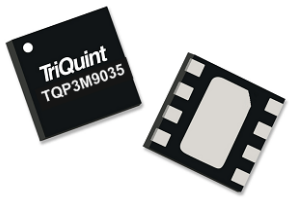
TQP3M9035

High Linearity LNA Gain Block

Applications

- Repeaters
- Mobile Infrastructure
- LTE / WCDMA / CDMA / GSM
- General Purpose Wireless
- TDD or FDD systems

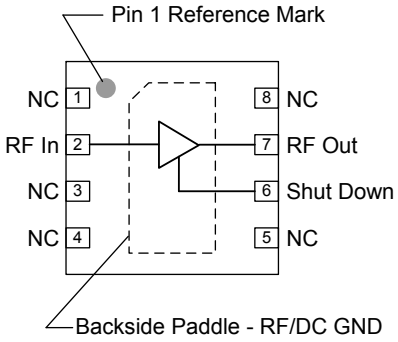


2x2 mm 8 Pin DFN Package

Product Features

- 50−4000 MHz Operating Range
- 0.65 dB Noise Figure @ 1900 MHz
- 16.5 dB Gain @ 1900 MHz
- +37 dBm Output IP3
- +22.5 dBm P1dB
- Shut-down capability
- Unconditionally stable
- 50 Ohm Cascadable Gain Block
- +5V Single Supply, 115 mA Current
- 2x2 mm 8 Pin DFN plastic package

Functional Block Diagram



General Description

The TQP3M9035 is a high-linearity, low noise gain block amplifier in a low-cost surface-mount package. At 1900 MHz, the amplifier typically provides 16.5 dB gain, +37 dBm OIP3, and 0.65 dB Noise Figure. The LNA is also designed to be broadband without the requirement for external matching. The device is housed in a lead-free/green/RoHS-compliant industry-standard 2x2 mm package.

The TQP3M9035 has the benefit of having high linearity while also providing very low noise across a broad range of frequencies. This allows the device to be used in both receive and transmit chains for high performance systems. The amplifier is internally matched using a high performance E-pHEMT process and only requires an external RF choke and blocking/bypass capacitors for operation from a single +5V supply. The low noise amplifier integrates a shut-down biasing capability to allow for operation for TDD applications.

The TQP3M9035 covers the 50−4000 MHz frequency band and is targeted for wireless infrastructure or other applications requiring high linearity and/or low noise figure.

Pin Configuration

Pin #	Symbol
1, 3, 4, 5, 8	No Connect or GND
2	RF In
6	Shut Down
7	RF Out
Backside Paddle	RF/DC GND

Ordering Information

Part No.	Description
TQP3M9035	High Linearity LNA Gain Block
TQP3M9035-PCB	500−4000 MHz Eval. Board

Standard T/R size = 2500 pieces on a 7” reel.

Absolute Maximum Ratings

Parameter	Rating
Storage Temperature	−65 to 150°C
Supply Voltage (V_{DD})	+6 V
RF Input Power, CW, 50Ω,T = 25°C	+23 dBm

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_{DD})	+4.75	+5	+5.25	V
T_{CASE}	−40		+85	°C
T_J (for >10^6 hours 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: +25°C, V_{DD} =+5V, 50 Ω system.

Parameter	Conditions	Min	Typ	Max	Units
Operational Frequency Range		50		4000	MHz
Test Frequency			1900		MHz
Gain		15	16.5	18	dB
Input Return Loss			13		dB
Output Return Loss			10		dB
Output P1dB		+20	+23		dBm
Output IP3	Pout=+4 dBm/tone, Δf=1 MHz	+32.5	+37		dBm
Noise Figure			0.65	1.0	dB
Power Shutdown Control (Pin 6)	On state	0		0.8	V
	Off state (Power down)	3		V_{DD}	V
Current, I_{DD}	On state		115	150	mA
	Off state (Power down)		3		mA
Shutdown pin current, I_{SD}	V_{PD} ≥ 3 V		100		µA
Thermal Resistance, θ_{jc}	channel to case			50	°C/W

Device Characterization Data

S-Parameters

Test conditions unless otherwise noted: V_{DD}=+5 V, I_{DD}=115 mA (typ.), Temp=+25°C, 50 Ohm system

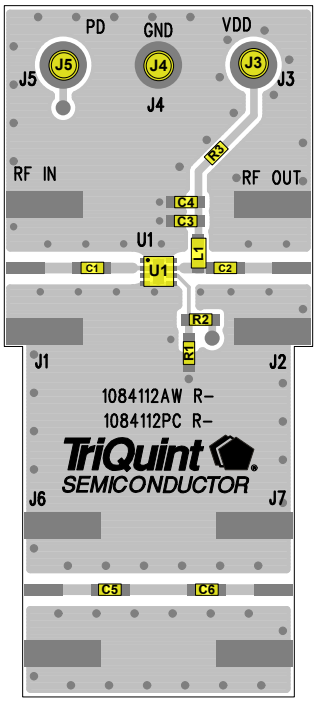
Freq (GHz)	S11 (dB)	S11 (ang)	S21 (dB)	S21 (ang)	S12 (dB)	S12 (ang)	S22 (dB)	S22 (ang)
50	-11.5	-43.9	28.8	165.0	-31.8	13.5	-22.0	-106.8
100	-13.8	-43.3	28.2	161.3	-31.5	8.5	-26.5	172.1
200	-14.8	-50.7	27.6	151.4	-31.4	6.5	-20.1	99.9
400	-15.0	-74.6	26.1	132.1	-31.4	9.2	-14.9	57.7
600	-15.0	-93.2	24.5	116.9	-31.3	13.3	-13.1	35.6
800	-14.9	-106.9	23.0	104.8	-30.9	17.6	-12.2	19.5
1000	-15.0	-117.2	21.6	94.8	-30.3	21.5	-11.8	6.5
1200	-15.0	-125.4	20.4	86.1	-29.7	23.5	-11.6	-5.1
1400	-15.1	-131.8	19.4	78.2	-29.0	25.1	-11.4	-16.0
1600	-15.2	-137.5	18.5	71.0	-28.3	25.8	-11.2	-26.4
1800	-15.4	-142.3	17.6	64.2	-27.6	25.5	-11.0	-36.2
2000	-15.6	-147.1	16.9	57.7	-27.0	25.1	-10.7	-45.5
2200	-15.8	-151.7	16.2	51.4	-26.4	24.4	-10.4	-54.5
2400	-15.9	-156.6	15.6	45.4	-25.9	22.8	-10.1	-62.8
2600	-16.1	-161.5	15.0	39.5	-25.4	21.2	-9.7	-70.6
2800	-16.1	-166.5	14.5	33.6	-25.0	19.3	-9.3	-77.8
3000	-16.5	-174.6	14.0	27.9	-24.6	17.4	-8.7	-82.9
3200	-16.4	179.5	13.6	22.3	-24.2	15.1	-8.3	-88.4
3400	-16.0	176.3	13.2	16.8	-23.8	12.8	-8.0	-94.5
3600	-15.4	173.5	12.8	11.2	-23.5	10.3	-7.8	-100.7
3800	-14.8	170.9	12.5	5.6	-23.2	7.9	-7.6	-106.8
4000	-14.2	169.0	12.2	-0.1	-22.9	4.7	-7.4	-113.2

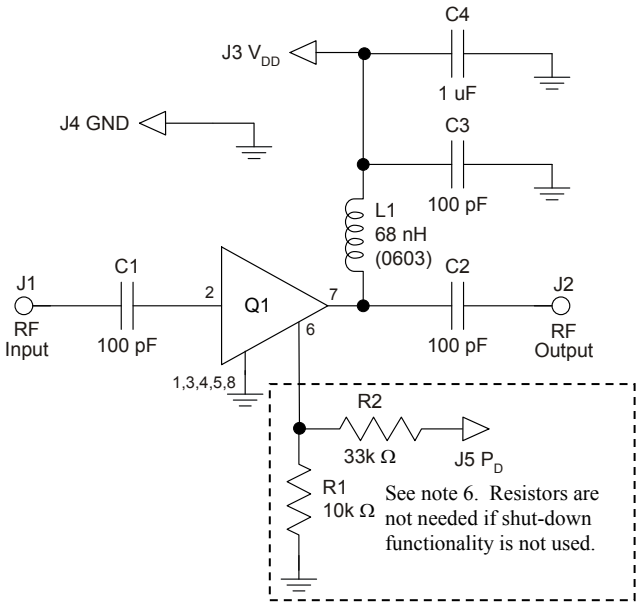
Noise Parameters

Test conditions unless otherwise noted: V_{DD}=+5 V, I_{DD}=115 mA (typ.), Temp=+25°C, 50 Ohm system

Freq (MHz)	NF_{min} (dB)	MagOpt (mag)	AngOpt (deg)	Rn (Ω)
700	0.41	0.100	118	0.046
1100	0.50	0.127	140	0.048
1500	0.59	0.113	165	0.060
1900	0.49	0.229	166	0.045
2300	0.59	0.267	179	0.048
2700	0.74	0.300	-166	0.051

TQP3M9035-PCB Evaluation Board





Notes:

1. See Evaluation Board PCB Information section for material and stack-up.
2. R3 (0 Ω jumper) is not shown on the schematic and may be replaced with copper trace in the target application layout.
3. All components are of 0402 size unless stated on the schematic.
4. C1, C2, and C3 are non-critical values. The reactive impedance should be as low as possible at the frequency of operation for optimal performance.
5. The L1 value is non-critical and needs to provide high reactive impedance at the frequency of operation.
6. R1 and R2 are optional and do not need to be loaded if the shut-down functionality is not needed; i.e. FDD applications. If R1 and R2 are not loaded, the LNA will operate in its standard “ON” state.
7. A through line is included on the evaluation board to de-embed the board losses.

Bill of Material - TQP3M9035-PCB

Reference Des.	Value	Description	Manuf.	Part Number
N/A	N/A	Printed Circuit Board	TriQuint	1084112
U1	n/a	High Linearity LNA Gain Block	TriQuint	TQP3M9035
R1	10K Ω	Resistor, Chip, 0402, 5%, 1/16W	various	various
R2	33K Ω	Resistor, Chip, 0402, 5%, 1/16W	various	various
R3	0 Ω	Resistor, Chip, 0402, 5%, 1/16W	various	various
L1	68 nH	Inductor, 0603, 5%, Ceramic	various	various
C4	1.0 uF	Cap., Chip, 0402, 10%, 10V, X5R	various	various
C1, C2, C3, C5, C6	100 pF	Cap., Chip, 0402, 5%, 50V, NPO/COG	various	various
J3, J4, J5	n/a	Solder Turret	various	various

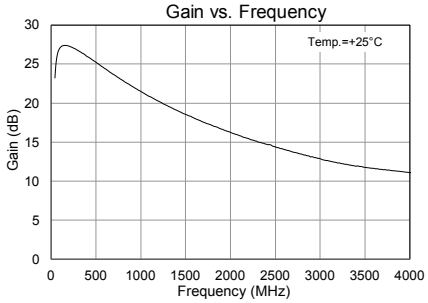
Typical Performance TQP3M9035-PCB V_{DD} = 5 V

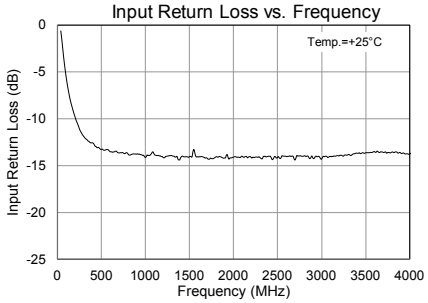
Test conditions unless otherwise noted: V_{DD}=+5 V, I_{DD}=110 mA (typ.), Temp=+25°C

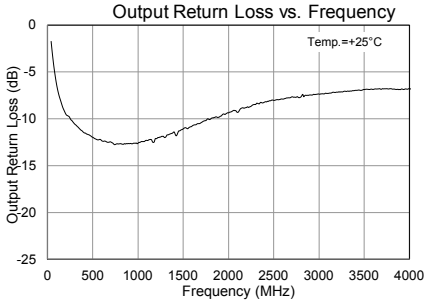
Parameter	Conditions	Typical Value			Units
Frequency		900	1900	2600	MHz
Gain		22.0	16.5	14.0	dB
Input Return Loss		14	13	15	dB
Output Return Loss		13	10	8	dB
Output P1dB		+23	+23	+23	dBm
Output IP3	Pout= +4 dBm/tone, Δf=1 MHz	+37.2	+37.0	+37.3	dBm
Noise figure (1)		0.55	0.65	1.0	dB

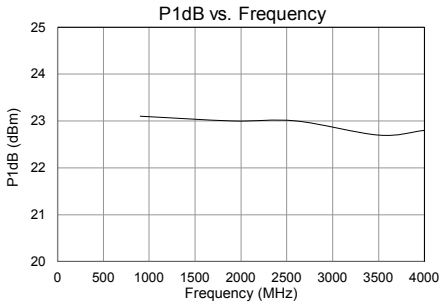
Notes:
1. Noise figure data shown in the table above is de-embedded from the eval board loss.

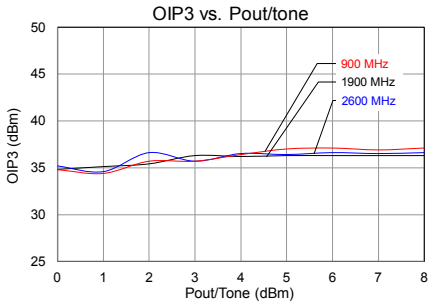
Performance Plots - TQP3M9035-PCB V_{DD} = 5 V

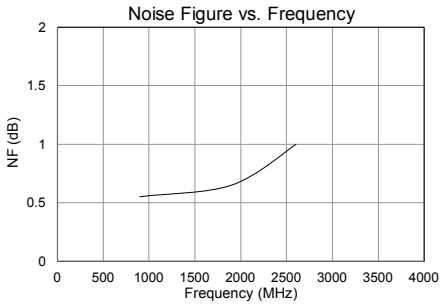


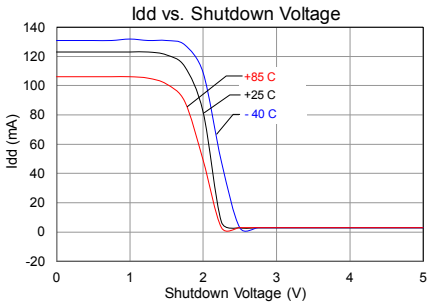












Typical Performance – TQP3M9035-PCB V_{DD} = 3.3 V

Test conditions unless otherwise noted: V_{DD}=+3.3 V, I_{DD}=67 mA (typ.), Temp=+25°C

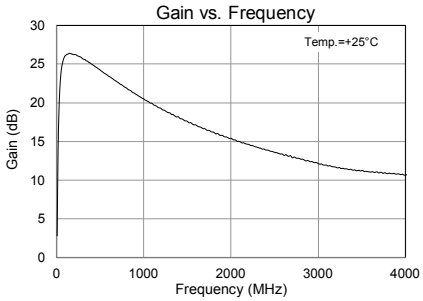
Parameter	Conditions	Typical Value		Units
Frequency		900	1900	MHz
Gain		21.2	15.8	dB
Input Return Loss		11.4	11.9	dB
Output Return Loss		15.6	10.6	dB
Output P1dB		+19	+18.8	dBm
Output IP3	Pout= +5 dBm/tone, Δf=1 MHz	+32.7	+33	dBm
Noise figure (1)		0.55	0.65	dB

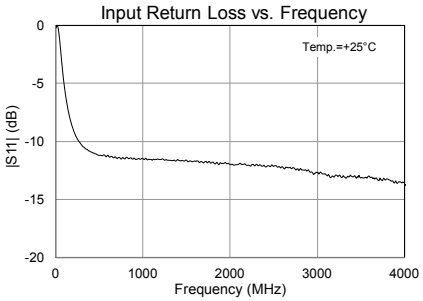
Notes:

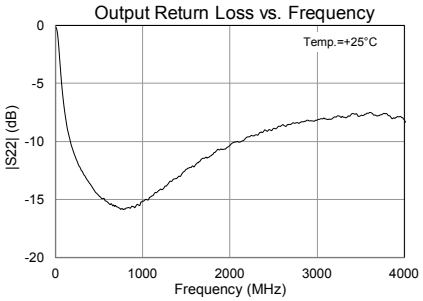
1. Noise figure data shown in the table above is de-embedded from the eval board loss.

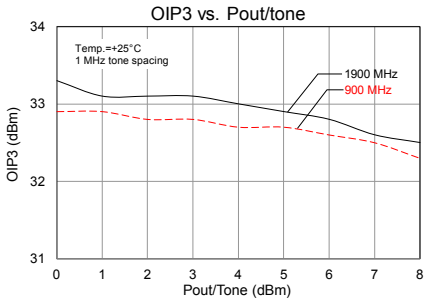
Performance Plots - TQP3M9035-PCB V_{DD} = 3.3 V

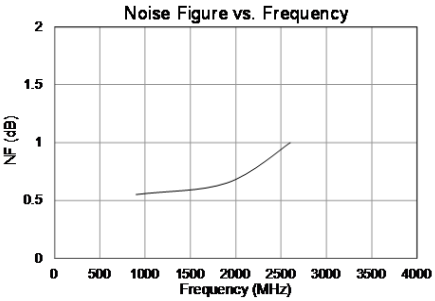
Test conditions unless otherwise noted: V_{DD} =+3.3 V, I_{DD} = 67 mA, T_{CASE} = +25°C, 50 Ω system



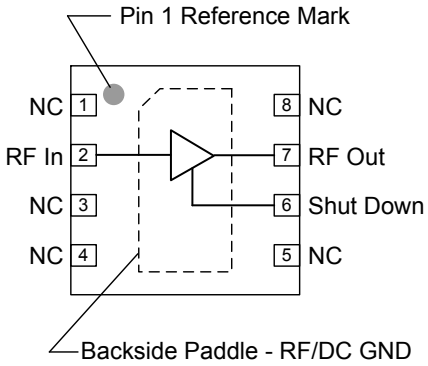








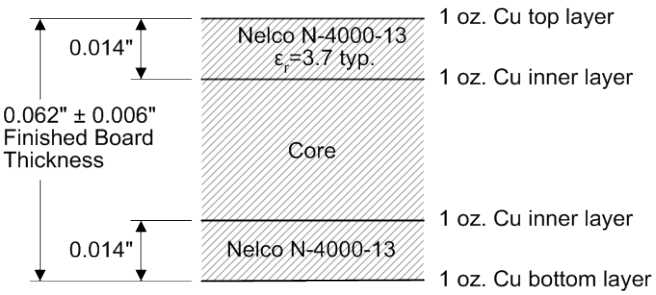
Pin Configuration and Description



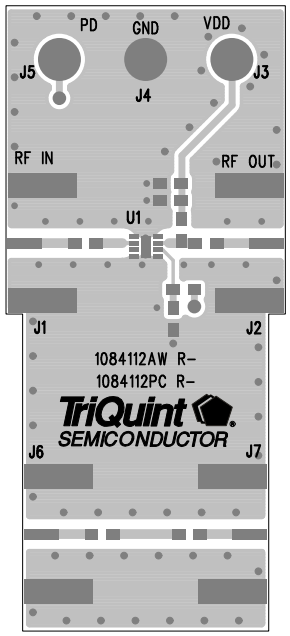
Pin No.	Symbol	Description
2	RF In	RF Input pin. A DC Block is required.
6	Shut Down	A high voltage turns off the device. If the pin is not connected or is less than 1V, then the device will operate under its normal operating condition.
7	RF Out / DCBias	RF Output pin. DC bias will also need to be injected through a RF bias choke/inductor for operation.
1, 3, 4, 5, 8	NC	No electrical connection. Provide grounded land pads for PCB mounting integrity.
Backside Paddle	RF/DC GND	RF/DC ground. Use recommended via pattern to minimize inductance and thermal resistance; see PCB Mounting Pattern for suggested footprint.

Evaluation Board PCB Information

TriQuint PCB 1084112 Material and Stack-up



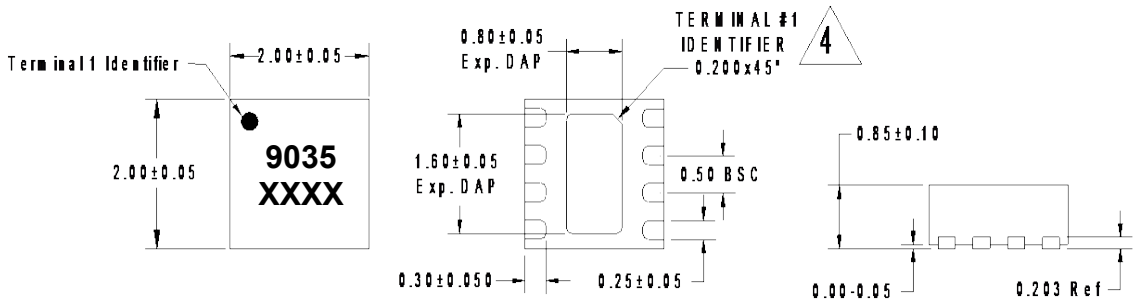
50 ohm line dimensions: width = .031”, spacing = .035”



Mechanical Information

Package Marking and Dimensions

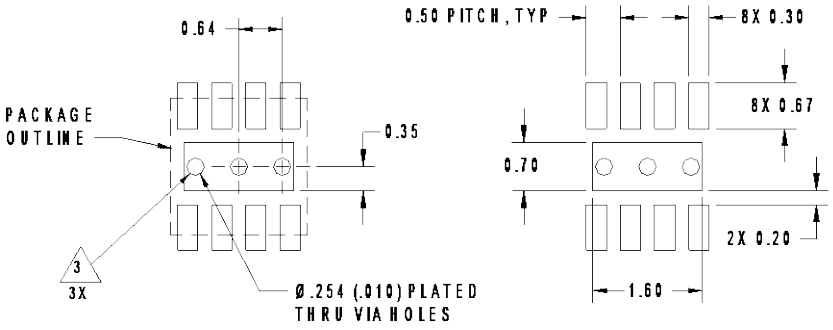
Marking: Part number – 9035
Lot Code – XXXX



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. Vias are required under the backside paddle of this device for proper RF/DC grounding and thermal dissipation. 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:	Passes ≥ 250 V to < 500 V
Test:	Human Body Model (HBM)
Standard:	JEDEC Standard JESD22-A114

ESD Rating:	Class IV
Value:	Passes ≥ 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 ($C_{15}H_{12}Br_4O_2$) Free
- PFOS Free
- SVHC Free

Contact Information

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

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For technical questions and application information: **Email:** sjcapplications.engineering@tqs.com

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