

BL022

50-3000 MHz Wideband LNA Gain Block



Device Features

- Low Noise Figure: $NF = 0.95 @ 1900\text{MHz}$
- High Linearity: $OIP3 = 36 \text{ dBm} @ 1900 \text{ MHz}$
- Output $P1 \text{ dB} = 22 \text{ dBm} @ 1900 \text{ MHz}$
- Gain = $17 \text{ dB} @ 1900 \text{ MHz}$
- Internally matched to 50 ohms
- $V_{dd}: 5.0\text{V}$
- Lead-free/RoHS-compliant SOT-89 SMT package



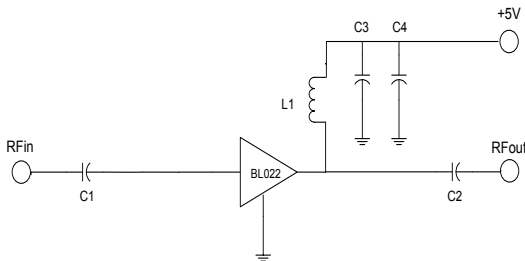
Product Description

The BL022 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 50-3000 MHz. The BL022 is internally matched to 50 Ohms and requires no external matching components. It is available in RoHS-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	700~1000MHz	1.7~2.2GHz	2.5~3.0GHz
C1	1nF	68pF	47pF	33pF
C2	1nF	68pF	47pF	33pF
C3	100pF	100pF	100pF	100pF
C4	1nF	1nF	1nF	1nF
L1	680nH	47nH	68nH	27nH

Typical Performance¹

Parameter	Frequency					Unit
	70	900	1900	2140	2650	
Gain	26.0	22.0	17.0	16.0	14.5	dB
S_{11}^2	-8.0	-11.5	-12.0	-12.0	-10.0	dB
S_{22}	-23.0	-29.0	-21.0	-26.0	-20.0	dB
$OIP3^3$	33.0	33.5	36.0	36.0	36.5	dBm
$P1\text{dB}$	22.0	22.0	22.0	22.0	22.0	dBm
Noise Figure	1.00	0.90	0.95	1.05	1.25	dB

¹ Device performance _ measured on a BeRex evaluation board at 25°C, 50 Ω system.

² S_{11} can be improved by a shunt capacitor. (refer to application circuits)

³ $OIP3$ _ measured on two tones with a output power 5dBm/ tone , $F2-F1 = 1 \text{ MHz}$.

	Min.	Typical	Max.	Unit
Bandwidth	50		3000	MHz
$I_d @ (V_d = 5\text{V})$	60	70	85	mA
V_d		5.0		V
dG/dT		-0.004		dB/°C
R_{TH}		79.8		°C/W
Operating Case Temperature	-40		+85	°C

Absolute Maximum Ratings

Parameter	Rating	Unit
Storage Temperature	-55 to +155	°C
Junction Temperature	+220	°C
Operating Voltage	+7	V
Supply Current	190	mA
Input RF Power	24	dBm

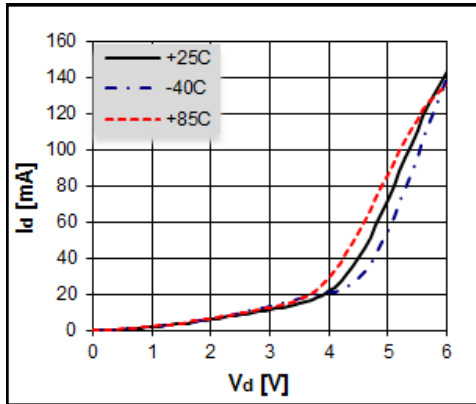
Operation of this device above any of these parameters may result in permanent damage.

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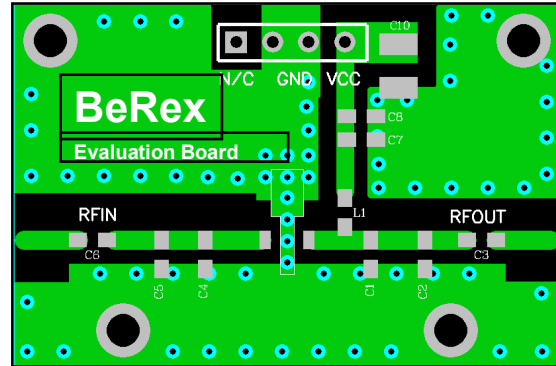
50-3000 MHz Wideband LNA Gain Block



V-I Characteristics



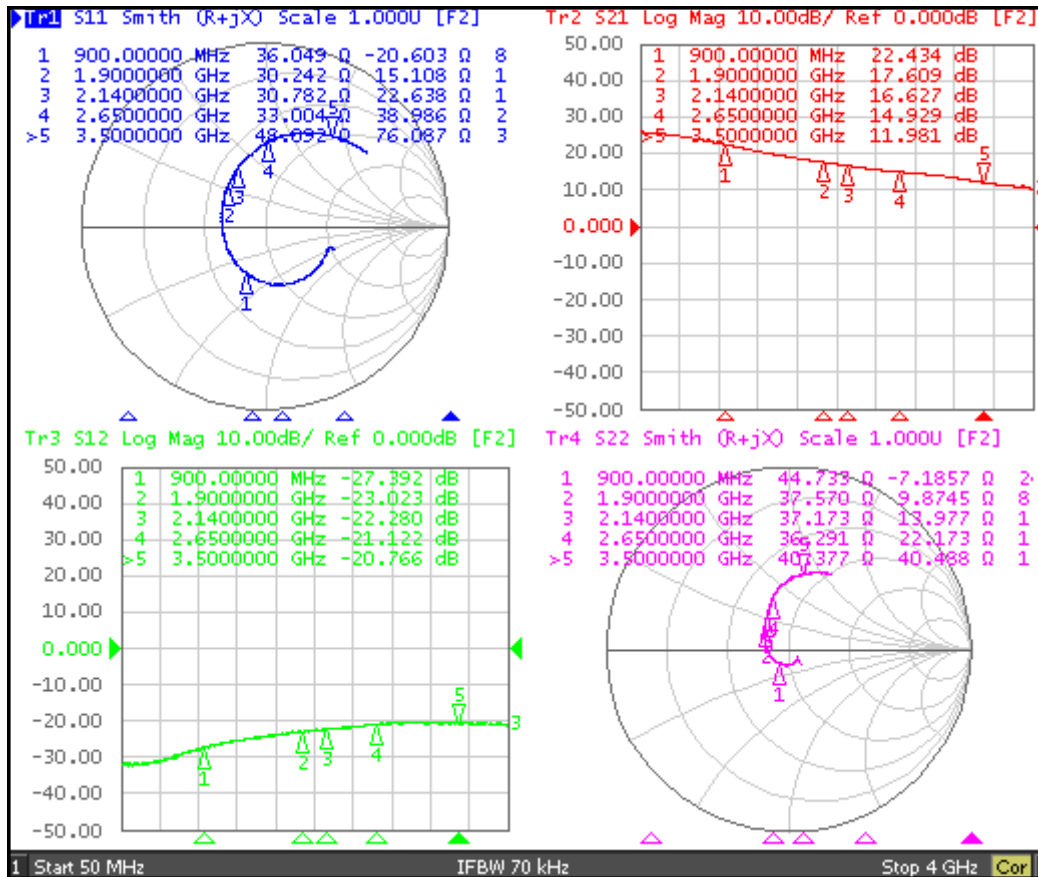
BeRex SOT89 Evaluation Board



*Dielectric constant _ 4.2 *31mil thick FR4 PCB

Typical Device Data

S-parameters (Vd=5V, Id=70mA, T=25°C)



Preliminary Datasheet

BeRex

•website: www.berex.com

•email: sales@berex.com

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Rev. A

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50-3000 MHz Wideband LNA Gain Block



S-Parameter

(Vdevice = 5.0V, Id = 70mA, T = 25 °C, calibrated to device leads)

Freq [MHz]	S11 [Mag]	S11 [Ang]	S21 [Mag]	S21 [Ang]	S12 [Mag]	S12 [Ang]	S22 [Mag]	S22 [Ang]
100	0.37	-18.62	19.45	167.38	0.03	11.11	0.07	-45.22
500	0.35	-60.85	16.81	133.42	0.03	27.40	0.08	-66.59
1000	0.26	-122.81	12.39	97.56	0.05	32.85	0.09	-136.31
1500	0.24	172.43	9.16	71.80	0.06	26.57	0.13	163.19
2000	0.33	123.97	7.25	50.52	0.07	16.69	0.19	129.77
2500	0.43	95.03	5.83	32.2	0.08	7.26	0.27	111.65
3000	0.53	72.98	5.04	12.65	0.10	-6.94	0.35	96.72
3500	0.61	53.74	3.97	-4.44	0.09	-16.96	0.42	79.25
4000	0.68	36.10	3.29	-19.03	0.09	-27.43	0.47	59.73

Preliminary Datasheet

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50-3000 MHz Wideband LNA Gain Block

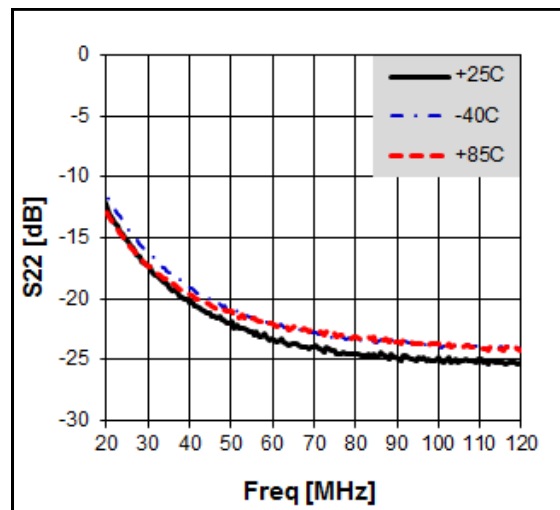
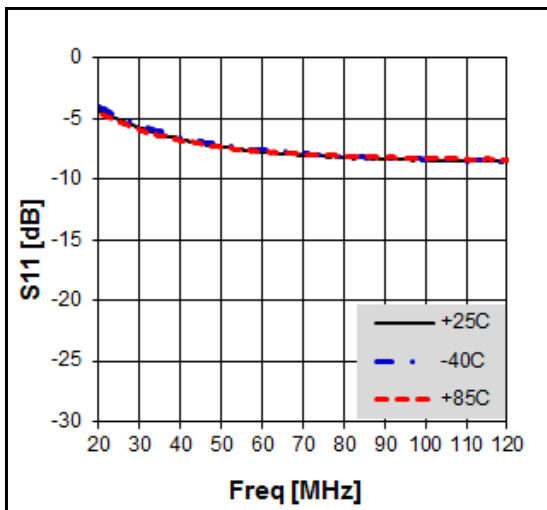


Application Circuit: 70 MHz

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

Typical Performance

$V_d = 5V, I_d = 70mA$

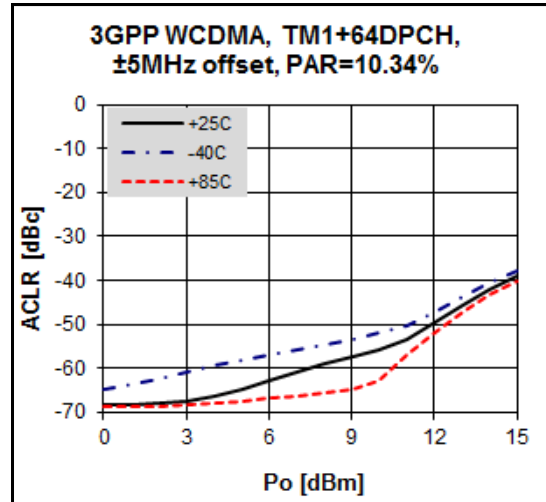
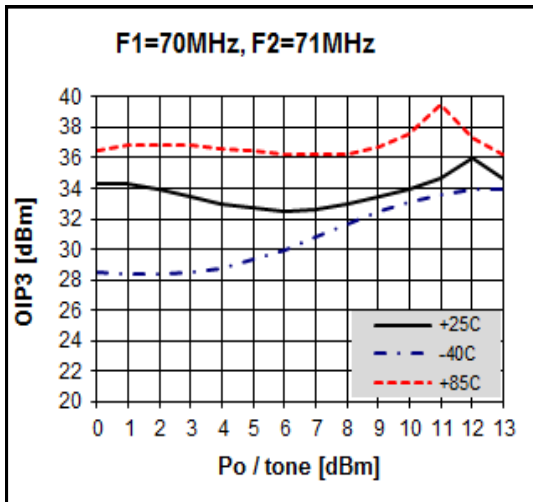
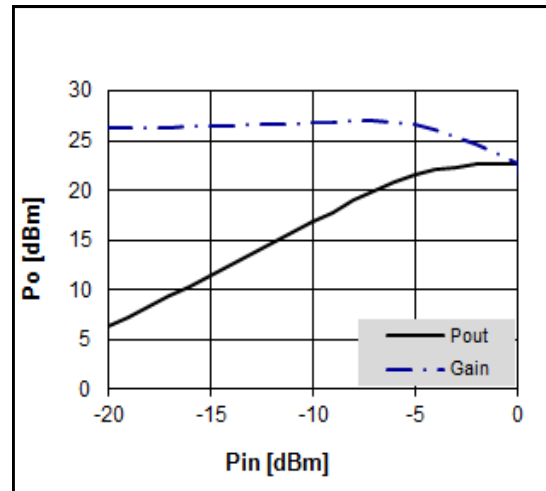
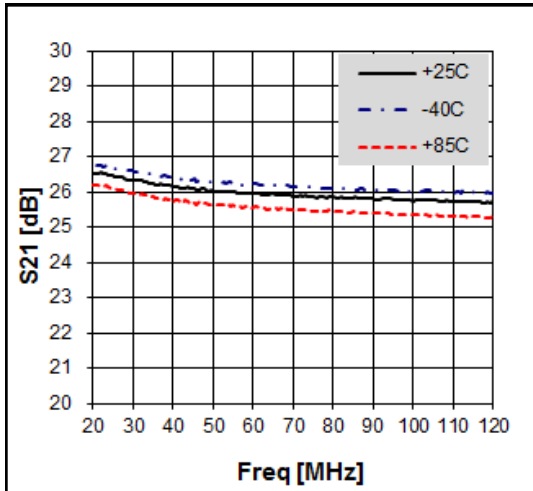


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50-3000 MHz Wideband LNA Gain Block



$V_d = 5V, I_d = 70mA$



Noise Figure Temperature Performance

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

Freq	MHz	70	900	1900	2140	2650
Temp [°C]	-40	0.80	0.7	0.85	0.90	1.00
	25	1.00	0.9	0.95	1.05	1.25
	85	1.50	1.15	1.40	1.50	1.70

Preliminary Datasheet

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50-3000 MHz Wideband LNA Gain Block

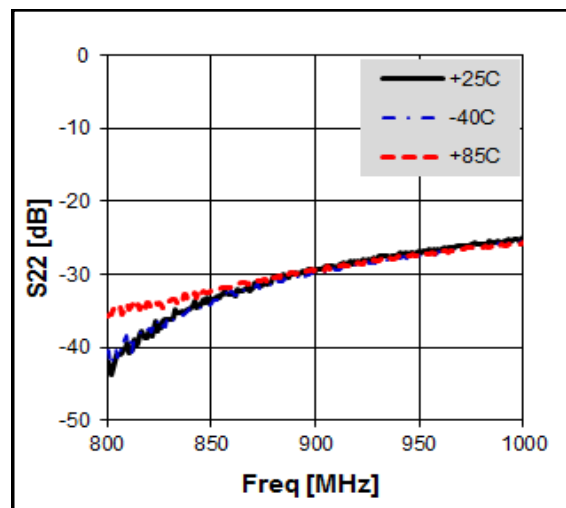
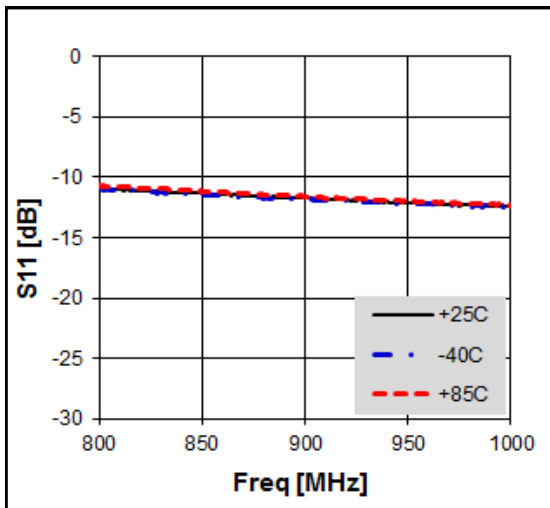


Application Circuit: 900 MHz

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

Typical Performance

$V_d = 5V, I_d = 70mA$



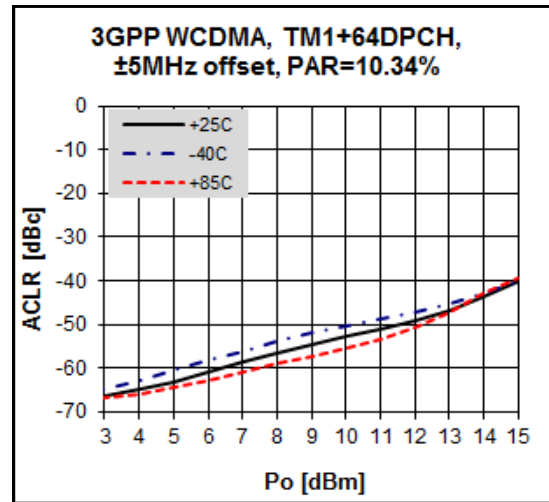
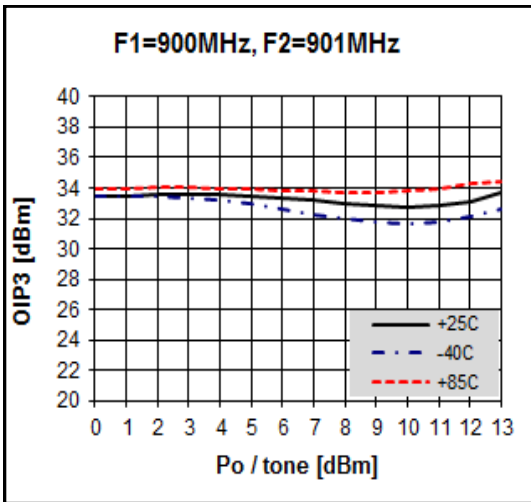
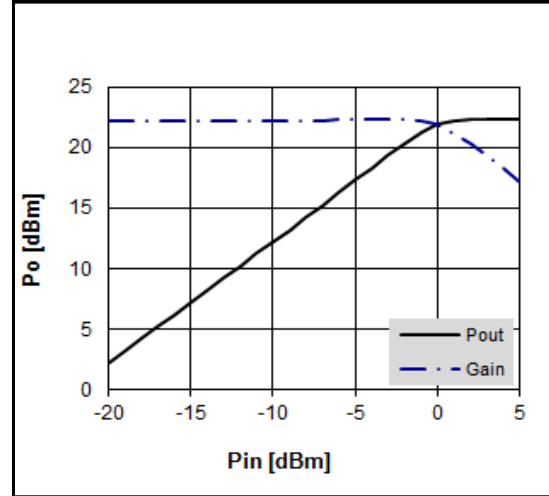
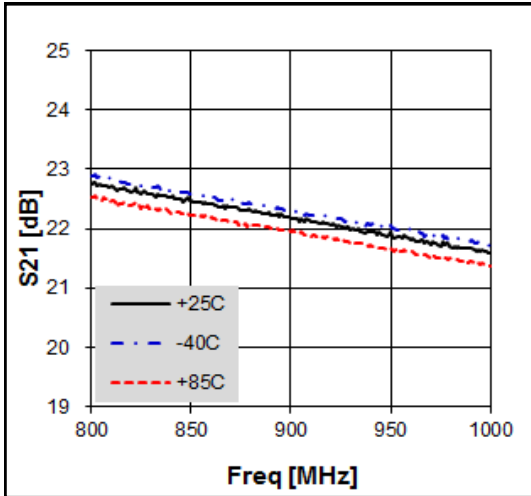
Preliminary Datasheet

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50-3000 MHz Wideband LNA Gain Block



$V_d = 5V, I_d = 70mA$



Noise Figure Temperature Performance

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

Freq	MHz	70	900	1900	2140	2650
Temp [°C]	-40	0.80	0.7	0.85	0.90	1.00
	25	1.00	0.9	0.95	1.05	1.25
	85	1.50	1.15	1.40	1.50	1.70

Preliminary Datasheet

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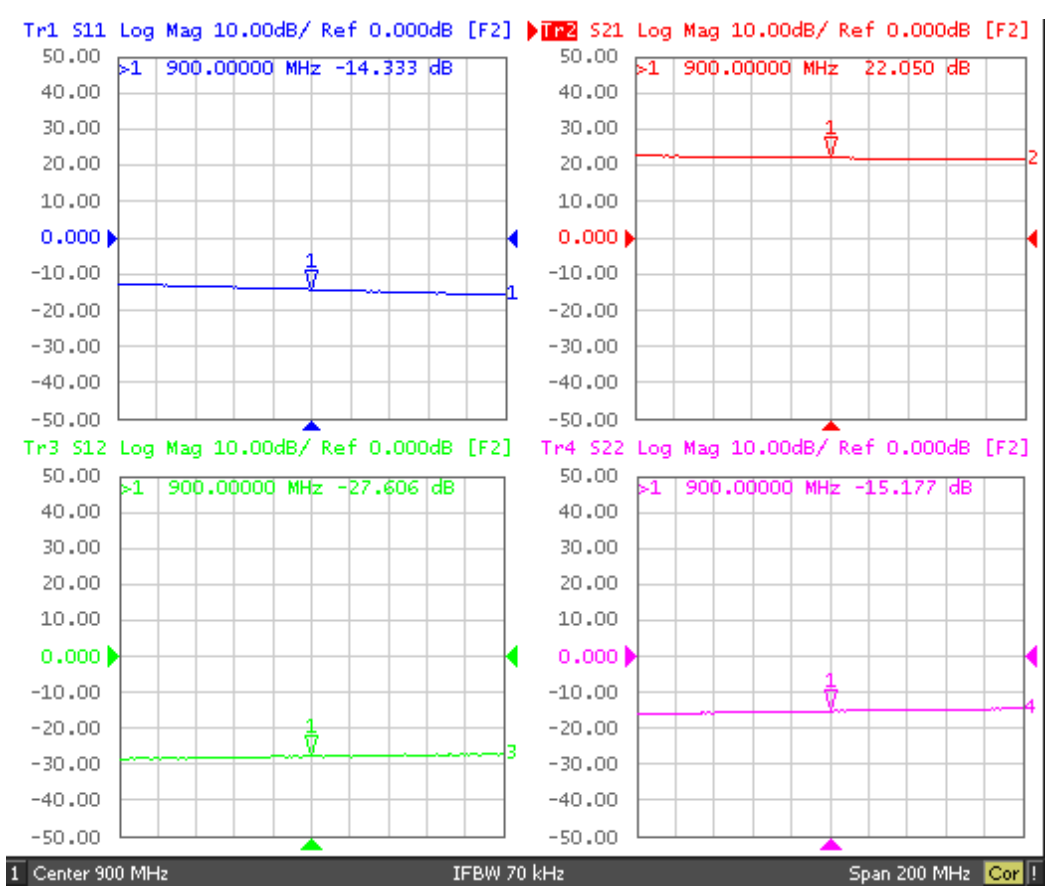
50-3000 MHz Wideband LNA Gain Block



- Application for Improved S11 at 900 MHz

Schematic Diagram	BOM	Tolerance	Evaluaiton Board diagram
	C1	68pF	± 5%
	C2	68pF	± 5%
	C3	100pF	± 5%
	C4	1nF	± 5%
	C5	0.75pF	± 5%
	L1	47nH	± 5%

Preliminary Datasheet



Freq [MHz]	Vcc [V]	Icc [mA]	Gain [dB]	OIP3 [dBm] ⁽¹⁾	P1dB [dBm]	IRL [dB]	ORL [dB]	NF [dB]
900	5	70	22	33	22.4	-14.3	-15.1	0.95

(1) OIP3 _ measured on two tones with a output power 5dBm/ tone , F2—F1 = 1 MHz.

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50-3000 MHz Wideband LNA Gain Block

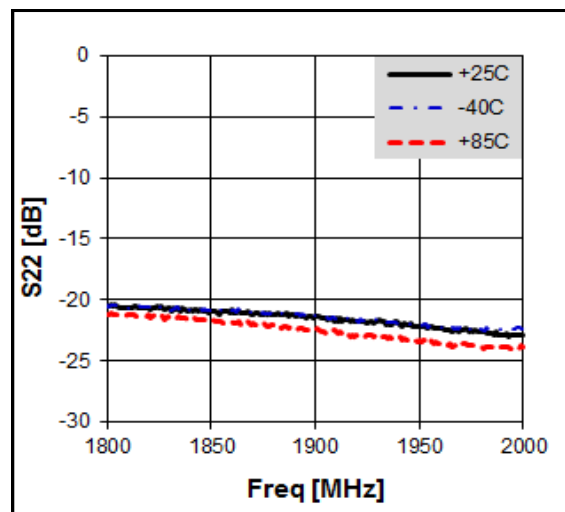
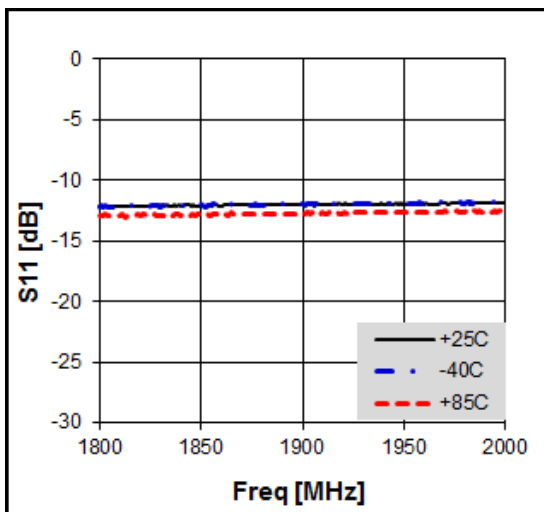


Application Circuit: 1900 MHz

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

Typical Performance

$V_d = 5V, I_d = 70mA$



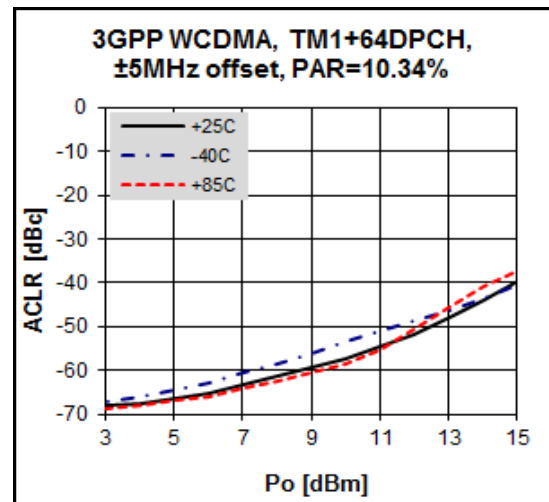
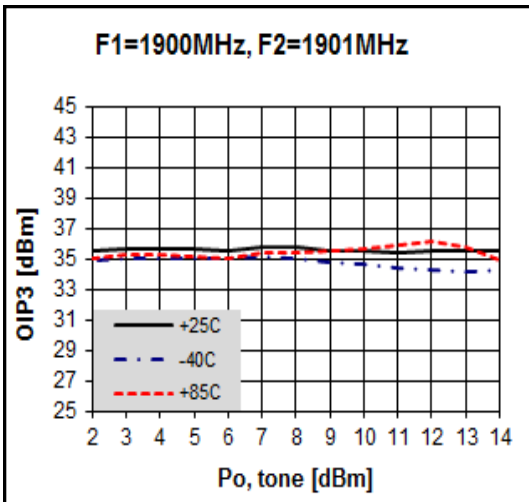
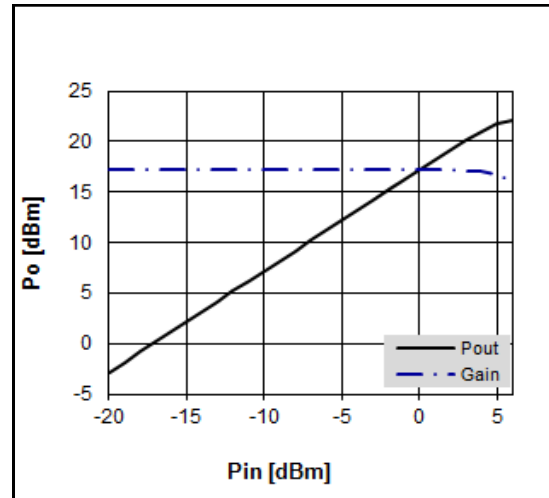
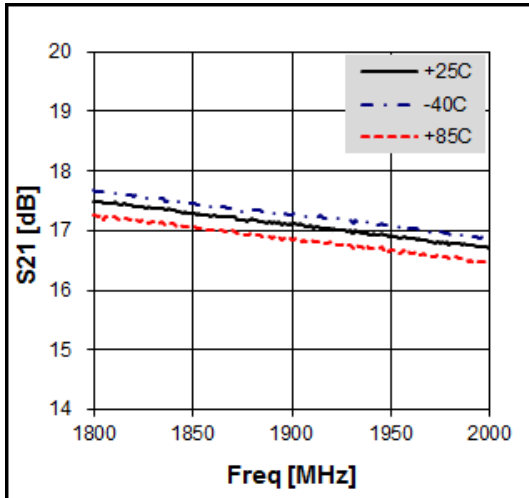
Preliminary Datasheet

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50-3000 MHz Wideband LNA Gain Block



$V_d = 5V, I_d = 70mA$



Noise Figure Temperature Performance

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

Freq	MHz	70	900	1900	2140	2650
Temp [°C]	-40	0.80	0.7	0.85	0.90	1.00
	25	1.00	0.9	0.95	1.05	1.25
	85	1.50	1.15	1.40	1.50	1.70

Preliminary Datasheet

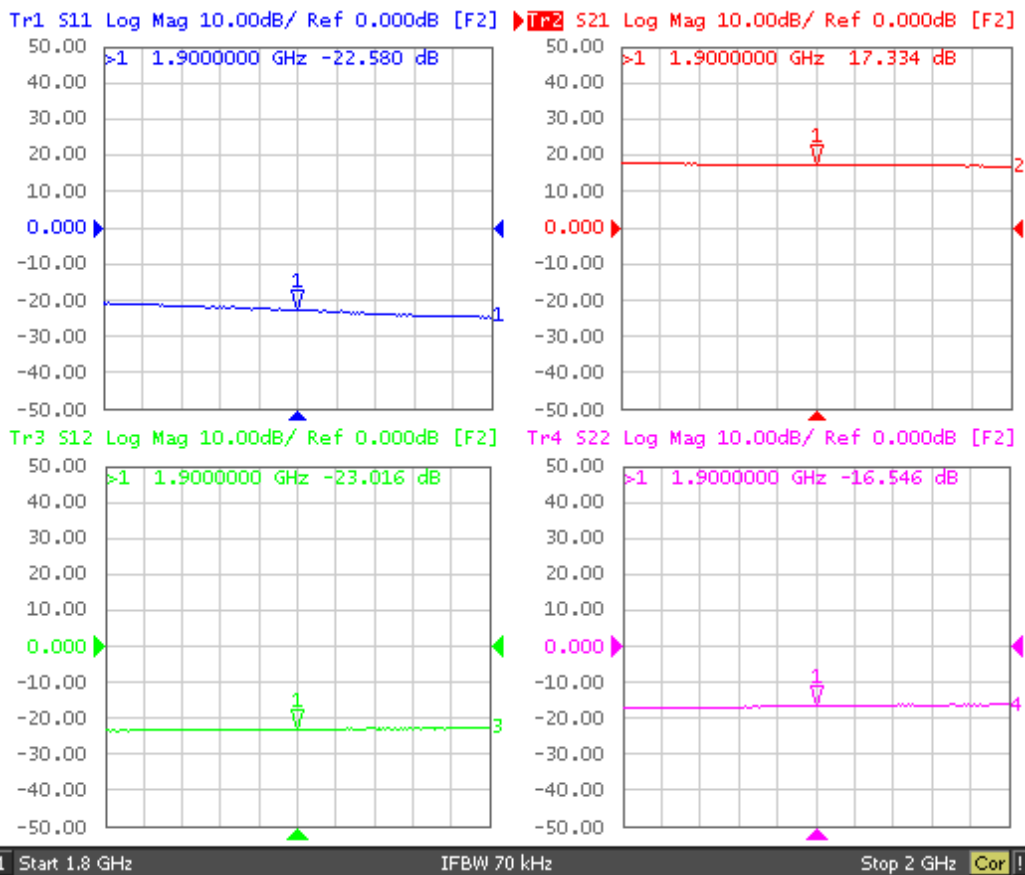
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50-3000 MHz Wideband LNA Gain Block



- Application for Improved S11 at 1900 MHz

Schematic Diagram	BOM	Tolerance	Evaluation Board
	C1	47pF	± 5%
	C2	47pF	± 5%
	C3	100pF	± 5%
	C4	1nF	± 5%
	C5	0.3pF	± 5%
	L1	68nH	± 5%



Freq [MHz]	Vcc [V]	Icc [mA]	Gain [dB]	OIP3 [dBm] ⁽¹⁾	P1dB [dBm]	IRL [dB]	ORL [dB]	NF [dB]
1900	5	70	17.3	34.5	21.7	-22.5	-16.5	1.12

(1) OIP3 _ measured on two tones with a output power 5dBm/ tone , F2—F1 = 1 MHz.

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50-3000 MHz Wideband LNA Gain Block

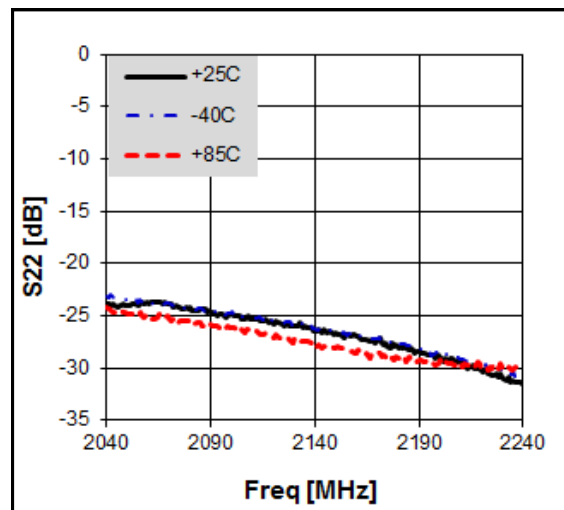
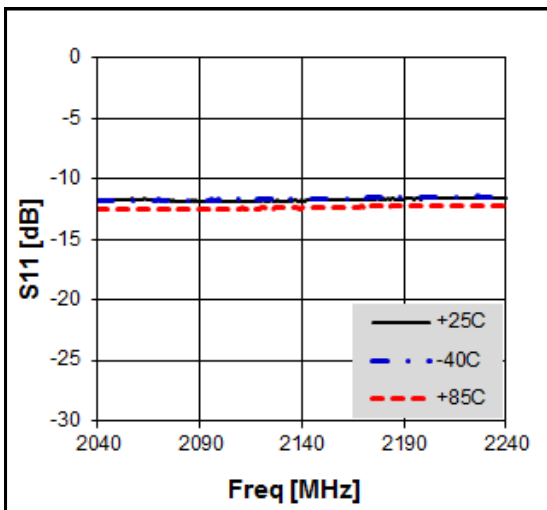


Application Circuit: 2140 MHz

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

Typical Performance

$V_d = 5V, I_d = 70mA$



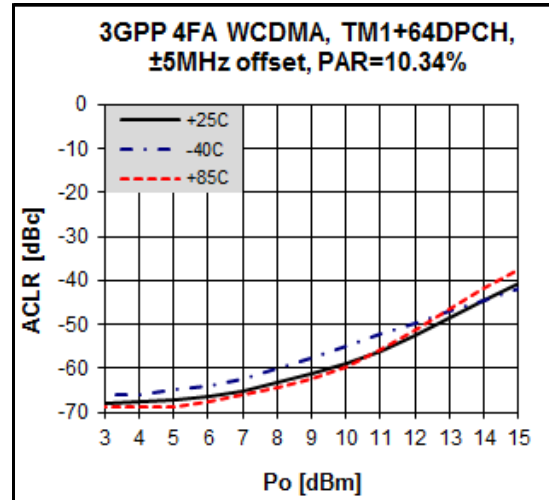
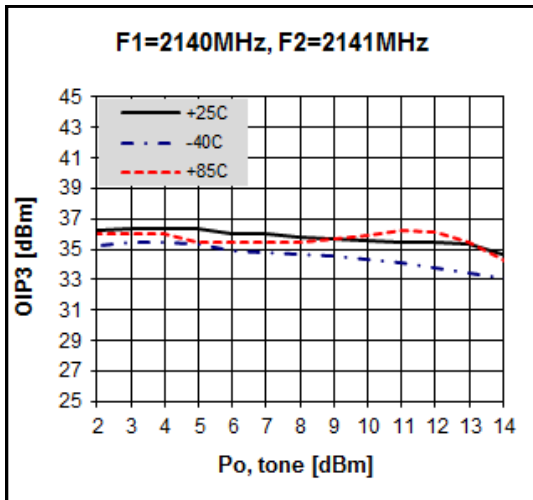
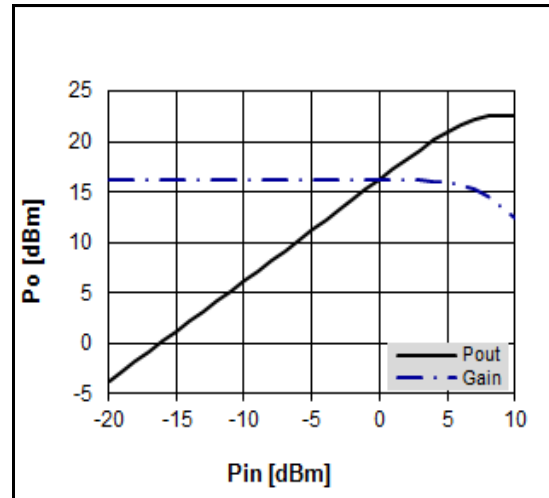
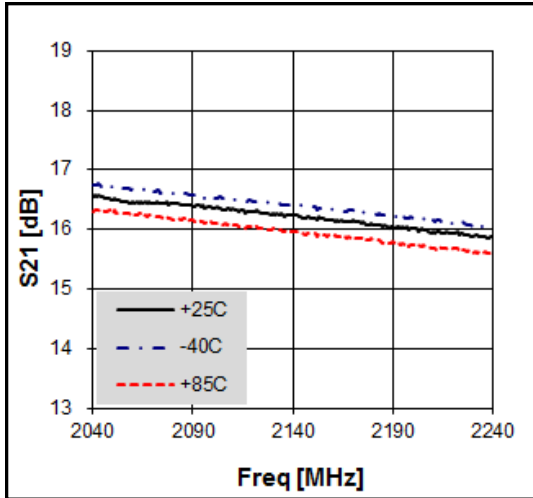
Preliminary Datasheet

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50-3000 MHz Wideband LNA Gain Block



$V_d = 5V, I_d = 70mA$



Noise Figure Temperature Performance

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

Freq	MHz	70	900	1900	2140	2650
Temp [°C]	-40	0.80	0.7	0.85	0.90	1.00
	25	1.00	0.9	0.95	1.05	1.25
	85	1.50	1.15	1.40	1.50	1.70

Preliminary Datasheet

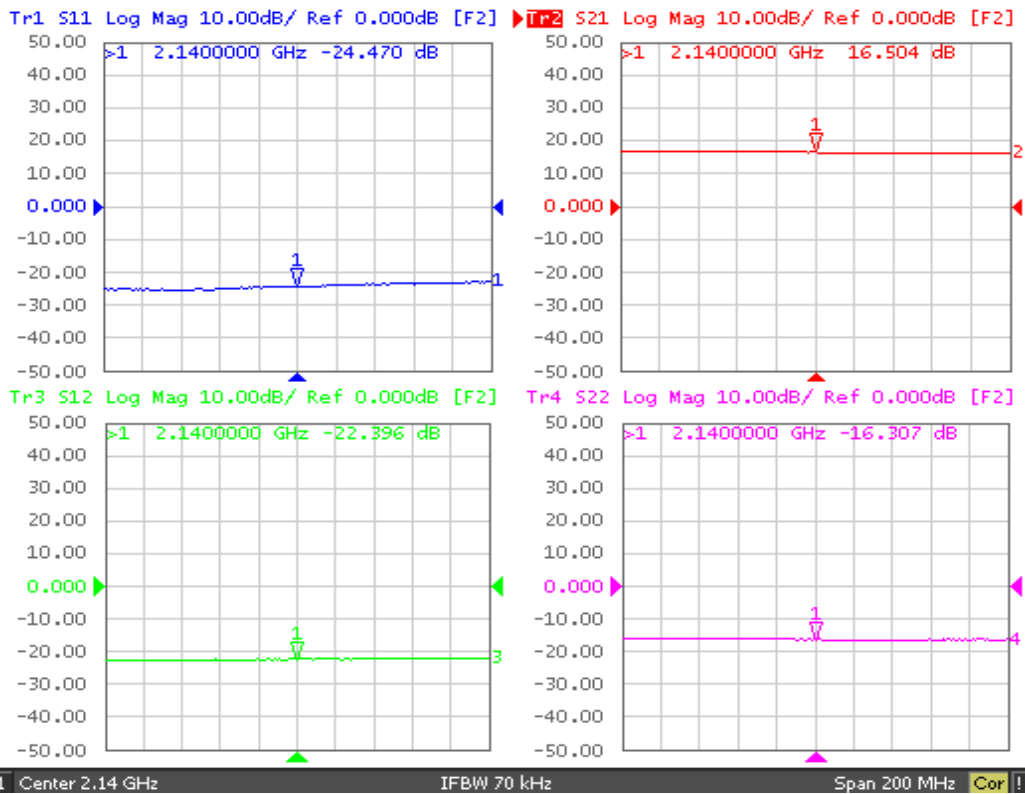
BL022

50-3000 MHz Wideband LNA Gain Block



- Application for Improved S11 at 2140 MHz

Schematic Diagram	BOM	Tolerance	Evaluation Board
	C1	47pF	± 5%
	C2	47pF	± 5%
	C3	100pF	± 5%
	C4	1nF	± 5%
	C5	0.3pF	± 5%
	L1	68nH	± 5%



Freq [MHz]	Vcc [V]	Icc [mA]	Gain [dB]	OIP3 [dBm] ⁽¹⁾	P1dB [dBm]	IRL [dB]	ORL [dB]	NF [dB]
2140	5	70	16.5	34.5	21.7	-24.4	-16.3	1.2

(1) OIP3 _ measured on two tones with a output power 5dBm/ tone , F2—F1 = 1 MHz.

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50-3000 MHz Wideband LNA Gain Block

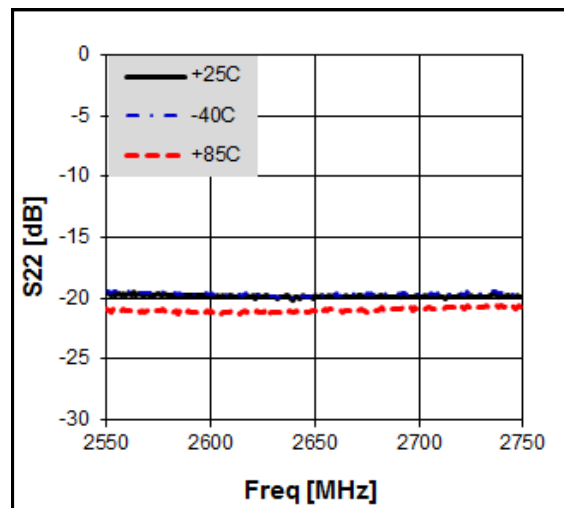
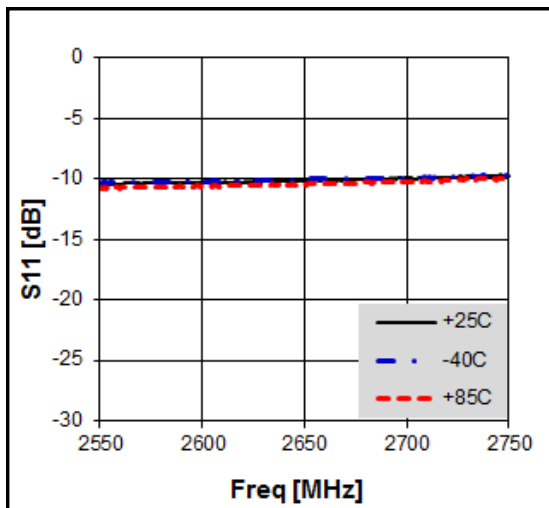


Application Circuit: 2650 MHz

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

Typical Performance

$V_d = 5V, I_d = 70mA$



Preliminary Datasheet

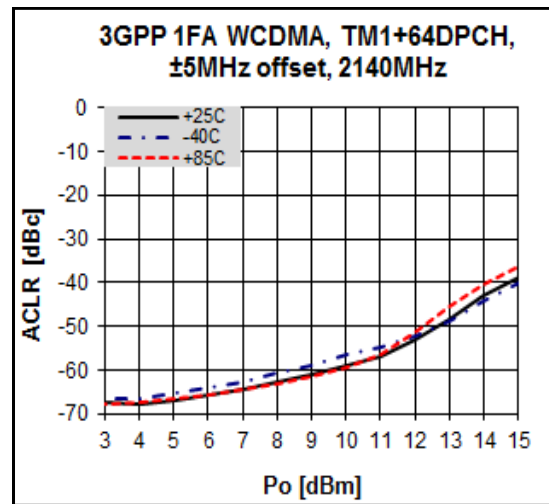
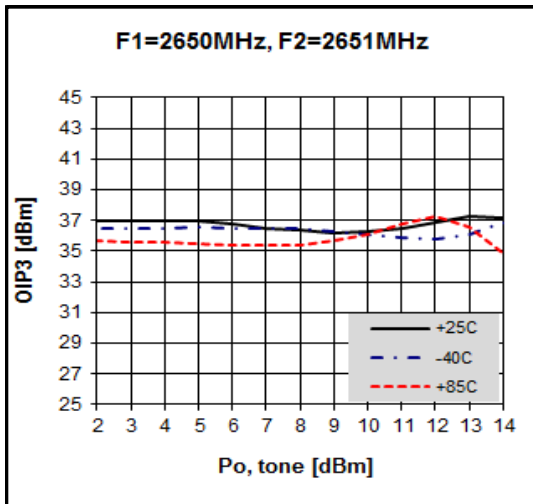
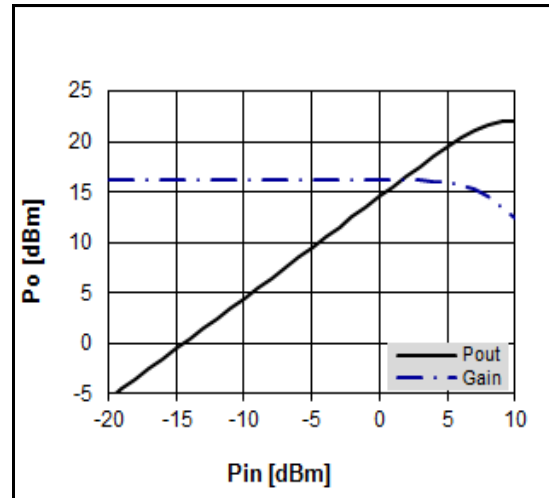
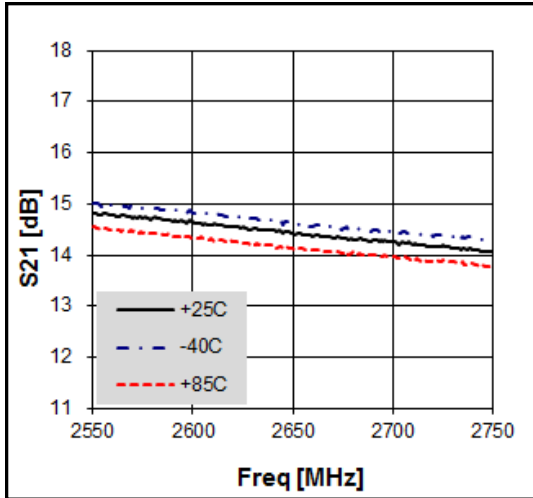
BL022

50-3000 MHz Wideband LNA Gain Block



Preliminary Datasheet

$V_d = 5V, I_d = 70mA$



Noise Figure Temperature Performance

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

Freq	MHz	70	900	1900	2140	2650
Temp [°C]	-40	0.80	0.7	0.85	0.90	1.00
	25	1.00	0.9	0.95	1.05	1.25
	85	1.50	1.15	1.40	1.50	1.70

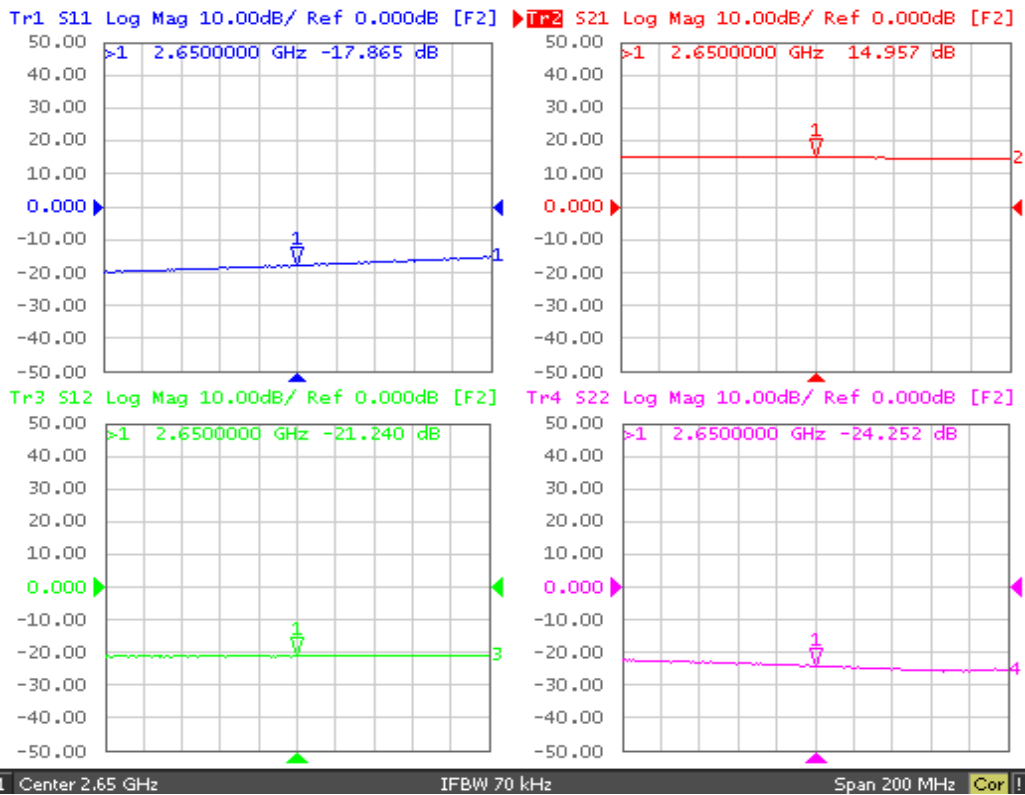
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50-3000 MHz Wideband LNA Gain Block



- Application for Improved S11 at 2650 MHz

Schematic Diagram	BOM	Tolerance	Evaluation Board
	C1	33pF	± 5%
	C2	33pF	± 5%
	C3	100pF	± 5%
	C4	1nF	± 5%
	C5	0.3pF	± 5%
	L1	27nH	± 5%

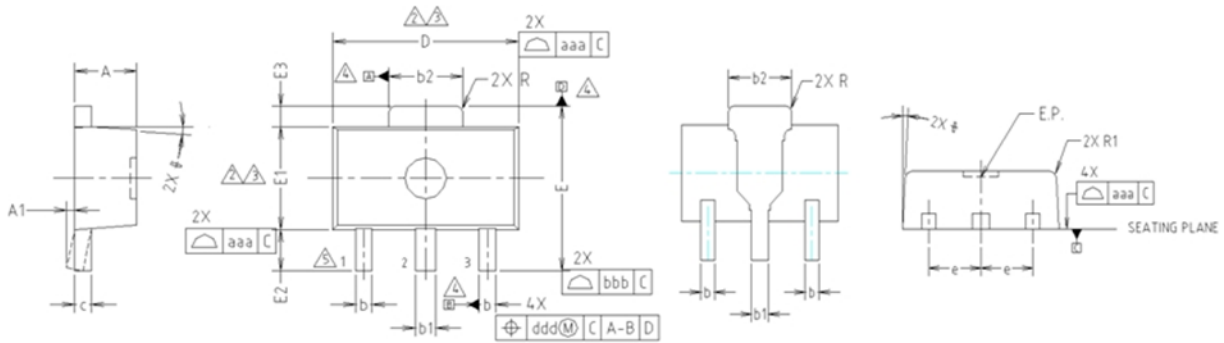


Freq [MHz]	Vcc [V]	Icc [mA]	Gain [dB]	OIP3 [dBm] ⁽¹⁾	P1dB [dBm]	IRL [dB]	ORL [dB]	NF [dB]
2650	5	70	14.9	35	21.3	-17.8	-24.2	1.4

(1) OIP3 _ measured on two tones with a output power 5dBm/ tone , F2—F1 = 1 MHz.

BL022

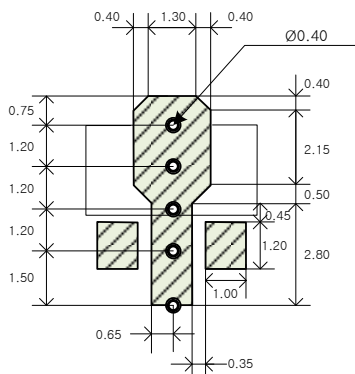
50-3000 MHz Wideband LNA Gain Block



- 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	
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			

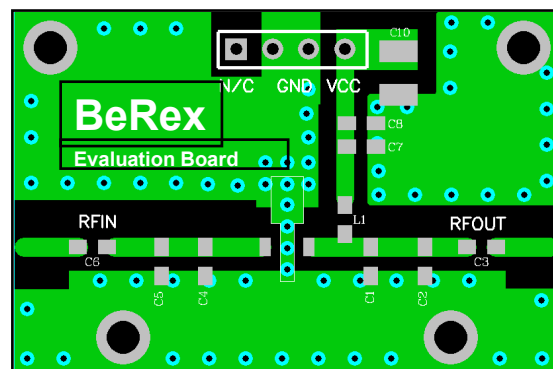
PCB Land Pattern



Note : All dimension _ millimeters

PCB lay out _ on BeRex website

PCB Mounting

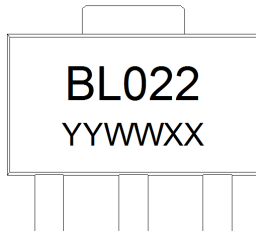


BL022

50-3000 MHz Wideband LNA Gain Block

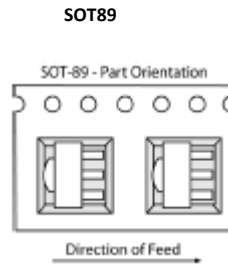


Package Marking



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

ESD Rating:	Class 1A
Value:	Passes <500V
Test:	Human Body Model (HBM)
Standard:	JEDEC Standard JESD22-A114B
MSL Rating:	Level 1 at +265°C convection reflow
Standard:	JEDEC Standard J-STD-020

NATO CAGE code:

2	N	9	6	F
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