A Microchip Technology Company

2.4 GHz High-Power, High-Gain Power Amplifier

SST12LP14A

Data Sheet

SST12LP14A is a versatile power amplifier based on the highly-reliable InGaP/ GaAs HBT technology. 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 at 22 dBm. SST12LP14A has excellent linearity while meeting 802.11g spectrum mask at 23 dBm. The excellent on-chip power detector provides a reliable solution to board-level power control. SST12LP14A is offered in 16-contact VQFN package.

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 5
  - Meets 802.11g OFDM ACPR requirement up to 23 dBm
  - ~3% 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_{OUT} = 22 dBm for 802.11g
  - ~25%/240 mA @ P_{OUT} = 23 dBm for 802.11b
- **Single-pin low I_{REF} power-up/down control**
  - I_{REF} <2 mA
- **Low idle current**
  - ~70 mA I_{CQ}
- **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 802.11b/g/n)**
- **Home RF**
- **Cordless phones**
- **2.4 GHz ISM wireless equipment**

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Product Description

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_{OUT} = 22 dBm for 802.11g and 25% power-added efficiency @ P_{OUT} = 23 dBm for 802.11b.

The SST12LP14A has excellent linearity, typically ~3% added EVM at 21 dBm output power with 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 85 mA total power consumption at 17 dBm linear 54 Mbps 802.11g output power) which is desirable in embedded applications such as in handheld 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_{REF} ~2 mA) makes the SST12LP14A controllable by an on/off switching signal directly from the baseband chip. These features coupled with low operating current make the SST12LP14A ideal for the final stage power amplification in battery-powered 802.11b/g/n WLAN transmitter applications.

SST12LP14A has an excellent on-chip, single-ended power detector, which features a wide dynamic-range (>15 dB) with dB-wise linear operation 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

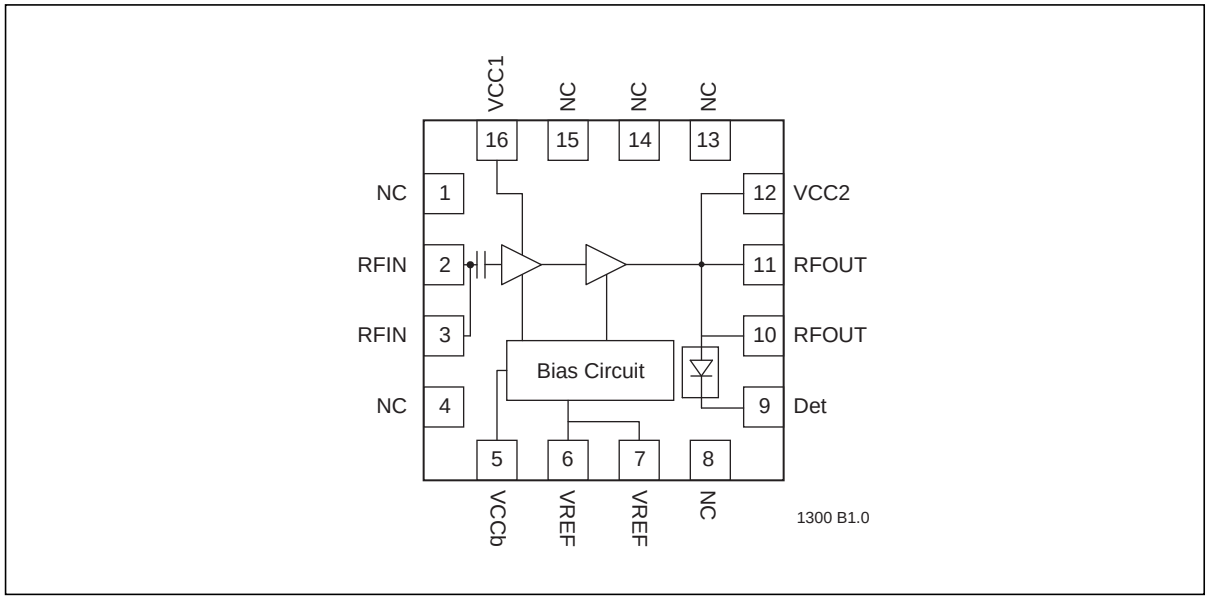


Figure 1: Functional Block Diagram

Pin Assignments

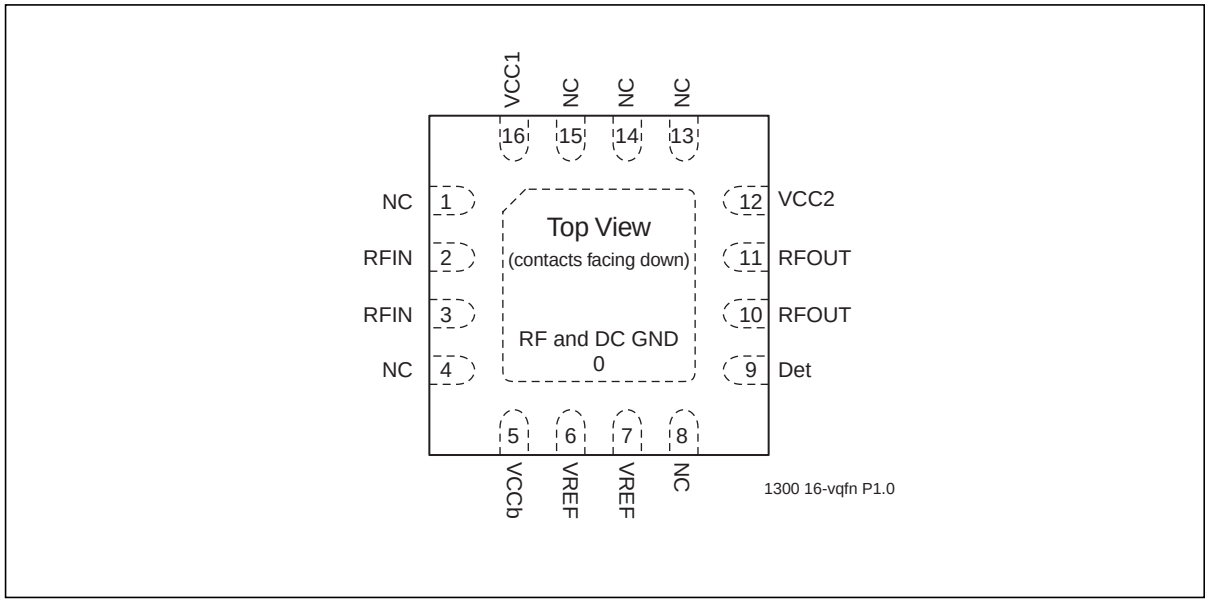


Figure 2: Pin Assignments for 16-contact VQFN

Pin Descriptions

Table 1: Pin Description

Symbol	Pin No.	Pin Name	Type[1]	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	1st and 2nd stage idle current control
VREF	7		PWR	1st and 2nd 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, 2nd 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, 1st stage

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1. I=Input, O=Output

Electrical Specifications

The AC and DC specifications for the power amplifier interface signals. Refer to Table 3 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})[1] . . . . . +26 dBm
Supply Voltage at pins 5, 12, and 16 (V_{CC}) . . . . . -0.3V to +4.6V
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) . . . . . -40ºC to +85ºC
Storage Temperature (T_{STG}) . . . . . -40ºC to +120ºC
Maximum Junction Temperature (T_J) . . . . . +150ºC
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.

Table 2: Operating Range

Range	Ambient Temp	V_{DD}
Industrial	-40°C to +85°C	3.3V

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Table 3: DC Electrical Characteristics

Symbol	Parameter	Min.	Typ	Max.	Unit	Test Conditions
V_{CC}	Supply Voltage at pins 5, 12, 16	3.0	3.3	4.2	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	

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Table 4: AC Electrical Characteristics for Configuration

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

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Typical Performance Characteristics

Test Conditions: V_{CC} = 3.3V, T_A = 25°C, unless otherwise specified

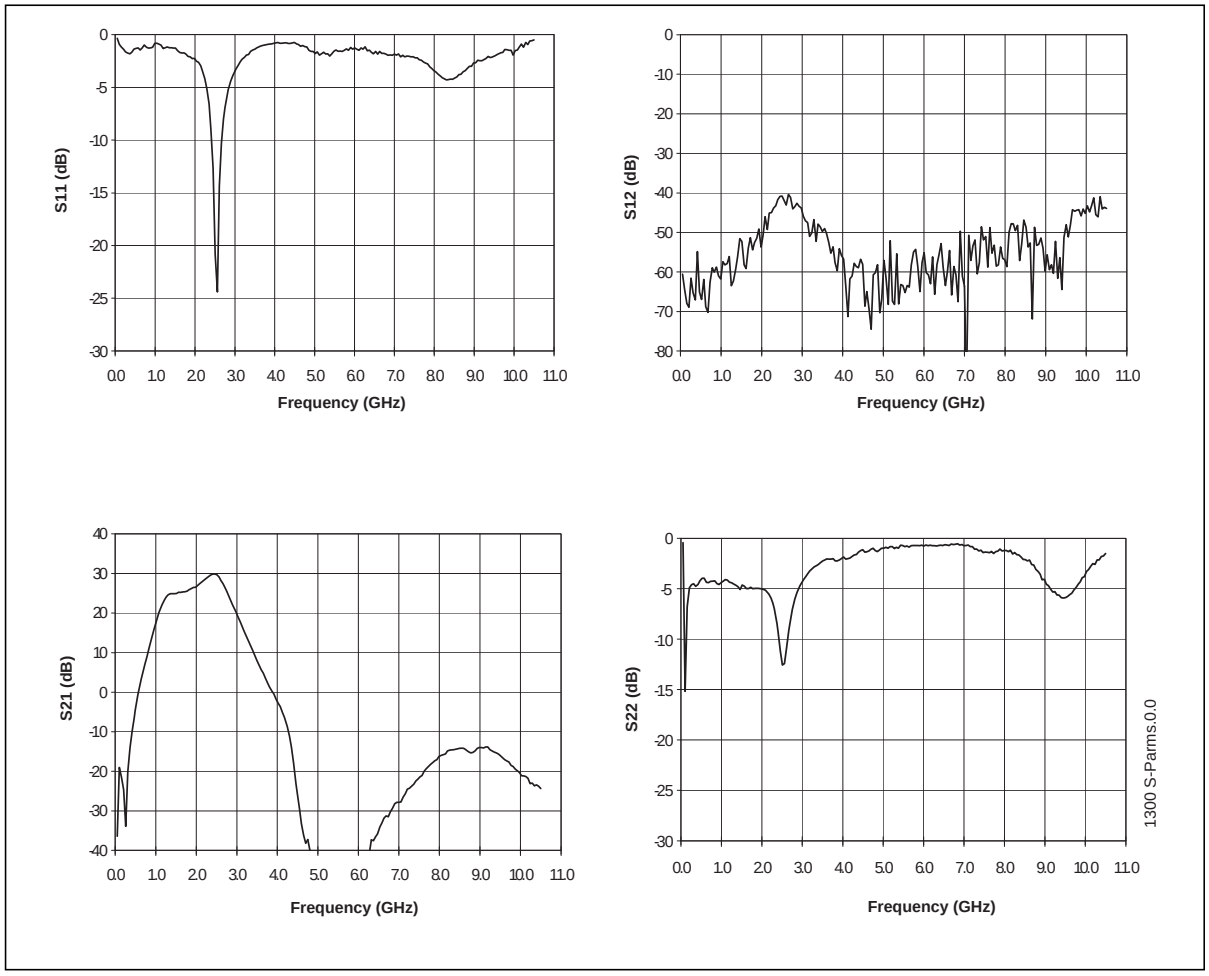


Figure 3: S-Parameters

Typical Performance Characteristics

Test Conditions: V_{CC} = 3.3V, T_A = 25°C, 54 Mbps 802.11g OFDM signal

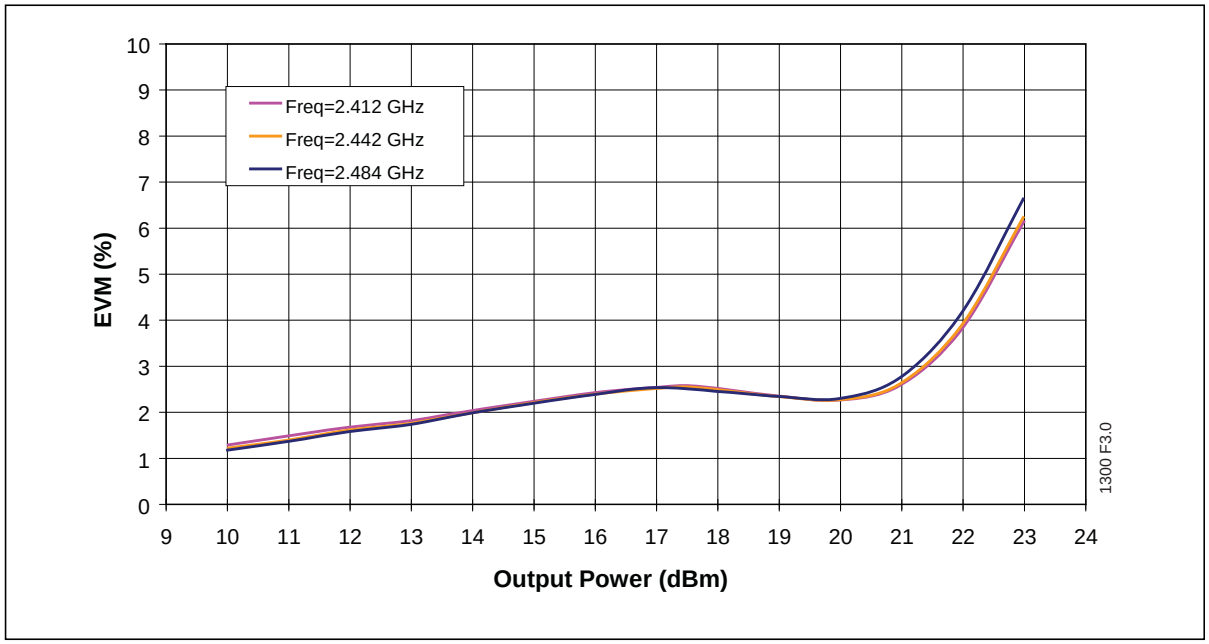


Figure 4: EMV versus Output Power using Sequence plus Equalizer Channel Estimation

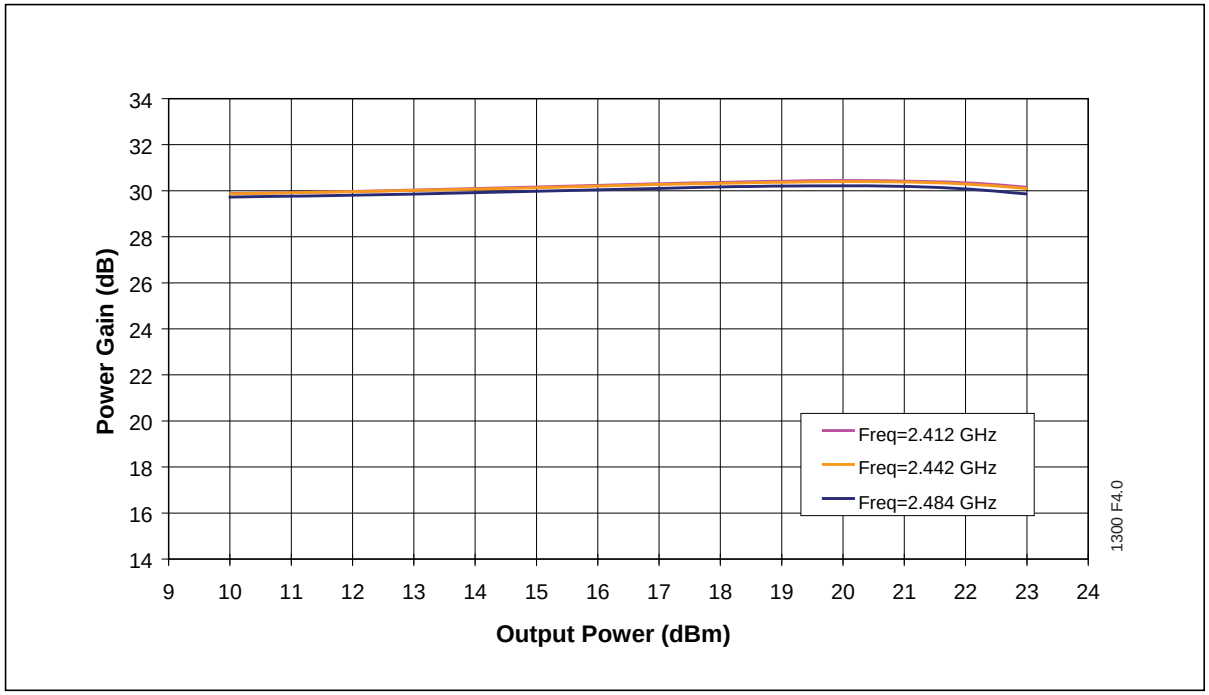


Figure 5: Power Gain versus Output Power

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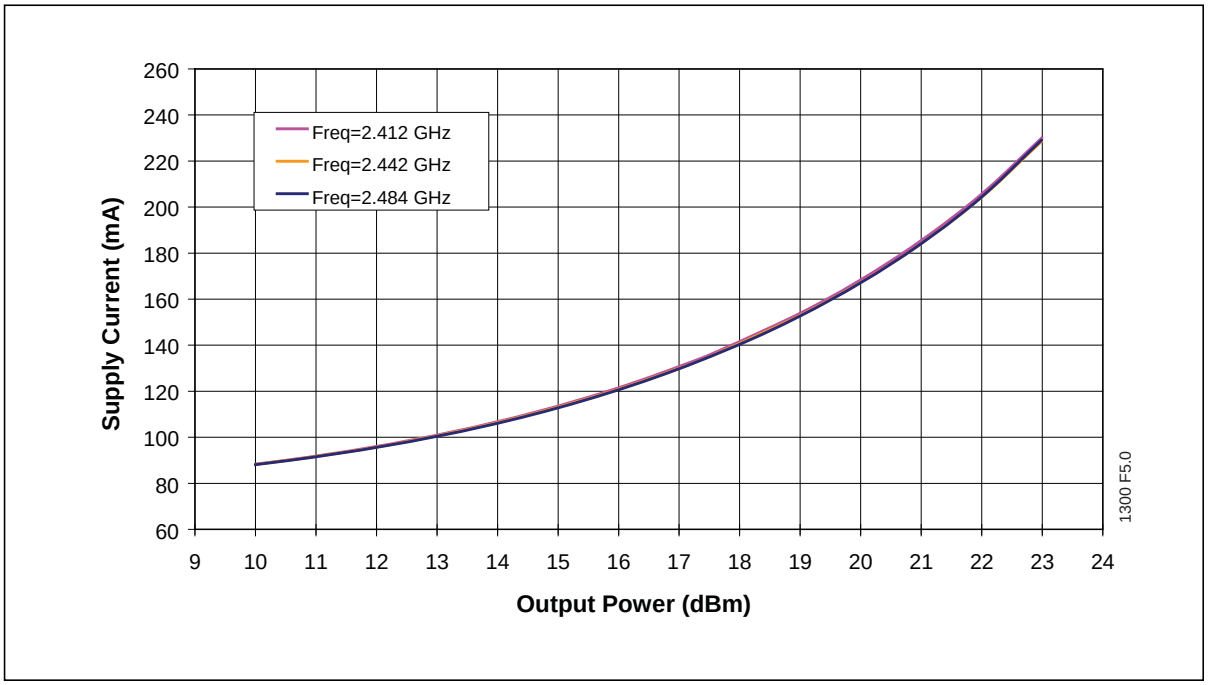


Figure 6: Total Current Consumption for 802.11g operation versus Output Power

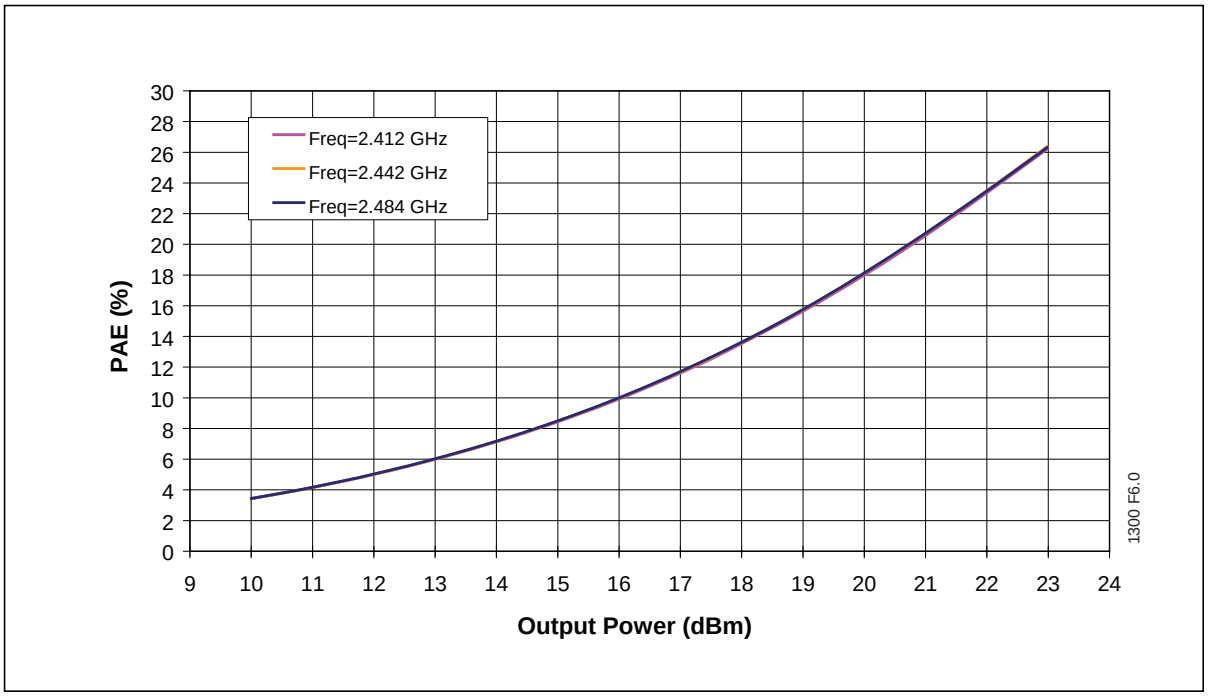


Figure 7: PAE versus Output Power

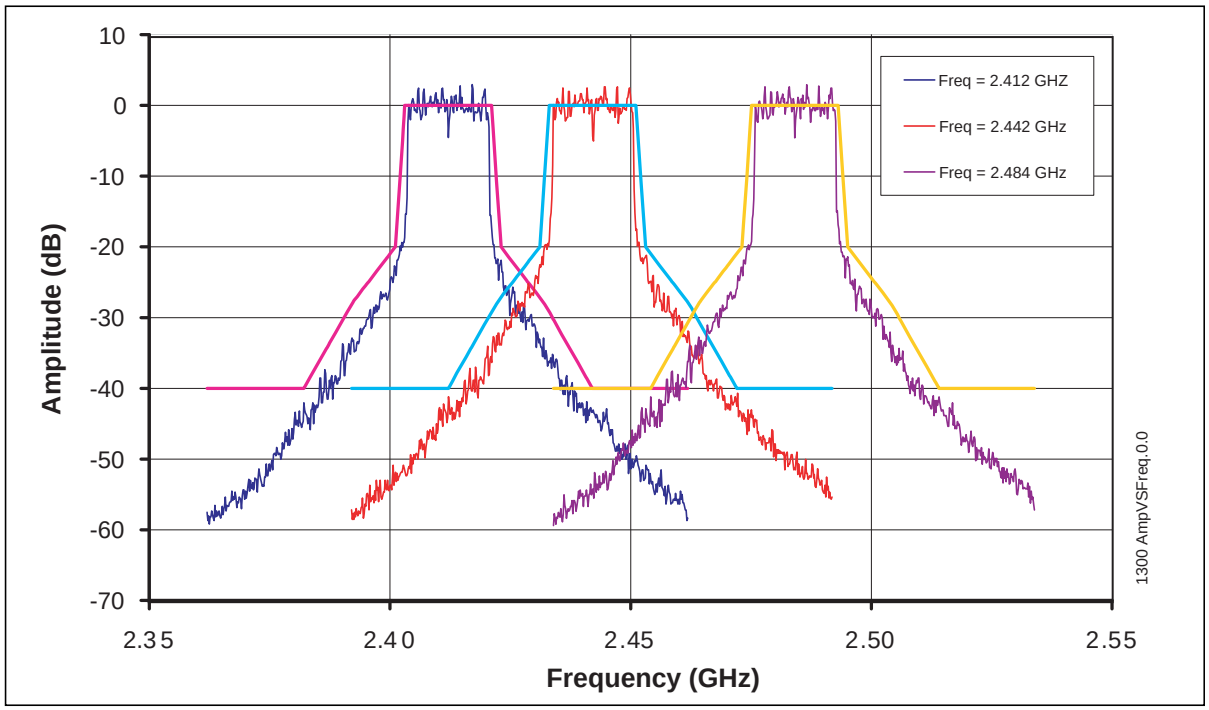


Figure 8: 802.11g Spectrum Mask at 23 dBm

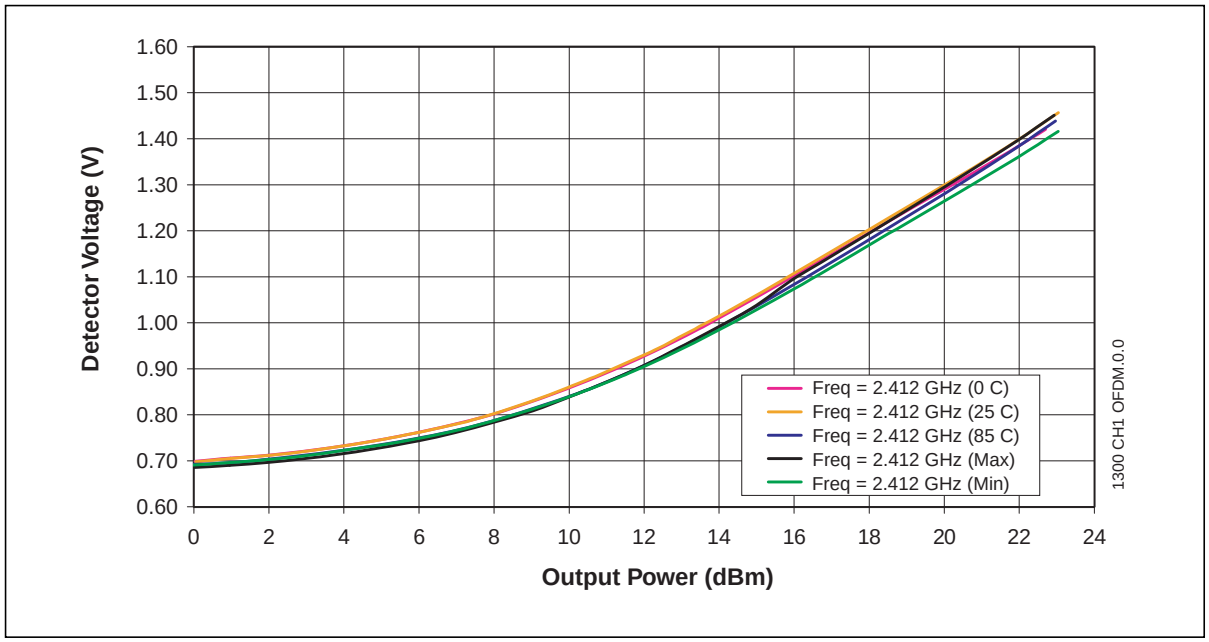


Figure 9: CH1 Detector Characteristics Over Temperature with 2:1 Output VSWR All Phases

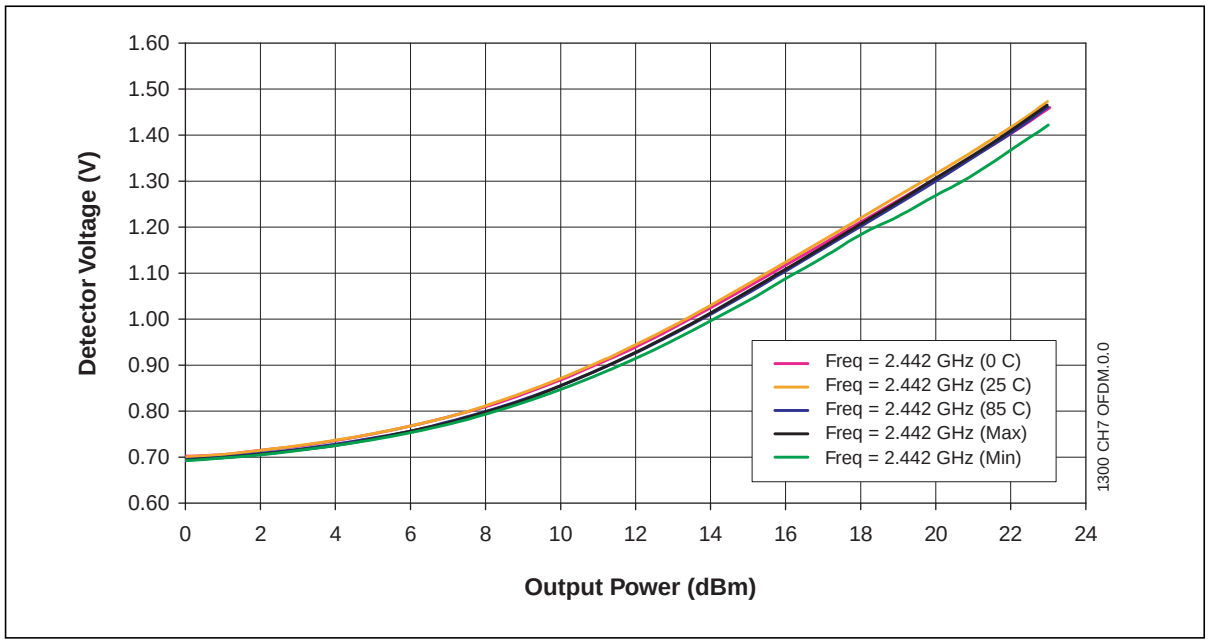


Figure 10: CH7 Detector Characteristics Over Temperature with 2:1 Output VSWR All Phases

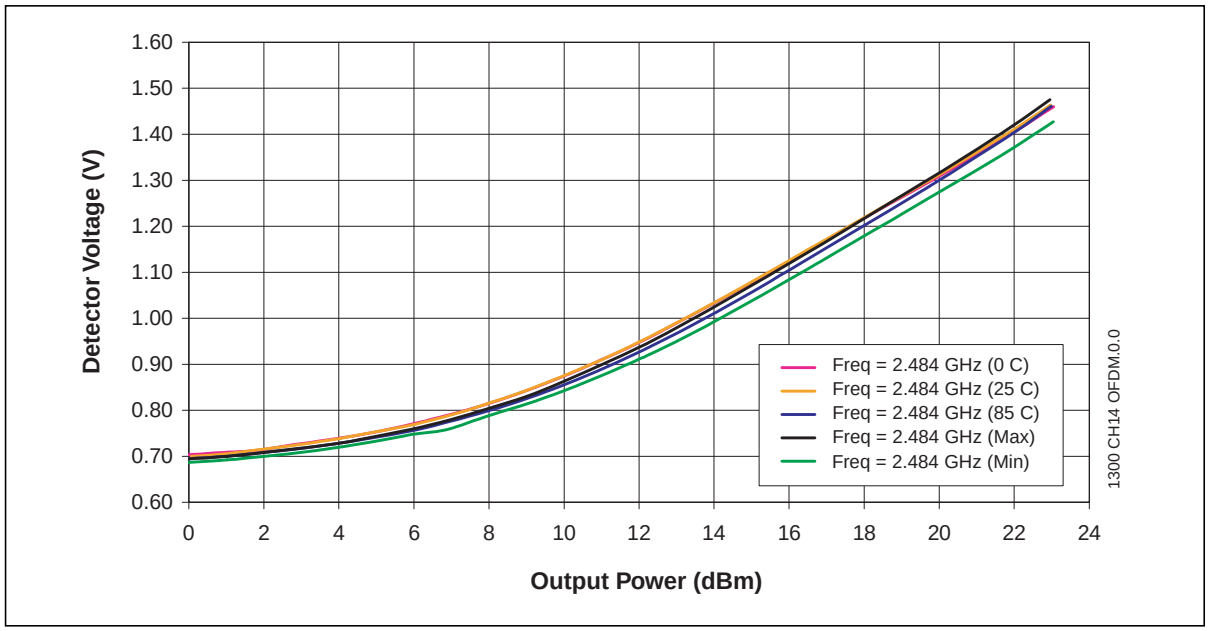


Figure 11: CH14 Detector Characteristics Over Temperature with 2:1 Output VSWR All Phases

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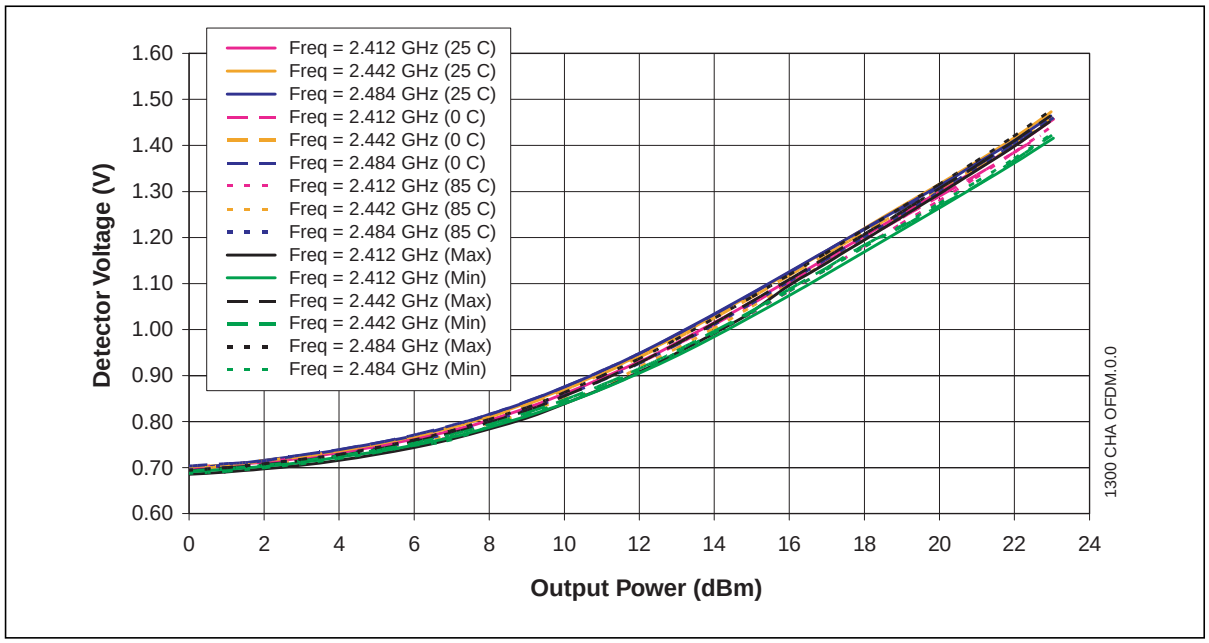


Figure 12: Detector Characteristics Over Temperature and Over Frequency with 2:1 Output VSWR All Phases

Typical Performance Characteristics

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

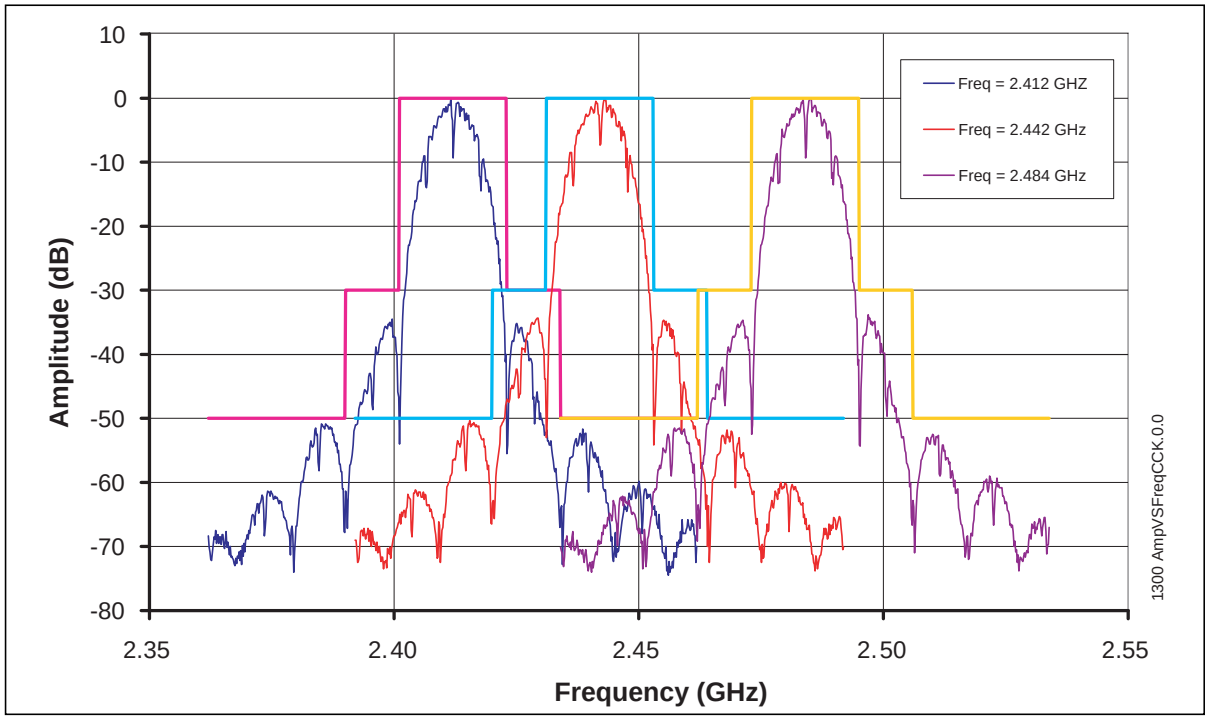


Figure 13:802.11B Spectrum Mask at 23 dBm

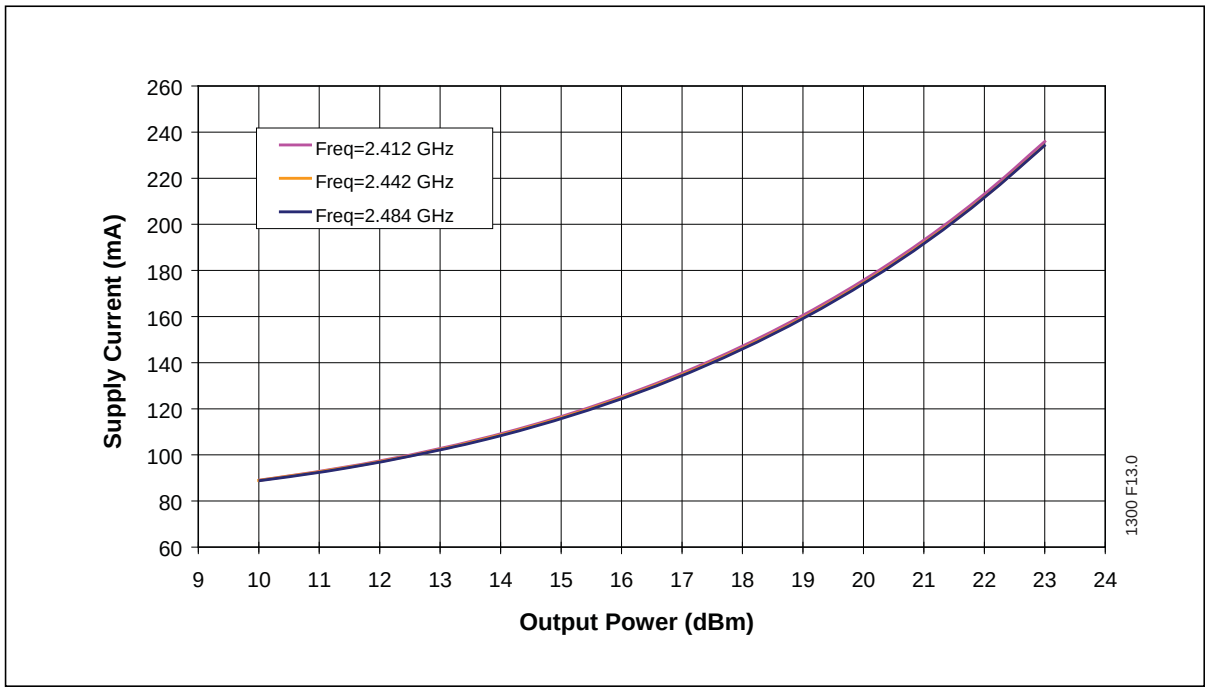


Figure 14: Total Current Consumption for 802.11B Operation versus Output Power

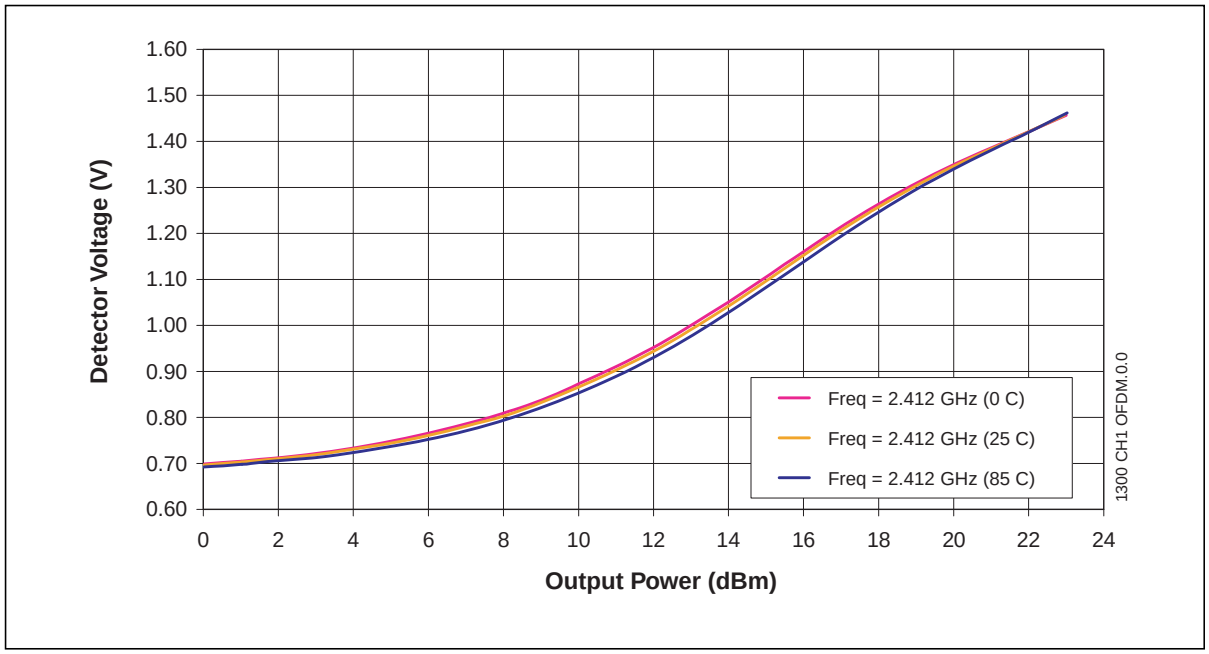


Figure 15: CH1 Detector Characteristics Over Temperature

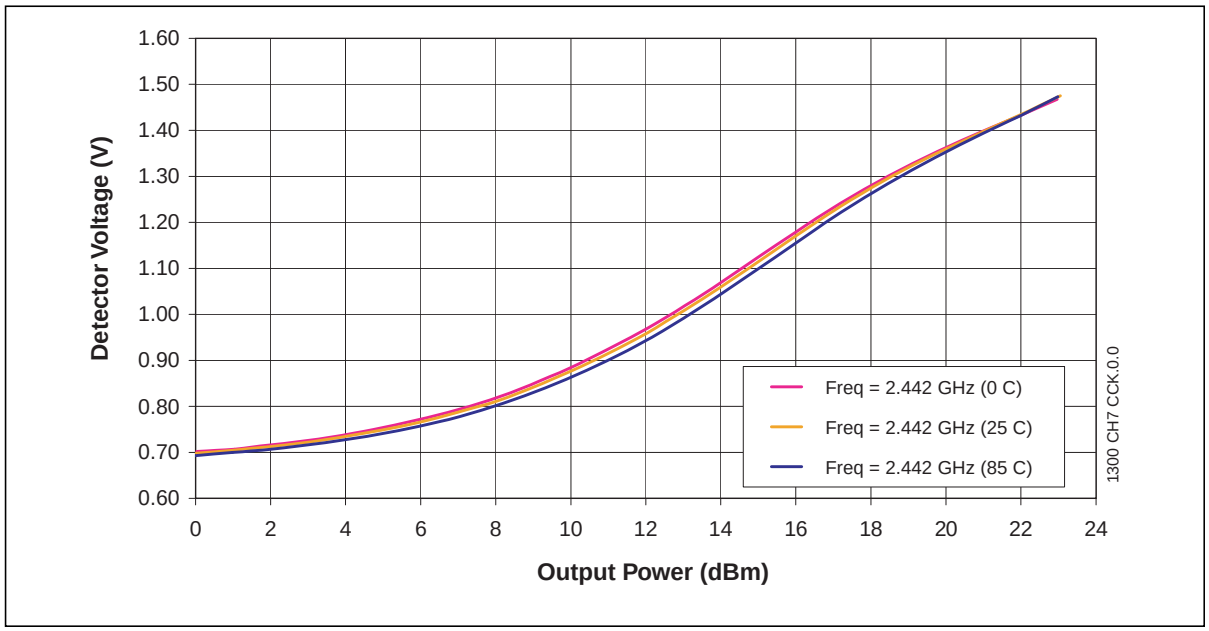


Figure 16: CH7 Detector Characteristics Over Temperature

Typical Performance Characteristics

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

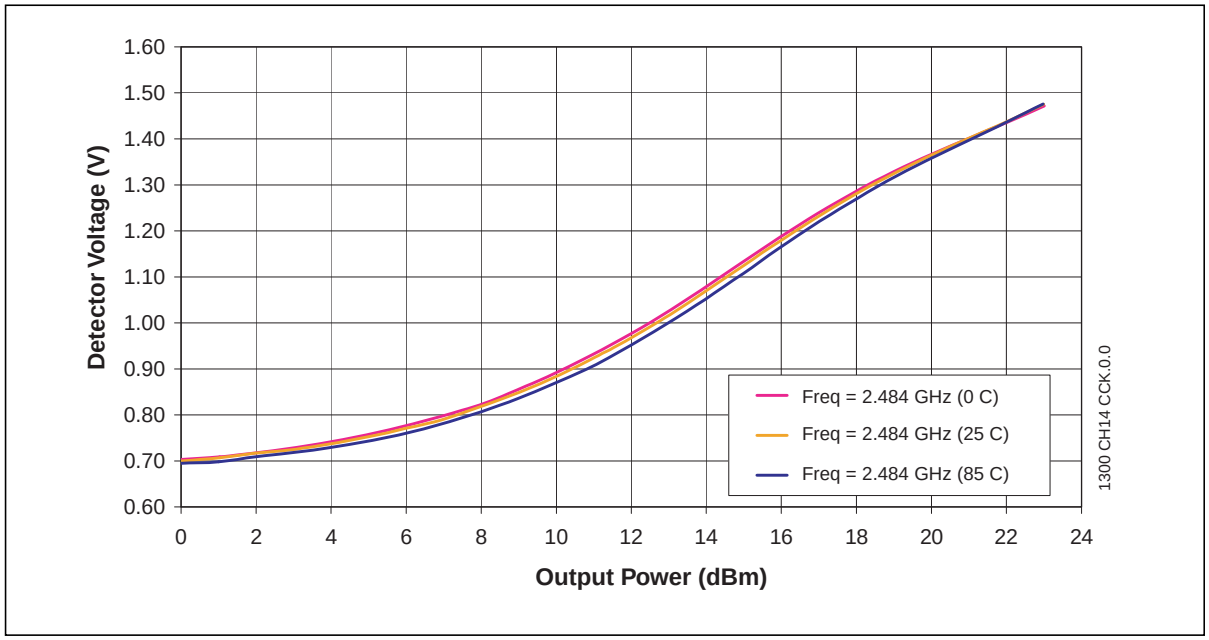


Figure 17: CH14 Detector Characteristics Over Temperature

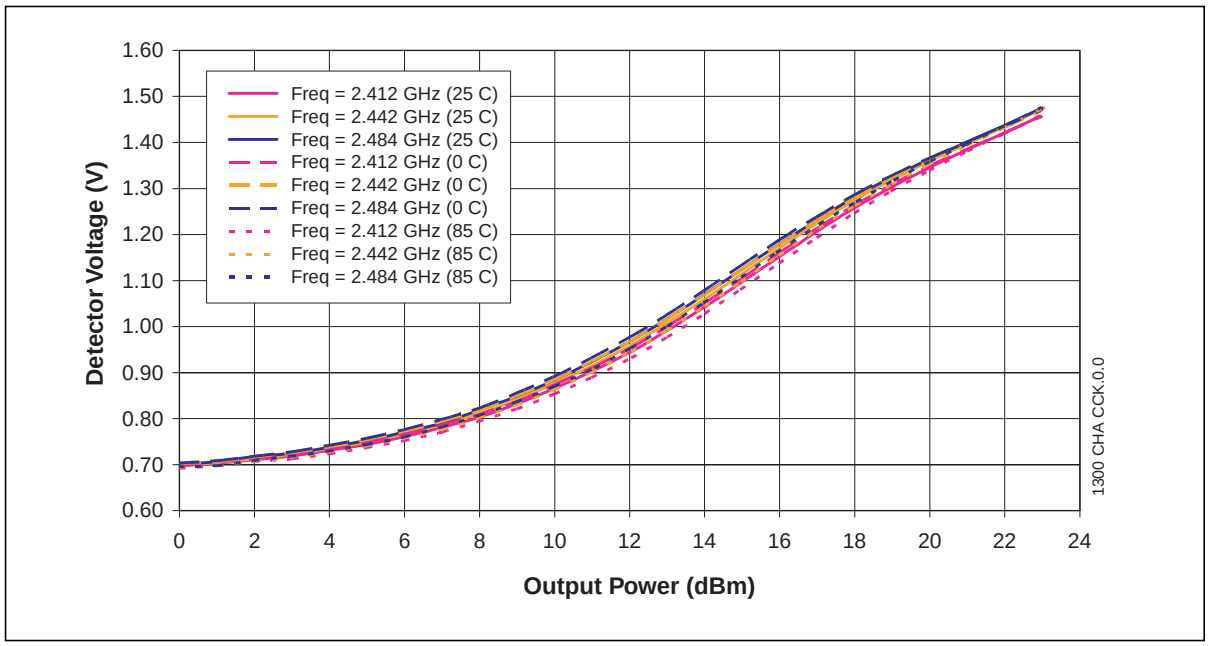


Figure 18: Detector Characteristics Over Temperature and Frequency

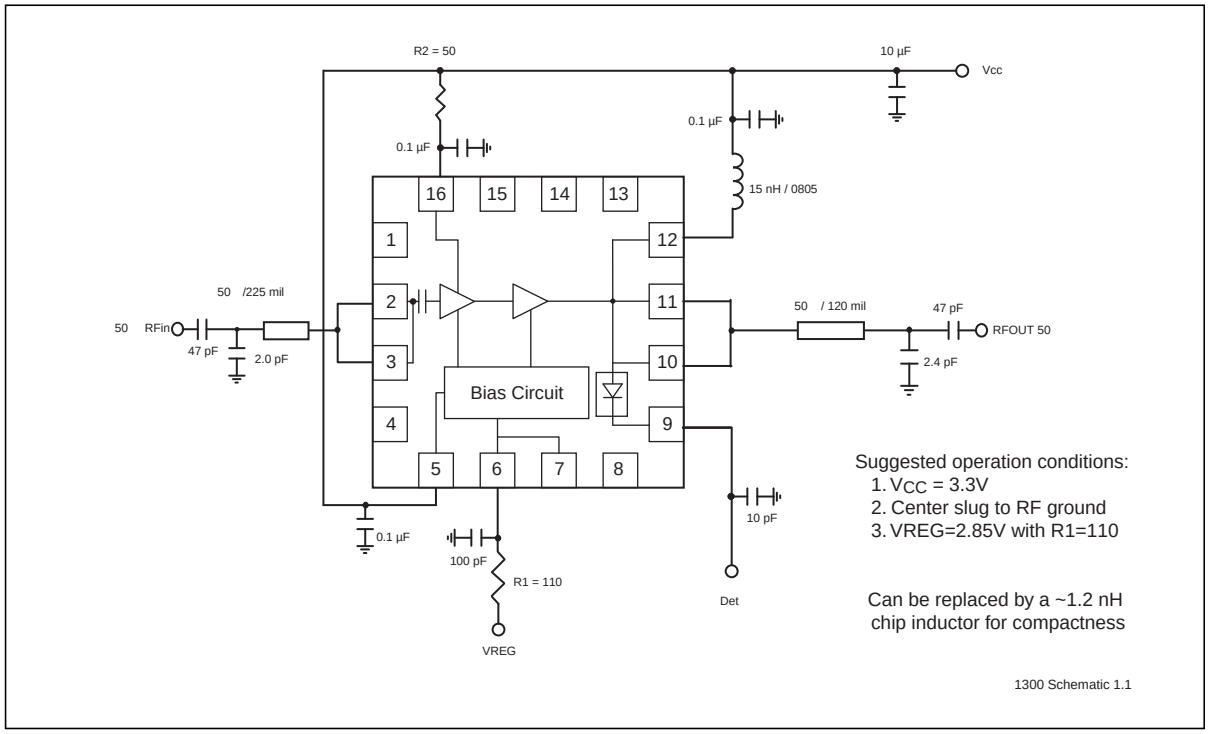
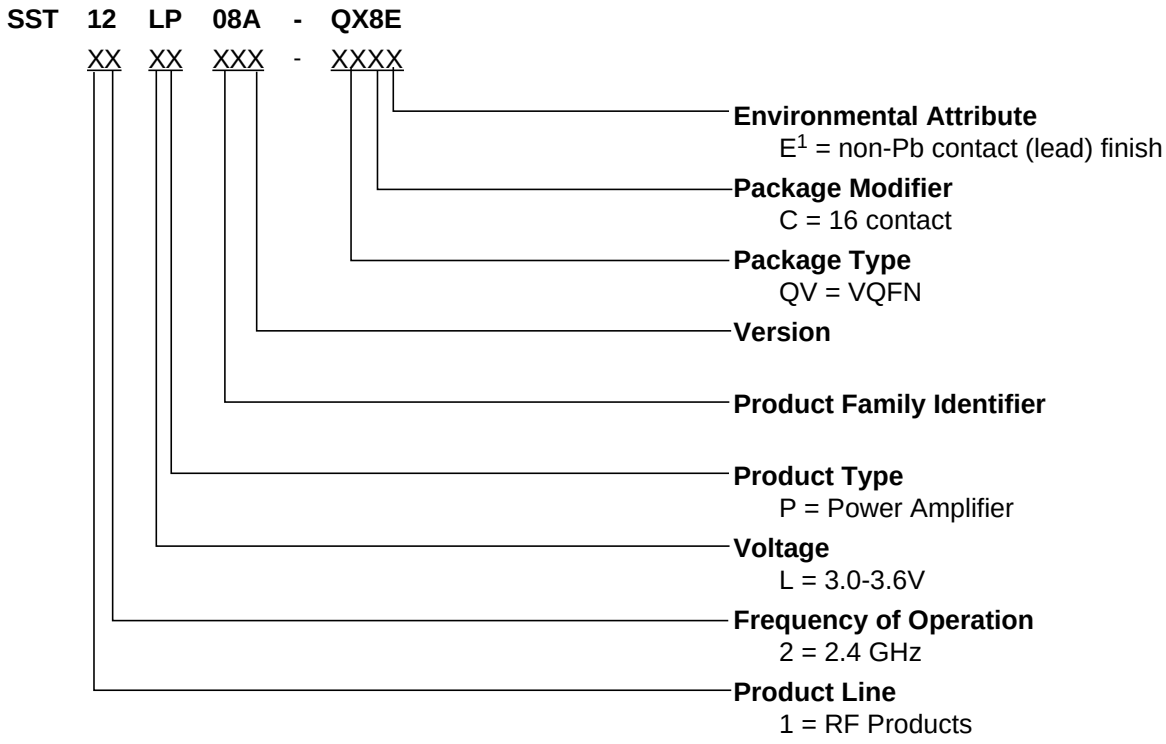


Figure 19: Typical Schematic for High-Power/High-Efficiency 802.11b/g Applications

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

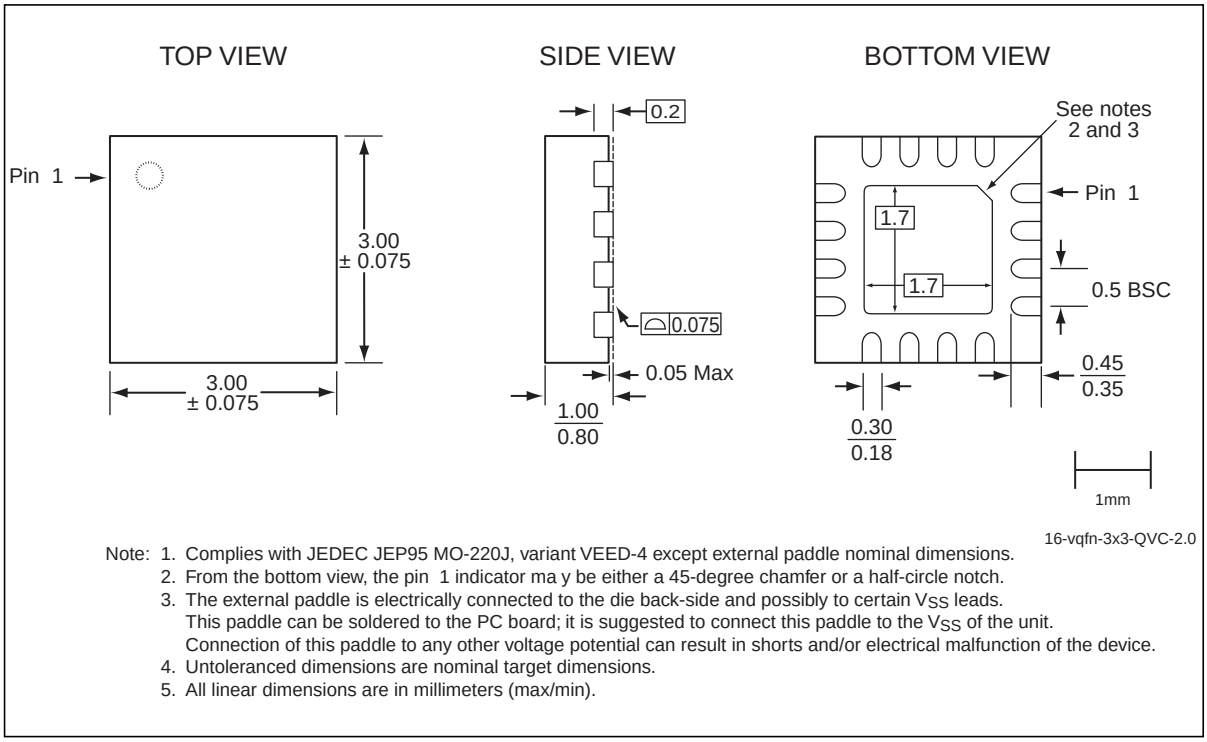
SST12LP14A Evaluation Kits

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.

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Packaging Diagrams



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 ma y 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 V_{SS} leads. This paddle can be soldered to the PC board; it is suggested to connect this paddle to the V_{SS} 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).

Figure 20: 16-Contact Very-thin Quad Flat No-lead (VQFN)
SST Package Code: QVC

Table 5: Revision History

Revision	Description	Date
00	• Initial release of data sheet	Jun 2005
01	• Removed Stability and Ruggedness parms from Table 4 on page 6 • Updated the schematic in Figure 19 on page 17	Sep 2005
02	• Updated the schematic in Figure 19 on page 17 • Updated Figures 4, 5, 6, 7, and 14 • Made minor updates to the “Features” section • Made minor updates to the “Electrical Specifications” section • Applied new format.	Mar 2006
03	• Updated document status from Preliminary Specification to Data Sheet	Apr 2008
04	• Updated “Contact Information” on page 18.	Feb 2009
A	• Updated “Features” and “Electrical Specifications” • Updated maximum voltage from 4.2V to 4.6V. • Applied new document format • Released document under letter revision system • Updated Spec number from S71300 to DS75045	Feb 2012

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Specifications are subject to change without notice. Refer to www.microchip.com for the most recent documentation. For the most current package drawings, please see the Packaging Specification located at http://www.microchip.com/packaging.

Memory sizes denote raw storage capacity; actual usable capacity may be less.

SST makes no warranty for the use of its products other than those expressly contained in the Standard Terms and Conditions of Sale.

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