

Applications

- Base Station Receivers
- Tower Mount Amplifiers
- Balanced Amplifiers
- FDD-LTE, TDD-LTE, WCDMA, CDMA, GSM
- General Purpose Wireless

Product Features

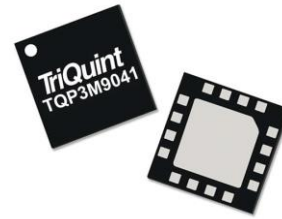
- 0.33 dB NFmin (Single Channel) at 2600 MHz
- 2300–6000 MHz operational bandwidth
- Gain = 18.4 dB at 2600 MHz
- +20.2 dBm Input IP3
- Integrated shut-down biasing feature
- Bias adjustable
- Does not require negative voltage supply
- 4x4 mm 16-pin QFN package

General Description

The TQP3M9041 is a high linearity, ultra low noise figure dual device amplifier in a 4x4 mm package. At 2600 MHz in a balanced configuration, this LNA provides 18.4dB gain, 20.2 dBm IIP3 and 0.8 dB noise figure. The part does not require a negative supply for operation and is bias adjustable for both drain current and voltage. The device is housed in a green/RoHS-compliant industry standard QFN package.

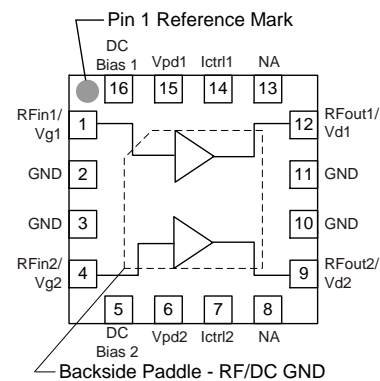
The TQP3M9041 consists of a single monolithic GaAs E-pHEMT die and integrates bias circuitry as well as shut-down capability allowing the LNA to be useful for both FDD and TDD applications.

The TQP3M9041 is optimized for the 2500–2700 MHz band, but can be used outside of the band. TriQuint offers pin-compatible dual LNAs for 500–1500 MHz (TQP3M9039) and 1500–2300 MHz (TQP3M9040). The balanced amplifier is optimized for high performance receivers in wireless infrastructure and can be used for base-station transceivers or tower-mounted amplifiers.



16-pin 4x4 mm QFN Package

Functional Block Diagram



Pin Configuration

| Pin No. | Label |
|-----------------|------------|
| 1 | RFIn1/Vg1 |
| 4 | RFIn2/Vg2 |
| 12 | RFout1/Vd1 |
| 9 | RFout2/Vd2 |
| 2, 3, 10, 11 | Ground |
| 16 | DC Bias 1 |
| 5 | DC Bias 2 |
| 15 | Vpd1 |
| 6 | Vpd2 |
| 14 | Ictrl1 |
| 7 | Ictrl2 |
| Backside Paddle | RF/DC GND |

Ordering Information

| Part No. | Description |
|---------------|--------------------------------|
| TQP3M9041 | 2300–6000 MHz Dual LNA |
| TQP3M9041-PCB | 2500–2700 MHz Evaluation Board |

Standard T/R size = 2500 pieces on a 13" reel

Absolute Maximum Ratings

| Parameter | Rating |
|---|--------------|
| Storage Temperature | -65 to 150°C |
| Drain Voltage (V_d) | +7 V |
| I_d , $V_d = 5V$ (per channel) | 300 mA |
| Input Power (CW) | +22 dBm |
| Input Power (DC OFF condition) | +22 dBm |
| Input Power (DC OFF condition & 10% Duty Cycle) | +30 dBm |

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

Recommended Operating Conditions

| Parameter | Min | Typ | Max | Units |
|--|-----|------|------|-------|
| V_{pd} | 0 | | +5 | V |
| V_g | 0 | +0.5 | +1 | V |
| V_d | +2 | | +5 | V |
| I_d , per channel | | 57 | 80 | mA |
| Operating Temp. Range | -40 | | +105 | °C |
| T_{ch} (for >10 ⁶ hrs MTTF) | | | 190 | °C |

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

Electrical Specifications

Test conditions unless otherwise noted: $V_d = +4.35V$, Temp.=+25°C, tuned balanced configuration. The Noise Figure is de-embedded to the input pin of the input hybrid coupler.

| Parameter | Conditions | Min | Typ | Max | Units |
|--------------------------------------|------------------------------------|------|-------|-------|-------|
| Operational Frequency Range | | 2300 | | 6000 | MHz |
| Test Frequency | | | 2600 | | MHz |
| Gain | | 17.2 | 18.4 | 19.6 | dB |
| Output P1dB | | | +22.5 | | dBm |
| Input IP3 | Pin=-13 dBm/tone, $\Delta f=1$ MHz | +17 | +20.2 | | dBm |
| Output IP3 | Pout=+5 dBm/tone, $\Delta f=1$ MHz | | +38.2 | | dBm |
| Noise Figure | Balanced Configuration | | 0.8 | 1.15 | dB |
| Drain Voltage, V_d | | | +4.35 | | V |
| Drain Current, I_d | Single Channel | 35 | 57 | 80 | mA |
| Power Down Control Voltage, V_{pd} | On-State | 0 | | +0.3 | V |
| | Off-State | +2.1 | | V_d | V |
| Thermal Resistance, θ_{jc} | Junction to case - per channel | | 53 | | °C/W |

De-embedded S-parameters Data

Test conditions unless otherwise noted: $V_{DD}=+4.35$ V, $I_{DD}=57$ mA, $Temp=+25^{\circ}C$, 50 Ohm system

| Freq (MHz) | S11 (dB) | S11 (ang) | S21 (dB) | S21 (ang) | S12 (dB) | S12 (ang) | S22 (dB) | S22 (ang) |
|------------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
| 10 | -0.08 | -1.55 | 31.76 | -178.90 | -65.61 | 72.04 | -3.83 | 5.41 |
| 100 | -0.50 | -10.68 | 32.14 | 166.28 | -52.51 | 55.96 | -1.53 | 2.04 |
| 200 | -1.05 | -19.42 | 31.64 | 151.59 | -49.17 | 66.30 | -1.46 | -2.87 |
| 500 | -3.22 | -37.41 | 28.96 | 121.07 | -42.32 | 70.95 | -1.73 | -10.88 |
| 750 | -4.87 | -45.81 | 26.85 | 104.52 | -39.50 | 69.80 | -1.93 | -16.10 |
| 1000 | -6.16 | -52.39 | 25.05 | 91.86 | -37.11 | 71.15 | -2.08 | -21.29 |
| 1200 | -7.06 | -57.60 | 23.85 | 83.20 | -35.62 | 68.87 | -2.22 | -25.66 |
| 1400 | -7.76 | -62.48 | 22.80 | 75.39 | -34.21 | 67.84 | -2.33 | -30.17 |
| 1600 | -8.45 | -68.59 | 21.91 | 67.93 | -32.82 | 65.63 | -2.46 | -35.08 |
| 1800 | -9.08 | -74.44 | 21.10 | 60.75 | -31.80 | 63.08 | -2.59 | -40.23 |
| 2000 | -9.57 | -82.20 | 20.38 | 53.44 | -30.84 | 60.61 | -2.76 | -46.28 |
| 2200 | -9.79 | -86.21 | 19.63 | 44.72 | -30.49 | 54.60 | -3.25 | -52.79 |
| 2300 | -9.82 | -84.43 | 18.95 | 43.91 | -30.09 | 62.95 | -3.09 | -51.68 |
| 2400 | -9.84 | -91.72 | 18.86 | 41.02 | -29.15 | 59.62 | -2.92 | -56.18 |
| 2500 | -9.86 | -95.33 | 18.62 | 37.63 | -28.66 | 57.75 | -2.94 | -59.74 |
| 2600 | -9.98 | -99.27 | 18.33 | 34.26 | -28.31 | 56.06 | -3.06 | -62.94 |
| 2700 | -9.94 | -103.51 | 18.07 | 31.03 | -27.82 | 54.48 | -3.03 | -66.14 |
| 2800 | -9.88 | -105.66 | 17.80 | 27.96 | -27.46 | 52.93 | -3.01 | -69.18 |
| 3000 | -10.07 | -111.89 | 17.30 | 21.52 | -26.72 | 49.72 | -3.10 | -75.44 |
| 3200 | -10.20 | -114.68 | 16.77 | 15.32 | -26.10 | 46.67 | -3.14 | -81.16 |
| 3400 | -9.85 | -121.75 | 16.42 | 10.10 | -25.13 | 44.73 | -3.09 | -86.87 |
| 3600 | -10.15 | -126.13 | 16.07 | 3.95 | -24.62 | 40.82 | -3.18 | -92.92 |
| 3800 | -10.35 | -131.51 | 15.70 | -2.03 | -23.94 | 38.08 | -3.26 | -98.91 |
| 4000 | -11.47 | -137.19 | 15.37 | -6.61 | -23.29 | 36.19 | -3.23 | -99.29 |
| 4250 | -11.77 | -148.96 | 15.01 | -14.80 | -22.49 | 31.20 | -3.43 | -107.68 |
| 4500 | -12.31 | -165.19 | 14.67 | -23.65 | -21.74 | 24.83 | -3.83 | -116.92 |
| 4750 | -14.33 | 173.97 | 14.14 | -33.60 | -21.58 | 15.26 | -4.72 | -126.02 |
| 5000 | -13.32 | -164.72 | 13.63 | -35.01 | -21.34 | 29.91 | -3.76 | -126.65 |
| 5250 | -11.33 | 158.91 | 13.84 | -46.81 | -19.30 | 17.10 | -4.12 | -145.25 |
| 5500 | -10.50 | 136.31 | 13.58 | -57.49 | -18.52 | 8.06 | -4.70 | -160.18 |
| 5750 | -9.39 | 120.64 | 13.11 | -67.85 | -17.91 | 0.21 | -5.11 | -175.27 |
| 6000 | -7.88 | 105.14 | 12.50 | -78.40 | -17.38 | -8.68 | -5.53 | 168.20 |

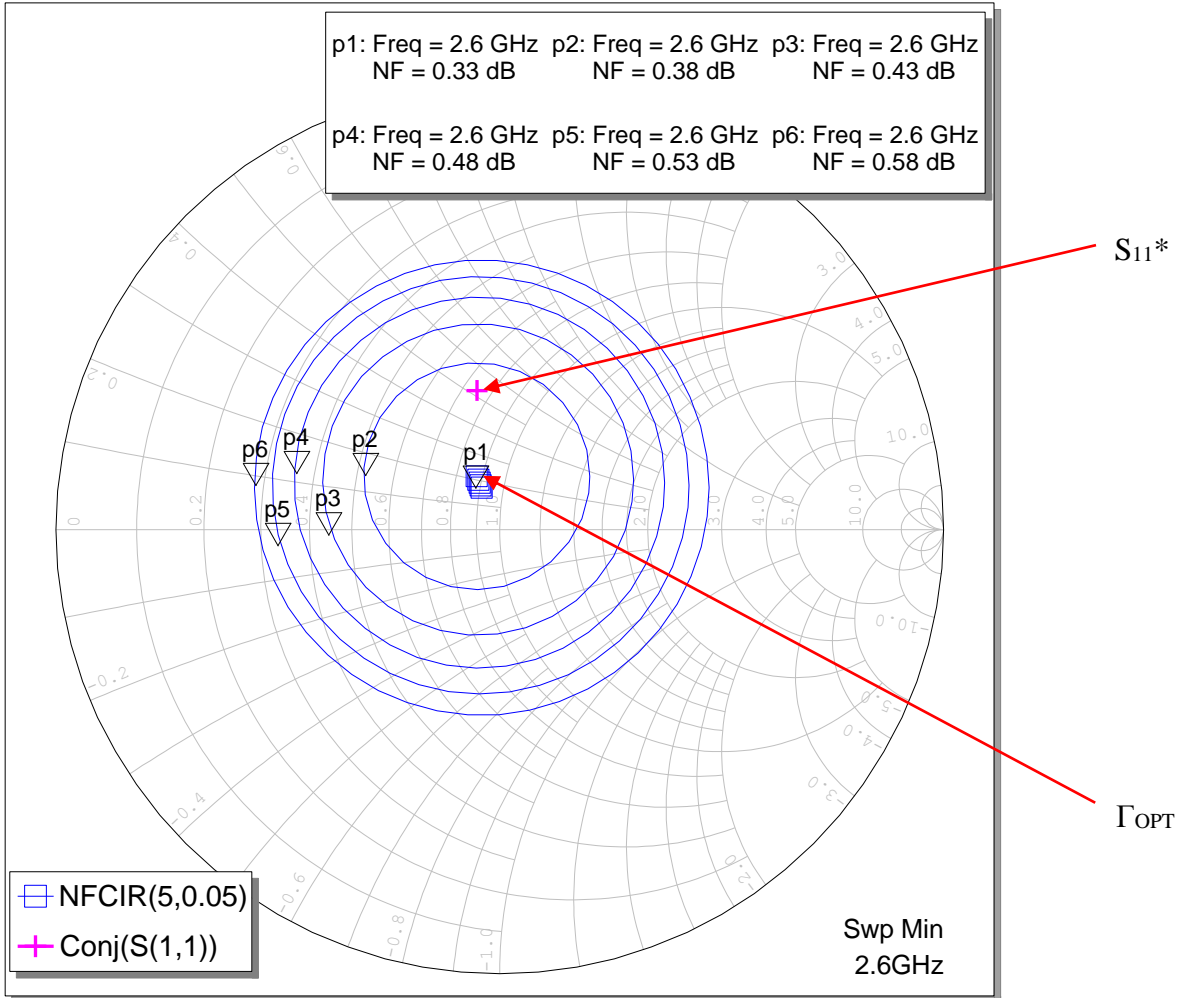
Noise Parameters

Test conditions unless otherwise noted: $V_{DD}=+4.35$ V, $I_{DD}=57$ mA, $Temp=+25^{\circ}C$, 50 Ohm system

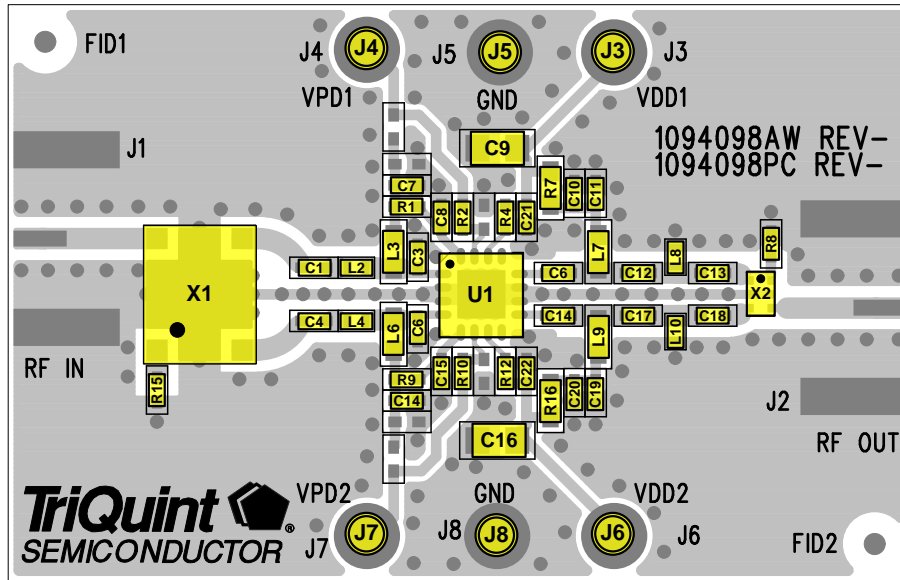
| Freq (GHz) | NF _{min} (dB) | Γ_{Opt} (mag) | Γ_{Opt} (deg) | Rn (Ω) |
|------------|------------------------|----------------------|----------------------|-----------------|
| 2 | 0.16 | 0.16 | 57.92 | 0.05 |
| 2.1 | 0.21 | 0.17 | 71.64 | 0.05 |
| 2.2 | 0.30 | 0.20 | 53.88 | 0.07 |
| 2.3 | 0.24 | 0.15 | 84.16 | 0.05 |
| 2.35 | 0.27 | 0.13 | 97.19 | 0.05 |
| 2.4 | 0.29 | 0.13 | 101.49 | 0.05 |
| 2.5 | 0.32 | 0.13 | 117.86 | 0.05 |
| 2.6 | 0.33 | 0.14 | 113.34 | 0.04 |
| 2.7 | 0.34 | 0.12 | 112.27 | 0.05 |
| 2.8 | 0.38 | 0.10 | 141.65 | 0.05 |
| 2.9 | 0.38 | 0.11 | 153.72 | 0.05 |
| 3 | 0.53 | 0.13 | -152.67 | 0.06 |
| 3.2 | 0.64 | 0.03 | 89.21 | 0.06 |
| 3.4 | 0.56 | 0.09 | 176.76 | 0.06 |
| 3.6 | 0.54 | 0.16 | -105.65 | 0.07 |
| 3.8 | 0.64 | 0.17 | -130.46 | 0.08 |
| 4 | 0.62 | 0.16 | -127.44 | 0.06 |

Noise Figure Circles at 2600 MHz

Noise parameter measurements taken at the package pin reference plane. The gate and drain are biased externally through bias-tees. The achievable NFmin will worsen with on board non-ideal bias circuit.



TQP3M9041-PCB Evaluation Board (2500–2700 MHz)



See Evaluation Board PCB Information section for PCB material and stack-up.

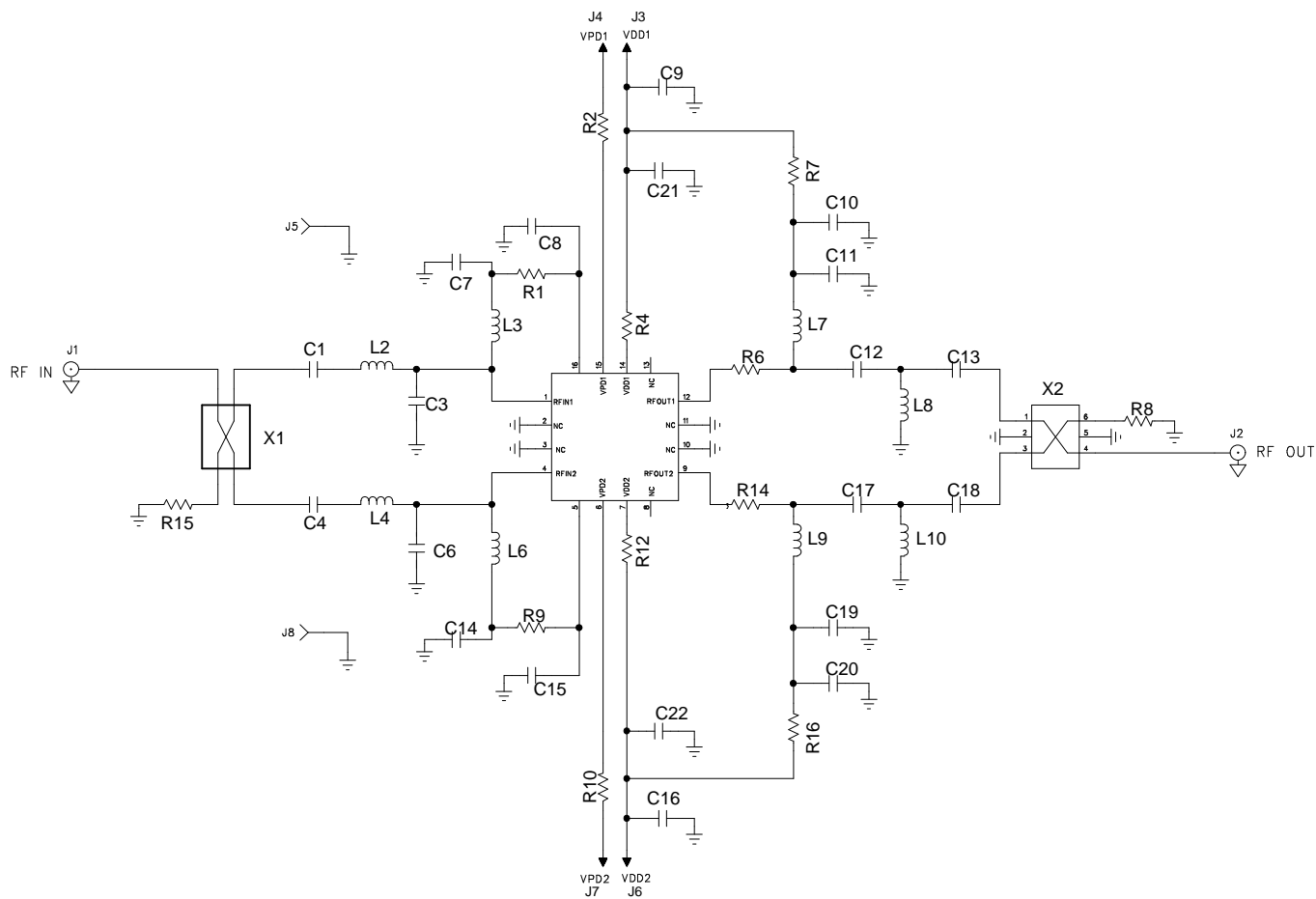
Bill of Material – TQP3M9041-PCB

| Reference Des. | Value | Description | Manuf. | Part Number |
|--------------------------|---------|----------------------------|-----------|----------------|
| U1 | n/a | Dual LNA | TriQuint | TQP3M9041 |
| X1 | n/a | Hybrid Coupler | Anaren | X3C26P1-03S |
| X2 | n/a | Hybrid Coupler | Anaren | C2327J5003AHF |
| R1, R9 | 330 Ω | RES, 0402, +/-5%, 1/10W | Various | |
| R8, R15 | 51 Ω | RES, 0402, +/-5%, 1/10W | Various | |
| R4, R12 | 2.7K Ω | RES, 0402, +/-5%, 1/10W | Various | |
| R7, R16 | 6.8 Ω | RES, 0603, +/-5%, 1/8W | Various | |
| R2, R6, R10, R14, L2, L4 | 0 Ω | RES, 0402, +/-5%, 1/10W | Various | |
| C1, C4, C7, C14 | 22 pF | CAP, 0402, +/-5%, 50V | Panasonic | ECJ-0EC1H220J |
| C11, C19, C21, C22 | 100 pF | CAP, 0402, +/-5%, 50V | Panasonic | ECJ-0EC1H101J |
| C9, C16 | 0.01 uF | CAP, 0805, +/-5%, 50V, X7R | Various | |
| C10, C20 | 1000 pF | CAP, 0402, +/-10%, 50V | Various | |
| C12, C13, C17, C18 | 1 pF | CAP, 0402, +/-0.05pF, 25V | AVX | 04023J1R0ABSTR |
| L3, L6, L7, L9 | 47 nH | IND, 0603, +/-5%, 600mA | Coilcraft | 0402CS-1N2XJL |
| L8, L10 | 2.2 nH | IND, 0402, +/-5% | Coilcraft | 0603CS-47NXJL |
| C3, C6, C8, C15 | DNP | | | |

Notes:

1. R2, R6, R10, and R14 may be replaced with metal trace in target applications.
2. L2 and L4, or an equivalent transmission line length, are required for impedance matching.

Application Circuit – TQP3M9041-PCB



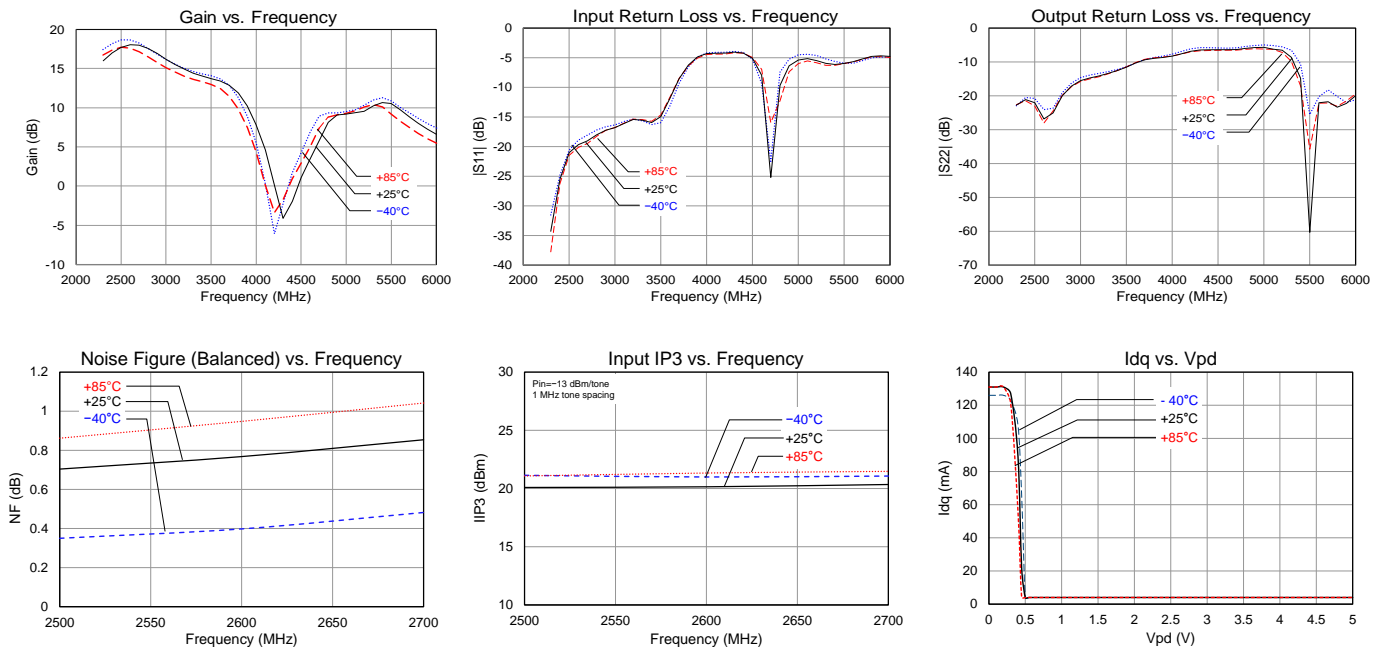
Typical Performance (Balanced Configuration)

Test conditions unless otherwise noted: $V_d = +4.35\text{ V}$, $I_d = 57\text{ mA}$, $\text{Temp.} = +25^\circ\text{C}$. NF is de-embedded to the input pin of the input hybrid coupler.

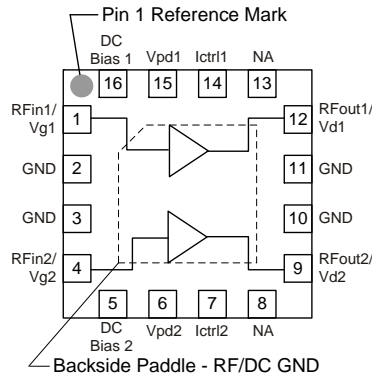
| Parameter | Typical Value | | | Units |
|---|---------------|-------|-------|-------|
| Frequency | 2500 | 2600 | 2700 | MHz |
| Gain | 18.1 | 18.1 | 17.7 | dB |
| Noise Figure | 0.7 | 0.77 | 0.85 | dB |
| Input Return Loss | 22 | 19 | 18 | dB |
| Output Return Loss | 22 | 29 | 26 | dB |
| Output P1dB | +22.6 | +22.5 | +22.5 | dBm |
| IIP3 (Pin/tone = -13 dBm, $\Delta f = 1\text{ MHz}$) | +20.1 | +20.2 | +20.3 | dBm |

Performance Plots (Balanced Configuration)

Test conditions unless otherwise noted: $V_d = +4.35\text{ V}$, $I_d = 57\text{ mA}$, $\text{Temp.} = +25^\circ\text{C}$



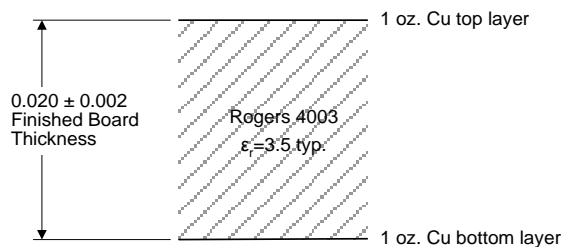
Pin Configuration and Description



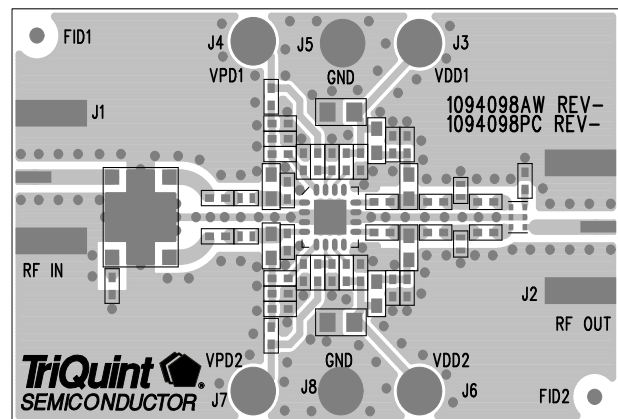
| Pin No. | Label | Description |
|-----------------|------------|---|
| 1 | RFIn1/Vg1 | RF input pin for channel 1. Gate voltage bias pin for channel 1. |
| 2, 3, 10, 11 | GND | No internal connection but should be grounded to provide PCB mounting integrity and isolation between the two RF paths. |
| 4 | RFIn2/Vg2 | RF input pin for channel 2. Gate voltage bias pin for channel 2. |
| 5 | DC Bias 2 | DC out bias for channel 2 |
| 6 | Vpd2 | Power down control voltage for channel 1 |
| 7 | Ictrl2 | Channel 2 drain current control |
| 8, 13 | NA | No internal connection. These pins can be grounded to provide PCB mounting integrity. |
| 9 | RFout2/Vd2 | RF output pin for channel 2. Gate voltage bias pin for channel 2. |
| 12 | RFout1/Vd1 | RF output pin for channel 1. Drain voltage bias pin for channel 1. |
| 14 | Ictrl1 | Channel 1 drain current control |
| 15 | Vpd1 | Power down control voltage for channel 1 |
| 16 | DC Bias 1 | DC out bias for channel 1 |
| Backside Paddle | RF/DC GND | RF/DC Ground. Follow recommended via pattern and ensure good solder attach for best thermal and electrical performance. |

Evaluation Board PCB Information

TriQuint PCB 1094098 Material and Stack-up



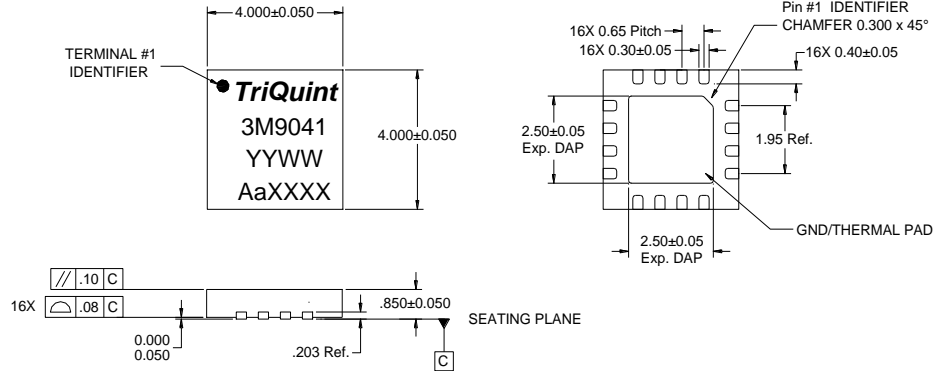
50 ohm line dimensions: width = .040", spacing = .020"



Mechanical Information

Package Marking and Dimensions

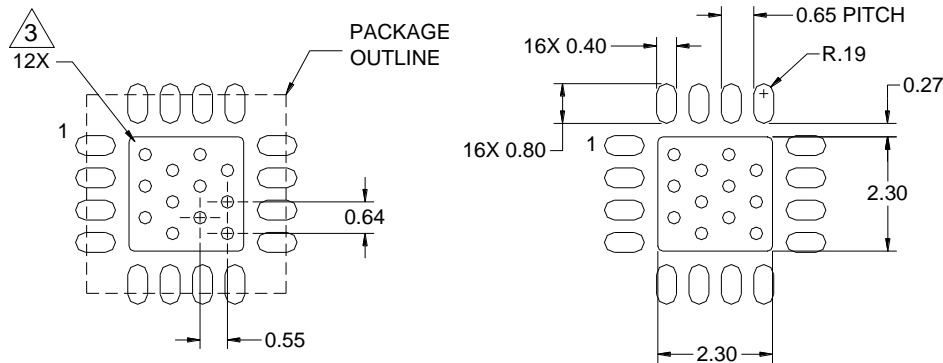
Marking: Part number – 3M9041
Year, week - YYWW
Assembly code - AaXXXX



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



COMPONENT SIDE

Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. Use 1 oz. copper minimum for top and bottom layer metal.
3. 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").
4. Ensure good package backside paddle solder attach for reliable operation and best electrical performance.

Product Compliance Information

ESD Sensitivity Ratings



Caution! ESD-Sensitive Device

ESD Rating: Class 1A
Value: ≥ 250 V and < 500 V
Test: Human Body Model (HBM)
Standard: JEDEC Standard JESD22-A114

ESD Rating: Class C3
Value: > 1000 V
Test: Charged Device Model (CDM)
Standard: JEDEC Standard JESD22-C101

MSL Rating

MSL Rating: Level 1
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.

Package contact plating: NiPdAu

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:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A ($\text{C}_{15}\text{H}_{12}\text{Br}_4\text{O}_2$) Free
- PFOS Free
- SVHC Free

Contact Information

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

Web: www.triquint.com

Tel: 877-800-8584

Email: customer.support@qorvo.com

For information about the merger of RFMD and TriQuint as Qorvo:

Web: www.qorvo.com

For technical questions and application information:

Email: sjcappliations.engineering@qorvo.com

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- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
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- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
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- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели,
кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: ocean@oceanchips.ru

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А