



### 2-18 GHz Radar Warning Receiver

The RR017 is designed for Radar Warning Receiver (RWR) applications where low cost and small size and are of prime importance, with filtering, amplification, detection and pulse parameter measurement being combined into one multi-function unit.

Two amplitude measurement channels allow direction finding by amplitude comparison between adjacent antennas. A 20dB switched attenuator can be selected to allow amplitude measurement above  $-15\text{dBm}$ . An IFM, fed from one of the amplitude channels via an SPDT switch, performs 10 bits of frequency measurement on the selected input. Frequency resolution is nominally 25 MHz over a 2 to 18 GHz band. The RR017 is internally triggered and generates a full PDW giving the following data: Time of arrival, Pulse amplitude (from the two selected antennas), Pulse frequency and Pulse width.

#### FEATURES

- 2 to 18 GHz Frequency range
- 25MHz Frequency resolution
- 0.2dB Amplitude resolution
- Pulse Descriptor Word Output
- USB2 interface
- Sensitivity  $-57\text{dBm}$  (or better)
- Small form factor

The standard data interface is USB2 with optional 50MHz clocked 16-bit parallel interface via a separate 37 way MDM connector.

The small size eases the burden on UAV and AFV payloads in particular and the reduced power consumption renders a double benefit, as a smaller, lighter power supply is required RF connections are made by SMA, DC power & USB2 uses a 25 way MDM, parallel data uses a separate 37 way MDM connector.

External 50 MHz clock input can be selected to operate the time of arrival (TOA) counter (shared clock source for the parallel data output PDWs), hence the PDWs generated have fully correlated TOA digits.

#### APPLICATIONS

- Affordable Radar Warning Receiver for
- AFV
- UAV
- Remote sensing
- Air, sea and land platforms

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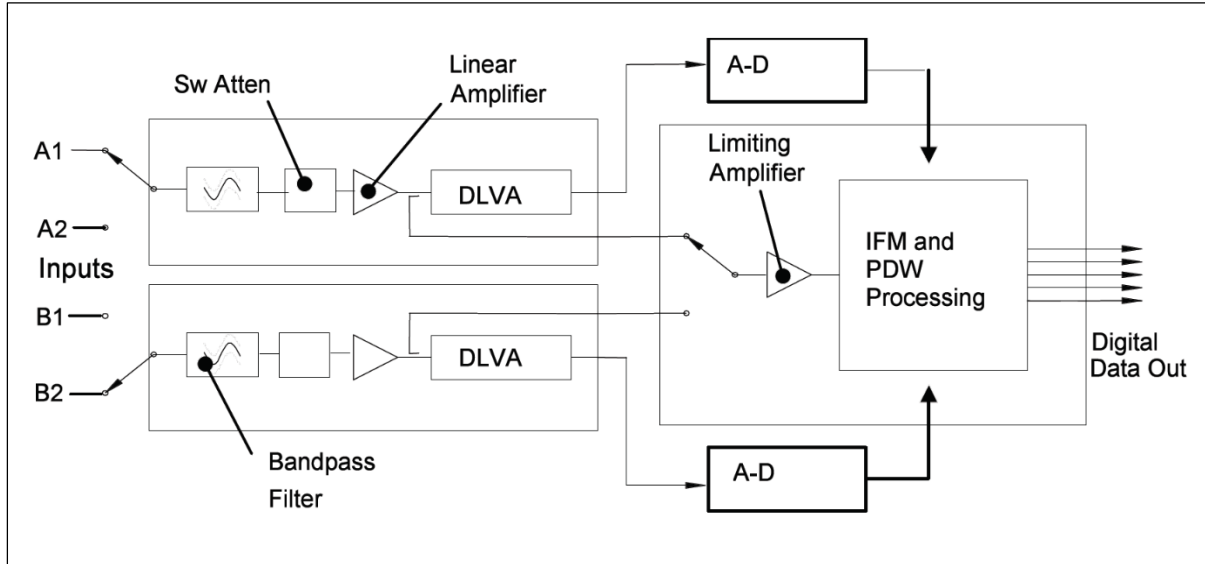
## Electrical Specification: -20°C to +85°C

Operating Frequency	2 to 18 GHz
Out of Band Rejection	DC to 1.5 GHz > 40 dB 20 to 26 GHz > 30 dB
Operating Dynamic Range - Digital attenuator unselected	-57 to -15 dBm
Operating Dynamic Range - Digital attenuator selected	-37 to +5 dBm
Frequency Measurement Coding	1900 + 25xCode MHz
Frequency Measurement Resolution	10 bits, 25 MHz nom
Frequency Measurement Accuracy over operating dynamic range	< 15 MHz RMS
Minimum Pulse Width	75 nsec
Frequency Measurement Triggering	Internal
Pulse Width & Time of Arrival Resolution	10 nsec
Amplitude Measurement Resolution	9 bits, 0.2dB nom
Amplitude Measurement Coding	-70 + 0.2xCode dB
Amplitude Measurement Accuracy	< 1.5 dB abs ave
Amplitude Measurement Tracking (Between video outputs at the Same Frequency, Temperature & Power level)	< 0.5 dB abs ave
Amplitude Measurement Tracking (at same frequency and temperature, with less than 20dB difference between 2 signals)	< 1.5 dB abs ave
Pulse on Pulse performance (Simultaneous signal >10dB)	Yes (see Note 1)
Amplitude measurement Video Coupling	DC coupled
Recovery Time	300 ns typical (500 nsec max)
RF Input Switch Isolation (RF inputs 1-2)	30 dB min
RF Input Switch Isolation (A-B)	70 dB min
RF Input Switch Speed	< 200 nsec
RF Input Switch Control	LVTTL
Input Return Loss at Ports A1,A2,B1,B2	7 dB min (10 dB typ)
Clock Input (req'd if using Parallel data port or TOA Correlation)	50 MHz
Dimensions	160 x 160 x 20mm
Weight	975 grams max
Microwave Input Connectors	SMA Female
Power and control	25 & 37 way MDM
Power Dissipation (operating)	20W max
Power-up Time	2 seconds max

**Note 1:** Minimum Frequency separation 100MHz, Leading edge separation > 500ns.

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## BLOCK DIAGRAM



## OPERATING MODES

LVTTTL Control inputs are provided for direct control over the Input selection, the IFM measurement channel and the switched attenuator but in addition these functions may be controlled from the USB2 interface although this introduces a delay depending on the USB2 transfer time. An auto mode is available for the attenuator and the IFM channel to simplify the operation.

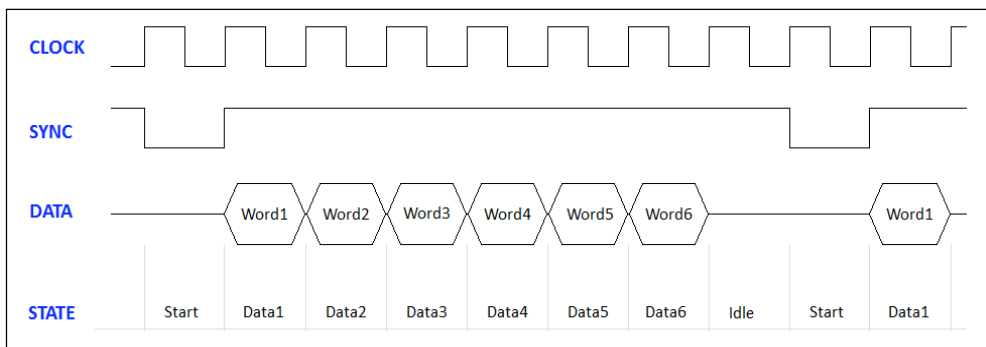
The IFM can be directed to either of the measurement channels by the use of a TTL or USB command or alternatively using Auto Freq mode the internal thresholding determines the amplitude channel with the highest signal and route the IFM accordingly. This process functions on a pulse-by-pulse basis but reduces the minimum pulse width to 120ns due to the switching delay. The mode of operation can be specified from the USB2 interface and can be changed as required.

The switched attenuator can be introduced, to both channels simultaneously, to enable the amplitude of high-level signals to be measured. This can be manually controlled or using Auto Atten mode the system detects on over-range measurement and switch the attenuation automatically. This process functions on a pulse-by-pulse basis but reduces the minimum pulse width to 200ns due to the switching delay.

RR017 generates a PDW following the end of a received pulse, the maximum reported pulse width is 650us. Under CW conditions a PDW is generated after a pre-settable time, up to the maximum 650us with the CW Present flag set, PDWs continue to be generated with the same interval for the duration of the CW signal.

## PARALLEL DATA TRANSFER

Each PDW is transferred in 8 clock cycles. The diagram illustrates a full transfer plus the start of the next transfer. Each Word block represents a portion of PDW data.



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## Pulse Descriptor Word (PDW) Format

Each PDW is transferred in 8 clock cycles. The diagram illustrates a full transfer plus the start of the next transfer. Each Word block represents a portion of PDW data.

BIT	DataWords (1/2)			DataWords (3/4)			DataWords (3/4)		
0	Frequency	0		Pulse Width 0	Time	of	Arrival	0	
1	Frequency	1		Pulse Width 1	Time	of	Arrival	1	
2	Frequency	2		Pulse Width 2	Time	of	Arrival	2	
3	Frequency	3		Pulse Width 3	Time	of	Arrival	3	
4	Frequency	4		Pulse Width 4	Time	of	Arrival	4	
5	Frequency	5		Pulse Width 5	Time	of	Arrival	5	
6	Frequency	6		Pulse Width 6	Time	of	Arrival	6	
7	Frequency	7		Pulse Width 7	Time	of	Arrival	7	
8	Frequency	8		Pulse Width 8	Time	of	Arrival	8	
9	Frequency	9		Pulse Width 9	Time	of	Arrival	9	
10	Reserved			Pulse Width 10	Time	of	Arrival	10	
11	Reserved			Pulse Width 11	Time	of	Arrival	11	
12	Amplitude	CHA	0	Pulse Width 12	Time	of	Arrival	12	
13	Amplitude	CHA	1	Pulse Width 13	Time	of	Arrival	13	
14	Amplitude	CHA	2	Pulse Width 14	Time	of	Arrival	14	
15	Amplitude	CHA	3	Pulse Width 15	Time	of	Arrival	15	
0	Amplitude	CHA	4	POP Present CHA	Time	of	Arrival	16	
1	Amplitude	CHA	5	POP Present CHB	Time	of	Arrival	17	
2	Amplitude	CHA	6	CW present	Time	of	Arrival	18	
3	Amplitude	CHA	7	Ambiguity Bad Data	Time	of	Arrival	19	
4	Amplitude	CHA	8	Threshold Bad Data	Time	of	Arrival	20	
5	Reserved			Active IFM Channel	Time	of	Arrival	21	
6	Amplitude	CHB	0	Ant Select 0 state	Time	of	Arrival	22	
7	Amplitude	CHB	1	Ant Select 1 state	Time	of	Arrival	23	
8	Amplitude	CHB	2	Re-Measure state	Time	of	Arrival	24	
9	Amplitude	CHB	3	Auto Freq state	Time	of	Arrival	25	
10	Amplitude	CHB	4	Auto Atten state	Time	of	Arrival	26	
11	Amplitude	CHB	5	Reserved	Time	of	Arrival	27	
12	Amplitude	CHB	6	Reserved	Time	of	Arrival	28	
13	Amplitude	CHB	7	Reserved	Time	of	Arrival	29	
14	Amplitude	CHB	8	Reserved	Time	of	Arrival	30	
15	Reserved			Reserved	Time	of	Arrival	31	

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## PSU & Control Interface: 25-way MDM

Pin	Signal	Direction	Description
1	USBDM	Bi-dir	USB data minus
2	USB Vcc	USB Power	Power from host USB controller
3	Re-Measure	Input – LVTTTL2	Initiate manual measurement
4	IFM Channel Select	Input – LVTTTL2	IFM channel selection (A-B)
5	Antenna Select (0)	Input – LVTTTL2	Antenna channel A selection
6	CLK IN (-)	Input – LVDS	Master clock input 1
7	-BLANKING	Input – LVTTTL2	Blanking signal input
8	Reserved1	Output – LVTTTL	Spare logic output
9	+5V	Input	Positive supply (2A max)
10	GND	Ground	Supply ground
11	+5V	Input	Positive supply (2A max)
12	GND	Ground	Supply ground
13	+3.3V	Input	Positive supply (1A max)
14	USB DP	Bi-dir	USB data plus
15	Reserved1	Input	Spare logic input
16	DGND	Ground	Digital ground
17	Attenuator	Input – LVTTTL2	Attenuator control
18	Antenna Select (1)	Input – LVTTTL2	Antenna channel B selection
19	CLK IN (+)	Input - LVDS	Master clock input 1
20	Reserved1	Input	Spare logic input
21	GND	Ground	Supply ground
22	-5V	Input	Negative supply (300mA typ)
23	GND	Ground	Supply ground
24	GND	Ground	Supply ground
25	+3.3V	Input	Positive supply (1A max)

1 This pin is reserved and must be left floating for normal unit operation.

2 LVTTTL inputs are +5V tolerant.

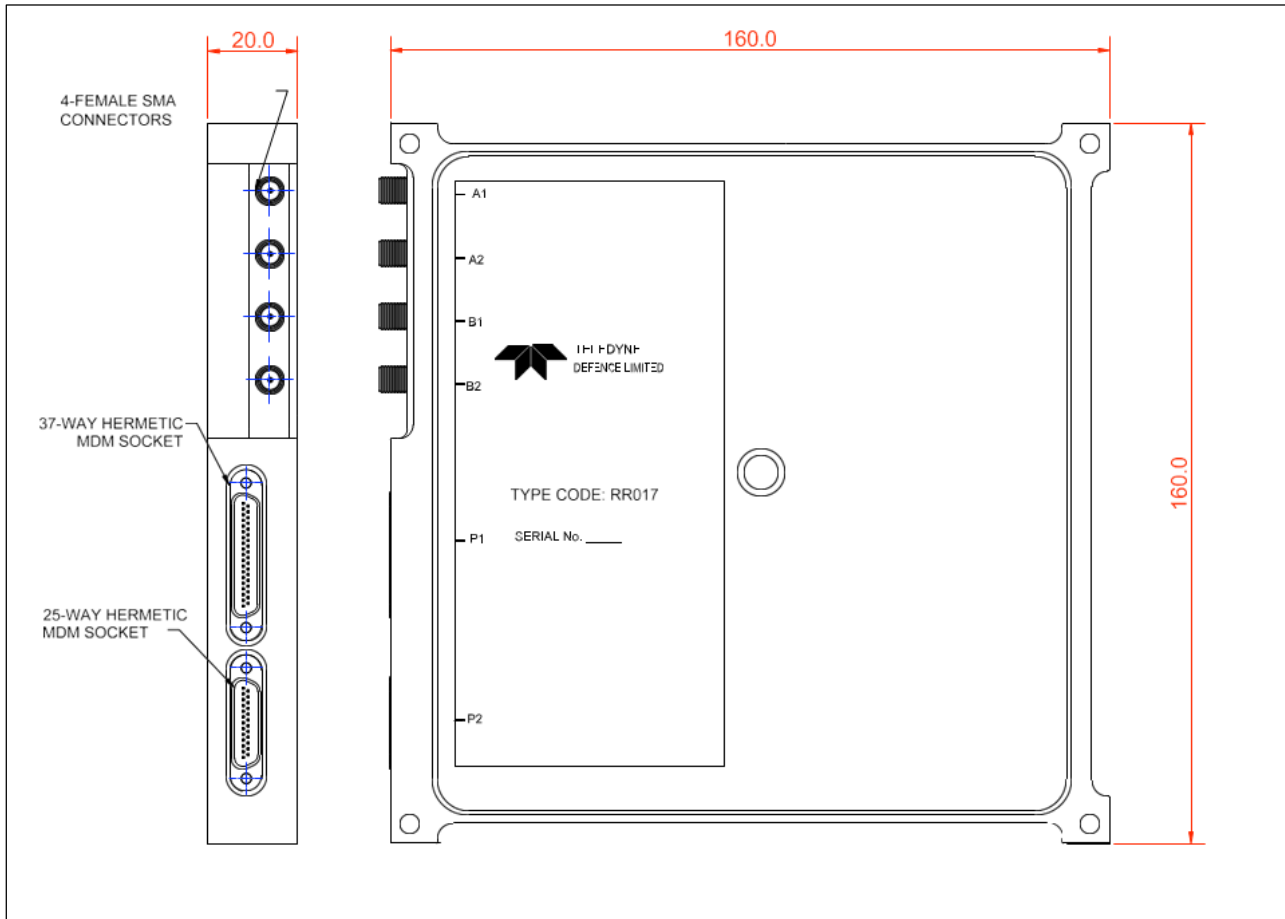
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## Parallel Data Interface: 37-way MDM

Pin	Signal	Direction	Description
1	DGND	Ground	Digital Ground
2	Data(15)+	Output -LVDS	Parallel Data Word
3	Data(14)+	Output -LVDS	Parallel Data Word
4	Data(13)+	Output -LVDS	Parallel Data Word
5	Data(12)+	Output -LVDS	Parallel Data Word
6	Data(11)+	Output -LVDS	Parallel Data Word
7	Data(10)+	Output -LVDS	Parallel Data Word
8	Data(09)+	Output -LVDS	Parallel Data Word
9	Data(08)+	Output -LVDS	Parallel Data Word
10	Data(07)+	Output -LVDS	Parallel Data Word
11	Data(06)+	Output -LVDS	Parallel Data Word
12	Data(05)+	Output -LVDS	Parallel Data Word
13	Data(04)+	Output -LVDS	Parallel Data Word
14	Data(03)+	Output -LVDS	Parallel Data Word
15	Data(02)+	Output -LVDS	Parallel Data Word
16	Data(01)+	Output -LVDS	Parallel Data Word
17	Data(00)+	Output -LVDS	Parallel Data Word
18	DataSync+	Output -LVDS	Data Sync
19	CLK_IN+	Input - LVDS	Master Clock Input
20	Data(15)-	Output -LVDS	Parallel Data Word
21	Data(14)-	Output -LVDS	Parallel Data Word
22	Data(13)-	Output -LVDS	Parallel Data Word
23	Data(12)-	Output -LVDS	Parallel Data Word
24	Data(11)-	Output -LVDS	Parallel Data Word
25	Data(10)-	Output -LVDS	Parallel Data Word
26	Data(09)-	Output -LVDS	Parallel Data Word
27	Data(08)-	Output -LVDS	Parallel Data Word
28	Data(07)-	Output -LVDS	Parallel Data Word
29	Data(06)-	Output -LVDS	Parallel Data Word
30	Data(05)-	Output -LVDS	Parallel Data Word
31	Data(04)-	Output - LVDS	Parallel Data Word
32	Data(03)-	Output - LVDS	Parallel Data Word
33	Data(02)-	Output - LVDS	Parallel Data Word
34	Data(01)-	Output - LVDS	Parallel Data Word
35	Data(00)-	Output - LVDS	Parallel Data Word
36	DataSync-	Output - LVDS	Data Sync
37	CLK_IN-	Input - LVDS	Master Clock Input

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OUTLINE DRAWING



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