AM090945SF-1H Power Amplifier

Technical/User Manual
(Version 2)

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By

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1) General description.

AM090945SF-1H is a general-purpose power amplifier (PA) for Radio transmitter application. It has a built-in, on-off control, which is TTL compatible, and a temperature sensor for over temperature alarm. This manual provides the operating instruction, as well as technical specifications.

2) Operating instruction (User Manual)

Figure 1 is the photograph of the PA. All the connections are labeled on the top cover of the PA. The turn-on procedure is described below.

A. Connect the PA according to the label shown on the top cover.
B. Apply +13.6 volts to the DC pin on the top left corner of PA.
C. Apply the radio signal to the amplifier. The radio signal can be from 0.1-watt to 3-watt to reach the desired output power at the "ANT" terminal.
D. Monitor the output power at the "ANT" terminal.

Figure 1: Photo of AM090945SF-1H PA

3) Technical Manual

3.1) Specification

Table 1 shows the specification. The PA delivers a single-tone output power of 30 watts with 9dB gain over the 895-905MHz frequency band. It has a built-in on-off control, which is TTL compatible, and a temperature sensor for over temperature alarm. The PA will work with all possible modulation schemes.

Table 1: Module Specifications

Parameters	Specifications	Comments
Frequency	895 – 905MHz	
Gain at 30W	> 9dB	
Gain Variation from 895 to 936 MHz	+/- 1dB	
Power at saturation	> 30W	
Input & Output Impedance	50 Ohms	
Voltage Supply	13.6V +/- 15%	Regulator could be used
Supply Current	<12A PA ON <0.2A PA OFF	
T/R Signal	TTL Low for TX TTL High for RX	Input Impedance > 50k Ohms. For open signal gives TTL High.
Module switching time	<10ms	
Temperature Alarm	TTL Low for ON TTL High for OFF	
VSWR Protection	Comply	Isolator protection
RF Connectors	TNC-Female	
DC & Control Interface	Feed thru Pins	
Mechanical Package Size	5.94 x 2.5 x 2.25”	

3.2) PA Technical Design

AM090945SF-1H is a single-stage power amplifier, which provides amplification from 895MHz to 905MHz with 9dB minimum gain. Figure 2 shows the overall block diagram of the module and Figure 3 shows a photo of the module internal SMT assembly.

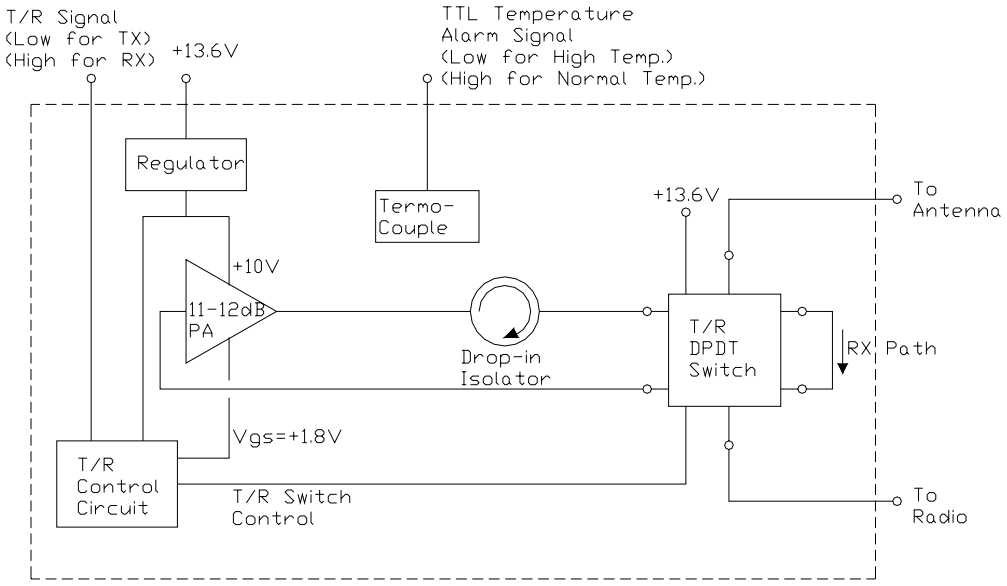

Figure 2: AM090945SF-1H Module Top Level Schematic

Figure 3: Photo of Module SMT Assembly

Figures 4, 5, 6, 7 show the detailed schematics of the RF circuit, the +10V Regulator circuit, the T/R Switching circuit and the Temperature Sensing circuit respectively.

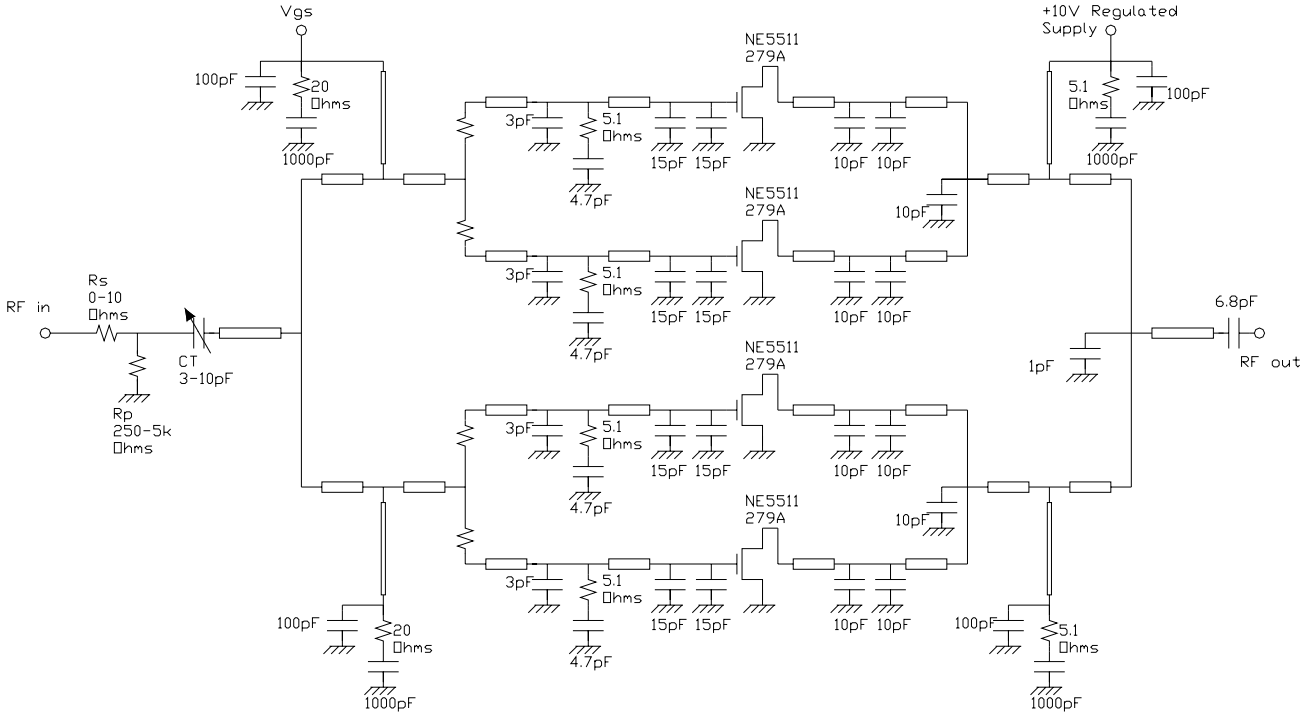

Figure 4: Detailed Circuit Schematic of RF Circuit (PA)

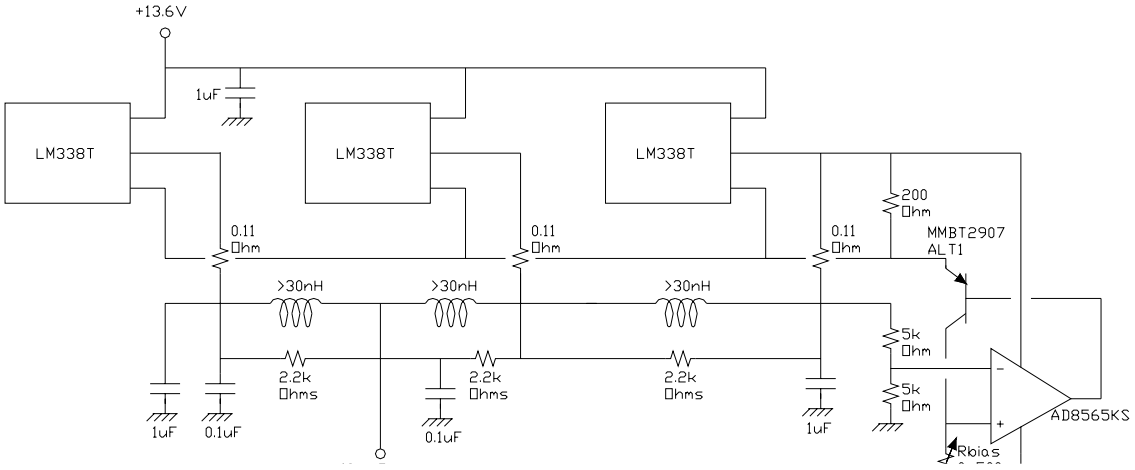

Figure 5: Detailed Circuit Schematic of +10V Regulator

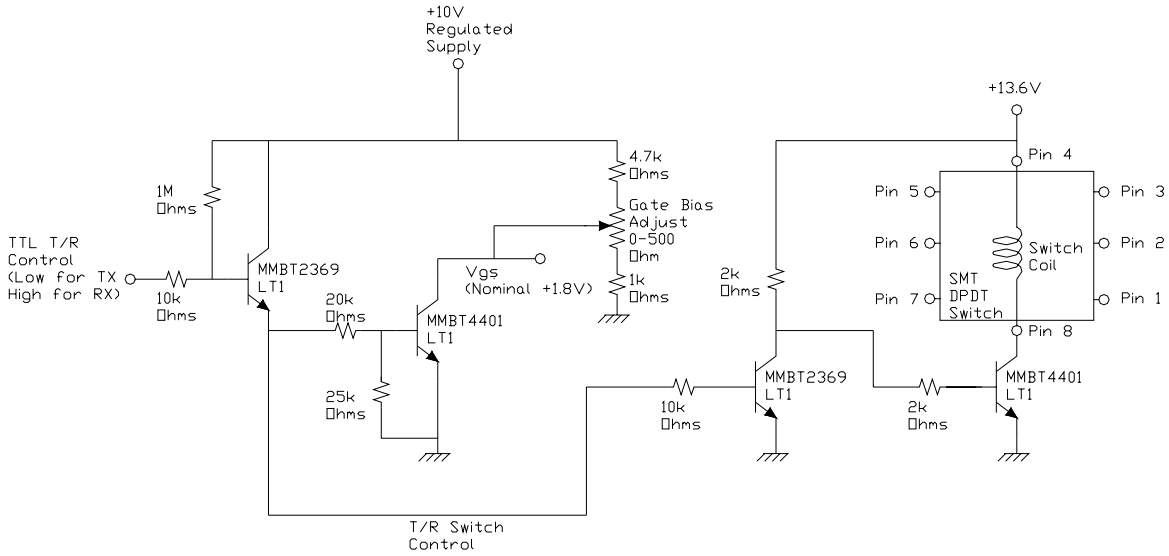

Figure 6: Detailed Circuit Schematic of T/R Circuit

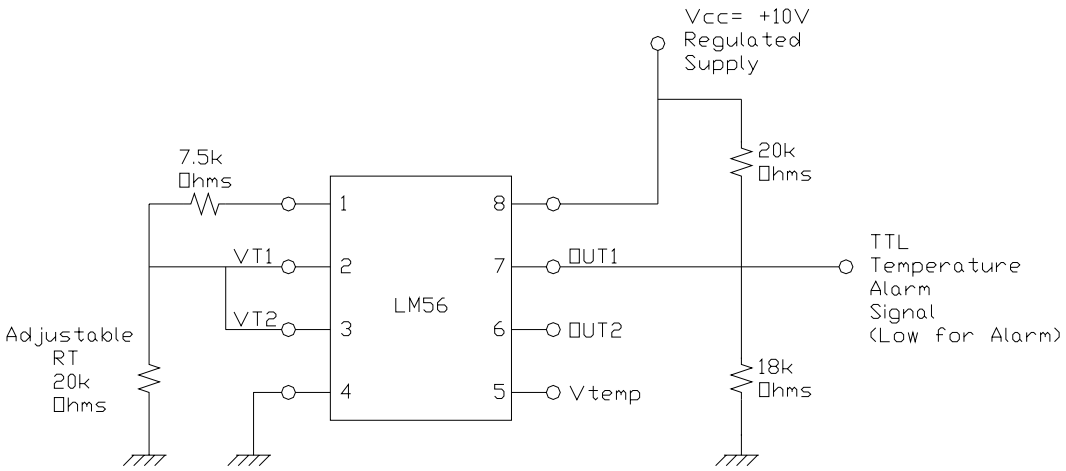

Figure 7: Detailed Circuit Schematic of Temperature Sensing Circuit

Table 2. Parts list.

DESCRIPTION
A) Package
HOUSING
Lid
B) Major Components
PCB BOARD
Right-Angle TNC Jack
10W LDMOS Power FET
0.9GHz 50W Isolator
NPN Switching Transistor
NPN Switching Transistor
PNP Transistor
Temperature Sensor
OpAmp
5A Regulator
MECHANICAL RELAY
C) Resistors
Zero Ohms 0603 SMT Resistor
5 Ohms 0603 SMT Resistors
50 Ohms 0603 SMT Resistors
200 Ohms 0603 SMT Resistors
510 Ohms 0603 SMT Resistors

1 kOhm 0603 SMT Resistor
2 kOhms 0603 SMT Resistors
4.7k Ohms 0603 SMT Resistors
5 kOhms 0603 SMT Resistors
7.5 kOhms 0603 SMT Resistors
10 kOhms 0603 SMT Resistors
18 kOhms 0603 SMT Resistors
20k Ohms 0603 SMT Resistors
25k Ohms 0603 SMT Resistors
100 MOhms 0603 SMT Resistors
0.22 Ohm 2512 Thick Film Low Ohm Resitor
1/4W Leaded Resistors
Trim Pot 500 Ohms
PVZ2 500 Ohms Potentiometer
D) Capacitors
100 pF 0603 SMT Capacitor
1000 pF 0603 SMT Capacitor
4.7 pF ATC100 SMT Capacitor
10 pF ATC100 SMT Capacitor
15 pF ATC100 SMT Capacitor
1 pF ATC100 SMT Capacitor
3 pF ATC100 SMT Capacitor
6.8 pF ATC100 SMT Capacitor
10 pF ATC100 SMT Capacitor
0.1 uF 0805 Capacitor
1 uF 35V Capacitor
3 - 10pF Variable Capacitor
E) Misc.
5000pF 10A DC Pin
Low Current DC Pins with filter
4-40 Ground Lug
2-56 1/4" Socket Screws for PCB
4-40 1/4" Socket Screws for Isolator Assembly
Teflon Barrel
No. 2 Lock washer
No. 4 Lock washer
Jumpers

3.3) Tuning & Adjustments Procedure

No user tuning is required during module installation. The following tuning procedures are used by factory personnel during module manufacturing.

a) +10V Regulator Output Adjustment
Make sure the regulator output is +10V ± 0.2V. If the output needs adjustment use the variable resistor labeled R_{bias} in Figure 5 to adjust the output voltage. Change

supply voltage of +13.6V by ± 2.0V and make sure regulator output is stable around +10V (i.e. < 0.3V variation).

b) T/R Control Check
Make sure the SMT switch is in TX mode for T/R Signal < 0.5V and in RX mode for > 2.2V. No adjustment is needed for the T/R circuit in Figure 6. Measure input resistance of T/R pin, value should be >50kOhms. Disconnect T/R signal module should revert to RX mode. Total module current should drop below 0.1A in RX mode.

c) Quiescent PA Current Adjustment
With module turned on in TX mode adjust the variable resistor labeled Gate Bias Adjust in Figure 6 until V_{gs}=+1.8V. Measure the module DC current under no RF input and in the TX mode. Adjust Gate Bias incrementally until total module quiescent current is equal to 2A. Note that under RF power the current increases, therefore this adjustment should be made with no RF input power.

d) Temperature Sensing Adjustment
Place Module on a hot plate and adjust the hot plate temperature to 80°C. With the module turned on in TX mode increase the hot plate temperature gradually to 90°C. The Temperature Alarm show go from TTL high to TTL low. Adjust RT resistor in Figure 7 to change the threshold temperature to be at +85°C ± 4°C.

e) RF Module TX Gain
Connect the module to the Network analyzer. Turn on module and apply low T/R signal for TX mode and measure gain using S-parameter setup gain should be >10dB from 890 – 910MHz. If gain needs adjustment change values of R_s & R_p resistors in Figure 4. Gain at 940MHz should be < gain at 910MHz.

f) RF Module Input Return Loss
Input return loss of module should be > 10dB from 890 to 910MHz. Input return loss could be adjusted used tunable capacitor labeled CT in Figure 4. Output return loss should be >15dB.

g) RF Module RX Gain
Connect the module to the Network analyzer. Turn on module and apply high T/R signal for RX mode and measure gain using S-parameter setup insertion loss should be < 1dB from 890 – 910MHz. Input & output return losses should be > 15dB.

h) RF Module Power
Using AMCOM power setup, connect then turn on the module in TX mode. Adjust signal generator frequency to 900MHz and increase input power until output power is equal to 30W (i.e. 34.8dBm). RF Gain of Module should not drop below 9dB at 30W output power. Power could be adjusted using the quiescent DC current of the PA by adjusting V_{gs}. The DC current should be

increased in increments of 100mA and repeat power measurements until desired power is achieved. Sweep power from 890 to 910MHz to make sure power and gain are flat with frequency.

Appendix I shows the Module Test Traveler used in manufacturing.

The EUT antennas must be mounted a minimum distance of 20 cm away from all persons and must not be co-located or operating in conjunction with any other antenna.

Appendix I

Test Traveler of 30W T/R Module

(P/N AM090945SF-1H)

Part Serial No.: Date:

A) TX State (Voltage Supply= 13.6V ± 15%)

Parameter	Specification	Measured	Pass /Fail	Comment
Frequency	895 – 905MHz			
Small Signal Gain	-	13.6dB		
Gain at 30W output	> 8dB	11.1dB		
Power at Saturation	> 30W	46W		Gain > 8dB
Input Return Loss	> 10dB	17.6dB		
Output Return Loss	> 10dB	23.3dB		
Supply Current	< 12A	8.4A		
T/R Signal Threshold for TX	> 0.5V	0.7V		
Temp. Alarm ON	< 0.5V	0.22V		Bottom housing at > 88°C
Temp. Alarm OFF	> 2.2V	4.6V		Bottom housing at < 82°C
Module switching time	< 10ms	6ms		
VSWR Stability	Stable	Stable		VSWR < 5

B) RX State (Voltage Supply= 13.6V ± 15%)

Parameter	Specification	Measured	Pass /Fail	Comment
Frequency	895 – 905MHz			
Insertion Loss for RX	< 0.7dB	0.55dB		
Input Return Loss	> 15dB	24dB		
Output Return Loss	> 15dB	20dB		
Supply Current	< 0.2A	0.02A		
T/R Signal Threshold for RX	> 2.2V	1.5V		
Module switching time	< 10ms	6ms		

Test Technician: _____ Signature: _____

Quality Control: _____ Signature: _____