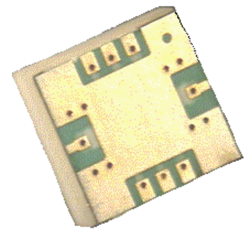
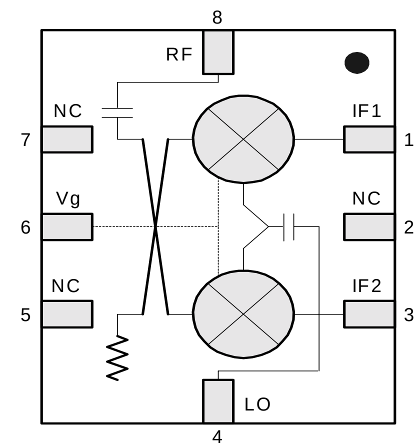
Preliminary Information

Agilent AMMP-6530
5 – 30 GHz Image Rejection Mixer
Data Sheet





top view
package base: GND

Pin	Function
1	IF_1
2	
3	IF_2
4	RF/LO
5	
6	Vg
7	
8	RF/LO

Features

- **Wide frequency range: 5 - 30 GHz**
- **Good conversion gain: -8 dB**
- **Image Rejection: 15 dB**
- **High Input IP3: +18dBm**
- **Surface Mount**

Applications

- Microwave Radio systems
- Satellite VSAT and DBS systems
- Commercial grade military
- 802.16 & 802.20 WiMax BWA systems
- WLL and MMDS loops
- Test Instruments
- Military Radios, Radar, & ECM

Description

The AMMP-6530 MMIC is a broadband I/Q mixer, which can be used as an image rejection mixer (IRM), SSB up-converter or down converter. The AMMP-6530 utilizes two distributed passive FET mixers and a Lange coupler realized in 0.15um gate length PHEMT technology.

AMMP-6530 is a monolithic PHEMT image-rejection mixer designed for use in commercial digital radios and wireless LANs. The mixer can be used as a drain pumped mixer for a low conversion loss application, or can be gate pumped, as a resistive mixer, for a higher linearity application. Under the gate pumping operation, the AMMP-6530 is also applicable as a SSB up-converter.

The mixer requires an off-chip 90-degree hybrid to achieve signal image rejection and –1V (Typ.) DC biasing.

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AMMP-6530 DC Specifications/Physical Properties

Symbol	Parameters and Test Conditions	Units	Min	Typ.	Max
V_{gg}	Gate Supply Operating Voltage	V		-1	

AMMP-6530 Typical performances

T_A= 25°C, V_{gg}=-1 V, Z_o=50 Ω

Symbol	Parameters and Test Conditions	Units	Gate Pumped	Drain Pumped	Up Conversion
F_{RF}	RF Frequency Range	GHz	5 - 30	5 - 30	5 - 30
F_{LO}	LO Frequency Range	GHz	5 - 30	5 - 30	5 - 30
F_{IF}	IF Frequency Range	GHz	DC - 5	DC - 5	DC – 5
P_{LO}	Lo port pumping power	dBm	> 10	> 10	> 0
CG	RF to IF conversion gain	dB	-10	-8	-15
RL_RF	RF Port Return Loss	dB	5	10	5
RL_LO	LO Port Return Loss	dB	10	5	10
RL_IF	IF Port Return Loss	dB	10	10	10
IR	Image rejection ratio	dB	15	15	15
LO-RF Iso.	LO to RF port Isolation	dB	22	22	25
LO-IF Iso.	LO to IF port Isolation	dB	25	25	25
RF-IF Iso.	RF to IF port Isolation	dB	15	15	15
IIP3	Input IP3, Fdelta=100MHz, Prf=-10dBm, Plo=15dBm	dBm	18	10	-
P-1	Input port power at 1dB gin compression point, Plo=+10dBm	dBm	+8	0	-
NF	Noise Figure	dB	10	12	-

Biasing and Operation

The recommended DC bias condition for optimum performance, and reliability is Vgg=-1 volts. There is no current consumption for the gate biasing because the FET mixer was designed as the passive operation.

For down conversion, the AMMP-6530 may be configured in a low loss or high linearity application. In a low loss configuration, the LO is applied through the drain (Pin8, power divider side) as shown in Figure 3(a). In this configuration, the AMMC-6530 is a "drain pumped mixer". For higher linearity application, the LO is applied through the gate (Pin4, Lange coupler side) as shown in Figure 3(b). In this configuration, the AMMC-6530 is a "gate pumped mixer" (or Resistive mixer). The mixer is also suitable for up-conversion applications under the gate pumped mixer operation shown in Figure 3(b).

Figure 1 is a simple block diagram, as reference for Figure 2, which shows the bond pad locations. Figure 3 is a schematic of the image-rejection (SSB) mixer MMIC connected to a quadrature hybrid.

Figures 2 through Figure 19 show typical measurement results under the image rejection operation. Data presented for the AMMP-6530 was obtained using the circuit described here. Please note that the image rejection and isolation performance is dependent on the selection of the low frequency quadrature hybrid. The performance specification of the low frequency quadrature hybrid as well as the phase balance and VSWR of the interface to the AMMP-6530 will affect the overall mixer performance.

Revision Date: 25 June 2004
Revision Number: 6

AMMP-6530 Typical performance under the Gate pumped mixer operation (T_A = 25°C, V_g =-1 V)

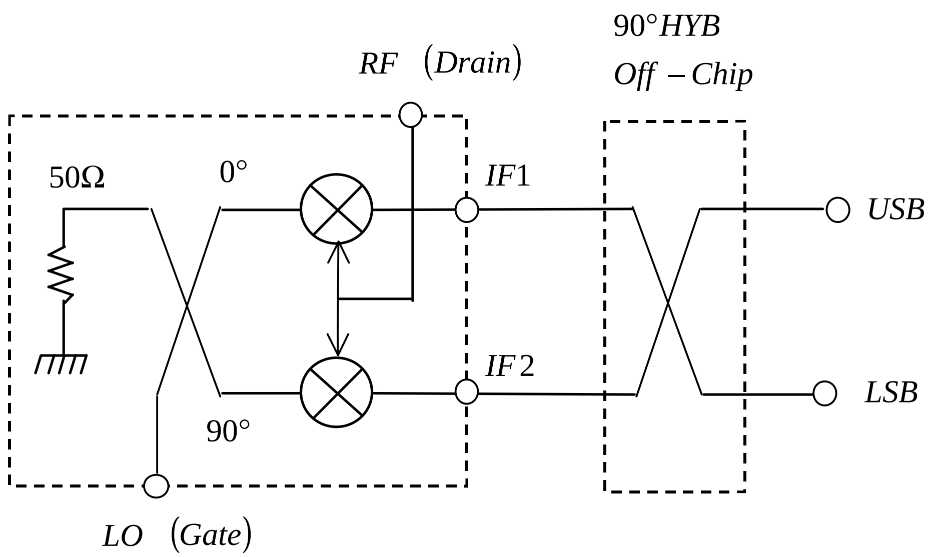

Figure 1. AMMP-6530 application diagram for SSB mixer applications. 50Ω termination is required for the unwanted side-band termination. This is used for highly linear down conversion or Up conversion mixer application

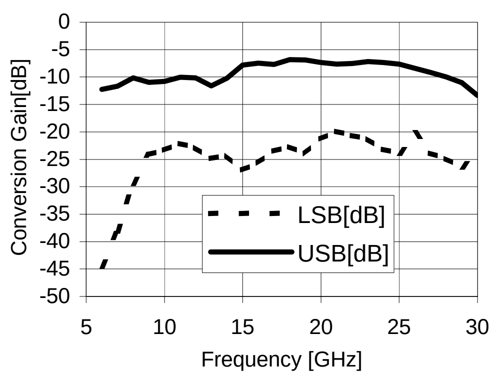

Figure 2. AMMP-6530 Typical conversion Gain, Plo=+10dBm, Fif=1GHz

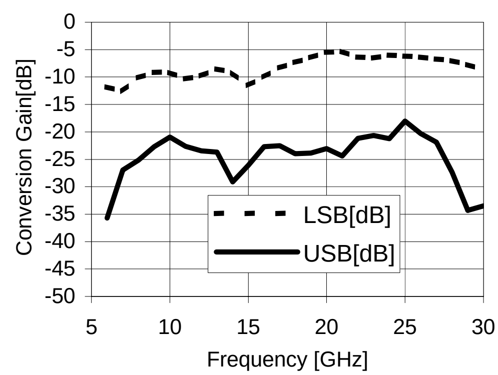

Figure 3. AMMP-6530 Typical conversion loss, Plo=+10dBm, Fif=1GHz

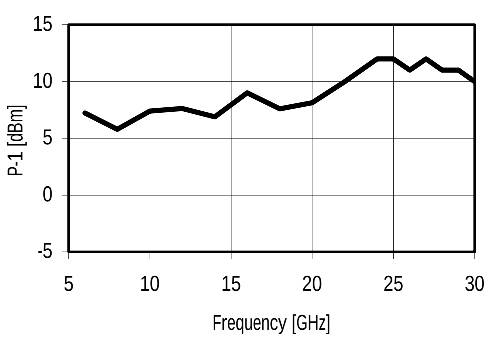

Figure 4. AMMP-6530 Typical RF port input power (@P-1), Plo=+10 dBm, Fif=1GHz

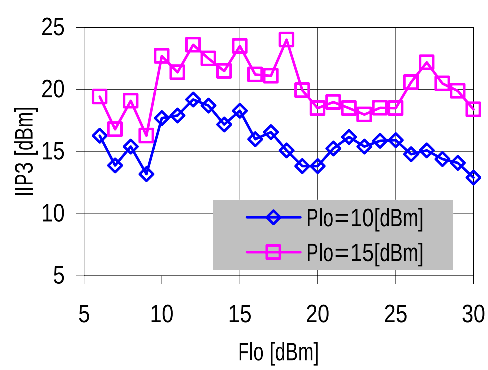

Figure 5. AMMP-6530 Typical IP3, Fif=1GHz

Revision Date: 25 June 2004
Revision Number: 6

AMMP-6530 Typical performances under the Up-conversion mixer operation (Gate pumped operation) (T_A = 25°C, V_g =-1 V)

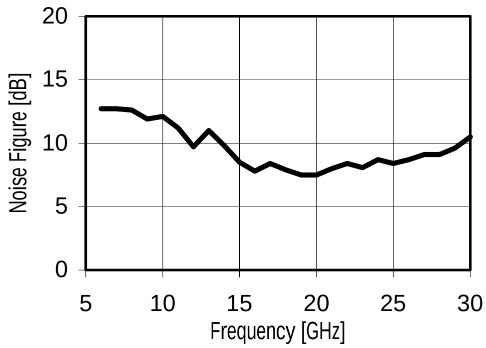

Figure 6. AMMP-6530 Typical Noise Figure, Plo=+7dBm, Fif=1GHz

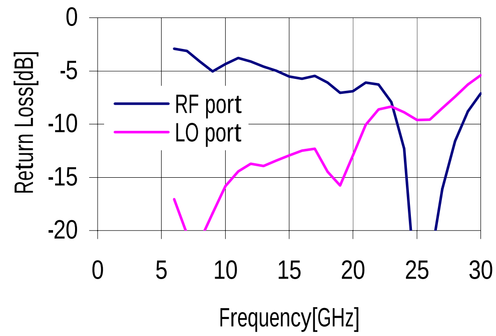

Figure 7. AMMP-6530 Typical Return Loss vs. Frequency, Plo=+10dBm

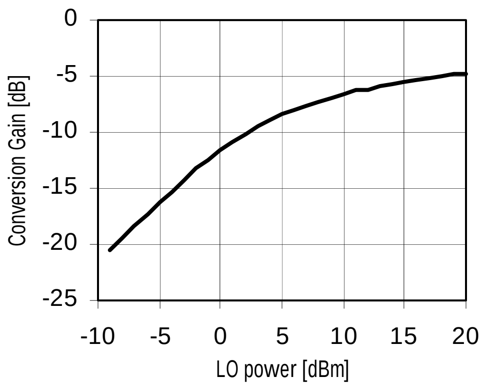

Figure 8. AMMP-6530 Typical Conversion gain vs. LO power, Prf=-20dBm, Frf=21GHz, and Flo=20GHz

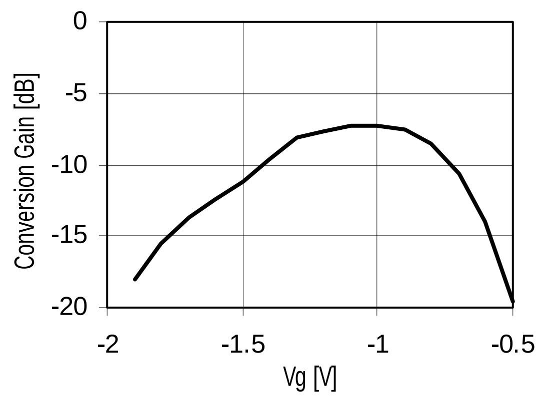

Figure 9. AMMP-6530 Typical Conversion gain vs. Gate voltage, Frf=20GHz, and Plo=+10dBm

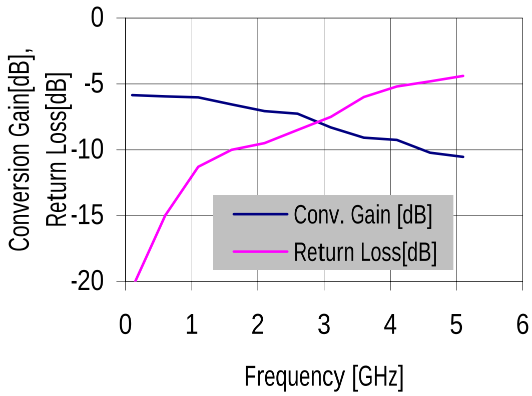

Figure 10. AMMP-6530 Typical Conversion gain and Return Loss vs. IF frequency, Frf=20GHz, and Plo=+10dBm

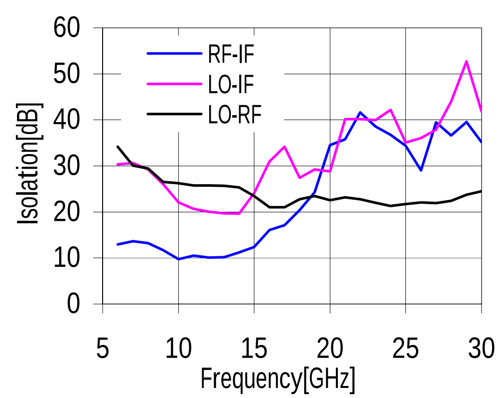

Figure 11. AMMP-6530 Typical Isolation vs. Frequency, Plo=+10dBm, Fif=1GHz

Revision Date: 25 June 2004
Revision Number: 6

AMMP-6530 Typical performances under the Up-conversion mixer operation (Gate pumped operation)
(T_A = 25°C, V_g =-1 V)

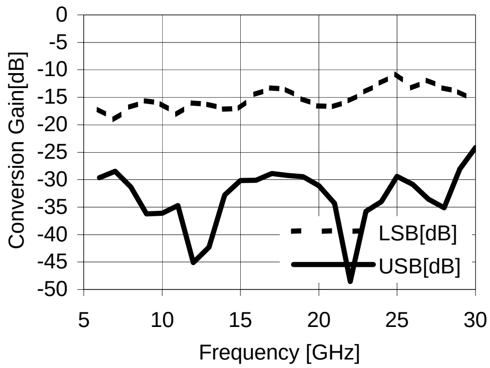

Figure 14. AMMP-6530 Typical conversion Gain, Plo=+5dBm, Pif=+5dBm, and Fif=1GHz

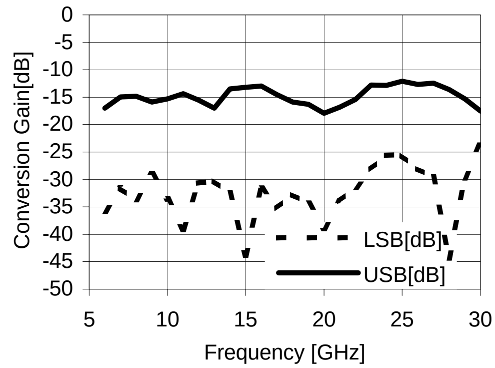

Figure 15. AMMP-6530 Typical conversion Gain, Plo=+5dBm, Pif=+5dBm, and Fif=1GHz

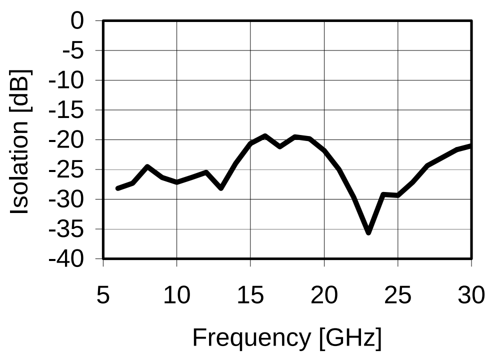

Figure 16. AMMP-6530 Typical LO-RF Isolation, Plo=+5dBm, Pif=+5dBm, and Fif=1GHz

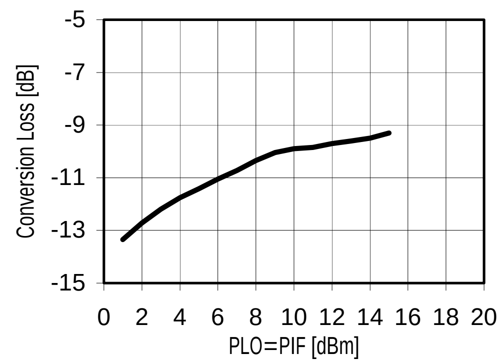

Figure 17. AMMP-6530 Typical conversion gain vs. LO power, Plo=Pif, Fif=1GHz, and Frf=25GHz

AMMP-6530 Typical performances under the Drain pumped mixer operation (T_A=25°C, V_g=-1 V)

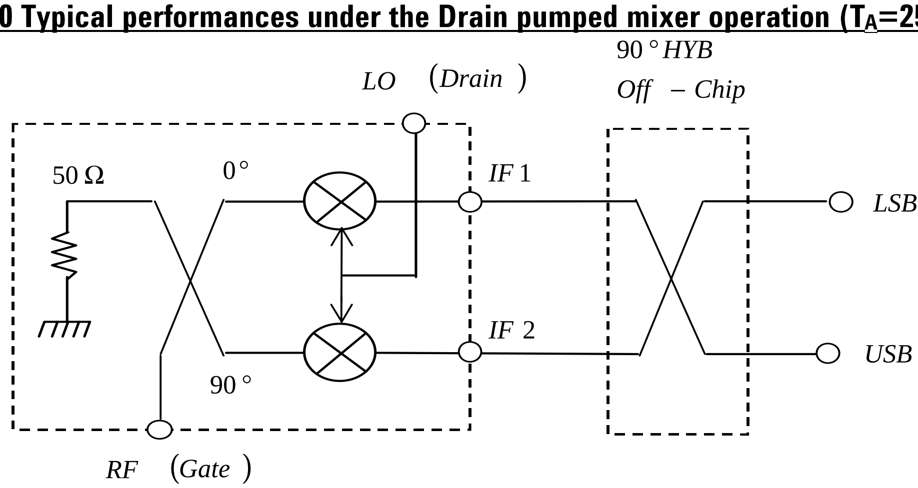

Figure 18. AMMP-6530 application diagram for SSB mixer applications. 50Ω termination is required for the unwanted side-band termination. Low conversion loss mixer configuration

This preliminary data is provided to assist you in the evaluation of product(s) currently under development. Until Agilent Technologies releases this product for general sales, Agilent Technologies reserves the right to alter prices, specifications, features, capabilities, functions, release dates, and remove availability of the product(s) at anytime.

Revision Date: 25 June 2004
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AMMP-6530 Typical performances under the Drain pumped mixer operation (T_A = 25°C, V_g =-1 V)

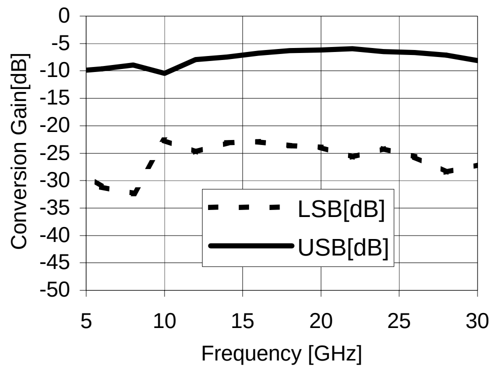


Figure 19. AMMP-6530 Typical conversion Gain, Plo=+10dBm, Fif=1GHz

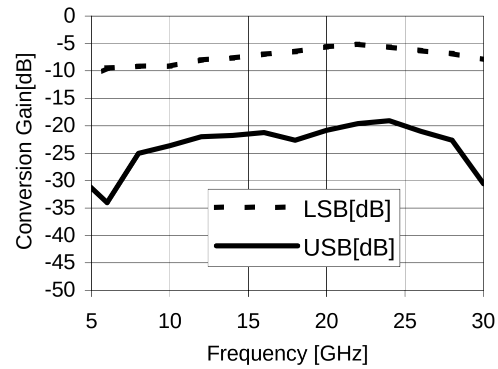


Figure 20. AMMP-6530 Typical conversion loss, Plo=+10dBm, Fif=1GHz

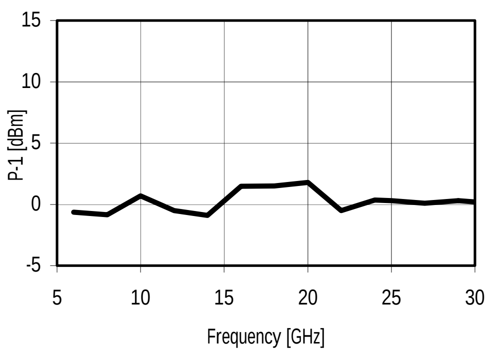


Figure 21. AMMP-6530 Typical RF port input power (@P-1), Plo=+10dBm, Fif=1GHz

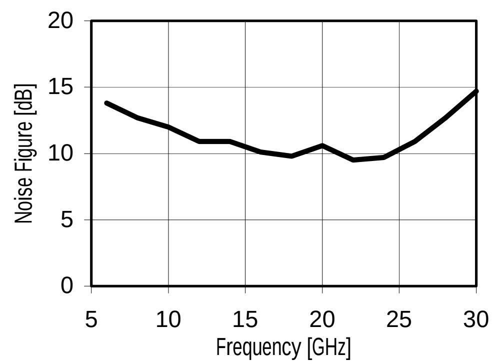


Figure 22. AMMP-6530 Typical Noise Figure, Plo=+7dBm, Fif=1GHz

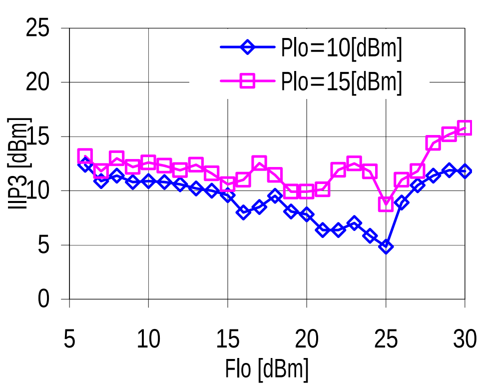


Figure 23. AMMP-6530 Typical IP3, Plo=+10dBm, Fif=1GHz

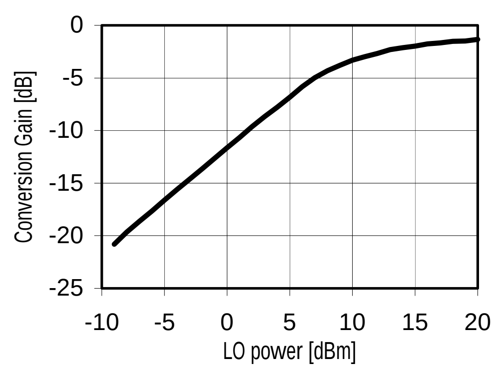
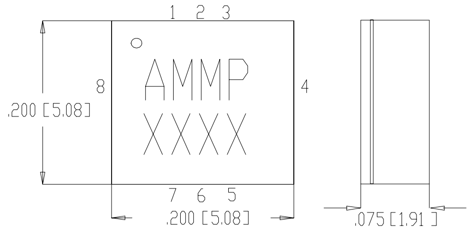
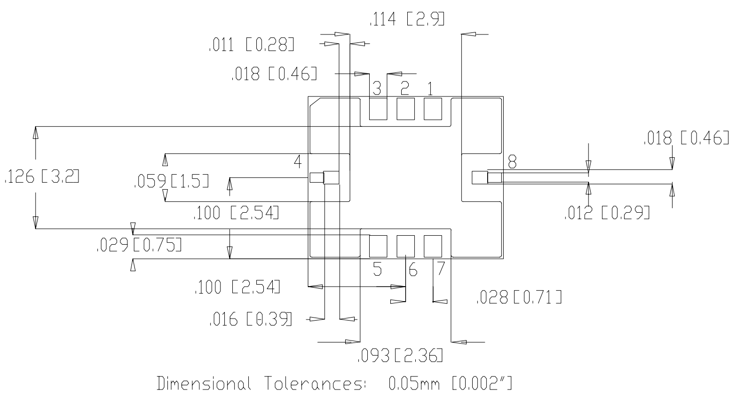


Figure 24. AMMP-6530 Typical Conversion gain vs. LO power, Prf=-20dBm, Frf=21GHz, and Flo=20GHz

Revision Date: 25 June 2004
Revision Number: 6



TOP VIEW

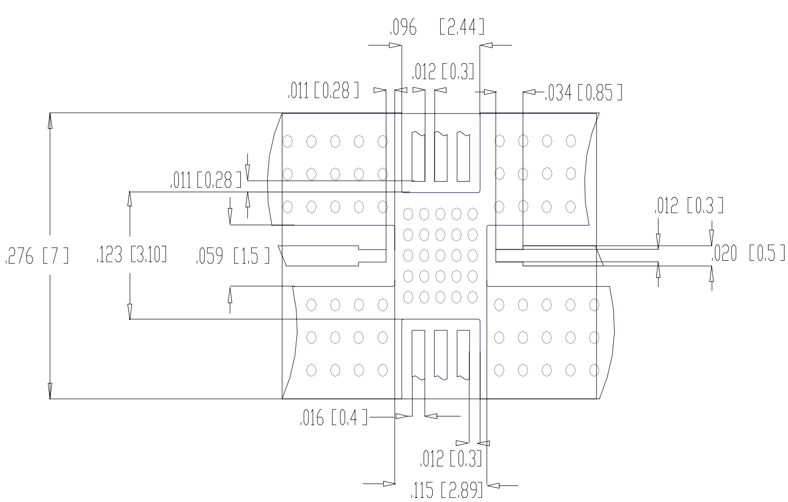


BOTTOM VIEW

NOTES:

1. • INDICATES PIN 1
2. DIMENSIONS ARE IN INCHES [MILIMETERS]
3. ALL GROUNDS MUST BE SOLDERED TO PCB RF GND

PCB Land Pattern



Material is Rogers RO4350, 0.010" thick.

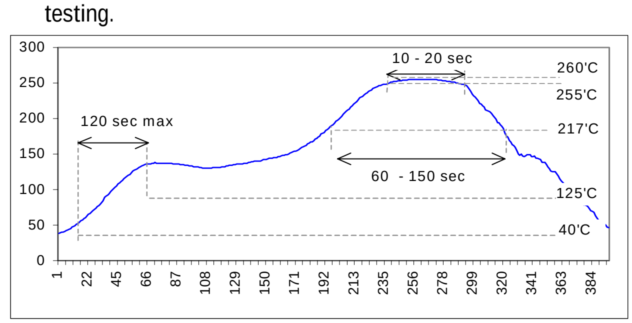
Recommended SMT Attachment

The AMMC Packaged Devices are compatible with high volume surface mount PCB assembly processes.

The PCB material and mounting pattern, as defined in the data sheet, optimizes RF performance and is strongly recommended. ***For power devices, ground vias should be silver filled.*** An electronic drawing of the land pattern is available via the provided link or upon request from Agilent Sales & Application Engineering.

Manual Assembly

1. Follow ESD precautions while handling packages.
2. Handling should be along the edges with tweezers or from topside if using a vacuum collet.
3. Recommended attachment is conductive solder paste. Please see recommended solder reflow profile. Conductive epoxy is *not* recommended. Hand soldering is *not* recommended.
4. Apply solder paste using a stencil printer or dot placement. The volume of solder paste will be dependent on PCB and component layout and should be controlled to ensure consistent mechanical and electrical performance. ***Excessive solder will degrade RF performance.***
5. Follow solder paste and vendor's recommendations when developing a solder reflow profile. A standard profile will have a steady ramp up from room temperature to the pre-heat temperature to avoid damage due to thermal shock.
6. Packages have been qualified to withstand a peak temperature of 260°C for 20 seconds. Verify that the profile will not expose device beyond these limits.
7. Clean the module with acetone. Rinse with alcohol. Allow the module to fully dry before testing.



Recommended solder reflow profile

Revision Date: 25 June 2004
Revision Number: 6

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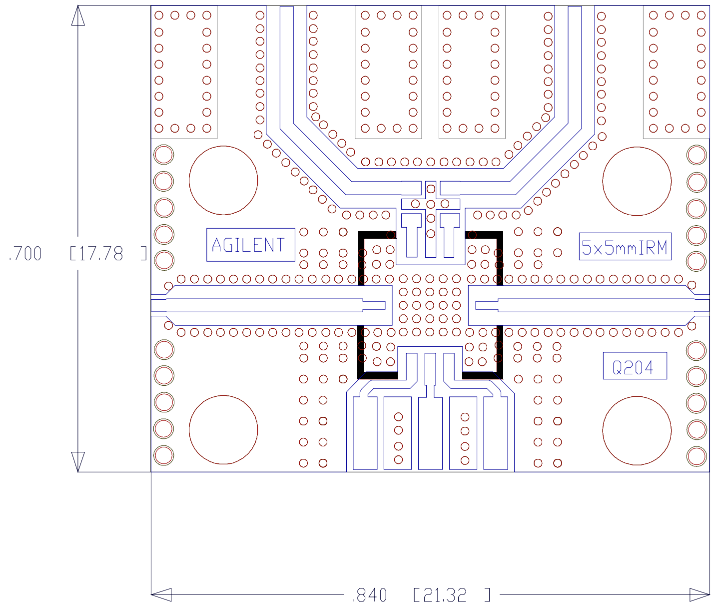
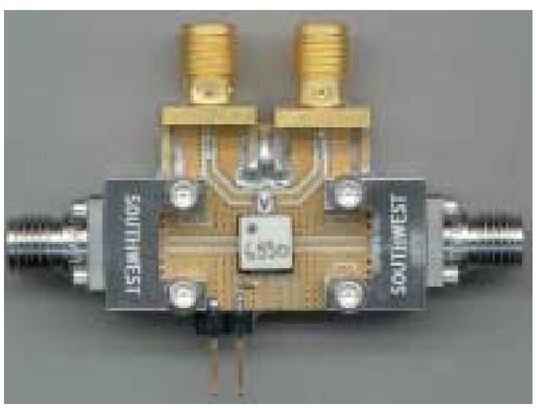
Evaluation PCB



IF1 IF2

LO/RF (Drain)



RF/LO (Gate)

Gnd Vg

List of Material

Item	Description	Manufacturer	Manufacturer P/N
RF/LO connectors	Edge Mount DC-40GHz	Southwest Microwave	1492-04A
IF connectors	PC Mount DC-12 GHz	Johnson Components	142-0701-841
DC Connector	Edge Mount Pin Conn.	Tyco Electronics	4-103747-0
Image Reject Mixer	6-30GHz IRM	Agilent	**AMMP-6530**
90° Hybrid Coupler	SMT coupler	AVX	*Various* (DB0805A0915AWTR)
0.1uF capacitor (optional)	SMT 0402 bypass cap.	Various	Various

For product information and a complete list of Agilent contacts and distributors, please go to our website:
www.agilent.com/semiconductors *E-mail:* SemiconductorSupport@agilent.com
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