ASL13C

5 ~ 3000 MHz MMIC Amplifier

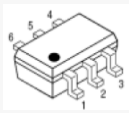
Features

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

Description

The ASL13C is 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 a SOT363 package and passes through the stringent DC, RF, and reliability tests.

RoHS-compliant



Package Style: SOT363

Typical Performance

(Supply Voltage = +5 V, T_A = +25 °C, Z_0 = 50 Ω)

Parameters	Units	Typical	
Frequency	MHz	824 ~ 960	1920 ~ 2170
Gain	dB	18.5	13.0
S11	dB	-18	-16
S22	dB	-10	-10
Output IP3[1)]	dBm	34.5	36.5
Noise Figure	dB	0.85	0.75
Output P1dB	dBm	22	22
Current	mA	59	59
Device Voltage	V	+4.5	+4.5

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

Product Specifications

(Supply Voltage = +5 V, T_A = +25 °C, Z_0 = 50 Ω)

Parameters	Units	Min	Typ	Max
Testing Frequency	MHz		2000	
Gain	dB	12	13	
S11	dB		-18	
S22	dB		-12	
Output IP3	dBm	34.5	36.5	
Noise Figure	dB		0.75	0.95
Output P1dB	dBm	20	22	
Current	mA		59	
Device Voltage	V		+4.5	

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, 50 Ω matched as in 2000 MHz application circuit)*	+22 dBm
Thermal Resistance	184 °C/W

The operation of this device in excess of any of these limits may cause permanent damage.

* Refer to the max. input power data at http://www.asb.co.kr/pdf/Maximum_Input_Power_Analysis.pdf. The max. Input RF power, in principle, depends upon the application frequency, the matching circuit, and device voltage.

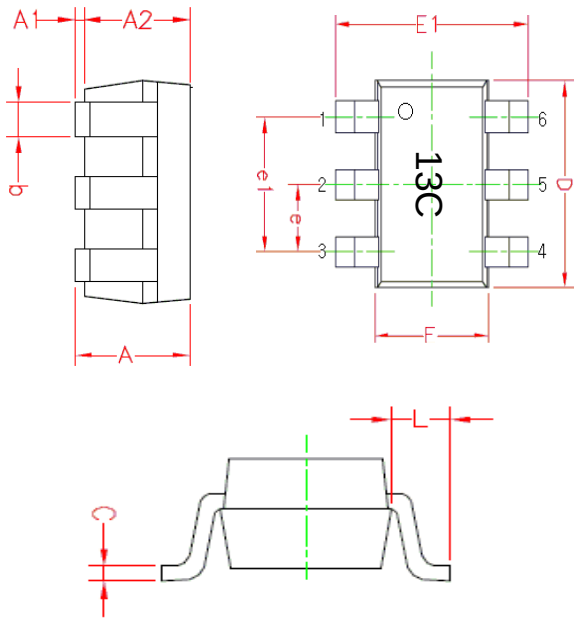
Application Circuit

- CDMA & GSM
- WCDMA
- TETRA
- IF
- 2000 MHz (3.3 V, 59 mA)
- 2100 ~ 2400 MHz (5 V, 59 mA)
- IF (30 ~ 600 MHz)

Pin Configuration

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

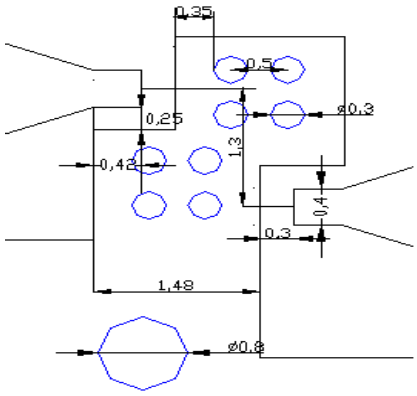
Outline Drawing



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: Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

Moisture Sensitivity Level (MSL)

Level 3 at 260 °C reflow

APPLICATION CIRCUIT

CDMA & GSM

824 ~ 960 MHz

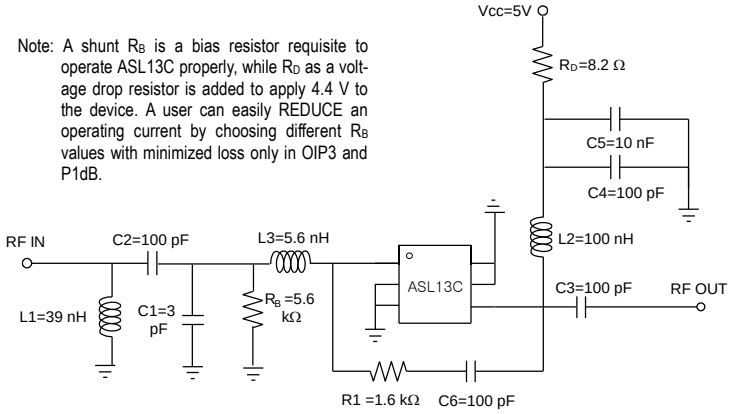
+5 V

Frequency (MHz)	824	894	890	960
Magnitude S21 (dB)	19.0	18.5	18.5	18.0
Magnitude S11 (dB)	-18	-18	-18	-18
Magnitude S22 (dB)	-10	-10	-10	-10
Output P1dB (dBm)	22		22	
Output IP3[1)] (dBm)	34.5		34.5	
Noise Figure (dB)	0.80		0.85	
Device Voltage (V)	+4.5		+4.5	
Current (mA)	59		59	

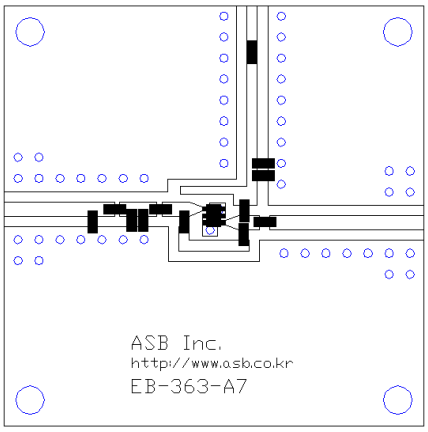
1) OIP3 is measured with two tones at an output power of +10 dBm/tone separated by 1 MHz.

Schematic

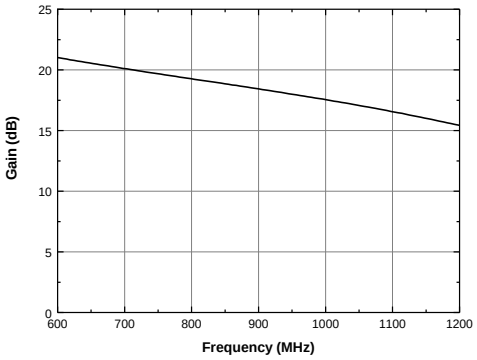
Note: A shunt R_B is a bias resistor requisite to operate ASL13C properly, while R_D as a voltage drop resistor is added to apply 4.4 V to the device. A user can easily REDUCE an operating current by choosing different R_B values with minimized loss only in OIP3 and P1dB.

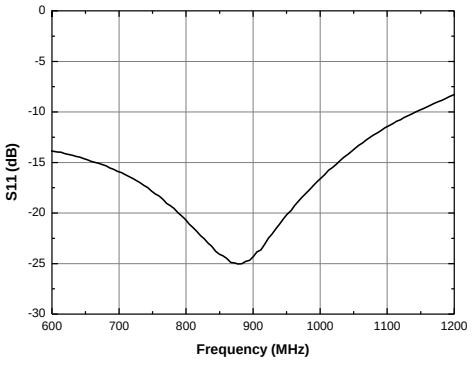


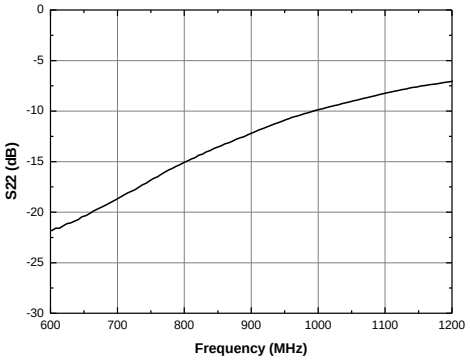
Board Layout (FR4, 40x40 mm², 0.8T)

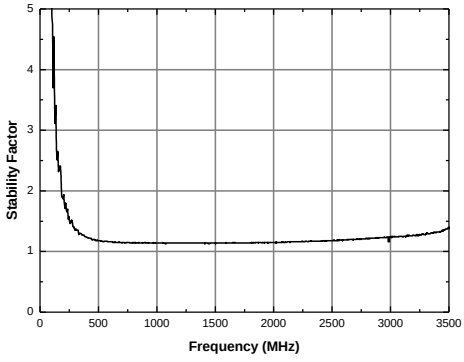


S-parameters & K-factor









APPLICATION CIRCUIT

WCDMA

1920 ~ 2170 MHz

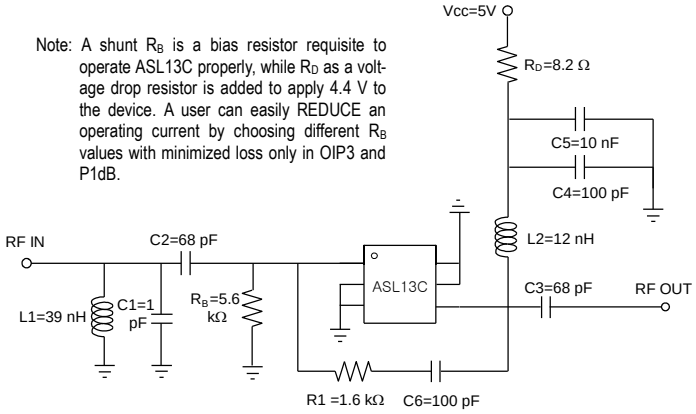
+5 V

Frequency (MHz)	1920	2170
Magnitude S21 (dB)	13.5	12.5
Magnitude S11 (dB)	-18	-16
Magnitude S22 (dB)	-14	-10
Output P1dB (dBm)	22	22
Output IP3[1)] (dBm)	37.0	36.5
Noise Figure (dB)	0.75	0.75
Device Voltage (V)	+4.5	+4.5
Current (mA)	59	59

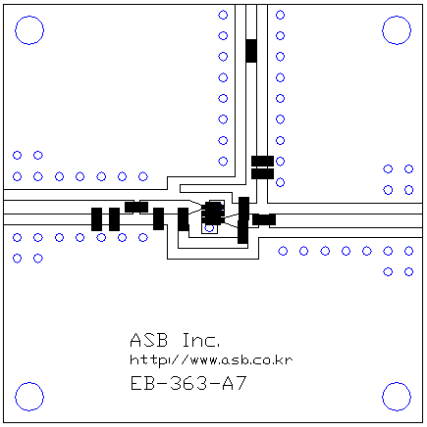
1) OIP3 is measured with two tones at an output power of +10 dBm/tone separated by 1 MHz.

Schematic

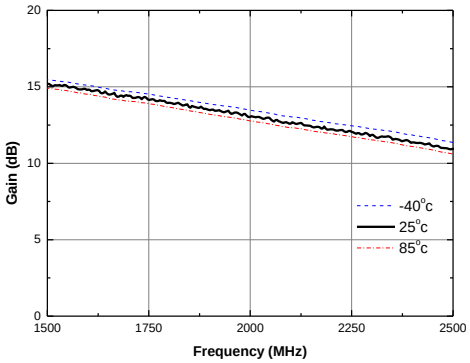
Note: A shunt R_B is a bias resistor requisite to operate ASL13C properly, while R_D as a voltage drop resistor is added to apply 4.4 V to the device. A user can easily REDUCE an operating current by choosing different R_B values with minimized loss only in OIP3 and P1dB.

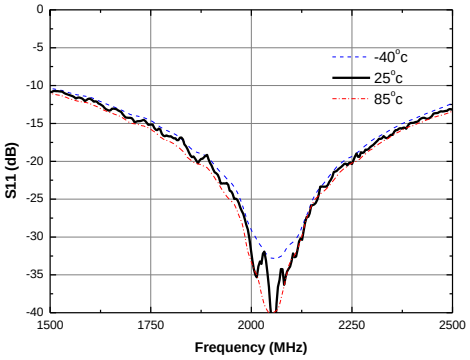


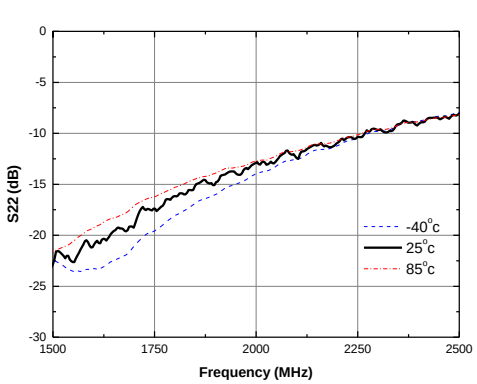
Board Layout (FR4, 40x40 mm², 0.8T)

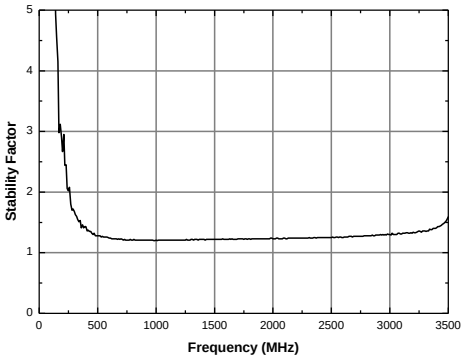


S-parameters & K-factor

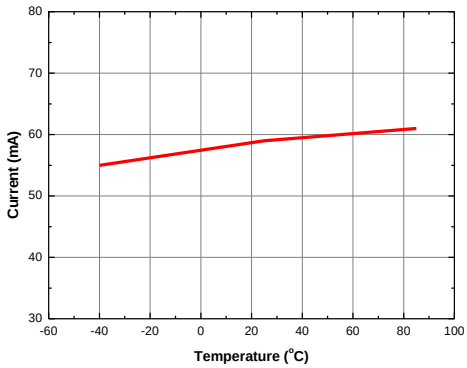




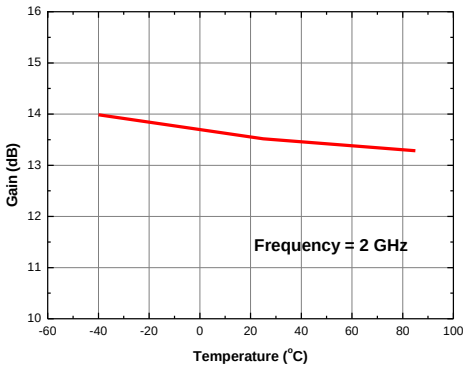




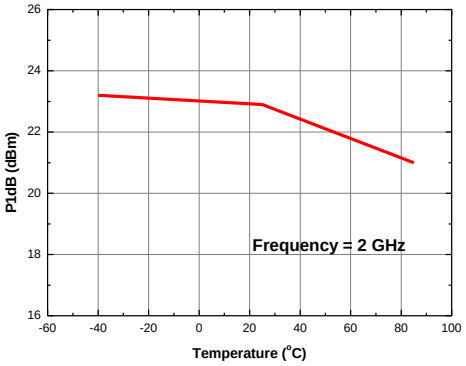
Current vs. Temperature



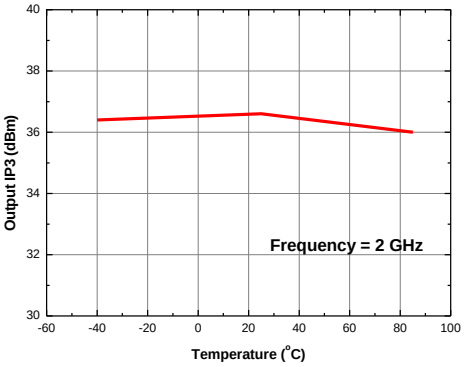
Gain vs. Temperature



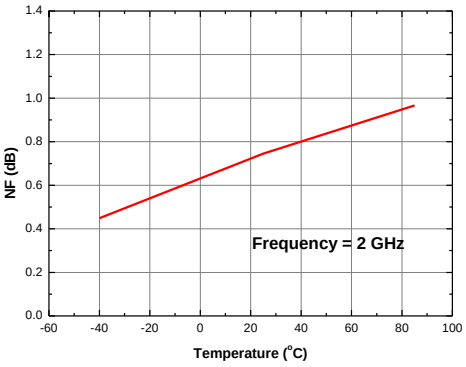
P1dB vs. Temperature



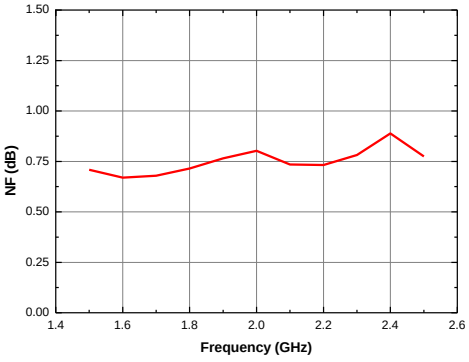
Output IP3 vs. Temperature



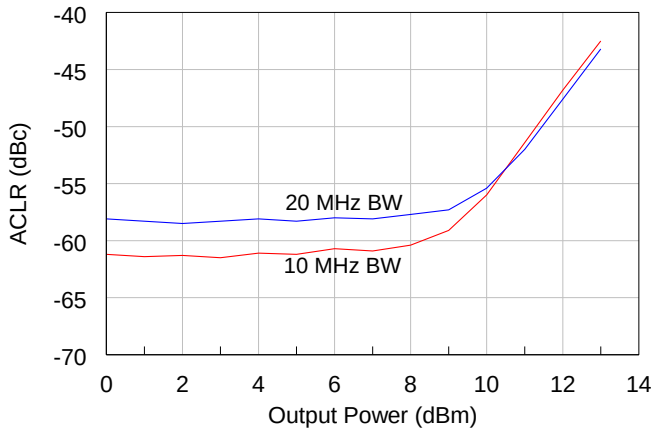
NF vs. Temperature



NF vs. Frequency

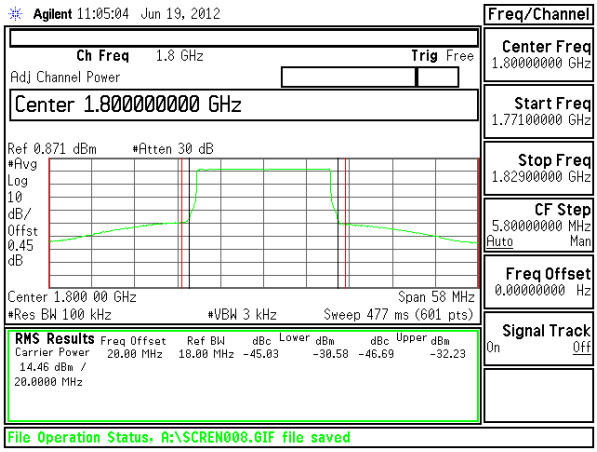


LTE ACLR – 10 MHz & 20 MHz



1) Test Source : LTE_FDD_test model 3.1, BW: 10 MHz & 20 MHz, Test Frequency: 1.8 GHz

LTE ACLR – 20 MHz



2) Test Source : LTE_FDD_test model 3.1, BW: 20 MHz, Test Frequency: 1.8 GHz

APPLICATION CIRCUIT

TETRA

350 ~ 450 MHz

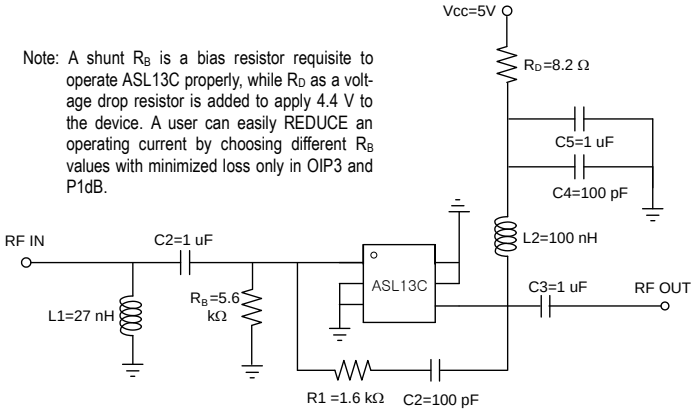
+5 V

Frequency (MHz)	350	400	450
Magnitude S21 (dB)	24.0	23.5	23.0
Magnitude S11 (dB)	-18	-18	-18
Magnitude S22 (dB)	-10	-10	-10
Output P1dB (dBm)	22	22	22
Output IP3[1)] (dBm)	32.5	33.0	33.5
Noise Figure (dB)	0.95	0.90	0.85
Device Voltage (V)	+4.5	+4.5	+4.5
Current (mA)	59	59	59

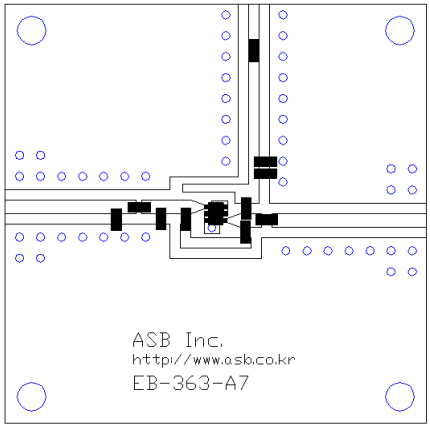
1) OIP3 is measured with two tones at an output power of +10 dBm/tone separated by 1 MHz.

Schematic

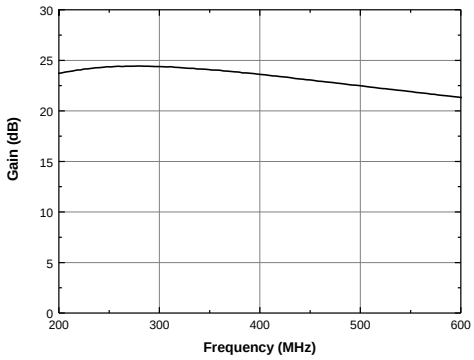
Note: A shunt R_B is a bias resistor requisite to operate ASL13C properly, while R_D as a voltage drop resistor is added to apply 4.4 V to the device. A user can easily REDUCE an operating current by choosing different R_B values with minimized loss only in OIP3 and P1dB.

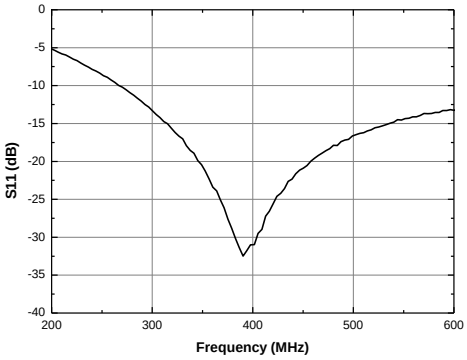


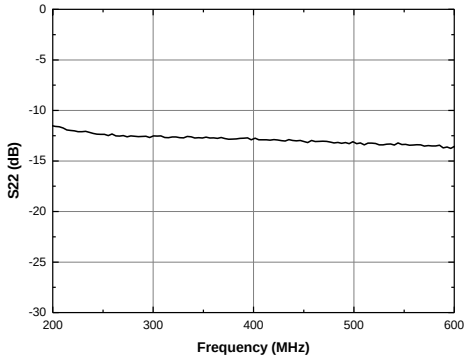
Board Layout (FR4, 40x40 mm², 0.8T)

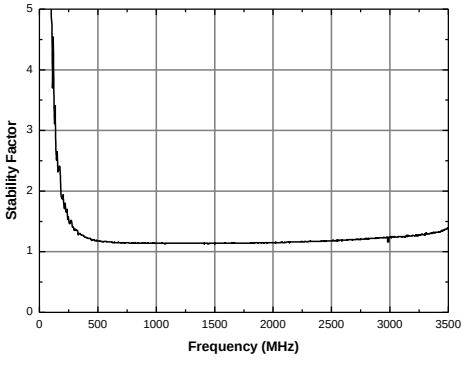


S-parameters & K-factor









APPLICATION CIRCUIT

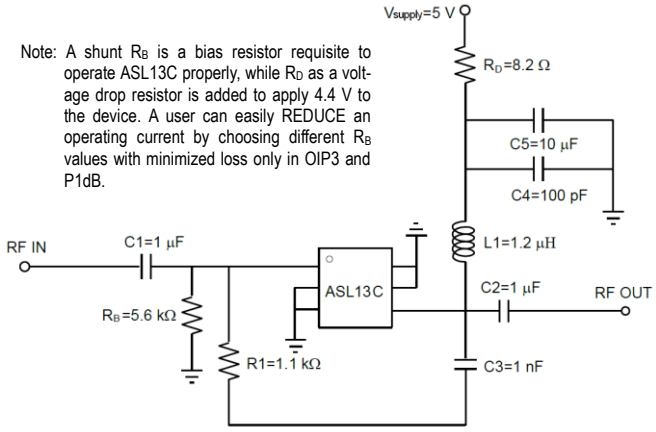
IF
30 ~ 450 MHz
+5 V

Frequency (MHz)	30	150	300	450
Magnitude S21 (dB)	25.0	24.5	23.5	22.0
Magnitude S11 (dB)	-15	-15	-14	-13
Magnitude S22 (dB)	-12	-13	-14	-15
Output P1dB (dBm)	22	22	22	22
Output IP3[1)] (dBm)	31	33	35	35
Noise Figure (dB)	0.85	0.75	0.75	0.70
Device Voltage (V)	+4.5	+4.5	+4.5	+4.5
Current (mA)	59	59	59	59

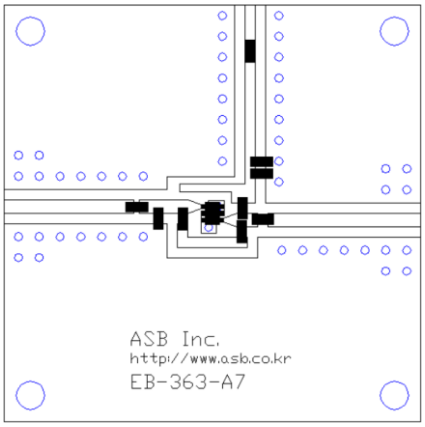
1) OIP3 is measured with two tones at an output power of +10 dBm/tone separated by 1 MHz.

Schematic

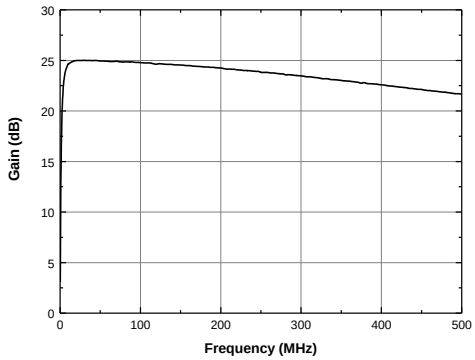
Note: A shunt R_B is a bias resistor requisite to operate ASL13C properly, while R_D as a voltage drop resistor is added to apply 4.4 V to the device. A user can easily REDUCE an operating current by choosing different R_B values with minimized loss only in OIP3 and P1dB.

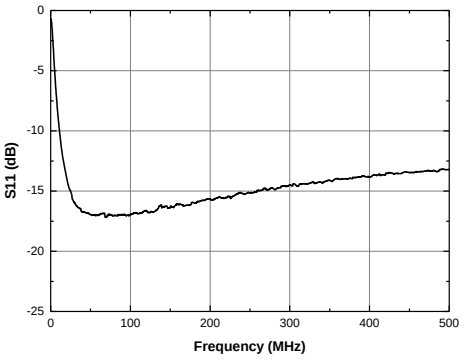


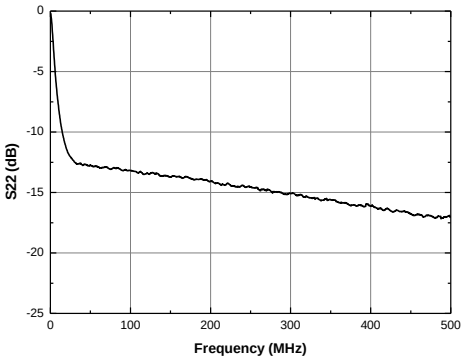
Board Layout (FR4, 40x40 mm², 0.8T)

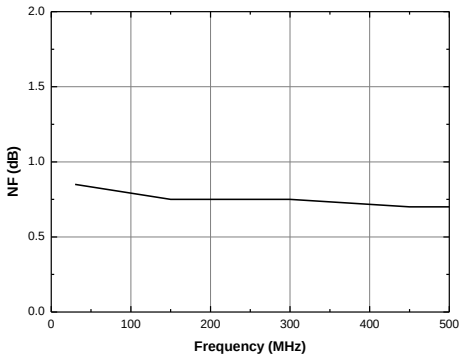


S-parameters & Noise Figure









APPLICATION CIRCUIT

2000 MHz

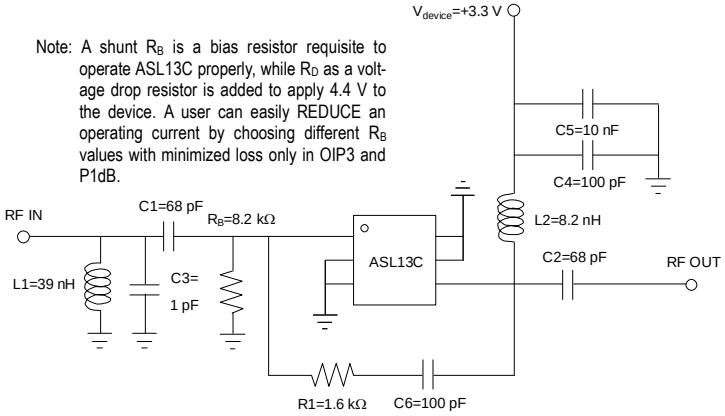
+3.3 V

Frequency (MHz)	2000
Magnitude S21 (dB)	13
Magnitude S11 (dB)	-18
Magnitude S22 (dB)	-13
Output P1dB (dBm)	19
Output IP3[1] (dBm)	35
Noise Figure (dB)	0.7
Device Voltage (V)	3.3
Current (mA)	59

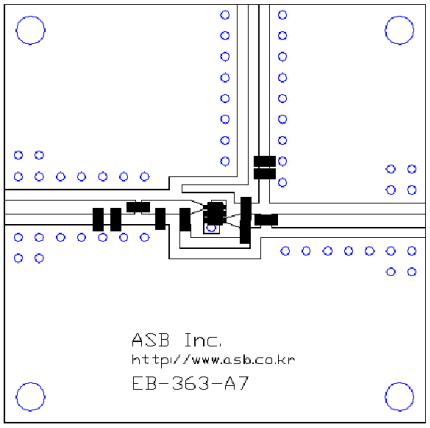
1) OIP3 is measured with two tones at an output power of +4 dBm/tone separated by 1 MHz.

Schematic

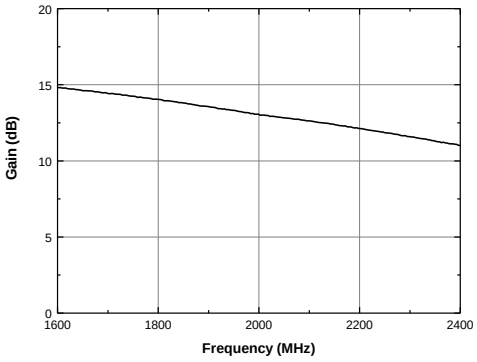
Note: A shunt R_B is a bias resistor requisite to operate ASL13C properly, while R_D as a voltage drop resistor is added to apply 4.4 V to the device. A user can easily REDUCE an operating current by choosing different R_B values with minimized loss only in OIP3 and P1dB.

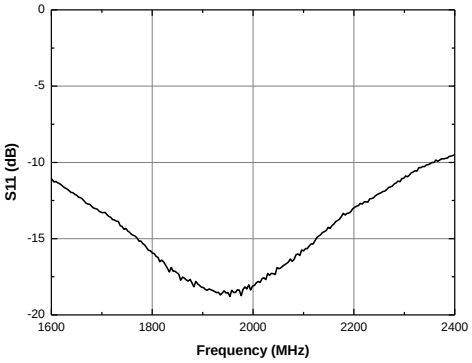


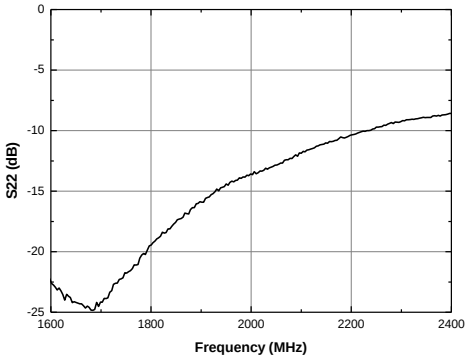
Board Layout (FR4, 40x40 mm², 0.8T)

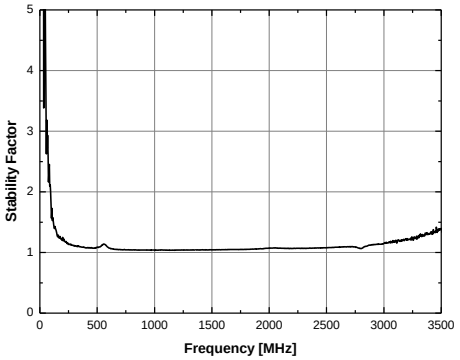


S-parameters & K-factor









APPLICATION CIRCUIT

2100 ~ 2400 MHz

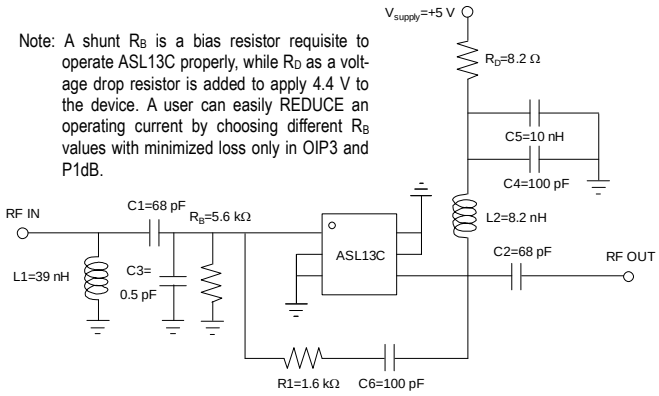
+5 V

Frequency (MHz)	2100	2400
Magnitude S21 (dB)	12.4	11.3
Magnitude S11 (dB)	-13	-16
Magnitude S22 (dB)	-18	-12
Output P1dB (dBm)	22.5	22.5
Output IP3[1)] (dBm)	36	36
Noise Figure (dB)	0.9	0.8
Device Voltage (V)	+4.5	+4.5
Current (mA)	59	59

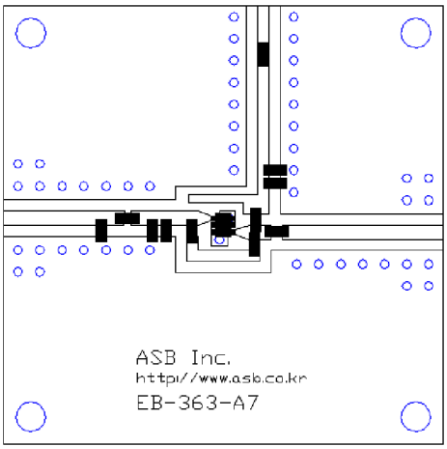
1) OIP3 is measured with two tones at an output power of +10 dBm/tone separated by 1 MHz.

Schematic

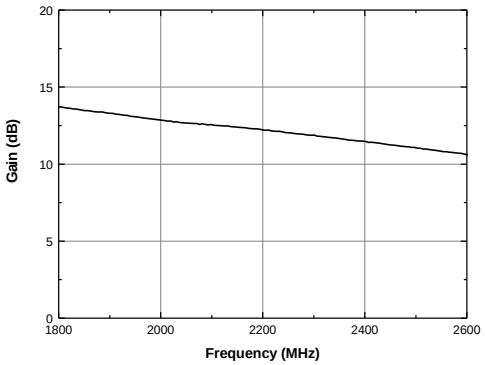
Note: A shunt R_B is a bias resistor requisite to operate ASL13C properly, while R_D as a voltage drop resistor is added to apply 4.4 V to the device. A user can easily REDUCE an operating current by choosing different R_B values with minimized loss only in OIP3 and P1dB.

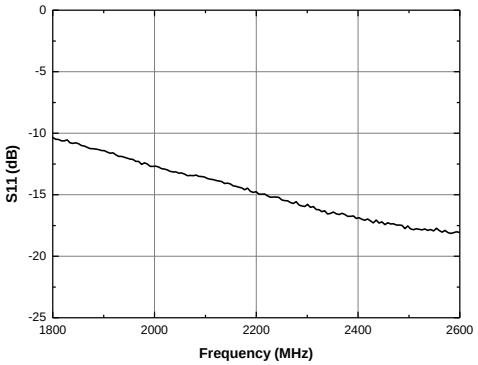


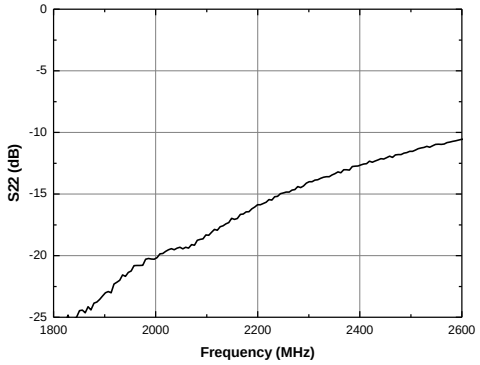
Board Layout (FR4, 40x40 mm², 0.8T)

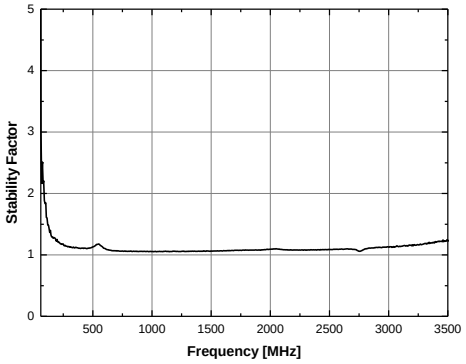


S-parameters & K-factor









APPLICATION CIRCUIT

IF

30 ~ 600 MHz

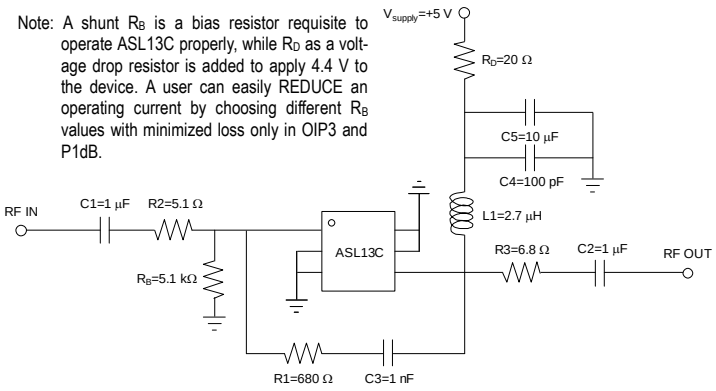
+5 V

Frequency (MHz)	30	88	220	600
Magnitude S21 (dB)	20.5	20.5	20.0	18.0
Magnitude S11 (dB)	-20	-21	-18	-14
Magnitude S22 (dB)	-13	-13	-13	-15
Output P1dB (dBm)	17	18	18	18
Output IP3[1)] (dBm)	27	29	30	30
Noise Figure (dB)	1.6	1.3	1.5	1.3
Device Voltage (V)	+4.22	+4.22	+4.22	+4.22
Current (mA)	39	39	39	39

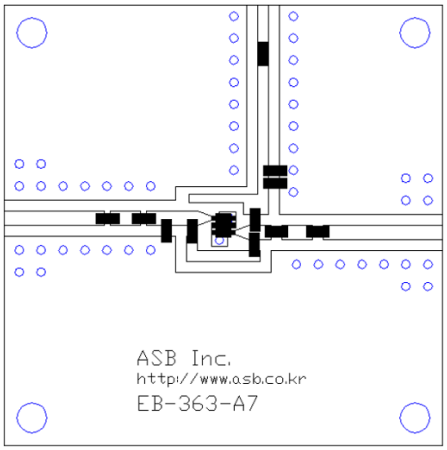
1) OIP3 is measured with two tones at an output power of +5 dBm/tone separated by 1 MHz.

Schematic

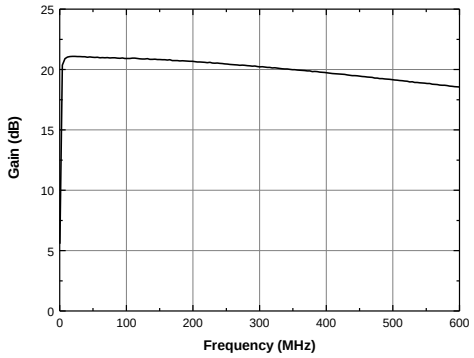
Note: A shunt R_B is a bias resistor requisite to operate ASL13C properly, while R_D as a voltage drop resistor is added to apply 4.4 V to the device. A user can easily REDUCE an operating current by choosing different R_B values with minimized loss only in OIP3 and P1dB.

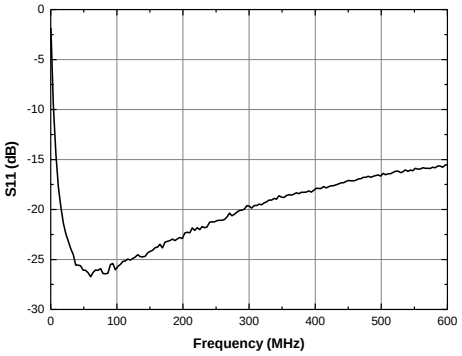


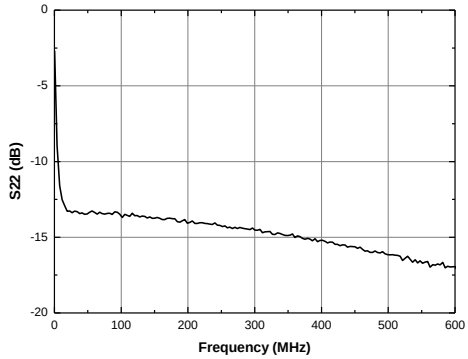
Board Layout (FR4, 40x40 mm², 0.8T)

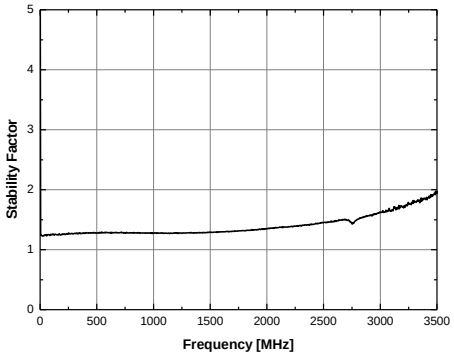


S-parameters & K-factor









Recommended Soldering Reflow Profile