1. Description

- The M0036 is a wideband, 4-bit Digital Controlled True-Time Delay operating from 5 to 13GHz. It provides true time delay (TTD) functionality with a precise minimum step of 52ps. The integrated on-chip equalizer optimizes gain flatness across the band. The device maintains an insertion loss of -19.5dB and achieves return loss better than -15dB, making it an ideal solution for advanced RF and microwave systems requiring precise time control.

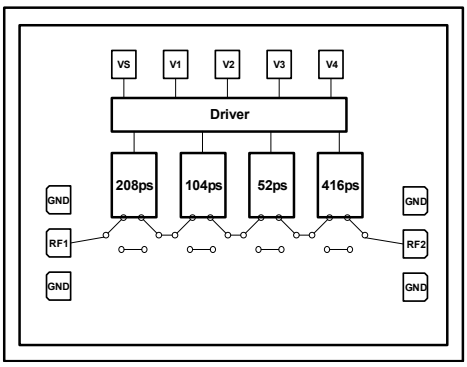


Figure 1. M0036 Functional Block Diagram

2. Applications

- TX/RX Modules
- Radar
- Defense
-

3. Features

- Frequency Range: 5 -13GHz
- Insertion Loss: 19.5dB
- Input/Output Return Loss: -15dB
- Time Delay Step: 52ps
- Time Delay Range: 0 – 780ps
- Time Delay Accuracy: 3%
- Control Voltage: 0/+5V
- Die Size: 4.4 x 3.4 x 0.1mm

4. Brief Typical Performance

Table 1. Brief Typical Performance

Parameter	5-13GHz	Units
Insertion Loss	19.5	dB
Insertion Loss Flatness	±1.5	dB
Input/Output Return Loss	-15	dB
Time Delay Step	52	ps
Time Delay Range	0-780	ps
Time Delay Accuracy	3	%
Amplitude Error	±0.6	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	7
12	Disclaimer	7

5. Recommended Operating Conditions

Table 2. Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Units
Operating Temperature Range	-55	25	125	°C
Control Voltage, V1-V4	-	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
Insertion Loss	IL		19.5		dB
Input Return Loss	RL_{IN}		-15		dB
Output Return Loss	RL_{OUT}		-15		dB
Time Delay Accuracy	A		3		%
Amplitude Error	ΔIL		±0.6		dB

[1]. Test condition: Input signal CW

7. Typical Performance Curve

■ Small-signal Characteristics Curve

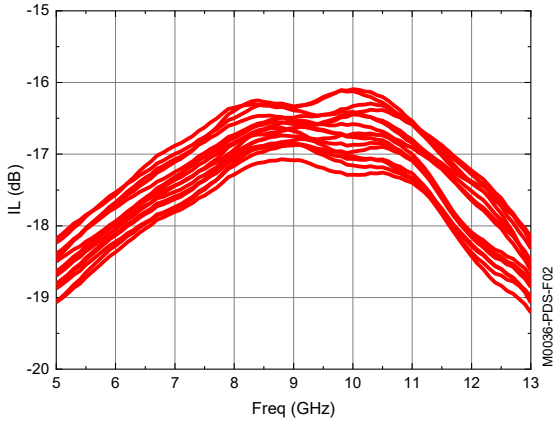


Figure 2. Full State Insertion Loss Characteristics

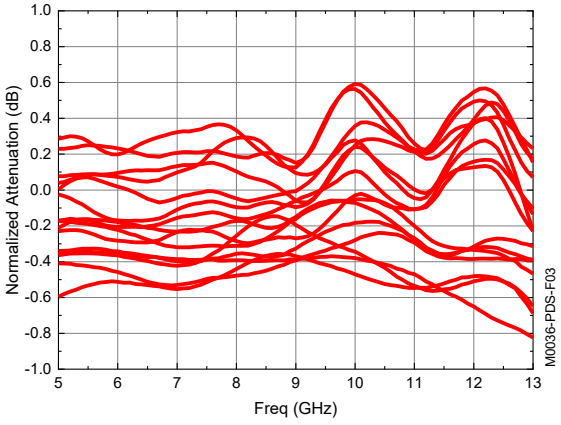


Figure 3. Full State Amplitude Error Characteristics

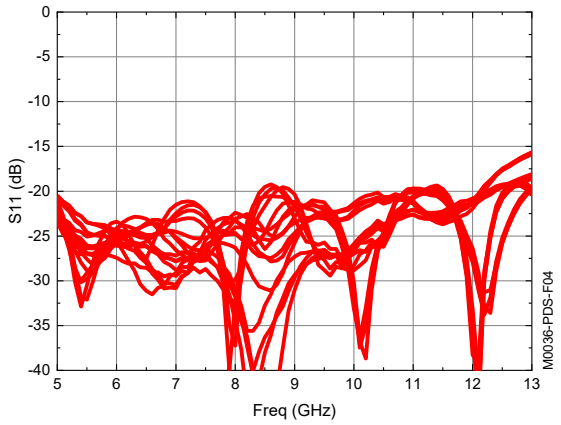


Figure 4. Full State Input Return Loss Characteristics

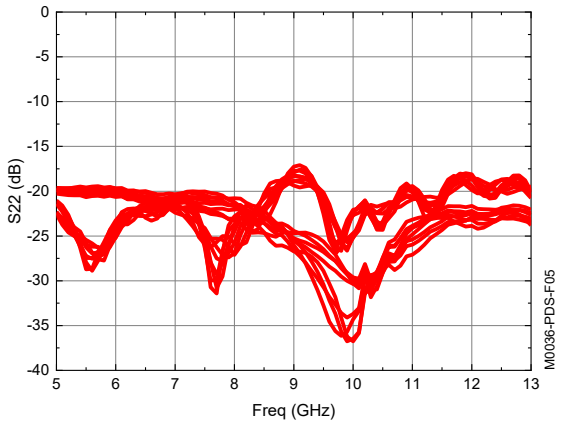


Figure 5. Full State Output Return Loss Characteristics

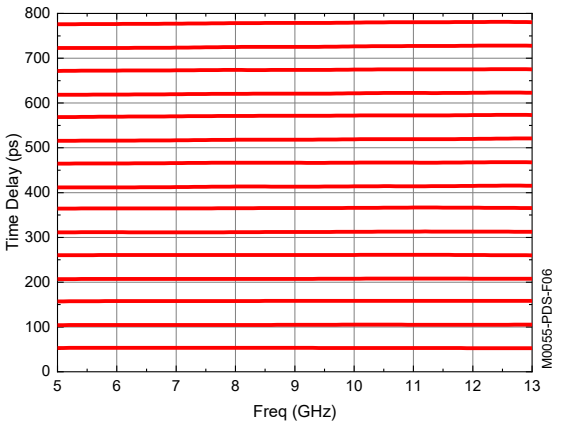


Figure 6. Full State Time Delay Characteristics

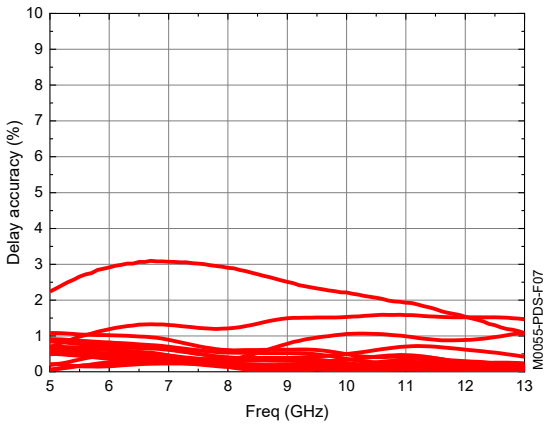
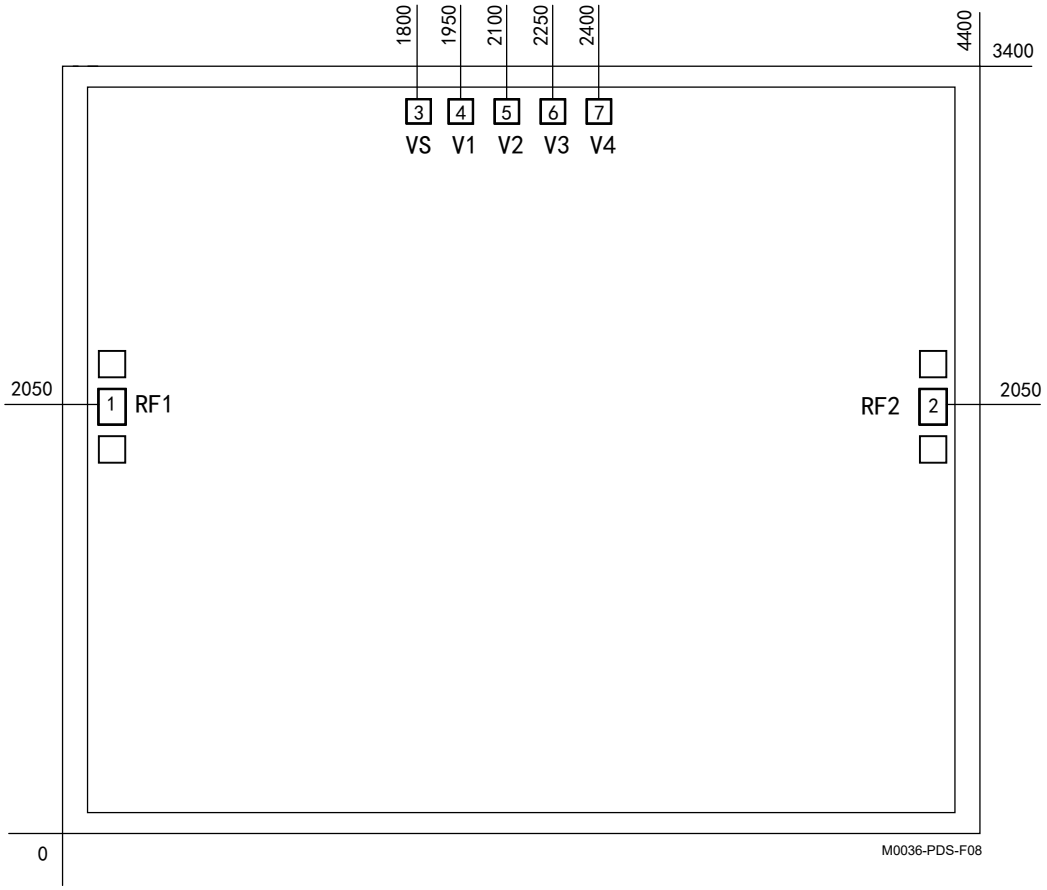


Figure 7. Full State Delay Accuracy Characteristics

8. Outline Dimensions



Dimensions shown in micrometre

Figure 8. M0036 Outline Dimensions

Table 4. Pad Description

Pad	Symbol	Description
1	RF1	RF Input
2	RF2	RF Output
3	VS	Driver Power Supply
4,5,6,7	V1, V2, V3, V4	Control Voltage

Table 5. Truth Table

Logic “0”=0V, Logic”1”=+5V

	V1	V2	V3	V4	VS
0(Reference)	0	0	0	0	-5
52ps	1	0	0	0	-5
104ps	0	1	0	0	-5
208ps	0	0	1	0	-5
416ps	0	0	0	1	-5
780ps	1	1	1	1	-5

9. Assembly Information

■ Assembly Diagram

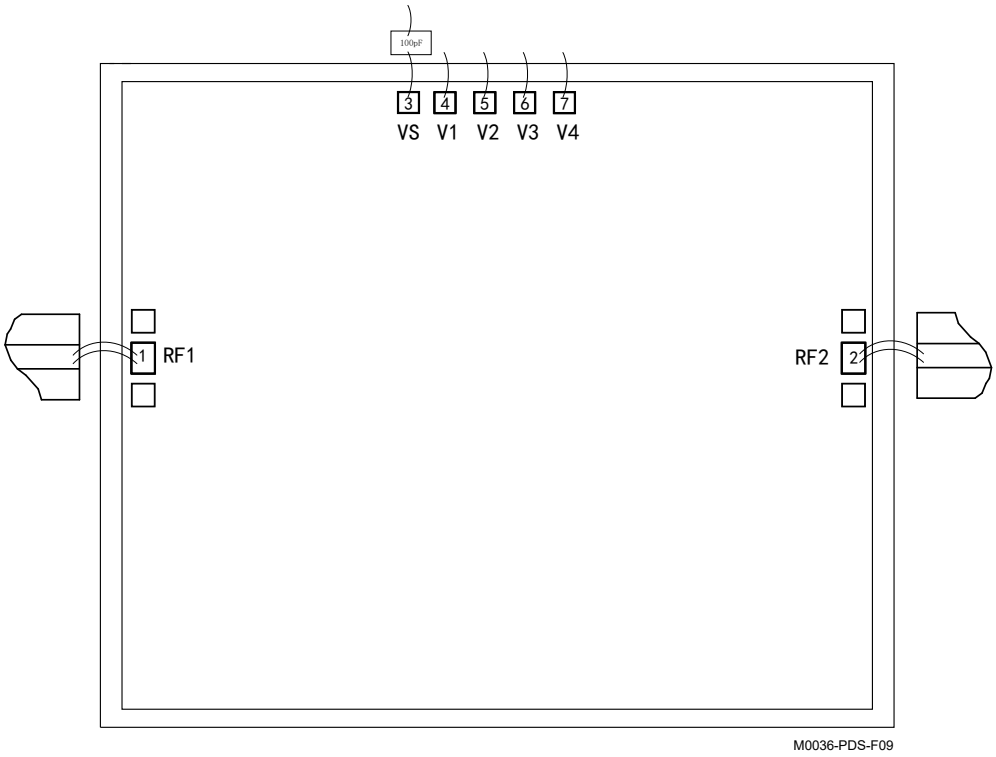


Figure 9. M0036 Assembly Diagram

- **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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