DATA SHEET

GRF9123

CATV and General Purpose Amplifier 0.05 to 2 GHz

PRELIMINARY DATA SHEET

FEATURES

- 0.05 to 2 GHz Operation
- High Gain: 21.5 dB at 1800 MHz
- Outstanding Noise Figure and Linearity
- Compact 2.0 x 2.0 mm DFN-8 Package
- Process: GaAs pHEMT

Reference: 5 V / 140 mA / 1.8 GHz

- Gain: 21.5 dB
- OIP3: 40 dBm
- OP1dB: 19 dBm
- Evaluation Board Noise Figure: 1.1 dB

APPLICATIONS

- Cable and Terrestrial
- DOCSIS 4.0
- CATV, Cable Modem and Set Top Box
- General Purpose Gain Block

ORDERING INFORMATION

Buy it Now

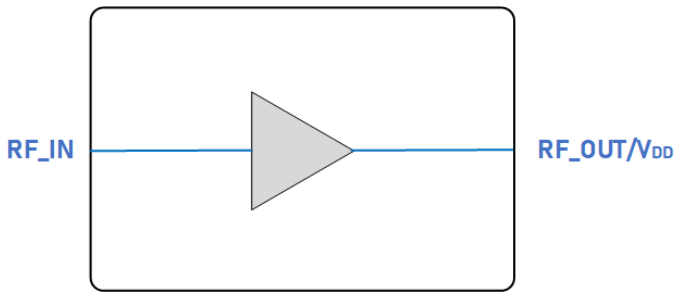
DESCRIPTION

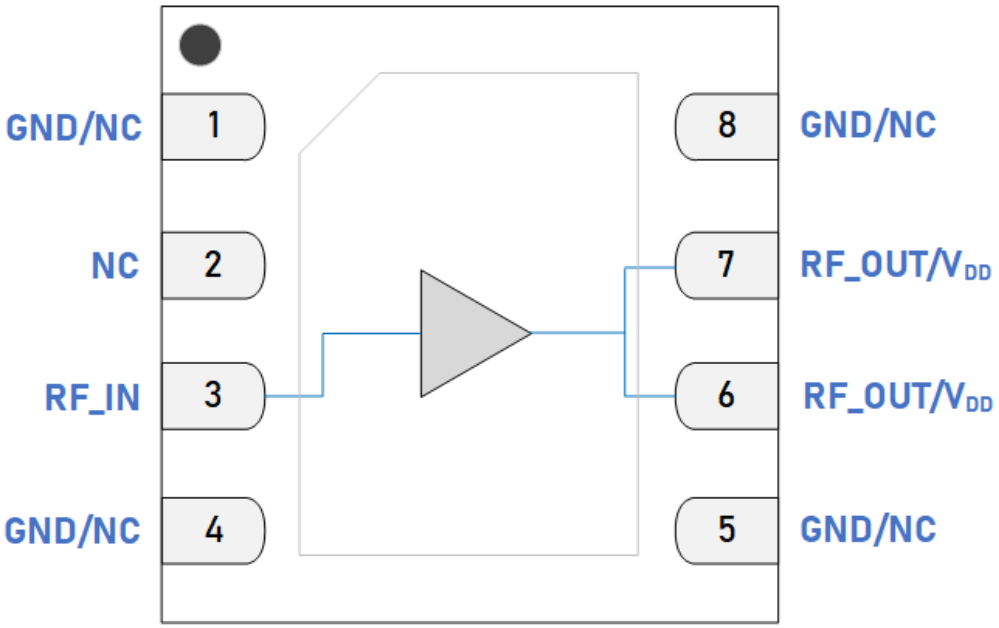
The GRF9123 is a broadband, linear gain block designed for use in 75 ohm CATV and 50 ohm general purpose applications.

Please consult the GRF applications engineering team for application notes and custom tuning/evaluation board data. De-embedded S-parameters are available on the website.

Additional tunes can be found on the GRF9123 "Custom Tunes" product page: GRF9123 Custom Tunes

BLOCK DIAGRAM





Note: Pin 2 tied to RF_IN on evaluation board.

Pin Out (Top View)

Pin Assignments

Pin	Name	Description	Note
1, 4, 5, 8	GND/NC	Ground or No Connect	No internal connection to die. We recommend connecting these pins to ground. Pins 3 and 6 may be connected to RF_IN and RF_OUT traces if PCB trace width requires.
2	NC	No Connect	Pin 2 tied to RF_IN on evaluation board. No internal connection to die.
3	RF_IN	RF Input	External match must provide DC block.
6, 7	RF_OUT/V_{DD}	RF Output	Provides device V_{DD} via external bias inductor/ferrite.
PKG BASE	GND	Ground	Provides DC and RF ground as well as thermal heat sink. Recommend multiple 8 mil vias beneath the package for optimal RF and thermal performance. Refer to evaluation board top layer graphic on schematic page.

Absolute Ratings

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	V_{DD}	0	6	V
RF Input Power: CW, Load VSWR < 2:1, V_{DD} = 5 V	$P_{IN\ MAX}$		TBD	dBm
Operating Temperature (Package Base)	$T_{PKG\ BASE}$	-40	105	°C
Maximum Channel Temperature (MTTF >10^6 Hours)	T_{MAX}		170	°C
Maximum Dissipated Power	$P_{DISS\ MAX}$		TBD	mW

Electrostatic Discharge

Charged Device Model	CDM	TBD		V
Human Body Model	HBM	TBD		V

Storage

Storage Temperature	T_{STG}	-65	150	°C
Moisture Sensitivity Level	MSL		1	--

Caution! ESD Sensitive Device.

Exceeding Absolute Maximum Rating conditions may cause permanent damage.

Note: For additional information, please refer to Manufacturing Note MN-001 - Packaging and Manufacturing Information.

All Guerrilla RF products are provided in RoHS compliant lead (Pb)-free packaging. For additional information, please refer to the Certificate of RoHS Compliance.

Recommended Operating Conditions

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Supply Voltage	V_{DD}	3	5	6	V	
Operating Temperature Range	$T_{PKG\ BASE}$	-40		85	°C	
RF Frequency Range	F_{RF}	0.05	1.8	2	GHz	Typical application schematic with external matching components **(notes 1 & 2)**.
RF_IN Port Impedance	Z_{RFIN}		75		Ω	
RF_OUT Port Impedance	Z_{RFOUT}		75		Ω	

Note 1: Operation outside of this range is supported by using different custom tunes. Examples of other optimized tunes can be found here: GRF9123 Custom Tunes

Note 2: Contact the Guerrilla RF Applications team for guidance on optimizing the tuning of the device for alternative bands.

Nominal Operating Parameters - General

The following conditions apply unless noted otherwise; Typical Application Schematic, V_{DD} = 5 V, I_{DD} = 140 mA, F_{TEST} = 1.8 GHz, 75 Ω system impedance, $T_{PKG\ BASE}$ = 25 °C. Evaluation board losses are included within the specifications.

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Supply Current	I_{DD}		140		mA	V_{DD} = 5 V.

Thermal Data

Thermal Resistance (Infrared Scan)	Θ_{JC}		TBD		°C/W	On standard evaluation board **(note 3)**.

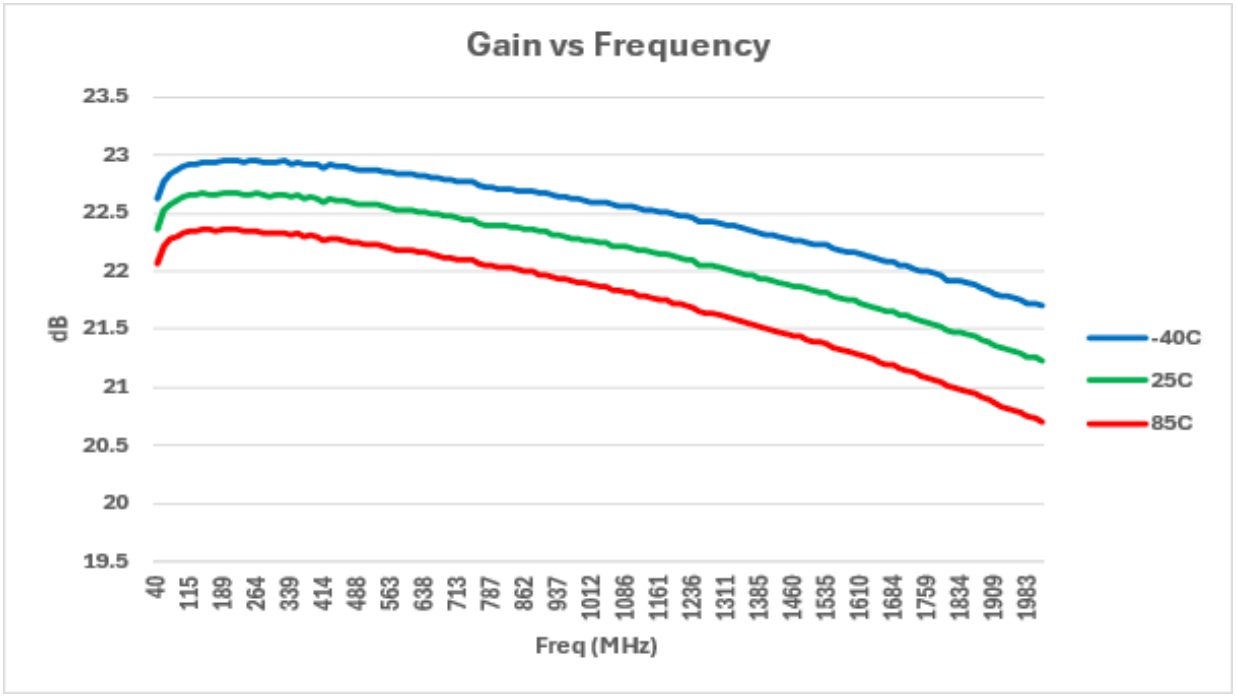
Note 3: MTTF > 10^6 hours for $T_j \leq 170$ °C

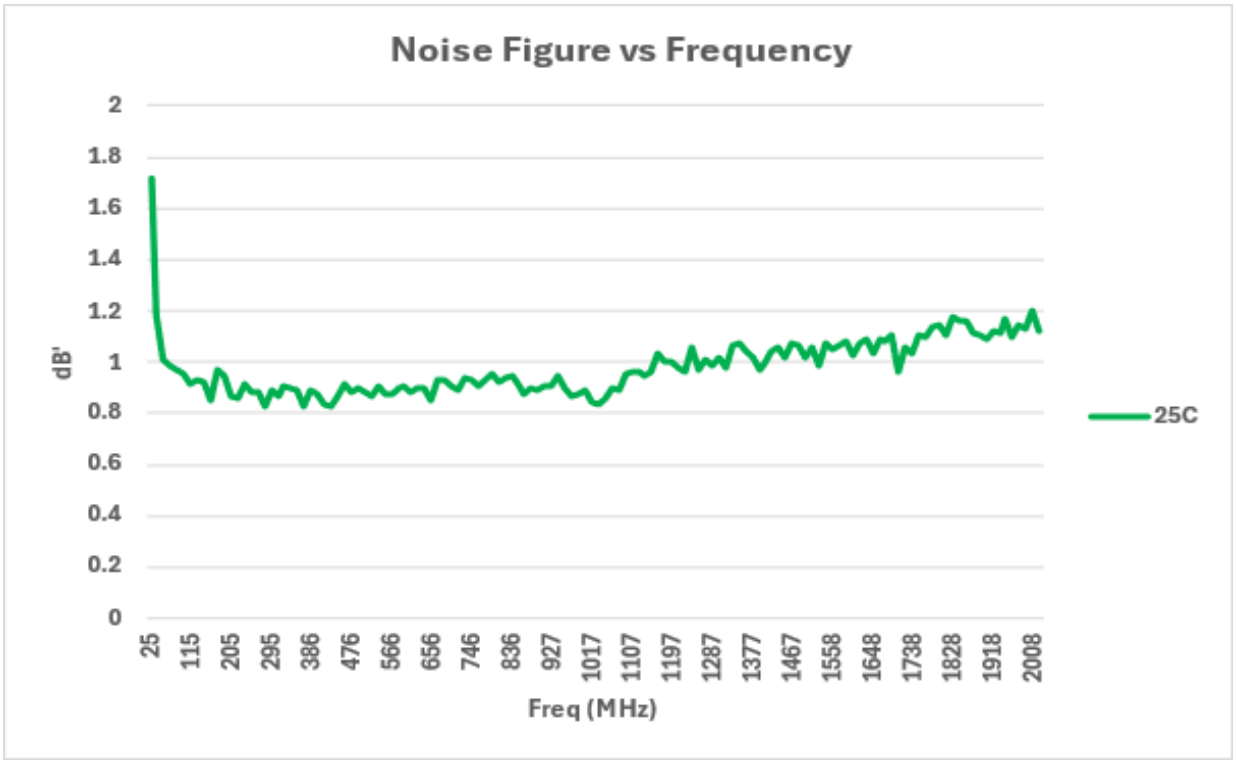
Nominal Operating Parameters - RF

The following conditions apply unless noted otherwise; Typical Application Schematic, V_{DD} = 5 V, I_{DD} = 140 mA, F_{TEST} = 1.8 GHz, 75 Ω system impedance, $T_{PKG\ BASE}$ = 25 °C. Evaluation board losses are included within the specifications.

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Gain	S21		22.5		dB	50 MHz
			21.5			1800 MHz
Reverse Isolation	S12		-25.5		dB	50 MHz
			-27.7			1800 MHz
Input Return Loss	-|S11|		17.7		dB	50 MHz
			19.3			1800 MHz
Output Return Loss	-|S22|		31.8		dB	50 MHz
			26.6			1800 MHz
Noise Figure	NF		1.0		dB	50 MHz (evaluation board F to F).
			1.1			1800 MHz (evaluation board F to F).
Output 3rd Order Intercept Point	OIP3		45		dBm	+3 dBm P_{OUT} per tone at 6 MHz spacing at 1200 MHz.
			40.5			+3 dBm P_{OUT} per tone at 6 MHz spacing at 1800 MHz.
Output 2nd Order Intercept Point	OIP2H		50		dBm	+3 dBm P_{OUT} per tone at 30 MHz spacing at 500 MHz.
			43.6			+3 dBm P_{OUT} per tone at 30 MHz spacing at 1800 MHz.
Output 2nd Order Intercept Point	OIP2L		61		dBm	+3 dBm P_{OUT} per tone at 30 MHz spacing at 500 MHz.
			61			+3 dBm P_{OUT} per tone at 30 MHz spacing at 1800 MHz.
Output 1 dB Compression Power	OP1dB		19.8		dBm	1200 MHz
			18.9			1800 MHz

GRF9123 Typical Operating Curves: 5 V, 0.05 to 1.8 GHz Tune





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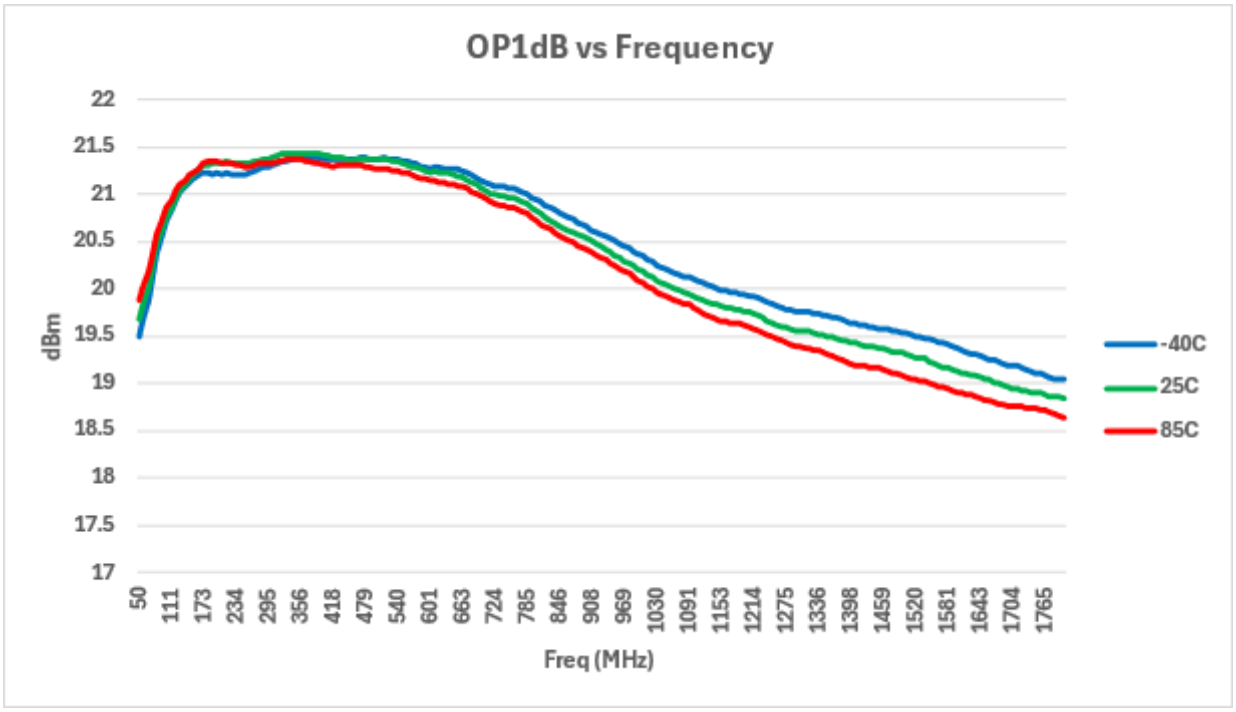

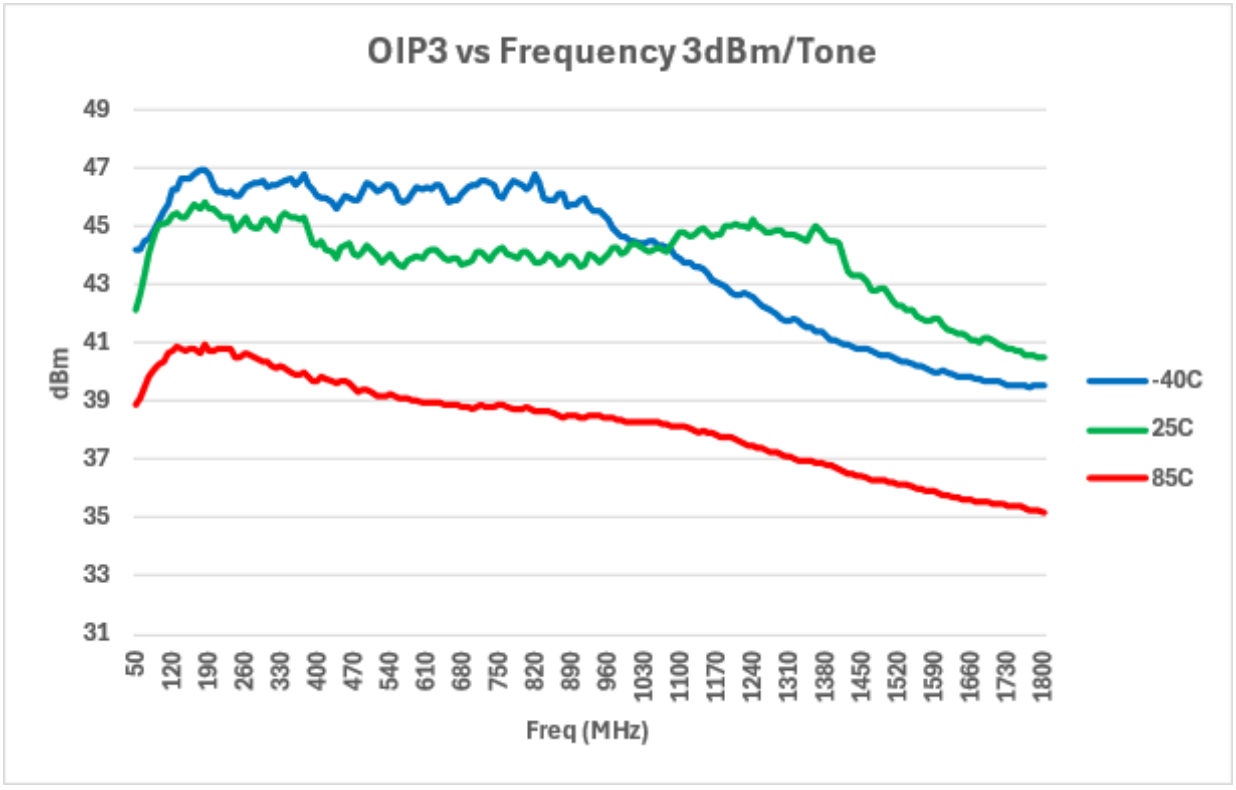

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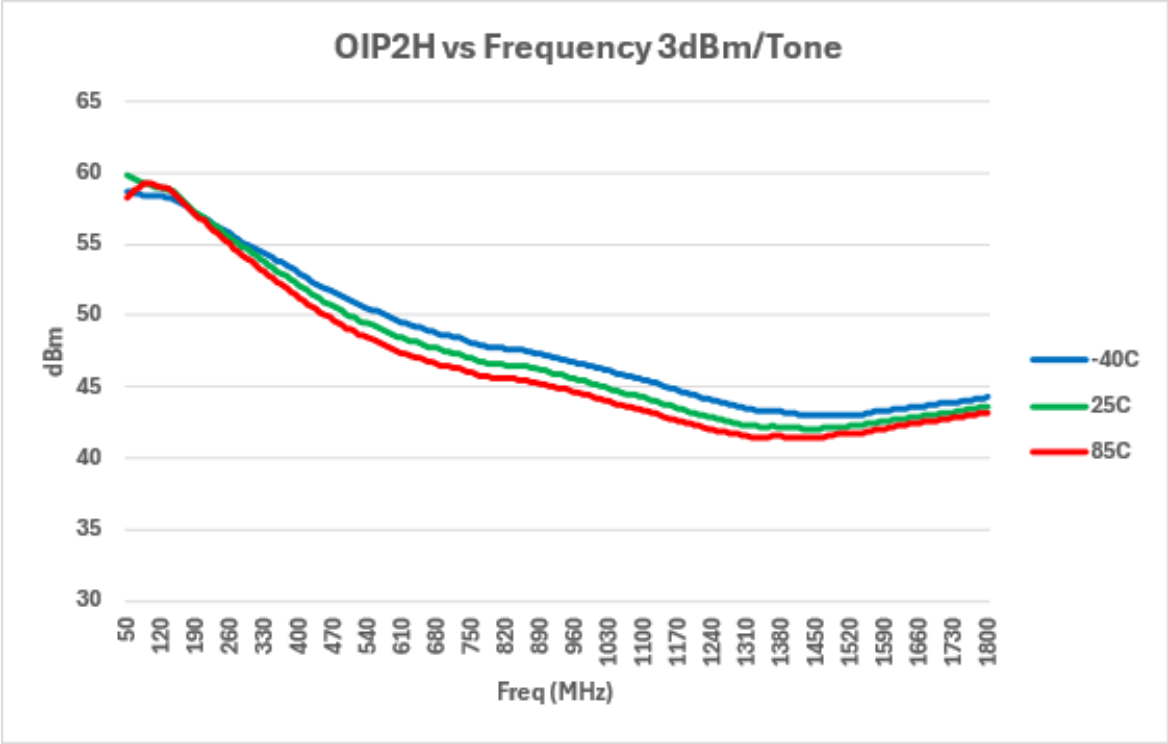

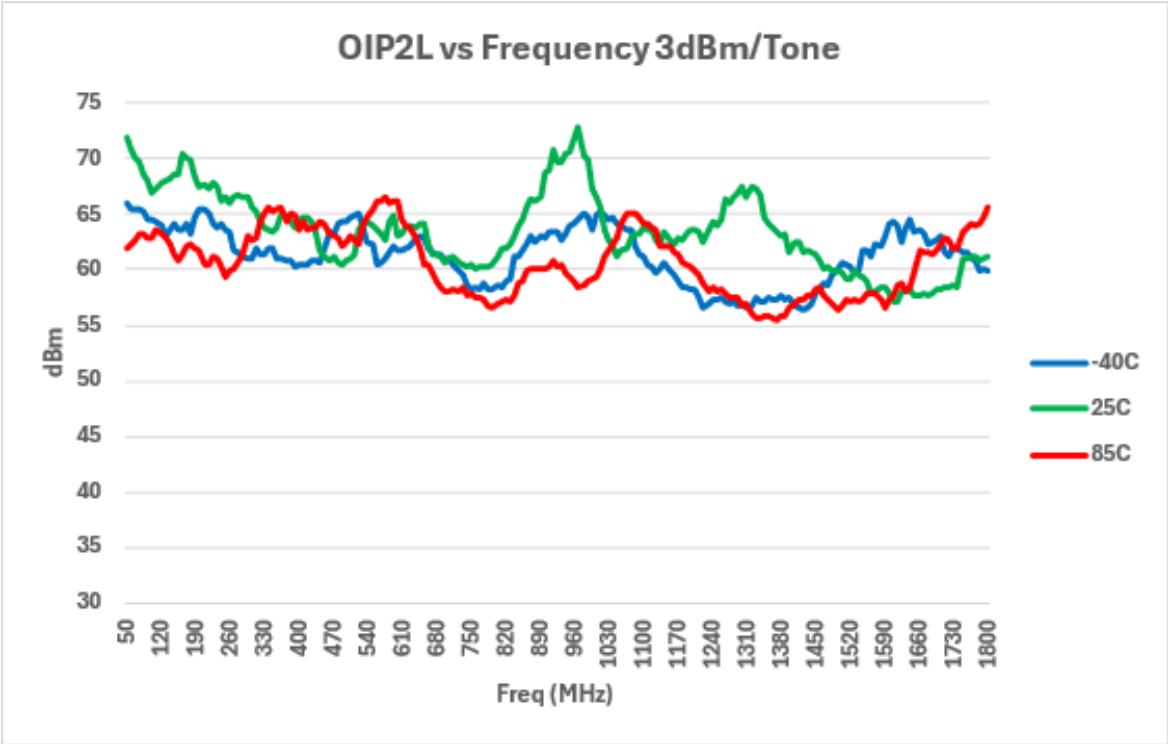

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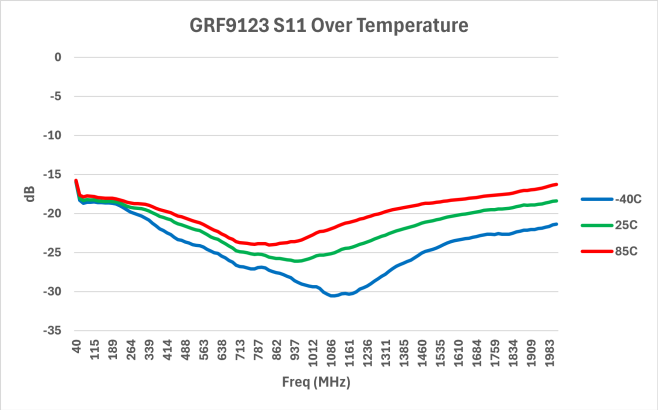
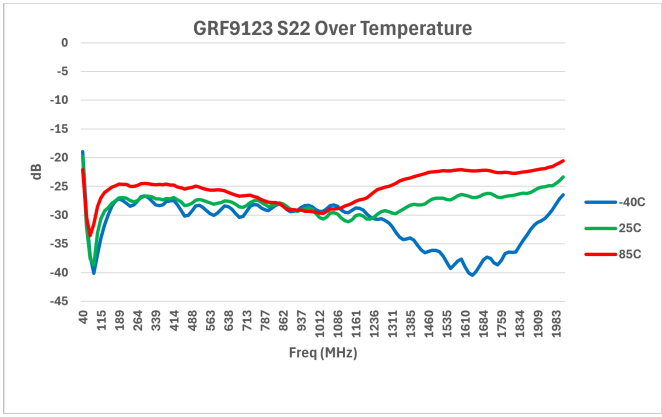
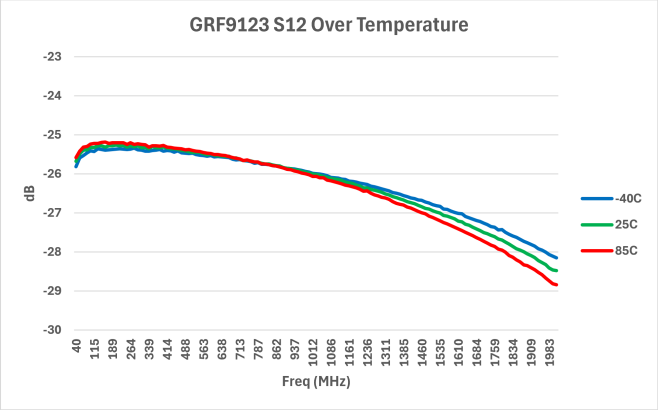
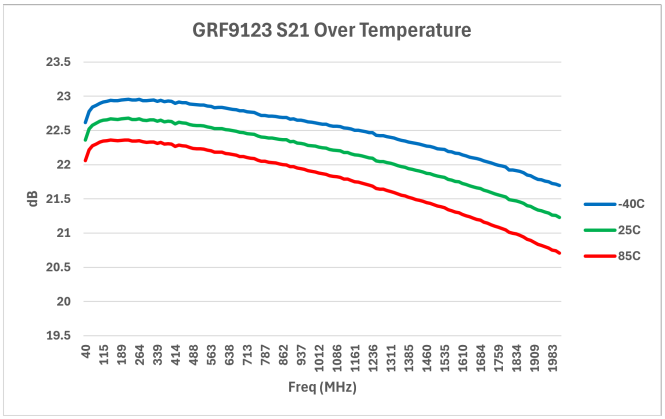
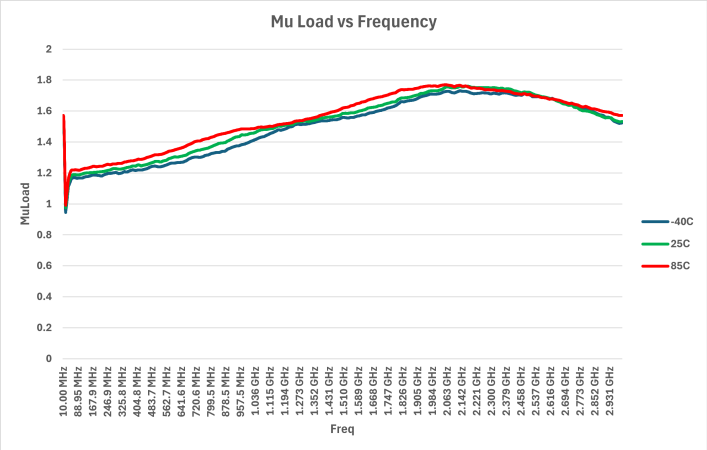
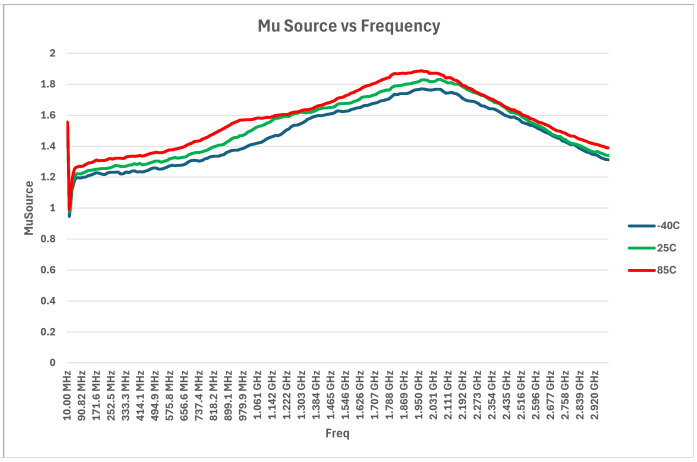




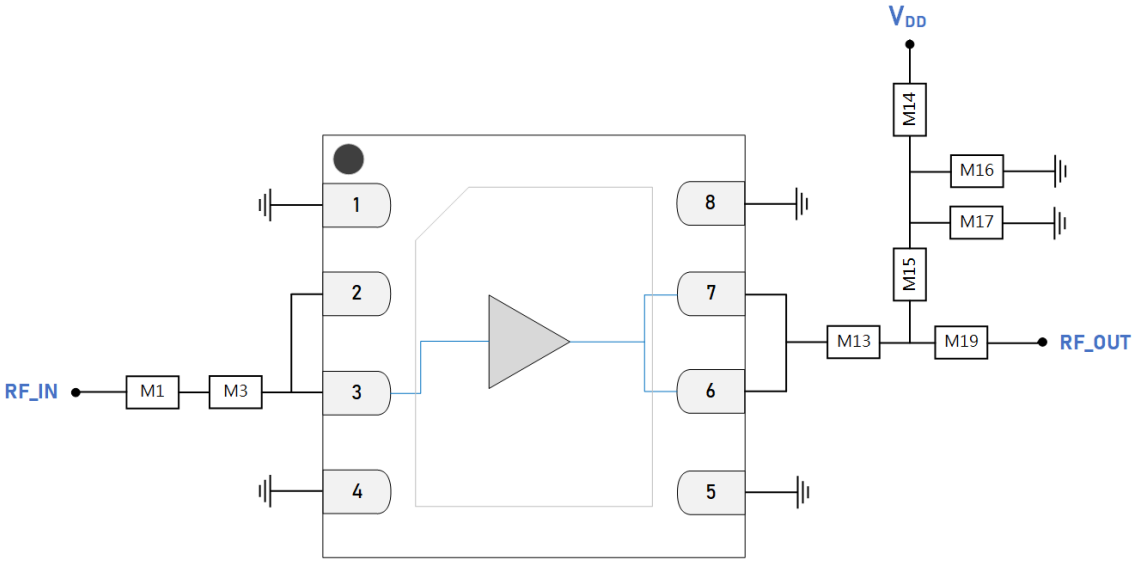






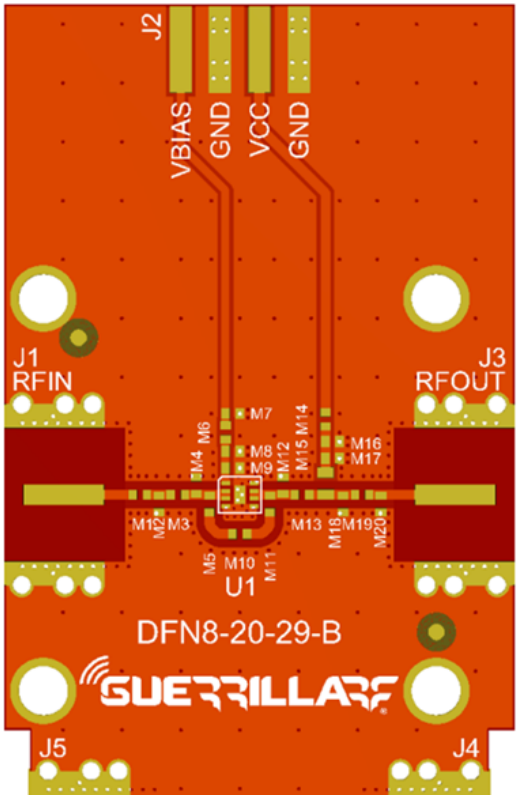


Note: Mu factor ≥ 1.0 implies unconditional stability.



Note: Pin 2 tied to RF_IN on evaluation board.

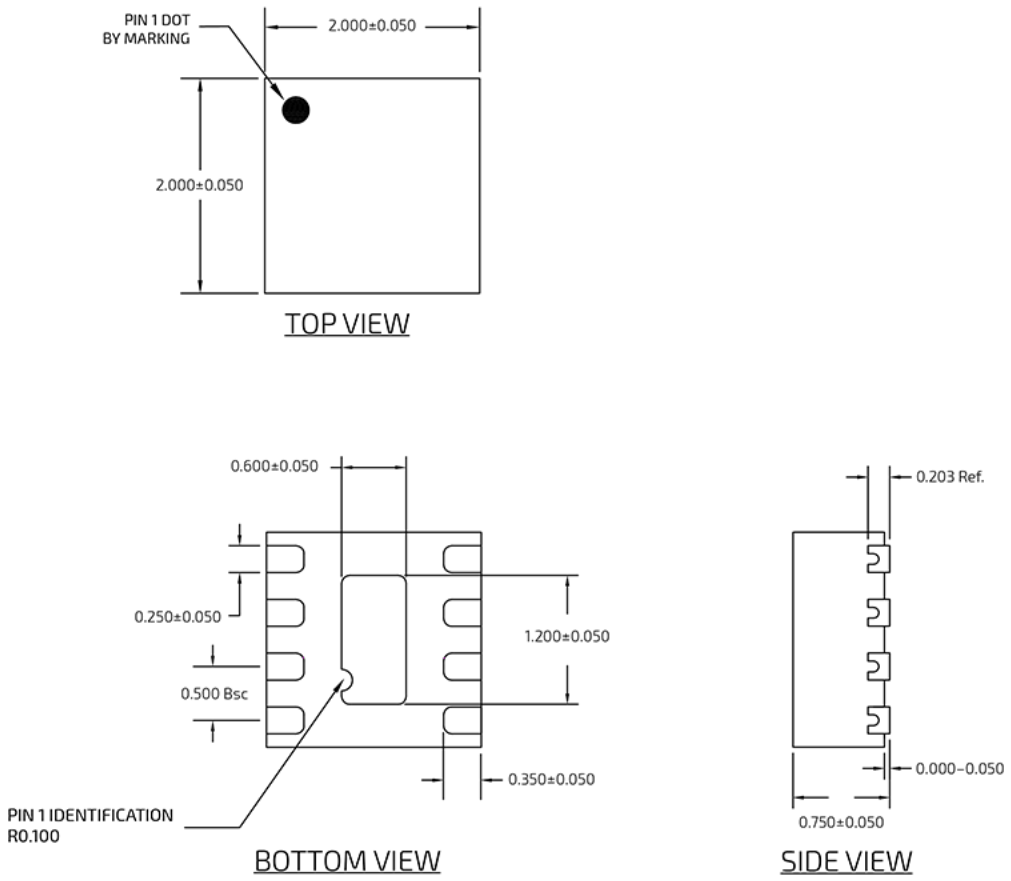
GRF9123 Standard Evaluation Board Schematic



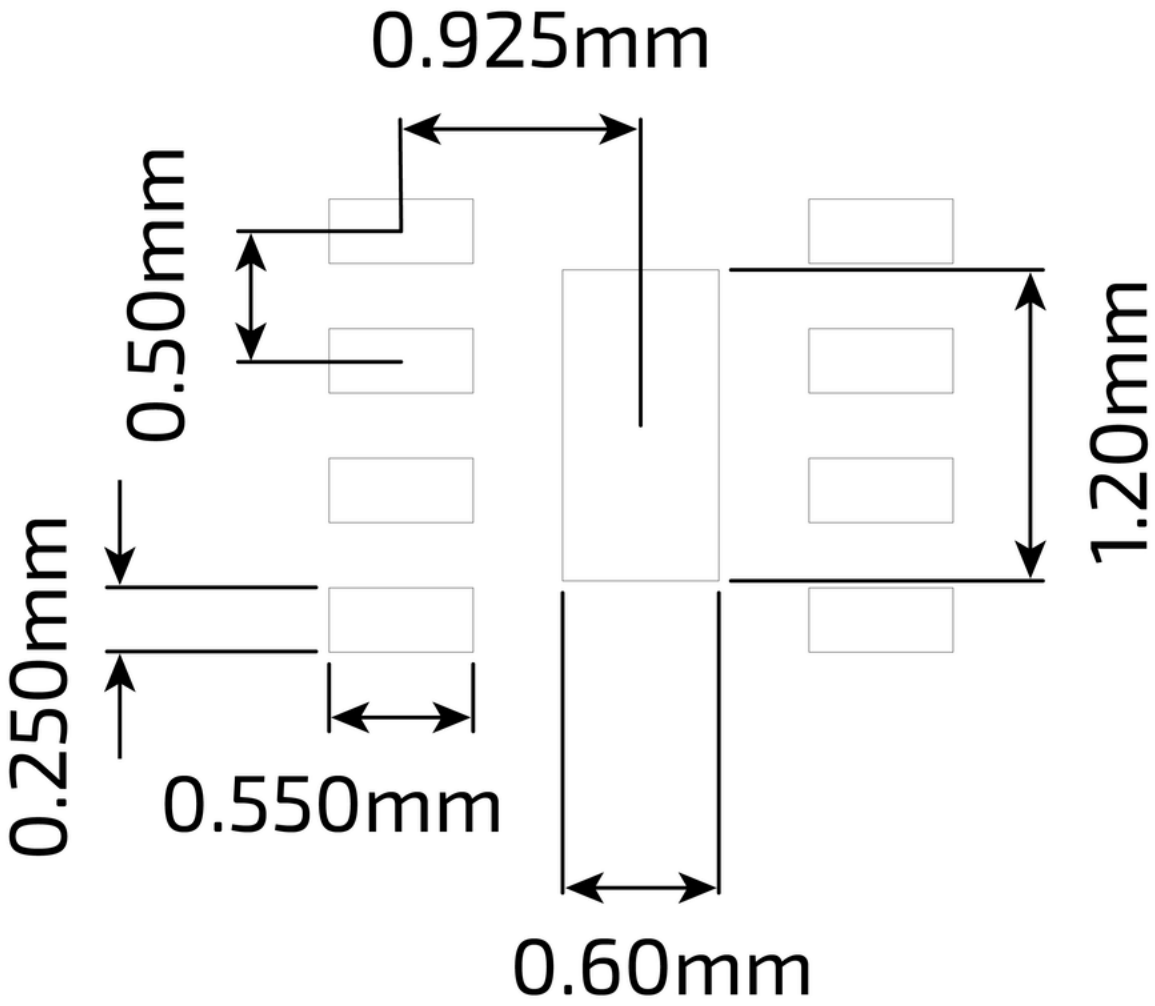
GRF9123 Evaluation Board Assembly Diagram

GRF9123 Evaluation Board Assembly Diagram Reference: 0.05 to 1.8 GHz Tune

Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M1	Capacitor	Murata	GRM	1000 pF	0402	ok
M3	Inductor	Murata	LQW15AN	3.3 nH	0402	ok
M13	Inductor	Murata	LQW15AN	4.3 nH	0402	ok
M14	Resistor	Kamaya	RMC	0 Ω	0402	ok
M15	Inductor	Coilcraft	0603AF	680 nH	0603	ok
M16, M17	Capacitor	Murata	GRM15	1000 pF	0402	ok
M19	Capacitor	Murata	GRM15	100 pF	0402	ok
J1, J3	F- Connector	Trompeter	CBJE130-1	75 Ω	--	--
Evaluation Board	DFN8-20-29-B					



DFN 8 2x2mm Package Dimensions



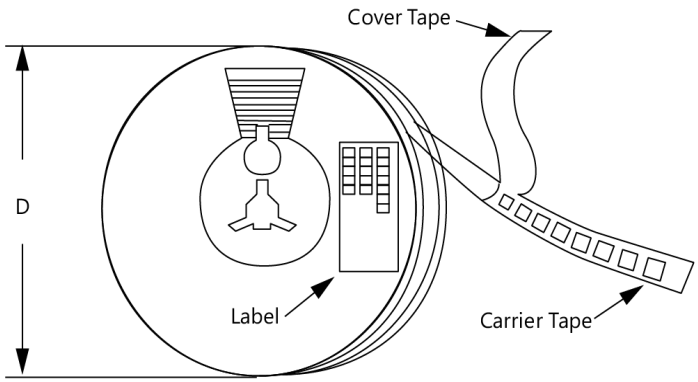
DFN 8 2x2mm Suggested PCB Footprint (Top View)

Package Marking Diagram

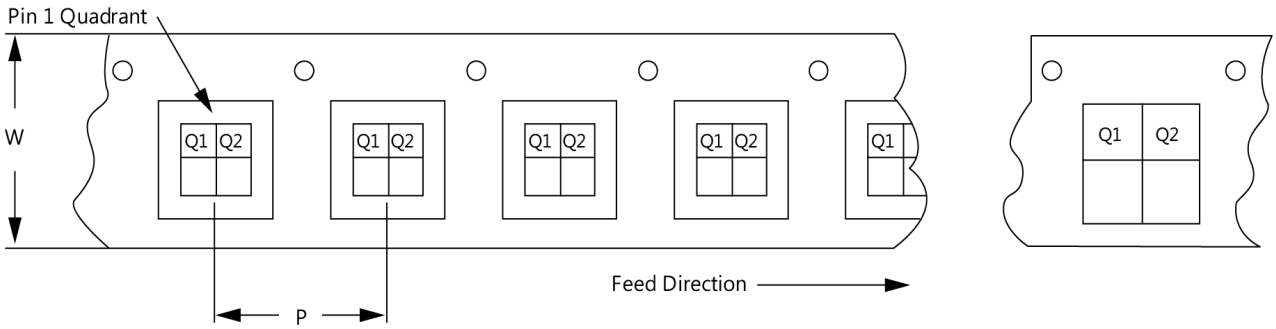
Line 1: "Y" = YEAR (single digit). "WW" = WORK WEEK the Device was assembled.
Line 2: "XXXX" = Device Part Number.

Tape and Reel Information

Guerrilla RF's tape and reel specification complies with Electronics Industries Association (EIA) standards for "Embossed Carrier Tape of Surface Mount Components for Automatic Handling" (reference EIA-481). Devices are loaded with pins down into the carrier pocket with protective cover tape and reeled onto a plastic reel. Each reel is packaged in a cardboard box. There are product labels on the reel, the protective ESD bag, and the outside surface of the box. For the latest reel specifications and package information (including units/reel), please visit Package Manufacturing Information | Guerrilla RF (guerrilla-rf.com).



Tape and Reel Packaging with Reel Diameter Noted (D)



Carrier Tape Width (W), Pitch (P), Feed Direction and Pin 1 Quadrant Information

Revision History

Revision Date	Description of Change
April 24, 2025	Preliminary Data Sheet.

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Data Sheet Classifications

Data Sheet 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 taken within the Guerrilla RF Applications Lab. Any MIN/MAX limits represented within the data sheet are based solely on *estimated* part-to-part variations and process spreads. All parametric values are subject to change pending the collection of additional data.
Release Ø	All data based on measurements taken with *production-released* material. TYP values are based on a combination of ATE and bench-level measurements, with MIN/MAX limits defined using *modelled estimates* that account for part-to-part variations and expected process spreads. Although unlikely, future refinements to the TYP/MIN/MAX values may be in order as multiple lots are processed through the factory.
Release A-Z	All data based on measurements taken with production-released material *derived from multiple lots which have been fabricated over an extended period of time*. MIN/MAX limits may be refined over previous releases as more statistically significant data is collected to account for process spreads.

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