*User’s Guide*

# *TPS549B22 SWIFT™ Step-Down Converter Evaluation Module User's Guide*

TEXAS INSTRUMENTS

**ABSTRACT**

This user's guide describes the characteristics, operation, and use of the TPS549B22 Evaluation Module (EVM). The user's guide includes test information, descriptions, and results. A complete schematic diagram, printed-circuit board layouts, and bill of materials are also included in this document. Throughout this user's guide, the abbreviations EVM, TPS549B22EVM, and the term evaluation module are synonymous with the TPS549B22EVM-847, unless otherwise noted.

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## Trademarks

PMBus™ is a trademark of SMIF, Inc..
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# 1 Introduction

The PWR847EVM evaluation module uses the TPS549B22 device. The TPS549B22 is a highly integrated synchronous buck converter that is designed for up to 25-A current output.

## 1.1 Before You Begin

The following warnings and cautions are noted for the safety of anyone using or working close to the TPS549B22EVM-847. Observe all safety precautions.

| | | |
|---|---|---|
|  | **Warning** | The TPS549B22EVM-847 circuit module may become hot during operation due to dissipation of heat. Avoid contact with the board. Follow all applicable safety procedures applicable to your laboratory. |
|  | **Caution** | Do not leave the EVM powered when unattended. |

**WARNING**

The circuit module has signal traces, components, and component leads on the bottom of the board. This may result in exposed voltages, hot surfaces or sharp edges. Do not reach under the board during operation.

**CAUTION**

The circuit module may be damaged by over temperature. To avoid damage, monitor the temperature during evaluation and provide cooling, as needed, for your system environment.

**CAUTION**

Some power supplies can be damaged by application of external voltages. If using more than 1 power supply, check your equipment requirements and use blocking diodes or other isolation techniques, as needed, to prevent damage to your equipment.

**CAUTION**

The communication interface is not isolated on the EVM. Be sure no ground potential exists between the computer and the EVM. Also be aware that the computer is referenced to the Battery- potential of the EVM.

## 2 Description

The PWR-847EVM is designed as a single output DC-DC converter that demonstrates the TPS549B22 in a typical low-voltage application while providing a number of test points to evaluate the performance. It uses a nominal 12-V input bus to produce a regulated 1-V output at up to 25-A load current.

### 2.1 Typical End-User Applications

- Enterprise Storage, SSD, NAS
- Wireless and Wired Communication Infrastructure
- Industrial PCs, Automation, ATE, PLC, Video Surveillance
- Enterprise Server, Switches, Routers
- ASIC, SoC, FPGA, DSP Core and I/O Rails

### 2.2 EVM Features

- Regulated 1-V output up to 25-A, steady-state output current
- Convenient test points for probing critical waveforms
- PMBus™ connector for easy connection with the TI USB adapter

## 3 EVM Electrical Performance Specifications

Table 3-1 lists the PWR-847EVM electrical performance specifications.

**Table 3-1. PWR-847EVM Electrical Performance Specifications**

| Parameter | | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Input Characteristics** | | | | | | |
| | Voltage range | $V_{IN}$ tied to VDD | 5 | 12 | 14 | V |
| | Maximum input current | $V_{IN}$ = 12 V, $I_O$ = 25 A | | | 12 | A |
| | No load input current | $V_{IN}$ = 12 V, $I_O$ = 0 A | | 60 | | mA |
| **Output Characteristics** | | | | | | |
| $V_{OUT}$ | Output voltage | Output current = 10 A | | 1 | | V |
| $I_{OUT}$ | Output load current | $I_{OUT(min)}$ to $I_{OUT(max)}$ | 0 | | 25 | A |
| | Output voltage regulation | Line regulation: input voltage = 5 V to 14 V | | 0.5% | | |
| | | Load regulation: output current = 0 A to $I_{OUT(max)}$ | | 0.5% | | |
| $V_{OUT}$ | Output voltage ripple | $V_{IN}$ = 12 V, $I_{OUT}$ = 25 A | | 10 | | $mV_{PP}$ |
| $V_{OUT}$ | Output overcurrent | | | 32 | | A |
| **Systems Characteristics** | | | | | | |
| | Switching frequency | $F_{SW}$ | | 650 | | kHz |
| $V_{OUT}$ | Peak efficiency | $V_{IN}$ = 12 V, $I_O$ = 12 A, $F_{SW}$ = 650 kHz | | 90% | | |
| | Operating temperature | $T_{oper}$ | 0 | | 85 | °C |

# 4 Schematic

Figure 4-1 illustrates the PWR-847EVM schematic.

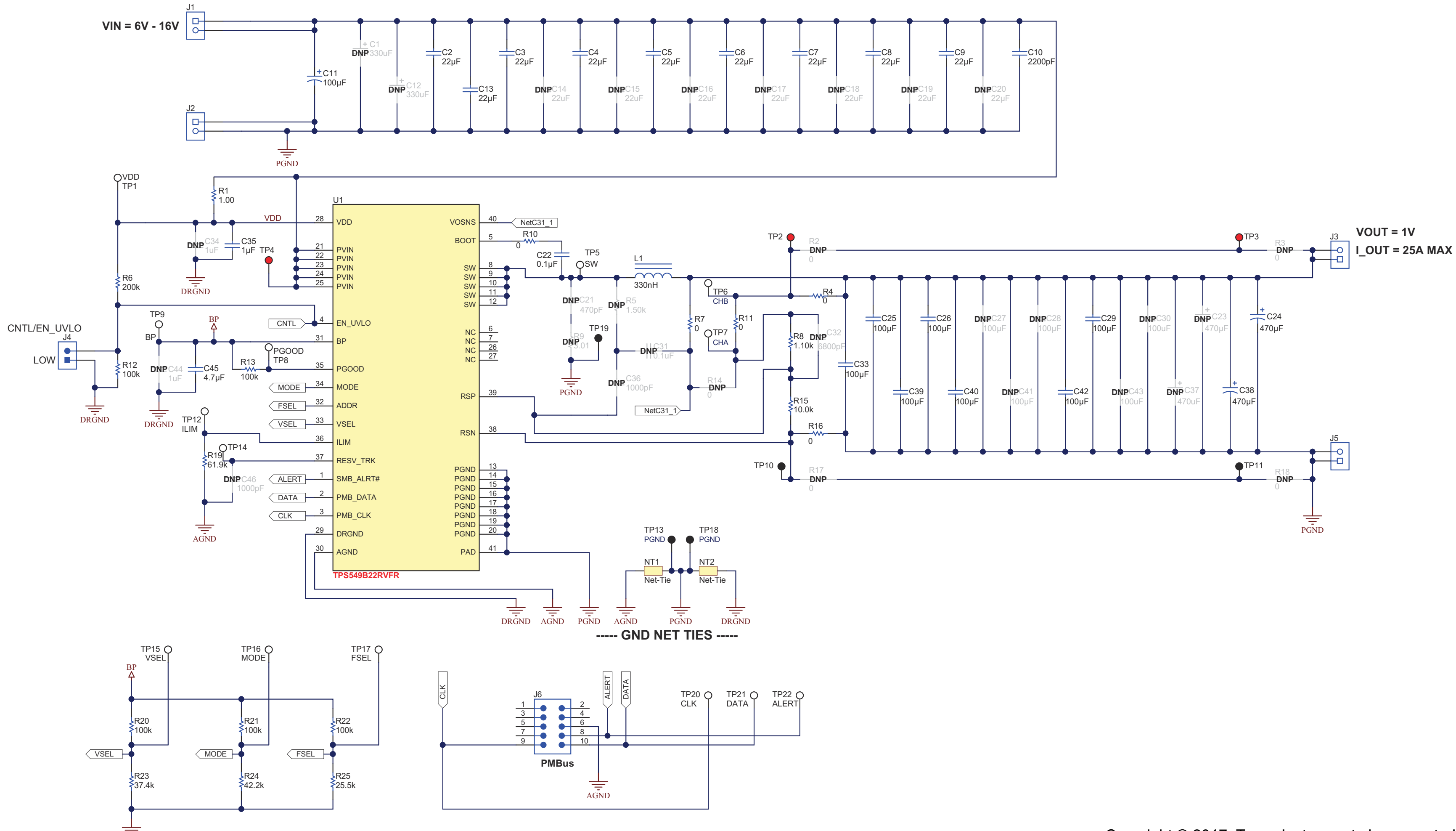




**Figure 4-1. PWR-847EVM Schematic**

# 5 Test Setup

## 5.1 Test and Configuration Software

To change any of the default configuration parameters on the EVM, it is necessary to obtain the TI Fusion Digital Power Designer software. This can be downloaded from the TI website.

### 5.1.1 Description

The Fusion Digital Power Designer is the graphical user interface (GUI) used to configure and monitor the Texas Instruments TPS549B22 power converter installed on this evaluation module. The application uses the PMBus protocol to communicate with the controller over serial bus by way of a TI USB adapter. This adapter can be purchased at http://www.ti.com/tool/usb-to-gpio.

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**Note**

The TI USB adapter must be purchased separately. It is not included with this EVM kit.

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### 5.1.2 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.
- Monitor status registers. Items such as input voltage, output voltage, output current, temperature, and warnings and faults are continuously monitored and displayed by the GUI.
- Configure common operating characteristics such as VOUT, UVLO, soft-start time, warning and fault thresholds, fault response, and ON/OFF.

This software is available for download at http://www.ti.com/tool/fusion_digital_power_designer.

## 6 Test Equipment

**Voltage Source:** The input voltage source VIN must be a 0-V to 18-V variable DC source capable of supplying at least 12 $A_{DC}$.

**Multimeters:** It is recommended to use two separate multimeters Figure 7-1. One meter is used to measure $V_{IN}$ and one to measure $V_{OUT}$.

**Output Load:** A variable electronic load is recommended for testing Figure 7-1. It must be capable of 25 A at voltages as low as 0.6 V.

**Oscilloscope:** An oscilloscope is recommended for measuring output noise and ripple. Output ripple must be measured using a tip-and-barrel method or better as shown in Figure 7-2.The scope must be adjusted to 20-MHz bandwidth, AC coupling at 50 mV/division, and must be set to 1-µs/division.

**Fan:** During prolonged operation at high loads, it may be necessary to provide forced air cooling with a small fan aimed at the EVM. Temperature of the devices on the EVM must be maintained below 105°C.

**USB-to-GPIO Interface Adapter:** A communications adapter is required between the EVM and the host computer. This EVM was designed to use TI's USB-to-GPIO adapter. Purchase this adapter at http://www.ti.com/tool/usb-to-gpio.

**Recommended Wire Gauge:** The voltage drop in the load wires must be kept as low as possible in order to keep the working voltage at the load within its operating range. Use the AWG 14 wire (2 wires parallel for VOUT positive and 2 wires parallel for the VOUT negative) of no more than 1.98 feet between the EVM and the load. This recommended wire gauge and length should achieve a voltage drop of no more than 0.2 V at the maximum 25-A load.

# 7 PWR-847EVM

Figure 7-1 and Figure 7-2 illustrate the PWR-847EVM overview, tip and barrel measurement.

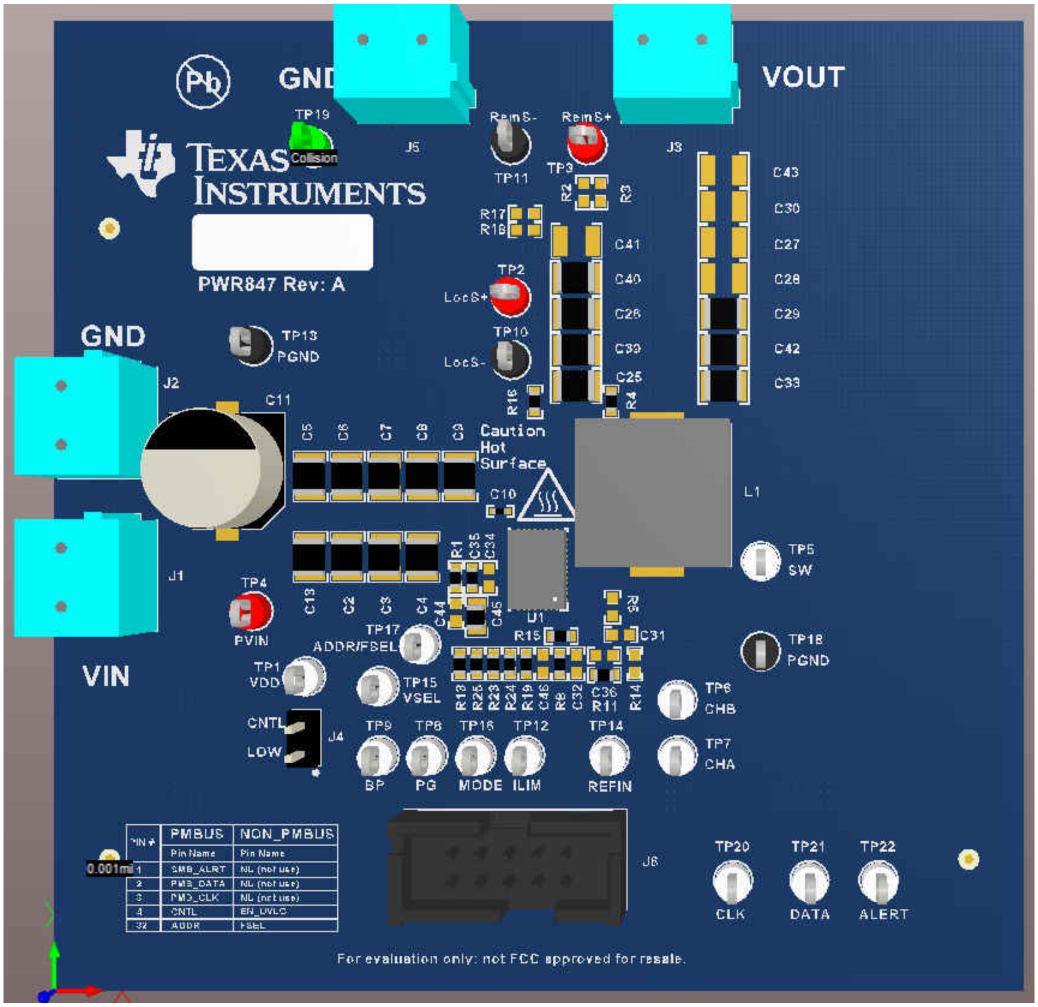


Figure 7-1. PWR-847EVM Overview

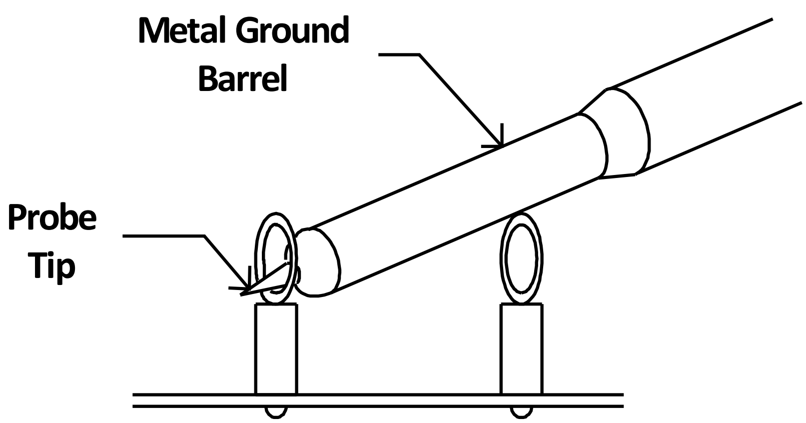


Figure 7-2. Tip and Barrel Measurement

Figure 7-3 illustrates the EVM and USB interface adapter.

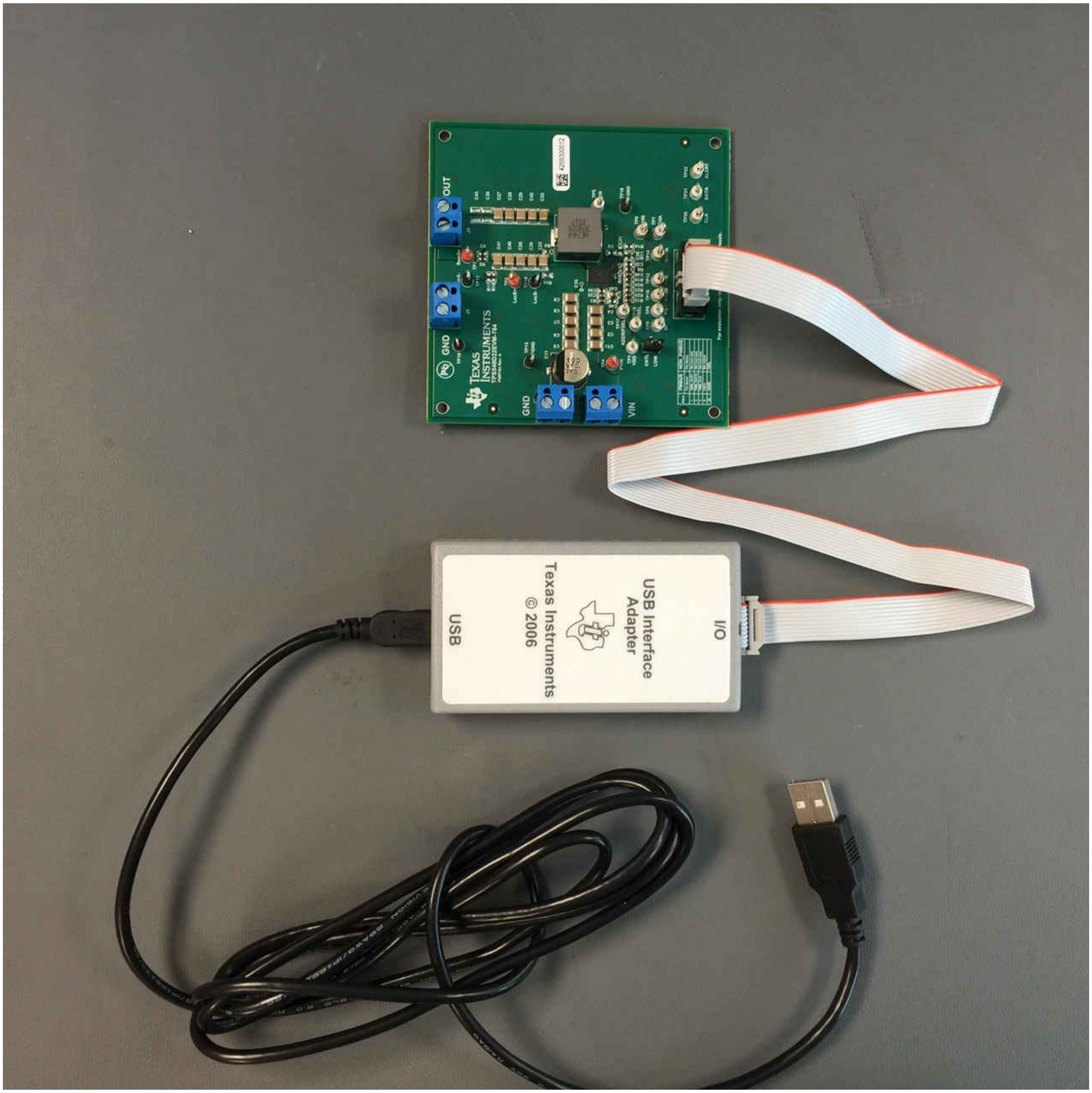


**Figure 7-3. EVM and USB Interface Adapter**

# 8 List of Test Points, Jumpers, and Switch

Table 8-1 lists the test points and their descriptions.

**Table 8-1. Test Point Functions**

| Item | Type | Name | Description |
|---|---|---|---|
| TP5 | T-H loop | SW | Power supply Switch node |
| TP7 | T-H loop | CH-A | Measure loop stability |
| TP6 | T-H loop | CH-B | Measure loop stability |
| TP2 | T-H loop | LocS+ | Sense VOUT + locally across C25. Use for efficiency and ripple measurements |
| TP10 | T-H loop | LocS- | Sense VOUT– locally across C25. Use for efficiency and ripple measurements |
| TP3 | T-H loop | RemS+ | Remote sense + |
| TP11 | T-H loop | RemS- | Remote sense – |
| TP4 | T-H loop | PVIN | Sense VIN + across C10 |
| TP13 | T-H loop | PGND | Sense VIN – across C10 |
| TP1 | T-H loop | VDD | Supplies the internal circuitry |
| TP17 | T-H loop | ADDR | Monitor the ADDR external resistor divider ratio during initial power up. |
| TP15 | T-H loop | VSEL | Monitor the VSEL external resistor divider ratio during initial power up. |
| TP9 | T-H loop | BP | LDO output |
| TP8 | T-H loop | PG | Power good |
| TP16 | T-H loop | MODE | Monitor the MODE external resistor divider ratio during initial power up. |
| TP12 | T-H loop | ILIM | Program over-current limit. |
| TP14 | T-H loop | RESV_TRK | Do not connect. |
| TP19 | T-H loop | PGND | Common GND |
| TP18 | T-H loop | PGND | Common GND |
| TP20 | T-H loop | PMB_CLK | Clock input for the PMBus interface. |
| TP21 | T-H loop | PMB_DATA | Data I/O for the PMBus interface. |
| TP22 | T-H loop | SMB_ALRT# | $\overline{\text{Alert}}$ output for the PMBus interface. |
| JP4 | 2-pin jumper | CNTL | Shunts control pin to GND |

# 9 EVM Configuration Using the Fusion GUI

The TPS549B22 installed on this EVM leave the factory pre-configured. See Table 9-1 for a short list of key factory configuration parameters as obtained from the configuration file.

**Table 9-1. Key Factory Configuration Parameters**

| Cmd ID With Phase | Cmd Code Hex | Encoded Hex [HiByte\|LoByte] | Comments |
|---|---|---|---|
| CAPABILITY | 0x19 | 0xD0 | Max Bus: 1000 kHz; PEC: Yes; SMBALERT#: Yes |
| MFR_00 | 0xD0 | 0x00 | 0 |
| MFR_01 (PGOOD_DLY) | 0xD1 | 0x12 | PGD:1024?s [010b], POD:1024?s [010b] |
| MFR_02 | 0xD2 | 0x13 | CM: True, HICLOFF: True, SST: 0x00, FORCESKIPSS: True, SEQ: False, TRK: False |
| MFR_03 | 0xD3 | 0x93 | FS:650 kHz [011b], RCSP:R ? 1 [01b], DCAP3:True |
| MFR_04 | 0xD4 | 0x80 | DCAP3_Offset:0mV [00b], DCAP3_Offset_Sel:True |
| MFR_06 | 0xD6 | 0x05 | VDDUVLO:4.25V [101b] |
| MFR_07 | 0xD7 | 0x8F | VTRKIN:1.25V [1111b], TRKOPTION:False, SPARE:False, VPBAD:True |
| MFR_33 | 0xF1 | 0x00 | 0 |
| MFR_42 | 0xFA | 0x00 | 0 |
| MFR_44 | 0xFC | 0x0201 | ID: 0x020 (TPS549B22), Revision: 0x8 |
| ON_OFF_CONFIG | 0x02 | 0x17 | Mode: CONTROL Pin Only; Control: Active High, Turn off Immediately |
| OPERATION | 0x01 | 0x00 | Operation is not used to enable regulatio; Unit: ImmediateOff; Margin: None |
| STATUS_BYTE | 0x78 | 0x00 | Status: Output Off, Vout OV Fault, IOUT OC Fault, Vin UV Fault, Temperature, CML |
| STATUS_CML | 0x7E | 0x00 | Status: Invalid Command, Invalid Data, PEC Fault, Other Comms Fault |
| STATUS_IOUT | 0x7B | 0x00 | Status: Iout OC Fault, Iout OC Fault with LV Shutdown, Iout UC Fault |
| STATUS_VOUT | 0x7A | 0x00 | Status: Vout OV Fault, OV Warning, UV Fault, UV Warning |
| VOUT_COMMAND | 0x21 | 0x01CD | VOUT_COMMAND=0.900 V |
| VOUT_MARGIN_HIGH | 0x25 | 0x0266 | VOUT_MARGIN_HIGH=1.199 V |
| VOUT_MARGIN_LOW | 0x26 | 0x0266 | VOUT_MARGIN_LOW=1.199 V |
| WRITE_PROTECT | 0x10 | 0x00 | Enable Writes To All Commands |

If it is desired to configure the EVM to settings other than the factory settings shown in Table 9-1, the TI Fusion Digital Power Designer software can be used for reconfiguration. It is necessary to have input voltage applied to the EVM prior to launching the software so that the TPS549B22 installed is active and able to respond to the GUI and the GUI can recognize the device.

# 10 Test Procedure

## 10.1 Line and Load Regulation Measurement Procedure

Use the following procedures for line and load regulation measurement.

1. Connect VOUT to J3 and VOUT_GND to J5 Figure 7-1.
2. Ensure that the electronic load is set to draw 0 $A_{DC}$.
3. Connect VIN to J1 and VIN_GND to J2 Figure 7-1.
4. Connect the USB interface adapter as shown in Figure 7-3.
5. Increase $V_{IN}$ from 0 V to 12 V using the digital multimeter to measure input voltage.
6. Launch the Fusion GUI software. See the screen shots in Section 12 for more information.
7. Configure the EVM operating parameters as desired.
8. Use the other digital multimeter or the oscilloscope to measure output voltage $V_{OUT}$ at TP2 and TP10 as you vary the external voltage source.

**Table 10-1. List of Test Points for Line and Load Measurements**

| Test Point | Node Name | Description |
|---|---|---|
| TP2 | LocS+ | Sense VOUT + locally across C5. Use for efficiency and ripple measurements |
| TP10 | LocS– | Sense VOUT - locally across C5. Use for efficiency and ripple measurements |
| TP4 | PVIN | Sense VIN + across C10 |
| TP13 | PGND | Sense VIN - across C10 |

9. Vary the load from 0 $A_{DC}$ to maximum rated output 25 $A_{DC}$. $V_{OUT}$ must remain in regulation as defined in Table 3-1.
10. Vary $V_{IN}$ from 5 V to 14 V. $V_{OUT}$ must remain in regulation as defined in Table 3-1.
11. Decrease the load to 0 A.
12. Decrease $V_{IN}$ to 0 V or turn off the supply.

## 10.2 Efficiency

To measure the efficiency of the power train on the EVM, it is important to measure the voltages at the correct location. This is necessary because otherwise the measurements will include losses in efficiency that are not related to the power train itself. Losses incurred by the voltage drop in the copper traces and in the input and output connectors are not related to the efficiency of the power train, and they must not be included in efficiency measurements.

**Table 10-2. List of Test Points for Efficiency Measurements**

| Test Point | Node Name | Description |
|---|---|---|
| TP2 | LocS+ | Sense VOUT + locally across C25. Use for efficiency and ripple measurements |
| TP10 | LocS- | Sense VOUT - locally across C25. Use for efficiency and ripple measurements |
| TP4 | PVIN | Sense VIN + across C10 |
| TP13 | PGND | Sense VIN - across C10 |

Input current can be measured at any point in the input wires, and output current can be measured anywhere in the output wires of the output being measured. Using these measurement points result in efficiency measurements that do not include losses due to the connectors and PCB traces.

## 10.3 Equipment Shutdown

1. Reduce the load current to 0 A.
2. Reduce input voltage to 0 V.
3. Shut down the external fan if in use.
4. Shut down equipment.

# 11 Performance Data and Typical Characteristic Curves

Figure 11-1 through Figure 11-14 present typical performance curves for the PWR-847EVM.

## 11.1 Efficiency

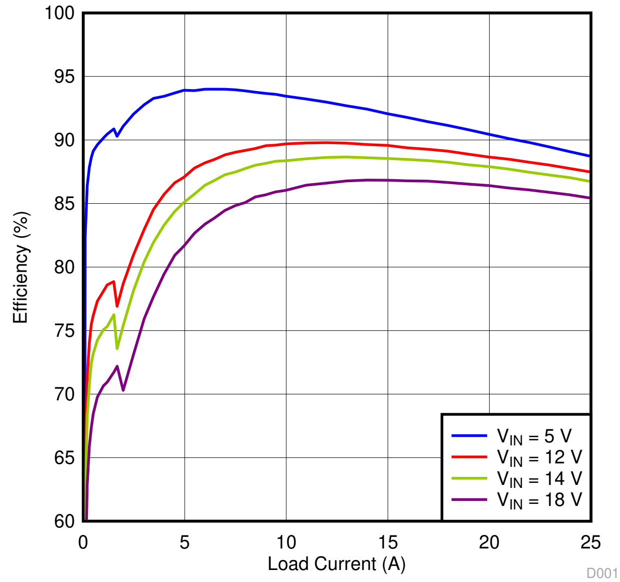


**Figure 11-1. Efficiency vs Output Current SKIP Mode**

## 11.2 Load Regulation

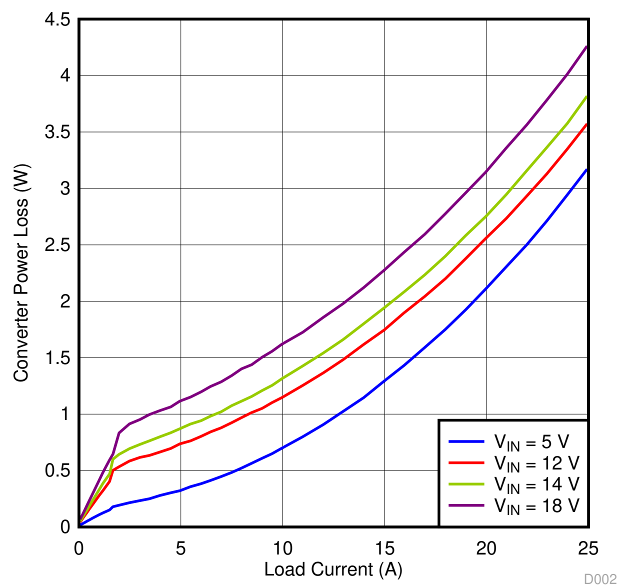


**Figure 11-2. Power Loss vs Output Current SKIP Mode**

## 11.3 Line Regulation

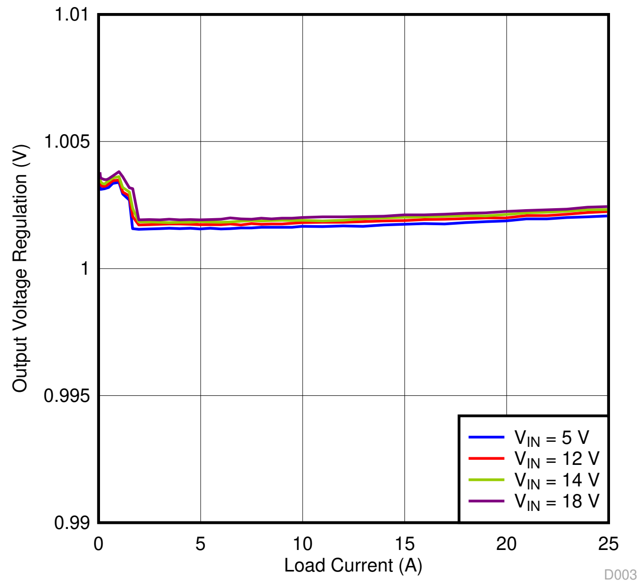


**Figure 11-3. Line Regulation of 1-V Output**


**Figure 11-4. PMBus $V_{OUT}$ Step-Up = 0.6 V to 1.2 V at 0 A**


Figure 11-5. PMBus $V_{OUT}$ Step-Down = 1.2 V to 0.6 V at 0 A


Figure 11-6. PMBus $V_{OUT}$ Step-Up = 0.6 V to 1.2 V at 25 A

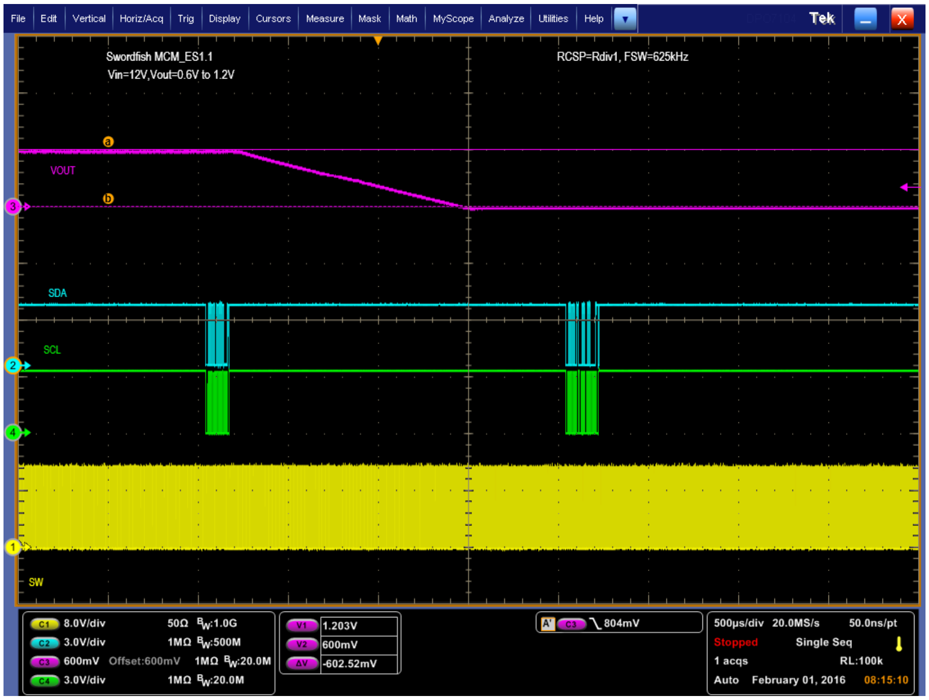


Figure 11-7. PMBus $V_{OUT}$ Step-Down = 1.2 V to 0.6 V at 25 A

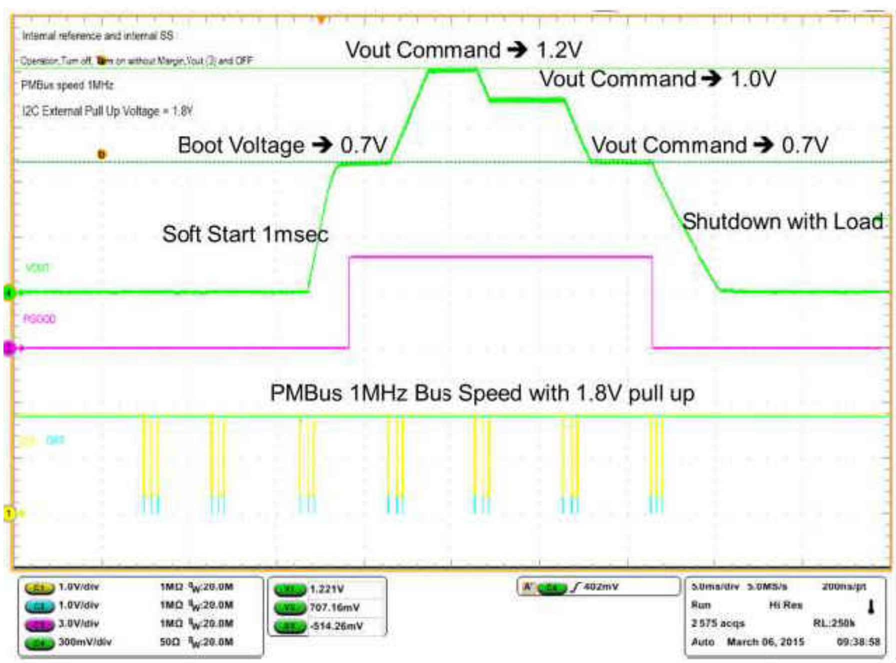


Figure 11-8. PMBUS Multiple Commands

## 11.4 Transient Response


**Figure 11-9. Transient Response of 1-V Output at 12 $V_{IN}$, Transient is 0.5 A to 15.5 A, the Step is 15 A at 40 A/µs**

## 11.5 Output Ripple

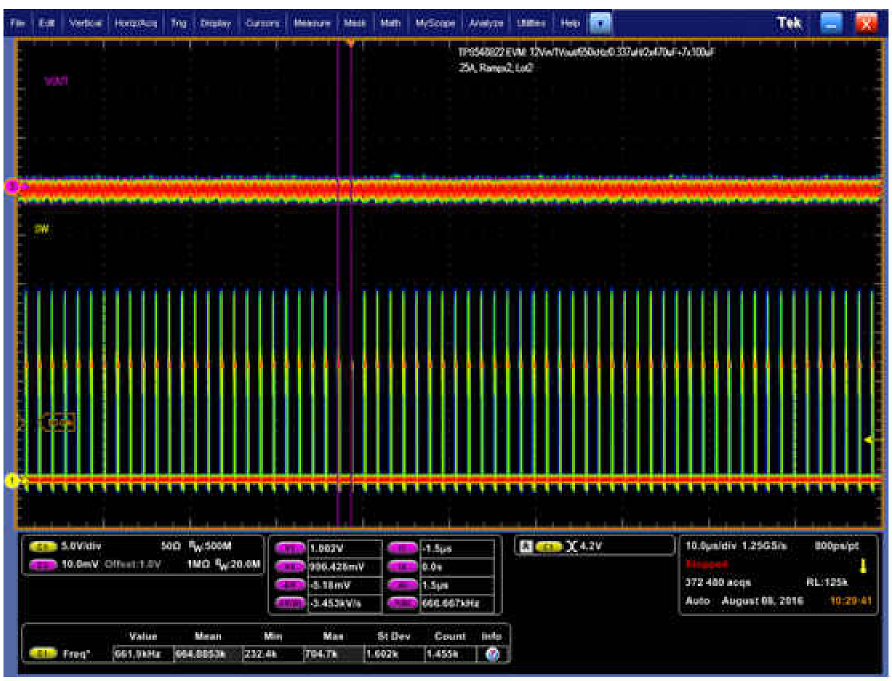


**Figure 11-10. Output Ripple and SW Node of 1-V Output at 12 $V_{IN}$, 25-A Output**

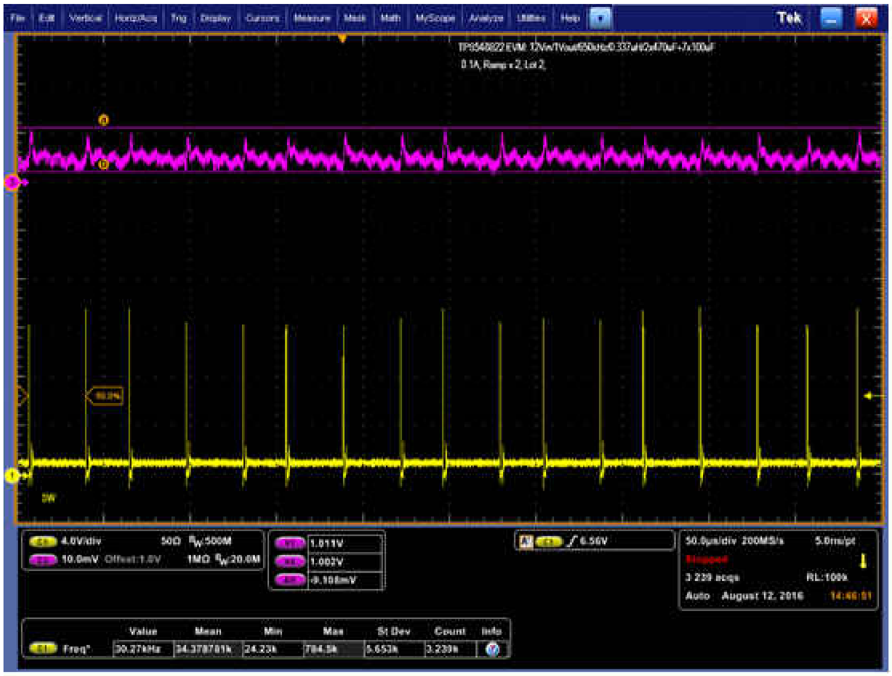


**Figure 11-11. Output Ripple and SW Node of 1-V Output at 12 $V_{IN}$, 0-A Output**

## 11.6 Control On

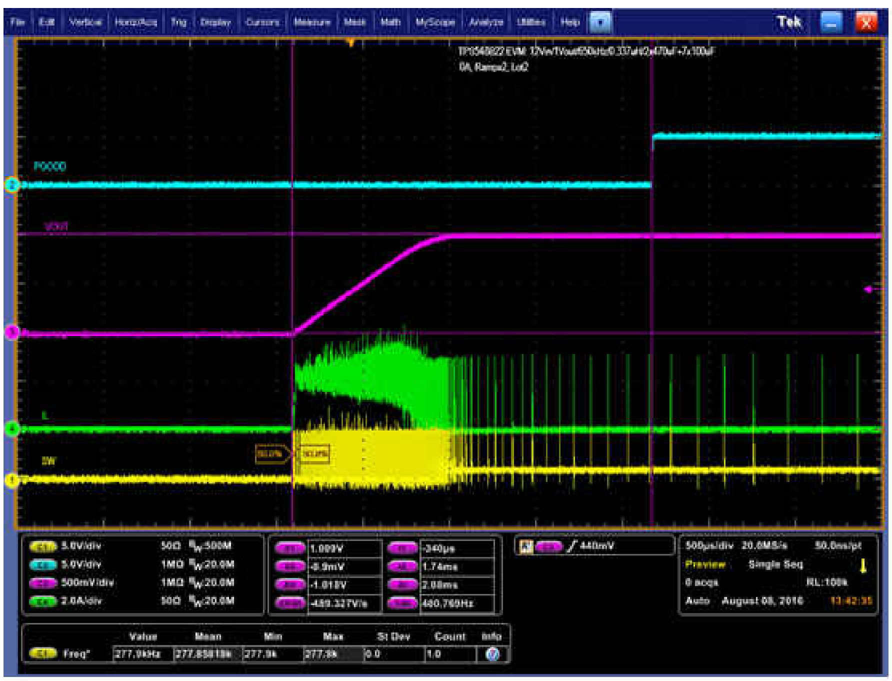


**Figure 11-12. Start up from Control, 1-V Output at 12 $V_{IN}$, 0-A Output**

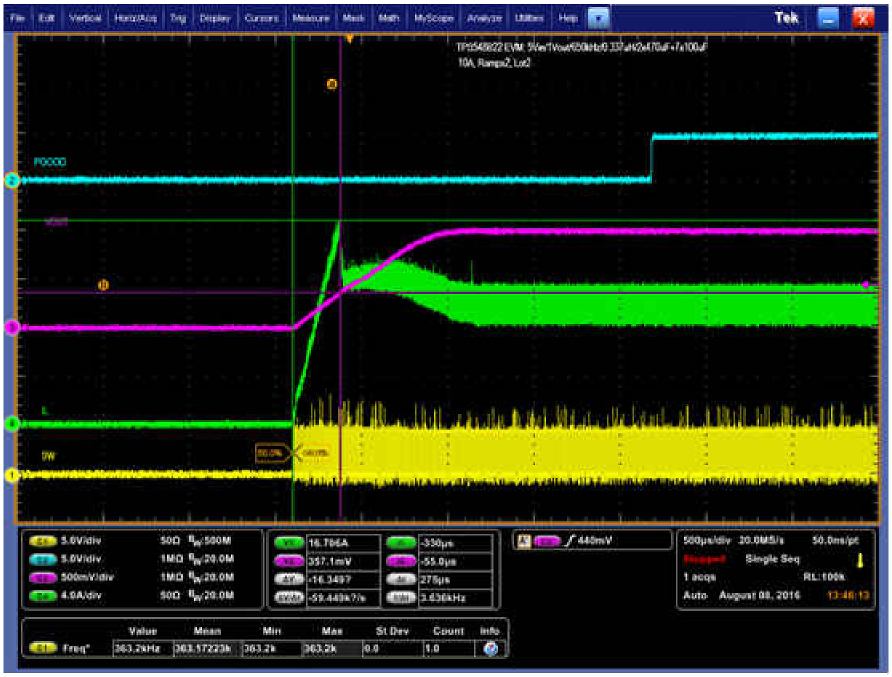


**Figure 11-13. 0.5-V Pre-bias start up from Control, 1-V Output at 12 $V_{IN}$, 10-A Output**

## 11.7 Control Off


**Figure 11-14. Start-Up and Shutdown, 1-V Output at 12 $V_{IN}$, 0.5-A Output**

## 11.8 Thermal Image

Figure 11-15 illustrates the thermal image at 1-V output at 12 $V_{IN}$, 25-A output, 650 kHz at 25°C ambient.

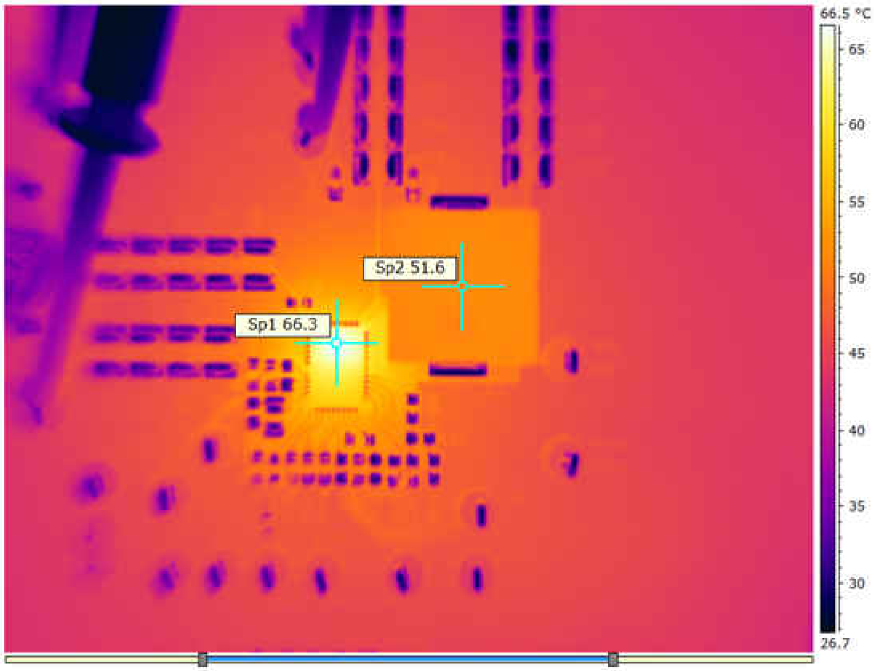


**Figure 11-15. Thermal Image at 1-V Output at 12 $V_{IN}$, 25-A Output, 650 kHz at 25°C Ambient**

# 12 Fusion GUI

Figure 12-1 through Figure 12-4 illustrate the Fusion GUI launch and installation dialog windows.

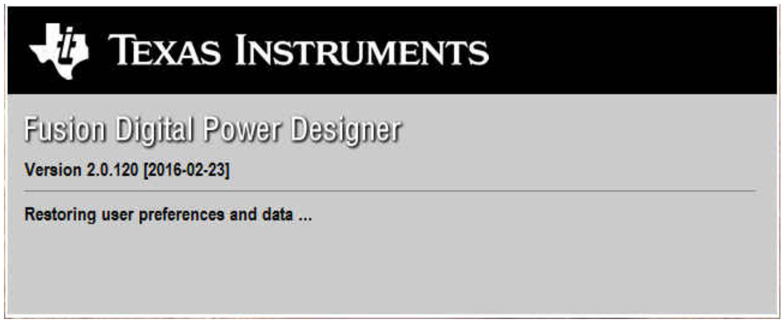


**Figure 12-1. First Window at Fusion Launch**

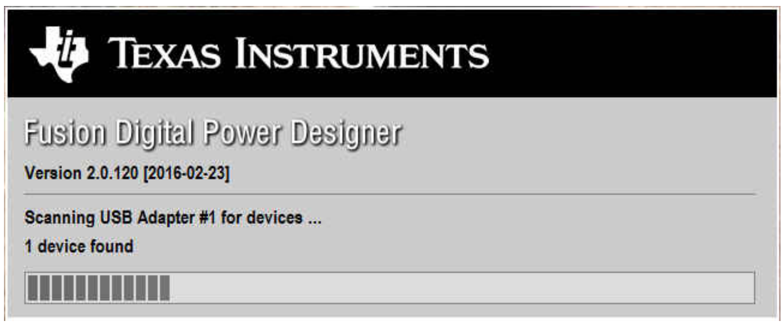


**Figure 12-2. Scan Finds Device Successfully**


**Figure 12-3. Software Launch Continued**


**Figure 12-4. Software Launch Continued**

Use the *All Config* tab to configure all of the configurable parameters (Figure 12-5). The screen also shows other details like hexadecimal (hex) encoding. Use this screen to configure:

- Power Good Delay
- Power On Delay
- Mode Settings
- Frequency, RAMP, DCAP3
- VDD UVLO
- On/Off Configuration
- Track and Sequencing
- Write Protect
- VOUT Command Voltage
- VOUT Margin
- Operation

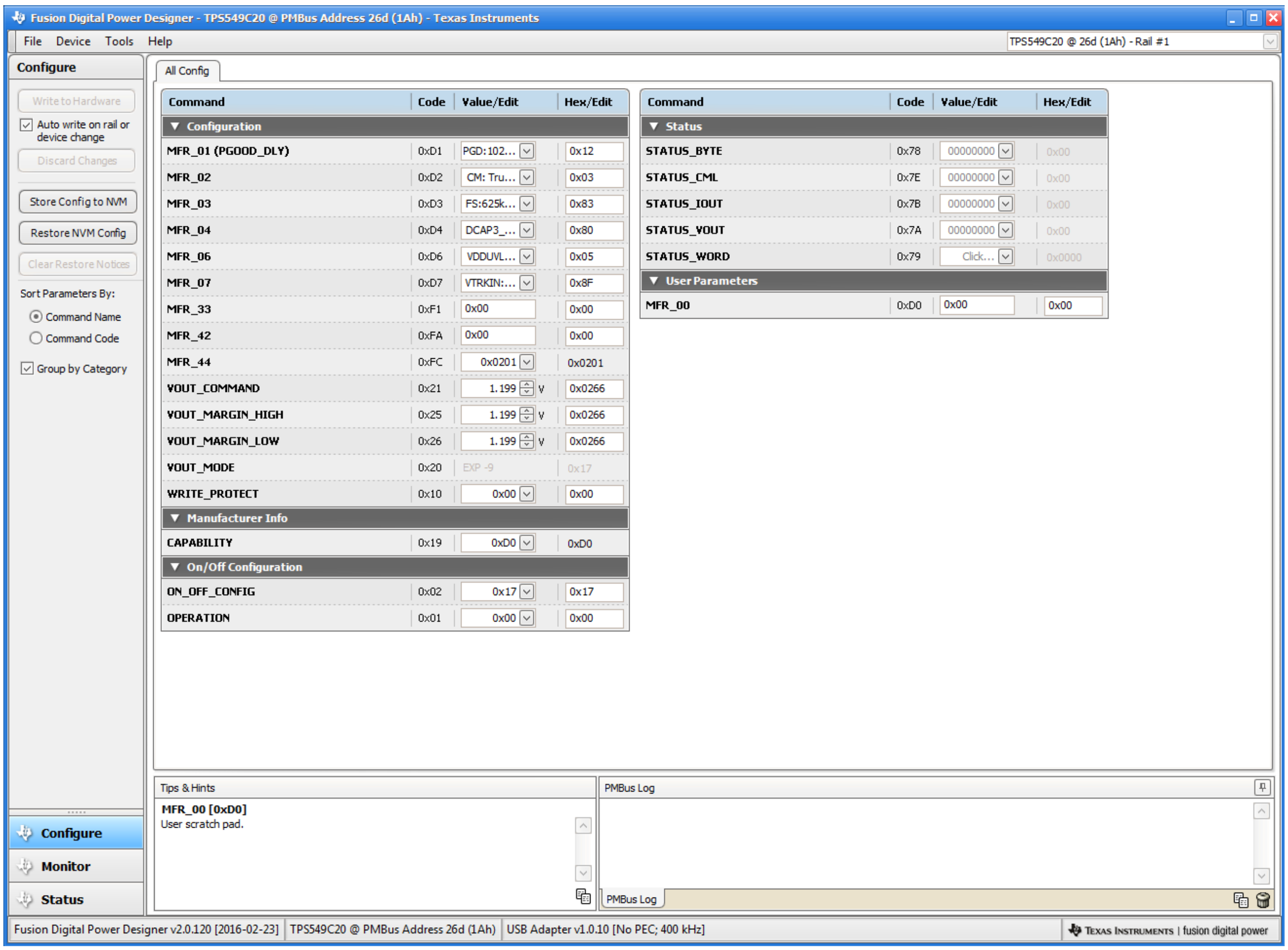


**Figure 12-5. First Screen After Successful Launch Configure: Limits and On/Off**

Changing the frequency prompts a pop-up window with details of the options Figure 12-6).

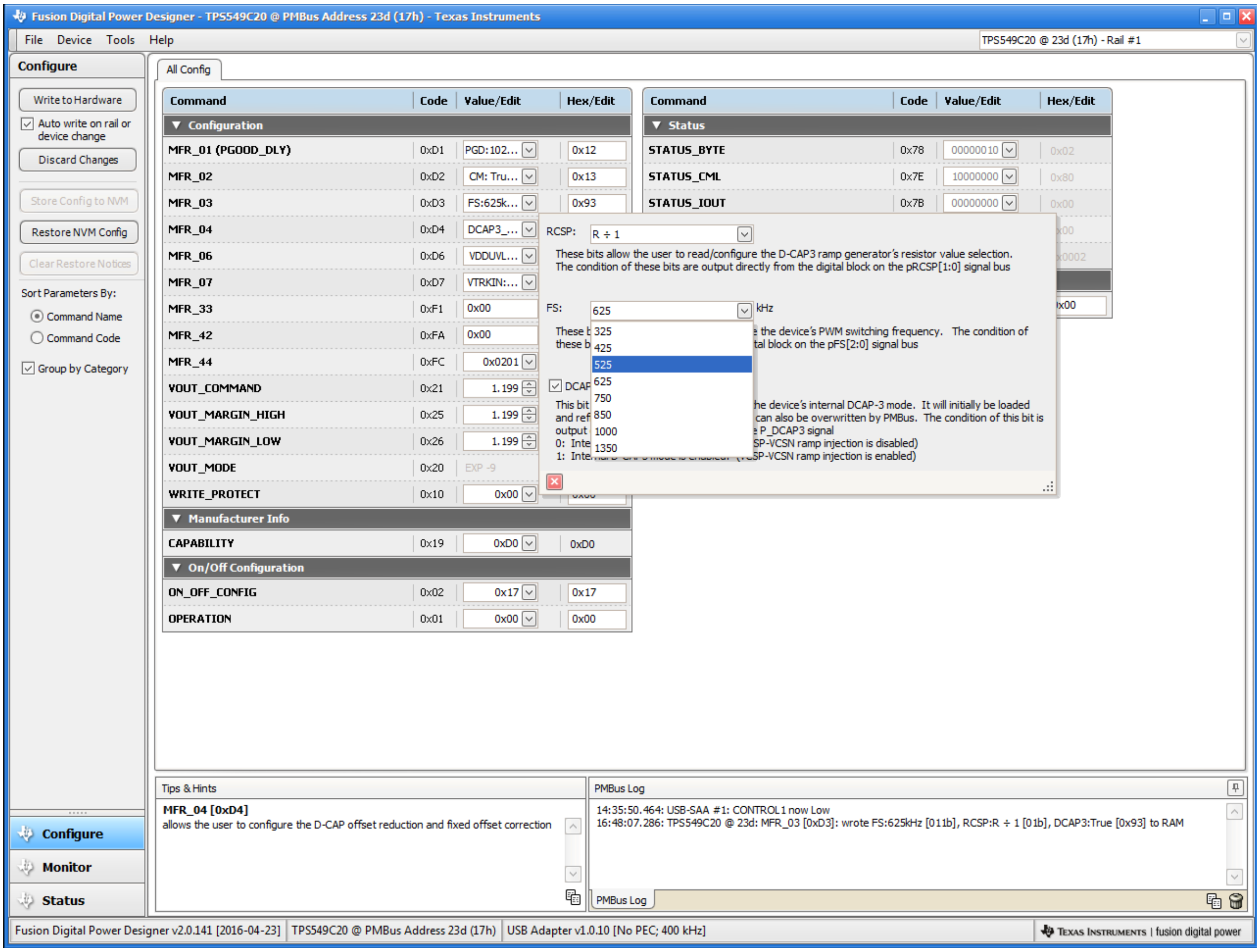

**Figure 12-6. Configure: Frequency- FS Configuration Pop-up**

After a change is selected, orange **U** icon is displayed to offer *Undo Change* option. Change is not retained until either *Write to Hardware* or *Store Config to NVM* is selected. When *Write to Hardware* is selected, change is committed to volatile memory and defaults back to previous setting on input power cycle. When *Store Config to NVM* is selected, change is committed to nonvolatile memory and becomes the new default (Figure 12-7).

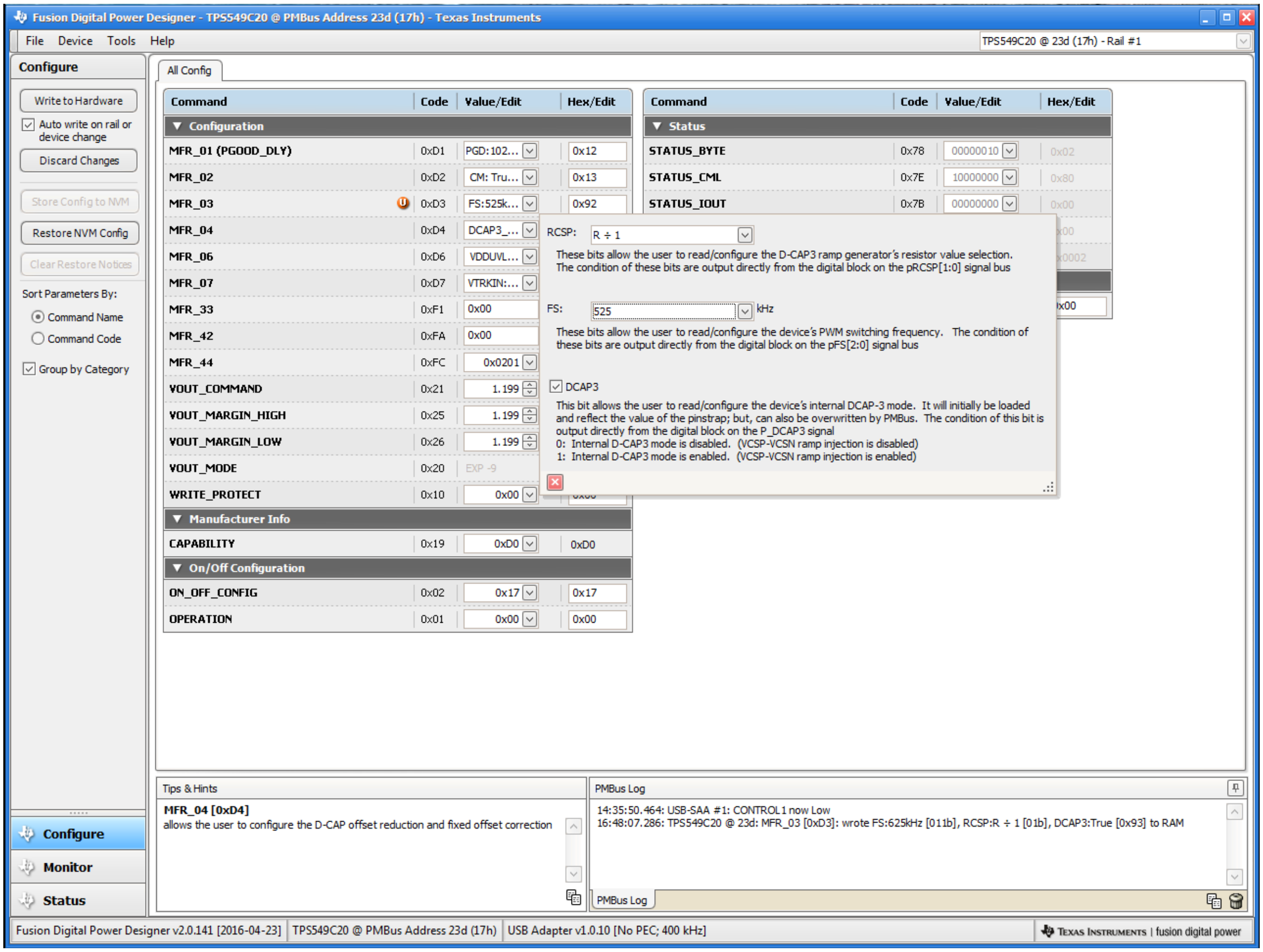


**Figure 12-7. Configure: Frequency- FS Config Pop-Up with Change**

After making changes to one or more configurable parameters, the changes can be committed to nonvolatile memory by selecting *Store Config to NVM*. This action prompts a *confirm selection* pop-up, and if confirmed, the changes are committed to nonvolatile memory (Figure 12-8).

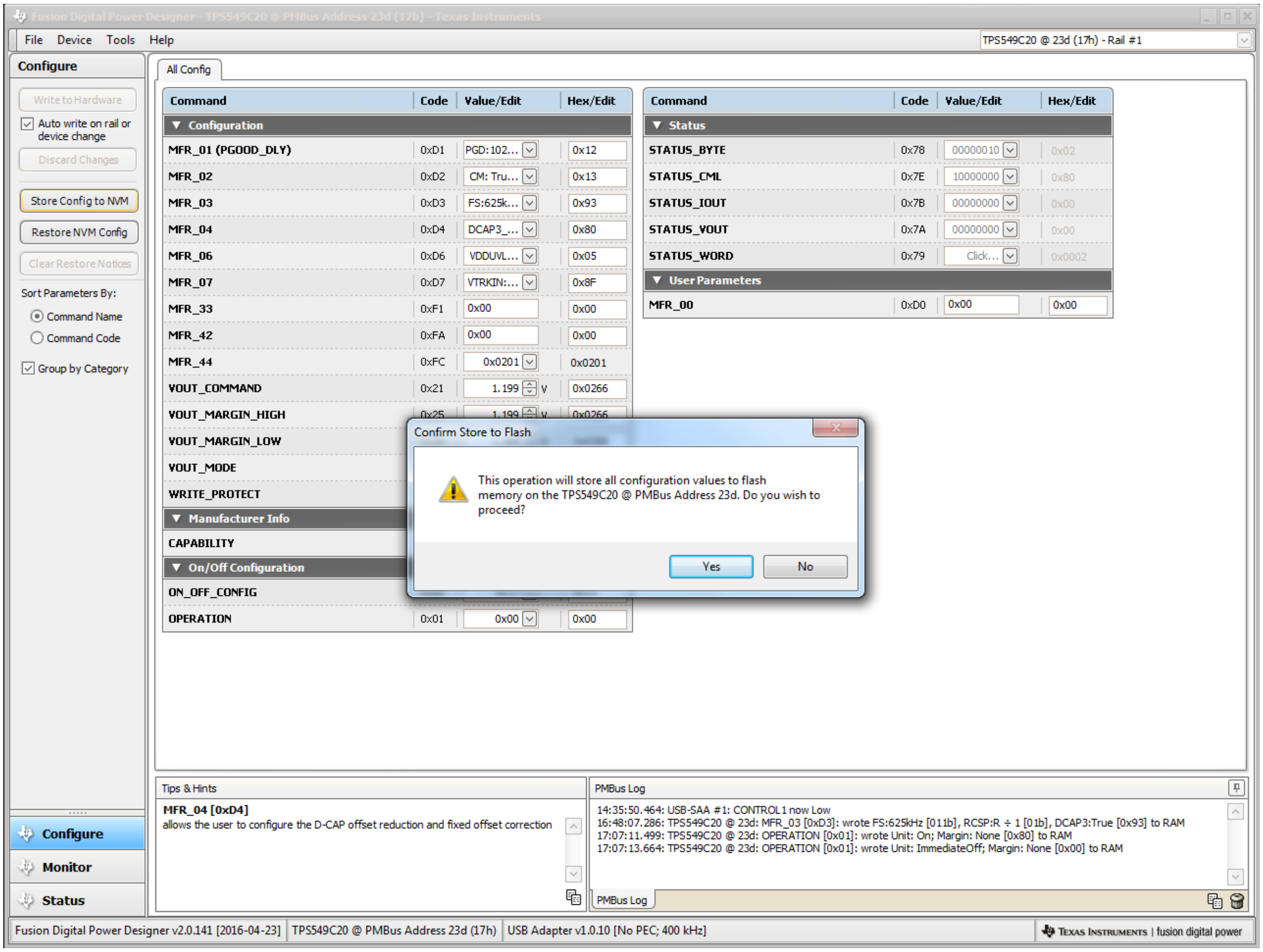


**Figure 12-8. Configure: *Store Config to NVM***

In the lower left corner, the different view screens can be changed. The view screens can be changed between *Configure*, *Monitor* and *Status* as needed (Figure 12-9).

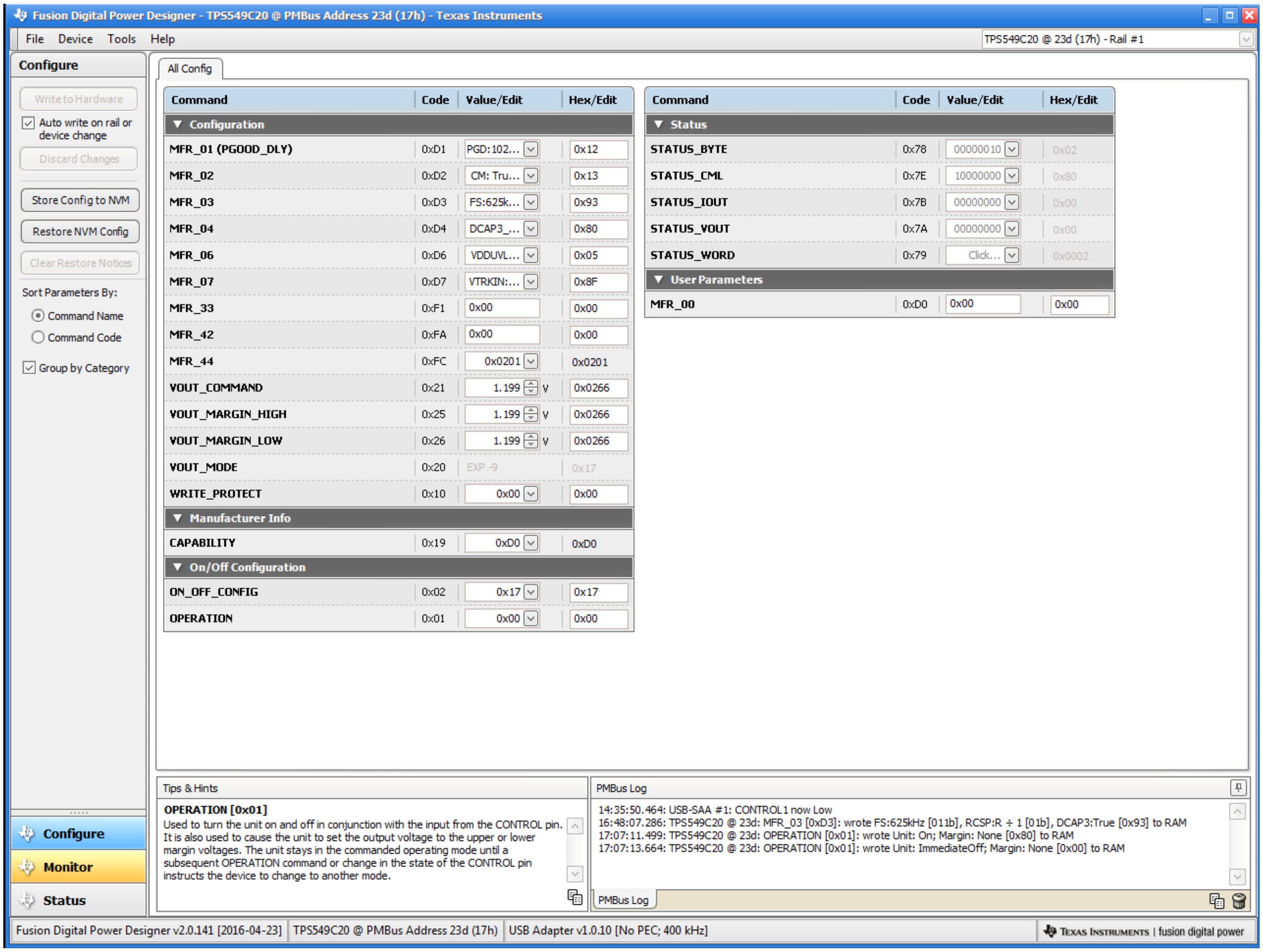

**Figure 12-9. Change View Screen to Monitor Screen**

Selecting *System Dashboard* from mid-left screen adds a new window which displays system-level information (Figure 12-10).

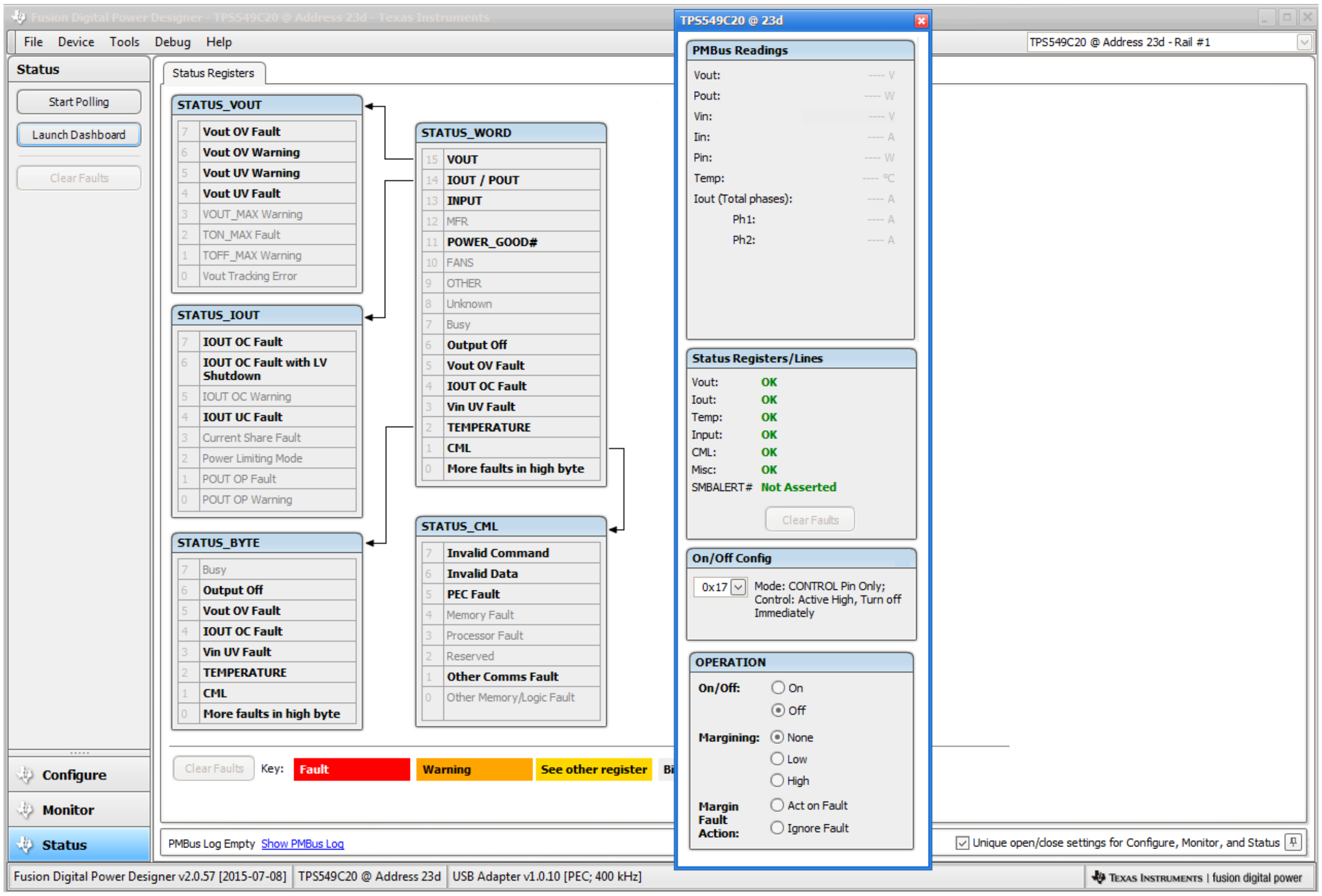


**Figure 12-10. System Dashboard**

Selecting *Status* from lower left corner shows the status of the controller (Figure 12-11).

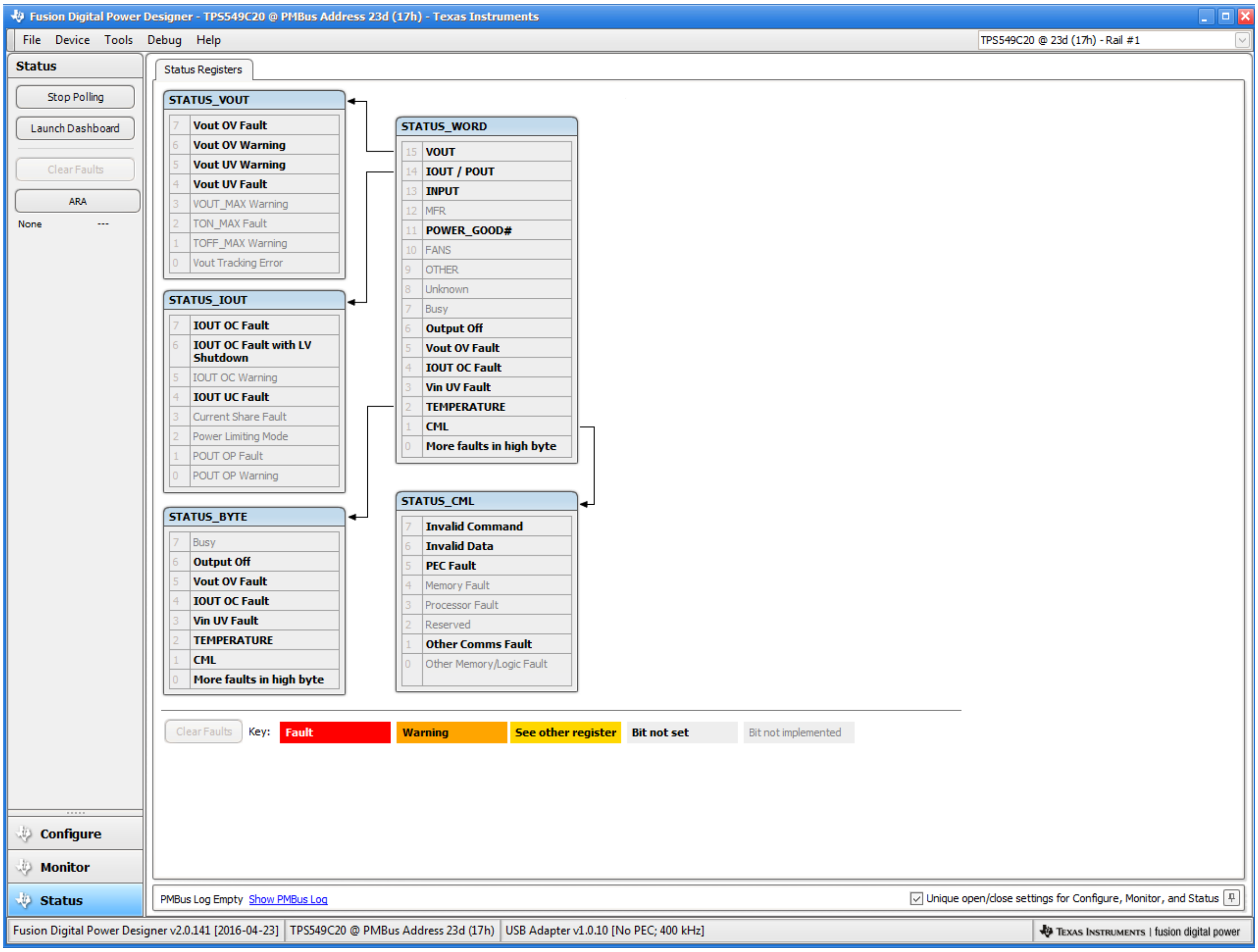


**Figure 12-11. Status Screen**

Selecting *Store User Configuration to Flash Memory* from the device pull-down menu has the same functionality as the *Store Config to NVM* button from the configure screen. It results in committing the current configuration to nonvolatile memory (Figure 12-12).

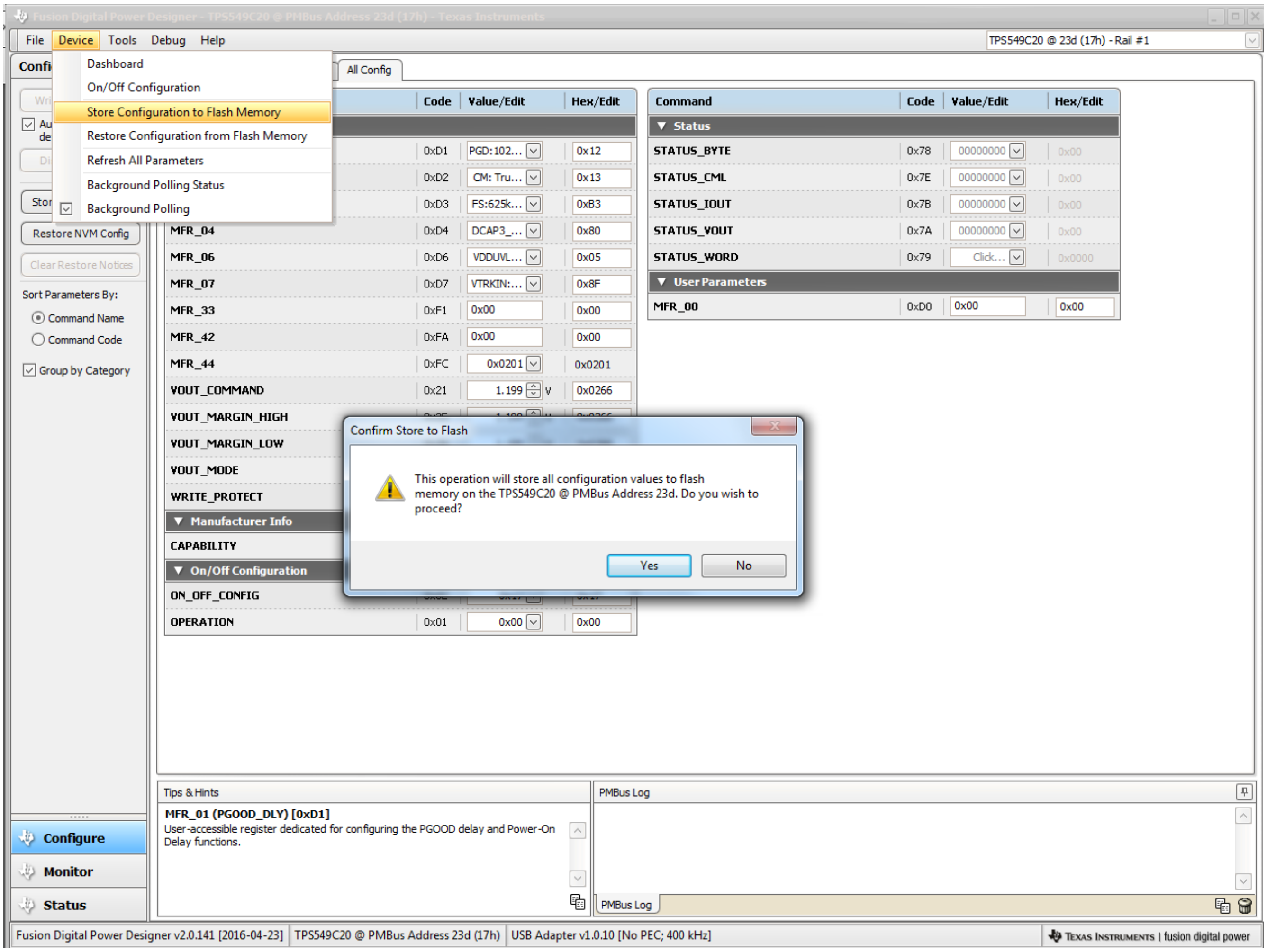


**Figure 12-12. Store Configuration To Memory**

Selecting *PMBus Logging* (Figure 12-13) from the Tools drop-down menu enables the logging of all PMBus activity. This includes communications traffic for each polling loop between the GUI and the device. The user is prompted to select a location for the file to be stored. See next screen (Figure 12-14).

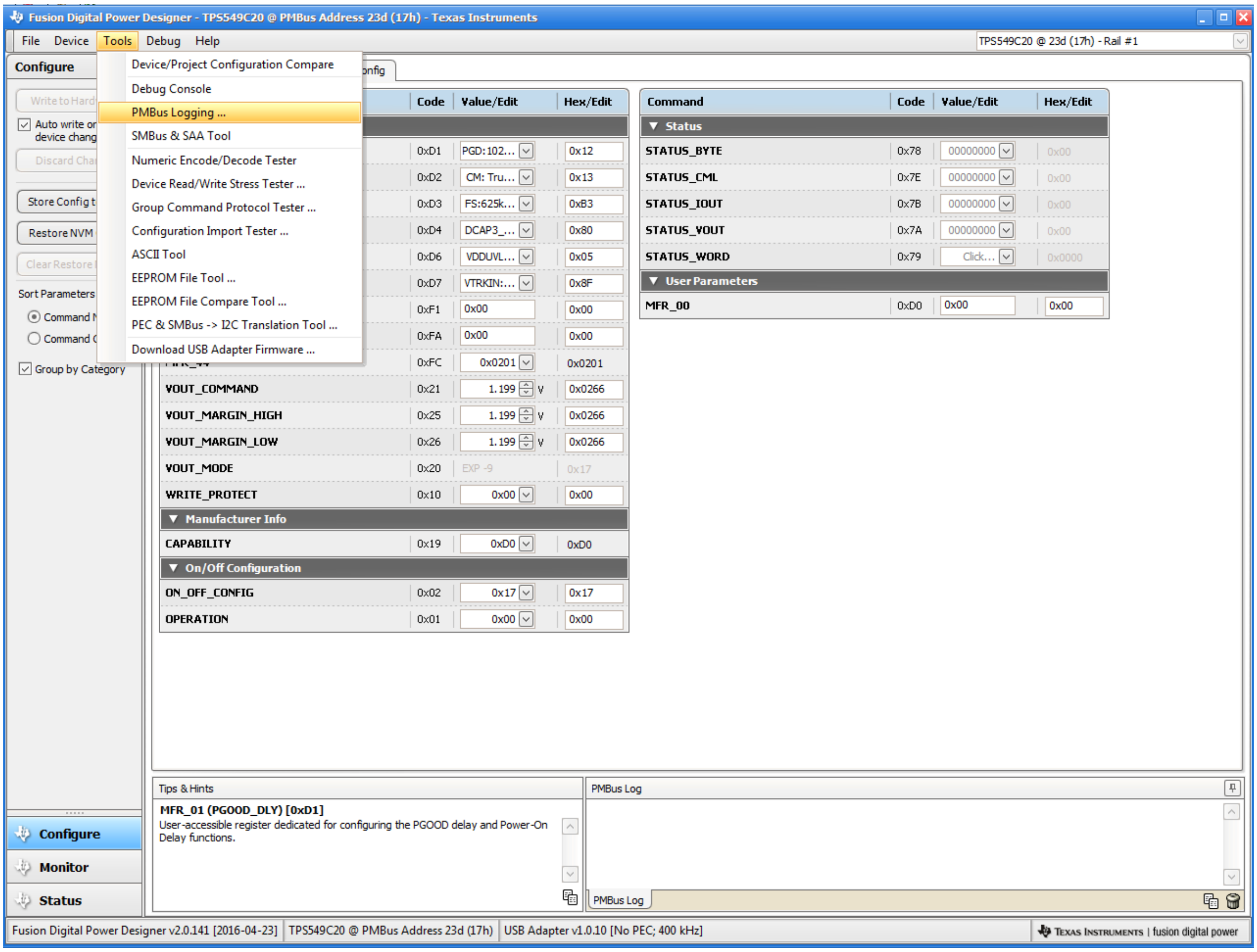


**Figure 12-13. PMBus Logging**

Select the storage location for the file and the type of file. As shown (Figure 12-14), the file is a CSV file to be stored in the directory path shown. Logging begins when the *Start Logging* button is selected, and stops when it is reselected (as *Stop Logging*). This file can rapidly grow in size, so caution is advised when using this function.

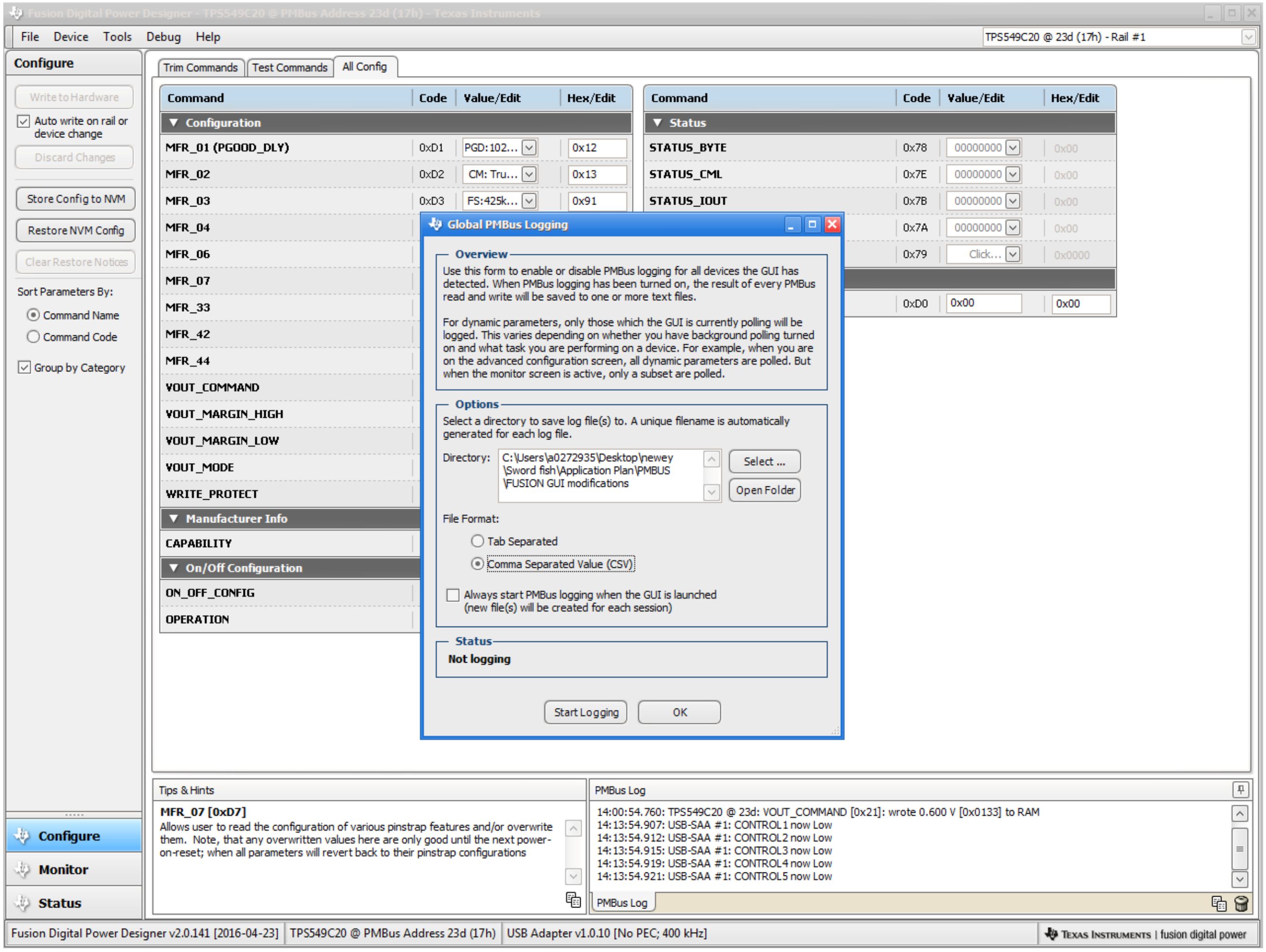


**Figure 12-14. PMBus Log Details**

## 13 EVM Assembly Drawing and PCB Layout

Figure 13-1 through Figure 13-10 show the design of the PWR-847EVM printed-circuit board (PCB). The PWR-847EVM has a 2-oz. copper finish for all layers.

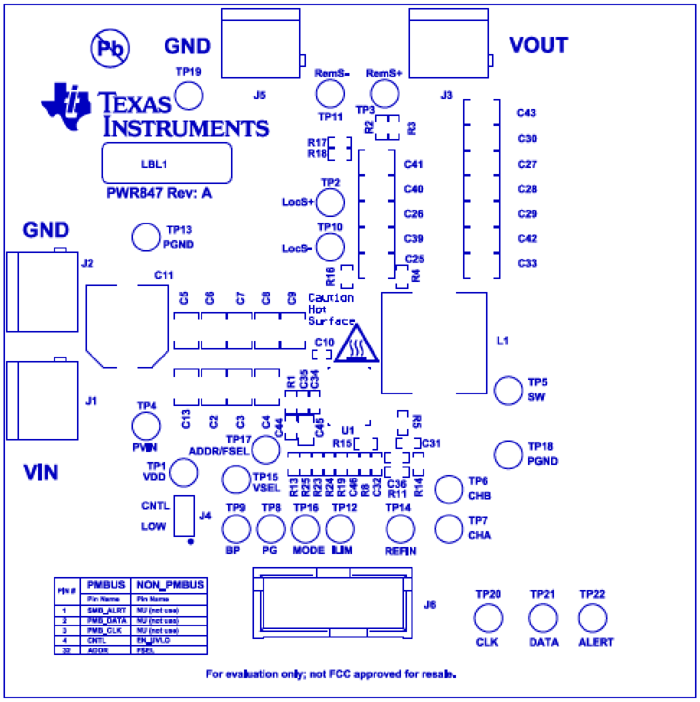


Figure 13-1. PWR-847EVM Top Layer Assembly Drawing (Top View)

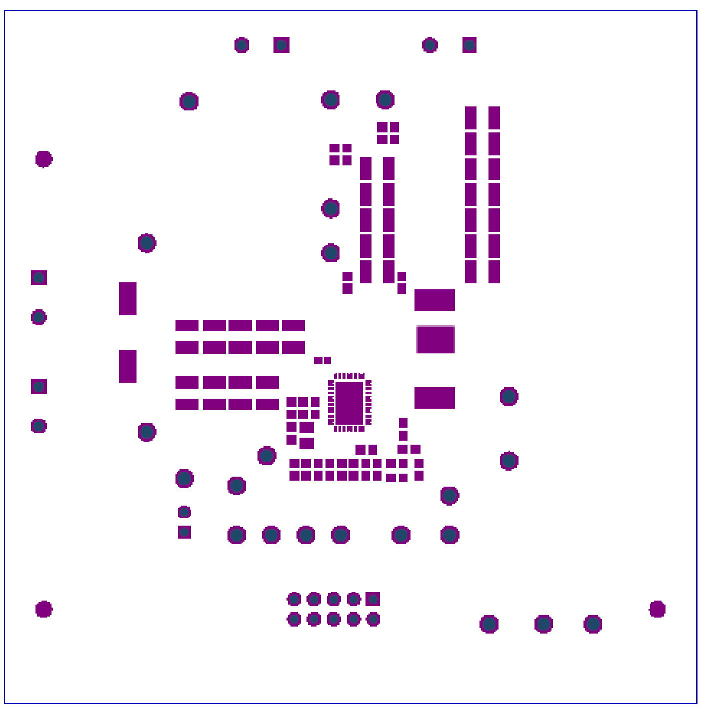

Figure 13-2. PWR-847EVM Top Solder Mask (Top View)

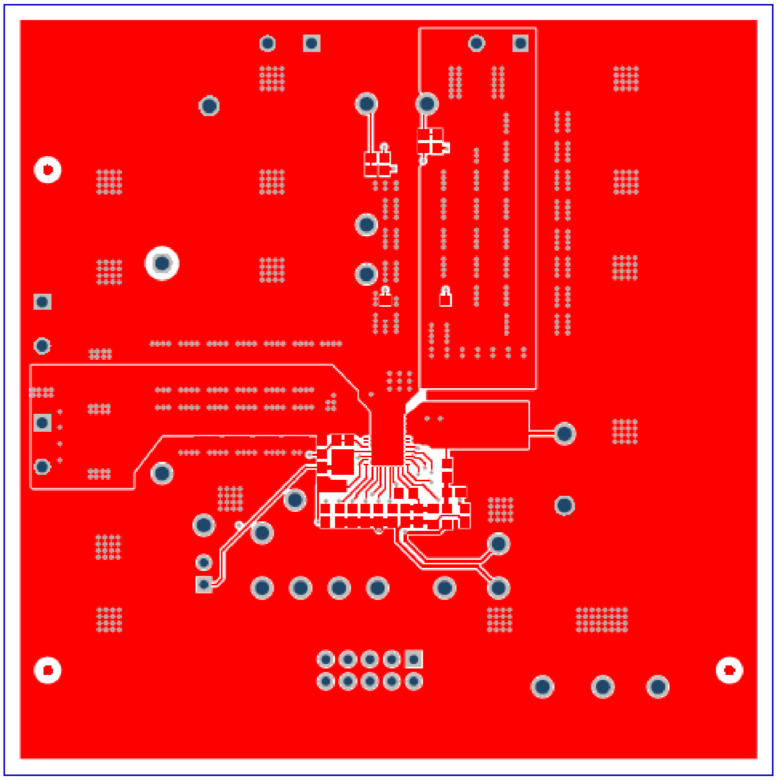

**Figure 13-3. PWR-847EVM Top Layer (Top View)**

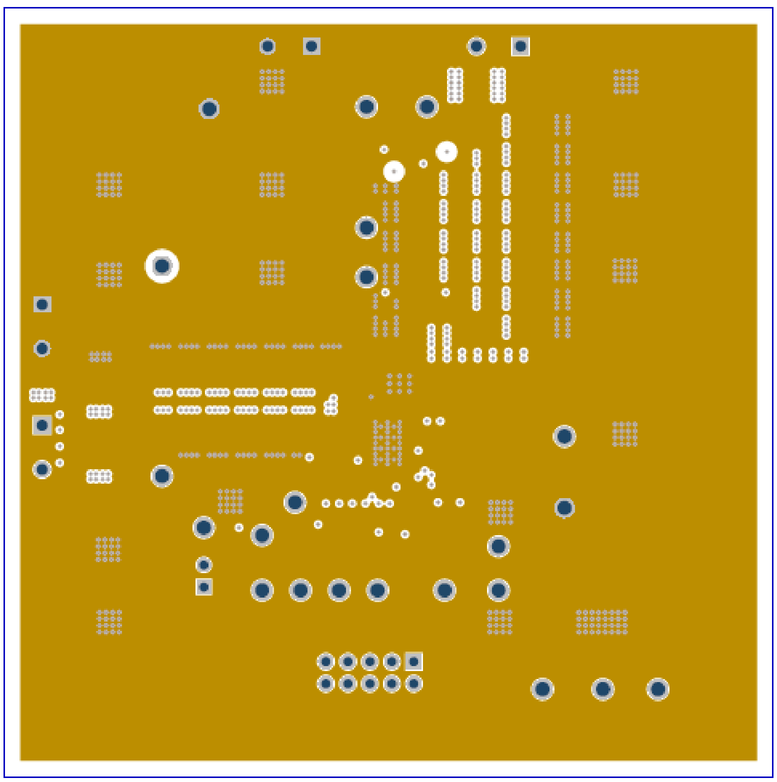

**Figure 13-4. PWR-847EVM Inner Layer 1 (Top View)**

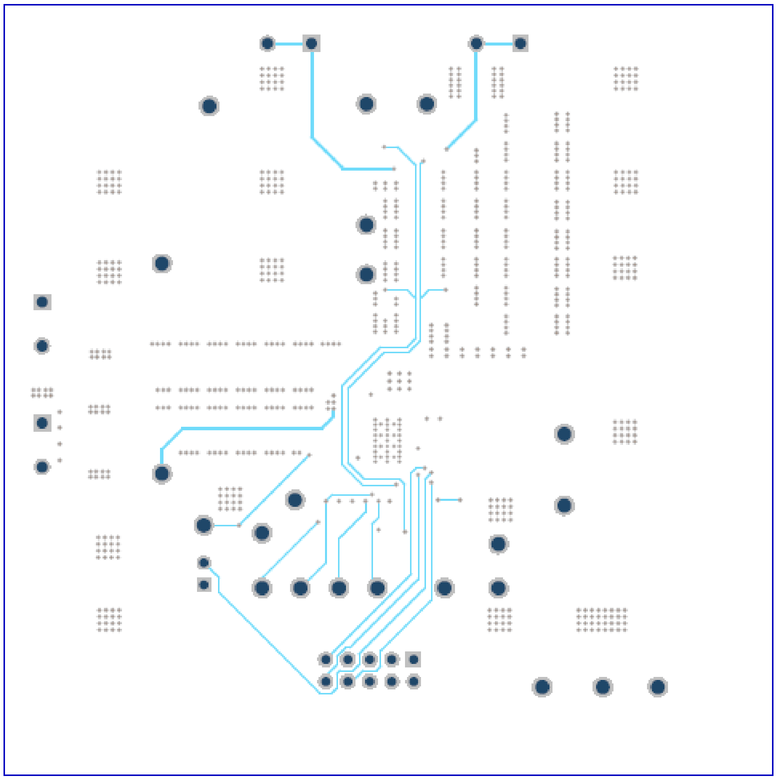

**Figure 13-5. PWR-847EVM Inner Layer 2 (Top View)**

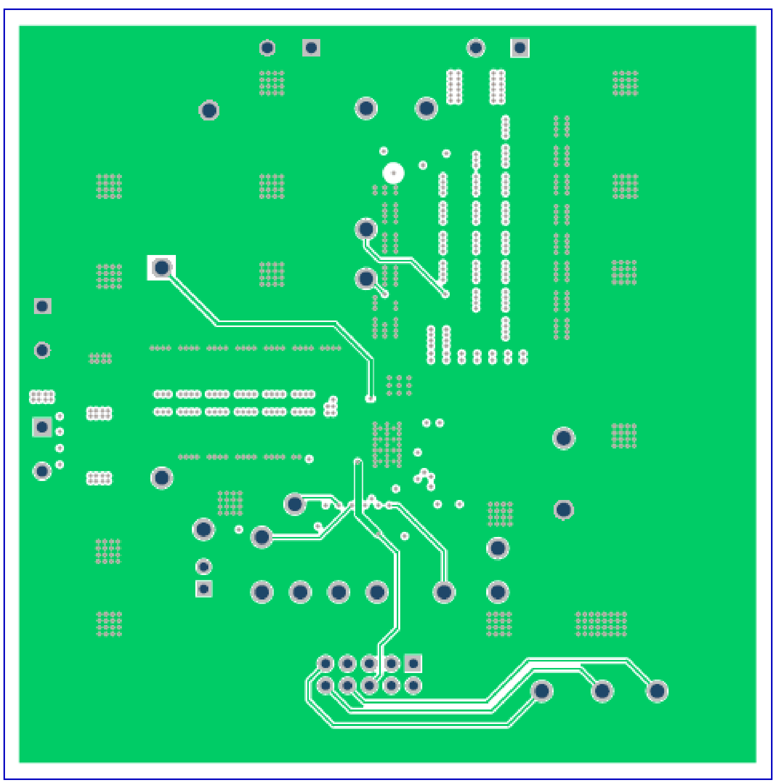

**Figure 13-6. PWR-847EVM Inner Layer 3 (Top View)**

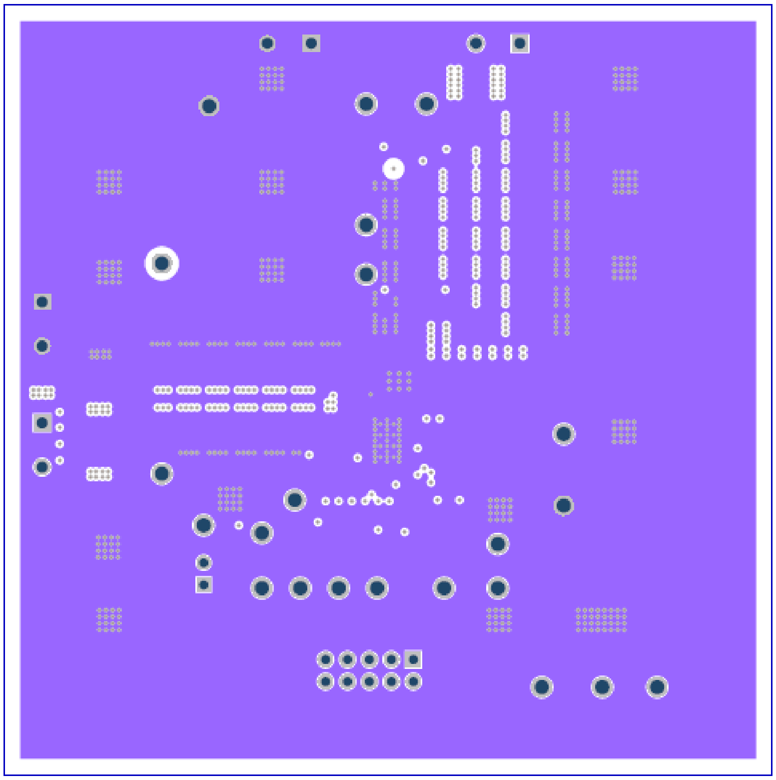

Figure 13-7. PWR-847EVM Inner Layer 4 (Top View)

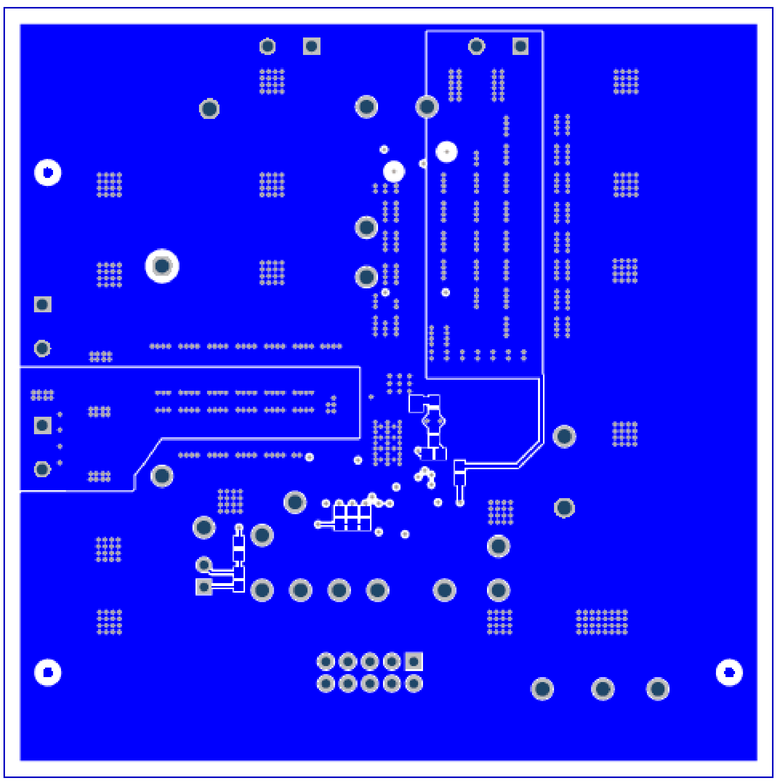

Figure 13-8. PWR-847EVM Bottom Layer (Top View)

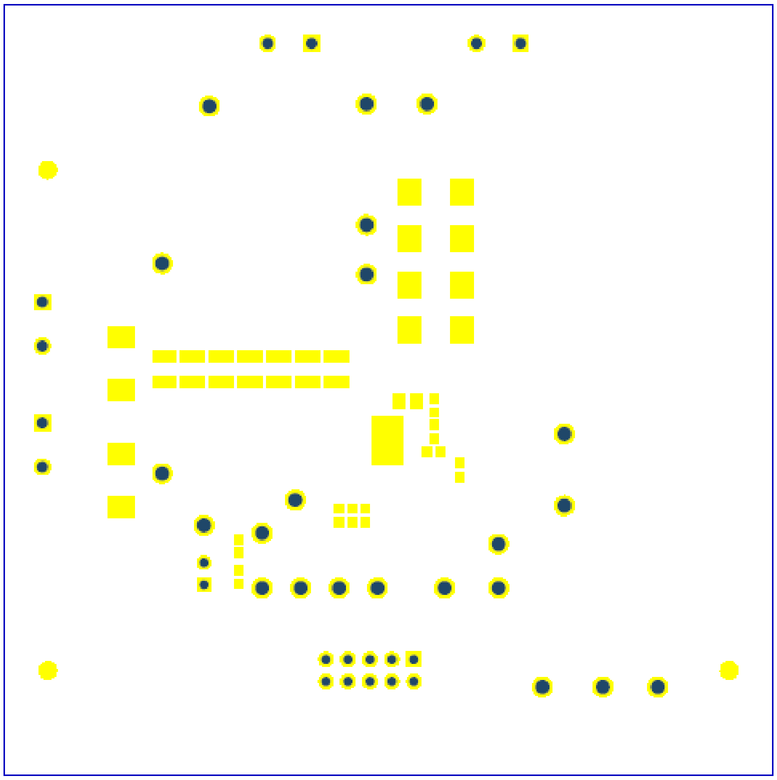

**Figure 13-9. PWR-847EVM Bottom Solder Mask (Top View)**

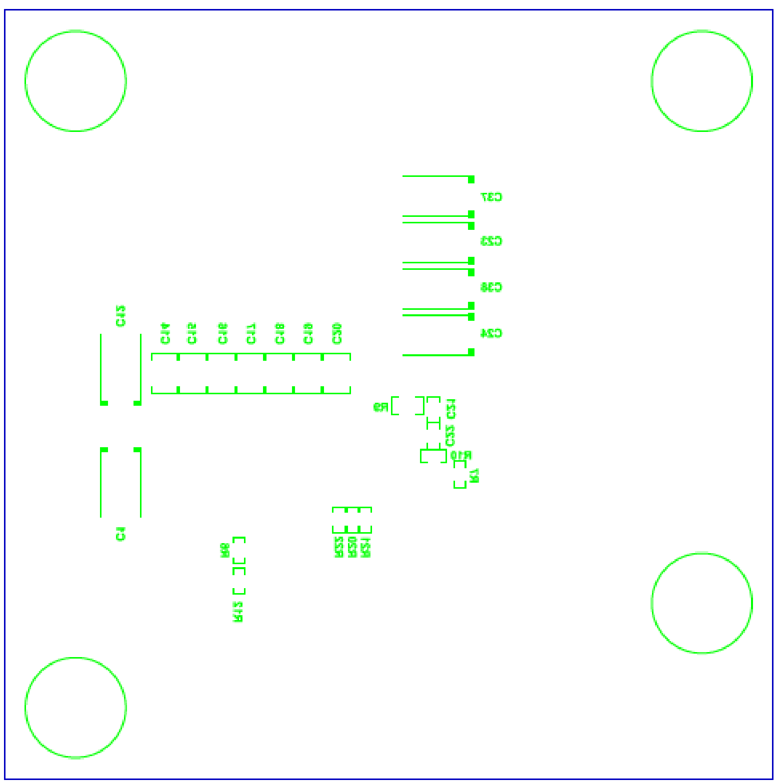

**Figure 13-10. PWR-847EVM Bottom Overlay Layer (Top View)**

# 14 List of Materials

The EVM components list, according to the schematic, is shown in Table 14-1.

**Table 14-1. PWR847 List of Materials**

| Designator | Qty | Value | Description | Package Reference | Part Number | Manufacturer | Alternate Part Number | Alternate Manufacturer |
|---|---|---|---|---|---|---|---|---|
| !PCB1 | 1 | | Printed Circuit Board | | PWR847 | Any | | |
| C2, C3, C4, C5, C6, C7, C8, C9, C13 | 9 | 22uF | CAP, CERM, 22 µF, 25 V, +/- 10%, X7R, 1210 | 1210 | GRM32ER71E226KE15L | Murata | | |
| C10 | 1 | 2200pF | CAP, CERM, 2200 pF, 25 V, +/- 10%, X5R, 0402 | 0402 | GRM155R61E222KA01D | Murata | | |
| C11 | 1 | 100uF | CAP, AL, 100uF, 35V, +/-20%, 0.15 ohm, SMD | SMT Radial G | EEE-FC1V101P | Panasonic | | |
| C22 | 1 | 0.1uF | CAP, CERM, 0.1 µF, 50 V, +/- 10%, X7R, 0603 | 0603 | GRM188R71H104KA93D | Murata | | |
| C24, C38 | 2 | 470uF | CAP, Tantalum Polymer, 470 µF, 2.5 V, +/- 20%, 0.006 ohm, 7.3x2.8x4.3mm SMD | 7.3x2.8x4.3mm | 2R5TPF470M6L | Panasonic | | |
| C25, C26, C29, C33, C39, C40, C42 | 7 | 100uF | CAP, CERM, 100 µF, 6.3 V, +/- 20%, X5R, 1210 | 1210 | GRM32ER60J107ME20L | Murata | | |
| C35 | 1 | 1uF | CAP, CERM, 1 µF, 16 V, +/- 10%, X5R, 0603 | 0603 | C0603C105K4PACTU | Kemet | | |
| C45 | 1 | 4.7uF | CAP, CERM, 4.7 µF, 16 V, +/- 10%, X7R, 0805 | 0805 | GRM21BR71C475KA73L | Murata | | |
| H9, H10, H11, H12 | 4 | | Bumpon, Hemisphere, 0.44 X 0.20, Clear | Transparent Bumpon | SJ-5303 (CLEAR) | 3M | | |
| J1, J2, J3, J5 | 4 | | TERMINAL BLOCK 5.08MM VERT 2POS, TH | TERM_BLK, 2pos, 5.08mm | ED120/2DS | On-Shore Technology | | |
| J4 | 1 | | Header, 100mil, 2x1, Tin, TH | Header, 2 PIN, 100mil, Tin | PEC02SAAN | Sullins Connector Solutions | | |
| J6 | 1 | | Header (shrouded), 100mil, 5x2, Gold, TH | 5x2 Shrouded header | 5103308-1 | TE Connectivity | | |
| L1 | 1 | 330nH | Inductor, Shielded Drum Core, Ferrite, 330 nH, 50 A, 0.000165 ohm, SMD | 12.5x13mm | 744309033 | Wurth Elektronik | | |
| LBL1 | 1 | | Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll | PCB Label 0.650"H x 0.200"W | THT-14-423-10 | Brady | | |
| R1 | 1 | 1.00 | RES, 1.00, 1%, 0.1 W, 0603 | 0603 | RC0603FR-071RL | Yageo America | | |
| R4, R7, R10, R11, R16 | 5 | 0 | RES, 0, 5%, 0.1 W, 0603 | 0603 | CRCW06030000Z0EA | Vishay-Dale | | |
| R6 | 1 | 200k | RES, 200 k, 1%, 0.1 W, 0603 | 0603 | CRCW0603200KFKEA | Vishay-Dale | | |
| R8 | 1 | 1.10k | RES, 1.10 k, 1%, 0.1 W, 0603 | 0603 | CRCW06031K10FKEA | Vishay-Dale | | |
| R12, R13, R20, R21, R22 | 5 | 100k | RES, 100 k, 1%, 0.1 W, 0603 | 0603 | CRCW0603100KFKEA | Vishay-Dale | | |
| R15 | 1 | 10.0k | RES, 10.0k ohm, 1%, 0.1W, 0603 | 0603 | CRCW060310K0FKEA | Vishay-Dale | | |
| R19 | 1 | 61.9k | RES, 61.9 k, 1%, 0.1 W, 0603 | 0603 | CRCW060361K9FKEA | Vishay-Dale | | |
| R23 | 1 | 37.4k | RES, 37.4 k, 1%, 0.1 W, 0603 | 0603 | CRCW060337K4FKEA | Vishay-Dale | | |
| R24 | 1 | 42.2k | RES, 42.2 k, 1%, 0.1 W, 0603 | 0603 | CRCW060342K2FKEA | Vishay-Dale | | |
| R25 | 1 | 25.5k | RES, 25.5 k, 1%, 0.1 W, 0603 | 0603 | CRCW060325K5FKEA | Vishay-Dale | | |

## Table 14-1. PWR847 List of Materials (continued)

| Designator | Qty | Value | Description | Package Reference | Part Number | Manufacturer | Alternate Part Number | Alternate Manufacturer |
|---|---|---|---|---|---|---|---|---|
| TP1, TP5, TP6, TP7, TP8, TP9, TP12, TP14, TP15, TP16, TP17, TP20, TP21, TP22 | 14 | White | Test Point, Multipurpose, White, TH | White Multipurpose Testpoint | 5012 | Keystone | | |
| TP2, TP3, TP4 | 3 | Red | Test Point, Multipurpose, Red, TH | Red Multipurpose Testpoint | 5010 | Keystone | | |
| TP10, TP11, TP13, TP18, TP19 | 5 | Black | Test Point, Multipurpose, Black, TH | Black Multipurpose Testpoint | 5011 | Keystone | | |
| U1 | 1 | | 1.5-V to 16-V VIN, 4.5-V to 22-V VDD, 25-A SWIFT Synchronous Step-Down Converter with Full Differential Sense, RVF0040A (LQFN-CLIP-40) | RVF0040A | TPS549B22RVFR | Texas Instruments | TPS549B22RVFT | Texas Instruments |
| C1, C12 | 0 | 330uF | CAP, TA, 330 µF, 6.3 V, +/- 20%, 0.025 ohm, SMD | 7.3x2.8x4.3mm | 6TPE330ML | Sanyo | | |
| C14, C15, C16, C17, C18, C19, C20 | 0 | 22uF | CAP, CERM, 22 µF, 25 V, +/- 10%, X7R, 1210 | 1210 | GRM32ER71E226KE15L | Murata | | |
| C21 | 0 | 470pF | CAP, CERM, 470 pF, 50 V, +/- 10%, X7R, 0603 | 0603 | GRM188R71H471KA01D | Murata | | |
| C23, C37 | 0 | 470uF | CAP, Tantalum Polymer, 470 µF, 2.5 V, +/- 20%, 0.006 ohm, 7.3x2.8x4.3mm SMD | 7.3x2.8x4.3mm | 2R5TPF470M6L | Panasonic | | |
| C27, C28, C30, C41, C43 | 0 | 100uF | CAP, CERM, 100 µF, 6.3 V, +/- 20%, X5R, 1210 | 1210 | GRM32ER60J107ME20L | Murata | | |
| C31 | 0 | 0.1uF | CAP, CERM, 0.1 µF, 50 V, +/- 10%, X7R, 0603 | 0603 | GRM188R71H104KA93D | Murata | | |
| C32 | 0 | 6800pF | CAP, CERM, 6800 pF, 50 V, +/- 10%, X7R, 0603 | 0603 | GRM188R71H682KA01D | Murata | | |
| C34, C44 | 0 | 1uF | CAP, CERM, 1 µF, 16 V, +/- 10%, X5R, 0603 | 0603 | C0603C105K4PACTU | Kemet | | |
| C36 | 0 | 1000pF | CAP, CERM, 1000 pF, 25 V, +/- 10%, X7R, 0603 | 0603 | GRM188R71E102KA01D | Murata | | |
| C46 | 0 | 1000pF | CAP, CERM, 1000 pF, 50 V, +/- 5%, C0G/NP0, 0603 | 0603 | C0603C102J5GACTU | Kemet | | |
| FID1, FID2, FID3, FID4, FID5, FID6 | 0 | | Fiducial mark. There is nothing to buy or mount. | Fiducial | N/A | N/A | | |
| R2, R3, R14, R17, R18 | 0 | 0 | RES, 0, 5%, 0.1 W, 0603 | 0603 | CRCW06030000Z0EA | Vishay-Dale | | |
| R5 | 0 | 1.50k | RES, 1.50 k, 1%, 0.1 W, 0603 | 0603 | RC0603FR-071K5L | Yageo America | | |
| R9 | 0 | 3.01 | RES, 3.01 ohm, 1%, 0.125W, 0805 | 0805 | CRCW08053R01FKEA | Vishay-Dale | | |
| | Notes: | Unless otherwise noted in the Alternate Part Number or Alternate Manufacturer columns, all parts may be substituted with equivalents. | | | | | | |

## 15 Revision History

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

**Changes from Revision * (March 2017) to Revision A (August 2021)** **Page**

- Updated user's guide title............................................................................................................................ 3
- Updated the numbering format for tables, figures, and cross-references throughout the document. ................3