BNT22

500-8000 MHz BROADBAND AMPLIFIER

Device Features

- Gain = 20.5dB @ 3.5GHz
- Output P1 dB = 19.5 dBm @ 3.5GHz
- OIP3 = 34.0dBm @ 3.5GHz
- Internally matched to 50 ohms
- Gain Flatness < ±0.5dB @ 0.7~4GHz
- Integrated Blocking Capacitors in Amplifier
- Green/RoHS2 Compliant DFN 8L 2x2 Package
- Fast shut down to support TDD systems

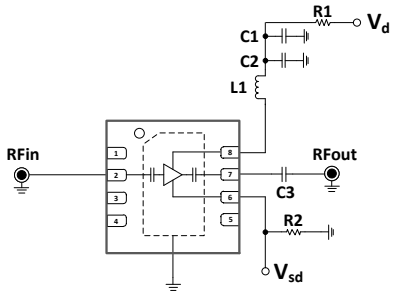
Product Description

The BNT22 is a BroadBand, GaAs E-pHEMT Amplifier that is ideal for applications demanding high linearity in a wideband of 500-8000 MHz. The BNT22 is internally matched to 50 Ohms, and has wideband flat gain performance with gain flatness below 1dB at frequency range of 700 ~ 4000 MHz with one series capacitor. DC Input / Output block capacitors are integrated in a chip. It can be used in fast shutdown switching speed for TD-LTE & TD-5G NR application. It is available in RoHS2-compliant DFN 8L 2X2 package. These devices are 100% DC and RF tested to assure quality and performance.

Applications

- Repeaters
- Mobile Infrastructure
- TD-LTE / WCDMA /5G NR / WIFI
- General Purpose Wireless

Applications Circuit



BOM	900MHz	1.8GHz	2.65GHz	3.5GHz	4.9GHz
C1	1uF	1uF	1uF	1uF	1uF
C2	100pF	100pF	100pF	100pF	100pF
C3	15pF	15pF	15pF	15pF	15pF
R1	3Ω	3Ω	3Ω	3Ω	3Ω
R2	20kΩ	20kΩ	20kΩ	20kΩ	20kΩ
L1	18nH	10nH	4.7nH	3.3nH	2.2nH

Part Marking (XX: Wafer number)

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		500		8000	MHz
Test Frequency			3500		MHz
Gain		19.0	20.5		dB
Input Return Loss			-15.9		dB
Output Return Loss			-18.2		dB
Output IP3	5 dBm / tone , Δf=1 MHz	31.0	34.0		dBm
Output P1dB		18.5	19.5		dBm
5G NR ACLR*		9.1	10.1		dBm
Noise Figure			1.8		dB

*ACLR Channel Power measured at -50dBc.
- 5G set-up: 3GPP 5G NR, 100MHz BW, ±100MHz offset, PAR 9.5 at 0.01% Prob.
* NF : Losses on input and output transmission lines on PCB are not de-embedded.

Recommended Operating Conditions[1]

Parameter	Min	Typ	Max	Unit
Bandwidth	500		8000	MHz
I_d @ (V_d = 5V)	74	93	112	mA
V_d	4.75	5.0	5.25	V
dG/dT		0.009		dB/°C
R_{TH}		56.6		°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	170	°C
Supply Voltage	+7.0	V
Supply Current	180	mA
Input RF Power	24	dBm

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

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Recommended Operating Conditions[2]

Parameter	Condition	Min.	Typical	Max.	Unit
Power Shutdown Control	On state	0		0.67	V
	Off state(Power shutdown)	1.17		Vd	V
Current, I_d	On state 5V	74	93	112	mA
	Off state(Power shutdown)		1.7		mA
Power Shutdown pin current, I_{sd}	$1.17V \leq V_{sd} < V_d$		17		uA
Switchcing Time	Rise time(10% to 90%)		200		ns
	Fall time(90% to 10%)		100		ns

Typical RF Performance (Vd=5V, Id=93mA, T=25°C)

Parameter	Frequency						Unit
	900	1800	2140	2650	3500	4900	MHz
Gain	21.1	21.1	21.0	20.8	20.5	20.0	dB
S11	-20.8	-23.3	-22.2	-18.7	-15.9	-13.5	dB
S22	-13.7	-18.9	-20.6	-16.0	-18.2	-16.6	dB
OIP3	37.5	35.0	35.0	35.0	34.0	34.0	dBm
P1dB	20.0	20.5	20.5	20.0	19.5	19.0	dBm
LTE 20M ACLR*	11.2	11.2	11.2	11.2	-	-	dBm
5G NR ACLR*	-	-	-	-	10.1	9.0	dBm
Noise Figure*	1.6	1.6	1.7	1.7	1.9	2.0	dB

*ACLR Channel Power measured at -50dBc.
- LTE set-up: 3GPP LTE, FDD E-TM3.1, 20MHz BW, ±20MHz offset, PAR 9.75 at 0.01% Prob.
- 5G NR Downlink FR1 : SCS 30KHz, CBW 100MHz, 256QAM, PAR 9.66 at 0.01% Prob.
* NF : Losses on input and output transmission lines on PCB are not de-embedded.

Wideband RF Performance (Vd=5V, Id=93mA, T=25°C, 1.8GHz Application)

Parameter	Frequency						Unit
	900	1800	2140	2650	3500	4900	MHz
Gain	20.8	21.1	21.0	20.8	20.4	19.5	dB
S11	-13.0	-23.8	-22.4	-18.7	-14.3	-8.5	dB
S22	-10.4	-19.2	-21.1	-23.4	-19.3	-10.1	dB
OIP3	37.0	35.0	35.0	34.5	33.0	32.0	dBm
P1dB	20.0	20.5	20.5	19.5	19.5	18.5	dBm
LTE 20M ACLR*	11.3	11.1	11.2	10.5	-	-	dBm
5G NR ACLR*	-	-	-	-	9.7	6.8	dBm
Noise Figure	1.6	1.6	1.7	1.7	1.9	2.0	dB

*ACLR Channel Power measured at -50dBc.
- LTE set-up: 3GPP LTE, FDD E-TM3.1, 20MHz BW, ±20MHz offset, PAR 9.75 at 0.01% Prob.
- 5G NR Downlink FR1 : SCS 30KHz, CBW 100MHz, 256QAM, PAR 9.66 at 0.01% Prob.
* NF : Losses on input and output transmission lines on PCB are not de-embedded.
* The performance of this table is the value when circuit matched with 1800MHz application (refer to page1)

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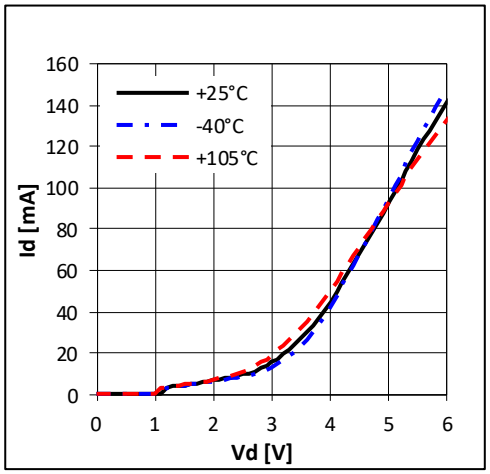
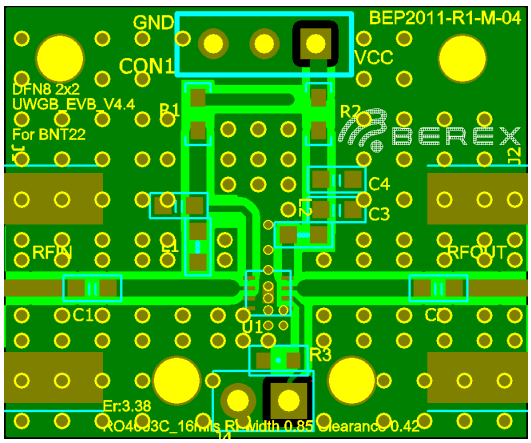
V-I Characteristics



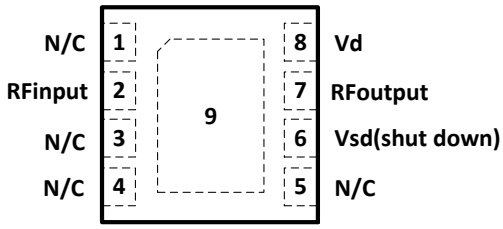
Evaluation Board



*Dielectric constant_3.38 *RF pattern width 0.85T *16mil thick RO4003 PCB

Pin Configuration

TOP VIEW



DC PACKAGE
8-LEAD(2mm x2mm) PLASTIC DFN
EXPOSED PAD(PIN9) IS GND, MUST BE SOLDERED TO PCB

Pin No.	Name	Description
2	RFinput	RFinput pin.
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	RFoutput pin.
8	Vd	V_d pin. Supply Vd through choke/Inductor for the device.
1,3,4,5	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.

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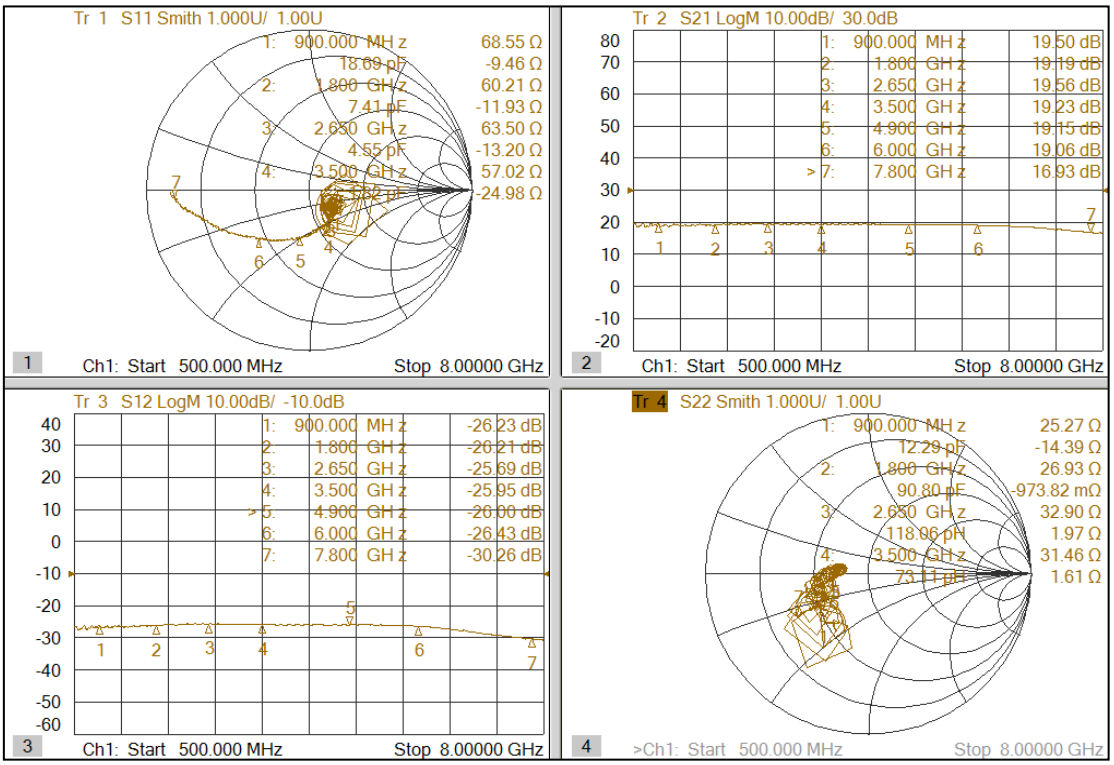
Typical Device Data

S-parameters (V_d=5.0V, I_d=93mA, T=25°C, No Matching Circuit)



S-Parameter

(V_d = 5.0V, I_d = 93mA, T = 25 °C, No Matching Circuit)

Freq [MHz]	S11 Mag	S11 Ang	S21 Mag	S21 Ang	S12 Mag	S12 Ang	S22 Mag	S22 Ang
500	0.229	-68.783	9.370	-151.460	0.047	41.404	0.418	-129.780
1000	0.120	-41.149	10.032	173.342	0.052	13.501	0.285	-149.729
1500	0.214	-34.286	8.184	154.691	0.045	2.536	0.379	-158.747
2000	0.172	-40.163	8.814	141.940	0.049	-3.727	0.315	-172.961
2500	0.162	-42.885	9.449	128.776	0.051	-10.311	0.241	172.778
3000	0.193	-48.188	9.219	114.544	0.051	-18.334	0.223	170.800
3500	0.237	-61.626	8.621	99.043	0.050	-26.514	0.235	178.784
4000	0.244	-78.074	8.876	87.558	0.050	-31.718	0.209	165.769
4500	0.279	-89.675	8.899	70.610	0.050	-39.337	0.197	178.466
5000	0.309	-104.752	8.955	57.042	0.050	-47.715	0.203	174.935
5500	0.357	-120.880	8.920	43.300	0.049	-54.960	0.217	176.962
6000	0.429	-136.109	8.889	29.222	0.048	-64.526	0.218	-174.766
6500	0.526	-150.094	8.638	13.199	0.043	-75.747	0.252	-158.864
7000	0.638	-161.409	7.967	0.624	0.038	-81.683	0.369	-151.674
7500	0.762	-170.764	7.294	-13.823	0.033	-89.870	0.459	-149.826
8000	0.852	-178.659	6.662	-28.498	0.030	-95.999	0.506	-151.109

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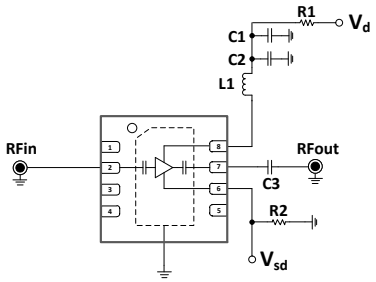
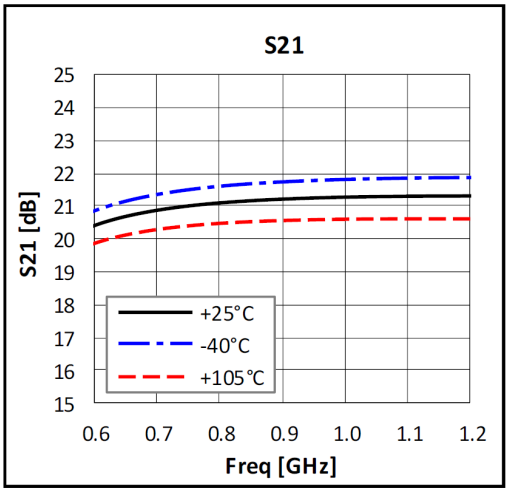
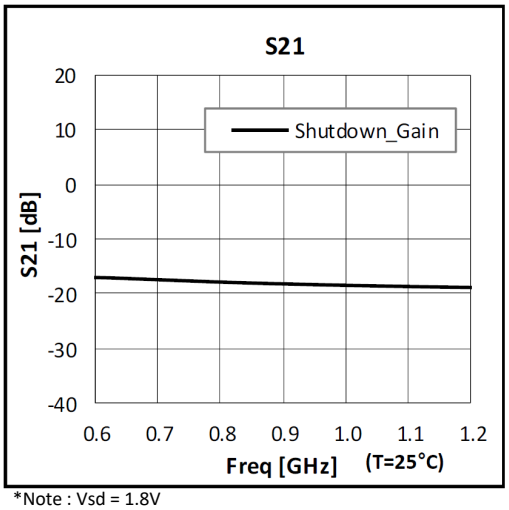
900MHz Application Circuit

Schematic Diagram	BOM		Size
	C1	1uF	1608(0603)
	C2	100pF	1608(0603)
	C3	15pF	1608(0603)
	R1	3Ω	1608(0603)
	R2	20kΩ	1608(0603)
	L1	18nH	1608(0603)

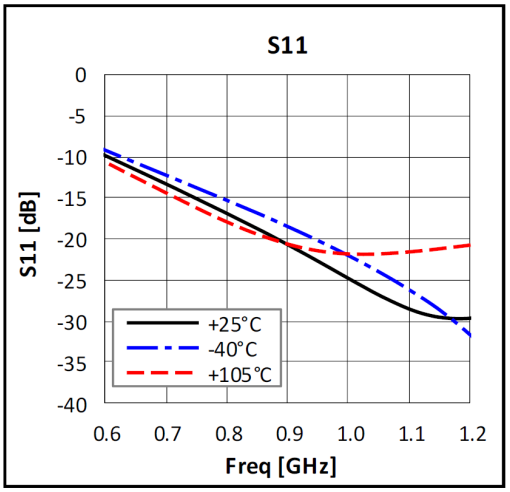
Typical Performance

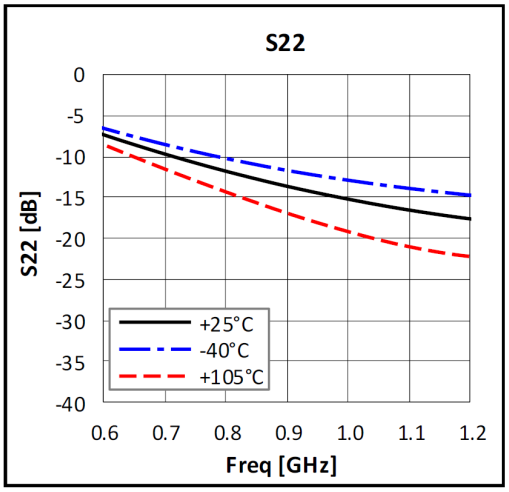
(V_d = 5.0V, I_d = 93mA)





*Note : Vsd = 1.8V





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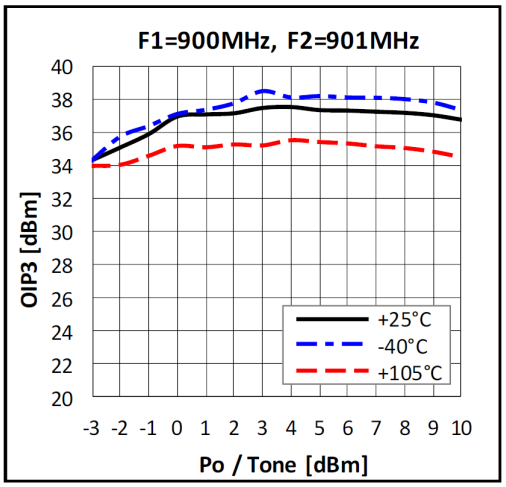
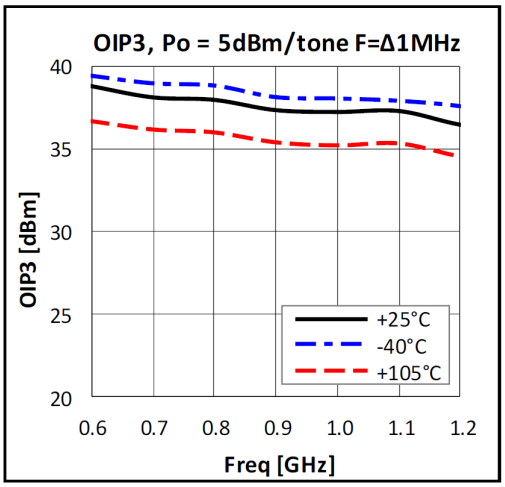
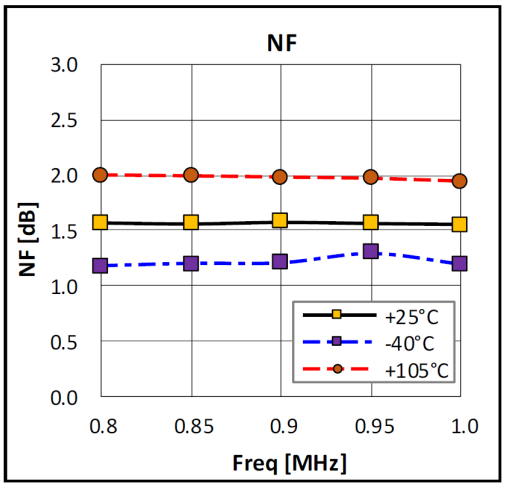
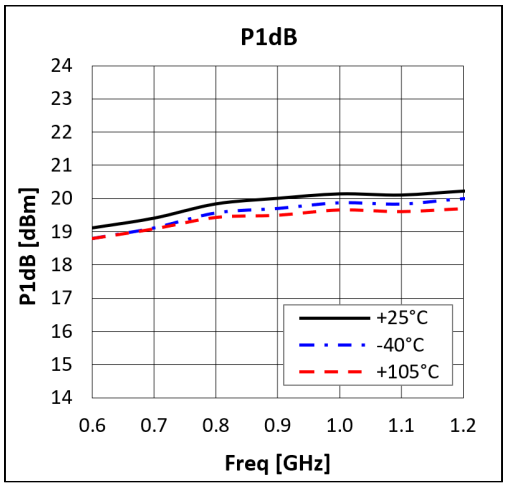
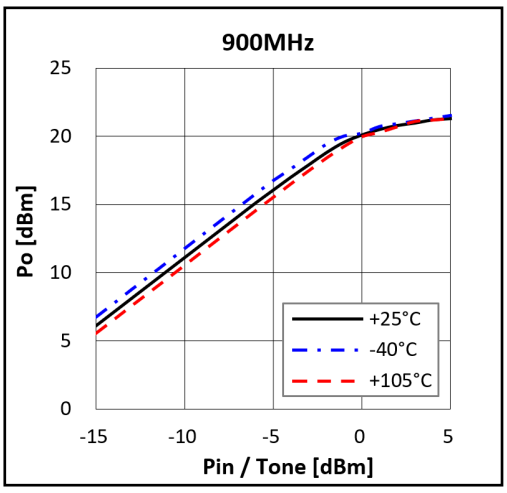
V_d = 5.0V, I_d = 93mA

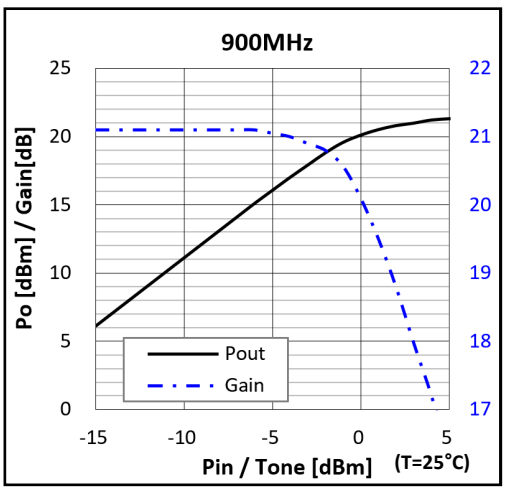












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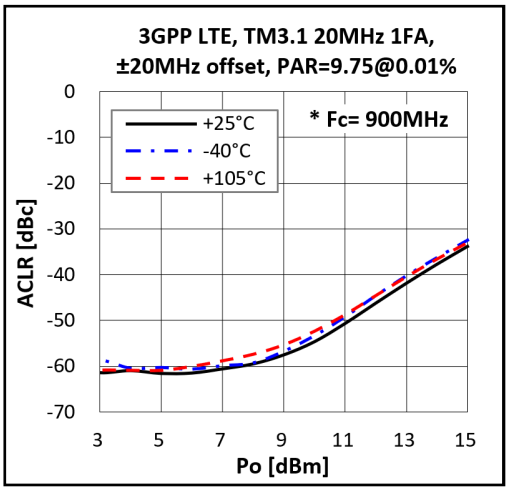
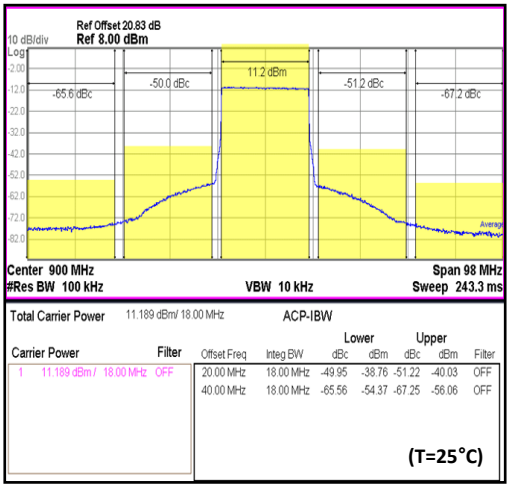
V_d = 5.0V, I_d = 93mA





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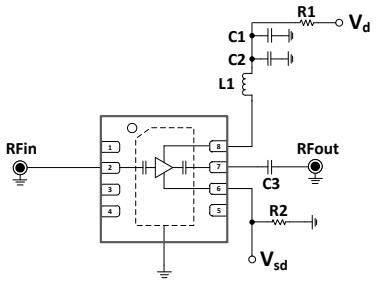
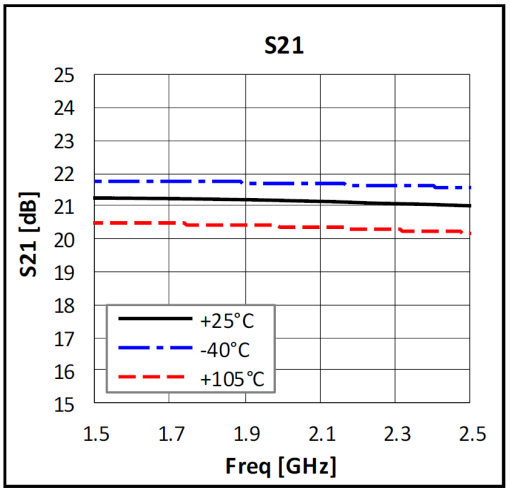
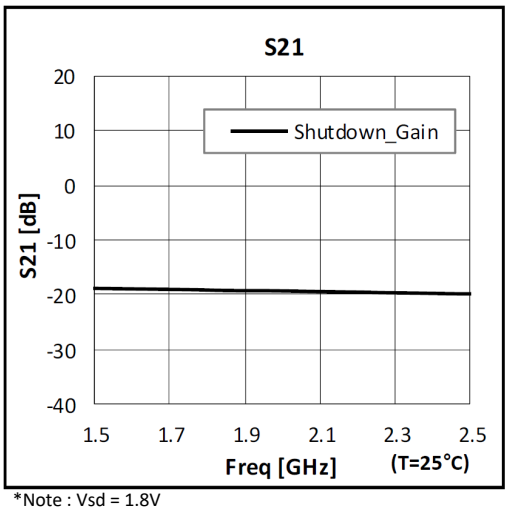
1.8GHz Application Circuit

Schematic Diagram	BOM		Size
	C1	1uF	1608(0603)
	C2	100pF	1608(0603)
	C3	15pF	1608(0603)
	R1	3Ω	1608(0603)
	R2	20kΩ	1608(0603)
	L1	10nH	1608(0603)

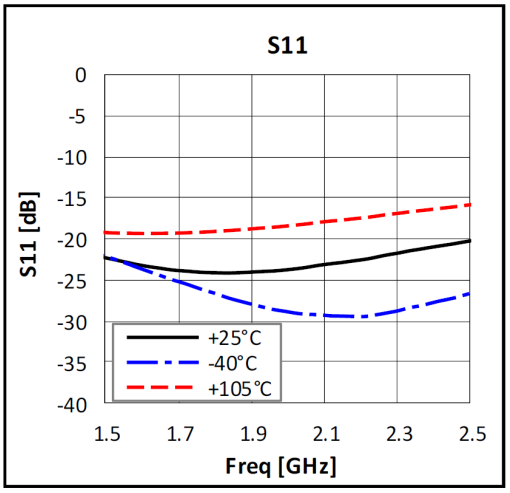
Typical Performance

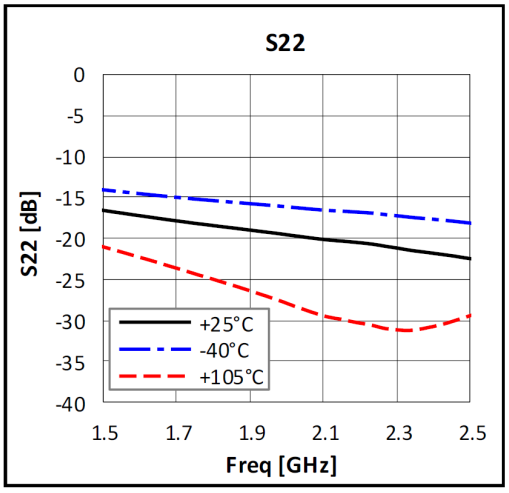
(V_d = 5.0V, I_d = 93mA)





*Note : Vsd = 1.8V





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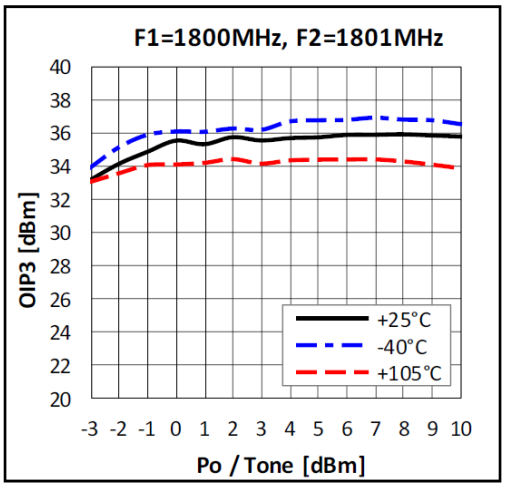
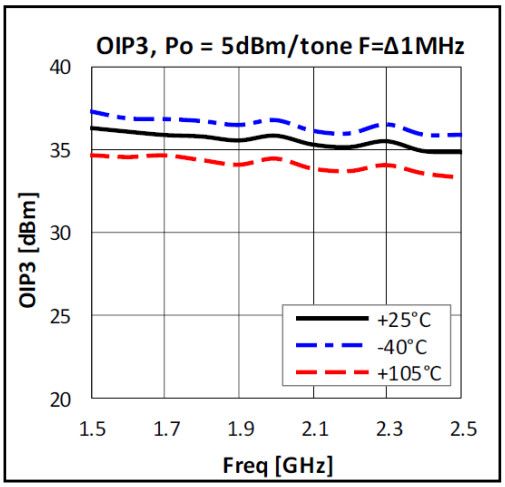
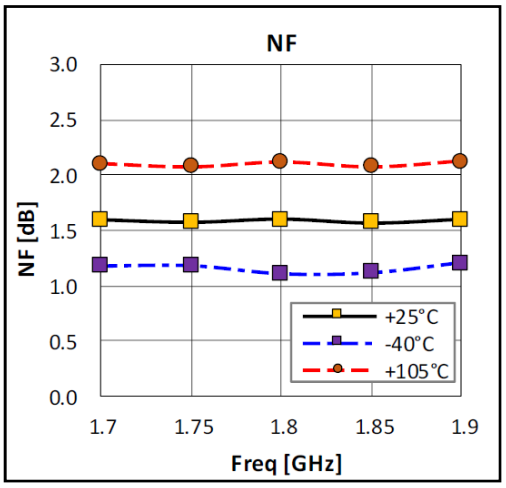
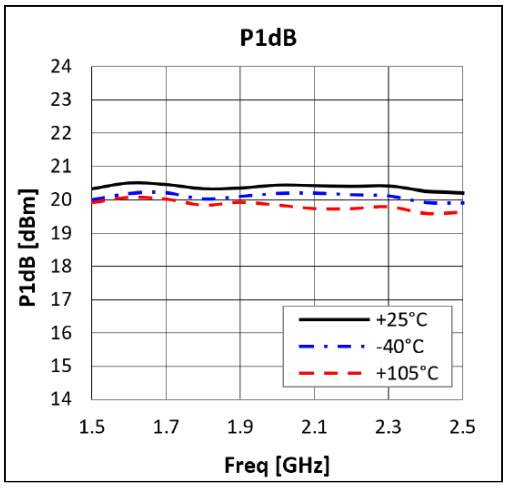
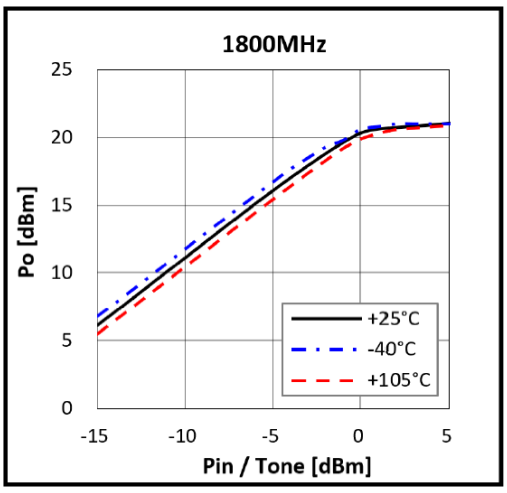
V_d = 5.0V, I_d = 93mA

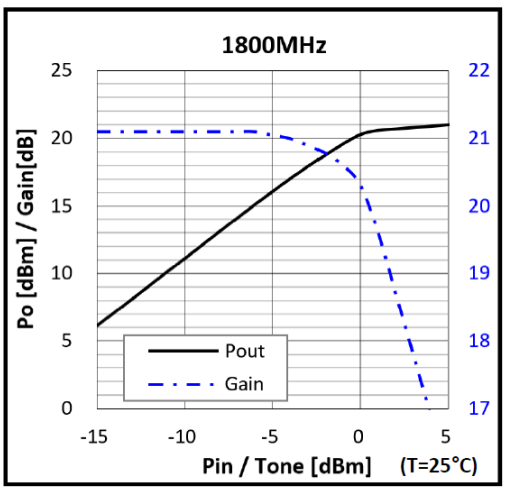












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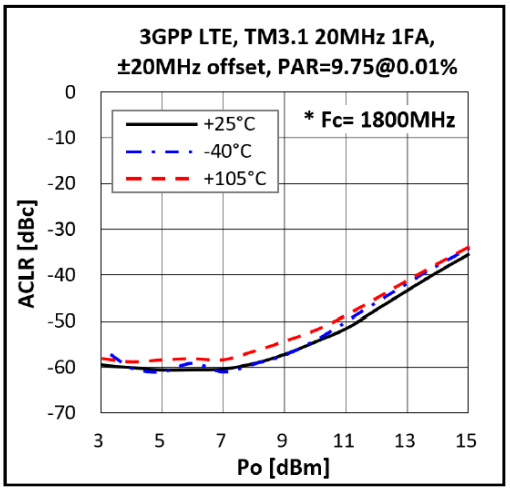
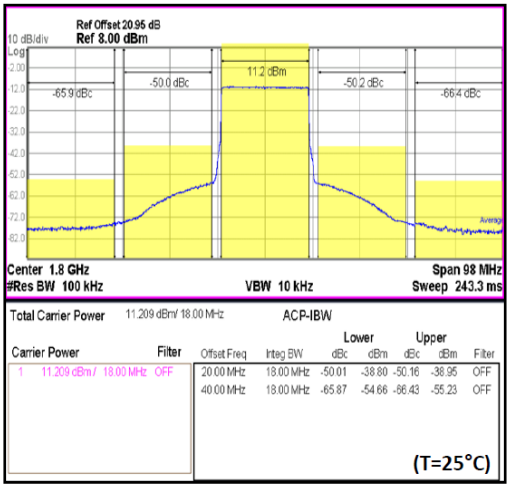
V_d = 5.0V, I_d = 93mA





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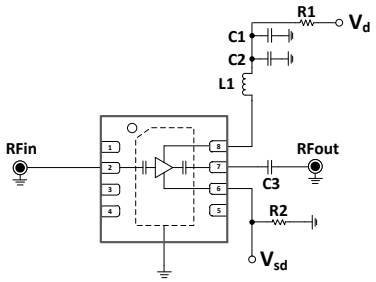
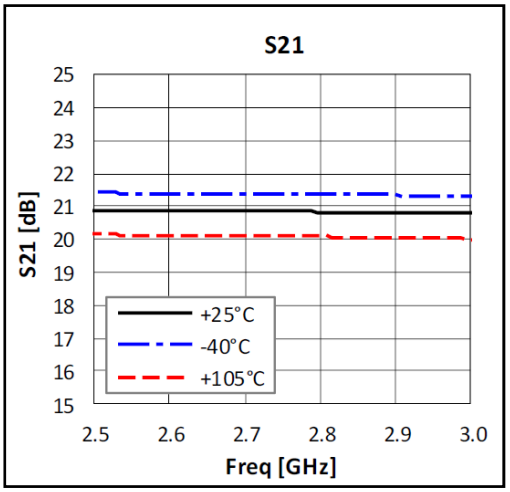
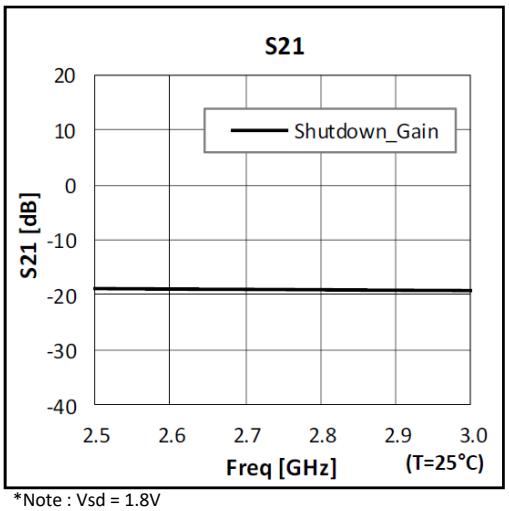
2.65GHz Application Circuit

Schematic Diagram	BOM		Size
	C1	1uF	1608(0603)
	C2	100pF	1608(0603)
	C3	15pF	1608(0603)
	R1	3Ω	1608(0603)
	R2	20kΩ	1608(0603)
	L1	4.7nH	1608(0603)

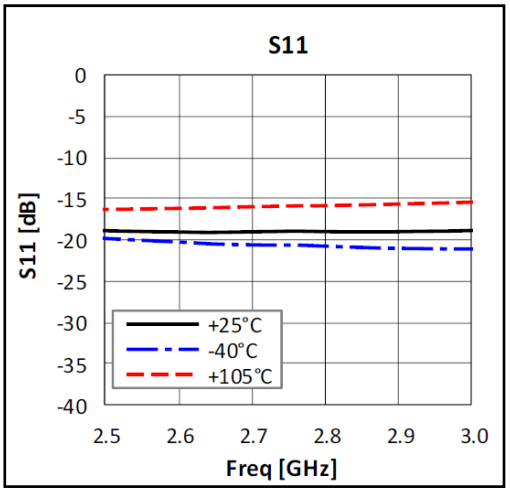
Typical Performance

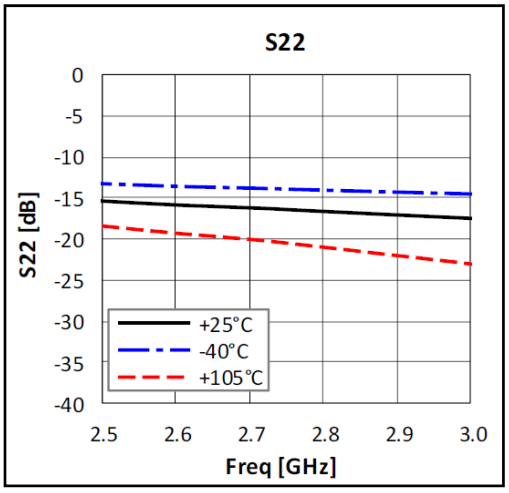
(V_d = 5.0V, I_d = 93mA)





*Note : Vsd = 1.8V





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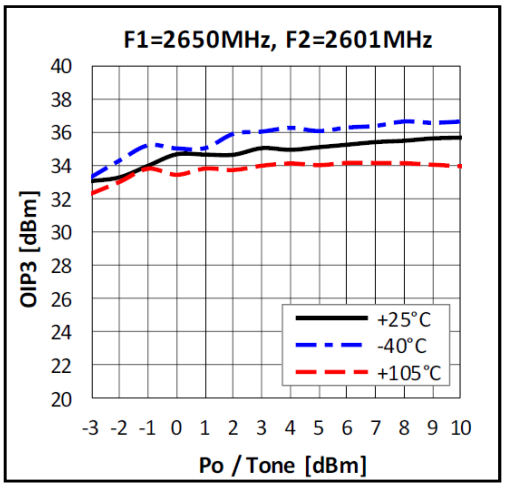
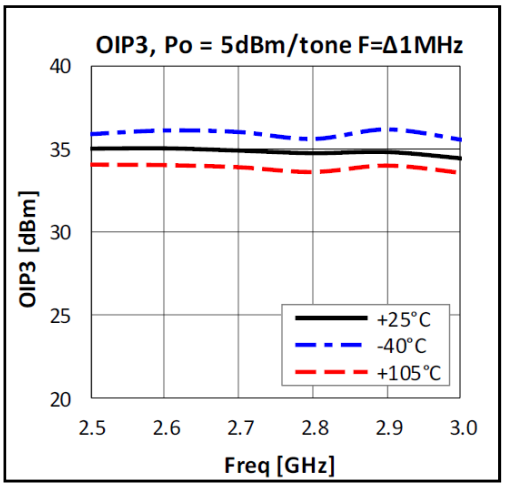
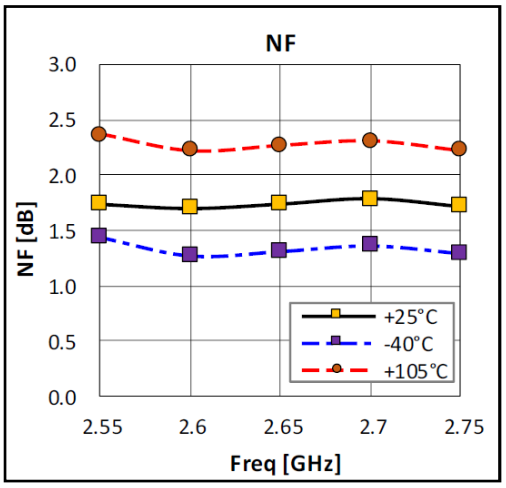
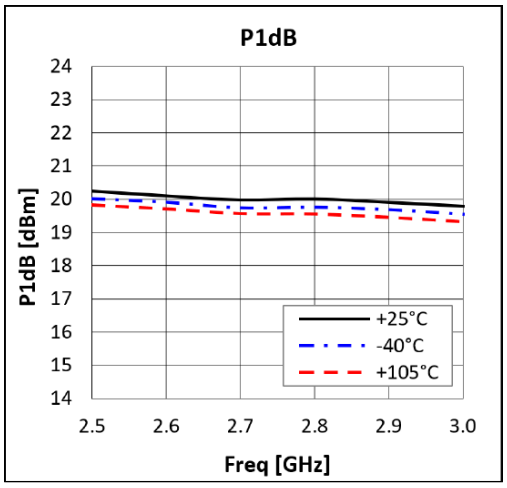
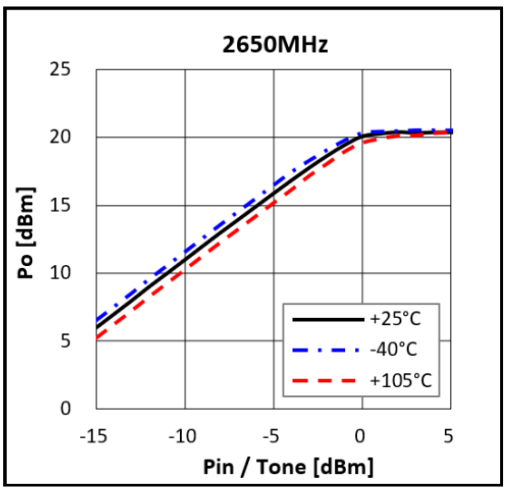
V_d = 5.0V, I_d = 93mA

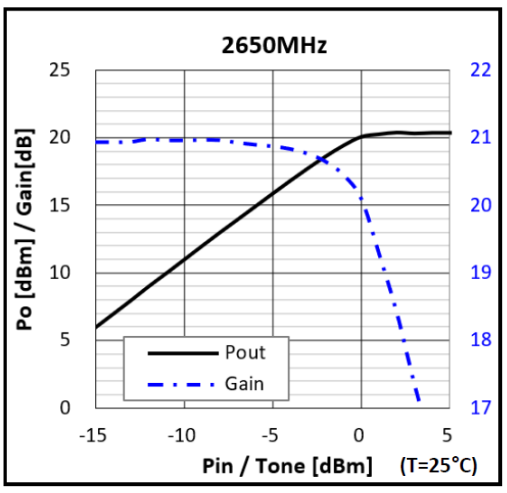












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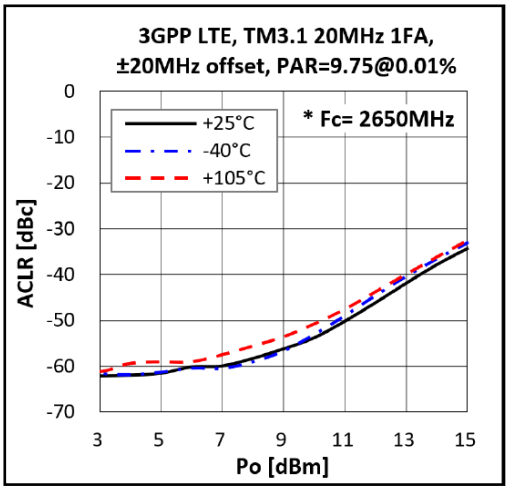
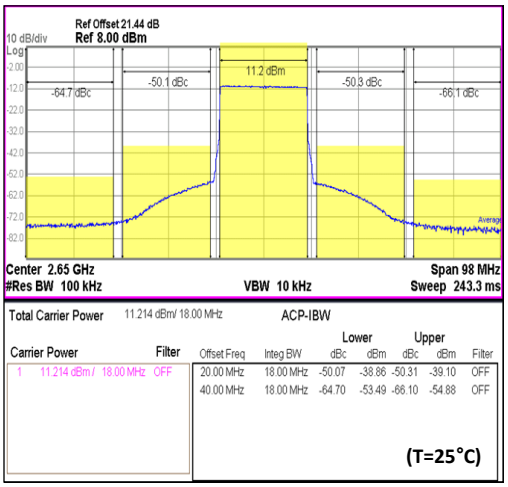
V_d = 5.0V, I_d = 93mA





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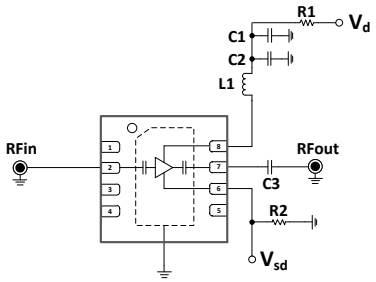
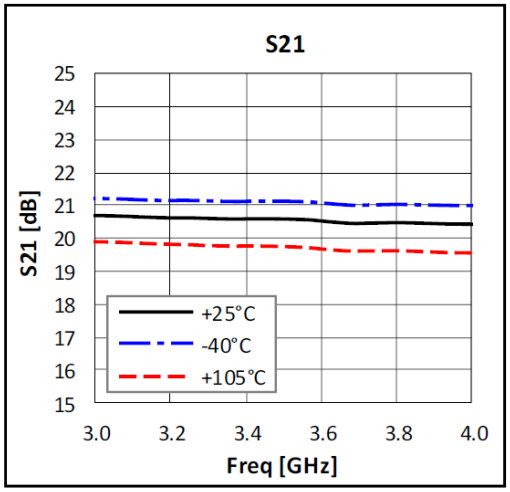
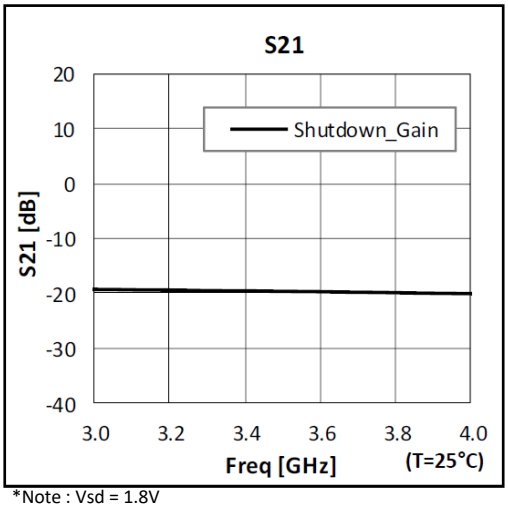
3.5GHz Application Circuit

Schematic Diagram	BOM		Size
	C1	1uF	1608(0603)
	C2	100pF	1608(0603)
	C3	15pF	1608(0603)
	R1	3Ω	1608(0603)
	R2	20kΩ	1608(0603)
	L1	3.3nH	1608(0603)

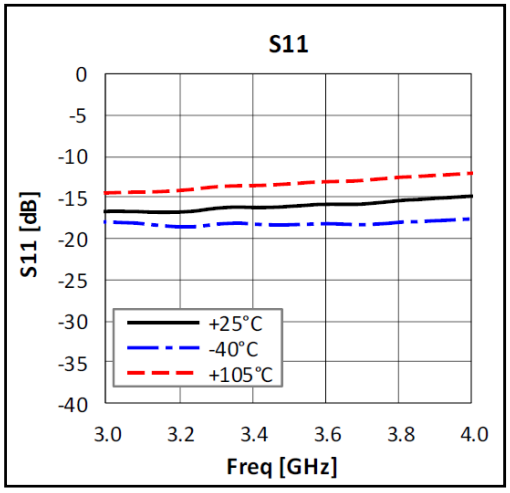
Typical Performance

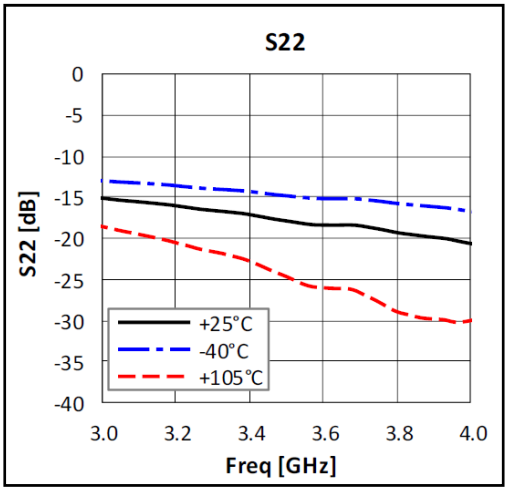
(V_d = 5.0V, I_d = 93mA)





*Note : Vsd = 1.8V





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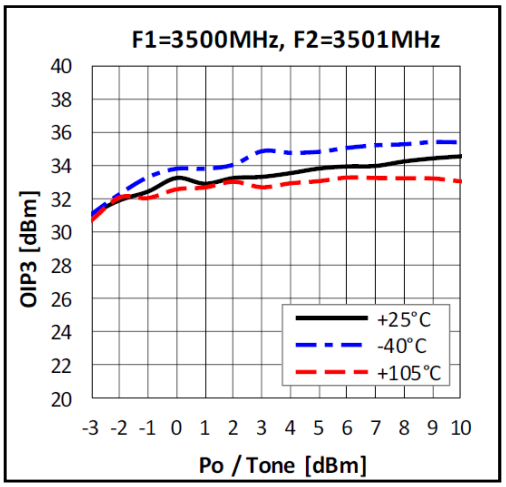
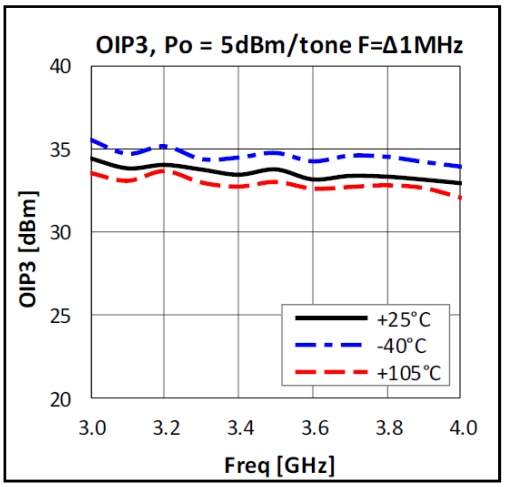
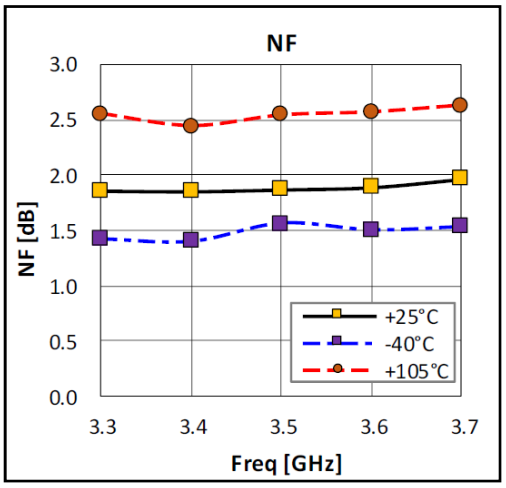
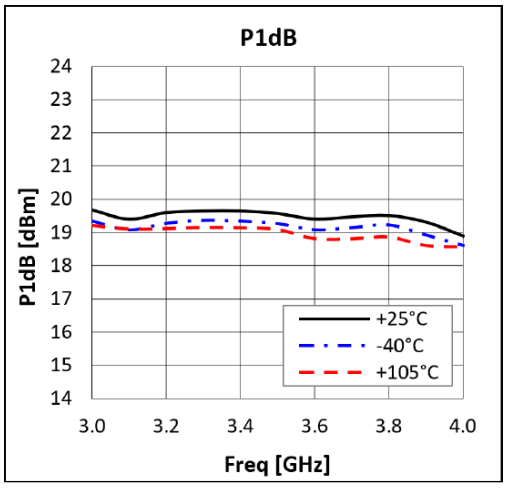
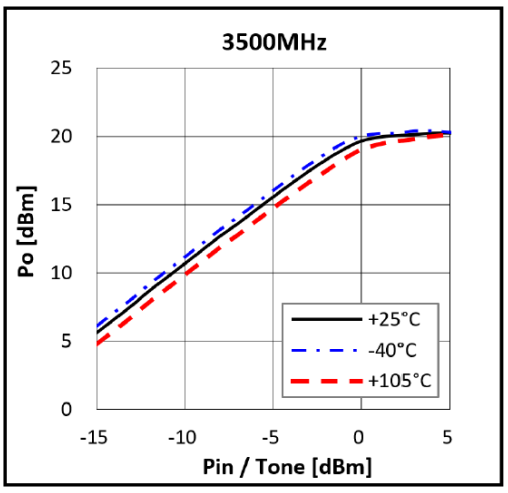
V_d = 5.0V, I_d = 93mA

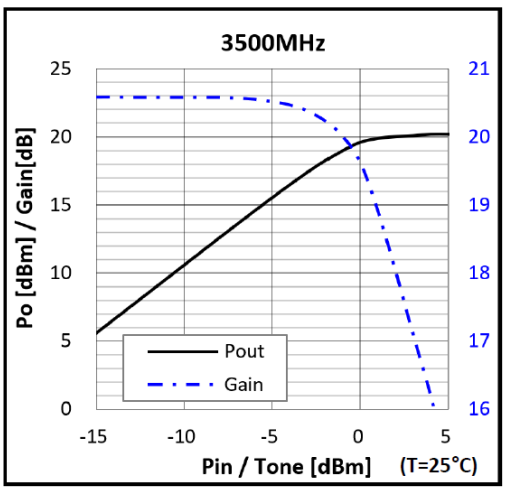












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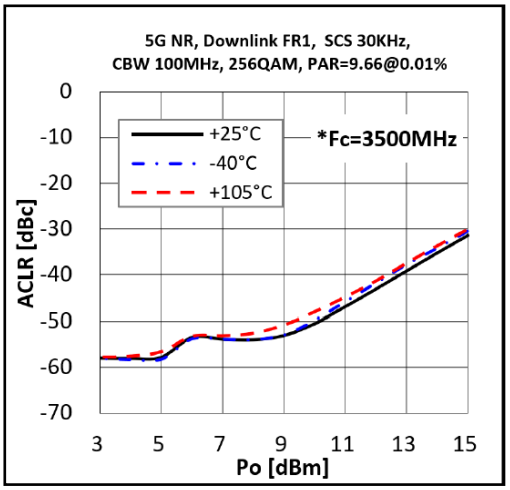
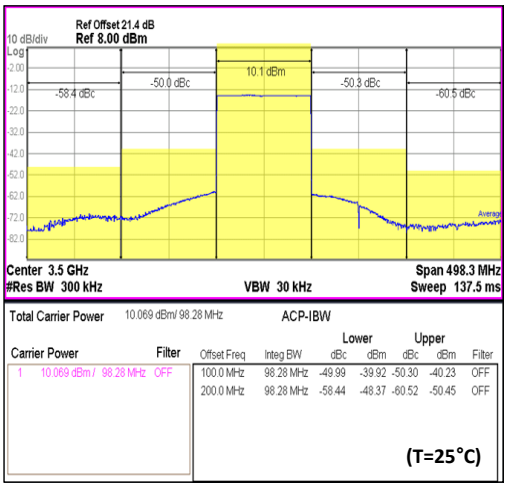
V_d = 5.0V, I_d = 93mA





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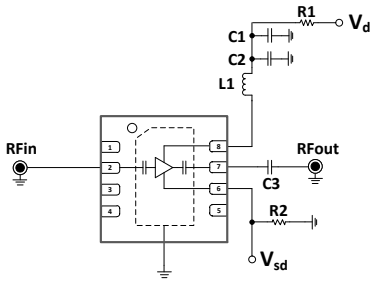
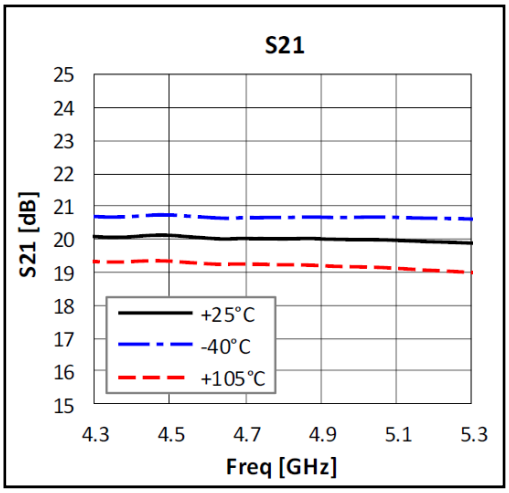
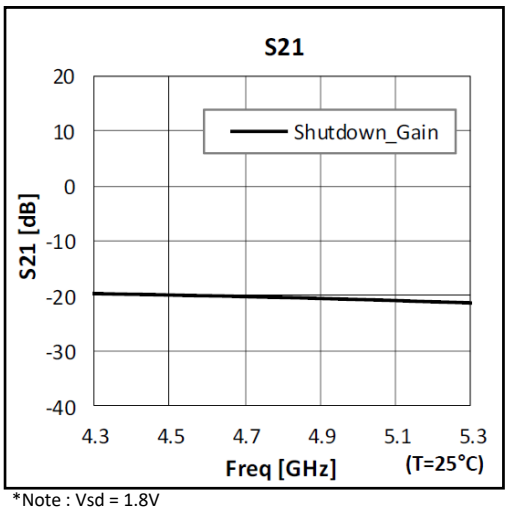
4.9GHz Application Circuit

Schematic Diagram	BOM		Size
	C1	1uF	1608(0603)
	C2	100pF	1608(0603)
	C3	15pF	1608(0603)
	R1	3Ω	1608(0603)
	R2	20kΩ	1608(0603)
	L1	2.2nH	1608(0603)

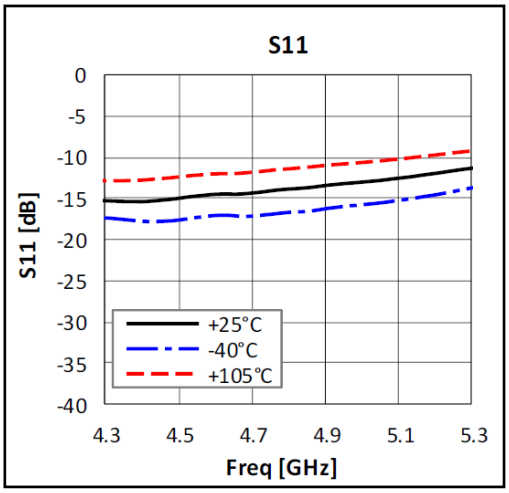
Typical Performance

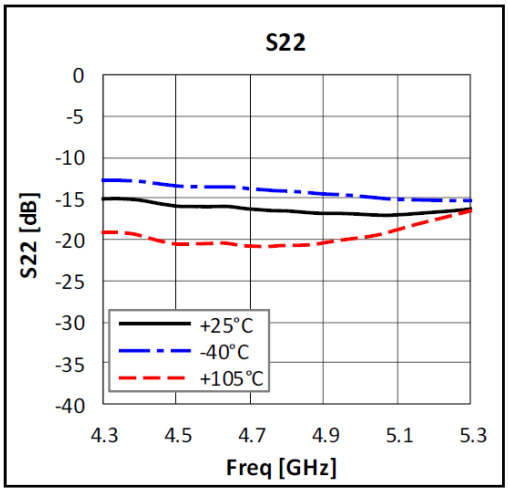
(V_d = 5.0V, I_d = 93mA)





*Note : Vsd = 1.8V





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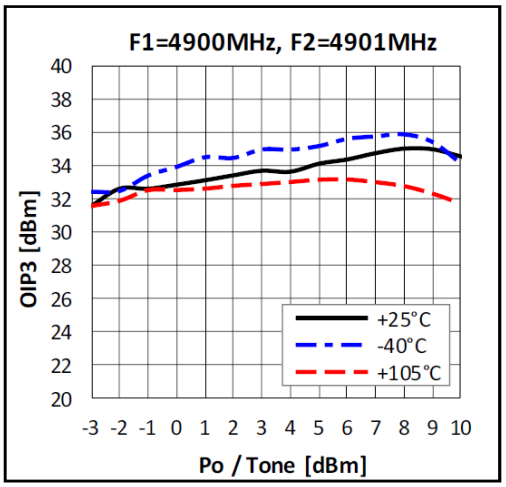
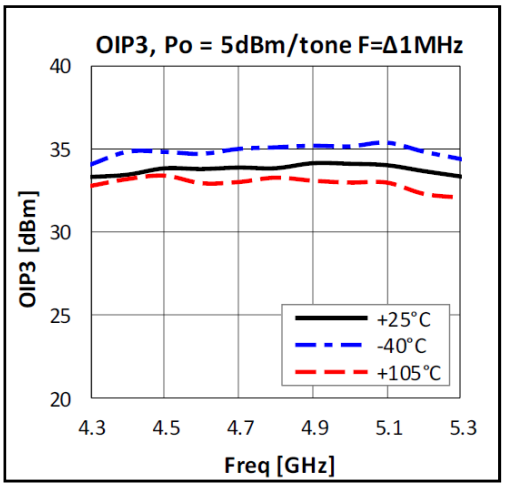
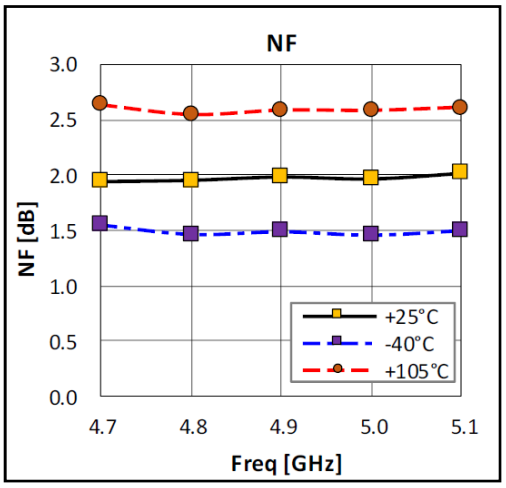
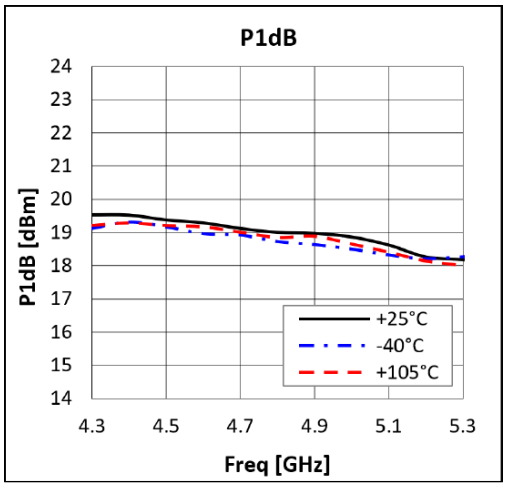
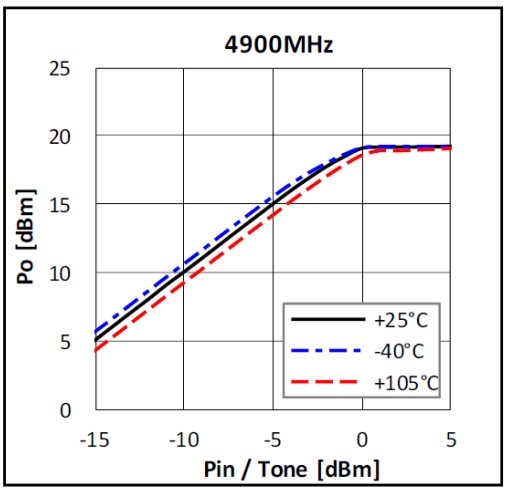
V_d = 5.0V, I_d = 93mA

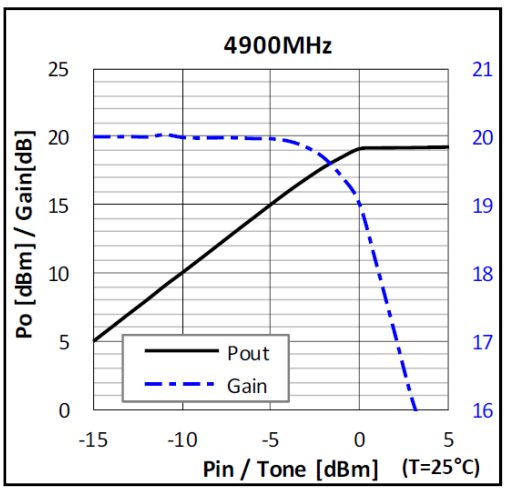












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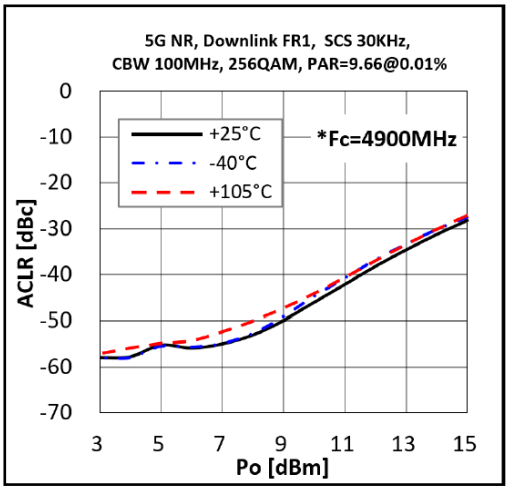
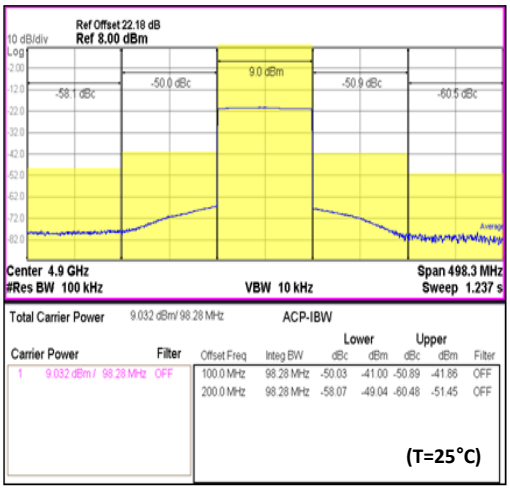
V_d = 5.0V, I_d = 93mA





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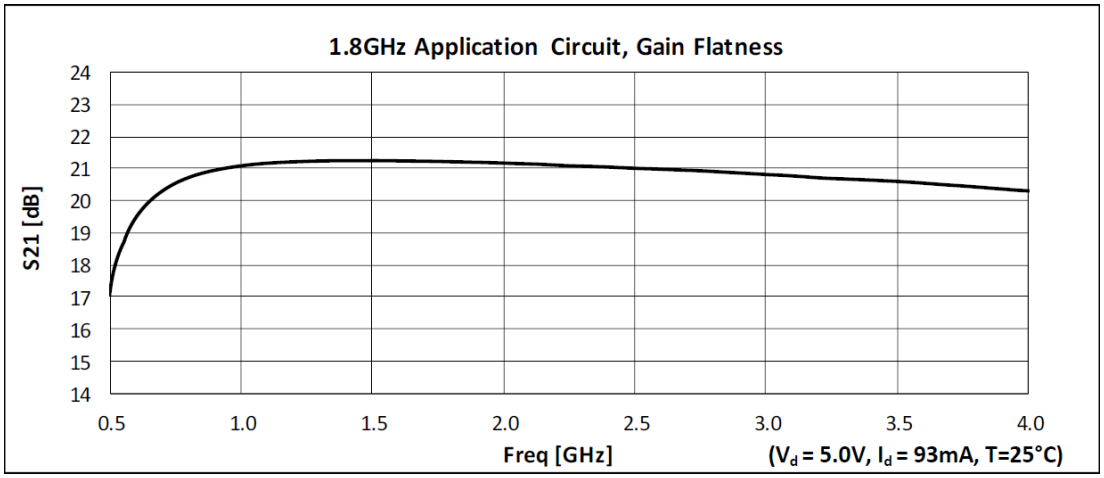
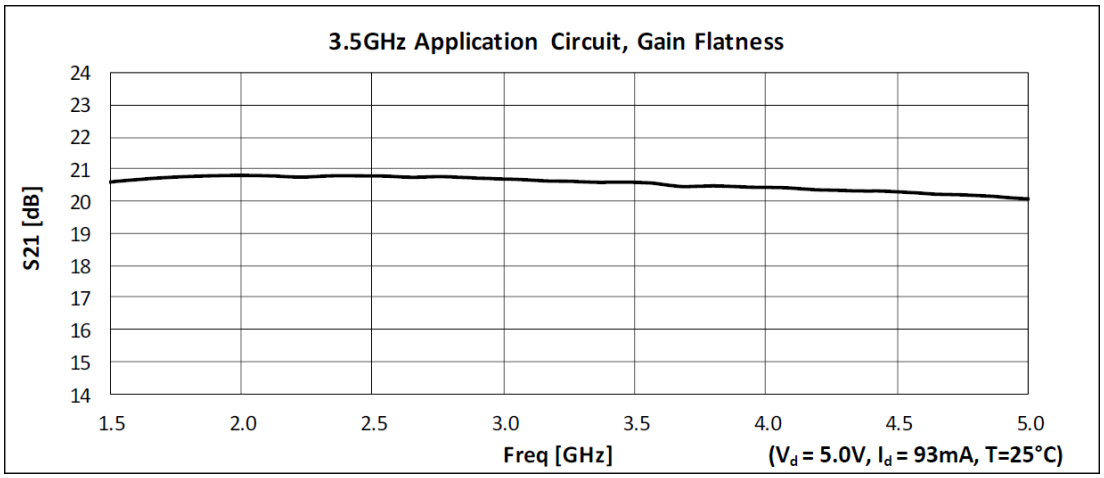
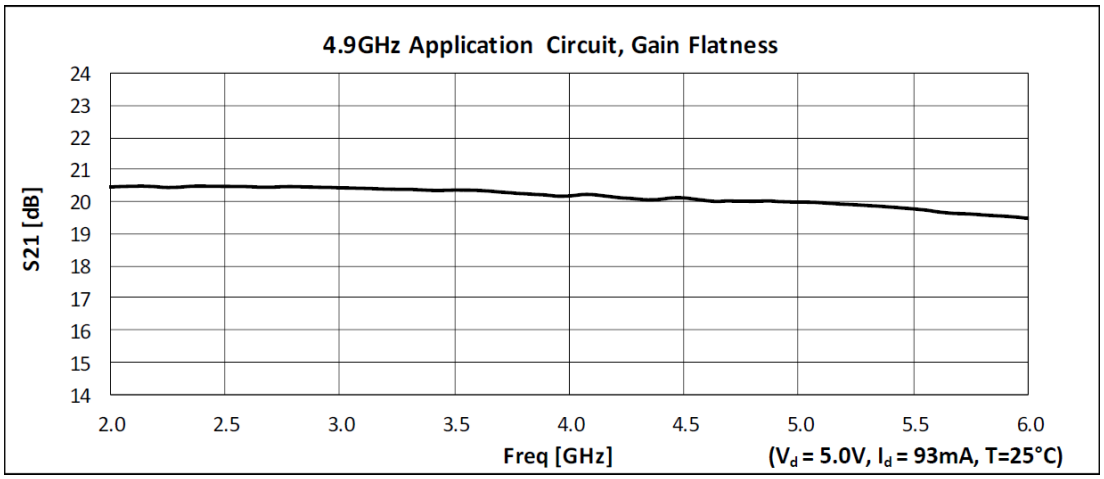
Wide Band Application Circuit



*Refer to Page.8



*Refer to Page.14



*Refer to Page.17

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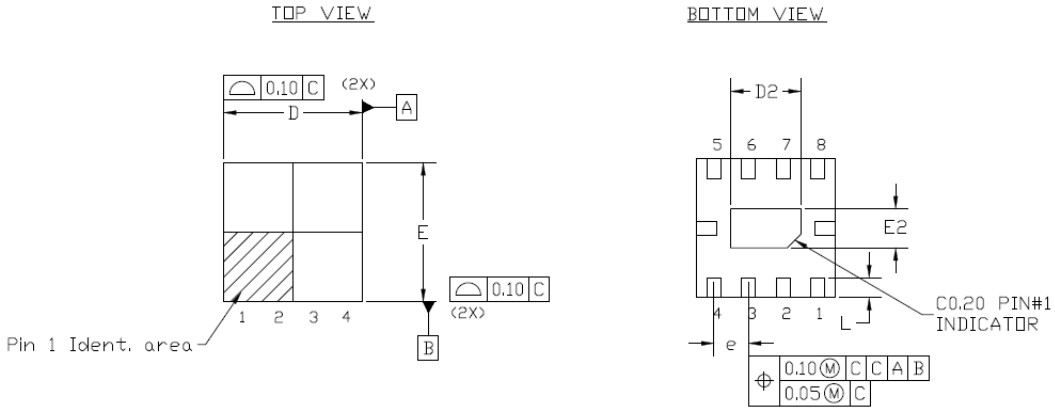
Package Outline Dimension



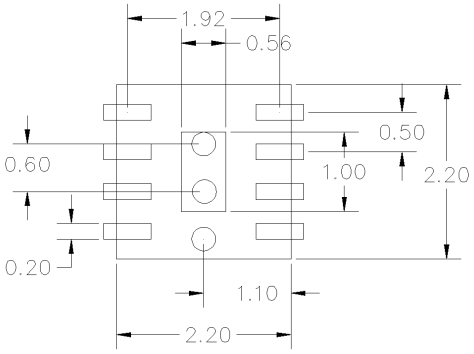
SYMBOL	COMMON					
	DIMENSIONS MILLIMETER			DIMENSIONS INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.50	0.55	0.60	0.020	0.022	0.024
A3	0.150 REF			0.006 REF		
A1	0.00	0.02	0.05	0.000	0.001	0.002
b	0.15	0.20	0.25	0.006	0.008	0.010
D	1.90	2.00	2.10	0.075	0.079	0.083
D2	0.92	1.02	1.12	0.036	0.040	0.044
E	1.90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

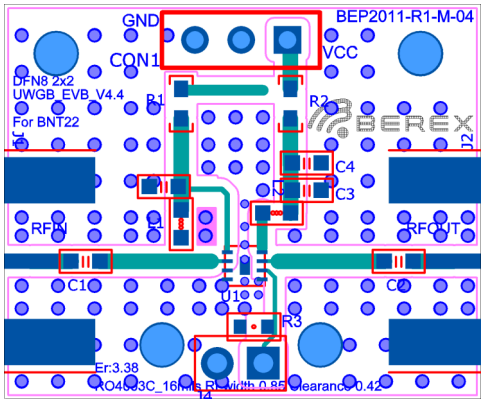
PCB Land Pattern



Note : All dimension _ millimeters

PCB lay out _ on BeRex website

PCB Mounting



*Dielectric constant _ 3.38 *RF pattern width 0.85T *16mil thick RO4003C PCB

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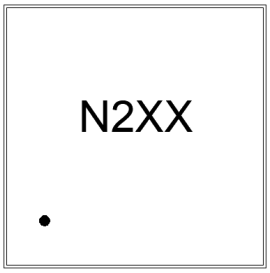
Package Marking

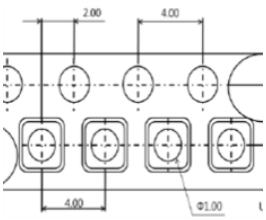


XX = Wafer No.

Pin 1

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 1B
Value:	**Passes <1000V**
Test:	Human Body Model (HBM)
Standard:	JEDEC Standard JS-001-2017
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.

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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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