SST12LP17A

2.4 GHz WLAN, High-Efficiency Power Amplifier Module

Features

- Input/Output ports internally matched to 50Ω and DC decoupled
- High gain:
  - Typically 28 dB gain across 2.4–2.5 GHz
- High linear output power:
  - >24 dBm P1dB
    - Single-tone measurement. Please refer to "Absolute Maximum Stress Ratings" on page 5
  - Meets 802.11g OFDM ACPR requirement up to 21.5 dBm
  - 3% EVM up to 17.5 dBm for 54 Mbps 802.11g signal
  - 2.5% EVM up to 17 dBm for 802.11n, MCS7, 40 MHz
  - Meets 802.11b ACPR requirement up to 22.5 dBm
  - Meets Bluetooth® spectrum mask for 3 Mbps at 17 dBm typical
- High power-added efficiency/Low operating current for 802.11b/g/n applications
  - ~28%/138 mA @ P_{OUT} = 21.5 dBm for 802.11g
  - ~33%/155 mA @ P_{OUT} = 22.5 dBm for 802.11b
- Single-pin low I_{REF} power-up/down control
  - I_{REF} <2 mA
- Low idle current
  - ~60 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
- Low shut-down current (~2 µA)
- Stable performance over temperature
  - ~2 dB gain variation between -40°C to +85°C
  - ~1 dB power variation between -40°C to +85°C
- Excellent on-chip power detection
  - >15 dB dynamic range, dB-wise linear
  - VSWR insensitive, temperature stable
- Packages available
  - 10-contact X2QFN – 1.5mm x 1.5mm x 0.4mm
- Non-Pb (lead-free), RoHS compliant, and Halogen free

Applications

- WLAN (IEEE 802.11b/g/n)
- Bluetooth®
- Cordless phones
- 2.4 GHz ISM wireless equipment

1.0 PRODUCT DESCRIPTION

The SST12LP17A is a versatile power amplifier based on the highly-reliable InGaP/GaAs HBT technology.The input/output RF ports are fully matched to 50Ω internally. These RF ports are DC decoupled and require no DC-blocking capacitors or matching components. This helps reduce the system board's Bill of Materials (BOM) cost.

SST12LP17A is a 2.4 GHz fully-integrated, high-efficiency Power Amplifier module designed in compliance with IEEE 802.11b/g/n/ac applications. It typically provides 28 dB gain with 28% power-added efficiency (PAE) @ POUT = 21.5 dBm for 802.11g and 33% PAE @ POUT = 22.5 dBm for 802.11b.

This power amplifier has excellent linearity, typically 3% added EVM at 17.5 dBm output power which is essential for 54 Mbps 802.11g operation while meeting 802.11g spectrum mask at 21.5 dBm and 802.11b spectrum mask at 22.5 dBm. Using MCS7 modulation, with 40 MHz bandwidth, the SST12LP17A provides 17 dBm at 2.5% EVM.

The device 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 SST12LP17A controllable by an on/off switching signal directly from the baseband chip. These features, coupled with low operating current, make the SST12LP17A ideal for the final stage power amplification in battery-powered 802.11b/g/n WLAN transmitter and Bluetooth applications.

The SST12LP17A has an excellent on-chip, single-ended power detector, which features wide dynamic-range, >15 dB, with dB-wise linear performance. The excellent on-chip power detector provides a reliable solution to board-level power control.

The SST12LP17A is offered in a 10-contact X2QFN package. See Figure 3-1 for pin assignments and Table 3-1 for pin descriptions.

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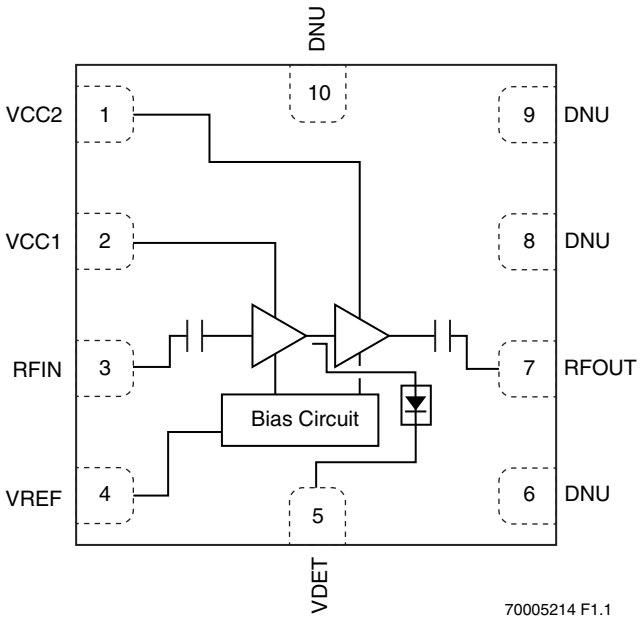
2.0 FUNCTIONAL BLOCKS

FIGURE 2-1: FUNCTIONAL BLOCK DIAGRAM



3.0 PIN ASSIGNMENTS

FIGURE 3-1: PIN ASSIGNMENTS FOR 10-CONTACT X2QFN

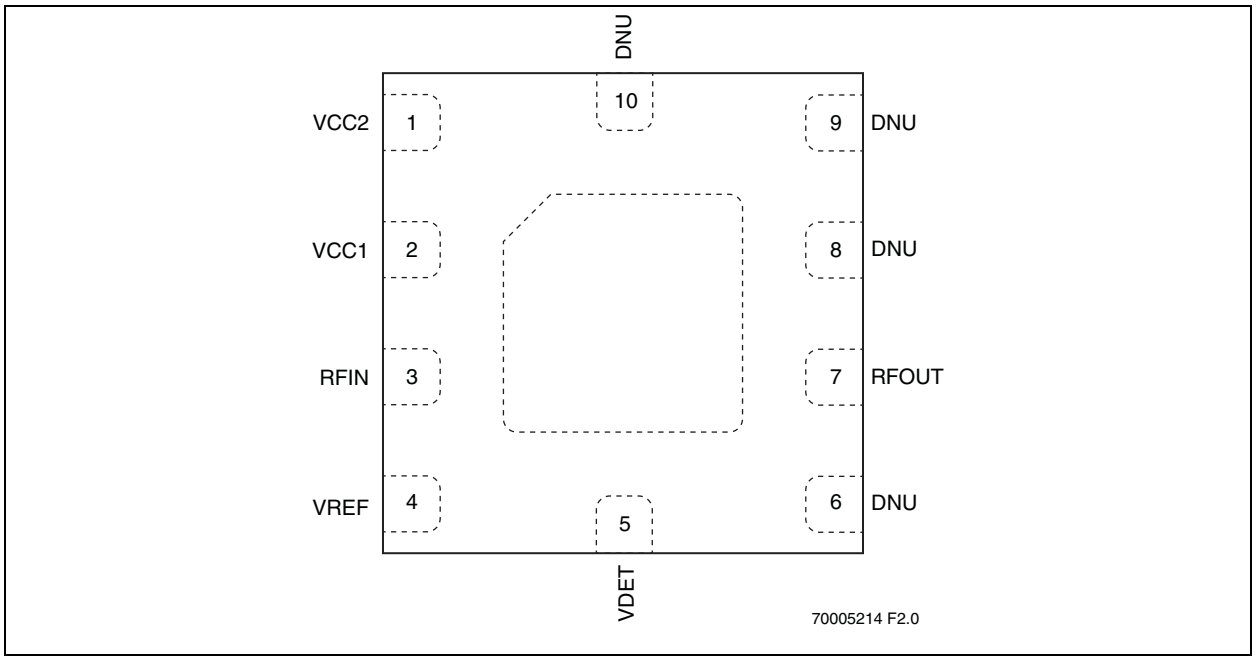


TABLE 3-1: PIN DESCRIPTION

Symbol	Pin No.	Pin Name	Type[1]	Function
GND	0	Ground		Low inductance ground pad
VCC2	1	Power Supply	PWR	Power supply, 2nd stage
VCC1	2	Power Supply	PWR	Power supply, 1st stage
RFIN	3		I	RF input, DC decoupled
VREF	4		PWR	1st and 2nd stage idle current control
VDET	5		O	On-chip power detector
DNU	6	Do Not Use		Do not use or connect
RFOUT	7		O	RF output, DC decoupled
DNU	8	Do Not Use		Do not use or connect
DNU	9	Do Not Use		Do not use or connect
DNU	10	Do Not Use		Do not use or connect

1. I=Input, O=Output

4.0 ELECTRICAL SPECIFICATIONS

The DC and RF specifications for the power amplifier are specified below. Refer to Table 4-2 for the DC voltage and current specifications.

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 pin 3 (P_{IN}) . . . . . +5 dBm
Average output power from Pin 7 (P_{OUT})[1] . . . . . +25.5 dBm
Supply Voltage at pins 1 and 2 (V_{CC})[2] . . . . . -0.3V to +6.0V
Reference voltage to pin 4 (V_{REF}) . . . . . -0.3V to +3.3V
DC supply current (I_{CC})[3] . . . . . 300 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
ESD Level for Human Body Model, HBM. 1250V

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.
2. V_{CC} maximum rating of 6.0V for RF output power levels up to 10 dBm.
3. Measured with 100% duty cycle 54 Mbps 802.11g OFDM Signal

TABLE 4-1: OPERATING RANGE

Range	Ambient Temp	V_{CC}
Industrial	-40°C to +85°C	3.0V to 4.6V

TABLE 4-2: DC ELECTRICAL CHARACTERISTICS AT 25°C

Symbol	Parameter	Min.	Typ	Max.	Unit
V_{CC}	Supply Voltage at pins 1 and 2	3.0	3.3	4.6	V
I_{CQ}	Idle current to meet EVM ~3% @ 17.5 dBm Output Power, 802.11g OFDM 54 Mbps signal		60		mA
V_{REF}	Reference Voltage for pin 4	2.80	2.85		V
I_{CC}	Current consumption to meet 802.11g OFDM 54 Mbps spectrum mask @ 21.5 dBm		138		mA
	Current consumption to meet 802.11b DSSS 54 Mbps spectrum mask @ 22.5 dBm		155		mA
	Current consumption to meet EVM ~3% @ 17.5 dBm Output Power with 802.11g OFDM 54 Mbps signal		100		mA

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TABLE 4-3: RF CHARACTERISTICS AT 25°C

Symbol	Parameter	Min.	Typ	Max.	Unit
F_{L-U}	Frequency range	2412		2484	MHz
G	Small signal gain	27	28		dB
G_{VAR1}	Gain variation over band (2412–2484 MHz)			±0.5	dB
G_{VAR2}	Gain ripple over channel (20 MHz)		0.2		dB
2f, 3f, 4f, 5f	Harmonics at 23 dBm, without external filters			-40	dBc
EVM	EVM @ 17.5 dBm output with 802.11g OFDM 54 Mbps signal		3		%
	EVM @ 17 dBm output with MCS7-40 MHz bandwidth		2.5		%
P_{OUT}	Output Power to meet 802.11g OFDM 54 Mbps spectrum mask	20.5	21.5		dBm
	Output Power to meet 802.11b DSSS 1 Mbps spectrum mask	21	22.5		dBm
	Output Power to meet 802.11n, with MCS0-HT20 spectrum mask		20		dBm

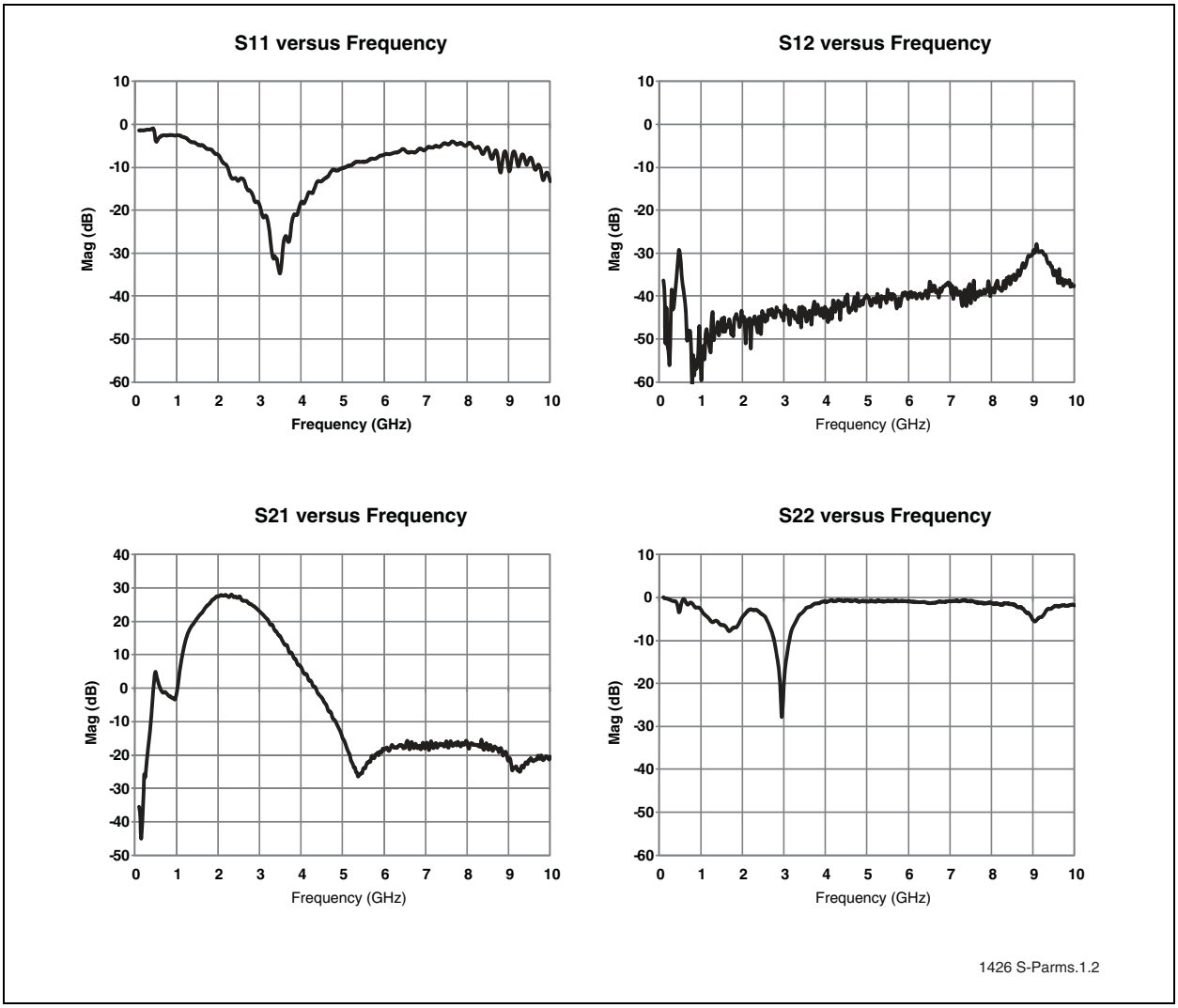
TABLE 4-4: CHARACTERISTICS AT 25°C FOR BLUETOOTH APPLICATIONS

Symbol	Parameter	Min.	Typ	Max.	Unit
F_{L-U}	Frequency range	2412		2484	MHz
G	Small signal gain (configured as shown in Figure 5-7 on page 10)	26	28		dB
	Small signal gain (V_{REF} = 3.0V with 1.5kΩ series resistor)	23	26		dB
ICC	DC current at 17 dBm CW (configured as shown in Figure 5-7 on page 10)		100		mA
	DC current at 12 dBm CW (V_{REF} = 3.0V with 1.5kΩ series resistor)		50		mA
Power	Meeting Bluetooth spectrum power density using 3 Mbps modulation (-20 dBm at 1.5 MHz and -40 dBm at 2.5 MHz, 100 kHz RBW) (configured as shown in Figure 5-7 on page 10)		17		dBm
	Meeting Bluetooth spectrum power density using 3 Mbps modulation (-20 dBm at 1.5 MHz and -40 dBm at 2.5 MHz, 100 kHz RBW) (V_{REF} = 3.0V with 1.5kΩ series resistor)		12		dBm

5.0 TYPICAL PERFORMANCE CHARACTERISTICS

Test Conditions: V_{CC} = 3.3V, V_{REF} = 2.85V, T_A = 25°C

FIGURE 5-1: S-PARAMETER



Test Conditions: V_{CC} = 3.3V, V_{REF} = 2.85V, T_A = 25°C, 54 Mbps 802.11g OFDM Signal, unless otherwise noted. Equalizer Training Setting using Channel Estimation Sequence only

FIGURE 5-2: DYNAMIC EVM VERSUS OUTPUT POWER

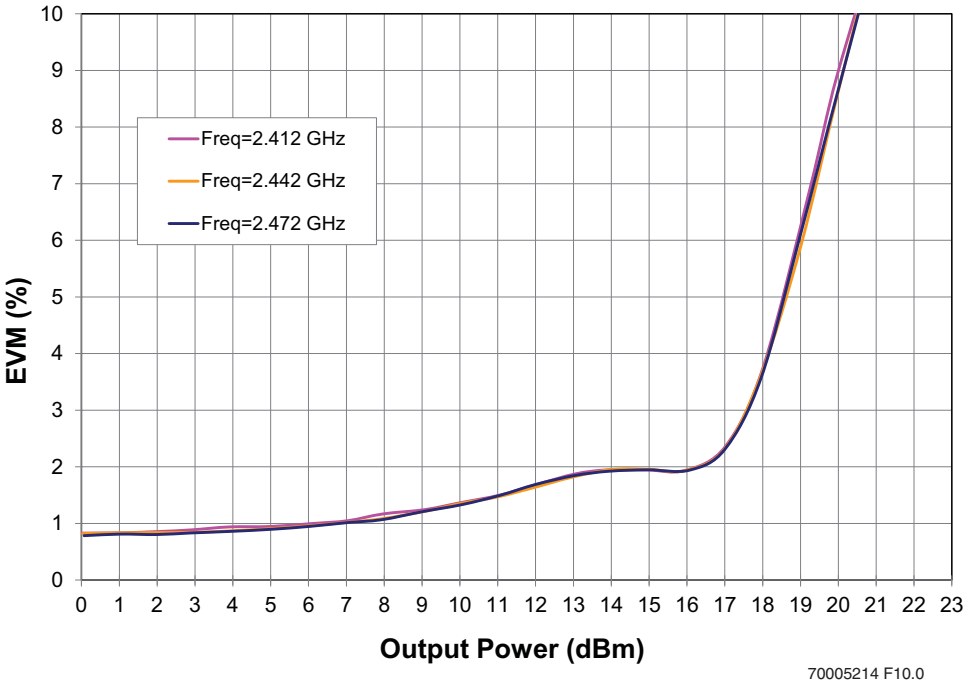


FIGURE 5-3: DYNAMIC EVM VERSUS OUTPUT POWER WITH MCS7-HT40 MODULATION

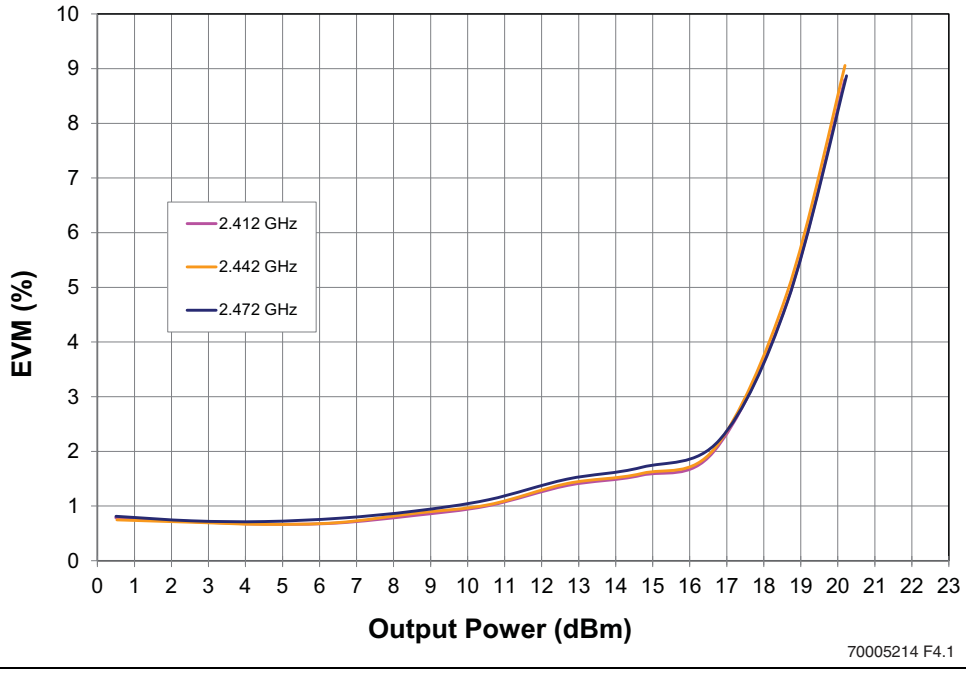


FIGURE 5-4: POWER GAIN VERSUS OUTPUT POWER

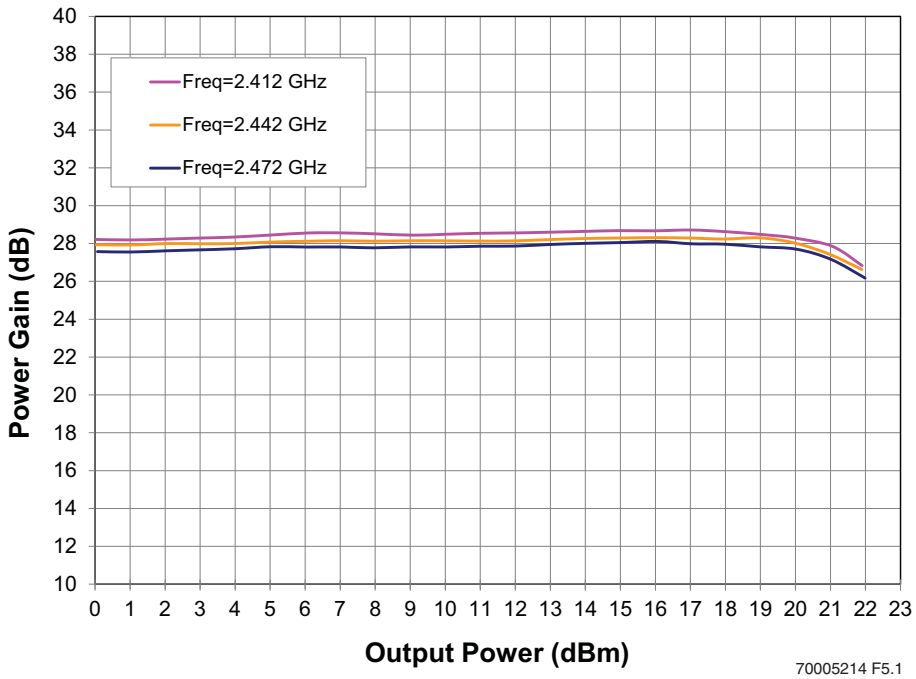


FIGURE 5-5: TOTAL CURRENT CONSUMPTION VERSUS OUTPUT POWER

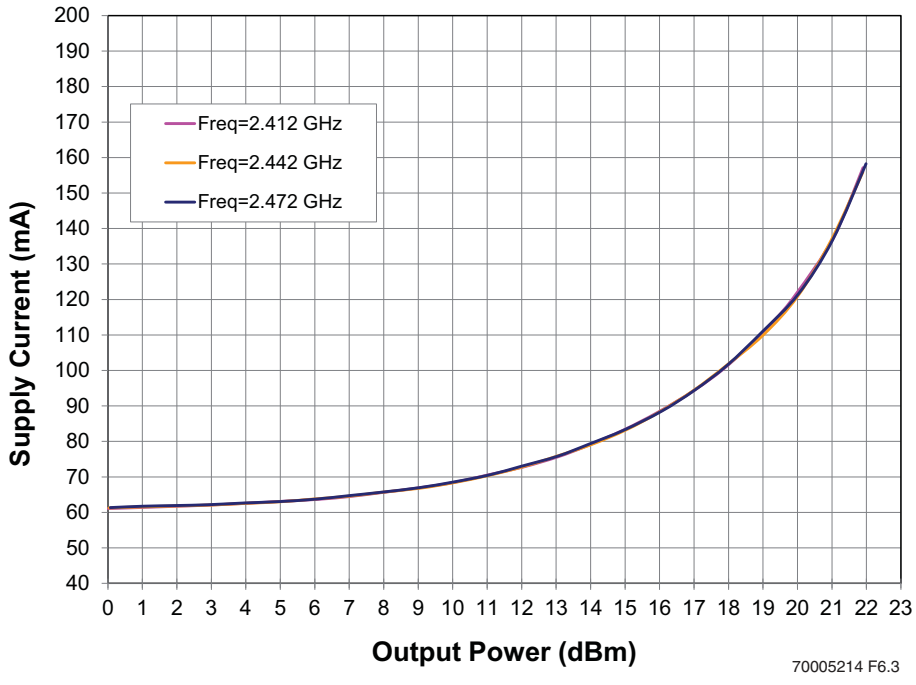


FIGURE 5-6: DETECTOR CHARACTERISTICS VERSUS OUTPUT POWER

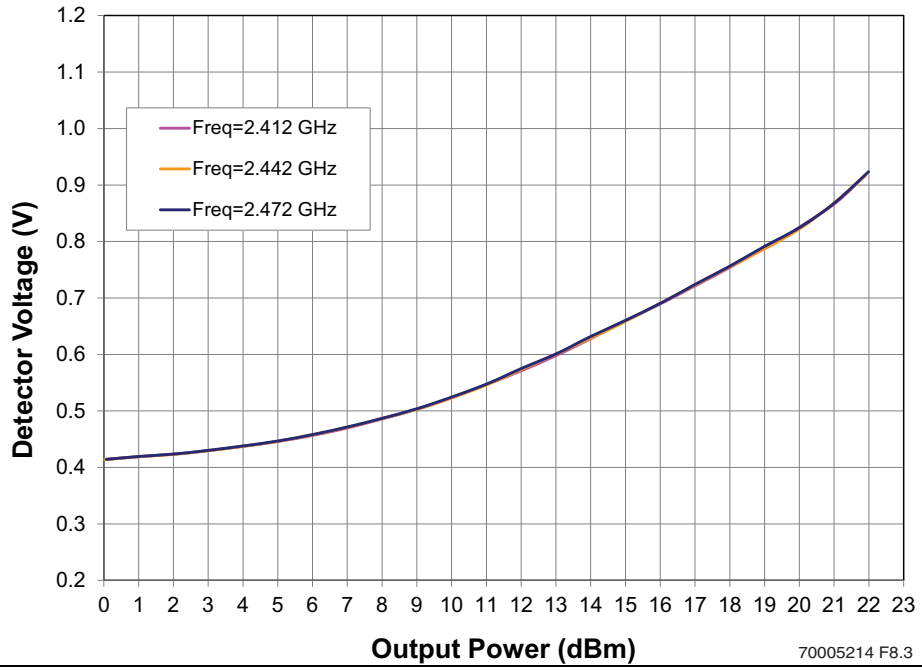
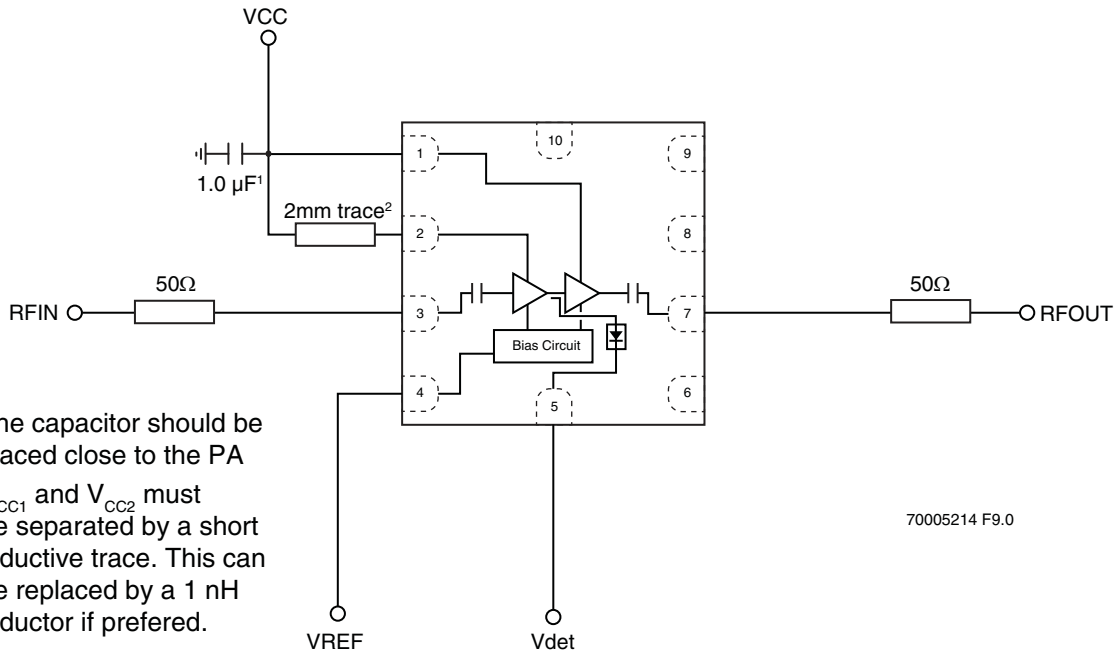


FIGURE 5-7: TYPICAL SCHEMATIC FOR HIGH-EFFICIENCY 802.11B/G/N APPLICATIONS

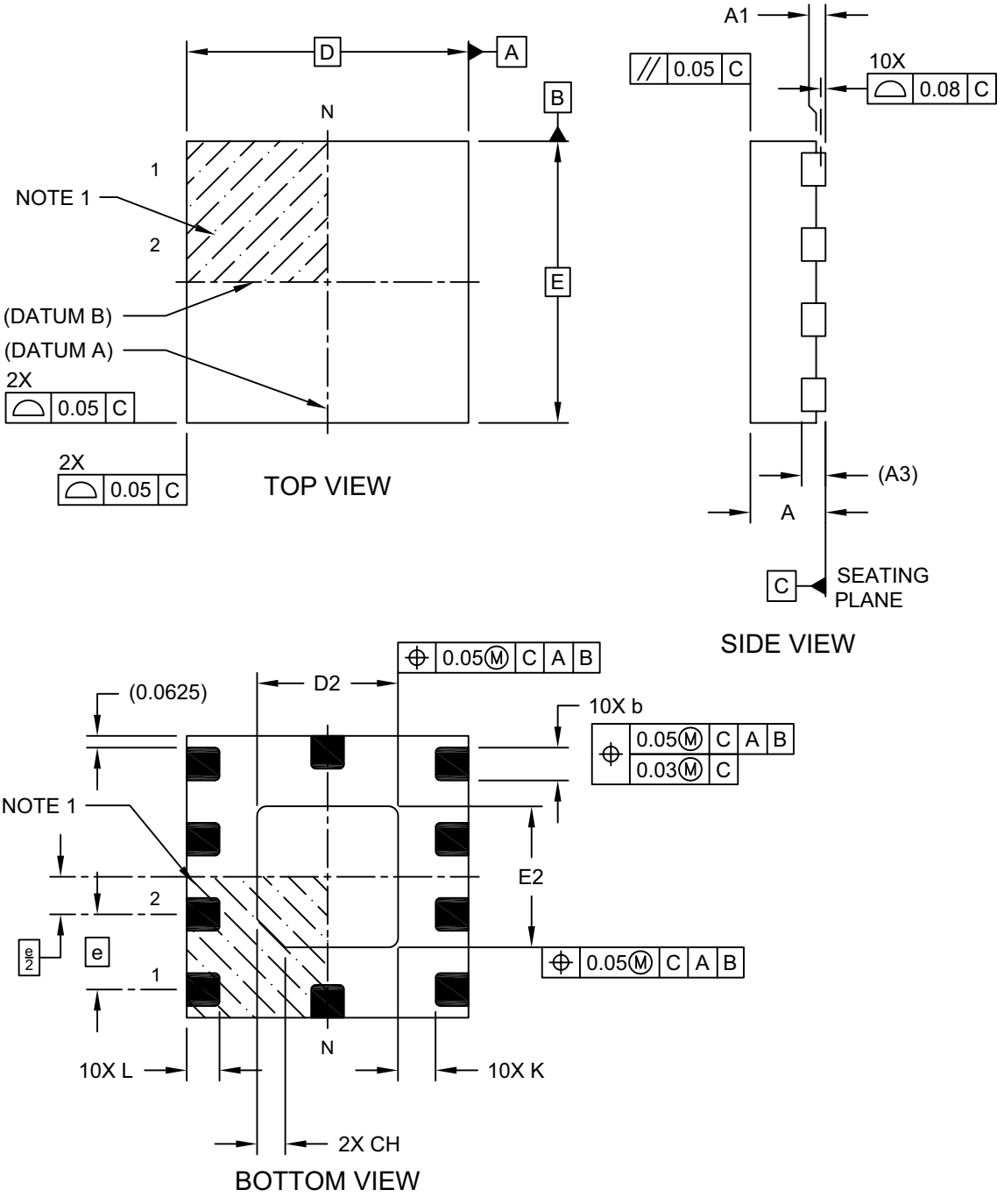


Notes:

1. The capacitor should be placed close to the PA
2. V_{CC1} and V_{CC2} must be separated by a short inductive trace. This can be replaced by a 1 nH inductor if prefered.

10-Lead Super-Thin Plastic Quad Flat, No Lead Package (9X) - 1.5x1.5 mm Body [X2QFN]. 0.75x0.75 mm Exposed Pad

Note:	For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Microchip Technology Drawing C04-376A Sheet 1 of 2

10-Lead Super-Thin Plastic Quad Flat, No Lead Package (9X) - 1.5x1.5 mm Body [X2QFN]. 0.75x0.75 mm Exposed Pad

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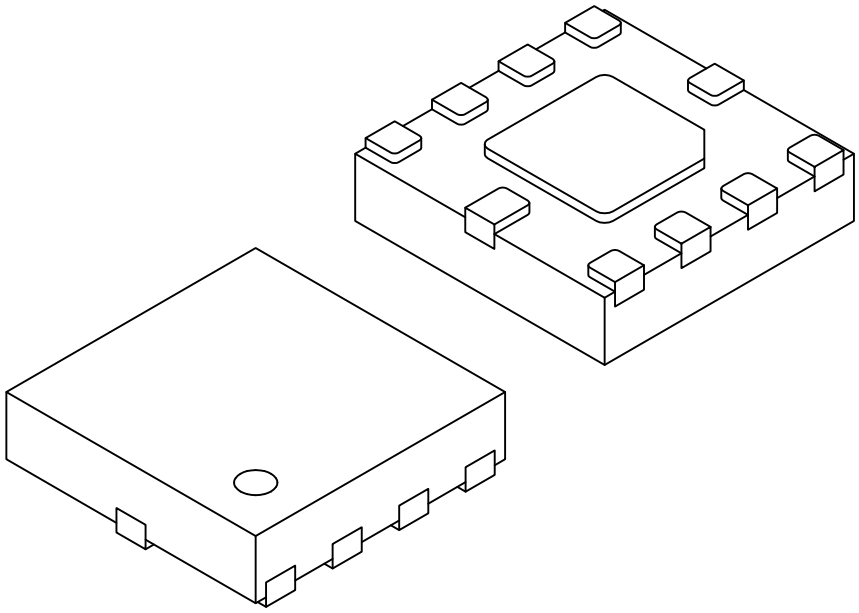

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Terminals	N		10	
Pitch	e		0.40 BSC	
Overall Height	A	0.30	0.35	0.40
Standoff	A1	0.00	0.02	0.05
Terminal Thickness	(A3)		0.127 REF	
Overall Width	E		1.50 BSC	
Exposed Pad Width	E2	0.70	0.75	0.80
Overall Length	D		1.50 BSC	
Exposed Pad Length	D2	0.70	0.75	0.80
Exposed Pad Corner Chamfer	CH	-	0.15	-
Terminal Width	b	0.125	0.175	0.225
Terminal Length	L	0.125	0.175	0.225
Terminal-to-Exposed-Pad	K	0.20	-	-

Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Package is saw singulated
3. Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

REF: Reference Dimension, usually without tolerance, for information purposes only.

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TABLE 5-1: REVISION HISTORY

Revision	Description	Date
A	• Initial release of data sheet	Apr 2015

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PART NO. **XXX**

Device **Package**

Device:	SST12LP17A	= 2.4 GHz High-Gain, High-Efficiency Power Amplifier
Package:	9X	= X2QFN (1.5mm x 1.5mm), 0.4 max thickness 10-contact
Evaluation Kit Flag	K	= Evaluation Kit

Valid Combinations:

SST12LP17A-9X
SST12LP17A-9X-K

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