# EVAL_TDA48415_1.2VOUT user guide

## User guide for TDA48415 evaluation board

## About this document

### Scope and purpose

The TDA48415 is a synchronous buck regulator, providing a compact, high-performance, and flexible solution in a small 3 mm x 4 mm QFN package.

Key features offered by TDA48415 include internal soft-start, precision 0.6 V reference voltage, Power Good, thermal protection, programmable switching frequency in the range of 600 kHz to 1 MHz, enable input, input undervoltage lockout (UVLO) and overvoltage lockout (OVLO) for proper start-up, , input overvoltage protection (Input OVLO), latched-off overvoltage protection (OVP), overcurrent protection (OCP) and pre-bias start-up.

This user guide contains the schematic and bill of materials for the EVAL_TDA48415_1.2VOUT engineering evaluation board. It describes operation and use of the evaluation board itself. Detailed application information for TDA48415 is available in the TDA48415 datasheet.

### Intended audience

This document is intended for design engineers evaluating TDA48415 performance with the EVAL_TDA48415_1.2VOUT engineering evaluation board.

## About this product group

### Target applications

- Server power supply units (PSU)
- Energy storage systems
- Telecommunications infrastructure
- Integrated POL voltage regulators

### Product family

Infineon's DC-DC regulators provide best-in-class power efficiency, safety features, and robust performance. The regulators support energy-conscious products, best load, and line-transient performance and reducing power consumption, making them a suitable choice for demanding applications. In specific, the synchronous buck converter family combine high efficiency, compact, power-dense packaging, high-frequency switching capabilities, robust control, as well as protection features. These optimizations reduce power loss, enhance thermal management, simplify design, and support modern performance requirements in a range of electronics applications.

### Evaluation Board

EVAL_TDA48415_1.2VOUT board is available for design engineers to evaluate the performance of the TDA48415, including its efficiency, power loss, and other characteristics.

# Important notice

“Evaluation Boards and Reference Boards” shall mean products embedded on a printed circuit board (PCB) for demonstration and/or evaluation purposes, which include, without limitation, demonstration, reference and evaluation boards, kits and design (collectively referred to as “Reference Board”).

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# Safety precautions

*Note: Please note the following warnings regarding the hazards associated with development systems.*

**Table 1 Safety precautions**

| | |
|---|---|
|  | **Caution:** *The heat sink and device surfaces of the evaluation or reference board may become hot during testing. Hence, necessary precautions are required while handling the board. Failure to comply may cause injury.* |
|  | **Caution:** *The evaluation or reference board contains parts and assemblies sensitive to electrostatic discharge (ESD). Electrostatic control precautions are required when installing, testing, servicing or repairing the assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with electrostatic control procedures, refer to the applicable ESD protection handbooks and guidelines.* |

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# 1 TDA48415 features

### Features

- Input voltage range of 2.95 V to 6 V, 1.65 V to 6 V input voltage range with external bias supply
- Precision reference voltage (0.6 V +/- 0.5%)
- Adaptive fast COT control for ultrafast transient response
- Stable with ceramic output capacitors
- No external compensation
- Optional forced continuous conduction mode (FCCM), and diode emulation mode (DEM) for enhanced light load efficiency
- Selectable switching frequency from 600 kHz to 1 MHz
- Programmable soft-start time with a typical of 1 ms and enhanced pre-bias start-up
- Voltage tracking with external reference input (0.4 V to 1.2 V)
- Programmable over current protection limit with internal thermal compensation
- Enable input with voltage monitoring capability
- Power good output
- Non-latch OCP, UVP, input OVP, thermal shutdown and latch-off output OVP
- Operating temperature: -40°C < $T_j$ < 125°C
- Package: 3 mm x 4 mm QFN-21
- Pb-free, halogen-free and RoHS compliant

### Product validation

Qualified for industrial applications according to the relevant tests of the JEDEC47/20/22 standard.

# 2 Board information

## 2.1 Evaluation board

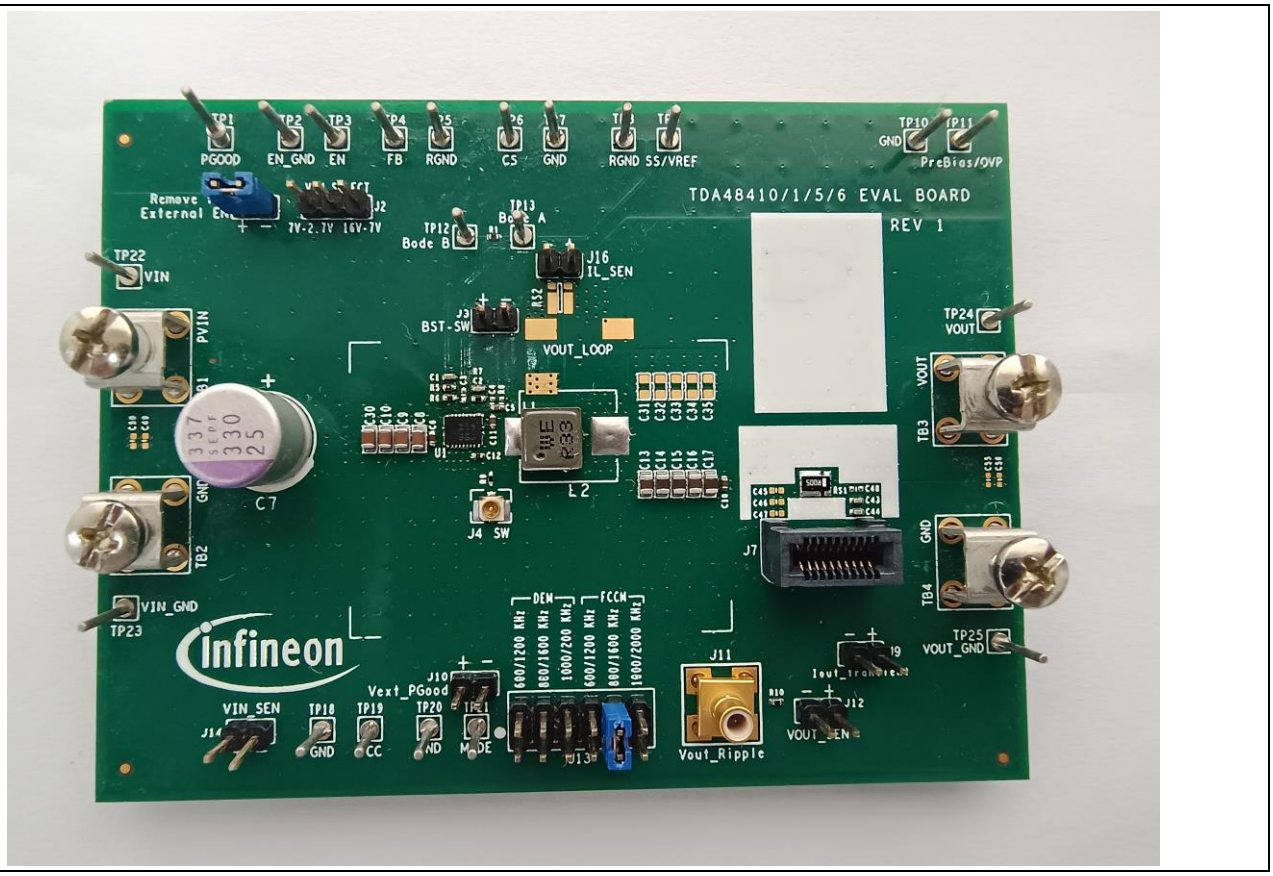



**Figure 1 Evaluation board**

## 2.2 Board features

$V_{IN}$ = 5 V, $V_{OUT}$ = 1.2 V at 0 to 15 A

$F_{SW}$ = 600 kHz/800 kHz/1000 kHz

L = 330 nH

$C_{IN}$ = 10 x 22 µF (25 V, ceramic 0805) + 1 x 2.2 µF (25 V, ceramic 0805) + 1 x 330 µF (25 V, electrolytic, optional)

$C_{OUT}$ = 10 x 47 µF (6.3 V, ceramic 0805) + 1 x 2.2 µF (6.3 V, ceramic 0805)

## 2.3 Connections and operating instructions

The TDA48415 evaluation board requires a single +5 V for the input power and can deliver up to 15 A load current. The operation modes and OCP limits can be selected through jumpers.

**Table 2 Connections**

| Label | | Description |
|---|---|---|
| Input | PVIN | Connect input power (+5 V) to this pin |
| | GND | Return of input power |
| | PVIN, PGND_SNS | Sense pins for the input voltage |
| Output | VOUT | $V_{OUT}$ (+1.2 V), connect a DC load (15 A max.) to this pin |
| | PGND | Return of $V_{OUT}$ |
| | VOUT, PGND_SNS | Sense pins for the output voltage |
| Enable | EN | Connect a scope probe to this pin to monitor enable signal. Alternatively, an external enable signal can be applied to this pin to overdrive the onboard enable signal. |
| | GND | |
| Bode | BODE_A | For bode plot measurement |
| | BODE_B | |
| Soft-start | SS/VREF | Connect a capacitor to this pin to get different soft-start times |
| Mode | FCCM | Use a jumper to select FCCM or DEM, and switching frequency. Three preset switching frequencies are: 600 kHz, 800 kHz, 1000 kHz. |
| | DEM | |
| CS | | Default connected to GND. Use a resistor to connect to CS to configure the current limit. |
| $P_{GOOD}$ | PGOOD | Connect a scope probe to this pin to monitor Power Good signal |
| | GND | GND |
| $R_{GND}$ | RGND | Differential remote sense negative input. Connect this pin directly to the negative side of the voltage sense point. Short to GND if remote sense is not used. |
| $V_{CC}$ | VCC | Standard evaluation board is configured to use the internal low-dropout regulator (LDO). Connect a scope probe to this pin to monitor the output of the internal LDO. |
| | GND | |

## 2.4 Layout

The PCB is a six-layer board using FR4 material. Top and bottom layers use 2 oz. copper and inner layers use 1 oz. copper. The PCB thickness is 1.6 mm. The TDA48415 and other major power components are mounted on the top side of the board.

## 2.5 PCB layout

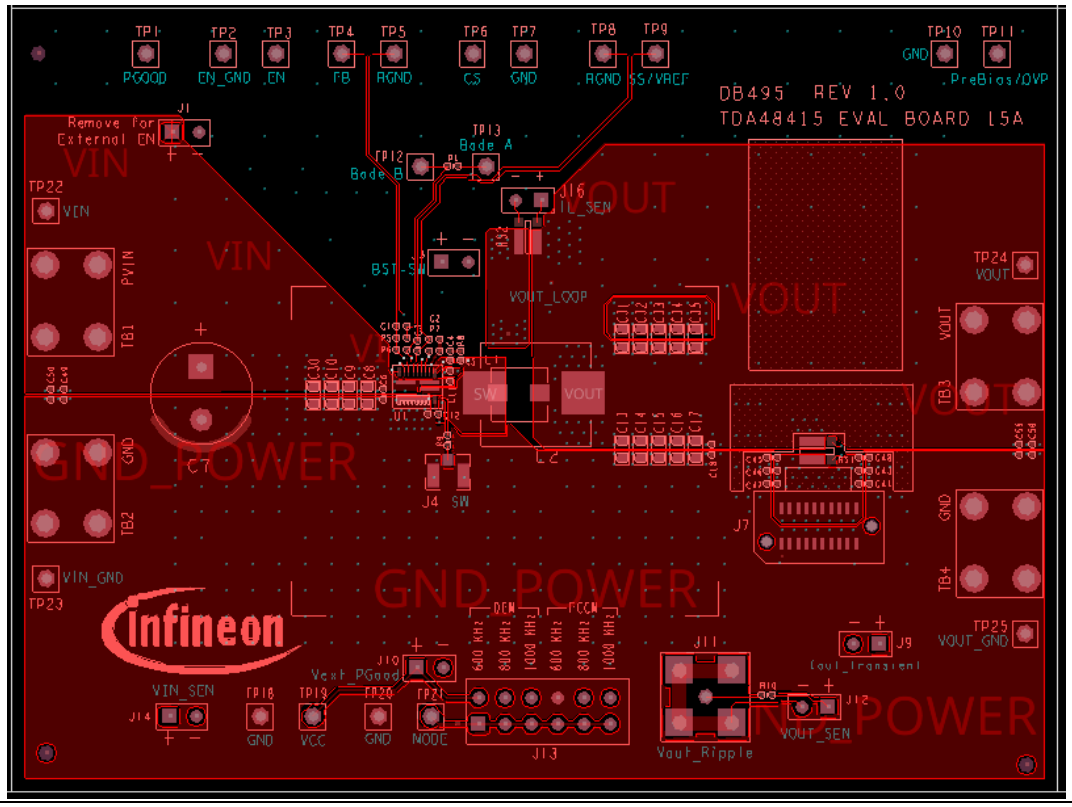



**Figure 2 Top layer**

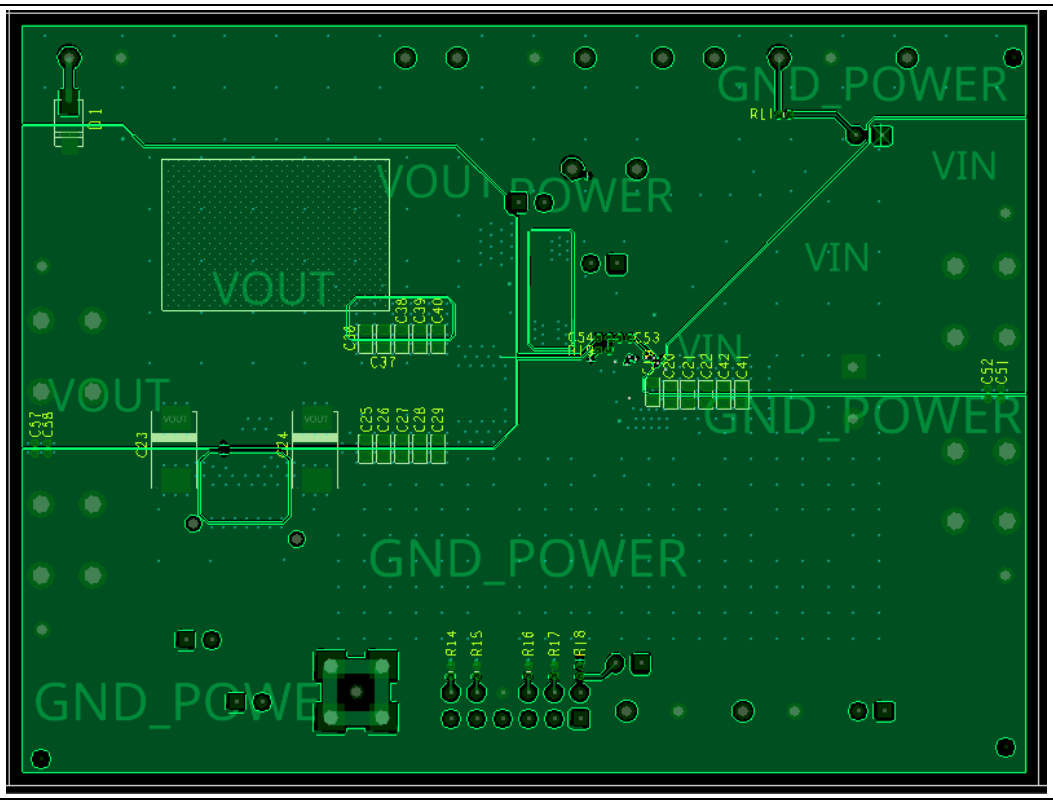



**Figure 3 Bottom layer**

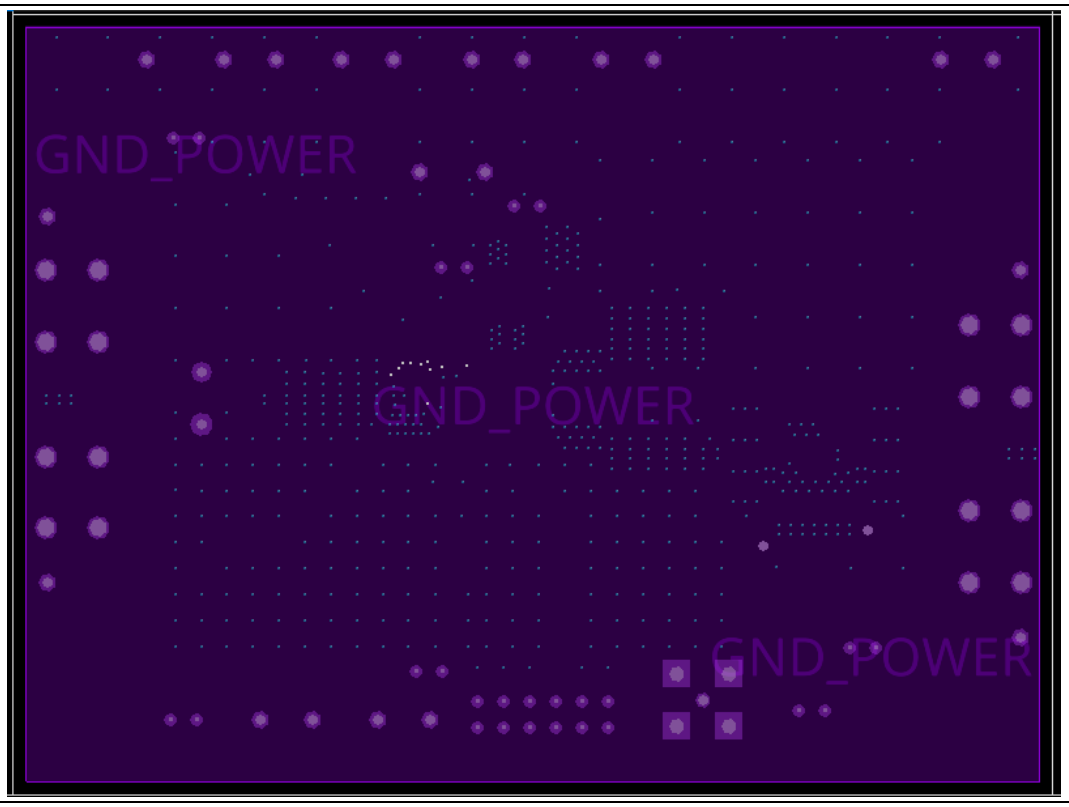



**Figure 4 Inner layer 1**

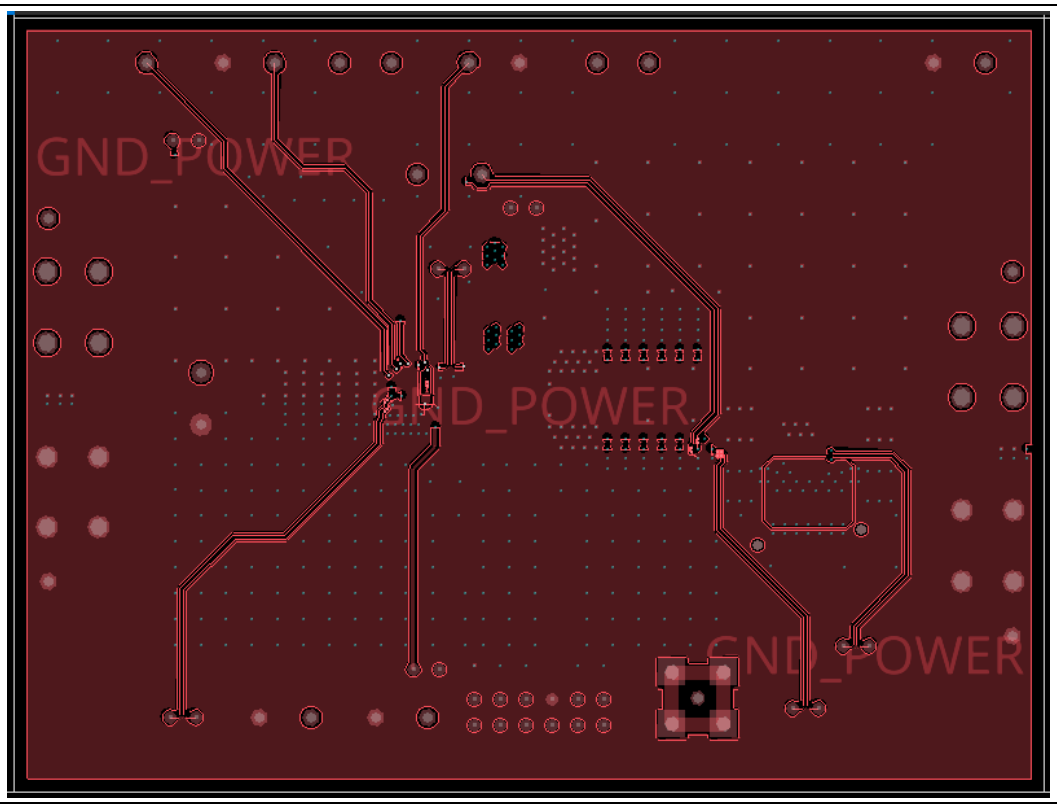



**Figure 5 Inner layer2**

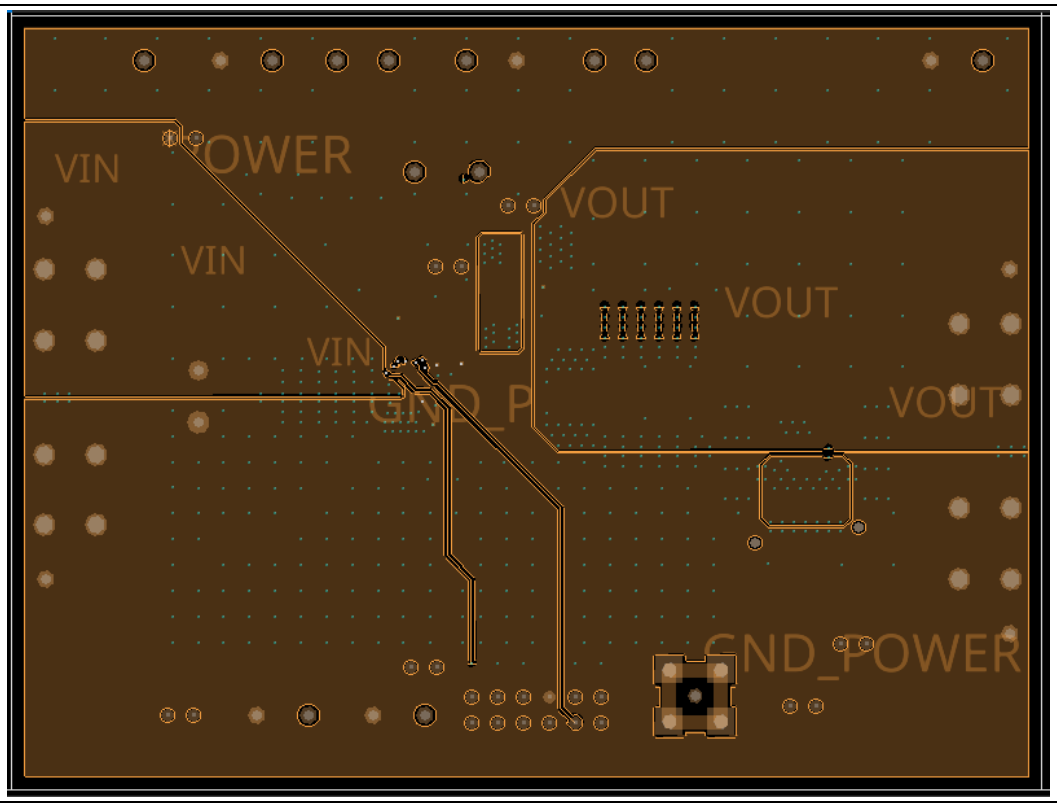



**Figure 6 Inner layer 3**

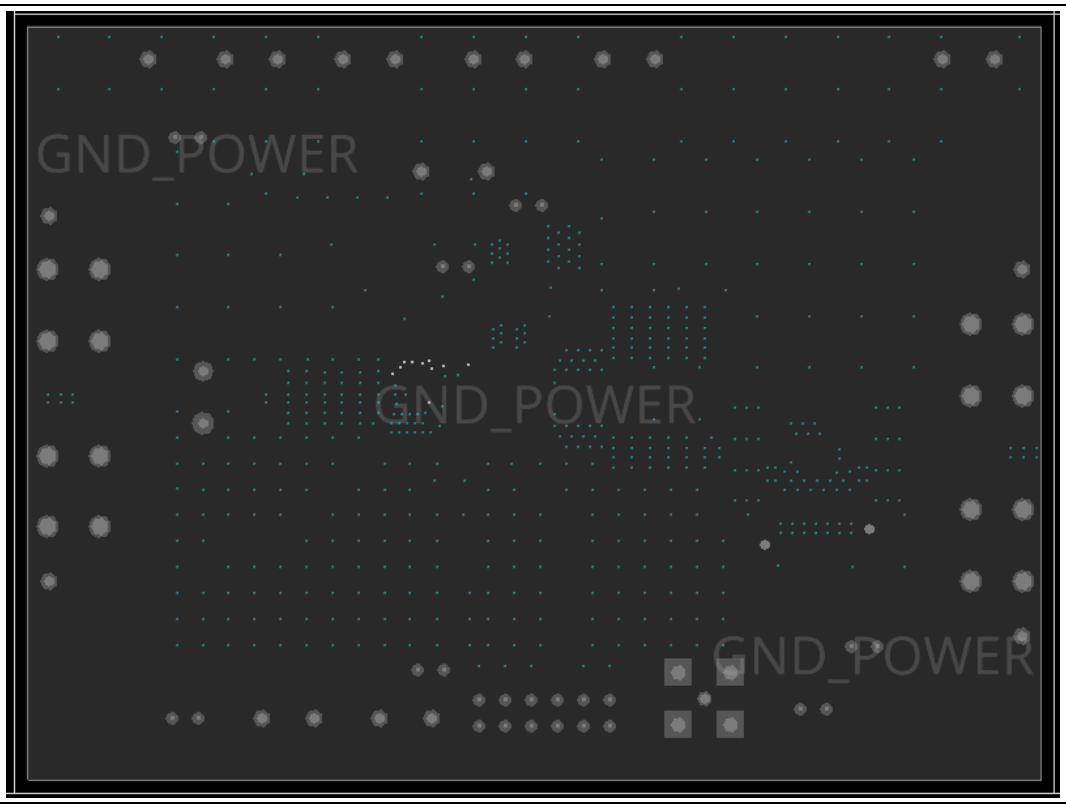



**Figure 7 Inner layer 4**

## 2.6 Schematic

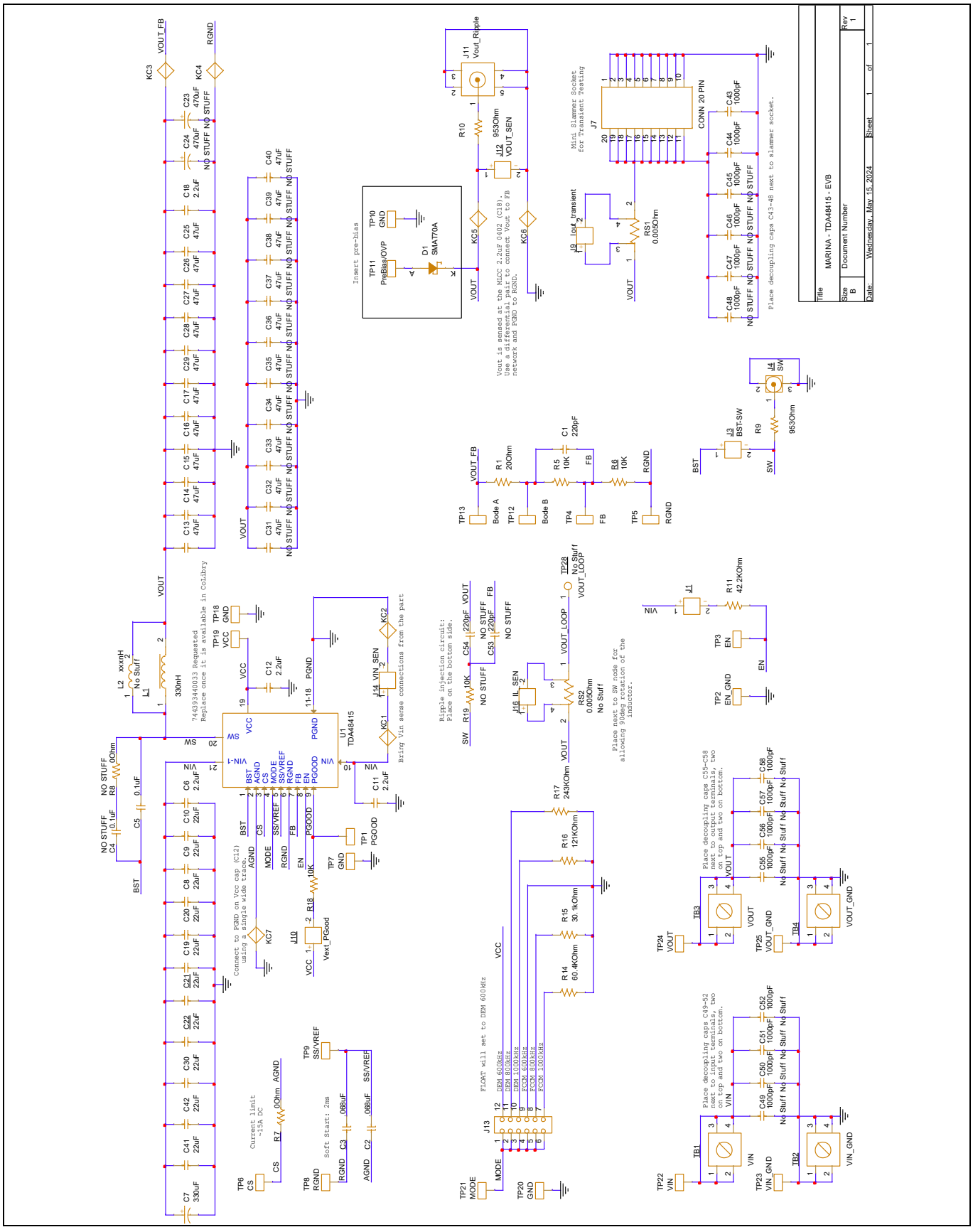


**Figure 8 Schematic of the TDA48415 evaluation board $V_{IN}$ = 5V, $V_{OUT}$ = 1.2V, $I_{OUTmax}$ = 15A**

## 2.7 Bill of materials

**Table 3 Bill of materials**

| Sl.No | Quantity | Reference | Value | Manufacturer | Part Number |
|---|---|---|---|---|---|
| 1 | 3 | C1,C53,C54 | 220 pF | TDK Corporation | C1005X7R1H221K050BA |
| 2 | 2 | C2,C3 | .068 uF | Yageo | CC0402KRX7R7BB683 |
| 3 | 2 | C4,C5 | 0.1 uF | Murata | GRM155R71C104KA88D |
| 4 | 3 | C6,C11,C18 | 2.2 uF | Murata | GRM155R61E225KE11D |
| 5 | 1 | C7 | 330 uF | Panasonic Electronic Components | 25SEPF330M |
| 6 | 10 | C8,C9,C10,C19,C20,C21,C22,C30,C41,C42 | 22 uF | Murata | GRM21BR61E226ME44L |
| 7 | 1 | C12 | 2.2 uF | TDK | C1005X5R1C225K050BC |
| 8 | 20 | C13,C14,C15,C16,C17,C25,C26,C27,C28,C29,C31,C32,C33,C34,C35,C36,C37,C38,C39,C40 | 47 uF | TDK | C2012X5R0J476M |
| 9 | 2 | C23,C24 | 470 uF | Panasonic | 6TPF470MAH |
| 10 | 14 | C43,C44,C45,C46,C47,C48,C49,C50,C51,C52,C55,C56,C57,C58 | 1000 pF | Kemet | C0402C102K5RAC7867 |
| 11 | 1 | D1 | SMAT70A | Diodes Incorporated | SMAT70A-13 |
| 12 | 2 | J1,J16 | IL_SEN | Harwin Inc. | M20-9990246 |
| 13 | 1 | J3 | BST-SW | Harwin Inc. | M20-9990246 |
| 14 | 1 | J4 | SW | TE Connectivity AMP Connectors | 1909763-1 |
| 15 | 1 | J7 | CONN 20 PIN | Samtec Inc. | HSEC8-110-01-S-DV-A-K-TR |
| 16 | 1 | J9 | Iout_transient | Harwin Inc. | M20-9990246 |
| 17 | 1 | J10 | Vext_PGood | Harwin Inc. | M20-9990246 |
| 18 | 1 | J11 | Vout_Ripple | Cinch Connectivity Solutions Johnson | 131-3701-261 |
| 19 | 1 | J12 | VOUT_SEN | Harwin Inc. | M20-9990246 |

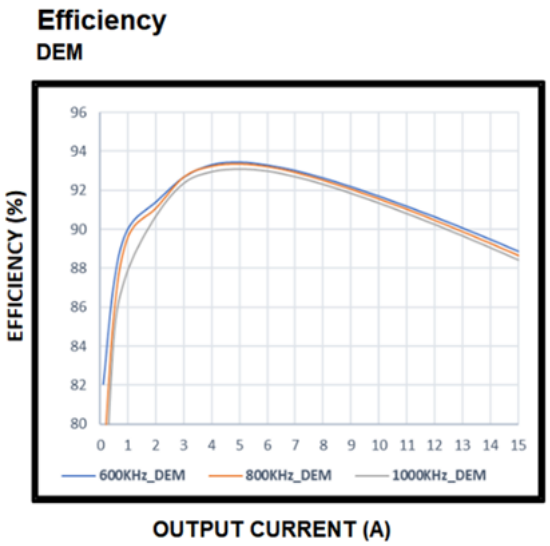
| Sl.No | Quantity | Reference | Value | Manufacturer | Part Number |
|---|---|---|---|---|---|
| 20 | 1 | J13 | | Harwin Inc. | M20-9760646 |
| 21 | 1 | J14 | VIN_SEN | Harwin Inc. | M20-9990246 |
| 22 | 1 | L1 | 330 nH | Wurth Elektronik | 744393440033 |
| 23 | 2 | RS1,RS2 | 0.005 Ohm | Delta Electronics | RL1632T4F-R005-FNH |
| 24 | 1 | R1 | 20 Ohm | Yageo | RE0402FRE0720RL |
| 25 | 4 | R5,R6,R18,R19 | 10K | Yageo | AC0402FR-0710KL |
| 26 | 2 | R7,R8 | 0 Ohm | Yageo | RC0402FR-070RL |
| 27 | 2 | R9,R10 | 953 Ohm | Yageo | RC0402FR-07953RL |
| 28 | 1 | R11 | 42.2 KOhm | Yageo | RC0402FR-0742K2L |
| 29 | 1 | R14 | 60.4 KOhm | Yageo | RC0402FR-0760K4L |
| 30 | 1 | R15 | 30.1 kOhm | Vishay | CRCW040230K1FKED |
| 31 | 1 | R16 | 121 KOhm | Yageo | RC0402FR-07121KL |
| 32 | 1 | R17 | 243 KOhm | Yageo | RC0402FR-07243KL |
| 33 | 1 | TB1 | VIN | Keystone Electronics | 7693 |
| 34 | 1 | TB2 | VIN_GND | Keystone Electronics | 7693 |
| 35 | 1 | TB3 | VOUT | Keystone Electronics | 7693 |
| 36 | 1 | TB4 | VOUT_GND | Keystone Electronics | 7693 |
| 37 | 1 | TP1 | PGOOD | Vector Electronics | K31C/M |
| 38 | 1 | TP2 | EN_GND | Vector Electronics | K31C/M |
| 39 | 1 | TP3 | EN | Vector Electronics | K31C/M |
| 40 | 1 | TP4 | FB | Vector Electronics | K31C/M |
| 41 | 2 | TP5,TP8 | RGND | Vector Electronics | K31C/M |

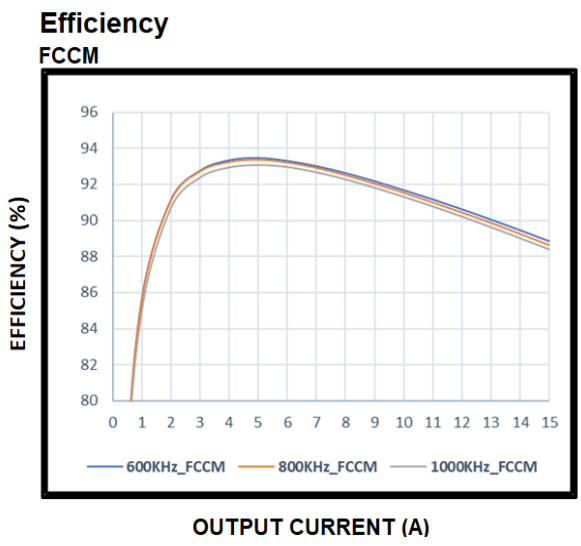
| Sl.No | Quantity | Reference | Value | Manufacturer | Part Number |
|---|---|---|---|---|---|
| 42 | 1 | TP6 | CS | Vector Electronics | K31C/M |
| 43 | 4 | TP7,TP10,TP18,TP20 | GND | Vector Electronics | K31C/M |
| 44 | 1 | TP9 | SS/VREF | Vector Electronics | K31C/M |
| 45 | 1 | TP11 | PreBias/ OVP | Vector Electronics | K31C/M |
| 46 | 1 | TP12 | Bode B | Vector Electronics | K31C/M |
| 47 | 1 | TP13 | Bode A | Vector Electronics | K31C/M |
| 48 | 1 | TP19 | VCC | Vector Electronics | K31C/M |
| 49 | 1 | TP21 | MODE | Vector Electronics | K31C/M |
| 50 | 1 | TP22 | VIN | Vector Electronics | K31C/M |
| 51 | 1 | TP23 | VIN_GND | Vector Electronics | K31C/M |
| 52 | 1 | TP24 | VOUT | Vector Electronics | K31C/M |
| 53 | 1 | TP25 | VOUT_GND | Vector Electronics | K31C/M |
| 54 | 1 | U1 | TDA48415 | Infineon Technologies | TDA48415 |

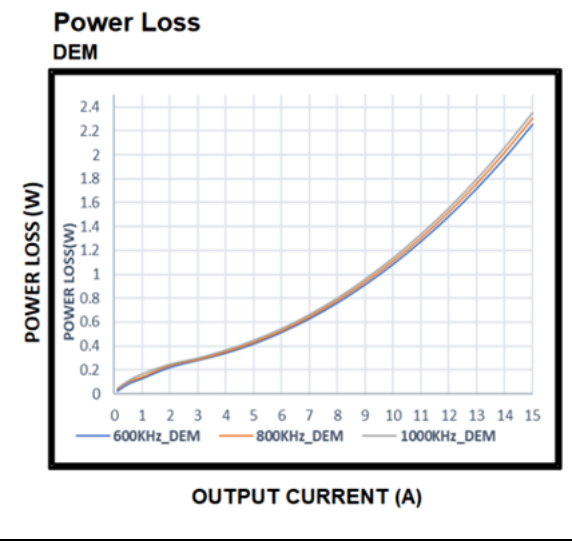
# 3 Evaluation board test results

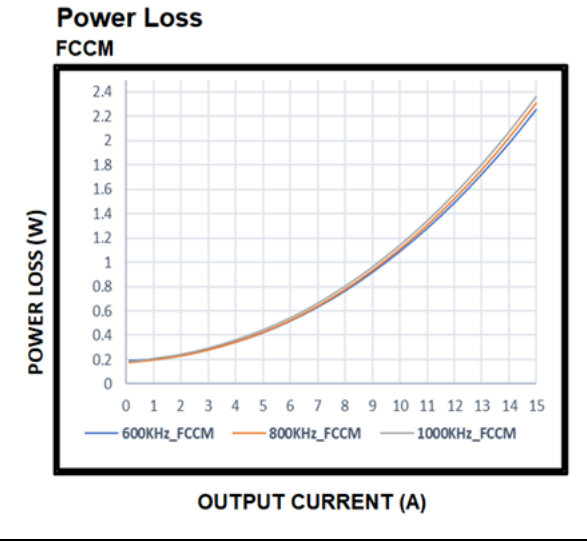
## 3.1 Typical efficiency and power loss curves

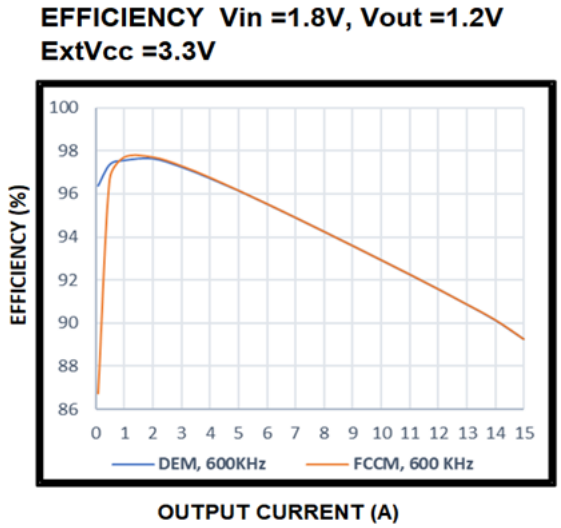
$V_{IN}$ = 5 V, $V_{CC}$ = internal LDO, $I_{OUT}$ = 0 A – 15 A, $F_{SW}$ = 800 kHz, L=330 nH, room temperature, natural convection. Note that the efficiency and power loss curves include losses of the TDA48415, inductor losses, losses of the input and output capacitors, and PCB trace losses.

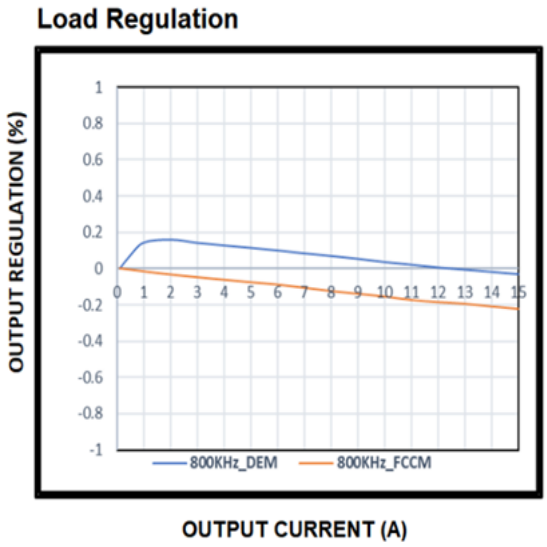


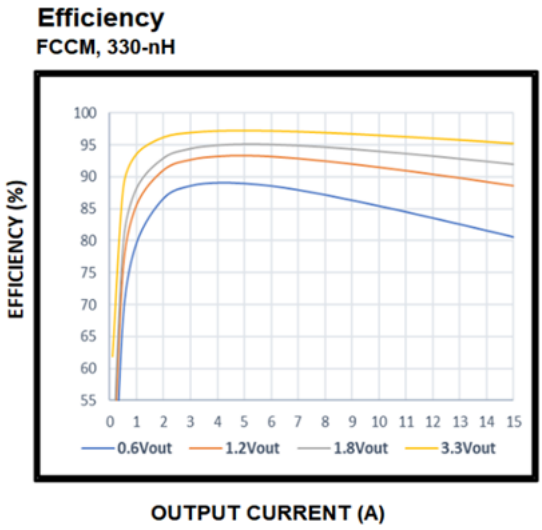



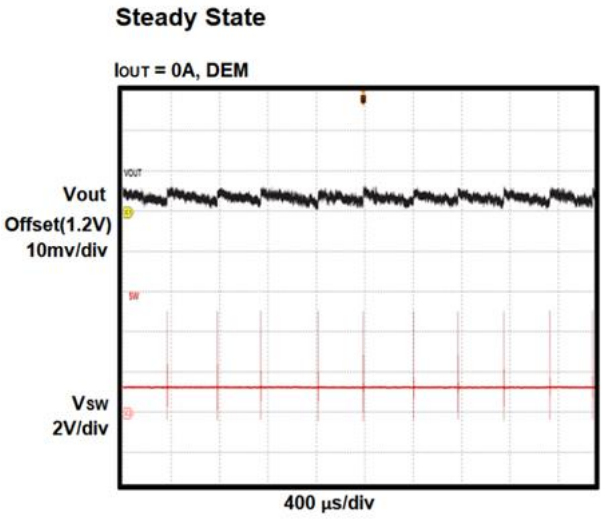



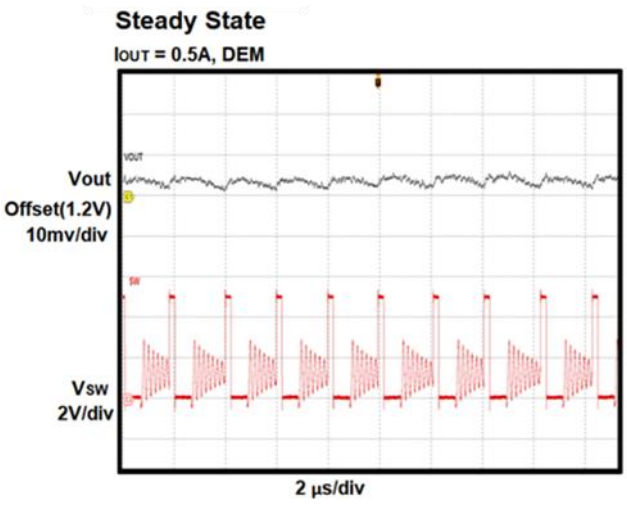



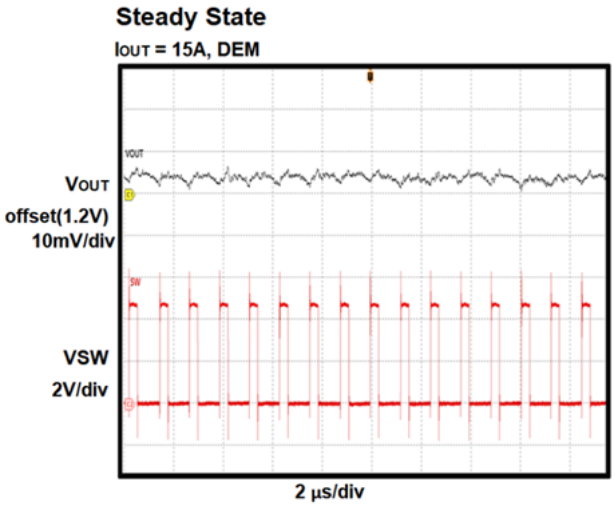

EFFICIENCY Vin =1.8V, Vout =1.2V
ExtVcc =3.3V
EFFICIENCY (%)
100
98
96
94
92
90
88
86
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
DEM, 600KHz
FCCM, 600 KHz
OUTPUT CURRENT (A)

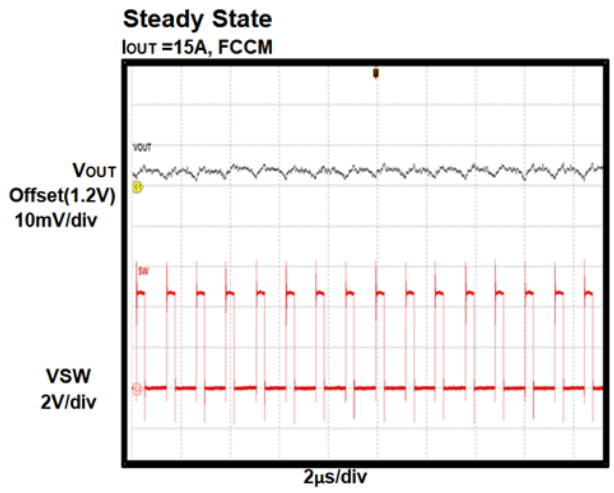

Load Regulation
OUTPUT REGULATION (%)
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
800KHz_DEM
800KHz_FCCM
OUTPUT CURRENT (A)

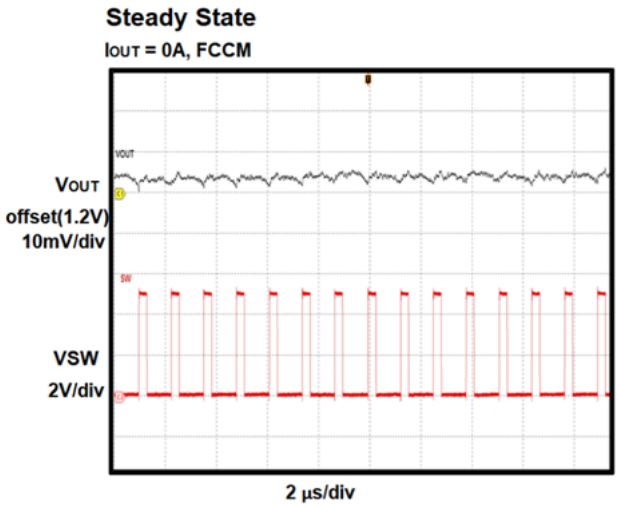

Efficiency
FCCM, 330-nH
EFFICIENCY (%)
100
95
90
85
80
75
70
65
60
55
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
0.6Vout
1.2Vout
1.8Vout
3.3Vout
OUTPUT CURRENT (A)

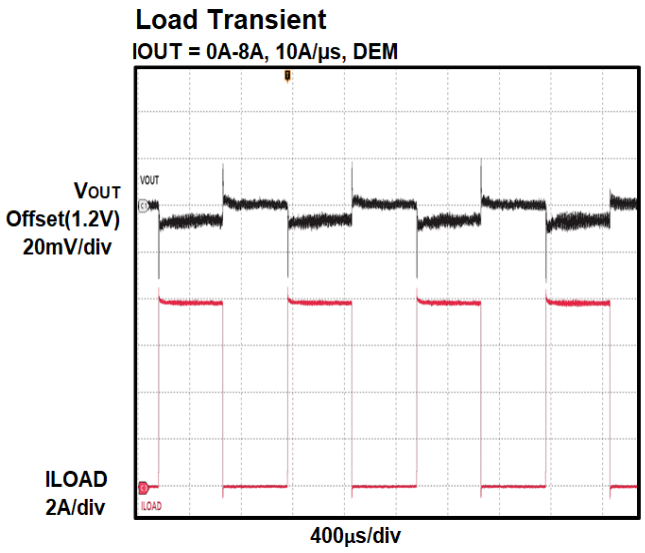

Steady State
IOUT = 0A, DEM
Vout
Offset(1.2V)
10mv/div
Vsw
2V/div
400 µs/div

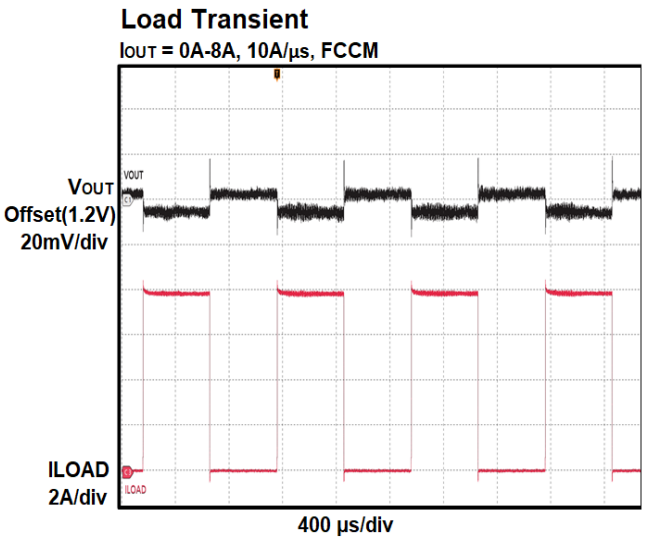

Steady State
IOUT = 0.5A, DEM
Vout
Offset(1.2V)
10mv/div
Vsw
2V/div
2 µs/div

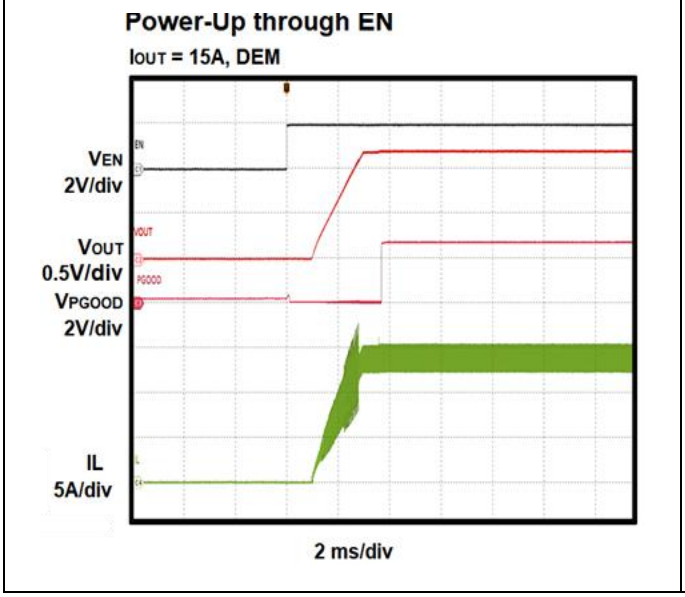

Steady State
IOUT = 15A, DEM
VOUT
offset(1.2V)
10mV/div
VSW
2V/div
2 µs/div

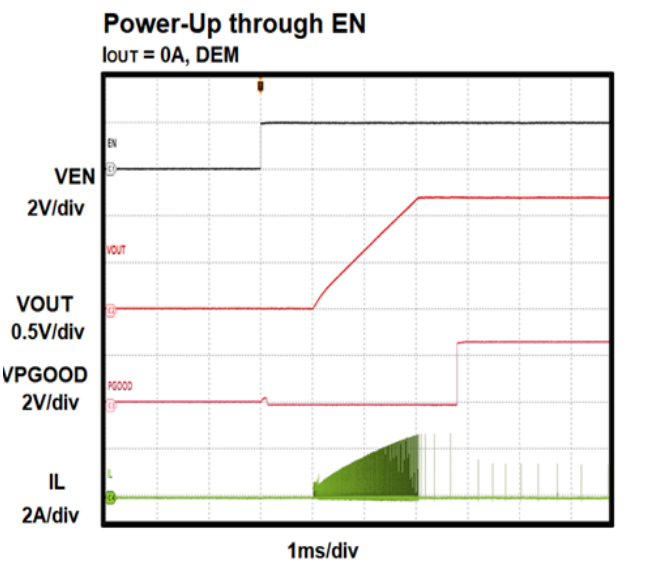

Steady State
IOUT =15A, FCCM
VOUT
Offset(1.2V)
10mV/div
VSW
2V/div
2µs/div


Steady State
IOUT = 0A, FCCM
VOUT
offset(1.2V)
10mV/div
VSW
2V/div
2 µs/div

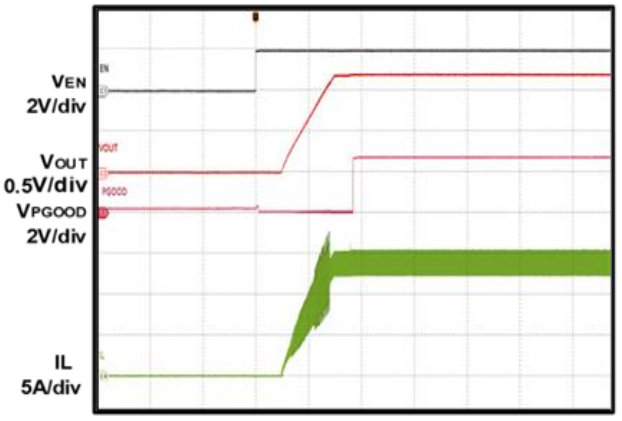

Load Transient
IOUT = 0A-8A, 10A/µs, DEM
VOUT
Offset(1.2V)
20mV/div
ILOAD
2A/div
400µs/div


Load Transient
IOUT = 0A-8A, 10A/µs, FCCM
VOUT
Offset(1.2V)
20mV/div
ILOAD
2A/div
400 µs/div

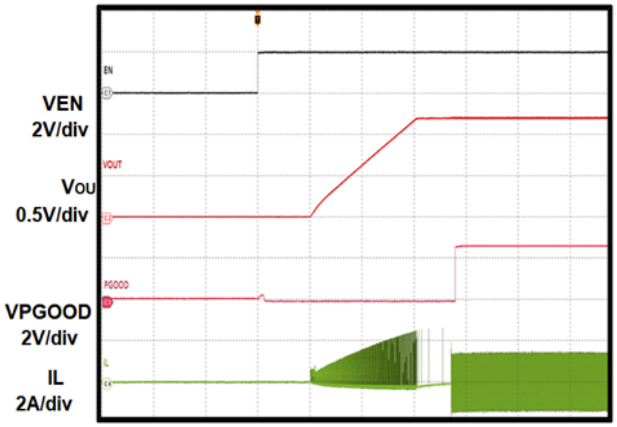

Power-Up through EN
IOUT = 15A, DEM
VEN
2V/div
VOUT
0.5V/div
VPGOOD
2V/div
IL
5A/div
2 ms/div


Power-Up through EN
IOUT = 0A, DEM
VEN
2V/div
VOUT
0.5V/div
VPGOOD
2V/div
IL
2A/div
1ms/div

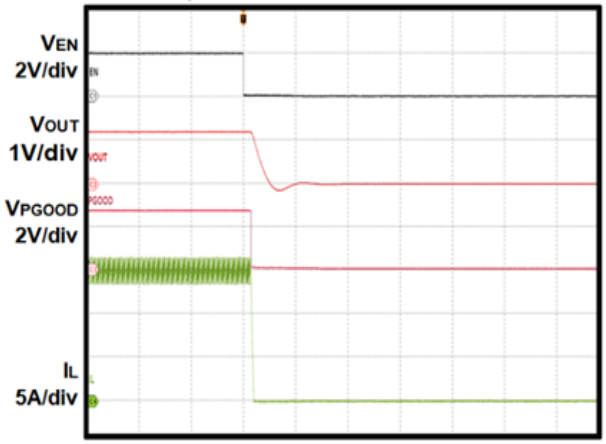
Power-Up through EN
IOUT = 15A, FCCM



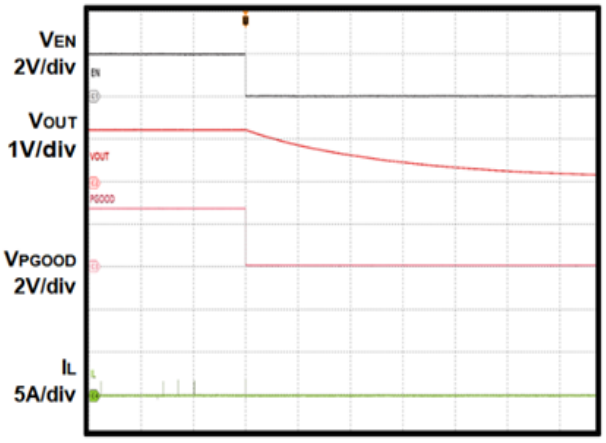

Power-Up through EN
IOUT = 0A, FCCM



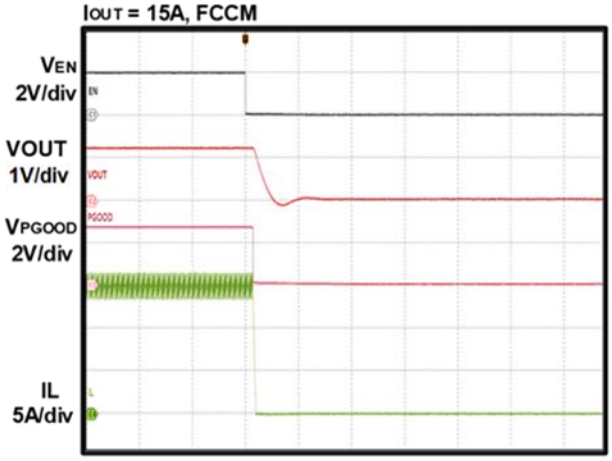

Power-Down through EN
IOUT = 15A, DEM



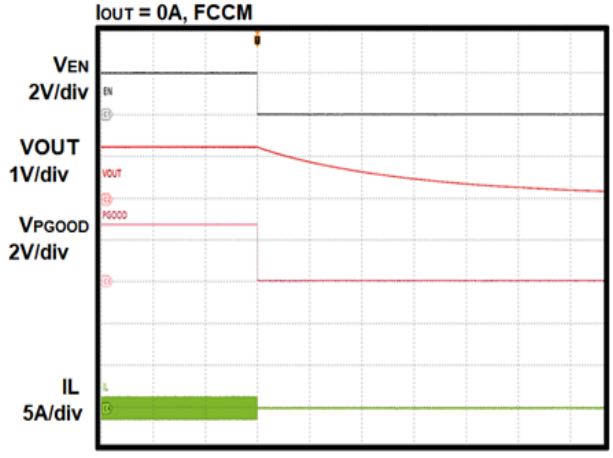

Power-Down through EN
IOUT = 0A, DEM



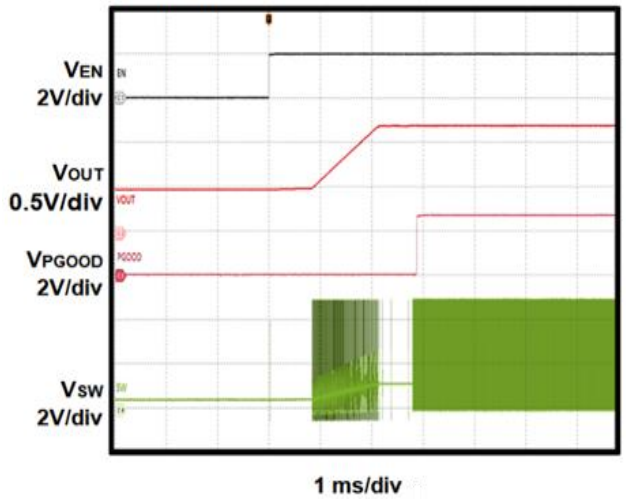

Power-Down through EN
IOUT = 15A, FCCM



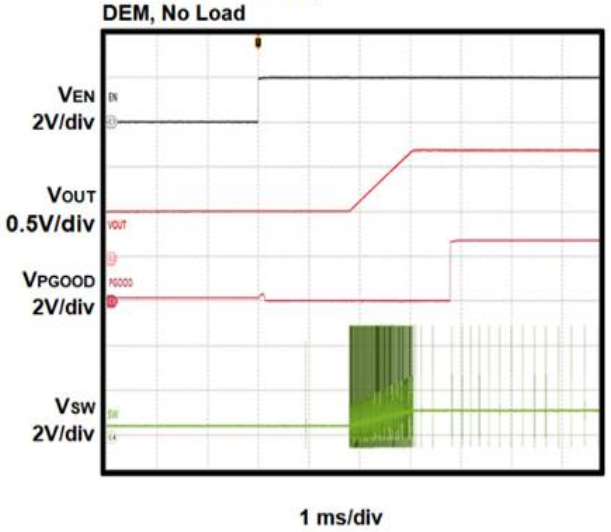

Power-Down through EN
IOUT = 0A, FCCM



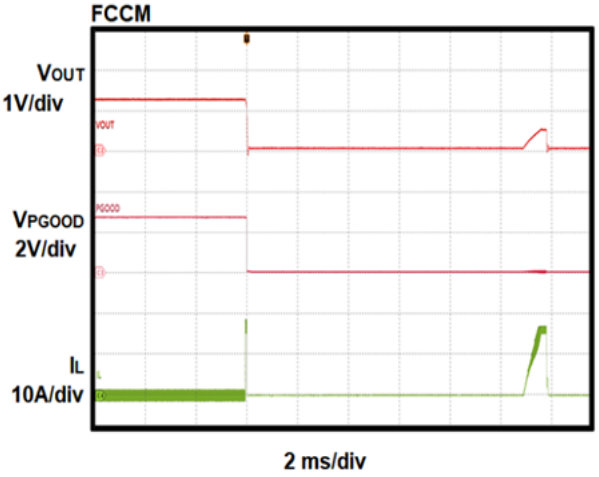
Pre-Bias Start-Up
FCCM, No Load



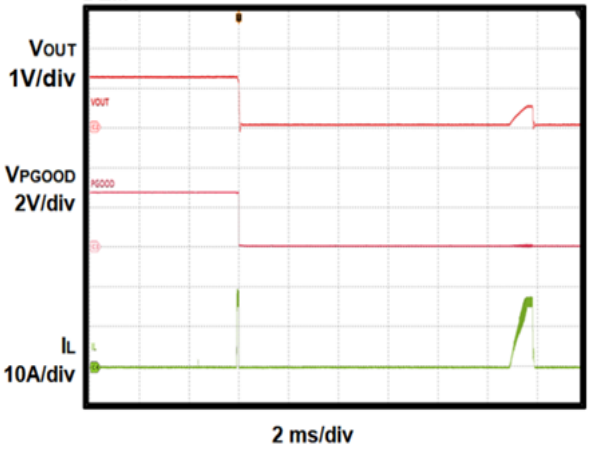

Pre-Bias Start-Up
DEM, No Load



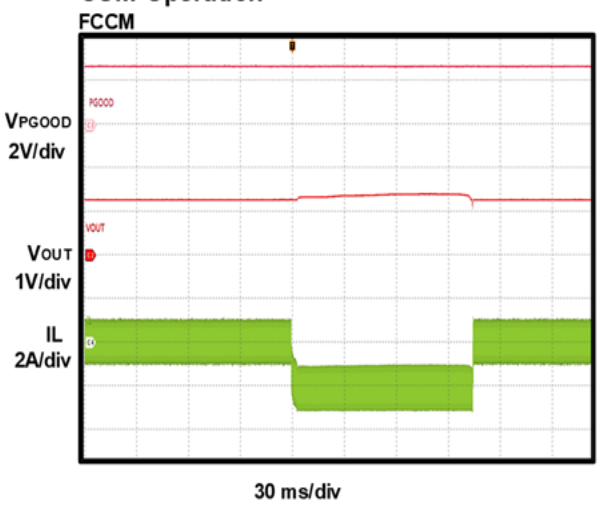

Over-Current Protection
FCCM



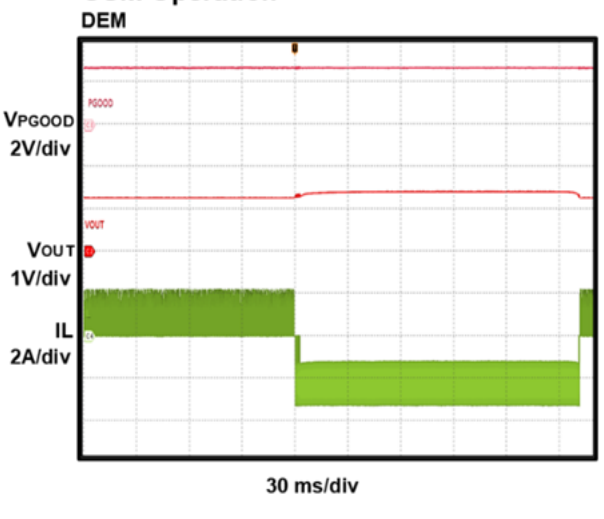

Over-Current Protection
DEM

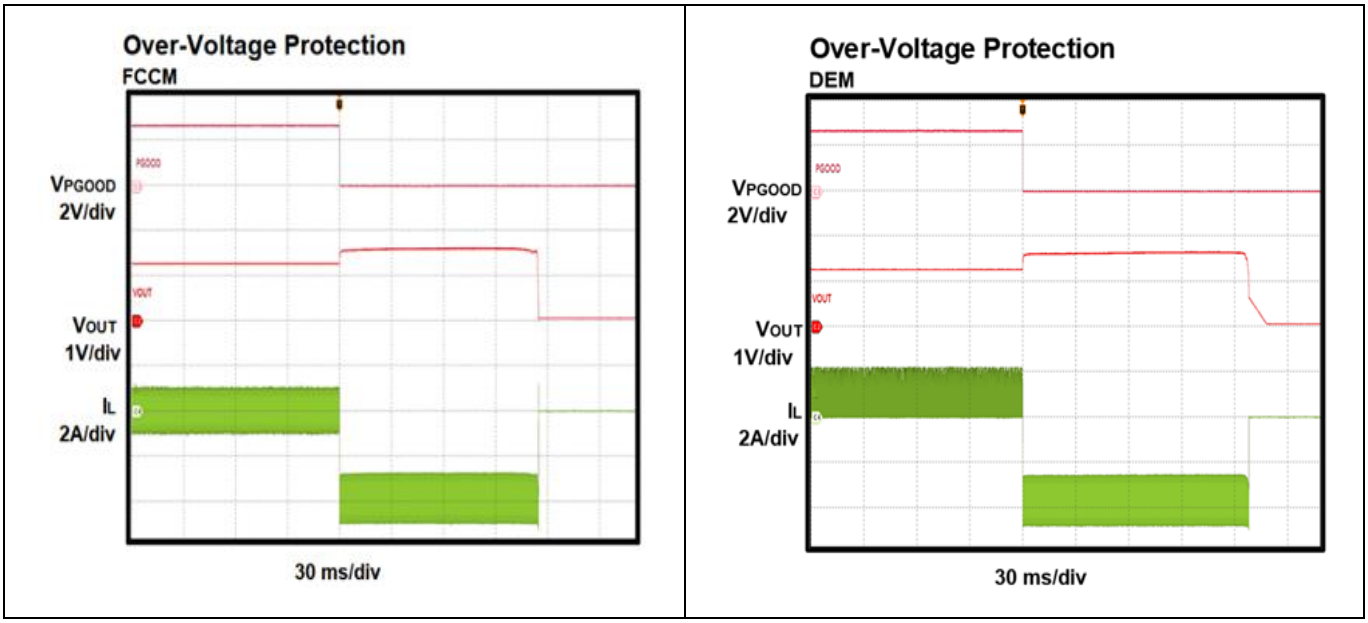



OSM Operation
FCCM




OSM Operation
DEM




Over-Voltage Protection
FCCM
VPGOOD
2V/div
VOUT
1V/div
IL
2A/div
30 ms/div
Over-Voltage Protection
DEM
VPGOOD
2V/div
VOUT
1V/div
IL
2A/div
30 ms/div

# 4 Quick start guide

The EVAL Board can be tested from 2.95 V to 6 V input voltage by connecting the Jumper J1.

A lower input voltage as low as 1.8 V with external 3.3 V VCC bias can be set by using an external VCC supply.

Do the following steps to start working on the evaluation board:

1. Connect the positive and negative terminals of the load to the VOUT and GND pins, respectively
2. Preset the power supply output voltage between 2.95 V and 6 V, and then turn off the power supply
3. Connect the positive and negative terminals of the power supply output to the VIN and GND pins, respectively. Ensure that the power supply has a current limit high enough to supply the power
4. Turn the power supply on. The evaluation board will power up automatically
5. To use the enable function, apply a digital input to the EN pin. Drive EN above 1.2 V to turn on the regulator. Drive EN below 1 V to turn off the regulator
6. Use R5 and R6 to set the output voltage with VFB = 0.6 V
7. Use jumper J13 to select the operating frequency (600 kHz, 800 kHz, or 1000 kHz) and select FCCM or DEM mode

# 5 Related resources

- DC-DC converters
- Integrated POL voltage regulators

# Revision history

| Document revision | Date | Description of changes |
|---|---|---|
| V 1.0 | 2025-09-03 | Initial release |

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**UG091933**

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Customer shall check the Evaluation Board for any physical damage which may have occurred during transport. If customer detects any damages or defects in the Evaluation Board, customer shall not connect the Evaluation Board to a power source. Customer shall contact Infineon for further support. If customer observes unusual operating behavior during the evaluation process, customer shall immediately shut off the power supply to the Evaluation Board and consult Infineon for support.
Customer shall not touch the Evaluation Board during operation and keep a safe distance.
Customer shall not touch the Evaluation Board after disconnecting the power supply, several components may still store electrical voltage and can discharge through physical contact. Several parts, like heat sinks and transformers, may still be very hot. Allow the components to cool before touching or servicing.
The electrical installation must be completed in accordance with the appropriate safety requirements.