2.4 GHz High-Power and High-Gain Power Amplifier

SST12LP15A

Data Sheet

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
  - Added EVM~3.5% up to 23 dBm for application over 2.3–2.4 GHz or 2.5–2.6 GHz WiBro/WiMax frequency bands
  - 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 @ P_{OUT} = 24 dBm for 802.11g
  - ~27%/350 mA @ P_{OUT} = 25 dBm for 802.11b
- **Built-in Ultra-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
  - ~1 dB detector variation over 0°C to +85°C
- **Low shut-down current (< 0.1 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 @ P_{OUT} = 24 dBm for 802.11g and 27% power-added efficiency @ P_{OUT} = 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. This device can be configured for applications with an added EVM of approximately 3.5%, up to 23 dBm over 2.3–2.4 GHz or 2.5–2.6 GHz WiBro/ WiMax frequency bands. 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 I_{REF} ~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.

Data Sheet

FUNCTIONAL BLOCKS

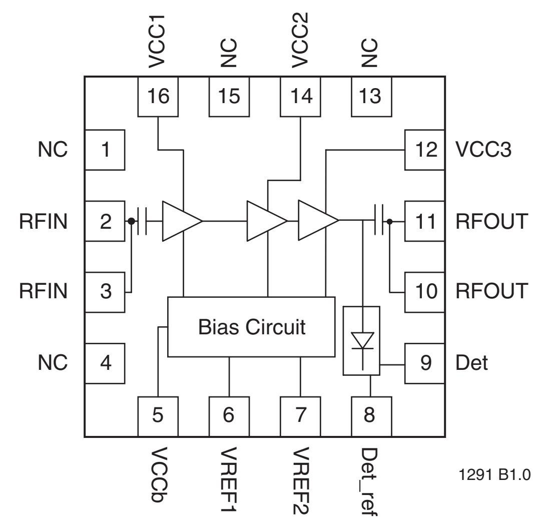

FIGURE 1: Functional Block Diagram

PIN ASSIGNMENTS

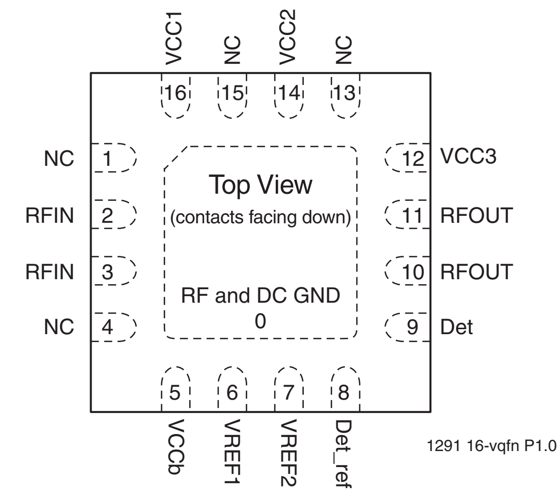

FIGURE 2: Pin Assignments for 16-contact VQFN

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 pins.
RFIN	2		I	RF input, DC decoupled
RFIN	3		I	RF input, DC decoupled
NC	4	No Connection		Unconnected pins.
VCCb	5	Power Supply	PWR	Supply voltage for bias circuit
VREF1	6		PWR	1st and 2nd stage idle current control
VREF2	7		PWR	3rd stage idle current control
Det_ref	8		O	On-chip power detector reference
Det	9		O	On-chip power detector
RFOUT	10		O	RF output
RFOUT	11		O	RF output
VCC3	12	Power Supply	PWR	Power supply, 3rd stage
NC	13	No Connection		Unconnected pins.
VCC2	14	Power Supply	PWR	Power supply, 2nd stage
NC	15	No Connection		Unconnected pins.
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 2 for the DC voltage and current specifications. Refer to Figures 3 through 12 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] . . . . +28 dBm
Supply Voltage at pins 5, 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 . . . . 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_{CC}
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, 14, 16	3.0	3.3	4.2	V	
I_{CC}	Supply Current					
	for 802.11g, 24 dBm		300		mA	
	for 802.11b, 25 dBm		350		mA	
I_{CQ}	Idle current for 802.11g to meet EVM<4% @ 23dBm		70		mA	
I_{OFF}	Shut down current			0.1	µA	
V_{REG1}	Reference Voltage for 1st Stage, with 169Ω resistor	2.85	2.90	2.95	V	
V_{REG2}	Reference Voltage for 2nd Stage, with 140Ω resistor	2.85	2.90	2.95	V	

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TABLE 3: AC Electrical Characteristics for Configuration

Symbol	Parameter	Min.	Typ	Max.	Unit
F_{L-U}	Frequency range in 802.11b/g applications (see Figure 13)	2400		2485	MHz
F_{L-U}	Frequency range in 2.3-2.4 GHz applications (see Figure 14)	2300		2400	MHz
F_{L-U}	Frequency range in 2.5-2.6 GHz applications (see Figure 15)	2500		2600	MHz
P_{OUT}	Output power				
	@ PIN = -10 dBm 11b signals		23		dBm
	@ PIN = -10 dBm 11g signals		23		dBm
G	Small signal gain	31	32		dB
G_{VAR1}	Gain variation over each band (2400-2485 MHz)			±0.5	dB
G_{VAR2}	Gain ripple over channel (Gain variation over 20 MHz)		0.2		dB
Output VSWR Ruggedness	Survivable time@ 25 dBm (to 50Ω) 54 Mbps OFDM signal when VSWR=10:1 all phases	10			second
ACPR	Meet 11b spectrum mask	24	25		dBm
	Meet 11g OFDM 54 MBPS spectrum mask	24	25		dBm
Added EVM	@ 23 dBm output with 11g OFDM 54 MBPS signal		3.5		%
2f, 3f, 4f, 5f	Harmonics at 22 dBm, without trapping capacitors			-40	dBc

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TYPICAL PERFORMANCE CHARACTERISTICS

TEST CONDITIONS: V_{CC} = 3.3V, T_A = 25°C

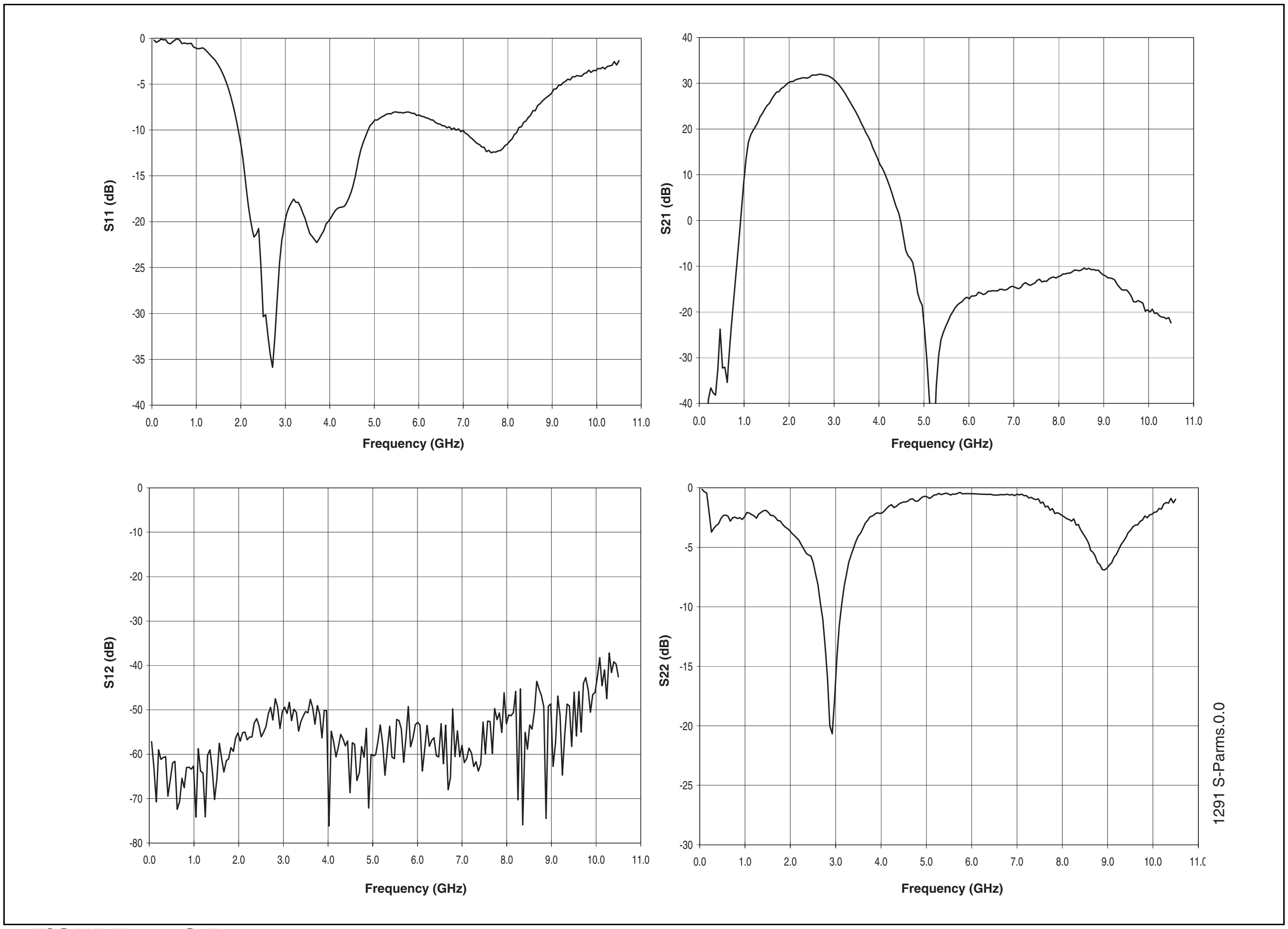


FIGURE 3: S-Parameters

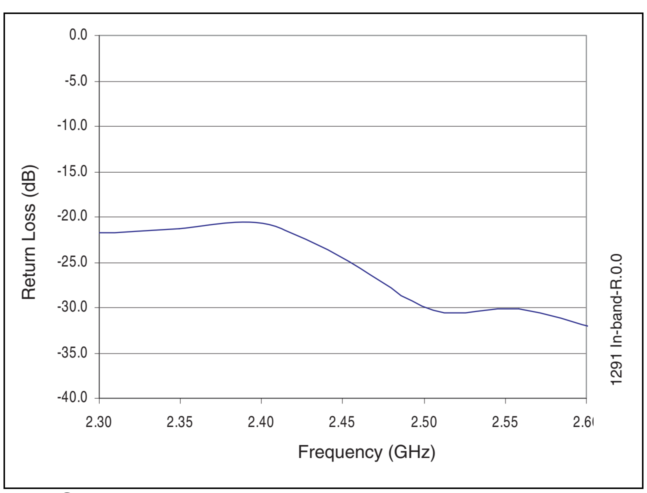


FIGURE 4: In-band Return Loss

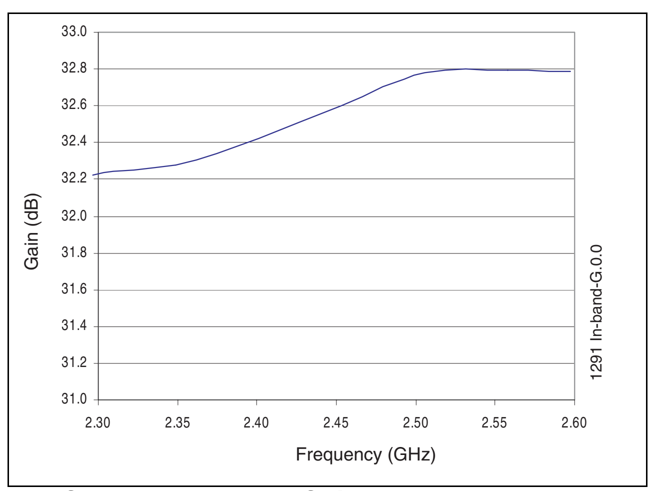


FIGURE 5: In-band Gain Flatness

TYPICAL PERFORMANCE CHARACTERISTICS

TEST CONDITIONS: F1 = 2.45 GHZ, F2 = 2.451 GHZ, V_{CC} = 3.3V, T_A = 25°C

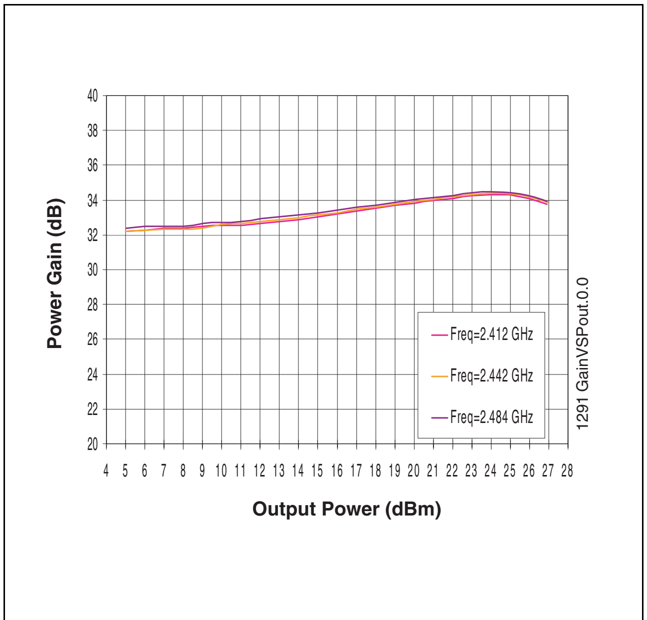


FIGURE 6: Gain vs P_{OUT}

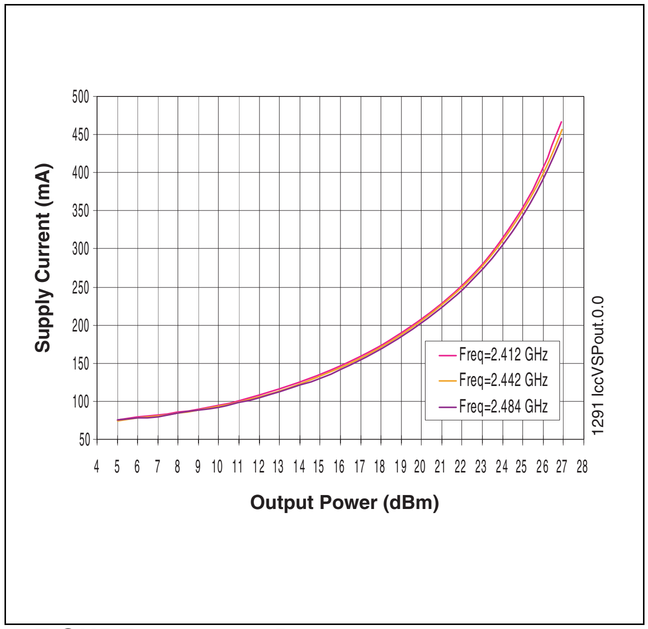


FIGURE 8: I_{CC} vs P_{OUT}

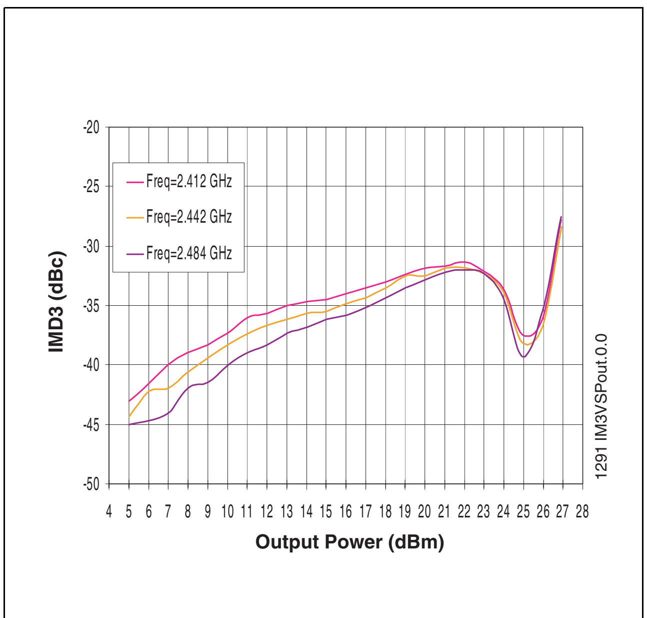


FIGURE 7: IM3 vs P_{OUT}

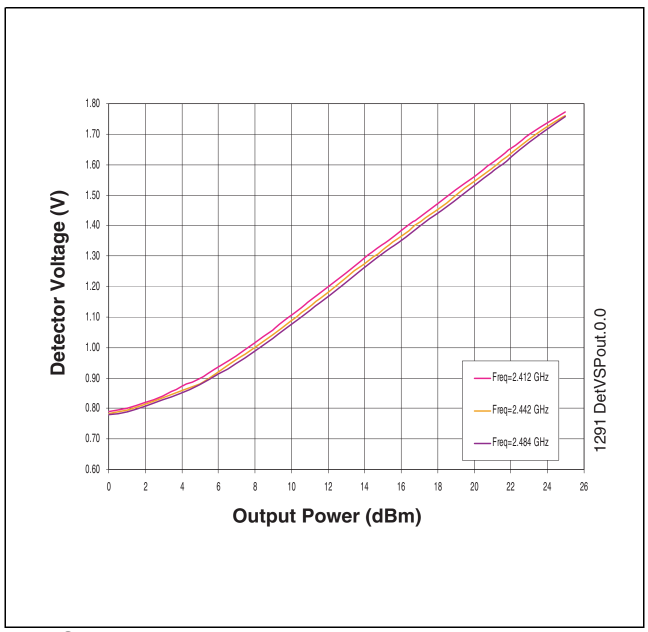


FIGURE 9: Detectors vs P_{OUT}

TYPICAL PERFORMANCE CHARACTERISTICS

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

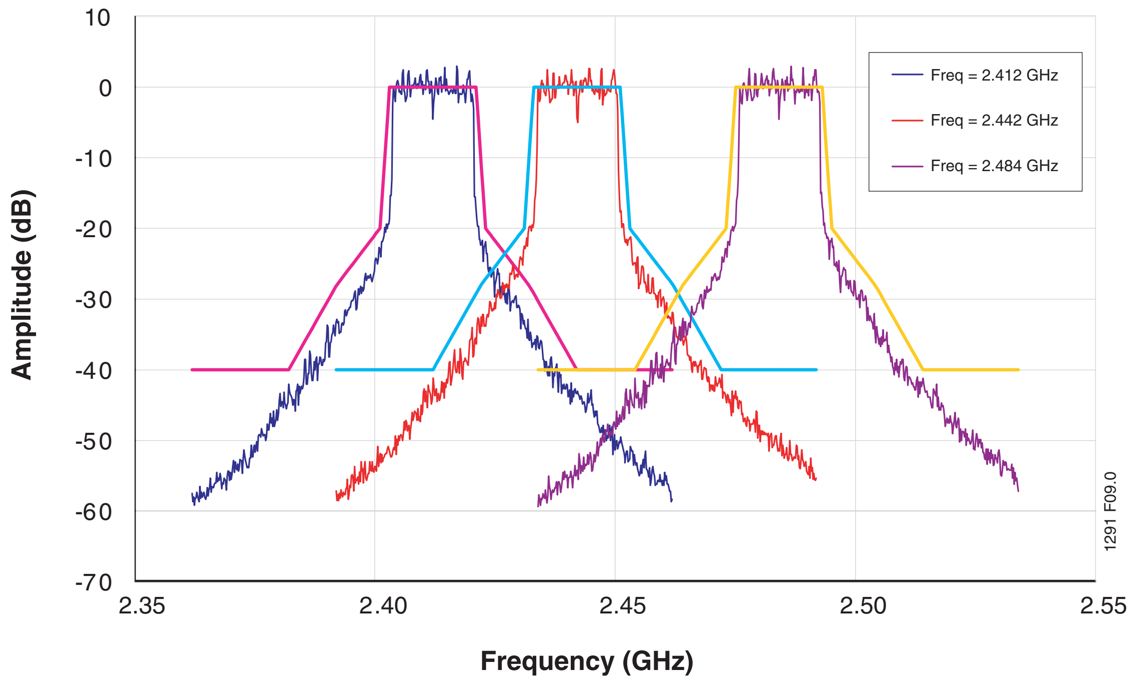


FIGURE 10: 802.11g Spectrum Mask at 24 dBm, DC current 300 mA

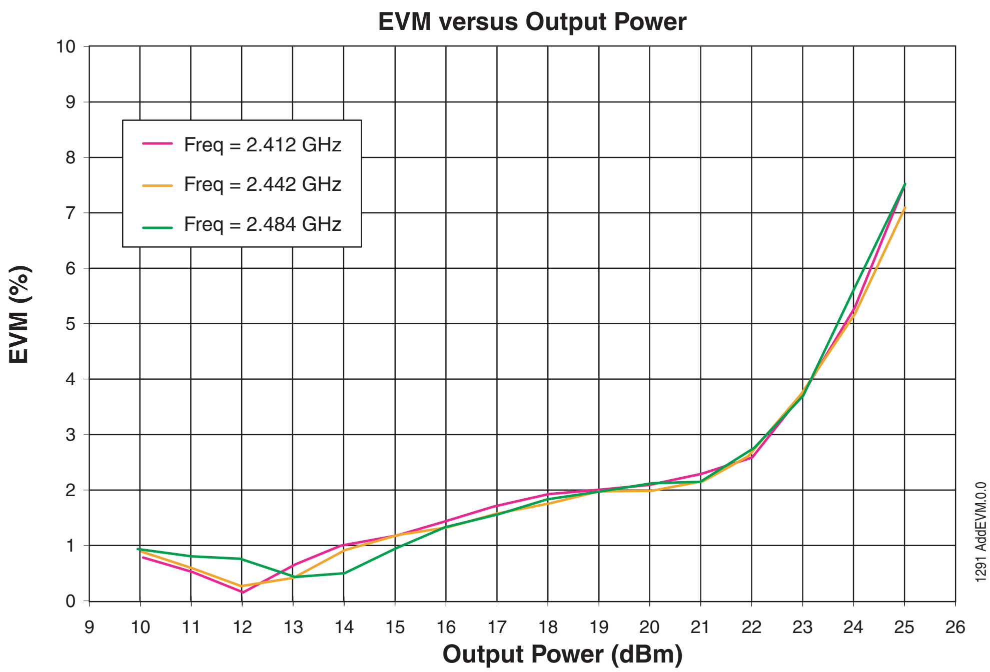


FIGURE 11: 802.11g Spectrum Mask at 23/24 dBm, DC current 240/290 mA

TYPICAL PERFORMANCE CHARACTERISTICS

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

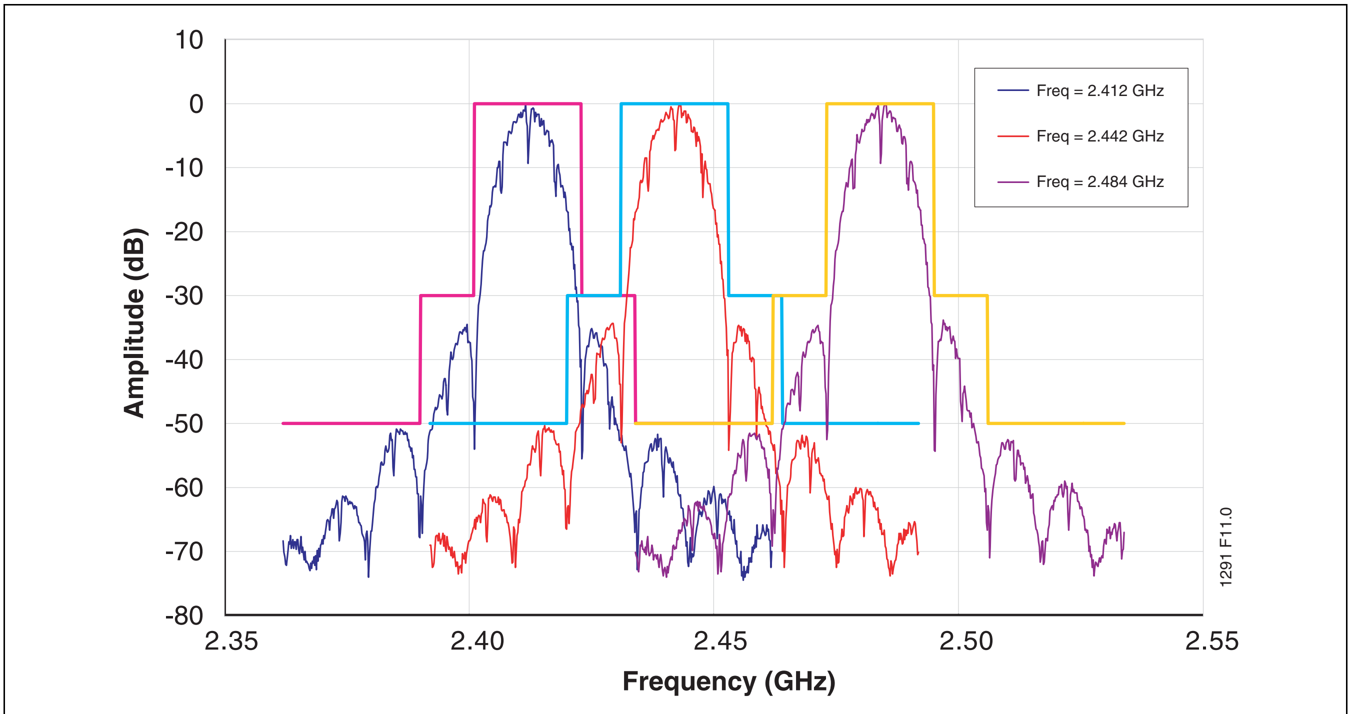


FIGURE 12: 802.11b Spectrum Mask at 25 dBm, DC current 350 mA

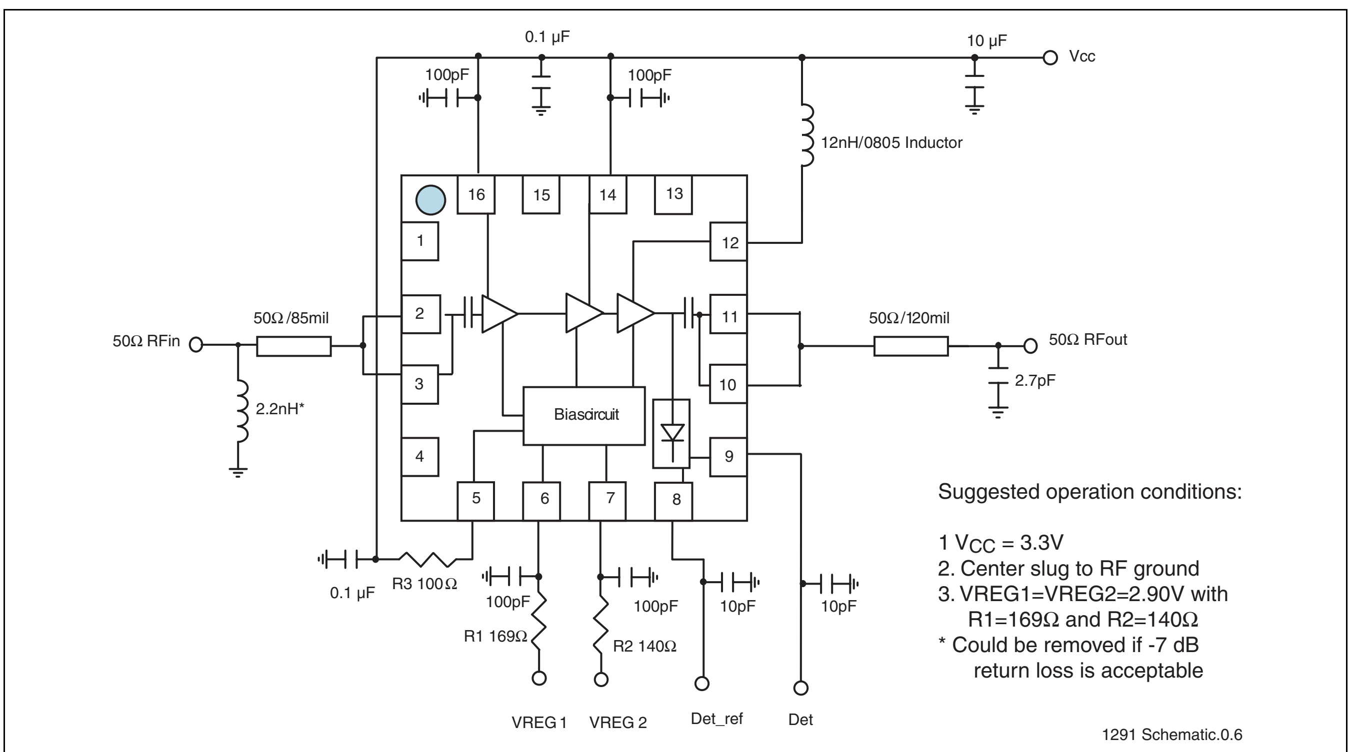


FIGURE 13: Typical Schematic for High-Power, High-Efficiency 802.11b/g Applications

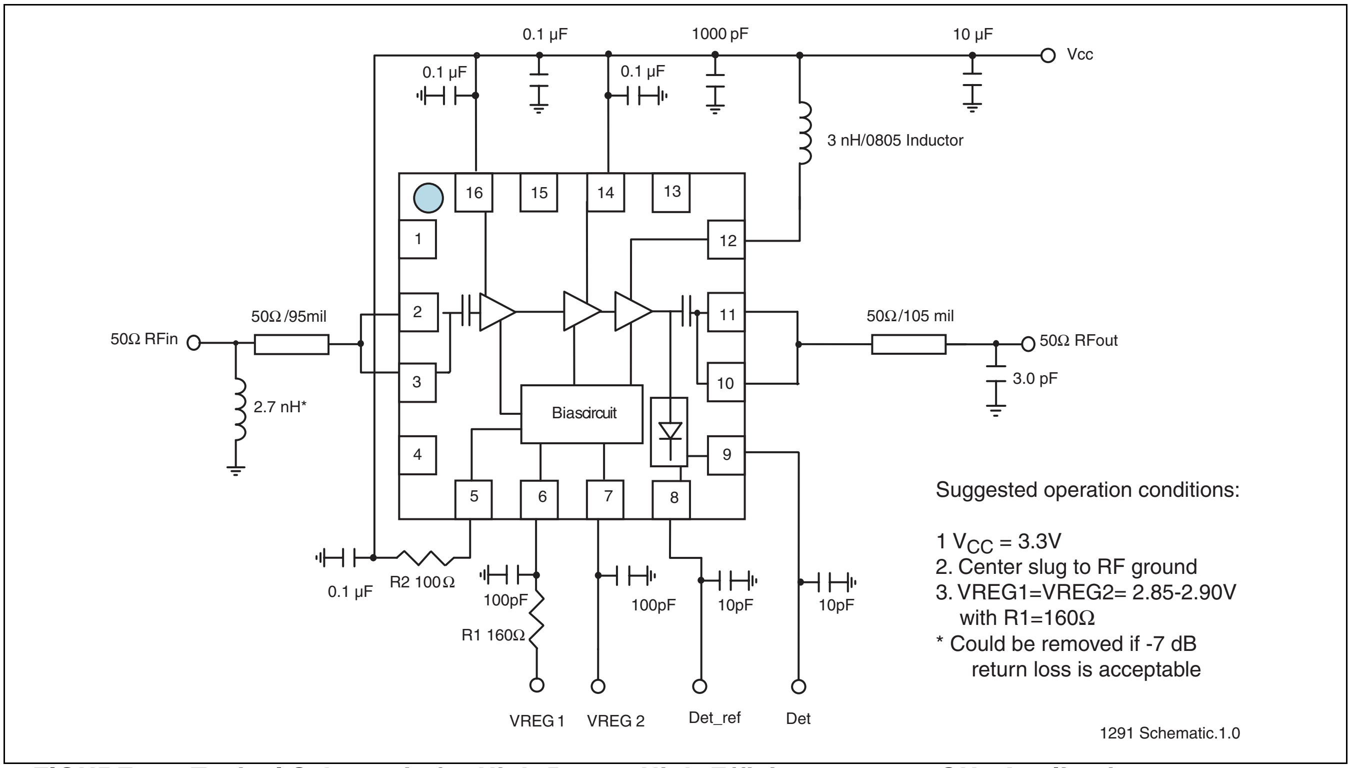


FIGURE 14: Typical Schematic for High-Power, High-Efficiency 2.3-2.4 GHz Applications

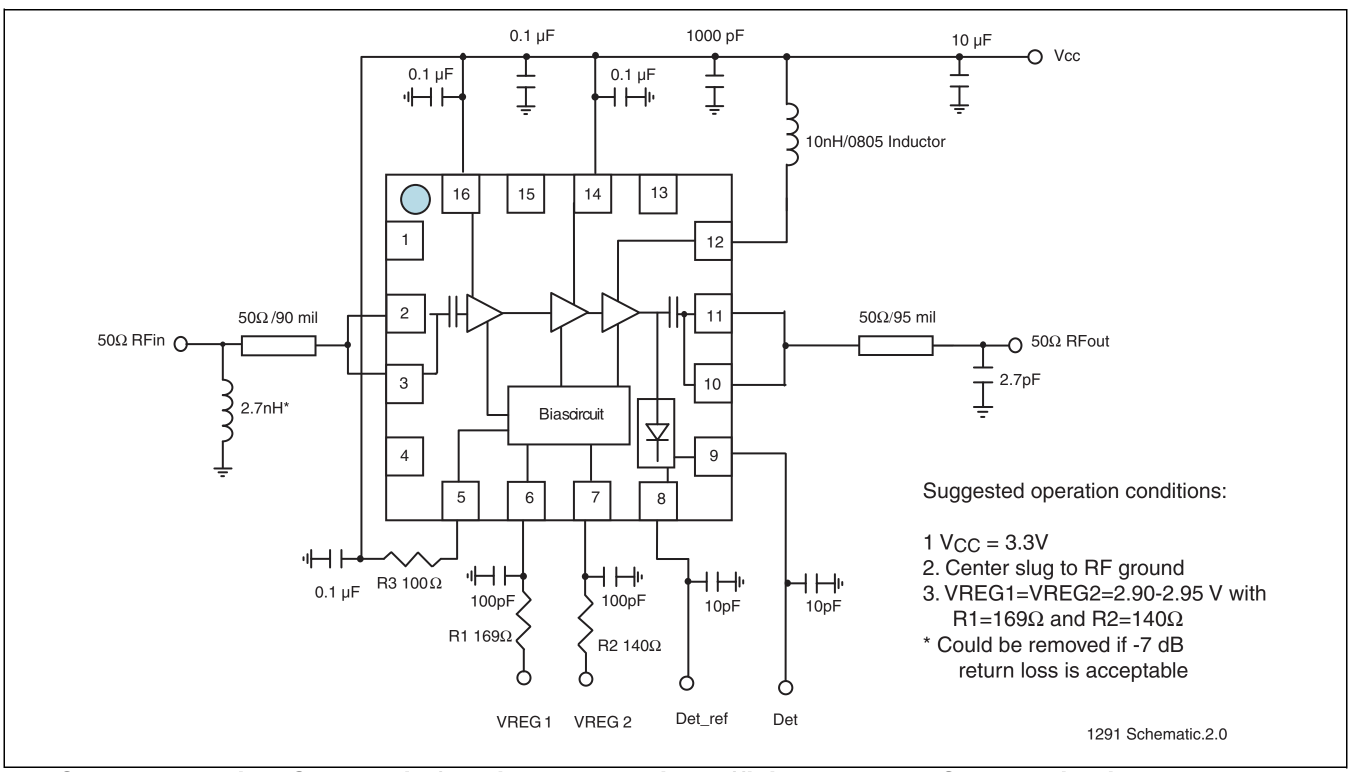


FIGURE 15: Typical Schematic for High-Power, High-Efficiency 2.5-2.6 GHz Applications

PRODUCT ORDERING INFORMATION

SST12LP 15A - QVC E
SSTXXLP XXX - XXX X

Environmental Attribute
E[1] = non-Pb contact (lead) finish

Package Modifier
C = 16 contact

Package Type
QV = VQFN

Version

Product Family Identifier

Product Type
P = Power Amplifier

Voltage
L = 3.0-3.6V

Frequency of Operation
2 = 2.4 GHz

Product Line
1 = SST Communications

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

Valid combinations for SST12LP15A

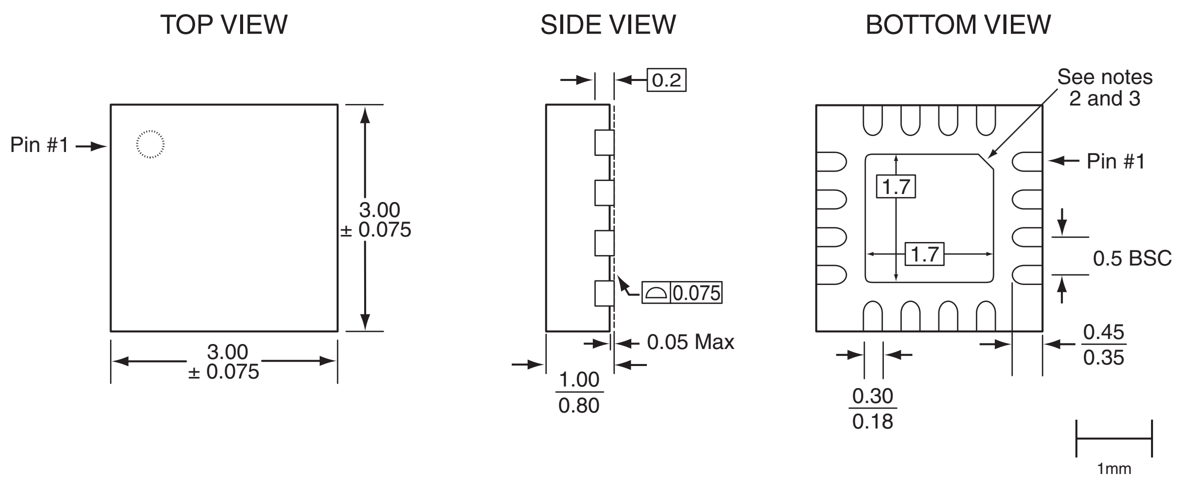
SST12LP15A-QVCE

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.

PACKAGING DIAGRAMS



16-vqfn-3x3-QVC-2.0

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

TABLE 4: Revision History

Revision	Description	Date
00	• Initial release of data sheet	Mar 2005
01	• Updated values for gain and efficiency on page 1 • Updated values for VREG1 and VREG2 in Table 2 on page 4 • Removed stability parameter from Table 3 on page 5 • Updated the typical application schematic on page 9 • Updated QVC package drawing. • Updated “Absolute Maximum Stress Ratings” on page 4	Mar 2006
02	• Added information for 2.3-2.4 and 2.5-2.6 applications • Removed leaded part numbers	Jul 2006

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