

# 2.4-2.5 GHz / 4.9-5.8 GHz Dual-Band Power Amplifier Module

## SST13LP05



*Preliminary Specifications*

### FEATURES:

- **High Gain:**
  - Typically 29 dB gain across 2.4-2.5 GHz
  - Typically 29-26 dB gain across 4.9-5.8 GHz
- **High linear output power:**
  - >25 dBm P1dB (Pulsed single-tone signal) across 2.4-2.5 GHz
  - Meets 802.11b OFDM ACPR requirement up to 23.5 dBm across 2.4-2.5 GHz
  - Meets 802.11g OFDM ACPR requirement up to 23 dBm across 2.4-2.5 GHz
  - Added EVM ~4% up to 19 dBm for 54 Mbps 802.11g signal across 2.4-2.5 GHz
  - >24 dBm P1dB across 4.9-5.8 GHz
  - Meets 802.11a OFDM ACPR requirement up to 22.5 dBm across 4.9-5.8 GHz
  - Added EVM ~4% up to 18 dBm for 54 Mbps 802.11a signal across 4.9-5.8 GHz
- **High power-added efficiency/Low operating current for 802.11a/b/g applications**
  - ~160 mA @  $P_{OUT} = 19$  dBm for 802.11g
  - ~235 mA @  $P_{OUT} = 23.5$  dBm for 802.11b
  - ~270 mA @  $P_{OUT} = 18$  dBm for 802.11a
- **Built-in Ultra-low  $I_{REF}$  power-up/down control**
  - $I_{REF} < 2$  mA
- **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 across 2.4-2.5 GHz
  - ~3/1 dB gain/max linear power variation between 0°C to +85°C across 4.9-5.8 GHz
  - $\pm 0.5$  dB detector variation between 0°C to +85°C
- **Low shut-down current (< 2  $\mu$ A)**
- **20 dB dynamic range on-chip power detection**
- **Built-in input/output matching**
- **Packages available**
  - 16-contact LGA package (4mm x 4mm)
- **All non-Pb (lead-free) devices are ROHS compliant.**

### APPLICATIONS:

- **WLAN (IEEE 802.11a/g/b)**
- **Japanese WLAN**
- **HyperLAN2**
- **Multimedia**
- **Home RF**
- **Cordless phones**

### PRODUCT DESCRIPTION

The SST13LP05 is a fully matched, dual-band power amplifier module (PAM) based on the highly-reliable InGaP/GaAs HBT technology. This PAM provides excellent RF performance, temperature-stable power detectors, and low-current analog on/off control interfaces. The SST13LP05 provides stable RF and power detector performance over a large  $V_{CC}$  power supply variation, with an ultra-low shut-down current.

With a near-zero Rest of Bill of Materials (RBOM), the SST13LP05 is designed for 802.11a/b/g applications covering frequency bands 2.4-2.5 GHz and 4.9-5.8 GHz for U.S., European, and Japanese markets.

The SST13LP05 has excellent linearity, typically 4% added Error Vector Magnitude (EVM) at 19 dBm output power. This output power is essential for 54 Mbps 802.11g operation while meeting 802.11g spectrum mask at 23 dBm and 802.11b spectrum mask at 23.5 dBm. For 802.11a opera-

tion, the SST13LP05 typically demonstrates <4% added EVM at 18 dBm output power while meeting 802.11a spectrum mask at 22.5 dBm.

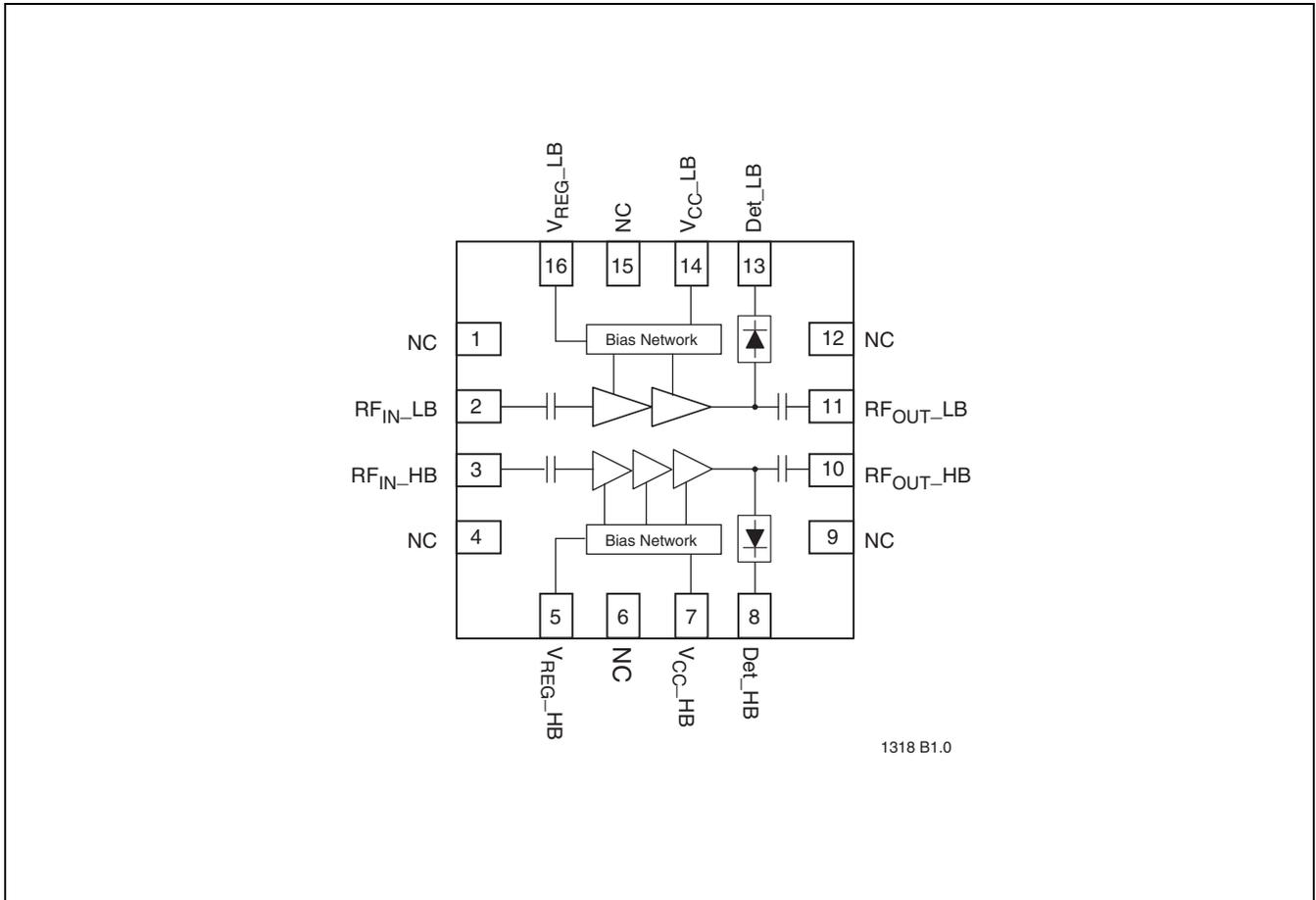
The SST13LP05 also has wide-range (>20 dB), temperature-stable ( $\pm 0.5$  dB across 0°C to +85°C), directionally-coupled, power detectors which provide a reliable and cost-effective solution to board-level power control. The device's analog on/off control can be driven by an analog or digital control signal from either a transceiver or baseband chip.

These features, coupled with low operating current, make the SST13LP05 ideal for the final stage power amplification in both battery-powered 802.11a/b/g WLAN transmitters and access point applications.

The SST13LP05 is offered in a 16-contact LGA package. See Figure 2 for pin assignments and Table 1 for pin descriptions.

Preliminary Specifications

**FUNCTIONAL BLOCKS**



**FIGURE 1: Functional Block Diagram**



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Preliminary Specifications

## PIN ASSIGNMENTS

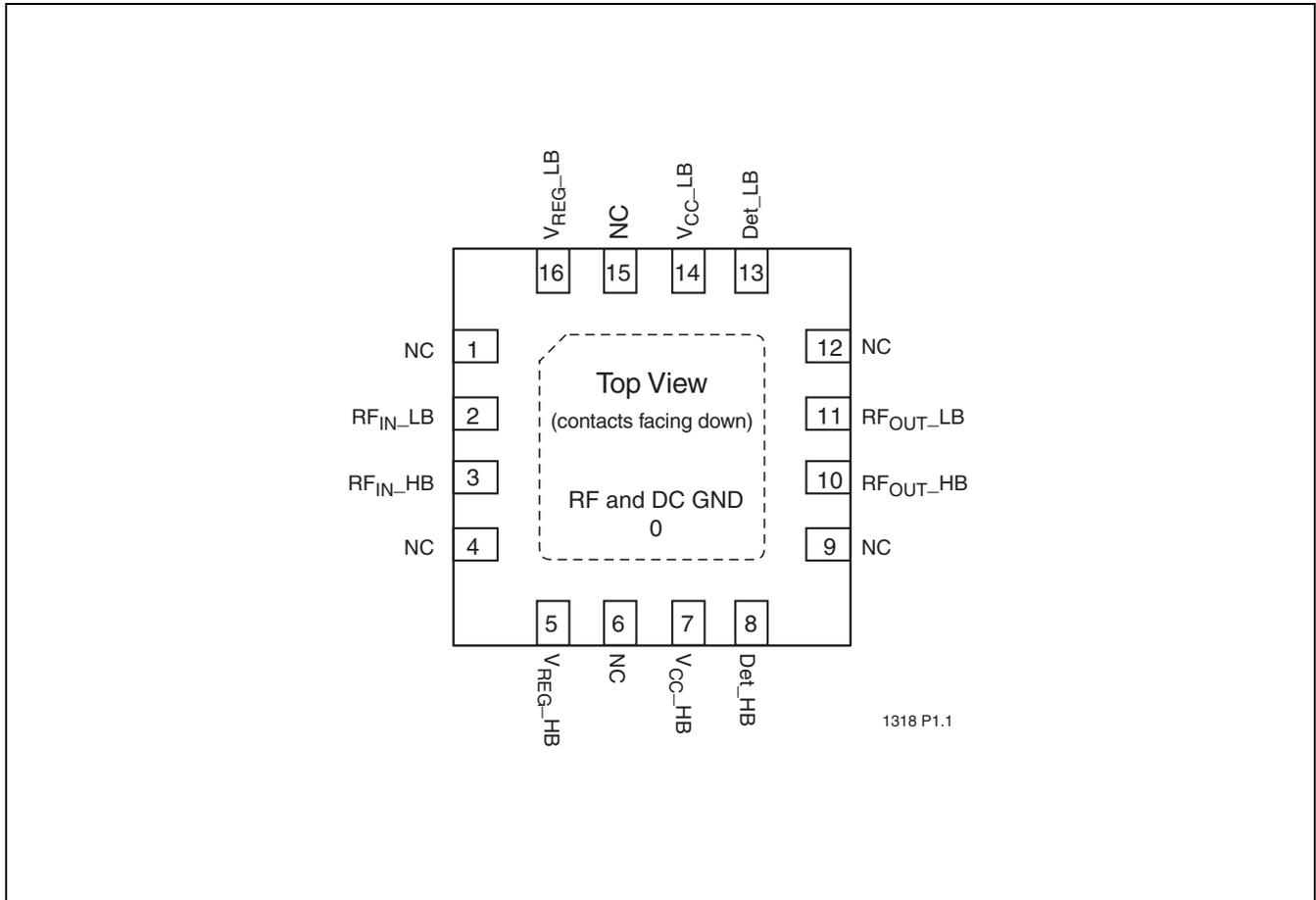


FIGURE 2: Pin Assignments for 16-contact LGA



## 2.4-2.5 GHz / 4.9-5.8 GHz Dual-Band Power Amplifier SST13LP05

Preliminary Specifications

### PIN DESCRIPTIONS

**TABLE 1: Pin Description**

Symbol	Pin No.	Pin Name	Type	Function
GND	0	Ground		Ground Pad
NC	1	No Connection		Unconnected Pin
RF <sub>IN</sub> _LB	2		I	50Ω Matched RF Input for Low Band, AC coupled
RF <sub>IN</sub> _HB	3		I	50Ω Matched RF Input for High Band, AC coupled
NC	4	No Connection		Unconnected Pin
V <sub>REG</sub> _HB	5	Power Supply	PWR	Analog current control for High Band
NC	6	No Connection		Unconnected Pin
V <sub>CC</sub> _HB	7	Power Supply	PWR	V <sub>CC</sub> Power Supply for High Band
D <sub>ET</sub> _HB	8		O	Detector Voltage Output for High Band
NC	9	No Connection		Unconnected Pin
RF <sub>OUT</sub> _HB	10	Power Supply	O/PWR	50Ω Matched RF output for High Band
RF <sub>OUT</sub> _LB	11	Power Supply	O/PWR	50Ω Matched RF output for Low Band
NC	12	No Connection		Unconnected Pin
D <sub>ET</sub> _LB	13		O	Detector Voltage Output for Low Band
V <sub>CC</sub> _LB	14	Power Supply	PWR	V <sub>CC</sub> Power Supply for Low Band
NC	15	No Connection		Unconnected Pin
V <sub>REG</sub> _LB	16	Power Supply	PWR	Analog current control for Low Band

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# 2.4-2.5 GHz / 4.9-5.8 GHz Dual-Band Power Amplifier SST13LP05

Preliminary Specifications

## ELECTRICAL SPECIFICATIONS

The AC and DC specifications for the power amplifier interface signals. Refer to Tables 2 and 4 for the DC voltage and current specifications. Refer to Figures 3 through 22 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.

Supply Voltage ( $V_{CC}$ )	-0.3V to +3.6V
Reference Voltage ( $V_{REF}$ )	-0.3V to +3.3V
DC supply current ( $I_{CC}$ )	400 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

Preliminary Specifications

### For 802.11b/g Operation

**TABLE 2: DC Electrical Characteristics**

Symbol	Parameter	Min.	Typ	Max.	Unit
V <sub>CC</sub>	Supply Voltage	3.0	3.3	3.6	V
I <sub>CC</sub>	Supply Current for 802.11g, 19 dBm for 802.11b, 23.5 dBm		160 235		mA mA
I <sub>REG</sub>	Analog control current at On state			2	mA
V <sub>REG</sub>	Reference Voltage		2.95		V

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**TABLE 3: AC Electrical Characteristics for Configuration**

Symbol	Parameter	Min.	Typ	Max.	Unit
F <sub>L-U</sub>	Frequency range	2.4		2.5	GHz
G	Small signal gain	28	29		dB
G <sub>VAR1</sub>	Gain variation over temperature 0°C – 85°C	-1		1	dB
G <sub>VAR2</sub>	Gain flatness over any 50 MHz bandwidth	-0.3		0.3	dB
ACPR	Meet 11b spectrum mask Meet 11g OFDM 54 Mbps spectrum mask	22 22	23 23		dBm dBm
Added EVM	P <sub>OUT</sub> = 19 dBm with 54Mbps 11g OFDM signal when operating at 3.3V Vcc			-28 4	dB %
2f, 3f, 4f, 5f	Harmonics at P <sub>OUT</sub> = 20 dBm Spurious non-harmonics at P <sub>OUT</sub> = 20 dBm In/Out return loss at 50 Ω nominal impedance			-50 -60	dBc dBc
		6			dB

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## 2.4-2.5 GHz / 4.9-5.8 GHz Dual-Band Power Amplifier SST13LP05

Preliminary Specifications

### For 802.11a Operation

**TABLE 4: DC Electrical Characteristics**

Symbol	Parameter	Min.	Typ	Max.	Unit
V <sub>CC</sub>	Supply Voltage	3	3.3	3.6	V
I <sub>CC</sub>	Supply Current for 802.11a, 18 dBm		270		mA
I <sub>REG</sub>	Analog control current at On state			2	μA
V <sub>REG</sub>	Reference Voltage		2.95		V

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**TABLE 5: AC Electrical Characteristics for Configuration**

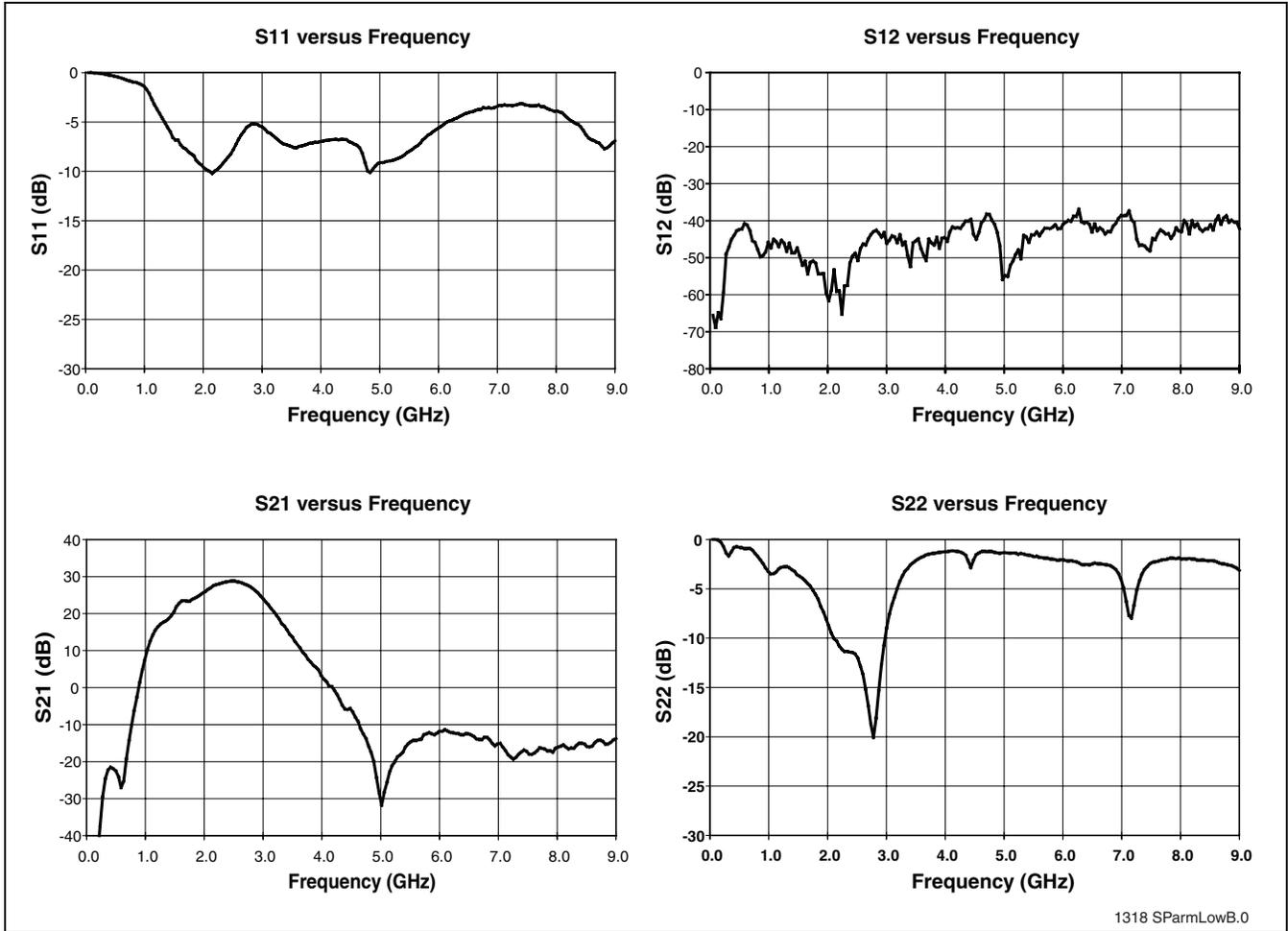
Symbol	Parameter	Min.	Typ	Max.	Unit
F <sub>L-U</sub>	Frequency range	4.92		5.805	GHz
G	Small signal gain across 4.9- 5.8 GHz	26			dB
G <sub>VAR1</sub>	Gain variation over temperature 0°C – 85°C	-1		1	dB
G <sub>VAR2</sub>	Gain flatness over any 100 MHz bandwidth	-0.5		0.5	dB
ACPR	Meet 11a OFDM 54 Mbps spectrum mask	22	22.5		dBm
Added EVM	P <sub>OUT</sub> = 18 dBm with 54Mbps 11aOFDM signal when operating at 3.3V Vcc			-28	dB
2f, 3f, 4f, 5f	Harmonics at 20 dBm			4	%
				-45	dBc

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Preliminary Specifications

**Typical Low Band Performance for 802.11b/g**

Test Conditions:  $V_{CC} = 3.3V$ ,  $T_A = 25^{\circ}C$ ,  $V_{REF} = 2.95V$  unless otherwise noted



**FIGURE 3: Low Band S-Parameters**



# 2.4-2.5 GHz / 4.9-5.8 GHz Dual-Band Power Amplifier

## SST13LP05

Preliminary Specifications

Test Conditions:  $V_{CC} = 3.3\text{ V}$ ,  $V_{REF} = 2.95\text{ V}$ , 54 Mbps 802.11g OFDM signal

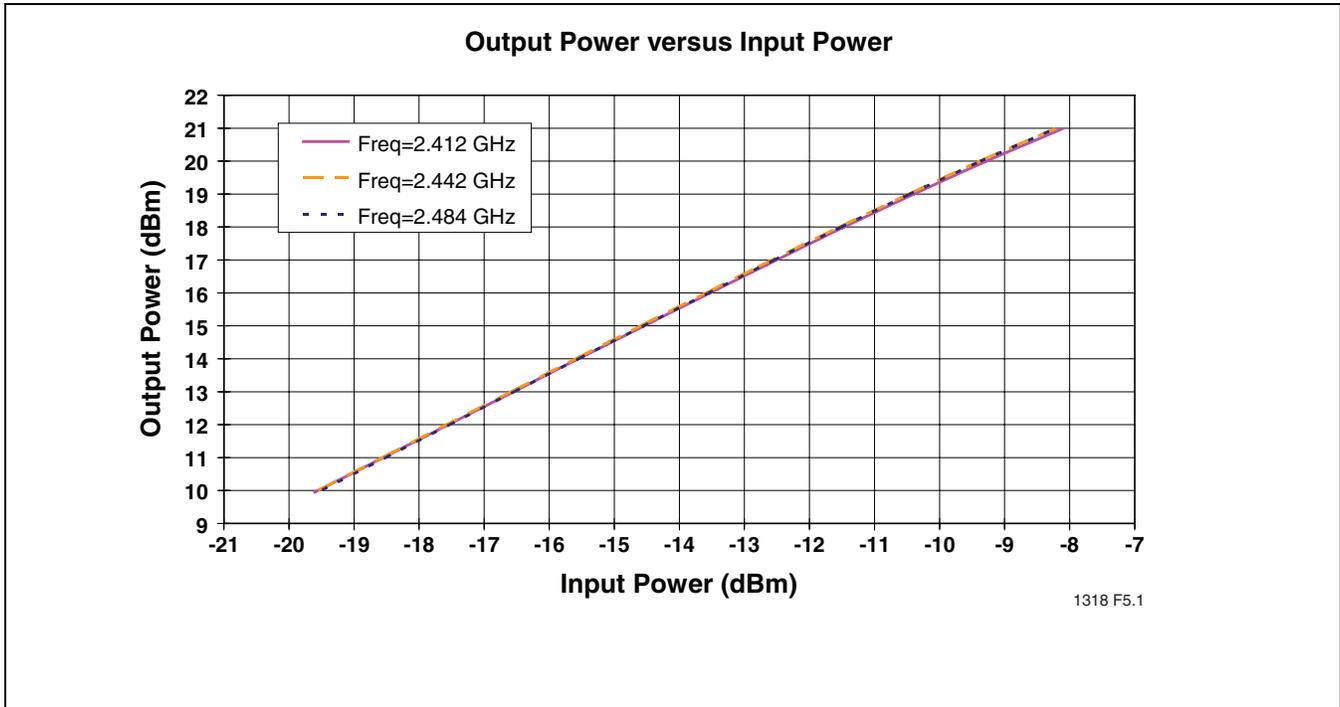


FIGURE 4: Low Band Output Power versus Input Power

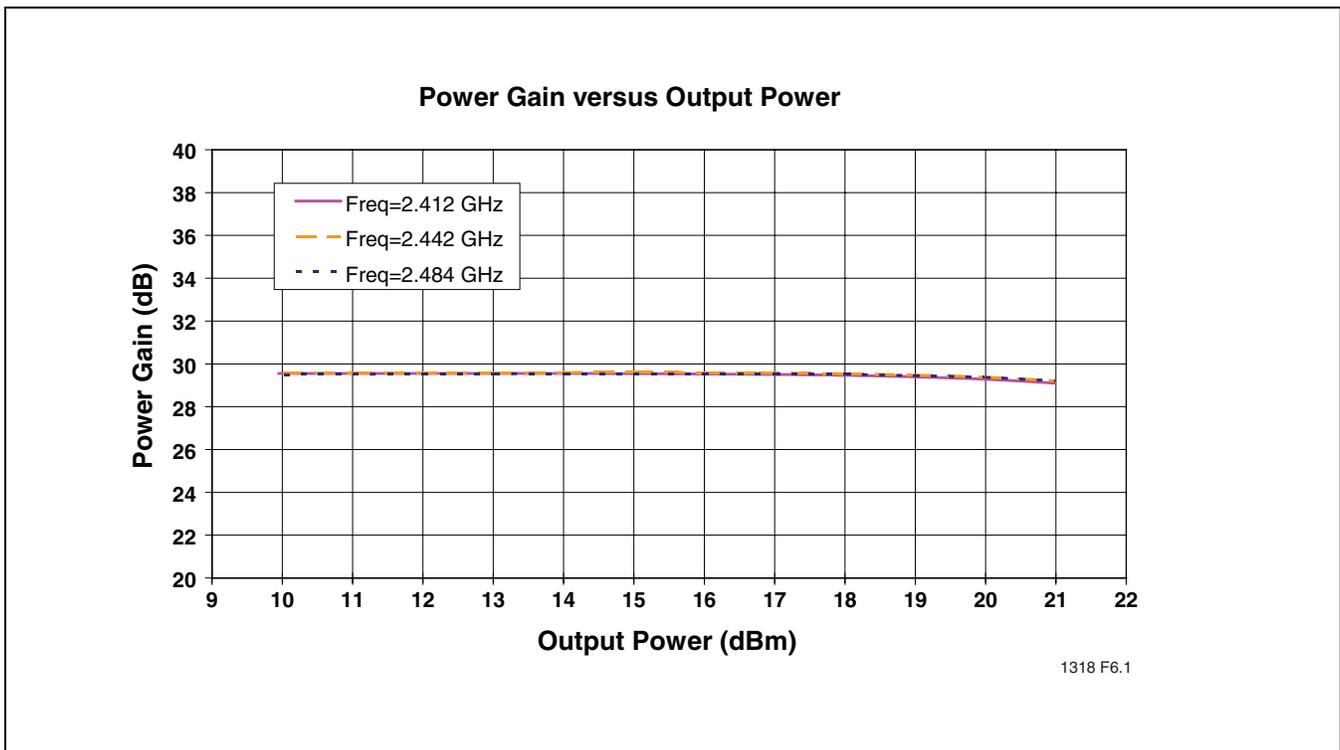


FIGURE 5: Low Band Power Gain versus Output Power

Preliminary Specifications

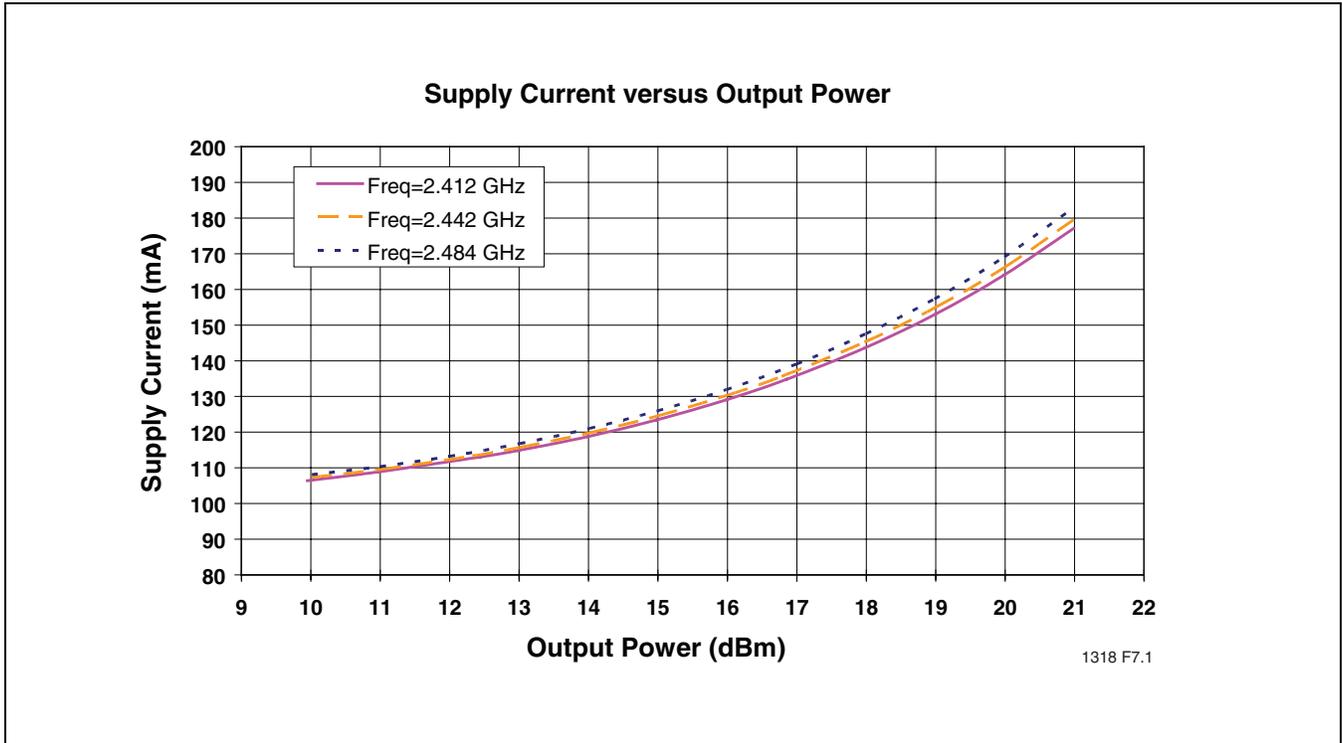


FIGURE 6: Low Band Supply Current versus Output Power

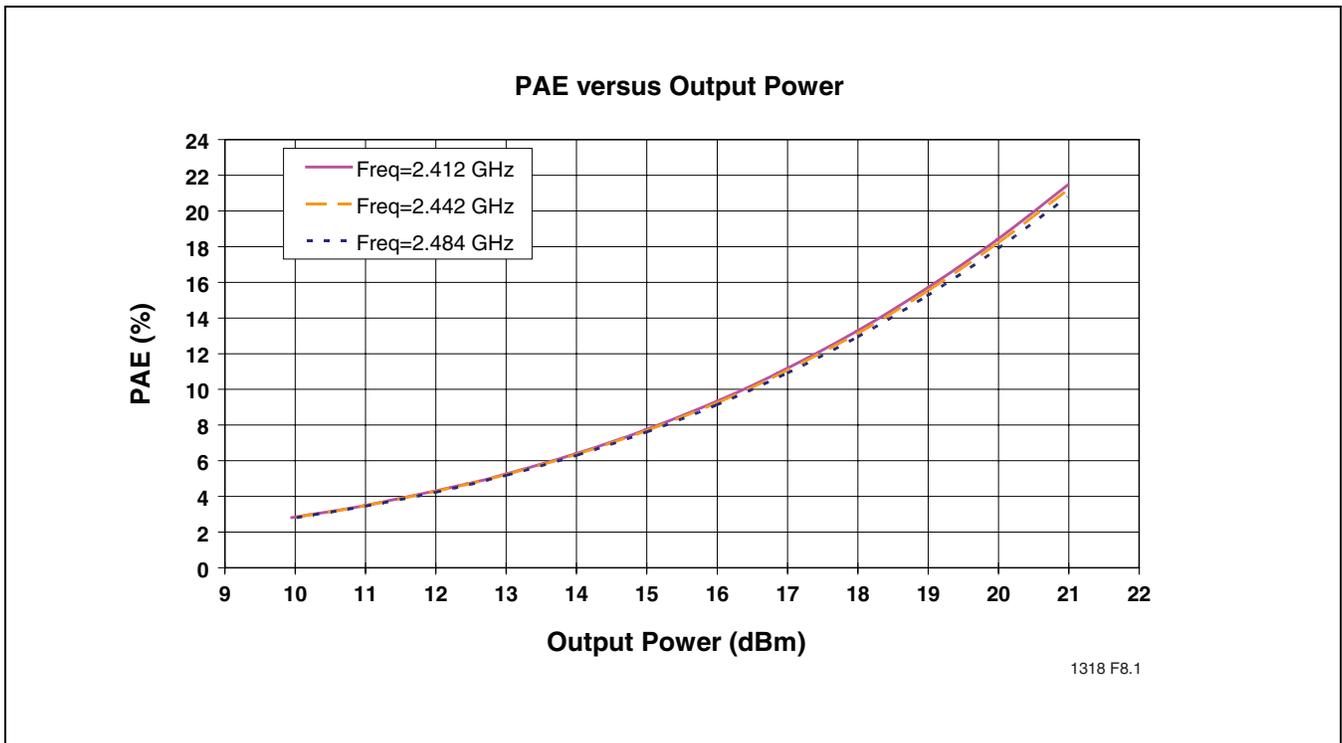


FIGURE 7: Low Band PAE versus Output Power



# 2.4-2.5 GHz / 4.9-5.8 GHz Dual-Band Power Amplifier SST13LP05

Preliminary Specifications

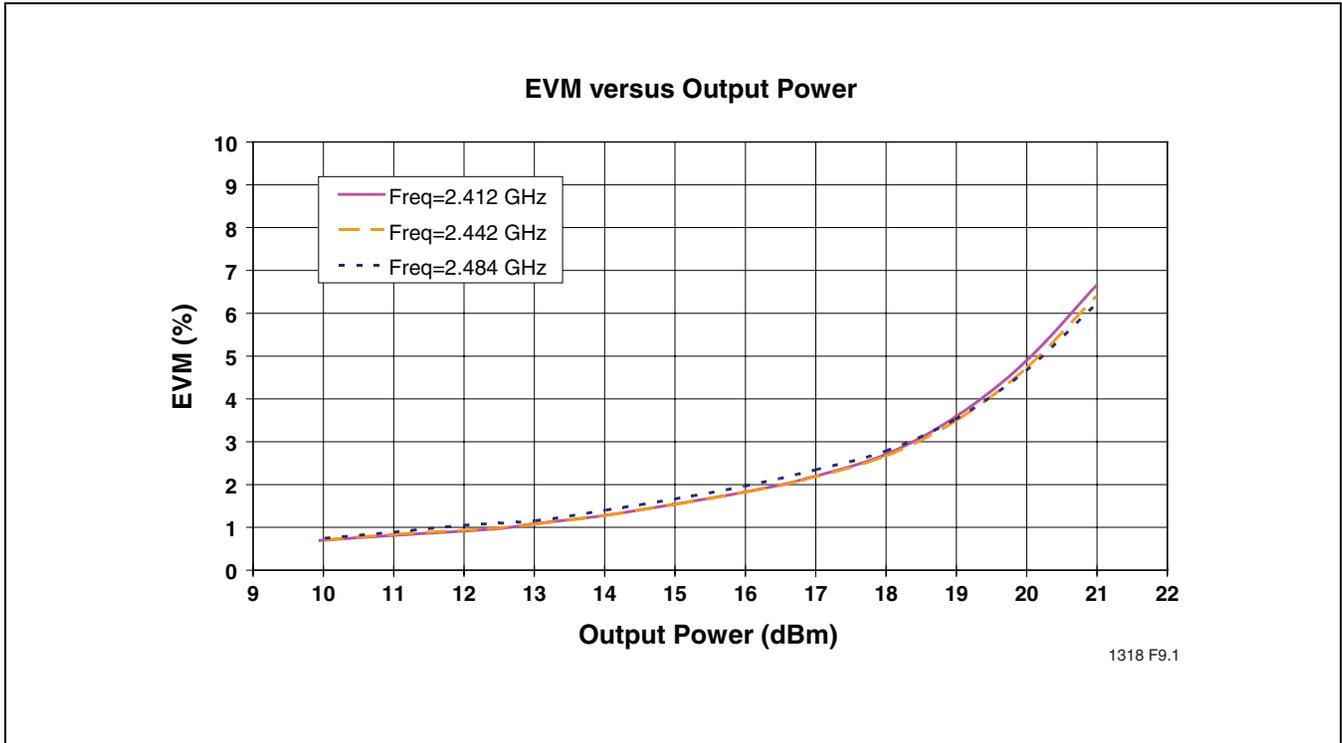


FIGURE 8: Low Band EMV versus Output Power

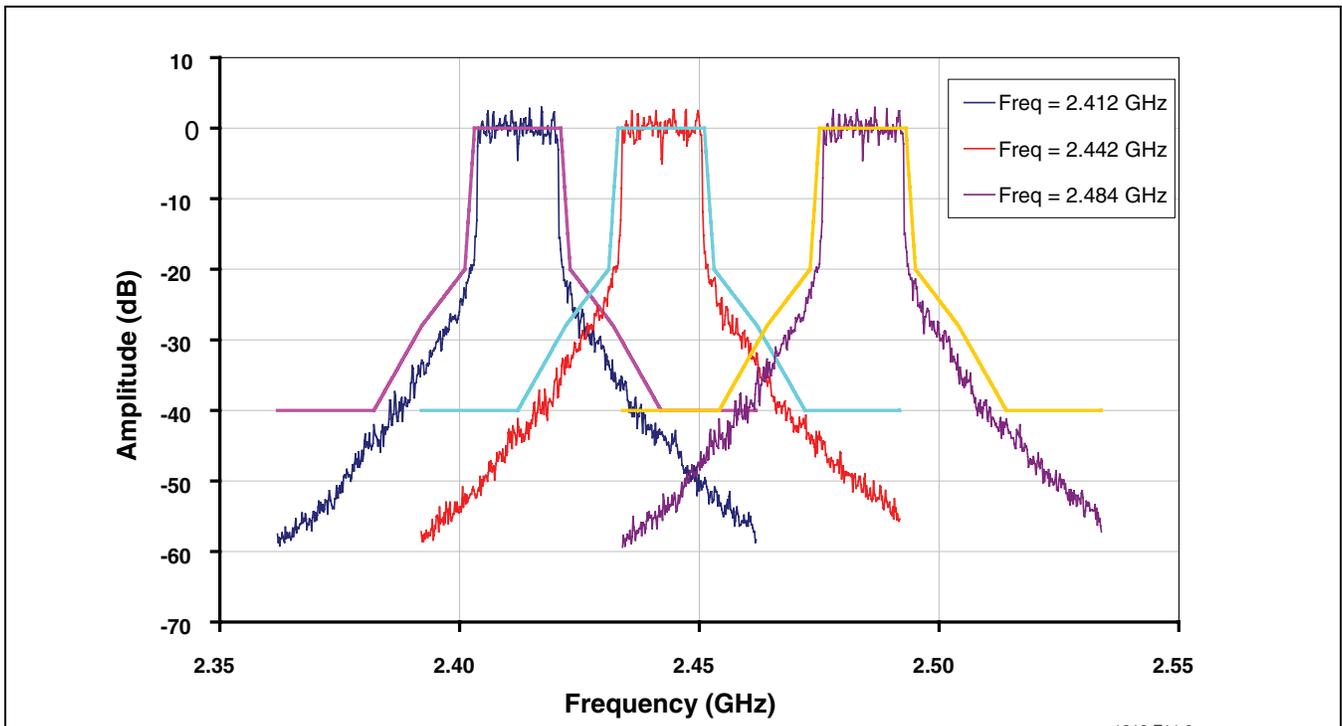
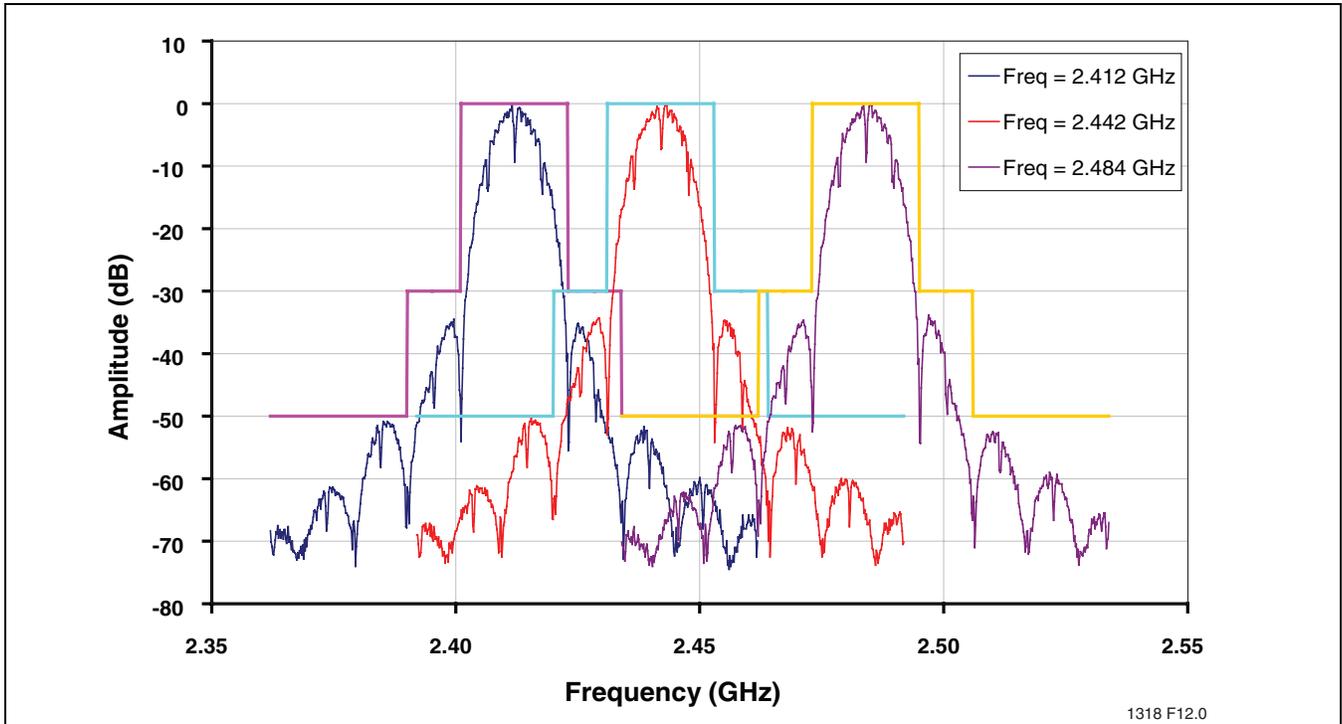


FIGURE 9: Low Band 802.11b Spectrum Mask at 23 dBm with DC Current of 220 mA

Preliminary Specifications

**Test Conditions:**  $V_{CC} = 3.3V$ ,  $V_{REF} = 2.95V$ ,  $T_A = 25^\circ C$ , 1 Mbps 802.11b CCK Signal



**FIGURE 10: Low Band 802.11b Spectrum Mask at 23.5 dBm with DC Current of 235 mA**



# 2.4-2.5 GHz / 4.9-5.8 GHz Dual-Band Power Amplifier SST13LP05

Preliminary Specifications

## Low Band Power Detector Characteristics

Test Conditions:  $V_{CC} = 3.3V$ ,  $V_{REF} = 2.95V$ ,  $T_A = 25^{\circ}C$ , 54 Mbps 802.11g OFDM Signal

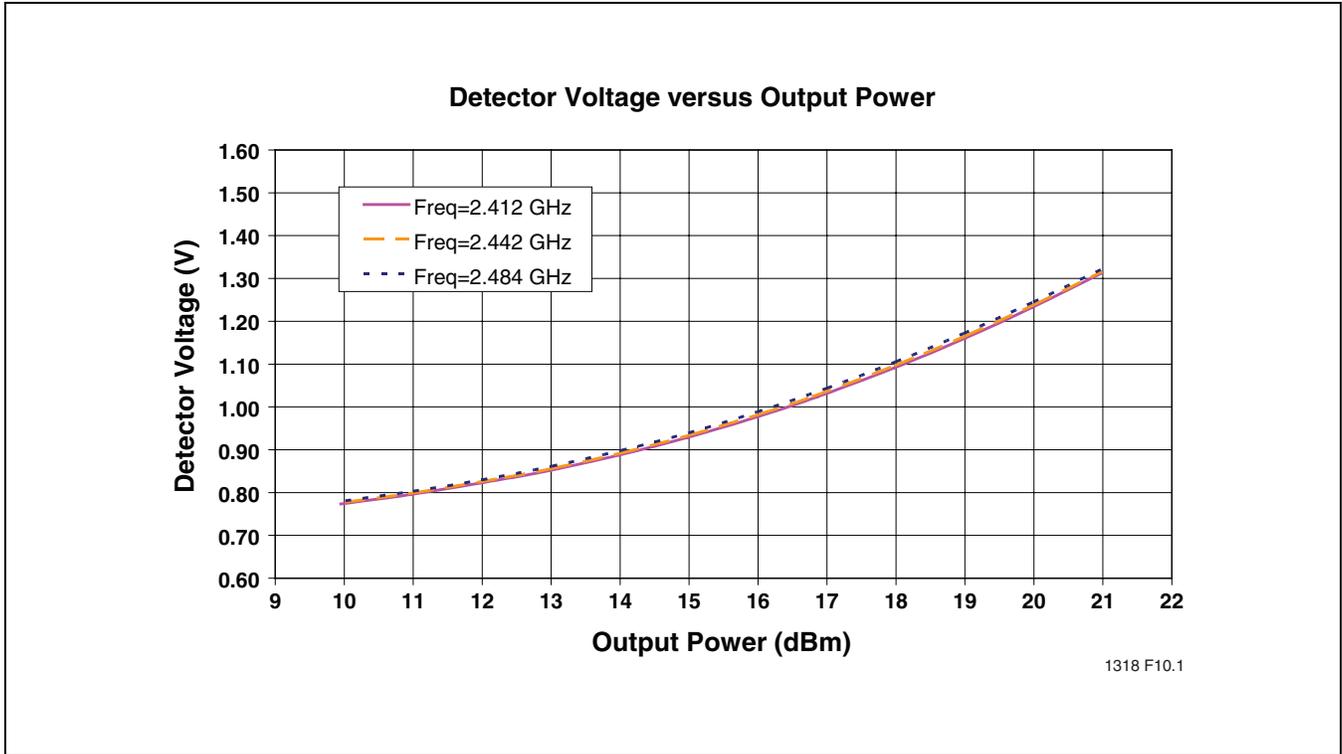
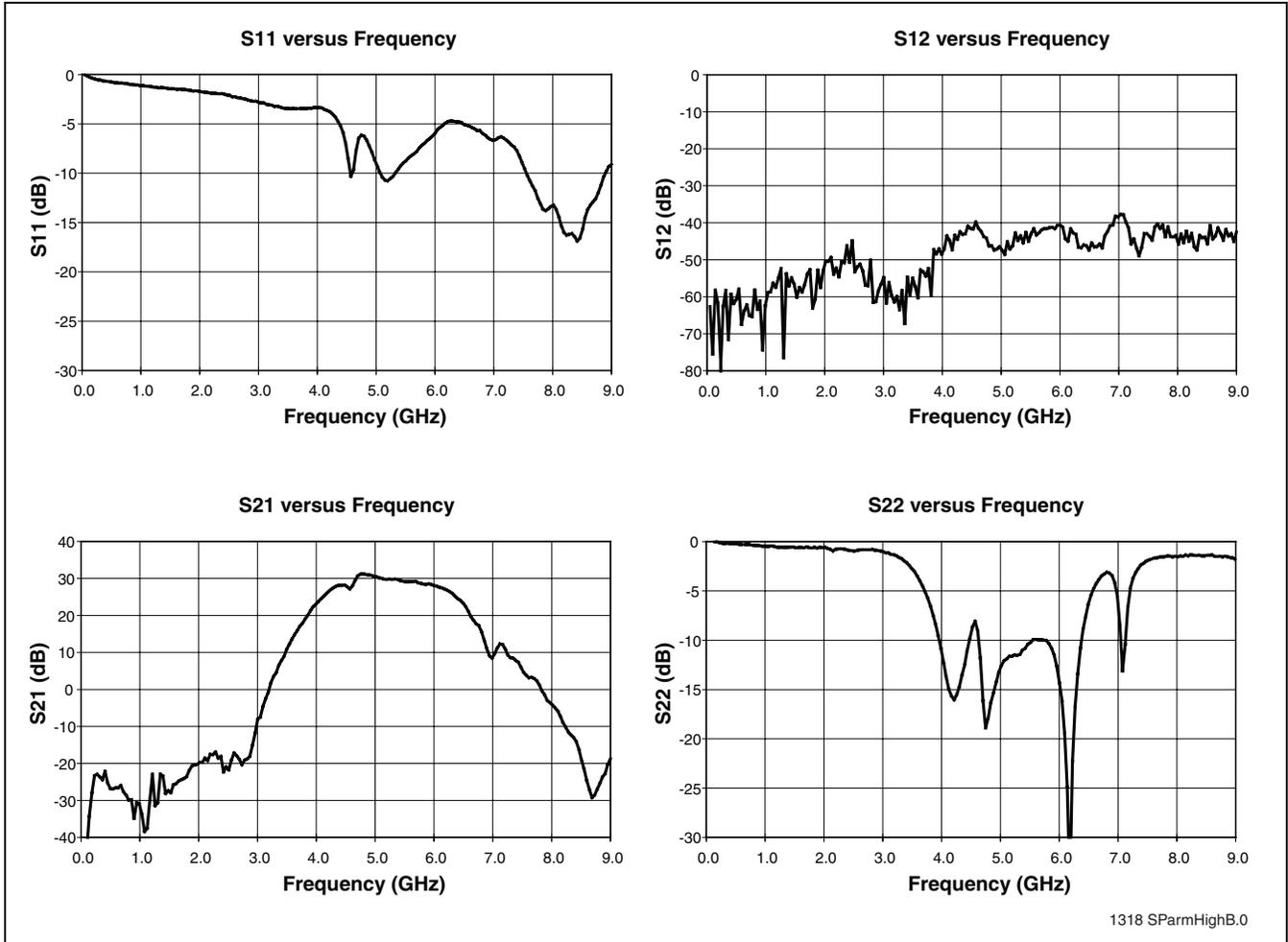


FIGURE 11: Low Band Detector Voltage versus Output Power

Preliminary Specifications

**Typical High Band Performance for 802.11a**

Test Conditions:  $V_{CC} = 3.3V$ ,  $T_A = 25^\circ C$ ,  $V_{REF} = 2.95V$  unless otherwise noted



**FIGURE 12: High Band S-Parameters**



# 2.4-2.5 GHz / 4.9-5.8 GHz Dual-Band Power Amplifier SST13LP05

Preliminary Specifications

Test Conditions:  $V_{CC} = 3.3V$ ,  $V_{REF} = 2.95V$ , 54 Mbps 802.11a OFDM Signal

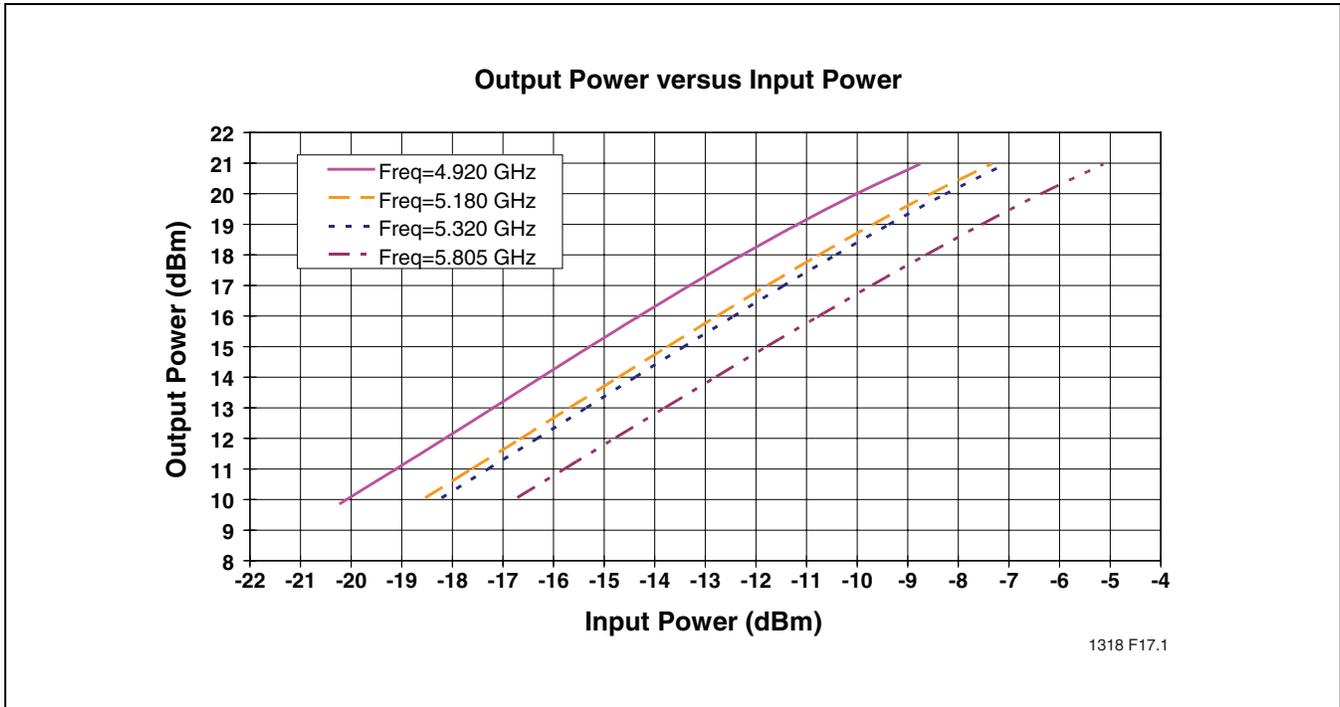


FIGURE 13: High Band Output Power versus Input Power

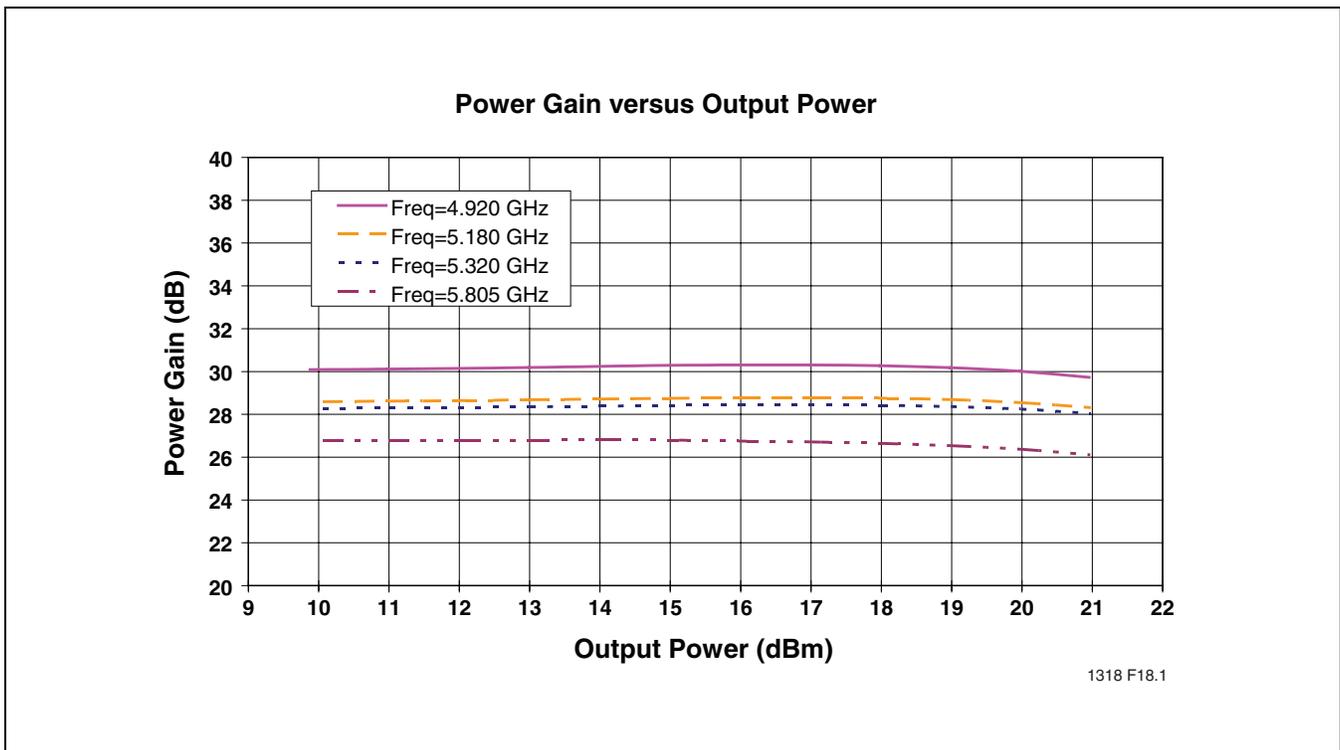


FIGURE 14: High Band Power Gain versus Output Power

Preliminary Specifications

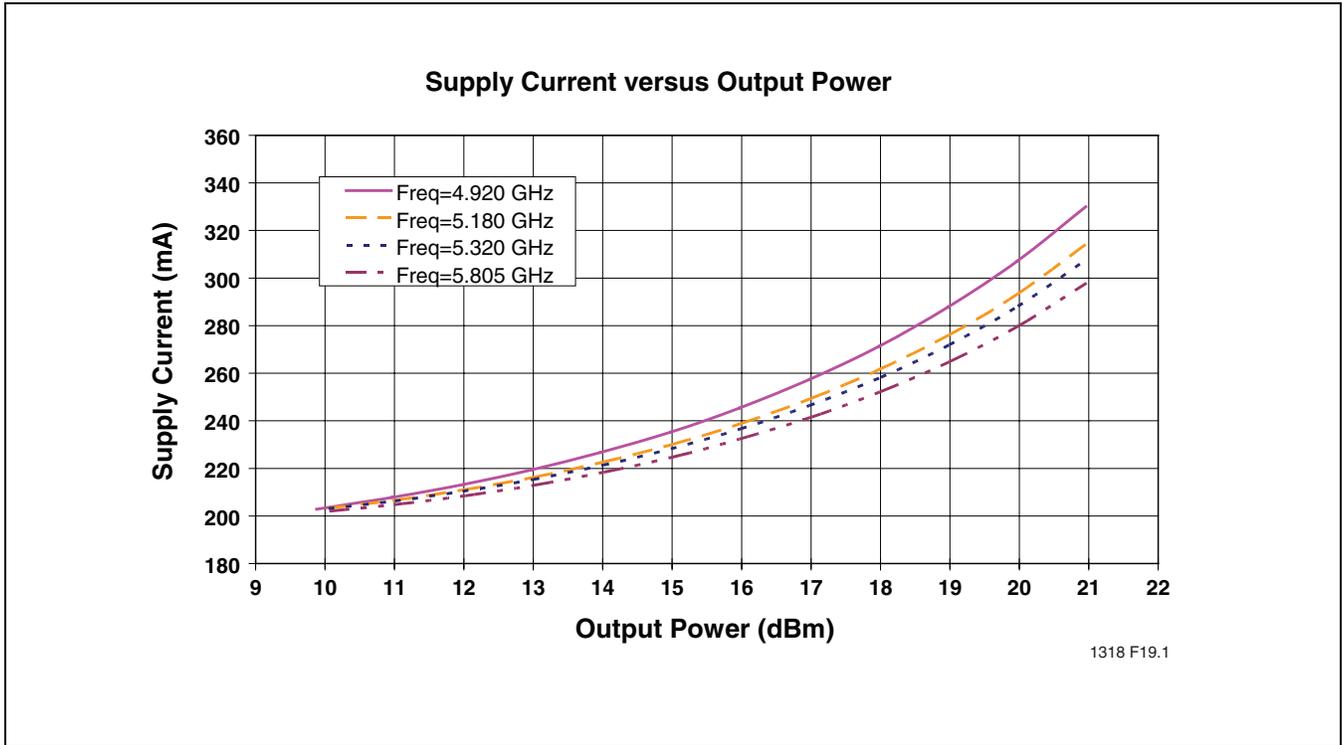


FIGURE 15: High Band Supply Current versus Output Power

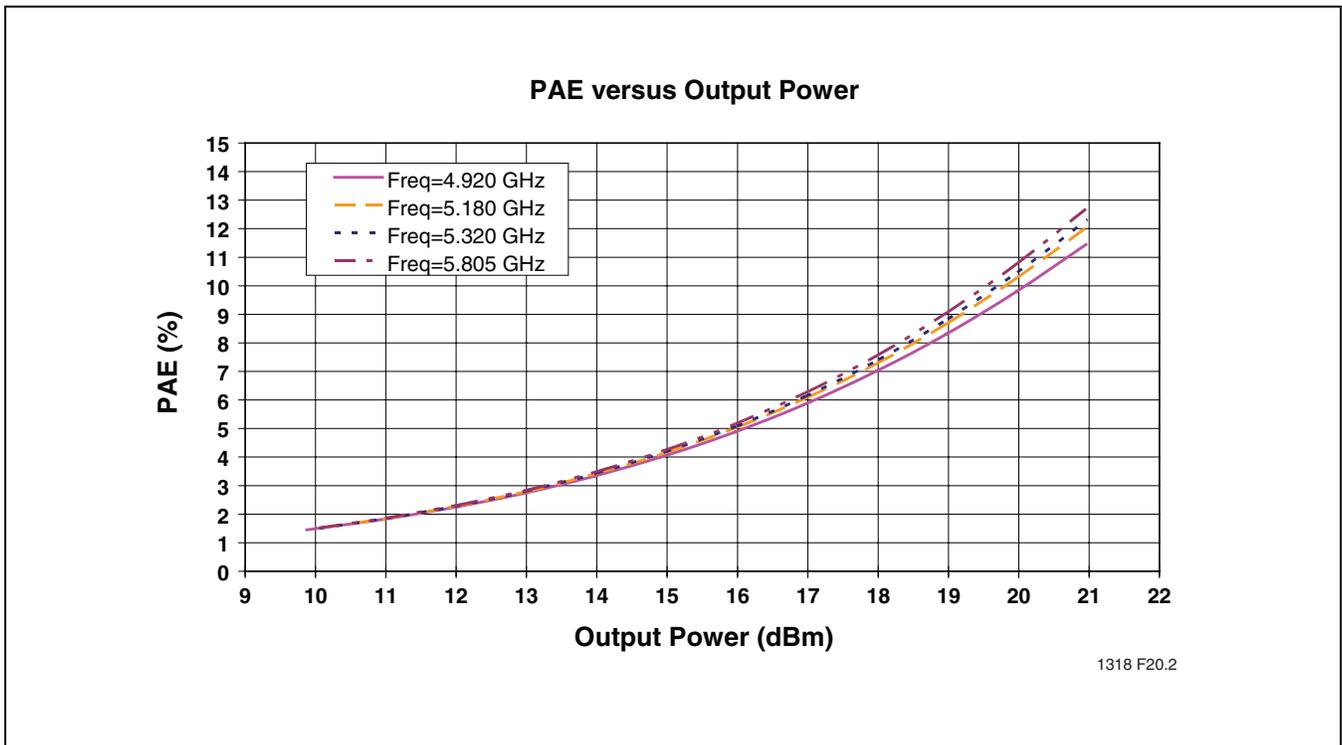


FIGURE 16: High Band PAE versus Output Power



# 2.4-2.5 GHz / 4.9-5.8 GHz Dual-Band Power Amplifier SST13LP05

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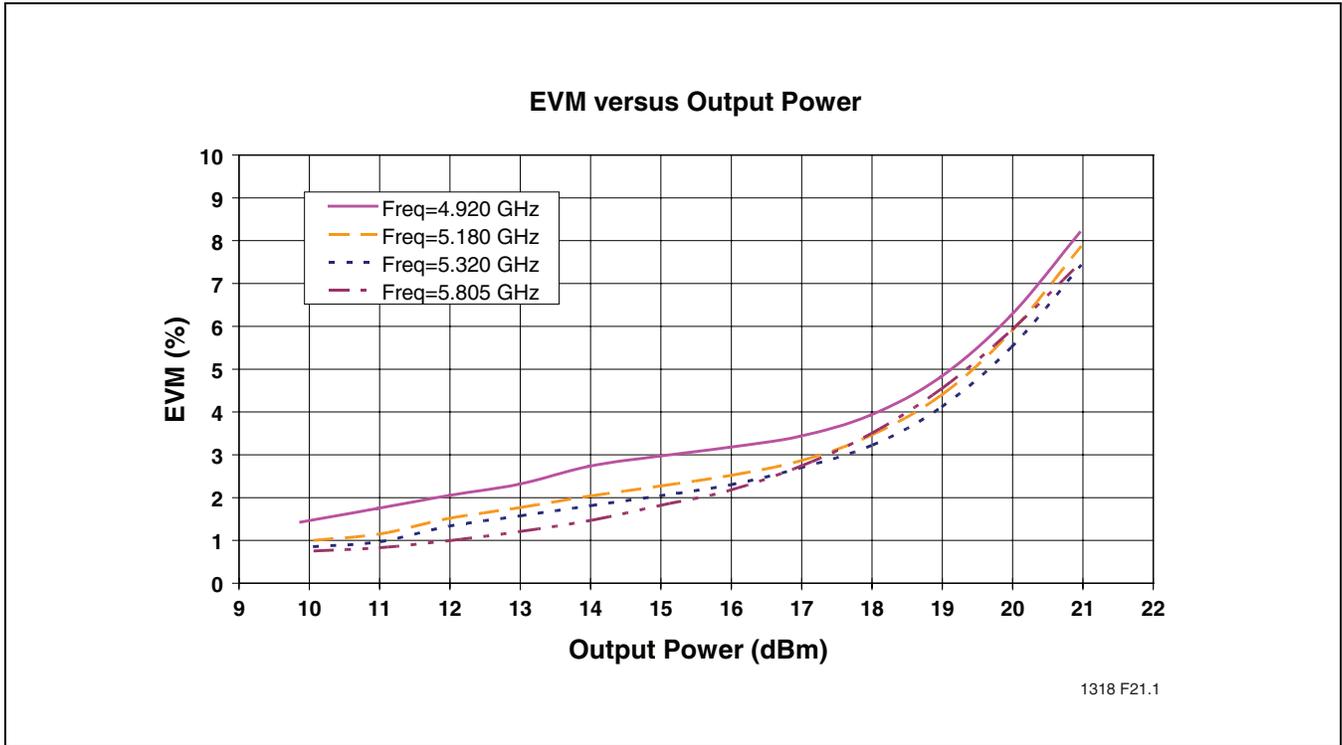


FIGURE 17: High Band EVM versus Output Power

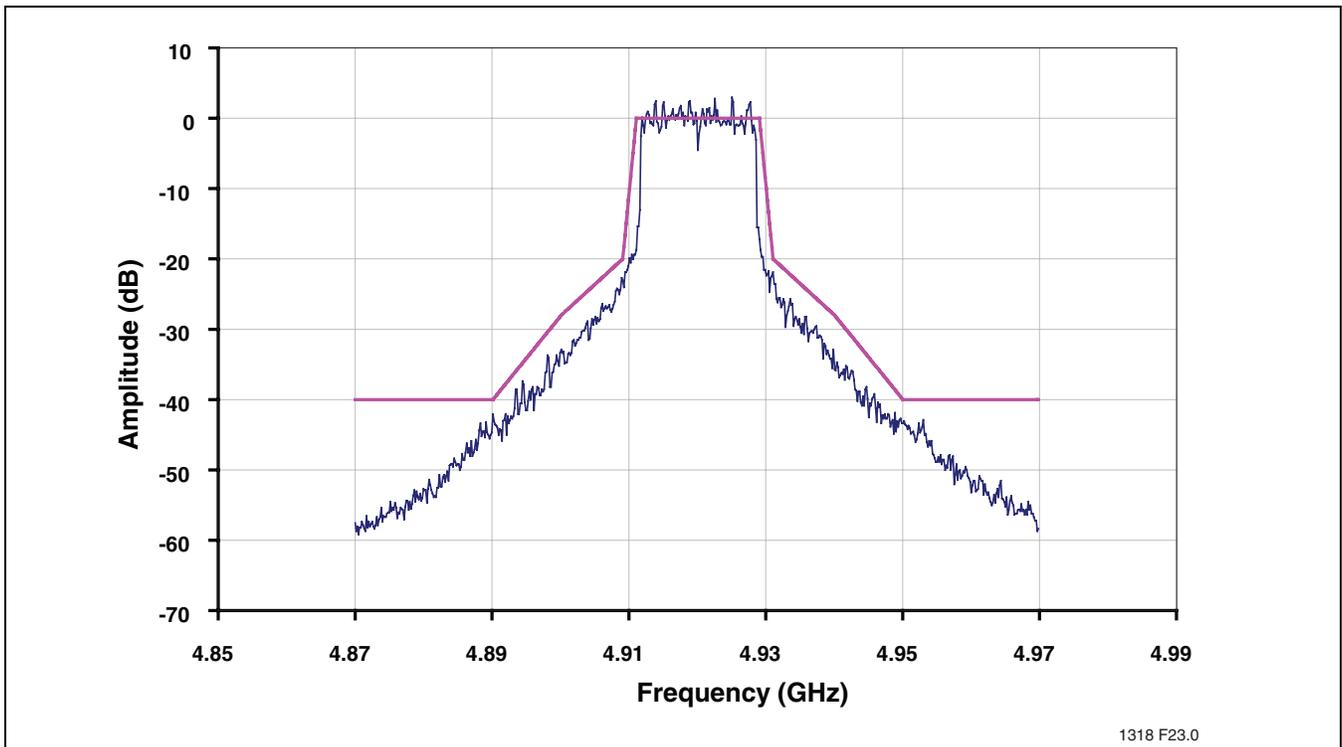
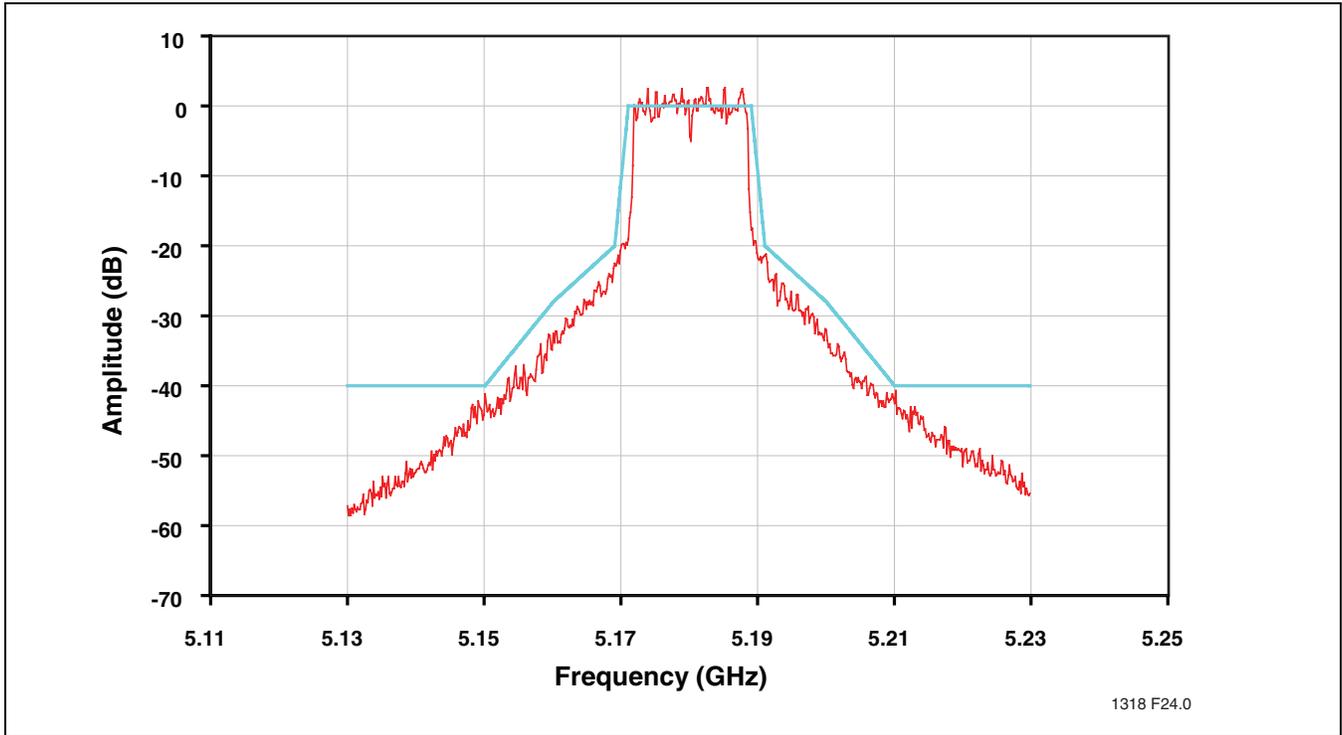
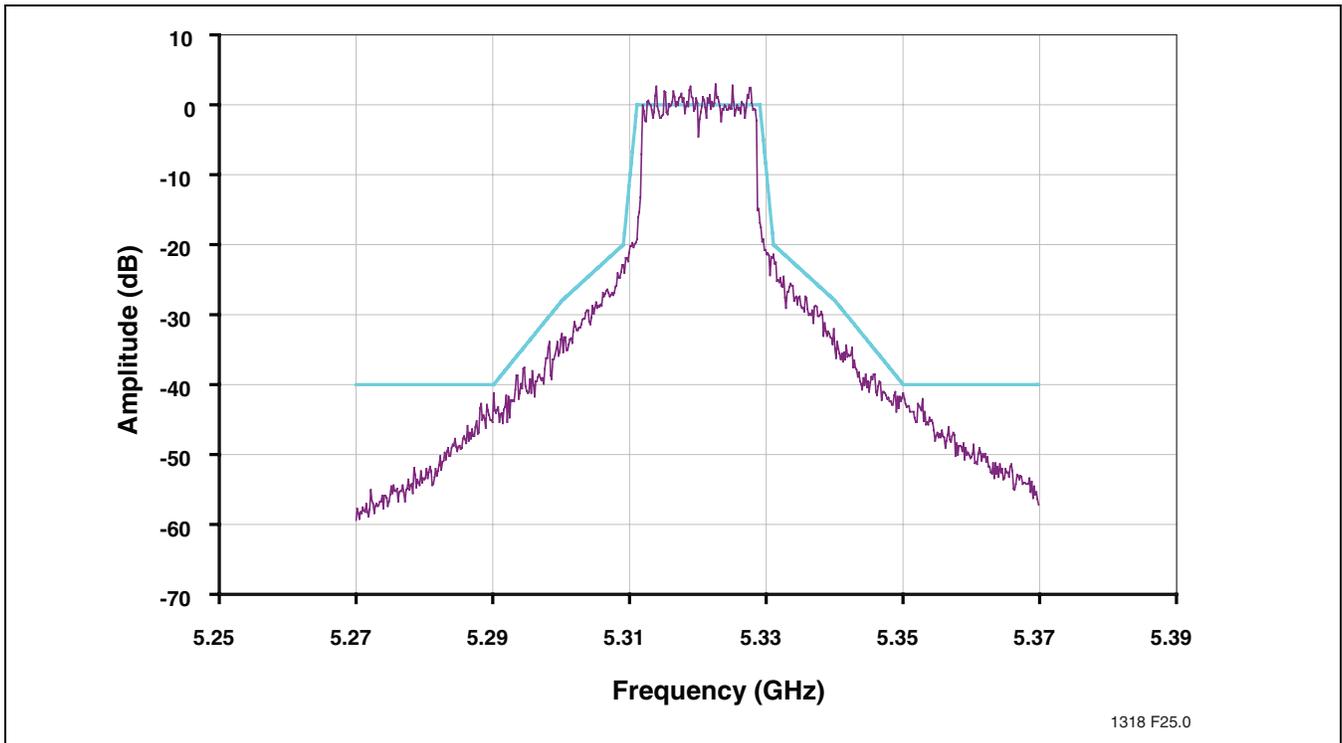


FIGURE 18: High Band 802.11a Spectrum Mask at 4.92 GHz at Output Power 22.5 dBm with DC Current at 370 mA

Preliminary Specifications



**FIGURE 19: High Band 802.11a Spectrum Mask at 5.18 GHz at Output Power 22.5 dBm with DC Current at 355 mA**

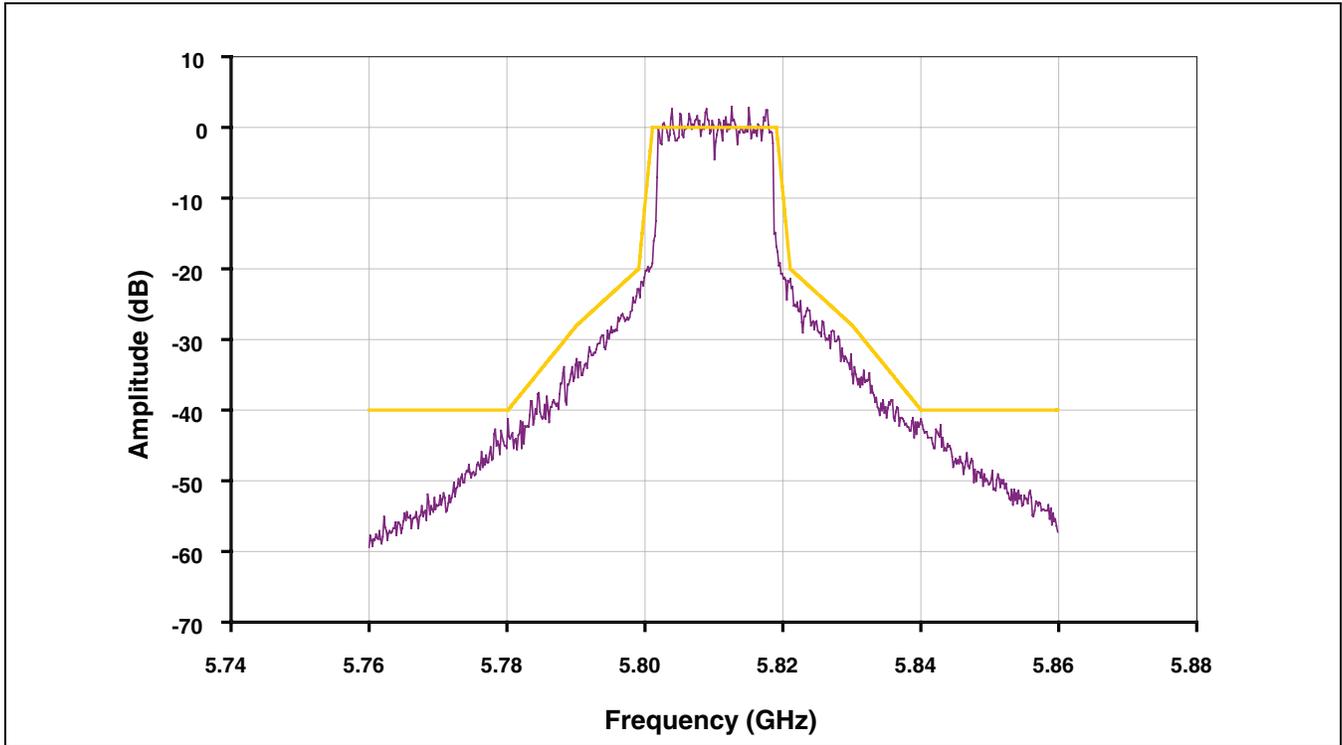


**FIGURE 20: High Band 802.11a Spectrum Mask at 5.32 GHz at Output Power 23 dBm with DC Current at 360 mA**



# 2.4-2.5 GHz / 4.9-5.8 GHz Dual-Band Power Amplifier SST13LP05

Preliminary Specifications

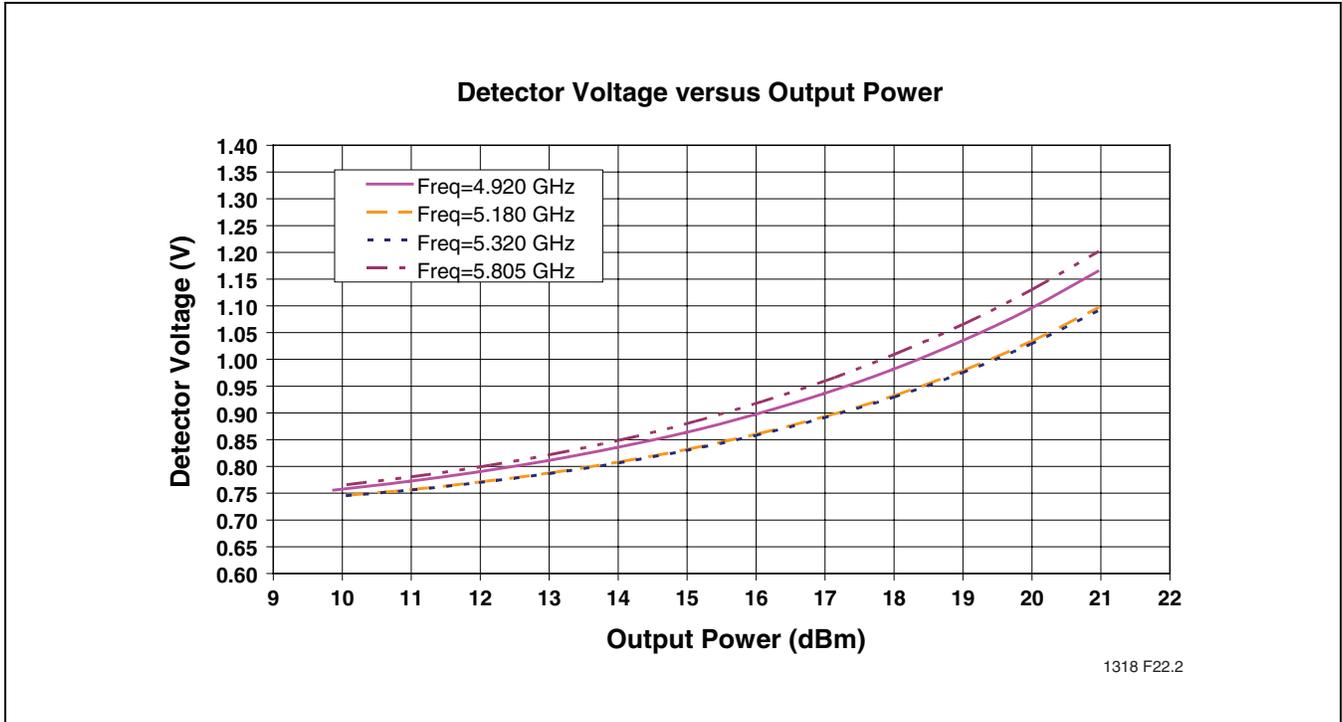


**FIGURE 21: High Band 802.11a Spectrum Mask at 5.805 GHz at Output Power 23 dBm with DC Current at 350 mA**

Preliminary Specifications

**High Band Power Detector characteristics**

Test Conditions:  $V_{CC} = 3.3V$ ,  $V_{REF} = 2.95V$ ,  $T_A = 25^\circ C$ , 54 Mbps 802.11a OFDM Signal

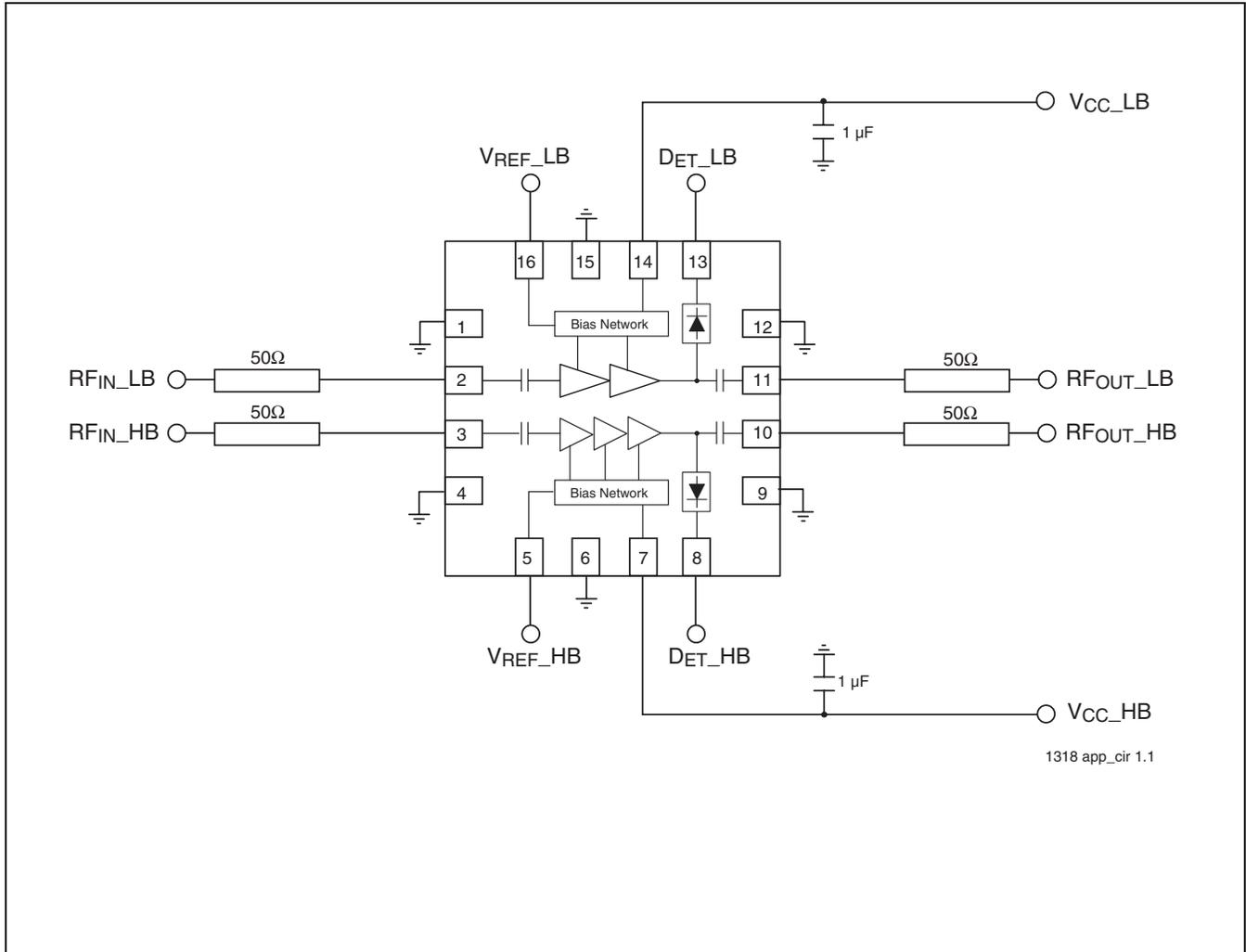


**FIGURE 22: High Band Detector Voltage versus Output Power**



# 2.4-2.5 GHz / 4.9-5.8 GHz Dual-Band Power Amplifier SST13LP05

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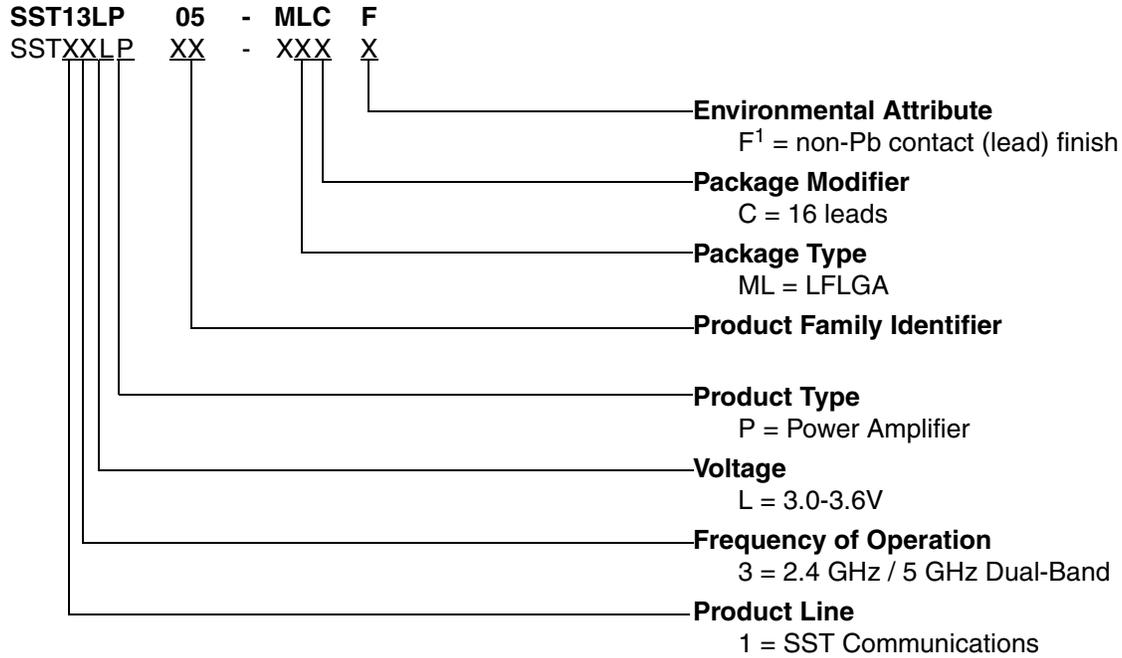
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FIGURE 23: Typical Application Circuit



Preliminary Specifications

**PRODUCT ORDERING INFORMATION**




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1. Environmental suffix "F" denotes non-Pb solder.  
 SST non-Pb solder devices are "RoHS Compliant".

**Valid combinations for SST13LP05**

SST13LP05-MLCF

**SST13LP05 Evaluation Kits**

SST13LP05-MLCF-K

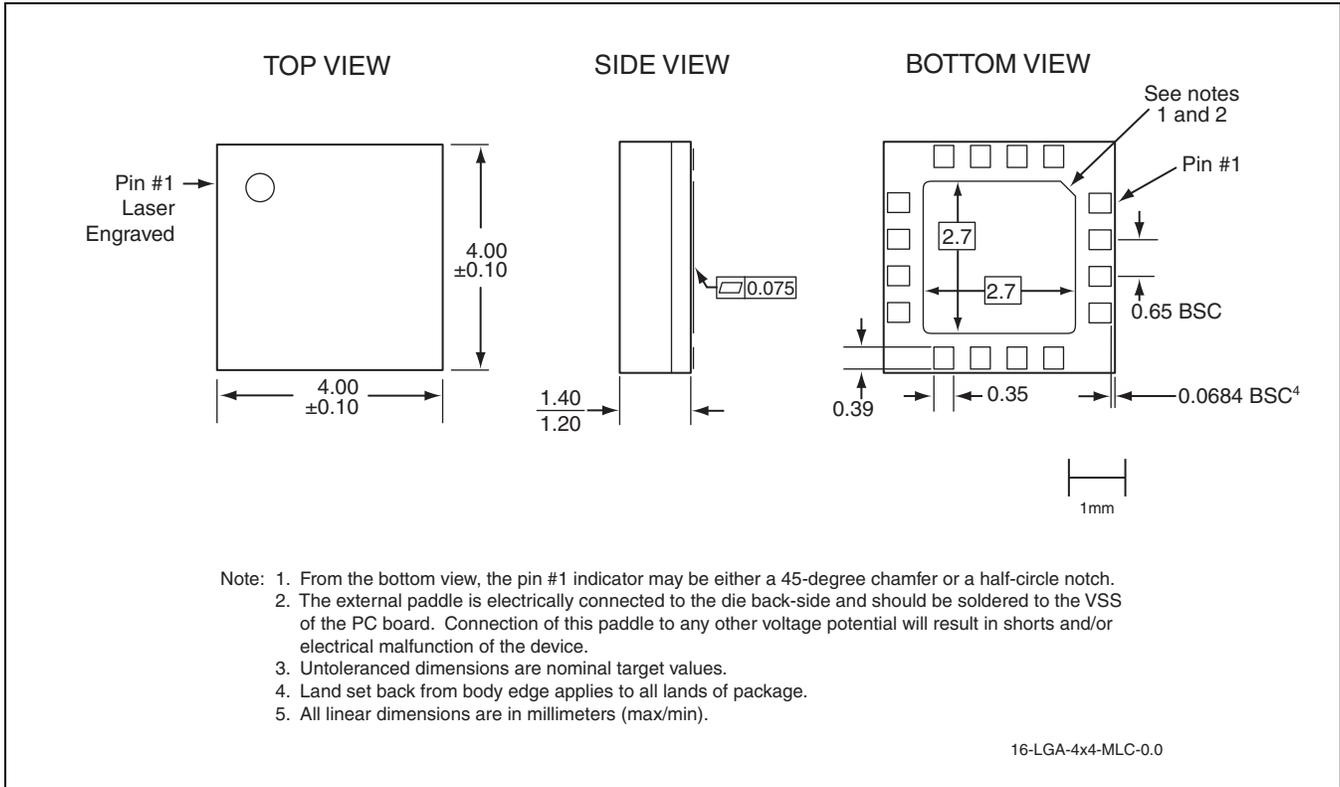
**Note:** Consult your SST sales representative to confirm availability of valid combinations.



# 2.4-2.5 GHz / 4.9-5.8 GHz Dual-Band Power Amplifier

## SST13LP05

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**FIGURE 24: 16-contact Low-profile, Fine-pitch, Land Grid Array (LFLGA)**  
**SST Package Code: MLC**

**TABLE 6: Revision History**

Revision	Description	Date
00	• Initial release of data sheet.	Dec 2006



## 2.4-2.5 GHz / 4.9-5.8 GHz Dual-Band Power Amplifier SST13LP05

Preliminary Specifications

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