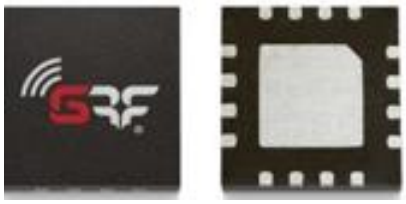
DATA SHEET

PRELIMINARY DATA SHEET



GRF0010

GaN HEMT Power Transistor
15 Watt P3dB
DC to 8 GHz

FEATURES

- Operating Frequency Range: DC to 8 GHz
- Operating Drain Voltage: 28 and 50 Volt
- Maximum Output Power: 15 Watt (P3dB)
- Suitable for Pulsed, Linear Applications
- 100% DC & RF Production Tested
- Compact 3 x 3 mm QFN-16 Package

Reference: 50 V / 15 mA / 3.5 GHz

- Saturated Gain: 14.5 dB
- Saturated Drain Efficiency: 62 %
- Saturated Output Power: 42 dBm

APPLICATIONS

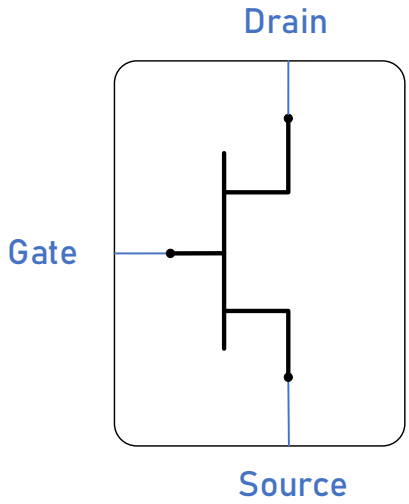
- Cellular Infrastructure
- Radar
- Communications
- Test Instrumentation

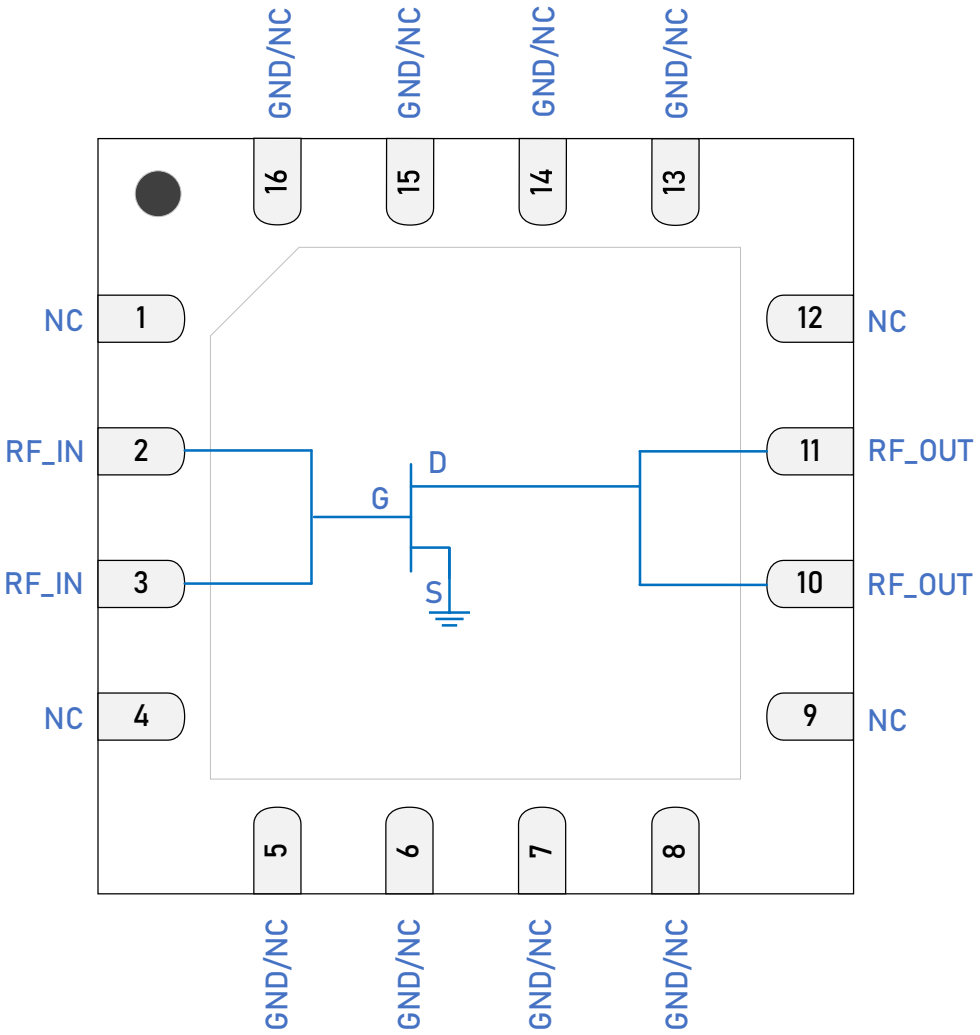
DESCRIPTION

The GRF0010 is a 15 W (P3dB) unmatched discrete GaN-on-SiC HEMT which operates from DC to 8 GHz on a 50 V supply rail. The wide bandwidth makes the GRF0010 suitable for a variety of applications including cellular infrastructure, radar, communications, and test instrumentation, and can support both linear and pulse operations. The device is housed in an industry-standard 3 x 3 mm surface mount QFN-16 package. Lead free and RoHS compliant.

Please consult with the GRF applications engineering team for custom tuning/evaluation board data.

BLOCK DIAGRAM





3 x 3 mm Pin Out (Top View)

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Pin Assignments

Pin	Name	Description	Note
1, 4, 9, 12	NC	No Connect	No internal connection to die. These pins should not be connected.
2, 3	RF_IN	Gate Voltage	Connected to GATE terminal of GaN transistor.
5, 6, 7, 8, 13, 14, 15, 16	GND/NC	Ground or No Connect	No internal connection to die. It is strongly recommended that these pins be connected to ground.
10, 11	RF_OUT	Drain Voltage	Connected to DRAIN terminal of GaN transistor.
PKG BASE	SOURCE	Source Connection	Connected to the SOURCE terminals of the GaN transistor. Provides DC and RF ground as well as thermal heat sink. **In order to match the device's rated performance, it is strongly recommended to use multiple thermal vias beneath the package for optimal RF and thermal performance**. Refer to evaluation board top layer graphic on schematic page.

GaN HEMT Power-up / Power-down Procedure:

To turn the transistor ON:

1. Set V_{GS} to -5 V.
2. Turn on V_{DS} to normal operation voltage (50 V).
3. Slowly increase V_{GS} to set I_{DS} current to 15 mA.
4. Apply RF power.

To turn the transistor OFF:

1. Turn the RF power off.
2. Decrease V_{GS} to -5 V.
3. Turn off V_{DS}. Wait a few seconds for Drain capacitor to discharge.
4. Turn off V_{GS}.

Absolute Ratings

Parameter	Symbol	Min.	Max.	Unit
Operating Voltage	V_{DS}		55	V
Drain to Gate Breakdown Voltage	B_{VDG}		TBD	V
Drain to Source Voltage	V_{DS}		150	V
Gate to Source Voltage	V_{GS}	-8	2	V
Drain Current	I_D		TBD	mA
RF Input Power: 50 Ω, V_{DS} = 50 V, I_{DS} = 15 mA, $T_{PKG\ BASE}$ = 85 °C.	$P_{IN\ MAX}$		TBD	dBm
RF Input Power: 10:1 VSWR, V_{DS} = 50 V, I_{DS} = 15 mA, $T_{PKG\ BASE}$ = 85 °C.	$P_{IN\ MAX}$		TBD	dBm
Output Mismatch Stress: V_{DS} = 50 V, P_{OUT} = P_{SAT} pulsed = TBD.	$VSWR_{MAX}$		TBD	
Operating Temperature (package base).	$T_{PKG\ BASE}$	-40	105	°C
Maximum Junction Temperature (MTTF > 10^6 hours).	$T_{J\ MAX}$		225	°C
Maximum Dissipated Power	$P_{DISS\ MAX}$		TBD	W

Electrostatic Discharge

Human Body Model	HBM	200		V
Charged Device Model	CDM	500		V

Storage

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

Note 1: Exceeding any of these limits may cause permanent damage to the device or reduce the lifetime (MTTF).
Note 2: Guerrilla-RF does not recommend sustained operation above the maximum operating conditions.

Caution! ESD Sensitive Device.
Exceeding Absolute Maximum Rating conditions may cause permanent damage.

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

All Guerrilla RF products are provided in RoHS compliant lead (Pb)-free packaging requiring no exemptions. Additional information for this topic can be found at this link - *Environmental and Restricted Substance Statement Library*

Recommended Operating Conditions

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
RF Frequency Range	F_{TEST}	DC	3.5	8	GHz	Typical application schematic **(notes 3 & 4)**.
Drain to Source Voltage	V_{DS}	TBD	50	TBD	V	Typical application schematic.
Drain Current (Quiescent)	I_{DQ}		15		mA	Typical application schematic.
Drain Current: RF	$I_{D\text{-}Drive}$	TBD			mA	Typical application schematic.
Gate Voltage	V_{GS}		-2.5		V	Typical application schematic.
Gate Current: RF	$I_{G\text{-}Drive}$		TBD		mA	Typical application schematic, P_{OUT} = 15 W.
Operating Temperature	$T_{PKG\ BASE}$	-40		85	°C	On package base.
Gate Port Impedance	Z_{RFIN}		50		Ω	Typical application schematic.
Drain Port Impedance	Z_{RFOUT}		50		Ω	Typical application schematic.

Note 3: Operation outside of this range is possible, but with degraded performance of some parameters.

Note 4: 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 3.3 to 3.7 GHz tuning set, V_{DS} = 50 V, I_{DS} = 15 mA, P_{OUT} = 15 W, F_{TEST} = 3.5 GHz, Pulsed CW (100 µs pulse width, 10% duty cycle, no modulation), 50 Ω system impedance, T_{AMB} = 25 °C, $T_{PKG\ BASE}$ = -40 to 85 °C. Evaluation board losses are included within the specifications.

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Drain Source Breakdown Voltage	V_{BDSS}	150			V	
Drain Source Leakage Current	I_{DLK}		50		µA	V_{GS} = -8 V, V_{DS} = 50 V.
Drain Current: Quiescent	I_{DQ}		15		mA	No RF applied.
Gate Threshold Voltage	V_{GS}	-3.4		-1.5	V	V_{DS} = 50 V.
Gate Bias Voltage	V_{GS}		-2.5		V	
Drain Voltage	V_{DS}		50		V	
Drain Current: RF	$I_{D\text{-}DRIVE}$		TBD		mA	RF applied, P_{OUT} = 15 W.
Gate Current: RF	$I_{G\text{-}DRIVE}$		TBD		mA	RF applied, P_{OUT} = 15 W.
Gate Leakage Current	$I_{G\text{-}LEAK}$		TBD		µA	

Thermal And Reliability Information – CW [1, 2, 3]: $T_{CHANNEL}$ = 85 °C

Thermal Resistance (Infrared Scan)	θ_{JC}		TBD		°C /W	P_{OUT} = TBD. On standard evaluation board.
Channel Temperature	$T_{CHANNEL}$		TBD		°C	

Note 5: MIN/MAX limits defined using modelled estimates that account for part-to-part variations and expected process spreads. As additional production lots are fabricated, accumulated test data will be used to refine the MIN/MAX limits.

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Nominal Operating Parameters – RF: DC to 8 GHz

The following conditions apply unless noted otherwise: typical application schematic using the 3.3 to 3.7 GHz tuning set, V_{DS} = 50 V, I_{DS} = 15 mA, P_{OUT} = 15 W, F_{TEST} = 3.5 GHz, Pulsed CW (100 µs pulse width, 10% duty cycle, no modulation), 50 Ω system impedance, T_{AMB} = 25 °C, $T_{PKG\ BASE}$ = -40 to 85 °C. Evaluation board losses are included within the specifications.

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Small Signal Gain	G_{SS}		15		dB	At $I_{DS} \leq 1.1 * I_{DS}$.
Power Gain	G_{MAX}		17		dB	Max gain vs. power.
Saturated Gain	G_{SAT}		14.5		dB	At 2.5 dB compression referenced to G_{MAX}.
Saturated Drain Efficiency	$D_{Eff\ (SAT)}$		62		%	
Saturated Output Power	P_{SAT}		42		dBm	
Ruggedness	Ψ	At 2.5 dB compression. Output VSWR = 10:1 (all angles)				No damage or shift in performance.

Note 6: MIN/MAX limits defined using *modelled estimates* that account for part-to-part variations and expected process spreads. As additional production lots are fabricated, accumulated test data will be used to refine the MIN/MAX limits.

Typical Performance:

Single-Tone Pulse CW (10% duty cycle, 100 µs pulse width). 2nd Harmonic not optimized.

1. Optimum Peak Power at 2.5 dB compression.
2. Optimum Peak Efficiency at 2.5 dB compression.

V_{DS} = 50 V, I_{DS} = 15 mA, T_{AMB} = 25 °C

Frequency (MHz)	P_{OUT}[1] (dBm)	Gain[2] (dB)	Drain Eff[2] (%)
1000	41.74	24.8	71.8
1200	42.0	24.2	71.8
1400	42.22	23.6	64.6
1600	42.03	20.8	71.9
1800	42.07	19.8	73.4
2000	42.1	19.9	70.4
2200	42.1	18.9	61.3
2400	41.9	18.0	56.2
2600	42.10	17.4	57.2
2800	42.10	17.5	54.8
3000	42.2	18.0	57.9
3500	42.2	17.2	61.2
4000	42.2	15.8	60.0
4500	42.23	15.8	62.9
5000	42.1	15.1	60.4
5500	42.15	13.9	59.9
6000	42.05	13.4	58.7

V_{DS} = 28 V, I_{DS} = 15 mA, T_{AMB} = 25 °C

Frequency (MHz)	P_{OUT}[1] (dBm)	Gain[2] (dB)	Drain Eff[2] (%)
1000	39.1	22.1	71.0
1200	39.3	20.5	71.8
1400	39.9	20.5	73.4
1600	39.37	18.0	72.2
1800	39.45	17.5	71.1
2000	39.38	16.4	64.0
2200	39.52	15.7	65.2
2400	39.37	16.1	57.9
2600	39.67	15.8	59.3
2800	39.7	16.3	59.0
3000	39.86	15.6	61.5
3500	40.0	14.9	64.9
4000	39.87	15.2	64.1
4500	39.84	14.3	65.0
5000	39.68	13.6	62.95
5500	39.7	12.6	62.5
6000	39.6	11.8	61.1

Typical Performance:

Load Pull Measurements: V_{DS} = 50 V, I_{DS} = 15 mA. Single-Tone Pulse CW (10% duty cycle, 100 µs pulse width).

For Optimum Peak Power at 2.5 dB Compression

Frequency (MHz)	Z_{IN} (F0)	ZI (F0)	Gain (dB)	P_{OUT} (dBm)	P_{OUT} (W)	Eff (%)	AMPM (deg)
1000	7.8 -j30.1	56.1 +j8.4	23.8	41.74	14.93	63.2	1.6
1200	8.7 -j31.4	54.3 +j7.0	22.6	42.0	15.85	63.3	3.6
1400	6.7 -j26.1	51.5 +j15.6	22.3	42.22	16.67	62.7	2.8
1600	10.5 -j24.6	37.4 +j23.4	20.3	42.03	15.96	63.3	1.6
1800	12.2 -j21.6	30.5 +j21.9	19.4	42.07	16.11	61.7	3.2
2000	9.8 -j16.5	36.8 +j23.3	18.1	42.1	16.22	60.2	2.2
2200	7.0 -j13.2	32.6 +j20.0	17.9	42.1	16.22	55.4	2.5
2400	6.0 -j11.7	36.8 +j15.4	17.0	41.9	15.49	49.0	5.3
2600	4.7 -j9.2	33.4 +j19.5	17.1	42.1	16.22	51.1	2.5
2800	4.2 -j8.6	30.3 +j22.2	17.0	42.1	16.22	50.9	4.0
3000	4.0 -j6.4	24.9 +j21.1	17.0	42.2	16.6	52.1	3.7
3500	3.9 -j3.2	21.8 +j19.3	16.4	42.2	16.6	53.9	2.3
4000	3.2 +j1.1	17.0 +j15.6	15.8	42.2	16.6	53.1	0.6
4500	3.4 +j4.8	14.5 +j12.9	14.9	42.23	16.71	53.6	-0.3
5000	3.4 +j7.6	14.5 +j10.8	14.3	42.1	16.22	53.6	0.8
5500	3.2 +j9.8	11.7 +j7.6	13.4	42.15	16.41	54.2	1.3
6000	3.9 +j12.7	11.2 +j5.5	12.7	42.05	16.03	53.1	2.1

For Optimum Peak Efficiency at 2.5 dB Compression

Frequency (MHz)	Z_{IN} (F0)	ZI (F0)	Gain (dB)	P_{OUT} (dBm)	P_{OUT} (W)	Eff (%)	AMPM (deg)
1000	7.8 -j30.1	66.7 +j23.5	24.8	41.36	13.68	71.8	1.6
1200	6.3 -j23.5	70.2 +j56.0	24.2	39.82	9.59	71.8	-1.7
1400	5.1 -j21.2	57.8 +j38.5	23.6	41.2	13.18	64.6	2.6
1600	10.6 -j18.0	32.1 +j45.9	20.8	40.8	12.02	71.9	0.8
1800	8.9 -j15.0	27.1 +j46.6	19.8	40.5	11.22	73.4	-1.7
2000	7.0 -j13.6	24.8 +j38.9	19.9	40.97	12.5	70.4	-1.7
2200	6.5 -j12.3	28.5 +j33.1	18.9	41.51	14.16	61.3	2.1
2400	4.5 -j8.9	31.4 +j38.3	18.0	41.2	13.18	56.2	3.2
2600	4.1 -j7.0	26.5 +j40.0	17.4	40.9	12.3	57.2	5.1
2800	3.4 -j6.5	25.1 +j34.0	17.5	41.46	14.0	54.8	2.8
3000	3.1 -j5.1	17.0 +j30.9	18.0	41.48	14.06	57.9	3.0
3500	2.8 -j0.5	12.1 +j28.9	17.2	41.0	12.59	61.2	3.0
4000	2.9 +j2.7	11.3 +j23.5	15.8	41.4	13.8	60.0	0.7
4500	3.0 +j5.9	8.7 +j17.0	15.8	41.61	14.49	62.9	0.1
5000	2.8 +j8.9	8.6 +j14.4	15.1	41.24	13.3	60.4	-0.2
5500	2.8 +j10.9	6.8 +j10.4	13.9	41.18	13.12	59.9	0.1
6000	3.4 +j14.1	6.8 +j8.0	13.4	41.26	13.37	58.7	1.4

Typical Performance:

Load Pull Measurements: V_{DS} = 28 V, I_{DS} = 15 mA. Single-Tone Pulse CW (10% duty cycle, 100 µs pulse width).

For Optimum Peak Power at 2.5 dB Compression

Frequency (MHz)	Z_{IN} (F0)	ZI (F0)	Gain (dB)	P_{OUT} (dBm)	P_{OUT} (W)	Eff (%)	AMPM (deg)
1000	9.5 -j33.4	31.6 -j4.7	21.3	39.1	8.13	57.6	4.1
1200	8.6 -j29.3	28.5 -j6.0	20.0	39.3	8.51	56.0	3.6
1400	6.6 -j26.4	28.6 -j6.0	19.3	39.9	9.77	52.4	3.3
1600	12.2 -j24.6	28.7 +j0.4	17.4	39.37	8.65	56.5	5.3
1800	11.3 -j20.6	32.1 +j4.0	16.3	39.45	8.81	60.2	3.7
2000	8.9 -j16.7	32.3 +j0.5	15.2	39.38	8.67	54.8	3.5
2200	6.8 -j13.0	27.7 +j2.6	15.5	39.52	8.95	53.6	1.0
2400	4.4 -j10.5	31.2 +j2.5	15.2	39.37	8.65	51.0	2.4
2600	4.2 -j8.8	26.7 +j5.6	15.6	39.67	9.27	53.6	2.0
2800	3.9 -j7.5	25.9 +8.6	15.7	39.7	9.33	54.3	2.1
3000	3.5 -j6.0	25.6 +j8.9	15.2	39.86	9.68	54.9	1.6
3500	3.6 -j2.6	23.7 +j8.4	14.5	40.0	10.0	57.2	2.6
4000	2.7 +j1.4	20.2 +j8.4	13.9	39.87	9.71	57.8	0.4
4500	3.7 +j4.6	18.8 +j6.8	12.9	39.84	9.64	56.5	0.7
5000	2.7 +j8.2	16.3 +j3.2	12.7	39.68	9.29	57.0	1.6
5500	2.8 +j10.6	14.0 -j0.2	11.7	39.7	9.33	55.2	1.7
6000	3.6 +j13.8	14.3 -j1.8	11.1	39.6	9.12	53.7	2.1

For Optimum Peak Efficiency at 2.5 dB Compression

Frequency (MHz)	Z_{IN} (F0)	ZI (F0)	Gain (dB)	P_{OUT} (dBm)	P_{OUT} (W)	Eff (%)	AMPM (deg)
1000	7.0 -j27.1	66.8 +23.5	22.1	37.0	5.01	71.0	-1.2
1200	7.0 -j24.6	54.5 +j6.9	20.5	38.16	6.55	71.8	0.5
1400	5.0 -j21.6	51.5 +j15.6	20.5	38.8	7.59	73.4	1.1
1600	9.8 -j19.5	41.0 +j27.3	18.0	38.06	6.4	72.2	0.7
1800	8.8 -j15.1	29.8 +j33.4	17.5	37.36	5.45	71.1	0.6
2000	8.6 -j14.9	33.5 +j18.9	16.4	38.7	7.41	64.0	3.0
2200	6.4 -j11.2	37.8 +j26.1	15.7	38.41	6.93	65.2	4.6
2400	4.4 -j8.8	30.7 +j23.7	16.1	38.38	6.89	57.9	6.1
2600	3.8 -j6.8	30.3 +j23.9	15.8	38.63	7.29	59.3	4.4
2800	3.1 -j5.7	23.8 +j22.3	16.3	38.71	7.43	59.0	3.1
3000	3.2 -j4.5	23.5 +j22.1	15.6	39.1	8.13	61.5	3.1
3500	2.9 -j0.6	16.3 +j22.9	14.9	38.38	6.89	64.9	1.2
4000	2.3 +j2.8	11.9 +j14.6	15.2	38.58	7.21	64.1	-2.4
4500	2.8 +j6.7	9.3 +j12.2	14.3	38.27	6.71	65.0	-3.4
5000	2.6 +j9.4	9.8 +j8.4	13.6	38.4	6.92	62.95	-3.3
5500	2.6 +j11.5	7.2 +j3.8	12.6	38.83	7.64	62.5	-4.4
6000	3.2 +j14.8	7.5 +j3.1	11.8	38.32	6.79	61.1	-3.2

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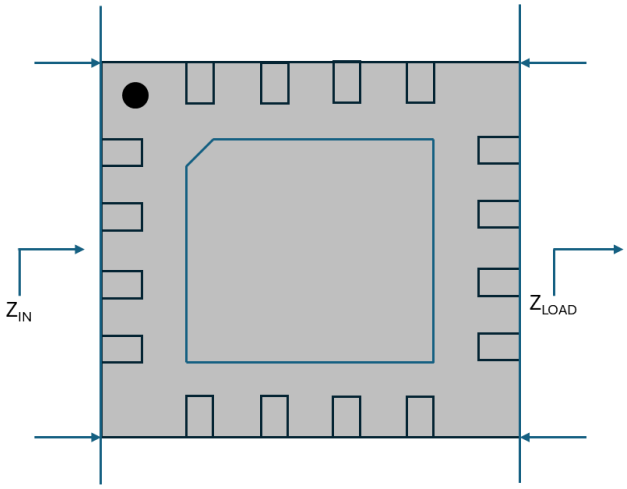
Load Pull Measurement Notes:

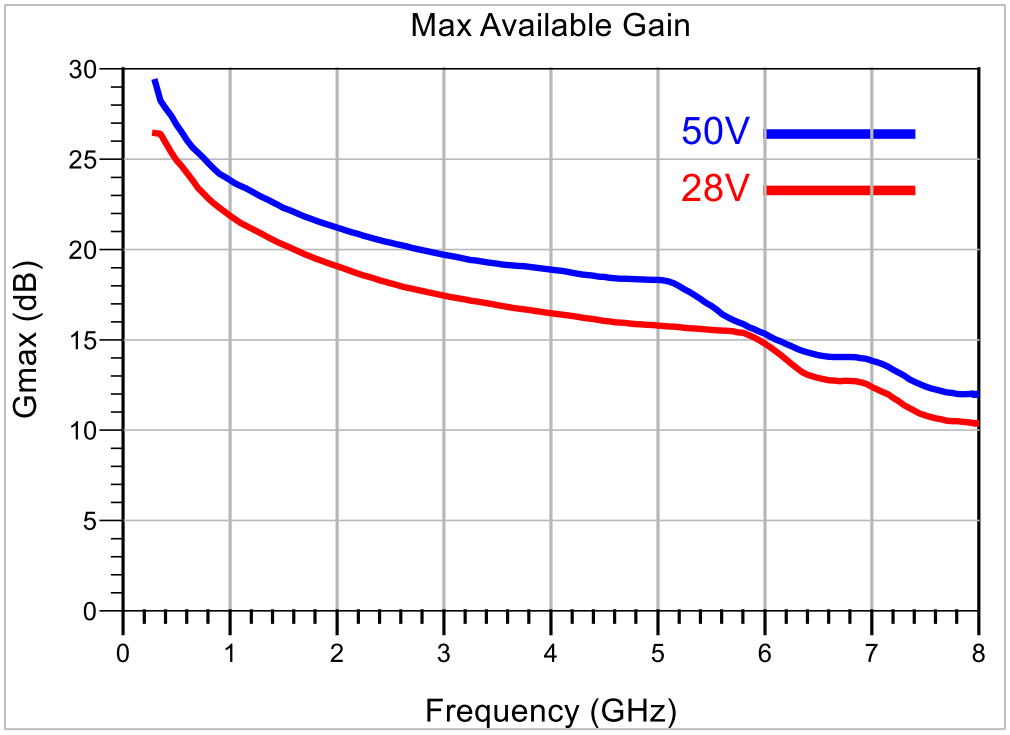
1. Source and load impedance at 2nd harmonic are set to 10 Ω.
2. With proper 2nd harmonic termination, expect +5% efficiency for Source and similar with Drain 2nd harmonic.
3. Z_{LOAD}: measured impedance presented to the output of the device in the reference plane.
4. Z_{IN}: measured input impedance at the input of the device in the reference plane.

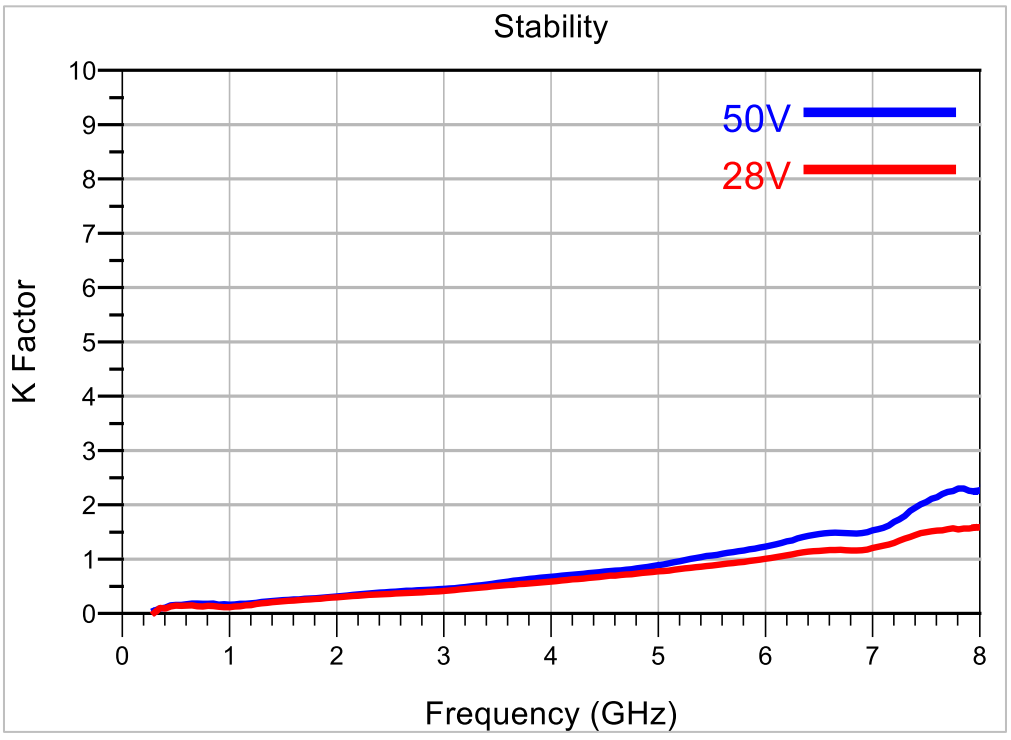
Impedance Reference Plane



Raw data and full Load Pull measurement report available at request: sales@guerrilla-rf.com

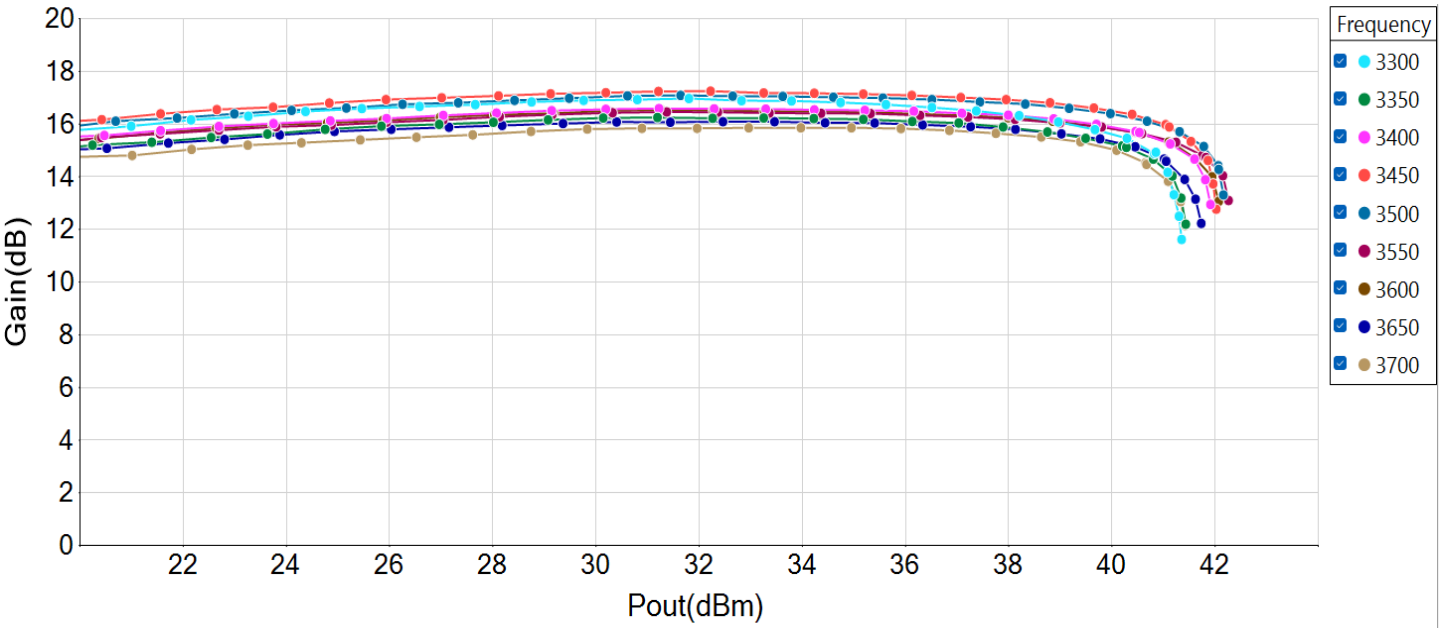
Typical Operating Curves: Maximum Available Gain and K-Factor vs. Frequency



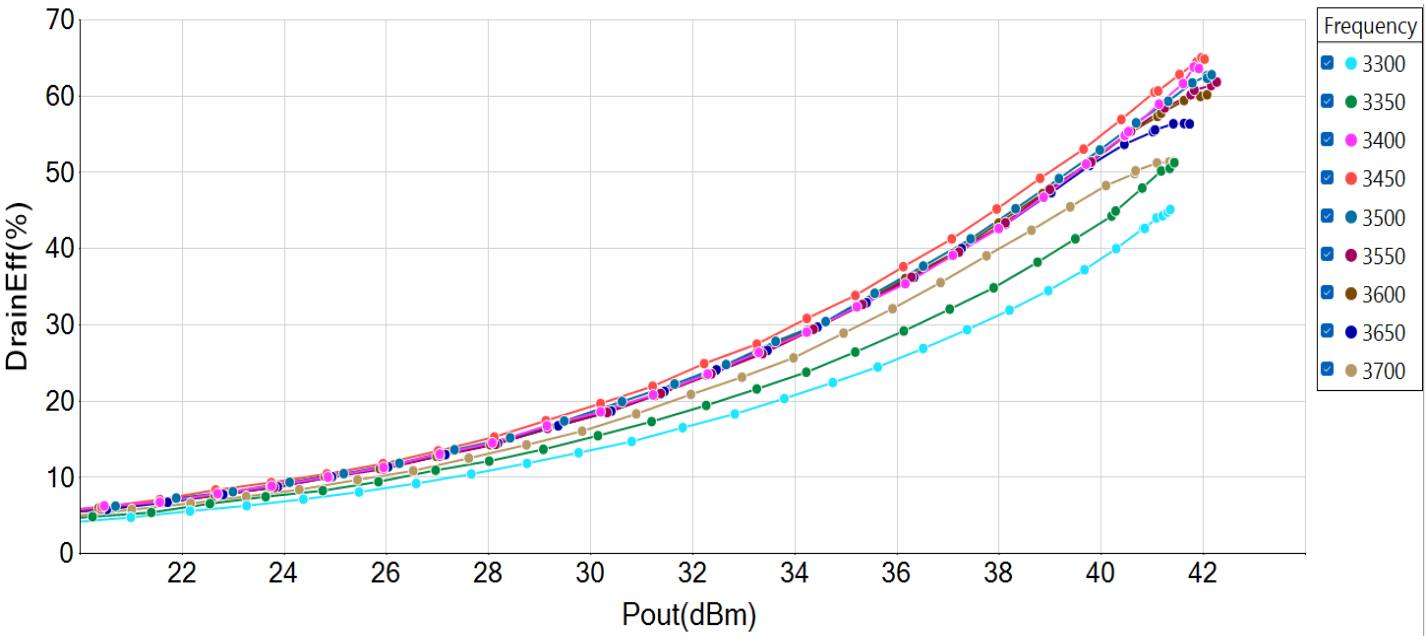


Typical Operating Curves: 3.3 to 3.7 GHz, 50 V, Pulsed CW (10% duty cycle, 100 µs pulse width)

Gain vs. Output Power and Frequency

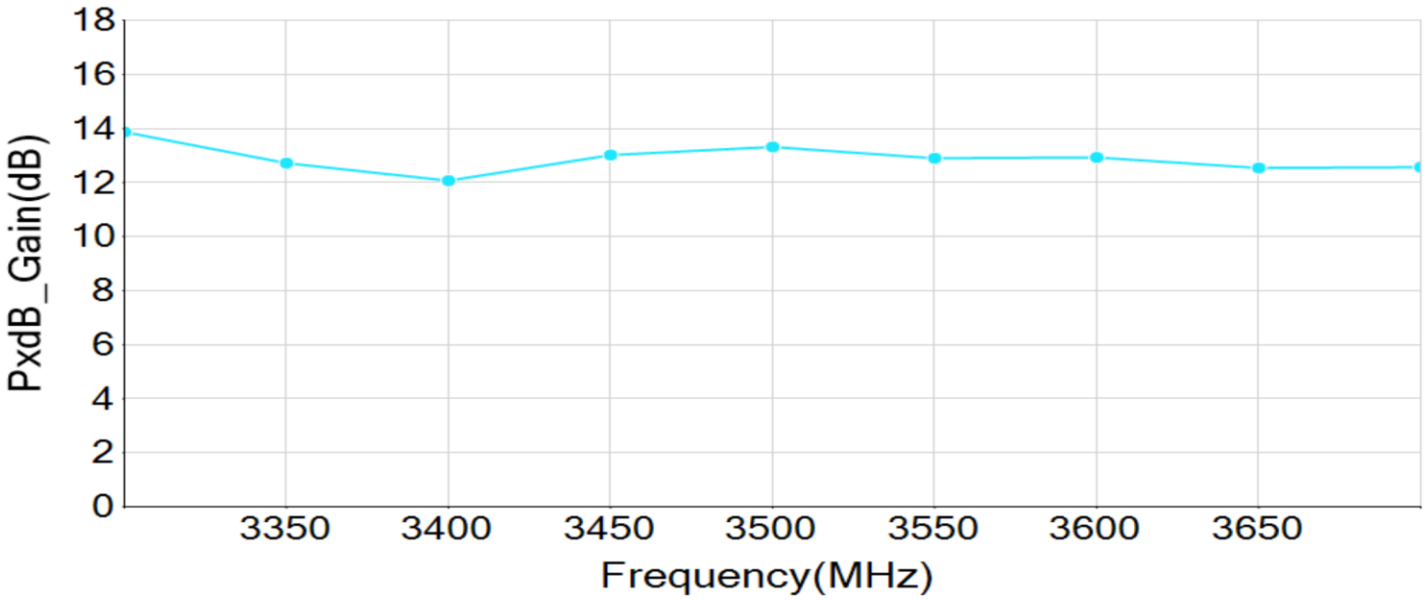


Drain Efficiency vs. Output Power and Frequency

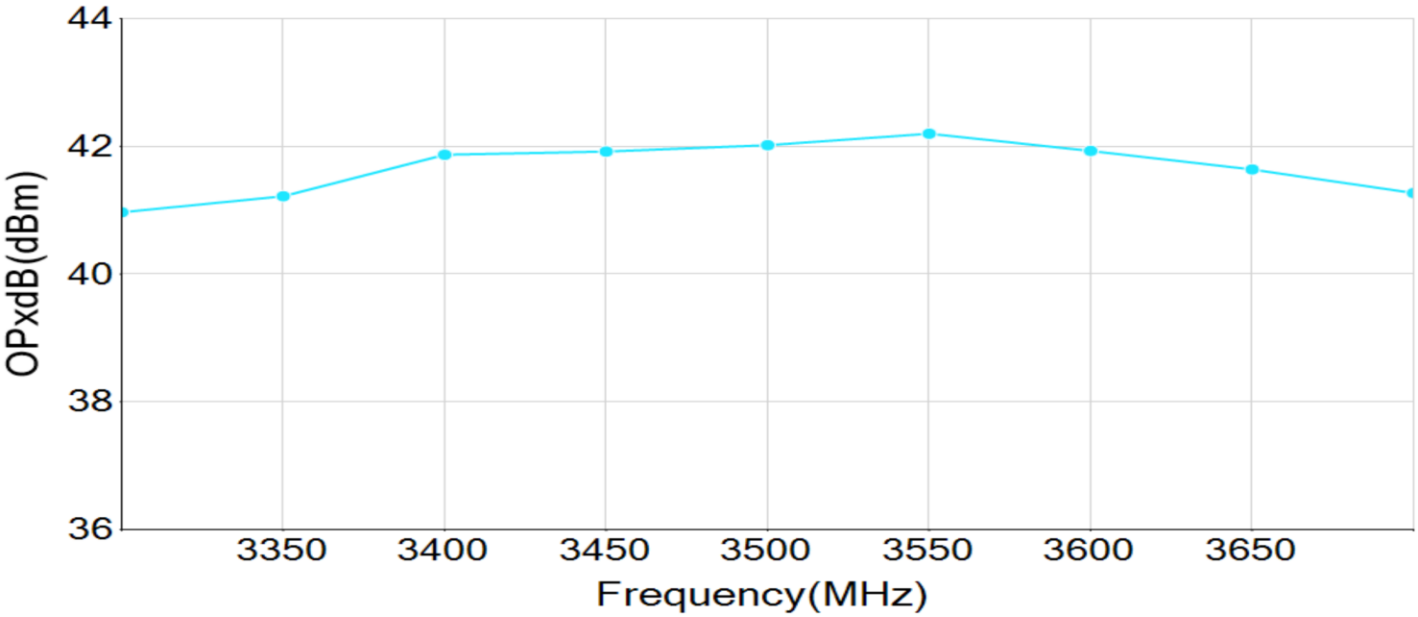


Typical Operating Curves: 3.3 to 3.7 GHz, 50 V, Pulsed CW (10% duty cycle, 100 µs pulse width)

Gain vs. Frequency: 2.5 dB Compression



Pout vs. Frequency: 2.5 dB Compression



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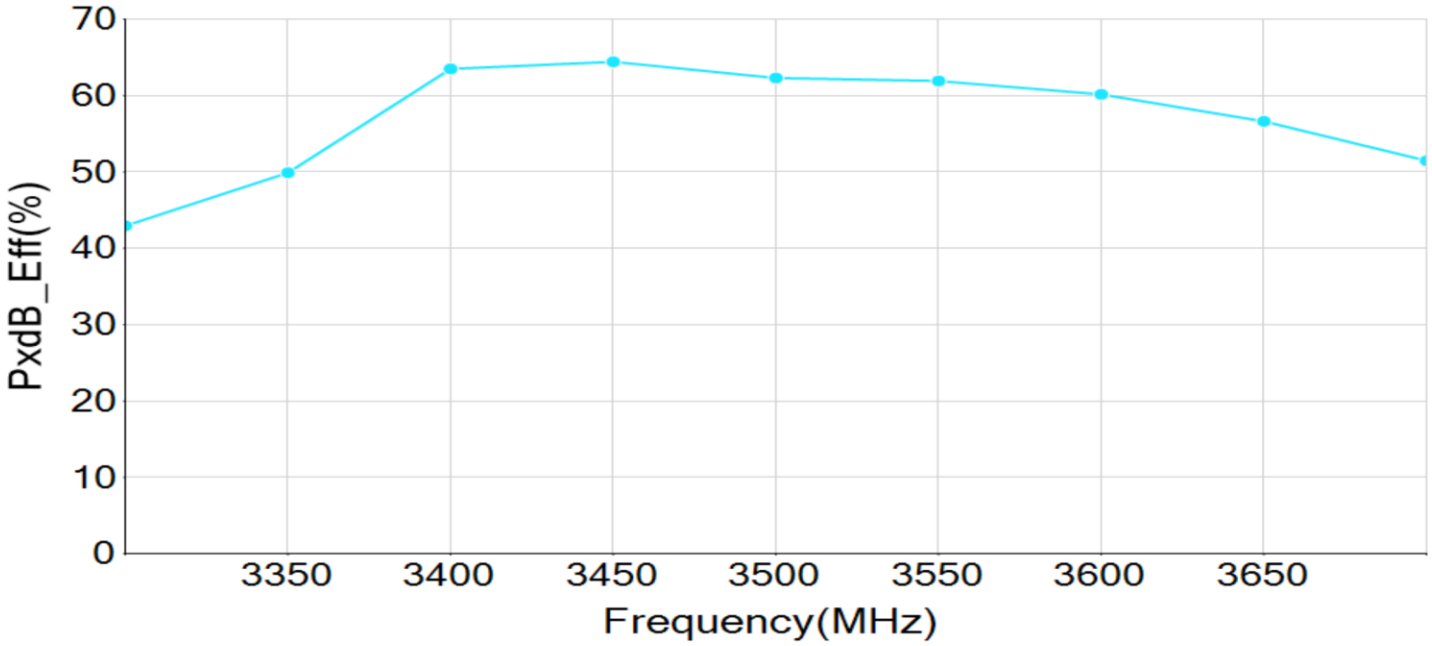
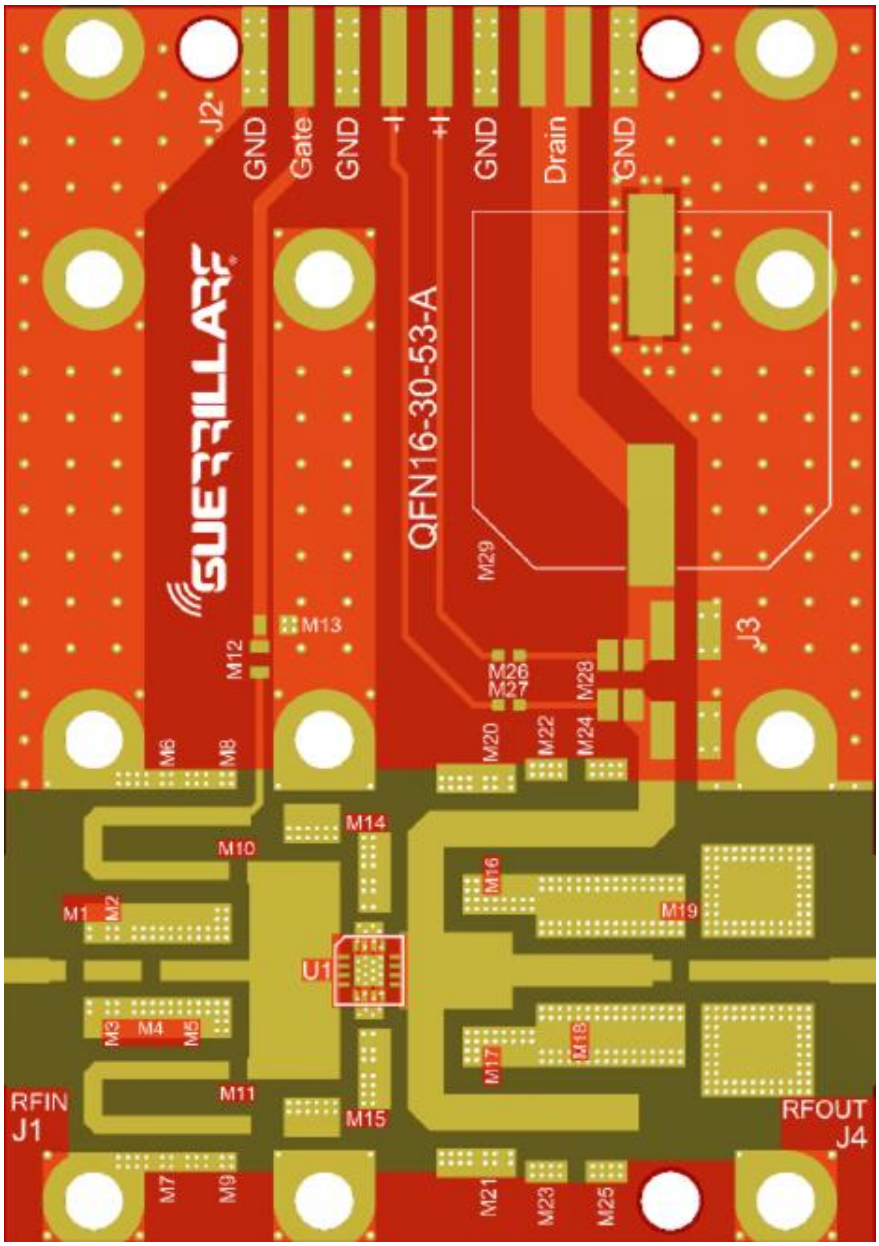
Typical Operating Curves: 3.3 to 3.7 GHz

Drain Efficiency vs. Frequency: 2.5 dB Compression



GRF0010 Evaluation Board Assembly Diagram



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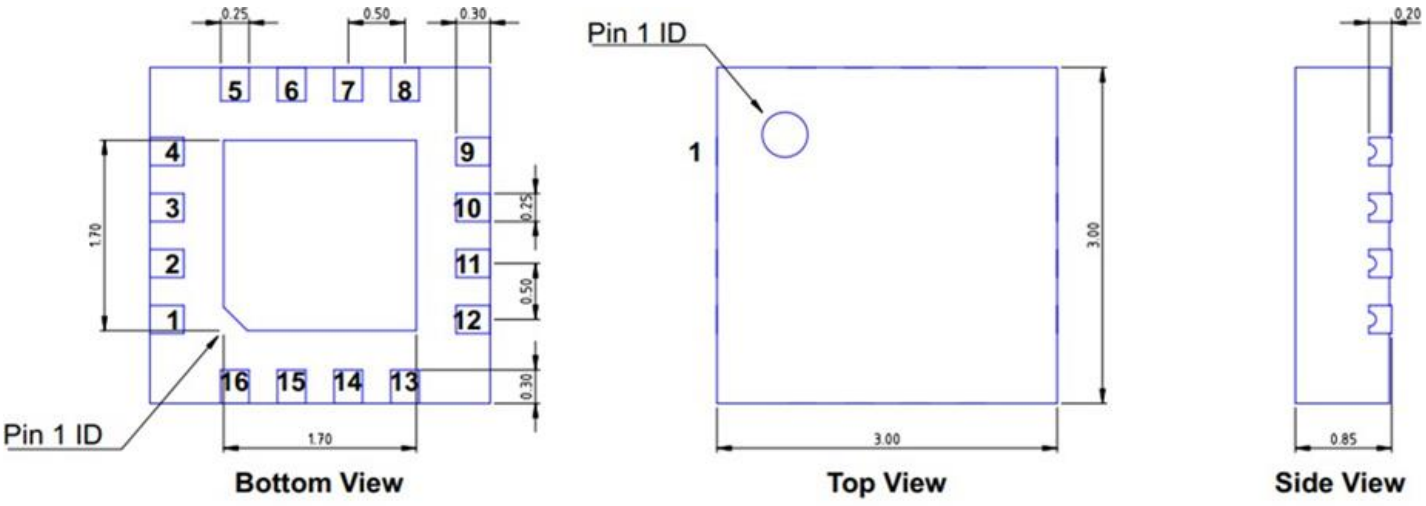
GRF0010 Evaluation Board Assembly Diagram Reference: 3.3 to 3.7 GHz Tune

Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M1	Resistor	Various	5%	2 Ω	0805	ok
M2, M3	Resistor	Various	5%	1 kΩ	0805	ok
M4	Capacitor	ATC	N/A	3.9 pF	0805	ok (Murata)
M5	Capacitor	ATC	N/A	1.5 pF	0805	ok (Murata)
M6	Capacitor	ATC	N/A	6.8 pF	0805	ok (Murata)
M7, M9, M11	DNP	--	--	--	--	--
M8	Capacitor	Murata	GRM	10 nF	0805	ok
M10	Resistor	Various	5%	5.1 Ω	0805	ok
M12	Resistor	Various	5%	0 Ω	0805	ok
M13	Capacitor	Murata	GRM	10 µF	0805	ok
M14, M15	Capacitor	ATC	N/A	0.5 pF	0805	ok (Murata)
M16, M17	Capacitor	ATC	N/A	0.3 pF	0805	ok (Murata)
M18	Capacitor	ATC	N/A	1.0 pF	0805	ok (Murata)
M19	Capacitor	ATC	N/A	6.8 pF	0805	ok (Murata)
M20, M21	Capacitor	ATC	N/A	3.0 pF	0805	ok (Murata)
M22, M23, M24, M25	Capacitor	Murata	GRM	10 µF	1210	ok
M26, M27	Resistor	Various	5%	1 kΩ	0603	ok
M28	Resistor	Ohmite	5%	0.01 Ω	1206	ok
M29	Electrolytic Capacitor	Various	N/A	220 µF	12.5 mm	ok
U1	GaN PA GRF0010	Guerrilla-RF	--	--	3 x 3 mm	no
J1, J4	SMA Connector	Various	--	--	--	--
J2	DC Connector	Various	--	--	--	--
J3	DNP	--	--	--	--	--
Evaluation Board	QFN16-30-53-A	--	--	--	--	--

Package Outline Drawing



QFN16 3x3mm

Dimensions in millimeters
Dimensional Tolerance: ±0.05

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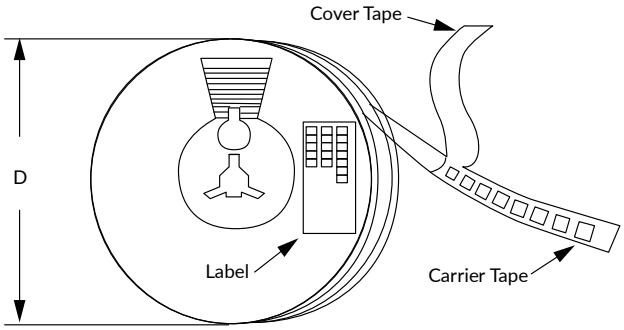
Package Marking Diagram

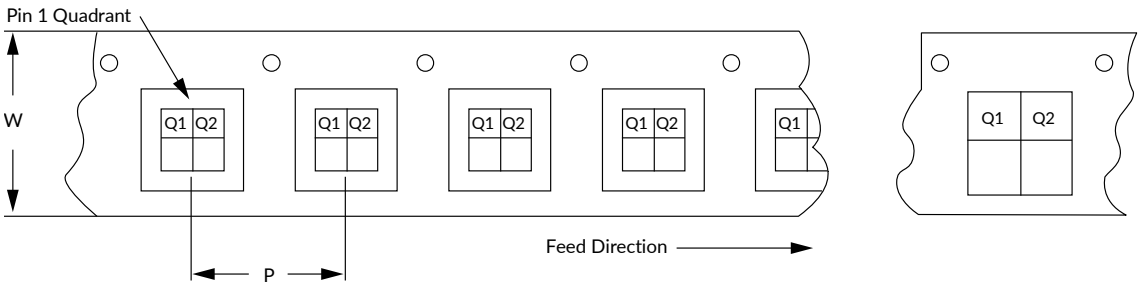
- Line 1: "YY" = YEAR. "WW" = WORK WEEK the device was assembled.
- Line 2: "GRF" = Guerrilla RF.
- Line 3: "XXXX" = Device PART NUMBER.

Tape and Reel Information

Guerrilla RF's tape and reel specification complies with Electronic Industries Alliance (EIA) standards for "Embossed Carrier Tape of Surface Mount Components for Automatic Handling" (reference EIA-481). See the following page for the Tape and Reel Specification and Device Package Information table, which includes units per reel.

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 Tape and Reel Reference Table, please refer to: https://www.guerrilla-rf.com/prodFiles/Manufacturing/MN001.pdf





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

Revision History

Revision Date	Description of Change
September 23, 2024	Preliminary Data Sheet.
October 23, 2024	Updated plots on pages 10, 11 & 12.
April 25, 2025	Converted Data Sheet to new format only. No change to device or device specifications.
May 19, 2025	Updated Tables on page 8, 9 & 10. Added new Max Gain and Stability plots. Removed S-parameter plots. Added HBM and CDM sepcifications.

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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 limited evaluation board measurements taken within the Guerrilla RF Applications Lab. 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.