1. Description

- The M7112 is a Bi-Directional Amplifier MMIC integrated amplifier, SPDT switch and digital control circuit, fabricated on GaAs p-HEMT MMIC process. It operates over 14-19.5GHz, the OP-1dB of Rx is 15.5dBm with 10dB gain and 3.5dB noise figure, the OP-1dB of Tx is 18.5dBm with 20.5dB gain.

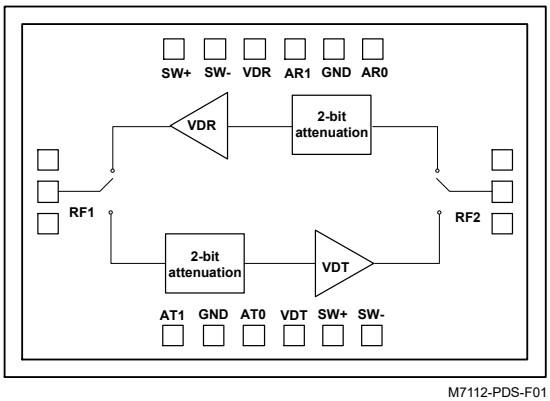


Figure 1. M7112 Functional Block Diagram

2. Applications

- TX/RX Modules
- Telecommunications
- Radar
- Defense

3. Features[1]

- Frequency Range: 14-19.5GHz
- Tx Small Signal Gain: 20.5dB
- Tx S11/S22: -14dB/-18dB
- Tx Output P-1dB: 18.5dBm
- Tx Quiescent Current: 70mA
- Tx Dynamic Current at OP-1dB: 90mA
- Rx Small Signal Gain: 10dB
- Rx S11/S22: -11dB/-13dB
- Rx Noise Figure: 3.5dB
- Rx Output P-1dB: 15.5dBm
- Rx Quiescent Current: 105mA
- Rx Dynamic Current at OP-1dB:150mA
- Die Size: 2.0 x 2.0 x 0.1mm

[1] On-wafer Test

4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	14-19.5GHz	Units
Tx Small Signal Gain	20.5	dB
Tx Output P-1dB	18.5	dBm
Tx Quiescent Current	70	mA
Tx Dynamic Current at OP-1dB	90	mA
Rx Small Signal Gain	10	dB
Rx Noise Figure	3.2	dB
Rx Output P-1dB	15.5	dBm
Rx Quiescent Current	105	mA
Rx Dynamic Current at OP-1dB	150	mA

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5. Recommended Operating Conditions

Table 2. Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Units
Operating Temperature Range	-55	25	150	°C
R_X Supply Voltage, VDR	-	5	-	V
T_X Supply Voltage, VDT	-	5	-	V
T_X / R_X Control Voltage, SW+/ SW-	-	0/5	-	V

6. RF Characteristics (T_C = 25˚C)

Table 3. RF Characteristics[1]

Parameter	Symbol	Min.	Typ.	Max.	Units
T_X Small Signal Gain	S21_T_X	-	20.5	-	dB
T_X S11	S11_T_X	-	-14	-	dB
T_X S22	S22_T_X	-	-18	-	dB
T_X Output P_{-1dB}	OP_{-1dB}_T_X	-	18.5	-	dBm
T_X Power Gain at OP_{-1dB}	Gain_T_X		20	-	dB
T_X Quiescent Current	I_{DQ}_T_X	-	70	-	mA
T_X Dynamic Current at OP_{-1dB}	I_d_T_X	-	90	-	mA
R_X Small Signal Gain	S21_R_X	-	10	-	dB
R_X S11	S11_R_X	-	-11	-	dB
R_X S22	S22_R_X	-	-13	-	dB
R_X Noise Figure	NF	-	3.5	-	dB
R_X Output P_{-1dB}	OP_{-1dB}_R_X	-	15.5	-	dBm
R_X Power Gain at OP_{-1dB}	Gain_R_X	-	10	-	dB
R_X Quiescent Current	I_{DQ}_R_X	-	105	-	mA
R_X Dynamic Current at OP_{-1dB}	I_d_R_X	-	150	-	mA

[1] Test condition: Input signal Pulsed, Pulse width = 10μs, Duty cycle = 40%

7. Typical Performance Curve

■ Small-signal Characteristics Curve

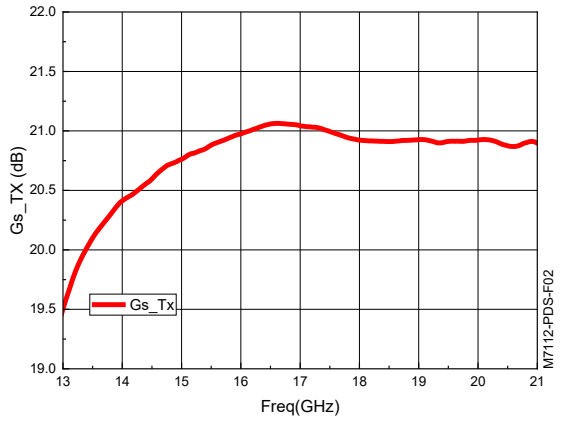


Figure 2. T_X Small-signal Gain Characteristics

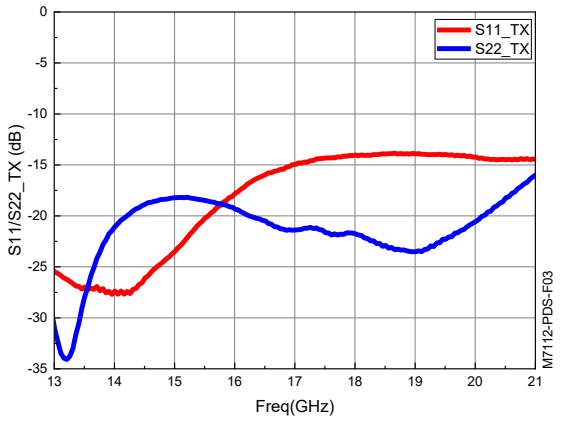


Figure 3. T_X Small-signal S11/S22 Characteristics

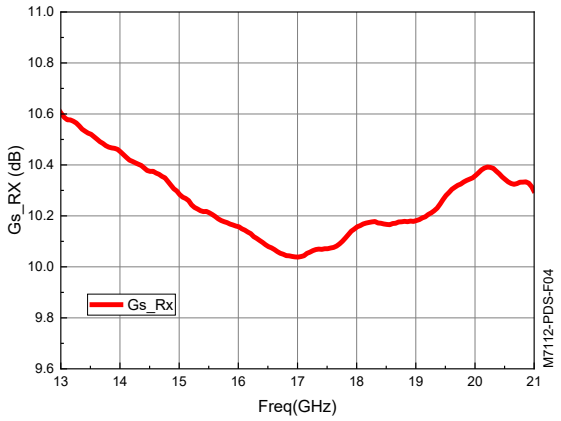


Figure 4. R_X Small-signal Gain Characteristics

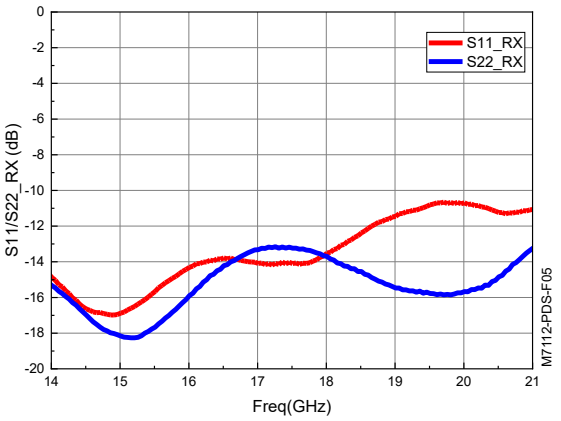


Figure 5. R_X Small-signal S11/S22 Characteristics

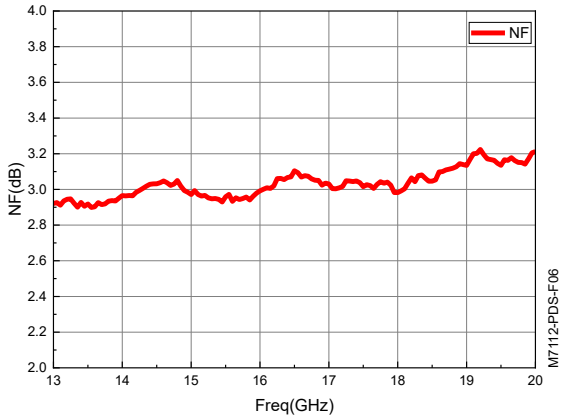


Figure 6. R_X NF Characteristics

■ Power Characteristic Curve (25℃)

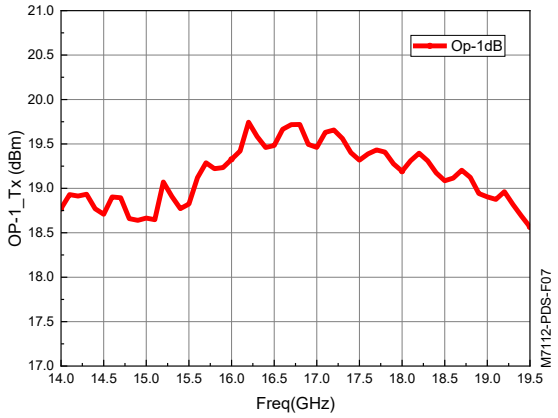


Figure 7. T_X OP_{-1dB} Characteristics

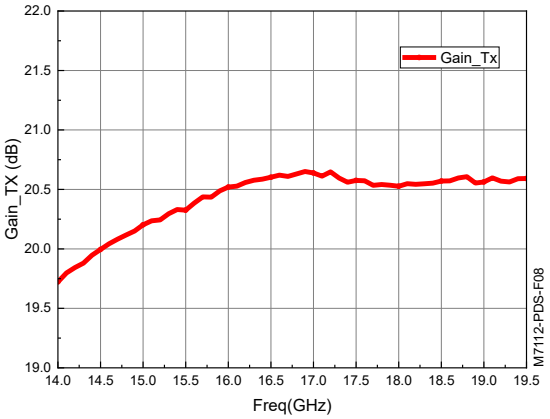


Figure 8. T_X Power Gain at OP_{-1dB}

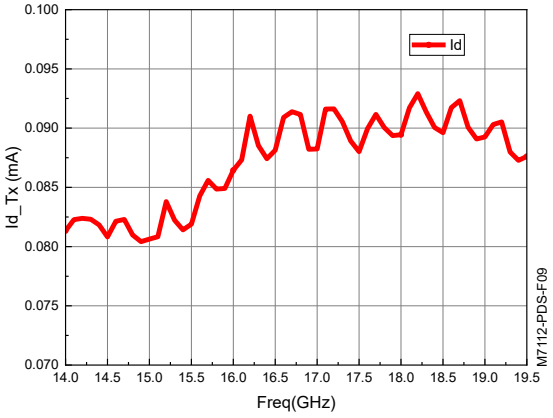


Figure 9. T_X Dynamic Current at OP_{-1dB}

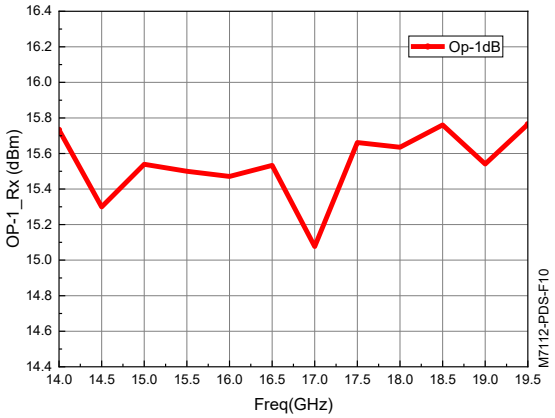


Figure 10. R_X OP_{-1dB} Characteristics

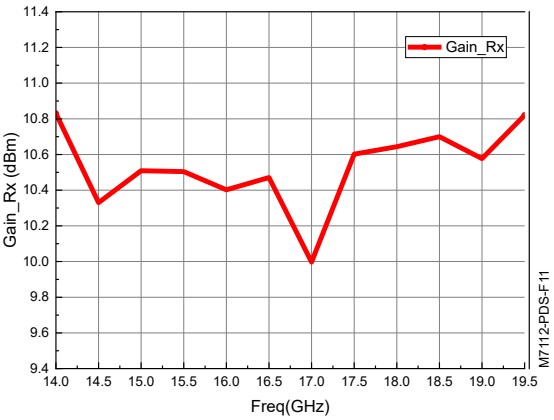


Figure 11. R_X Power Gain at OP_{-1dB}

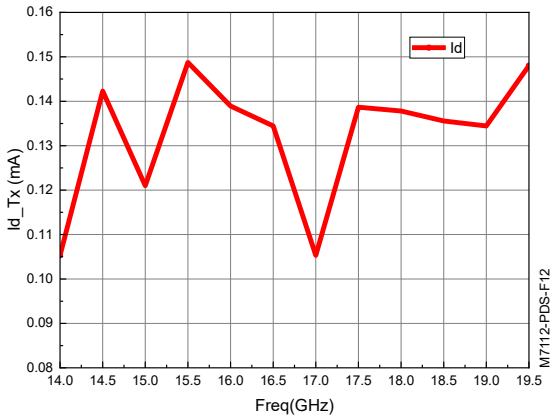
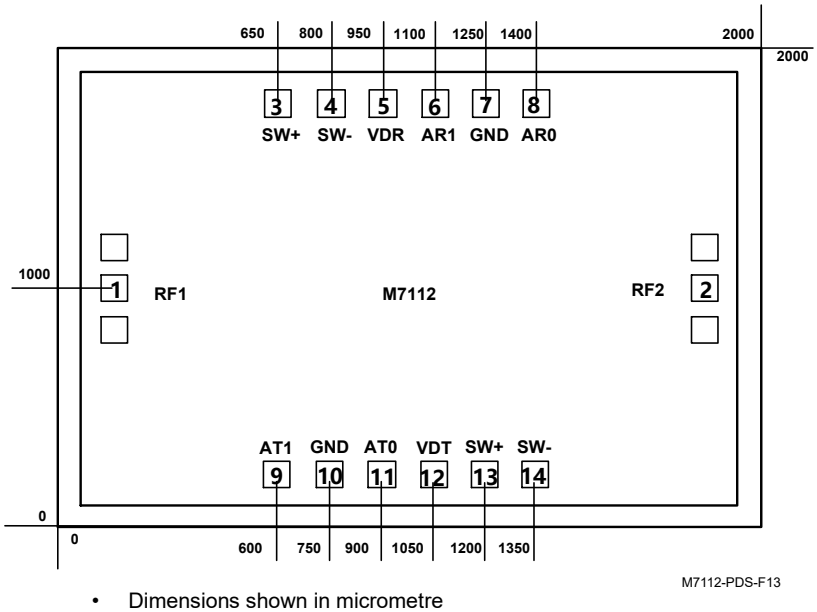


Figure 12. R_X Dynamic Current at OP_{-1dB}

8. Outline Dimensions



- Dimensions shown in micrometre

Figure 13. M7112 Outline Dimensions

Table 4. Pad Description

Pad	Symbol	Description
1	RF1	T_X Input / R_X Output
2	RF2	T_X Output / R_X Input
3/13	SW+	T_X / R_X Control Voltage (Arbitrary pad can be selected)
4/14	SW-	T_X / R_X Control Voltage (Arbitrary pad can be selected)
5	VDR	R_X Supply Voltage
12	VDT	T_X Supply Voltage
8	AR0	R_X Attenuation Bit 1dB, Enabled When Bond-wire to GND
6	AR1	R_X Attenuation Bit 2dB, Enabled When Bond-wire to GND
11	AT0	T_X Attenuation Bit 1dB, Enabled When Bond-wire to GND
9	AT1	T_X Attenuation Bit 2dB, Enabled When Bond-wire to GND
7/10	GND	Ground

Table 5. Truth Table

VDT	VDR	SW+	SW-	RF1 to RF2	RF2 to RF1
5	0	0	-5	ON	OFF
0	5	-5	0	OFF	ON

9. Assembly Information

■ Assembly Diagram

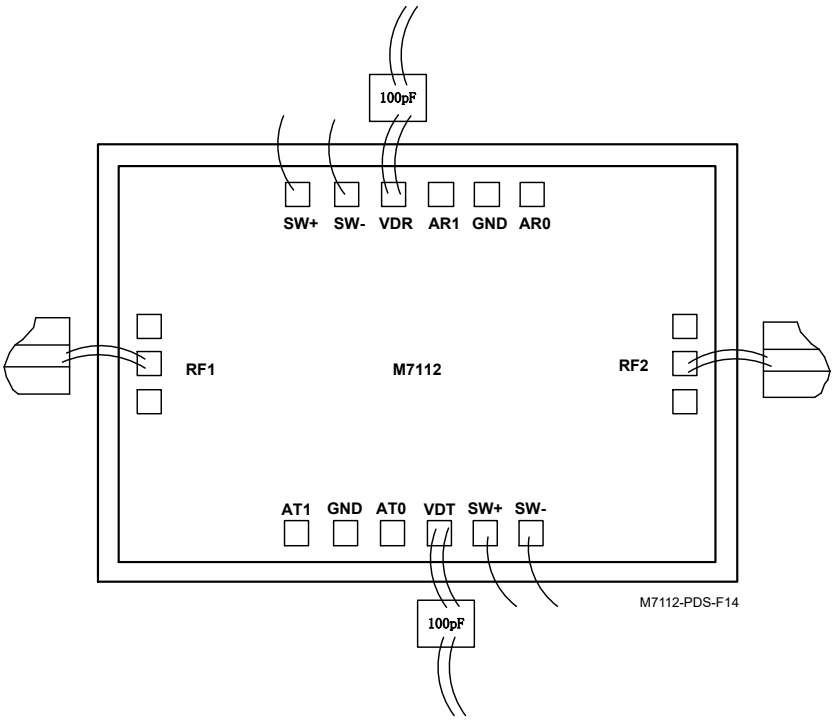


Figure 14. M7112 Assembly Diagram

- **Eutectic Die Attach:** It is best to use an 80% Au/20% Sn preform. Do not expose the chip to a temperature greater than 300°C for more than 30sec.
- **Wire Bonding:** RF bonds made with 1mil gold wire are recommended for the RF ports. Keep all bonds as short as possible, less than 0.35mm.

10. Handling Precautions

■ Storage

All bare dies ship in either Waffle or Gel Pak, which is an ESD protective container, and then sealed in an ESD protective bag. After opening the sealed ESD protective bag, all dies must be stored in a dry nitrogen environment.

■ Cleanliness

Handle the dies in a clean environment. Never use liquid cleaning systems to clean the dies.

- **ESD Caution**

  ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore proper ESD precautions should be taken to avoid performance degradation or loss of functionality.



11. Contact Information

For the latest specifications, additional product information, technical support and sales support, please contact:

- **Email:** RF.support@raytrontek.com
- **Web:** www.raytrontek.com

12. Disclaimer

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