The SST12LP18E is a versatile power amplifier based on the highly-reliable InGaP/GaAs HBT technology. The SST12LP18E is a 2.4 GHz high-efficiency Power Amplifier designed in compliance with IEEE 802.11b/g/n/ac applications. It typically provides 25 dB gain with 32% power-added efficiency, while meeting 802.11g spectrum mask at 21.5 dBm. The SST12LP18E can be configured for high-linearity for 802.11ac operation or for high-power, high-efficiency operation. This power amplifier also features easy board-level usage along with high-speed power-up/down control through a single reference voltage pin and is offered in a 8-contact XSON package.

Features

- **High gain:**
  - Typically 25 dB gain across 2.4~2.5 GHz

- **High linear output power:**
  - >26 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
  - Meets 802.11b ACPR requirement up to 22.5 dBm
  - ~3% added EVM up to 18 dBm for 54 Mbps 802.11g signal
  - 17 dBm at 1.8% EVM, 802.11ac, 256 QAM, 2.4 GHz

- **High power-added efficiency/Low operating current for 802.11b/g/n applications**
  - ~32%/135 mA @ POUT = 21.5 dBm for 802.11g
  - ~36%/150 mA @ POUT = 22.5 dBm for 802.11b

- **Single-pin low IREF power-up/down control**
  - IREF <2 mA

- **Low idle current for high-efficiency operation**
  - ~50 mA ICQ

- **High-speed power-up/down control**
  - 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**
  - ~1 dB gain/power variation between -20°C to +85°C

- **Excellent on-chip power detection**
  - >15 dB dynamic range on-chip power detection
  - Temperature and VSWR insensitive

- **Simple output matching**

- **Packages available**
  - 8-contact XSON – 2mm x 2mm

- **All non-Pb (lead-free) devices are RoHS compliant**

Applications

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

The SST12LP18E is a versatile power amplifier based on the highly-reliable InGaP/GaAs HBT technology.

The SST12LP18E is a 2.4 GHz high-efficiency Power Amplifier designed in compliance with IEEE 802.11b/g/n/ac applications. It typically provides 25 dB gain with 32% power-added efficiency (PAE) @ POUT = 21.5 dBm for 802.11g and 36% PAE @ POUT = 22.5 dBm for 802.11b.

The SST12LP18E 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. SST12LP18E can also be configured for high-linearity with EVM <1.8% at typically 17 dBm for 802.11ac operation.

The SST12LP18E 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 IREF ~2 mA) makes the SST12LP18E controllable by an on/off switching signal directly from the baseband chip. These features, coupled with low operating current, make the SST12LP18E ideal for the final stage power amplification in battery-powered 802.11b/g/n/ac WLAN transmitter applications.

The SST12LP18E has an excellent on-chip, single-ended power detector, which features wide-range (>15 dB) with dB-wise linear operation. The excellent on-chip power detector is both temperature and VSWR insensitive; therefore, it provides a reliable solution to board-level power control.

The SST12LP18E is offered in 8-contact XSON package. See Figure 2 for pin assignments and Table 1 for pin descriptions.
Functional Blocks

Figure 1: Functional Block Diagram
2.4 GHz High-Efficiency, High-Gain Power Amplifier
SST12LP18E

Pin Assignments

Figure 2: Pin Assignments for 8-contact XSON

Table 1: Pin Description

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Pin No.</th>
<th>Pin Name</th>
<th>Type†</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>GND</td>
<td>0</td>
<td>Ground</td>
<td></td>
<td>Low inductance GND pad</td>
</tr>
<tr>
<td>VCC1</td>
<td>1</td>
<td>Power Supply</td>
<td>PWR</td>
<td>Power supply, 1st stage</td>
</tr>
<tr>
<td>RFIN</td>
<td>2</td>
<td>I</td>
<td>RF input, DC decoupled</td>
<td></td>
</tr>
<tr>
<td>VCCb</td>
<td>3</td>
<td>PWR</td>
<td>Supply voltage for bias circuit</td>
<td></td>
</tr>
<tr>
<td>VREF</td>
<td>4</td>
<td>PWR</td>
<td>1st and 2nd stage idle current control</td>
<td></td>
</tr>
<tr>
<td>Det</td>
<td>5</td>
<td>O</td>
<td>On-chip power detector</td>
<td></td>
</tr>
<tr>
<td>RFOUT</td>
<td>6</td>
<td>O</td>
<td>RF output</td>
<td></td>
</tr>
<tr>
<td>RFOUT</td>
<td>7</td>
<td>O</td>
<td>RF output</td>
<td></td>
</tr>
<tr>
<td>VCC2</td>
<td>8</td>
<td>Power Supply</td>
<td>PWR</td>
<td>Power supply, 2nd stage</td>
</tr>
</tbody>
</table>

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 13 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 pin 2 (P\textsubscript{IN}): +5 dBm
- Average output power (P\textsubscript{OUT}): +26 dBm
- Supply Voltage at pins 1, 3, and 8 (V\textsubscript{CC}): -0.3V to +4.2V
- Reference voltage to pin 4 (V\textsubscript{REF}): -0.3V to +3.3V
- DC supply current (I\textsubscript{CC}): 300 mA
- Operating Temperature (T\textsubscript{A}): -40ºC to +85ºC
- Storage Temperature (T\textsubscript{STG}): -40ºC to +120ºC
- Maximum Junction Temperature (T\textsubscript{J}): +150ºC
- Surface Mount Solder Reflow Temperature: 260ºC 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>
<thead>
<tr>
<th>Table 2: Operating Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Range</strong></td>
</tr>
<tr>
<td>Industrial</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3: DC Electrical Characteristics at 25ºC for High-Linearity Configurations(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symbol</strong></td>
</tr>
<tr>
<td>V\textsubscript{CC}</td>
</tr>
<tr>
<td>I\textsubscript{CC}</td>
</tr>
<tr>
<td>I\textsubscript{CC}</td>
</tr>
<tr>
<td>I\textsubscript{CC}</td>
</tr>
<tr>
<td>I\textsubscript{CC}</td>
</tr>
<tr>
<td>V\textsubscript{REF}</td>
</tr>
</tbody>
</table>

1. See Figure 8
Table 4: DC Electrical Characteristics at 25°C for High-Efficiency Configurations

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>V&lt;sub&gt;CC&lt;/sub&gt;</td>
<td>Supply Voltage at pins 1, 3, and 8</td>
<td>3.0</td>
<td>3.3</td>
<td>3.6</td>
<td>V</td>
</tr>
<tr>
<td>I&lt;sub&gt;CQ&lt;/sub&gt;</td>
<td>Idle current to meet EVM ~3% @ 18 dBm Output Power with 802.11g OFDM 54 Mbps signal</td>
<td>50</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>I&lt;sub&gt;CC&lt;/sub&gt;</td>
<td>Current Consumption @ 18 dBm Output Power with 802.11g OFDM 54 Mbps signal</td>
<td>95</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Current Consumption to meet 802.11g OFDM 6 Mbps Spectrum mask @ 21.5 dBm Output Power</td>
<td>135</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>Current Consumption to meet 802.11b DSSS 1 Mbps Spectrum mask @ 22.5 dBm Output Power</td>
<td>150</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>V&lt;sub&gt;REG&lt;/sub&gt;</td>
<td>Reference Voltage with 360Ω resistor</td>
<td>2.7</td>
<td>2.8</td>
<td>2.9</td>
<td>V</td>
</tr>
</tbody>
</table>

1. See Figure 14

Table 5: RF Electrical Characteristics at 25°C

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>F&lt;sub&gt;L-U&lt;/sub&gt;</td>
<td>Frequency range</td>
<td>2412</td>
<td>2484</td>
<td>MHz</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>Small signal gain</td>
<td>24</td>
<td>25</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>G&lt;sub&gt;V1&lt;/sub&gt;</td>
<td>Gain variation over band (2412–2484 MHz)</td>
<td>±0.5</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>G&lt;sub&gt;V2&lt;/sub&gt;</td>
<td>Gain ripple over channel (20 MHz)</td>
<td>0.2</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>EVM</td>
<td>EVM@ 18 dBm Output Power with 802.11g OFDM 54 Mbps signal&lt;sup&gt;1&lt;/sup&gt;</td>
<td>3.0</td>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>EVM@ 17 dBm Output Power with 802.11ac 20 MHz BW&lt;sup&gt;2&lt;/sup&gt;</td>
<td>1.8</td>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>P&lt;sub&gt;OUT&lt;/sub&gt;</td>
<td>Output Power to meet 802.11g OFDM 6 Mbps Spectrum mask</td>
<td>20.5</td>
<td>21.5</td>
<td>dBM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Output Power to meet 802.11b DSSS 1 Mbps Spectrum mask</td>
<td>21.5</td>
<td>22.5</td>
<td>dBM</td>
<td></td>
</tr>
<tr>
<td>2f, 3f, 4f, 5f Harmonics at 23 dBm, without external filters</td>
<td>-30</td>
<td></td>
<td></td>
<td>dBC</td>
<td></td>
</tr>
</tbody>
</table>

1. See Figure 14
2. See Figure 8

Table 6: Typical Performance with Different Bias Options for High-Efficiency Configuration

<table>
<thead>
<tr>
<th>V&lt;sub&gt;REG&lt;/sub&gt; (V)</th>
<th>R&lt;sub&gt;1&lt;/sub&gt; (Ω)</th>
<th>I&lt;sub&gt;CQ&lt;/sub&gt; (mA)</th>
<th>I&lt;sub&gt;CC&lt;/sub&gt; @ P&lt;sub&gt;OUT&lt;/sub&gt;= 18 dBm&lt;sup&gt;2&lt;/sup&gt; (mA)</th>
<th>Typical Performance with Each Biased Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.85</td>
<td>500</td>
<td>45</td>
<td>95</td>
<td>Meet added EVM &lt; 3% up to 18 dBm output power at -40°C</td>
</tr>
<tr>
<td>2.80</td>
<td>360</td>
<td>50</td>
<td>95</td>
<td>Meet added EVM &lt; 3% up to 18 dBm output power at -40°C</td>
</tr>
<tr>
<td>2.70</td>
<td>180</td>
<td>50</td>
<td>95</td>
<td>Meet added EVM &lt; 3% up to 18 dBm output power at -20°C</td>
</tr>
<tr>
<td>2.70</td>
<td>33</td>
<td>72</td>
<td>110</td>
<td>Meet added EVM &lt; 3% up to 18 dBm output power at -40°C</td>
</tr>
<tr>
<td>2.70</td>
<td>0</td>
<td>82</td>
<td>120</td>
<td>Meet added EVM &lt; 3% up to 18 dBm output power at -40°C</td>
</tr>
</tbody>
</table>

1. See Figure 14
2. At room temperature
Typical Performance Characteristics
Test Conditions: \( V_{CC} = 3.3 \text{V}, \ T_A = 25^\circ \text{C} \), unless otherwise specified

**Figure 3:** S-Parameters
2.4 GHz High-Efficiency, High-Gain Power Amplifier

SST12LP18E

A Microchip Technology Company

Data Sheet

High-Linearity Configuration for 802.11b/g/n/ac

Typical Performance Characteristics
Test Conditions: \( V_{CC} = 3.3V, \ V_{REF} = 2.8V, \ T_A = 25^\circ C, \) 54 Mbps 802.11g OFDM Signal; Equalizer Training Setting using Channel Estimation Sequence Only

![EVM versus Output Power](image1)

**Figure 4:** EVM versus Output Power

![Power Gain versus Output Power](image2)

**Figure 5:** Power Gain versus Output Power
High-Linearity Configuration (continued)

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

**Figure 7:** Detector Characteristics versus Output Power
High-Linearity Configuration (continued)

**Figure 8:** Typical Schematic for High-Linearity 802.11b/g/n/ac Applications

- **VCC**
- **0.1 µF**
- **6.8 nH / 0603**
- **10 µF**
- **12LP18E**
- **RFIN**
- **100 pF**
- **50Ω**
- **1.0 nH**
- **1.8 pF**
- **RFOUT**
- **100 pF**
- **100 pF**
- **R1 = 0Ω**
- **VREG**
- **Vdet**

Test conditions:
- **VCC = 3.3 V**
- **VREG = 2.80 V**
High-Efficiency Configuration for 802.11b/g/n Operation

Typical Performance Characteristics
Test Conditions: $V_{CC} = 3.3\text{V}$, $V_{REF} = 2.8\text{V}$, $T_A = 25^\circ\text{C}$, 54 Mbps 802.11g OFDM Signal; Equalizer Training Setting using Channel Estimation Sequence Only

Figure 9: EVM versus Output Power

Figure 10: Power Gain versus Output Power
High-Efficiency Configuration (continued)

**Figure 11:** Total Current Consumption for 802.11g operation versus Output Power

**Figure 12:** PAE versus Output Power
High-Efficiency Configuration (continued)

**Figure 13:** Detector Characteristics versus Output Power
High-Efficiency Configuration (continued)

Figure 14: Typical Schematic for High-Efficiency 802.11b/g/n Applications

Test conditions:
VCC = 3.3 V
VREG = 2.80 V
**Product Ordering Information**

- **SST12LP18E-QX8E**
  - **Environmental Attribute**: E¹ = non-Pb contact (lead) finish
  - **Package Modifier**: 8 = 8 contact
  - **Package Type**: QX = XSON
  - **Product Family Identifier**: P = Power Amplifier
  - **Voltage**: L = 3.0-3.6V
  - **Frequency of Operation**: 2 = 2.4 GHz
  - **Product Line**: 1 = RF Products

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

**Valid combinations for SST12LP18E**
- SST12LP18E-QX8E

**SST12LP18E Evaluation Kits**
- SST12LP18E-QX8E-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

Figure 15: 8-Contact Extremely-thin Small Outline No-lead (XSON)
SST Package Code: QX8

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; its approximate shape and location is as shown.
3. From the bottom view, the pin #1 indicator 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 VSS. This paddle must be soldered to the PC board; it is required to connect this paddle to the VSS 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).
Table 7: Revision History

<table>
<thead>
<tr>
<th>Revision</th>
<th>Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Initial release of data sheet</td>
<td>Mar 2011</td>
</tr>
<tr>
<td>B</td>
<td>Revised “Electrical Specifications” on page 5 from 4.0V max stress to 4.6V</td>
<td>Mar 2012</td>
</tr>
<tr>
<td></td>
<td>Updated Figure 9 on page 11 to show “sequence only” EVM response</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Added Figures 9-8 on pages 11-10 to provide High-Linearity information</td>
<td>Jul 2012</td>
</tr>
<tr>
<td></td>
<td>Updated Table 5 on page 6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Updated Figure 15 on page 16 to reflect new pin 1 indicator</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clarified Features on page 1</td>
<td></td>
</tr>
</tbody>
</table>