ZL9006MEVAL1Z, ZL9010MEVAL1Z

6A and 10A Evaluation Board Setup Procedure

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The ZL9006M, ZL9010M is a variable output, step-down PMBus-compliant digital power supply. Included in the module is a high-performance digital PWM controller, power MOSFETs, an inductor, and all the passive components required for a highly integrated DC/DC power solution. This power module has built-in auto-compensation algorithms, which eliminate the need for manual compensation design work. The ZL9006M, ZL9010M operates over a wide input voltage range and supports an output voltage range of 0.6V to 3.6V, which can be set by external resistors or via PMBus. Only bulk input and output capacitors are needed to finish the design. The output voltage can be precisely regulated to as low as 0.6V with ±1% output voltage regulation over line, load, and temperature variations.

The ZL9006M, ZL9010M functions as a switch mode power supply with added benefits of auto compensation, programmable power management features, parametric monitoring, and status reporting capabilities.

The ZL9006M, ZL9010M is packaged in a thermally enhanced, compact (17.2mmx11.45mm) and low profile (2.5mm) over-molded high-density array (HDA) package module suitable for automated assembly by standard surface mount equipment. The ZL9006M, ZL9010M is Pb-free and RoHS compliant.

Figure 1 represents a typical implementation of the ZL9006M, ZL9010M. For PMBus operation, it is recommended to tie the Enable pin (EN) to "disable" mode.

Recommended Equipment

- 0V to 15V power supply with at least 5A source current capability
- Electronic load capable of sinking current up to 10A
- Digital multimeters (DMMs)
- 100MHz quad-trace oscilloscope

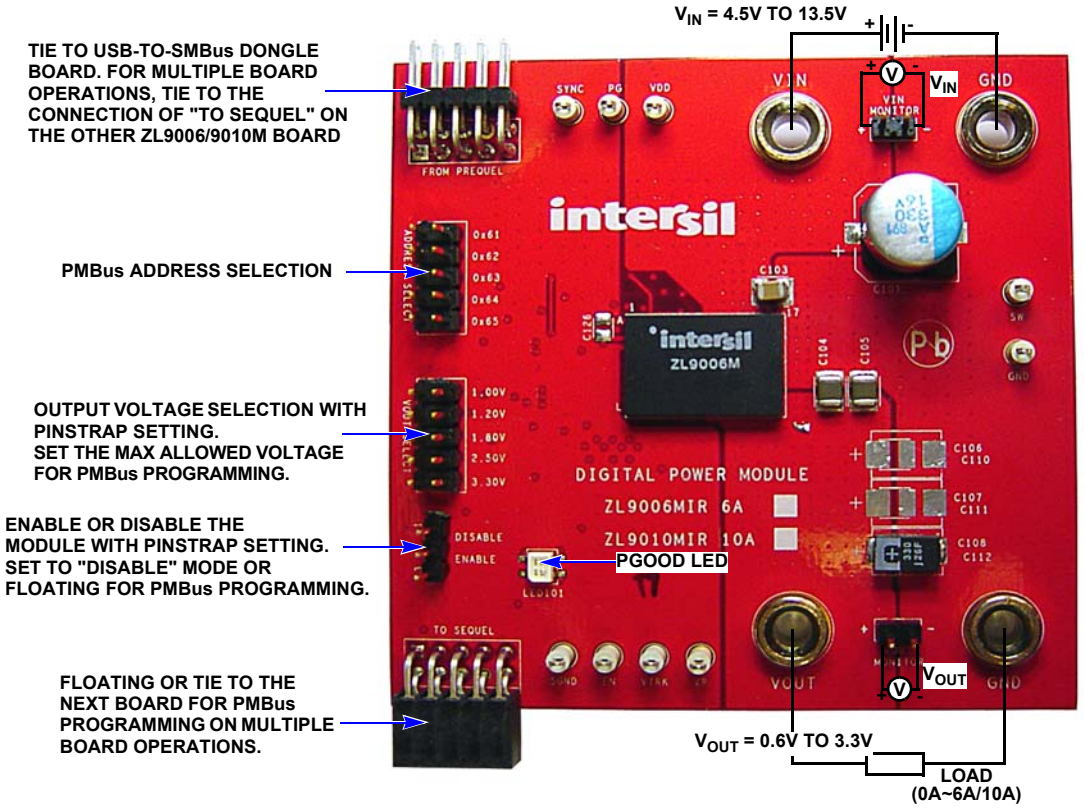

FIGURE 1. ZL9006M, ZL9010M BOARD IMAGE

Quick Start

The inputs are P2A (VIN) and P2B (GND). The outputs are P1A (VOUT) and P1B (GND). Refer to Figure 1 for connections. There are two ways to evaluate this evaluation board: I^2C/PMBus programing (Steps 1 through 4) and quick pinstrap power-up (Step 6).

1. Install the PowerNavigator™ software using the CD included in the ZL9006M, ZL9010M kit. For PMBus operation, connect the USB-to-PMBus dongle board to J7 of the ZL9006M, ZL9010M board and connect the USB cable from the computer to the dongle board.
2. Connect a power supply capable of sourcing at least 5A to the input (VIN P2A & GND P2B) of the ZL9006M, ZL9010M evaluation board, with a voltage between 4.5V to 13.5V. Connect an electronic load or the device to be powered to the output (VOUT P1A & GND P1B) of the board. All connections, the low voltage and high current V_{OUT} lines should be able to carry the desired load current and should be made as short as possible.
3. Check the connections of "VOUT select" and "address select". Make sure that the selections are correct. When changing the output voltage through the I^2C/PMBus, the voltage pinstrap sets the maximum allowed voltage. Thus, check the pinstrap setting on J5 before programming to a higher output voltage. For single board operations, the "address select" connection can be floating or any address listed on the board. But for multiple board operations, each board should have a unique address.
4. Move the ENABLE switch to “DISABLE” and turn on the power to program the power module using powerNavigator evaluation software. It allows modification of all ZL9006/9010M PMBus parameters. See Application Note AN2033 for PMBus command details. Use the mouse-over pop-ups for PowerNavigator help.
5. After programming, the ENABLE switch can then be moved to “ENABLE” and the ZL9006M, ZL9010M can be tested. Alternately, the PMBus ONOFF, CONFIG, and OPERATION commands can be used.
6. Pinstrap power-up option: if no I^2C/PMBus device is available to program the power module, the pinstrap option can allow users to power up the device to check the electrical functions without I^2C/PMBus connections. Simply follow Step 2 to connect the wires, then turn on the ENABLE switch. There are two pinstrap functions to be configured: Voltage and PMBus address. Ensure that input power is turned off, and then set the address and voltage pinstraps using J4 and J5. If no voltage is selected on J5, the default output voltage is 1.5V.

For different input and output voltages, the switching frequency will need to be adjusted, as shown in Table 1. The default frequency is 615kHz.

TABLE 1. RECOMMENDED FREQUENCY FOR DIFFERENT INPUT AND OUTPUT VOLTAGES

V_{OUT}–V_{IN}	3.3V	5.0V	12.0V
0.6 - 1.5	300kHz	400kHz	400kHz
1.5 - 2.5	300kHz	615kHz	615kHz
2.5 - 3.6	300kHz	471kHz	800kHz

Evaluation Board Information

The evaluation board size is 3 inches x 3 inches. It is a 4-layer board, containing 2-ounce copper on the top and bottom layers and 1-ounce copper on all internal layers. The board can be used as a 6A/10A reference design. Refer to the “Layout” section beginning on page 4. The board is made up of FR4 material and all components including the solder attachment are lead-free.

Thermal Considerations and Current Derating

Board layout is very critical in order to make the module operate safely and deliver maximum allowable power. To work in the high temperature environments and carry large currents, the board layout needs to be carefully designed to maximize thermal performance. To achieve this, select enough trace width, copper weight and the proper connectors.

This evaluation board is designed for running 6A/10A at room temperature without additional cooling systems needed. However, if the output voltage is increased or the board is operated at elevated temperatures, then the available current is derated. Refer to the derated current curves in the datasheets (FN8422 and FN7959) to determine the output current available.

For layout of designs using the ZL9006M, ZL9010M, the thermal performance can be improved by adhering to the following design tips:

1. Use the top and bottom layers to carry the large current. VOUT, SW, PGND and VIN should have large, solid planes. Place enough thermal vias to connect the power planes in different layers under and around the module.
2. SW pad is switching node that generate switching noise. Keep the pad under the module. For noise-sensitive applications, it is recommended to keep SW pads only on the top and inner layers of the PCB; do not place SW pads exposed to the outside on the bottom layer of the PCB. To improve the thermal performance, the SW pads can be extended in the inner layer, as shown in SW pad on layer 3 (Figure 6). Make sure that layer 2 and layer 4 have the GND layers to cover the extended areas of phase pads at layer 3 to avoid noise coupling.
3. If the ambient temperature is high or the board space is limited, airflow is needed to dissipate more heat from the modules. A heat sink can also be applied to the top side of the module to further improve the thermal performance (heat sink recommendation: Aavid Thermalloy, part number 375224B00032G, www.aavid.com). Place the heat sink on the module’s top surface on the power side that has the VIN and VOUT pads underneath.

ZL9006M, ZL9010M Board Schematic

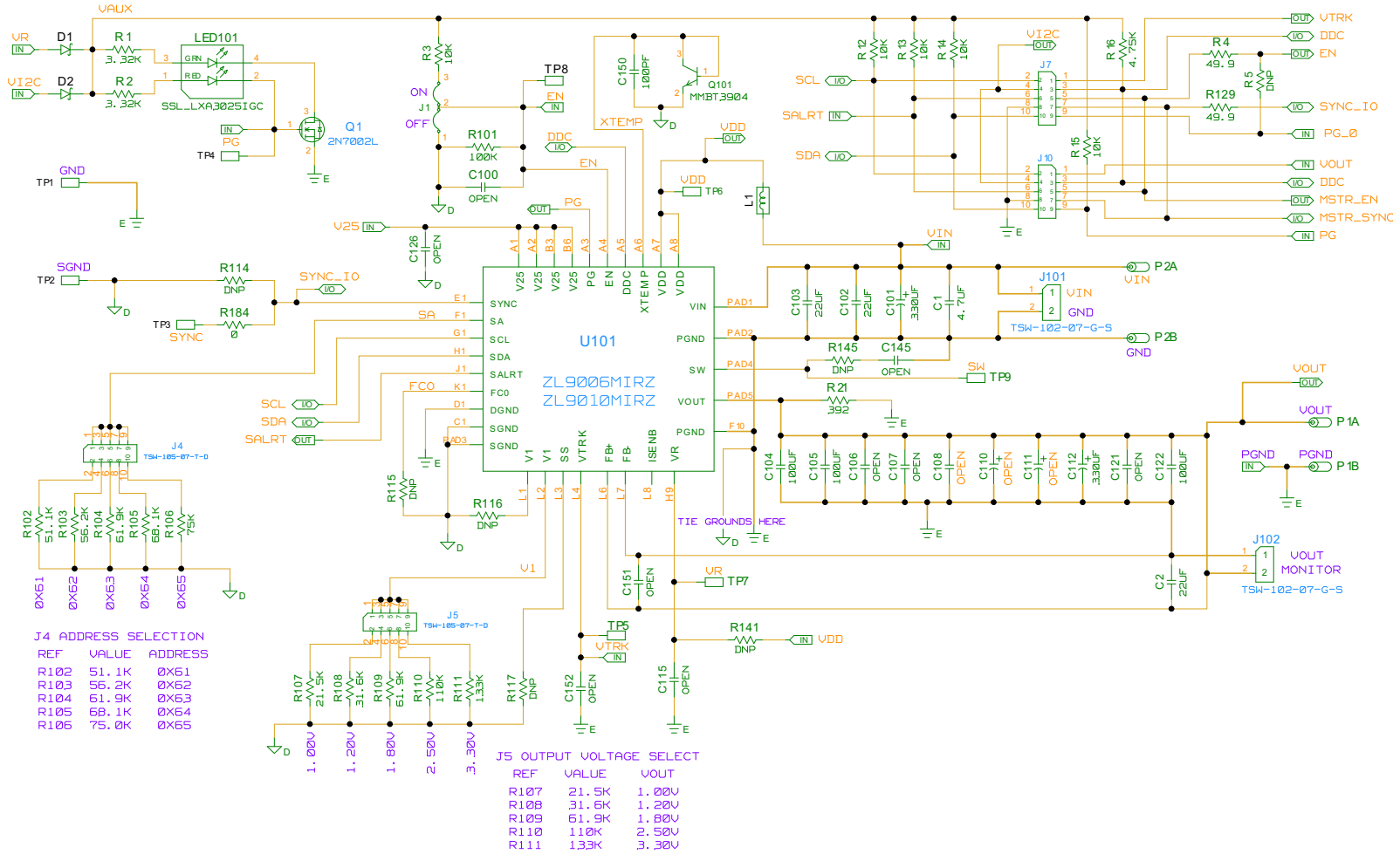

FIGURE 2. ZL9006M, ZL9010M BOARD SCHEMATIC

Layout

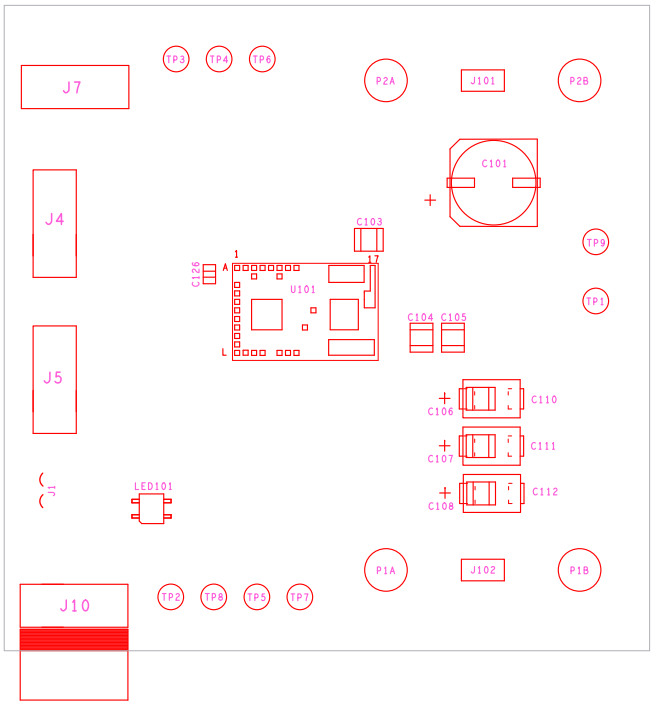

FIGURE 3. ASSEMBLY TOP

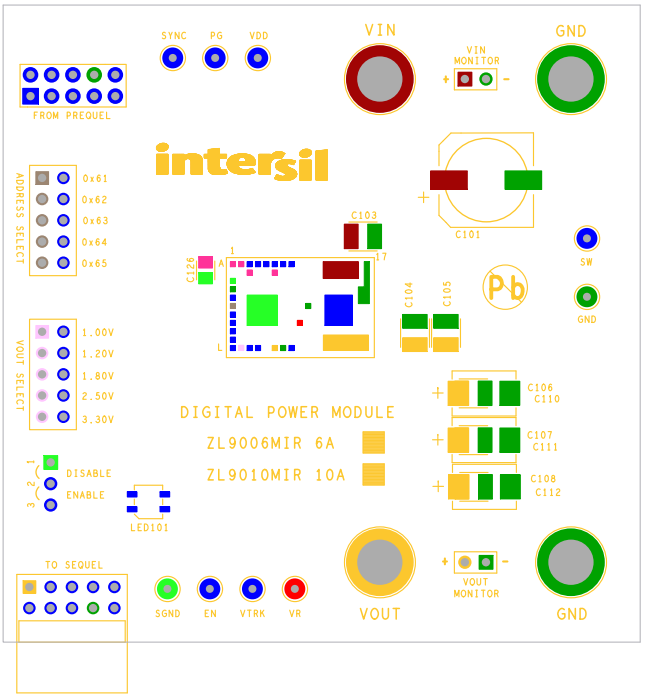

FIGURE 4. SILK SCREEN TOP

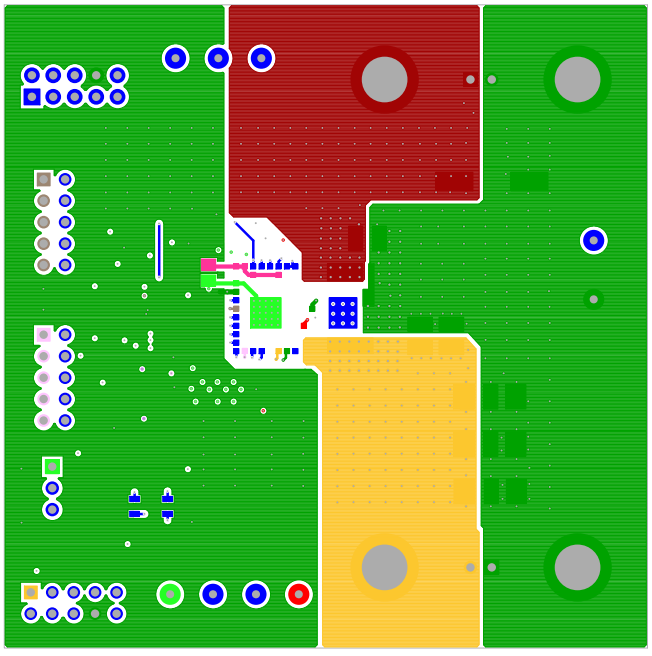

FIGURE 5. TOP LAYER COMPONENT SIDE

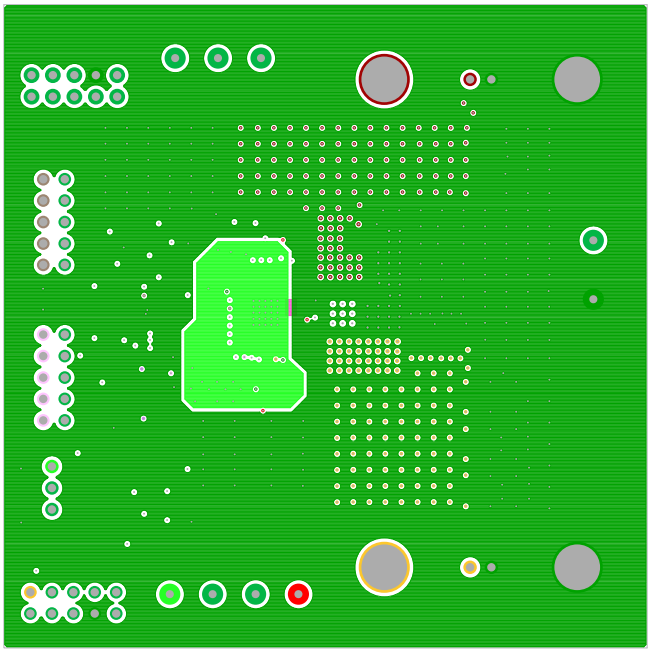

FIGURE 6. LAYER 2

Layout (Continued)

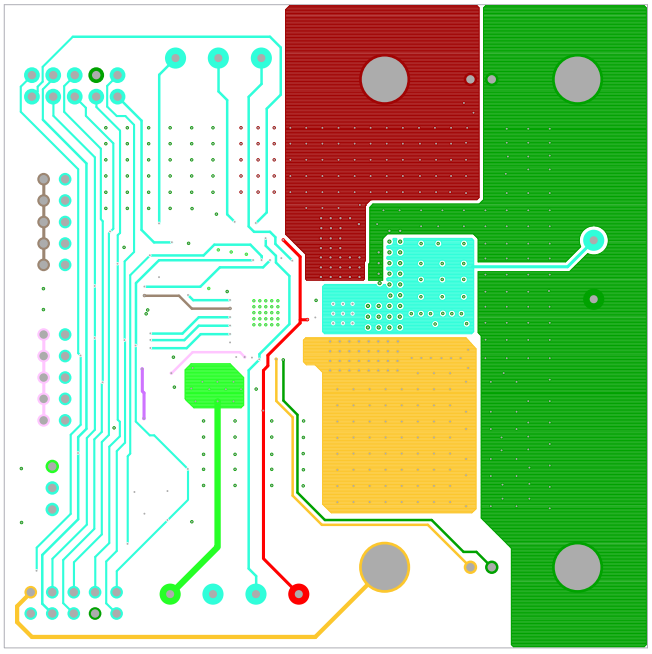

FIGURE 7. LAYER 3

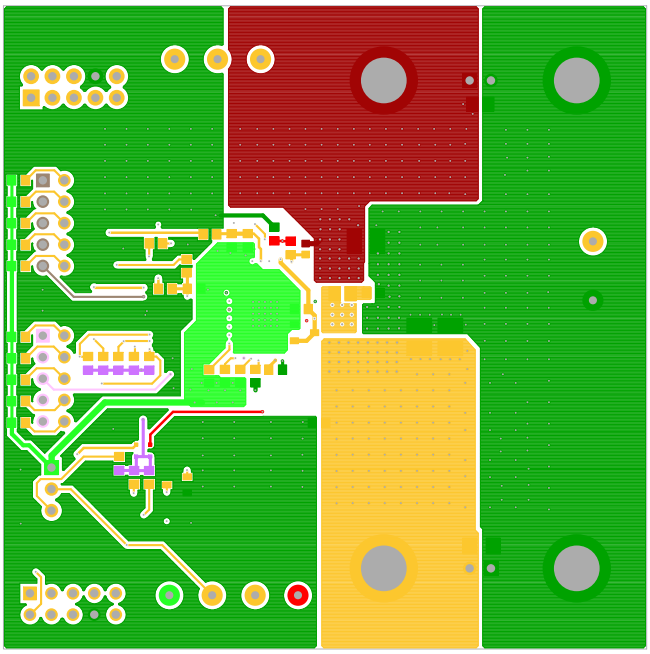

FIGURE 8. BOTTOM LAYER SOLDER SIDE

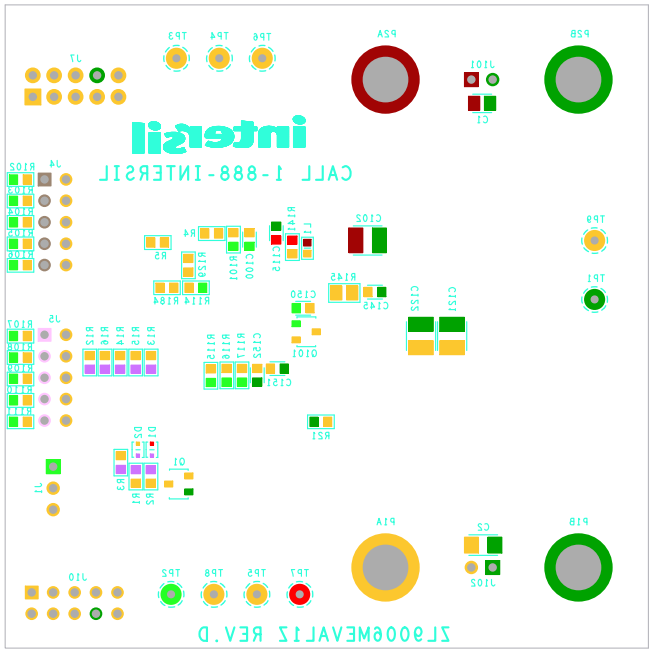

FIGURE 9. SILK SCREEN BOTTOM

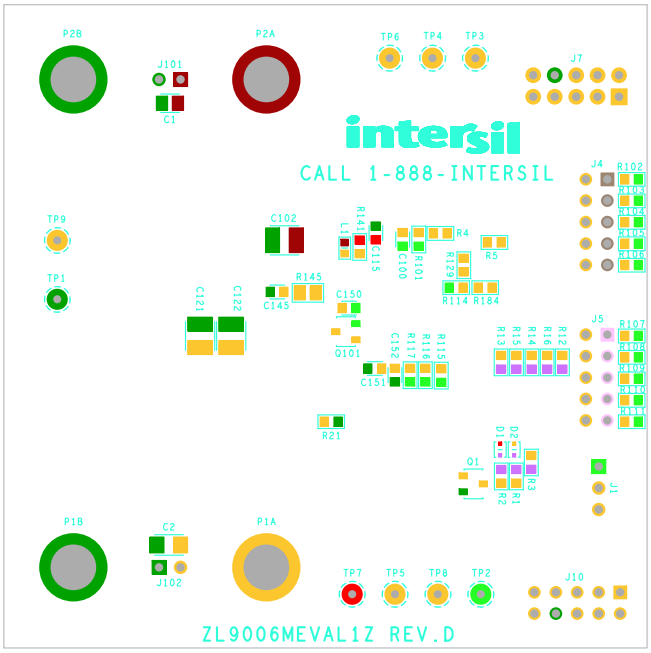

FIGURE 10. SILK SCREEN BOTTOM (MIRRORED)

Layout (Continued)

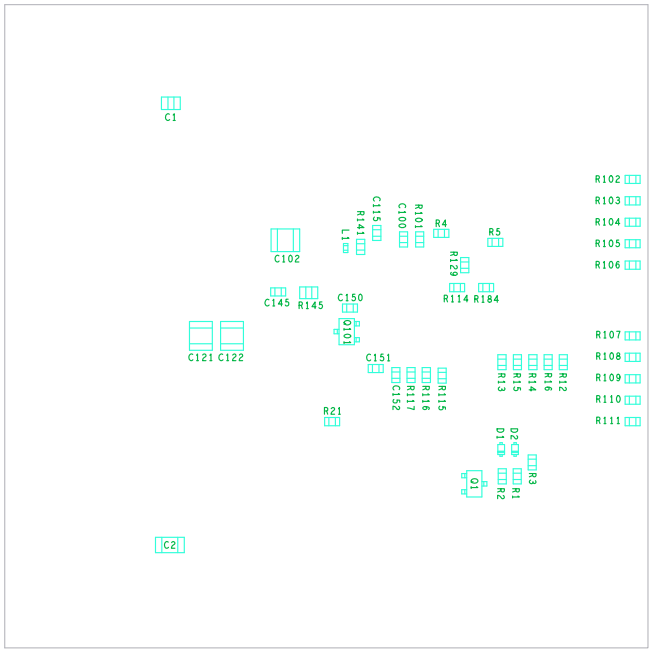

FIGURE 11. ASSEMBLY BOTTOM

Bill of Materials

PART NUMBER	QTY	REF DES	MANUFACTURER	DESCRIPTION
12066C226KAT2A	1	C2	AVX	Ceramic Capacitor
2N7002L	1	Q1	On Semi	N-Channel 60V 115mA MOSFET
5002	9	TP1-TP9	Keystone	Miniature White Test Point 0.100 Pad 0.040 Thole
575-4	4	P1A, P1B, P2A, P2B	Keystone	Solder Mount Banana Plug
6TPF330M9L	1	C112	Sanyo-Poscap	TPF Series Low Esr Products Capacitor
APXA160ARA331MJCOG	1	C101	Nippon	AL Polymer PXA Series Capacitor (RoHS Comp.)
BAT54XV2T1	2	D1, D2	On-semi	30V 200mW Schottky Barrier Diode
BLM15BD102SN1D	1	L1	Murata	Chip Ferrite Bead
GRM21BR71C475KA73L	1	C1	Murata	Ceramic Capacitor
GRM32ER61E226KE15L	2	C102, C103	Murata	Ceramic Chip Capacitor
H1045-00101-50V5	1	C150	Generic	Multilayer Capacitor
H1045-OPEN	5	C100, C115, C145, C151, C152	Generic	Multilayer Capacitor
H1046-OPEN	1	C126	Generic	Multilayer Capacitor
H1082-00107-6R3V20	4	C104, C105, C108, C122	Generic	Ceramic Chip Capacitor
H1082-OPEN	3	C106, C107, C121	Generic	Ceramic Chip Capacitor
H2505-DNP-DNP-1	6	R5, R114-R117, R141	Generic	Metal Film Chip Resistor (Do Not Populate)
H2506-DNP-DNP-1	1	R145	Generic	Metal Film Chip Resistor (Do Not Populate)
H2511-00R00-1/16W1	1	R184	Generic	Thick Film Chip Resistor
H2511-01002-1/16W1	5	R3, R12-R15	Generic	Thick Film Chip Resistor
H2511-01003-1/16W1	1	R101	Generic	Thick Film Chip Resistor
H2511-01103-1/16W1	1	R110	Generic	Thick Film Chip Resistor
H2511-01333-1/16W1	1	R111	Generic	Thick Film Chip Resistor
H2511-02152-1/16W1	1	R107	Generic	Thick Film Chip Resistor
H2511-03162-1/16W1	1	R108	Generic	Thick Film Chip Resistor
H2511-03321-1/16W1	2	R1, R2	Generic	Thick Film Chip Resistor
H2511-03920-1/16W1	1	R21	Generic	Thick Film Chip Resistor
H2511-04751-1/16W1	1	R16	Generic	Thick Film Chip Resistor
H2511-049R9-1/16W1	2	R4, R129	Generic	Thick Film Chip Resistor
H2511-05112-1/16W1	1	R102	Generic	Thick Film Chip Resistor

Bill of Materials (Continued)

PART NUMBER	QTY	REF DES	MANUFACTURER	DESCRIPTION
H2511-05622-1/16W1	1	R103	Generic	Thick Film Chip Resistor
H2511-06192-1/16W1	2	R104, R109	Generic	Thick Film Chip Resistor
H2511-06812-1/16W1	1	R105	Generic	Thick Film Chip Resistor
H2511-07502-1/16W1	1	R106	Generic	Thick Film Chip Resistor
JUMPER-3-100	1	J1	Generic	Three Pin Jumper
MMBT3904	1	Q101	Micro Commercial Components	NPN General Purpose Amplifier
SSL-LXA3025IGC	1	LED101	Lumex	3mm x 2.5mm Surface Mount Red/Green LED
SSQ-105-02-T-D-RA	1	J10	Samtec	10 Pin Socket 2.54mm x 2.54mm (0.100) Right Angle
TSW-102-07-G-S	2	J101, J102	Samtec	2 Pin Header 2.54mm (0.100) Pitch
TSW-105-07-T-D	2	J4, J5	Samtec	10 Pin Header 2.54mm x 2.54mm (0.100)
TSW-136-10	1	J7	Samtec	10 Pin Header 2.54mm x 2.54mm (0.100)
ZL9006MIRZ or ZL9010MIRZ	1	U101	Intersil	Digital DC/DC PMBus 6A/10A Power Module

ZL9006M, ZL9010M Efficiency Curves

Test conditions: room temperature and no air flow.

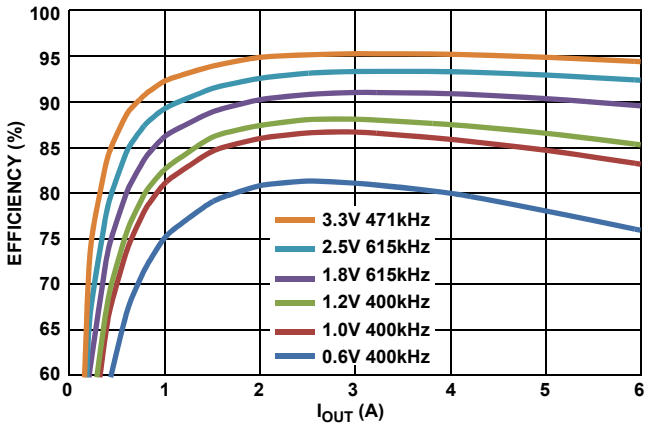

FIGURE 12. ZL9006M EFFICIENCY, V_{IN} = 5V

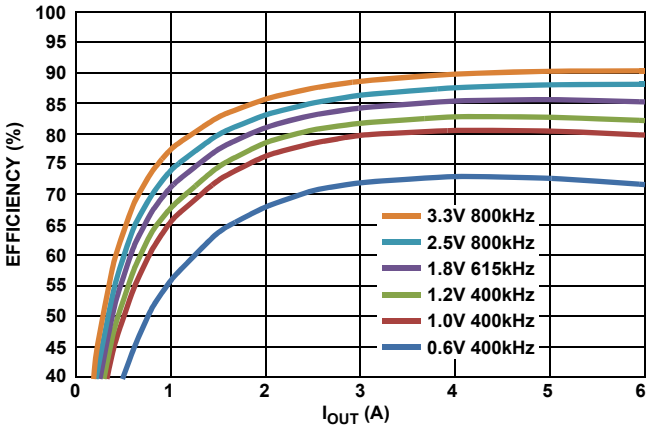

FIGURE 13. ZL9006M EFFICIENCY, V_{IN} = 12V

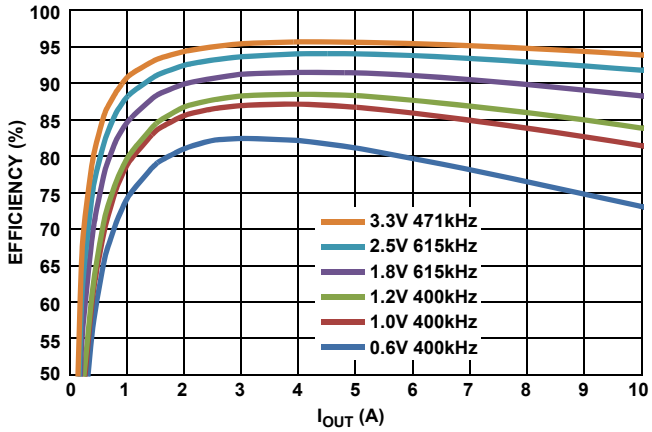

FIGURE 14. ZL9010M EFFICIENCY, V_{IN} = 5V

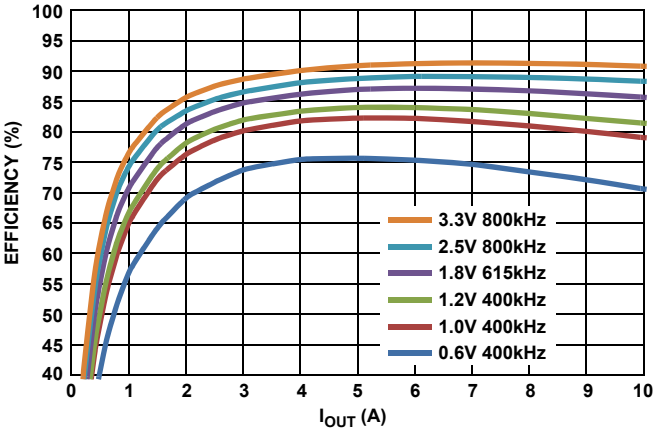

FIGURE 15. ZL9010M EFFICIENCY, V_{IN} = 12V

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- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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