*User's Guide*

# *TPS389006Q1EVM Multichannel Voltage Supervisor with I²C User Guide*


**ABSTRACT**

This user guide describes the operational use of the TPS389006Q1EVM evaluation module (EVM) as a reference design for engineering demonstration and evaluation of the TPS389006-Q1 Multichannel Overvoltage and Undervoltage I²C Programmable Voltage Supervisor and Monitor. This guide contains the EVM schematic, bill of materials (BOM), assembly drawing, and top and bottom board layouts.


## Table of Contents



## List of Figures

## List of Tables



## Trademarks

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# 1 Introduction

The TPS389006Q1EVM is an evaluation module (EVM) for the TPS389006-Q1 Multichannel Overvoltage and Undervoltage I²C Programmable Voltage Supervisor and Monitor. Test points are provided to give the user additional access, if needed, for oscilloscope or multi-meter measurements.

The TPS389006Q1EVM comes pre-populated with TPS38900603NRTERQ1. This IC variant is configured for six integrated multichannel window inputs to monitor six distinct input voltage rails with two remote sense pins. The device also includes internal glitch immunity and noise filters to eliminate false resets resulting from erroneous signals. The TPS389006-Q1 device does not require any external resistors for setting overvoltage and undervoltage reset thresholds which optimizes and improves the reliability for safety systems.

I²C functionality gives flexibility in selecting thresholds, reset delays, glitch filters, and pin functionality. This device offers CRC error checking, sequence logging during turn ON or turn OFF, and a built-in ADC for voltage readouts to provide redundant error checking. In addition, TPS389006-Q1 offers a sync feature for tagging rails as they come up. Rail tagging works across multiple instances of TPS389006-Q1 devices. If users need a different TPS389006-Q1 variant, the existing device must be removed from the board. The EVM board is designed to support all possible options by changing jumper configurations and is capable of daisy-chaining, via 10-pin ribbon, up to three evaluation boards.

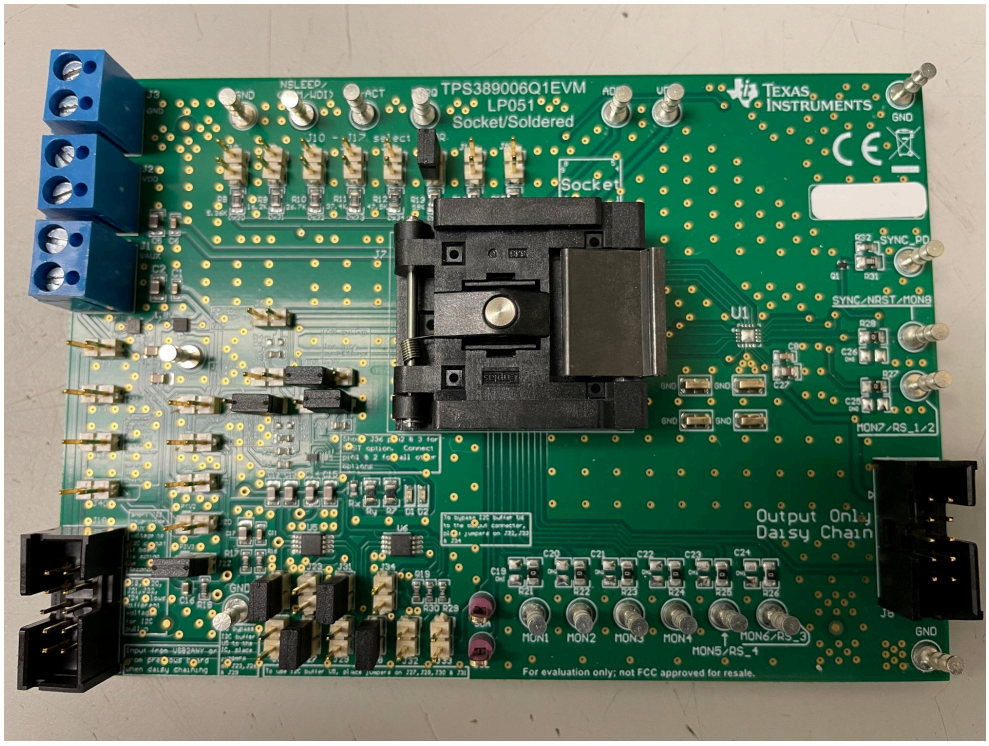


**Figure 1-1. TPS389006Q1EVM Board Top**

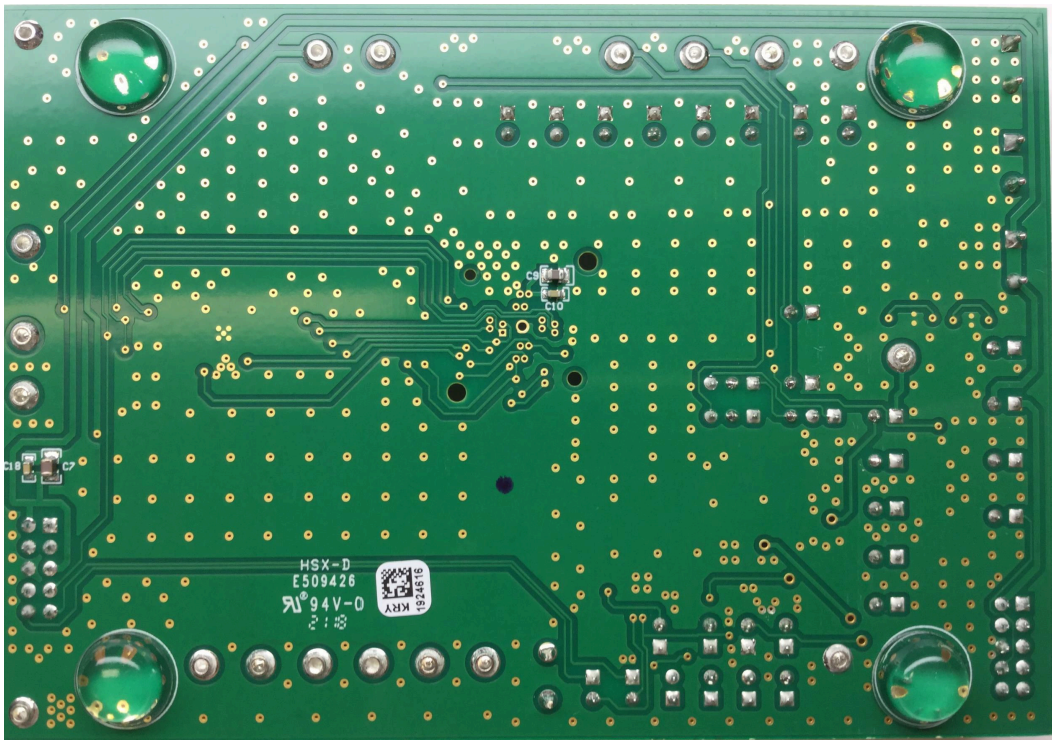


**Figure 1-2. TPS389006Q1EVM Board Bottom**

## 1.1 Related Documentation

Datasheet: *TPS389006-Q1 Multichannel Overvoltage and Undervoltage I²C Programmable Voltage Supervisor and Monitor*

## 1.2 TPS389006-Q1 Applications

- Advanced Driver Assistance System (ADAS)
- Sensor fusion
- Medical robotics
- Industrial robotics

## 2 Schematic, Bill of Materials, and Layout

This section provides a detailed description of the TPS389006Q1EVM schematic, bill of materials (BOM), and layout.

## 2.1 TPS389006Q1EVM Schematic

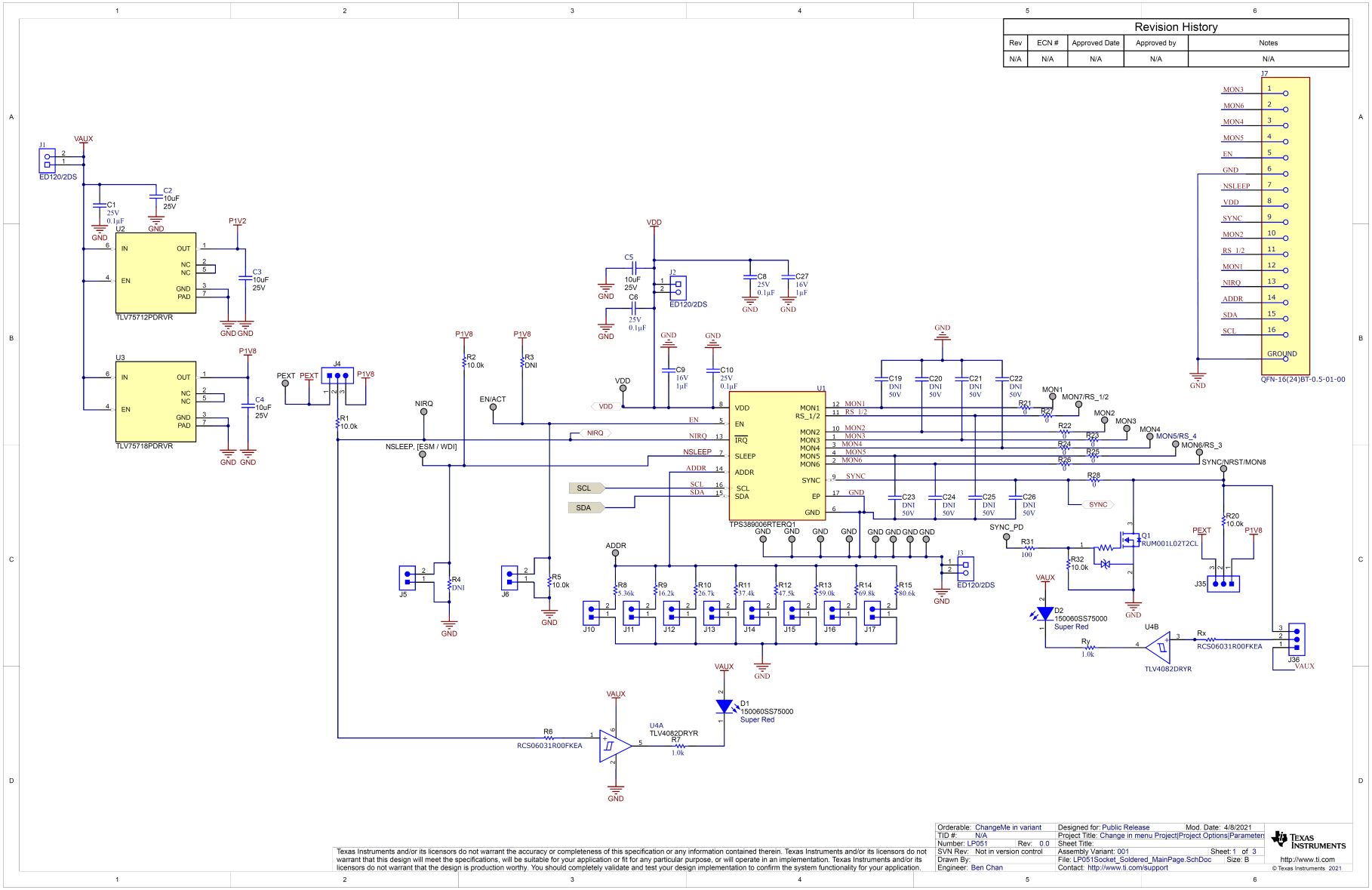


**Figure 2-1. TPS389006Q1EVM Main Schematic**

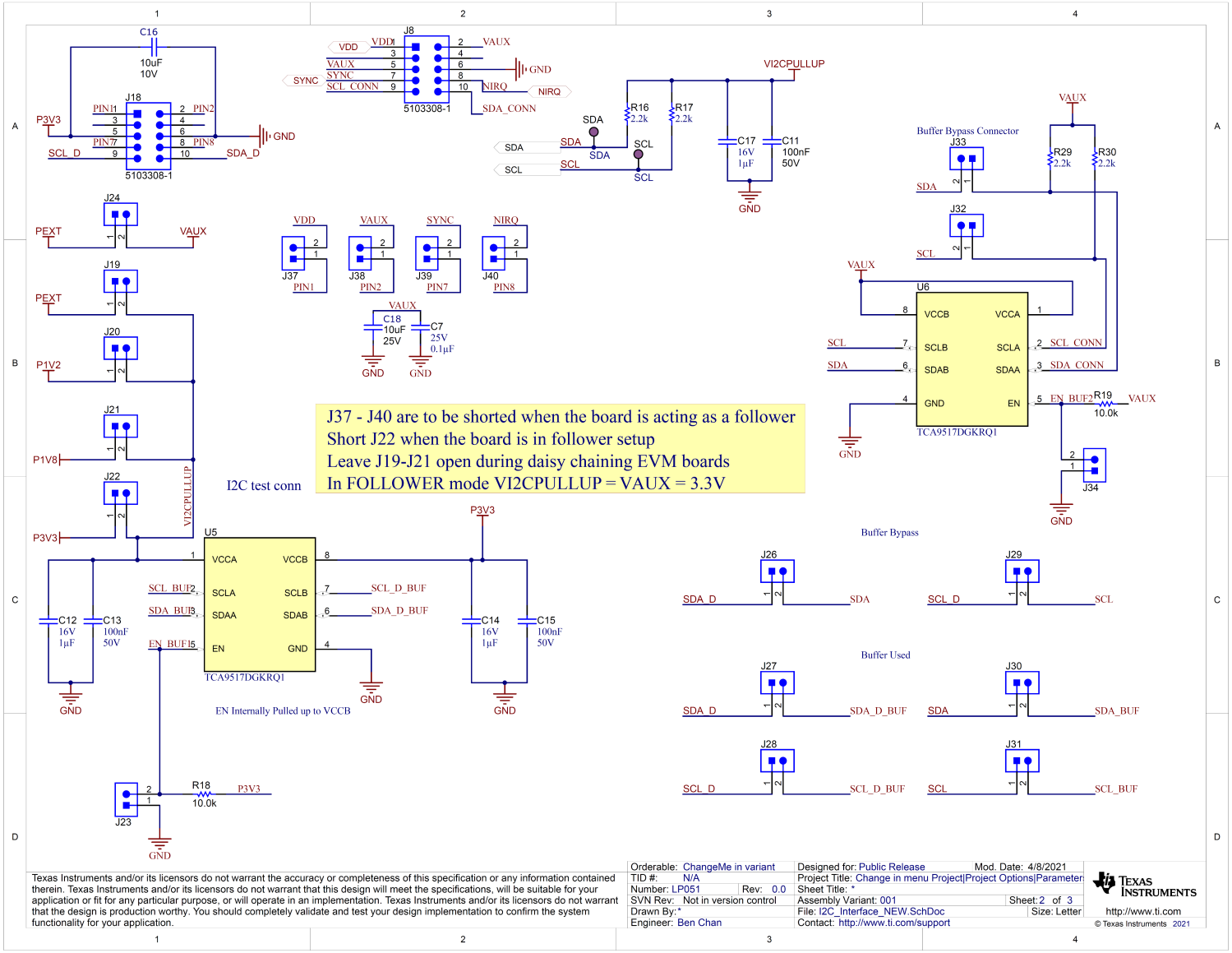


**Figure 2-2. TPS389006Q1EVM I²C Schematic with Buffers**

## 2.2 TPS389006Q1EVM Bill of Materials

**Table 2-1. BOM**

| DESIGNATOR | QTY | VALUE | DESCRIPTION | PACKAGE REFERENCE | PART NUMBER | MANUFACTURER |
|---|---|---|---|---|---|---|
| PCB | 1 | LP051 | Printed Circuit Board | | TPS389006Q1EVM | Any |
| C1, C6, C7, C8, C10 | 5 | 0.1 µF | CAP, CERM, 0.1 µF, 25 V, +/- 10%, X5R, 0603 | 0603 | CL10A104KA8NNNC | Samsung Electro-Mechanics |
| C2, C3, C4, C5, C18 | 5 | 10 µF | 10 µF ±10% 25 V Ceramic Capacitor X7S 0805 (2012 Metric) | 0805 | C2012X7S1E106K125AC | TDK |
| C9, C12, C14, C17, C27 | 5 | 1 µF | CAP, CERM, 1 µF, 16 V,+/- 10%, X7R, AEC-Q200 Grade 1, 0805 | 0805 | C0805C105K4RACAUTO | Kemet |
| C11 | 1 | 0.1 µF | CAP, CERM, 0.1 µF, 50 V, +/- 10%, X7R, 0603 | 0603 | 06035C104KAT2A | AVX |
| C13, C15, C19(DNI), C20(DNI), C21(DNI), C22(DNI), C23(DNI), C24(DNI), C25(DNI), C26(DNI) | 2 | 0.1 µF | CAP, CERM, 0.1 µF, 50 V, +/- 10%, X7R, 0805 (C19 - C26 DO NOT POPULATE) | 0805 | C0805C104K5RACTU | Kemet |
| C16 | 1 | 10 µF | 10 µF ±10% 10 V Ceramic Capacitor X5R 0603 (1608 Metric) | 0603 | C1608X5R1A106K080AC | TDK |
| D1, D2 | 2 | Super Red | LED, Super Red, SMD | LED_0603 | 150060SS75000 | Wurth Elektronik |
| EN/ACT, MON1, MON2, MON3, MON4, MON5/ RS_4, MON6/ RS_3, MON7, NIRQ, NSLEEP/, SYNC/NRST/ MON8, SYNC_PD, TP6a, TP6b, TP6c, TP6d, TP_ADDR, TP_EXT, VDD | 19 | Turret | Terminal, Turret, TH, Triple | Keystone 1598-2 | 1598-2 | Keystone |
| GND1, GND2, GND3, GND4 | 4 | Test Point (SMD) | Test Point, Miniature, SMT | Miniature, SMT | 5019 | Keystone |
| H1, H2, H3, H4 | 4 | Bumpon Pad | Bumpon, Hemisphere, 0.44 X 0.20, Clear | Transparent Bumpon | SJ-5303 (CLEAR) | 3M |
| J1, J2, J3 | 3 | Terminal Block | Terminal Block, 5.08 mm, 2x1, Brass, TH | 2x1 5.08 mm Terminal Block | ED120/2DS | On-Shore Technology |
| J4, J35, J36 | 3 | Header | Header, 100mil, 3x1, Gold, TH | 3x1 Header | TSW-103-07-G-S | Samtec |
| J5, J6, J10, J11, J12, J13, J14, J15, J16, J17, J19, J20, J21, J22, J23, J24, J26, J27, J28, J29, J30, J31, J32, J33, J34, J37, J38, J39, J40 | 29 | Header | Header, 100mil, 2x1, Gold, TH | 2x1 Header | TSW-102-07-G-S | Samtec |
| J7 | 1 | Socket | QFN CLAMSHELL 16 PIN RTE THRU HOLE WITH CENTER GND | 16-Pin Socket | QFN-16(24)BT-0.5-01 | Enplas |
| J8, J18 | 2 | Shrouded Header | Header (shrouded), 100mil, 5x2, Gold, TH | 5x2 Shrouded header | 5103308-1 | TE Connectivity |

**Table 2-1. BOM (continued)**

| DESIGNATOR | QTY | VALUE | DESCRIPTION | PACKAGE REFERENCE | PART NUMBER | MANUFACTURER |
|---|---|---|---|---|---|---|
| Q1 | 1 | MOSFET | MOSFET N-CH 20 V, 0.1 A, VMT3 | SOT723 | RUM001L02T2CL | ROHM Semiconductor |
| R1, R18, R19, R32 | 4 | 10 kΩ | RES, 10.0 kΩ, 1%, 0.1 W, 0603 | 0603 | RC0603FR-0710KL | Yageo |
| R2, R5, R20 | 3 | 10 kΩ | RES, 10.0 kΩ, 1%, 0.1 W, 0603 | 0603 | RCG060310K0FKEA | Vishay Draloric |
| R3(DNI) | 0 | 10 kΩ | RES, DNP, 1%, 0.1 W, 0603 (DO NOT POPULATE) | 0603 | RCG060310K0FKEA | Vishay Draloric |
| R4(DNI) | 0 | 21 kΩ | RES, DNP, 1%, 0.1 W, 0603 (DO NOT POPULATE) | 0603 | RC0603FR-0721KL | Yageo |
| R6, Rx | 2 | 1 Ω | 1 Ohms ±1% 0.25 W, ¼ W Chip Resistor 0603 (1608 Metric) Automotive AEC-Q200, Pulse Withstanding Thick Film | 0603 | RCS06031R00FKEA | Vishay |
| R7, Ry | 2 | 1 kΩ | RES, 1.0 kΩ, 5%, 0.125 W, AEC-Q200 Grade 0, 0805 | 0805 | ERJ-6GEYJ102V | Panasonic |
| R8 | 1 | 5.36 kΩ | RES, 5.36 k, 1%, 0.125 W, AEC-Q200 Grade 0, 0805 | 0805 | ERJ-6ENF5361V | Panasonic |
| R9 | 1 | 16.2 kΩ | RES, 16.2 kΩ, 1%, 0.125 W, AEC-Q200 Grade 0, 0805 | 0805 | ERJ-6ENF1622V | Panasonic |
| R10 | 1 | 26.7 kΩ | RES, 26.7 kΩ, 1%, 0.125 W, AEC-Q200 Grade 0, 0805 | 0805 | ERJ-6ENF2672V | Panasonic |
| R11 | 1 | 37.4 kΩ | RES, 37.4 kΩ, 1%, 0.125 W, AEC-Q200 Grade 0, 0805 | 0805 | ERJ-6ENF3742V | Panasonic |
| R12 | 1 | 47.5 kΩ | RES, 47.5 kΩ, 1%, 0.125 W, AEC-Q200 Grade 0, 0805 | 0805 | ERJ-6ENF4752V | Panasonic |
| R13 | 1 | 59 kΩ | RES, 59 kΩ, 1%, 0.125 W, AEC-Q200 Grade 0, 0805 | 0805 | ERJ-6ENF5902V | Panasonic |
| R14 | 1 | 69.8 kΩ | RES, 69.8 kΩ, 1%, 0.125 W, AEC-Q200 Grade 0, 0805 | 0805 | ERJ-6ENF6982V | Panasonic |
| R15 | 1 | 80.6 kΩ | RES, 80.6 kΩ, 1%, 0.125 W, AEC-Q200 Grade 0, 0805 | 0805 | ERJ-6ENF8062V | Panasonic |
| R16, R17, R29, R30 | 4 | 2.2 kΩ | RES, 2.2 kΩ, 5%, 0.1 W, 0603 | 0603 | RC0603JR-072K2L | Yageo |
| R21, R22, R23, R24, R25, R26, R27, R28 | 8 | 0 Ω | RES, 0 Ω, 5%, 0.125 W, 0805 | 0805 | RC0805JR-070RL | Yageo |
| R31 | 1 | 100 Ω | RES, 100 Ω, 5%, 0.125 W, AEC-Q200 Grade 0, 0805 | 0805 | ERJ-6GEYJ101V | Panasonic |
| SCL, SDA | 2 | Test Points | Test Point, Multipurpose, Purple, TH | Purple Multipurpose Testpoint | 5129 | Keystone |
| U1 | 0 | IC | ASIL-D Multichannel Overvoltage and Undervoltage I2C Programmable Voltage Supervisor and Monitor | WQFN16 | TPS38900603NRTERQ1 | TI |
| U2 | 1 | IC | 1 A Low-Quiescent-Current Low-Dropout (LDO) Regulator, 1.2 V, DRV0006A (WSON-6) | WSON-6 | TLV75712PDRVR | TI |
| U3 | 1 | IC | 1 A Low-Quiescent-Current Low-Dropout (LDO) Regulator, 1.8 V,DRV0006A (WSON-6) | WSON-6 | TLV75718PDRVR | TI |
| U4 | 1 | IC | Dual-Channel, Low-Power Comparator with Integrated Reference | SON6 | TLV4082DRYR | TI |
| U5, U6 | 2 | IC | Automotive, Level-Shifting $I^2C$ Bus Repeater, DGK0008A (VSSOP-8) | VSSOP-8 (DGK0008A) | TCA9517DGKRQ1 | TI |

**Table 2-1. BOM (continued)**

| DESIGNATOR | QTY | VALUE | DESCRIPTION | PACKAGE REFERENCE | PART NUMBER | MANUFACTURER |
|---|---|---|---|---|---|---|
| FID1, FID2, FID3 | 0 | | Fiducial mark. There is nothing to buy or mount. | Fiducial | N/A | N/A |

## 2.3 Layout and Component Placement

Figure 2-3 and Figure 2-4 show the top and bottom assemblies of the printed circuit board (PCB) to show the component placement on the EVM.

Figure 2-5 and Figure 2-6 show the top and bottom layouts, Figure 2-7 and Figure 2-8 show the top and bottom layers, and Figure 2-9 and Figure 2-10 shows the top and bottom solder masks of the EVM.

## 2.4 Layout

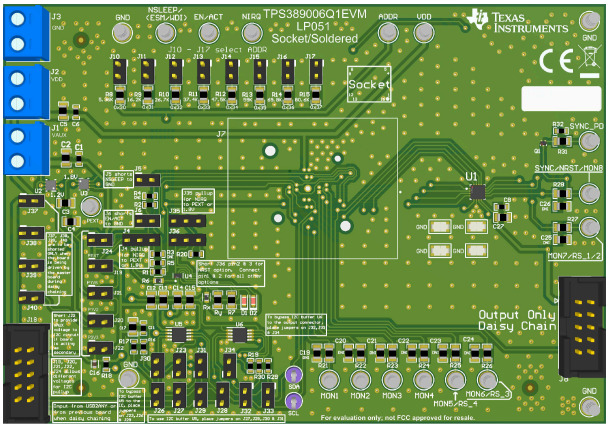


**Figure 2-3. Component Placement—Top Assembly**

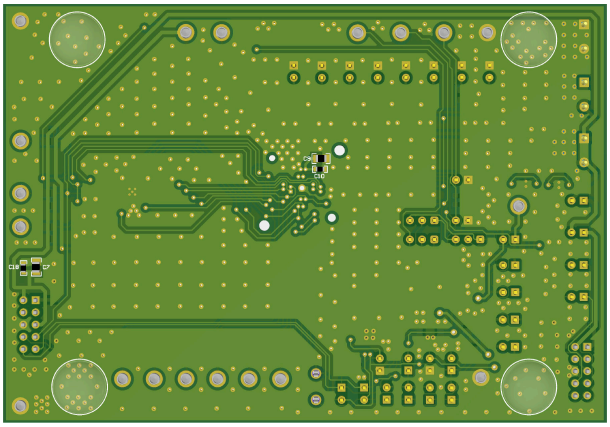

**Figure 2-4. Component Placement—Bottom Assembly**

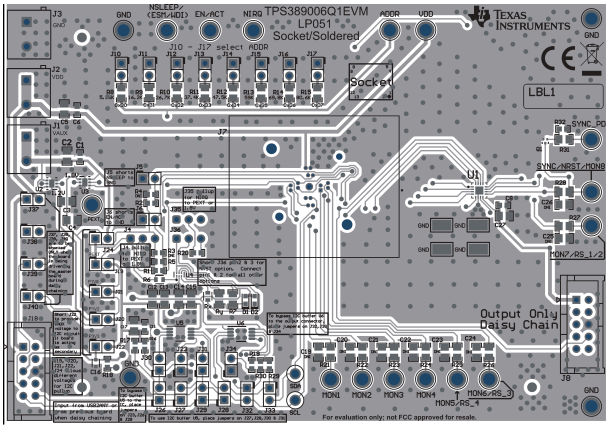


**Figure 2-5. Layout—Top**

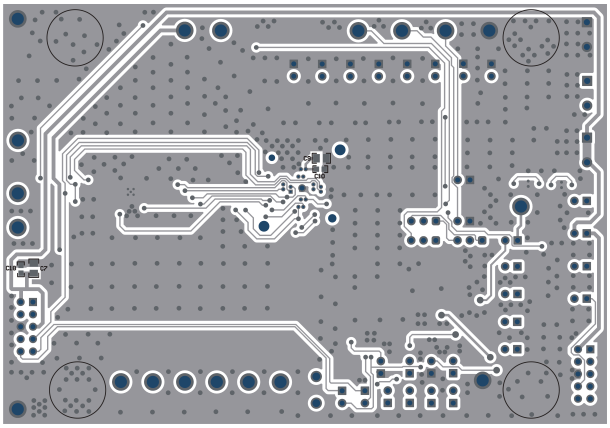

**Figure 2-6. Layout—Bottom**

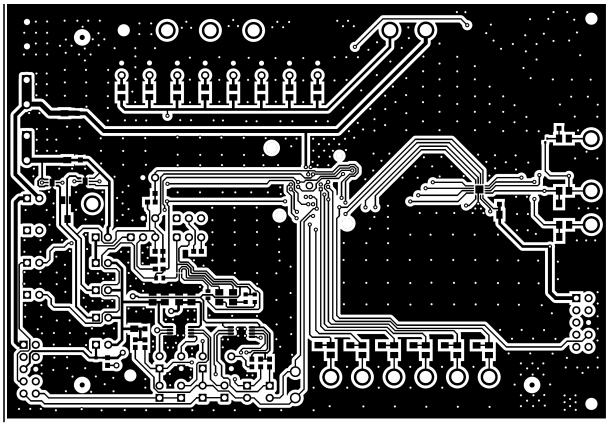

Figure 2-7. Top Layer

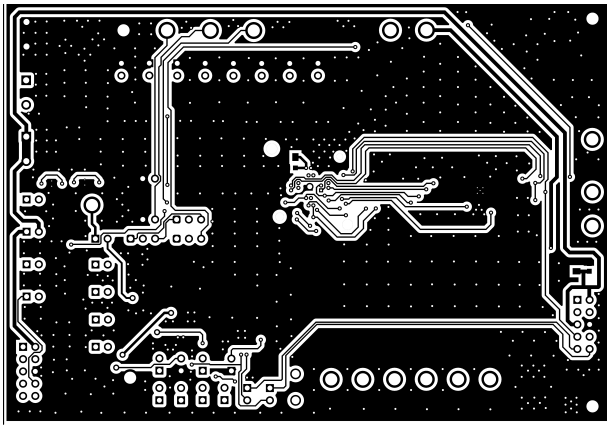

Figure 2-8. Bottom Layer

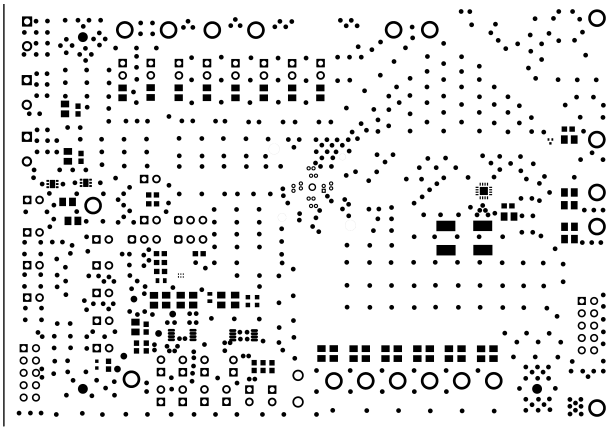

Figure 2-9. Top Solder Mask

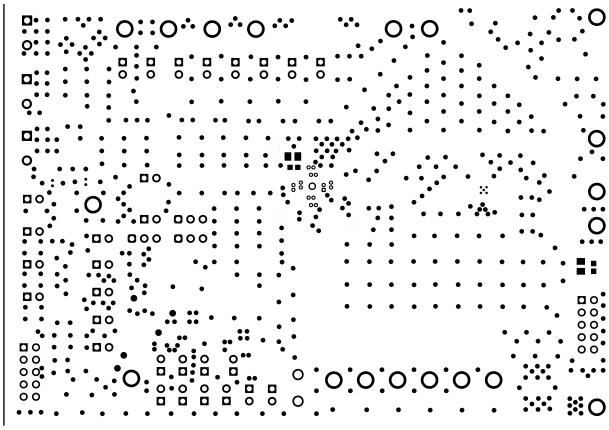

Figure 2-10. Bottom Solder Mask

# 3 EVM Connectors

This section describes the connectors, jumpers, and test points on the EVM as well as how to connect, set up, and properly use the EVM. Each device has an independent supply connection, but all grounds are connected on the board.

## 3.1 EVM Test Points

Table 3-1 lists the EVM test points as well as their functional descriptions. All TPS389006-Q1 pins have a corresponding test point on the EVM. These test points are located close to the pins for more accurate measurements. In addition to the test points listed below, the EVM also has four additional GND test points.

**Table 3-1. Test Points**

| TEST POINT SILKSCREEN LABEL | FUNCTION | DESCRIPTION |
|---|---|---|
| MON1 | Connection to MON1 pin | Allows the user to monitor voltage rail #1 |
| MON2 | Connection to MON2 pin | Allows the user to monitor voltage rail #2 |
| MON3 | Connection to MON3 pin | Allows the user to monitor voltage rail #3 |
| MON4 | Connection to MON4 pin | Allows the user to monitor voltage rail #4 |
| MON5/RS_4 | Connection to MON5 pin | Allows the user to monitor voltage rail #5 |
| MON6/RS_3 | Connection to MON6 pin | Allows the user to monitor voltage rail #6 |
| MON7/RS_1/2 | Connection to RS_1/2 pin | Allows the user to remote sense MON1 or MON2 |
| SYNC/NRST/MON8 | Connection to SYNC pin | SYNC pin indicates the number of monitored rails that have exited fault status and assigns tag values to each monitor voltage rail |
| SYNC_PD | Connection to SYNC_PD | Forcing the SYNC pin to toggle during test and increments an internal tag counter for each of the monitored channel (for debug purposes only) |
| ADDR | Connection to ADDR pin | Allows the user to measure the $I^2C$ address voltage |
| NIRQ | Connection to NIRQ pin | Allows the user to monitor the interrupt (NIRQ) output |
| EN/ACT | Connection to ACT pin | Allows the user to set the ACT input to VDD or GND |
| $\overline{\text{SLEEP}}$/ESM/WDI | Connection to $\overline{\text{SLEEP}}$ pin | Allows the user to set $\overline{\text{SLEEP}}$ input |
| SCL | Connection to SCL pin | Allows the user to monitor the clock signal input |
| SDA | Connection to SDA pin | Allows the user to monitor the data signal input |
| PEXT | External power supply | Allows the user to apply a power supply voltage that is not provided from the EVM |
| GND | GND for EVM | GND for EVM |

## 3.2 EVM Jumpers

Table 3-2 lists the jumpers on the TPS389006Q1EVM. As ordered, the EVM will have thirty-five (35) jumpers installed. Figure 3-1 is provided as visual aid.

**Table 3-2. List of On-board Jumpers**

| JUMPER | JUMPER CONFIGUATION | DESCRIPTION |
|---|---|---|
| J1 | VAUX | For connecting VAUX power to the EVM |
| J2 | VDD | For connecting VDD power to the EVM |
| J3 | GND | For connecting GND to the EVM |
| J4 | Shunted (default) Pin 2 to Pin 3 | For connecting ACT, NIRQ, and $\overline{\text{SLEEP}}$ to P1V8 or PEXT (Any external power) |
| J5 and J6 | Open | For manually pulling down $\overline{\text{SLEEP}}$ and ACT pins to GND |
| J10, J11, J12, J13, J14, J15, J16, and J17 | J15 shunted | Shunting any one of J10-J17 jumpers will select the $I^2C$ address for TPS389006-Q1 IC on the EVM |
| J19, J20, and J21 | Open | For connecting to the on-board $I^2C$ buffer and pull-up voltage rail to either P1V8, PEXT or P1V2. Only shunt one of these jumpers at a time. Please remove the shunt of J22 when using one of these jumpers. |
| J22 | Shunt | For connecting to the on-board buffer $I^2C$ and pull-up voltage rail to P3V3. During "daisy-chain" configuration, J22 will need to be shunted and J19, J20, and J21 will need to be open on the secondary EVMs. |
| J23 | Shunted | Disables (U5) $I^2C$ buffer |
| J24 | Open | Connects PEXT to VAUX |
| J26 and J29 | Shunted | Shunting both J26 and J29 will bypass the $I^2C$ (U5) buffer for SDA and SCL signal lines |
| J27, J28, J30, and J31 | Open | Shunting these jumpers will buffer SCL and SDA $I^2C$ signal lines by using the on-board (U5) buffer. |
| J32 and J33 | Shunted | Shunting both J32 and J33 will bypass the $I^2C$ (U6) buffer for SDA and SCL signal lines |
| J34 | Shunted | Disables (U6) $I^2C$ buffer |
| J35 | Shunted (default) Pin 1 to Pin 2 | SYNC pin is pulled up to P1V8 |
| J36 | Shunted (default) Pin 2 to Pin 3 | Input to one of (U4) comparators to indicate the SYNC pin has "tagged" a voltage rail that is not in a fault condition |
| J37, J38, J39, J40 | Open | If multiple EVMs are connected in a "daisy-chain" configuration, the following EVM boards will need to have J37, J38, J39, and J40 all shunted. By shunting these jumpers, VDD, VAUX, SYNC, and NIRQ signals will be provided as inputs from the primary EVM board. Also, J22 will need to be shunted and J19, J20, and J21 will need to be open on the secondary EVMs during "daisy-chain" configuration. |

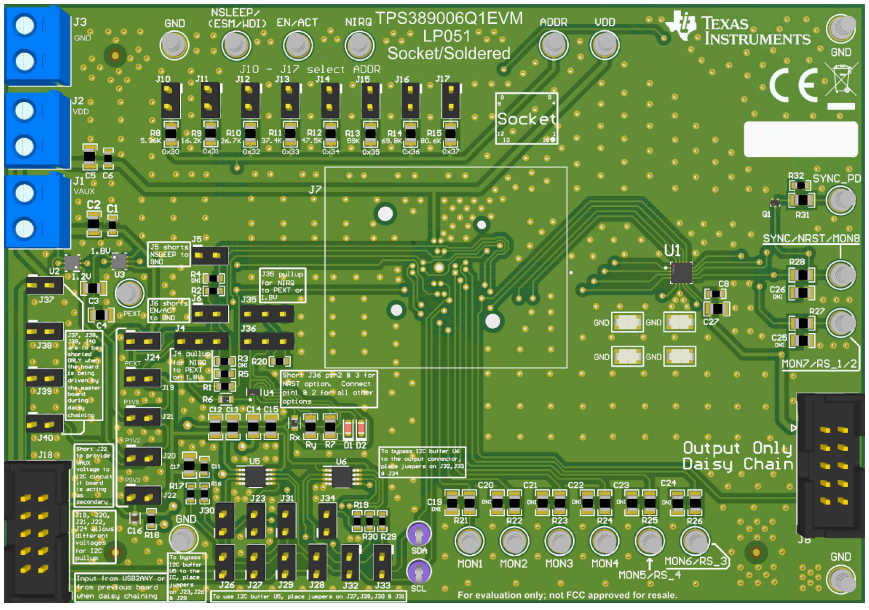


**Figure 3-1. TPS389006Q1EVM Jumper Locations**

# 4 EVM Setup and Operation

This section describes the functionality and operation of the TPS389006Q1EVM. Refer to the TPS389006-Q1 Multichannel Overvoltage and Undervoltage I²C Programmable Voltage Supervisor and Monitor datasheet for details on the electrical characteristics of the device.

The TPS389006Q1EVM comes with the TPS38900603NRTERQ1 IC meaning the device is capable of monitoring up to six separate voltage rails. The EVM is capable of many different configurations in order to fully evaluate the functionality of all the TPS389006-Q1 device variants. The default jumper configuration of the TPS389006Q1EVM is mentioned in Table 3-2.

The TPS389006Q1EVM comes with USB to GPIO connector, I²C bus repeaters, comparators, two LDOs, socket and solder down footprints, the ability to monitor up to eight (8) voltage rails, the option to daisy-chain up to three EVMs at a time via 10-pin connector, jumper selectable I²C address, I²C pullup voltage options, and TPS38900603NRTERQ1 IC. The TPS389006Q1EVM also provides the ability for each monitored rail to be voltage divided down by resistor dividers on each of the monitored/input lines. The user must choose appropriately sized resistors such that the divided voltage is above, below or within the window of the voltage threshold depending on the type of input sensing topology is setup for each monitored input channel. Consult the Device Threshold Table in the TPS389006-Q1 datasheet to ensure proper voltage monitored values.

The TPS389006Q1EVM is designed to be daisy-chain where the primary board is connected to the USB to GPIO connector (J18) and its output connector (J8) provides VDD, VAUX, SYNC, SCL, SDA, NIRQ, and GND to the secondary board's (J18) connector via a 10-pin ribbon cable. When the daisy-chain option is being used, jumpers on the secondary board (J19-J22 and J37-J40) must be configured properly or else possible damage to the IC or EVM may occur. Jumper settings of J19, J20, and J21 must be left open whereas J22, J37, J38, J39, and J40 need to be shunted with jumpers for proper setup of the secondary board during daisy-chain setup. Also, the I²C rail voltage for the secondary board in the daisy-chain mode is defined as VI2CPULLUP = VAUX = 3.3 V. See Figure 2-2 for reference.

**Equipment Needed for TPS389006Q1EVM Evaluation**

- TPS389006Q1EVM
- TI's USB Interface Adapter (with ribbon cable)
- Power Supply (3.3 V)
- Multimeters
- Multi-channel Oscilloscope (review evaluation waveforms)
- Jumper Wires/Cables

## 4.1 Setup and GUI Installations

### 4.1.1 TPS389006Q1EVM Hardware Setup

Follow the steps below for TPS389006Q1EVM hardware setup:

1. Connect VAUX (J1) and VDD (J2) to 3.3 V from the power supply.
2. Connect GND (J3) to ground from the power supply.
3. Make sure the jumpers are connected as per the guidelines in the Table 3-2.
4. Before allowing the output of the power supply to be engaged, check if the power supply voltage is set at 3.3 V and the power supply output current is limited to 10 mA.
5. Connect the TI's USB Interface Adapter to J18 (USB2GPIO Connector) using a 10-pin ribbon cable.
6. Connect the TI's USB Interface Adapter to the computer's USB port.
7. Connect any voltage supply rail that needs monitoring to any of the voltage monitoring inputs (MON1 - MON8).
8. The description of the TPS389006Q1EVM connections can be found in Figure 4-1.

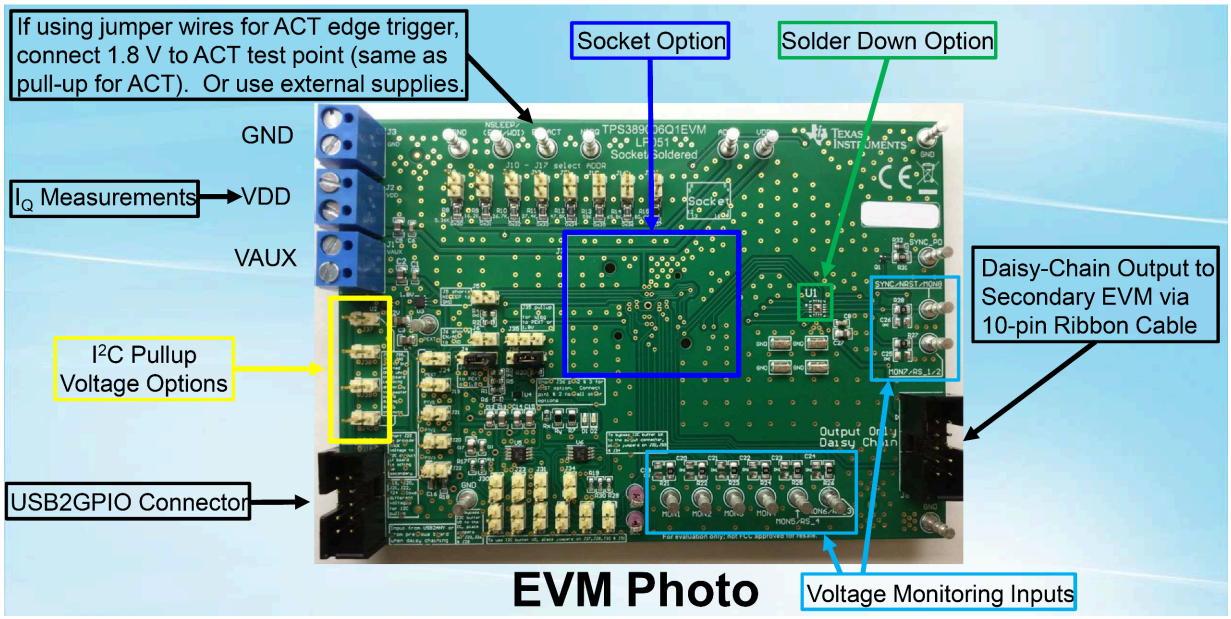


**Figure 4-1. TPS389006Q1EVM Connection Description**

### 4.1.2 TPS389006Q1EVM Software Setup

Follow the steps below for TPS389006Q1EVM GUI software installation:

1. Install the GUI
   a. Download the Fusion Digital Power Designer Platform GUI for TPS389006Q1EVM
   b. Open the downloaded file.
   c. In the Welcome Wizard window, click Next.
   d. Accept the license agreement and then click Next.

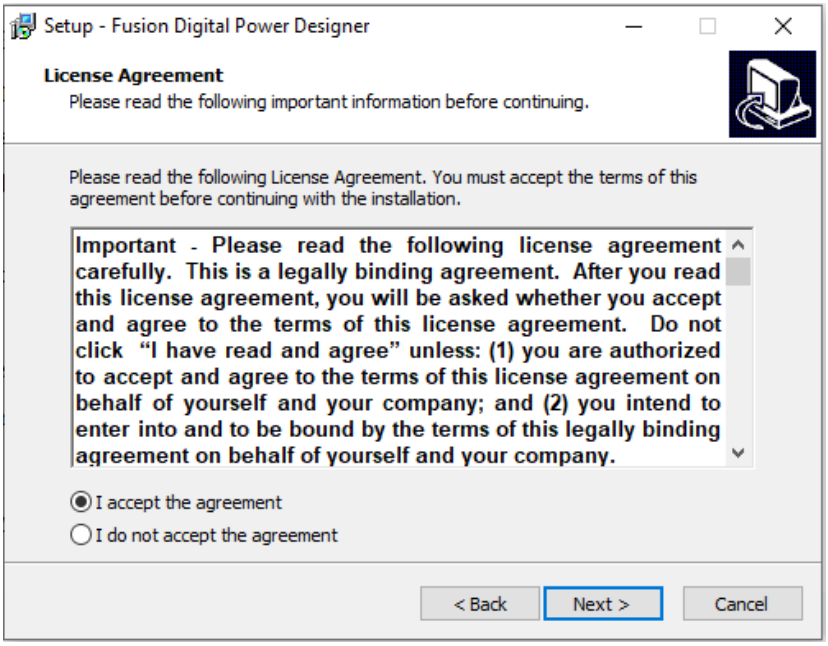


**Figure 4-2. Setup License Agreement Window**

   e. The default destination folder works best. Click Next.

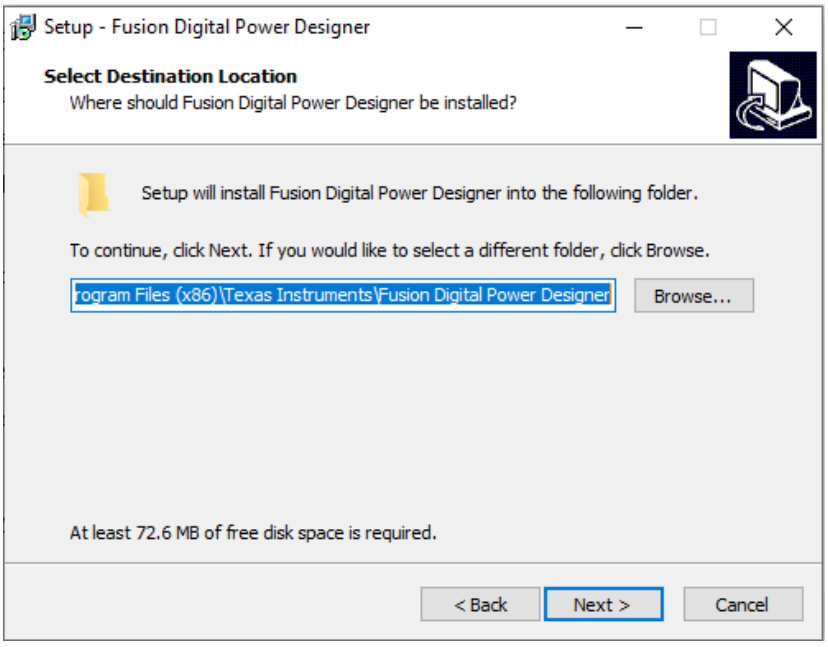


**Figure 4-3. Setup Destination Window**

f. Click Next for the Select Start Menu Folder option.

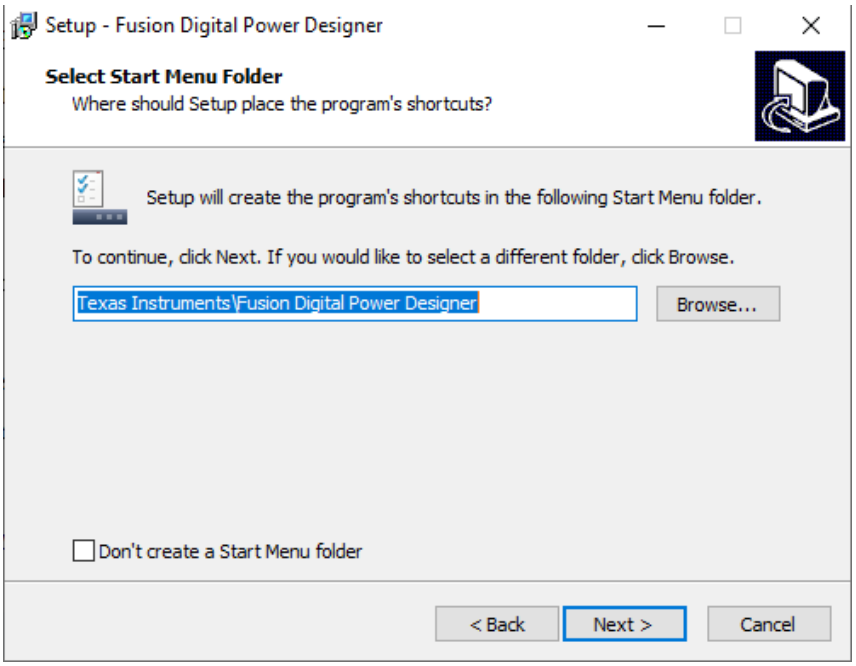


**Figure 4-4. Setup Window - Start Menu Selection**

g. There is no need to install additional options for this EVM. Click Next.

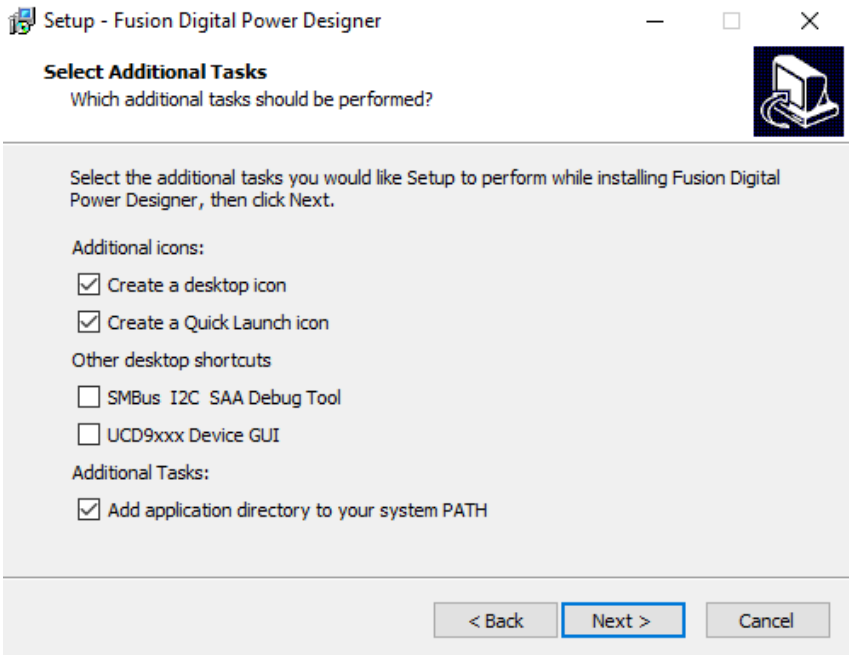


**Figure 4-5. Setup Window - Additional Tasks**

h. Finally click Install to install the Fusion software.

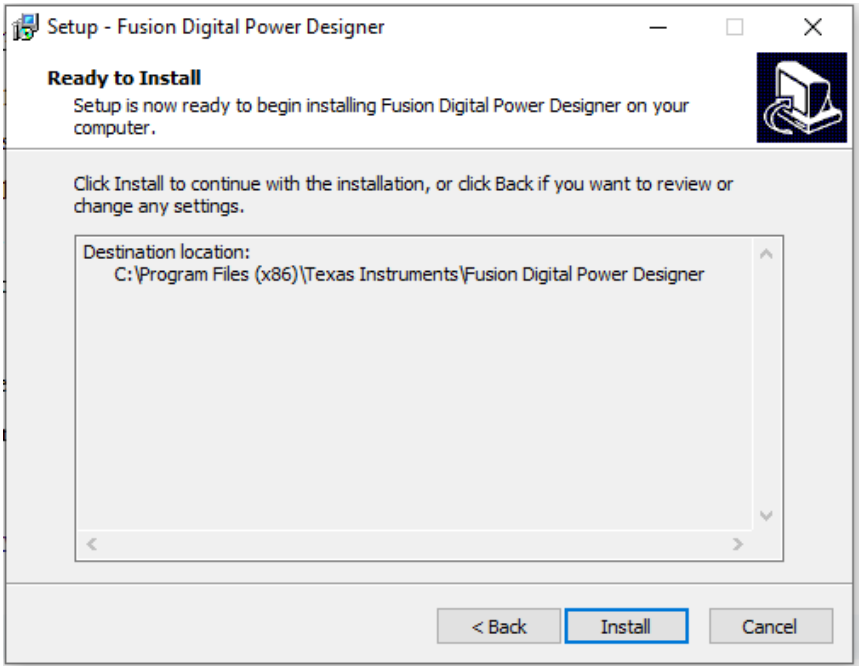


**Figure 4-6. Setup Installation Window**

i. Click on Finish to complete the installation setup and launch the software.


**Figure 4-7. Installation Complete Window**

## 4.2 Quick Start to TPS389006Q1EVM GUI

Please follow the steps below precisely to quickly evaluate the TPS389006-Q1. In this quick start, the TPS389006Q1EVM will be setup to monitor several power supply rails after the ACT pin is triggered.

1. Make the hardware connections and software installation described in Section 4.1 have been completed. Feel free to skip the GUI installation if the Fusion Digital Power Designer for TPS389006Q1EVM GUI has been installed already.
2. Power the EVM by turning on the power supply. Note that the voltage and current limits at the power supply should be set at 3.3 V and 10 mA.
3. Once the TI's USB Interface Adapter is connected to EVM and the laptop, launch the evaluation software Fusion Digital Power Designer.
4. Click on **I2C GUI** on the bottom right of GUI.

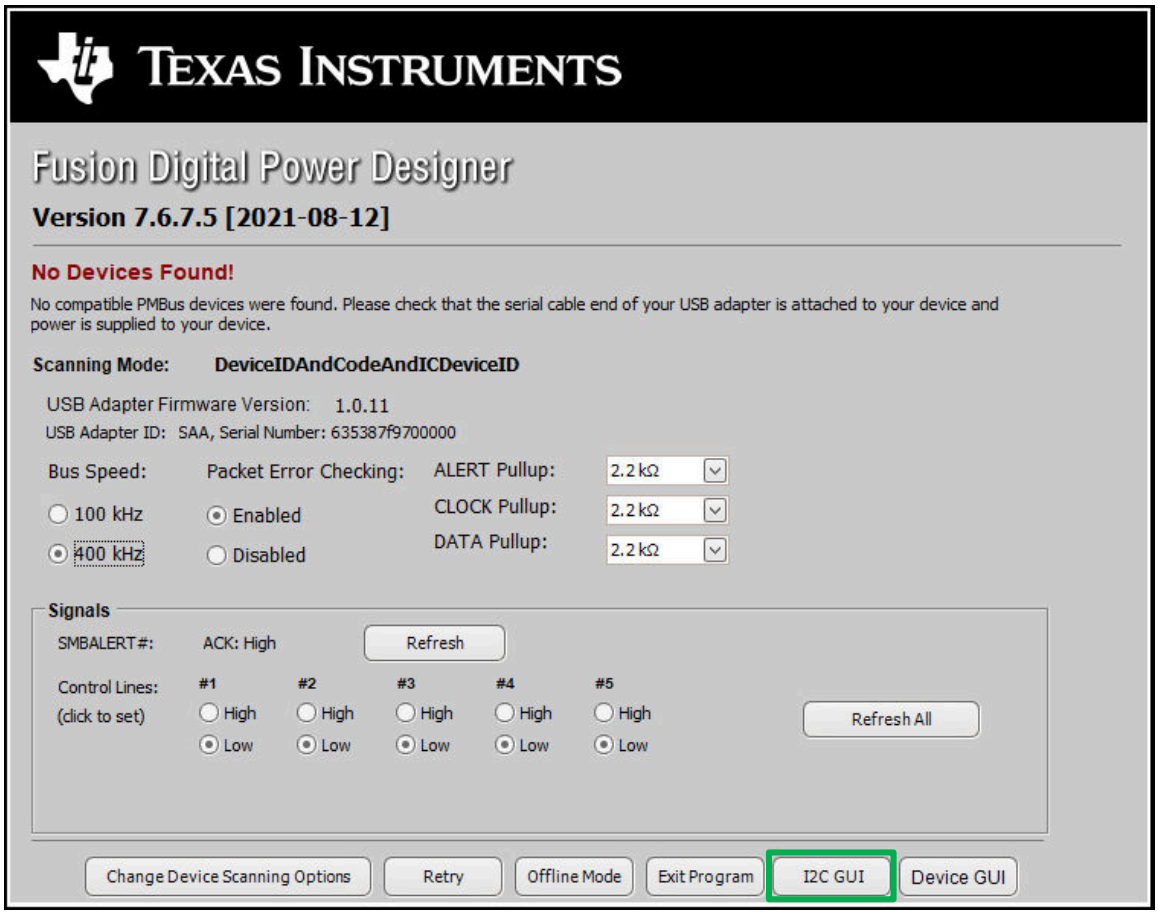


**Figure 4-8. Fusion Welcome Window**

5. Click on **Change Scan Mode** to select **TPS389xxx** and then click **OK**.

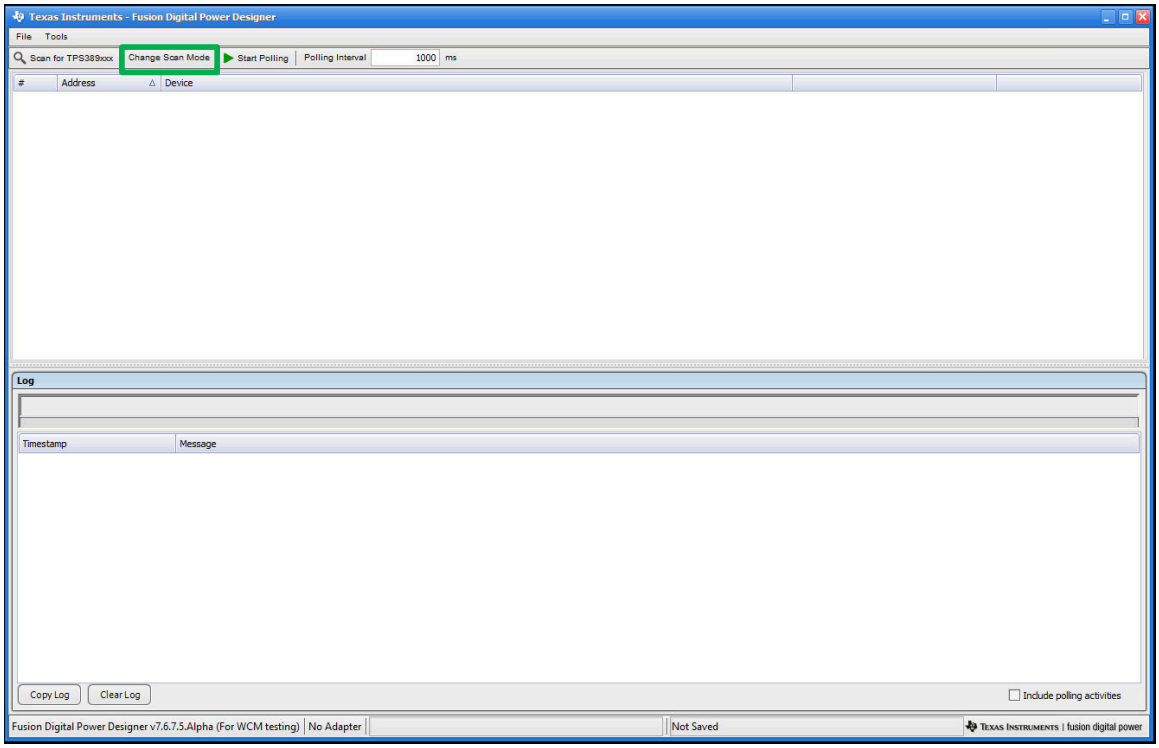


**Figure 4-9. Fusion Scan Window**

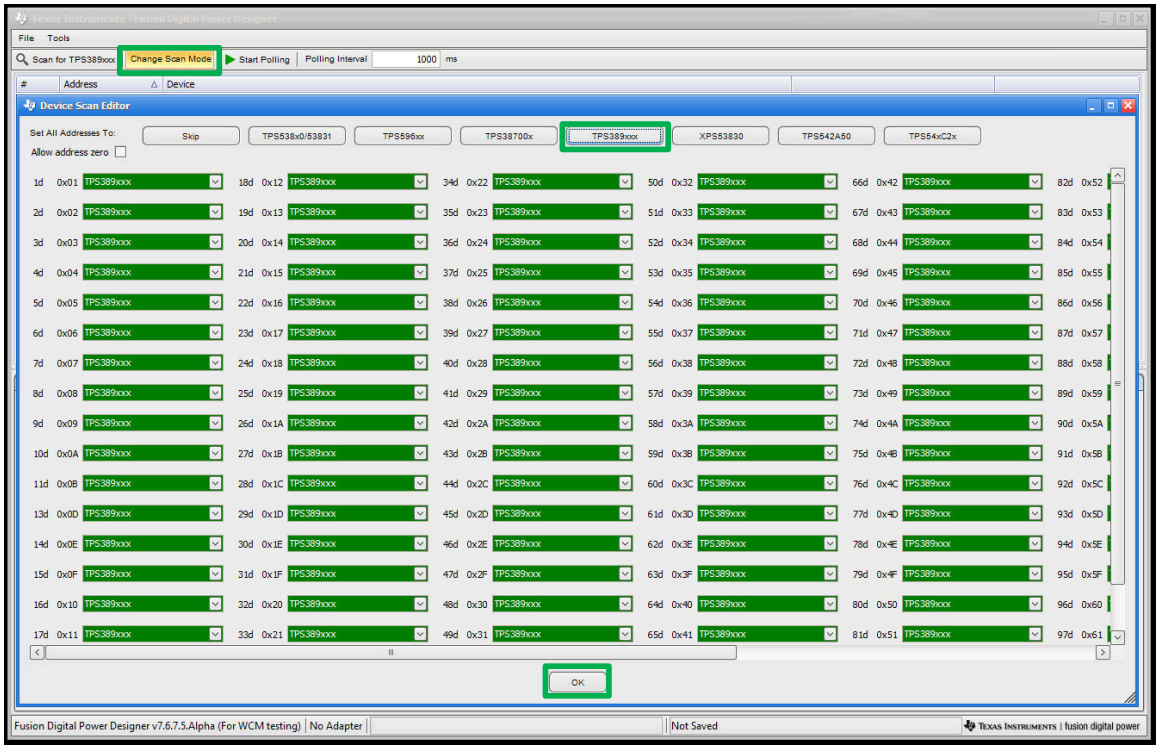


**Figure 4-10. Fusion Scan Selection Window**

6. Scan for the TPS389006Q1EVM by clicking on "***Scan for TPS389xxx***" on top left of the window.

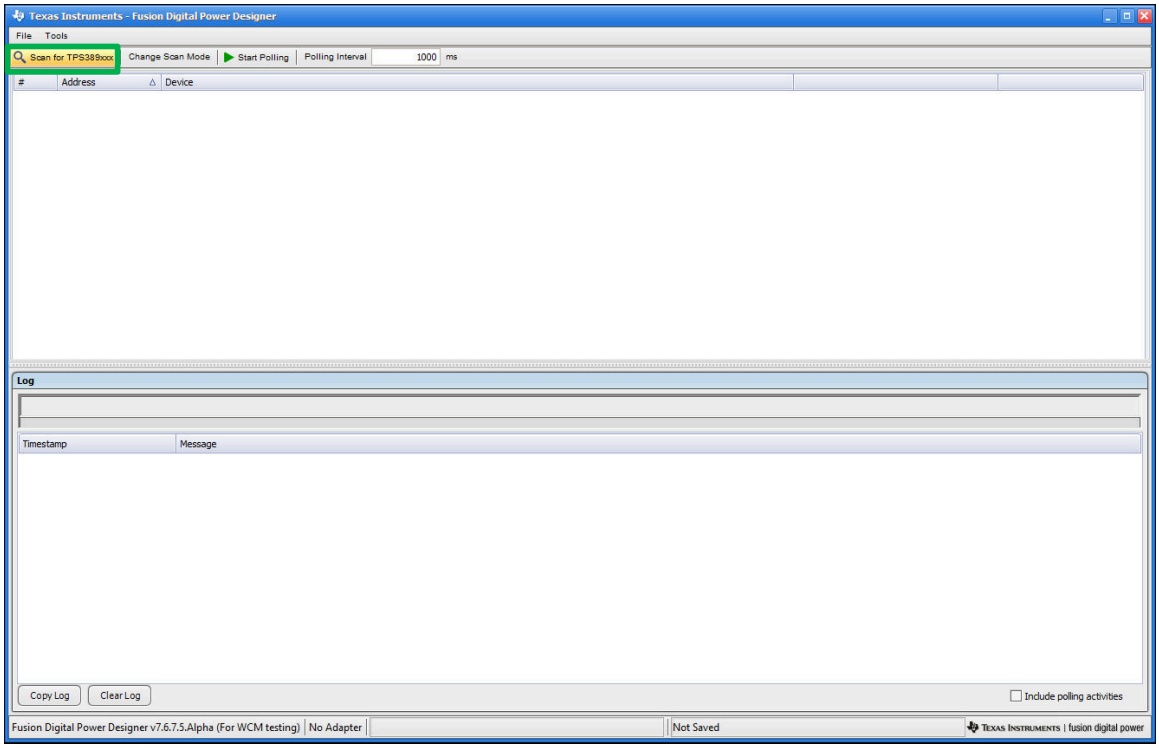


**Figure 4-11. Fusion Scan Window - Scanning for TPS389006Q1EVM**

7. Once the EVM is discovered, select "**Click to Configure**".

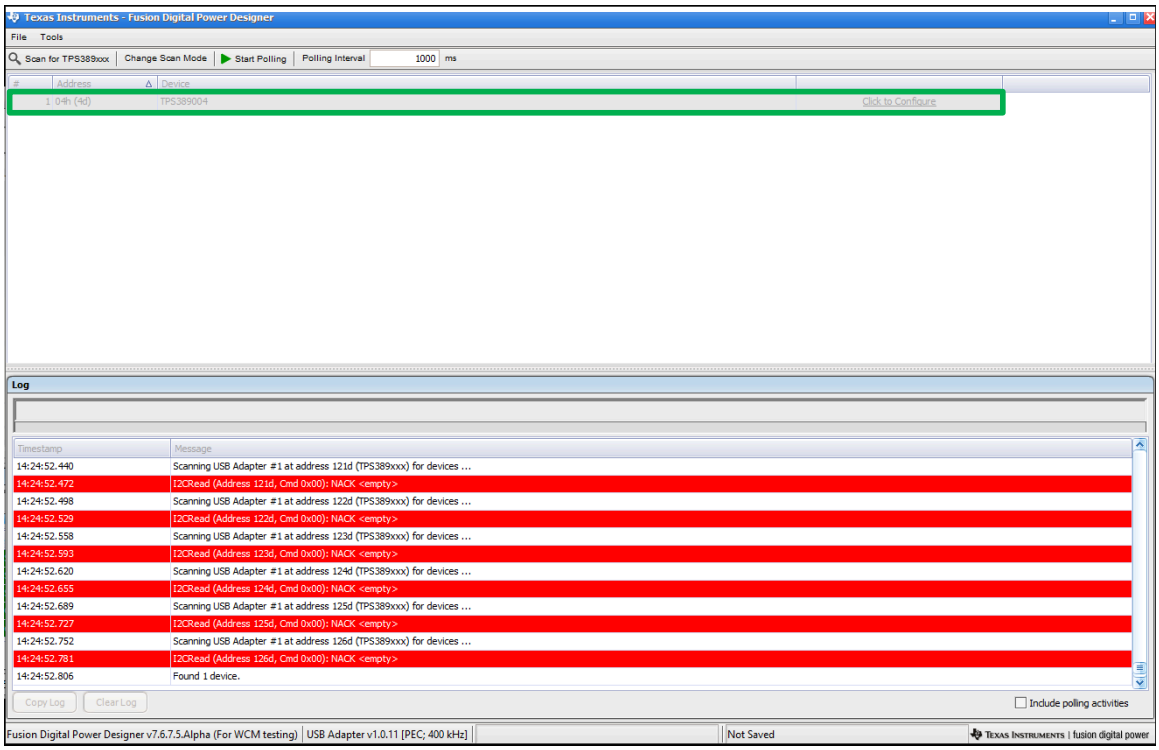


**Figure 4-12. Fusion Scan Window - Scan for TPS389006Q1EVM Completed**

8. Once "**Click to Configure**" has been selected the Fusion Digital Power Device GUI for the TPS389006-Q1 will appear as shown below. The GUI screenshot shows the **General Config**, **Sequencing**, **Clear/Reset**, **Telmetry**, and Polling (Plotting the monitored voltage rails) sub-windows.

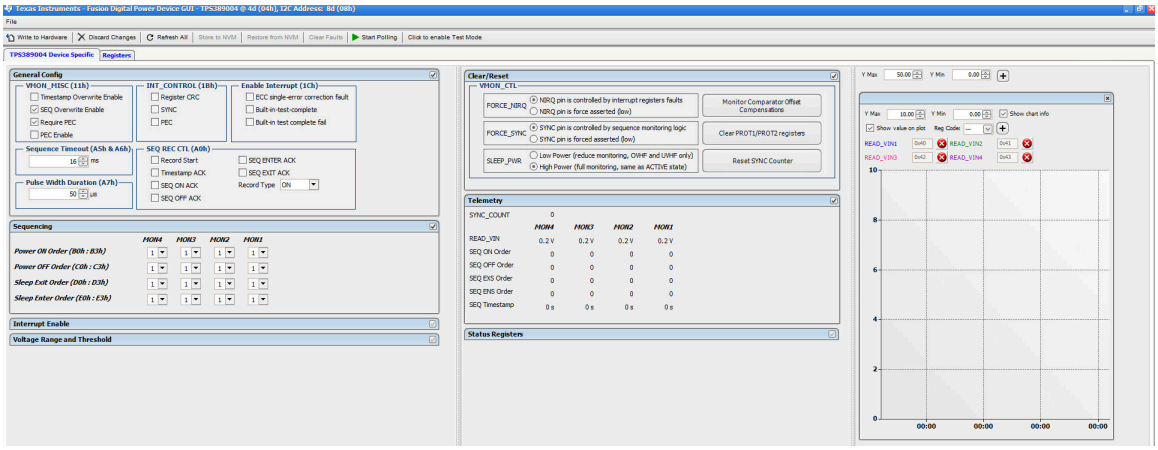

**Figure 4-13. Fusion Digital Power Device GUI - TPS389006Q1EVM (screenshot #1)**

9. The GUI screenshot below continues to show the additional sub-windows that are in the GUI for the TPS389006-Q1. The GUI screenshot includes the **Interrupt Enable**, **Voltage Range and Threshold**, **Status Registers**, and Polling (Plotting the monitored voltage rails) sub-windows.

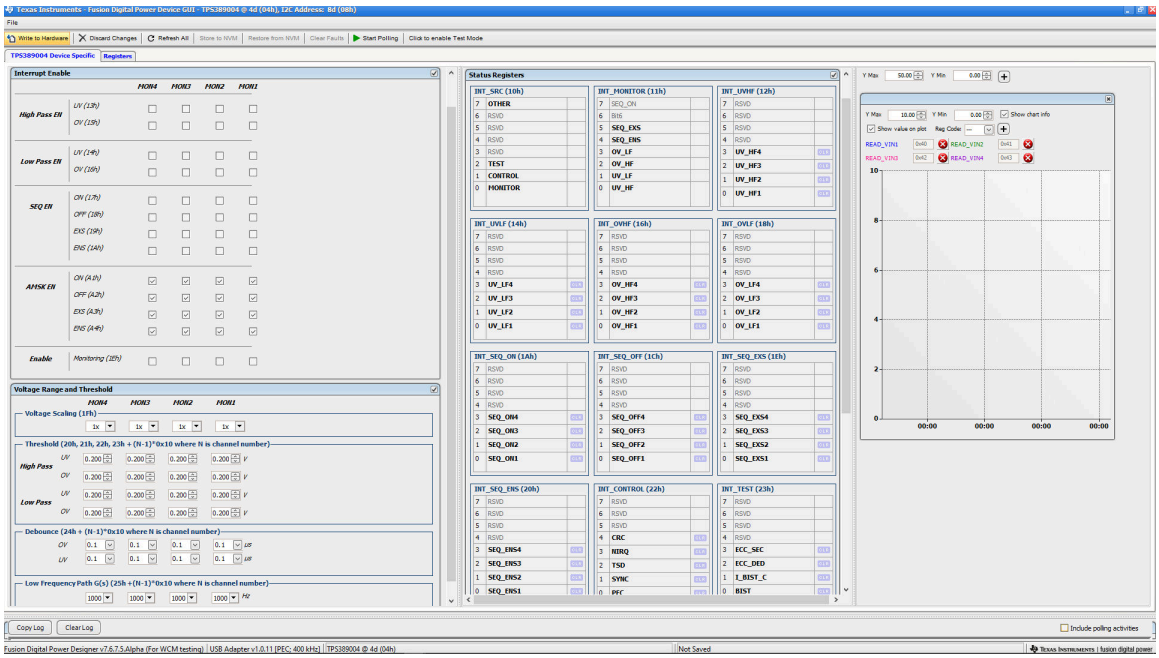

**Figure 4-14. Fusion Digital Power Device GUI - TPS389006Q1EVM (screenshot #2)**

10. The last GUI screenshot below shows the last five registers in the **Status Registers** sub-window.

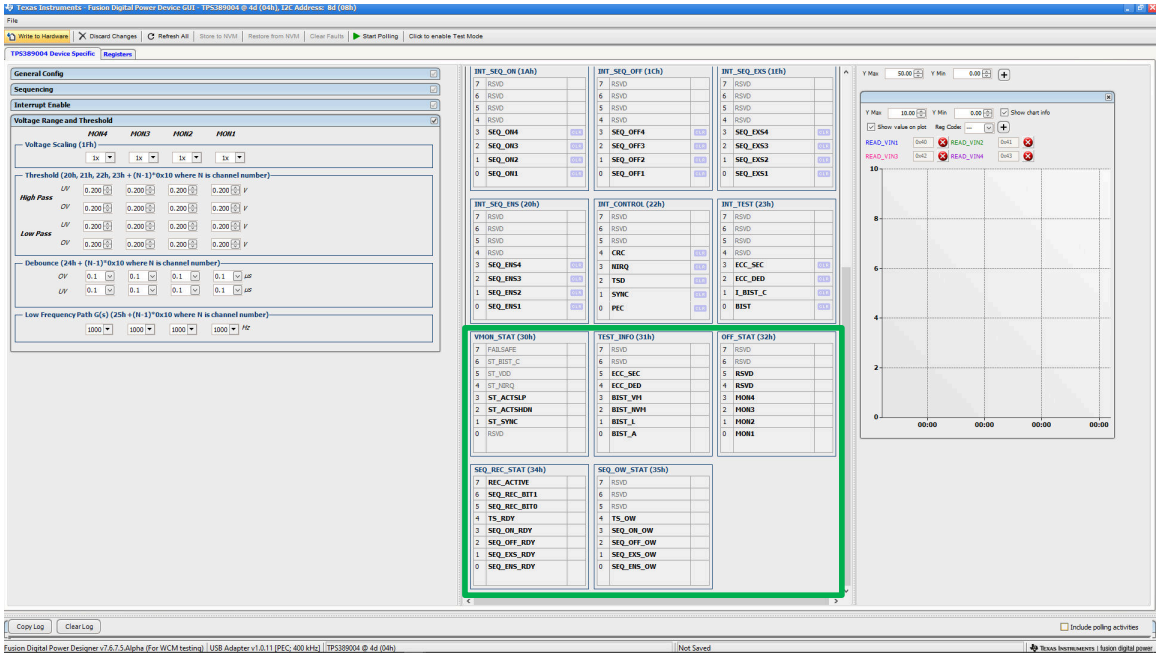


**Figure 4-15. Fusion Digital Power Device GUI - TPS389006Q1EVM (screenshot #3)**

### 4.3 Example Operation of TPS389xxx-Q1

The example below shows a TPS389004-Q1 monitoring four (4) voltage supply rails on the TPS389006Q1EVM. Please follow the steps in Section 4.1.1 and Section 4.1.2 before evaluating the TPS389004-Q1. In this example, the TPS389006Q1EVM will be setup to monitor several power supply rails after the ACT pin is asserted. Below, Figure 4-16 shows how the TPS389006Q1EVM was setup to monitor four (4) voltage supply rails.

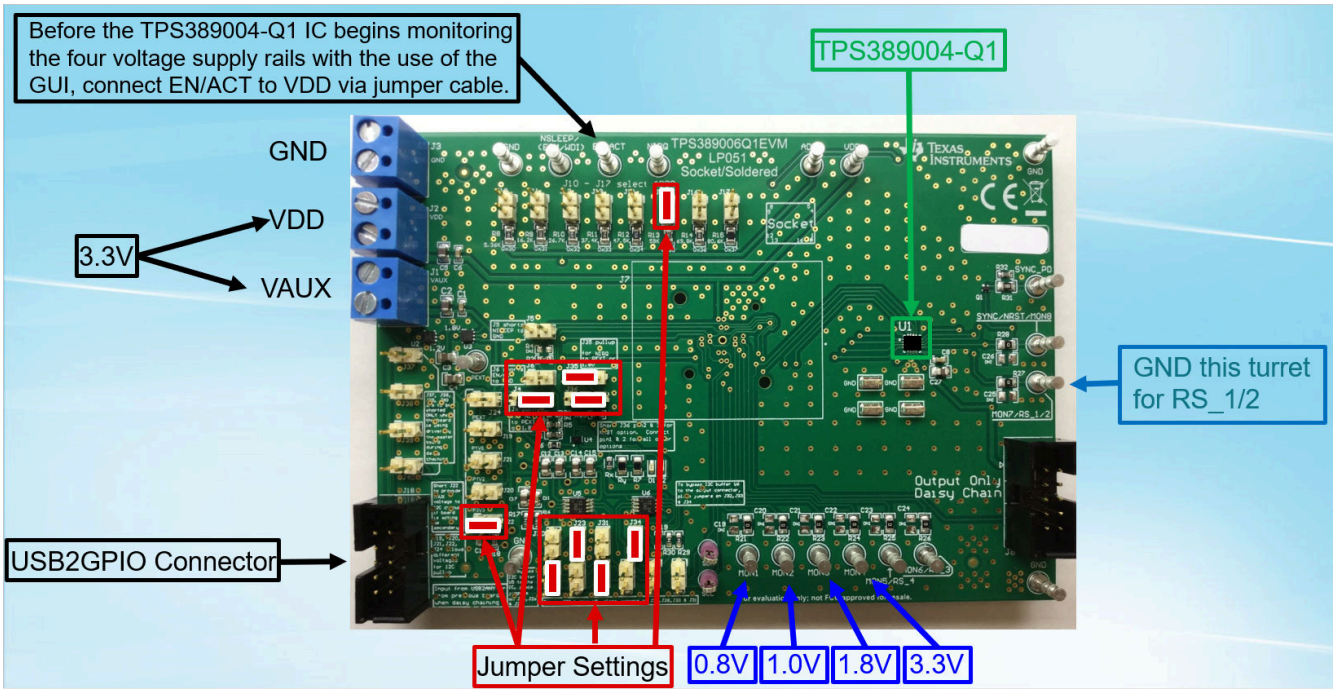


**Figure 4-16. TPS389006Q1EVM Monitoring Four (4) Voltage Supply Rails**

1. Connect the TPS389006Q1EVM VDD and VAUX inputs to a 3.3 V external power supply. Note that the voltage and current limits of the power supply should be set at 3.3 V and 10 mA.
2. Connect the TPS389006Q1EVM with TI's USB Interface Adapter ribbon to J18 (USB2GPIO connector). Connect the USB plug from the USB Interface Adapter to the computer's USB port. The TI USB Interface Adapter will communicate to the TPS389004-Q1 IC via $I^2C$ protocols.
3. Ensure the jumper settings, highlighted in red in Figure 4-16, are set on the TPS389006Q1EVM.
4. Ground turret **(MON7/RS_1/2)**.
5. Apply 0.8 V to MON1, 1.0 V to MON2, 1.8 V to MON3, 3.3 V to MON4 to the turrets of TPS389006Q1EVM.
6. Final Connections should look similar to Figure 4-16.
7. Open up the Fusion Digital Power Designer GUI on the computer and follow Section 4.2.
8. Once the EVM is discovered and **Click to Configure** has been selected, the GUI will look like Figure 4-13, Figure 4-14, Figure 4-15.
9. Scroll to the bottom of the **Interrupt Enable** sub-window and enable all four monitoring inputs by clicking the empty boxes. The GUI screenshot, Figure 4-17 below, shows all the monitoring inputs being selected in the highlighted "black-box".
10. In the **Voltage Range and Theshold** sub-window, enter the undervoltage (UV) and overvoltage (OV) threshold values for the monitoring inputs. One thing to note, any monitoring inputs that are higher than 1.5 V needs to select "**4x**" in the **Voltage Scaling (1Fh)** field. The GUI screenshot below, highlighted by a "yellow-box", shows what has been described above.
11. Once steps 9 and 10 are completed, press "**Write to Hardware**" and the USB Interface Adapter will communicate to the TPS389004-Q1 IC. Next, press "**Start Polling**" and both the Telemetry (shown in the highlighted orange-box) and the graphical waveform of the monitored inputs (shown in the highlighted red-box) will be shown in the GUI.

12. If one of the monitored inputs senses a fault, an interupt indicator will be displayed (illumination of a red LED) on the TPS389006Q1EVM. Also, one of the bit registers found in the **Status Registers** sub-window, highlighted in the green-box, will also show a fault in red color.
13. In order to clear the fault interupt, press "**Stop Polling**", go to the **Status Registers** sub-window, locate the red color fault interupt and click on "**CLR**" and click on "**Write to Hardware**". This procedure will clear the fault interupt and allow the device to continue to monitor the input channels.
14. Steps 8 through 13 refers to Figure 4-17 below.

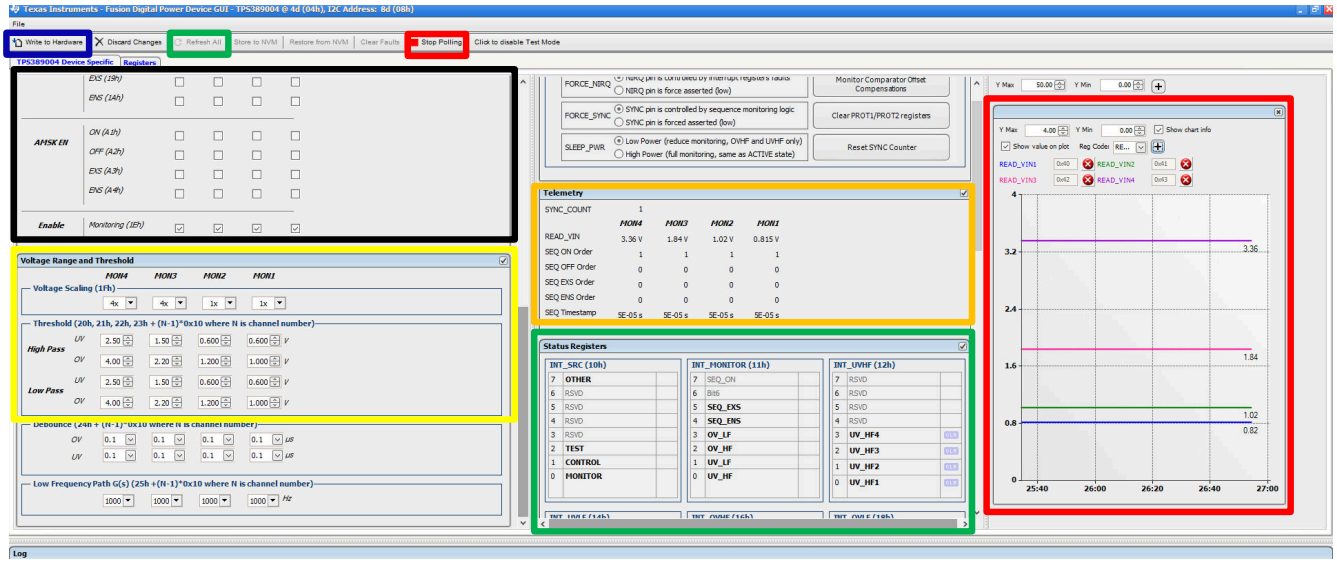


**Figure 4-17. TPS389006Q1EVM GUI Setup for Monitoring Four (4) Voltage Supply Rails**

## 5 Revision History

| DATE | REVISION | NOTE |
|---|---|---|
| February 2022 | * | Initial Release |

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NOTE:

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**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**

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- *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.*

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**Concerning EVMs Including Radio Transmitters:**

This device complies with Industry Canada license-exempt RSSs. 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.

**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.

**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.

**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

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http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page

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2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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   8.1 *General Limitations*. IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS OR THE USE OF THE EVMS , REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN TWELVE (12) MONTHS AFTER THE EVENT THAT GAVE RISE TO THE CAUSE OF ACTION HAS OCCURRED.

   8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY USE OF AN EVM PROVIDED HEREUNDER, INCLUDING FROM ANY WARRANTY, INDEMITY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS, , EXCEED THE TOTAL AMOUNT PAID TO TI BY USER FOR THE PARTICULAR EVM(S) AT ISSUE DURING THE PRIOR TWELVE (12) MONTHS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

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