Using the TPS53819AEVM-123 Wide Input Voltage, Eco-mode, Single Synchronous Step-Down Controller with PMBus™

The TPS53819AEVM-123 evaluation module (EVM) is designed to evaluate the TPS53819A. The TPS53819A is a small-size single-buck controller with adaptive on-time D-CAP2 mode control. It provides a fixed 1.2-V output at up to 25 A from a nominal 12-V input bus. This controller is an analog PWM controller allowing programming and monitoring via the PMBus interface. The TPS53819AEVM-123 also uses a 5 mm × 6 mm TI power block MOSFET (CSD87350Q5D) for high power density and superior thermal performance.

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1 Description

The TPS53819AEVM-123 is designed to use a regulated 12-V bus to produce a regulated 1.2-V output at up to 25 A of load current. The TPS53819AEVM-123 is designed to demonstrate the TPS53819A in a typical low voltage application while providing a number of test points to evaluate the performance of the TPS53819A.

1.1 Typical Applications

- Point of load systems
- Storage computer
- Server computer
- Multi-function printer
- Embedded computing

1.2 Features

- Regulated 1.2-V output, marginable and trimmable via the PMBus interface
- 25-A DC steady state output current
- D-CAP2™ more control supporting all ceramic output capacitors
- Programmable soft start via the PMBus interface
- Programmable enable function via the PMBus interface
- Fault report via the PMBus interface
- J2 for external enable function
- Supports pre-bias output voltage start-up
- High efficiency and high-power density by using a TI power block MOSFET
- Convenient test points for probing critical waveforms
- Cycle-by-cycle Valley Overcurrent Limit Protection

2 Electrical Performance Specifications

Table 1. TPS53819AEVM-123 Electrical Performance Specifications(1)

Parameter	Test Conditions	MIN	TYP	MAX	UNITS
INPUT CHARACTERISTICS					
Voltage range, V_{IN}		8	12	14	V
Maximum input current	V_{IN} = 8 V, I_{OUT} = 25 A		4.3		A
No load input current	V_{IN} = 14 V, I_{OUT} = 0 A with auto skip mode		1		mA
OUTPUT CHARACTERISTICS					
Output voltage, V_{OUT}			1.2		V
Output load current, I_{OUT}		0		25	A
Output voltage regulation	Line Regulation: Input voltage = 8 V to 14 V		0.5%		
	Load Regulation: Output current = 0 A to 25 A		0.5%		
Output voltage ripple	V_{IN} = 12 V I_{OUT} = 25 A		10		mVpp
Output over current	IOUT_OC Fault Flag Asserted	25			A
SYSTEMS CHARACTERISTICS					
Switching frequency			425		kHz
Peak efficiency	V_{IN} = 12 V, I_{OUT} = 10 A		91.0%		
Full load efficiency	V_{IN} = 12 V, I_{OUT} = 25 A		87.9%		
Loop bandwidth	V_{IN} = 12 V, I_{OUT} = 25 A		111		kHz
Phase margin	V_{IN} = 12 V, I_{OUT} = 25 A		91.4		º
Operating temperature			25		ºC

(1) This design uses TI Default PMBus settings

3 Schematic

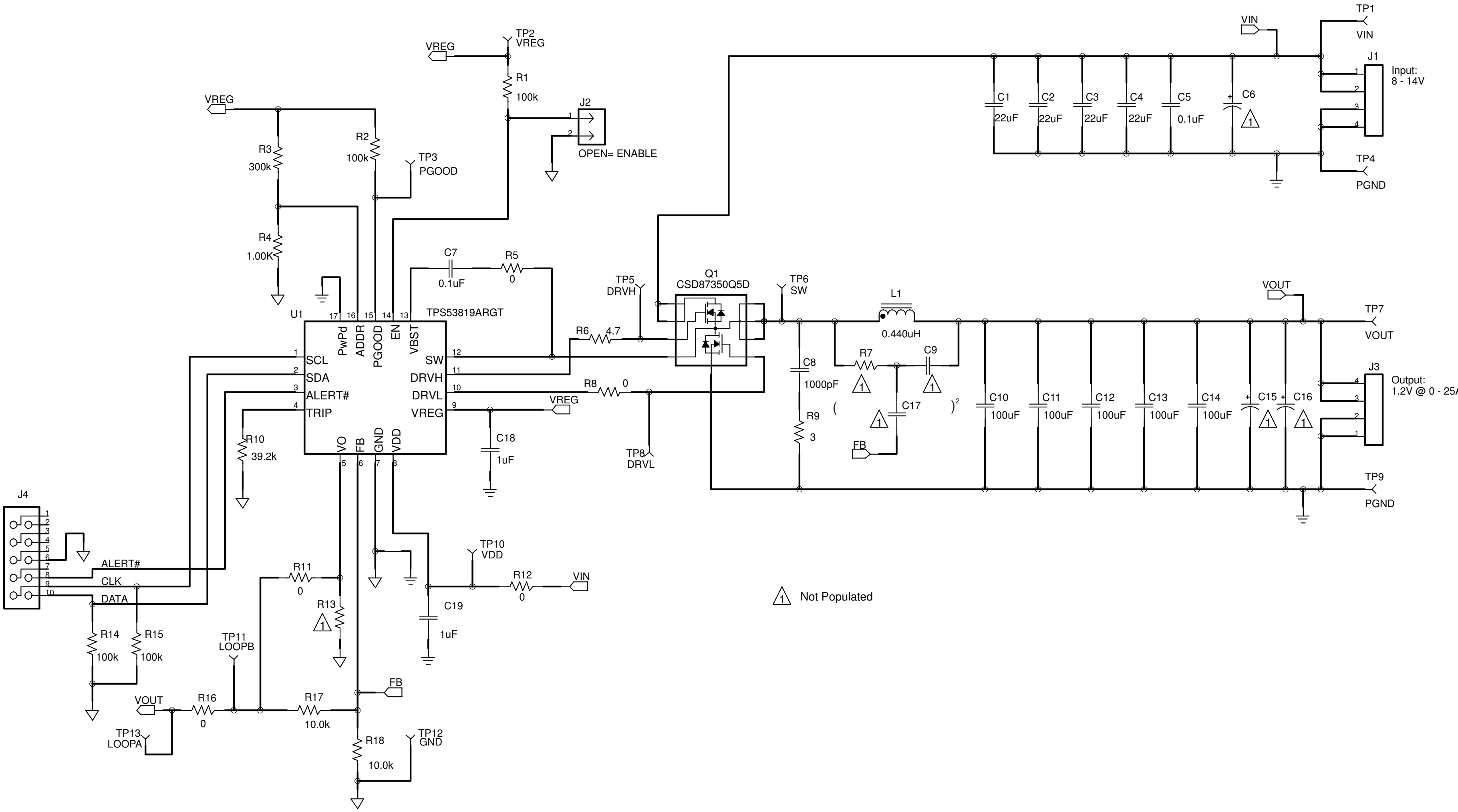


Figure 1. TPS53819AEVM-123 Schematic

4 Test Setup

4.1 Test and Configuration Software

In order to change any of the default configuration parameters on the EVM, it is necessary to obtain the TI Fusion Digital Power Designer software.

4.1.1 Description

Fusion Digital Power Designer is the Graphical User Interface (GUI) used to configure and monitor Texas Instrument's (TI) TPS53819A power controller on this evaluation module (EVM). The application uses the PMBus protocol to communicate with the controller over serial bus by way of a TI USB Interface Adapter EVM included.

4.1.2 Features

Some of the tasks performed with the GUI include:

- Turn on or off the power supply output, either through the hardware control line or the PMBus operation command.
- Configure common operating characteristics such as V_{OUT}, switching frequency, soft start time and more.
- Monitor status and warnings or fault conditions real-time.

The software is available for download at this location:
http://focus.ti.com/docs/toolsw/folders/print/fusion_digital_power_designer.html

4.2 Test Equipment

Voltage Source: The input voltage source V_{IN} should be a 0–14-V variable DC source capable of supplying 30 Adc. Connect VIN to J4 as shown in Figure 3.

Multimeters:

- **V1:** VIN at TP1 (VIN) to TP4 (PGND)
- **V2:** VOUT at TP7 (VOUT) to TP9 (PGND)
- **A1:** VIN input current

Output Load: The output load should be an electronic constant-resistance mode load capable of 0 Adc to 25 Adc at 1.2 V. An electronic constant-current load is also acceptable.

Oscilloscope: A digital or analog oscilloscope can be used to measure the output ripple. The oscilloscope must be set for 1-MΩ impedance, 20-MHz bandwidth, AC coupling, 2-µs per division horizontal resolution, 20-mV per division vertical resolution. As shown in Figure 2, test points TP7 and TP9 can be used to measure the output ripple voltage by placing the oscilloscope probe tip through TP7 and holding the ground barrel to TP9. It is not recommended to use a long leaded ground connection because this may induce additional noise due to a large ground loop. Alternatively the output ripple can be measured directly across C14 with a short ground lead as shown in Figure 3. To measure other waveforms, adjust the oscilloscope as needed.

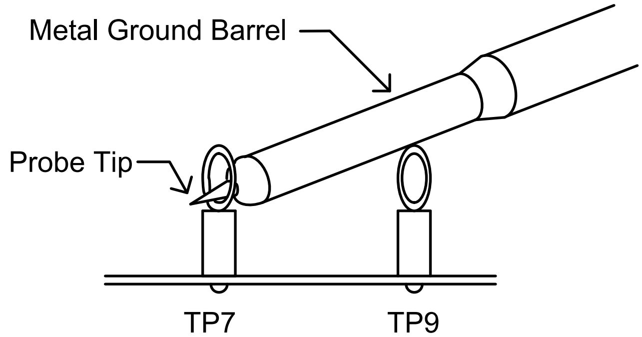


Figure 2. Tip and Barrel Measurement for V_{OUT} Ripple

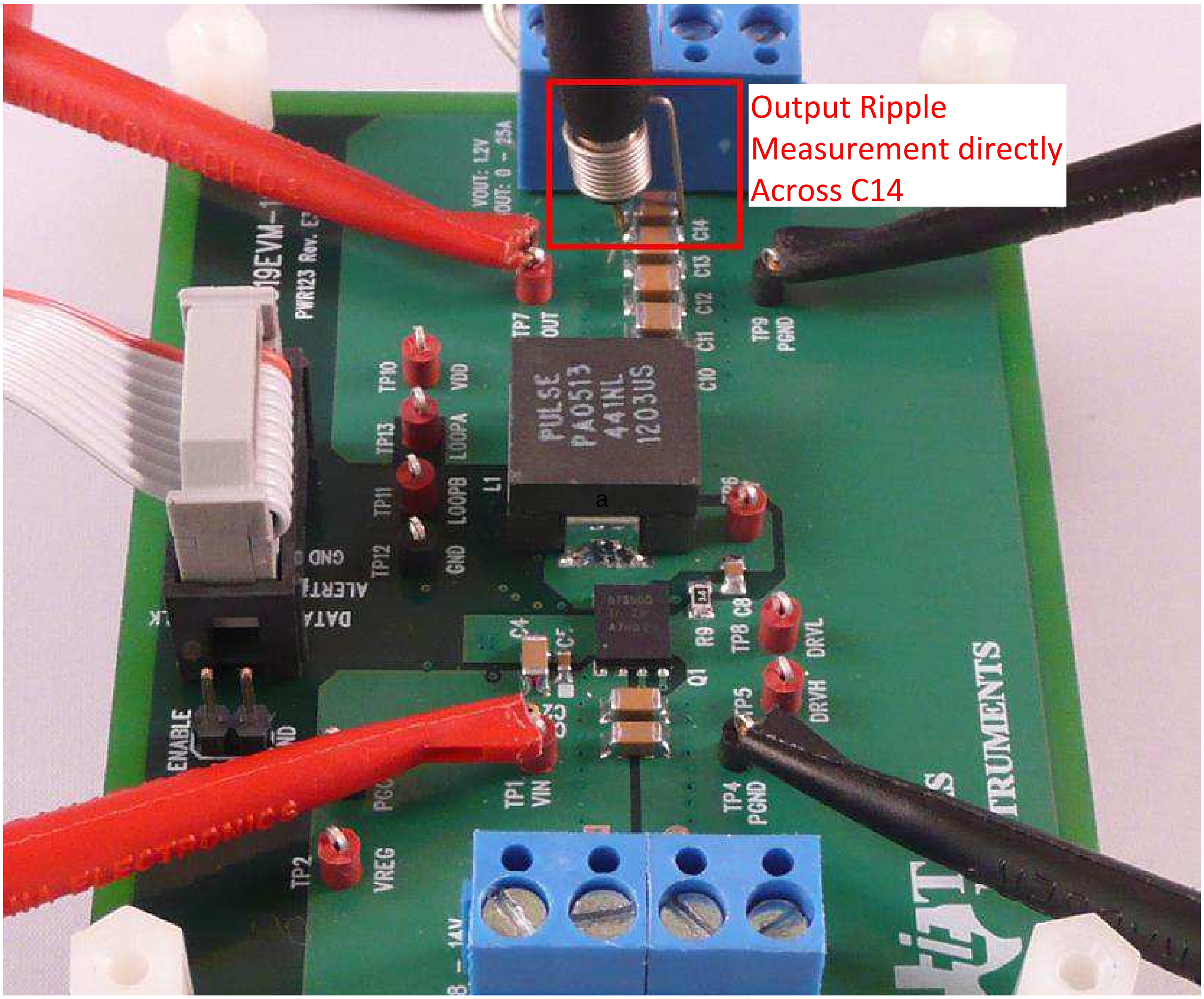


Figure 3. Probe with Short Ground Lead for V_{OUT} Ripple Across C14

Fan: Some of this EVM's components may approach temperatures of 60°C during operation. A small fan capable of 200–400 LFM is recommended to reduce component temperatures while the EVM is operating. Exercise caution when touching the EVM while the fan is not running and always exercise caution when touching any circuits that may be live or energized.

Recommended Wire Gauge:

- **V_{IN} to J1 (12-V input):** The recommended wire size is 1 × AWG #14 per input connection, with the total length of wire less than 4 feet (2 feet input, 2 feet return).
- **J3 to LOAD:** The minimum recommended wire size is 2 × AWG #14, with the total length of wire less than 4 feet (2 feet input, 2 feet return).

4.3 Recommended Test Setup

Figure 4 is the recommended test set up to evaluate the TPS53819AEVM-123. Working at an ESD workstation, make sure that any wrist straps, bootstraps or mats are connected referencing the user to earth ground before power is applied to the EVM.

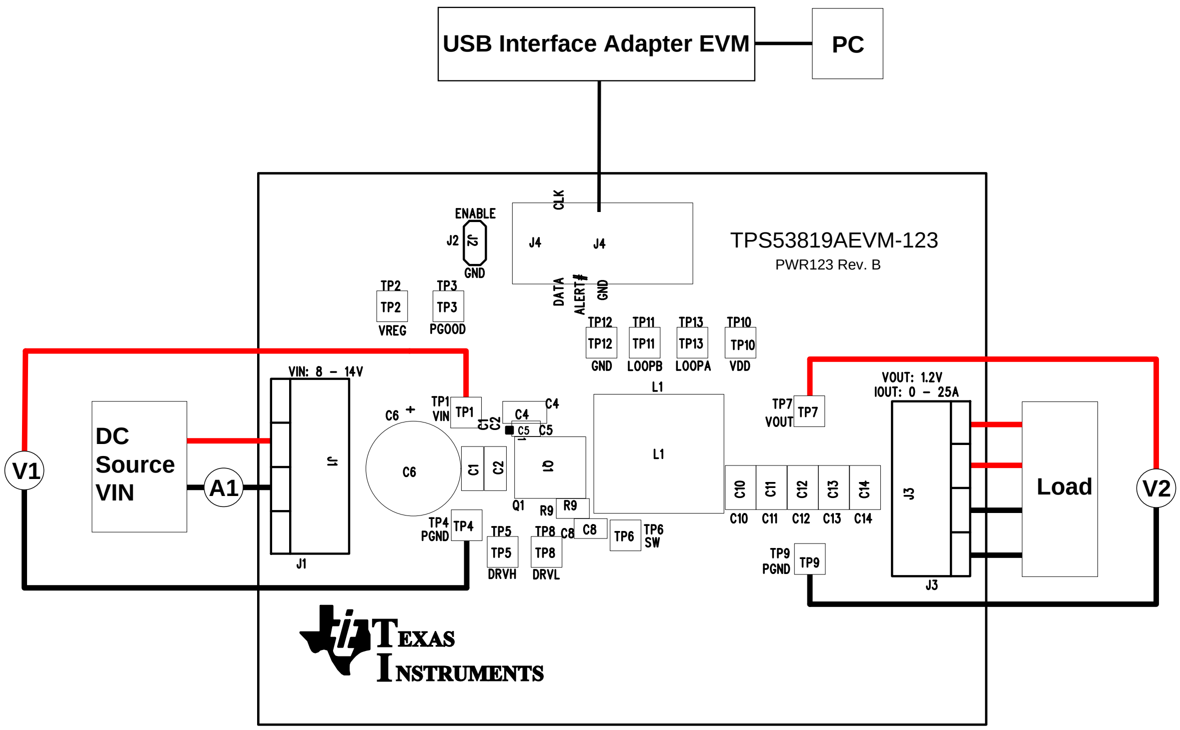


Figure 4. TPS53819AEVM-123 Recommended Test Set Up

4.3.1 Input Connections

1. Prior to connecting the DC input source V_{IN}, it is advisable to limit the source current from V_{IN} to 10-A maximum. Make sure V_{IN} is initially set to 0 V and connected to J1 as shown in Figure 4.
2. Connect a voltmeter V1 at TP1 and TP4 to measure the input voltage.
3. Connect a current meter to A1 to measure the input current.

4.3.2 Output Connections

1. Connect Load to J3 and set Load to constant resistance mode to sink 0 Adc before V_{IN} is applied.
2. Connect a voltmeter V2 at TP7 and TP9 to measure the output voltage.

4.3.3 Other Connections

1. When using a fan, ensure air is flowing across the EVM.
2. Connect the ribbon cable from the USB interface adapter to J4.

4.4 List of Test Points

Table 2. The Functions of Each Test Points

Test Points	Name	Description
TP1	VIN	Input voltage
TP2	VREG	5-V LDO output
TP3	PGOOD	Power good
TP4	PGND	GND reference for V_{IN}
TP5	DRVH	High-side driver output
TP6	SW	Switching node
TP7	VOUT	Output voltage
TP8	DRVL	Low-side driver output
TP9	PGND	GND reference for VOUT
TP10	VDD	Controller power-supply input
TP11	LOOPB	Input B for loop injection
TP12	GND	GND for sensitive analog circuitry
TP13	LOOPA	Input A for loop injection

4.5 Jumper Configuration: Enable Selection

The controller can be enabled and disabled by J3.

Default setting: No Jumper shorts on J3 to Enable the controller.

Table 3. Enable Selection

Jumper Position	Enable Selection
Jumper shorts on J3	Disable the controller
No jumper shorts on J3	Enable the controller

5 EVM Configuration Using the Fusion GUI

In order to configure the TPS53819A controller on the EVM from its default values, it is required to use the TI Fusion Digital Power Designer software. It is necessary to have input voltage applied to the EVM prior to launching the software so the TPS53819A may respond to the GUI and the GUI can recognize the TPS53819A. At least 4.25 V must be applied to the V_{DD} pin to overcome the default UVLO setting.

5.1 Configuration Procedure

1. Adjust the input supply to provide at least 4.25 V.
2. Apply the input voltage to the EVM. Refer to Figure 4 for connections and test setup.
3. Launch the Fusion GUI software. If prompted, select GUI scan mode to *DEVICE_CODE* only. Refer to Figure 5 for changing device scanning options. The software will recognize the TPS53819A device on the EVM and load the GUI.
4. Configure the EVM operating parameters as needed.

CAUTION

Some parameters can be configured, such as switching frequency, to values that can result in erratic or unexpected behavior on this EVM. Consult the TPS53819A datasheet for guidance in configuration of parameters and impact on component selection.

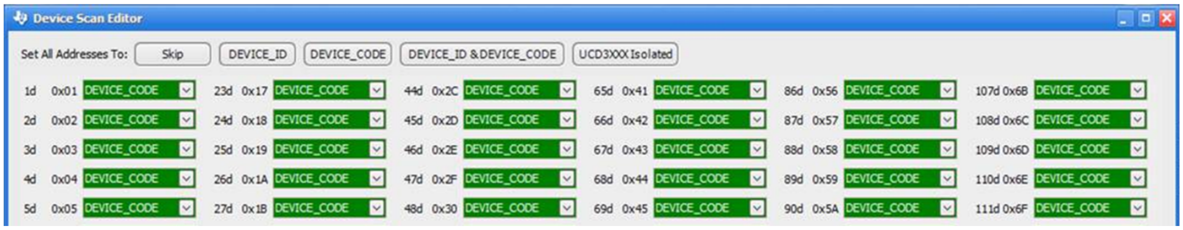


Figure 5. Selection of Device Scan Options

5.2 *Default Fusion GUI Screenshots and Description*

Figure 6 is a screenshot of the *General* tab of the Fusion GUI with default configuration where the general configuration parameters can be set. After modifying a parameter the **Write to Hardware** button must be clicked to apply it. When power cycling all parameters reset to the values stored in flash. To change the values stored in flash, click the **Store RAM to Flash** button. Figure 7 is a screenshot of the *All Config* tab where all accessible registers are viewed. Figure 8 is a screenshot of the Status screen selected on the bottom-left corner. The USB adapter settings are found in the File menu of the Digital Fusion GUI.

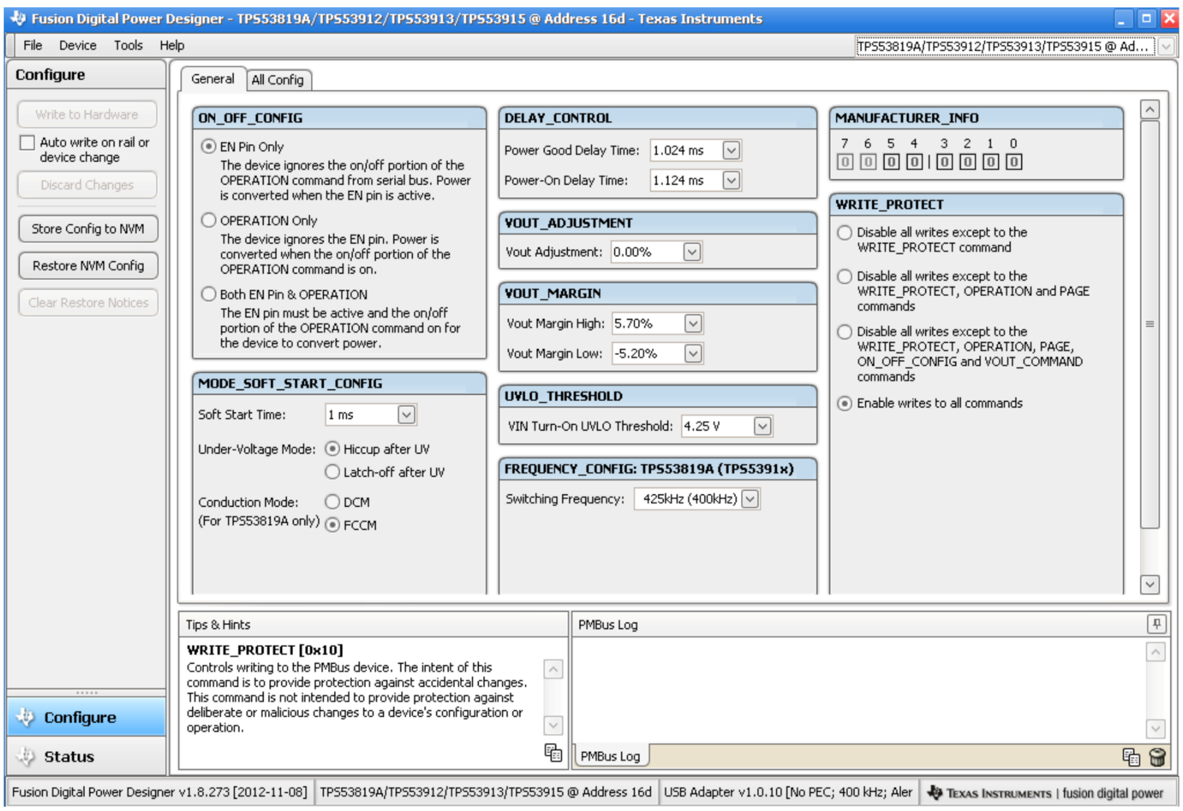


Figure 6. TPS53819A GUI Configure General Tab

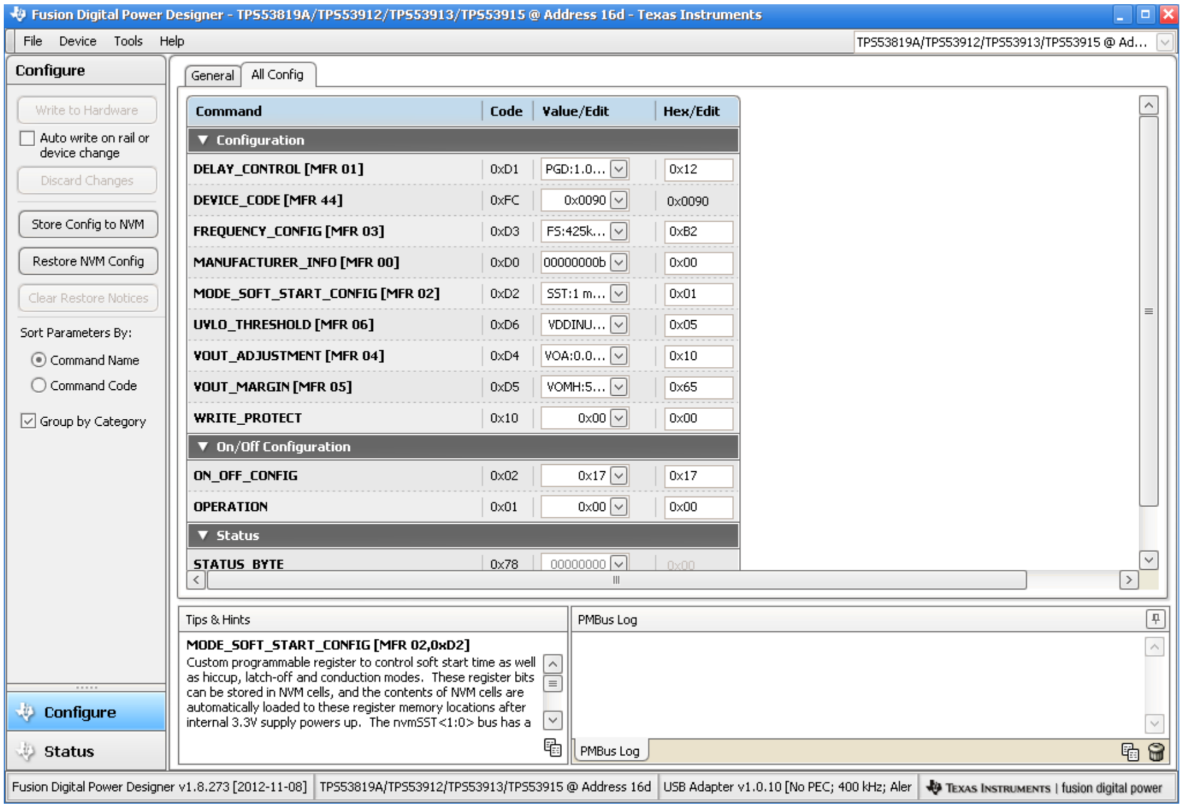


Figure 7. TPS53819A GUI Configure, All Config Tab

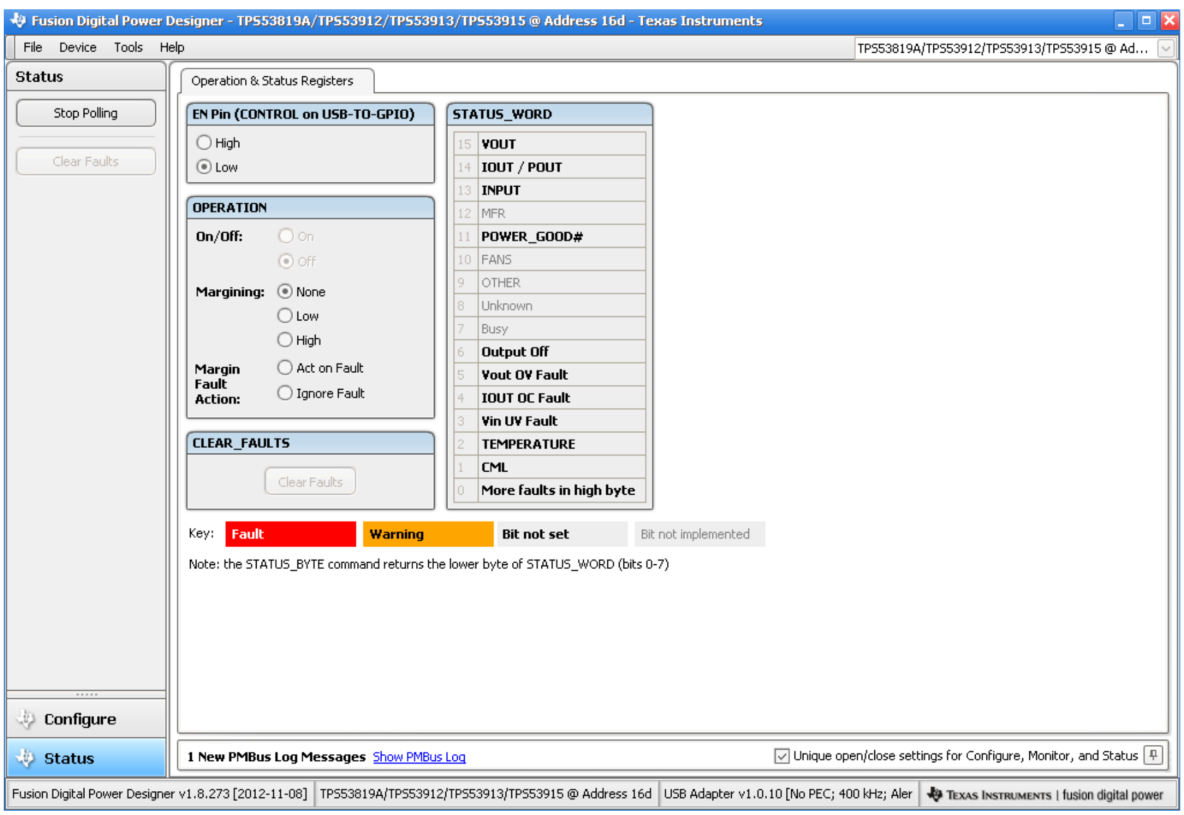


Figure 8. TPS53819A GUI Status

6 Test Procedure

6.1 Line and Load Regulation and Efficiency Measurement Procedure

1. Set up EVM as described in Section 4 and Figure 4.
2. Ensure Load is set to constant resistance mode and to sink 0 Adc
3. Ensure the jumper provided in the EVM shorts on J2 before V_{IN} is applied.
4. Increase VIN from 0 V to 12 V, using V1 to measure input voltage.
5. Remove the jumper on J3 to enable the controller.
6. Use V2 to measure V_{OUT} voltage.
7. Vary Load from 0 to 25 Adc, V_{OUT} should remain in load regulation.
8. Vary V_{IN} from 8 V to 14 V, V_{OUT} should remain in line regulation.
9. Put the jumper on J3 to disable the controller.
10. Decrease Load to 0 A.
11. Decrease V_{IN} to 0 V.

6.2 Control Loop Gain and Phase Measurement Procedure

TPS53819AEVM-123 contains a place holder for a 10-Ω series resistor in the feedback loop for loop response analysis.

1. Replace R16 with a 10-Ω resistor.
2. Set up EVM as described in Section 4 and Figure 4.
3. Connect isolation transformer to test points marked TP13 and TP11.
4. Connect input signal amplitude measurement probe (Loop B) to TP11. Connect output signal amplitude measurement probe (Loop A) to TP13.
5. Connect ground lead of Loop A and Loop B to TP12.
6. Inject around 10 mV or less signal through the isolation transformer.
7. Sweep the frequency from 100 Hz to 1 MHz with 10 Hz or lower post filter. The control loop gain and phase margin can be measured.
8. Disconnect isolation transformer from bode plot test points before making other measurements (Signal injection into feedback may interfere with accuracy of other measurements).

6.3 Equipment Shutdown

1. Shut down Load
2. Shut down V_{IN}
3. Shut down fan

7 Performance Data and Typical Characteristic Curves

Figure 9 through Figure 12 present typical performance curves for TPS53819AEVM-123.

7.1 Efficiency

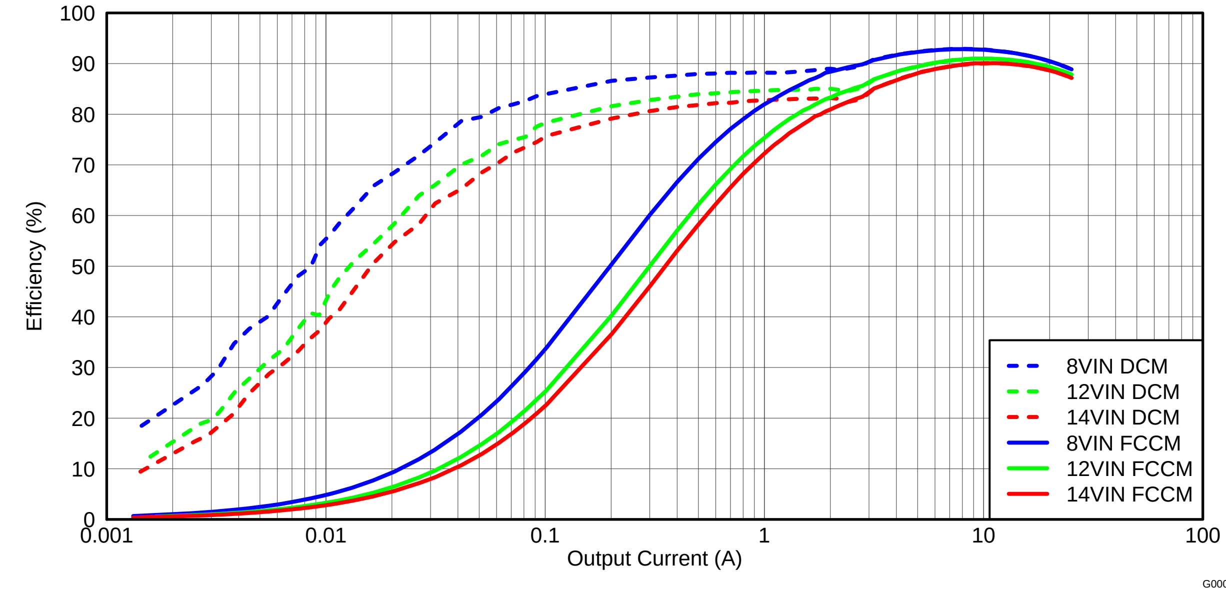


Figure 9. TPS53819AEVM-123 Efficiency

7.2 Load Regulation

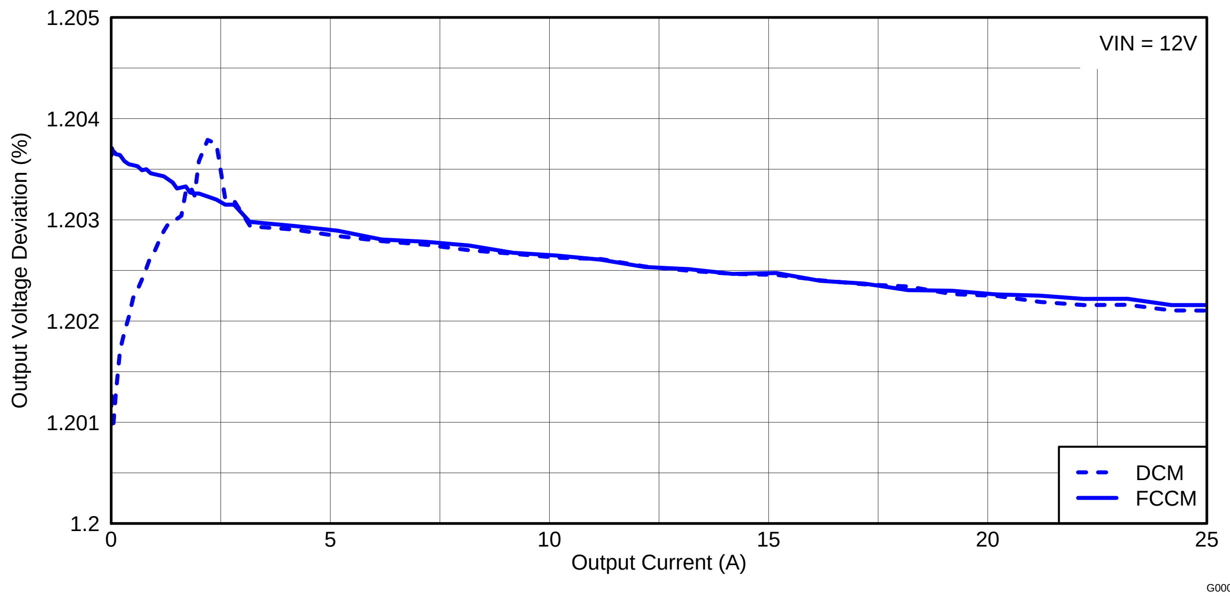


Figure 10. TPS53819AEVM-123 Load Regulation

7.3 Line Regulation

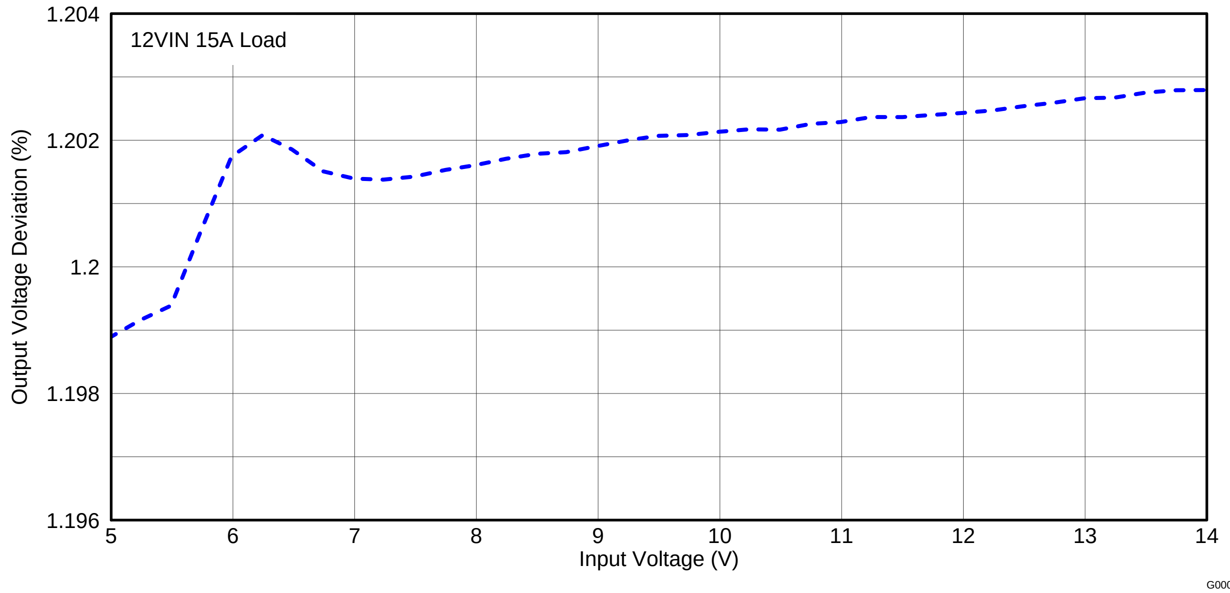


Figure 11. TPS53819AEVM-123 Line Regulation

7.4 f_{SW} Versus Load

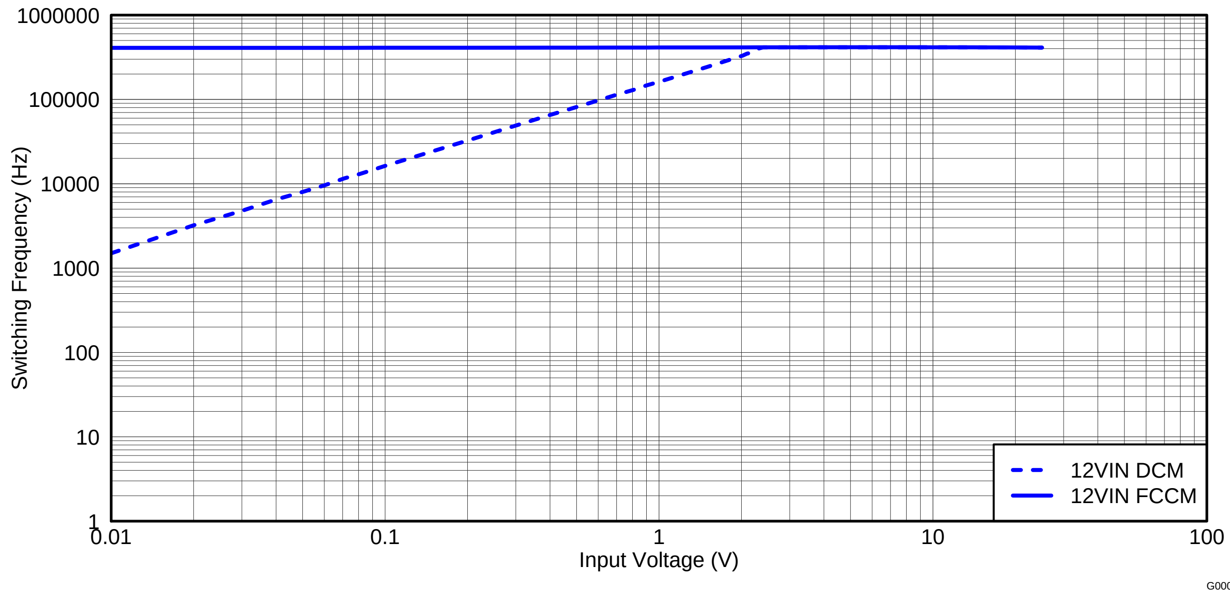


Figure 12. TPS53819AEVM-123 f_{SW} Versus Load

7.5 Bode Plot

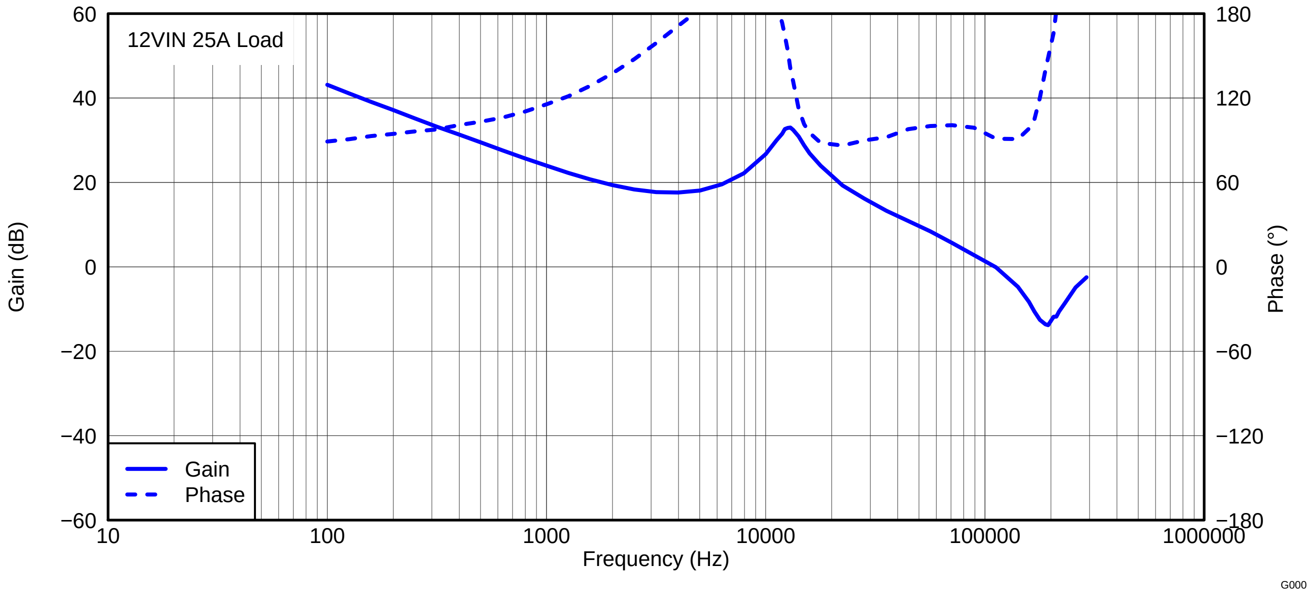


Figure 13. TPS53819AEVM-123 Loop Response Gain and Phase

7.6 Transient Response

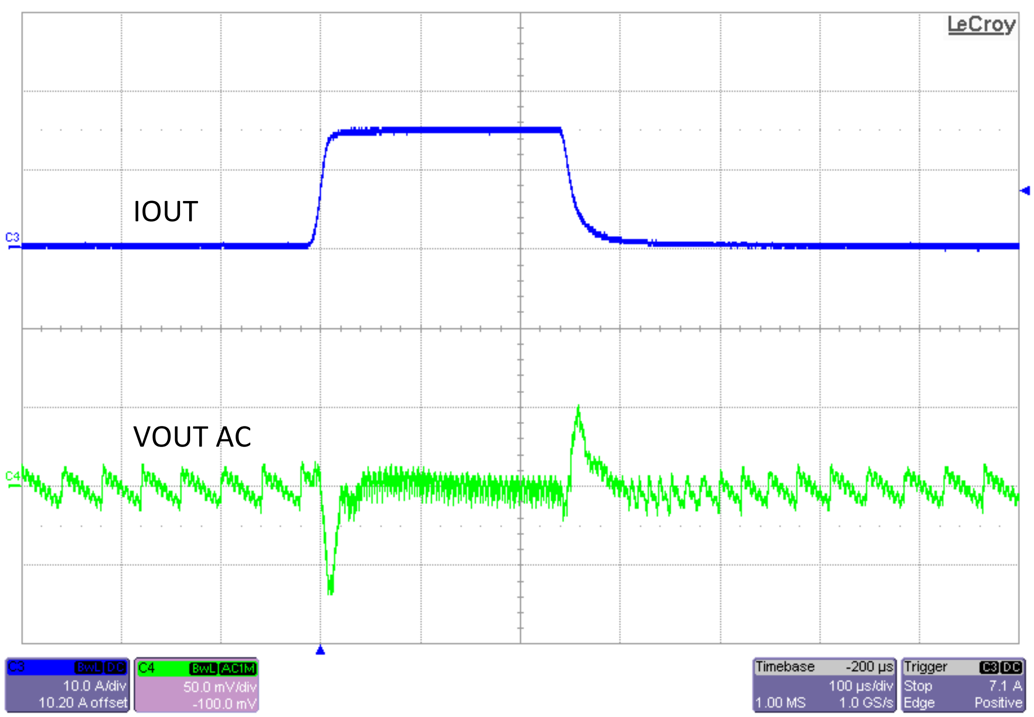


Figure 14. TPS53819AEVM-123 Load Transient, 12 V_{IN}, 0–15-A Eco-mode

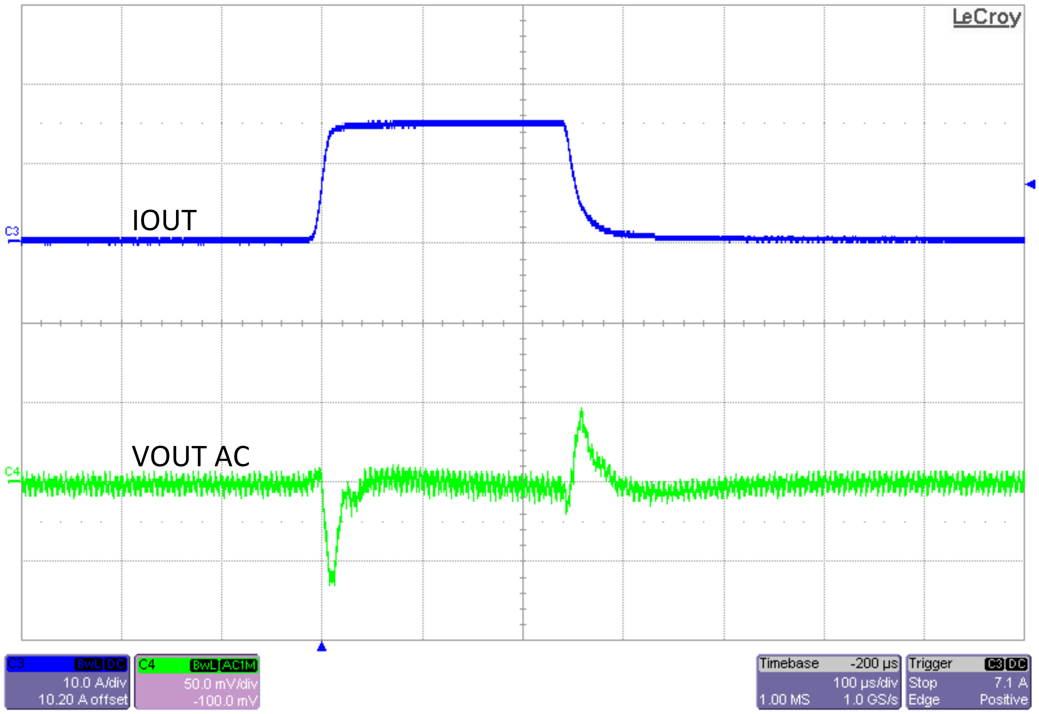


Figure 15. TPS53819AEVM-123 Load Transient, 12 V_{IN}, 0–15-A FCCM

7.7 Output Ripple

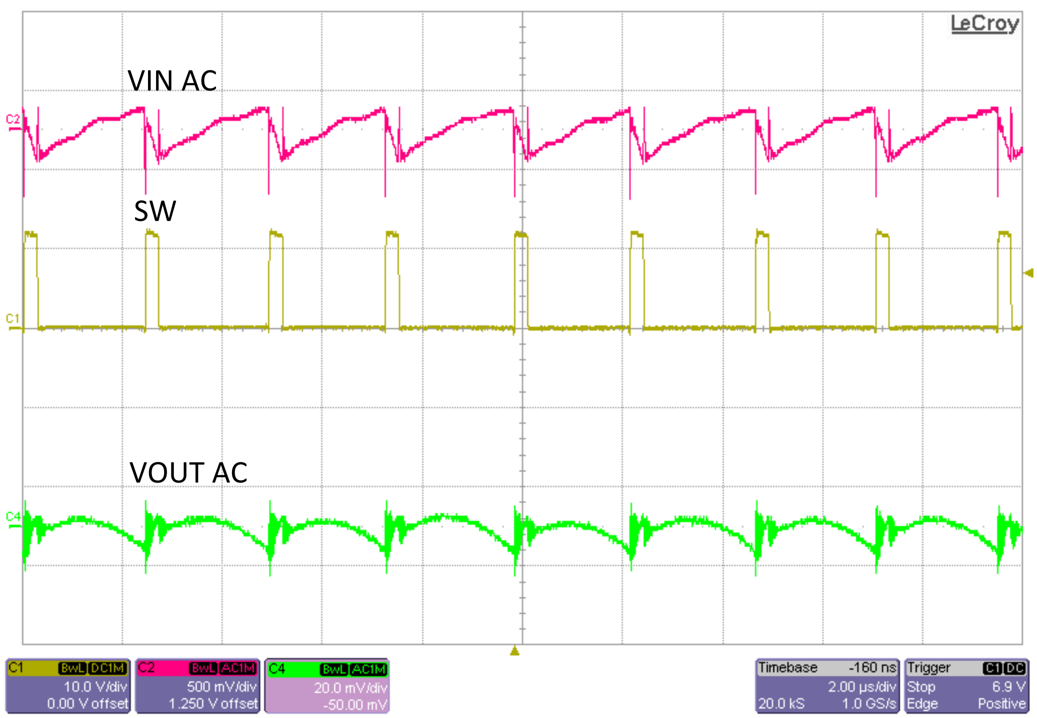


Figure 16. TPS53819AEVM-123 Output Ripple, 12 V_{IN}, 25 A

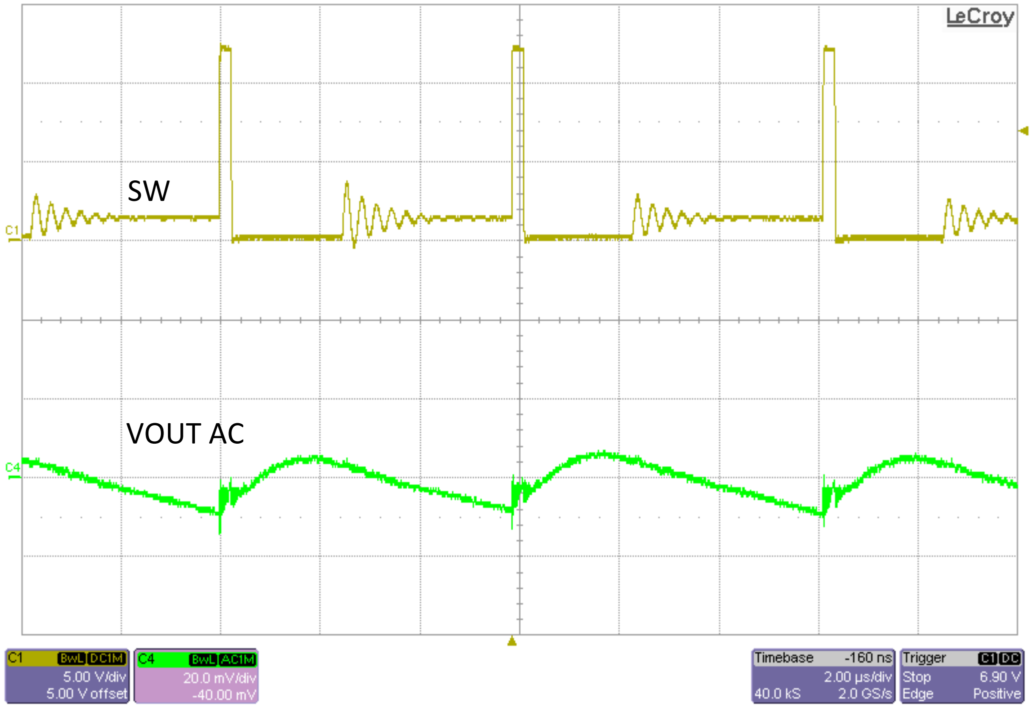


Figure 17. TPS53819AEVM-123 Output Ripple, 12 V_{IN}, 1-A Load Eco-mode

7.8 Switching Node

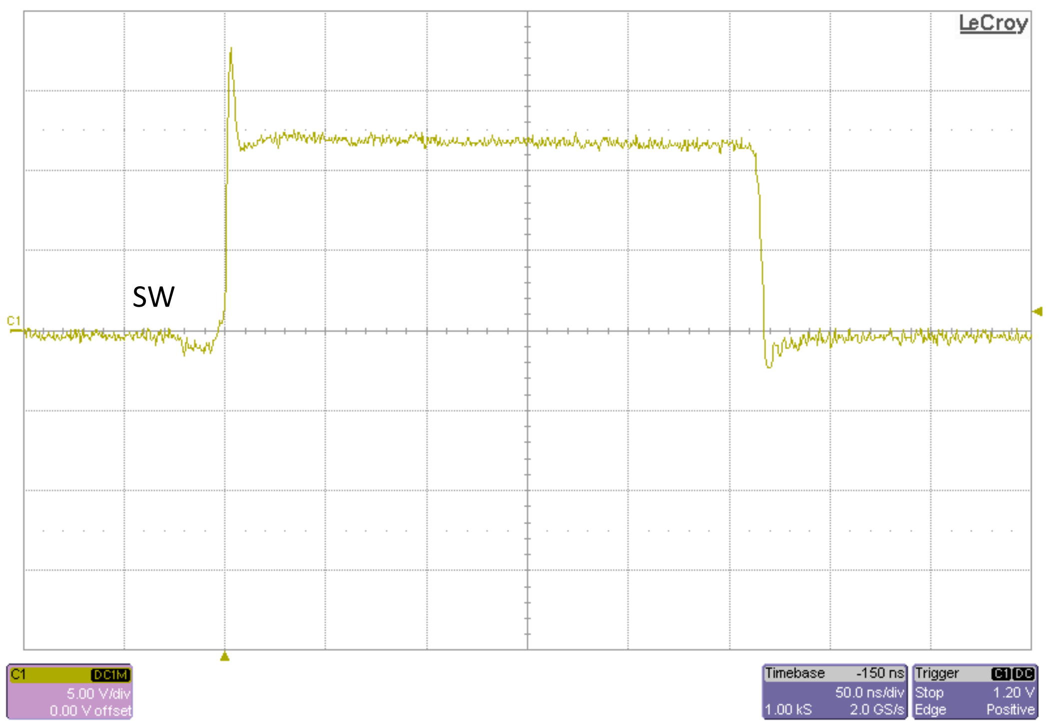


Figure 18. TPS53819AEVM-123 Switching Node, 12-V_{IN}, 25-A Load Full Bandwidth

7.9 Turn On Waveform

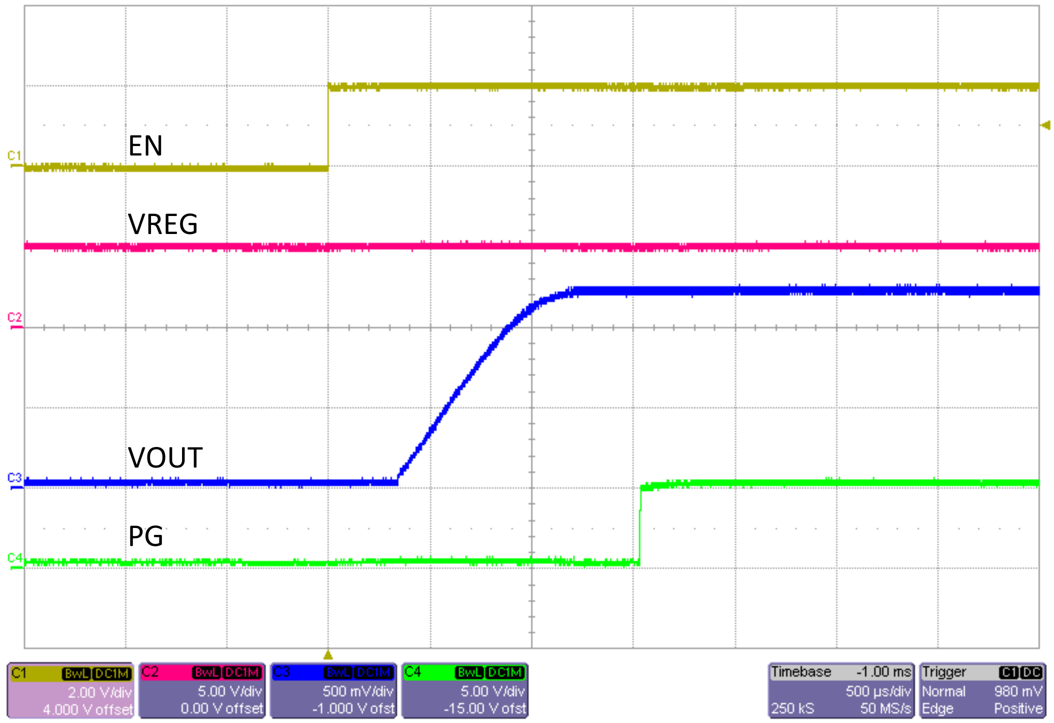


Figure 19. TPS53819AEVM-123 Enable Turn on Waveform, 12-V_{IN}, 1-Ω Load

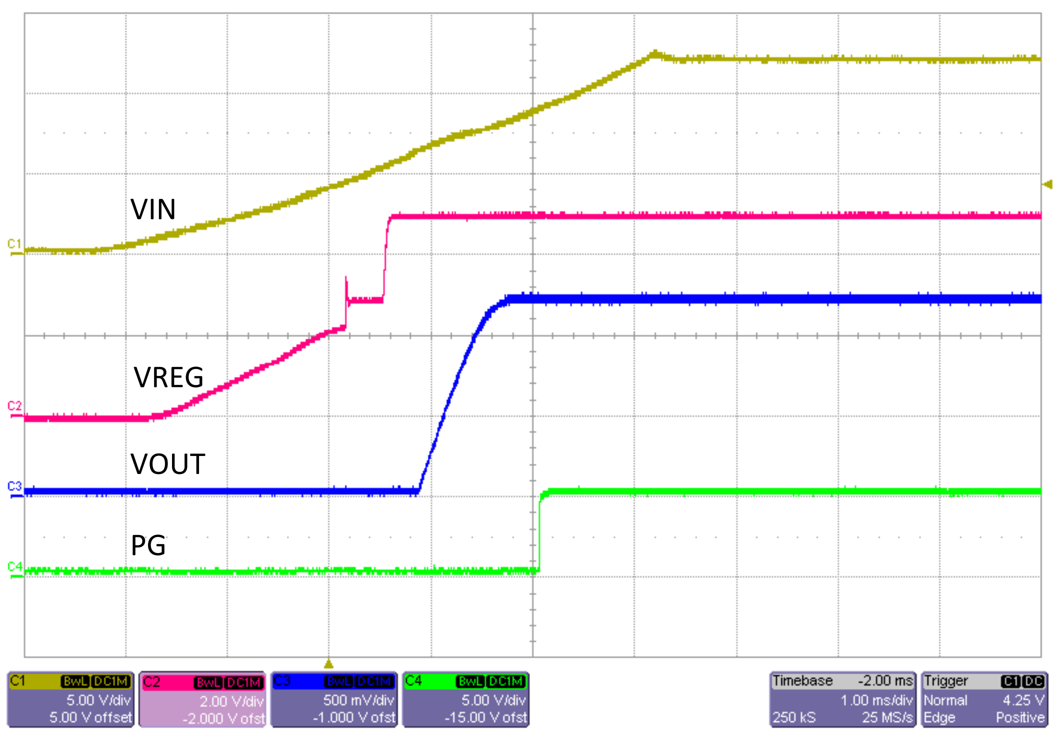


Figure 20. TPS53819AEVM-123 V_{IN} Turn on Waveform, 12-V_{IN}, 1-Ω Load

7.10 Turn Off Waveform

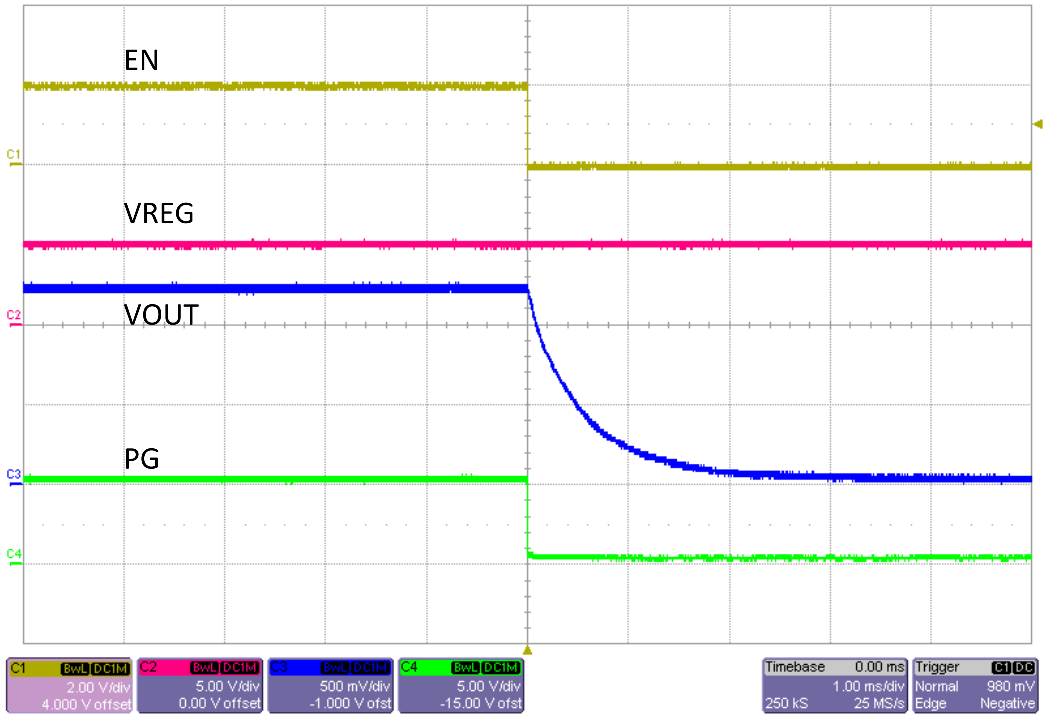


Figure 21. TPS53819AEVM-123 Enable Turn off Waveform, 12 V_{IN}, 1-Ω Load

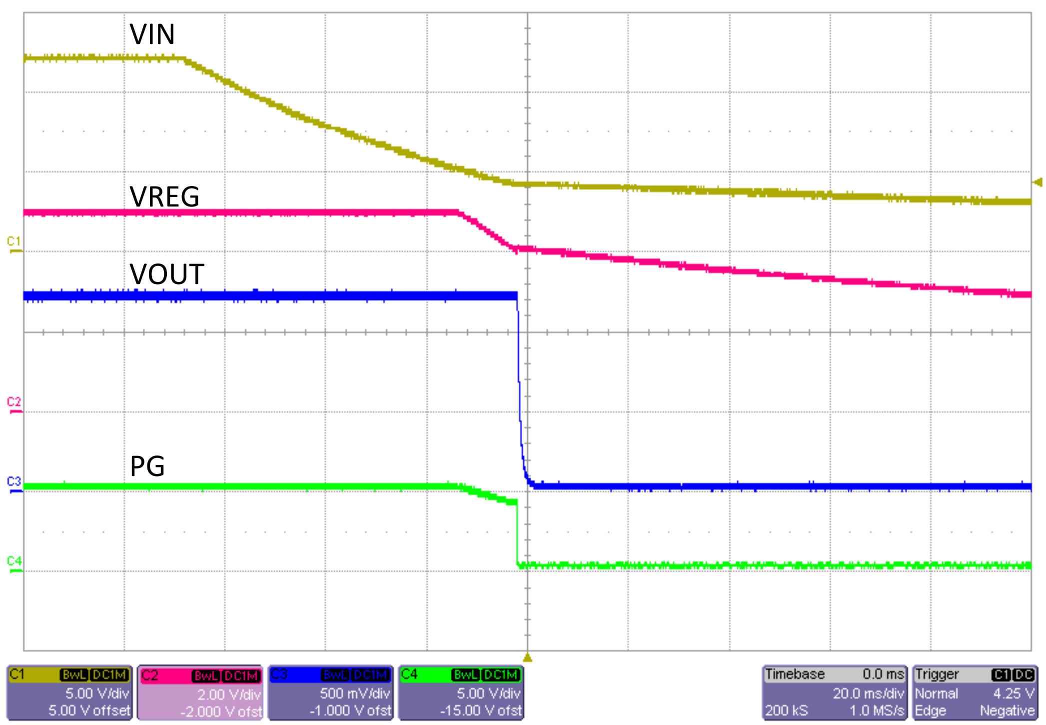


Figure 22. TPS53819AEVM-123 V_{IN} Turn off Waveform, 12 V_{IN}, 1-Ω Load

7.11 Pre-bias Turn On Waveform

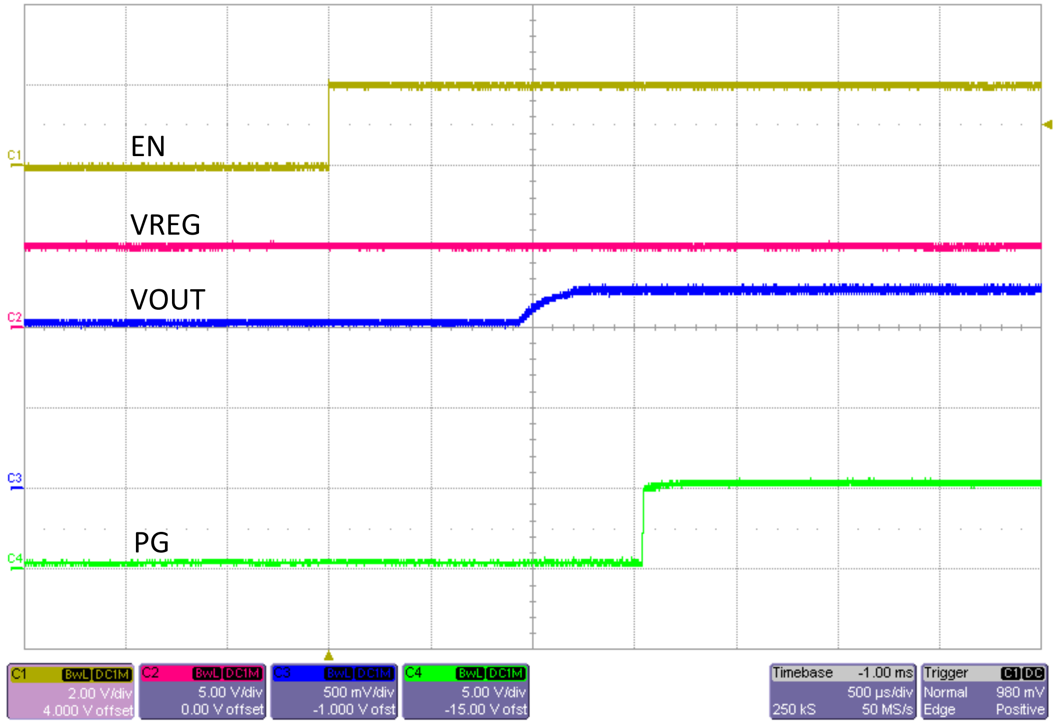
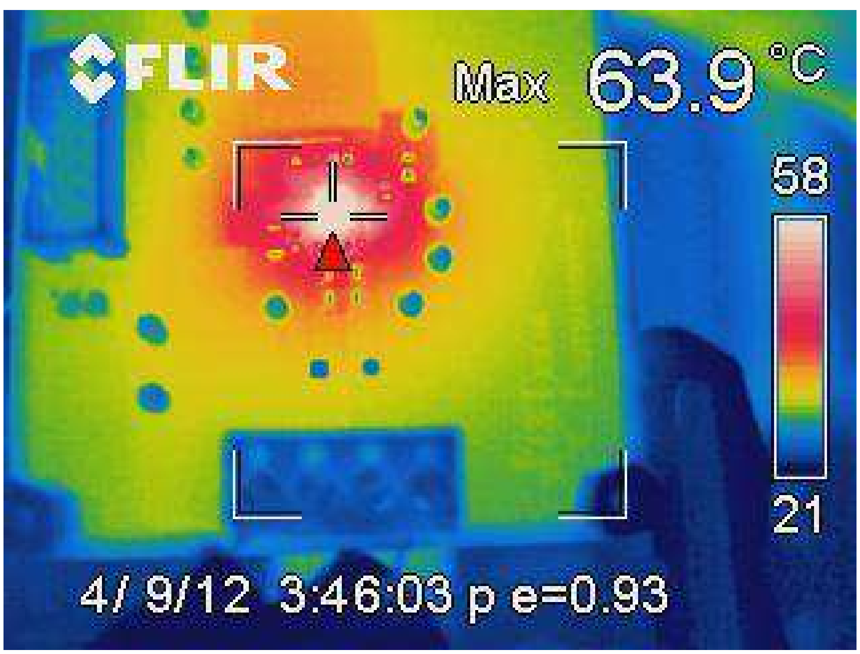


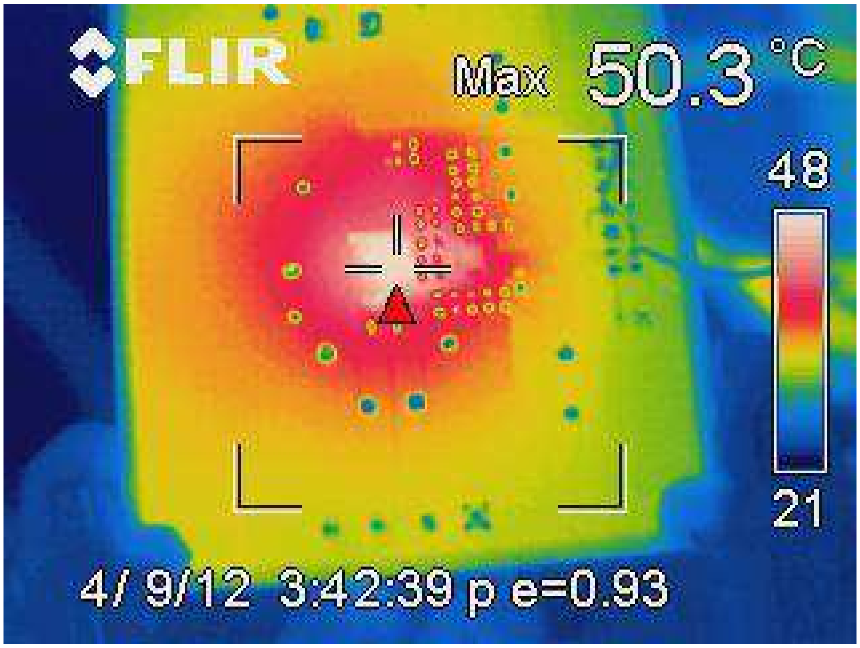
Figure 23. TPS53819AEVM-123 Enable Turn on waveform, 12 V_{IN}, 1-Ω Load, 1-V Pre-bias

7.12 Thermal Images



NOTE: Hottest point is the CSD87350Q5D

Figure 24. TPS53819AEVM-123 Top Board, 12 V_{IN}, 25-A Fan



NOTE: Hottest point is below the CSD87350Q5D

Figure 25. TPS53819AEVM-123 Bottom Board, 12 V_{IN}, 25-A Fan

8 EVM Assembly Drawing and PCB layout

Figure 26 through Figure 33 show the design of the TPS53819AEVM-123 printed-circuit board (PCB). The EVM has been designed using 6 layers, 2-oz copper circuit board.

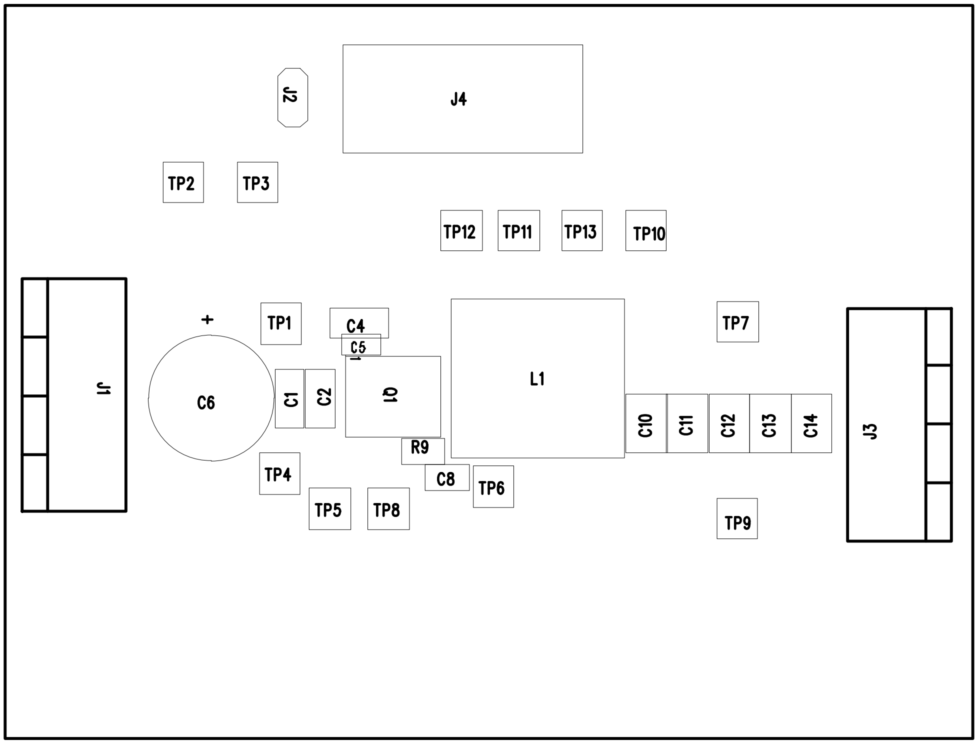


Figure 26. TPS53819AEVM-123 Top Layer Assembly Drawing (Top view)

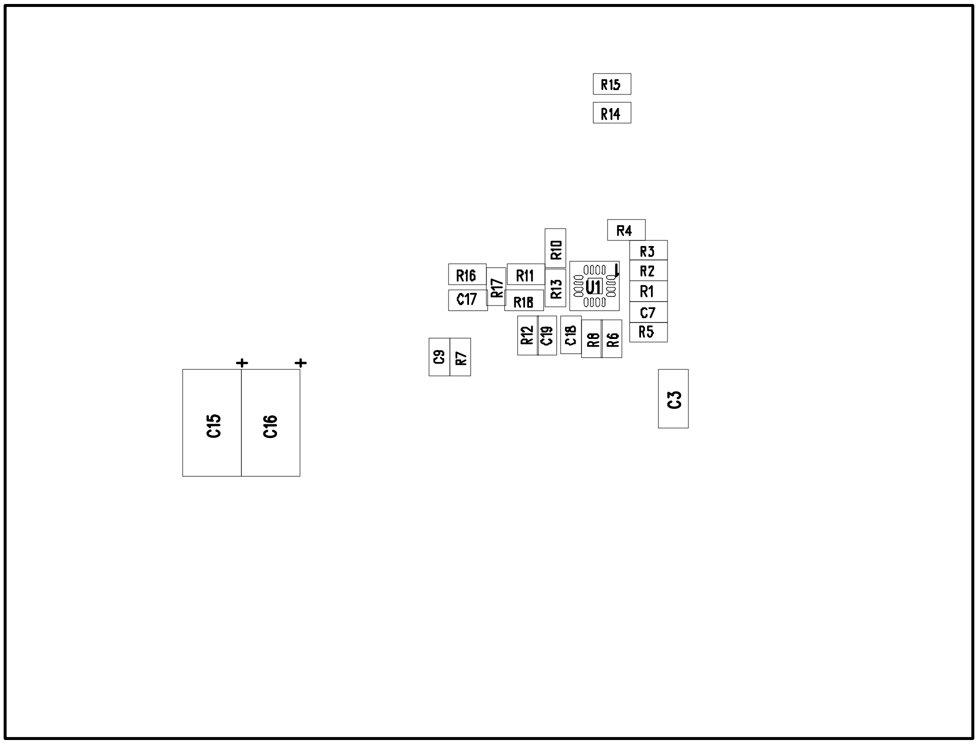


Figure 27. TPS53819AEVM-123 Bottom Layer Assembly Drawing (Bottom view)

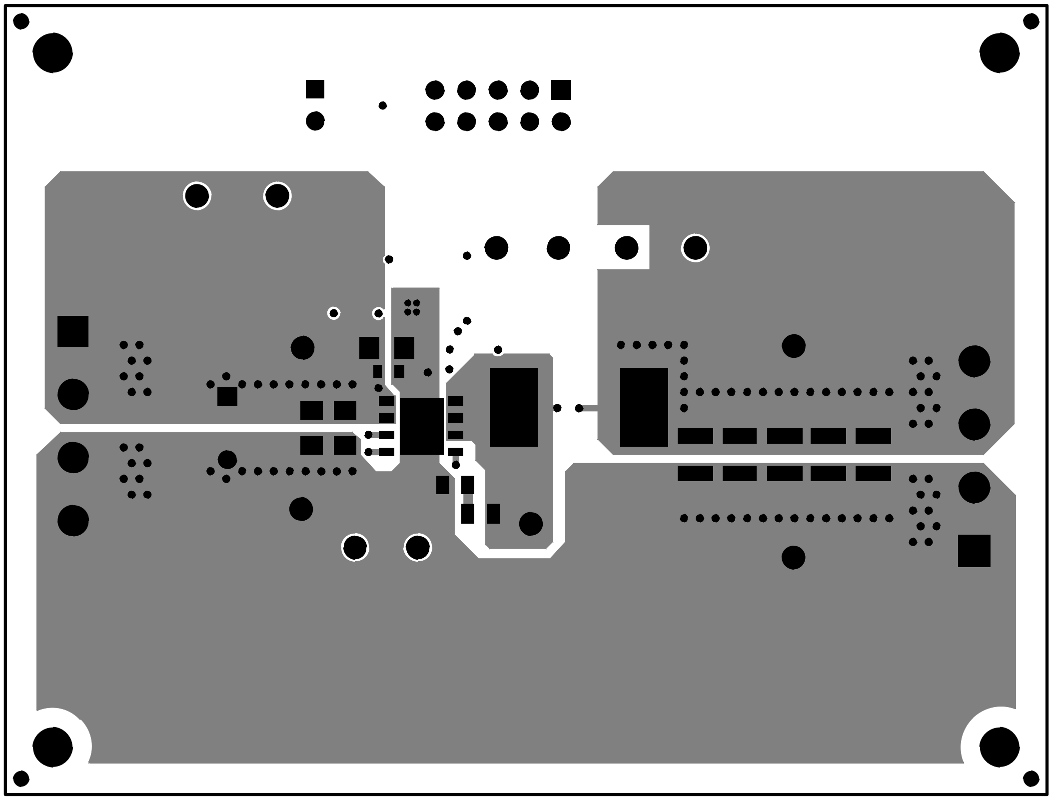


Figure 28. TPS53819AEVM-123 Top Copper (Top view)

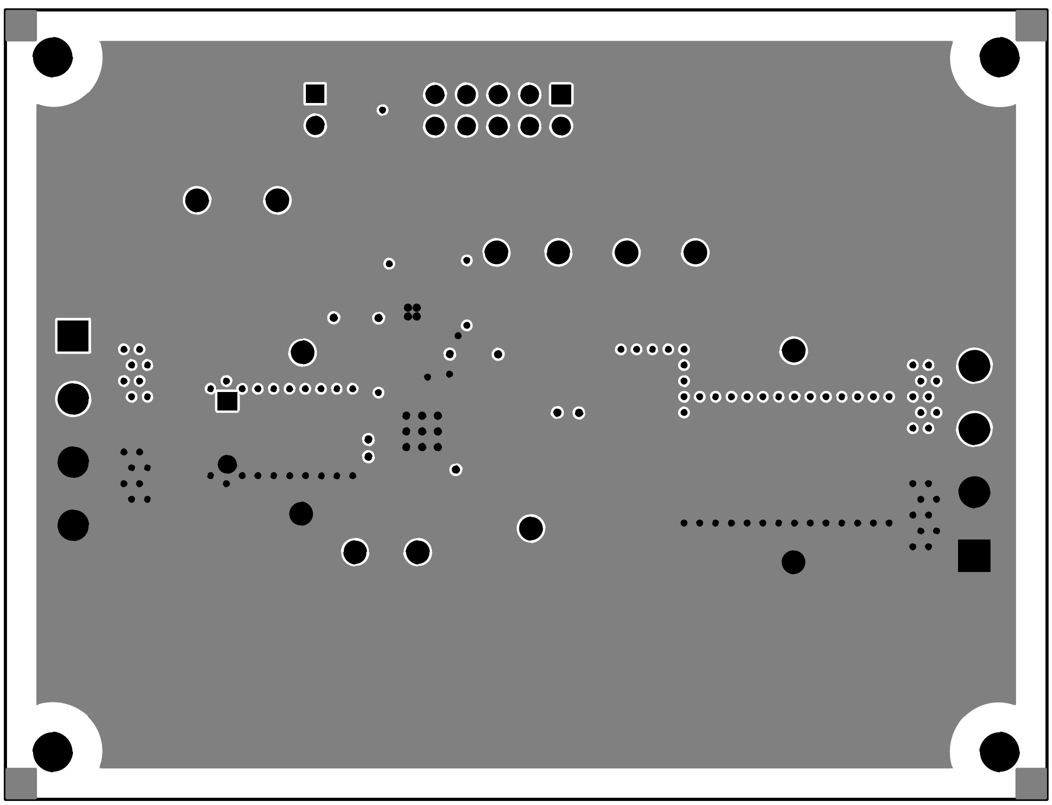


Figure 29. TPS53819AEVM-123 Internal Layer 1 (Top view)

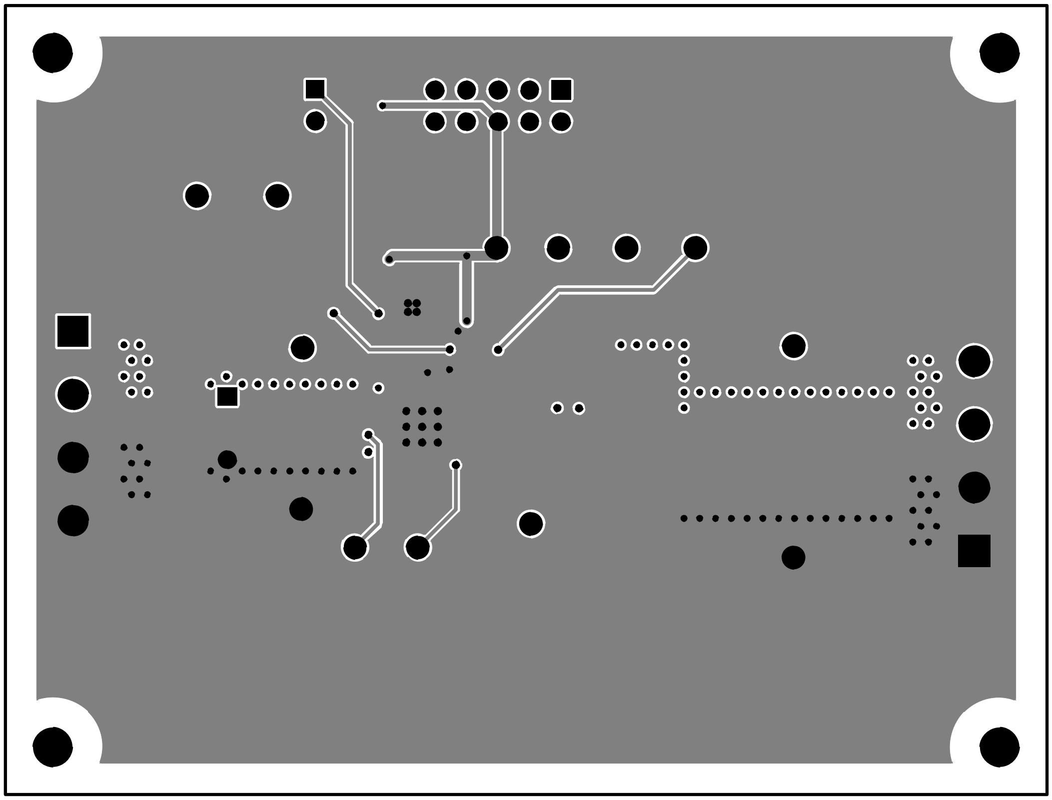


Figure 30. TPS53819AEVM-123 Internal Layer 3 (Top view)

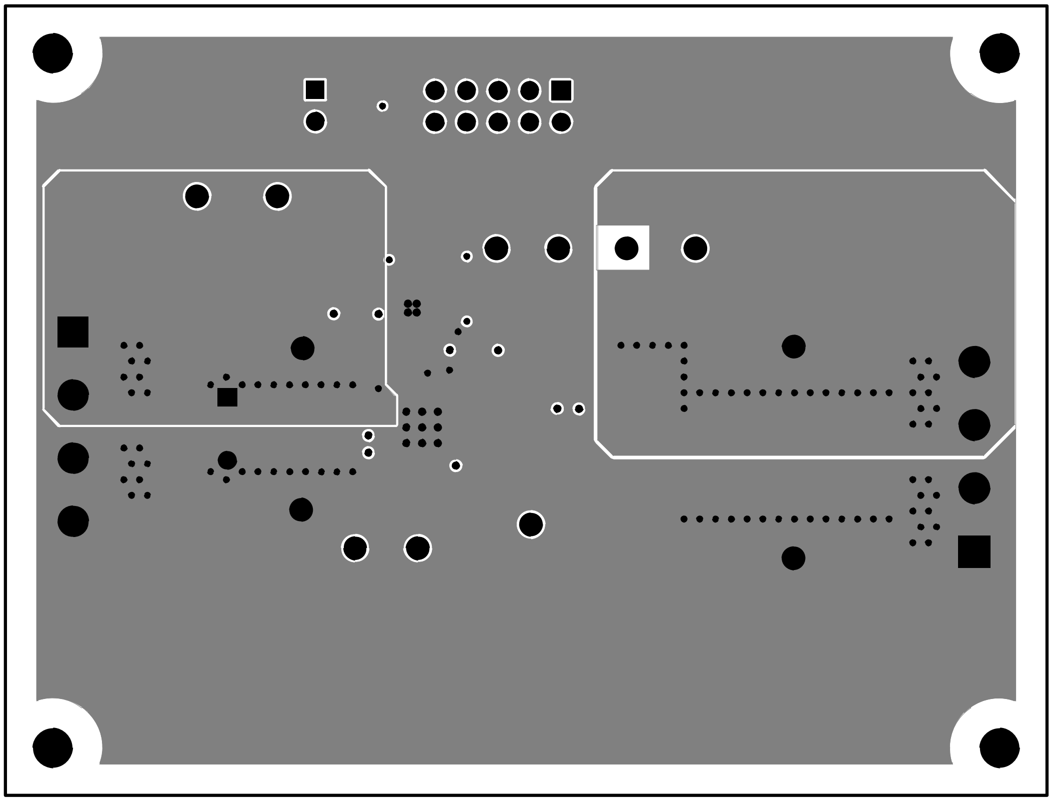


Figure 31. TPS53819AEVM-123 Internal Layer 4 (Top view)

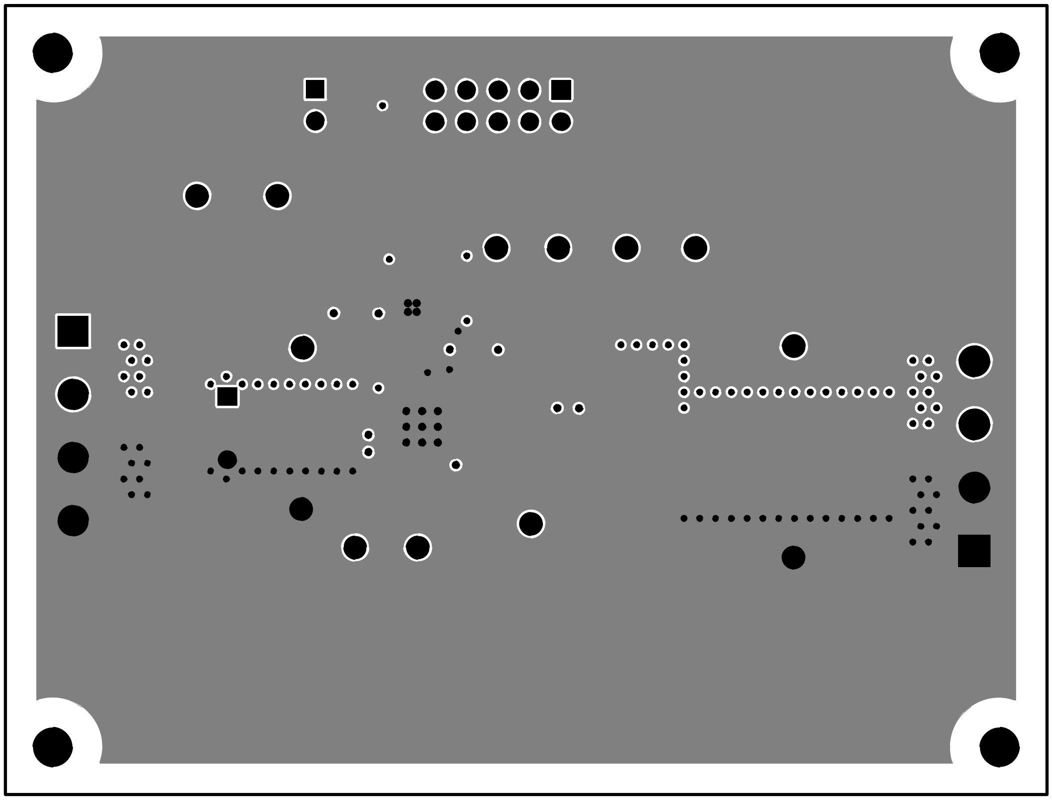


Figure 32. TPS53819AEVM-123 Internal Layer 5 (Top view)

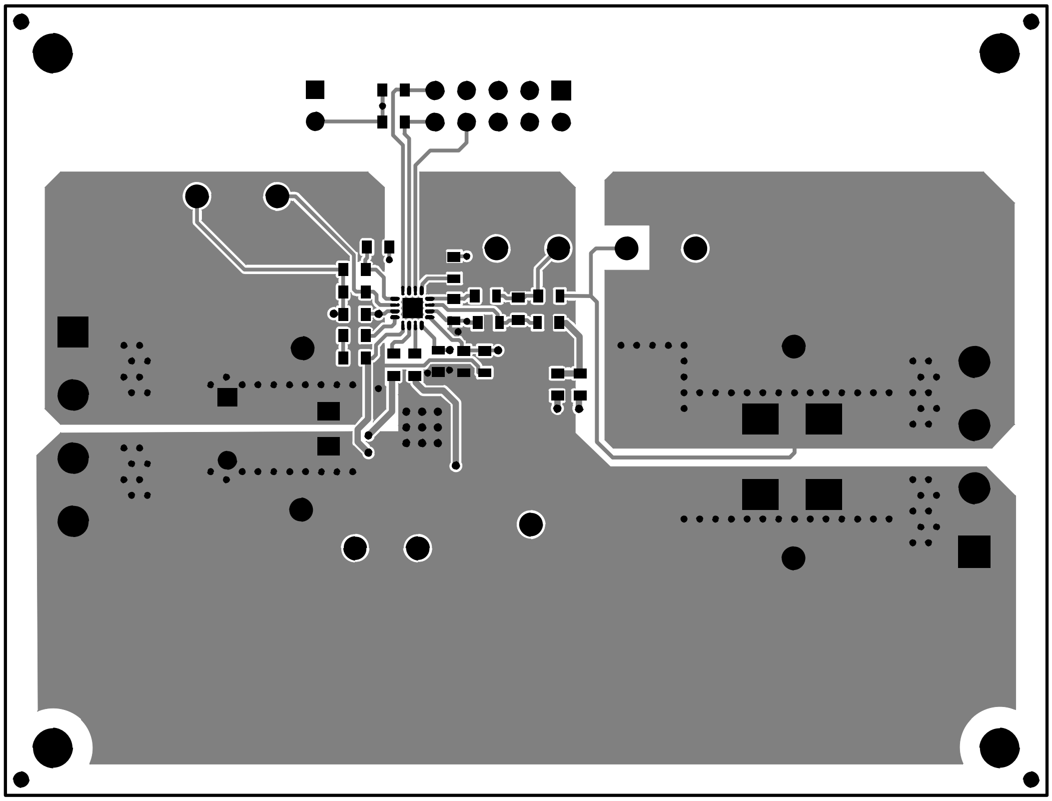


Figure 33. TPS53819AEVM-123 Bottom Copper (Top view)

9 Bill of Materials

Table 4. TPS53819AEVM-123 List of Materials

Count	RefDes	Description	Part Number	MFR
4	C1-4	Capacitor, Ceramic, 22µF, 16V, X5R, 10%	GRM31CR61C226ME15L	Murata
2	C5 C7	Capacitor, Ceramic, 0.1µF, 50V, X7R, 10%	Std	Std
0	C6	Capacitor, OSCON, 330uF, 16V	16SEP330M	Sanyo
1	C8	Capacitor, Ceramic, 1000pF, 50V, X7R, 20%	Std	Std
0	C9 C17	Capacitor, Ceramic, 50V, X7R, 10%	Std	Std
5	C10-14	Capacitor, Ceramic, 100µF, 6.3V, X5R, 20%	GRM32ER60J107ME20L	Murata
0	C15-16	Capacitor, POSCAP, SMT, 2.5V, 330µF, 8 mΩ	2R5TPE330M9 or 6TPE330MIL	Sanyo
2	C18 C19	Capacitor, Ceramic, 1µF, 16V, X7R, 10%	Std	Std
2	J1 J3	Terminal Block, 4-pin, 15-A, 5.1mm	ED120/4DS	OST
1	J2	Header, Male 2-pin, 100mil spacing,	PEC02SAAN	Sullins
1	J4	Connector, Male Straight 2x5 pin, 100mil spacing, 4 Wall	N2510-6002RB	3M
1	L1	Inductor, Toroid, 0.440µH, 30A, 0.0032ohm	PA0513.441NLT or 744309047	Pulse or WE
1	Q1	MOSFET, Dual N-Chan, 30V 27A	CSD87350Q5D	TI
4	R1-2 R14-15	Resistor, Chip, 100 kΩ, 1/16W, 1%	Std	Std
1	R3	Resistor, Chip, 300 kΩ, 1/16W, 1%	Std	Std
1	R4	Resistor, Chip, 1.00 kΩ, 1/16W, 1%	Std	Std
2	R6	Resistor, Chip, 4.7 Ω, 1/16W, 1%	Std	Std
1	R9	Resistor, Chip, 3 Ω, 1/4W, 1%	Std	Std
0	R7 R13	Resistor, Chip, 1/16W, 1%	Std	Std
1	R10	Resistor, Chip, 39.2 kΩ, 1/16W, 1%	Std	Std
5	R5 R8 R11-12 R16	Resistor, Chip, 0 Ω, 1/10W, 1%	Std	Std
2	R17-18	Resistor, Chip, 10.0 kΩ, 1/16W, 1%	Std	Std
10	TP1-3 TP5-8 TP10-11 TP13	Test Point, Red, Thru Hole Color Keyed	5000	Keystone
3	TP4 TP9 TP12	Test Point, Black, Thru Hole Color Keyed	5001	Keystone
1	U1	IC, Single Synchronous Step-Down Controller with PMBus	TPS53819ARGT	TI
1	—	Shunt, 100-mil, Black	929950-00	3M
1	—	PCB, 2.5 In x 3.3 In x 0.062 In	PWR123	Any
4	—	STANDOFF HEX .375"L 4-40THR NYL	1902B	Keystone
4	—	STANDOFF M/F HEX 4-40 NYL 1.00"L	4806	Keystone

EVALUATION BOARD/KIT/MODULE (EVM) ADDITIONAL TERMS

Texas Instruments (TI) provides the enclosed Evaluation Board/Kit/Module (EVM) under the following conditions:

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please visit www.ti.com/esh or contact TI.

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REGULATORY COMPLIANCE INFORMATION

As noted in the EVM User's Guide and/or EVM itself, this EVM and/or accompanying hardware may or may not be subject to the Federal Communications Commission (FCC) and Industry Canada (IC) rules.

For EVMs **not** subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant

Caution

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concerning EVMs including detachable antennas

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

Concernant les EVMs avec appareils radio

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

【Important Notice for Users of this Product in Japan】

This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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http://www.tij.co.jp

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http://www.tij.co.jp

EVALUATION BOARD/KIT/MODULE (EVM)
WARNINGS, RESTRICTIONS AND DISCLAIMERS

For Feasibility Evaluation Only, in Laboratory/Development Environments. Unless otherwise indicated, this EVM is not a finished electrical equipment and not intended for consumer use. It is intended solely for use for preliminary feasibility evaluation in laboratory/development environments by technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems and subsystems. It should not be used as all or part of a finished end product.

Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.
2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard.
3. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

Certain Instructions. It is important to operate this EVM within TI's recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, some circuit components may have case temperatures greater than 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

Agreement to Defend, Indemnify and Hold Harmless. You agree to defend, indemnify and hold TI, its licensors and their representatives harmless from and against any and all claims, damages, losses, expenses, costs and liabilities (collectively, "Claims") arising out of or in connection with any use of the EVM that is not in accordance with the terms of the agreement. This obligation shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if the EVM fails to perform as described or expected.

Safety-Critical or Life-Critical Applications. If you intend to evaluate the components for possible use in safety critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, such as devices which are classified as FDA Class III or similar classification, then you must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265

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TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

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