

### Device Features

- Gain = 14.8 dB @ 900MHz
- OIP3 = 40.8 dBm @ 900 MHz
- Output P1 dB = 22.2 dBm @ 900 MHz
- N.F = 1.95dB @ 900 MHz
- Internally matched to 50 ohms
- Green/RoHS2 Compliant DFN 8L 2x2 Package



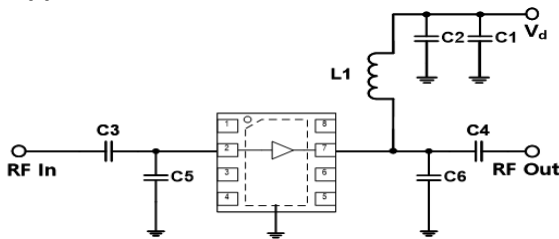
### Product Description

The BBA31 is a BroadBand, GaAs E-pHEMT Amplifier that is ideal for applications demanding high linearity and gain flatness in a bandwidth of 50-5000 MHz. The BBA31 is internally matched to 50 Ohms and requires no external matching components. It is available in RoHS2-compliant DFN 8L 2x2 mm<sup>2</sup> Surface mount package. These devices are 100% DC and RF tested to assure quality and performance.

### Applications

- Repeaters
- Mobile Infrastructure
- Defense/Aerospace
- LTE / WCDMA / EDGE / CDMA
- General Purpose Wireless
- IF amplifier, RF driver amplifier

### Applications Circuit



BOM@GHz	0.05~1.5	0.5~3.0	3.0~5.0
C1	1uF	1uF	1uF
C2	100pF	100pF	100pF
C3	2.2nF	100pF	22pF
C4	2.2nF	100pF	22pF
L1	1uH	22nH	1.0nH
C5	–	–	0.5pF
C6	–	–	0.75pF

### Electrical Specifications

Device performance \_ measured on a BeRex evaluation board at 25°C, Vd=5V, 50 Ω system.

Parameter	Conditions	Min	Typ	Max	Unit
Operational Frequency Range		50		5000	MHz
Test Frequency			900		MHz
Gain		13.7	14.8		dB
Input Return Loss			-14.9		dB
Output Return Loss			-13.0		dB
Output IP3	5 dBm / tone, Δf=1 MHz	37.8	40.8		dBm
Output P1dB		21.2	22.2		dBm
LTE 20M ACLR*		11.9	12.9		dBm
Noise Figure			1.95	2.15	dB

\*ACLR Channel Power measured at -50dBc.

- LTE set-up: 3GPP LTE, FDD E-TM3.1, 20MHz BW, ±20MHz offset, PAR 9.75 at 0.01% Prob.

### Recommended Operating Conditions

Parameter	Min	Typ	Max	Unit
Bandwidth	50		5000	MHz
I <sub>d</sub> @ (V <sub>d</sub> = 5V)	80	100	120	mA
V <sub>d</sub>	4.75	5.0	5.25	V
dG/dT		-0.003		dB/°C
R <sub>TH</sub>		40.1		°C/W
Operating Case Temperature	-40		+105	°C

Electrical specifications are measured at specified test conditions.

Specifications are not guaranteed over all recommended operating conditions.

### Absolute Maximum Ratings

Parameter	Rating	Unit
Storage Temperature	-55 to +155	°C
Junction Temperature	+170	°C
Supply Voltage	+7	V
Supply Current	190	mA
Input RF Power	20	dBm

Operation of this device above any of these parameters may result in permanent damage.

### Typical Performance (Vd=5V, Id=100mA, T=25°C)

Parameter	Frequency								Unit
	100	900	1800	2140	2650	3500	4500	MHz	
Gain	15.0	14.8	14.8	14.6	14.5	14.5	15.5	dB	
S11	-19.0	-14.9	-21.7	-21.0	-12.2	-13.1	-13.3	dB	
S22	-17.8	-13.0	-24.0	-21.7	-11.8	-12.1	-14.1	dB	
OIP3	40.1	40.8	39.2	37.9	36.8	37.4	30.5	dBm	
P1dB	21.8	22.2	21.8	20.8	20.1	20.9	16.9	dBm	
LTE 20M ACLR*	13.4	12.9	11.8	11.1	10.5	-	-	dBm	
5G NR ACLR*	-	-	-	-	-	10.6	5.7	dBm	
Noise Figure	1.8	1.9	2.1	2.3	2.3	2.4	3.7	dB	

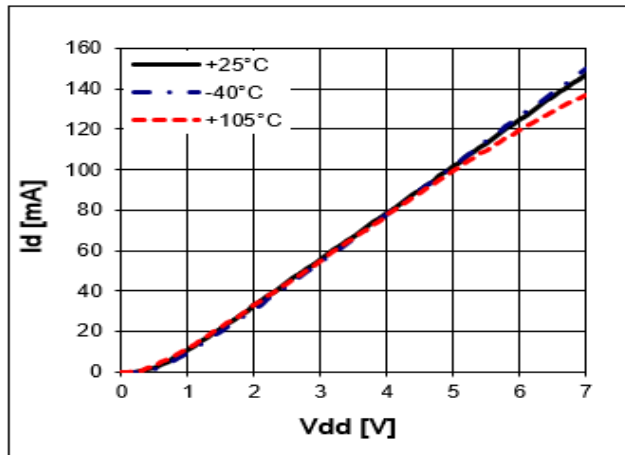
\*ACLR Channel Power measured at -50dBc.

- LTE set-up: 3GPP LTE, FDD E-TM3.1, 20MHz BW, ±20MHz offset, PAR 9.75 at 0.01% Prob.

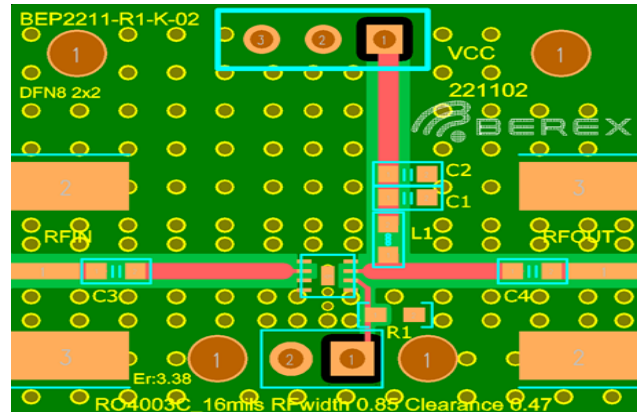
- 5G set-up: 3GPP 5G NR, 100MHz BW, ±100MHz offset, PAR 9.5 at 0.01% Prob.

- See "Application Note" on page 1 for 3.5 GHz & 4.5 GHz tuning points

### V-I Characteristics

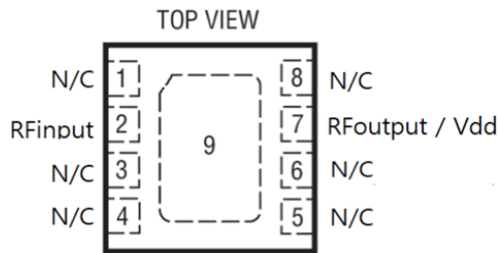


### Evaluation Board



\*Dielectric constant \_ 3.38 \*RF pattern width 0.85T \*16mil thick

### Pin Configuration



DC PACKAGE  
8-LEAD (2mm × 2mm) PLASTIC DFN  
EXPOSED PAD (PIN 9) IS GND, MUST BE SOLDERED TO PCB

Pin No.	Name	Description
2	RFinut	RFinut pin.
7	RFoutut	RFoutut / V <sub>dd</sub> pin. Supply
1,3,4, 5,6,8	NC	No internal connection to die. May be connected to ground.
9	Backside Paddle	Exposed Pad is RF/DC ground, must be soldered to PCB.

## 50-5000 MHz Flat Gain BroadBand AMP

### Wideband Performance (Vd=5V, Id=100mA, T=25°C)

Parameter	Frequency						Unit
	50	100	250	500	900	1500	
Gain	15.3	15.0	14.9	14.9	14.8	14.4	dB
S11	-14.2	-19.0	-21.6	18.8	-24.3	-26.4	dB
S22	-18.7	-17.8	-17.6	-15.9	-19.0	-17.5	dB
OIP3	36.8	40.0	40.7	40.7	39.2	37.7	dBm
P1dB	21.7	21.8	21.9	22.0	21.9	21.2	dBm
LTE 20M ACLR*	-	13.4	13.5	13.4	12.9	11.9	dBm
Noise Figure	1.7	1.8	2.1	2.0	1.9	2.1	dB

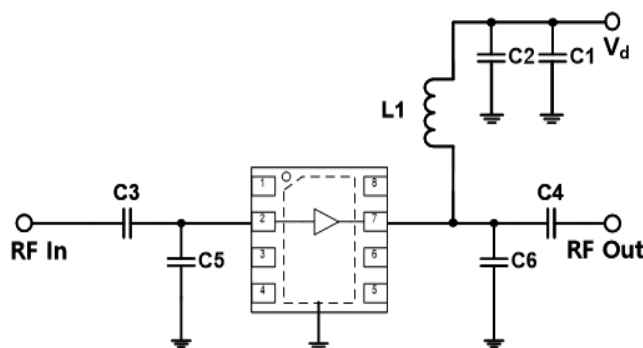
Parameter	Frequency						Unit
	500	900	1800	2140	2650	3500	
Gain	14.4	14.8	14.8	14.6	14.5	13.6	dB
S11	-12.2	-14.9	-21.7	-21.0	-12.2	-7.1	dB
S22	-10.0	-13.0	-24.0	-21.7	-11.8	-6.3	dB
OIP3	39.3	40.8	39.2	37.9	36.8	35.0	dBm
P1dB	21.4	22.2	21.8	20.8	20.1	19.3	dBm
LTE 20M ACLR*	12.7	12.8	11.8	11.1	10.5	-	dBm
5G NR ACLR*	-	-	-	-	-	9.5	dBm
Noise Figure	1.9	1.9	2.1	2.3	2.3	2.7	dB

Parameter	Frequency			Unit
	3500	4500	5000	
Gain	14.5	15.5	13.5	dB
S11	-13.1	-13.3	-5.0	dB
S22	-12.1	-14.1	-6.0	dB
OIP3	37.4	30.5	26.7	dBm
P1dB	20.9	16.9	12.2	dBm
5G NR ACLR*	10.6	5.7	1.6	dBm
Noise Figure	2.4	3.7	4.9	dB

\*ACLR Channel Power measured at -50dBc.

- LTE set-up: 3GPP LTE, FDD E-TM3.1, 20MHz BW, ±20MHz offset, PAR 9.75 at 0.01% Prob.

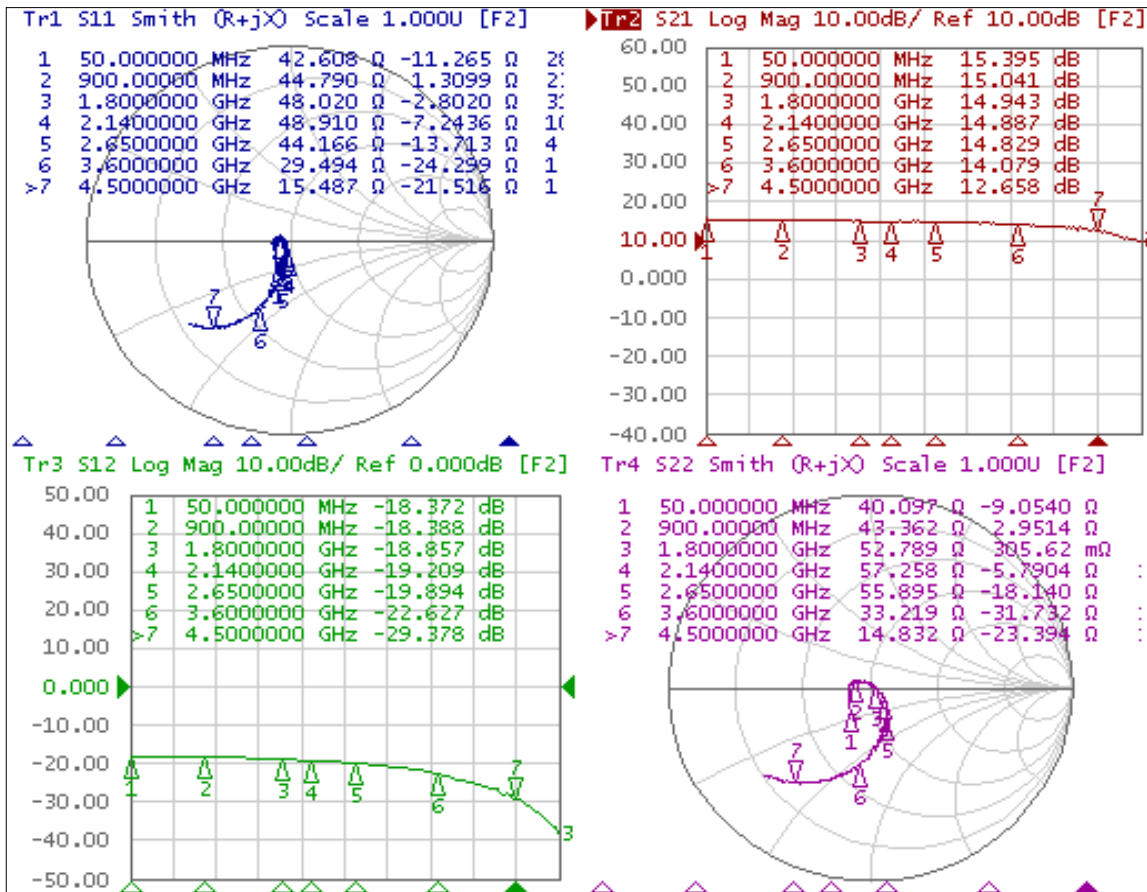
- 5G set-up: 3GPP 5G NR, 100MHz BW, ±100MHz offset, PAR 9.5 at 0.01% Prob.



BOM@GHz	0.03~1.5	0.5~3.5	3.5~5.0	Remark
C1	1uF	1uF	1uF	0603
C2	100pF	100pF	100pF	0603
C3	2.2nF	100pF	22pF	0603
C4	2.2nF	100pF	22pF	0603
L1	1uH	22nH	1.0nH	0603
C5	-	-	0.5pF	0603
C6	-	-	0.75pF	0603

### Typical Device Data

S-parameters ( $V_d=5V, I_d=100mA, T=25^\circ C$ )

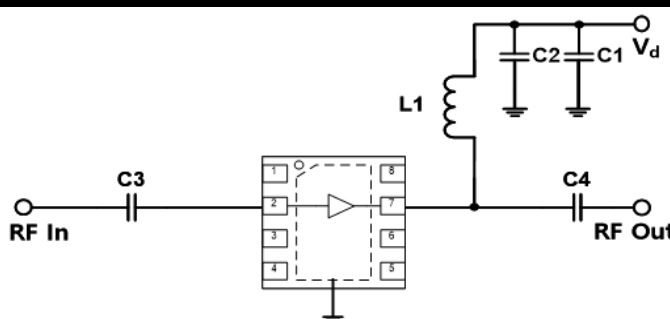


### S-Parameter

( $V_{device} = 5.0V, I_d = 100mA, T = 25^\circ C$ , calibrated to device leads)

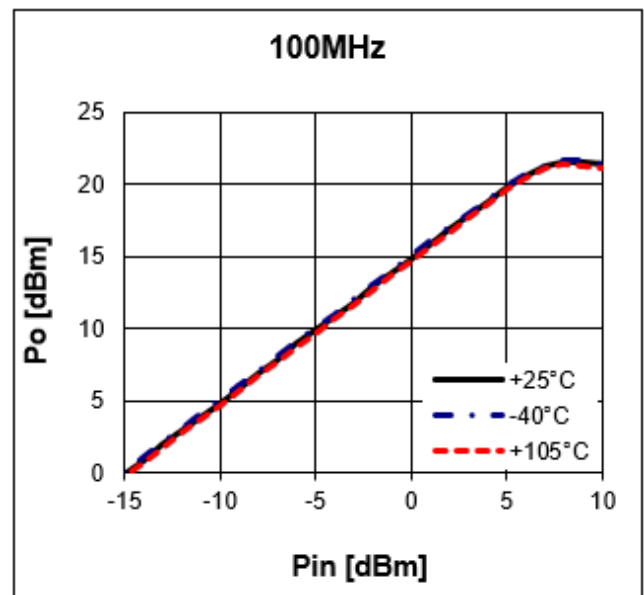
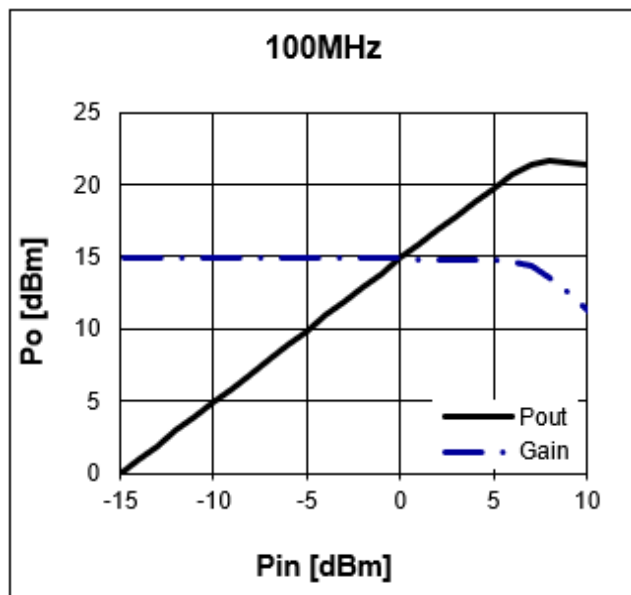
Freq [MHz]	S11 [Mag]	S11 [Ang]	S21 [Mag]	S21 [Ang]	S12 [Mag]	S12 [Ang]	S22 [Mag]	S22 [Ang]
	200	0.07	-162.53	5.64	170.31	0.12	-2.12	0.10
400	0.07	-179.30	5.60	165.26	0.12	-6.70	0.10	-172.86
900	0.05	-164.84	5.65	149.22	0.12	-15.13	0.07	-154.10
1900	0.04	-113.24	5.55	113.70	0.11	-36.58	0.04	-22.19
2100	0.07	-104.17	5.56	106.90	0.11	-38.70	0.05	-23.69
2800	0.18	-103.99	5.46	79.80	0.09	-57.97	0.20	-68.02
3600	0.38	-113.07	5.06	46.96	0.07	-82.97	0.40	-96.90
4400	0.56	-126.90	4.34	9.32	0.04	-106.34	0.58	-123.38
5000	0.65	-139.13	3.01	-14.23	0.01	-143.90	0.69	-139.08

### Application Circuit: 100 MHz

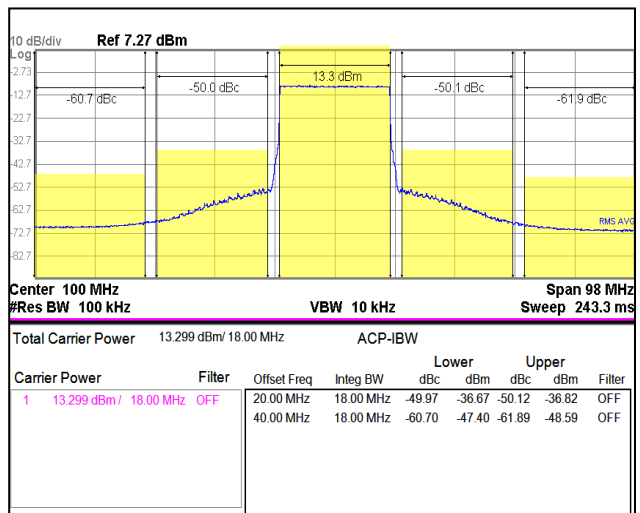
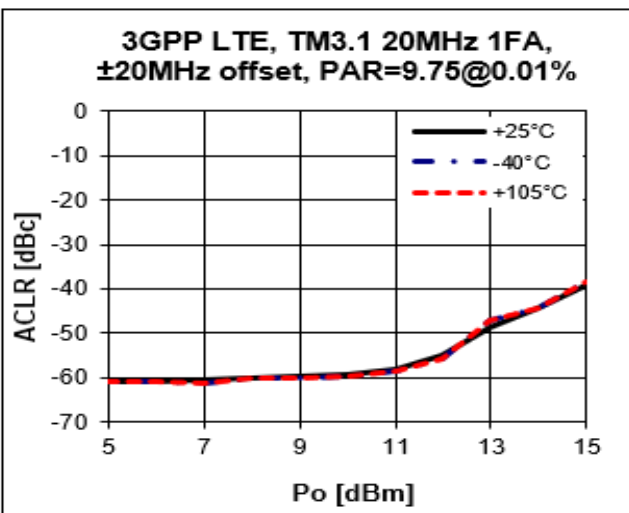
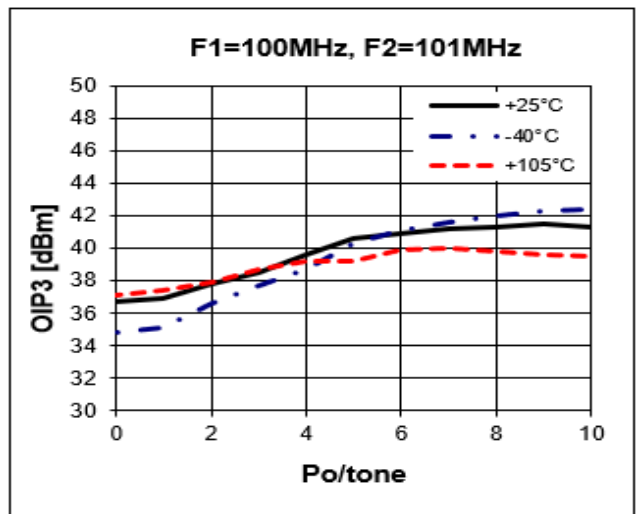
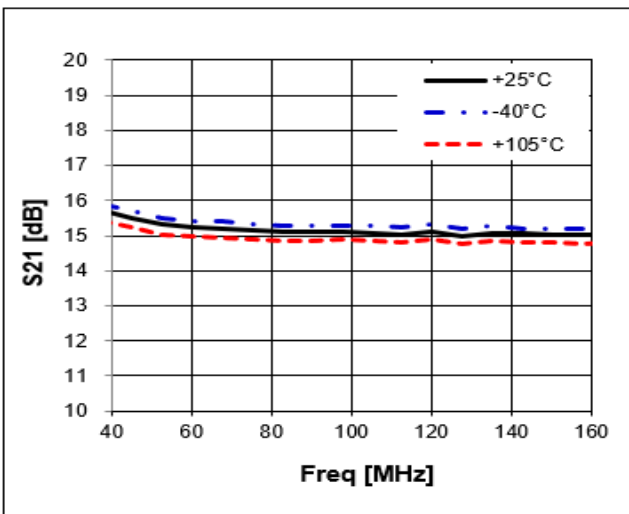
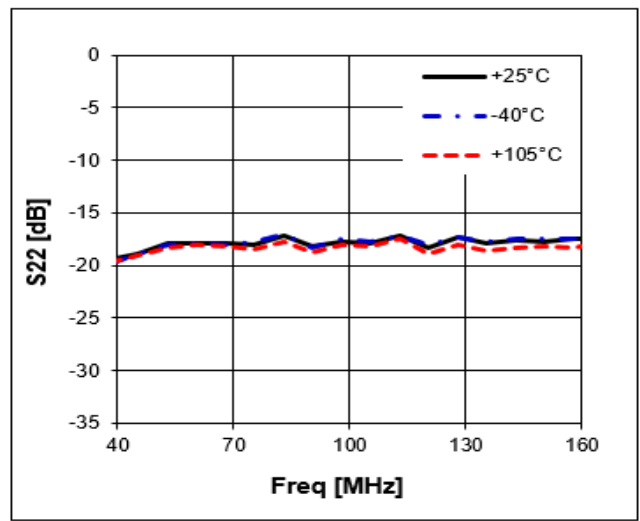
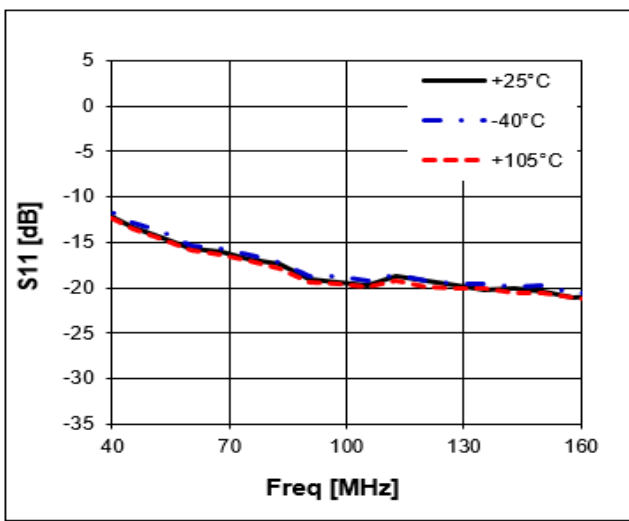
Schematic Diagram	BOM		Size
	C1	1uF	0603
	C2	100F	0603
	C3	2.2nF	0603
	C4	2.2nF	0603
	L1	1uH	0603
	U1	BBA31	DFN 2x2

### Typical Performance

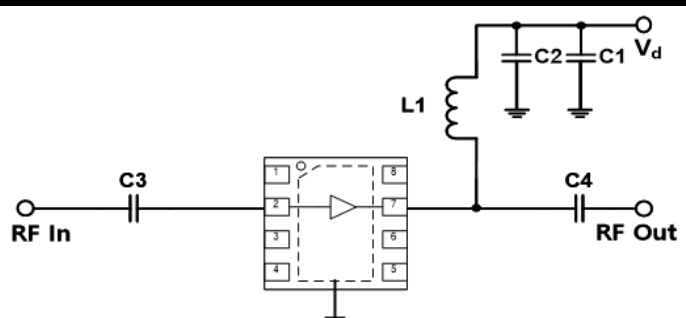
(Vd=5V, Id=100mA, T=25°C)



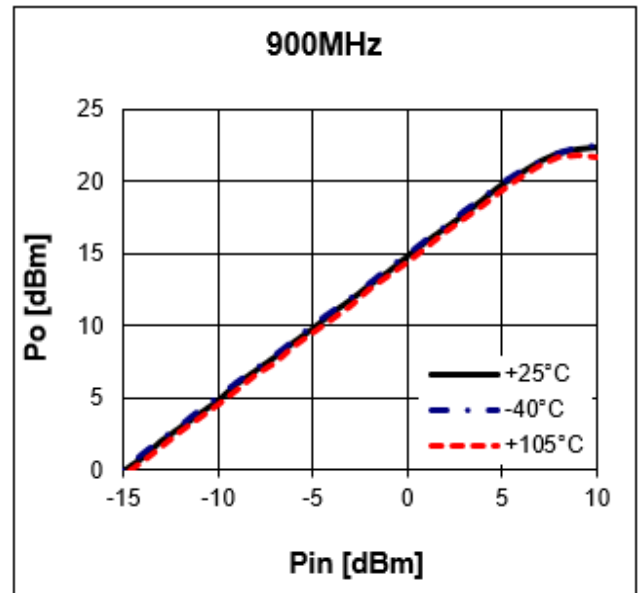
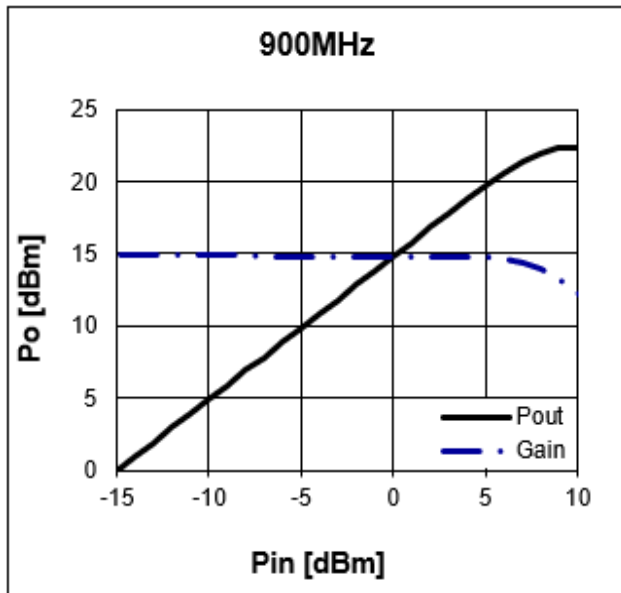
## 50-5000 MHz Flat Gain BroadBand AMP



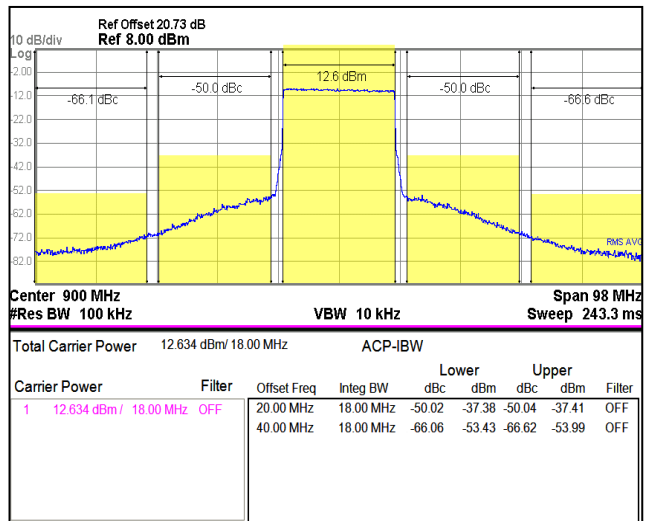
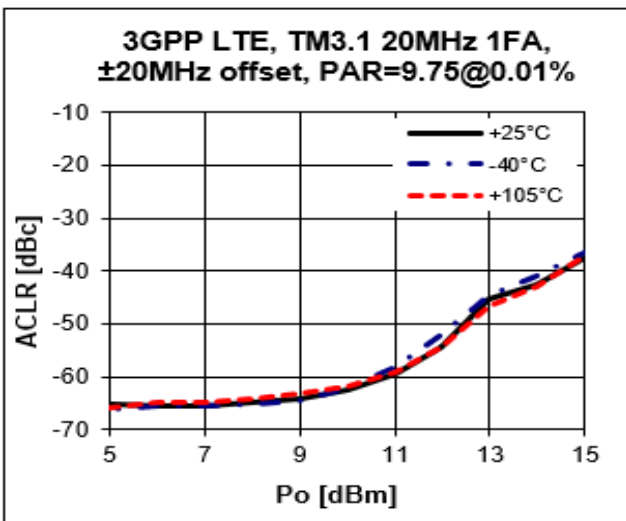
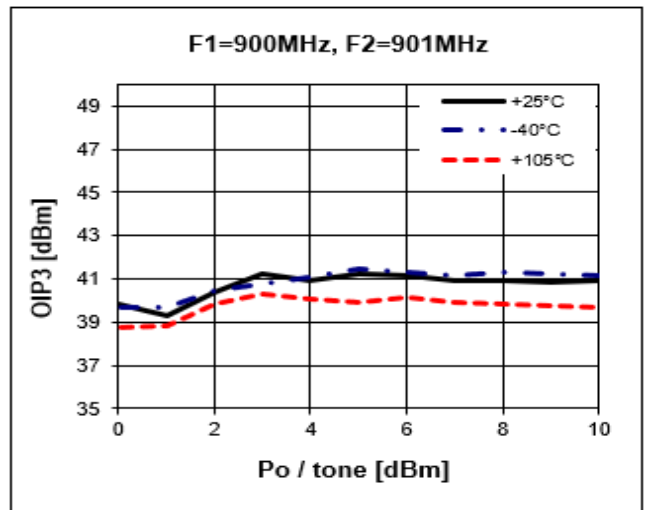
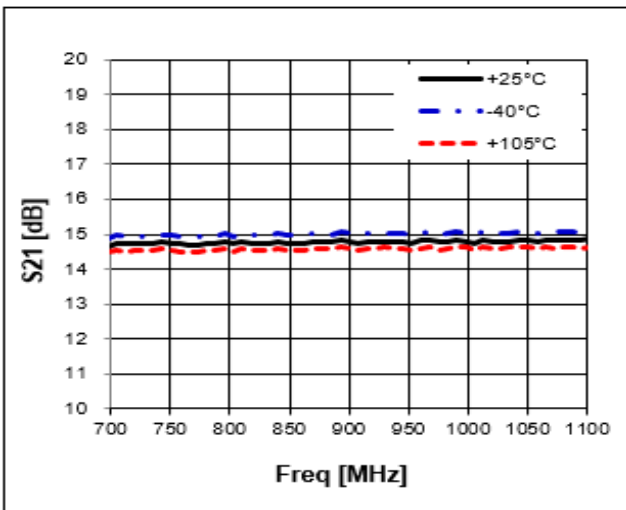
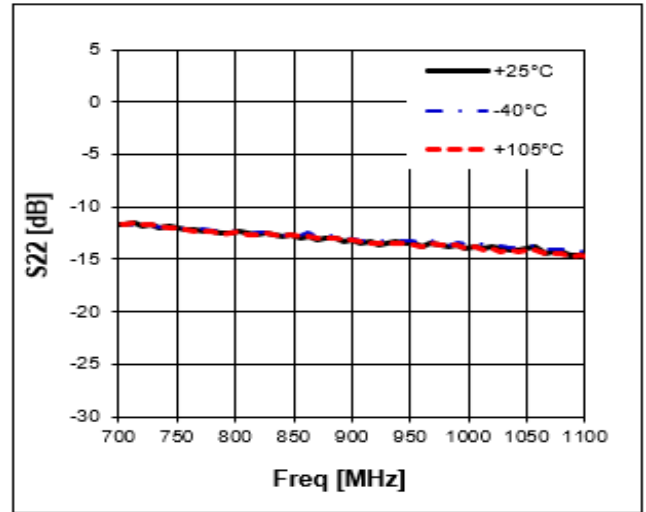
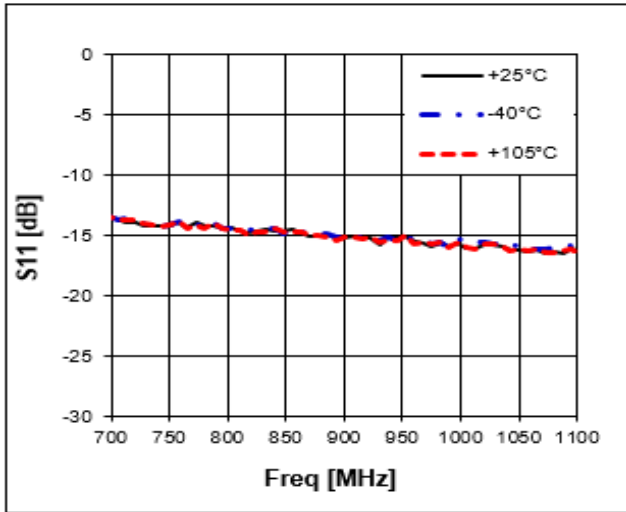
### Application Circuit: 900 MHz

Schematic Diagram	BOM		Size
	C1	1uF	0603
	C2	100F	0603
	C3	100F	0603
	C4	100F	0603
	L1	1uH	0603
	U1	BBA31	DFN 2x2

### Typical Performance (Vd=5V, Id=100mA, T=25°C)

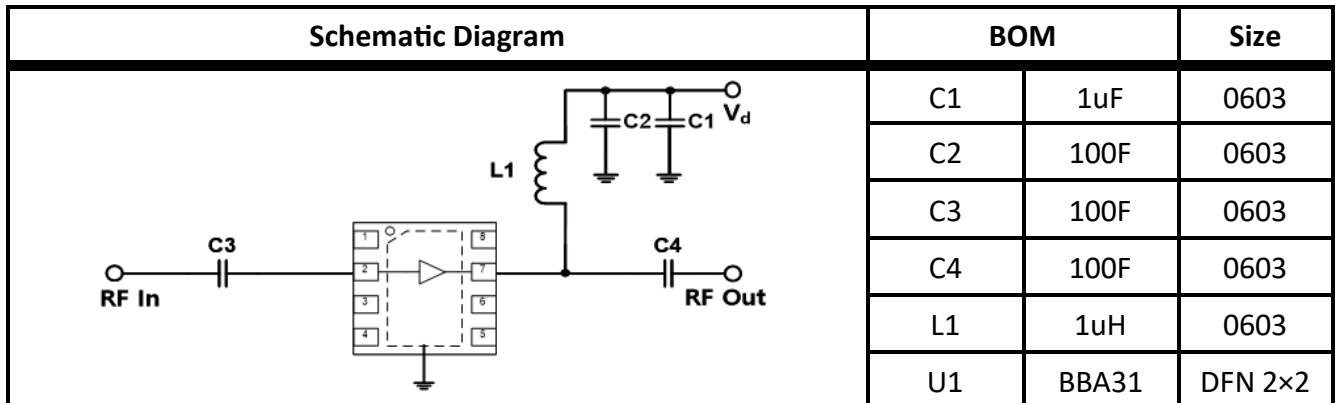


## 50-5000 MHz Flat Gain BroadBand AMP

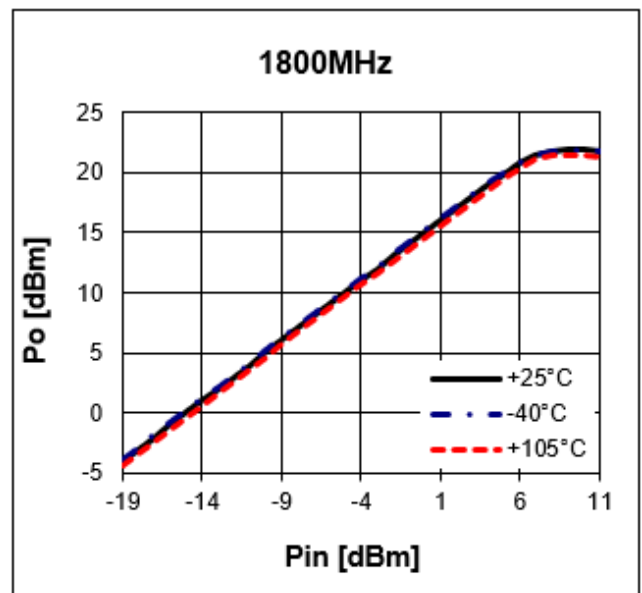
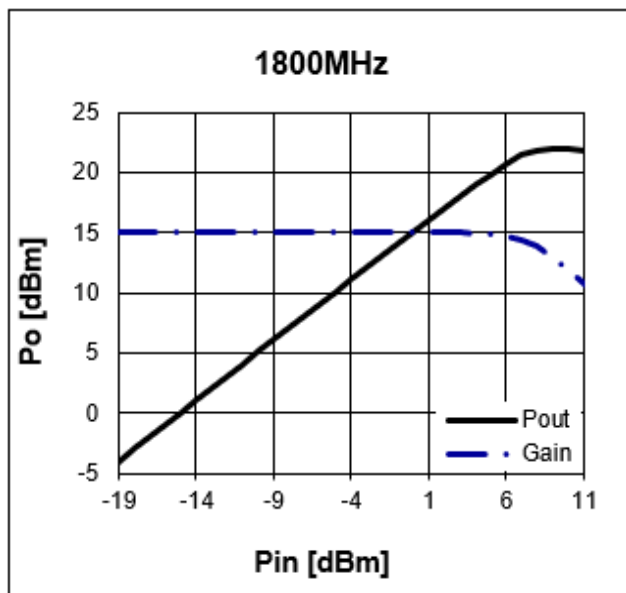




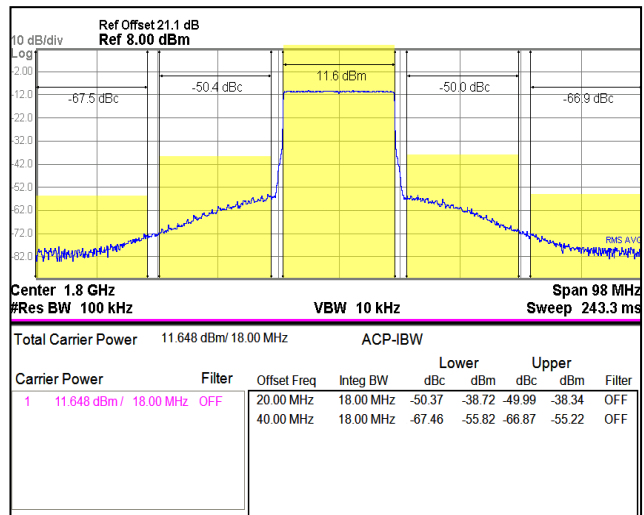
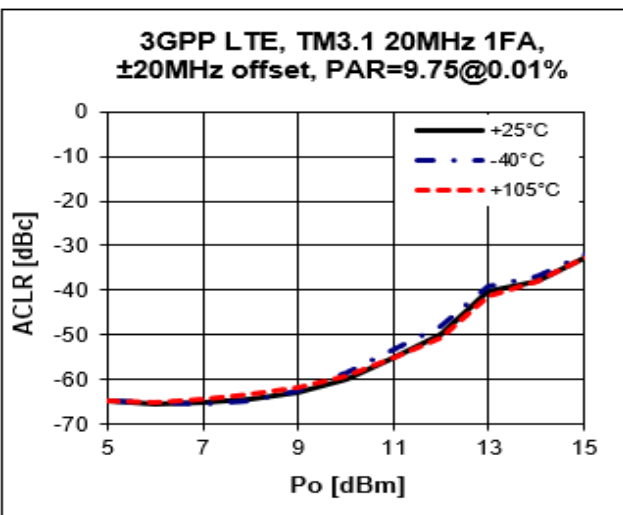
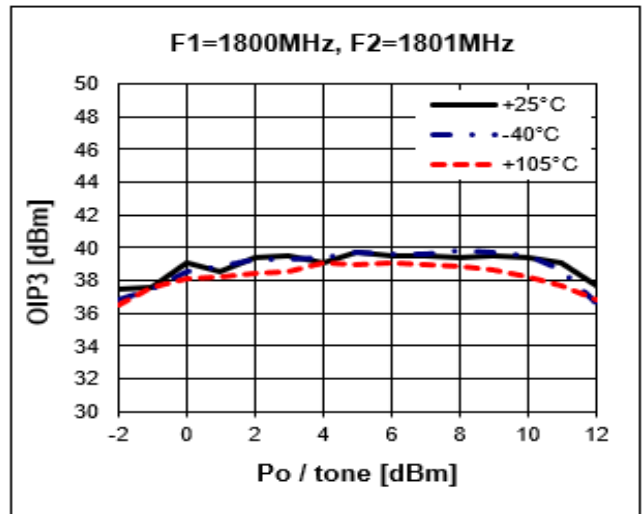
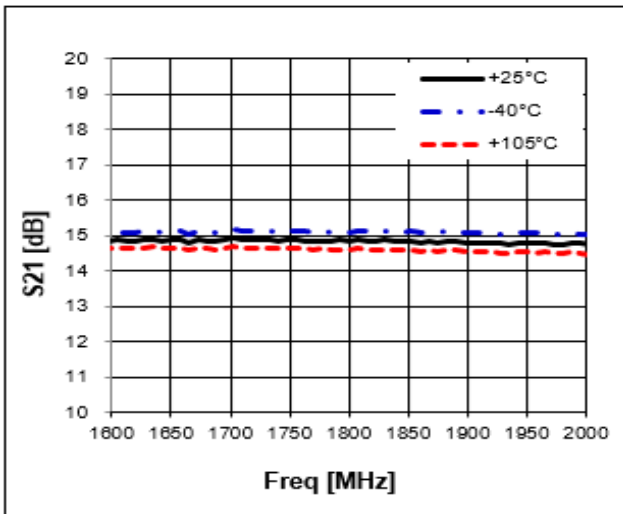
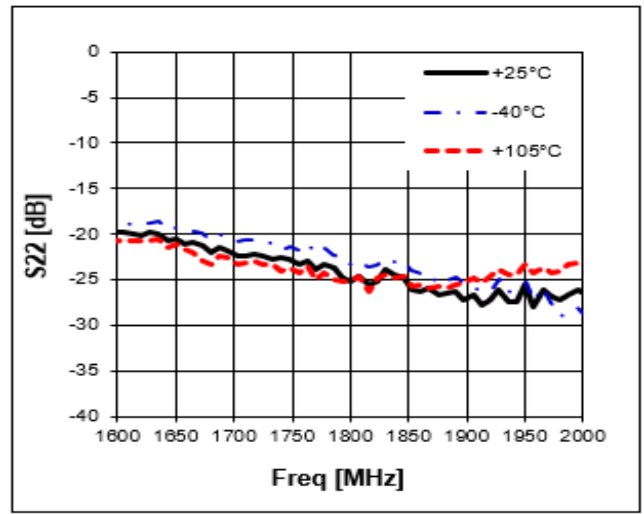
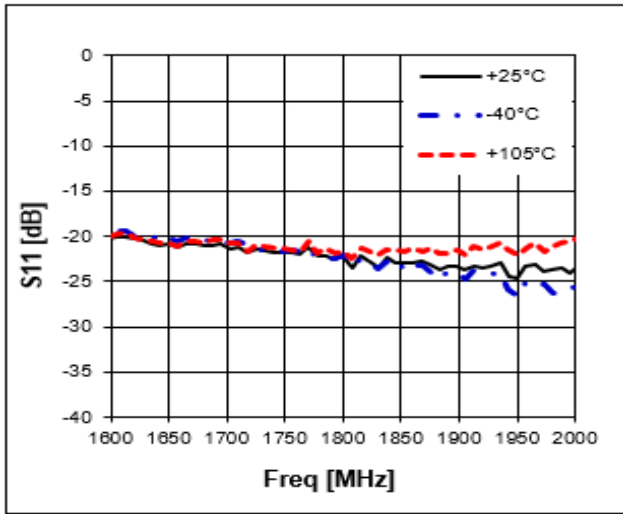
### Application Circuit: 1800 MHz



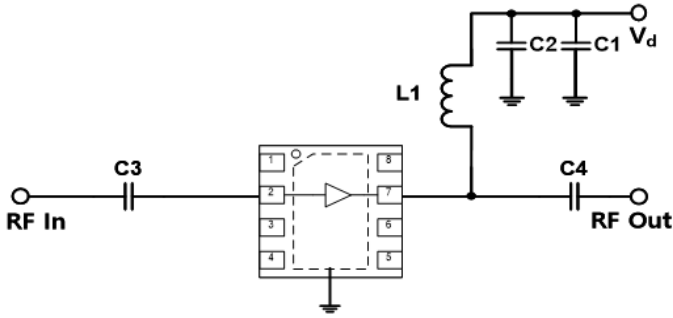
### Typical Performance (Vd=5V, Id=100mA, T=25°C)



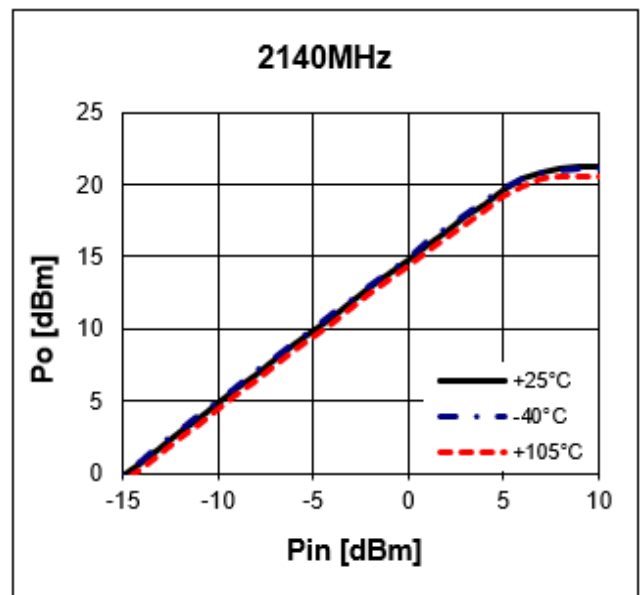
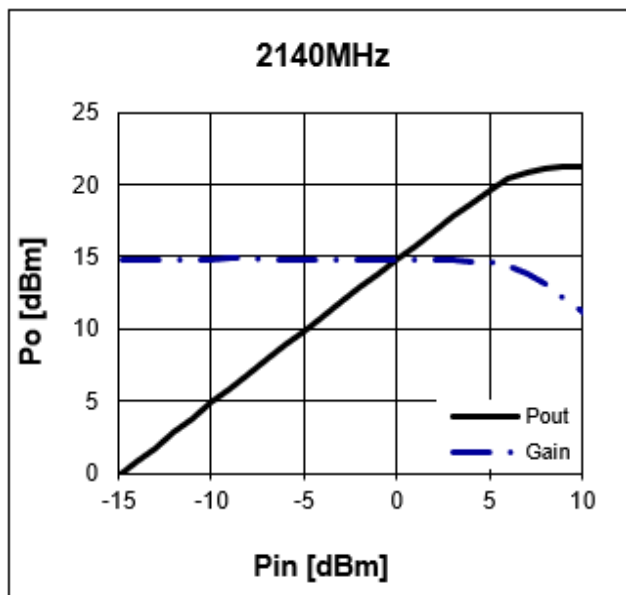
## 50-5000 MHz Flat Gain BroadBand AMP



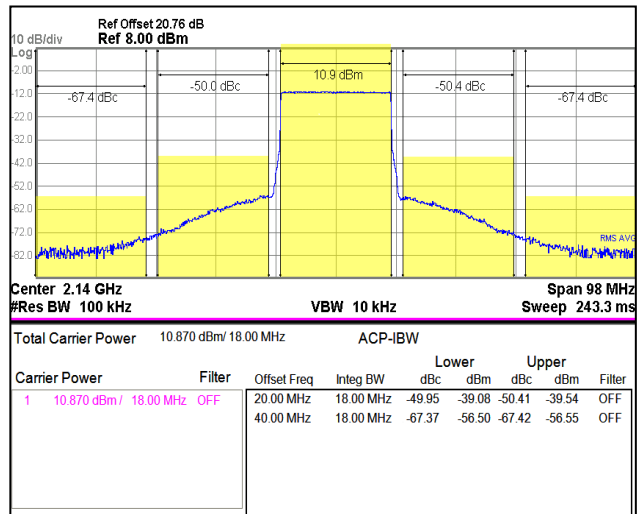
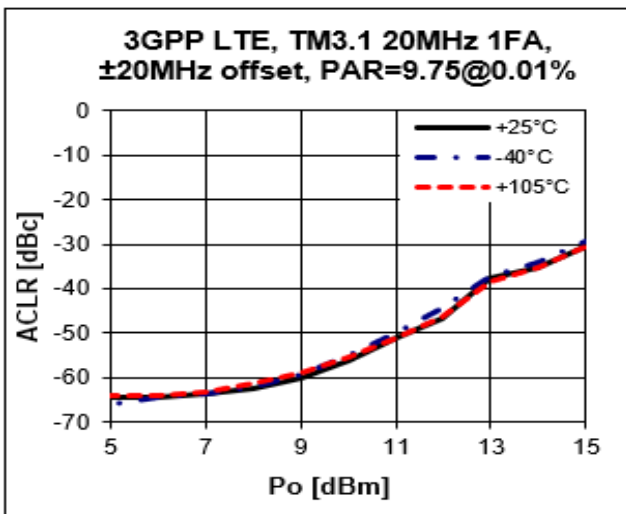
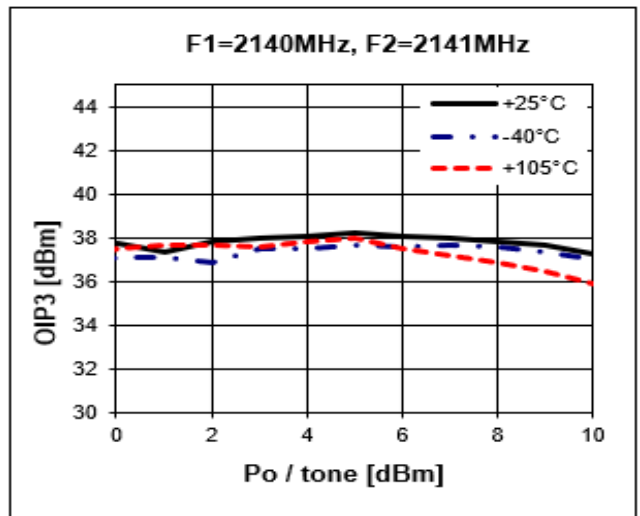
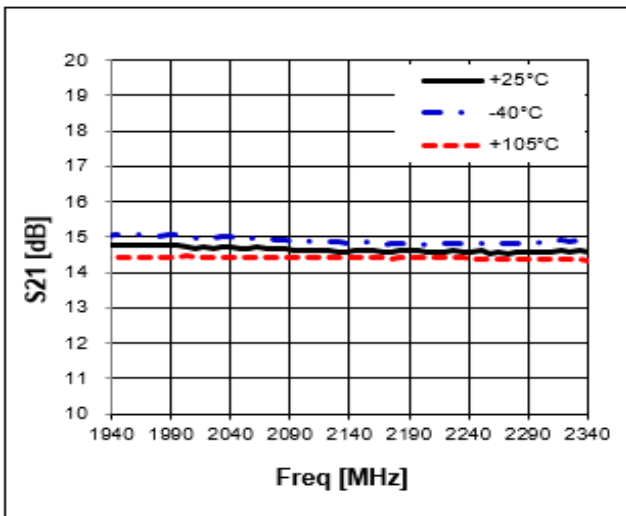
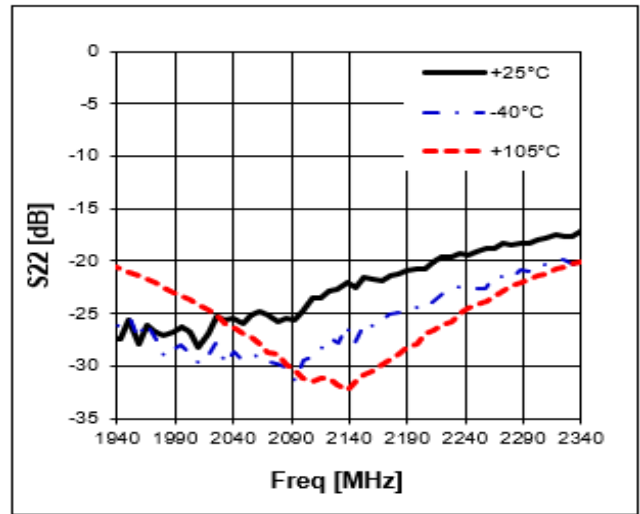
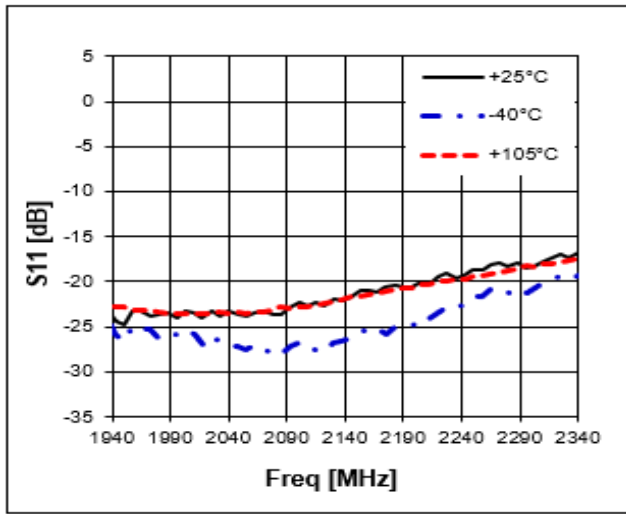
### Application Circuit: 2140 MHz

Schematic Diagram	BOM	Size	
	C1	1uF	0603
	C2	100F	0603
	C3	100F	0603
	C4	100F	0603
	L1	1uH	0603
	U1	BBA31	DFN 2x2

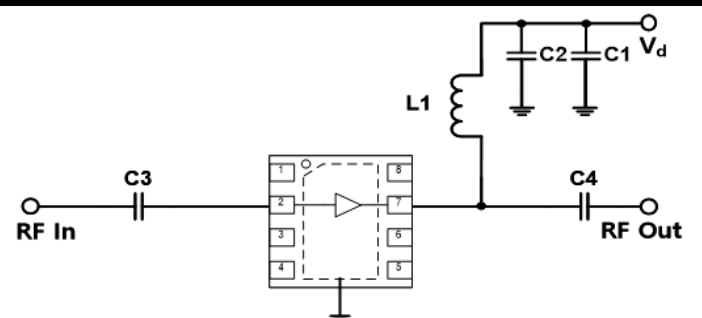
### Typical Performance (Vd=5V, Id=100mA, T=25°C)



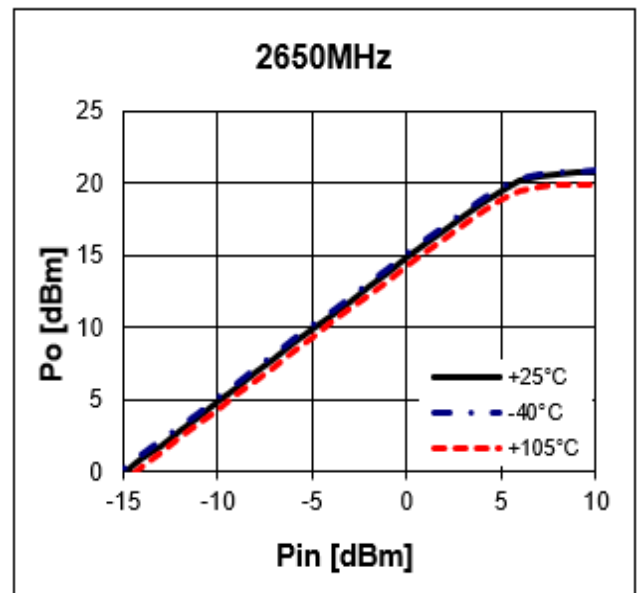
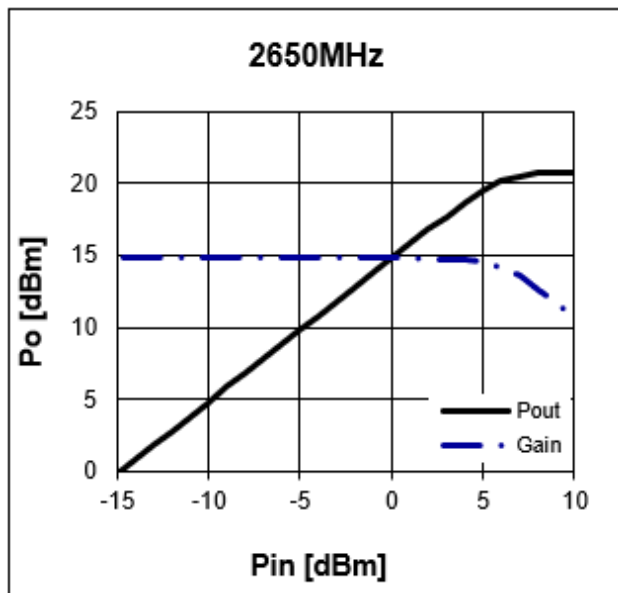
## 50-5000 MHz Flat Gain BroadBand AMP



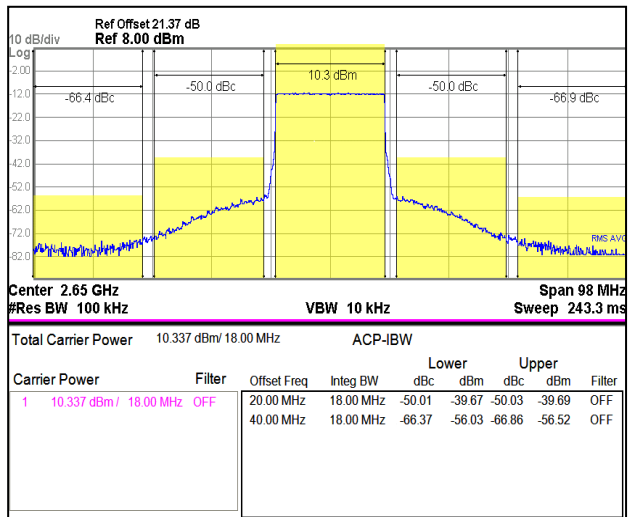
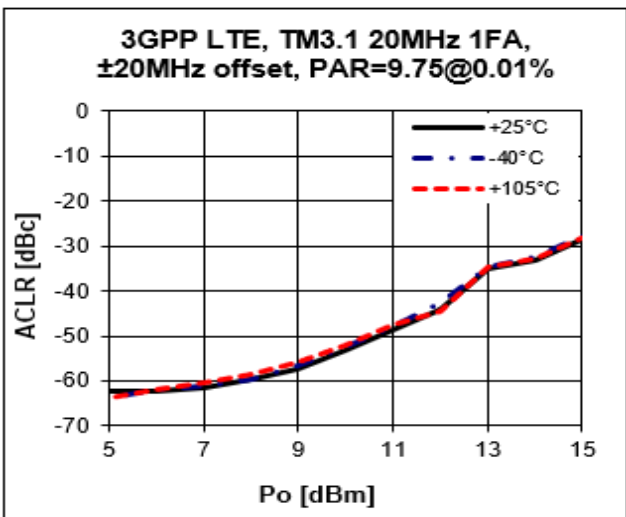
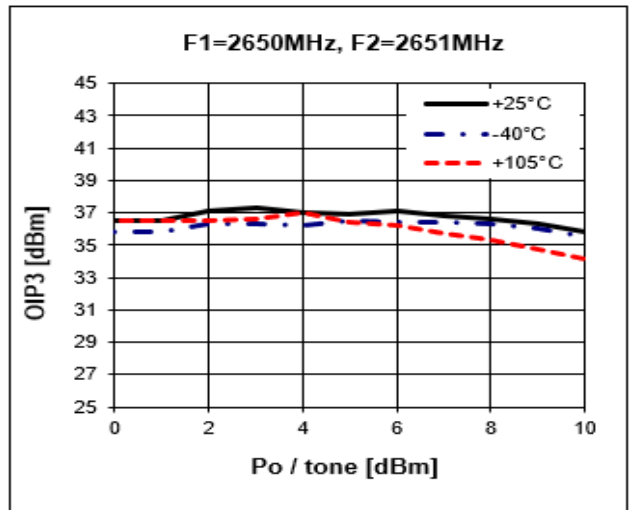
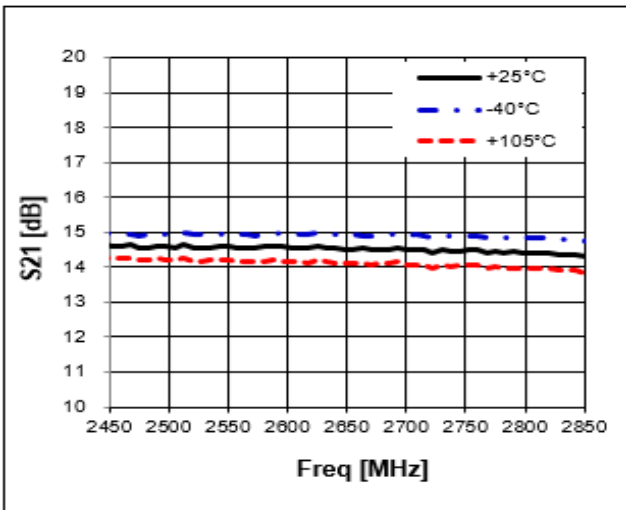
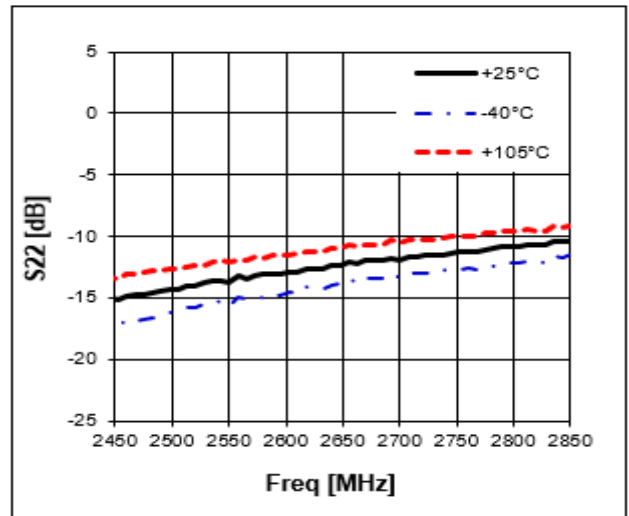
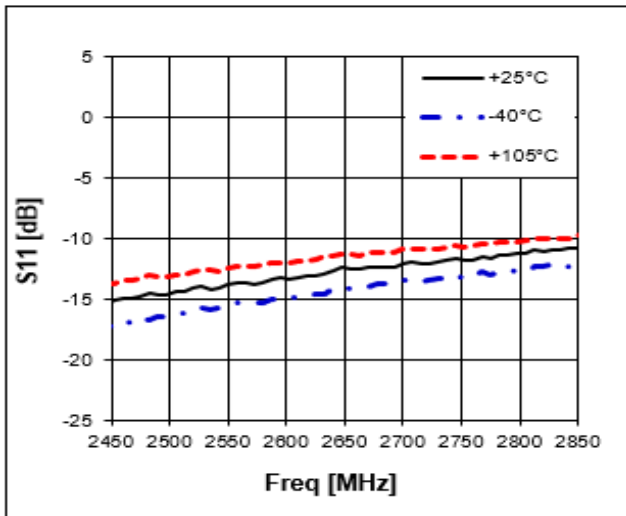
### Application Circuit: 2650 MHz

Schematic Diagram	BOM		Size
	C1	1uF	0603
	C2	100F	0603
	C3	100F	0603
	C4	100F	0603
	L1	1uH	0603
	U1	BBA31	DFN 2x2

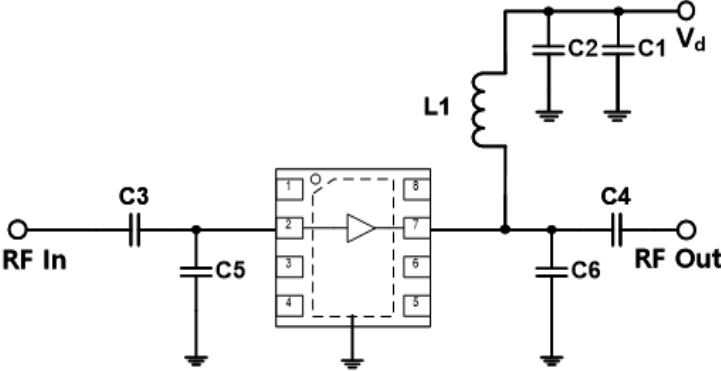
### Typical Performance (Vd=5V, Id=100mA, T=25°C)

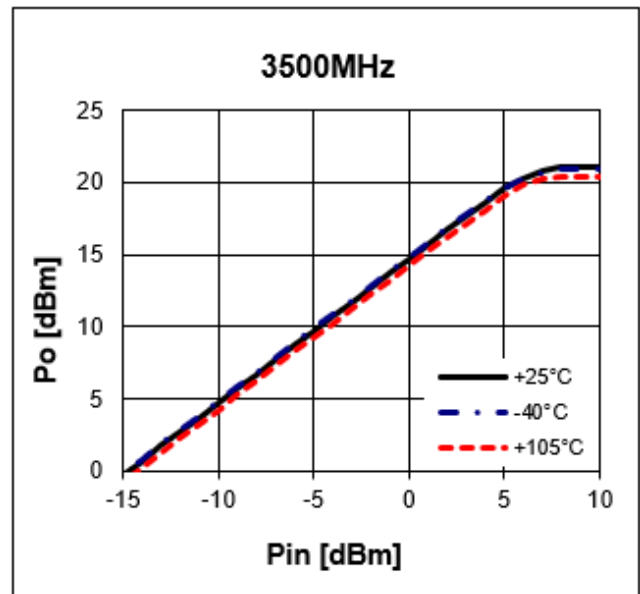
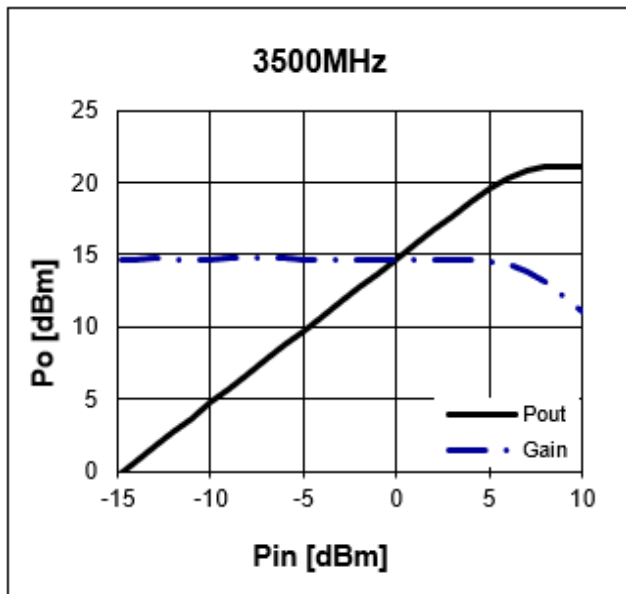


## 50-5000 MHz Flat Gain BroadBand AMP

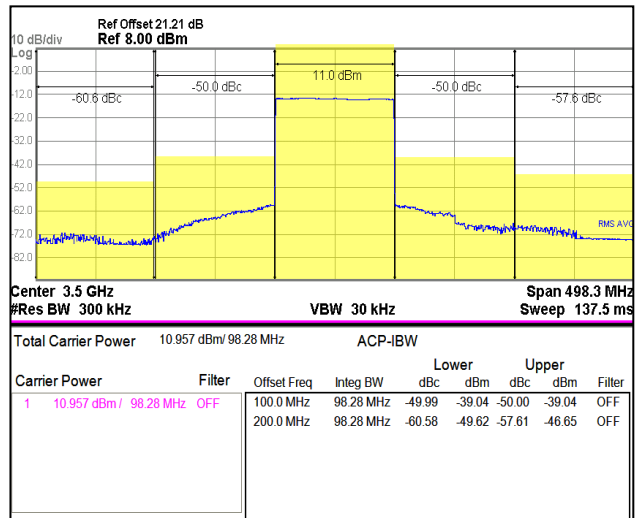
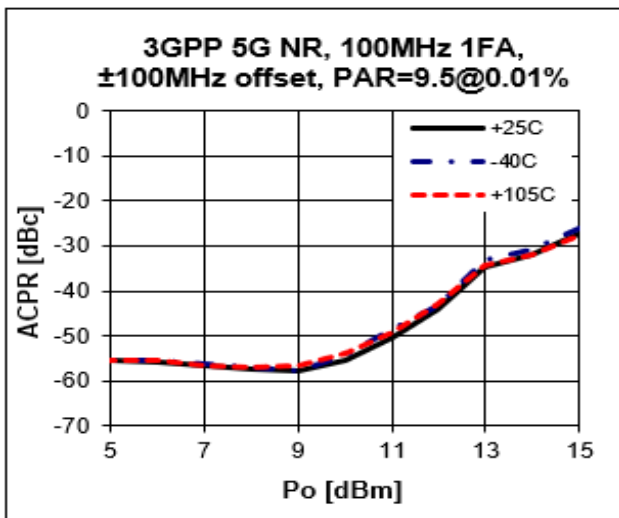
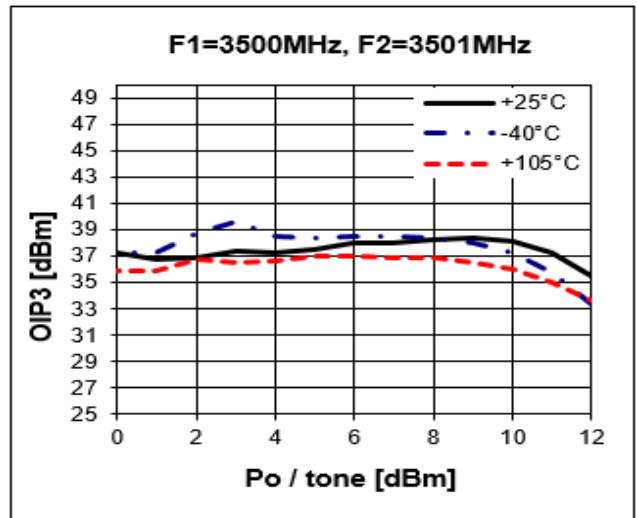
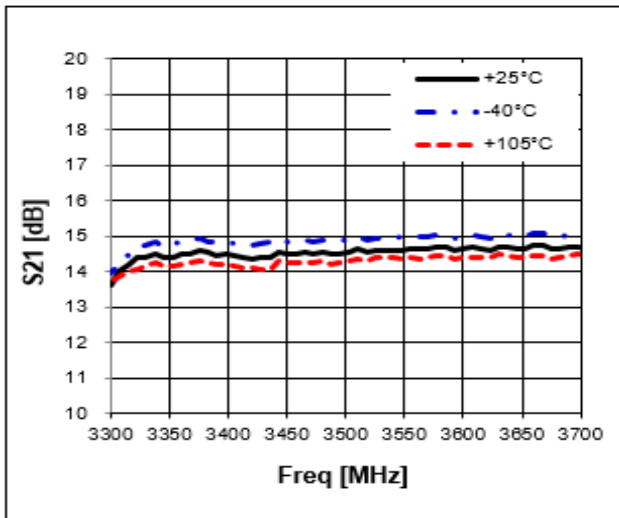
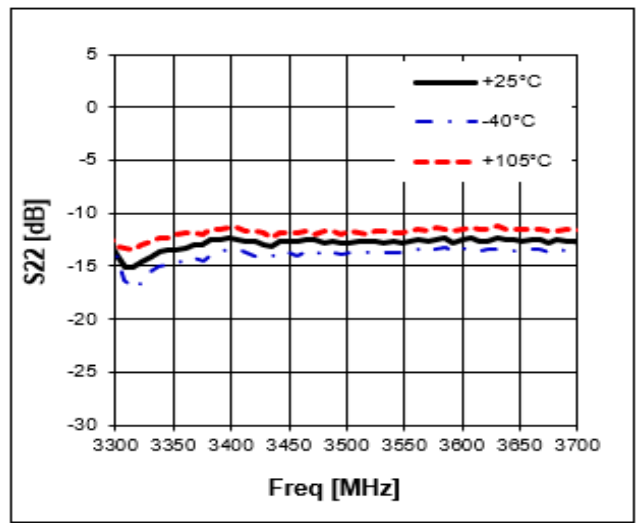
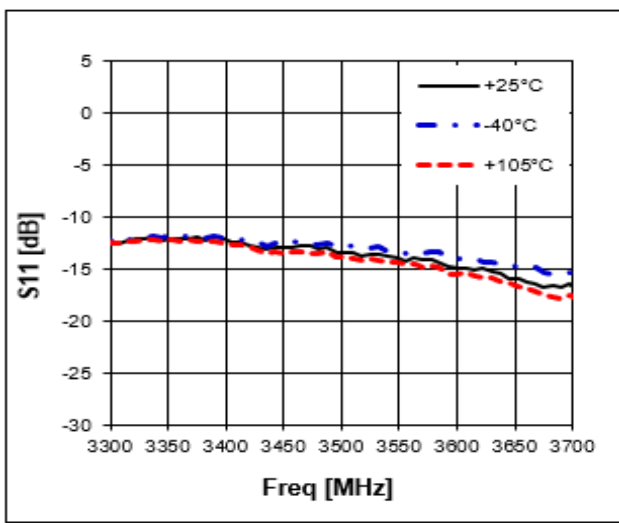


**Application Circuit: 3500 MHz**

Schematic Diagram	BOM	Size	
	C1	1uF	0603
	C2	100pF	0603
	C3	22pF	0603
	C4	22pF	0603
	C5	0.5pF	0603
	C6	0.75pF	0603
	L1	1nH	0603
	U1	BBA31	DFN 2x2

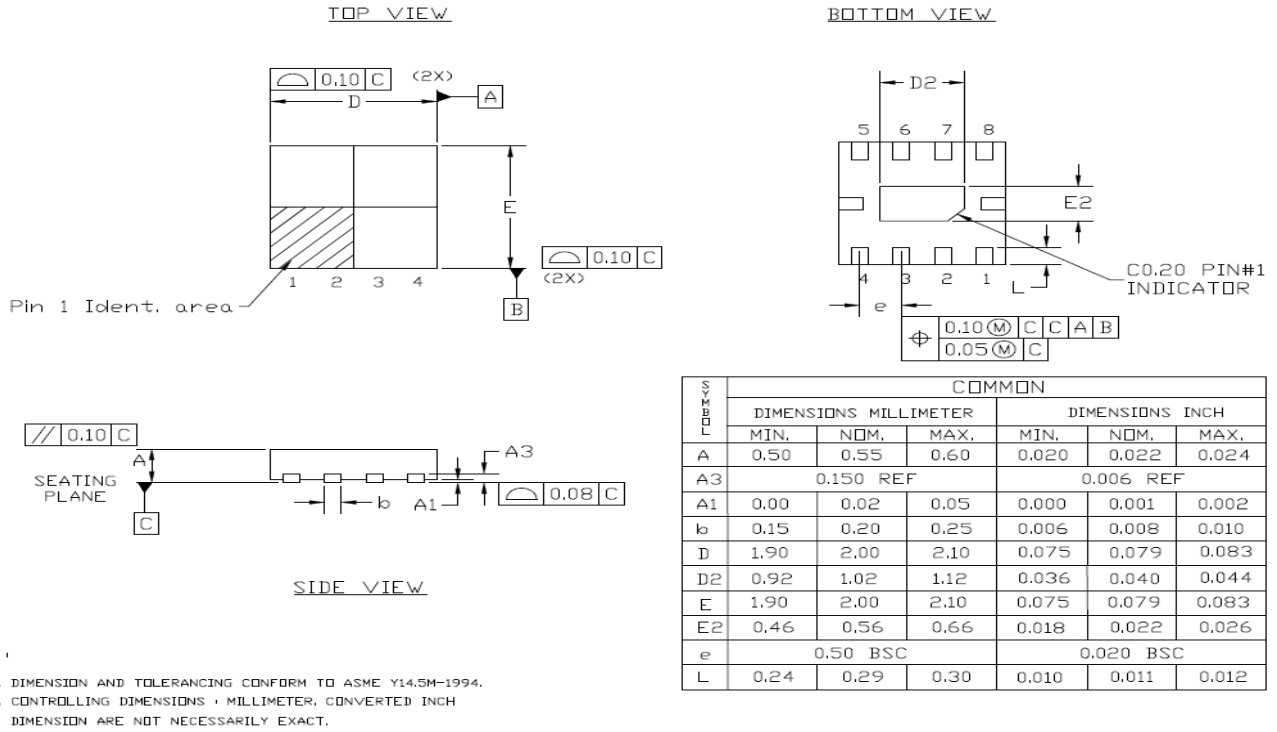
**Typical Performance**  
 (Vd=5V, Id=100mA, T=25°C)


## 50-5000 MHz Flat Gain BroadBand AMP

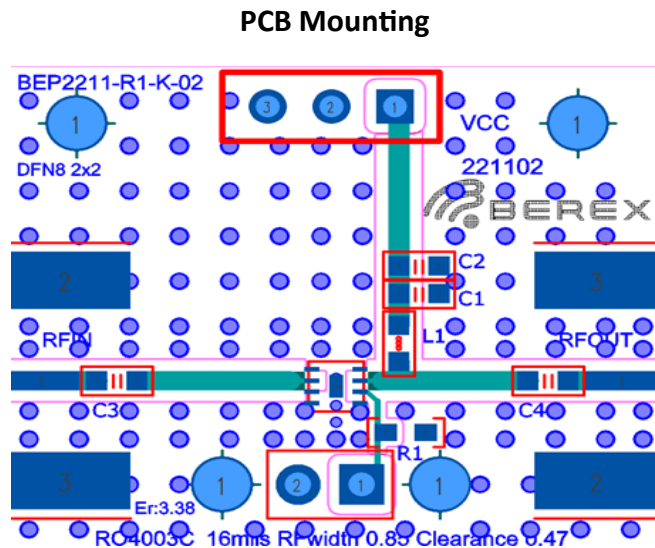
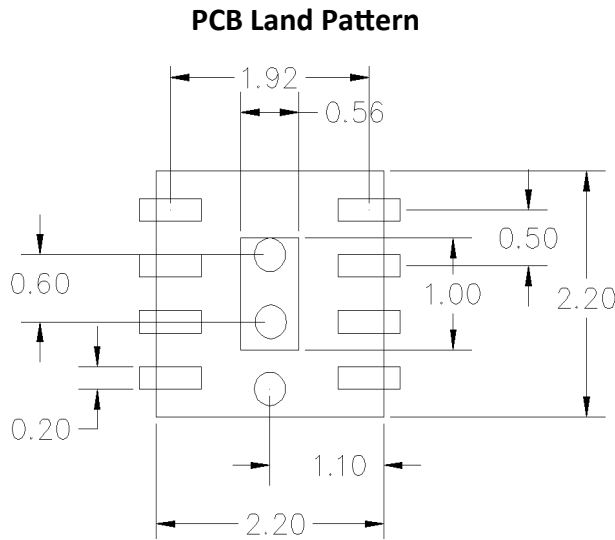




### Package Outline Dimension



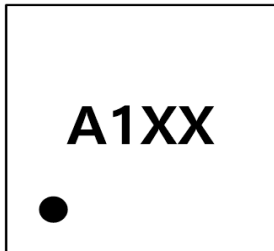
### Suggested PCB Land Pattern and PAD Layout



Note : All dimension \_ millimeters

PCB lay out \_ on BeRex website

### Package Marking



XX = Wafer No.

Pin 1

### Lead plating finish

100% Tin Matte finish

(All BeRex products undergoes a 1 hour, 150 degree C, Anneal bake to eliminate thin whisker growth concerns.)

### MSL / ESD Rating

**ESD Rating:** Class 1C  
**Value:** Passes <2000V  
**Test:** Human Body Model (HBM)  
**Standard:** JEDEC Standard JS-001-2017

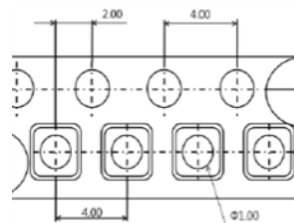
**MSL Rating:** Level 1 at +260°C convection reflow  
**Standard:** JEDEC Standard J-STD-020



Proper ESD procedures should be followed when handling this device.

### Tape & Reel

**DFN 8L 2x2**



Packaging information:

Tape Width (mm): 8

Reel Size (inches): 7

Device Cavity Pitch (mm): 4

Devices Per Reel: 3000

**RoHS Compliance**

This part is compliant with Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive 2011/65/EU as amended by Directive 2015/863/EU.

This product also is compliant with a concentration of the Substances of Very High Concern (SVHC) candidate list which are contained in a quantity of less than 0.1%(w/w) in each components of a product and/or its packaging placed on the European Community market by the BeRex and Suppliers.

**NATO CAGE code:**

2	N	9	6	F
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