Applications

- Bluetooth™ wireless technology (Class 1)
- USB dongles
- PCMCIA, flash cards
- Access points
- 2.4 GHz cordless telephone

Features

- +22.5 dBm Output Power
- Low current 108 mA typical @ P_{OUT} = +20 dBm
- CMOS Enable Interface
- Power-control and power-down modes
- 3.3 V single supply operation
- Thin, lead-free 6 pin QFN package

Ordering Information

Part Number	Package	Remark
PA2423U	6 pin QFN (0.5 mm height)	Samples
PA2423U-R	6 pin QFN (0.5 mm height)	Tape & Reel
PA2423U-EV1	Evaluation Kit	

Product Description

A monolithic, high-efficiency, silicon-germanium power amplifier IC, the PA2423U is designed for 2.4 GHz wireless applications, including Bluetooth™ Class1 and 2.4 GHz cordless telephone applications. It delivers +22.5 dBm output power making it capable of overcoming insertion losses of up to 2.5 dB between amplifier output and antenna input.

The PA2423U provides a digital control input for controlling power up and power down modes of operation.

The PA2423U operates at 3.3 V DC. At typical output power level (+22.5 dBm), the current consumption is 135 mA.

The silicon/silicon-germanium structure of the PA2423U, and its exposed die-pad package, soldered to the system PCB, provide high thermal conductivity and a subsequently low junction temperature. This device is capable of operating at a duty cycle of 100 percent. The device is pin for pin compatible to the PA2423L.

Functional Block Diagram

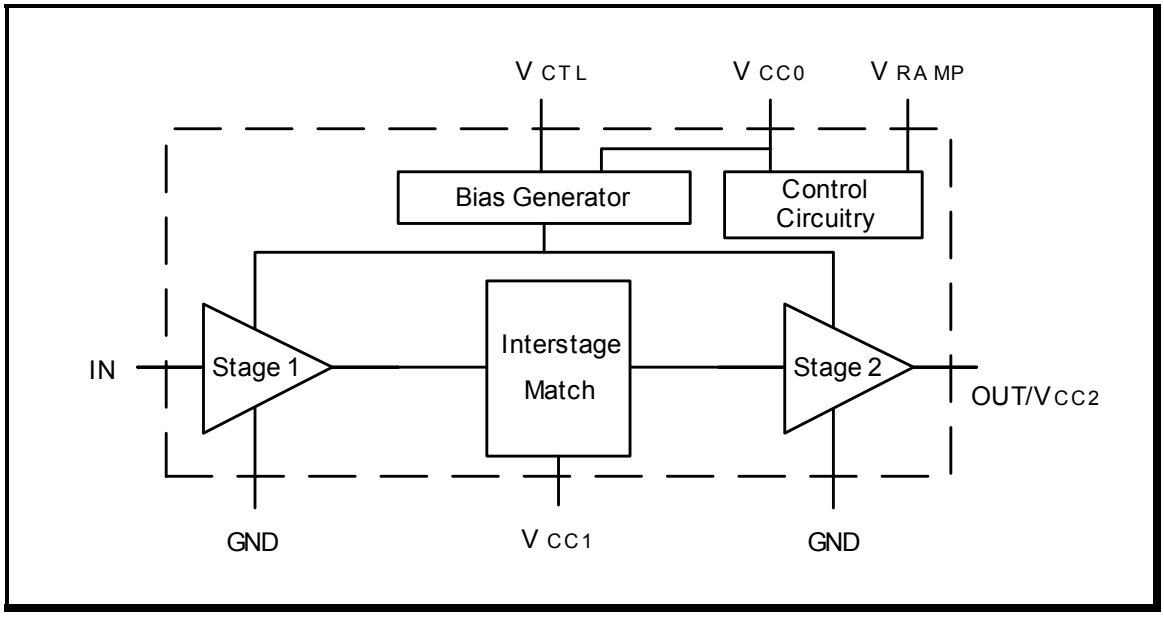


Figure 1: PA2423U Block Diagram

Pin-Out Diagram

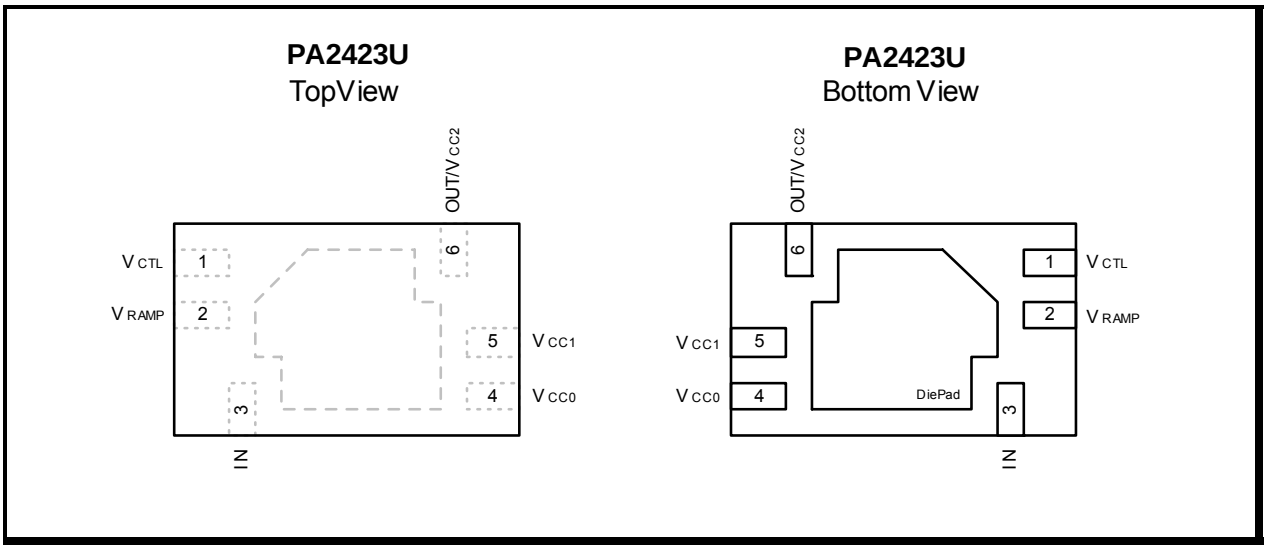


Figure 2: PA2423U Pin-Out

Pin Out Description

Pin No.	Name	Description
1	V_{CTL}	Controls the output level of the power amplifier. An analog control signal between 0 V and V_{CC} varies the PA output power between minimum and maximum values
2	V_{RAMP}	Power Amplifier Enable pin. A digital control signal with logic high (power up) and logic low (power down) is used to turn the device on and off.
3	IN	Power amplifier RF input, external input matching network with DC blocking is required
4	V_{CC0}	Bias supply voltage
5	V_{CC1}	Stage 1 collector supply voltage, external inter-stage matching network is required
6	OUT/V_{CC2}	PA Output and Stage2 collector supply voltage, external output matching network with DC blocking is required
Die Pad	GND	Heatslug Die Pad is ground

Absolute Maximum Ratings

Operation in excess of any one of above Absolute Maximum Ratings may result in permanent damage. This device is ESD sensitive. Handling and assembly of this device should be at ESD protected workstations.

Symbol	Parameter	Min.	Max.	Unit
V_{CC}	Supply Voltage	-0.3	+3.6	V
V_{CTL}	Control Voltage	-0.3	V_{CC}	V
V_{RAMP}	Ramping Voltage	-0.3	V_{CC}	V
IN	RF Input Power	-	+8	dBm
T_A	Operating Temperature Range	-40	+85	°C
T_{STG}	Storage Temperature Range	-40	+150	°C
T_j	Maximum Junction Temperature	-	+150	°C

DC Electrical Characteristics

Conditions: $V_{CC0} = V_{CC1} = V_{CC2} = V_{RAMP} = V_{CTL} = 3.3$ V, $P_{IN} = 0$ dBm, $T_A = 25$ °C, f = 2.45 GHz, input and output externally matched to 50Ω unless otherwise noted.

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{CC}	Supply Voltage	2.7	3.3	3.6	V
I_{CC}	Supply Current ($I_{CC} = I_{VCC0} + I_{VCC1} + I_{VCC2}$), $V_{CTL} = 3.3$ V, $P_{OUT\_MAX} \leq 22.5$ dBm	-	135	160	mA
ΔIcc_{TEMP}	Supply Current variation over temperature from $T_A = 25$ °C (-40 °C < T_A < +85 °C)	-	25	-	%
V_{CTL}	PA Output Power Control Voltage Range	0	-	V_{CC}	V
I_{CTL}	Current sunk by V_{CTL} pin	-	200	250	µA
V_{RAMP}	Logic High Voltage	2.0	-	-	V
	Logic Low Voltage	-	-	0.8	V
I_{stdby}	Leakage Current when $V_{RAMP} = 0$ V, No RF, V_{CTL} = high	-	0.5	10	µA

AC Electrical Characteristics

Conditions: V_{CC0} = V_{CC1} = V_{CC2} = V_{RAMP} = V_{CTL} = 3.3 V, P_{IN} = 0 dBm T_A = 25 °C, f = 2.45 GHz, input and output externally matched to 50Ω unless otherwise noted.

Symbol	Parameter	Min.	Typ.	Max.	Unit
f_{L-U}	Frequency Range	2400	-	2500	MHz
P_{OUT_MAX}	Output Power @ V_{CTL} = 3.3 V	20.0	22.5	-	dBm
P_{OUT_MIN}	Output Power @ V_{CTL} = 0.4 V	-	-20	0	dBm
ΔP_{temp}	Output Power variation over temperature (-40 °C < T_A <+85 °C)	-	1	2	dB
dP_{OUT} /d V_{CTL}	Control Voltage Sensitivity	-	-	120	dBm/V
G_{SS}	Gain @ P_{IN} = -25 dBm	25.5	28.5	-	dB
G_{VAR}	Gain Variation over band (2400-2500 MHz)	-	0.2	1.0	dB
2f	Harmonics	-	-45	-30	dBc
3f,		-	-40	-35	
$IS_{21}I_{OFF}$	Isolation in “OFF” State, V_{RAMP} = 0 V	15	36	-	dB
$IS_{12}I$	Reverse Isolation	32	42	-	dB
STAB	Stability (P_{IN} = 0 dBm, Load VSWR = 6:1)	All non-harmonically related outputs less than -50 dBc			

Typical Performance Characteristics

Test Conditions: SiGe PA2423U-EV1: V_{CC0} = V_{CC1} = V_{CC2} = V_{RAMP} = V_{CTL} = 3.3 V, P_{IN} = 0 dBm, T_A = 25 °C, f = 2.45 GHz, input and output externally matched to 50Ω unless otherwise noted

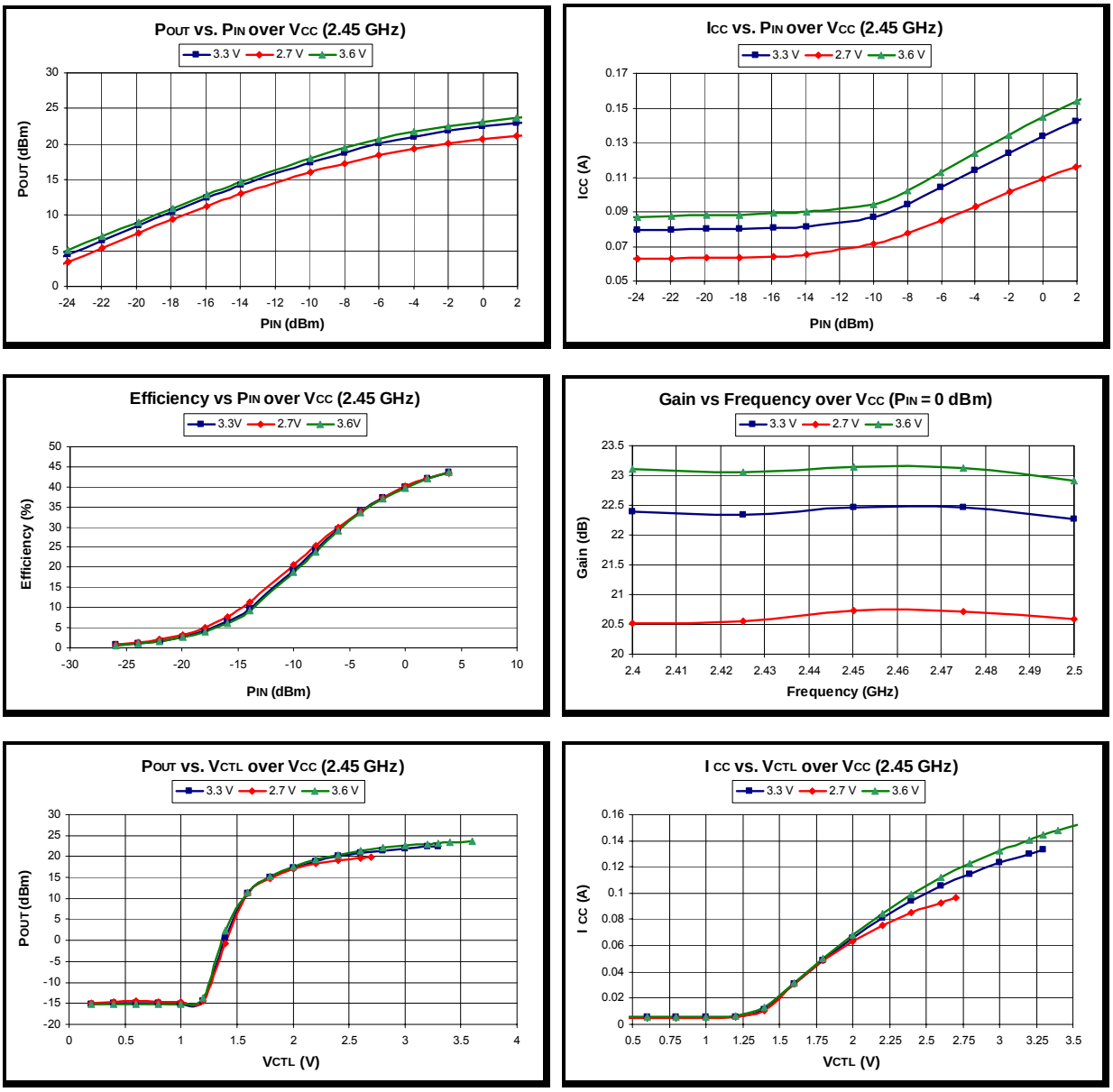


Figure 3: PA2423U Typical Performance Characteristics

Typical Performance Characteristics (Continued)

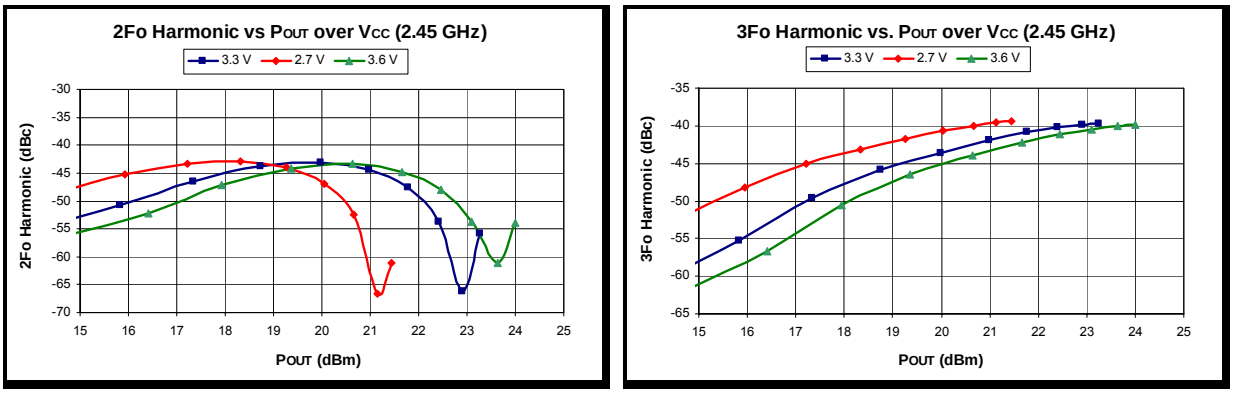


Figure 4: PA2423U Typical Performance Characteristics (Continued)

Application Circuit

Figure 5 is a representation of the PA2423U application circuit. For a detailed schematic and layout, refer to SiGe's PA2523U-EK1 Evaluation Kit Data Sheet (*Document Number: 131-DST-02*).

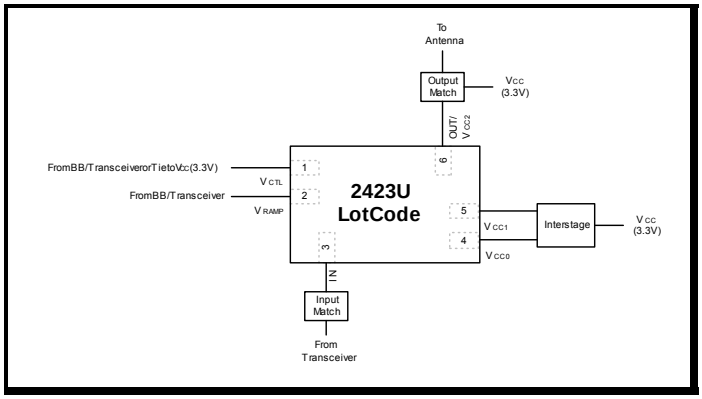


Figure 5: PA2423U Application Circuit

Branding Information

Figure 6 shows the branding for the PA2423U, including the Pin 1 location relative to the branding.

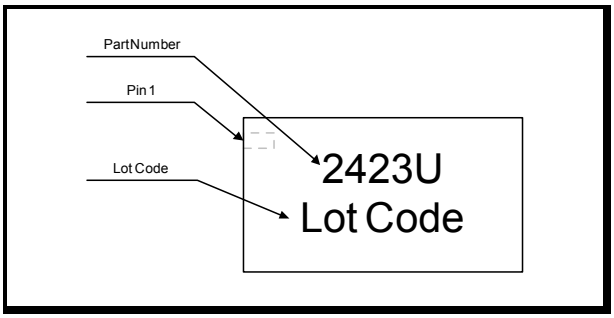


Figure 6: PA2423U Branding Information

Tape and Reel Information

Table 1 and Figure 7 show the PA2423U tape and reel information.

Parameter	Value
Reel Diameter	7 inches
Reel Width	8 mm
Units per Reel	3000

Table 1: PA2423U Tape and Reel Information

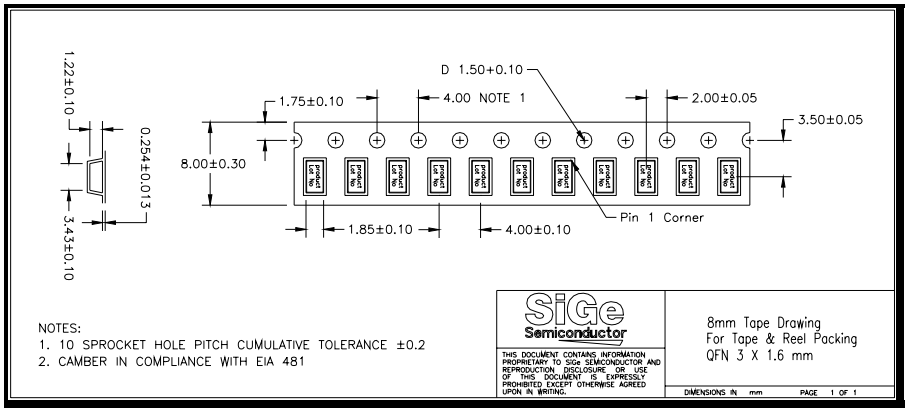
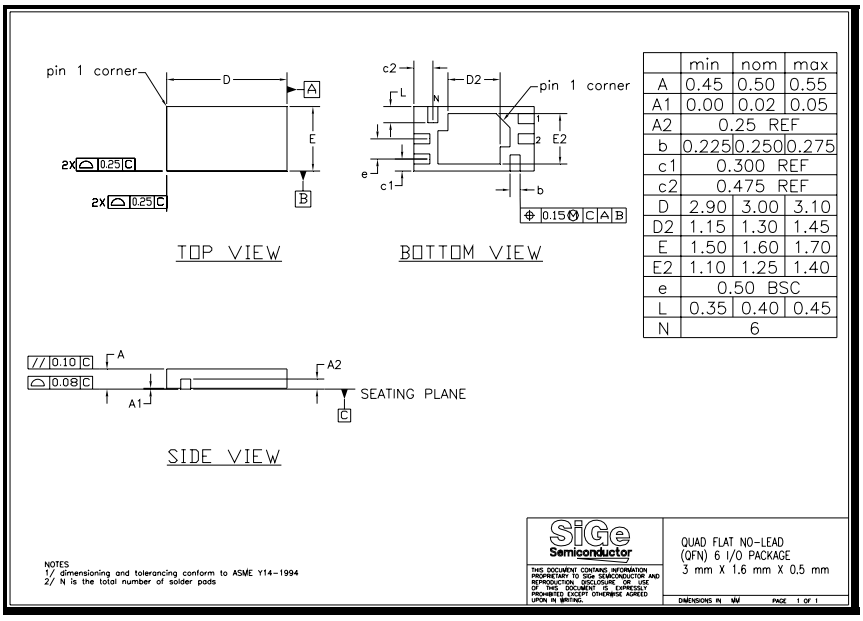


Figure 7: PA2423U Tape and Reel Diagram

Package Dimensions

The PA2423U is packaged in a 1.6 mm x 3.0 mm 6 pin QFN package, with a height of 0.5 mm. The detailed package drawing is shown in Figure 8. The underside of the package is an exposed die-pad structure. This allows for direct soldering to the PCB for enhanced thermal conductivity. The package dimensions are shown in the drawing below. The PA2423U is lead free.



	min	nom	max
A	0.45	0.50	0.55
A1	0.00	0.02	0.05
A2		0.25 REF	
b	0.225	0.250	0.275
c1		0.300 REF	
c2		0.475 REF	
D	2.90	3.00	3.10
D2	1.15	1.30	1.45
E	1.50	1.60	1.70
E2	1.10	1.25	1.40
e		0.50 BSC	
L	0.35	0.40	0.45
N		6	

Figure 8: PA2423U Package Drawing

Recommended Application PCB Footprint Layout

Figure 9 shows SiGe's recommended PA2423U Application PCB footprint.

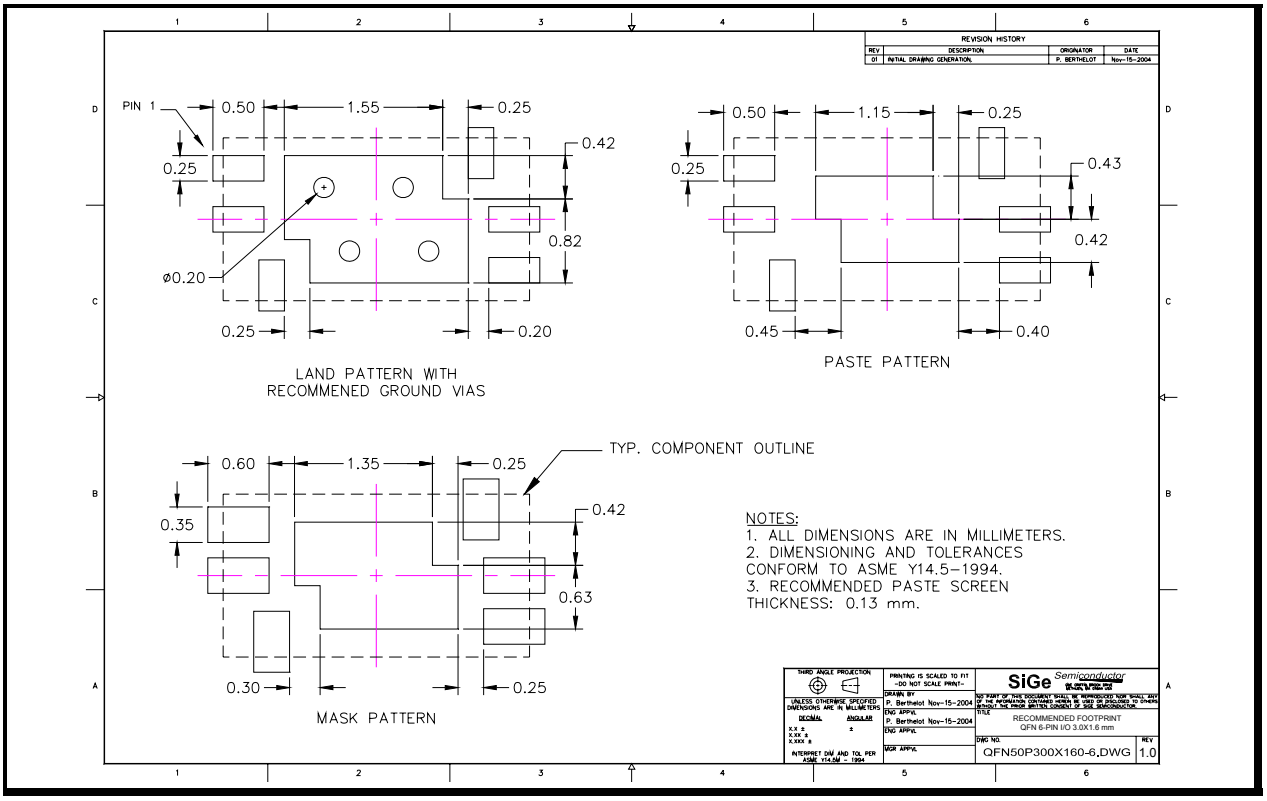


Figure 9: PA2423U Recommended Application PCB Footprint

Applications Information

For test and design purposes, SiGe Semiconductor offers an evaluation board for the PA2423U. The order part number for the evaluation board is PA2423U-EV1. The evaluation board is intended to simplify the testing with respect to RF performance of this power amplifier.

The application note, 131-DST-02 provides the supporting information for using the evaluation board. It contains information on the schematic, bill of materials and recommended layout for the power amplifier and the input and output matching networks. To assist in the design process, this layout is available, upon request, in gerber file format.

Using V_{RAMP}

V_{RAMP} is a digital pin used to power-up and power-down the PA2423U in time division duplex systems such as Bluetooth™ 1.1. During receive mode, V_{RAMP} voltage is pulled down, PA2423U acts as a 35 dB isolation block between the radio and the antenna while consuming a modest 1 µA. In transmit mode, V_{RAMP} voltage is pulled to V_{CC} and PA2423U offers 19 dB to 21 dB of large signal gain.

Using V_{CTL}

V_{CTL} is an analog pin that is designed to control the gain of PA2423U. Applying a voltage between 0 V and V_{CC} will adjust the gain between -15 dB and 21 dB. Used in combination with a variable drive level to PA2423U, the V_{CTL} function can greatly optimize the PAE of the system at all four Bluetooth™ transmitted power levels.

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Product Preview
The datasheet contains information from the product concept specification. SiGe Semiconductor, Inc. reserves the right to change information at any time without notification.

Preliminary Information
The datasheet contains information from the design target specification. SiGe Semiconductor, Inc. reserves the right to change information at any time without notification.

Production testing may not include testing of all parameters.

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