BNT02

40-6000 MHz BroadBand AMP

Preliminary Datasheet

Device Features

- Gain = 17.5 dB @ 3500MHz
- OIP3 = 37.5 dBm @ 3500MHz
- Output P1 dB = 19.6 dBm @ 3500 MHz
- N.F = 1.5dB @ 3500MHz
- Internally matched to 50 ohms
- RoHS2-compliant SOT-89 SMT package

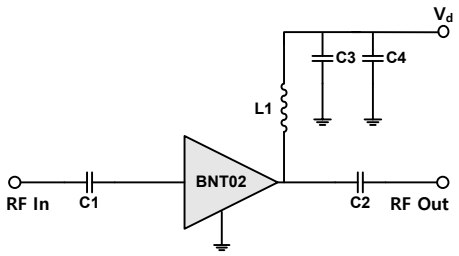
Product Description

The BNT02 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 BNT02 is internally matched to 50 Ohms. It is available in RoHS2-compliant SOT-89 SMT package. 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	70MHz	900MHz	1.8GHz	2.65GHz	3.5GHz
C1	10nF	200pF	4.7pF	3.5pF	47pF
C2	10nF	200pF	200pF	3.5pF	1pF
C3	100pF	100pF	100pF	100pF	100pF
C4	1uF	1uF	1uF	1uF	1uF
L1	820nH	33nH	3.3nH	5.6nH	22nH

Typical Performance[1]

Parameter	Frequency					Unit
Vd=5V	**70**	**900**	**2140**	**3500**	**4650**	**MHz**
Gain	21.7	20.8	19.3	17.5	17.3	dB
S11	13.5	16.0	24.5	13.2	17.3	dB
S22	21.4	21.1	20.3	12.5	18.0	dB
OIP3[2]	38.6	38.0	37.7	37.5	37.1	dBm
P1dB	22.0	22.3	21.8	19.6	18.9	dBm
LTE 20M ACLR	13.1	13.1	12.3	9.8	9.2	dBm
5G NR ACLR	-	-	-	9.6	8.8	dBm
Noise Figure	0.9	1.0	1.1	1.5	1.9	dB

Parameter	Frequency					Unit
Vd=3.3V	**70**	**900**	**2140**	**3500**	**4650**	**MHz**
Gain	21.2	20.3	18.8	16.7	16.6	dB
S11	12.2	14.3	20.9	11.6	14.9	dB
S22	18.0	19.0	18.1	10.8	14.8	dB
OIP3[2]	33.1	32.3	33.0	31.1	29.2	dBm
P1dB	18.5	18.3	18.2	16.0	15.4	dBm
LTE 20M ACLR	8.6	8.5	8.2	6.1	5.1	dBm
5G NR ACLR	-	-	-	5.8	4.8	dBm
Noise Figure	0.8	0.9	1.1	1.5	1.8	dB

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

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

*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.

	Min.	Typical	Max.	Unit
Bandwidth	40		6000	MHz
I_d @ (Vd = 5V)	76	85	93	mA
I_d @ (Vd = 3.3V)	43	48	53	mA
dG/dT		0.006		dB/°C
R_{TH}		49.4		°C/W
Operating Case Temperature	-40		+105	°C

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Typical RF Performance[1] : 5V

Parameter	Frequency								Unit
	70	900	1800	2140	2650	3500	4650	5800	MHz
Gain	21.7	20.8	19.8	19.3	18.8	17.5	17.3	14.7	dB
S11	13.5	16.0	23.1	24.5	15.0	13.2	17.3	7.1	dB
S22	21.4	21.1	22.6	20.3	26.3	12.5	18.0	5.1	dB
OIP3[2]	38.6	38.0	37.6	37.7	38.1	37.5	37.1	32.1	dBm
P1dB	22.0	22.3	21.7	21.8	21.8	19.6	18.9	17.2	dBm
LTE 20M ACLR*	13.1	13.1	12.1	12.3	12.2	9.8	9.2	7.6	dBm
5G NR ACLR*	-	-	-	-	-	9.6	8.8	-	dBm
Noise Figure	0.9	1.0	1.1	1.1	1.2	1.5	1.9	2.2	dB

Typical RF Performance[1] : 3.3V

Parameter	Frequency								Unit
	70	900	1800	2140	2650	3500	4650	5800	MHz
Gain	21.2	20.3	19.3	18.8	18.2	16.7	16.6	13.6	dB
S11	12.2	14.3	18.8	20.9	13.7	11.6	14.9	6.3	dB
S22	18.0	19.0	32.0	18.1	20.1	10.8	14.8	4.6	dB
OIP3[2]	33.1	32.3	33.9	33.0	33.1	31.1	29.2	23.8	dBm
P1dB	18.5	18.3	17.8	18.2	18.0	16.0	15.4	13.3	dBm
LTE 20M ACLR*	8.6	8.5	8.2	8.2	8.1	6.1	5.1	1.9	dBm
5G NR ACLR*	-	-	-	-	-	5.8	4.8	-	dBm
Noise Figure	0.8	0.9	1.1	1.1	1.2	1.5	1.8	2.0	dB

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

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

*ACLR Channel Power measured at -50dBc.

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

Absolute Maximum Ratings

Parameter	Rating	Unit
Storage Temperature	-55 to +155	°C
Junction Temperature	+170	°C
Operating 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.

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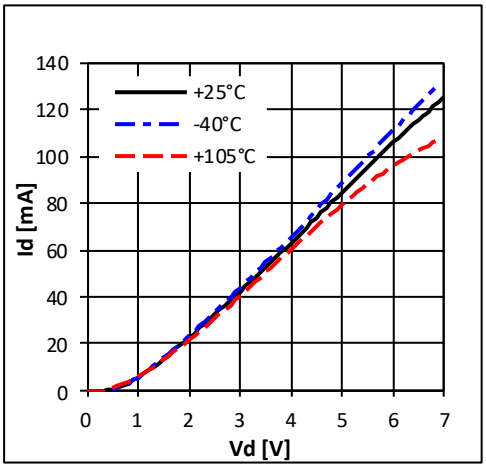
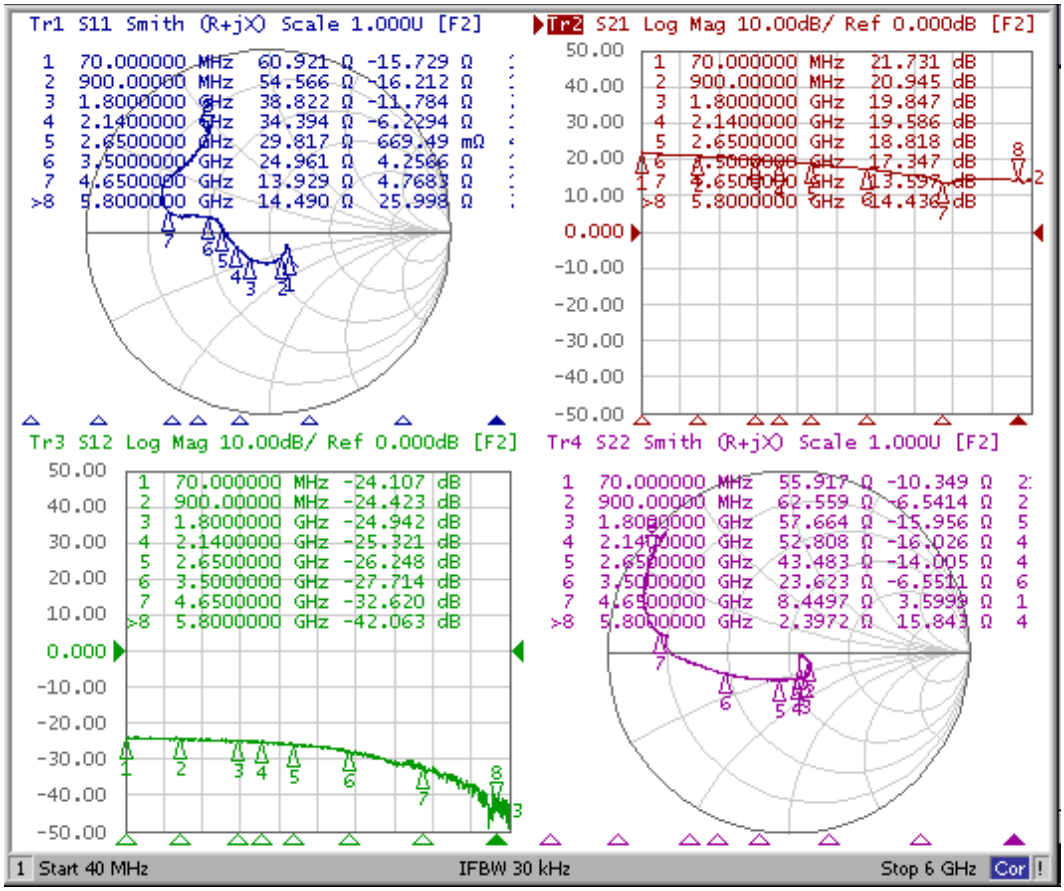
V-I Characteristics



Typical Device Data

S-parameters (Vd=5V, Id=85mA, T=25°C)



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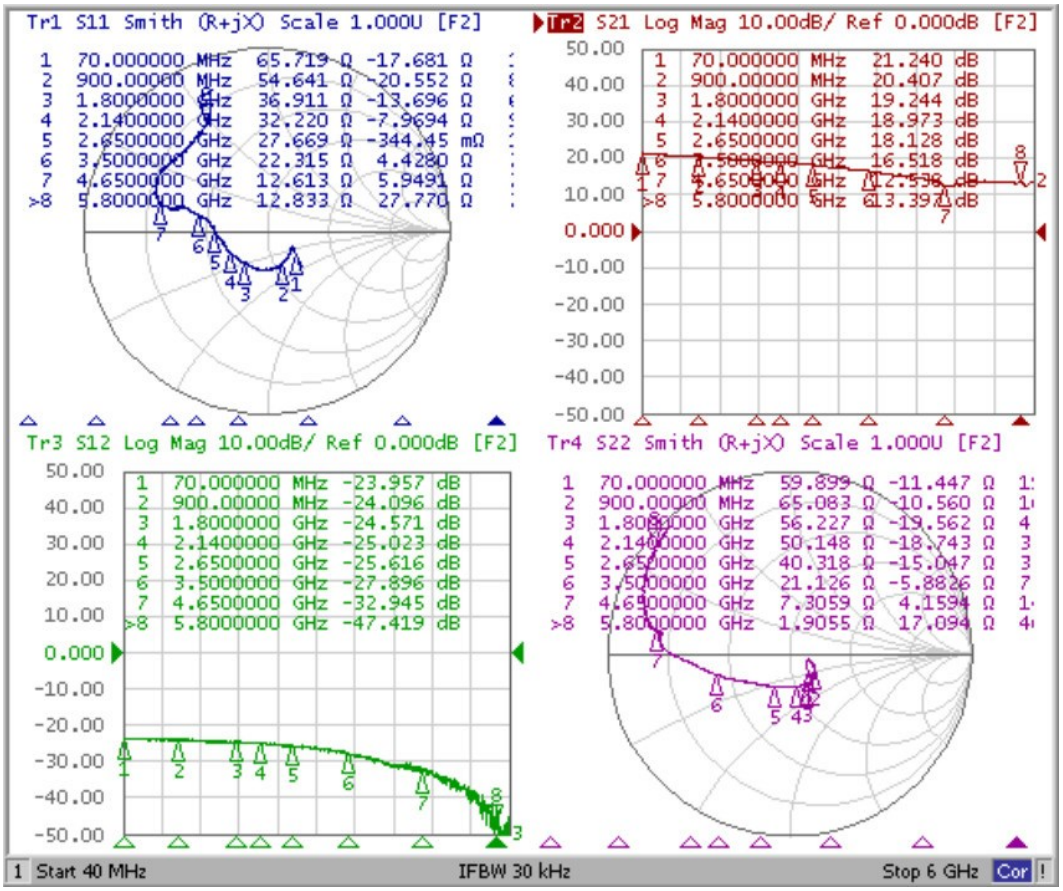
Typical Device Data

S-parameters (Vd=3.3V, Id=48mA, T=25°C)



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S-Parameter

(Vdevice = 5.0V, I_d = 85mA, 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]
200	0.126	-35.333	11.904	168.129	0.062	-1.391	0.07	-30.167
400	0.128	-39.713	11.778	159.731	0.061	-6.013	0.075	-16.391
600	0.14	-50.206	11.54	150.657	0.062	-10.917	0.095	-18.283
800	0.153	-59.484	11.304	141.862	0.06	-14.864	0.113	-21.591
1000	0.164	-70.094	11.009	133.166	0.06	-18.7	0.134	-26.211
1200	0.17	-81.692	10.749	124.242	0.058	-21.365	0.15	-35.025
1400	0.175	-94.873	10.374	115.845	0.058	-25.474	0.16	-41.264
1600	0.174	-109.593	10.099	107.941	0.057	-30.548	0.166	-47.39
1800	0.18	-126.748	9.84	100.087	0.057	-30.826	0.163	-54.669
2000	0.186	-143.027	9.62	92.135	0.056	-34.761	0.159	-63.606
2200	0.205	-157.62	9.446	84.134	0.054	-39.419	0.153	-72.968
2400	0.22	-170.332	9.184	75.248	0.052	-44.064	0.149	-87.182
2600	0.246	179.098	8.77	66.856	0.051	-48.612	0.158	-102.115
2800	0.27	174.103	8.408	58.778	0.047	-55.355	0.178	-118.58
3000	0.288	167.703	8.041	51.433	0.046	-55.98	0.212	-135.233
3200	0.307	166.804	7.758	43.169	0.045	-64.014	0.265	-147.213
3400	0.326	166.376	7.534	35.327	0.042	-64.843	0.33	-157.135
3600	0.352	166.571	7.128	27.29	0.039	-69.352	0.406	-164.136
3800	0.379	167.771	6.722	19.357	0.036	-79.975	0.481	-170.289
4000	0.408	167.466	6.387	11.059	0.032	-79.326	0.562	-175.049
4200	0.427	167.225	6.094	3.824	0.028	-83.891	0.667	178.563
4400	0.458	169.183	5.704	-2.99	0.03	-84.599	0.677	172.536
4600	0.537	169.729	4.908	-10.696	0.024	-89.265	0.701	171.875
4800	0.633	157.708	4.849	-4.725	0.022	-96.009	0.746	170.452
5000	0.605	146.919	5.333	-12.843	0.019	-102.194	0.778	167.783
5200	0.591	140.703	5.221	-20.561	0.015	-114.04	0.815	164.369
5400	0.594	134.356	5.346	-28.647	0.013	-127.23	0.849	159.694
5600	0.604	127.563	5.234	-37.082	0.01	-152.493	0.879	153.765
5800	0.635	121.988	5.291	-45.221	0.007	-173.81	0.918	144.933
6000	0.779	115.236	5.353	-48.558	0.007	134.017	0.943	134.816

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S-Parameter

(Vdevice = 3.3V, I_d = 48mA, 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]
200	0.163	-30.786	11.297	167.965	0.064	-0.788	0.101	-24.538
400	0.164	-36.74	11.12	159.148	0.063	-6.554	0.107	-17.148
600	0.176	-48.371	10.91	149.785	0.064	-9.379	0.127	-22.379
800	0.192	-59.052	10.657	140.852	0.062	-13.901	0.147	-27.865
1000	0.203	-70.402	10.357	132.069	0.061	-17.901	0.168	-32.033
1200	0.207	-82.124	10.084	122.768	0.061	-20.831	0.182	-39.737
1400	0.213	-95.913	9.728	114.289	0.06	-24.165	0.192	-46.066
1600	0.213	-109.434	9.45	106.242	0.059	-26.886	0.192	-54.341
1800	0.215	-125.048	9.177	98.178	0.059	-32.572	0.189	-62.017
2000	0.227	-141.511	8.992	89.973	0.057	-36.861	0.186	-70.458
2200	0.243	-154.414	8.822	81.688	0.057	-42.031	0.182	-81.552
2400	0.254	-166.999	8.526	72.577	0.053	-44.555	0.18	-95.153
2600	0.285	-177.157	8.116	63.742	0.05	-46.847	0.194	-110.892
2800	0.301	175.938	7.745	55.633	0.05	-53.928	0.213	-124.602
3000	0.325	170.216	7.371	48.523	0.048	-57.997	0.252	-139.836
3200	0.354	168.336	7.068	40.015	0.045	-63.731	0.308	-151.064
3400	0.376	167.97	6.851	31.939	0.042	-70.098	0.379	-160.058
3600	0.398	166.442	6.462	23.896	0.04	-72.002	0.448	-166.602
3800	0.425	166.086	6.075	15.985	0.034	-79.414	0.516	-172.521
4000	0.449	164.739	5.75	7.604	0.032	-81.658	0.598	-177.369
4200	0.468	164.066	5.464	0.485	0.027	-81.649	0.697	176.794
4400	0.494	165.183	5.074	-6.266	0.027	-83.593	0.711	170.874
4600	0.57	166.59	4.341	-13.29	0.024	-89.114	0.733	170.085
4800	0.667	155.639	4.334	-7.165	0.022	-87.944	0.775	168.634
5000	0.651	144.326	4.823	-15.86	0.018	-91.387	0.803	165.84
5200	0.635	137.622	4.687	-23.836	0.013	-111.684	0.838	162.243
5400	0.638	131.267	4.795	-32.266	0.012	-114.341	0.87	157.074
5600	0.651	124.104	4.655	-40.639	0.006	-149.436	0.899	151.06
5800	0.672	119.384	4.703	-48.791	0.003	-175.68	0.935	142.366
6000	0.828	111.716	4.78	-51.953	0.002	136.153	0.956	132.358

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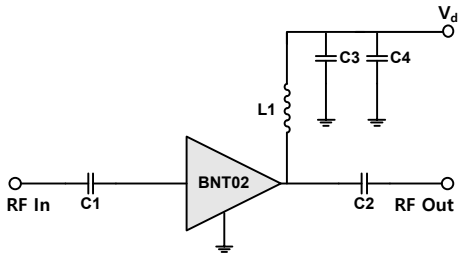
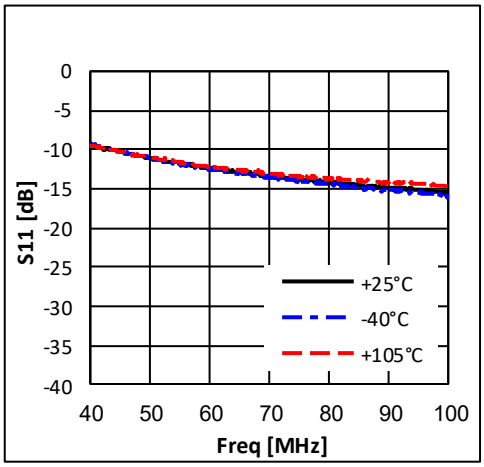
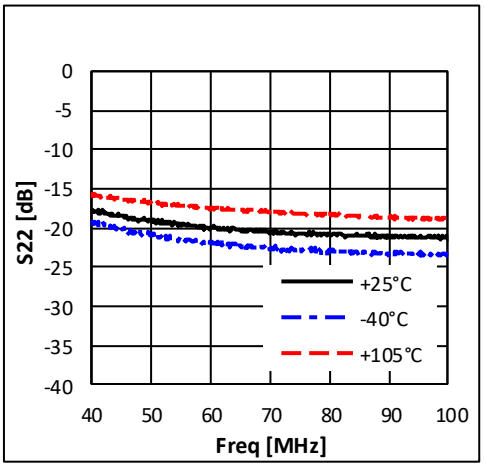
Application Circuit: 70 MHz

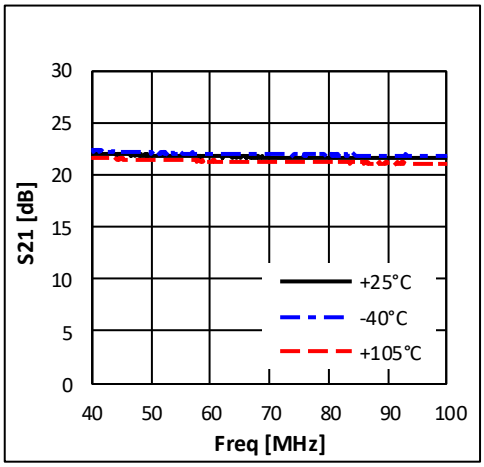
Schematic Diagram	BOM		Tolerance
	C1	10nF	± 5%
	C2	10nF	± 5%
	C3	100pF	± 5%
	C4	1uF	± 5%
	L1	820nH	± 5%

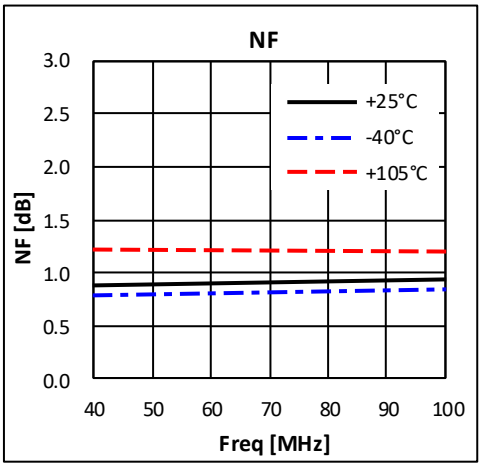
Typical Performance

V_d = 5V, I_d = 85mA









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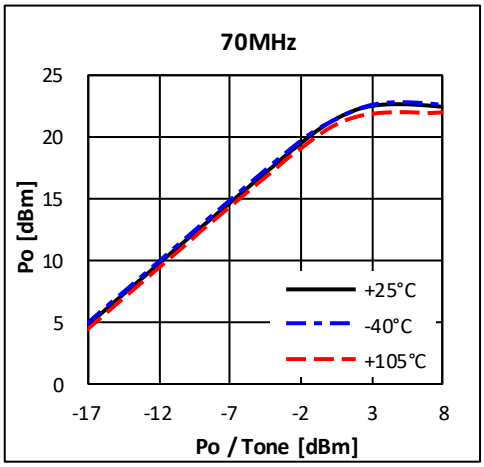
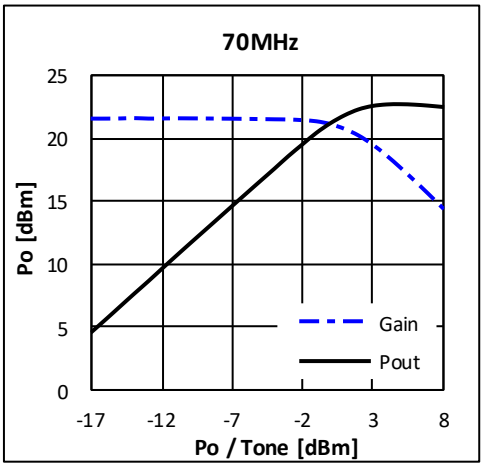
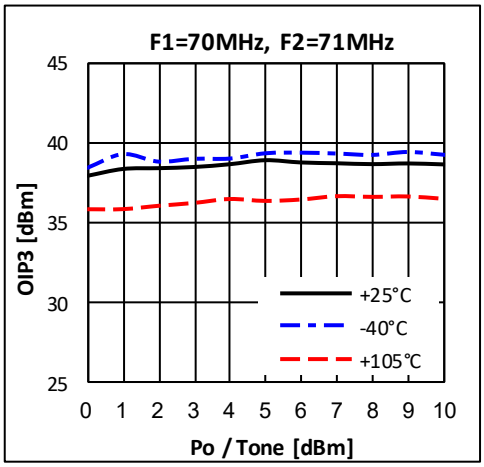
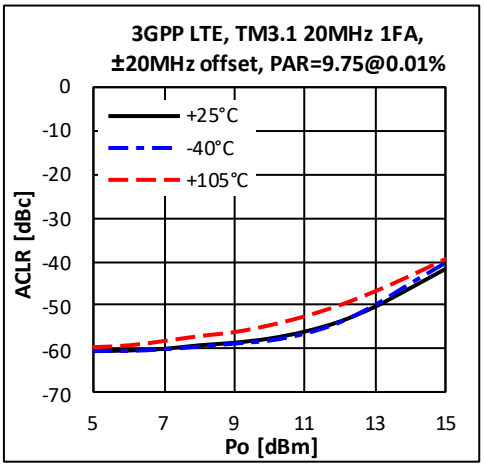
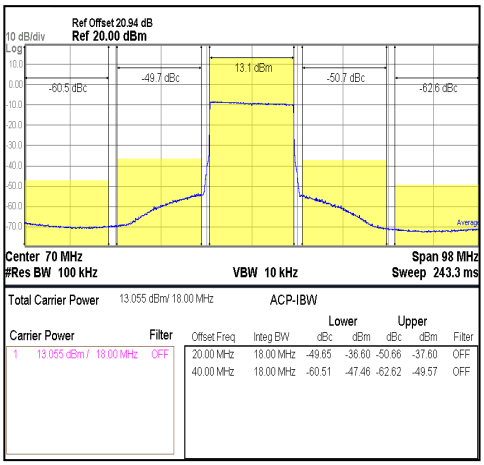
V_d = 5V, I_d = 85mA











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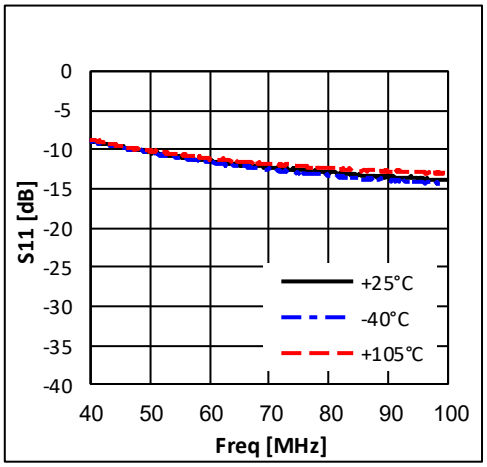
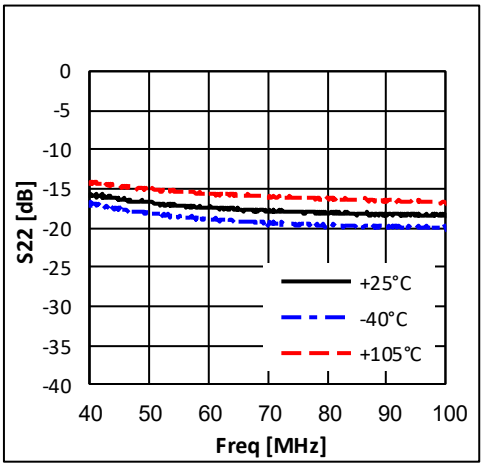
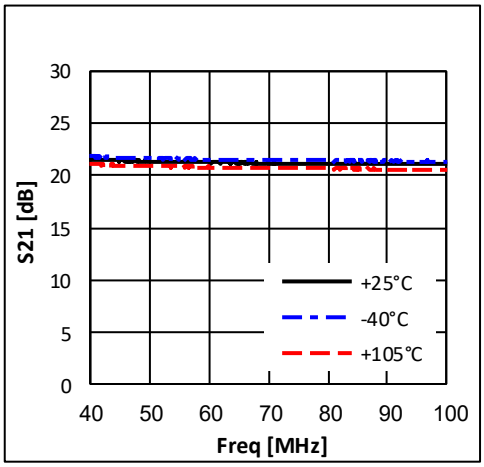
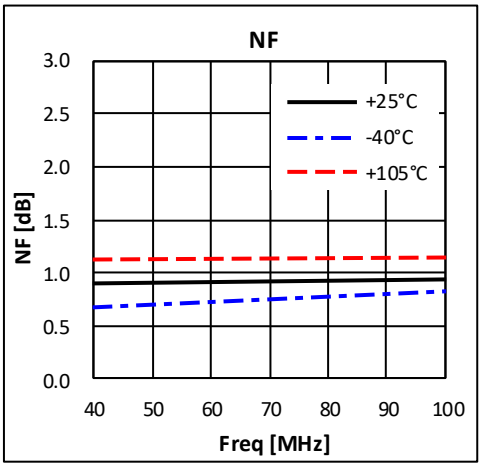
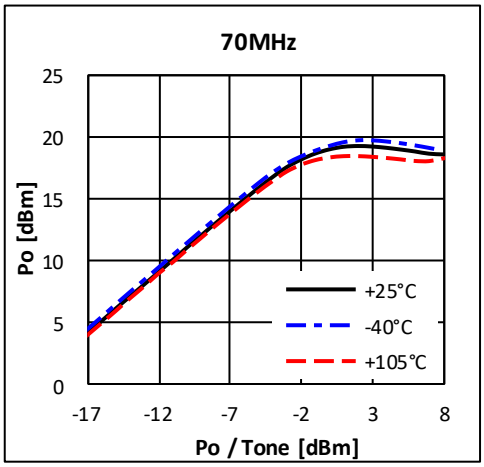
V_d = 3.3V, I_d = 48mA

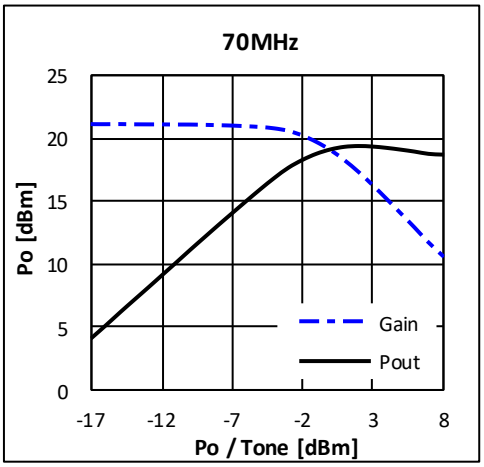












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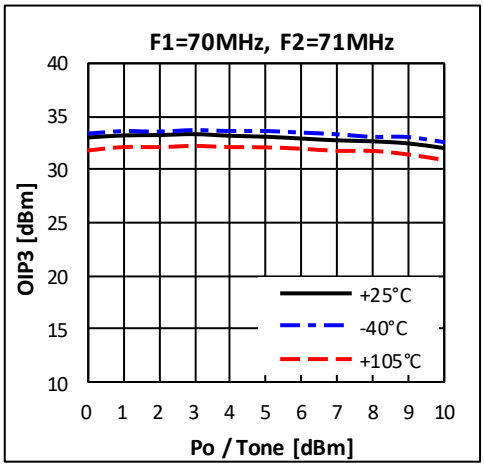
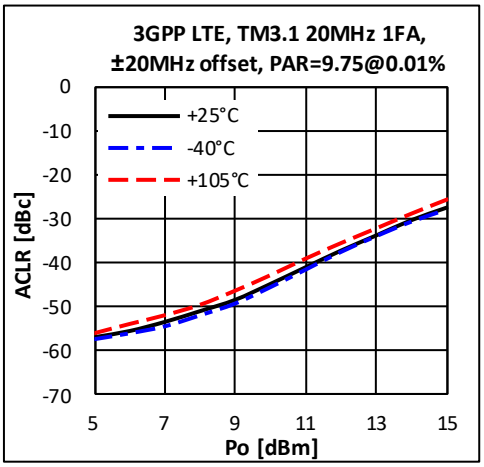
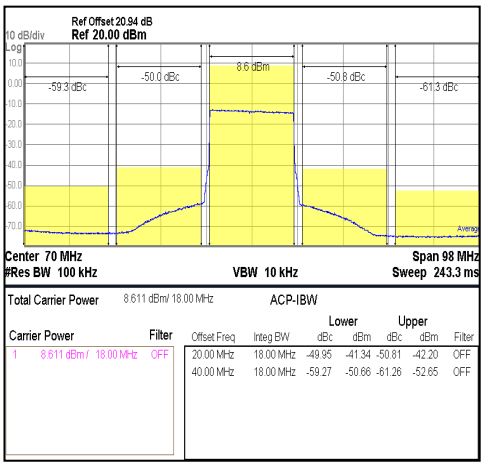
V_d = 3.3V, I_d = 48mA







Preliminary Datasheet

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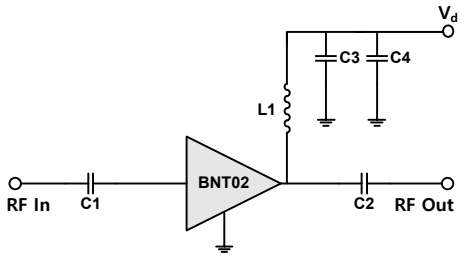
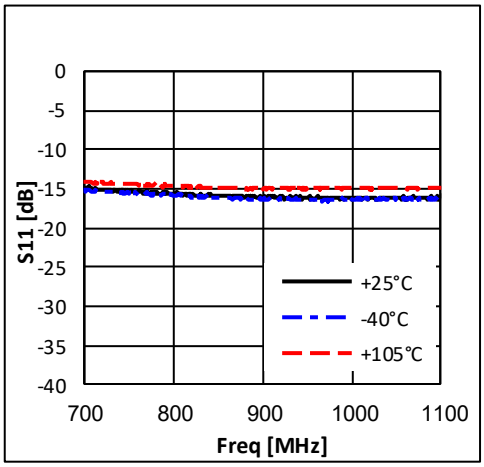
Preliminary Datasheet

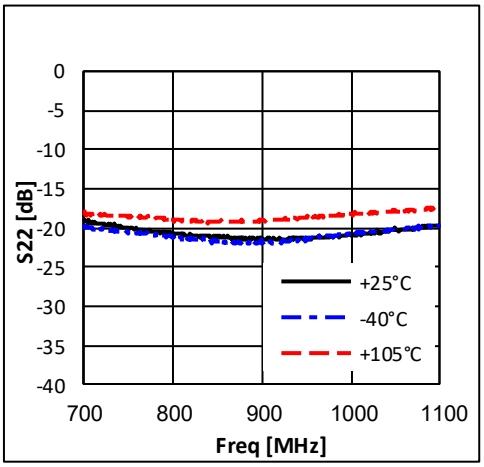
Application Circuit: 900MHz

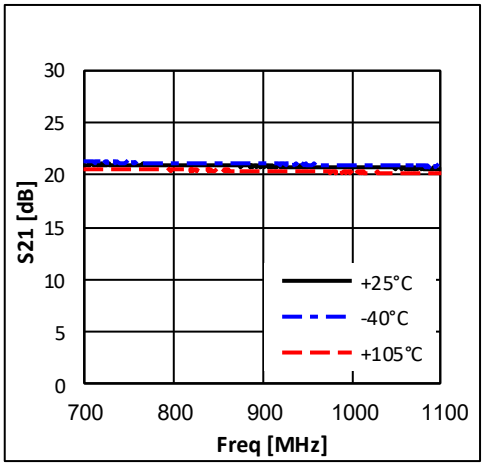
Schematic Diagram	BOM		Tolerance
	C1	200pF	± 5%
	C2	200pF	± 5%
	C3	100pF	± 5%
	C4	1uF	± 5%
	L1	33nH	± 5%

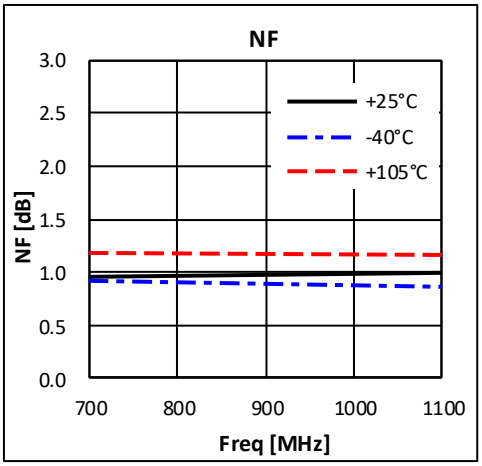
Typical Performance

V_d = 5V, I_d = 85mA









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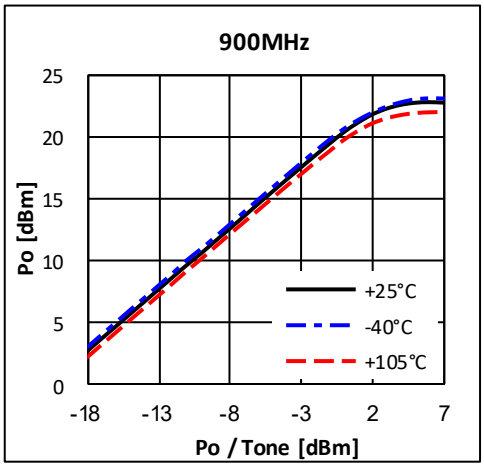
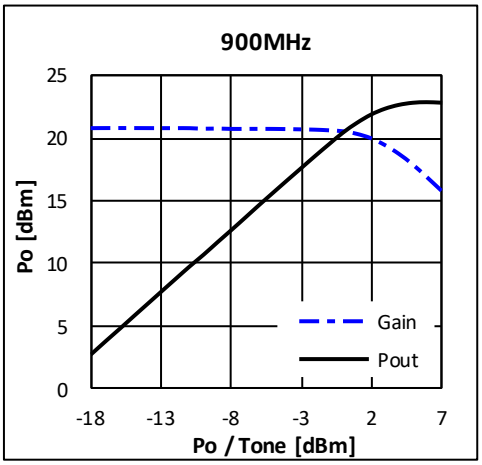
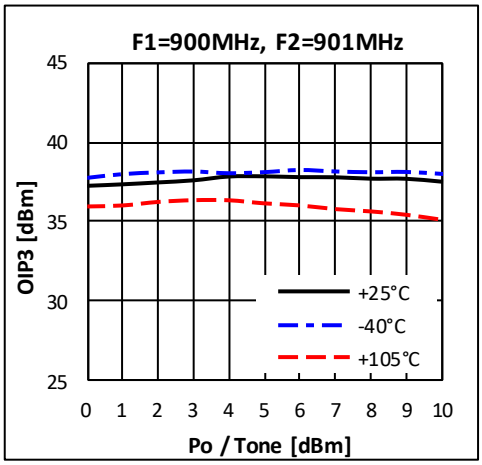
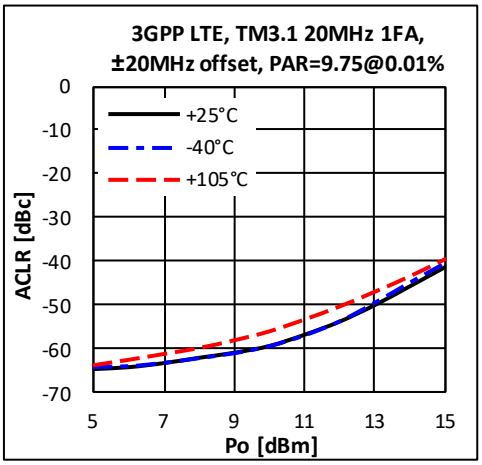
Preliminary Datasheet

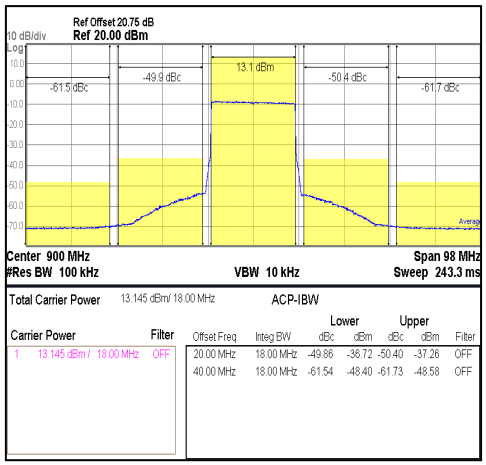
V_d = 5V, I_d = 85mA











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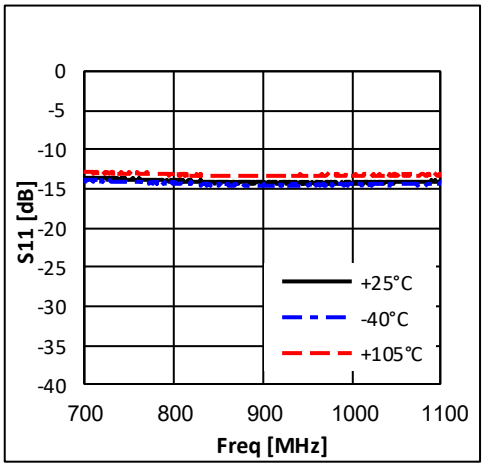
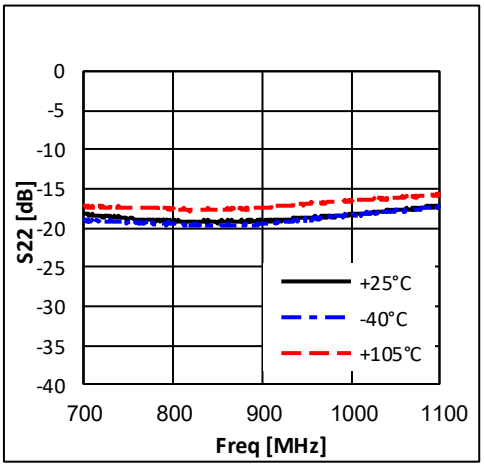
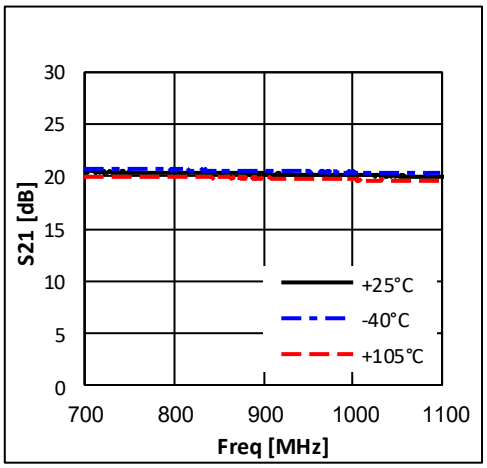
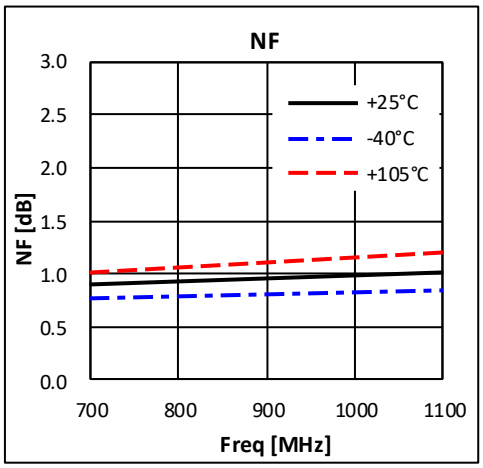
Preliminary Datasheet

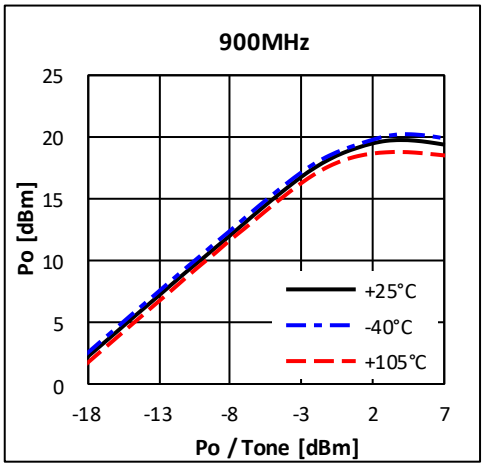
V_d = 3.3V, I_d = 48mA

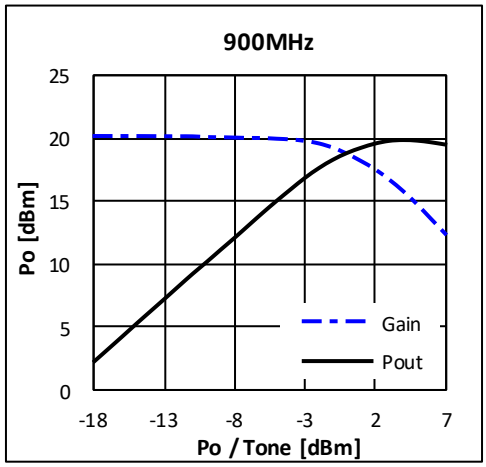












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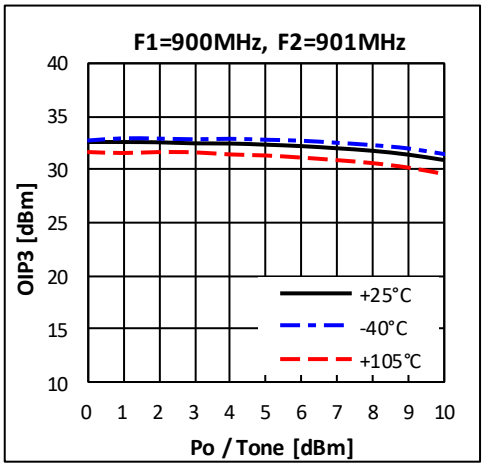
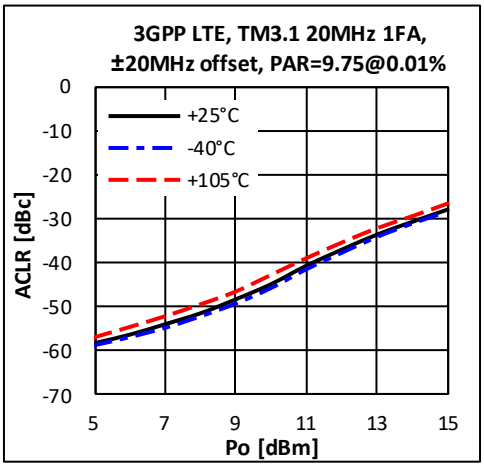
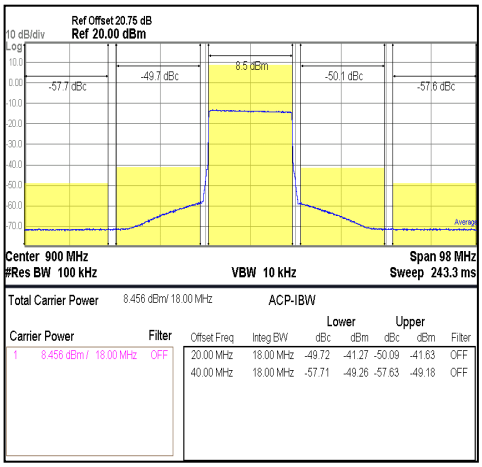
V_d = 3.3V, I_d = 48mA







Preliminary Datasheet

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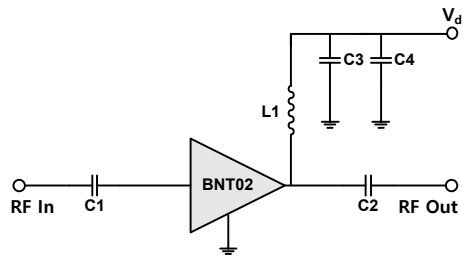
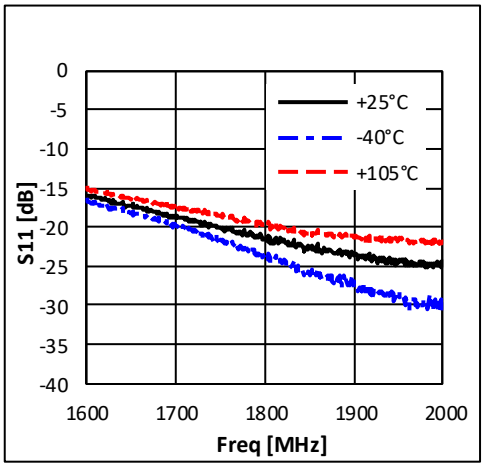
Preliminary Datasheet

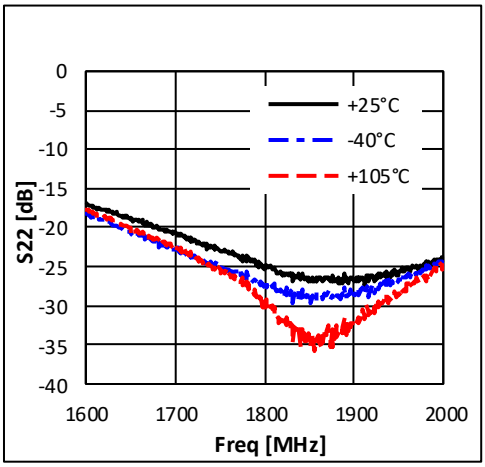
Application Circuit: 1800 MHz

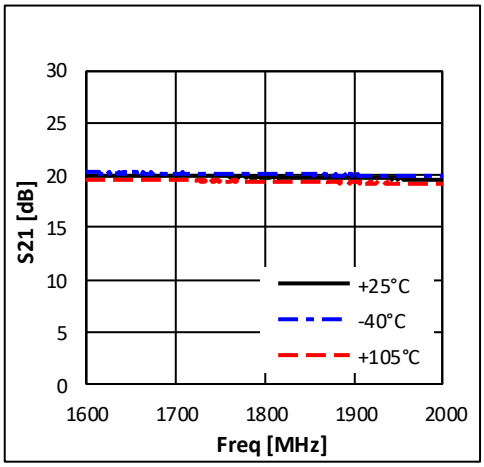
Schematic Diagram	BOM		Tolerance
	C1	4.7pF	± 5%
	C2	200pF	± 5%
	C3	100pF	± 5%
	C4	1uF	± 5%
	L1	3.3nH	± 5%

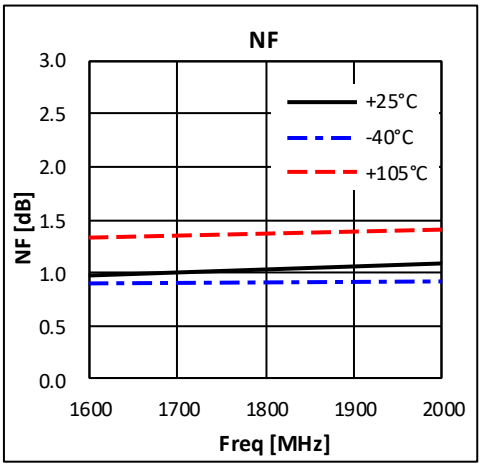
Typical Performance

V_d = 5V, I_d = 85mA









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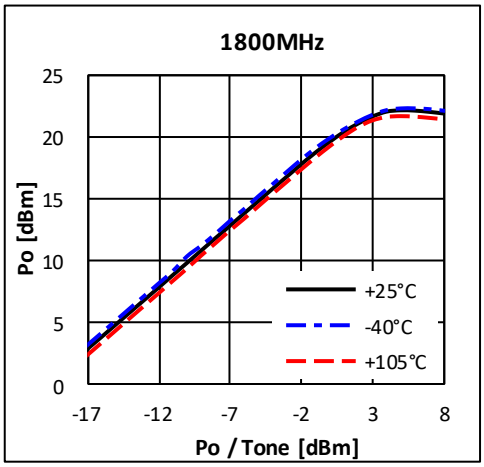
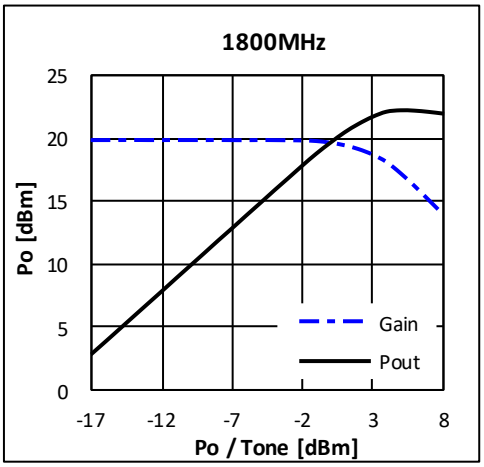
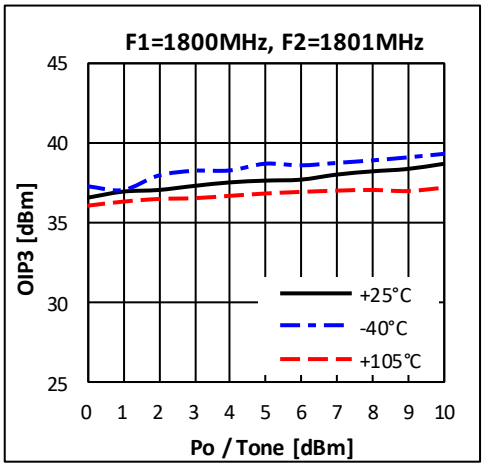
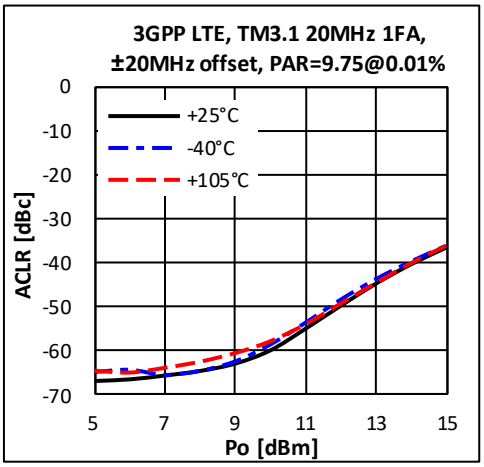
Preliminary Datasheet

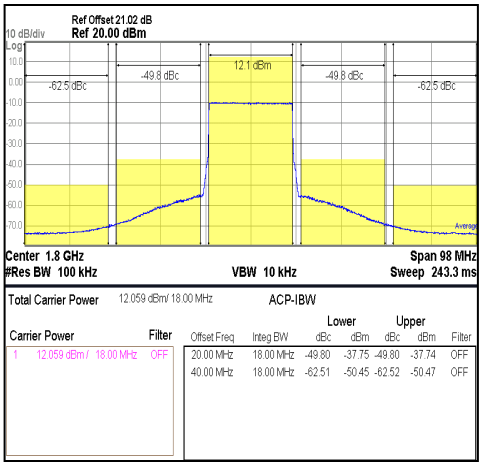
V_d = 5V, I_d = 85mA











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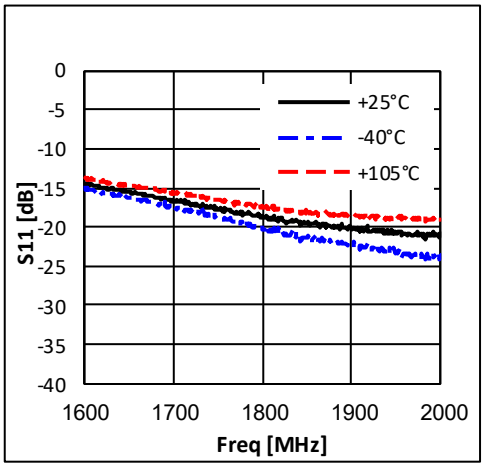
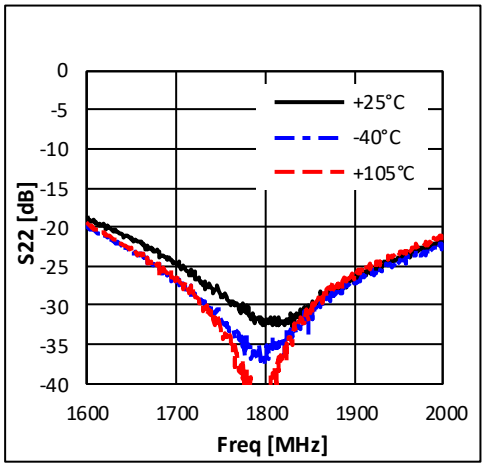
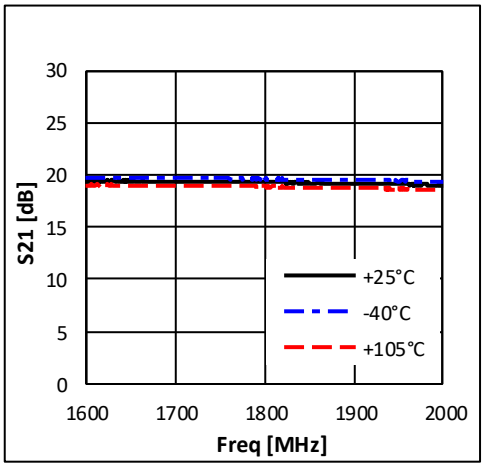
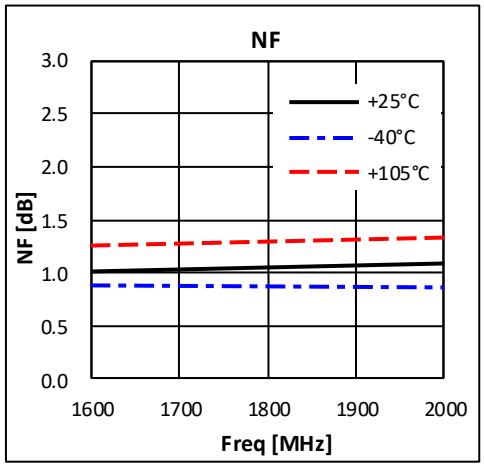
Preliminary Datasheet

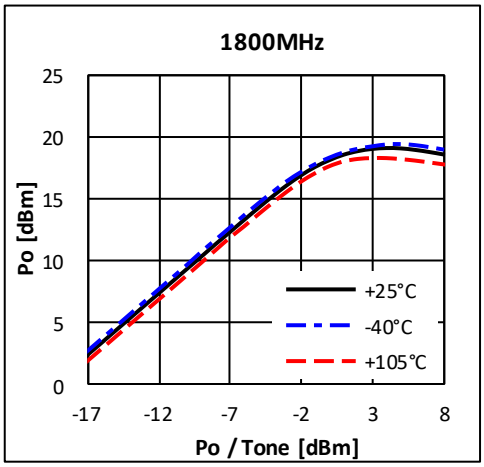
V_d = 3.3V, I_d = 48mA

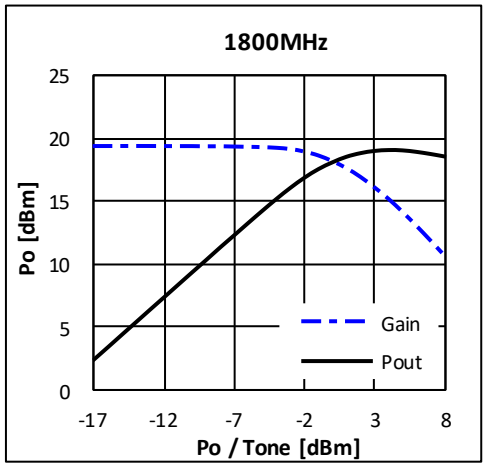












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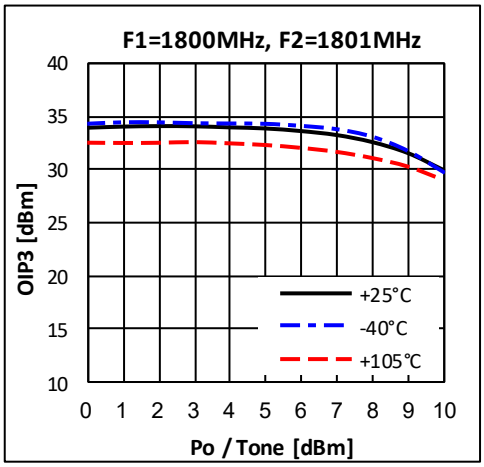
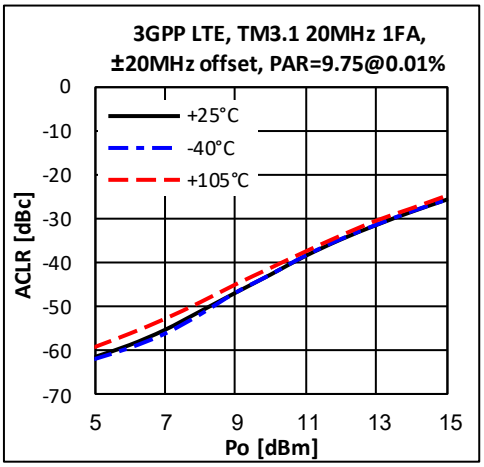
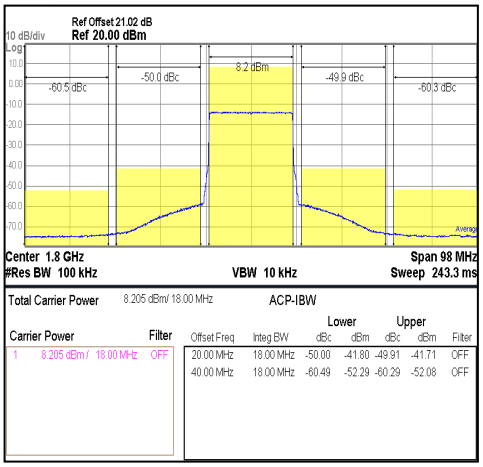
V_d = 3.3V, I_d = 48mA







Preliminary Datasheet

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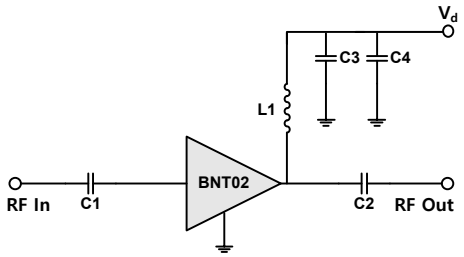
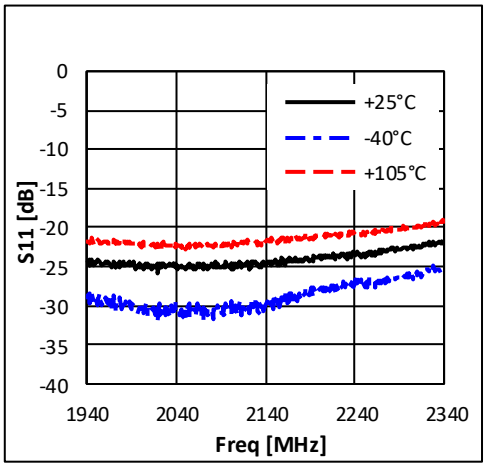
Preliminary Datasheet

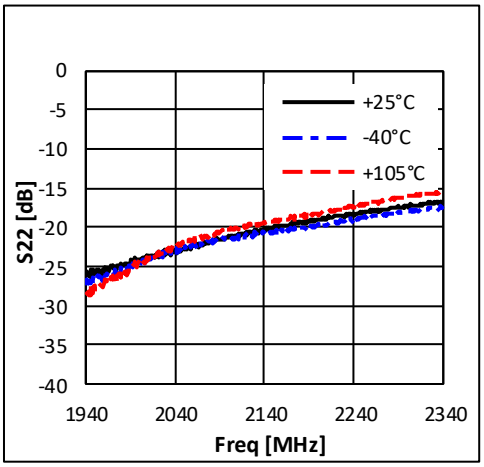
Application Circuit: 2140 MHz

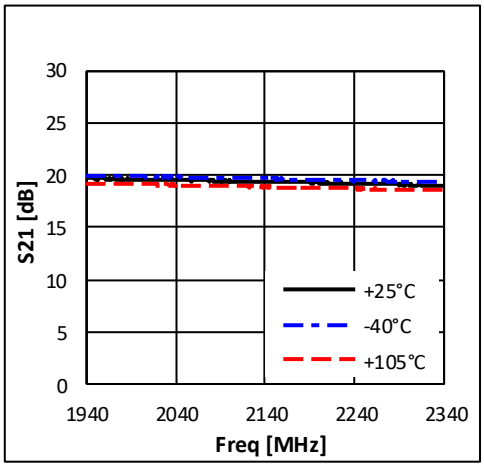
Schematic Diagram	BOM		Tolerance
	C1	4.7pF	± 5%
	C2	200pF	± 5%
	C3	100pF	± 5%
	C4	1uF	± 5%
	L1	3.3nH	± 5%

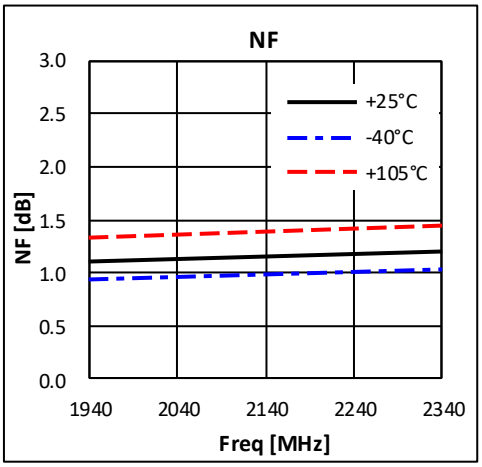
Typical Performance

V_d = 5V, I_d = 85mA









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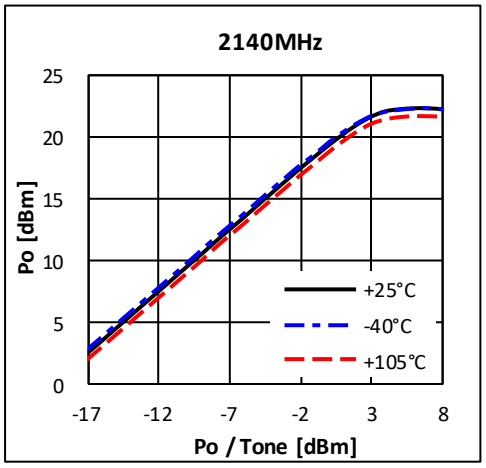
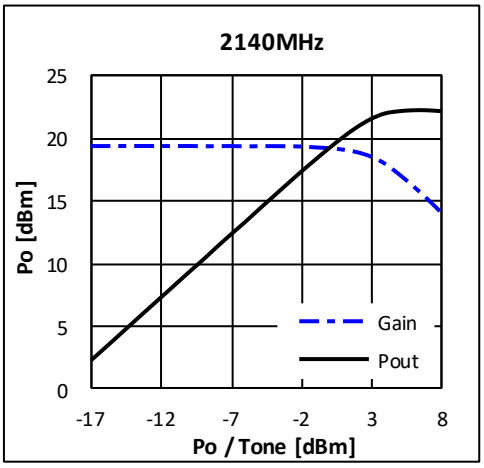
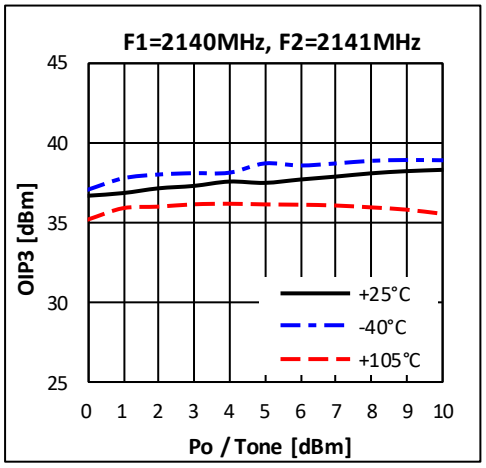
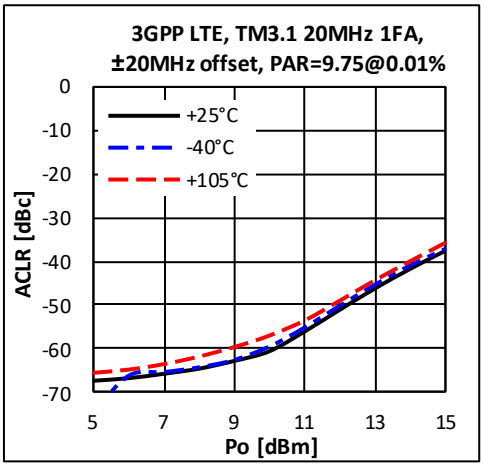
Preliminary Datasheet

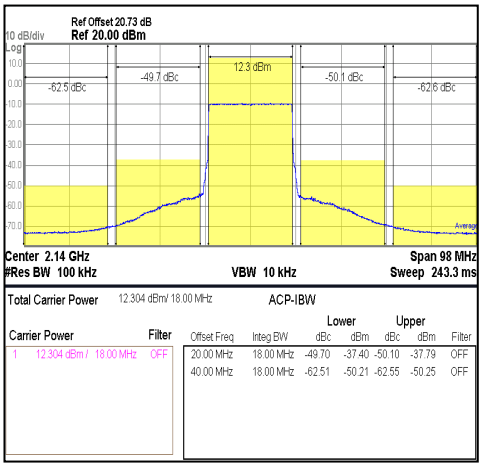
V_d = 5V, I_d = 85mA











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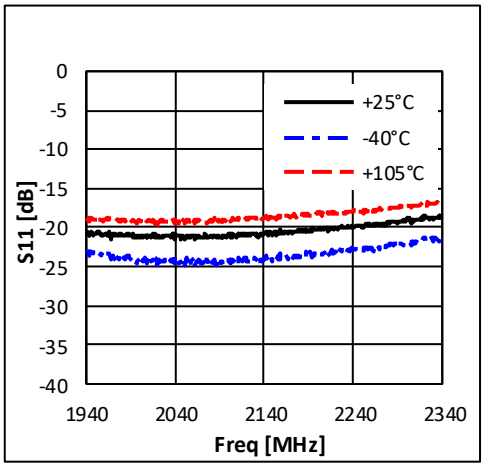
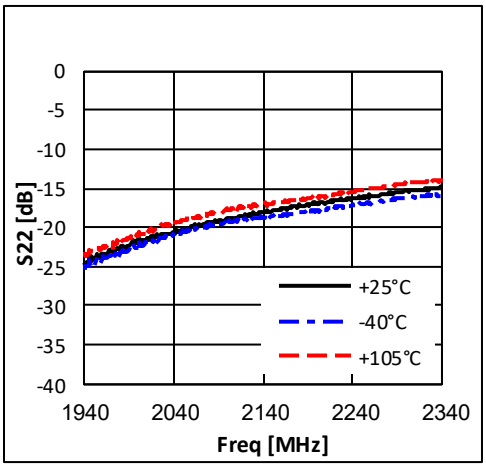
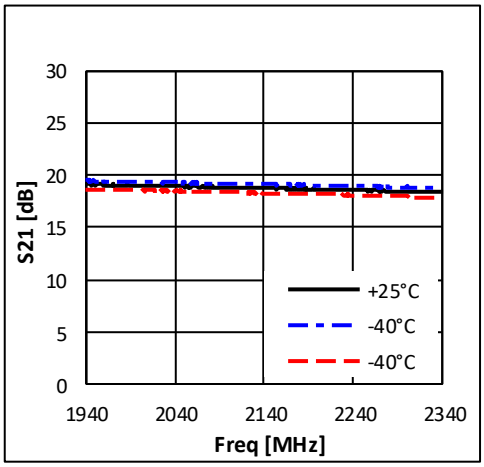
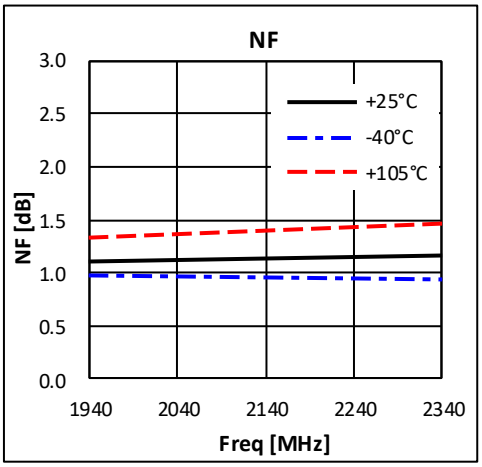
Preliminary Datasheet

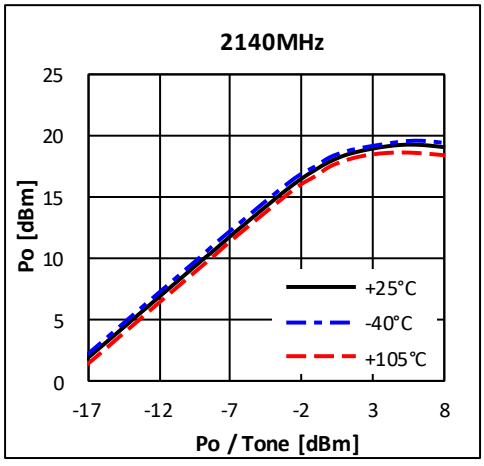
V_d = 3.3V, I_d = 48mA

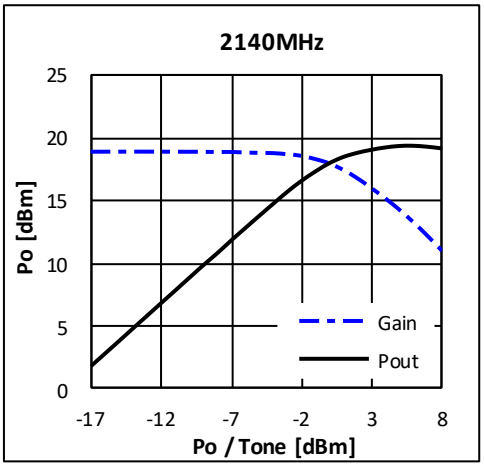












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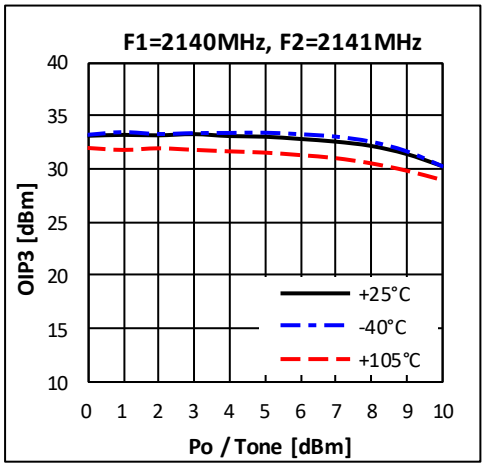
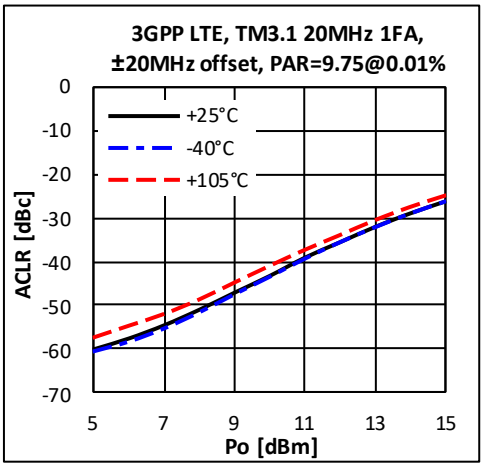
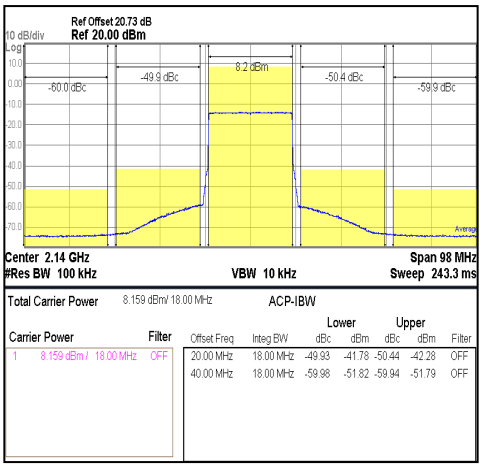
V_d = 3.3V, I_d = 48mA







Preliminary Datasheet

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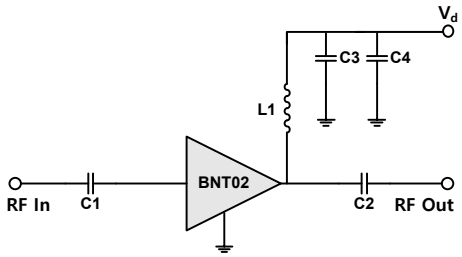
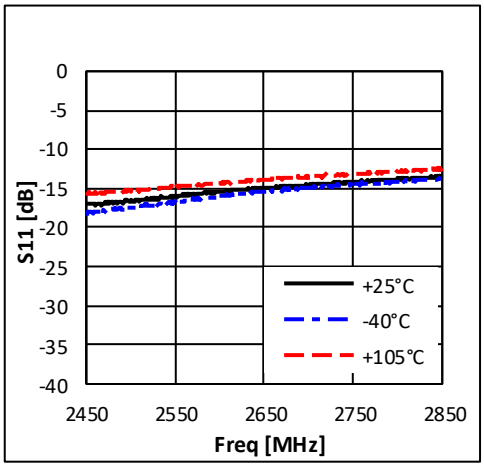
Preliminary Datasheet

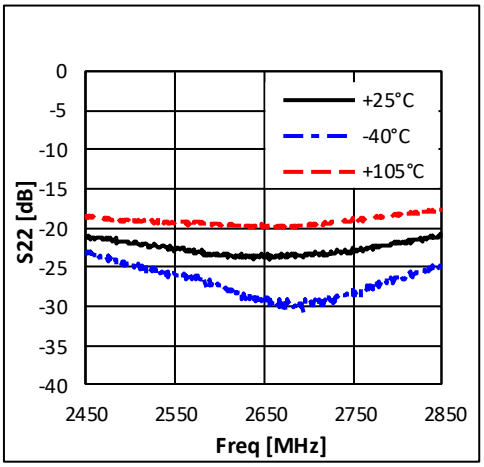
Application Circuit: 2650 MHz

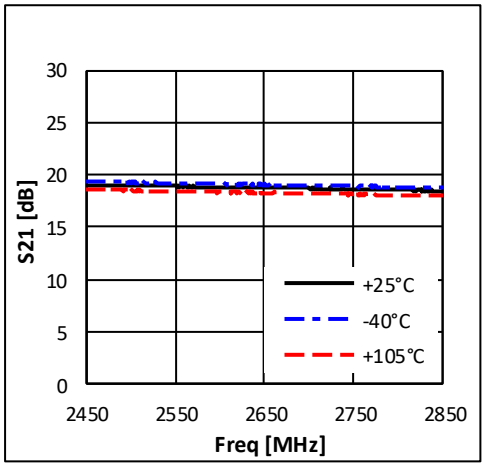
Schematic Diagram	BOM		Tolerance
	C1	3.5pF	± 5%
	C2	3.5pF	± 5%
	C3	100pF	± 5%
	C4	1uF	± 5%
	L1	5.6nH	± 5%

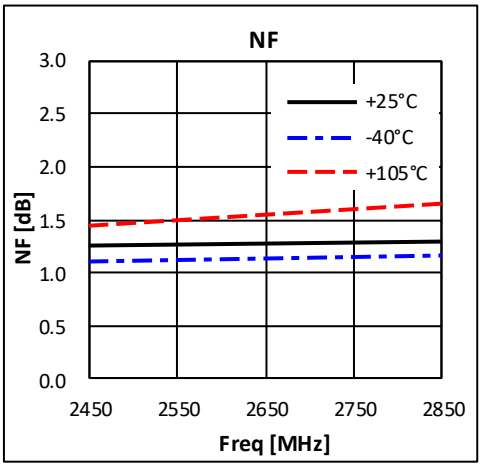
Typical Performance

V_d = 5V, I_d = 85mA









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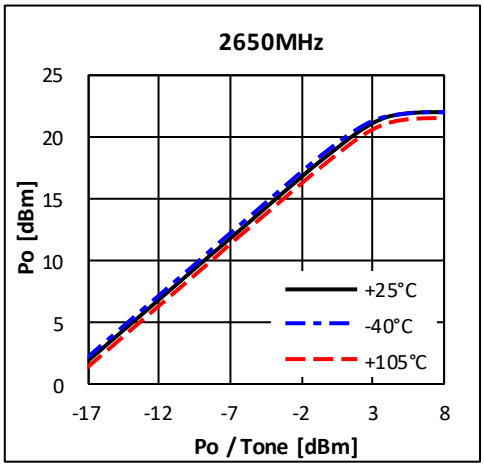
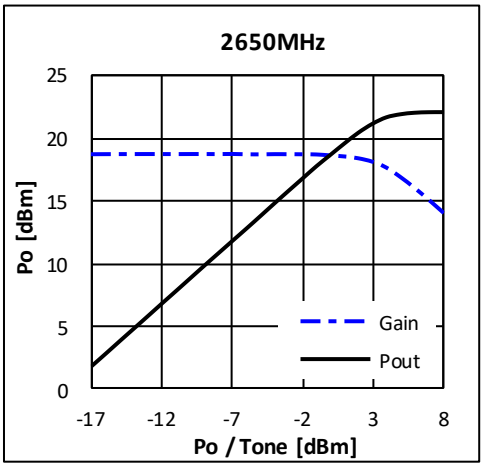
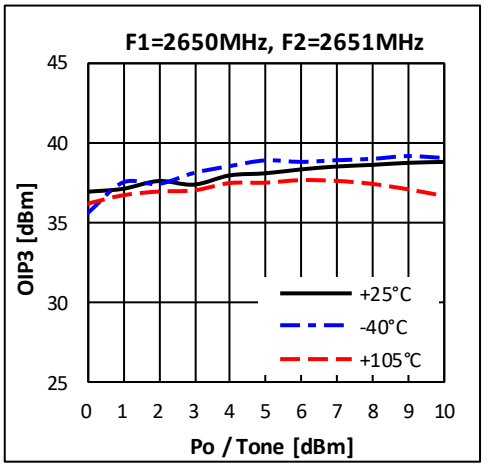
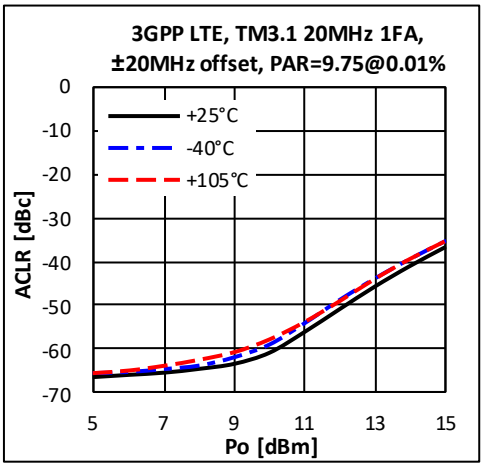
Preliminary Datasheet

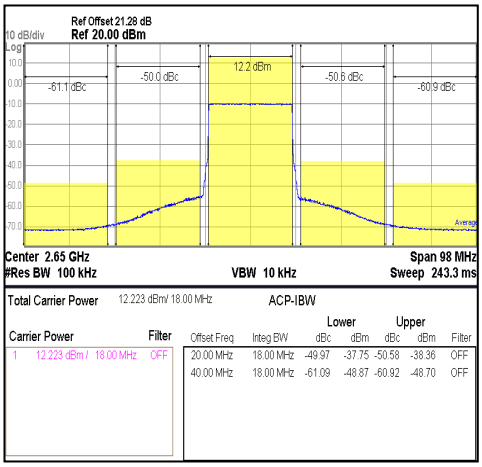
V_d = 5V, I_d = 85mA











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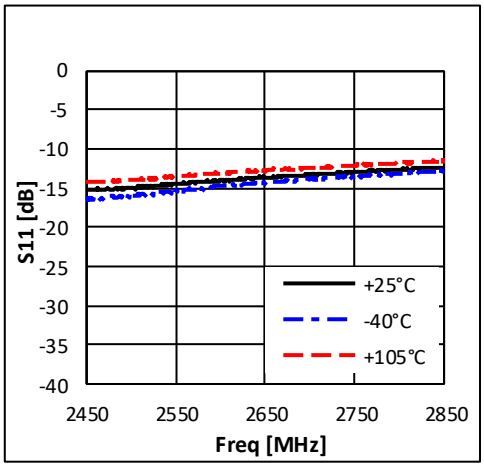
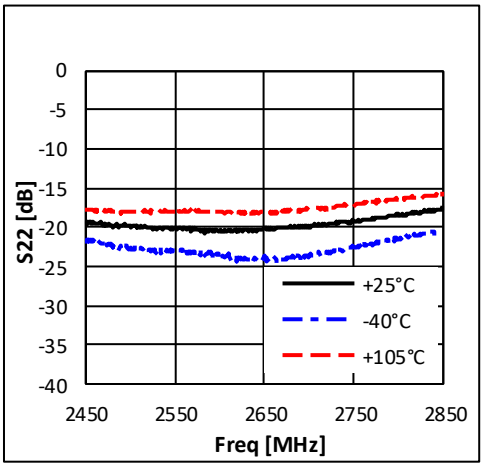
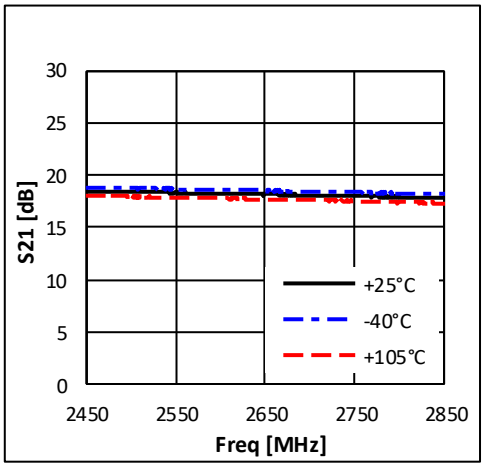
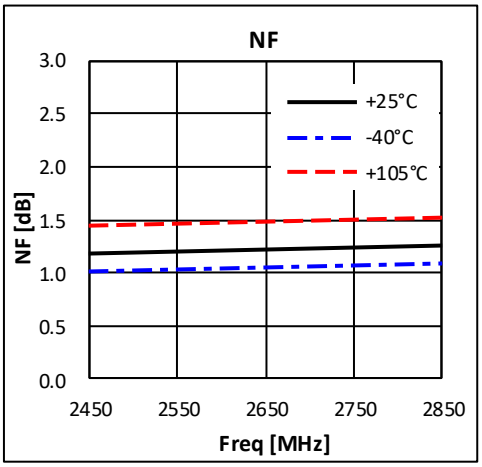
Preliminary Datasheet

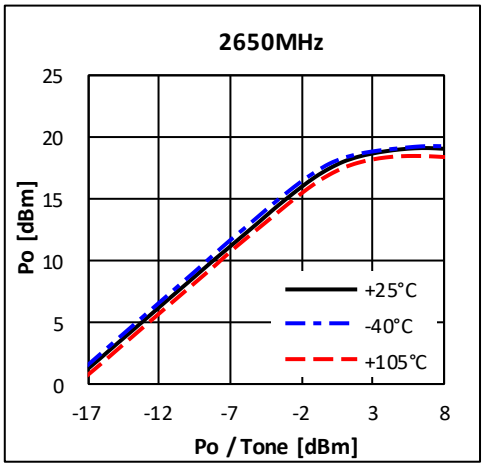
V_d = 3.3V, I_d = 48mA

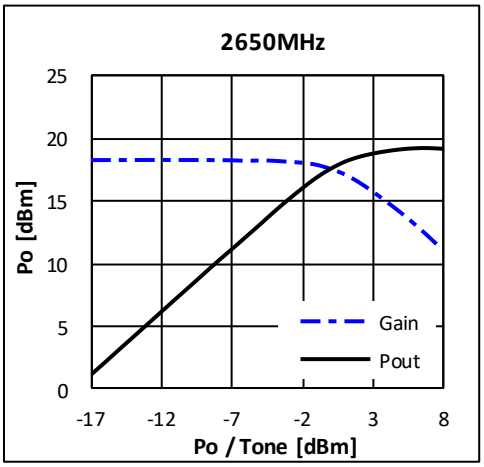












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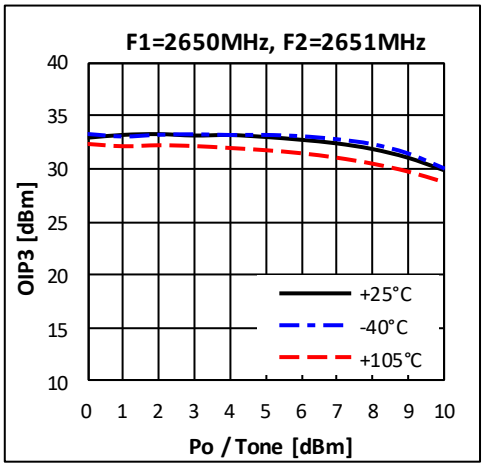
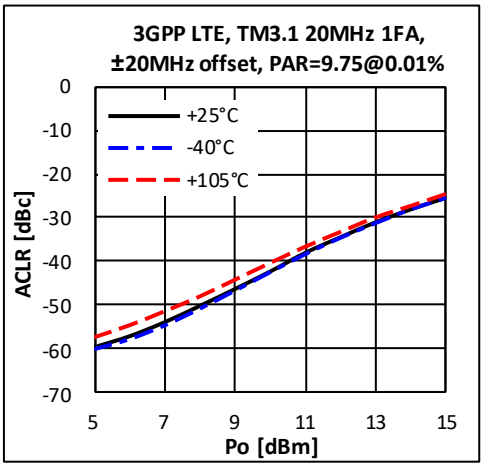
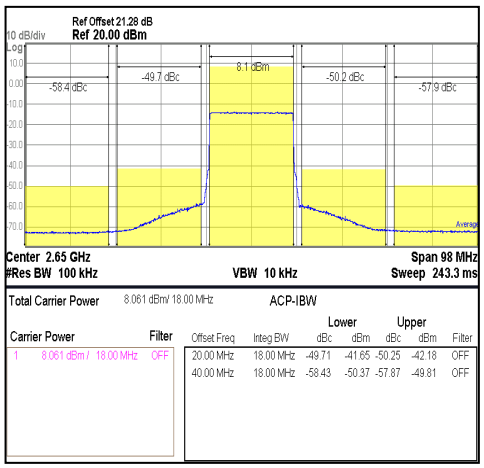
V_d = 3.3V, I_d = 48mA







Preliminary Datasheet

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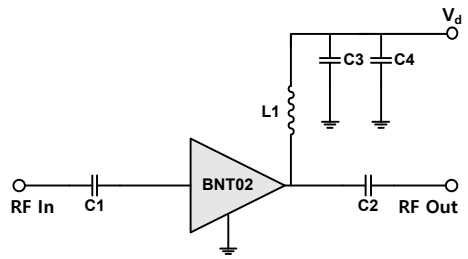
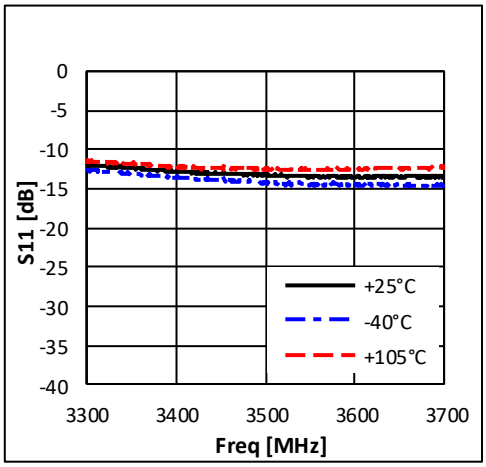
Preliminary Datasheet

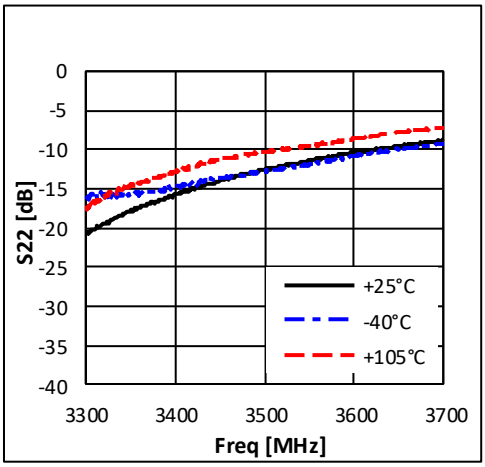
Application Circuit: 3500 MHz

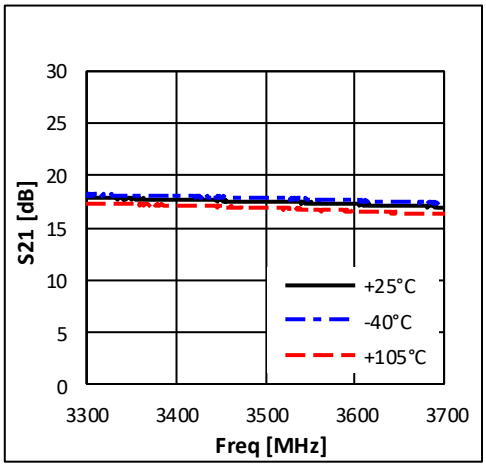
Schematic Diagram	BOM		Tolerance
	C1	47pF	± 5%
	C2	1pF	± 5%
	C3	100pF	± 5%
	C4	1uF	± 5%
	L1	22nH	± 5%

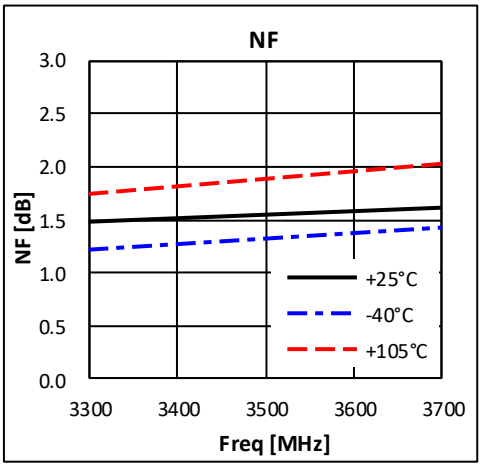
Typical Performance

V_d = 5V, I_d = 85mA









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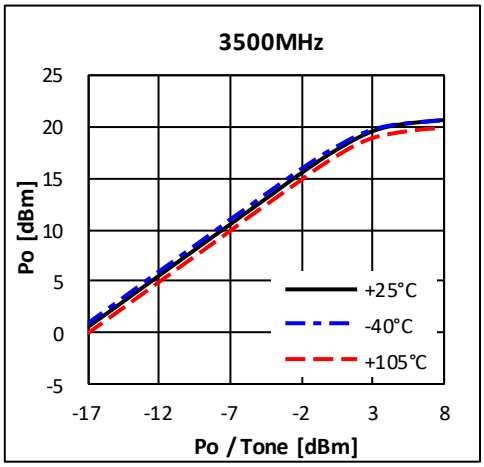
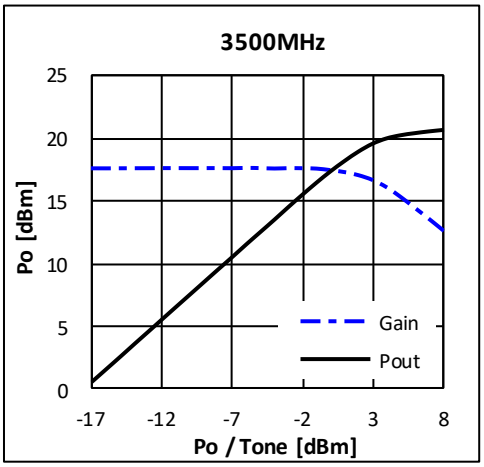
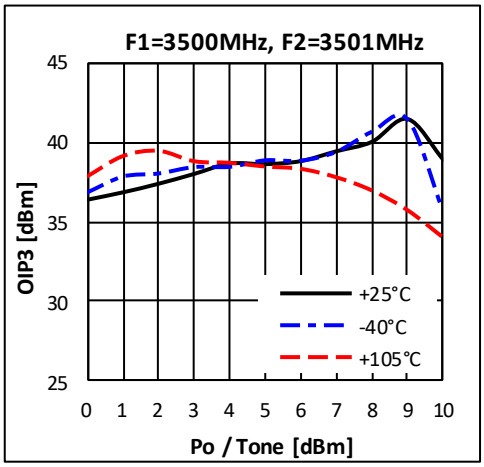
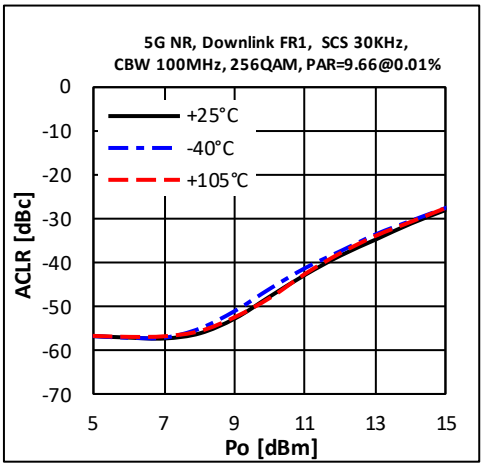
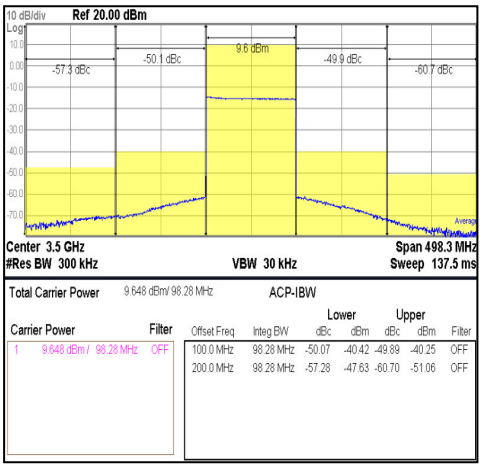
V_d = 5V, I_d = 85mA











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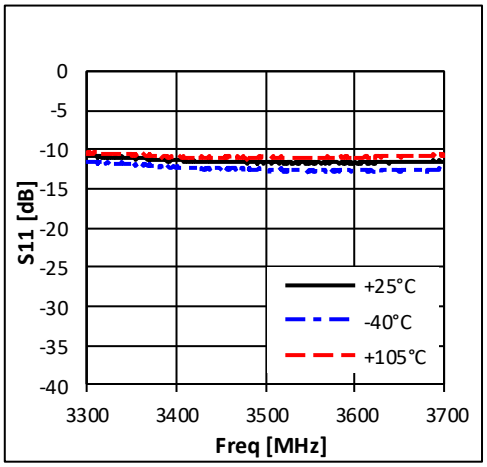
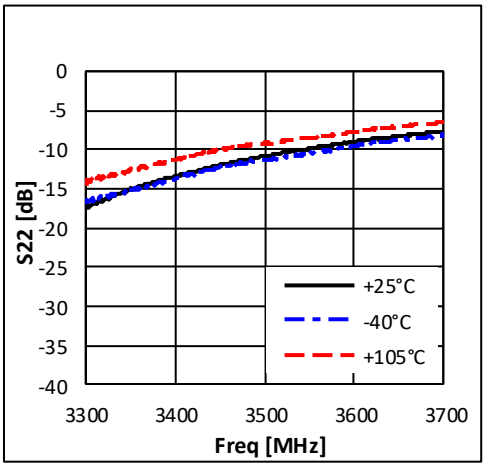
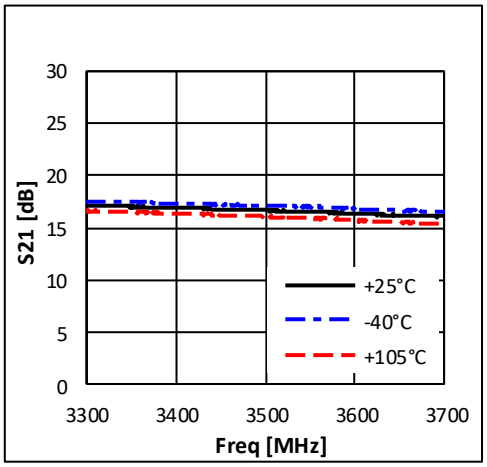
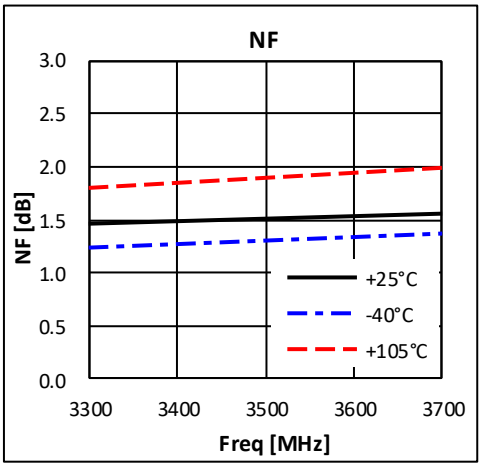
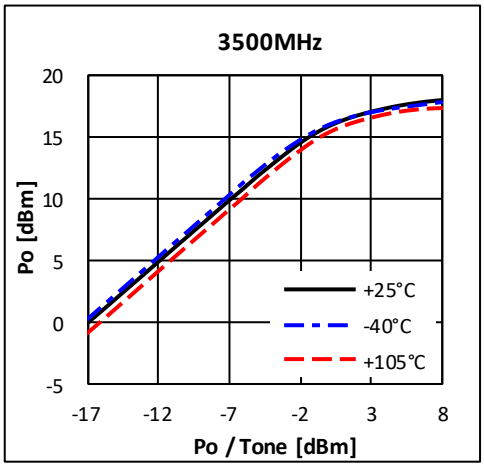
V_d = 3.3V, I_d = 48mA

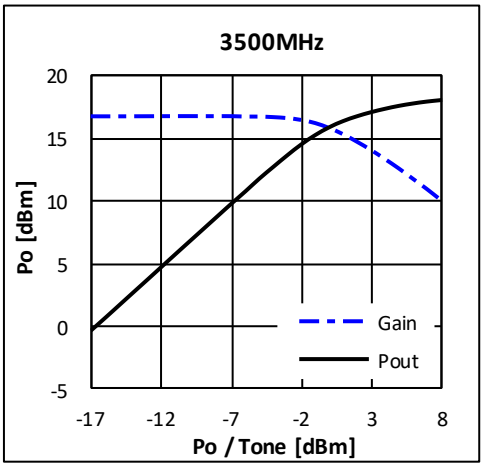












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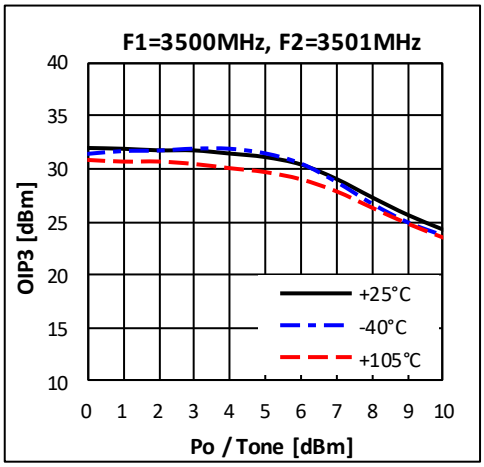
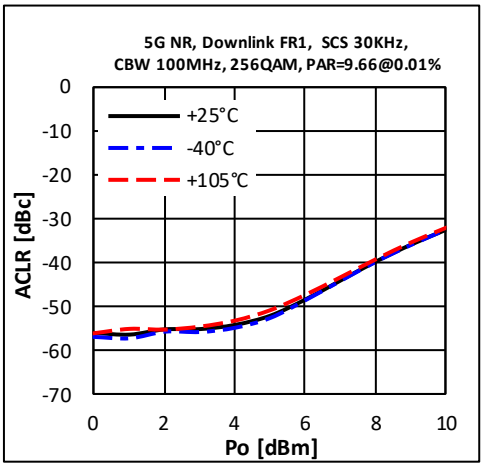
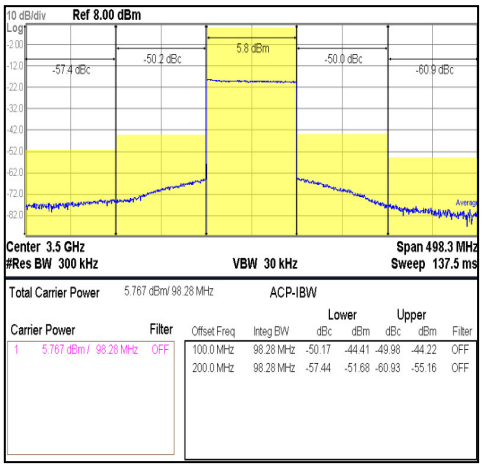
Preliminary Datasheet

V_d = 3.3V, I_d = 48mA







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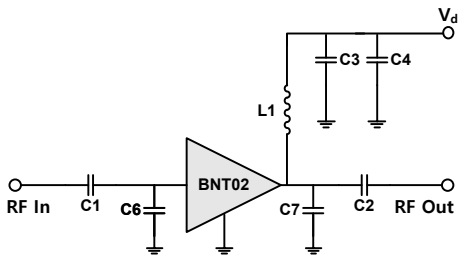
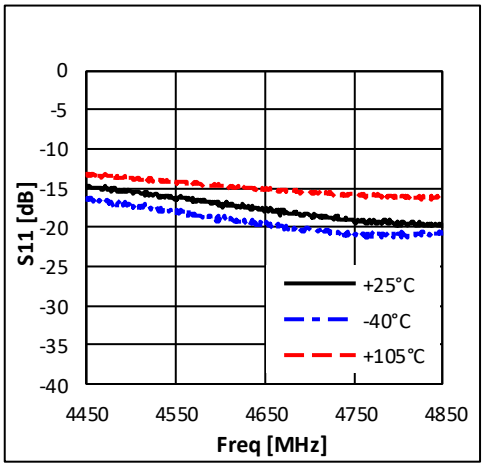
Preliminary Datasheet

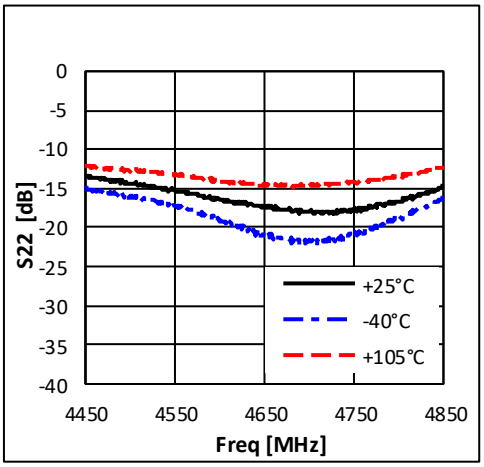
Application Circuit: 4650 MHz

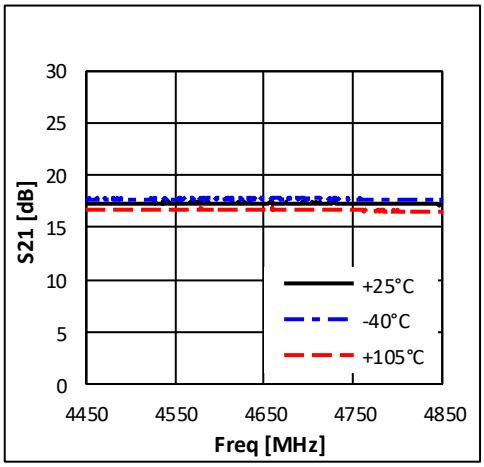
Schematic Diagram	BOM		Tolerance
	C1	2pF	± 5%
	C2	2pF	± 5%
	C3	100pF	± 5%
	C4	1uF	± 5%
	C6	0.3pF	± 5%
	C7	0.5pF	± 5%
	L1	1nH	± 5%

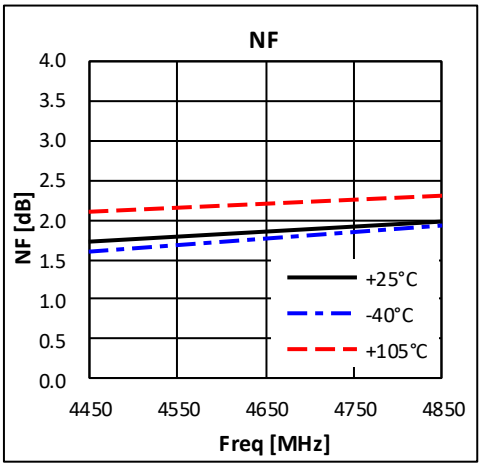
Typical Performance

V_d = 5V, I_d = 85mA









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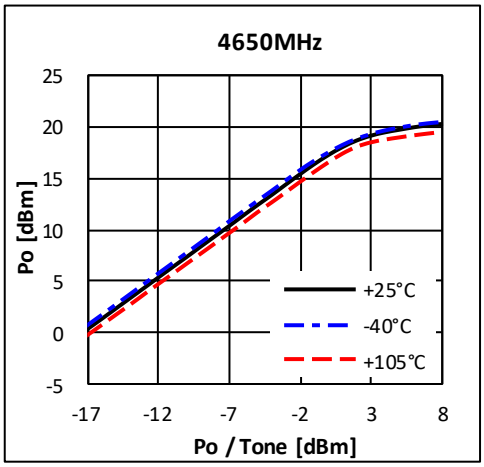
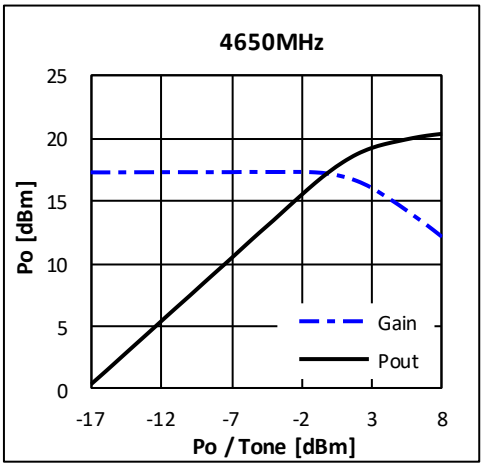
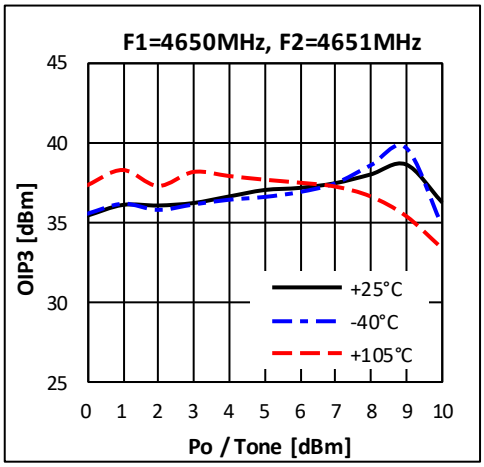
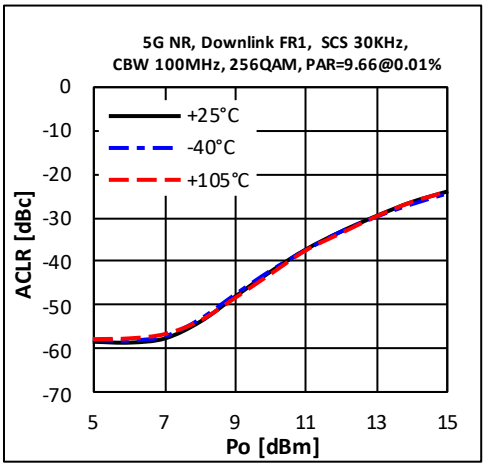
Preliminary Datasheet

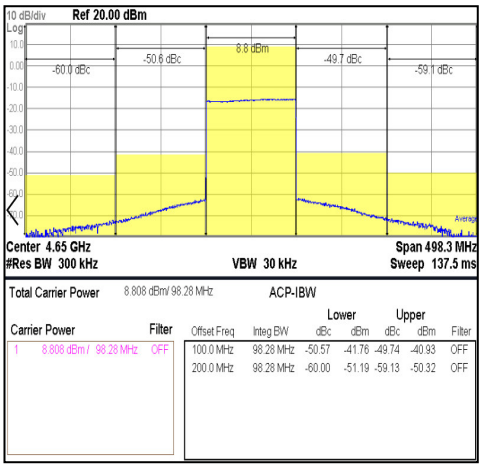
V_d = 5V, I_d = 85mA











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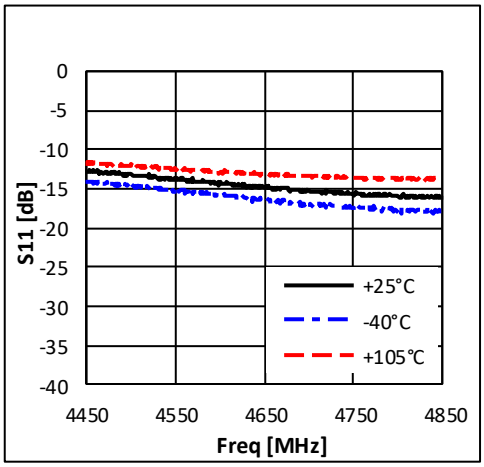
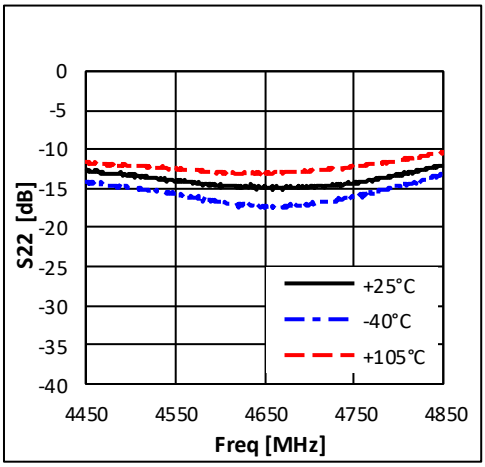
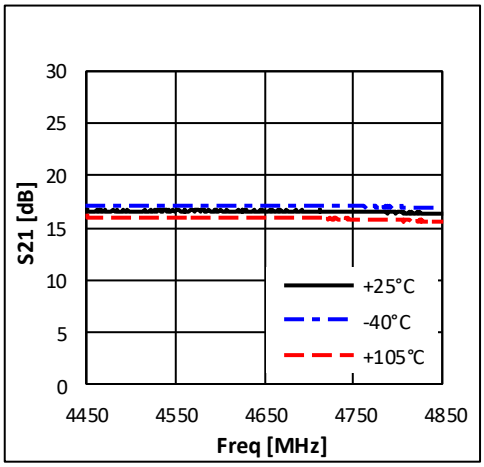
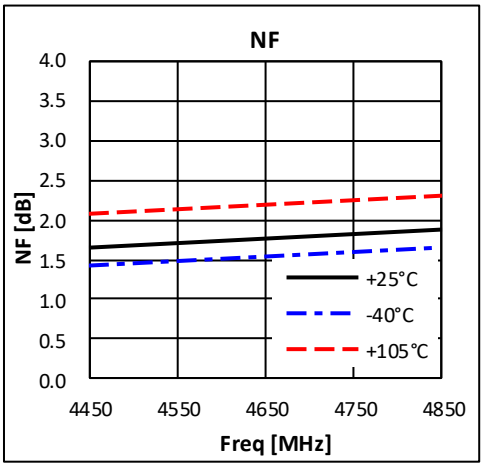
Preliminary Datasheet

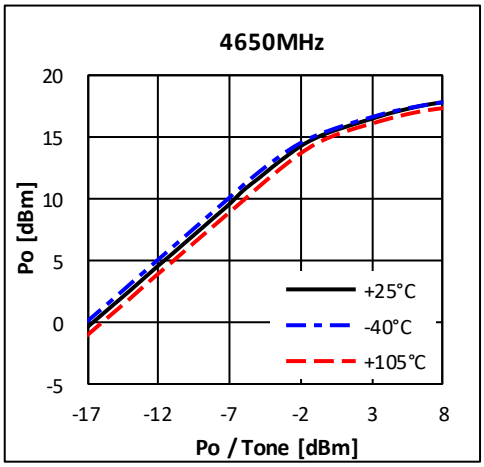
V_d = 3.3V, I_d = 48mA

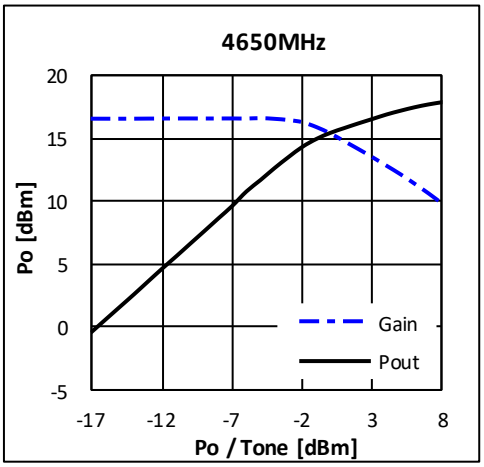












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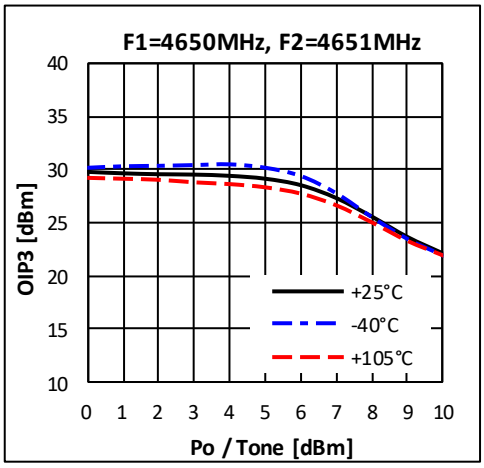
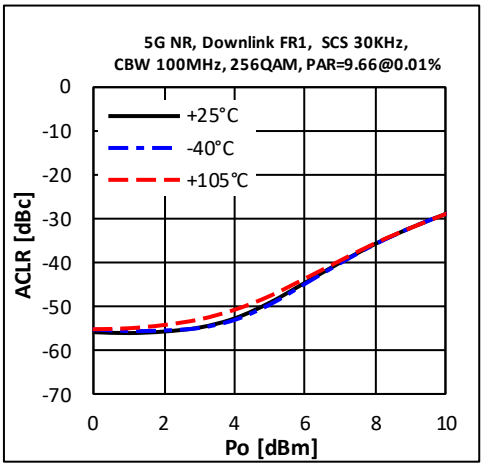
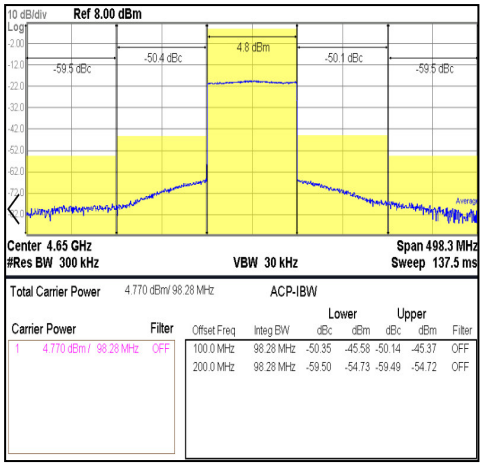
V_d = 3.3V, I_d = 48mA







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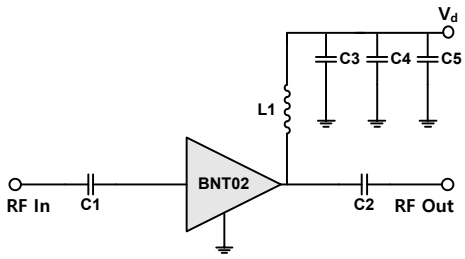
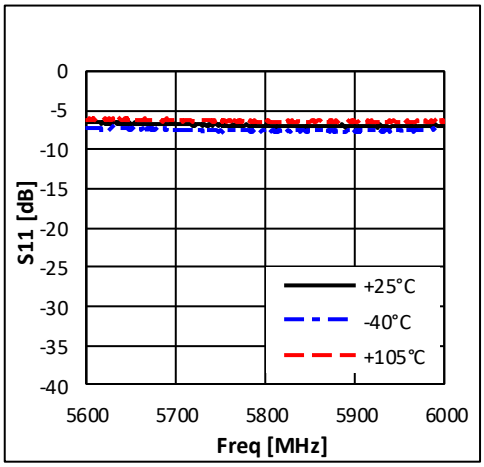
Preliminary Datasheet

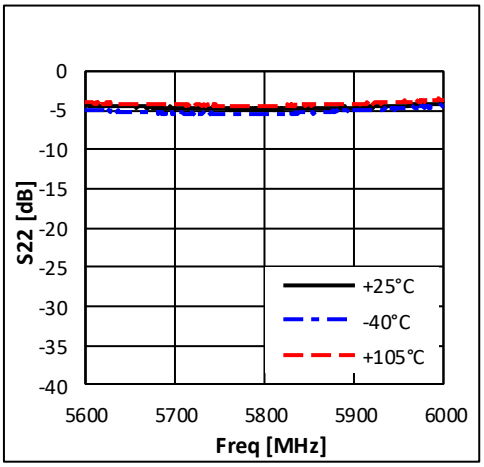
Application Circuit: 5800 MHz

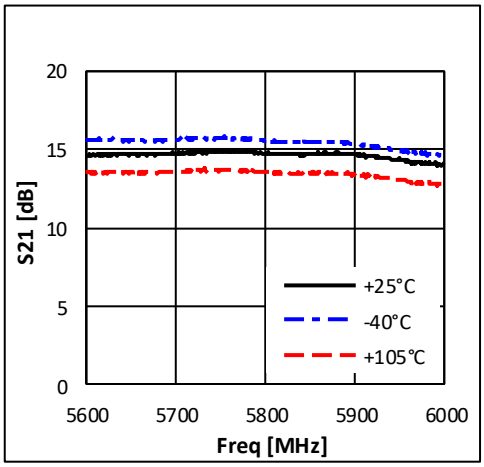
Schematic Diagram	BOM		Tolerance
	C1	1.5pF	± 5%
	C2	1.5pF	± 5%
	C3	100pF	± 5%
	C4	1nF	± 5%
	C5	1uF	± 5%
	L1	1nH	± 5%

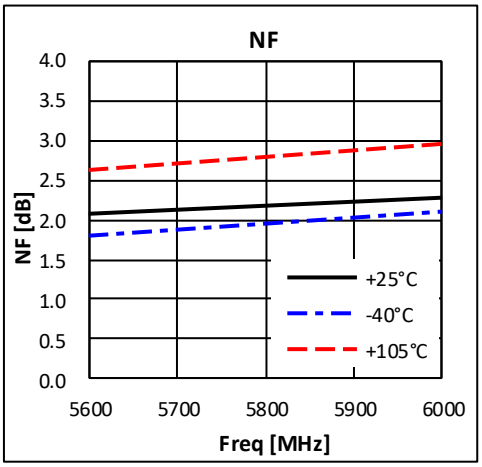
Typical Performance

V_d = 5V, I_d = 85mA









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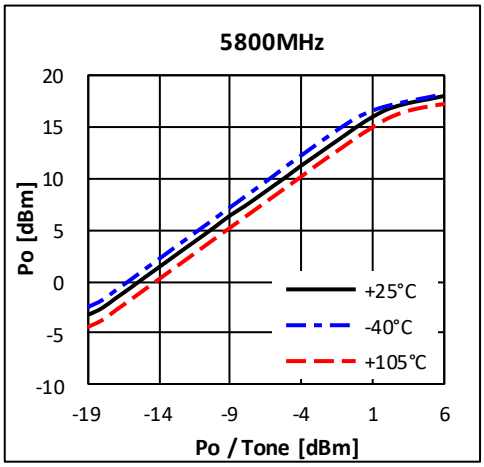
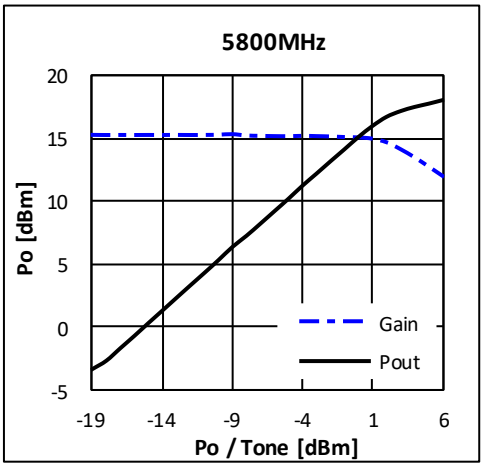
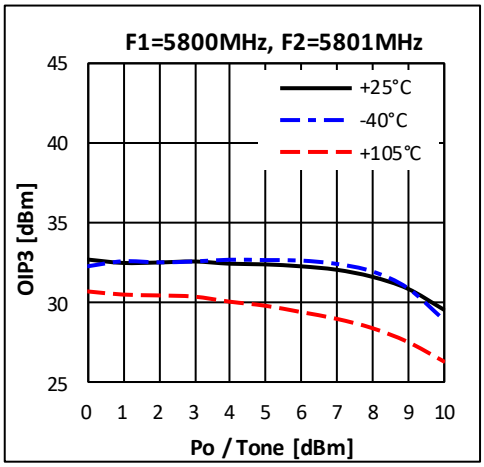
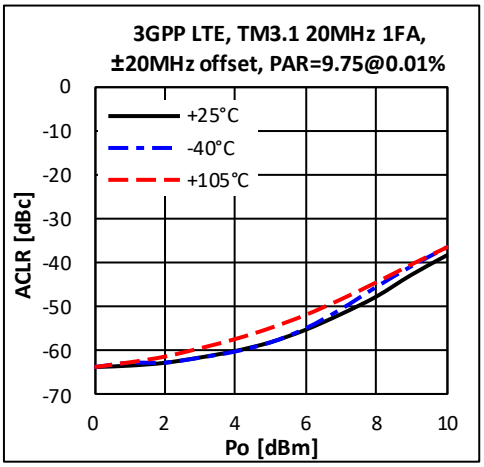
Preliminary Datasheet

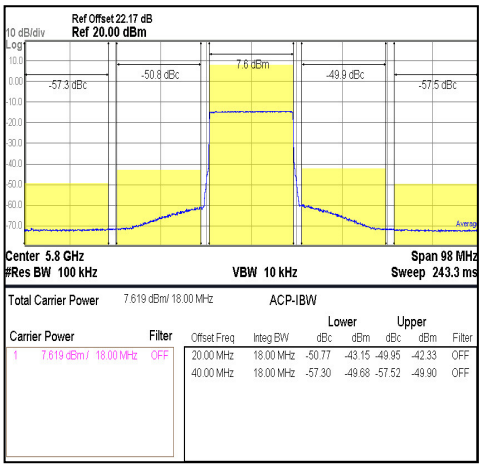
V_d = 5V, I_d = 85mA











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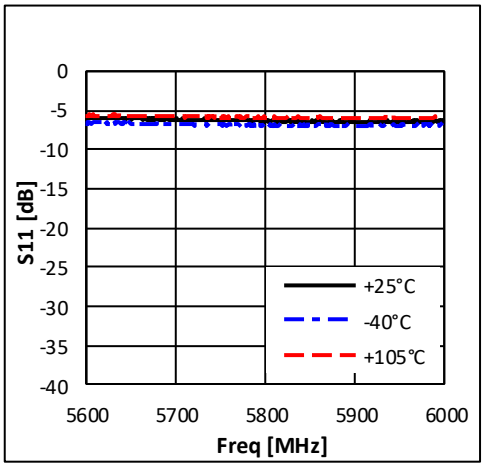
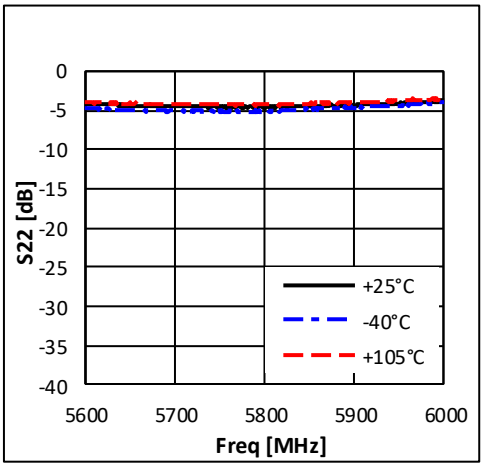
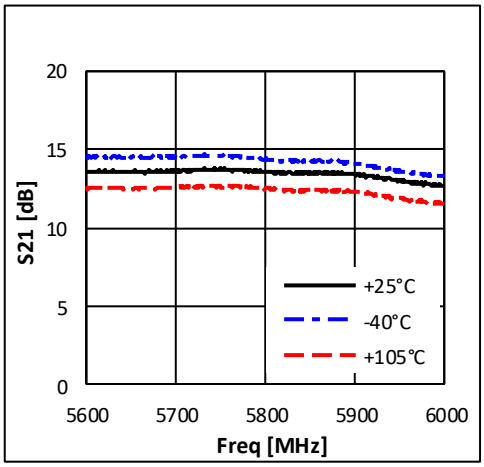
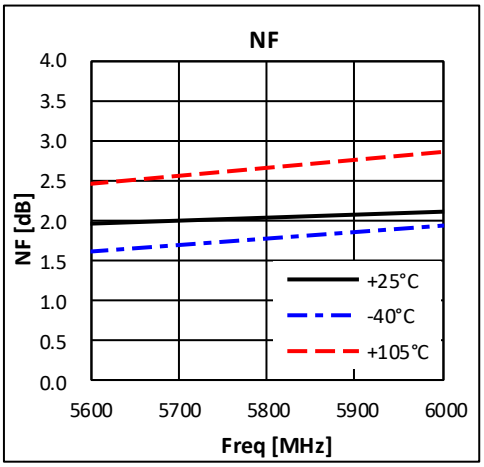
Preliminary Datasheet

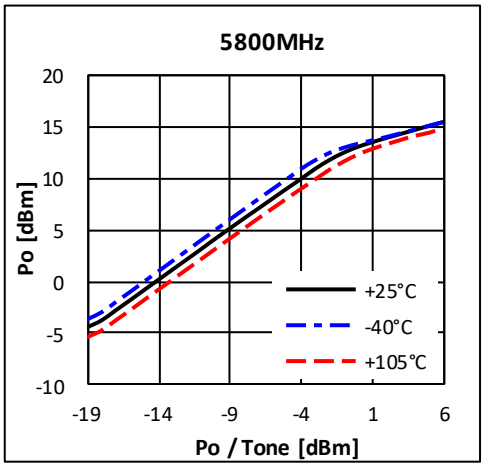
V_d = 3.3V, I_d = 48mA

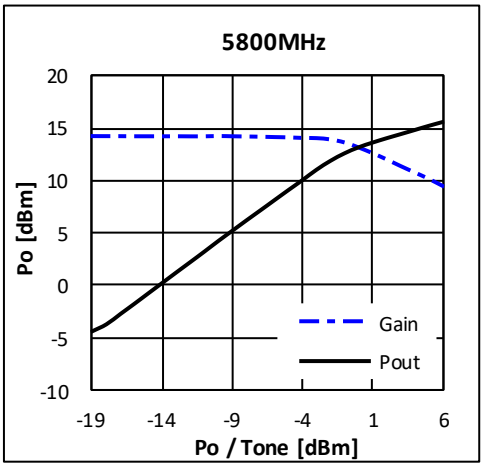












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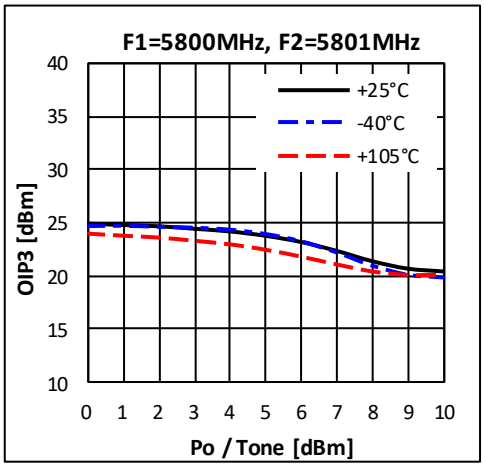
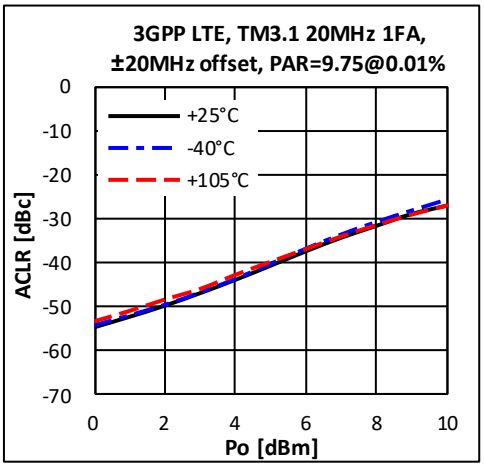
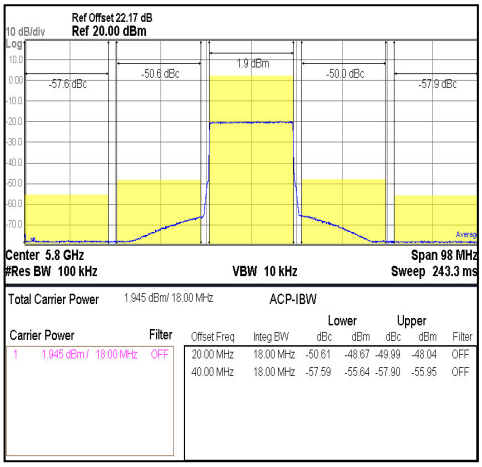
Preliminary Datasheet

V_d = 3.3V, I_d = 48mA







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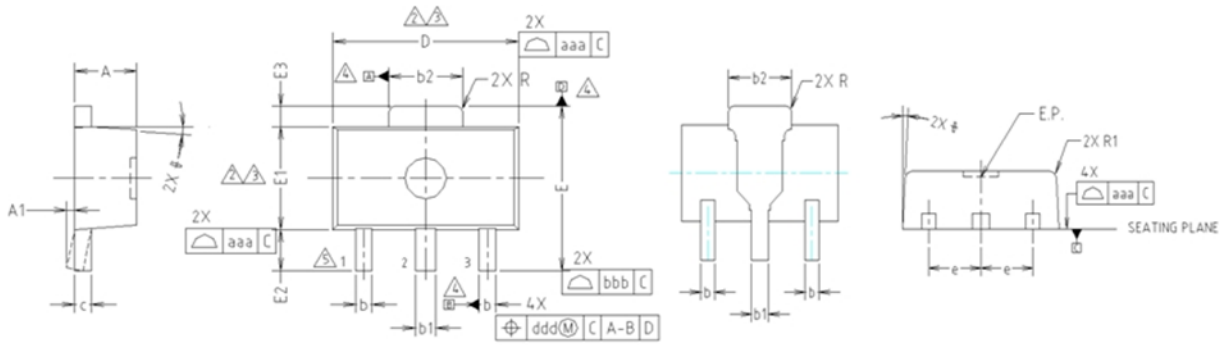
Preliminary Datasheet

Package Outline Dimension

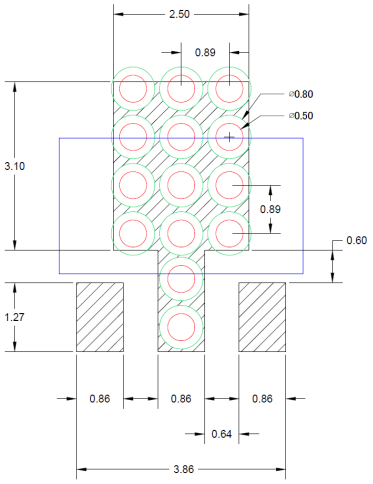


NOTE:
1. DIMENSIONS IN MILLIMETERS.
2. DIMENSION D DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.5mm PER END. DIMENSION E1 DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.5mm PER SIDE.
3. DIMENSIONS D AND E1 ARE DETERMINED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY EXCLUSIVE OF MOLD FLASH, TIE BAR BURRS, GATE BURRS AND INTERLEAD FLASH, BUT INCLUDING ANY MISMATCH BETWEEN THE TOP AND BOTTOM OF THE PLASTIC BODY.
4. DATUMS A, B AND D TO BE DETERMINED 0.18mm FROM THE LEAD TIP.
5. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.

SYMBOL	MILLIMETERS MINIMUM	NOMINAL	MAXIMUM	NOTE
A	1.40	1.50	1.60	
A1	0.00	–	0.10	
b	0.38	0.42	0.48	
b1	0.48	0.52	0.58	
b2	1.79	1.82	1.87	
c	0.40	0.42	0.46	
D	4.40	4.50	4.70	2,3
E	3.70	4.00	4.30	
E1	2.40	2.50	2.70	2,3
E2	0.80	1.00	1.20	
E3	0.40	0.50	0.60	
e	1.50 TYP.			
θ	4° TYP.			
R	0.15 TYP.			
R1	–	–	0.20	

SYMBOL	TOLERANCES OF FORM AND POSITION	NOTE
aaa	0.15	
bbb	0.20	
ccc	0.10	
ddd	0.10	

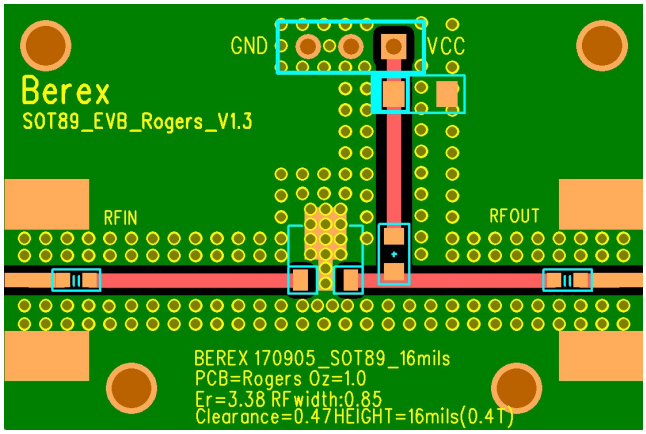
PCB Land Pattern



Note : All dimension _ millimeters

PCB lay out _ on BeRex website

PCB Mounting



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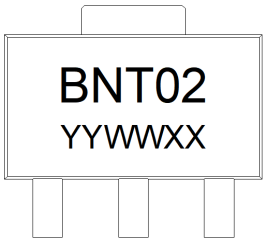
Preliminary Datasheet

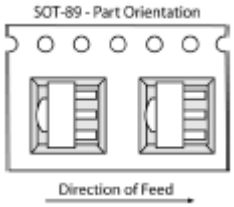
Package Marking



YY = Year, WW = Working Week,
XX = Wafer No.

Tape & Reel

SOT89



Packaging information:

Tape Width (mm): 12

Reel Size (inches): 7

Device Cavity Pitch (mm): 8

Devices Per Reel: 1000

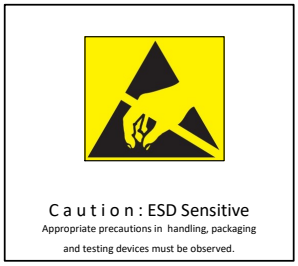
Lead plating finish

100% Tin Matte finish

(All BeRex products undergoes a 1 hour, 150 degree C, Anneal bake to eliminate thin whisker growth concerns.)

MSL / ESD Rating

ESD Rating:	Class 1C
Value:	**Passes <2000V**
Test:	Human Body Model (HBM)
Standard:	JEDEC Standard JESD22-A114B
MSL Rating:	**Level 1 at +265°C convection reflow**
Standard:	JEDEC Standard J-STD-020



Proper ESD procedures should be followed when handling this device.

NATO CAGE code:

2	**N**	**9**	**6**	**F**

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