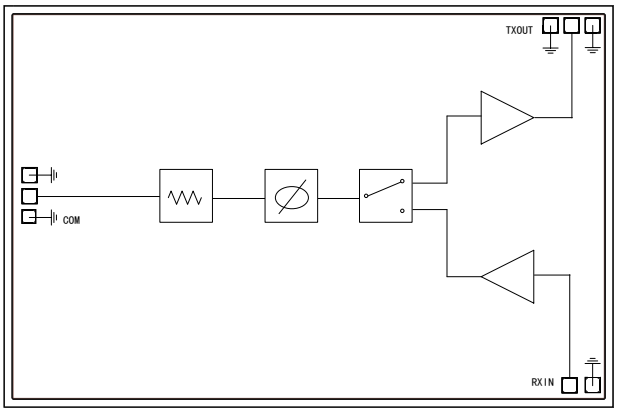
1. Description

• The M7118C_1(M) is a Multi-Function MMIC integrated Amplifier, 6-bit Digital Phase-Shifter, 6-bit Digital Attenuator, Temperature Compensation Circuit, SPDT Switch and Digital Control Circuit, fabricated on GaAs p-HEMT MMIC process. It operates over 2-6GHz, the IP_{1dB} of Rx is 8dBm with -2dB gain and 6.5dB noise figure, the OP_{1dB} of Tx is 10.5dBm with -2dB gain. It provides 360° of phase coverage with a LSB of 5.625° and 31.5dB of attenuation coverage with a LSB of 0.5dB.



M7118C_1(M)-PDS-

Figure 1. M7118C_1(M) Functional Block Diagram

2. Applications

- TX/RX Modules
- Defense

3. Features[1]

- Frequency Range: 2-6GHz
- T_X Small Signal Gain: -2dB
- T_X VSWR: 1.5/1.5
- T_X OP_{1dB}: 10.5dBm
- T_X Single Positive Supply: 5V/30mA
- R_X Small Signal Gain: -2dB
- R_X VSWR: 1.5/1.5
- R_X Noise Figure: 6.5dB
- R_X IP_{1dB}: 8dBm
- R_X Single Positive Supply: 5V/90mA
- RMS Phase Error: 3°
- Amplitude Error: ±0.5dB
- RMS Attenuation Error: 0.3dB
- Relative Phase: ±3°
- Die Size: 4.3mm x 2.8mm x 0.1mm

[1] On-wafer Test

4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	5-13GHz	Units
T_X Small Signal Gain	-2	dB
T_X OP1dB	10.5	dBm
T_X Single Positive Supply	30	mA
R_X Small Signal Gain	-2	dB
R_X Noise Figure	6.5	dB
R_X IP1dB	8	dBm
R_X Single Positive Supply	90	mA
RMS Phase Error	3	°
Amplitude Error	±0.5	dB
RMS Attenuation Error	0.3	dB
Relative Phase	±3	°

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5. Recommended Operating Conditions

Table 2. Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Units
Operating Temperature Range	-55	25	125	°C
Supply Voltage, VEE	-	-5	-	V
R_X/T_X Supply Voltage, VD	-	5	-	V
T_X/R_X Control Voltage, SW1	-	5/0	-	V
6-bit Digital Attenuator Control Voltage, A1-A6	-	0/5	-	V
6-bit Digital Phase Shift Control Voltage, P1-P6	-	0/5	-	V

6. RF Characteristics (T_C = 25˚C)

Table 3. RF Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units
T_X Small Signal Gain	$S21_T_X$	-	-2	-	dB
T_X Input RL	$RL_{in}_T_X$	-	1.5	-	-
T_X Output RL	$RL_{out}_T_X$	-	1.5	-	-
T_X Output P_{-1dB}	$OP_{1dB}_T_X$	-	10.5	-	dBm
T_X Single Positive Supply	ID_T_X	-	30	-	mA
R_X Small Signal Gain	$S21_R_X$	-	-2	-	dB
R_X Input RL	$RL_{in}_R_X$	-	1.5	-	-
R_X Output RL	$RL_{out}_R_X$	-	1.5	-	-
R_X Noise Figure	NF	-	6.5	-	dB
R_X Input P_{-1dB}	$IP_{-1dB}_R_X$	-	8	-	dBm
R_X Single Positive Supply	$I_d_R_X$	-	90	-	mA
RMS Phase Error	RMS (°)	-	3	-	°
Amplitude Error	ΔIL	-	0.5	-	dB
RMS Attenuation Error	RMS_A	-	0.3	-	dB
Relative Phase	RMS_P	-	3	-	°

7. Typical Performance Curve

■ TX Small-signal Characteristics Curves (25℃)

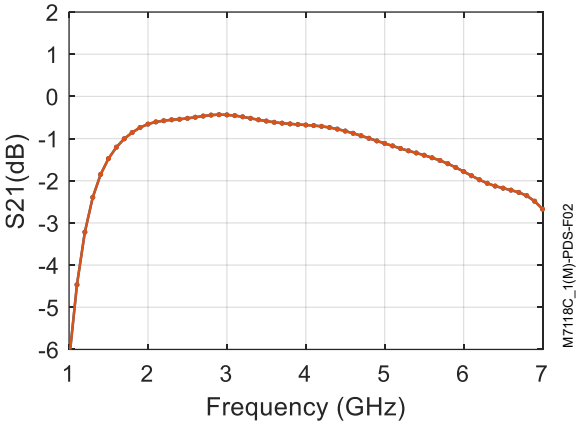


Figure 2. T_X Small-signal Gain Characteristics

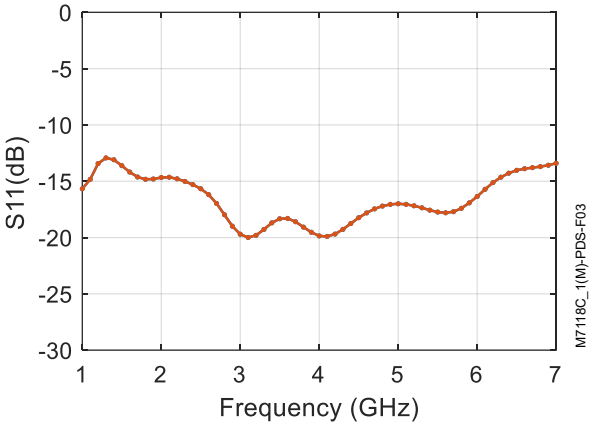


Figure 3. T_X Small-signal S11 Characteristics

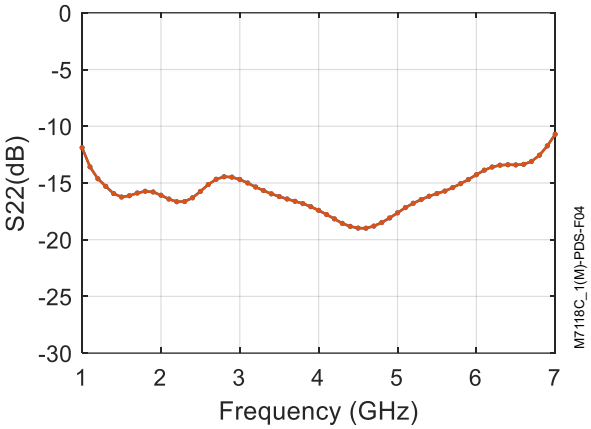


Figure 4. T_X Small-signal S22 Characteristics

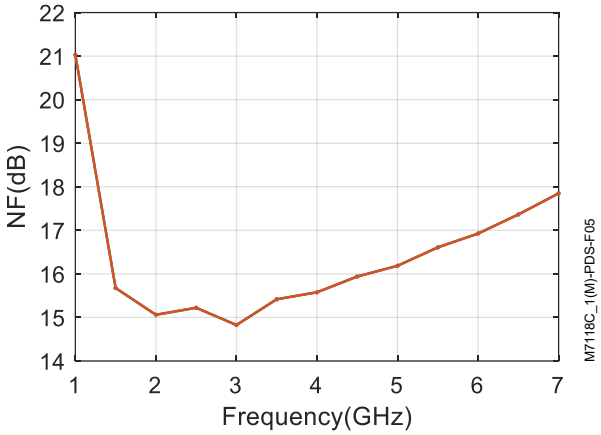


Figure 5. T_X Noise Figure Characteristics

■ RX Small-signal Characteristics Curves (25℃)

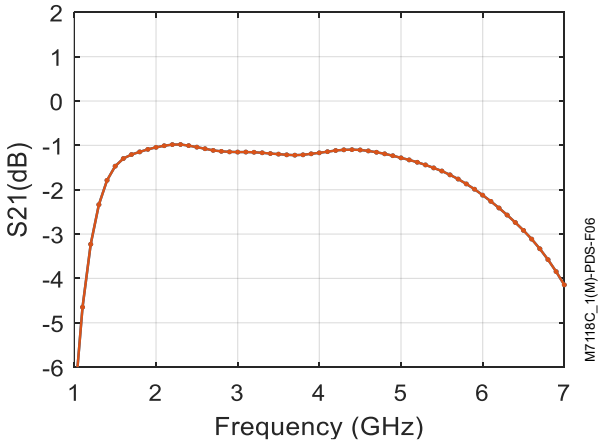


Figure 6. R_X Small-signal Gain Characteristics

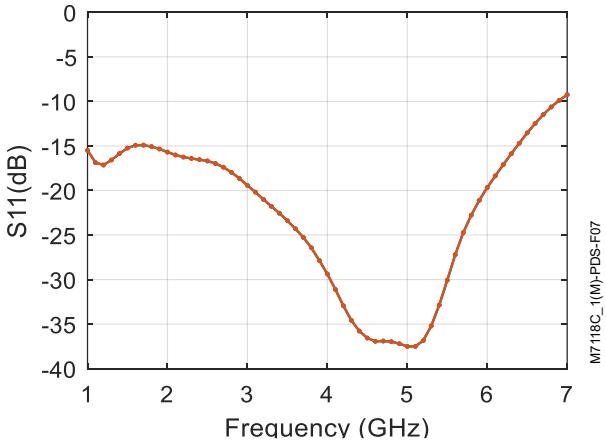


Figure 7. R_X Small-signal S11 Characteristics

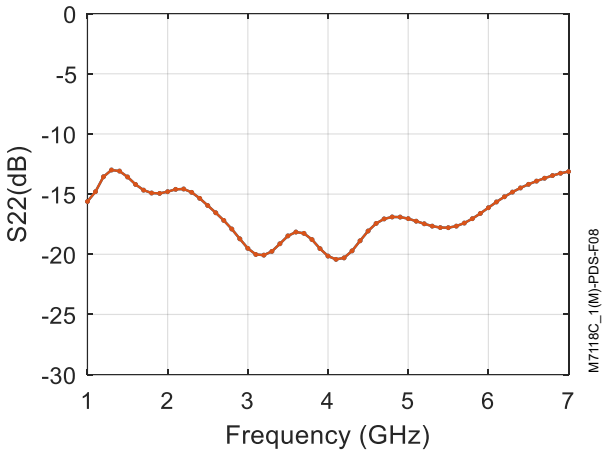


Figure 8. R_X Small-signal S22 Characteristics

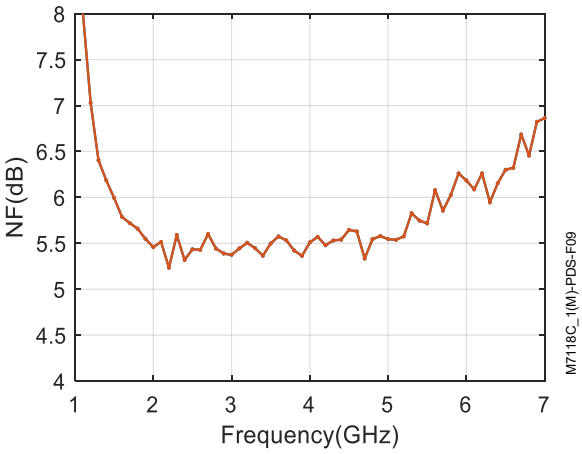


Figure 9. R_X Noise Figure Characteristics

■ Full State Attenuation Characteristics Curves (25℃)

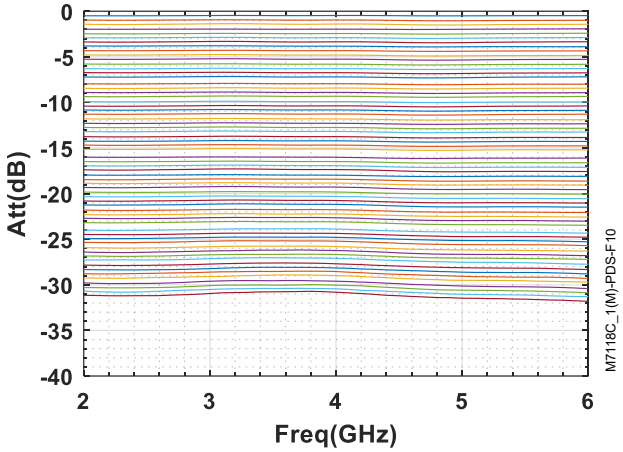


Figure 10. Full State Attenuation Characteristics

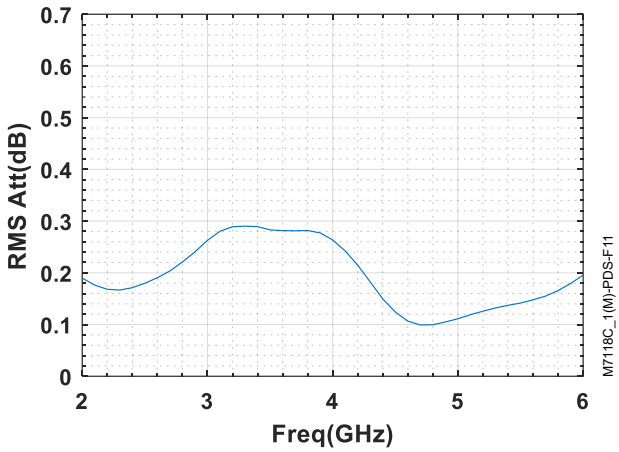


Figure 11. RMS Attenuation Error Characteristics

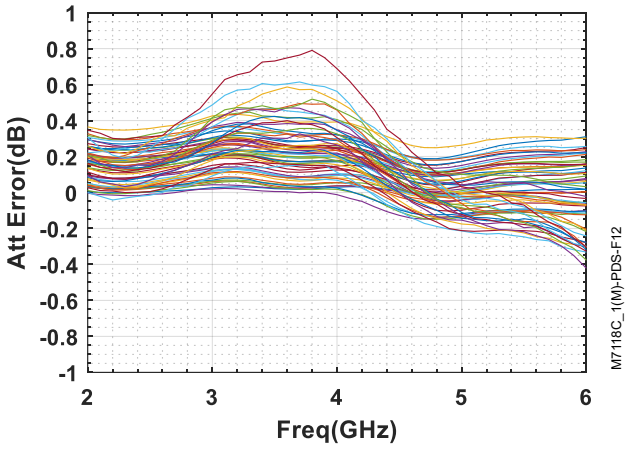


Figure 12. Full State Attenuation Error Characteristics

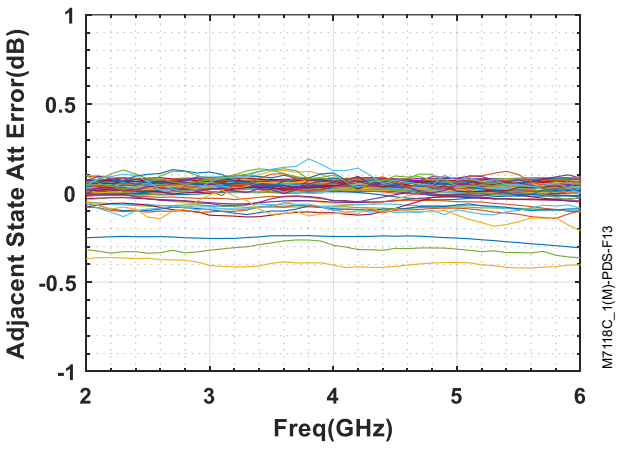


Figure 13. Adjacent State Attenuation Error Characteristics

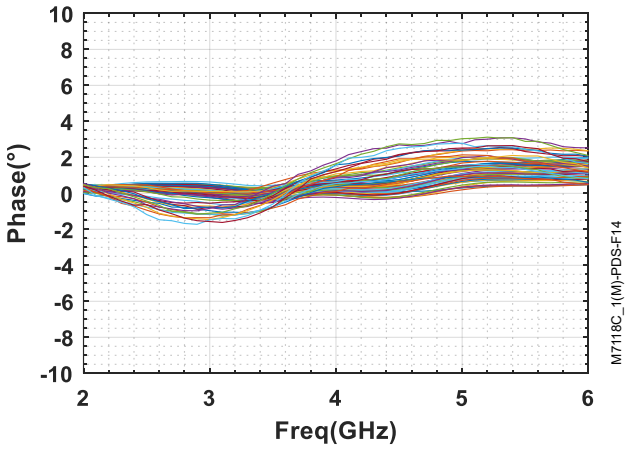


Figure 14. Full State Relative Phase Characteristics

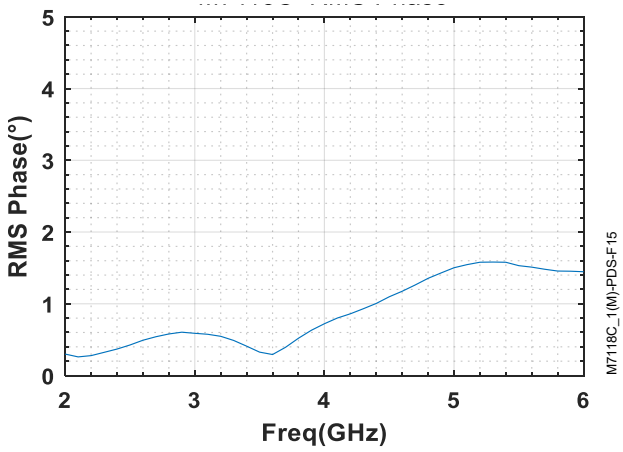


Figure 15. RMS Relative Phase Characteristics

■ Full State Phase Shift Characteristics Curves (25℃)

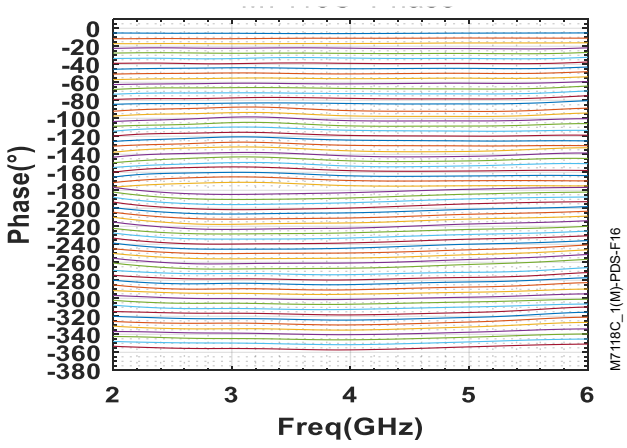


Figure 16. Full State Phase Shift Characteristics

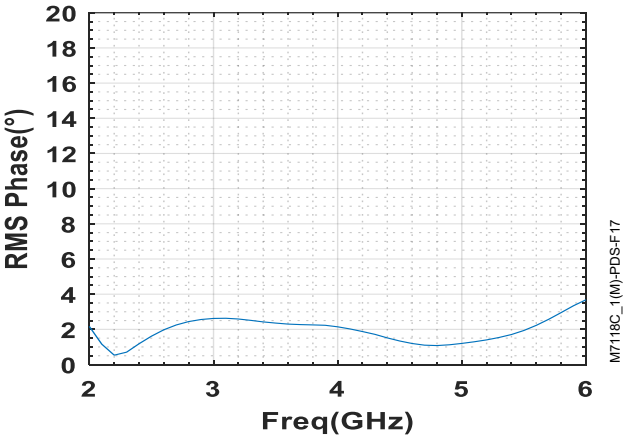


Figure 17. RMS Phase Error Characteristics

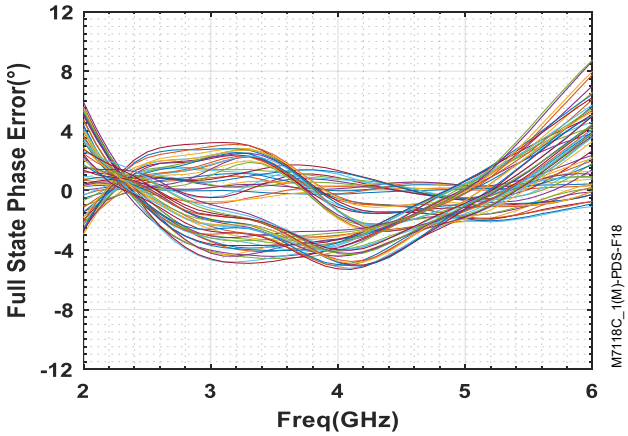


Figure 18. Full State Phase Error Characteristics

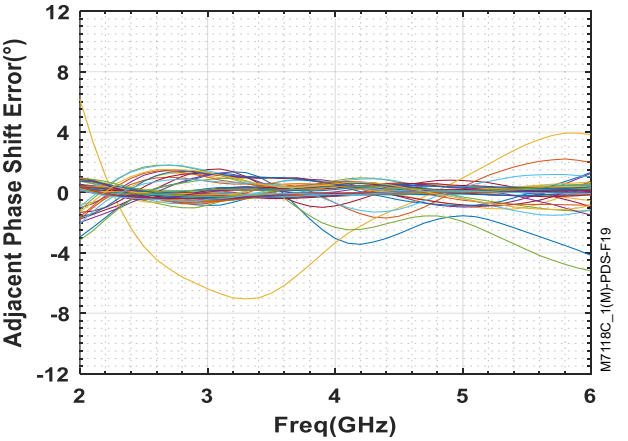


Figure 19. Adjacent Phase Shift Error Characteristics

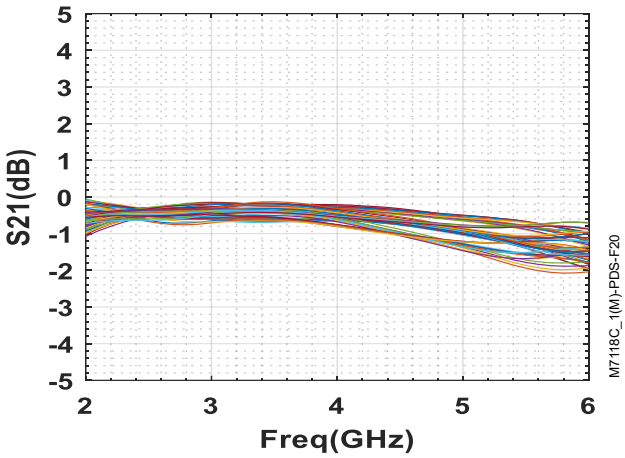


Figure 20. Full State Amplitude Error Characteristics

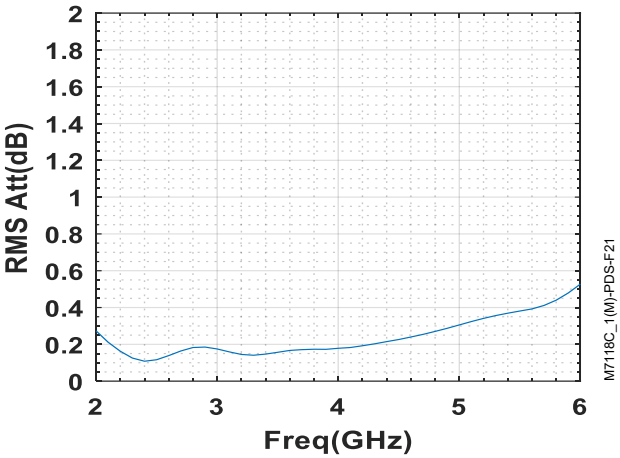


Figure 21. RMS Amplitude Error Characteristics

■ Power Characteristics Curves (25℃)

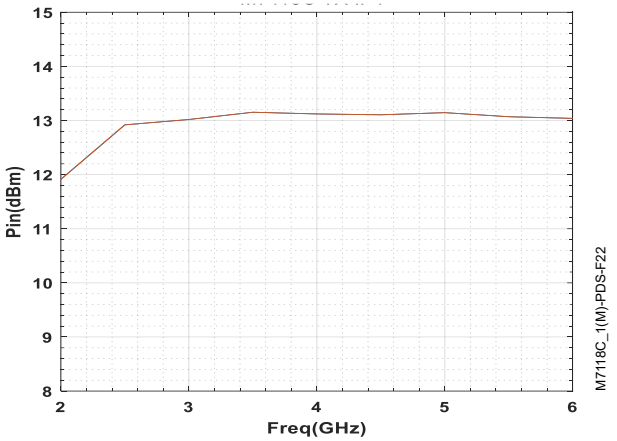


Figure 22. T_X IP-1dB Characteristics

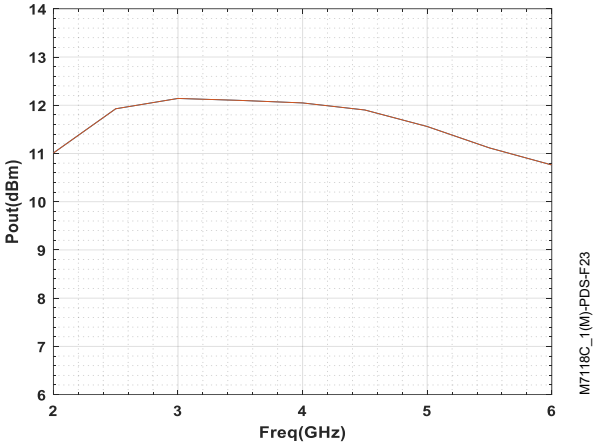


Figure 23. T_X OP-1dB Characteristics

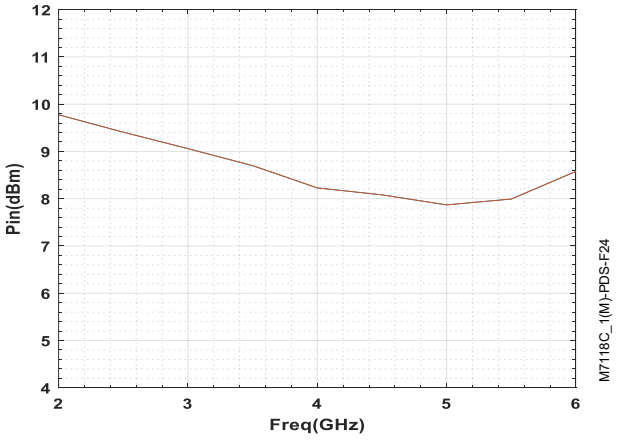


Figure 24. R_X IP-1dB Characteristics

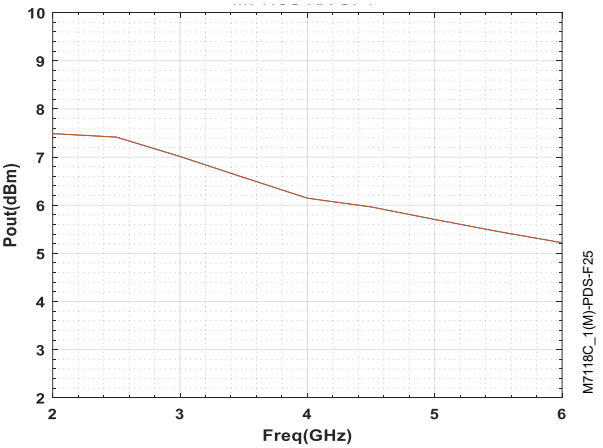
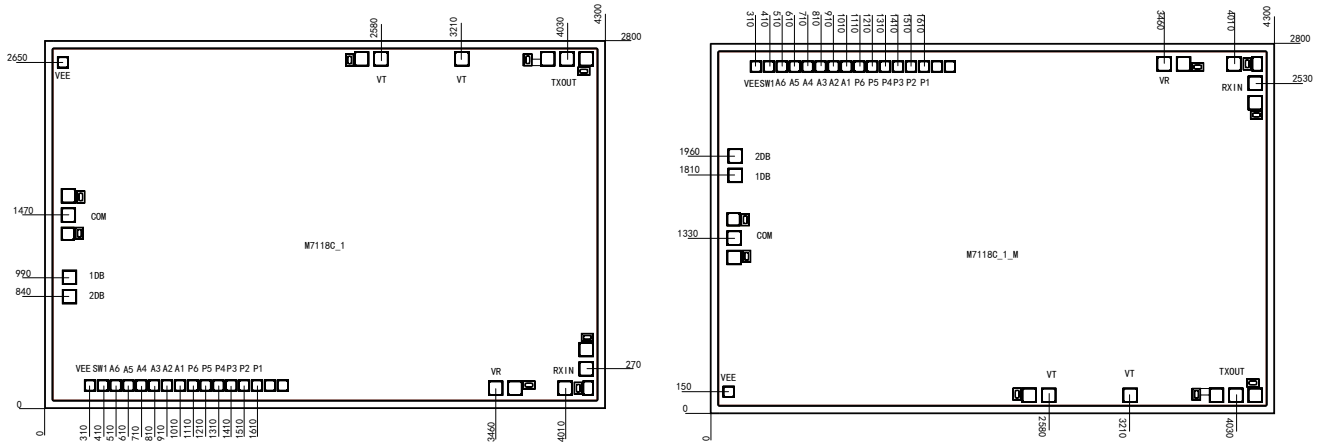


Figure 25. R_X OP-1dB Characteristics

8. Outline Dimensions



M7118C_1(M)-PDS-F26

- Dimensions shown in micrometre

Figure 26. M7118C_1(M)Outline Dimensions

Table 4. Pad Description

Pad	Symbol	Description
	COM	T_X Input / R_X Output
	TXOUT	T_X Output
	RXIN	R_X Input (Arbitrary pad can be selected)
	VEE	Supply Voltage (Arbitrary pad can be selected)
	VR、VT	RX /TX Supply Voltage (Arbitrary pad can be selected)
	SW1	T_X / R_X Control Voltage
	A1-A6	6 Bit Attenuator Control Voltage
	P1-P6	6 Bit Phase-Shifter Control Voltage
	1DB	Attenuation Bit 1dB, Enabled When Bond-wire to GND
	2DB	Attenuation Bit 2dB, Enabled When Bond-wire to GND

Table 5. Truth Table[1]

5-1：Tx/Rx/Load Control Truth Table

	VT	VR	VEE	SW1
TX	5V	0V	-5V	1
RX	0V	5V	-5V	0

5-2：Attenuator Truth Table

	A1	A2	A3	A4	A5	A6
0dB	0	0	0	0	0	0
0.5dB	1	0	0	0	0	0
1dB	0	1	0	0	0	0
2dB	0	0	1	0	0	0
4dB	0	0	0	1	0	0
8dB	0	0	0	0	1	0
16dB	0	0	0	0	0	1

5-3：Phase-Shift Truth Table

	P1	P2	P3	P4	P5	P6
0°	0	0	0	0	0	0
5.625°	1	0	0	0	0	0
11.25°	0	1	0	0	0	0
22.5°	0	0	1	0	0	0
45°	0	0	0	1	0	0
90°	0	0	0	0	1	0
180°	0	0	0	0	0	1

[1] “0” for low voltage -0.5V~+0.5V, and “1” for high voltage +3V~+5.5V.

9. Assembly Information

■ Assembly Diagram

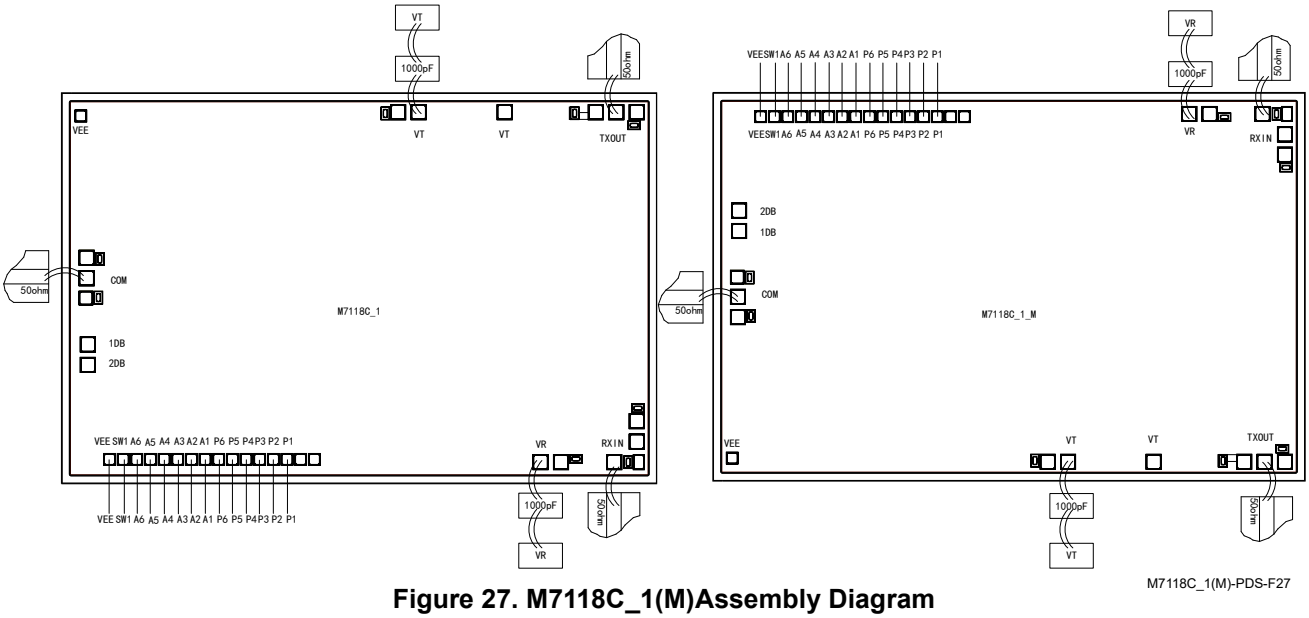


Figure 27. M7118C_1(M)Assembly Diagram

- **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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Raytron Microwave

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