

# Restrictions:

IDT's ZSPM15xx-KIT01 Evaluation Kit hardware is designed only for evaluation of the ZSPM15xx True-Digital PWM Controller IC and the ZSPM9060 DrMOS power stage; laboratory setup; and module development. The kit hardware must not be used for module production and production test setups.

IDT shall not be liable for any damages arising out of defects resulting from (i) delivered hardware and software, (ii) non-observance of instructions contained in this manual, or (iii) misuse, abuse, use under abnormal conditions, or alteration by anyone other than IDT. To the extent permitted by law, IDT hereby expressly disclaims and User expressly waives any and all warranties, whether express, implied, or statutory, including, without limitation, implied warranties of merchantability and of fitness for a particular purpose, statutory warranty of non-infringement, and any other warranty that may arise by reason of usage of trade, custom, or course of dealing.



**Important Safety Warning:** These procedures can result in high currents, which can cause severe injury or death. Only trained professional staff should connect external equipment. Ensure that all staff have read and understood this document and the high voltage safety disclaimer that is included with the kit.

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# 1 Introduction

This document describes the use of IDT's ZSPM15xx-KIT01 for evaluating DC/DC point-of-load (POL) applications and provides additional kit information, including the circuit diagram and board layout. The kit incorporates IDT's ZSPM15xx digital PWM controller IC and a ZSPM9060 DrMOS to form a "smart" buck converter (a.k.a. step-down DC-to-DC converter).

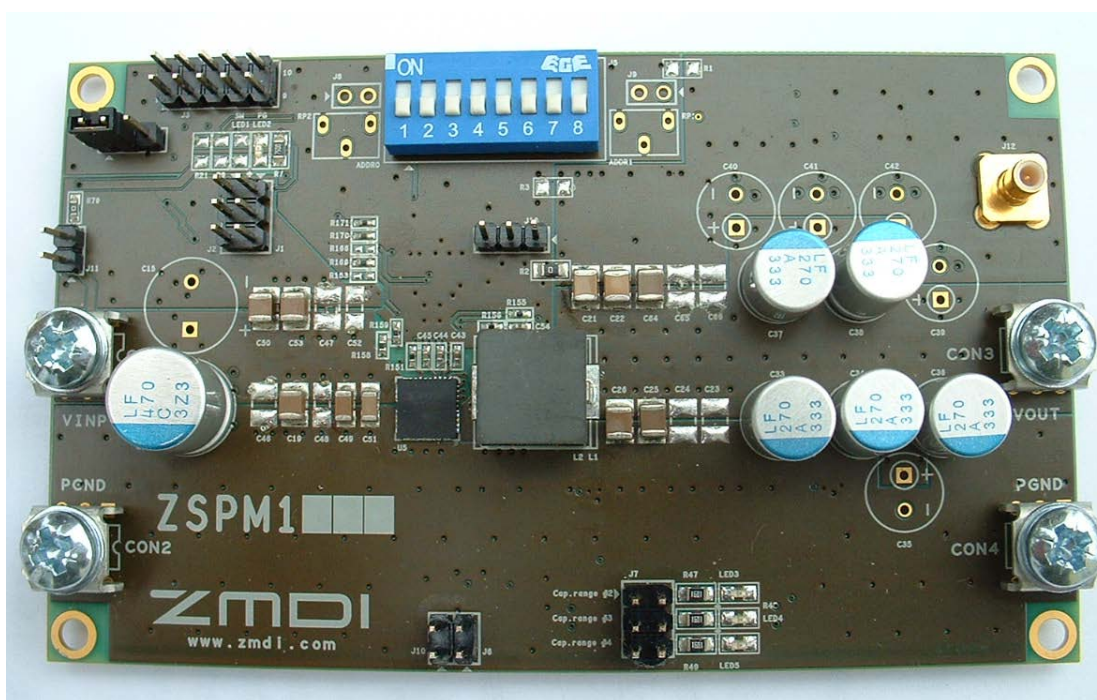
Note: The ZSPM15xx Family includes the ZSPM1501, ZSPM1502, ZSPM1503, ZSPM1504, ZSPM1505, ZSPM1506, ZSPM1507, ZSPM1508, ZSPM1509, ZSPM1511, ZSPM1512, and ZSPM1513. Unless otherwise noted, all references to the ZSPM15xx apply to all these products.

The ZSPM15xx-KIT01 Evaluation Kit hardware functions as a fixed-voltage self-starting autonomous DC/DC converter, which requires no software or subsequent programming.

## Kit Contents:

- ZSPM15xx Evaluation Board
- *Startup Information* document
- *Safety Disclaimer* document

**Figure 1.1 ZSPM15xx-KIT01 Evaluation Kit**



## 2 ZSPM15xx Evaluation Board

### 2.1. Evaluation Board Overview

The ZSPM15xx Evaluation Kit provides all the necessary components for a first evaluation of IDT's ZSPM15xx digital PWM controller.

In addition to the ZSPM15xx controller, the Evaluation Board features the ZSPM9060 DrMOS power stage. The number of output capacitors can be selected with a jumper on the Evaluation Board. The electrical specifications can be found in Table 2.1, and the schematic is provided in Appendix B.

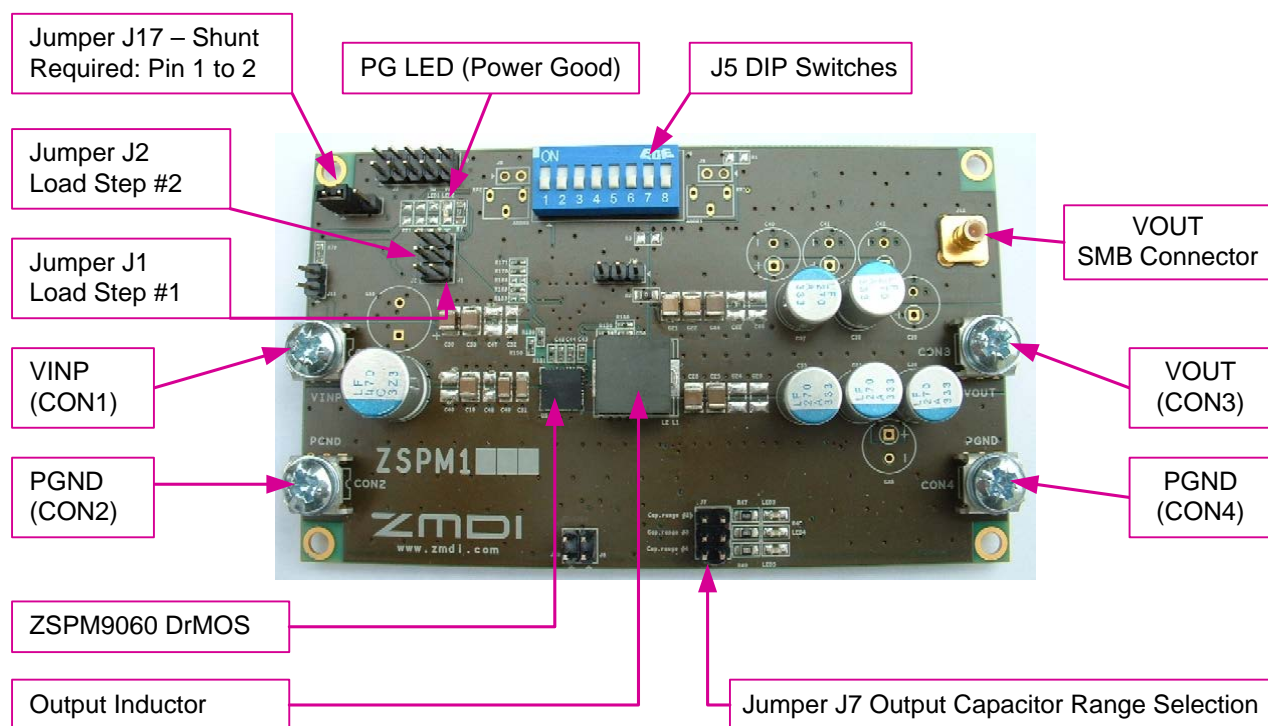
**Table 2.1 Key Design Parameters for the Evaluation Kit Power Stage**

Parameter	Value
Input voltage	10.8 to 13.2 V
Output voltage range	ZSPM1501: 0.85V
	ZSPM1502: 1.00V
	ZSPM1503: 1.20V
	ZSPM1504: 1.50V
	ZSPM1505: 1.80V
	ZSPM1506: 2.00V
	ZSPM1507: 2.50V
	ZSPM1508: 3.30V
	ZSPM1509: 5.00V
	ZSPM1511: 0.85V
	ZSPM1512: 1.00V
	ZSPM1513: 1.20V
Maximum output current	40A**
Switching frequency	500kHz
<p>* Refer to Table 5.2 for BOM variations and the specific output voltages, which depend on the ZSPM15xx product number.</p> <p>** The ZSPM9060 provided has an output power limitation of 50W. The maximum output current is therefore a function of the output voltage.</p>	

An on-board transient load is also provided for generating load transients with high current slew rates.

Figure 2.1 shows the ZSPM15xx Evaluation Board and the board connections that will be completed in the subsequent setup steps. Do not make the connections at this point.

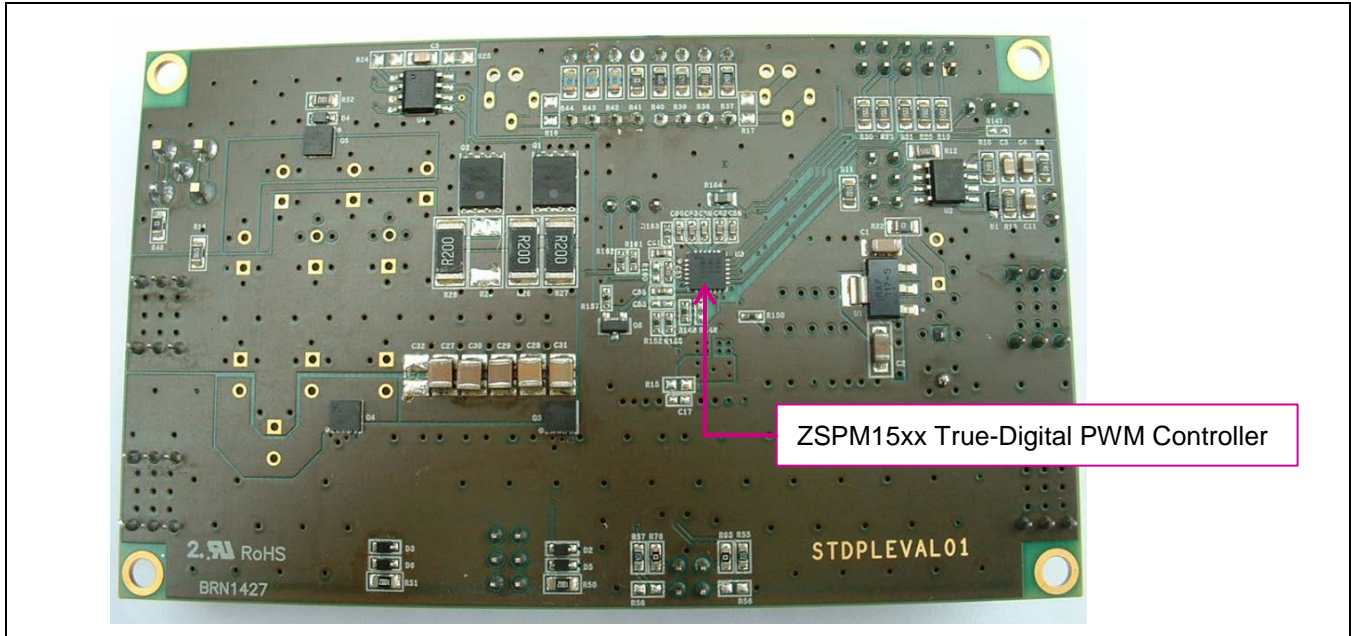
**Figure 2.1 ZSPM15xx-KIT01 Evaluation Board (Top Side)**



**Notes:**

- Jumper pins J1 and J2 are used to connect the onboard load transient found on the back of the board. The user can achieve transient load steps by placing a jumper across pins 2 and 3 on J1 and/or J2 (white arrows on the board indicate pin 1; see section 4.3). Power resistors in series with the power MOSFETs are used as loads for the load steps, and the current level is therefore output voltage dependent.
- The center pin on J1 or J2 can be used as a trigger for an oscilloscope.
- Jumper J7 can be used to select the amount of capacitance connected to the output of the ZSPM9060 (see section 4.2).
- The J5 DIP switch must be set to the proper compensation scheme. Further details are provided in section 4.2.
- The SMB connector on the right side of the board is intended for connection to an oscilloscope to provide a low noise measurement of the output voltage's transient response.

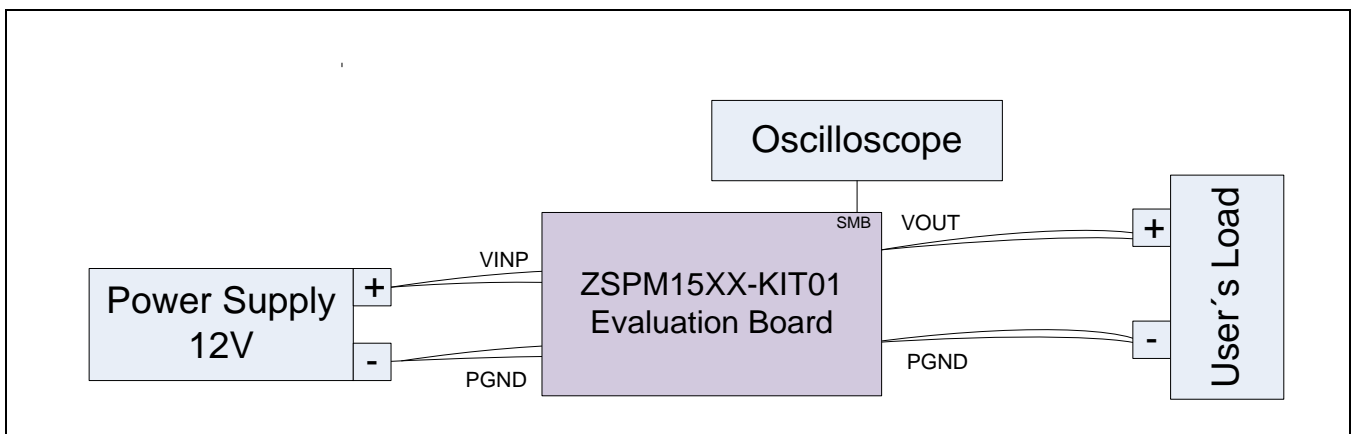
**Figure 2.2 ZSPM15xx-KIT01 Evaluation Board (Bottom Side)**



## 2.2. General Setup for the Evaluation System

The basic setup for using the ZSPM15xx Evaluation Kit is illustrated in Figure 2.3.

**Figure 2.3 Pink Power Evaluation Kit Setup**





### 2.2.1. User Instrumentation

The following user equipment is required or recommended for demonstrating the features of the ZSPM15xx Evaluation Kit:

- **DC power supply:** An external power supply is required for the ZSPM15xx Evaluation Board. Its output voltage should be at least 12V with a rated output current of approximately 1A to 8A depending on the test conditions.
- **Electronic load:** An external DC load is highly recommended as the Evaluation Board features only transient loads due to constraints on power dissipation. While an electronic load can be very advantageous, load resistors could also be sufficient for testing. Ensure that the electronic load has an adequate power rating.
- **Oscilloscope:** Connecting an oscilloscope to the Evaluation Kit is strongly recommended for measuring the performance of the Evaluation Board in the time domain. The Evaluation Board features an SMB connector connected to the output of the power stage for easy connection to an oscilloscope.

## 3 Evaluation Kit Setup

This section covers the steps for powering up the ZSPM15xx Evaluation Kit for the first time.



**Important Safety Warning:** The following procedures can result in high currents, which can cause severe injury or death. Only trained professional staff should connect external equipment. Do not enable the power supply connected to the input terminals until indicated in the following steps.

Follow this step-by-step instruction to power up the ZSPM15xx Evaluation Board:

- Step 1:** Connect the power supply to the connectors labeled CON1 (VINP in Figure 2.1) and CON2 (PGND). Connect the load to the CON3 (VOUT) and CON4 (PGND) connectors. The load can be either a resistor or an electronic load.
- Step 2:** Set the power supply voltage to 12V and enable the output of the power supply. If the power supply has no enable button, ensure that the output voltage is set to 12V before connecting it to the ZSPM15xx Evaluation Board.
- Step 3:** The power-good (PG) LED on the board should be on now (see Figure 2.1) and a voltage consistent with the preconfigured output voltage for ZSPM15xx product number (see section Table 5.2) should be present on the output terminals.

## 4 Evaluation Board Hardware and Software Setup

### 4.1. Introduction

The ZSPM15xx is a fixed-output voltage controller that is pre-configured with settings determined by the ZSPM15xx product number.

The output voltage is set as part of the configuration data. For output voltages up to 1.2V, the controller is configured to operate without a feedback divider. For output voltages above 1.2V, the controller is configured to operate with a feedback divider. Refer to the bill of materials (BOM) for the specific ZSPM15xx product number given in Table 5.2 for detailed information about the output voltage feedback divider.

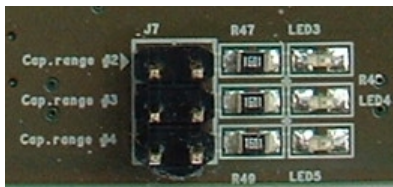
The ZSPM15xx has four pre-configured compensators. The four compensators have been optimized for specific ranges of output capacitors. Section 4.2 describes how the Evaluation Board can be configured for any of the four options for output capacitor ranges, allowing simple comparisons of the dynamic performance of the complete solution. The output capacitor range can be selected on header J7 (see section 4.2). The *ZSPM15xx Data Sheet* provides further information about the compensation loop configuration of the ZSPM15xx controller and typical performance measurements.

### 4.2. Output Capacitor Range Selection

The ZSPM15xx controller can be configured with one of four sets of compensation loop parameters. Each set of compensation parameters has been designed to match a range of output capacitors (see the *ZSPM15xx Data Sheet* for more information on the output capacitor ranges and compensation loop settings). The ZSPM15xx Evaluation Board allows the user to test the performance of the controller for each of the four output capacitor ranges. In the final application, the set of compensation parameters would be selected via a pin-strapping resistor as described in the data sheet.

A minimum number of ceramic capacitors are always connected to the output of the ZSPM9060 (capacitor range #1, which is selected if there is no jumper on J7) and additional capacitor banks can be selected with a jumper on header J7 (see Table 4.1). On the Evaluation Board, one of the three LEDs adjacent to J7 will turn green to indicate if capacitor range #2, #3, or #4 has been selected (see Figure 2.1). If none of the LEDs are on, it means that capacitor range #1 has been selected.

**Figure 4.1 J7 – Output Capacitor Range Hardware Selection**

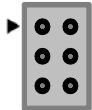

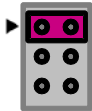

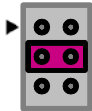

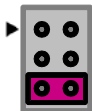



**Important:** Do not place more than one jumper on J7 at a time.

**Important:** For the output capacitor range selected by J7, a corresponding setting on the J5 DIP switch must be made as shown in Table 4.1 to select the ZSPM15xx compensation loop configuration (Comp0, Comp1, Comp2, or Comp3) optimized for the selected output capacitors.



**Table 4.1 ZSPM15xx Evaluation Board – Output Capacitors**

Capacitor Range Setting	Capacitance Range	J7 Header *	J5 DIP Switch Setting **
#1	200-500 $\mu$ F		<b>Comp0</b> <b>xxxx1000</b> 
#2	500-1000 $\mu$ F		<b>Comp1</b> <b>xxxx0100</b> 
#3	1200-2500 $\mu$ F		<b>Comp2</b> <b>xxxx0010</b> 
#4	2500-4000 $\mu$ F		<b>Comp3</b> <b>xxxx0001</b> 
<p>* For both J7 and the J5 DIP switch, the settings must be made one-at-a-time. Do not place more than one jumper on J7 at a time. Do not set more than one position to ON in the group of four settings on the right of the DIP switch or in the group of four settings on the left.</p> <p>** The first four settings of the J5 DIP switch (indicated with x) are for selecting the over-current protection threshold, for which the settings are given in section 4.4. For this step, this first set of switches can be considered “do not care,” except that no more than one switch in this group can be set to ON at a time.</p>			

There is a provision on right side of the DIP switch for adding a jumper and a potentiometer or fixed resistor for selecting one of seven slew rate settings. For each set of compensation loop parameters, there is a choice of seven slew rates for the output voltage during power-up. The selection of the slew rate can be used to limit the input current of the DC/DC converter while it is ramping up the output voltage. The current needed to charge the output capacitors increases in direct proportion to the slew rate. See the *ZSPM15xx Data Sheet* for further details.

#### 4.2.1. Output Capacitor Range Test Procedure

To test the performance of the four selectable compensators, follow these simple steps:

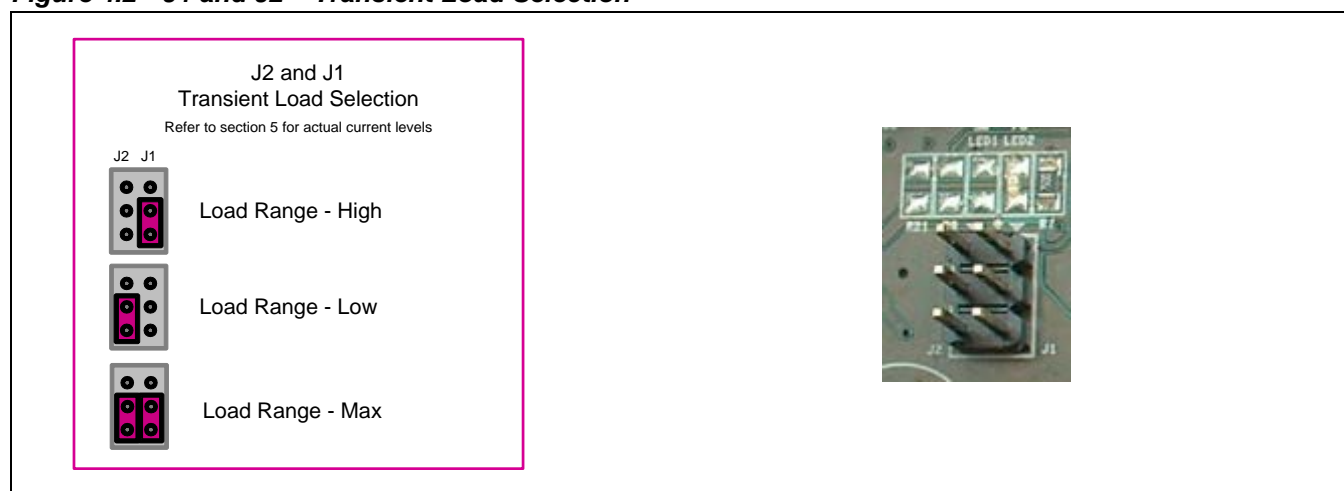
1. Make sure that the input voltage from the power supply to the ZSPM15xx Evaluation Board is OFF.
2. Select the ZSPM15xx output capacitor range via header J7 and set the corresponding position on the J5 DIP switch per Table 4.1.
3. Apply the input voltage to the ZSPM15xx Evaluation Board.
4. Measure the dynamic performance with an oscilloscope using either the on-board transient loads (see section 4.3) or an external electronic load.

#### 4.3. On Board Transient Loads

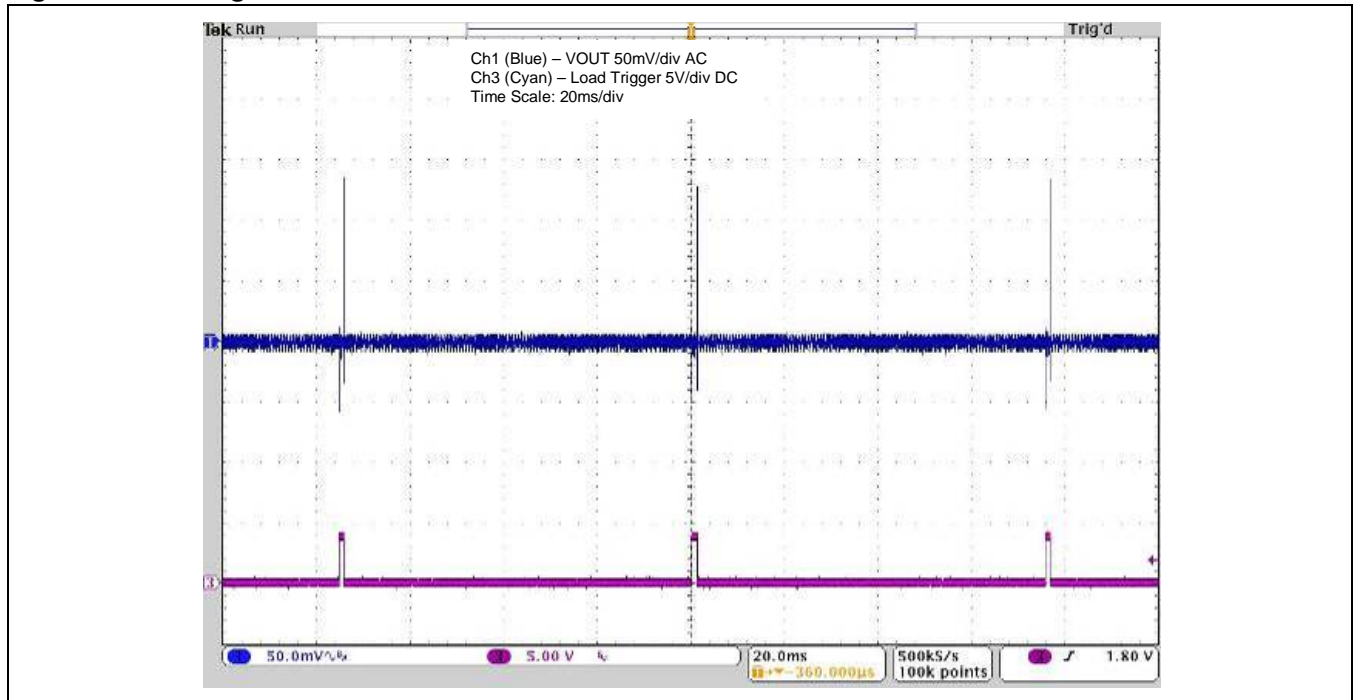
The ZSPM15xx Evaluation Board has on-board transient loads that can be used to test the dynamic performance of the ZSPM15xx controller. The transient loads consist of a simple timer circuit driving a power MOSFET. The power MOSFET is connected in series with resistors connected across the output of the ZSPM9060. A schematic of the transient load circuitry is provided in Appendix B.

There are two transient loads that can be enabled via headers J1 and J2 respectively (see Figure 4.2). The two loads can be enabled simultaneously to achieve a larger current step. The timing signal for the transient loads has an ON time of approximately 1 millisecond with a time period of approximately 80 milliseconds (see Figure 4.3).

**Figure 4.2 J1 and J2 – Transient Load Selection**



**Figure 4.3 Timing for the On-Board Transient Loads**

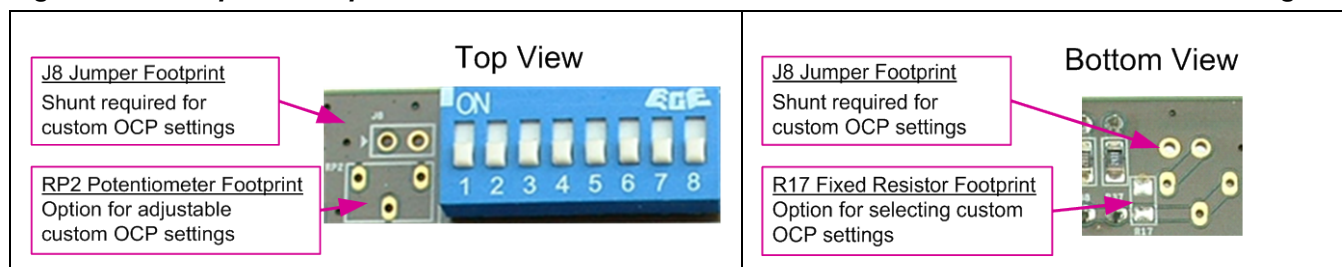


#### 4.4. Setting the Over Current Protection (OCP)

The ZSPM15xx-KIT01 can be configured to support a wide range of different over-current protection (OCP) thresholds based on the user's selection for the inductor. The voltage between the ISNSP and ISNSN pins triggers the OCP protection if the threshold is exceeded. This voltage represents the over-current threshold because faults are detected by measuring the voltage across the DCR of the selected inductor. Table 4.2 lists the different configuration options for selecting the OCP voltage threshold via the total resistance connected to the CONFIG0 pin on the ZSPM15xx.

The ZSPM15xx-KIT01 has the four preset current limit settings given in Table 4.3, which correspond to the index settings shaded pink in Table 4.2. If no preset is selected, the current limit is set to index 29 (70.0mV.) The presets can be selected with positions 1 through 4 on the J5 DIP switch (see Figure 4.4). There is provision on left side of the J5 DIP switch for the footprints for jumper J8 and potentiometer RP2 or fixed resistor R17 (on the back of the board) for achieving custom OCP settings. When RP2 or R17 is used, the J8 jumper must be shorted.

**Figure 4.4 Footprint for Optional Additional Resistance on the CONFIG0 Pin for Custom OCP Settings**



Selecting a custom OCP resistor is a simple calculation. For example, for a design with a maximum current of 20A and an inductor with 2mΩ resistance (DCR), the OCP can be calculated with the following equation:

$$20A \times 1.25 \text{ (25\% current limit buffer)} \times 0.002\Omega = 50mV$$

Next select the resistor from Table 4.2 that correlates with an over-current threshold voltage of 50mV, which is 15.8kΩ (index 25). For more details, see the *ZSPM15xx Data Sheet*.






Note: Due to the temperature compensation feature, the ZSPM15xx over-current threshold should be based on the current sense signal at 25°C. Temperature drift is automatically compensated within the ZSPM15xx.

Recommendation: For the selection of the over-current threshold voltage, include the tolerance of the inductor's DCR and take the parasitic effects of the circuit board layout into account.

**Table 4.2 ZSPM15xx – OCP Pin Strap Resistor Selection**

Index	Resistor Value Using the E96 Series	OCP Voltage Selection at 25°C	Index	Resistor Value Using the E96 Series	OCP Voltage Selection at 25°C
0	0Ω	3.0mV	15	5.360kΩ	20.0mV
1	392Ω	4.0mV	16	6.040kΩ	22.5mV
2	576Ω	5.0mV	17	6.810kΩ	25.0mV
3	787Ω	6.0mV	18	7.680kΩ	27.5mV
4	1.000kΩ	7.0mV	19	8.660kΩ	30.0mV
5	1.240kΩ	8.0mV	20	9.530kΩ	32.5mV
6	1.500kΩ	9.0mV	21	10.50kΩ	35.0mV
7	1.780kΩ	10.0mV	22	11.80kΩ	37.5mV
8	2.100kΩ	11.25mV	23	13.00kΩ	40.0mV
9	2.430kΩ	12.5mV	24	14.30kΩ	45.0mV
10	2.800kΩ	13.75mV	25	15.80kΩ	50.0mV
11	3.240kΩ	15.0mV	26	17.40kΩ	55.0mV
12	3.740kΩ	16.25mV	27	19.10kΩ	60.0mV
13	4.220kΩ	17.5mV	28	21.00kΩ	65.0mV
14	4.750kΩ	18.75mV	29	23.20kΩ	70.0mV

**Table 4.3 Current Limiting Setting Options**

OCP Index	Pin Strap Resistor Value	Inductor Voltage Threshold for OCP	DIP Switch Setting *
9	2.430kΩ	12.5mV	<b>1000xxxx</b> 
10	2.800kΩ	13.75mV	<b>0100xxxx</b> 
11	3.240kΩ	15.0mV	<b>0010xxxx</b> 
12	3.740kΩ	16.25mV	<b>0001xxxx</b> 
29	23.20kΩ	70mV	<b>0000xxxx</b> 
* The last four positions of the DIP switch (indicated with x) are for selecting the capacitor compensation, for which the settings are given in section 4.2. For this step, this last set of switches can be considered “do not care,” except that no more than one switch in this group can be set to ON at a time.			

## 5 Variations in Preconfigured Output Voltage and Bills of Materials (BOM) by ZSPM15xx Product Number

Table 5.1 lists the full bill of materials (BOM) for the ZSPM1502 Evaluation Board, for which the schematics and board layout are given in Appendix B and Appendix A respectively.

The prefigured nominal voltage output for each ZSPM15xx product number is given in Table 5.2, which also lists the differences in BOMs compared to Table 5.1 according to the product number for the different ZSPM15xx Evaluation Boards.

**Table 5.1 Base Bill of Materials for ZSPM1502**

#	Qty.	Reference	Part Description / Value	Circuit Board Footprint	Vendor Part Number
1	4	CON1, CON2, CON3, CON4	HEADER 3X2	PowerTab_ERNI_M4-6pin	
2	1	C1	1 $\mu$ F/25V	smd_1206	
3	1	C2	10 $\mu$ F/16V	1206	
4	2	C3, C5	100nF/25V	smd_0805alt	
5	1	C4	1 $\mu$ F/25V	smd_0805alt	
6	1	C11	470nF/25V	smd_0805alt	
7	1	C15	DNP	ELKO_RADIAL_10x125_50	
8	1	C16	470 $\mu$ F/16V	ELKO_RADIAL_10x125_50	Nichicon PLF1C471MDO1
9	DNP	C17, C55, R147, R150, 4153, R160, R166	DNP	402	
10	3	C19, C50, C53	10 $\mu$ F/25V	smd_1210	AVX 12103C106KAT2A
11	4	C21, C22, C28, C31	47 $\mu$ F/10V	smd_1210	Murata GRM32ER71A476ME15
12	DNP	C23, C47, C65, C66	DNP	smd_1210	
13	1	C24	DNP	smd_1210	AVX 12106D107KAT2A
14	6	C25, C26, C27, C29, C30, C64	100 $\mu$ F/6.3V	smd_1210	AVX 12106D107KAT2A
15	1	C32	DNP	smd_1210	GRM32ER71A476ME15
16	5	C33, C34, C36, C37, C38	470 $\mu$ F/6.3V	El_Cap_8mm_ver	Nichicon PLF0J471MCO6
17	DNP	C35, C39, C40, C41, C42	DNP	El_Cap_8mm_ver	
18	3	C43, C54, C59, C67	1 $\mu$ F/10V	402	
19	1	C44	1 $\mu$ F/16V	402	
20	1	C45	100n/25V	402	
21	1	C46	DNP	smd_1210	
22	1	C48	DNP	smd_1206	
23	1	C49	10 $\mu$ F/25V	smd_1206	AVX 12103C106KAT2A
24	1	C51	100nF/25V	smd_1206	
25	1	C52	DNP	smd_1206	
26	1	C56	100nF	402	
27	1	C57	47pF	402	
28	4	C58, C61, C62, C63	4.7 $\mu$ F/10V	402	
29	1	C60	100nF/10V	402	
30	1	D1	MSE1PB-M3 /89A	MicroSMP	
31	5	D2, D3, D4, D5, D6	PMEG4010BEA	SOD323	
32	3	J1, J2, J18	CON3	jumper3	



#	Qty.	Reference	Part Description / Value	Circuit Board Footprint	Vendor Part Number
33	1	J3	PMBUS	MHDR2X5	
34	1	J5	DIP-Switch	DIP8_254	CTS Electrocomponents 206-8ST
35	1	J6	LSE	jumper2_254	
36	1	J7	Capacitor Range Selection	jumper2x3	
37	DNP	J8, J9	DNP	jumper2_254	
38	1	J10	PWM	jumper2_254	
39	1	J11	VIN	jumper2_254	
40	1	J12	VOOUT+	SMB	
41	1	J17	CON3	header3_254	
42	DNP	LED1	DNP	smd_0805alt	OSRAM TLMS1000-GS08
43	1	LED2	PGOOD	smd_0805alt	OSRAM LG L29K-F2J1-24-Z
44	1	LED3	OCG1	smd_0805alt	OSRAM LG L29K-F2J1-24-Z
45	1	LED4	OCG2	smd_0805alt	OSRAM LG L29K-F2J1-24-Z
46	1	LED5	OCG3	smd_0805alt	OSRAM LG L29K-F2J1-24-Z
47	DNP	L1	DNP	Coil_W7443310047	Würth 7443320047
48	1	L2	330nH/0.32mR	Coil_W744301033	Würth 744301033
49	2	Q1, Q2	FDMS7658AS	Power56	Fairchild Semiconductor FDMS7658AS
50	3	Q3, Q4, Q5	FDMC7660	POWER33	Fairchild Semiconductor FDMC7660
51	1	Q6	MMBT3904	SOT23	ONSEMI MC33269DTG
52	DNP	RP1, RP2	DNP	BOURNS_3266W	
53	DNP	R1, R3, R9, R16, R17, R24, R25	DNP	smd_0805alt	
54	5	R2, R21, R22, R41, R46	0R	smd_0805alt	
55	1	R7	750R	smd_0805alt	
56	1	R8	51R	smd_0805alt	
57	1	R10	2k49	smd_0805alt	
58	2	R11, R12	51k	smd_0805alt	
59	1	R13	220k	smd_0805alt	
60	1	R14	510R	smd_0805alt	
61	DNP	R15, R56, R58	DNP	603	
62	6	R19, R20, R23, R30, R31, R39	15k	smd_0805alt	
63	1	R26	0R1	2512	
64	DNP	R27, R29	DNP	2512	
65	1	R28	0R2	2512	
66	1	R37	12k5	smd_0805alt	
67	1	R38	13k75	smd_0805alt	
68	1	R40	16k25	smd_0805alt	
69	1	R42	1k78	smd_0805alt	
70	1	R43	4k75	smd_0805alt	
71	1	R44	10k5	smd_0805alt	
72	3	R47, R48, R49	1k6	smd_0805alt	
73	3	R50, R51, R52	10k	smd_0805alt	

#	Qty.	Reference	Part Description / Value	Circuit Board Footprint	Vendor Part Number
74	2	R55, R57	4k7	603	
75	3	R76, R79, R95	0R	603	
76	2	R148, R162	10R	402	
77	5	R149, R151, R157, R169, R170	0R	402	
78	3	R152, R165, R171	10k	402	
79	2	R155, R156	1050R	402	
80	1	R158	9k1	402	
81	2	R159, R161	1k	402	
82	1	R163	51R	402	
83	1	R164	WE742792038	0805c	Würth 742792038
84	1	U1	NCP1117-5V	FAN1616AS5X	ONSEMI NCP1117-5V
85	1	U2	NE555D	SOIC8	
86	1	U3	ZSPM1502	QFN50P400X400-24V6N	ZSPM1502ZA1W0
87	1	U4	FAN3227TMX	SOIC8	Fairchild Semiconductor FAN3227TMX
88	1	U5	ZSPM9060	DrMOS (Intel STD)	ZSPM9060ZA1R

**Table 5.2 Differences in Nominal Vout and Bills of Materials Depending on ZSPM15xx Product Number**

KIT	U3 Controller	Vout	L1 Value	Current Sense <sup>1)</sup>		Feedback Divider		Output Caps	Load-J1 <sup>2)</sup>		Load-J2 <sup>2)</sup>		Transient Load Current <sup>3)</sup>	
P/N	IDT P/N	(Nom.)	(Würth P/N)	C54, C67	R155, R156	R161/ 0.1%	R160/ 0.1%	Rated V	R26 Ω	R27 Ω	R28 Ω	R29 Ω	I <sub>NOM HIGH</sub> (A)	I <sub>NOM LOW</sub> (A)
ZSPM1501-KIT01	ZSPM1501ZA1W0	0.85	330nH (744301033)	1μF	1k05	1k	DNP	6.3	0R1	DNP	0R2	DNP	*	*
ZSPM1502-KIT01	ZSPM1502ZA1W0	1.00	330nH (744301033)	1μF	1k05	1k	DNP	6.3	0R1	DNP	0R2	DNP	10	5
ZSPM1503-KIT01	ZSPM1503ZA1W0	1.20	330nH (744301033)	1μF	1k05	1k	DNP	6.3	0R1	DNP	0R2	DNP	*	*
ZSPM1504-KIT01	ZSPM1504ZA1W0	1.50	470nH (744301047)	1μF	1k	750	1k	6.3	0R18	DNP	0R36	DNP	*	*
ZSPM1505-KIT01	ZSPM1505ZA1W0	1.80	470nH (744301047)	1μF	1k	750	1k	6.3	0R18	DNP	0R36	DNP	10	5
ZSPM1506-KIT01	ZSPM1506ZA1W0	2.00	470nH (744301047)	1μF	1k	750	1k	6.3	0R18	DNP	0R36	DNP	*	*
ZSPM1507-KIT01	ZSPM1507ZA1W0	2.50	1000nH (7443310100)	820nF	1k05	1k	1k	6.3	0R25	DNP	0R5	DNP	10	5
ZSPM1508-KIT01	ZSPM1508ZA1W0	3.30	2200nH (7443310220)	470nF	1k18	3k3	1k	10	1R3	1R3	1R3	DNP	5	2.5
ZSPM1509-KIT01	ZSPM1509ZA1W0	5.00	2200nH (7443310220)	470nF	1k18	3k3	1k	10	2R0	2R0	2R0	DNP	5	2.5
ZSPM1511-KIT01	ZSPM1511ZA1W0	0.85	680nH (7443310068)	1μF	1k	1k	DNP	6.3	0R1	DNP	0R2	DNP	*	*
ZSPM1512-KIT01	ZSPM1512ZA1W0	1.00	680nH (7443310068)	1μF	1k	1k	DNP	6.3	0R1	DNP	0R2	DNP	*	*
ZSPM1513-KIT01	ZSPM1513ZA1W0	1.20	680nH (7443310068)	1μF	1k	1k	DNP	6.3	0R1	DNP	0R2	DNP	*	*

1) For all kits, the C67 and C54 capacitors are rated for 10V.

2) For rows marked DNP for R27 and/or R29, the component is not placed; however, the footprint is available for adding custom load values.

3) Transient load current for rows marked with an asterisk (\*) can be calculated by dividing the output voltage by the total load resistance.

## 6 Support

IDT provides additional support for the ZSPM15xx-KIT01. If further support is needed, contact IDT at [www.IDT.com/go/support](http://www.IDT.com/go/support).

## 7 Related Documents

Document
<i>ZSPM15xx Feature Sheet</i>
<i>ZSPM15xx Data Sheet</i>

Visit the ZSPM15xx product pages on [www.IDT.com](http://www.IDT.com) or contact your nearest sales office for the latest version of these documents.

## 8 Definitions of Acronyms

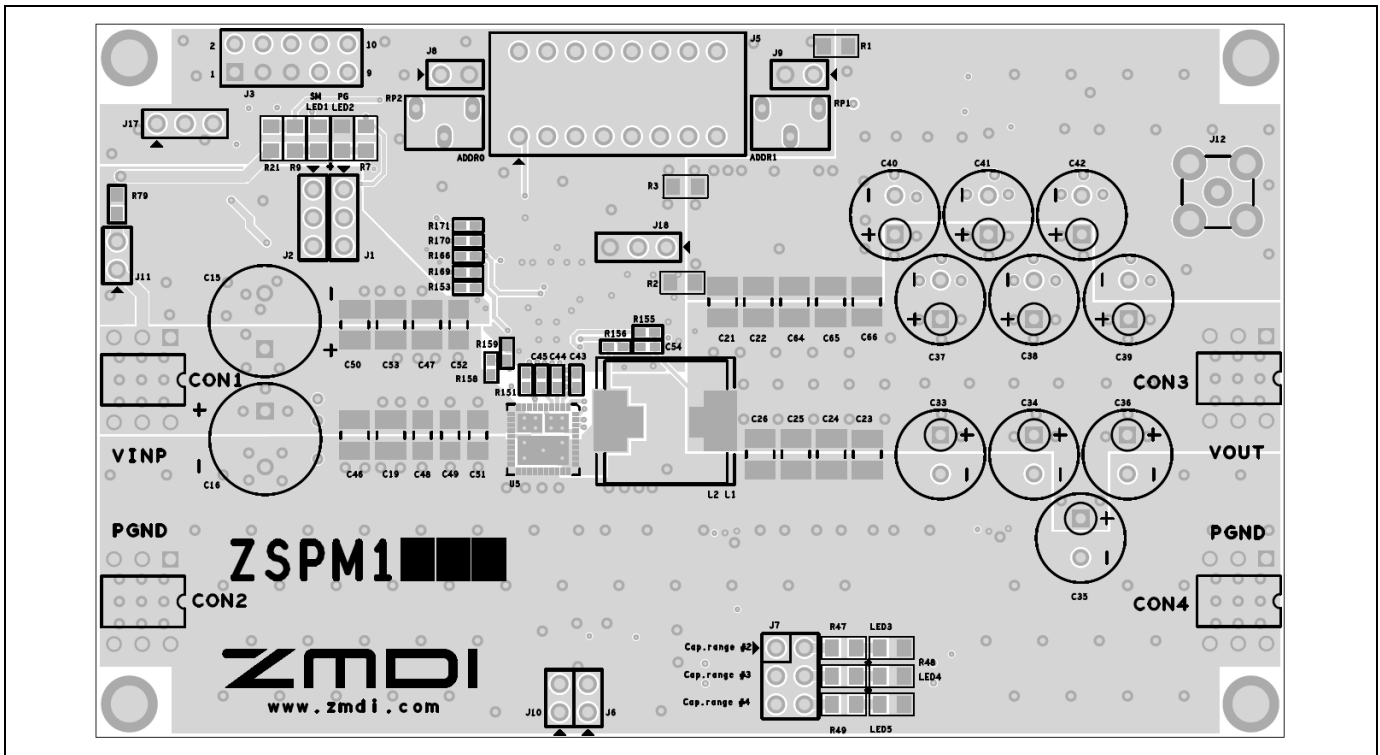
Term	Description
PWM	Pulse Width Modulation
SMB	Sub-miniature Version B

## 9 Document Revision History

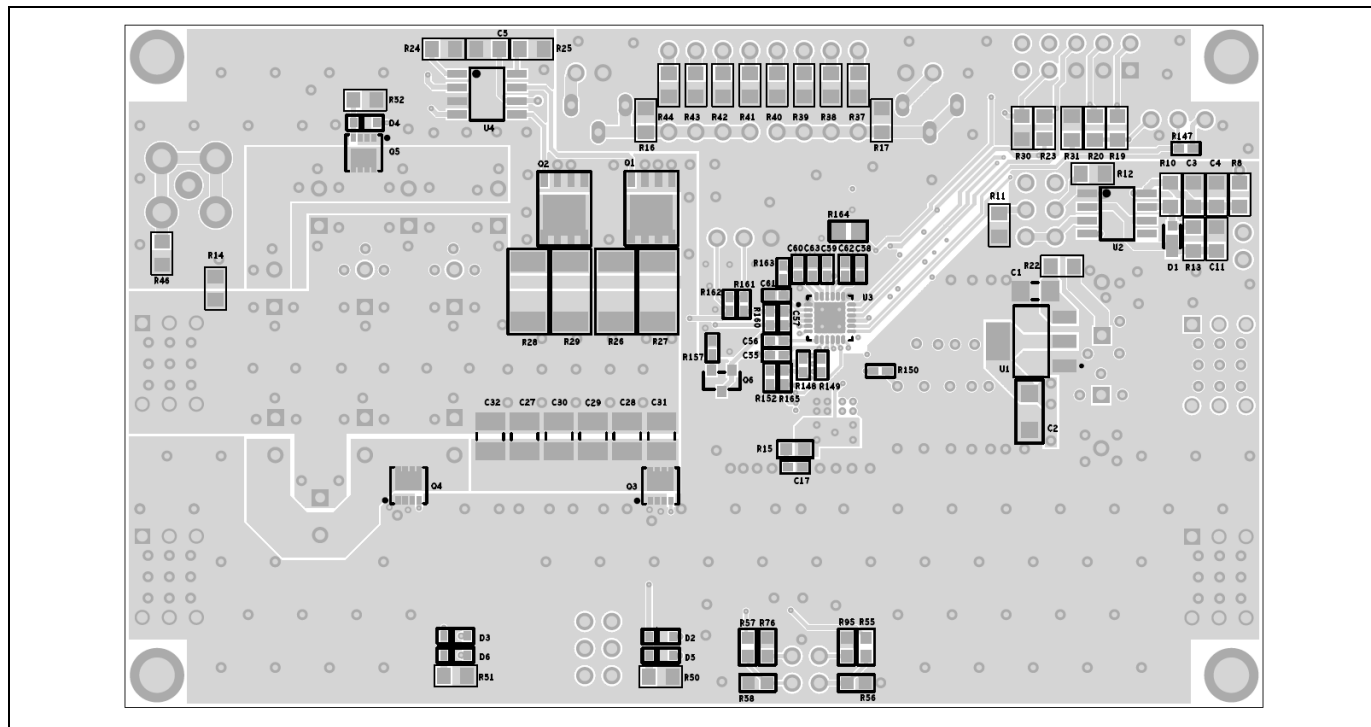
Revision	Date	Description
1.00	December 2, 2014	First release.
1.10	March 9, 2015	Edits to add ZSPM1507, ZSPM1508, and ZSPM1509. Updates for contact information.
1.20	April 27, 2015	Edits to add ZSPM1511, ZSPM1512, and ZSPM1513. Corrections for resistor value for Table 4.3. Minor edits for clarity.
	April 11, 2016	Changed to IDT branding.

## Appendix A: ZSPM15xx Evaluation Board

Figure A. 1 ZSPM15xx Evaluation Board Top-Side Layout

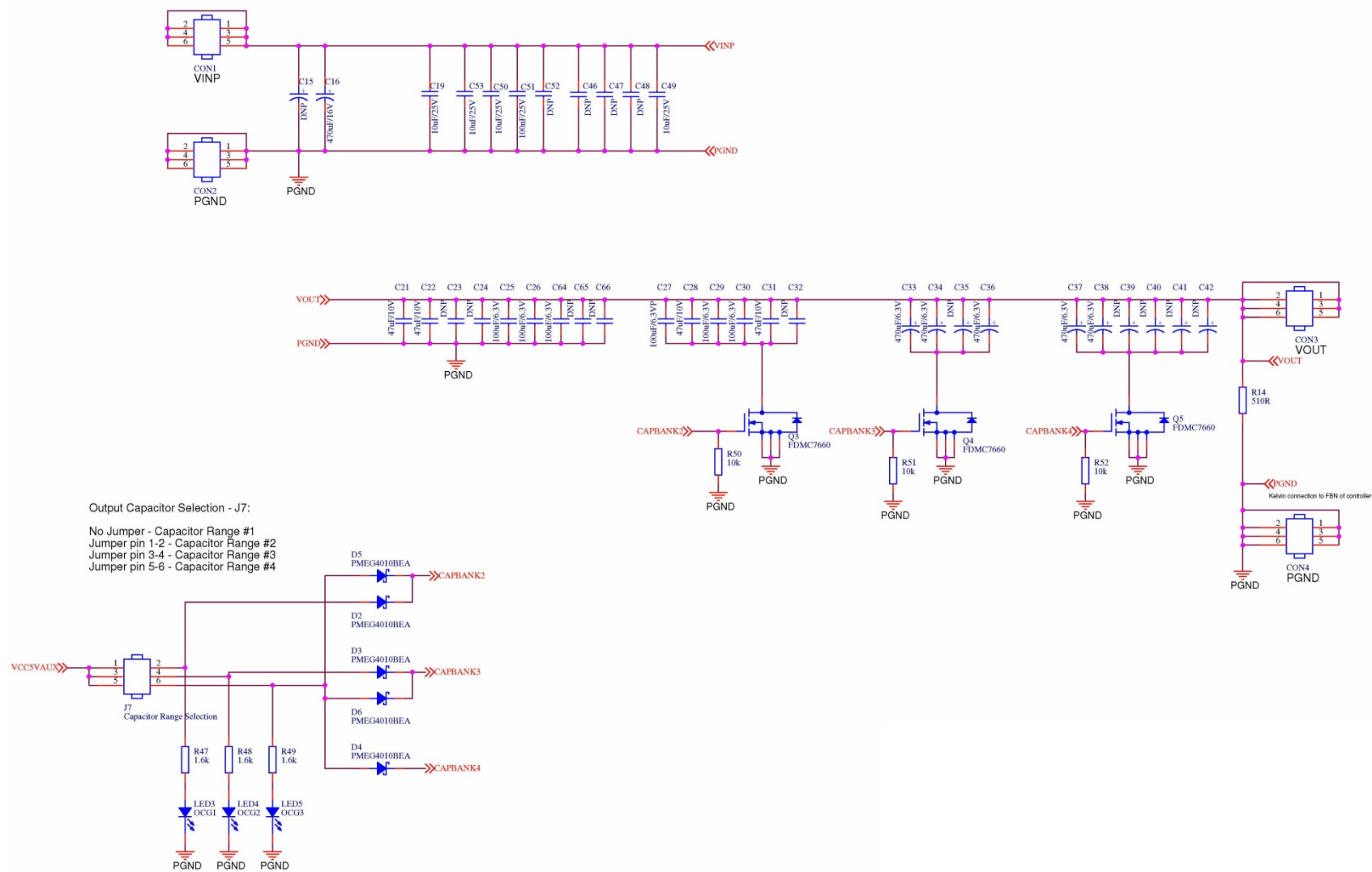


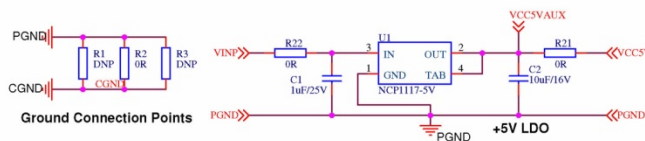
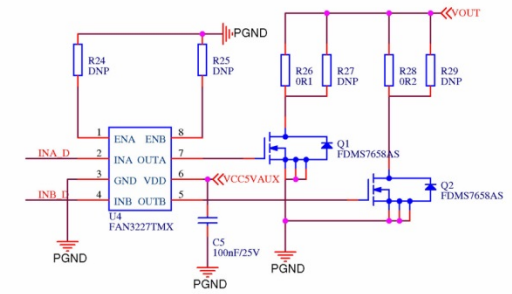
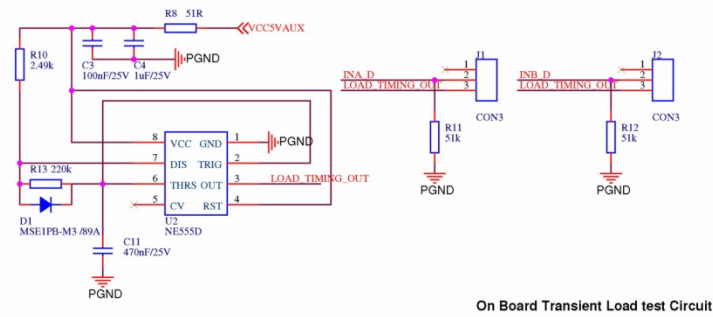
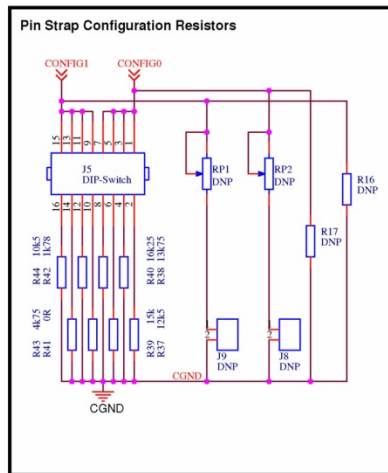
**Figure A. 2 ZSPM15xx Evaluation Board Bottom-Side Layout**



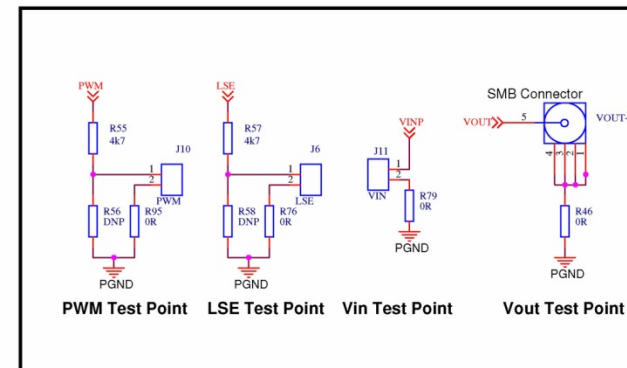
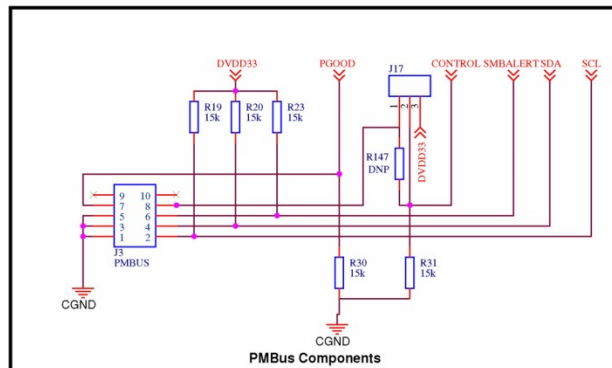








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