TAT8857A1H

CATV Doubler – Hybrid RFIC

Applications

- CATV Line Amplifiers
- CATV System Amplifiers
- Distribution Nodes
- Green Applications

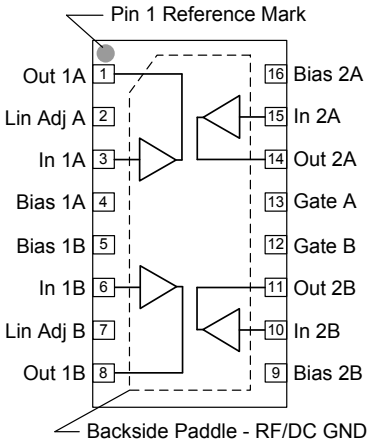


SOIC-16 Wide Package

Product Features

- 75 Ω, 40-1000 MHz Bandwidth
- GaAs pHEMT & MESFET Technology
- User configurable gain: 21 - 27 dB
- Integrated linearization
- Flexible bias voltage and current for optimum efficiency
- SOIC-16 Wide Package

Functional Block Diagram



General Description

The TAT8857A1H is a cost effective 75 Ω RFIC Amplifier designed for use in Doubler CATV applications up to 1000 MHz. It works with readily available SMT baluns and transformers to provide a highly flexible low cost replacement for traditional hybrids.

Gain of the TAT8857A1H may be easily adjusted by varying external components, allowing for a family of Doubler solutions to be developed from a single RFIC.

The TAT8857A1H provides integrated linearization to improve the 3rd order distortion performance.

The TAT8857A1H may be protected against transient surges with the TQP200002 and an output high pass filter network. Consult TriQuint for discussion.

The TAT8857A1H supports traditional 24 V and 12 V supply voltages. Bias current may be adjusted to suit particular requirements with standard or active biasing approaches. Consult TriQuint for further discussion.

Pin Configuration

Pin No.	Label	Pin No.	Label
1	OUT 1A	10	IN 2B
2	LIN ADJ A	11	OUT 2B
3	IN 1A	12	GATE B
4	BIAS 1A	13	GATE A
5	BIAS 1B	14	OUT 2A
6	IN 1B	15	IN 2A
7	LIN ADJ B	16	BIAS 2A
8	OUT 1B	Backside Paddle	RF/DC GND
9	BIAS 2B		

Ordering Information

Part No.	Description
TAT8857A1H	CATV Doubler RFIC
TAT8857A1H-PCB 24V	40-1000 MHz Eval. Board
TAT8857A1H-PCB 12V	40-1000 MHz Eval. Board

Standard T/R size = 1000 pieces on a 7” x 12mm reel

© 2013 TriQuint

Absolute Maximum Ratings

Parameter	Rating
Storage Temperature	−65 to 150°C

Operation of this device outside the parameter ranges given above may cause permanent damage.

Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
Supply Voltage (V_{CC})		24		V
I_{CC}		350		mA
T_{CASE}	−20		+115	°C
T_J (for >10^6 hours MTTF)			+150	°C

Electrical performance is measured and guaranteed under conditions noted in the electrical specifications table. Specifications are not guaranteed over all recommended operating conditions.

Electrical Specifications

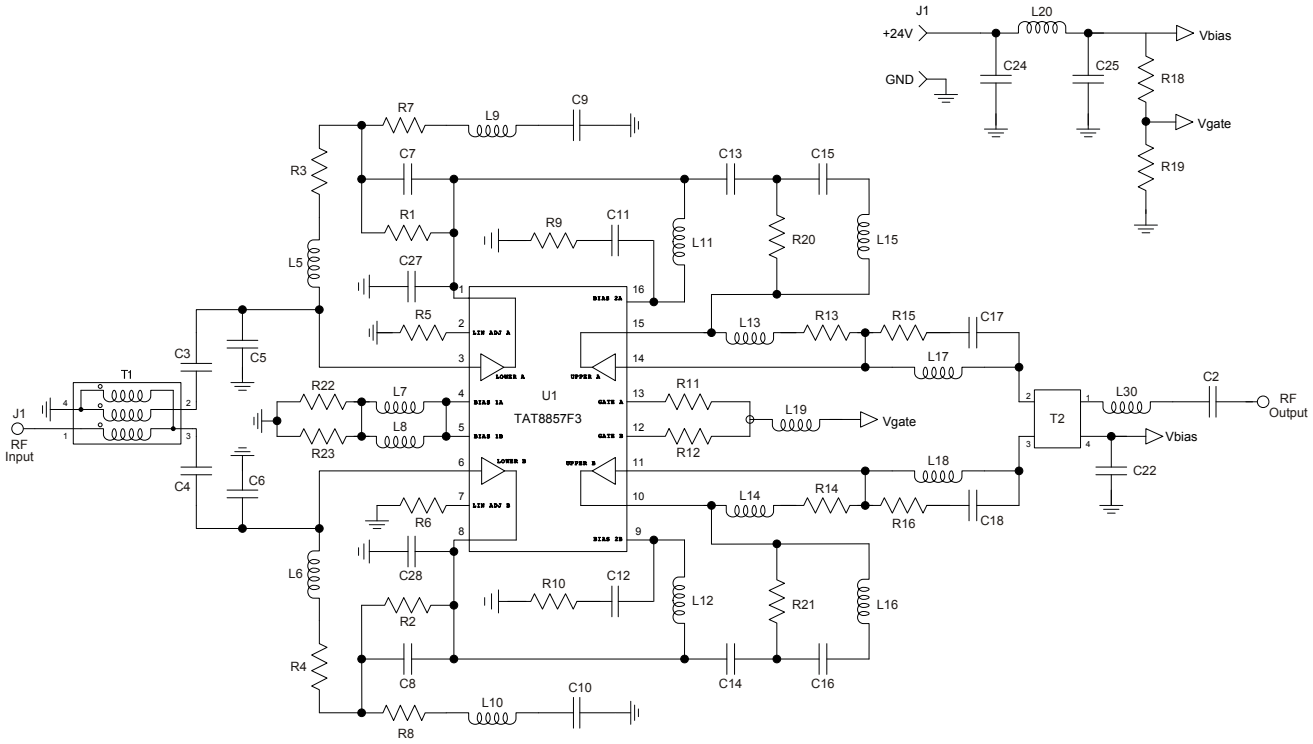
Test conditions unless otherwise noted: V_{CC} =+24V, Temp= +25°C, 75 Ω system.

Parameter	Conditions	Min	Typ	Max	Units
Operational Frequency Range		40		1000	MHz
Test Frequency			40		MHz
Gain			25		dB
Input Return Loss			18		dB
Output Return Loss			17		dB
Output P1dB	f= 500 MHz		31		dBm
Output IP3	f1=225 MHz, f2=325 MHz, Pout= +15 dBm/tone		52		dBm
Composite Triple Beat (1)			-73		dBc
Composite Second Order (1)			-74		dBc
Composite Intermodulation Noise (1)			60		dB
XMOD (1)			-68		dBc
Noise Figure			4.0		dB
V_{bias}			24		V
I_{DD} (2)			350		mA
Thermal Resistance, θ_{jc}	Module (junction to case)		3.4		°C/W

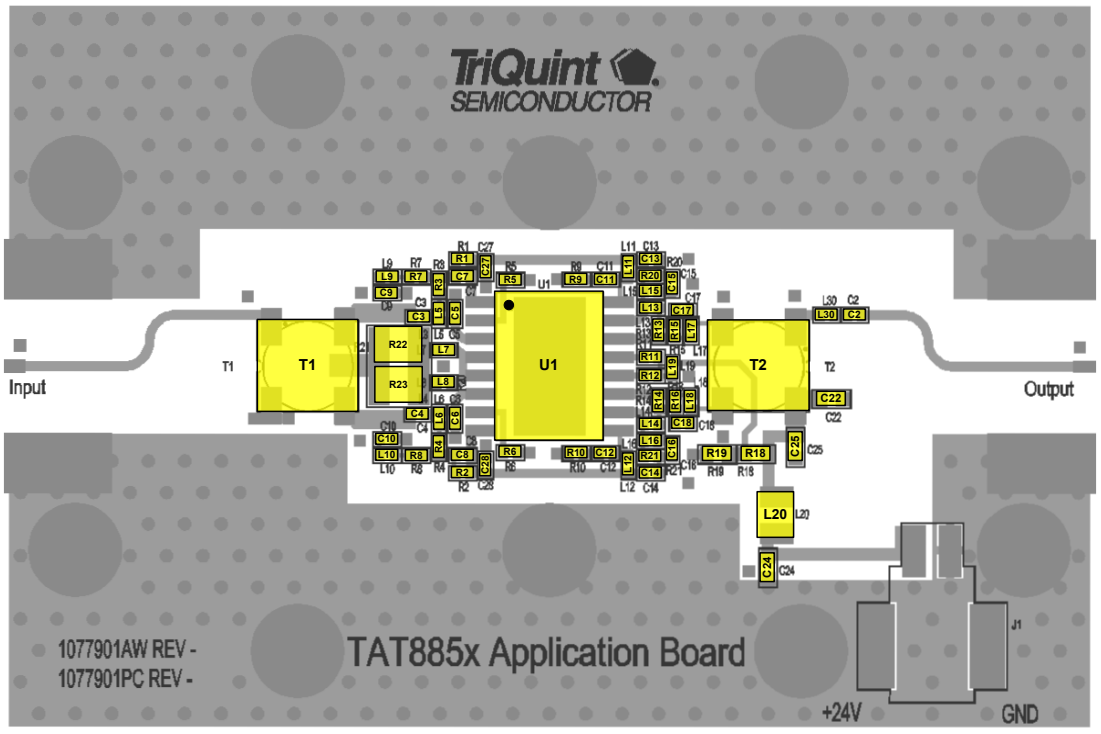
Notes:
1. 79ch. NTSC + QAM (6dB offset) to 1003.25 MHz, 13dB uptilt from 55.25 MHz to 1003.25 MHz, 40 dBmV/ch at 55.25 MHz and the equivalent of 53 dBmV/ch at 1003.25 MHz.
2. Active biasing is easily implemented with traditional dual-pnp approaches. Biasing at 12 V is also possible.

© 2013 TriQuint

TAT8857A1H-PCB Evaluation Board V_{CC} = 24V



TAT8857A1H-PCB Evaluation Board Layout V_{CC} = 24V



© 2013 TriQuint

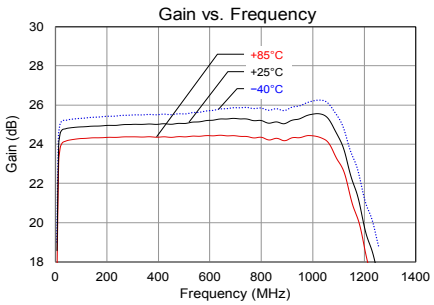
Bill of Material – TAT8857A1H-PCB V_{CC} = 24V

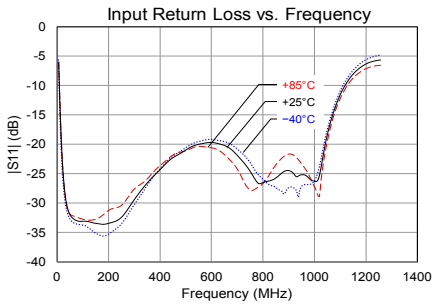
Reference Des.	Value	Description	Manuf.	Part Number
n/a	n/a	Printed Circuit Board	TriQuint	1077901
U1	n/a	TAT8857 CATV Doubler, SOIC-16	TriQuint	TAT6281
T1	n/a	TX Line Transformer, 3rd winding, 1:1	Macom	MABA-009210-CT1760
T2	n/a	TX Line Transformer, Special, 2:1	Macom	MABA-007681-CT2010
			Mini-Circuits	TRS2-1T-1+
C5, C6	1.8 pF	CAP 0402, ± 0.1pF, 50V, NPO	TDK	C1005C0G1H1R8B
C27, C28	0.7 pF	CAP 0402, ± 0.075pF, 25V, NPO	Panasonic	ECD-G0ER709
C17, C18	0.5 pF	CAP 0402, ± 0.25pF, 50V, NPO/COG	Murata	GRM1555C1HR50CZ01D
C15, C16	2.2 pF	CAP 0402, ± 0.25pF, 50V, NPO/COG	Murata	GRM1555C1H2R2CZ01D
C24, C25	0.033 uF	CAP 0603, 10%, 50V, X7R	AVX	06035C333KAZ2A
C2, C3, C4, C7, C8, C11, C12	0.01 uF	CAP 0402, 10%, 50V, X7R	various	
C9, C10	82 pF	CAP 0402, 5%, 50V, NPO/COG	Murata	GRM1555C1H820JZ01D
C13, C14	330 pF	CAP 0402, 5%, 50V, NPO/COG	TDK	CGA2B2C0G1H331J
C22	0.01 uF	CAP 0603, 10%, 50V, X7R	AVX	06035C103KAT2A
L11, L12	470 nH	IND 0402, 5%	CoilCraft	0402AF-471XJLU
L15, L16	9 nH	IND 0402, 5%	CoilCraft	0402CS-9NXJLW
L17, L18	8.2 nH	IND 0402, 5%	CoilCraft	0402CS-8N2JLW
L30	3.9 nH	IND 0402, 5%	CoilCraft	0402CS-3N9XJLW
L20	900 nH	IND 1008, 10%	CoilCraft	1008AF-901XKLC
L5, L6	15 nH	IND 0402, 5%	CoilCraft	0402CS-15NXJL
L13, L14	27 nH	IND 0402, 5%	CoilCraft	0402CS-27NXJL
L7, L8, L19	600 Ω	RES 0402, 300mA bead	Murata	BLM15BD601SN1
L9, L10	82 nH	IND 0402, 5%	CoilCraft	0402CS-82NXJLU
R1, R2	27 kΩ	RES 0402, 1%, 50V, 1/16W	various	
R11, R12	18.2 Ω	RES 0402, 1%, 50V, 1/10W	various	
R13, R14	1.3 kΩ	RES 0402, 1%, 50V, 1/16W	various	
R18	2.7 kΩ	RES 0603, 1%, 75V, 1/10W	various	
R19	2.0 kΩ	RES 0603, 1%, 75V, 1/10W	various	
R3, R4	390 Ω	RES 0402, 1%, 50V, 1/10W	various	
R5, R6	8.06 kΩ	RES 0402, 1%, 50V, 1/10W	various	
R15, R16	43 Ω	RES 0402, 1%, 50V, 1/10W	various	
R7, R8	180 Ω	RES 0402, 1%, 50V, 1/16W	various	
R9, R10	100 Ω	RES 0402, 1%, 50V	various	
R20, R21	33 Ω	RES 0402, 1%, 50V, 1/16W	various	
R22, R23	5.1 Ω	RES 1210, 5%, 1/2W	various	

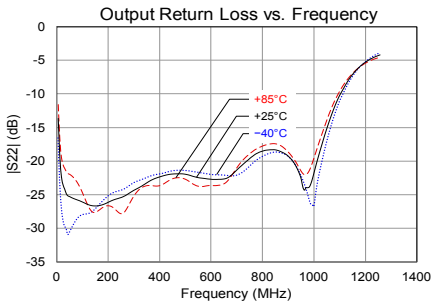
© 2013 TriQuint

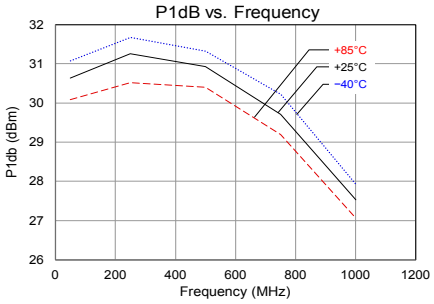
Performance Plots – TAT8857A1H-PCB V_{CC} = 24V

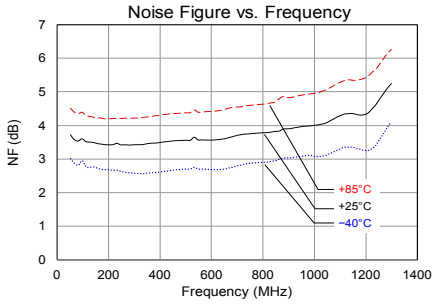
Test conditions unless otherwise noted: V_{CC}=+24 V, I_{DD} = 350 mA, T_{CASE} = +25°C, 75 Ω system

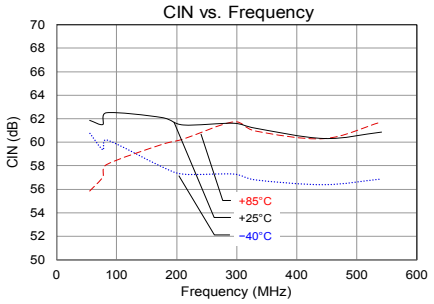


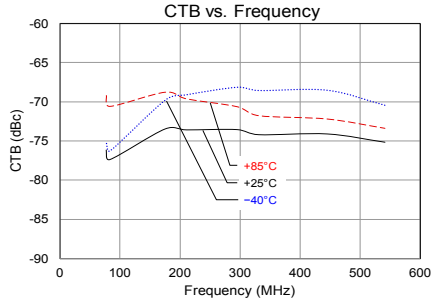


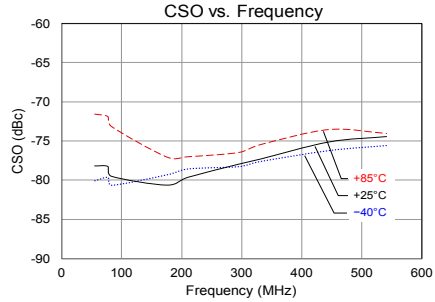


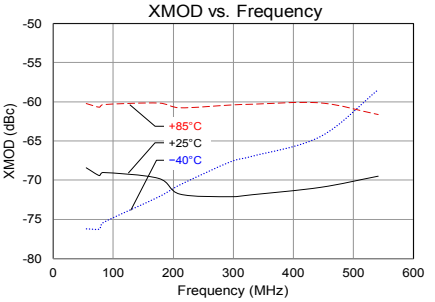










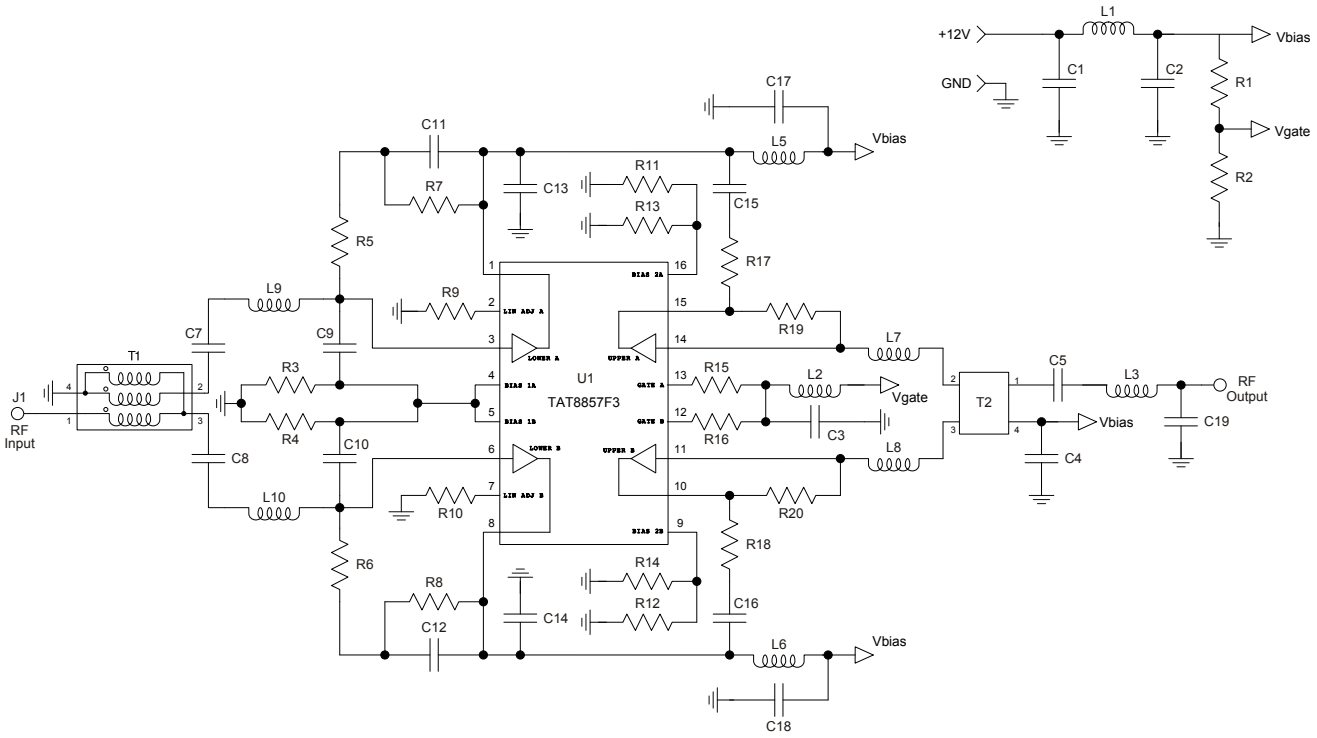


Notes:

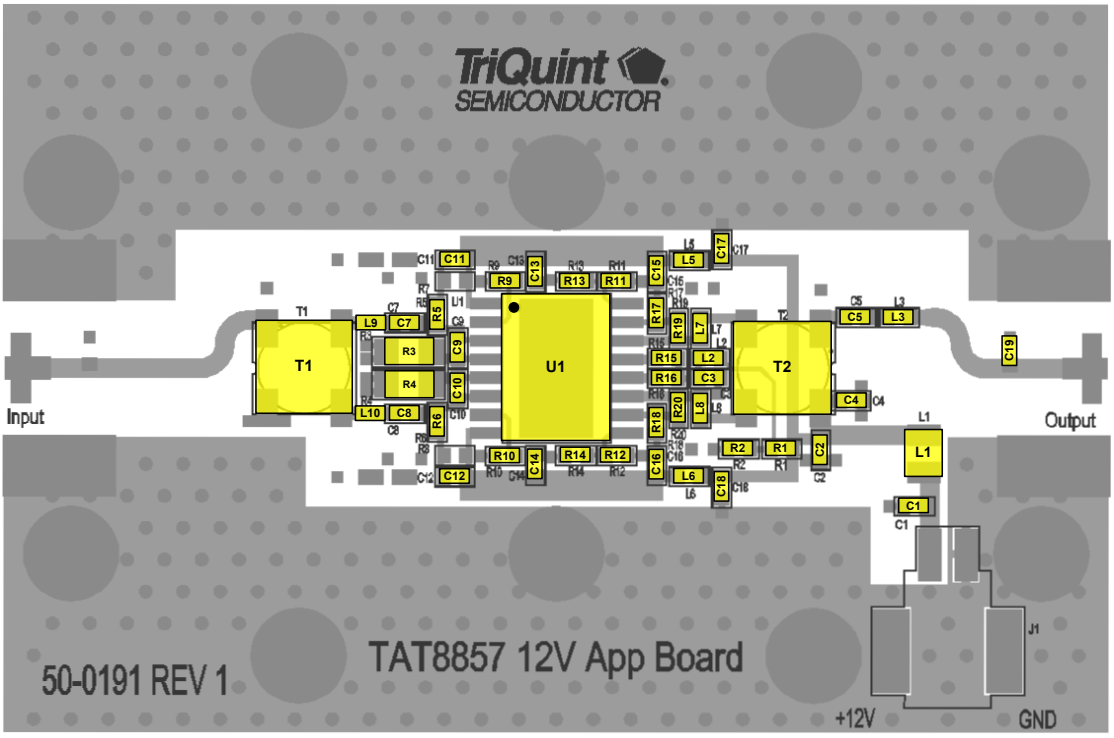
1. CIN, CTB, CSO, XMOD test conditions: 79ch. NTSC + QAM (6dB offset) to 1003.25MHz
   13dB uptilt from 55.25MHz to 1003.25MHz,
   40dBmV/ch at 55.25 MHz and the equivalent of 53 dBmV/ch at 1003.25 MHz

© 2013 TriQuint

TAT8857A1H-PCB Evaluation Board V_{CC} = 12V



TAT8857A1H-PCB Evaluation Board Layout V_{CC} = 12V



© 2013 TriQuint

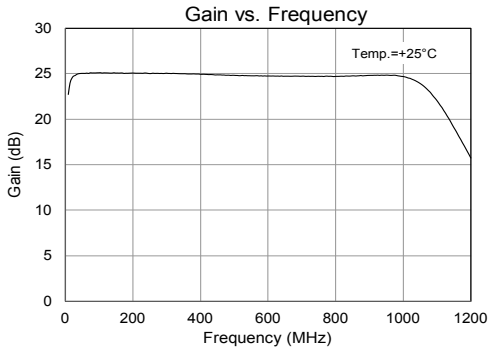
Bill of Material – TAT8857A1H-PCB V_{CC} = 12V

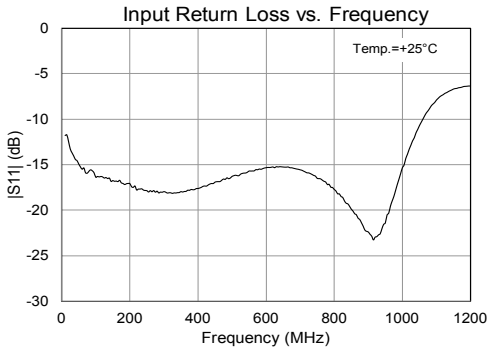
Reference Des.	Value	Description	Manuf.	Part Number
n/a	n/a	Printed Circuit Board	TriQuint	1077901
U1	n/a	TAT8857 CATV Doubler, SOIC-16	TriQuint	TAT8857
T1	n/a	TX Line Transformer, 3rd winding, 1:1	Macom	MABA-08483-CT1760
T2	n/a	TX Line Transformer, Special, 2:1	Macom	MABA-007681-CT2010
			Mini-Circuits	TRS2-1T-1+
L1	910 nH	Ind 1008 ±10% 1400mA	Coil Craft	1008AF-901XKLC
L2	600 Ω	Ferrite Bead 0603 100mA	Murata	BLM18HD601SN1
L3	3.9 nH	Ind 0603 ±5%	Coil Craft	0603CS-3N9XJL
L5, L6	560 nH	Ind 0603 ±5% 530mA	Coil Craft	0603AF-561XJR
L7, L8	11 nH	Ind 0603 ±5% 700mA	Coil Craft	0603CS-11NXJL
L9, L10	2.2 nH	Ind 0603 ±5% 100 mA	Coil Craft	0603CS-2N2XJL
C1, C2	0.033 uF	Cap 0603 ±10% 50V X7R	AVX	06035C333KAZ2A
C3	100 pF	Cap 0603 ±5% 50V NPO/COG	AVX	06035A101JAT2A
C4, C5, C7, C8, C11, C12, C17, C18	0.01 uF	Cap 0603 ±5% 50V X7R	AVX	06035C103JAT2A
C9, C10	3.3 pF	Cap 0603 ±0.1pF 50V	AVX	06035J3R3BBSTR
C13, C14	2.7 pF	Cap 0603 ±0.1pF 200V NPO/COG	AVX	06032U2R7BAT2A
C15, C16	330 pF	Cap 0603 ±5% 50V NPO/COG	AVX	06035A331JAT2A
C19	0.5 pF	Cap 0603 ±0.05pF 50V NPO/COG	AVX	06035J0R5ABSTR
R1	2.70 KΩ	Res 0603 ±1% 1/10W	various	
R2	680 Ω	Res 0603 ±1% 1/10W	various	
R3, R4	20.0 Ω	Res 1206 ±1% 1/4W	various	
R5, R6	220 Ω	Res 0603 ±1% 1/10W	various	
R7, R8	n/a	DNP		
R9, R10	3.09 KΩ	Res 0603 ±1% 1/10W	various	
R11, R12, R13, R14	6.80 Ω	Res 0603 ±1% 1/10W	various	
R15, R16	33.0 Ω	Res 0603 ±1% 1/10W	various	
R17, R18	5.10 Ω	Res 0603 ±1% 1/10W	various	
R19, R20	909 Ω	Res 0603 ±1% 1/10W	various	

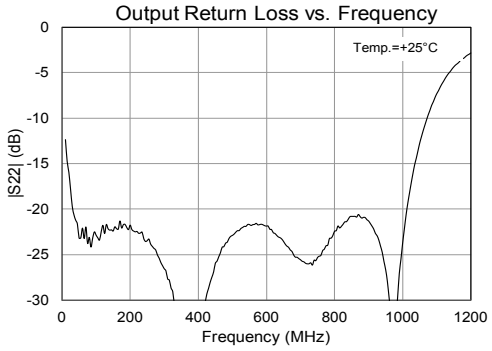
© 2013 TriQuint

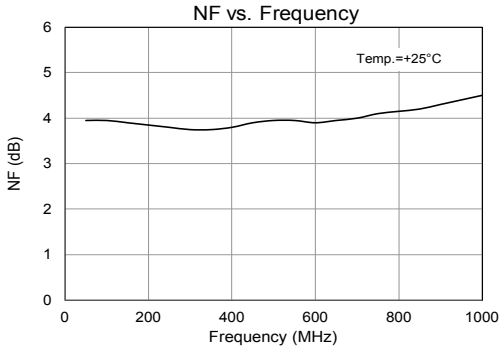
Performance Plots – TAT8857A1H-PCB V_{CC} = 12V

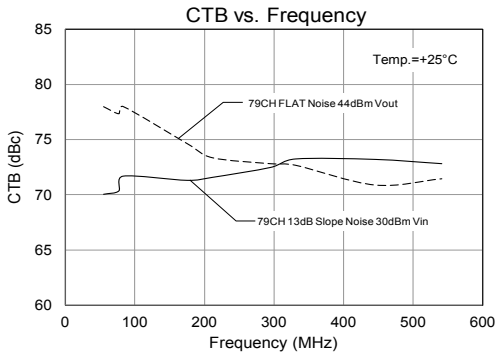
Test conditions unless otherwise noted: V_{CC}=+12 V, I_{DD} = 350 mA, T_{CASE} = +25°C, 75 Ω system

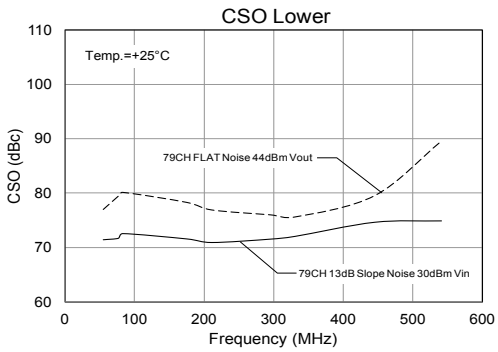


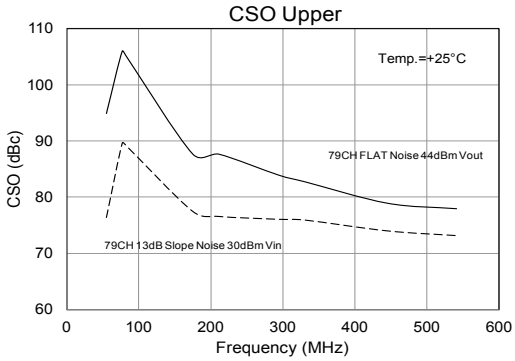












© 2013 TriQuint

Detailed Device Description

The TAT8857A1H is similar to other parts offered on the market; it contains two separate amplifiers. A major difference is the TAT8857A1H allows much flexibility to set gain and bias to cover multiple applications without an additional stage. This makes it ideal for green designs. It uses a cost effective high voltage MESFET technology (designed for CATV) and a pHEMT process (developed for high-volume applications). On-chip linearization is also utilized.

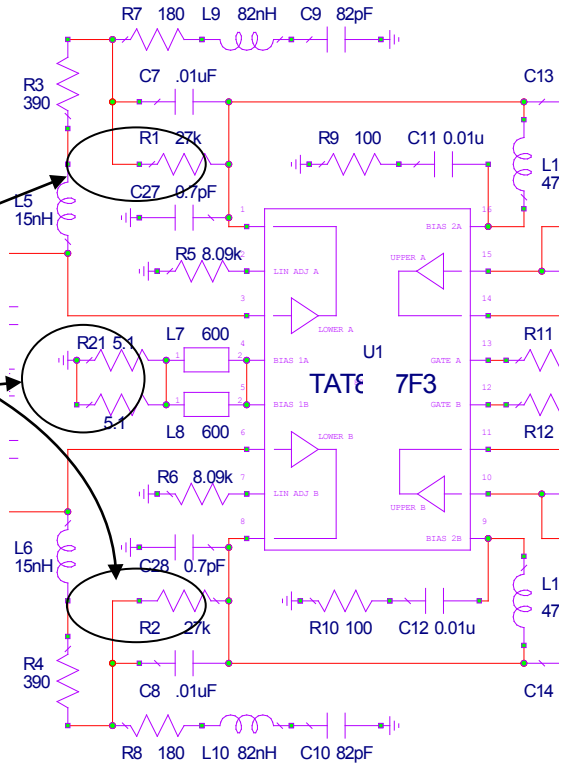
Bias Current Adjustment

Bias current is determined by 2 settings:

1. Size of DC feedback resistors - decreasing R1 & R2 will increase IDD
2. Tail resistors - decreasing R21 will increase IDD, but lead to wider variations

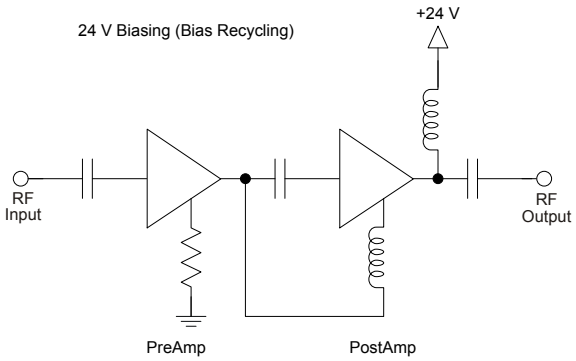
Active biasing schemes are possible but not necessary for most applications.

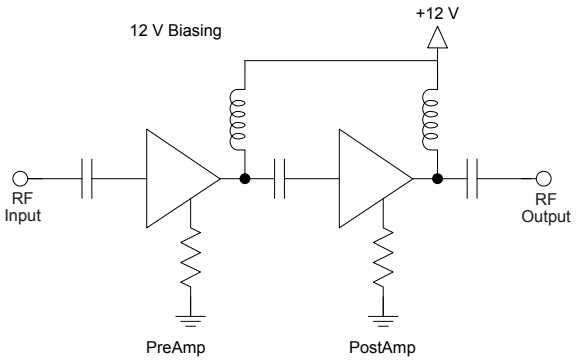
Best performance is with IDD = 350mA



Voltage Biasing: 24V and 12V

The TAT8857A1H has two amplifiers which can be configured to split a 24 V supply (and share the same current) or both amplifiers can be biased from a 12V supply and draw current independently.





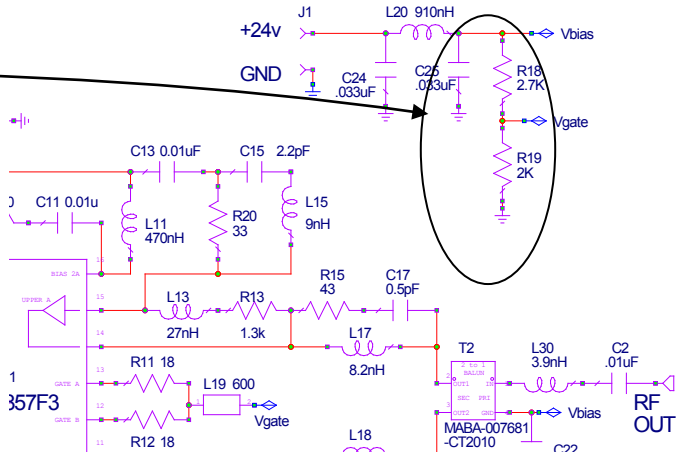
© 2013 TriQuint

Detailed Device Description (contd.)

For 24 V operation, select values for the resistor divider network (R18,R19) that will yield the desired gate voltage (Vgate).

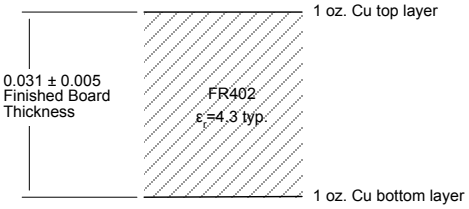
R18 should be restricted to 2.7K Ohms or less to prevent gate leakage currents in the output FET from affecting Vgate.

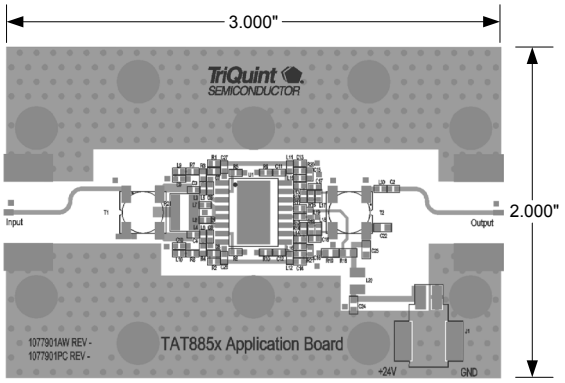
Do not put any capacitance on Vgate as this could result in a turn-on over-voltage condition that could damage the output FET.



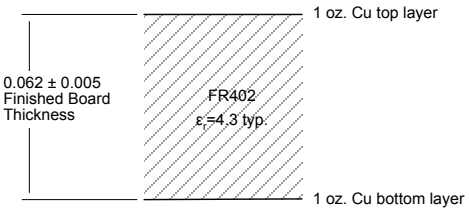
Evaluation Board PCB Information

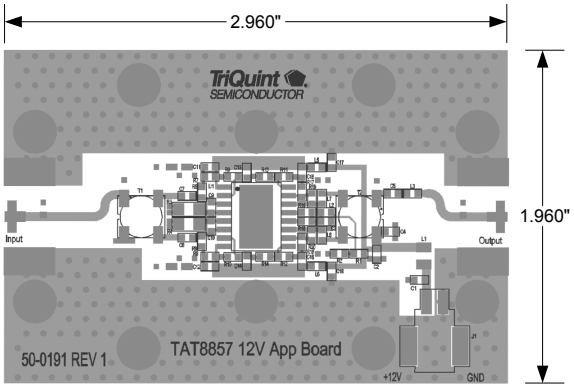
TriQuint PCB 1077901 Material and Stack-up 24 V





TriQuint PCB 50-0191 Material and Stack-up 12 V

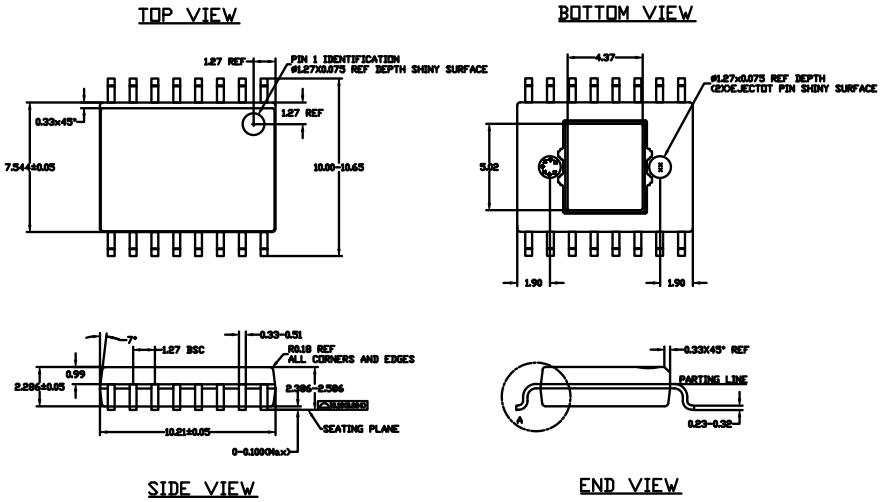




© 2013 TriQuint

Mechanical Information

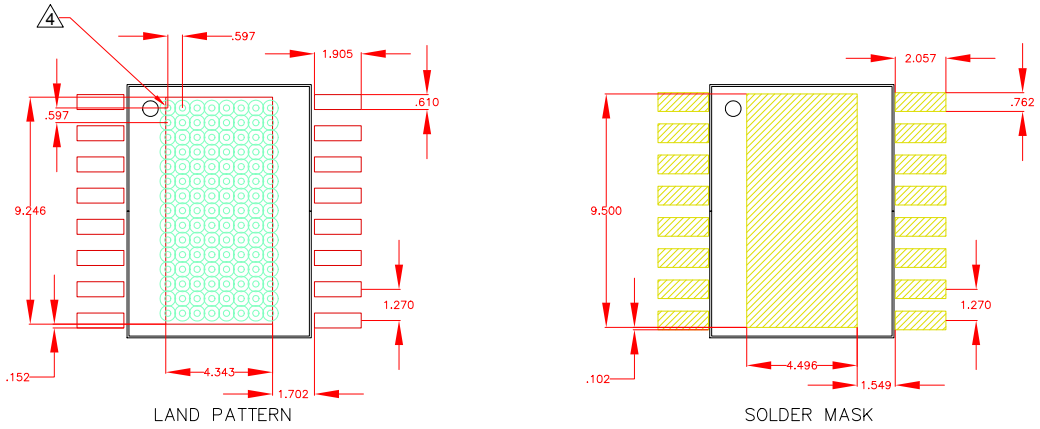
Package Marking and Dimensions



NOTES:

1. All dimensions are in millimeters. Angles are in degrees.
2. Except where noted, this part outline conforms to JEDEC standard MO-220, Issue E (Variation VGGC) for thermally enhanced plastic very thin fine pitch quad flat no lead package (QFN).
3. Dimension and tolerance formats conform to ASME Y14.4M-1994.
4. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012.

PCB Mounting Pattern



Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. Use 1 oz. copper minimum for top and bottom layer metal.
3. A heat sink underneath the area of the PCB for the mounted device is strictly required for proper thermal operation. Damage to the device can occur without the use of one.
4. Vias are required under the backside paddle of this device for proper RF/DC grounding and thermal dissipation.
5. Do not remove or minimize via hole structure in the PCB. Thermal and RF grounding is critical.
6. We recommend a 0.35mm (#80/.0135") diameter bit for drilling via holes and a final plated thru diameter of 0.25 mm (0.10”).
7. Ensure good package backside paddle solder attach for reliable operation and best electrical performance.

© 2013 TriQuint

Product Compliance Information

ESD Sensitivity Ratings



Caution! ESD-Sensitive Device

ESD Rating: Class III
Value: Passes ≥ 500 V
Test: Human Body Model (HBM)
Standard: JEDEC Standard JESD22-A114

MSL Rating

MSL Rating: Level 3
Test: 260°C convection reflow
Standard: JEDEC Standard IPC/JEDEC J-STD-020

Solderability

Compatible with both lead-free (260 °C max. reflow temperature) and tin/lead (245 °C max. reflow temperature) soldering processes.

Contact plating: Matte Tin

RoHs Compliance

This part is compliant with EU 2002/95/EC RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment).

This product also has the following attributes:

- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_4O_2$) Free
- PFOS Free
- SVHC Free

Contact Information

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

Web: www.triquint.com **Tel:** +1.503.615.9000
Email: info-sales@triquint.com **Fax:** +1.503.615.8902

For technical questions and application information:

Email: sjcapplications.engineering@triquint.com

Important Notice

The information contained herein is believed to be reliable. TriQuint makes no warranties regarding the information contained herein. TriQuint assumes no responsibility or liability whatsoever for any of the information contained herein. TriQuint assumes no responsibility or liability whatsoever for the use of the information contained herein. The information contained herein is provided "AS IS, WHERE IS" and with all faults, and the entire risk associated with such information is entirely with the user. All information contained herein is subject to change without notice. Customers should obtain and verify the latest relevant information before placing orders for TriQuint 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.

TriQuint 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.

© 2013 TriQuint