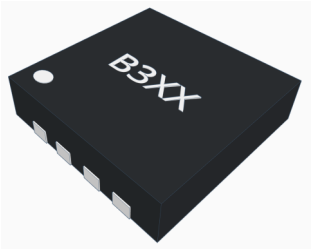
BLB03

1500 – 4000 MHz High Linearity LNA

Device Features

- Operated at 3.0V and 5.0V
- 35.5 dBm Output IP3 at 0dBm/tone at 3500MHz
- 16.4 dB Gain at 3500 MHz
- 20.1 dBm P1dB at 3500MHz
- 0.83 dB NF at 3500MHz
- Fast shut down to support TDD systems
- Green/RoHS2 Compliant DFN 8L 2x2 Package

Part Marking (XX:Wafer number)



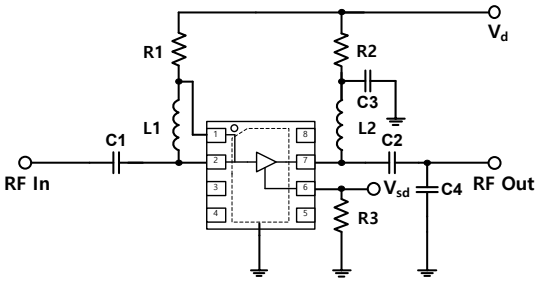
Product Description

BeRex's BLB03 is a high linearity LNA, based on GaAs material with E-pHEMT process and packaged in a RoHS2-compliant DFN 8L 2x2 mm^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 1.5~4.0GHz. It can be used in fast shutdown switching speed for TD-LTE 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	5V Value	3V Value	5V Value	3V Value
Freq	1.5~3G	1.5~3G	3~4G	3~4G
C1,C2,C3	20pF	20pF	20pF	20pF
C4	N/A	N/A	0.3pF	0.3pF
R1	9.1Kohm	6.8Kohm	9.1Kohm	6.8Kohm
R2	3 ohm	3 ohm	3 ohm	3 ohm
R3	20kohm	20kohm	20kohm	20kohm
L1	15nH	15nH	15nH	15nH
L2	8.2nH	8.2nH	8.2nH	8.2nH

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		1500		4000	MHz
Test Frequency			3500		MHz
Gain		14.9	16.4		dB
Input Return Loss			-12.9		dB
Output Return Loss			-10.5		dB
Output IP3	0 dBm / tone , Δf=1 MHz	32.5	35.5		dBm
Output P1dB		19.1	20.1		dBm
Noise Figure			0.83	1.03	dB

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

Device performance _ measured on a BeRex evaluation board at 25°C, Vd=3V, 50 Ω system.

Parameter	Conditions	Min	Typ	Max	Unit
Operational Frequency Range		1500		4000	MHz
Test Frequency			3500		MHz
Gain		14.2	15.7		dB
Input Return Loss			-10.6		dB
Output Return Loss			-11.2		dB
Output IP3	0 dBm / tone , Δf=1 MHz	27.8	30.8		dBm
Output P1dB		14.8	15.8		dBm
Noise Figure			0.85	1.05	dB

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

Recommended Operating Conditions[1]

Parameter	Min	Typ	Max	Unit
Bandwidth	1500		4000	MHz
I_d @ (V_d = 5.0V)	46	57	68	mA
I_d @ (V_d = 3.0V)	27	34	41	mA
V_d	3	5	5.25	V
dG/dT		-0.008		dB/°C
R_{TH}		34.1		°C/W
Operating Case Temperature	-40		+105	°C

Electrical specifications are measured at specified test conditions.

Specifications are not guaranteed over all recommended operating conditions.

Recommended Operating Conditions[2]

Paramter	Condition	Min.	Typical	Max.	Unit
Shutdown Control	On state	0		0.9	V
	Off state(shutdown)	1.17		V_{DD}	V
Current, IDD	On state 5V	46	57	68	mA
	On state 3V	27	34	41	mA
	Off state(shutdown)	5	7	9	mA
Shutdown pin current,Isd	$1.17V \leq V_{sd} < V_{DD}$		150		uA
Switching Time	Rise time(10% to 90%)		140		ns
	Fall time(90% to 10%)		40		ns

Absolute Maximum Ratings

Parameter	Rating	Unit
Storage Temperature	-55 to +155	°C
Junction Temperature	+160	°C
Supply Voltage	+6	V
Supply Current	120	mA
Input RF Power	21	dBm

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

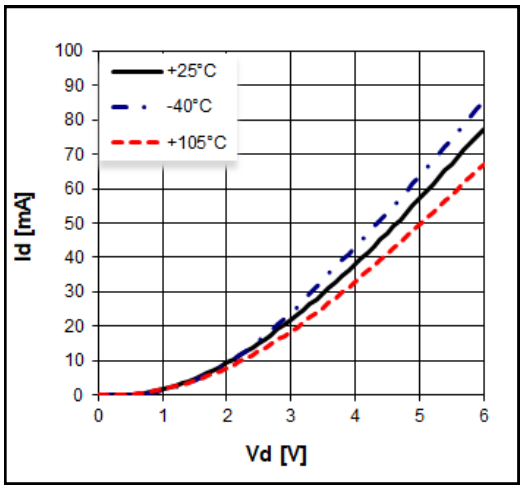
Typical Performance (Vd=5.0V, Id=57mA , T=25°C)

Parameter	Frequency				Unit
V_d = 5V	**1850**	**2140**	**2650**	**3500**	**MHz**
Gain	20.3	19.5	18	16.4	dB
S11	-14.4	-15.1	-15.1	-12.9	dB
S22	-6.8	-7.3	-7.8	-10.5	dB
OIP3	33.9	34.3	35.8	35.5	dBm
P1dB	20.9	21.2	21	20.1	dBm
Noise Figure	0.64	0.68	0.73	0.83	dB

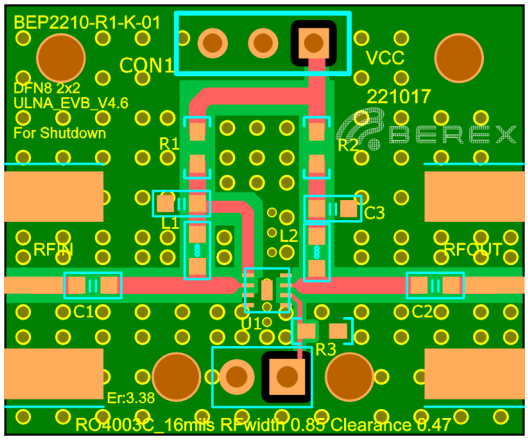
Typical Performance (Vd=3.0V, Id=34mA, T=25°C)

Parameter	Frequency				Unit
V_d = 3V	**1850**	**2140**	**2650**	**3500**	**MHz**
Gain	19.5	18.6	17	15.7	dB
S11	-11.9	-12.7	-12.7	-10.6	dB
S22	-7.0	-7.4	-7.8	-11.2	dB
OIP3	29.6	29.6	30.3	30.8	dBm
P1dB	16.5	16.8	16.6	15.8	dBm
Noise Figure	0.64	0.68	0.73	0.85	dB

V-I Characteristics

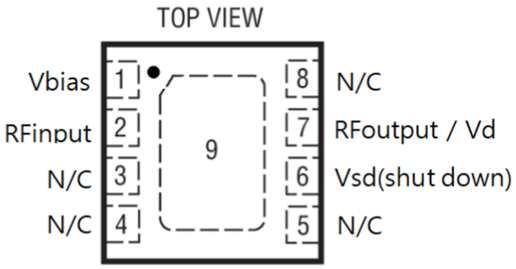


Evaluation Board



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

Pin Configuration and Description

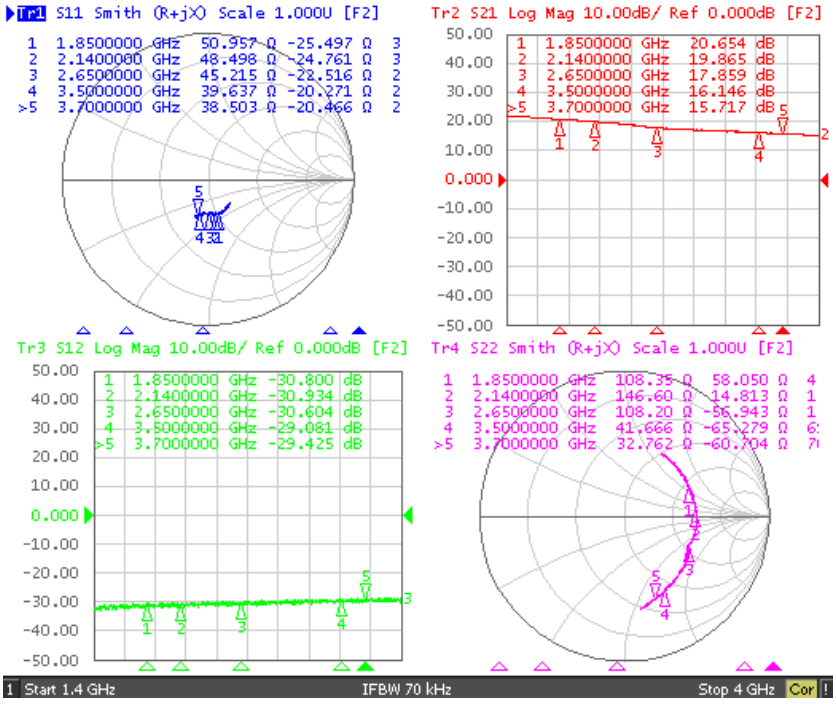


DC PACKAGE
8-LEAD (2mm × 2mm) PLASTIC DFN

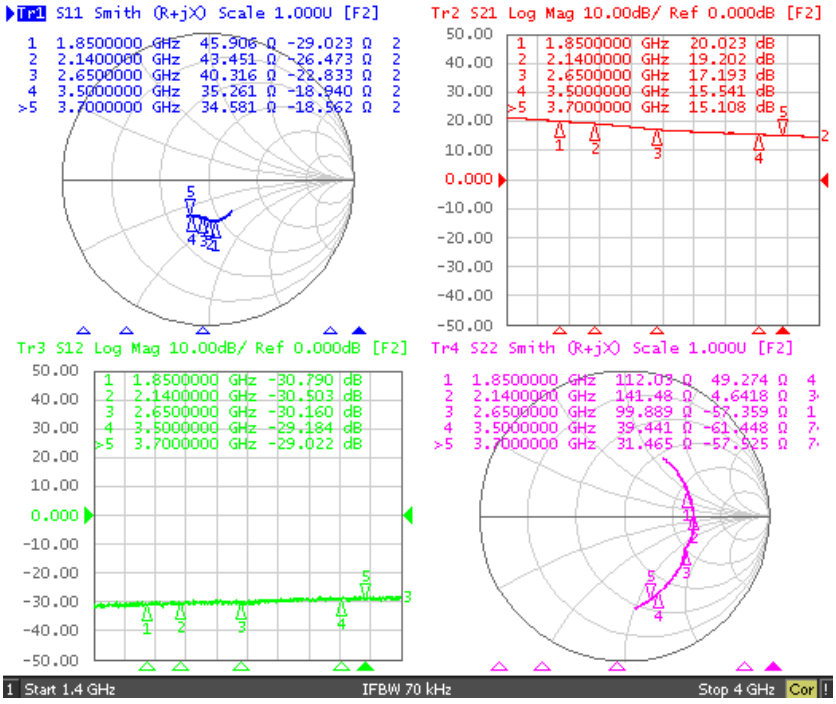
Pin No.	Name	Description
1	Vbias	Vbias sets Idq through external resistor for V_d=5V or V_d=3.3V.
2	RFinput	RFinput pin. A DC Block with High Q performance is required.
6	Vsd(shut down)	Power on/off control pin. 1.17V≤Vsd disables device. Vsd are not loaded, the LNA will operate in its standard “ON” state.
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=57mA , T=25°C)



S-parameters (V_d=3.0V, I_d=34mA, T=25°C)



S-Parameter

(Vd=5.0V,Id = 57mA, T = 25 °C, calibrated to device leads)

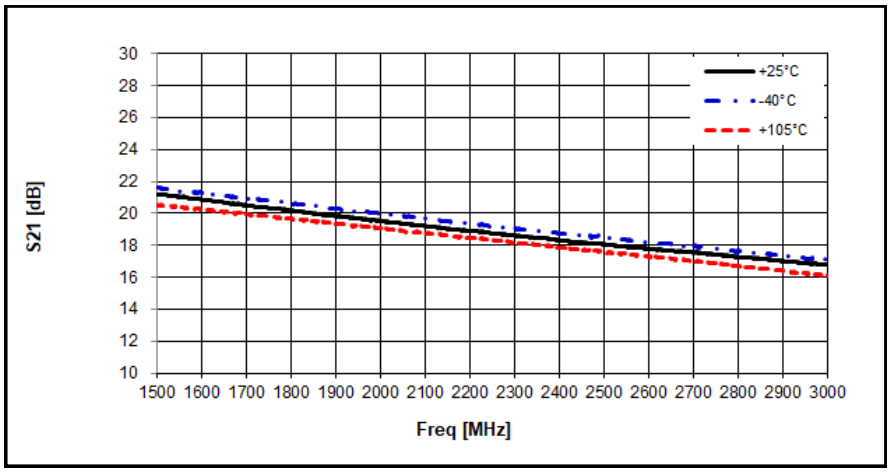
Freq [MHz]	S11 Mag	S11 Ang	S21 Mag	S21 Ang	S12 Mag	S12 Ang	S22 Mag	S22 Ang
1400	0.22	-48.10	12.57	138.29	0.025	50.66	0.50	59.09
1600	0.24	-63.52	11.77	122.96	0.026	40.26	0.50	43.40
1800	0.25	-71.32	10.95	110.41	0.027	35.05	0.49	28.03
2000	0.24	-76.46	10.33	98.67	0.029	35.60	0.50	14.54
2200	0.24	-80.73	9.69	88.18	0.029	29.61	0.50	1.12
2400	0.23	-85.23	8.81	77.72	0.028	27.96	0.50	-11.30
2600	0.24	-87.56	7.98	70.34	0.029	22.55	0.49	-22.57
2800	0.24	-92.60	7.49	63.96	0.030	24.65	0.51	-29.18
3000	0.24	-96.30	7.06	58.41	0.031	23.03	0.54	-39.12
3200	0.24	-100.78	6.78	50.86	0.032	21.35	0.55	-48.95
3400	0.25	-103.61	6.55	44.42	0.032	17.00	0.58	-57.57
3600	0.25	-105.48	6.23	37.65	0.032	13.75	0.60	-65.81
3800	0.27	-108.04	5.99	31.44	0.034	13.23	0.63	-73.33
4000	0.28	-108.31	5.81	25.18	0.033	6.89	0.65	-80.04

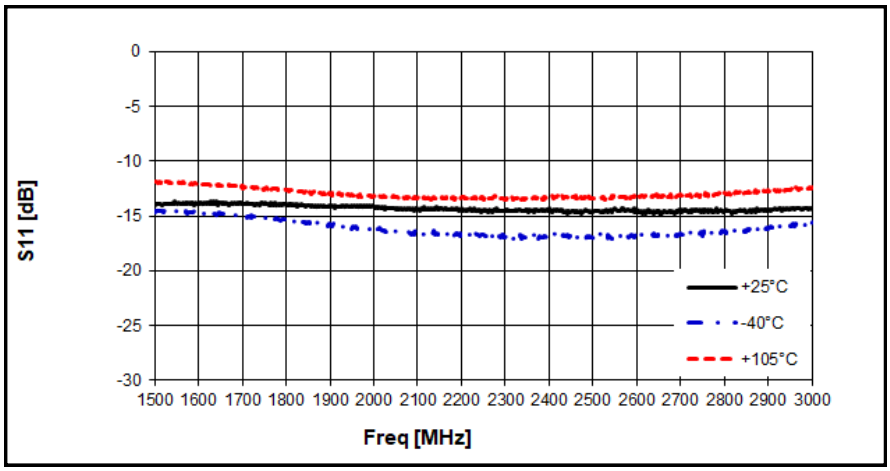
(Vd=3.0V,Id = 34mA, T = 25 °C, calibrated to device leads)

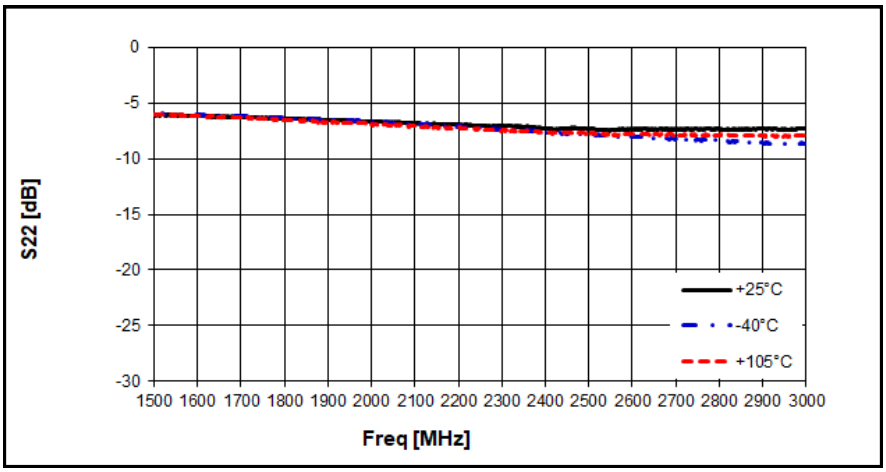
Freq [MHz]	S11 Mag	S11 Ang	S21 Mag	S21 Ang	S12 Mag	S12 Ang	S22 Mag	S22 Ang
1400	0.27	-54.12	11.68	138.84	0.027	48.70	0.49	56.43
1600	0.29	-69.63	10.95	123.29	0.028	42.06	0.48	40.52
1800	0.29	-78.87	10.14	110.55	0.027	42.89	0.47	24.77
2000	0.28	-85.20	9.60	98.75	0.030	38.74	0.47	11.24
2200	0.28	-89.50	9.01	88.19	0.032	31.08	0.49	-1.69
2400	0.27	-93.83	8.17	77.62	0.031	30.36	0.49	-14.12
2600	0.27	-97.66	7.41	69.90	0.032	26.40	0.48	-25.52
2800	0.27	-102.26	6.97	63.63	0.032	24.81	0.50	-32.82
3000	0.26	-106.54	6.59	57.74	0.033	22.43	0.52	-42.44
3200	0.26	-111.13	6.32	49.91	0.035	17.74	0.54	-52.02
3400	0.27	-114.33	6.09	43.48	0.036	17.81	0.57	-60.85
3600	0.27	-116.53	5.78	36.40	0.036	13.11	0.59	-68.74
3800	0.28	-118.25	5.59	30.09	0.037	13.41	0.62	-76.76
4000	0.29	-119.02	5.41	23.70	0.040	8.86	0.65	-82.83

Typical Performance

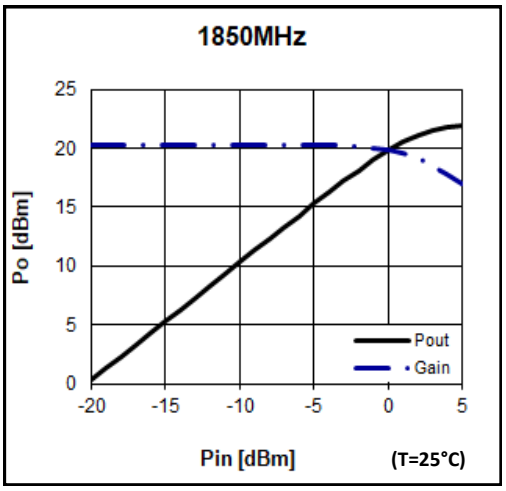
V_d = 5V, I_d = 57mA

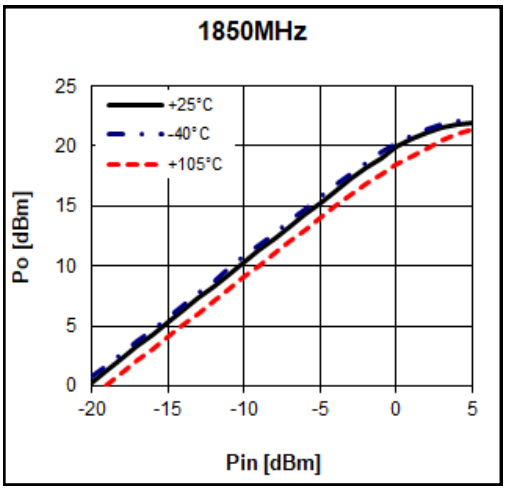


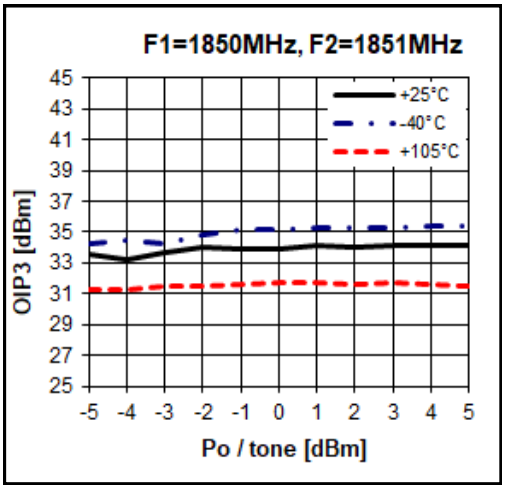


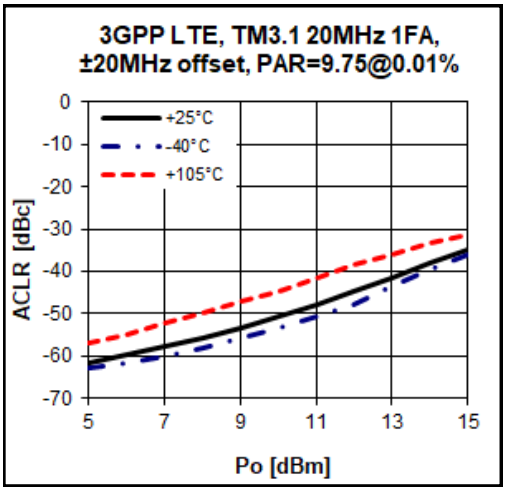


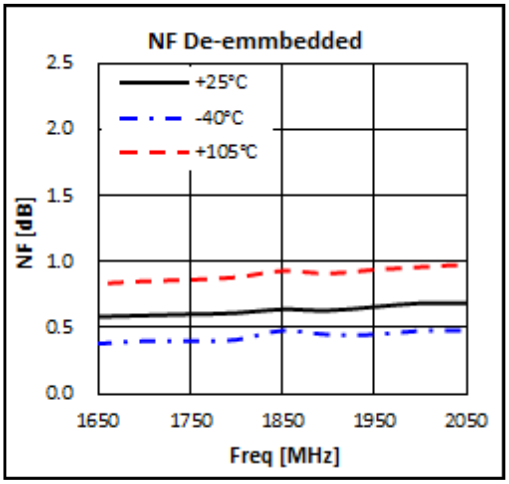
V_d = 5V, I_d = 52mA

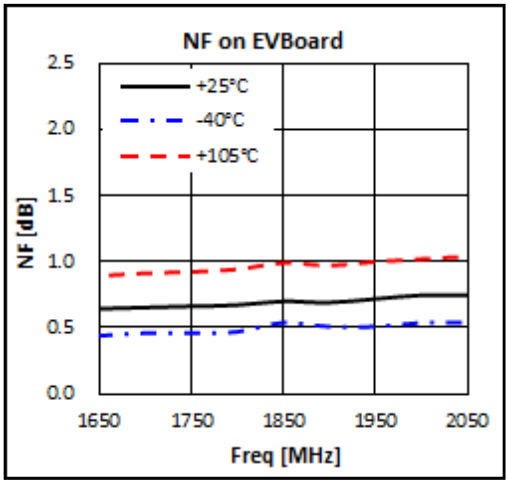




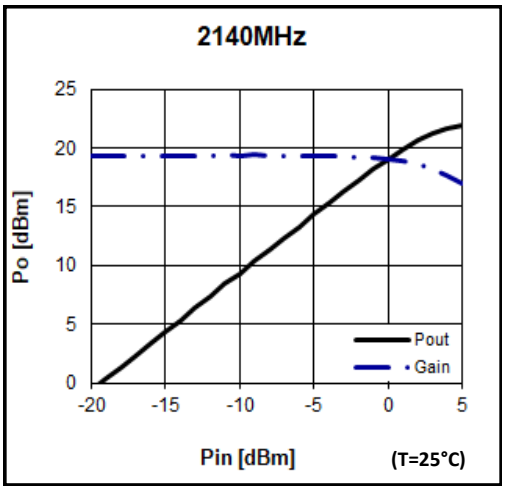


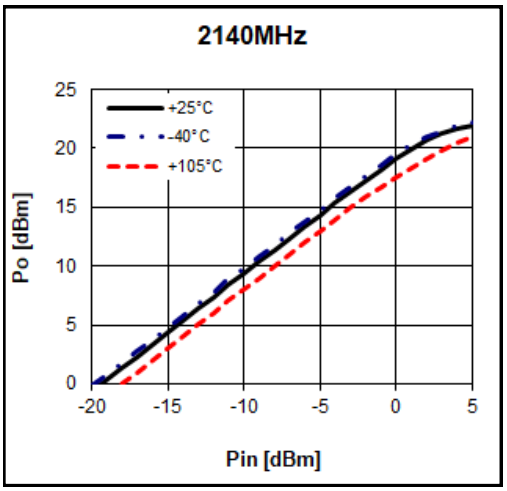


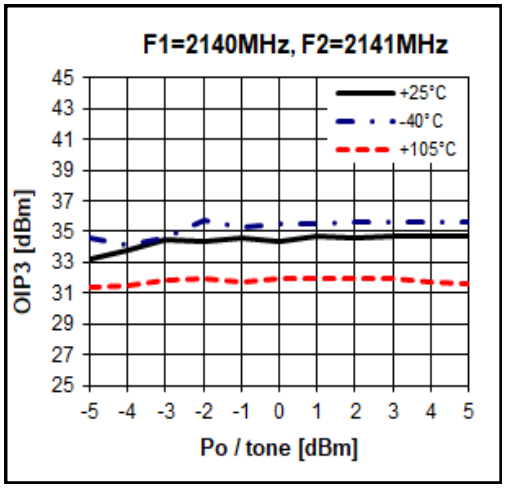


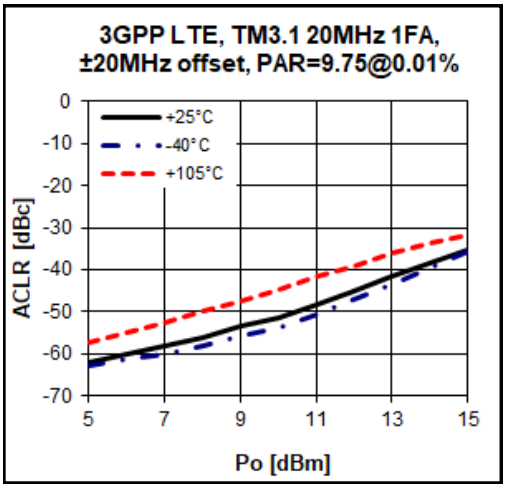


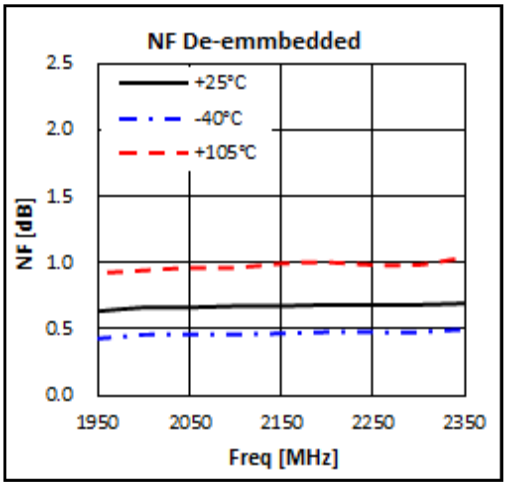
V_d = 5V, I_d = 52mA

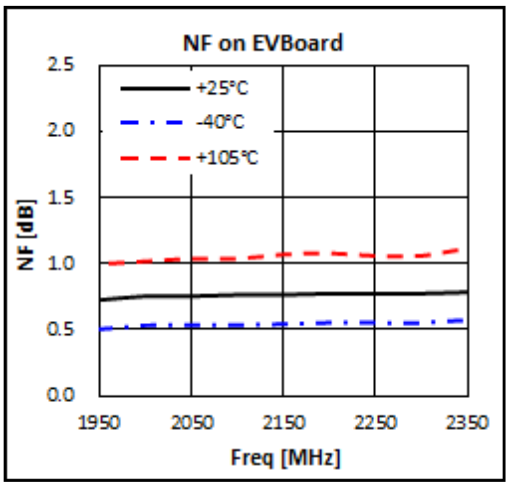




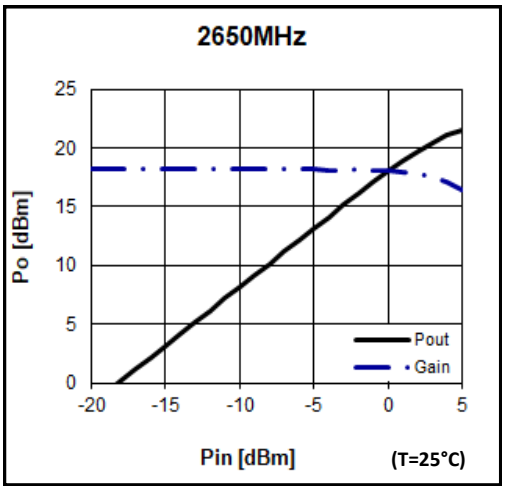


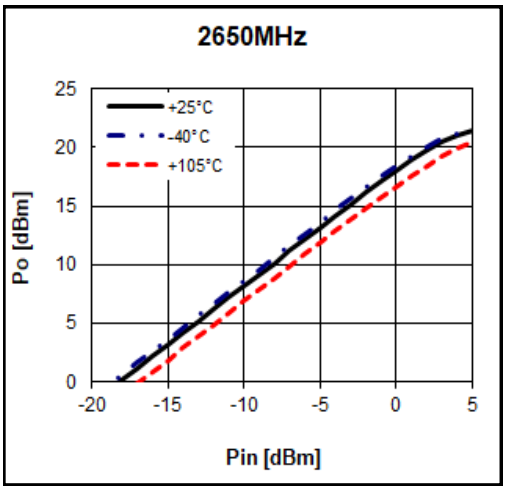


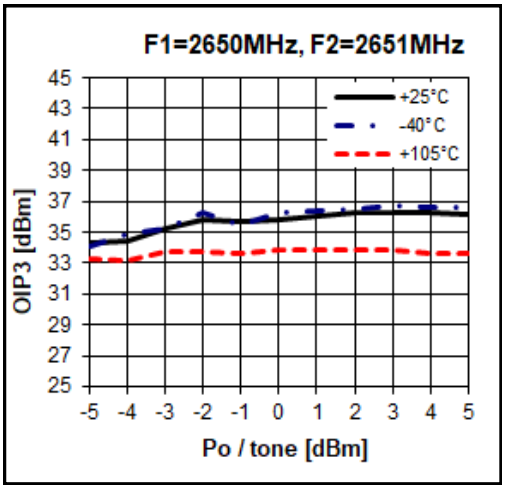


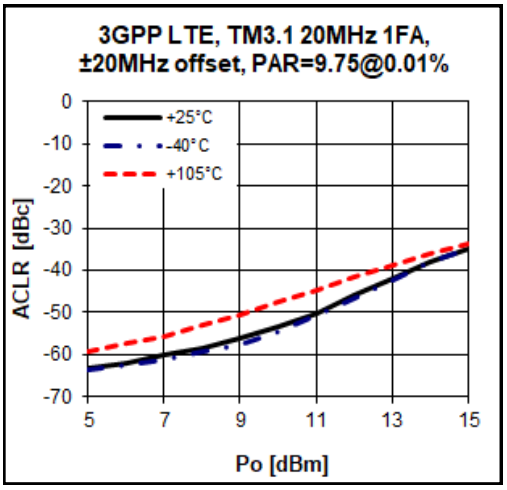


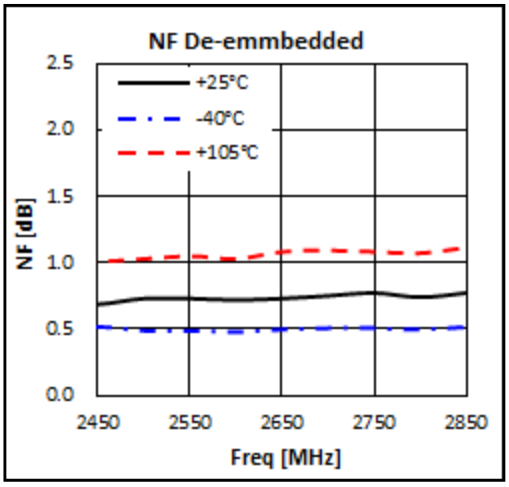
V_d = 5V, I_d = 52mA

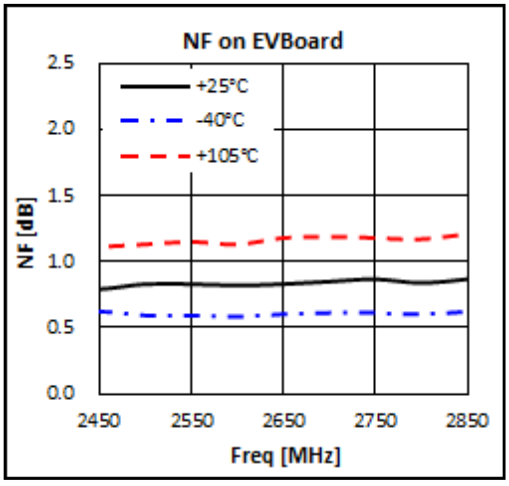




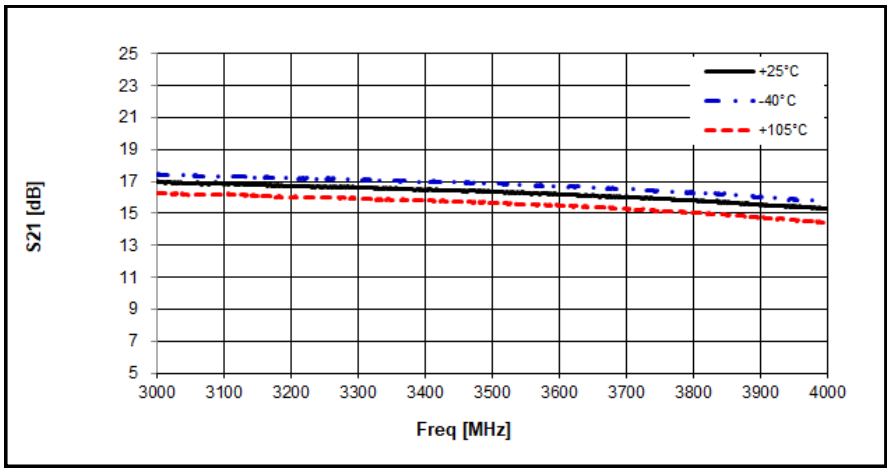


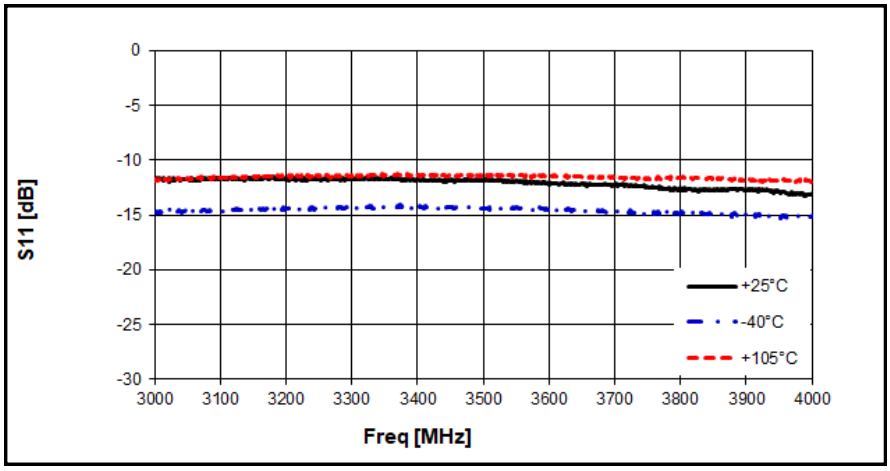


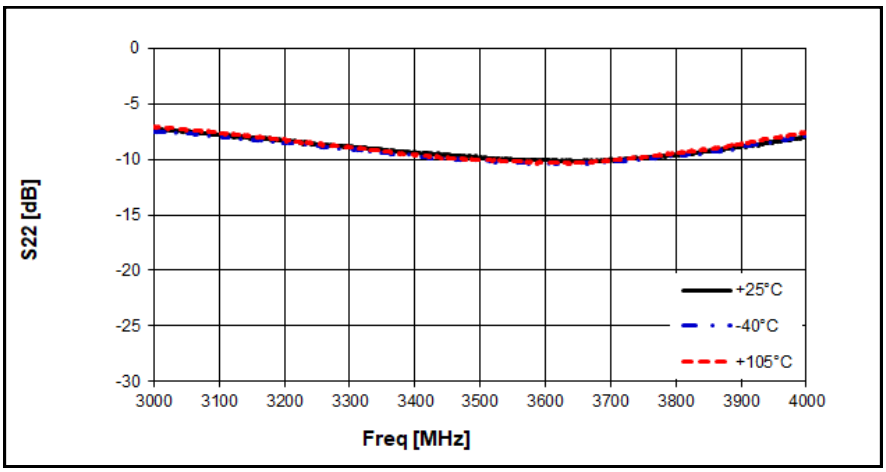




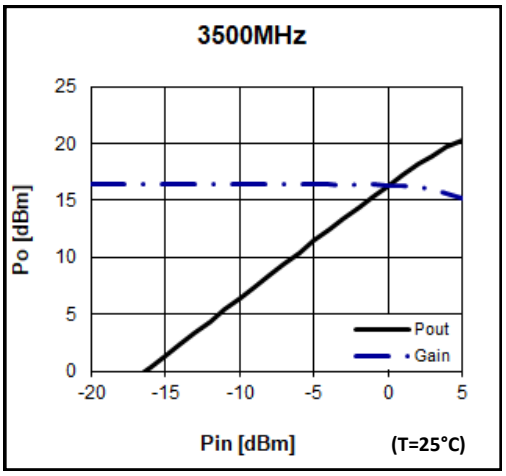
V_d = 5V, I_d = 57mA

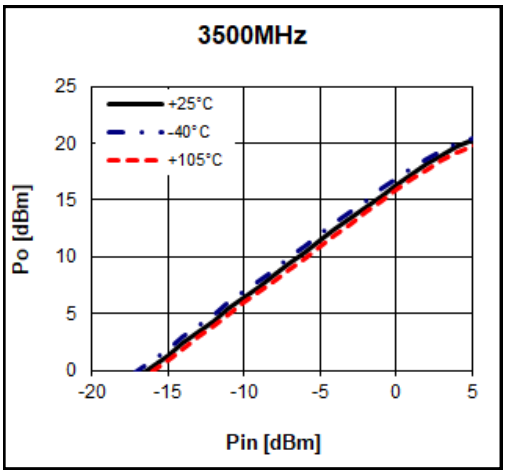


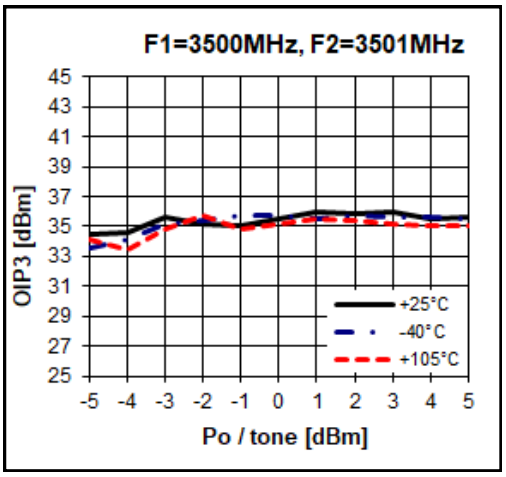


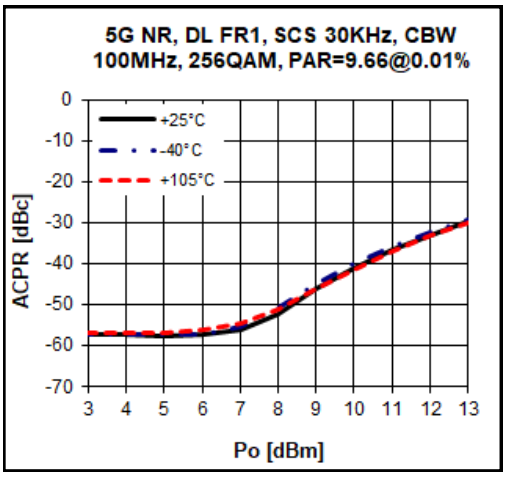


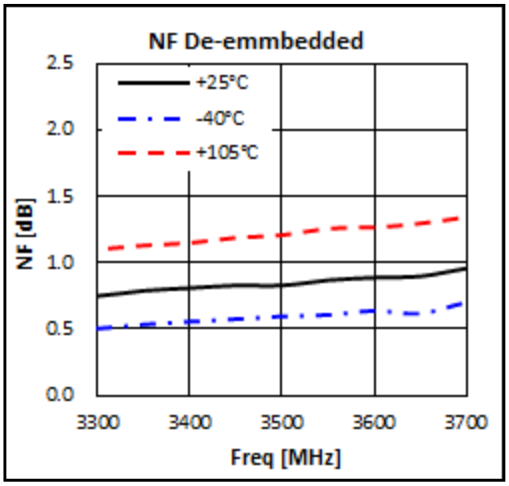
V_d = 5V, I_d = 52mA

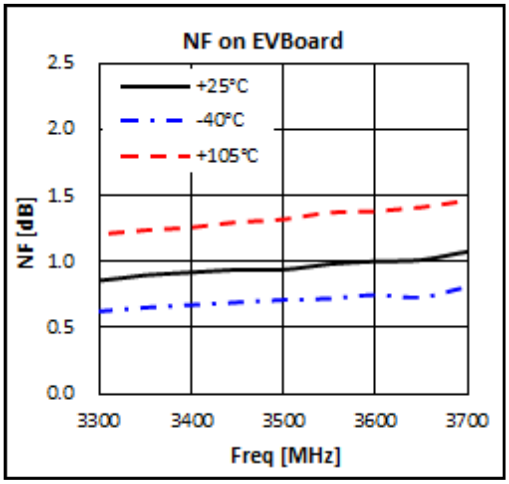






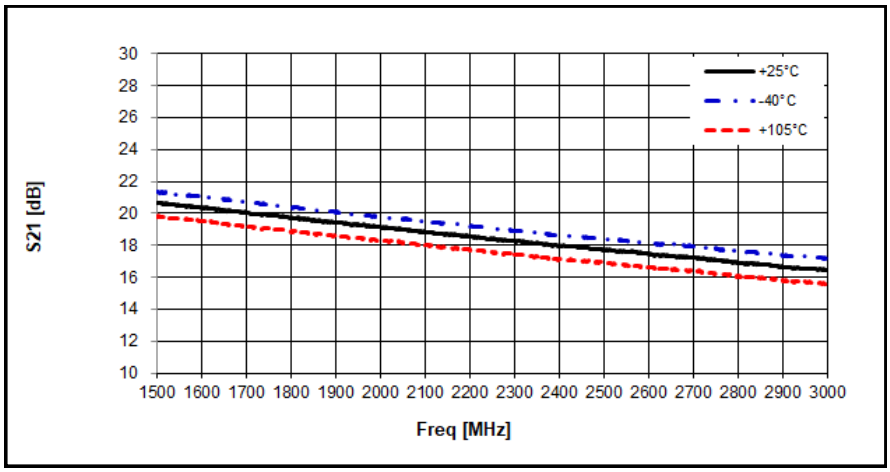


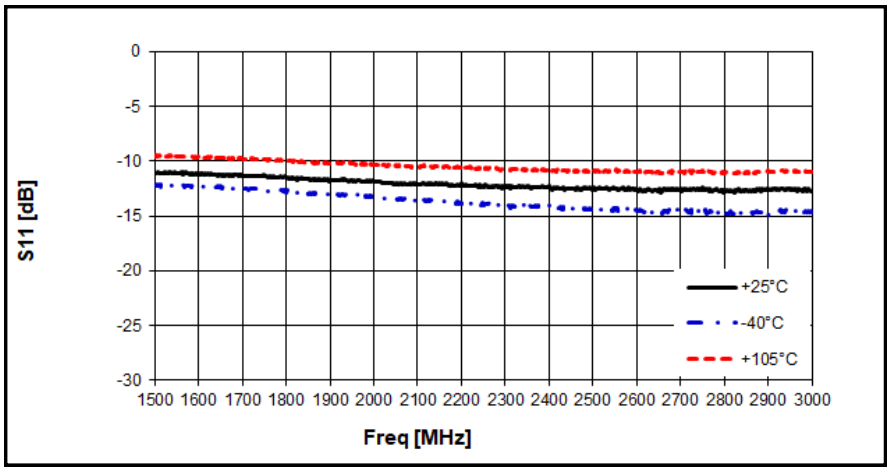


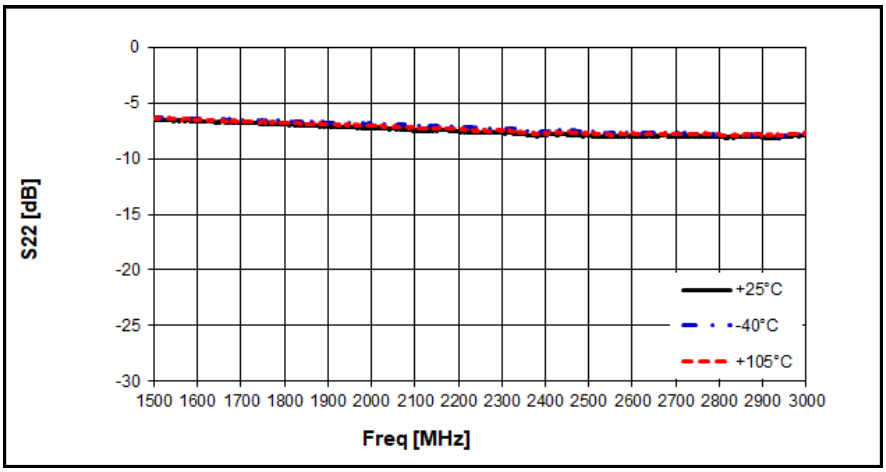


Typical Performance

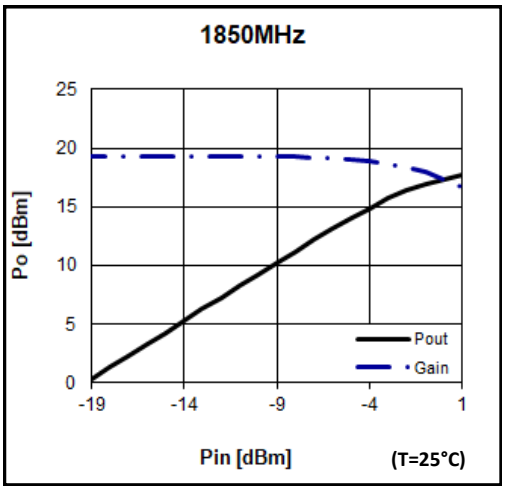
V_d = 3V, I_d = 34mA

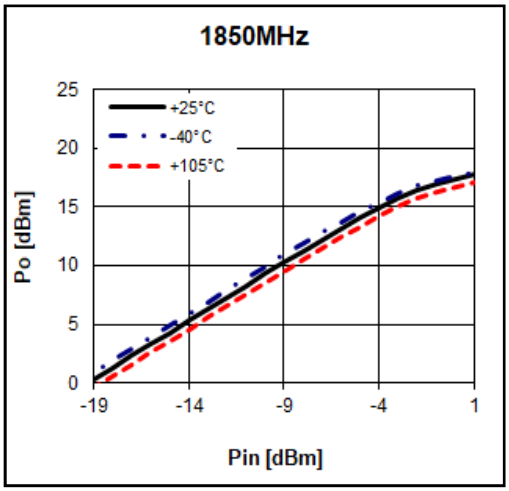


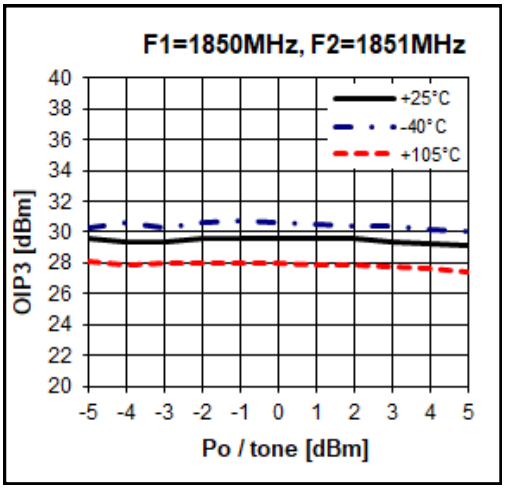


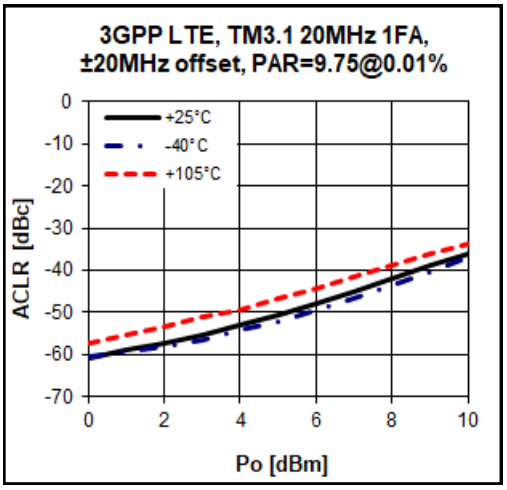


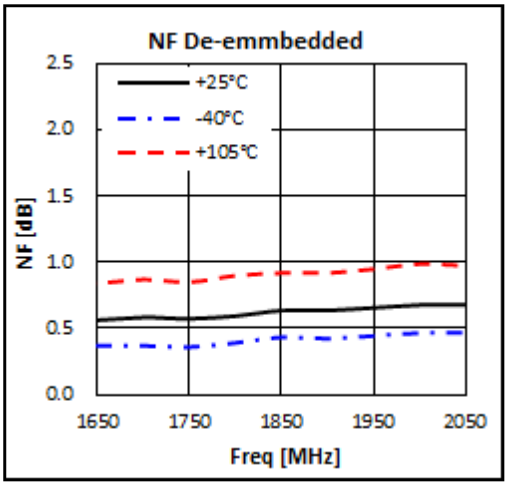
V_d = 3V, I_d = 34mA

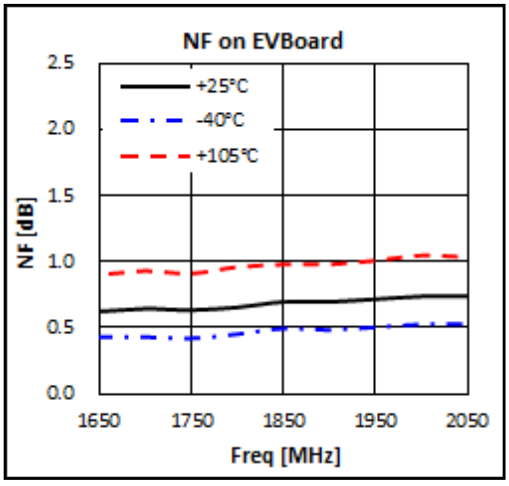




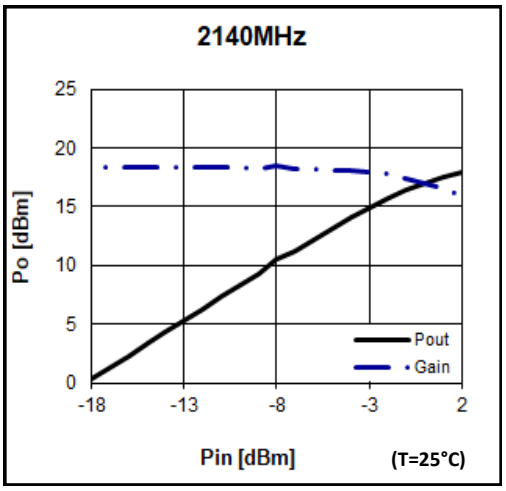


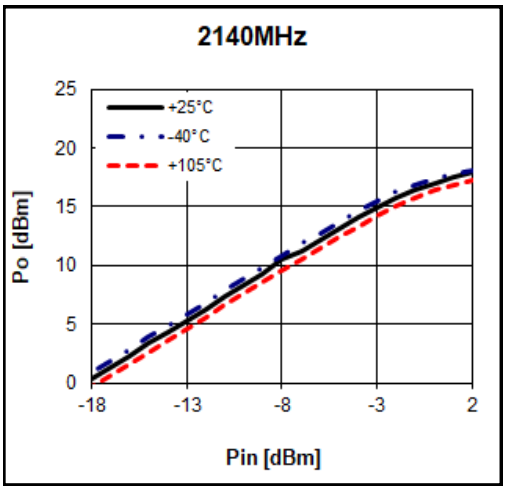


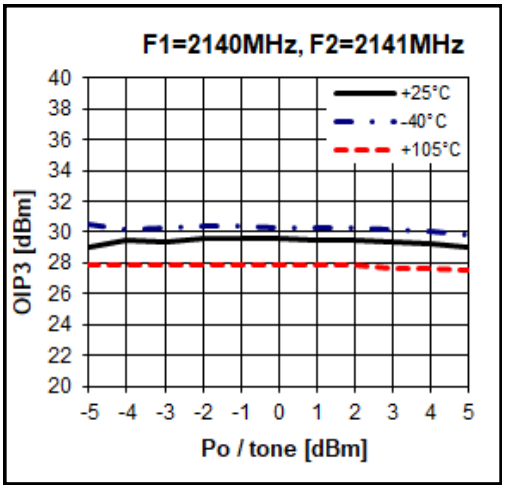


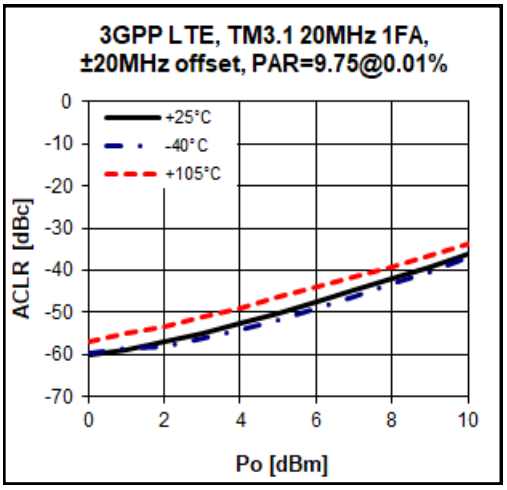


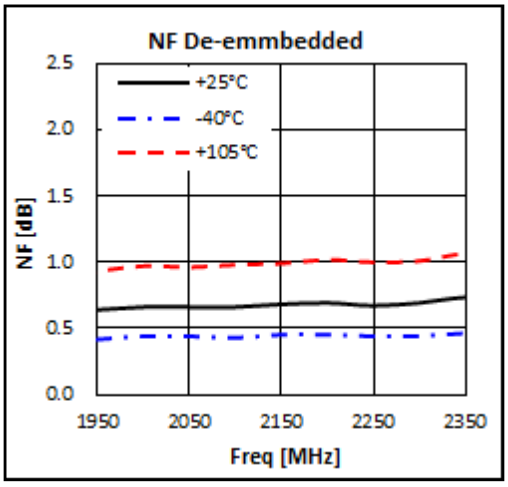
V_d = 3V, I_d = 34mA

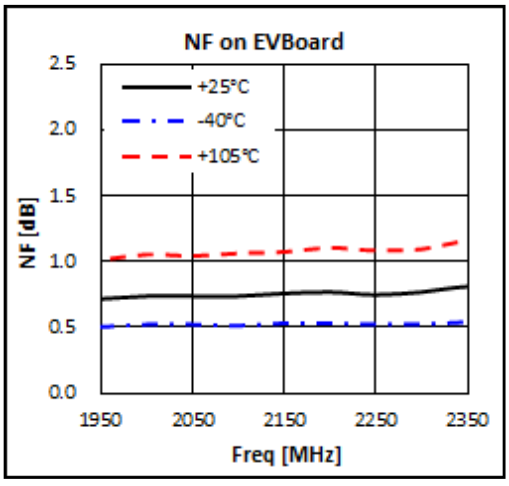




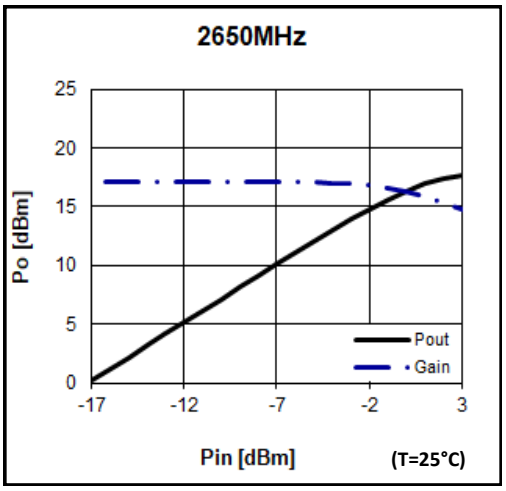


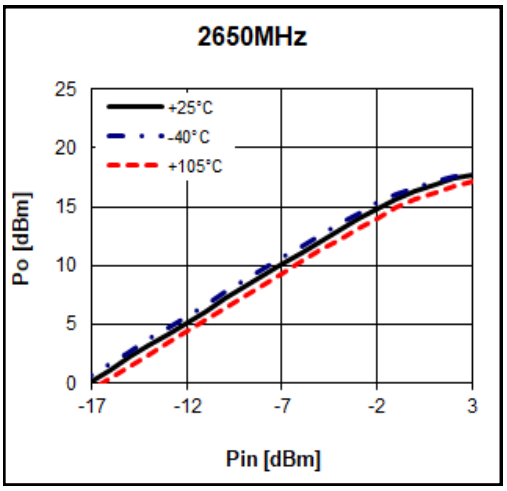


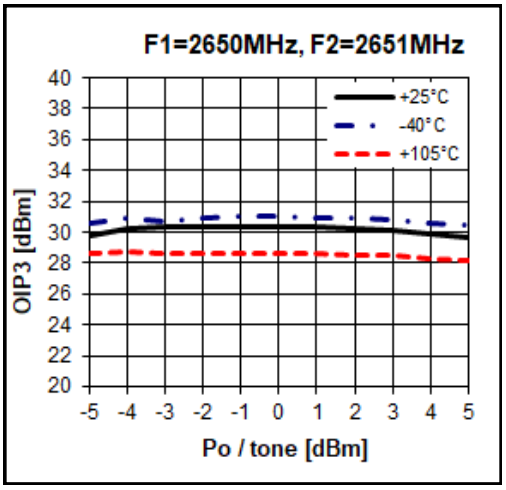


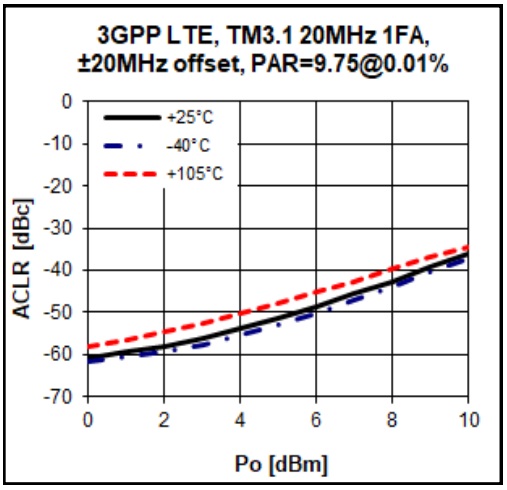


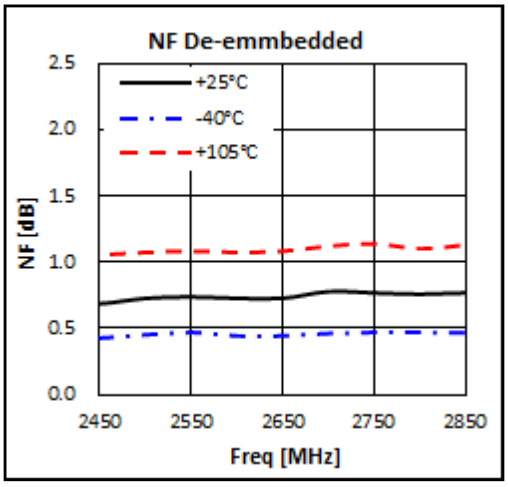
V_d = 3V, I_d = 34mA

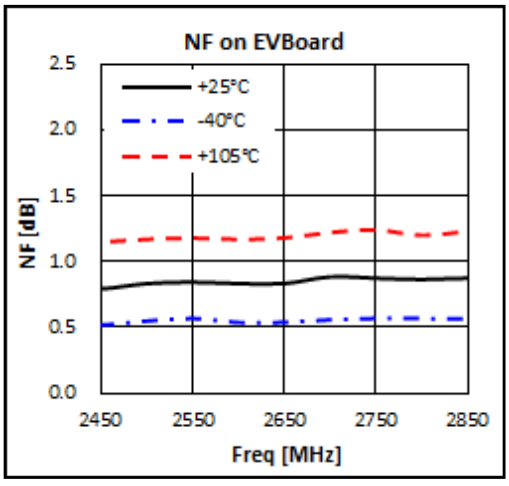




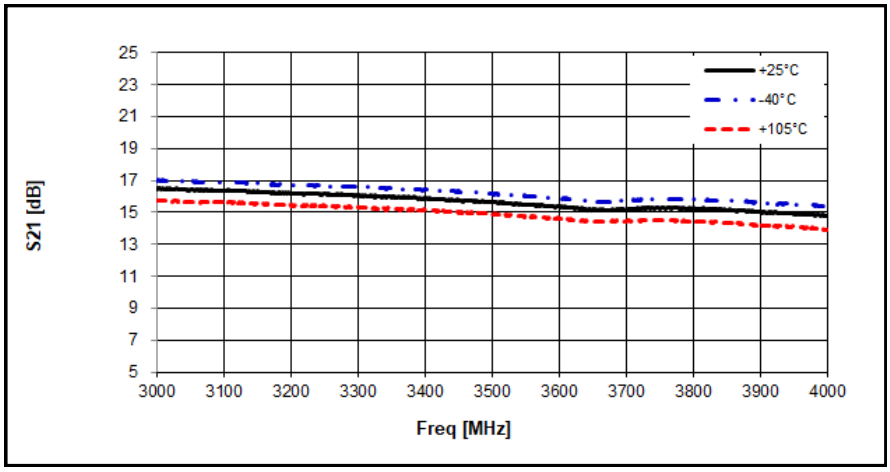


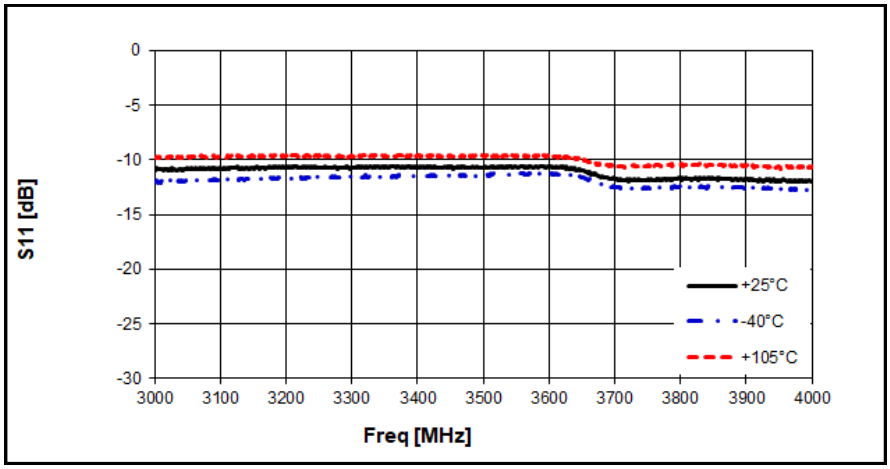


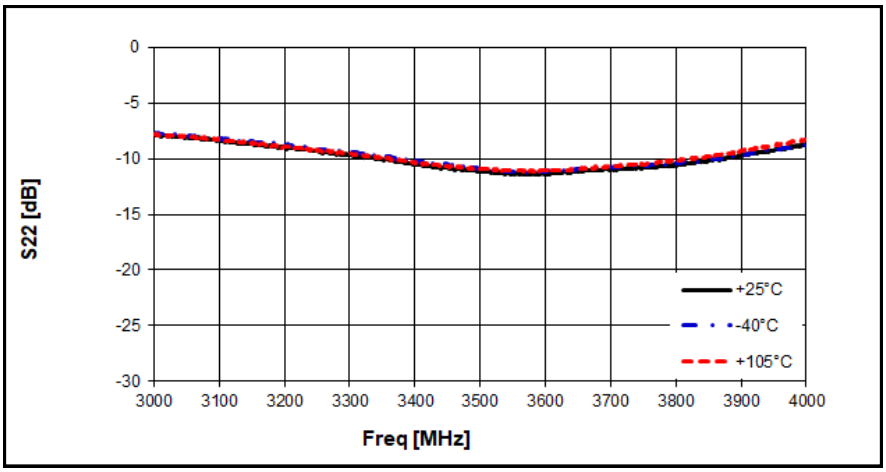




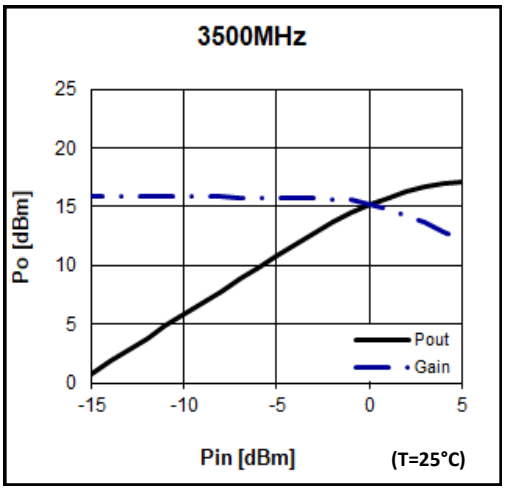
V_d = 3V, I_d = 34mA

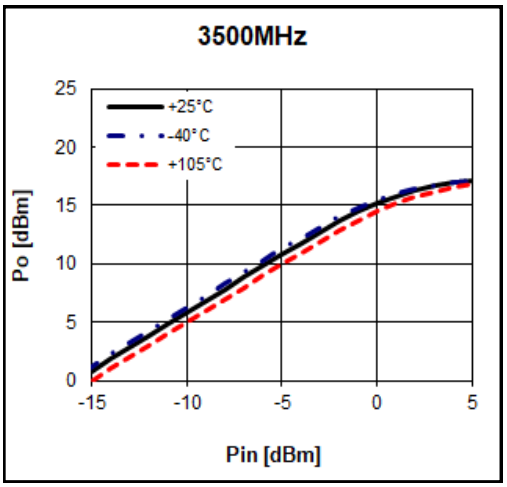


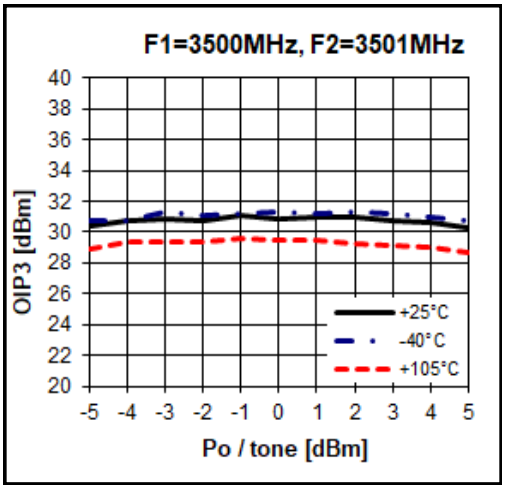


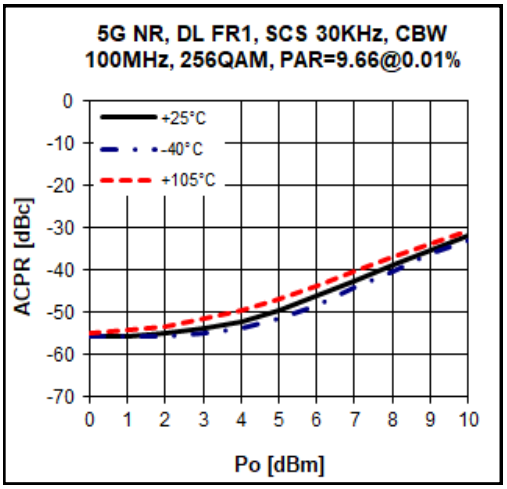


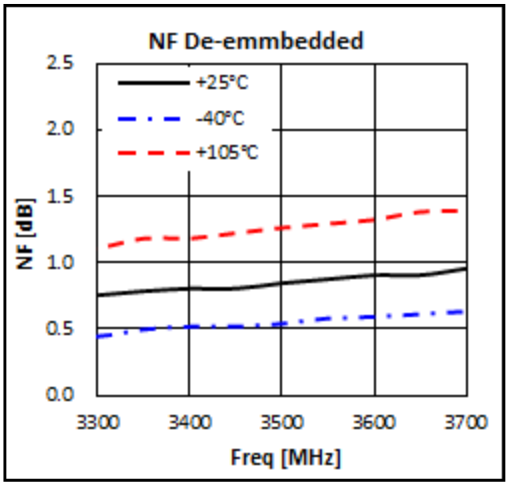
V_d = 3V, I_d = 34mA

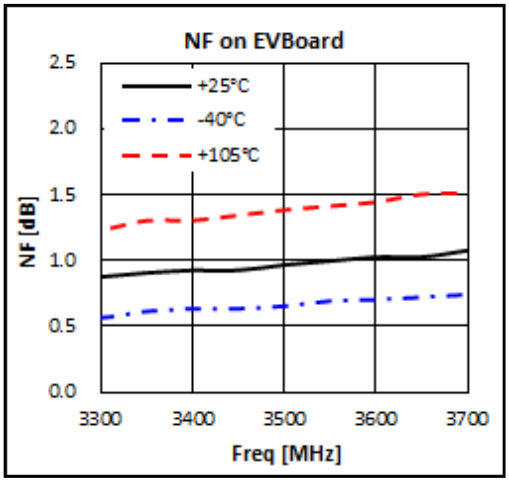




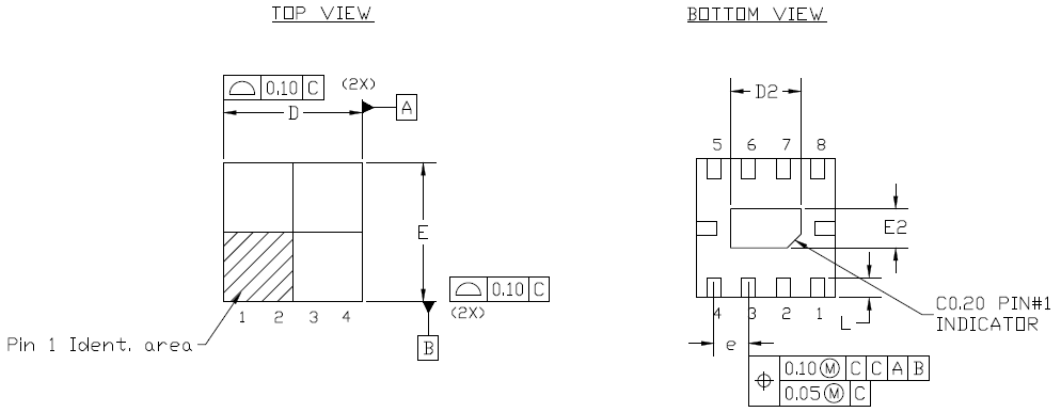








Package Outline Dimension



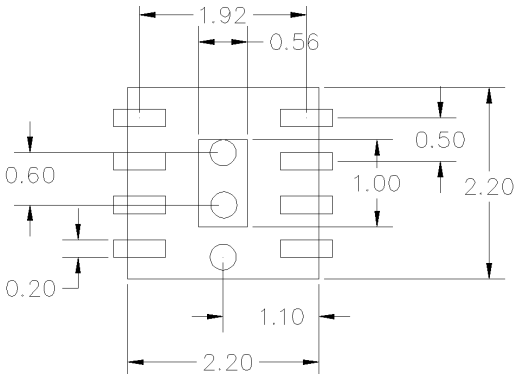
SYMBOL	COMMON					
	DIMENSIONS MILLIMETER			DIMENSIONS INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.50	0.55	0.60	0.020	0.022	0.024
A3	0.150 REF			0.006 REF		
A1	0.00	0.02	0.05	0.000	0.001	0.002
b	0.15	0.20	0.25	0.006	0.008	0.010
D	1.90	2.00	2.10	0.075	0.079	0.083
D2	0.92	1.02	1.12	0.036	0.040	0.044
E	1.90	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

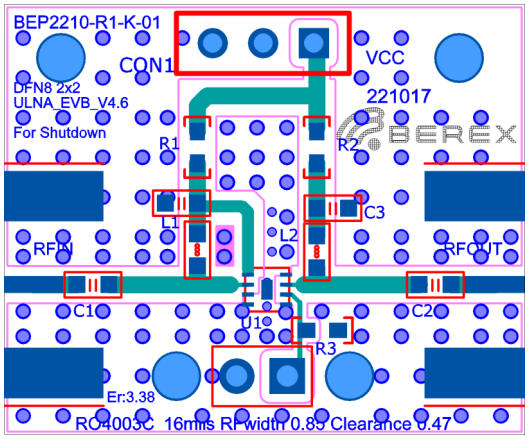
PCB Land Pattern



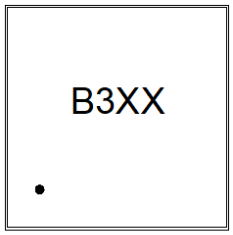
Note : All dimension _ millimeters

PCB lay out _ on BeRex website

PCB Mounting



Package Marking

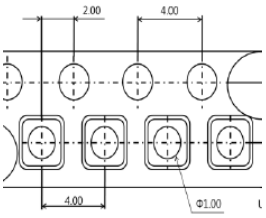


Pin 1

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

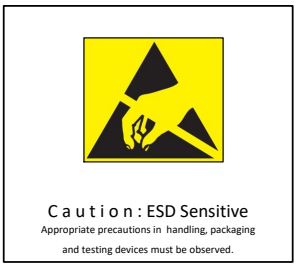
Lead plating finish

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 < 2000 V
Test:	Human Body Model (HBM)
Standard:	JEDEC Standard JS-001-2014
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**