

# Digital Radio Receiver Down Converter Modules for 37 to 40 GHz

## Technical Data

### DRR1-38XX

#### Features

- **Low Noise PHEMT MMIC Front End Amplifier**
- **Image Reject Mixer**
- **Integrated Silicon Bipolar VCO Local Oscillator**
- **Low Phase Noise**
- **Operated Over -30°C to +70°C**
- **Excellent Tuning Linearity**
- **Sample Output for Phase Locking**

#### Description

This digital radio receiver module provides the RF receive and down conversion function for 38 GHz digital radios.

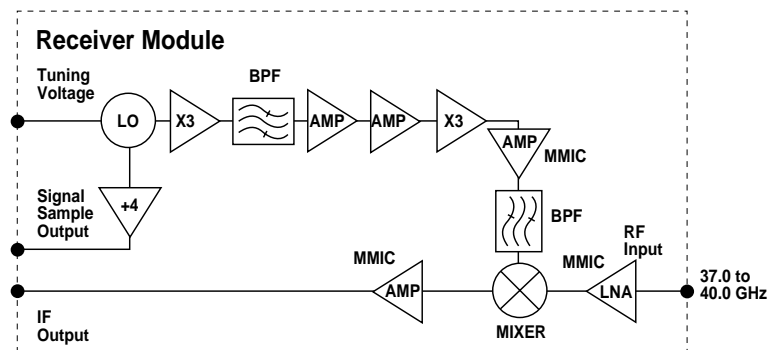
This module offers excellent phase noise performance and can be easily phase locked to a frequency reference. The receiver module is ideal for use in radios using 2 and 4 FSK modulation. The low noise figure is achieved by using the Hewlett-Packard PHEMT MMIC technology coupled with an image reject mixer to minimize the noise figure. The receiver module features an integrated ultra low

noise silicon bipolar VCO operating in the S/C band as the local oscillator. A portion of the oscillator output is coupled off and is applied to a frequency divider network. The low frequency output from the frequency divider can be used to phase lock the source. The local oscillator output is applied to a frequency multiplier network to produce the desired LO frequency to the mixer.

#### Applications

The digital radio receiver module provides the total RF receive and down conversion function in radios operating in the 37 to 40 GHz band.

#### Block Diagram



## DDR1-38XX Absolute Maximum Ratings ( $T_A = -30$ to $+70^\circ\text{C}$ )

Parameters	Units	Ratings
DC Circuit Power +8.5	Volts	10
+5.0	Volts	+5.5
-5.0	Volts	-5.5
Tuning Voltage	Volts	14

### Notes:

1. Operation in excess of any one of these parameters may result in permanent damage.
2. A thermal interface medium must be used between the bottom of the package and its mating surface to ensure optimum heat transfer.

## DDR1-38XX Electrical Characteristics

Parameters	Units	Min.	Typ.	Max.	Extended Range 39.5 – 40.0
RF Tuning Range	GHz	37		39.5	40
IF Frequency	MHz	630 or 1260			
IF Bandwidth	MHz	±20			
LO Frequency	GHz	RF – IF			
Gain <sup>[1]</sup>	dB	18		27	16 Min
Gain Flatness over 300 MHz	dB			±1	±1.5
Noise Figure	dB		7.5	9	9.5 Max
Operating Temperature Range	°C	-30		70	
Power Input at P-1dB	dBm	-20	-17		
LO Leakage at I <sup>[2]</sup>	dBm			-15	
LO Leakage at R <sup>[3]</sup>	dBm			-15	
Return Loss RF Port <sup>[4]</sup>	dB	8	10		5 Min
Return Loss IF Port	dB	14			
Image Rejection	dB	10	13		
Sample Out Frequency	MHz	1,010		1,080	1,094
Sample Out Power	dBm	-10		0	
Spurious Output <sup>[5]</sup>	dBc			-60	
Phase Noise @ 100 KHz	dBc/Hz		-83	-80	
Tuning Voltage	V	1		12	15 Max
Input Capacitance, Nom	pf		1,000		
LO Tuning Sensitivity	MHz/V		400	500	
LO Tuning Sensitivity Variation			1.5 : 1		
DC Circuit Power: 8.5 Volts	mA		270	350	
5 Volts	mA		470	650	
-5 Volts	mA		20	30	
Case Dimensions	inches	3.5 x 1.25 x 0.40			
Max Power at Input/no damage	dBm			7	
Humidity Non Condensing	%		85		
Condensing	%		95		
Connectors		WR 28			

### Notes:

1. Gain degrades to 16 dB minimum from 39.5 to 40 GHz.
2. LO and Harmonic/sub-harmonic leakage at I with RF terminated into a waveguide.
3. LO and Harmonic/sub-harmonic leakage at R up to 50 GHz.
4. RF port return loss degrades to 5 dB minimum from 39.5 to 40 GHz.
5. Measured at IF port within the IF bandwidth with single tone RF input of < -20 dBm.

## DRR1-38XX Typical Performance

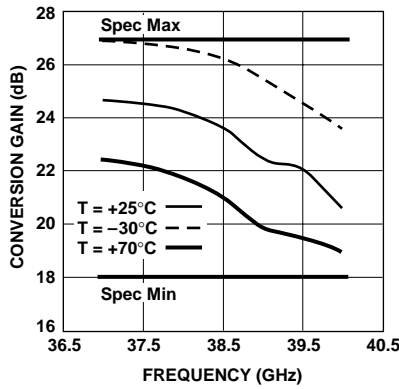


Figure 1. Conversion Gain vs. Frequency.

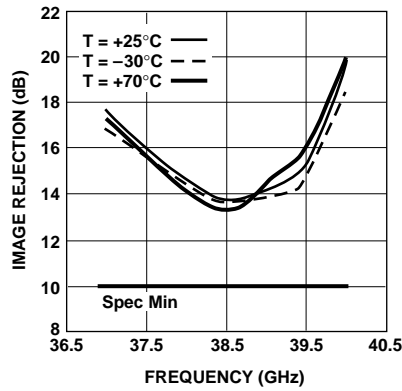


Figure 2. Image Rejection vs. Frequency.

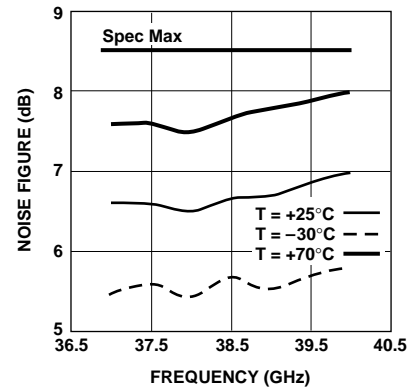


Figure 3. Noise Figure vs. Frequency.

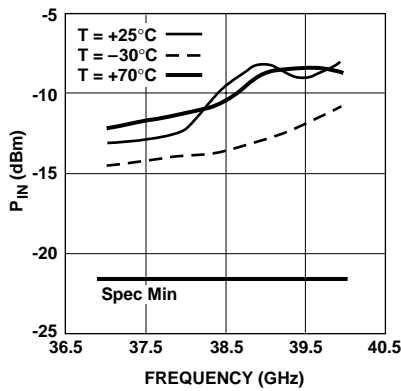


Figure 4. Power In at  $P_{1dB}$  Out vs. Frequency.

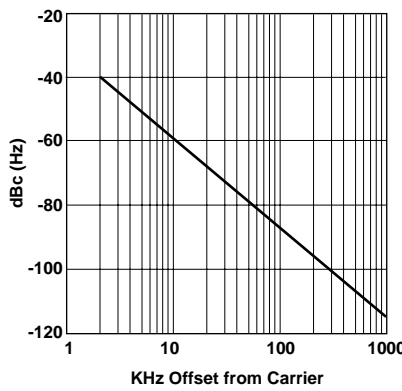


Figure 5. Phase Noise at 40 GHz vs. KHz Offset from Carrier.

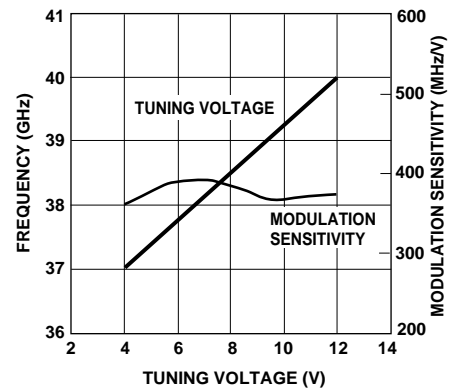


Figure 6. Tuning Voltage vs. Frequency and Modulation Sensitivity.

## Powering Up Instructions

The -5 volts must be applied to the receiver module **before** applying the +5 volts. Likewise when shutting down the receiver module the +5 volts must be removed before the -5 volts is

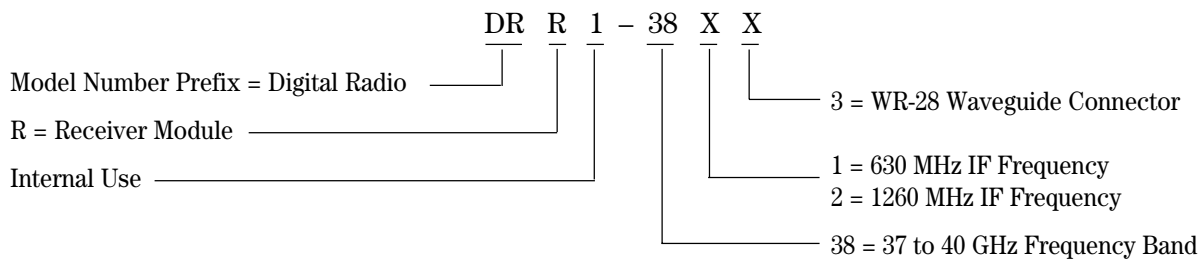
turned off. The +8.5 volts can be turned on in any sequence. Failure to follow this procedure could cause permanent damage to the module.

## Mounting Instructions

Case must be mounted firmly, with screws, to an adequate metallic structure that has sufficient thermal properties to maintain the module case at a temperature not to exceed 70°C.

## Product Options

Specify part number followed by option. For example:



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