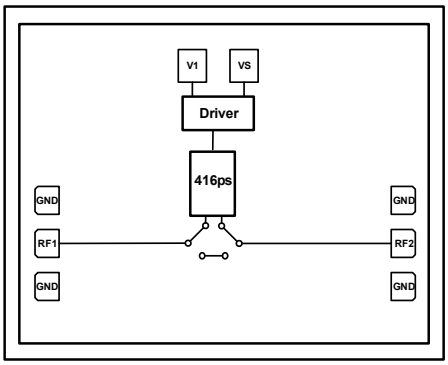
1. Description

- The M0033 is a wideband, 1-bit Digital Controlled Delay Line operating from 5 to 13GHz. It provides true time delay (TTD) functionality with a precise 416ps. The integrated on-chip equalizer optimizes gain flatness across the band. The device maintains an insertion loss of <8dB and achieves return loss better than 15dB, making it an ideal solution for advanced RF and microwave systems requiring precise time control.



M0033-PDS-F01

Figure 1. M0033 Functional Block Diagram

2. Applications

- TX/RX Modules
- Radar
- Defense

3. Features

- Frequency Range: 5-13GHz
- Time Delay: 416ps
- Insertion Loss: 8dB
- Input/Output Return Loss: -15dB
- Control Voltage: 0/+5V
- Die Size: 2.2mm x 2.4mm x 0.1mm

4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	5-13GHz	Units
Time Delay	416	ps
Insertion Loss	8	dB
Input/Output Return Loss	-15	dB
Time Delay Error	±3	ps
Amplitude Error	±0.5	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, V1	-	0/5	-	V
Reference Voltage, VS	-	-5	-	V

6. RF Characteristics (T_C = 25˚C)

Table 3. RF Characteristics[1]

Parameter	Symbol	Min.	Typ.	Max.	Units
Time Delay	TD	-	416	-	ps
Insertion Loss	IL	-	8	-	dB
Input Return Loss	RL_{IN}	-	-15	-	dB
Output Return Loss	RL_{OUT}	-	-15	-	dB
Time Delay Error	Error	-	±3	-	ps
Amplitude Error	ΔIL	-	0.5	-	dB

[1]. Test condition: Input signal CW

7. Typical Performance Curve

■ Small-signal Characteristics Curve

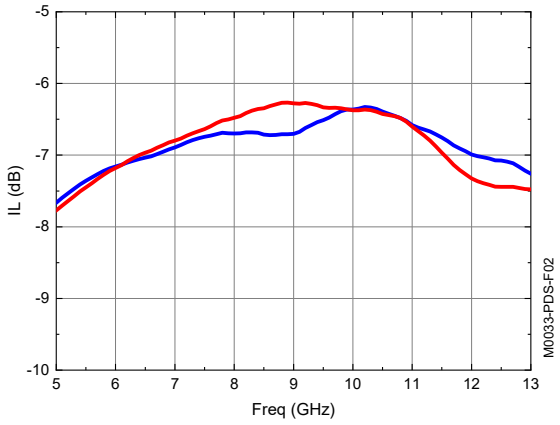


Figure 2. Full state Insertion Loss Characteristics

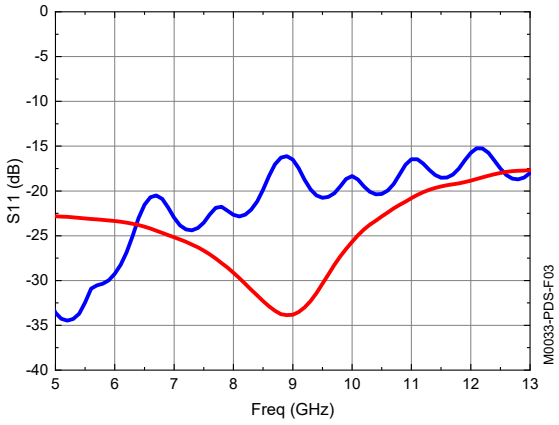


Figure 3. Full state Input Return Loss Characteristics

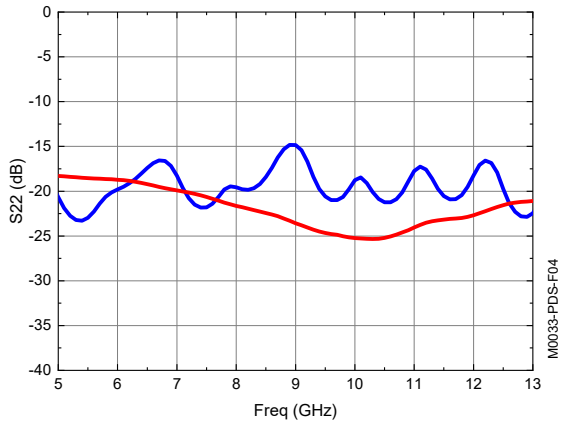


Figure 4. Full state Output Return Loss Characteristics

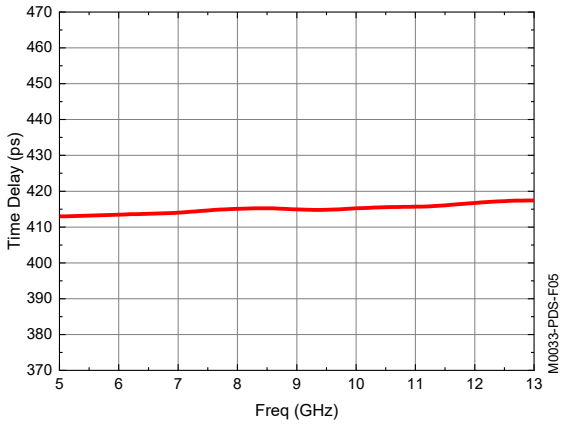


Figure 5. Time Delay Characteristics

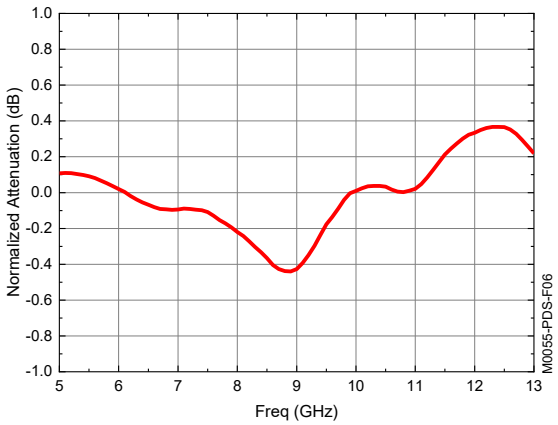
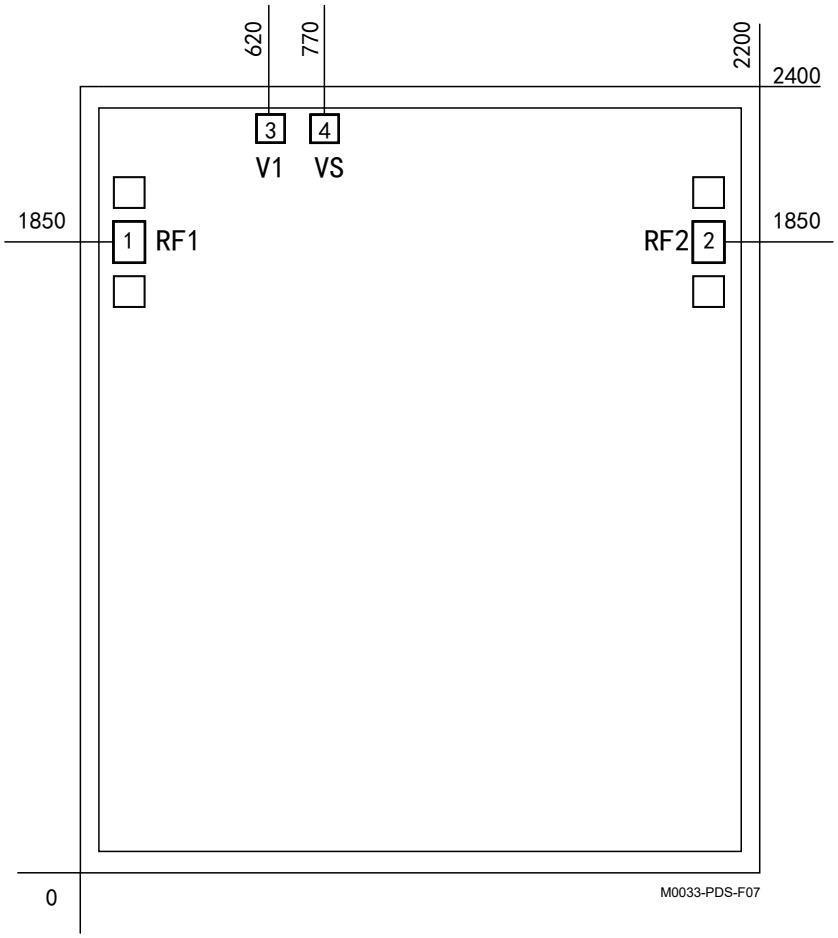


Figure 6. Amplitude error Characteristics

8. Outline Dimensions



Dimensions shown in micrometre

Figure 7. M0033 Outline Dimensions

Table 4. Pad Description

Pad	Symbol	Description
1	RF1	RF Input
2	RF2	RF Output
3	V1	Control Voltage
4	VS	Driver Power Supply

Table 5. Truth Table

	V1	VS
0(Reference)	0	-5
416ps	5	-5

9. Assembly Information

■ Assembly Diagram

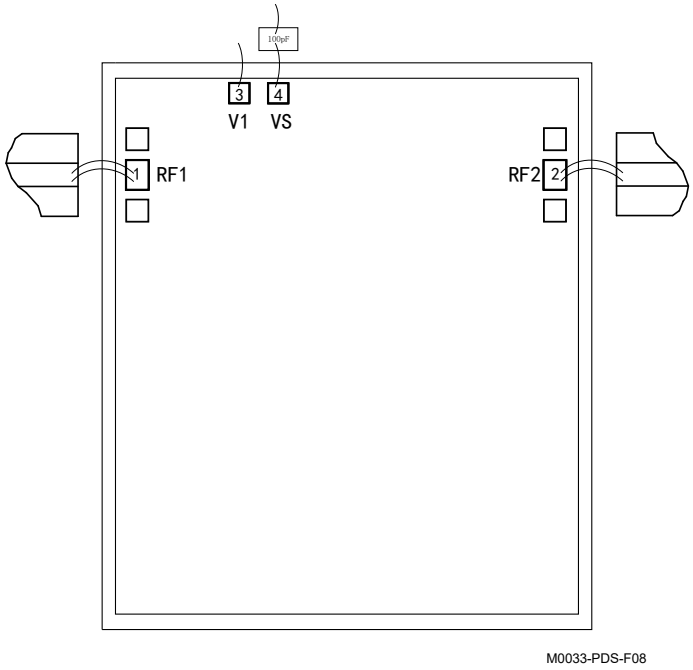


Figure 8. M0033 Assembly Diagram

- **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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