

### Device Features

- Low Noise Figure: NF = 1.1 @ 1900MHz
- High Linearity: OIP3 = 35.5 dBm @ 1900 MHz
- Output P1 dB = 22 dBm @ 1900 MHz
- Gain = 19 dB @ 1900 MHz
- Internally matched to 50 ohms
- 5V/70mA, MTTF > 100 Years, MSL 1, Class 1A
- RoHS2-compliant SOT-89 SMT package



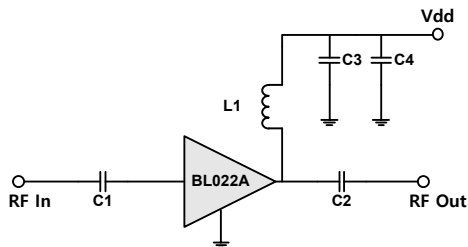
### Product Description

The BL022A is a high performance, wideband, LNA GaAs E-pHEMT gain block that is ideal for applications demanding low noise and high linearity in a wideband of 50-6000 MHz. The BL022A is internally matched to 50 Ohms and requires no external matching components. It is available in RoHS2-compliant, SOT-89 SMT package and has a Class 1A ESD rating (HBM) These devices are 100% DC and RF tested to assure quality and performance.

### Applications

- Base station Infrastructure/RFID
- Commercial/Industrial

### Applications Circuit



BOM	50~500MHz	0.7~1GHz	1.7~2.2GHz	2.5~3GHz	3.4~3.8GHz
C1	1nF	68pF	47pF	33pF	10pF
C2	1nF	68pF	47pF	33pF	22pF
C3	100pF	100pF	100pF	100pF	100pF
C4	1nF	1nF	1nF	1nF	1nF
L1	680nH	47nH	68nH	27nH	22nH

### 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		6000	MHz
Test Frequency			1900		MHz
Gain		17.5	19.0		dB
Input Return Loss			-24.0		dB
Output Return Loss			-11.0		dB
Output IP3	5 dBm / tone , Δf=1 MHz	32.5	35.5		dBm
Output P1dB		21.0	22.0		dBm
Noise Figure			1.5	1.7	dB

\* NF : Losses on input and output transmission lines on PCB are not de-embedded.

### Recommended Operating Conditions

Parameter	Min	Typ	Max	Unit
Bandwidth	50		6000	MHz
I <sub>d</sub> @ (V <sub>d</sub> = 5V)	56	70	84	mA
V <sub>d</sub>	4.75	5.0	5.25	V
dG/dT		-0.009		dB/°C
R <sub>TH</sub>		79.8		°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	+180	°C
Supply Voltage	+7	V
Supply Current	190	mA
Input RF Power	24	dBm

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

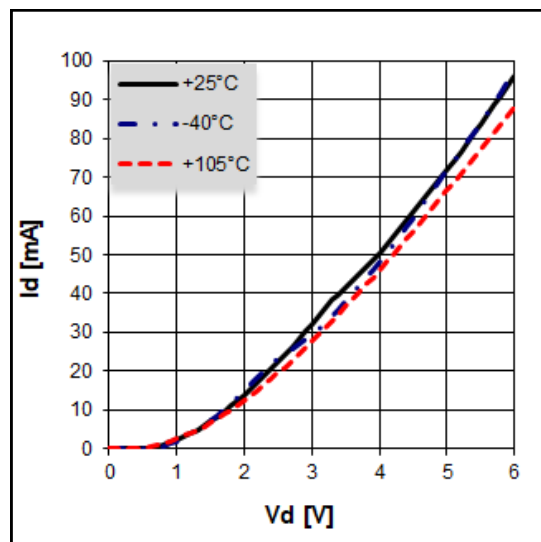
### Typical Performance (Vd=5V, Id=70mA, T=25°C)

Parameter	Frequency						Unit
	70	900	1900	2140	2650	3500	
V <sub>d</sub> = 5V	70	900	1900	2140	2650	3500	MHz
Gain	26.0	23.0	19.0	18.5	17.5	16.0	dB
S11 <sup>1</sup>	-7.5	-18.0	-24.0	-25.0	-13.5	-9.3	dB
S22	-16.0	-15.0	-11.0	-10.0	-11.0	-20.0	dB
OIP3	39.5	36.5	35.5	35.0	34.0	31.5	dBm
P1dB	20.3	22.0	22.0	22.0	22.0	21.0	dBm
Noise Figure	1.60	1.35	1.50	1.55	1.80	2.10	dB

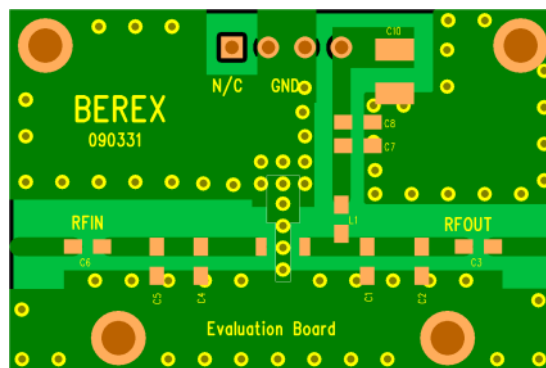
<sup>1</sup> S11 can be improved by a shunt capacitor. (refer to application circuits)

\* NF : Losses on input and output transmission lines on PCB are not de-embedded.

### V-I Characteristics



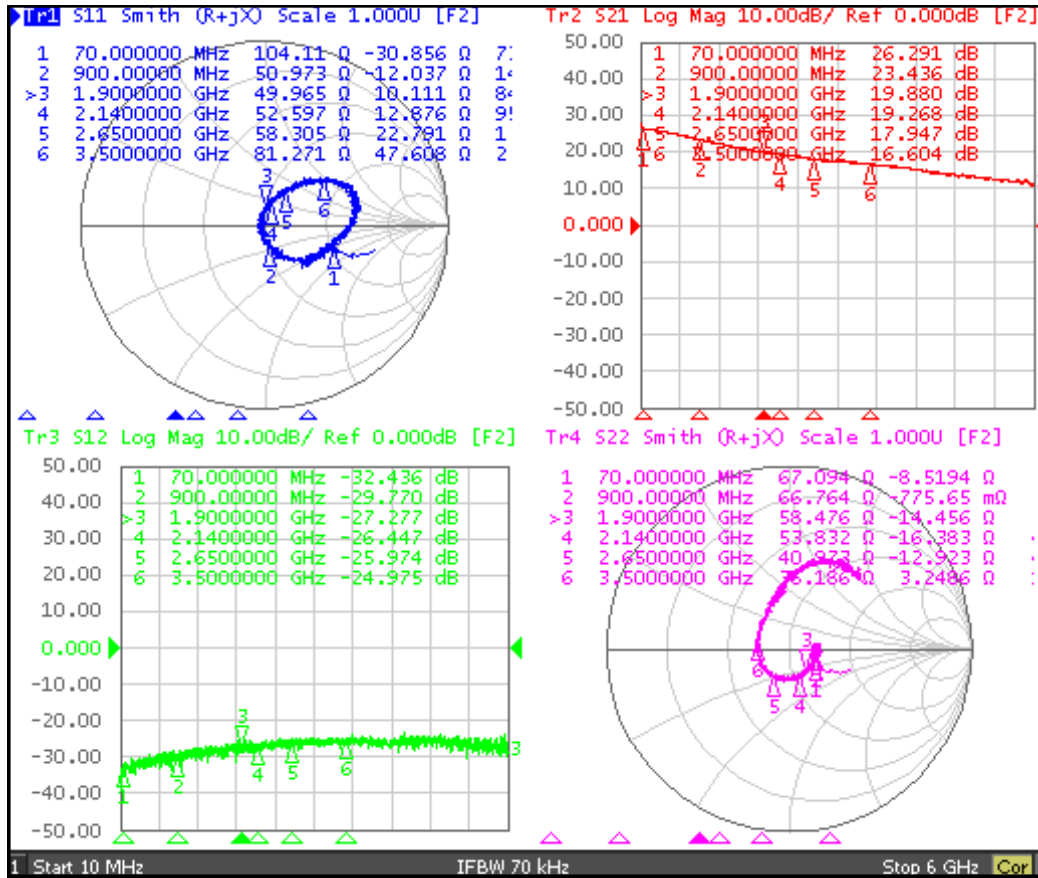
### BeRex SOT89 Evaluation Board



\*Dielectric constant\_ 4.2 \*31mil thick FR4 PCB

### Typical Device Data

S-parameters ( $V_d=5V, I_d=70mA, T=25^\circ C$ )

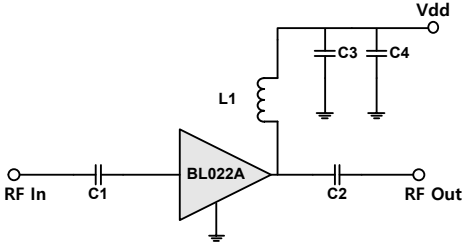


### S-Parameter

( $V_{device} = 5.0V, I_d = 70mA, T = 25^\circ C$ , calibrated to device leads)

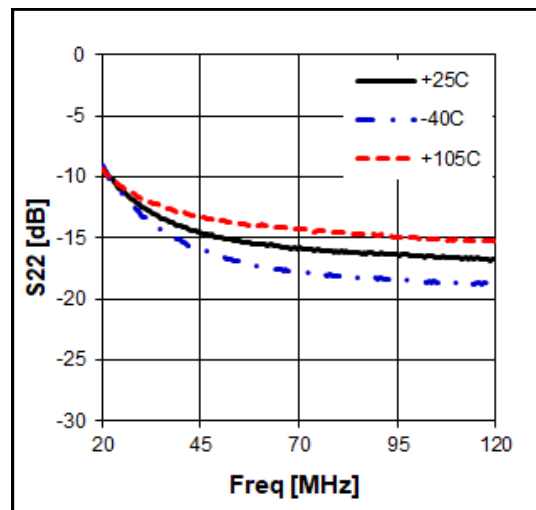
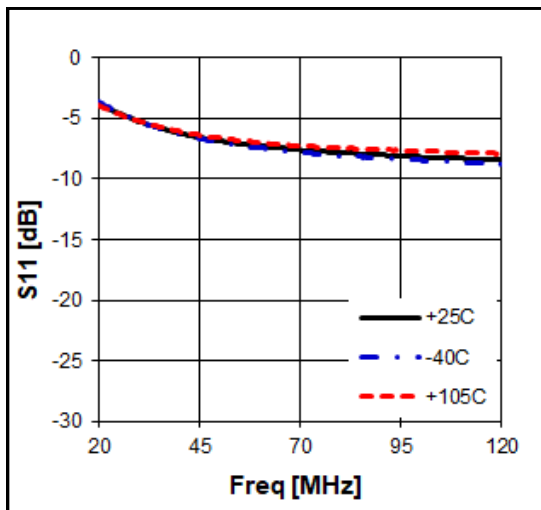
Freq [MHz]	S11	S11	S21	S21	S12	S12	S22	S22
	[Mag]	[Ang]	[Mag]	[Ang]	[Mag]	[Ang]	[Mag]	[Ang]
100	0.39	-19.38	20.55	167.42	0.02	11.98	0.15	-14.89
200	0.34	-26.97	19.95	160.72	0.03	21.38	0.12	-9.49
400	0.29	-43.26	18.63	145.13	0.02	11.52	0.14	-1.61
1200	0.05	-116.50	13.04	95.26	0.04	14.81	0.14	-12.87
2000	0.11	79.67	9.68	57.99	0.04	4.73	0.16	-61.71
2800	0.23	58.65	7.46	20.49	0.05	-17.66	0.21	-115.71
3600	0.43	34.22	6.59	-9.46	0.05	-29.29	0.20	162.43
4400	0.51	14.44	5.43	-44.47	0.05	-46.41	0.28	102.49
5200	0.41	-10.03	4.51	-79.65	0.05	-80.46	0.46	79.17
6000	0.32	-45.78	3.63	-115.93	0.04	-136.64	0.56	45.62

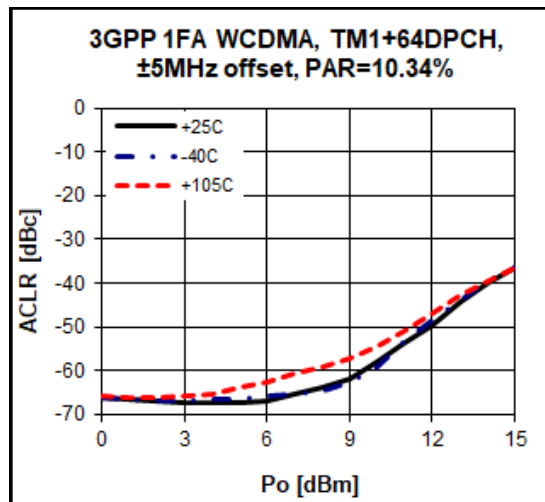
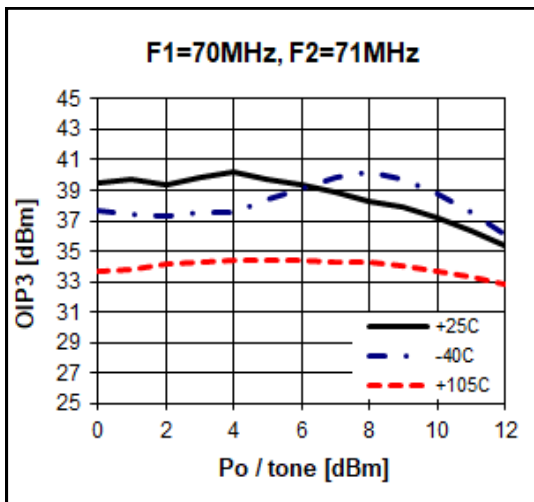
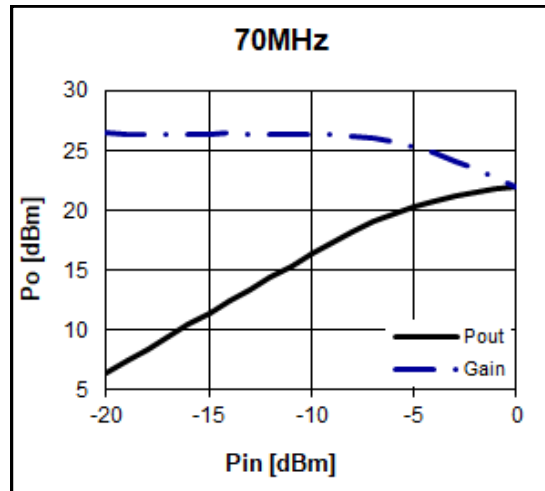
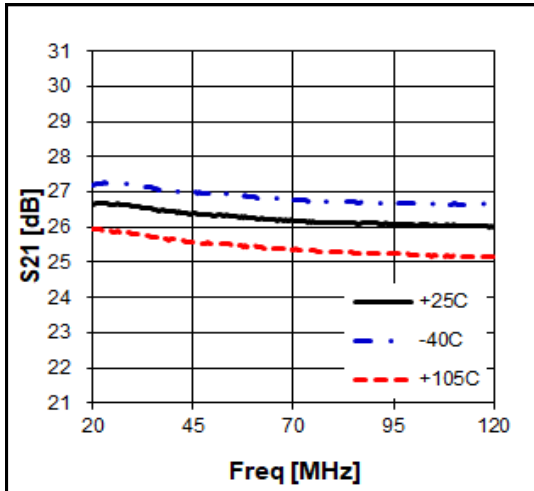
### Application Circuit: 70 MHz

Schematic Diagram		BOM	Tolerance
		C1	1nF ± 5%
		C2	1nF ± 5%
		C3	100pF ± 5%
		C4	1nF ± 5%
		L1	680nH ± 5%

### Typical Performance

(Vd=5V, Id=70mA, T=25°C)





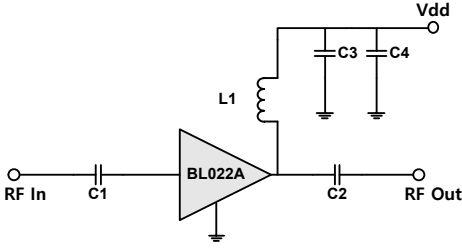
### Noise Figure Temperature Performance

(V<sub>ds</sub> = 5.0V, I<sub>ds</sub> = 70mA)

Freq	MHz	70	900	1900	2140	2650	3500
Temp [°C]	-40	1.55	1.20	1.40	1.45	1.60	1.80
	25	1.60	1.35	1.50	1.55	1.80	2.10
	105	1.70	1.40	1.80	1.85	2.00	2.50

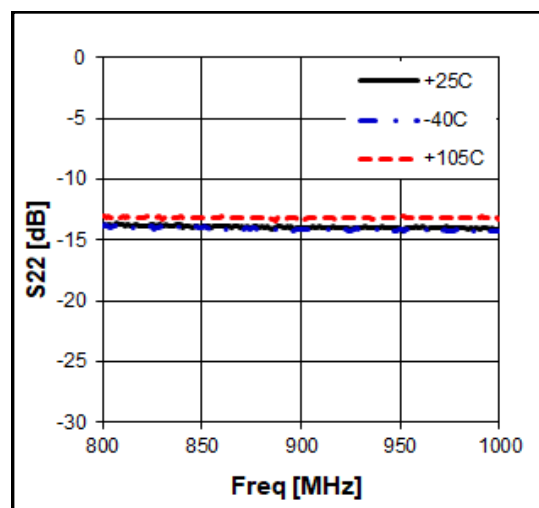
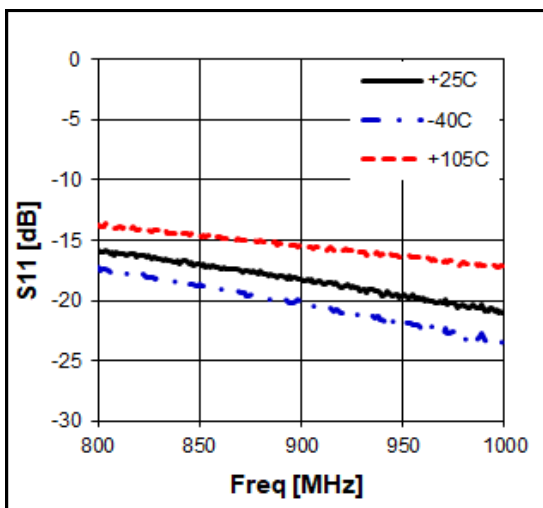
\* NF : Losses on input and output transmission lines on PCB are not de-embedded.

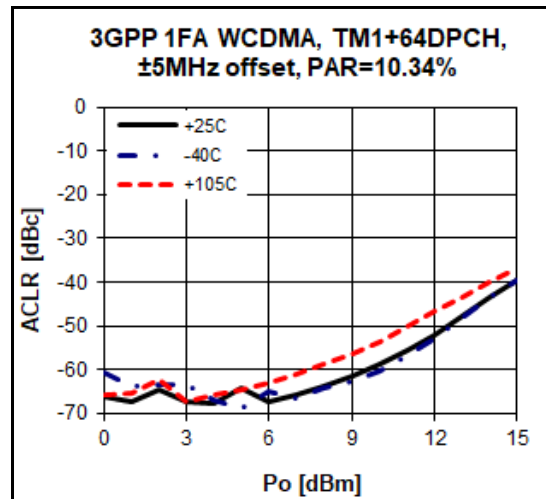
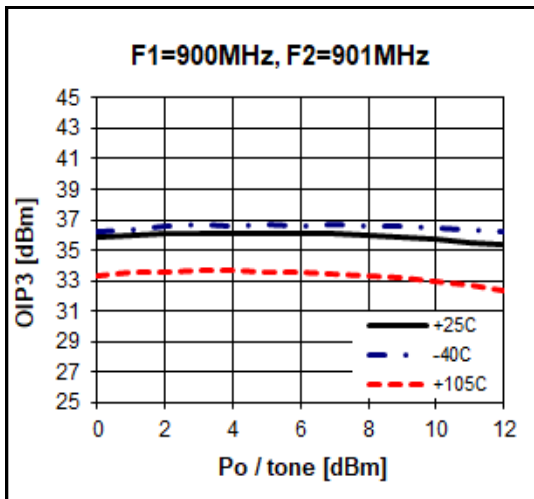
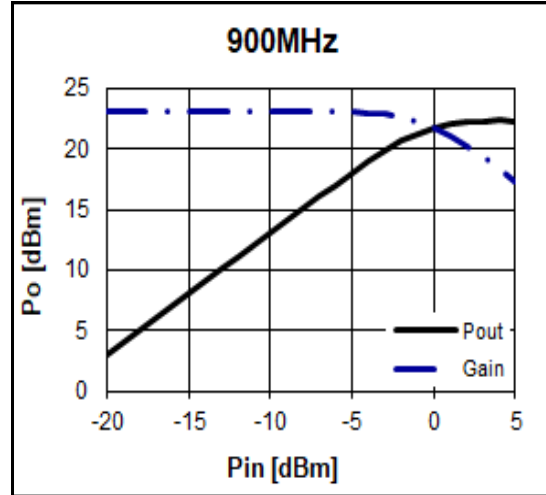
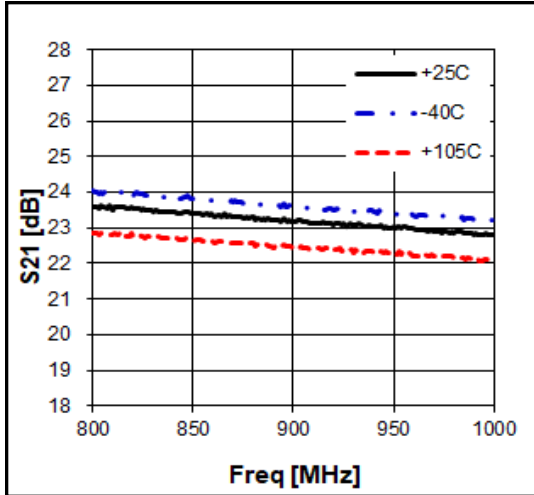
### Application Circuit: 900 MHz

Schematic Diagram		BOM	Tolerance
		C1	68pF ± 5%
		C2	68pF ± 5%
		C3	100pF ± 5%
		C4	1nF ± 5%
		L1	47nH ± 5%

### Typical Performance

(Vd=5V, Id=70mA, T=25°C)





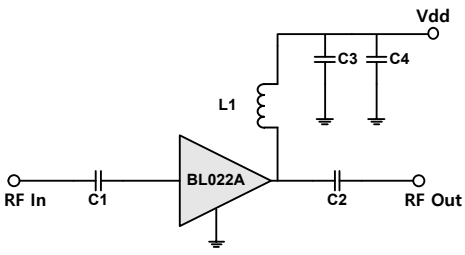
### Noise Figure Temperature Performance

(V<sub>ds</sub> = 5.0V, I<sub>ds</sub> = 70mA)

Freq	MHz	70	900	1900	2140	2650	3500
Temp [°C]	-40	1.55	1.20	1.40	1.45	1.60	1.80
	25	1.60	1.35	1.50	1.55	1.80	2.10
	105	1.70	1.40	1.80	1.85	2.00	2.50

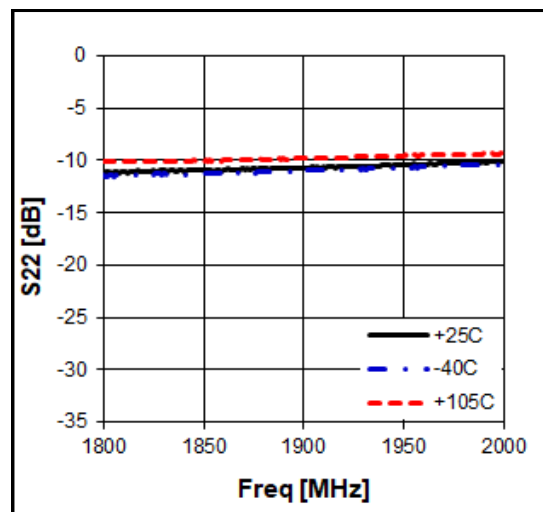
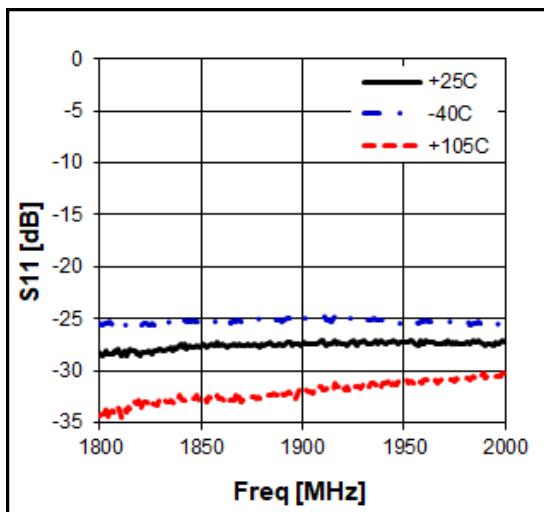
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### Application Circuit: 1900 MHz

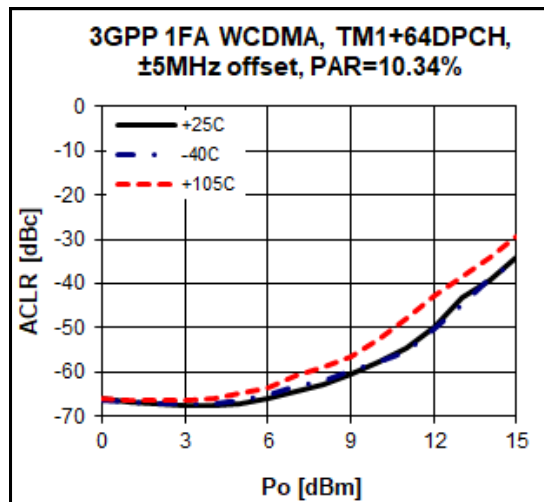
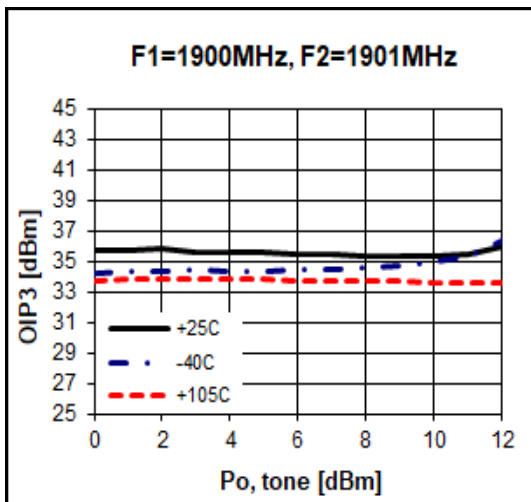
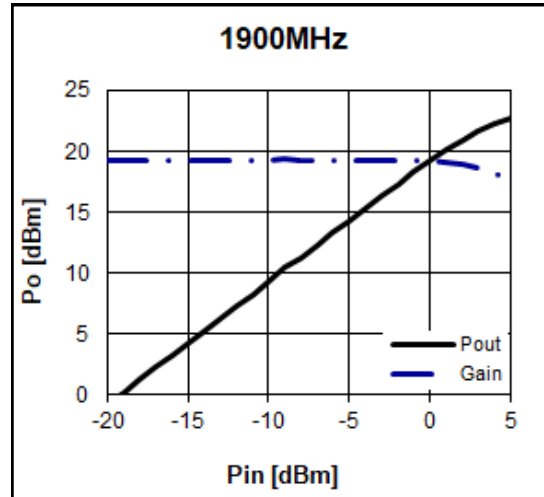
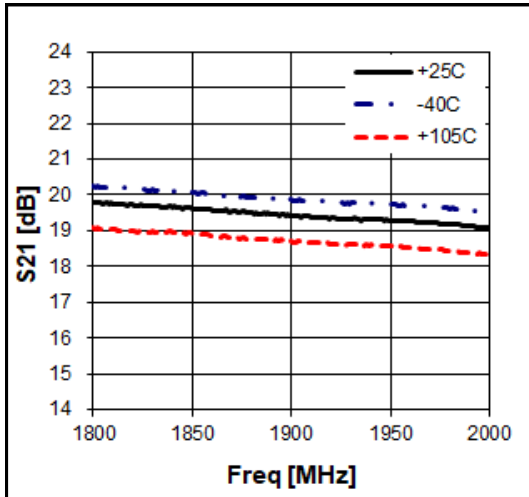
Schematic Diagram		BOM	Tolerance
	C1	47pF	± 20%
	C2	47pF	± 5%
	C3	100pF	±5%
	C4	1nF	±5%
	L1	68nH	±5%

### Typical Performance

(Vd=5V, Id=70mA, T=25°C)







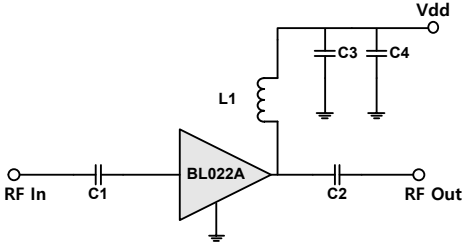
### Noise Figure Temperature Performance

(Vds = 5.0V, Ids = 70mA)

Freq	MHz	70	900	1900	2140	2650	3500
Temp [°C]	-40	1.55	1.20	1.40	1.45	1.60	1.80
	25	1.60	1.35	1.50	1.55	1.80	2.10
	105	1.70	1.40	1.80	1.85	2.00	2.50

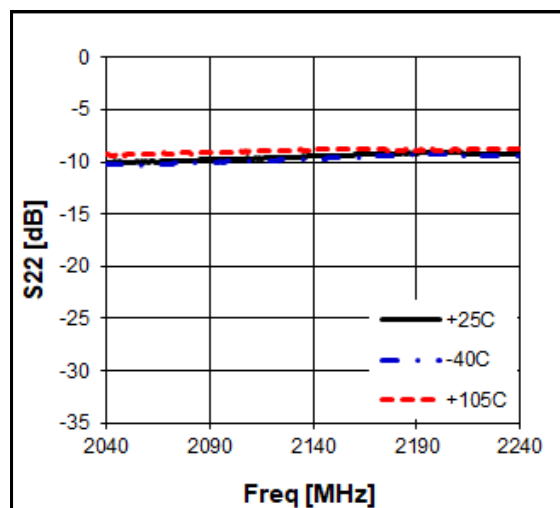
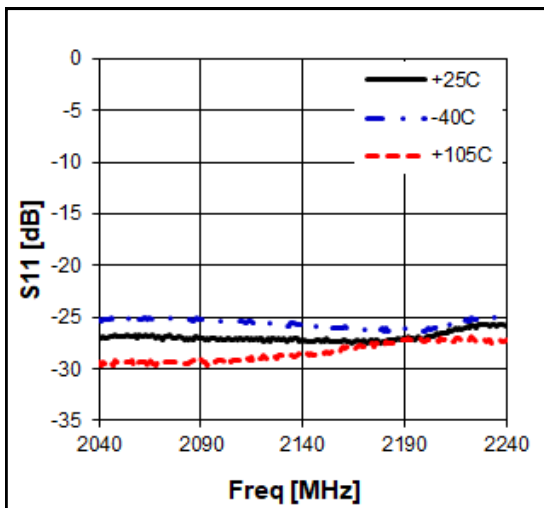
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### Application Circuit: 2140 MHz

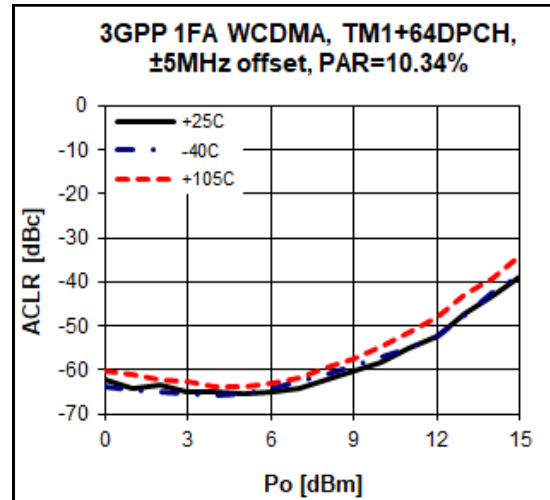
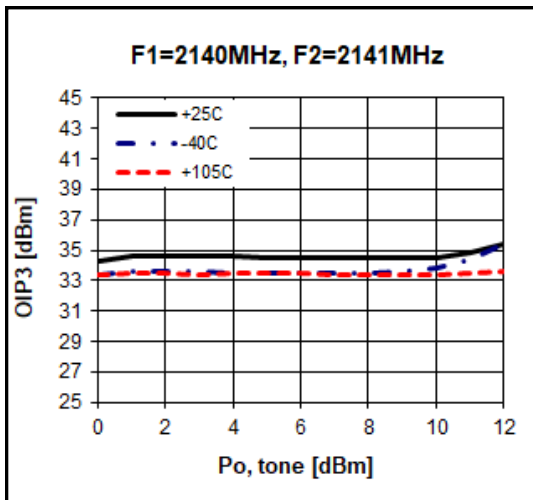
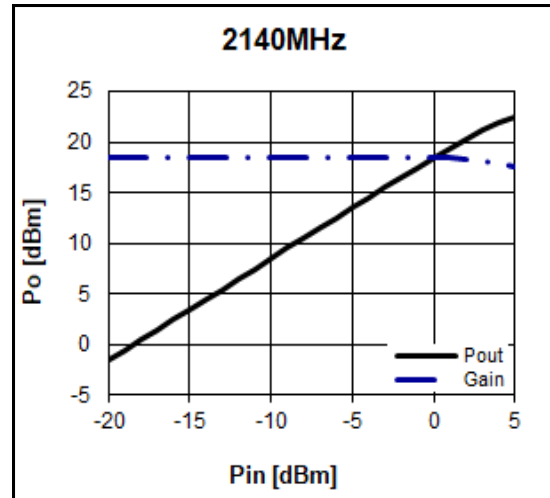
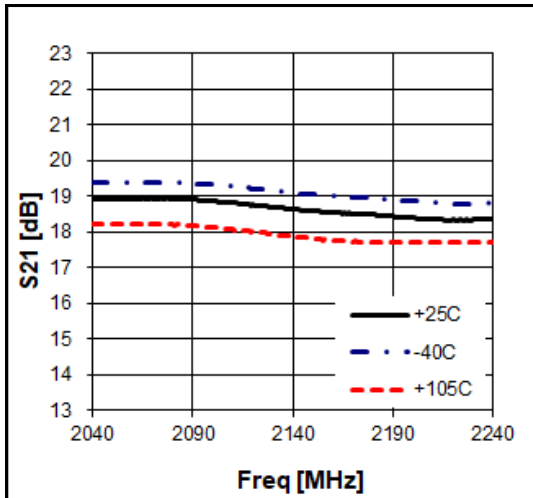
Schematic Diagram		BOM	Tolerance
	C1	47pF	± 5%
	C2	47pF	± 5%
	C3	100pF	± 5%
	C4	1nF	± 5%
	L1	68nH	± 5%

### Typical Performance

(Vd=5V, Id=70mA, T=25°C)



$V_d = 5V, I_d = 70mA$



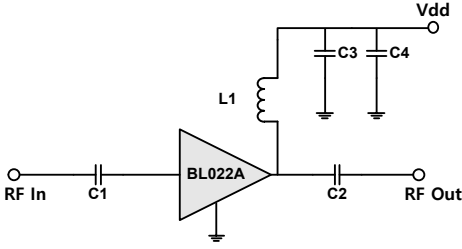
### Noise Figure Temperature Performance

( $V_{ds} = 5.0V, I_{ds} = 70mA$ )

Freq	MHz	70	900	1900	2140	2650	3500
Temp [°C]	-40	1.55	1.20	1.40	1.45	1.60	1.80
	25	1.60	1.35	1.50	1.55	1.80	2.10
	105	1.70	1.40	1.80	1.85	2.00	2.50

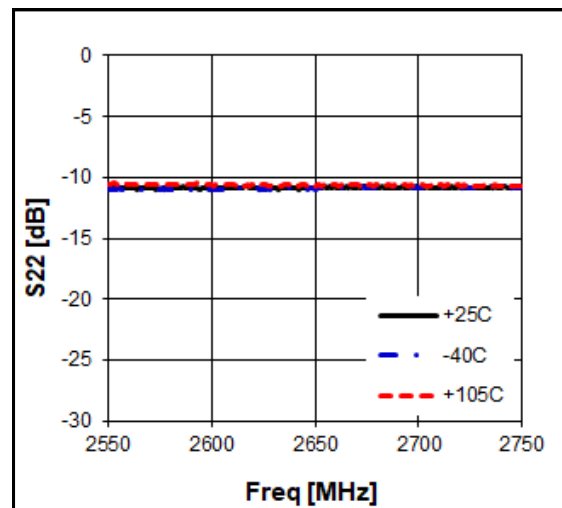
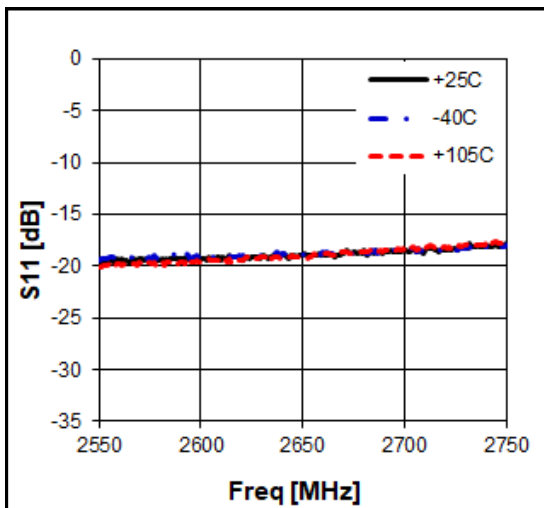
\* NF : Losses on input and output transmission lines on PCB are not de-embedded.

### Application Circuit: 2650 MHz

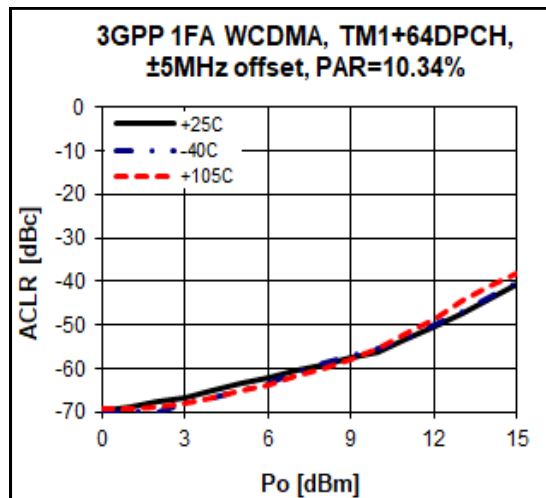
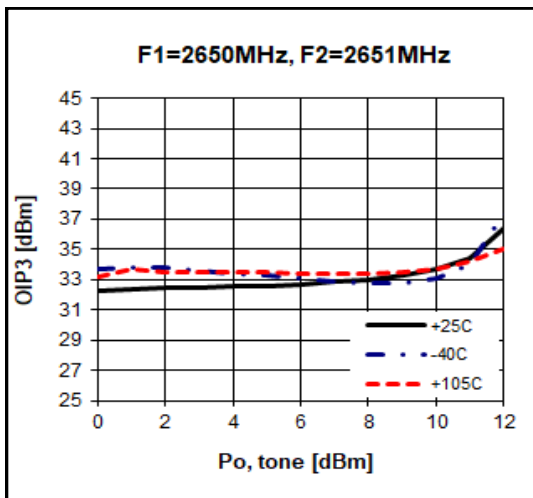
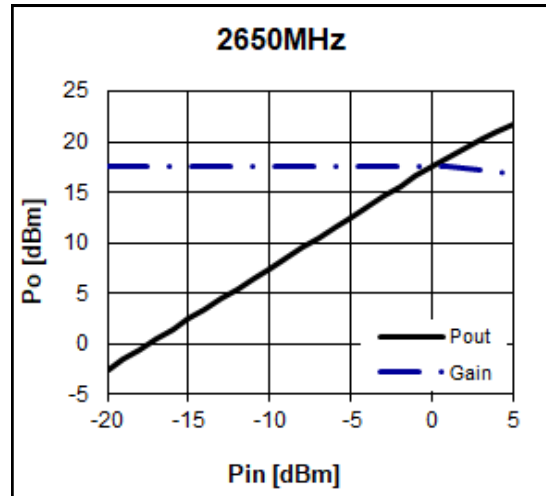
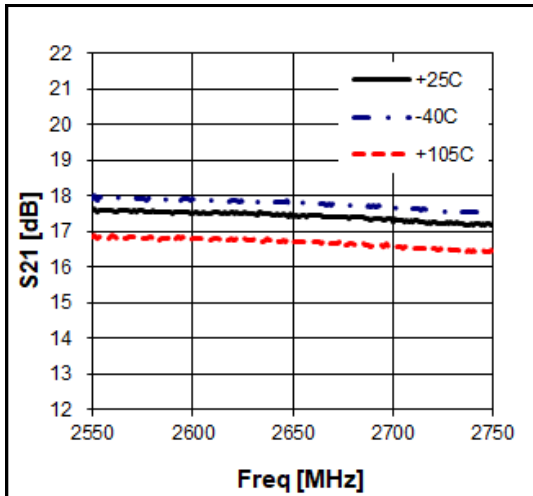
Schematic Diagram		BOM	Tolerance
	C1	33pF	± 5%
	C2	33pF	± 5%
	C3	100pF	± 5%
	C4	1nF	± 5%
	L1	27nH	± 5%

### Typical Performance

(Vd=5V, Id=70mA, T=25°C)



$V_d = 5V, I_d = 70mA$



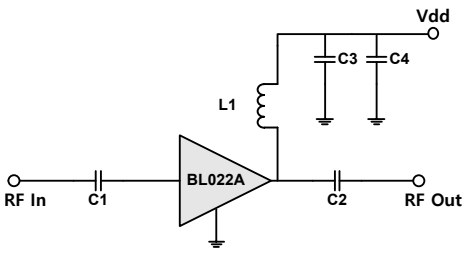
### Noise Figure Temperature Performance

(V<sub>ds</sub> = 5.0V, I<sub>ds</sub> = 70mA)

Freq	MHz	70	900	1900	2140	2650	3500
Temp [°C]	-40	1.55	1.20	1.40	1.45	1.60	1.80
	25	1.60	1.35	1.50	1.55	1.80	2.10
	105	1.70	1.40	1.80	1.85	2.00	2.50

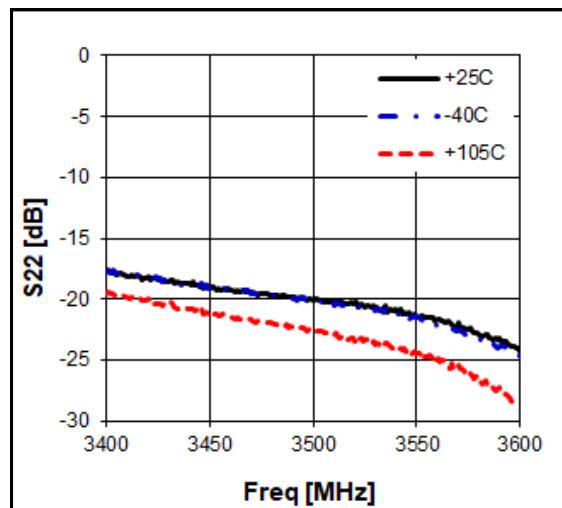
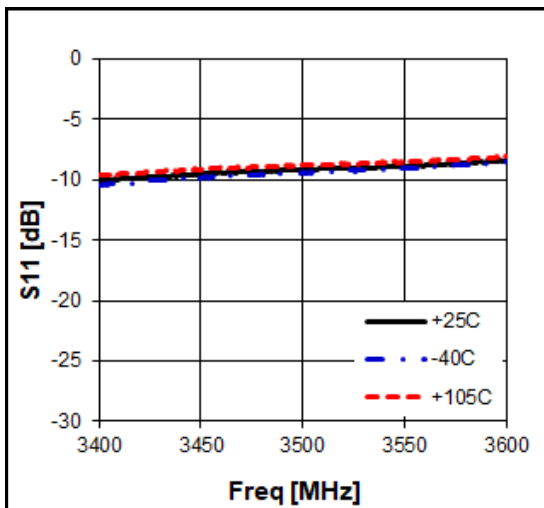
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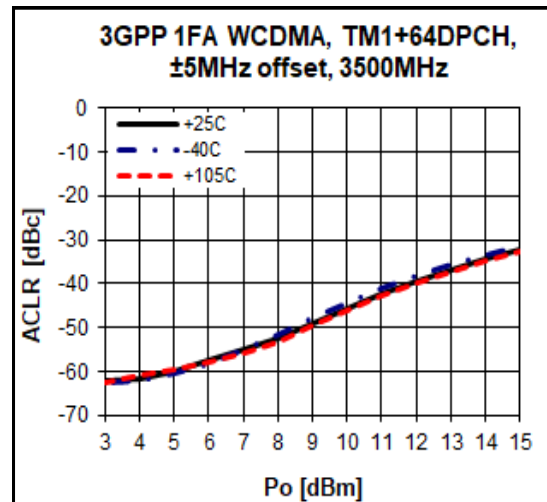
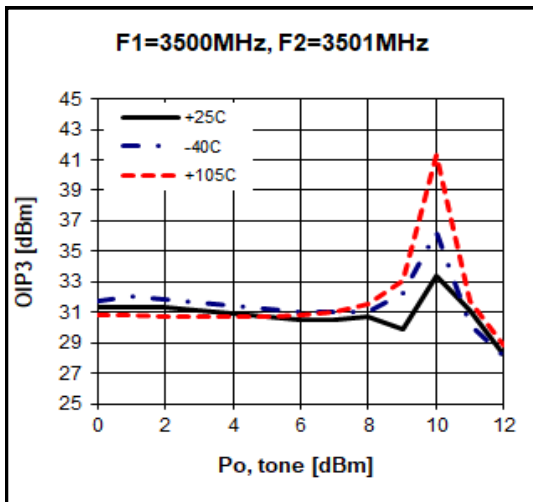
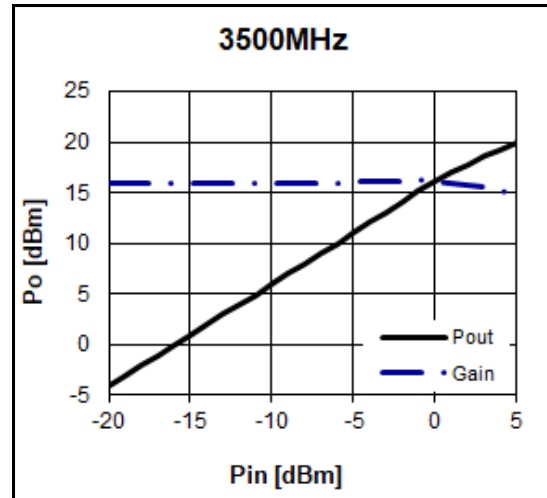
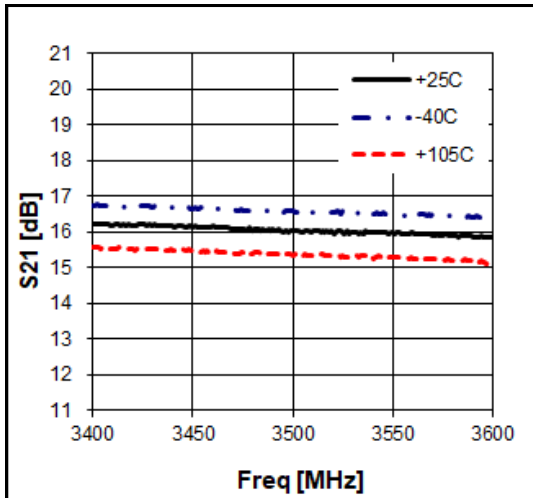
### Application Circuit: 3500 MHz

Schematic Diagram		BOM	Tolerance
	C1	10pF	± 5%
	C2	22pF	± 5%
	C3	100pF	± 5%
	C4	1nF	± 5%
	L1	22nH	± 5%

### Typical Performance

(Vd=5V, Id=70mA, T=25°C)





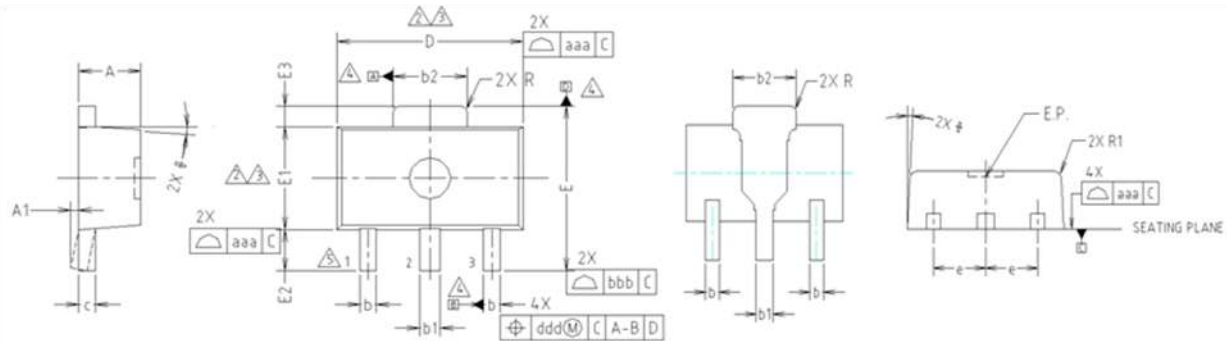
### Noise Figure Temperature Performance

(V<sub>ds</sub> = 5.0V, I<sub>ds</sub> = 70mA)

Freq	MHz	70	900	1900	2140	2650	3500
Temp [°C]	-40	1.55	1.20	1.40	1.45	1.60	1.80
	25	1.60	1.35	1.50	1.55	1.80	2.10
	105	1.70	1.40	1.80	1.85	2.00	2.50

\* NF : Losses on input and output transmission lines on PCB are not de-embedded.

### Package Outline Dimension

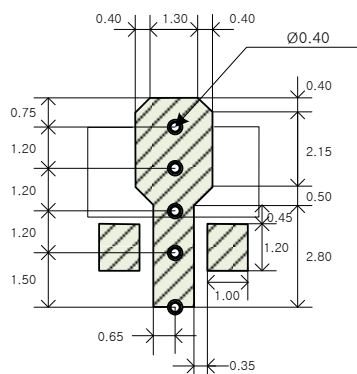


- NOTE:**  
 1. DIMENSIONS IN MILLIMETERS.
- ⚠ DIMENSION D DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.5mm PER END. DIMENSION E1 DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.5mm PER SIDE.
  - ⚠ 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.
  - ⚠ DATUMS A, B AND D TO BE DETERMINED 0.18mm FROM THE LEAD TIP.
  - ⚠ 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	2,3
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.			
φ	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

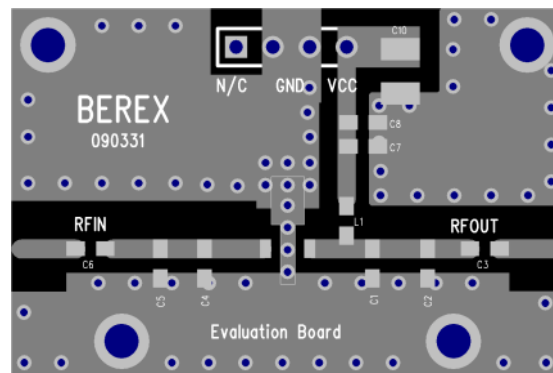
**PCB Land Pattern**



Note : All dimension \_ millimeters

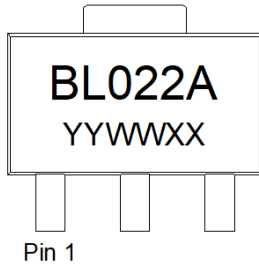
PCB lay out \_ on BeRex website

**PCB Mounting**



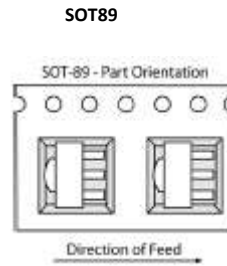


### Package Marking



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

### Tape & Reel



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

<b>ESD Rating:</b>	Class 1A
<b>Value:</b>	<b>Passes &lt;500V</b>
<b>Test:</b>	Human Body Model (HBM)
<b>Standard:</b>	JEDEC Standard JS-001-2014
<b>MSL Rating:</b>	<b>Level 1 at +260°C convection reflow</b>
<b>Standard:</b>	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
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