3 MHz, 1.6 A PWM Synchronous Buck Converter, High Efficiency, PWM Only, Low Ripple, Fixed Output Voltage

NCV6323FGEVB

NCV6323F is a synchronous Buck converter optimized to supply different sub−systems from a pre−regulator supply rail in the 2.8 V to 5.5 V range. The device is able to deliver up to 1.6 A DC (85°C ambient temperature) on a fixed output voltage. Operation with 3 MHz switching frequency allows employing small size inductor and capacitors. Technology and internal structure allows the IC to operate from a wide input voltage range. Synchronous rectification offers improved system efficiency and integrated feedback network allows very simple and straightforward implementation to power supply designers with only a few components to select.

The NCV6323F is housed in in a space saving Wettable flank DFN8, 2 × 2 mm (0.8 mm thickness), 0.5 mm pitch package.

Features

- 2.8 V to 5.5 V Input Voltage Range
- Fixed Output Voltage
- Up to 1.6 A DC Output Current (85°C Ambient Temperature)
- Up to 1.2 A DC Output Current (105°C Ambient Temperature)
- 3 MHz Switching Frequency
- Synchronous Rectification
- Soft Start/Over Current Protection
- Thermal Shutdown Protection
- Output Active Discharge (Disabled)
- Enable Input/Power Good (PG) Option
- WDFNW8, 2 × 2 mm, 0.5 mm Pitch Package
- Maximum 0.8 mm Thickness
- AEC−Q100 Qualified and PPAP Capable
- This is a Pb−Free Device

Typical Application

- Automotive Advanced Driver−Assistance System (ADAS)
  - Front Camera – Rear View Camera
  - Surround View
  - Blind Spot Monitoring
- Automotive Telematics Clusters – Camera
- Automotive Space−Optimized Systems
- Point of Load

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EVAL BOARD USER'S MANUAL

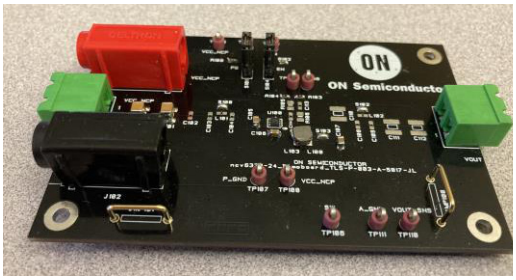

Figure 1. NCV6323FGEVB

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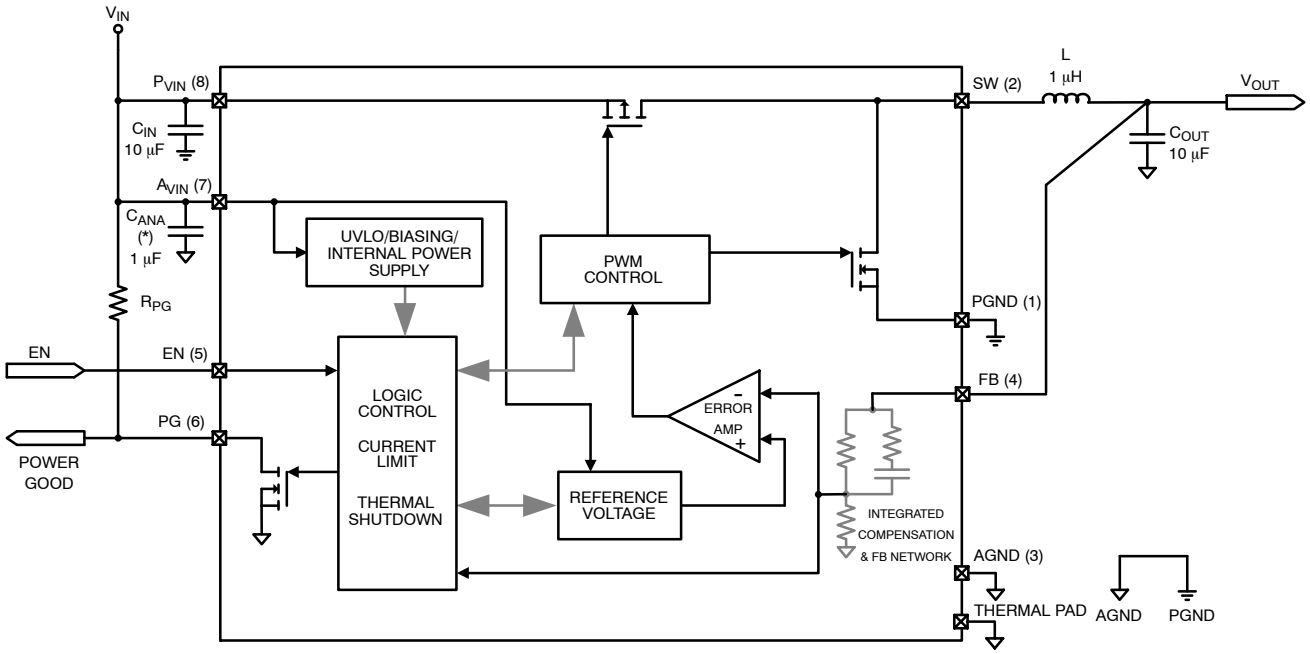
BLOCK DIAGRAM



(*) C_{ANA} is optional.

Figure 2. NCV6323F Block Diagram & Minimum Application Schematic

PIN ASSIGNMENT

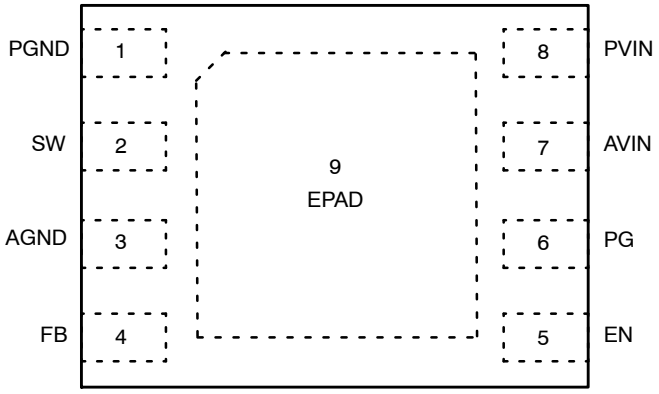


Figure 3. Pin Out (Top View)

Table 1. PIN FUNCTION DESCRIPTION

Pin	Name	Type	Description
1	PGND	Power Ground	*Switch Ground.* This pin is the power ground and carries the high switching current. High quality ground must be provided to prevent noise spikes. To avoid high−density current flow in a limited PCB track, a local ground plane that connects all PGND terminals together is recommended. Analog and power grounds should only be connected together in one location with a trace.
2	SW	Power Output	*Switch Node.* This pin supplies drive power to the inductor. Typical application uses 1.0 μH inductor; refer to application section for more information. This pin must be connected with short large PCB connections.
3	AGND	Analog Ground	*Analog Ground.* Analog and digital modules ground. Must be connected to the system ground.
4	FB	Analog Input	*Feedback* Voltage from the buck converter output. This is the input for the internal regulation loop. Connect this pin directly to the output voltage rail, preferably as close as possible to positive terminal of the output capacitor. It is recommended to follow as much as possible PCB layout recommendation in the application section to avoid noise on this input.
5	EN	Digital Input	*Enable Input.* High level at this pin enables the device. Low level at this pin disables the device.
6	PG	Open Drain	*Power Good.* It is open drain output. Low level at this pin indicates the device is out of regulation, while high impedance at this pin indicates the device output voltage is within expected range. If not used this pin can be left unconnected.
7	AVIN	Analog Input	*Analog Supply.* This pin is the device analog and digital supply. Can be connected directly to the V_{IN} plane with an optional 1 μF or 4.7 μF ceramic capacitor
8	PVIN	Analog Input	*Power Supply.* This pin is the power supply of the device. A 10 μF or larger ceramic capacitor must bypass this input to the ground. This capacitor should be placed as close as possible to pin. This pin must be connected with short large PCB connections.
9	EPAD	Analog Ground	*Exposed Thermal Pad.* Must be soldered to system Ground plane to achieve power dissipation performances. This pin is internally connected to AGND

SCHEMATIC

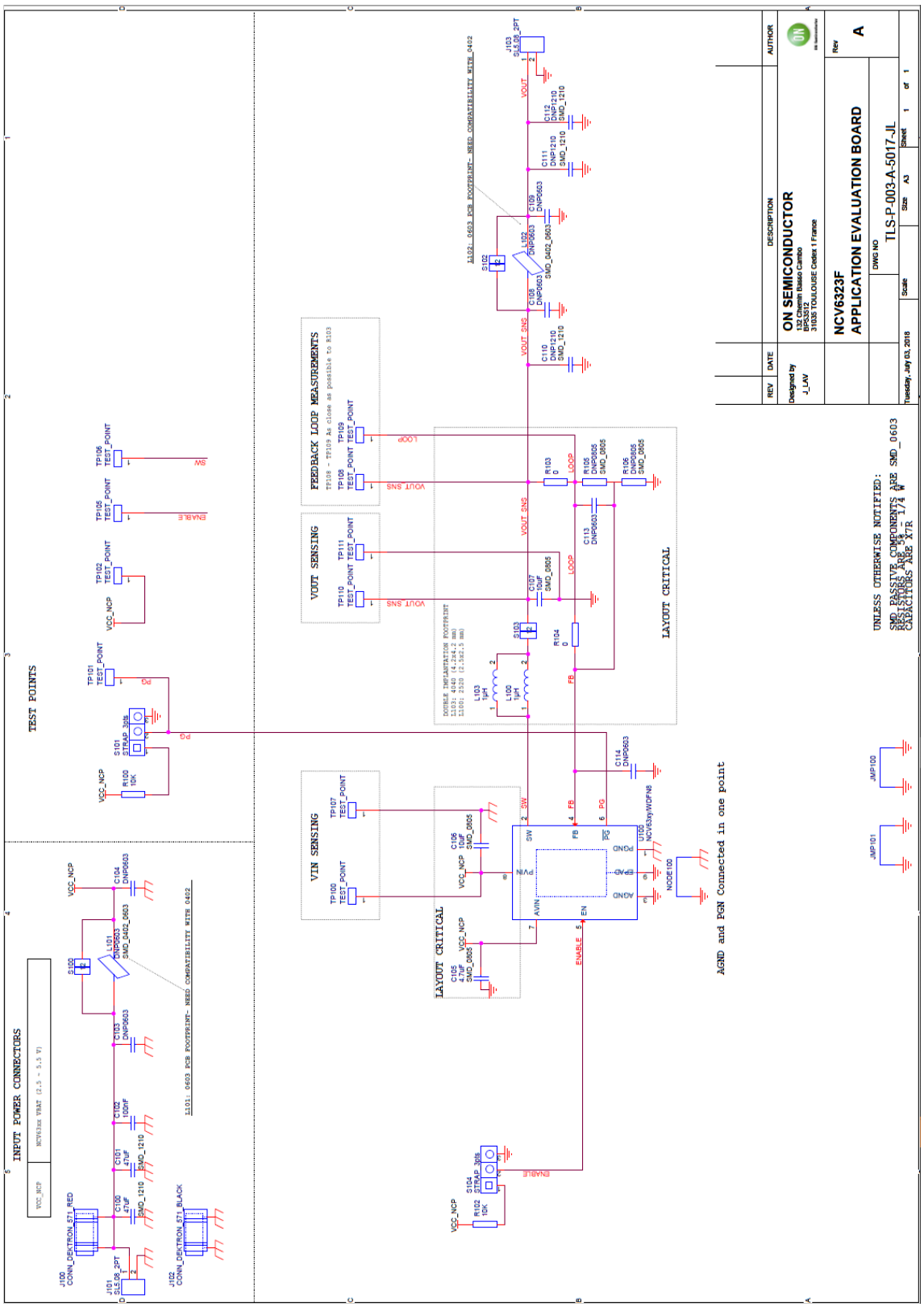


Figure 4. Demo Board Schematic

Electrical Characteristics

For electrical characteristics, please refer to the NCV6323F datasheet available on the ON Semiconductor website: http://www.onsemi.com.

Schematic Diagram

The Figure 4 describes the schematic of the NCV6323F evaluation board. The higher resolution document, as well as the complete BOM (Bill Of Material) are available on the ON Semiconductor website: http://www.onsemi.com.

PCB Description

This is a 4 layers PCB with 2 signal layers (top and bottom) with void spaces filled with GND as well as a VCC and a GND inner layers.

The Top and Bottom layers are built with 1 oz (35 µm) finished copper weight while the 2 internal layers are built with 0.5 oz (17.5 µm) copper weight and the PCB total size is 92 × 60 mm.

The Gerber files are available on the ON Semiconductor website: http://www.onsemi.com.

The Figure 5 and 6 describe respectively the top layer, with the silk serigraphy indicating the components location and the bottom layer.

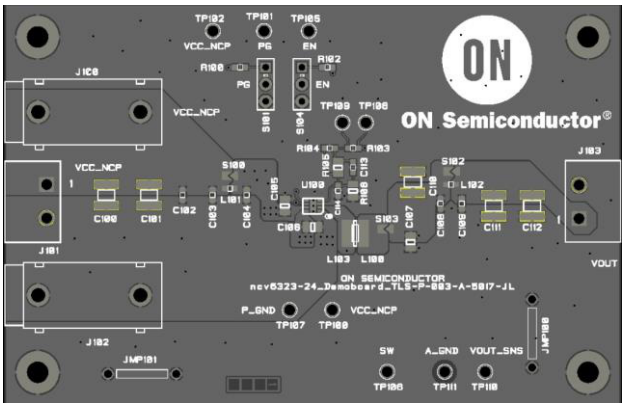


Figure 5. Top Layer

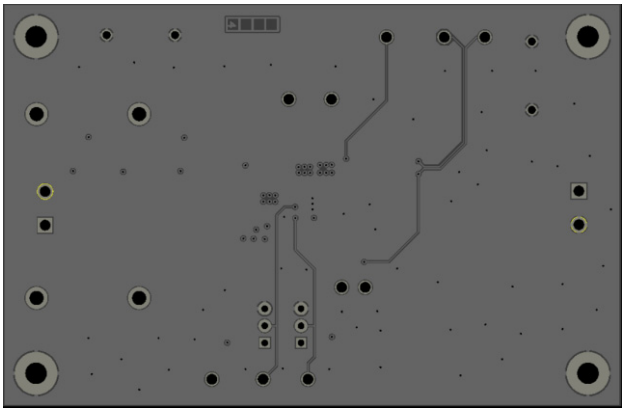


Figure 6. Bottom Layer

Layout Comments

In the NCV6323F data sheet, the user will find detailed information and recommendation about proper layout for this IC. Between the two proposed layouts, this demo board implements the solution with two separate P_{VIN} and A_{VIN} decoupling capacitors. There is no significant improvement comparing to the single P_{VIN} and A_{VIN} decoupling capacitor more space saving solution (this can be verified by removing the C105 capacitor).

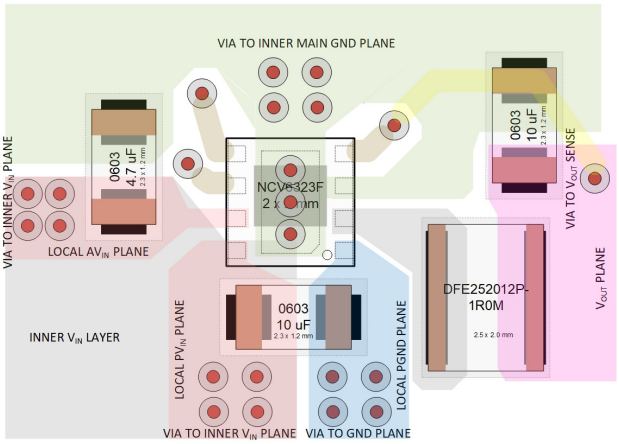


Figure 7. NCV6323F Demo Board Layout

Board Configuration and Operation

Prior to operate the board, the user has to configure two jumpers (Figure 8). For operation with NCV6323F, the S101 (PG) jumper should always be configured in position 1−2 and the S104 (EN) jumper connects the EN pin to GND (position 2–3), disabling the NCV6323F or to a pull up to V_{IN} (position 1–2) enabling the NCV6323F. The S100 and S103 jumpers should be shorted by solder.

To connect the input voltage, the NCV6323F features two options:

- J101 5.08 mm 2−point header connector (WEIDMULLER 1510360000). Use the BLZP 5.08HC/02/180 SN OR BX (WEIDMULLER 1943580000) or equivalent matting 5.08 mm female plug. PIN 1 = V_{IN} / PIN 2 = GND
- J100 & J102 2 × Test Jack, 10 A, 1.94 mm (DEKTRON 571−xxx). Connect the V_{IN} to the red Jack and the GND to the black one.

The output voltage is available at the J103 2−point header connector (WEIDMULLER 1510360000)

- PIN 1 = V_{OUT}
- PIN 2 = GND

(Figure 8)

The board provides easy−to−probe test points to monitor the various important analog and digital signals (Figure 9).

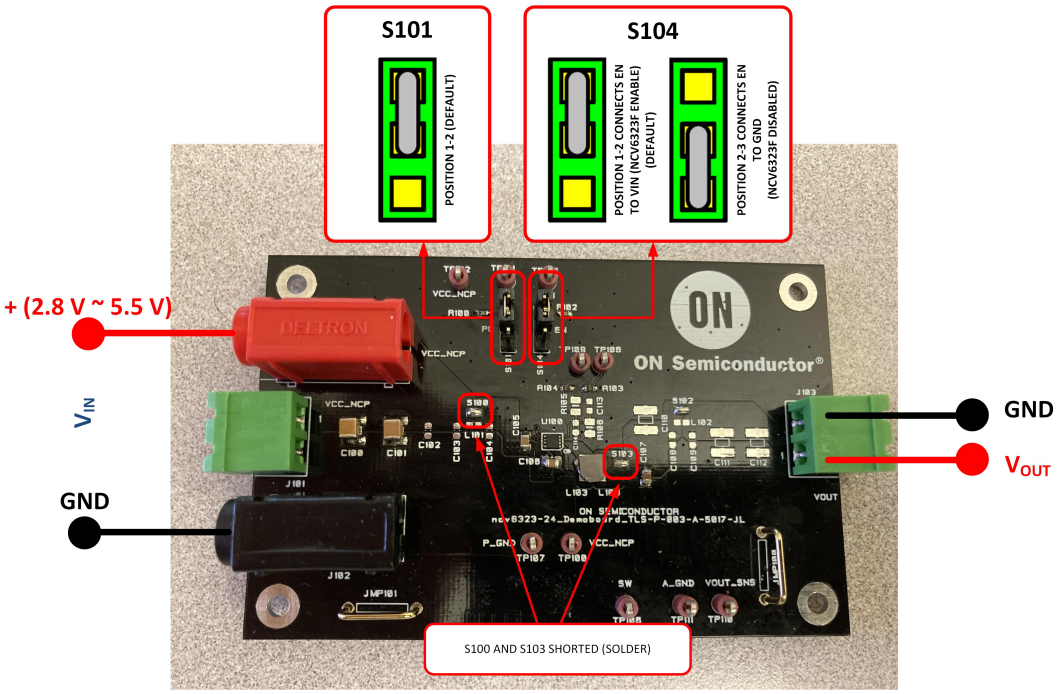


Figure 8. Configuration and Connection

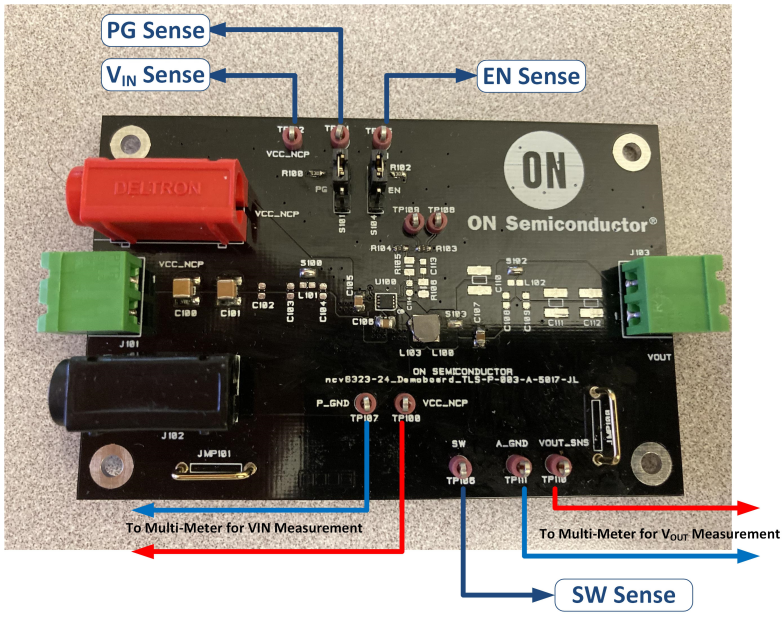


Figure 9. Test Points Description

Test Procedure

1. Prepare equipments:
   a. DC power supply
   b. Electronic load (or variable resistor passive)
   c. Multimeters
   d. Oscilloscope
2. Check jumper setup.
3. Set the power supply to 5.0 V with a current compliance higher than 1 A, and then disable the output of the power supply.
4. Connect the power supply to the evaluation board's connectors V_{IN} and GND.
5. Disable output of the electronic load and connect it to the evaluation board's connectors V_{OUT} and GND.
6. Enable the output of the power supply and check the output voltage of the evaluation board. The output voltage should correspond to the voltage settings of the NCV6323F mounted on the board.
7. Verify the current from the power supply is in the 5~7 mA range
8. Monitor the output voltage and SW node signal using an oscilloscope. The converter should operate in PWM with a typical switching frequency is in the 3 MHz range and a low Duty Cycle.
9. Increase the electronic load to 1.0 A. Typical input supply current depends on the version of NCV6323F mounted on the board.
10. Monitor the output voltage and SW node signal using the oscilloscope. The converter should operate in PWM with a typical switching frequency is in the 3 MHz range and a larger Duty Cycle.
11. After the test is completed, make sure to disable the output of power supply prior to remove the power connectors to protect the device from damage caused by possible high voltage spike in input.

Phase/Gain Margin/Loop Response Analysis

For a DC to DC converter, it is important to verify that the phase and gain margin are large enough to allow safe operation. The NCV6323F demo board features all the necessary hardware to trace the Bode plot transfer function and to measure the control loop stability with an AP310 or equivalent frequency response analyzer.

Replace the R103 0 Ω resistor by a 20 Ω resistor to inject the perturbation signal. The tests points TP108 and TP109 are connected directly to the R103 resistor allowing easy connection of the analyzer input and of the injection signal.

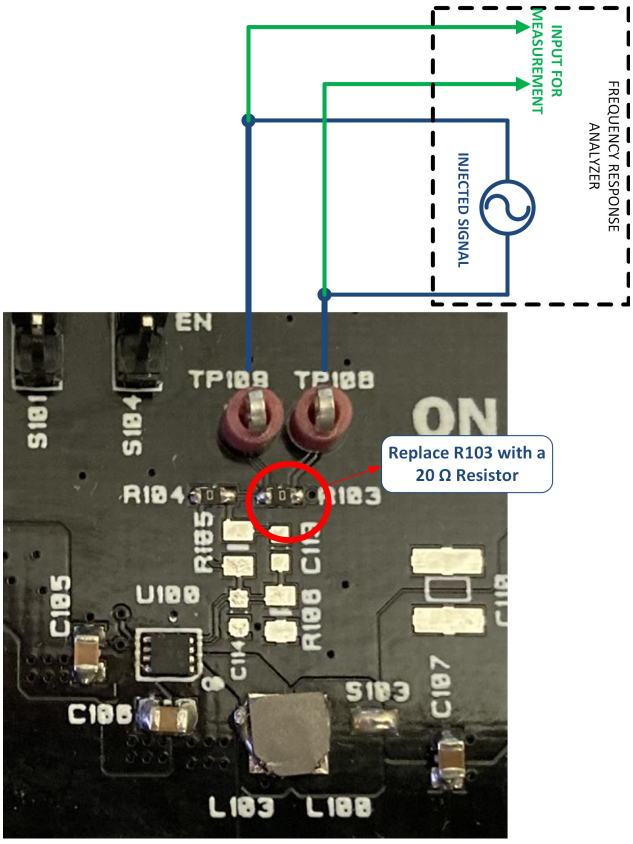


Figure 10. Settings for Loop Response Analysis

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