TRF2436EVM

This user's guide provides an overview of the TRF2436 evaluation module (EVM) to get you started using the TRF2436EVM right away. It also provides a general description of the features and functions to be considered when using this module.

Contents

List of Figures

List of Tables

1 Introduction

1.1 Purpose

The TRF2436 EVM provides a platform for evaluating the TRF2436 high-power, dual-band RF front-end under various signals, reference, and supply conditions. Use this document with the EVM schematic diagram supplied. Using the TRF2436EVM, you can rapidly evaluate the TRF2436 with a minimum of manual setup.

1.2 System Requirements

Use the following equipment when evaluating the TRF2436EVM:

- +3.3-V power supply, 800 mA.
- Signal generator: Agilent ESG Series (with baseband I/Q modulation option for modulated testing) or equivalent.
- Spectrum analyzer: Agilent PSA Series (with phase noise option) or equivalent.
- Vector signal analyzer: Agilent 89600 Series for 802.16x modulated EVM testing or equivalent.

1.3 Power Requirements

The demonstration board requires only one supply for proper operation. Connect +3.3 V at P1 and the return to P2. Always terminate active PA outputs before enabling the power supply.

Voltage Limits

Exceeding the maximum input voltages can damage EVM components. Undervoltage can cause improper operation of some or all of the EVM components.

1.4 Hardware Configuration

The TRF2436EVM can be set up in a variety of configurations to accommodate a specific mode of operation. Before starting an evaluation, decide on the configuration and make the appropriate connections or changes. The demonstration board comes with the following factory-set configuration:

Jumper J10 installed between 1-2
Jumper J11 installed between 2-3
Jumper J12 installed between 1-2
Jumper J13 installed between 1-2
Jumper J14 installed between 1-2

LO input drive
The TRF2436 has been designed to be driven with a differential LO input. A simple balun centered at ~2.6 GHz can be used to convert a single-ended input from an RF source to a differential pair to provide a differential LO to the EVM through SMA connectors J3 and J4.

The 2436 will function if driven single-ended, but it is not designed to operate in this condition, nor has it been evaluated in this condition. To drive the LO single-ended, connect an RF source to the LOP SMA (J3) and terminate the LON SMA (J4) input with 50 Ω.

Filtering
The TRF2436EVM is provided with no filtering. The mixer output, PA input/LNA output, and RF input/output pins are brought out directly to SMA connectors on the EVM. Filtering may be incorporated by:

- Connecting an external filter to RFANTA (J6) for filtering after the PA in TX mode or before the LNA in RX mode.
- Connecting an external filter between the MFA (J8) and RFA (J9) jacks for filtering between the mixer and PA/LNA stages

2 TRF2436EVM Operational Procedure

2.1 TX Operation

1. Connect +3.3 V to P1 and ground to P2 but do not turn on.
2. Connect differential LO source to LOP/LON jacks (or use external balun).
   Set the appropriate frequency and power level between 0 to +4 dBm. Remember that for A-band operation, the LO input frequency is doubled inside the TRF2436; so, the LO should be set to half the frequency desired at the mixer LO port.
3. Connect an IF source to the IF port. Set to 374 MHz with a typical power level of –20 dBm.
4. Set ABSEL (J12) to a logic high 1.
5. Set TR (J13) to a logic high 1.
6. Set PA_B SEL (J11) to a logic low 0.
7. Set PA_A SEL (J10) to logic high 1.
8. RXDGC = don't care
9. For mixer stage measurement:
   a. Terminate RFA (J9) and RFANTA (J6) into 50 Ω.
   b. Connect a spectrum analyzer to MFA (J8).
   c. Turn on the 3.3-V power supply (~300 mA to 320 mA).
   d. Observe the output of the mixer stage on a spectrum analyzer.
10. For PA stage measurement:
    a. Terminate IF (J7) and MFA (J8) into 50 Ω.
    b. Apply an RF to RFA (J9).
    c. Connect a spectrum analyzer to RFANTA (J6).
    d. Turn on the power supply.
    e. Observe the PA output on a spectrum analyzer.

2.2 RX Operation

1. Set TR (J13) to logic 0.
2. Set PA_A SEL (J10) to logic 0.
3. Connect a differential LO source to the LOP/LON SMAs (or use an external balun). Set the LO to an appropriate frequency, with the power level between 0 to +4 dBm. Remember that for A-band operation, the LO input frequency is doubled inside the TRF2436; so, the LO should be set to half the frequency desired at the mixer LO port.
4. For mixer stage measurement:
    a. Terminate RFA (J9) and RFANTA (J6) into 50 Ω.
    b. Connect an RF source to MFA (J8). Set to a desired RF frequency and typical power level of –20 dBm.
    c. Connect a spectrum analyzer to the IF (J7) output.
    d. Turn on the 3.3-V power supply (~90 mA).
    e. Observe the IF output on a spectrum analyzer (374 MHz).
5. For LNA stage measurement:
    a. Terminate IF (J7) and MFA (J8) into 50 Ω.
    b. Connect an RF source to RFANTA (J6). Set to a desired frequency and typical power level of –40 dBm.
    c. Connect a spectrum analyzer to RFA (J9).
    d. Turn on the power supply.
    e. Observe the LNA output on a spectrum analyzer.
    f. Use jumper J14 (RXDGC) to select between LNA high (pins 2-3) and low gain (pins 1-2) modes.

3 Physical Description

This section describes the physical characteristics and PCB layout of the EVM and lists the components used on the module.

3.1 PCB Layout

The EVM is constructed on a 4-layer, 3.6-inch × 3.6-inch, 0.042-inch thick PCB using Polycad 370 Turbo/HR material. Figure 1 through Figure 4 show the PCB layout for the EVM.

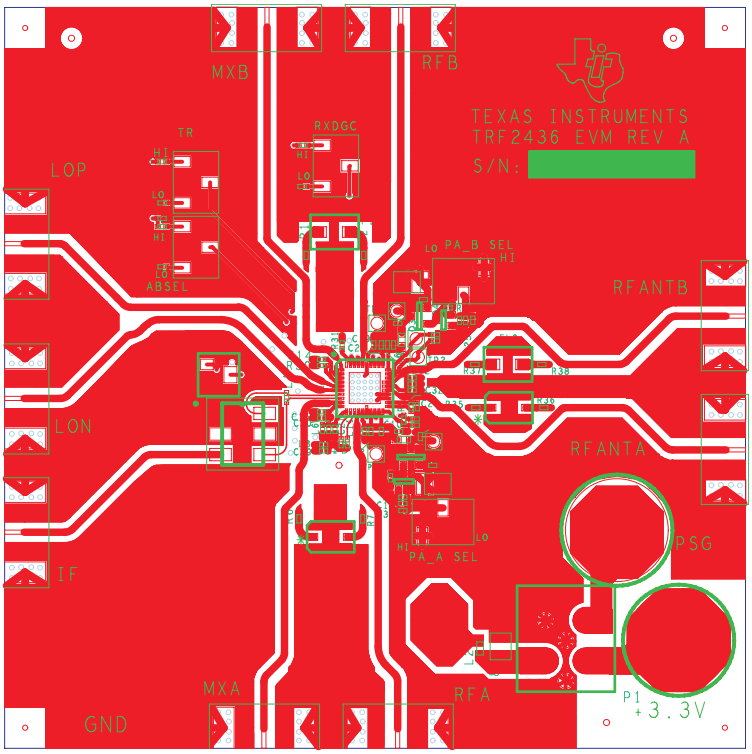


Figure 1. Top Layer 1

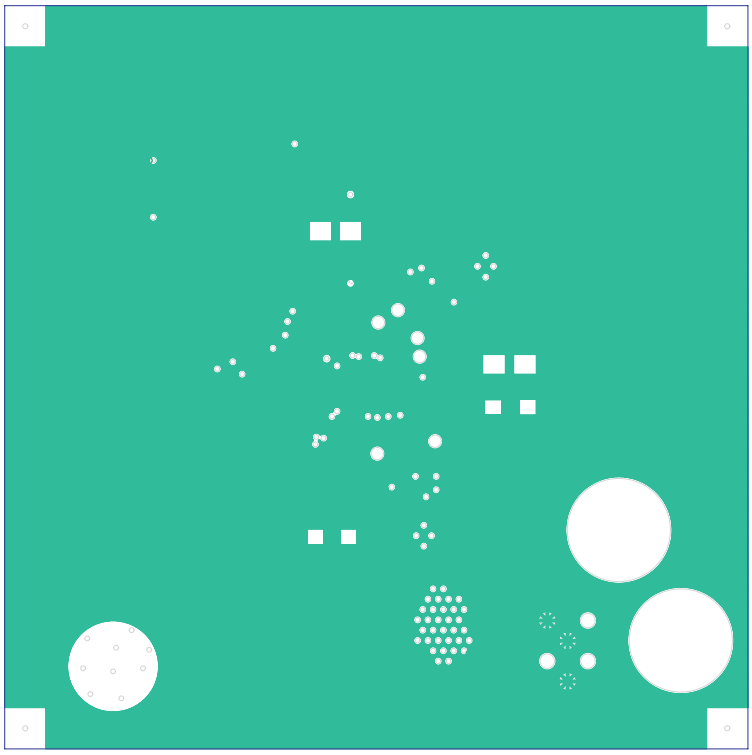


Figure 2. Ground Plane Layer 2

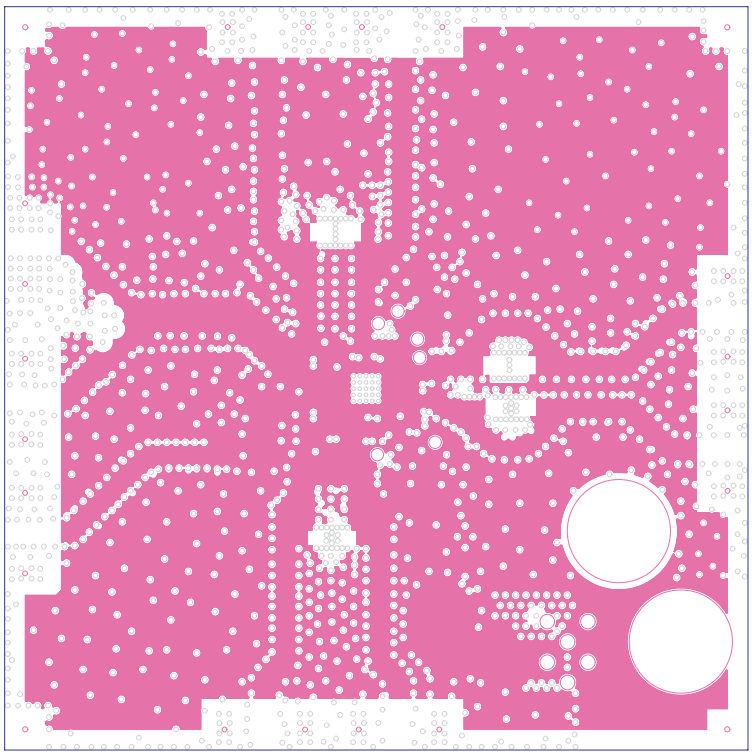


Figure 3. Power Plane Layer 3

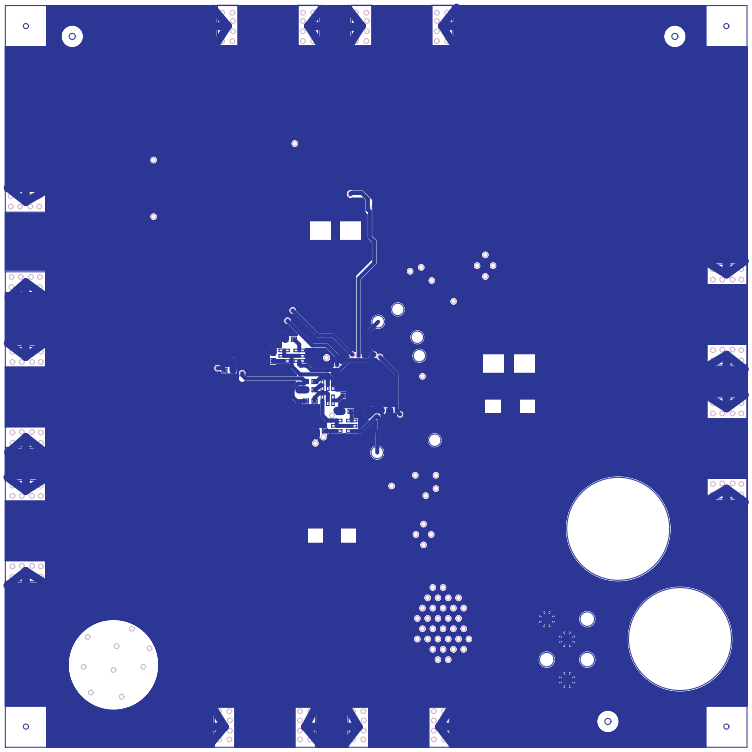


Figure 4. Bottom Layer 4

3.2 Part List

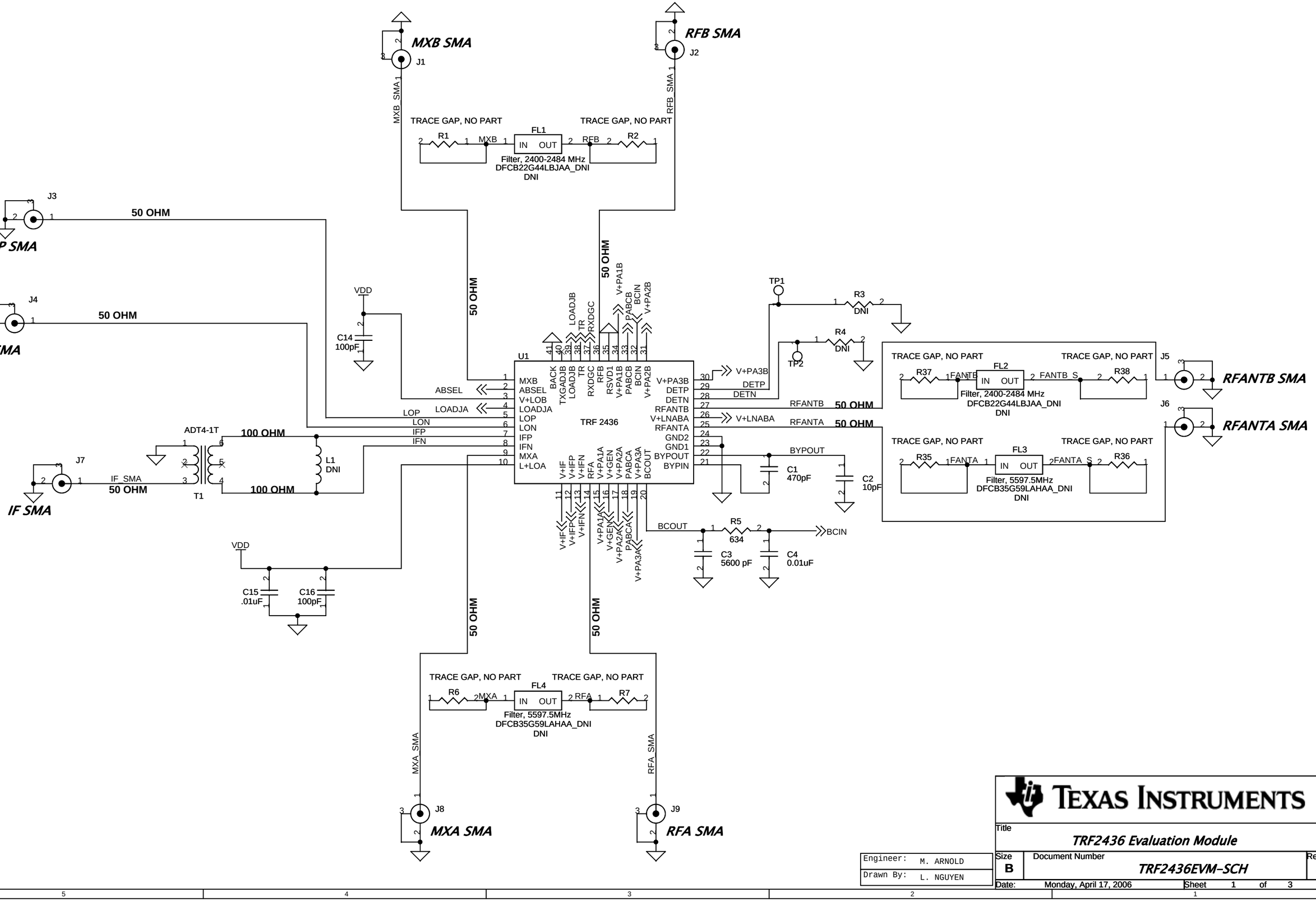
Table 1 lists the parts used in constructing the EVM.

Table 1. TRF2436EVM PARTS LIST

QTY	Ref	Value	Part Number	Note
1	C1	470pF	GRM033R71C471KD	
1	C2	10pF	GRM1555C1H100JZ	
1	C3	5600pF	C0402C562K3RACT	
7	C4 C6 C11 C15 C17 C24 C33	0.01µF	GRM155R71E103KA	
12	C5 C9 C12–C14 C16 C19 C20 C22 C25 C26 C31	100pF	GRM1555C1H101JD	
3	C7 C8 C18	10µF	ECJ-4YB1A106K	
3	C10 C23 C29	1000pF	GRM155R71H102KA	
2	C21 C32	1.2pF	04025A1R2BAT2A	
1	C28	0.1µF	ECJ-0EB1A104K	
2	FL1 FL2	Filter, 2400–2484MHz	DFCB22G44LBJAA	DNI
2	FL3 FL4	Filter, 5597.5MHz	DFCB35G59LAHAA	DNI
1	FL5	Filter Block, DC power	BNX002-01	
9	J1–J9	MXB SMA	142-0701-841	
5	J10–J14	PA_A SEL	54201-S08-3	
4	L1 R3 R4 R31			DNI
3	L2 L3 L7	27Ω at 100MHz	EXC-ML16A270U	
4	L6 L8 L10 L12	120Ω at 100MHz	BLM15AG102SN1D	
2	L9 L11	33nH	LQW15AN33NJ00D	
1	P1	+3.3V_IN	ST-351A	
1	P2	PSG	ST-351B	
2	Q1 Q3	IRLML6401	IRLML6401	
2	Q2 Q4	MMST2222A	MMST2222A-7	
8	R1 R2 R6 R7 R35–R38	TRACE GAP, NO PART		DNI
1	R5	634	ERJ-2RKF6340X	
9	R8–R13 R15 R32 R33	10K	ERJ-2GEJ103X	
7	R16–R18 R24 R25 R28 R29	1K	ERJ-2GEJ102X	
4	R20–R23	200	ERJ-2RKF2000X	
1	R26	750	ERJ-2GEJ751X	
1	R27	2K POT	3214W-1-202E	
1	R30	5.1K	ERJ-2GEJ512X	
1	T1	ADT4-1T	ADT4-1T	
6	TP1–TP6	T POINT R	5015	
1	U1	TRF2436	TRF2436	
2	U2 U3	MMDT3906	MMDT3906-7	
1	U4	MMDT3904	MMDT3904-7	

3.3 Schemtic Drawing

The schematic drawing for the TRF2436EVM appears on the following page.



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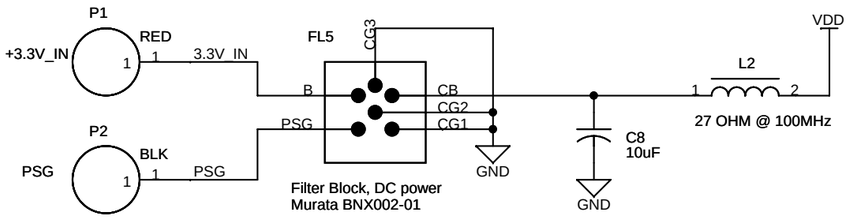
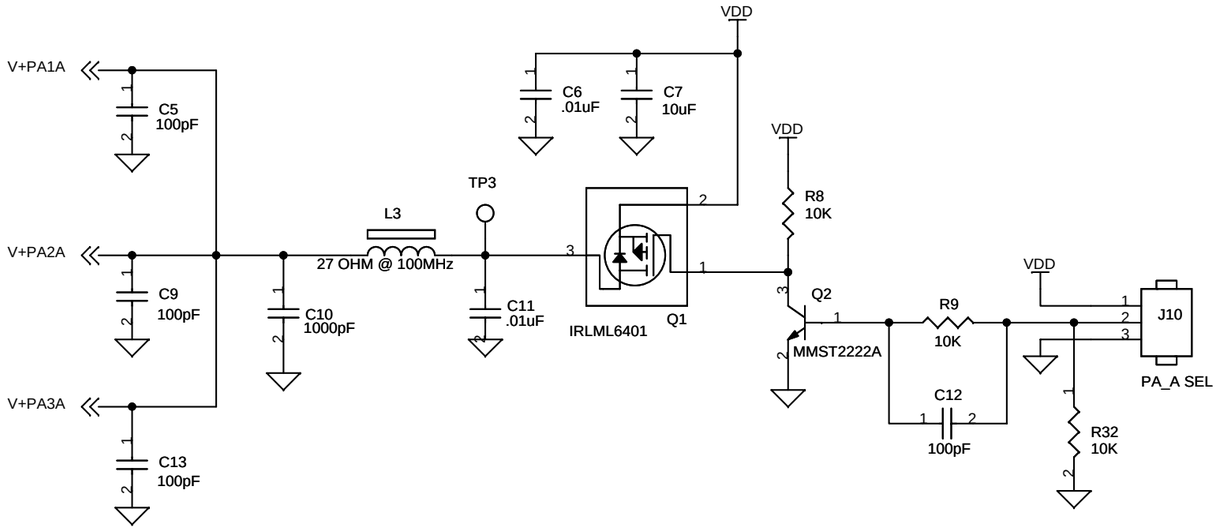
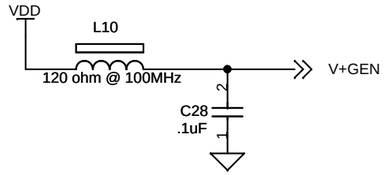
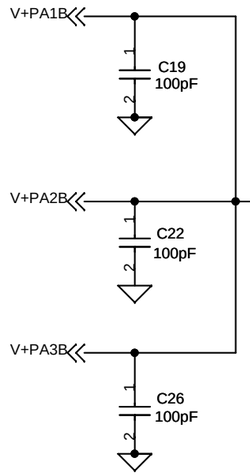
Size	Document Number	Rev
B	*TRF2436EVM-SCH*	A

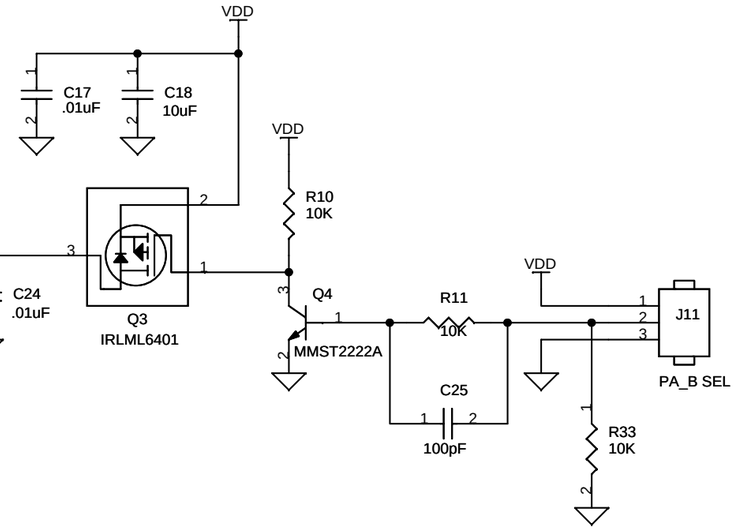
Date: Monday, April 17, 2006 Sheet 1 of 3

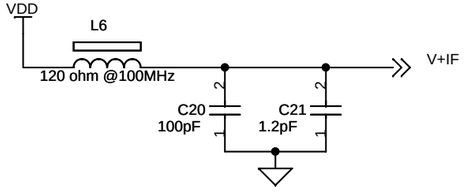


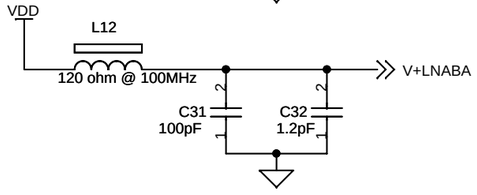


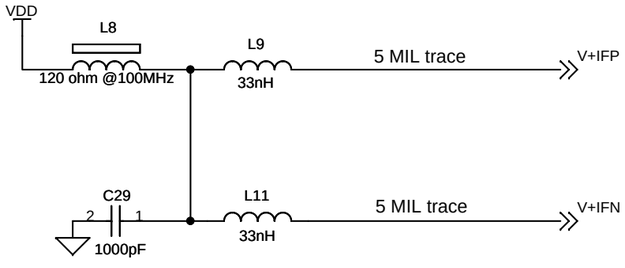


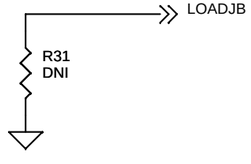


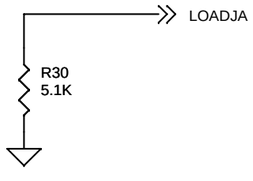












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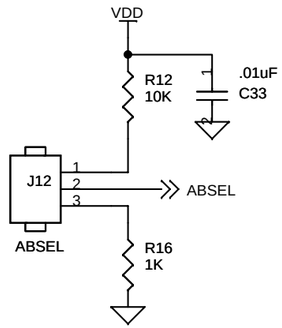
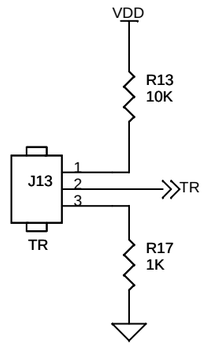
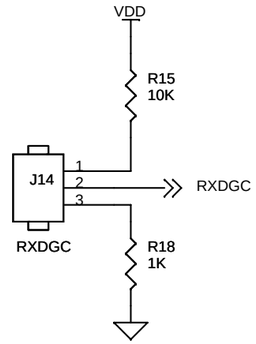
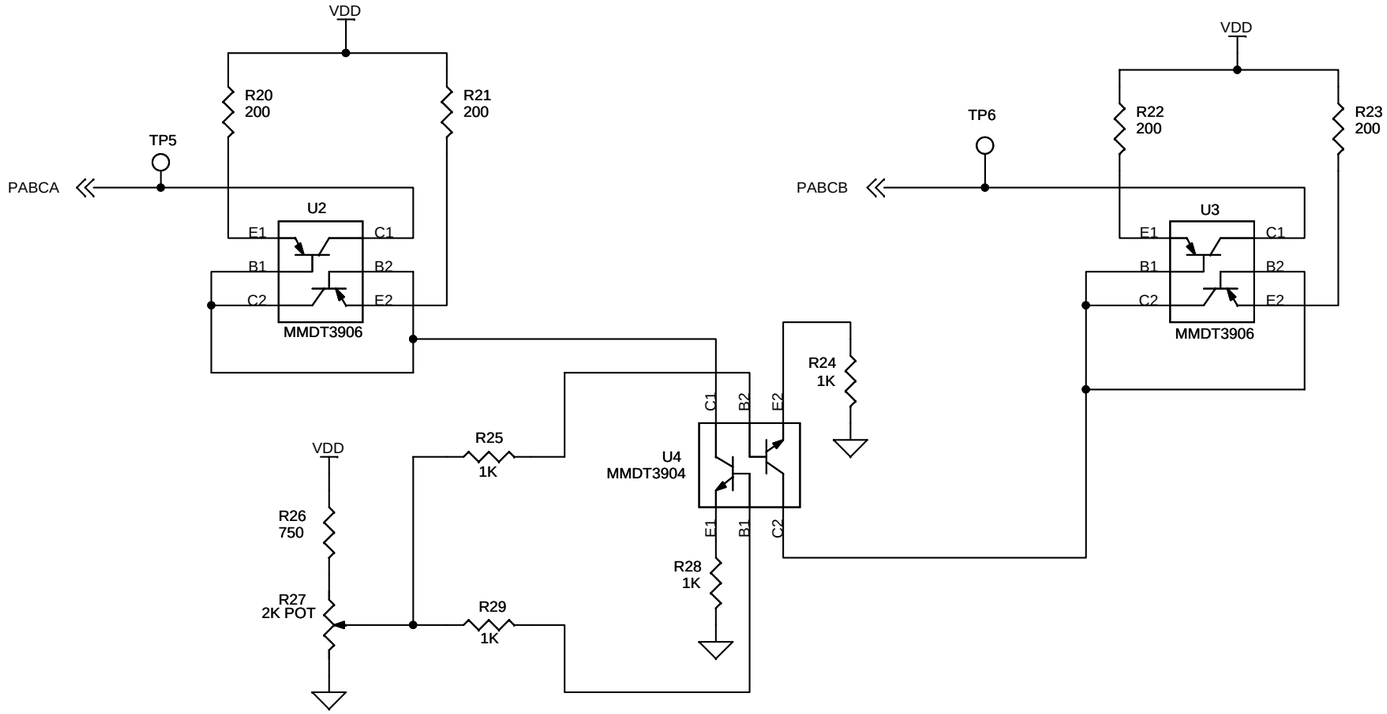
Size: B	Document Number: *TRF2436EVM-SCH*	Rev: A
Date: Thursday, April 13, 2006	Sheet 2 of 3	









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EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 0 V to 3.3 V and the output voltage range of 0 V to 3.3 V.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than 85°C. The EVM is designed to operate properly with certain components above 85°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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