2.4 GHz High-Linearity Power Amplifier
SST12LP10

FEATURES:

• High Gain:
  – >26 dB gain across 2.4~2.5 GHz over temperature 0°C to +80°C

• High linear output power:
  – ~27 dBm P1dB
  – Meets 802.11g OFDM ACPR requirement up to 23 dBm
  – Over 20 dBm linear output with total system EVM<5% for 54 Mbps 802.11g signal
  – Meets 802.11b ACPR requirement up to 23 dBm

• High power-added efficiency/Low operating current for both 802.11g/b applications
  – ~19% @ POUT = 20 dBm for 802.11g
  – ~30% @ POUT = 24 dBm for 802.11b

• Ultra-low Reference Current
  – ~3 mA Total IREF

• Low idle current
  – ~60 mA ICO

• 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 +80°C

• Low shut-down current (< 0.1 µA)

• Simple input/output matching

• Packages available
  – 16-contact VQFN (3mm x 3mm)
  – Non-Pb (lead-free) packages available

APPLICATIONS:

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

PRODUCT DESCRIPTION

The SST12LP10 is a high-performance power amplifier based on the highly-reliable InGaP/GaAs HBT technology.

The SST12LP10 can be easily configured for high-power, high-efficiency applications with superb power-added efficiency while operating over the 2.4~2.5 GHz frequency band. It provides over 26 dB gain with 19% power-added efficiency @ POUT = 20 dBm for 802.11g and 30% power-added efficiency @ POUT = 24 dBm for 802.11b.

The SST12LP10 has excellent linearity (over 20 dBm linear output with total system EVM<5%) which is essential for 54 Mbps 802.11g operation.

The power amplifier IC also features easy board-level usage along with high-speed power-up/down control and ultra-low reference current (~3 mA). These features coupled with low operating current make the SST12LP10 ideal for the final stage power amplification in battery-powered 802.11g/b WLAN transmitter applications.

The SST12LP10 is offered in 16-contact VQFN package. See Figure 1 for pin assignments and Table 1 for pin descriptions.
FUNCTIONAL BLOCKS

FUNCTIONAL BLOCK DIAGRAM

- VCC
- 1
- NC
- 2
- RFIN
- 3
- NC
- 4
- Bias Circuit
- 5
- NC
- 6
- VREG1
- 7
- VREG2
- 8
- NC
- 9
- NC
- 10
- RFIN
- 11
- RFOU
- 12
- VCC2
- 13
- NC
- 14
- NC
- 15
- NC
- 16
PIN ASSIGNMENTS

FIGURE 1: PIN ASSIGNMENTS FOR 16-CONTACT VQFN

PIN DESCRIPTIONS

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>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>I</td>
<td>RF input, DC decoupled</td>
<td></td>
</tr>
<tr>
<td>RFIN</td>
<td>3</td>
<td>I</td>
<td>RF input, DC decoupled</td>
<td></td>
</tr>
<tr>
<td>NC</td>
<td>4</td>
<td>No Connection</td>
<td></td>
<td>Unconnected pins.</td>
</tr>
<tr>
<td>NC</td>
<td>5</td>
<td>No Connection</td>
<td></td>
<td>Unconnected pins.</td>
</tr>
<tr>
<td>VREG1</td>
<td>6</td>
<td>PWR</td>
<td>1st stage idle current control</td>
<td></td>
</tr>
<tr>
<td>VREG2</td>
<td>7</td>
<td>PWR</td>
<td>2nd stage idle current control</td>
<td></td>
</tr>
<tr>
<td>NC</td>
<td>8</td>
<td>No Connection</td>
<td></td>
<td>Unconnected pins.</td>
</tr>
<tr>
<td>NC</td>
<td>9</td>
<td>No Connection</td>
<td></td>
<td>Unconnected pins.</td>
</tr>
<tr>
<td>RFOUT</td>
<td>10</td>
<td>O</td>
<td>RF output</td>
<td></td>
</tr>
<tr>
<td>RFOUT</td>
<td>11</td>
<td>O</td>
<td>RF output</td>
<td></td>
</tr>
<tr>
<td>VCC2</td>
<td>12</td>
<td>Power Supply</td>
<td>PWR</td>
<td>Power supply, 2nd stage</td>
</tr>
<tr>
<td>NC</td>
<td>13</td>
<td>No Connection</td>
<td></td>
<td>Unconnected pins.</td>
</tr>
<tr>
<td>VCCb</td>
<td>14</td>
<td>Power Supply</td>
<td>PWR</td>
<td>Supply voltage for bias circuit</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</td>
<td>PWR</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 2 through 11 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 12, 14, 16 (\(V_{CC}\)) ................................................ -0.3V to +4.6V
Reference voltage to pins 6 (\(V_{REF1}\)) and pin 7 (\(V_{REF2}\)) ......................... -0.3V to +3.6V
DC supply current (\(I_{CC}\)) .......................................................... 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: ........................................... “with-Pb” units1: 240°C for 3 seconds
.......................................................... “non-Pb” units: 260°C for 3 seconds

1. Certain “with-Pb” package types are capable of 260°C for 3 seconds; please consult the factory for the latest information.

OPERATING RANGE

<table>
<thead>
<tr>
<th>Range</th>
<th>Ambient Temp</th>
<th>(V_{CC})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial</td>
<td>-40ºC to +85ºC</td>
<td>3.3V</td>
</tr>
</tbody>
</table>

TABLE 2: DC ELECTRICAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Min.</th>
<th>Typ</th>
<th>Max.</th>
<th>Unit</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(V_{CC})</td>
<td>Supply Voltage at pins 12, 14, 16</td>
<td>3.0</td>
<td>3.3</td>
<td>4.2</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>(I_{CC})</td>
<td>Supply Current</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for 802.11g, 20 dBm</td>
<td>160</td>
<td>mA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for 802.11g, 23 dBm</td>
<td>230</td>
<td>mA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for 802.11b, 24 dBm</td>
<td>270</td>
<td>mA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(I_{CQ})</td>
<td>Idle Current</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for both 802.11b/g to meet EVM @ 20.5 dBm</td>
<td>70</td>
<td>mA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>for only 802.11b to meet ACPR @ 22 dBm</td>
<td>50</td>
<td>mA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(I_{OFF})</td>
<td>Shut down current</td>
<td>&lt;0.1</td>
<td>µA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(V_{REG1})</td>
<td>Reference Voltage for 1st Stage, without drop resistor</td>
<td>2.70</td>
<td></td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(V_{REG2})</td>
<td>Reference Voltage for 2nd Stage, without drop resistor</td>
<td>2.70</td>
<td></td>
<td>V</td>
<td></td>
<td></td>
</tr>
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</table>
## TABLE 3: AC ELECTRICAL CHARACTERISTICS FOR CONFIGURATION

<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</td>
<td>2400</td>
<td></td>
<td>2500</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 = -4 dBm 11b signals</td>
<td>22</td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td></td>
<td>@ PIN = -2 dBm 11b signals</td>
<td>24</td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td></td>
<td>@ PIN = -8 dBm 11g signals</td>
<td>18</td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td></td>
<td>@ PIN = -6 dBm 11g signals</td>
<td>20</td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>( G )</td>
<td>Small signal gain</td>
<td>26</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>( G_{VAR1} )</td>
<td>Gain variation over band (2400~2485 MHz)</td>
<td></td>
<td>1</td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>( G_{VAR2} )</td>
<td>Gain ripple over channel (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></td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td></td>
<td>Meet 11g OFDM 54 MBPS spectrum mask</td>
<td>23</td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>( Added EVM )</td>
<td>@ 20.5 dBm output with 11g OFDM 54 MBPS signal</td>
<td>3</td>
<td>3.5</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>&lt;-40</td>
<td>dBc</td>
</tr>
</tbody>
</table>
TYPICAL PERFORMANCE CHARACTERISTICS

Test Conditions: \(V_{CC} = 3.3\,\text{V}, \, T_A = 25^\circ\text{C}\)

**FIGURE 2: S-PARAMETERS**

**FIGURE 3: IN-BAND RETURN LOSS**

**FIGURE 4: IN-BAND GAIN FLATNESS**
TWO-TONE MEASUREMENTS
Test Conditions: $V_{CC} = 3.3V$, $T_A = 25^\circ C$, $F_1 = 2.45$ GHz, $F_2 = 2.451$ GHz

FIGURE 5: RF OUTPUT POWER

FIGURE 6: GAIN VS $P_{OUT}$

FIGURE 7: $I_{CC}$ VS $P_{OUT}$

FIGURE 8: IM3 VS $P_{OUT}$

FIGURE 9: HARMONICS
TYPICAL PERFORMANCE CHARACTERISTICS

**TEST CONDITIONS:** $V_{CC} = 3.3V$, $T_A = 25^\circ C$, $F = 2.45$ GHz WHEN NOT SPECIFIED

**FIGURE 10:** 802.11G SPECTRUM AT 20/22/23 dBm, ADDED EVM @ 2.45 GHz
2.4 GHz High-Linearity Power Amplifier
SST12LP10

Preliminary Specifications

FIGURE 11: 802.11B SIGNAL OUTPUT MASK AT 24 dBM

FIGURE 12: TYPICAL SCHEMATIC FOR HIGH-POWER, HIGH-EFFICIENCY 802.11B/G APPLICATIONS

* R2 and R3 can be adjusted to fit any reference voltage supply between 2.7~3.3V, e.g. R1=R2=0Ω for VREG1=VREG2=2.7V and R1=100Ω R2=100Ω for VREG1=VREG2=2.8V. Center slug to RF ground.
## PRODUCT ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SST12LP10-QVC</td>
<td>SST12LP10-QVCE</td>
</tr>
<tr>
<td>SST12LP10-QVCE-K</td>
<td>SST12LP10-QVCE-K</td>
</tr>
<tr>
<td>SST12LP10 Evaluation Kits</td>
<td>SST12LP10-QVCE-K</td>
</tr>
</tbody>
</table>

**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”.
2.4 GHz High-Linearity Power Amplifier
SST12LP10

PACKAGING DIAGRAMS

16-CONTACT VERY-THIN QUAD FLAT NO-LEAD (VQFN)
SST PACKAGE CODE: QVC

TABLE 4: REVISION HISTORY

<table>
<thead>
<tr>
<th>Revision</th>
<th>Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>S71280: SST conversion of data sheet GP1210</td>
<td>Jan 2005</td>
</tr>
</tbody>
</table>
Preliminary Specifications

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