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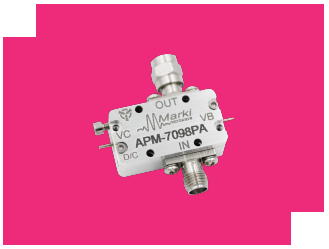
APM-7098PA

0.1GHz – 22GHz Low Phase Noise Amplifier

DEVICE OVERVIEW

General Description

The APM-7098 is a broadband distributed, low phase noise LO driver amplifier designed to provide a saturated +23 dBm output power with low DC power consumption. This amplifier uses GaAs HBT technology for low phase noise, and is optimized to provide enough power to drive the LO port of an S-diode mixer from 100 MHz to 18 GHz or of an H or L diode mixer from 100 MHz to 22 GHz. This amplifier can be operated with a variety of bias conditions for both low power and high-power applications.



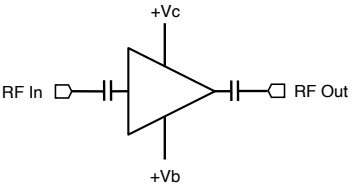
Features

- -165 dBc/Hz phase noise at 10 kHz offset frequency
- +23 dBm output power
- Low DC power consumption
- Positive-only biasing
- No sequencing required
- Unconditionally stable

Applications

- Mobile test and measurement equipment
- Radar and satellite communications
- 5G transceivers
- Driver amplifier L,H,S – diode mixers
- NLTL Driver
- Suitable as a T3 drive

Functional Block Diagram



Part Ordering Options

Part Number	Description	Package	Connectors	Green Status	Product Lifecycle	Export Classification
APM-7098PA	0.1GHz – 22GHz Low Phase Noise Amplifier	PA	Standard	REACH RoHS	Released	EAR99

Table Of Contents

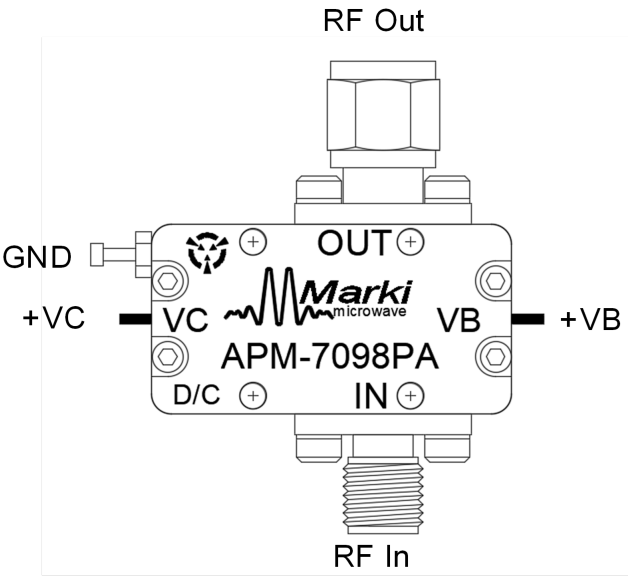
Revision History

Revision Code	Revision Date	Comment
-	2020-08-01	Datasheet Initial Release
A	2020-09-01	Updated maximum thermal specifications, recommended operating conditions, performance plots and application information.
B	2020-10-01	Updated min output power and small signal gain specs.
C	2021-01-01	Updated thermal resistance and max input power specs.
D	2021-08-01	Updated thermal resistance.
E	2023-02-01	Added IP2 plots.

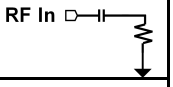
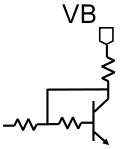
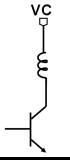
Port Configuration and Functions

Port Diagram

A port diagram of the APM-7098PA is shown below.



Port Functions

Port	Function	Connector Type	Description	Equivalent Circuit for Package
RF In	RF Input	2.92F	This is the RF Input port of the amplifier die. It is RF matched to 50 Ω, and has built-in DC blocking capacitors.	
RF Out	RF Output	2.92M	Housing or outside of the coaxial cables must be connected to a DC/RF ground potential with high thermal and electrical conductivity.	
VB	Base Current Mirror Bias Port	-	Port VB is the DC voltage bias for the current mirror that controls collector current supplied to the amplifier. Larger voltages result in a higher current draw through port VC, effectively functioning as a gain control pin of the amplifier. See section 3.6 for performance at different bias conditions.	
VC	Collector DC Supply Port	-	Port VC is the DC voltage supply for that supplies the amplifier's collector current. It is connected internally through the amplifier die's RF output port.	

Specifications

Absolute Maximum Ratings

The Absolute Maximum Ratings indicate limits beyond which damage may occur to the device. If these limits are exceeded, the device may become inoperable or have a reduced lifetime.

Parameter	Maximum Rating	Unit
Collector Positive Bias Voltage (Vc)	9	V
Maximum Operating Temperature	85	°C
Maximum Storage Temperature	150	°C
Max Junction Temperature for MTTF > 1E6 Hours	125	°C
Max Power Dissipation for MTTF of 1E6 hours at 85°C Baseplate Temperature	630	mW
Minimum Operating Temperature	-40	°C
Minimum Storage Temperature	-65	°C
Positive Bias Current (Ic)	150	mA
Positive DC Current Mirror Voltage (Vb)	9	V
RF Input Power	20	dBm
θJC, Junction to Ambient Thermal Resistance	63	ºC/W

Package Information

Parameter	Details	Rating
Weight	Package name: PA	14.6g
Dimensions	-	28.45 x 14.99 mm

Recommended Operating Conditions

The Recommended Operating Conditions indicate the limits, inside which the device should be operated, to guarantee the performance given in Electrical Specifications Operating outside these limits may not necessarily cause damage to the device, but the performance may degrade outside the limits of the electrical specifications. For limits, above which damage may occur, see Absolute Maximum Ratings.

Parameter	Min	Nominal	Max	Unit
Ambient Temperature	-40	25	40	°C
Bias Voltage (VB)	5	7	9	V
Power Supply DC Voltage (VC)	5	8	9	V
Power Supply DC Current (with RF Input) [1]	-	-	150	mA
Input Power for Saturation	7	10	16	dBm
Power Supply DC Current (Ic) (No RF Input) [2]	26	44	65	mA

[1] Operation above recommended max power supply DC current will result in reduced MTTF.
[2] Ic should be modified by changing bias voltage VB to maintain junction temperature within MTTF target for given operating conditions. Recommended operating current conditions without RF input applied. Please see typical performance plots on page 12 for relationship between RF input power and DC current draw.

Sequencing Requirements

There is no sequencing required to power up or power down the amplifier.
Amplifier must have an output load connected during operation.

Electrical Specifications

The electrical specifications apply at TA=+25°C in a 50Ω system. Min and Max limits apply only to our connectorized units and are guaranteed at TA=+25°C. Die are 100% DC tested and RF tested on a per lot basis

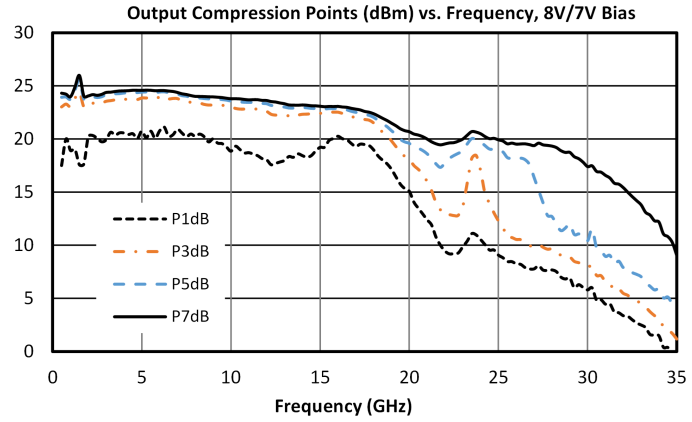
Parameter	Test Conditions	Minimum Frequency (GHz)	Maximum Frequency (GHz)	Min	Typ	Max	Unit
Collector Current, Ic	8V/6V	-	-	-	35	-	mA
Collector Current, Ic	8V/7V	-	-	-	44	-	mA
Collector Current, Ic	-	-	-	-	54	-	mA
Current Mirror Current, Ib	8V/6V	-	-	-	3.6	-	mA
Current Mirror Current, Ib	8V/7V	-	-	-	4.4	-	mA
Current Mirror Current, Ib	8V/8V	-	-	-	5.1	-	mA
Input IP3	8V/7V bias, -20 dBm Input Power	0.1	22	-	10	-	dBm
Input Return Loss	8V/7V bias, -25 dBm Input Power	0.1	22	-	19	-	dB
Noise Figure	-	0.1	22	-	4.6	-	dB
Output IP3	8V/7V bias, -20 dBm Input Power	0.1	22	-	24	-	dBm
Output P1dB	8V/7V bias	0.5	22	-	18	-	dBm
Output Power [1]	8V/7V bias	0.5	22	19	23	-	dBm
Output Return Loss	8V/7V bias, -25 dBm Input Power	0.1	22	-	13	-	dB
Phase Noise @ 10 kHz Offset	+10 dBm Input power	-	1	-	-165	-	dBc/Hz
Reverse Isolation	8V/7V bias, -25 dBm Input Power	0.01	22	-	5	-	dB
Small Signal Gain	8V/7V bias, -25 dBm Input Power	0.1	22	-	14	-	dB

[1] Saturated Output Power specification defined using the APM-7098PA P7dB compression curve shown in section 3.7.

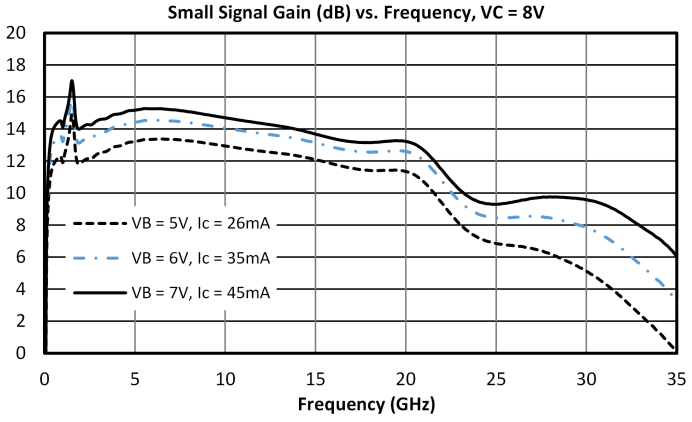
Typical Performance Plots

Operation above Max Ic = 120mA will result in reduced MTTF.

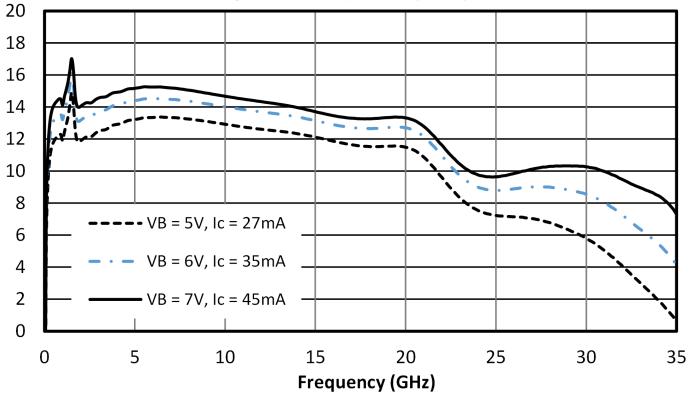
Output Compression Points (dBm) vs. Frequency, 8V/7V Bias



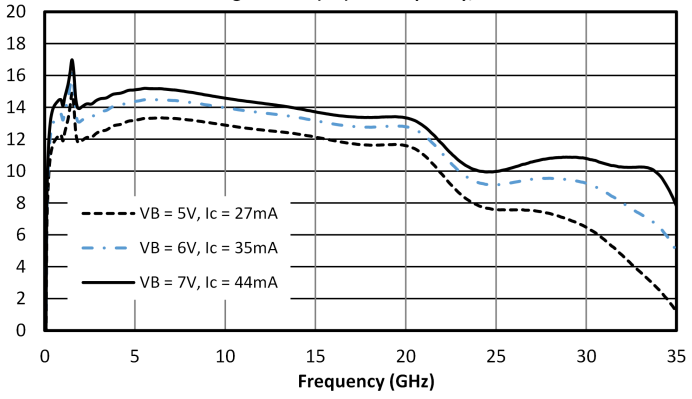
Small Signal Gain (dB) vs. Frequency, VC = 8V



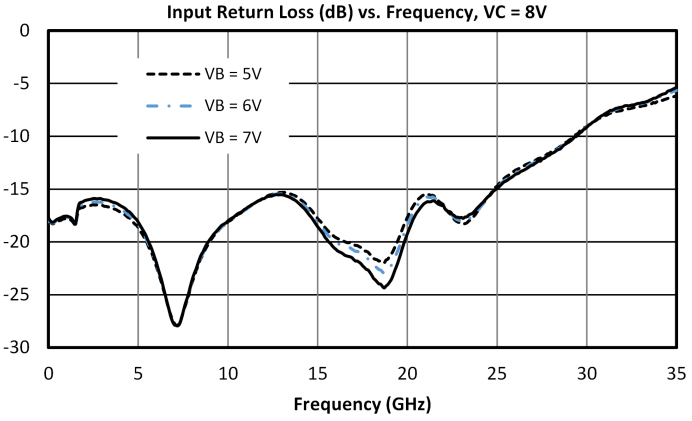
Small Signal Gain (dB) vs. Frequency, VC = 7V



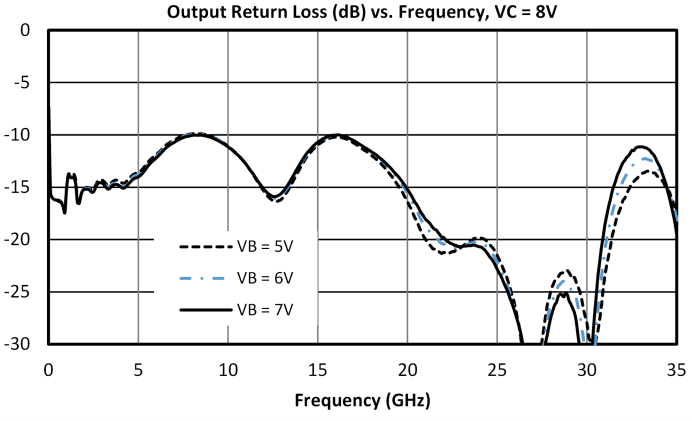
Small Signal Gain (dB) vs. Frequency, VC = 6V



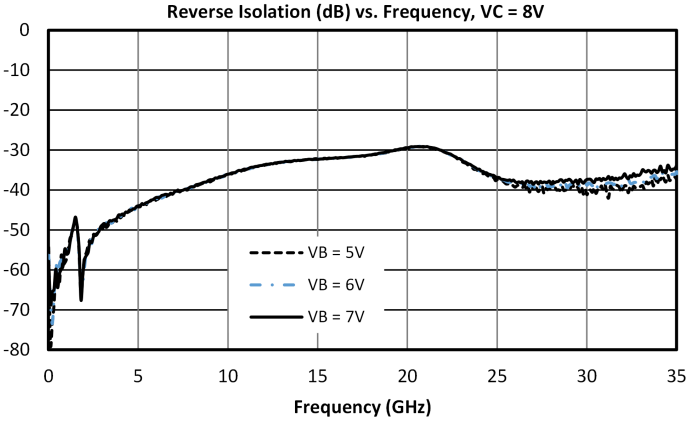
Input Return Loss (dB) vs. Frequency, VC = 8V



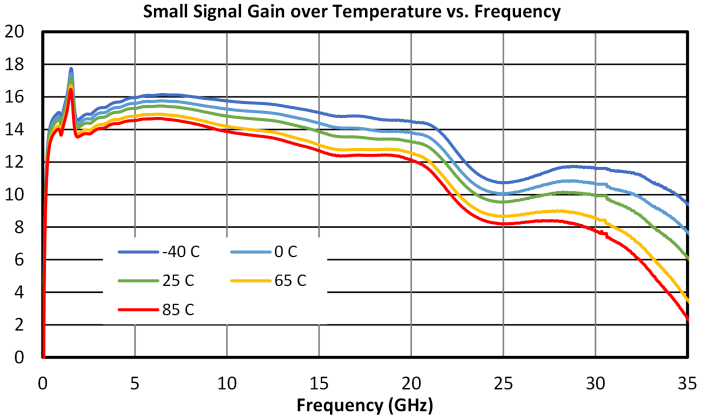
Output Return Loss (dB) vs. Frequency, VC = 8V



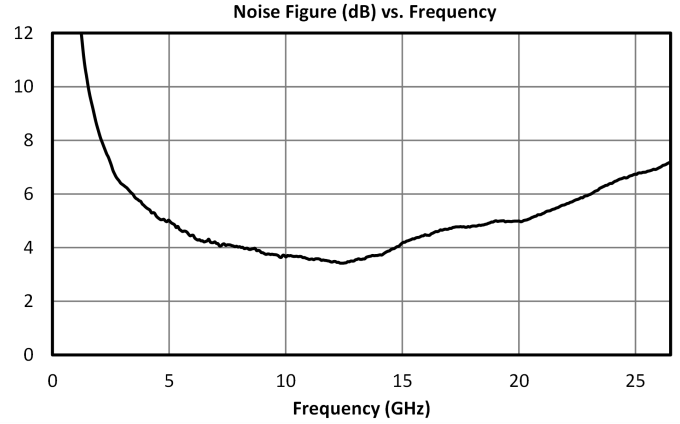
Reverse Isolation (dB) vs. Frequency, VC = 8V



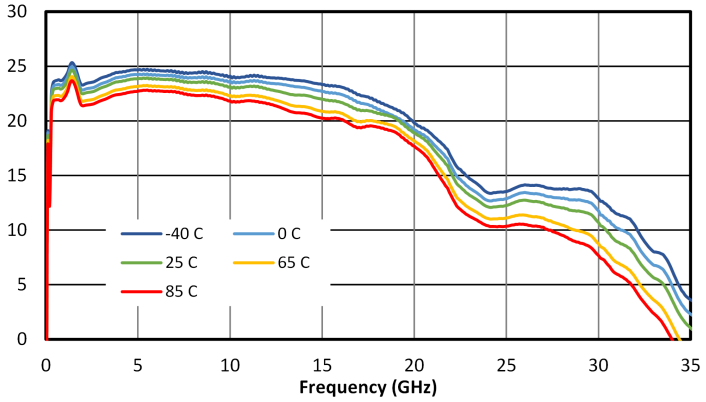
Small Signal Gain over Temperature vs. Frequency



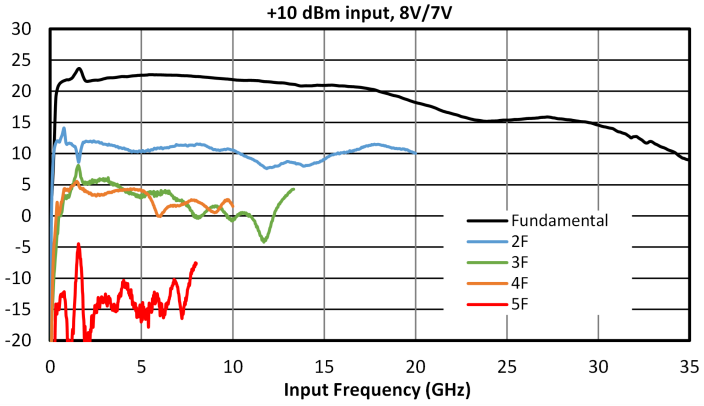
Noise Figure (dB) vs. Frequency



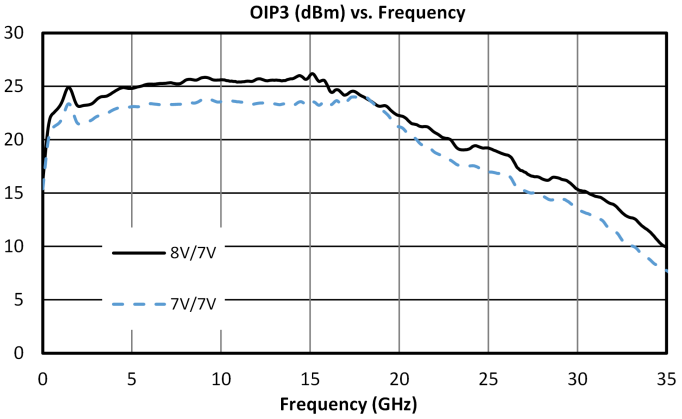
Saturated Output Power over Temperature vs. Frequency



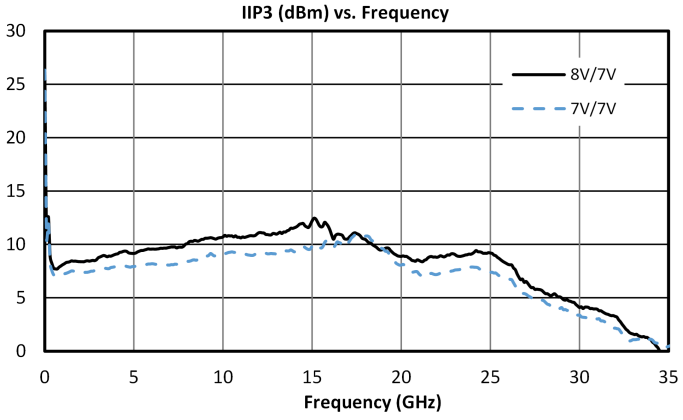
Saturated Harmonic Response (dBm) vs. Input Frequency, +10 dBm input, 8V/7V



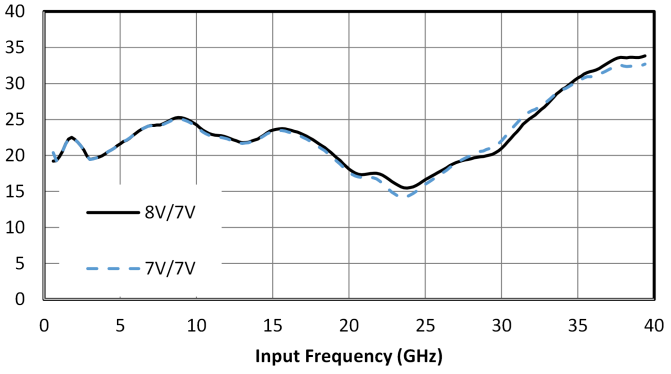
OIP3 (dBm) vs. Frequency



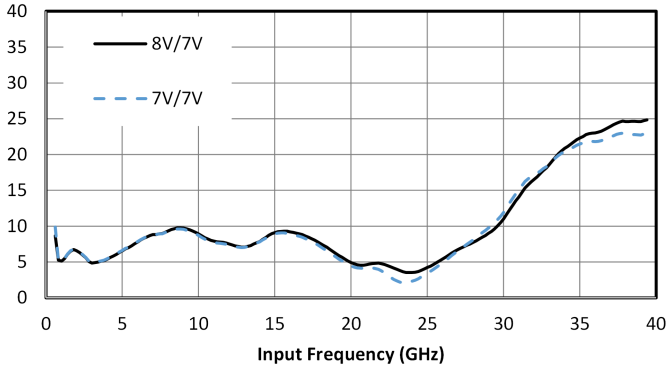
IIP3 (dBm) vs. Frequency



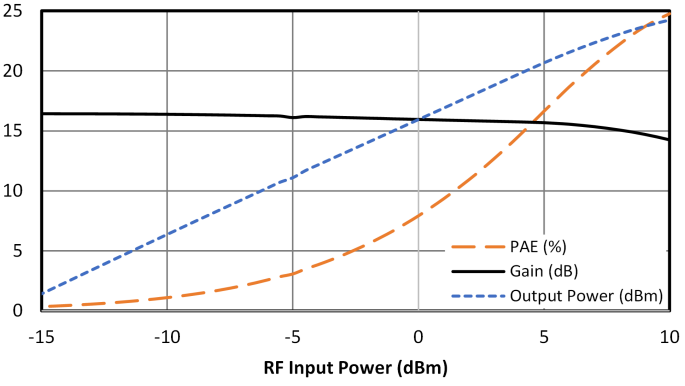
OIP2 (dBm)[8] vs. Frequency

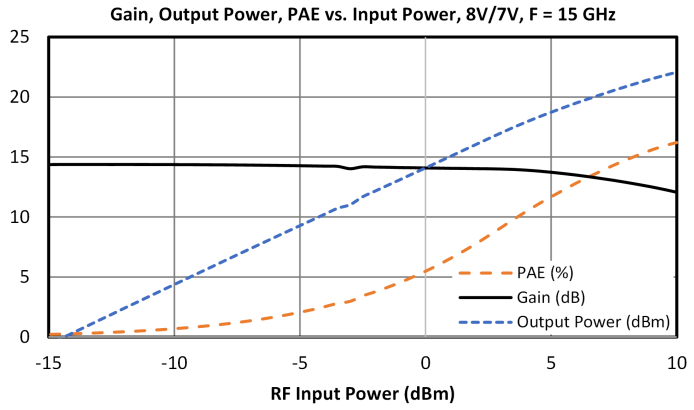


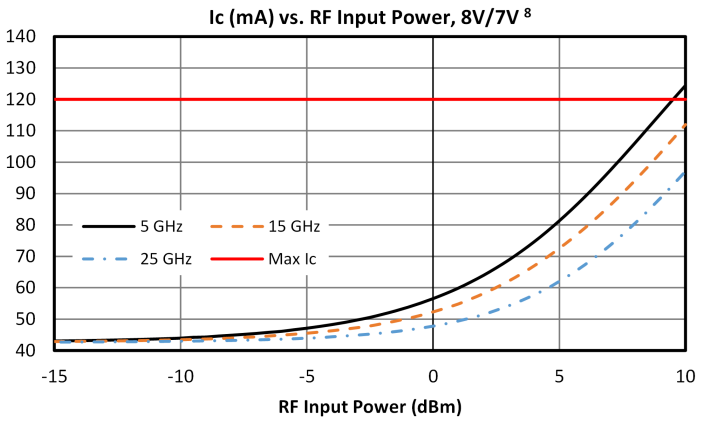
IIP2 (dBm)[8] vs. Frequency

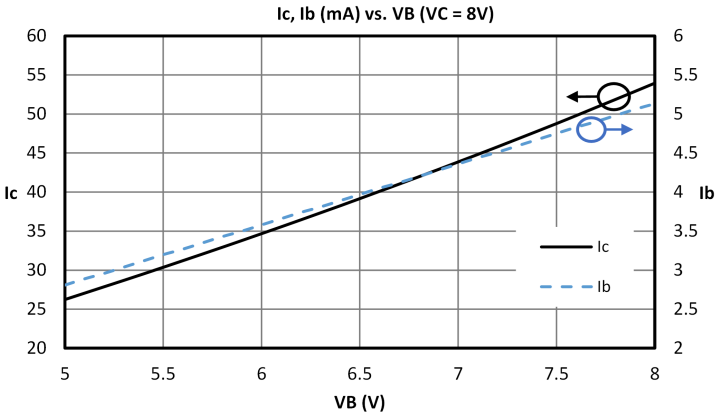


Gain, Output Power, PAE vs. Input Power, 8V/7V, F = 5 GHz



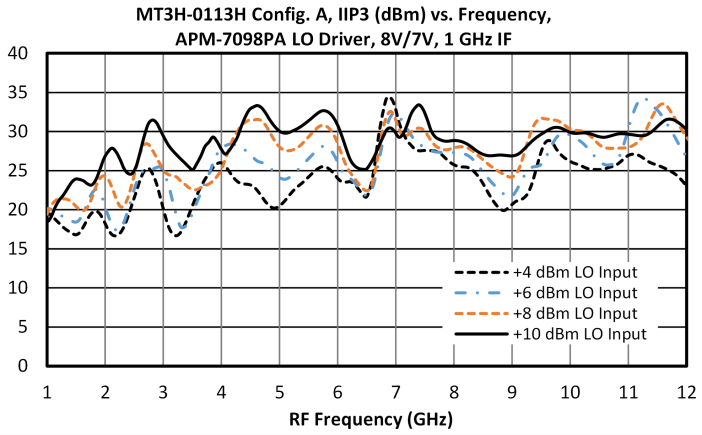


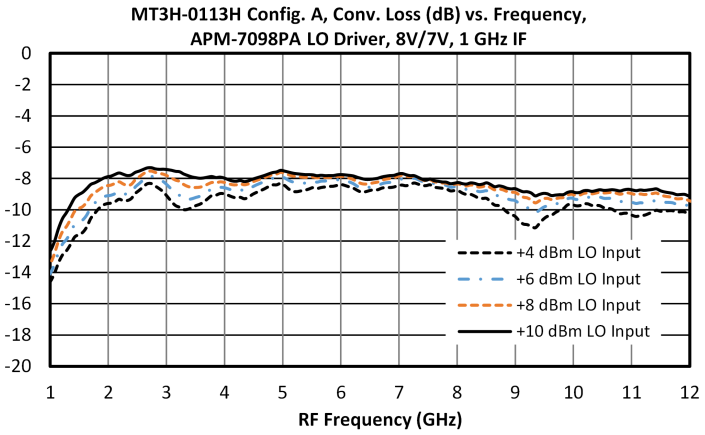


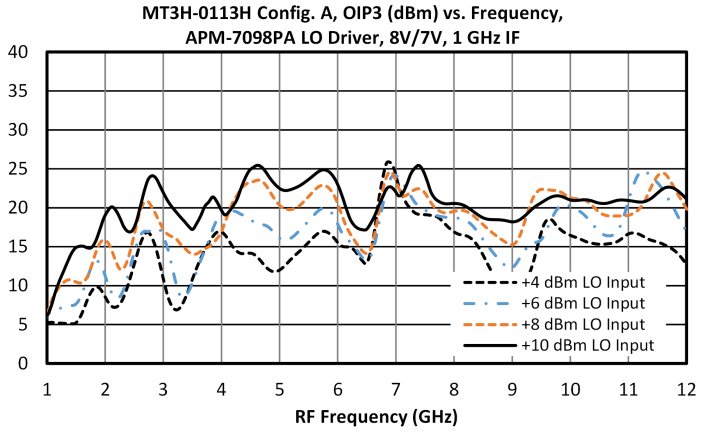


Typical Performance Plots of Marki MT3H-0113H Driven With APM-7098PA

Specified LO input power is defined as the input to the APM-7098PA LO driver.

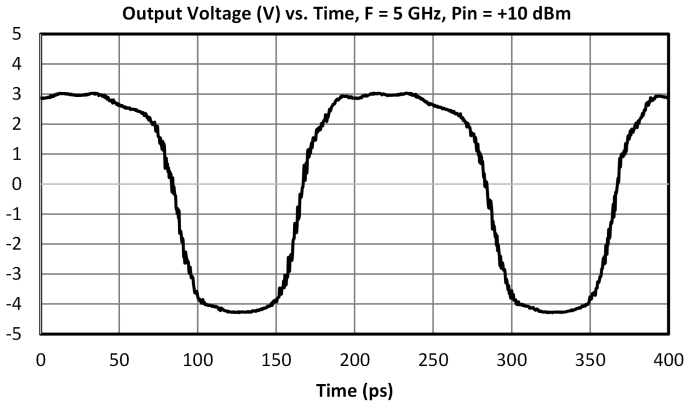


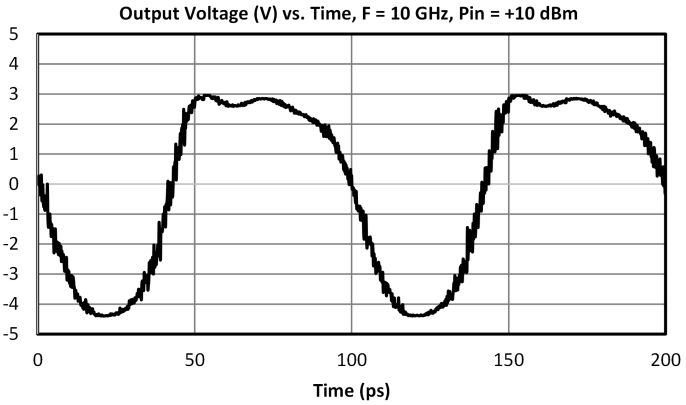


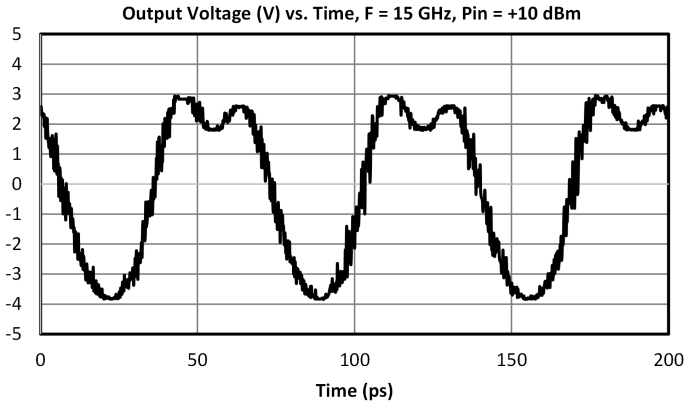


9 Time Domain Plots

Fast rise time is desirable for linear T3 mixer operation.



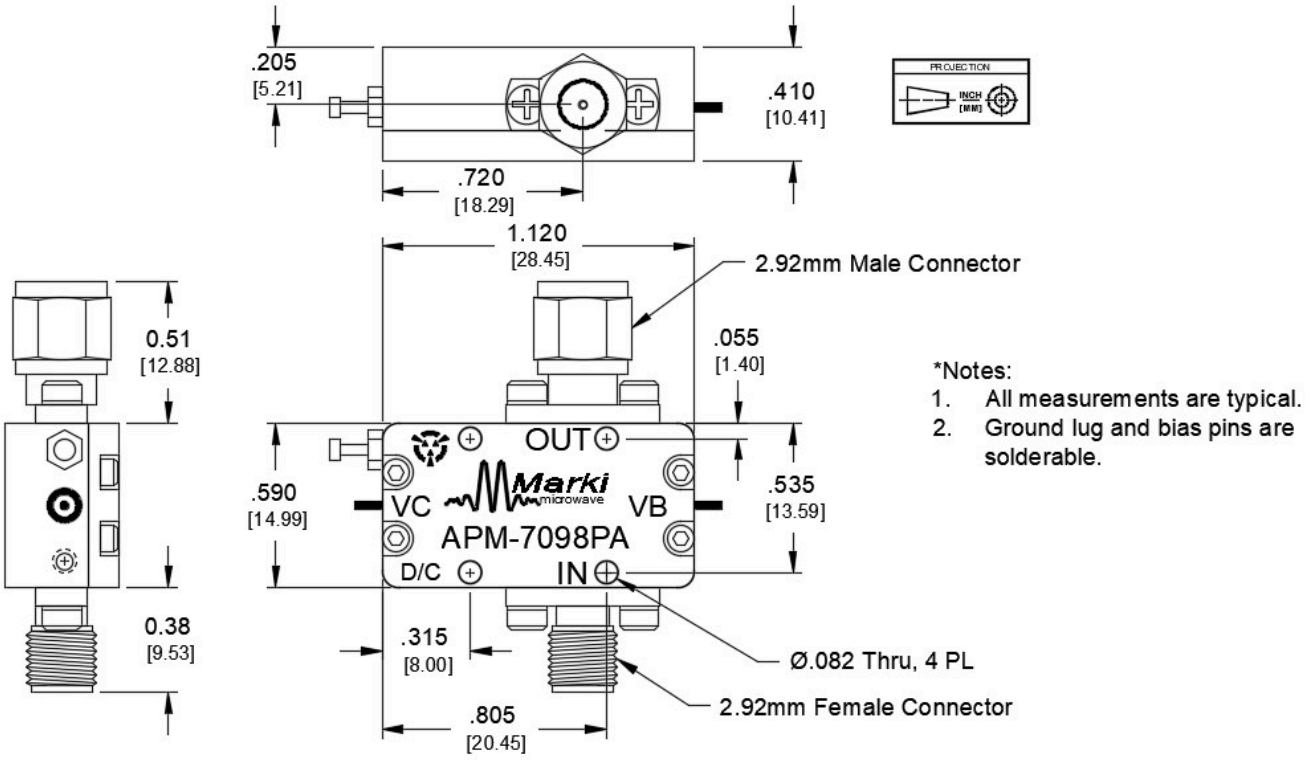




Mechanical Data

Outline Drawing

Download : Outline 2D Drawing | Outline 3D Drawing | Outline 3D STP



*Notes:
1. All measurements are typical.
2. Ground lug and bias pins are solderable.

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