A Microchip Technology Company

# 2.4 GHz High-Efficiency, High-Gain Power Amplifier Module
## SST12LP17E

***Data Sheet***

*The SST12LP17E is a versatile power amplifier based on the highly-reliable InGaP/GaAs HBT technology. SST12LP17E is a 2.4 GHz fully-integrated, high-efficiency Power Amplifier module designed in compliance with IEEE 802.11b/g/n applications. It typically provides 29 dB gain with 28% power-added efficiency. The SST12LP17E has excellent linearity while meeting 802.11g spectrum mask at 21.5 dBm. The SST12LP17E also features easy board-level usage along with high-speed power-up/down control through a single combined reference voltage pin and is offered in an 8-contact USON package.*

## Features

- **Input/Output ports matched to 50Ω internally and DC decoupled**
- **High gain:**
  - Typically 29 dB gain across 2.4–2.5 GHz
- **High linear output power:**
  - >24 dBm P1dB
    - Single-tone measurement. Please refer to “Absolute Maximum Stress Ratings” on page 5
  - Meets 802.11g OFDM ACPR requirement up to 21.5 dBm
  - ~3% added EVM up to 18 dBm for 54 Mbps 802.11g signal
  - Meets 802.11b ACPR requirement up to 22.5 dBm
- **High power-added efficiency/Low operating current for both 802.11b/g/n applications**
  - ~28%/153 mA @ $P_{OUT}$ = 21.5 dBm for 802.11g
  - ~33%/163 mA @ $P_{OUT}$ = 22.5 dBm for 802.11b
- **Single-pin low $I_{REF}$ power-up/down control**
  - $I_{REF}$ <2 mA
- **Low idle current**
  - ~80 mA $I_{CQ}$
- **High-speed power-up/down**
  - Turn on/off time (10%- 90%) <100 ns
  - Typical power-up/down delay with driver delay included <200 ns
- **Low shut-down current (~2 µA)**
- **Limited variation over temperature**
  - ~2 dB gain variation between -40°C to +85°C
  - ~1 dB power variation between -40°C to +85°C
- **Excellent on-chip power detection**
- **>15 dB dynamic range on-chip power detection**
- **Packages available**
  - 8-contact USON – 2mm x 2mm
- **All non-Pb (lead-free) devices are RoHS compliant**

## Applications

- **WLAN (IEEE 802.11b/g/n)**
- **Home RF**
- **Cordless phones**
- **2.4 GHz ISM wireless equipment**

# Product Description

The SST12LP17E is a versatile power amplifier based on the highly-reliable InGaP/GaAs HBT technology.The input/output RF ports are fully matched to 50Ω internally. These RF ports are DC decoupled and require no DC-blocking capacitors or matching components. This helps reduce the system board's Bill of Materials (BOM) cost.

The SST12LP17E is a 2.4 GHz fully-integrated, high-efficiency Power Amplifier module designed in compliance with IEEE 802.11b/g/n applications. It typically provides 29 dB gain with 28% power-added efficiency (PAE) @ POUT = 21.5 dBm for 802.11g and 33% PAE @ POUT = 22.5 dBm for 802.11b.

The SST12LP17E has excellent linearity, typically ~3% added EVM at 18 dBm output power which is essential for 54 Mbps 802.11g operation while meeting 802.11g spectrum mask at 21.5 dBm and 802.11b spectrum mask at 22.5 dBm.

The SST12LP17E also features easy board-level usage along with high-speed power-up/down control through a single combined reference voltage pin. Ultra-low reference current (total $I_{REF}$ ~2 mA) makes the SST12LP17E controllable by an on/off switching signal directly from the baseband chip. These features, coupled with low operating current, make the SST12LP17E ideal for the final stage power amplification in battery-powered 802.11b/g/n WLAN transmitter applications.

The SST12LP17E has an excellent on-chip, single-ended power detector, which features wide-range (>15 dB) with dB-wise linearization. The excellent on-chip power detector provides a reliable solution to board-level power control.

The SST12LP17E is offered in 8-contact USON package. See Figure 2 for pin assignments and Table 1 for pin descriptions.

## Functional Blocks

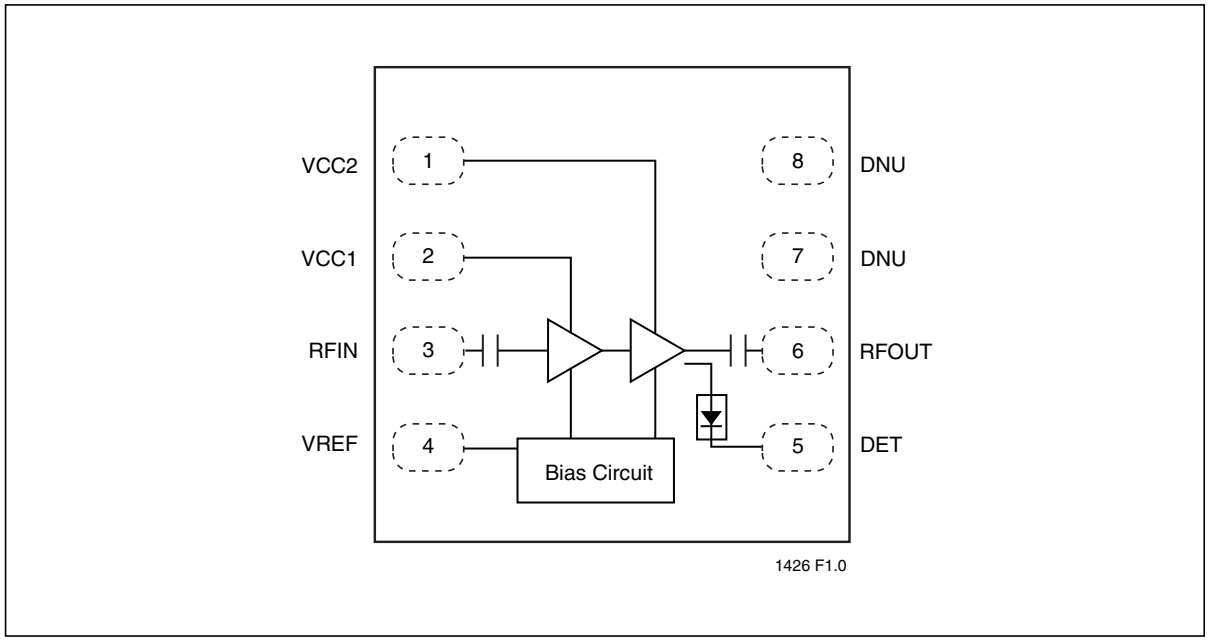


**Figure 1:** Functional Block Diagram

# Pin Assignments

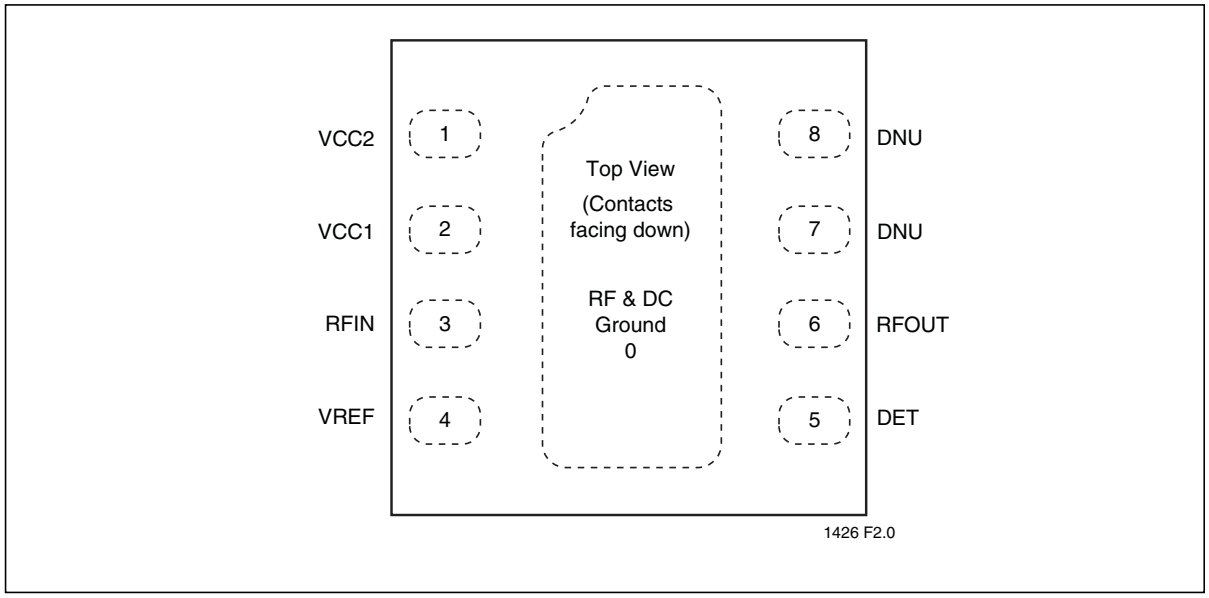


**Figure 2:** Pin Assignments for 8-contact USON

# Pin Descriptions

**Table 1:** Pin Description

| Symbol | Pin No. | Pin Name | Type[1] | Function |
|---|---|---|---|---|
| GND | 0 | Ground | | Low inductance ground pad |
| VCC2 | 1 | Power Supply | PWR | Power supply, 2nd stage |
| VCC1 | 2 | Power Supply | PWR | Power supply, 1st stage |
| RFIN | 3 | | I | RF input, DC decoupled |
| VREF | 4 | | PWR | 1st and 2nd stage idle current control |
| DET | 5 | | O | On-chip power detector |
| RFOUT | 6 | | O | RF output, DC decoupled |
| DNU | 7 | Do Not Use | | Do not use or connect |
| DNU | 8 | Do Not Use | | Do not use or connect |

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1. I=Input, O=Output

# Electrical Specifications

The DC and RF specifications for the power amplifier are specified below. Refer to Table 3 for the DC voltage and current specifications. Refer to Figures 3 through 8 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 beyond absolute maximum stress rating conditions may affect device reliability.)

Input power to pin 3 ($P_{IN}$) . . . . . +5 dBm
Average output power from Pin 6 ($P_{OUT}$)[1] . . . . . +25.5 dBm
Supply Voltage at pins 1 and 2 ($V_{CC}$) . . . . . -0.3V to +4.6V
Reference voltage to pin 4 ($V_{REF}$) . . . . . -0.3V to +3.3V
DC supply current ($I_{CC}$)[2] . . . . . 300 mA
Operating Temperature ($T_A$) . . . . . -40°C to +85°C
Storage Temperature ($T_{STG}$) . . . . . -40°C to +120°C
Maximum Junction Temperature ($T_J$) . . . . . +150°C
Surface Mount Solder Reflow Temperature . . . . . 260°C for 10 seconds

1. Never measure with CW source. Pulsed single-tone source with <50% duty cycle is recommended. Exceeding the maximum rating of average output power could cause permanent damage to the device.
2. Measured with 100% duty cycle 54 Mbps 802.11g OFDM Signal

**Table 2:** Operating Range

| Range | Ambient Temp | $V_{CC}$ |
|---|---|---|
| Industrial | -40°C to +85°C | 3.3V |

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**Table 3:** DC Electrical Characteristics at 25°C

| Symbol | Parameter | Min. | Typ | Max. | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage at pins 1 and 2 | 3.0 | 3.3 | 4.2 | V |
| $I_{CQ}$ | Idle current to meet EVM ~3% @ 18 dBm Output Power, 802.11g OFDM 54 Mbps signal | | 80 | | mA |
| $V_{REG}$ | Reference Voltage for pin 4 | 2.70 | 2.75 | 2.80 | V |
| $I_{CC}$ | Current consumption to meet 802.11g OFDM 54 Mbps spectrum mask @ 21.5 dBm | | 155 | | mA |
| | Current consumption to meet 802.11b DSSS 54 Mbps spectrum mask @ 22.5 dBm | | 165 | | mA |
| | Current consumption to meet EVM ~3% @ 18 dBm Output Power with 802.11g OFDM 54 Mbps signal | | 125 | | mA |

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**Table 4:** RF Characteristics at 25°C

| Symbol | Parameter | Min. | Typ | Max. | Unit |
|---|---|---|---|---|---|
| $F_{L-U}$ | Frequency range | 2412 | | 2484 | MHz |
| G | Small signal gain | 27.5 | 29 | | dB |
| $G_{VAR1}$ | Gain variation over band (2412–2484 MHz) | | | ±0.5 | dB |
| $G_{VAR2}$ | Gain ripple over channel (20 MHz) | | 0.2 | | dB |
| 2f, 3f, 4f, 5f | Harmonics at 23 dBm, without external filters | | | -40 | dBc |
| EVM | Added EVM @ 18 dBm output with 802.11g OFDM 54 Mbps signal | | 3 | | % |
| $P_{OUT}$ | Output Power to meet 802.11g OFDM 54 Mbps spectrum mask | 20.5 | 21.5 | | dBm |
| | Output Power to meet 802.11b DSSS 1 Mbps spectrum mask | 21.5 | 22.5 | | dBm |

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# Typical Performance Characteristics

## Test Conditions: $V_{CC}$ = 3.3V, $T_A$ = 25°C, unless otherwise specified

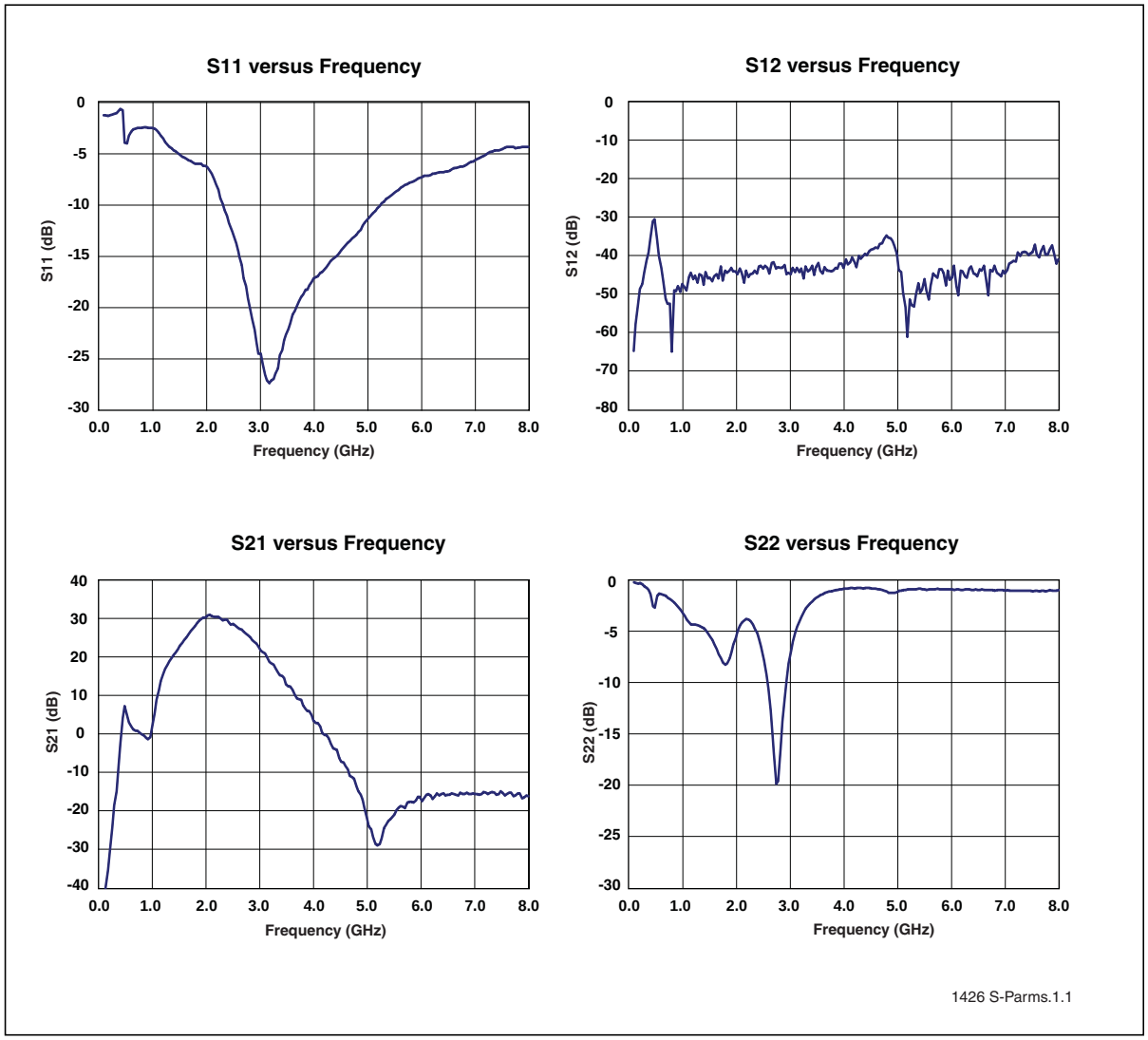
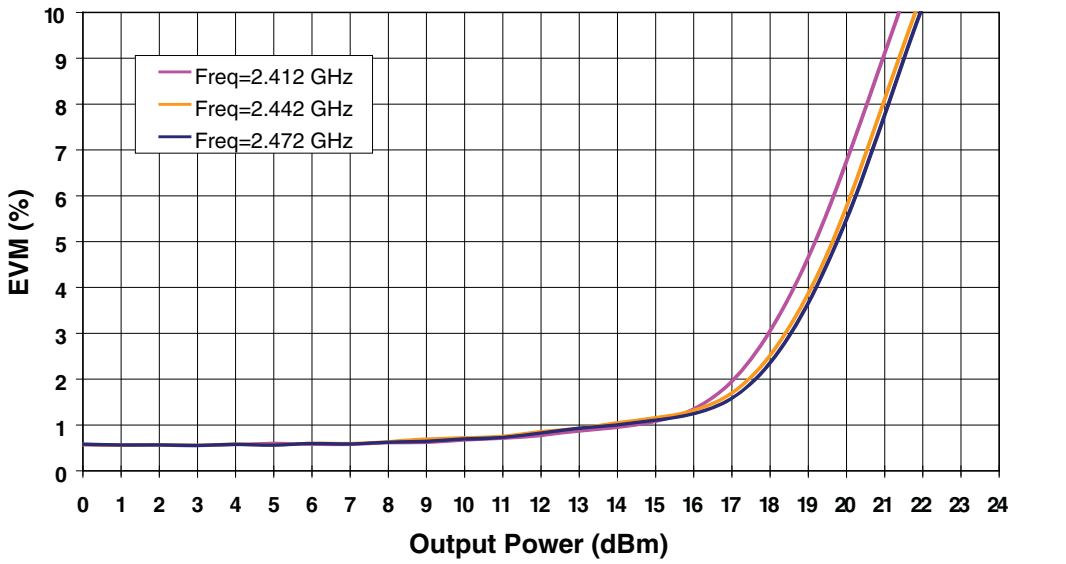



**Figure 3:** S-Parameters

# Typical Performance Characteristics

## Test Conditions: $V_{CC}$ = 3.3V, $T_A$ = 25°C, 54 Mbps 802.11g OFDM Signal Equalizer Training Setting using Channel Estimation Sequence and Data




**Note:** When using Channel Estimation Sequence Only in the Equalizer Training settings, the EVM will measure typically 0.3% higher than shown for up to 18 dBm output power.

**Figure 4:** EVM versus Output Power

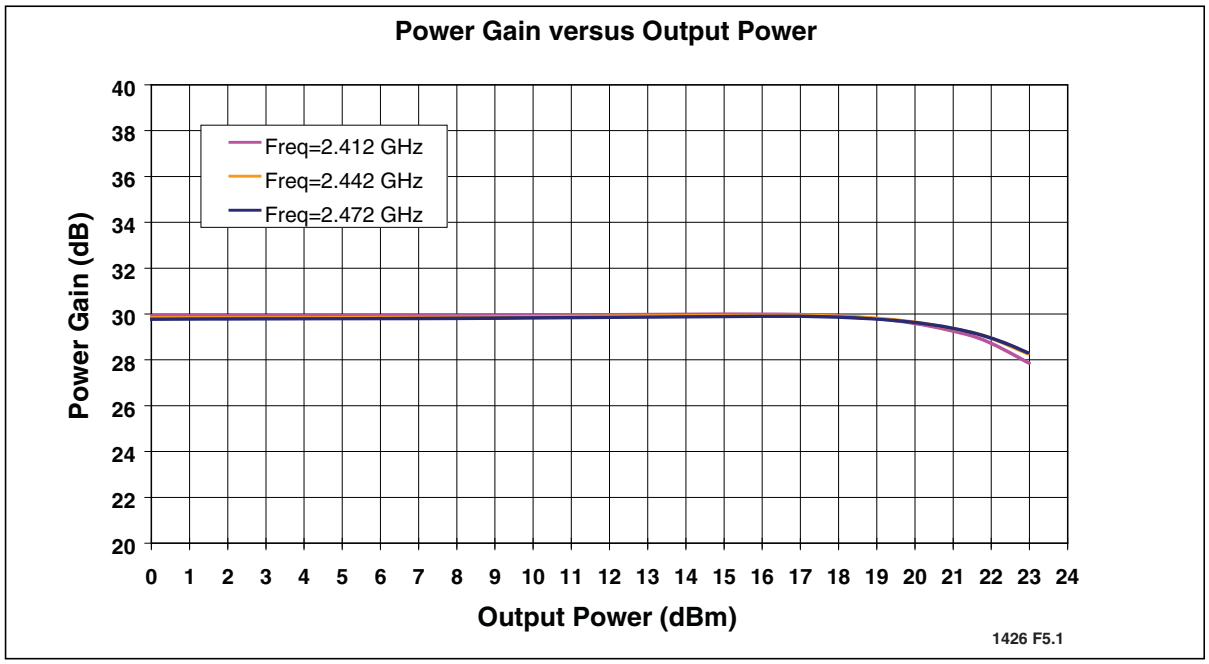



**Figure 5:** Power Gain versus Output Power

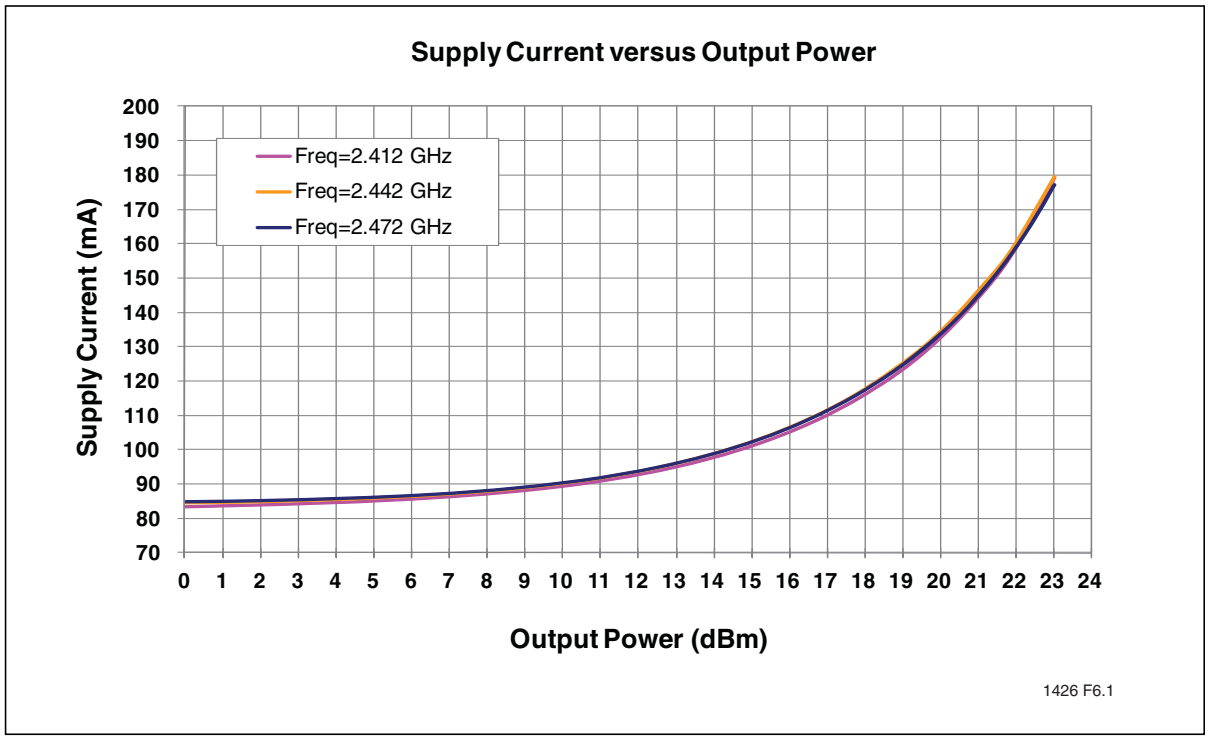



**Figure 6:** Total Current Consumption for 802.11g operation versus Output Power

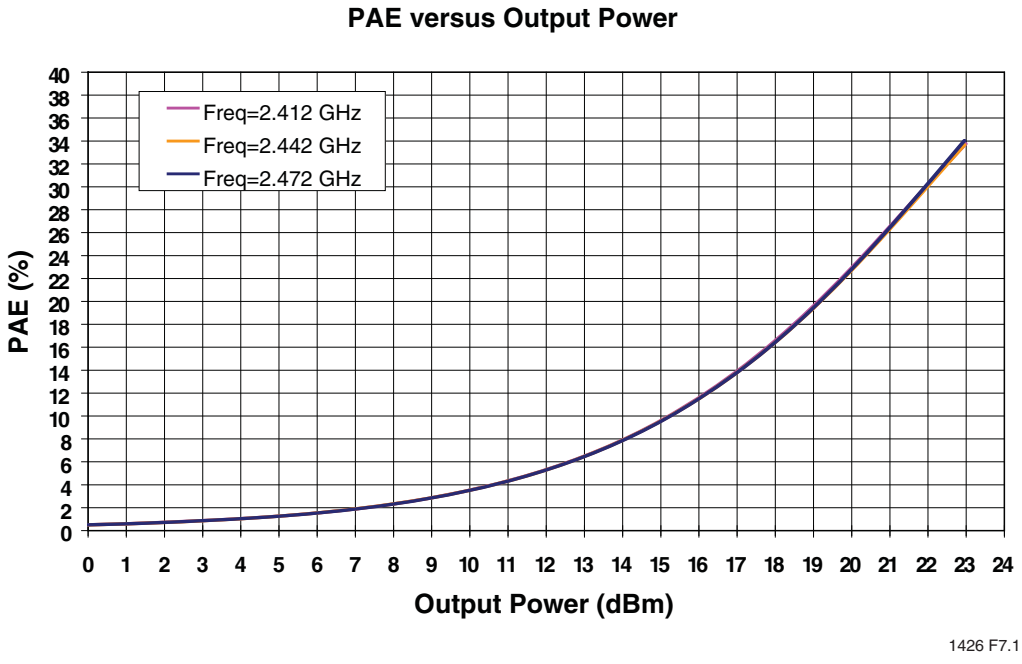



**Figure 7:** PAE versus Output Power

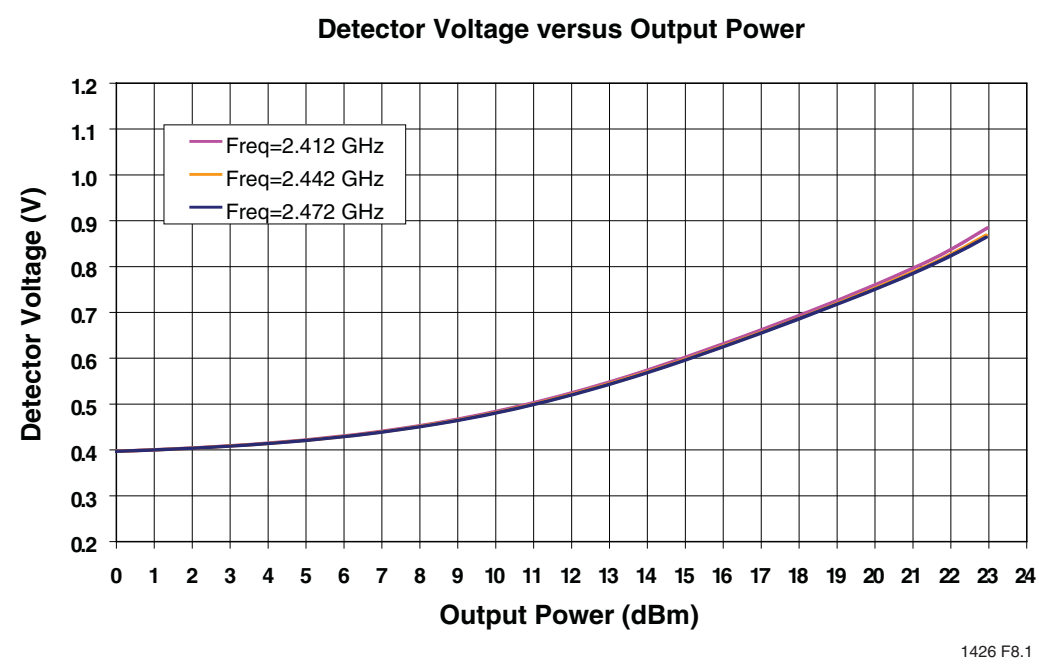



**Figure 8:** Detector Characteristics versus Output Power

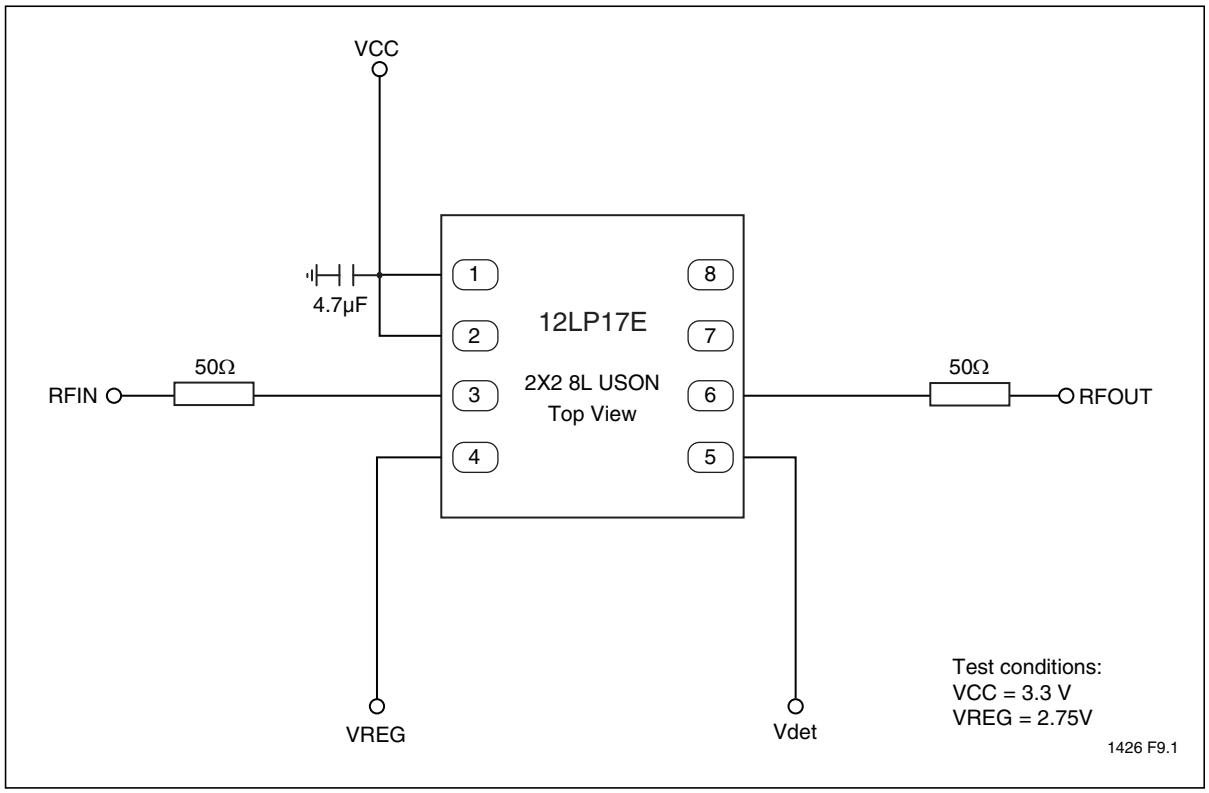
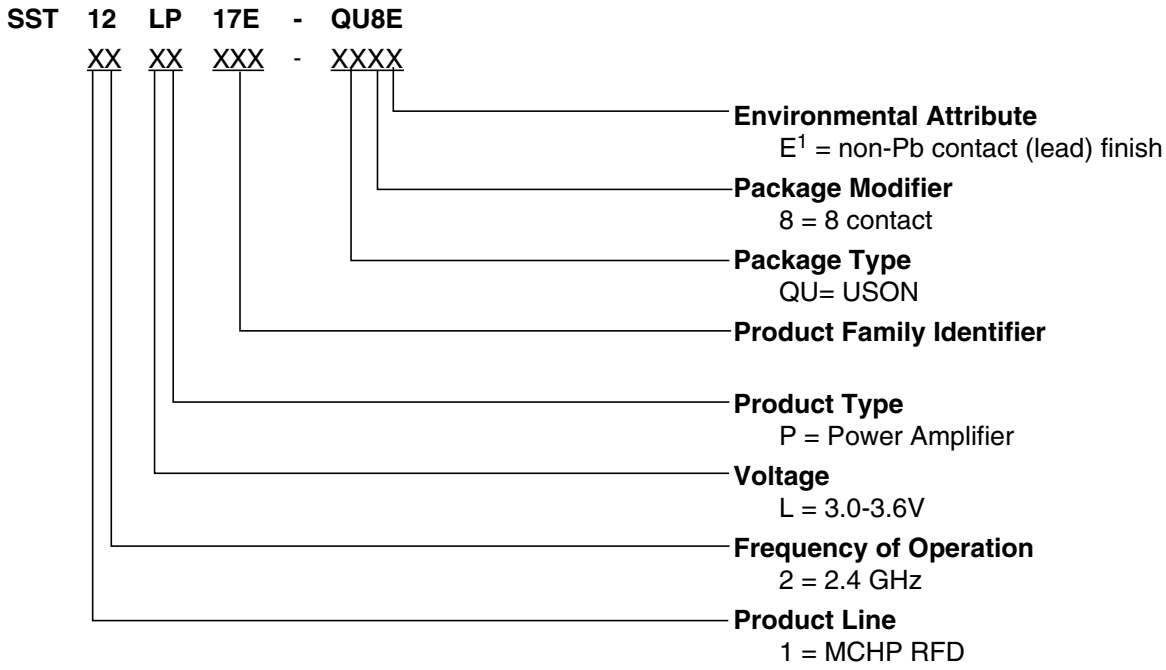



**Figure 9:** Typical Schematic for High-Efficiency 802.11b/g/n Applications

# Product Ordering Information




1. Environmental suffix “E” denotes non-Pb solder. SST non-Pb solder devices are “RoHS Compliant”.

## Valid combinations for SST12LP17E

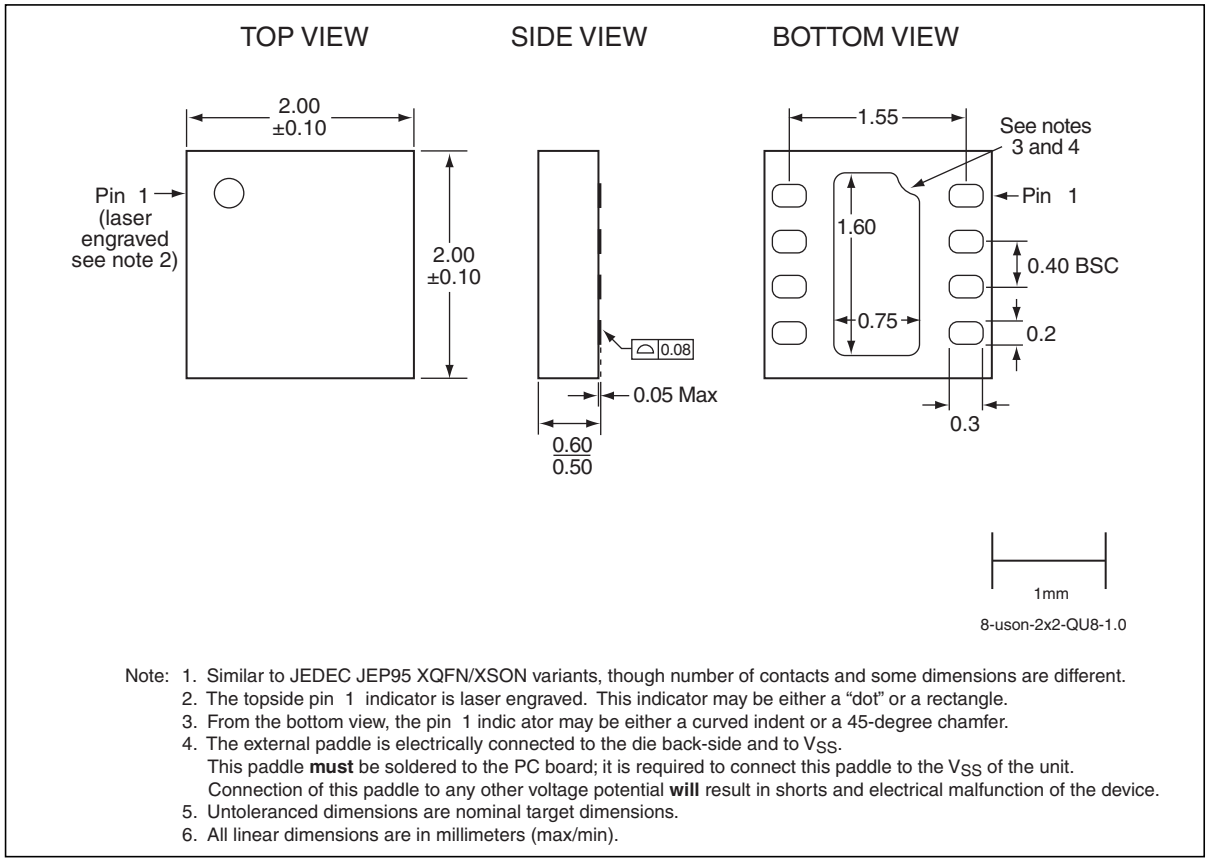
SST12LP17E-QU8E

## SST12LP17E Evaluation Kits

SST12LP17E-QU8E-K

**Note:** Valid combinations are those products in mass production or will be in mass production. Consult your SST sales representative to confirm availability of valid combinations and to determine availability of new combinations.

## Packaging Diagrams




Note:
1. Similar to JEDEC JEP95 XQFN/XSON variants, though number of contacts and some dimensions are different.
2. The topside pin 1 indicator is laser engraved. This indicator may be either a “dot” or a rectangle.
3. From the bottom view, the pin 1 indic ator may be either a curved indent or a 45-degree chamfer.
4. The external paddle is electrically connected to the die back-side and to $V_{SS}$.
   This paddle **must** be soldered to the PC board; it is required to connect this paddle to the $V_{SS}$ of the unit.
   Connection of this paddle to any other voltage potential **will** result in shorts and electrical malfunction of the device.
5. Untoleranced dimensions are nominal target dimensions.
6. All linear dimensions are in millimeters (max/min).

**Figure 10:** 8-Contact Ultra-thin Small Outline No-lead (USON)
SST Package Code: QU8

**Table 5:** Revision History

| Revision | Description | Date |
|---|---|---|
| 00 | • Initial release of data sheet | Apr 2010 |
| A | • Modified “Features”, “Product Description” on page 2, Table 1 on page 4, Table 3 on page 5, Table 4 on page 6, Figure 1 on page 3, and Figure 9 on page 11.<br>• Replaced Figures 3-8. | Apr 2011 |
| B | • Updated document type to “Data Sheet”<br>• Changed supply voltage in “Electrical Specifications” on page 5<br>• Revised VCC values in Table 3 on page 5 | Oct 2011 |

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