

# ZL6100EVAL2Z Dual Channel Evaluation Board

## Description

The ZL6100 is an integrated mixed-signal power conversion and management IC that combines an efficient step-down DC/DC converter with key power and thermal management functions in a single package. The ZL6100 incorporates current sharing and adaptive efficiency-optimization algorithms to provide a flexible, efficient power IC building block.

The ZL6100EVAL2Z platform is a 6-layer board with two power rails. One rail is a single phase, 30A power rail. The other rail is a dual phase, 60A power rail demonstrating the current sharing capability of the ZL6100.

A USB to SMBus adapter board can be used to connect the eval board to a PC. The PMBus command set is accessed by using the Zilker Labs PowerNavigator™ evaluation software from a PC running Microsoft Windows.

## Features

- 30A Single-phase and 60A Dual-phase Rails
- Optimized for Efficiency
- Configurable Through SMBus
- Onboard Enable Switch
- Power Good Indicators

## Target Specifications

- $V_{IN} = 12V$
- $V_{OUT1} = 1.8V/60A$  max
- $V_{OUT2} = 1.5V/30A$  max
- $f_{SW} = 300kHz$
- Efficiency: 90% at 50% load
- Output Ripple:  $\pm 1.5\%$
- Dynamic response:  $\pm 3\%$   
(50%-70%-50% load step,  $di/dt = 2.5A/\mu s$ )
- Board Temperature:  $+25^{\circ}C$

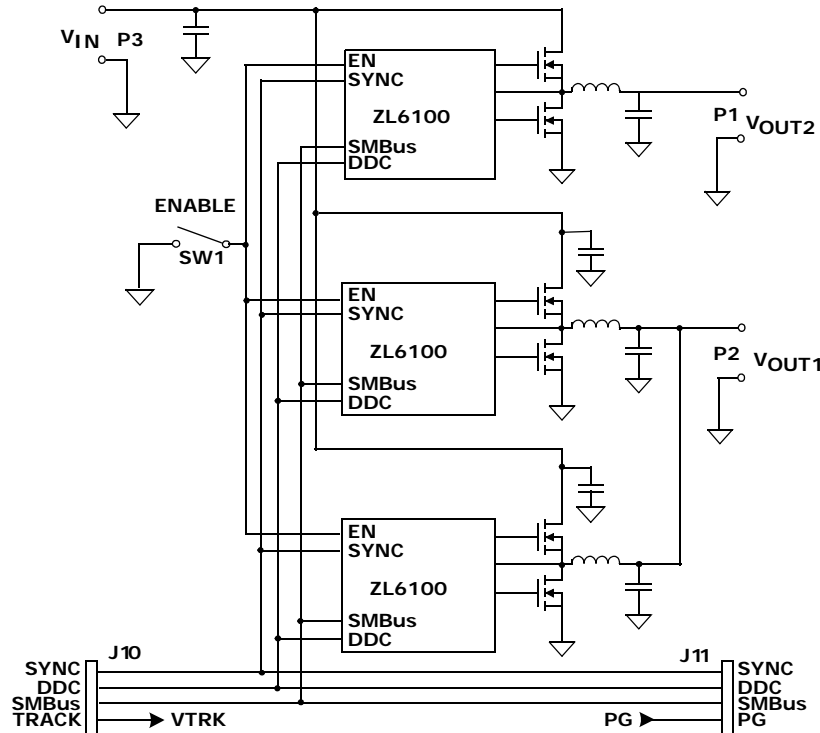


FIGURE 1. ZL6100EVAL2Z BLOCK DIAGRAM

## Functional Description

The ZL6100EVAL2Z provides all circuitry required to demonstrate the features of the ZL6100. The ZL6100EVAL2Z has a functionally-optimized ZL6100 circuit layout that allows efficient operation up to the maximum output current. Power and load connections are provided through plug-in sockets.

All features of the ZL6100 such as current sharing, soft-start delay and ramp times, supply sequencing, voltage tracking, and voltage margining are available on this evaluation board. For voltage tracking, the board is set up for the single phase rail ( $V_{OUT2}$ ) to track the dual phase rail ( $V_{OUT1}$ ). Contact the Zilker Labs sales office for configuring the board for other tracking combinations.

Figure 1 shows a functional block diagram of the ZL6100EVAL2Z board. The SMBus address is selectable through a jumper on the top side of the board. All power to the board ( $V_{IN}$  and I<sup>2</sup>C bus) must be removed before changing the jumpers.

The hardware enable function is controlled by a toggle switch on the ZL6100EVAL2Z board. The power good (PG) LEDs indicate the correct state of PG when external power is applied to the ZL6100EVAL2Z board. (Note: If a USB board is connected to the ZL6100EVAL2Z and no power is applied to the board, the PG LEDs will turn on even though the power rails are not enabled.) The right angle headers at opposite ends of the board are for connecting a USB to SMBus adapter board or for daisy chaining of multiple evaluation boards.

Figures 2 and 3 show the two phases of the 60A circuit. Figure 4 shows the single phase operational circuit. The circuit consists of the ZL6100 IC with its minimal component count to realize a 30A buck converter. The board layout has been optimized for thermal performance.

Figure 5 is the Interface and Figure 9 SMBus address selection circuitry.

## Operation

### PMBus Operation

The ZL6100 utilizes the PMBus protocol. The PMBus functionality can be controlled via USB from a PC running the PowerNavigator evaluation software in a Windows XP or Windows 2000/NT operating system.

Install the ZL6100EVAL2Z software using the CD included in the ZL6100EVAL2Z kit.

For board operation, connect the included USB-to-SMBus adapter board to J10 of the ZL6100EVAL2Z board. Connect the desired load and an appropriate power supply to the input and connect the included USB cable to the PC running the PowerNavigator evaluation software. Place the ENABLE switch in "DISABLE" and turn on the power.

The evaluation software allows modification of all ZL6100 PMBus parameters. Each of the ZL6100 devices have

been pre-configured as described in this document, but the user may modify the operating parameters through the eval software or by loading a predefined scenario from a configuration file.

Use the mouse-over pop-ups for PowerNavigator help. Refer to Zilker Labs application note AN2033 "PMBus™ Command Set DDC Products", Intersil Corporation, 2009 for PMBus details.

The ENABLE switch can then be moved to "ENABLE" and the ZL6100EVAL2Z board can be tested. Alternately, the PMBus ON-OFF CONFIG and OPERATION commands may be used.

## Quick Start Guide

### Stand Alone Operation

1. Set ENABLE switch to "DISABLE"
2. Apply load to VOUT+/VOUT- for each channel
3. Connect power supply to VIN+/VIN- (supply turned off)
4. Turn power supply on
5. Set ENABLE switch to "ENABLE"
6. Monitor ZL6100EVAL2Z board operation using an oscilloscope

### USB (PMBus) Operation

1. Set ENABLE switch to "DISABLE"
2. Apply load to VOUT+/VOUT- for each channel
3. Connect power supply to VIN+/VIN- (supply turned off)
4. Turn power supply on
5. Insert the Zilker Labs Eval Kit CD
6. Connect USB to SMBus adapter board to J10 of ZL6100EVAL2Z
7. Connect supplied USB cable from computer to USB to SMBus adapter board
  - a) Upon first-time connection, the Found New Hardware Wizard will appear.
  - b) Windows XP users: Select 'No' at prompt to search the Internet for drivers.
  - c) Follow the steps on the screen to install the drivers from the CD.
8. Install the PowerNavigator evaluation software by running setup.exe from the PowerNavigator\_installer folder on the CD.
9. Set ENABLE switch on EVB to "ENABLE"
10. Monitor and configure the ZL6100EVAL2Z board using PMBus commands in the evaluation software
11. Test the ZL6100EVAL2Z operation using an oscilloscope and the evaluation software.

# Board Schematics

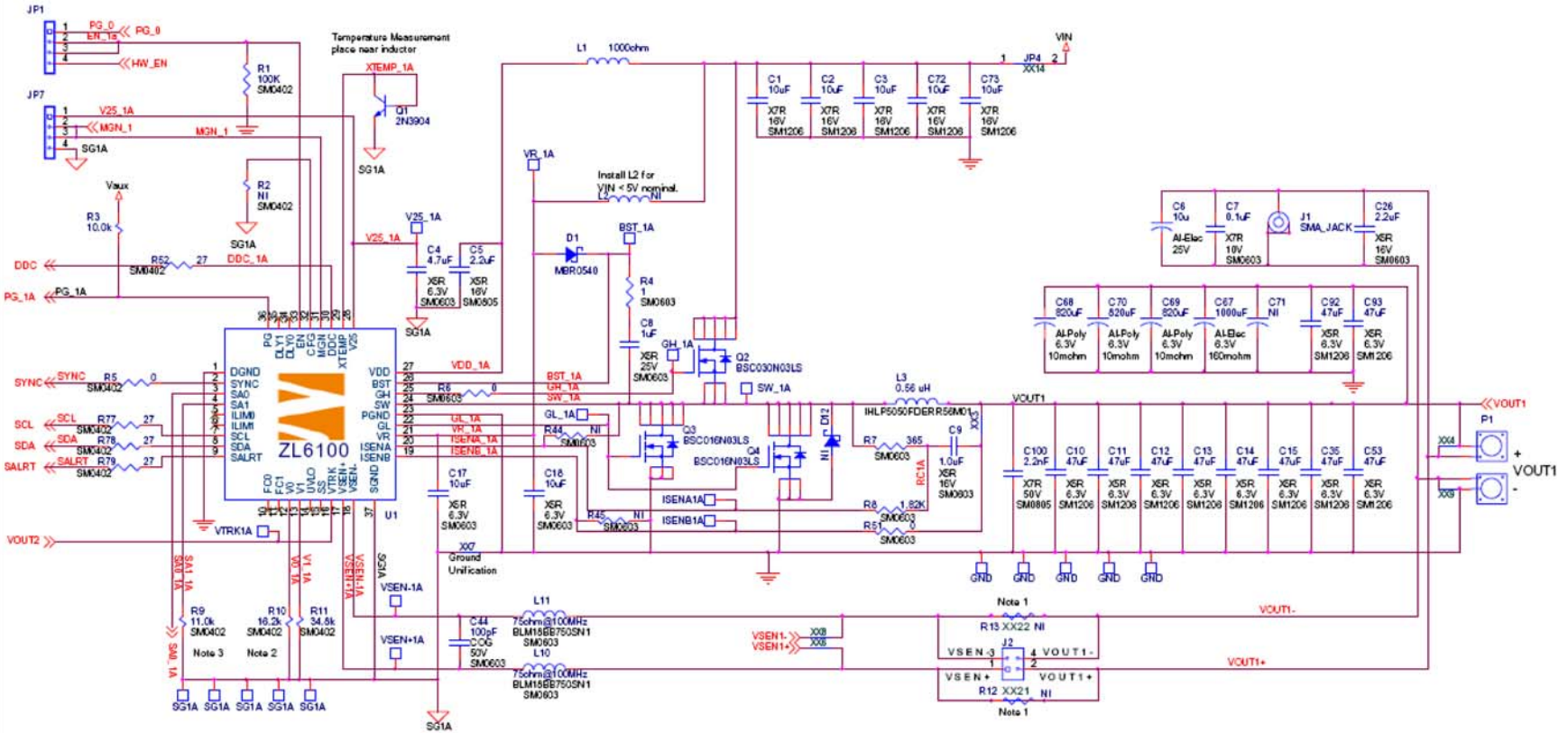


FIGURE 2. ZL6100EVAL2Z 60A CURRENT SHARING RAIL (PHASE A) CIRCUIT

# Board Schematics (Continued)

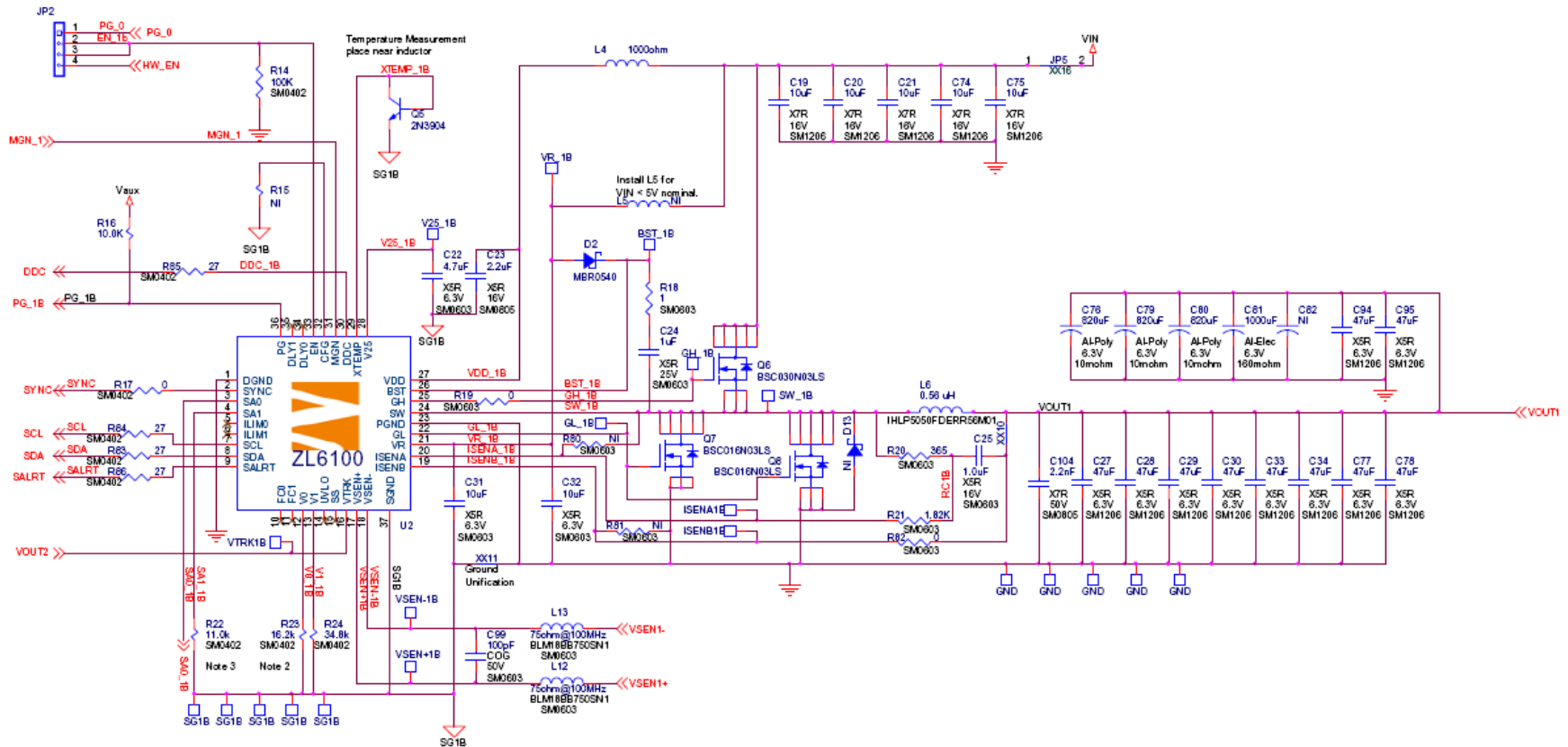


FIGURE 3. ZL6100EVAL2Z 60A CURRENT SHARING RAIL (PHASE B) CIRCUIT

# Board Schematics (Continued)

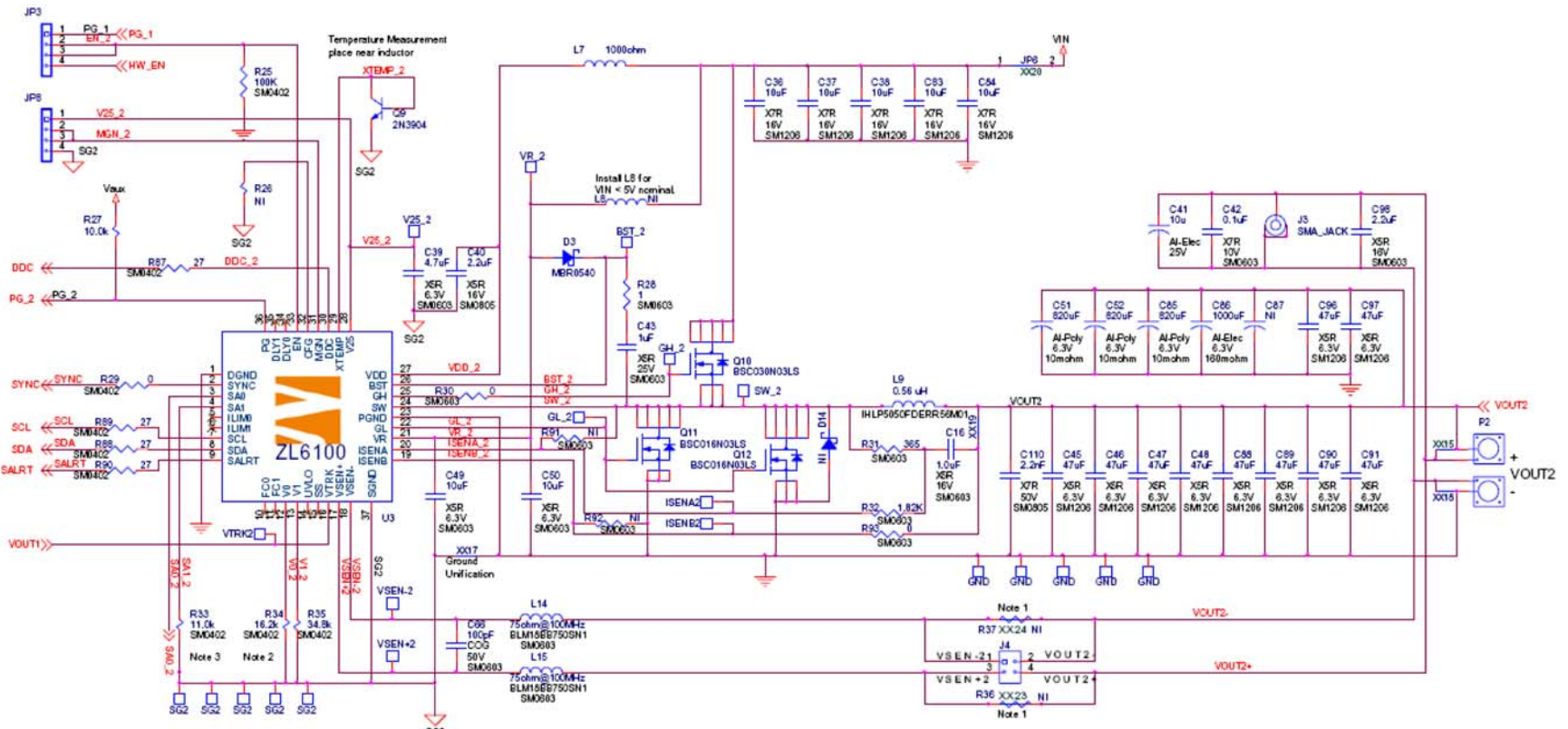


FIGURE 4. ZL6100EVAL2Z 30A SINGLE PHASE RAIL CIRCUIT

# Board Schematics (Continued)

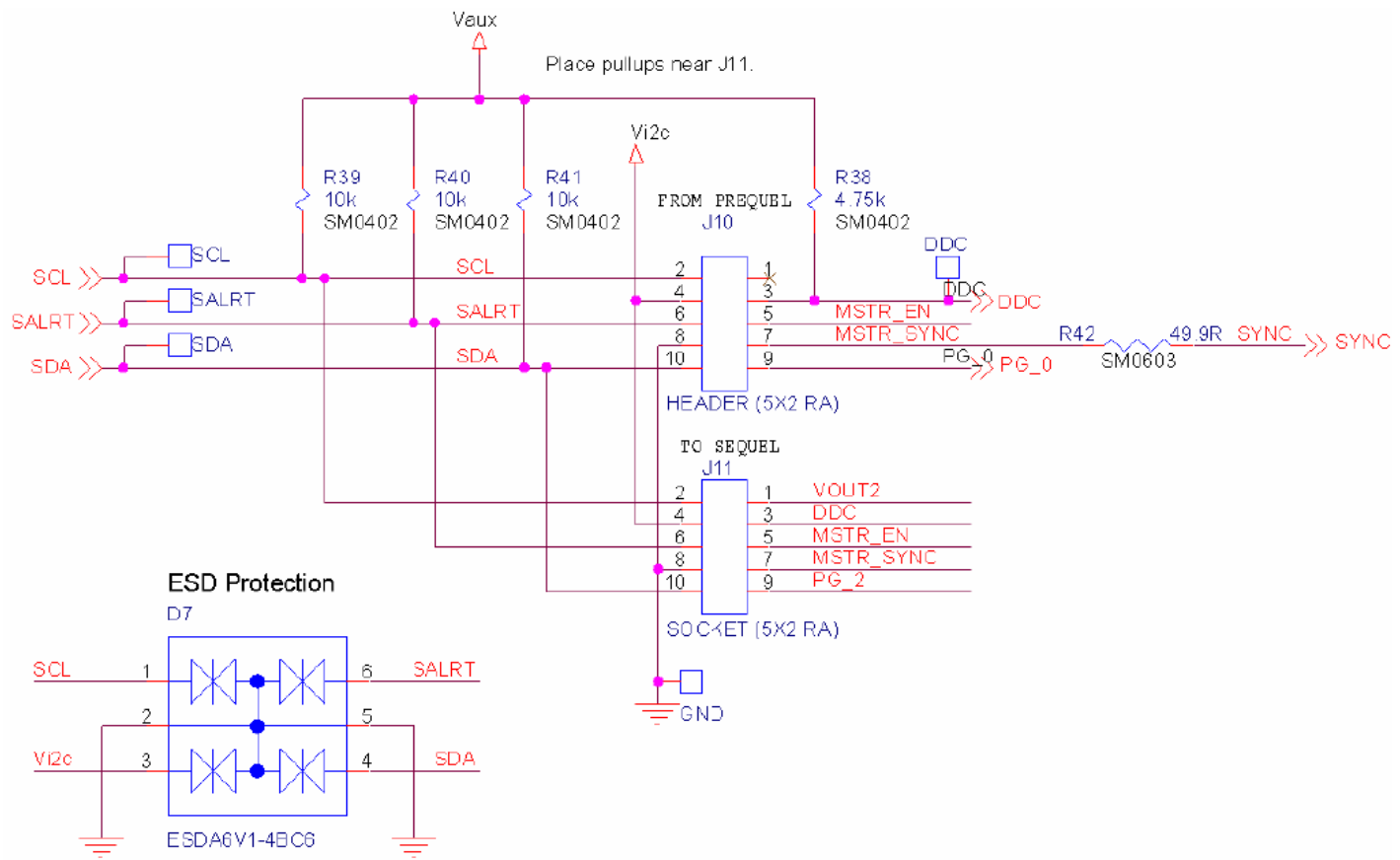


FIGURE 5. ZL6100EVAL2Z INTERFACE CIRCUITRY



# Board Schematics (Continued)

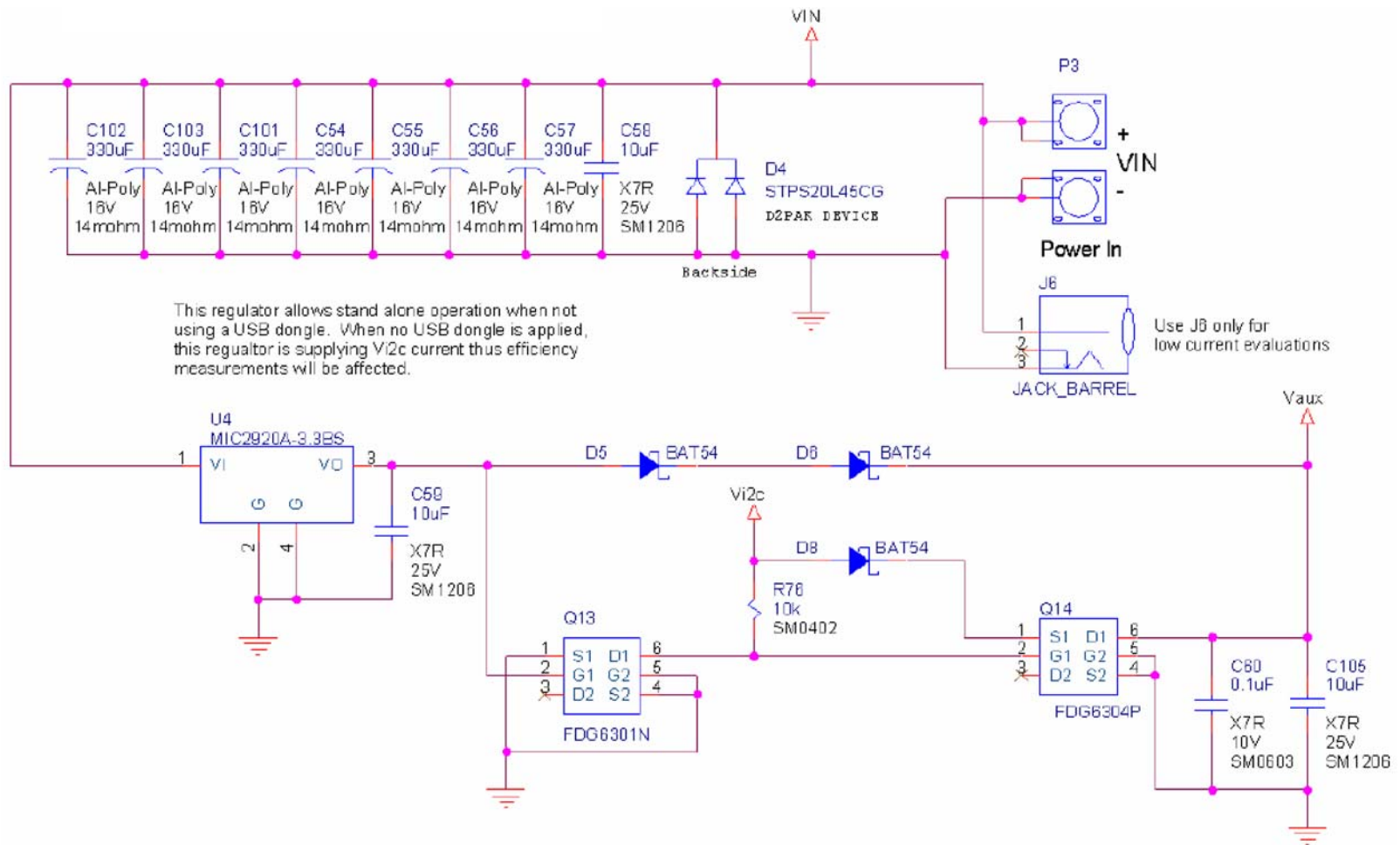


FIGURE 6. POWER-IN CIRCUIT

# Board Schematics (Continued)

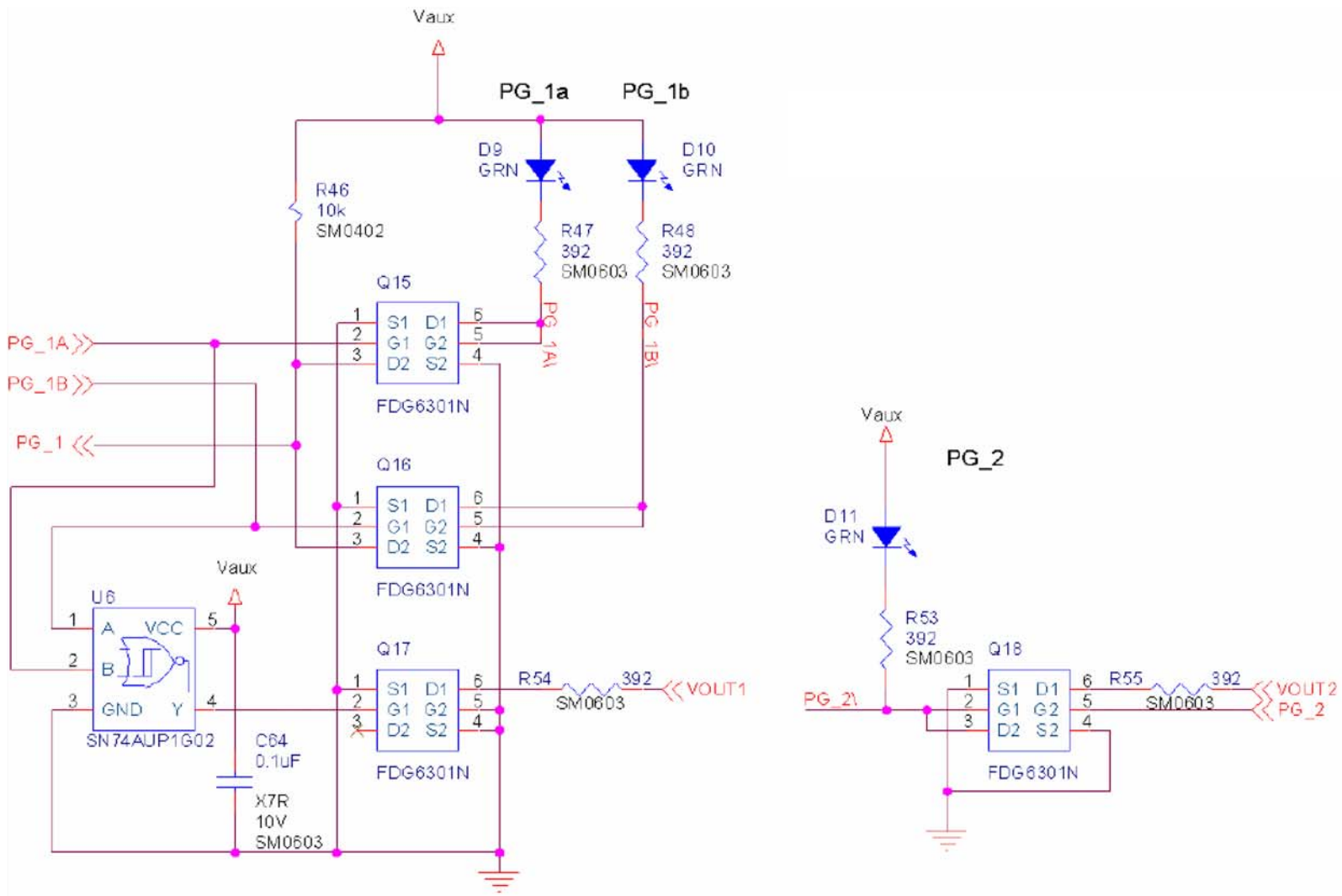


FIGURE 7. PG LED CIRCUITRY



# Board Schematics (Continued)

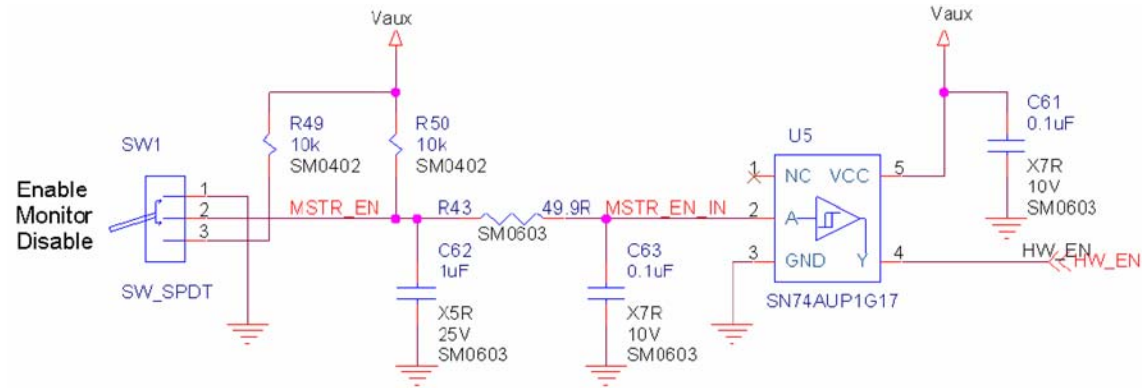


FIGURE 8. ENABLE SWITCH DEBOUNCE CIRCUIT

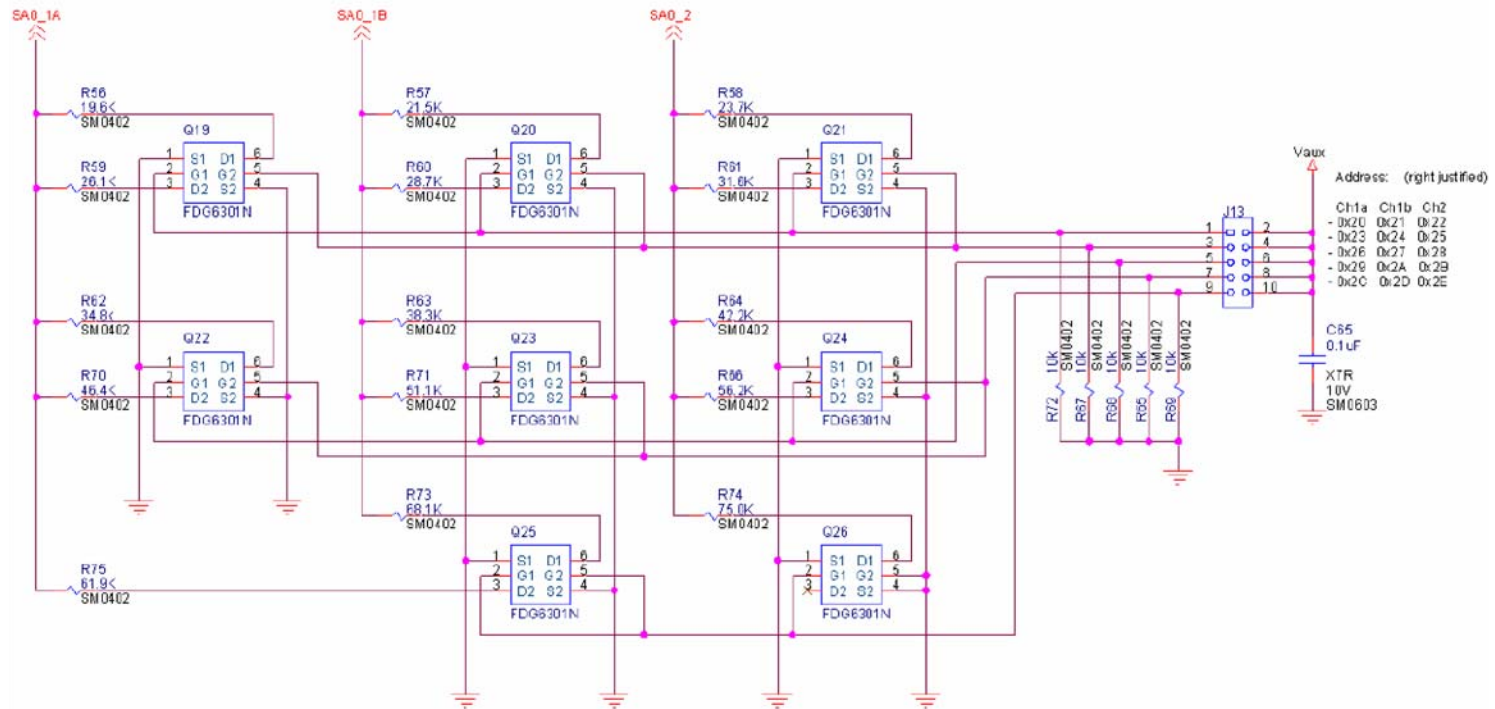


FIGURE 9. ADDRESS SELECTION CIRCUITRY

# Board Layout – 6 Layers

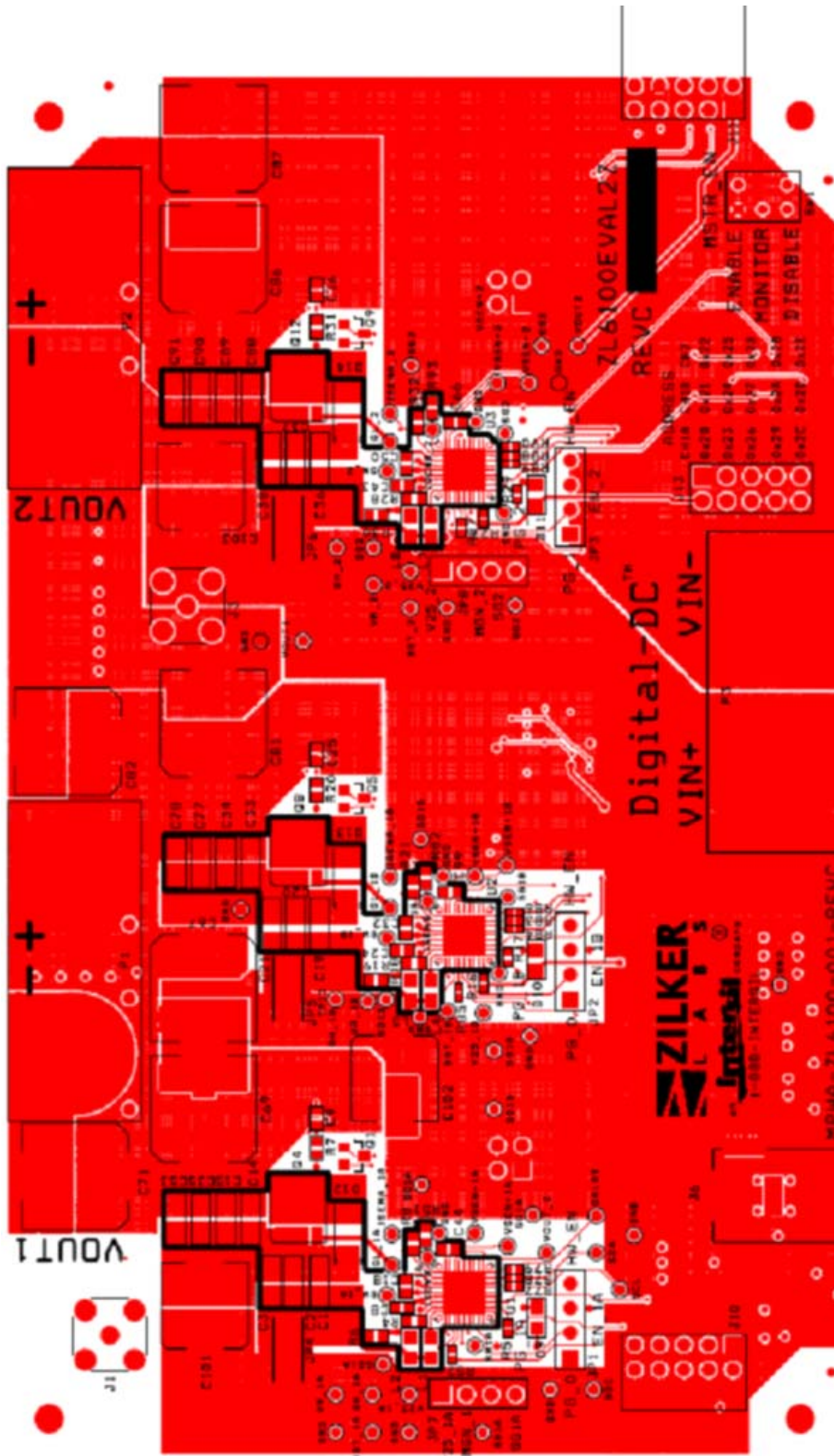


FIGURE 10. PCB – TOP LAYER

Board Layout – 6 Layers (Continued)

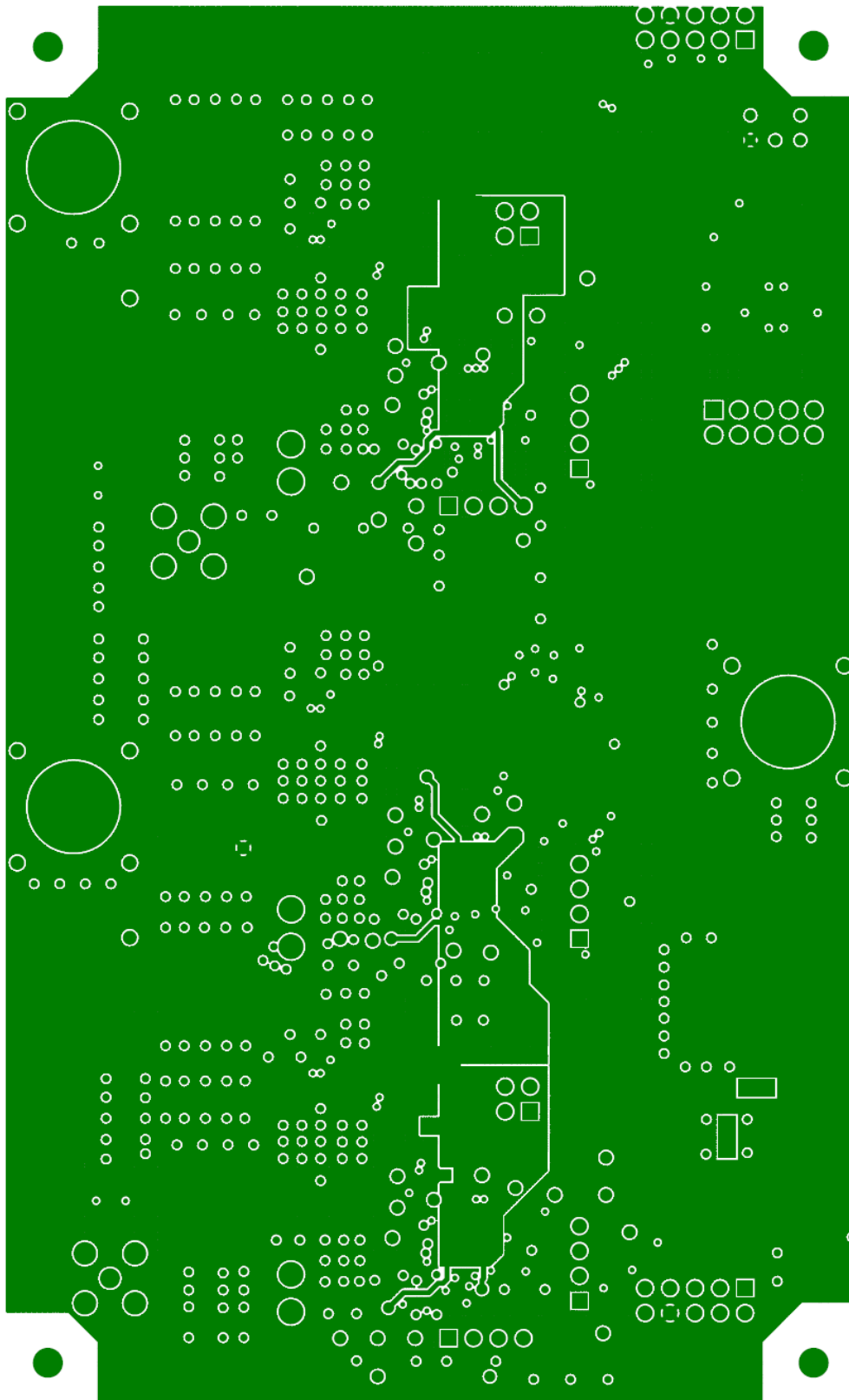


FIGURE 11. PCB – INNER LAYER 1 (VIEWED FROM TOP)

Board Layout – 6 Layers (Continued)

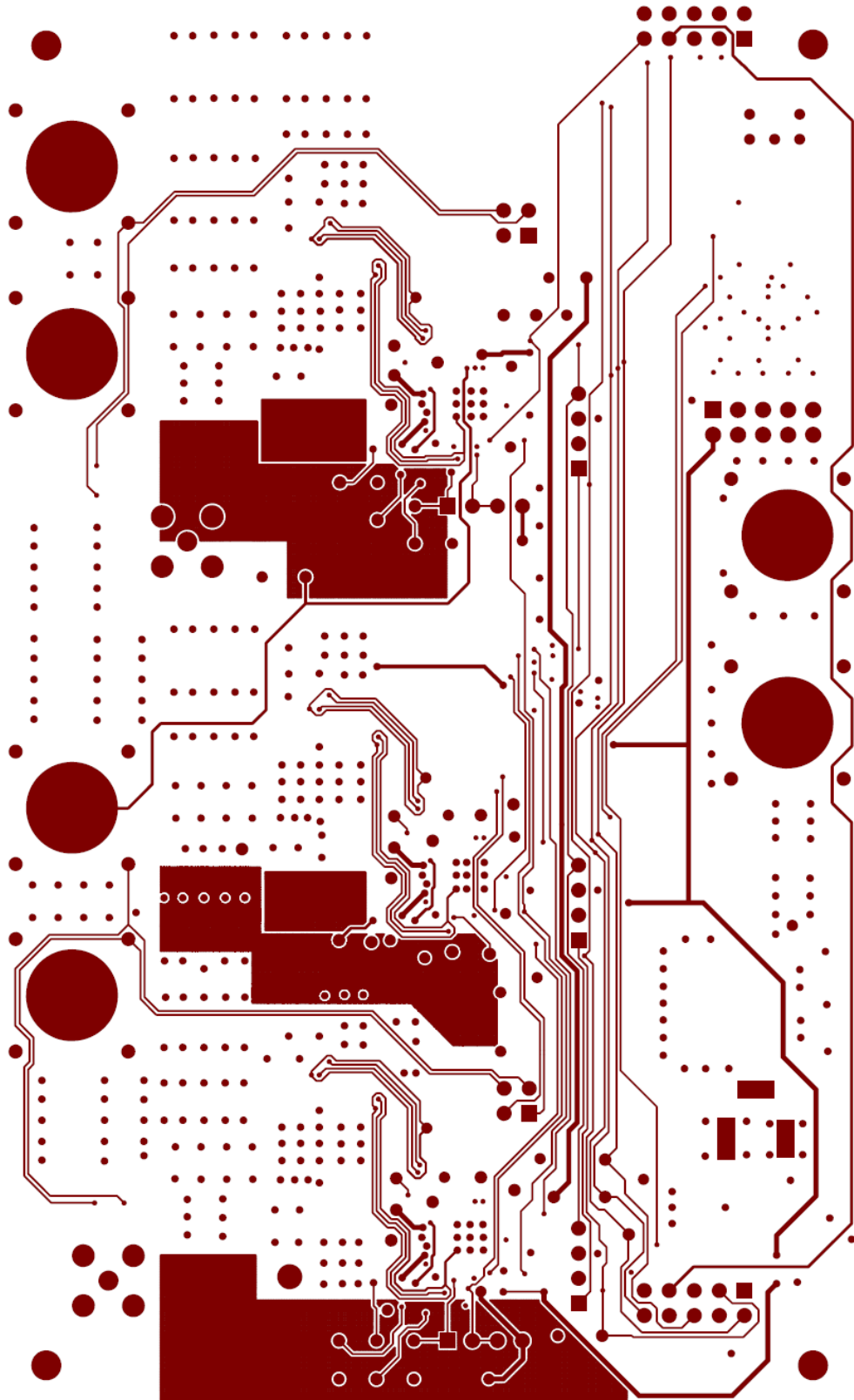


FIGURE 12. PCB – INNER LAYER 2 (VIEWED FROM TOP)

Board Layout – 6 Layers (Continued)

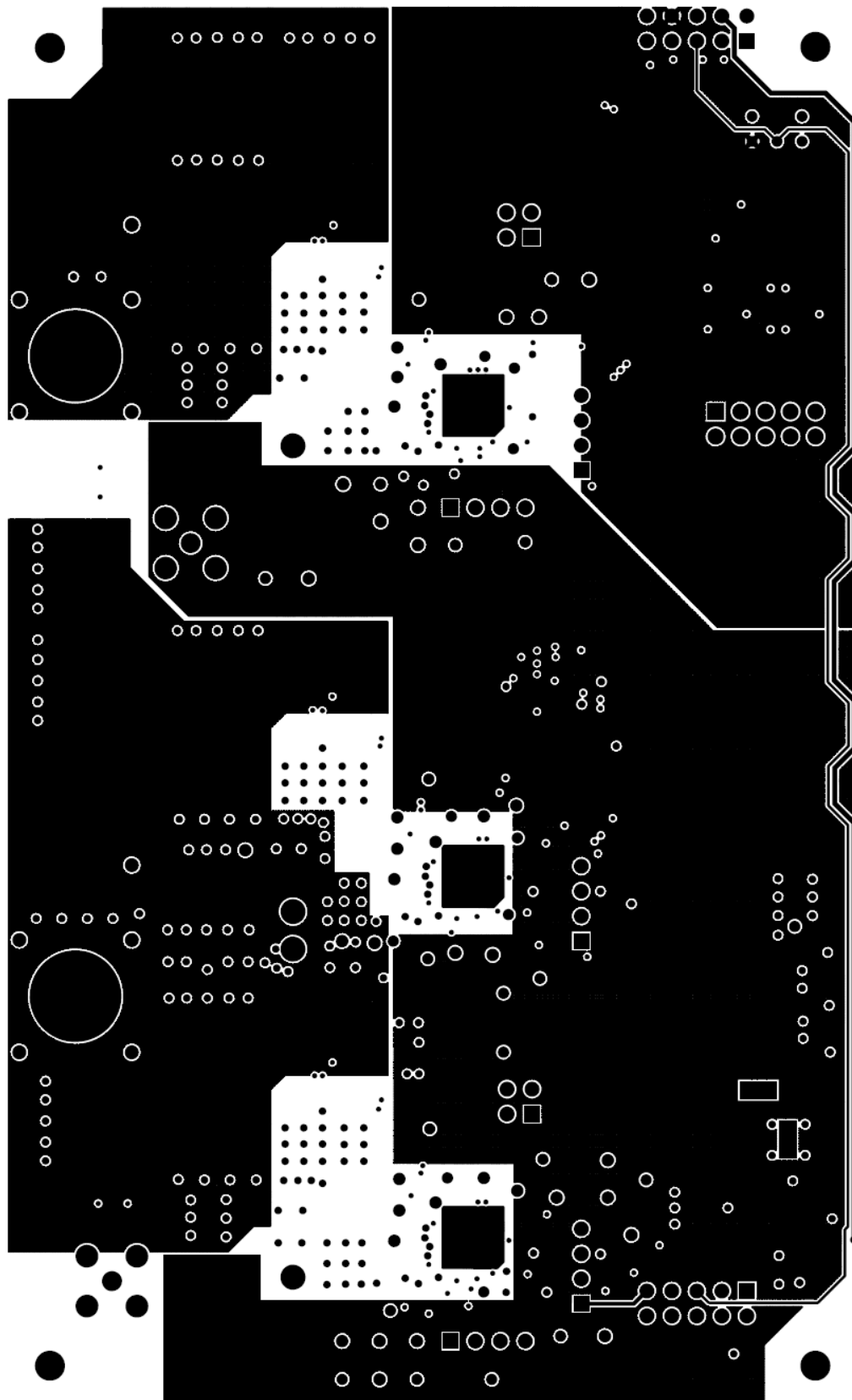


FIGURE 13. INNER LAYER 3 (VIEWED FROM TOP)

Board Layout – 6 Layers (Continued)

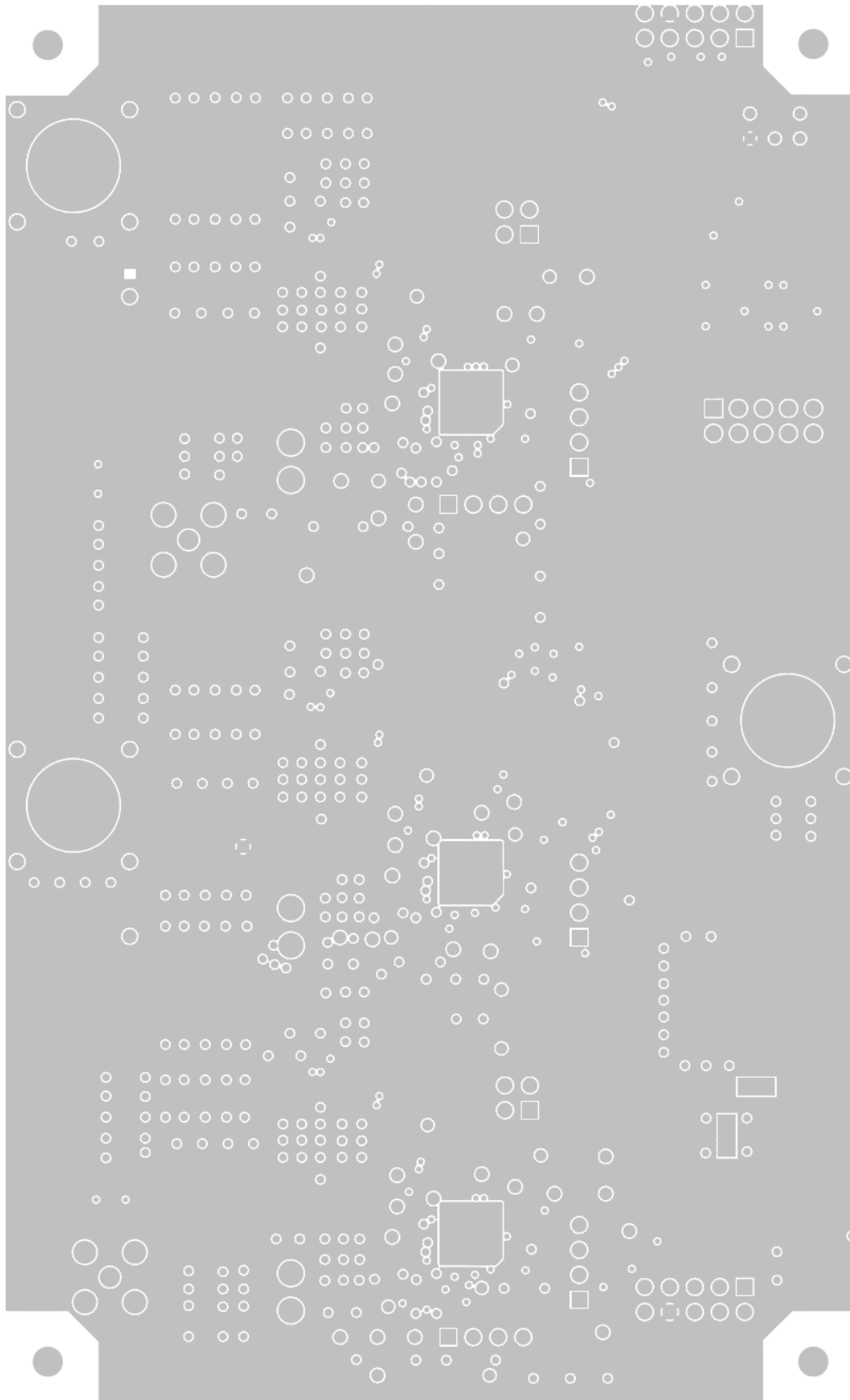


FIGURE 14. INNER LAYER 4 (VIEWED FROM TOP)



Board Layout – 6 Layers (Continued)

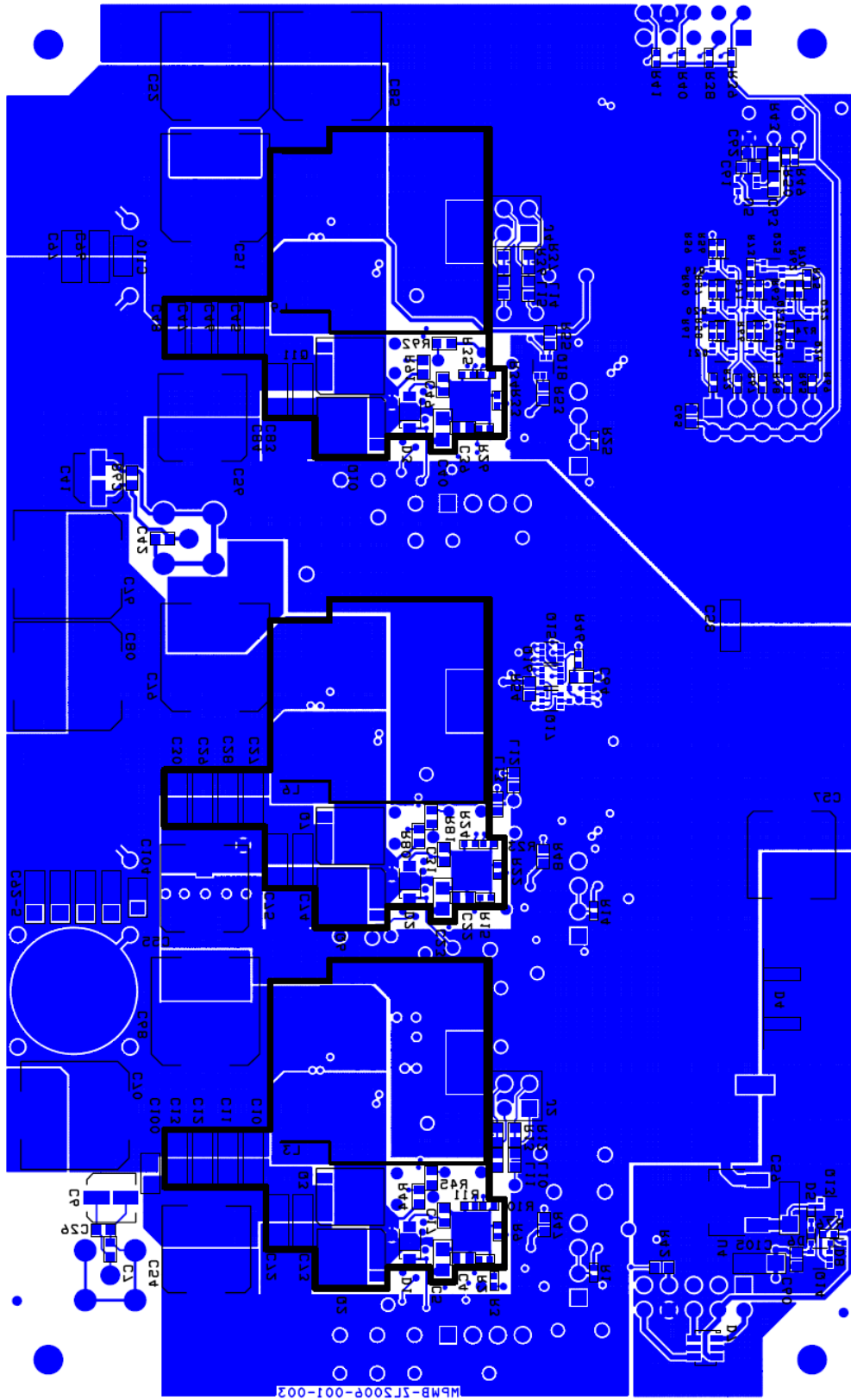
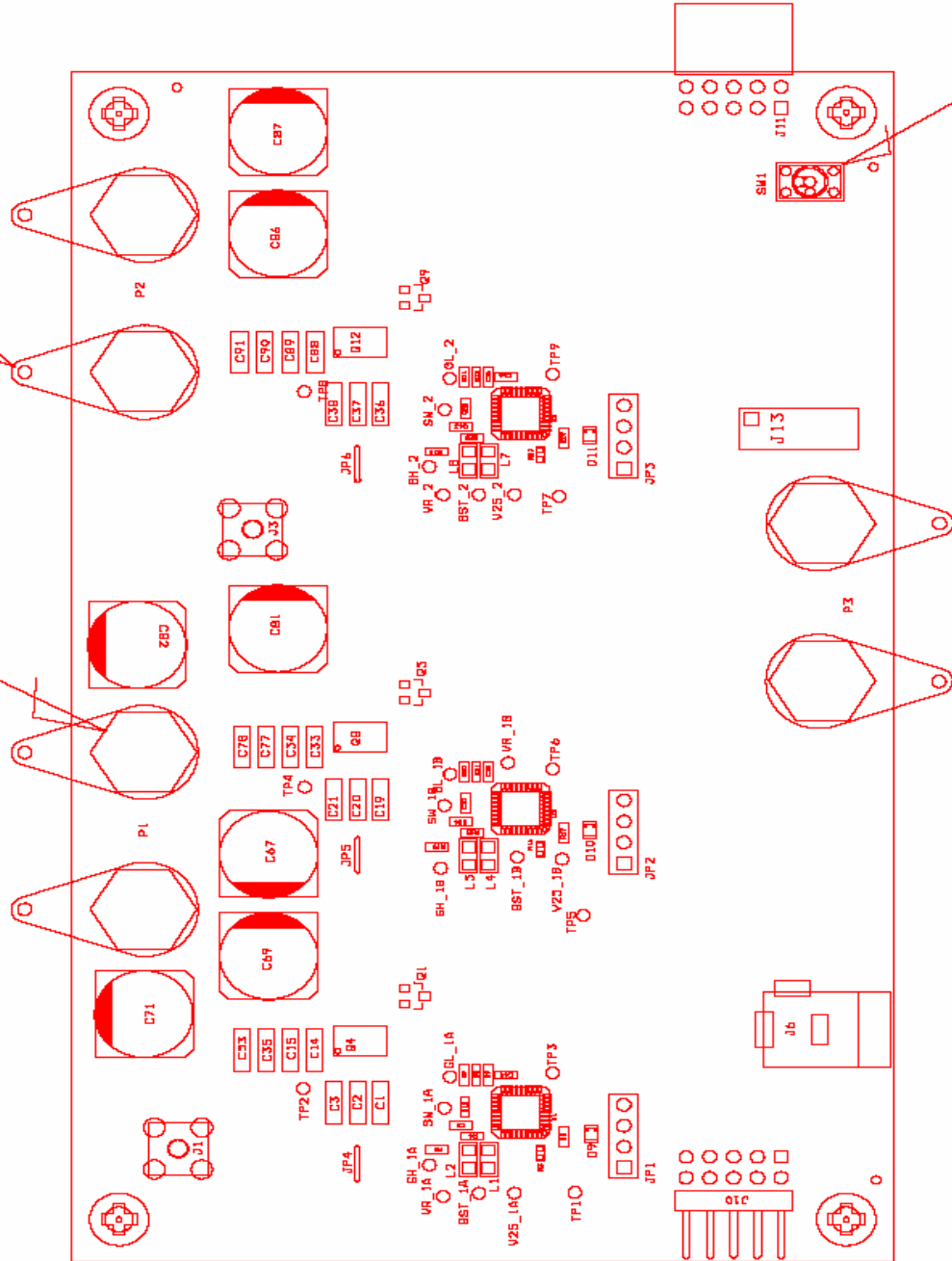


FIGURE 15. PCB – BOTTOM LAYER (VIEWED FROM TOP)

Board Layout – 6 Layers (Continued)

TORQUE BANANA JACKS TO 15+/-5 IN.-LB.  
WITH RING TAB STRAIGHT ON TOP SIDE.  
(6) PLACES.



DO NOT EXPOSE SW1 TO CLEANING PROCESS,  
IT'S NOT A SEALED SWITCH.  
ASSEMBLE LAST IF REQUIRED.

FIGURE 16. TOP ASSEMBLY DRAWING

Board Layout – 6 Layers (Continued)

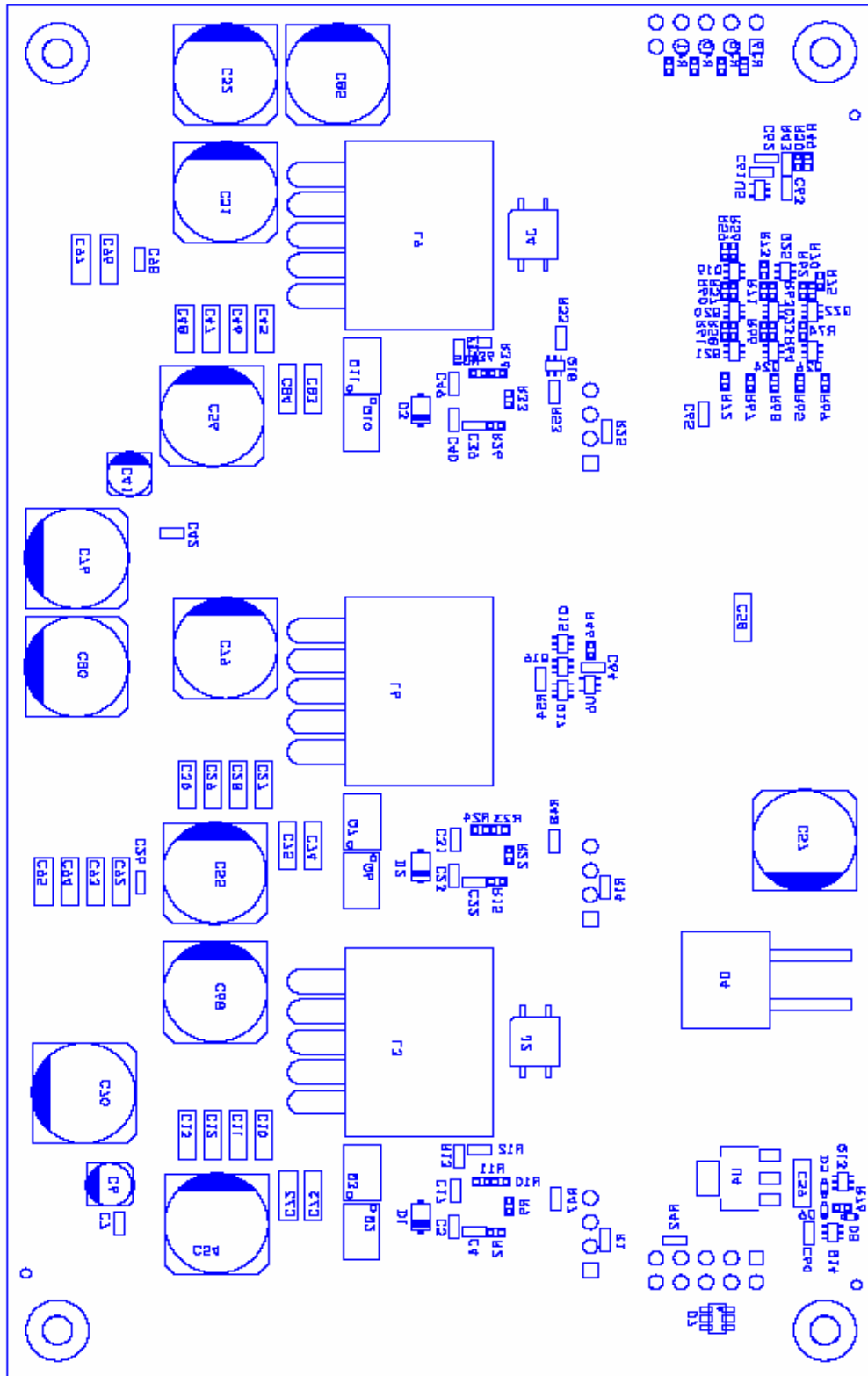


FIGURE 17. BOTTOM ASSEMBLY DRAWING

## Application Note 1507

### Bill of Materials

| PART NUMBER          | QTY | UNIT | REFERENCE DESIGNATOR                               | DESCRIPTION  | MFR NAME           | MFR PART           |
|----------------------|-----|------|--|--|--------------------|--------------------|
| H1045-00104-16V10-T  | 7   | ea   | C7, C42, C60, C61, C63, C64, C65                   | CAP, SMD, 0603, 0.1µF, 16V, 10%, X7R, ROHS                 | MURATA             | GRM39X7R104K016AD  |
| H1045-00105-25V10-T  | 7   | ea   | C8, C9, C16, C24, C25, C43, C62                    | CAP, SMD, 0603, 1µF, 25V, 10%, X5R, ROHS                   | MURATA             | GRM188R61E105KA12D |
| H1045-00106-6R3V20-T | 6   | ea   | C17, C18, C31, C32, C49, C50                       | CAP, SMD, 0603, 10µF, 6.3V, 20%, X5R, ROHS                 | TDK                | C1608X5R0J106M     |
| H1045-00225-16V10-T  | 2   | ea   | C26, C98   | CAP, SMD, 0603, 2.2µF, 16V, 10%, X5R, ROHS                 | MURATA             | GRM188R61C225KE15D |
| H1045-00475-6R3V10-T | 3   | ea   | C4, C22, C39                                       | CAP, SMD, 0603, 4.7µF, 6.3V, 10%, X5R, ROHS                | VENKEL             | C0603X5R6R3-475KNE |
| H1045-DNP            | 0   | ea   | C44, C66, C99                                      | CAP, SMD, 0603, DNP PLACE HOLDER, ROHS                     |                    |                    |
| H1046-00225-25V10-T  | 3   | ea   | C5, C23, C40                                       | CAP, SMD, 0805, 2.2µF, 25V, 10%, X5R, ROHS                 | PANASONIC          | ECJ-2FB1E225K      |
| H1065-00106-25V10-T  | 18  | ea   | a) C1, C2, C3, C19, C20, C21, C36, C37, C38, C58,  | CAP, SMD, 1206, 10µF, 25V, 10%, X5R, ROHS                  | VENKEL             | C1206X5R250-106KNE |
| H1065-00106-25V10-T  | 0   | ea   | b) C59, C72-C75, C83, C84, C105                    | CAP, SMD, 1206, 10µF, 25V, 10%, X5R, ROHS                  | VENKEL             | C1206X5R250-106KNE |
| H1065-00476-6R3V20-T | 30  | ea   | a) C10 to C15, C27 to C30, C33 to C35, C45 to C48, | CAP, SMD, 1206, 47µF, 6.3V, 20%, X5R, ROHS                 | MURATA             | GRM31CR60J476ME19L |
| H1065-00476-6R3V20-T | 0   | ea   | b) C53, C77, C78, C88 to C97                       | CAP, SMD, 1206, 47µF, 6.3V, 20%, X5R, ROHS                 | MURATA             | GRM31CR60J476ME19L |
| APXA160ARA331MJCOG   | 7   | ea   | C54, C55, C56, C57, C101, C102, C103               | CAP, SMD, 10x12, 330µF, 16V, 20%, 14mΩ, ALUM. ELEC., ROHS  | NIPPON CHEMI-CON   | APXA160ARA331MJCOG |
| APXA6R3ARA821MJCOG   | 9   | ea   | C51, C52, C68, C69, C70, C76, C79, C80, C85        | CAP, SMD, 10x12, 820µF, 6.3V, 20%, 10mΩ, ALUM. ELEC., ROHS | NIPPON CHEMI-CON   | APXA6R3ARA821MJCOG |
| EMVA250ADA100MD55G   | 2   | ea   | C6, C41  | CAP, SMD, 4x5.2, 10µF, 25V, 20%, ALUM. ELEC., ROHS         | NIPPON CHEMI-CON   | EMVA250ADA100MD55G |
| EMZA6R3ADA102MHA0G   | 3   | ea   | C67, C81, C86                                      | CAP, SMD, 8x10, 1000µF, 6.3V, 20%, ALUM. ELEC., ROHS       | NIPPON CHEMI-CON   | EMZA6R3ADA102MHA0G |
| EMZA6R3ADA102MHA0G   | 0   | ea   | DNP (C71, C82, C87)                                | CAP, SMD, 8x10, 1000µF, 6.3V, 20%, ALUM. ELEC., ROHS       | NIPPON CHEMI-CON   | EMZA6R3ADA102MHA0G |
| IHLP5050FDERR56M01   | 3   | ea   | L3, L6, L9   | COIL-PWR INDUCTOR, SMD, 13mm, 0.56µH, 20%, 37A, ROHS       | VISHAY             | IHLP5050FDERR56M01 |
| 108-0740-001         | 6   | ea   | P1, P2, P3 (2 EACH)                                | CONN-JACK, BANANA-SS-SDRLESS, VERTICAL, ROHS               | JOHNSON COMPONENTS | 108-0740-001       |
| 142-0701-201         | 0   | ea   | DNP (J1, J3)                                       | CONN-RF, SMA JACK, 50Ω, BMT, ST                            | JOHNSON COMPONENTS | 142-0701-201       |

## Application Note 1507

### Bill of Materials (Continued)

| PART NUMBER       | QTY | UNIT | REFERENCE DESIGNATOR                   | DESCRIPTION  | MFR NAME            | MFR PART          |
|-------------------|-----|------|--|--|---------------------|-------------------|
| 3-644456-4        | 3   | ea   | JP1, JP2, JP3                          | CONN-HEADER, 1x4, VERTICAL, TIN, WHT NYLON, ROHS             | AMP/TYCO            | 3-644456-4        |
| 881545-2          | 4   | ea   | a) JP1-Pins 3 and 4, JP2-Pins 3 and 4, | CONN-JUMPER, SHUNT LP W/HANDLE, 2P, 2.54mm, BLK, ROHS        | TYCO ELECTRONICS    | 881545-2          |
| 881545-2          | 0   | ea   | b) JP3-Pins 3 and 4, J13-Pins 1 and 2  | CONN-JUMPER, SHUNT LP W/HANDLE, 2P, 2.54mm, BLK, ROHS        | TYCO ELECTRONICS    | 881545-2          |
| PJ-002A           | 1   | ea   | J6                                     | CONN-POWER JACK, TH, 2.1mm, 16V@2.5A, BLK, R/A, ROHS         | CUI, INC            | PJ-002A           |
| SSQ-105-02-T-D-RA | 1   | ea   | J11                                    | CONN-SOCKET STRIP, TH, 2x5, 2.54mm, TIN, R/A, ROHS           | SAMTEC              | SSQ-105-02-T-D-RA |
| TSW-105-07-T-D    | 1   | ea   | J13                                    | CONN-HEADER, 2x5, BRKAWY, 2.54mm, TIN, ROHS                  | SAMTEC              | TSW-105-07-T-D    |
| TSW-105-08-T-D-RA | 1   | ea   | J10                                    | CONN-HEADER, 2X5, BRKAWY, 2.54mm, TIN, R/A, ROHS             | SAMTEC              | TSW-105-08-T-D-RA |
| BAT54XV2T1G-T     | 3   | ea   | D5, D6, D8                             | DIODE-SCHOTTKY, SMD, 2P, SOD523, 30V, 200mA, ROHS            | ON SEMICONDUCTOR    | BAT54XV2T1G       |
| MBR0540T1G-T      | 3   | ea   | D1, D2, D3                             | DIODE-RECTIFIER, SMD, SOD-123, 2P, 40V, 0.5A, ROHS           | ON SEMICONDUCTOR    | MBR0540T1G        |
| STPS20L45CG       | 1   | ea   | D4                                     | DIODE-RECTIFIER, SCHOTTKY, SMD, D2PAK, 45V, 10A, ROHS        | STMICRO ELECTRONICS | STPS20L45CG       |
| CMD17-21VGC/TR8-T | 3   | ea   | D9, D10, D11                           | LED, SMD, 0805, GREEN, CLEAR, 10mcd, 2.1V, 20mA, 570nm, ROHS | CHICAGO MINIATURE   | CMD17-21VGC/TR8   |
| BLM18BB750SN1-T   | 6   | ea   | L10, L11, L12, L13, L14, L15           | FERRITE CHIP, SMD, 0603,75Ω, 25%, 300mA, 0.7Ω, ROHS          | MURATA              | BLM18BB750SN1     |
| BLM21AG102SN1D-T  | 0   | ea   | DNP (L2, L5, L8)                       | FERRITE CHIP, SMD, 0805, 1000Ω, 200mA, 100MHZ, ROHS          | MURATA              | BLM21AG102SN1D    |
| BLM21AG102SN1D-T  | 3   | ea   | L1, L4, L7                             | FERRITE CHIP, SMD, 0805, 1000Ω, 200mA, 100MHZ, ROHS          | MURATA              | BLM21AG102SN1D    |
| ESDA6V1-4BC6      | 1   | ea   | D7                                     | DIODE-TVS, ESD, QUAD BI-DIRECTIONAL, 6P, SOT23-6L, 80W, ROHS | STMICRO ELECTRONICS | ESDA6V1-4BC6      |
| MIC2920A-3.3WS    | 1   | ea   | U4                                     | IC-LDO REGULATOR, 4P, SOT-223, 3.3V, 400mA, ROHS             | MICREL              | MIC2920A-3.3WS    |
| SN74AUP1G02DCKR   | 1   | ea   | U6                                     | IC-SINGLE 2-INPUT POSITIVE-NOR GATE, SMD, 5P, SC70-5, ROHS   | TEXAS INSTRUMENTS   | SN74AUP1G02DCKR   |

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### Bill of Materials (Continued)

| PART NUMBER          | QTY | UNIT | REFERENCE DESIGNATOR                           | DESCRIPTION  | MFR NAME            | MFR PART          |
|----------------------|-----|------|--|--|---------------------|-------------------|
| SN74AUP1G17DCKR      | 1   | ea   | U5   | IC-BUFFER, SCHMITT TRIGGER, 5P, SC-70-5, 3.6V, 4mA, ROHS     | TEXAS INSTRUMENTS   | SN74AUP1G17DCKR   |
| ZL6100ALNFT          | 3   | ea   | U1, U2, U3                                     | IC-DIGITAL DC-DC CONTROLLER, 36P, QFN, 6x6, ROHS             | INTERSIL            | ZL6100ALNFT       |
| BSC016N03LSG         | 6   | ea   | Q3, Q4, Q7, Q8, Q11, Q12                       | TRANSIST-MOS, N-CHANNEL, 8P, PG-TDSON-8, 30V, 100A, ROHS     | INFINEON TECHNOLOGY | BSC016N03LSG      |
| BSC030N03LS G        | 3   | ea   | Q2, Q6, Q10                                    | TRANSISTOR-MOS, N-CHANNEL, 8P, PG-TDSON-8, 30V, 100A, ROHS   | INFINEON TECHNOLOGY | BSC030N03LS G     |
| FDG6301N-T           | 13  | ea   | Q13, Q15 to Q26                                | TRANSIST-MOS, DUAL N-CHANNEL, SMD, SC70-6, 25V, 220mA, ROHS  | FAIRCHILD           | FDG6301N          |
| FDG6304P             | 1   | ea   | Q14  | TRANSIST-MOS, DUAL P-CHANNEL, 6P, SC70-6, -25V, -0.41A, ROHS | FAIRCHILD           | FDG6304P          |
| MMBT3904LT1G-T       | 3   | ea   | Q1, Q5, Q9                                     | TRANSISTOR, NPN, SOT-23, 3P, 40V, 0.2A.0.35W, ROHS           | ON SEMICONDUCTOR    | MMBT3904LT1G-T    |
| H2510-00R00-1/16W-T  | 15  | ea   | R5, R17, R29, R52, R77, R78, R79, R83 to R90   | RES, SMD, 0402, 0Ω, 1/16W, 5%, TF, ROHS                      | VENKEL              | CR0402-16W-00T    |
| H2510-01002-1/16W1-T | 15  | ea   | a) R3, R16, R27, R39, R40, R41, R46, R49, R50, | RES, SMD, 0402, 10k, 1/16W, 1%, TF, ROHS                     | PANASONIC           | ERJ-2RKF1002X     |
| H2510-01002-1/16W1-T | 0   | ea   | b) R65, R67, R68, R69, R72, R76                | RES, SMD, 0402, 10k, 1/16W, 1%, TF, ROHS                     | PANASONIC           | ERJ-2RKF1002X     |
| H2510-01003-1/16W1-T | 3   | ea   | R1, R14, R25                                   | RES, SMD, 0402, 100k, 1/16W, 1%, TF, ROHS                    | PANASONIC           | ERJ2RKF1003       |
| H2510-01102-1/16W1-T | 3   | ea   | R9, R22, R33                                   | RES, SMD, 0402, 11k, 1/16W, 1%, TF, ROHS                     | PANASONIC           | ERJ-2RKF1102V     |
| H2510-01622-1/16W1-T | 3   | ea   | R10, R23, R34                                  | RES, SMD, 0402, 16.2k, 1/16W, 1%, TF, ROHS                   | PANASONIC           | ERJ-2RKF1622      |
| H2510-01962-1/16W1-T | 1   | ea   | R56  | RES, SMD, 0402, 19.6k, 1/16W, 1%, TF, ROHS                   | PANASONIC           | ERJ-2RKF1962      |
| H2510-02152-1/16W1-T | 1   | ea   | R57  | RES, SMD, 0402, 21.5k, 1/16W, 1%, TF, ROHS                   | PANASONIC           | ERJ-2RKF2152X     |
| H2510-02372-1/16W1-T | 1   | ea   | R58  | RES, SMD, 0402, 23.7k, 1/16W, 1%, TF, ROHS                   | PANASONIC           | ERJ-2RKF2372V     |
| H2510-02612-1/16W1-T | 1   | ea   | R59  | RES, SMD, 0402, 26.1k, 1/16W, 1%, TF, ROHS                   | VENKEL              | CR0402-16W-2612FT |
| H2510-02701-1/16W1-T | 1   | ea   | R38  | RES, SMD, 0402, 2.7k, 1/16W, 1%, TF, ROHS                    | VENKEL              | CR0402-16W-2701FT |
| H2510-02872-1/16W1-T | 1   | ea   | R60  | RES, SMD, 0402, 28.7k, 1/16W, 1%, TF, ROHS                   | PANASONIC           | ERJ-2RKF2872X     |



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### Bill of Materials (Continued)

| PART NUMBER          | QTY | UNIT | REFERENCE DESIGNATOR                             | DESCRIPTION   | MFR NAME  | MFR PART          |
|----------------------|-----|------|--|---|-----------|-------------------|
| H2510-03162-1/16W1-T | 1   | ea   | R61  | RES, SMD, 0402, 31.6k, 1/16W, 1%, TF, ROHS                | VENKEL    | CR0402-16W-3162FT |
| H2510-03482-1/16W1-T | 4   | ea   | R11, R24, R35, R62                               | RES, SMD, 0402, 34.8k, 1/16W, 1%, TF, ROHS                | PANASONIC | ERJ-2RKF3482      |
| H2510-03832-1/16W1-T | 1   | ea   | R63  | RES, SMD, 0402, 38.3k, 1/16W, 1%, TF, ROHS                | PANASONIC | ERJ-2RKF3832      |
| H2510-04222-1/16W1-T | 1   | ea   | R64  | RES, SMD, 0402, 42.2k, 1/16W, 1%, TF, ROHS                | PANASONIC | ERJ-2RKF4222X     |
| H2510-04642-1/16W1-T | 1   | ea   | R70  | RES, SMD, 0402, 46.4k, 1/16W, 1%, TF, ROHS                | PANASONIC | ERJ2RKF4642       |
| H2510-05112-1/16W1-T | 1   | ea   | R71  | RES, SMD, 0402, 51.1k, 1/16W, 1%, TF, ROHS                | PANASONIC | ERJ-2RKF5112X     |
| H2510-05622-1/16W1-T | 1   | ea   | R66  | RES, SMD, 0402, 56.2k, 1/16W, 1%, TF, ROHS                | PANASONIC | ERJ-2RKF5622      |
| H2510-06192-1/16W1-T | 1   | ea   | R75  | RES, SMD, 0402, 61.9k, 1/16W, 1%, TF, ROHS                | VENKEL    | CR0402-16W-6192FT |
| H2510-06812-1/16W1-T | 1   | ea   | R73  | RES, SMD, 0402, 68.1k, 1/16W, 1%, TF, ROHS                | VENKEL    | CR0402-16W-6812FT |
| H2510-07502-1/16W1-T | 1   | ea   | R74  | RES, SMD, 0402, 75k, 1/16W, 1%, TF, ROHS                  | VENKEL    | CR0402-16W-7502FT |
| H2510-DNP            | 0   | ea   | R2, R15, R26                                     | RES, SMD, 0402, DNP, DNP, DNP, TF, ROHS                   |           |                   |
| H2511-00010-1/10W1-T | 2   | ea   | R4, R18  | RES, SMD, 0603, 1Ω, 1/10W, 1%, TF, ROHS                   | PANASONIC | ERJ-3RQF1R0V      |
| H2511-00R00-1/10W-T  | 7   | ea   | R6, R19, R28, R30, R51, R82, R93                 | RES, SMD, 0603, 0Ω, 1/10W, TF, ROHS                       | VENKEL    | CR0603-10W-000T   |
| H2511-01871-1/10W1-T | 3   | ea   | R8, R21, R32                                     | RES, SMD, 0603, 1.87k, 1/10W, 1%, TF, ROHS                | VENKEL    | CR0603-10W-1871FT |
| H2511-03650-1/10W1-T | 3   | ea   | R7, R20, R31                                     | RES, SMD, 0603, 365Ω, 1/10W, 1%, TF, ROHS                 | VENKEL    | CR0603-10W-3650FT |
| H2511-03920-1/10W1-T | 5   | ea   | R47, R48, R53, R54,                              | RES, SMD, 0603, 392Ω, 1/10W, 1%, TF, ROHS                 | PANASONIC | ERJ-3EKF3920V     |
| H2511-049R9-1/10W1-T | 2   | ea   | R42, R43   | RES, SMD, 0603, 49.9Ω, 1/10W, 1%, TF, ROHS                | VENKEL    | CR0603-10W-49R9FT |
| H2511-DNP            | 0   | ea   | R12, R13, R36, R37, R44, R45, R80, R81, R91, R92 | RES, SMD, 0603, DNP-PLACE HOLDER, ROHS                    |           |                   |
| G13AP-RO             | 1   | ea   | SW1  | SWITCH-TOGGLE, THRU-HOLE, 5P, SPDT, 3POS, ON-OFF-ON, ROHS | NKK       | G13AP-RO          |
| 4-40X1/4-SCREW-SS    | 4   | ea   | Four corners                                     | SCREW, 4-40x1/4in, PHILLIPS, PAN, STAINLESS STEEL, ROHS   | KEYSTONE  | 9900              |
| DNP                  | 0   | ea   | C100, C104, C110                                 | DO NOT POPULATE OR PURCHASE                               |           |                   |
| DNP                  | 0   | ea   | D12, D13, D14                                    | DO NOT POPULATE OR PURCHASE                               |           |                   |

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### Bill of Materials (Continued)

| PART NUMBER         | QTY | UNIT | REFERENCE DESIGNATOR                       | DESCRIPTION   | MFR NAME | MFR PART          |
|---------------------|-----|------|--|---|----------|-------------------|
| DNP                 | 0   | ea   | J2, J4                                     | DO NOT POPULATE OR PURCHASE                           |          |                   |
| DNP                 | 0   | ea   | JP4, JP5, JP6, JP7, JP8                    | DO NOT POPULATE OR PURCHASE                           |          |                   |
| DNP                 | 0   | ea   | a) TP1-TP10, TP12-TP40, TP42, TP43, TP46,  | DO NOT POPULATE OR PURCHASE                           |          |                   |
| DNP                 | 0   | ea   | b) TP48 to TP56, TP58 to TP65, TP67, TP68, | DO NOT POPULATE OR PURCHASE                           |          |                   |
| DNP                 | 0   | ea   | c) TP70 to TP75                            | DO NOT POPULATE OR PURCHASE                           |          |                   |
| VC-234-8            | 6   | ea   | P1, P2, P3 (COVER BOTTOMS OF POSTS)        | CAPLUG-ROUND VINYL CLOSURE, FLEXIBLE, 0.5x0.234, ROHS | CAPLUGS  | VC-234-8          |
| H1045-00104-16V10-T | 7   | ea   | C7, C42, C60, C61, C63, C64, C65           | CAP, SMD, 0603, 0.1 $\mu$ F, 16V, 10%, X7R, ROHS      | MURATA   | GRM39X7R104K016AD |

## Default Configuration Text

The following text is loaded into the ZL6100 devices on the EV2 as default settings. Each PMBus command is loaded via the PowerNavigator software. The # symbol is used for a comment line.

```
# Configuration file for ZL6100EVAL2Z-Ch1A
#Erase default and user stores
RESTORE_FACTORY
STORE_USER_ALL
STORE_DEFAULT_ALL
RESTORE_DEFAULT_ALL
```

```
MFR_ID           Zilker_Labs
MFR_MODEL        ZL6100EVAL2ZR2
MFR_REVISION     Cfg Rev 1.1
MFR_LOCATION     Austin_TX
MFR_DATE         08_27_09
MFR_SERIAL       ch1A
```

```
VOUT_COMMAND     1.80
VOUT_DROOP       0.5
VOUT_UV_Fault_LIMIT 1.53
VOUT_UV_FAULT_RESPONSE 0x80
VOUT_OV_Fault_LIMIT 2.07
VOUT_OV_FAULT_RESPONSE 0x80
OVUV_CONFIG      0x80
```

```
IOUT_SCALE       1.13
IOUT_CAL_OFFSET  1.00
```

```
IOUT_OC_FAULT_LIMIT 45.0
IOUT_AVG_OC_FAULT_LIMIT 40.0
IOUT_UC_FAULT_LIMIT -40.0
IOUT_AVG_UC_FAULT_LIMIT -40.0
MFR_IOUT_OC_FAULT_RESPONSE 0xBF
MFR_IOUT_UC_FAULT_RESPONSE 0xBF
```

```
VIN_OV_FAULT_LIMIT 14.0
VIN_OV_WARN_LIMIT  13.5
VIN_OV_FAULT_RESPONSE 0x80
```

```
VIN_UV_WARN_LIMIT  4.641
VIN_UV_FAULT_LIMIT  4.50
VIN_UV_FAULT_RESPONSE 0x80
```

```
OT_FAULT_RESPONSE 0xBF
UT_FAULT_RESPONSE 0xBF
```

```
POWER_GOOD_ON     1.35
POWER_GOOD_DELAY   10.0
```

```
TON_DELAY         15
TON_RISE           5
TOFF_DELAY        15
TOFF_FALL         5
```

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```
DEADTIME                0x3838
DEADTIME_CONFIG         0x0606
MAX_DUTY                96
INDUCTOR                0.56

FREQUENCY_SWITCH        300 # kHz

#CompZL Taps for G=36,   Q=0.25,   f=3.5kHz,   fsw=300kHz, Vi=12, Vo=1.8
PID_TAPS    A=13553.75, B=-23599.50, C=10109.25 # dIo=30-45A @ 2.5A/us, dVo=+/-3%

# Advanced
USER_CONFIG              0x6050 # SYNC Input
MFR_CONFIG               0x82D4
INTERLEAVE               0x0000
TEMPCO_CONFIG            0xA4
TRACK_CONFIG             0x00

# Advanced 2
MISC_CONFIG              0x4080
ISHARE_CONFIG            0x0121 # Ishare Group 1, members 2, position 1, CS En
DDC_CONFIG               0x0101 # DDC Rail ID 1, Broadcast Group 1
DDC_GROUP                0x00000000

STORE_DEFAULT_ALL
RESTORE_DEFAULT_ALL

-----
# Configuration file for ZL6100EVAL2Z-Ch1B

#Erase default and user stores
RESTORE_FACTORY
STORE_DEFAULT_ALL
STORE_USER_ALL
RESTORE_DEFAULT_ALL

MFR_ID                   Zilker_Labs
MFR_MODEL                 ZL6100EVAL2ZR2
MFR_REVISION              Cfg Rev 1.1
MFR_LOCATION              Austin_TX
MFR_DATE                  08_27_09
MFR_SERIAL                ch1B

VOUT_COMMAND              1.80
VOUT_DROOP                0.5
VOUT_UV_Fault_LIMIT      1.53
VOUT_UV_FAULT_RESPONSE   0x80
VOUT_OV_Fault_LIMIT      2.07
VOUT_OV_FAULT_RESPONSE   0x80
OVUV_CONFIG              0x80

IOUT_SCALE                1.13
IOUT_CAL_OFFSET           1.00

IOUT_OC_FAULT_LIMIT       45.0
IOUT_AVG_OC_FAULT_LIMIT  40.0
IOUT_UC_FAULT_LIMIT       -40.0
```

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IOUT\_AVG\_UC\_FAULT\_LIMIT -40.0  
MFR\_IOUT\_OC\_FAULT\_RESPONSE 0xBF  
MFR\_IOUT\_UC\_FAULT\_RESPONSE 0xBF

VIN\_OV\_FAULT\_LIMIT 14.0  
VIN\_OV\_WARN\_LIMIT 13.5  
VIN\_OV\_FAULT\_RESPONSE 0x80

VIN\_UV\_WARN\_LIMIT 4.641  
VIN\_UV\_FAULT\_LIMIT 4.50  
VIN\_UV\_FAULT\_RESPONSE 0x80

OT\_FAULT\_RESPONSE 0xBF  
UT\_FAULT\_RESPONSE 0xBF

POWER\_GOOD\_ON 1.35  
POWER\_GOOD\_DELAY 10.0

TON\_DELAY 5  
TON\_RISE 5  
TOFF\_DELAY 5  
TOFF\_FALL 5  
DEADTIME 0x3838  
DEADTIME\_CONFIG 0x0606  
MAX\_DUTY 96  
INDUCTOR 0.56

FREQUENCY\_SWITCH 300 # kHz

#CompZL Taps for G=36, Q=0.25, f=3.5kHz, fsw=300kHz, Vi=12, Vo=1.8  
PID\_TAPS A=13553.75, B=-23599.50, C=10109.25 # dIo=30-45A @ 2.5A/us, dVo=+/-3%

# Advanced  
USER\_CONFIG 0x6050 # SYNC INPUT  
MFR\_CONFIG 0x82D4  
INTERLEAVE 0x0000  
TEMPCO\_CONFIG 0xA4  
TRACK\_CONFIG 0x00

# Advanced 2  
MISC\_CONFIG 0x4080  
ISHARE\_CONFIG 0x0125 # Ishare Group 1, members 2, position 2, CS En  
DDC\_CONFIG 0x0101 # DDC Rail ID 1, Broadcast Group 1  
DDC\_GROUP 0x00000000  
STORE\_DEFAULT\_ALL  
RESTORE\_DEFAULT\_ALL

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-----  
# Configuration file for ZL6100EVAL2Z-Ch2

#Erase default and user stores

RESTORE\_FACTORY  
STORE\_DEFAULT\_ALL  
STORE\_USER\_ALL  
RESTORE\_DEFAULT\_ALL

MFR\_ID                   Zilker\_Labs  
MFR\_MODEL                ZL6100EVAL2ZR2  
MFR\_REVISION             Cfg Rev 1.1  
MFR\_LOCATION             Austin\_TX  
MFR\_DATE                 08\_27\_09  
MFR\_SERIAL               ch2

VOUT\_COMMAND            1.50  
VOUT\_DROOP               0.0  
VOUT\_UV\_Fault\_LIMIT     1.275  
VOUT\_UV\_FAULT\_RESPONSE   0x80  
VOUT\_OV\_Fault\_LIMIT     1.80  
VOUT\_OV\_FAULT\_RESPONSE   0x80  
OVUV\_CONFIG             0x80

IOUT\_SCALE              1.16  
IOUT\_CAL\_OFFSET         -0.25

IOUT\_OC\_FAULT\_LIMIT     45.0  
IOUT\_AVG\_OC\_FAULT\_LIMIT  38.0  
IOUT\_UC\_FAULT\_LIMIT     -15.0  
IOUT\_AVG\_UC\_FAULT\_LIMIT  -12.0  
MFR\_IOUT\_OC\_FAULT\_RESPONSE 0xBF  
MFR\_IOUT\_UC\_FAULT\_RESPONSE 0xBF

VIN\_OV\_FAULT\_LIMIT     14.0  
VIN\_OV\_WARN\_LIMIT       13.5  
VIN\_OV\_FAULT\_RESPONSE   0x80

VIN\_UV\_WARN\_LIMIT       4.641  
VIN\_UV\_FAULT\_LIMIT      4.50  
VIN\_UV\_FAULT\_RESPONSE   0x80

OT\_FAULT\_RESPONSE       0xBF  
UT\_FAULT\_RESPONSE       0xBF

POWER\_GOOD\_ON           1.35  
POWER\_GOOD\_DELAY        10

TON\_DELAY               20  
TON\_RISE                 5  
TOFF\_DELAY               20  
TOFF\_FALL                5  
DEADTIME                 0x3838  
DEADTIME\_CONFIG         0x0606  
MAX\_DUTY                 96  
INDUCTOR                 0.56

FREQUENCY\_SWITCH        300 # kHz

# CompZL Taps for G=37,    Q=0.25,        f=3.5kHz,        fsw=300kHz, Vi=12,    Vo=1.5  
PID\_TAPS        A=15207.50, B=-26479.50, C=11342.75    # dIo=15-22.5A @ 2.5A/us, dVo=+/-3%



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```
# Advanced
USER_CONFIG          0x0030 # SYNC Output
MFR_CONFIG           0x82D5
INTERLEAVE           0x0140
TEMPCO_CONFIG        0xA8
TRACK_CONFIG         0x00

# Advanced 2
MISC_CONFIG          0x0080
ISHARE_CONFIG        0x0200 # Ishare Group 2, members 1, position 1, CS disabled
DDC_CONFIG           0x0202 # DDC Rail ID 2, Broadcast Group 2
DDC_GROUP            0x00000000
STORE_DEFAULT_ALL
RESTORE_DEFAULT_ALL
```

## Measured Data

The following data was acquired using a ZL6100EVAL2Z rev 3 evaluation board.

### Efficiency

The measured input power includes the quiescent current for all three controllers on the evaluation board and is included in the efficiency measurement for the separate channels. Adaptive diode emulation and adaptive frequency modes are disabled for these efficiency measurements.

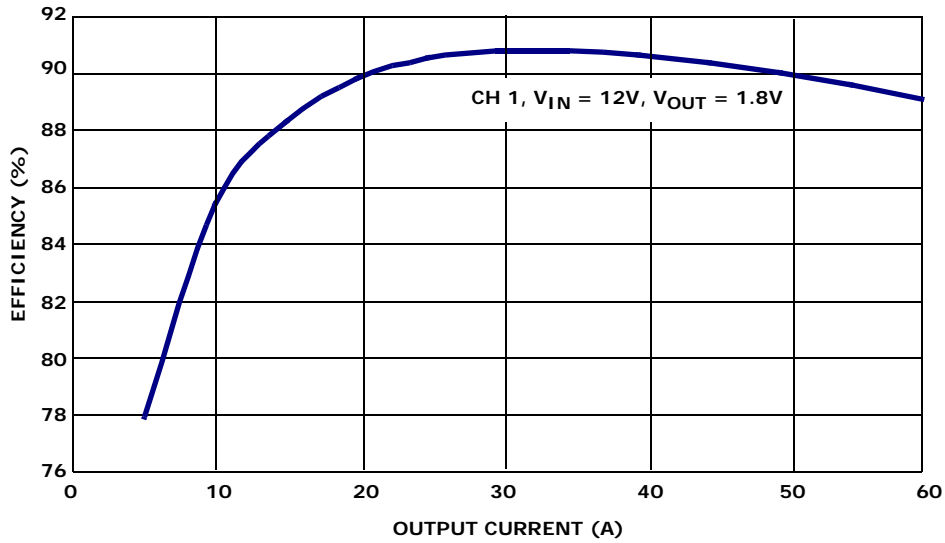


FIGURE 18. CHANNEL 1 EFFICIENCY

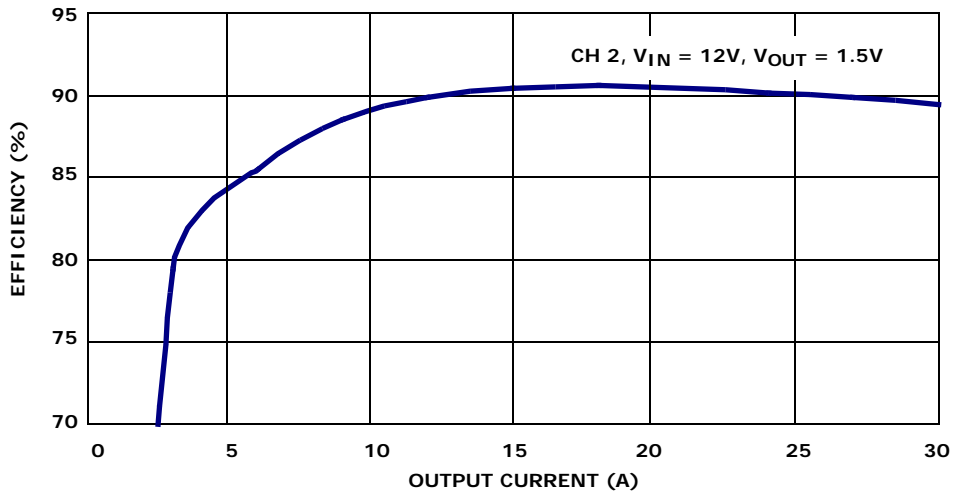


FIGURE 19. CHANNEL 2 EFFICIENCY

## Ramp-up/Ramp-down Characteristics

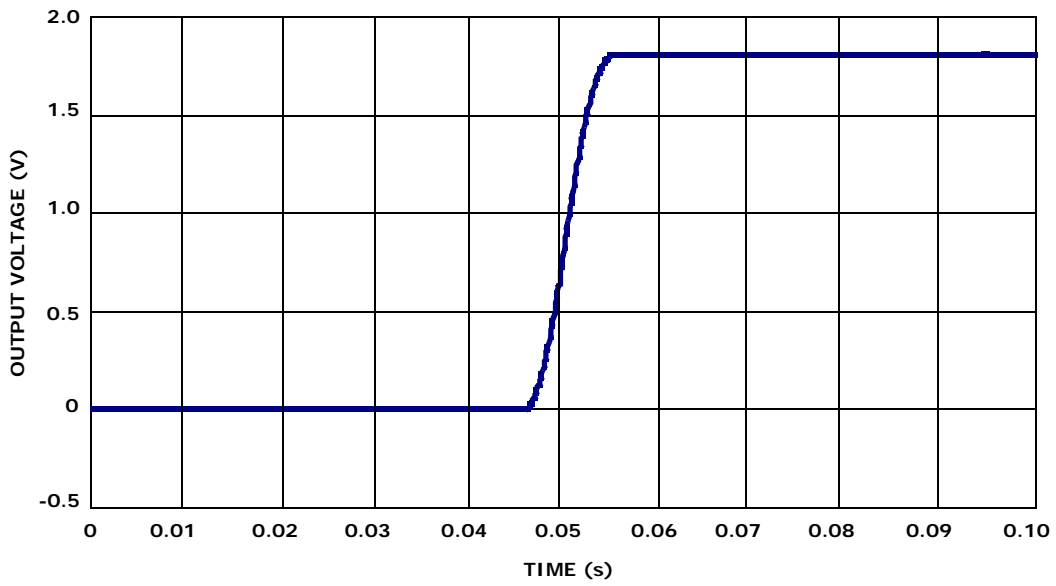


FIGURE 20. CHANNEL 1 RAMP UP

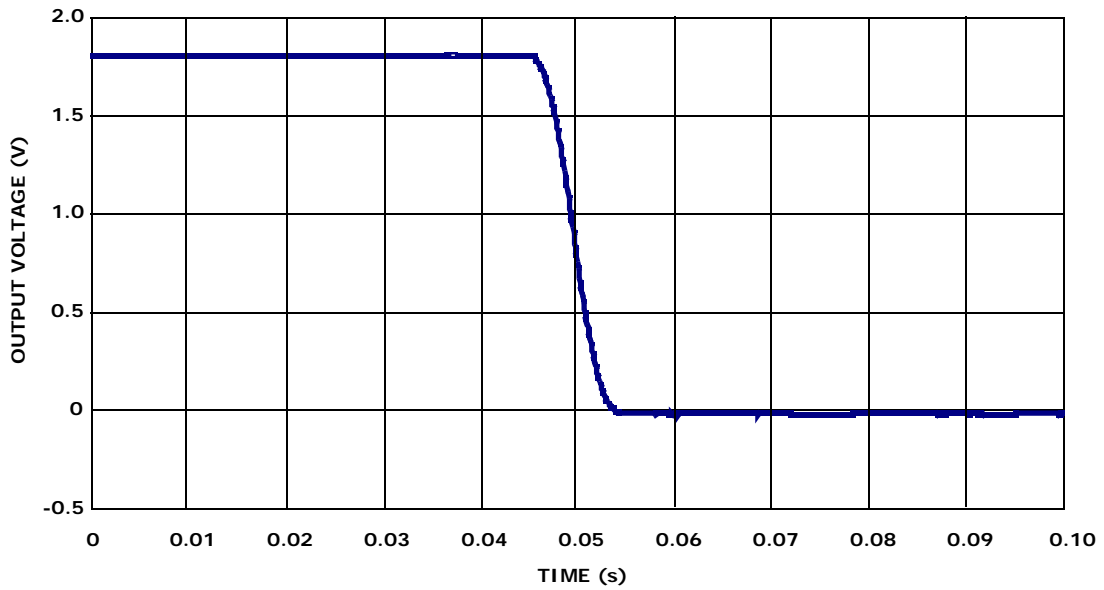


FIGURE 21. CHANNEL 1 RAMP DOWN

## Ramp-up/Ramp-down Characteristics (Continued)

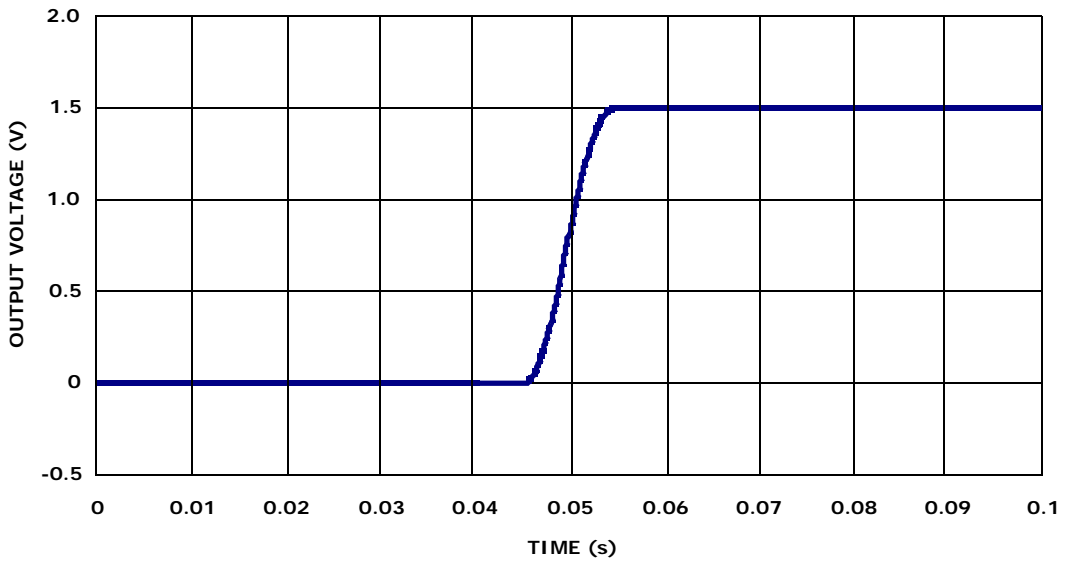


FIGURE 22. CHANNEL 2 RAMP UP

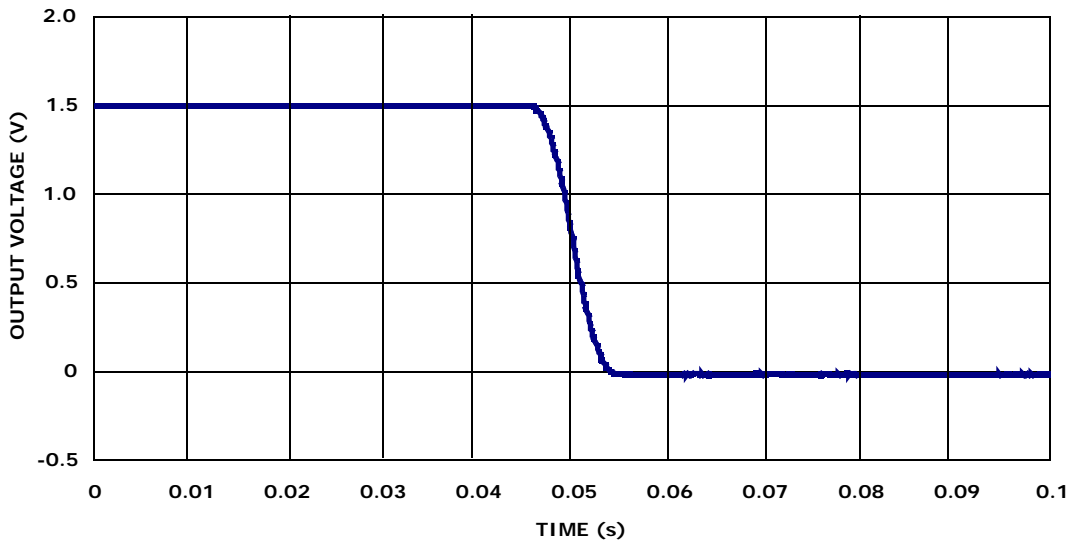


FIGURE 23. CHANNEL 2 RAMP DOWN

## Dynamic Load Response

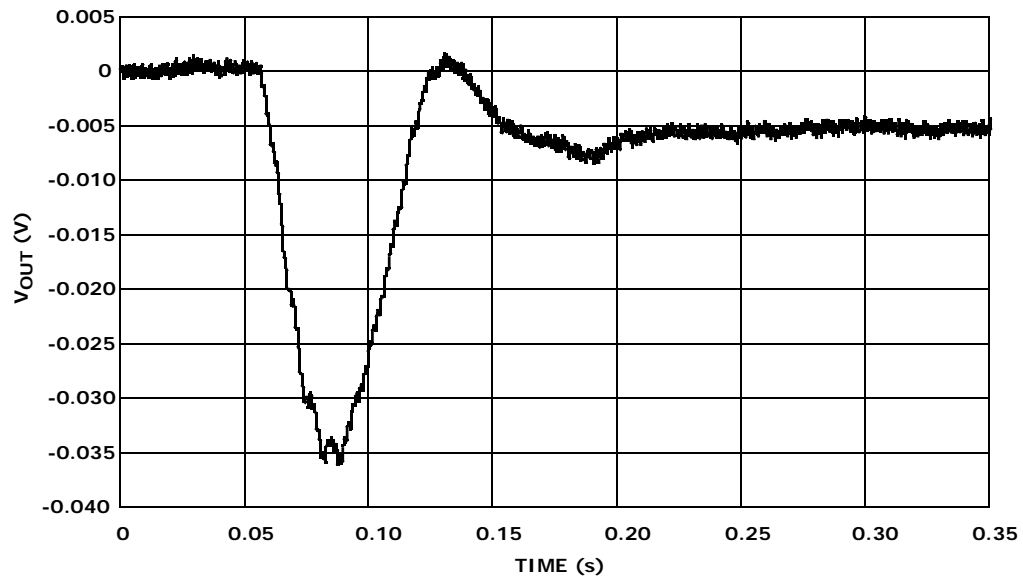


FIGURE 24. CHANNEL 1 DYNAMIC RESPONSE, 30A TO 42A LOAD STEP

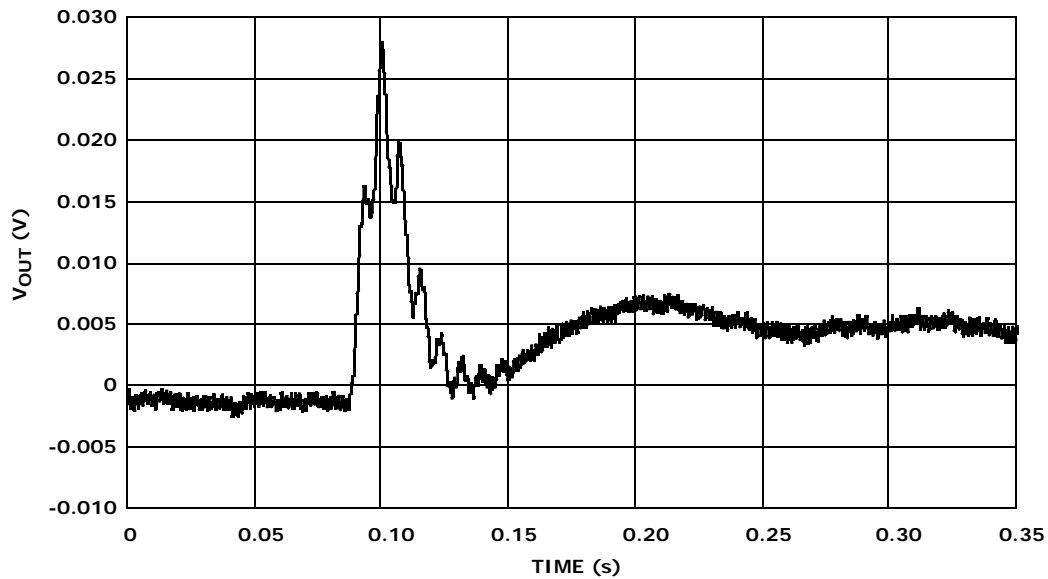


FIGURE 25. CHANNEL 1 DYNAMIC RESPONSE, 42A TO 30A LOAD STEP

## Dynamic Load Response (Continued)

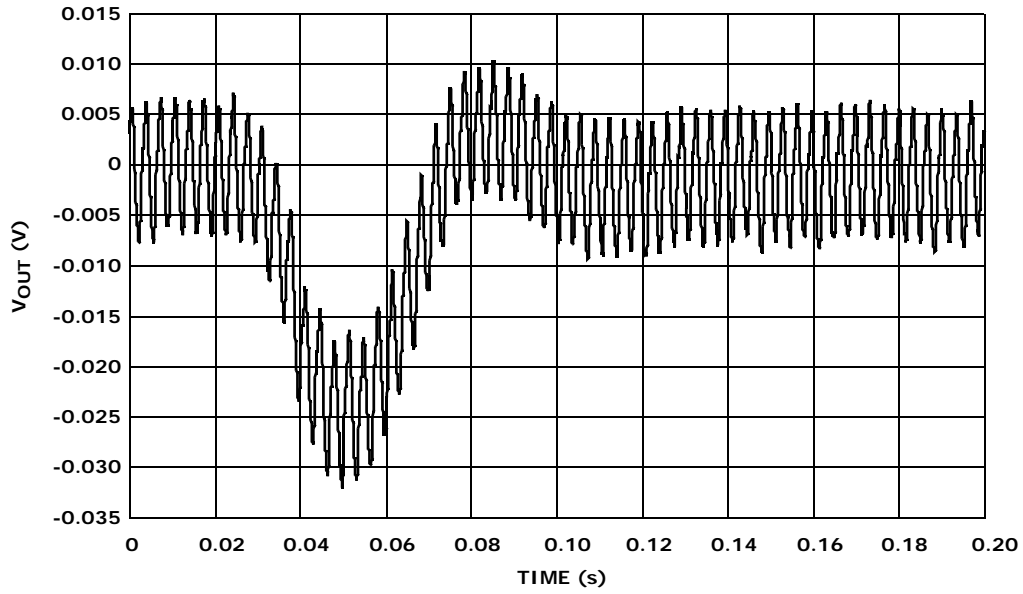


FIGURE 26. CHANNEL 2 DYNAMIC RESPONSE, 21A TO 15A LOAD STEP

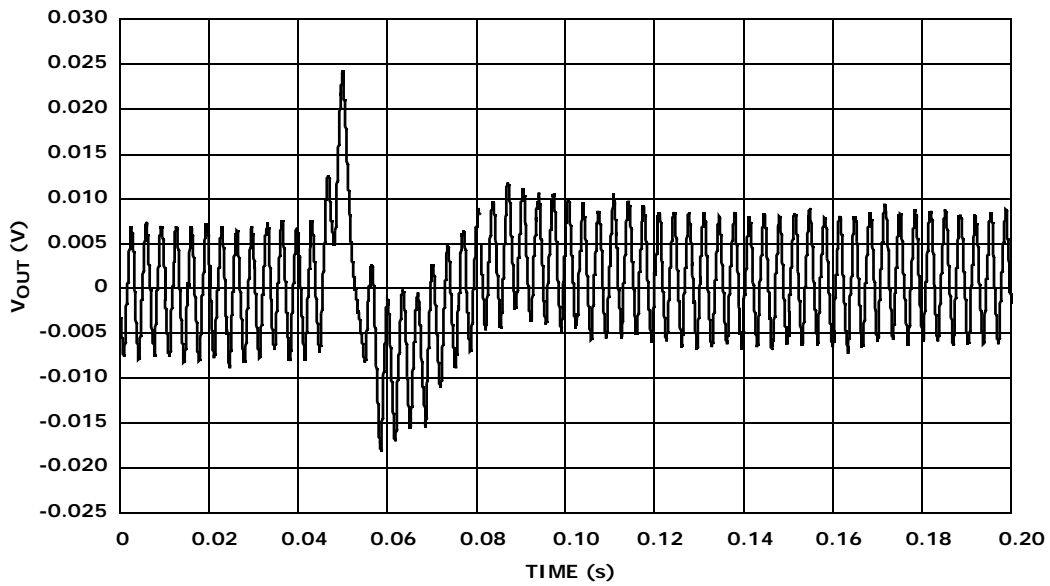


FIGURE 27. CHANNEL 2 DYNAMIC RESPONSE, 15A TO 21A LOAD STEP



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| ORDERABLE<br>PART NUMBER | DESCRIPTION   |
|--------------------------|---|
| ZL6100EVAL2Z             | ZL6100 Two Channel Evaluation Kit (EVB, USB Adapter, Cable, Software) |

### References

12. *ZL6100 Data Sheet*, Intersil Corporation, 2009.
13. AN2033 – *PMBus™ Command Set*, Intersil Corporation, 2009.

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*Intersil Corporation reserves the right to make changes in circuit design, software and/or specifications at any time without notice. Accordingly, the reader is cautioned to verify that the Application Note or Technical Brief is current before proceeding.*

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