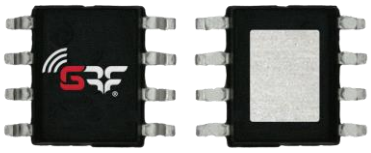
DATA SHEET

PRELIMINARY DATA SHEET



GRF7896

CATV and General Purpose Amplifier 1 to 1000 MHz

FEATURES

- 5 to 1000 MHz Operation
- Outstanding Noise Figure and Linearity
- 3.9 x 4.9 mm SOIC-8 EP Package
- Process: GaAs pHEMT

Reference: 5 V / 270 mA / 350 MHz

- Gain: 25.6 dB
- OIP2L: 82 dBm
- OIP2H: 76 dBm
- OIP3: 42 dBm
- OP1dB: 26.4 dBm
- Evaluation Board Noise Figure: 1.3 dB

APPLICATIONS

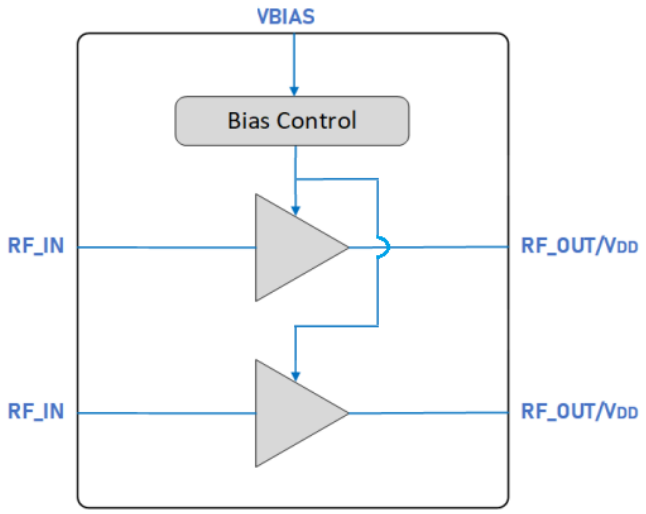
- Cable, Terrestrial and Satellite
- DOCSIS
- CATV, Cable Modem and Set Top Box
- General Purpose Gain Block

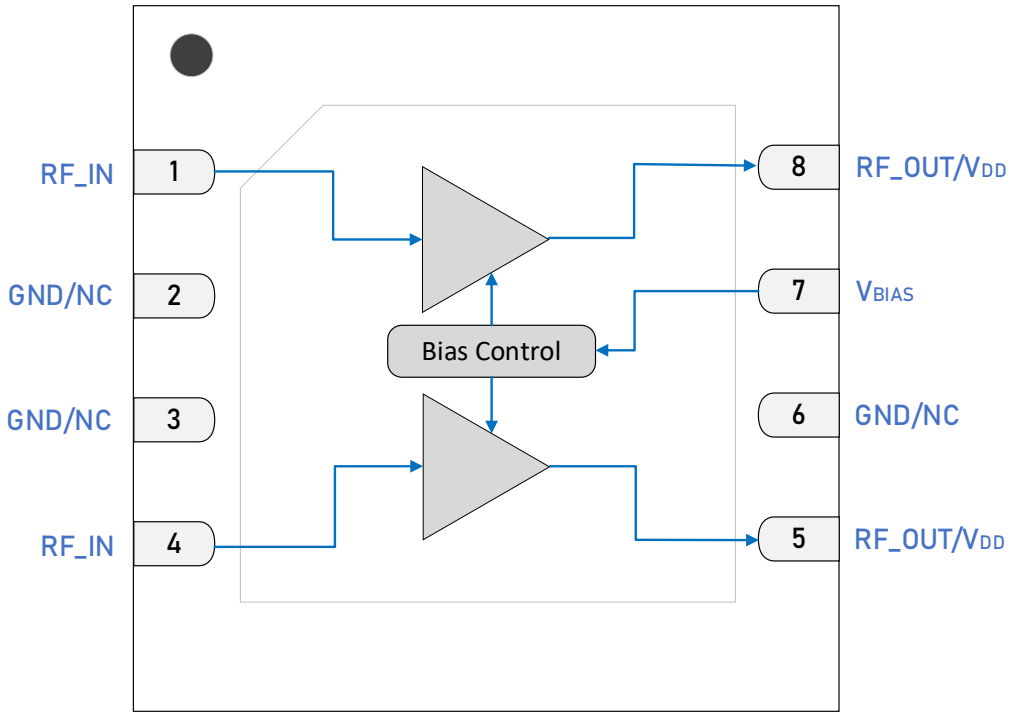
DESCRIPTION

The GRF7896 is a broadband, linear, dual-balanced gain block designed for use in 75 Ω CATV and 50 Ω general purpose applications.

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

BLOCK DIAGRAM





3.9 x 4.9 mm SOIC-8 EP Pin Out (Top View)

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Pin Assignments

Pin	Name	Description	Note
1, 4	RF_IN	RF Input	External match must provide DC block.
2, 3, 6	GND/NC	Ground or No Connect	No internal connection to die. We recommend connecting these pins to ground.
5, 8	RF_OUT/V_{DD}	RF Output	Provides device V_{DD} via external bias inductor/ferrite bead. DC block required at evaluation board output.
7	V_{BIAS}	Bias Voltage	Applied through series resistor.
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	5.25	V
Bias Voltage	V_{BIAS}	0	5.25	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	85	°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		TBD	--

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*

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Recommended Operating Conditions

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Supply Voltage	V_{DD}	4.5	5	5.25	V	
Bias Voltage	V_{BIAS}	4.5	5	5.25	V	
Operating Temperature (package base)	$T_{PKG\ BASE}$	-40		85	°C	
RF Frequency Range	F_{RF}	5	350	1000	MHz	Typical application schematic with external matching components **(notes 1 & 2).**
RF_IN Port Impedance	Z_{RFIN}		75		Ω	Single-ended.
RF_OUT Port Impedance	Z_{RFOUT}		75		Ω	Single-ended.

Note 1: Operation outside this range is possible, but with degraded performance of some parameters.

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, V_{BIAS} = 5 V, I_{DD} = 270 mA, F_{TEST} = 350 MHz, $T_{PKG\ BASE}$ = 25 °C. Evaluation board losses are included within the specifications.

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Supply Current	I_{DD}		270		mA	V_{DD} = 5 V, V_{BIAS} = 5 V.
Bias Current	I_{BIAS}		200		µA	V_{DD} = 5 V, V_{BIAS} = 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 $T_{CHANNEL}$ ≤ 170 °C.

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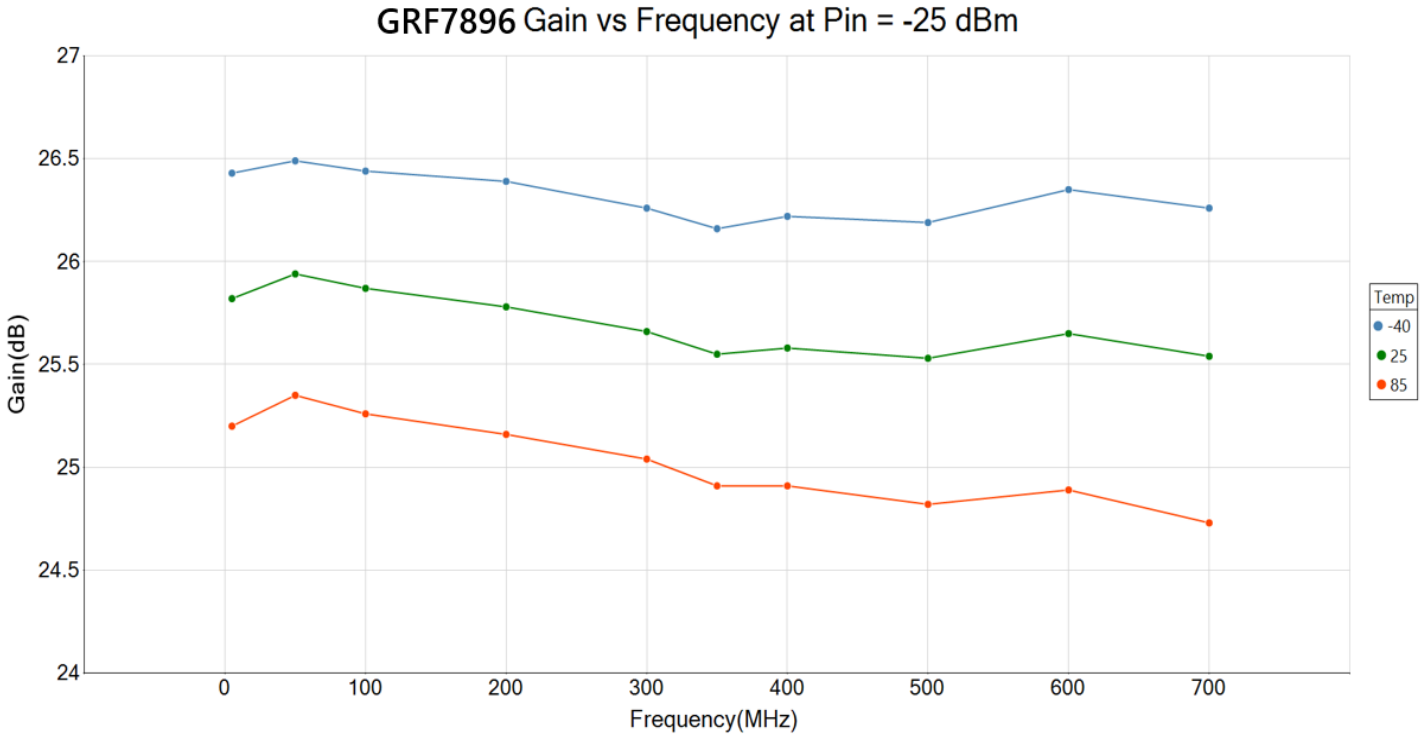
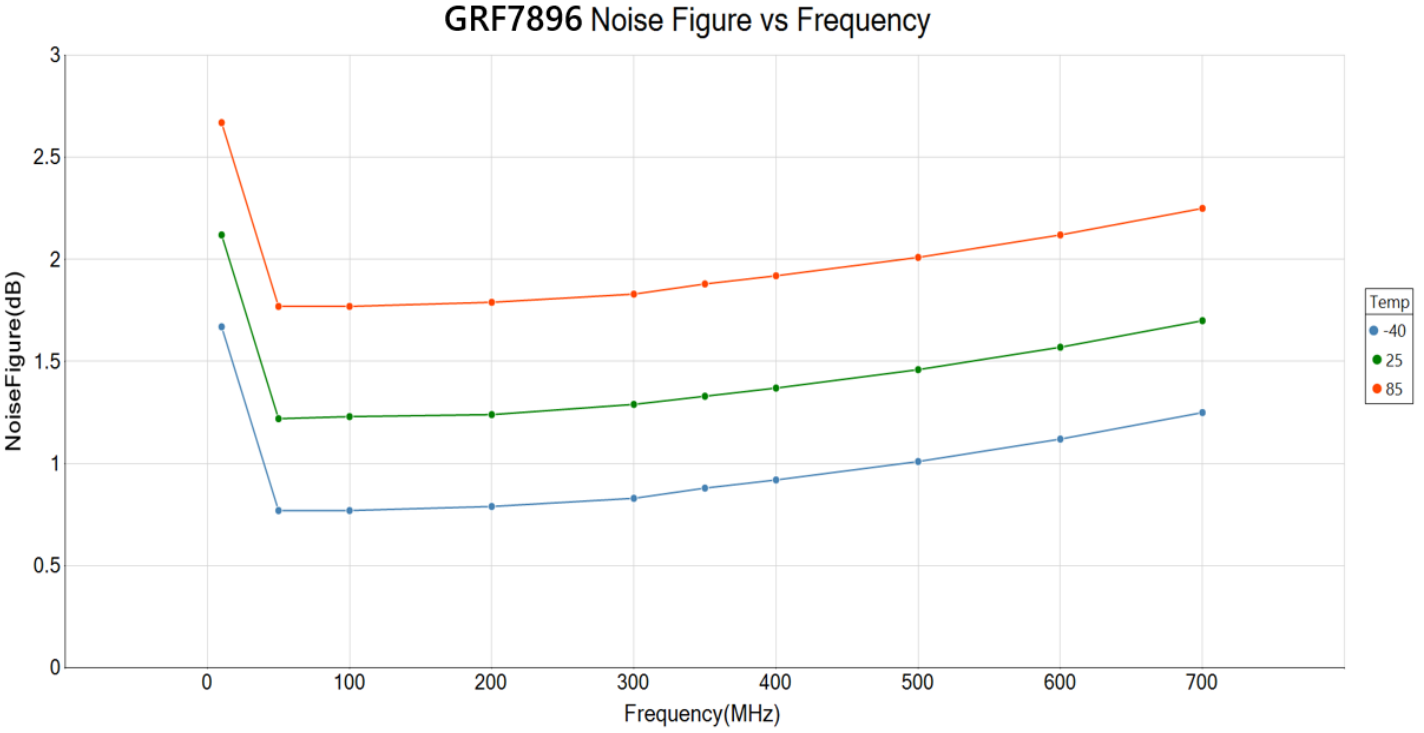
Nominal Operating Parameters – RF

The following conditions apply unless noted otherwise: typical application schematic, V_{DD} = 5 V, V_{BIAS} = 5 V, I_{DD} = 270 mA, F_{TEST} = 350 MHz, 75 Ω system, $T_{PKG\ BASE}$ = 25 °C. Evaluation board losses are included within the specifications.

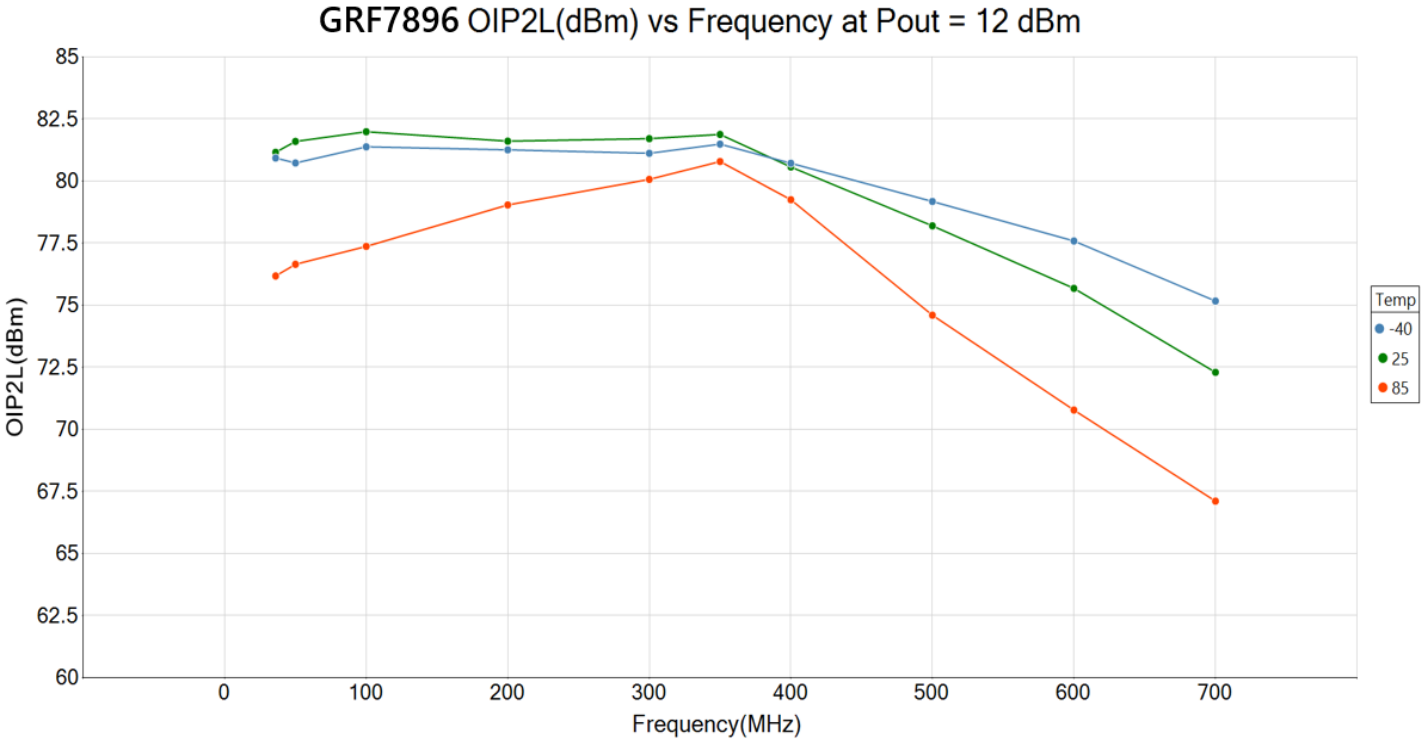
Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Gain	S21		25.5		dB	50 MHz.
			25.6		dB	350 MHz.
			25.3		dB	700 MHz.
S-Parameters	S12		< -17		dB	50 – 700 MHz.
			< -27		dB	50 - 700 MHz.
			< -18		dB	50 - 700 MHz.
Noise Figure	NF		1.2		dB	50 MHz (evaluation board F to F).
			1.3		dB	350 MHz (evaluation board F to F).
			1.7		dB	700 MHz (evaluation board F to F).
Output 2nd Order Intercept Point Low	OIP2L		81		dBm	12 dBm P_{OUT} per tone. 50 MHz at 30 MHz spacing.
			82		dBm	12 dBm P_{OUT} per tone. 350 MHz at 30 MHz spacing.
			73		dBm	12 dBm P_{OUT} per tone. 700 MHz at 30 MHz spacing.
Output 2nd Order Intercept Point High	OIP2H		76		dBm	12 dBm P_{OUT} per tone. 50 MHz at 30 MHz spacing.
			76		dBm	12 dBm P_{OUT} per tone. 350 MHz at 30 MHz spacing.
			71		dBm	12 dBm P_{OUT} per tone. 700 MHz at 30 MHz spacing.
Output 3rd Order Intercept Point	OIP3		41		dBm	12 dBm P_{OUT} per tone. 50 MHz at 6 MHz spacing.
			42		dBm	12 dBm P_{OUT} per tone. 350 MHz at 6 MHz spacing.
			41.8		dBm	12 dBm P_{OUT} per tone. 700 MHz at 6 MHz spacing.
Output 1 dB Compression Power	OP1dB		26.7		dBm	50 MHz.
			26.4		dBm	350 MHz.
			26		dBm	700 MHz.

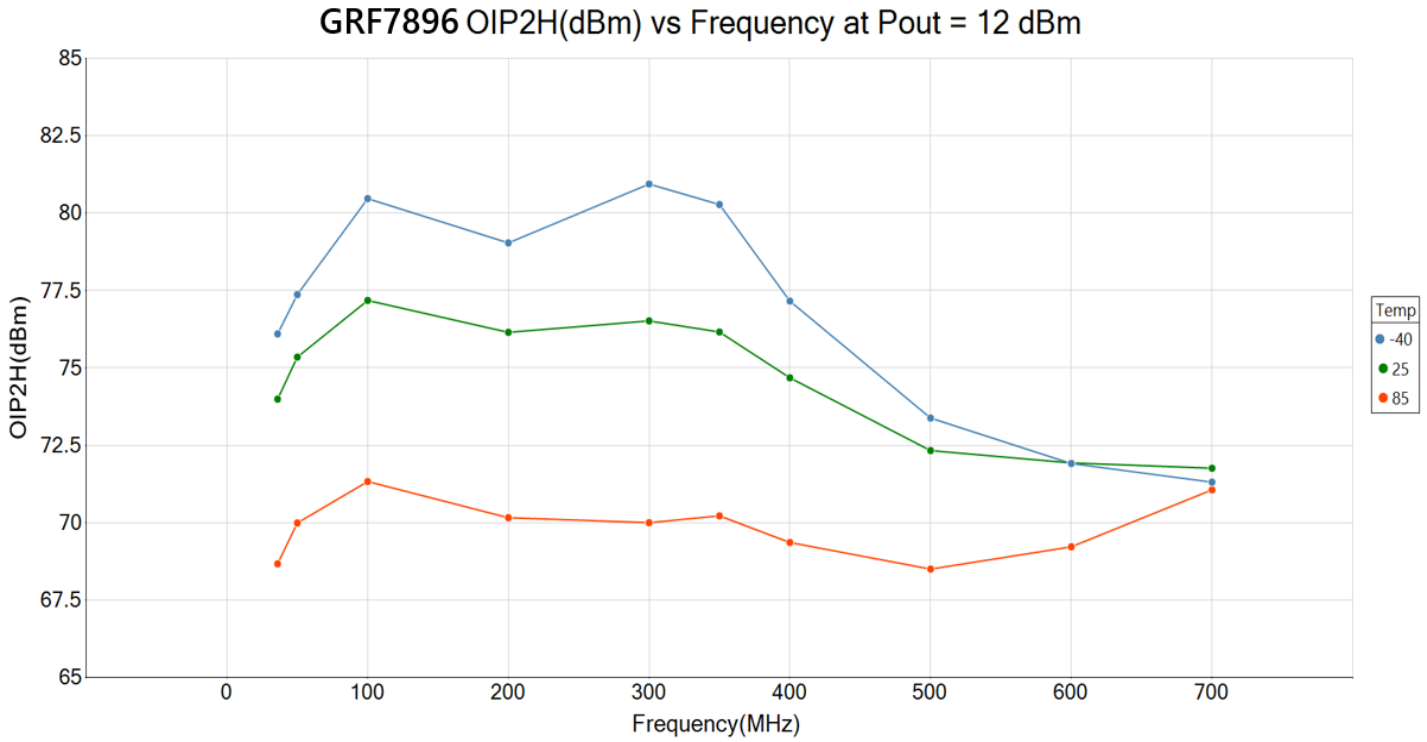
GRF7896 Typical Operating Curves: 5 V, 5 to 700 MHz Tune



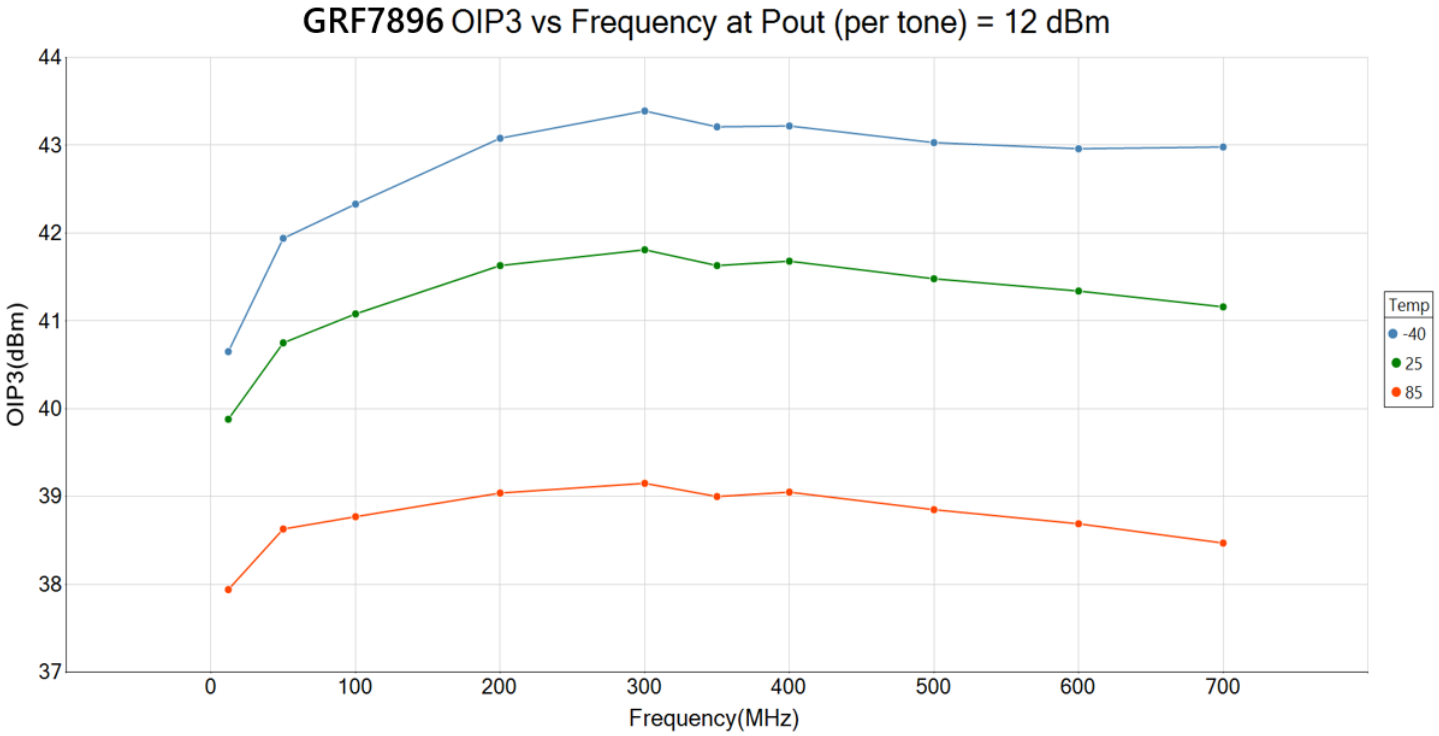


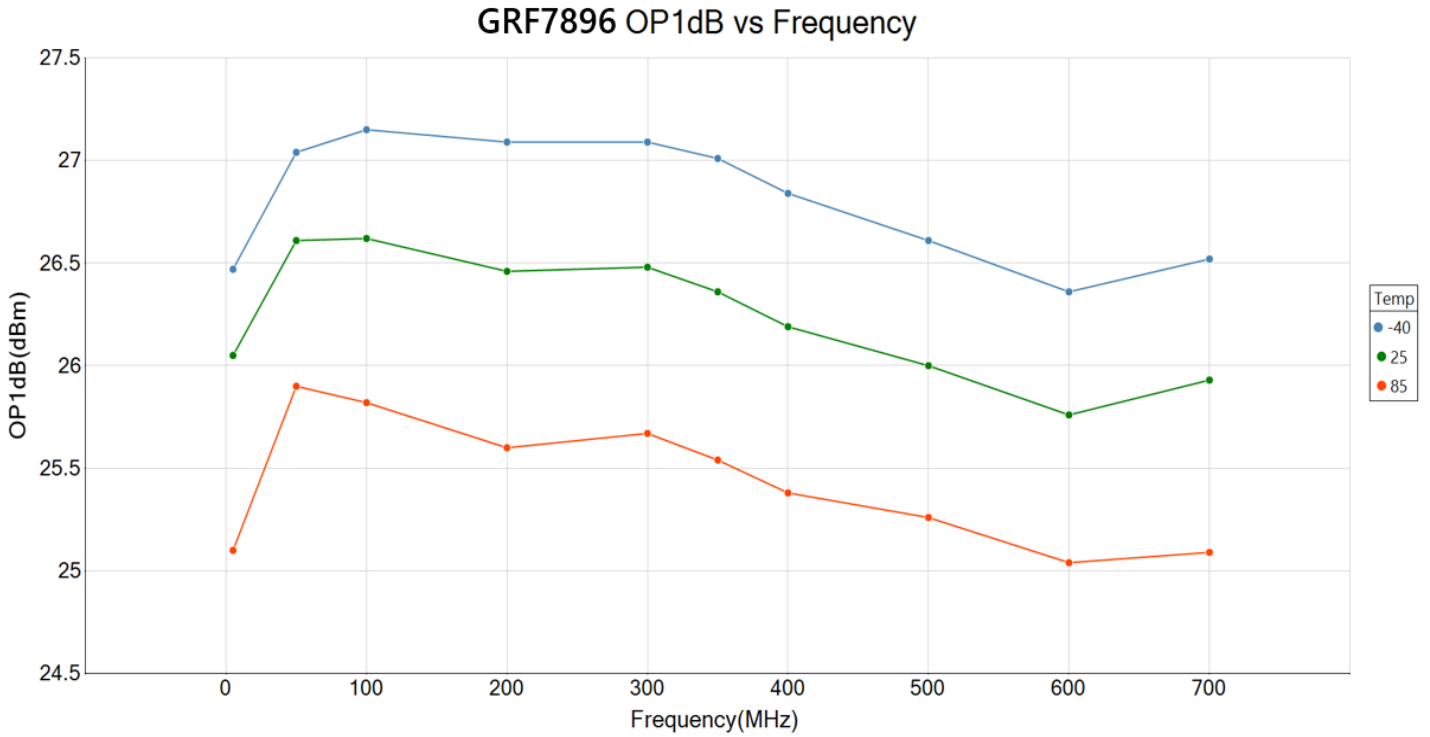
GRF7896 Typical Operating Curves: 5 V, 5 to 700 MHz Tune





GRF7896 Typical Operating Curves: 5 V, 5 to 700 MHz Tune





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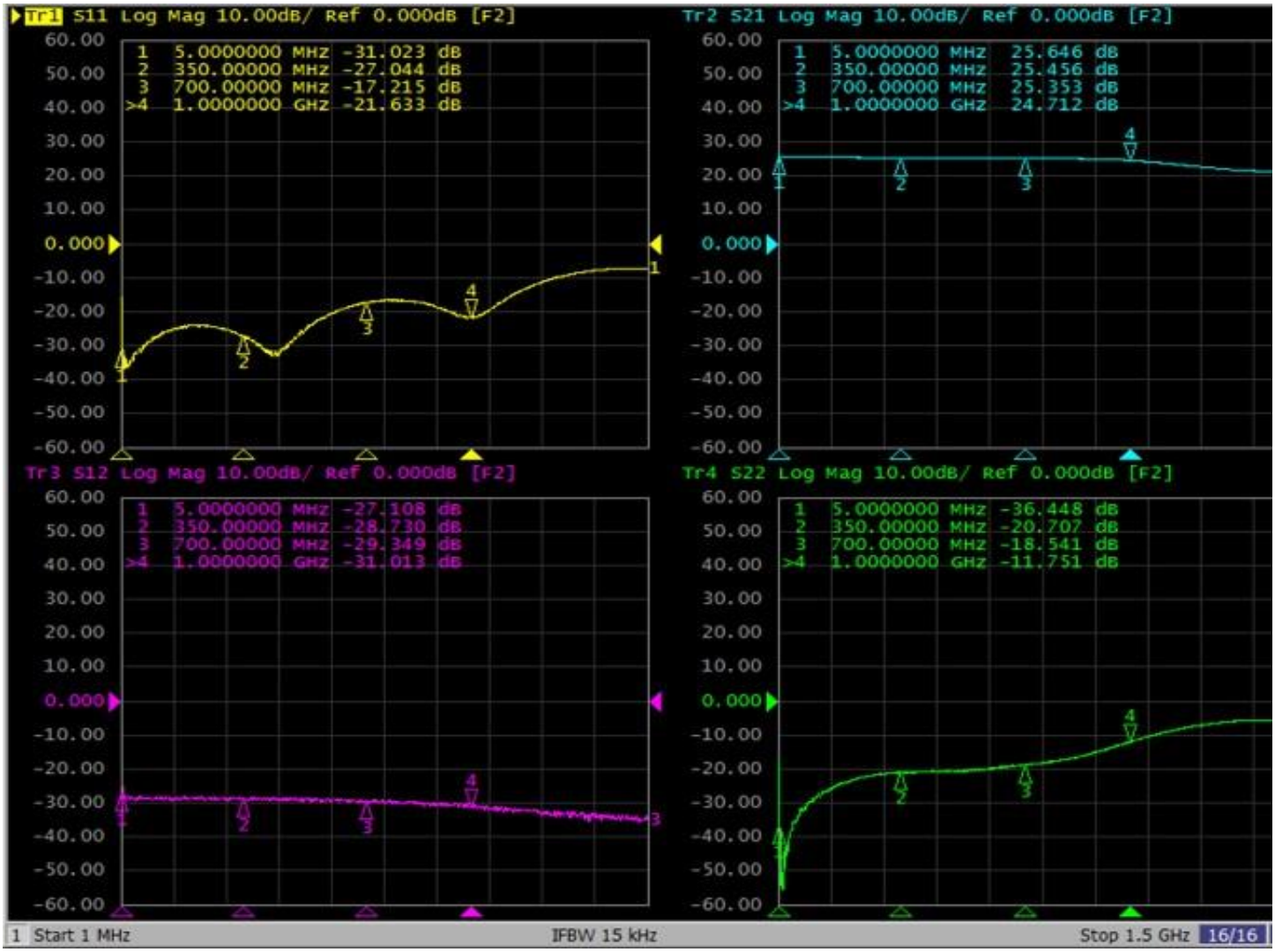
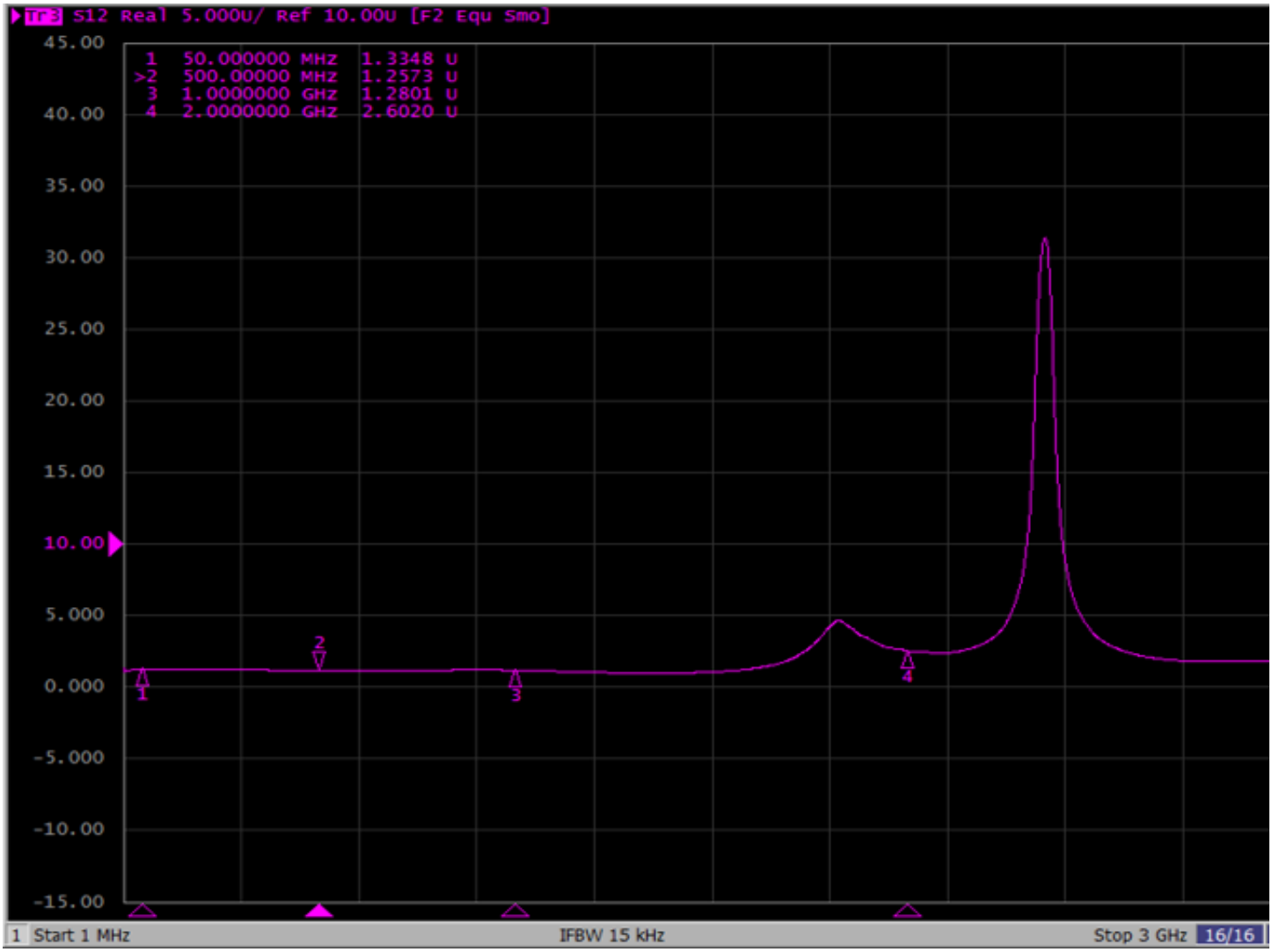
GRF7896 Typical Operating Curves: S-Parameters (5 to 1000 MHz in 75 Ω system)



GRF7896 Typical Operating Curves: Stability Mu Factor (5 to 1000 MHz in 75 Ω system)



Note: Mu Factor ≥ 1.0 implies unconditional stability.

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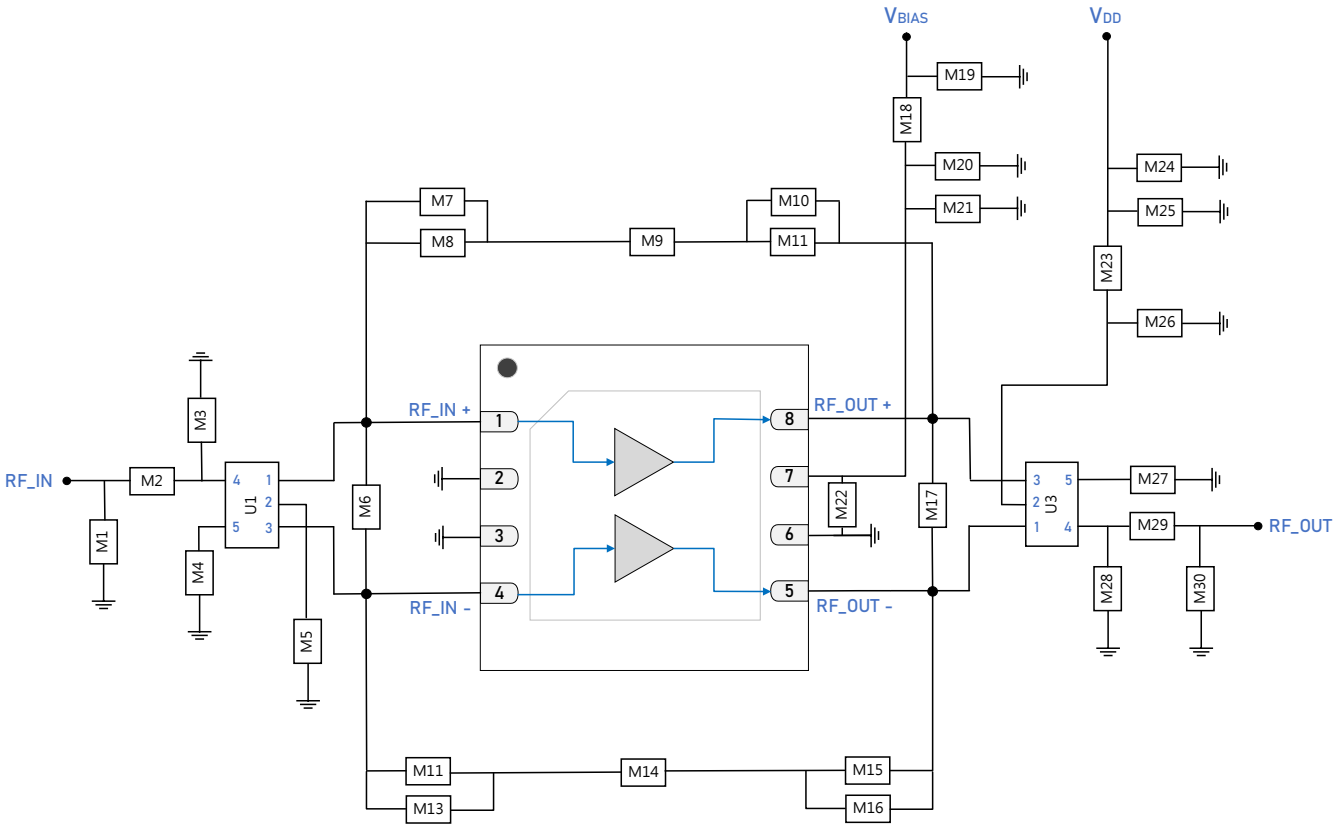
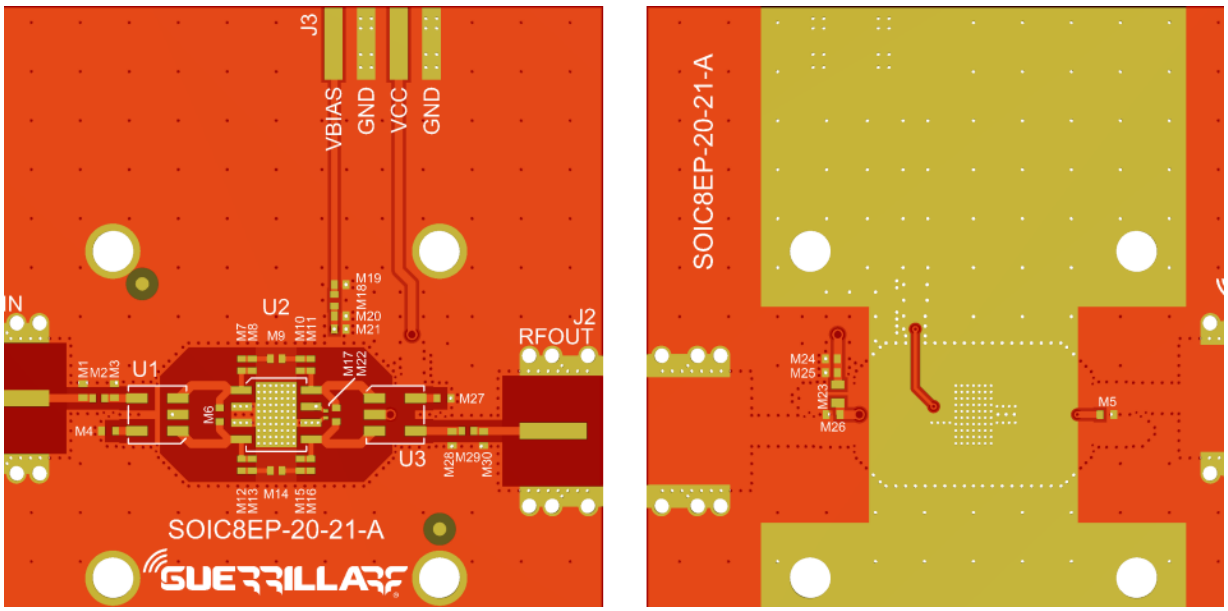


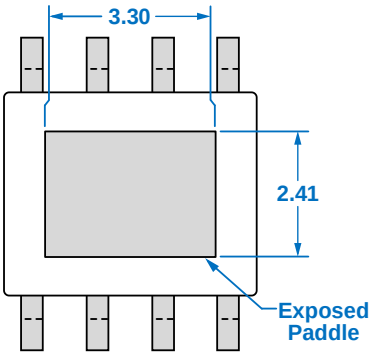
GRF7896 Standard Evaluation Board Schematic



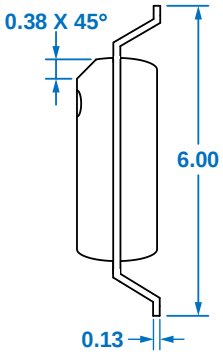
GRF7896 Evaluation Board Assembly Diagram

GRF7896 Evaluation Board Assembly Diagram Reference: 5 to 700 MHz Tune

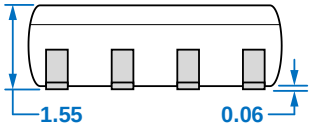
Component	Type	Manufacturer	Family/Part Number	Value	Package Size	Substitution
M3, M5, M6, M11, M16, M17, M21, M22, M26, M28, M30	DNP					
M1	Capacitor	Murata	GJM	0.9 pF		
M2, M4, M9, M14, M20, M25, M27, M29	Capacitor	Murata	GRM	0.1 µF	0402	ok
M7, M12	Inductor	Murata	LQG15WH	68 nH	0402	ok
M8, M13	Resistor	Various	5%	180 Ω	0402	ok
M10, M15	Resistor	Various	5%	1150 Ω	0402	ok
M18	Resistor	Various	5%	20 kΩ	0402	ok
M19, M24	Capacitor	Murata	GRM	1000 pF		
M23	Ferrite	Murata	BLM18KG102SH1	N/A	0402	no
U1, U3	Balun	MiniRF	MRFXF0837	N/A	N/A	no
Evaluation Board	SOIC8EP-20-020-B					



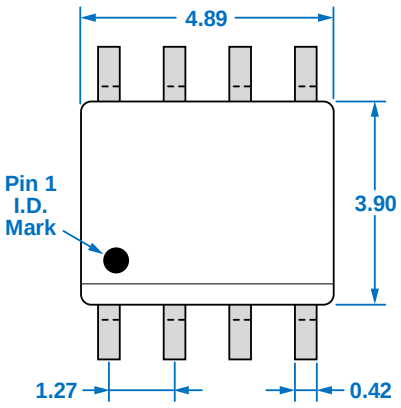
BOTTOM VIEW



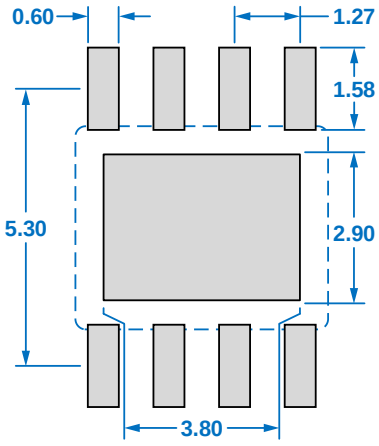
SIDE VIEW



FRONT VIEW



TOP VIEW



RECOMMENDED
LAND PATTERN

3.9 x 4.9 mm SOIC-8 EP Footprint and Package Dimensions

Package Marking Diagram

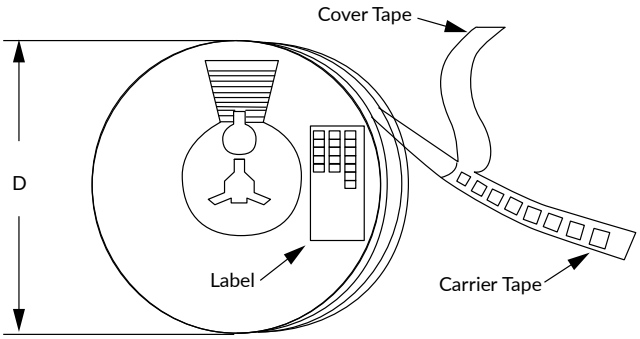
- Line 1: "YY" = YEAR. "WW" = WORK WEEK device was assembled.
- Line 2: "XXXX" = Device PART NUMBER.

Tape and Reel Information

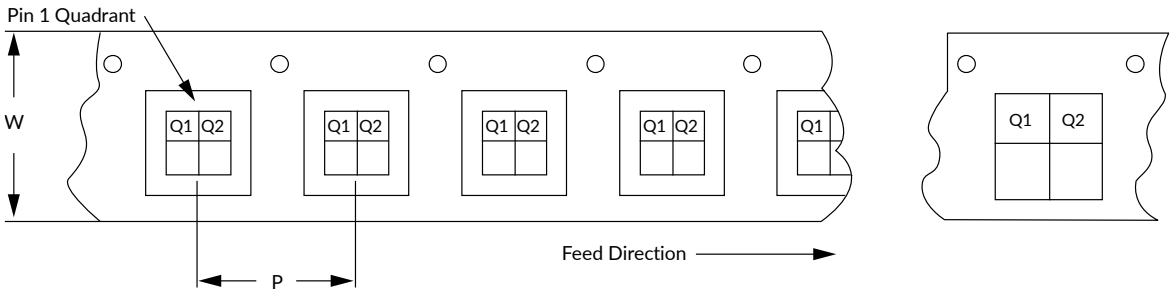
Guerrilla RF's tape and reel specification complies with Electronic Industries Alliance (EIA) standards for "Embossed Carrier Tape of Surface Mount Components for Automatic Handling" (reference EIA-481). See the following page for the Tape and Reel Specification and Device Package Information table, 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: 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
March 18, 2025	Preliminary Data Sheet.

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.