



Preliminary

GRF4042

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

Package: 2.0 x 2.0 mm QFN-12



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 15 to 90 mA.

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

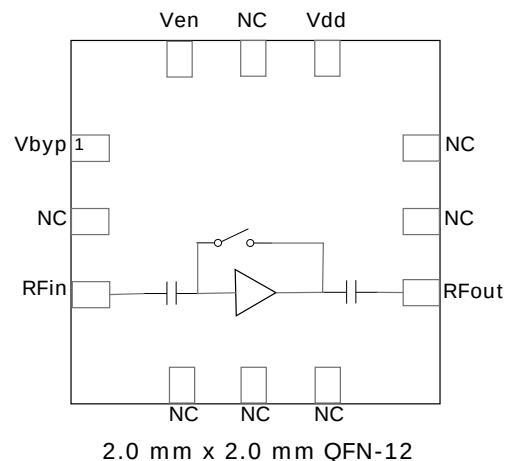
Features

- 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
- Process: GaAs pHEMT
- U.S. Patents: 8,970,296 and 9,160,279

Applications

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

Functional Block Diagram



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}		+190	°C
Maximum Dissipated Power (Note: De-rate 8 mW/°C for T _{AMB} > +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

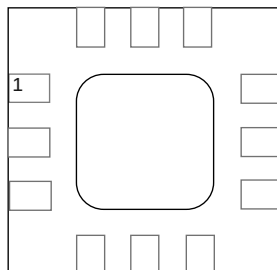


Caution! ESD Sensitive Device



Exceeding Absolute Maximum Rating conditions may cause permanent damage to the device.

Pin Out (Top View)



Pin Assignments:

Pin	Name	Description	Note
1	V_{BYPASS}	Low Insertion Loss Bypass	See control logic truth table
2	NC	No Connect or Ground	No internal connection to die
3	RF_In	RF Input	Internally DC blocked. Note: Do not apply DC voltage > 0.5 volts.
4	NC	No Connect or Ground	No internal connection to die
5	NC	No Connect or Ground	No internal connection to die
6	NC	No Connect or Ground	No internal connection to die
7	RF_Out	RF Output	Internally DC blocked. Note: Do not apply DC voltage > 0.5 volts.
8	NC	No Connect or Ground	No internal connection to die
9	NC	No Connect or Ground	No internal connection to die
10	V_{DD}	Supply Voltage Input	Provide device Vdd via external bias inductor
11	NC	No Connect or Ground	No internal connection to die
12	V_{ENABLE}	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

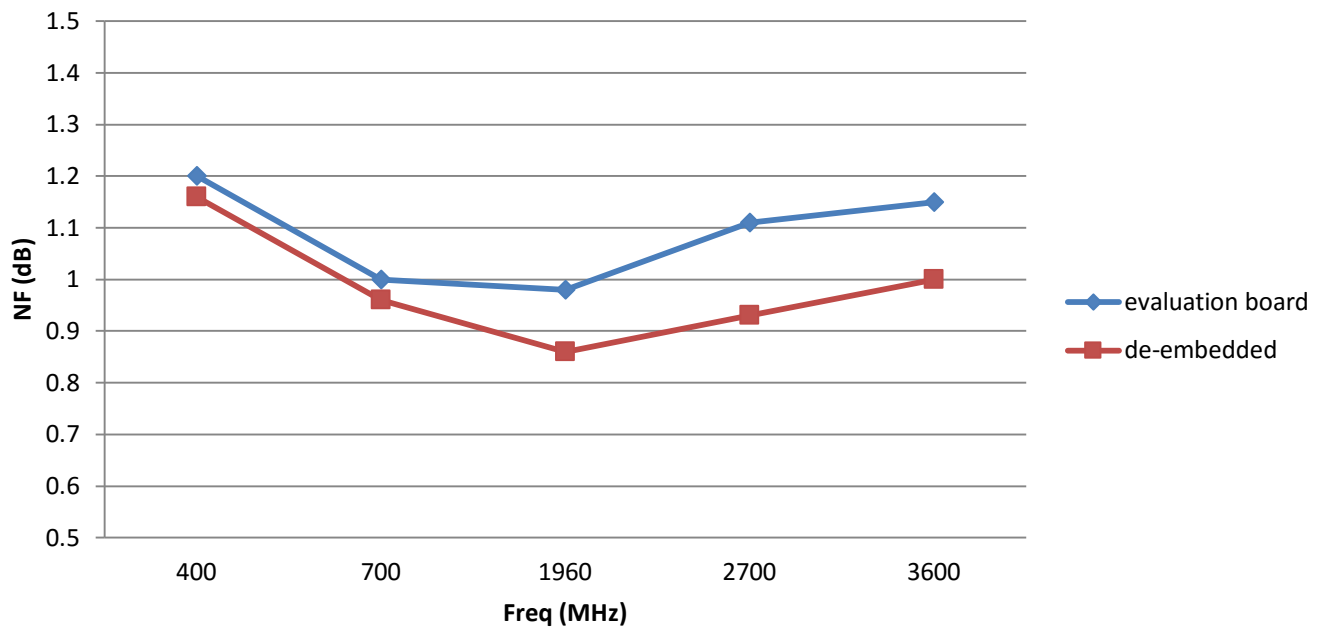
Control Logic Truth Table

Mode	Description	Vdd	V _{ENABLE}	V _{BYPASS}
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

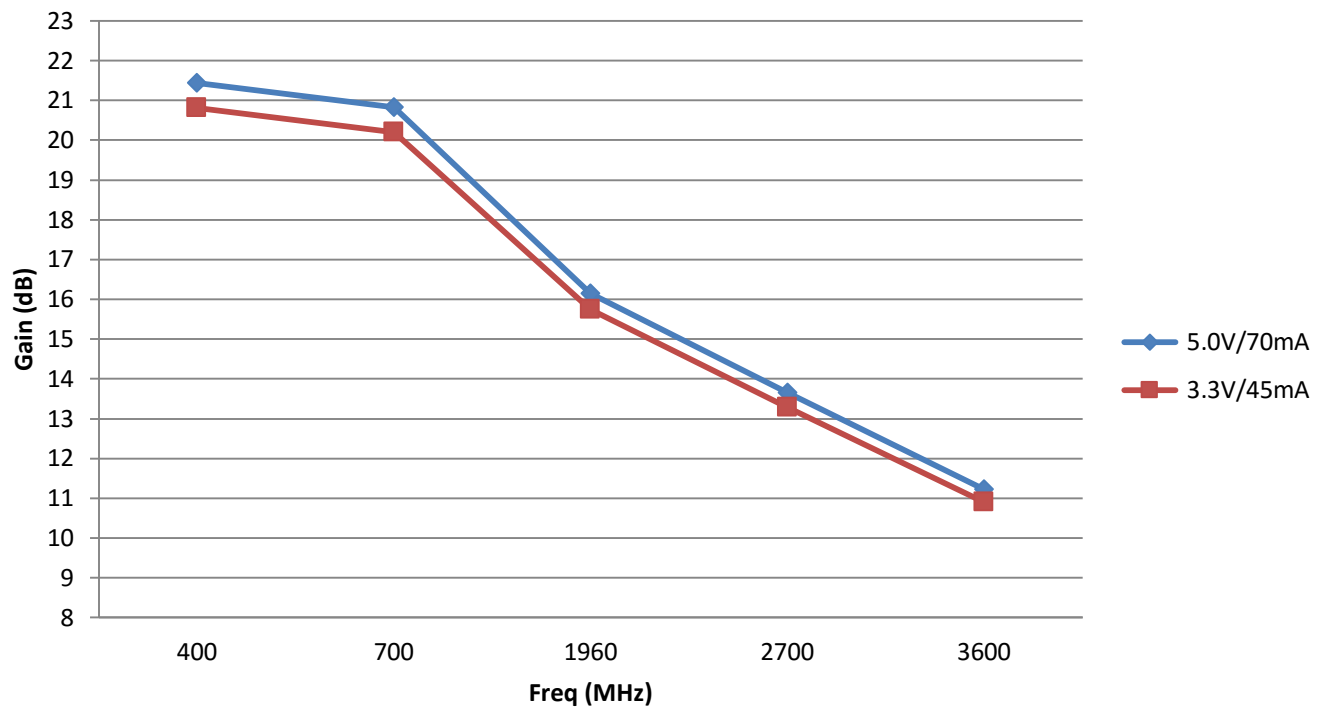
Nominal Operating Parameters:

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	S ₂₁	14.7	16.2		dB	
Input Return Loss	S ₁₁		-9.0		dB	
Output Return Loss	S ₂₂		-11.5		dB	
Noise Figure	NF		0.85	1.1	dB	(Board Losses De-embedded)
Input Third Order Intercept Point	IIP3	+15.0	+18.0		dBm	
Input 1dB Compression Point	IP1dB	+2.5	+4.5		dBm	
Supply Current	I _{DD}		70		mA	
Enable Current	I _{ENABLE}		2.8		mA	
Bypass Mode						V _{DD} : 5.0 V; Ven: Low; V _{byp} : High
Gain	S(2,1)	-3.0	-2.0		dB	
Input 1dB Compression Point	IP1dB	+20.0	+22.0		dBm	
Input Third Order Intercept Point	IIP3	+35.0	+38.0		dBm	
Disabled Mode (Guerrilla Armor™)						V _{DD} = 5.0 V, Ven: Low; V _{byp} : Low
Gain	S(2,1)		-35 dB		dB	
Thermal Data						
Thermal Resistance (Infra-Red Scan)	Θ _{jc}		132		°C/W	
Channel Temperature @ +85 C reference (Package heat sink)	T _{CHANNEL}		131		°C	V _{DD} : 5.0 V; I _{DDQ} : 70 mA; No RF; Dissipated Power: 350 mW

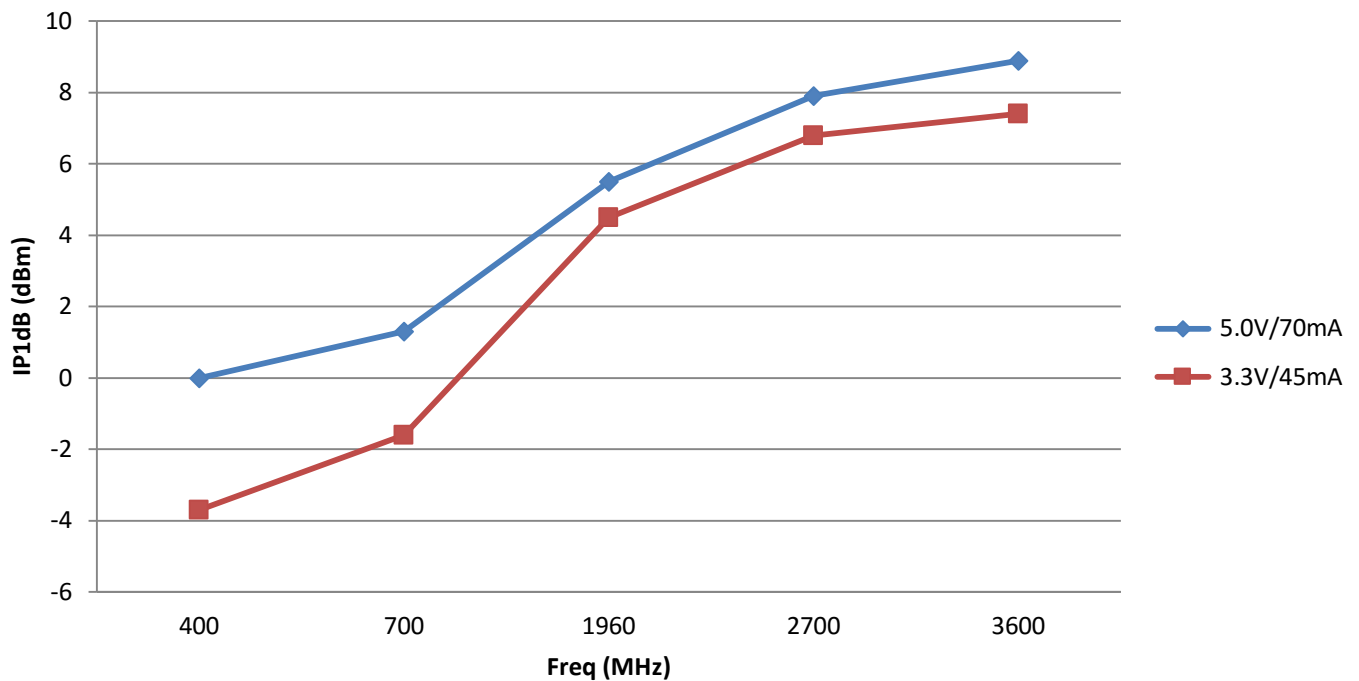
GRF4042 Noise Figure vs. Frequency (Gain Mode)



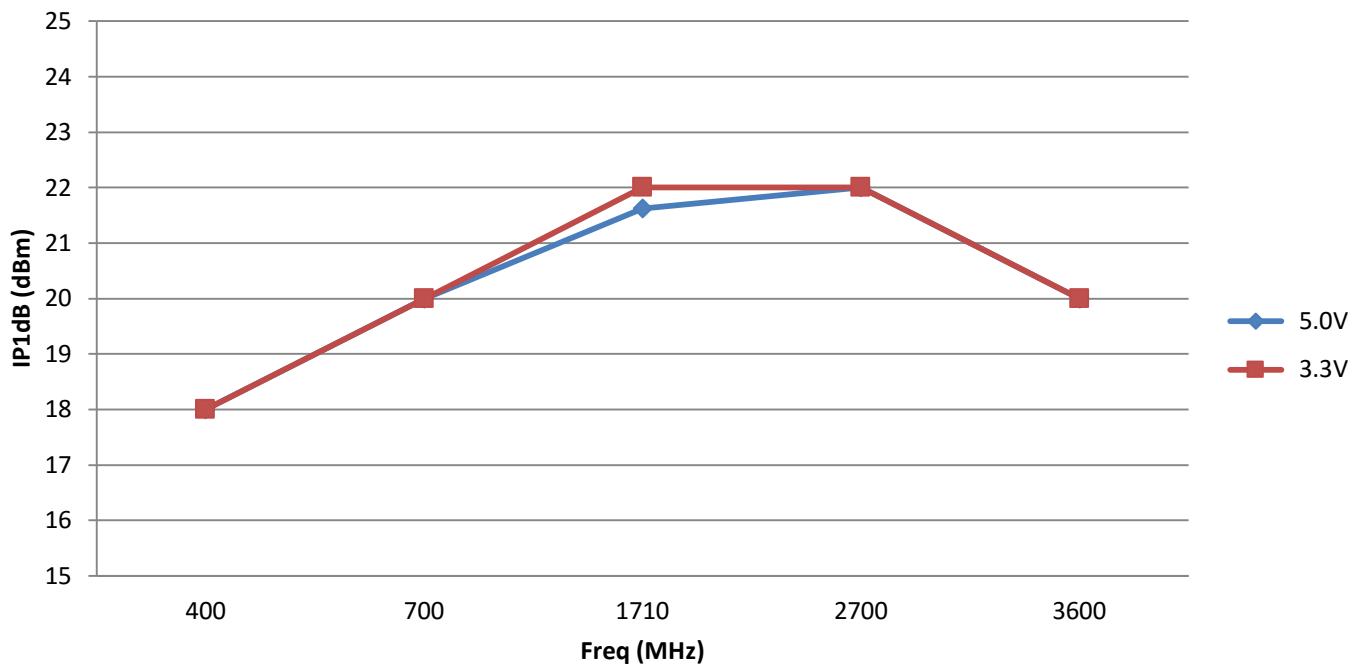
GRF4042 Evaluation Board Gain vs. Frequency (Gain Mode)



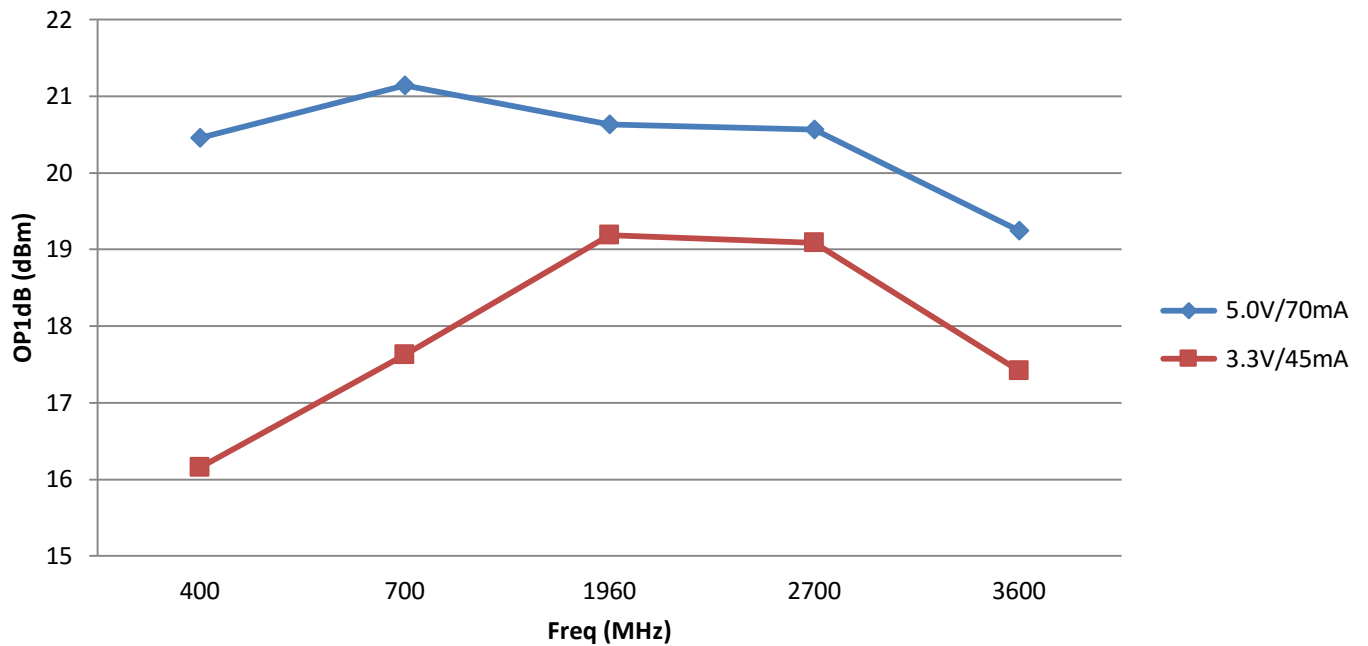
GRF4042 Evaluation Board IP1dB vs. Frequency (Gain Mode)



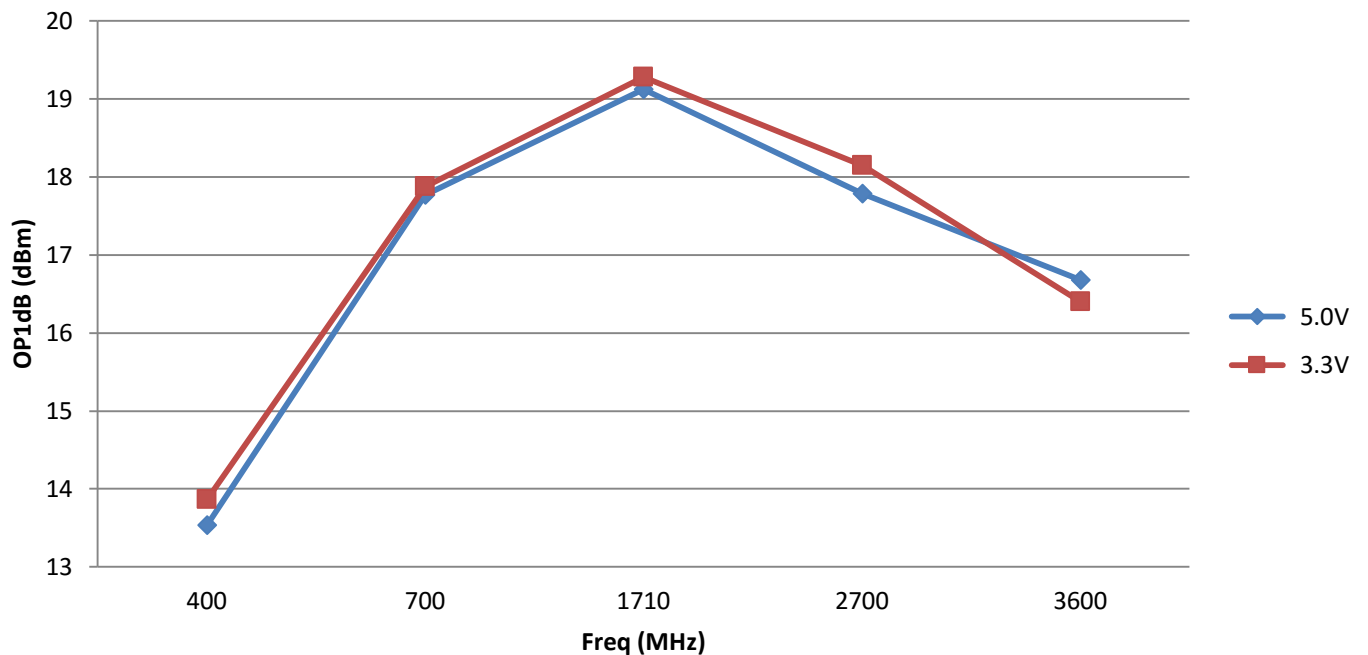
GRF4042 Evaluation Board IP1dB vs. Frequency (Bypass Mode)



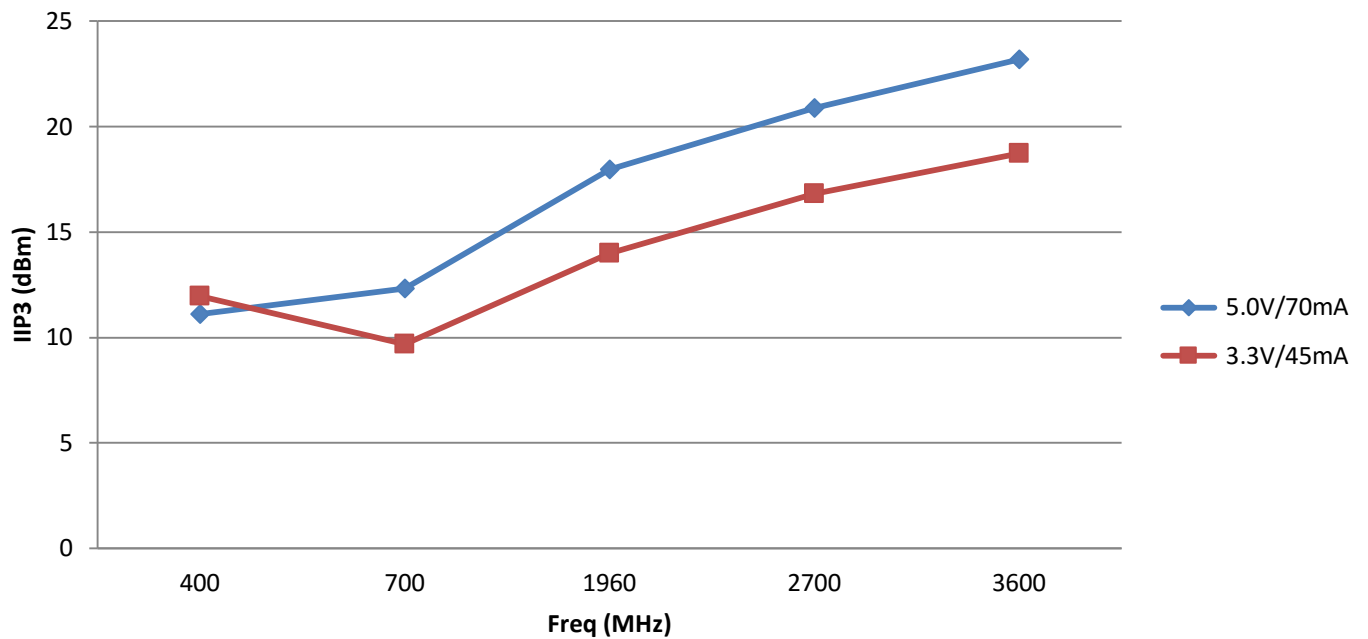
GRF4042 Evaluation Board OP1dB vs. Frequency (Gain Mode)



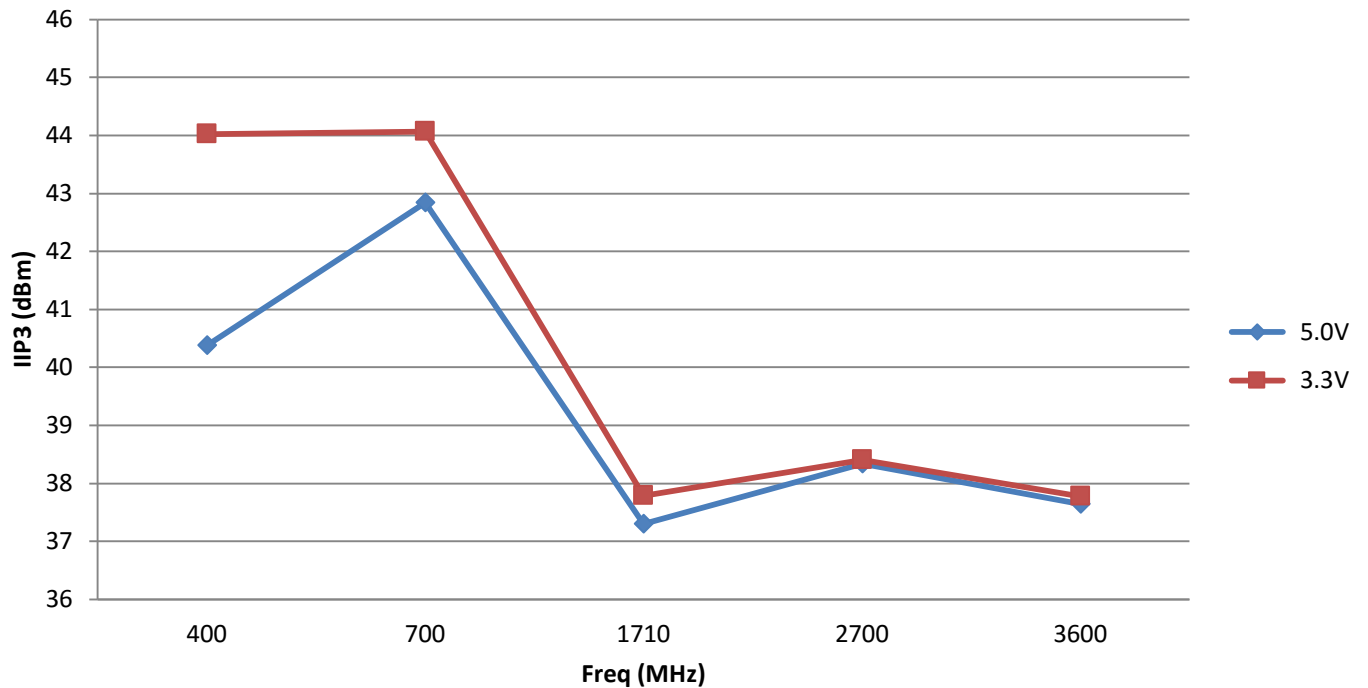
GRF4042 Evaluation Board OP1dB vs. Frequency (Bypass Mode)



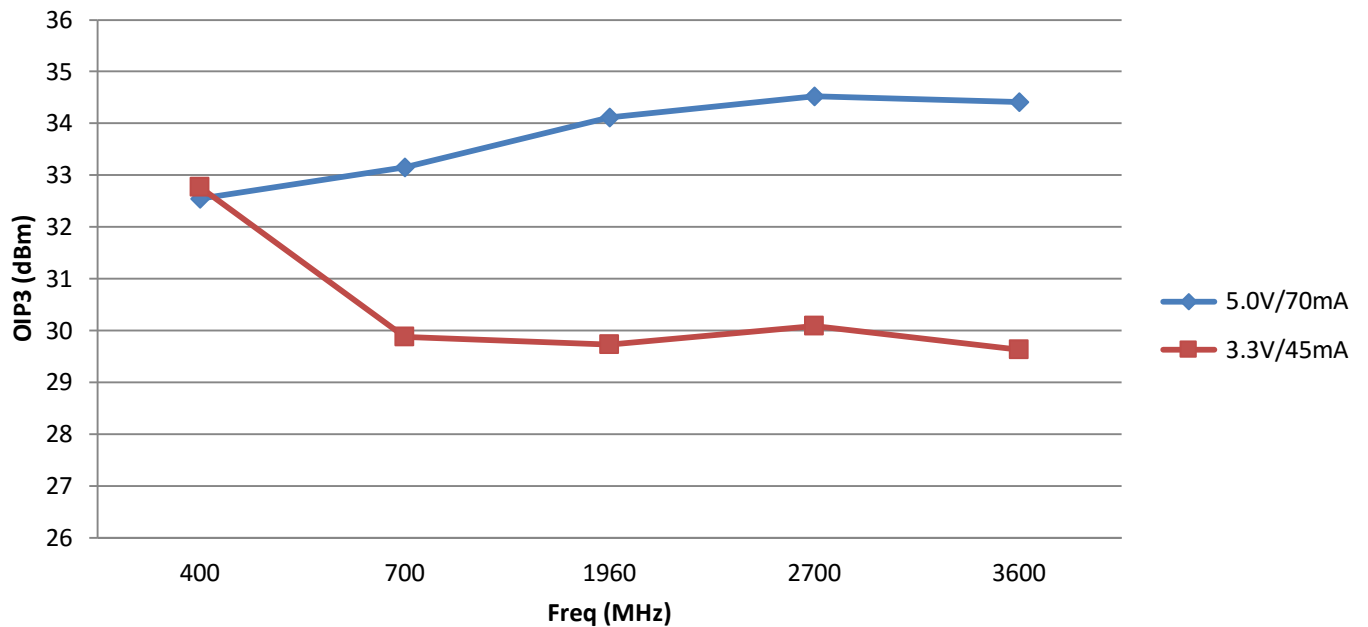
GRF4042 Evaluation Board IIP3 vs. Frequency (Gain Mode)



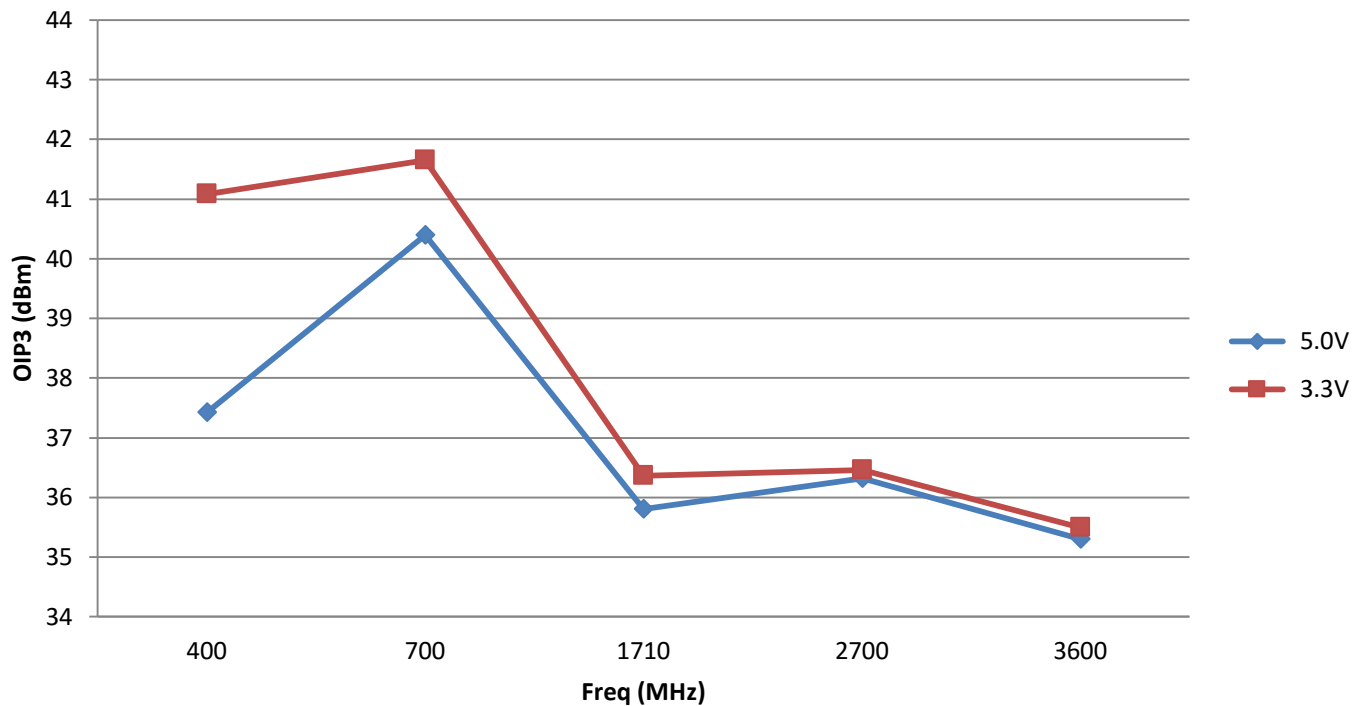
GRF4042 Evaluation Board IIP3vs. Frequency (Bypass Mode)



GRF4042 Evaluation Board OIP3 vs. Frequency (Gain Mode)

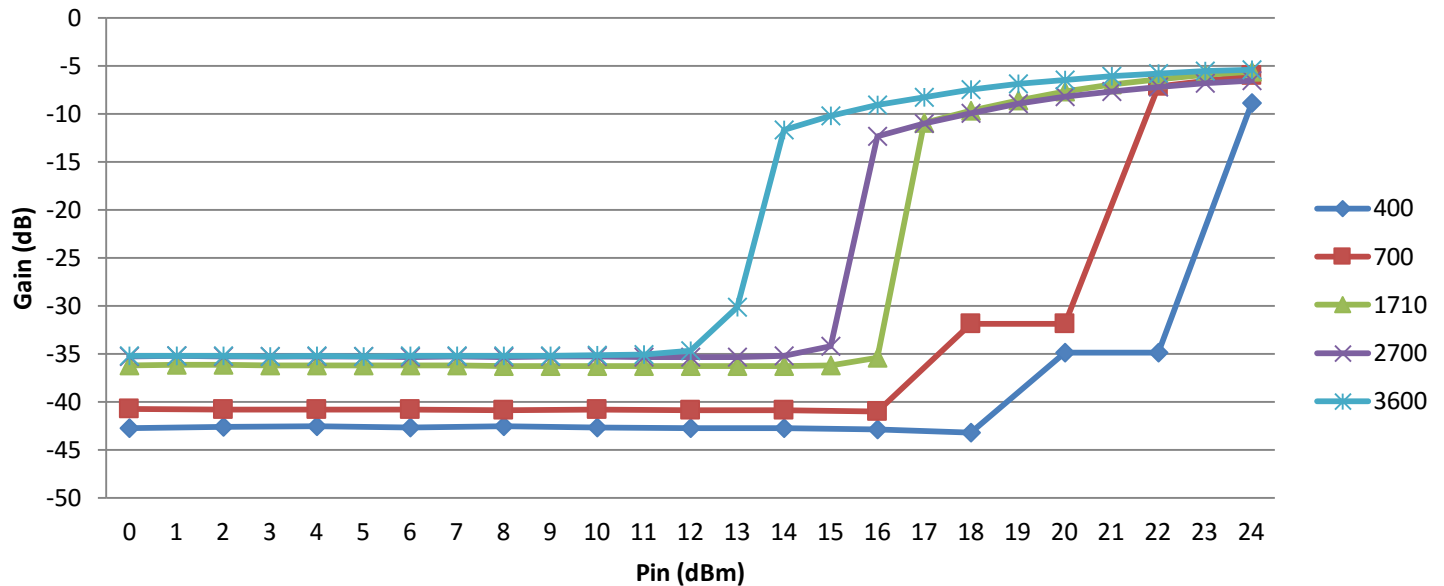


GRF4042 Evaluation Board OIP3 vs. Frequency (Bypass Mode)

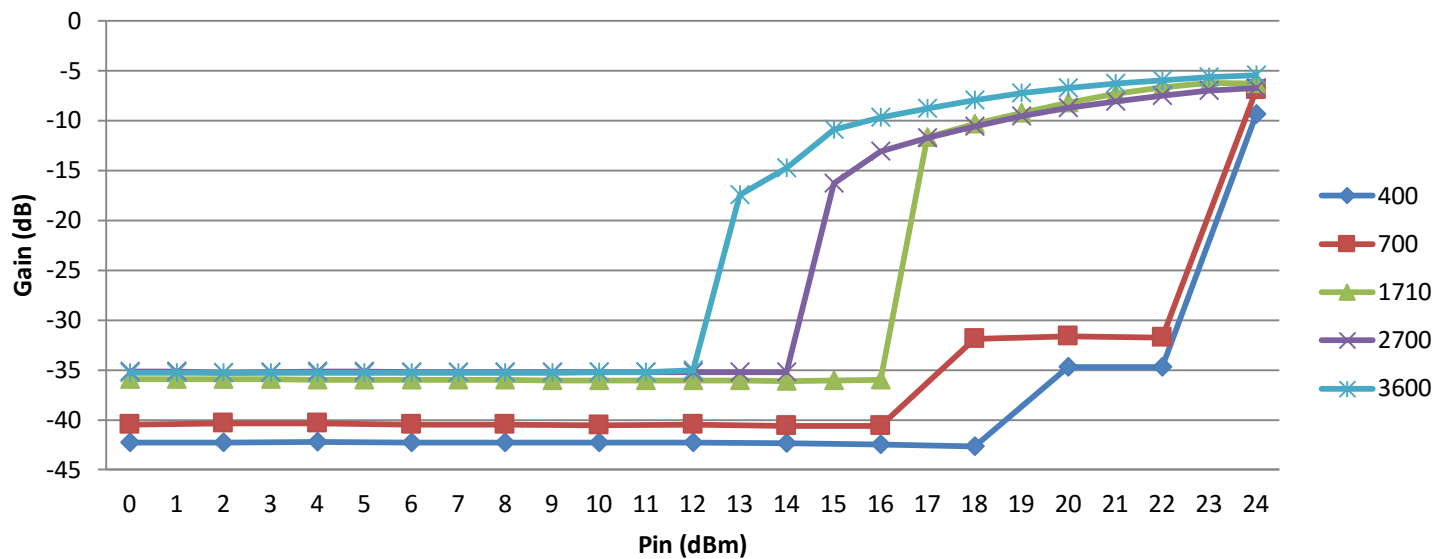


GRF4042 Evaluation Board Guerrilla Armor Response (Disabled Mode Isolation vs. RF Input Power)

GRF4042 Evaluation Board Gain vs. Input Power; (Vdd: 5.0V; Venable = Vbypass = 0.0V)

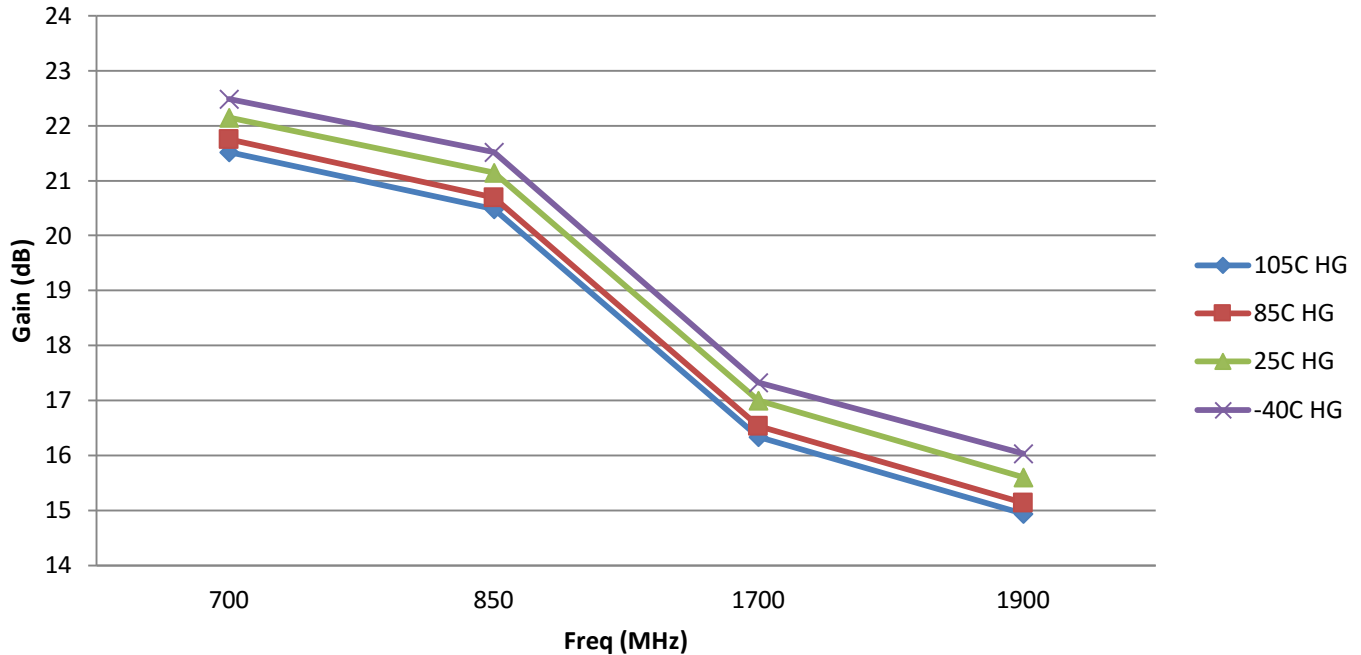


GRF4042 Evaluation Board Gain vs. Input Power; (Vdd: 3.3V; Venable = Vbypass = 0.0V)

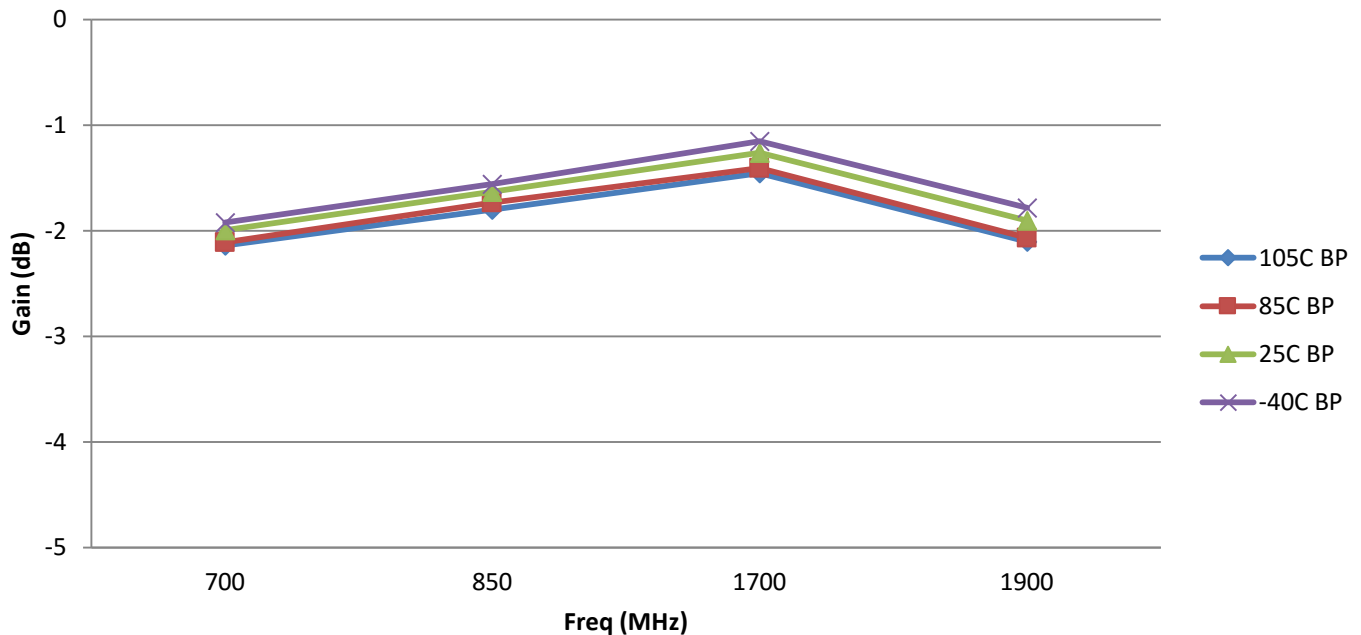


GRF4042 Data vs. Temperature; Vdd: 4.2 and Iddq: 50 mA

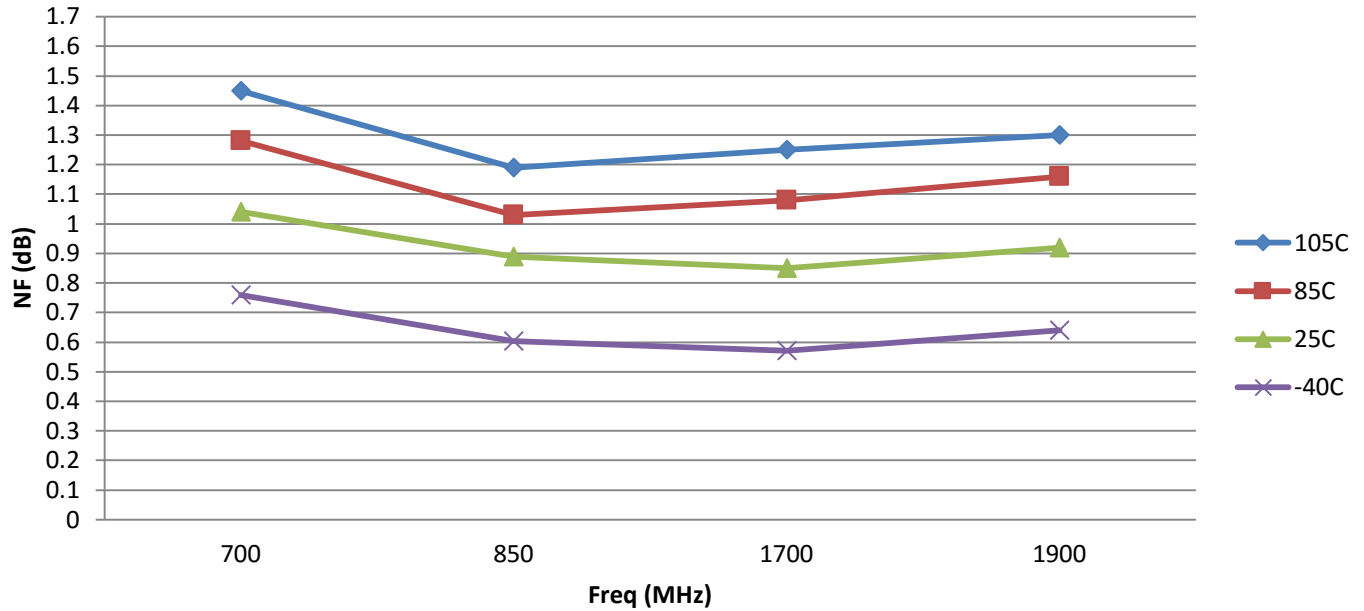
GRF4042 Evaluation Board Gain vs. Frequency over Temperature (Gain Mode)



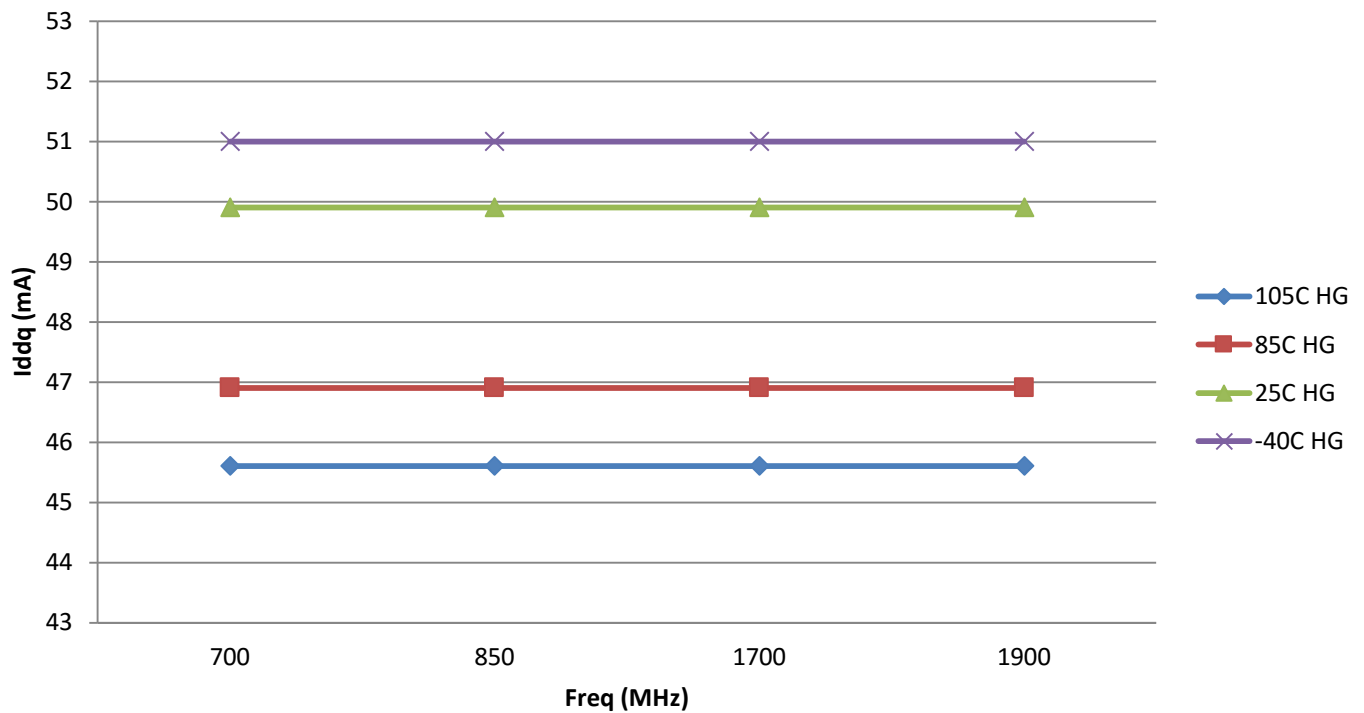
GRF4042 Evaluation Board Gain vs. Frequency over Temperature (Bypass Mode)



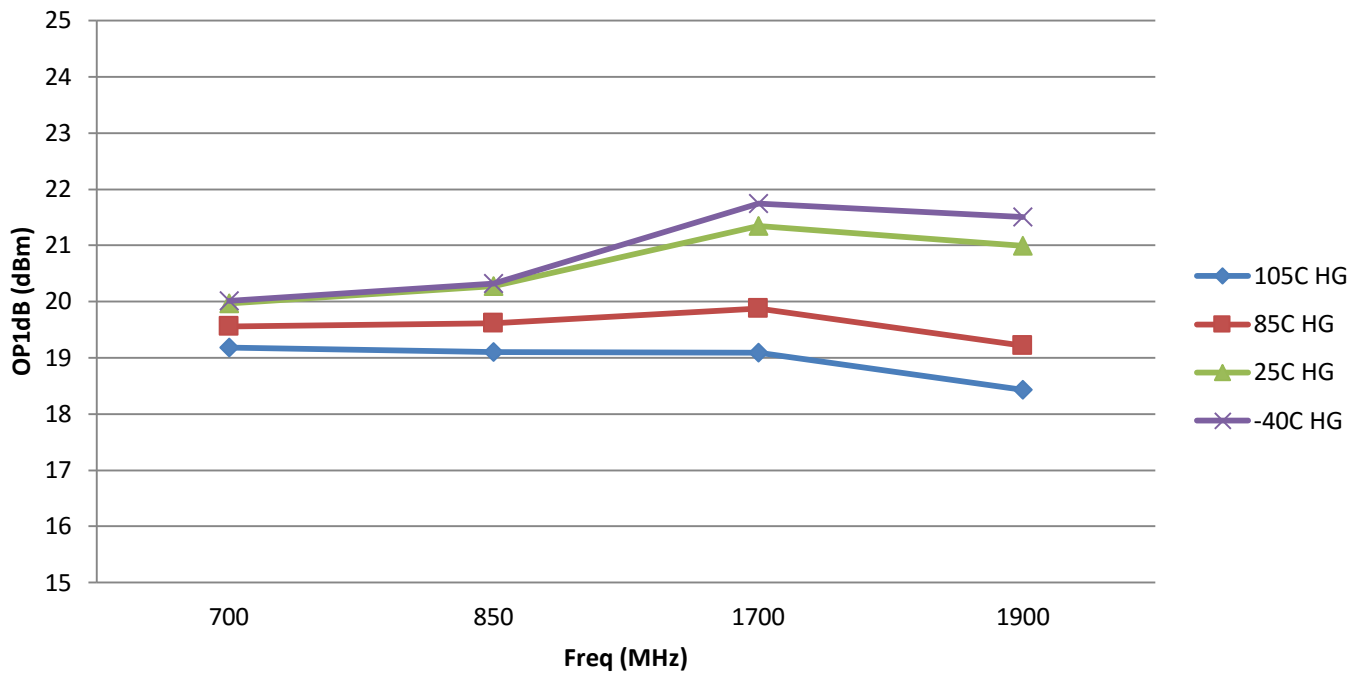
**GRF4042 Evaluation Board Noise Figure vs. Frequency over Temperature:
4.2V/50mA**



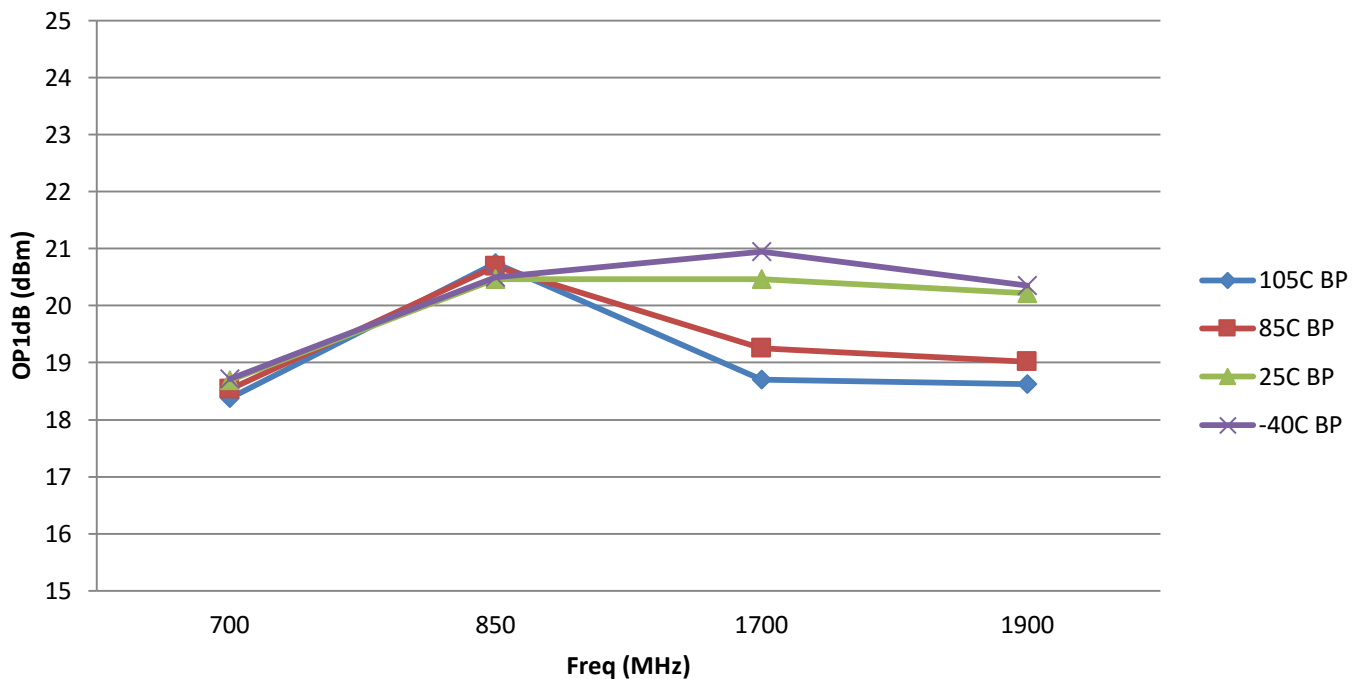
GRF4042 Iddq vs. Temperature; Vdd: 4.2 volts; Iddq: 50 mA



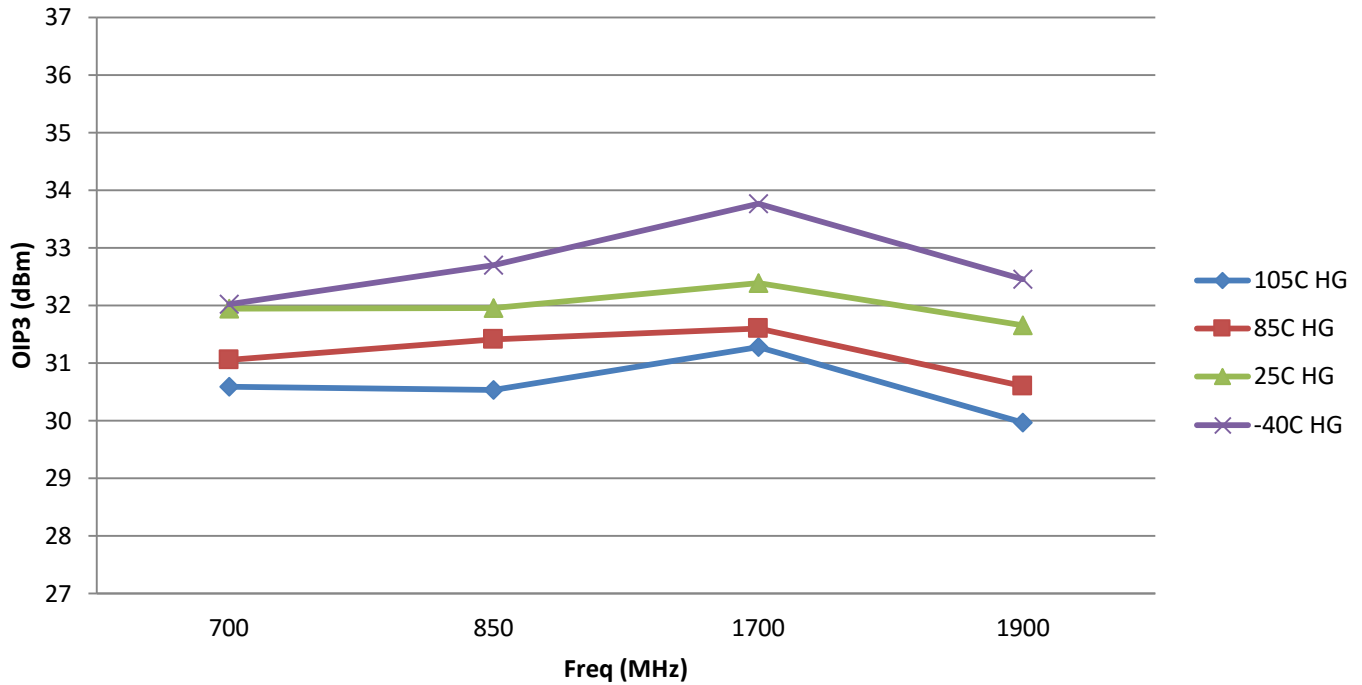
GRF4042 Evaluation Board OP1dB vs. Frequency over Temperature (Gain Mode)



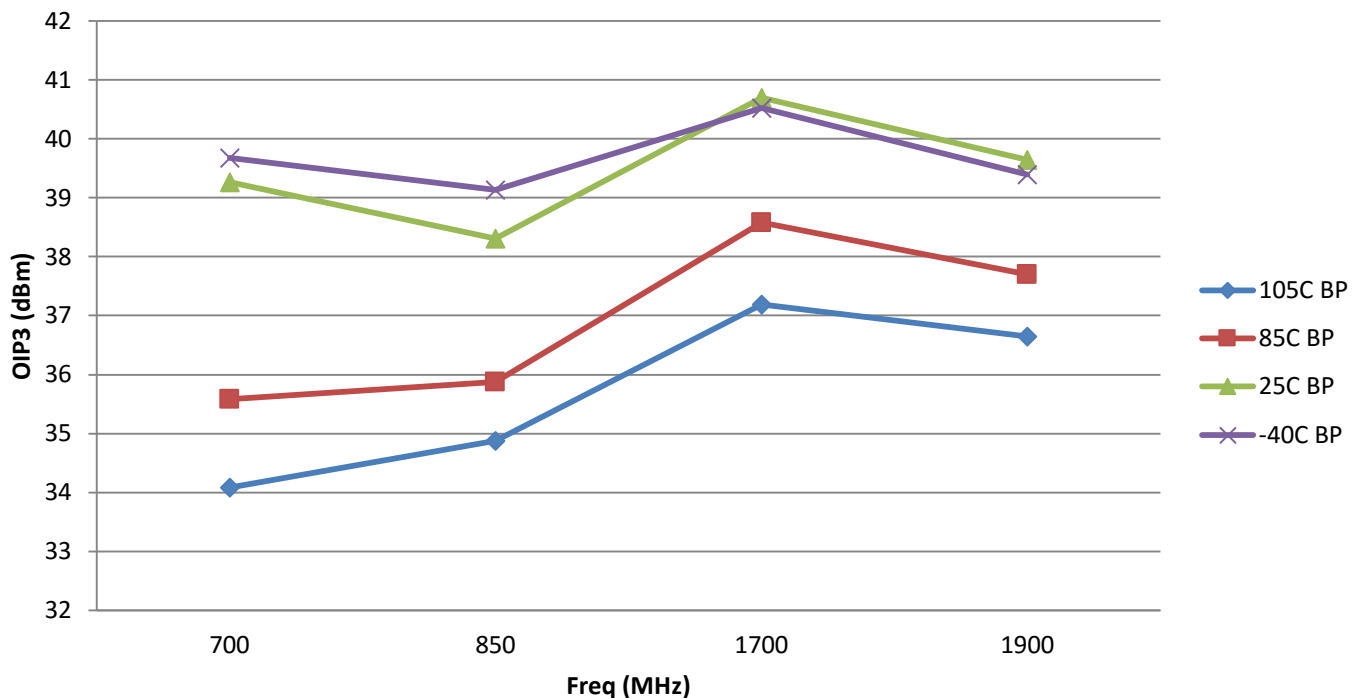
GRF4042 Evaluation Board OP1dB vs. Frequency over Temperature (Bypass Mode)



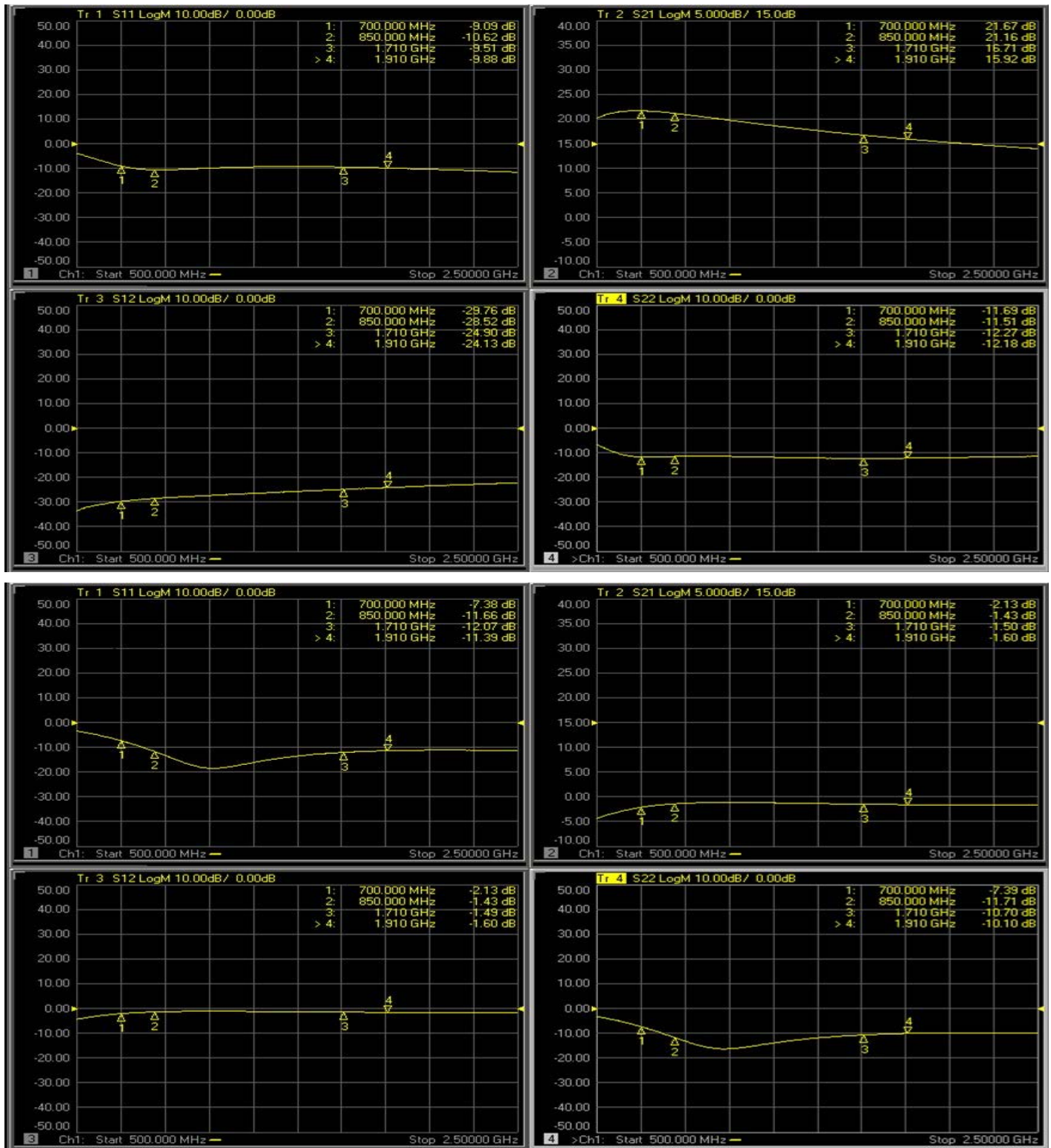
GRF4042 Evaluation Board OIP3 vs. Frequency over Temperature (Gain Mode)

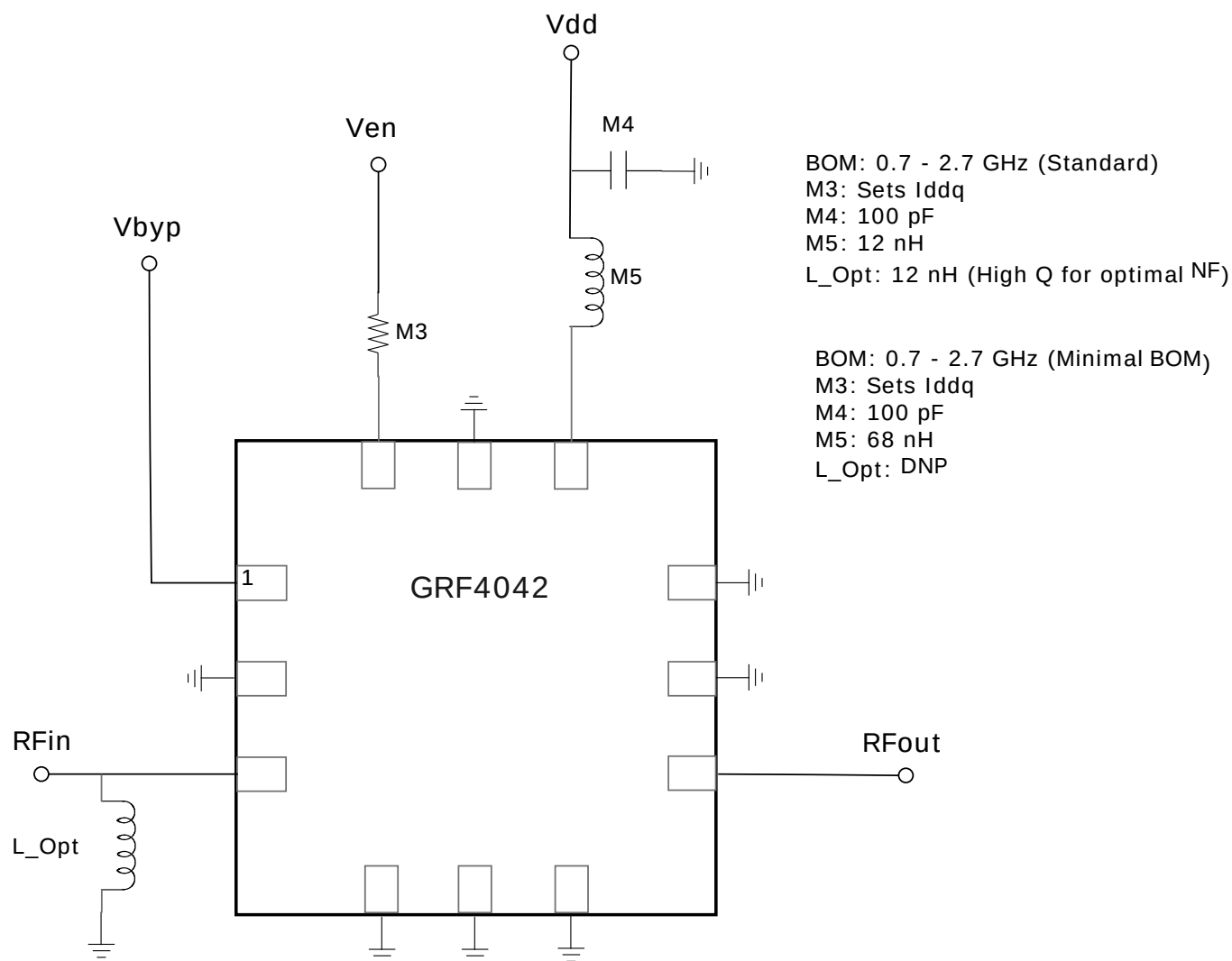


GRF4042 Evaluation Board OIP3 vs. Frequency over Temperature (Bypass Mode)

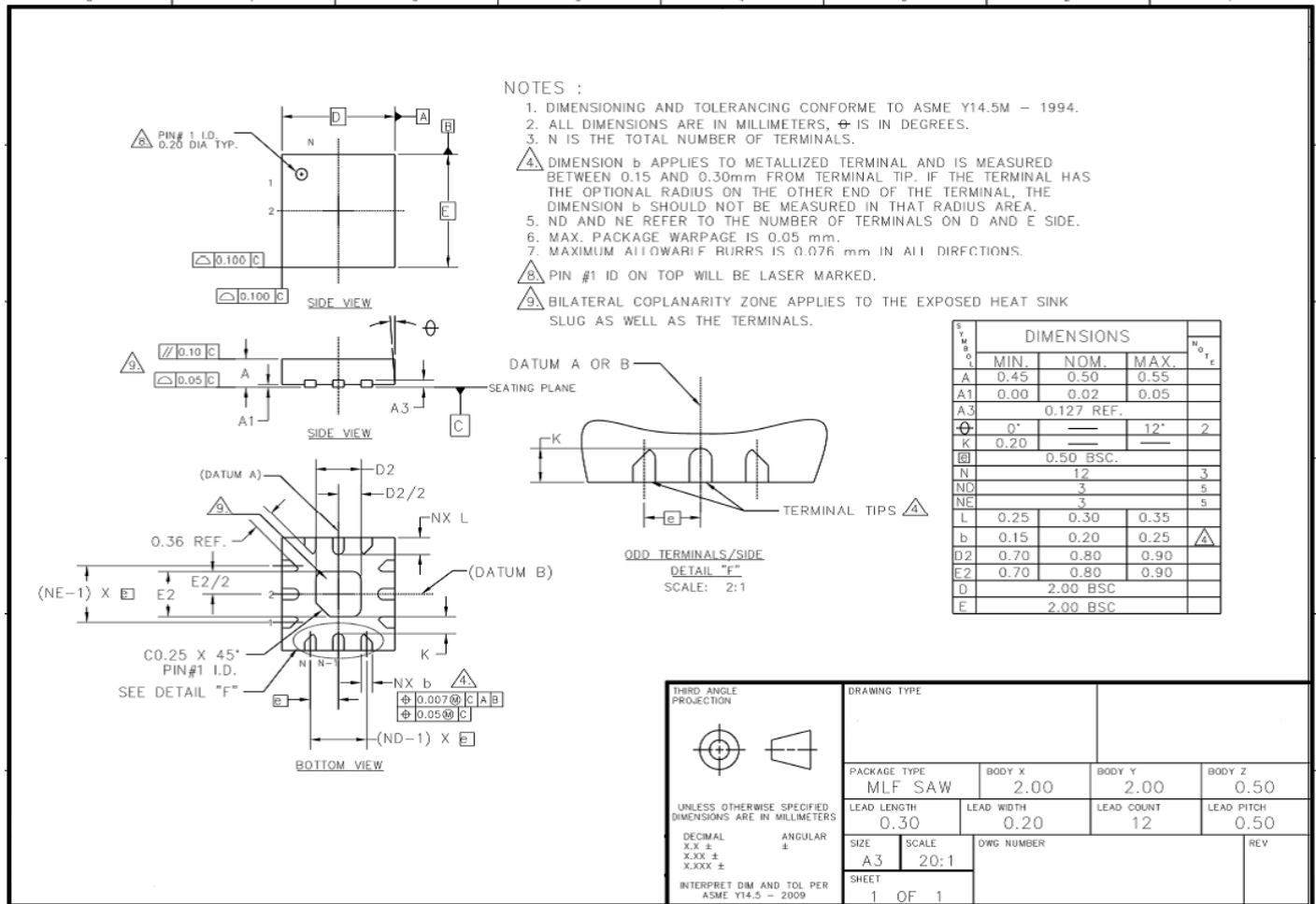


GRF4042 Evaluation Board S-Parameters (4.2V/50 mA): Gain and Bypass Modes





GRF4042 Evaluation Board Application Schematic (0.7 to 2.7 GHz)



GRF4042 QFN-12 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.

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