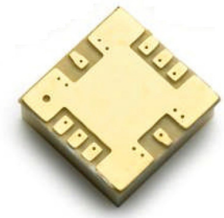
AMMP-6532

20-32 GHz GaAs MMIC LNA/IRM Receiver in SMT Package

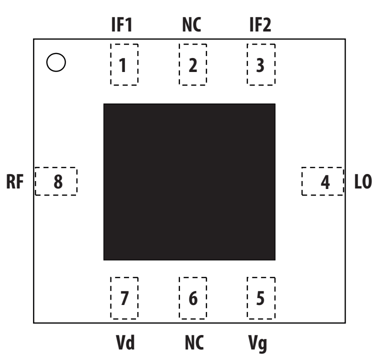
Data Sheet



Description

Avago Technologies' AMMP-6532 is an easy-to-use broadband integrated receiver in a surface mount package. The MMIC includes a 4, -stage LNA to provide gain amplification and a gate-pumped image-reject mixer for frequency translation. The overall receiver performs Single Side Band down-conversion in the 20 to 32 GHz RF signal range. The LO and RF are matched to 50Ω. The IF output is provided in 2-port format where an external 90-degree hybrid can be utilized for full image rejection. The LNA requires a 3V, 83mA power supply, where the mixer bias is a simple –1V, 0.1mA. The MMIC is fabricated using PHEMT technology. The surface mount package allows elimination of "chip & wire" assembly for lower cost. This MMIC is a cost effective alternative to multi-chip solution that have higher loss and complex assembly.

Package Diagram



Note:
1. This MMIC uses depletion mode pHEMT devices.
2. Negative supply is used for mixer bias.

Features

- Surface Mount Package (5.0 x 5.0 x 1.25 mm)
- Integrated Low Noise Amplifier
- Integrated Image Reject Mixer
- 50 Ω Input and Output Match
- Single Supply Bias Pin

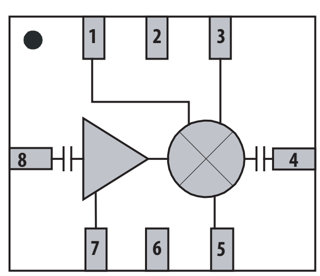
Specifications Vd=3.0V (83mA), Vg=-1.0V (0.1mA)

- RF Frequency: 20 to 32 GHz
- IF frequency: 1 to 5 GHz
- Conversion Gain (RF/IF): 13dB
- Input Intercept Point: -4dBm
- Image Supression: > 15 db
- Total Noise Figure: 3 dB

Applications

- Microwave Radio systems
- Satellite VSAT, DBS Up/Down Link
- LMDS & Pt-Pt mmW Long Haul
- Broadband Wireless Access (including 802.16 and 802.20 WiMax)
- WLL and MMDS loops

Functional Block Diagram



Pin	Function
1	IF1
2	NC
3	IF2
4	LO
5	Vg
6	NC
7	Vd
8	RF

Top view
Package base: GND

Attention: Observe Precautions for handling electrostatic sensitive devices.

ESD Machine Mode (Class A): 50V
(Class 0): 150V
ESD Human Body Model (Class 1A)

Refer to Avago Application Note A004R: Electrostatic Discharge Damage and Control.

Note: MSL Rating = Level 2A

Electrical Specifications

1. Small/Large -signal data measured in a fully de-embedded test fixture form TA = 25°C.
2. Pre-assembly into package performance verified 100% on-wafer.
3. This final package part performance is verified by a functional test correlated to actual performance at one or more frequencies.
4. Specifications are derived from measurements in a 50 Ω test environment. Aspects of the amplifier performance may be improved over a more narrow bandwidth by application of additional conjugate, linearity, or low noise (Γopt) matching.
5. NF is measure on-wafer. Additional bond wires (-0.2nH) at Input could improve NF at some frequencies.

Table 1. RF Electrical Characteristics

TA=25°C, Vd=3.0V, Vg=-1V,Idq=83mA Zo=50 Ω, LO=+15dBm, IF=2GHz

	RF=22GHz, LO=24GHz			RF=30GHz, LO=32GHz				
Parameter	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**	**Comment**
Noise Figure into 50 Ω, NF		3	4.5		3	4.5	dB	
Conversion Gain, CG	10	13		10	13		dB	
Input Third Order Intercept, IIP3	-5	-4		-5	-4		dBm	
Image Rejection, Sup	15			15			dB	

Table 2. Recommended Operating Range

1. Ambient operational temperature TA = 25°C unless otherwise noted.
2. Channel-to-backside Thermal Resistance (Tchannel (Tc) = 34°C) as measured using infrared microscopy. Thermal Resistance at backside temperature (Tb) = 25°C calculated from measured data.

Description	Min.	Typical	Max.	Unit	Comments
Drain Supply Current, Id	60		90	mA	Vd = 4.0 V
Drain Supply Voltage, Vd		3	5	V	
Gate Supply Voltage, Vg		-1.0		V	Ig = 0.1mA
RF Frequency, RFfreq	20		32	GHz	
LO Frequency, LOfreq	18		34	GHz	
IF Frequency, IFfreq	1		3.5	GHz	
LO Drive Power, LO	+10	+15	+22	dBm	

Table 3. Thermal Properties

Parameter	Test Conditions	Value
Thermal Resistance, θjc	Ambient operational temperature TA = 25°C Channel-to-backside Thermal Resistance Tchannel(Tc)=34°C Thermal Resistance at backside temperature Tb=25°C	θjc = 27 °C/W

Absolute Minimum and Maximum Ratings

Table 4. Minimum and Maximum Ratings

Description Pin	Min.	Max.	Unit	Comments
Drain to Ground Supply Voltage, Vd		5.5	V	
Gate to Ground Voltage, Vg		+0.8	V	
Drain Current , Id		100	mA	
Gate Current, Ig		1	mA	
RF CW Input Power, Pin		10	dB	
Channel Temperature, Tch		+150	°C	
Storage Temperature, Tstg	-65	+150	°C	
Maximum Assembly Temperature, Tmax		360	°C	60 second maximum

Notes:
1. Operation in excess of any one of these conditions may result in permanent damage to this device.

AMMP-6532 Typical Performance

Data obtained from 2.4-mm connector based test fixture, and this data is including connecter loss, and board loss. (T_A = 25°C, Vdd=3V, Idq=83mA, V_g=-1.1 V, Z_{in} = Z_{out} = 50Ω)

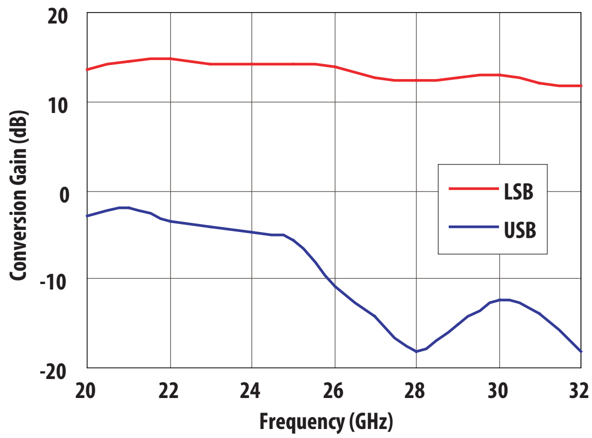


Figure 1. Receiver Conversion Gain

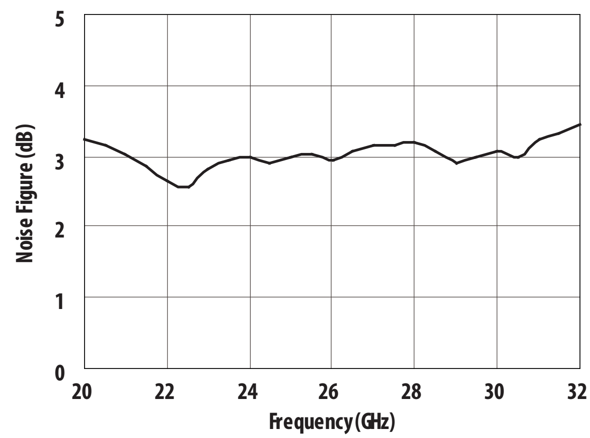


Figure 2. Typical Noise Figure

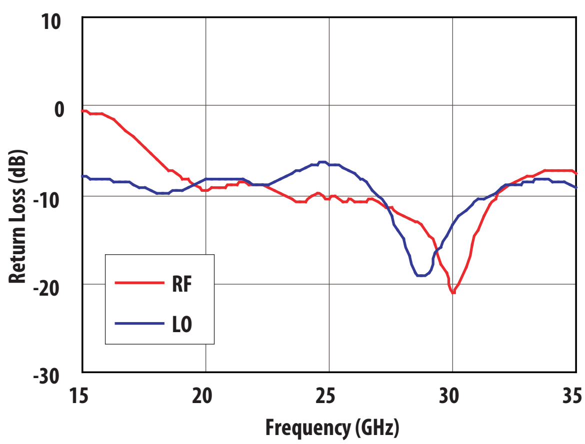


Figure 3. Return Loss at RF & LO Ports

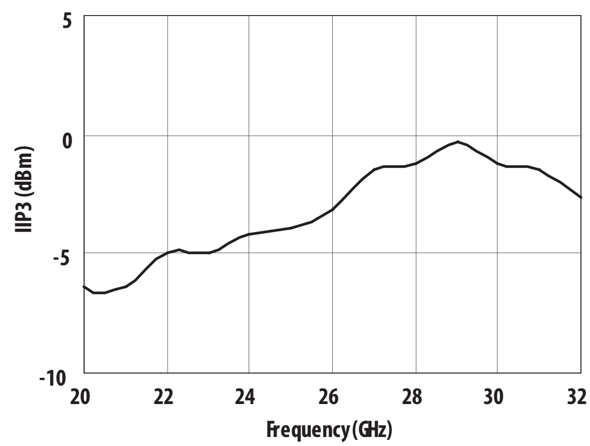


Figure 4. Typical Input IP3

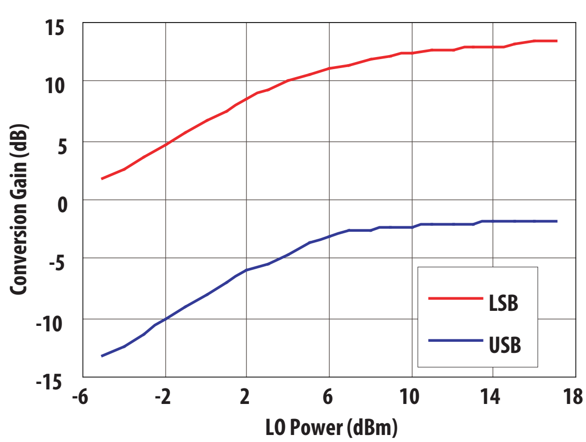


Figure 5. Cony Gain vs. LO Power (RF=23GHz)

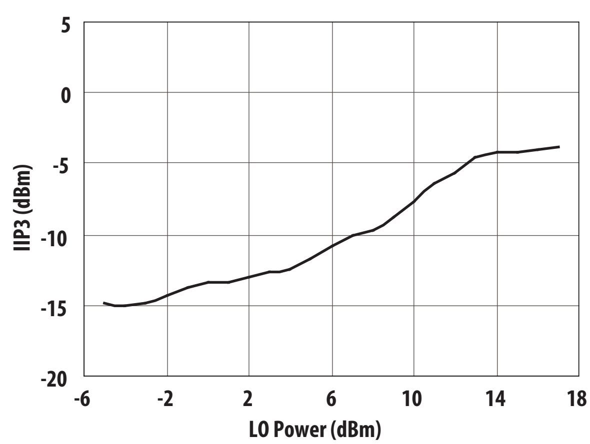


Figure 6. Input IP3 vs. LO Power (RF=23GHz)

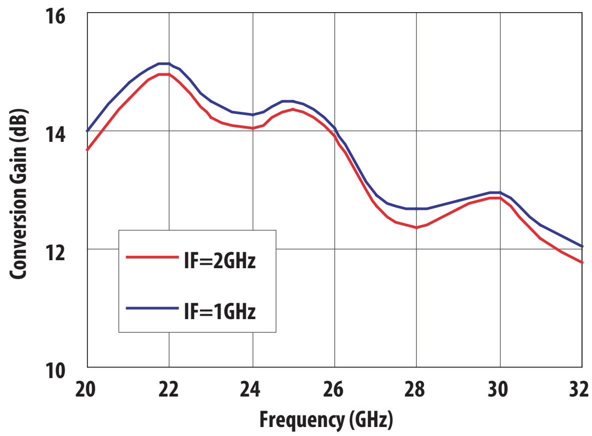


Figure 7. LSB Conversion Gain at Two IF Frequencies

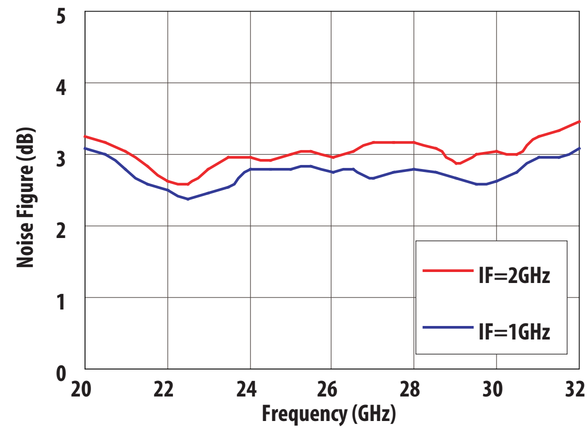


Figure 8. Noise Figure at Two IF Frequencies

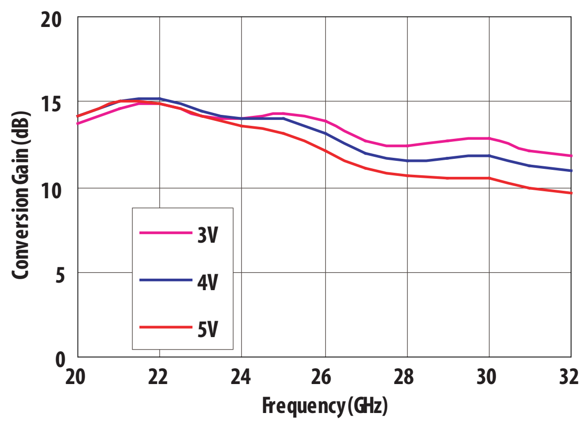


Figure 9. Receiver Conversion Gain over Vdd

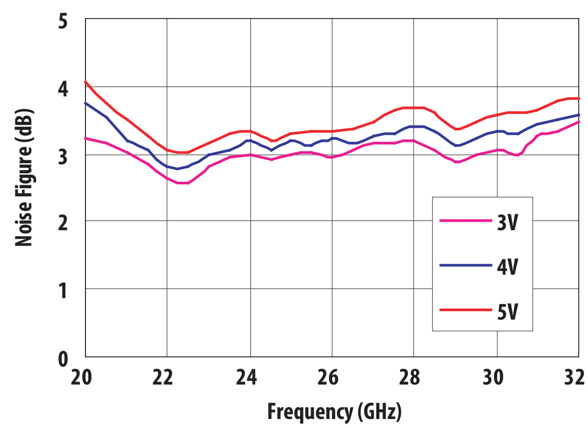


Figure 10. Noise Figure over Vdd

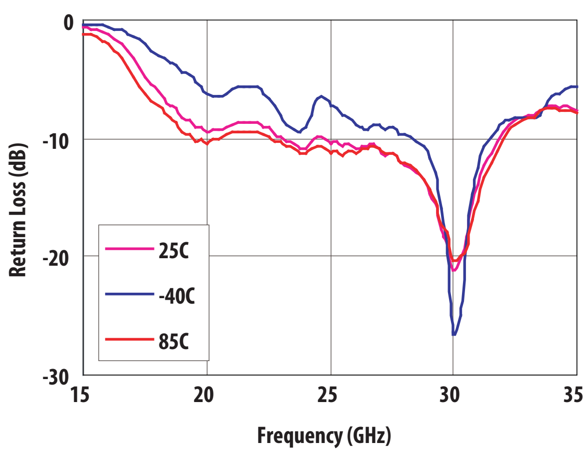


Figure 11. Return Loss at RF oaver Temp

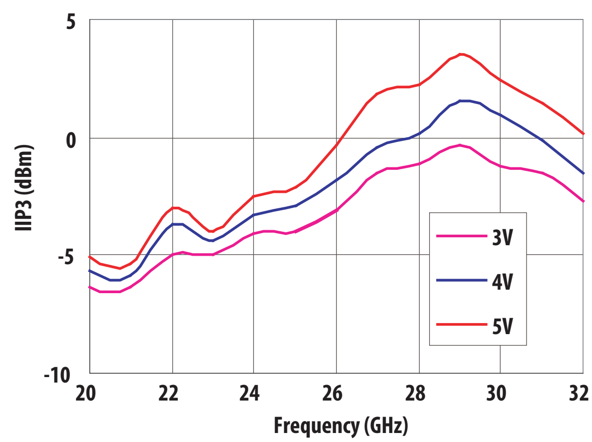


Figure 12. Input IP3 over Vdd

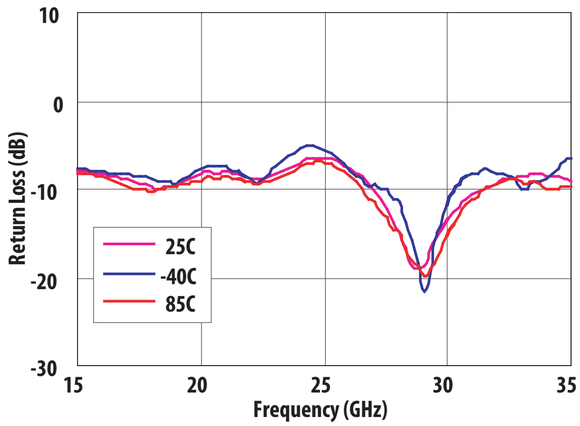


Figure 13. Return Loss at LO over Temp

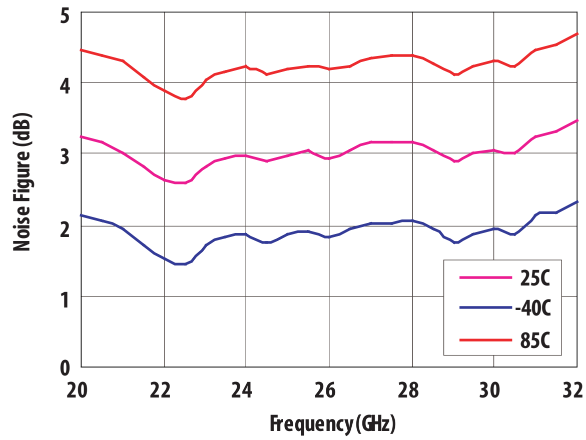


Figure 14. Noise Figure over Temp

Biasing and Operation

The AMMP-6532 is normally biased with a positive drain supply connected to the VDD pin and a negative gate voltage connected to the Vg pin through bypass capacitors as shown in Figure 17. The recommended drain supply voltage is 3 V and gate bias voltage is -1V. The corresponding currents are 83mA and 0.1mA respectively. The typical required LO level is +15dBm and it should come from a low noise driver to ensure that overall Front End NF is low.

The image rejection performance is dependent on the selection of the IF quadrature hybrid. The performance of the IF hybrid as well as the phase balance and VSWR of the interface to the AMMP-6532 will affect the overall front end performance. It should be noted that the placement of the external IF Hybrid coupler should be as symmetrical as possible in regard to the two IF outputs to obtain optimal performance.

The NF will be lowest when the IF hybrid's phase and magnitude imbalance are smallest since noise from image signal is greatly rejected.

Theoretically, IF frequencies can be as low as DC. However, when direct conversion is used (IF=DC), a so-called phenomenon DC-offset could occur at the two IF outputs. In most practical applications, IF should be more than a few hundreds KHz to avoid DC-offset correction.

Refer the Absolute Maximum Ratings table for allowed DC and thermal condition.

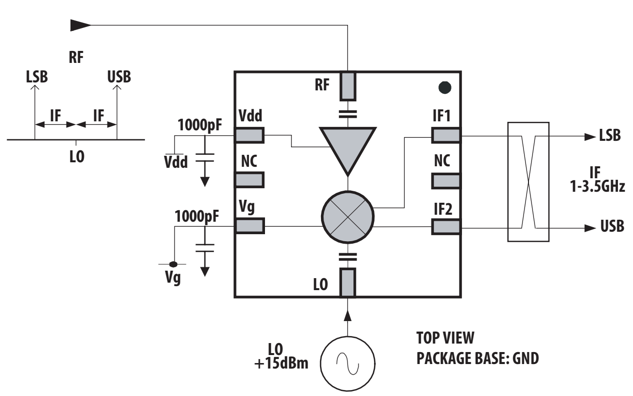


Figure 15. Application of Receiver with IF Balun

AMMP-6532 Part Number Ordering Information

Part Number	Devices Per Container	Container
AMMP-6532-BLKG	10	Antistatic bag
AMMP-6532-TR1G	100	7" Reel
AMMP-6532-TR2G	500	7" Reel

Package Dimension, PCB Layout and Tape and Reel information

Please refer to Avago Technologies Application Note 5520, AMxP-xxxx production Assembly Process (Land Pattern A).

For product information and a complete list of distributors, please go to our web site: **www.avagotech.com**

AV02-1022EN - July 8, 2013

AVAGO TECHNOLOGIES