PA-1
User Manual

Revision	Modified		Checked		Module Name
	Date	By	Date	By	
					PA-1
					Description
					In-Line, Bi-Directional RF switching module for 420 to 475MHz. PA-1 includes a 120mW RF Power Amplifier for the transmit direction and a SAW filter with LNA for the receive direction.
					Remarks
					Item Number
					52450041

1. TABLE OF CONTENTS

TABLE OF FIGURES

2. PROJECT DESCRIPTION

PA-1 is an in-line, Bi-Directional RF switching module for 420 to 475MHz. It includes a 120mW RF Power Amplifier for the transmit direction and a SAW filter with LNA for the receive direction. In addition to the item number, check-boxes are provided to indicate power output level. When the Control Input line is low (typically below 1V), the module is in Receive Mode. When the Control Input is high (typically above 1.2V), the module is in Transmit Mode. The PA-1 typically operates from a 5Vdc supply or battery voltage down to 3.5Vdc. Test Pad PD is a Power Detector output that provides an analog voltage that is proportional to the transmit output power.

FCC ID: LW9-PA1
IC ID: 2119B-PA1

Note: Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Note: The user is cautioned that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons. The antenna(s) used for this transmitter must not transmit simultaneously with any other antenna or transmitter, except in accordance with FCC and IC multi-transmitter product procedures.

Note: Under Industry Canada regulations, this radio transmitter may only operate using an antenna of the same type and equal or lesser gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Remarque : L'opération est soumis à deux conditions suivantes: (1) ce dispositif ne peut pas causer de brouillage, et (2) ce dispositif doit accepter toute interférence, y compris le brouillage qui peut causer intempestif de fonctionnement du dispositif.

Remarque : L'utilisateur est averti que les changements ou modifications non expressément approuvées par la partie responsable de la conformité pouvaient annuler l'autorisation l'utilisateur à faire fonctionner l'équipement.

Remarque : L'utilisation utilisée pour cet émetteur doit être installée pour fournir une distance de séparation d'au moins 20 cm de toutes les personnes. L'utilisation utilisée pour cet émetteur ne doit pas transmettre simultanément avec une autre antenne ou émetteur, sauf conformément aux procédures de produits multi-transmitter de FAC et IC.

3. TECHNICAL SPECIFICATION

Parameter	Min.	Typ.	Max.	Unit	Notes
Supply Voltage	3.5	4.0	6.0	Vdc	
Supply Current TX 120mW		180±10%		mA	50 ohm load
Supply Current RX			1.0	mA	
TX Frequency Range	420		475	MHz	
RX Frequency Range	450		472	MHz	Limited by Rx SAW filter.
RF Output Power	19		20.8	dBm	10dBm input
RF Receive Signal Gain		20±10%		dB	
Switching Time RX to TX			0.5	mS	
Switching Time TX to RX			0.3	mS	
Control Input High		1.2	12.0	Vdc	TX Mode
Control Input Low	-2.0	1.0		Vdc	RX Mode
Operating Temperature	-30º		85º	C	

4. FUNCTIONAL DESCRIPTION

4.1. Operation

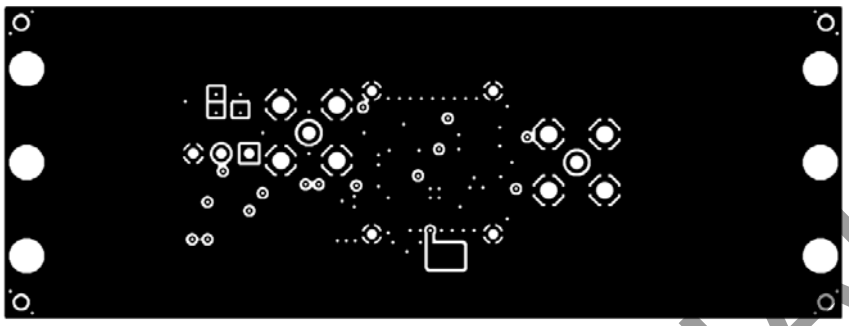
When the logic level on the Control Input line is low (typically below 1V), the module is in receive mode. The RF switches are configured to route the incoming RF signal from the antenna through a SAW filter and Low Noise Amplifier (LNA) for increased sensitivity. The SAW filter allows only in-band signals to pass, therefore out of band interference is reduced significantly. SAW filters may be changed to accommodate frequencies within the TX frequency range other than 450 to 472 MHz, or omitted in favor of external band pass filters. Aside from boosting the incoming signal, the LNA's amplification helps to offset the signal loss from the SAW filter and lengths of cable. The amplified signal is connected to the RF module via the onboard SMB connector marked X2.

When the logic level on the Control Input line is high (typically above 1.2V), the module is in transmit mode. The RF switches are configured to route the transmitted signal from the RF module to the PA-1 Power Amplifier. The Power Amplifier boosts the transmitted signal power. After the PA, the amplified signal is fed through a Low Pass Filter to suppress harmonics. The amplified signal is then fed to the antenna via the onboard SMB connector marked ANT. Test Pad PD is a Power Detector output that provides an analog voltage proportional to the transmit output power.

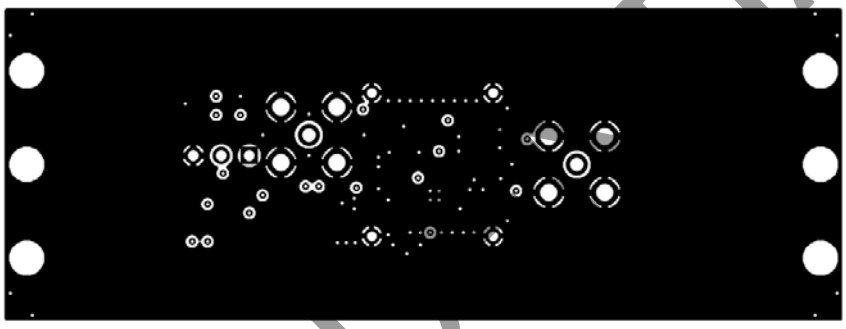
Solder Jumper	UP	DOWN
Closed	11KΩ pull-up to +3.3Vdc	9KΩ pull-down to Ground
Open	Default, 100K pull-down	

5. PCB

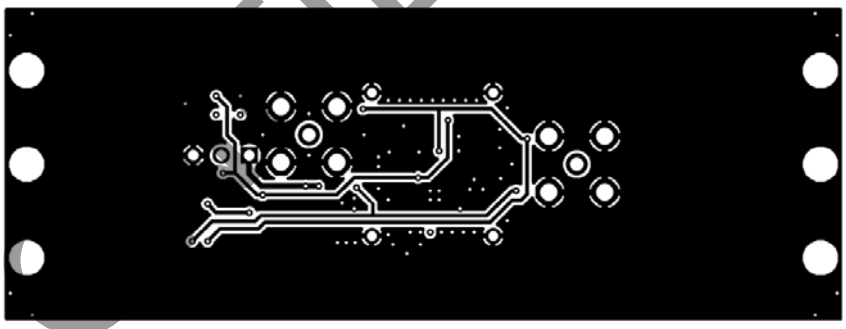
5.1. PCB Layers



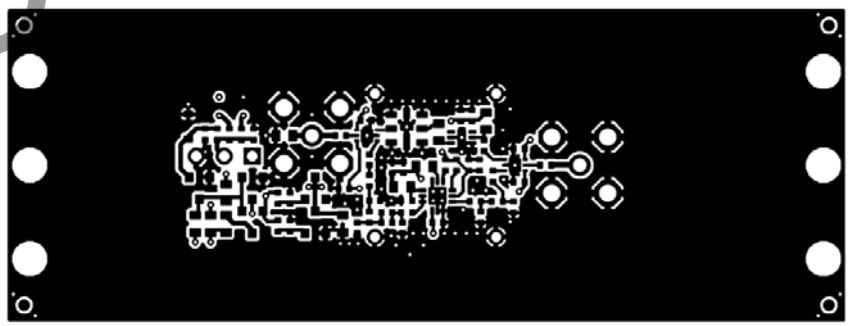
TOP LAYER



LAYER 2



LAYER 3



BOTTOM LAYER

Figure 1, PA-1 PCB Layers

5.2. Component Placement

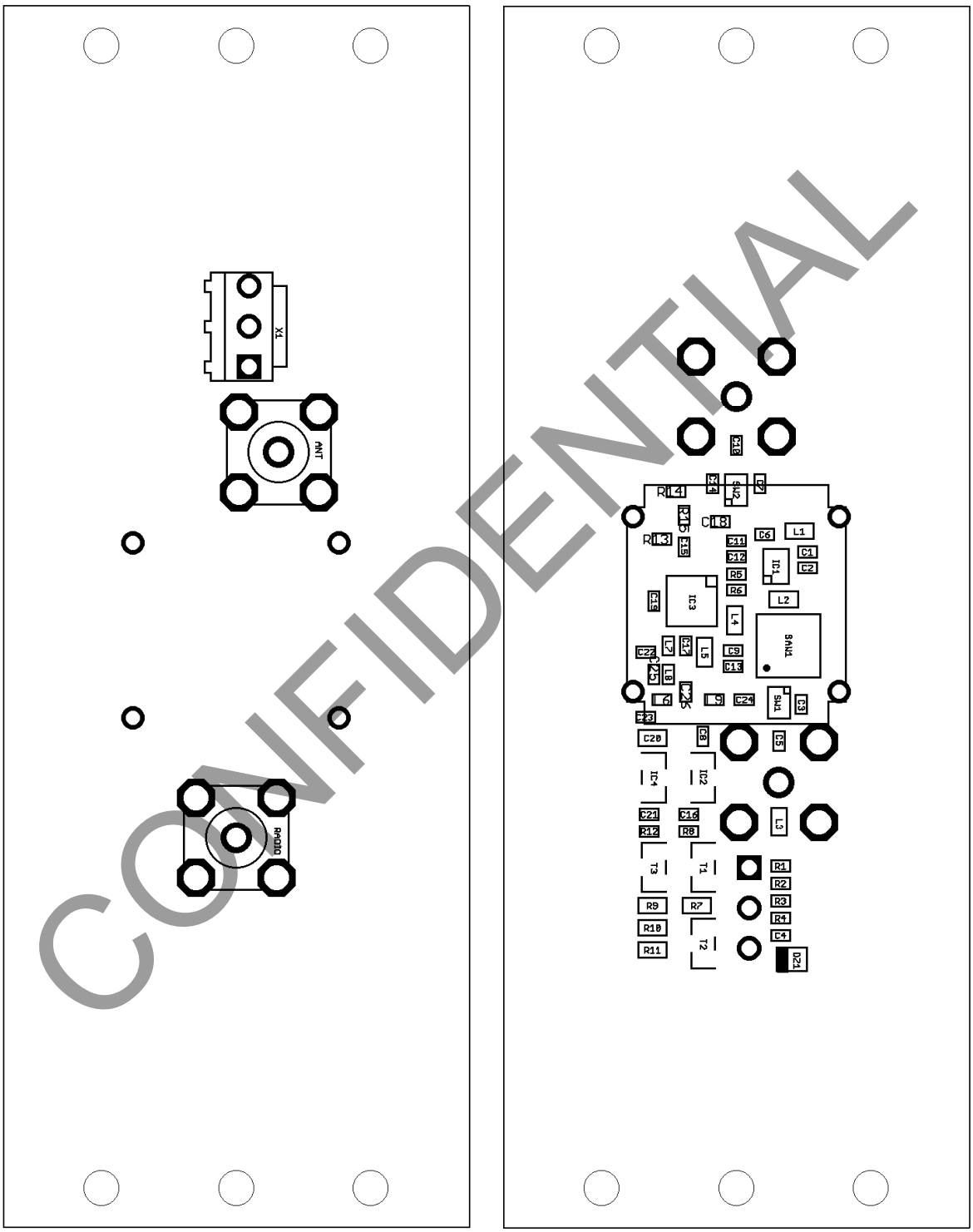


Figure 2, PA-1 Top Components (left); Bottom Components (right)