DATA SHEET

GRF2014

Broadband Linear Gain Block
0.03 to 4 GHz

RELEASE Ø DATA SHEET

FEATURES

- Flexible Bias Voltage and Current
- Internally Matched to 50 Ω
- Process: GaAs pHEMT

Reference: 5 V / 150 mA / 900 MHz

- Gain: 15.9 dB
- OIP3: 43.5 dBm
- OP1dB: 24 dBm

Reference: 8 V / 150 mA / 900 MHz

- Gain: 15.9 dB
- OIP3: 41 dBm
- OP1dB: 27.5 dBm

APPLICATIONS

- Linear Driver Amplifier
- Small Cells and Cellular Repeaters
- Distributed Antenna Systems
- IF Amplifier
- General Purpose Linear Gain Block

ORDERING INFORMATION

Buy it Now

DESCRIPTION

GRF2014 is a broadband, linear gain block designed for small cell, wireless infrastructure and other high performance applications. It exhibits outstanding broadband linearity and return loss from 500 to 2700 MHz with a single match.

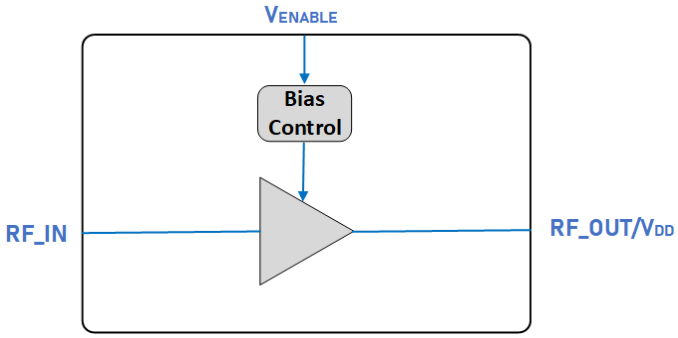
The device is operated from a supply voltage of 2.7 to 8 V with adjustable I_{DDQ} for optimal efficiency and linearity.

The device is internally matched to 50 Ω at the input and output ports needing only an external DC block on the input and a bias choke on the output.

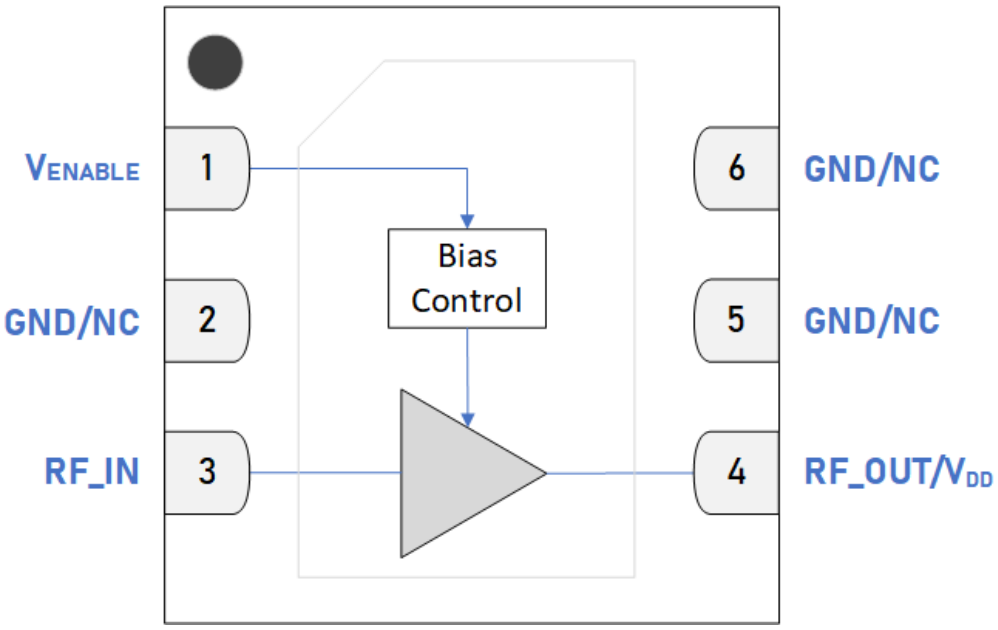
Consult with the GRF applications engineering team for custom tuning/evaluation board data and device S-parameters.

Additional tunes can be found on the GRF2014 “Custom Tunes” product page: GRF2014 Custom Tunes

BLOCK DIAGRAM



www.guerrilla-rf.com • (336) 510-7840 • sales@guerrilla-rf.com • 2000 Pisgah Church Rd., Greensboro, NC 27455



Pin Out (Top View)

Pin Assignments

Pin	Name	Description	Note
1	V_{ENABLE}	Enable Voltage Input	V_{ENABLE} and series resistor set I_{DDQ}. V_{ENABLE} < 0.2 volts disables device. On-die pull-down resistor will turn the device off if this node is allowed to float.
2, 5, 6	GND/NC	Ground or No Connect	No internal connection to die. We recommend connecting these pins to ground.
3	RF_IN	RF Input	Internally matched to 50 Ω. An external DC blocking capacitor must be used.
4	RF_OUT/V_{DD}	RF Output	Internally matched to 50 Ω. V_{DD} must be applied through a choke to this pin.
PKG BASE	GND	Ground	Provides DC and RF ground for LNA, 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	9	V
RF Input Power: Load VSWR < 2:1, $V_{DD} \leq 8$ V	$P_{IN\ MAX}$		21	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	$P_{DISS\ MAX}$		1.5	W

Electrostatic Discharge

Human Body Model	HBM	250		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}	2.7	5	9	V	
Operating Temperature (package base)	$T_{PKG\ BASE}$	-40		105	°C	
RF Frequency Range	F_{RF}	30	900	4000	MHz	Typical application schematic with external matching components **(notes 1 & 2)**.
RF_IN Port Impedance	Z_{RFIN}		50		Ω	
RF_OUT Port Impedance	Z_{RFOUT}		50		Ω	

Note 1: Operation outside of this range is supported by using different custom tunes. Examples of other optimized tunes can be found here: GRF2014 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 using the 500 to 2700 MHz tuning set, V_{DD} = 5 V, V_{ENABLE} = 3.3 V, I_{DD} = 150 mA, F_{TEST} = 900 MHz, 50 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}		150		mA	V_{DD} = 5 V, V_{ENABLE} = 3.3 V.
Enable Current	I_{ENABLE}		5.5		mA	
Switching Rise Time	T_{RISE}		200		ns	Disabled mode to Gain mode **(note 3)**.
Switching Fall Time	T_{FALL}		200		ns	Gain mode to Disabled mode **(note 4)**.

Disabled Mode

Leakage Current	$I_{LEAKAGE}$		800		µA	V_{DD} = 5 V, V_{ENABLE} = 0 V.

Thermal Data

Thermal Resistance (Infrared Scan)	Θ_{JC}		38		°C/W	On standard evaluation board **(note 5)**.
Channel Temperature at 85 °C Reference (Package Base)	$T_{CHANNEL}$		114		°C	V_{DD} = 5 V, V_{ENABLE} = 3.3 V, I_{DDQ} = 150 mA, No RF applied, P_{DISS} = 750 mV **(note 5)**.

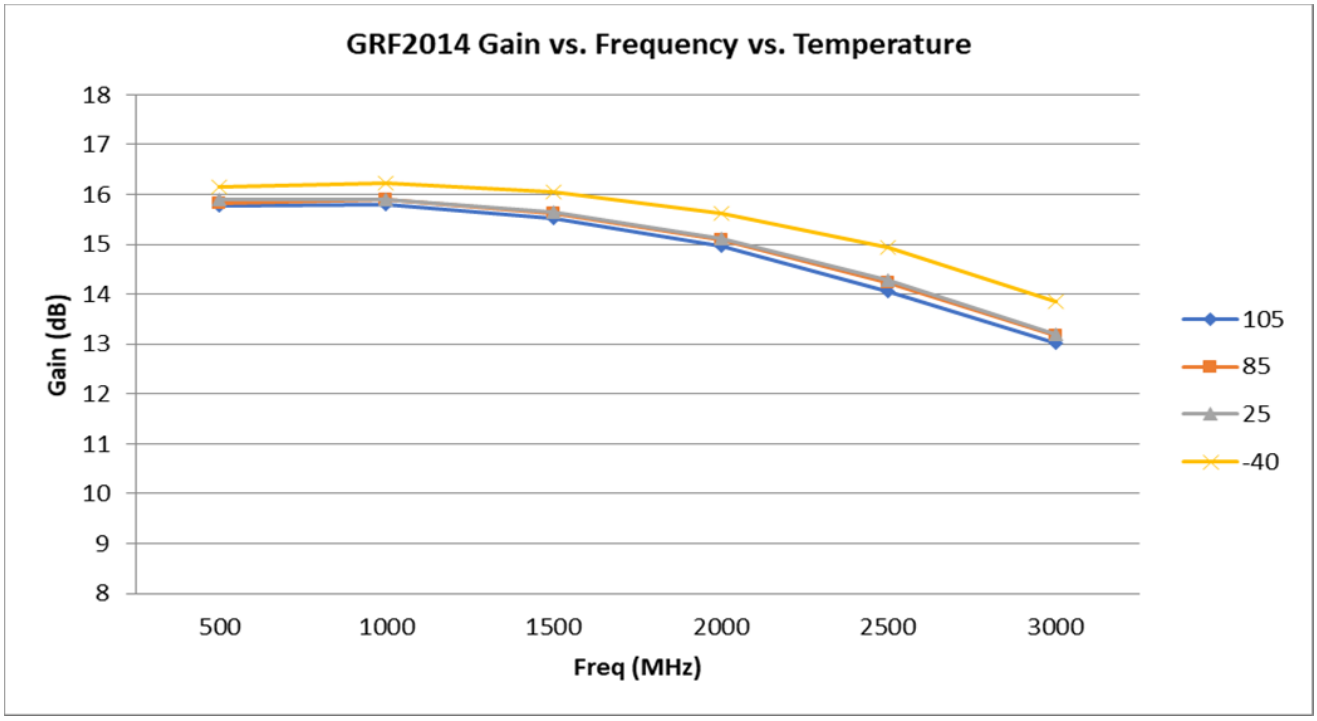
Note 3: Switching Time: 50% of V_{ENABLE} to 90% of P_{OUT}.
Note 4: Switching Time: 50% of V_{ENABLE} to 10% of P_{OUT}.
Note 5: MTTF > 10^6 hours for $T_{CHANNEL}$ < 170 °C.

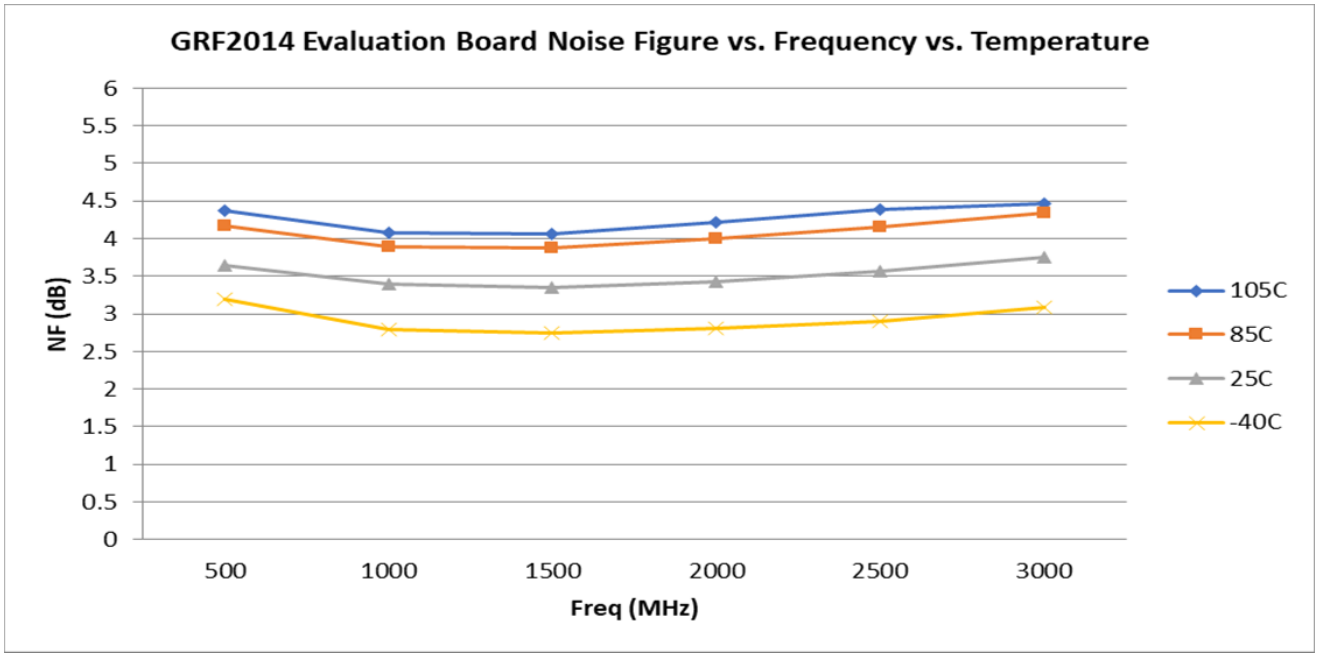
Nominal Operating Parameters - RF

The following conditions apply unless noted otherwise: typical application schematic using the 500 to 2700 MHz tuning set, V_{DD} = 5 V, V_{ENABLE} = 3.3 V, I_{DD} = 150 mA. F_{TEST} = 900 MHz, 50 Ω system impedance, $T_{PKG\ BASE}$ = 25 °C. Evaluation board losses are included within the specifications.

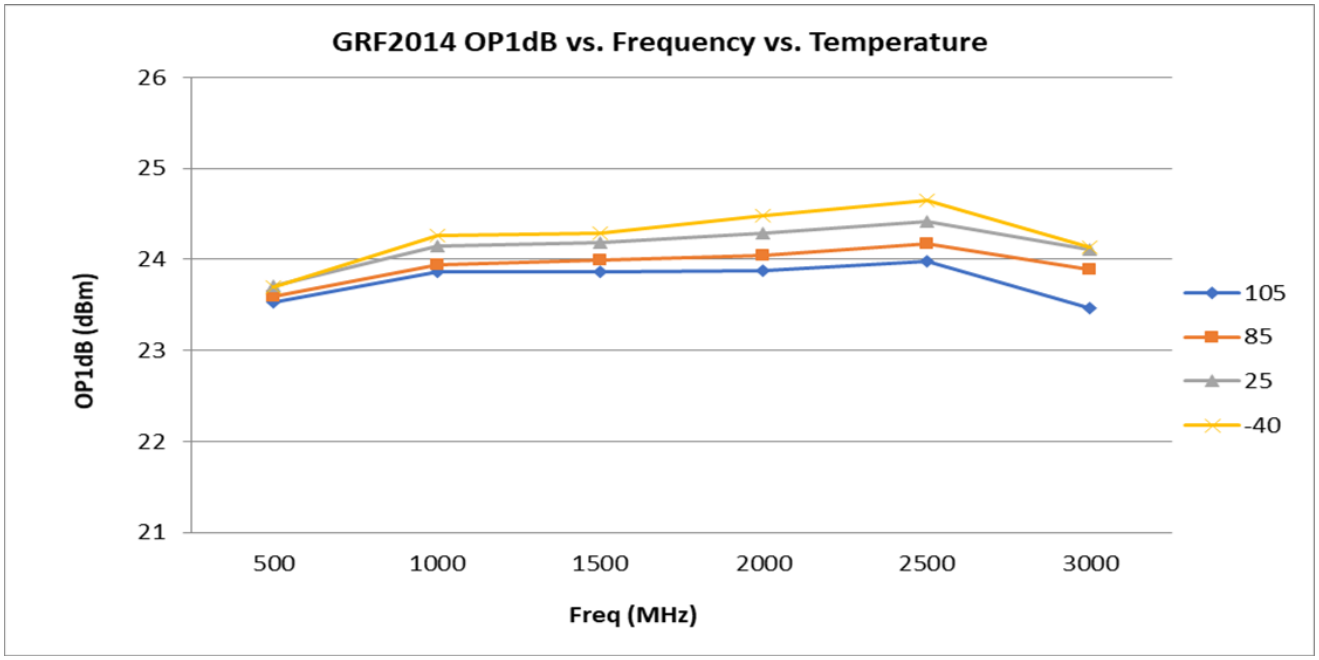
Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Gain	S21	14.9	15.9		dB	
Noise Figure	NF		3.4		dB	On standard evaluation board.
Output 3rd Order Intercept Point	OIP3		43.5		dBm	2 dBm P_{OUT} per tone at 2 MHz spacing (899 and 901 MHz).
Output 1 dB Compression Power	OP1dB	22.7	24		dBm	

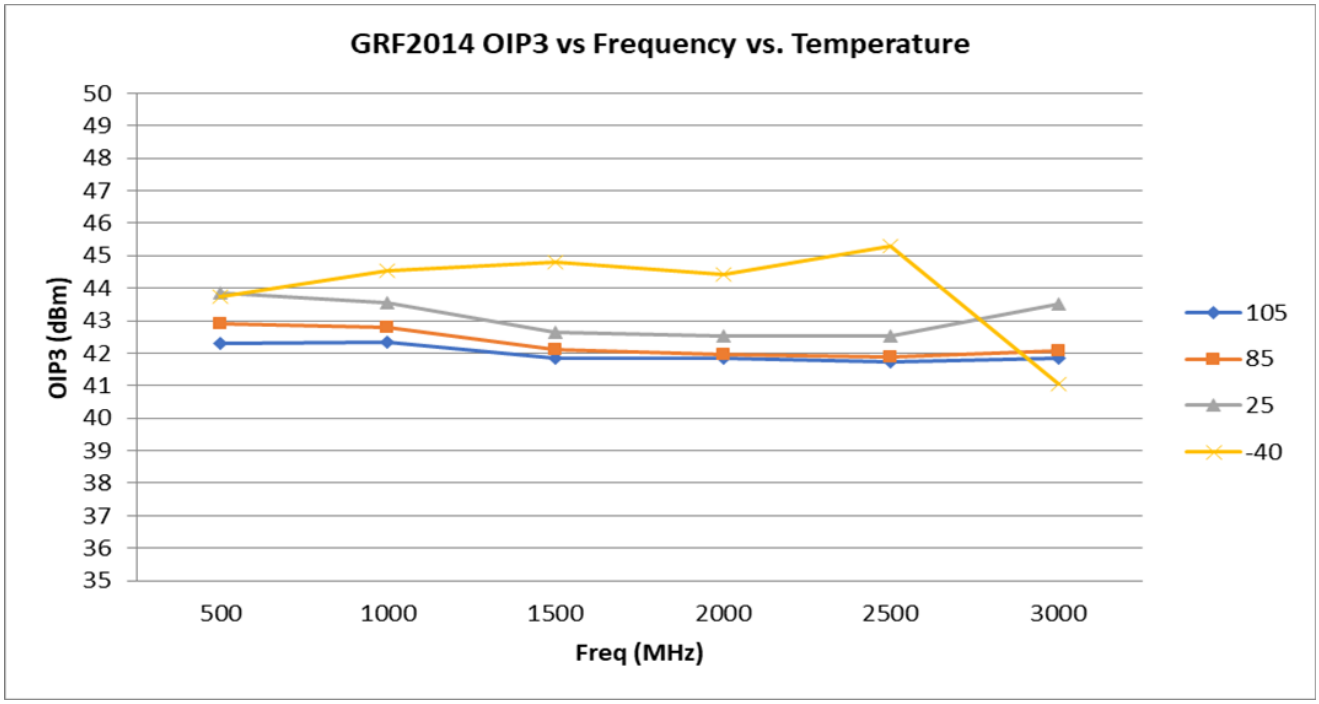
GRF2014 Typical Operating Curves: 5 V, 150 mA, 500 to 2700 MHz Tune



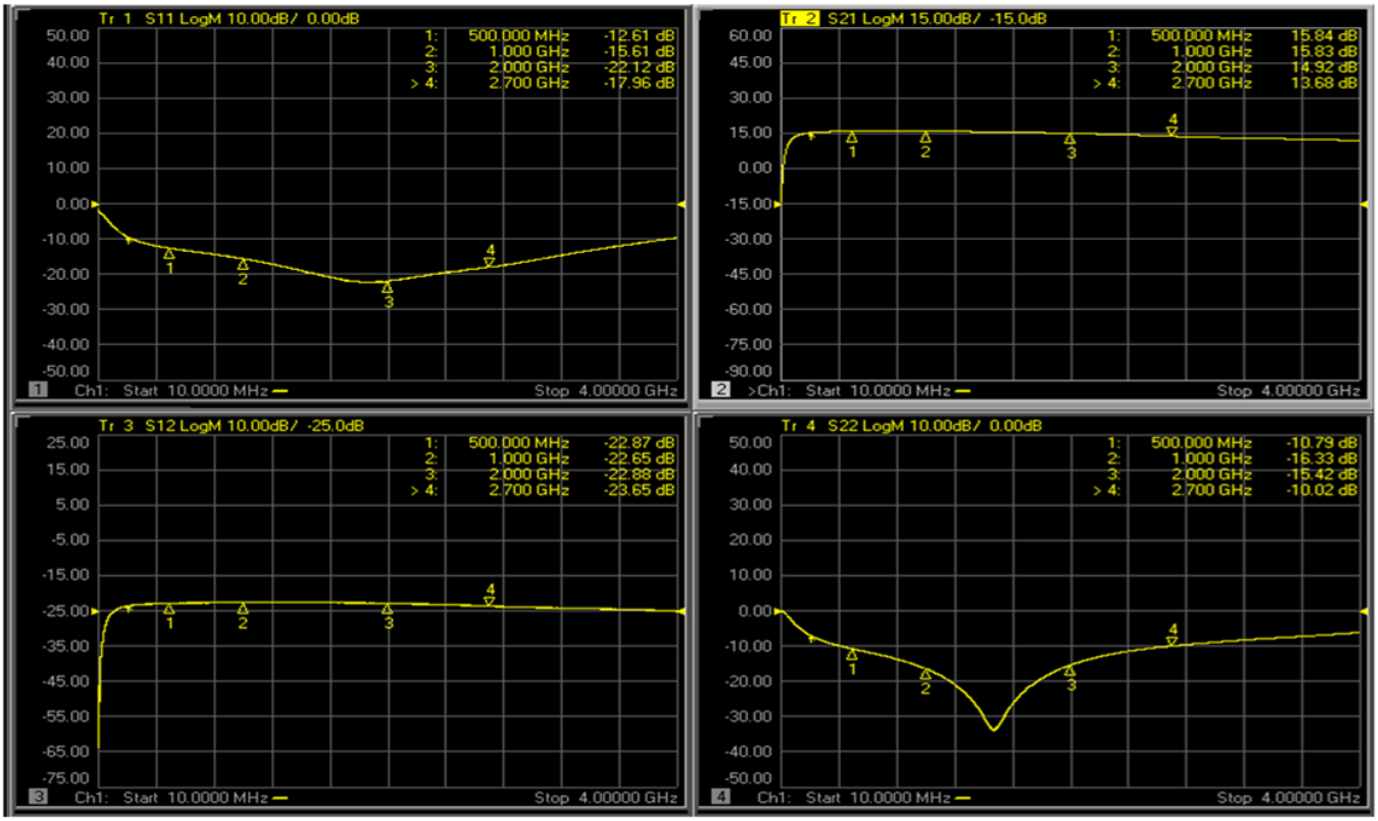


GRF2014 Typical Operating Curves: 5 V, 150 mA, 500 to 2700 MHz Tune

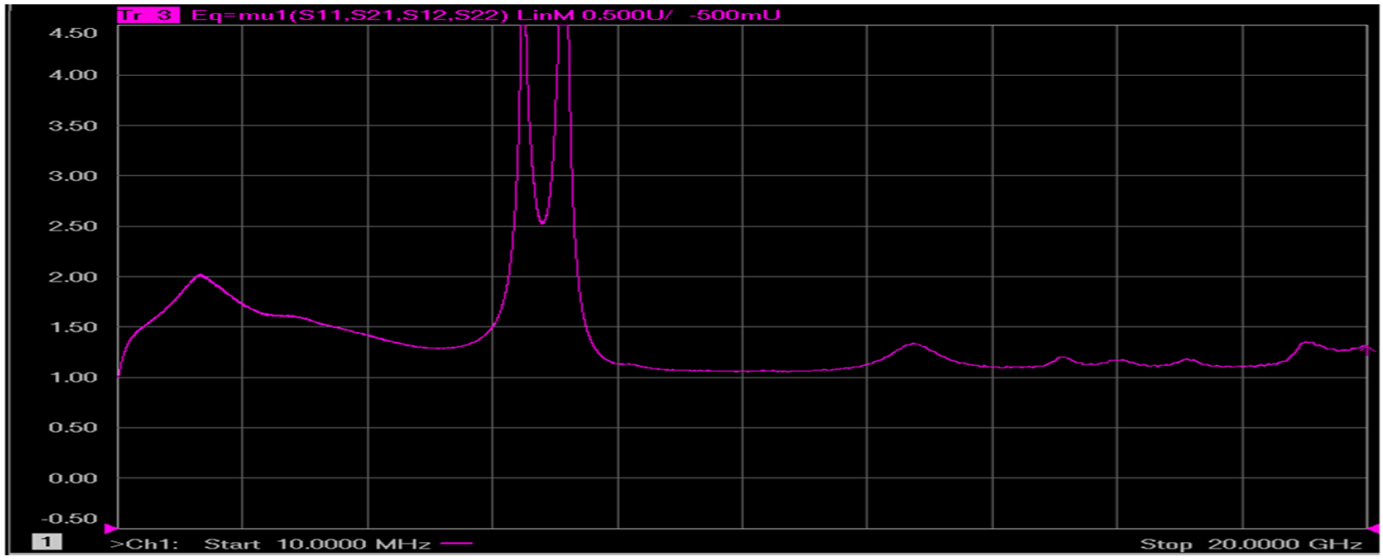




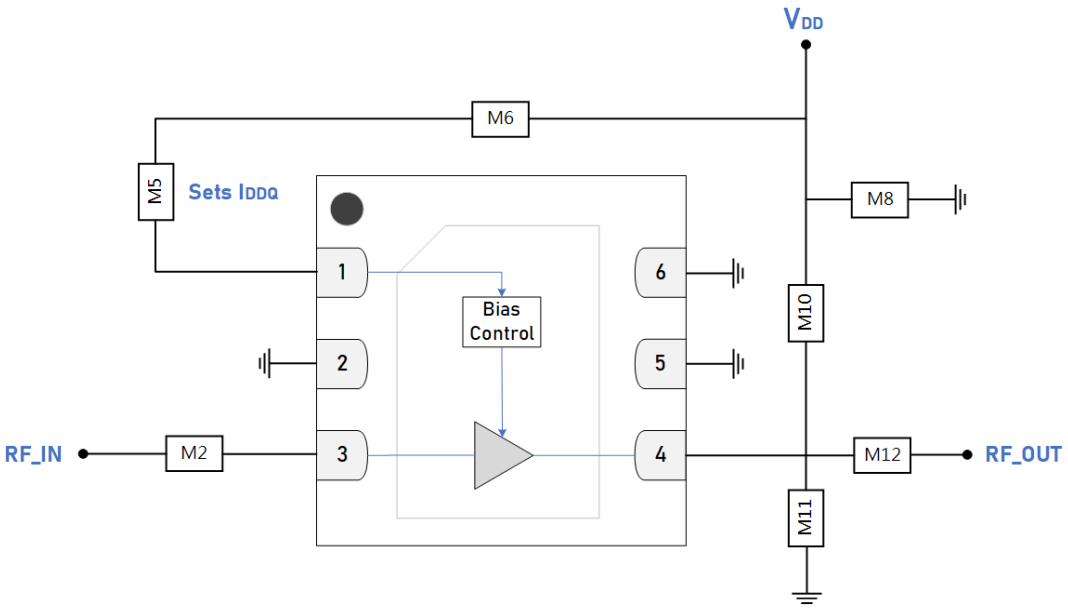
GRF2014 Typical Operating Curves: S-Parameters (500 to 2700 MHz Tune)



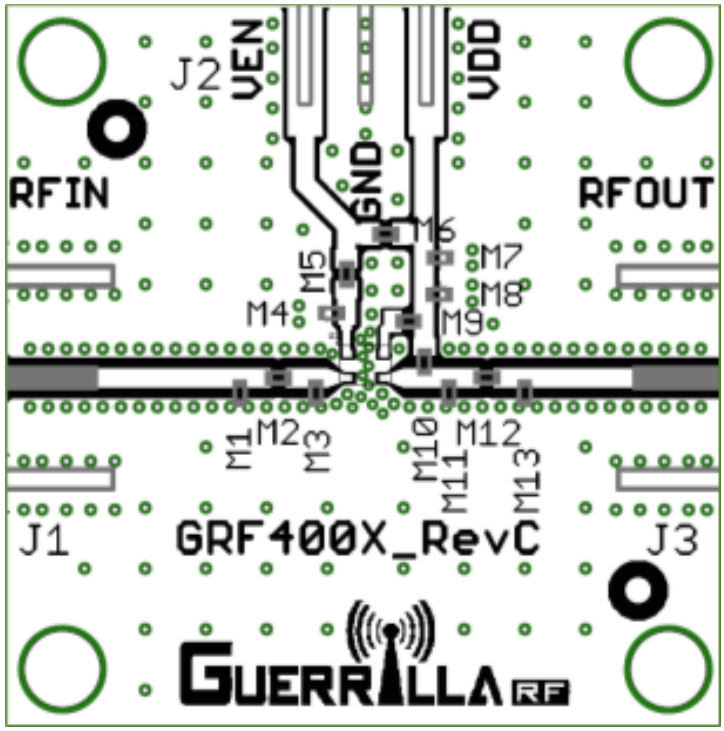
GRF2014 Typical Operating Curves: Stability Mu Factor (10 MHz to 20 GHz)



Note: Mu Factor ≥ 1.0 implies unconditional stability.



GRF2014 Standard Evaluation Board Schematic

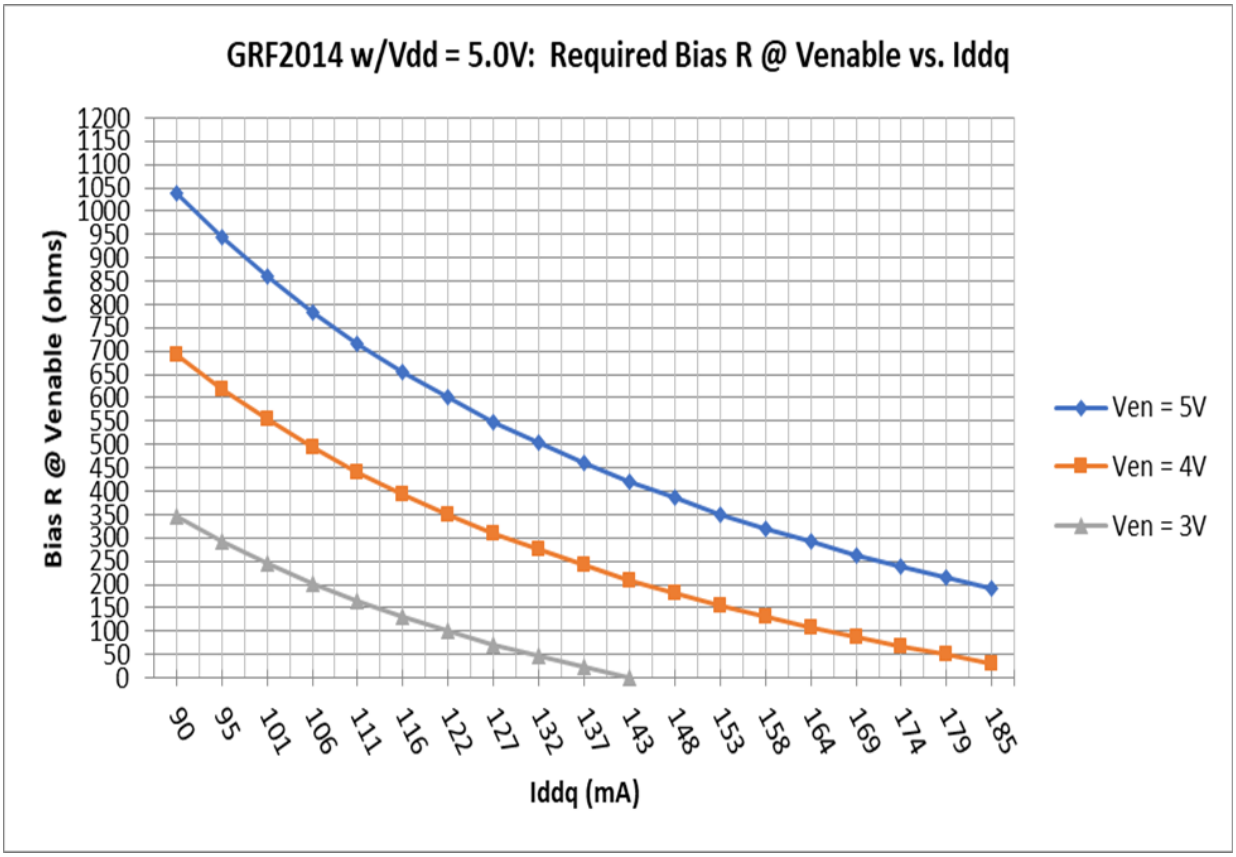


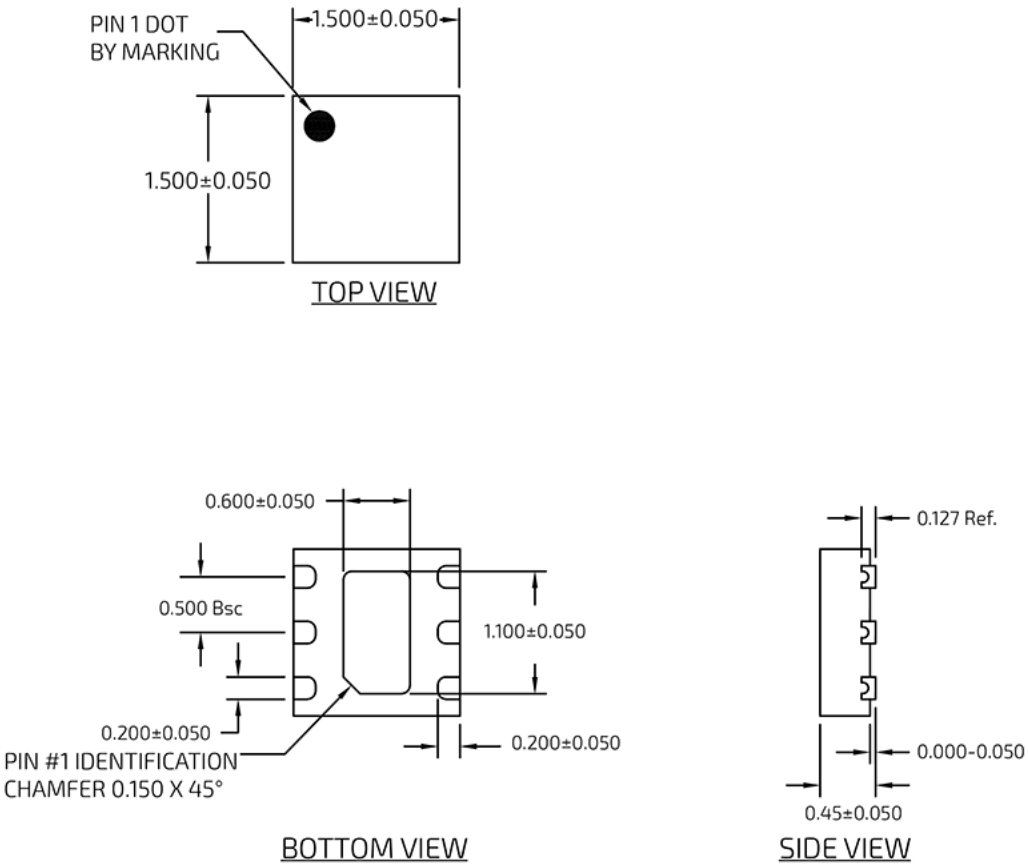
GRF2014 Evaluation Board Assembly Diagram

GRF2014 Standard Evaluation Board BOM: 500 to 2700 MHz Tune

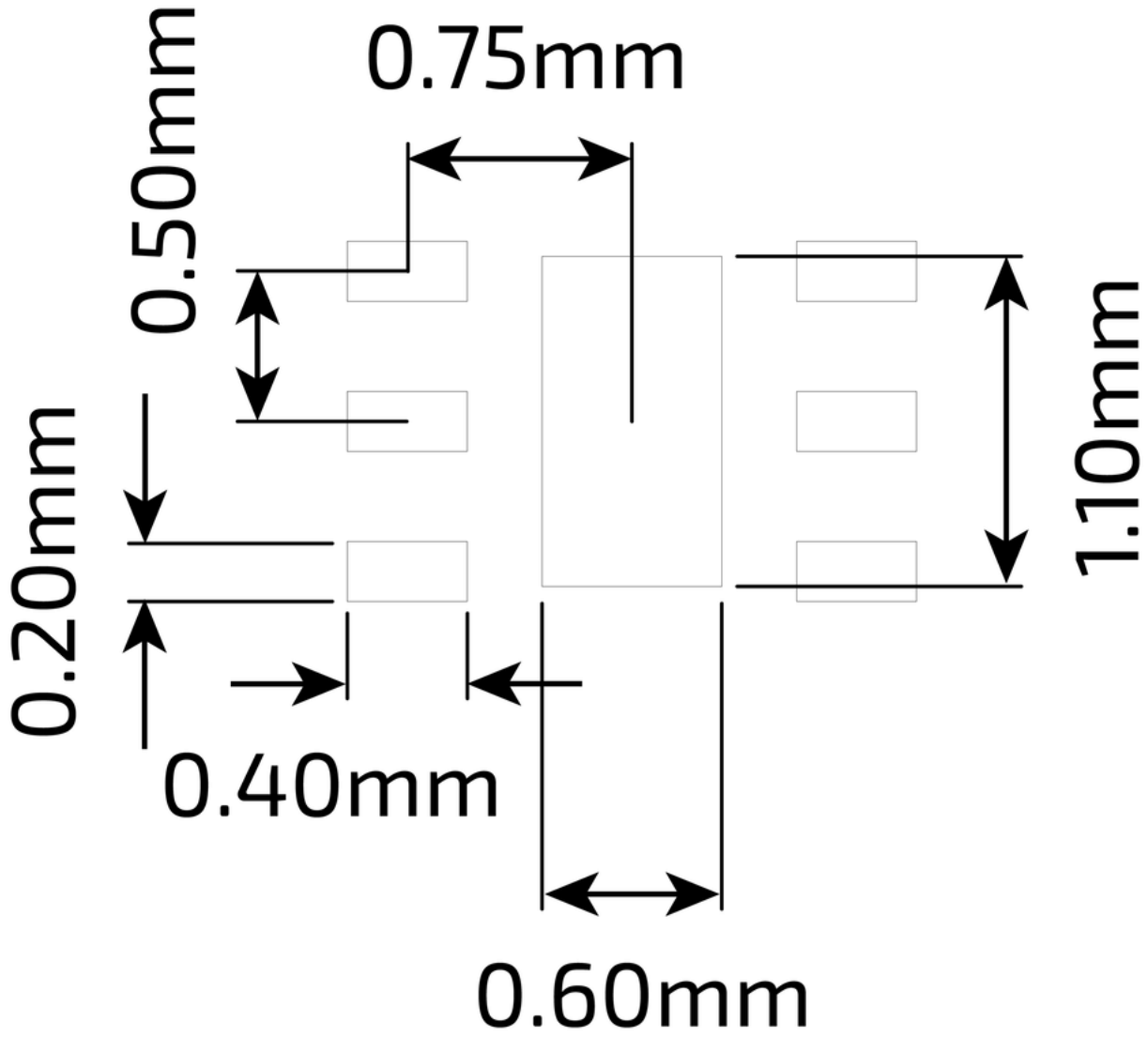
Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M2	Capacitor	Murata	GRM	100 pF	0402	ok
M5	Resistor	Various	5%	see curves	0402	ok
M6	Resistor (jumper)	Various	5%	0 Ω	0402	ok
M8	Capacitor	Murata	GRM	0.1 uF	0402	ok
M10	Inductor	Various	MLC	33 nH	0402	ok
M11	Capacitor	Murata	GRM	0.5 pF	0402	ok
M12	Capacitor	Murata	GRM	100 pF	0402	ok
Evaluation Board	GRF400X_RevC					

GRF2014 Bias Resistor Selection Curves





DFN 6 1.5x1.5mm Package Dimensions



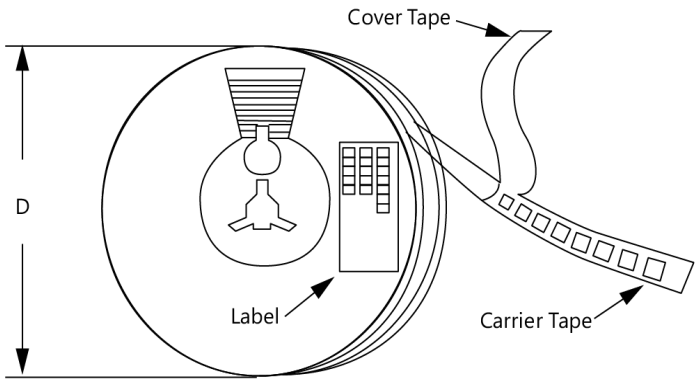
DFN 6 1.5x1.5mm Suggested PCB Footprint (Top View)

Package Marking Diagram

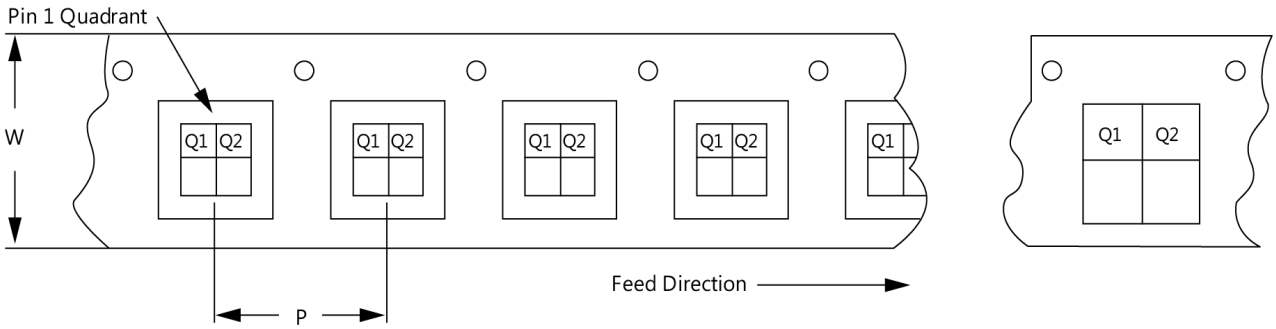
Line 1: “Y” = YEAR (single digit). “WW” = WORK WEEK the Device was assembled.
Line 2: “XXXX” = Device Part Number.

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
January 13, 2017	Preliminary Data Sheet.
May 31, 2019	Release Ø Data Sheet.
July 17, 2024	Upgraded Data Sheet to new format. Raised OP1dB lower limit from 22.5 to 22.7 dBm & lowered Venable from 5v to 3.3v to match PTP
May 29, 2025	Extended frequency range from 50 - 3800 MHz to 30 - 4000 MHz.

www.guerrilla-rf.com • (336) 510-7840 • sales@guerrilla-rf.com • 2000 Pisgah Church Rd., Greensboro, NC 27455

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.

www.guerrilla-rf.com • (336) 510-7840 • sales@guerrilla-rf.com • 2000 Pisgah Church Road, Greensboro, NC 27455