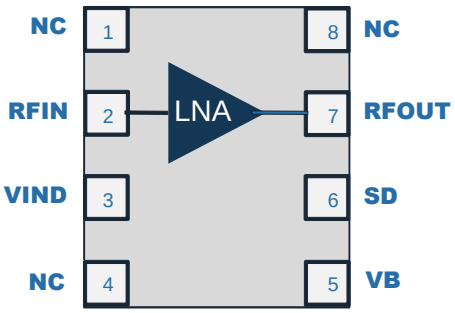
RFLA1022

Low Noise, High Linearity Amplifier 400MHz to 1500MHz

Package: DFN, 8-pin, 2.0mm x 2.0mm

RFMD's RFLA1022 is a Low Noise, High Linearity Amplifier housed in a 2.0mm x 2.0mm DFN package. The LNA features a shutdown (SD) pin that can be used to turn off the LNA. The V_{BIAS} (VB) pin can be used to adjust the current of the LNA. Noise figure of 0.45dB and an IIP3 of 27dBm make this component ideal for receiver input lineups. This module is internally matched to 50Ω on all RF ports but does require DC blocks and bias feed inductors.



Functional Block Diagram

Features

- Frequency Range 400MHz to 1500MHz
- Matched Internally, DC Blocks Required
- Shutdown Mode
- Gain = 17.5dB at 880MHz
- Noise Figure of 0.45dB Typical
- Input IP3 = 27dBm
- Single +3V / +5V Supply
- Small 8-Pin, 2.0mm x 2.0mm DFN

Applications

- LTE, TD-LTE, 3G, and 2G Cellular Infrastructure Application
- PA Driver Amplifiers
- Low Noise, High Linearity Gain Blocks

Ordering Information

RFLA1022SQ	Sample bag with 25 pieces
RFLA1022SR	7" Reel with 100 pieces
RFLA1022TR7	7" Reel with 2500 pieces
RFLA1022PCK-410	400MHz to 1500MHz PCBA with 5-piece sample bag

RF Micro Devices Inc. 7628 Thorndike Road, Greensboro, NC 27409-9421
For sales or technical support, contact RFMD at +1.336.678.5570 or customerservice@rfmd.com.

DS140616

Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Voltage	+5.5	V_{DC}
Control Voltage	+5.5	V_{DC}
DC Supply Current	230	mA
Power Dissipation	1.25	W
Max RF Input Power	32	dBm
Storage Temperature	-40 to +150	°C
ESD Rating (HBM)	250	V
Moisture Sensitivity Level	MSL1	

Caution! ESD sensitive device.

RFMD Green: RoHS status based on EU Directive 2011/65/EU (at time of this document revision), halogen free per IEC 61249-2-21, < 1000ppm each of antimony trioxide in polymeric materials and red phosphorus as a flame retardant, and <2% antimony in solder.

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

Recommended Operating Condition

Parameter	Specification			Unit
	Min	Typ	Max	
Operating Temperature Range	-40		+85	°C
Operating Junction Temperature			150	°C
Supply Voltage		5[1]		V
		3[2]		V

Notes
1. 5V Operation
2. 3V Operation

Nominal Operating Parameters

Parameter	Specification			Unit	Condition
	Min	Typ	Max		
LNA Performance					**Temp = 25°C, V_{CC} = 5V, 140mA, 880MHz, Standard Application Circuit**
Frequency Range	400		1500	MHz	
Gain (On Mode)		17.5		dB	SD = 5V
Noise Figure		0.45		dB	
Input P1dB		5.5		dBm	
Input IP3		27		dBm	
Gain (Off Mode)		10		dB	SD = 0V
Input Return Loss		-16		dB	SD = 5V
Output Return Loss		-15		dB	
LNA Performance					**Temp = 25°C, V_{CC} = 3V, 80mA, 880MHz, Standard Application Circuit**
Frequency Range	400		1500	MHz	

Parameter	Specification			Unit	Condition
	Min	Typ	Max		
LNA Performance - Continued					**Temp = 25°C, V_{CC} = 3V, 80mA, 880MHz, Standard Application Circuit**
Gain (On Mode)		16.5		dB	SD = 3V
Noise Figure		0.39		dB	
Input P1dB		2.5		dBm	
Input IP3		17		dBm	
Gain (Off Mode)		0		dB	SD = 0V
Input Return Loss		-14.5		dB	SD = 3V
Output Return Loss		-17		dB	
Overall					
SD Voltage	0		VCC	V	5V Operation
Logic High			VCC	V	
Logic Low	0			V	
SD Voltage	0		VCC	V	3V Operation
Logic High			VCC	V	
Logic Low	0			V	
Thermal Resistance		51		°C/W	85°C at 120mA, 5V
Current					
Current		140		mA	On Mode, SD =5V, 5V operation
		1		mA	Off Mode, SD = 0V, 5V operation
		80		mA	On Mode, SD = 3V, 3V operation
		1		mA	Off mode, SD = 0V, 3V operation

Typical RF Performance: 5V, 800MHz 25°C

Parameter	Unit	1.1V	1.4V	2.0V	2.6V	3.2V	3.8V	4.2V	4.5V
Gain	dB	16.42	16.6	16.9	17	17.1	17.2	17.2	17.2
Noise Figure	dB	0.34	0.34	0.35	0.35	0.37	0.40	0.43	0.44
Input IP3	dBm	16.12	14	17.7	21.5	24	28.1	29	27.5
Input P1dB	dBm	-3.2	-1.42	0.96	2.8	4.2	5.4	5.87	6.22
Input Return Loss	dB	-14	-14.5	-15.2	-15.5	-15.6	-15.8	-15.8	-15.9
Output Return Loss	dB	-13	-14	-14.4	-14.8	-15	-15.1	-15.2	-15.2
VCC Current	mA	32	43	65	85	106	126	140	150
SD Current	mA	0.238	0.24	0.23	0.28	0.22	0.22	0.22	0.23
VB Current	mA	0.63	0.89	1.43	1.97	2.5	3.06	3.42	3.68

Typical RF Performance: 3V, 800MHz, 25°C

Parameter	Unit	1.3V	1.6V	1.9V	2.2V	2.85V	3.0V
Gain	dB	16.1	16.3	16.4	16.6	16.7	16.8
Noise Figure	dB	0.36	0.34	0.34	0.35	0.36	0.36
Input IP3	dBm	13.92	13.3	14.2	15.2	15.9	16
Input P1dB	dBm	-2.7	-1.21	0	0.8	2.1	2.2
Input Return Loss	dB	-13	-13.5	-13.8	-14	-14.4	-14.5
Output Return Loss	dB	-14.9	-15.6	-16.1	-16.4	-16.8	-16.9
VCC Current	mA	32	42	52	62	82	88
SD Current	mA	0.11	0.11	0.1	0.1	0.1	0.1
VB Current	mA	0.79	1.06	1.32	1.58	2.2	2.3

Typical RF Performance: 5V, 25°C, VB = 1.1V

Parameter	Unit	400MHz	600MHz	800MHz	1000MHz	1200MHz	1500MHz
Gain	dB	22.47	19.37	17.17	15.33	13.76	11.77
Noise Figure	dB	0.28	0.36	0.34	0.42	0.46	0.55
Input IP3	dBm	10.91	13.45	16.12	15.58	15.36	15.73
Input P1dB	dBm	-4.59	-3.47	-3.16	-3.27	-3.2	-3.33
Input Return Loss	dB	-12.8	-13.26	-13.87	-14.38	-14.82	-14.91
Output Return Loss	dB	-17.12	-15.55	-13.68	-12.12	-10.85	-9.43
VCC Current	mA	32	32	32	32	32	32
SD Current	mA	0.23	0.34	0.24	0.23	0.23	0.23
VB Current	mA	0.61	0.61	0.63	0.62	0.63	0.62

Typical RF Performance: 5V, 25°C, VB = 1.4V

Parameter	Unit	400MHz	600MHz	800MHz	1000MHz	1200MHz	1500MHz
Gain	dB	22.72	19.58	17.4	15.54	13.97	11.99
Noise Figure	dB	0.26	0.34	0.34	0.41	0.45	0.55
Input IP3	dBm	10.47	12.1	14	15.47	16.84	18.96
Input P1dB	dBm	-3.15	-1.77	-1.42	-1.64	-1.63	-1.71
Input Return Loss	dB	-13.78	-13.93	-14.42	-14.94	-15.34	-15.31
Output Return Loss	dB	-18.94	-16.71	-14.42	-12.66	-11.28	-9.75
VCC Current	mA	43	43	43	43	43	43
SD Current	mA	0.23	0.35	0.23	0.24	0.23	0.23
VB Current	mA	0.88	0.88	0.89	0.89	0.89	0.89

Typical RF Performance: 5V, 25°C, VB = 2.0V

Parameter	Unit	400MHz	600MHz	800MHz	1000MHz	1200MHz	1500MHz
Gain	dB	23	19.84	17.63	15.77	14.21	12.25
Noise Figure	dB	0.27	0.34	0.35	0.43	0.47	0.59
Input IP3	dBm	13.77	15.43	17.71	20.21	21.96	21.18
Input P1dB	dBm	-0.69	0.75	0.96	0.91	0.98	0.66
Input Return Loss	dB	-14.94	-14.64	-15.03	-15.53	-15.91	-15.67
Output Return Loss	dB	-20.91	-18.09	-15.27	-13.26	-11.71	-10.13
VCC Current	mA	65	65	65	65	65	65
SD Current	mA	0.22	0.37	0.23	0.23	0.23	0.23
VB Current	mA	1.41	1.41	1.43	1.42	1.42	1.41

Typical RF Performance: 5V, 25°C, VB = 2.6V

Parameter	Unit	400MHz	600MHz	800MHz	1000MHz	1200MHz	1500MHz
Gain	dB	23.14	19.96	17.77	15.92	14.35	12.4
Noise Figure	dB	0.27	0.35	0.35	0.44	0.48	0.62
Input IP3	dBm	17.13	19.4	21.5	22.31	21.35	19.41
Input P1dB	dBm	0.8	2.65	2.79	2.77	2.57	2.57
Input Return Loss	dB	-15.59	-15.05	-15.35	-15.8	-16.14	-15.82
Output Return Loss	dB	-21.75	-18.89	-15.69	-13.55	-11.95	-10.32
VCC Current	mA	85	85	85	85	85	85
SD Current	mA	0.22	0.37	0.23	0.24	0.23	0.23
VB Current	mA	1.95	1.96	1.97	1.96	1.96	1.96

Typical RF Performance: 5V, 25°C, VB = 3.2V

Parameter	Unit	400MHz	600MHz	800MHz	1000MHz	1200MHz	1500MHz
Gain	dB	23.23	20.04	17.85	15.99	14.44	12.5
Noise Figure	dB	0.28	0.35	0.37	0.47	0.5	0.66
Input IP3	dBm	19.34	21.37	23.98	22.84	21.05	19.09
Input P1dB	dBm	1.42	3.64	4.2	4.3	4.19	4.07
Input Return Loss	dB	-16.01	-15.3	-15.54	-15.98	-16.29	-15.86
Output Return Loss	dB	-22.09	-19.33	-15.94	-13.72	-12.06	-10.43
VCC Current	mA	106	106	106	106	106	106
SD Current	mA	0.22	0.37	0.22	0.23	0.22	0.23
VB Current	mA	2.5	2.5	2.51	2.5	2.51	2.5

Typical RF Performance: 5V, 25°C, VB = 3.8V

Parameter	Unit	400MHz	600MHz	800MHz	1000MHz	1200MHz	1500MHz
Gain	dB	23.69	20.1	17.91	16.05	14.53	12.57
Noise Figure	dB	0.3	0.37	0.4	0.48	0.57	0.69
Input IP3	dBm	19.63	20.34	28.06	23.74	22.6	19.78
Input P1dB	dBm	1.73	4.11	5.35	5.5	6.15	5.13
Input Return Loss	dB	-16.32	-15.44	-15.68	-16.09	-16.4	-15.87
Output Return Loss	dB	-22.16	-19.63	-16.1	-13.81	-12.17	-10.5
VCC Current	mA	126	126	126	126	126	126
SD Current	mA	0.22	0.38	0.22	0.22	0.22	0.22
VB Current	mA	3.05	3.06	3.06	3.05	3.41	3.05

Typical RF Performance: 5V, 25°C, VB = 4.2V

Parameter	Unit	400MHz	600MHz	800MHz	1000MHz	1200MHz	1500MHz
Gain	dB	23.31	20.12	17.94	16.08	14.53	12.59
Noise Figure	dB	0.32	0.4	0.43	0.51	0.57	0.73
Input IP3	dBm	19.06	19.27	29.04	24.85	22.6	20.53
Input P1dB	dBm	1.9	4.32	5.87	6.29	6.15	6
Input Return Loss	dB	-16.46	-15.53	-15.72	-16.15	-16.40	-15.88
Output Return Loss	dB	-22.13	-19.71	-16.14	-13.83	-12.17	-10.53
VCC Current	mA	140	140	140	140	140	140
SD Current	mA	0.22	0.38	0.22	0.22	0.22	0.22
VB Current	mA	3.41	3.41	3.42	3.41	3.41	3.41

Typical RF Performance: 5V, 25°C, VB = 4.5V

Parameter	Unit	400MHz	600MHz	800MHz	1000MHz	1200MHz	1500MHz
Gain	dB	23.32	20.14	17.94	16.09	14.54	12.62
Noise Figure	dB	0.34	0.42	0.44	0.54	0.59	0.75
Input IP3	dBm	18.46	18.57	27.54	25.71	23.56	21.21
Input P1dB	dBm	2	4.48	6.22	6.81	6.68	6.6
Input Return Loss	dB	-16.58	-15.59	-15.77	-16.14	-16.4	-15.87
Output Return Loss	dB	-22.14	-19.82	-16.18	-13.85	-12.16	-10.52
VCC Current	mA	150	150	150	150	150	150
SD Current	mA	0.22	0.38	0.22	0.21	0.22	0.22
VB Current	mA	3.67	3.68	3.69	3.68	3.68	3.68

Typical RF Performance: 3V, 25°C, VB = 1.3V

Parameter	Unit	400MHz	600MHz	800MHz	1000MHz	1200MHz	1500MHz
Gain	dB	22.17	19.01	16.81	14.98	13.44	11.51
Noise Figure	dB	0.28	0.35	0.36	0.42	0.46	0.55
Input IP3	dBm	9.25	11.24	13.92	14.78	15.39	16.71
Input P1dB	dBm	-4.91	-3.05	-2.69	-2.63	-2.57	-2.66
Input Return Loss	dB	-12.01	-12.34	-12.86	-13.39	-13.89	-14.19
Output Return Loss	dB	-20.78	-17.48	-15.61	-13.98	-12.65	-11.24
VCC Current	mA	32	32	32	32	32	32
SD Current	mA	0.1	0.21	0.11	0.11	0.1	0.11
VB Current	mA	0.78	0.78	0.79	0.79	0.79	0.8

Typical RF Performance: 3V, 25°C, VB = 1.6V

Parameter	Unit	400MHz	600MHz	800MHz	1000MHz	1200MHz	1500MHz
Gain	dB	22.42	19.24	17.03	15.19	13.65	11.73
Noise Figure	dB	0.27	0.34	0.34	0.41	0.46	0.56
Input IP3	dBm	9.17	10.85	13.27	15.34	17.11	19.8
Input P1dB	dBm	-3.69	-1.77	-1.21	-1.16	-1.09	-1.27
Input Return Loss	dB	-12.79	-12.88	-13.32	-13.87	-14.37	-14.61
Output Return Loss	dB	-24.18	-18.82	-16.48	-14.58	-13.11	-11.6
VCC Current	mA	42	42	42	42	42	42
SD Current	mA	0.1	0.22	0.1	0.1	0.1	0.1
VB Current	mA	1.04	1.05	1.06	1.06	1.06	1.06

Typical RF Performance: 3V, 25°C, VB = 1.9V

Parameter	Unit	400MHz	600MHz	800MHz	1000MHz	1200MHz	1500MHz
Gain	dB	22.58	19.39	17.19	15.34	13.8	11.88
Noise Figure	dB	0.27	0.34	0.34	0.43	0.45	0.57
Input IP3	dBm	9.74	11.52	14.22	16.82	18.89	20.82
Input P1dB	dBm	-2.86	-0.85	-0.04	-0.07	0.01	-0.07
Input Return Loss	dB	-13.33	-13.22	-13.62	-14.17	-14.69	-14.87
Output Return Loss	dB	-27.15	-19.74	-17	-14.96	-13.4	-11.85
VCC Current	mA	52	52	52	52	52	52
SD Current	mA	0.11	0.22	0.1	0.1	0.1	0.1
VB Current	mA	1.3	1.31	1.32	1.32	1.32	1.33

Typical RF Performance: 3V, 25°C, VB = 2.2V

Parameter	Unit	400MHz	600MHz	800MHz	1000MHz	1200MHz	1500MHz
Gain	dB	22.71	19.5	17.3	15.47	13.91	12.19
Noise Figure	dB	0.25	0.34	0.35	0.42	0.47	0.62
Input IP3	dBm	10.14	12.1	15.14	17.84	19.7	18.86
Input P1dB	dBm	-2.49	-0.25	0.8	0.91	0.98	2.63
Input Return Loss	dB	-13.76	-13.51	-13.88	-14.39	-14.92	-15.27
Output Return Loss	dB	-30.55	-20.49	-17.41	-15.19	-13.57	-12.15
VCC Current	mA	62	62	62	62	62	62
SD Current	mA	0.11	0.23	0.1	0.1	0.1	0.1
VB Current	mA	1.57	1.58	1.58	1.58	1.58	2.17

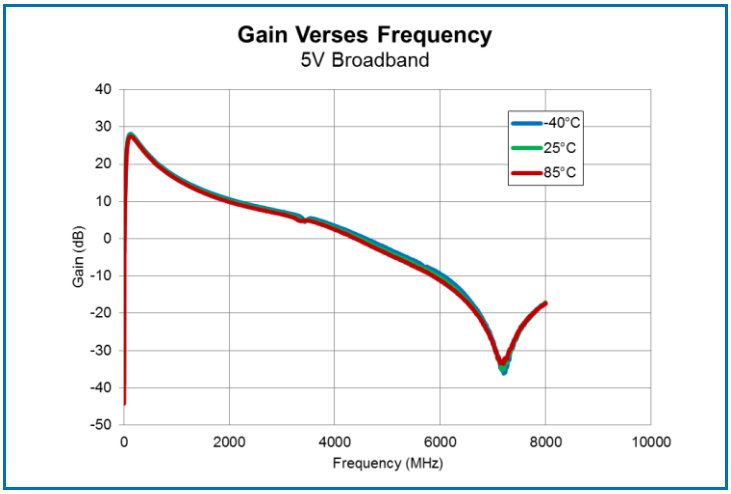
Typical RF Performance: 3V, 25°C, VB = 2.85V

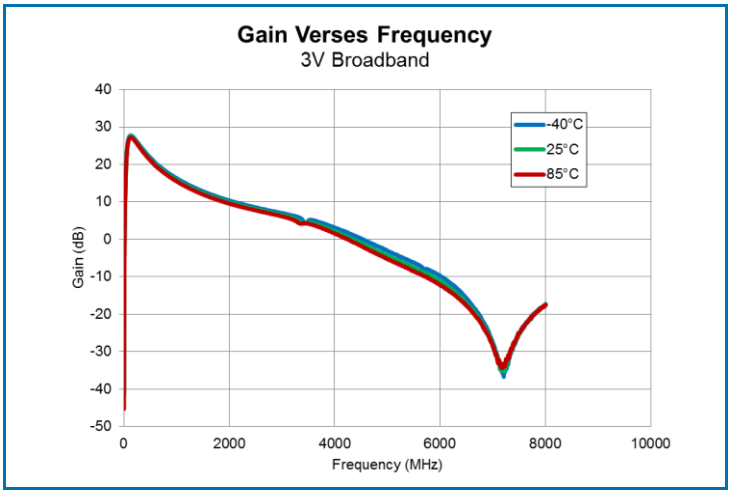
Parameter	Unit	400MHz	600MHz	800MHz	1000MHz	1200MHz	1500MHz
Gain	dB	22.88	19.71	17.47	15.64	14.1	12.19
Noise Figure	dB	0.26	0.35	0.36	0.44	0.5	0.62
Input IP3	dBm	9.92	11.97	15.89	18.65	19.6	18.86
Input P1dB	dBm	-2.12	0.43	2.06	2.42	2.67	2.63
Input Return Loss	dB	-14.42	-14.02	-14.27	-14.79	-15.27	-15.27
Output Return Loss	dB	-36.47	-21.73	-17.93	-15.48	-13.77	-12.15
VCC Current	mA	82	82	82	82	82	82
SD Current	mA	0.1	0.24	0.1	0.1	0.09	0.1
VB Current	mA	2.16	2.31	2.16	2.17	2.17	2.17

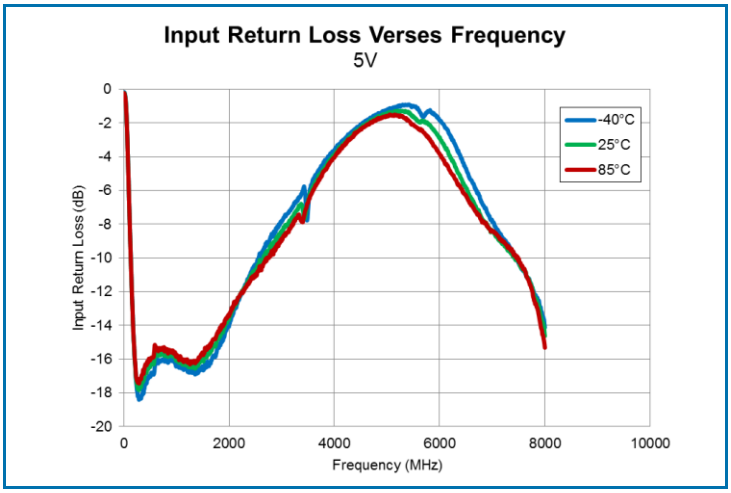
Typical RF Performance: 3V, 25°C, VB = 3.0V

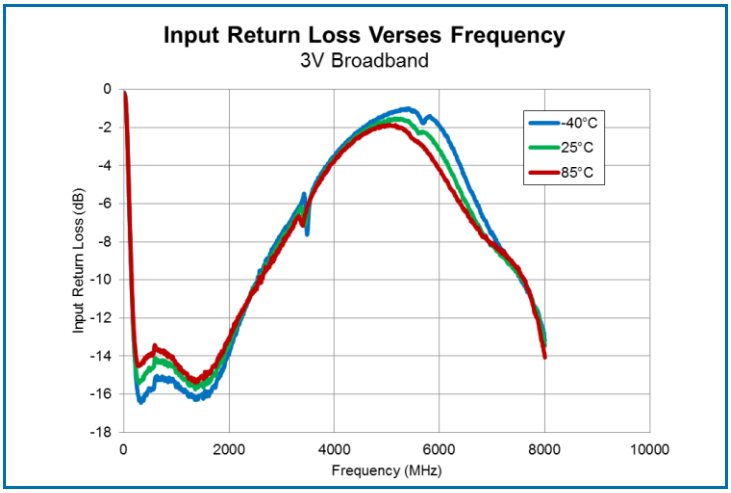
Parameter	Unit	400MHz	600MHz	800MHz	1000MHz	1200MHz	1500MHz
Gain	dB	22.92	19.71	17.52	15.65	14.13	12.23
Noise Figure	dB	0.27	0.35	0.36	0.44	0.48	0.63
Input IP3	dBm	9.79	11.97	15.95	18.81	19.62	18.87
Input P1dB	dBm	-2.07	0.43	2.24	2.85	3.04	3.08
Input Return Loss	dB	-14.54	-14.02	-14.3	-14.88	-15.35	-15.32
Output Return Loss	dB	-36.48	-21.73	-18.03	-15.52	-13.8	-12.16
VCC Current	mA	88	88	88	88	88	88
SD Current	mA	0.1	0.24	0.1	0.09	0.1	0.1
VB Current	mA	2.29	2.31	2.3	2.3	2.31	2.31

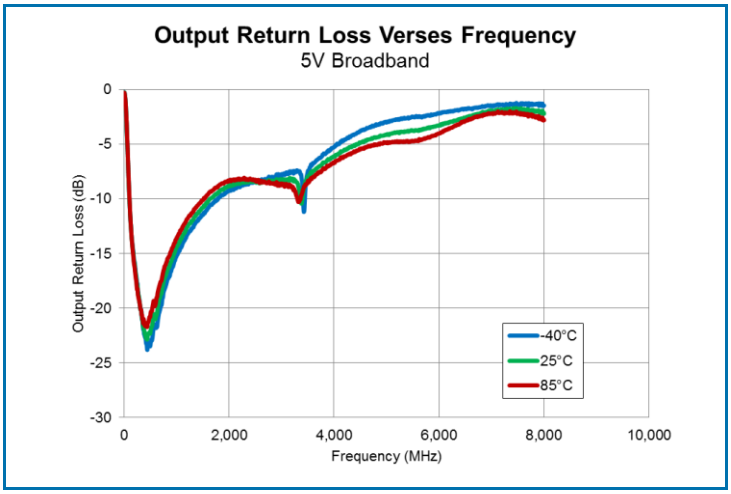
Typical Performance: V_{DD} = 5V, Current = 140mA and V_{DD} = 3V, Current 80mA

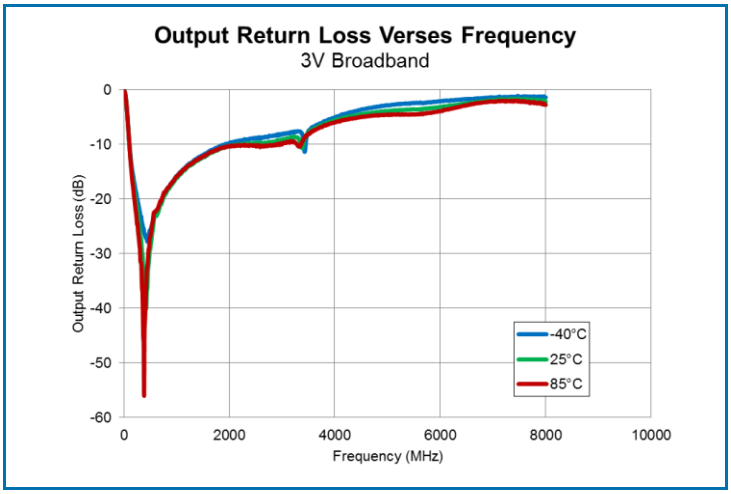




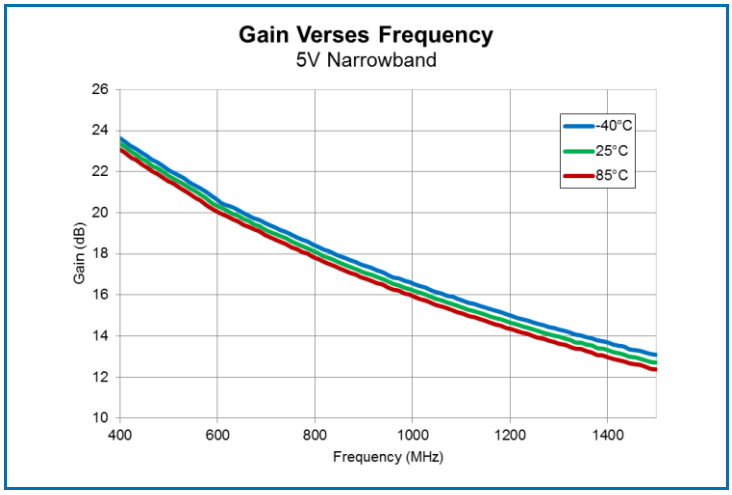


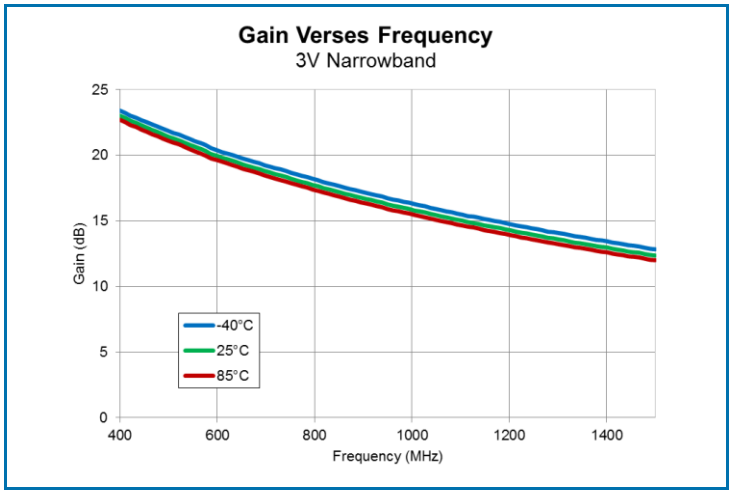


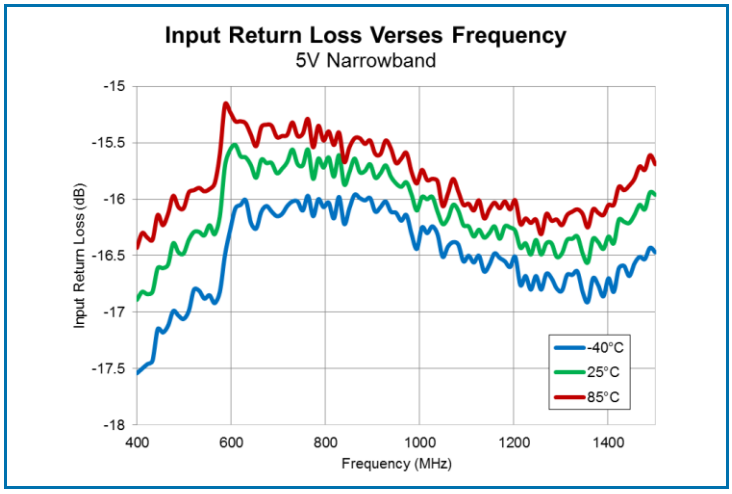


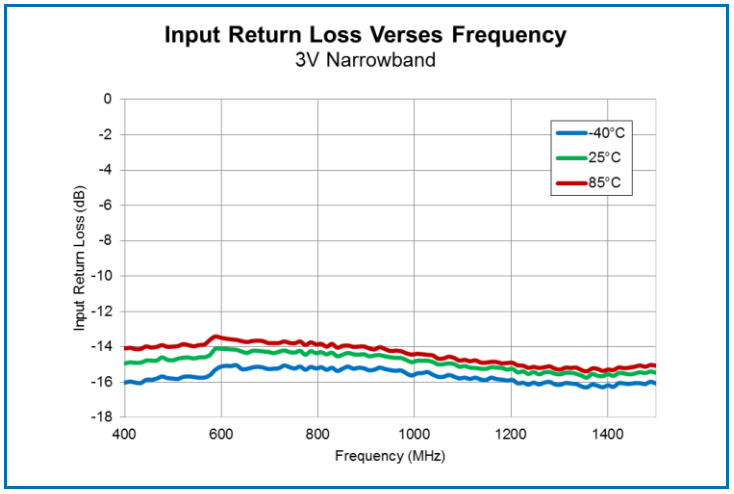


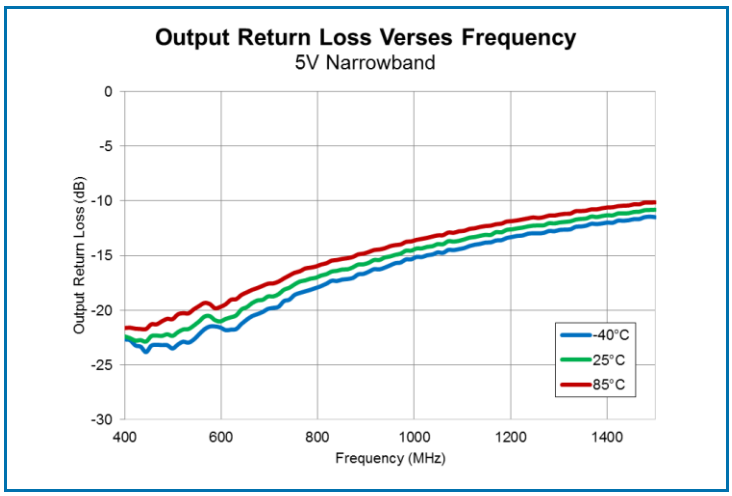
Typical Performance: V_{DD} = 5V, Current = 140mA and V_{DD} = 3V, Current 80mA

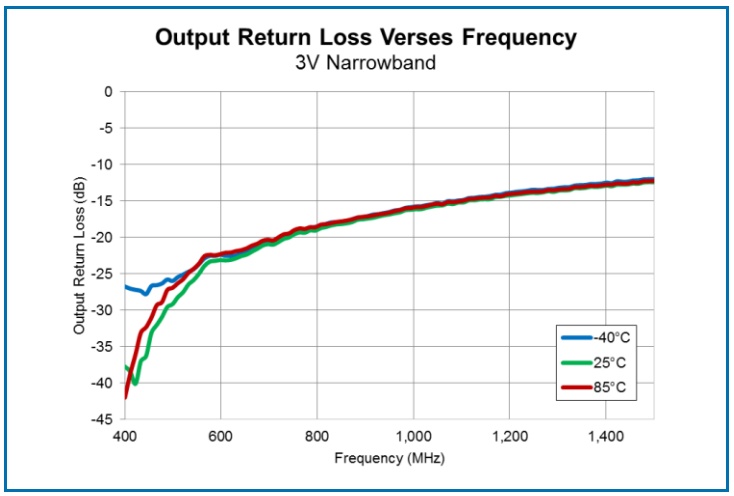




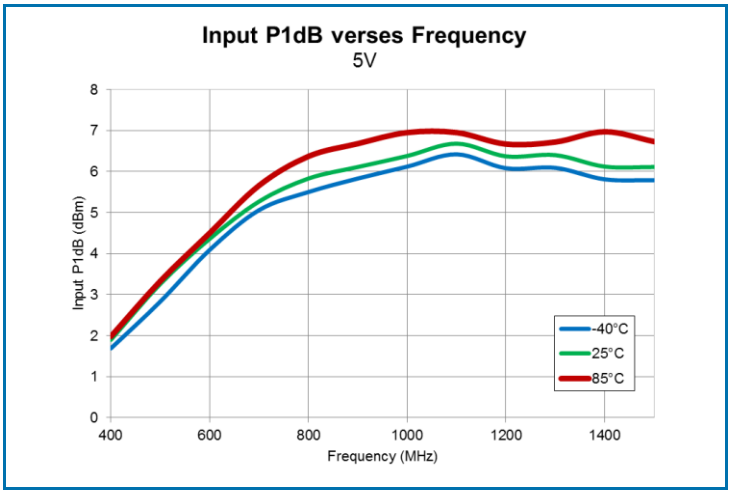


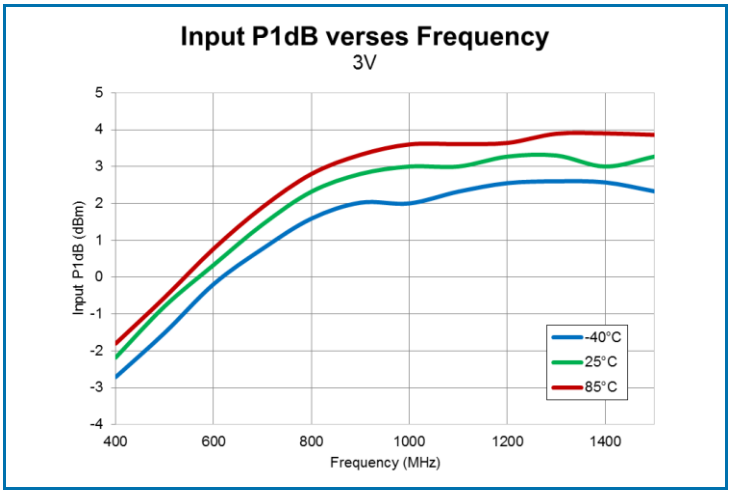


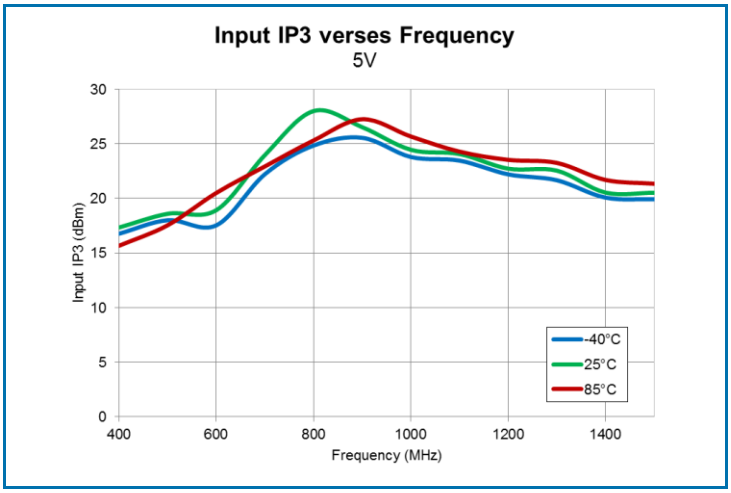


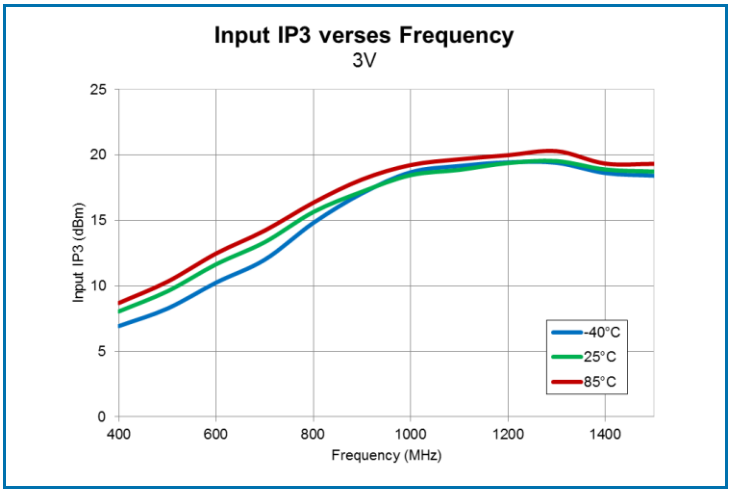


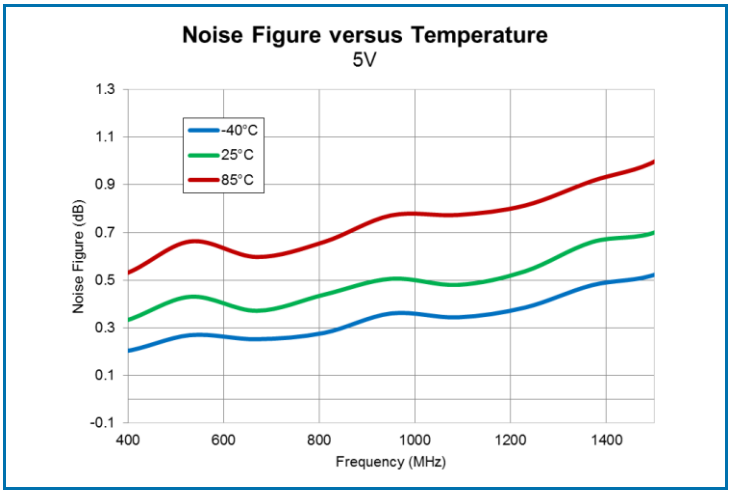
Typical Performance: V_{DD} = 5V, Current = 140mA and V_{DD} = 3V, Current 80mA

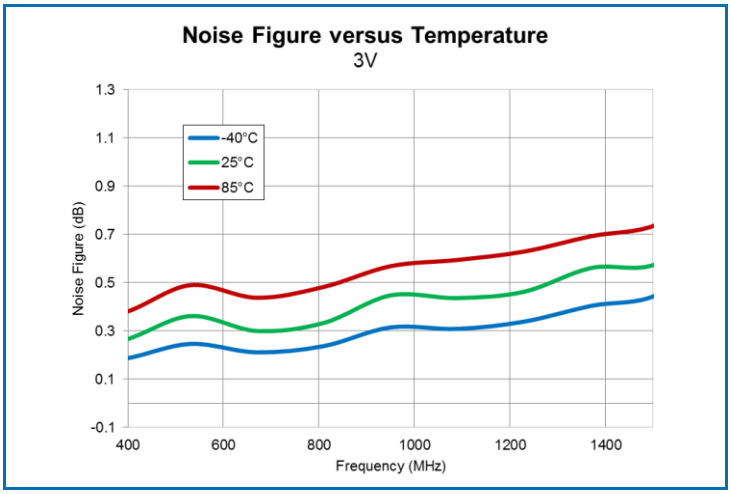




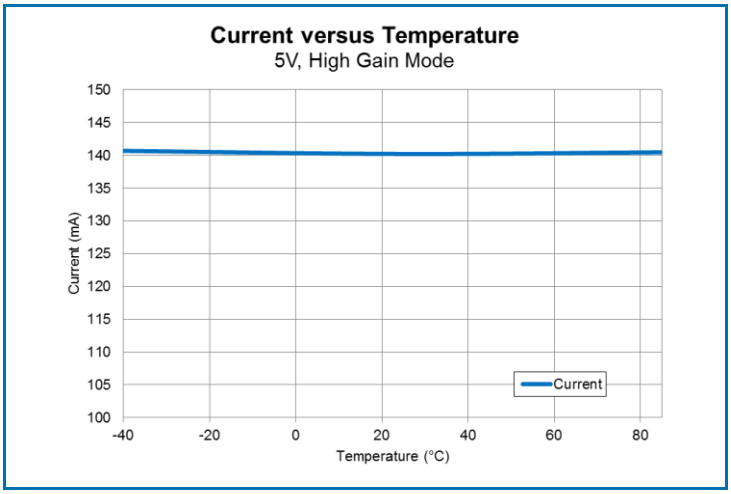


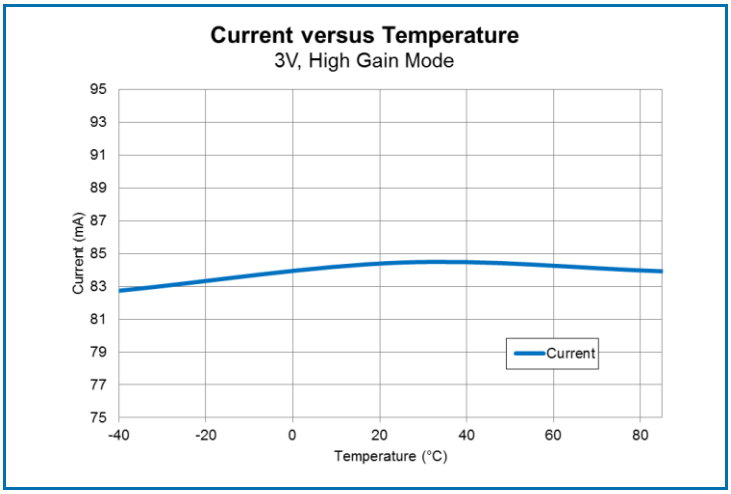




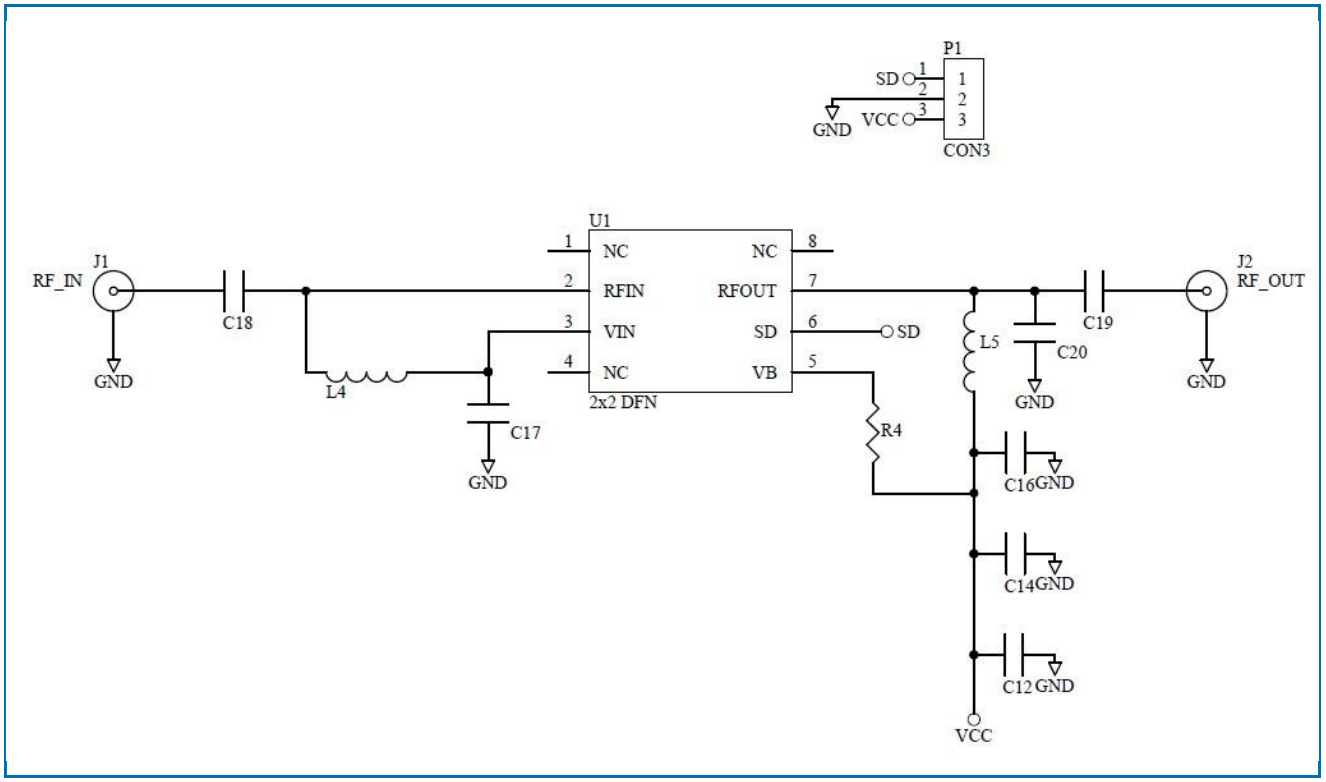


Typical Performance: V_{DD} = 5V, Current = 140mA and V_{DD} = 3V, Current 80mA





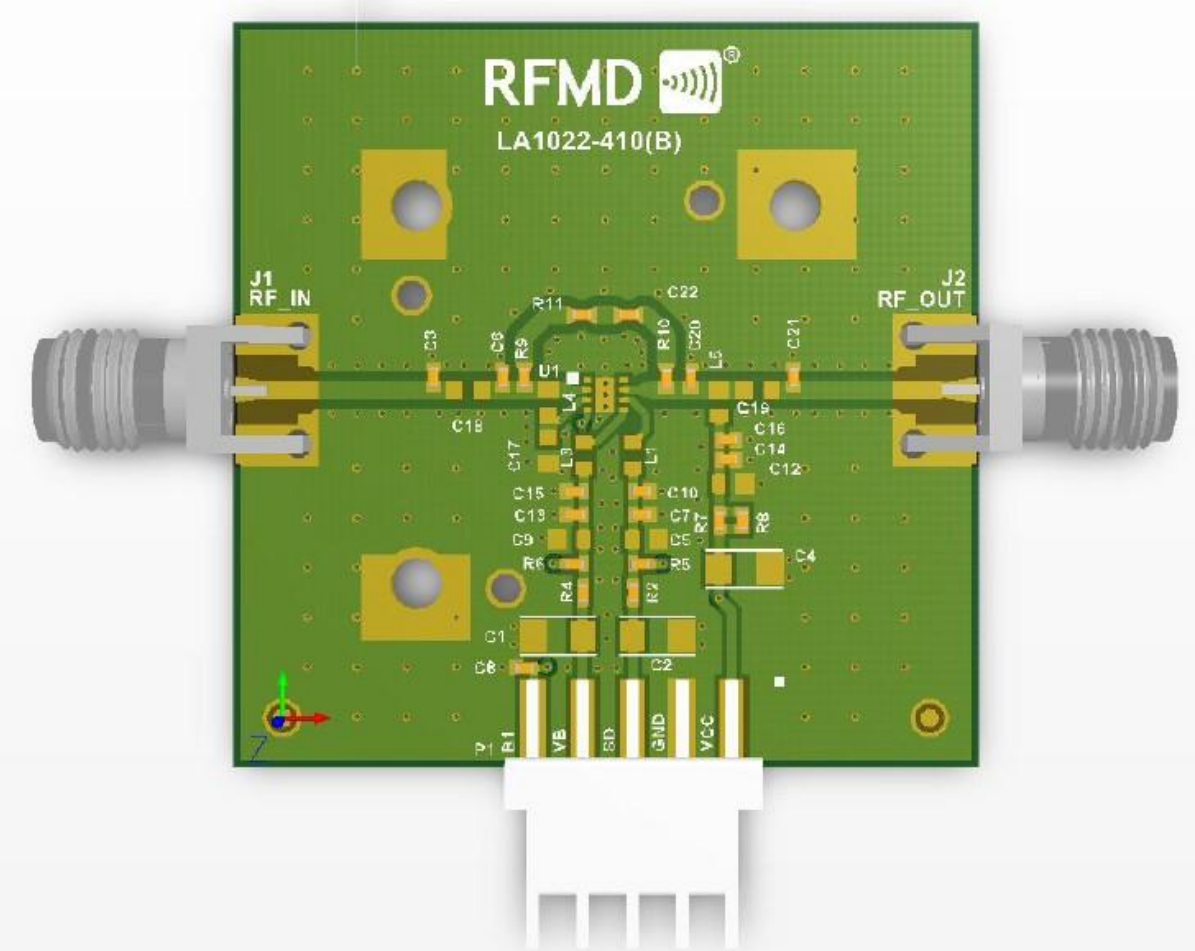
Evaluation Board Schematic Wideband Tune



Evaluation Board Bill of Materials (BOM)

Description	Reference Designator	Manufacturer	Manufacturer's P/N
Evaluation Board		DDI	LA1022-410(B)
RFLA1022 Module	U1	RFMD	RFLA1022
CAP, 0.1µF, 10%, 16v, X7R, 0402	C14, C17	Murata Electronics	GRM155R71C104KA88D
CAP, 10pF, 5%, 50V, C0G, 0402	C16	Murata Electronics	GRM1555C1H100JA01D
CAP, 22µF, 10%, 10V, TANT-A	C4	AVX Corporation	TAJA226K010RNJ
CAP, 10000pF, 10%, 50V, X7R, 0603	C18-C19	Murata Electronics	GRM188R71H103KA01D
CONN, SMA, END LNCH, UNIV, HYB MNT, FLT	J1, J6	Heilind Electronics	PER MAT-21-1022
CAP, 1.0pF, ±0.25pF, 50V, COG, 0402	C20	Murata Electronics	GRM1555C1HR0CA01D
RES, 0Ω, 0402	R4	Kamaya, inc.	RMC1/16SJPTH
CONN, HDR, ST, PLRZD, 4-PIN	P1	ITW Pancon	MPSS100-4C
IND, 82nH, 5%, W/W, 0603	L4-L5	Coilcraft, inc.	0603CS-82NXJLW

Evaluation Board Assembly Drawing



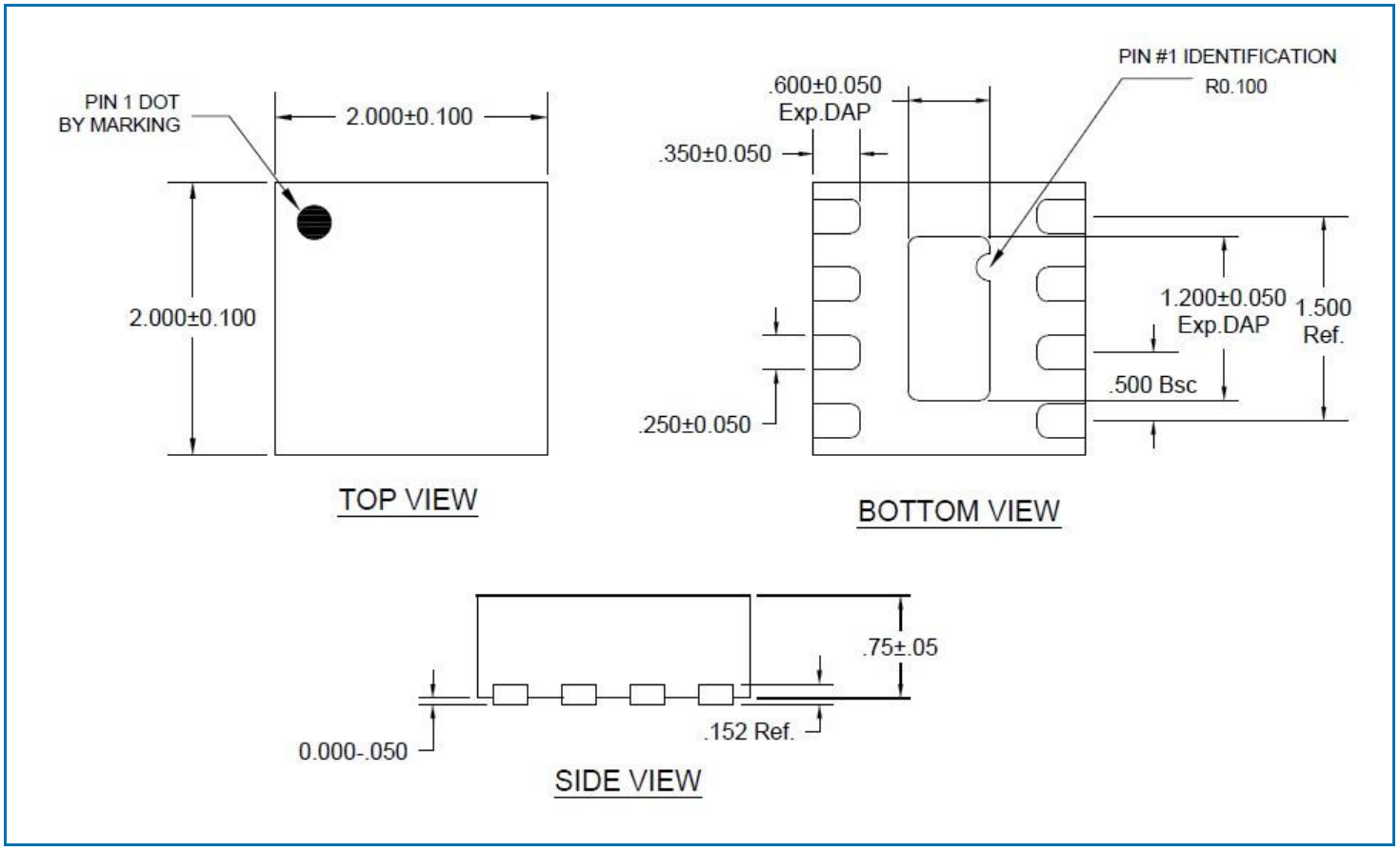
Pin Names and Descriptions

Pin	Name	Description
1	NC	No connect
2	RFIN	RF Input; Internally 50Ω matched, DC block required
3	VIND	External gate bias fed through a choke inductor to pin 2
4	NC	No connect
5	VB	Bias voltage
6	SD	Shutdown pin to turn off the LNA
7	RFOUT	RF Output; Internally 50Ω matched, DC block required
8	NC	No connect

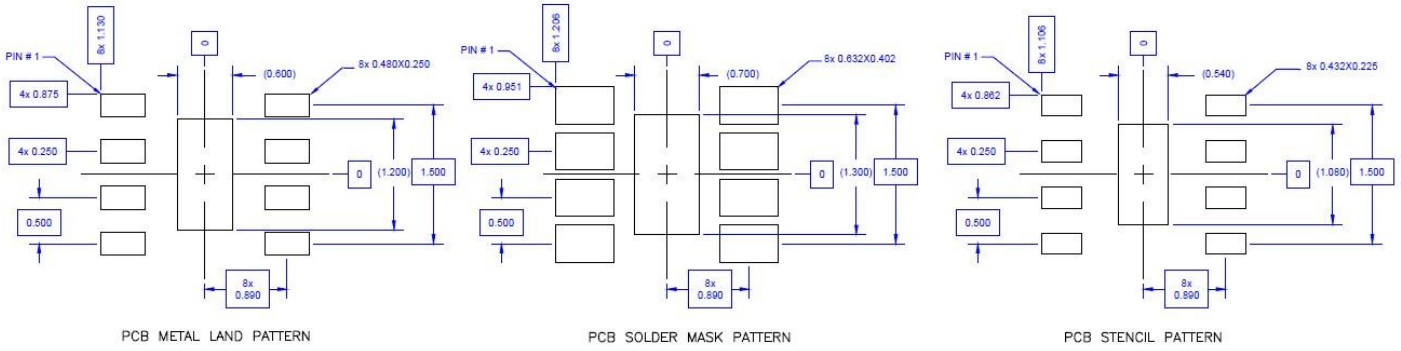
Truth Table

	SD
LNA On	1
LNA Off	0

Package Outline Drawing (Dimensions in millimeters)



Stencil, PCB Pattern



Thermal vias for center slug should be incorporated into the PCB design. The number and size of thermal vias will depend on the application, the power dissipation, and the electrical requirements. Example of the number and size of vias can be found on the RFMD evaluation board layout.

Branding Diagram