A 2 WATT DRIVER AMPLIFIERS FOR 3456MHZ

by chuck steer wa3iac

Back in the day, having one watt of power on 3456MHz was considered big power. Now it is not unusual to see surplus amplifiers on the web with power of 40 watts or more for less then a dollar a watt. This two watt amplifiers described in this article will work for anyone needing a low level, class AB driver or just QRP power amplifier for roving or microwave beacon. Weather your needs are for CW, SSB, FM, or digital mode this amplifier will most likely work for you.

About MMIC's in general

Micro monolithic integrated circuit have been with us for sometime now. Low power ones work up to 8 or 10GHz. with only 10 or 15 mW of output power. The gain of most of the MMIC's became lower as frequency increased about 1000MHz. The major advantage was that little or on tuning was needed. Add to this the lower cost, MMIC's became very popular with most builder. The main drawback was that the quiescent current was a bit higher then when using a FET for the same power output. Even so, MMIC's still found there way into most projects, and most were match to about 50 Ohms in and out. As the years moved on and so did MMIC's and we saw power increase and noise figures decrease. Now finding one watt at 2 or 3GHz is not uncommon. Most of these devices now are +5 volt and come in new packages (SOIC-8, SOF-26). With very little tuning it was an easy using MMIC were easy to build and test. The band withe of the 3.5GHz amplifier was not DC to 2GHz but was about 800MHz. With the center about 3456MHz the 2 watt MMIC covers 3000 to 3800MHz without tuning.

The application note gave the test frequency as 3500MHz making it ideal for the ham radio band. As with MMIC's in the past, only two capacitors (good RF type) are needed in the RF path. One on the input and one on the output line. The board was FR4, .031 thickness. FR4 has some loss but is usable at 3456MHz if the lines are keep short.

Unlike the first generation MMIC's, most require a bias line (pin 1). This isn't a problem because in this amplifier the bias is +5 volts, but must be at or below the supply voltage. The power up/down must be at or less then +5 volts so just adding a simple resistor divider works fine. All that is needed is some by passing capacitors and a chock and you have an amplifiers.

About the SZP-3026Z device

The SZP-3026Z is a high linearity 3.0-3.8 GHz 2W single stage Class AB Hetero junction Bipolar Transistor (HBT) amplifier housed in a proprietary surface-mountable plastic encapsulated package. The HBT amplifier is made with InGaP on GaAs device technology and fabricated with MOCVD for an ideal combination of low cost and high reliability. This product is specifically designed as a flexible final or driver stage for 802.16 WiMAX equipment in the 3.0-3.8 GHz bands, and it can operate from a 3V to 6V supply. Unlike the lower power MMIC’s the SZP-3026Z is per-matched to approximately 5 ohms on the input for broadband performance and ease of matching at the board level. It features an output power detector, on/off power control, ESD protection, excellent overall robustness, and a proprietary hand re workable and thermally enhanced SOF-26 package.

General Specifications:

Frequency Range: 3000MHz to 3800MHz
Gain: 12dB at 3500MHz
Noise Figure: 5.1dB at 3500MHz
P1 dB: +33.2dBm at 3500MHz
IMD3: -43dBc at 3500MHz (+23dBm per tone at 1MHz spacing)
In/Out Return Loss: -18dB/-10dB at 3400-3600MHz
SOF-26 Package

pin 1 active bias circuit

pin 2 RF input, and has a DC voltage present

pin 3 power up/down.

This voltage should be less then the voltage on pin 1 and limited to less then 10mA

pin 4 power detector.

The output voltage samples the power at the input of the amplifiers not the output.

Pin 5 RF output and Vcc.

Pin 6 n/c

Figure 1 is the schematic

Figure 2 is the completed printed circuit board

Figure 3 parts list

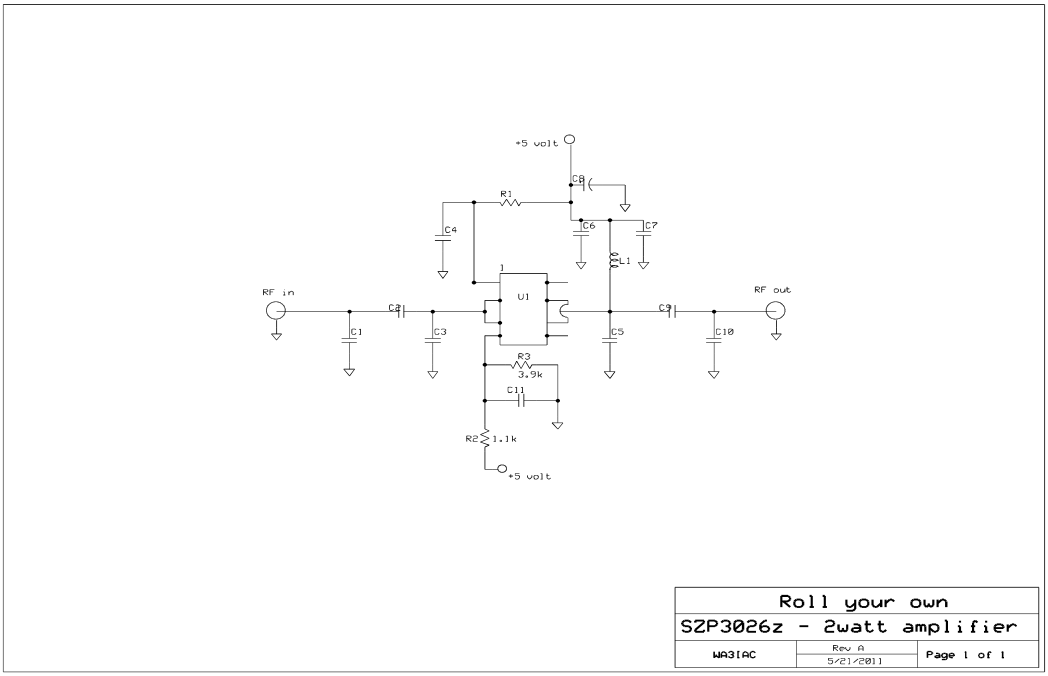

Figure 1

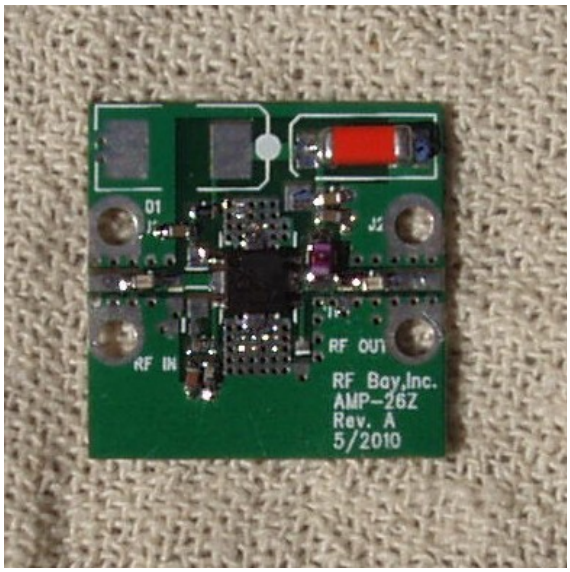

Figure 2

NAME	VALUE	SIZE	REMARKS
U1	SZP-3026z	SOF-26 package	2 watt MMIC
R1	0 Ohm	0402, 0603 may be used	
R2	1.1k	0402, 0603 may be used	
R3	3.9k	0402, 0603 may be used	
C1	SBT	0402, 0603 ceramic	SBT = select by test
C2	10pf	ATC 600S	
C3	SBT	0402, 0603 ceramic	select by test
C4	.1uF	0402, 0603 ceramic	
C5	1 pf	0402, 0603 ceramic	select by test
C6	.1uF	0402, 0603 ceramic	
C7	10pf	0402, 0603 ceramic	
C8	10uF	1210, “B” size	
C9	10pf	ATC 600S	
C10	SBT	0402, 0603 ceramic	select by test
C11	1pf	0402, 0603 ceramic	
L1	30nH, 1.2A,	805	Coil craft

Figure 3

Assembling components on the printed circuit board

Mount the SZP-3026z device first by first tinning the bottom then heating the board to between 180 and 190deg to flow the solder. Having done that, solder the body of the device to the board leads to the pads. A good ground connection is essential not only for the return but for the device to disperse the heat within.

The board layout is for a 0402 size component but I used 0603 that just fit on the pads. The 10pf capacitors used in the RF path were ATC 600S found on Ebay. Although 0402 ceramic capacitors seem to work OK at that frequency. All other capacitors were 0603 and the chock was 0805 size.

As for soldering, I use the three-second rule. That is not to apply heat for more then three seconds. If retouching is needed, let the component cool down before re-soldering.

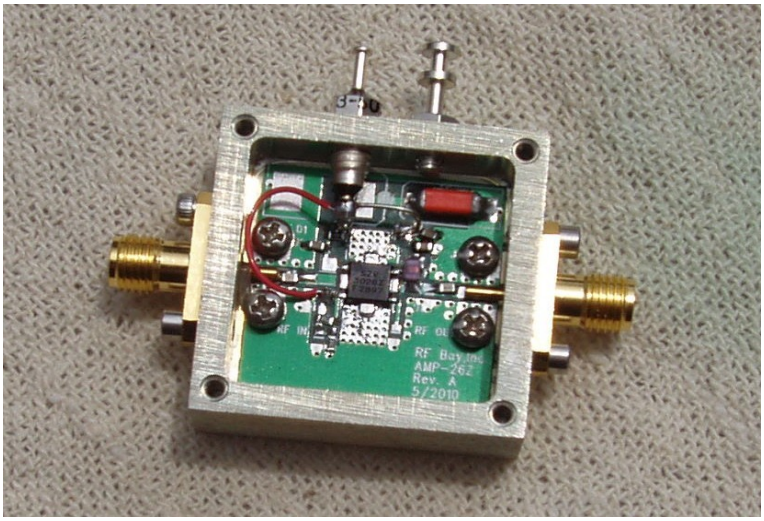

Figure 4 complete unit

NOTES:

Detail Spec on Web as follows:

SZP-3026Z DATA SHEET AND S PARAMETER:

http://www.rfmd.com/CS/Documents/SZP-3026ZDS.pdf

http://www.rfmd.com/CS/Documents/SZP-3026(Z)_OutlineSPACEDrawing.pdf

Digi-Key: www.digikey.com/

Mouser : www.mouser.com/

Milled housing: www.rfmicrowave.it/

Complete kits are not available. I have a limited supply of printed circuit boards and/or SZP-3026Z

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