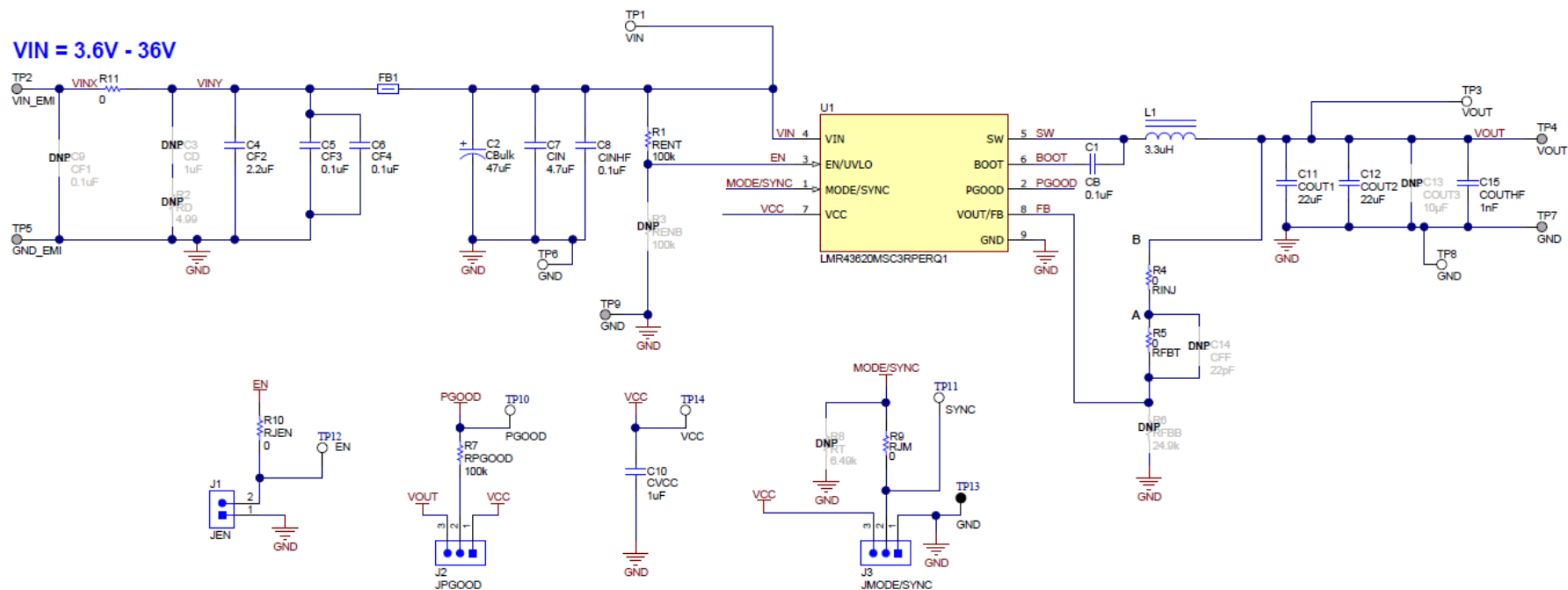


Figure 3-1. LMR43620MQ3EVM -2M Schematic

## 4 Board Layout

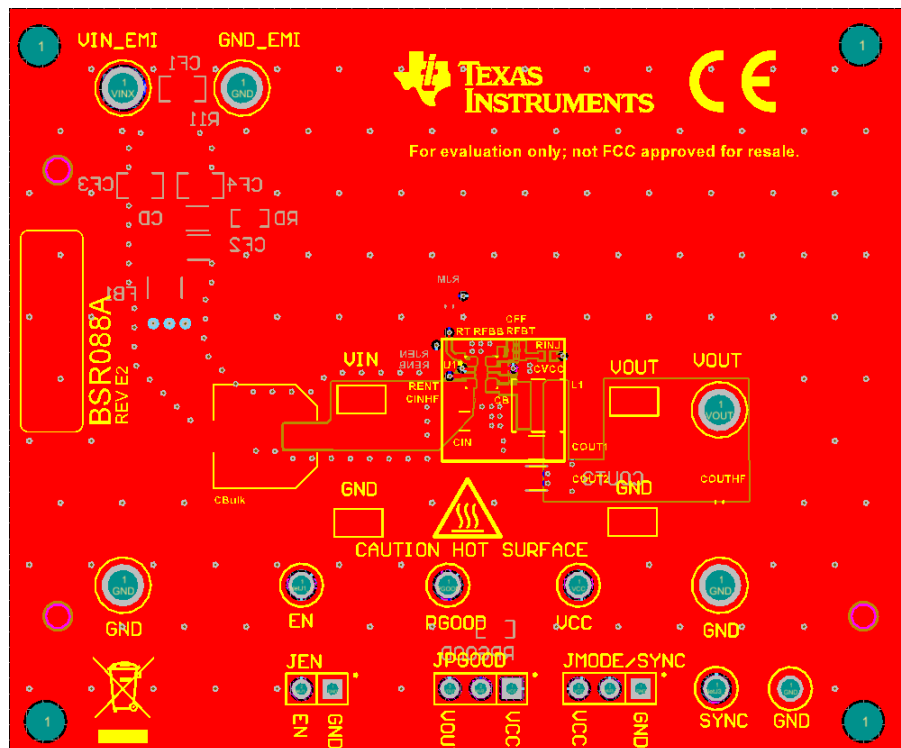


Figure 4-1. Top View of EVM

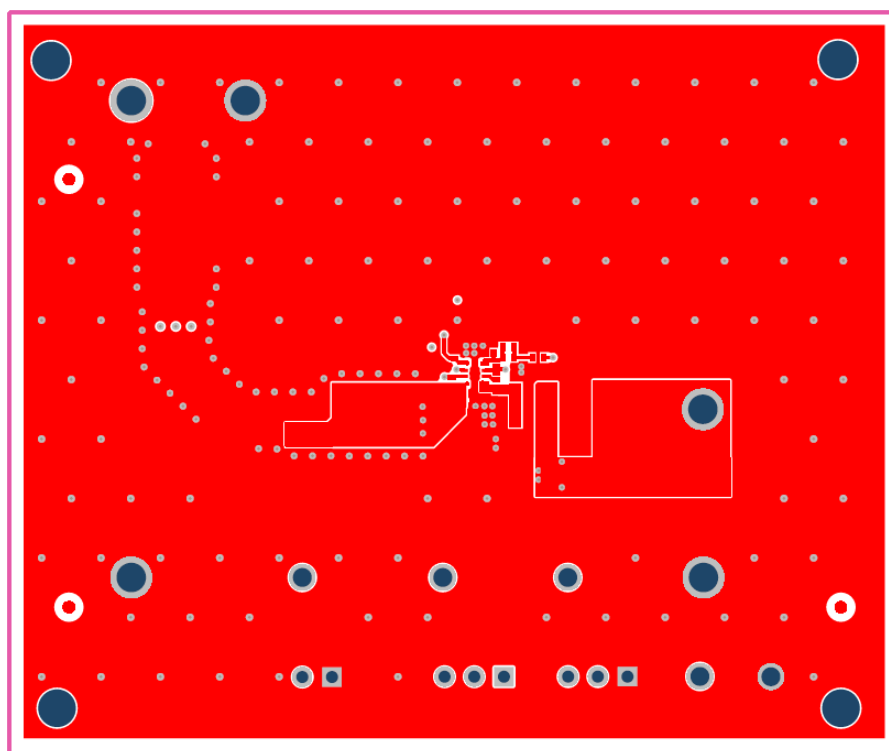
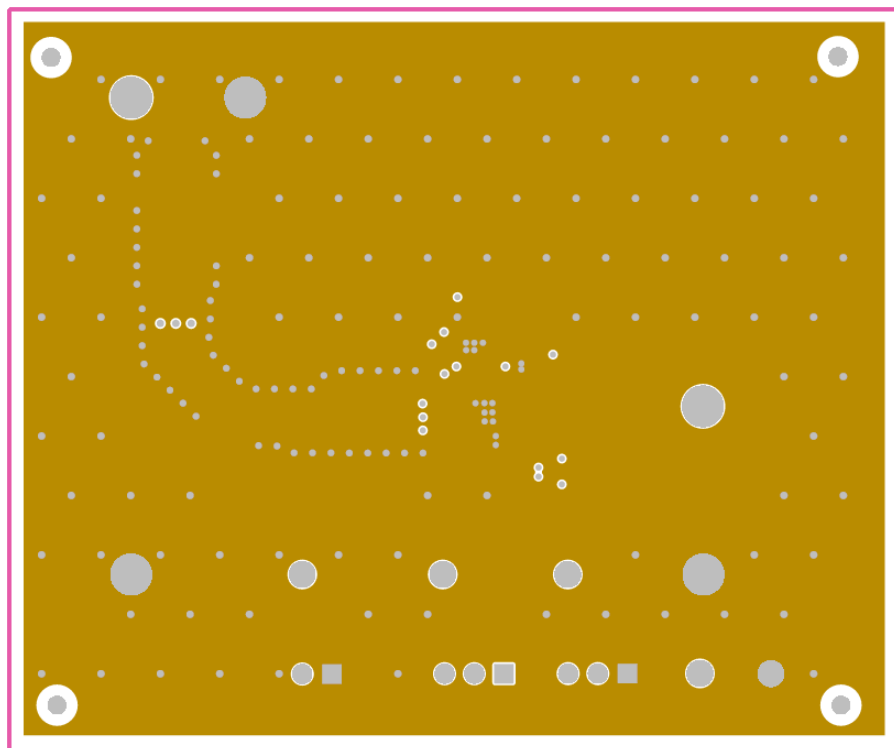
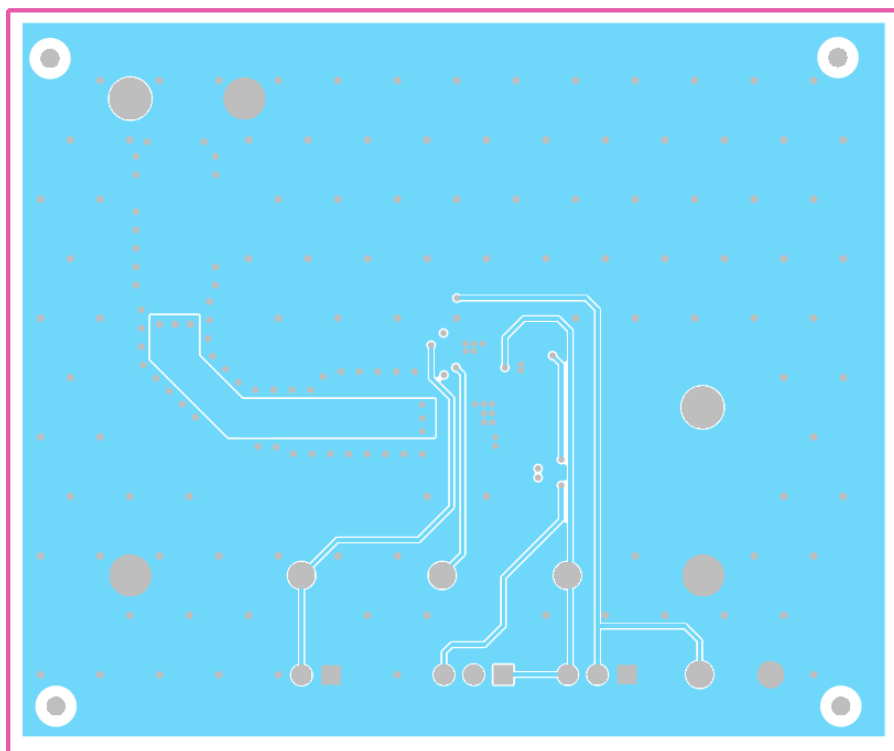


Figure 4-2. EVM Top Copper Layer



**Figure 4-3. Mid-Layer One**



**Figure 4-4. Mid-Layer Two**



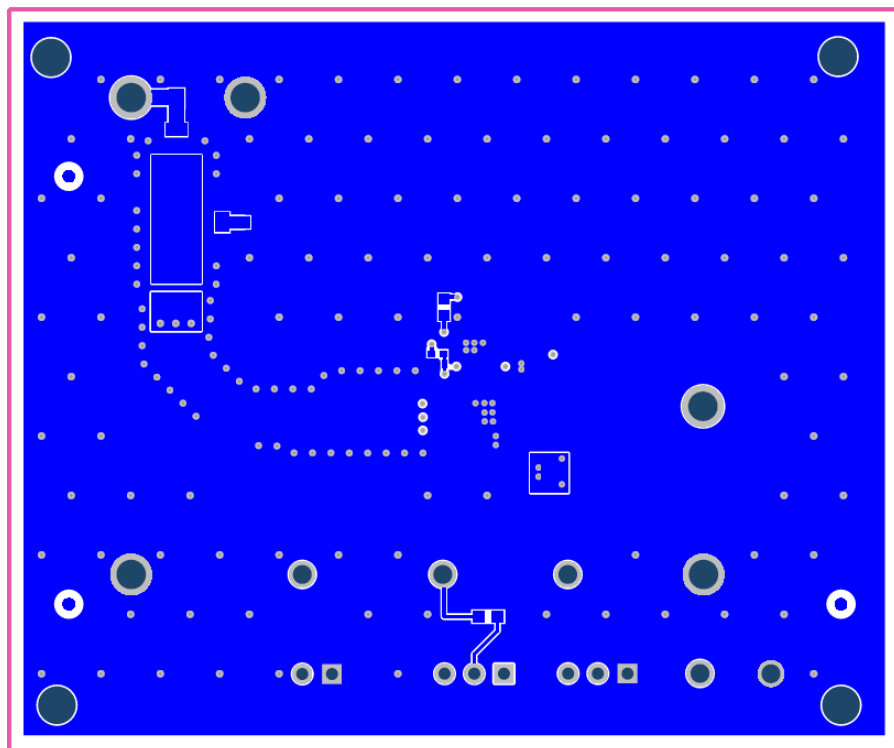


Figure 4-5. EVM Bottom Copper Layer

## 5 Bill of Materials

**Table 5-1. Bill of Materials**

| DESIGNATOR                         | COMMENT                          | DESCRIPTION                                                                                   | MANUFACTURER     | PART NUMBER          | QTY |
|------------------------------------|----------------------------------|-----------------------------------------------------------------------------------------------|------------------|----------------------|-----|
| C1                                 | CB                               | CAP, CERM, 0.1 $\mu$ F, 25 V, $\pm$ 20%, X7R, 0402                                            | TDK              | C1005X7R1E104M050BB  | 1   |
| C2                                 | CBulk                            | CAP, AL, 47 $\mu$ F, 80 V, $\pm$ 20%, 1.3 $\Omega$ , AEC-Q200, SMD                            | Panasonic        | EEE-FN1K470UP        | 1   |
| C3                                 | CD                               | CAP, CERM, 1 $\mu$ F, 100 V, $\pm$ 10%, X7R, 1206                                             | TDK              | C3216X7R2A105K160AA  | 0   |
| C4                                 | CF2                              | CAP, CERM, 2.2 $\mu$ F, 100 V, $\pm$ 10%, X7S, AEC-Q200 Grade 1, 1206                         | TDK              | CGA5L3X7S2A225K160AB | 1   |
| C5, C6                             | CF3, CF4                         | CAP, CERM, 0.1 $\mu$ F, 100 V, $\pm$ 10%, X7R, AEC-Q200 Grade 1, 0805                         | TDK              | CGA4J2X7R2A104K125AA | 2   |
| C7                                 | CIN                              | CAP, CERM, 4.7 $\mu$ F, 50 V, $\pm$ 10%, X7R, 1206                                            | MuRata           | GRM31CR71H475KA12L   | 1   |
| C8                                 | CINHF                            | CAP, CERM, 0.1 $\mu$ F, 50 V, $\pm$ 10%, X7R, AEC-Q200 Grade 1, 0402                          | MuRata           | GCM155R71H104KE02D   | 1   |
| C9                                 | CF1                              | CAP, CERM, 0.1 $\mu$ F, 100 V, $\pm$ 10%, X7R, AEC-Q200 Grade 1, 0805                         | TDK              | CGA4J2X7R2A104K125AA | 0   |
| C10                                | CVCC                             | CAP, CERM, 1 $\mu$ F, 16 V, $\pm$ 10%, X7R, 0603                                              | Würth Elektronik | 885012206052         | 1   |
| C11, C12                           | COUT1, COUT2                     | Chip Multilayer Ceramic Capacitors for General Purpose, 1206, 22 $\mu$ F, X6S, 22%, 10%, 25 V | Murata           | GRM31CC81E226KE11L   | 2   |
| C13                                | COUT3                            | CAP, CERM, 10 $\mu$ F, 50 V, $\pm$ 10%, X7R, AEC-Q200 Grade 1, 1206                           | TDK              | CGA5L1X7R1H106K160AC | 0   |
| C14                                | CFF                              | CAP, CERM, 22 pF, 50 V, $\pm$ 5%, C0G/NP0, AEC-Q200 Grade 1, 0402                             | TDK              | CGA2B2NP01H220J050BA | 0   |
| C15                                | COUTHF                           | CAP, CERM, 1000 pF, 100 V, $\pm$ 10%, X7R, 0603                                               | MuRata           | GRM188R72A102KA01D   | 1   |
| FB1                                | FB1                              | Ferrite Bead, 600 $\Omega$ at 100 MHz, 3 A, 1210                                              | Taiyo Yuden      | FBMH3225HM601NT      | 1   |
| FID1, FID2, FID3, FID4, FID5, FID6 | Fiducial                         | Fiducial mark. There is nothing to buy or mount.                                              | N/A              | N/A                  | 0   |
| J1                                 | JEN                              | Header, 100mil, 2x1, Gold, TH                                                                 | Samtec           | HTSW-102-07-G-S      | 1   |
| J2, J3                             | JPGOOD, JMODE/<br>SYNC           | Header, 100 mil, 3x1, Gold, TH                                                                | Samtec           | HTSW-103-07-G-S      | 2   |
| L1                                 | XAL4030-332MEB                   | Inductor, Shielded, Composite, 3.3 $\mu$ H, 5.5 A, 0.026 $\Omega$ , SMD                       | Coilcraft        | XAL4030-332MEB       | 1   |
| LBL1                               | THT-14-423-10                    | Thermal Transfer Printable Labels, 0.650" W $\times$ 0.200" H - 10,000 per roll               | Brady            | THT-14-423-10        | 1   |
| R1                                 | RENT                             | RES, 100 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402                                               | Vishay-Dale      | CRCW0402100KFKED     | 1   |
| R2                                 | RD                               | RES, 4.99, 1%, 0.1 W, AEC-Q200 Grade 0, 0603                                                  | Vishay-Dale      | CRCW06034R99FKEA     | 0   |
| R3                                 | RENB                             | RES, 100 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402                                               | Vishay-Dale      | CRCW0402100KFKED     | 0   |
| R4, R5, R10                        | RINJ, RFBT, RJEN                 | RES, 0, 5%, 0.063 W, AEC-Q200 Grade 0, 0402                                                   | Vishay-Dale      | CRCW04020000Z0ED     | 3   |
| R6                                 | RFBB                             | RES, 24.9 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402                                              | Vishay-Dale      | CRCW040224K9FKED     | 0   |
| R7                                 | RPGOOD                           | RES, 100 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603                                                 | Vishay-Dale      | CRCW0603100KFKEA     | 1   |
| R8                                 | RT                               | RES, 6.49 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402                                              | Vishay-Dale      | CRCW04026K49FKED     | 0   |
| R9                                 | RJM                              | RES, 0, 5%, 0.1 W, AEC-Q200 Grade 0, 0603                                                     | Vishay-Dale      | CRCW06030000Z0EA     | 1   |
| R11                                | RFILTJ                           | RES, 0, 1%, 0.5 W, 1206                                                                       | Keystone         | 5108                 | 1   |
| SH-J1                              | SNT-100-BK-G                     | Shunt, 100 mil, Gold plated, Black                                                            | Samtec           | SNT-100-BK-G         | 1   |
| TP1, TP3, TP6, TP8                 | VIN, VOUT, GND, GND              | Test Point, Miniature, SMT                                                                    | Keystone         | 5015                 | 4   |
| TP2, TP4, TP5, TP7, TP9            | VIN_EMI, VOUT, GND_EMI, GND, GND | Terminal, Turret, TH, Double                                                                  | Keystone         | 1502-2               | 5   |

**Table 5-1. Bill of Materials (continued)**

| DESIGNATOR             | COMMENT              | DESCRIPTION                                                                    | MANUFACTURER      | PART NUMBER        | QTY |
|------------------------|----------------------|--------------------------------------------------------------------------------|-------------------|--------------------|-----|
| TP10, TP11, TP12, TP14 | PGOOD, SYNC, EN, VCC | Test Point, Multipurpose, White, TH                                            | Keystone          | 5012               | 4   |
| TP13                   | GND                  | Test Point, Multipurpose, Black, TH                                            | Keystone          | 5011               | 1   |
| U1                     | LMR43620MSC3RPERQ1   | 36-V, 2-A Buck Converter with 1.5- $\mu$ A IQ in 2-mm $\times$ 2-mm HotRod QFN | Texas Instruments | LMR43620MSC3RPERQ1 | 1   |

## 6 Test Results

### 6.1 LMR43620MQ3EVM-2M Test Results

The LMR43620MQ3EVM-2M variant is used for the following images.

#### 6.1.1 Efficiency and Load Regulation

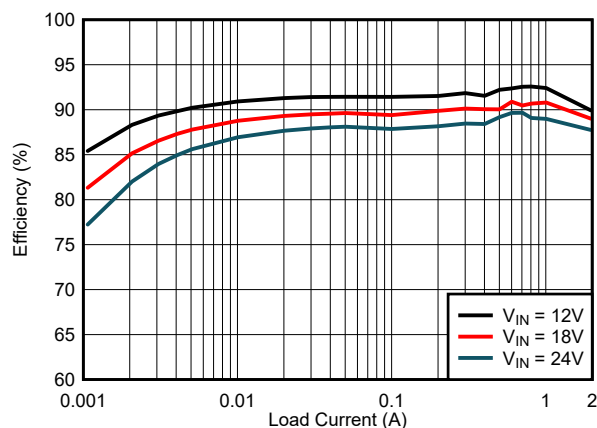


Figure 6-1. 3.3 V<sub>OUT</sub>, 2.2-MHz Efficiency

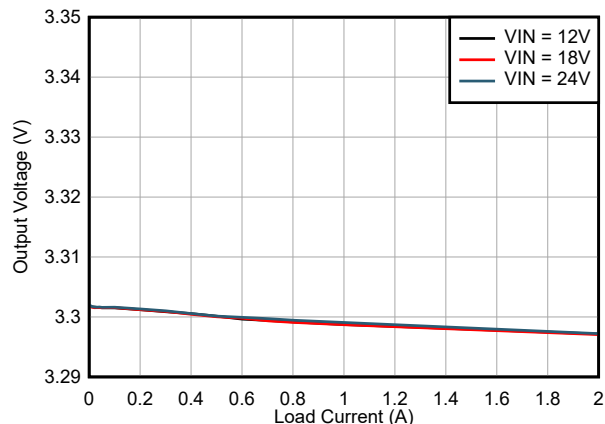


Figure 6-2. 3.3 V<sub>OUT</sub>, 2.2-MHz Load Regulation

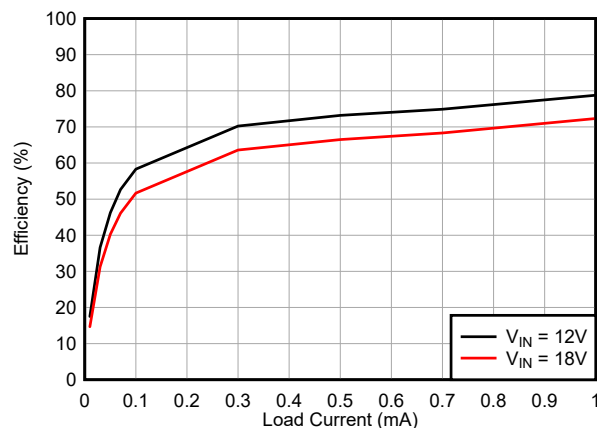


Figure 6-3. 3.3 V<sub>OUT</sub>, Light Load Efficiency

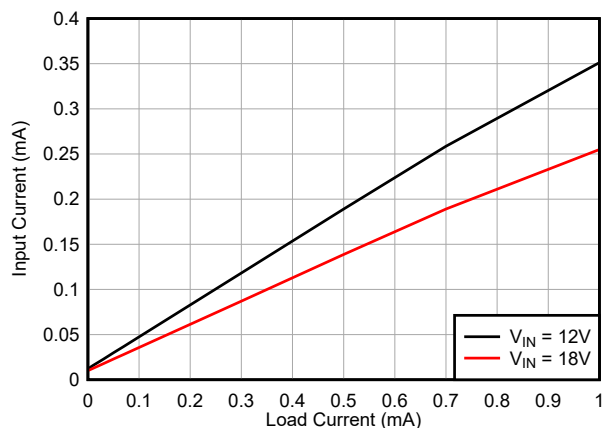


Figure 6-4. Input Current vs Load Current for 3.3 V<sub>OUT</sub>

#### 6.1.2 Load Transients

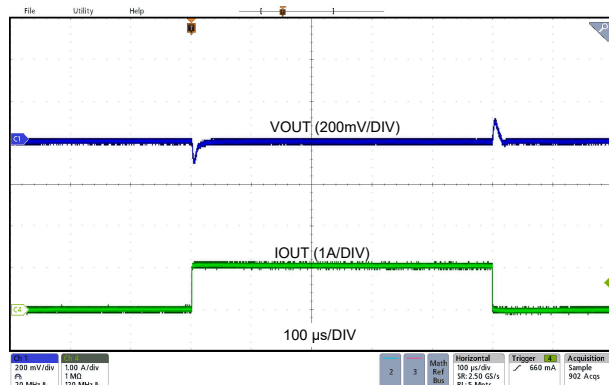


Figure 6-5. Load Transient 12 V<sub>IN</sub>, 3.3 V<sub>OUT</sub>, I<sub>OUT</sub> = 0 A to 1 A, Slew Rate = 1 A/μs (FPWM)

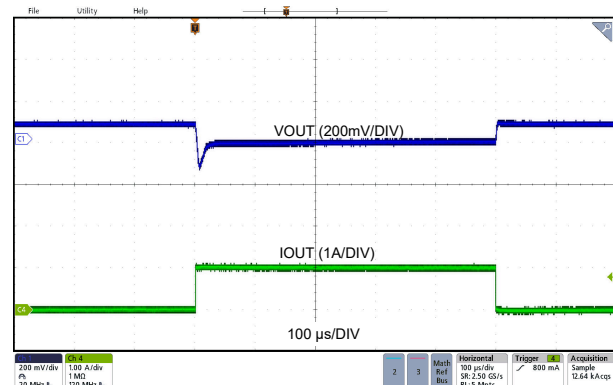
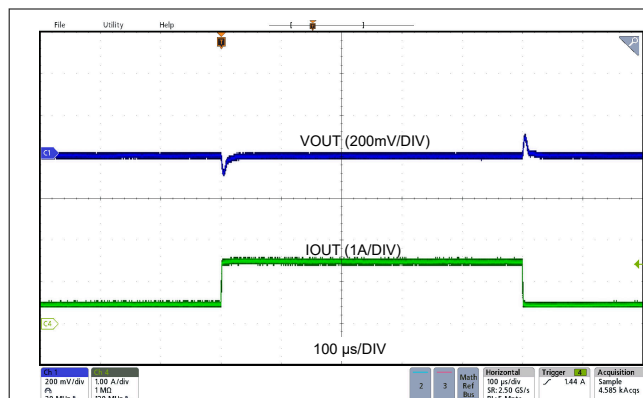
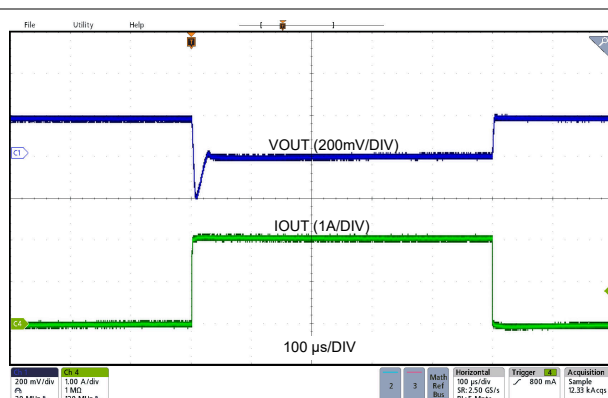


Figure 6-6. Load Transient 12 V<sub>IN</sub>, 3.3 V<sub>OUT</sub>, I<sub>OUT</sub> = 0 A to 1 A, Slew Rate = 1 A/μs (AUTO)

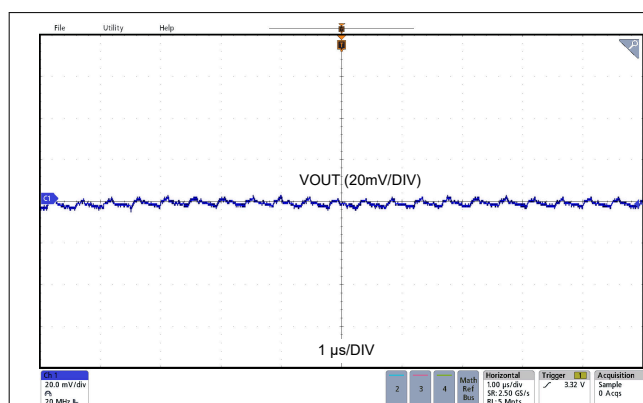


**Figure 6-7. Load Transient 12 V<sub>IN</sub>, 3.3 V<sub>OUT</sub>, I<sub>OUT</sub> = 0.5 A to 1.5 A, Slew Rate = 1 A/μs (FPWM)**

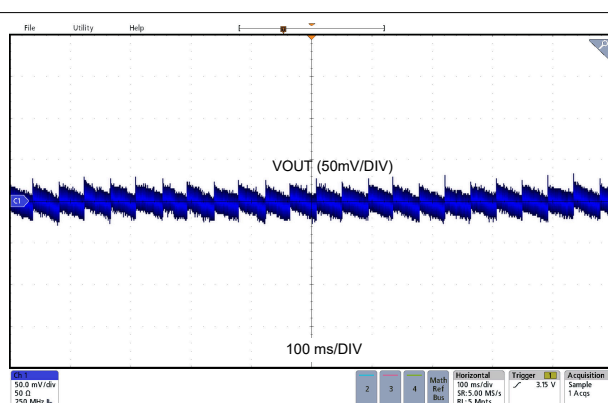


**Figure 6-8. Load Transient 12 V<sub>IN</sub>, 3.3 V<sub>OUT</sub>, I<sub>OUT</sub> = 0 A to 2 A, Slew Rate = 1 A/μs (AUTO)**

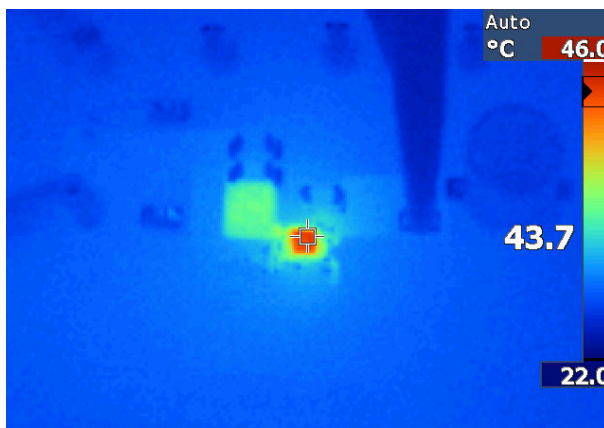
### 6.1.3 Output Ripple and Thermal Picture



**Figure 6-9. Output Ripple at 12 V<sub>IN</sub>, 3.3 V<sub>OUT</sub> (Fixed), 2-A Load**

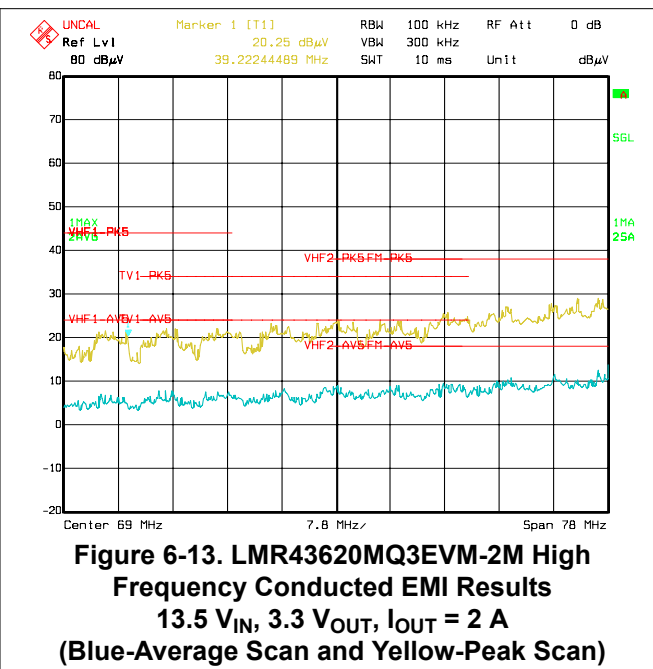
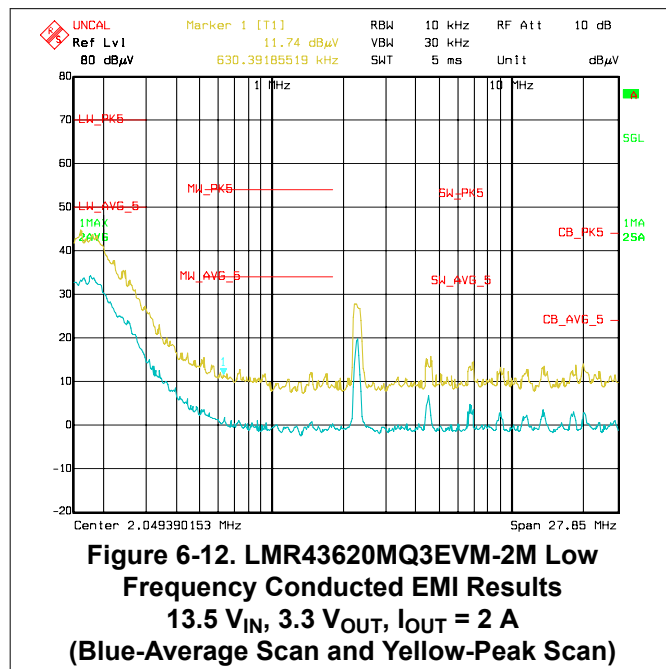


**Figure 6-10. Output Ripple at 12 V<sub>IN</sub>, 3.3 V<sub>OUT</sub> (Fixed), No Load**



**Figure 6-11. Thermal Capture, 12 V<sub>IN</sub>, 3.3 V<sub>OUT</sub>, 2-A Load, 2.2 MHz,  $\theta_{JA} \approx 46^\circ\text{C/W}$**

## 6.1.4 Conducted EMI



## 7 Revision History

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

| Changes from Revision A (July 2021) to Revision B (December 2021)                                                                                                                                                                                                                                                                                                        | Page                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| <ul style="list-style-type: none"> <li>Updated EVM schematic, BoM, and test results for RTM release.....</li> </ul>                                                                                                                                                                                                                                                      | 3                                 |
| Changes from Revision * (February 2020) to Revision A (July 2021)                                                                                                                                                                                                                                                                                                        | Page                              |
| <ul style="list-style-type: none"> <li>First public release.....</li> <li>Changed instances of LMR43620 to LMR43620-Q1.....</li> <li>Updated images throughout document.....</li> <li>Updated PGOOD test point description.....</li> <li>Updated JPGOOD and JMODE/RT jumper descriptions.....</li> <li>Updated Table 5-1 .....</li> <li>Added Section 6 .....</li> </ul> | 3<br>3<br>3<br>3<br>4<br>10<br>12 |

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Last updated 10/2025