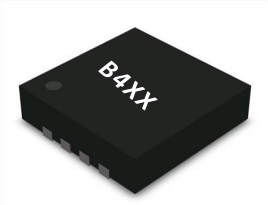
BLB04

2500 – 5000 MHz High Linearity LNA

Device Features

- Operated at 3.3V and 5.0V
- 33.0dBm Output IP3 at 0dBm/tone at 3600MHz
- 18.0dB Gain at 3600MHz
- 18.7dBm P1dB at 3600MHz
- 0.59dB NF at 3600MHz
- Fast shut down to support TDD systems
- Lead-free/Green/RoHS Compliant DFN8 2x2 Package

Part Marking (XX:Wafer number)



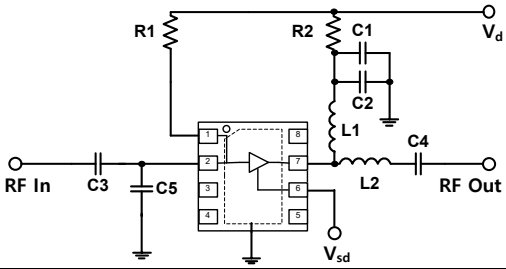
Product Description

BeRex's BLB04 is a high linearity LNA, based on GaAs E-pHEMT process and packaged in a RoHS-compliant DFN 8L 2x2mm^2 Surface mount package. It is designed for use where low noise and high linearity are required and features low noise and high OIP3 at Frequency range of 2.5~5.0GHz. It is fast enable switching speed for TDD-5G application. All devices are 100% RF/DC tested and classified as HBM ESD Class 1C.

Applications

- Base station Infrastructure
- Commercial/Industrial/Military wireless system
- TDD or FDD LTE system/5G NR

Applications Circuit



BOM	2.65GHz	3.6GHz	4.55&4.9GHz	Marks
C1	1nF	1nF	1nF	
C2	100pF	100pF	100pF	
C3	5.1pF	2pF	2pF	HQ
C4	5pF	2pF	2pF	
C5	0.75pF	0.3pF	0.3pF	
R1	1.8Kohm	1.8Kohm	1.8Kohm	5V
R2	0ohm	0ohm	0ohm	
L1	2.2nH	1.8nH	2.2nH	
L2	LINE	1nH	LINE	

*3.3V R1 910 ohm

Electrical Specifications

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

Parameter	Conditions	Min	Typ	Max	Unit
Operational Frequency Range		2500		5000	MHz
Test Frequency			3600		MHz
Gain		16.5	18.0		dB
Input Return Loss			-21.5		dB
Output Return Loss			-15.0		dB
Output IP3	0 dBm / tone , Δf=1 MHz	30.0	33.0		dBm
Output P1dB		17.7	18.7		dBm
Noise Figure			0.59	0.79	dB

* Noise Figure data has input trace loss de-embedded.

Device performance _ measured on a BeRex evaluation board at 25°C, V_d=3.3V, 50 Ω system.

Parameter	Conditions	Min	Typ	Max	Unit
Operational Frequency Range		2500		5000	MHz
Test Frequency			3600		MHz
Gain		16.3	17.8		dB
Input Return Loss			-19.0		dB
Output Return Loss			-17.0		dB
Output IP3	0 dBm / tone , Δf=1 MHz	31.5	34.5		dBm
Output P1dB		14.5	15.5		dBm
Noise Figure			0.58	0.78	dB

* Noise Figure data has input trace loss de-embedded.

Recommended Operating Conditions[1]

Parameter	Min	Typ	Max	Unit
Bandwidth	2500		5000	MHz
I_d @ (V_d = 5.0V)	39	49	59	mA
I_d @ (V_d = 3.3V)	36	44	52	mA
V_d	3.3	5.0	5.25	V
dG/dT		-0.005		dB/°C
R_{TH}		53		°C/W
Operating Case Temperature	-40		+125	°C

Electrical specifications are measured at specified test conditions.

Specifications are not guaranteed over all recommended operating conditions.

Recommended Operating Conditions[2]

Paramter	Condition	Min.	Typical	Max.	Unit
Shutdown Control	On state	0		0.9	V
	Off state(shutdown)	1.17		V_d	V
Current, I_d	On state 5V	39	49	59	mA
	On state 3.3V	36	44	52	mA
	Off state(shutdown)	5	7	9	mA
Shutdown pin current,Isd	$1.17V \leq V_{sd} < V_D$		200		uA
Switching Time	Rise time(10% to 90%)		150		ns
	Fall time(90% to 10%)		50		ns

Absolute Maximum Ratings

Parameter	Rating	Unit
Storage Temperature	-55 to +155	°C
Junction Temperature	+150	°C
Supply Voltage	+7.0	V
Supply Current	130	mA
Input RF Power	30	dBm

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

Typical Performance (V_d=5.0V, I_d=49mA , T=25°C)

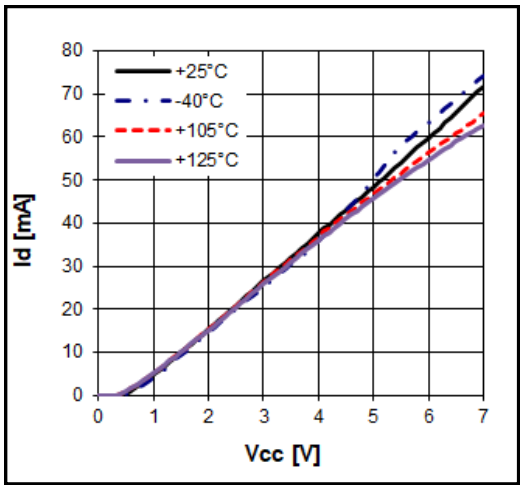
Parameter	Frequency				Unit
V_d = 5V	**2650**	**3600**	**4550**	**4900**	**MHz**
Gain	19.2	18.0	16.0	15.2	dB
S11	-10.5	-21.5	-13.4	-11.0	dB
S22	-8.0	-15.0	-11.2	-10.0	dB
OIP3	34.0	33.0	36.5	36.5	dBm
P1dB	21.0	18.7	18.0	17.5	dBm
5G NR ACLR*	10.0	7.6	8.0	7.0	dBm
Noise Figure	0.52	0.59	0.74	0.78	dB

Typical Performance (V_d=3.3V, I_d=44mA, T=25°C)

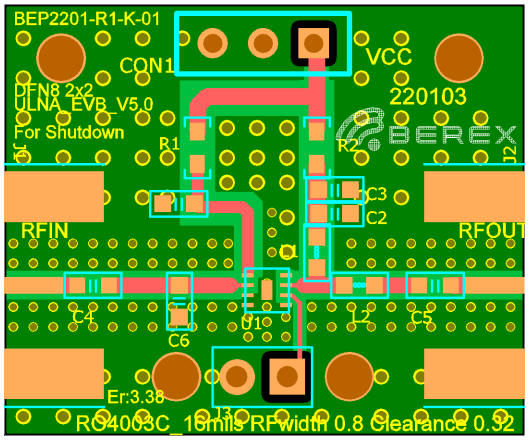
Parameter	Frequency				Unit
V_d = 5V	**2650**	**3600**	**4550**	**4900**	**MHz**
Gain	19.0	17.8	15.8	15.0	dB
S11	-10.5	-19.0	-13.5	-11.0	dB
S22	-9.0	-17.0	-11.8	-10.0	dB
OIP3	34.0	34.5	35.0	35.0	dBm
P1dB	18.0	15.5	15.0	14.8	dBm
5G NR ACLR*	6.4	4.4	4.3	3.7	dBm
Noise Figure	0.47	0.58	0.73	0.77	dB

*ACLR Channel Power measured at -50dBc.
- 5G NR Downlink FR1 : SCS 30KHz, CBW 100MHz, 256QAM, PAR 9.66 at 0.01% Prob.
* Noise Figure data has input trace loss de-embedded.

V-I Characteristics

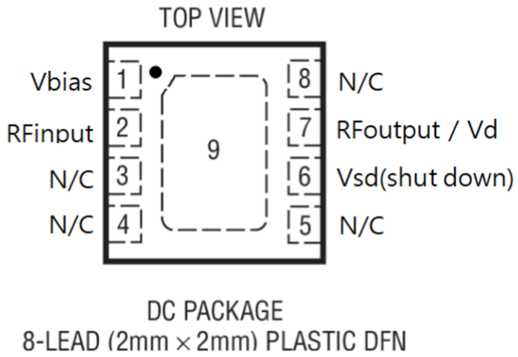


Evaluation Board



*Dielectric constant _ 4.2 *RF pattern width 24mil *16mil thick RO4003 PCB

Pin Configuration and Description

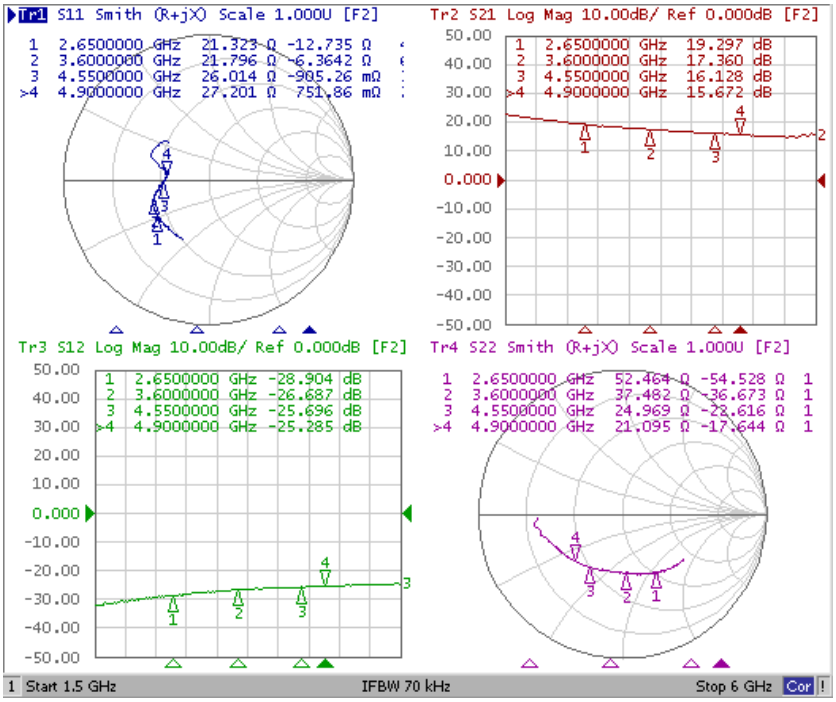


DC PACKAGE
8-LEAD (2mm × 2mm) PLASTIC DFN

Pin No.	Name	Description
1	Vbias	Vbias sets Idq through external resistor for V_d=5V or V_d=3.3V.
2	RFinput	RFinput pin. A DC Block with High Q performance is required.
6	Vsd(shut down)	Power on/off control pin. 1.17V≤V_{sd} disables device. If function is not desired, may be connected to ground.
7	RFoutput / Vd	RFoutput / V_d pin. Supply Vd through choke/Inductor for the device.
3,4,5,8	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.

Typical Device Data

S-parameters (V_d=5.0V, I_d=49mA , T=25°C)

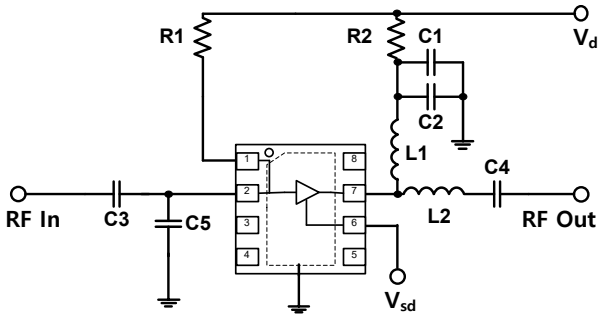


S-Parameter

(V_d=5.0V,I_d = 49mA, T = 25 °C, calibrated to device leads)

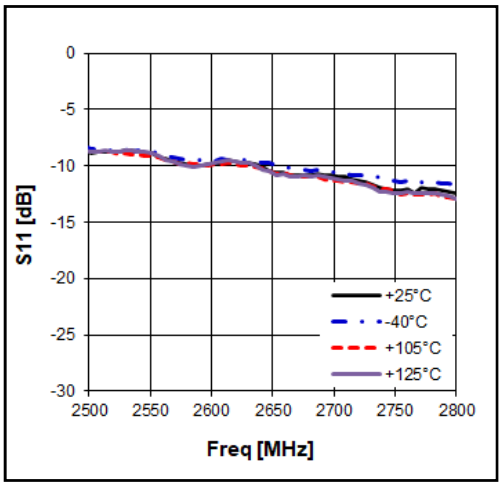
Freq [MHz]	S11 Mag	S11 Ang	S21 Mag	S21 Ang	S12 Mag	S12 Ang	S22 Mag	S22 Ang
2500	0.44	-143.54	9.70	52.99	0.04	30.01	0.48	-56.11
2600	0.44	-145.97	9.32	49.22	0.04	27.62	0.47	-58.80
2800	0.44	-150.75	9.04	42.55	0.04	24.59	0.45	-64.33
3000	0.43	-154.00	8.44	36.32	0.04	19.84	0.43	-68.68
3200	0.41	-157.36	8.12	29.99	0.04	16.01	0.41	-73.81
3400	0.41	-160.33	7.76	24.41	0.04	13.60	0.40	-79.24
3600	0.40	-163.16	7.43	18.50	0.05	11.13	0.39	-85.42
3800	0.38	-166.53	7.25	12.41	0.05	8.57	0.39	-92.20
4000	0.36	-169.17	6.99	5.46	0.05	6.38	0.39	-100.11
4200	0.34	-172.18	6.75	-0.83	0.05	3.20	0.39	-107.57
4400	0.32	-174.84	6.50	-7.74	0.05	-0.51	0.40	-114.68
4600	0.30	-178.87	6.29	-13.78	0.05	-4.55	0.42	-121.92
4800	0.28	177.63	6.10	-20.27	0.05	-7.69	0.44	-129.77
5000	0.27	174.99	5.90	-26.49	0.05	-10.13	0.46	-136.93

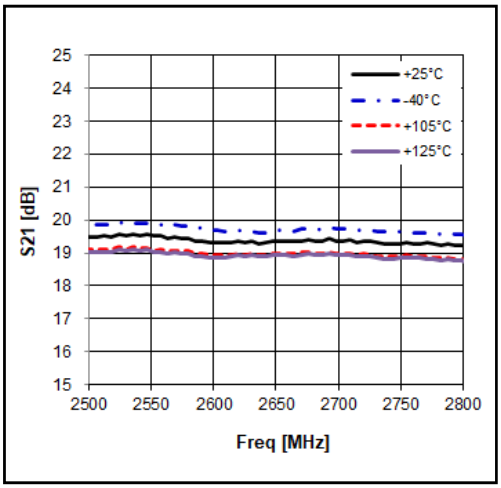
Application Circuit: 2650 MHz

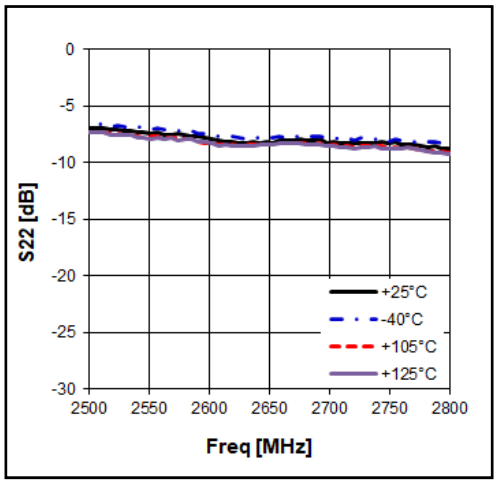
Schematic Diagram	BOM		size	Marks
	C1	1nF	1608	
	C2	100pF	1608	
	C3	5.1pF	1608	Johanson Technology 251R14S5R1BV4(HighQ)
	C4	5pF	1608	Distance to pin7 : 6.5mm
	C5	0.75pF	1608	Distance to pin2 : 5.0mm
	L1	2.2nH	1608	
	L2	Line	1608	Characteristics change when it is 0ohm.
	R1	1.8Kohm	1608	
	R2	0ohm	1608	

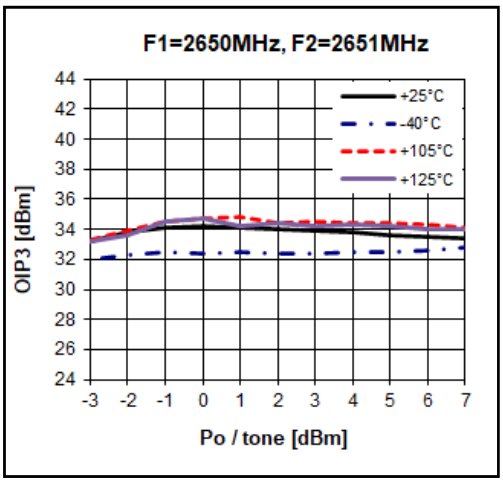
Typical Performance

V_d = 5V, I_d = 49mA

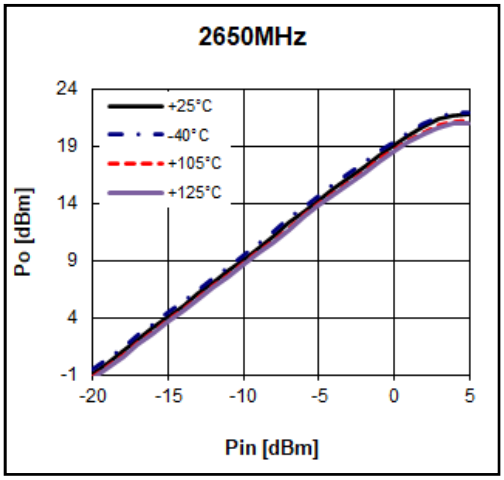


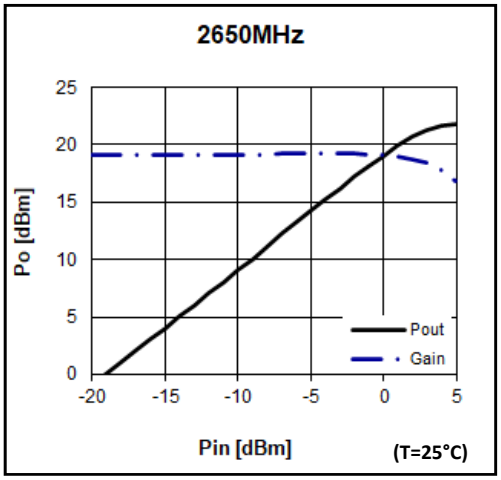


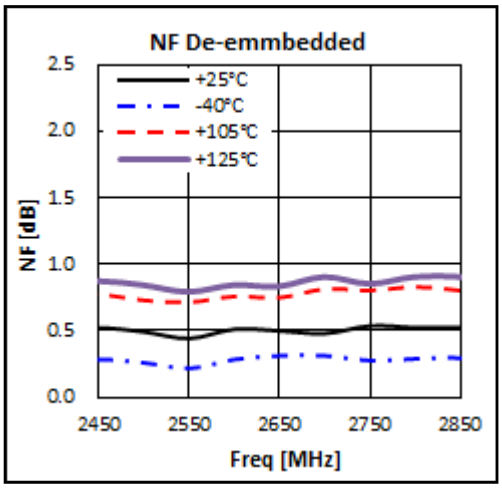


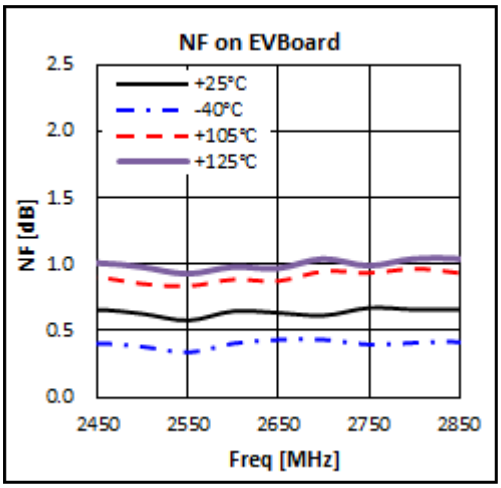


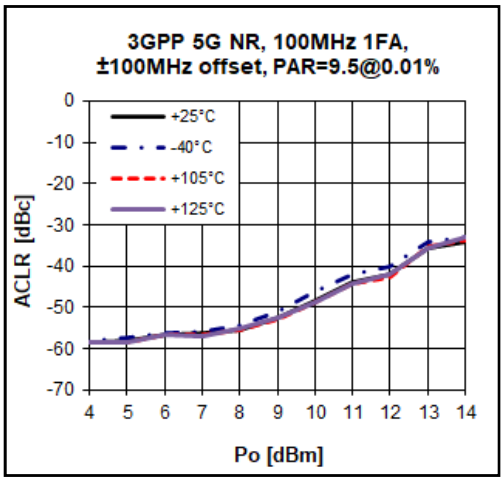
V_d = 5V, I_d = 49mA

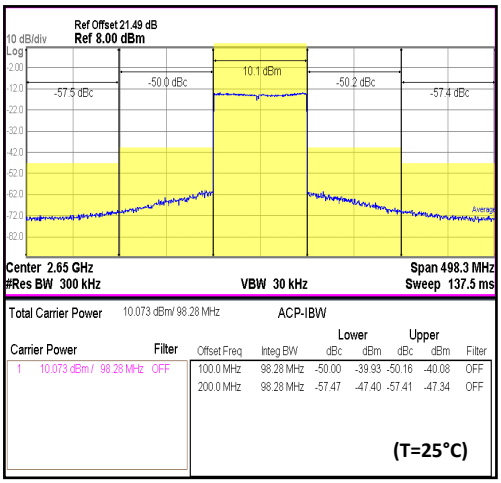




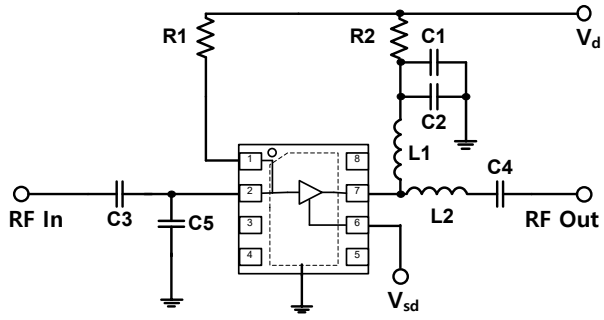






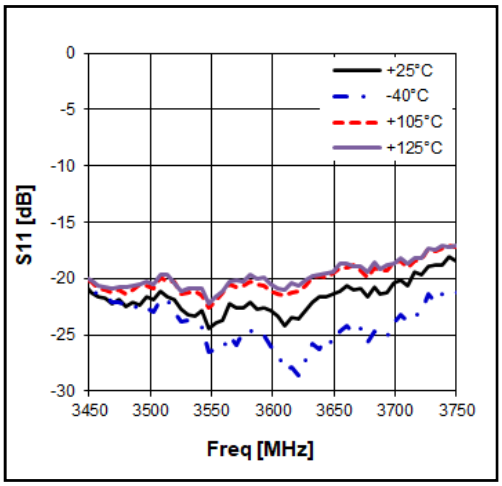


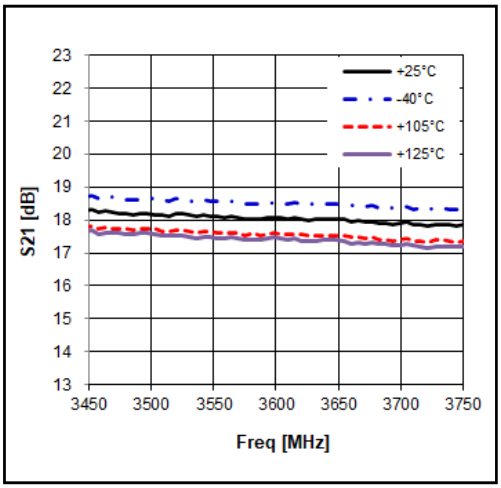
Application Circuit: 3600 MHz

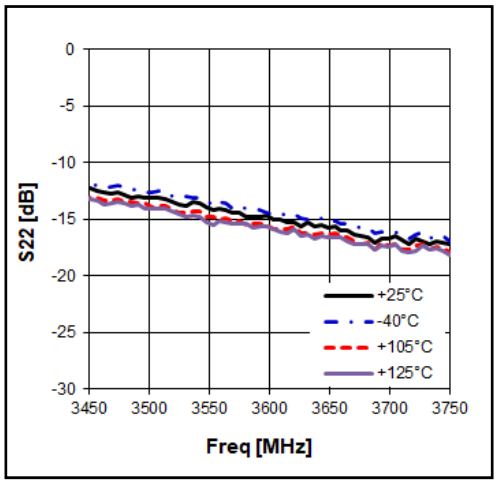
Schematic Diagram	BOM		size	Marks
	C1	1nF	1608	
	C2	100pF	1608	
	C3	2pF	1608	Johanson Technology 251R14S2R0BV4(HighQ)
	C4	2pF	1608	Distance to pin7 : 6.5mm
	C5	0.3pF	1608	Distance to pin2 : 2.9mm
	L1	1.8nH	1608	
	L2	1nH	1608	
	R1	1.8Kohm	1608	
	R2	0ohm	1608	

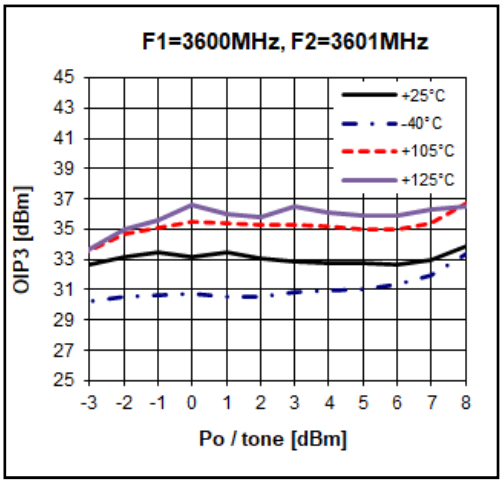
Typical Performance

V_d = 5V, I_d = 49mA

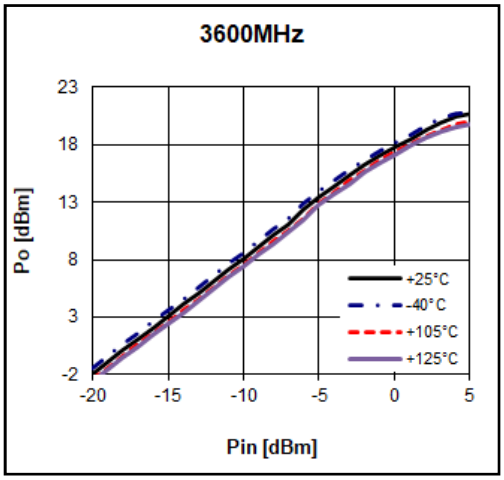


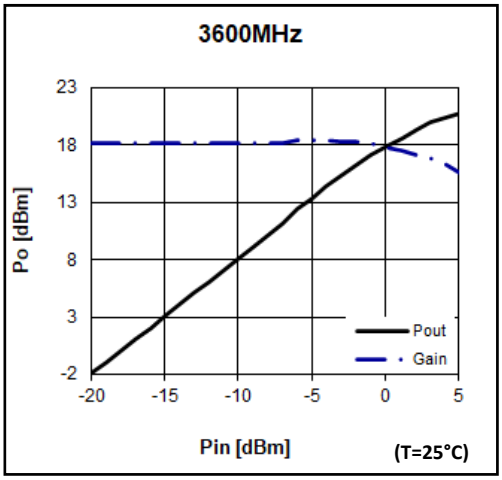


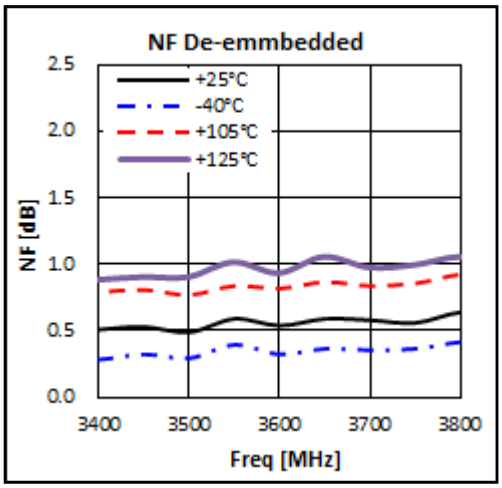


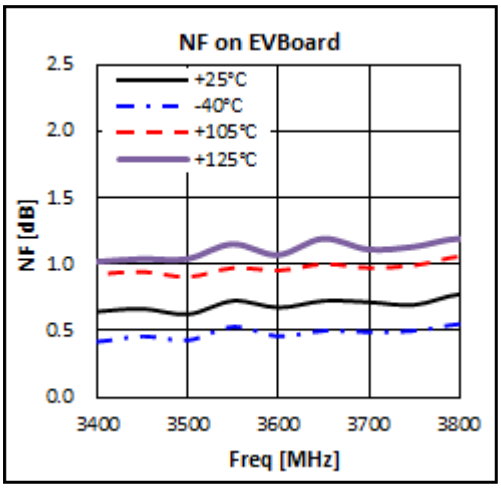


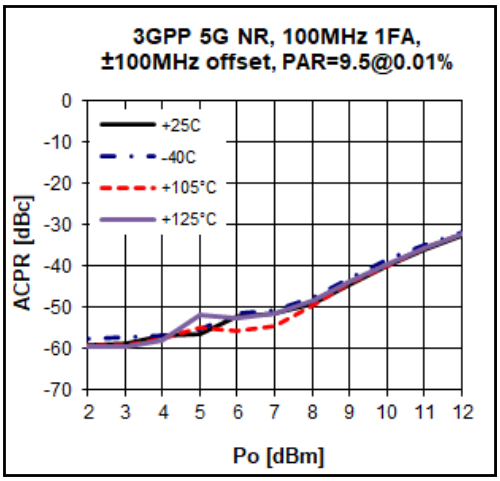
V_d = 5V, I_d = 49mA

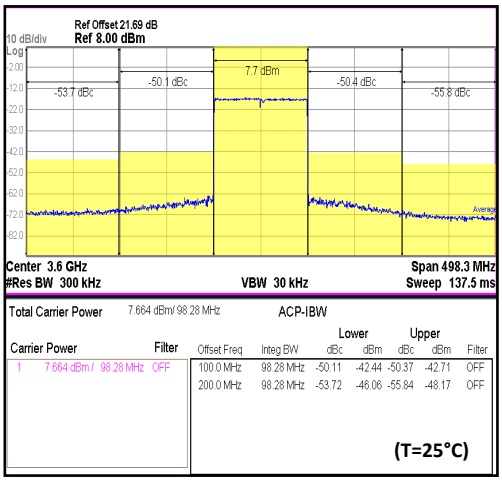




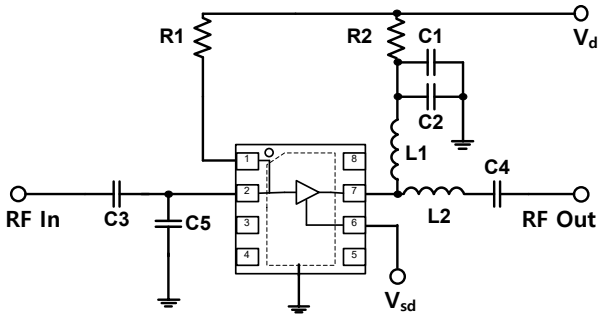








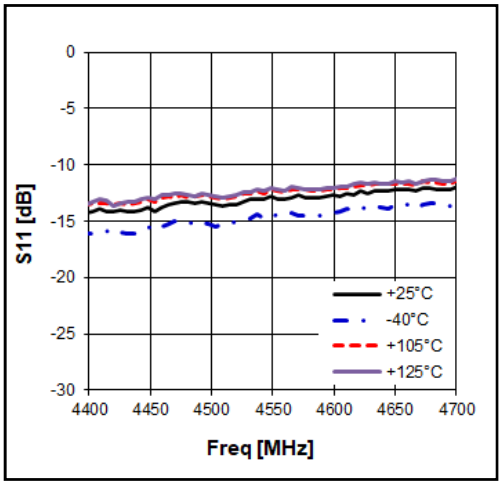
Application Circuit: 4550 MHz

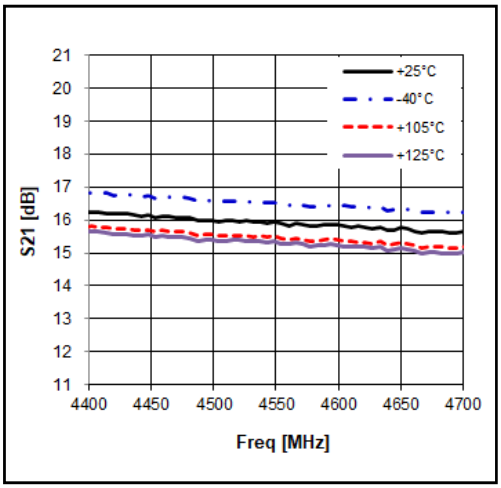


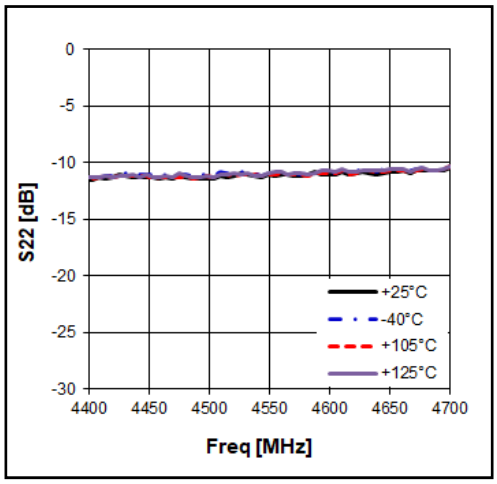
BOM		size	Marks
C1	1nF	1608	
C2	100pF	1608	
C3	2pF	1608	Johanson Technology 251R14S2R0BV4(HighQ)
C4	2pF	1608	Distance to pin7 : 6.5mm
C5	0.3pF	1608	Distance to pin2 : 2.1mm
L1	2.2nH	1608	
L2	Line	1608	Characteristics change when it is 0ohm.
R1	1.8Kohm	1608	
R2	0ohm	1608	

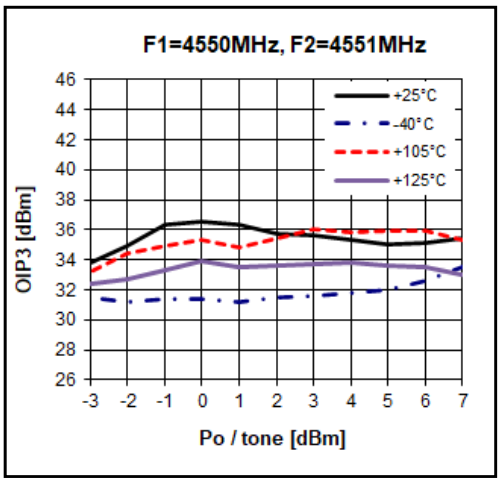
Typical Performance

V_d = 5V, I_d = 49mA

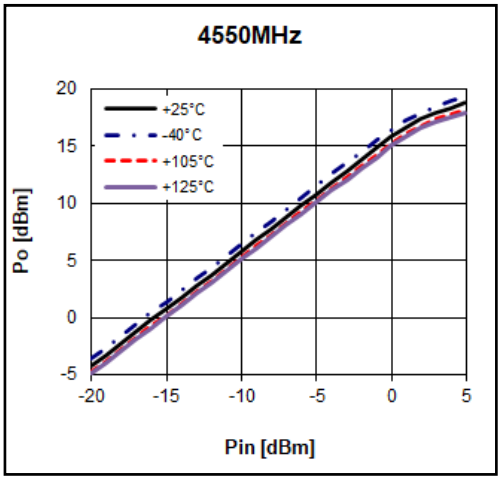


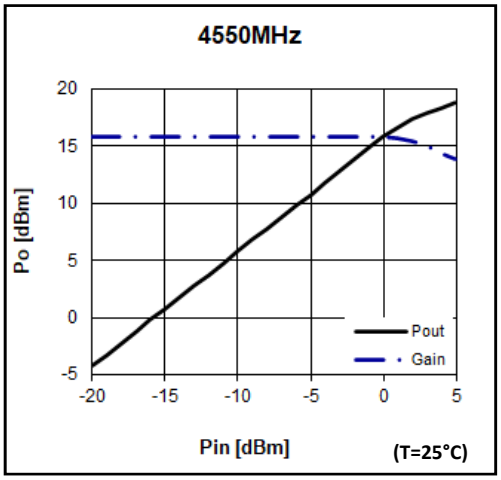


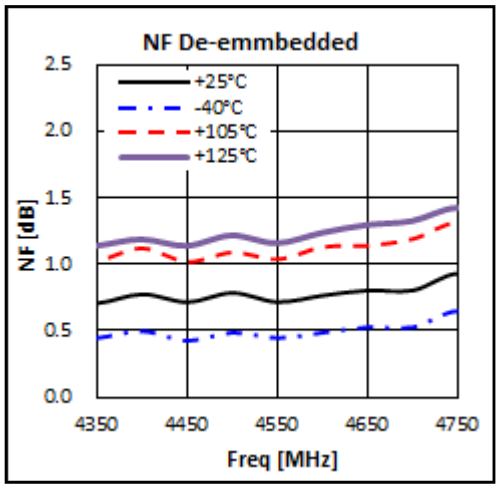


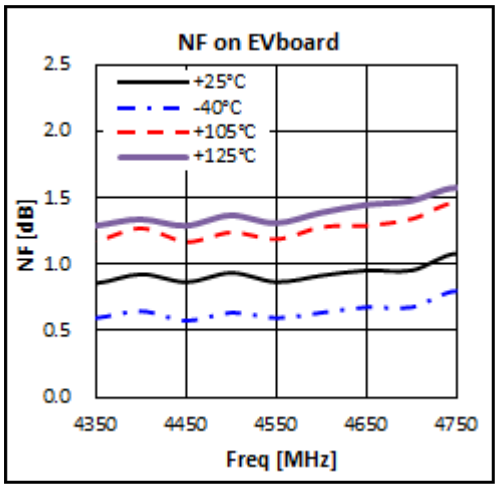


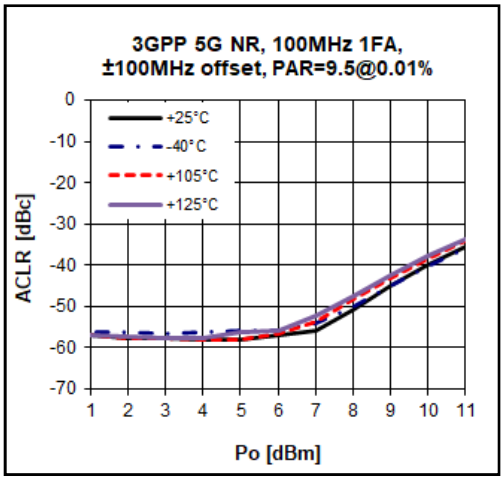
V_d = 5V, I_d = 49mA

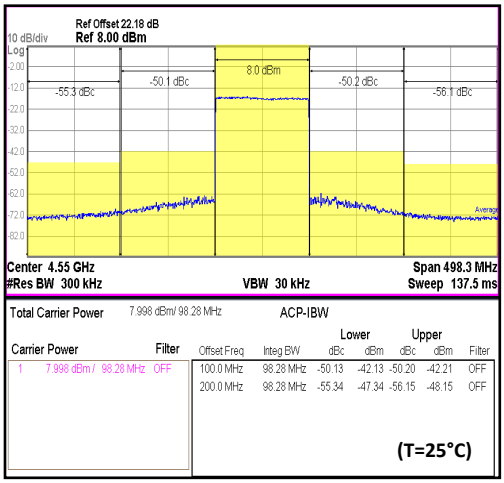




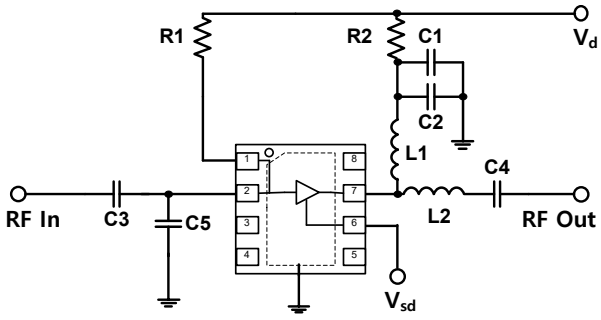








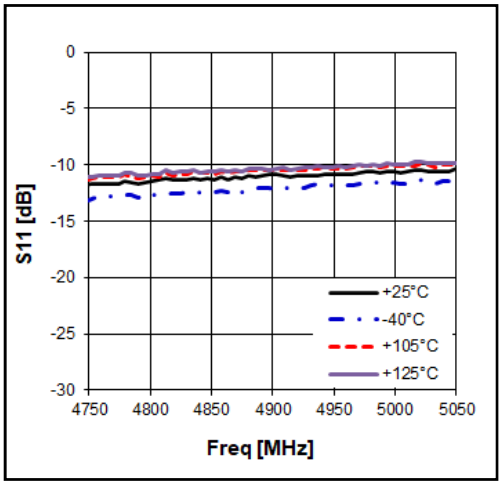
Application Circuit: 4900 MHz

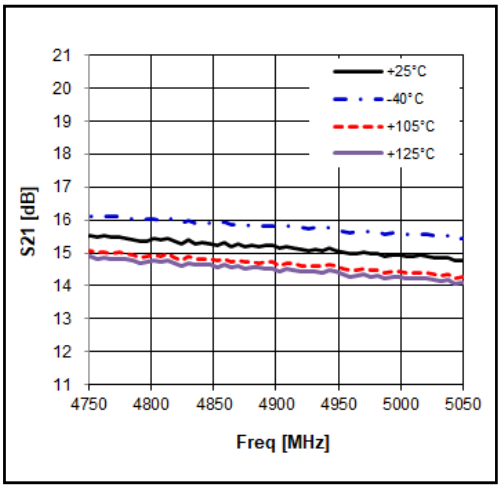


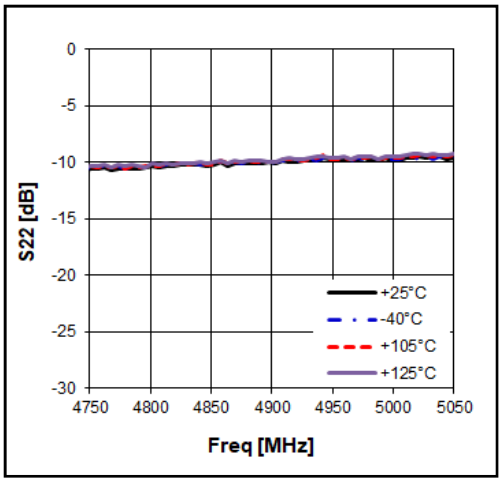
BOM		size	Marks
C1	1nF	1608	
C2	100pF	1608	
C3	2pF	1608	Johanson Technology 251R14S2R0BV4(HighQ)
C4	2pF	1608	Distance to pin7 : 6.5mm
C5	0.3pF	1608	Distance to pin2 : 2.1mm
L1	2.2nH	1608	
L2	Line	1608	Characteristics change when it is 0ohm.
R1	1.8Kohm	1608	
R2	0ohm	1608	

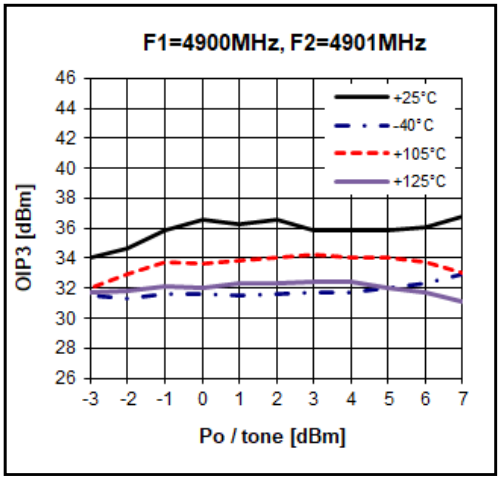
Typical Performance

V_d = 5V, I_d = 49mA

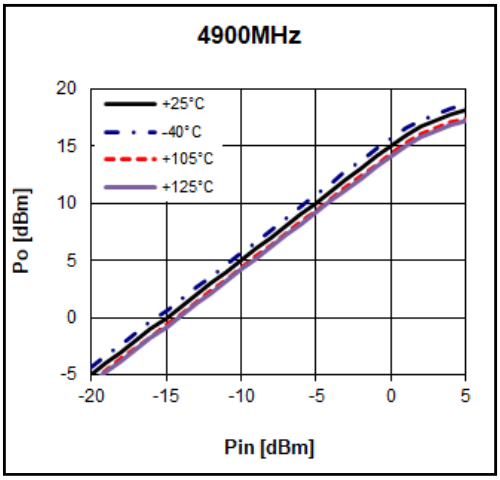


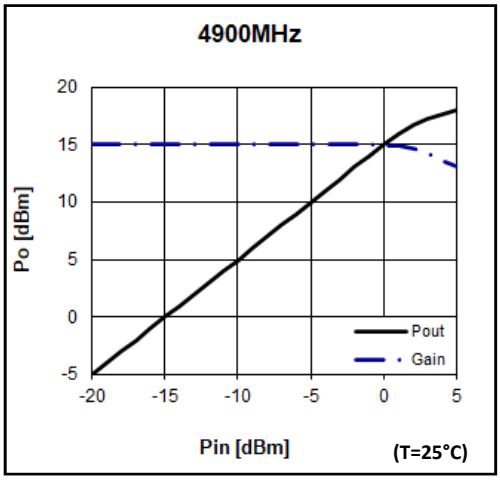


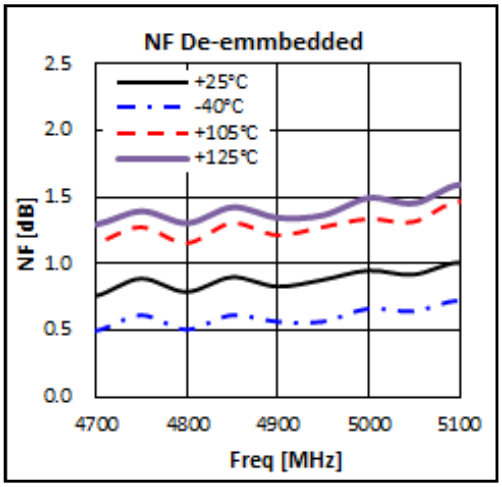


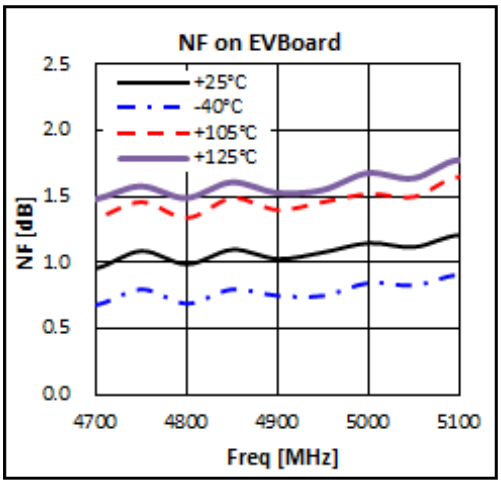


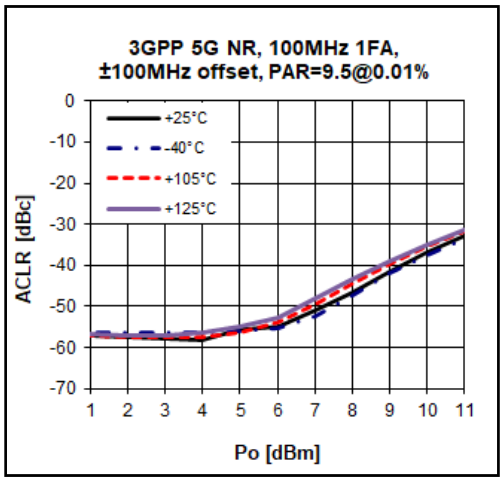
V_d = 5V, I_d = 49mA

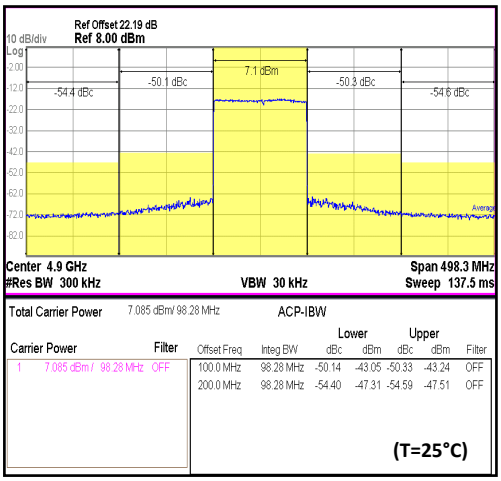






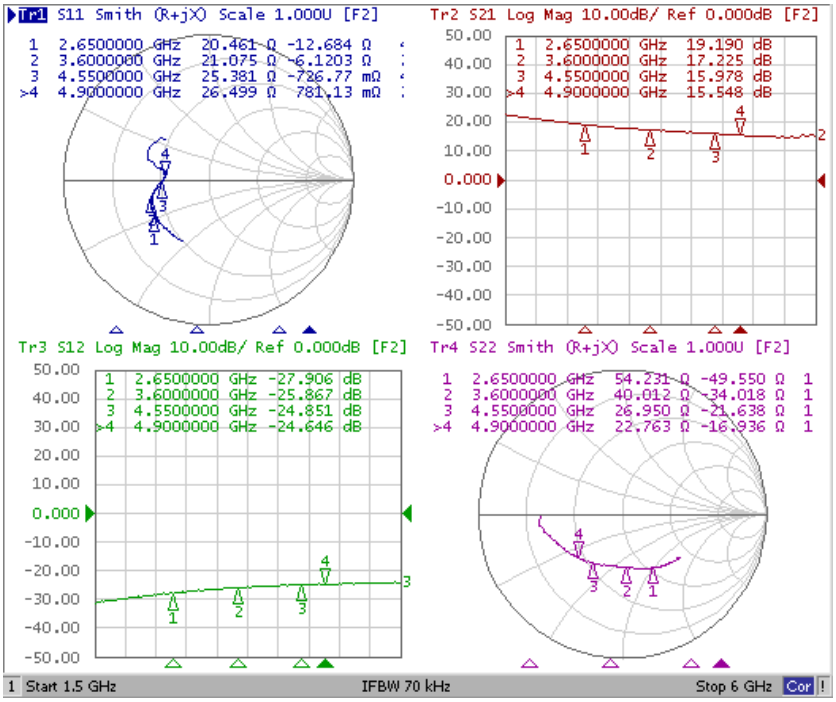






Typical Device Data

S-parameters (V_d=3.3V, I_d=44mA , T=25°C)

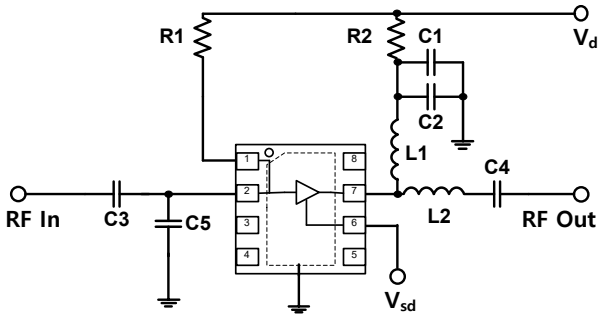


S-Parameter

(V_d=3.3V,I_d = 44mA, T = 25 °C, calibrated to device leads)

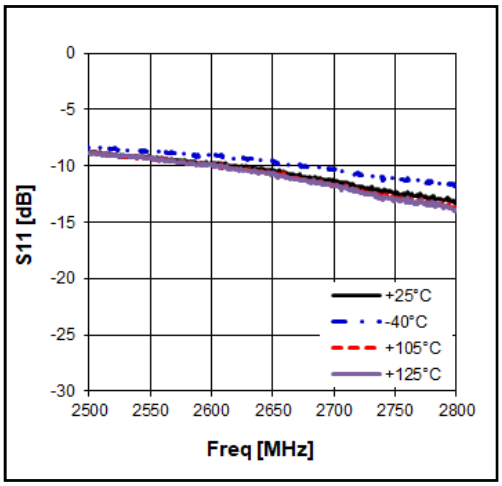
Freq [MHz]	S11 Mag	S11 Ang	S21 Mag	S21 Ang	S12 Mag	S12 Ang	S22 Mag	S22 Ang
2500	0.45	-143.44	9.51	50.90	0.04	25.76	0.44	-56.64
2600	0.45	-145.41	9.11	47.97	0.04	25.44	0.43	-58.63
2800	0.44	-149.79	8.74	41.61	0.04	22.57	0.42	-63.19
3000	0.44	-152.84	8.19	36.27	0.04	20.11	0.41	-68.28
3200	0.43	-156.64	7.91	29.69	0.05	16.87	0.39	-74.01
3400	0.42	-160.03	7.58	24.21	0.05	13.97	0.38	-79.68
3600	0.41	-162.97	7.26	18.55	0.05	8.76	0.37	-85.57
3800	0.39	-166.59	7.10	12.57	0.05	6.93	0.37	-92.73
4000	0.37	-169.41	6.88	5.68	0.05	3.61	0.37	-99.73
4200	0.35	-172.10	6.70	-0.47	0.05	0.92	0.38	-107.79
4400	0.34	-175.00	6.39	-7.23	0.06	-3.37	0.38	-114.82
4600	0.32	-178.43	6.25	-13.61	0.06	-5.65	0.40	-122.92
4800	0.31	178.42	6.03	-20.12	0.06	-9.58	0.42	-130.96
5000	0.30	175.22	5.87	-26.08	0.06	-13.90	0.44	-138.67

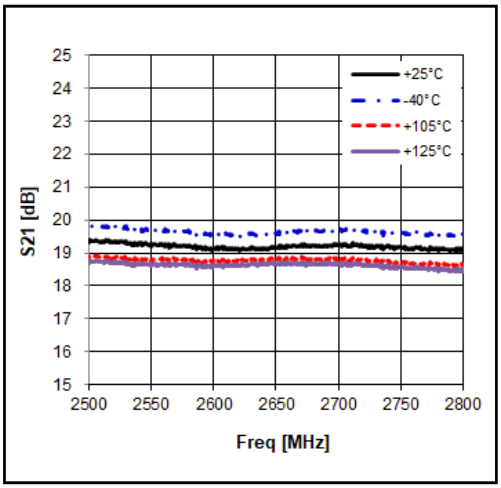
Application Circuit: 2650 MHz

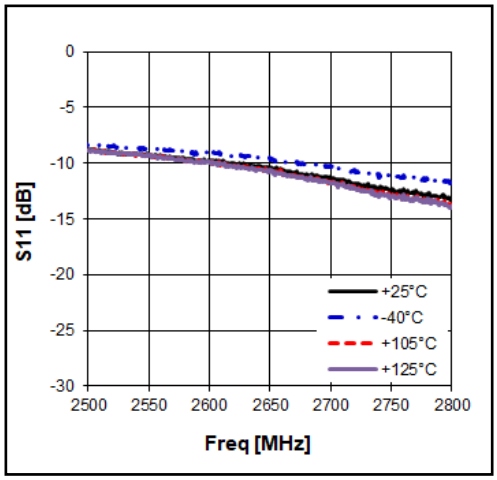
Schematic Diagram	BOM		size	Marks
	C1	1nF	1608	
	C2	100pF	1608	
	C3	5.1pF	1608	Johanson Technology 251R14S5R1BV4(HighQ)
	C4	5pF	1608	Distance to pin7 : 6.5mm
	C5	0.75pF	1608	Distance to pin2 : 5.0mm
	L1	2.2nH	1608	
	L2	Line	1608	Characteristics change when it is 0ohm.
	R1	910ohm	1608	
	R2	0ohm	1608	

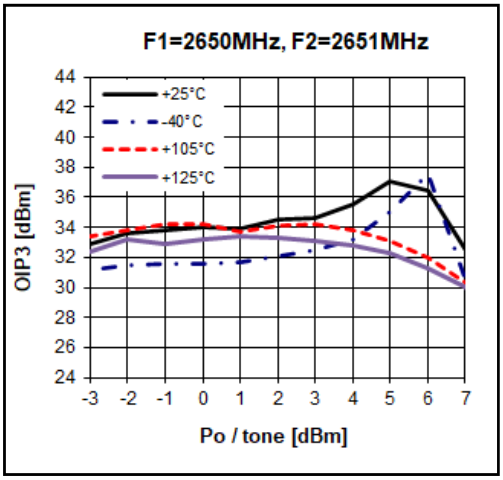
Typical Performance

V_d = 3.3V, I_d = 44mA

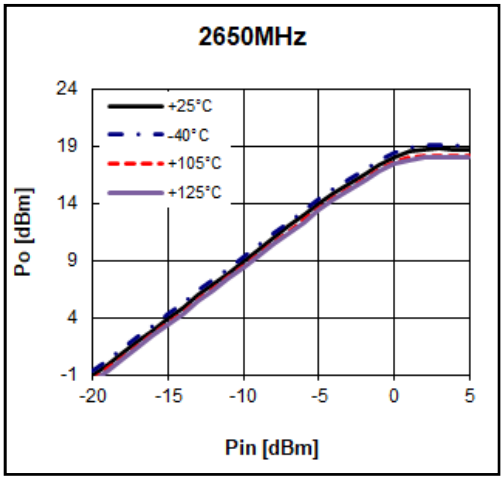


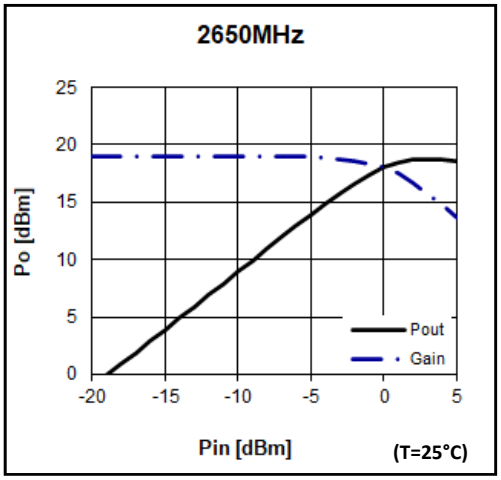


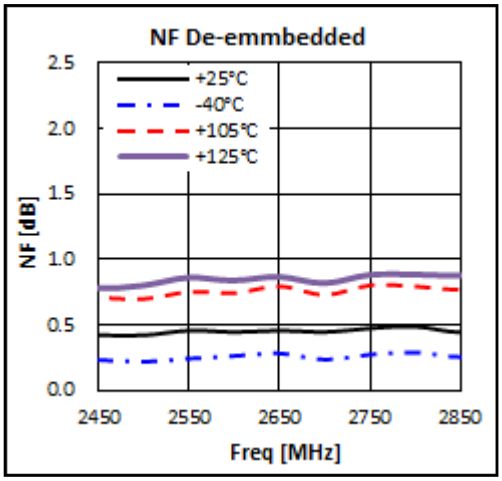


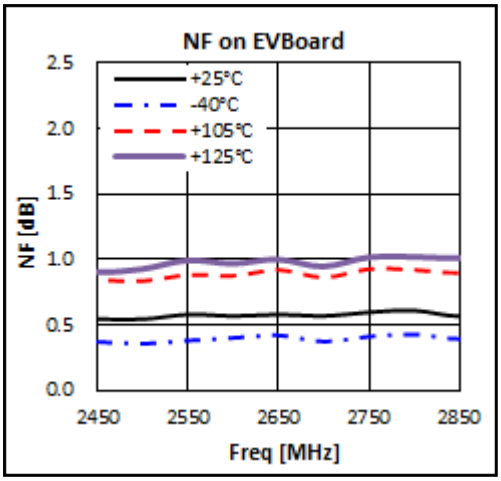


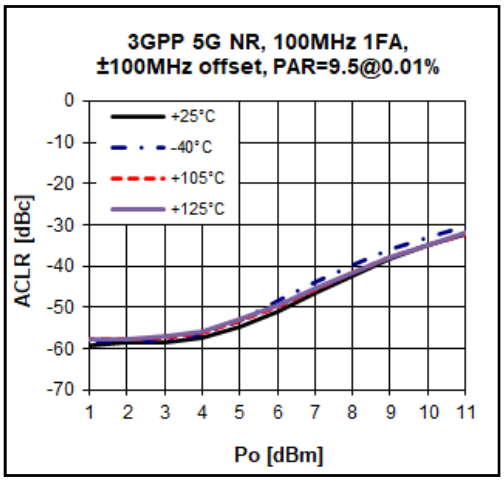
V_d = 3.3V, I_d = 44mA

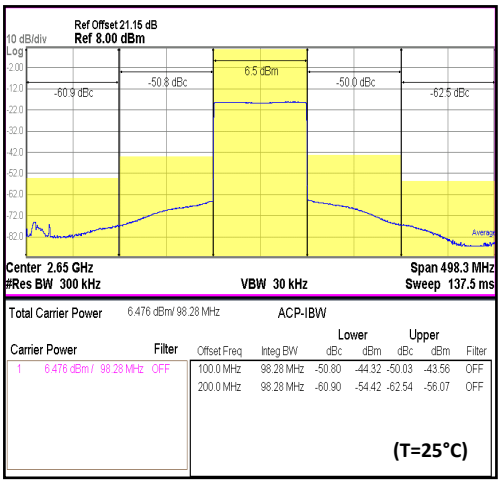




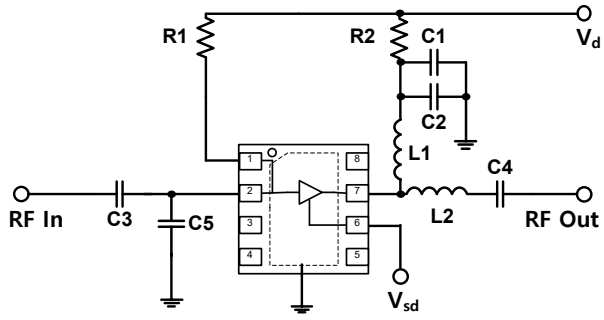






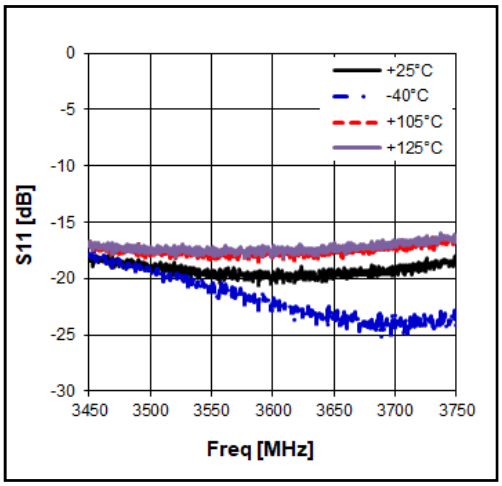


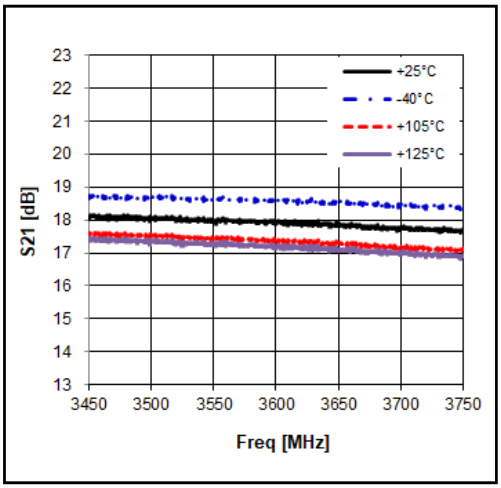
Application Circuit: 3600 MHz

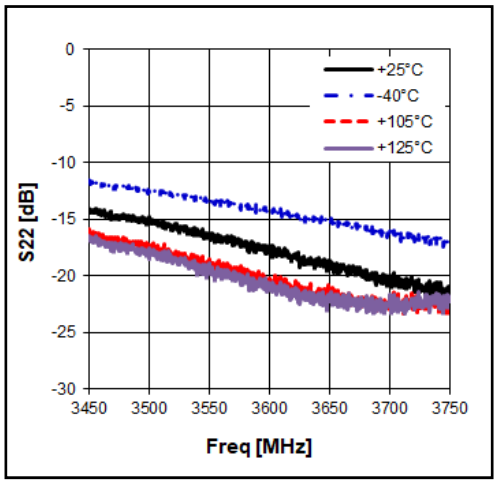
Schematic Diagram	BOM		size	Marks
	C1	1nF	1608	
	C2	100pF	1608	
	C3	2pF	1608	Johanson Technology 251R14S2R0BV4(HighQ)
	C4	2pF	1608	Distance to pin7 : 6.5mm
	C5	0.3pF	1608	Distance to pin2 : 2.9mm
	L1	1.8nH	1608	
	L2	1nH	1608	
	R1	910ohm	1608	
	R2	0ohm	1608	

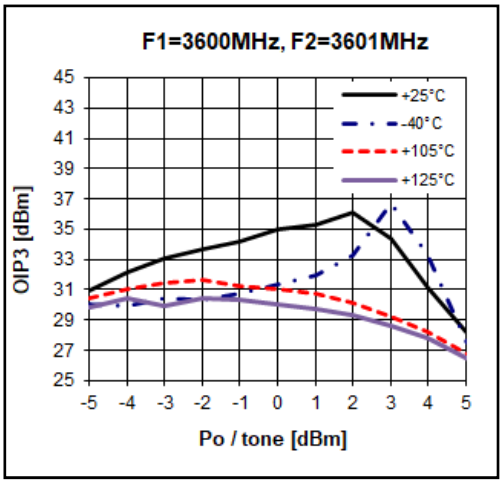
Typical Performance

V_d = 3.3V, I_d = 44mA

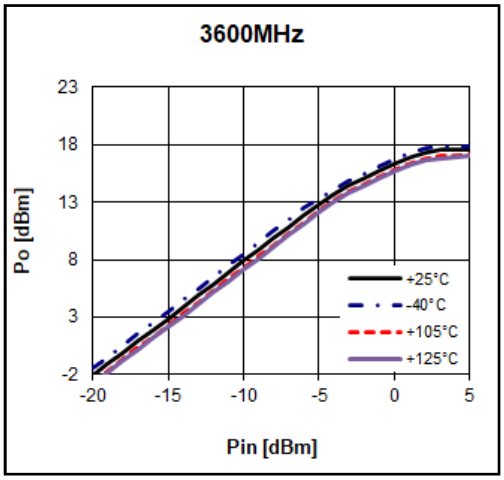


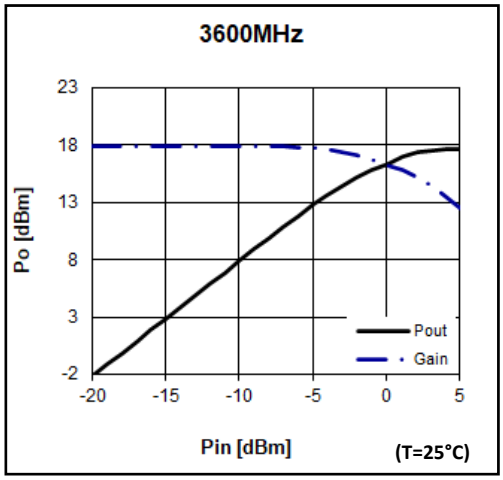


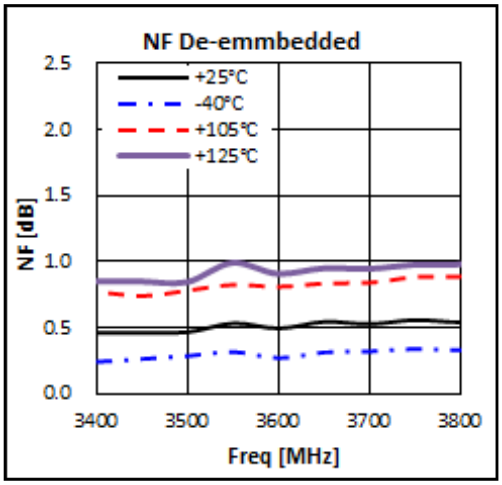


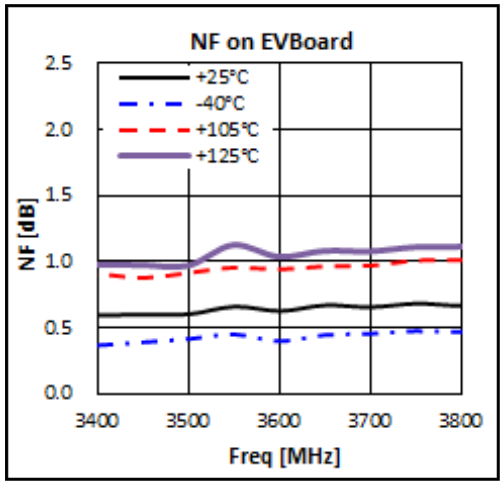


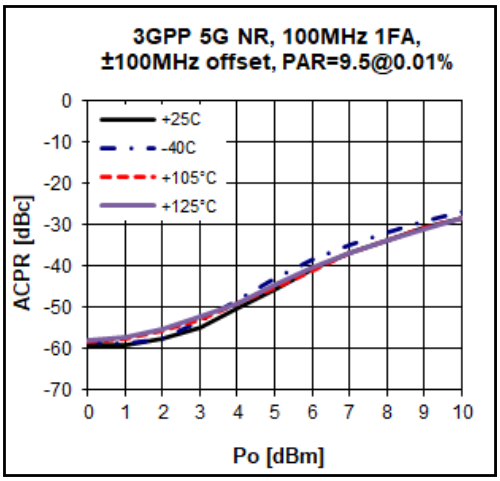
V_d = 3.3V, I_d = 44mA

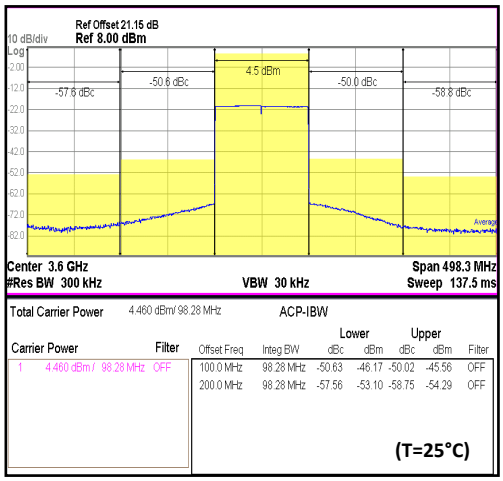




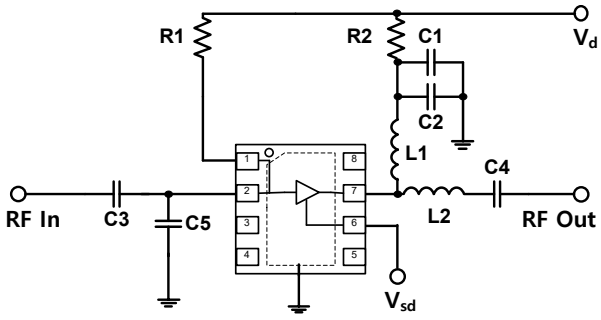






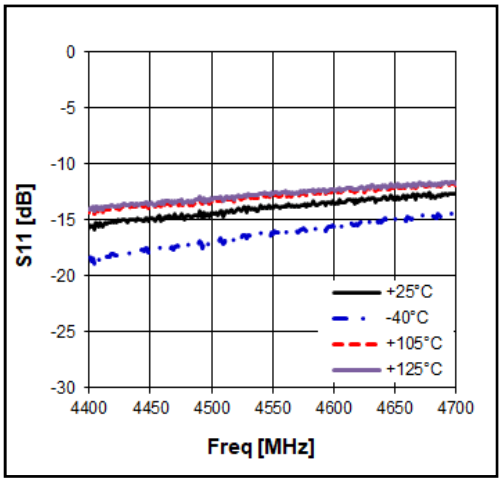


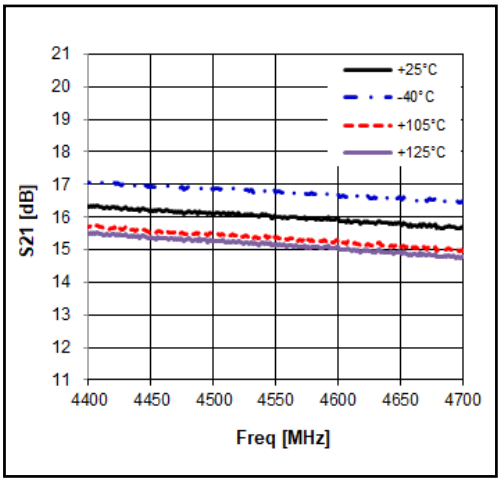
Application Circuit: 4550 MHz

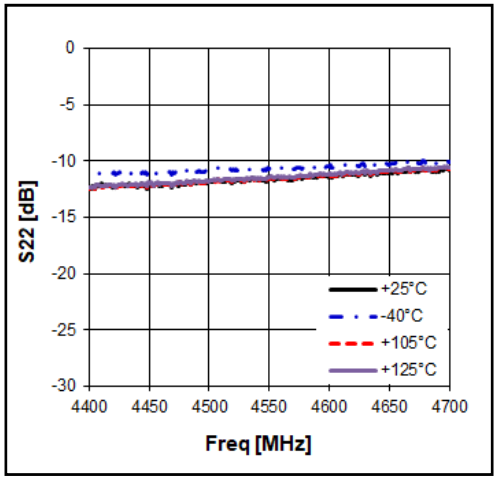
Schematic Diagram	BOM		size	Marks
	C1	1nF	1608	
	C2	100pF	1608	
	C3	2pF	1608	Johanson Technology 251R14S2R0BV4(HighQ)
	C4	2pF	1608	Distance to pin7 : 6.5mm
	C5	0.3pF	1608	Distance to pin2 : 2.1mm
	L1	2.2nH	1608	
	L2	Line	1608	Characteristics change when it is 0ohm.
	R1	1.8Kohm	1608	
	R2	0ohm	1608	

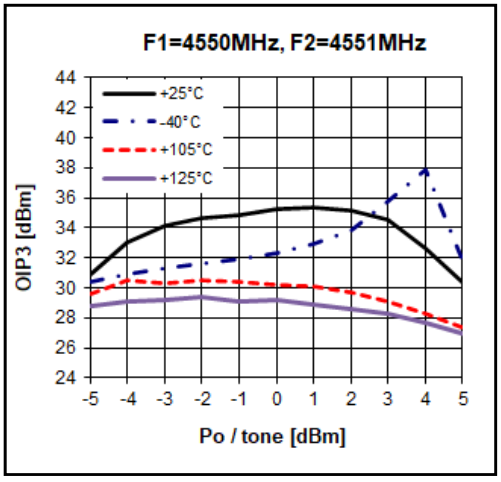
Typical Performance

V_d = 3.3V, I_d = 44mA

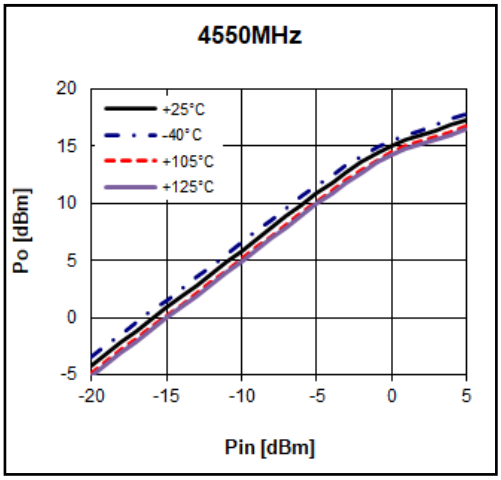


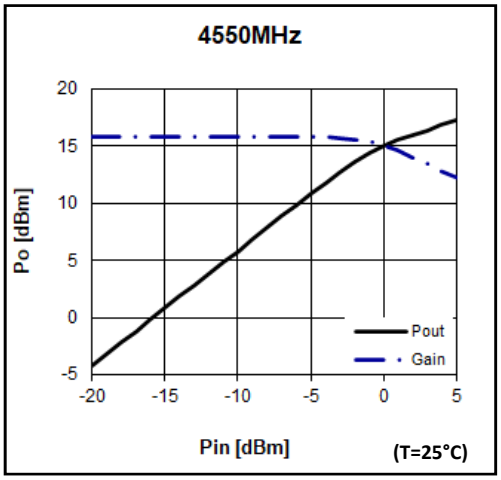


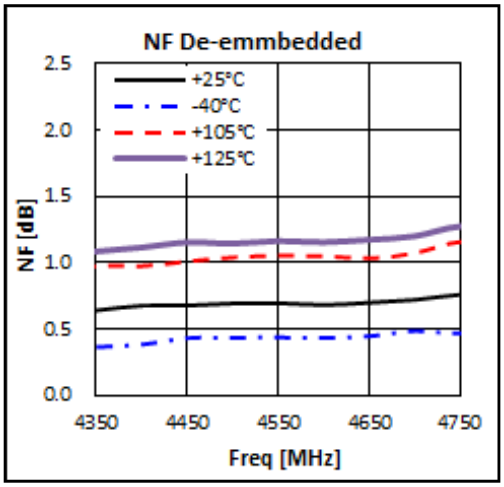


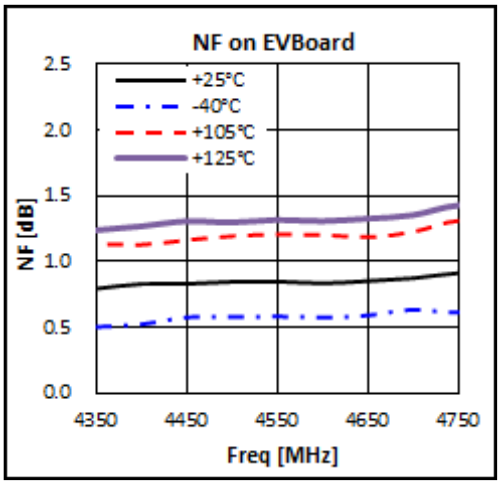


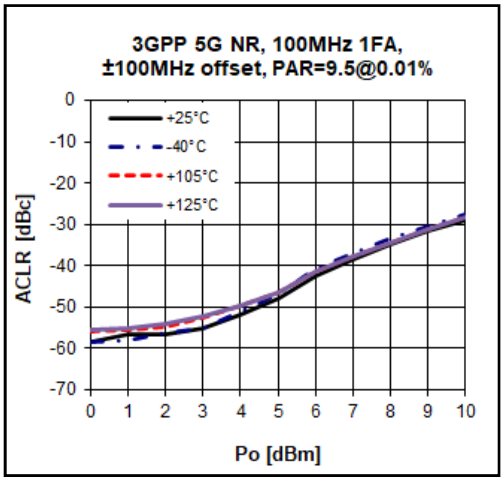
V_d = 3.3V, I_d = 44mA

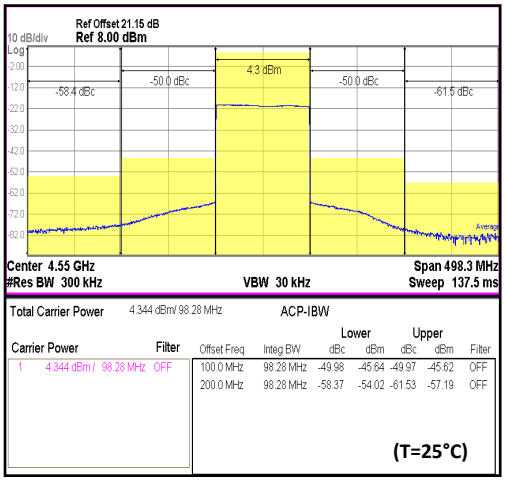




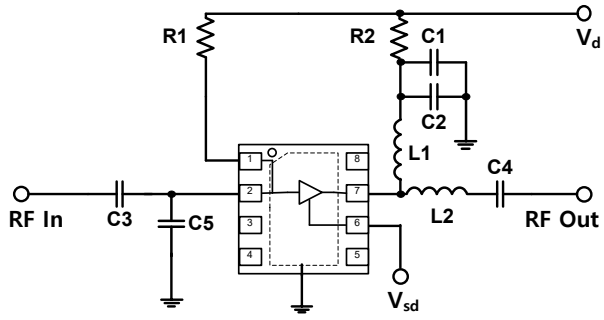






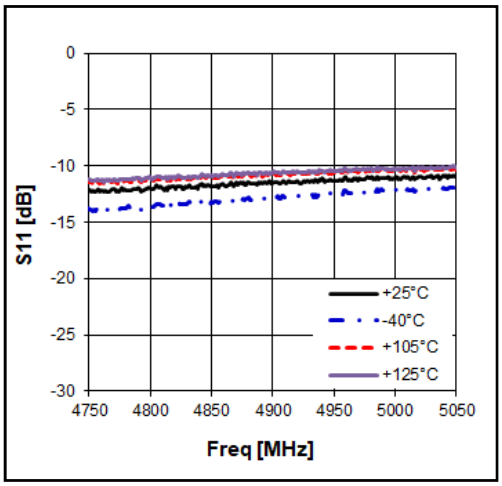


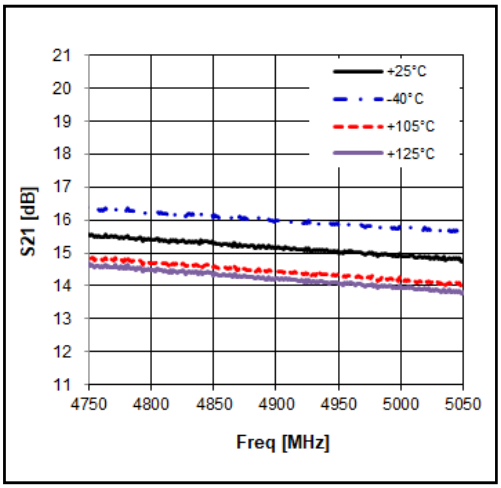
Application Circuit: 4900 MHz

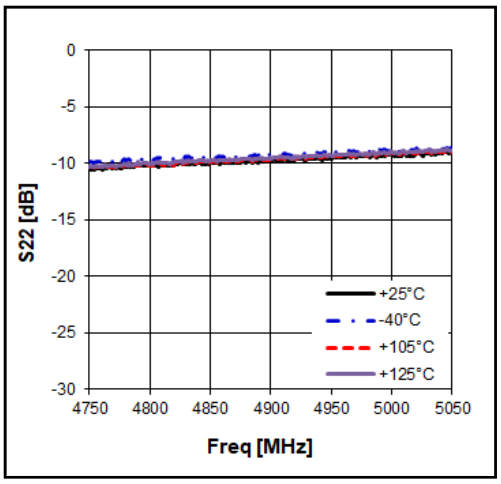
Schematic Diagram	BOM		size	Marks
	C1	1nF	1608	
	C2	100pF	1608	
	C3	2pF	1608	Johanson Technology 251R14S2R0BV4(HighQ)
	C4	2pF	1608	Distance to pin7 : 6.5mm
	C5	0.3pF	1608	Distance to pin2 : 2.1mm
	L1	2.2nH	1608	
	L2	Line	1608	Characteristics change when it is 0ohm.
	R1	1.8Kohm	1608	
	R2	0ohm	1608	

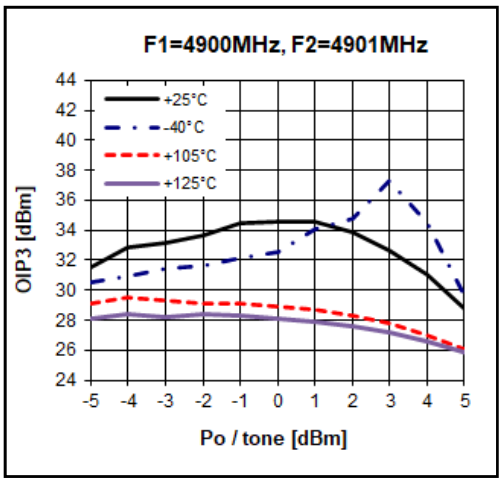
Typical Performance

V_d = 3.3V, I_d = 44mA

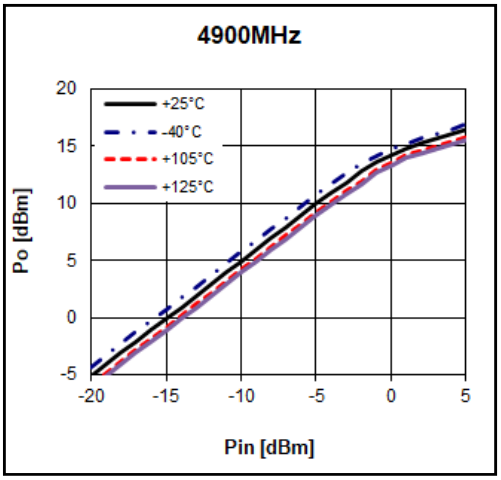


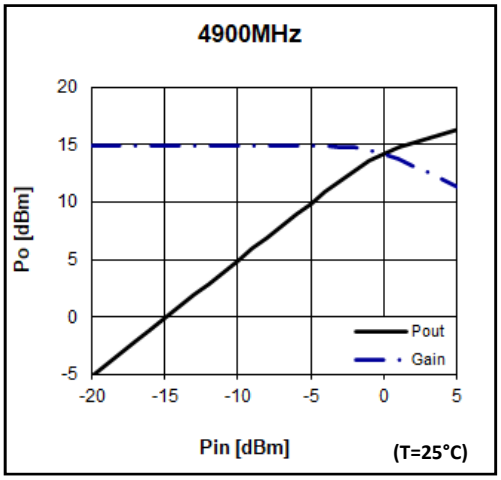


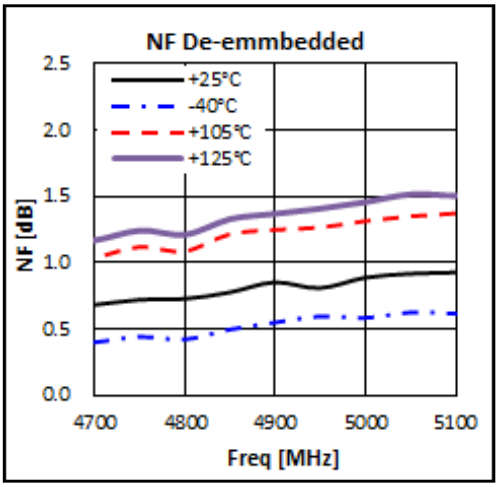


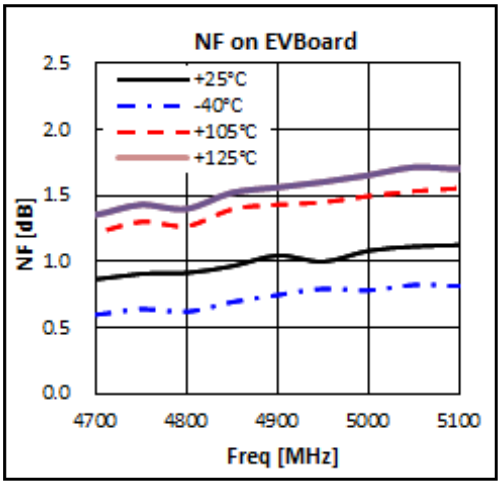


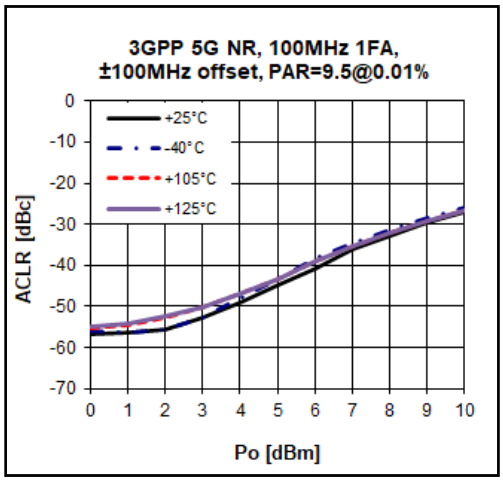
V_d = 3.3V, I_d = 44mA

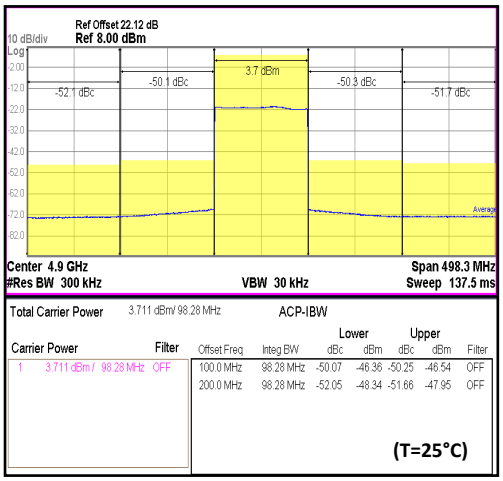




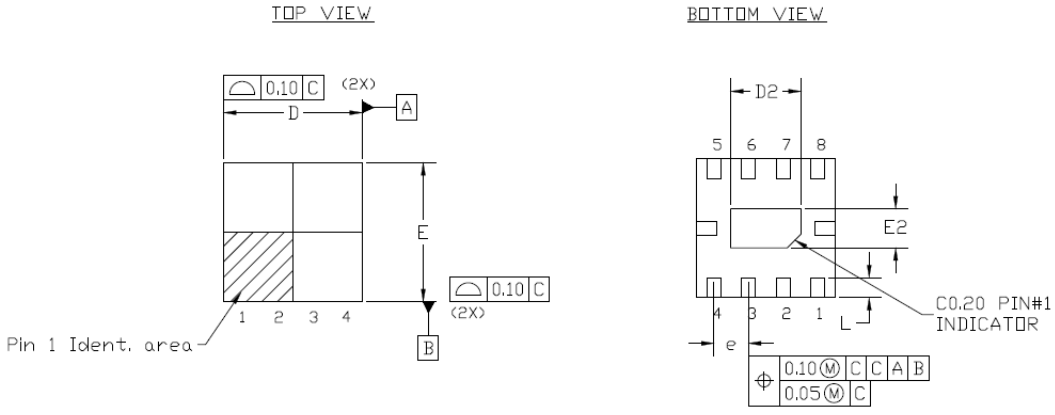








Package Outline Dimension



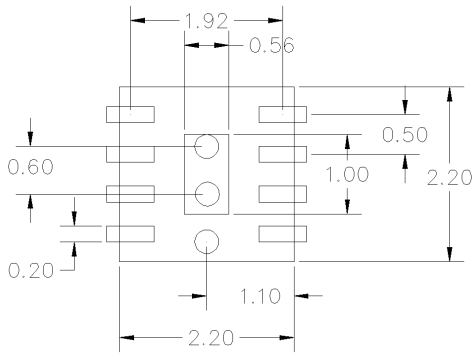
SYMBOL	COMMON					
	DIMENSIONS MILLIMETER			DIMENSIONS INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.50	0.55	0.60	0.020	0.022	0.024
A3	0.150 REF			0.006 REF		
A1	0.00	0.02	0.05	0.000	0.001	0.002
b	0.15	0.20	0.25	0.006	0.008	0.010
D	1.90	2.00	2.10	0.075	0.079	0.083
D2	0.92	1.02	1.12	0.036	0.040	0.044
E	1.90	2.00	2.10	0.075	0.079	0.083
E2	0.46	0.56	0.66	0.018	0.022	0.026
e	0.50 BSC			0.020 BSC		
L	0.24	0.29	0.30	0.010	0.011	0.012

NOTES :

1. DIMENSION AND TOLERANCING CONFORM TO ASME Y14.5M-1994.
2. CONTROLLING DIMENSIONS : MILLIMETER, CONVERTED INCH DIMENSION ARE NOT NECESSARILY EXACT.

Suggested PCB Land Pattern and PAD Layout

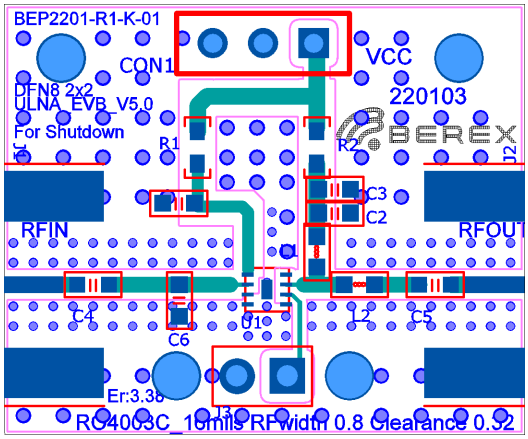
PCB Land Pattern



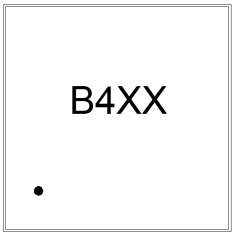
Note : All dimension _ millimeters

PCB lay out _ on BeRex website

PCB Mounting



Package Marking

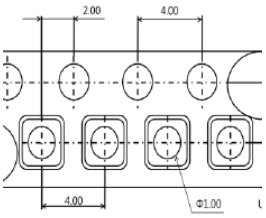


Pin 1

XX = Wafer No.

Tape & Reel

DFN 8L 2x2



Packaging information:

Tape Width (mm): 8

Reel Size (inches): 7

Device Cavity Pitch (mm): 4

Devices Per Reel: 3000

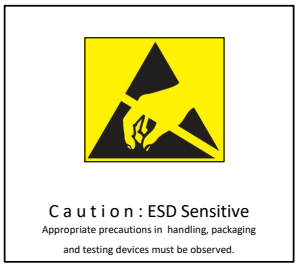
Lead plating finish

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 ≥ 1000V to < 2000 V
Test:	Human Body Model (HBM)
Standard:	JEDEC Standard JS-001-2017
ESD Rating:	Class C2
Value:	Passes ≥ 500V to < 1000 V
Test:	Charged Device Model (CDM)
Standard:	JEDEC Standard JS-002-2018
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**