Advanced Semiconductor Business Inc.

ASL13W

5-3000 MHz MMIC Amplifier

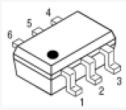
Features

- 13 dB Gain at 2000 MHz
- 22 dBm P1dB at 2000 MHz
- 38 dBm OIP3 at 2000 MHz
- 0.9 dB NF at 2000 MHz
- MTTF > 100 Years
- Single Supply

Description

The ASL13W, a wideband linear low noise amplifier MMIC, has a low noise and high linearity at low bias current, being suitable for use in both receiver and transmitter of telecommunication systems up to 3 GHz. S11 down to –20 dB is easily achieved for low noise application to provide a good productivity. The amplifier is available in an SOT-363 package and passes through the stringent DC, RF, and reliability tests.

RoHS-compliant



Package Style: SOT-363

Typical Performance

Parameters	Units	Typical				
Frequency	MHz	150	900	2000	2450	2600
Gain	dB	23.5	19	13	11.5	11
S11	dB	-15	-20	-20	-20	-18
S22	dB	-11	-15	-15	-16	-15
Output IP3[1)]	dBm	33	35.5	38	37.5	37.5
Noise Figure	dB	0.6	0.9	0.9	1.1	1.15
Output P1dB	dBm	21.5	22	22	22	22
Current	mA	60	60	60	60	60
Device Voltage	V	5	5	5	5	5

1) OIP3 is measured with two tones at an output power of +10 dBm/tone separated by 1 MHz.

Application Circuit

- IF (50 ~ 450 MHz)
- TETRA
- LTE
- CDMA
- GSM
- WCDMA
- 350 ~ 500 MHz
- 960 ~ 1200 MHz
- 2300 ~ 2600 MHz

Product Specifications

Parameters	Units	Min	Typ	Max
Testing Frequency	MHz		2000	
Gain	dB	12	13	
S11	dB		-20	
S22	dB		-15	
Output IP3	dBm	36	38	
Noise Figure	dB		0.9	1.1
Output P1dB	dBm	20	22	
Current	mA	45	60	80
Device Voltage	V		5	

Absolute Maximum Ratings

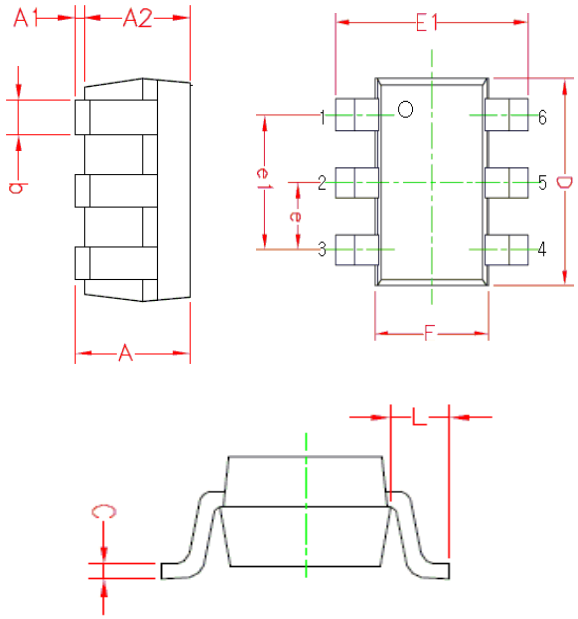
Parameters	Rating
Operating Case Temperature	-40 to +85°C
Storage Temperature	-40 to +150°C
Device Voltage	+6 V
Operating Junction Temperature	+150°C
Input RF Power (CW, 50ohm matched)*	22 dBm

* Please find the max. input power data from http://www.asb.co.kr/pdf/Maximum_Input_Power_Analysis.pdf

Pin Configuration

Pin No.	Function
1	RF IN
4	RF OUT / Bias
2,3,5,6	GND

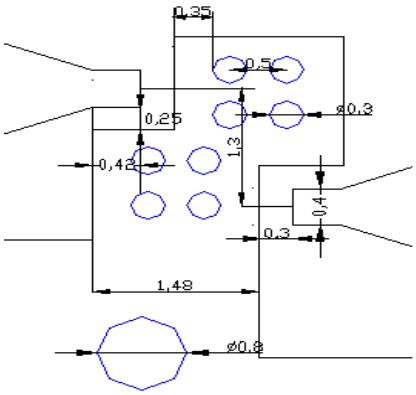
Outline Drawing



Symbols	Dimensions (In mm)		
	MIN	NOM	MAX
A	0.90	1.00	1.10
A1	0.025	0.062	0.10
A2	0.875	0.937	1.00
b	0.20	0.30	0.40
C	0.10	0.125	0.15
D	1.90	2.00	2.10
F	1.15	1.25	1.35
E1	2.00	2.10	2.20
e	--	0.65BSC	--
e1	--	1.30BSC	--
L	--	0.425REF	--

Pin NO.	Function	Pin NO.	Function.
1	RF IN	4	RF OUT / Bias
2	GND	5	GND
3	GND	6	GND

Mounting Recommendation (in mm)



Note: 1. The number and size of ground via holes in a circuit board is critical for thermal and RF grounding considerations.
2. We recommend that the ground via holes be placed on the bottom of lead pin 2 for better RF and thermal performance, as shown in the drawing at the left side.

ESD Classification & Moisture Sensitivity Level

ESD Classification	
HBM	Class 1A
	Voltage Level: 400 V
MM	Class A
	Voltage Level: 50 V

CAUTION: ESD-sensitive device!

Moisture Sensitivity Level (MSL)	
	Level 3 at 260°C reflow

OIP3 & Noise Figure Vs. Bias Resistor

R_D (ohm)	R_B (ohm)	V_D (V)	Ic (mA)	CDMA		WCDMA		R_D (ohm)	R_B (ohm)	V_D (V)	Ic (mA)	CDMA		WCDMA	
				NF (dB)	OIP3 (dBm)	NF (dB)	OIP3 (dBm)					NF (dB)	OIP3 (dBm)	NF (dB)	OIP3 (dBm)
8.2	5.6k	4.47	60	0.89	36	0.9	38.2	20	6.8k	3.87	51	0.83	35.3	0.89	37
	5.1k	4.58	56	0.89	34.5	0.89	36.2		6.2k	4.09	47	0.83	34	0.89	36
	4.7k	4.87	39	0.91	32	0.93	33.4		5.6k	4.28	39	0.86	32.2	0.89	34.7
	4.3k	4.9	28	0.88	28.7	0.9	30.1		5.1k	4.35	32	0.86	29.8	0.9	31.8
10	5.6k	4.38	58	0.87	35.6	0.89	37.5		4.7k	4.5	28	0.86	27.2	0.91	29.5
	5.1k	4.49	45	0.82	33.5	0.92	35.4	30	8.2k	3.31	57	0.8	34.9	0.88	37
	4.7k	4.6	38	0.84	31.4	0.9	32.2		7.5k	3.47	50	0.83	33.9	0.87	36.3
	4.3k	4.71	27	0.85	27.8	0.94	29.3		6.8k	3.68	44	0.82	32.8	0.87	35.3
12	6.2k	4.25	62	0.82	35.9	0.91	37.6		6.2k	3.84	38	0.83	30.8	0.88	33.4
	5.6k	4.33	51	0.82	35.1	0.89	36.8		5.6k	4.01	33	.81	28.7	0.89	31.6
	5.1k	4.49	42	0.81	32.4	0.91	34		5.1k	4.19	29	0.85	26.7	0.91	29.5
	4.7k	4.57	33	0.84	30	0.91	31.5								
	4.3k	4.7	28	0.86	27	0.91	29.2								
15	6.2k	4.15	57	0.82	35.3	0.93	37								
	5.6k	4.28	49	0.85	34.1	0.89	35.9								
	5.1k	4.4	38	0.84	31.7	0.88	33.3								
	4.7k	4.54	29	0.87	28.5	0.9	30.6								
	4.3k	4.63	26	0.85	26.1	0.92	28.9								

* Test Application Circuit : ASL13W CDMA / WCDMA application circuit

* OIP3 Test Condition : Freq. – 894MHz / – 2140MHz, +10dBm output power per tone

* V_D : Applied voltage to the device

APPLICATION CIRCUIT

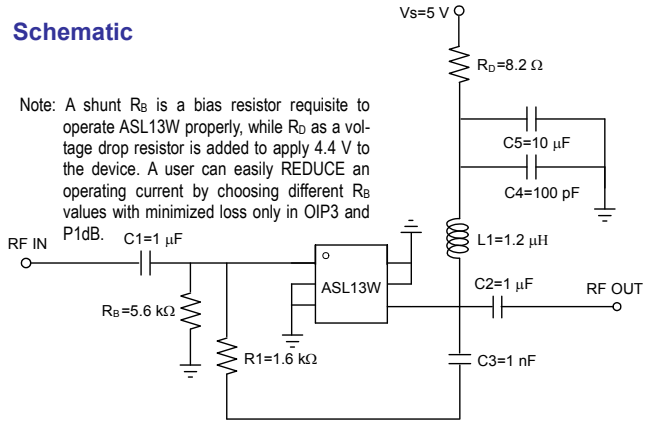
IF
50 ~ 450
+5 V

Frequency (MHz)	50	150	300	450
Magnitude S21 (dB)	24.7	23.5	22.3	21
Magnitude S11 (dB)	-12	-15	-14	-12
Magnitude S22 (dB)	-12	-11	-12	-13
Output P1dB (dBm)	21.5	21.5	21.5	21.5
Output IP3[1)] (dBm)	31	33	35	35
Noise Figure (dB)	0.8	0.6	0.8	0.8
Device Voltage (V)	5	5	5	5
Current (mA)	60	60	60	60

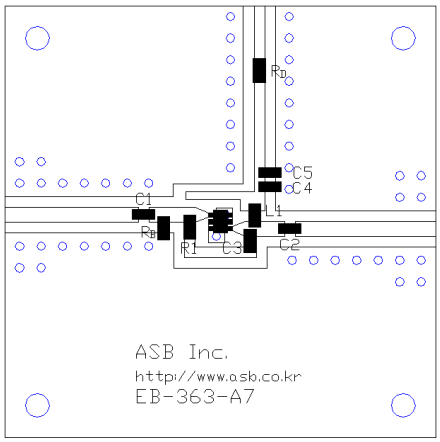
1) OIP3 is measured with two tones at an output power of +10 dBm/tone separated by 1 MHz.

Schematic

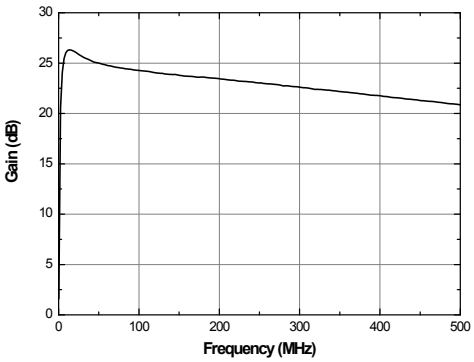
Note: A shunt R_B is a bias resistor requisite to operate ASL13W properly, while R_D as a voltage drop resistor is added to apply 4.4 V to the device. A user can easily REDUCE an operating current by choosing different R_B values with minimized loss only in OIP3 and P1dB.

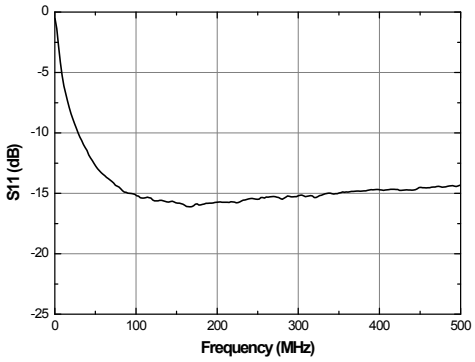


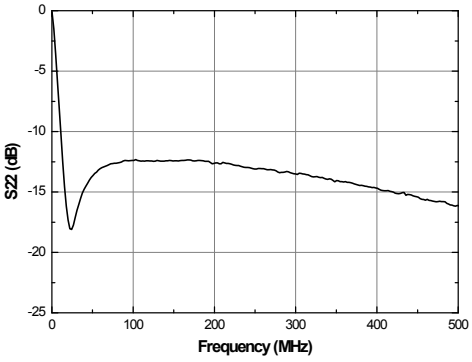
Board Layout (FR4, 40x40 mm^2, 0.8T)

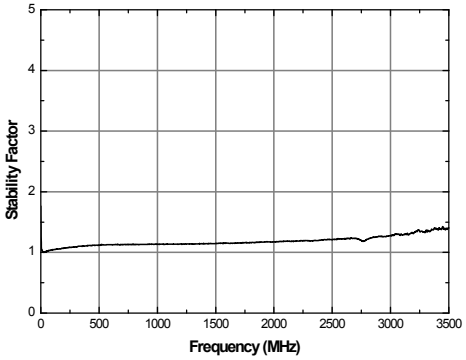


S-parameters & K-factor









APPLICATION CIRCUIT

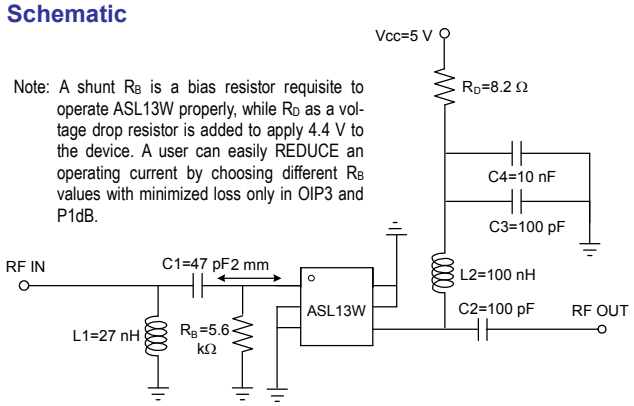
TETRA
420 ~ 460
+5 V

Frequency (MHz)	420~460
Magnitude S21 (dB)	23
Magnitude S11 (dB)	-15
Magnitude S22 (dB)	-18
Output P1dB (dBm)	22
Output IP3[1] (dBm)	34
Noise Figure (dB)	0.7
Device Voltage (V)	5
Current (mA)	60

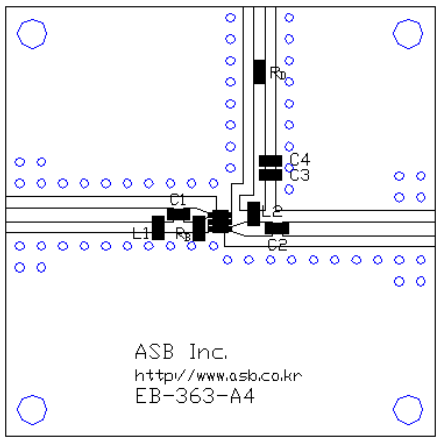
1) OIP3 is measured with two tones at an output power of +10 dBm/tone separated by 1 MHz.

Schematic

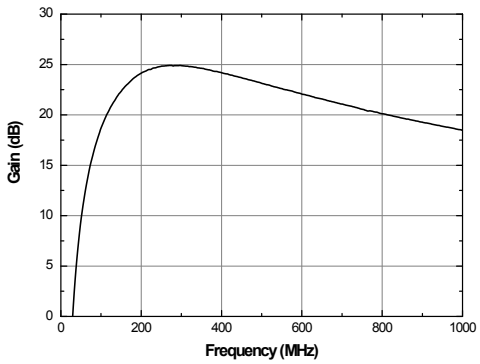
Note: A shunt R_B is a bias resistor requisite to operate ASL13W properly, while R_D as a voltage drop resistor is added to apply 4.4 V to the device. A user can easily REDUCE an operating current by choosing different R_B values with minimized loss only in OIP3 and P1dB.

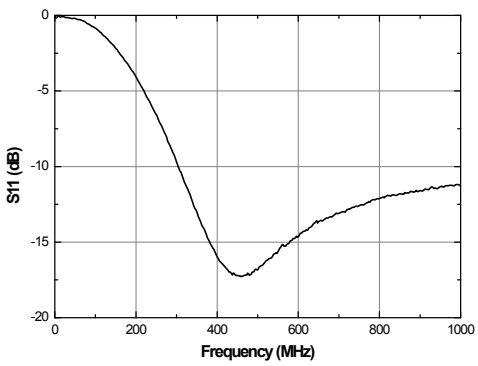


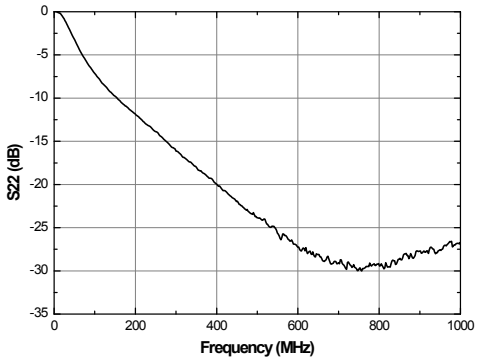
Board Layout (FR4, 40x40 mm^2, 0.8T)

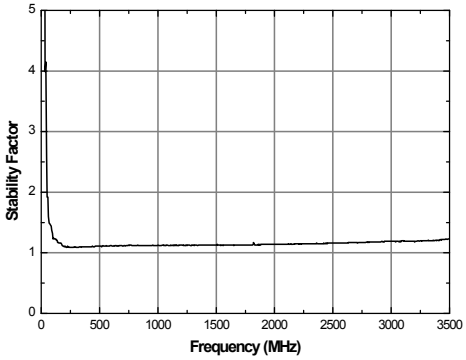


S-parameters & K-factor









APPLICATION CIRCUIT

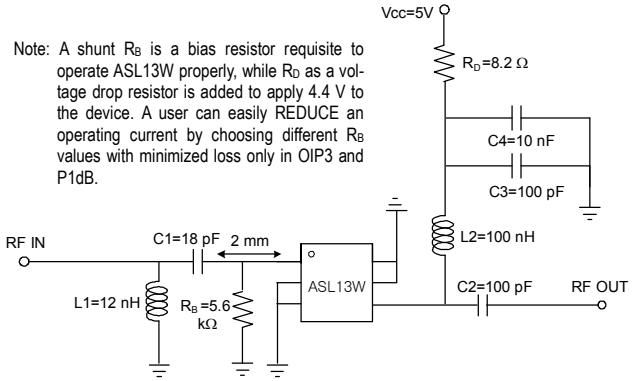
LTE
698 ~ 787
+5 V

Frequency (MHz)	698~787
Magnitude S21 (dB)	19.8
Magnitude S11 (dB)	-20
Magnitude S22 (dB)	-13
Output P1dB (dBm)	22
Output IP3[1] (dBm)	34.5
Noise Figure (dB)	0.75
Device Voltage (V)	5
Current (mA)	60

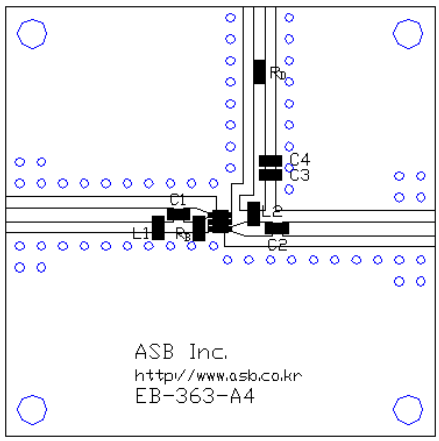
1) OIP3 is measured with two tones at an output power of +10 dBm/tone separated by 1 MHz.

Schematic

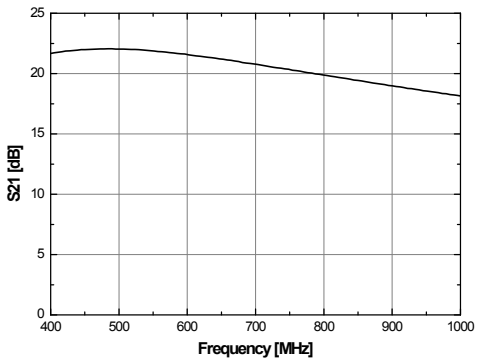
Note: A shunt R_B is a bias resistor requisite to operate ASL13W properly, while R_D as a voltage drop resistor is added to apply 4.4 V to the device. A user can easily REDUCE an operating current by choosing different R_B values with minimized loss only in OIP3 and P1dB.

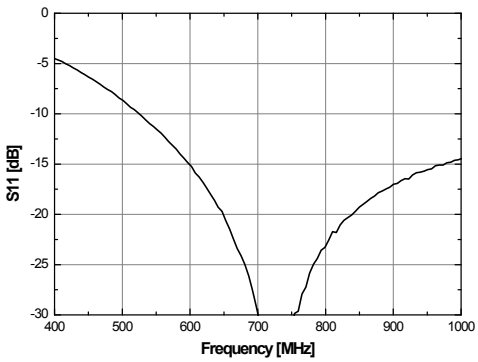


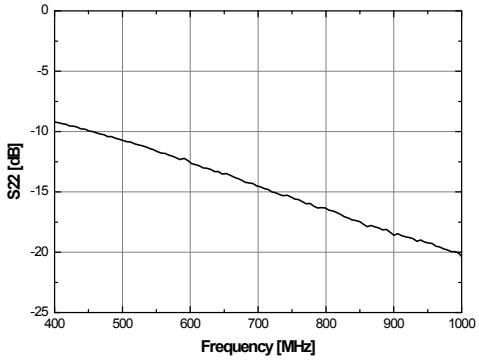
Board Layout (FR4, 40x40 mm^2, 0.8T)

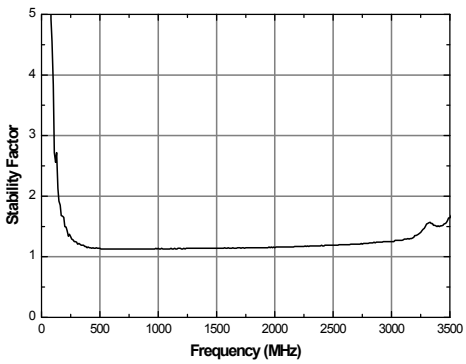


S-parameters & K-factor









APPLICATION CIRCUIT

CDMA & GSM

824 ~ 960

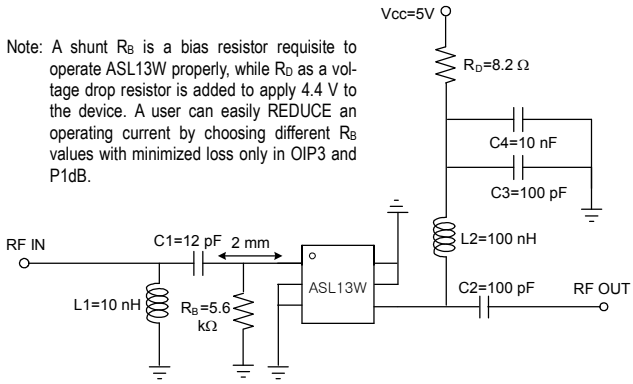
+5 V

Frequency (MHz)	824	894	890	960
Magnitude S21 (dB)	19.5	19	19	18.5
Magnitude S11 (dB)	-20	-20	-20	-18
Magnitude S22 (dB)	-14	-15	-15	-16
Output P1dB (dBm)	22		22	
Output IP3[1] (dBm)	35		35.5	
Noise Figure (dB)	0.9		0.95	
Device Voltage (V)	5		5	
Current (mA)	60		60	

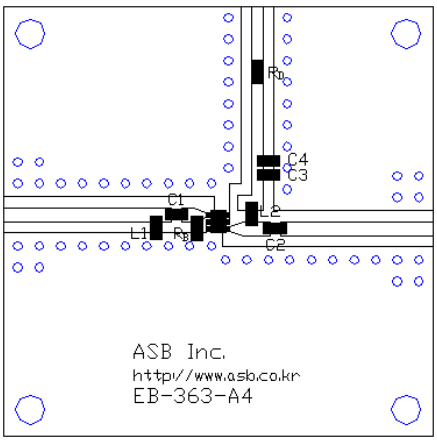
1) OIP3 is measured with two tones at an output power of +10 dBm/tone separated by 1 MHz.

Schematic

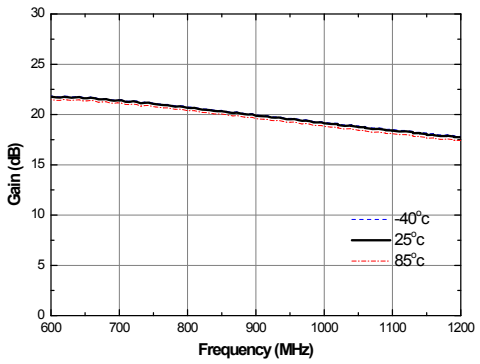
Note: A shunt R_B is a bias resistor requisite to operate ASL13W properly, while R_D as a voltage drop resistor is added to apply 4.4 V to the device. A user can easily REDUCE an operating current by choosing different R_B values with minimized loss only in OIP3 and P1dB.

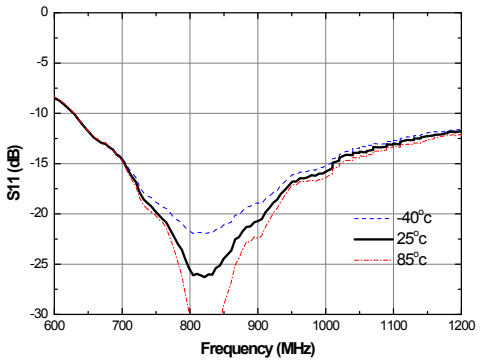


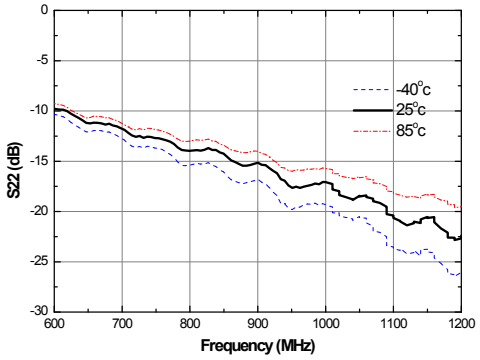
Board Layout (FR4, 40x40 mm^2, 0.8T)

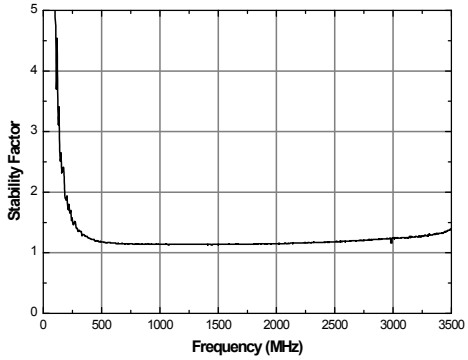


S-parameters & K-factor

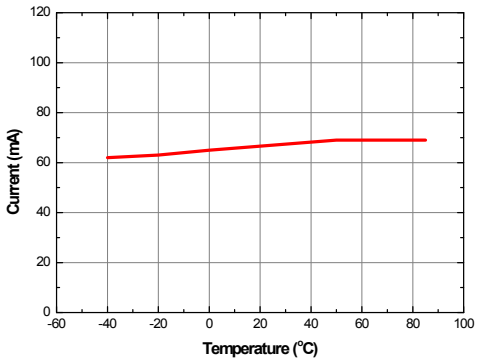




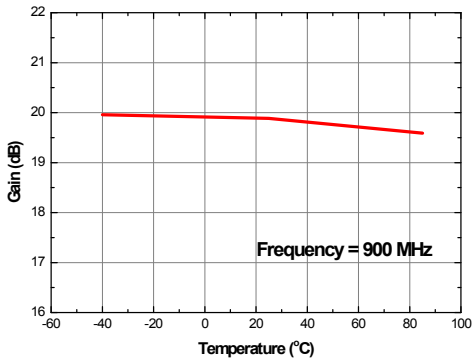




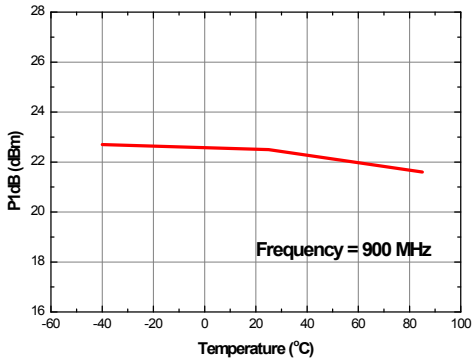
Current vs. Temperature



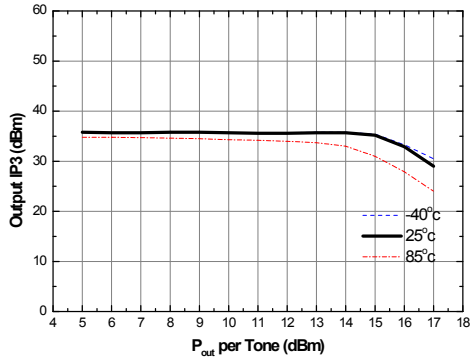
Gain vs. Temperature



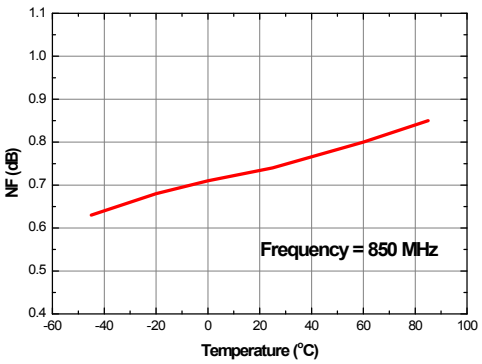
P1dB vs. Temperature



Output IP3 vs. Tone Power (Frequency = 900 MHz)



NF vs. Temperature (Frequency = 850MHz)



APPLICATION CIRCUIT

WCDMA

1920 ~ 2170

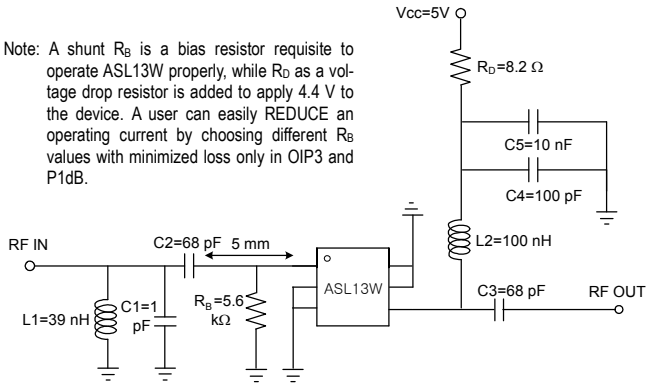
+5 V

Frequency (MHz)	1920	1980	2110	2170
Magnitude S21 (dB)	13.2	13	12.3	12.2
Magnitude S11 (dB)	-20	-20	-18	-17
Magnitude S22 (dB)	-15	-15	-15	-15
Output P1dB (dBm)	22		22	
Output IP3[1)] (dBm)	38		38	
Noise Figure (dB)	0.9		0.95	
Device Voltage (V)	5		5	
Current (mA)	60		60	

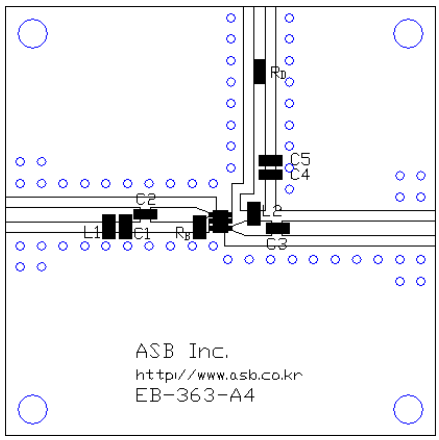
1) OIP3 is measured with two tones at an output power of +10 dBm/tone separated by 1 MHz.

Schematic

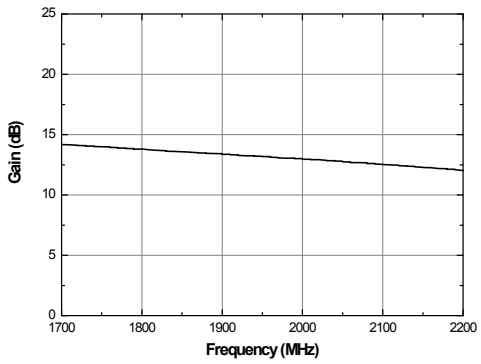
Note: A shunt R_B is a bias resistor requisite to operate ASL13W properly, while R_D as a voltage drop resistor is added to apply 4.4 V to the device. A user can easily REDUCE an operating current by choosing different R_B values with minimized loss only in OIP3 and P1dB.

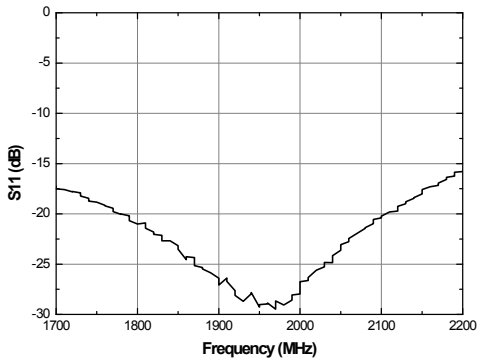


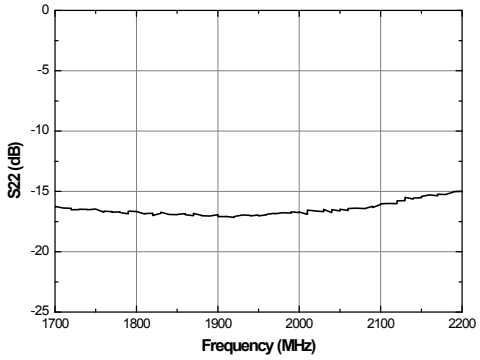
Board Layout (FR4, 40x40 mm^2, 0.8T)

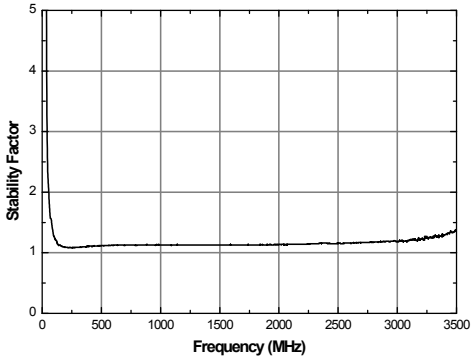


S-parameters & K-factor

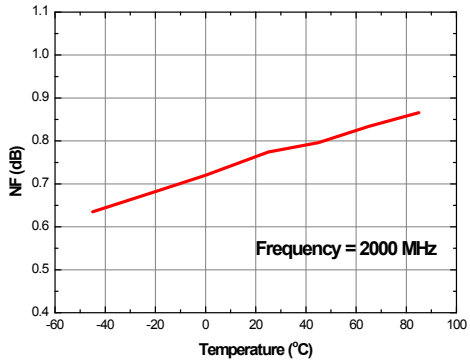








NF vs. Temperature



APPLICATION CIRCUIT

350 ~ 500

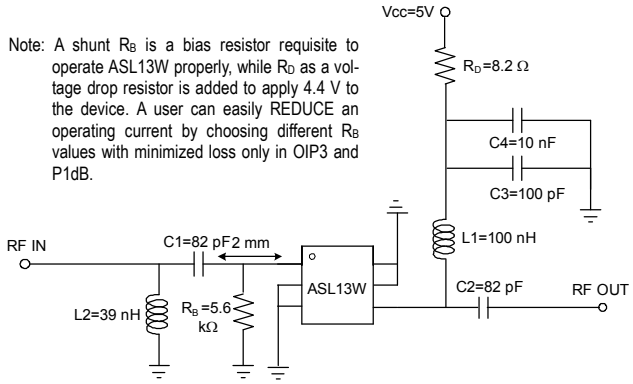
+5 V

Frequency (MHz)	350	430	500
Magnitude S21 (dB)	24	23	22.5
Magnitude S11 (dB)	-15	-15	-15
Magnitude S22 (dB)	-18	-18	-20
Output P1dB (dBm)	21	21.5	21.5
Output IP3[1] (dBm)	33	34	34.5
Noise Figure (dB)	0.85	0.85	0.85
Device Voltage (V)	5	5	5
Current (mA)	60	60	60

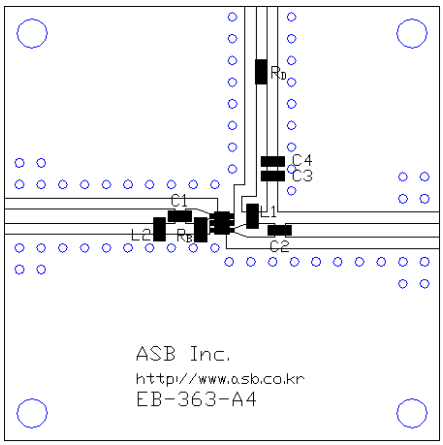
1) OIP3 is measured with two tones at an output power of +10 dBm/tone separated by 1 MHz.

Schematic

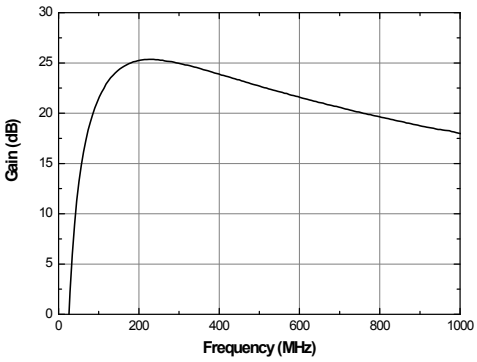
Note: A shunt R_B is a bias resistor requisite to operate ASL13W properly, while R_D as a voltage drop resistor is added to apply 4.4 V to the device. A user can easily REDUCE an operating current by choosing different R_B values with minimized loss only in OIP3 and P1dB.

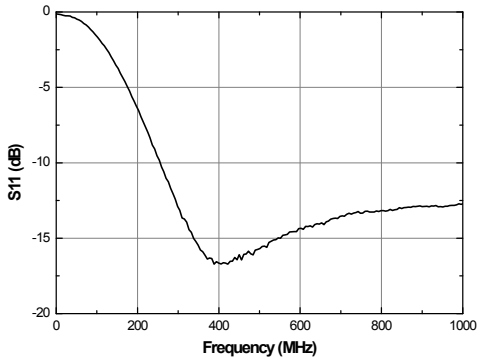


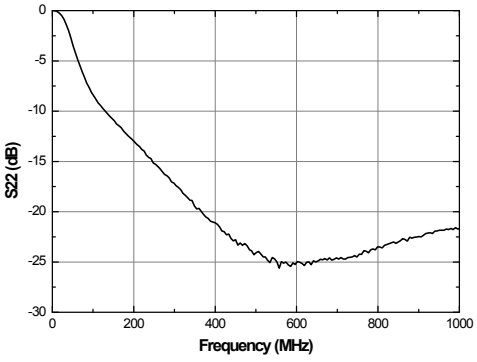
Board Layout (FR4, 40x40 mm^2, 0.8T)

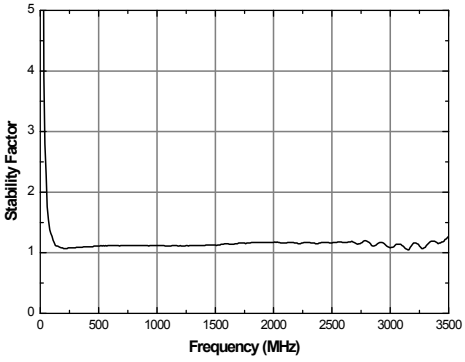


S-parameters & K-factor









APPLICATION CIRCUIT

960 ~ 1200

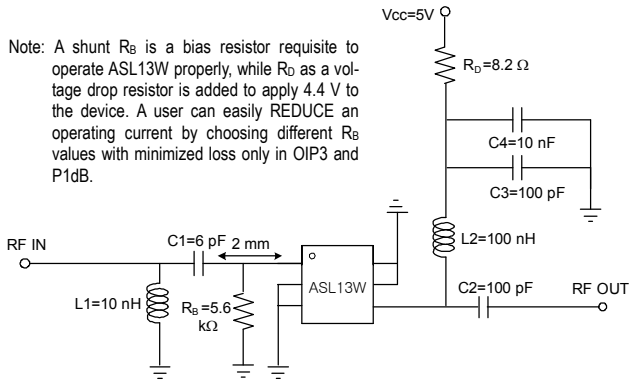
+5 V

Frequency (MHz)	960	1200
Magnitude S21 (dB)	18.5	17
Magnitude S11 (dB)	-15	-15
Magnitude S22 (dB)	-15	-17
Output P1dB (dBm)	22	22
Output IP3[1] (dBm)	35.5	37
Noise Figure (dB)	0.95	0.9
Device Voltage (V)	5	5
Current (mA)	60	60

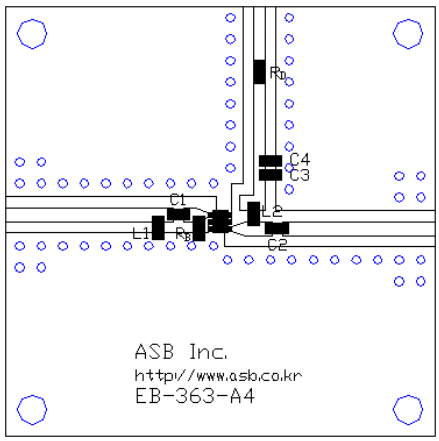
1) OIP3 is measured with two tones at an output power of +10 dBm/tone separated by 1 MHz.

Schematic

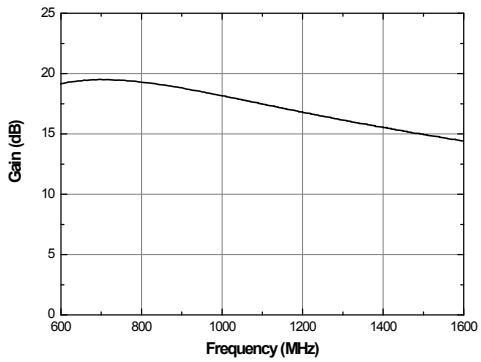
Note: A shunt R_B is a bias resistor requisite to operate ASL13W properly, while R_D as a voltage drop resistor is added to apply 4.4 V to the device. A user can easily REDUCE an operating current by choosing different R_B values with minimized loss only in OIP3 and P1dB.

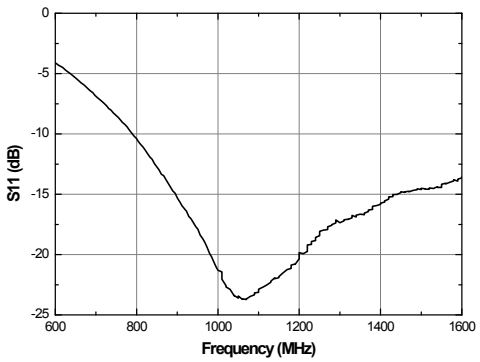


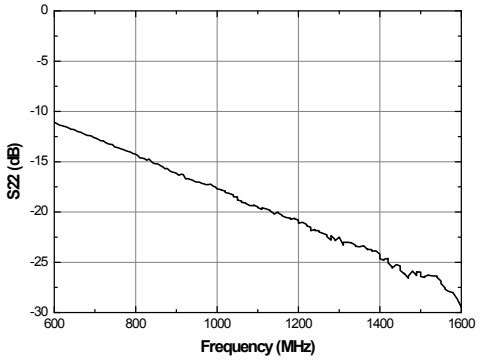
Board Layout (FR4, 40x40 mm^2, 0.8T)

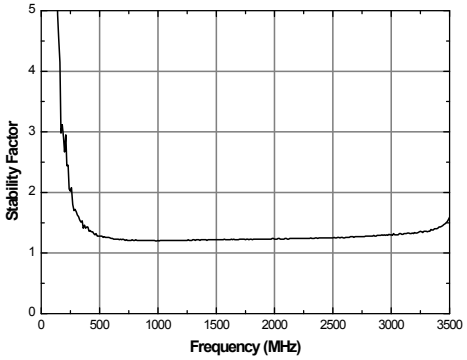


S-parameters & K-factor









APPLICATION CIRCUIT

2300 ~ 2600

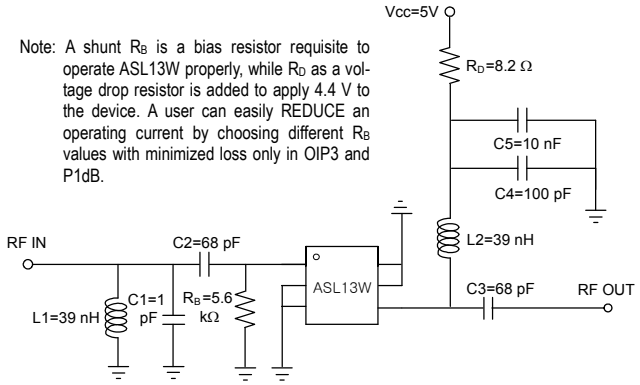
+5 V

Frequency (MHz)	2300	2450	2600
Magnitude S21 (dB)	12	11.5	11
Magnitude S11 (dB)	-20	-20	-18
Magnitude S22 (dB)	-16	-16	-15
Output P1dB (dBm)	22	22	22
Output IP3[1)] (dBm)	38	37.5	37.5
Noise Figure (dB)	1.0	1.1	1.15
Device Voltage (V)	5	5	5
Current (mA)	60	60	60

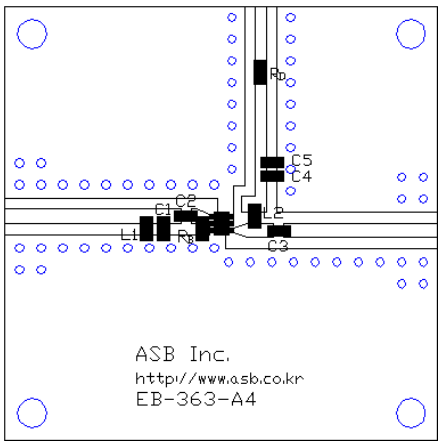
1) OIP3 is measured with two tones at an output power of +10 dBm/tone separated by 1 MHz.

Schematic

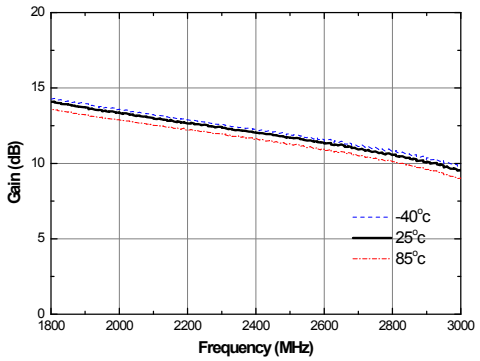
Note: A shunt R_B is a bias resistor requisite to operate ASL13W properly, while R_D as a voltage drop resistor is added to apply 4.4 V to the device. A user can easily REDUCE an operating current by choosing different R_B values with minimized loss only in OIP3 and P1dB.

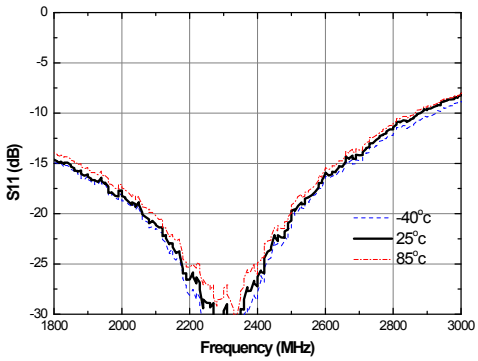


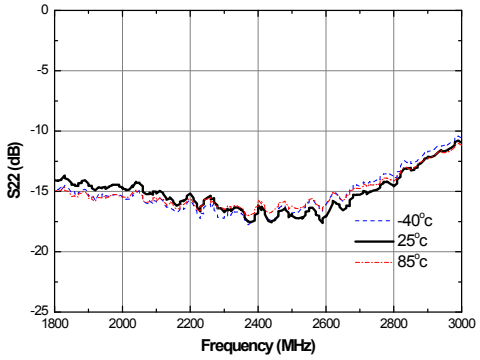
Board Layout (FR4, 40x40 mm^2, 0.8T)

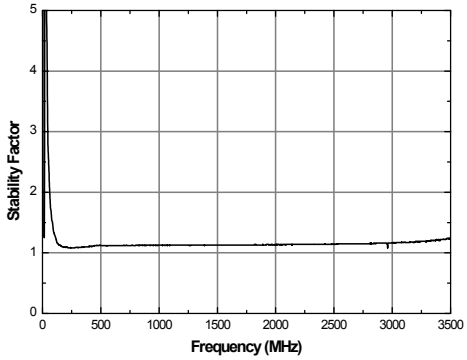


S-parameters & K-factor

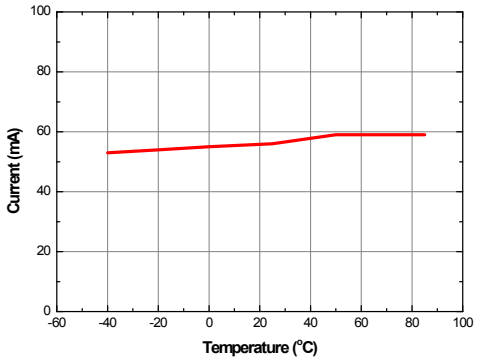




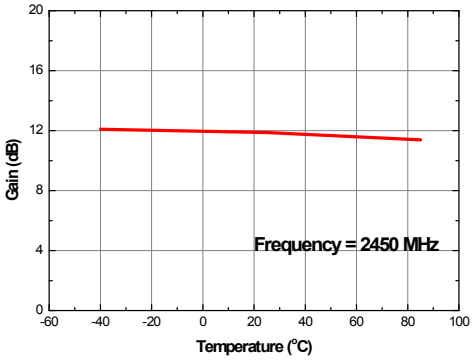




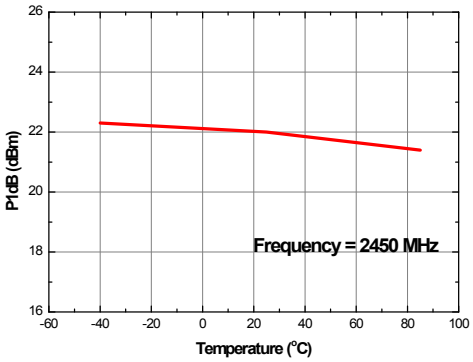
Current vs. Temperature



Gain vs. Temperature



P1dB vs. Temperature



Output IP3 vs. Tone Power (Frequency = 2450 MHz)