F0180

Single Channel Broadband Ultra-Low Noise Amplifier 400MHz to 6000MHz

Description

The F0180 is a single channel 400MHz to 6000MHz Wideband / Ultra-Low Noise Amplifier (LNA) used in receiver applications.

The F0180 LNA provides 20.9dB of gain with 0.6dB noise figure and 32.2dBm OIP3 performance at 3600MHz. The device uses a single 5V supply and 70mA typical of I_{DD}.

The F0180 is packaged in a 2 × 2 mm 8-DFN with 50Ω single-ended RF input and output impedances for ease of integration into the signal path.

Competitive Advantage

- Ultra-low noise performance of 0.6dB at 3.6GHz over wide bandwidths improves receiver sensitivity
- Extended temperature operation up to 115°C
- High gain and linearity

Features

- RF range: 400MHz to 6000MHz
- 20.9dB typical gain at 3600MHz
- 0.6dB typical NF at 3600MHz
- +32.2dBm typical OIP3 at 3600MHz
- 20.1dBm typical OP1dB at 3600MHz
- 50Ω Single-ended input/output impedances
- +5V power supply
- I_{DD} = 70mA
- Standby mode for power saving
- 1.8V/3.3V logic standby control
- Operating temperature (T_{EP}) range: -40°C to +115°C
- 2 × 2 mm, 8-DFN package

Applications

- 5G wireless infrastructure
- Repeaters/DAS
- Public safety infrastructure
- General-purpose RF

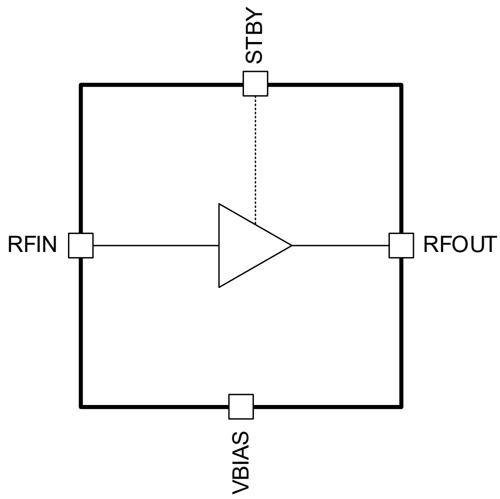


Figure 1. Block Diagram

Contents

Figures

1. Pin Information

1.1 Pin Assignments

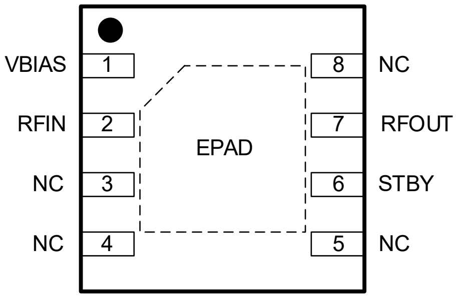


Figure 2. Pin Assignments – Top View

1.2 Pin Descriptions

Number	Name	Description
1	VBIAS	Bias Control. Connect bias setting resistor to V_{DD}.
2	RFIN	RF input. Must use external DC block. DC block is also a tuning element and must be close to the pin for best RF performance.
3, 4, 5, 8	NC	No internal connection. These pins can be left unconnected or connected to ground (highly recommended). Use a via as close to the pin as possible if grounded.
6	STBY	Standby pin. With Logic LOW applied to this pin (or if the pin is left unconnected), the amplifier is powered ON. With Logic HIGH applied to this pin, the amplifier is powered OFF and it is in Standby mode. Pin is 1.8V/3.3V logic compatible.
7	RFOUT	RF output internally matched to 50Ω. An external pull-up inductor to common V_{DD} is required to bias the amplifier. Must use an external DC block after the pull-up inductor. DC block is also a tuning element and must be close to the pin for best RF performance.
-	EPAD	Exposed pad. Internally connected to ground. Solder this exposed pad to a Printed Circuit Board (PCB) pad that uses multiple ground vias to provide heat transfer out of the device into the PCB ground planes. These multiple ground vias are also required to achieve the specific RF performance.

2. Specifications

2.1 Absolute Maximum Ratings

Caution: Do not operate at or near the maximum ratings listed for extended periods of time. Exposure to such conditions can adversely impact product reliability and result in failures not covered by warranty.

Parameter	Minimum	Maximum	Unit
Supply Voltage V_{DD} to GND	-0.3	+6.0	V
STBY to GND	-0.3	VDD	V
RFOUT Externally Applied DC Voltage	-	6	V
ON STATE: RF CW Input Power (RFIN) applied for 24 hours maximum. V_{DD} = 5V, T_{EP} = -40 to 115˚C, based on a 50Ω system. [1]	-	27	dBm
OFF STATE: RF CW Input Power (RFIN) applied for 24 hours maximum. V_{DD} = 5V, T_{EP} = -40 to 115˚C, based on a 50Ω system. [1]	-	27	dBm
Electrostatic Discharge – HBM (JEDEC/ESDA JS-001-2017)	-	1000	V
Electrostatic Discharge – CDM (JEDEC JS-002-2018)	-	500	V

1. Exposure to these maximum RF levels can result in significantly higher IDD current draw due to overdriving the amplifier stages.

2.2 Recommended Operating Conditions

Parameter	Minimum	Maximum	Unit
Power Supply Voltage (V_{DD})	3.15	5.25	V
Operating Temperature Referenced from Exposed Pad (T_{EP})	-40	+115	°C
RF Frequency Range	400	6000	MHz

2.3 Thermal Specifications

Parameter	Minimum	Typical	Maximum	Unit
Maximum Junction Temperature	-		+150	°C
Maximum Storage Temperature Range	-65		+150	°C
Lead Temperature (soldering. 10s)	-		+260	°C
Junction to Case Thermal resistance θ_{JC}[1]		48.8		°C/W

1. Case is defined as the exposed pad.

2.4 Electrical Specifications

2.4.1. General Electrical Specifications

See the F0180 Typical Application Circuit. Specifications apply when operated as a low noise amplifier with V_{DD} = 5V, T_{EP} = 25°C, STBY = Logic LOW, f_{RF} = 3600MHz, Z_S = Z_L = 50Ω, unless otherwise stated. Evaluation Kit trace and connector losses are de-embedded.

Parameter	Symbol	Test Conditions	Minimum	Typical	Maximum	Unit
DC Characteristics						
Logic Input High Voltage	V_{IH}	-	***1.17***[1]	-	Lower of (V_{DD}, 5.25)	V
Logic Input Low Voltage	V_{IL}	-	-0.3	-	***0.63***	V
Logic Current	I_{IH}, I_{IL}	V_{STBY} = 1.8V for I_{IH} and V_{STBY} = 0V for I_{IL}	***-100***	-	***+100***	µA
Quiescent Current	I_{DD}	-	55	70	***95***	mA
Standby Current	I_{DD_STBY}	V_{STBY}= 1.8V	-	2		mA
Transient Characteristics						
Power ON Settling Time	t_{ON}	50% STBY to RF output within 0.1dB and 1° of final value	-	0.5	1	µs
Power OFF Settling Time	t_{OFF}	50% STBY to RF output within -20dB from LNA ON gain	-	80	-	ns

1. Specifications in the minimum/maximum columns that are shown in ***bold italics*** are confirmed by test.

2.4.2. RF Electrical Specifications—0.4-6GHz BOM with 5V Vdd

See the F0180 Typical Application Circuit. Typical specifications apply when operated as a low noise amplifier with V_{DD} = 5V, T_{EP} = 25°C, STBY = Logic LOW, f_{RF} = 3600MHz, Z_S = Z_L = 50Ω. Minimum and maximum specifications apply across process, 4.75V – 5.25V operating voltage, and full operating temperature, unless otherwise stated. Evaluation Kit trace and connector losses are de-embedded.

Parameter	Symbol	Test Conditions	Minimum	Typical	Maximum	Unit
Gain [1]	G	f_{RF} = 900MHz	-	23.8	-	dB
		f_{RF} = 1900MHz	19.0	21		dB
		f_{RF} = 2500MHz	-	20.6	-	dB
		f_{RF} = 3600MHz T_{EP} = 25°C	***19.00***[1]	20.9	-	dB
		f_{RF} = 3300MHz – 4200MHz	18.5	-	-	dB
		f_{RF} = 4900MHz	-	19.4	-	dB
Gain Flatness	G_{FLAT}	Any 200MHz BW within 700MHz – 1000MHz	-	0.7	-	dB
		Any 200MHz BW within 1800MHz – 2200MHz	-	0.25	-	dB
		Any 200MHz BW within 2300MHz – 2700MHz	-	0.06	-	dB
		Any 200MHz BW within 3300MHz – 4200MHz	-	0.15	-	dB
		Any 200MHz BW within 4400MHz – 5000MHz	-	0.5	-	dB
RF Input Return Loss	RL_{IN}	f_{RF} = 900MHz	-	5.2	-	dB
		f_{RF} = 1900MHz	7.3	8.5		dB
		f_{RF} = 2500MHz		9.3	-	dB
		f_{RF} = 3600MHz	8.6	11.0	-	dB
		f_{RF} = 4900MHz	-	11.3	-	dB
RF Output Return Loss	RL_{OUT}	f_{RF} = 900MHz	-	13.6	-	dB
		f_{RF} = 1900MHz	13.8	16.8		dB
		f_{RF} = 2500MHz		17.6	-	dB
		f_{RF} = 3600MHz	6.3	8.0	-	dB
		f_{RF} = 4900MHz	-	6.8	-	dB
Reverse Isolation	ISO_{REV}	f_{RF} = 400MHz – 6000MHz	28	-	-	dB
STBY Mode Gain	G_{STBY}	f_{RF} = 3600MHz Input power up to 22dBm	-	-20	-	dB

Parameter	Symbol	Test Conditions	Minimum	Typical	Maximum	Unit
Noise Figure	NF	f_{RF} = 900MHz	-	0.43	-	dB
		f_{RF} = 1900MHz	-	0.5		dB
		f_{RF} = 2500MHz	-	0.56	-	dB
		f_{RF} = 3600MHz	-	0.6		dB
		f_{RF} = 3300MHz – 4200MHz -40 to 115°C	-	-	1.27	dB
		f_{RF} = 4900MHz	-	0.77	-	dB
Output IP3 (P_{OUT} = 2 dBm/tone, Δf = 1MHz)	OIP3	f_{RF} = 900MHz	-	29.48	-	dBm
		f_{RF} = 1900MHz		34.24	-	dBm
		f_{RF} = 2500MHz	-	34.52	-	dBm
		f_{RF} = 3600MHz	27	32.2	-	dBm
		f_{RF} = 4900MHz	-	31.25	-	dBm
Output P1dB	OP1dB	f_{RF} = 900MHz	-	17.2	-	dBm
		f_{RF} = 1900MHz		19.2	-	dBm
		f_{RF} = 2500MHz	-	19.9	-	dBm
		f_{RF} = 3600MHz	15.7	20.1	-	dBm
		f_{RF} = 4900MHz	-	19.8	-	dBm
Stability	K	V_{DD} = 4.75 – 5.25V T_{EP} = -40°C – +115°C f_{RF} = 10MHz – 20GHz	1	-	-	

1. Specifications in the minimum/maximum columns that are shown in ***bold italics*** are confirmed by test.

2.4.3. RF Electrical Specifications—0.4-6GHz BOM with 3.3V Vdd

See the F0180 Typical Application Circuit. Typical specifications apply when operated as a low noise amplifier with V_{DD} = 3.3V, T_{EP} = 25°C, STBY = Logic LOW, f_{RF} = 3600MHz, Z_S = Z_L = 50Ω. Minimum and maximum specifications apply across process, 3.15V – 3.45V operating voltage, and full operating temperature, unless otherwise stated. Evaluation Kit trace and connector losses are de-embedded.

Parameter	Symbol	Test Conditions	Minimum	Typical	Maximum	Unit
Gain [1]	G	f_{RF} = 900MHz	-	23.8	-	dB
		f_{RF} = 1900MHz		21.2		dB
		f_{RF} = 2500MHz	-	20.8	-	dB
		f_{RF} = 3600MHz T_{EP} = 25°C		21		dB
		f_{RF} = 3300MHz – 4200MHz		21		dB
		f_{RF} = 4900MHz		20		dB
Gain Flatness	G_{FLAT}	Any 200MHz BW within 700MHz – 1000MHz		0.7		dB
		Any 200MHz BW within 1800MHz – 2200MHz		0.3		dB
		Any 200MHz BW within 2300MHz – 2700MHz		0.1		dB
		Any 200MHz BW within 3300MHz – 4200MHz		0.15		dB
		Any 200MHz BW within 4400MHz – 5000MHz	-	0.5		dB
RF Input Return Loss	RL_{IN}	f_{RF} = 900MHz	-	5		dB
		f_{RF} = 1900MHz		7.2		dB
		f_{RF} = 2500MHz		8.5		dB
		f_{RF} = 3600MHz		12.8		dB
		f_{RF} = 4900MHz		12.96		dB
RF Output Return Loss	RL_{OUT}	f_{RF} = 900MHz		13.4		dB
		f_{RF} = 1900MHz		16.3		dB
		f_{RF} = 2500MHz		16.1		dB
		f_{RF} = 3600MHz		7.3		dB
		f_{RF} = 4900MHz		7.09		dB
Reverse Isolation	ISO_{REV}	f_{RF} = 400MHz – 6000MHz		29		dB
STBY Mode Gain	G_{STBY}	f_{RF} = 3600MHz Input power up to 22dBm		-20		dB

Parameter	Symbol	Test Conditions	Minimum	Typical	Maximum	Unit
Noise Figure	NF	f_{RF} = 900MHz	-	0.58		dB
		f_{RF} = 1900MHz		0.56		dB
		f_{RF} = 2500MHz		0.59		dB
		f_{RF} = 3600MHz		0.7		dB
		f_{RF} = 4900MHz		0.97		dB
Output IP3 (P_{OUT} = 2 dBm/tone, ∆f = 1MHz)	OIP3	f_{RF} = 900MHz		22.05		dBm
		f_{RF} = 1900MHz		23.6		dBm
		f_{RF} = 2500MHz		23.5		dBm
		f_{RF} = 3600MHz		23.6		dBm
		f_{RF} = 4900MHz		25.18		dBm
Output P1dB	OP1dB	f_{RF} = 900MHz		11.8		dBm
		f_{RF} = 1900MHz		13.5		dBm
		f_{RF} = 2500MHz		13.5		dBm
		f_{RF} = 3600MHz		13.6		dBm
		f_{RF} = 4900MHz	-	14.9		dBm
Stability	K	V_{DD} = 3.15 – 3.45V T_{EP} = -40°C – +115°C f_{RF} = 10MHz – 20GHz	1	-	-	

2.4.4. RF Electrical Specifications—400MHz to 600MHz

See the F0180 Typical Application Circuit. Typical specifications apply when operated as a low noise amplifier with V_{DD} = 5V, T_{EP} = 25°C, STBY = Logic LOW, f_{RF} = 500MHz, Z_S = Z_L = 50Ω. Minimum and maximum specifications apply across process, 4.75V – 5.25V operating voltage, and full operating temperature, unless otherwise stated. Evaluation Kit trace and connector losses are de-embedded.

Parameter	Symbol	Test Conditions	Minimum	Typical	Maximum	Unit
Gain	G		-	28.2	-	dB
Gain Variation Over Process	G_{PROC}	f_{RF} = 500MHz	-	1	-	dB
Gain Variation Over Temperature	G_{TEMP}	V_{DD} = 5.0V f_{RF} = 500MHz T_{EP} = -40°C – +115°C	-	0.3	-	dB
Gain Flatness	G_{FLAT}	Any 100MHz BW	-	0.8	-	dB
Reverse Isolation	ISO_{REV}			32	-	dB

Parameter	Symbol	Test Conditions	Minimum	Typical	Maximum	Unit
STBY Mode Gain	G_{STBY}	f_{RF} = 500MHz Input power up to 22dBm	-	-43	-	dB
Noise Figure	NF	f_{RF} = 500MHz	-	0.75	-	dB
RF Input Return Loss	RL_{RFIN}			15.6		dB
RF Output Return Loss	RL_{RFOUT}			17.6		dB
Output Third Order Intercept Point	OIP3	Pout=2dBm/tone, Δf = 1MHz		33.2		dBm
Output 1dB Compression Point	OP1dB			16.6		dBm
Stability	K	V_{DD} = 4.75 – 5.25V T_{EP} = -40°C – +115°C f_{RF} = 10MHz – 20GHz	1	-	-	

2.4.5. RF Electrical Specifications—700MHz to 1000MHz

See the F0180 Typical Application Circuit. Typical specifications apply when operated as a low noise amplifier with V_{DD} = 5V, T_{EP} = 25°C, STBY = Logic LOW, f_{RF} = 850MHz, Z_S = Z_L = 50Ω. Minimum and maximum specifications apply across process, 4.75V – 5.25V operating voltage, and full operating temperature, unless otherwise stated. Evaluation Kit trace and connector losses are de-embedded.

Parameter	Symbol	Test Conditions	Minimum	Typical	Maximum	Unit
Gain	G		-	25.8	-	dB
Gain Variation Over Process	G_{PROC}		-	0.8	-	dB
Gain Variation Over Temperature	G_{TEMP}	V_{DD} = 5.0V f_{RF} = 850MHz T_{EP} = -40°C – +115°C	-	0.4	-	dB
Gain Flatness	G_{FLAT}	Any 100MHz BW	-	0.7	-	dB
Reverse Isolation	ISO_{REV}			31	-	dB
STBY Mode Gain	G_{STBY}	f_{RF} = 850MHz Input power up to 22dBm	-	-40	-	dB
Noise Figure	NF	f_{RF} = 850MHz	-	0.5	-	dB
RF Input Return Loss	RL_{RFIN}			23		dB
RF Output Return Loss	RL_{RFOUT}			21		dB
Output Third Order Intercept Point	OIP3	Pout=2dBm/tone, Δf = 1MHz		31.5		dBm
Output 1dB Compression Point	OP1dB			17.5		dBm
Stability	K	V_{DD} = 4.75 – 5.25V T_{EP} = -40°C – +115°C f_{RF} = 10MHz – 20GHz	1	-	-	

2.4.6. RF Electrical Specifications—1500MHz to 3000MHz

See the F0180 Typical Application Circuit. Typical specifications apply when operated as a low noise amplifier with V_{DD} = 5V, T_{EP} = 25°C, STBY = Logic LOW, f_{RF} = 2100MHz, Z_S = Z_L = 50Ω. Minimum and maximum specifications apply across process, 4.75V – 5.25V operating voltage, and full operating temperature, unless otherwise stated. Evaluation Kit trace and connector losses are de-embedded.

Parameter	Symbol	Test Conditions	Minimum	Typical	Maximum	Unit
Gain	G		-	21.4	-	dB
Gain Variation Over Process	G_{PROC}		-	0.8	-	dB
Gain Variation Over Temperature	G_{TEMP}	V_{DD} = 5.0V f_{RF} = 2100MHz T_{EP} = -40°C – +115°C	-	1.2	-	dB
Gain Flatness	G_{FLAT}	Any 200MHz BW	-	0.5	-	dB
Reverse Isolation	ISO_{REV}			29	-	dB
STBY Mode Gain	G_{STBY}	f_{RF} = 2100MHz Input power up to 22dBm	-	-30	-	dB
Noise Figure	NF	f_{RF} = 2100MHz	-	0.55	-	dB
RF Input Return Loss	RL_{RFIN}			16		dB
RF Output Return Loss	RL_{RFOUT}			13.5		dB
Output Third Order Intercept Point	OIP3	Pout=2dBm/tone, Δf = 1MHz		33.9		dBm
Output 1dB Compression Point	OP1dB			18.5		dBm
Stability	K	V_{DD} = 4.75 – 5.25V T_{EP} = -40°C – +115°C f_{RF} = 10MHz – 20GHz	1	-	-	

2.4.7. RF Electrical Specifications—3300MHz to 4200MHz

See the F0180 Typical Application Circuit. Typical specifications apply when operated as a low noise amplifier with V_{DD} = 5V, T_{EP} = 25°C, STBY = Logic LOW, f_{RF} = 3600MHz, Z_S = Z_L = 50Ω. Minimum and maximum specifications apply across process, 4.75V – 5.25V operating voltage, and full operating temperature, unless otherwise stated. Evaluation Kit trace and connector losses are de-embedded.

Parameter	Symbol	Test Conditions	Minimum	Typical	Maximum	Unit
Gain	G		-	21.3	-	dB
Gain Variation Over Process	G_{PROC}		-	0.7	-	dB
Gain Variation Over Temperature	G_{TEMP}	V_{DD} = 5.0V f_{RF} = 3600MHz T_{EP} = -40°C – +115°C	-	1.5	-	dB
Gain Flatness	G_{FLAT}	Any 200MHz BW	-	0.4	-	dB
Reverse Isolation	ISO_{REV}			31	-	dB

Parameter	Symbol	Test Conditions	Minimum	Typical	Maximum	Unit
STBY Mode Gain	G_{STBY}	f_{RF} = 3600MHz Input power up to 22dBm	-	-20	-	dB
Noise Figure	NF	f_{RF} = 3600MHz	-	0.62	-	dB
RF Input Return Loss	RL_{RFIN}			12.7		dB
RF Output Return Loss	RL_{RFOUT}			13.8		dB
Output Third Order Intercept Point	OIP3	Pout=2dBm/tone, Δf = 1MHz		32		dBm
Output 1dB Compression Point	OP1dB			18.1		dBm
Stability	K	V_{DD} = 4.75 – 5.25V T_{EP} = -40°C – +115°C f_{RF} = 10MHz – 20GHz	1	-	-	

2.4.8. RF Electrical Specifications—4400MHz to 5000MHz

See the F0180 Typical Application Circuit. Typical specifications apply when operated as a low noise amplifier with V_{DD} = 5V, T_{EP} = 25°C, STBY = Logic LOW, f_{RF} = 4700MHz, Z_S = Z_L = 50Ω. Minimum and maximum specifications apply across process, 4.75V – 5.25V operating voltage, and full operating temperature, unless otherwise stated. Evaluation Kit trace and connector losses are de-embedded.

Parameter	Symbol	Test Conditions	Minimum	Typical	Maximum	Unit
Gain	G		-	20.6	-	dB
Gain Variation Over Process	G_{PROC}		-	0.55	-	dB
Gain Variation Over Temperature	G_{TEMP}	V_{DD} = 5.0V f_{RF} = 4700MHz T_{EP} = -40°C – +115°C	-	1.7	-	dB
Gain Flatness	G_{FLAT}	Any 200MHz	-	1	-	dB
Reverse Isolation	ISO_{REV}			42	-	dB
STBY Mode Gain	G_{STBY}	f_{RF} = 4700MHz Input power up to 22dBm	-	-16	-	dB
Noise Figure	NF	f_{RF} = 4700MHz	-	0.78	-	dB
RF Input Return Loss	RL_{RFIN}			10.7		dB
RF Output Return Loss	RL_{RFOUT}			20.3		dB
Output Third Order Intercept Point	OIP3	Pout=2dBm/tone, Δf = 1MHz		29.3		dBm
Output 1dB Compression Point	OP1dB			15.6		dBm
Stability	K	V_{DD} = 4.75 – 5.25V T_{EP} = -40°C – +115°C f_{RF} = 10MHz – 20GHz	1	-	-	

3. Typical Operating Conditions

Unless otherwise noted, for the typical operating conditions (TOC) graphs on the following pages, the following conditions apply:

- V_{DD} = 5.0V
- STBY = LOW
- T_{EP} = +25°C
- Z_L = Z_S = 50Ω single-ended
- P_{OUT} = +2dBm/Tone and 1MHz Tone Spacing for OIP3
- All temperatures are referenced to the exposed pad
- Evaluation kit traces and connector losses are de-embedded

4. Typical Performance Characteristics

4.1 Full band typical Performance with 5V supply(0.4GHz – 6GHz)

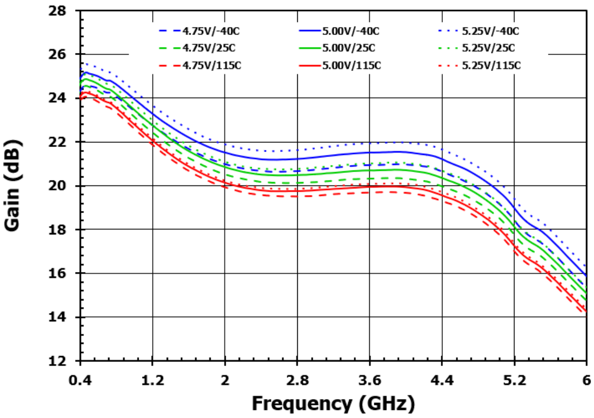


Figure 3. Gain

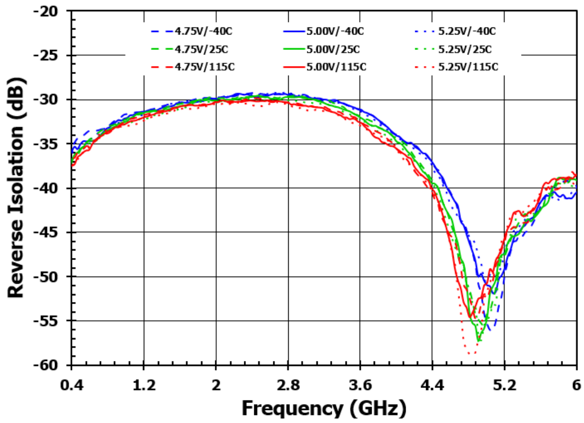


Figure 4. Reverse Isolation

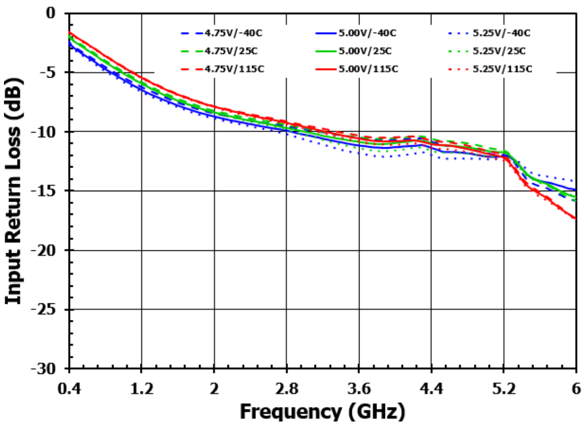


Figure 5. Input Return Loss

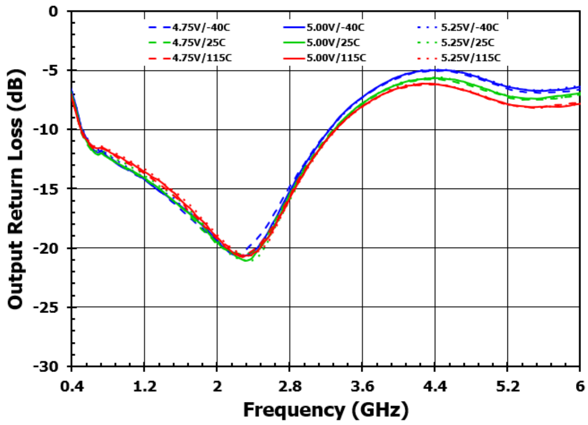


Figure 6. Output Return Loss

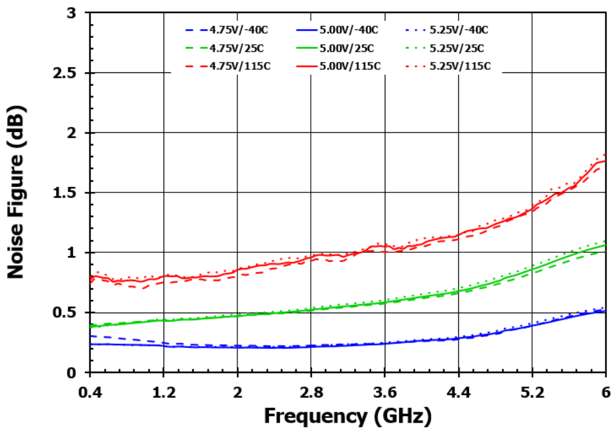


Figure 7. Noise Figure

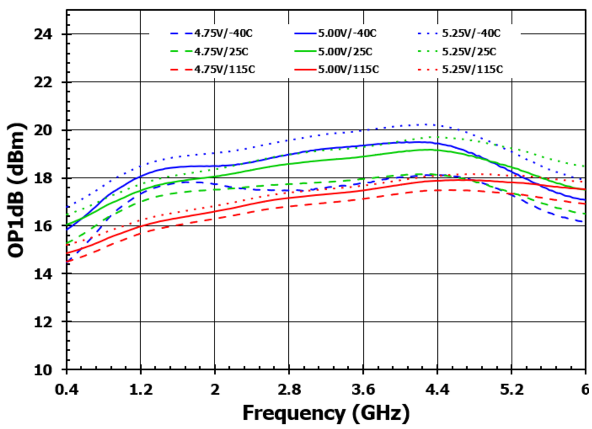


Figure 8. OP1dB

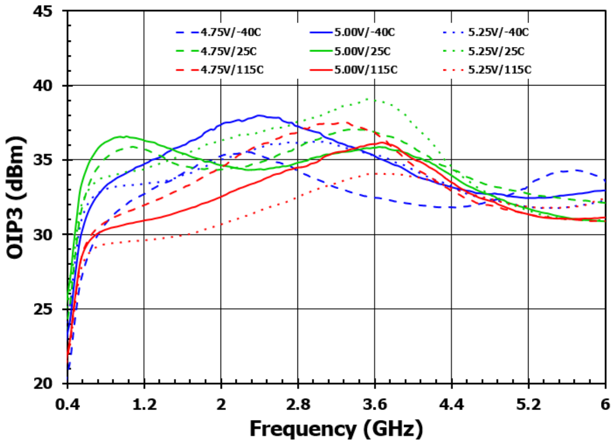


Figure 9. OIP3

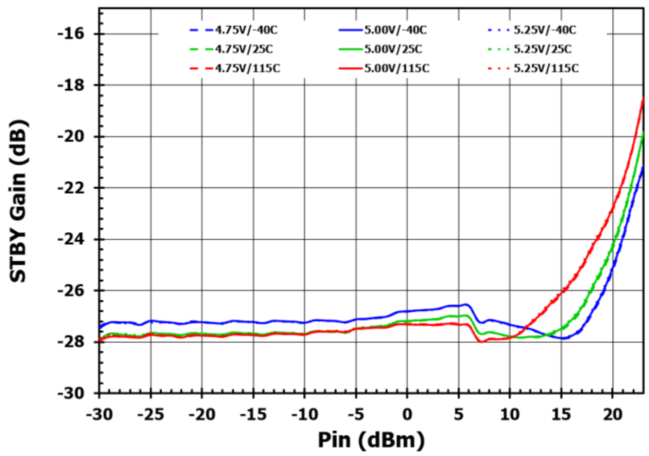


Figure 10. Standby Gain@3.6GHz

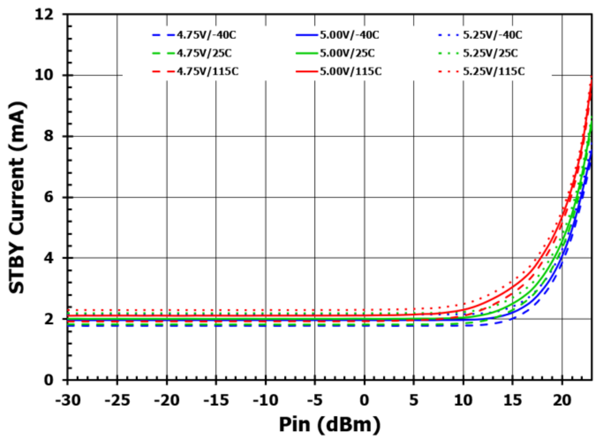


Figure 11. Standby Current@3.6GHz

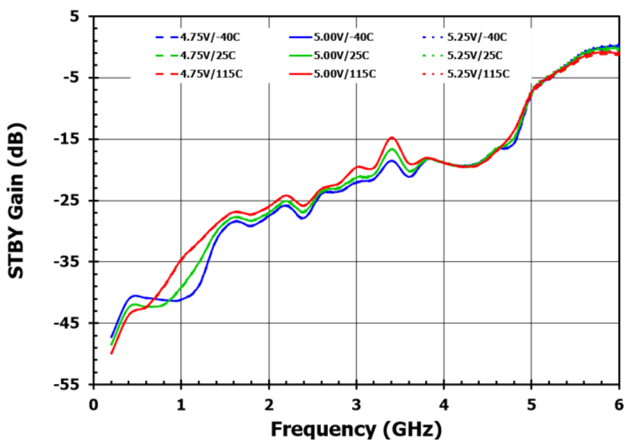


Figure 12. Standby Gain @22dBm Input

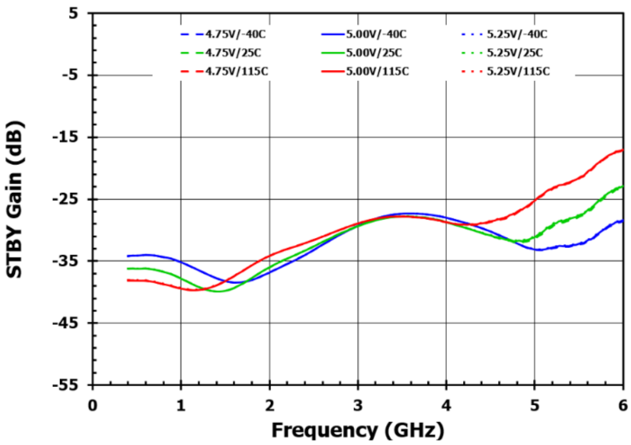


Figure 13. Standby Gain@10dBm Input

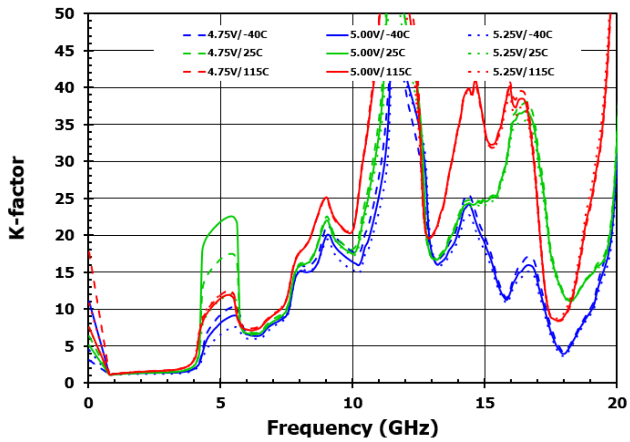


Figure 14. K factor

4.2 Full band typical Performance with 3.3V supply(0.4GHz – 6GHz)

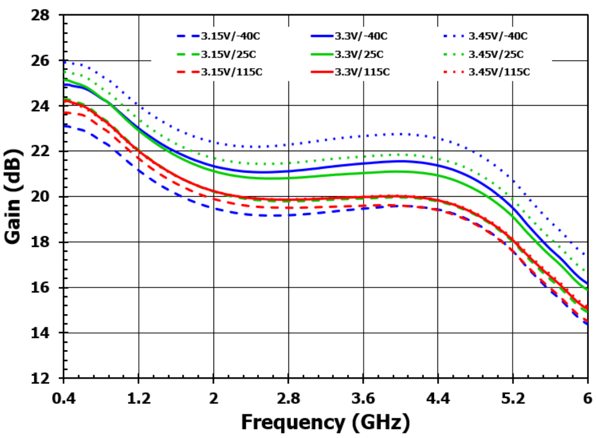


Figure 15. Gain

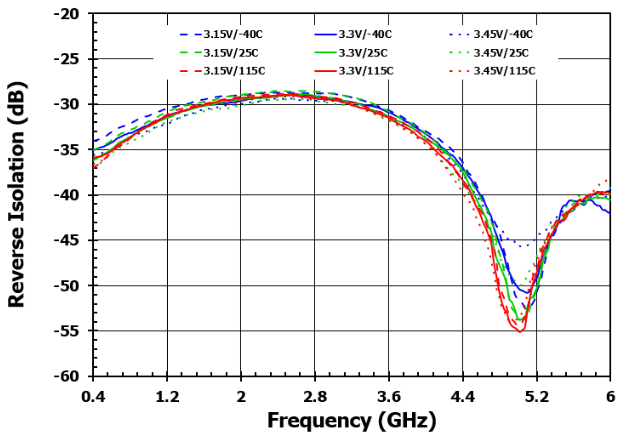


Figure 16. Reverse Isolation

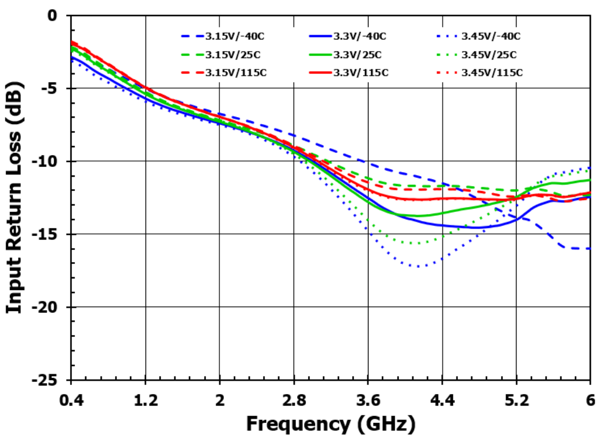


Figure 17. Input Return Loss

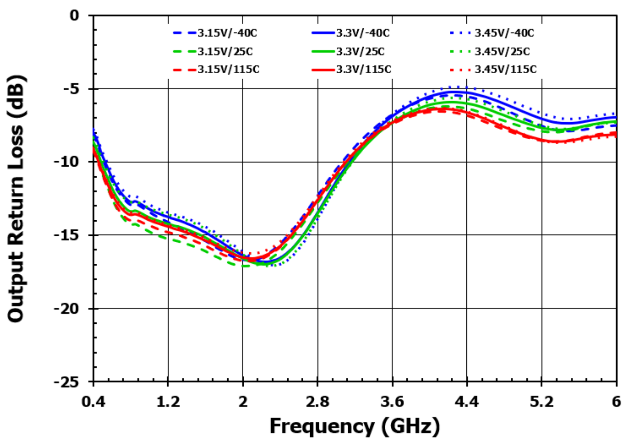


Figure 18. Output Return Loss

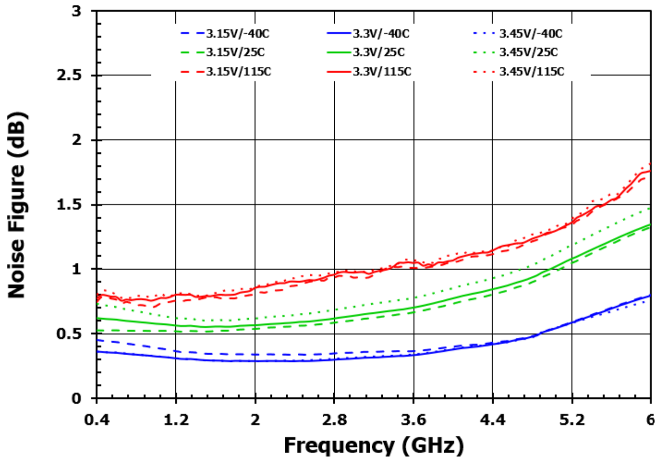


Figure 19. Noise Figure

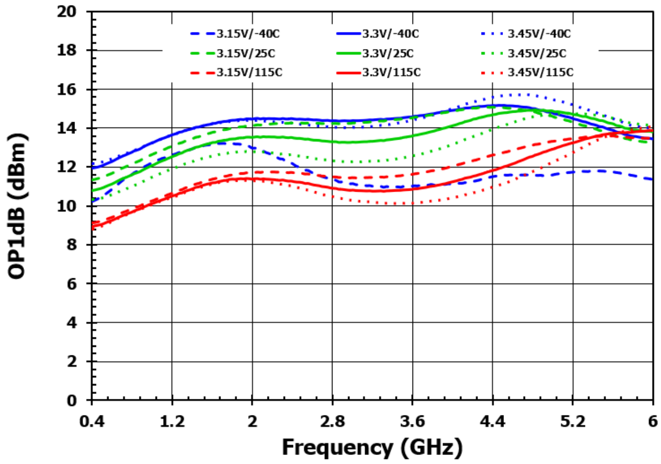


Figure 20. OP1dB

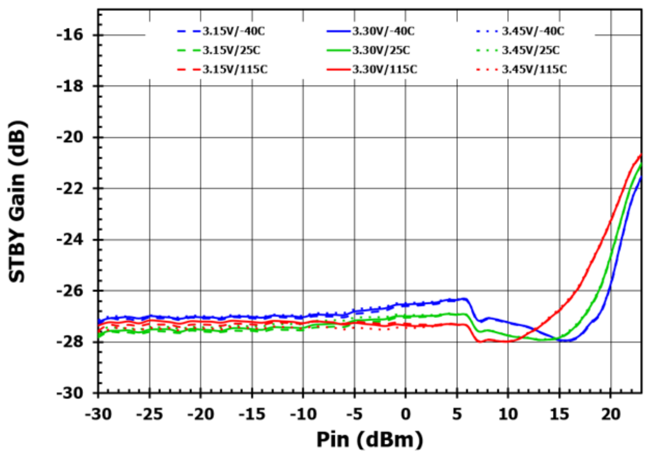


Figure 21. Standby gain@3.6GHz

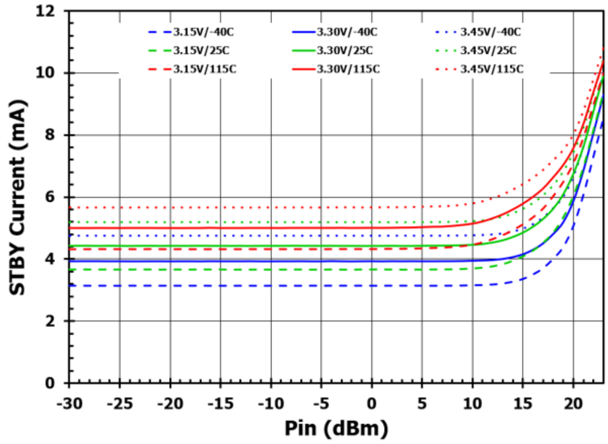


Figure 22. Standby current@3.6GHz

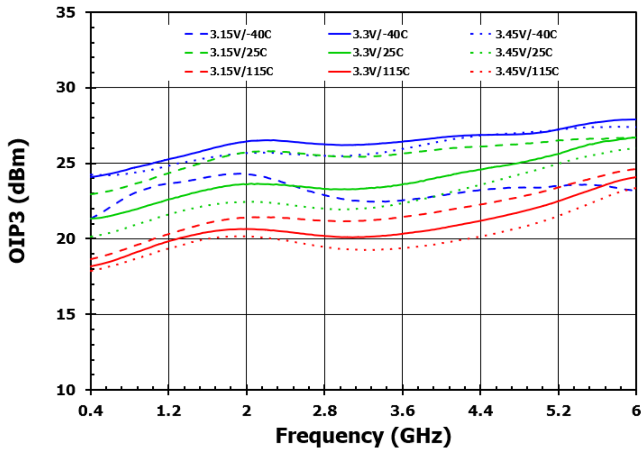


Figure 23. OIP3

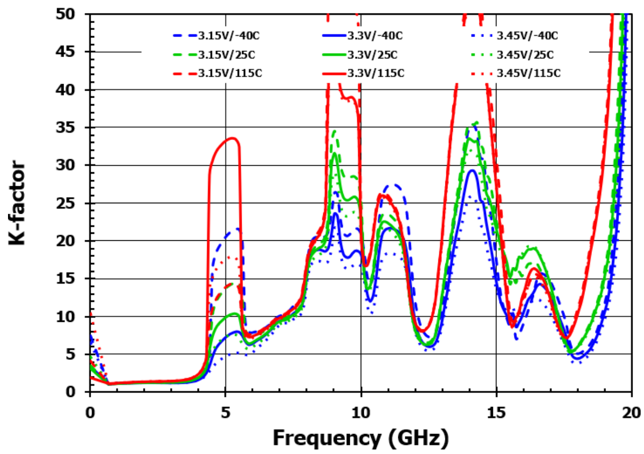


Figure 24. K factor

4.3 Typical Performance (0.4GHz – 0.6GHz)

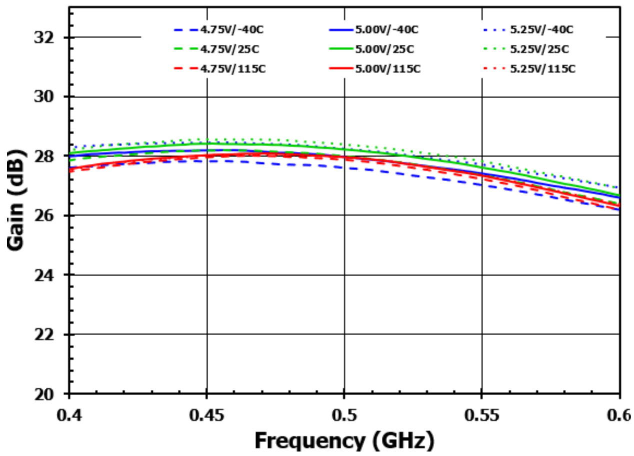


Figure 25. Gain

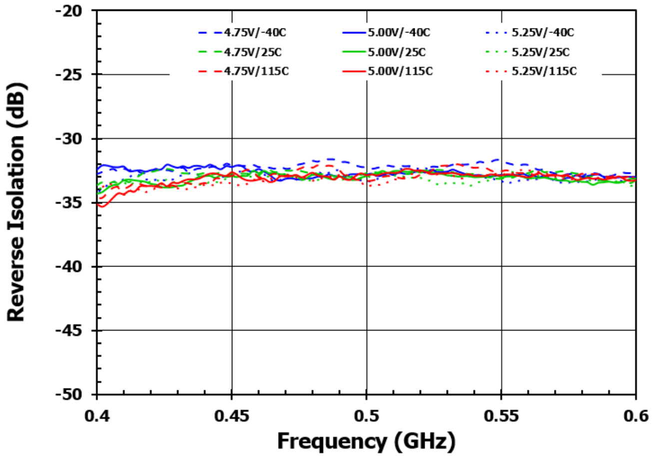


Figure 26. Reverse Isolation

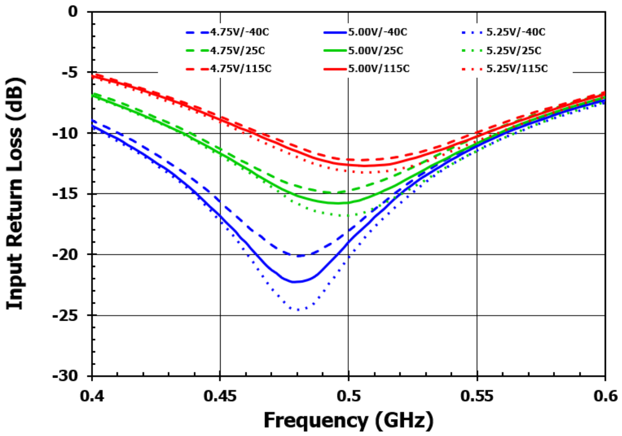


Figure 27. Input Return Loss

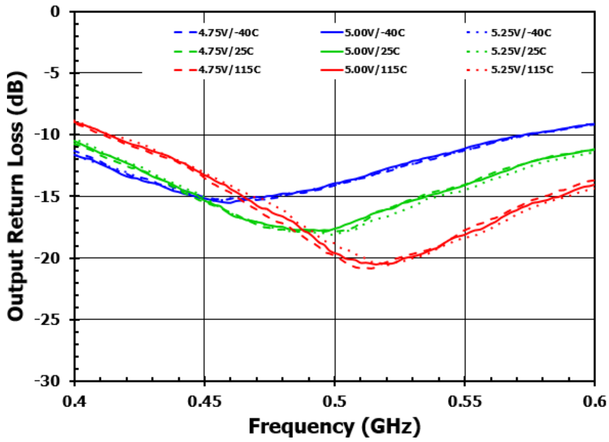


Figure 28. Output Return Loss

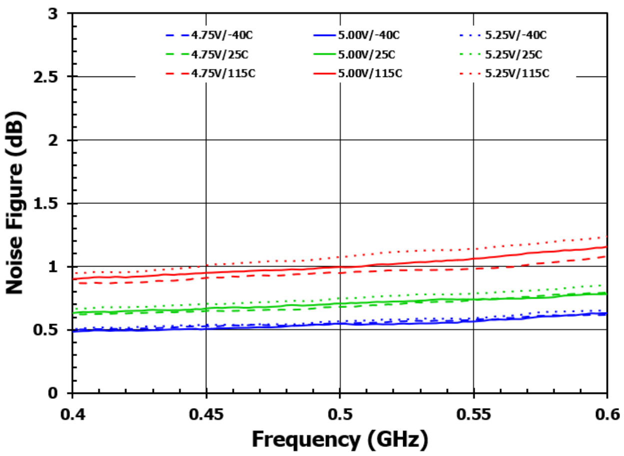


Figure 29. Noise Figure

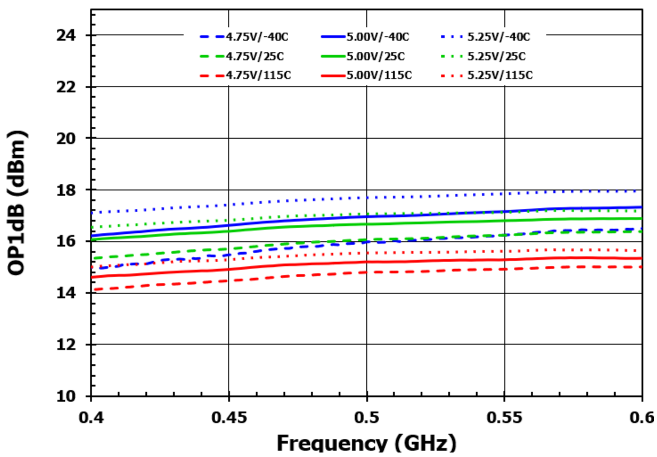


Figure 30. OP1dB

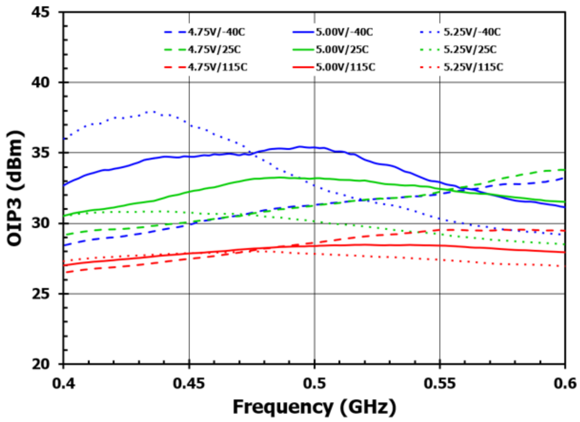


Figure 31. OIP3

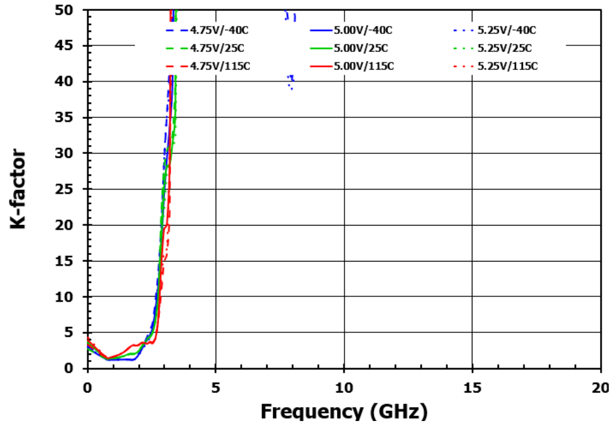


Figure 32. K factor

4.4 Typical Performance (0.7GHz – 1.0GHz)

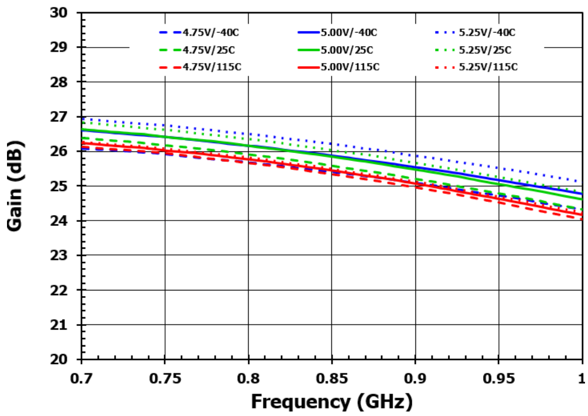


Figure 33. Gain

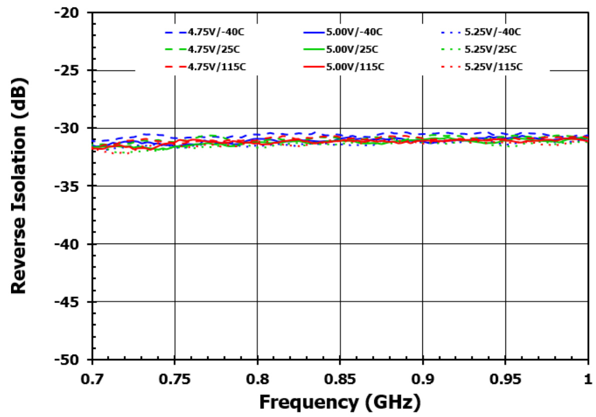


Figure 34. Reverse Isolation

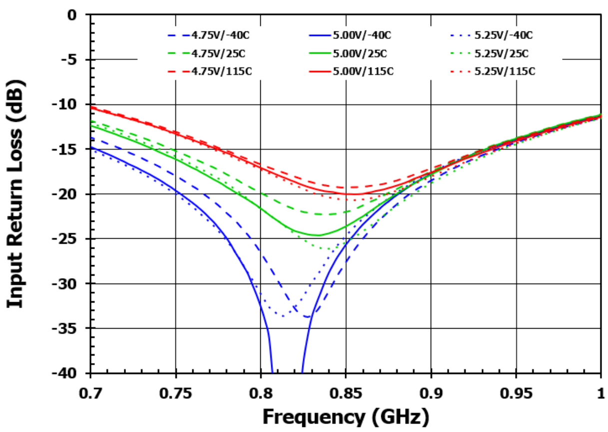


Figure 35. Input Return Loss

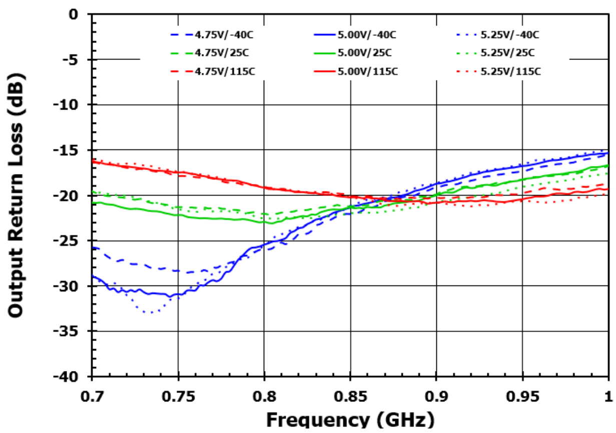


Figure 36. Output Return Loss

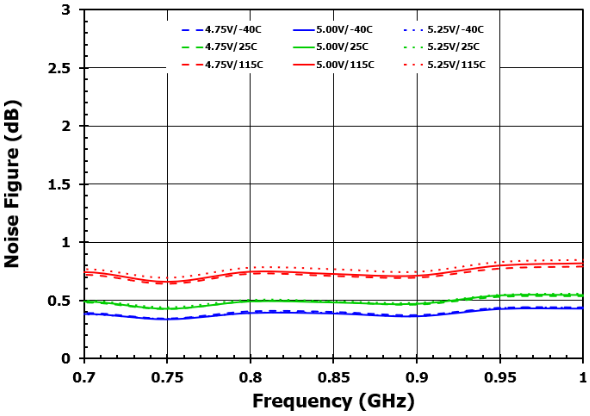


Figure 37. Noise Figure

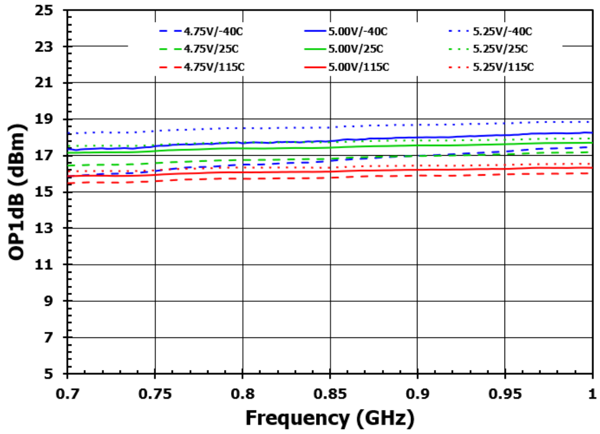


Figure 38. OP1dB

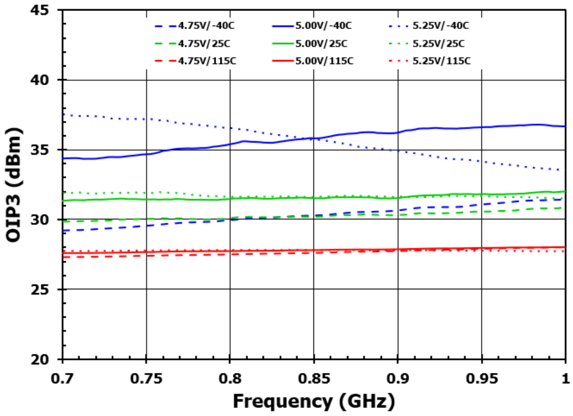


Figure 39. OIP3

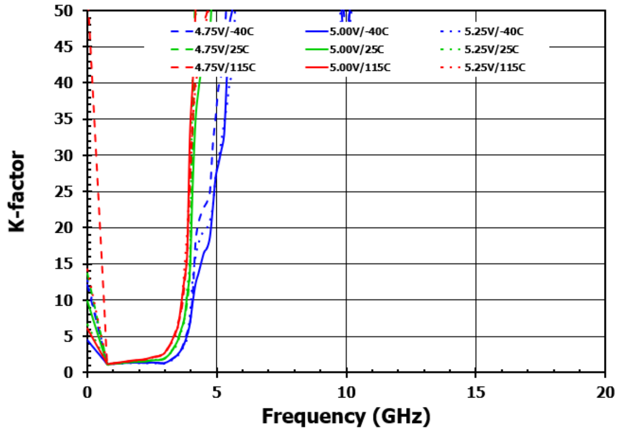


Figure 40. K factor

4.5 Typical Performance (1.5GHz – 3GHz)

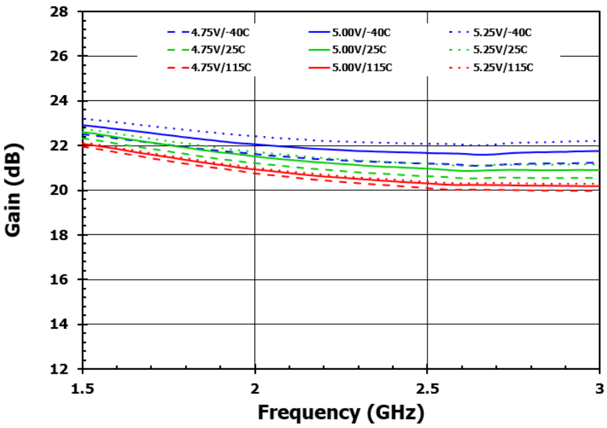


Figure 41. Gain

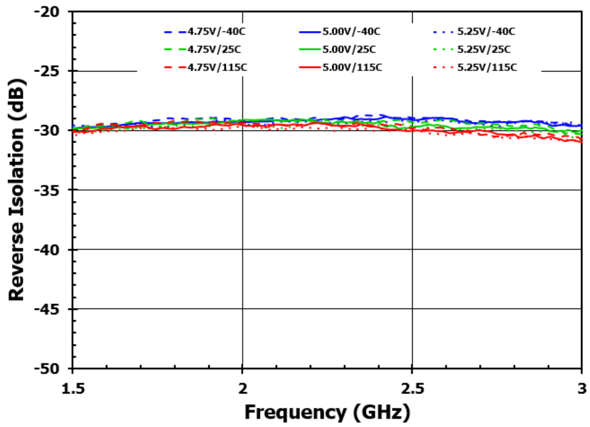


Figure 42. Reverse Isolation

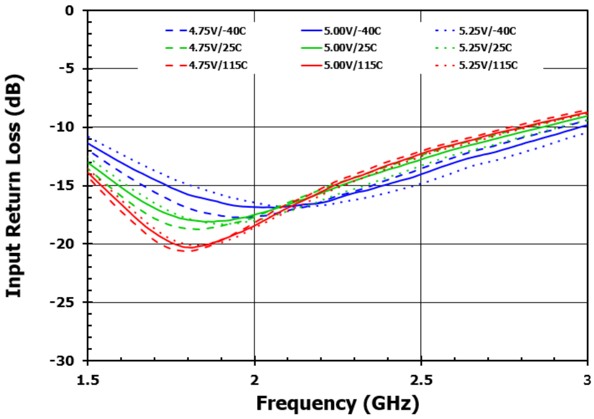


Figure 43. Input Return Loss

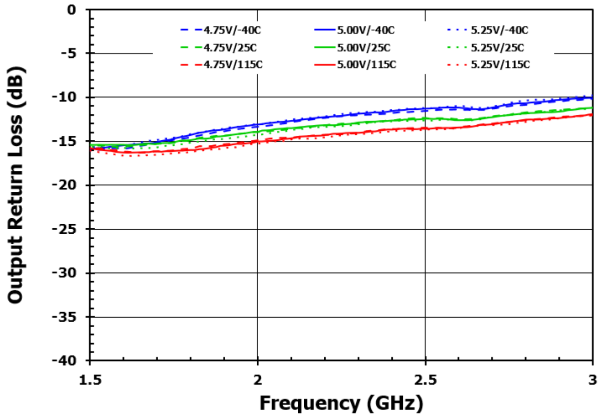


Figure 44. Output Return Loss

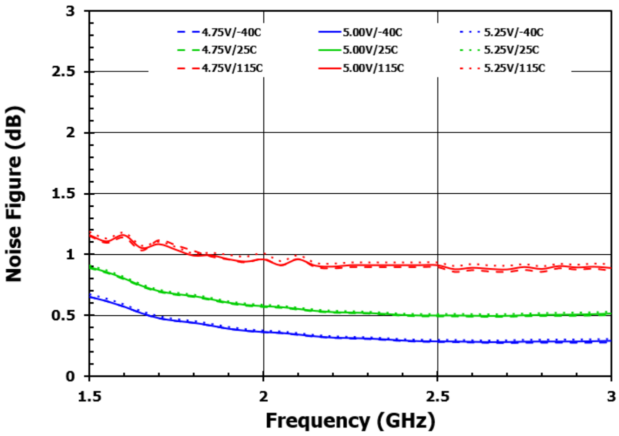


Figure 45. Noise Figure

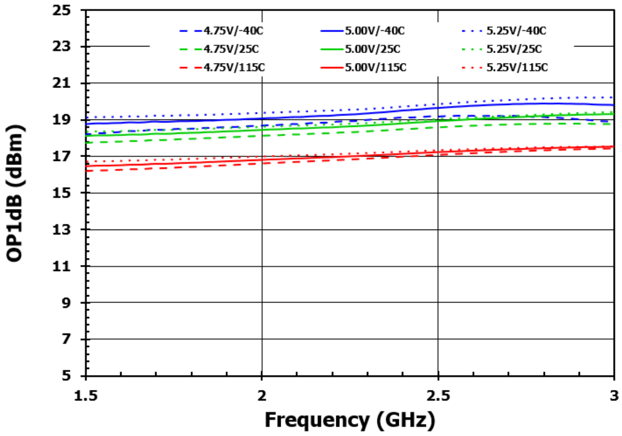


Figure 46. OP1dB

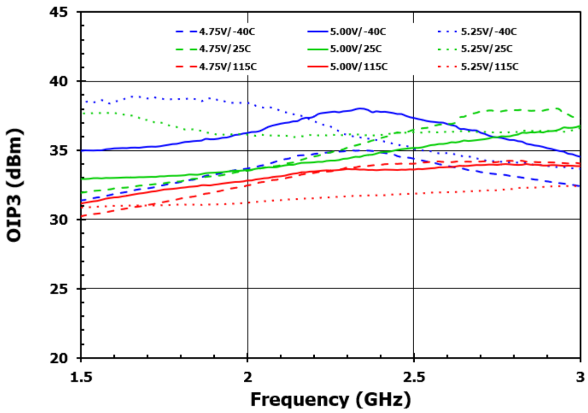


Figure 47. OIP3

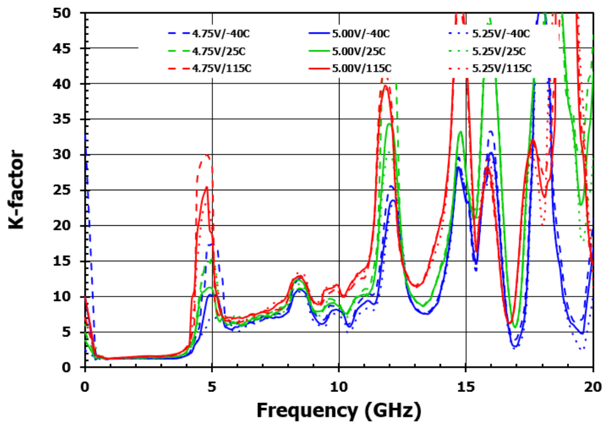


Figure 48. K factor

4.6 Typical Performance (3.3GHz – 4.2GHz)

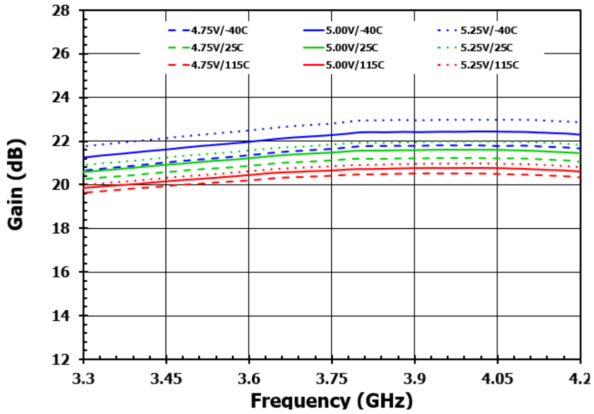


Figure 49. Gain

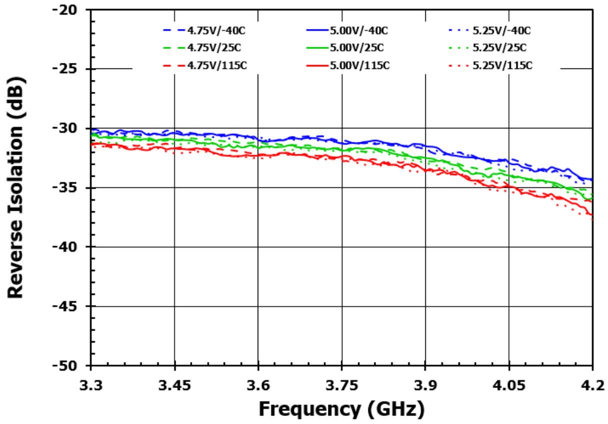


Figure 50. Reverse Isolation

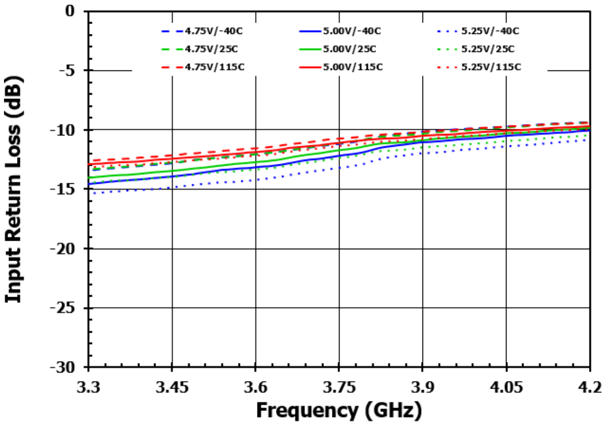


Figure 51. Input Return Loss

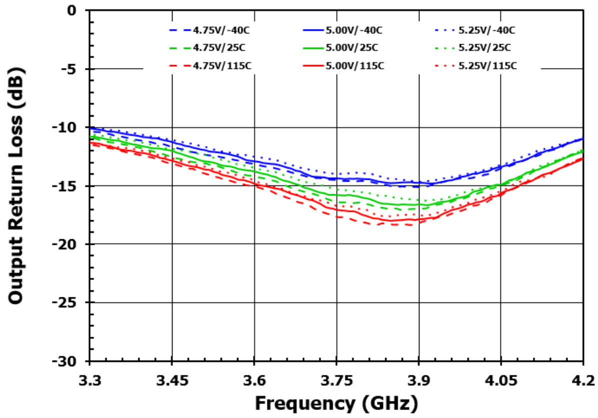


Figure 52. Output Return Loss

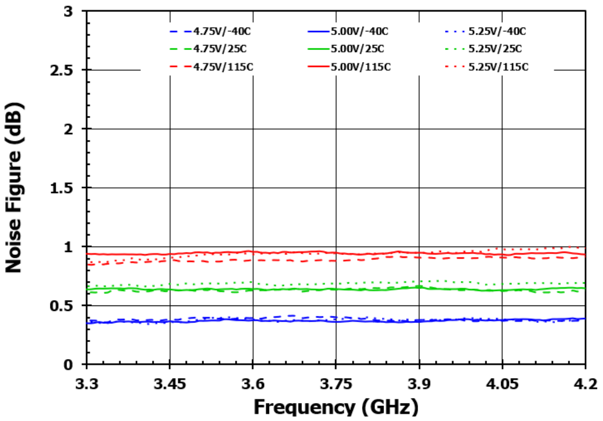


Figure 53. Noise Figure

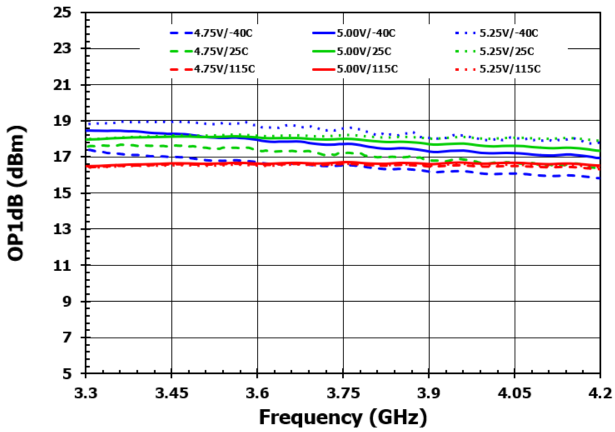


Figure 54. OP1dB

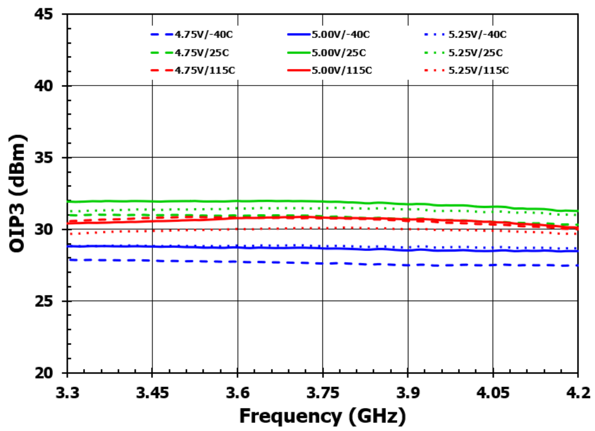


Figure 55. OIP3

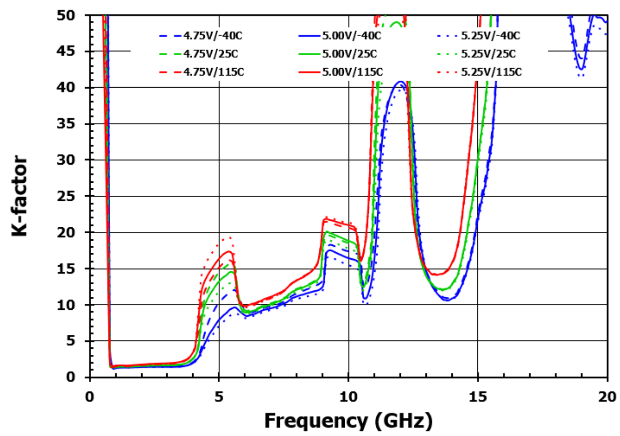


Figure 56. K Factor

4.7 Typical Performance (4.4GHz – 5GHz)

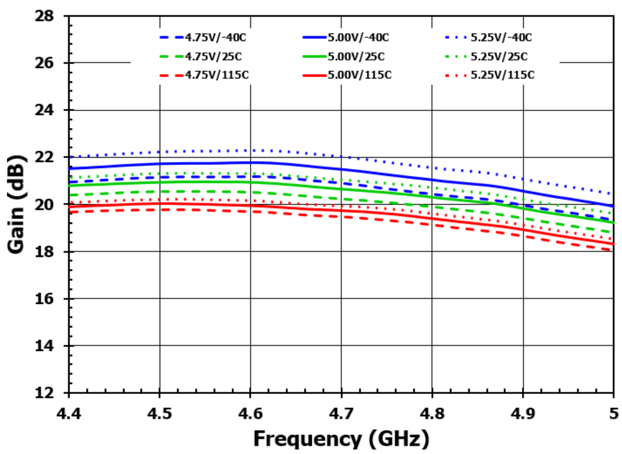


Figure 57. Gain

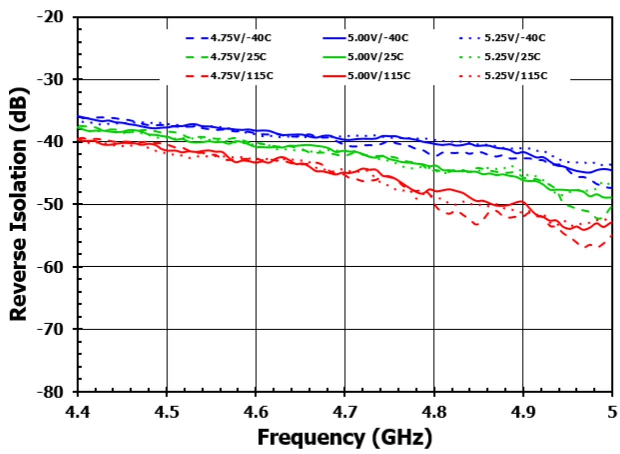


Figure 58. Reverse Isolation

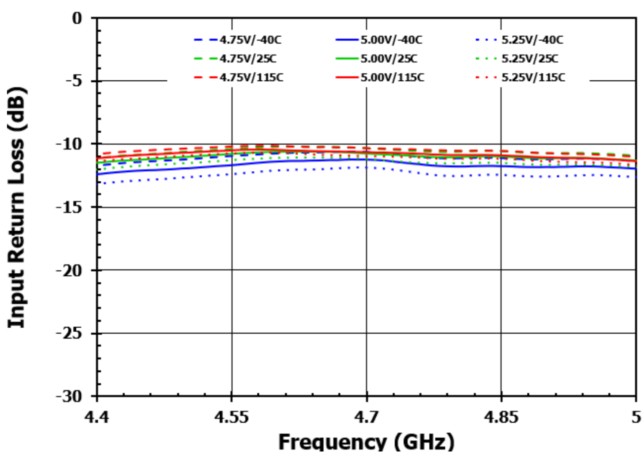


Figure 59. Input Return Loss

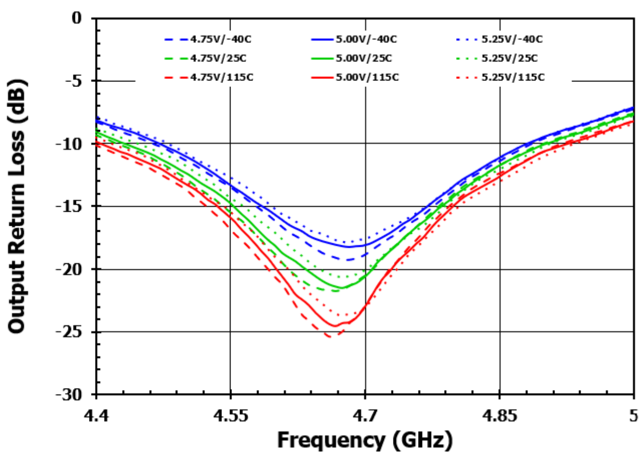


Figure 60. Output Return Loss

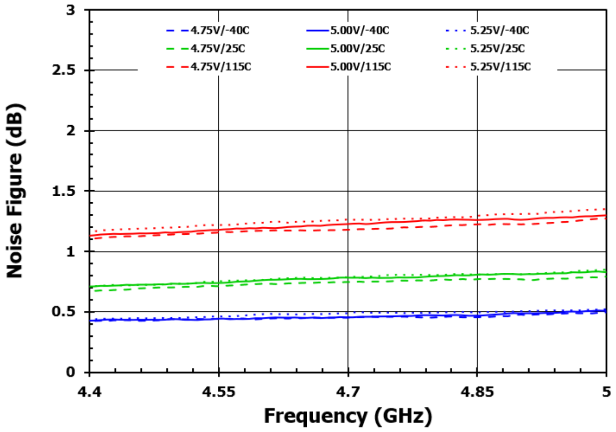


Figure 61. Noise Figure

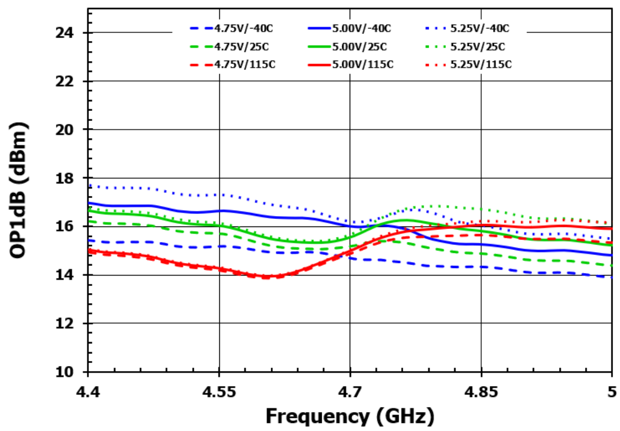


Figure 62. OP1dB

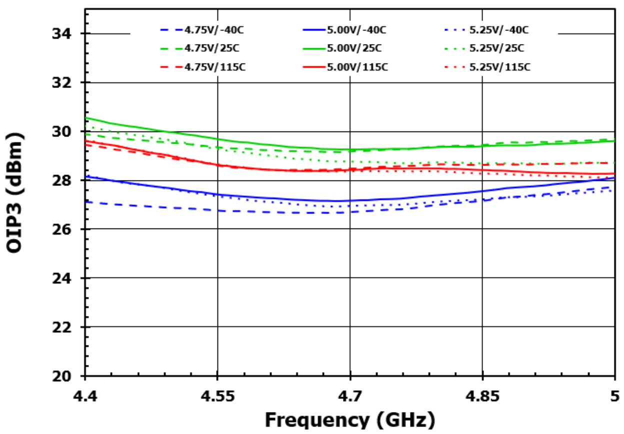


Figure 63. OIP3

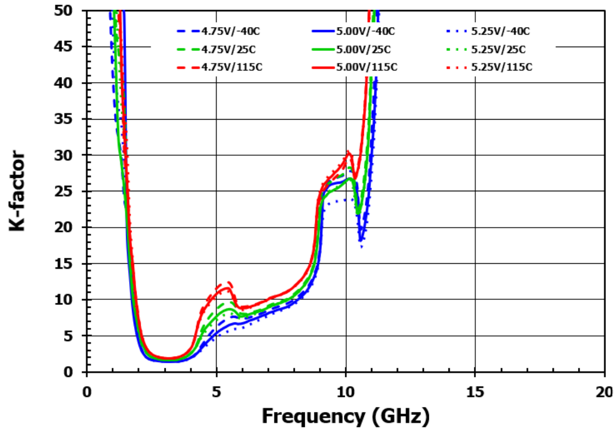


Figure 64. K Factor

5. Functional Description

5.1 Programming

The F0180 uses the control pins (STBY) to place the LNA into its standby mode. The following section provides specific details on the functionality of STBY pin.

5.2 STBY Mode Programming

The F0180 allows for the shutdown of amplifier.

Table 1. STBY Mode Truth Table

Pin	Logic	Amplifier State
6 / STBY	Low	Power On
	High	Standby

6. Evaluation Kit Information

6.1 Evaluation Board

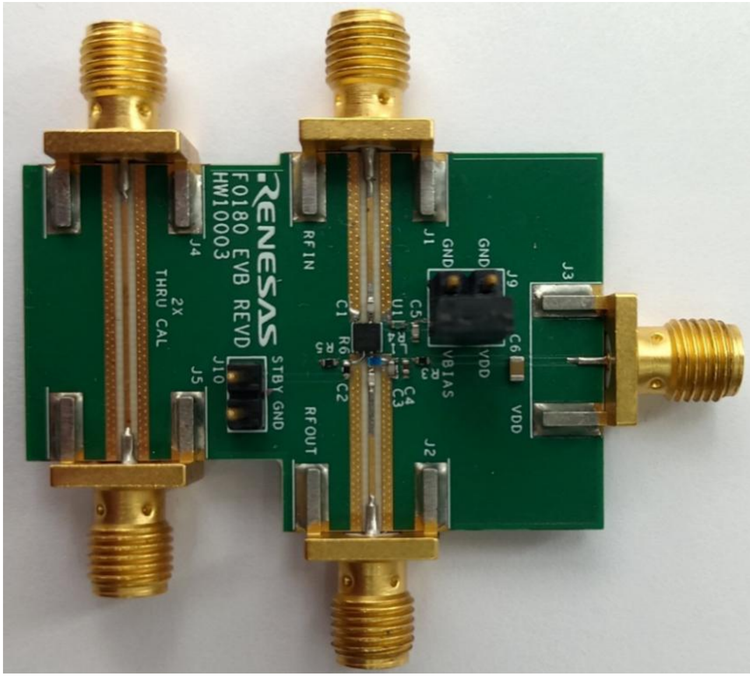


Figure 65. Evaluation Kit - Top View

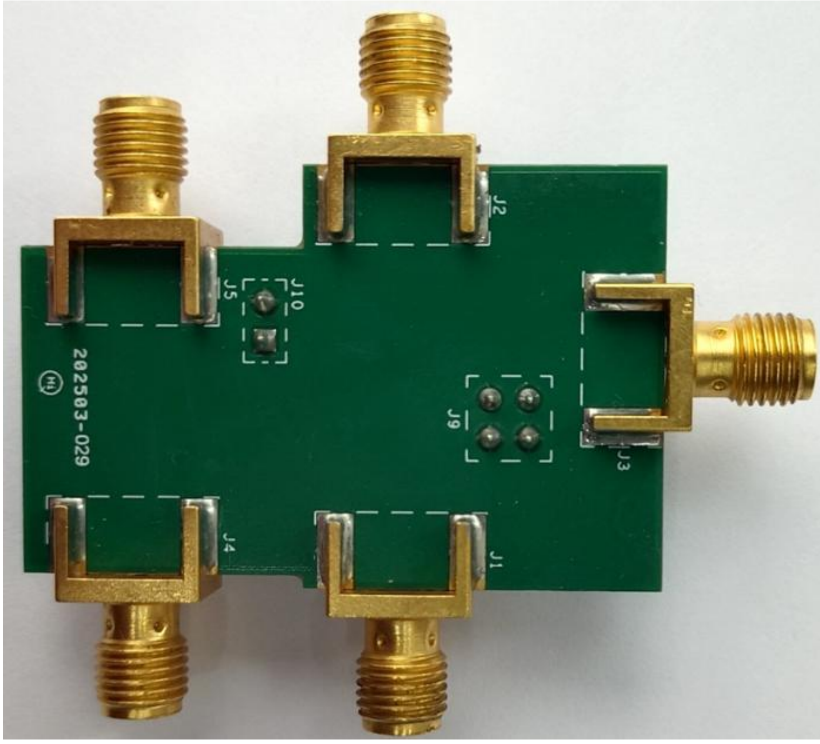


Figure 66. Evaluation Kit - Bot View

6.2 Evaluation Kit Schematic

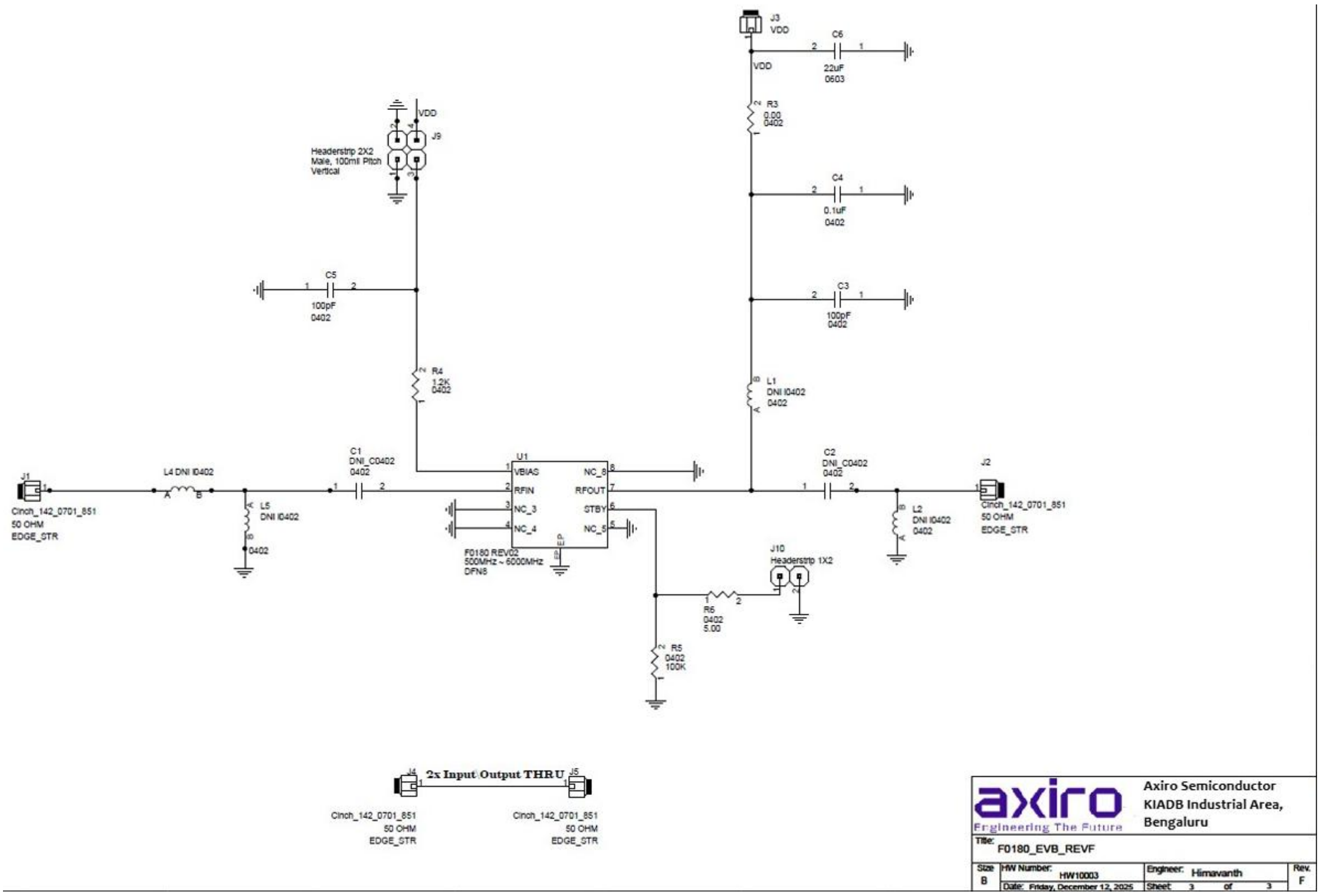


Figure 67. Evaluation Kit schematic

6.3 Bill of Materials

6.3.1. 0.4-6GHz(5V Vdd)

Part Reference	Qty	Value	Part Number	Description	Manufacturer
R3	1	0 ohm	ERJ-2GE0R00X	Thick Film Resistors - SMD 0402 Zero ohms 5% Tol AEC-Q200	Panasonic
R4	1	1.21Kohm	ERA-2ARB1211X	Thin Film Resistors - SMD 0402 1.21Kohms 0.1% .063W 10ppm AEC-Q200	Panasonic
R6	1	5.1 ohm	ERJ-H2CF5R10X	Thick Film Resistors - SMD 0402 5.1Ohm 1% AEC-Q200	Panasonic
R5	1	100 kohm	ERJ-2GEJ104X	100 kOhms ±5% 0.1W, 1/10W Chip Resistor 0402	Panasonic
C1	1	15pF	GJM1555C1H150JB01	CAP CER 15F 50V C 0402	Murata
C2	1	15pF	GJM1555C1H150JB01	CAP CER 15PF 50V C 0402	Murata
C6	1	22uF	GRM158R61A226ME15D	CAP CER 22uF 50V C0G/NP0 0402	Murata
C3, C5	2	100pF	GCM1555C1H101JA16J	100 pF ±5% 50V Ceramic Capacitor C0G, NP0 0402	Murata
C4	1	0.1uF	GRM155R61H104KE14D	CAP CER 0.1UF 50V X5R 0402	Murata
L1	1	18nH	0402DC-18NXGRW	RF Inductors - SMD 1005 18nH Unshielded 2% 1.1A 137.9mOhms	Murata
L4	1	0 ohm	ERJ-2GE0R00X	Thick Film Resistors - SMD 0402 Zero ohms 5% Tol AEC-Q200	Panasonic

6.3.2. 0.4-6GHz(3.3V Vdd)

Part Reference	Qty	Value	Part Number	Description	Manufacturer
R3	1	0 ohm	ERJ-2GE0R00X	Thick Film Resistors - SMD 0402 Zero ohms 5% Tol AEC-Q200	Panasonic
R4	1	33nH	LQG15WZ33NG02D	RF Inductors- SMD 0402 33nH Unshielded 2% 220mA, 1.5ohms	Murata
R6	1	5.1 ohm	ERJ-H2CF5R10X	Thick Film Resistors - SMD 0402 5.1Ohm 1% AEC-Q200	Panasonic
R5	1	100 kohm	ERJ-2GEJ104X	100 kOhms ±5% 0.1W, 1/10W Chip Resistor 0402	Panasonic

C1	1	15pF	GJM1555C1H150JB01	CAP CER 15F 50V C 0402	Murata
C2	1	15pF	GJM1555C1H150JB01	CAP CER 15PF 50V C 0402	Murata
C6	1	22uF	GRM158R61A226ME15D	CAP CER 22uF 50V C0G/NP0 0402	Murata
C3, C5	2	100pF	GCM1555C1H101JA16J	100 pF ±5% 50V Ceramic Capacitor C0G, NP0 0402	Murata
C4	1	0.1uF	GRM155R61H104KE14D	CAP CER 0.1UF 50V X5R 0402	Murata
L1	1	18nH	0402DC-18NXGRW	RF Inductors - SMD 1005 18nH Unshielded 2% 1.1A 137.9mOhms	Murata
L4	1	0 ohm	ERJ-2GE0R00X	Thick Film Resistors - SMD 0402 Zero ohms 5% Tol AEC-Q200	Panasonic

6.3.3. 400MHz-600MHz

Part Reference	Qty	Value	Part Number	Description	Manufacturer
R3	1	0 ohm	ERJ-2GE0R00X	Thick Film Resistors - SMD 0402 Zero ohms 5% Tol AEC-Q200	Panasonic
R4	1	1.21kohm	ERA-2ARB1211X	Thin Film Resistors - SMD 0402 1.21Kohms 0.1% .063W 10ppm AEC-Q200	Panasonic
R6	1	5.1 ohm	ERJ-H2CF5R10X	Thick Film Resistors - SMD 0402 5.1Ohm 1% AEC-Q200	Panasonic
R5	1	100 kohm	ERJ-2GEJ104X	100 kOhms ±5% 0.1W, 1/10W Chip Resistor 0402	Panasonic
C1	1	15pF	GJM1555C1H150JB01	CAP CER 15F 50V C 0402	Murata
C2	1	15pF	GJM1555C1H150JB01	CAP CER 15PF 50V C 0402	Murata
C6	1	22uF	GRM158R61A226ME15D	CAP CER 22uF 50V C0G/NP0 0402	Murata
C3, C5	2	100pF	GCM1555C1H101JA16J	100 pF ±5% 50V Ceramic Capacitor C0G, NP0 0402	Murata
C4	1	0.1uF	GRM155R61H104KE14D	CAP CER 0.1UF 50V X5R 0402	Murata
L1	1	18nH	0402DC-18NXGRW	RF Inductors - SMD 1005 18nH Unshielded 2% 1.1A 137.9mOhms	Murata

L4	1	33nH	LQW15AN33NG8Z	Multilayer Inductor 0402 (1005 Metric)	Murata
L5	1	470kohm	-	-	Various

6.3.4. 700MHz—1GHz

Part Reference	Qty	Value	Part Number	Description	Manufacturer
R3	1	0 ohm	ERJ-2GE0R00X	Thick Film Resistors - SMD 0402 Zero ohms 5% Tol AEC-Q200	Panasonic
R4	1	1.21Kohm	ERA-2ARB1211X	Thin Film Resistors - SMD 0402 1.21Kohms 0.1% .063W 10ppm AEC-Q200	Panasonic
R6	1	5.1 ohm	ERJ-H2CF5R10X	Thick Film Resistors - SMD 0402 5.1Ohm 1% AEC-Q200	Panasonic
R5	1	100 kohm	ERJ-2GEJ104X	100 kOhms ±5% 0.1W, 1/10W Chip Resistor 0402	Panasonic
C1	1	15pF	GJM1555C1H150JB01	CAP CER 15F 50V C 0402	Murata
C2	1	15pF	GJM1555C1H150JB01	CAP CER 15PF 50V C 0402	Murata
C6	1	22uF	GRM158R61A226ME15D	CAP CER 22uF 50V C0G/NP0 0402	Murata
C3, C5	2	100pF	GCM1555C1H101JA16J	100 pF ±5% 50V Ceramic Capacitor C0G, NP0 0402	Murata
C4	1	0.1uF	GRM155R61H104KE14D	CAP CER 0.1UF 50V X5R 0402	Murata
L1	1	18nH	0402DC-18NXGRW	RF Inductors - SMD 1005 18nH Unshielded 2% 1.1A 137.9mOhms	Murata
L4	1	13nH	LQW15AN13NG8Z	Multilayer Inductor 0402 (1005 Metric)	Murata
L5	1	470kohm	-	-	Various

6.3.5. 1.5GHz—3GHz

Part Reference	Qty	Value	Part Number	Description	Manufacturer
R3	1	0 ohm	ERJ-2GE0R00X	Thick Film Resistors - SMD 0402 Zero ohms 5% Tol AEC-Q200	Panasonic

R4	1	1.21Kohm	ERA-2ARB1211X	Thin Film Resistors - SMD 0402 1.21Kohms 0.1% .063W 10ppm AEC-Q200	Panasonic
R6	1	5.1 ohm	ERJ-H2CF5R10X	Thick Film Resistors - SMD 0402 5.1Ohm 1% AEC-Q200	Panasonic
R5	1	100 kohm	ERJ-2GEJ104X	100 kOhms ±5% 0.1W, 1/10W Chip Resistor 0402	Panasonic
C1	1	2.7pF	GQM1555G2D2RO7BB01	CAP CER 2.7F 200VdC 0402	Murata
C2	1	15pF	GJM1555C1H150JB01	CAP CER 15PF 50V C 0402	Murata
C6	1	22uF	GRM158R61A226ME15D	CAP CER 22uF 50V C0G/NP0 0402	Murata
C3, C5	2	100pF	GCM1555C1H101JA16J	100 pF ±5% 50V Ceramic Capacitor C0G, NP0 0402	Murata
C4	1	0.1uF	GRM155R61H104KE14D	CAP CER 0.1UF 50V X5R 0402	Murata
L1	1	18nH	0402DC-18NXGRW	RF Inductors - SMD 1005 18nH Unshielded 2% 1.1A 137.9mOhms	Murata
L4	1	0 ohm	ERJ-2GE0R00X	Thick Film Resistors - SMD 0402 Zero ohms 5% Tol AEC-Q200	Panasonic
L5	1	5nH	LQW15AN5N0G8Z	Multilayer Inductor 0402 (1005 Metric)	Murata

6.3.6. 3.3GHz-4.2GHz

Part Reference	Qty	Value	Part Number	Description	Manufacturer
R3	1	0 ohm	ERJ-2GE0R00X	Thick Film Resistors - SMD 0402 Zero ohms 5% Tol AEC-Q200	Panasonic
R4	1	1.21Kohm	ERA-2ARB1211X	Thin Film Resistors - SMD 0402 1.21Kohms 0.1% .063W 10ppm AEC-Q200	Panasonic
R6	1	5.1 ohm	ERJ-H2CF5R10X	Thick Film Resistors - SMD 0402 5.1Ohm 1% AEC-Q200	Panasonic
R5	1	100 kohm	ERJ-2GEJ104X	100 kOhms ±5% 0.1W, 1/10W Chip Resistor 0402	Panasonic
C1	1	15pF	GJM1555C1H150JB01	CAP CER 15F 50V C 0402	Murata
C2	1	3pF	GQM1555G2D3R0BB01	CAP CER 3PF 200V C 0402	Murata

C6	1	22uF	GRM158R61A226ME15D	CAP CER 22uF 50V C0G/NP0 0402	Murata
C3, C5	2	100pF	GCM1555C1H101JA16J	100 pF ±5% 50V Ceramic Capacitor C0G, NP0 0402	Murata
C4	1	0.1uF	GRM155R61H104KE14D	CAP CER 0.1UF 50V X5R 0402	Murata
L1	1	2.4nH	LQG15HN2N4C02D	Multilayer Inductor 800 mA 0402 (1005 Metric)	Murata
L4	1	0 ohm	ERJ-2GE0R00X	Thick Film Resistors - SMD 0402 Zero ohms 5% Tol AEC-Q200	Panasonic

6.3.7. 4.4GHz—5GHz

Part Reference	Qty	Value	Part Number	Description	Manufacturer
R3	1	0 ohm	ERJ-2GE0R00X	Thick Film Resistors - SMD 0402 Zero ohms 5% Tol AEC-Q200	Panasonic
R4	1	1.21Kohm	ERA-2ARB1211X	Thin Film Resistors - SMD 0402 1.21Kohms 0.1% .063W 10ppm AEC-Q200	Panasonic
R6	1	5.1 ohm	ERJ-H2CF5R10X	Thick Film Resistors - SMD 0402 5.1Ohm 1% AEC-Q200	Panasonic
R5	1	100 kohm	ERJ-2GEJ104X	100 kOhms ±5% 0.1W, 1/10W Chip Resistor 0402	Panasonic
C1	1	5pF	GJM1555C1H5R0WB01D	CAP CER 5F 50V C 0402	Murata
C2	1	0.7pF	GJM1555C1HR70WB01D	CAP CER 0.7F 50V C 0402	Murata
C6	1	22uF	GRM158R61A226ME15D	CAP CER 22uF 50V C0G/NP0 0402	Murata
C3, C5	2	100pF	GCM1555C1H101JA16J	100 pF ±5% 50V Ceramic Capacitor C0G, NP0 0402	Murata
C4	1	0.1uF	GRM155R61H104KE14D	CAP CER 0.1UF 50V X5R 0402	Murata
L1	1	1.7nH	LQW15AN1N7C80	Unshielded Multilayer Inductor 800 mA 125mOhm Max 0402 (1005 Metric)	Murata
L4	1	0 ohm	ERJ-2GE0R00X	Thick Film Resistors - SMD 0402 Zero ohms 5% Tol AEC-Q200	Panasonic

7. Application Information

7.1 Power Supplies

Use a common V_{DD} power supply for all pins requiring DC power. Bypass all supply pins with external capacitors to minimize noise and fast transients. Supply noise can degrade the noise figure, and fast transients can trigger ESD clamps and cause them to fail. Supply voltage change, or transients should have a slew rate smaller than 1V / 20µs. In addition, keep all control pins at 0V (±0.3V) while the supply voltage ramps up or while it returns to zero.

7.2 Control Pin Interface

If control signal integrity is a concern and clean signals cannot be assured because of issues such as overshoot, undershoot, ringing, the following circuit at the input of each control pin is recommended. This applies to control Pins 6 shown in **Error! Reference source not found.**68.

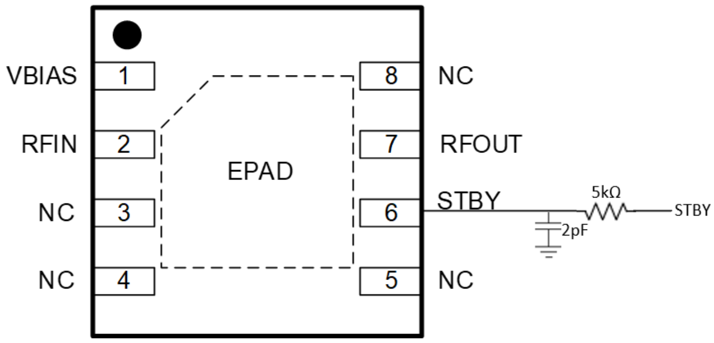
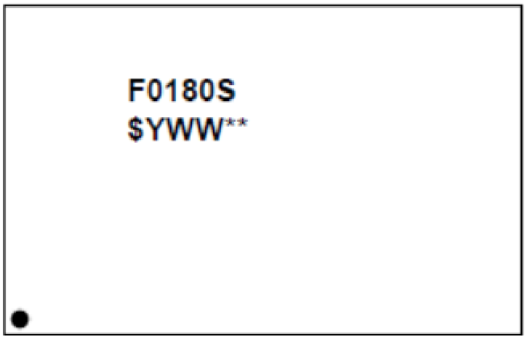


Figure 68. Control Pin Interface Schematic

8. Package Outline Drawings

The package outline drawings are located at the end of this document, The package information is the most current data available and is subject to change without revision of this document.

9. Marking Diagram



- Line 1: “F0180S” is the truncated part number.
- Line 2: “$” represents the Mark code, “YWW” has one digit for the year and two digits for week that the part was assembled, “ ** ” denotes Lot seq.

10. Ordering Information

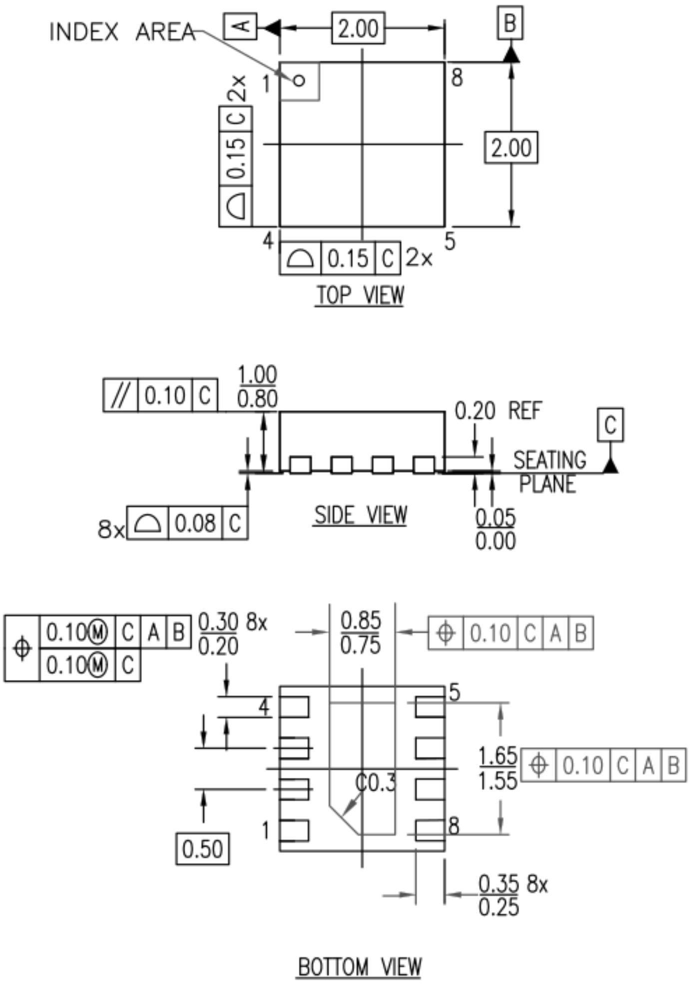
Part Number	Package Description	MSL Rating	Carrier Type	Temperature Range
RA81F0180STGNS#BB0	2 × 2 mm 8-DFN	1	Cut reel	-40° to +115°C
RA81F0180STGNS#KB0		1	Tape & Reel	-40° to +115°C
RTKA81F01800P500RU	Evaluation Board 400MHz to 600MHz Tune			
RTKA81F01800P700RU	Evaluation Board 700MHz to 1000MHz Tune			
RTKA81F01802P100RU	Evaluation Board 1500MHz to 3000MHz Tune			
RTKA81F01803P600RU	Evaluation Board 3000MHz to 4200MHz Tune			
RTKA81F01804P700RU	Evaluation Board 4400MHz to 5000MHz Tune			

11. Revision History

Revision	Date	Description
0.01	Feb 26, 2026	Initial release.

8-DFN, Package Outline Drawing

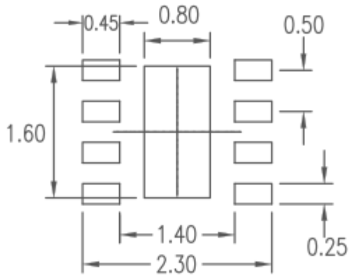
2.0 x 2.0 x 0.9 mm Body, Epad 0.8 x 1.6 mm, 0.5mm Pitch
NB/NBG8P3, PSC-4178-03, Rev 01, Page 1



NOTE:
1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5–2009.
2. ALL DIMENSIONS ARE IN MMILLIMETERS.

8-DFN, Package Outline Drawing

2.0 x 2.0 x 0.9 mm Body, Epad 0.8 x 1.6 mm, 0.5mm Pitch
NB/NBG8P3, PSC-4178-03, Rev 01, Page 2



RECOMMENDED LAND PATTERN DIMENSION

NOTES:
1. ALL DIMENSIONS ARE IN mm. ANGLES IN DEGREES.
2. TOP DOWN VIEW. AS VIEWED ON PCB.
3. LAND PATTERN RECOMMENDATION PER IPC-7351B GENERIC REQUIREMENT FOR SURFACE MOUNT DESIGN AND LAND PATTERN.

Package Revision History		
Date Created	Rev No.	Description
Oct 9, 2017	Rev 01	New Format