Evaluating the ADP15193

FEATURES

- 2.6V to 5.5V operating voltage range
- Up to 20A current capability
- Integrated 1mΩ power MOSFET
- Current reporting without external sense resistor.
- Adjustable slew rate control
- Configurable undervoltage lockout
- Output pre-charge detection
- Quick output discharge
- Power good output
- Thermal shutdown
- Proven PCB layout
- Fully assembled and tested

EVALUATION KIT CONTENTS

- ADP15193EVKIT evaluation board
- 4-inch patch cable

DOCUMENTS NEEDED

- ADP15193 data sheet

GENERAL DESCRIPTION

The ADP15193EVKIT provides a proven design to evaluate the ADP15193 hot-swap e-fuse with an integrated 20A MOSFET. The ADP15193EVKIT kit uses the ADP15193 in a 2mm x 3mm FC2QFN.

ADP15193EVKIT EVALUATION BOARD 3D RENDERING

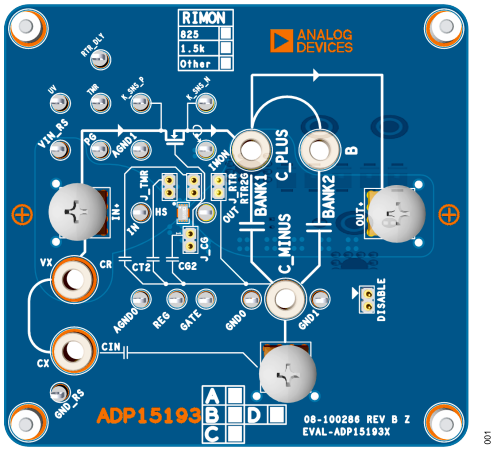

Figure 1. Evaluation Board (Front)

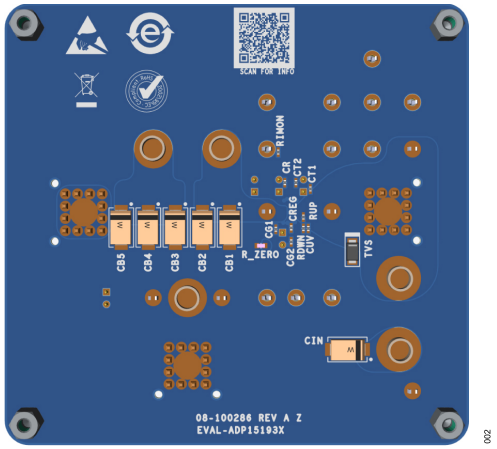

Figure 2. Evaluation Board (Back)

TABLE OF CONTENTS

REVISION HISTORY

6/2026—Rev. 1 to Rev. 2

Changes to Table 5 ... 15
Added Potential Future Products Section and Table 6; Renumbered Sequentially ... 15

5/2026—Rev. 0 to Rev. 1

Changed EVAL-ADP15193 to ADP15193EVKIT (Throughout) ... 1
Changes to Figure 1 ... 1
Changes to Figure 3 ... 3
Changes to Figure 12 ... 11
Changes to Table 5 ... 15

3/2026—Revision 0: Initial Version

QUICK START GUIDE

The ADP15193EVKIT is fully assembled and tested. Follow the steps below to verify board operation.

Caution: Do not turn on the power supply until all connections are completed.

1. Turn on the power supply and set the supply to 3.3V, then disable the power supply.
2. Connect the positive terminal of the power supply to the **IN+** terminal, using the M5 screw provided. Connect the negative terminal of the power supply to the **GND** terminal.
3. Connect the positive load terminal of the load (initially off) to the **OUT+** terminal, using the M5 screw provided. Connect the negative load terminal to the same **GND** terminal as the power supply.
4. Enable the power supply.
5. Verify that the voltage between the **OUT+** and **GND** terminals equals the input voltage.
6. Verify that the internal regulator voltage (**REG**) is approximately 1.8V.
7. Turn on the load. Increase the current above 20A and verify that the circuit breaker disconnects the load from the input supply.
8. The ADP15193EVKIT is now ready for evaluation.

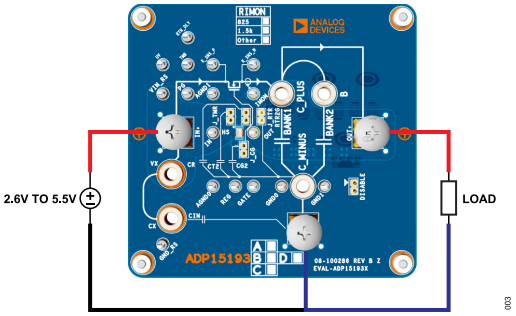

Figure 3. ADP15193EVKIT Connection Diagram

DETAILED DESCRIPTION OF HARDWARE

The ADP15193EVKIT provides a proven design to evaluate the ADP15193. The ADP15193EVKIT can be conveniently connected between the system power and the load using the provided M5 screws for the input and output. The ADP15193EVKIT operates between 2.6V and 5.5V (depending on the version) up to 20A load current capability.

Table 1. Input Voltage Range

Model	Input range
ADP15193AAFB+	2.8V to 3.6V
ADP15193BAFB+	2.8V to 3.6V
ADP15193CAFB+	2.6V to 5.5V
ADP15193DAFB+	2.8V to 3.6V

SAFE CIRCUIT BREAKER THRESHOLD

All ADP15193 versions have a fixed safe CB threshold, set to approximately 22A. This threshold is not based on the IMON level.

ADP15193B, C and D, in addition to the CB, have two OCP thresholds, based on the IMON levels; for RIMON = 1.5kΩ

- Slow: I_{LOAD} > 13A – about 1ms delay
- Fast: I_{LOAD} > 19A – about 2µs delay.

SETTING RETRY DELAY TIME (RETRY_DLY)

The ADP15193EVKIT allows the user to evaluate the following retry/delay scenarios:

- J_RTR and RTR2G headers not shorted – RETRY_DLY pin floating (Case 1)
- J_RTR shorted – The pin is connected to CR capacitor (Case 2)
- RTR2G shorted – The pin shorted to GND (Case 3)

Case 1: Auto-retry is set internally to approximately 100ms.

Case 2: Auto-retry timing is controlled by the external CR capacitor.

Case 3: Auto-retry is disabled; the DUT latches off during a fault.

TIMER (TMR)

TMR pin has an 100nF capacitor connected to ground. An additional 100nF can be added by shorting J_TMR.

$$t_{TMR}\left[ms\right] = \frac{C_{TMR}[nF]}{6.25} \quad (1)$$

where:
t_{TMR} is timer duration.
C_{TMR} is the external capacitor between the TMR pin and GND.

One capacitor: t_{TMR} = 16ms

Two capacitors: t_{TMR} = 32ms

SETTING THE OUTPUT SLEW RATE (GATE)

On the evaluation board, CG1 (10nF) is connected from GATE to GND, controlling the inrush current during startup.

$$I_{INRUSH} = \frac{I_{GATE} \times C_{LOAD}}{C_{GATE} + 6nF} \quad (2)$$

During startup, I_{GATE} ≅ 8µA.

An additional 10nF capacitor (CG2) can be added in parallel to CG1 by shorting J_CG.

BANK1 is 660µF, while BANK2 is 990µF.

Using BANK1, I_{INRUSH} ≅ 330mA (CG1) and 203mA (CG1IICG2).

Using BANK1 II BANK2, I_{INRUSH} ≅ 825mA (CG1) and 507mA (CG1IICG2).

ADP15193 internal circuitry makes sure that the inrush current does not exceed 500mA, regardless of the CG value for ADP15193A/B/C.

UNDERVOLTAGE LOCKOUT

The undervoltage protection is built-in and it depends on the chip variant.

Table 2. Input UVLO Levels

Model	Input UVLO
ADP15193AAFD+T	2.75V
ADP15193BAFD+T	2.64V
ADP15193CAFD+T	2.54V
ADP15193DAFD+T	2.64V

OVERVOLTAGE LOCKOUT

The overvoltage protection is built-in, and it is not user-defined. For ADP15193, the overvoltage threshold is not user-adjustable, and it depends on the chip variant.

Table 3. OVLO Levels

Model	Input OVLO
ADP15193AAFD+T	3.75V
ADP15193BAFD+T	3.75V
ADP15193CAFD+T	5.7V
ADP15193DAFD+T	3.75V

CURRENT MONITOR (IMON)

The ADP15193 IMON pin is the output of an accurate current sense amplifier and provides a source current proportional to the load current flowing into the main switch. The factory-trimmed current ratio is set to 42µA/A. On the ADP15193EVKIT, the IMON current is converted to voltage by the RIMON (825Ω, 0.1% for ADP15193A and 1.5kΩ, 0.1% for ADP15193B, C and D). To minimize the noise in a normal application, RIMON is placed near to an MCU or an ADC.

DETAILED DESCRIPTION OF HARDWARE

TOTAL MOSFET ON RESISTANCE

The ADP15193EVKIT makes it easy to measure the MOSFET ON resistance by measuring the voltage drop across the Kelvin-sense test points K_SNS_P and K_SNS_N for a known current.

$$R_{DS\_ON}\left[\text{m}\Omega\right] = \frac{\left(V_{K\_SNS\_P} - V_{K\_SNS\_N}\right)[mV]}{I_{LOAD}[A]} \quad (3)$$

where:
R_{DS_ON} is the MOSFET ON resistance.
I_{LOAD} is the load current.
$V_{K\_SNS\_P}$ and $V_{K\_SNS\_N}$ are the voltages at the respective test points.

BOARD CONFIGURATIONS

Input and output can be configured as follows:

1. Output: Output capacitance Bank 1 (660µF) or Bank 1 + Bank 2 (1650µF)
2. Input: Input capacitance absent (VX-CX not shorted) or input capacitance present (VX-CX shorted) – E-Fuse mode.

BOARD CONTROLS

Using the jumpers supplied with the kit, DUT behavior can be altered:

1. Board enable: The board is enabled when the DISABLE jumper absent and disabled when the DISABLE jumper is present.
2. TMR control: 100nF when J_TMR header is not shorted, 200nF when it is.
3. RETRY_DLY control: The pin is floating when J_RTR is not shorted, 330nF to GND when it is.
4. Retry disable: Shorting the RTR2G header (RETRY_DLY pin is connected to GND), the DUT does not recover from a fault, regardless of the J_RTR jumper status.
5. GATE control: C_{GATE} is 10nF when the J_CG is not shorted and 20nF when it is.

SIGNAL MONITORING

DUT operation can be monitored using the on-board test-points:

1. The pair VIN_RS and GND_RS are used as power supply remote sense, if available.
2. IN is used to scope the input voltage supply.
3. OUT is used to scope the output voltage.
4. PG is used to scope the power-good status.
5. The pair K_SNS_P and K_SNS_N are used to Kelvin sense the voltage drop across the power FET and determine the R_{DS_ON}.
6. IMON is used to sense the reported load current based on the IMON gain (typ. 42µA/A) and the R_{IMON}. The R_{IMON} is 825Ω (0.1%) when using ADP15193A and 1.5kΩ (0.1%) for ADP15193B, C and D. The reason for the difference is to enable the user to test the slow and fast OCP, available only for the B, C, and D versions.

BOARD SPECIFICATIONS

Table 4. DUT Operation Range on ADP15193EVKIT

Parameter	Typical Value	Unit
Load Capacitance	660 and 1650 (selectable)	µF
Rising UVLO Threshold	2.54, 2.64 or 2.75	V
Rising OVLO Threshold	3.75 or 5.7	V
UV Turn ON Threshold	2.9	V
Start-Up Current Limit (ADP15193EVKITA, B, and C)	500	mA
Start-Up Current Limit (ADP15193EVKITD)	800	mA
Maximum Load Current	20	A
Power-Good Threshold	0.9	VIN
Quick Output Discharge Current	150	mA
Maximum Ambient Temperature	125	°C
Thermal Shutdown	150	°C

TEST PLOTS

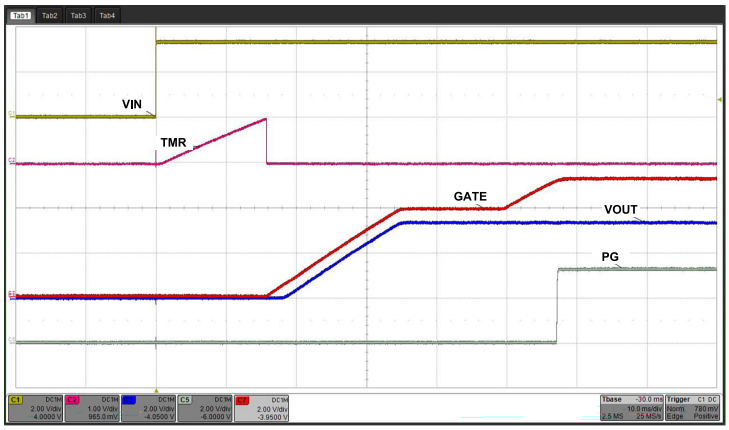

Figure 4. Power Up with BANK1 (1600µF) Load Capacitor and No DC Load – CG1IICG2, CT1

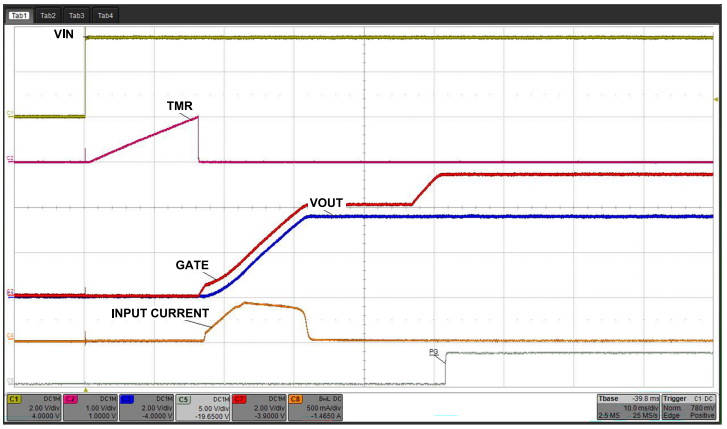

Figure 5. Power Up with BANK1 (1600µF) Load Capacitor and No DC Load – CG1, CT1

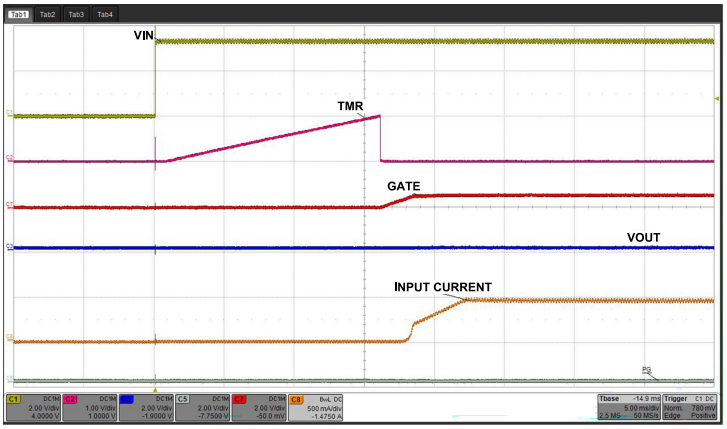

Figure 6. Power Up into a Short Circuit (Detail)

TEST PLOTS

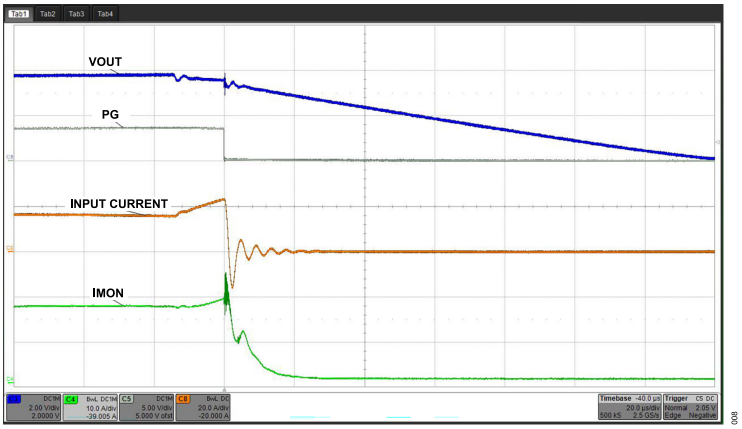

Figure 7. Overcurrent Stepping the Load from 15A to 30A

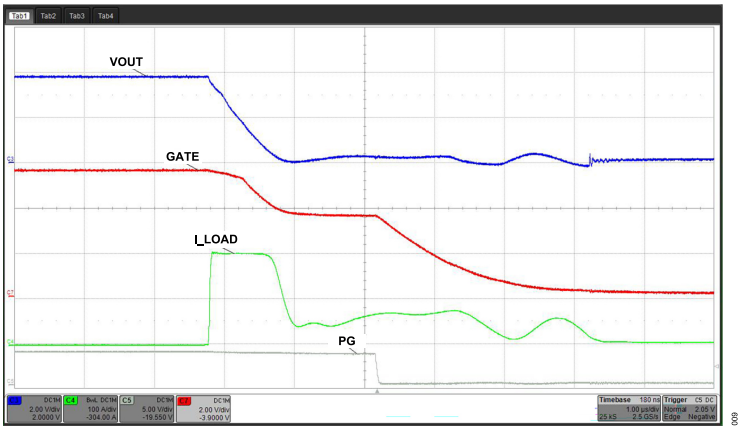

Figure 8. Severe Overcurrent (200A); COUT = 20µF

THERMAL IMAGE

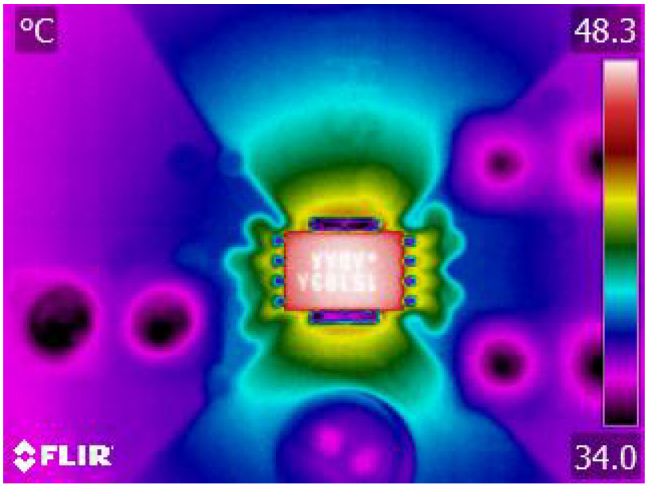

Figure 9. ADP15193EVKIT Thermal Image [°C] with 20A Current Under Natural Air Flow for 30 minutes

TELEMETRY ACCURACY

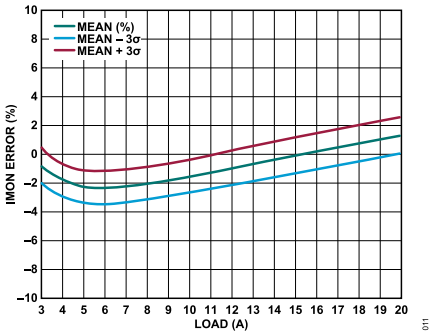

Figure 10. IMON Error [%] Measured Across 30 Boards (25°C), Load Between 3A and 20A

EVALUATION BOARD SCHEMATICS AND ARTWORK

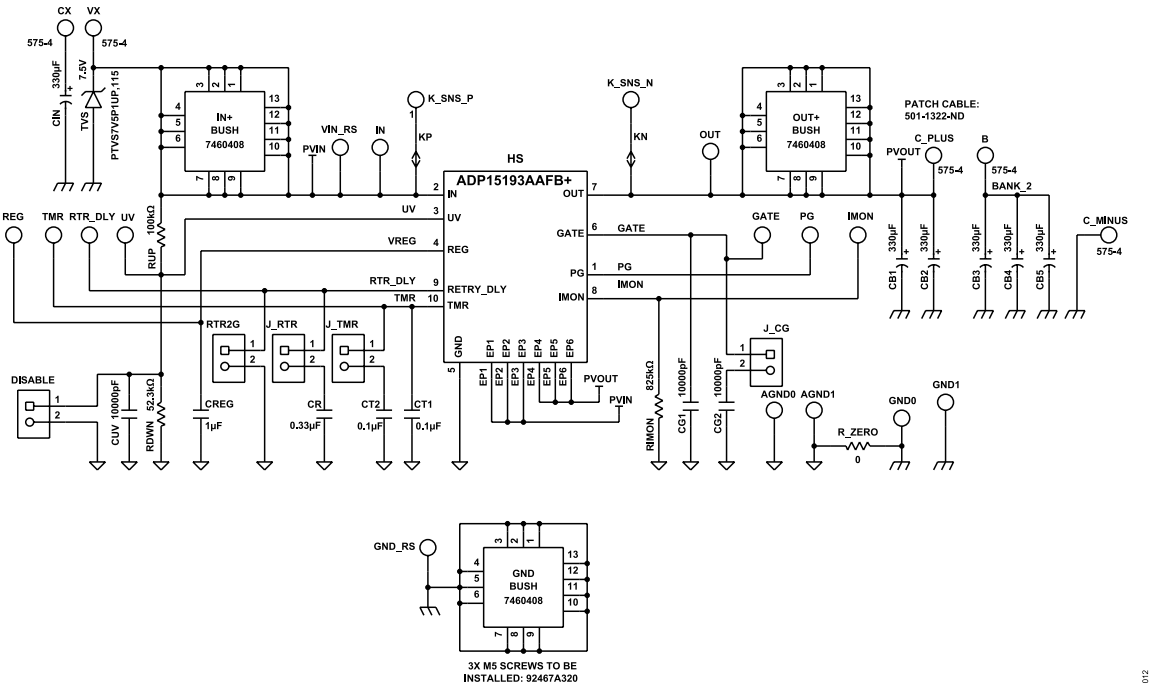

Figure 11. ADP15193EVKIT Evaluation Board Schematics

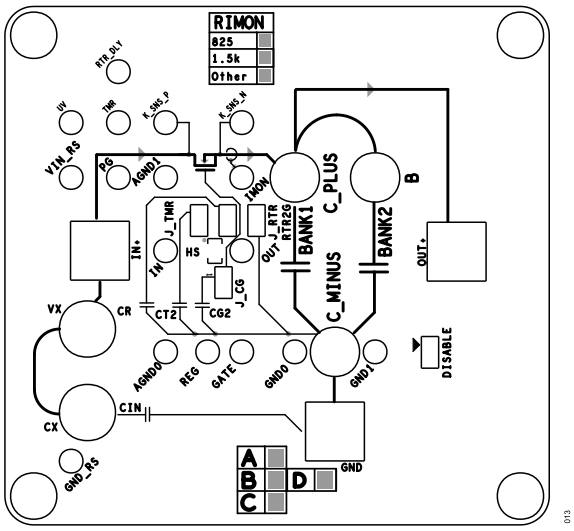

Figure 12. Silkscreen Top

EVALUATION BOARD SCHEMATICS AND ARTWORK

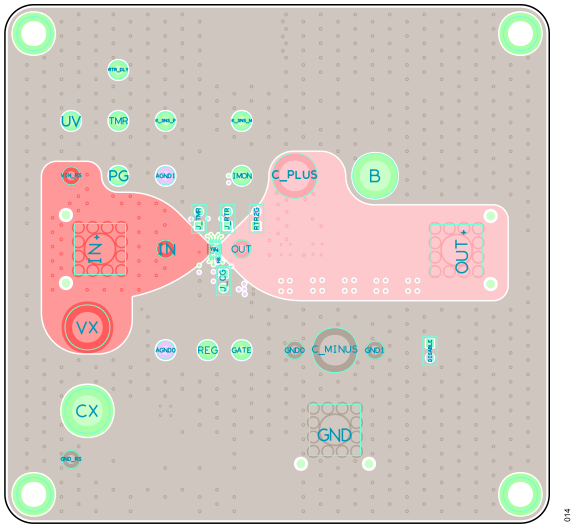

Figure 13. Top Layer

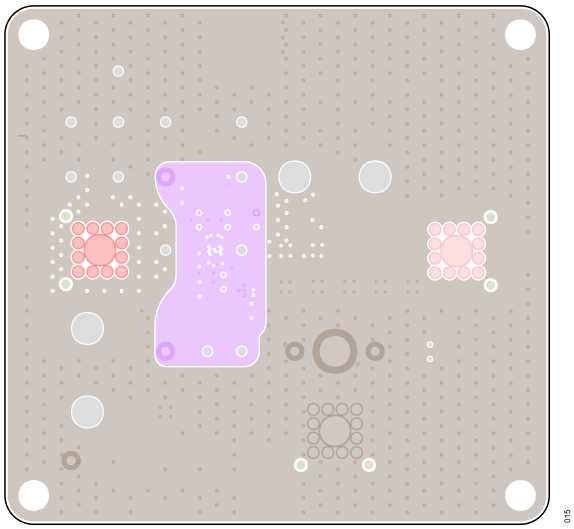

Figure 14. Layer 2

EVALUATION BOARD SCHEMATICS AND ARTWORK

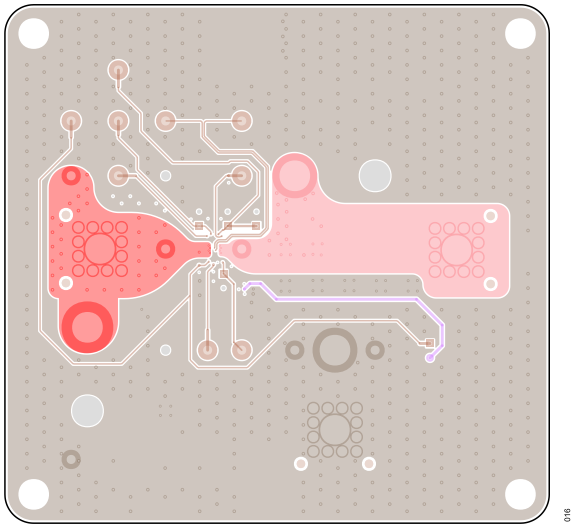

Figure 15. Layer 3

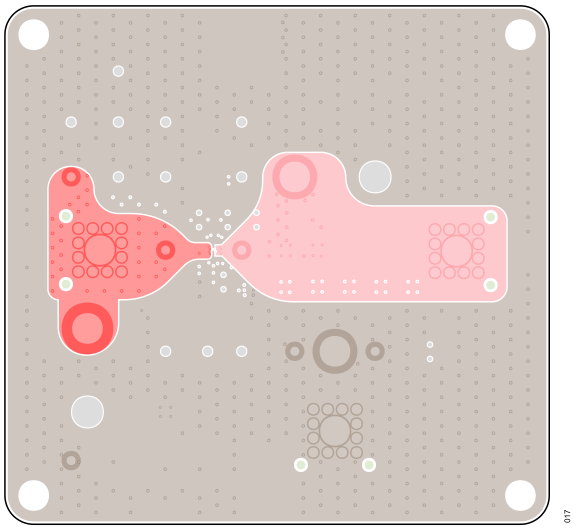

Figure 16. Layer 4, 5

EVALUATION BOARD SCHEMATICS AND ARTWORK

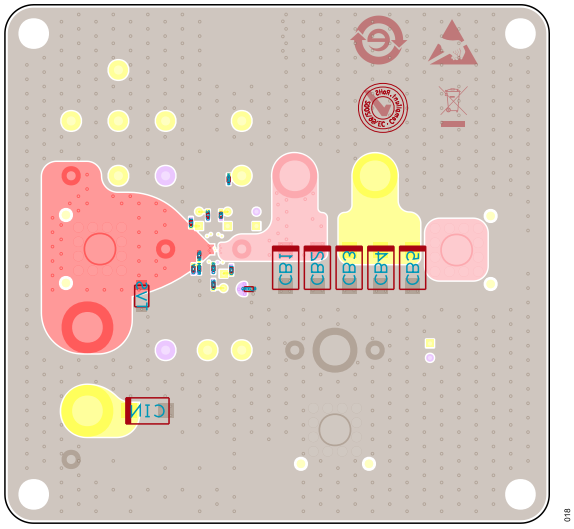

Figure 17. Bottom Layer

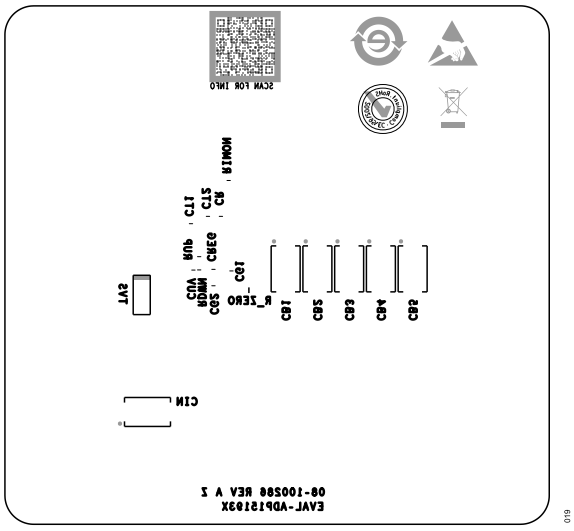

Figure 18. Silk Screen Bottom (Mirrored)

ORDERING INFORMATION

EVALUATION BOARDS

Table 5. Evaluation Boards

Model	Description
ADP15193AEVKIT#	Evaluation Board for ADP15193A
ADP15193BEVKIT#	Evaluation Board for ADP15193B
ADP15193DEVKIT#	Evaluation Board for ADP15193D

POTENTIAL FUTURE PRODUCTS

Table 6. Potential Future Products

Model	Description
ADP15193CEVKIT#	Evaluation Board for ADP15193C

BILL OF MATERIALS

Table 7. Bill of Materials[1]

Item	Quantity	Description	Reference Designtor	Part Number	Manufacturer	Value
1	17	Test point	AGND0, AGND1, GATE, GND0,GND1, GND_RS, IMON, IN,K_SNS_N, K_SNS_P, OUT,PG, REG, RTR_DLY, TMR, UV,VIN_RS	5011	Keystone Electronics	N/A
2	5	Receptacle, jack, banana	B, CX, C_MINUS, C_PLUS, VX	575-4	Keystone Electronics	575-4
3	6	Capacitor tantalum polymer, 330µF, 10V, 2917	CB1, CB2, CB3, CB4, CB5, CIN	10TCE330M	Panasonic	330µF
4	3	Capacitor, surface-mount device (SMD) (0402), 10000pF, 10%, 50V, X7R, ceramic	CG1, CG2, CUV	CGA2B3X7R1H103K050BB	TDK	10nF
5	1	Capacitor, SMD (0402), 0.33µF, 20%, 25V, X5R	CR	C1005X5R1E334M050BB	TDK	0.33µF
6	1	Capacitor, SMD (0402), 1µF, X7R	CREG	GRM155Z71A105KE01	Murata	1µF
7	2	Capacitor, SMD ,(0402), 0.1µF, 10%; 50V, X7R, ceramic	CT1, CT2	C1005X7R1H104K050BB; GRM155R71H104KE14; C1005X7R1H104K050BE;	TDK, Murata, Taiyo Yuden	0.1µF
8	5	Connector, male, through hole, single row, straight	DISABLE, J_CG, J_RTR,J_TMR, RTR2G	800-10-002-10-001000	Mill-Max	800-10-002-10-001000
9	3	Threaded bush, M5	GND, IN+, OUT+	7460408	Würth Elektronik	7460408
10	1	IC, hot swap solutions with current report output; FC2QFN10-6EP	HS	ADP15193X (where X can be A, B, C or D)	Analog Devices, Inc.	ADP15193X
11	1	Resistor, SMD (0402), 52.3kΩ, 0.1%, +/-25PPM/DEGC; 0.0630W	RDWN	ERA-2AEB5232	Panasonic	52.3kΩ
12	1	Resistor,SMD (0402), 825Ω, 0.10%, +/-10PPM/DEGC, 0.0630W (ADP15193A)	RIMON	ERA-2ARB8250	Panasonic	825Ω
		Resistor, SMD (0402), 1.5kΩ, 0.10%, +/-10PPM/DEGC, 0.0630W (ADP15193B, C, and D)		ERA-2AEB152X	Panasonic	1.5kΩ
13	1	Resistor, SMD (0402), 100kΩ, 0.10%, +/-25PPM/DEGK, 0.0630W	RUP	TNPW0402100KBE	Vishay	100kΩ
14	1	Resistor, SMD (0603), 0Ω	R_ZERO	RK73Z1JT	Koa Speer	0Ω

ORDERING INFORMATION

Table 7. Bill of Materials[1] (Continued)

Item	Quantity	Description	Reference Designtor	Part Number	Manufacturer	Value
15	1	Transient voltage suppressor diode 7.5VWM 12.9VC SOD128	TVS	PTVS7V5P1UP,115	Nexperia	7.5V
16	4	Stand-off WA-SMSI SMD steel spacer	STD1, STD2, STD3, STD4	9774040360R	Würth Elektronik	9774040360R

[1] Parts may be substituted with equivalent parts.

ORDERING INFORMATION

NOTES

ESD Caution
ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.