

# 2.4 GHz High-Power, High-Gain Power Amplifier

## SST12LP14A



Preliminary Specifications

### FEATURES:

- **High Gain:**
  - Typically 29 dB gain across 2.4~2.5 GHz over temperature 0°C to +85°C
- **High linear output power:**
  - >28 dBm P1dB
    - Please refer to “Absolute Maximum Stress Ratings” on page 4
  - Meets 802.11g OFDM ACPR requirement up to 23 dBm
  - ~4% added EVM up to 21 dBm 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**
  - ~23%/210 mA @ P<sub>OUT</sub> = 22 dBm for 802.11g
  - ~25%/240 mA @ P<sub>OUT</sub> = 23 dBm for 802.11b
- **Single-pin low I<sub>REF</sub> power-up/down control**
  - I<sub>REF</sub> <2 mA
- **Low idle current**
  - ~70 mA I<sub>CQ</sub>
- **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
- **Low shut-down current (< 0.1 μA)**
- **Excellent On-chip power detection**
  - <+/- 0.3dB variation between 0°C to +85°C
  - <+/- 0.4dB variation with 2:1 VSWR mismatch
  - <+/- 0.3dB variation Ch1 through Ch14
- **20 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 SST12LP14A is a versatile power amplifier based on the highly-reliable InGaP/GaAs HBT technology.

The SST12LP14A can be easily configured for high-power applications with good power-added efficiency while operating over the 2.4- 2.5 GHz frequency band. It typically provides 29 dB gain with 23% power-added efficiency @ P<sub>OUT</sub> = 22 dBm for 802.11g and 25% power-added efficiency @ P<sub>OUT</sub> = 23 dBm for 802.11b.

The SST12LP14A has excellent linearity, typically ~4% added EVM at 21 dBm output power which is essential for 54 Mbps 802.11g operation while meeting 802.11g spectrum mask at 23 dBm. The SST12LP14A can also be configured for high-efficiency operation (typically 17 dBm linear 54 Mbps 802.11g output power at 85 mA total power consumption) which is desirable in embedded applications such as in hand-held units.

The SST12LP14A 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<sub>REF</sub> ~2 mA) makes the SST12LP14A control-

lable by an on/off switching signal directly from the base-band chip. These features coupled with low operating current make the SST12LP14A ideal for the final stage power amplification in battery-powered 802.11g/b WLAN transmitter applications.

The SST12LP14A has an excellent on-chip, single-ended power detector, which features wide-range (>15 dB) with dB-wise linearization and high stability over temperature (< +/-0.3 dB 0°C to +85°C), frequency (<+/-0.3 dB across Channels 1 through 14), and output load (<+/-0.4 dB with 2:1 output VSWR all phases). The excellent on-chip power detector provides a reliable solution to board-level power control.

The SST12LP14A is offered in 16-contact VQFN package. See Figure 2 for pin assignments and Table 1 for pin descriptions.



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### FUNCTIONAL BLOCKS

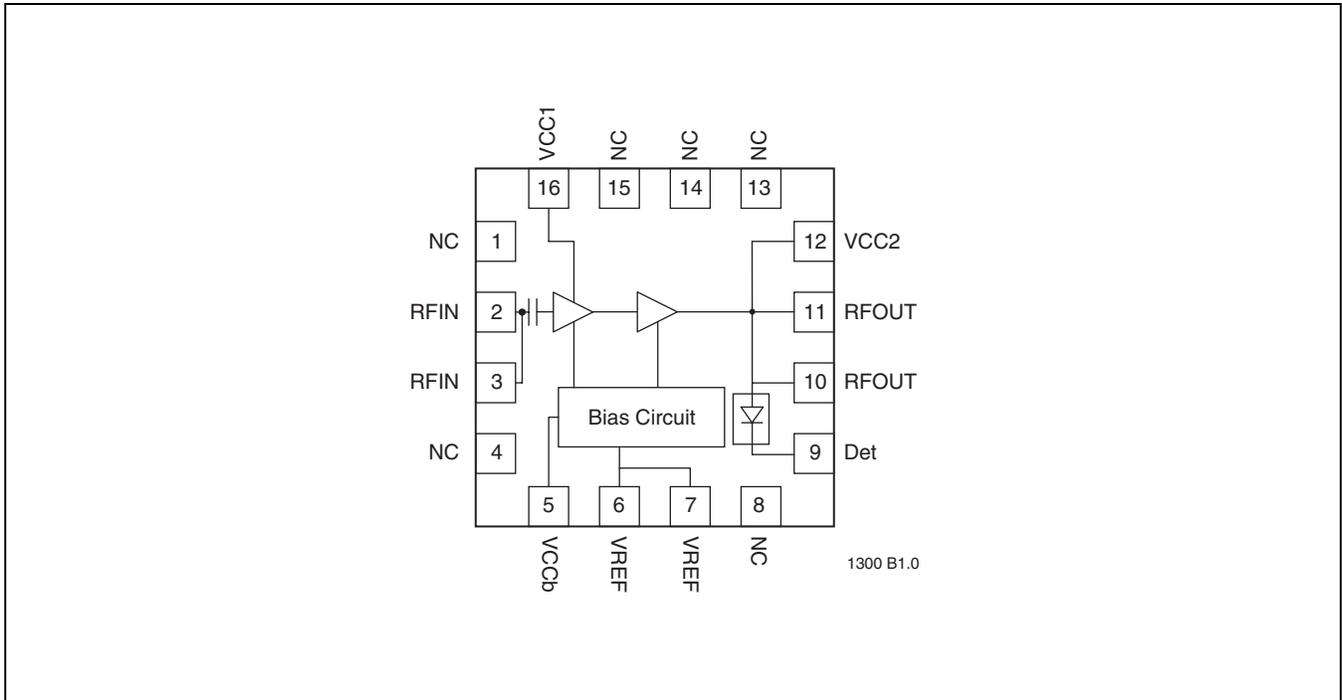


FIGURE 1: Functional Block Diagram



## 2.4 GHz High-Power, High-Gain Power Amplifier SST12LP14A

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### PIN ASSIGNMENTS

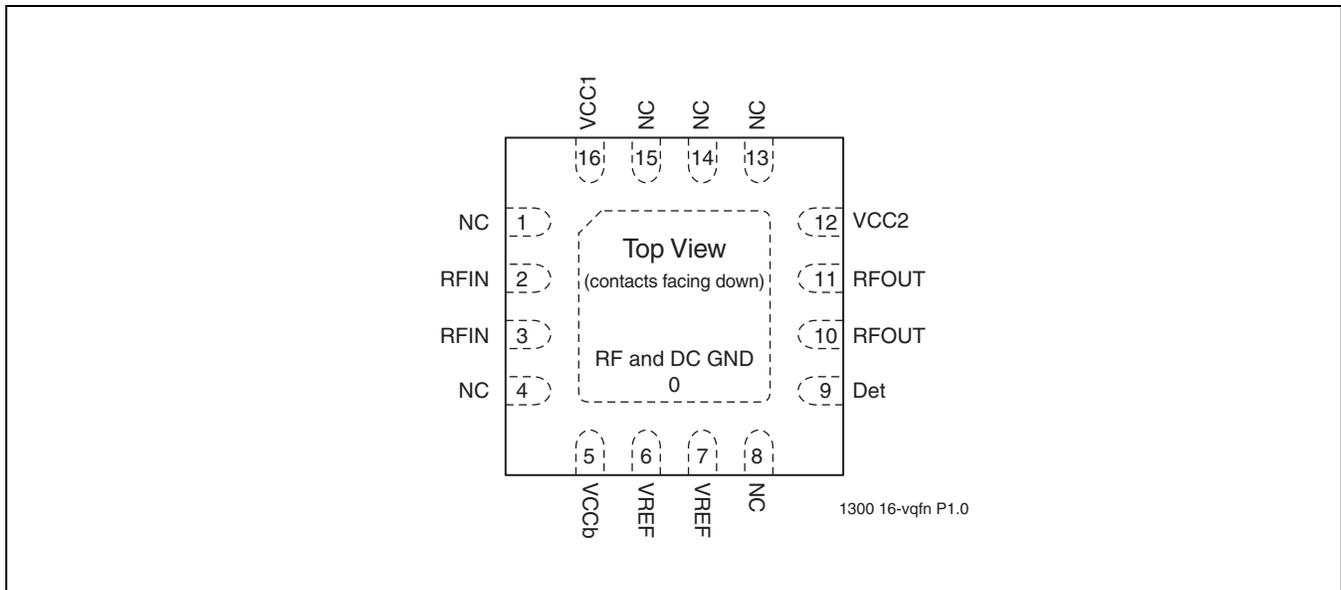


FIGURE 2: Pin Assignments for 16-contact VQFN

### PIN DESCRIPTIONS

TABLE 1: Pin Description

Symbol	Pin No.	Pin Name	Type <sup>1</sup>	Function
GND	0	Ground		The center pad should be connected to RF ground with several low inductance, low resistance vias
NC	1	No Connection		Unconnected pin
RFIN	2		I	RF input, DC decoupled
RFIN	3		I	RF input, DC decoupled
NC	4	No Connection		Unconnected pin
VCCb	5	Power Supply	PWR	Supply voltage for bias circuit
VREF	6		PWR	1 <sup>st</sup> and 2 <sup>nd</sup> stage idle current control
VREF	7		PWR	1 <sup>st</sup> and 2 <sup>nd</sup> stage idle current control
NC	8	No Connection		Unconnected pin
Det	9		O	On-chip power detector
RFOUT	10		O	RF output
RFOUT	11		O	RF output
VCC2	12	Power Supply	PWR	Power supply, 2 <sup>nd</sup> stage
NC	13	No Connection		Unconnected pin
NC	14	No Connection		Unconnected pin
NC	15	No Connection		Unconnected pin
VCC1	16	Power Supply	PWR	Power supply, 1 <sup>st</sup> stage

1. I=Input, O=Output

T1.0 1300



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Preliminary Specifications

### 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 18 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 ( $P_{OUT}$ ) <sup>1</sup>	+26 dBm
Supply Voltage at pins 5, 12, and 16 ( $V_{CC}$ )	-0.3V to +4.0V
Reference voltage to pins 6 and 7 ( $V_{REF}$ )	-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
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.

#### Operating Range

Range	Ambient Temp	V <sub>CC</sub>
Industrial	-40°C to +85°C	3.3V

**TABLE 2: DC Electrical Characteristics**

Symbol	Parameter	Min.	Typ	Max.	Unit	Test Conditions
$V_{CC}$	Supply Voltage at pins 5, 12, 16	3.0	3.3	3.6	V	
$I_{CC}$	Supply Current					
	for 802.11g, 22 dBm		210		mA	
	for 802.11b, 23 dBm		230		mA	
$I_{CQ}$	Idle current for 802.11g to meet EVM<4% @ 21dBm		70		mA	
$I_{OFF}$	Shut down current			0.1	μA	
$V_{REG}$	Reference Voltage for, with 110Ω resistor	2.75	2.85	2.95	V	

T2.1 1300

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

Symbol	Parameter	Min.	Typ	Max.	Unit
F <sub>L-U</sub>	Frequency range	2400		2485	MHz
P <sub>OUT</sub>	Output power @ PIN = -6 dBm 11b signals @ PIN = -7 dBm 11g signals	22 21			 dBm dBm
G	Small signal gain	28	29		dB
G <sub>VAR1</sub>	Gain variation over band (2400~2485 MHz)			±0.5	dB
G <sub>VAR2</sub>	Gain ripple over channel (20 MHz)		0.2		dB
ACPR	Meet 11b spectrum mask Meet 11g OFDM 54 Mbps spectrum mask	22 22	23 23		 dBm dBm
Added EVM	@ 21 dBm output with 11g OFDM 54 Mbps signal		4		%
2f, 3f, 4f, 5f	Harmonics at 22 dBm, without external filters			-40	dBc

T3.2 1300



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### TYPICAL PERFORMANCE CHARACTERISTICS

TEST CONDITIONS:  $V_{CC} = 3.3V$ ,  $T_A = 25^\circ C$ , UNLESS OTHERWISE SPECIFIED

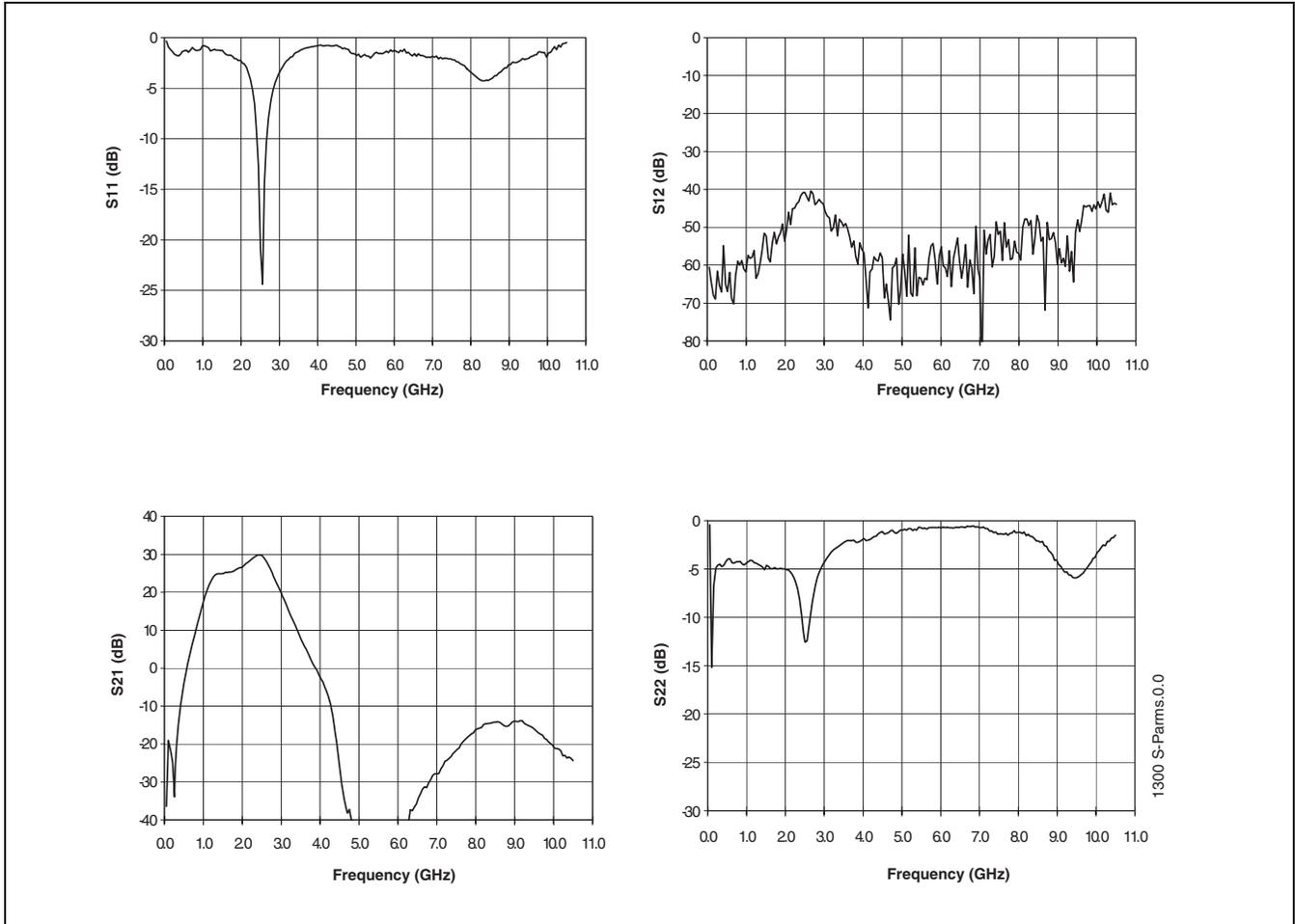


FIGURE 3: S-Parameters

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## TYPICAL PERFORMANCE CHARACTERISTICS

TEST CONDITIONS:  $V_{CC} = 3.3V$ ,  $T_A = 25^\circ C$ , 54 MBPS 802.11G OFDM SIGNAL

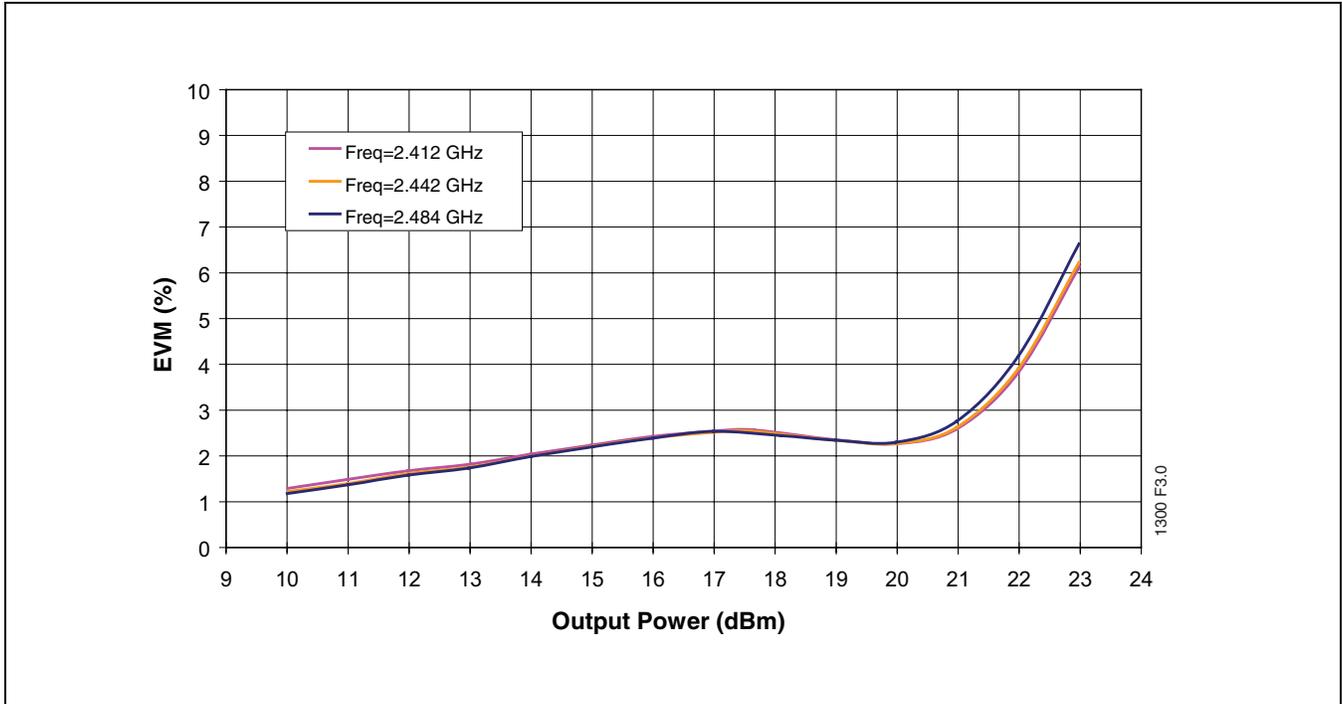


FIGURE 4: EMV versus Output Power

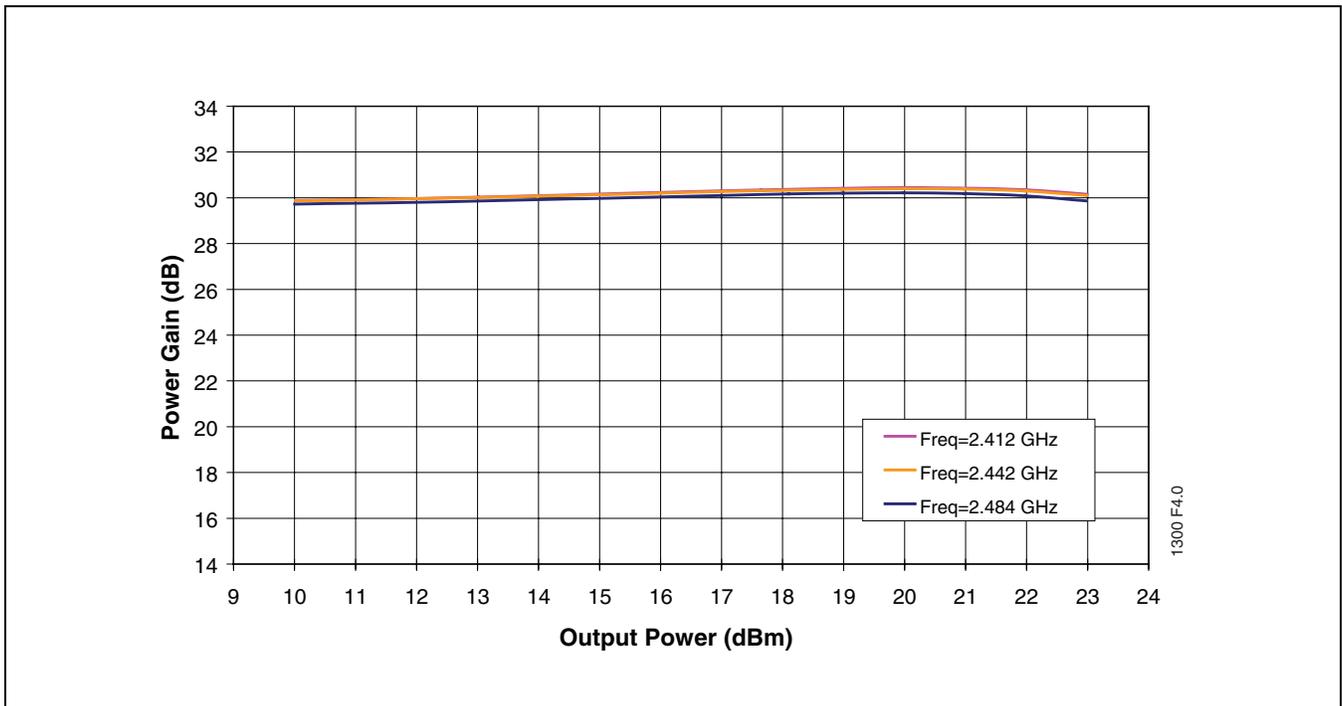


FIGURE 5: Power Gain versus Output Power



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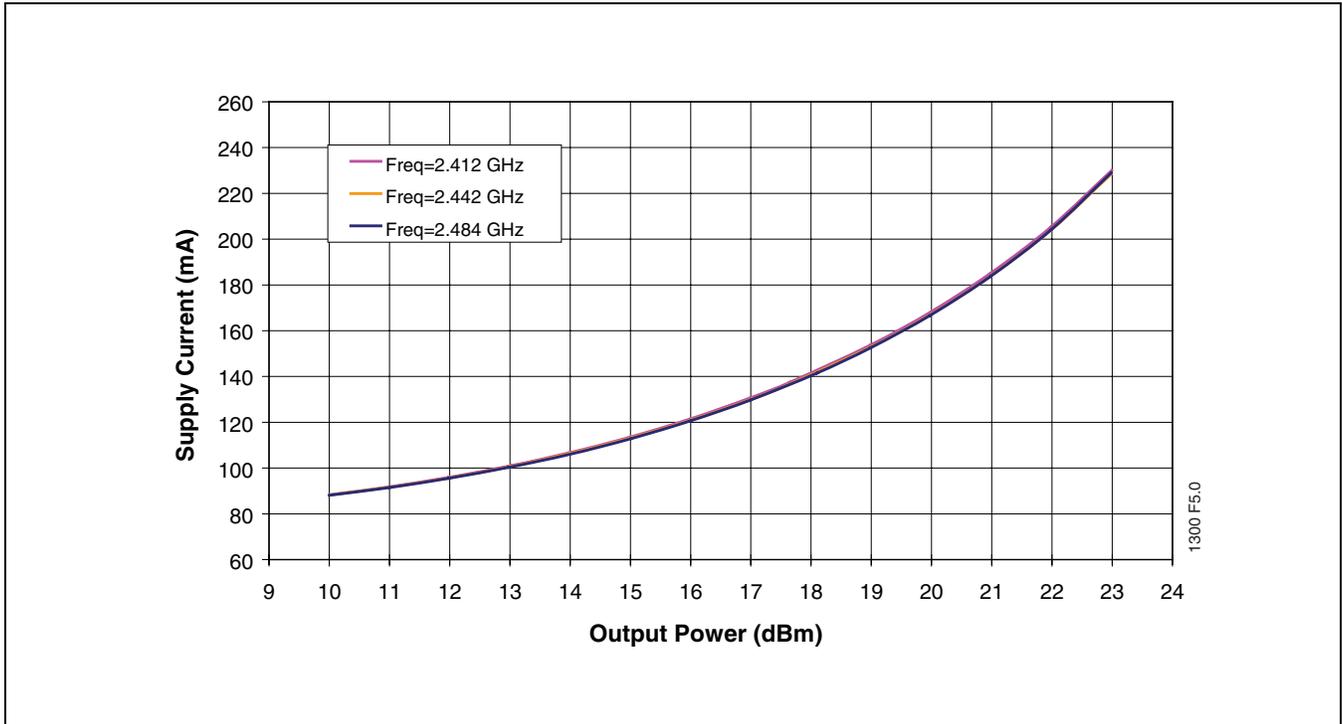


FIGURE 6: Total Current Consumption for 802.11g operation versus Output Power

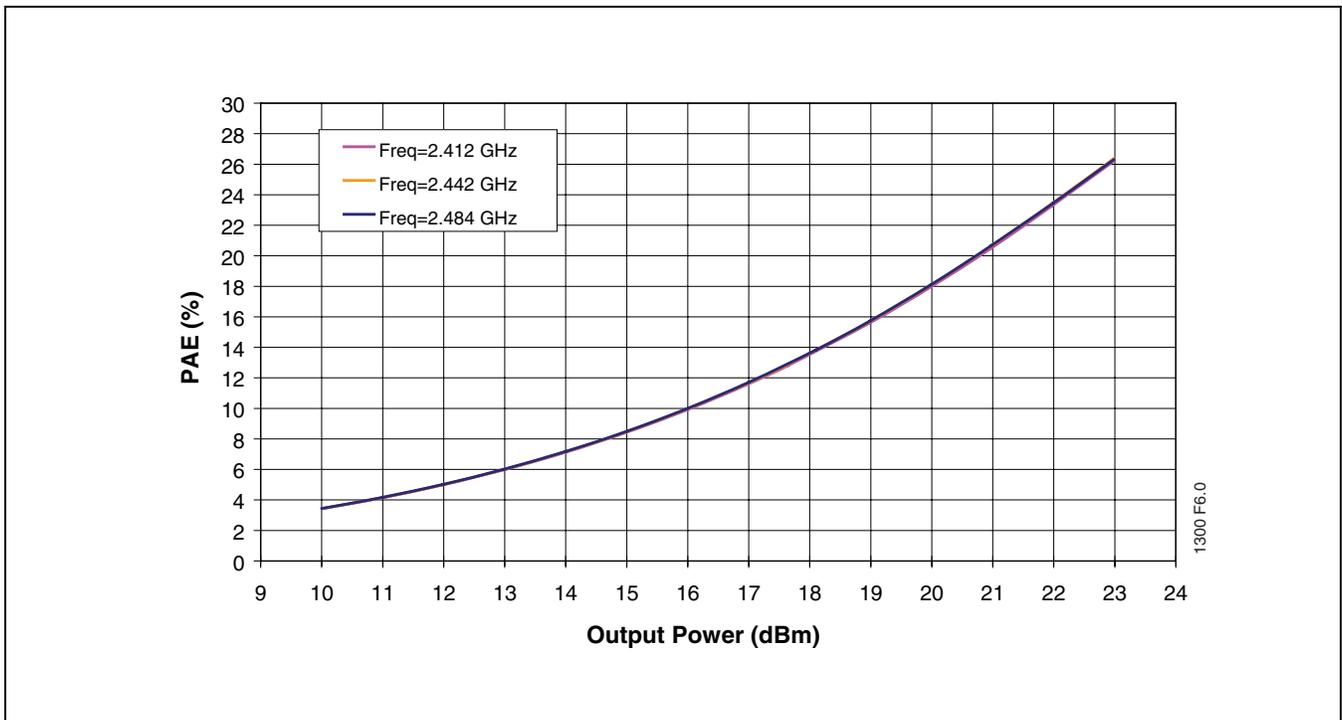


FIGURE 7: PAE versus Output Power

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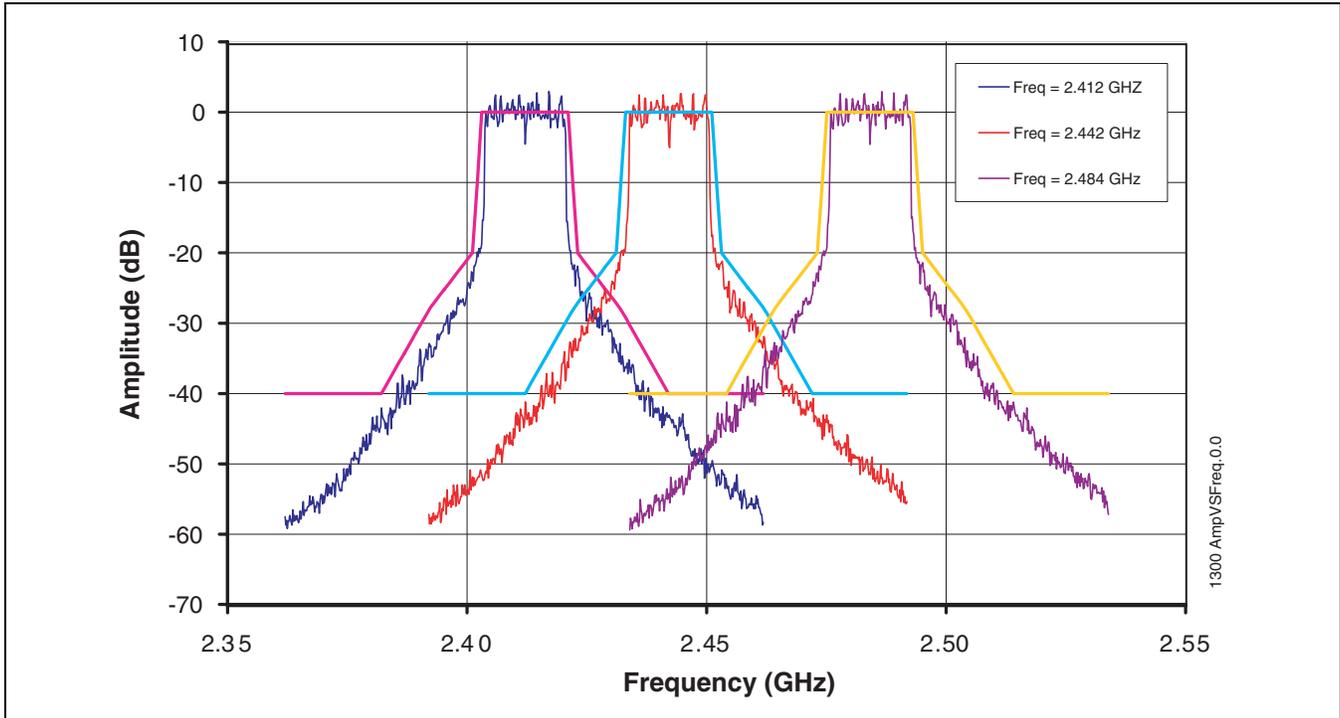


FIGURE 8: 802.11g Spectrum Mask at 23 dBm

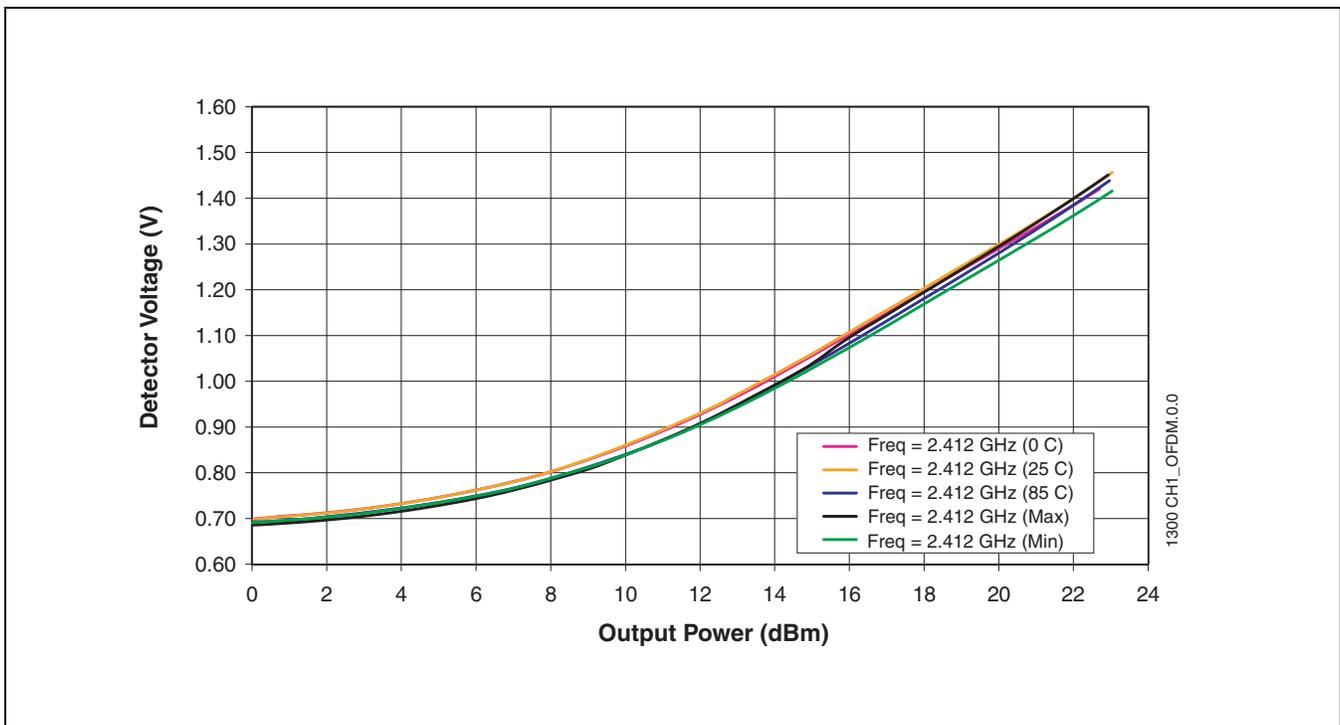


FIGURE 9: CH1 Detector Characteristics Over Temperature with 2:1 Output VSWR All Phases



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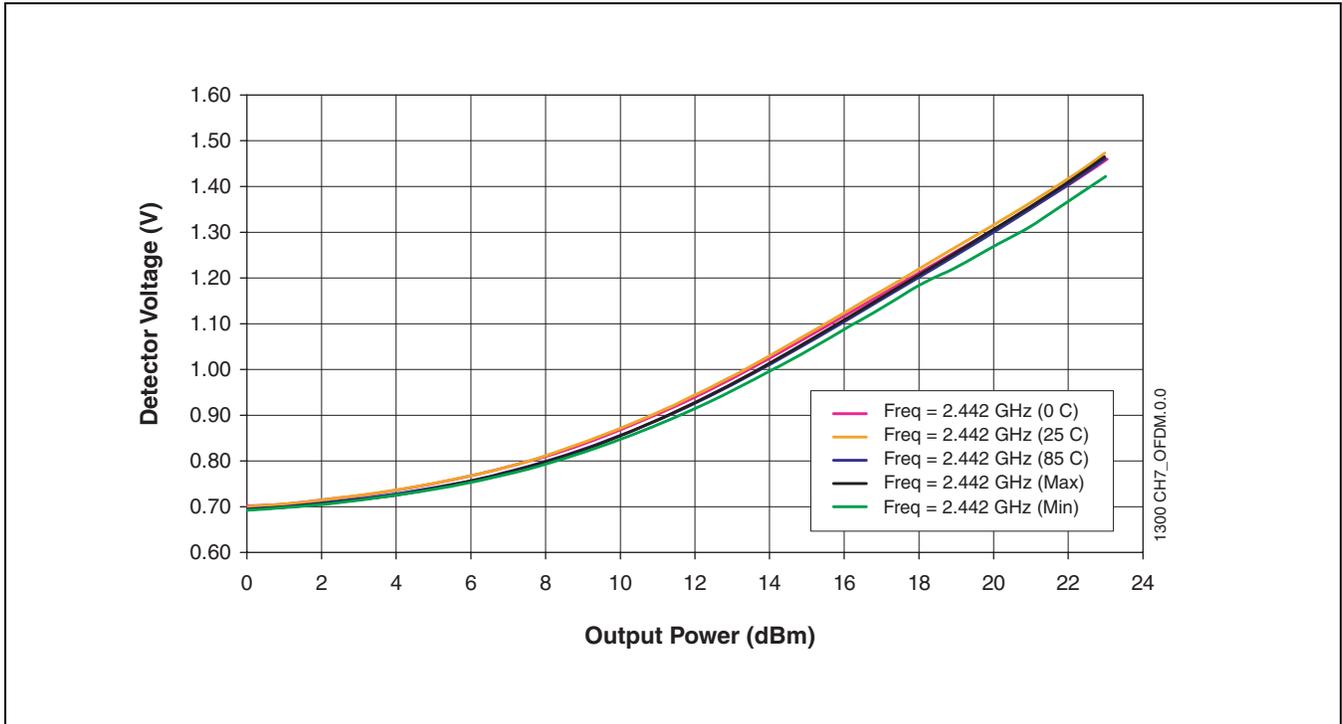


FIGURE 10: CH7 Detector Characteristics Over Temperature with 2:1 Output VSWR All Phases

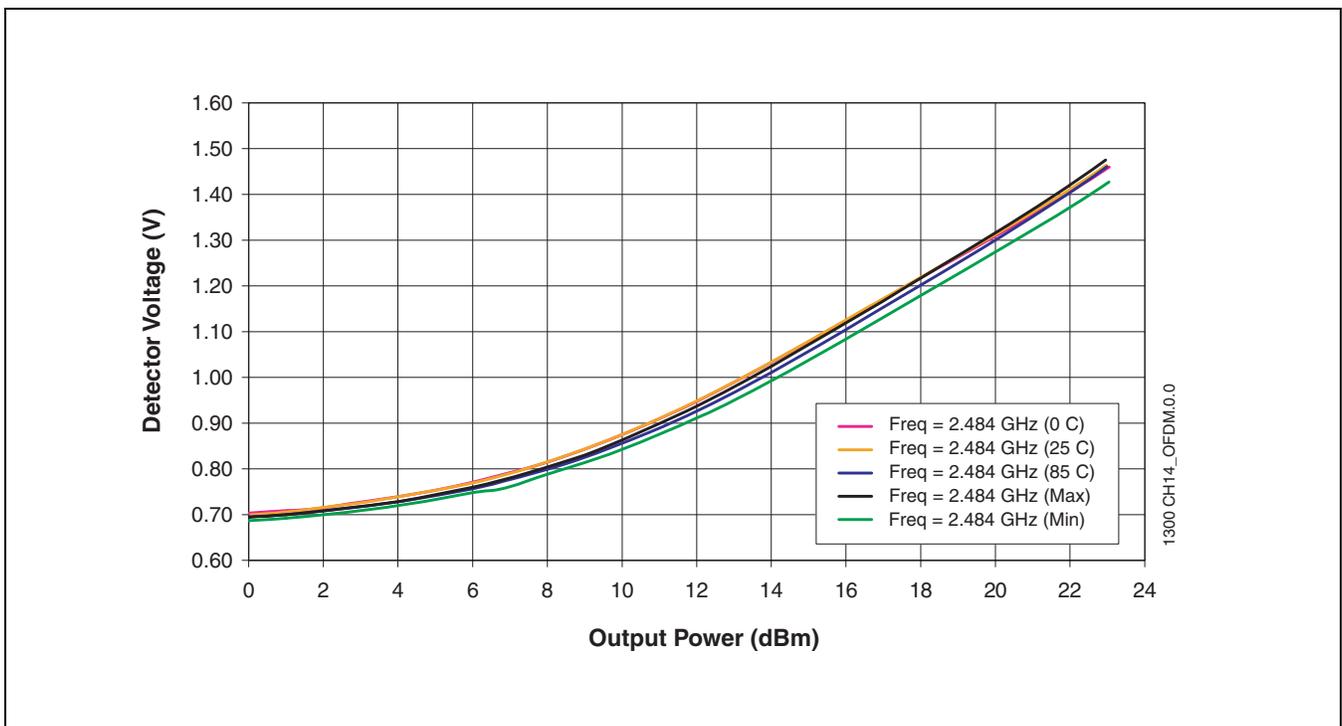
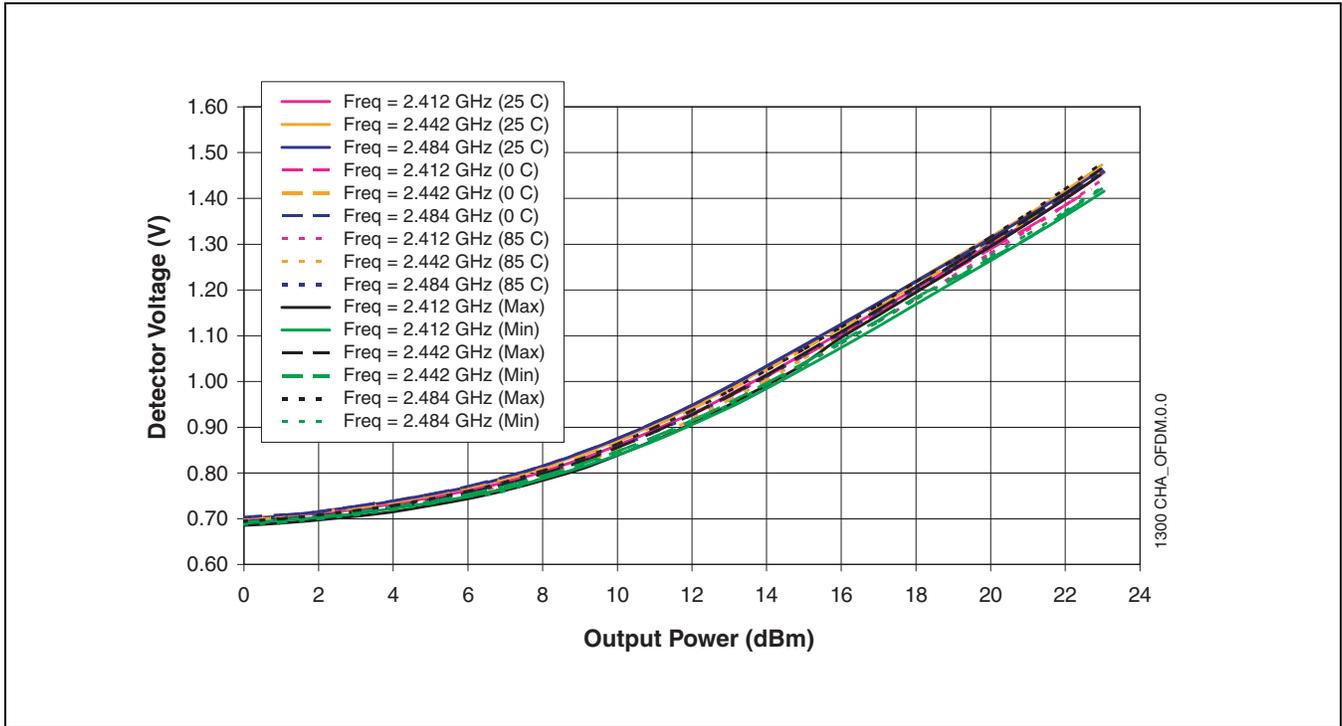


FIGURE 11: CH14 Detector Characteristics Over Temperature with 2:1 Output VSWR All Phases

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**FIGURE 12: Detector Characteristics Over Temperature and Over Frequency with 2:1 Output VSWR All Phases**



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## TYPICAL PERFORMANCE CHARACTERISTICS

TEST CONDITIONS:  $V_{CC} = 3.3V$ ,  $T_A = 25^\circ C$ , 1 MBPS 802.11B CCK SIGNAL

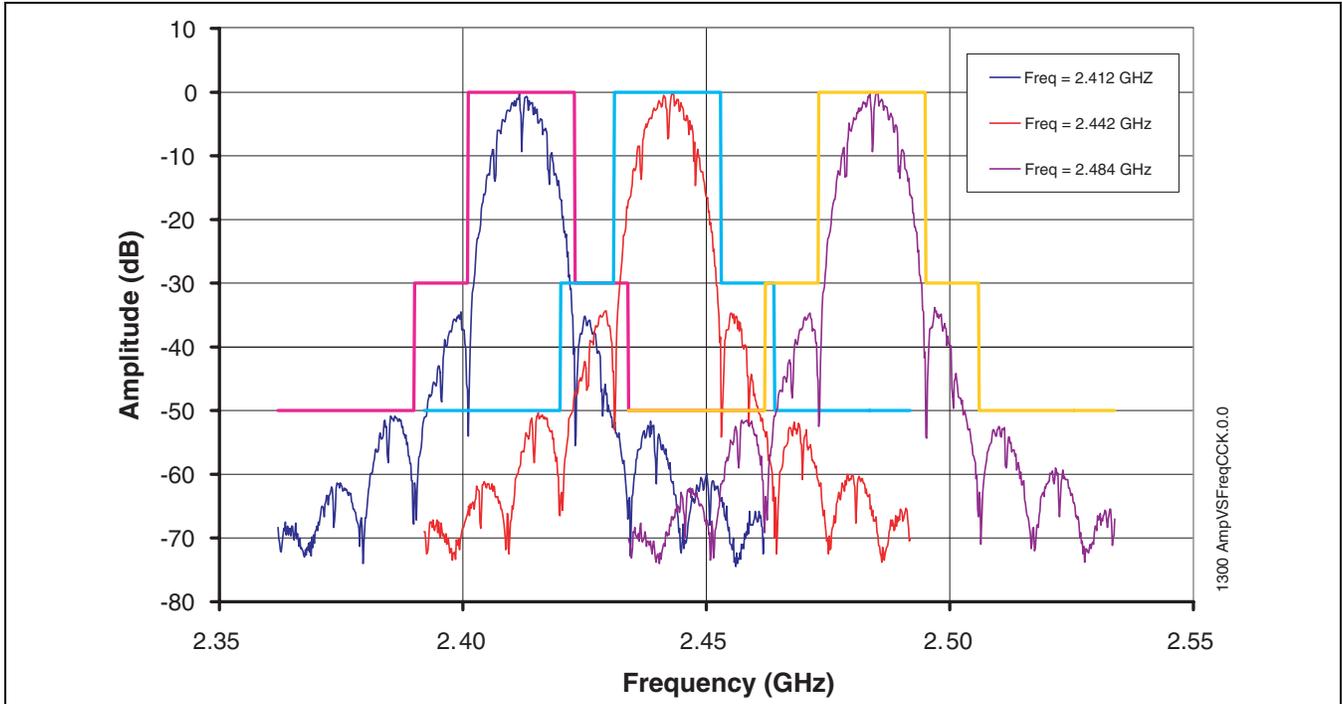


FIGURE 13: 802.11B Spectrum Mask at 23 dBm

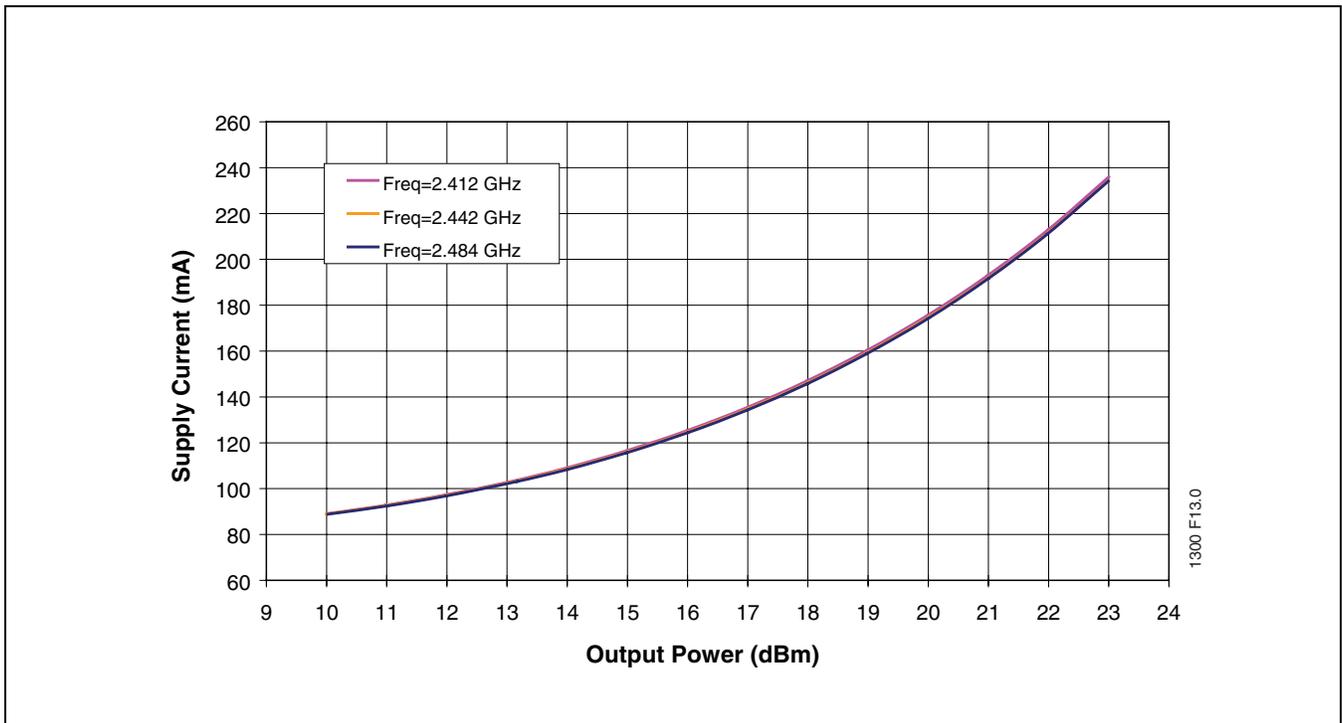


FIGURE 14: Total Current Consumption for 802.11B Operation versus Output Power

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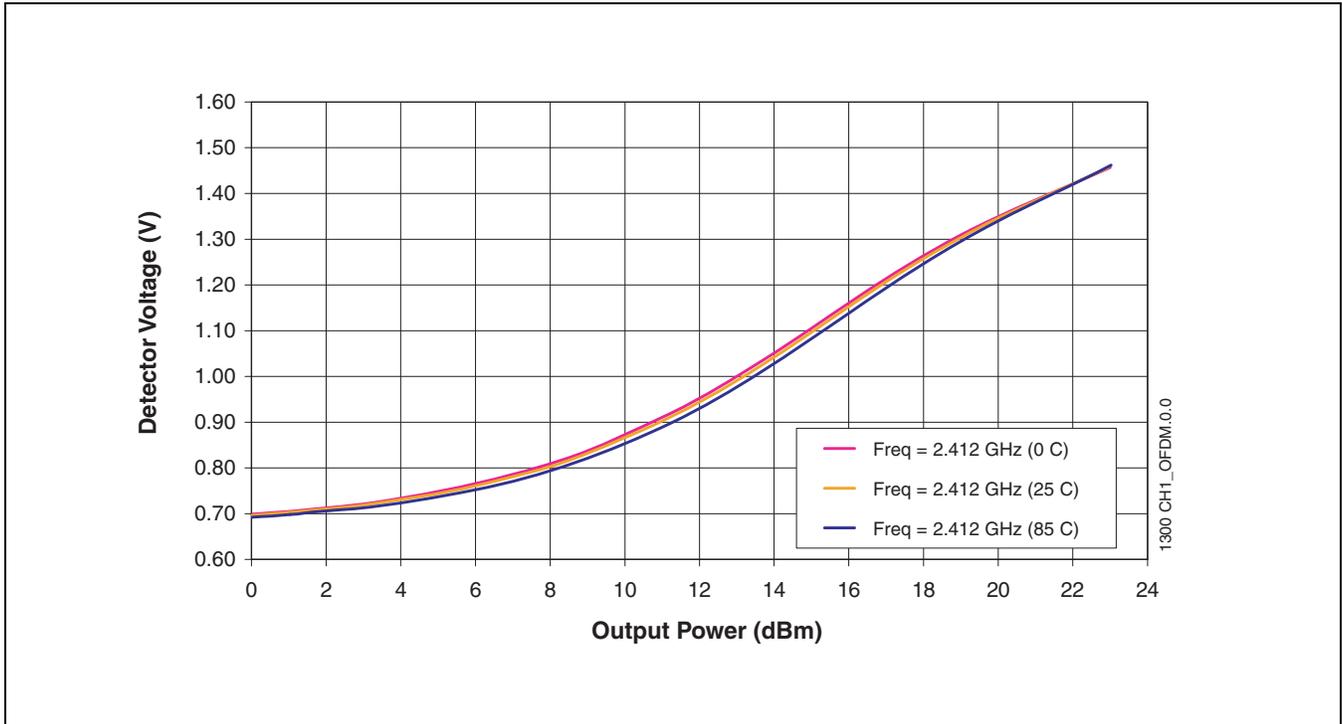


FIGURE 15: CH1 Detector Characteristics Over Temperature

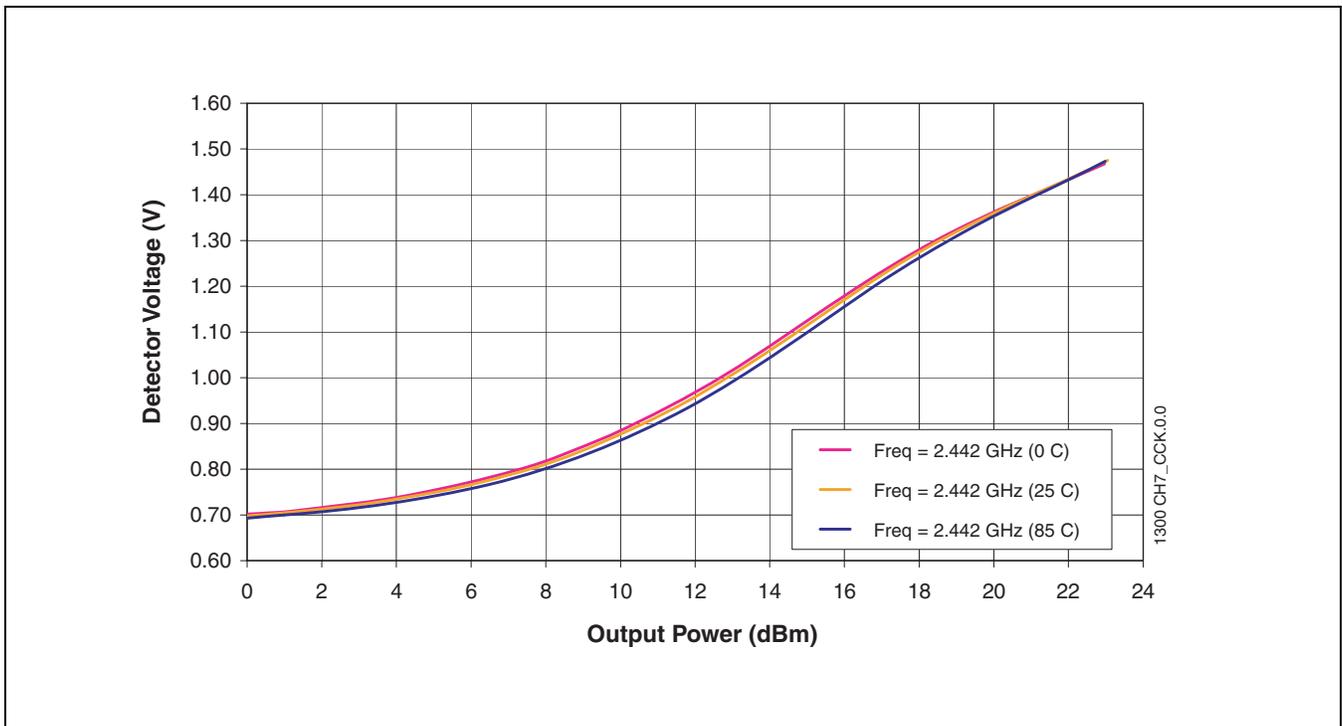


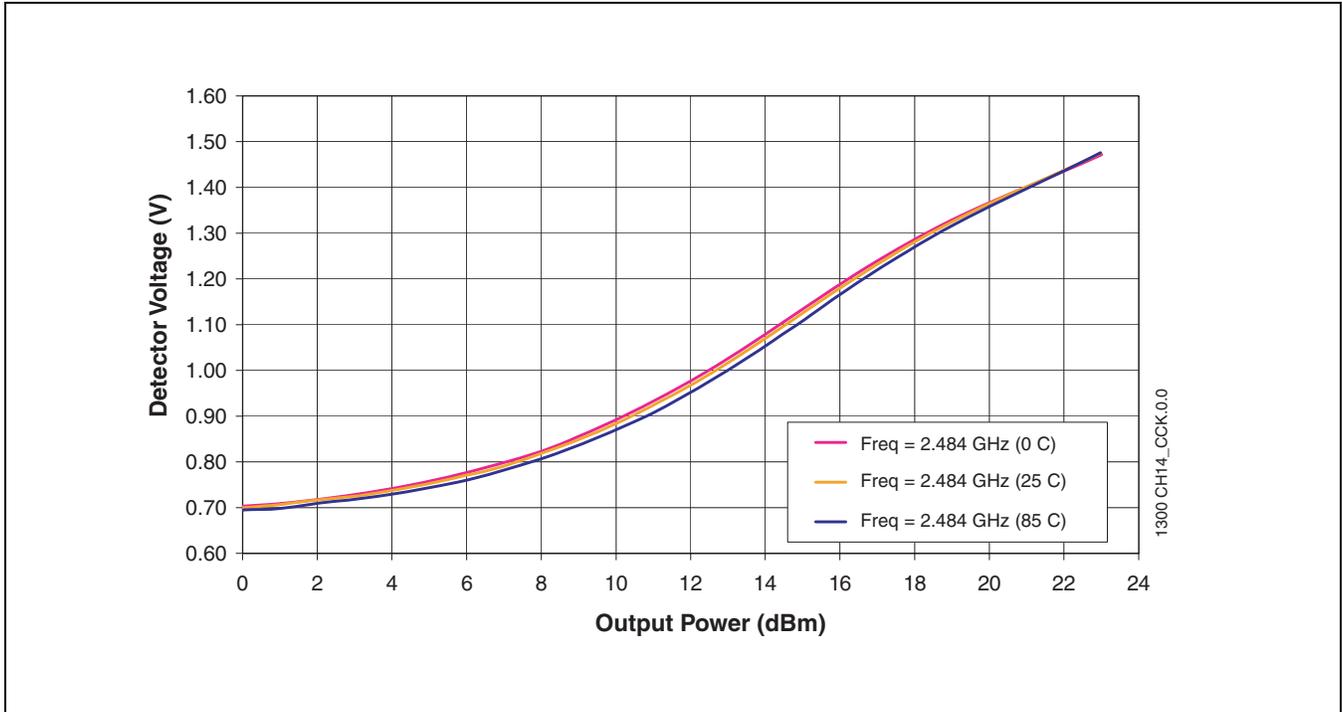
FIGURE 16: CH7 Detector Characteristics Over Temperature



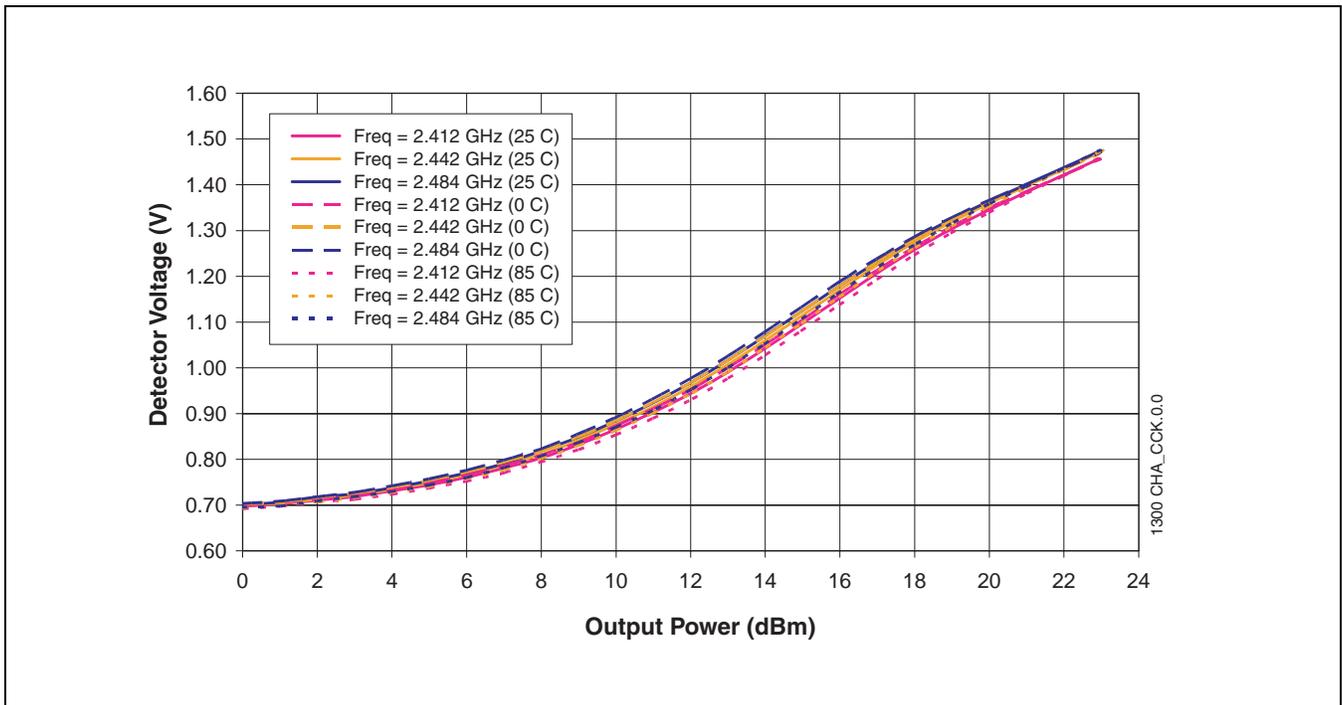
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**TYPICAL PERFORMANCE CHARACTERISTICS**

**TEST CONDITIONS:  $V_{CC} = 3.3V$ ,  $T_A = 25^\circ C$ , 1 MBPS 802.11B CCK SIGNAL**



**FIGURE 17: CH14 Detector Characteristics Over Temperature**



**FIGURE 18: Detector Characteristics Over Temperature and Frequency**



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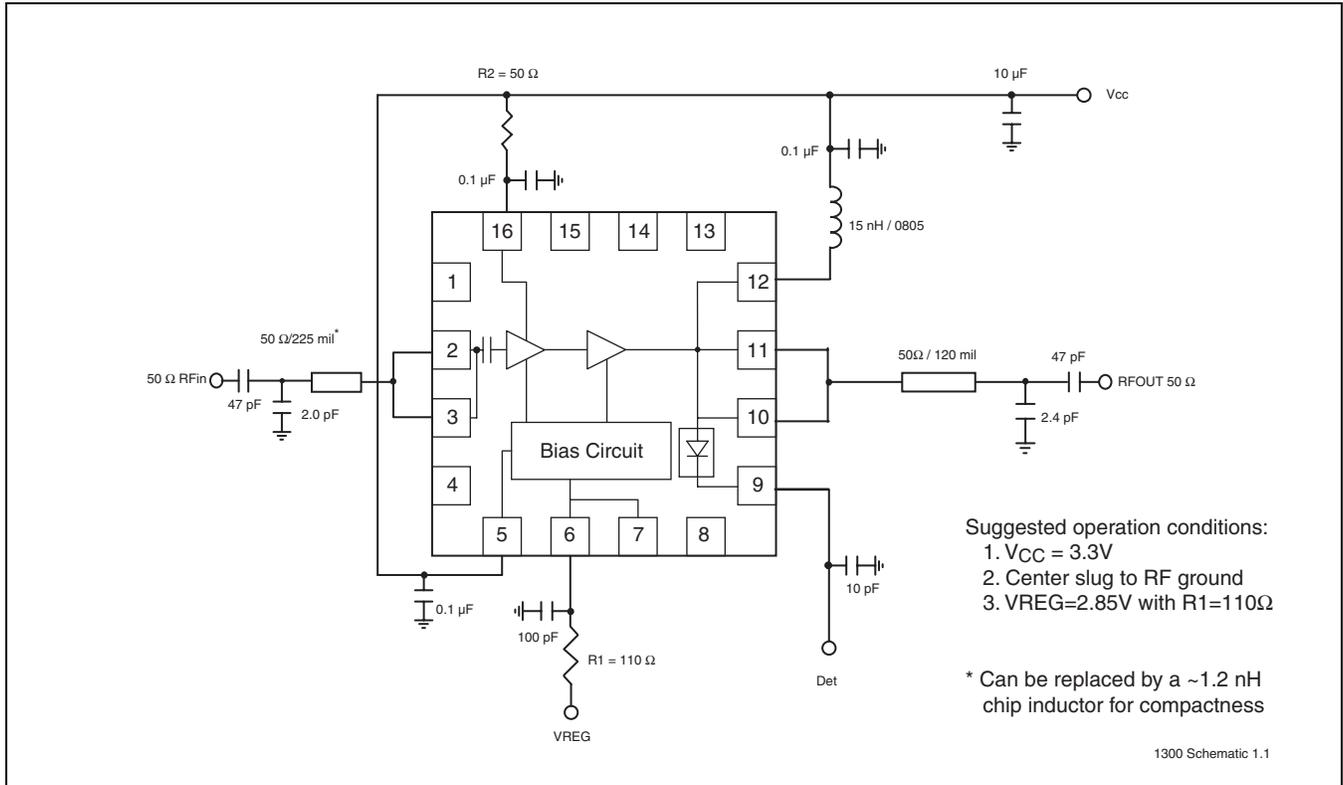


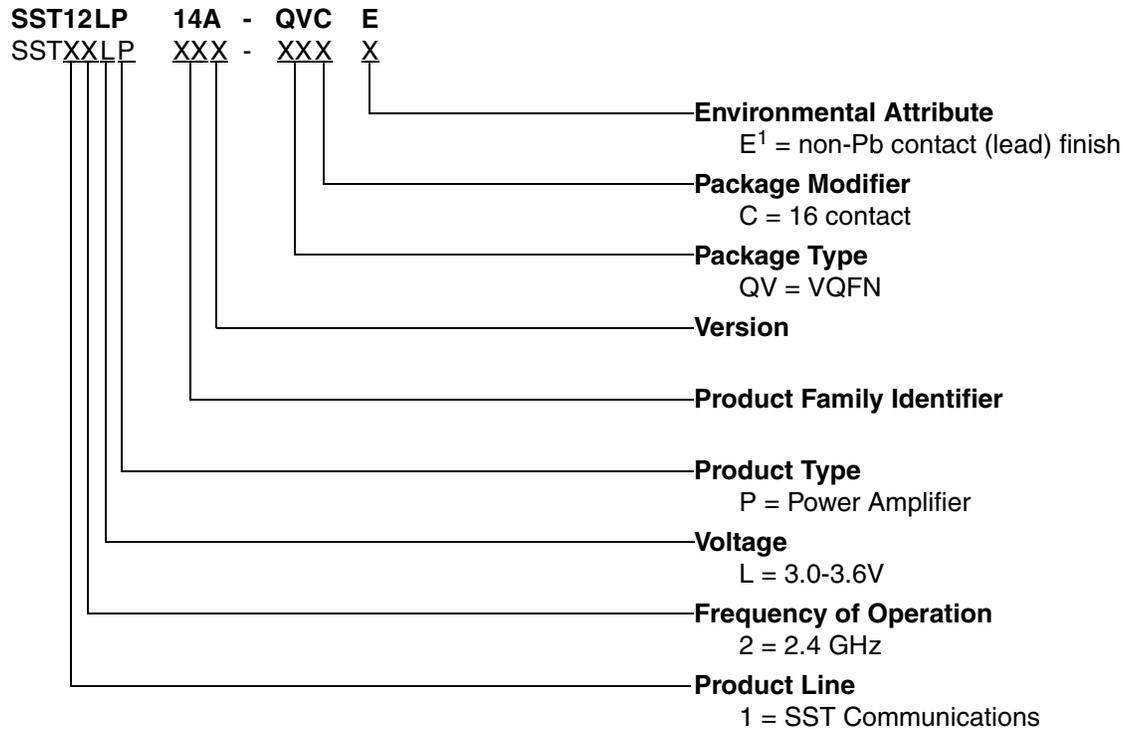
FIGURE 19: Typical Schematic for High-Power/High-Efficiency 802.11b/g Applications



## 2.4 GHz High-Power, High-Gain Power Amplifier SST12LP14A

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### PRODUCT ORDERING INFORMATION



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

#### Valid combinations for SST12LP14A

SST12LP14A-QVCE

#### SST12LP14A Evaluation Kits

SST12LP14A-QVCE-K

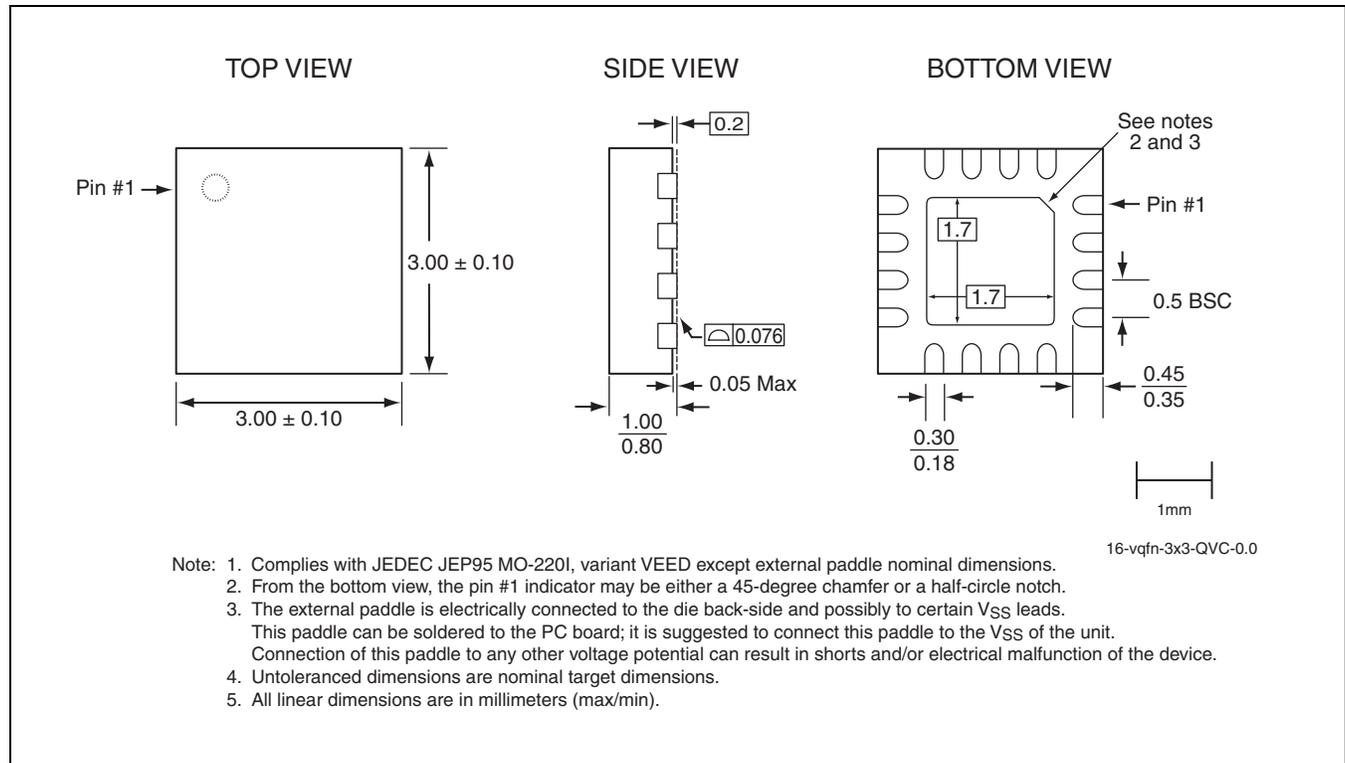
**Note:** Valid combinations are those products in mass production or will be in mass production. Consult your SST sales representative to confirm availability of valid combinations and to determine availability of new combinations.



## 2.4 GHz High-Power, High-Gain Power Amplifier SST12LP14A

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### PACKAGING DIAGRAMS



**FIGURE 20: 16-contact Very-thin Quad Flat No-lead (VQFN)  
SST Package Code: QVC**

**TABLE 4: Revision History**

Revision	Description	Date
00	<ul style="list-style-type: none"> <li>Initial release of data sheet</li> </ul>	Jun 2005
01	<ul style="list-style-type: none"> <li>Removed Stability and Ruggedness parms from Table 3 on page 5</li> <li>Updated the schematic in Figure 19 on page 15</li> </ul>	Sep 2005
02	<ul style="list-style-type: none"> <li>Updated the schematic in Figure 19 on page 15</li> <li>Updated Figures 4, 5, 6, 7, and 14</li> <li>Made minor updates to the "Features:" section</li> <li>Made minor updates to the "Electrical Specifications" section</li> <li>Applied new format.</li> </ul>	Mar 2006



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