

# ***TPS2358 Dual-Slot ATCA™ AdvancedMC™ Controller Evaluation Module***

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## **1 Introduction**

The Dual-Slot AdvancedMC™ Controller Evaluation Module (EVM) is a PCB platform for users to learn about the features and operation of the TPS2358 integrated circuit from Texas Instruments (TI). The TPS2358 Dual-Slot ATCA™ AdvancedMC™ Controller manages two 12-V and two 3.3-V power rails, and features inrush and fault current limiting, FET OR'ing, input UVLO protection and logic-level enable inputs. Current control on the 12-V rails has a high degree of programmability, including independent current limit and fast trip thresholds. Overcurrent fault timing is managed with user-programmable shut-down delays, and each of the four power channels has dedicated fault and power good reporting outputs. In addition, current sense and pass and block FET's for the 3.3-V channels are fully integrated into the device.

Power management applications based on the TPS2358 are easily configured to meet the requirements for 12-V and 3.3-V control of Advanced Mezzanine Card (AdvancedMC™) modules. Each device incorporated onto a Carrier Card provides full control for two AdvancedMC™ slots according to the requirements of the Advanced Telecommunications Computing Architecture (ATCA™) specification, PICMG 3.0. In addition, the input supply FET OR'ing control for the 12-V rails facilitates efficient redundant supply implementations in Micro Telecommunications Computing Architecture (MicroTCA™) systems.

## **2 Description**

### **2.1 Module Overview**

The TPS2358EVM is a single-board evaluation platform consisting of two main sections. When oriented with the board nomenclature and switch labels in a normal, upright reading position towards the user, the top portion contains the TPS2358 device and typically required components. The bottom section contains more ancillary circuitry intended to facilitate exercising the device through various application scenarios. Power connectors are organized with inputs along the left edge of the board, outputs along the right.

The main (upper) section of the board is comprised of the four power channels, including the featured device, support passives, input and output banana jacks, control FET's (for 12-V rails), and power planes. The board contains various capacitors for simulation of input bulk capacitance as may be present on driven AdvancedMC™ modules; alternatively, the user's test loads can be connected at the output banana jacks. Various timing capacitor options, for each power rail, are available and user-selectable via DIP switch S7. Numerous jumpers are provided throughout the circuit for maximum configuration flexibility. Test points are available for voltage and waveform monitoring.

The bottom section contains two expansion port connectors and the status LED's. Slide switches for actuation of the chip enable inputs are organized in a row along the bottom edge of the PCB.

## 2.2 Typical Applications

The TPS2358EVM was designed with independent input and output banana jacks for up to two each 12-V input and 3.3-V input power supplies, and up to two each 12-V and 3.3-V output power rails. This provides the greatest flexibility for configuring the EVM for either ATCA™ or MicroTCA™ applications.

By connecting the two 12-V inputs and two 3.3-V inputs together, the TPS2358EVM can manage the application of a single 12-V supply and single 3.3-V supply to two AdvancedMC-like loads. This configuration allows users to learn about the device operation in non-redundant applications. Driving the supply inputs independently while ganging together the common potential output nodes demonstrates operation in redundant systems, albeit through a common controller IC. In either case, switch-selectable timing capacitors complete device configuration for the target application.

As supplied from the factory, the EVM comes with current limits programmed for the requirements of Management Power and Payload Power control for AdvancedMC™ modules. However, limit thresholds on the 12-V channels are programmable by the user; instructions for modifying current limits are included below. This flexibility with the TPS2358 enables use in other, proprietary systems requiring 12-V and 3.3-V supply control.

Lastly, the EVM features two expansion ports and related jumpers needed to parallel multiple devices together to create a true redundant system. Additional EVM modules for this purpose can be ordered directly from the TI website at <http://www.productfolderURL>, or contact your local TI representative.

## 2.3 Features

The TPS2358EVM includes the following features:

- One TPS2358 Dual-Slot ATCA™ AdvancedMC™ Controller
- Programming and sense resistors (12-V)
- Low  $R_{DS(ON)}$  pass and block FET's (12-V)
- Input and output power jacks for external supply and optional load connection
- Up to 880  $\mu\text{F}$  ( $4 \times 220 \mu\text{F}$ ) jumpered load capacitors (each channel) for simulated Payload Power output bulk capacitance
- 150  $\mu\text{F}$  jumpered load capacitor for each Management Power channel
- Multiple, switch-selectable fault timer settings, each channel
- Slide switch actuation of enable inputs
- Expansion port headers

The use of these features is described in greater detail later in this document.

## 3 Electrical Specifications

### 3.1 Absolute Maximum Ratings

The absolute maximum ratings for the TPS2358EVM are given below in [Table 1](#).

**Table 1. Absolute Maximum Ratings<sup>(1)(2)</sup>**

| PARAMETER                                                                                             | RATING                                                       |
|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| Input voltage range, +12-V supply                                                                     | –0.3 V to 13.8 V                                             |
| Input voltage range, +3.3-V supply                                                                    | –0.3 V to 4 V                                                |
| Applied voltage, pins of J21, J22 $\overline{\text{EN}}12\text{x}$ , $\overline{\text{OREN}}\text{x}$ | –0.3 V to ( $V_{\text{IN}}(12\text{VINx}) + 0.5 \text{ V}$ ) |
| Applied voltage, pins of J21, J22 SUMx, $\overline{\text{EN}}3\text{x}$                               | –0.3 V to ( $V_{\text{IN}}(3\text{V3INx}) + 0.5 \text{ V}$ ) |
| Output current, 12-V outputs                                                                          | TBD                                                          |
| Output current, 3.3-V outputs                                                                         | Internally limited by device                                 |
| Output current, SUMx                                                                                  | –5 mA                                                        |
| Storage temperature range                                                                             | –55°C to 150°C                                               |

<sup>(1)</sup> All voltages are with respect to the EVM GND node.

<sup>(2)</sup> Currents are positive into and negative out of the specified terminal.

### 3.2 Recommended Operating Conditions

The recommended operating conditions for the TPS2358EVM are given in [Table 2](#).

**Table 2. Recommended Operating Conditions, TPS2358EVM<sup>(1)(2)</sup>**

| PARAMETER                                                      | MIN   | TYP | MAX   | UNITS |
|----------------------------------------------------------------|-------|-----|-------|-------|
| Input supply voltage, +12-V                                    | 8.8   | 12  | 13.2  | V     |
| Input supply voltage, +12-V (for specified $V_{\text{OUT}}$ )  | 11.3  | 12  | 13.2  | V     |
| Input supply voltage, +3.3-V                                   | 2.85  | 3.3 | 3.5   | V     |
| Input supply voltage, +3.3-V (for specified $V_{\text{OUT}}$ ) | 3.235 | 3.3 | 3.465 | V     |
| Load current, Payload Power Out (either channel)               |       |     | –7.4  | A     |
| Load current, Mgmt Power Out (either channel)                  |       |     | –165  | mA    |

<sup>(1)</sup> All voltages are with respect to the EVM GND node.

<sup>(2)</sup> Currents are positive into and negative out of the specified terminal.

### 3.3 Electrical Characteristics

The electrical characteristics of the TPS2358EVM are as listed in [Table 3](#).

**Table 3. Electrical Characteristics, TPS2358EVM<sup>(1)</sup>**

| PARAMETER                                                                                                                                             | CONDITIONS                                                                                             | MIN   | TYP  | MAX   | UNITS   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-------|------|-------|---------|
| <b>UNLESS OTHERWISE NOTED:</b> $V_{IN}(12VINx)$ and $V_{IN}(3V3INx)$ per <a href="#">Table 2</a> under (for specified $V_{OUT}$ ). $T_A = 25^\circ C$ |                                                                                                        |       |      |       |         |
| Output Voltage, Payload Power Out (either channel)                                                                                                    | $\overline{EN12x} = HI, \overline{OREN} = HI,$<br>$I_{LPWR} < I_{LPWR\_MAX}$                           | 10.8  |      | 13.2  | V       |
| Output Voltage, Mgmt Power Out (either channel)                                                                                                       | $\overline{EN3x} = HI, I_{LMP} < I_{LMP\_MAX}$                                                         | 3.135 |      | 3.465 | V       |
| Current limit threshold, Payload Power (either channel)                                                                                               |                                                                                                        | 7.4   | 8.36 | 9.1   | A       |
| Current limit threshold, Mgmt Power (either channel)                                                                                                  |                                                                                                        | 170   | 195  | 225   | mA      |
| Fast trip threshold, Payload Power (either channel)                                                                                                   |                                                                                                        |       |      | 24.5  | A       |
| Fast trip threshold, Mgmt Power (either channel)                                                                                                      |                                                                                                        |       |      | 400   | mA      |
| Output capacitance, Payload Power ( $C_{L\_PWR}$ ) (each channel)                                                                                     | All 4 load caps connected                                                                              | 704   | 880  | 1056  | $\mu F$ |
| Output capacitance, Mgmt Power ( $C_{L\_MP}$ ) (each channel)                                                                                         | Load cap connected                                                                                     | 120   | 150  | 180   | $\mu F$ |
| Output ramp time, Payload Power                                                                                                                       | $V_{IN} = 12V-13.2V,$<br>$V_O = 0V$ to $98\% \times V_{IN},$<br>$R_{LOAD} = 1K, C_{LOAD} = C_{L\_PWR}$ |       | 1.31 | 2.01  | mS      |
| Output ramp time, Mgmt Power                                                                                                                          | $V_{IN} = 3.3V-3.465V,$<br>$V_O = 0V$ to $98\% V_{IN},$<br>$R_{LOAD} = 270, C_{LOAD} = C_{L\_MP}$      |       | 2.57 | 3.74  | mS      |

<sup>(1)</sup> All voltages are with respect to the EVM GND node.

## 4 Schematic Diagram

The schematic diagram for the TPS2358EVM is shown in [Figure 1](#) and [Figure 2](#).

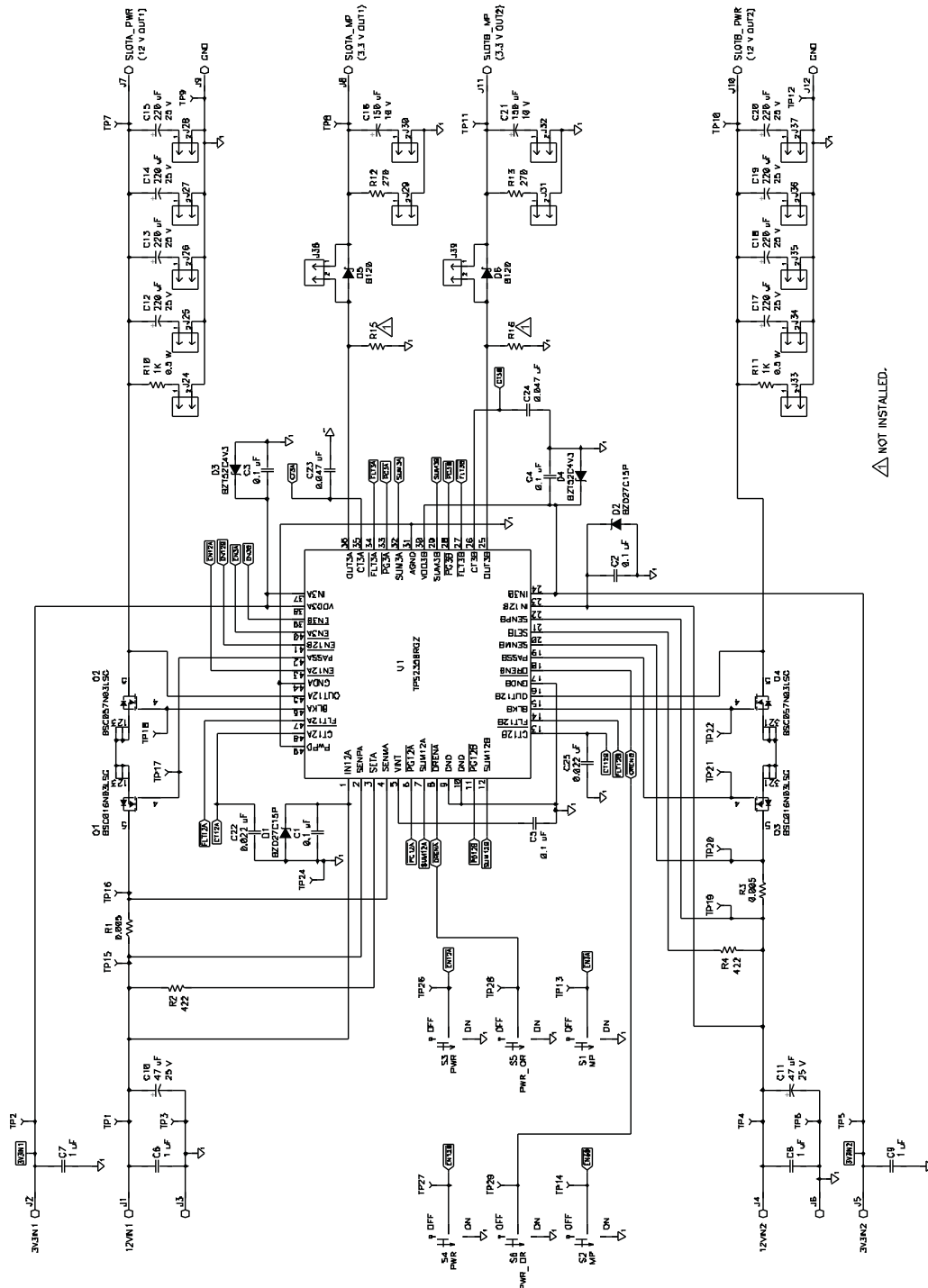


Figure 1. TPS2358 Evaluation Module Schematic Diagram, Sheet 1



## 5 Test Set-Up

### 5.1 Equipment Requirements

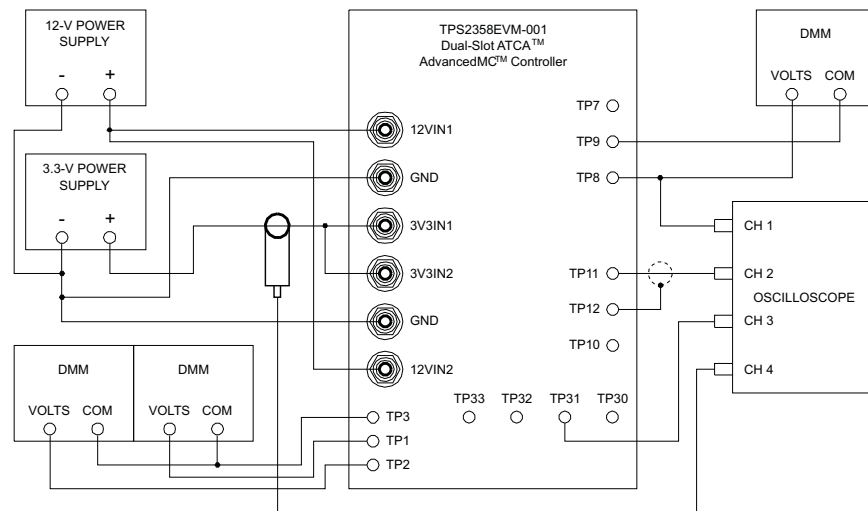
The following test and interface equipment (not supplied) is required to verify EVM module operation, and begin using the EVM.

- Power supply, 3.3 VDC, 500 mA minimum
- Power supply, 15 VDC, 10 A minimum
- Digital multimeters
- Oscilloscope, 4 channel, with current probe

Connect the TPS2358EVM and test equipment as shown in [Figure 3](#) for functional check-out of the board and a good starting point for user evaluation of device operation. Screen print labeling on the board employs a naming convention in keeping with the nomenclature of the target ATCA™ and MicroTCA™ applications. Input 3.3-V supplies are connected to the 3V3INx jacks, and 12-V supplies are connected to the 12VINx jacks. A cross-reference of power rail labeling to standards naming is shown in [Table 4](#).

**Table 4. TPS2358EVM Output Net and Jack Naming**

| REF.DES. | CONNECTOR  | LABEL DESCRIPTION                   |
|----------|------------|-------------------------------------|
| J8       | SLOT A MP  | AdvancedMC™ Slot A Management Power |
| J7       | SLOT A PWR | AdvancedMC™ Slot A Payload Power    |
| J9       | GND        | Common load return node for Slot A  |
| J11      | SLOT B MP  | AdvancedMC™ Slot B Management Power |
| J10      | SLOT B PWR | AdvancedMC™ Slot B Payload Power    |
| J12      | GND        | Common load return node for Slot B  |



- (1) The 3V3INx jacks can be jumpered together with a short test lead at the board, fed from a single lead from the power supply.
- (2) Run separate leads from the GND jacks back to a common return point made near the power supply output terminals.

**Figure 3. TPS2358EVM Set-up — Non-Redundant System Connection**

## 6 Test Procedure

The following procedure can be used to verify functional operation of the EVM assembly upon receipt.

### 6.1 Jumper Installation

The TPS2358EVM makes use of various jumpers for quick change of functional configurations. Verify the module was supplied with shunt jumpers installed across the headers listed in [Table 5](#). For 3-pin headers, note the pin pairs to be connected.. Reconfigure jumper connections if necessary.

**Table 5. Initial Jumper Settings**

| Signal and Control Jumpers     |
|--------------------------------|
| J13, J20                       |
| J16-2 to J16-3, J19-2 to J19-3 |
| J24 – J28                      |
| J29, J30                       |
| J31, J32                       |
| J33 - J37                      |
| J38, J39                       |

On the EVM board, place the ENABLE slide switches, located along the bottom edge of the PCB, in the initial positions shown in [Table 6](#).

**Table 6. ENABLE Switch Initial Positions**

| Section | Switch Name | Initial Position |
|---------|-------------|------------------|
| SLOT A  | MP          | HI               |
|         | PWR         | HI               |
|         | PWR_OR      | LO               |
| SLOT B  | MP          | HI               |
|         | PWR         | HI               |
|         | PWR_OR      | LO               |

Set all 8 DIP positions of switch S7 to the CLOSED position.



## 6.2 Check-Out Steps

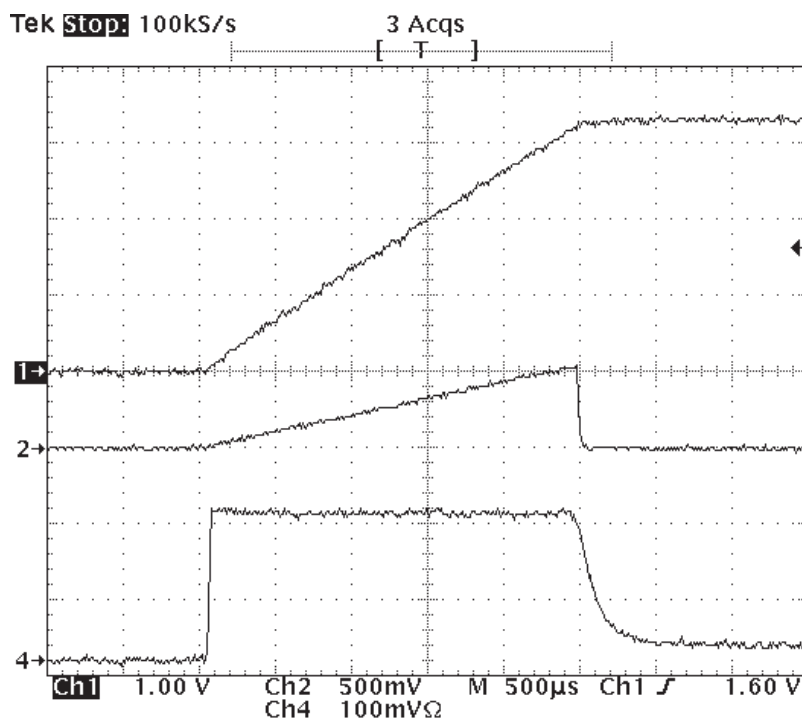
Turn the voltage adjust knobs of both power supplies fully CCW. Adjust the current limit control of the 15-V supply for 10 amps minimum output.

If not already done, connect the EVM and test equipment as shown in [Figure 3](#).

Turn on the 3.3-V power supply, and adjust the output for 3.3 V 5% at test point TP2. Turn on the second supply, and adjust the output for 12 V 5% at TP1. Verify all STATUS LED's (located just above the slide switches) are OFF.

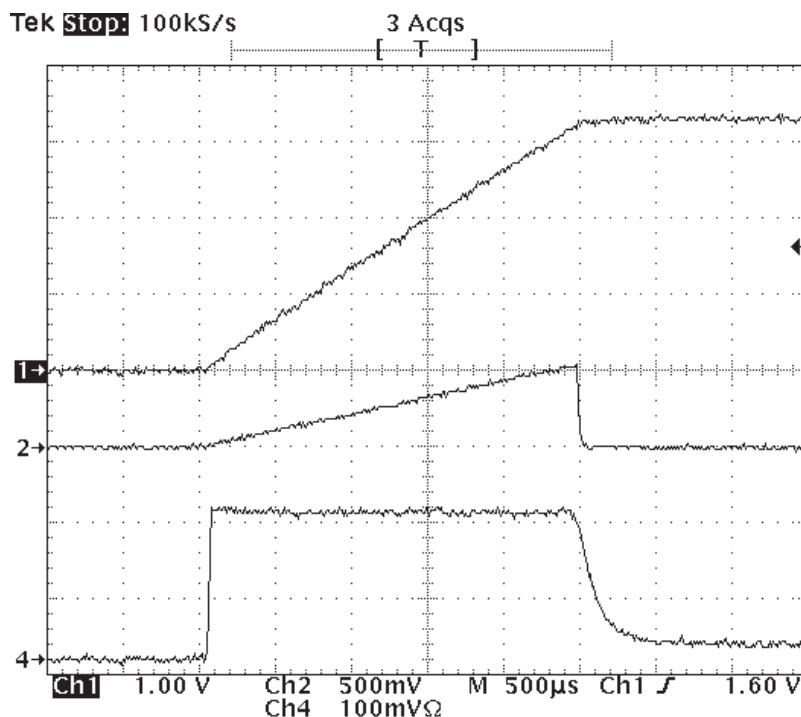
On the oscilloscope, set the Channel 1 and 2 amplifiers to the 2 V/div scale, and position the traces appropriately in the top half of the display for viewing 3.3-V magnitude waveforms. Set the Channel 3 amplifier scale to 100 or 200 mV/div, and position that trace about one division below center of the screen. Set the current pulse amplifier scale to 100 mA/div, and position that trace towards the bottom of the scope screen. Set the scope to trigger on the rising edge of Channel 1, at a threshold of about 1.5 V. Set the time base to 1 mS/div, and set the trigger mode to NORMAL.

On the EVM board, place the SLOT A MP ENABLE switch in the LO position. The SLOT A MP green STATUS LED should illuminate. On the oscilloscope, verify a waveform capture was obtained similar to the one shown in [Figure 4](#). The total voltage ramp time of the Channel 1 waveform, from 0 volts to about 3.2 volts should be 2.6 0.6 mS. The Channel 3 waveform should attain a peak amplitude (prior to pulling low again) of about 180 mV, for a nominal 2.6 ms output ramp time. The actual amplitude obtained varies linearly with the ramp time, and has some inherent tolerance of its own. The peak amplitude of the current pulse on Channel 4 should be 195 25 mA. A DVM can be used to verify the voltage at TP8 (with respect to ground at TP9) is within 10 mV of the 3.3-V input supply voltage at 3V3IN1 (TP2).



**Figure 4. Output Ramp-Up Waveforms – 3.3-A Rail**

Move the Channel 3 scope probe to test point TP30. Set the scope to trigger on Channel 2. Place the EVM SLOT B MP ENABLE switch in the LO position. The SLOT B MP green STATUS LED should illuminate. On the scope screen, verify a waveform capture was obtained similar to that shown in Figure 5. The Channel 2, 3 and 4 waveform parameters should be similar to those indicated above for Figure 4. A DVM can be used to verify the output voltage at TP11 (with respect to ground at TP12) is within 10 mV of the 3.3-V input supply setting.



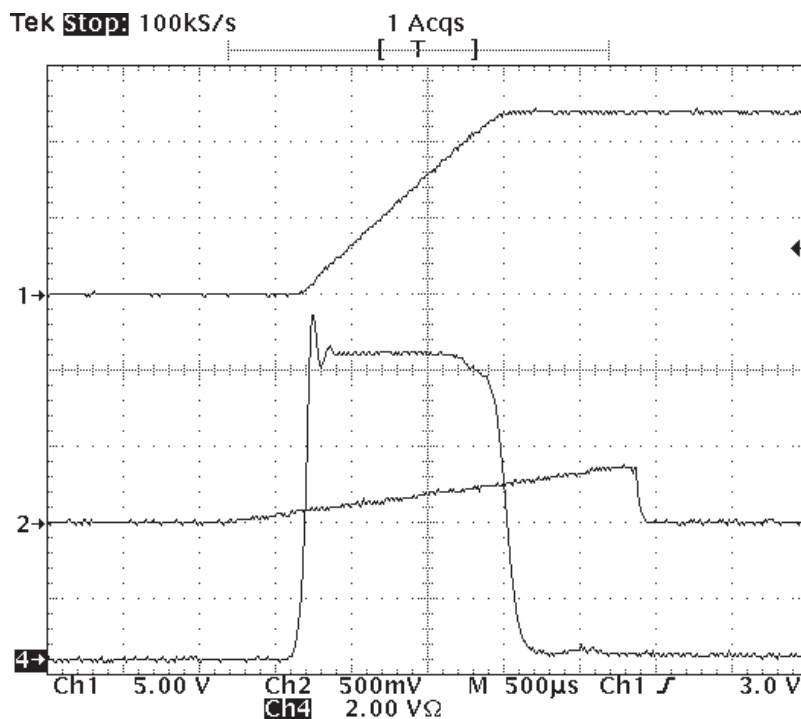
**Figure 5. Output Ramp-up Waveforms – 3.3B Rail**

Change the oscilloscope probe connections and amplifier settings as shown below. It may be beneficial to move the Channel 1 and 2 trace positions for viewing a couple of 12-V waveforms in the top half of the screen.

- Chan. 1 -- TP7: 5 V/div
- Chan. 2 -- TP10: 5 V/div
- Chan. 3 -- TP32: 100 or 200 mV/div

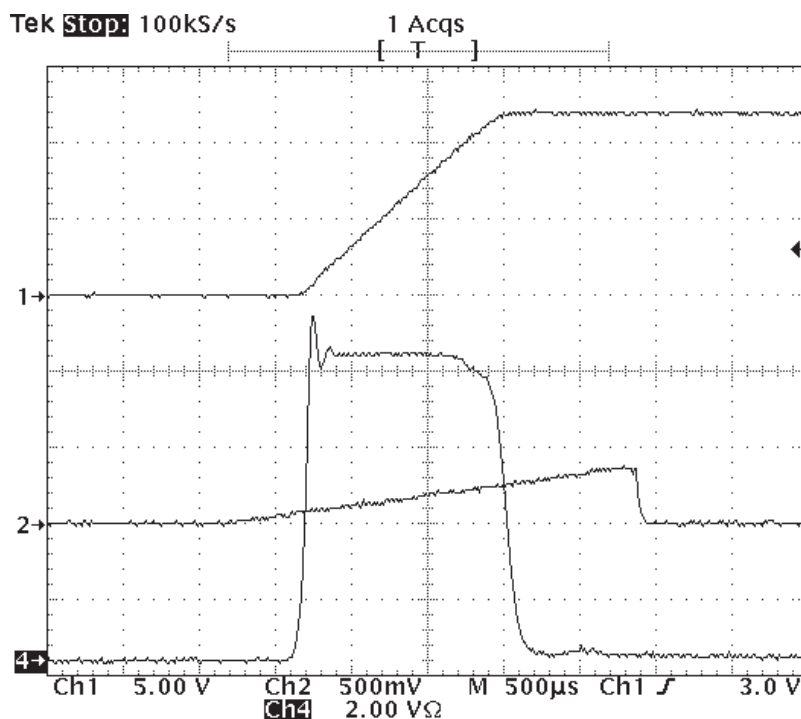
Remove the current probe from the 3.3 V supply lead, and clamp it across the 12VIN2 supply lead. Change the Channel 4 amplifier setting to 5 A/div. Set the time base to 500 S/div, and adjust the scope trigger threshold to about 3 volts.

On the EVM board, place the SLOT B PWR ENABLE switch to the LO position. The SLOT B PWR green LED should illuminate. On the scope, verify a waveform capture was obtained similar to that shown in Figure 6. The total voltage ramp time of the Channel 2 trace, from 0 volts to about 11.8 V should be 1.3  $\pm$  0.3 mS. Note that the extent of variance of the 12-V supply setting from a nominal 12.0 V affects this timing result. A linearly ramping waveform should be visible on the Channel 3 trace, terminating some time after the output (Channel 2) charges to input potential. The average amplitude of the current pulse (i.e., across the flattest part of the peak) on Channel 4 should be 7.9  $\pm$  0.8 A. A DVM can be used to verify the voltage at TP10 (with respect to ground at TP12) is essentially the same as the input supply potential at 12VIN2.



**Figure 6. Output Ramp-up Waveforms – 12B Rail**

Reconnect the Channel 3 scope probe to test point TP33. Set the scope to trigger on Channel 1. Disconnect the current probe and reconnect it across the 12VIN1 supply lead. Move the probe ground lead to test point TP9. Set the SLOT A PWR ENABLE switch to the LO position. The SLOT A PWR green STATUS LED should illuminate. On the scope, verify a waveform capture was obtained similar to that shown in Figure 7. The Channel 1, 3 and 4 waveform parameters should be similar to those indicated above for Figure 6. Again, the extent of variance of the 12-V supply setting from a nominal 12.0 V affects the ramp-up timing result. A DVM can be used to verify the voltage at TP7 (with respect to ground at TP9) is essentially the same as the input supply potential at 12VIN1.



**Figure 7. Output Ramp-up Waveforms – 12A Rail**

The 12-V channel input OR'ing operation can be confirmed as follows: connect voltmeters across the 12-V output test points (SLOT A at TP7, SLOT B at TP10) and a convenient ground point. Setting the SLOT A PWR\_OR switch to LO should cause the Slot A output voltage to drop by about 600 mV (i.e., a diode drop). Setting the SLOT B PWR\_OR switch to LO should cause the Slot B output to drop by about 600 mV.

When any of the output channels are disabled (ENABLE switch returned to HI position), the corresponding output should decay towards 0 volts.

Module operation as indicated in the above steps is a good indication of a fully functional board and correct set-up. This is also a good starting point for further test and user evaluation of the device.

## 7 EVM Feature Details

### 7.1 Test Points

The TPS2358EVM contains numerous test points throughout the circuit for user monitoring of waveforms and voltage measurement. [Table 7](#) lists the module test points and the signal available at each one. The EVM PCB layout connects all ground nodes and supply returns to a common GND node, via several power plane areas. However, due to potentially high loading conditions on the two Payload Power outputs, multiple ground test points are provided to mitigate the measurement impact of return current drops. Therefore, where appropriate, certain test points are paired in the table with the pertinent reference point for meter return connections.

**Table 7. Module Test Points**

| TEST POINT NAME | REF. POINT | SIGNAL NAME                | DESCRIPTION                                                        |
|-----------------|------------|----------------------------|--------------------------------------------------------------------|
| TP1             | TP3        | 12VIN1                     | Input 12 V supply for AdvancedMC™ Slot A                           |
| TP2             |            | 3V3IN1                     | Input 3.3 V supply for AdvancedMC™ Slot A                          |
| TP4             | TP6        | 12VIN2                     | Input 12 V supply for AdvancedMC™ Slot B                           |
| TP5             |            | 3V3IN2                     | Input 3.3 V supply for AdvancedMC™ Slot B                          |
| TP7             | TP9        | SLOTA_PWR                  | AdvancedMC™ Slot A Payload Power, 12 V output                      |
| TP8             |            | SLOTA_MP                   | AdvancedMC™ Slot A Management Power, 3.3 V output                  |
| TP10            | TP12       | SLOTB_PWR                  | AdvancedMC™ Slot B Payload Power, 12 V output                      |
| TP11            |            | SLOTB_MP                   | AdvancedMC™ Slot B Management Power, 3.3 V output                  |
| TP13            | TP24, TP25 | $\overline{\text{EN3A}}$   | Active-low enable input to TPS2358 for the channel A 3.3 V rail    |
| TP14            |            | $\overline{\text{EN3B}}$   | Active-low enable input to TPS2358 for the channel B 3.3 V rail    |
| TP15            | TP16       |                            | Slot A 12-V load current sense voltage                             |
| TP17            | TP24       | PASSA                      | TPS2358 channel A pass FET gate drive output                       |
| TP18            |            | BLKA                       | TPS2358 channel A block/OR'ing FET gate drive output               |
| TP19            | TP20       |                            | Slot B 12-V load current sense voltage                             |
| TP21            | TP25       | PASSB                      | TPS2358 channel B pass FET gate drive output                       |
| TP22            |            | BLKB                       | TPS2358 channel B block/OR'ing FET gate drive output               |
| TP26            | TP24, TP25 | $\overline{\text{EN12A}}$  | Active-low enable input to the TPS2358 for the channel A 12-V rail |
| TP27            |            | $\overline{\text{EN12B}}$  | Active-low enable input to the TPS2358 for the channel B 12-V rail |
| TP28            |            | $\overline{\text{ORENA}}$  | Channel A OR'ing FET/function enable signal to the TPS2358         |
| TP29            |            | $\overline{\text{ORENB}}$  | Channel B OR'ing FET/function enable signal to the TPS2358         |
| TP30            | TP24, TP25 | CT3B                       | Timing cap waveform for the Slot B 3.3-V rail (SLOTB_MP)           |
| TP31            |            | CT3A                       | Timing cap waveform for the Slot A 3.3-V rail (SLOTA_MP)           |
| TP32            |            | CT12B                      | Timing cap waveform for the Slot B 12-V rail (SLOTB_PWR)           |
| TP33            |            | CT12A                      | Timing cap waveform for the Slot A 12-V rail (SLOTA_PWR)           |
| TP34            | Var.       | $\overline{\text{FLT12A}}$ | Slot A 12-V open-drain, active-low FAULT output indication         |
| TP35            |            | $\overline{\text{PG12A}}$  | Slot A 12-V open-drain, active-low POWERGOOD output indication     |
| TP36            |            | $\overline{\text{FLT12B}}$ | Slot B 12-V open-drain, active-low FAULT output indication         |
| TP37            |            | $\overline{\text{PG12B}}$  | Slot B 12-V open-drain, active-low POWERGOOD output indication     |
| TP38            |            | $\overline{\text{FLT3A}}$  | Slot A 3.3-V open-drain, active-low FAULT output indication        |
| TP39            |            | $\overline{\text{PG3A}}$   | Slot A 3.3-V open-drain, active-low POWERGOOD output indication    |
| TP40            |            | $\overline{\text{FLT3B}}$  | Slot B 3.3-V open-drain, active-low FAULT output indication        |
| TP41            |            | $\overline{\text{PG3B}}$   | Slot B 3.3-V open-drain, active-low POWERGOOD output indication    |

On the TPS2358EVM, the device fault ( $\overline{\text{FLT}}_x$ ) and power good ( $\overline{\text{PG}}_x$ ) outputs are all used to drive the STATUS LED's. Power for LED drive is derived from a diode-OR of the two 3.3-V input supplies.

## 7.2 Connecting Loads to the TPS2358EVM

Each of the four power rails of the TPS2358EVM is supplied with some amount of load capacitance in the form of discrete electrolytics. The capacitors can be connected to or disconnected from their associated output nodes using 100-mil, 2-pin shunt jumpers across the on-board PCB headers. These capacitors are intended to simulate input bulk capacitance which may be encountered at the front ends of AdvancedMC™ modules plugged into the card slots of the target application. The AdvancedMC™ standard specifies the maximum allowable input capacitance on both Management and Payload Power rails. The TPS2358EVM provides up to 150  $\mu$ F capacitance on each of the two Management Power outputs, according to the AdvancedMC™ maximum limit. The EVM also provides up to 880  $\mu$ F of capacitance, implemented in increments of 220  $\mu$ F devices, on each of the Payload Power rails, to approximate the 800  $\mu$ F limit of the standard. In addition, low-level (mA) load resistors can be jumpered in across each output and return. These limited load resistors are intended primarily as reset devices between output ramp events, particularly when loaded with significant capacitance.

[Table 8](#) lists the EVM module's output voltage nodes, and for each one indicates the associated jumper reference designators, and the resultant load value with jumper installed.

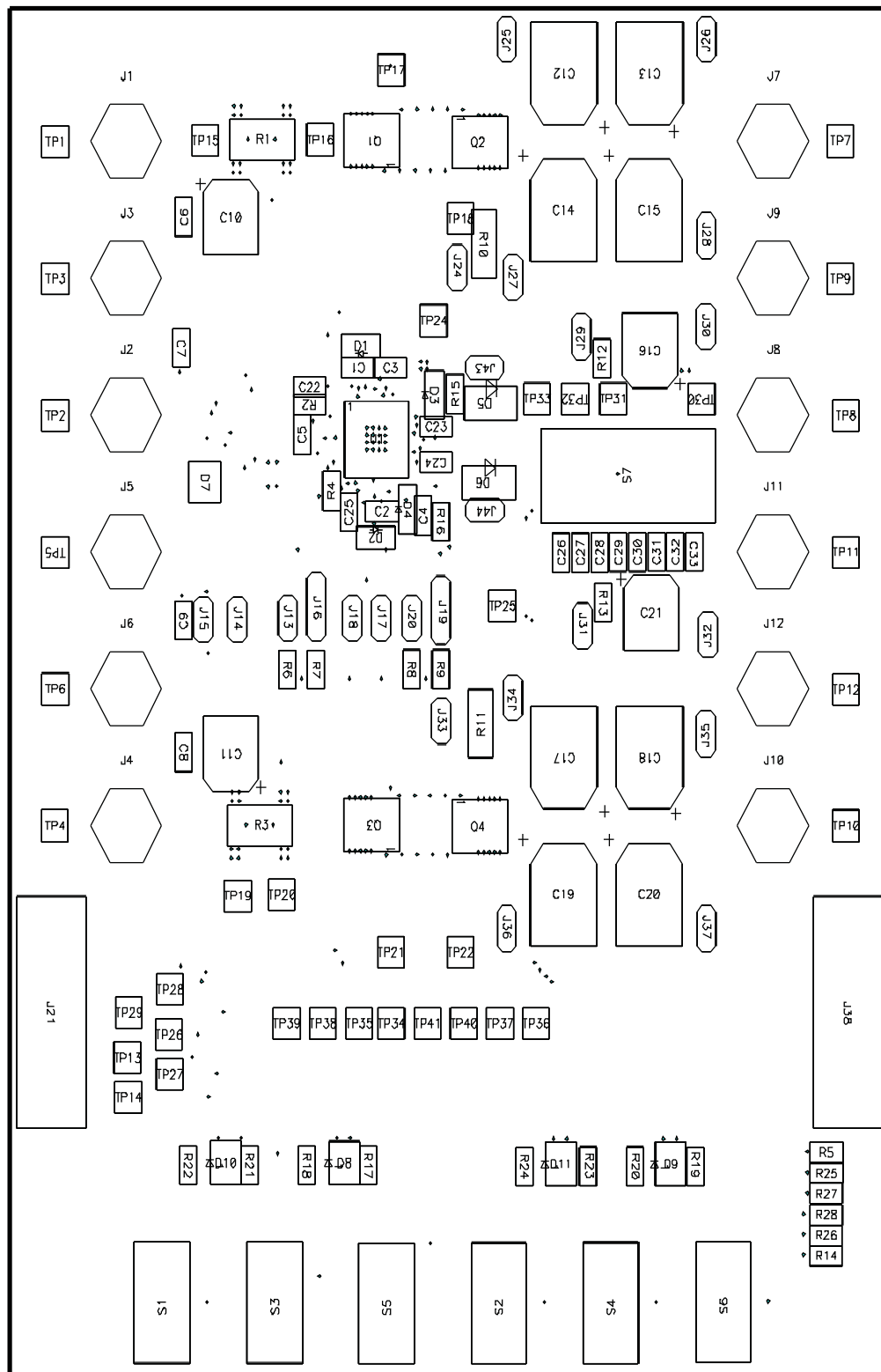
**Table 8. EVM On-board Loads**

| OUTPUT RAIL | JUMPER | DEVICE | VALUE        |
|-------------|--------|--------|--------------|
| SLOTA_MP    | J30    | C16    | 150 $\mu$ F  |
|             | J29    | R12    | 270 $\Omega$ |
| SLTB_MP     | J32    | C21    | 150 $\mu$ F  |
|             | J31    | R13    | 270 $\Omega$ |
| SLOTA_PWR   | J25    | C12    | 220 $\mu$ F  |
|             | J26    | C13    | 220 $\mu$ F  |
|             | J27    | C14    | 220 $\mu$ F  |
|             | J28    | C15    | 220 $\mu$ F  |
|             | J24    | R10    | 1 k $\Omega$ |
| SLOTB_PWR   | J34    | C17    | 220 $\mu$ F  |
|             | J35    | C18    | 220 $\mu$ F  |
|             | J36    | C19    | 220 $\mu$ F  |
|             | J37    | C20    | 220 $\mu$ F  |
|             | J33    | R11    | 1 k $\Omega$ |

Banana jacks are provided along the right-hand edge of the board for connection of the user's optional test loads. The output banana jack reference designators are listed in [Table 4](#) along with the voltage rail available at each one. Also, the net names are screen printed on the PCB, adjacent to their respective jacks.

## 8 Assembly Drawing and PCB Layout

The top assembly drawing and individual PCB layers for the TPS2358EVM are shown in the following figures.



**Figure 8.**

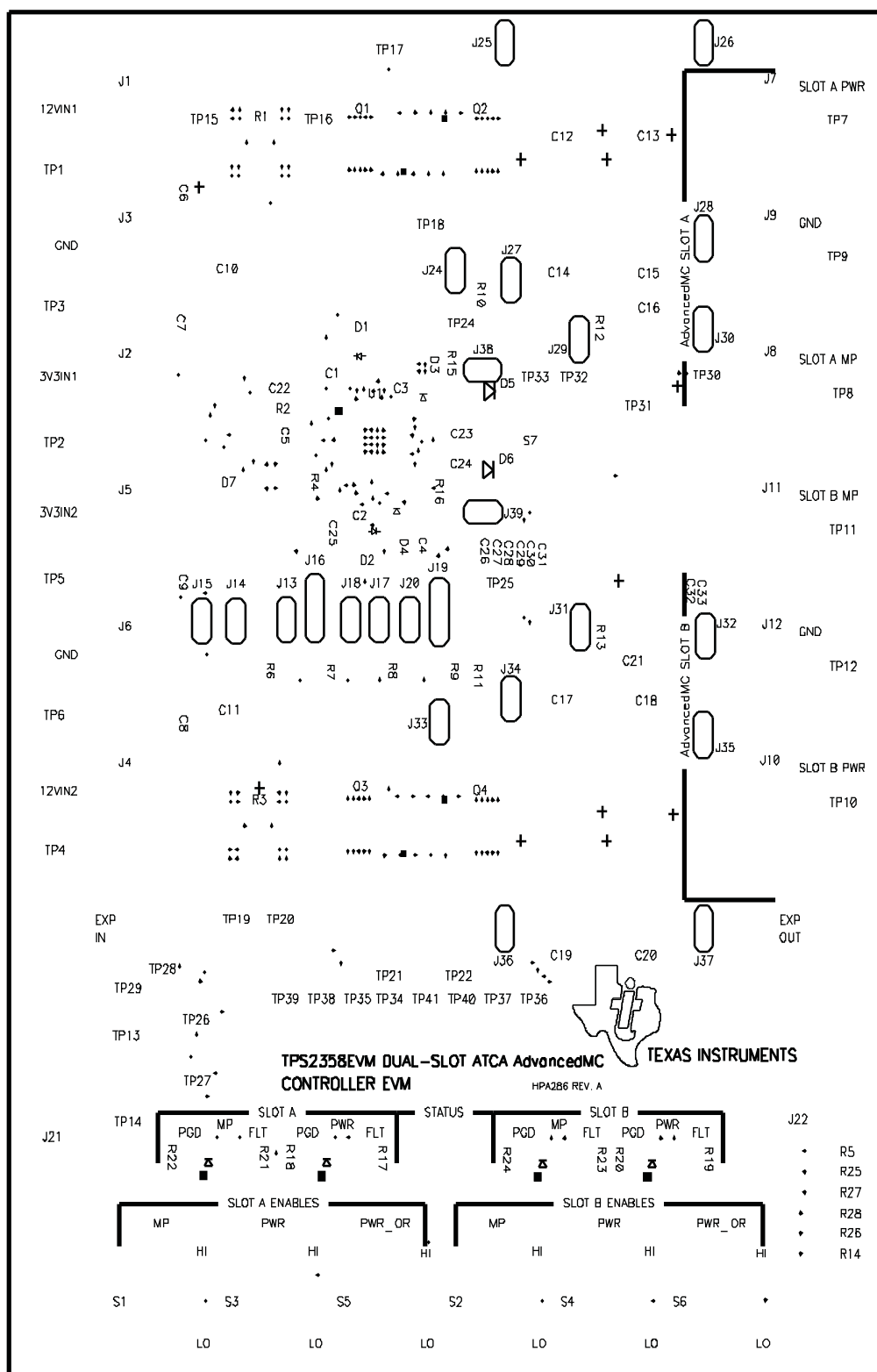


Figure 9.



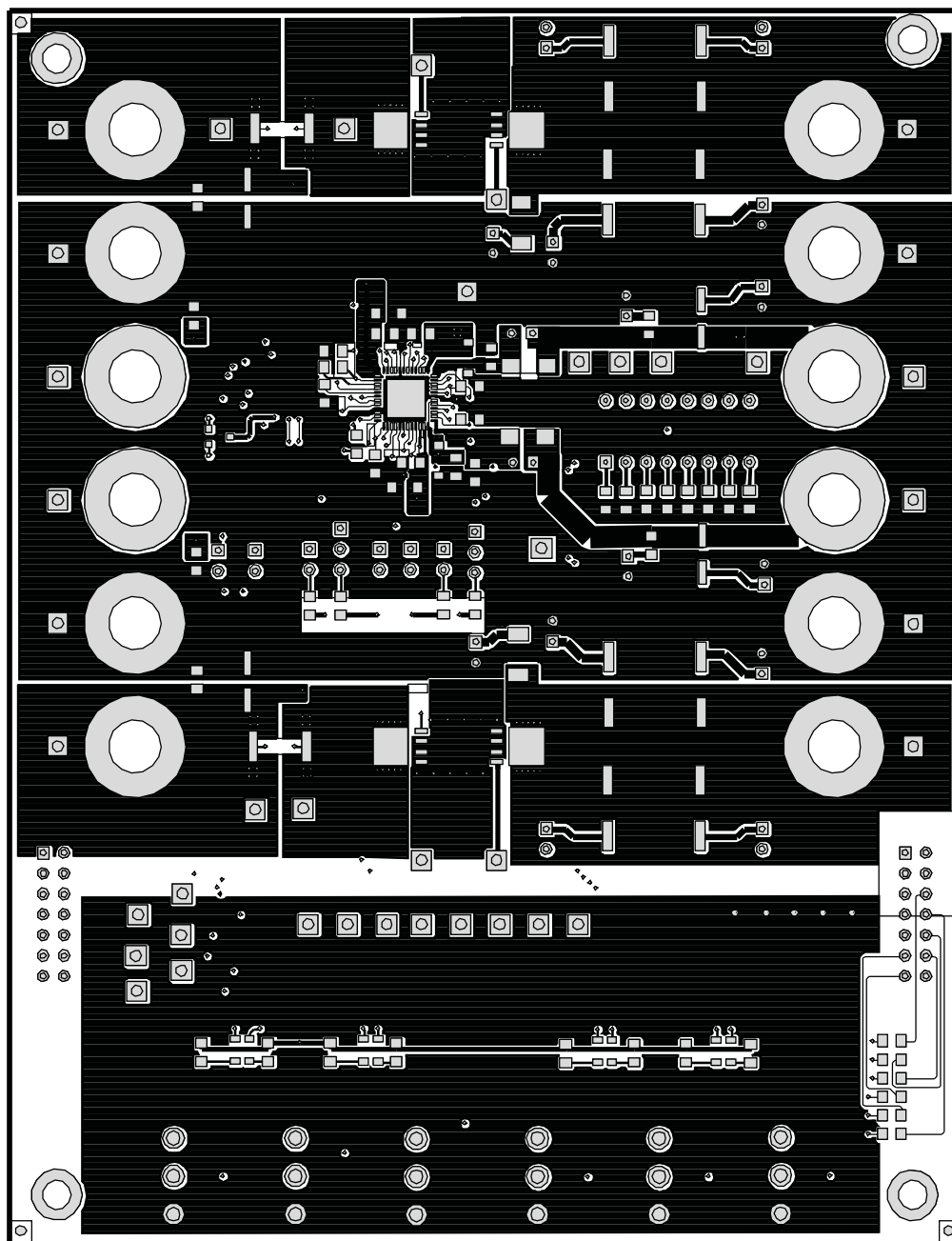


Figure 10.

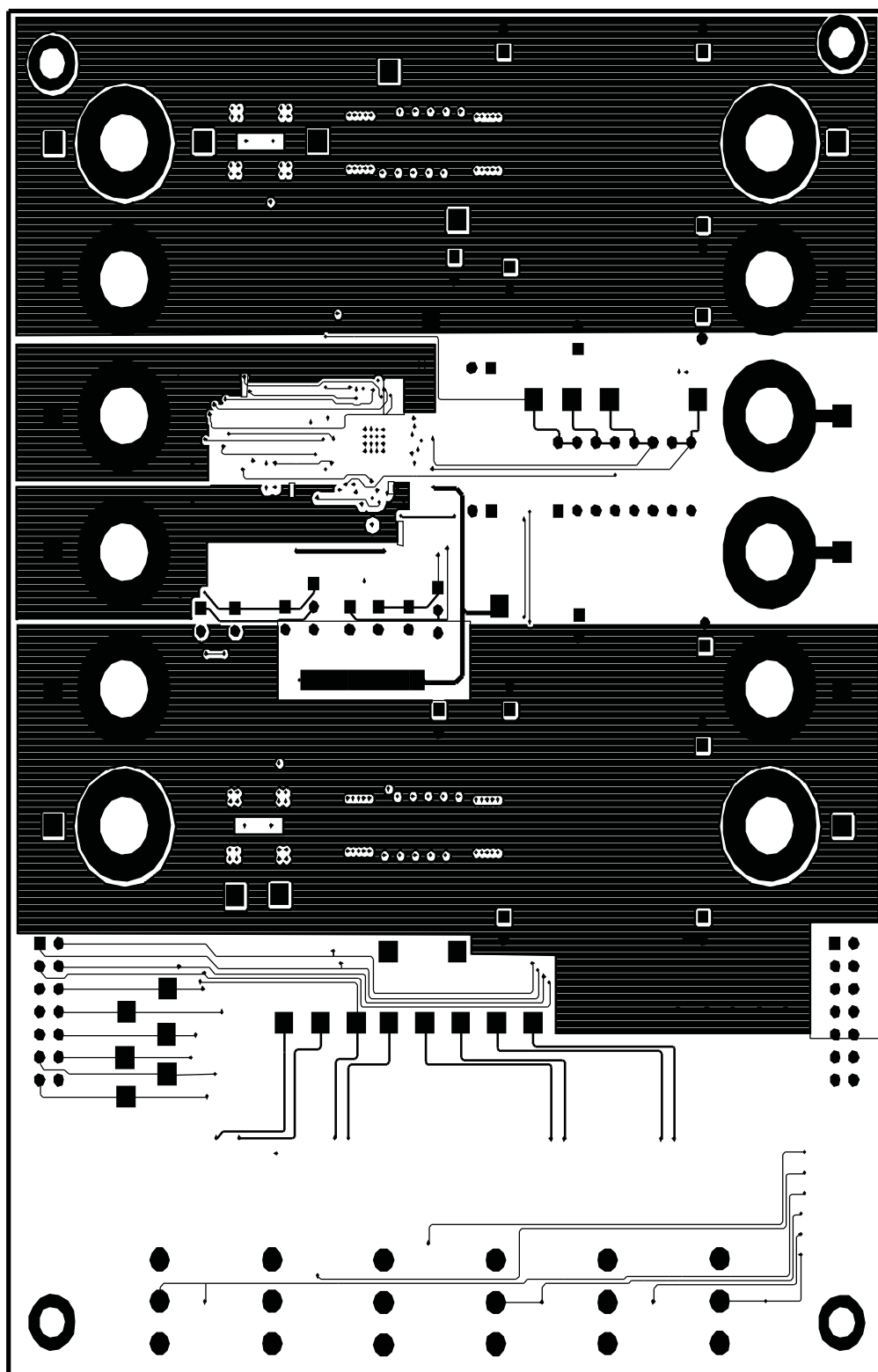


Figure 11.

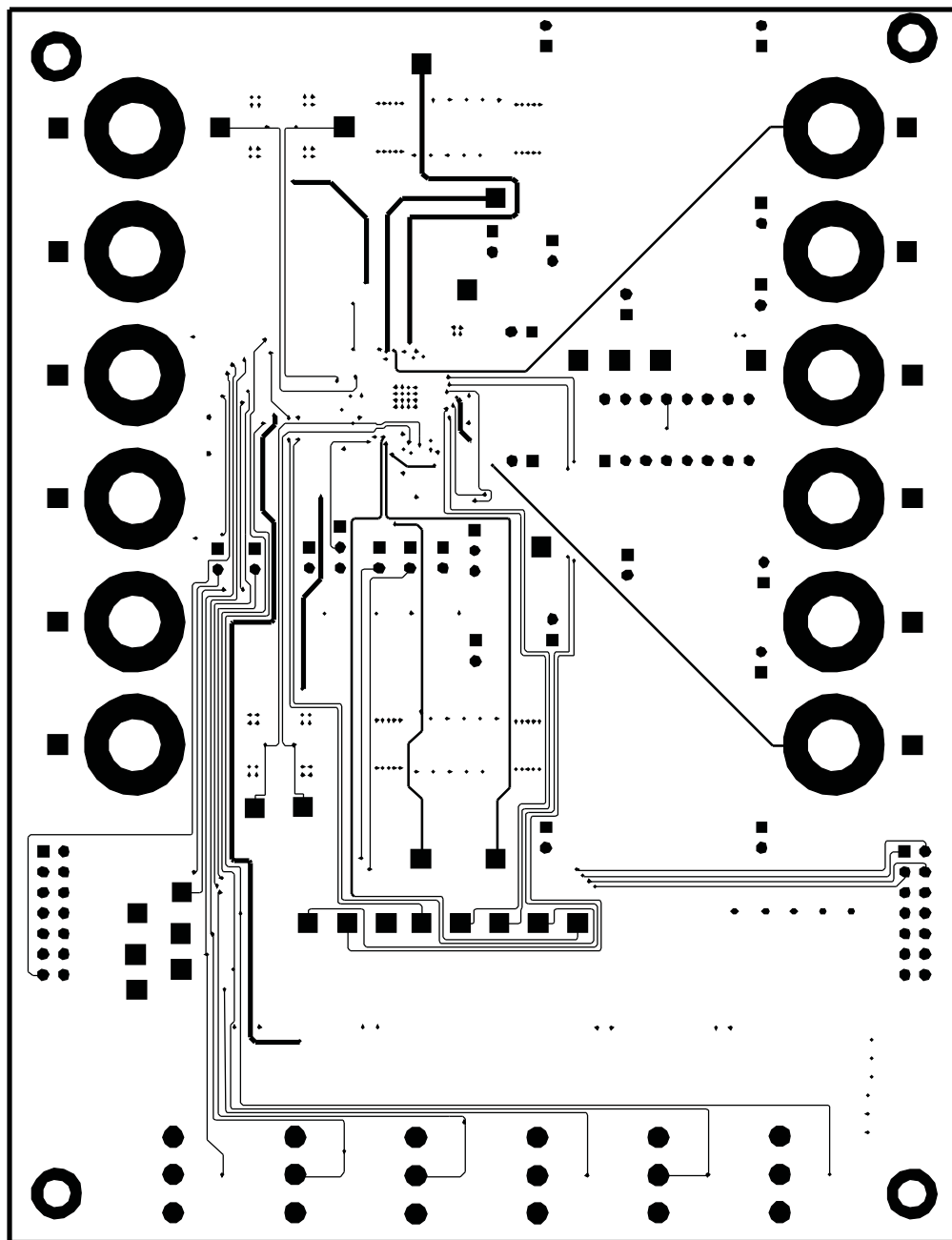
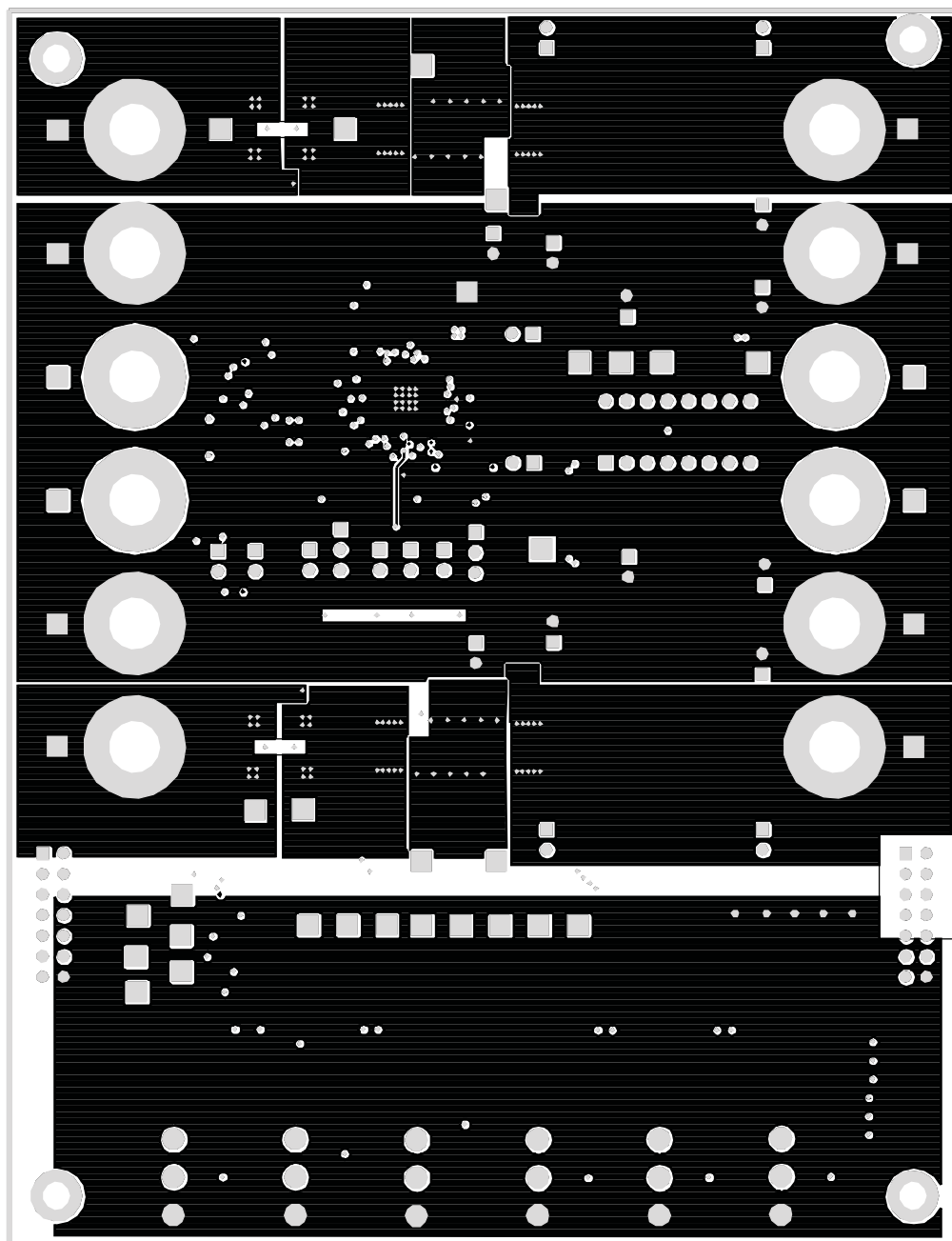


Figure 12.



**Figure 13.**

## 9 List of Materials

**Table 9. List of Materials<sup>(1)</sup>**

| COUNT | REF DES                                                                                                      | DESCRIPTION                                                              | PART NUMBER                                                                                           | MFR         |
|-------|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------------|
| 5     | C1, C2, C3, C4, C5                                                                                           | Capacitor, ceramic, 25 V, X7R, 20%, 0.1 $\mu$ F, 0805                    | Std.                                                                                                  | Std.        |
| 2     | C10, C11                                                                                                     | Capacitor, aluminum, SM, 25 V, 20%, 47 $\mu$ F, case D                   | EEV-FK1E470P                                                                                          | Panasonic   |
| 8     | C12, C13, C14, C15, C17, C18, C19, C20                                                                       | Capacitor, aluminum, SM, 25 V, 20%, 220 $\mu$ F, case F                  | EEV-FK1E221P                                                                                          | Panasonic   |
| 2     | C16, C21                                                                                                     | Capacitor, aluminum, SM, 10 V, 20%, 150 $\mu$ F, case D                  | EEV-FK1A151P                                                                                          | Panasonic   |
| 2     | C22, C25                                                                                                     | Capacitor, ceramic, 10 V, X7R, 10%, 0.022 $\mu$ F, 0805                  | Std.                                                                                                  | Std.        |
| 4     | C23, C24, C27, C29                                                                                           | Capacitor, ceramic, 10 V, X7R, 10%, 0.047 $\mu$ F, 0805                  | Std.                                                                                                  | Std.        |
| 2     | C26, C28                                                                                                     | Capacitor, ceramic, 10 V, X7R, 10%, 0.01 $\mu$ F, 0805                   | Std.                                                                                                  | Std.        |
| 2     | C30, C32                                                                                                     | Capacitor, ceramic, 10 V, X7R, 10%, 0.1 $\mu$ F, 0805                    | Std.                                                                                                  | Std.        |
| 0     | C31, C33                                                                                                     | Capacitor, ceramic, 10 V, X7R, 10%, USER, 0805                           | Std.                                                                                                  | Std.        |
| 4     | C6, C7, C8, C9                                                                                               | Capacitor, ceramic, 25 V, X7R, 20%, 1 $\mu$ F, 0805                      | Std.                                                                                                  | Std.        |
| 2     | D1, D2                                                                                                       | Diode, zener, 15 V at 50 mA, 800 mW max., Pzsm = 300 W, D0-219AB         | BZD27C15P                                                                                             | Vishay      |
| 2     | D3, D4                                                                                                       | Diode, zener, 4.3 V, 500 mW max., SOD-123                                | BZT52C4V3                                                                                             | Diodes      |
| 2     | D5, D6                                                                                                       | Diode, Schottky, 1 A, 20 V, SMA                                          | B120                                                                                                  | Diodes      |
| 1     | D7                                                                                                           | Diode, dual Schottky, com, cathode, 30 V, 200 mA, SOT-23                 | BAT54C                                                                                                | Diodes      |
| 4     | D8, D9, D10, D11                                                                                             | Diode, LED, red/green, 1210, 45/35 mcd @ 20 mA, 0.126 x 0.106in.         | LTST-C155KGJRKT                                                                                       | Lite-On     |
| 12    | J1, J2, J3, J4, J5, J6, J7, J8, J9, J10, J11, J12                                                            | Jack, banana, non-ins., PC mount, TH                                     | 3267                                                                                                  | Pomona      |
| 22    | J13, J14, J15, J17, J18, J20, J24, J25, J26, J27, J28, J29, J30, J31, J32, J33, J34, J35, J36, J37, J38, J39 | Header, 2 pin, 100-mil spacing, 0.100 in. x 2                            | PEC36SAAN                                                                                             | Sullins     |
| 2     | J16, J19                                                                                                     | Header, 3 pin, 100-mil spacing, 0.100 in. x 3                            | PEC36SAAN                                                                                             | Sullins     |
| 2     | J21, J22                                                                                                     | Header, PCB mnt., vert., 2 x 7, 100-mil spacing, 0.100 in. x 2 x 7       | 2514-6002UB                                                                                           | 3M          |
| 2     | Q1, Q3                                                                                                       | Transistor, NFET, 30 V, 100 A, $R_{DS(on)} < 5 \text{ m}\Omega$ , TDSO-8 | "BSC016N03LSG<br>## or<br>BSC022N03SG"                                                                | Infineon    |
| 2     | Q2, Q4                                                                                                       | Transistor, NFET, 30 V, $R_{DS(on)} < 20 \text{ m}\Omega$ , TDSO-8       | "BSC057N03LSG<br>## or<br>BSC050N03LSG<br>or<br>BSC042N03LSG<br>or BSC022N03SG<br>or<br>BSC016N03LSG" | Infineon    |
| 2     | R1, R3                                                                                                       | Resistor, metal strip, 1 W, 1%, 0.005, 2512                              | WSL2512-5L000FEA                                                                                      | Vishay-Dale |
| 2     | R10, R11                                                                                                     | Resistor, chip, 1/2 W, 5%, 1 k $\Omega$ , 2010                           | Std.                                                                                                  | Std.        |

<sup>(1)</sup> Part number information is for reference only to further illustrate component characteristics; substitution of other mfgs' part of equal or better specification is permissible. Substitution NOT allowed on part numbers marked with double asterisk (\*\*).

**Table 9. List of Materials (continued)**

| COUNT | REF DES                                                                                                                                                                                              | DESCRIPTION                                                  | PART NUMBER                                    | MFR                      |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|------------------------------------------------|--------------------------|
| 2     | R12, R13                                                                                                                                                                                             | Resistor, chip, 1/10 W, 5%, 270 $\Omega$ , 0805              | Std.                                           | Std.                     |
| 8     | R17, R18, R19, R20, R21, R22, R23, R24                                                                                                                                                               | Resistor, chip, 1/10 W, 5%, 470 $\Omega$ , 0805              | Std.                                           | Std.                     |
| 2     | R2, R4                                                                                                                                                                                               | Resistor, chip, 1/10 W, 1%, 422 $\Omega$ , 0805              | Std.                                           | Std.                     |
| 0     | R5, R14, R15, R16, R25, R26, R27, R28                                                                                                                                                                | Resistor, chip, 1/10 W, 5%, 0805,                            | Std.                                           | Std.                     |
| 2     | R6, R7                                                                                                                                                                                               | Resistor, chip, 1/10 W, 1%, 6.81 k $\Omega$ , 0805           | Std.                                           | Std.                     |
| 2     | R8, R9                                                                                                                                                                                               | Resistor, chip, 1/10 W, 1%, 3.32 k $\Omega$ , 0805           | Std.                                           | Std.                     |
| 6     | S1, S2, S3, S4, S5, S6                                                                                                                                                                               | Switch, slide, SPDT, vert. act., PC mount, 0.500 x 0.260 in. | "1101M2S3CBE2 or 1101M2S3CKE2 or 1101M2S3CQE2" | C&K Switch               |
| 1     | S7                                                                                                                                                                                                   | Switch, DIP, SPST, raised rocker, 8 pos., 0.380 x 0.880 inch | "76SB08S(T) or BD08"                           | "Grayhill or C&K Switch" |
| 34    | TP1, TP2, TP4, TP5, TP7, TP8, TP10, TP11, TP13, TP14, TP15, TP16, TP17, TP18, TP19, TP20, TP21, TP22, TP26, TP27, TP28, TP29, TP30, TP31, TP32, TP33, TP34, TP35, TP36, TP37, TP38, TP39, TP40, TP41 | Test point, white, 0.062 in. hole, TH                        | 5012                                           | Keystone                 |
| 6     | TP3, TP6, TP9, TP12, TP24, TP25                                                                                                                                                                      | Test point, black, 0.062 in. hole, TH                        | 5011                                           | Keystone                 |
| 1     | U1                                                                                                                                                                                                   | Dual-Slot ATCA AdvancedMC Controller, QFN-48                 | TPS2358RGZ                                     | Texas Instruments        |
| 1     | N/A                                                                                                                                                                                                  | PCB, FR-4, 4-layer, SMOBC, 4.63" x 6.0" x .062"              | HPA286**                                       | Any                      |
| 20    | N/A                                                                                                                                                                                                  | Shunt, open top                                              | 151-8000                                       | Kobiconn                 |
| 4     | N/A                                                                                                                                                                                                  | Spacer, nylon, hex, #6-32, 0.625"                            | 14HTSP020                                      | Eagle                    |
| 4     | N/A                                                                                                                                                                                                  | Screw, nylon, rnd hd, #6-32, 0.25"                           | 010632R025                                     | Eagle                    |

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