1. Description

- The M0098 is a 6-bit digital attenuator fabricated on GaAs MMIC process. It operates over 0.1-40GHz and provides 31.5dB of attenuation coverage with a LSB of 0.5dB. It also achieves a low RMS attenuation error of 1 dB, with an insertion loss less than 7dB.

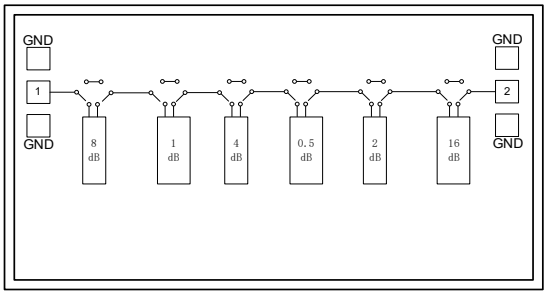


Figure 1. M0098 Functional Block Diagram

2. Applications

- TX/RX Modules
- Telecommunications
- Radar
- Defense

3. Features

- Frequency Range: 0.1GHz-40GHz
- 6-Bit Digital Attenuator
- 31.5dB Coverage with a LSB of 0.5dB
- Insert Loss: 7dB (typ.)
- RMS Attenuation Error: 1dB
- Die size: 2.0 x 1.0 x 0.1mm

4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	0.1GHz-40GHz	Units
Insert Loss	7	dB
Input Return Loss	-10	dB
Output Return Loss	-10	dB
RMS Attenuation Error	1	dB

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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	-	-7	-	dB
Input Return Loss	RL_{IN}	-	-10	-	dB
Output Return Loss	RL_{OUT}	-	-10	-	dB
RMS Attenuation Error	RMS_A	-	1	-	dB

7. Typical Performance Curve

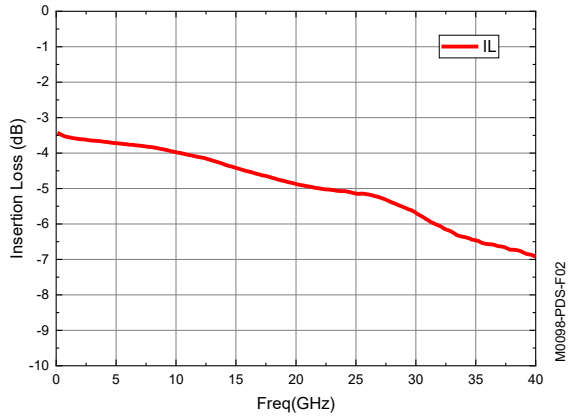


Figure 2. Reference State Insertion Loss Characteristics

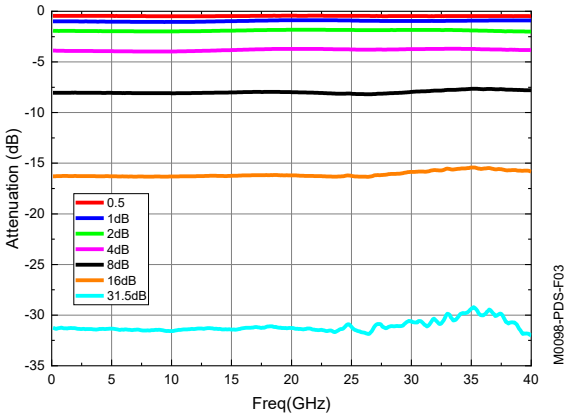


Figure 3. Basic State Attenuation Characteristics

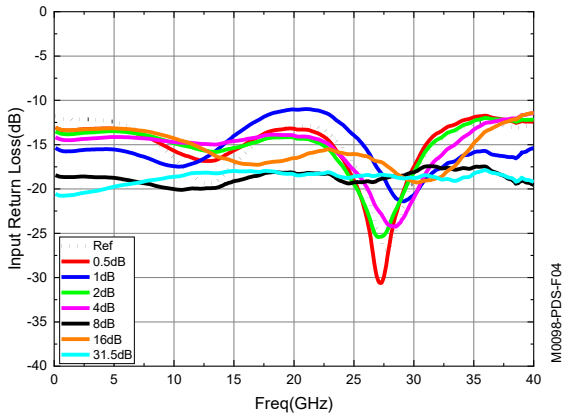


Figure 4. Basic State Input Return Loss Characteristics

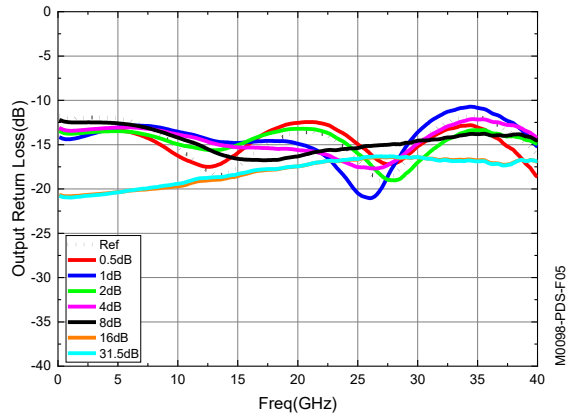


Figure 5. Basic State Output Return Loss Characteristics

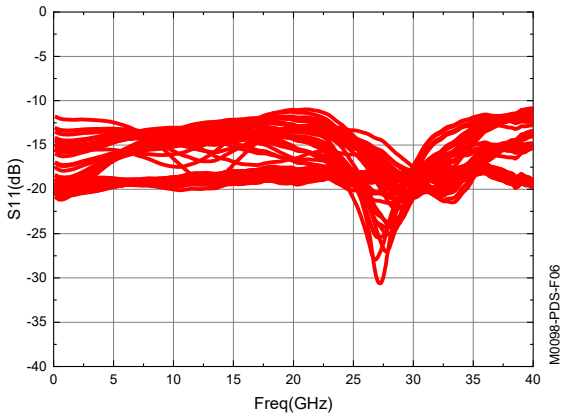


Figure 6. Full State Input Return Loss Characteristics

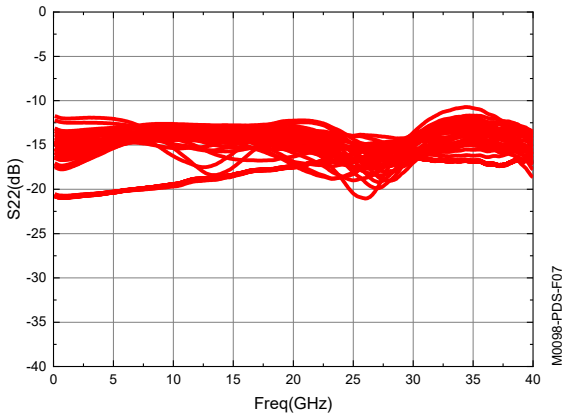


Figure 7. Full State Output Return Loss Characteristics

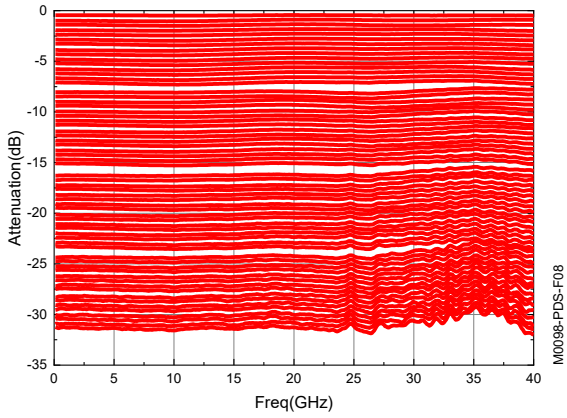


Figure 8. Full State Attenuation Characteristics

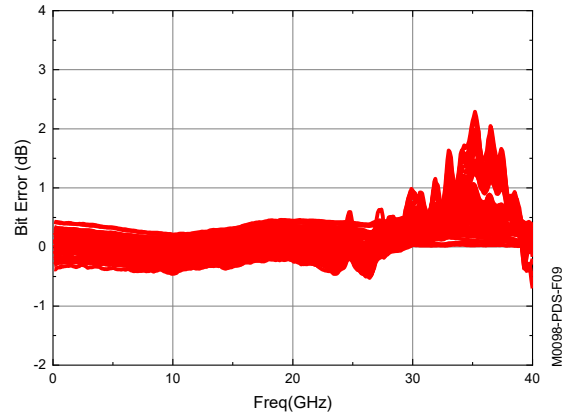


Figure 9. Full State Bit Error Characteristics

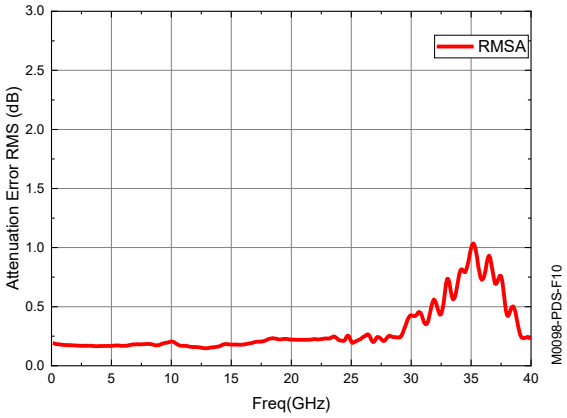


Figure 10. RMS Attenuation Error Characteristics

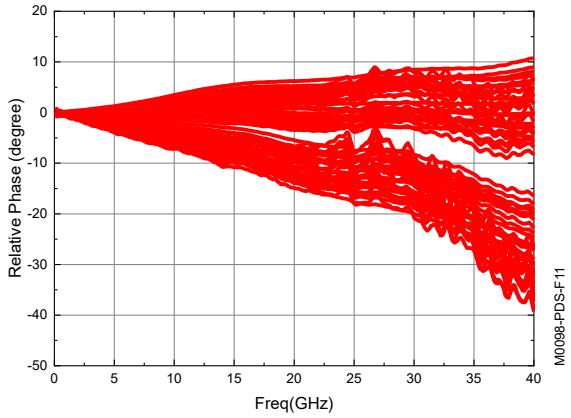
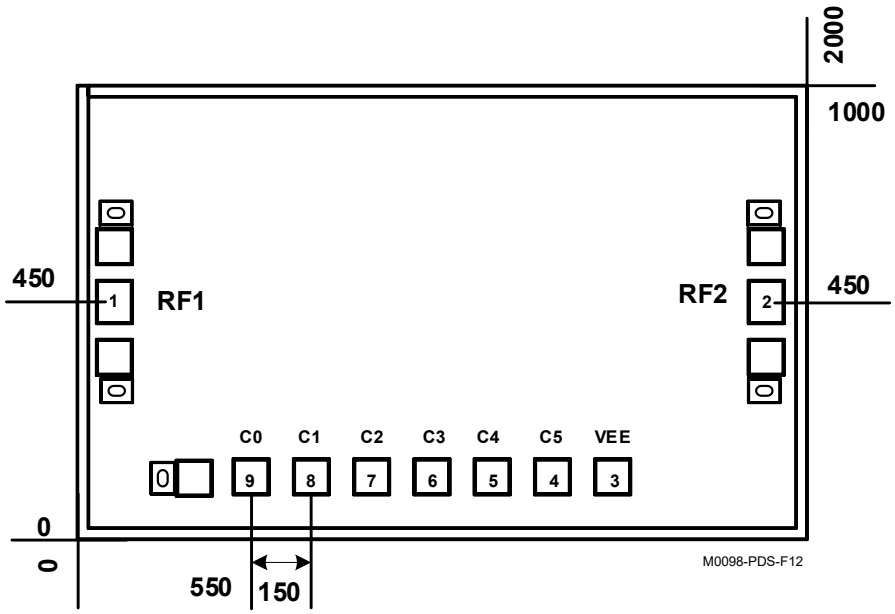


Figure 11. Full State Relative Phase Characteristics

8. Outline Dimensions



- Dimensions shown in micrometre

Figure 12. M0098 Outline Dimensions

Table 4. Pad Description

Pad	Symbol	Description
1	RF1	RF Input
2	RF2	RF Output
3	VEE	Driver Power Supply
4，5，6，7，8，9	C0-C5	Control Voltage

Table 5. Truth Table

Logic “0” = 0V, Logic”1” = +5V

	C5	C4	C3	C2	C1	C0	VEE
0(Reference)	0	0	0	0	0	0	-5
0.5dB	0	0	0	0	0	1	-5
1dB	0	0	0	0	1	0	-5
2dB	0	0	0	1	0	0	-5
4dB	0	0	1	0	0	0	-5
8dB	0	1	0	0	0	0	-5
16dB	1	0	0	0	0	0	-5
31.5dB	1	1	1	1	1	1	-5

9. Assembly Information

■ Assembly Diagram

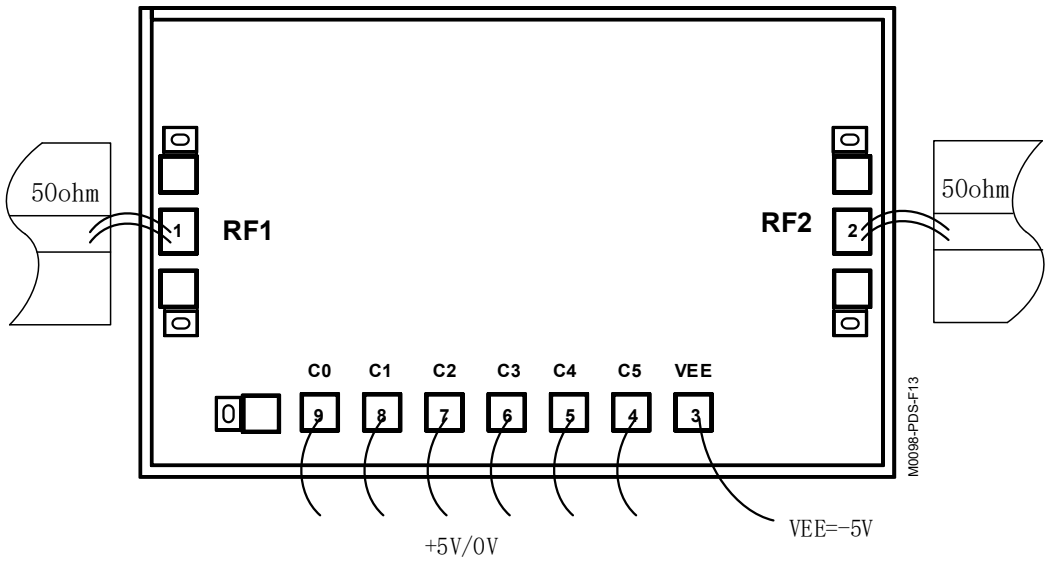


Figure 13. M0098 Assembly Diagram

- **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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