Product Specification

RS15501 Digital Step Attenuator

General Description

The RS15501 is a 1-bit digital step attenuator (DSA). It is available in a 2mm × 2mm, 8-lead QFN and provides 31.5dB attenuation range from 100 MHz to 10 GHz.

The RS15501 incorporates a negative voltage generator to operate with a single positive supply voltage from 2.7 V to 5.5 V applied to the VDD pin when all the GND pins are all connected to ground. The RS15501 provides one pin digital control interface.

Applications

- 3G/4G/5G wireless infrastructure
- Test equipment
- Land mobile radio system
- Point to point communication system

Features

- **Excellent RF Performance**
  - High Attenuation Accuracy and Low Insertion Loss
  - 0.8dB Insertion loss at 8GHz
- **High input linearity**
  - P0.1dB: 30dBm typical
  - Third-order intercept (IP3): 55 dBm typical
- **Programming interface**
  - GPIO

Functional Block Diagram

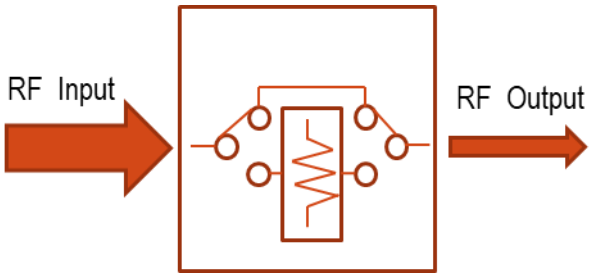


Figure 1

RFone Technology, Inc. www.rfonetech.com All Right Reserved

Absolute Maximum Ratings

Table 1

Parameter	Min	Max	Units
VDD to GND	-0.3	5.5	V
CTRL to GND	-0.3	5.5	V
Input Power		31	dBm
Storage Temperature Range	-60	150	°C
ESD Voltage– HBM		2000	V
ESD Voltage– CDM		500	V

Stresses above those listed above may cause permanent damage to the device. Functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Recommended Operating Conditions

Table 2

Parameter	Conditions	Min	Typ	Max	Units
Supply Voltage	/	2.7	3.3	5.5	V
Operating Temp Range	/	-40	25	105	°C
RF Frequency Range	/	50		10000	MHz
RF input Power, CW				25	dBm
RF input Power, Pulse				30	dBm
Logic High	/	1.2	3.3	Vdd	V
Logic Low	/	-0.3	0	0.7	V

Operation should be restricted to the limits in the Recommended Operating Conditions table. Operation between operating range maximum and absolute maximum for extended periods may reduce reliability.

Specification

Typical Application Circuit, Normal mode (VDD=3.3V), T_C = +25°C, Input power = 0dBm.

Table 3

Parameter	Conditions	Min	Typ	Max	Units
Operation Frequency	/	100		10000	MHz
Attenuation Range			31.5		dB
Insertion Loss	100MHz - 1.0GHz		0.5		dB
	1.0GHz - 3.0GHz		0.5		
	3.0GHz - 4.0GHz		0.6		
	4.0GHz - 6.0GHz		0.7		
	6.0GHz - 10.0GHz		1.0		
Attenuation Accuracy	100MHz - 1.0GHz		0.5		dB
	1.0GHz - 3.0GHz		0.5		
	3.0GHz - 4.0GHz		0.5		
	4.0GHz - 6.0GHz		0.8		
	6.0GHz - 10.0GHz		0.8		
Return Loss	100MHz - 6.0GHz		-20		dB
	6.0GHz - 8.0GHz		-12		
Input IP3	Pin = 18dBm/tone,20MHz spacing, 2.5 - 4.0GHz		55		dBm
Input 0.1dB Compression	100MHz above		30		dBm
Relative Phase	0dB to 32dB		20	30	degree
Switching Time	50% CTRL to 90% RF		500		ns
	50% CTRL to 10% RF		500		
Logic Input High Threshold		1.2		VDD	V
Logic Input Low Threshold		-0.3		0.7	V
Logic Current	For each control pin		3		μA
DC Current	VDD=3.3V		55		μA

 All Rights Reserved

Pin Diagram

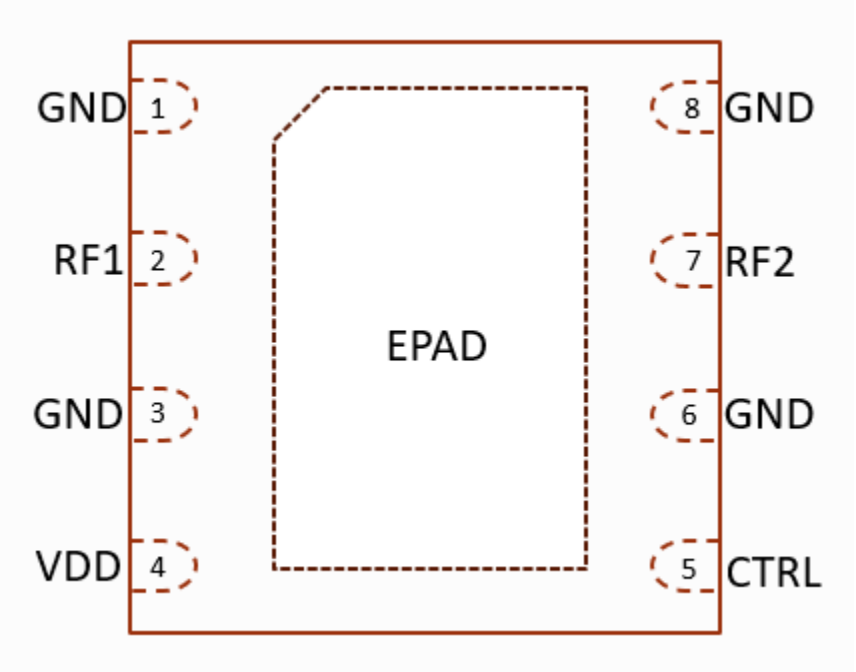


Figure 2

Pin Description

Table 4

Pin No.	Label	Description
1, 3, 6, 8, EPAD	GND	Ground
2	RF1	RF input or output
7	RF2	RF input or output
4	VDD	Power supply
5	CTRL	Control pin for attenuation (Internal pull high, attenuation mode)

Control Logic

Table 5

CTRL	Mode
High	31.5dB
Low	0dB

Typical Performance Characteristics

Figure 3 Insertion Loss

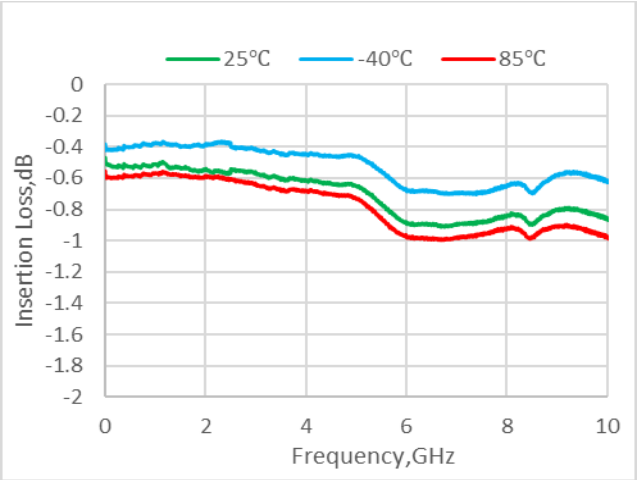


Figure 4 Relative Phase VS Attenuation Value

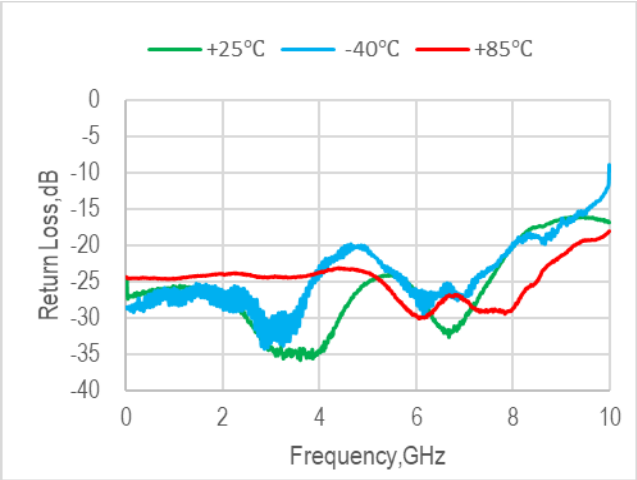


Figure 5 Return Loss RF1@CTRL=0V

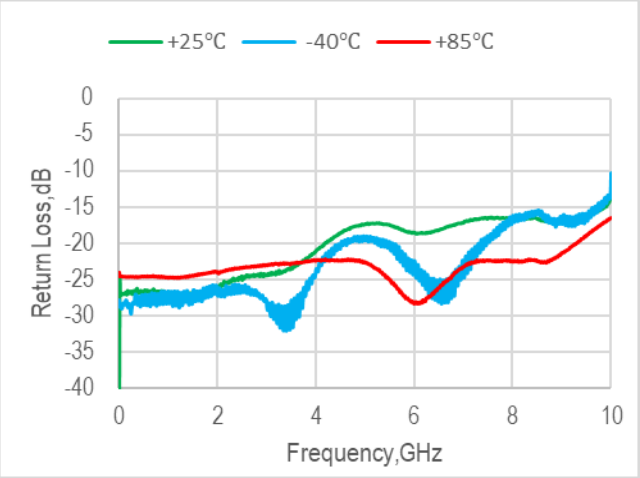


Figure 6 Return Loss RF1@CTRL=3.3V

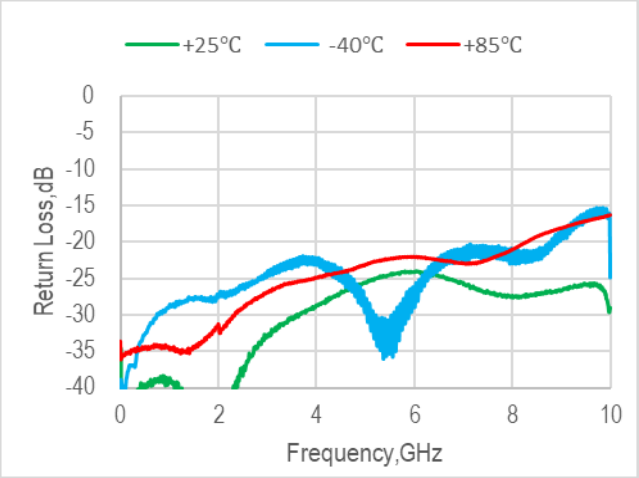


Figure 7 Return Loss RF2@CTRL=0V

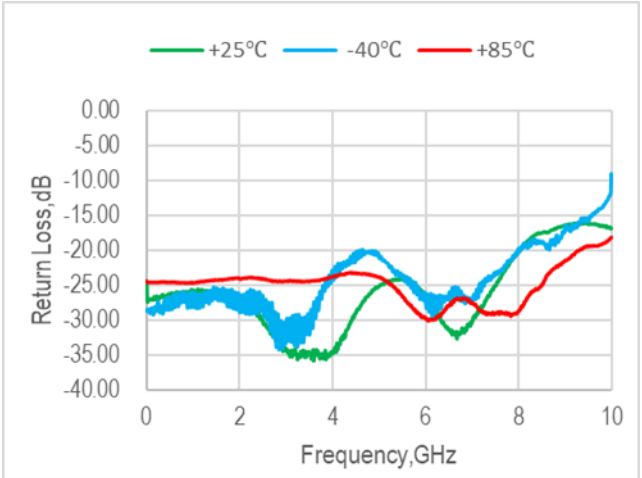
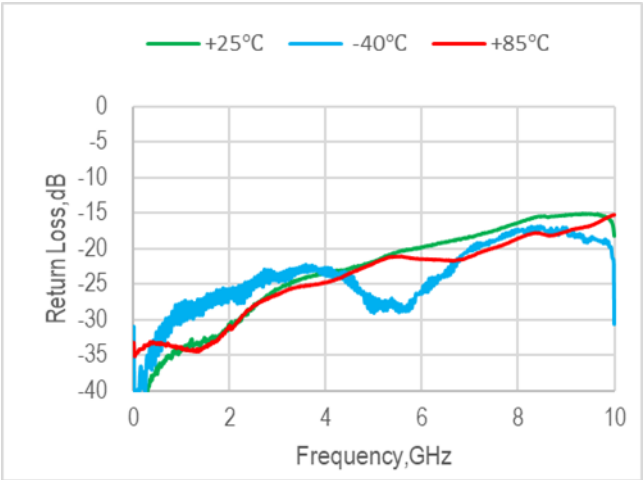


Figure 8 Return Loss RF2@CTRL=3.3V



Typical Performance Characteristics

Figure 9 Attenuation VS Frequency DC-10GHz

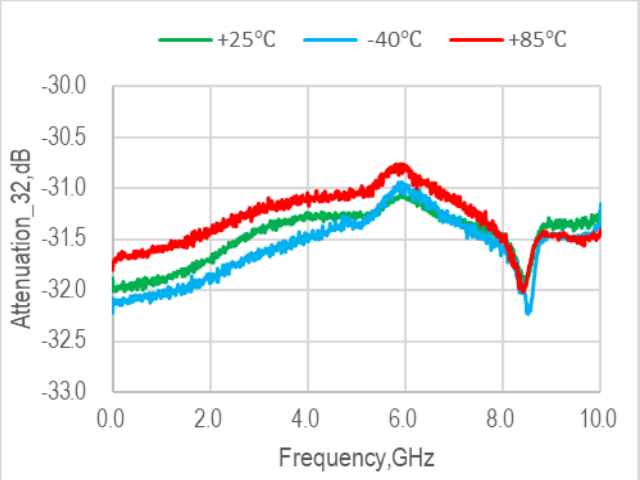


Figure 10 Attenuation VS Frequency 0.6-0.9GHz

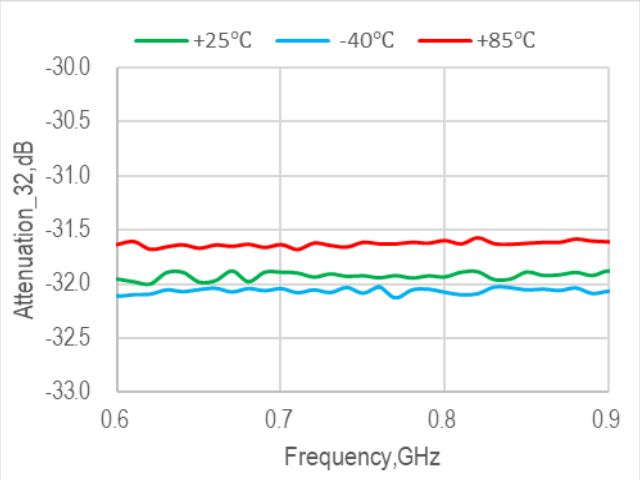


Figure 11 Attenuation VS Frequency 1.7-2.2GHz

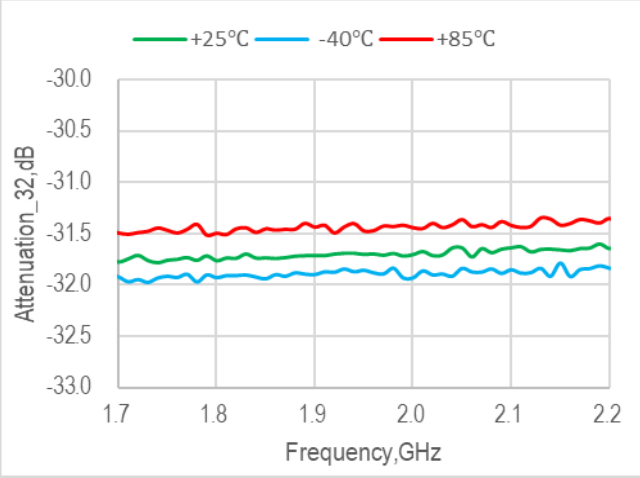


Figure 12 Attenuation VS Frequency 2.3-3.8GHz

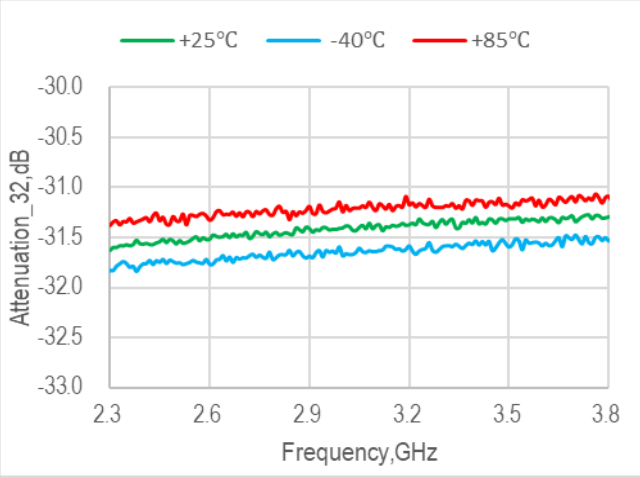


Figure 13 Attenuation VS Frequency 3.0-6.0GHz

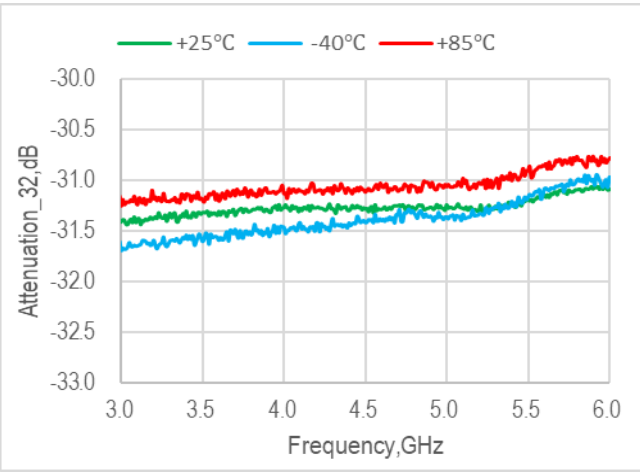
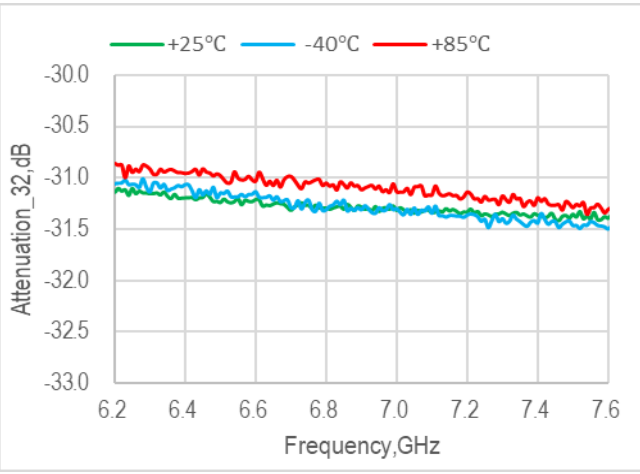
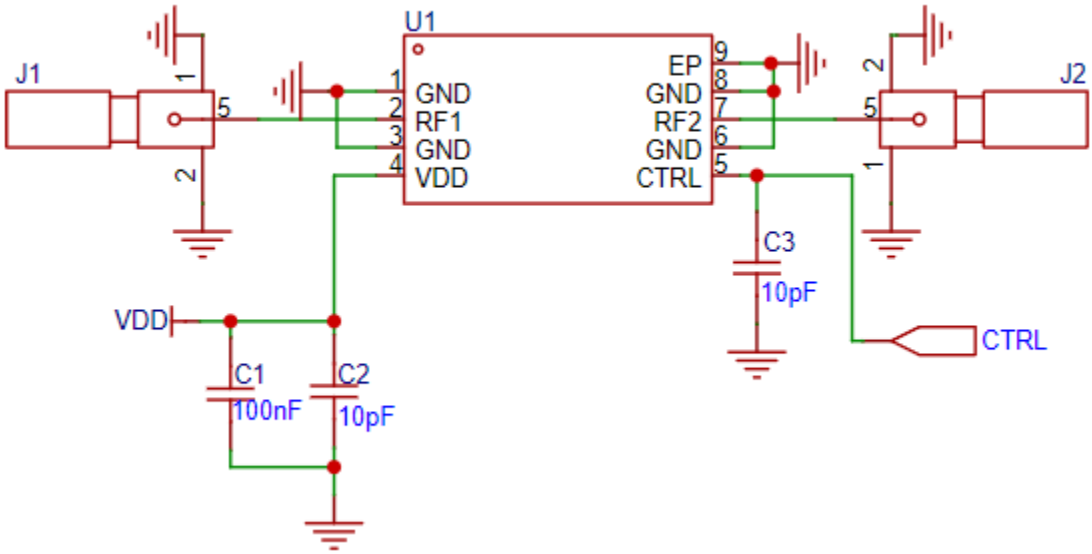


Figure 14 Attenuation VS Frequency 6.2-7.6GHz



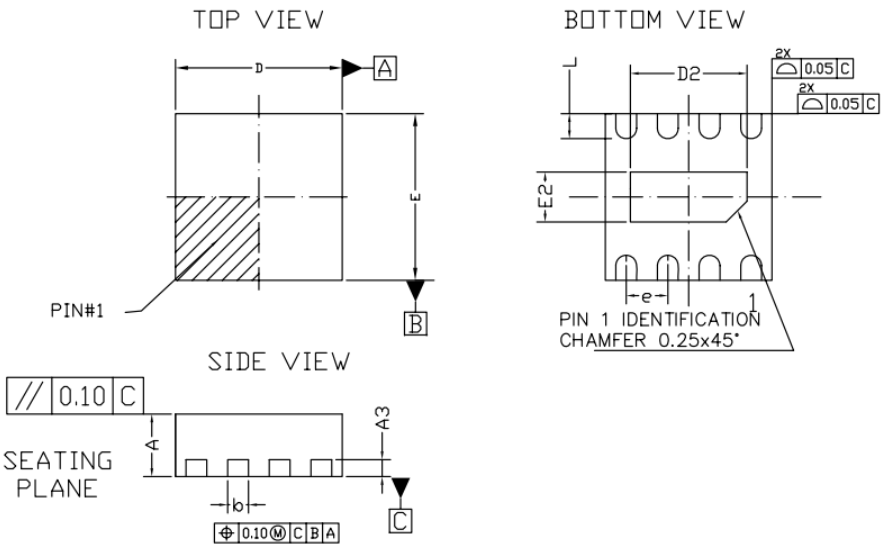
Application Information



Note: 40mil is the best distance between C2 and PIN4, the same to the distance between C3 and PIN5

Figure 15

Package Drawing



SYMBOL	COMMON DIMENSIONS MILLIMETER		
	MIN	NOM.	MAX
A	0.70	0.75	0.80
A3		0.203 BSC	
b	0.20	0.25	0.30
D	1.925	2.00	2.075
D2	1.35	1.40	1.45
E	1.925	2.00	2.075
E2	0.55	0.60	0.65
e		0.50 BSC	
L	0.25	0.30	0.35

NOTE:
1. DIMENSION AND TOLERANCING CONFORM TO ASME Y14.5M-1994.
2. CONTROLLING DIMENSIONS :MILLIMETER.

Figure 16

Revision History

Table 9

Revision Number	Revision Date	Description	Modifications
0	2022/2/11	Draft	—
0.2	2022/7/20	Update table with newest data	
0.3	2023/2/16	Preliminary Specification	
0.4	2024/1/5	Preliminary Specification	
0.5	2024/5/10	Product Specification	
0.6	2024/5/30	Updata	
1.0	2025/5/30	Updata	

Document Categories

Advance Information

The product is in a formative or design stage. The datasheet contains design target specifications for product development. Specifications and features may change in any manner without notice.

Preliminary Specification

The datasheet contains preliminary data. Additional data may be added at a later date. RFone Technology reserves the right to change specifications at any time without notice in order to supply the best possible product.

Product Specification

The datasheet contains final data. In the event RFone Technology decides to change the specifications, RFone Technology will notify customers of the intended changes by issuing a CNF (Customer Notification Form).

Sales Contact

For additional information, contact Sales at sales@rfonetech.com.

Disclaimers

The information in this document is believed to be reliable. However, RFone Technology assumes no liability for the use of this information. Use shall be entirely at the user's own risk. No patent rights or licenses to any circuits described in this document are implied or granted to any third party. RFone Technology 's products are not designed or intended for use in devices or systems intended for surgical implant, or in other applications intended to support or sustain life, or in any application in which the failure of the RFone Technology product could create a situation in which personal injury or death might occur. RFone Technology assumes no liability for damages, including consequential or incidental damages, arising out of the use of its products in such applications.

Patent Statement

RFone Technology products are protected under one or more of the following Chinese patents.For details, visit patents.rfonetech.com

Copyright and Trademark

©2019 – 2025, RFone Technology Inc. All rights reserved. The RFone Technology name, logo are registered trademarks.