DATA SHEET

Part No.	AN26102A
Package Code No.	ALGA011-W-0912ANB

Contents

AN26102A

SiGe Linear Power Amplifier for 2.4 GHz Band Applications

■ Overview

- AN26102A is Power amplifier IC for 2.4 GHz band (2 400 MHz to 2 500 MHz) applications.
- Realizing high performance by using 0.25 µm Bi-CMOS process (f_T = 50 GHz, f_{max} = 60 GHz).
- Achieving miniaturization by using chip size package.

■ Features

- Operating voltage V_{CC} = PAV_{CC} = +3.30 V typ.
- Low current consumption 145 mA typ. @Pout = +18 dBm
- High gain 30 dB typ. @fTX = 2450 MHz, Pout = +18 dBm
- Chip size package (11-pin WLCSP)

■ Applications

- 2.4 GHz band (2 400 MHz to 2 500 MHz) applications

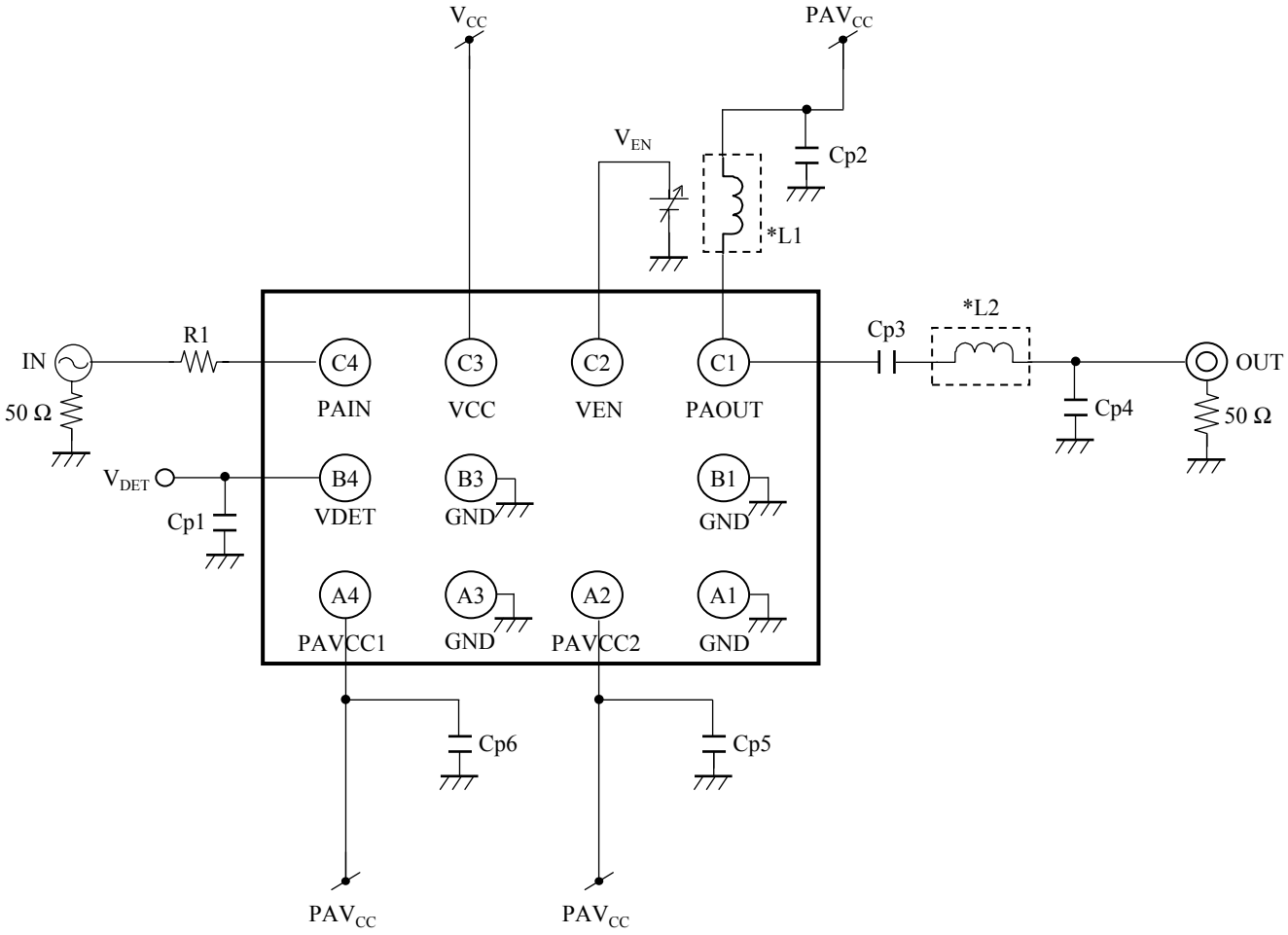
■ Package

- 11 pin Wafer Level Chip Size Package (WLCSP)
  Size : 1.16 mm × 0.86 mm (0.3mm pitch)

■ Type

- Bi-CMOS IC

■ Application Circuit Example (Block Diagram)



Notes)
- This application circuit is an example. The operation of mass production set is not guaranteed. You should perform enough evaluation and verification on the design of mass production set. You are fully responsible for the incorporation of the above application circuit and information in the design of your equipment.
- This block diagram is for explaining functions. The part of the block diagram may be omitted, or it may be simplified.
- *L1, *L2 is a substrate pattern L.

■ Pin Descriptions

Pin No.	Pin name	Type	Description
A1	GND	Ground	GND
A2	PAVCC2	Power Supply	2nd stage amplifier collector supply
A3	GND	Ground	GND
A4	PAVCC1	Power Supply	1st stage amplifier collector supply
B1	GND	Ground	GND
B3	GND	Ground	GND
B4	VDET	Output	Power detector output
C1	PAOUT	Output	RF output , 3rd stage amplifier collector supply
C2	VEN	Input	Bias circuit control
C3	VCC	Power Supply	Bias circuit supply
C4	PAIN	Input	RF input, DC block required

■ Absolute Maximum Ratings

Note) Absolute maximum ratings are limit values which do not result in damages to this IC, and IC operation is not guaranteed at these limit values.

A No.	Parameter	Symbol	Rating	Unit	Notes
1	Supply voltage	V_{CC}	4.5	V	*1
		PAV_{CC}	4.5	V	*1
2	Supply current	I_{CC}	300	mA	*1
3	Power dissipation	P_D	50	mW	*2
4	Operating ambient temperature	T_{opr}	–30 to +85	°C	*3
5	Storage temperature	T_{stg}	–40 to +150	°C	*3

Notes) *1 : The values under the condition not exceeding the above absolute maximum ratings and the power dissipation.

*2 : The power dissipation shown is the value at T_a = 85°C for the independent (unmounted) IC package without a heat sink. When using this IC, refer to the • P_D – T_a diagram in the ■ Technical Data and design the heat radiation with sufficient margin so that the allowable value might not be exceeded based on the conditions of power supply voltage, load, and ambient temperature.

*3 : Except for the power dissipation, operating ambient temperature, and storage temperature, all ratings are for T_a = 25°C.

■ Operating Supply Voltage Range

Parameter	Symbol	Range	Unit	Notes
Supply voltage range	V_{CC}	2.95 to 4.20	V	*1
	PAV_{CC}	2.95 to 4.20	V	*1

Note) *1 : The values under the condition not exceeding the above absolute maximum ratings and the power dissipation.

■ Allowable Current and Voltage Range

Notes) • Allowable current and voltage ranges are limit ranges which do not result in damages to this IC, and IC operation is not guaranteed within these limit ranges.
• Voltage values, unless otherwise specified, are with respect to GND.
• PAV_{CC} is voltage for PAVCC1, PAVCC2, PAOUT
• Do not apply external currents or voltages to any pin not specifically mentioned.

Pin No.	Pin name	Range	Unit	Notes
C2	VEN	– 0.3 to 4.0	V	—
C1	PAOUT	– 0.3 to PAV_{CC}	V	*1
A4	PAVCC2	– 0.3 to PAV_{CC}	V	—
A2	PAVCC1	– 0.3 to PAV_{CC}	V	—
C4	PAIN	—	V	*2

Notes) *1 : RF signal output pin. (Maximum output power is 23.5 dBm.)
*2 : RF signal input pin. (Maximum input power is –2 dBm.) Do not apply DC current.

■ Electrical Characteristics at V_{EN} = 2.85 V, V_{CC} = PAV_{CC} = 3.3 V

Note) Unless otherwise specified, T_a = 25°C±2°C, ZS = ZL = 50 Ω.

B No.	Parameter	Symbol	Conditions	Limits			Unit	Notes
				Min	Typ	Max		
DC electrical characteristics								
DC-1	Supply current (Active mode)	$I_{CC}H$	Current at Active mode (No RF signal input)	—	85	135	mA	—
DC-2	Supply current (Sleep mode)	$I_{CC}L$	Current at Sleep mode (No RF signal input)	—	20	30	µA	—
DC-3	SW voltage (Active mode)	VIH	V_{EN} for Active mode	2.70	2.85	3.40	V	—
DC-4	SW voltage (Sleep mode)	VIL	V_{EN} for Sleep mode	—	0.0	0.30	V	—
DC-5	SW current (Active mode)	IIH	Current at VEN pin VIH = V_{EN}	—	1.5	3.5	mA	—

■ Electrical Characteristics (continued) at V_{EN} = 2.85 V, V_{CC} = PAV_{CC} = 3.3 V

Note) Unless otherwise specified, T_a = 25°C±2°C, fTX = 2450 MHz, CW, ZS = ZL = 50 Ω.

B No.	Parameter	Symbol	Conditions	Limits			Unit	Notes
				Min	Typ	Max		
Power amplifier AC electrical characteristics								
A-1	Operation current (Signal : CW)	IDS	Active mode, f = fTX, CW Pout = +18 dBm	—	150	200	mA	—
A-2	Power gain (Signal : CW)	GDS	Active mode, f = fTX, CW Pout = +18 dBm	26	30	33.5	dB	—
A-3	2nd harmonics	HF2S	Active mode, f = fTX Pout = +18 dBm	—	–50	–40	dBc	—
A-4	DET output voltage (Pout = +18 dBm)	DET1S	Active mode, Pout = +18 dBm	0.3	0.43	0.495	V	—
A-5	DET output voltage (Pout = +22 dBm)	DET2S	Active mode, Pout = +22 dBm	0.485	0.58	0.72	V	—
A-6	Delta DET voltage	DDET	Active mode	0.02	0.15	0.22	V	—

■ Control Pin Mode Table

Note) See parameters B No. DC-3 / B No. DC-4 in the Electrical Characteristics for control voltage relation ranges.

Pin No.	Descriptions	Voltage		Note
		Low	High	
C3	Active/Sleep switching	Sleep	Active	—

■ Truth Table

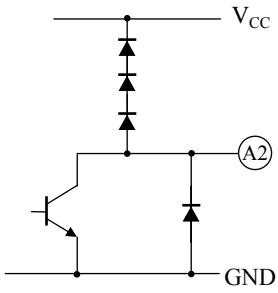
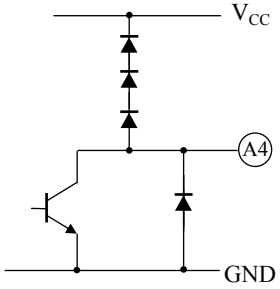
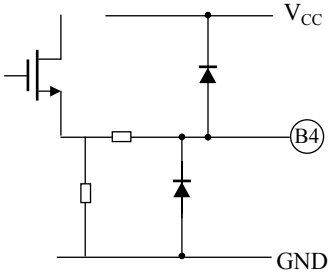
Note) See parameters B No. DC-3 / B No. DC-4 in the Electrical Characteristics for control voltage relation ranges.

CNT	PA	Mode
High	Active	PA Active
Low	Sleep	PA Sleep

■ Technical Data

• I/O block circuit diagrams and pin function descriptions

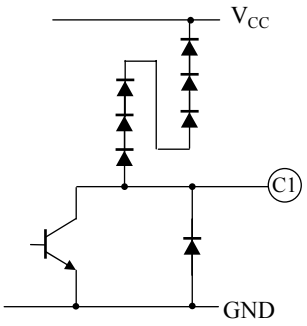
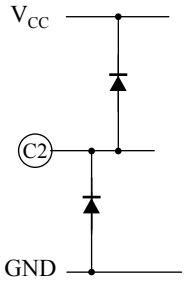
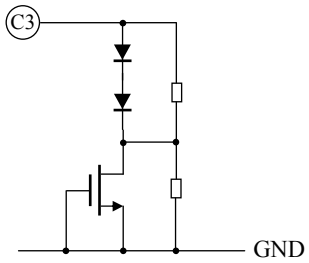
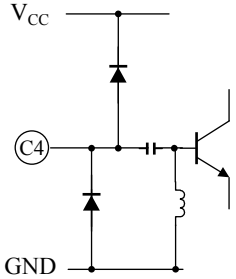
Note) The characteristics listed below are reference values based on the IC design and are not guaranteed.

Pin No.	Voltage	Internal circuit	Descriptions
A1	0.00 V	—	GND
A2	3.30 V		2nd stage amplifier collector supply (PAV_{CC})
A3	0.00 V	—	GND
A4	3.30 V		1st stage amplifier collector supply (PAV_{CC})
B1	0.00 V	—	GND
B3	0.00 V	—	GND
B4	—		Power detector output

■ Technical Data (continued)

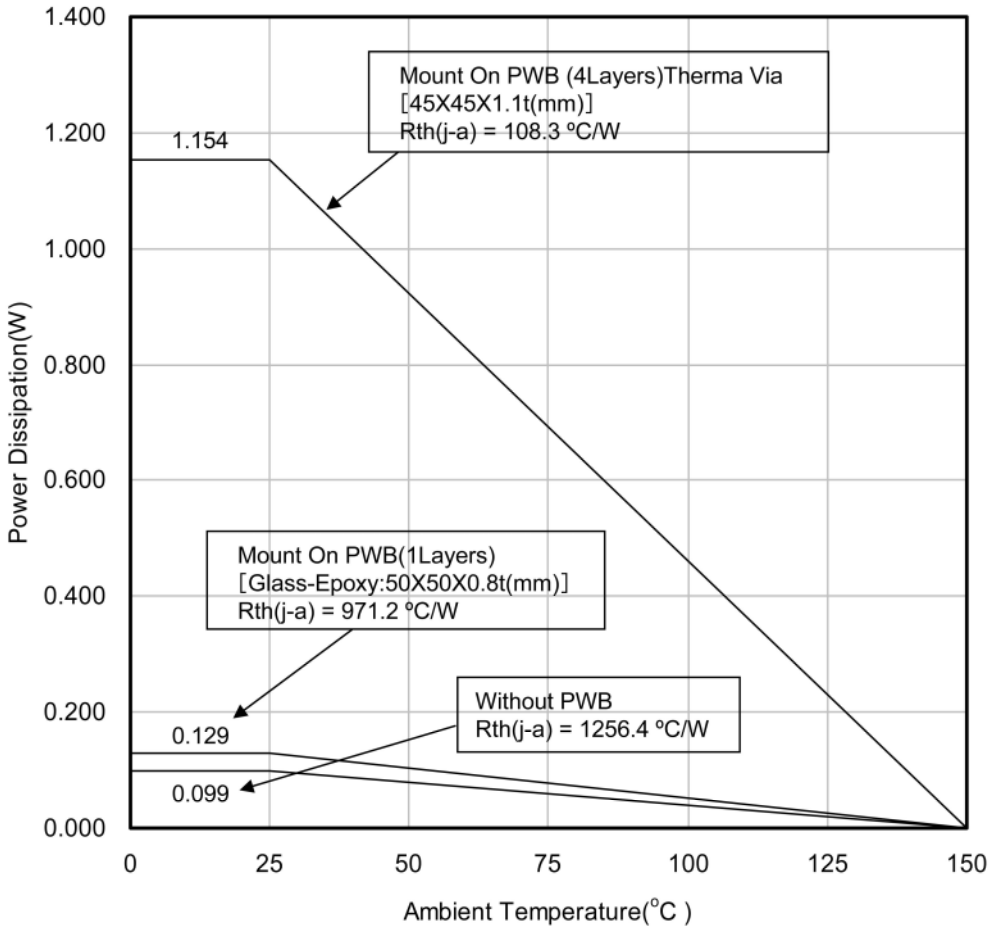
• I/O block circuit diagrams and pin function descriptions (continued)

Note) The characteristics listed below are reference values based on the IC design and are not guaranteed.

Pin No.	Voltage	Internal Circuit	Descriptions
C1	3.30 V		RF Output 3rd stage amplifier collector supply (PAV_{CC})
C2	—		Active/Sleep SW Input Less than 0.30 V : Sleep mode More than 2.70 V : Active mode
C3	3.30 V		Voltage supply (V_{CC})
C4	—		PA input

■ Technical Data (continued)

• P_D — T_a diagram



■ Usage Notes

• Special attention and precaution in using

1. This IC is intended to be used for general electronic equipment [2.4 GHz Band Applications].
   Consult our sales staff in advance for information on the following applications:
   ・Special applications in which exceptional quality and reliability are required, or if the failure or malfunction of this IC may directly jeopardize life or harm the human body.
   ・Any applications other than the standard applications intended.
   (1) Space appliance (such as artificial satellite, and rocket)
   (2) Traffic control equipment (such as for automobile, airplane, train, and ship)
   (3) Medical equipment for life support
   (4) Submarine transponder
   (5) Control equipment for power plant
   (6) Disaster prevention and security device
   (7) Weapon
   (8) Others : Applications of which reliability equivalent to (1) to (7) is required
2. Pay attention to the direction of LSI. When mounting it in the wrong direction onto the PCB (printed-circuit-board), it might smoke or ignite.
3. Pay attention in the PCB (printed-circuit-board) pattern layout in order to prevent damage due to short circuit between pins. In addition, refer to the Pin Description for the pin configuration.
4. Perform a visual inspection on the PCB before applying power, otherwise damage might happen due to problems such as a solder-bridge between the pins of the semiconductor device. Also, perform a full technical verification on the assembly quality, because the same damage possibly can happen due to conductive substances, such as solder ball, that adhere to the LSI during transportation.
5. Take notice in the use of this product that it might break or occasionally smoke when an abnormal state occurs such as output pin-V_{CC} short (Power supply fault), output pin-GND short (Ground fault), or output-to-output-pin short (load short) .
   And, safety measures such as an installation of fuses are recommended because the extent of the above-mentioned damage and smoke emission will depend on the current capability of the power supply.
6. When designing your equipment, comply with the range of absolute maximum rating and the guaranteed operating conditions (operating power supply voltage and operating environment etc.). Especially, please be careful not to exceed the range of absolute maximum rating on the transient state, such as power-on, power-off and mode-switching. Otherwise, we will not be liable for any defect which may arise later in your equipment.
   Even when the products are used within the guaranteed values, take into the consideration of incidence of break down and failure mode, possible to occur to semiconductor products. Measures on the systems such as redundant design, arresting the spread of fire or preventing glitch are recommended in order to prevent physical injury, fire, social damages, for example, by using the products.
7. When using the LSI for new models, verify the safety including the long-term reliability for each product.
8. When the application system is designed by using this LSI, be sure to confirm notes in this book.
   Be sure to read the notes to descriptions and the usage notes in the book.
9. Due to unshielded structure of this IC, under exposure of light, function and characteristic of the product cannot be guaranteed. During normal operation or even under testing condition, please ensure that IC is not exposed to light.
10. Basically, chip surface is ground potential. Please design to ensure no contact between chip surface and metal shielding.

Request for your special attention and precautions in using the technical information and semiconductors described in this book

(1) If any of the products or technical information described in this book is to be exported or provided to non-residents, the laws and regulations of the exporting country, especially, those with regard to security export control, must be observed.

(2) The technical information described in this book is intended only to show the main characteristics and application circuit examples of the products. No license is granted in and to any intellectual property right or other right owned by Panasonic Corporation or any other company. Therefore, no responsibility is assumed by our company as to the infringement upon any such right owned by any other company which may arise as a result of the use of technical information described in this book.

(3) The products described in this book are intended to be used for general applications (such as office equipment, communications equipment, measuring instruments and household appliances), or for specific applications as expressly stated in this book.
Consult our sales staff in advance for information on the following applications:
- Special applications (such as for airplanes, aerospace, automotive equipment, traffic signaling equipment, combustion equipment, life support systems and safety devices) in which exceptional quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or harm the human body.

It is to be understood that our company shall not be held responsible for any damage incurred as a result of or in connection with your using the products described in this book for any special application, unless our company agrees to your using the products in this book for any special application.

(4) The products and product specifications described in this book are subject to change without notice for modification and/or improvement. At the final stage of your design, purchasing, or use of the products, therefore, ask for the most up-to-date Product Standards in advance to make sure that the latest specifications satisfy your requirements.

(5) When designing your equipment, comply with the range of absolute maximum rating and the guaranteed operating conditions (operating power supply voltage and operating environment etc.). Especially, please be careful not to exceed the range of absolute maximum rating on the transient state, such as power-on, power-off and mode-switching. Otherwise, we will not be liable for any defect which may arise later in your equipment.
Even when the products are used within the guaranteed values, take into the consideration of incidence of break down and failure mode, possible to occur to semiconductor products. Measures on the systems such as redundant design, arresting the spread of fire or preventing glitch are recommended in order to prevent physical injury, fire, social damages, for example, by using the products.

(6) Comply with the instructions for use in order to prevent breakdown and characteristics change due to external factors (ESD, EOS, thermal stress and mechanical stress) at the time of handling, mounting or at customer's process. When using products for which damp-proof packing is required, satisfy the conditions, such as shelf life and the elapsed time since first opening the packages.

20100202