

Applications

- Wireless Infrastructure
- Repeaters, Boosters, DAS
- High Power Amplifiers
- Pico and Macro Base Stations
- FDD or TDD

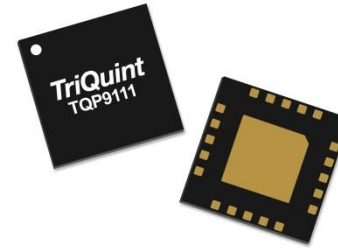
Product Features

- 1.8 – 2.7 GHz Frequency Range
- 29.8 dB Gain Typ.
- +46 dBm Output IP3 at +14 dBm/tone
- +32.5 dBm P1dB
- Integrated interstage matching
- Bias Adjustable
- Internal RF overdrive protection
- Internal DC overvoltage protection
- Shut-down capability

General Description

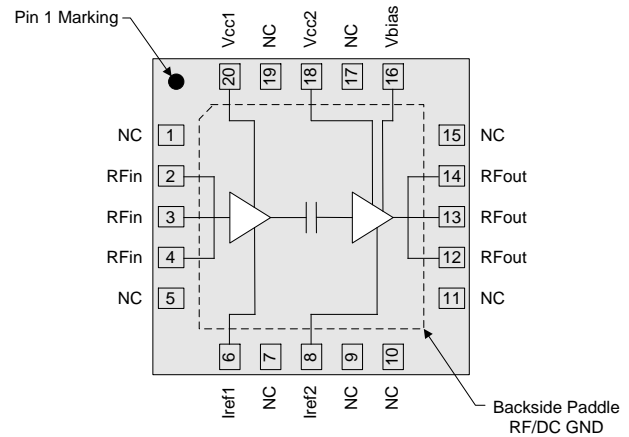
The TQP9111 is a high efficiency two-stage driver amplifier in a low-cost surface-mount package. The amplifier is able to achieve high performance with +46 dBm OIP3 and +32.5 dBm P1dB. This linear amplifier integrates two high performance amplifier stages onto a module to allow for a compact system design. The integrated inter-stage match minimizes performance variation that would otherwise be attributed to external matching component value and placement tolerances.

Both the input and output stage amplifiers are bias adjustable allowing the amplifier's power consumption to be reduced for occasions when high power performance is not required. Both stages can also be turned off when not being used for power savings or for TDD systems. The output match is externally tunable to allow the amplifier to be optimized for high power or high linearity applications. The TQP9111 is available in a RoHS-compliant 20-pin 4 x 4 mm surface mount package.



4x4 mm Leadless SMT Package

Functional Block Diagram



Top View

Pin Configuration

| Pin No. | Label |
|--------------------------------|-------------------|
| 1, 5, 7, 9, 10, 11, 15, 17, 19 | NC |
| 2, 3, 4 | RF in |
| 6 | I _{REF1} |
| 8 | I _{REF2} |
| 12, 13, 14 | RF out |
| 16 | V _{BIAS} |
| 18 | V _{CC2} |
| 20 | V _{CC1} |
| Backside Pad | GND |

Ordering Information

| Part No. | Description |
|-----------------|------------------------------|
| TQP9111 | 1.8–2.7 GHz Power Amplifier |
| TQP9111-PCB2140 | 1.8-2.2 GHz Evaluation board |
| TQP9111-PCB2600 | 2.3-2.7 GHz Evaluation board |

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

Absolute Maximum Ratings

| Parameter | Rating |
|-----------------------------------|---------------|
| Storage Temperature | -55 to 150 °C |
| Supply Voltage (V _{CC}) | +6.5 V |
| RF Input Power, CW, 50 Ω, 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 _{CC}) | | +5.0 | +5.25 | V |
| T _{CASE} | -40 | | +105 | °C |
| T _j for >10 ⁶ hours MTTF | | | +170 | °C |

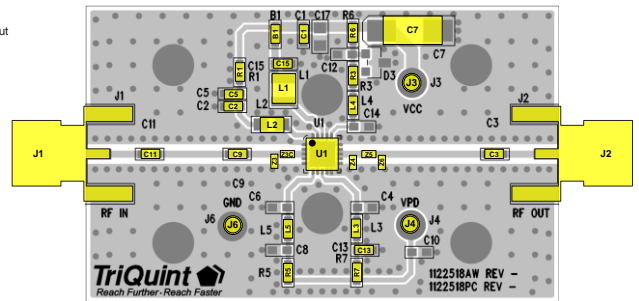
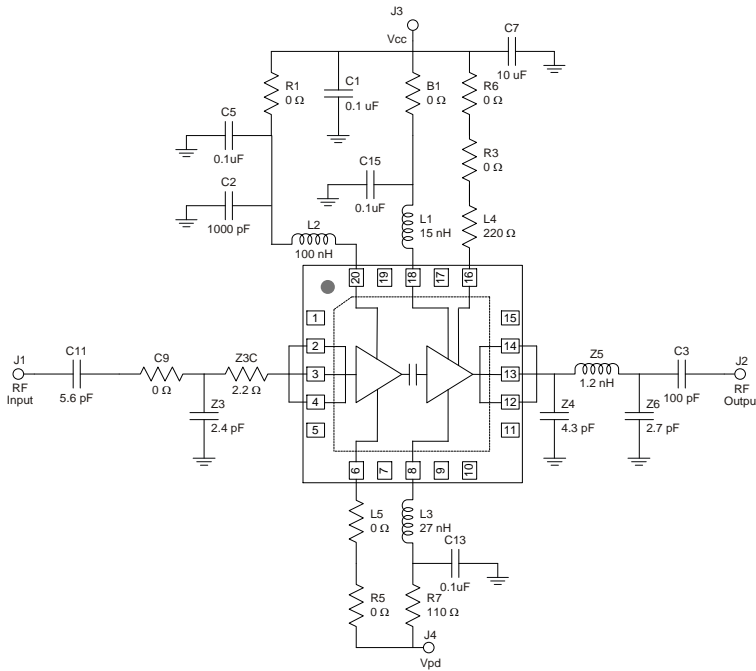
Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

Electrical Specifications

Test conditions unless otherwise noted: V_{CC} = +5.0 V, I_{CC} = 521 mA, I_{REF1} = 4.5 mA, I_{REF2} = 19.5 mA, Temp. = +25 °C, 50 Ω

| Parameter | Conditions | Min | Typ | Max | Units |
|-------------------------------------|--|------|-------|------|-------|
| Operational Frequency Range | | 1800 | | 2700 | MHz |
| Test Frequency | | | 2140 | | MHz |
| Gain | | | 29.8 | | dB |
| Input Return Loss | | | 13 | | dB |
| Output Return Loss | | | 20 | | dB |
| Noise Figure | | | 6.2 | | dB |
| Output P1dB | | | +32.5 | | dBm |
| Output IP3 | P _{out} = +11 dBm/ tone, Δf = 1 MHz | | +46 | | dBm |
| Current, I _{CC} | | | 521 | | mA |
| Current, I _{REF1} | | | 4.5 | | mA |
| Current, I _{REF2} | | | 19.5 | | mA |
| Total Current | | | 545 | | mA |
| Thermal Resistance, θ _{Jc} | Junction to case | | | 22.6 | °C/W |

TQP9111-PCB2140 Evaluation Board (1.8 – 2.2 GHz)



Bill of Material TQP9111-PCB2140

| Ref Des | Value | Description | Manuf. | Part Number |
|----------------------------|---------|------------------------------------|----------|-------------|
| U1 | | TQP9111 | TriQuint | TQP9111 |
| C1, C5, C13, C15 | 0.1 uF | CAP, 0603,10%, 50V, X7R | various | |
| C2 | 1000 pF | CAP, 0603, 5%, 50V, NPO | various | |
| C3 | 100 pF | CAP, 0603, 5%, 50V, NPO | various | |
| Z4 | 4.3 pF | CAP, 0402, +/-0.25PF. 50V. NPO/COG | various | |
| Z3C | 2.2 Ω | RES, 0402, 5PCT. 1/16W. CHIP. | various | |
| Z3 | 2.4 pF | CAP, 0402, +/- 0.1PF. 50V. NPO | various | |
| Z5 | 1.2 nH | IND, 0402, chip, +/-0.3 nH | various | |
| C7 | 10 uF | CAP, 6032, 20%, 50V, Tantalum | various | |
| Z6 | 2.7 pF | CAP, 0402, +/- 0.1PF. 50V. NPO/COG | various | |
| C11 | 5.6 pF | CAP, 0603, +/-0.1PF. 200V. NPO/COG | various | |
| R7 | 110 Ω | RES, 0603, 1PCT., 1/10W | various | |
| L4 | 220 Ω | RES, 0603, 1PCT., 1/16W | various | |
| B1, L5, R1, R5, C9, R3, R6 | 0 Ω | RES, 0603, 5%, 1/16W, Chip | various | |
| L1 | 15 nH | IND, 1008, 5%, Ceramic | various | |
| L2 | 100 nH | IND, 0805, 5%, Ceramic | various | |
| L3 | 27 nH | IND, 0603, 5%, Ceramic | various | |

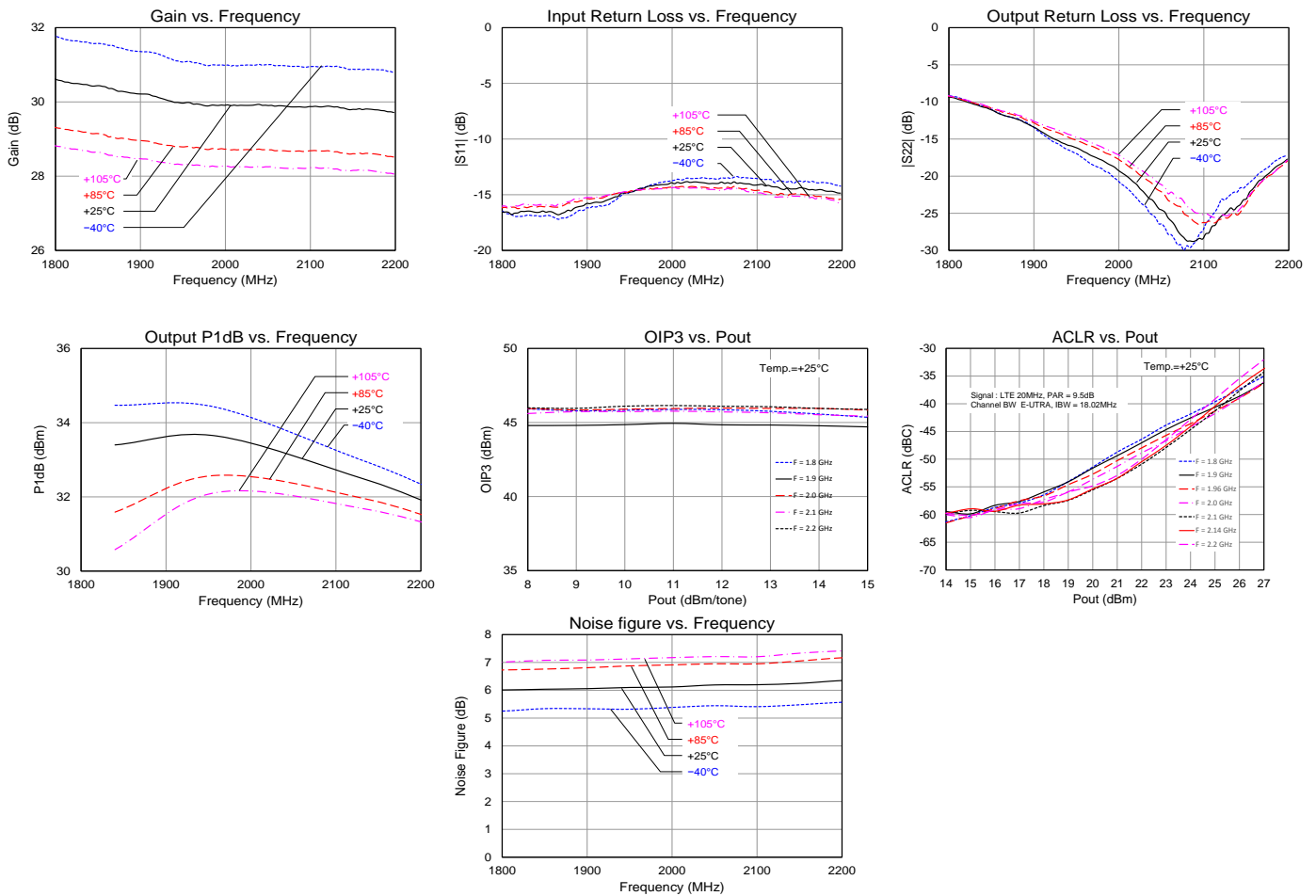
Typical Performance TQP9111-PCB2140

Test conditions unless otherwise noted: $V_{CC} = +5\text{ V}$, $I_{CQ} = 545\text{ mA}$ (typ.), $V_{PD} = +5\text{ V}$, Temp. = $+25\text{ }^{\circ}\text{C}$

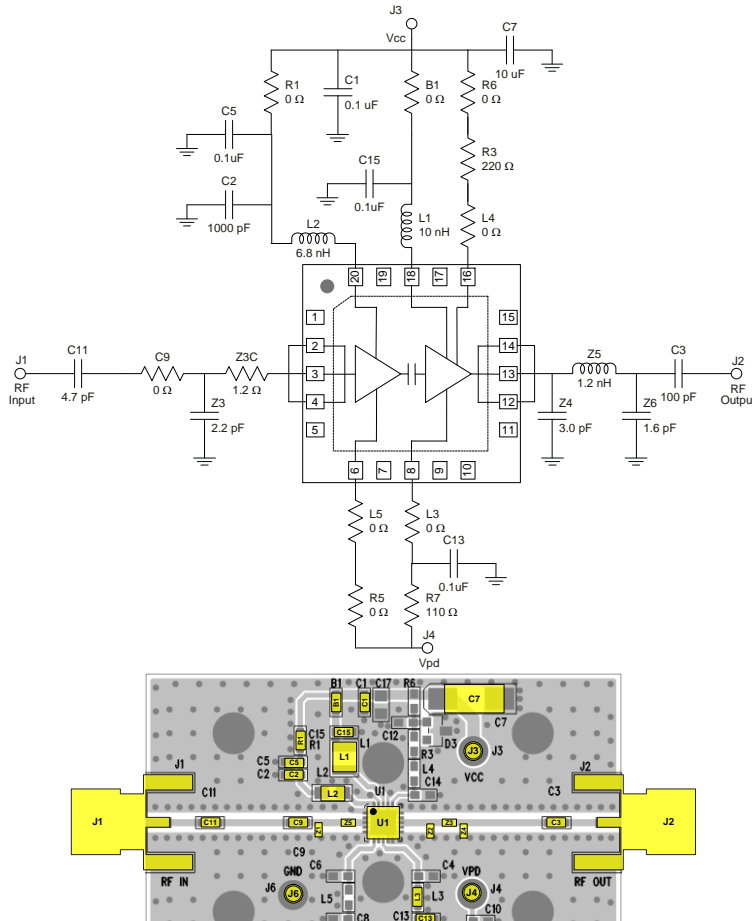
| Parameter | Conditions | Typical Value | | | Units |
|--------------------|---|---------------|-------|-------|-------|
| Frequency | | 1800 | 1960 | 2140 | MHz |
| Gain | | 30.4 | 30.0 | 29.8 | dB |
| Input Return Loss | | 15 | 14 | 13 | dB |
| Output Return Loss | | 9 | 15 | 20 | dB |
| Output P1dB | | +33.4 | +32.5 | +32.5 | dBm |
| OIP3 | Pout= +14 dBm/tone, $\Delta f=1\text{ MHz}$ | +46 | +46 | +46 | dBm |
| Noise Figure | | 6.0 | 6.1 | 6.2 | dB |

Performance Plots TQP9111-PCB2140

Test conditions unless otherwise noted: $V_{CC} = +5\text{ V}$, $I_{CQ} = 545\text{ mA}$ (typ.), $V_{PD} = +5\text{ V}$, Temp. = $+25\text{ }^{\circ}\text{C}$



TQP9111-PCB2600 Evaluation Board (2.3 – 2.7 GHz)



Bill of Material TQP9111-PCB2600

| Ref Des | Value | Description | Manuf. | Part Number |
|--------------------------------|---------|------------------------------------|----------|-------------|
| U1 | | TQP9111 | TriQuint | TQP9111 |
| C1, C5, C13, C15 | 0.1 uF | CAP, 0603,10%, 50V, X7R | various | |
| C2 | 1000 pF | CAP, 0603, 5%, 50V, NPO | various | |
| C3 | 100 pF | CAP, 0603, 5%, 50V, NPO | various | |
| Z4 | 3.0 pF | CAP, 0402, +/-0.25PF. 50V. NPO/COG | various | |
| Z3C | 1.2 Ω | RES, 0402, 5PCT. 1/16W. CHIP. | various | |
| Z3 | 2.2 pF | CAP, 0402, +/- 0.1PF. 50V. NPO | various | |
| Z5 | 1.2 nH | IND, 0402, chip, +/-0.3 nH | various | |
| C7 | 10 uF | CAP, 6032, 20%, 50V, Tantalum | various | |
| Z6 | 1.6 pF | CAP, 0402, +/- 0.1PF. 50V. NPO/COG | various | |
| C11 | 4.7 pF | CAP, 0603, +/-0.1PF. 200V. NPO/COG | various | |
| R7 | 110 Ω | RES, 0603, 1PCT., 1/10W | various | |
| R3 | 220 Ω | RES, 0603, 1PCT., 1/16W | various | |
| B1, L3, L4, L5, R1, R5, C9, R6 | 0 Ω | RES, 0603, 5%, 1/16W, Chip | various | |
| L1 | 10 nH | IND, 1008, 5%, Ceramic | various | |
| L2 | 6.8 nH | IND, 0805, 5%, Ceramic | various | |

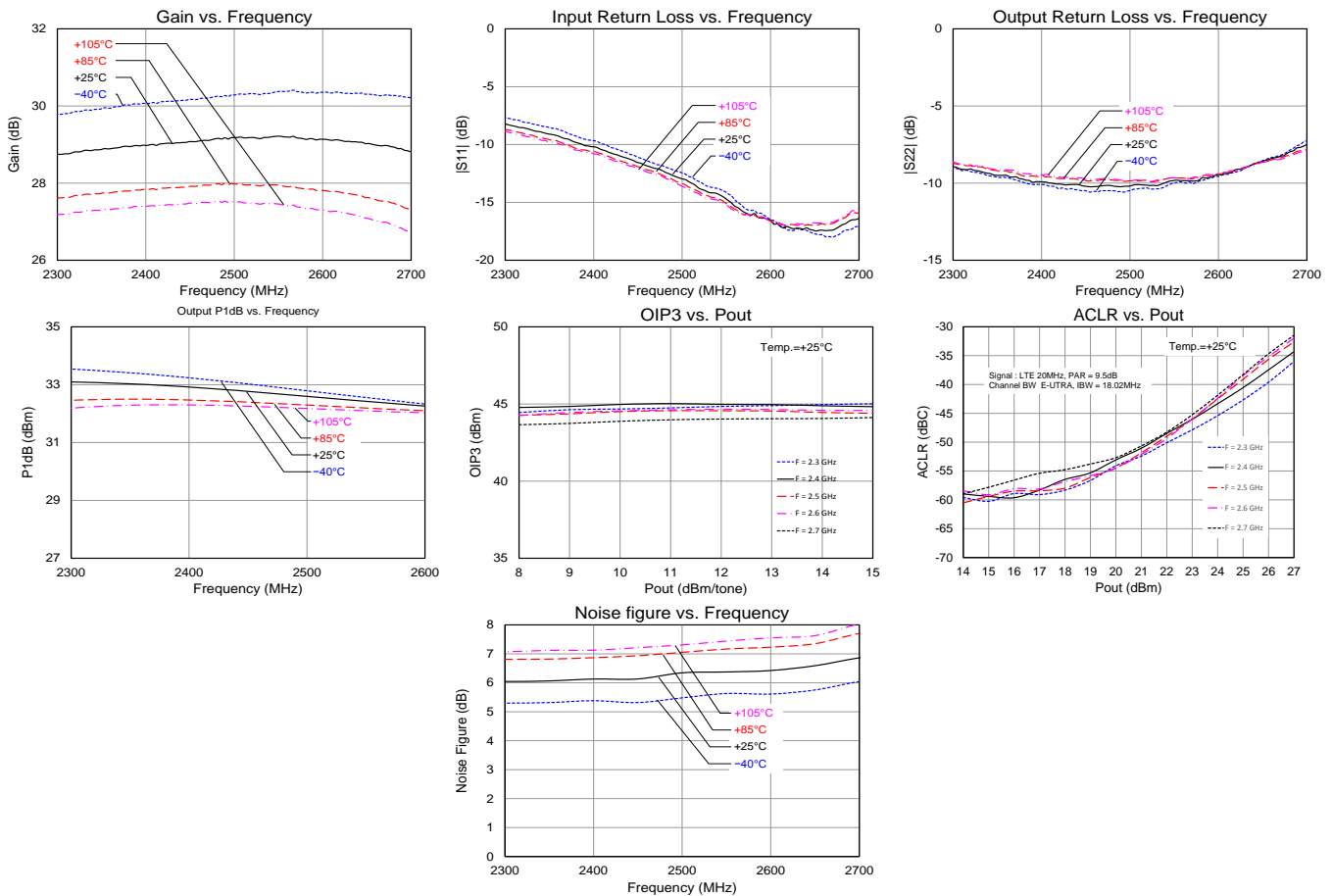
Typical Performance TQP9111-PCB2600

Test conditions unless otherwise noted: $V_{CC} = +5\text{ V}$, $I_{CQ} = 545\text{ mA}$ (typ.), $V_{pd} = +5\text{ V}$, $Temp. = +25\text{ }^{\circ}\text{C}$

| Parameter | Conditions | Typical Value | | | Units |
|--------------------|---|---------------|-------|-------|-------|
| Frequency | | 2300 | 2500 | 2700 | MHz |
| Gain | | 28.8 | 29.2 | 28.8 | dB |
| Input Return Loss | | 8 | 13 | 16 | dB |
| Output Return Loss | | 9 | 10 | 9 | dB |
| Output P1dB | | +33.0 | +32.8 | +32.0 | dBm |
| OIP3 | $P_{out} = +14\text{ dBm/tone}$, $\Delta f = 1\text{ MHz}$ | +45 | +44.5 | +44 | dBm |
| Noise Figure | | 6.0 | 6.3 | 6.9 | dB |

Performance Plots TQP9111-PCB2600

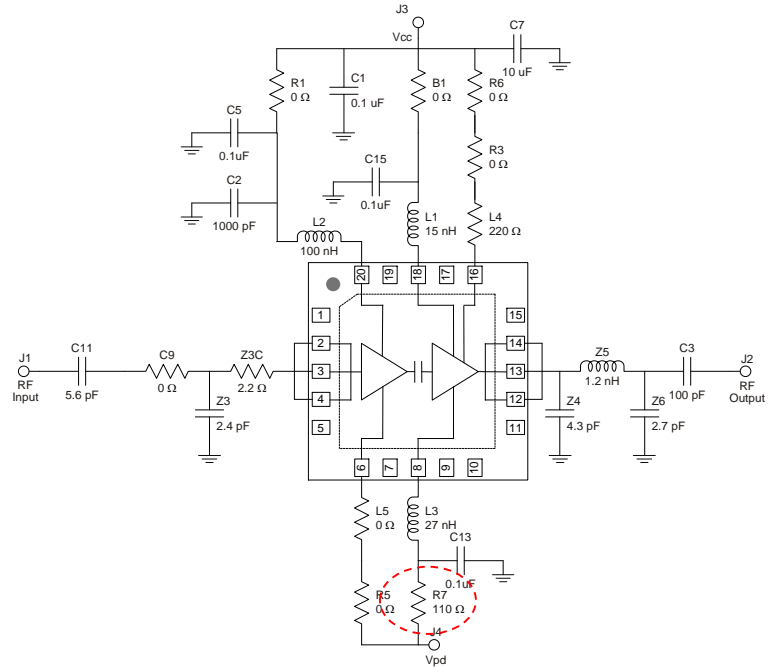
Test conditions unless otherwise noted: $V_{CC} = +5\text{ V}$, $I_{CQ} = 545\text{ mA}$ (typ.), $V_{pd} = +5\text{ V}$, $Temp. = +25\text{ }^{\circ}\text{C}$



Application Note – Reduced Bias Configurations TQP9111-PCB2140

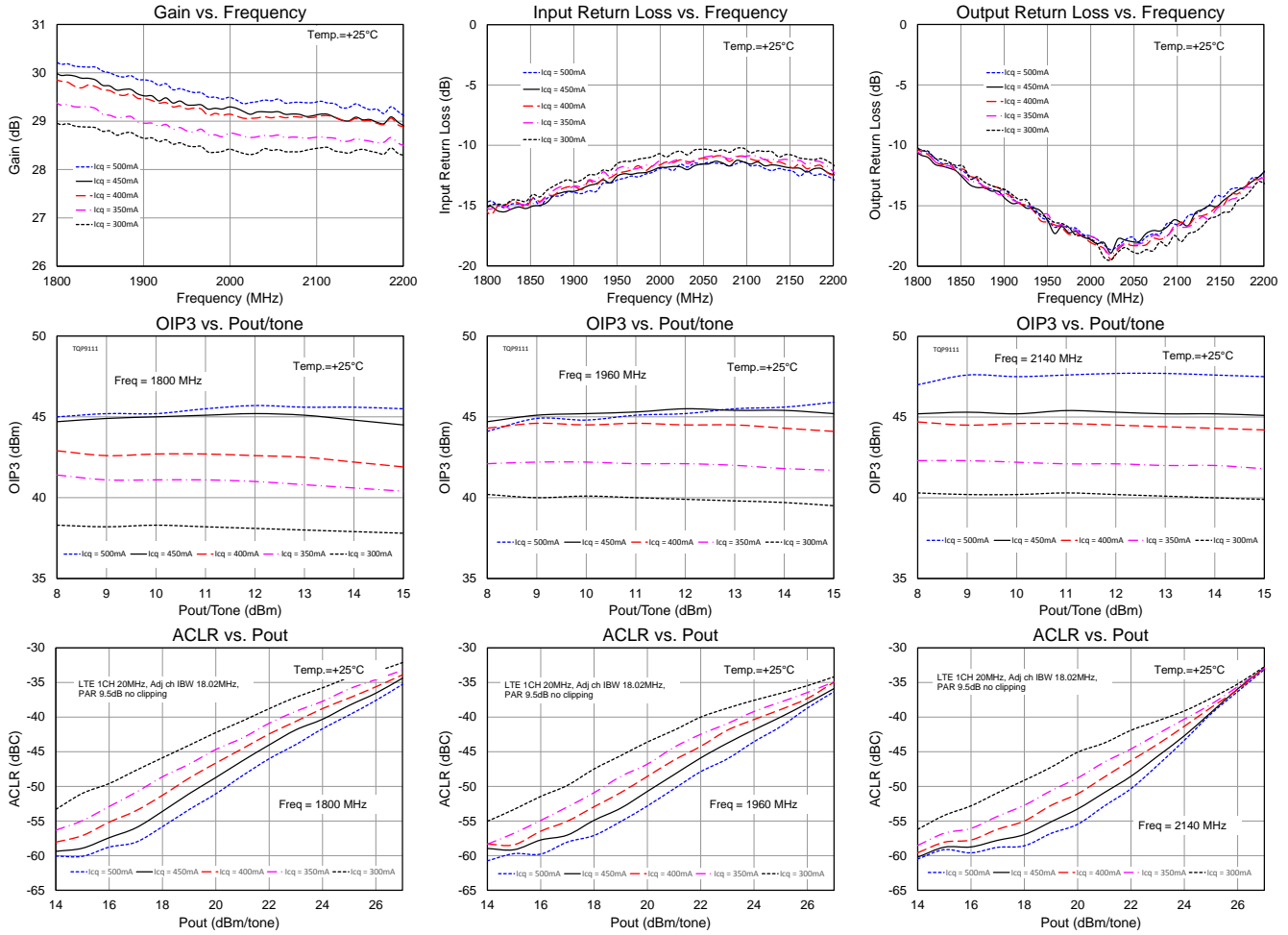
The TQP9111 can be configured to be operated with lower bias current by varying the bias-adjust resistor – R7. The recommended circuit configurations shown previously in this datasheet have the device operating in Class A/B operation. Lowering the current has small effect on the S-parameters and P1dB performance of the device, but will start to lower the OIP3 and ACLR/ACPR performance of the device as shown below. An example of the measured data below represents the TQP9111 measured and configured for 1.8 to 2.2 GHz applications. It is expected that variation of the bias current for other frequency applications will produce similar performance results.

| R7 (Ohms) | Icq (mA) | Pdiss (W) | P1dB (dBm) | OIP3 (dBm) |
|-----------|----------|-----------|------------|------------|
| 110 | 500 | 2.5 | +32.3 | +47.6 |
| 125 | 450 | 2.25 | +32.3 | +45.4 |
| 144 | 400 | 2.0 | +32.3 | +44.6 |
| 163 | 350 | 1.75 | +32.3 | +42.1 |
| 200 | 300 | 1.5 | +32.3 | +40.3 |



Performance Plots TQP9111-PCB2140

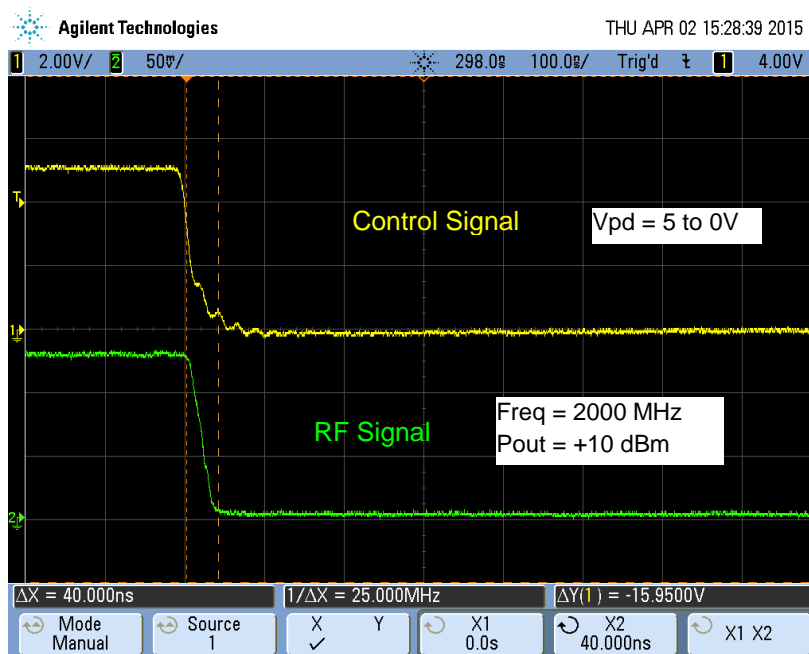
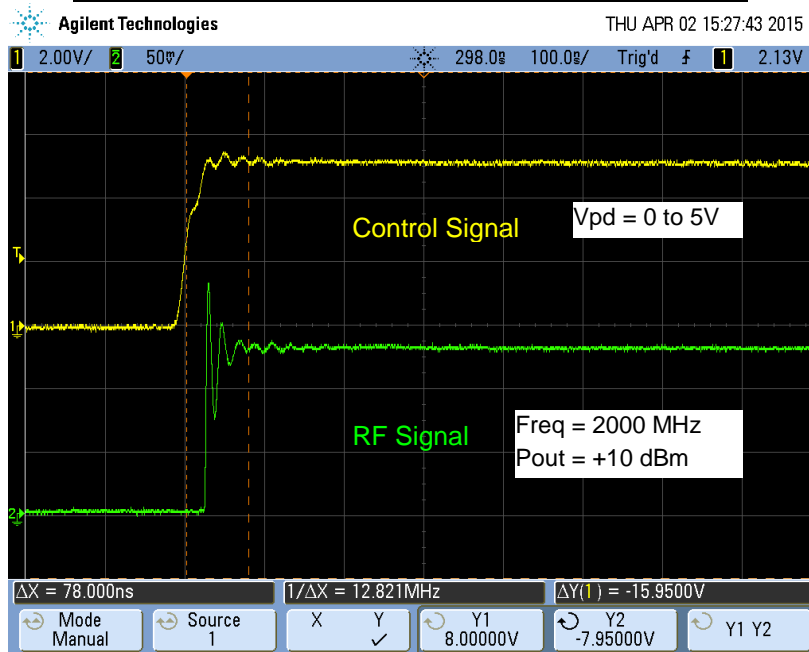
Test conditions unless otherwise noted: $V_{cc} = +5\text{ V}$, $V_{pd} = +5\text{ V}$, $Temp. = +25\text{ }^{\circ}\text{C}$



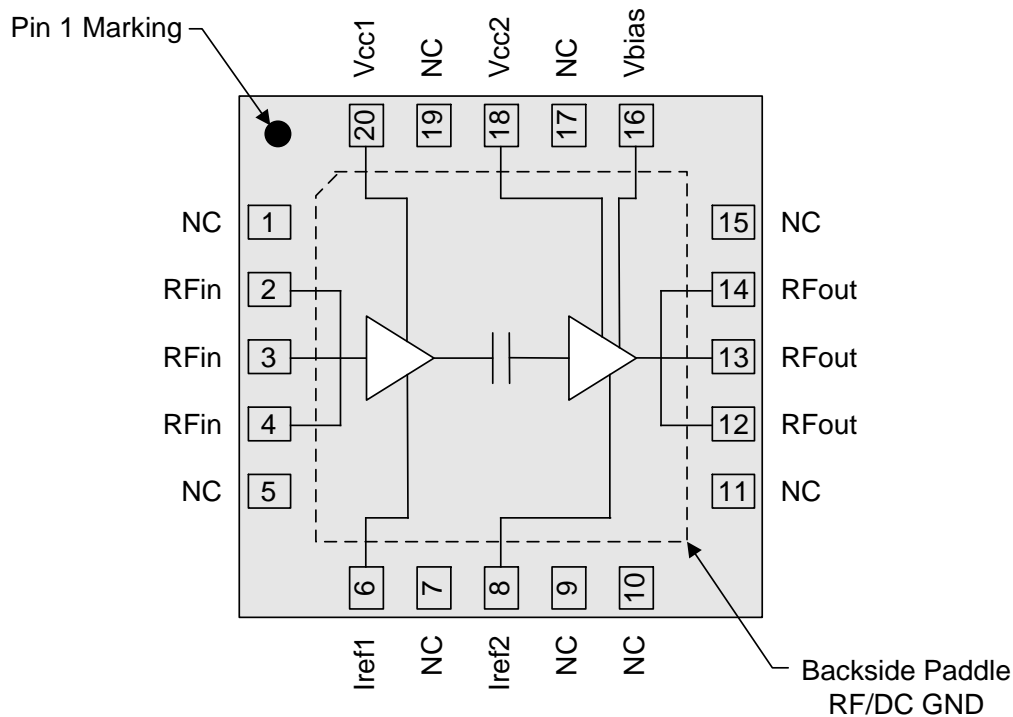
Switching Speed

Switching Speed Measurement based on TQS PCB2140 Application Board
Using Shutdown Circuit: $V_{PD}=5V$, $V_{DD}=5V$, $C13=56pF$

| Parameter | |
|---|------|
| Turn-off Transition (50% CNTR – 10% RF) | 40nS |
| Turn-on Transition (50% CNTR – 90% RF) | 85nS |



Pin Configuration and Description

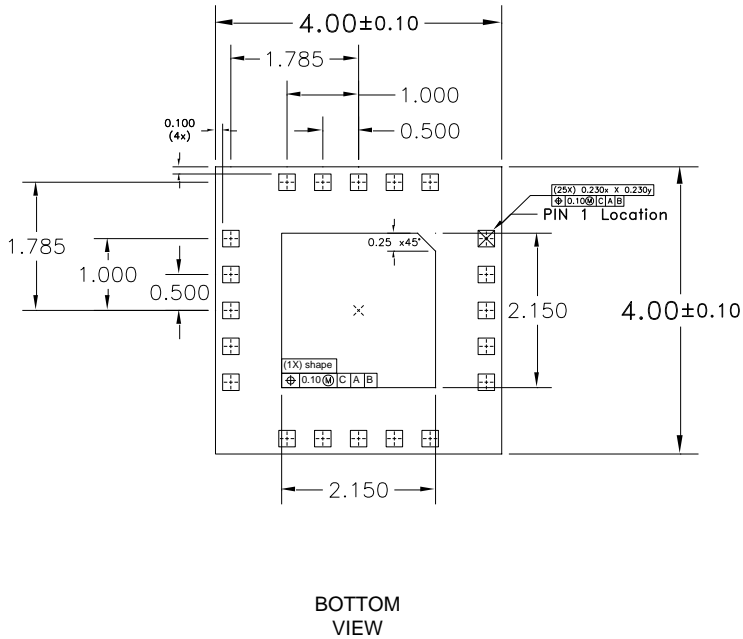
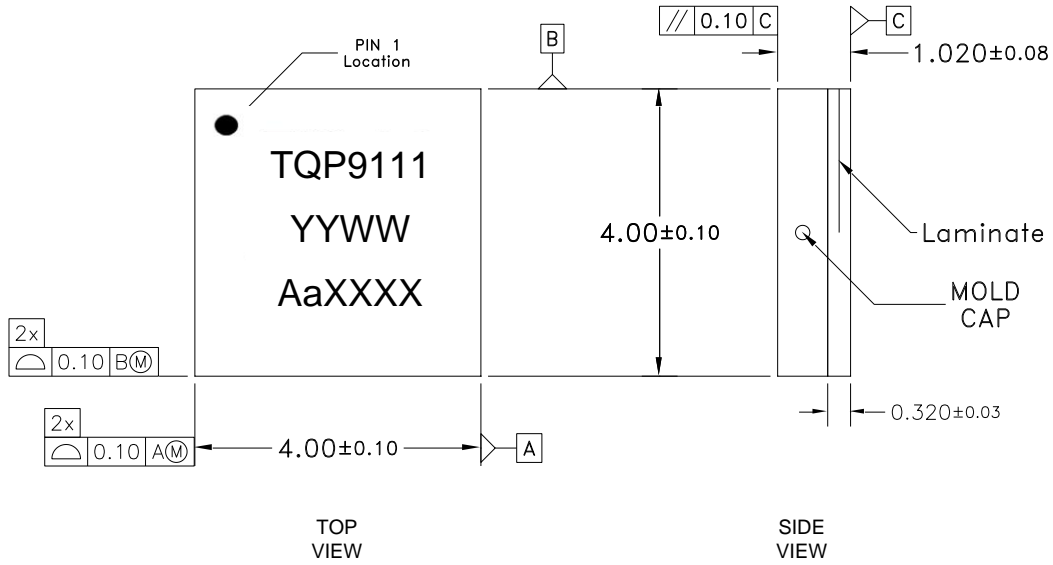


Top View

| Pin No. | Label | Description |
|--------------------------------|-------------------|--|
| 1, 5, 7, 9, 10, 11, 15, 17, 19 | NC | No internal connection. Provide grounded land pads for PCB mounting integrity. |
| 2, 3, 4 | RF in | RF input pins. Require DC blocking and RF match for optimal performance. |
| 6 | I _{REF1} | Sets the bias current for Amp1. Also can be used to power down. |
| 8 | I _{REF2} | Sets the bias current for Amp2. Also can be used to power down. |
| 12, 13, 14 | RF out | RF output pins. Require DC blocking and RF match for optimal performance. |
| 16 | V _{BIAS} | Voltage supply for active bias for the second stage amp. |
| 18 | V _{CC2} | 2 nd Stage DC voltage supply connection. |
| 20 | V _{CC1} | 1 st Stage DC voltage supply connection. |
| Backside Pad | GND | RF/DC ground. Use recommended via pattern to minimize inductance and thermal resistance; see PCB Mounting Pattern for suggested footprint. |

Package Marking and Dimensions

Marking: Part number – TQP9111
Date - YYWW
Lot code – AaXXXX



- Notes:
1. All dimensions are in millimeters. Angles are in degrees.
 2. Dimension and tolerance formats conform to ASME Y14.4M-1994.
 3. The terminal #1 identifier and terminal numbering conform to JESD 95-1 SPP-012.

Product Compliance Information

ESD Sensitivity Ratings



Caution! ESD-Sensitive Device

ESD Class: Class 1C
Volt. Range: ≥ 1000 V to < 2000 V
Test: Human Body Model (HBM)
Standard: ESDA/JEDEC Standard JS-001-2012

ESD Class: Class C3
Volt. Range: > 1000 V
Test: Charged Device Model (CDM)
Standard: JEDEC Standard JESD22-C101

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.

Package lead 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 (C₁₅H₁₂Br₄O₂) Free
- PFOS Free
- SVHC Free

Contact Information

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JONHON

«JONHON» (основан в 1970 г.)

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(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).



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