1. Description

- The M0097 is a 6-bit digital attenuator fabricated on GaAs MMIC process. It operates over 0.1-30GHz and provides 31.5dB of attenuation coverage with a LSB of 0.5dB. It also achieves a low RMS attenuation error of 0.4dB and RMS relative phase of 5°, with an insertion loss less than 5dB.

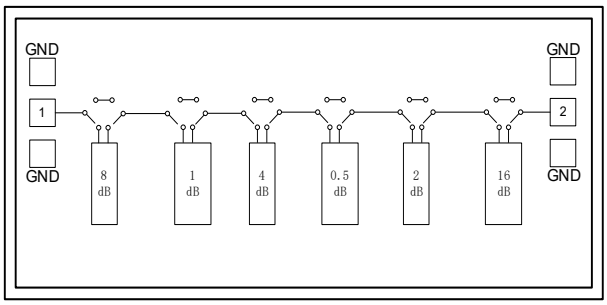


Figure 1. M0097 Functional Block Diagram

2. Applications

- TX/RX Modules
- Telecommunications
- Radar
- Defense

3. Features

- Frequency Range: 0.1GHz-30GHz
- 6-Bit Digital Attenuator
- 31.5dB Coverage with a LSB of 0.5dB
- Insert Loss: 5dB (typ.)
- RMS Attenuation Error: 0.4dB
- RMS Relative Phase: 5°
- Die size: 2.2x0.92 x 0.10mm

4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	0.1GHz-30GHz	Units
Insert Loss	5	dB
Input Return Loss	-10	dB
Output Return Loss	-10	dB
RMS Attenuation Error	0.4	dB
RMS Relative Phase	5	°

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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
Control Voltage, P1-P10	-	0/-5	-	V

6. RF Characteristics (T_C = 25°C)

Table 3. RF Characteristics[1]

Parameter	Symbol	Min.	Typ.	Max.	Units
Insertion Loss	IL	-	-5	-	dB
Input Return Loss	RL_{IN}	-	-10	-	dB
Output Return Loss	RL_{OUT}	-	-10	-	dB
RMS Attenuation Error	RMS_A	-	0.4	-	dB
RMS Relative Phase	RMS_P	-	5	-	°

7. Typical Performance Curve

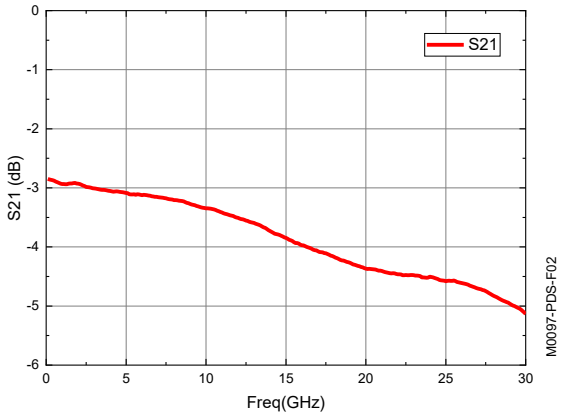


Figure 2. Reference State Insertion Loss Characteristics

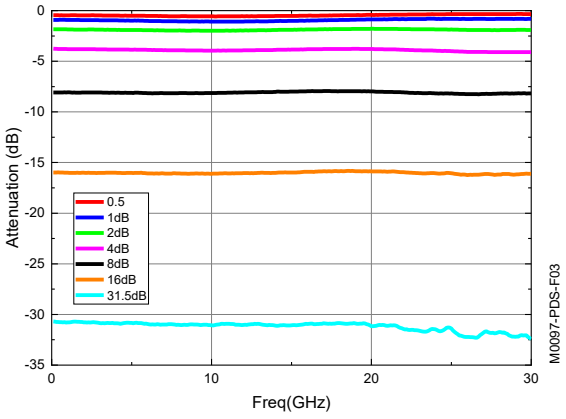


Figure 3. Basic State Attenuation Characteristics

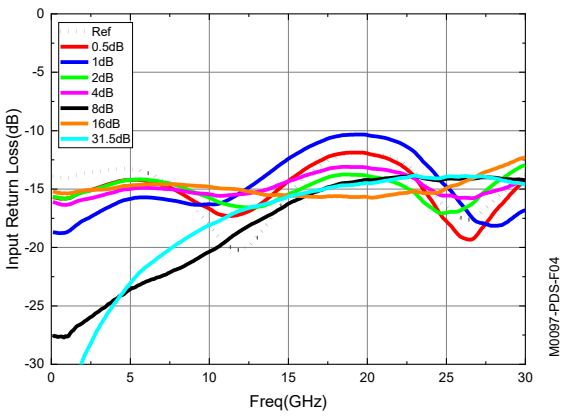


Figure 4. Basic State Input Return Loss Characteristics

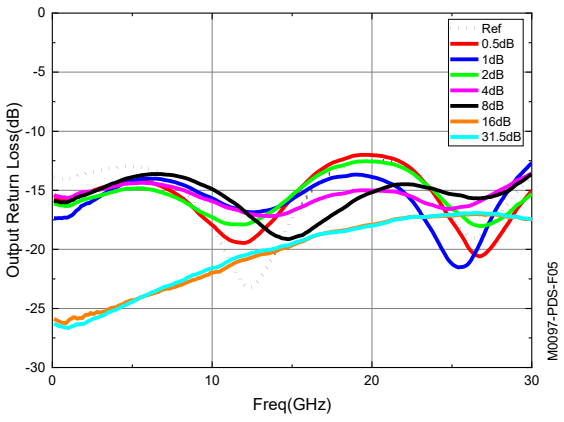


Figure 5. Basic State Output Return Loss Characteristics

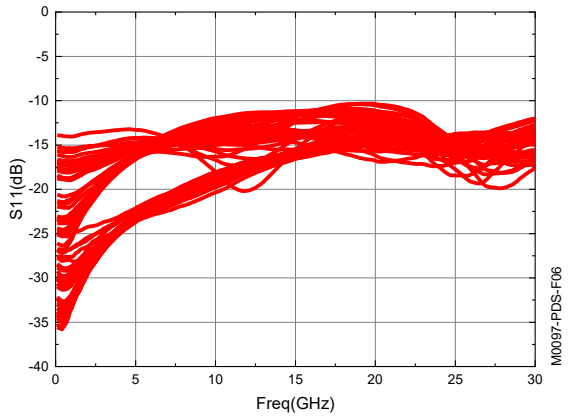


Figure 6. Full State Input Return Loss Characteristics

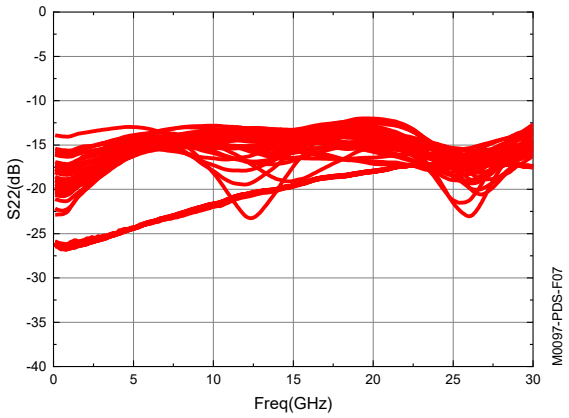


Figure 7. Full State Output Return Loss Characteristics

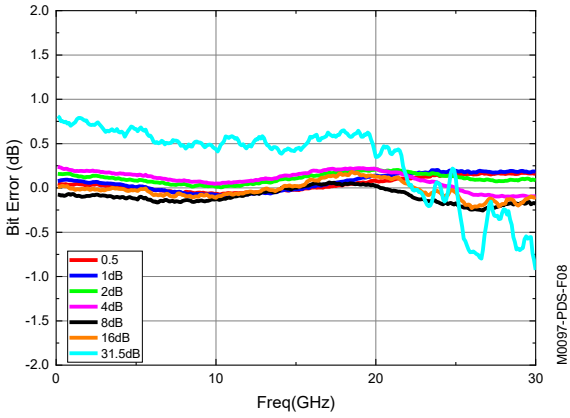


Figure 8. Basic State Attenuation Error Characteristics

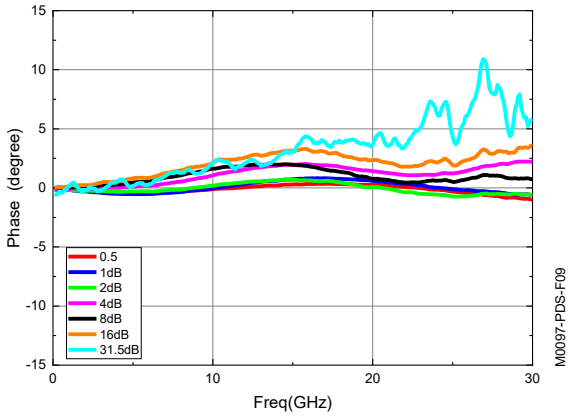


Figure 9. Basic State Relative Phase Characteristics

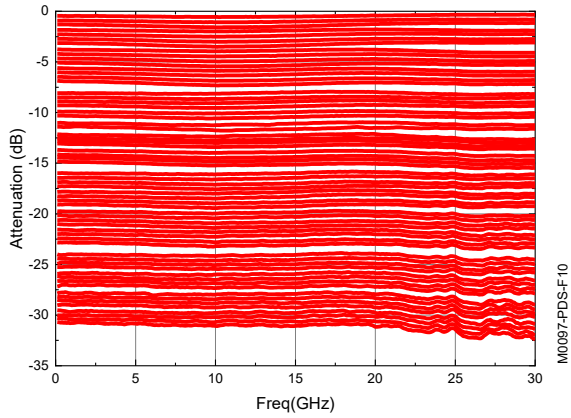


Figure 10. Full State Attenuation Characteristics

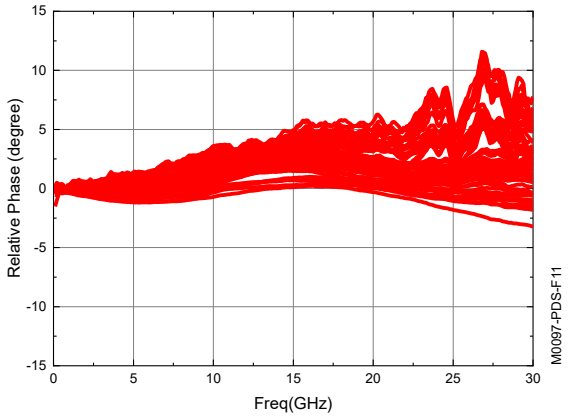


Figure 11. Full State Relative Phase Characteristics

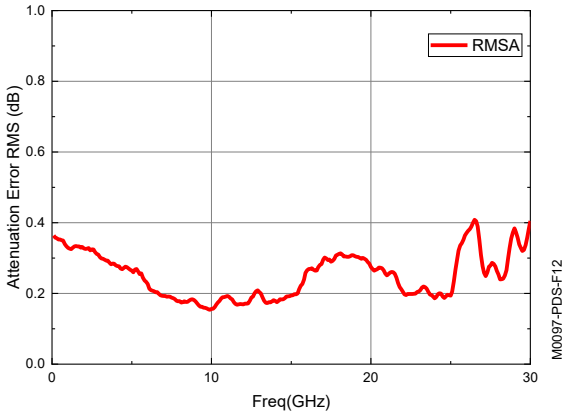


Figure 12. RMS Attenuation Error Characteristics

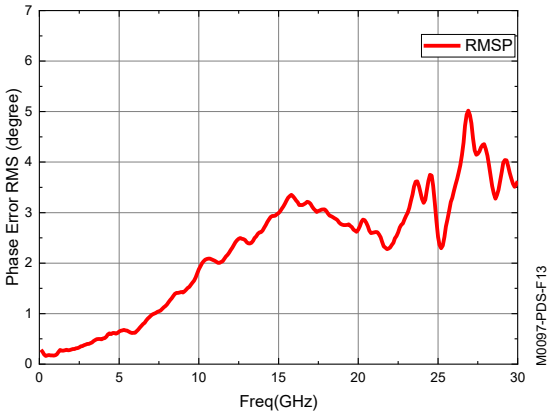
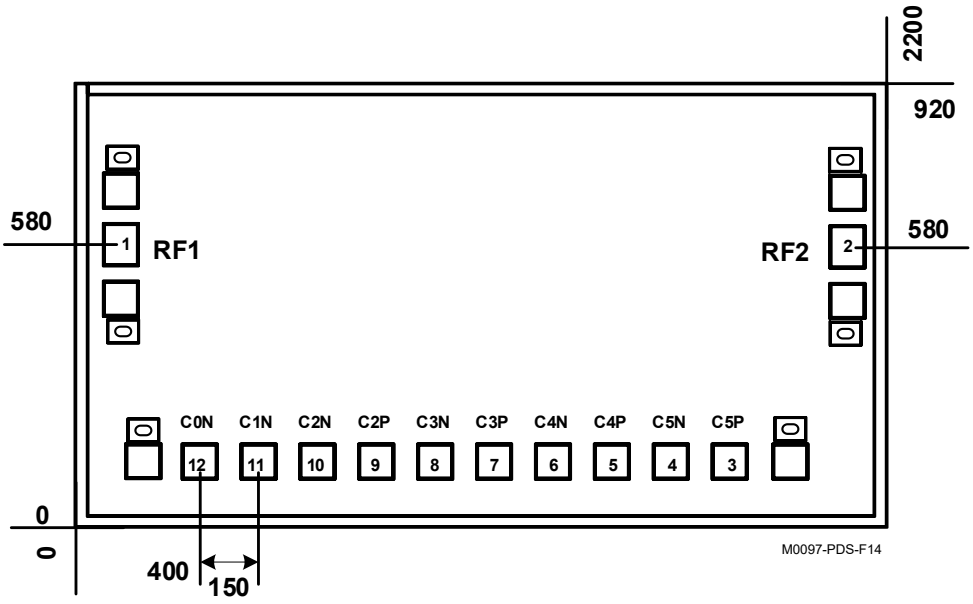


Figure 13. RMS Relative Phase Characteristics

8. Outline Dimensions



- Dimensions shown in micrometre

Figure 14. M0097 Outline Dimensions

Table 4. Pad Description

Pad	Symbol	Description
1	RF1	RF Input
2	RF2	RF Output
3, 4, 5, 6, 7, 8, 9, 10, 11, 12	C0N, C1N, C2N, C2P, C3N C3P, C4N, C4P, C5N, C5P	Control Voltage

Table 5. Truth Table

C5P	C5N	C4P	C4N	C3P	C3N	C2P	C2N	C1N	C0N	Attenuation State RF1-RF2 (dB)
16dB		8dB		4dB		2dB		1dB	0.5dB	
0	-5	0	-5	0	-5	0	-5	-5	-5	Reference
0	-5	0	-5	0	-5	0	-5	-5	0	0.5
0	-5	0	-5	0	-5	0	-5	0	-5	1
0	-5	0	-5	0	-5	-5	0	-5	-5	2
0	-5	0	-5	-5	0	0	-5	-5	-5	4
0	-5	-5	0	0	-5	0	-5	-5	-5	8
-5	0	0	-5	0	-5	0	-5	-5	-5	16
-5	0	-5	0	-5	0	-5	0	0	0	31.5

9. Assembly Information

■ Assembly Diagram

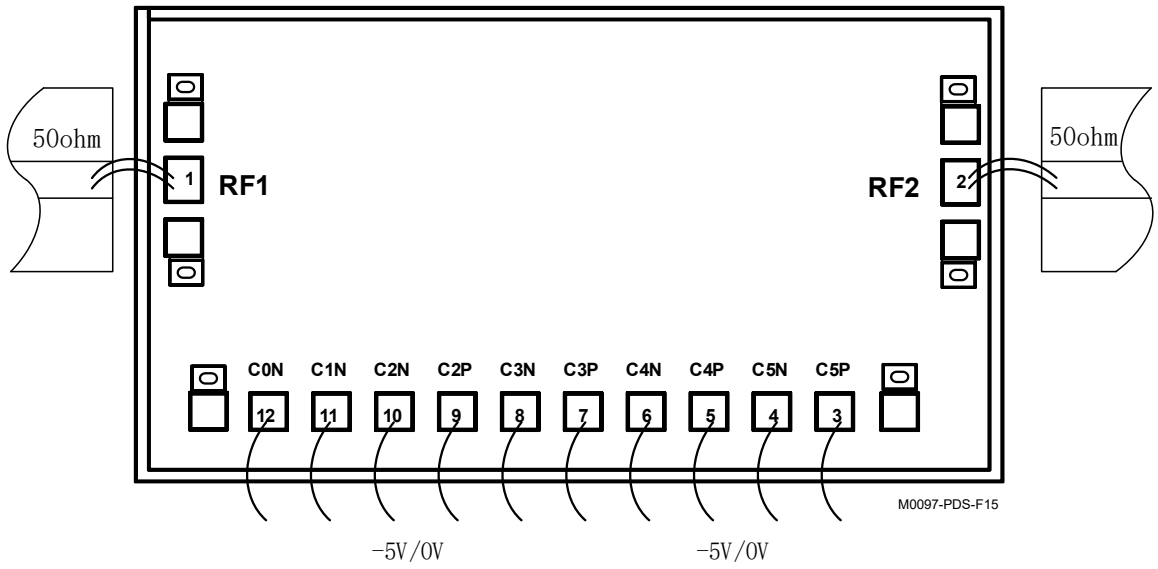


Figure 15. M0097 Assembly Diagram

- **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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