FEATURES:

- **High Gain:**
  - Typically 32 dB gain across 2.4–2.5 GHz over temperature 0°C to +85°C
- **High linear output power:**
  - >29 dBm P1dB
  - Please refer to “Absolute Maximum Stress Ratings” on page 4
  - Meets 802.11g OFDM ACPR requirement up to 25 dBm
  - Added EVM~4% up to 23 dBm for 54 Mbps 802.11g signal
  - Meets 802.11b ACPR requirement up to 25 dBm
- **High power-added efficiency/Low operating current for both 802.11g/b applications**
  - ~26%/300 mA @ POUT = 24 dBm for 802.11g
  - ~27%/350 mA @ POUT = 25 dBm for 802.11b
- **Built-in Ultra-low IREF power-up/down control**
  - IREF ~2 mA
- **Low idle current**
  - ~80 mA ICQ

- **High-speed power-up/down**
  - Turn on/off time (10%-90%) <100 ns
  - Typical power-up/down delay with driver delay included <200 ns
- **High temperature stability**
  - ~1 dB gain/power variation between 0°C to +85°C
  - ~1 dB detector variation over 0°C to +85°C
- **Low shut-down current (~1 µA)**
- **On-chip power detection**
- **25 dB dynamic range on-chip power detection**
- **Simple input/output matching**
- **Packages available**
  - 16-contact VQFN (3mm x 3mm)
- **All non-Pb (lead-free) devices are RoHS compliant**

APPLICATIONS:

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

PRODUCT DESCRIPTION

The SST12LP15A is a high-power and high-gain power amplifier based on the highly-reliable InGaP/GaAs HBT technology.

The SST12LP15A can be easily configured for high-power applications with superb power-added efficiency while operating over the 2.4-2.5 GHz frequency band. It typically provides 32 dB gain with 26% power-added efficiency @ POUT = 24 dBm for 802.11g and 27% power-added efficiency @ POUT = 25 dBm for 802.11b.

The SST12LP15A has excellent linearity, typically ~4% added EVM at 23 dBm output power which is essential for 54 Mbps 802.11g operation while meeting 802.11g spectrum mask at 25 dBm. SST12LP15A also has wide-range (>25 dB), temperature-stable (~1 dB over 85°C), single-ended/differential power detectors which lower users’ cost on power control.

The power amplifier IC also features easy board-level usage along with high-speed power-up/down control. Ultra-low reference current (total IREF ~2 mA) makes the SST12LP15A controllable by an on/off switching signal directly from the baseband chip. These features coupled with low operating current make the SST12LP15A ideal for the final stage power amplification in battery-powered 802.11g/b WLAN transmitter applications.

The SST12LP15A is offered in 16-contact VQFN package. See Figure 2 for pin assignments and Table 1 for pin descriptions.
FUNCTIONAL BLOCKS

![Functional Block Diagram](image)

FIGURE 1: Functional Block Diagram
PIN ASSIGNMENTS

![Pin Assignments for 16-contact VQFN](image)

PIN DESCRIPTIONS

<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>The center pad should be connected to RF ground with several low inductance, low resistance vias.</td>
</tr>
<tr>
<td>NC</td>
<td>1</td>
<td>No Connection</td>
<td></td>
<td>Unconnected pins.</td>
</tr>
<tr>
<td>RFIN</td>
<td>2</td>
<td>RF input, DC decoupled</td>
<td>I</td>
<td>RF input, DC decoupled</td>
</tr>
<tr>
<td>NC</td>
<td>3</td>
<td>No Connection</td>
<td></td>
<td>Unconnected pins.</td>
</tr>
<tr>
<td>VCCb</td>
<td>5</td>
<td>Power Supply PWR</td>
<td></td>
<td>Supply voltage for bias circuit</td>
</tr>
<tr>
<td>VREF1</td>
<td>6</td>
<td>Power Supply PWR</td>
<td></td>
<td>1st and 2nd stage idle current control</td>
</tr>
<tr>
<td>VREF2</td>
<td>7</td>
<td>Power Supply PWR</td>
<td></td>
<td>3rd stage idle current control</td>
</tr>
<tr>
<td>Det_ref</td>
<td>8</td>
<td>O</td>
<td></td>
<td>On-chip power detector reference</td>
</tr>
<tr>
<td>Det</td>
<td>9</td>
<td>O</td>
<td></td>
<td>On-chip power detector</td>
</tr>
<tr>
<td>RFOUT</td>
<td>10</td>
<td>O</td>
<td></td>
<td>RF output</td>
</tr>
<tr>
<td>RFOUT</td>
<td>11</td>
<td>O</td>
<td></td>
<td>RF output</td>
</tr>
<tr>
<td>VCC3</td>
<td>12</td>
<td>Power Supply PWR</td>
<td></td>
<td>Power supply, 3rd stage</td>
</tr>
<tr>
<td>NC</td>
<td>13</td>
<td>No Connection</td>
<td></td>
<td>Unconnected pins.</td>
</tr>
<tr>
<td>VCC2</td>
<td>14</td>
<td>Power Supply PWR</td>
<td></td>
<td>Power supply, 2nd stage</td>
</tr>
<tr>
<td>NC</td>
<td>15</td>
<td>No Connection</td>
<td></td>
<td>Unconnected pins.</td>
</tr>
<tr>
<td>VCC1</td>
<td>16</td>
<td>Power Supply PWR</td>
<td></td>
<td>Power supply, 1st stage</td>
</tr>
</tbody>
</table>

1. I=Input, O=Output
ELECTRICAL SPECIFICATIONS

The AC and DC specifications for the power amplifier interface signals. Refer to Table 2 for the DC voltage and current specifications. Refer to Figures 3 through 10 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
- Average output power (P_OUT).......................... +28 dBm
- Supply Voltage at pins 5, 12, 14, 16 (VCC)............ -0.3V to +4.6V
- Reference voltage to pins 6 (VREF1) and pin 7 (VREF2)............ -0.3V to +3.6V
- DC supply current (ICC).......................... 500 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.......................... 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.

Operating Range

<table>
<thead>
<tr>
<th>Range</th>
<th>Ambient Temp</th>
<th>VCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial</td>
<td>-40°C to +85°C</td>
<td>3.3V</td>
</tr>
</tbody>
</table>

TABLE 2: DC 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>VCC</td>
<td>Supply Voltage at pins 5, 12, 14, 16</td>
<td>3.0</td>
<td>3.3</td>
<td>4.2</td>
<td>V</td>
</tr>
<tr>
<td>ICC</td>
<td>Supply Current</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>for 802.11g, 24 dBm</td>
<td>300</td>
<td>mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>for 802.11b, 25 dBm</td>
<td>350</td>
<td>mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICQ</td>
<td>Idle current for 802.11g to meet EVM&lt;4% @ 23dBm</td>
<td>80</td>
<td>mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IOFF</td>
<td>Shut down current</td>
<td>1</td>
<td>μA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VREG1</td>
<td>Reference Voltage for 1st and 2nd Stage, with 270Ω resistor</td>
<td>2.85</td>
<td>2.90</td>
<td>2.95</td>
<td>V</td>
</tr>
<tr>
<td>VREG2</td>
<td>Reference Voltage for 3rd Stage, with 100Ω resistor</td>
<td>2.85</td>
<td>2.90</td>
<td>2.95</td>
<td>V</td>
</tr>
</tbody>
</table>
## TABLE 3: AC Electrical Characteristics for Configuration at 25ºC

<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>$F_{L-U}$</td>
<td>Frequency range in 802.11b/g applications (see Figure 11)</td>
<td>2400</td>
<td></td>
<td>2485</td>
<td>MHz</td>
</tr>
<tr>
<td>$P_{OUT}$</td>
<td>Output power</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>@ PIN = -10 dBm 11b signals</td>
<td>23</td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td></td>
<td>@ PIN = -10 dBm 11g signals</td>
<td>23</td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>$G$</td>
<td>Small signal gain</td>
<td>31</td>
<td>32</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>$G_{VAR1}$</td>
<td>Gain variation over each band (2400-2485 MHz)</td>
<td></td>
<td></td>
<td>±0.5</td>
<td>dB</td>
</tr>
<tr>
<td>$G_{VAR2}$</td>
<td>Gain ripple over channel (Gain variation over 20 MHz)</td>
<td>0.2</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>ACPR</td>
<td>Meet 11b spectrum mask</td>
<td>24</td>
<td>25</td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td></td>
<td>Meet 11g OFDM 54 MBPS spectrum mask</td>
<td>24</td>
<td>25</td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>Added EVM</td>
<td>@ 23 dBm output with 11g OFDM 54 MBPS signal</td>
<td>3.5</td>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>2f, 3f, 4f, 5f</td>
<td>Harmonics at 22 dBm, without trapping capacitors</td>
<td></td>
<td></td>
<td>-40</td>
<td>dBc</td>
</tr>
</tbody>
</table>
TYPICAL PERFORMANCE CHARACTERISTICS
Test Conditions: $V_{CC} = 3.3V$, $T_A = 25^\circ C$ Unless otherwise specified.

FIGURE 3: S-Parameters
TYPICAL PERFORMANCE CHARACTERISTICS
Test Conditions: $V_{CC} = 3.3V$, $T_A = 25^\circ C$, 54 Mbps 802.11g OFDM Signal

 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
2.4 GHz High-Power and High-Gain Power Amplifier
SST12LP15A

FIGURE 8: Detector Characteristic versus Output Power

Detector Voltage versus Output Power

- Freq = 2.412 GHz
- Freq = 2.442 GHz
- Freq = 2.484 GHz

FIGURE 9: 802.11g Spectrum Mask at 24 dBm, Total current 300 mA
TYPICAL PERFORMANCE CHARACTERISTICS

Test Conditions: $V_{CC} = 3.3V$, $T_A=25°C$, 1 Mbps 802.11b CCK signal

**FIGURE 10:** 802.11b Spectrum Mask at 25 dBm, Total current 350 mA

**FIGURE 11:** Typical Schematic for High-Power, High-Efficiency 802.11b/g Applications

Suggested operation conditions:

1. $V_{CC} = 3.3V$
2. Center slug to RF ground
3. $V_{REG1}=V_{REG2}=2.90V$ with $R1=270\Omega$ and $R2=100\Omega$

* Could be removed if -7 dB return loss is acceptable
PRODUCT ORDERING INFORMATION

Valid combinations for SST12LP15A
SST12LP15A-QVCE

SST12LP15A Evaluation Kits
SST12LP15A-QVCE-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.

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

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S71291-04-000 02/09
2.4 GHz High-Power and High-Gain Power Amplifier
SST12LP15A

Data Sheet

PACKAGING DIAGRAMS

FIGURE 12: 16-contact Very-thin Quad Flat No-lead (VQFN) SST Package Code: QVC

Note: 1. Complies with JEDEC JEP95 MO-220J, variant VEED-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 VSS leads.
   This paddle can be soldered to the PC board; it is suggested to connect this paddle to the VSS 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).

TABLE 4: Revision History

<table>
<thead>
<tr>
<th>Revision</th>
<th>Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Initial release of data sheet</td>
<td>Mar 2005</td>
</tr>
<tr>
<td>01</td>
<td>Updated values for gain and efficiency on page 1</td>
<td>Mar 2006</td>
</tr>
<tr>
<td></td>
<td>Updated values for VREG1 and VREG2 in Table 2 on page 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Removed stability parameter from Table 3 on page 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Updated the typical application schematic on page 10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Updated QVC package drawing.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Updated “Absolute Maximum Stress Ratings” on page 4</td>
<td></td>
</tr>
<tr>
<td>02</td>
<td>Added information for 2.3-2.4 and 2.5-2.6 applications</td>
<td>Jul 2006</td>
</tr>
<tr>
<td></td>
<td>Removed leaded part numbers</td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>Updated “Features:” and “Product Description” on page 1</td>
<td>Sep 2008</td>
</tr>
<tr>
<td></td>
<td>Revised Table 2 on page 4 and Table 3 on page 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Updated values in Figure 11 on page 10.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Removed two schematics</td>
<td></td>
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<tr>
<td></td>
<td>Updated Figures 3 - 8</td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>Updated “Contact Information” on page 13.</td>
<td>Feb 2009</td>
</tr>
</tbody>
</table>

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2.4 GHz High-Power and High-Gain Power Amplifier
SST12LP15A

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