

### Applications

- Wireless Infrastructure
- LTE / WCDMA / CDMA / EDGE
- PtP IF Gain Control
- General Purpose Wireless

### Product Features

- Integrates Amp + VVA + Amp functionality
- 500–2700 MHz Bandwidth
- 38 dB Gain (max gain setting)
- 4.0 dB Noise Figure
- +16 dBm P1dB
- +29 dBm OIP3
- +5V Supply Voltage
- Low Current

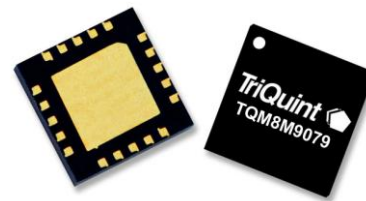
### General Description

The TQM8M9079 is an analog controlled variable gain amplifier (VGA) which operates from 500 to 2700 MHz. The VGA is able to provide broadband performance with +29 dBm OIP3 and +16 dBm P1dB over a wide frequency range while only consuming 95 mA current.

The TQM8M9079 integrates two broadband gain blocks with a voltage variable attenuator. The three stages are individually accessible via package I/O contacts. This permits full flexibility to insert other components or filters between the stages.

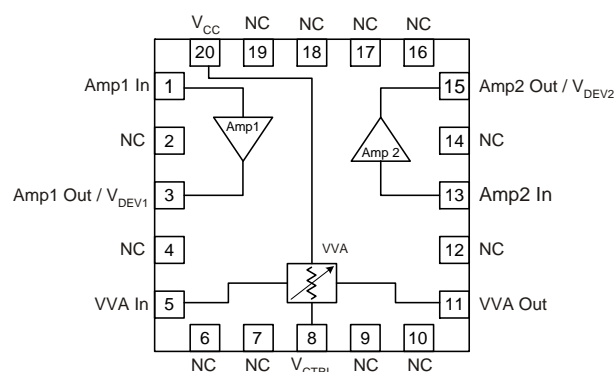
The TQM8M9079 is packaged in a RoHS-compliant, compact 5x5 mm surface-mount leadless package. Superior thermal design allows the product to have a minimum MTTF rating of 1000 years at a mounting temperature of +85° C.

The TQM8M9079 is targeted for use in wireless infrastructure, IF gain control in point-to-point applications, and for general purpose wireless.



20-pin 5x5 mm Leadless Package

### Functional Block Diagram



### Pin Configuration

| Pin No.                                   | Symbol                       |
|---|------------------------------|
| 1   | Amp1 In                      |
| 2, 4, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19 | NC (No Connect)              |
| 3   | Amp1 Out / V <sub>DEV1</sub> |
| 5   | VVA In                       |
| 8   | Vctrl                        |
| 11  | VVA Out                      |
| 13  | Amp2 In                      |
| 15  | Amp2 Out / V <sub>DEV2</sub> |
| 20  | Vcc                          |
| Backside Paddle                           | GND                          |

### Ordering Information

| Part No.      | Description                   |
|---------------|-------------------------------|
| TQM8M9079     | Variable Gain Amplifier       |
| TQM8M9079-PCB | 500–2700 MHz Evaluation Board |

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

### Absolute Maximum Ratings

| Parameter                          | Rating       |
|------------------------------------|--------------|
| Storage Temperature                | -65 to 150°C |
| RF Input Power, CW, 50Ω, T = 25°C  | +24 dBm      |
| Amplifier Voltage ( $V_{DEV1,2}$ ) | +4.5 V       |
| Control Voltage ( $V_{CTRL}$ )     | +6 V         |

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

### Recommended Operating Conditions

| Parameter                      | Min | Typ | Max | Units |
|--------------------------------|-----|-----|-----|-------|
| Control Voltage ( $V_{CTRL}$ ) | 0.5 |     | 5   | V     |
| Operating Temp. Range          | -40 |     | +85 | °C    |
| $T_J$ (for $>10^6$ hours MTTF) |     |     | 170 | °C    |

Electrical specifications are measured under test conditions as described or noted. Electrical specifications are not guaranteed over all recommended operating conditions.

### Electrical Specifications

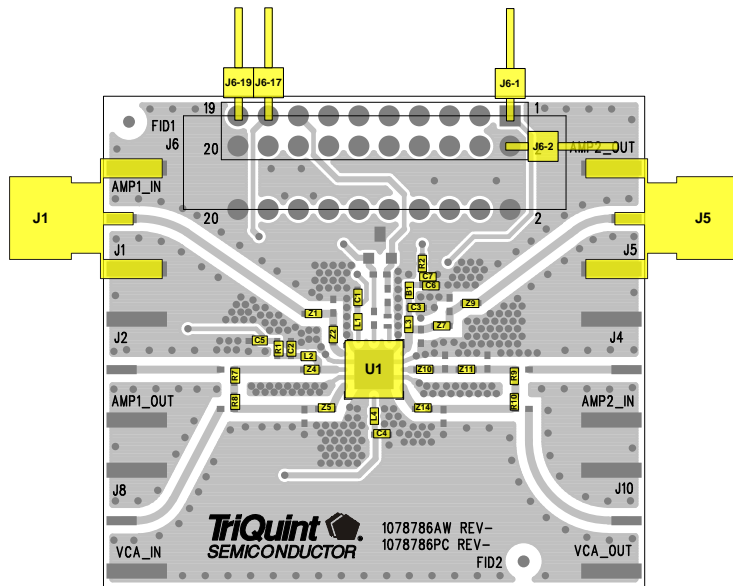
Test conditions unless otherwise noted:  $V_{CC}=+5V$ ,  $R_{BIAS}=24\Omega$ , Maximum gain setting, Temp.=+25°C

| Parameter                         | Conditions                        | Min | Typ  | Max  | Units |
|-----------------------------------|-----------------------------------|-----|------|------|-------|
| Operational Frequency Range       |                                   | 500 |      | 2700 | MHz   |
| Test Frequency                    |                                   |     | 2140 |      | MHz   |
| Gain                              |                                   | 35  | 38   |      | dB    |
| Gain Variation Range              | Note 1                            | 25  | 30   |      | dB    |
| Input Return Loss                 |                                   |     | 11   |      | dB    |
| Output Return Loss                |                                   |     | 20   |      | dB    |
| Output IP3                        | Pout=0 dBm/tone, $\Delta f=1$ MHz | +25 | +29  |      | dBm   |
| Output P1dB                       |                                   |     | +16  |      | dBm   |
| Noise Figure                      |                                   |     | 4.0  |      | dB    |
| Amplifier Current                 | Note 2                            | 77  | 95   | 117  | mA    |
| VVA Current (Pin 8)               | Note 3                            |     | 3.6  |      | mA    |
| Thermal Resistance, $\theta_{JC}$ | Junction to backside paddle       |     |      | 61   | °C/W  |

Notes:

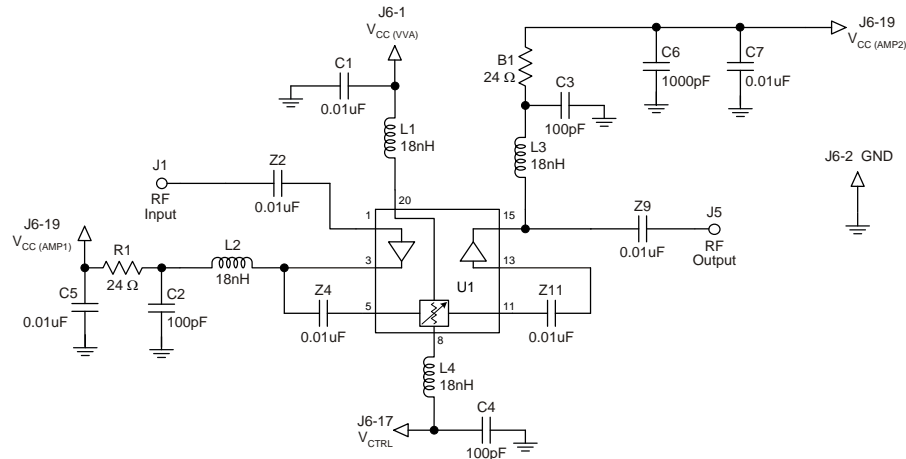
1. The Gain variation range is measured as the difference in gain with  $V_{ctrl} = 5$  V and  $V_{ctrl} = 0$  V.
2. Amp1 current (pin 3) and Amp2 current (pin 15) are typically 47.5 mA in each
3. VVA typical current is  $< 1$  mA for min attenuation and 3.6 mA for max attenuation

### TQM8M9079-PCB Evaluation Board (500–2700 MHz)



**Notes:**

1. See Evaluation Board PCB Information section for material and stack-up.
2. 0 Ω jumpers are not shown on the schematic and may be replaced with copper trace in the target application layout.



### Bill of Material – TQM8M9079-PCB

| Reference Des.                            | Value   | Description                        | Manuf.    | Part Number   |
|---|---------|------------------------------------|-----------|---------------|
| N/A                                       | N/A     | Printed Circuit Board              | TriQuint  | 1078786       |
| U1  | n/a     | Variable Gain Amplifier            | TriQuint  | TQM8M9079     |
| B1, R1                                    | 24 Ω    | Res., Chip, 0402, 5%, 1/16W        | various   |               |
| L1, L2, L3, L4                            | 18 nH   | Inductor, 0402, 5%, 3.1 GHz SRF    | CoilCraft | 0402CS-18NXJL |
| R2, R7, R8, R9, R10, Z1, Z5, Z7, Z10, Z14 | 0 Ω     | Res., Chip, 0402, 5%, 1/16W        | various   |               |
| C1, C5, C7, Z2, Z4, Z9, Z11               | 0.01 uF | Res., Chip, 0402, 5%, 1/16W        | various   |               |
| C2, C3, C4,                               | 100 pF  | Cap., Chip, 0402, 5%, 50V, NPO/COG | various   |               |
| C6  | 1000 pF | Cap., Chip, 0402, 10%, 50V, X5R    | various   |               |
| Z8  | 0.5 pF  | Cap., Chip, 0402, 5%, 50V, NPO/COG | various   |               |

### Typical Performance – TQM8M9079-PCB

Test conditions unless otherwise noted:  $V_{CC} = +5\text{ V}$ ,  $R_{BIAS} = 24\Omega$ , Maximum Gain Setting, Temp =  $25^\circ\text{C}$

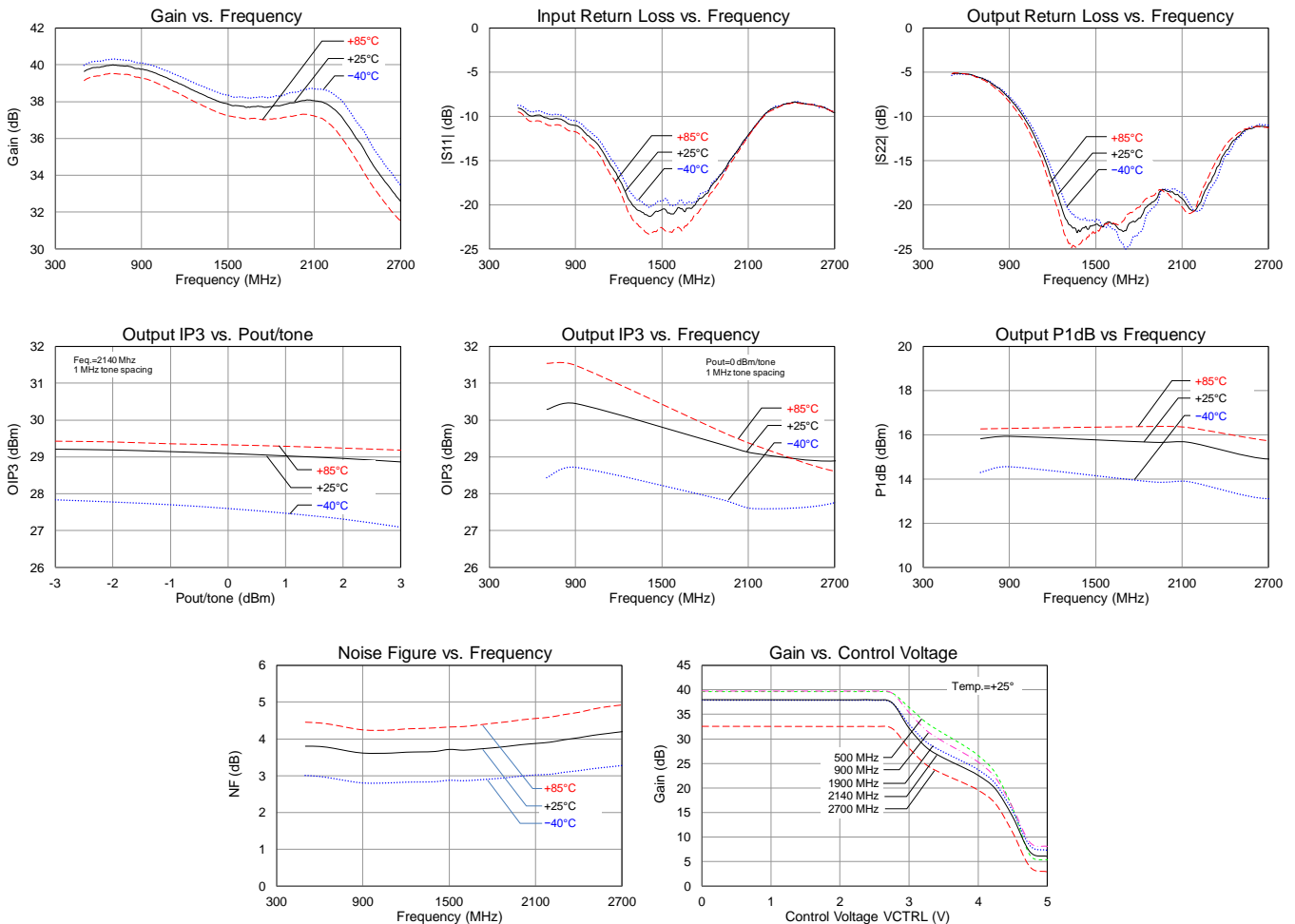
| Parameter             | Typical Value |       |       |       |       | Units |
|-----------------------|---------------|-------|-------|-------|-------|-------|
| Frequency             | 500           | 900   | 1900  | 2140  | 2700  | MHz   |
| Gain                  | 39.6          | 39.8  | 37.9  | 38.0  | 32.6  | dB    |
| Input Return Loss     | 9.1           | 11.0  | 16.7  | 11.2  | 9.6   | dB    |
| Output Return Loss    | 5.1           | 8.0   | 19.7  | 20.2  | 11.2  | dB    |
| Output IP3 (note 1)   | +30.3         | +30.4 | +29.4 | +29.1 | +28.9 | dBm   |
| Output P1dB           | +15.8         | +15.9 | +15.7 | +15.7 | +14.9 | dBm   |
| Noise Figure (note 2) | 4.0           | 3.9   | 4.0   | 4.1   | 4.3   | dB    |

Notes:

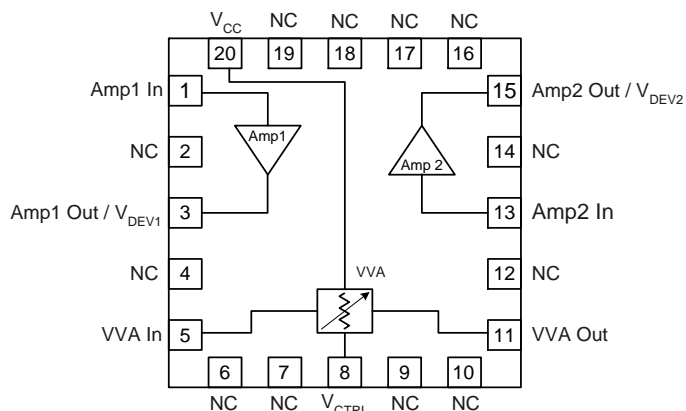
- IIP3 measured with two tones at an input power of +0 dBm / tone separated by 1 MHz.
- Evaluation board PCB losses de-embedded.

### Performance Plots – TQM8M9079-PCB

Test conditions unless otherwise noted:  $V_{CC} = +5\text{ V}$ ,  $R_{BIAS} = 24\Omega$ , Maximum Gain Setting, 50  $\Omega$  system.



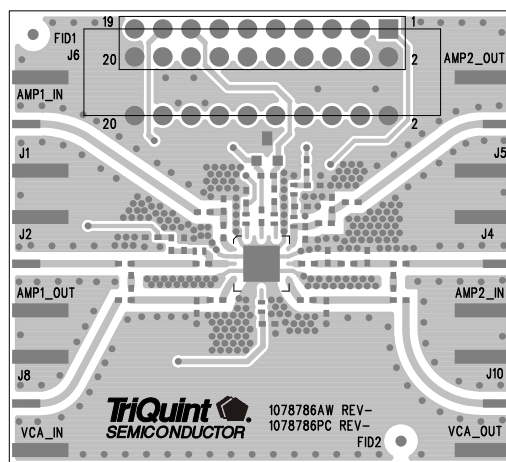
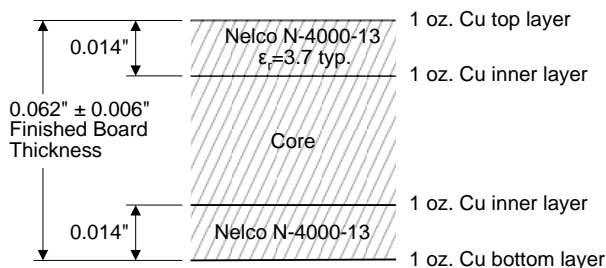
### Pin Configuration and Description



| Pin No.                                   | Symbol                     | Description   |
|---|----------------------------|---|
| 1   | Amp1 In                    | RF input (Amp1). DC blocking capacitor required.  |
| 2, 4, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19 | NC (No Connect)            | No electrical connection. Land pads should be provided for PCB mounting integrity.                                      |
| 3   | Amp1 Out/V <sub>DEV1</sub> | RF output / DC bias (Amp1), Bias resistor required (R <sub>BIAS</sub> )   |
| 5   | VVA In                     | RF input (VVA). DC blocking capacitor required.   |
| 8   | V <sub>CTRL</sub>          | Analog input for voltage controlled amplifier   |
| 11  | VVA Out                    | RF output (VVA). DC blocking capacitor required.  |
| 13  | Amp2 In                    | RF input (Amp2). DC blocking capacitor required.  |
| 15  | Amp2 Out/V <sub>DEV2</sub> | RF output / DC bias (Amp2), Bias resistor required (R <sub>BIAS</sub> )   |
| 20  | V <sub>CC</sub>            | DC supply for voltage variable attenuator.  |
| 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

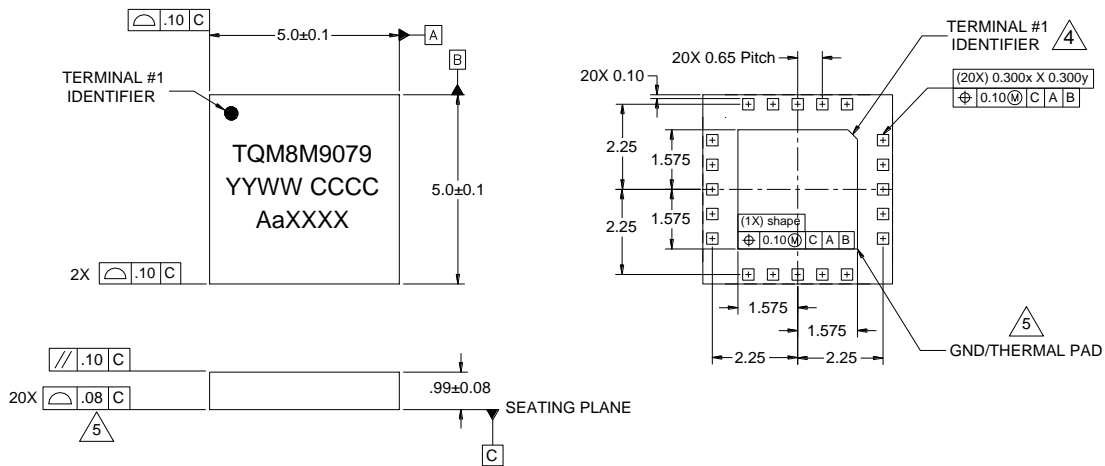
TriQuint PCB 1078786 Material and Stack-up



### Mechanical Information

#### Package Marking and Dimensions

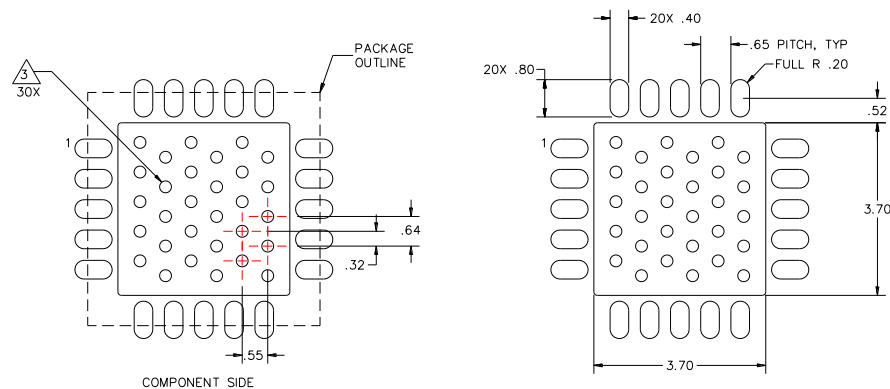
Marking: Part number – TQM8M9079  
 Year, week, country code – YYWW CCCC  
 Assembly code – AaXXXX



#### Notes:

1. All dimensions are in millimeters. Angles are in degrees.
2. Except where noted, this part outline conforms to JEDEC standard MO-270, Issue B (Variation DAE) for extra thin profile, fine pitch, internal stacking module (ISM).
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.
5. Co-planarity applies to the exposed ground/thermal pad as well as the contact pins.

### 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. 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 1B  
Value:  $\geq 500$  V to  $< 1000$  V  
Test: Human Body Model (HBM)  
Standard: JEDEC Standard JESD22-A114

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

**MSL Rating**

MSL Rating: Level 3  
Test:  $260^{\circ}\text{C}$  convection reflow  
Standard: JEDEC Standard IPC/JEDEC J-STD-020

**Solderability**

Compatible with both lead-free ( $260^{\circ}\text{C}$  max. reflow temperature) and tin/lead ( $245^{\circ}\text{C}$  max. reflow temperature) soldering processes.

Package contact plating: Electrolytic plated Au over Ni

**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 ( $\text{C}_{15}\text{H}_{12}\text{Br}_4\text{O}_2$ ) Free
- PFOS Free
- SVHC Free

**Contact Information**

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