

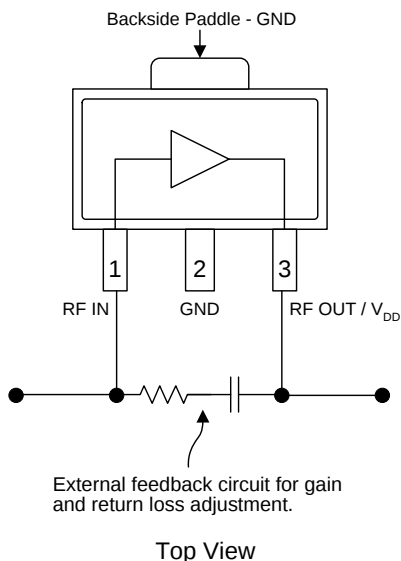
Product Overview

The TAT7457 is a low-cost RF amplifier designed for applications from DC to 2000 MHz. The balance of low noise and distortion provides an ideal solution for a wide range of broadband amplifiers used in cable television applications such as optical receivers and low noise front ends.

The TAT7457 has features allowing a great deal of design-in flexibility. Gain and return loss are adjustable with an external feedback resistor. An internal bias circuit mitigates the effect of temperature and process variation and an external resistor may be used to adjust the bias current to optimize distortion or noise performance. There are no on-chip capacitors limiting the low frequency response which extends down to DC.

The TAT7457 is fabricated using 6-inch GaAs pHEMT technology to optimize performance and cost. It provides excellent gain and return loss consistency inherent to the pHEMT process.

Functional Block Diagram



SOT-89 Package

Key Features

- Gain, return loss and bias externally adjustable
- On-chip active bias for consistent bias current and repeatable performance
- DC – 2000 MHz bandwidth
- Low noise: typical NF < 2 dB to 1000 MHz
- Flexible 5 V to 8 V biasing
- I_{DD} = 120 mA typical at V_{DD} 5 V in application circuit
- 19 dB typical gain in application circuit
- +40 dBm typical OIP3
- +61 dBm typical OIP2
- +21 dBm typical P1dB
- Low distortion: CSO -66 dBc, CTB -78 dBc
- (10 dBmV / ch at input, 80 ch NTSC flat)
- pHEMT device technology

Applications

- Single-ended and Push-pull Optical Receivers
- Low-noise Drop Amplifiers
- Distribution Amplifiers
- Multi-Dwelling Units
- Single-ended Gain Block

Ordering Information

Part Number	Description
TAT7457	75 Ω High Linearity pHEMT Amplifier
TAT7457EB	Assembled Evaluation Board
TAT7457TR	1000 pieces on a 7" reel

Absolute Maximum Ratings

Parameter	Rating
Storage Temperature Range	-65 to +150 °C
Device Voltage	+10 V

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability.

Recommended Operating Conditions

Parameter	Min	Typ	Max	Unit
V _{DD}	5		8	V
I _{DD}		120		mA
T _j for >10 ⁶ hours MTTF			+150	°C

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

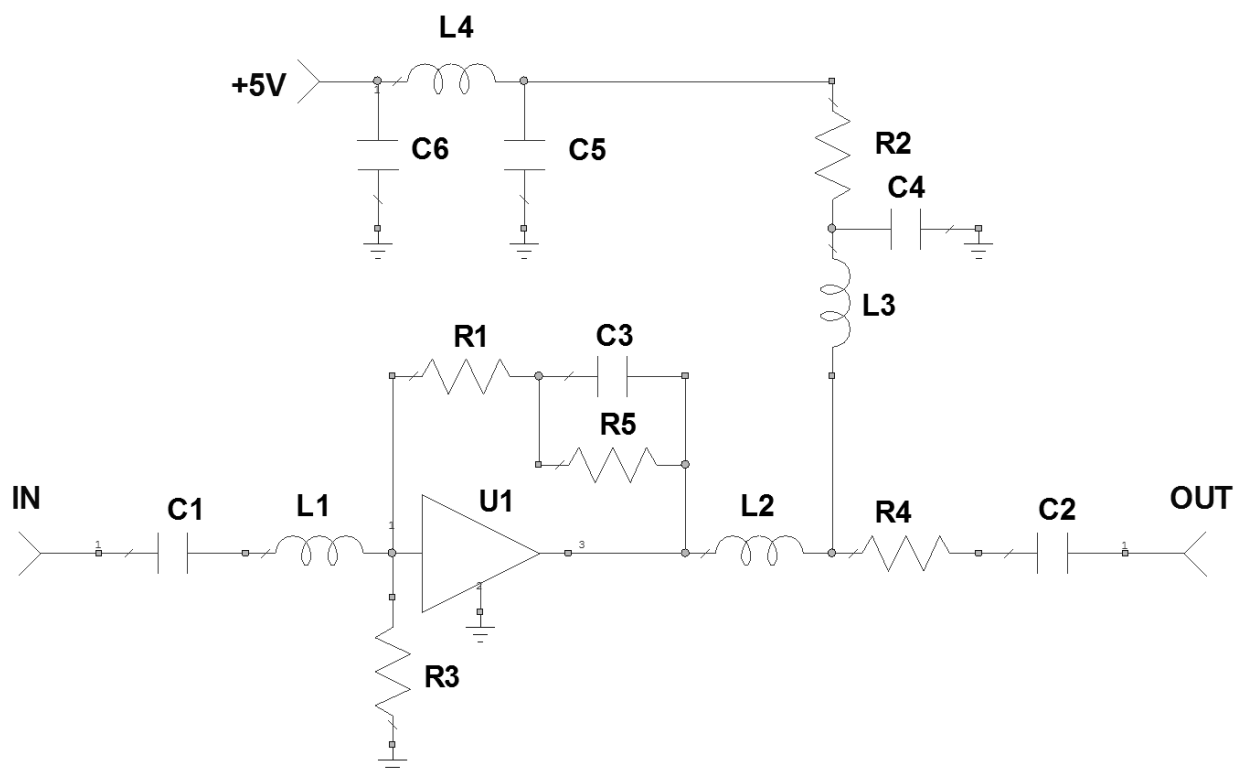
Electrical Specifications

Parameter	Condition ⁽¹⁾	Min	Typ	Max	Unit
Frequency Range		DC		1200	MHz
Gain	50-1000 MHz		19		dB
Gain Flatness			+/-0.7		dB
Noise Figure			2.0		dB
Input Return Loss			18		dB
Output Return Loss			18		dB
Gain	50-1200 MHz		19		dB
Gain Flatness			+/-0.7		dB
Noise Figure			2.3		dB
Input Return Loss			14		dB
Output Return Loss			17		dB
Output P1dB			+21		dBm
Output IP2	f1=225 MHz, f2= 325 MHz		61		dBm
Output IP3	Pout=+5 dBm / tone		40		dBm
CSO	10 dBmV / ch at input, flat loading, 80 channels NTSC+QAM up to 1218 MHz		-66		dBc
CTB			-78		dBc
Thermal Resistance, θ _{jc}	Junction to Case		38		°C/W

Notes:

- Typical performance at these conditions: Temp = +25 °C, V_{DD} = +5 V, 75 Ω system

Evaluation Board Schematic; DC – 1200 MHz





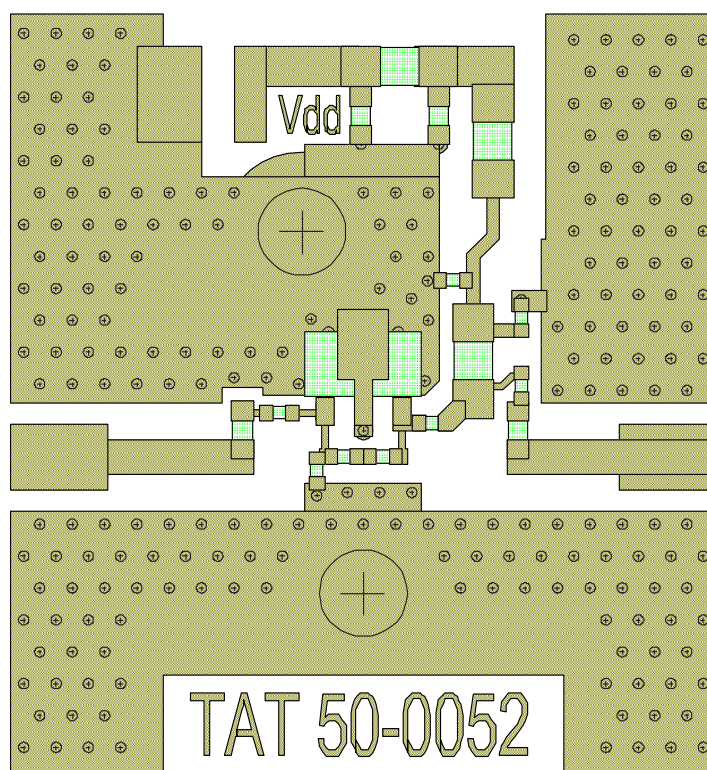
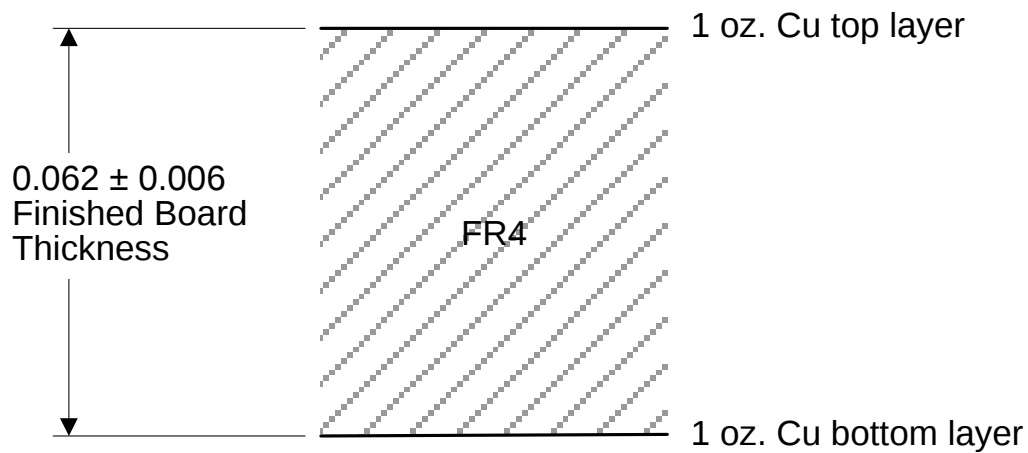
TAT7457

75Ω pHEMT Adjustable Gain RF Amplifier

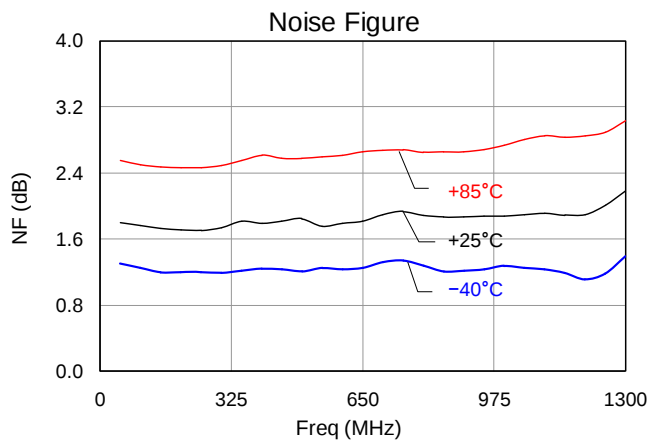
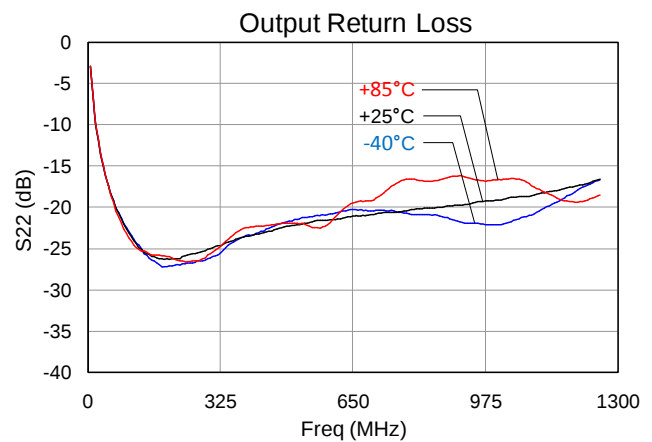
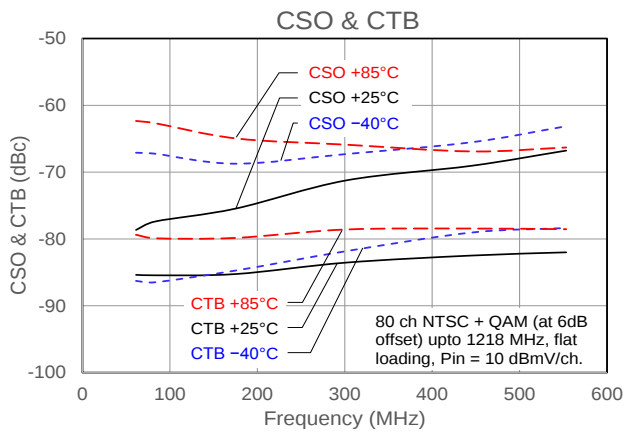
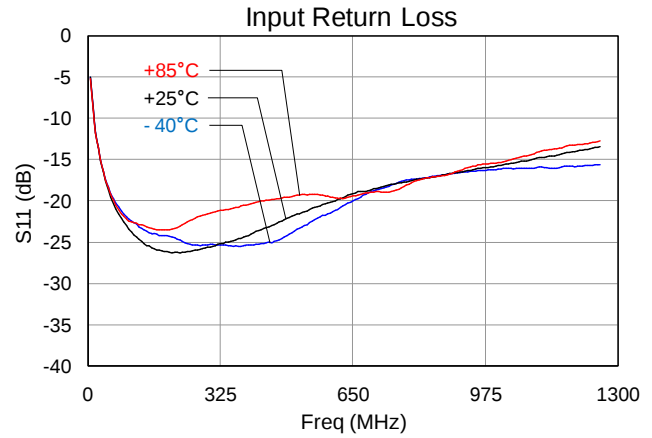
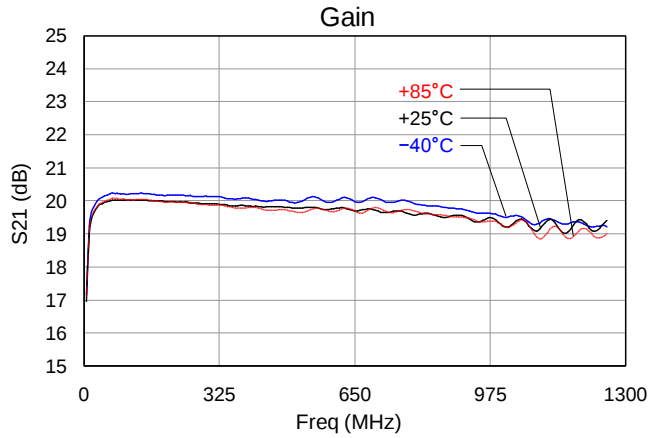
Evaluation Board Bill of Materials; DC – 1200 MHz

Ref Designator	Description	Manufacturer	Part Number
PCB	PCB, TAT7547	Qorvo	TAT 50-0052
U1	Amplifier, SOT-89	Qorvo	TAT7457
R1	RES, 1 kΩ, 1%, 1/10W, 0402	Panasonic	ERJ-2RKF1001X
R2	RES, 0 Ω, 1/4W, 1206	Kamaya	RMC1/8JPTP
R3	DNP	N/A	N/A
R4	RES, 0 Ω, 0402	Kamaya	RMC1/16SJPTH
R5	RES, 37.4 kΩ, 1%, 1/10W, 0402	Panasonic	ERJ-2RKF3742X
C1, C2	CAP, 0.01 uF, 10%, X7R, 16V, 0603	Murata	GRM188R71H103KA01D
C3, C4	CAP, 0.01 uF, 10%, X7R, 25V, 0402	Murata	GRM155R71E103JA01D
C5, C6	CAP, 0.1 uF, 10%, X7R, 16V, 0603	Murata	GRM188R71C104KA010
L1, L2	IND, 4.7 nH, 5%, W/W, 0402	Coilcraft	0402CS-4N7XJLW
L3	IND, 880 nH, +/-5%, 1206	Murata	LQH31HNR88J03
L4	IND, 0.9 uH, 10%, 1.3A, W/W, 1008	Coilcraft	1008AF-901XZKL
J1	CONN, HDR, RT ANG, 2 PIN, 0.100", T/H	Molex	022-28-8021
J2, J3	CONN. 75 OHM, EDGE LAUNCH F	Lighthouse Technology	LTI-FSF55NT-P

Evaluation Board PCB Stack Up and Material



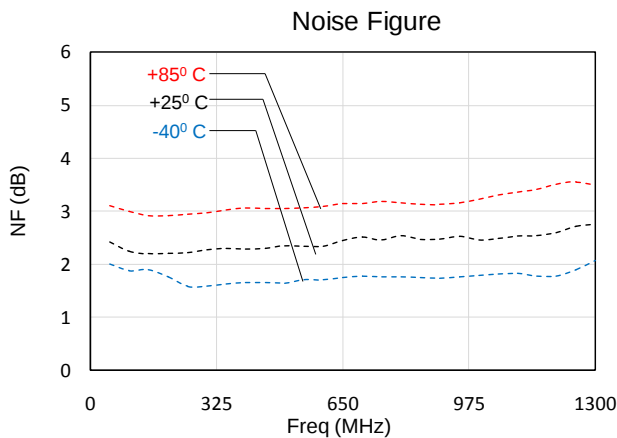
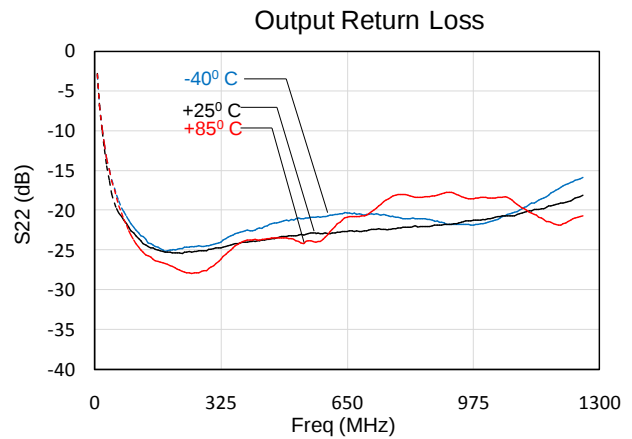
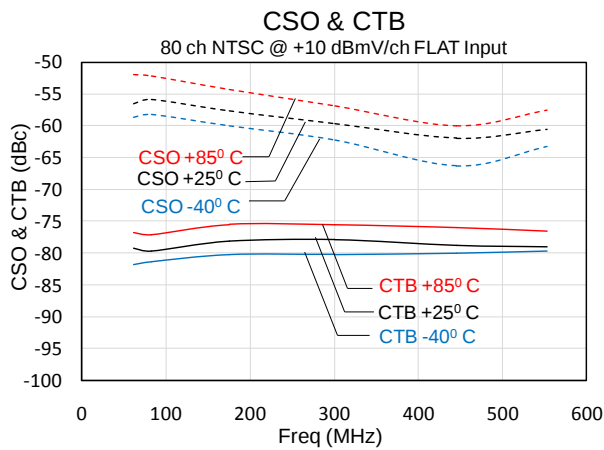
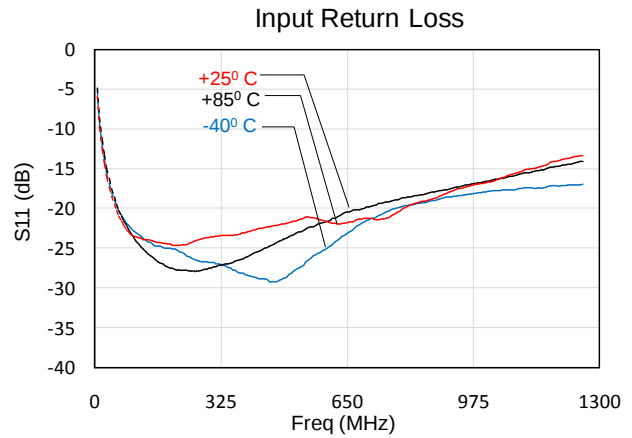
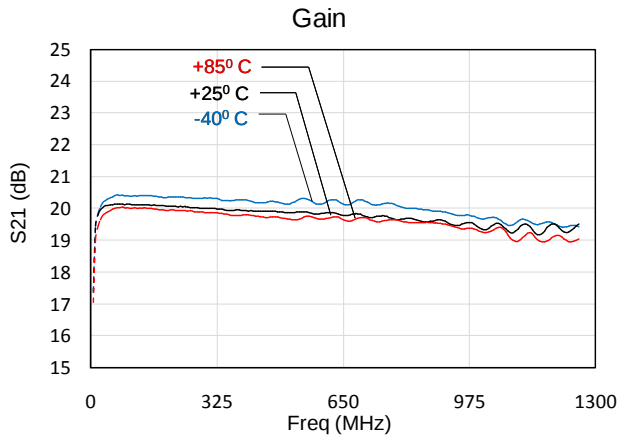
Performance Data at $V_{DD} = 5\text{ V}$ (DC – 1200 MHz)



Notes:

- (1) $V_{DD} = +5\text{ V}$, $I_{DD} = 120\text{ mA}$

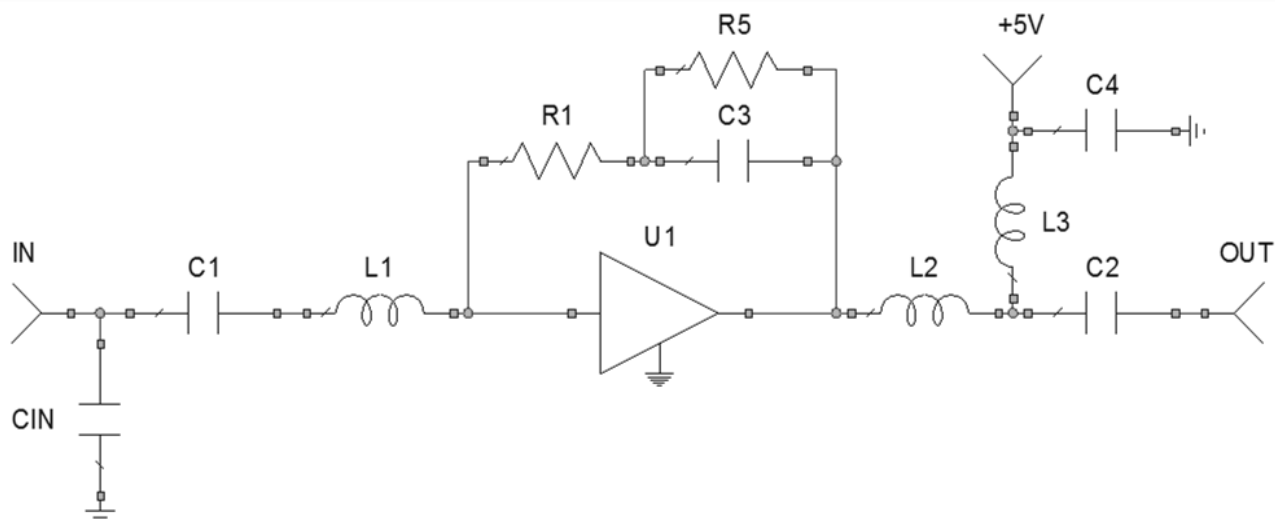
Performance Data at $V_{DD} = 8\text{ V}$ (DC – 1200 MHz)



Notes:

- (1) $V_{DD} = +8\text{ V}$, $I_{DD} = 140\text{ mA}$
- (2) I_{DD} adjusted with an external supply, similar to adjusting R3 and R5.

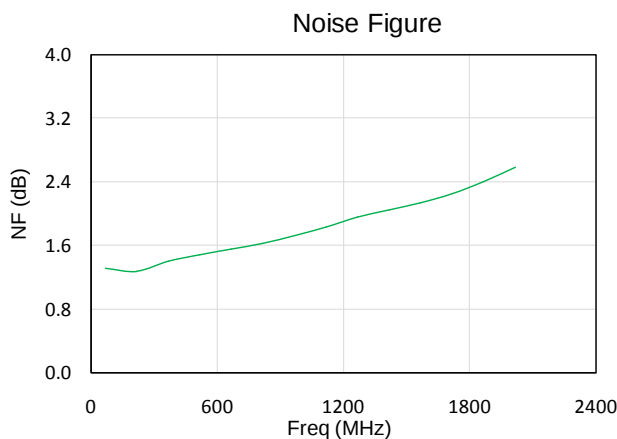
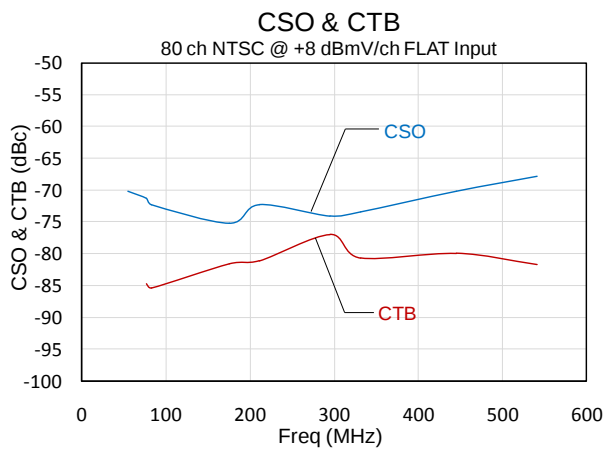
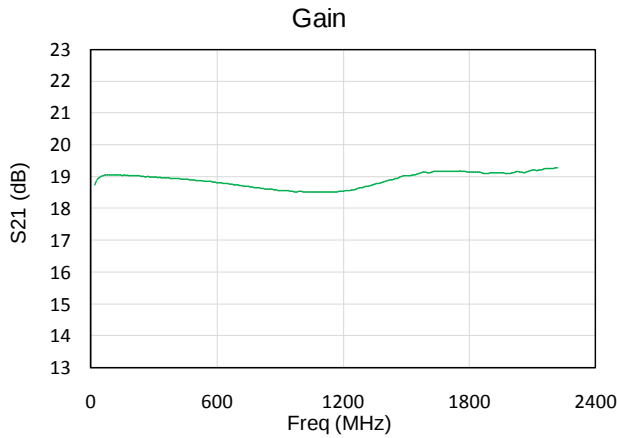
Typical Application Schematic; 2 GHz Satellite



Evaluation Board Bill of Materials for 2.0 GHz Satellite

Ref Designator	Description	Manufacturer	Part Number
PCB	TAT7547	Qorvo	TAT 50-0052
U1	Amplifier, SOT-89	Qorvo	TAT7457
R1	RES, 750 Ω, 1%, 0402	Panasonic	ERJ-2RKF7500X
R5	RES, 75 kΩ, 5%, 0402	Panasonic	ERJ-2GEJ753X
C1, C2	CAP, 0.01 uF, 10%, X7R, 16V, 0603	Murata	GRM188R71H103KA010D
C3	CAP, 560 pF, 10%, X7R, 16V, 0402	Murata	GCM155C1H561J16D
C4	CAP, 0.01 uF, 10%, X7R, 25V, 0402	Murata	GRM155R71E103JA01D
CIN	CAP, 0.5 pF +/-0.1 pF, 50V, C0G, 0603	Murata	GRM1885C1HR50BA01D
L1	IND, 2.7 nH, 5%, 0402	Murata	LQG15HS2N7S02D
L2	IND, 2.0 nH, 5%, 0402	Murata	LQG15HS2N0S02D
L3	IND, 880 nH, 10%, 1206	Murata	LQH31HNR88J03
J1	CONN, HDR, RT ANG, 2 PIN, 0.100", T/H	Molex	022-28-8021
J2, J3	CONN. 75 OHM, EDGE LAUNCH F	Lighthouse Technology	LTI-FSF55NT-P

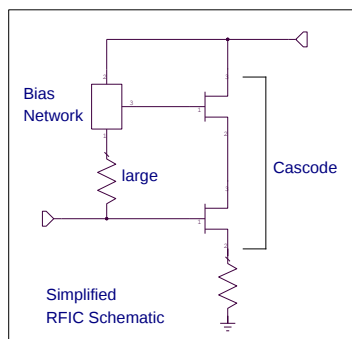
Performance Data for the 2.0 GHz Satellite



Notes:

- (1) VDD = +5 V, IDD = 120 mA

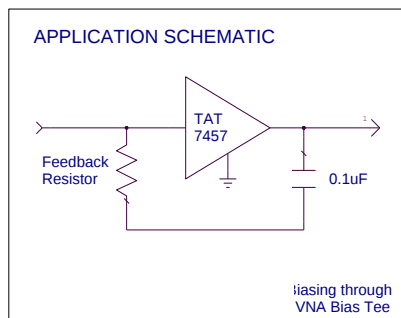
Detailed Device Description



The TAT7457 was designed to be a low cost general purpose amplifier suitable for a wide range of applications.

The TAT7457 is a high gain cascode amplifier with no internal shunt feedback.

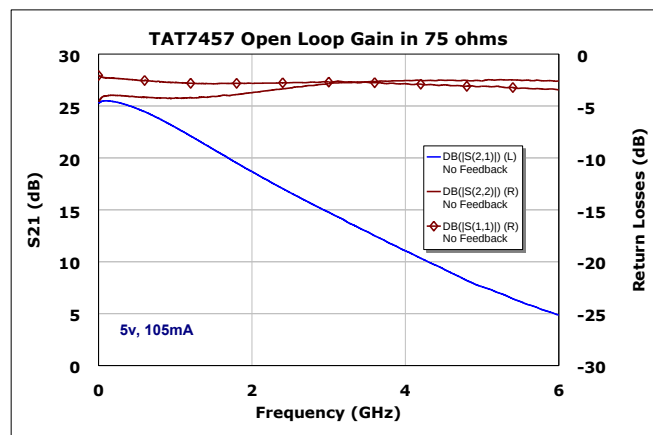
An on-chip biasing network sets the operating conditions for the FETs. This network stabilizes bias current against changes in temperature as well as against the normal process variations expected from wafer to wafer. Stabilized bias current will lead to more consistent RF performance.



Customers may set the gain and return loss of their amplifier by selecting an appropriate external feedback resistor.

Reducing the value of the feedback resistor will reduce the gain and lower the input and output impedances.

Low noise TIA designers may set the value of feedback to a high value (>1k ohm) for best performance.



There are no on-chip capacitors that limit the low frequency response, enabling the TAT7457 frequency response to extend to DC. The open loop gain (no external feedback) and high frequency gain performance is shown in the plot to the left.



TAT7457

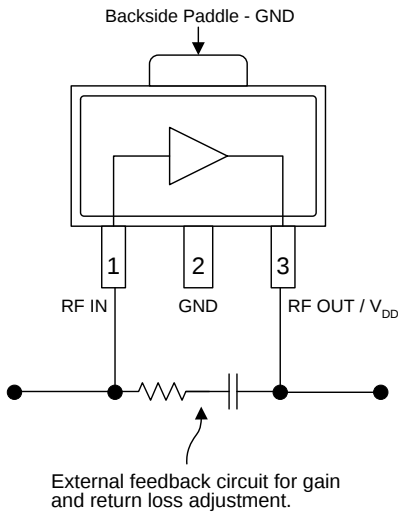
75 Ω pHEMT Adjustable Gain RF Amplifier

Distortion and noise performance may be optimized with simple changes to the application circuit.

Noise performance may be improved by adding a large resistor R3 of approximately 20 k Ω to ground. This resistor will reduce the bias current and improve noise.

Best distortion occurs on a 6v supply; however, for improved distortion on a 5V supply, bias current may be increased by adding a large pull up resistor R5 of approximately 75 k Ω in parallel with the feedback capacitor.

Pin Configuration and Description



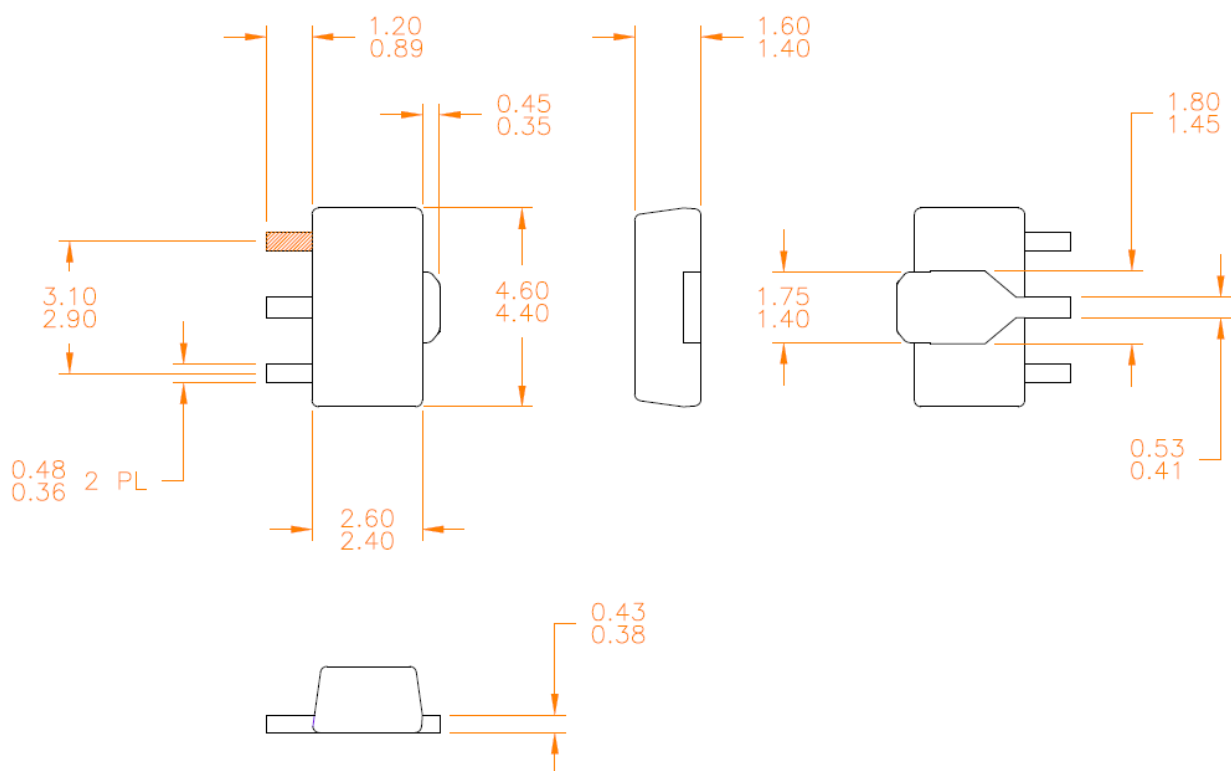
[Top View](#)

Pin Number	Label	Description
1	RF IN	RF Input
2	GND	Internally Not Connected
3	RF OUT/VDD	RF Output
Backside Paddle	GND	Ground. Use recommended via pattern to minimize inductance and thermal resistance. See PCB Mounting Pattern for suggested footprint.

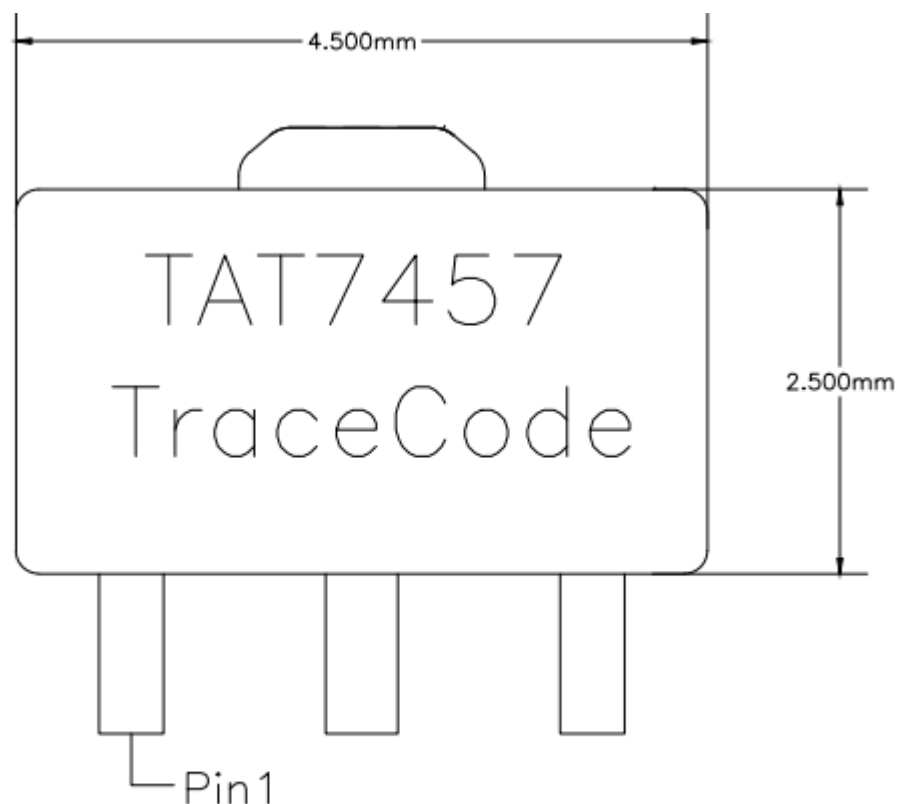
Package Dimensions

NOTES:

1. SHADED LEAD IS PIN 1.

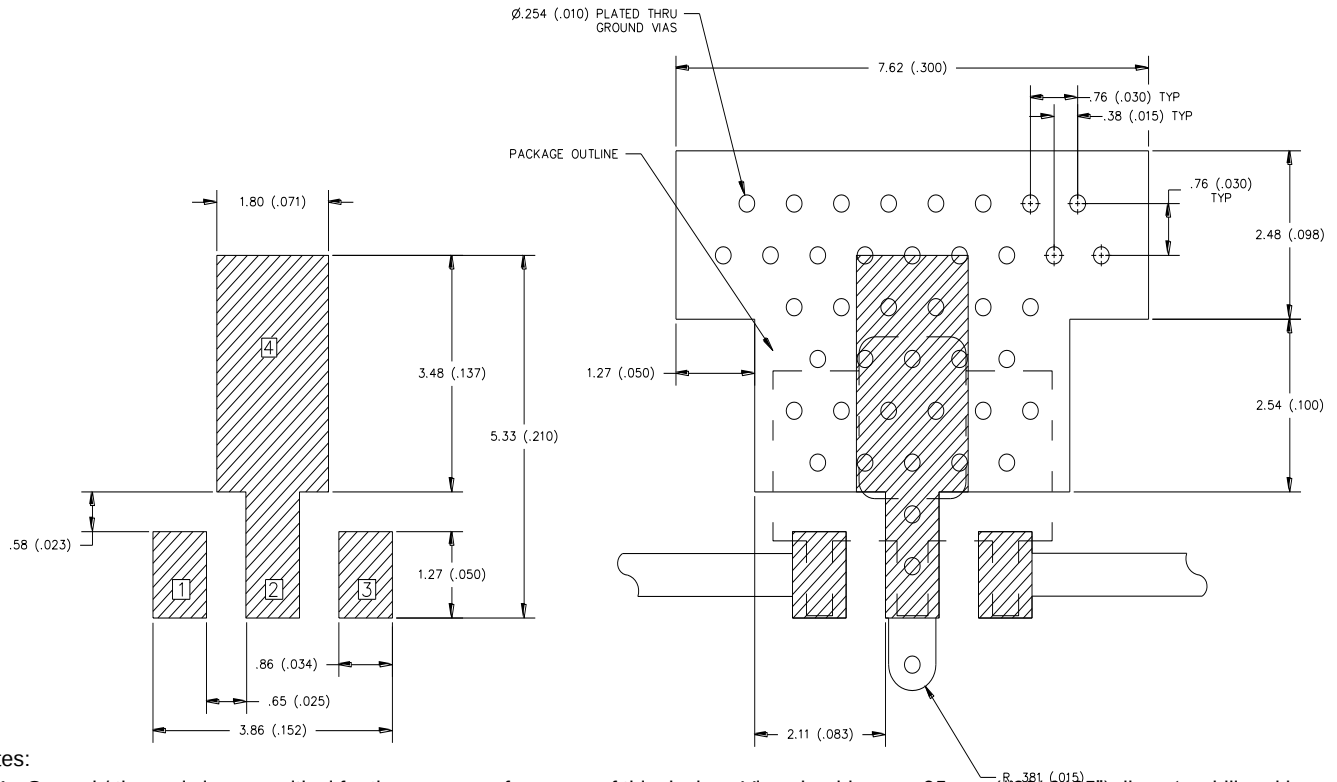


Package Marking



Line 1 – Part Number
Line 2 – Short Trace Code (Upto 4 Characters)
Trace Code to be assigned by Sub Con

PCB Mounting Pattern



Notes:

1. Ground / thermal vias are critical for the proper performance of this device. Vias should use a .35 mm (#80/.0135") diameter drill and have a final, plated thru diameter of .25 mm (.010").
2. Add as much copper as possible to inner and outer layers near the part to ensure optimal thermal performance.
3. RF trace width depends upon the PC board material and construction.



TAT7457

75Ω pHEMT Adjustable Gain RF Amplifier

Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	Class 1A (500V)	ESDA / JEDEC-A114
ESD – Charged Device Model (CDM)	Class 3 (1000V)	JEDEC JESD22-C101F
MSL1 – Moisture Sensitivity Level	Level 1	IPC/JEDEC J-STD-020



Caution!
ESD-Sensitive Device

Solderability

Compatible with both lead-free (260 °C max. reflow temp.) and tin/lead (245 °C max. reflow temp.) soldering processes.
Solder profiles available upon request.

Contact plating: Matte Sn

RoHS Compliance

This part is compliant with 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment) as amended by Directive 2015/863/EU.

This product also has the following attributes:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A (C₁₅H₁₂Br₄O₂) Free
- PFOS Free
- SVHC Free



Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

Tel: 1-844-890-8163

Web: www.qorvo.com

Email: customer.support@qorvo.com

Important Notice

The information contained herein is believed to be reliable; however, Qorvo makes no warranties regarding the information contained herein and assumes no responsibility or liability whatsoever for the use of the information contained herein. All information contained herein is subject to change without notice. Customers should obtain and verify the latest relevant information before placing orders for Qorvo products. The information contained herein or any use of such information does not grant, explicitly or implicitly, to any party any patent rights, licenses, or any other intellectual property rights, whether with regard to such information itself or anything described by such information. **THIS INFORMATION DOES NOT CONSTITUTE A WARRANTY WITH RESPECT TO THE PRODUCTS DESCRIBED HEREIN, AND QORVO HEREBY DISCLAIMS ANY AND ALL WARRANTIES WITH RESPECT TO SUCH PRODUCTS WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

Without limiting the generality of the foregoing, Qorvo products are not warranted or authorized for use as critical components in medical, life-saving, or life-sustaining applications, or other applications where a failure would reasonably be expected to cause severe personal injury or death.

Copyright 2019 © Qorvo, Inc. | Qorvo is a registered trademark of Qorvo, Inc.