BT09AG

5-4000 MHz Wideband Medium Power Amplifier

Device Features

- OIP3 = 43.0 dBm @ 900 MHz
- Gain = 20.0 dB @ 900 MHz
- Output P1 dB = 24.5 dBm @ 900 MHz
- RoHS2-compliant SOT-89 SMT package

Product Description

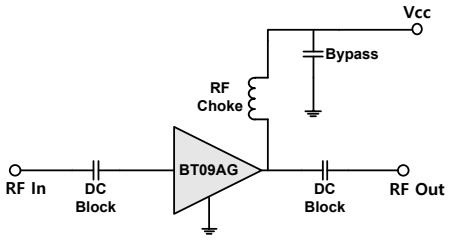
BeRex's BT09AG is a high performance and a high dynamic range amplifier in a low cost surface mount package(SOT-89) with a RoHS2-compliant, that incorporates reliable heterojunction-bipolar-transistor (HBT) devices fabricated with InGaP GaAs technology. This device is designed for use where high linearity is required and features high OIP3 and P1 with low consumption current(85mA) and requires a few external matching components such as a DC blocking capacitors on the In/Output pin, a bypass capacitor and a RF choke for the out port.

All devices are 100% RF/DC tested.

Applications

- Base station Infrastructure/RFID
- Commercial/Industrial/Military wireless system
- Wireless LAN

Application Circuits



*External matching circuit: refer to the page 5 to 13.

Electrical Specifications

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

Parameter	Conditions	Min	Typ	Max	Unit
Operational Frequency Range		5		4000	MHz
Test Frequency			900		MHz
Gain		17.5	20.0		dB
Input Return Loss			-17.0		dB
Output Return Loss			-14.0		dB
Output IP3	13 dBm/tone, Δf=1 MHz	40.0	43.0		dBm
Output P1dB		23.5	24.5		dBm
Noise Figure			4.2		dB

Recommended Operating Conditions

Parameter	Min	Typ	Max	Unit
Bandwidth	5		4000	MHz
I_C @ (Vc = 5V)	130	160	190	mA
V_C	4.75	5.0	5.25	V
R_{TH}		50		°C/W
Operating Case Temperature	-40		+85	°C

Electrical specifications are measured at specified test conditions.

Specifications are not guaranteed over all recommended operating conditions.

Absolute Maximum Ratings

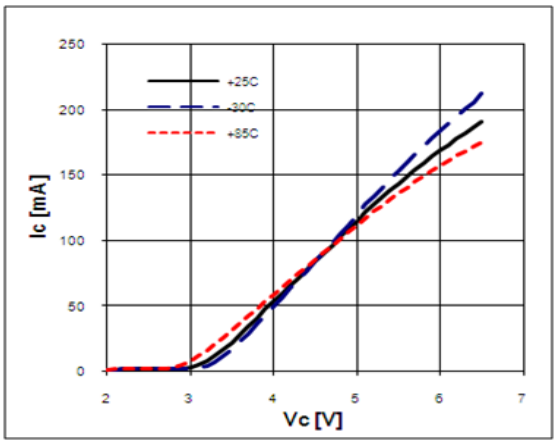
Parameter	Rating	Unit
Storage Temperature	-55 to +155	°C
Junction Temperature	+190	°C
Supply Voltage	+6.5	V
Supply Current	220	mA
Input RF Power	23	dBm

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

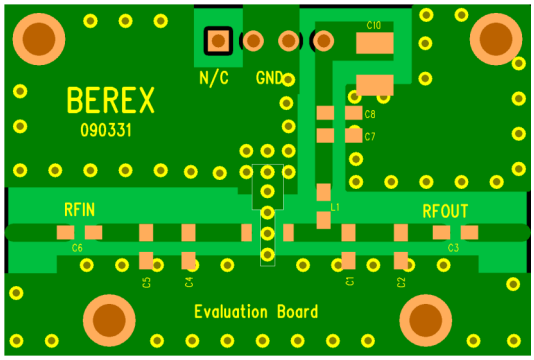
Typical Performance (Vc=5V, Ic=160mA, T=25°C)

Parameter	Frequency								Unit
	70	170	240	500	900	1900	2450	3500	MHz
Gain	24.7	25.0	24.8	23.0	20.0	14.5	12.5	9.20	dB
S11	-18.0	-19.0	-20.0	-17.0	-17.0	-22.0	-16.0	-17.0	dB
S22	-18.0	-16.0	-26.0	-16.0	-14.0	-16.0	-24.0	-23.0	dB
OIP3	39.0	40.0	40.0	41.5	43.0	43.0	43.0	39.0	dBm
P1dB	24.5	25.5	25.0	24.5	24.5	24.2	26.0	25.8	dBm
Noise Figure	3.7	3.8	3.9	3.8	4.2	4.2	4.3	5.0	dB

V-I Characteristics



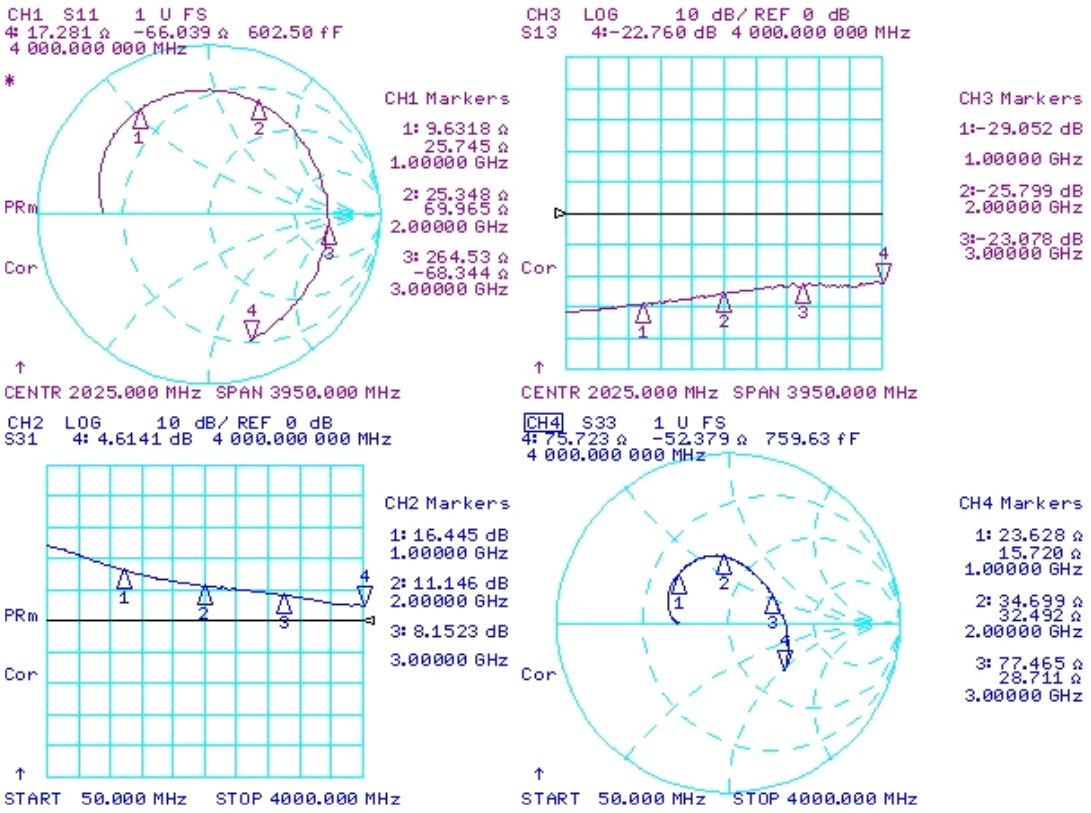
BeRex SOT89 Evaluation Board



*Dielectric constant _ 4.2 *RF pattern width 52mil *31mil thick FR4 PCB

Typical Device Data

S-parameters (Vc=5V, Ic=160mA, T=25°C)

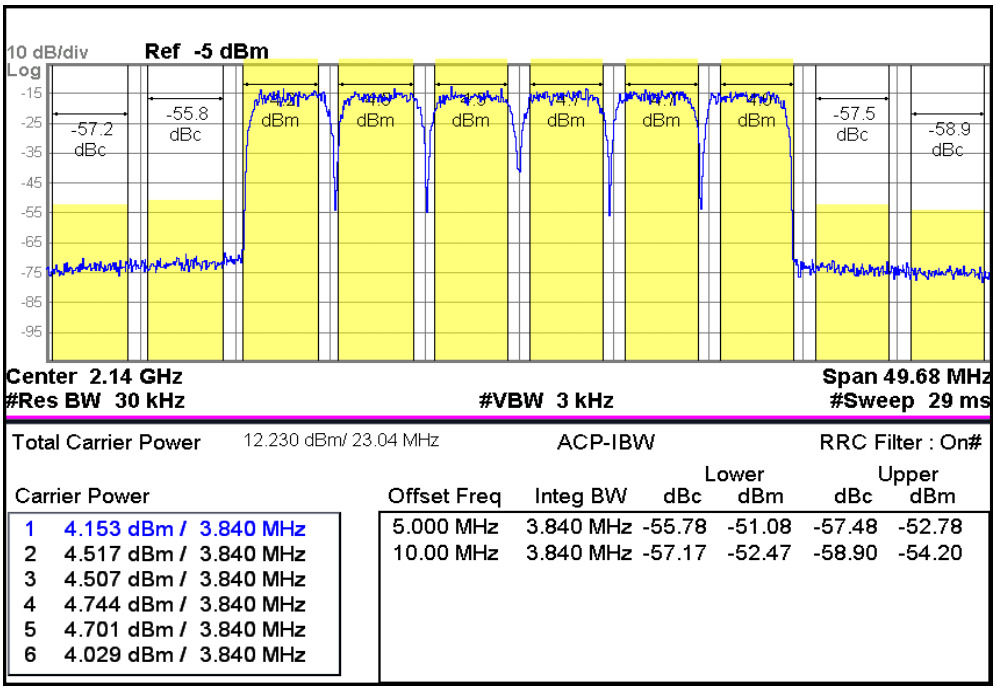


S-Parameter

(Vdevice = 5.0V, Icc = 160mA, T = 25 °C, calibrated to device leads)

Freq [MHz]	S11 dB	S11 Ang	S21 dB	S21 Ang	S12 dB	S12 Ang	S22 dB	S22 Ang
100	-4.07	176.11	23.805	162.696	-31.49	0.3816	-10.62	179.54
500	-3.168	154.36	20.639	108.6	-30.63	2.108	-8.770	164.09
1000	-2.660	124.21	16.421	66.7556	-29.14	-3.335	-7.815	137.25
1500	-2.673	95.30	13.291	37.077	-27.53	-12.30	-7.601	115.23
2000	-2.835	66.61	11.151	9.186	-25.83	-22.90	-8.033	94.350
2500	-3.238	32.55	9.711	-19.52	-24.37	-40.16	-9.343	70.088
3000	-3.108	-5.552	8.137	-49.49	-23.08	-63.43	-10.36	33.584
3500	-2.733	-42.25	6.121	-78.61	-23.30	-84.36	-9.213	-8.5102
4000	-2.13	-71.93	4.604	-100.97	-22.79	-104.55	-7.32	-41.052

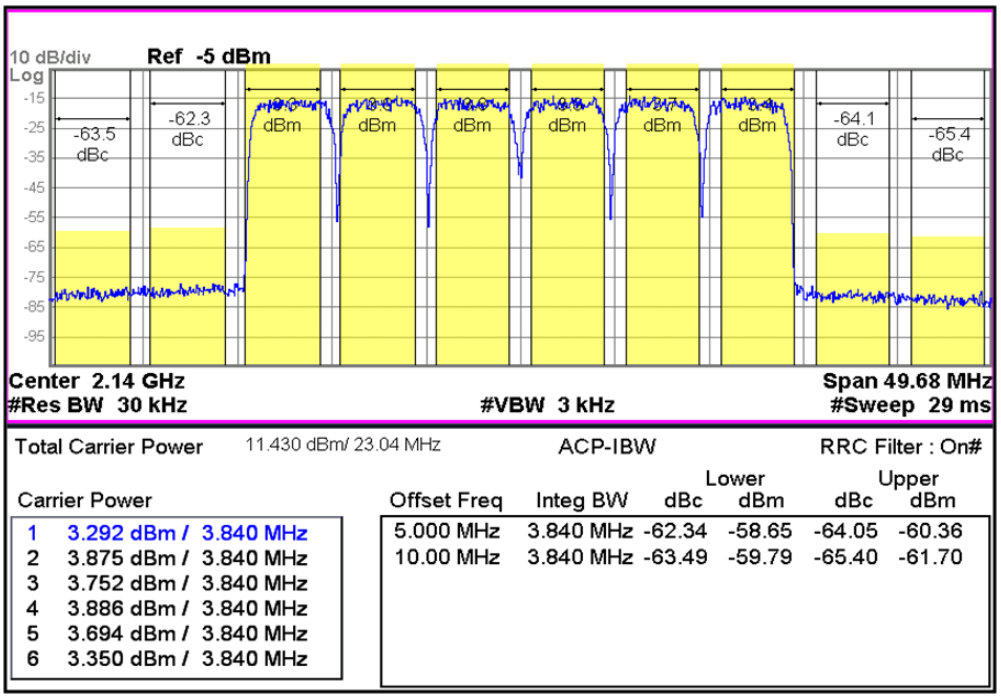
WCDMA 6FA 2140 –55dBc



Total Carrier Power 12.230 dBm/ 23.04 MHz ACP-IBW RRC Filter : On#

Carrier Power		Offset Freq	Integ BW	Lower dBc	Lower dBm	Upper dBc	Upper dBm
1	4.153 dBm / 3.840 MHz	5.000 MHz	3.840 MHz	-55.78	-51.08	-57.48	-52.78
2	4.517 dBm / 3.840 MHz	10.00 MHz	3.840 MHz	-57.17	-52.47	-58.90	-54.20
3	4.507 dBm / 3.840 MHz						
4	4.744 dBm / 3.840 MHz						
5	4.701 dBm / 3.840 MHz						
6	4.029 dBm / 3.840 MHz						

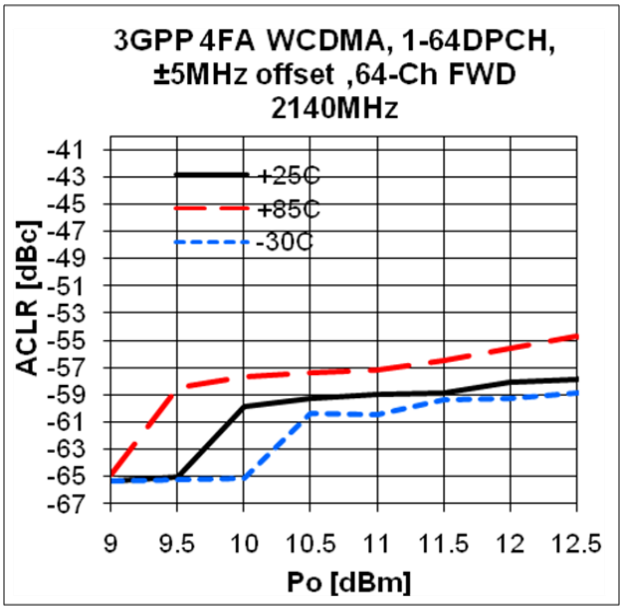
WCDMA 6FA 2140 –60dBc



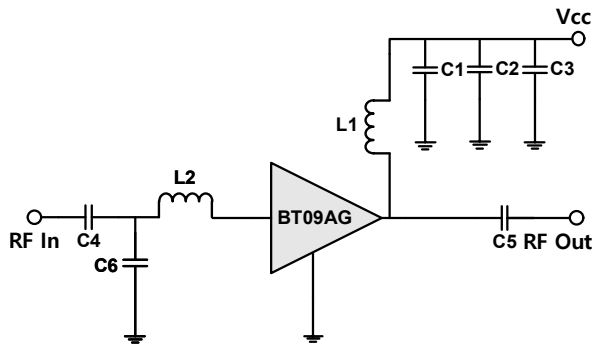
Total Carrier Power 11.430 dBm/ 23.04 MHz ACP-IBW RRC Filter : On#

Carrier Power		Offset Freq	Integ BW	Lower dBc	Lower dBm	Upper dBc	Upper dBm
1	3.292 dBm / 3.840 MHz	5.000 MHz	3.840 MHz	-62.34	-58.65	-64.05	-60.36
2	3.875 dBm / 3.840 MHz	10.00 MHz	3.840 MHz	-63.49	-59.79	-65.40	-61.70
3	3.752 dBm / 3.840 MHz						
4	3.886 dBm / 3.840 MHz						
5	3.694 dBm / 3.840 MHz						
6	3.350 dBm / 3.840 MHz						

ACLR



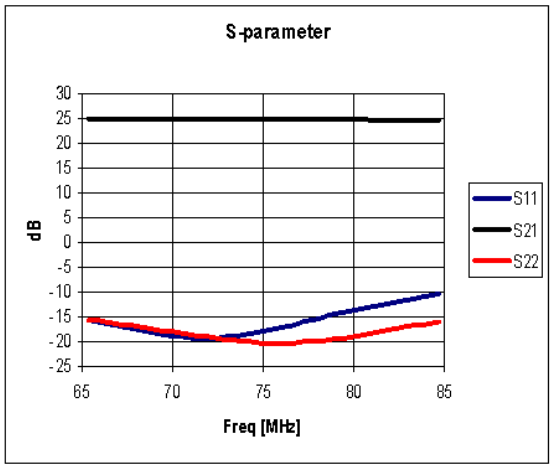
Application Circuit: 70~500 MHz

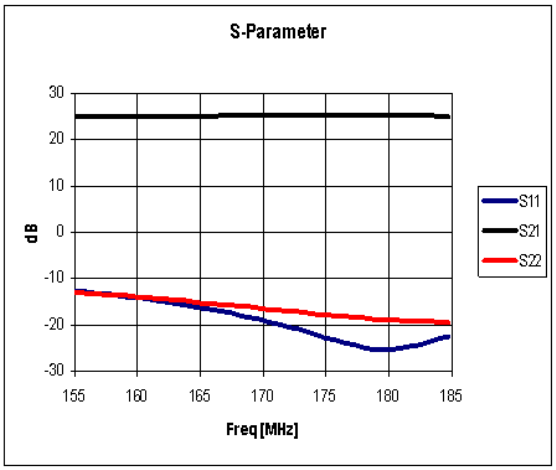


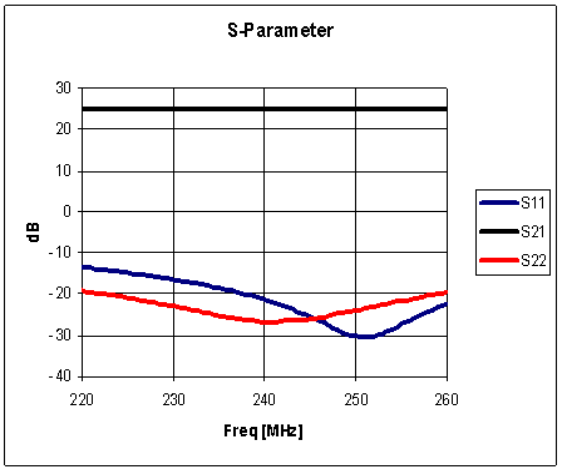
Schematic Diagram	BOM	70MHz	170MHz	240MHz	500MHz
	C1	100pF	100pF	100pF	100pF
	C2	100pF	100pF	100pF	100pF
	C3	10uF	10uF	10uF	10uF
	C4	8200pF	8200pF	8200pF	8200pF
	C5	8200pF	8200pF	8200pF	8200pF
	C6	86pF	33pF	22pF	10pF
	L1	330nH	100nH	100nH	100nH
	L2	47nH	18nH	12nH	4.7nH

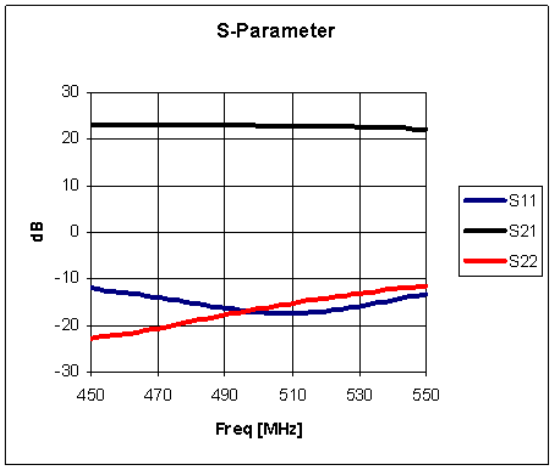
Typical Performance

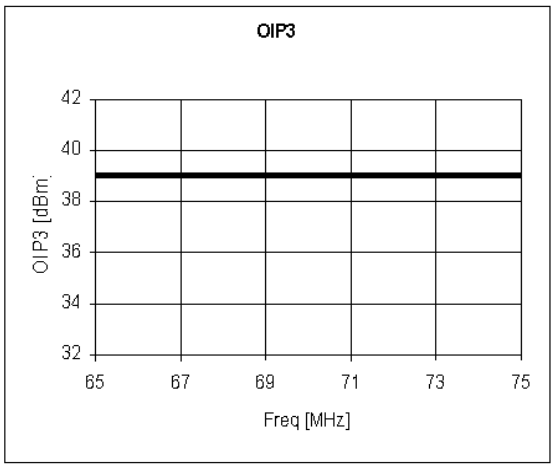
(Vc=5V, Ic=160mA, T=25°C)

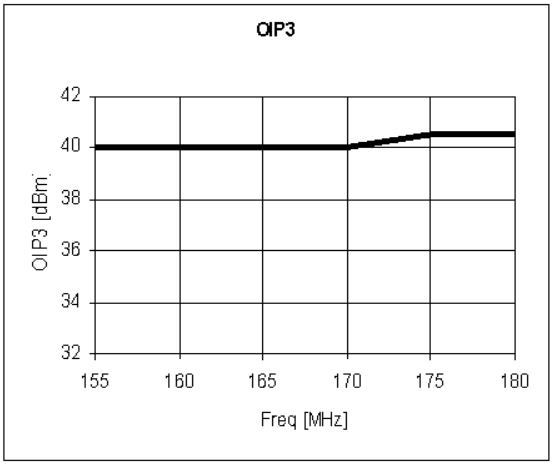


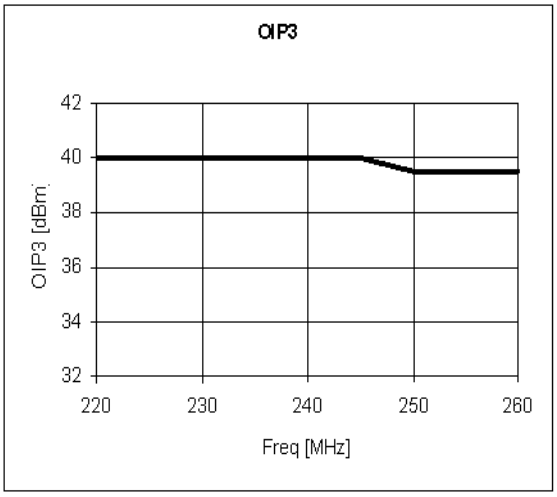


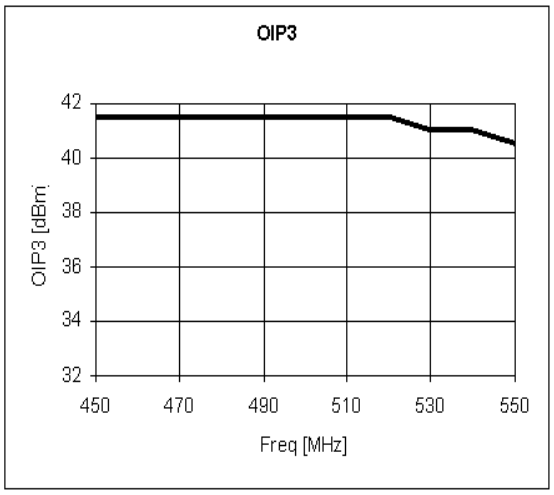




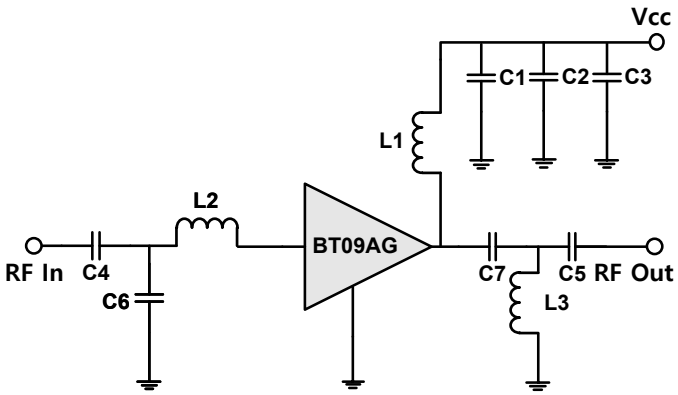




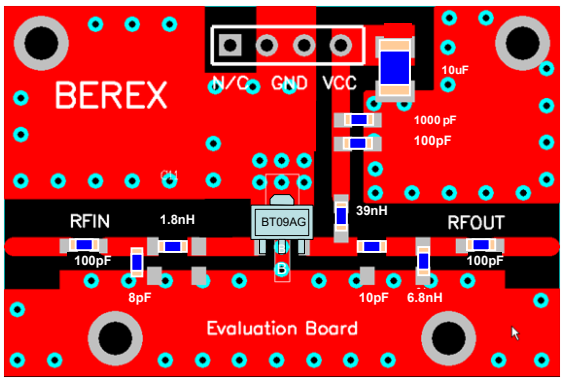




Application Circuit: 900 MHz



Schematic Diagram	BOM		Tolerance
	C1	100pF	±5%
	C2	1000pF	±5%
	C3	10uF	±20%
	C4	100pF	±5%
	C5	100pF	±5%
	C6	8pF	±5%
	C7	10pF	±5%
	L1	39nH	±5%
	L2	1.8nH	±5%
	L3	6.8nH	±5%



Note: 1. PCB: 31mil thick FR4.

2. Distance between the center of the series inductor (L2) and the input pin of BT09AG _ ***2.5mm.***

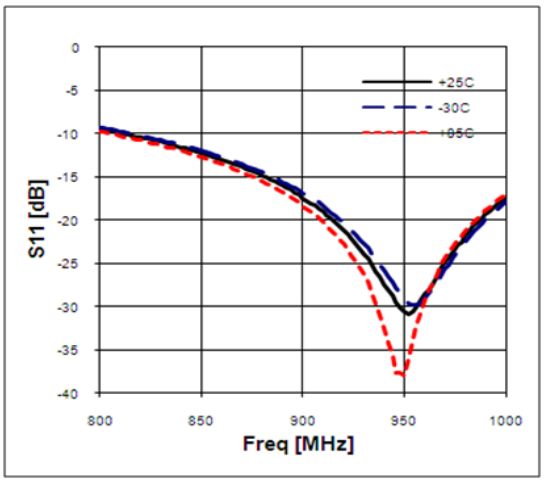
3. Distance between the center of the shunt cap(C6) and the input pin of BT09AG _ ***3.5mm.***

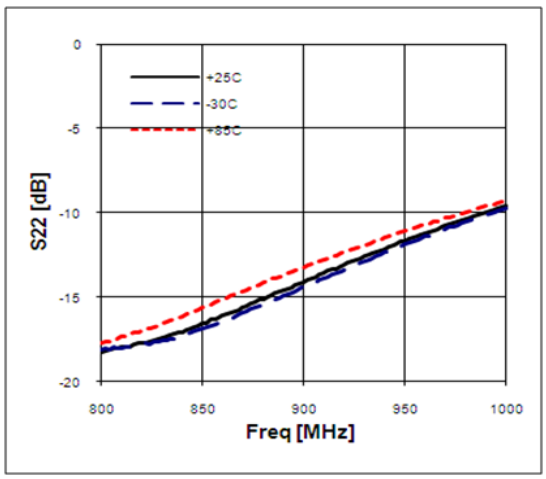
4. Distance between the center of the series cap(C7) and the output pin of BT09AG _ ***3.5mm.***

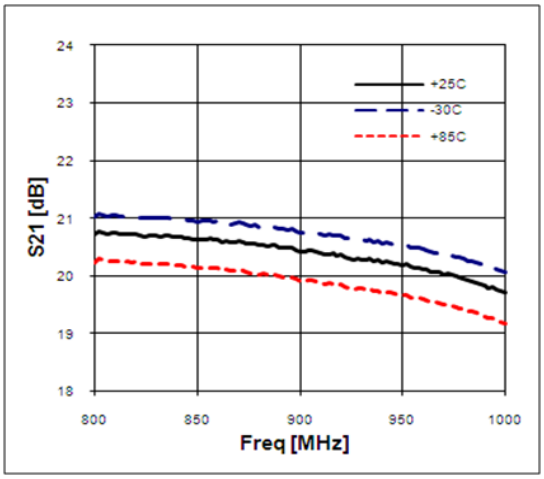
5. Distance between the center of the shunt inductor (L3) and the output pin of BT09AG _ ***6.0mm.***

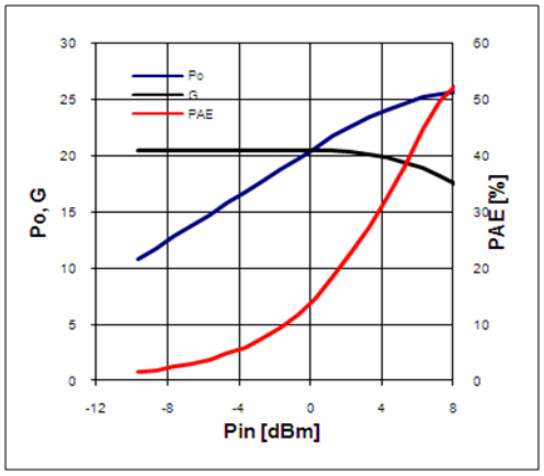
Typical Performance

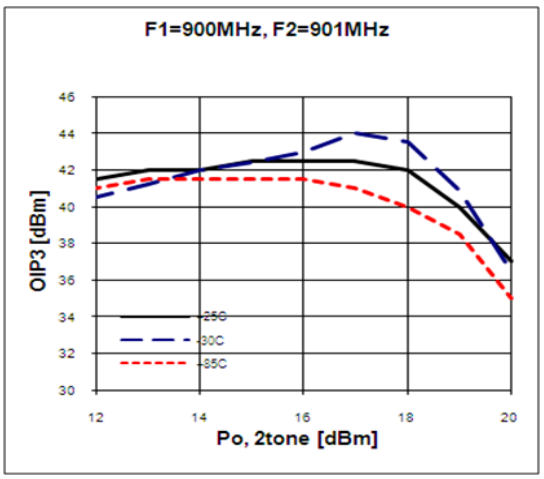
(Vc=5V, Ic=160mA, T=25°C)

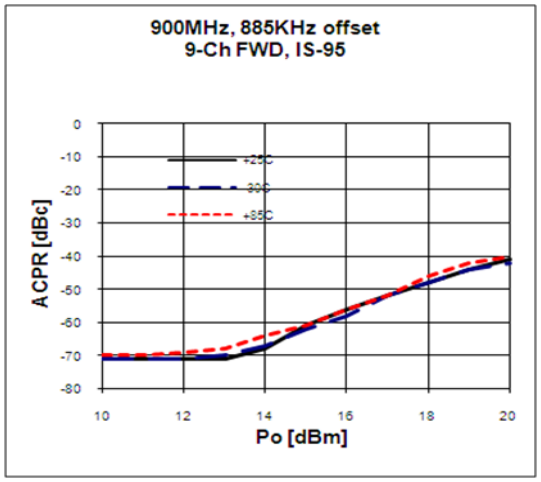




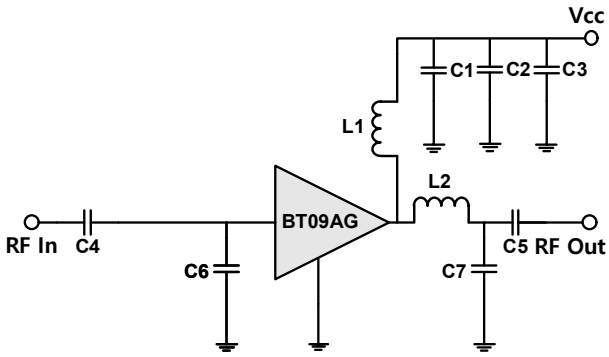


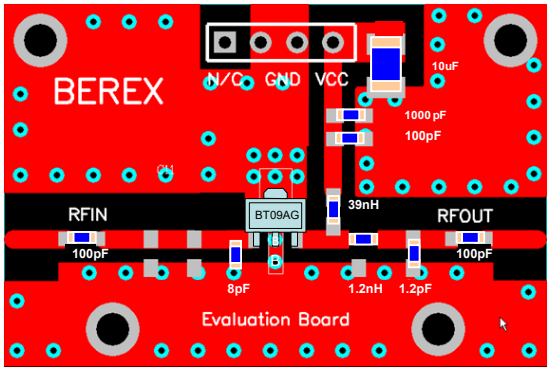






Application Circuit: 1900MHz

Schematic Diagram	BOM		Tolerance
	C1	100pF	±5%
	C2	1000pF	±5%
	C3	10uF	±20%
	C4	100pF	±5%
	C5	100pF	±5%
	C6	2pF	±5%
	C7	1.2pF	±5%
	L1	39nH	5%
	L2	1.2nH	2%

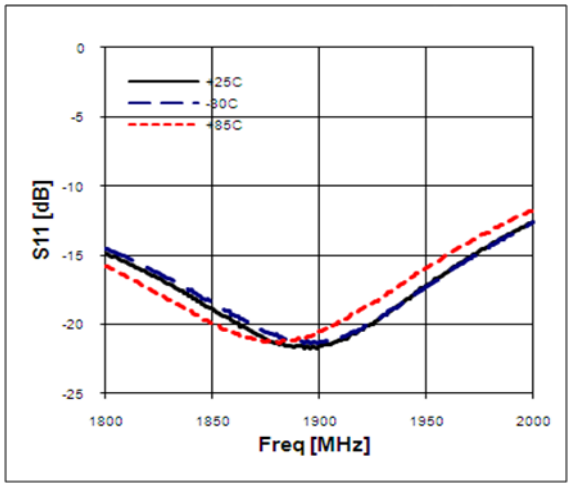


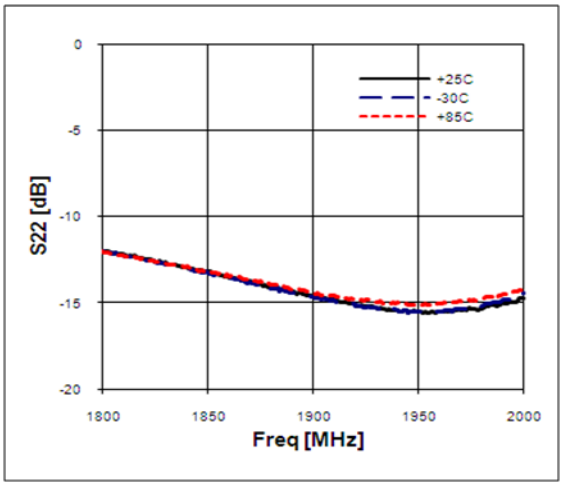
Note:

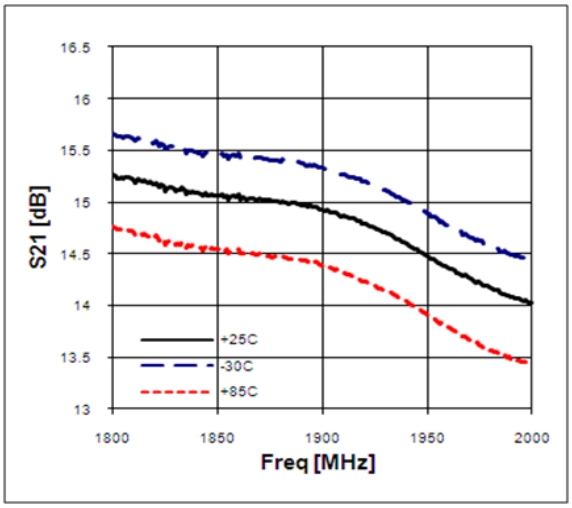
1. PCB: 31mil thick FR4.
2. Distance between the center of the shunt cap(C6) and the input pin of BT09AG _ ***1.0mm.***
3. Distance between the center of the series inductor(L2) and the output pin of BT09AG _ ***3.5mm.***
4. Distance between the center of the shunt cap(C7) and the output pin of BT09AG _ ***7.2mm.***

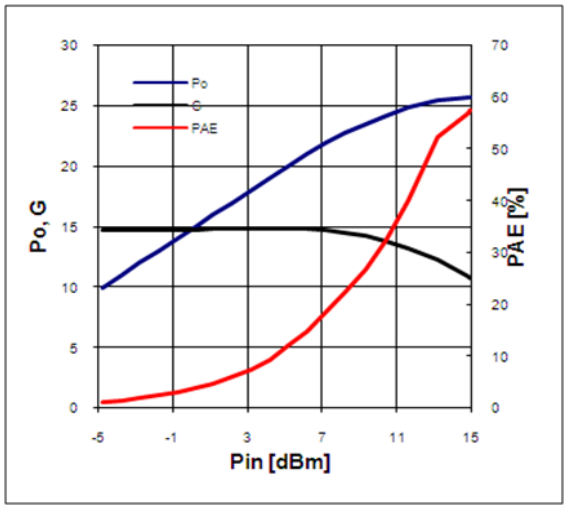
Typical Performance

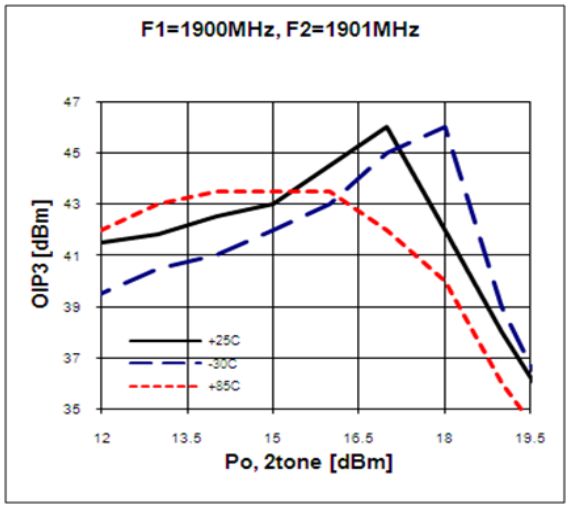
(Vc=5V, Ic=160mA, T=25°C)

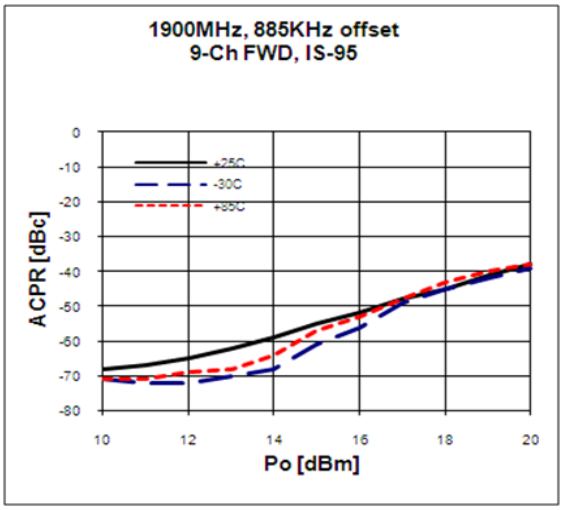




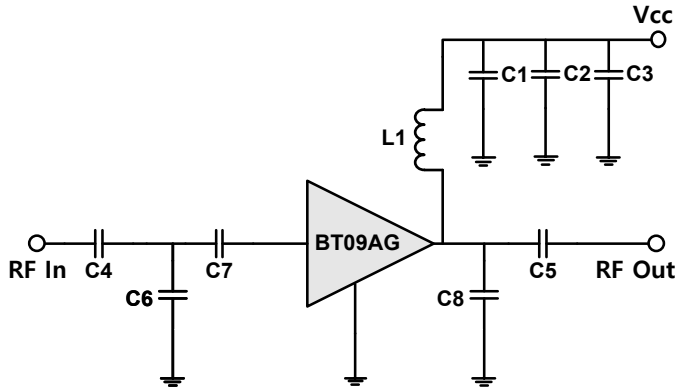


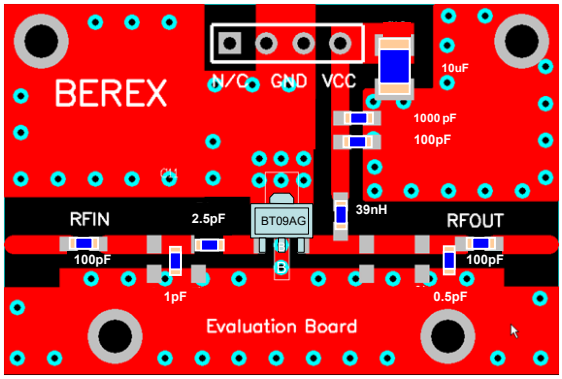






Application Circuit: 2450MHz

Schematic Diagram	BOM		Tolerance
	C1	100pF	±5%
	C2	1000pF	±5%
	C3	10uF	±20%
	C4	100pF	±5%
	C5	100pF	±5%
	C6	1pF	±5%
	C7	2.5pF	±5%
	C8	0.5pF	±5%
	L1	39nH	5%

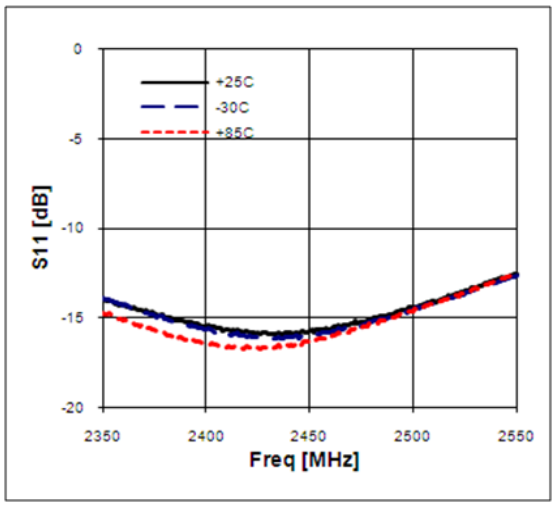


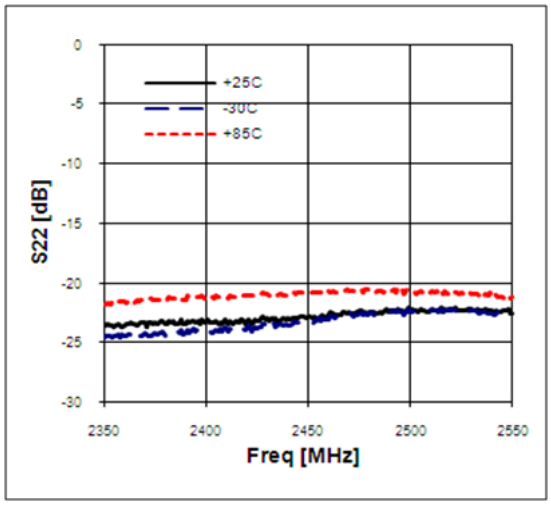
Note:

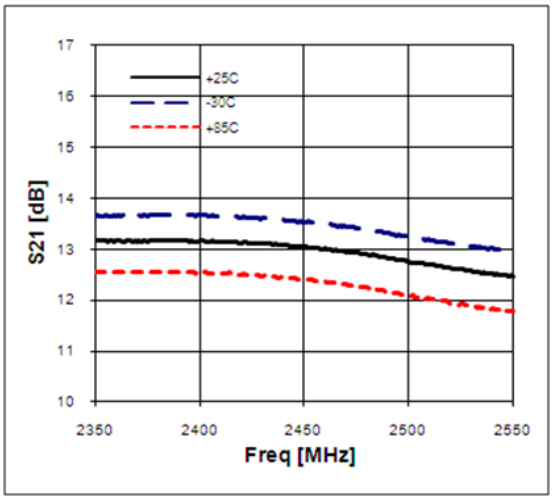
1. PCB: 31mil thick FR4.
2. Distance between the center of the series cap(C7) and the input pin of BT09AG _ ***2.5mm.***
3. Distance between the center of the shunt cap(C6) and the input pin of BT09AG _ ***3.5mm.***
4. Distance between the center of the shunt cap(C8) and the output pin of BT09AG _ ***9.0mm.***

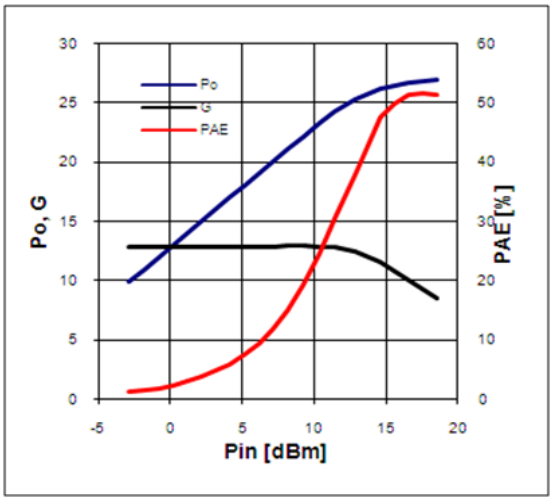
Typical Performance

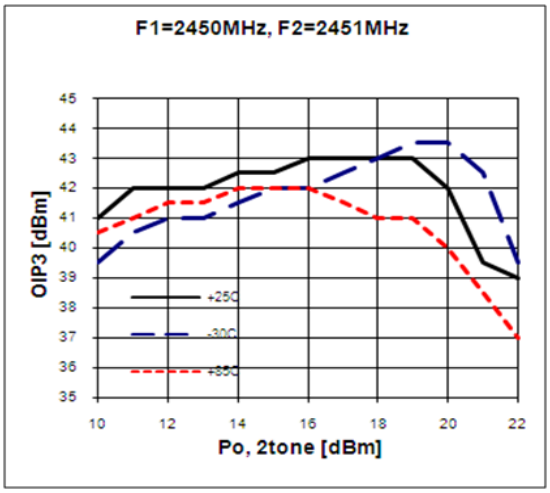
(Vc=5V, Ic=160mA, T=25°C)





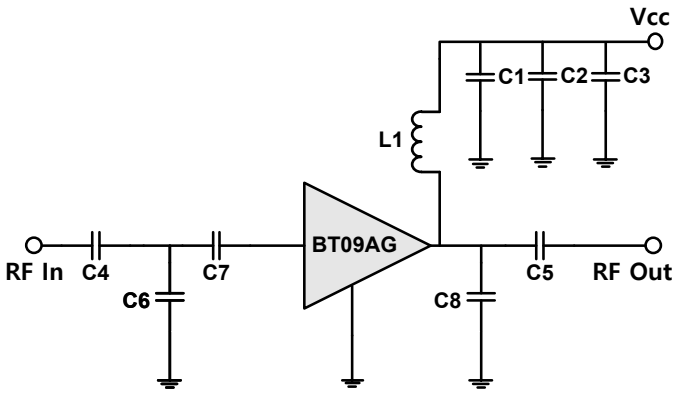




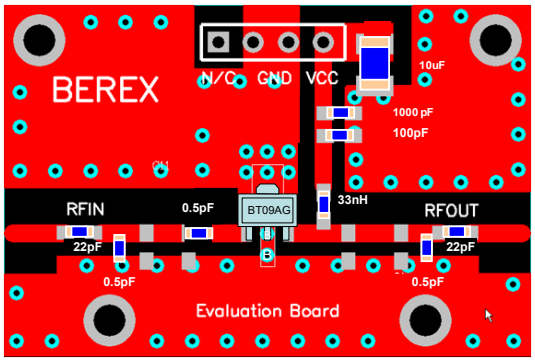


Application Circuit: 3500MHz

Schematic Diagram



BOM		Tolerance
C1	100pF	±5%
C2	1000pF	±5%
C3	10uF	±20%
C4	22pF	±5%
C5	22pF	±5%
C6	0.5pF	±5%
C7	0.5pF	±5%
C8	0.5pF	±5%
L1	33nH	±5%

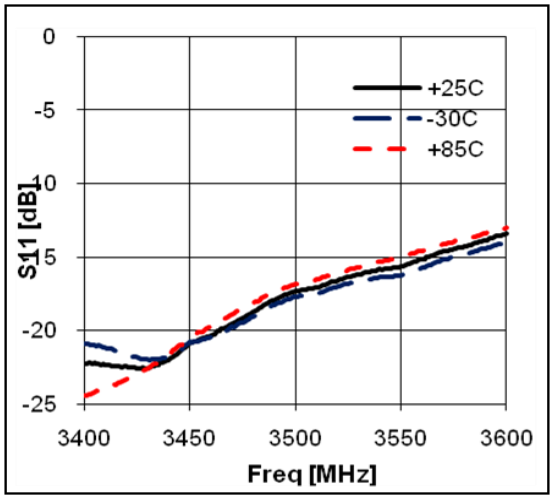


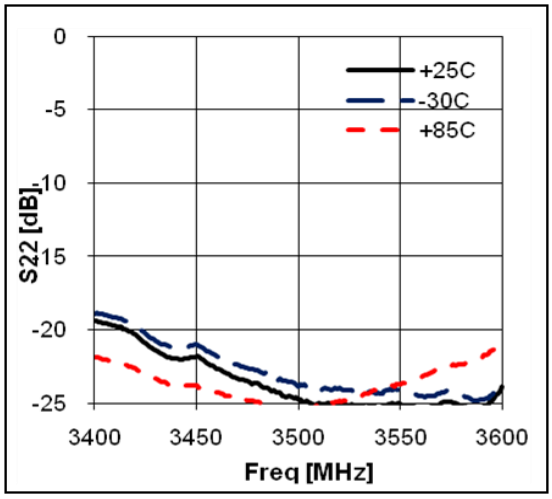
Note:

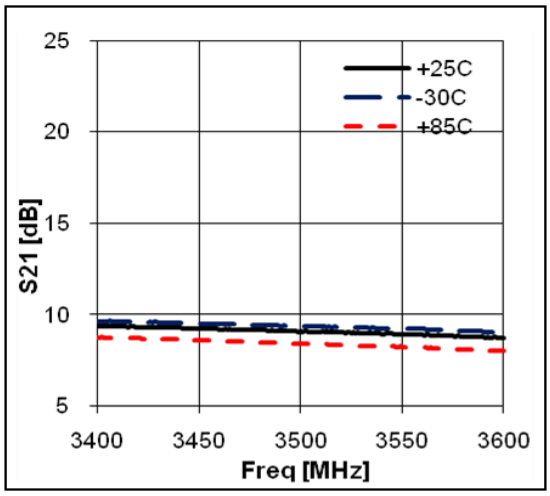
1. PCB: 31mil thick FR4.
2. Distance between the center of the series cap(C7) and the input pin of BT09AG _ ***2.5mm.***
3. Distance between the center of the shunt cap(C6) and the input pin of BT09AG _ ***9.2mm.***
4. Distance between the center of the shunt cap(C8) and the output pin of BT09AG _ ***8.0mm.***

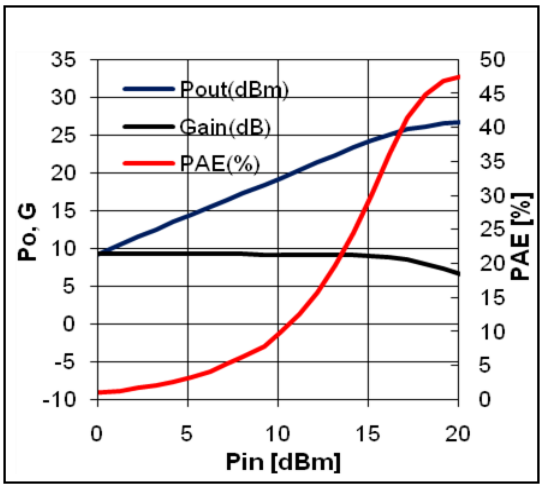
Typical Performance

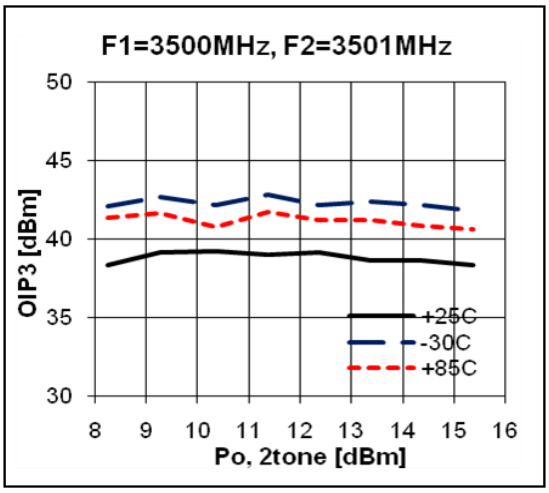
(Vc=5V, Ic=160mA, T=25°C)



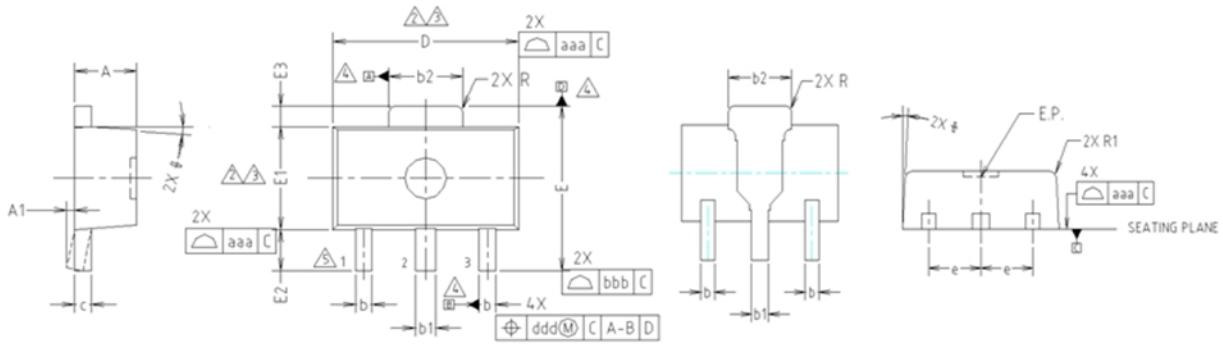








Package Outline Dimension



NOTE:

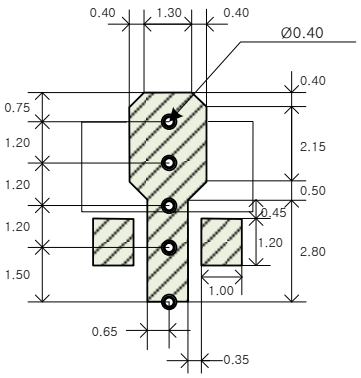
1. DIMENSIONS IN MILLIMETERS.
2. DIMENSION D DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.5mm PER END. DIMENSION E1 DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.5mm PER SIDE.
3. DIMENSIONS D AND E1 ARE DETERMINED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY EXCLUSIVE OF MOLD FLASH, TIE BAR BURRS, GATE BURRS AND INTERLEAD FLASH, BUT INCLUDING ANY MISMATCH BETWEEN THE TOP AND BOTTOM OF THE PLASTIC BODY.
4. DATUMS A, B AND D TO BE DETERMINED 0.18mm FROM THE LEAD TIP.
5. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.

SYMBOL	MILLIMETERS			NOTE
	MINIMUM	NOMINAL	MAXIMUM	
A	1.40	1.50	1.60	
A1	0.00	–	0.10	
b	0.38	0.42	0.48	
b1	0.48	0.52	0.58	
b2	1.79	1.82	1.87	
c	0.40	0.42	0.46	
D	4.40	4.50	4.70	2,3
E	3.70	4.00	4.30	
E1	2.40	2.50	2.70	2,3
E2	0.80	1.00	1.20	
E3	0.40	0.50	0.60	
e	1.50 TYP.			
θ	4° TYP.			
R	0.15 TYP.			
R1	–	–	0.20	

SYMBOL	TOLERANCES OF FORM AND POSITION	NOTE
aaa	0.15	
bbb	0.20	
ccc	0.10	
ddd	0.10	

Suggested PCB Land Pattern and PAD Layout

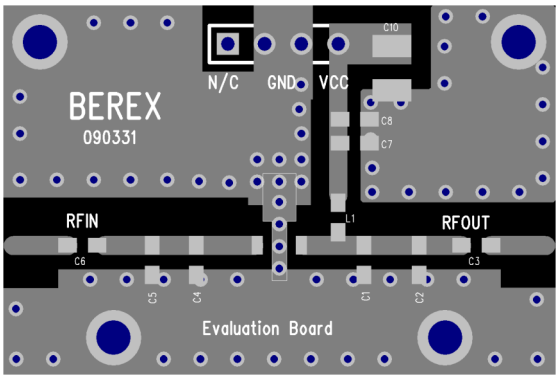
PCB Land Pattern



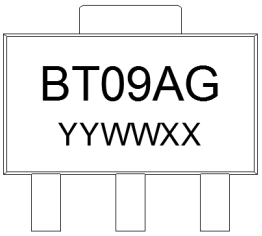
Note : All dimension are in millimeters

PCB lay out _ on BeRex website

PCB Mounting



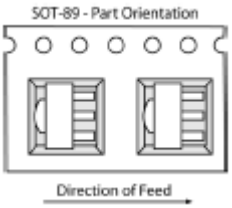
Package Marking



YY = Year, WW = Working Week,
XX = Wafer No.

Tape & Reel

SOT89



Packaging information:

Tape Width (mm): 12

Reel Size (inches): 7

Device Cavity Pitch (mm): 8

Devices Per Reel: 1000

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 1B
Value:	**Passes <1000V**
Test:	Human Body Model (HBM)
Standard:	JEDEC Standard JESD22-A114
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.

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**