A Microchip Technology Company

2.4 GHz High-Efficiency, High-Gain Power Amplifier

SST12LP18E

Data Sheet

The SST12LP18E is a versatile power amplifier based on the highly-reliable InGaP/GaAs HBT technology. The SST12LP18E is a 2.4 GHz high-efficiency Power Amplifier designed in compliance with IEEE 802.11b/g/n/ac applications. It typically provides 25 dB gain with 32% power-added efficiency, while meeting 802.11g spectrum mask at 21.5 dBm. The SST12LP18E can be configured for high-linearity for 802.11ac operation or for high-power, high-efficiency operation. This power amplifier also features easy board-level usage along with high-speed power-up/down control through a single reference voltage pin and is offered in a 8-contact XSON package.

Features

- **High gain:**
  - Typically 25 dB gain across 2.4~2.5 GHz
- **High linear output power:**
  - >26 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
  - Meets 802.11b ACPR requirement up to 22.5 dBm
  - ~3% added EVM up to 18 dBm for 54 Mbps 802.11g signal
  - 17 dBm at 1.8% EVM, 802.11ac, 256 QAM, 2.4 GHz
- **High power-added efficiency/Low operating current for 802.11b/g/n applications**
  - ~32%/135 mA @ P_{OUT} = 21.5 dBm for 802.11g
  - ~36%/150 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 for high-efficiency operation**
  - ~50 mA I_{CQ}
- **High-speed power-up/down control**
  - 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)**
- **Limited variation over temperature**
  - ~1 dB gain/power variation between -20°C to +85°C
- **Excellent on-chip power detection**
  - >15 dB dynamic range on-chip power detection
  - Temperature and VSWR insensitive
- **Simple output matching**
- **Packages available**
  - 8-contact XSON – 2mm x 2mm
- **All non-Pb (lead-free) devices are RoHS compliant**

Applications

- **WLAN (IEEE 802.11b/g/n/ac)**
- **Home RF**
- **Cordless phones**
- **2.4 GHz ISM wireless equipment**

Product Description

The SST12LP18E is a versatile power amplifier based on the highly-reliable InGaP/GaAs HBT technology.

The SST12LP18E is a 2.4 GHz high-efficiency Power Amplifier designed in compliance with IEEE 802.11b/g/n/ac applications. It typically provides 25 dB gain with 32% power-added efficiency (PAE) @ POUT = 21.5 dBm for 802.11g and 36% PAE @ POUT = 22.5 dBm for 802.11b.

The SST12LP18E has excellent linearity, typically ~3% added EVM at 18 dBm output power which is essential for 54 Mbps 802.11g operation while meeting 802.11g spectrum mask at 21.5 dBm. SST12LP18E can also be configured for high-linearity with EVM <1.8% at typically 17 dBm for 802.11ac operation.

The SST12LP18E 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 SST12LP18E controllable by an on/off switching signal directly from the baseband chip. These features, coupled with low operating current, make the SST12LP18E ideal for the final stage power amplification in battery-powered 802.11b/g/n/ac WLAN transmitter applications.

The SST12LP18E has an excellent on-chip, single-ended power detector, which features wide-range (>15 dB) with dB-wise linear operation. The excellent on-chip power detector is both temperature and VSWR insensitive; therefore, it provides a reliable solution to board-level power control.

The SST12LP18E is offered in 8-contact XSON package. See Figure 2 for pin assignments and Table 1 for pin descriptions.

Functional Blocks

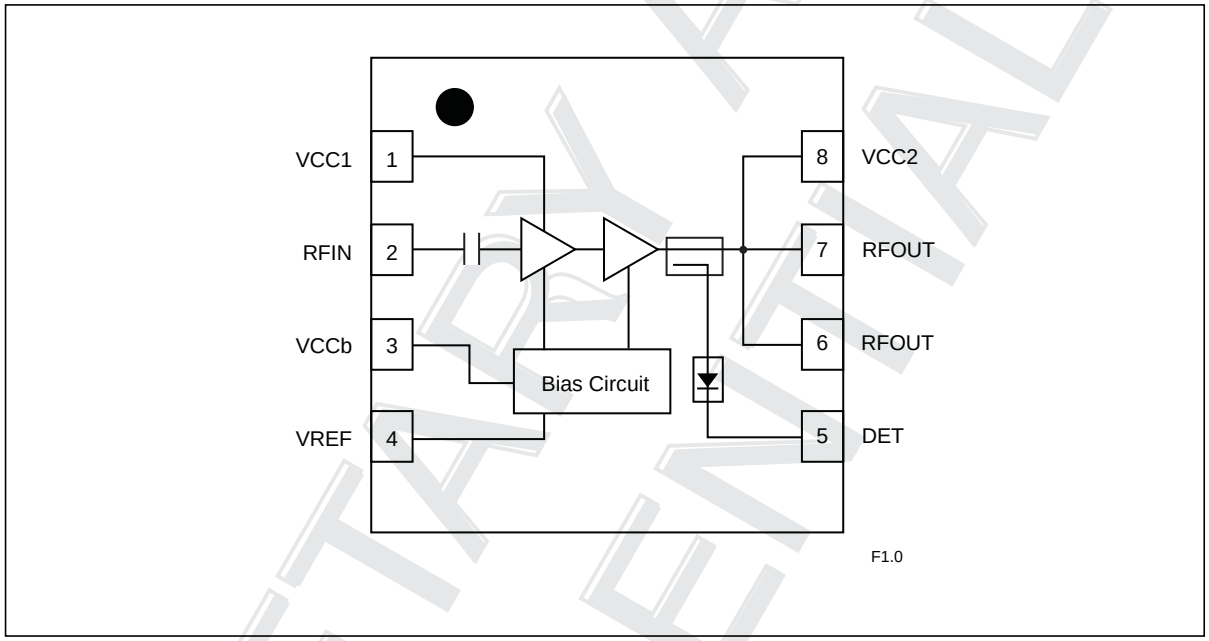

Figure 1: Functional Block Diagram

Pin Assignments

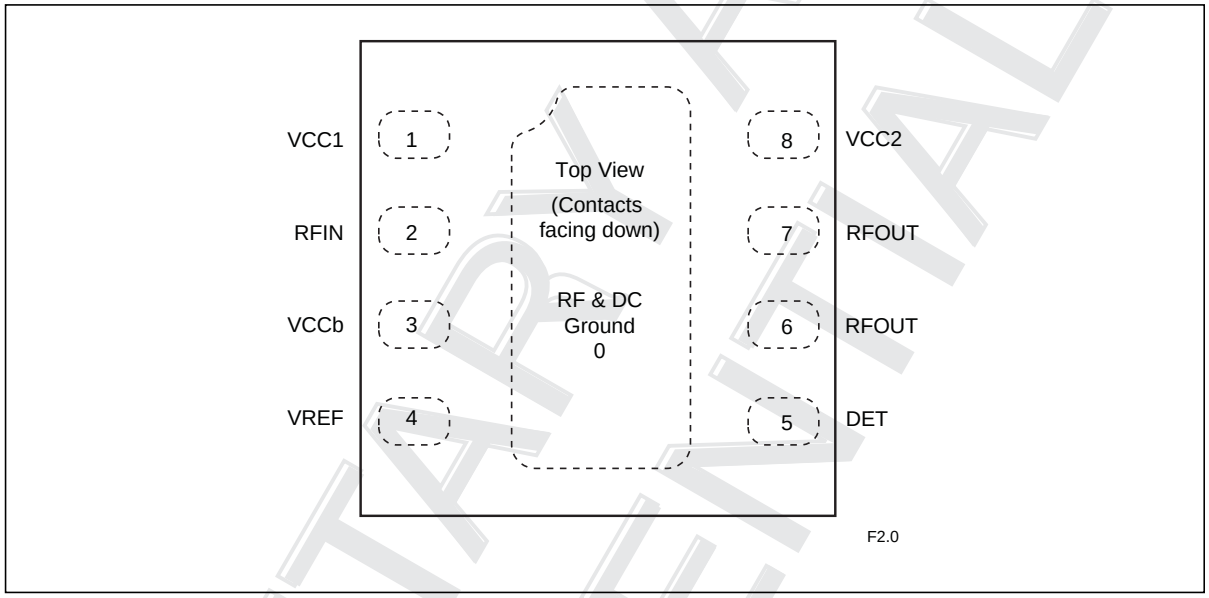

Figure 2: Pin Assignments for 8-contact XSON

Pin Descriptions

Table 1: Pin Description

Symbol	Pin No.	Pin Name	Type[1]	Function
GND	0	Ground		Low inductance GND pad
V_{CC1}	1	Power Supply	PWR	Power supply, 1st stage
RF_{IN}	2		I	RF input, DC decoupled
V_{CCb}	3	Power Supply	PWR	Supply voltage for bias circuit
VREF	4		PWR	1st and 2nd stage idle current control
Det	5		O	On-chip power detector
RFOUT	6		O	RF output
RFOUT	7		O	RF output
V_{CC2}	8	Power Supply	PWR	Power supply, 2nd stage

T1.0 75003

1. I=Input, O=Output

Electrical Specifications

The DC and RF specifications for the power amplifier are specified below. Refer to Table 3 for the DC voltage and current specifications. Refer to Figures 3 through 13 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 pin 2 (P_{IN}) . . . . . +5 dBm
Average output power (P_{OUT})[1] . . . . . +26 dBm
Supply Voltage at pins 1, 3, and 8(V_{CC}) . . . . . -0.3V to +4.2V
Reference voltage to pin 4 (V_{REF}) . . . . . -0.3V to +3.3V
DC supply current (I_{CC})[2] . . . . . 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

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. Measured with 100% duty cycle 54 Mbps 802.11g OFDM Signal

Table 2: Operating Range

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

T2.1 75003

Table 3: DC Electrical Characteristics at 25°C for High-Linearity Configurations[1]

Symbol	Parameter	Min.	Typ	Max.	Unit
V_{CC}	Supply Voltage at pins 1,3,and 8	3.0	3.3	3.6	V
I_{CQ}	Idle current to meet EVM ~1.8% @ 17 dBm Output Power with 802.11g OFDM 54 Mbps signal		110		mA
I_{CC}	Current Consumption @ 18 dBm Output Power with 802.11g OFDM 54 Mbps signal		140		
	Current Consumption to meet 802.11g OFDM 6 Mbps Spectrum mask @ 21.5 dBm Output Power		170		mA
	Current Consumption to meet 802.11b DSSS 1 Mbps Spectrum mask @ 22.5 dBm Output Power		180		mA
V_{REG}	Reference Voltage with 0Ω resistor	2.7	2.8	2.9	V

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1. See Figure 8

Table 4: DC Electrical Characteristics at 25°C for High-Efficiency Configurations[1]

Symbol	Parameter	Min.	Typ	Max.	Unit
V_{CC}	Supply Voltage at pins 1,3,and 8	3.0	3.3	3.6	V
I_{CQ}	Idle current to meet EVM ~3% @ 18 dBm Output Power with 802.11g OFDM 54 Mbps signal		50		mA
I_{CC}	Current Consumption @ 18 dBm Output Power with 802.11g OFDM 54 Mbps signal		95		
	Current Consumption to meet 802.11g OFDM 6 Mbps Spectrum mask @ 21.5 dBm Output Power		135		mA
	Current Consumption to meet 802.11b DSSS 1 Mbps Spectrum mask @ 22.5 dBm Output Power		150		mA
V_{REG}	Reference Voltage with 360Ω resistor	2.7	2.8	2.9	V

T4.1 75003

1. See Figure 14

Table 5: RF Electrical Characteristics at 25°C

Symbol	Parameter	Min.	Typ	Max.	Unit
F_{L-U}	Frequency range	2412		2484	MHz
G	Small signal gain	24	25		dB
G_{VAR1}	Gain variation over band (2412–2484 MHz)			±0.5	dB
G_{VAR2}	Gain ripple over channel (20 MHz)		0.2		dB
EVM	EVM@ 18 dBm Output Power with 802.11g OFDM 54 Mbps signal[1]		3.0		%
	EVM@ 17 dBm Output Power with 802.11ac 20 MHz BW[2]		1.8		%
P_{OUT}	Output Power to meet 802.11g OFDM 6 Mbps Spectrum mask	20.5	21.5		dBm
	Output Power to meet 802.11b DSSS 1 Mbps Spectrum mask	21.5	22.5		dBm
2f, 3f, 4f, 5f	Harmonics at 23 dBm, without external filters			-30	dBc

T5.2 75003

1. See Figure 14
2. See Figure 8

Table 6: Typical Performance with Different Bias Options for High-Efficiency Configuration

V_{REG} (V)	R1[1] (Ω)	I_{CQ}[2] (mA)	I_{CC} @ P_{OUT}= 18 dBm[2] (mA)	Typical Performance with Each Biased Option
2.85	500	45	95	Meet added EVM < 3% up to 18 dBm output power at -40ºC
2.80	360	50	95	Meet added EVM < 3% up to 18 dBm output power at -40ºC
2.70	180	50	95	Meet added EVM < 3% up to 18 dBm output power at -20ºC
2.70	33	72	110	Meet added EVM < 3% up to 18 dBm output power at -40ºC
2.70	0	82	120	Meet added EVM < 3% up to 18 dBm output power at -40ºC

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1. See Figure 14
2. At room temperature

Typical Performance Characteristics

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

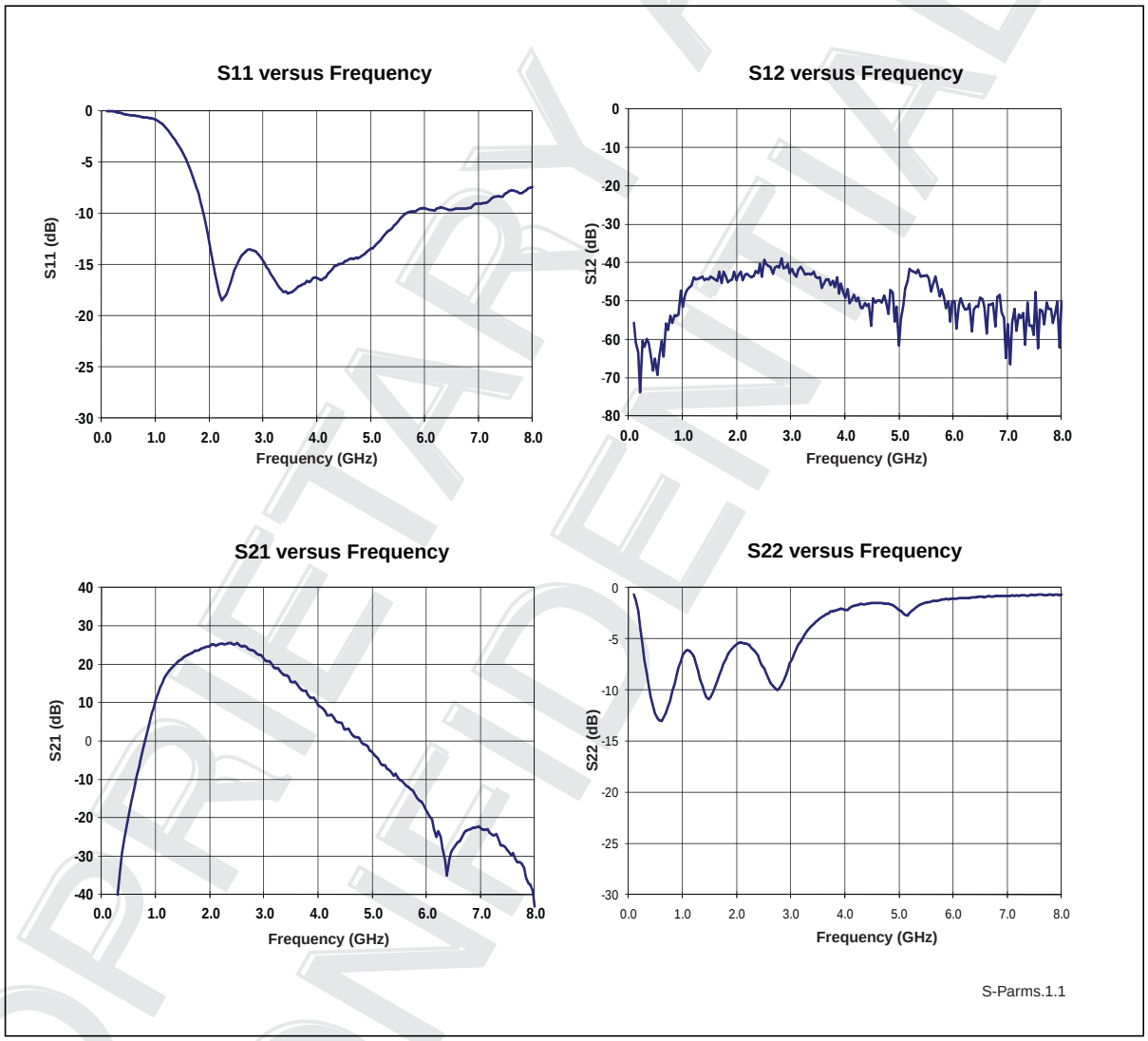


Figure 3: S-Parameters

High-Linearity Configuration for 802.11b/g/n/ac

Typical Performance Characteristics

Test Conditions: V_{CC} = 3.3V, V_{REF} = 2.8V, T_A = 25°C, 54 Mbps 802.11g OFDM Signal; Equalizer Training Setting using Channel Estimation Sequence Only

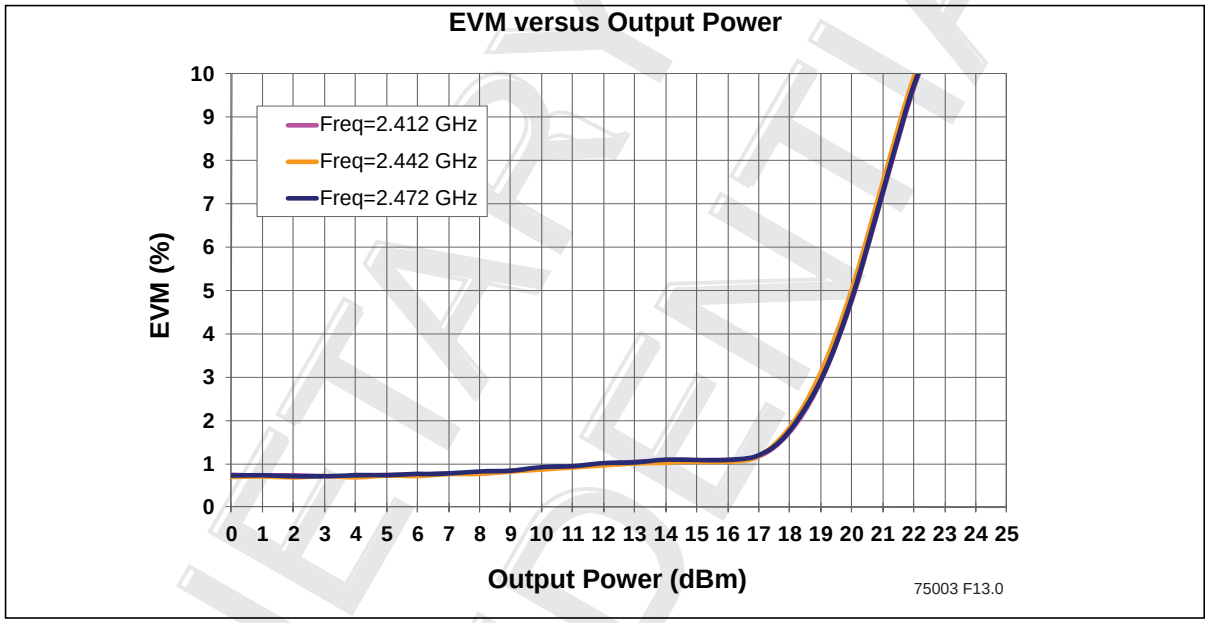


Figure 4: EVM versus Output Power

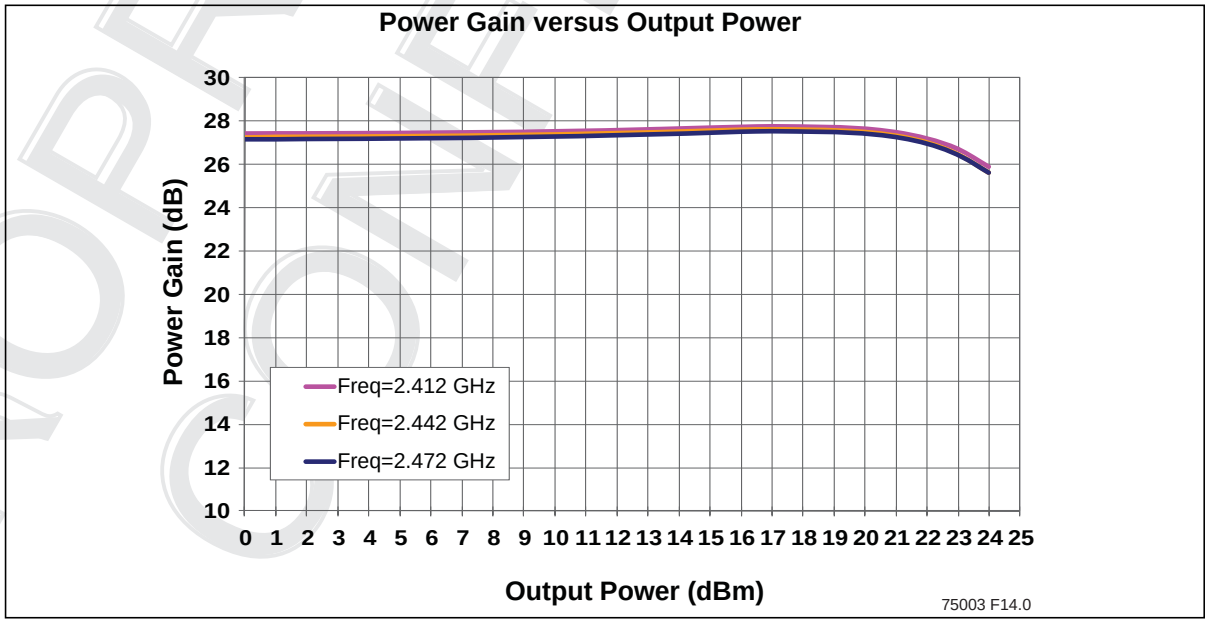


Figure 5: Power Gain versus Output Power

High-Linearity Configuration (continued)

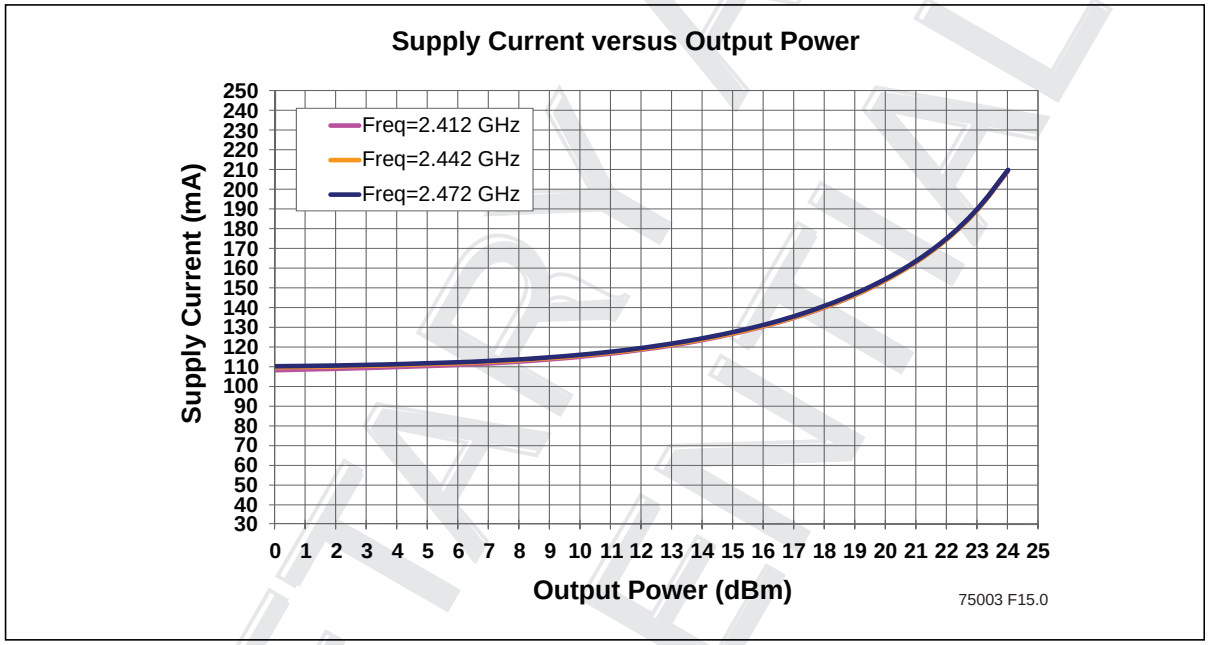


Figure 6: Total Current Consumption for 802.11g operation versus Output Power

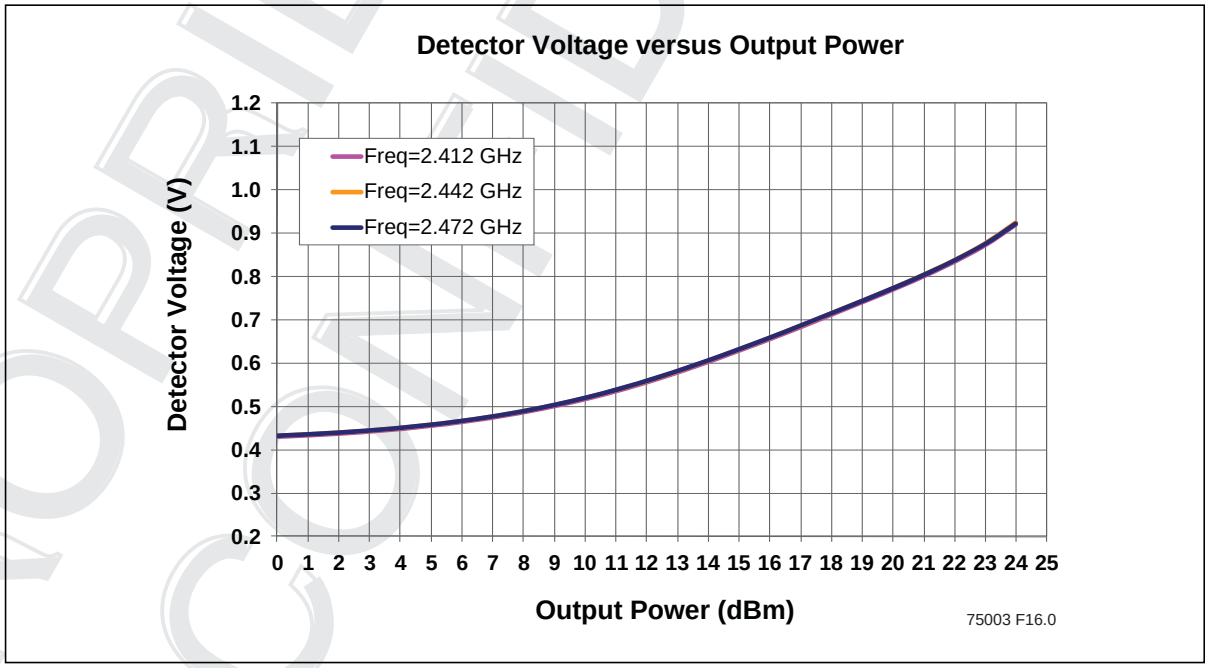


Figure 7: Detector Characteristics versus Output Power

High-Linearity Configuration (continued)

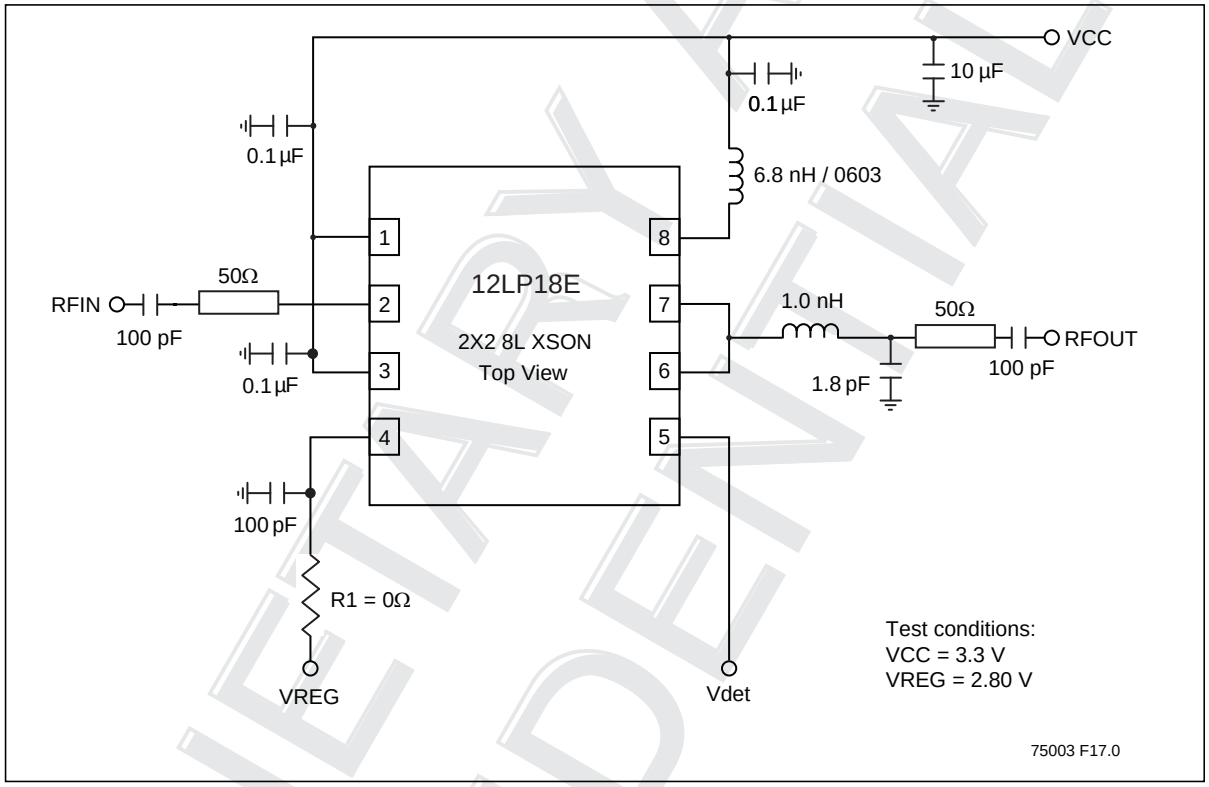


Figure 8: Typical Schematic for High-Linearity 802.11b/g/n/ac Applications

High-Efficiency Configuration for 802.11b/g/n Operation

Typical Performance Characteristics

Test Conditions: V_{CC} = 3.3V, V_{REF} = 2.8V, T_A = 25°C, 54 Mbps 802.11g OFDM Signal; Equalizer Training Setting using Channel Estimation Sequence Only

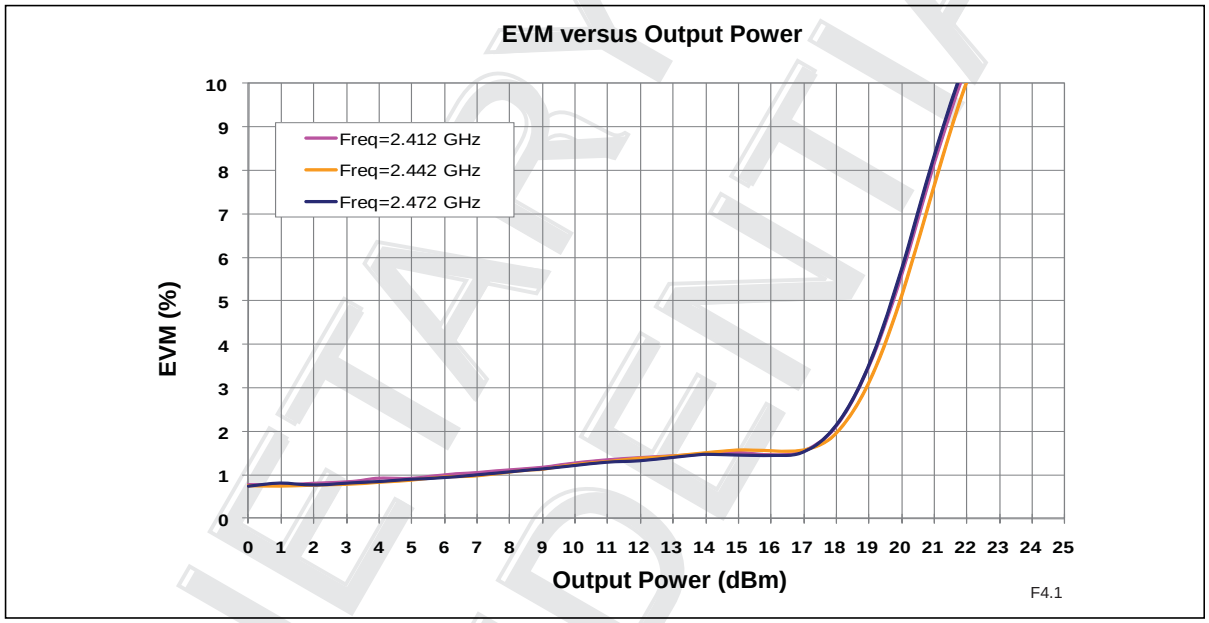


Figure 9: EVM versus Output Power

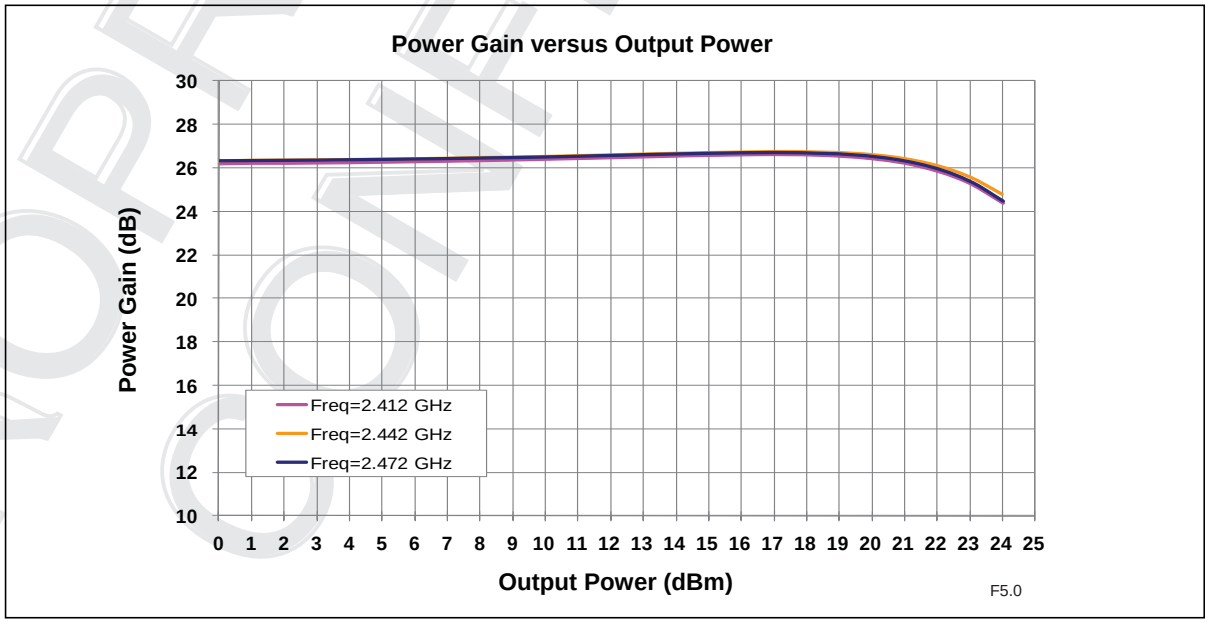


Figure 10: Power Gain versus Output Power

High-Efficiency Configuration (continued)

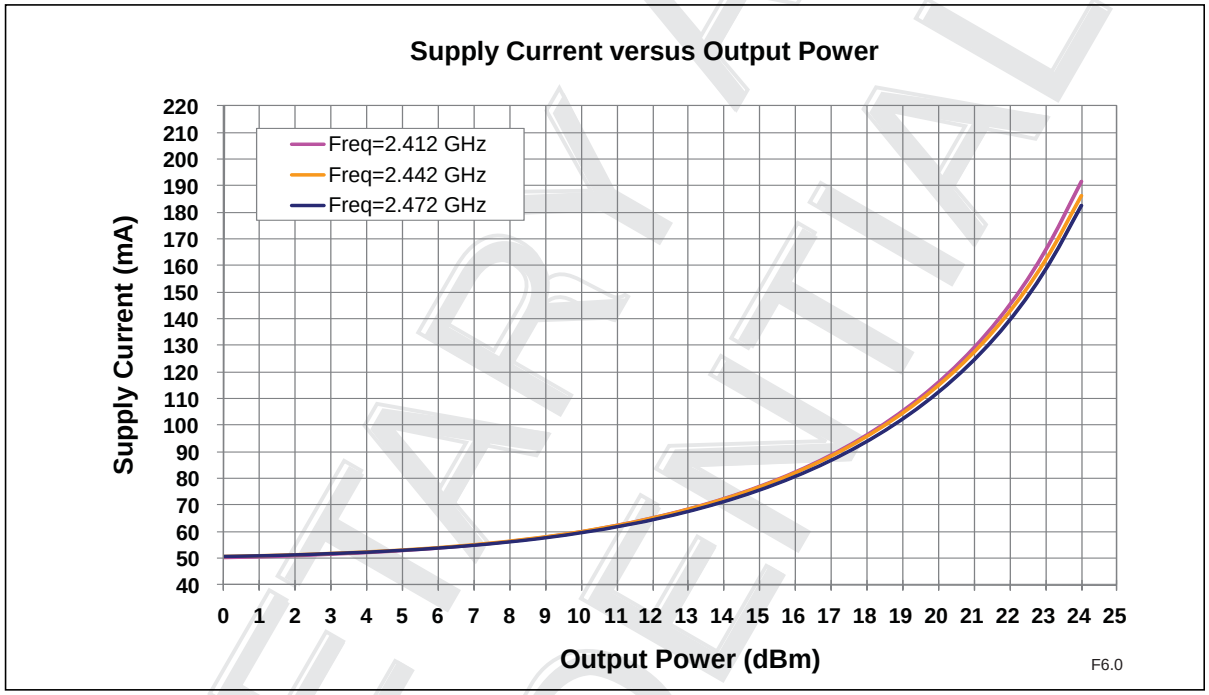


Figure 11: Total Current Consumption for 802.11g operation versus Output Power

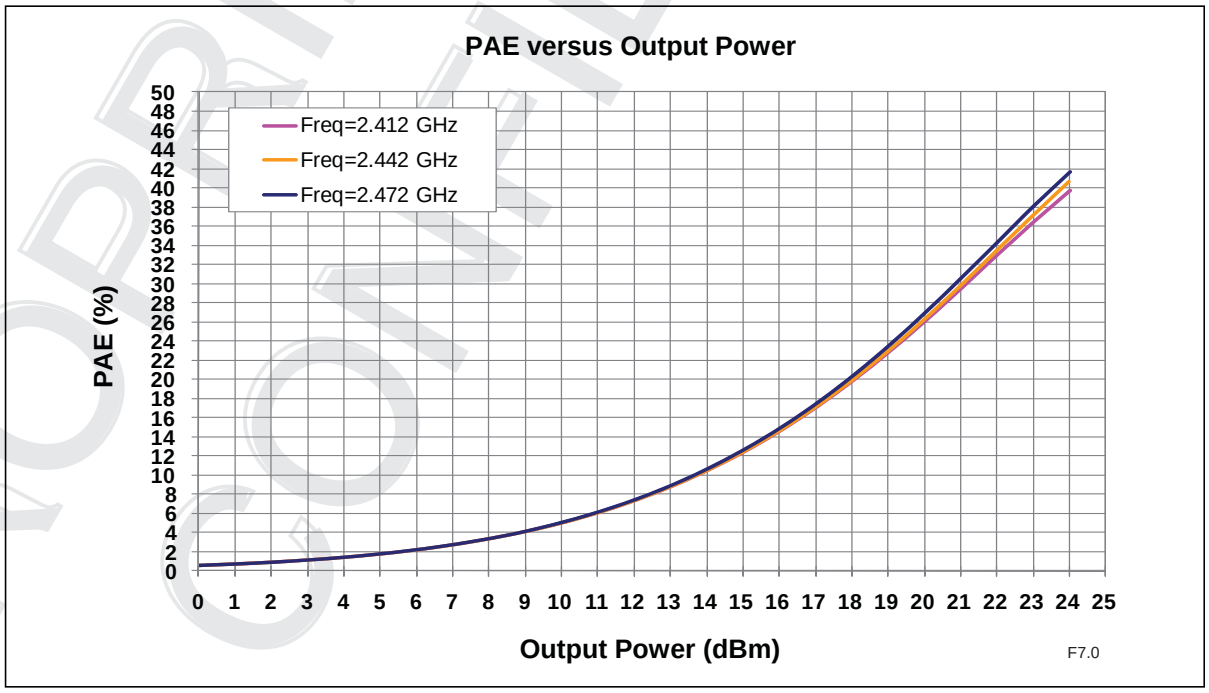


Figure 12: PAE versus Output Power

High-Efficiency Configuration (continued)

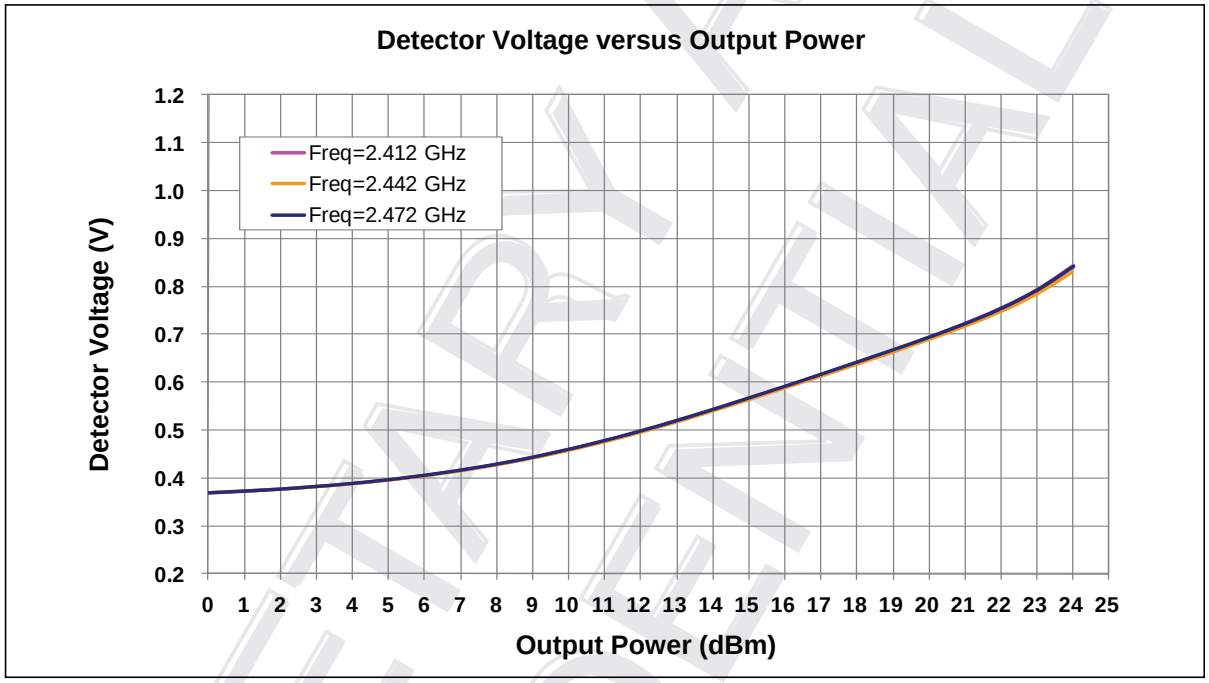


Figure 13: Detector Characteristics versus Output Power

High-Efficiency Configuration (continued)

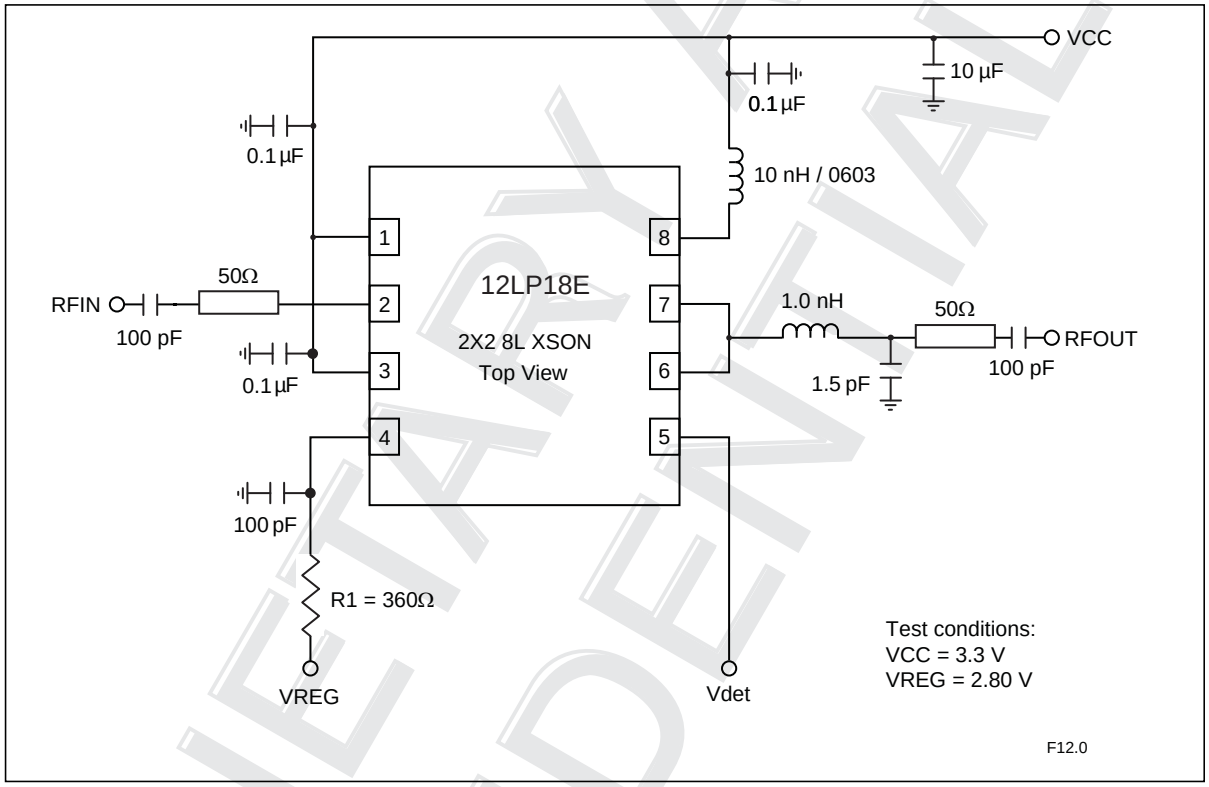
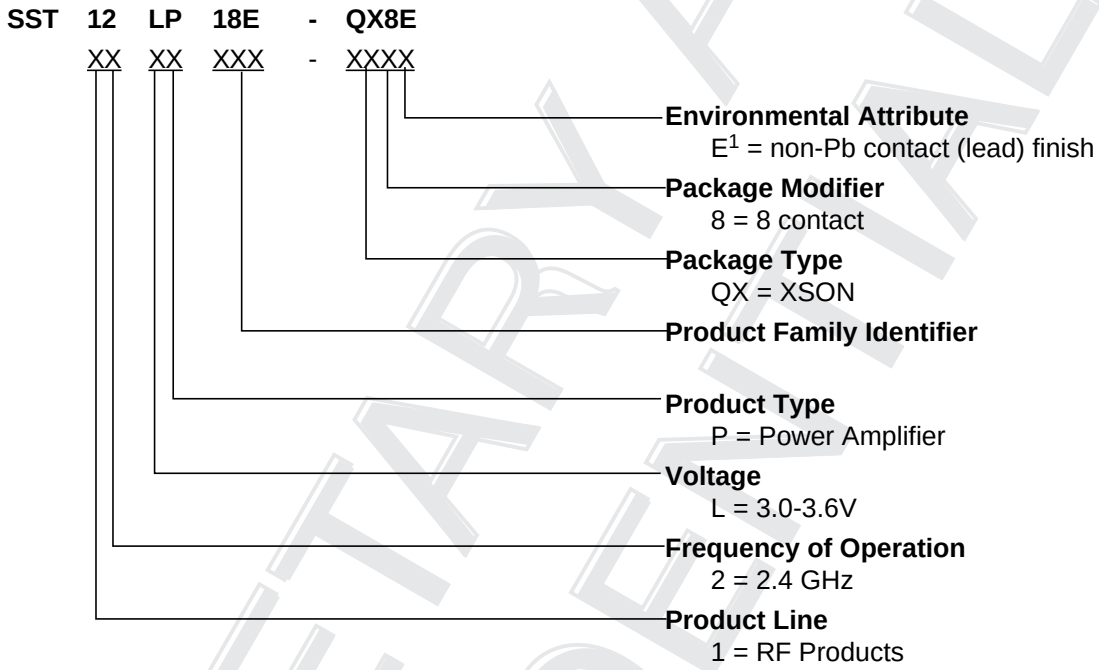


Figure 14: Typical Schematic for High-Efficiency 802.11b/g/n Applications

Product Ordering Information



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

Valid combinations for SST12LP18E

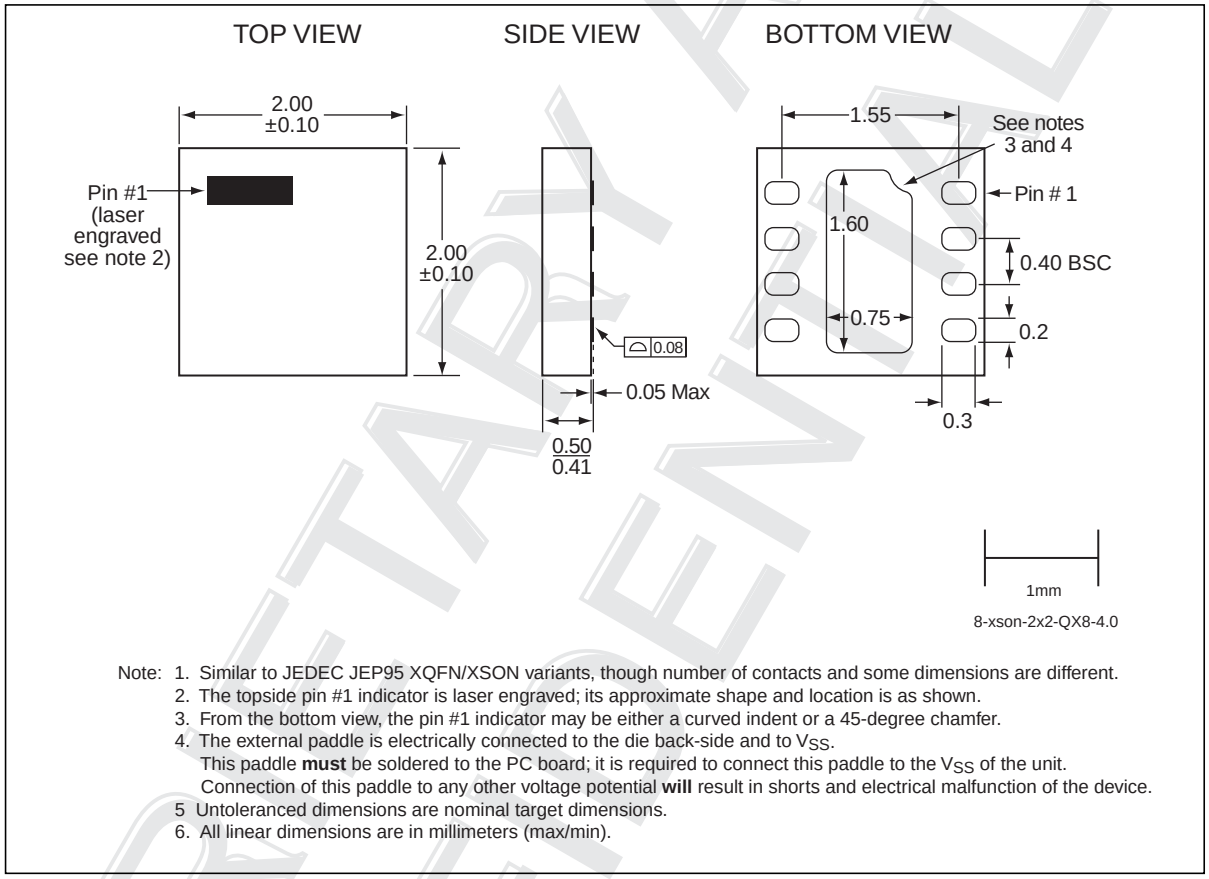
SST12LP18E-QX8E

SST12LP18E Evaluation Kits

SST12LP18E-QX8E-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



Note: 1. Similar to JEDEC JEP95 XQFN/XSON variants, though number of contacts and some dimensions are different.
2. The topside pin #1 indicator is laser engraved; its approximate shape and location is as shown.
3. From the bottom view, the pin #1 indicator may be either a curved indent or a 45-degree chamfer.
4. The external paddle is electrically connected to the die back-side and to V_{SS}.
This paddle **must** be soldered to the PC board; it is required to connect this paddle to the V_{SS} of the unit.
Connection of this paddle to any other voltage potential **will** result in shorts and electrical malfunction of the device.
5 Untoleranced dimensions are nominal target dimensions.
6. All linear dimensions are in millimeters (max/min).

Figure 15: 8-Contact Extremely-thin Small Outline No-lead (XSON)
SST Package Code: QX8

Table 7: Revision History

Revision	Description	Date
A	• Initial release of data sheet	Mar 2011
B	• Revised “Electrical Specifications” on page 5 from 4.0V max stress to 4.6V • Updated Figure 9 on page 11 to show “sequence only” EVM response	Mar 2012
C	• Added Figures 9-8 on pages 11-10 to provide High-Linearity information • Updated Table 5 on page 6 • Updated Figure 15 on page 16 to reflect new pin 1 indicator • Clarified Features on page 1	Jul 2012

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