# MICROCHIP

# SST12CP12

## 2.4 GHz High-Power and High-Gain Power Amplifier

### Features

- High Gain:
  - Typically 33 dB gain across 2.4–2.5 GHz over temperature -40°C to +85°C
- High linear output power, typical performance:
  - 1.75% dynamic EVM up to 23 dBm, MCS8, 40 MHz
  - 2.5% EVM up to 24 dBm, 802.11n, HT40
  - 3% EVM up to 25 dBm for 54 Mbps 802.11g signal
  - Meets 802.11g OFDM spectrum mask requirement up to 28.5 dBm
  - Meets 802.11b ACPR requirement up to 28.5 dBm
- High-speed power-up/down
  - Turn on/off time (10%-90%) <100 ns
- 10:1 VSWR survivability (unconditionally stable up to 28.5 dBm)
- On-chip power detection
  - 20 dB dynamic range
  - VSWR- and temperature-insensitive
- Simple input/output matching
- Packages available
  - 16-contact UQFN (3mm x 3mm)
- All non-Pb (lead-free) devices are RoHS compliant

### Applications

- WLAN (IEEE 802.11b/g/n)
- AP router
- WiMax (IEEE 802.16e)
- Home RF
- Cordless phones
- 2.4 GHz ISM wireless equipment
- 1.8 GHz Pico Cell

### Product Description

SST12CP12 is a high-power and high-gain power amplifier (PA) based on the highly-reliable InGaP/GaAs HBT technology.

Operating over the 2.4–2.5 GHz frequency band, the PA will typically provide 33 dB gain with 25% power-added efficiency @ $P_{OUT}$ = 28 dBm for 802.11g.

SST12CP12 has excellent linearity, providing less than 1.75%

dynamic EVM up to 23 dBm with MCS8, 40 MHz bandwidth modulation. It will also provide typically 3% added EVM at 25 dBm output power with 54 Mbps 802.11g operation while meeting 802.11g spectrum mask at 28.5 dBm. SST12CP12 also has a single-ended power detector for active power control.

The power amplifier IC also features high-speed power-up/-down control with the $V_{REF}$ control pins.

SST12CP12 is offered in 16-contact UQFN package. See Figure 2-1 for pin assignments and Table 3-1 for pin descriptions.

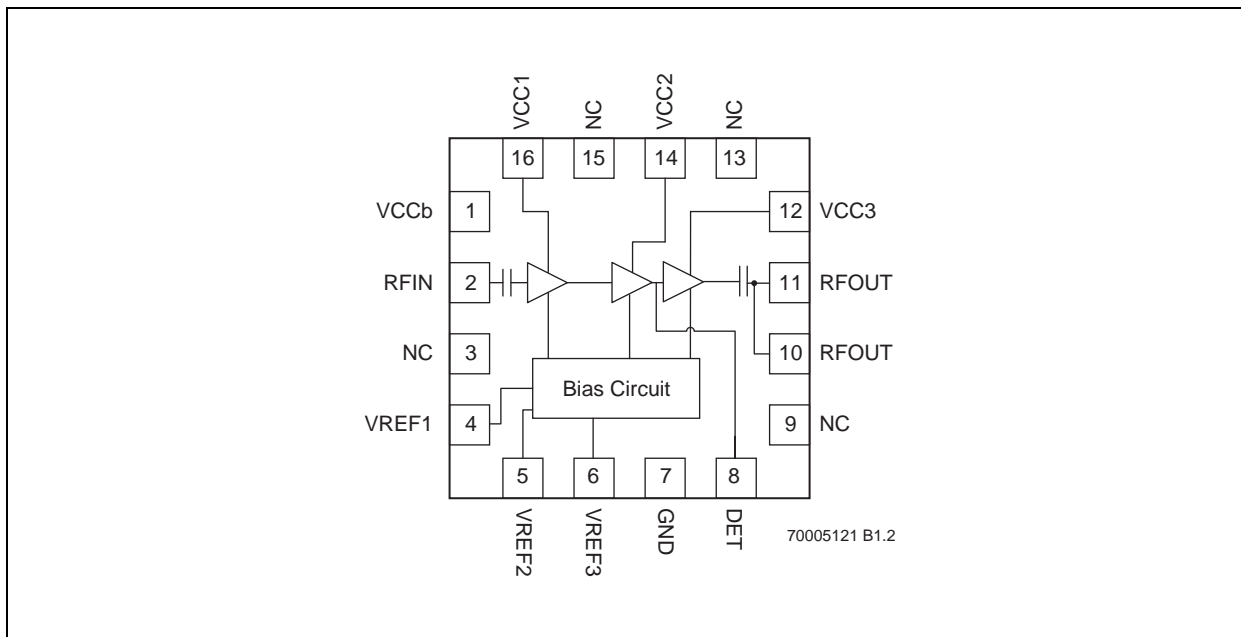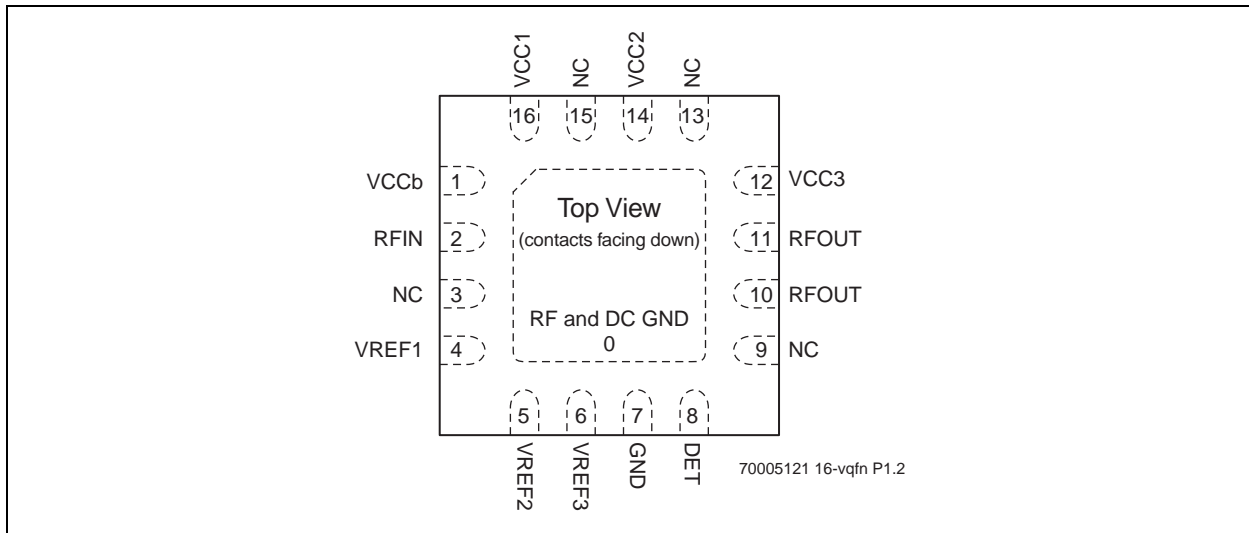## 1.0    FUNCTIONAL BLOCKS



**FIGURE 1-1:        FUNCTIONAL BLOCK DIAGRAM**

## 2.0 PIN ASSIGNMENTS



**FIGURE 2-1:** PIN ASSIGNMENTS FOR 16-CONTACT UQFN

## 3.0 PIN DESCRIPTIONS

**TABLE 3-1: PIN DESCRIPTION**

| Symbol | Pin No. | Pin Name | Type[1] | Function |
|---|---|---|---|---|
| GND | 0 | Ground | | The center pad should be connected to RF ground with several low inductance, low resistance vias. |
| VCCb | 1 | Power Supply | | Bias circuit supply |
| RFIN | 2 | | I | RF input, DC decoupled |
| NC | 3 | No Connection | | Unconnected, no internal connection |
| VREF1 | 4 | Power Supply | PWR | 1st stage idle-current control |
| VREF2 | 5 | Power Supply | PWR | 2nd stage idle-current control |
| VREF3 | 6 | Power Supply | PWR | 3rd stage idle-current control |
| GND | 7 | Ground | | |
| Det | 8 | | O | On-chip power detector |
| NC | 9 | No Connection | | Unconnected, no internal connection |
| RFOUT | 10 | | O | RF output |
| RFOUT | 11 | | O | RF output |
| VCC3 | 12 | Power Supply | PWR | Power supply, 3rd stage |
| NC | 13 | No Connection | | Unconnected, no internal connection |
| VCC2 | 14 | Power Supply | PWR | Power supply, 2nd stage |
| NC | 15 | No Connection | | Unconnected pins. |
| VCC1 | 16 | Power Supply | PWR | Power supply, 1st stage |

1. I=Input, O=Output

## 4.0    ELECTRICAL SPECIFICATIONS

The AC and DC specifications for the power amplifier interface signals. Refer to Table 4-2 for the DC voltage and current specifications. Refer to Figures 5-1 through 6-5 for the RF performance.

**Absolute Maximum Stress Ratings**  (Applied conditions greater than those listed under "Absolute Maximum Stress Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these conditions or conditions greater than those defined in the operational sections of this data sheet is not implied. Exposure to absolute maximum stress rating conditions may affect device reliability.)

Input power to pins 2 and 3 ($P_{IN}$) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 5 dBm
Supply Voltage at pins 5, 12, 14, 16 ($V_{CC}$) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . +6V
Reference voltage to pins 4 ($V_{REF1}$) and pin 7 ($V_{REF2}$) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .+3.5V
DC supply current ($I_{CC}$) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 750 mA
Operating Temperature ($T_A$) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . -40ºC to +85ºC
Storage Temperature ($T_{STG}$). . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . -40ºC to +120ºC
Maximum Junction Temperature ($T_J$) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . +150ºC
Surface Mount Solder Reflow Temperature . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 260°C for 10 seconds

### TABLE 4-1:    OPERATING RANGE

| Range | Ambient Temp | $V_{CC}$ |
|---|---|---|
| Industrial | -40°C to +85°C | 3.0V to 5.0V |

### TABLE 4-2:    DC ELECTRICAL CHARACTERISTICS AT 25ºC

| Symbol | Parameter | Min. | Typ | Max. | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage at pins 5, 12, 14, 16 | 4.0 | 5.0 | 5.5 | V |
| $I_{CC}$ | Average Current at 100% duty cycle | | | | |
| | for 802.11g, 28.5 dBm | | 670 | | mA |
| | for 802.11b, 28.5 dBm | | 670 | | mA |
| | for 802.11ac, 27 dBm | | 600 | | mA |
| $I_{CQ}$ | Idle current for 802.11g to meet EVM<3% @24.5 dBm, 100% duty cycle | | 325 | | mA |
| $V_{REG}$ | Reference Supply | 3.00 | 3.10 | 3.15 | V |

**TABLE 4-3:** **AC ELECTRICAL CHARACTERISTICS FOR CONFIGURATION AT 25ºC**

| Symbol | Parameter | Min. | Typ | Max. | Unit |
|---|---|---|---|---|---|
| $F_{L-U}$ | Frequency range in 802.11b/g/ac applications | 2400 | | 2500 | MHz |
| $P_{OUT}$ | Output power at 3% EVM with 802.11g OFDM at 54 Mbps | | 25 | | dBm |
| | Output power at 1.75% dynamic EVM with MCS8, 40 MHz | | 23 | | dBm |
| | Output power meeting 802.11g spectral mask | | 28.5 | | dBm |
| | Output power meeting 802.11ac spectral mask | | 27 | | dBm |
| | Output power meeting 802.11b spectral mask | | 28.5 | | dBm |
| G | Power gain | 32 | 33 | | dB |
| $G_{VAR}$ | Gain variation over 40 MHz | | | ±0.5 | dB |
| 2f | Harmonics at 29 dBm, 802.11b mask compliance | | -21 | | dBm/MHz |
| 2f | Harmonics at 27 dBm | | -38 | | dBm/MHz |

## 5.0    TYPICAL PERFORMANCE CHARACTERISTICS

**Test Conditions: $V_{CC}$ = 5.0V, $V_{REG}$ = 3.1V, $T_A$ = 25°C Unless otherwise specified**
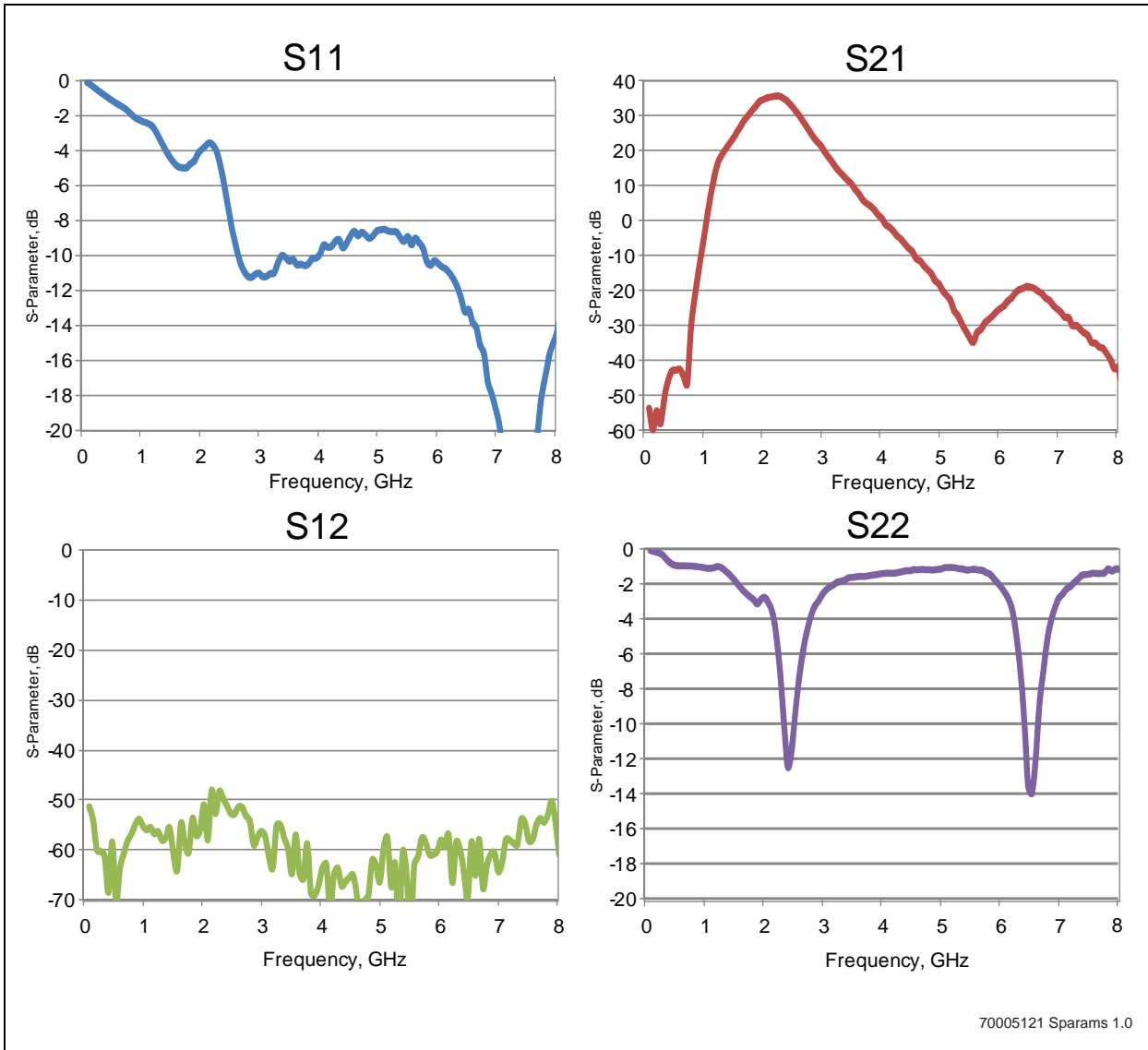


**FIGURE 5-1:        S-PARAMETERS**

## 6.0    802.11ac APPLICATIONS

**Typical Dynamic Performance Characteristics**
**Test Conditions: V$_{CC}$ = 5.0V, V$_{REG}$ = 3.1 V, T$_A$ = 25°C, MCS8 40 MHz signal, data duty cycle 23% (60 μs on /200 μs idle) unless otherwise specified**
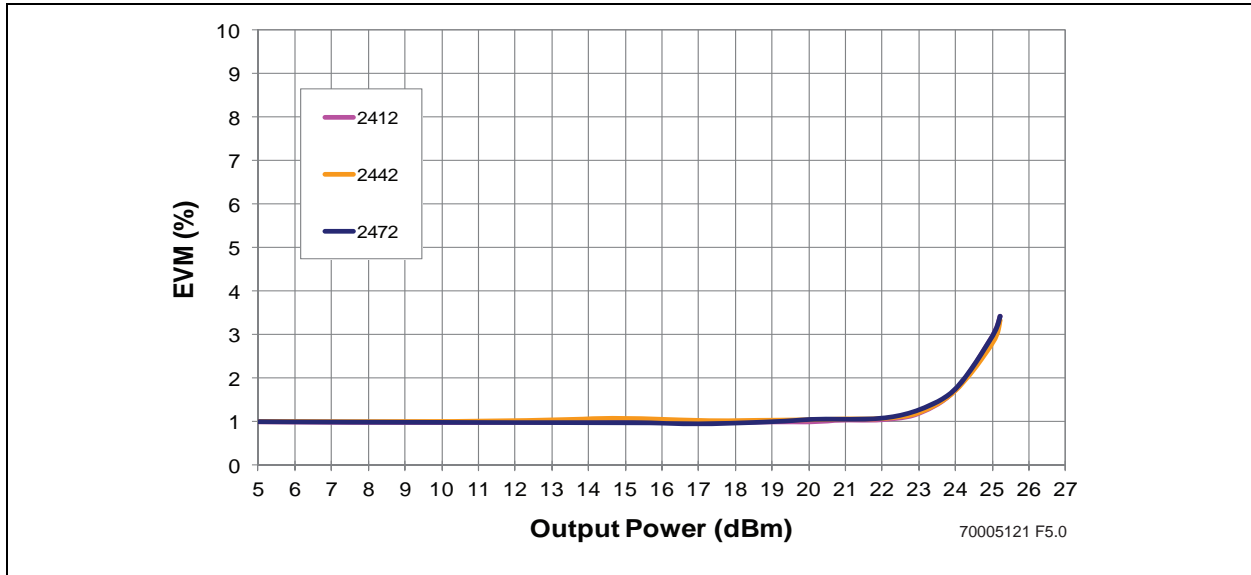


**FIGURE 6-1:**        **EVM VERSUS OUTPUT POWER, 100% DUTY CYCLE**
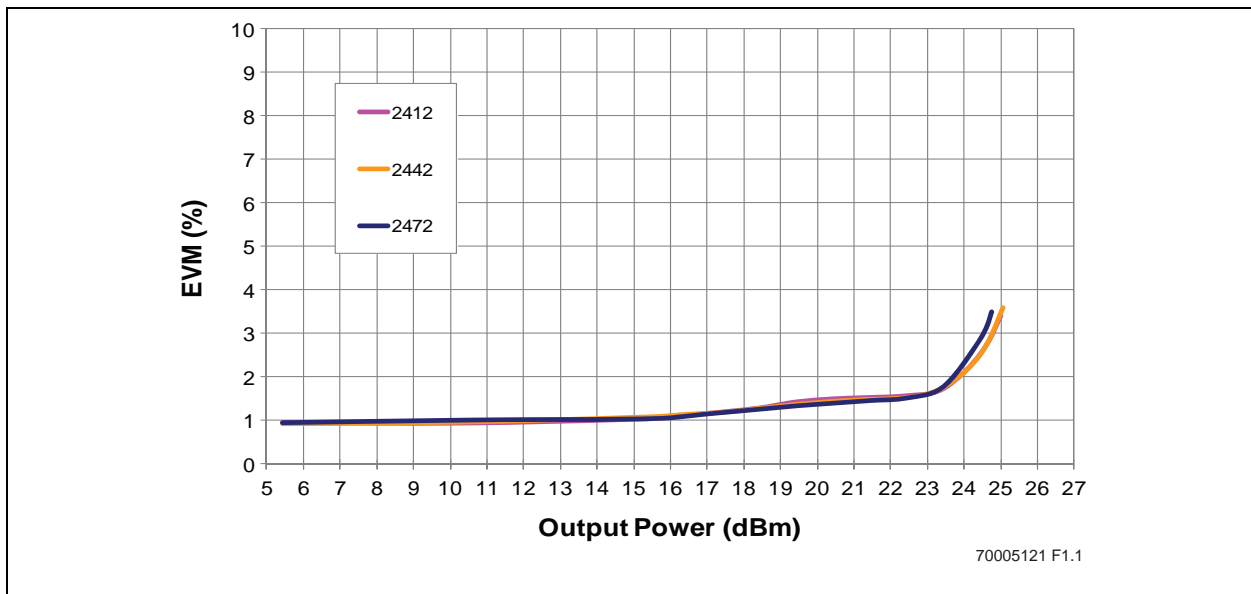


**FIGURE 6-2:**        **DYNAMIC EVM VERSUS OUTPUT POWER, 23% DUTY CYCLE**

## 802.11ac APPLICATIONS (CONTINUED)
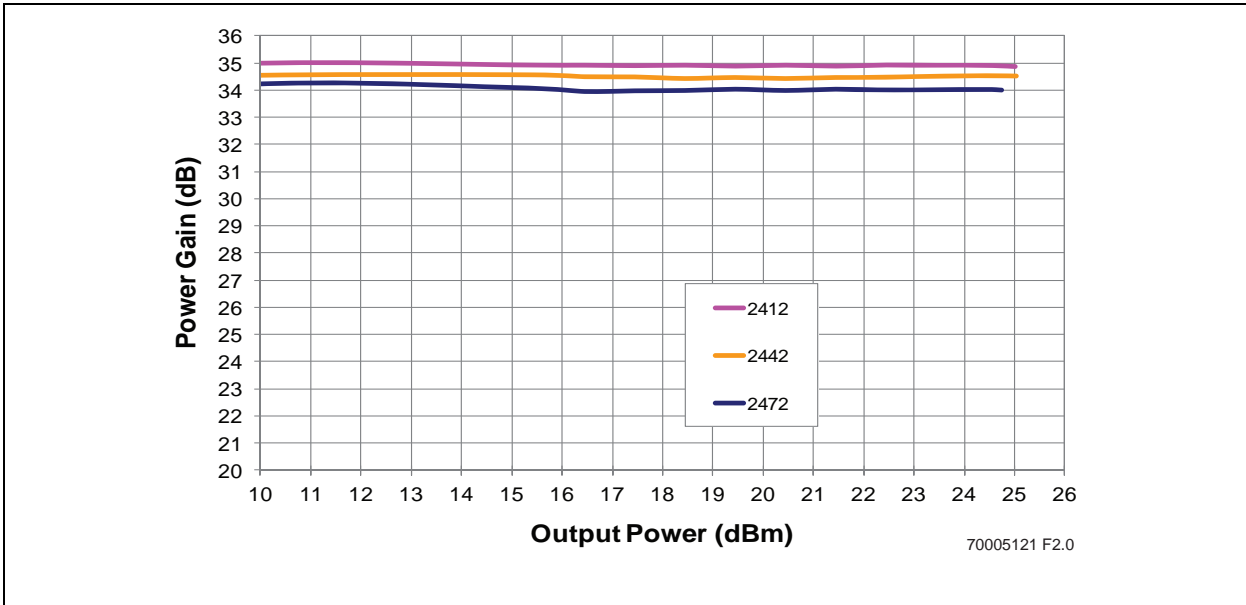


**FIGURE 6-3:** POWER GAIN VERSUS OUTPUT POWER
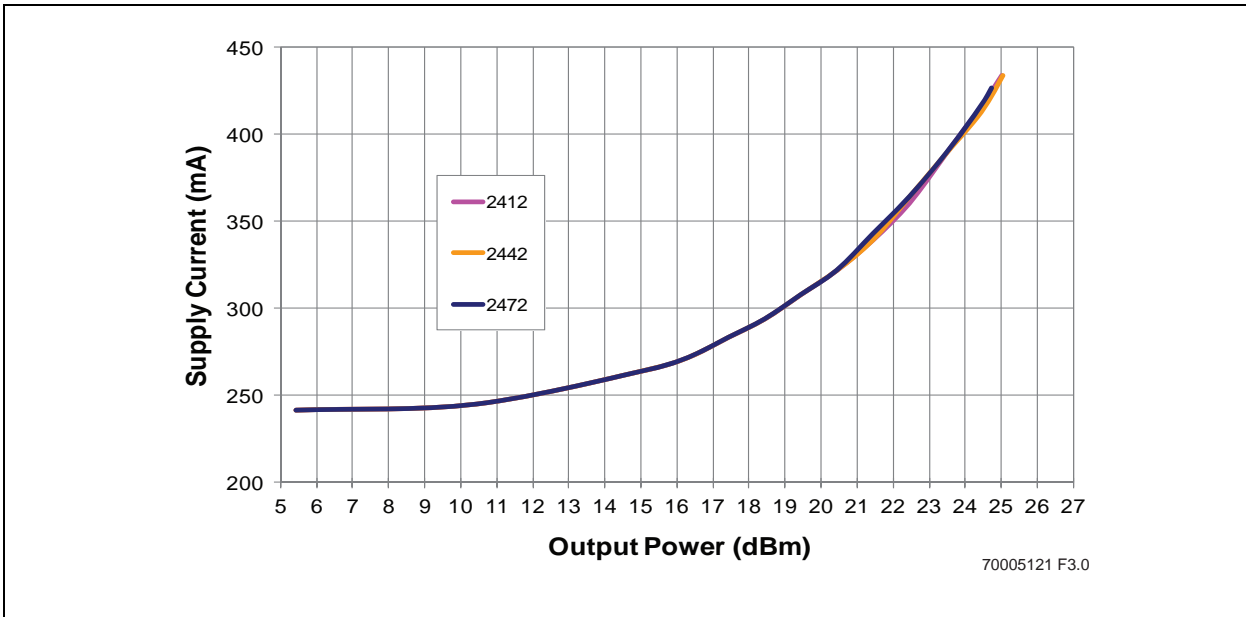


**FIGURE 6-4:** INSTANTANEOUS SUPPLY CURRENT VERSUS OUTPUT POWER FOR DYNAMIC OPERATION, 23% DUTY CYCLE

## 802.11ac APPLICATIONS (CONTINUED)
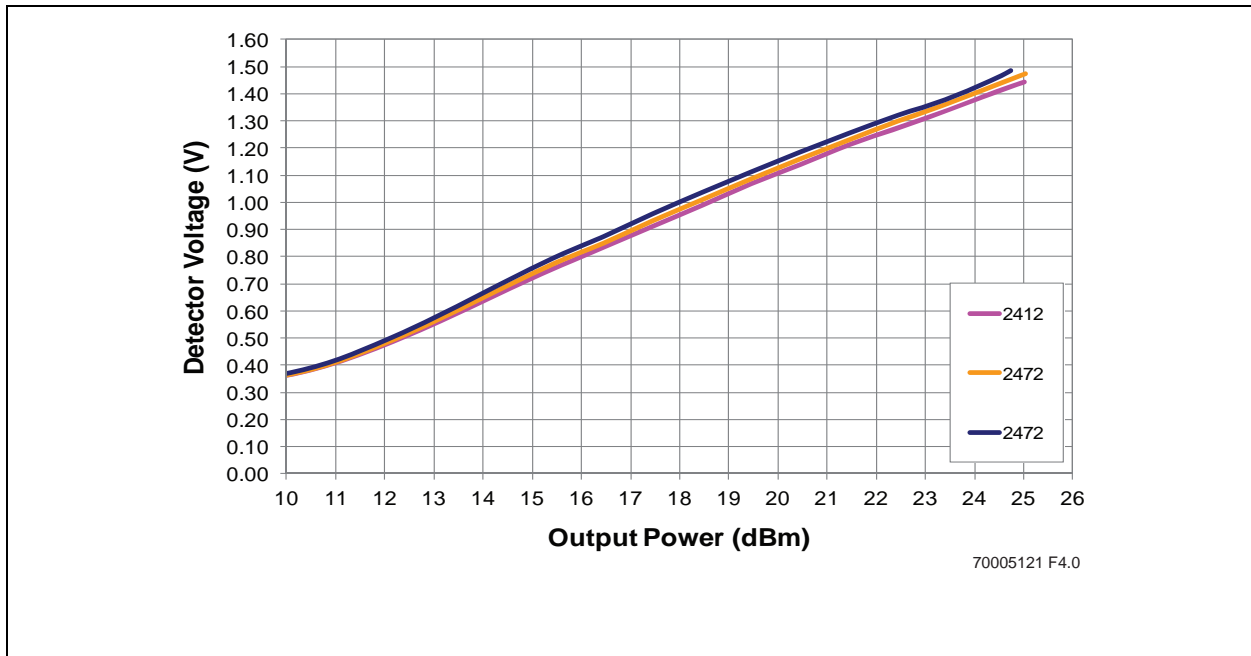


**FIGURE 6-5:** INSTANTANEOUS DETECTOR VOLTAGE VERSUS OUTPUT POWER
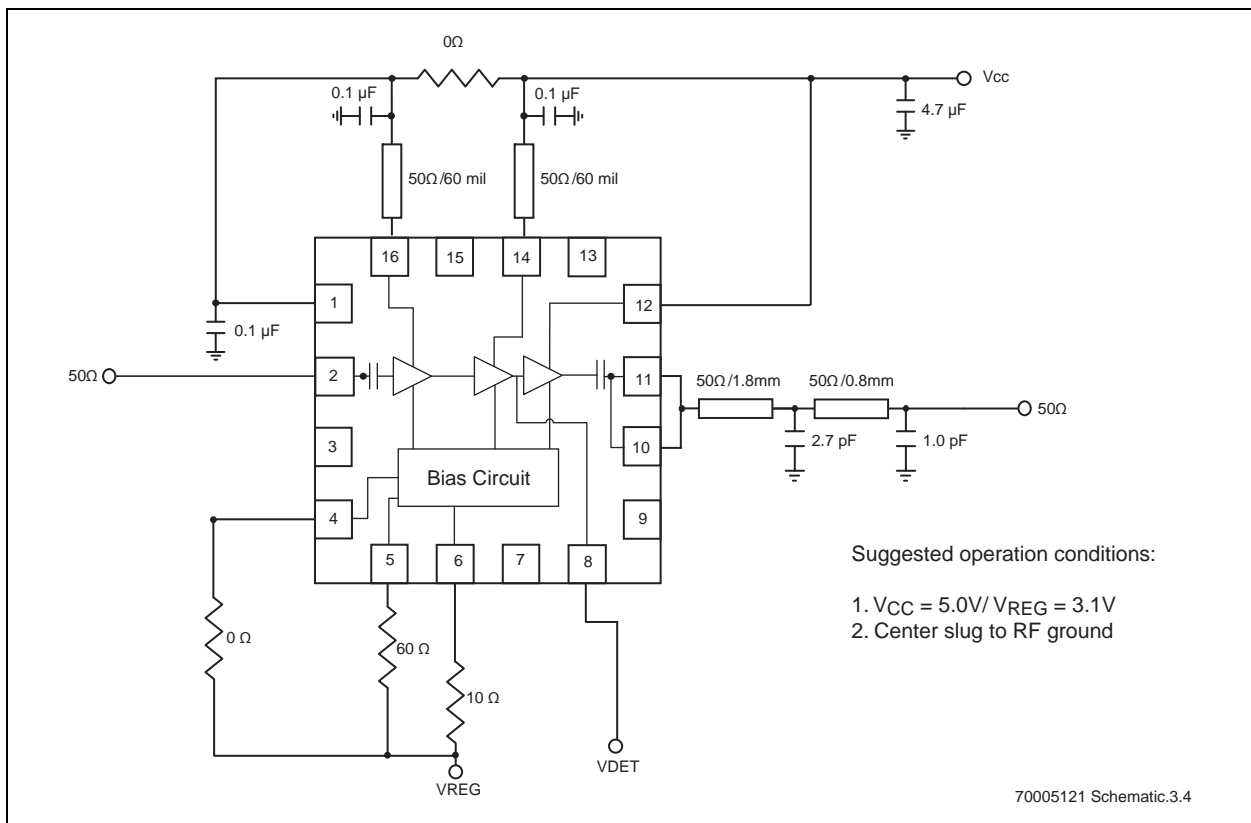


**FIGURE 6-6:** TYPICAL SCHEMATIC FOR 802.11AC APPLICATIONS

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## 7.0    PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office.

<u>**PART NO.**</u>    <u>**XXX**</u>

   **Device**    **Package**

| | | |
|---|---|---|
| Device: | SST12CP12 | = 2.4 GHz High-power and High-gain Power Amplifier |
| Package: | QUCE | = UQFN (3mm x 3mm), 0.6 max thickness 16-contact |
| Evaluation Kit Flag | K | = Evaluation Kit |

**Valid Combinations:**
SST12CP12-QUCE
SST12CP12-QUCE-K

## 8.0    PACKAGE INFORMATION

TOP VIEW

SIDE VIEW

BOTTOM VIEW

Pin #1 →

3.00
± 0.075

3.00
± 0.075

0.15

0.075

0.05 Max

$\dfrac{0.60}{0.50}$

See notes
2 and 3

1.7

1.7

← Pin #1

0.5 BSC

$\dfrac{0.45}{0.35}$

$\dfrac{0.30}{0.18}$

1mm
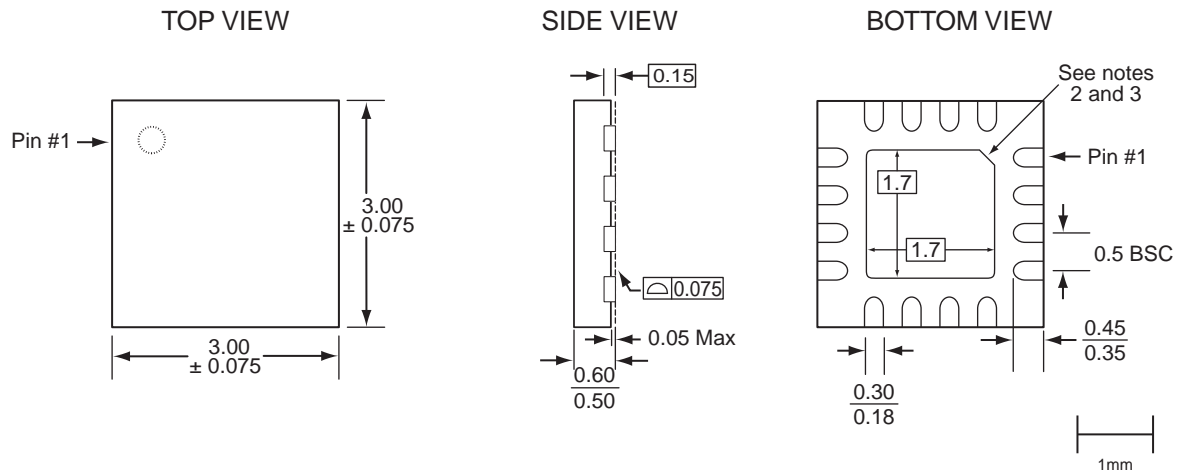
Note:  1.  Complies with JEDEC JEP95 MO-248D, variant UEED-4 except external paddle nominal dimensions.
2.  From the bottom view, the pin #1 indicator may be either a 45-degree chamfer or a half-circle notch.
3.  The external paddle is electrically connected to the die back-side and possibly to certain $V_{SS}$ leads.
This paddle can be soldered to the PC board; it is suggested to connect this paddle to the $V_{SS}$ of the unit.
Connection of this paddle to any other voltage potential can result in shorts and/or electrical malfunction of the device.
4.  Untoleranced dimensions are nominal target dimensions.
5.  All linear dimensions are in millimeters (max/min).

16-uqfn-3x3-QUC-0.0

**FIGURE 8-1:**        **16-CONTACT ULTRA-THIN QUAD FLAT NO-LEAD (UQFN)**
**PACKAGE CODE: QUC**

**TABLE 8-1:     REVISION HISTORY**

| Revision | Description | Date |
|----------|-------------|------|
| A | • Initial release of data sheet | Apr 2013 |

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