RF Power Amplifier for RFID 850 - 960 MHz

MAAPSS0095
V1

Features

- Single Supply Voltage
- Covers International RFID Band
  - 902 - 928 MHz, US
  - 865 - 868 MHz, EU
  - 948 - 958 MHz, Japan
- High Gain 3 Stage HBT Design
- High Efficiency: 50 %
- Lead-Free 3 mm 16-Lead PQFN Package
- 100% Matte Tin Plating
- Halogen-Free "Green" Mold Compound
- RoHS* Compliant and 260°C Re-flow Compatible

Description

M/A-COM's MAAPSS0095 is a high power three stage HBT power amplifier tuned to operate in the RFID bands in the US, the EU and Japan.

The MAAPSS0095 can also be used in other applications where high power and high efficiency are required, such as remote meter reading, electronic vehicle toll systems and ISM applications at 900 MHz. The high power and efficiency at 3.3 V make the MAAPSS0095 ideal for mobile applications.

The MAAPSS0095 is packaged in a lead-free 3 mm, 16-lead PQFN package and includes bias networks that can be controlled by analog signals to switch from active to standby modes.

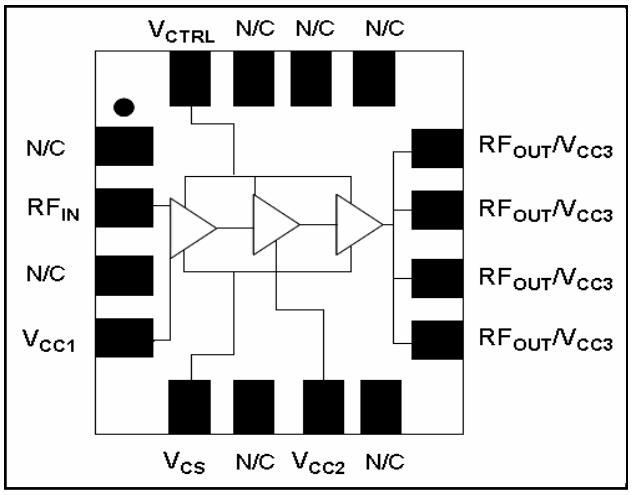
M/A-COM fabricates the MAAPSS0095 using a proprietary InGaP/GaAs HBT process for improved performance over temperature, higher reliability, and improved manufacturability.

Ordering Information[1]

Part Number	Package
MAAPSS0095TR	1000 piece reel
MAAPSS0095TR-3000	3000 piece reel
MAAPSS0095SMB	Sample Test Board

1. Reference Application Note M513 for reel size information.

Functional Block Diagram



Pin Configuration

Pin	Pin Name	Description
1	N/C	No Connection
2	RF_{IN}	RF Input
3	N/C	No Connection
4	V_{CC1}	1st Stage Supply
5	V_{CS}	Bias Supply Voltage
6	N/C	No Connection
7	V_{CC2}	2nd Stage Supply
8	N/C	No Connection
9	RF_{OUT}/V_{CC3}	RF Output, 3rd Stage Supply
10	RF_{OUT}/V_{CC3}	RF Output, 3rd Stage Supply
11	RF_{OUT}/V_{CC3}	RF Output, 3rd Stage Supply
12	RF_{OUT}/V_{CC3}	RF Output, 3rd Stage Supply
13	N/C	No Connection
14	N/C	No Connection
15	N/C	No Connection
16	V_{CTRL}	Control Voltage
17	Paddle[2]	RF & DC Ground

2. The exposed pad centered on the package bottom must be connected to RF and DC ground.

* Restrictions on Hazardous Substances, European Union Directive 2002/95/EC.

- **North America** Tel: 800.366.2266 / Fax: 978.366.2266
- **Europe** Tel: 44.1908.574.200 / Fax: 44.1908.574.300
- **Asia/Pacific** Tel: 81.44.844.8296 / Fax: 81.44.844.8298

Visit www.macom.com for additional data sheets and product information.

General Electrical Specifications [3]: T_C = +25°C, V_{CC} = +3.3 V, P_{IN} = +5 dBm

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Input impedance		Ohms	—	50	—
Input VSWR		Ratio	—	2.0:1	—
Control voltage range		V	0.2	—	2.7
Control voltage slope	$0 \le P_{OUT} \le 32$ dBm	dB/V	—	45	—
Duty cycle		%	—	100	—
Off current	$V_{CTRL1,2}$ = +0.2 V	µA	—	20	—
Control current	$V_{CTRL1,2}$ = +2.6 V, Pin = +5 dBm	mA	—	4	—

3. Operating at or within these electrical bias conditions, at case temperatures up to 85°C, will ensure MTTF > 5 x 10^6 hours.

Electrical Specifications: T_c = +25°C, Z_0 = 50 Ω, F= 960 MHz, V_{CC} = 3.3 V, V_{CTRL} = 2.6 V

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Output power	P_{IN} = +5 dBm	dBm	32.0	32.5	—
Power added efficiency	P_{IN} = +5 dBm	%	50	55	—
Input Return Loss	P_{IN} = -25 dBm	dB	—	12	—
Output Return Loss	P_{IN} = -25 dBm	dB	—	12	—
Harmonics	P_{IN} = +5 dBm	dBc	—	-45	—
Small Signal Gain	P_{IN} = -25 dBm	dB	35	37	—
Current	P_{IN} = -25 dBm	mA	100	180	250

Absolute Maximum Ratings

Parameter	Specifications				Remarks
	Min	Typ	Max	Unit	
V_{CC1}, V_{CC2}, V_{CC3} and V_{CS}	-0.5	—	6.0	V	No operation
$V_{CTRL1,2}$	-0.5	—	3.8	V	
Input power	—	—	+8	dBm	
Operating duty cycle	—	—	100	%	
Operating temperature	-40	—	85	°C	Measured at ground lead
Storage temperature	-20	—	125	°C	

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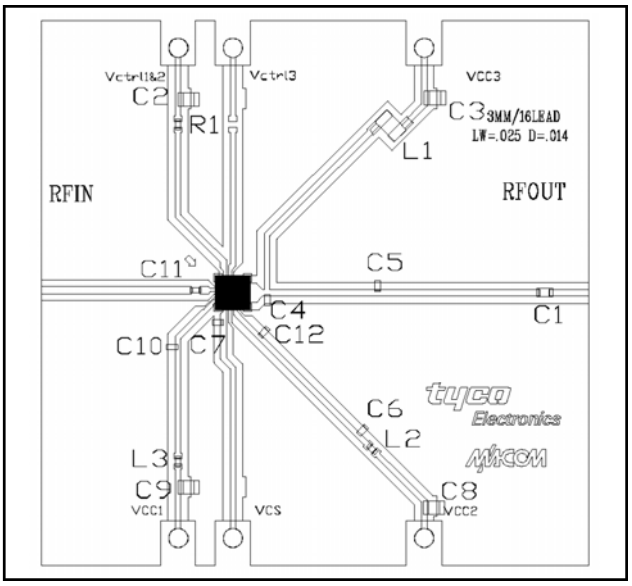
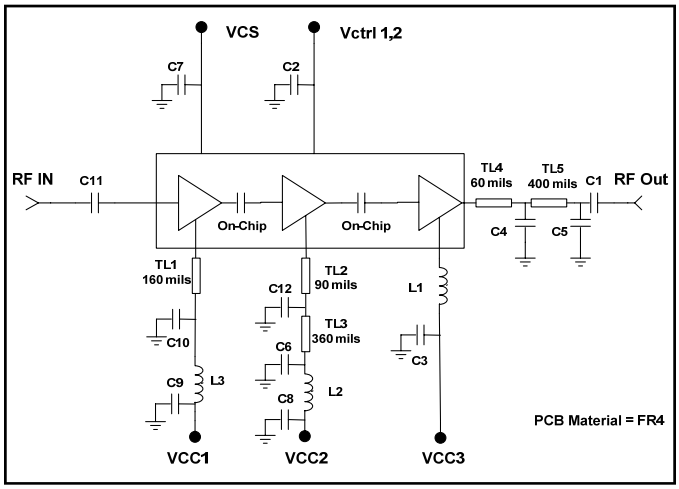
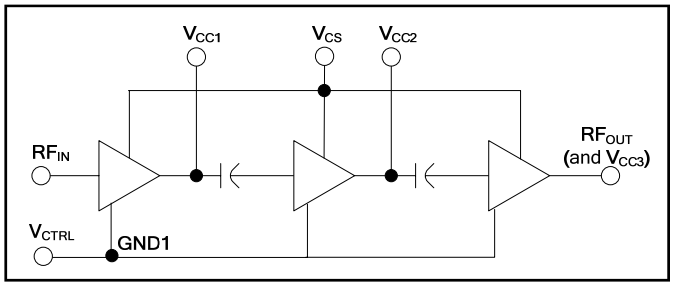
Recommended PCB Configuration



Evaluation Board Schematic



Functional Schematic



MAAPSS0095 External Parts List

Component	Value	Foot Print	Manufacturer
C1, C7, C11	100 pF	0402	Murata
C2, C3, C8, C9	3.3 µF	1208	Kemet
C4	20 pF	603	ATC 600 S
C5	8.2 pF	603	ATC 600 S
C6, C10	1000 pF	0402	Murata
C12	39 pF	603	ATC 600 S
L1	5.6 nH	-	Coilcraft 0906-5J
L2, L3	22 nH	0402	Toko
R1	0 Ohms	0402	-
TL1	50 Ω, 8° @ 900 MHz		
TL2	50 Ω, 4.4° @ 900 MHz		
TL3	50 Ω, 17.5° @ 900 MHz		
TL4	50 Ω, 2.9° @ 900 MHz		
TL5	50 Ω, 19.5° @ 900 MHz		

Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

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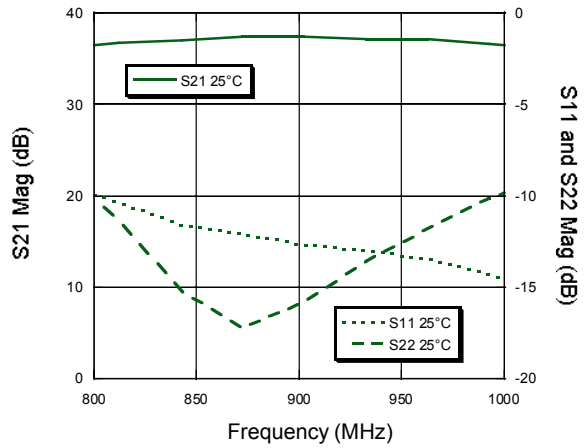
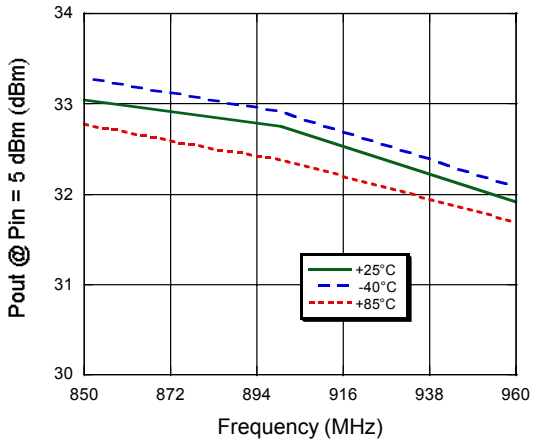
Typical Performance Curves:

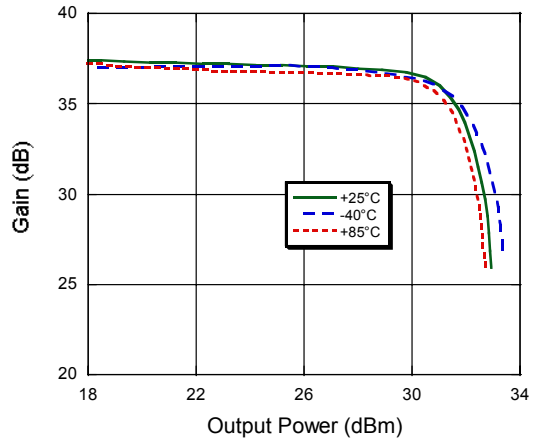
S11, S21 and S22



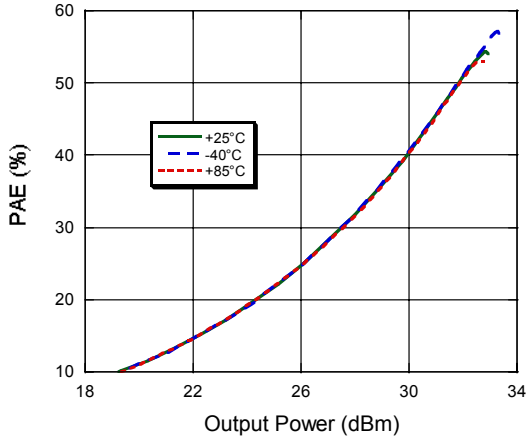
P_{OUT} @ Pin = 5 dBm



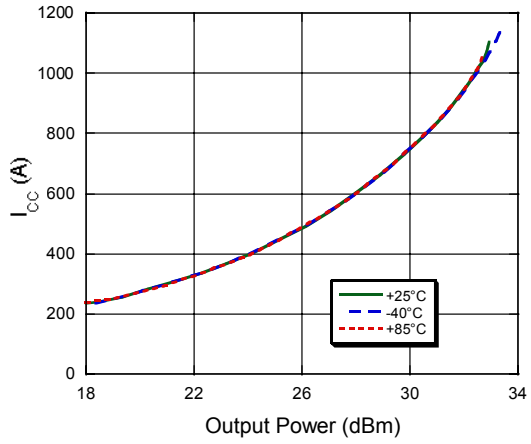
P1dB @ 900 MHz



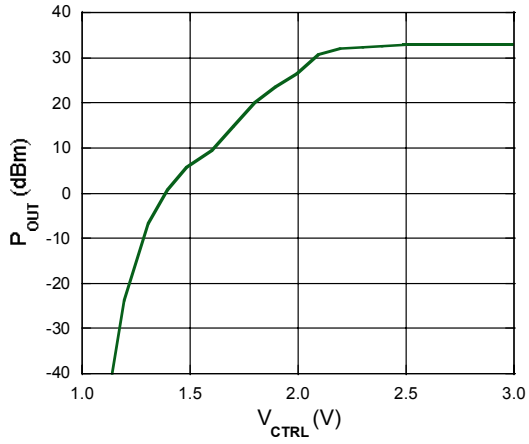
PAE @ 900 MHz



I_{CC} vs. P_{OUT} @ 900 MHz



P_{OUT} vs. V_{CTRL} @ 900 MHz



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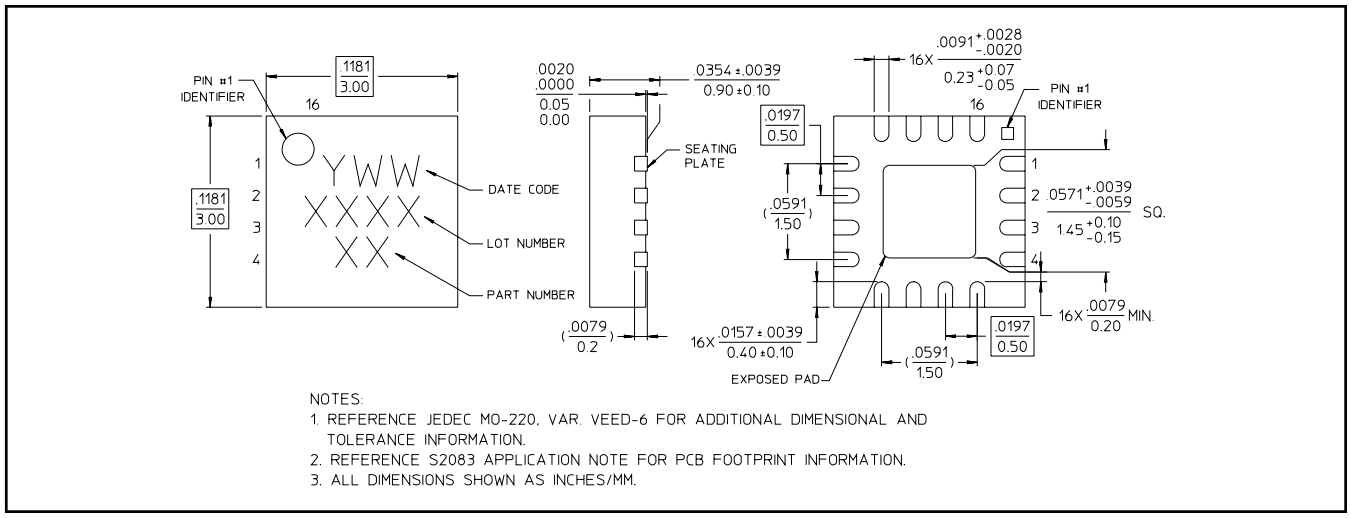
Lead Free 3 mm 16-Lead PQFN †



† Reference Application Note M538 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.

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