

Device Features

- Gain = 18.0 dB @ 3500MHz
- OIP3 = 37.0 dBm @ 3500MHz
- Output P1 dB = 19.0 dBm @ 3500 MHz
- N.F = 1.5dB @ 3500MHz
- Internally matched to 50 ohms
- Fast shut down to support TDD systems
- Green/RoHS2 Compliant DFN 8L 2x2 Package

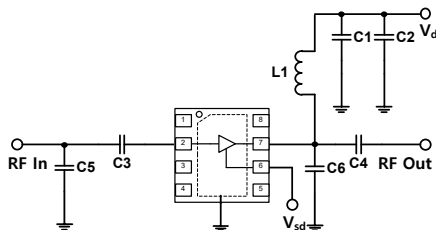
Product Description

The BNT21 is a BroadBand, GaAs E-pHEMT Amplifier that is ideal for applications demanding high linearity & Low Noise Figure in a wideband of 40-6000 MHz. The BNT21 is internally matched to 50 Ohms. It is available in RoHS2-compliant DFN 8L 2x2 mm² Surface mount package. It can be used in fast shutdown switching speed for TD-LTE & TD-5G NR application. These devices are 100% DC and RF tested to assure quality and performance.

Applications

- Repeaters
- Mobile Infrastructure
- Defense/Aerospace
- LTE / WCDMA / EDGE / CDMA / 5G NR
- General Purpose Wireless
- IF amplifier, RF driver amplifier

Applications Circuit



BOM	70M	900M	1.8G	3.5G	4.65G	5.8G
C1	1.2nF	1.2nF	1.2nF	1.2nF	1.2nF	1.2nF
C2	10uF	10uF	10uF	10uF	10uF	10uF
C3	10nF	200pF	200pF	1.5pF	2pF	1pF
C4	10nF	200pF	20pF	200pF	1.5pF	2pF
C5	N/A	N/A	N/A	N/A	N/A	0.3pF
C6	N/A	N/A	N/A	N/A	0.3pF	0.5pF
L1	820nH	33nH	5.6nH	1.8nH	1.2nH	18nH

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		50		6000	MHz
Test Frequency			3500		MHz
Gain		16.5	18.0		dB
Input Return Loss			-22.0		dB
Output Return Loss			-12.0		dB
Output IP3	5 dBm / tone , Δf=1 MHz	34.0	37.0		dBm
Output P1dB		18.0	19.0		dBm
5G NR ACLR*		7.7	8.7		dBm
Noise Figure			1.5	1.7	dB

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

Parameter	Conditions	Min	Typ	Max	Unit
Operational Frequency Range		50		6000	MHz
Test Frequency			3500		MHz
Gain		16.5	17.2		dB
Input Return Loss			-17.9		dB
Output Return Loss			-10.6		dB
Output IP3	5 dBm / tone , Δf=1 MHz	29	32		dBm
Output P1dB		14.2	15.2		dBm
5G NR ACLR*		4.7	5.7		dBm
Noise Figure			1.5	1.7	dB

*ACLR Channel Power measured at -50dBc.

- 5G NR Downlink FR1 : SCS 30KHz, CBW 100MHz, 256QAM, PAR 9.66 at 0.01% Prob.

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

Recommended Operating Conditions¹

Parameter	Min	Typ	Max	Unit
Bandwidth	50		6000	MHz
I _d @ (V _d = 5.0V)	68	85	102	mA
I _d @ (V _d = 3.3V)	39	48	57	mA
V _d	3.3	5	5.25	V
dG/dT		0.006		dB/°C
R _{TH}		49.4		°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 Conditions²

Parameter	Condition	Min.	Typical	Max.	Unit
Shutdown Control	On state	0		0.67	V
	Off state(shutdown)	1.17		V _{DD}	V
Current, I _{DD}	On state 5V	66	83	100	mA
	On state 3.3V	39	48	57	mA
	Off state(shutdown)		7		mA
Shutdown pin current, I _{SD}	1.17V ≤ V _{SD} < V _{DD}		150		uA
Switching Time	Rise time(10% to 90%)		220		ns
	Fall time(90% to 10%)		200		ns

Absolute Maximum Ratings

Parameter	Rating	Unit
Storage Temperature	-55 to +155	°C
Junction Temperature	+170	°C
Supply Voltage	+7	V
Supply Current	190	mA
Input RF Power	20	dBm

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

Typical RF Performance (V_d=5V, I_d=83mA, T=25°C)

Parameter	Frequency								Unit
	70	900	1800	2140	2650	3500	4650	5800	MHz
Gain	21.7	20.8	19.4	19.2	18.5	18.0	17.7	18.5	dB
S ₁₁	-13.5	-14.0	-10.6	-10.7	-10.7	-22.0	-12.6	-15.3	dB
S ₂₂	-21.1	-17.6	-13.0	-16.3	-12.3	-12.0	-13.6	-5.5	dB
OIP ₃	37.3	36.9	37.5	37.3	37.0	37.0	38.0	35.0	dBm
P _{1dB}	21.2	21.8	22.1	21.2	20.9	19.0	18.2	18.1	dBm
LTE 20M ACLR*	12.5	12.6	12.3	12.0	11.4	8.7	8.9	7.0	dBm
5G NR ACLR*	-	-	-	-	-	8.7	8.8	7.1	dBm
Noise Figure	0.9	1	1.1	1.1	1.2	1.5	1.8	2.1	dB

Typical RF Performance (V_d=3.3V, I_d=48mA, T=25°C)

Parameter	Frequency								Unit
	70	900	1800	2140	2650	3500	4650	5800	MHz
Gain	21.1	20.3	18.8	18.6	17.7	17.2	16.9	17.9	dB
S ₁₁	-13.1	-13.2	-9.7	-9.9	-9.5	-17.9	-10.8	-11.9	dB
S ₂₂	-18.3	-17.6	-13.3	-15.8	-11.1	-10.6	-11.0	-5.0	dB
OIP ₃	32.7	32.7	33.4	33.1	31.9	32.0	29.7	27.9	dBm
P _{1dB}	17.8	18.1	17.9	17.7	17.4	15.2	14.7	14.9	dBm
LTE 20M ACLR*	8.3	8.7	8.4	8.2	7.6	5.7	5.1	3.6	dBm
5G NR ACLR*	-	-	-	-	-	5.7	5.0	4.0	dBm
Noise Figure	0.8	0.9	1.1	1.1	1.2	1.5	2.0	2.0	dB

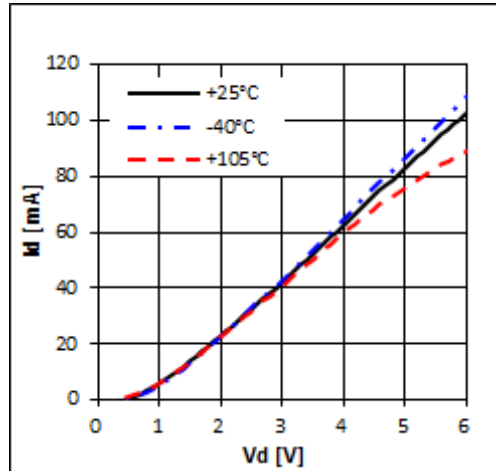
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- LTE set-up: 3GPP LTE, FDD E-TM3.1, 20MHz BW, ±20MHz offset, PAR 9.75 at 0.01% Prob.

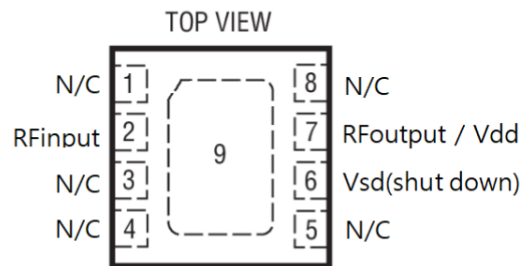
- 5G NR Downlink FR1 : SCS 30KHz, CBW 100MHz, 256QAM, PAR 9.66 at 0.01% Prob.

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V-I Characteristics

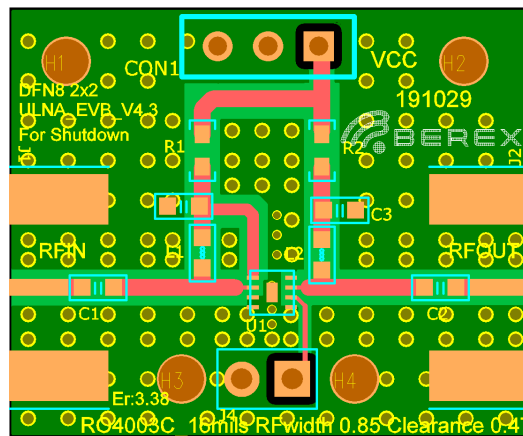


Pin Configuration



DC PACKAGE
 8-LEAD (2mm × 2mm) PLASTIC DFN
 EXPOSED PAD (PIN 9) IS GND, MUST BE SOLDERED TO PCB

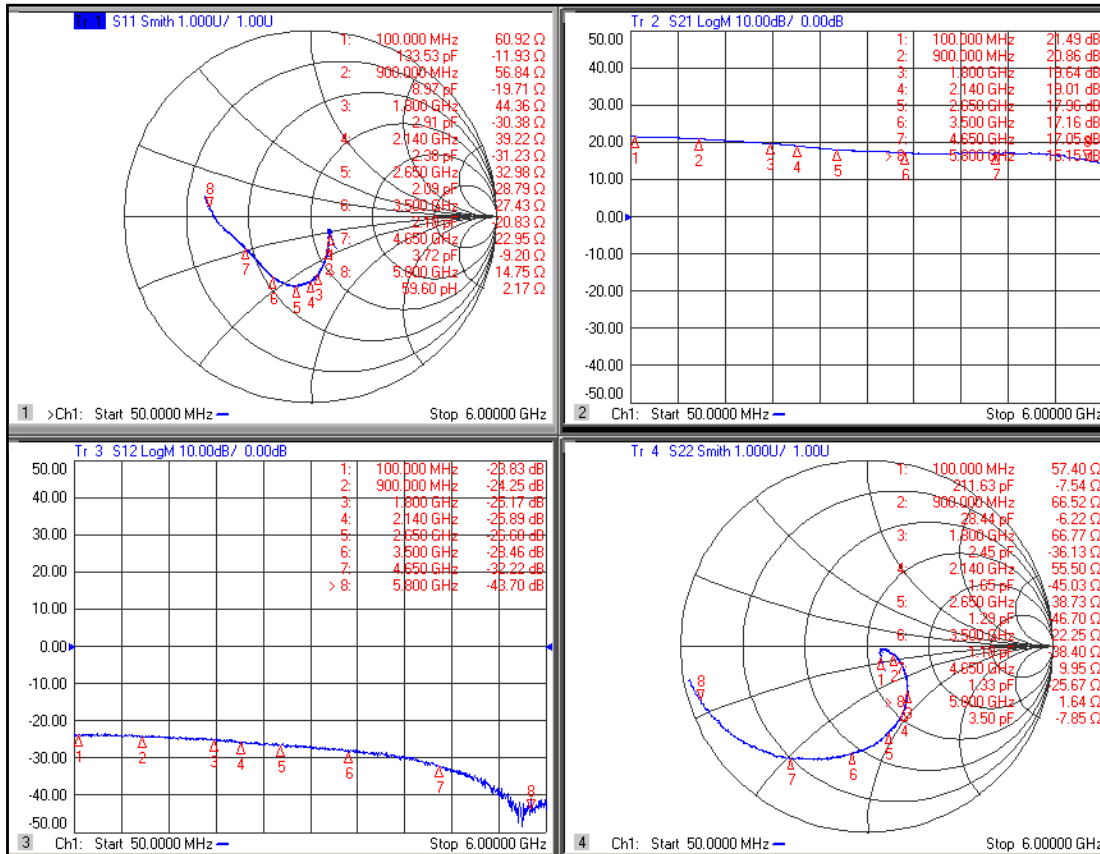
Evaluation Board



*Dielectric constant ϵ_r 3.38 *RF pattern width 0.85T *16mil thick RO4003PCB

Typical Device Data

S-parameters ($V_d=5V, I_d=83mA, T=25^\circ C$)



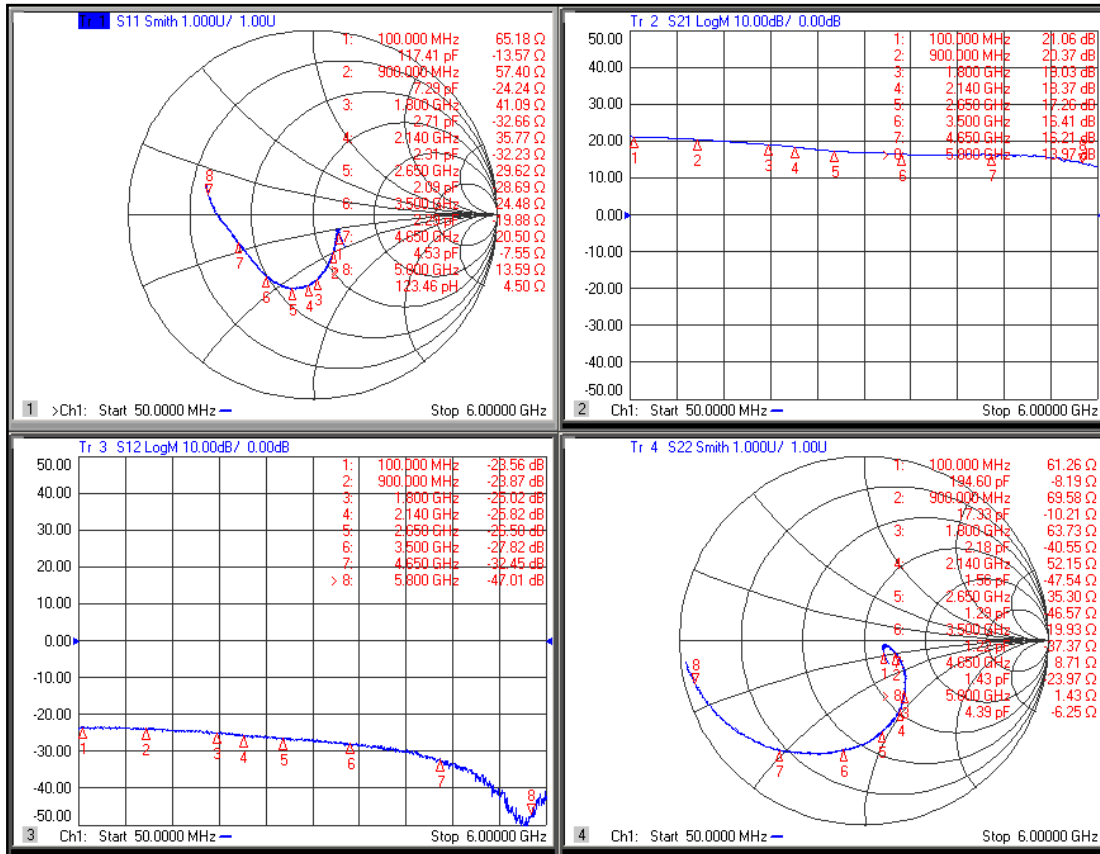
S-Parameter

(Vdevice = 5.0V, Id = 83mA, T = 25 °C, calibrated to device leads)

Freq	S11	S11	S21	S21	S12	S12	S22	S22
[MHz]	[Mag]	[Ang]	[Mag]	[Ang]	[Mag]	[Ang]	[Mag]	[Ang]
100	0.15	-41.87	11.88	171.45	0.06	4.24	0.10	-41.59
500	0.14	-46.57	11.57	156.70	0.06	-7.48	0.10	-10.31
1000	0.20	-63.87	10.92	135.21	0.06	-17.54	0.17	-20.53
2000	0.34	-86.09	9.20	94.96	0.05	-35.62	0.37	-54.86
3000	0.39	-109.17	7.62	61.12	0.04	-51.56	0.53	-85.24
4000	0.37	-136.21	6.97	27.21	0.03	-70.35	0.63	-108.64
5000	0.42	-163.04	7.01	-16.11	0.02	-110.74	0.79	-133.28
6000	0.58	169.35	5.13	-66.78	0.01	104.14	0.97	-169.48

Typical Device Data

S-parameters ($V_d=3.3V$, $I_d=48mA$, $T=25^\circ C$)

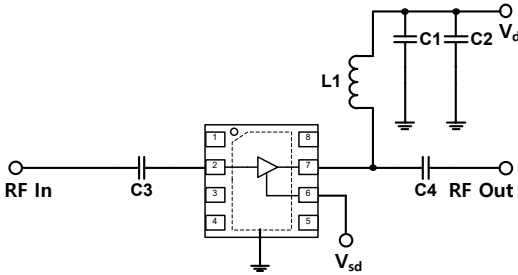


S-Parameter

(Vdevice = 3.3V, Id = 48mA, T = 25 °C, calibrated to device leads)

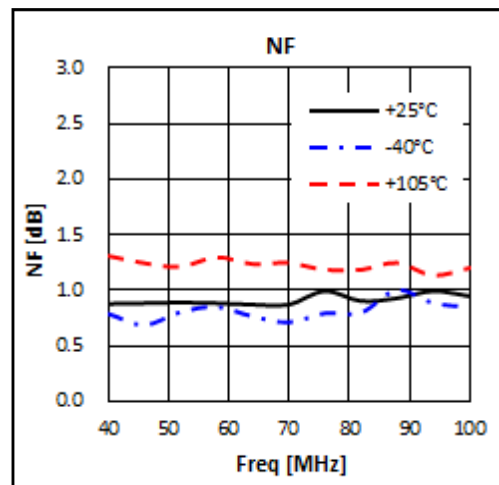
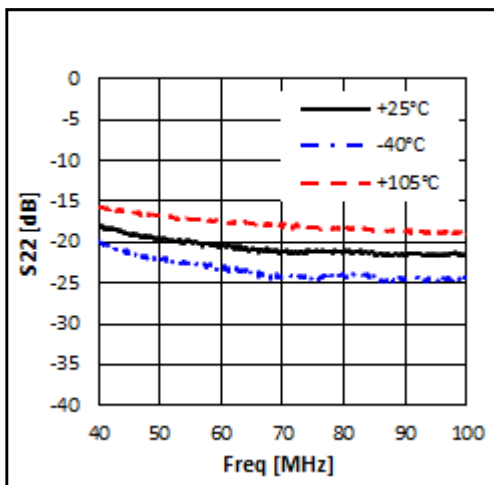
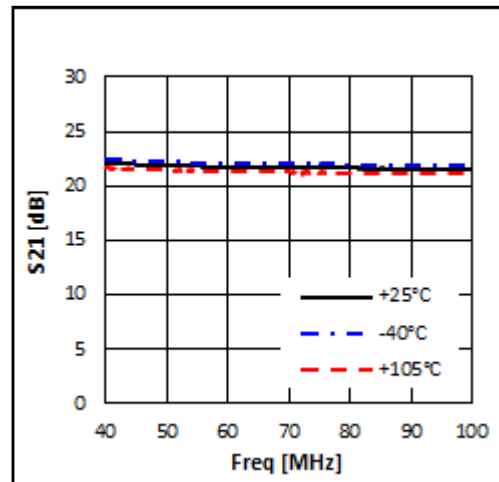
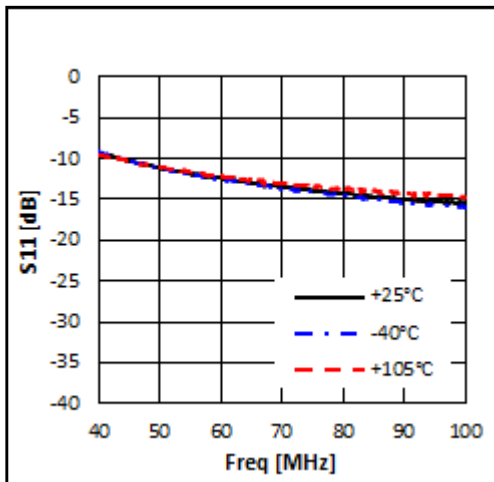
Freq [MHz]	S11	S11	S21	S21	S12	S12	S22	S22
	[Mag]	[Ang]	[Mag]	[Ang]	[Mag]	[Ang]	[Mag]	[Ang]
100	0.18	-35.30	11.31	171.45	0.07	4.15	0.12	-32.49
500	0.18	-43.45	11.00	155.81	0.06	-8.40	0.13	-13.70
1000	0.24	-63.99	10.30	133.64	0.06	-18.11	0.20	-24.72
2000	0.37	-89.90	8.56	92.64	0.05	-35.68	0.40	-58.25
3000	0.42	-113.79	7.04	58.31	0.04	-50.96	0.55	-88.19
4000	0.41	-141.09	6.40	23.57	0.03	-73.79	0.66	-111.49
5000	0.46	-169.01	6.31	-21.17	0.02	-105.64	0.80	-137.26
6000	0.60	164.02	4.47	-71.83	0.01	78.97	0.97	-172.81

Application Circuit: 70 MHz

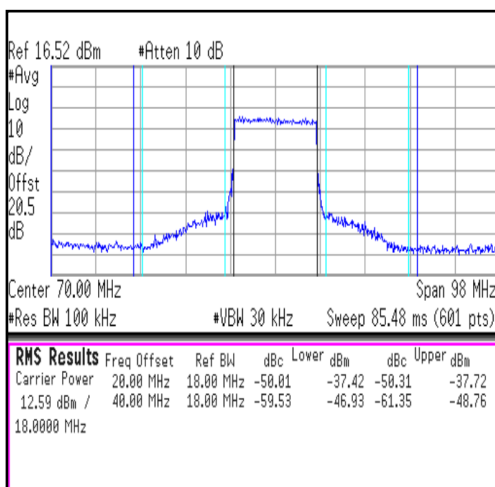
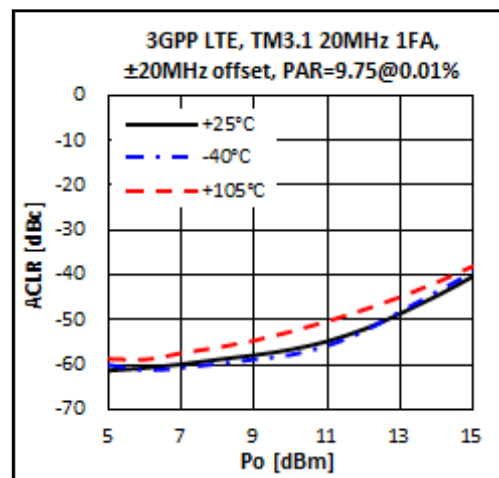
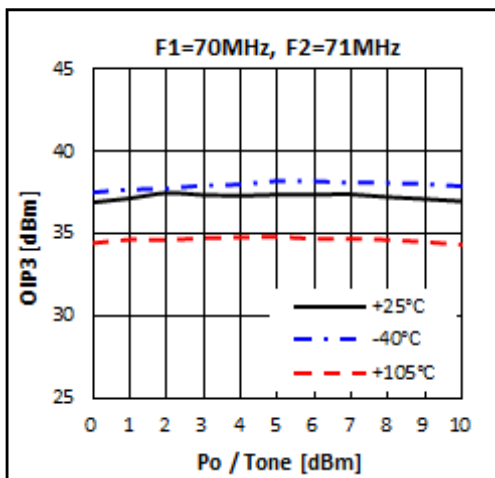
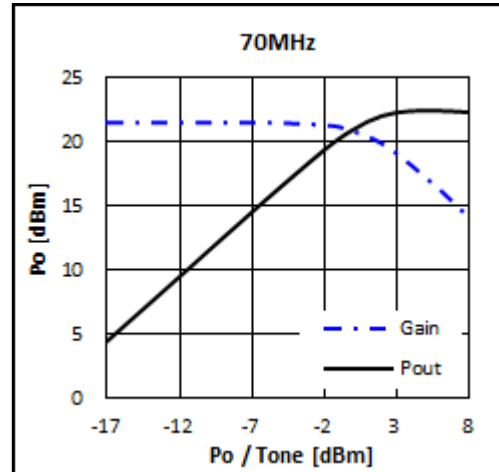
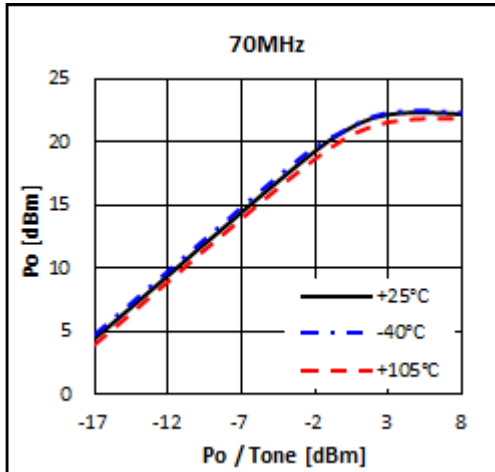
Schematic Diagram	BOM	Tolerance	
	C1	1.2nF	± 5%
	C2	10uF	± 10%
	C3	10nF	± 5%
	C4	10nF	± 5%
	L1	820nH	± 5%

Typical Performance

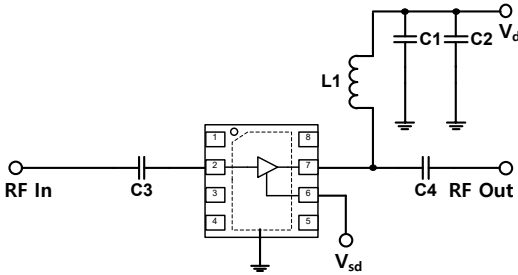
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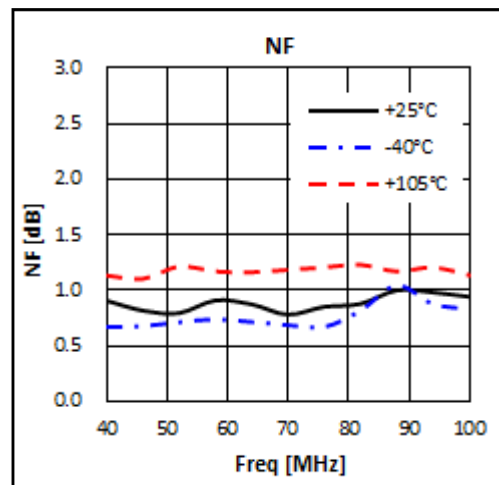
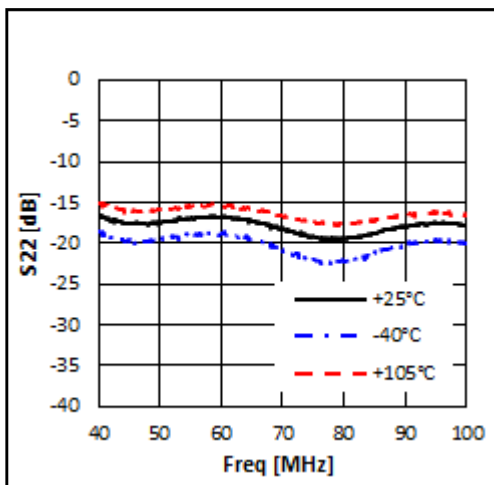
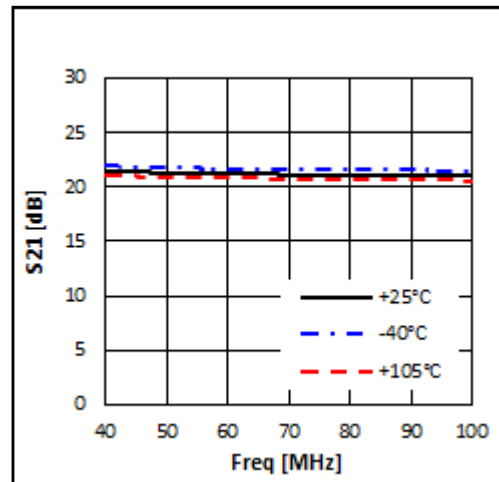
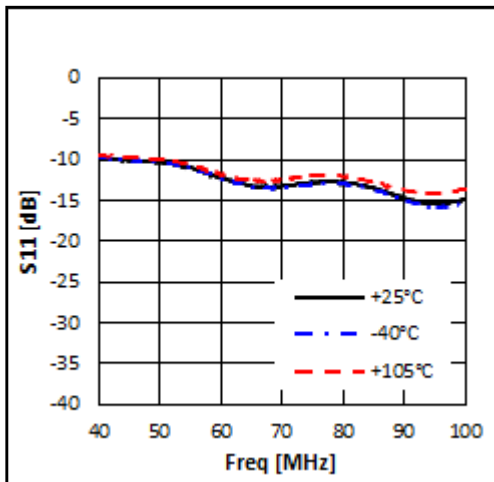


Application Circuit: 70 MHz

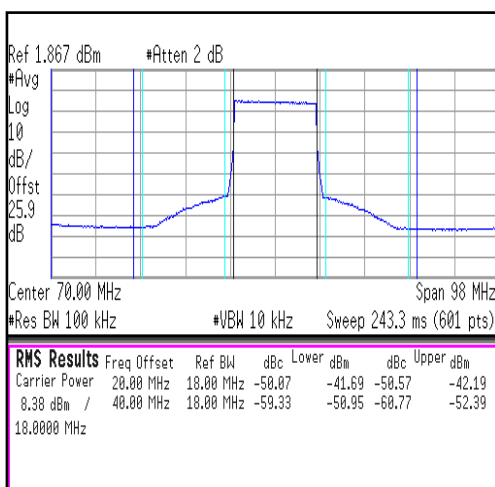
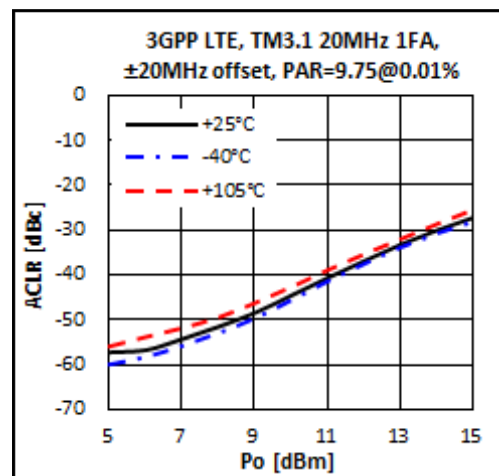
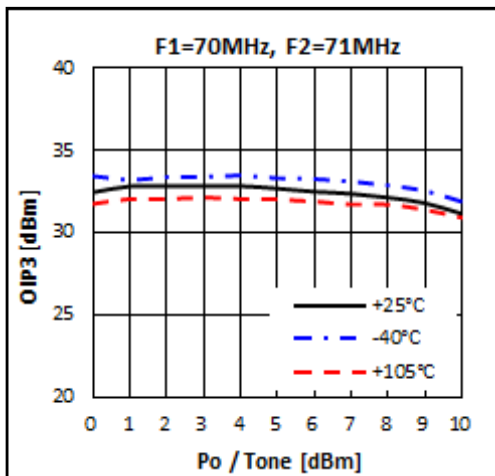
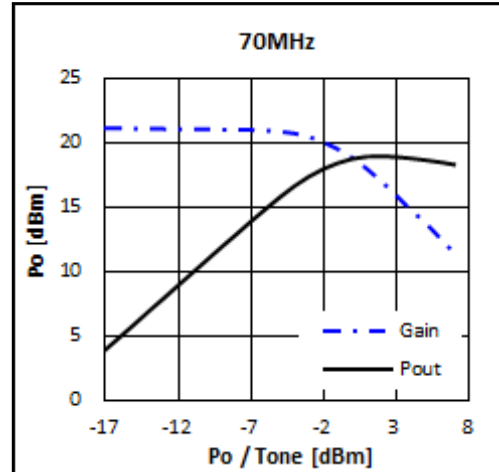
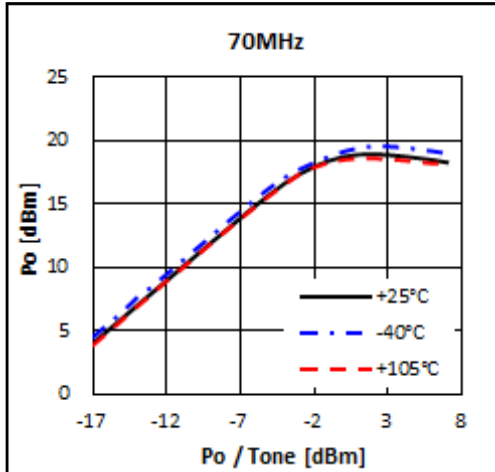
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		C4	10nF ± 5%
		L1	820nH ± 5%

Typical Performance

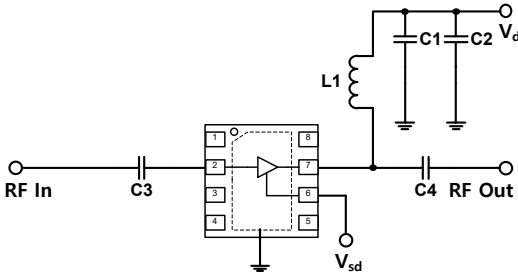
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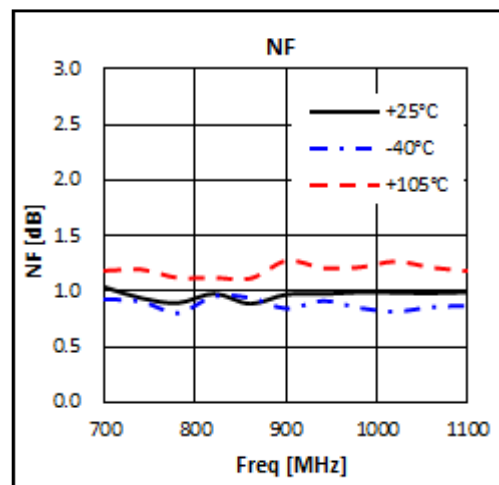
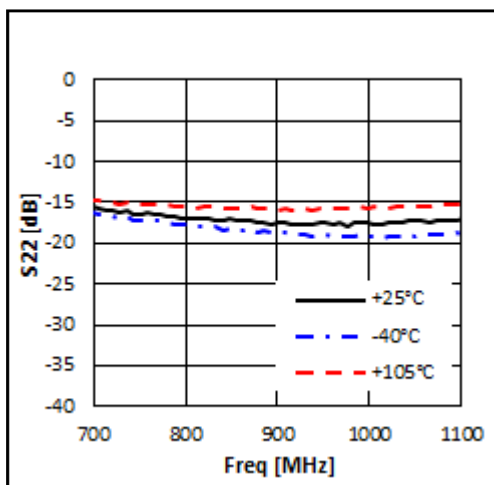
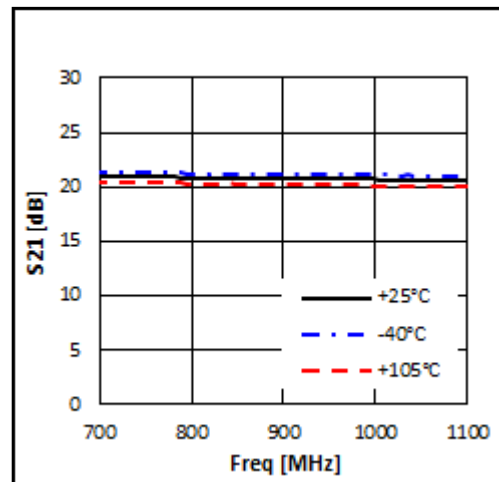
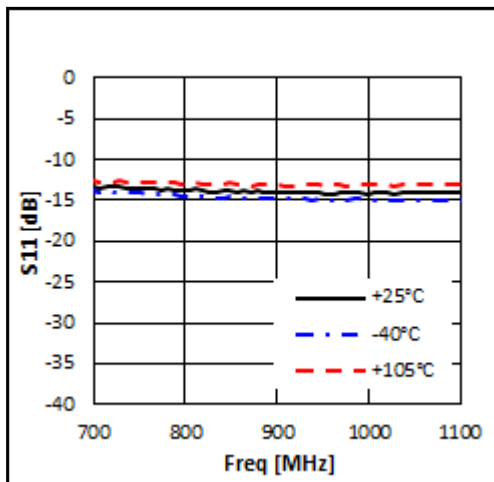


Application Circuit: 900MHz

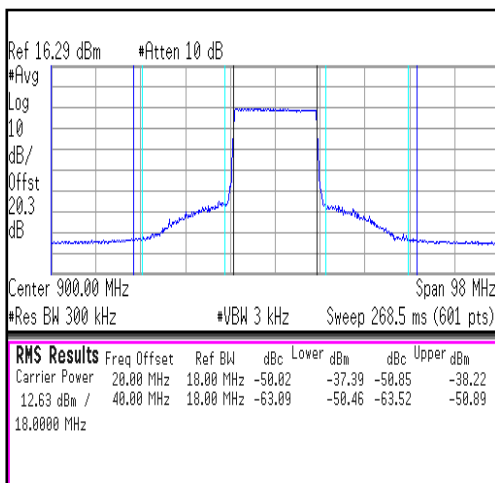
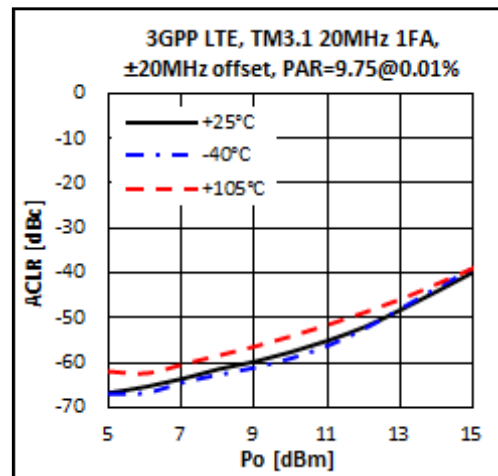
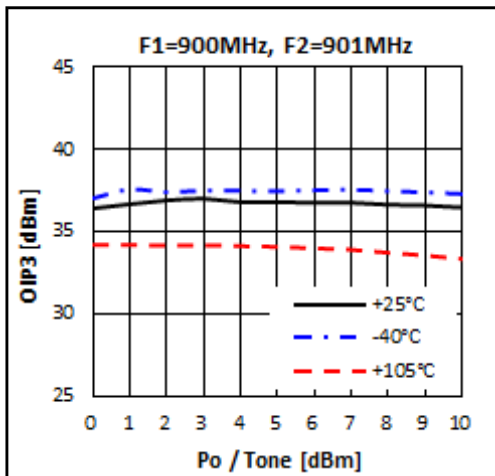
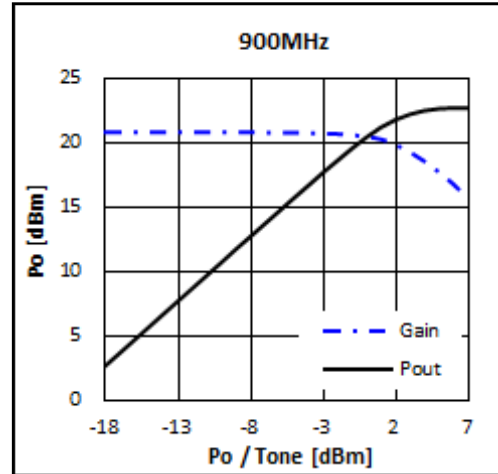
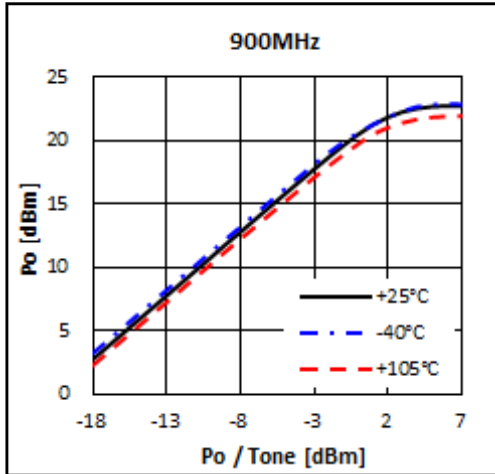
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Typical Performance

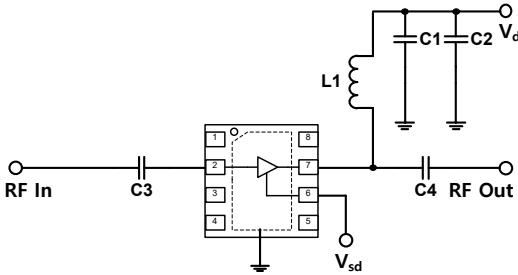
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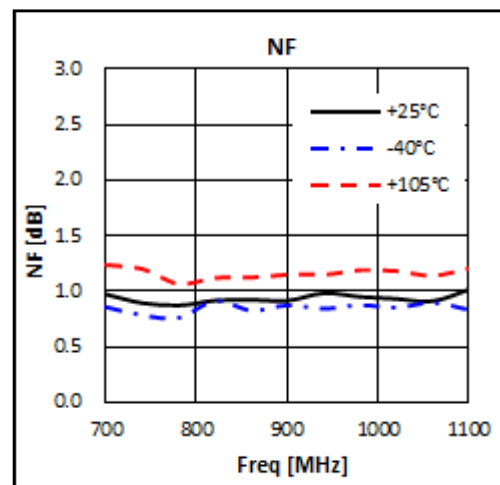
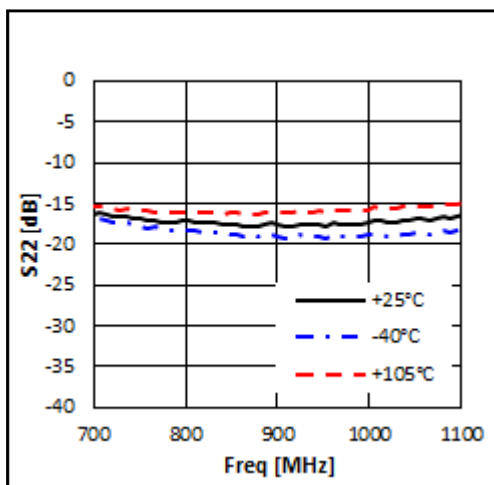
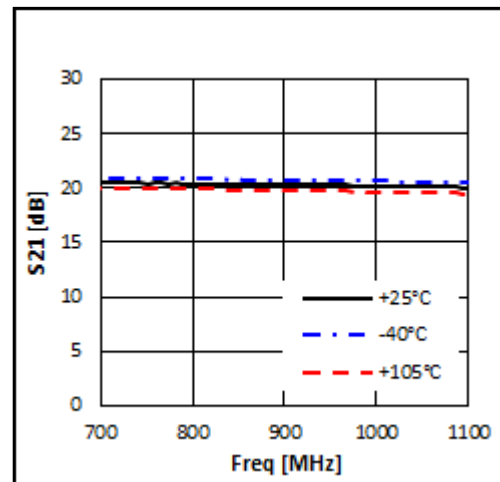
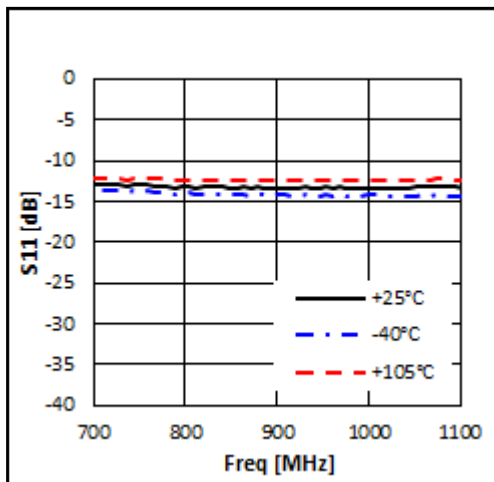


Application Circuit: 900MHz

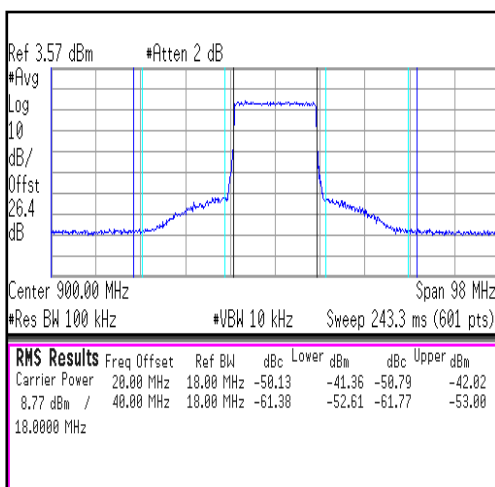
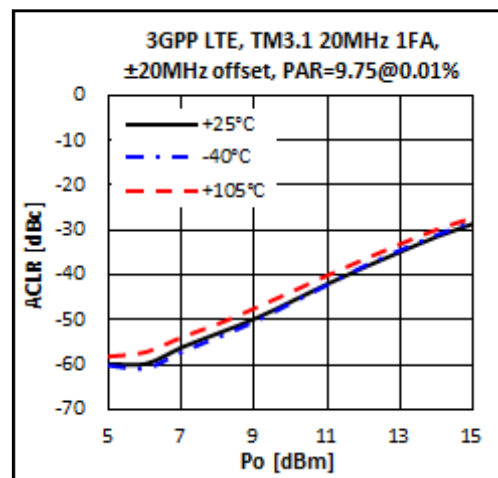
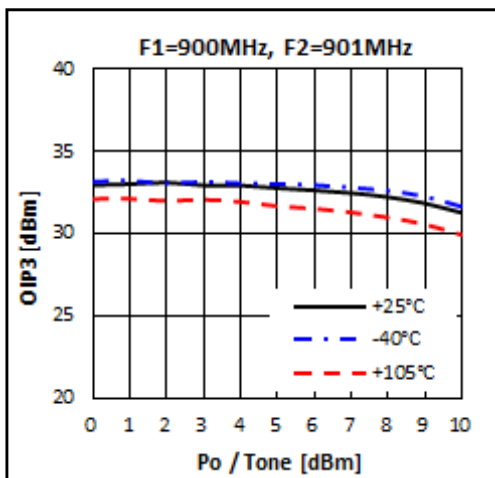
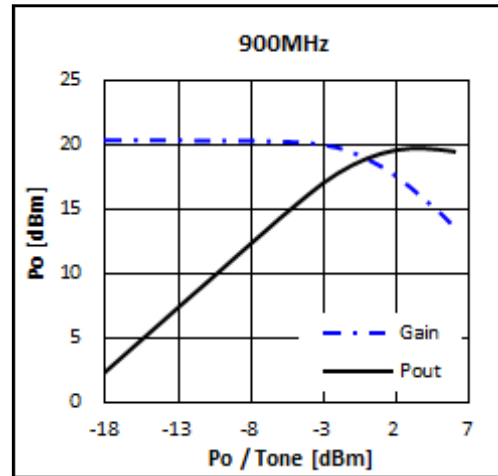
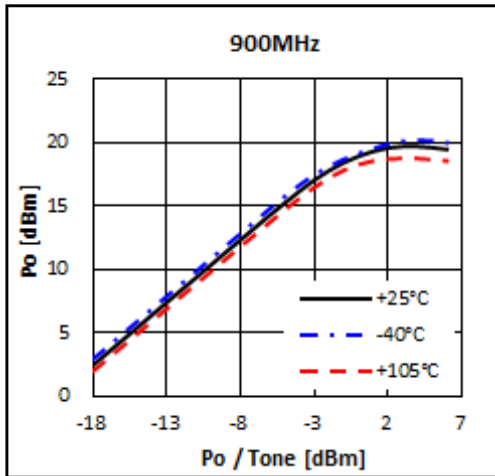
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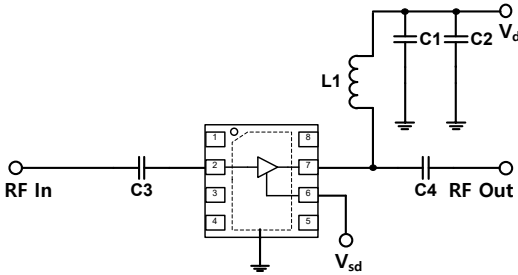
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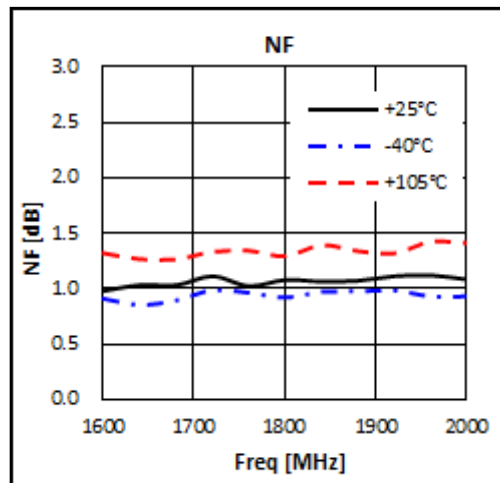
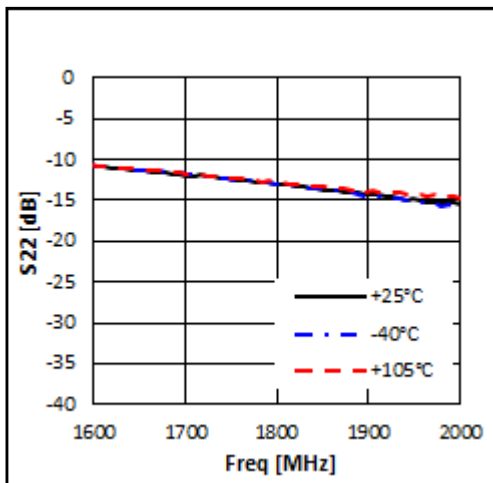
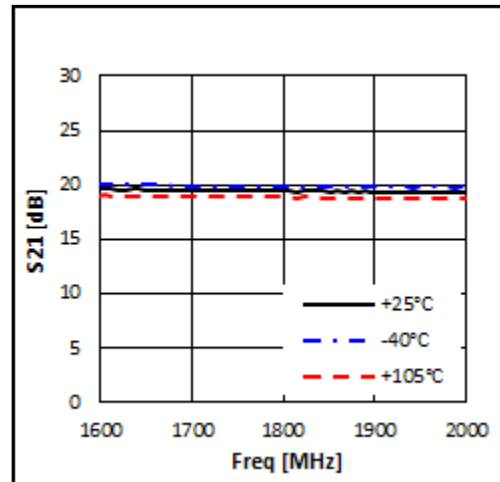
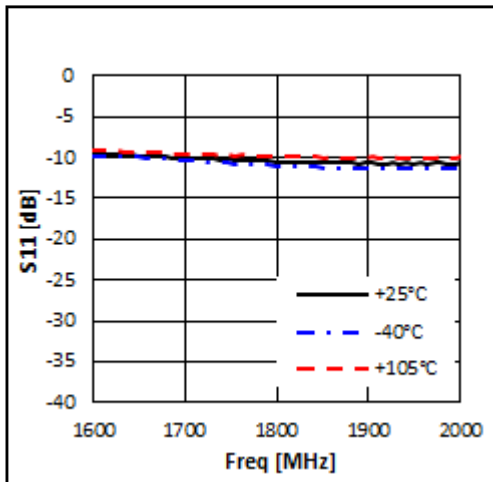


Application Circuit: 1800 MHz

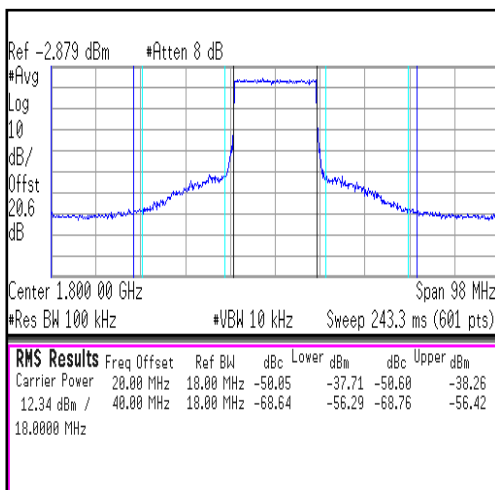
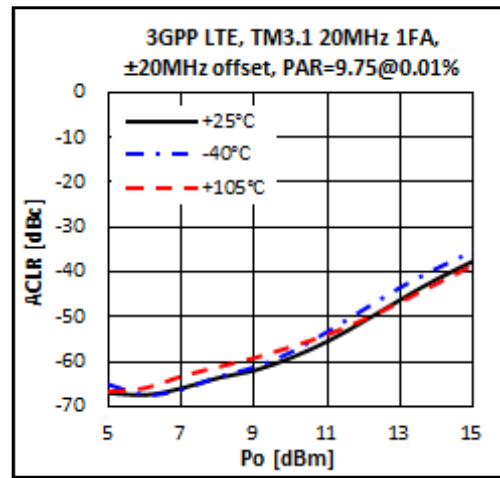
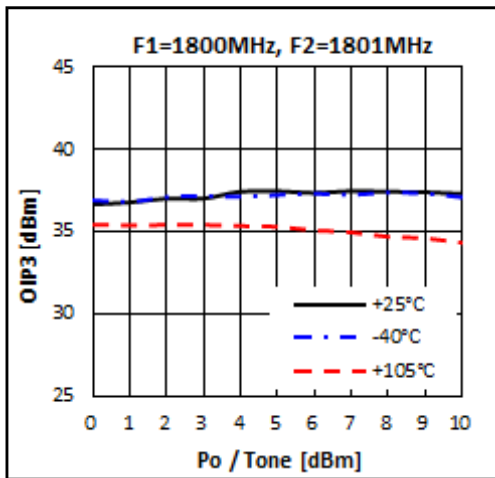
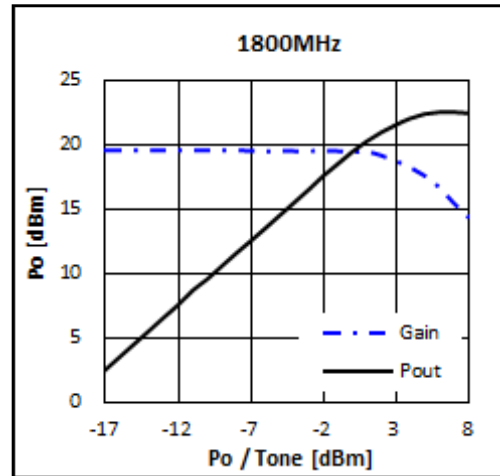
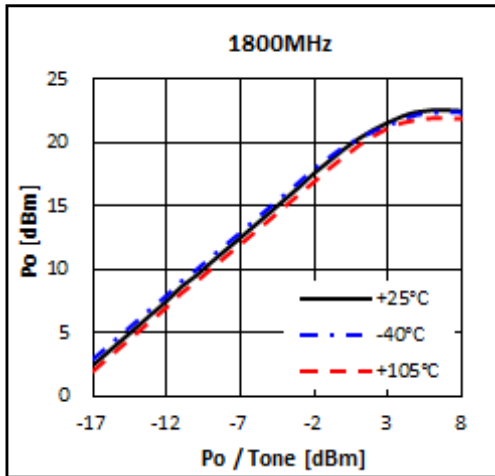
Schematic Diagram		BOM	Tolerance	
		C1	1.2nF	± 5%
		C2	10uF	± 10%
		C3	200pF	± 5%
		C4	20pF	± 5%
		L1	5.6nH	± 5%

Typical Performance

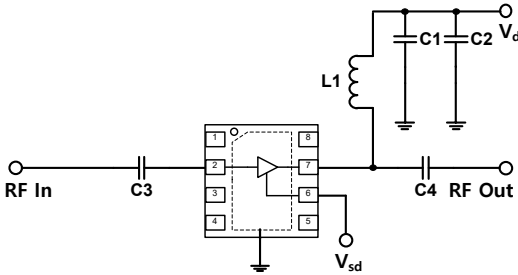
$V_{ds} = 5V, I_{ds} = 83mA$

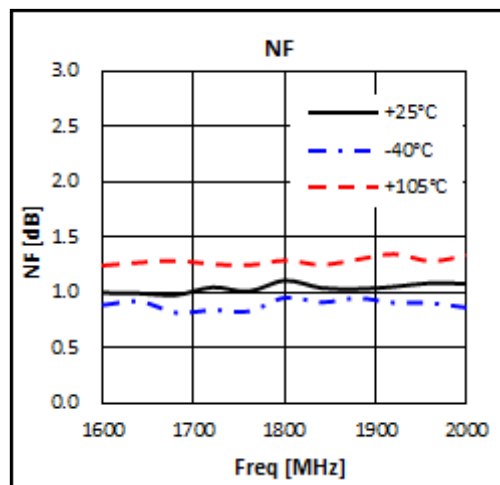
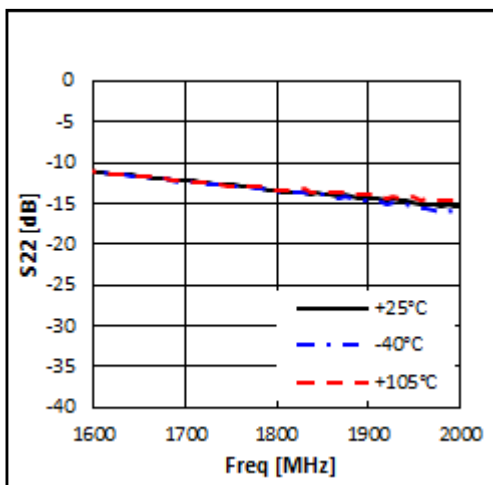
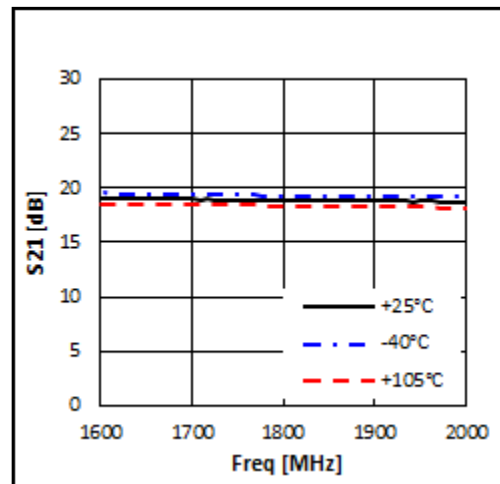
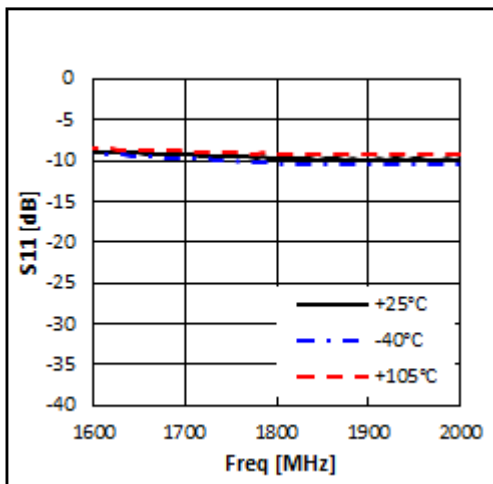


$V_{ds} = 5V, I_{ds} = 83mA$

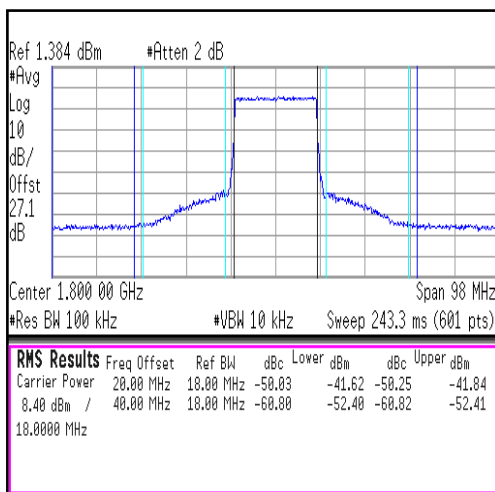
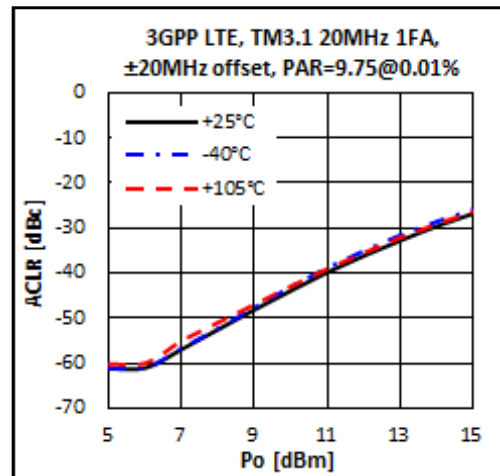
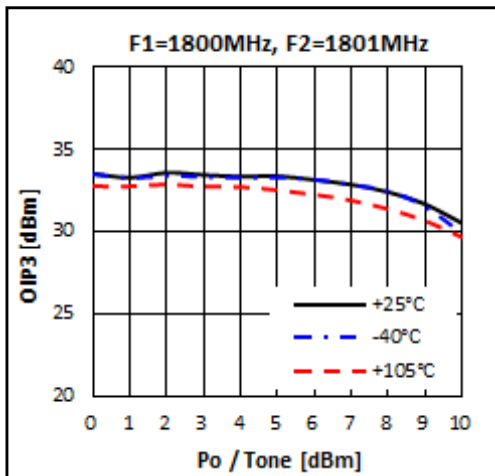
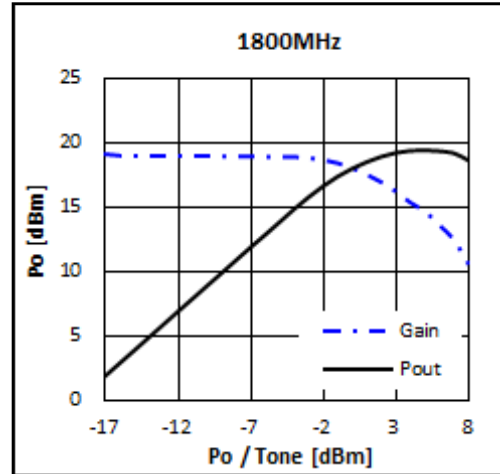
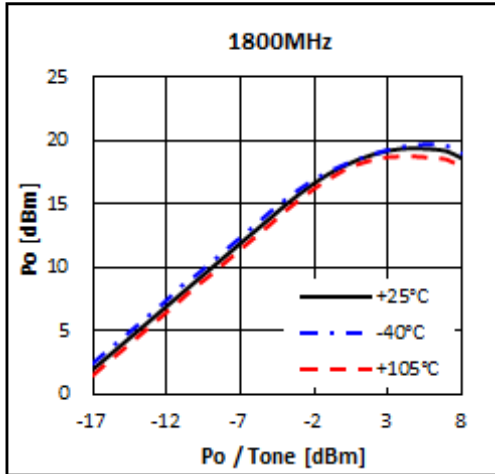


Application Circuit: 1800 MHz

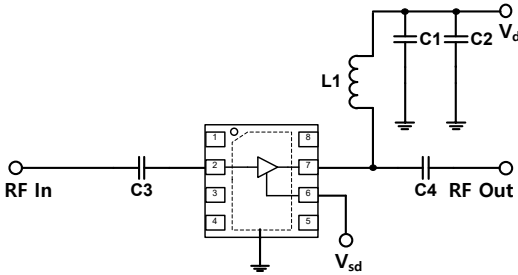
Schematic Diagram	BOM		Tolerance
	C1	1.2nF	± 5%
	C2	10uF	± 10%
	C3	200pF	± 5%
	C4	20pF	± 5%
	L1	5.6nH	± 5%

Typical Performance
 $V_{ds} = 3.3V, I_{ds} = 48mA$


$V_{ds} = 3.3V, I_{ds} = 48mA$

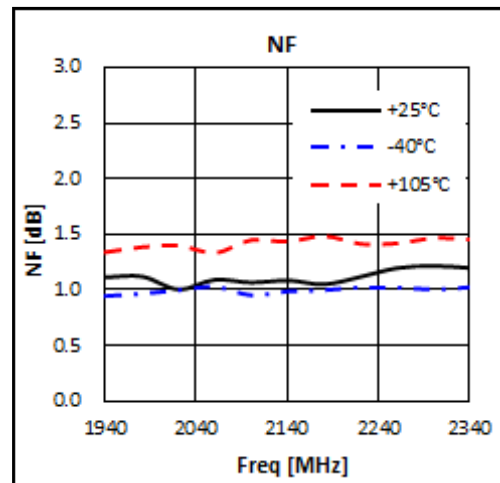
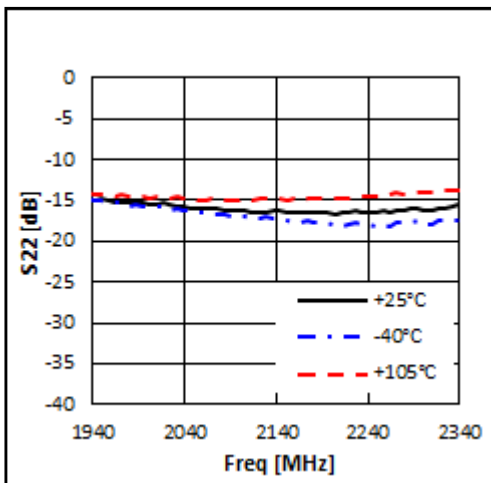
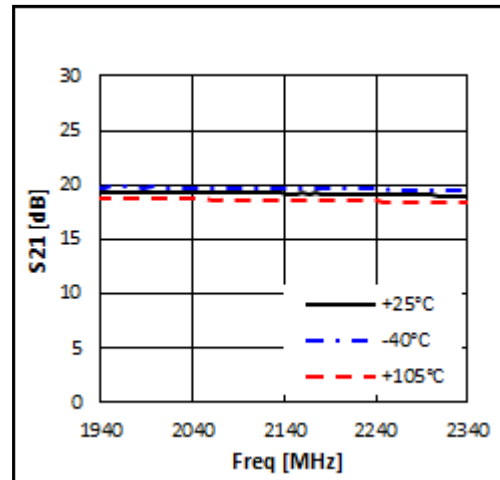
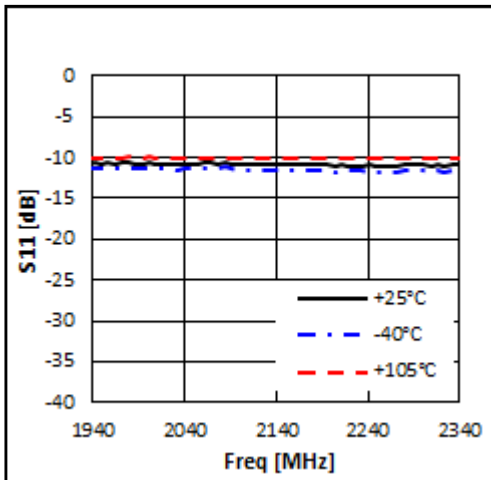


Application Circuit: 2140 MHz

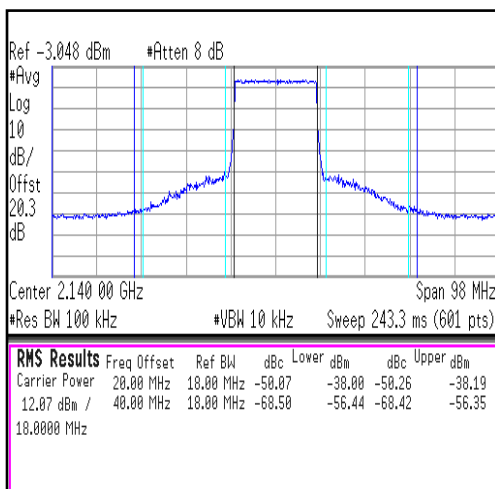
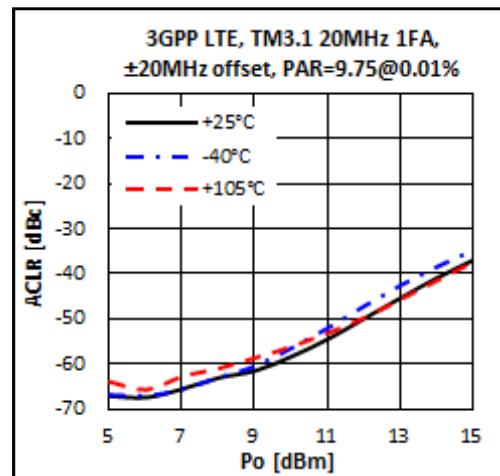
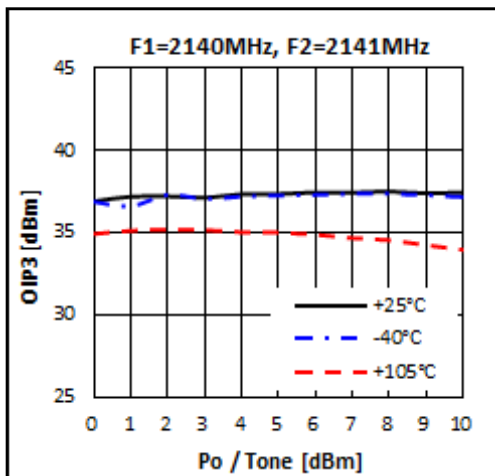
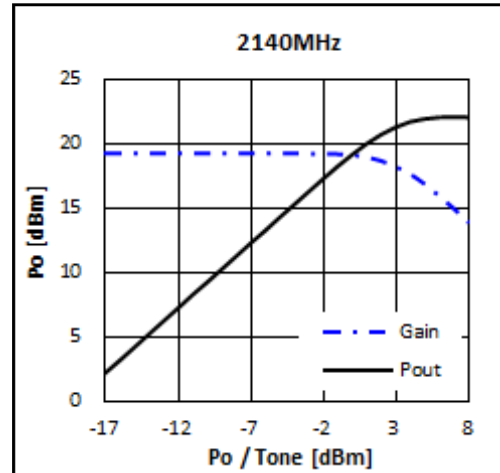
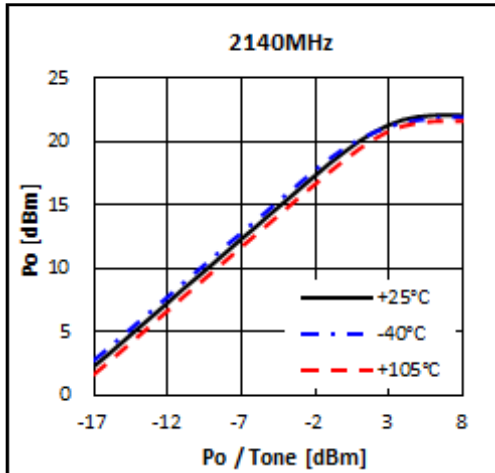
Schematic Diagram		BOM	Tolerance	
		C1	1.2nF	± 5%
		C2	10uF	± 10%
		C3	200pF	± 5%
		C4	20pF	± 5%
		L1	5.6nH	± 5%

Typical Performance

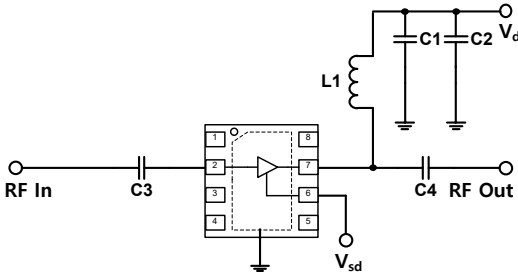
$V_{ds} = 5V, I_{ds} = 83mA$



$V_{ds} = 5V, I_{ds} = 83mA$

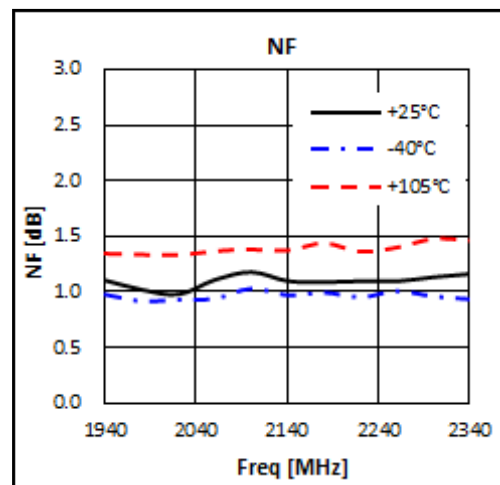
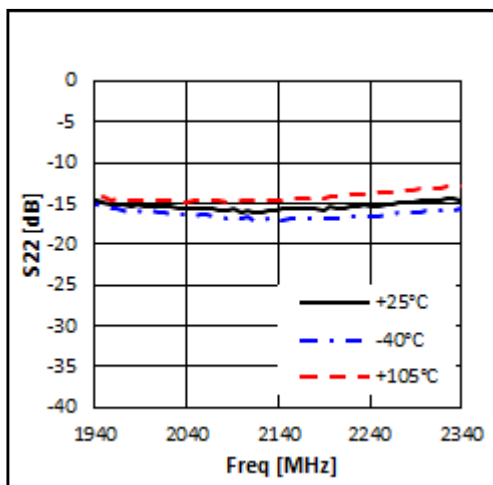
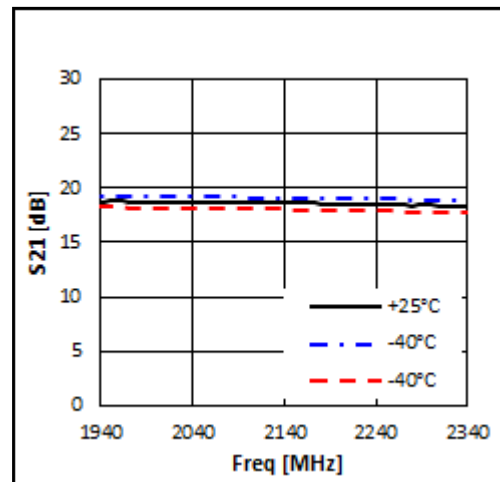
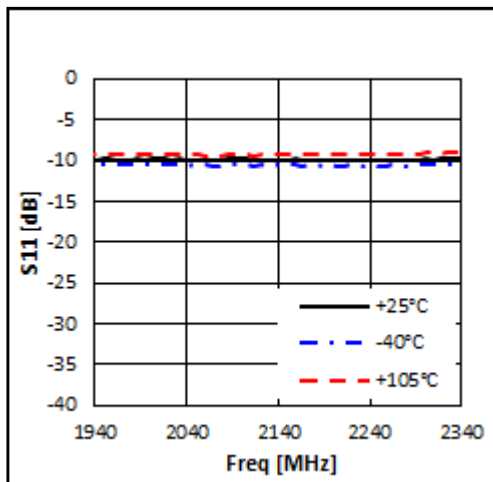


Application Circuit: 2140 MHz

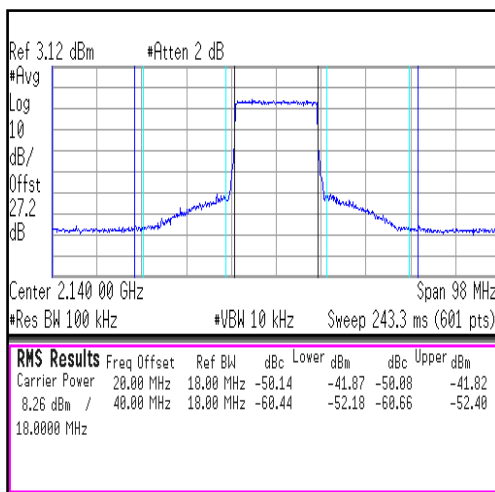
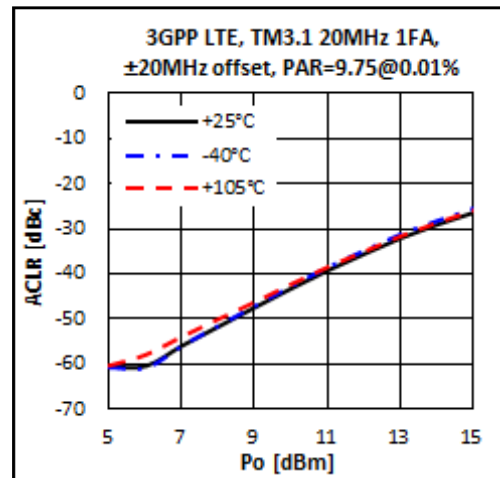
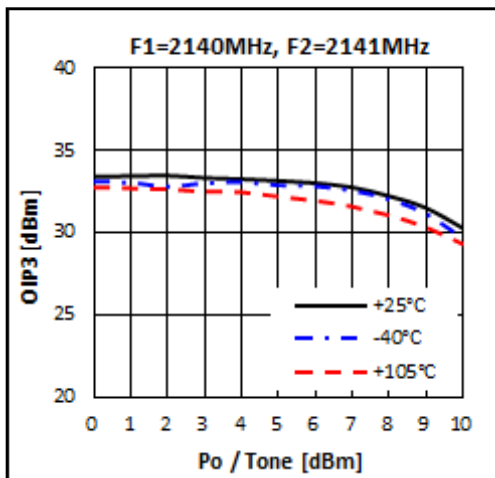
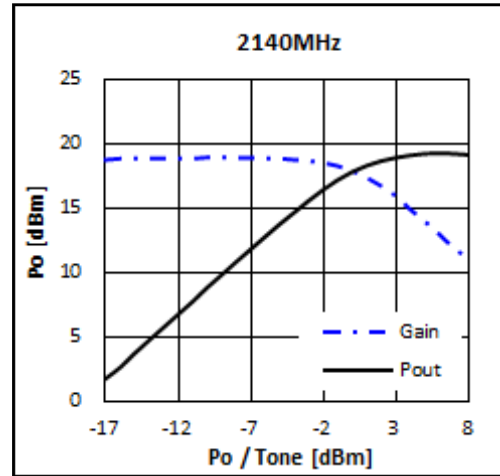
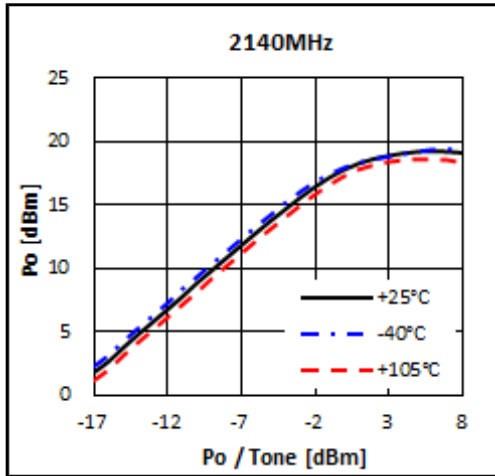
Schematic Diagram	BOM	Tolerance	
	C1	1.2nF	± 5%
	C2	10uF	± 10%
	C3	200pF	± 5%
	C4	20pF	± 5%
	L1	5.6nH	± 5%

Typical Performance

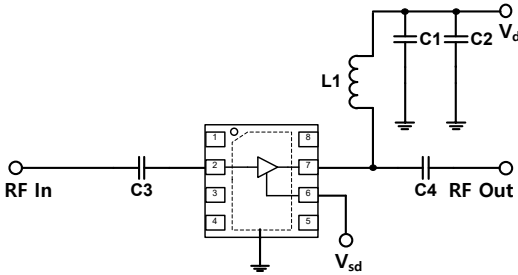
$V_{ds} = 3.3V, I_{ds} = 48mA$



$V_{ds} = 3.3V, I_{ds} = 48mA$

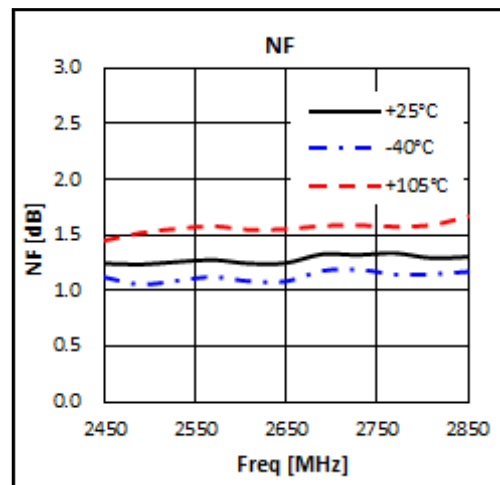
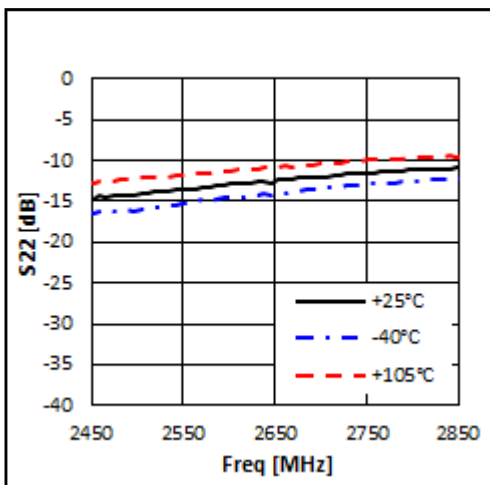
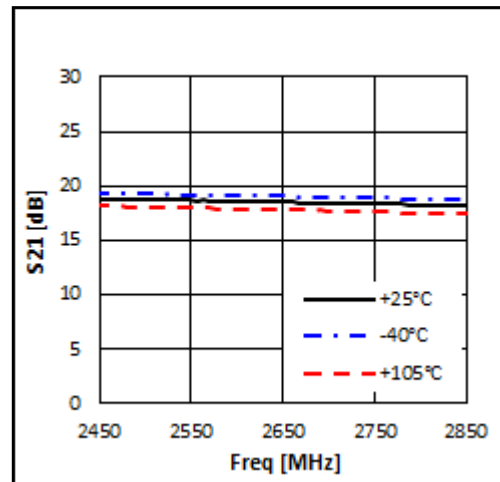
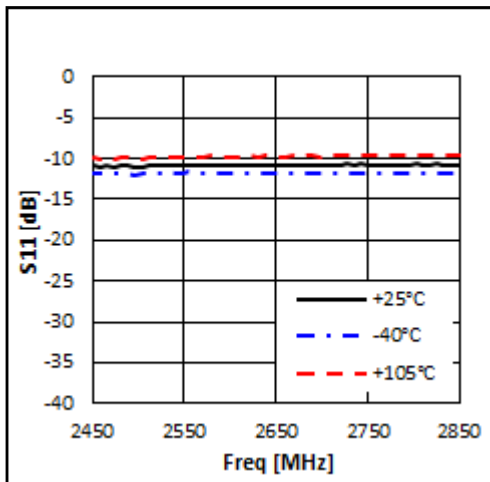


Application Circuit: 2650 MHz

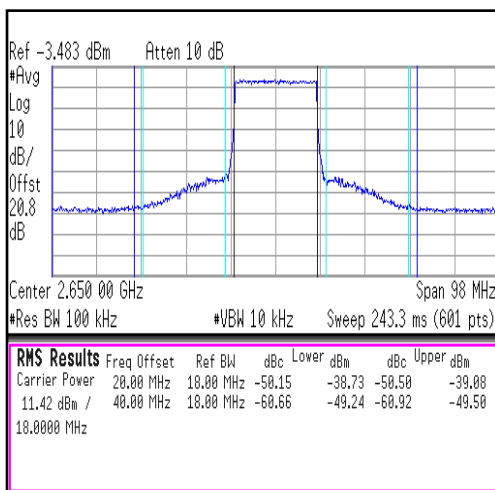
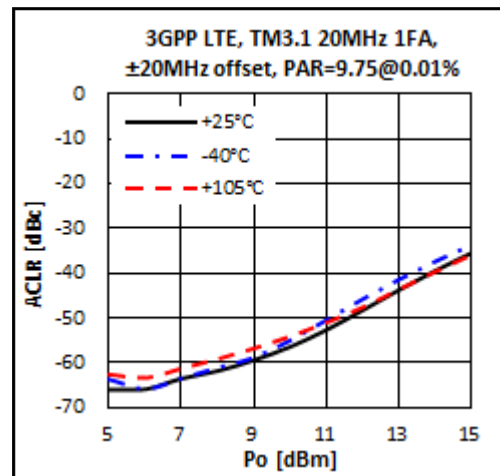
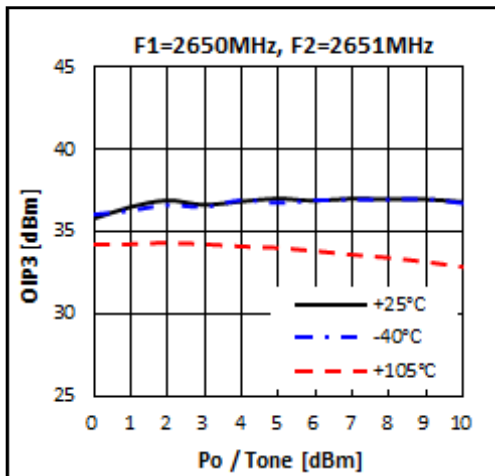
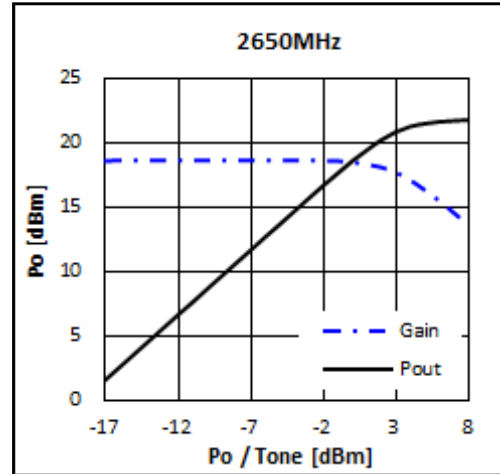
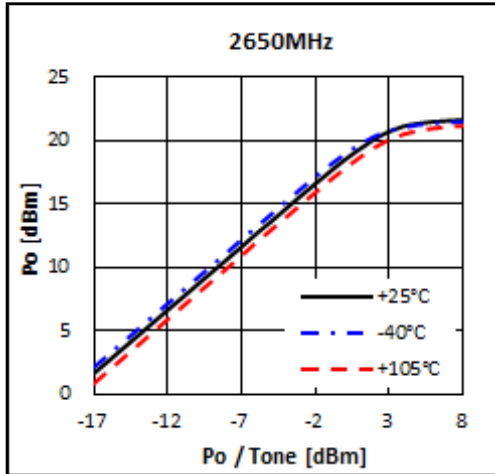
Schematic Diagram		BOM	Tolerance
		C1	1.2nF ± 5%
		C2	10uF ± 10%
		C3	200pF ± 5%
		C4	20pF ± 5%
		L1	5.6nH ± 5%

Typical Performance

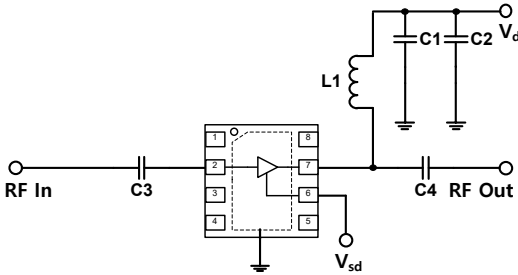
$V_{ds} = 5V, I_{ds} = 83mA$



$V_{ds} = 5V, I_{ds} = 83mA$

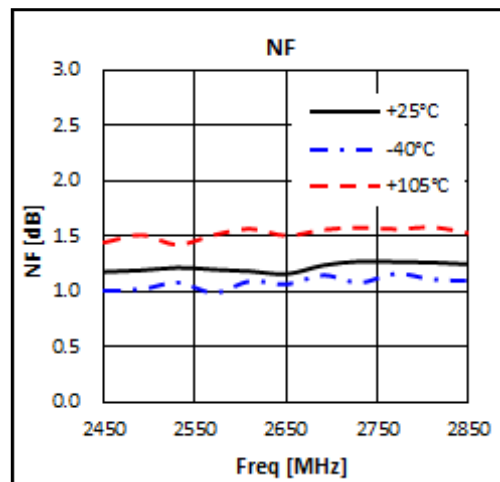
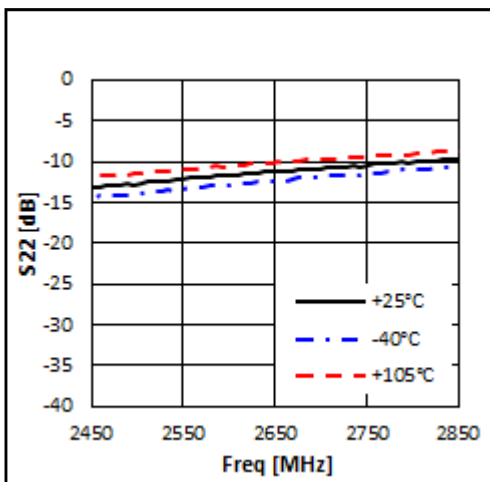
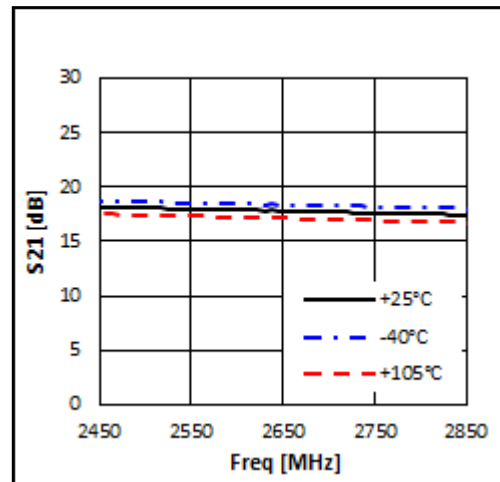
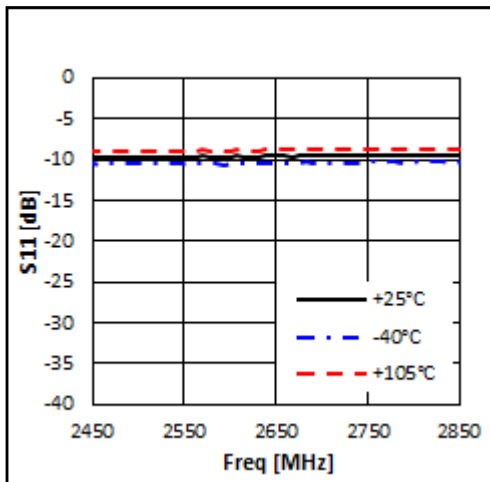


Application Circuit: 2650 MHz

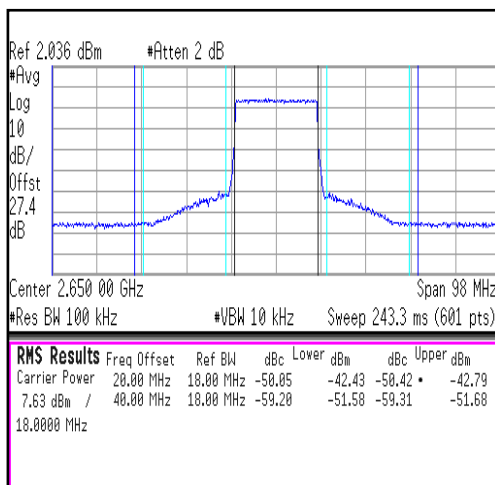
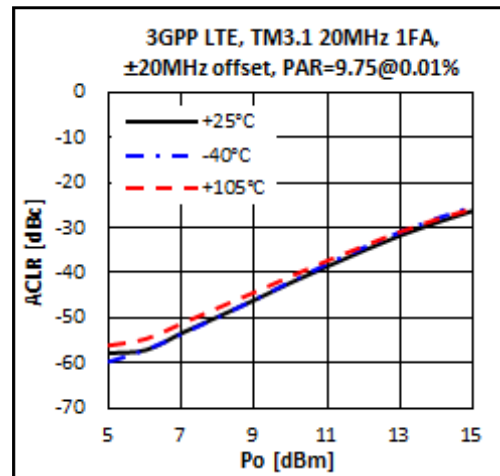
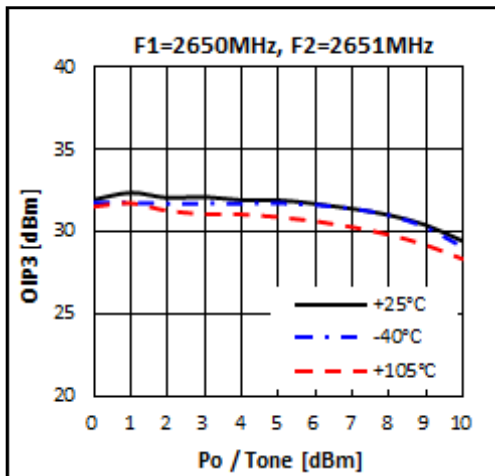
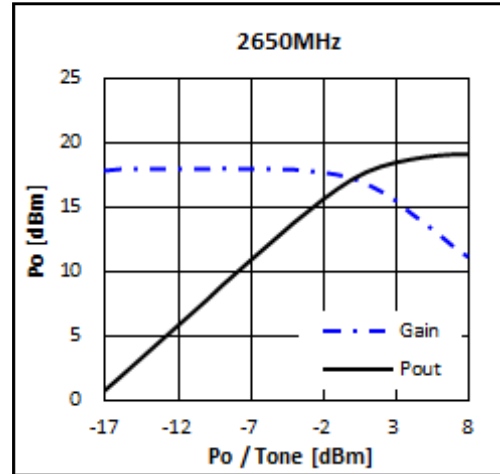
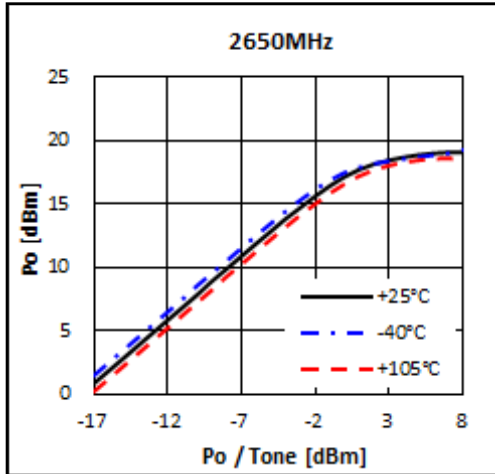
Schematic Diagram	BOM	Tolerance	
	C1	1.2nF	± 5%
	C2	10uF	± 10%
	C3	200pF	± 5%
	C4	20pF	± 5%
	L1	5.6nH	± 5%

Typical Performance

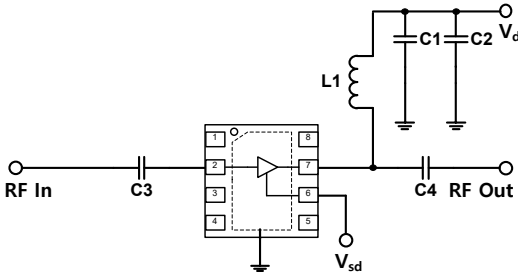
$V_{ds} = 3.3V, I_{ds} = 48mA$



$V_{ds} = 3.3V, I_{ds} = 48mA$

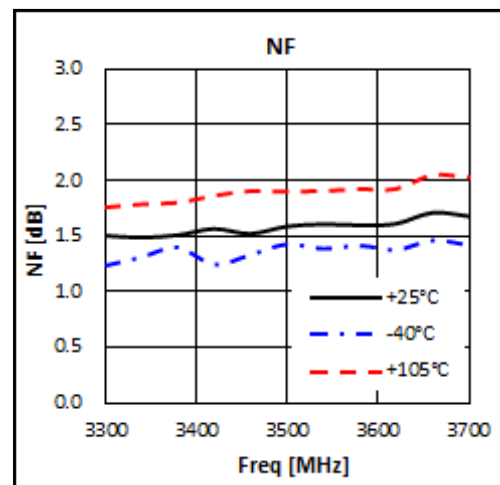
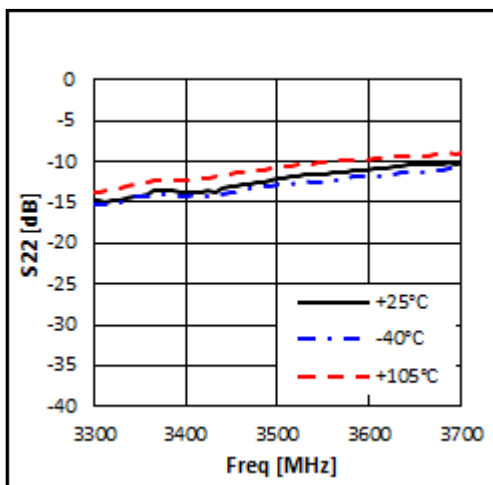
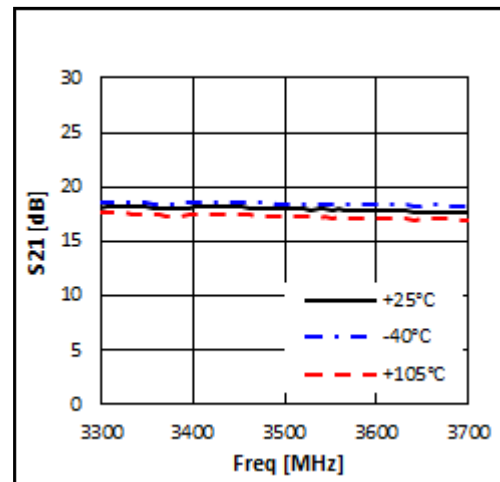
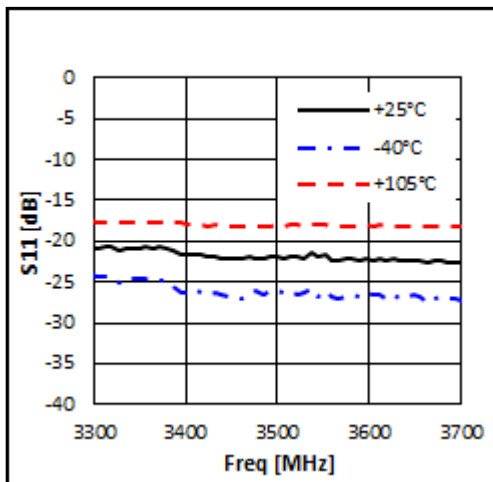


Application Circuit: 3500 MHz

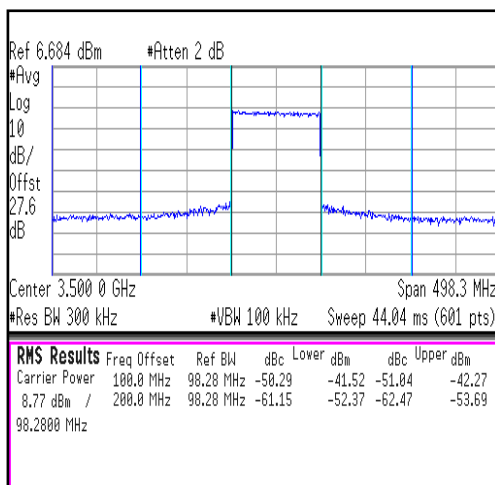
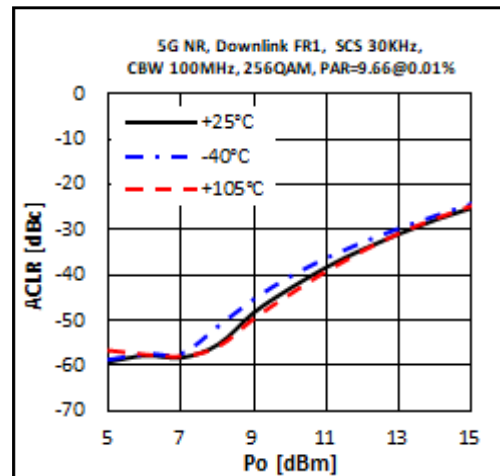
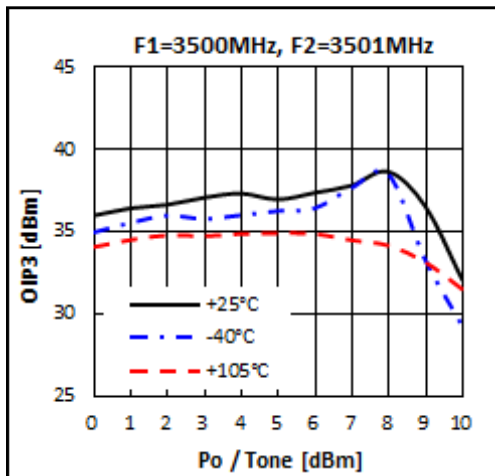
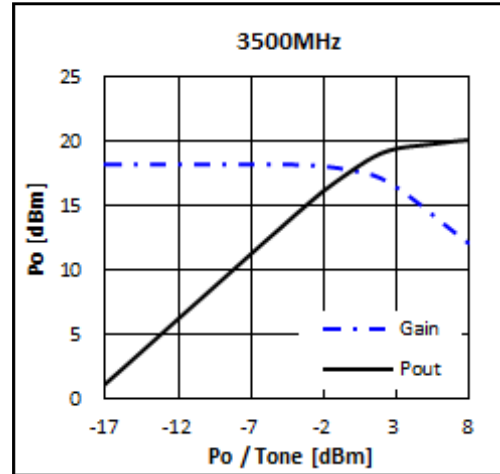
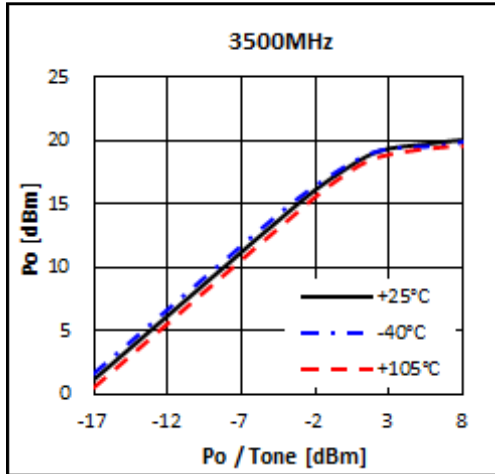
Schematic Diagram		BOM	Tolerance
		C1	1.2nF ± 5%
		C2	10uF ± 10%
		C3	1.5pF ± 0.25%
		C4	200pF ± 5%
		L1	1.8nH ± 5%

Typical Performance

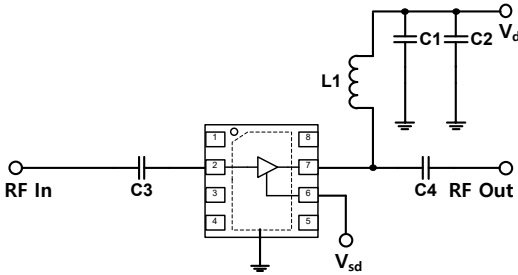
$V_{ds} = 5V, I_{ds} = 83mA$



$V_{ds} = 5V, I_{ds} = 83mA$

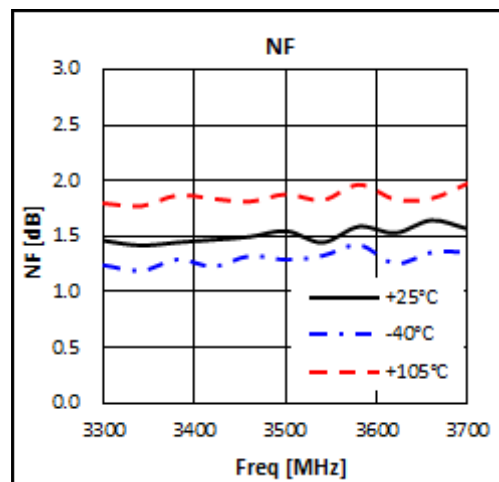
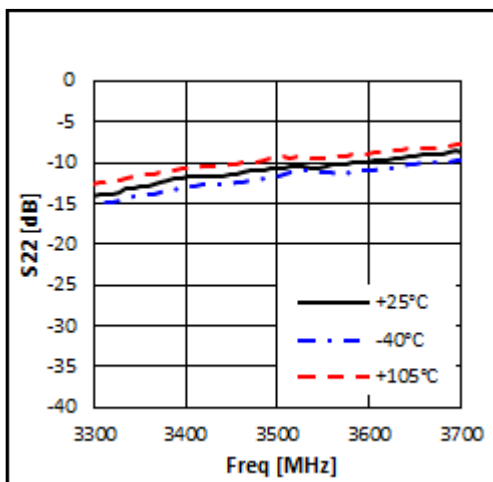
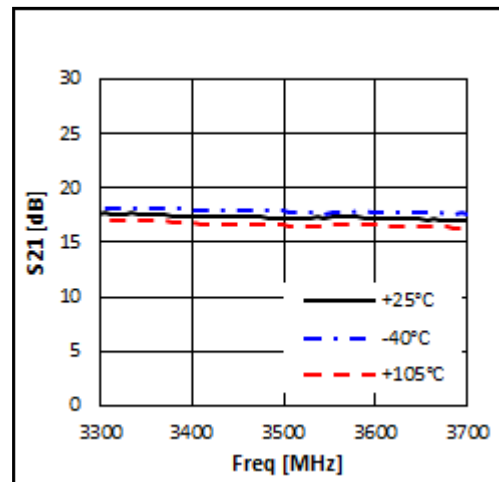
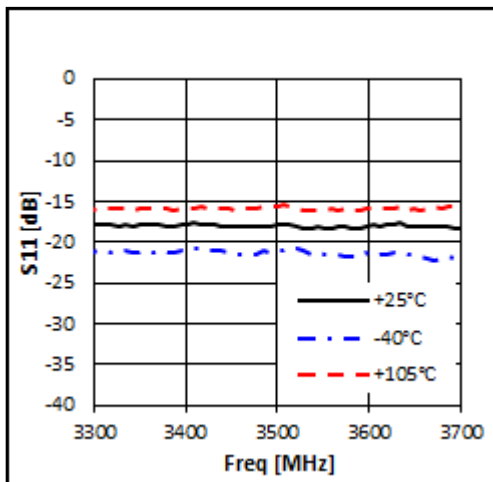


Application Circuit: 3500 MHz

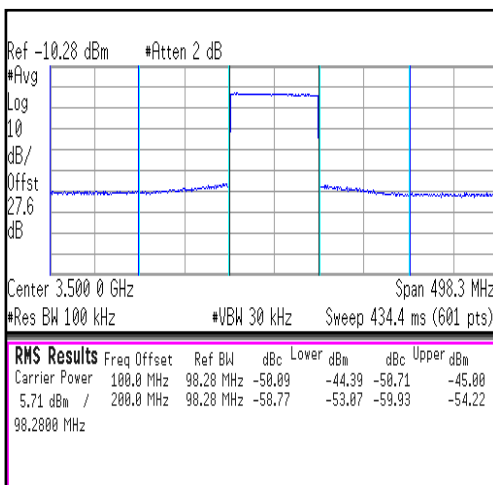
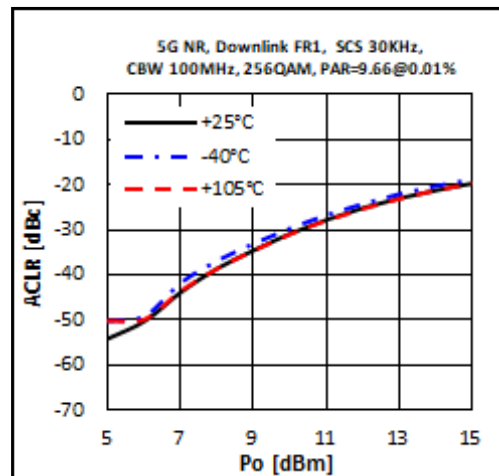
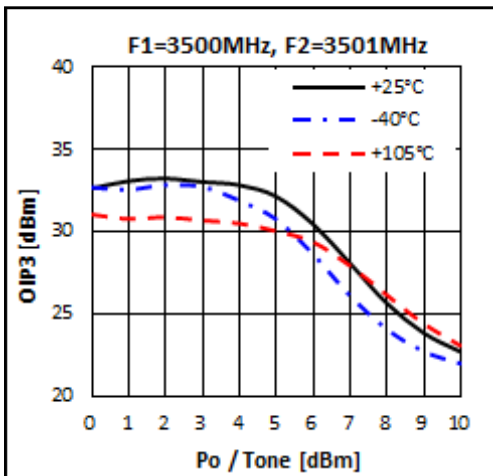
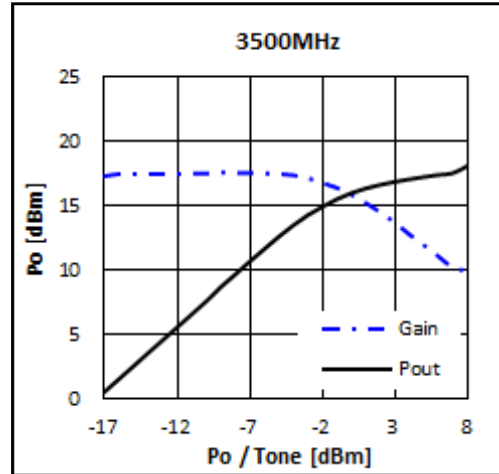
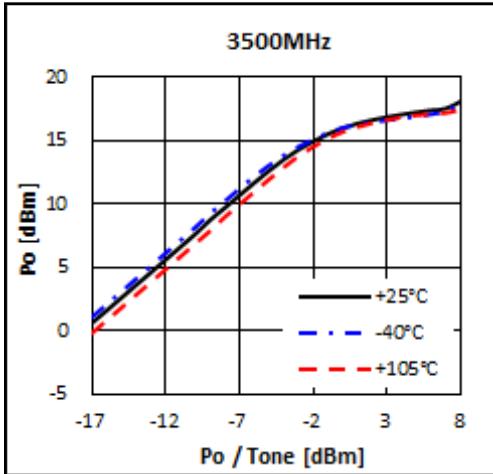
Schematic Diagram		BOM	Tolerance	
		C1	1.2nF	± 5%
		C2	10uF	± 10%
		C3	1.5pF	± 0.25%
		C4	200pF	± 5%
		L1	1.8nH	± 5%

Typical Performance

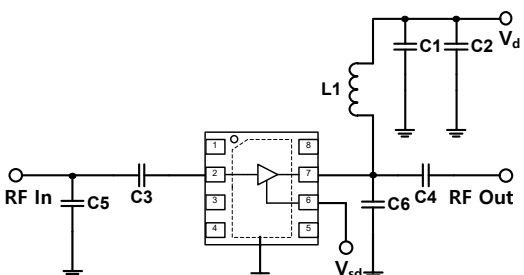
$V_{ds} = 3.3V$, $I_{ds} = 48mA$

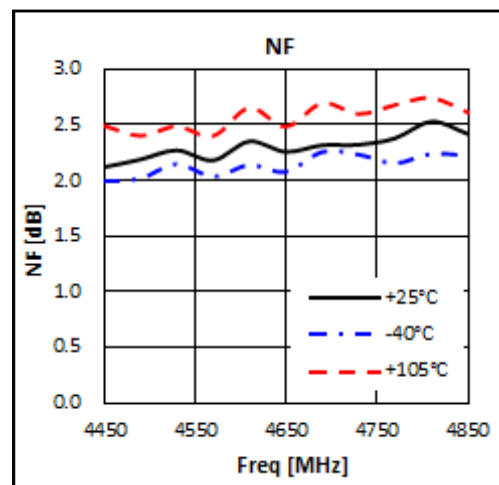
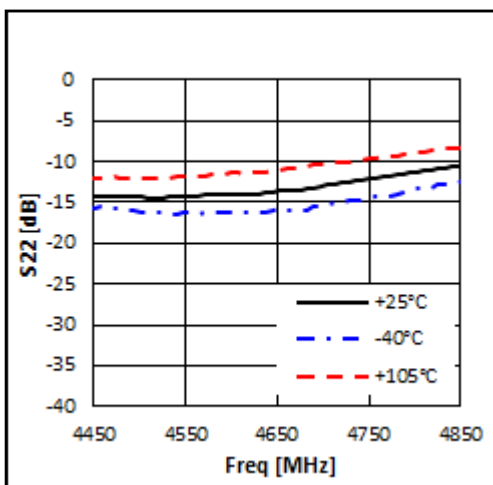
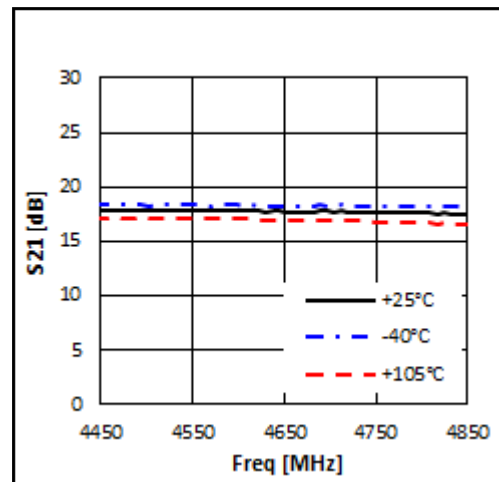
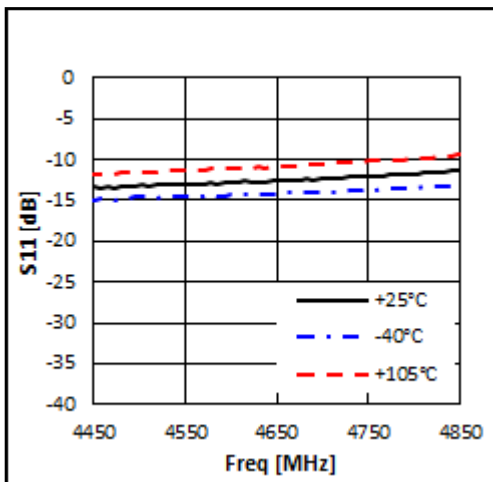


$V_{ds} = 3.3V, I_{ds} = 48mA$

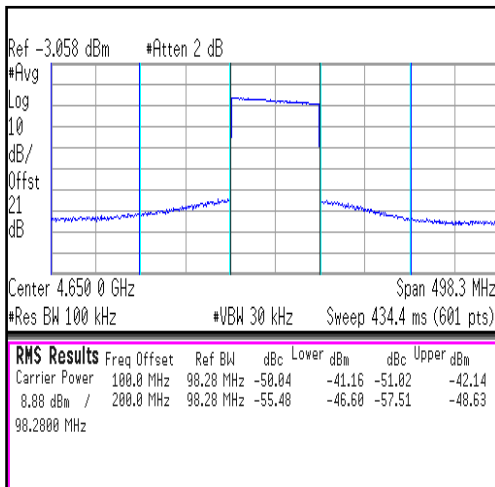
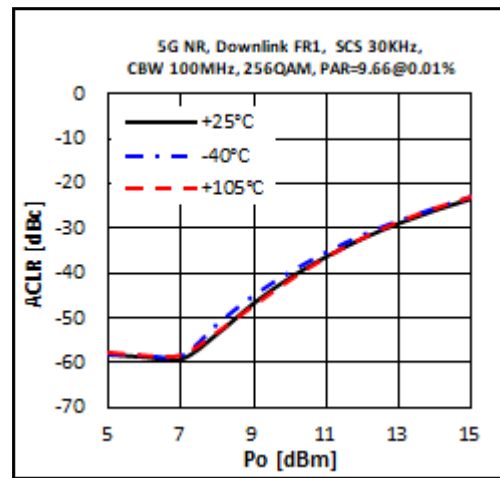
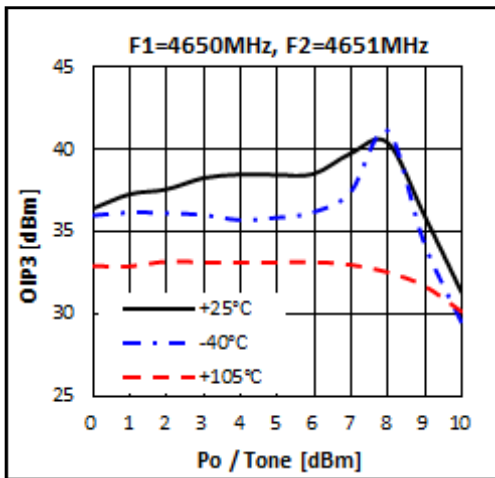
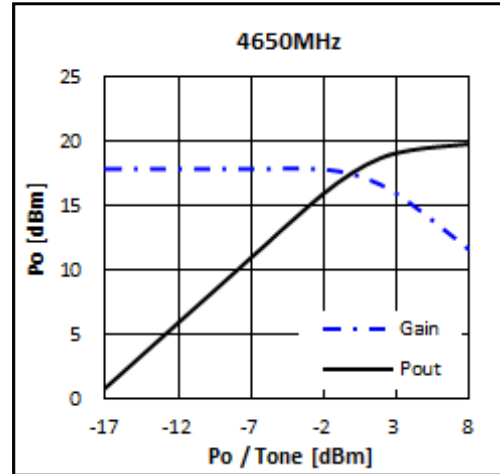
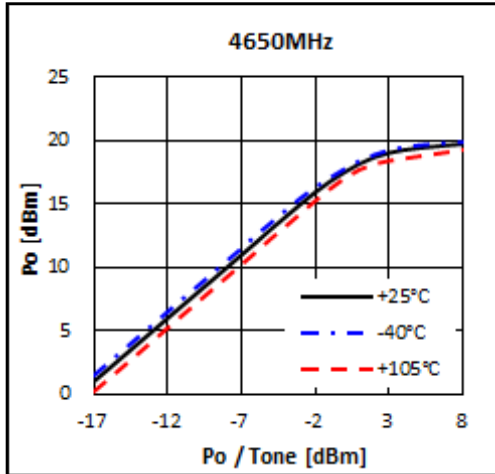


Application Circuit: 4650 MHz

Schematic Diagram	BOM		Tolerance
	C1	1.2nF	± 5%
	C2	10uF	± 10%
	C3	1pF	± 0.25%
	C4	2pF	± 0.25%
	C5	N/A	
	C6	0.3pF	± 0.25%
	L1	1.2nH	± 5%

Typical Performance
 $V_{ds} = 5V, I_{ds} = 83mA$


$V_{ds} = 5V, I_{ds} = 83mA$

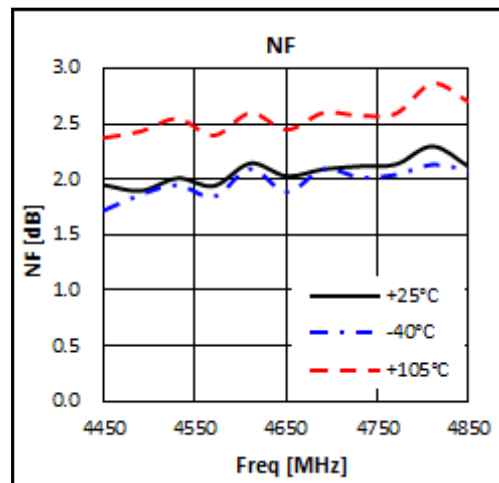
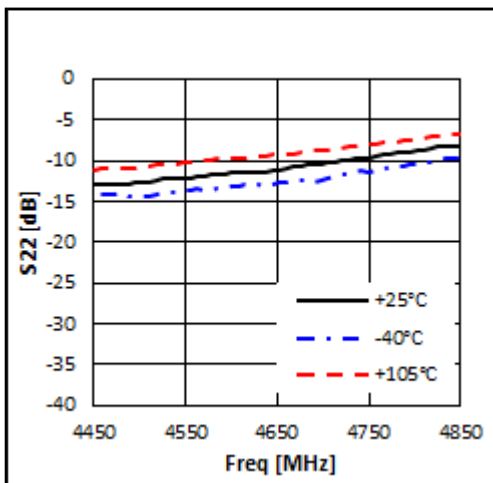
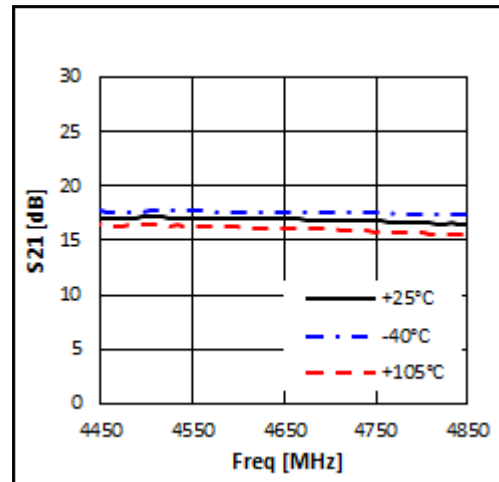
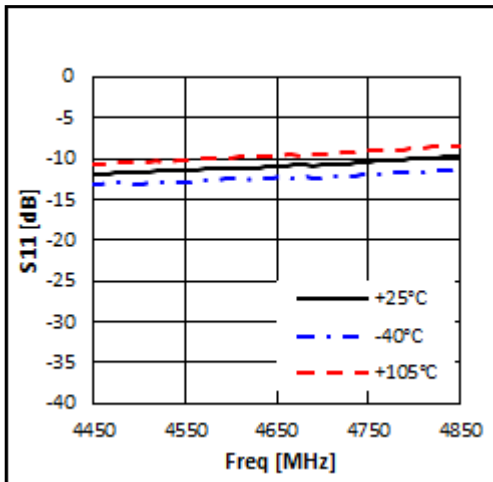


Application Circuit: 4650 MHz

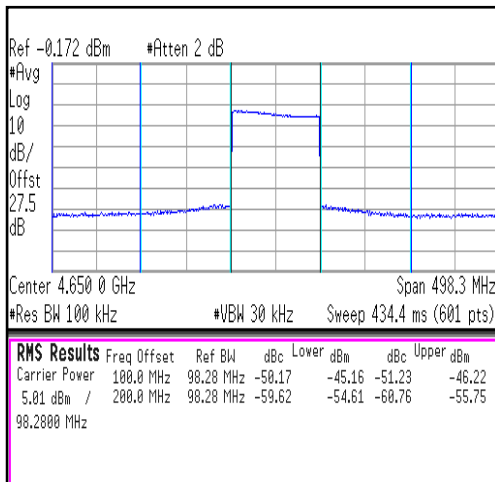
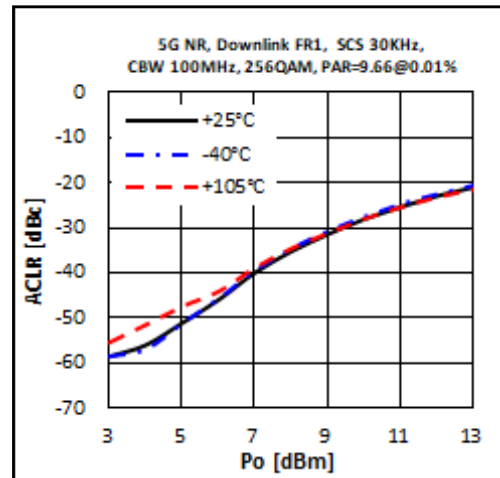
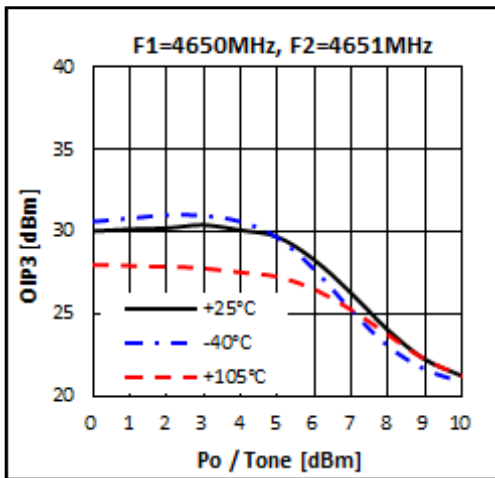
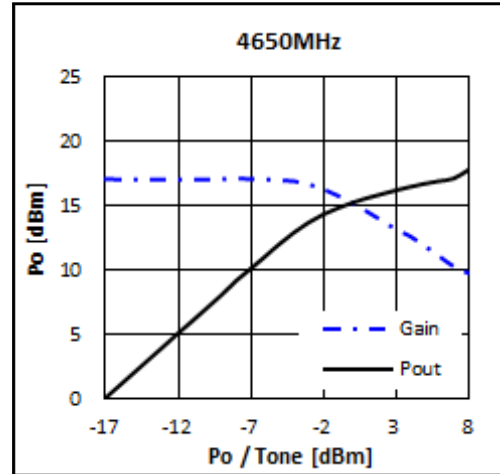
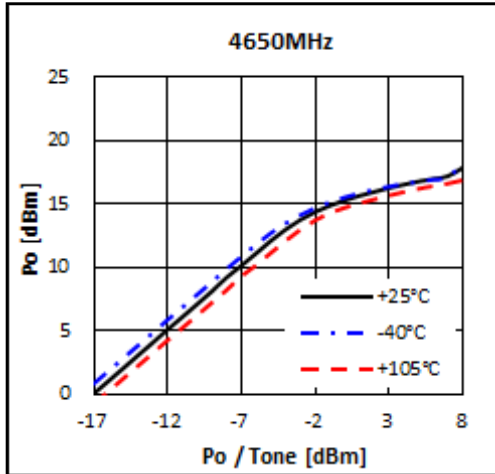
Schematic Diagram		BOM	Tolerance
		C1	1.2nF ± 5%
		C2	10uF ± 10%
		C3	1pF ± 0.25%
		C4	2pF ± 0.25%
		C5	N/A
		C6	0.3pF ± 0.25%
		L1	1.2nH ± 5%

Typical Performance

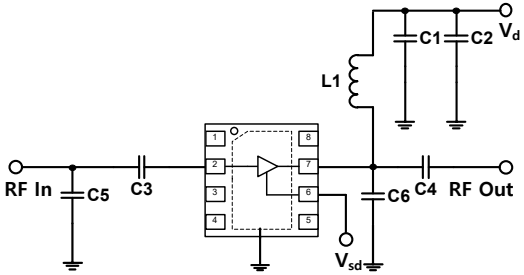
$V_{ds} = 3.3V, I_{ds} = 48mA$



$V_{ds} = 3.3V, I_{ds} = 48mA$

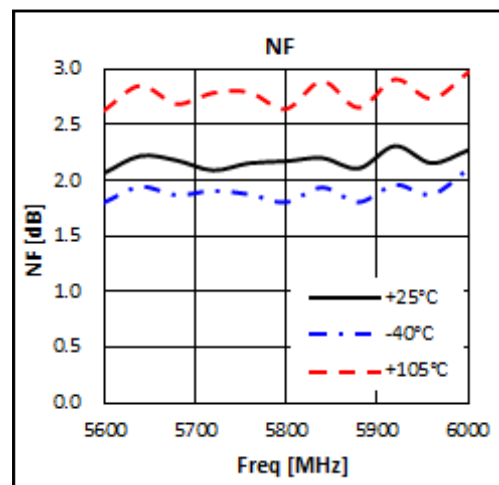
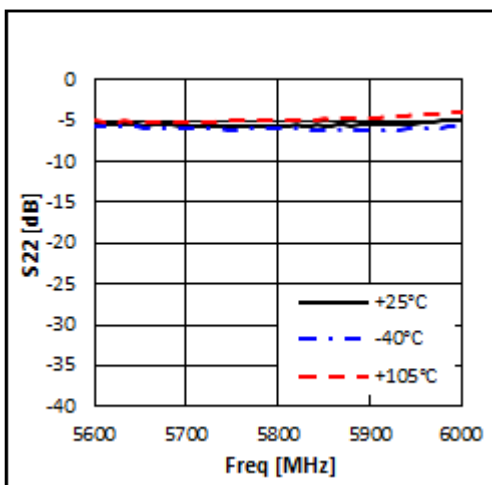
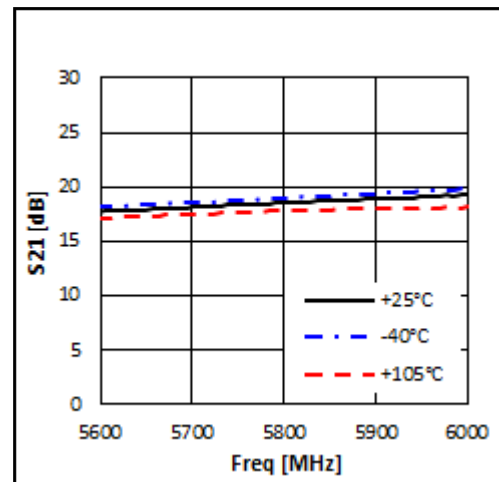
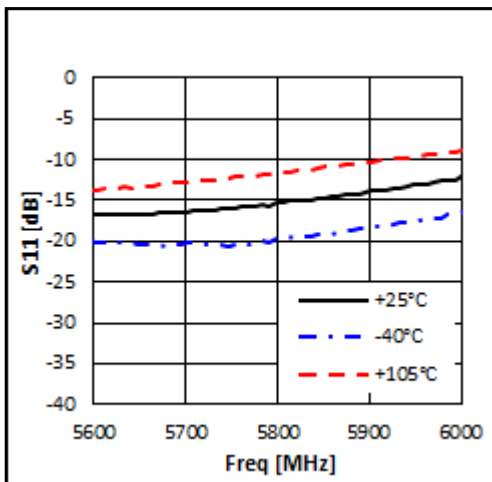


Application Circuit: 5800 MHz

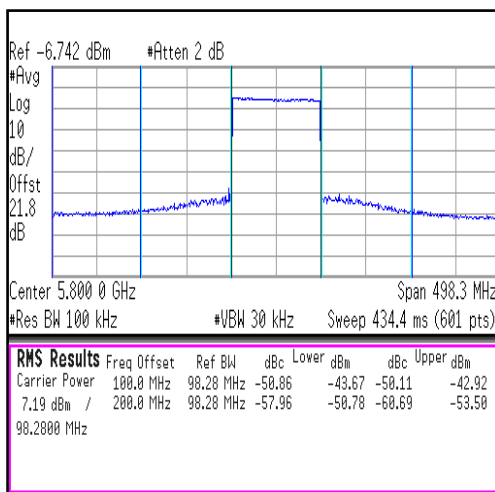
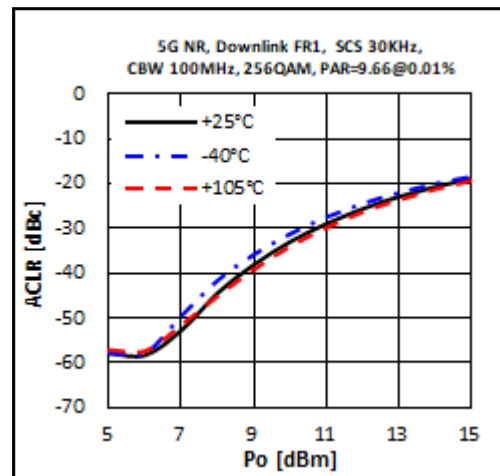
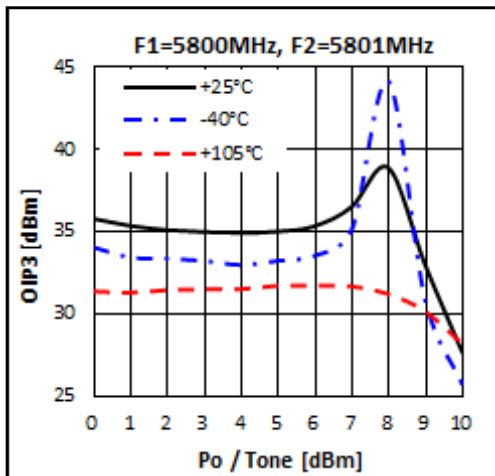
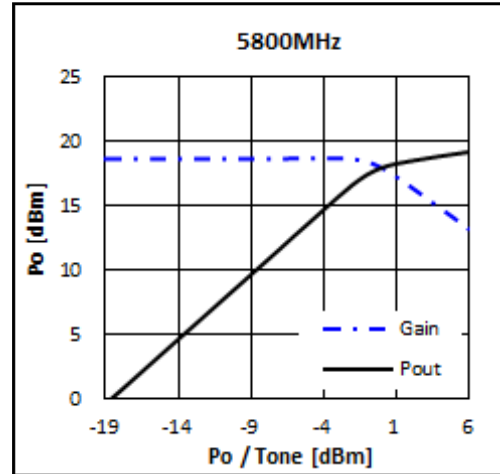
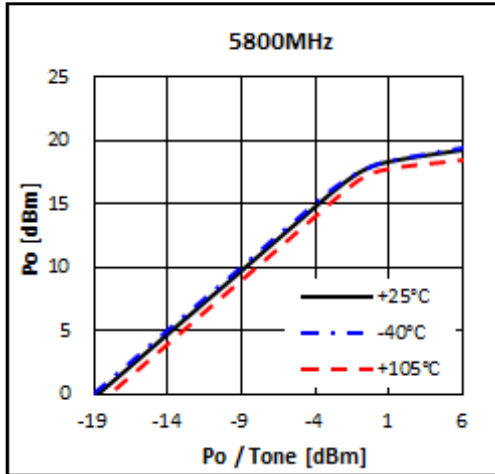
Schematic Diagram		BOM	Tolerance
		C1	1.2nF ± 5%
		C2	10uF ± 10%
		C3	1pF ± 0.25%
		C4	2pF ± 0.25%
		C5	0.3pF ± 0.25%
		C6	0.5pF ± 0.25%
		L1	18nH ± 5%

Typical Performance

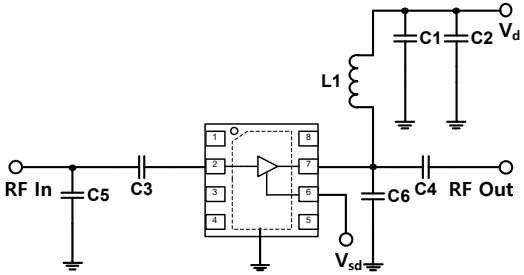
$V_{ds} = 5V, I_{ds} = 83mA$

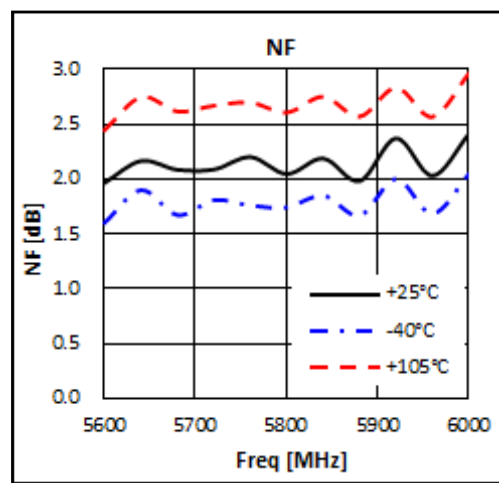
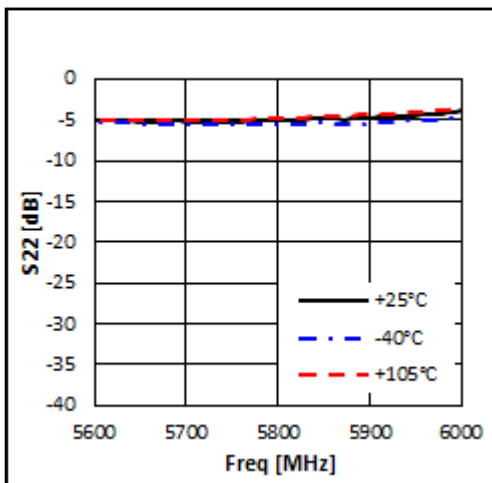
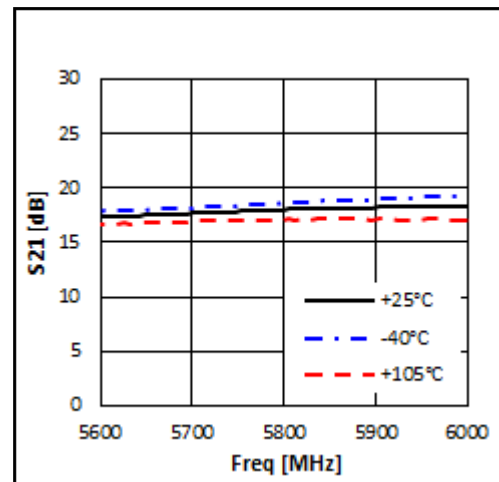
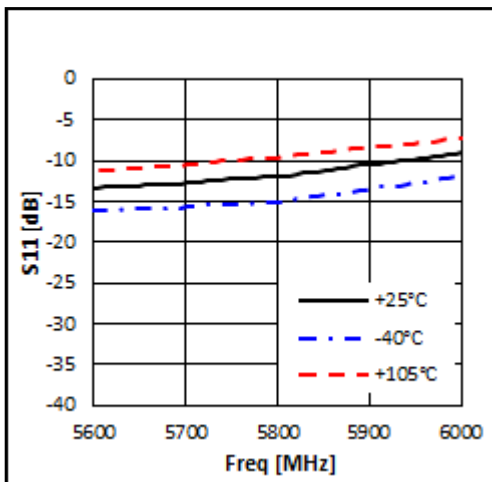


$V_{ds} = 5V, I_{ds} = 83mA$

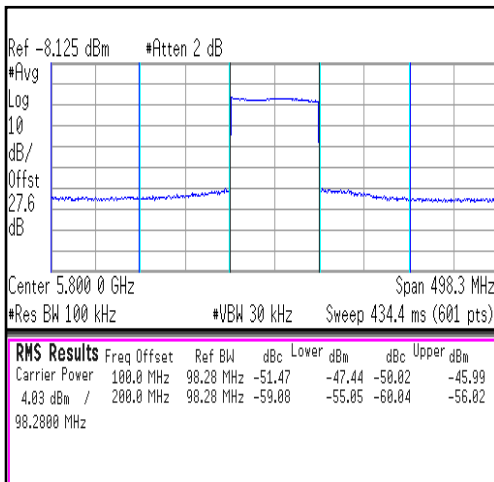
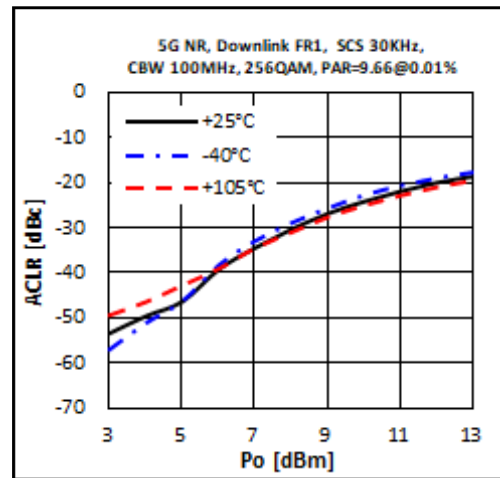
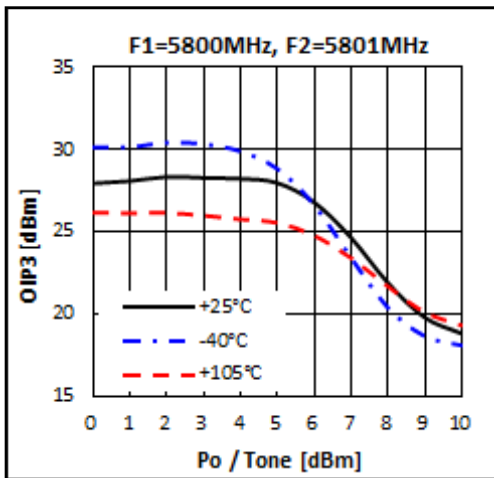
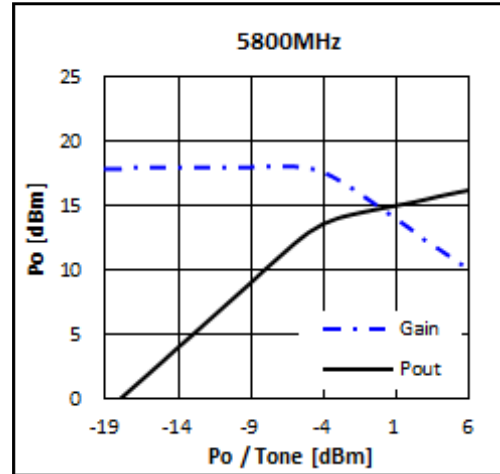
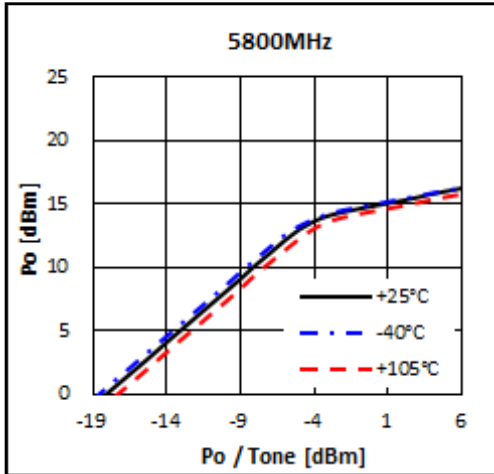


Application Circuit: 5800 MHz

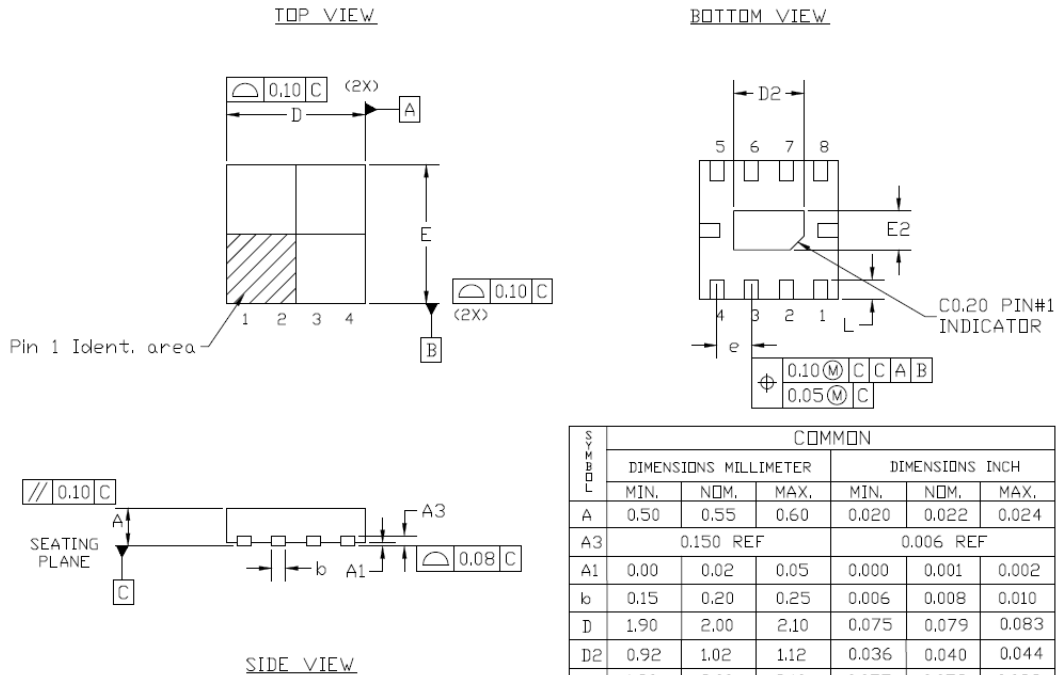
Schematic Diagram		BOM	Tolerance
		C1	1.2nF ± 5%
		C2	10uF ± 10%
		C3	1pF ± 0.25%
		C4	2pF ± 0.25%
		C5	0.3pF ± 0.25%
		C6	0.5pF ± 0.25%
		L1	18nH ± 5%

Typical Performance
 $V_{ds} = 3.3V, I_{ds} = 48mA$


$V_{ds} = 3.3V, I_{ds} = 48mA$



Package Outline Dimension



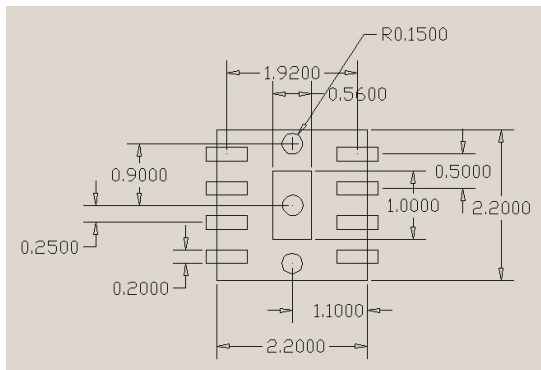
SYMBOL	COMMON					
	DIMENSIONS MILLIMETER			DIMENSIONS INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.50	0.55	0.60	0.020	0.022	0.024
A3	0.150 REF			0.006 REF		
A1	0.00	0.02	0.05	0.000	0.001	0.002
b	0.15	0.20	0.25	0.006	0.008	0.010
D	1.90	2.00	2.10	0.075	0.079	0.083
D2	0.92	1.02	1.12	0.036	0.040	0.044
E	1.90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

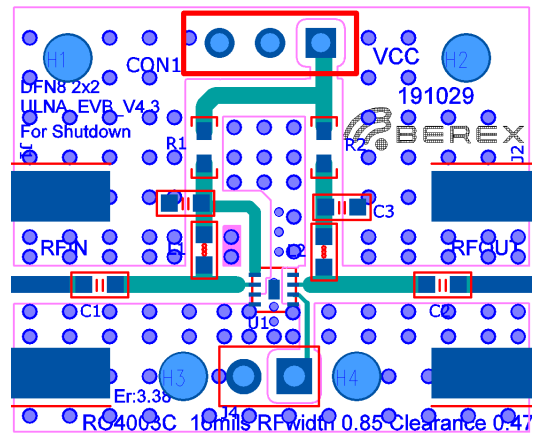
PCB Land Pattern



Note : All dimension _ millimeters

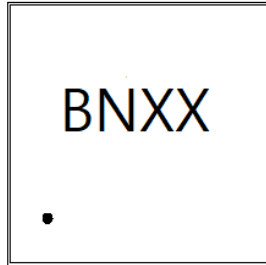
PCB lay out _ on BeRex website

PCB Mounting



*Dielectric constant _ 4.2 *RF pattern width 24mil *16mil thick FR4 PCB

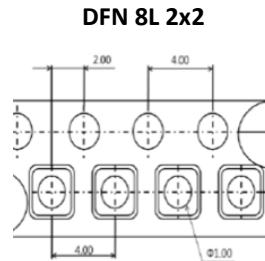
Package Marking



XX = Wafer No.

Pin 1

Tape & Reel



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-001-2014

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
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