User Guide

3CH-TS13102-EVM

Galvanic Isolated Blocking 60V Power Load Switch

Introduction

The Semtech 3CH-TS13102-EVM is an evaluation platform for test and experimentation of galvanic isolated blocking 60V power load switch based on the Semtech TS13102 Controller. This evaluation module provides an idea solution for power switch device with bi-directional blocking used for many different application areas, such as power load/rail switching, input supply muxing,isolated supply muxing,HVAC control and so on.

Objectives

The objective of this User Guide is to provide a fast, easy and thorough method to experiment with and evaluate the Semtech solutions for this isolated power switch. Semtech offers a range of solutions to meet the needs of a wide range of system developers. Developers are provided with all the information on how this EVM was built as a starting point for their own designs using the TS13102 and other Semtech components.

Contents

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Product Description

TS13102 is a galvanic isolated 60V power switch device with bi-directional blocking. The device includes a single integrated 225mOhm high voltage FET, allowing high efficiency switching of power loads or other high current applications. The 3-channel TS13102 EVM supports galvanic isolated 3-channel 60V rated switches, which can be independently supplied from 24VAC supply.

TS13102 EVM board has the following features:
1. Supports independent 3-channel load switches.

2. Provides the ability for the switch to stay on (latched-on) even when the CLK from microcontroller cease to exist.

3. Dithering feature enabled, where the switch is opened for a time much less than time-constant of relay switch, thereby allowing all 3 TS13102s powered and all 3 switches remain closed.

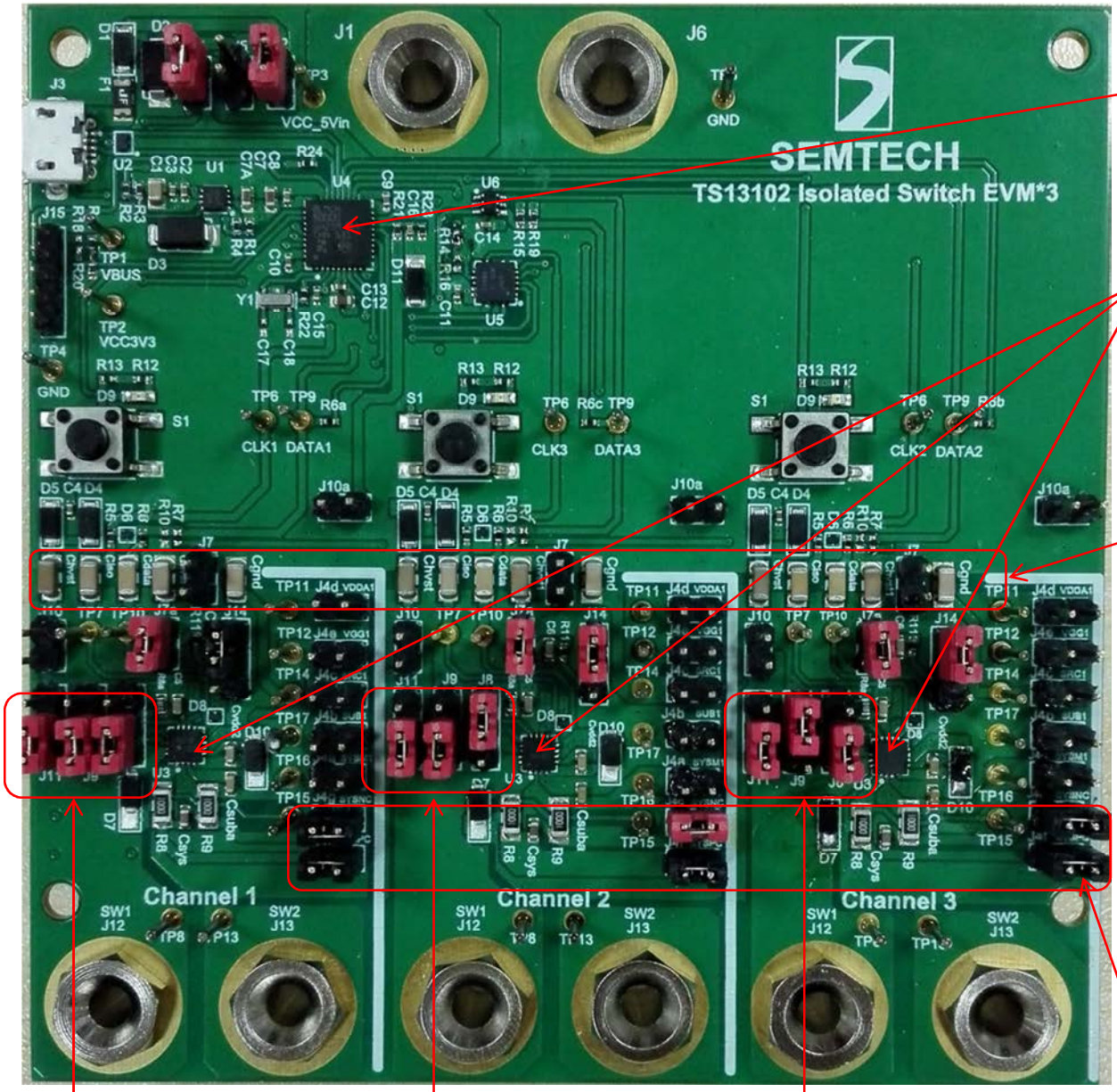
4. The TS13102 includes several protection features. Each FET has an integrated over-current shut-down to prevent device damage during short-circuit or other unusually high load conditions. If an over-current event is detected for a time the FET is latched off until the CLK turn off sequence is given.

5. Only a pair of GPIO pins can manage the command and control for up to 8 loads as long as each TS13102 has a unique address. The address pins are set using hard wired connections according to the Address Configuration Table shown in the Figure.

Address Configuration Table

Load #	AD2	AD1	AD0
0	SYSM	SYSM	SYSM
1	SYSM	SYSM	VDD
2	SYSM	VDD	SYSM
3	SYSM	VDD	VDD
4	VDD	SYSM	SYSM
5	VDD	SYSM	VDD
6	VDD	VDD	SYSM
7	VDD	VDD	VDD

3-CH-TS13102-EVM Jumper settings



Microcontroller

TS13102

Isoltation capacitors

The SYSP and SYSM pins for those TS13102 devices connected togother by these jumpers.

Load “0”address:

AD2AD1AD0=000

Load “1”address:

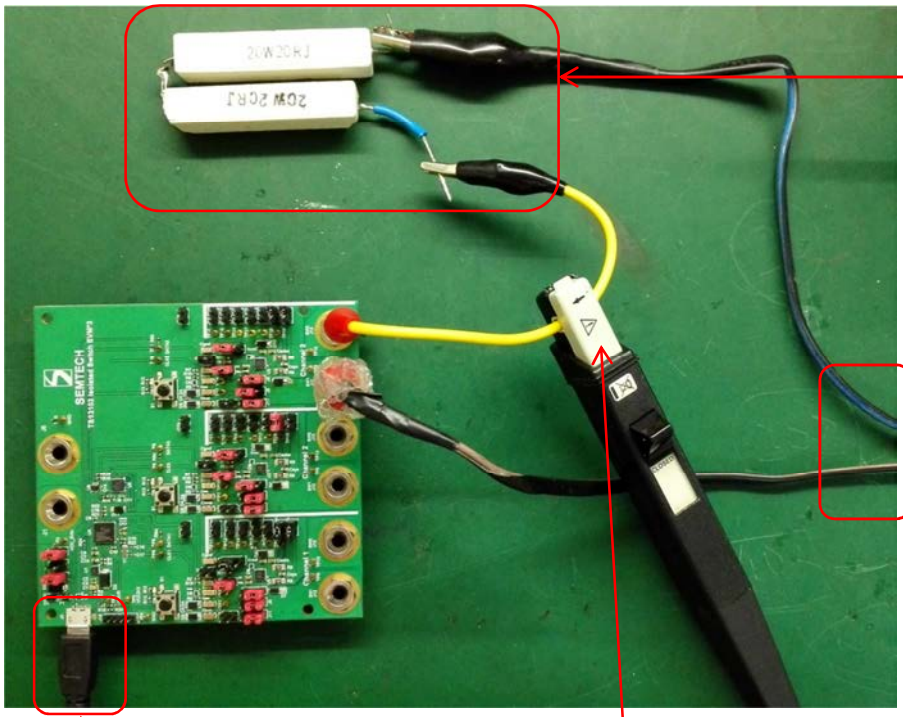
AD2AD1AD0=001

Load “2”address:

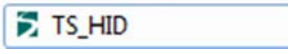
AD2AD1AD0=010

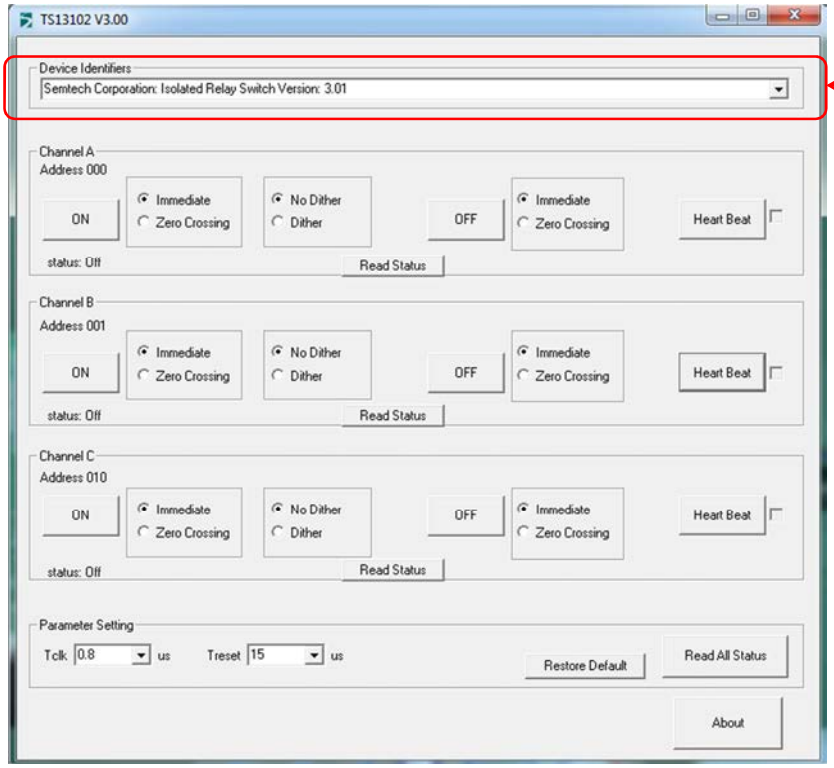
Standard Use

1. Verify that all power sources are either off or have their outputs disabled before proceeding.
2. The test set-up includes wires connection as shown below.

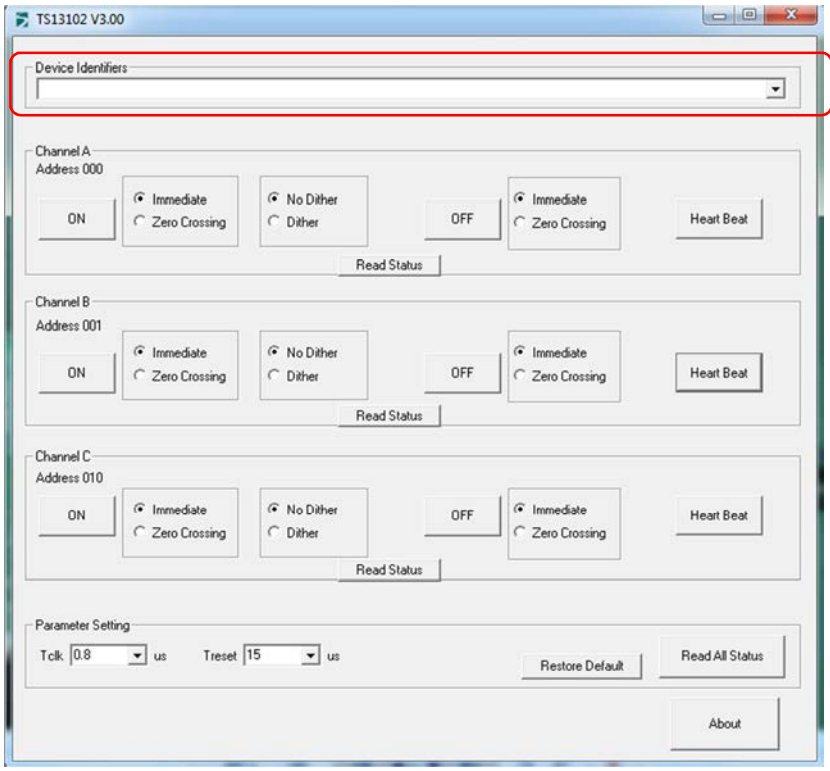


3. Connect the USB cable between TS13102EVM and computer.
4. Connect R-load and AC source,
5. Adjust the AC source to the desired input voltage range, such as 24Vac/2A.
6. Double-click the icon (TS_HID) to open the GUI that named “TS13102 V3.00”, then one window interface will appear.



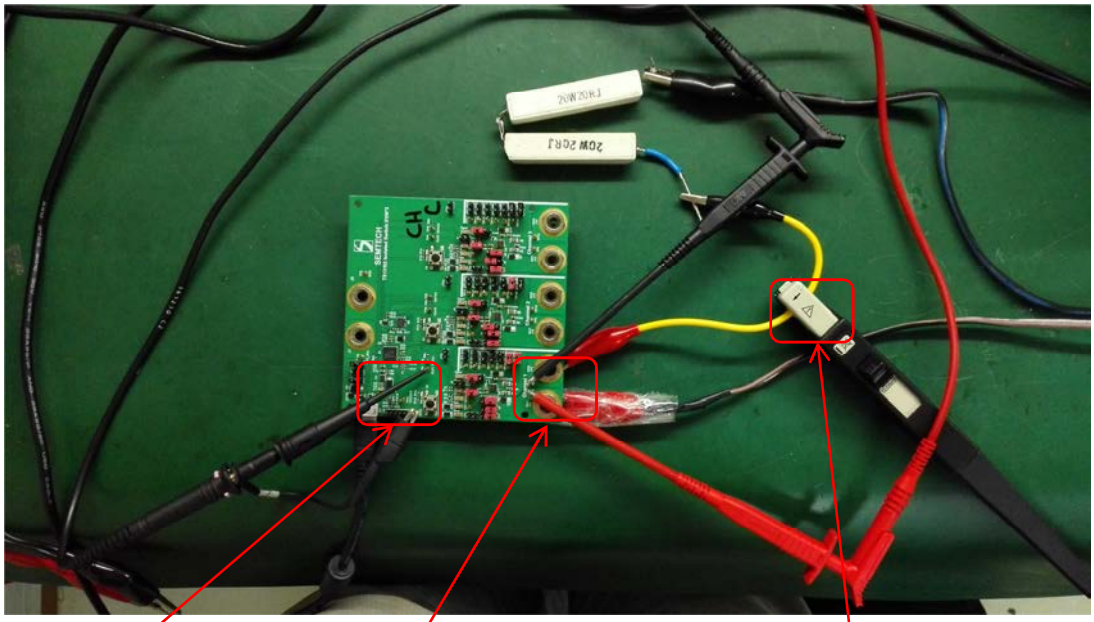


If see this text box, it means that communicated with MCU successfully.



Here means communication failed.

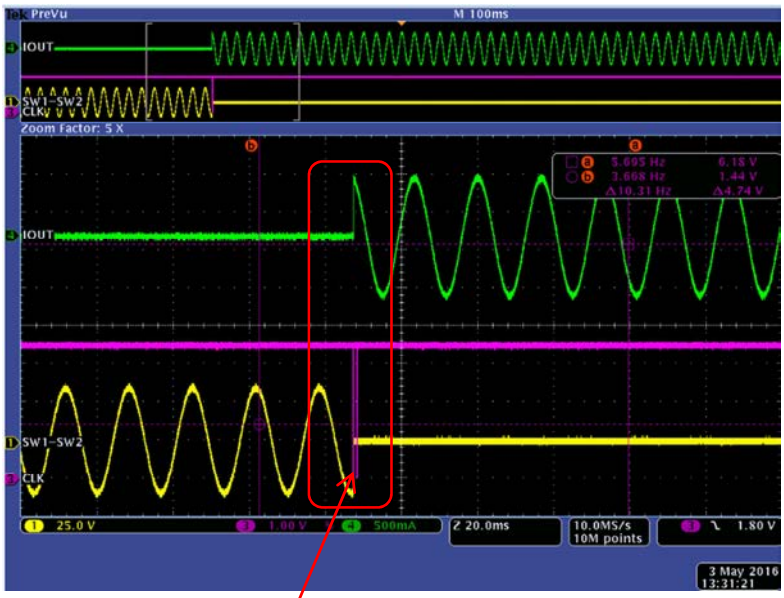
7. Turn on the AC power source , if necessary, can monitor the load current by using one current probe at load cable; voltage probe at CLK/DATA pin can monitor the clock/Data timing ,or diff-probe at SW1 and SW2 for AC source output voltage.



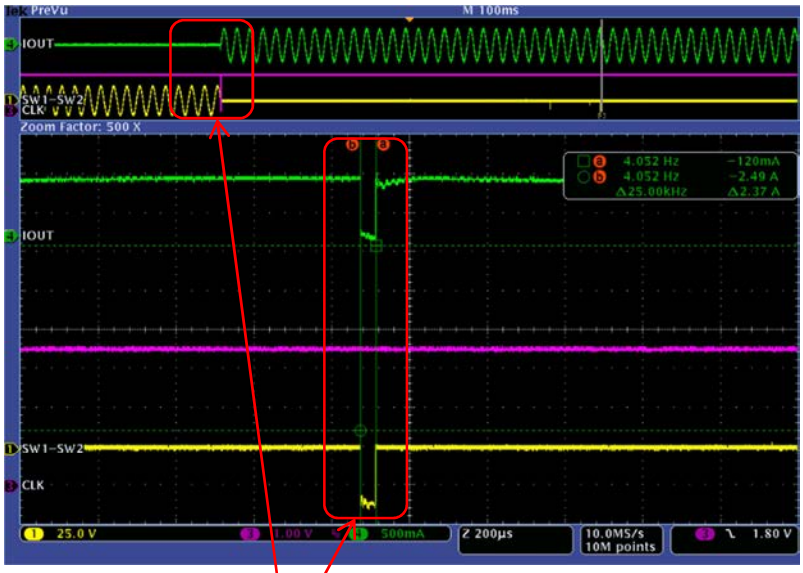
8. The window interface only support 3 channels command or control, for example, channel 2(address configure:001) selected to demonstrate turn-on or turn-off function; there are too many commands sent to the switches for various operation modes.

9. immediate turn-on and immediate turn-off function demonstration:

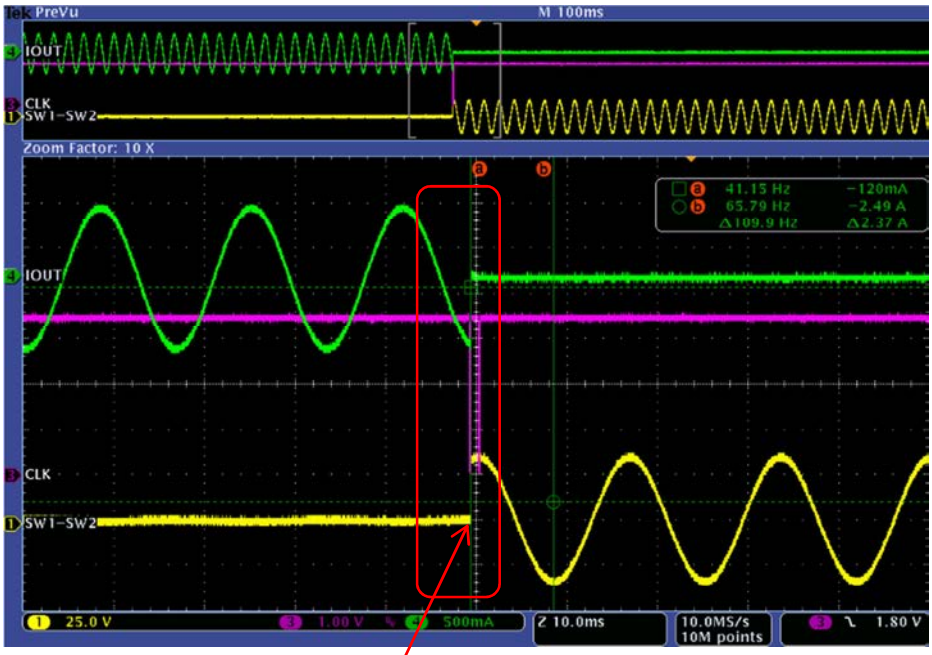
   Click the “ON” or “OFF” button to switch on or off the relevant relay (the physical push button on the board are not supported) after selecting the corresponding options.



Immediate turn-on with no dither



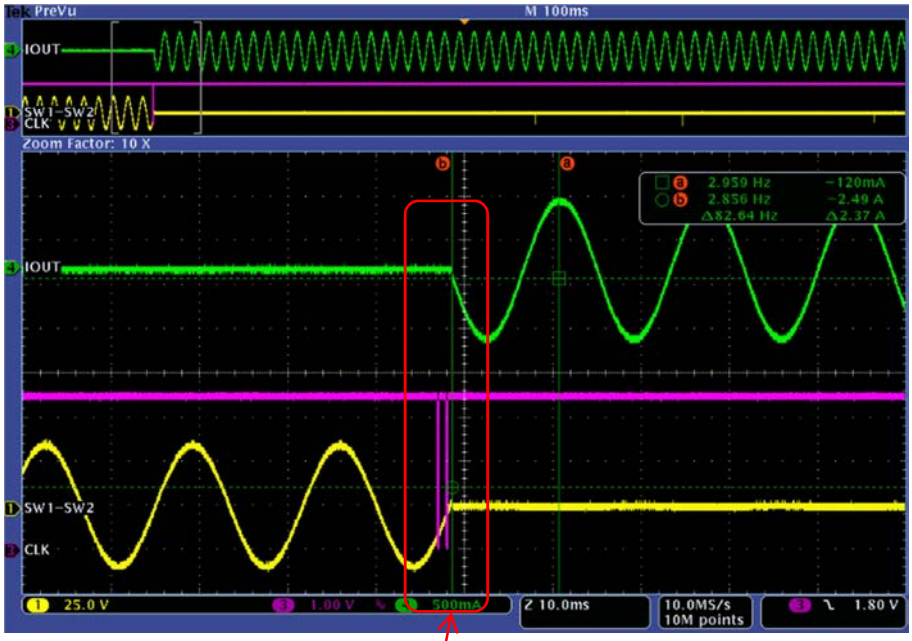
Immediate turn-on with dither



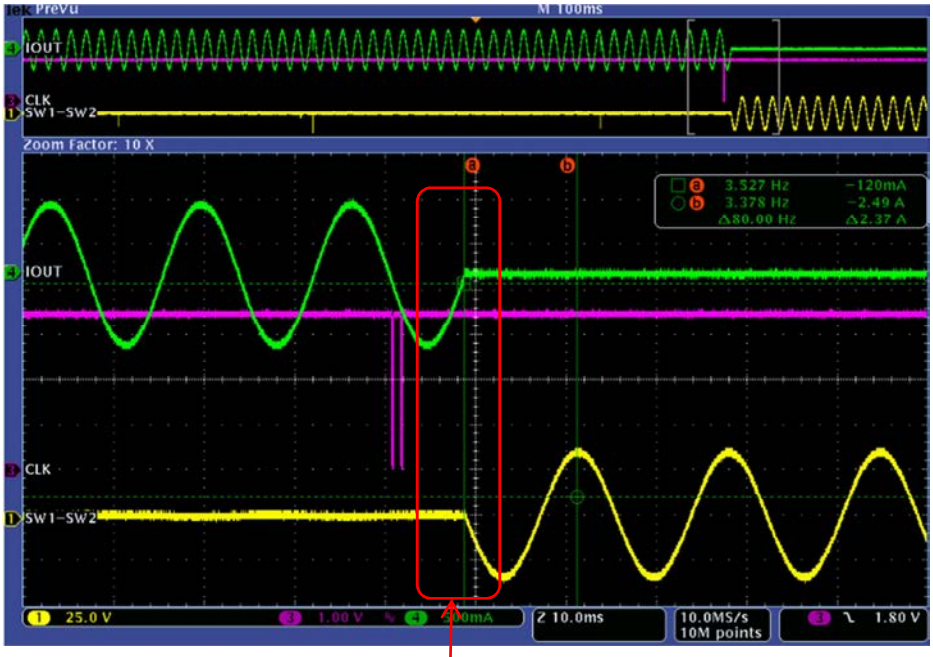
Immediate turn-off

10. zero-crossing turn-on and zero-crossing turn-off function demonstration:

Click the “ON” or “OFF” button to switch on or off the relevant relay (the physical push button on the board are not supported) after selecting the corresponding options.

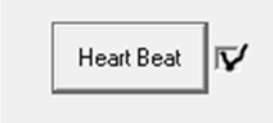


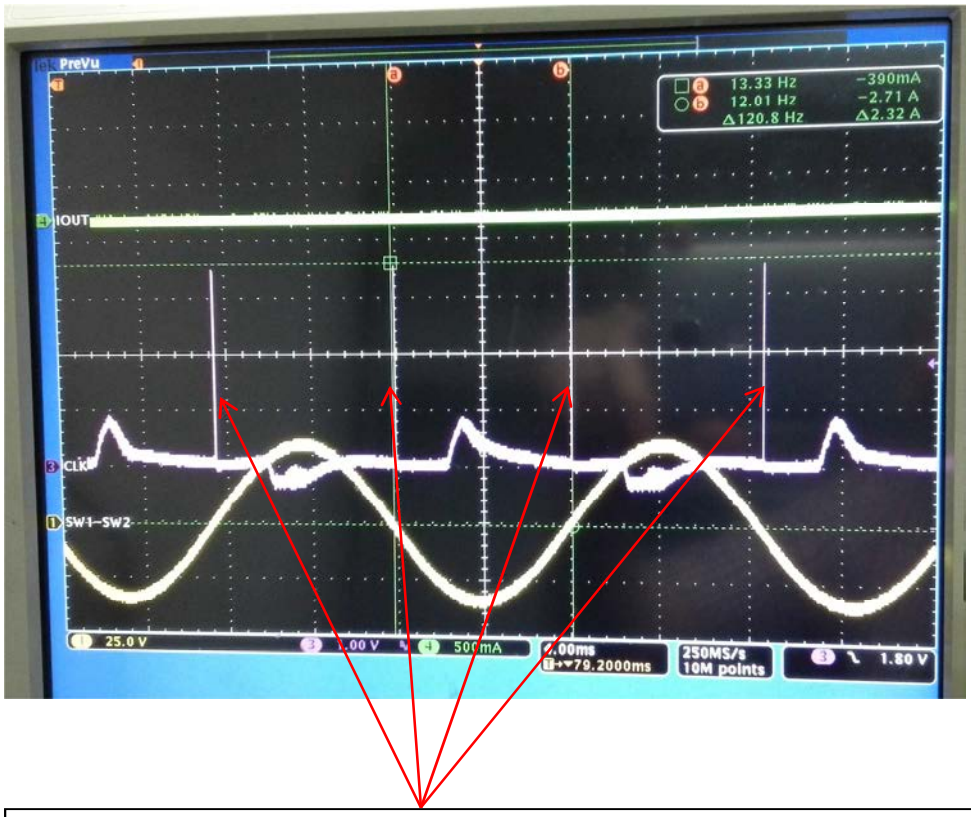
Zero-crossing turn-on with dither



Zero-crossing turn-off

11. Click the “Heart beat” button to activate the heart-beat signal (one pulse) from DATA pin which is synchronous with zero crossings of AC waveform when the swith is off. If detect the heart beat signals, the GUI shows in accordance with the following pattern.





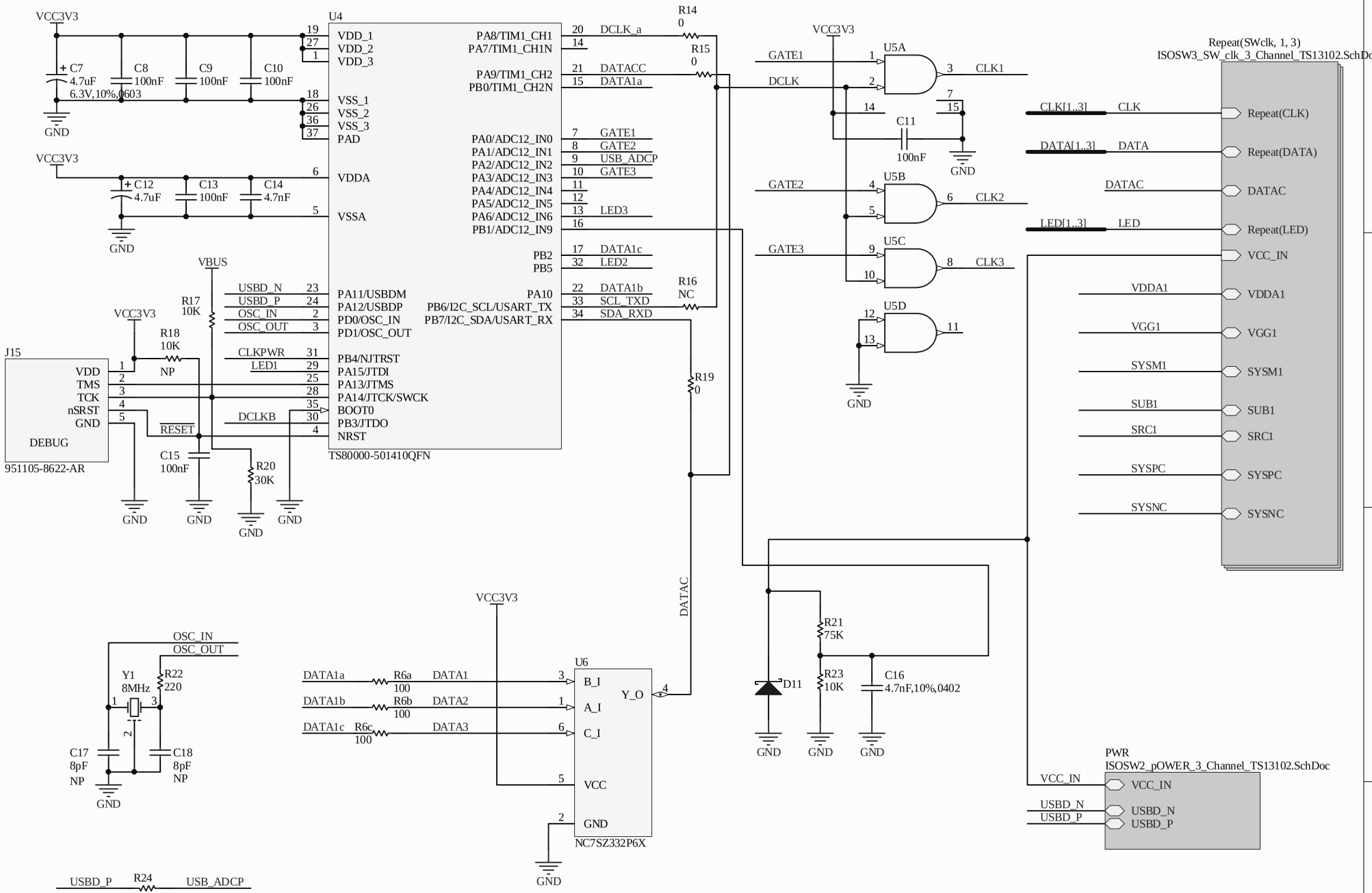
Heart-beat signals sent from DATA pin when the AC waveform is zero crossing.

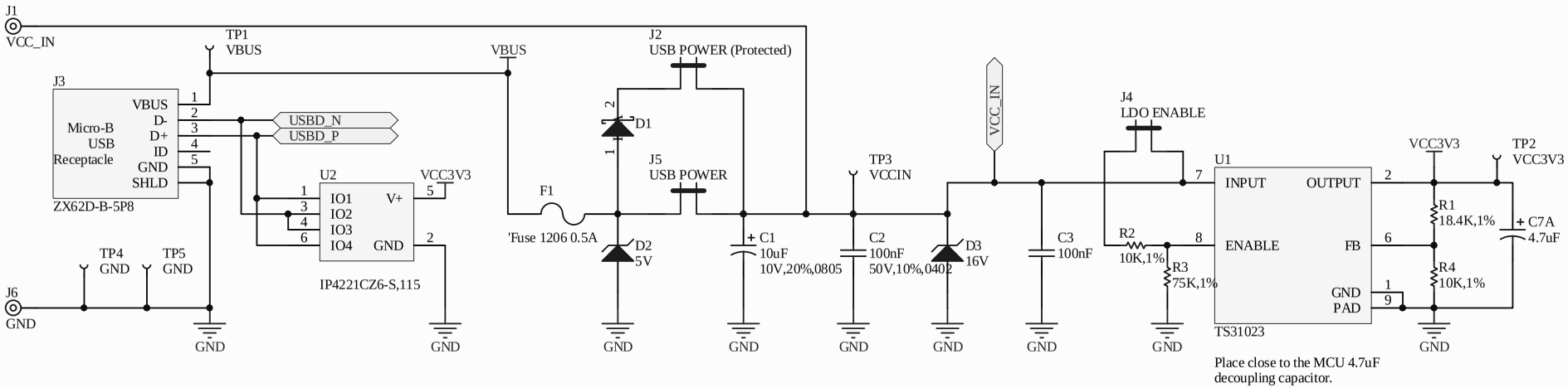
12. Turn off all connections and AC power source after all channels function verification.

Documentation

The following sections document the hardware design of the SC24243Q-EVM. This information can be used to better understand the functionality of the design, as well as assist in creating your own hardware solution based to some degree on this design

A.Schematic


VCC3V3
U4
VDD_1
VDD_2
VDD_3
VSS_1
VSS_2
VSS_3
PAD
VDDA
VSSA
PA8/TIM1_CH1
PA7/TIM1_CH1N
PA9/TIM1_CH2
PB0/TIM1_CH2N
PA0/ADC12_IN0
PA1/ADC12_IN1
PA2/ADC12_IN2
PA3/ADC12_IN3
PA4/ADC12_IN4
PA5/ADC12_IN5
PA6/ADC12_IN6
PB1/ADC12_IN9
PB2
PB5
PA11/USBDM
PA12/USBDP
PD0/OSC_IN
PD1/OSC_OUT
PB4/NJTRST
PA15/JTDI
PA13/JTMS
PA14/JTCK/SWCK
BOOT0
PB3/JTDO
NRST
PA10
PB6/I2C_SCL/USART_TX
PB7/I2C_SDA/USART_RX
DCLK_a
DATACC
DATA1a
GATE1
GATE2
USB_ADCP
GATE3
LED3
DATA1c
LED2
DATA1b
SCL_TXD
SDA_RXD
TS80000-501410QFN
C7
4.7uF
6.3V,10%,0603
C8
100nF
C9
100nF
C10
100nF
C12
4.7uF
C13
100nF
C14
4.7nF
GND
R14
0
R15
0
R16
NC
R17
10K
R18
10K
NP
R19
0
R20
30K
C15
100nF
VBUS
USBD_N
USBD_P
OSC_IN
OSC_OUT
CLKPWR
LED1
RESET
DCLKB
J15
VDD
TMS
TCK
nSRST
GND
DEBUG
951105-8622-AR
U5A
U5B
U5C
U5D
GATE1
GATE2
GATE3
DCLK
CLK1
CLK2
CLK3
C11
100nF
Repeat(SWclk, 1, 3)
ISOSW3_SW_clk_3_Channel_TS13102.SchDoc
CLK[1..3]
CLK
DATA[1..3]
DATA
DATAC
LED[1..3]
LED
Repeat(CLK)
Repeat(DATA)
DATAC
Repeat(LED)
VCC_IN
VDDA1
VGG1
SYSM1
SUB1
SRC1
SYSPC
SYSNC
R21
75K
R23
10K
C16
4.7nF,10%,0402
D11
Y1
8MHz
R22
220
C17
8pF
NP
C18
8pF
NP
U6
B_I
A_I
C_I
Y_O
VCC
GND
NC7SZ332P6X
R6a
R6b
R6c
100
DATA1
DATA2
DATA3
R24
1.5K
USB_ADCP
PWR
ISOSW2_pOWER_3_Channel_TS13102.SchDoc
Title
Size
Letter
Number
Revision
Date:
5/3/2016
Sheet of
File:
C:\Power management\..\ISOSW_CPU_3_Channel_TS13102.SchDoc
Drawn By:



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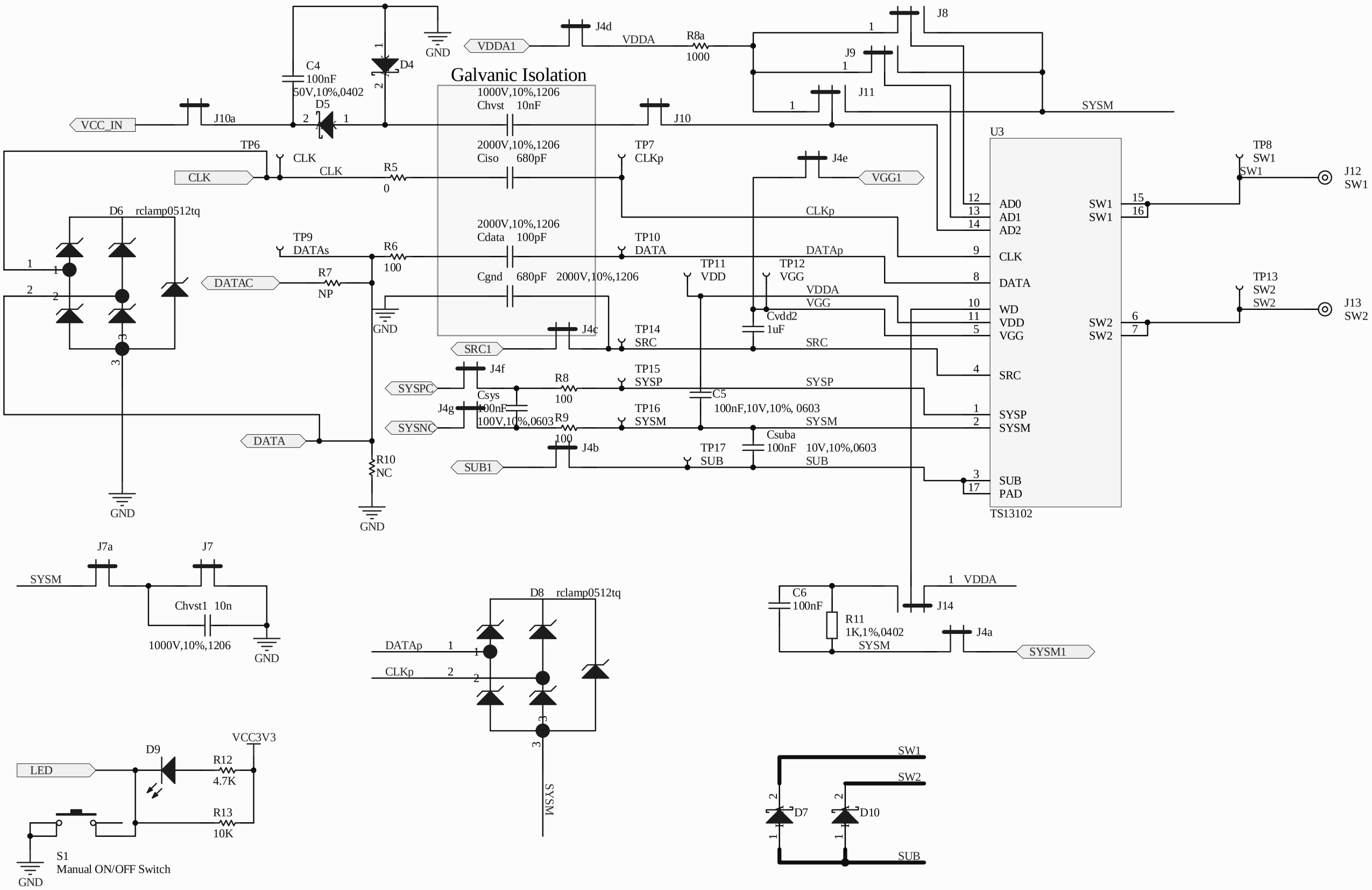


Title	***Isolated Switch EVM Switches***		
Size: Letter	Number:	Revision: 0.3	
Date: 5/3/2016	Time: 7:02:34 PM	Sheet 3 of 3	

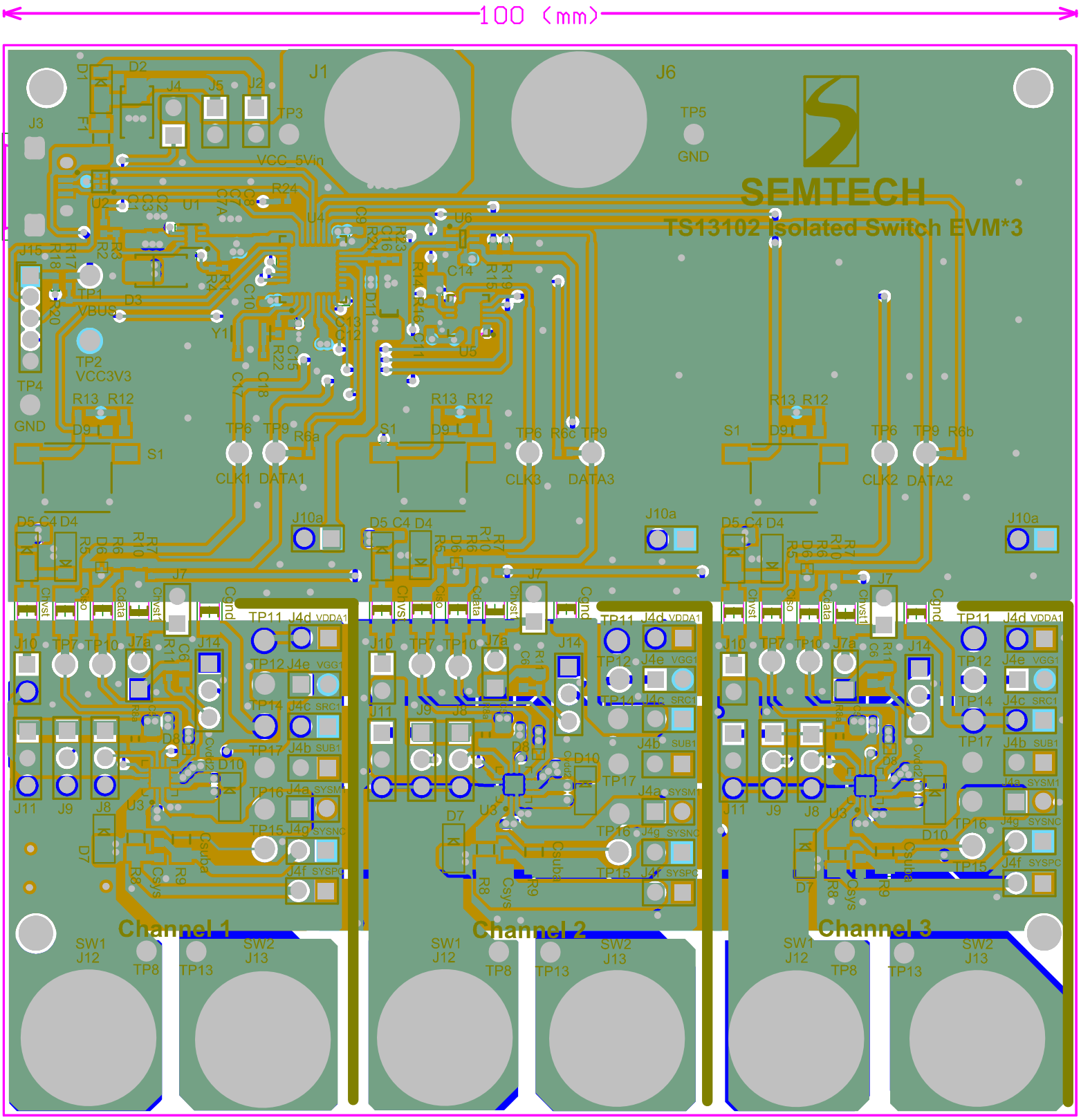
TRIUNE SYSTEMS
1101 Resource Dr
Suite 121
Plano, Texas 75074

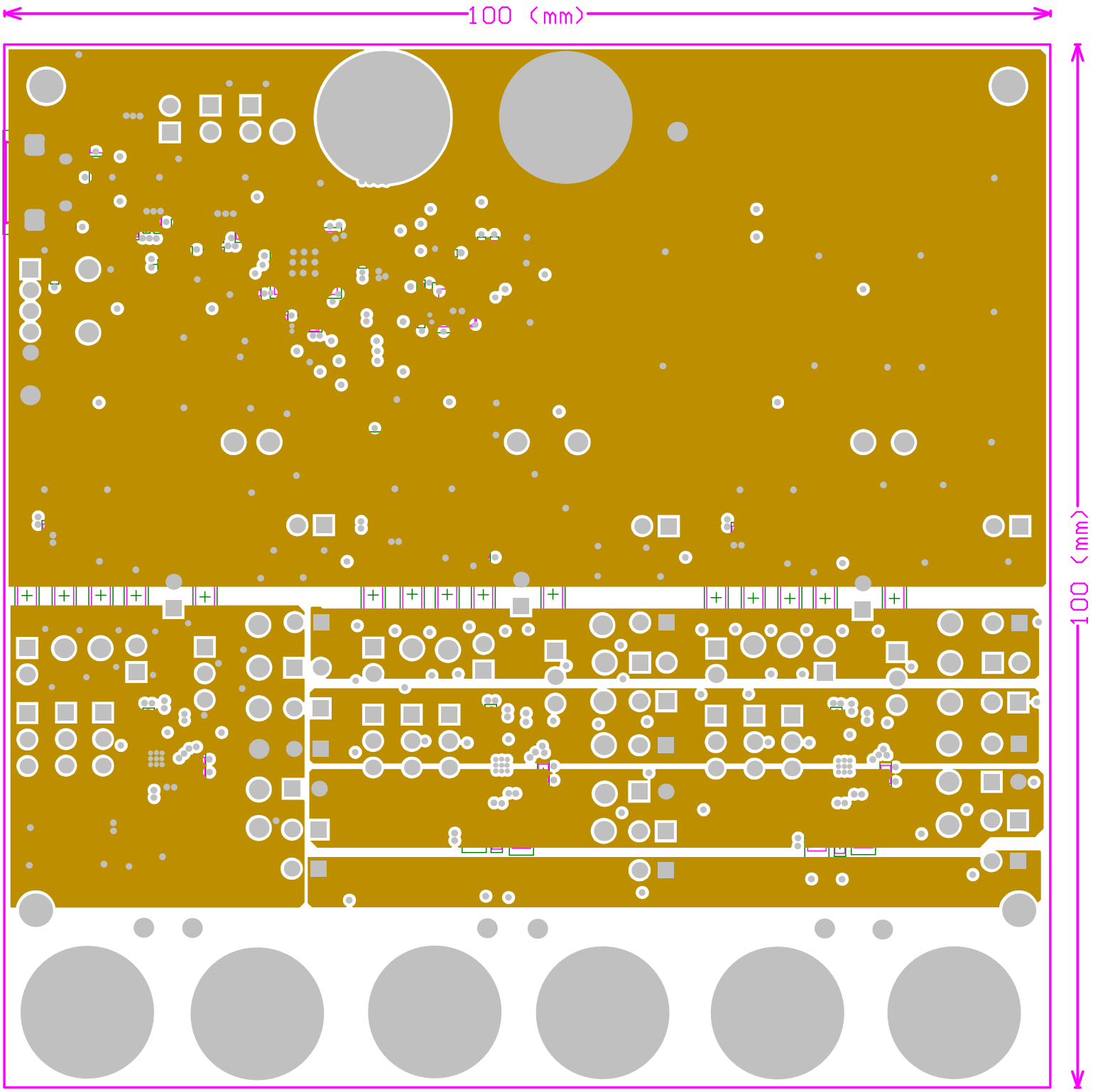
B.Bill Of Materials “BOM”

LogicalDesignator	Description	Value	Value2	Manufacturer	ManufacturerCode	Quantity
C1	Capacitor	10uF	10V,20%,0805			1
C2, C4	Capacitor	100nF	50V,10%,0402			4
C3	Capacitor	100nF	50V,10%,0402			1
C5	Capacitor	100nF	10V,10%, 0603			3
C6	Capacitor	100nF	10V,10%,0603			3
C7, C7A	Capacitor	4.7uF	6.3V,10%,0603	Tayio Yuden	JMK107BJ475KA-T	2
C8, C9, C10, C11, C13	Capacitor	100nF	10V,10%,0402			5
C12	Capacitor	4.7uF	6.3V,10%,0603	Tayio Yuden	JMK107BJ475KA-T	1
C14	Capacitor	4.7nF	10V,10%,0402			1
C15	Capacitor	100nF	10V, 10%,0402			1
C16	Capacitor	4.7nF	10V,10%,0402			1
C17, C18	Capacitor	NP				2
Cdata,	Capacitor	100pF	2000V,10%,1206			3
Cgnd	Capacitor	680pF	2000V,10%,1206			3
Chvst1	Capacitor	10n	1000V,10%,1206			1
Chvst	Capacitor	10nF	1000V,10%,1206			3
Ciso	Capacitor	680pF	2000V,10%,1206			3
Csuba	Capacitor	100nF	10V,10%,0603			3
Csys	Capacitor	100nF	100V,10%,0603			3
Cvdd2	Capacitor	1uF	10V,10%,0603			3
D1, D4, D5, D7, D10	Schottky Diode	'PowerDI-123		Diodes	DFLS160-7, Diode	13
D2	Zener Diode	5V,'SMA		Bourns	SMA J5.0CA, TVS Diode,	1
D3	Zener Diode	16V,'SMA		Bourns	SMA J16A, TVS Diode 16V	1
D6, D8	TVS diode	TVS diode, package:'SGB1006N3T		SEMTECH	rclamp0512tq	6
D9	LED	'0603 Green LED				3
D11	Schottky Diode	'Schottky Diode,'SOD123		Diodes	DFLS160-7	1
F1	Fuse	'Fuse 1206 0.5A				1
J1	Banana Jack					1
J6	Banana Jack					1
J12	Banana Jack					3
J13	Banana Jack					3
J3	Micro-B USB, Receptacle, 5 Position, SMT and Trough-Hole			Hirose	ZX62D-B-5P8	1
U2	USB ESD Protection	'USB ESD Protection		NXP	IP4221CZ6-S,115	1
J2	Jumper	'Connector, Pin Header, 2-Pin , 2.54mm pitch				1
J4	Jumper	'Connector, Pin Header, 2-Pin , 2.54mm pitch				1
J4a	Jumper	'Connector, Pin Header, 2-Pin , 2.54mm pitch				3
J4b	Jumper	'Connector, Pin Header, 2-Pin , 2.54mm pitch				3
J4c	Jumper	'Connector, Pin Header, 2-Pin , 2.54mm pitch				3
J4d	Jumper	'Connector, Pin Header, 2-Pin , 2.54mm pitch				3
J4e	Jumper	'Connector, Pin Header, 2-Pin , 2.54mm pitch				3
J4f	Jumper	'Connector, Pin Header, 2-Pin , 2.54mm pitch				3
J4g	Jumper	'Connector, Pin Header, 2-Pin , 2.54mm pitch				3
J5	Jumper	'Connector, Pin Header, 2-Pin , 2.54mm pitch				1
J7	Jumper	'Connector, Pin Header, 2-Pin , 2.54mm pitch				3
J7a	Jumper	'Connector, Pin Header, 2-Pin , 2.54mm pitch				3
J8, J9, J11, J14	Jumper	'Connector, Pin Header, 3-Pin , 2.54mm pitch				12
J10	Jumper	'Connector, Pin Header, 2-Pin , 2.54mm pitch				3
J10a	Jumper	'Connector, Pin Header, 2-Pin , 2.54mm pitch				3
J15	JTAG Debug Connector	'Connector, Pin Header, 5-Pin , 2.00mm pitch		3M	951105-8622-AR	1
R1	Resistor	18.4K	1%,0402			1
R2, R4	Resistor	10K	1%,0402			2
R3	Resistor	75K	'1%,0402			1
R5	Resistor	0	1%,0402			3
R6	Resistor	100	1%,0402			3
R6a,R6b,R6C	Resistor	100	1%,0402			3
R8a	Resistor	1000	1%, 0603			3
R8, R9	Resistor	100	1%, 1206			6
R10	Resistor	NP	1%,0402			3
R11	Resistor	1K	1%,0402			3
R12	Resistor	4.7K	1%,0402			3
R13	Resistor	10K	1%,0402			3
R17, R23	Resistor	10K	1%, 0402			2
R18,R14,	Resistor	NP				2
R7	Resistor	NP				3
R15, R16, R19	Resistor	0	1%, 0402			3

R20	Resistor	30K	1%, 0402			1
R21	Resistor	75K	1%, 0402			1
R22	Resistor	220	1%, 0402			1
R24	Resistor	1.5K	1%, 0402			1
S1	Switch	'Manual ON/OFF Switch,SW_FSM4JSMA		TE Connectivity	FSM4JSMA	3
TP1	Testpoint	'Test Points , single Pin,0.9mm diameter				1
TP2	Testpoint	'Test Points , single Pin,0.9mm diameter				1
TP3	Testpoint	'Test Points , single Pin,0.9mm diameter				1
TP4, TP5	Testpoint	'Test Points , single Pin,0.9mm diameter				2
TP6	Testpoint	'Test Points , single Pin,0.9mm diameter				3
TP7	Testpoint	'Test Points , single Pin,0.9mm diameter				3
TP8	Testpoint	'Test Points , single Pin,0.9mm diameter				3
TP9	Testpoint	'Test Points , single Pin,0.9mm diameter				3
TP10	Testpoint	'Test Points , single Pin,0.9mm diameter				3
TP11	Testpoint	'Test Points , single Pin,0.9mm diameter				3
TP12	Testpoint	'Test Points , single Pin,0.9mm diameter				3
TP13	Testpoint	'Test Points , single Pin,0.9mm diameter				3
TP14	Testpoint	'Test Points , single Pin,0.9mm diameter				3
TP15	Testpoint	'Test Points , single Pin,0.9mm diameter				3
TP16	Testpoint	'Test Points , single Pin,0.9mm diameter				3
TP17	Testpoint	'Test Points , single Pin,0.9mm diameter				3
U1	IC	Linear Regulator		Triune Systems	TS31023	1
U3	IC	60V isolated power switch,16pin QFN (3x3)		Triune Systems	TS13102	3
U4	IC	Single Channel Wireless Power Transmitter Controller		Triune Systems	TS80000-501410QFN	1
U5	IC	Quadruple 2-Input Positive-AND Gate		TI	SN74LV08ARGYR	1
U6	IC	OR gate,'SC70-6N		Fairchild	NC7SZ332P6X	1
Y1	Ceramic Resonator	Ceramic Resonator,8MHz		Murata	CSTCE8M00G55-R0	1

C.Board Layout

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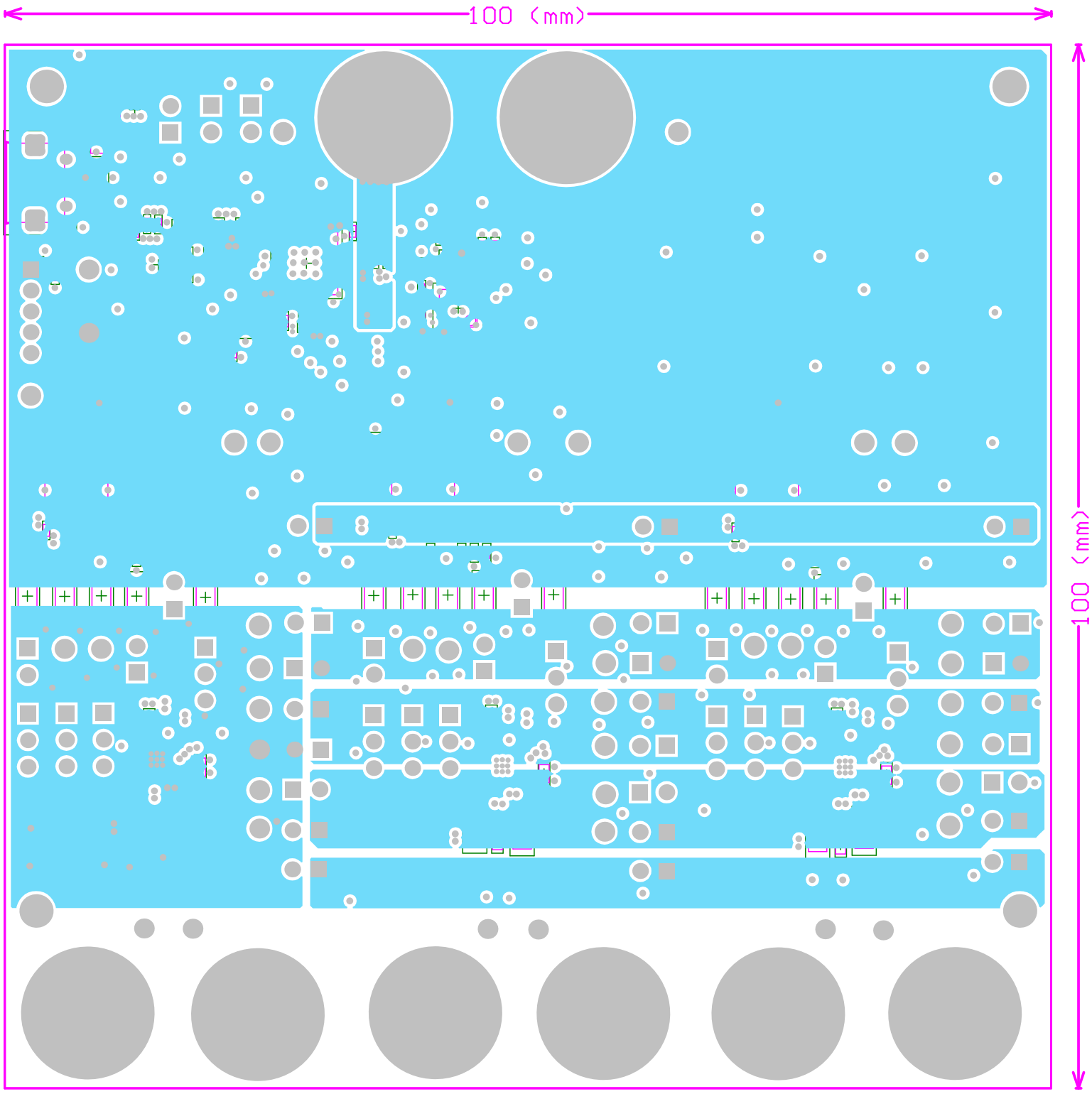
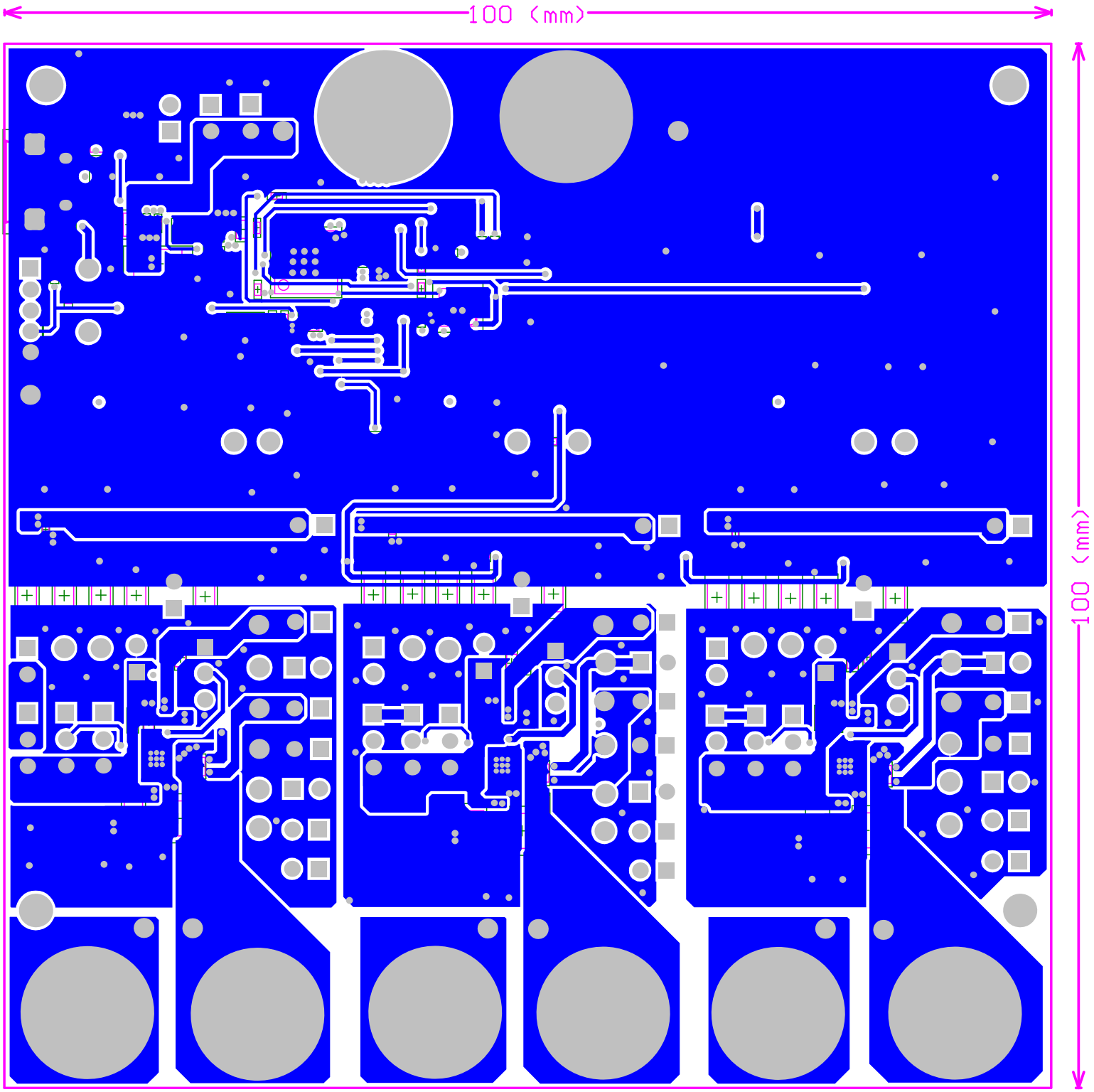
100 (mm)


100 (mm)
100 (mm)


100 (mm)
100 (mm)

Contact Information

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