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April 1st, 2010
Renesas Electronics Corporation

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R2J20701NP 1phase POL EVB (Rev.2.0)

R2J20701NP Evaluation Board

Introduction

The R2J20701NP 1phase POL EVB is an evaluation board for the single-phase DC/DC converter using the all-in-one SiP for POL (point-of-load).

R2J20701NP is including a peak current mode PWM IC, a high-side MOS FET and a low-side MOS FET in a thin small 56-pin QFN package (8mm × 8mm). Besides single-phase operation, it can also compose two-phase and multi-channel operation easily. In case of multi-channel operation, output voltage can make some sequence each other easily.

In this application note, the specifications, operating, and measurement result of the R2J20701NP 1pahse POL EVB are described. Diagrams of circuits, list of parts, and patterns of printed boards.

The following materials are available for reference.

- R2J20701NP Data sheet
- R2J20701NP 2phase POL EVB2 Application note
- R2J20701NP 2channel POL EVB2 Application note

Contents

1. Method of Using Evaluation Board

1.1 Specifications of Evaluation Board

Table 1 Main Specifications of Evaluation Board

Item	Pin Name	Recommended Condition (Initial setting)	Setting Range
Input voltage	VIN & VIN_RTN (for applying) TP-IN & TP-IN_RTN (for measuring)	12 V	8 V to 16 V
Output voltage	TP-OUT & TP-OUT_RTN	1.8 V	0.6 V ~
Output current	VOUT & VOUT_RTN	OCP: around 20 A	0 A to 35 A
Operating frequency		500 kHz	200 kHz to 1 MHz

1.2 Functions of Evaluation Board

(1) ON/OFF function
(2) Load transient response test circuit
(3) Soft-start function
(4) OCP function (OCP: Over Current Protection)
(5) External synchronous function

1.3 Method of Connecting Evaluation Board

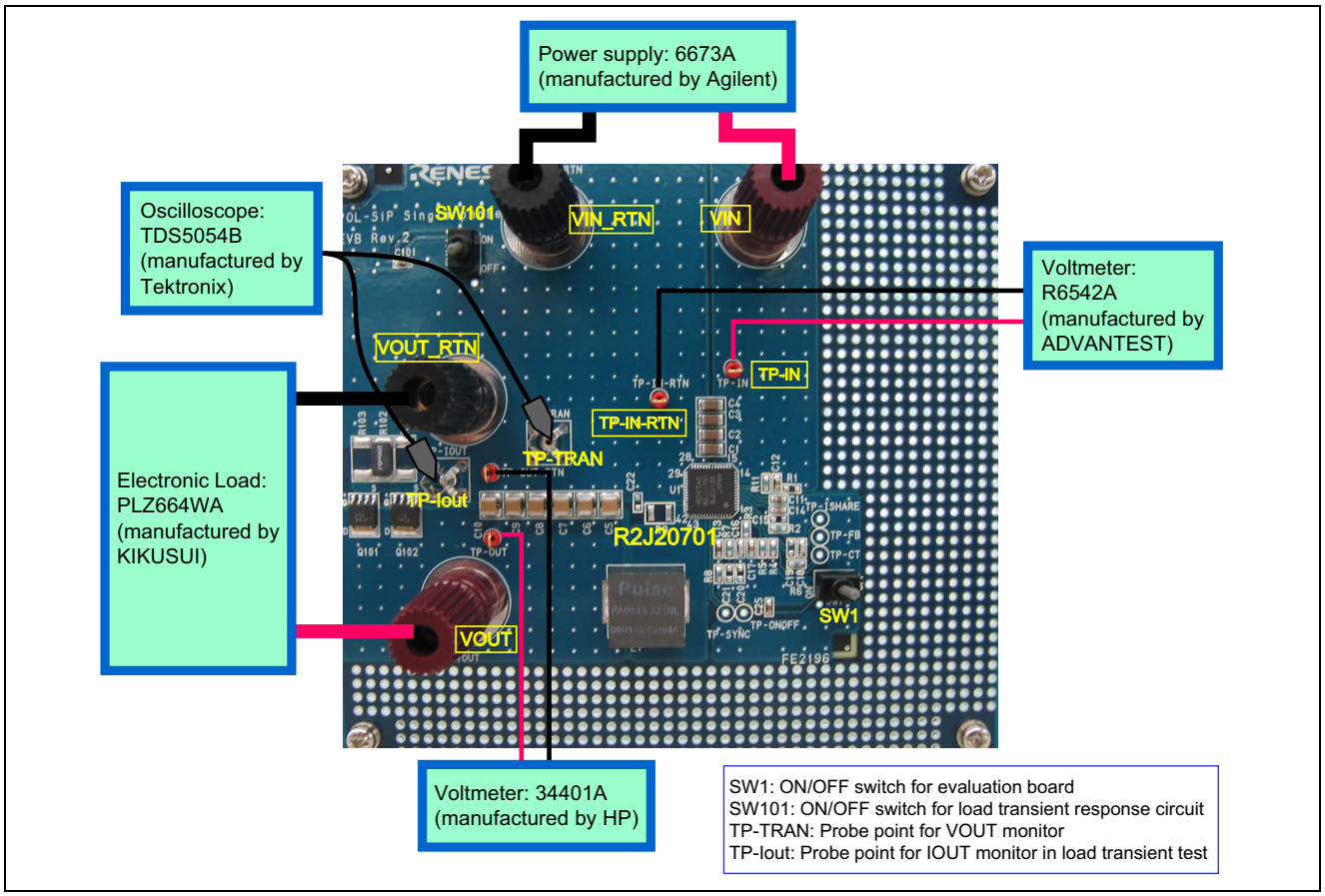

Figure 1 Connection Diagram of Evaluation Board

2. Result of Measurement by Evaluation Board

2.1 Efficiency/Loss/Regulation Data

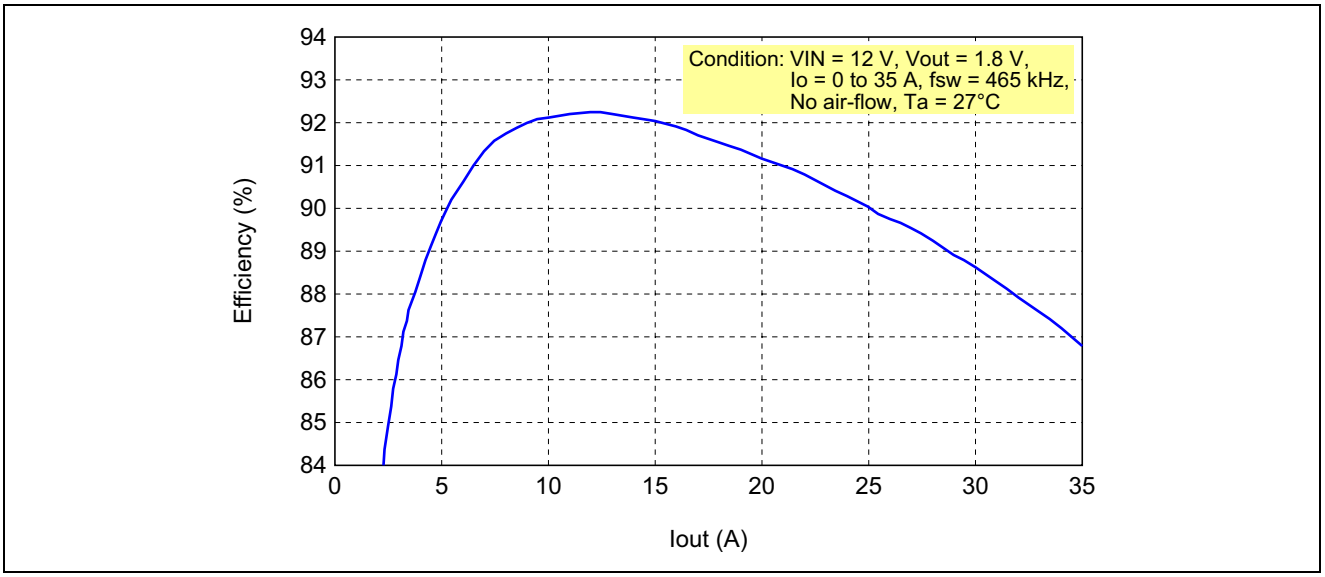

Figure 2 Efficiency vs. Output Current Characteristics

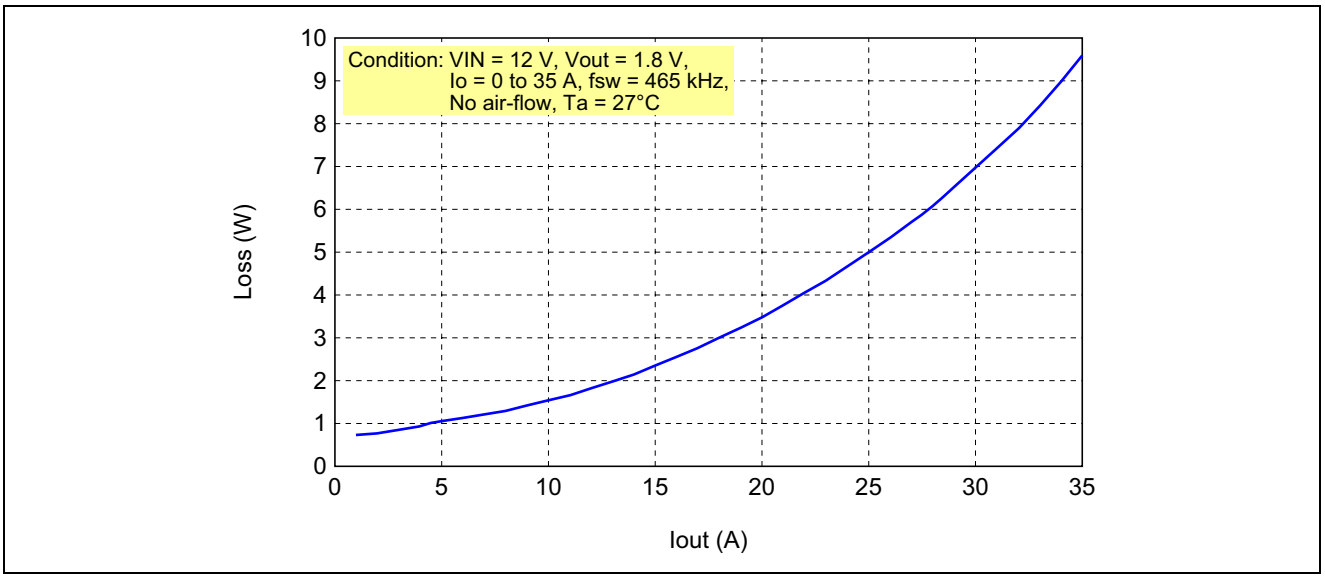

Figure 3 Loss vs. Output Current Characteristics

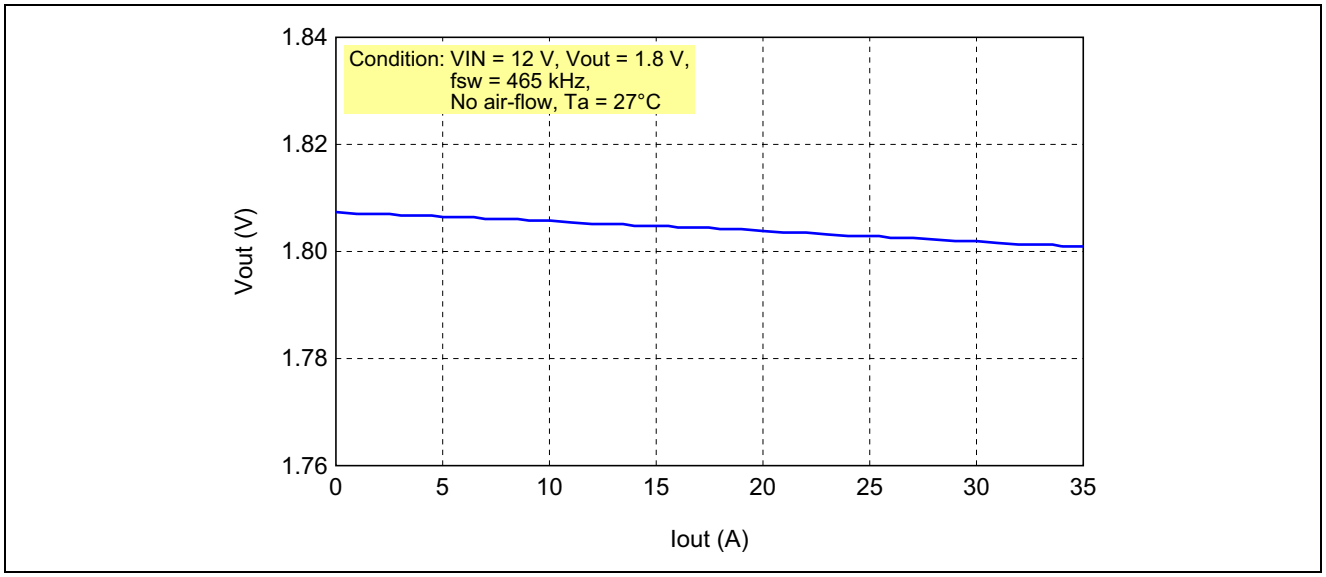

Figure 4 Output Voltage vs. Output Current Characteristics

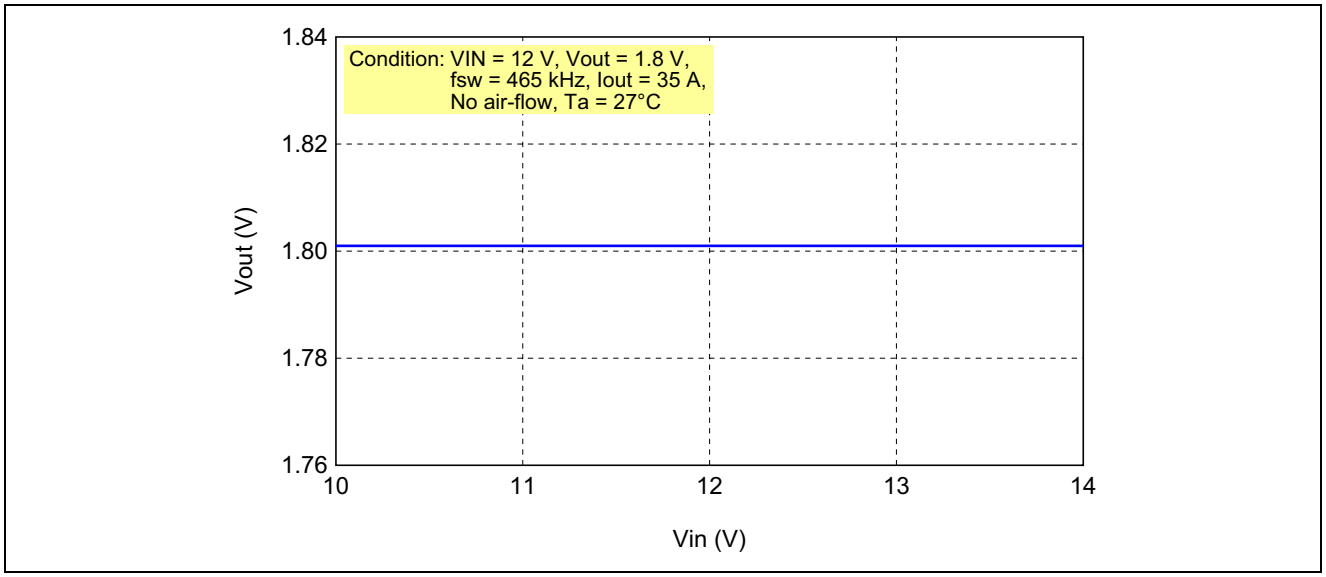

Figure 5 Output Voltage vs. Input Voltage Characteristics

2.2 Various Waveforms

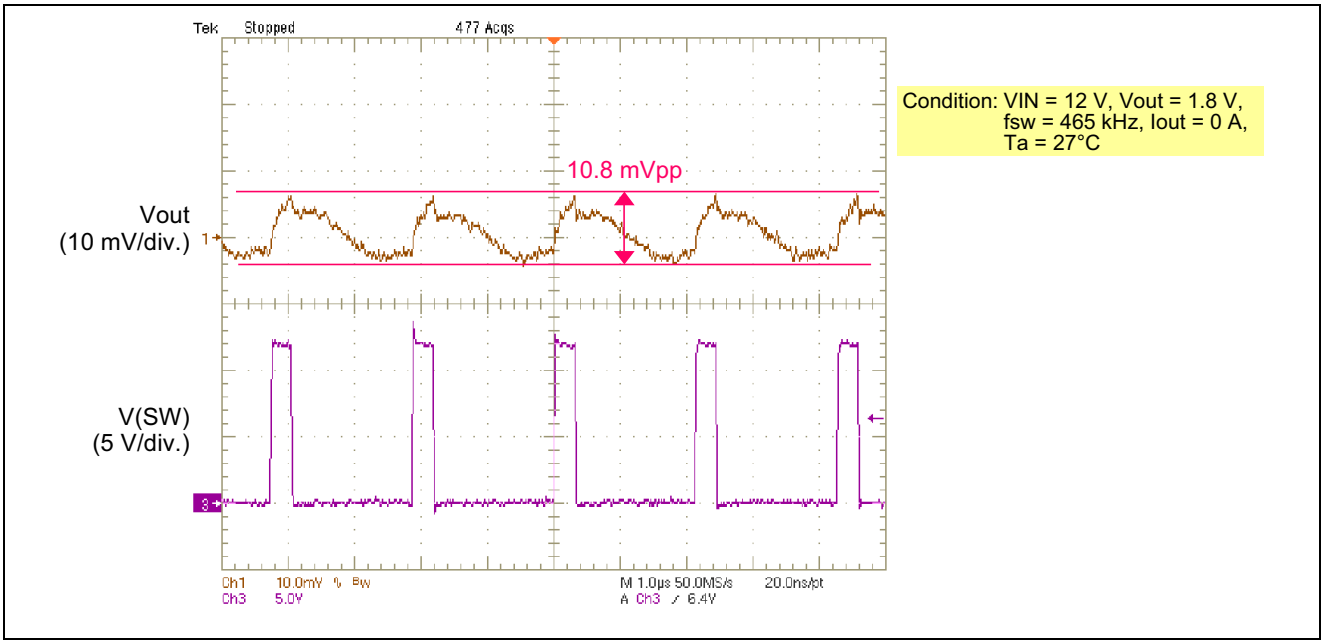

Figure 6 Vout Ripple Waveform (Iout = 0 A)

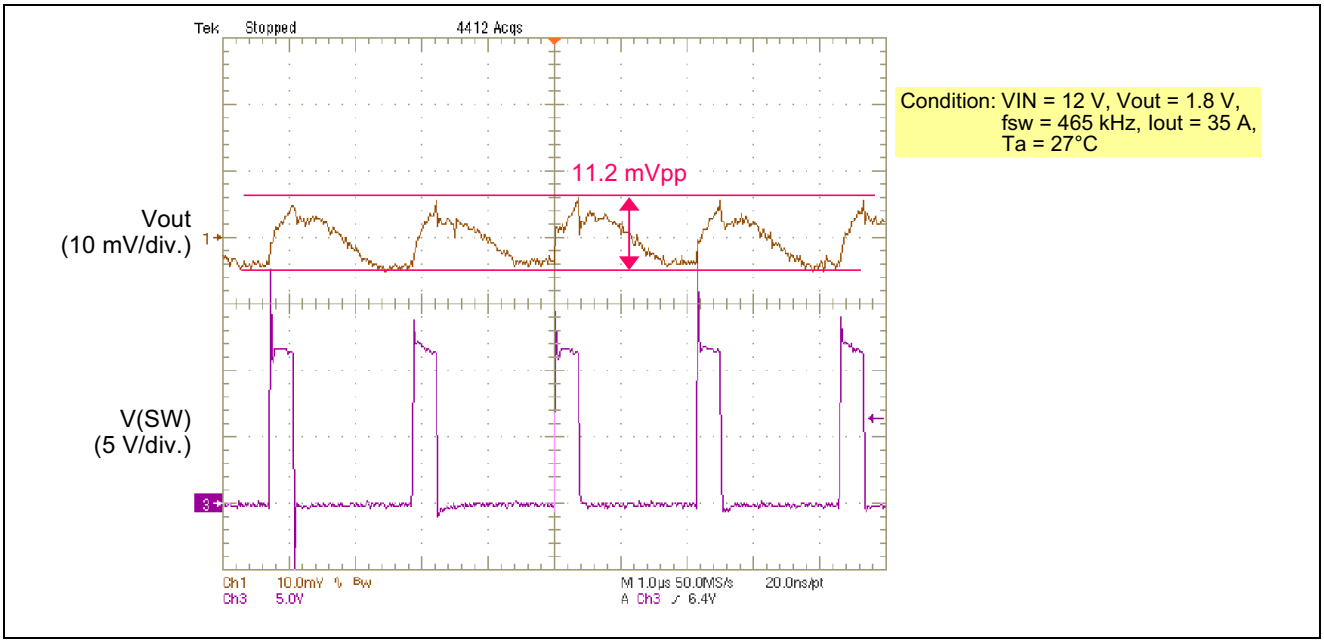

Figure 7 Vout Ripple Waveform (Iout = 35 A)

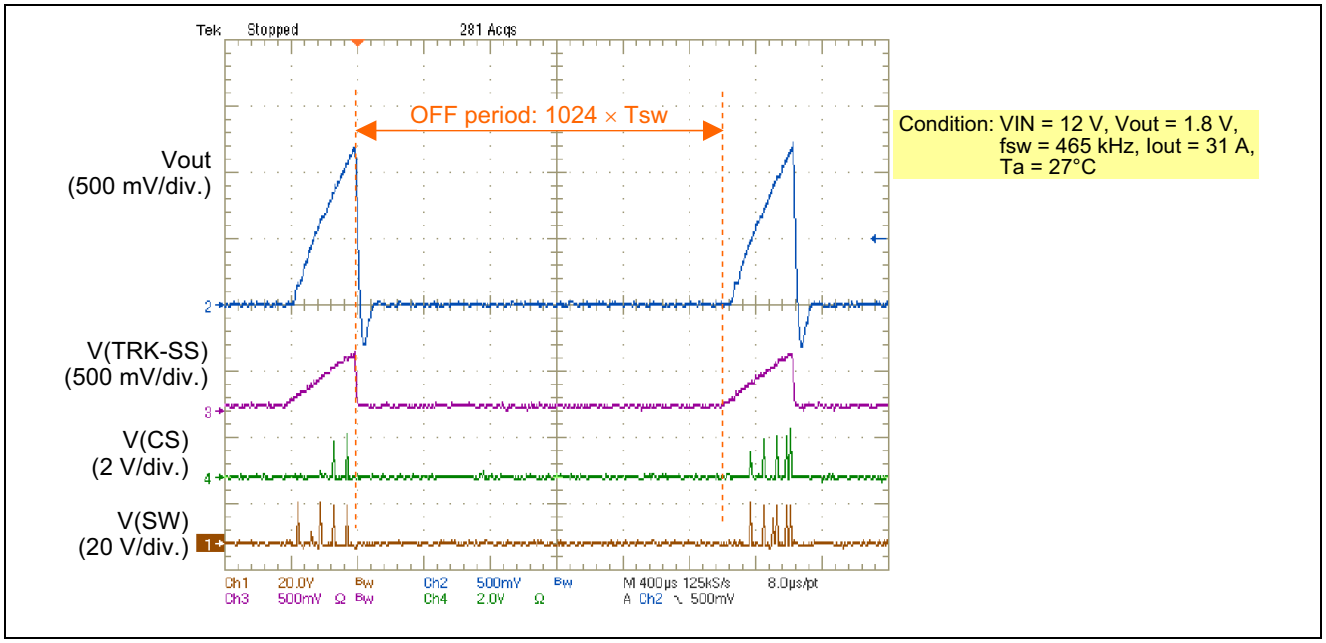

Figure 8 Waveform When the Over Current Protection

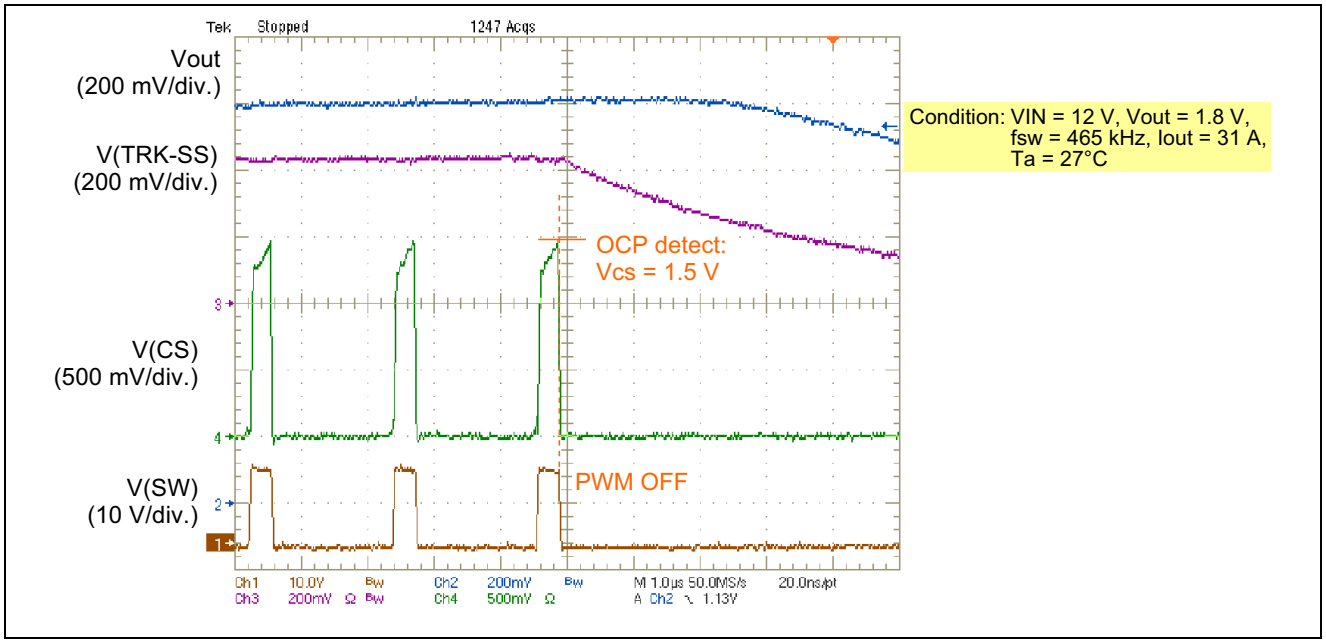

Figure 9 Waveform When the Over Current Protection (Zoom up)

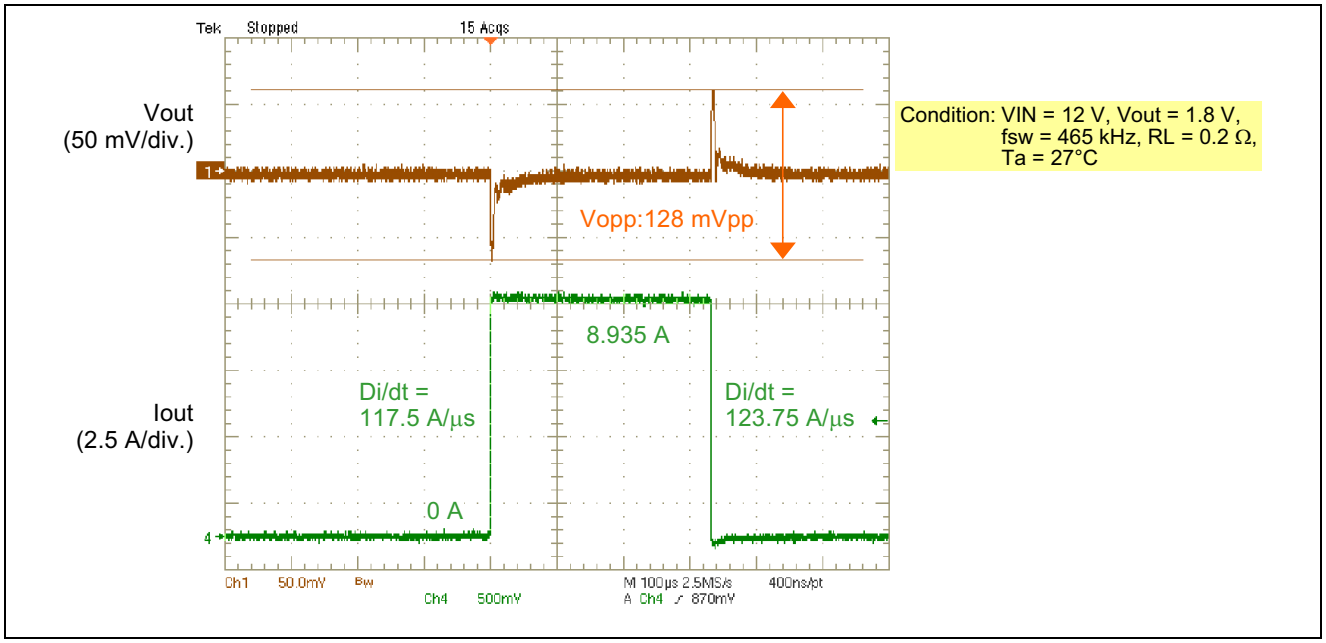

Figure 10 Waveform When the Load Transient Response Circuit On (RL = 0.2 Ω)

3. Circuit Diagram of Evaluation Board

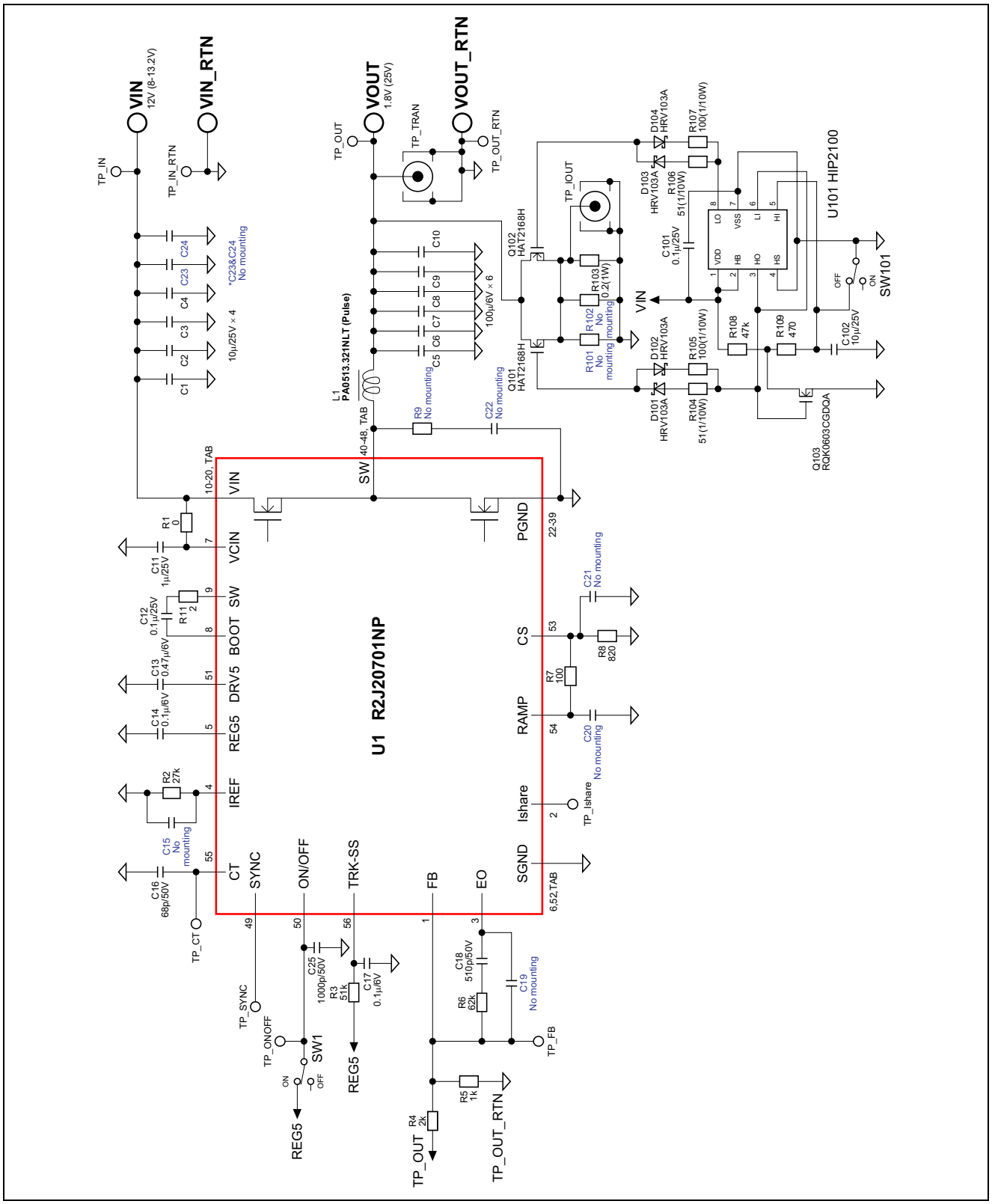

Figure 11 Circuit Diagram of Evaluation Board

4. List of Parts

Reference	Part No.	Vendor	Quantity	Description	Remarks
U1	R2J20701	Renesas	1	QFN56 IC	
L1	PA0513.321NLT	Pulse	1	0.32 μH	
C1, C2, C3, C4, C102, C23, C24	TMK316BJ106KL-T	YUDEN	5	10 μF/25 V/3216	C23, C24 No mounting
C5, C6, C7, C8, C9, C10	GRM32EB30J107ME16L	muRata	6	100 μF/6.3 V/3225	
C11	C1608JB1E105K	TDK	1	1 μF/25 V/1608	
C12, C14, C17, C101	C1608JB1E104K	TDK	4	0.1 μF/16 V/1608	
C13	C1608JB1C474K	TDK	1	0.47 μF/25 V/1608	
C15, C25	C1608JB1H102K	TDK	1	1000 pF/50 V/1608	C15 No mounting
C16	C1608CH1H680J	TDK	1	68 pF/50 V/1608	
C18	C1608CH1H511J	TDK	1	510 pF/50 V/1608	
C19	C1608CH1H101J	TDK	0	100 pF/50 V/1608	No mounting
C20	C1608CH1H100D	TDK	0	10 pF/50 V/1608	No mounting
C21	C1608CH1H040C	TDK	0	4 pF/50 V/1608	No mounting
C22	C1608CH1H222J	TDK	0	2200 pF/50 V/1608	No mounting
R1	RK73Z1JTTD	KOA	1	0 Ω/1608	
R2	RK73H1JTTD2702F	KOA	1	27 kΩ ± 1%/1608	
R3	RK73H1JTTD5102F	KOA	1	51 kΩ ± 1%/1608	
R4	RK73H1JTTD2001F	KOA	1	2 kΩ ± 1%/1608	
R5	RK73H1JTTD1001F	KOA	1	1 kΩ ± 1%/1608	
R6	RK73H1JTTD6202F	KOA	1	62 kΩ ± 1%/1608	
R7, R105, R107	RK73H1JTTD1000F	KOA	3	100 Ω ± 1%/1608	
R8	RK73H1JTTD8200F	KOA	1	820 Ω ± 1%/1608	
R9	R73B2BTTD3R0J	KOA	0	3 Ω/3225/1/4 W	No mounting
R11	RK73H1JTTD2R0F	KOA	1	2 Ω ± 1%/1608	
R101, R102, R103	SL1TTER20J	KOA	1	0.2 Ω/1 W/6.3 mm×3.1 mm	R101, R102 No mounting
R104, R106	RK73B1JTTD510J	KOA	2	51 Ω ± 5%/1608	
R108	RK73B1JTTD473J	KOA	1	47 kΩ ± 5%/1608	
R109	RK73B1JTTD471J	KOA	1	470 Ω ± 5%/1608	
Q101, Q102	HAT2168H	Renesas	2		
Q103	RQK0603CGDQA	Renesas	1		
D101, D102, D103, D104	HRV103A	Renesas	4		
U101	HIP2100	Intersil	1		
VIN, VOUT	T-6530-RED	Sato Parts	2		
VIN_RTN, VOUT_RTN	T-6530-BLACK	Sato Parts	2		
TP_IN, TP_IN_RTN, TP_OUT, TP_OUT_RTN	LC-2-G	Mac Eight	4		
SW1, SW101	G-22AP	Nihon Kaiheiki	2		
TP_TRAN, TP_IOUT	131-5031-00	Tektronix	2		

5. Evaluation Board Patterns

Board structure: Copper foil (70 μm) × 4 layers, 1.6 mmt

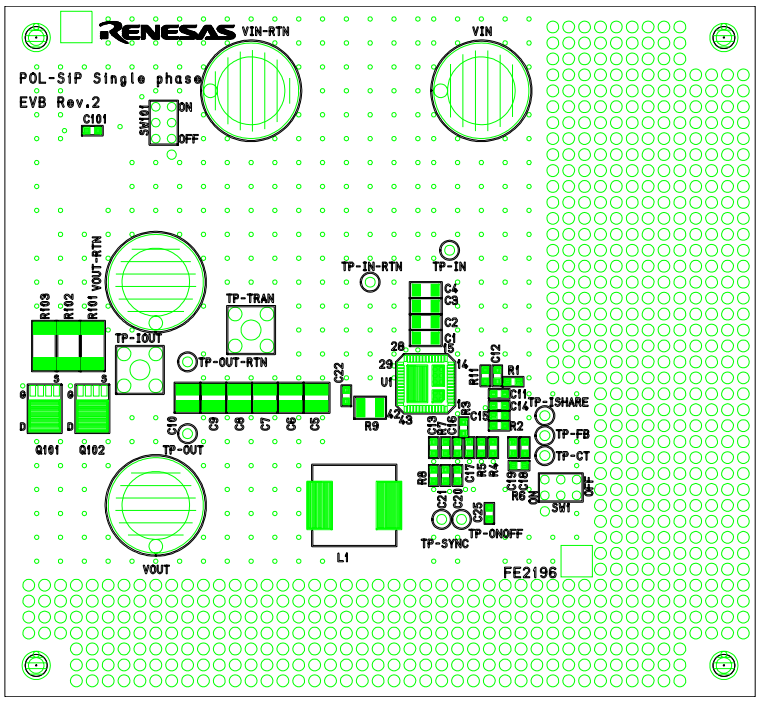

Figure 12 Top Silk Screen Pattern

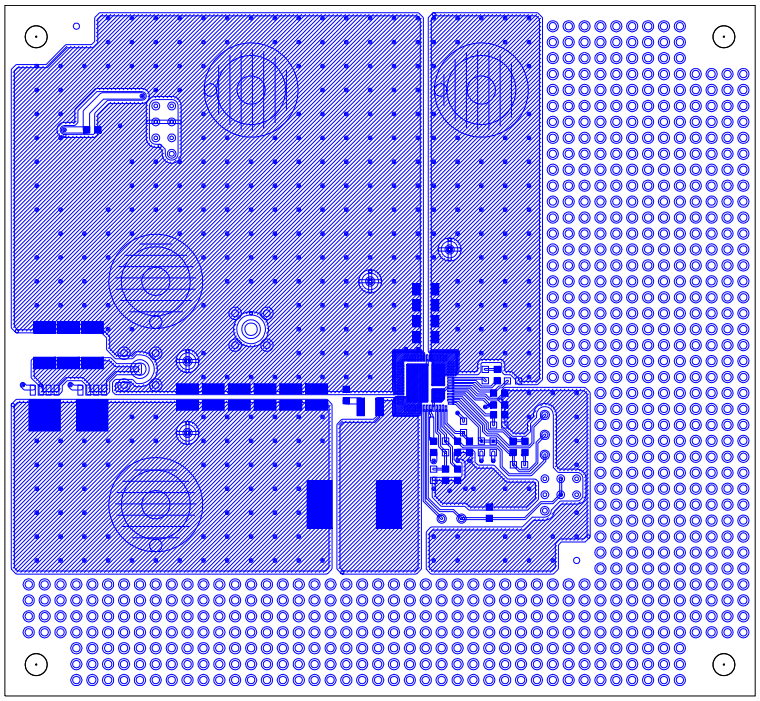

Figure 13 First Layer Pattern

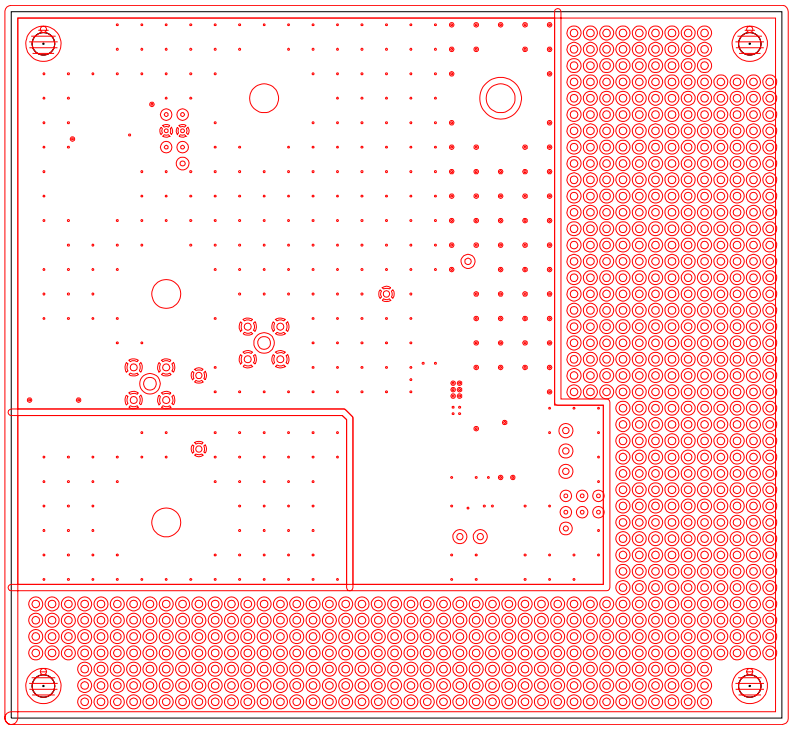

Figure 14 Second Layer Pattern

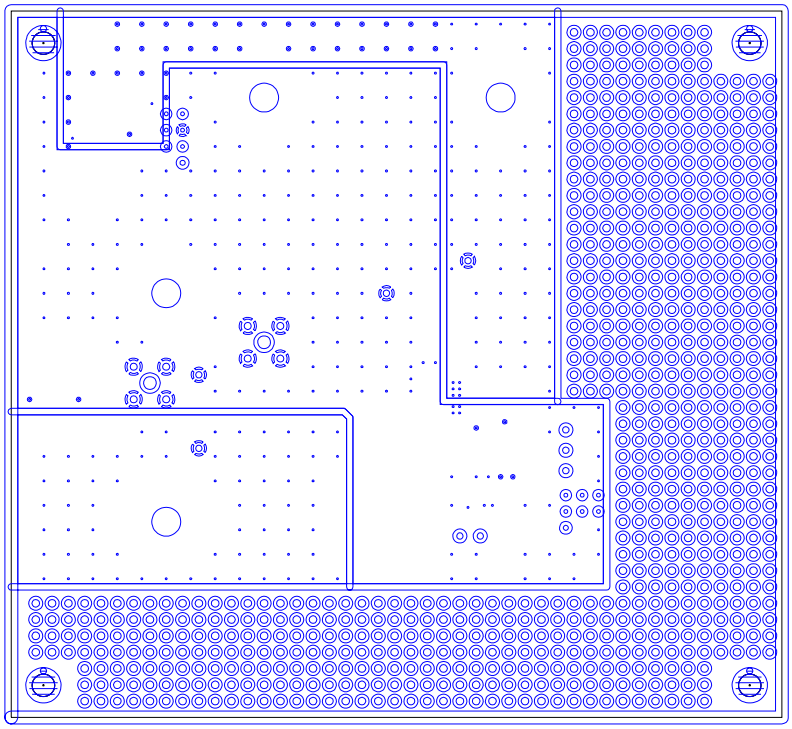

Figure 15 Third Layer Pattern

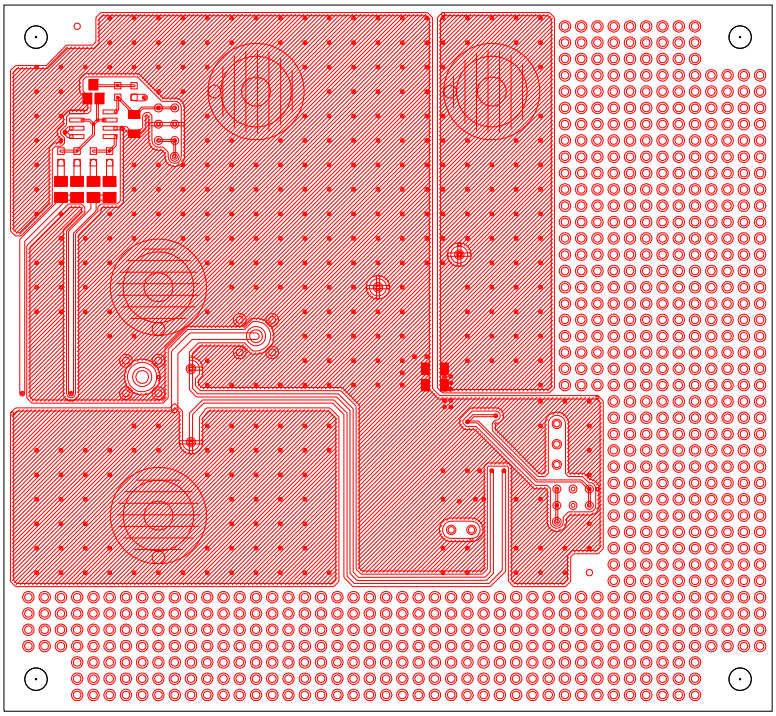

Figure 16 Fourth Layer Pattern

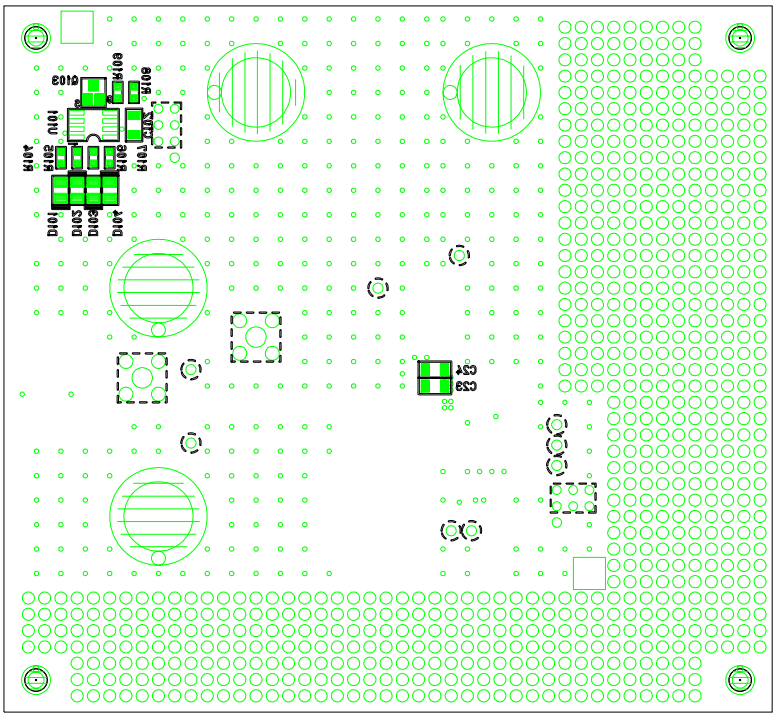

Figure 17 Bottom Silk Screen Pattern

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