1. Description

- The MA702(M) is a four-port directional coupler with an integrated 90° phase shifter fabricated on GaAs IPD process. It offers 1.5dB insertion loss from 10-20GHz. With port1 input and port4 matched, the phase differential between port2 and port3 is 0°; With port4 input and port1 matched, that differential is 180°.

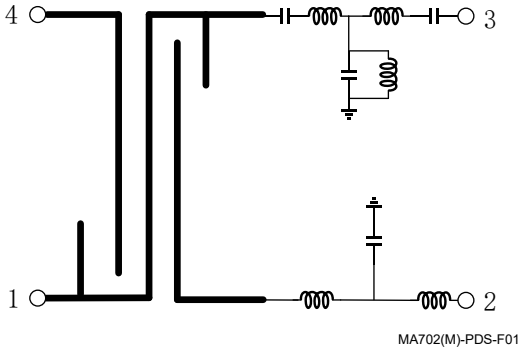


Figure 1. MA702(M) Functional Block Diagram

2. Applications

- Phased Array
- Tx/Rx module

3. Features[1]

- Frequency Range: 10-20GHz
- Insertion Loss1 S_{21}: -4dB
- Insertion Loss2 S_{31}: -3.8dB
- Insertion Loss3 S_{24}: -3.8dB
- Insertion Loss4 S_{34}: -4dB
- Isolation: -20dB
- Input/Output Return Loss: -12dB
- 0° phase error (port1 input): -2.5-2
- 180° phase error (port4 input): -4.5-1
- Die Size: 3.00 x 0.8 x 0.16mm

4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	10-20GHz	Units
Insertion Loss1 S_{21}	-4	dB
Insertion Loss2 S_{31}	-3.8	dB
Insertion Loss3 S_{24}	-3.8	dB
Insertion Loss4 S_{34}	-4	dB
Isolation	-20	dB
0° phase error (port1 input)	-2.5-2	-
180° phase error (port4 input)	-4.5-1	-
Port1 Return Loss	-16	dB
Port2 Return Loss	-12	dB
Port3 Return Loss	-12	dB
Port4 Return Loss	-16	dB

Table of Contents

No.	Contents	Page
1	Description	1
2	Applications	1
3	Features	1
4	Brief Typical Performance	1
5	Recommended Operating Conditions	3
6	RF Characteristics	3
7	Typical Performance Curve	3
8	Outline Dimensions	4
9	Assembly Information	5
10	Handling Precautions	6
11	Contact Information	6
12	Disclaimer	6

5. Recommended Operating Conditions

Table 2. Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Units
Operating Temperature Range	-55	25	125	°C

6. RF Characteristics (T_C = 25°C)

Table 3. RF Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units
Freq	Freq	10	-	20	GHz
Insertion Loss1 S_{21}	S_{21}	-3.6	-4	-4.5	dB
Insertion Loss2 S_{31}	S_{31}	-3.5	-3.8	-4.3	dB
Insertion Loss3 S_{24}	S_{24}	-3.3	-3.8	-4.2	dB
Insertion Loss4 S_{34}	S_{34}	-3.6	-4	-4.7	dB
Isolation	iso	-	-	-20	dB
0° phase error (port1 input)	Phase err1	-2.5	-	2	-
180° phase error (port4 input)	Phase err2	-4.5	-	1	-
Port1 Return Loss	S_{11}	-	-	-12	dB
Port2 Return Loss	S_{22}	-	-	-16	dB
Port3 Return Loss	S_{33}	-	-	-16	dB
Port4 Return Loss	S_{44}	-	-	-12	dB

7. Typical Performance Curve

■ Small-signal Characteristics Curve

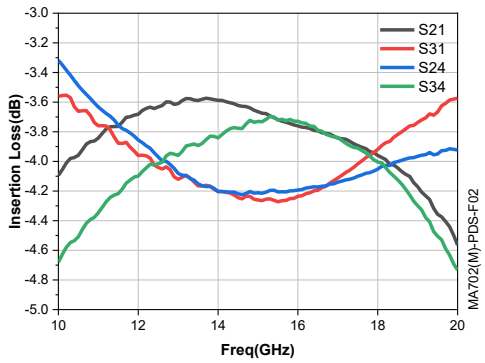


Figure 2. Insertion Loss Characteristics

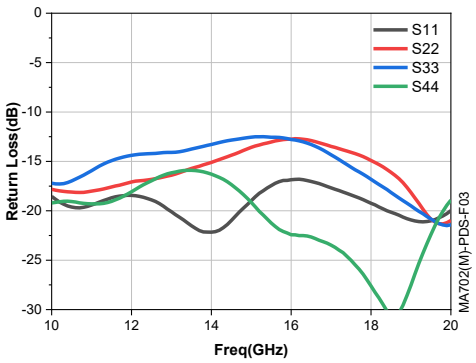


Figure 3. Return Loss Characteristics

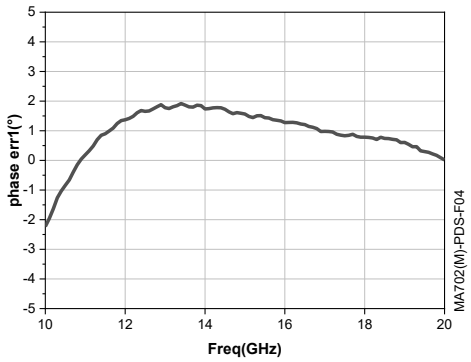


Figure 4. 0° phase error Characteristics

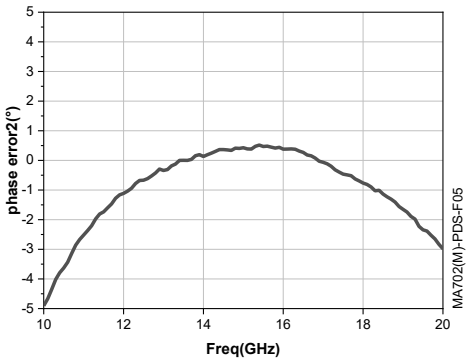


Figure 5. 180° phase error Characteristics

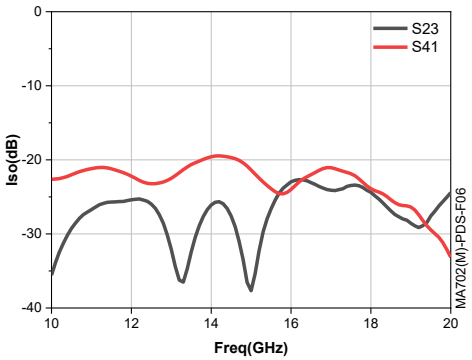
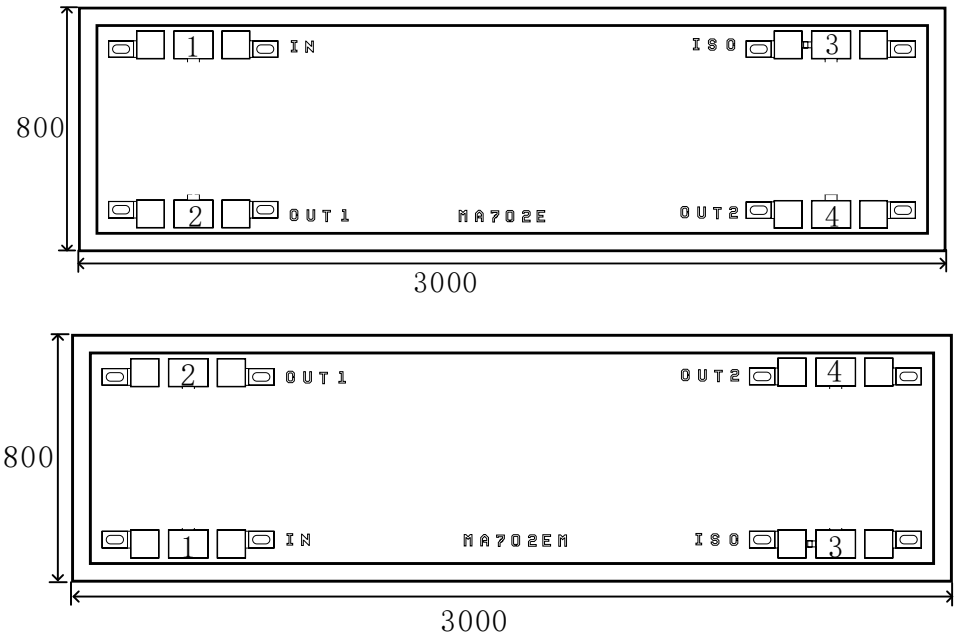


Figure 6. Isolation Characteristics

8. Outline Dimensions



• Dimensions shown in micrometre

MA702(M)-PDS-F07

Figure 7. MA702(M) Outline Dimensions

Table 4. Pad Description

Pad	Symbol	Description
1	IN	RFin
2	OUT1	RFout1
3	OUT2	RFout2
4	ISO	ISO

9. Assembly Information

■ Assembly Diagram

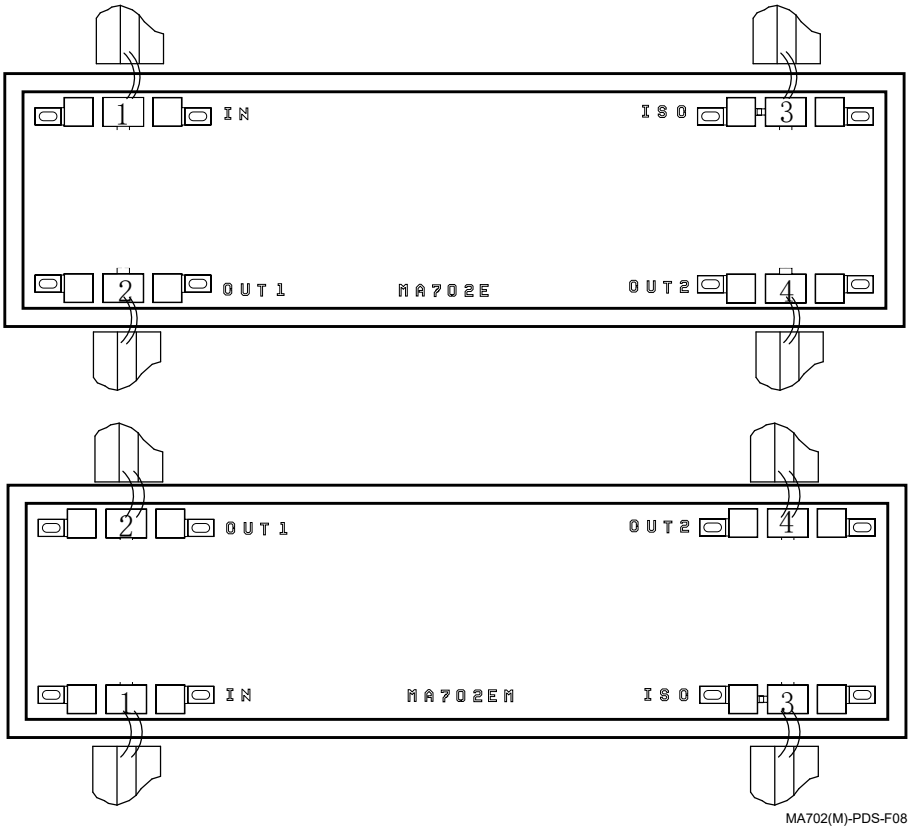


Figure 7. MA702(M) Assembly Diagram

- **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

The information provided here is believed to be reliable at the time of publication. Raytron reserves the right to make changes to its products, specifications and product descriptions at any time without notice. Raytron assumes no responsibility for the use of this information and all such information should entirely be at the user's own risk. Raytron makes no warranty about the suitability of its products for specific purpose or application and disclaims all liability, including without limitation consequential and incidental damages. Raytron does not authorize or warrant any Raytron products for use in the life support devices or systems.

Raytron Microwave

Copyright @ Raytron Technology Co.,Ltd.