GRF4042

Preliminary **Low Noise Amplifier with Bypass & Guerrilla Armor™; 0.4 – 2.7 GHz**

Package: 2.0 x 2.0 mm QFN-12

Features

- 0.7 GHz to 2.7 GHz (Single Tune)
- Bypass + Guerrilla Armor™
- NF: 0.85 dB @ 1.9 GHz
- Gain: 16.2 dB @ 1.9 GHz
- Bypass Gain: -2.0 dB @ 1.9 GHz
- OP1dB: +20.6 dBm @ 1.9 GHz
- Flexible Bias Voltage and Current
- Internally Matched to 50 Ω

Applications

- Cellular Repeaters and Signal Boosters
- Cellular Infrastructure
- Small Cells
- WLAN/ZigBee®/Bluetooth®
- 900 MHz ISM
- General Purpose Bypass Amplifier

Product Description

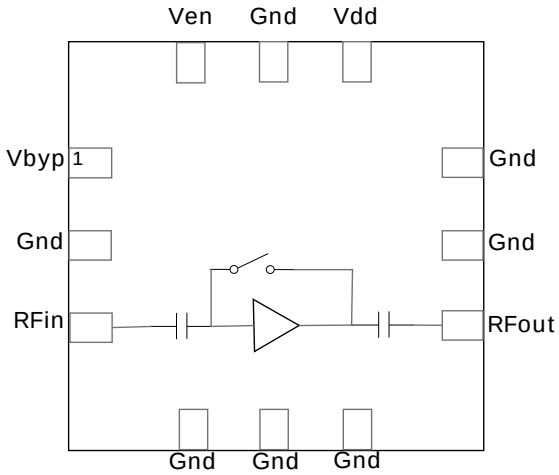
GRF4042 is a low noise amplifier (LNA) with low loss bypass designed for high performance applications up to 2.7 GHz. Guerrilla Armor™ technology provides exceptional off-state isolation in the presence of high RF input signal levels in LNA disabled mode.

With integrated matching, the device achieves outstanding noise figure (NF), high gain and high linearity over 400-2700 MHz using as few as three external components.

The LNA is operated from a single positive supply of 1.8 to 5.0 V with a selectable Iddq range of 20 to 90 mA.

Consult with the GRF applications engineering team for custom tuning/evaluation board data and device s-parameters.

Functional Block Diagram



2.0 mm x 2.0 mm QFN-12

Absolute Ratings

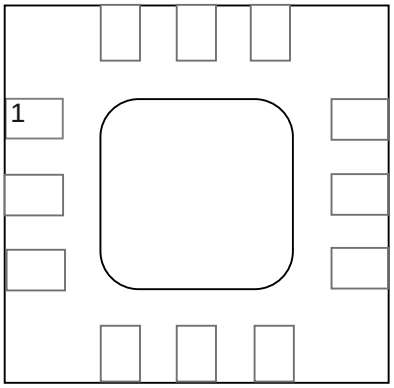
Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	V_{DD}	0	6.0	V
DC Voltage at Control Port (Pin 1)	V_{BYP}	0	V_{DD}	V
DC Voltage at Control Port (Pin 12)	V_{EN}	0	V_{DD}	
RF CW Input Power (LNA Gain Mode)	$P_{IN\ MAX}$		+17	dBm
RF CW Input Power (LNA Bypass Mode)	$P_{IN\ MAX}$		+27	dBm
RF CW Input Power (LNA Disabled Mode)	$P_{IN\ MAX}$		+27	dBm
Operating Temperature (Package heat sink)	T_{AMB}	-40	+105	°C
Storage Temperature	T_{STG}	-40	+150	°C
Maximum Channel Temperature	T_{MAX}		+160	°C
Maximum Dissipated Power (Note: De-rate 8 mW/°C for TAMB > +85C.	$P_{DISS\ MAX}$		500	mW
Electro Static Discharge:				
Charged Device Model: (TBD)	CDM	Class 4: 1000		Volts
Human Body Model: (TBD)	HBM	Class 1B: 500		Volts
Machine Model: (TBD)	MM	Class A: 50		Volts

Caution! ESD Sensitive Device: Exceeding Absolute Maximum Rating conditions may cause permanent damage to the device.

Nominal Operating Parameters

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
High Gain Mode						V_{DD} = 5.0 V; Temp: +25C
Test Frequency	F_{TEST}		1900		MHz	
Gain	S21		16.2		dB	
Input Return Loss	S11		-9.0		dB	
Output Return Loss	S22		-11.5		dB	
Noise Figure	NF		0.85		dB	(Board Losses De-embedded)
Input Third Order Intercept Point	IIP3		+18.0		dBm	
Input 1dB Compression Point	IP1dB		+5.5		dBm	
Supply Current	I_{DD}		70		mA	
Enable Current	I_{ENABLE}		2.8		mA	
BypassMode						Vdd: 5.0 V; Ven: Low; Vbyp: High
Gain	S(2,1)		-2.0		dB	
Input 1dB Compression Point	IP1dB		+22.0		dBm	
Input Third Order Intercept Point	IIP3		+38.0		dBm	
Disabled Mode (Guerrilla Armor™)						V_{DD} = 5.0 V, Ven: Low; Vbyp: Low
Gain	S(2,1)		-35 dB		dB	
Thermal Data						
Thermal Resistance (Infra-Red Scan)	Θjc		132		°C/W	
Channel Temperature @ +85 C reference (Package heat sink)	$T_{CHANNEL}$		131		°C	Vdd: 5.0 V; Iddq: 70 mA; No RF; Dissipated Power: 350 mW

Pin Out (Top View)

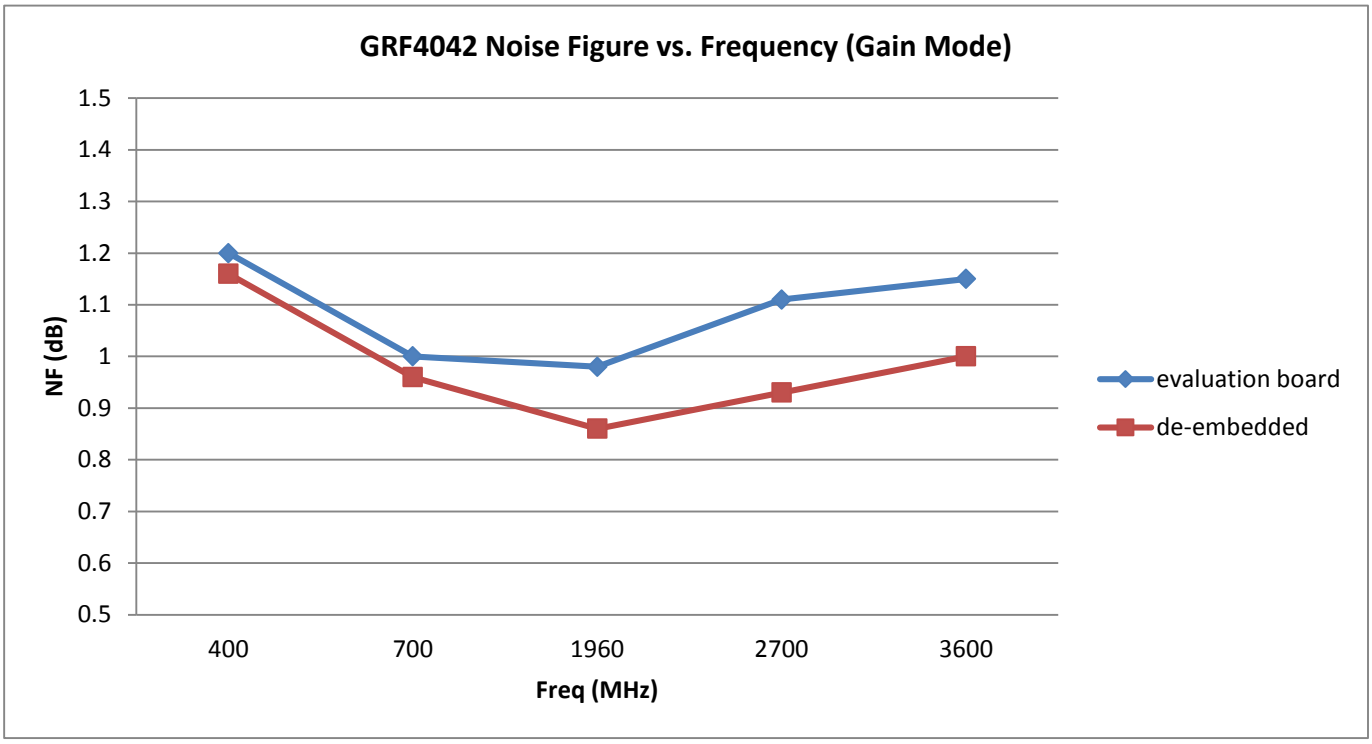


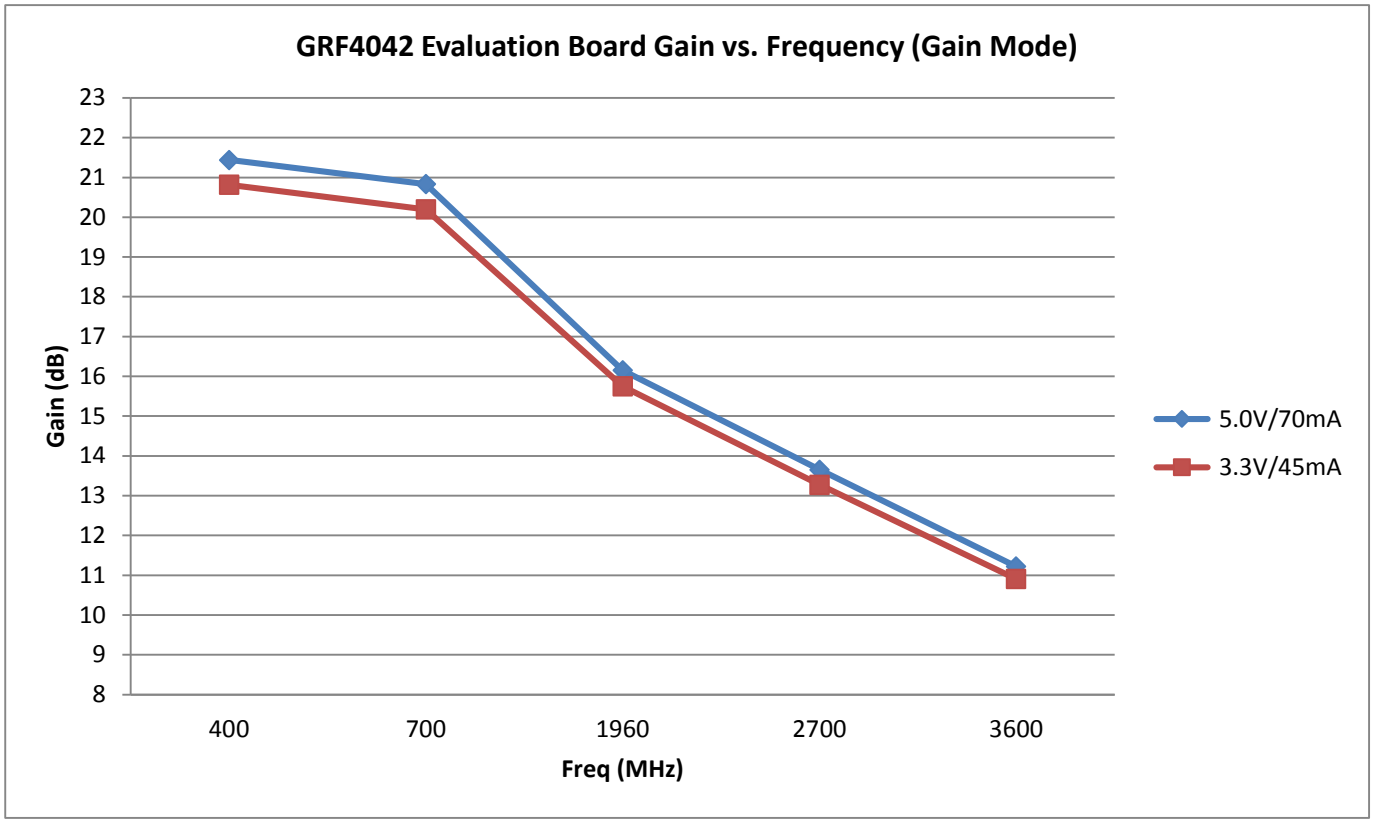
Pin Assignments

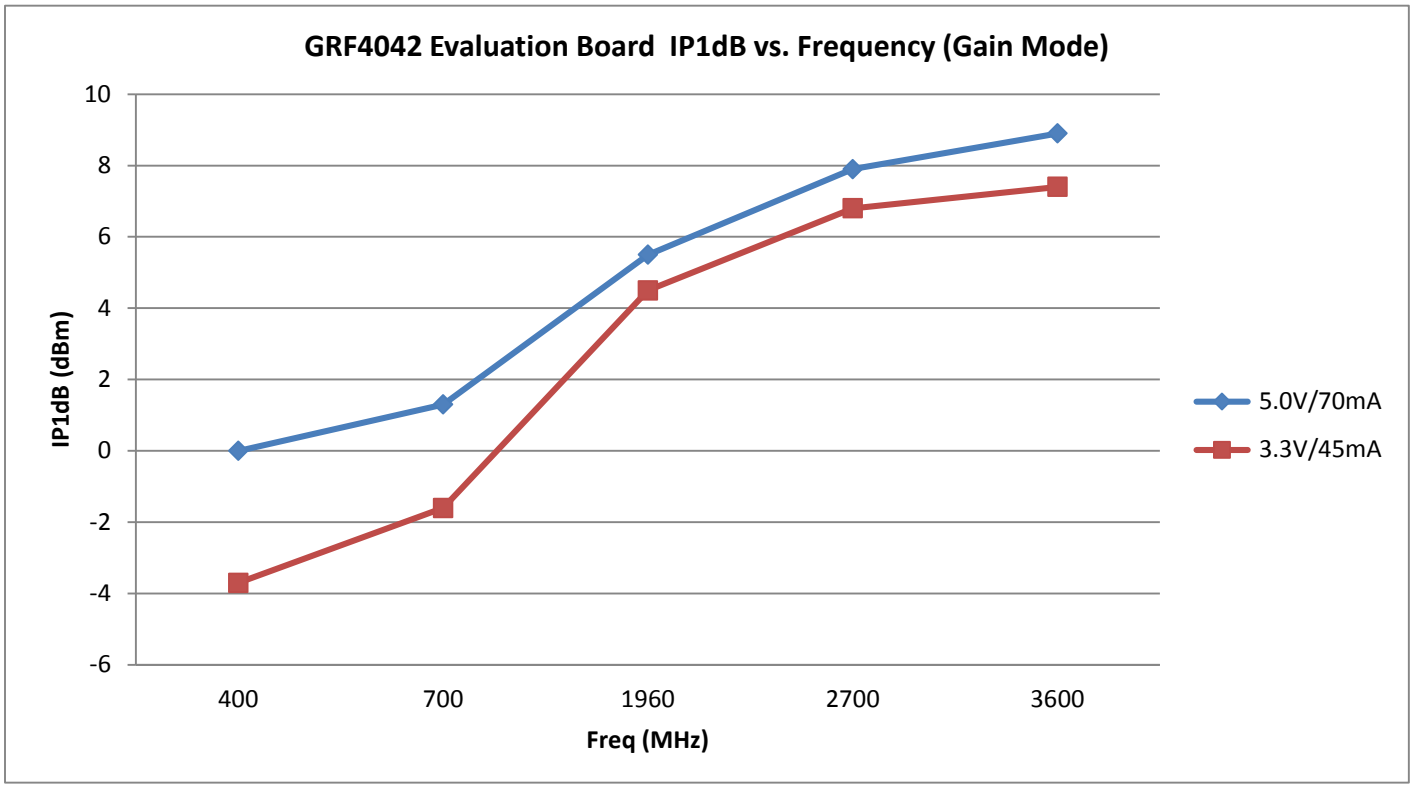
Pin	Name	Description	Note
1	Vbyp	Low Insertion Loss Bypass	See control logic truth table
2	Gnd	Ground	External match must provide DC block
3	RFin	RF Input	
4	Gnd	Ground	
5	Gnd	Ground	
6	Gnd	Ground	
7	RFout	RF Output	
8	Gnd	Ground	
9	Gnd	Ground	
10	Vdd	Supply Voltage Input	Provide device Vdd via external bias inductor
11	Gnd	Ground	
12	Ven	Enable Voltage Input	See control logic truth table. External resistor in series to set Iddq
PKG BASE	Gnd	Ground	Provides DC and RF ground for LNA, as well as thermal heat sink

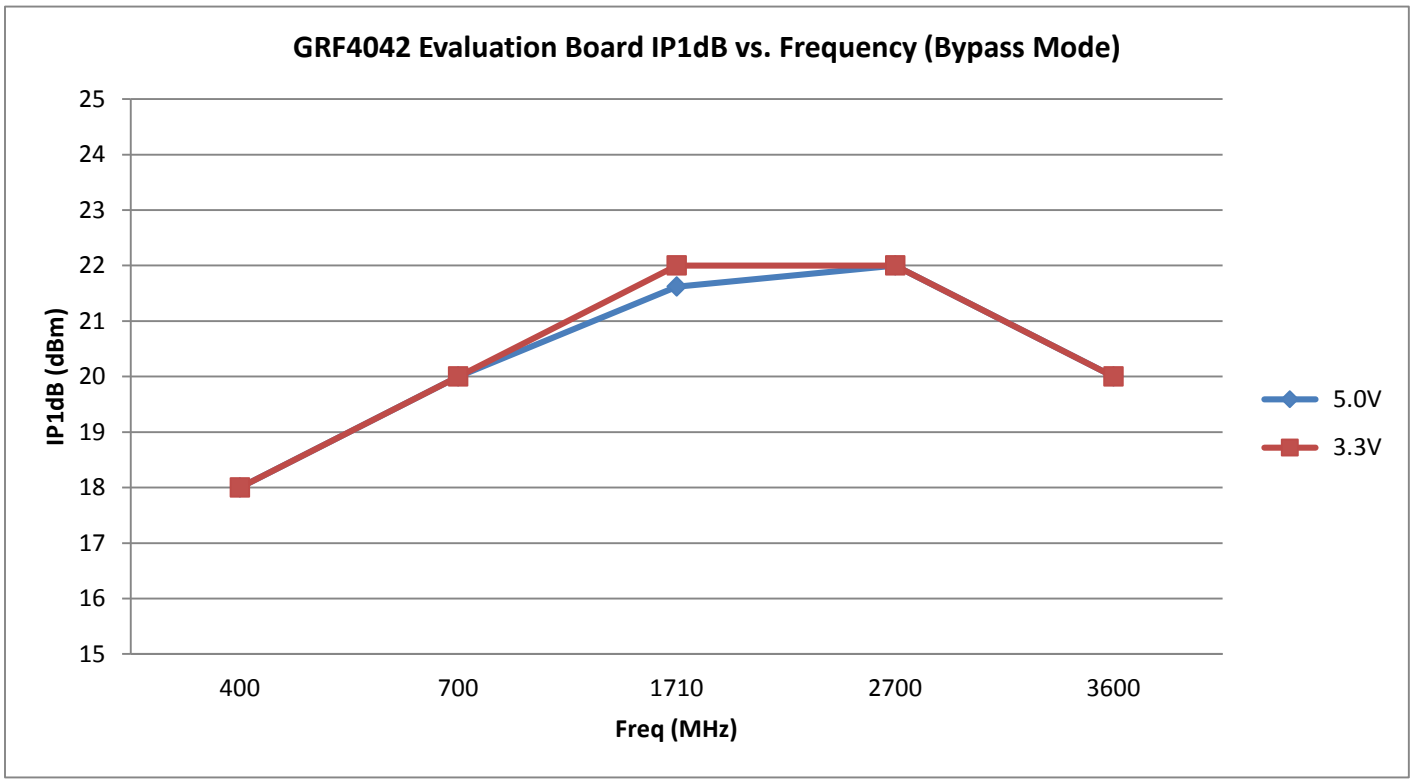
Control Logic Truth Table

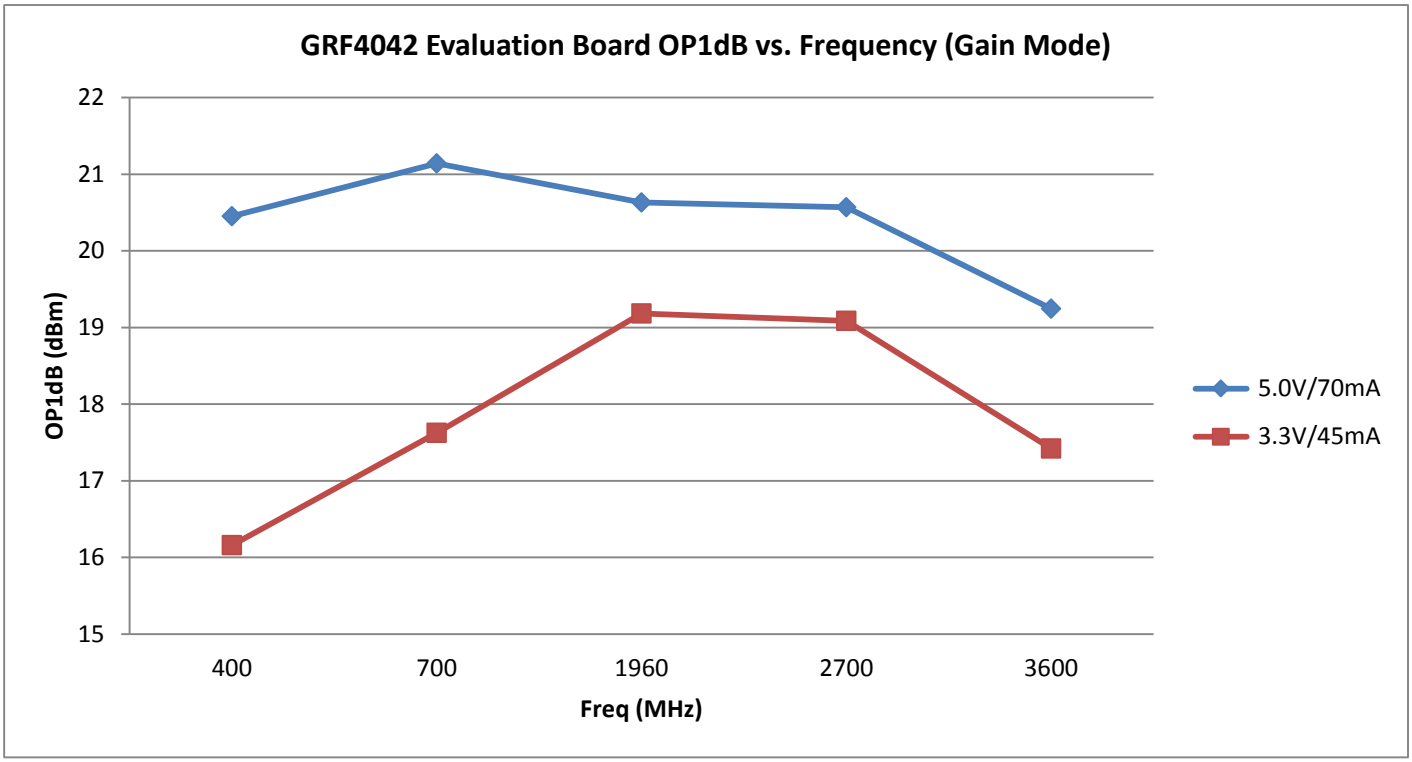
Mode	Description	Vdd	VEN	VBYP
High Gain	High LNA Gain	>= 1.8	1	0
Bypass	High Linearity Bypass	>= 1.8	0	1
Disabled Mode (Guerrilla Armor™)	LNA Powered Down	>= 1.8	0	0
Logic Level “0”	Logic Low	>= 1.8	0.0V to 0.2V	0.0V to 0.2V
Logic Level “1”	Logic High	>= 1.8	1.5V to Vdd	1.5V to Vdd

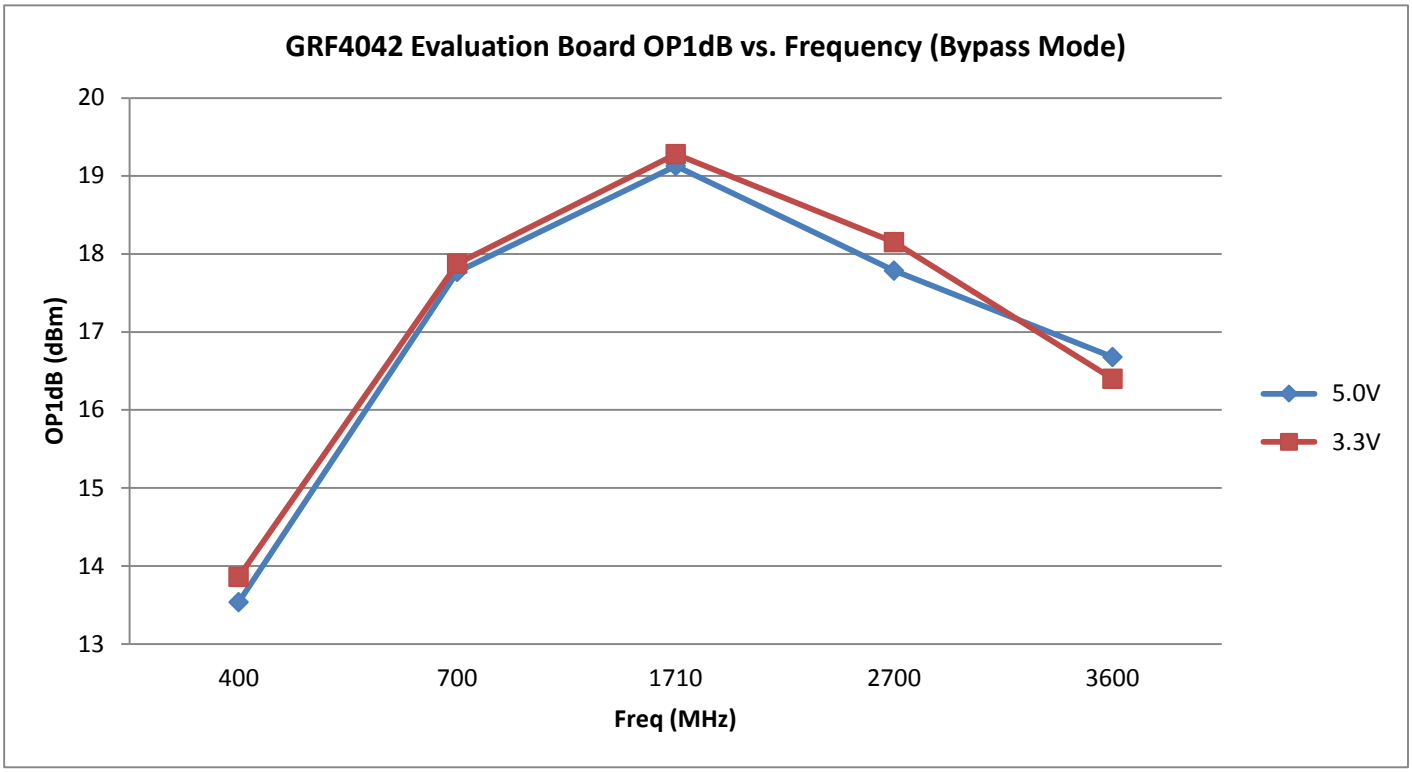

GRF4042 Noise Figure vs. Frequency (Gain Mode)
NF (dB)
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
400
700
1960
2700
3600
Freq (MHz)
evaluation board
de-embedded

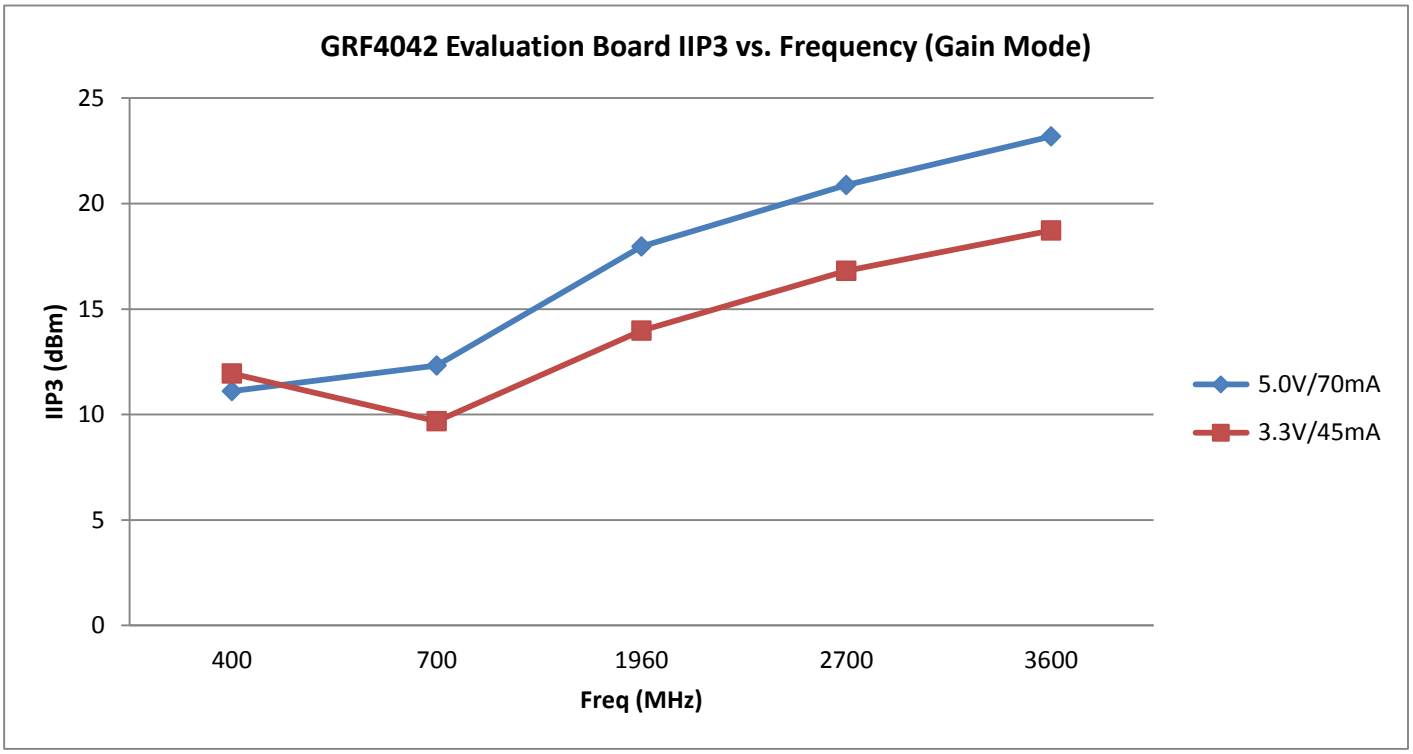

GRF4042 Evaluation Board Gain vs. Frequency (Gain Mode)
Gain (dB)
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
400
700
1960
2700
3600
Freq (MHz)
5.0V/70mA
3.3V/45mA

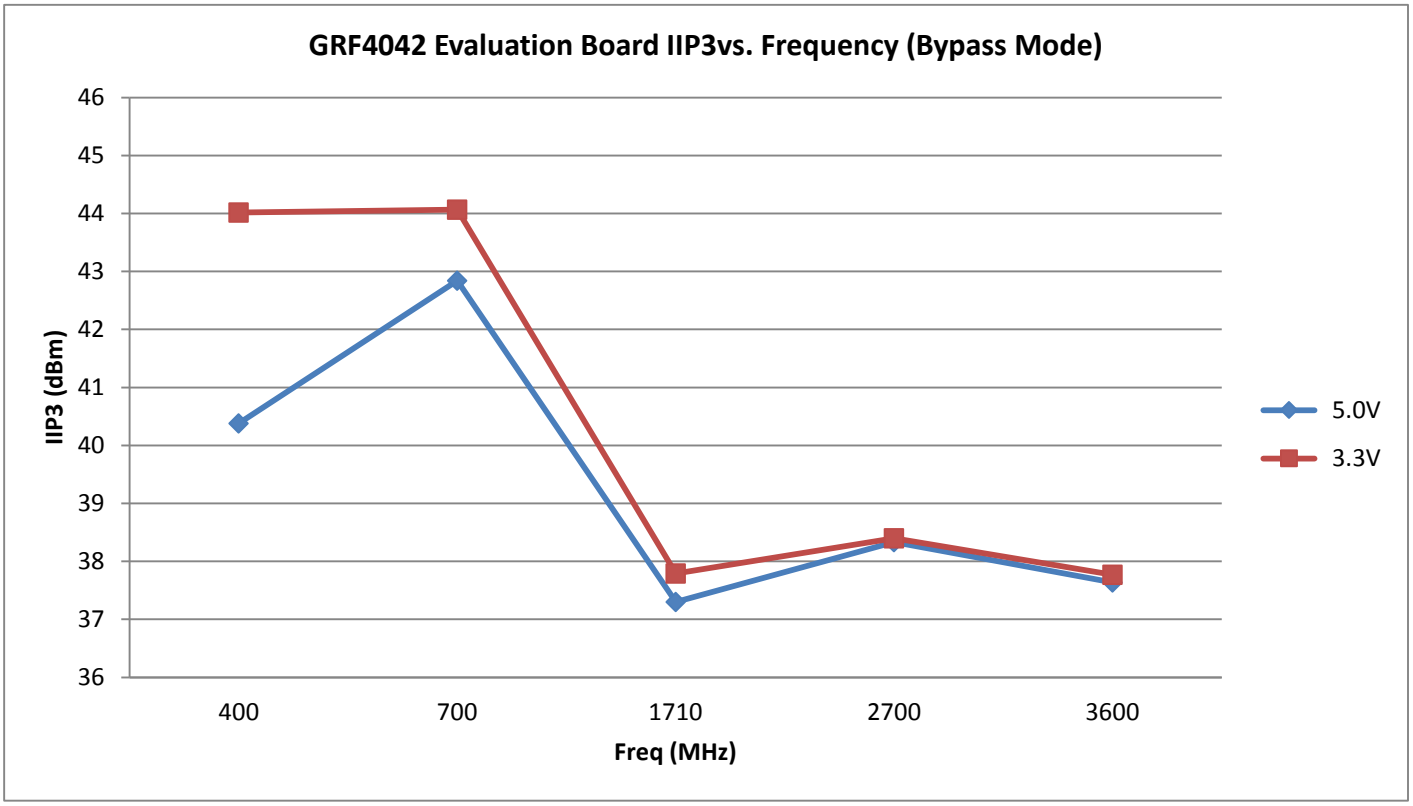

GRF4042 Evaluation Board IP1dB vs. Frequency (Gain Mode)
IP1dB (dBm)
10
8
6
4
2
0
-2
-4
-6
400
700
1960
2700
3600
Freq (MHz)
5.0V/70mA
3.3V/45mA

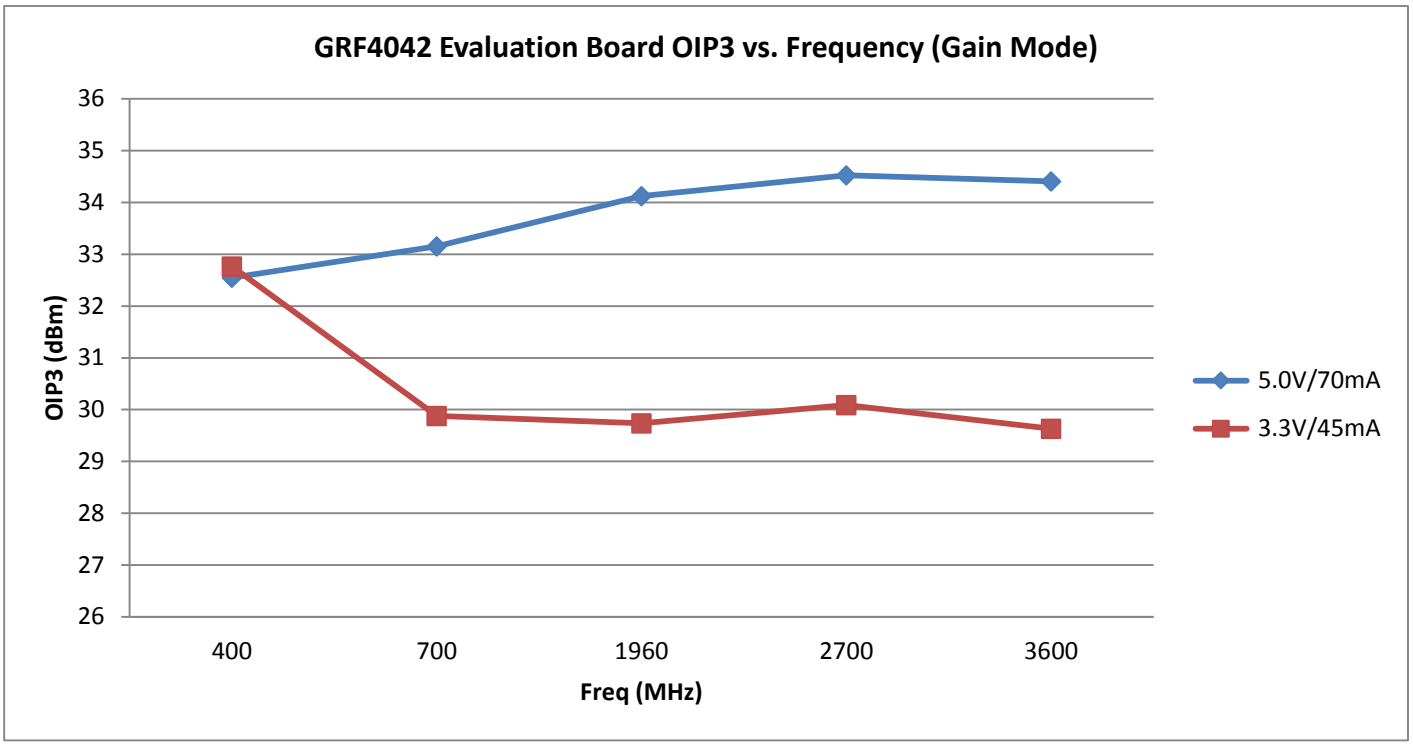

GRF4042 Evaluation Board IP1dB vs. Frequency (Bypass Mode)
IP1dB (dBm)
25
24
23
22
21
20
19
18
17
16
15
400
700
1710
2700
3600
Freq (MHz)
5.0V
3.3V

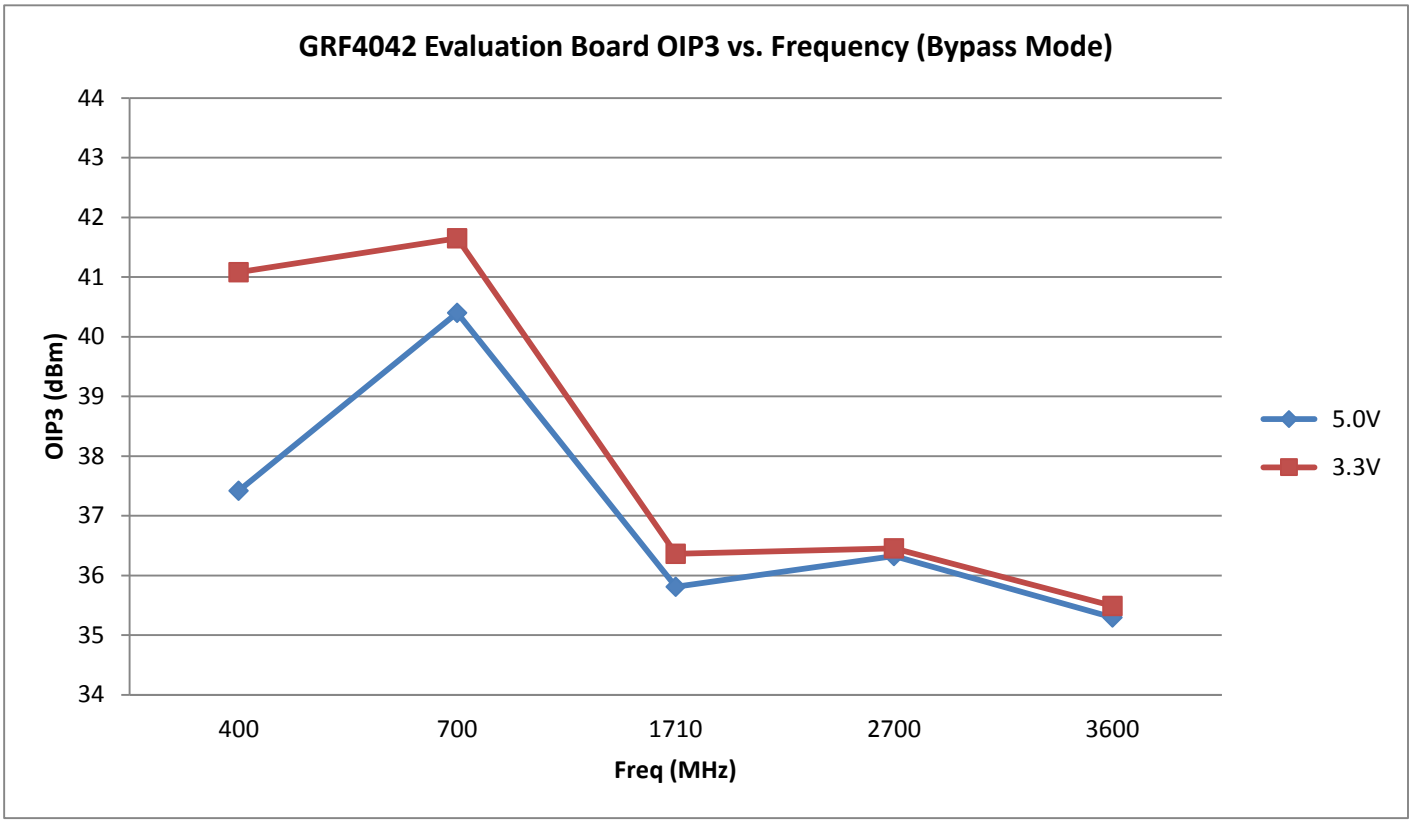

GRF4042 Evaluation Board OP1dB vs. Frequency (Gain Mode)
OP1dB (dBm)
22
21
20
19
18
17
16
15
400
700
1960
2700
3600
Freq (MHz)
5.0V/70mA
3.3V/45mA


GRF4042 Evaluation Board OP1dB vs. Frequency (Bypass Mode)
OP1dB (dBm)
20
19
18
17
16
15
14
13
400
700
1710
2700
3600
Freq (MHz)
5.0V
3.3V

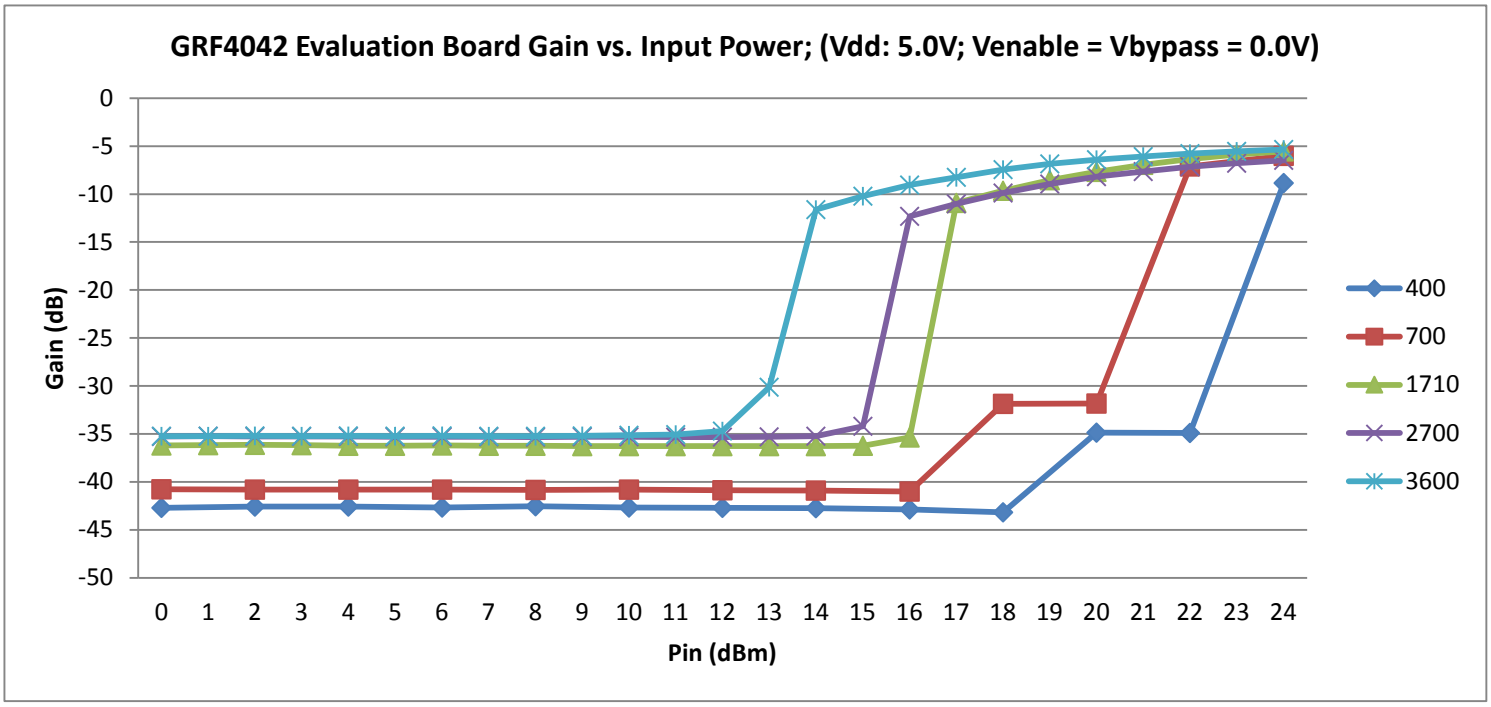

GRF4042 Evaluation Board IIP3 vs. Frequency (Gain Mode)
IIP3 (dBm)
25
20
15
10
5
0
400
700
1960
2700
3600
Freq (MHz)
5.0V/70mA
3.3V/45mA

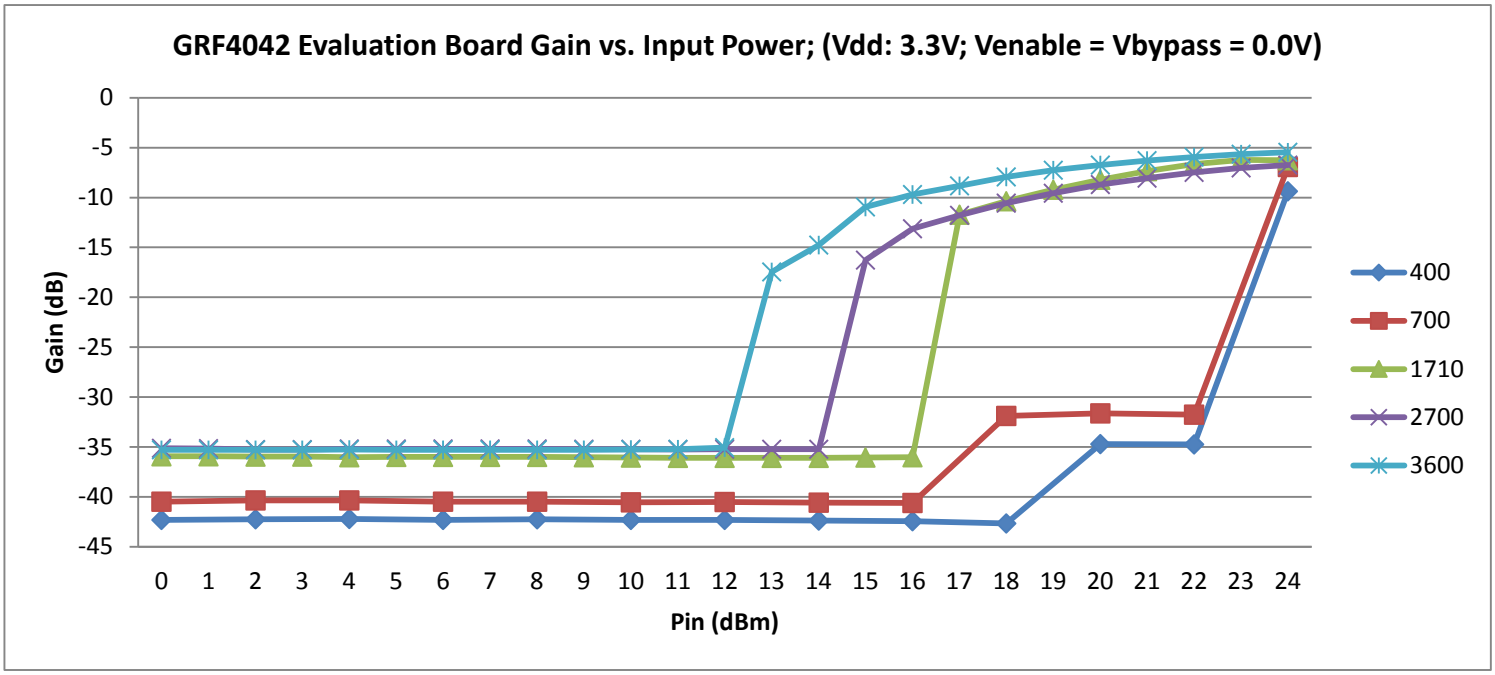

GRF4042 Evaluation Board IIP3vs. Frequency (Bypass Mode)
IIP3 (dBm)
46
45
44
43
42
41
40
39
38
37
36
400
700
1710
2700
3600
Freq (MHz)
5.0V
3.3V


GRF4042 Evaluation Board OIP3 vs. Frequency (Gain Mode)
OIP3 (dBm)
36
35
34
33
32
31
30
29
28
27
26
400
700
1960
2700
3600
Freq (MHz)
5.0V/70mA
3.3V/45mA

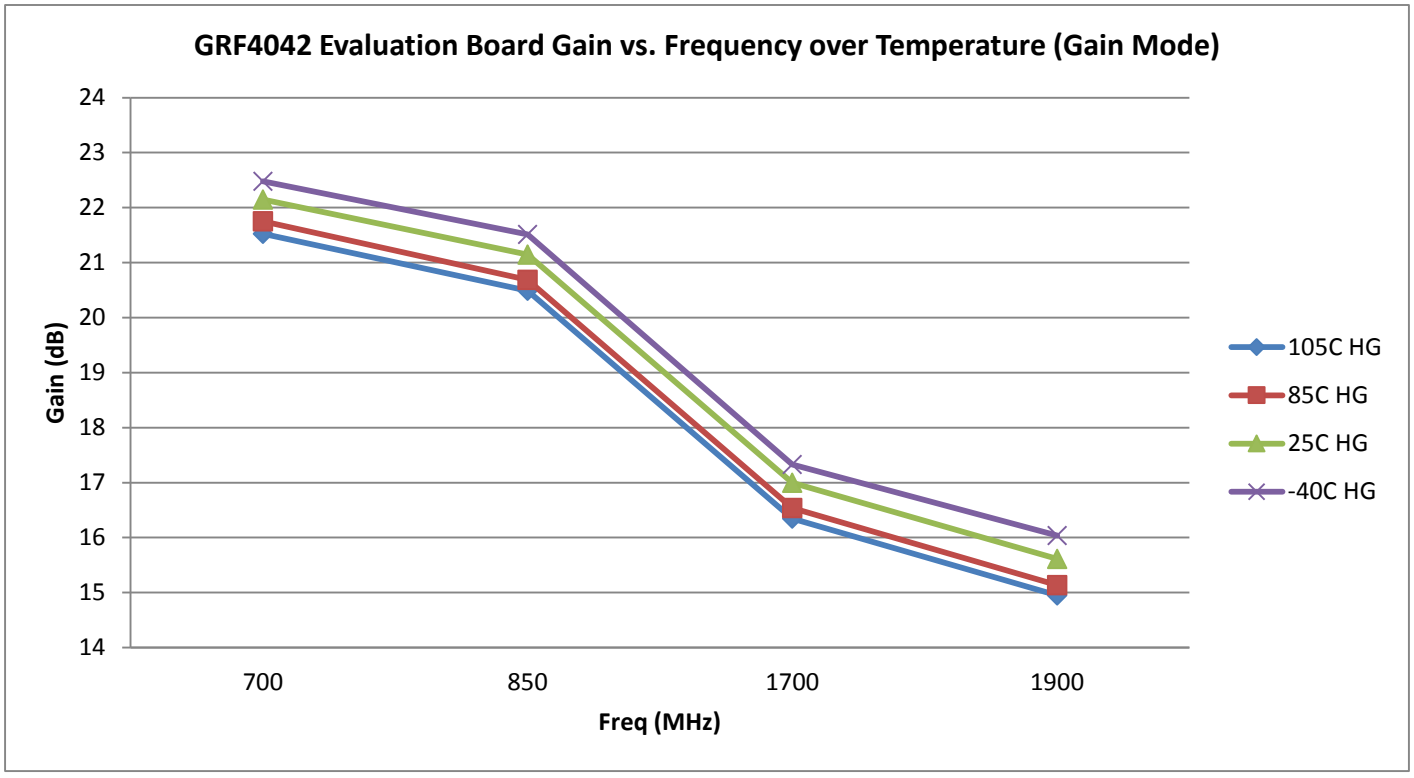

GRF4042 Evaluation Board OIP3 vs. Frequency (Bypass Mode)
OIP3 (dBm)
44
43
42
41
40
39
38
37
36
35
34
400
700
1710
2700
3600
Freq (MHz)
5.0V
3.3V

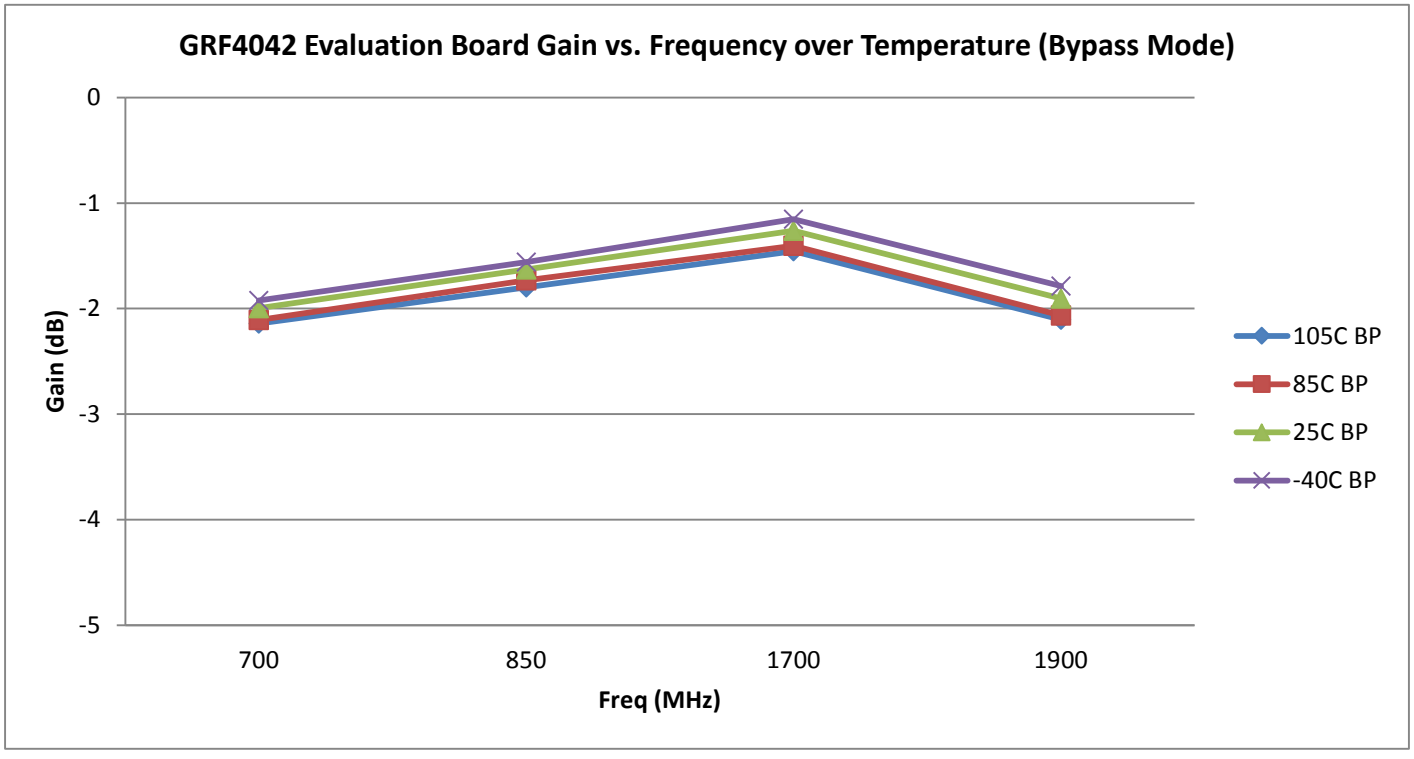
GRF4042 Evaluation Board Guerrilla Armor Response (Disabled Mode Isolation vs. RF Input Power)

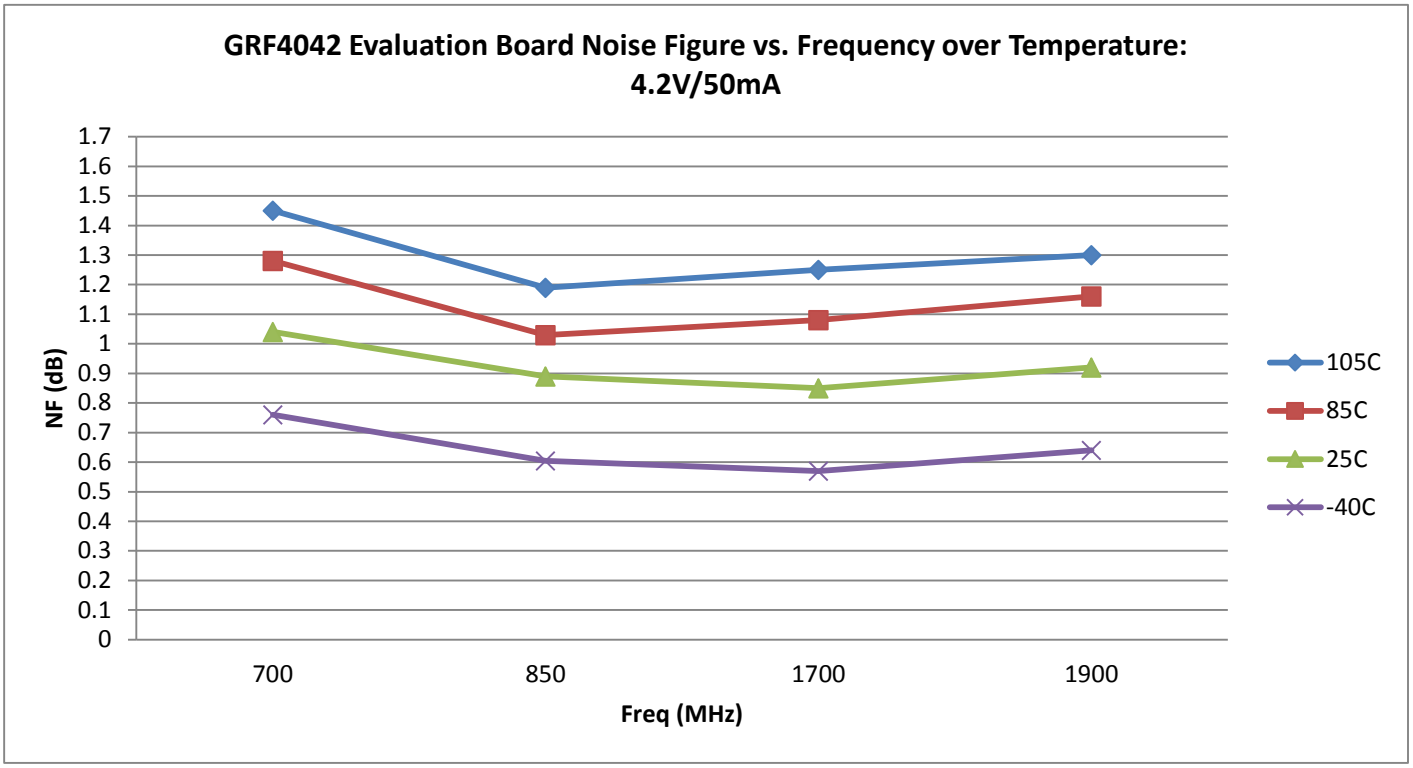


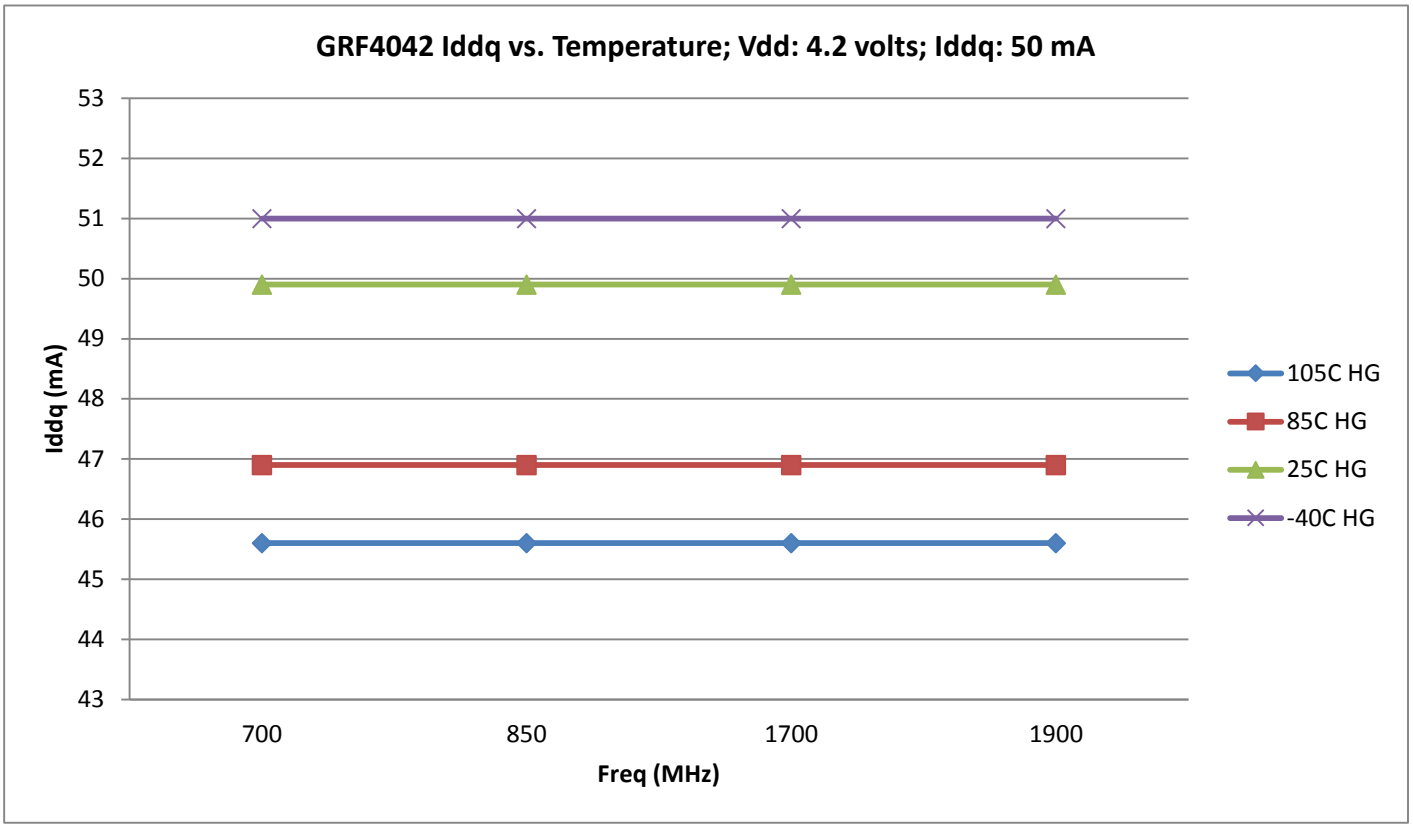


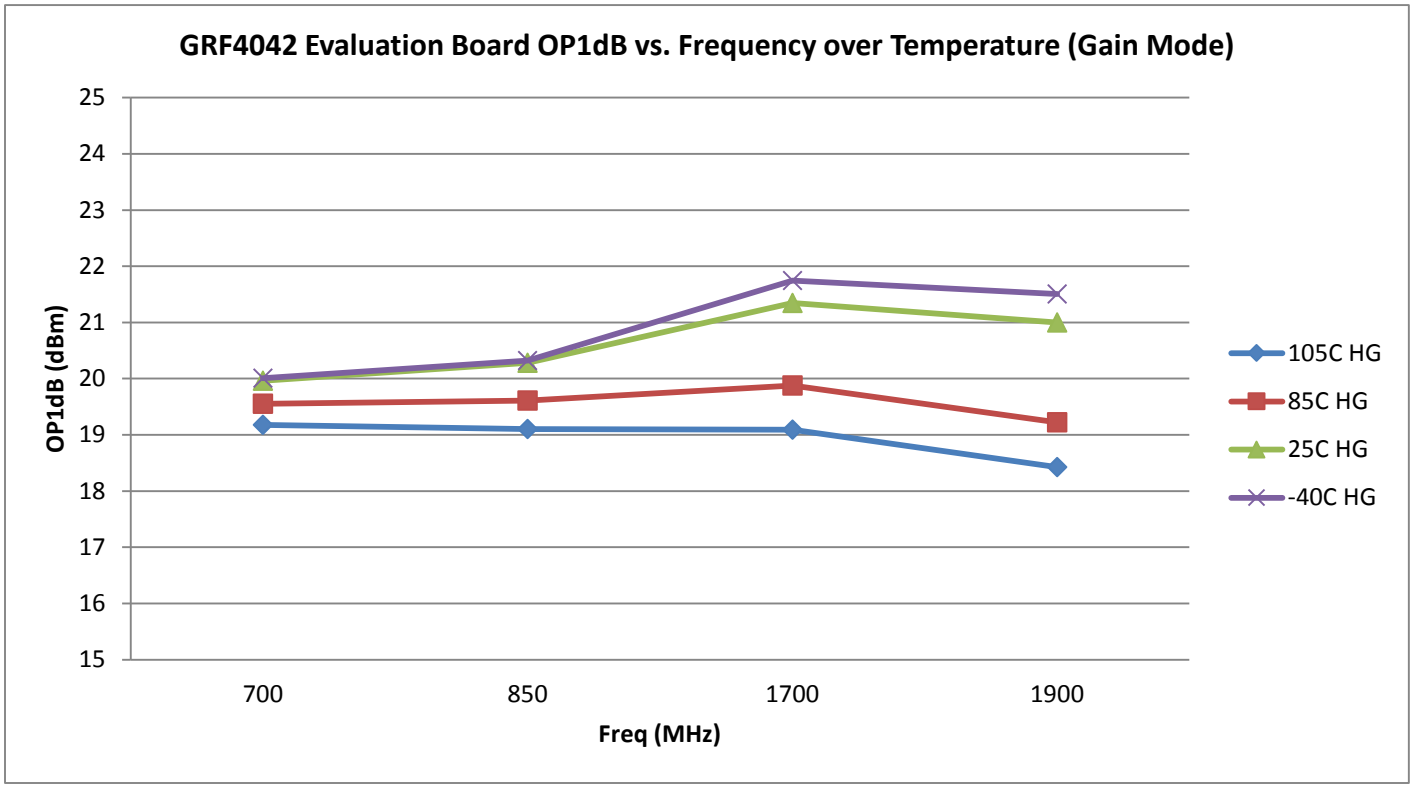
GRF4042 Data vs. Temperature; Vdd: 4.2 and Iddq: 50 mA

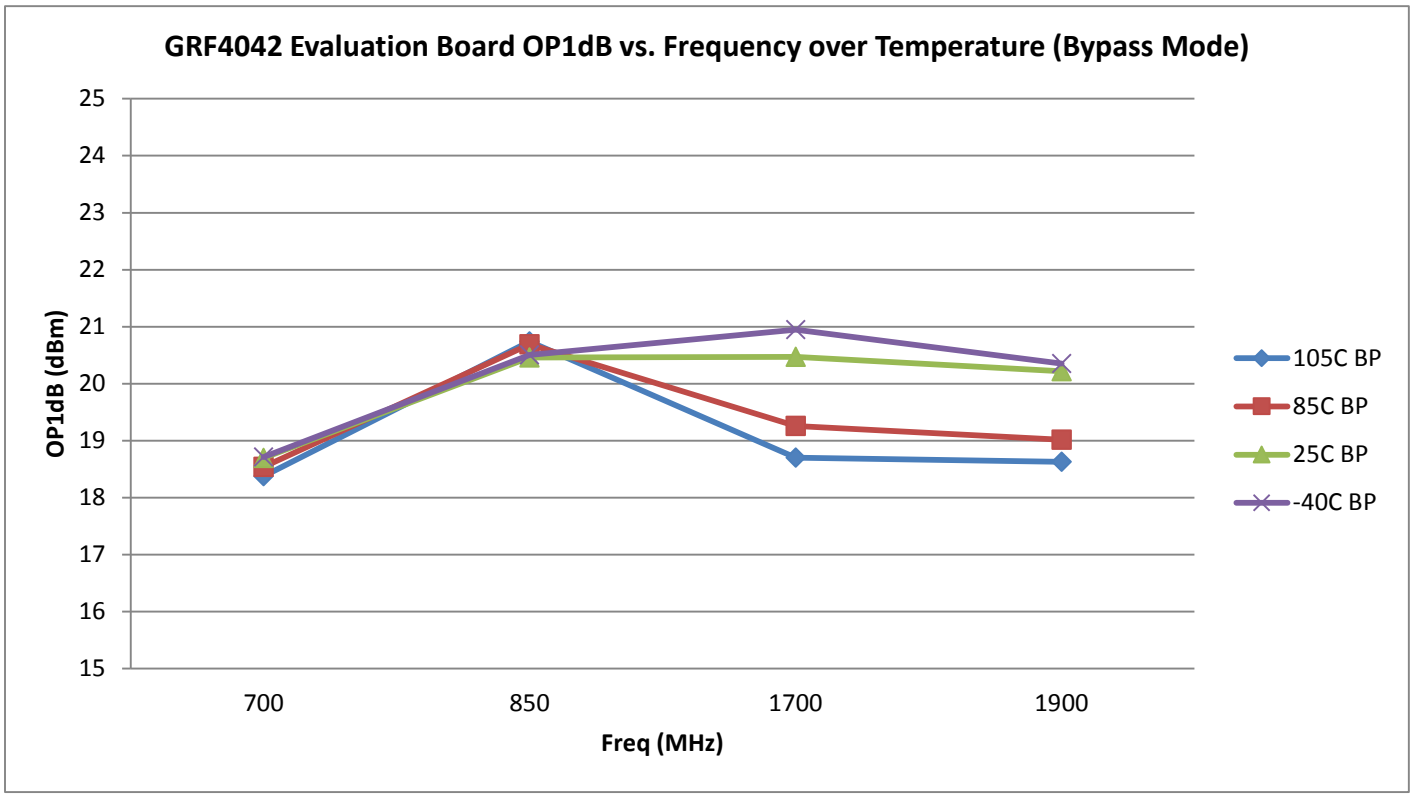


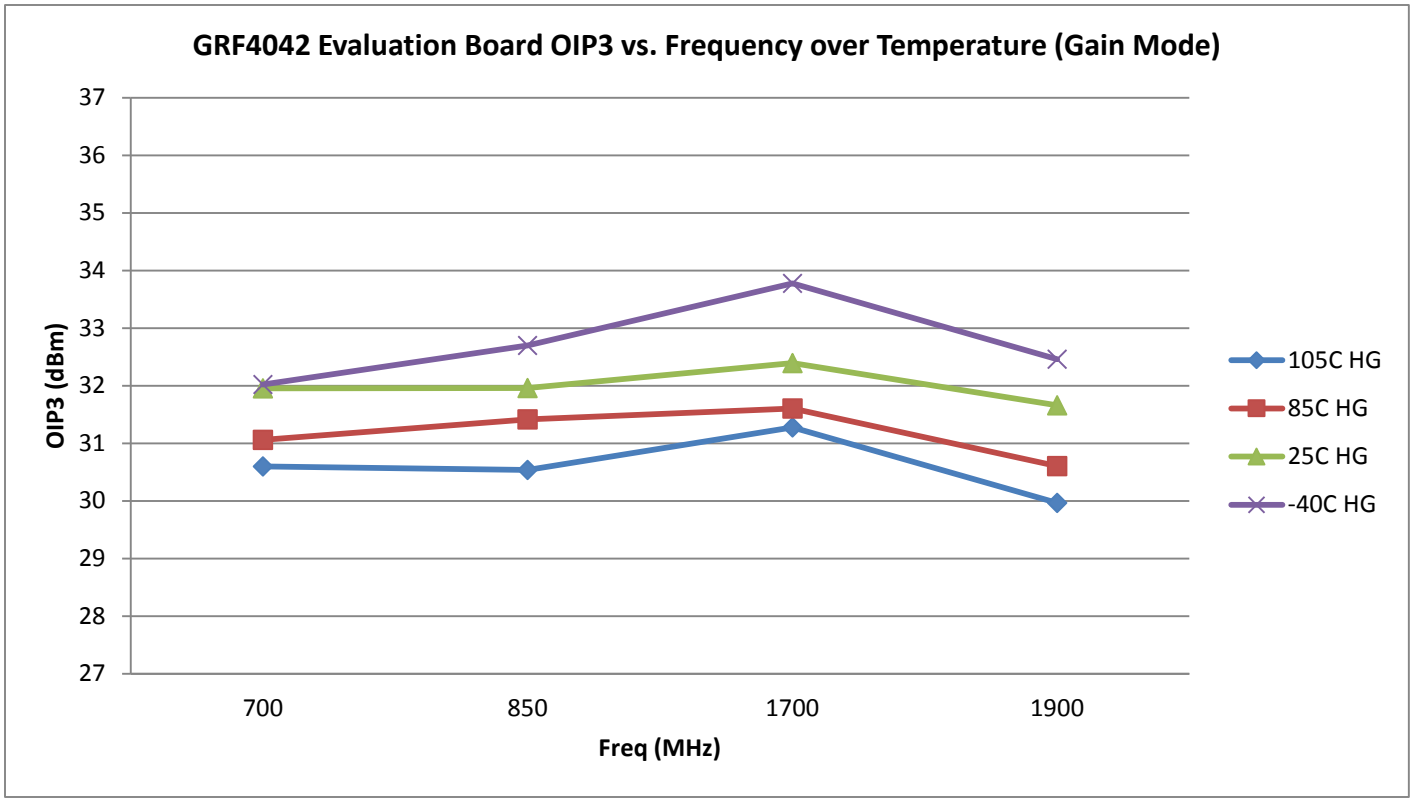


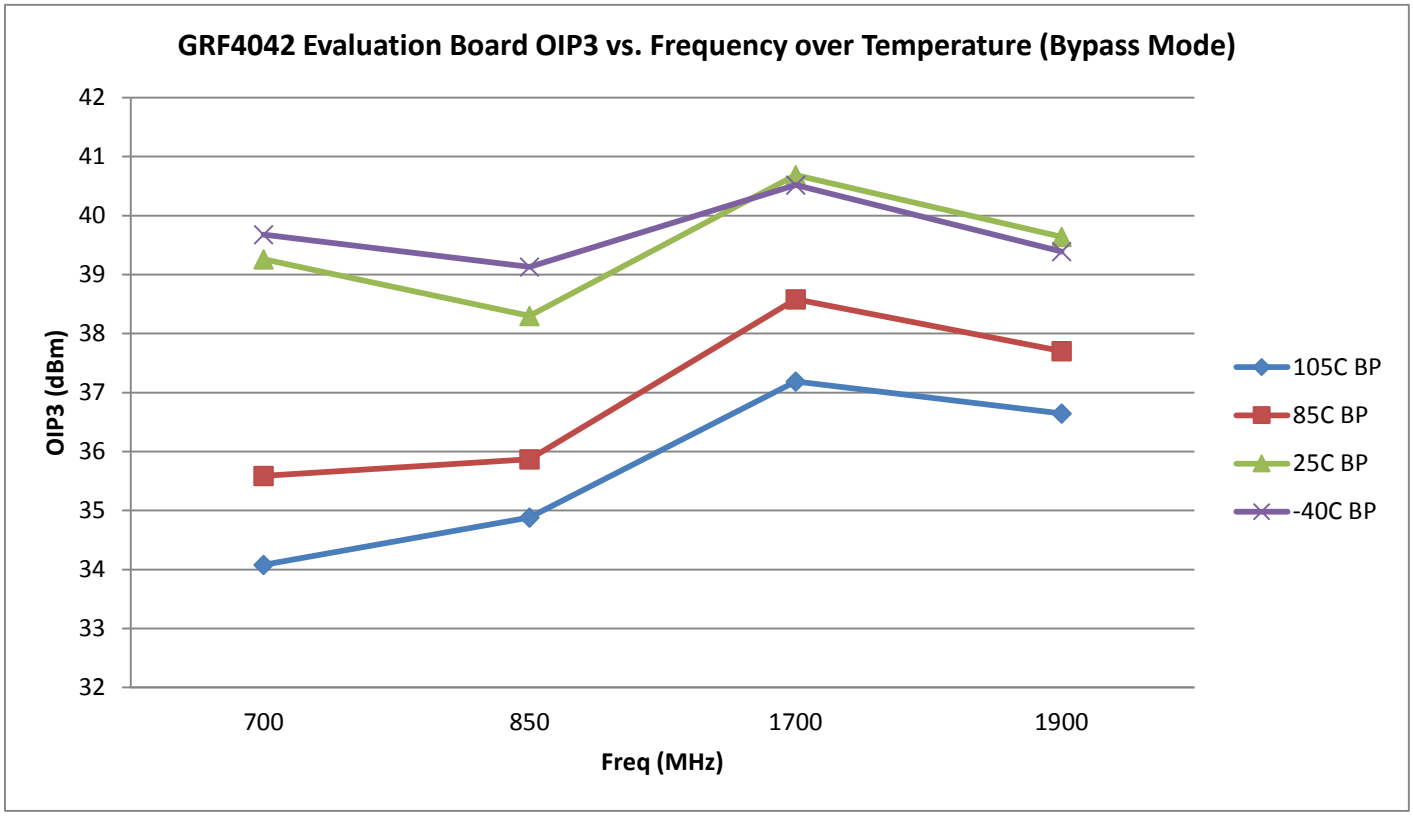

GRF4042 Evaluation Board Noise Figure vs. Frequency over Temperature: 4.2V/50mA
NF (dB)
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
700
850
1700
1900
Freq (MHz)
105C
85C
25C
-40C


GRF4042 Iddq vs. Temperature; Vdd: 4.2 volts; Iddq: 50 mA
Iddq (mA)
53
52
51
50
49
48
47
46
45
44
43
700
850
1700
1900
Freq (MHz)
105C HG
85C HG
25C HG
-40C HG

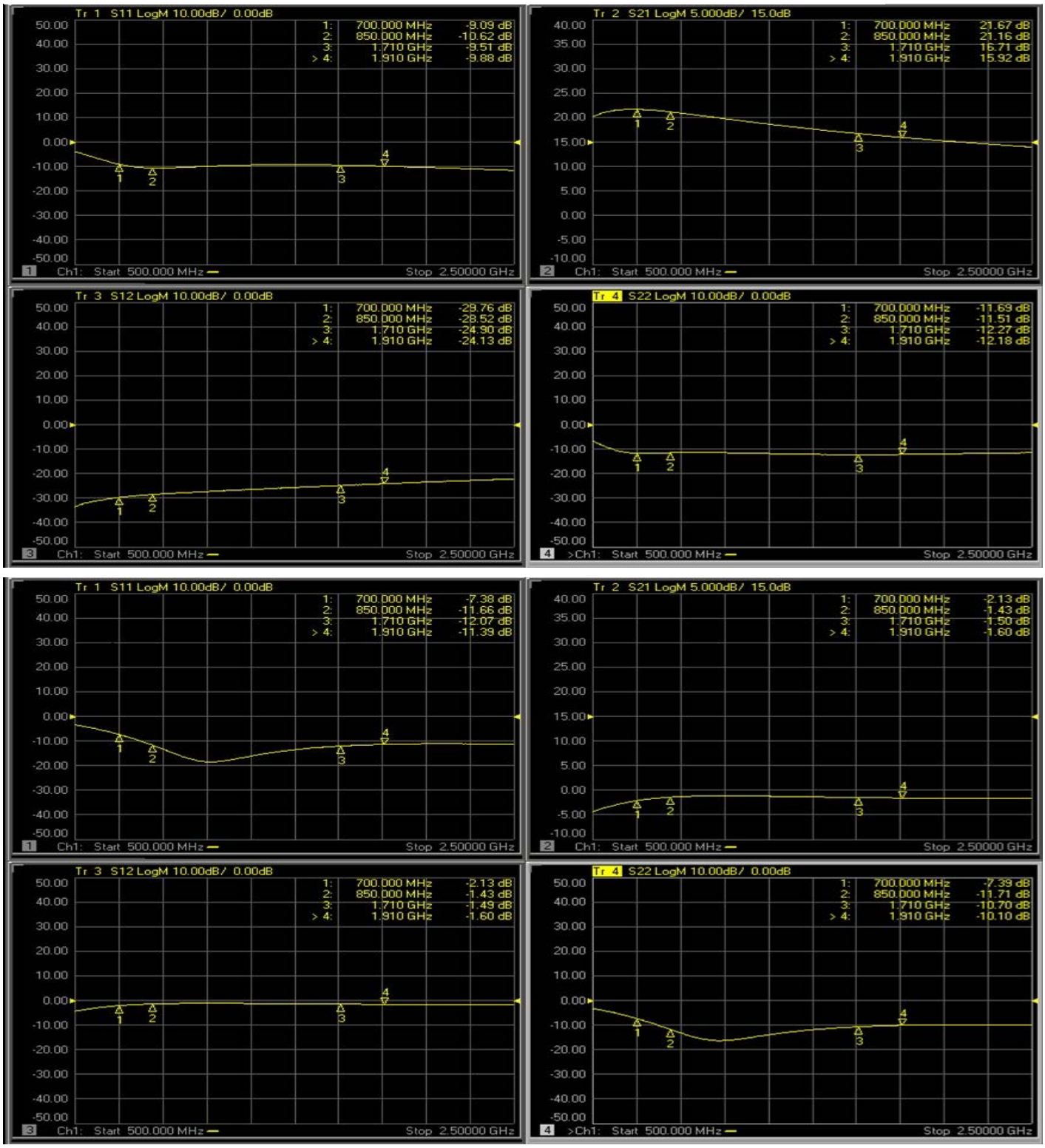

GRF4042 Evaluation Board OP1dB vs. Frequency over Temperature (Gain Mode)
OP1dB (dBm)
25
24
23
22
21
20
19
18
17
16
15
700
850
1700
1900
Freq (MHz)
105C HG
85C HG
25C HG
-40C HG

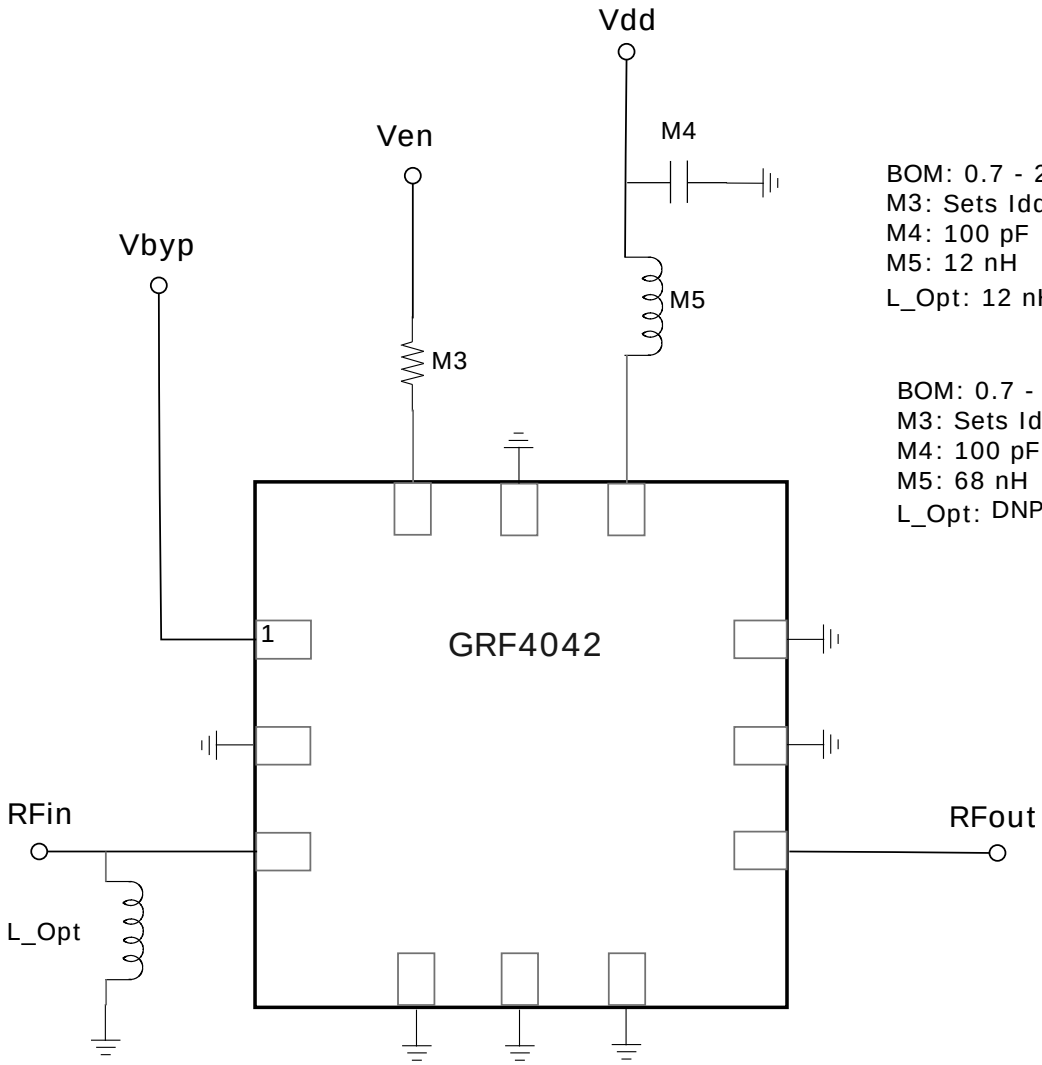

GRF4042 Evaluation Board OP1dB vs. Frequency over Temperature (Bypass Mode)
OP1dB (dBm)
25
24
23
22
21
20
19
18
17
16
15
700
850
1700
1900
Freq (MHz)
105C BP
85C BP
25C BP
-40C BP


GRF4042 Evaluation Board OIP3 vs. Frequency over Temperature (Gain Mode)
OIP3 (dBm)
37
36
35
34
33
32
31
30
29
28
27
700
850
1700
1900
Freq (MHz)
105C HG
85C HG
25C HG
-40C HG


GRF4042 Evaluation Board OIP3 vs. Frequency over Temperature (Bypass Mode)
OIP3 (dBm)
42
41
40
39
38
37
36
35
34
33
32
700
850
1700
1900
Freq (MHz)
105C BP
85C BP
25C BP
-40C BP

GRF4042 Evaluation Board S-Parameters (4.2V/50 mA): Gain and Bypass Modes

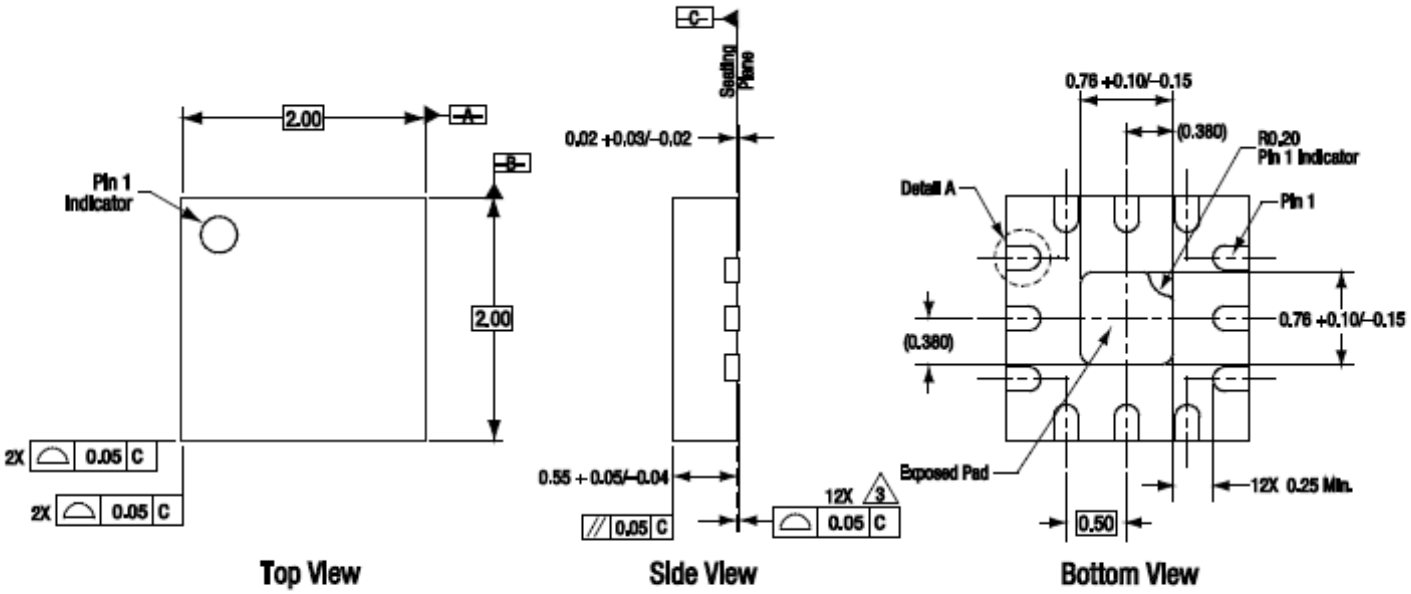


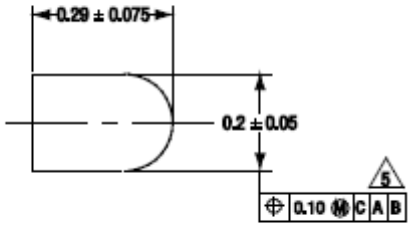


BOM: 0.7 - 2.7 GHz (Standard)
M3: Sets Iddq
M4: 100 pF
M5: 12 nH
L_Opt: 12 nH (High Q for optimal NF)

BOM: 0.7 - 2.7 GHz (Minimal BOM)
M3: Sets Iddq
M4: 100 pF
M5: 68 nH
L_Opt: DNP

GRF4042 Evaluation Board Application Schematic (0.7 to 2.7 GHz)





All measurements are in millimeters.
Dimensioning and tolerancing according to ASME Y14.5M-1994.
Coplanarity applies to the terminals and all other bottom surface metallization.
Dimension applies to metalized terminal. If the terminal has a radius on its end, the width dimension should not be measured in that radius area.

Detail A
Scale: 100X
12 Places

GRF4042 12-Pin QFN Package Dimensions

Data Sheet Release Status:	Notes
Advance	S-parameter and NF data based on EM simulations for the fully packaged device using foundry supplied transistor s-parameters. Linearity estimates based on device size, bias condition and experience with related devices.
Preliminary	All data based on evaluation board measurements in the Guerrilla RF Applications Lab.
Released	All data based on device qualification data. Typically, this data is nearly identical to the data found in the preliminary version. Max and min values for key RF parameters are included.