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April 1st, 2010
Renesas Electronics Corporation

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R2J20701NP 2channel POL EVB2

R2J20701NP Evaluation Board

Introduction

The R2J20701NP 2channel POL EVB2 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 2channel POL EVB2 are described. Diagrams of circuits, list of parts, and patterns of printed boards.

The following materials are available for reference.

- R2J20701NP Data sheet
- R2J20701NP 1phase POL EVB (Rev.2.0) Application note
- R2J20701NP 2phase POL EVB2 Application note

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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-OUT1 & TP-OUT_RTN1 TP-OUT2 & TP-OUT_RTN2	2.5 V 1.8 V	0.6 V ~ 0.6 V ~
Output current	VOUT1 & VOUT_RTN1 VOUT2 & VOUT_RTN2	OCP: around 23 A OCP: around 21 A	0 A to 35 A 0 A to 35 A
Operating frequency		480 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
- (6) Start-up sequence function

1.3 Method of Connecting Evaluation Board

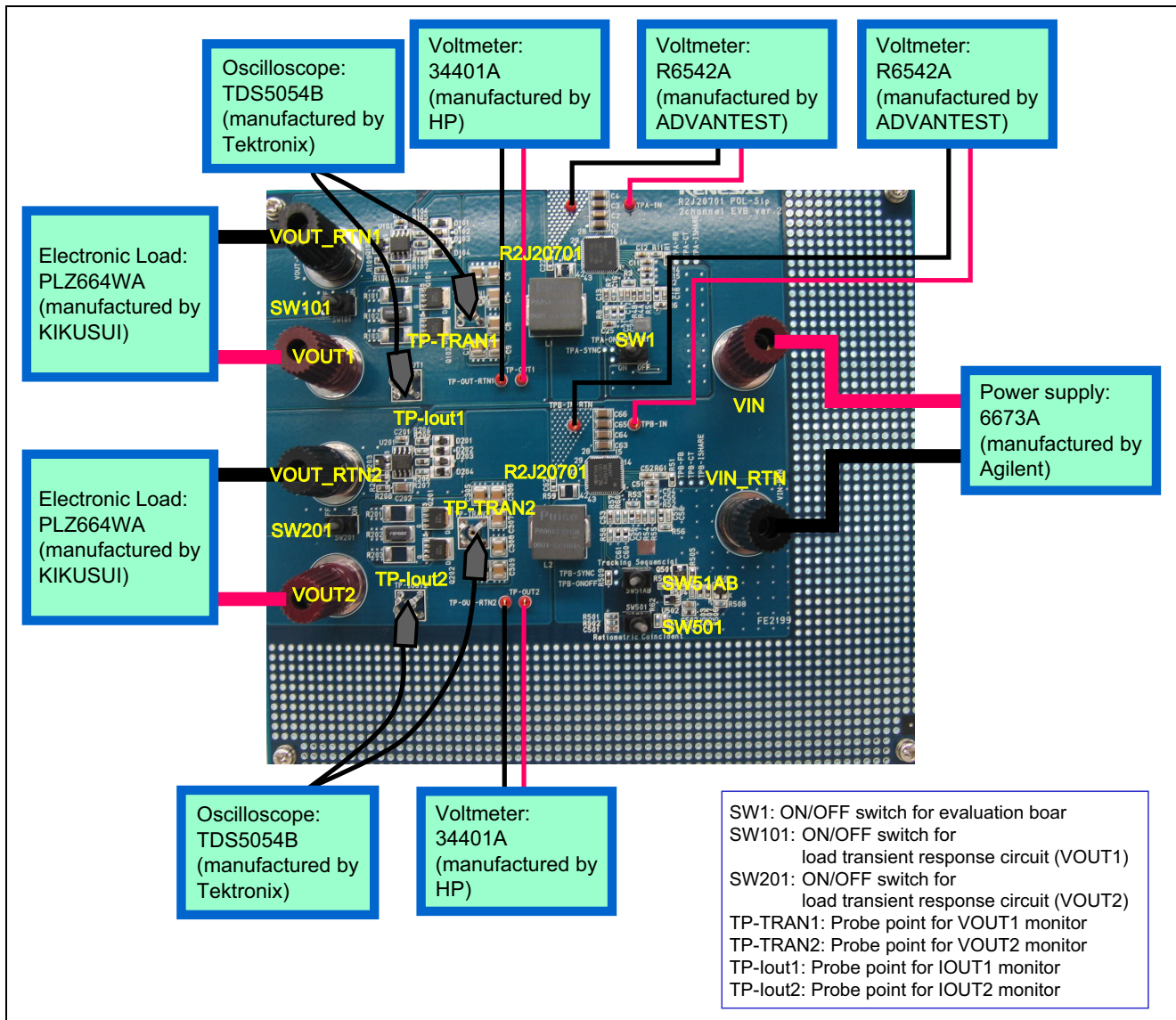


Figure 1 Connection Diagram of Evaluation Board

Table 1 Method of Sequence Switch Setting

Sequence	Sequential Tracking	Ratiometric Tracking	Coincident Tracking
SW51AB	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SW501	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

2. Result of Measurement by Evaluation Board

2.1 Efficiency/Loss/Regulation Data

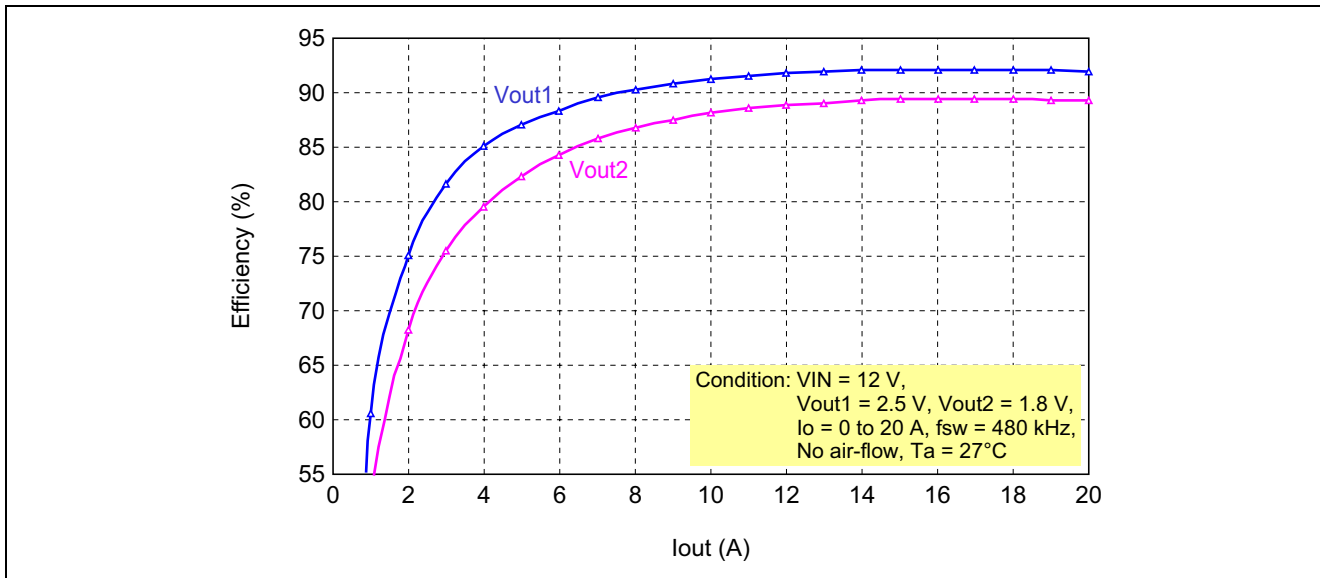


Figure 2 Efficiency vs. Output Current Characteristics

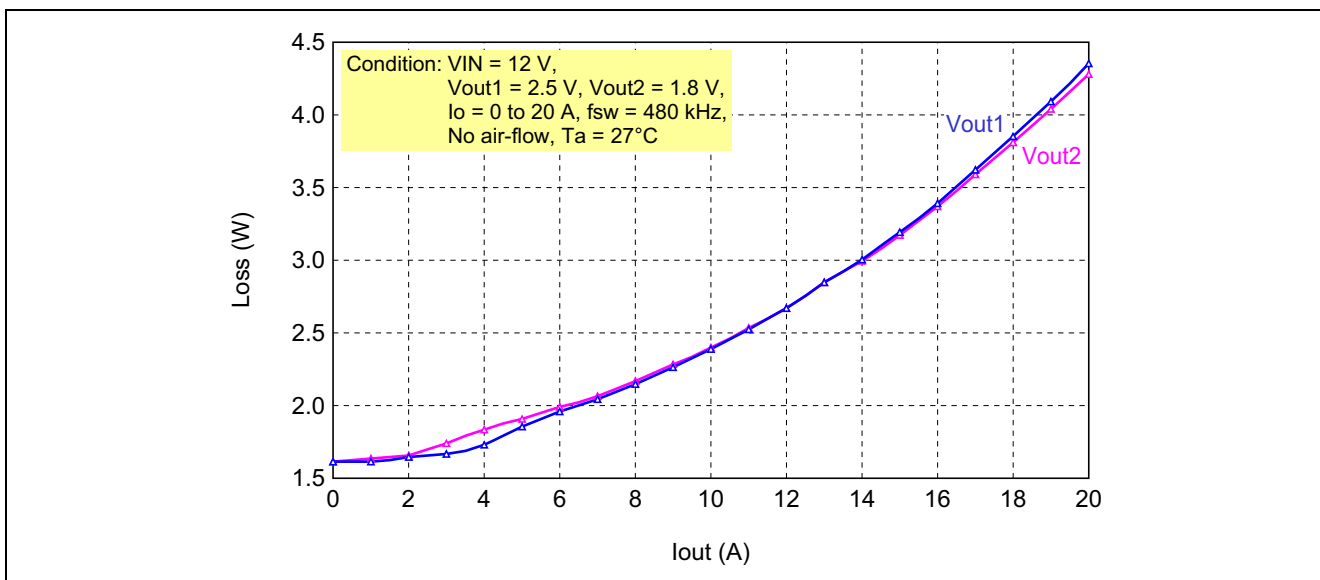


Figure 3 Loss vs. Output Current Characteristics

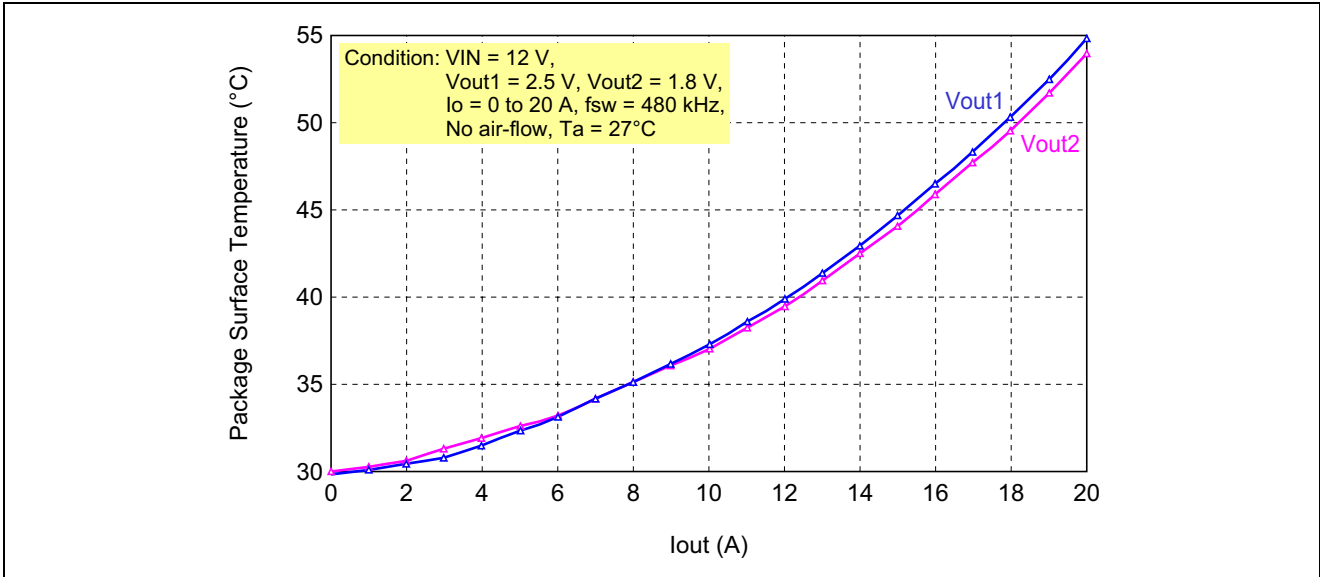


Figure 4 Package Surface Temperature vs. Output Current Characteristics

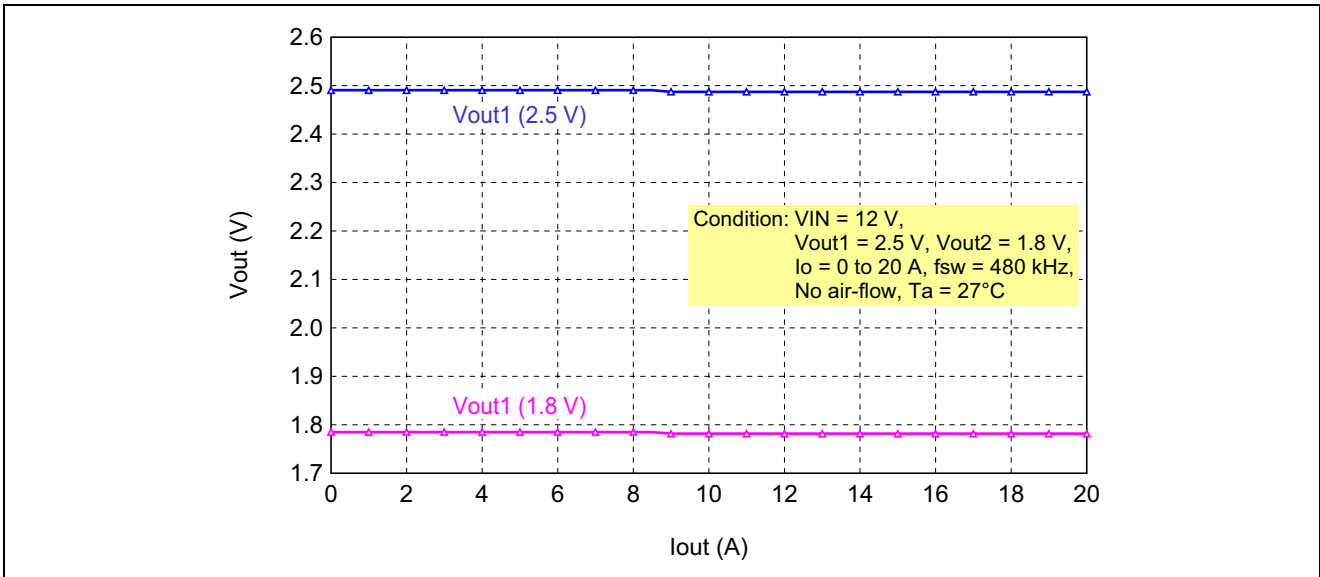


Figure 5 Output Voltage vs. Output Current Characteristics

2.2 Various Waveforms

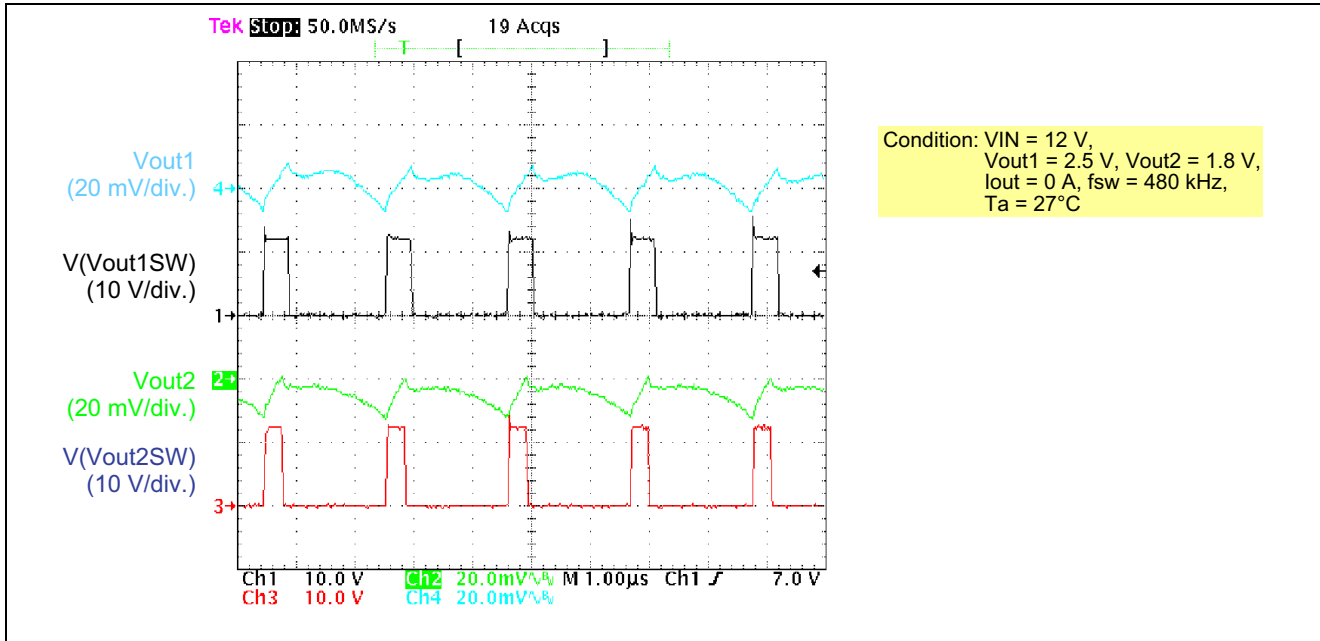


Figure 6 Vout Ripple Waveform

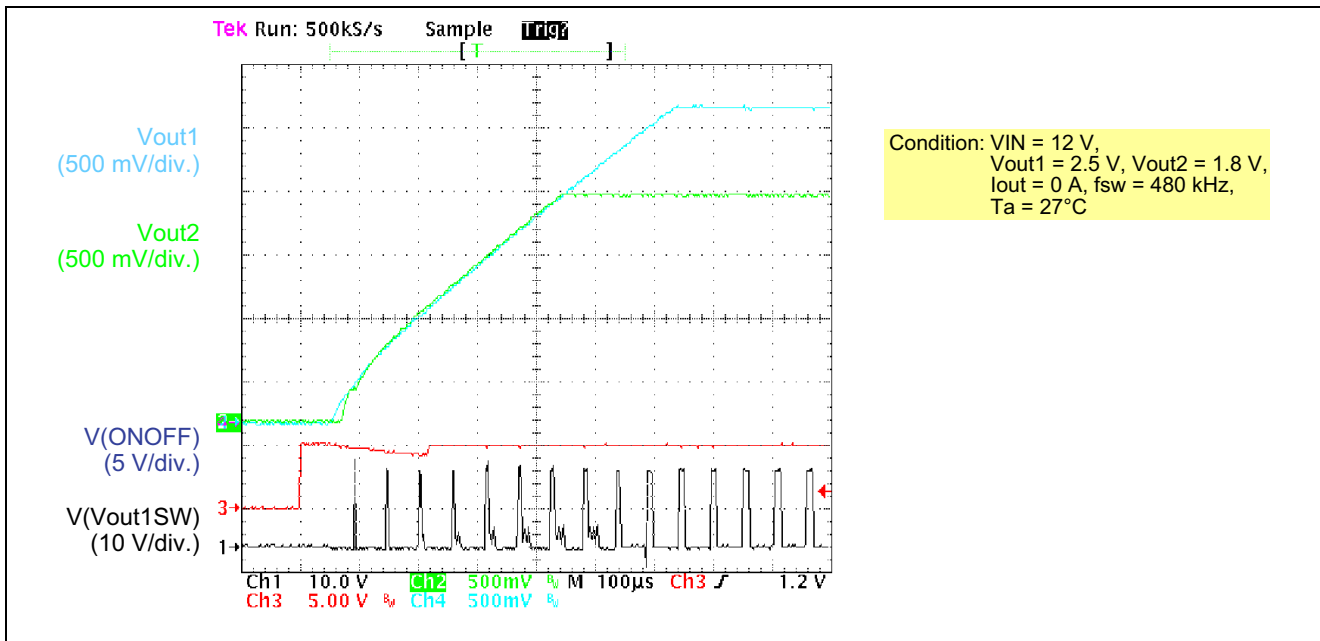


Figure 7 Vout Start-up Waveform (Coincident Tracking)

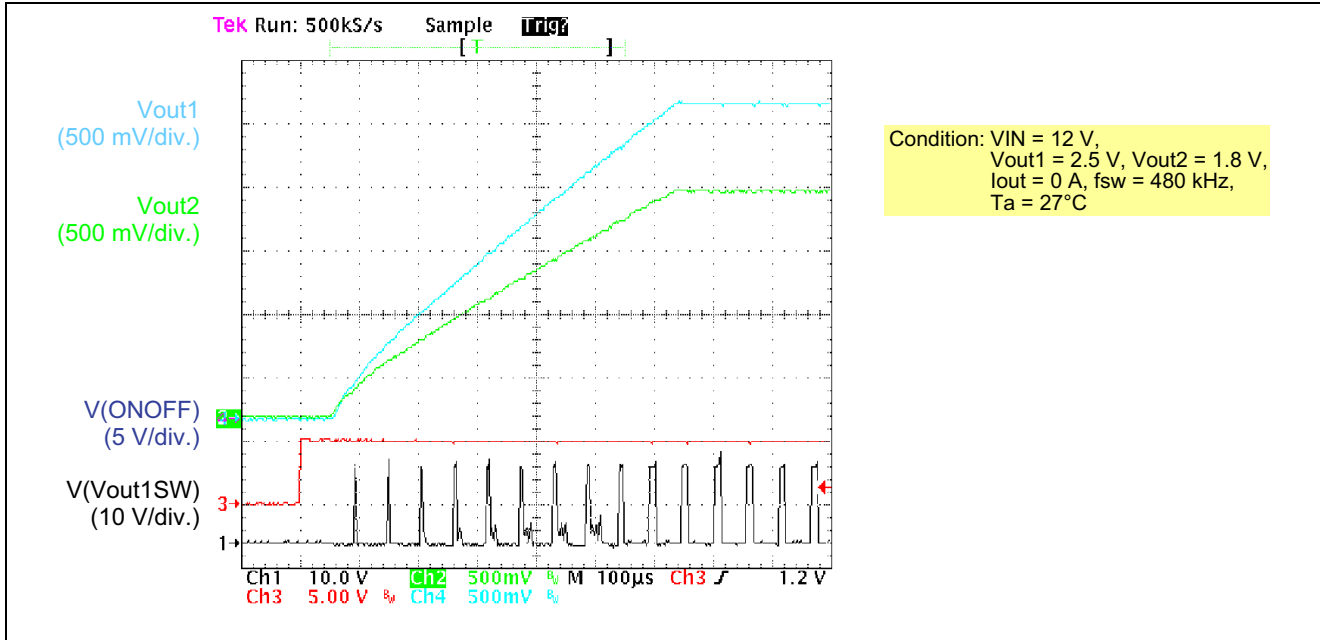


Figure 8 Vout Start-up Waveform (Ratiometric Tracking)

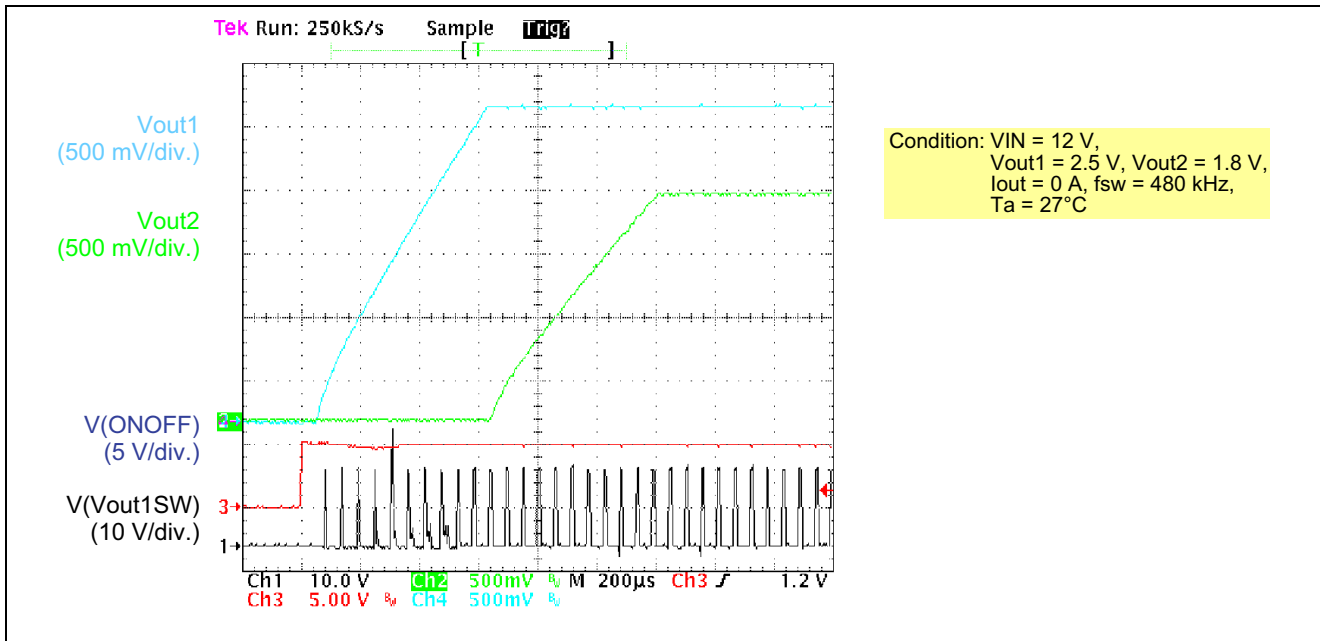


Figure 9 Vout Start-up Waveform (Sequential Tracking)

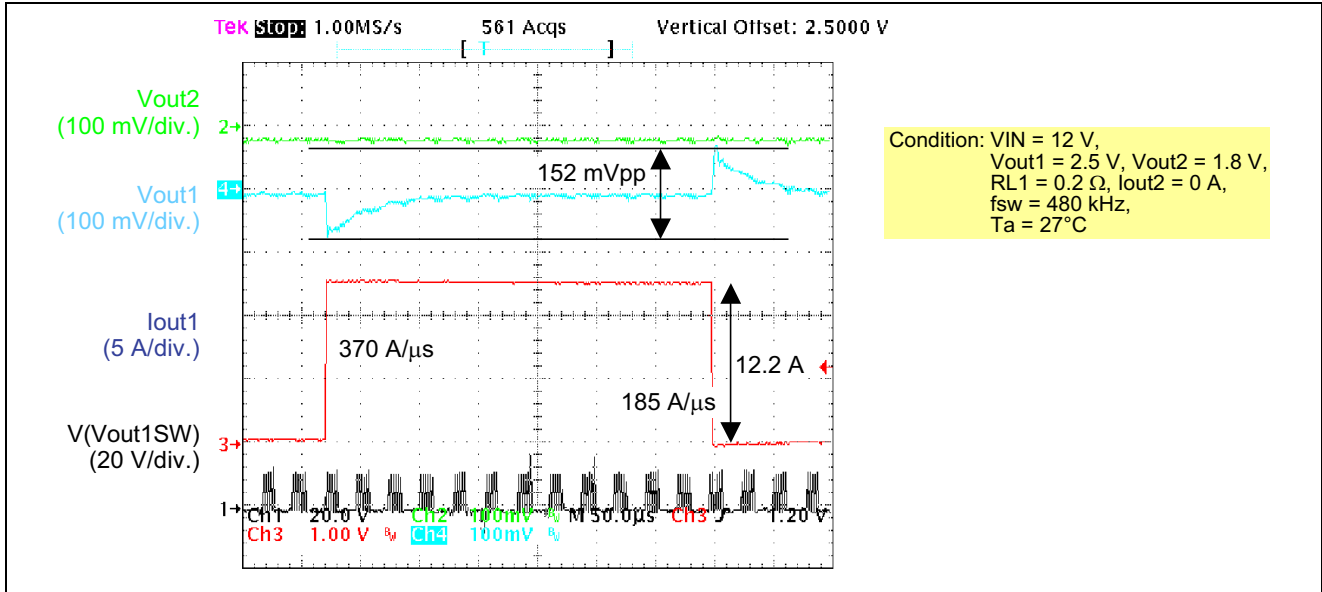


Figure 10 Waveform When the Load Transient Response Circuit On (Vout1)

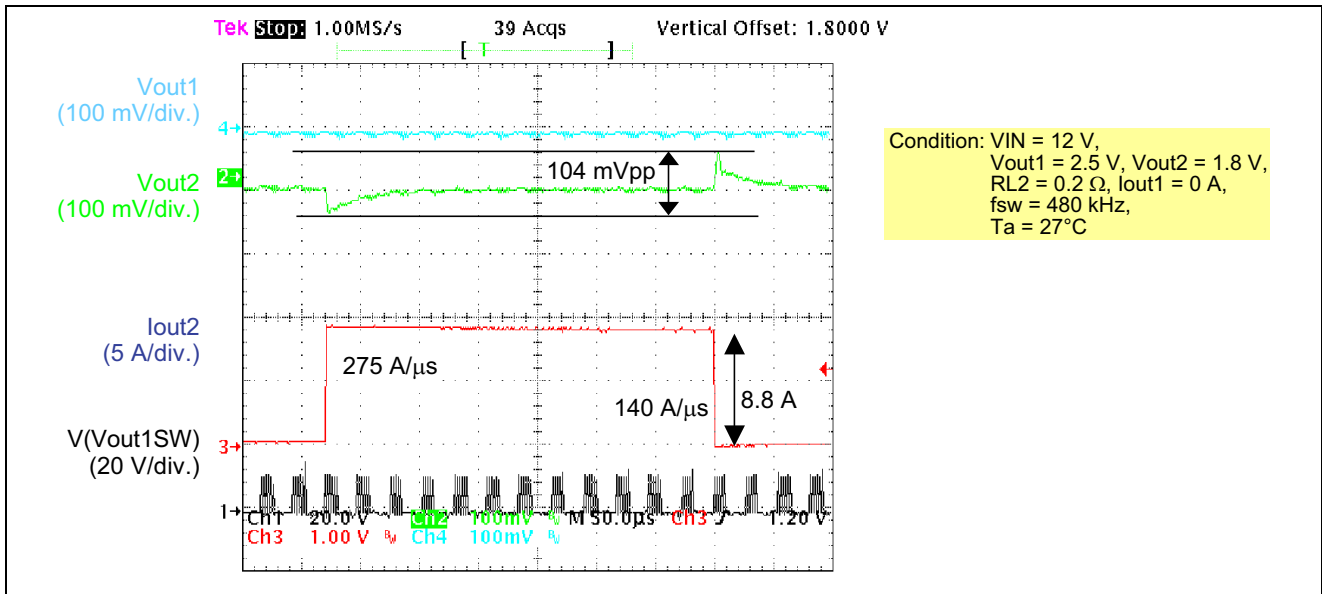


Figure 11 Waveform When the Load Transient Response Circuit On (Vout2)

3. Circuit Diagram of Evaluation Board

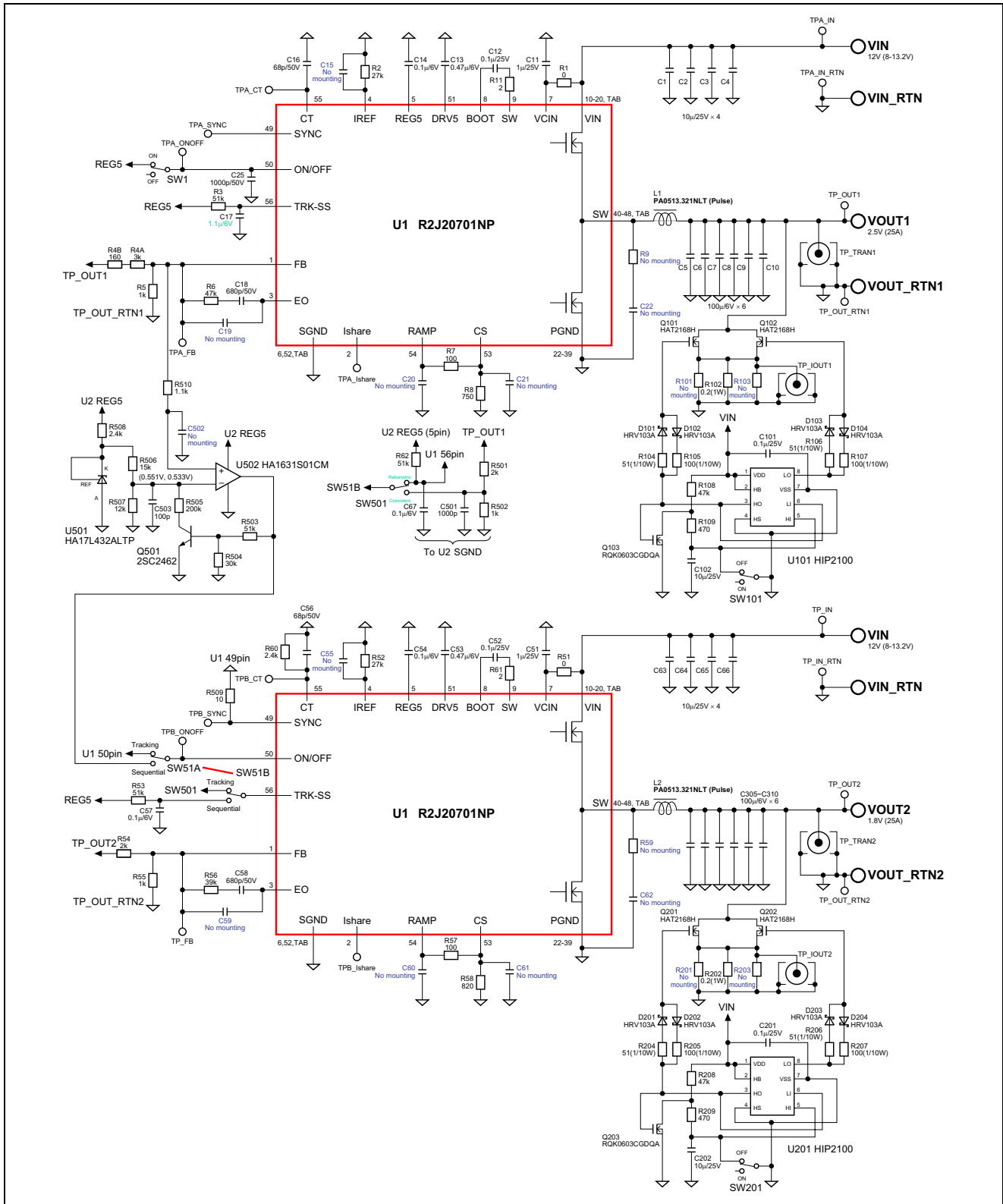


Figure 12 Circuit Diagram of Evaluation Board

4. List of Parts

Reference	Part No.	Vendor	Quantity	Description	Remarks
U1, U2	R2J20701NP	Renesas	2	QFN56 IC	
L1, L2	PA0513.321NLT	Pulse	2	0.32 μ H	
C1, C2, C3, C4, C63, C64, C65, C66, C102, C202	TMK316BJ106KL-T	YUDEN	10	10 μ F/25 V/3216	
C5, C6, C7, C8, C9, C10, C305, C306, C307, C308, C309, C310	GRM32EB30J107ME16L	muRata	12	100 μ F/6.3 V/3225	
C11, C51	C1608JB1E105KT	TDK	2	1 μ F \pm 10%/25 V/1608	
C12, C14, C17, C52, C54, C57, C67, C101, C201	C1608JB1E104KT	TDK	9	0.1 μ F \pm 10%/25 V/1608	
C13, C53	C1608JB1C474KT	TDK	2	0.47 μ F \pm 10%/16 V/1608	
C15, C25, C55, C501, C502	C1608JB1H102KT	TDK	3	1000 pF \pm 10%/50 V/1608	C15, C55, C502 No mounting
C16	C1608CH1H680JT	TDK	1	68 pF \pm 5%/50 V/1608	
C18, C58	C1608CH1H681JT	TDK	2	680 pF \pm 5%/50 V/1608	
C19, C59, C503	C1608CH1H101JT	TDK	1	100 pF \pm 5%/50 V/1608	C19, C59 No mounting
C20, C60	C1608CH1H100DT	TDK	0	10 pF \pm 0.5 pF/50 V/1608	No mounting
C21, C61	C1608CH1H040CT	TDK	0	4 pF \pm 0.25 pF/50 V/1608	No mounting
C22, C62	C1608CH1H222JT	TDK	0	2200 pF \pm 5%/50 V/1608	No mounting
R1, R51	RK73Z1JTDD	KOA	2	0 Ω /1608	
R2, R52	RK73H1JTDD2702F	KOA	2	27 k Ω \pm 1%/1608	
R3, R53, R62, R503	RK73H1JTDD5102F	KOA	4	51 k Ω \pm 1%/1608	
R54, R501	RK73H1JTDD2001F	KOA	2	2 k Ω \pm 1%/1608	
R4A	RK73B1JTDD302J	KOA	1	3 k Ω \pm 5%/1608	
R4B	RK73B1JTDD161J	KOA	1	160 Ω \pm 5%/1608	
R5, R55, R502	RK73H1JTDD1001F	KOA	3	1 k Ω \pm 1%/1608	
R6	RK73B1JTDD473J	KOA	1	47 k Ω \pm 5%/1608	
R56	RK73B1JTDD393J	KOA	1	39 k Ω \pm 5%/1608	
R7, R57, R105, R107, R205, R207	RK73H1JTDD1000F	KOA	6	100 Ω \pm 1%/1608	
R8	RK73B1JTDD751J	KOA	1	750 Ω \pm 5%/1608	
R58	RK73H1JTDD8200F	KOA	1	820 Ω \pm 1%/1608	
R9, R59	R73B2BTDD3R0J	KOA	0	3 Ω /3225/ 1/4 W	No mounting
R11, R61	RK73H1JTDD2R0F	KOA	2	2 Ω \pm 1%/1608	
R60, R508	RK73H1JTDD2401F	KOA	2	2.4 k Ω \pm 1%/1608	
R101, R102, R103, R201, R202, R203	SL1TTER20J	KOA	2	0.2 Ω /1 W/ 6.3 mm \times 3.1 mm \times 1.9 mm	R101, R103, R201, R203 No mounting
R104, R106, R204, R206	RK73B1JTDD510J	KOA	4	51 Ω \pm 5%/1608/ 1/10 W	
R108, R208	RK73B1JTDD473J	KOA	2	47 k Ω \pm 5%/1608	
R109, R209	RK73B1JTDD471J	KOA	2	470 Ω \pm 5%/1608	
R504	RK73B1JTDD303J	KOA	1	30 k Ω \pm 5%/1608	
R505	RK73B1JTDD204J	KOA	1	200 k Ω \pm 5%/1608	
R506	RK73B1JTDD153J	KOA	1	15 k Ω \pm 5%/1608	
R507	RK73B1JTDD123J	KOA	1	12 k Ω \pm 5%/1608	
R509	RK73B1JTDD100J	KOA	1	10 Ω /1608/ 1/10 W	
R510	RK73B1JTDD112J	KOA	1	1.1 k Ω \pm 5%/1608	
Q101, Q102, Q201, Q202	HAT2168H	Renesas	4	FET	
Q103, Q203	RQK0603CGDQA	Renesas	2	FET	
Q501	2SC2462	Renesas	1	TRS	
D101, D102, D103, D104, D201, D202, D203, D204	HRV103A	Renesas	8	Diode	
U101, U201	HIP2100	Intersil	2	Driver IC	
U501	HA17L432ALTP	Renesas	1	Shunt regulator	
U502	HA1631S01CM	Renesas	1	CMOS comparator	
VIN, VOUT1, VOUT2	T-6530-RED	Sato Parts	3		
VIN_RTN, VOUT_RTN1, VOUT_RTN2	T-6530-BLACK	Sato Parts	3		
TPA_IN, TPA_IN_RTN, TP_OUT1, TP_OUT_RTN1, TPB_IN, TPB_IN_RTN, TP_OUT2, TP_OUT_RTN2	LC-2-G	Mac Eight	8		
SW1, SW51AB, SW101, SW201, SW501	G-22AP	Nihon Kaiheiki	5		
TP_TRAN1, TP_IOUT1, TP_TRAN2, TP_IOUT2	131-5031-00	Tektronix	4		

5. Evaluation Board Patterns

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

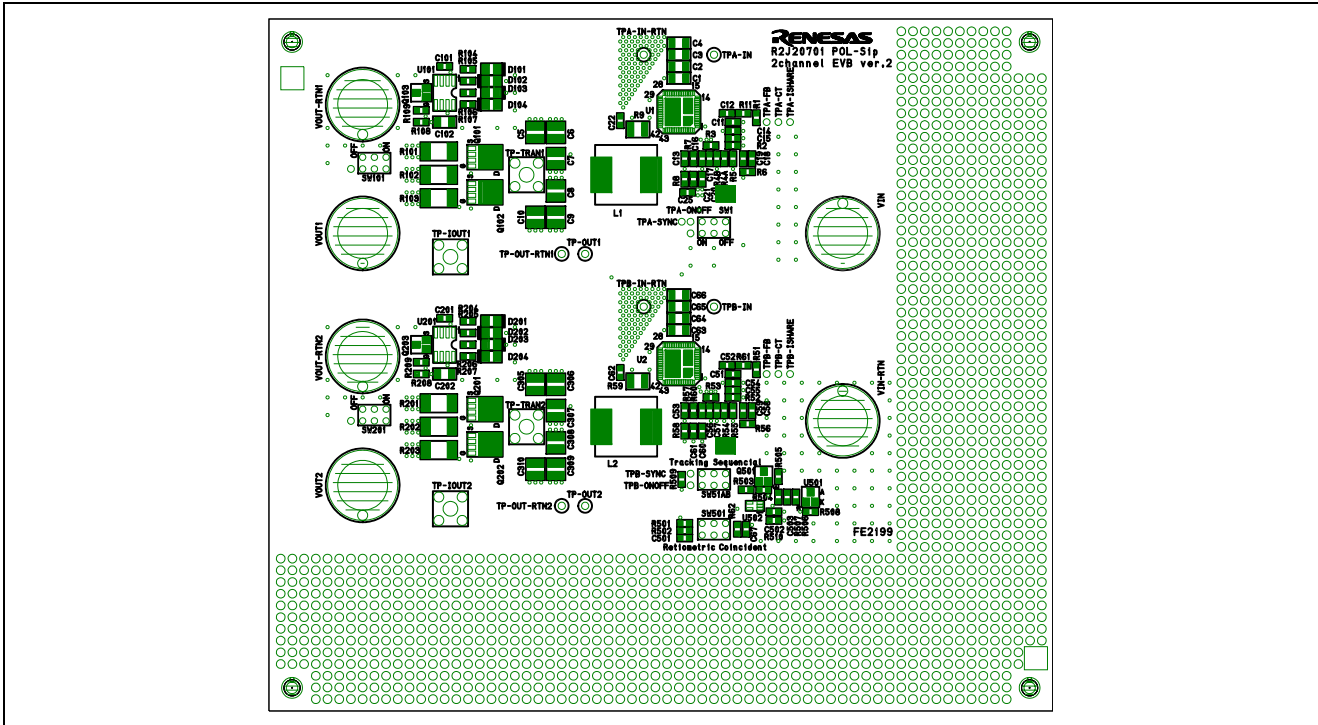


Figure 13 Top Silk Screen Pattern

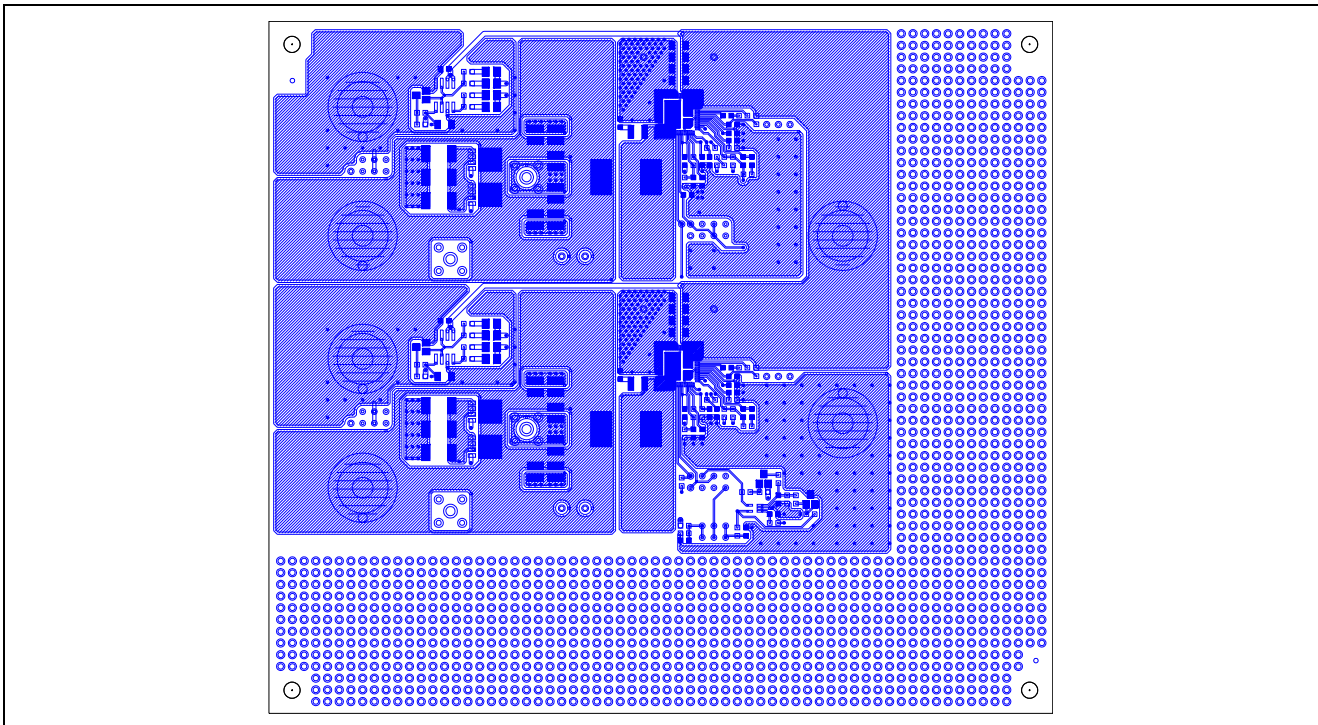


Figure 14 First Layer Pattern

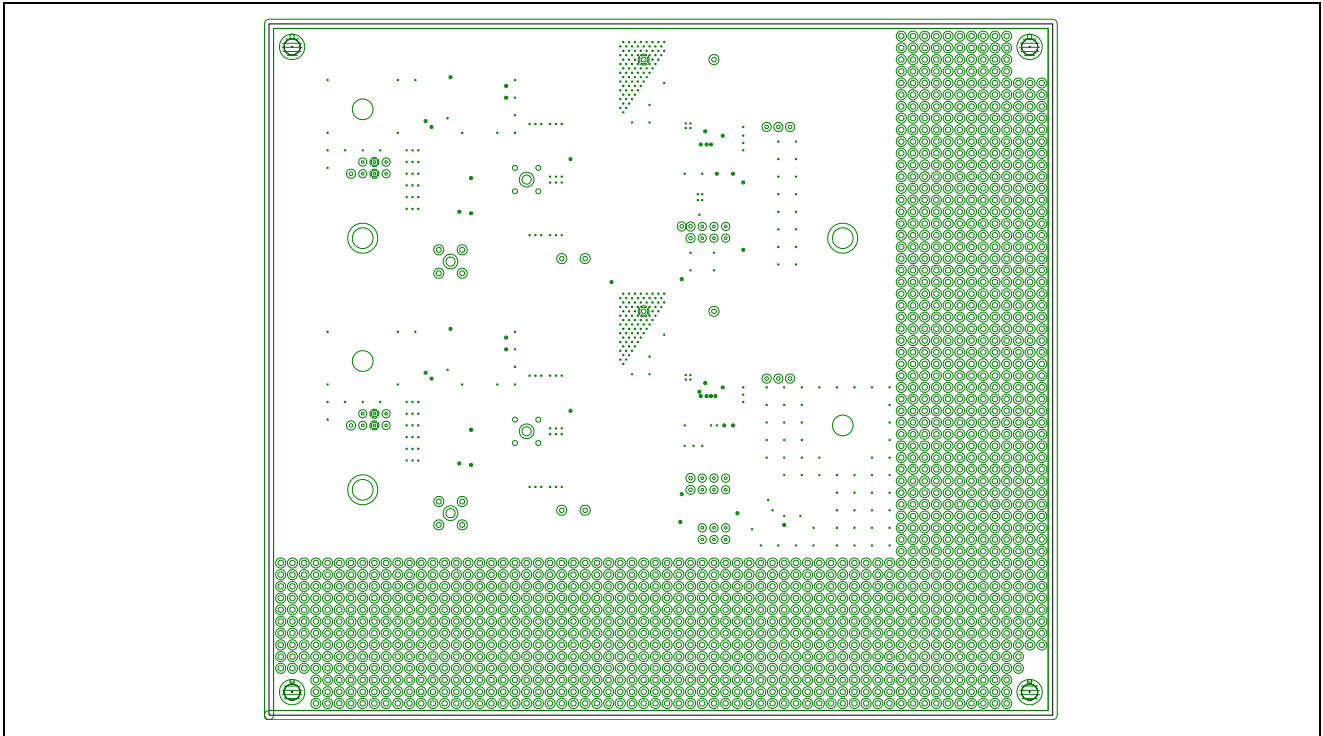


Figure 15 Second Layer Pattern

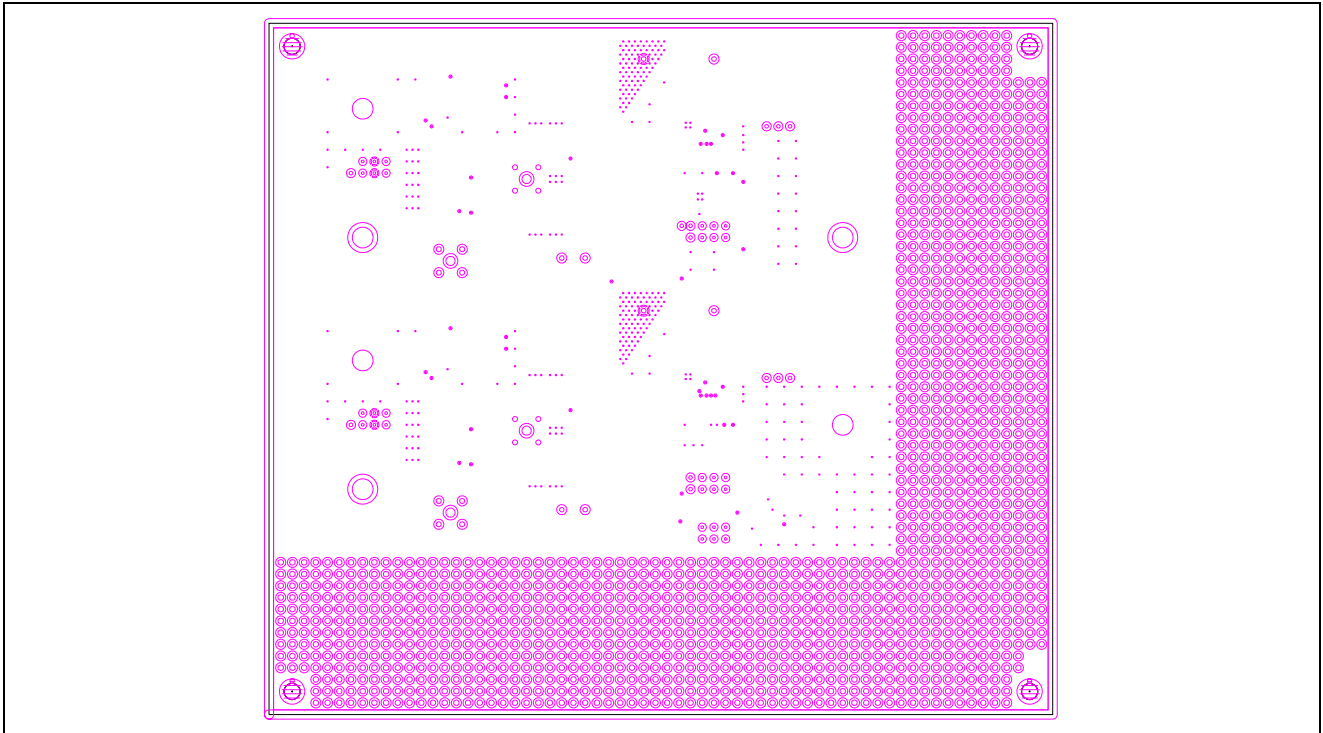


Figure 16 Third Layer Pattern

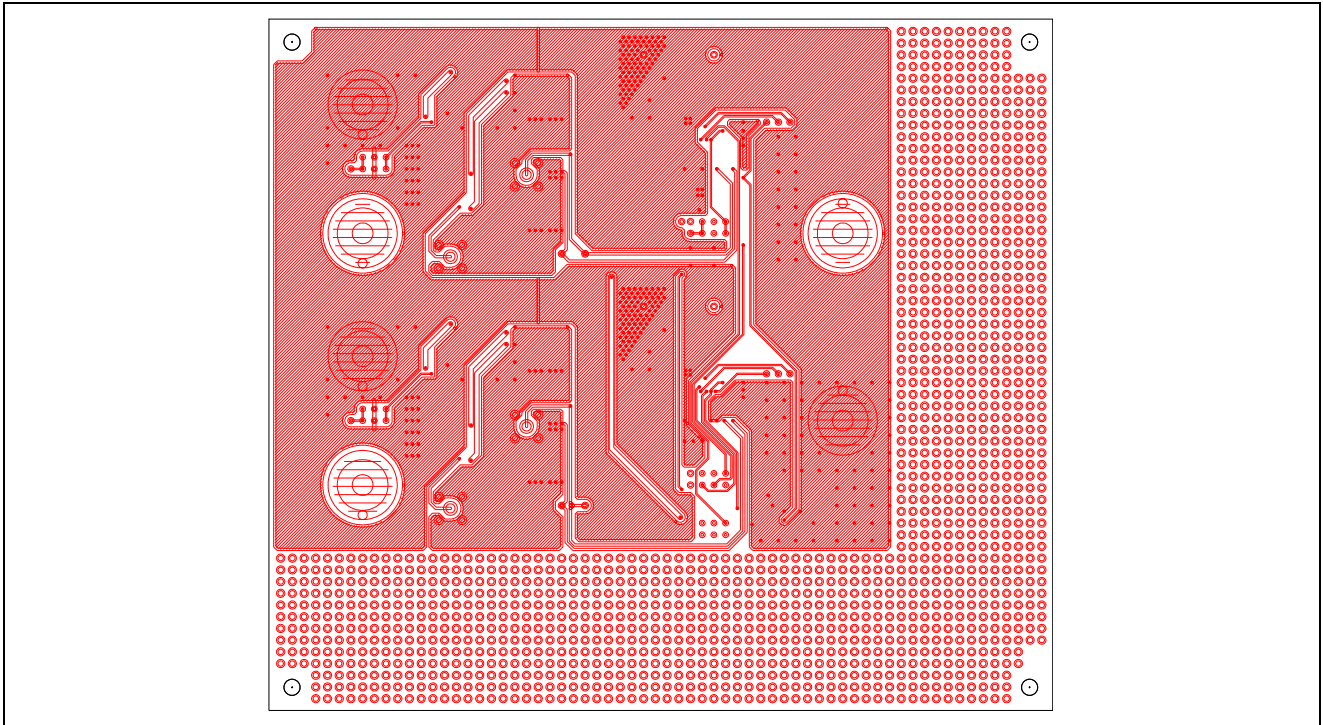


Figure 17 Fourth Layer Pattern

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