

## FEATURES

- Supports emerging 802.11ac high-data rate standard
- Fully integrated FEIC including 5GHz Power Amplifier, Low Noise Amplifier with Bypass mode and SP2T TX/RX Switch
- <1.8% Dynamic EVM @  $P_{OUT} = 16$  dBm with 802.11ac MCS9-HT80 waveform
- 30 dB of Linear Power Gain
- Power Detector with High Accuracy over 3:1 VSWR
- 2.8 dB RX Path Noise Figure with 13 dB Gain LNA Mode
- Single 3.0 to 4.8 V Supply Voltage
- 50  $\Omega$ -Internally Matched RF Ports
- Leadfree and RoHS Compliant
- 2.5 x 2.5 x 0.40 mm QFN Package

## APPLICATIONS

- 802.11a/n/ac WLAN for Fixed, Mobile and Handheld applications

## PRODUCT DESCRIPTION

The ANADIGICS AWL9583 is a high performance InGaP HBT FEIC that incorporates a 5GHz Power Amplifier, Low Noise Amplifier, RF Switch, and Power Detector. The FEIC is designed for WLAN transmit and receive applications in the 4.9 – 5.875 GHz band. Matched to 50 Ohms and DC blocked at all RF inputs and outputs, the part requires no additional RF matching components off-chip.

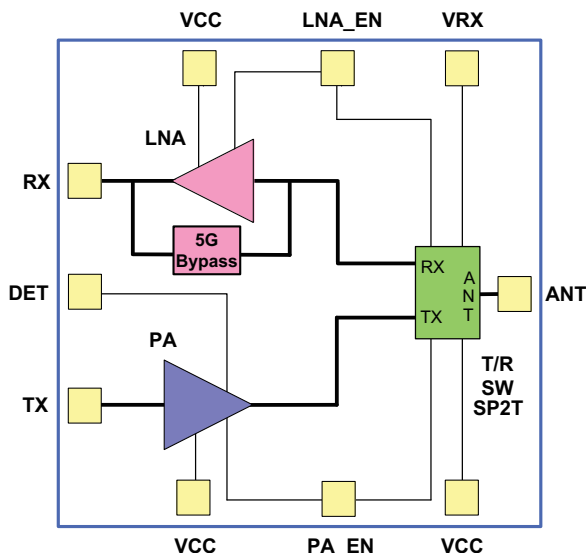
The antenna port is switched between WLAN transmit and WLAN receive with low loss switches. The integrated detector circuit facilitates accurate power control under varying load conditions.

All circuits are biased by a single +3.6 V supply and consume ultra low current in the OFF mode. The PA exhibits unparalleled linearity and efficiency for 802.11a/n/ac WLAN systems under the toughest signal conditions within these standards.



**2.5 mm x 2.5 mm x 0.40 mm  
Surface Mount Front End IC**

The AWL9583 is manufactured using advanced InGaP HBT technology that offers state-of-the-art performance, reliability, temperature stability and ruggedness.



**Figure 1: Block Diagram**

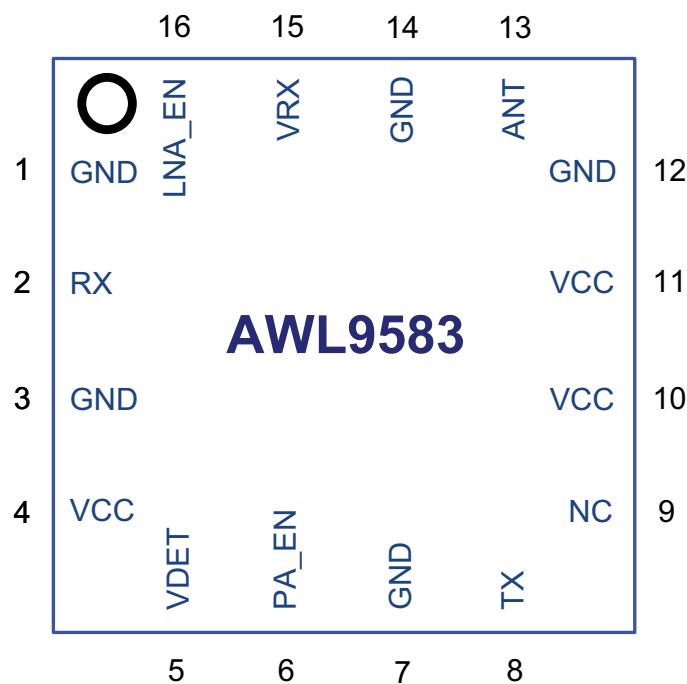


Figure 2: Pinout Diagram

Table 1: Pin Description Table

PIN	NAME	DESCRIPTION	PIN	NAME	DESCRIPTION
1	GND	Ground	9	NC	No Connection
2	RX	5 GHz receive output port	10	VCC	Power Supply
3	GND	Ground	11	VCC	Power Supply
4	VCC	Power Supply	12	GND	Ground
5	VDET	Power detector output. DC coupled	13	ANT	Antenna port
6	PA_EN	Power Amplifier Enable. On/ Off control for the Tx path power amplifier	14	GND	Ground
7	GND	Ground	15	VRX	Switch control receive path
8	TX	5 GHz RF transmit input port	16	LNA_EN	LNA Enable. On/Off control for the Rx path low noise amplifier

## ELECTRICAL CHARACTERISTICS

Table 2: Absolute Minimum and Maximum Ratings

PARAMETER	MIN	MAX	UNIT	COMMENTS
DC Power Supply	-	+6.0	V	
RF Input Level, 5 GHz PA	-	+5	dBm	Modulated
Operating Ambient Temperature	-40	+85	°C	
Storage Temperature	-55	+125	°C	
Storage Humidity	-	60	%	
Junction Temperature	-	150	°C	
ESD Tolerance	1000	-	V	Human body model (HBM)
	1000	-	V	Charged device model (CDM)
	100	-	V	Machine model (MM)
MSL Rating	MSL-1	-	-	

**Functional operation to the specified performance is not implied under these conditions. Operation of any single parameter in excess of the absolute ratings may cause permanent damage. No damage occurs if one parameter is set at the limit while all other parameters are set within normal operating ranges.**

Table 3: Operating Ranges

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Operating Frequency Ranges	4900	-	5925	MHz	802.11a/n/ac
DC Power Supply Voltage (V <sub>CC</sub> )	+3.0	+3.6	+4.8	V	With RF applied
Control Pin Voltage (PA_EN, LNA_EN, VRX)	+2.8 0	+3.2 0	+4.8 +0.4	V	Logic High/On Logic Low/Off
Operating Temperature	-40	-	+85	°C	

**The device may be operated safely over these conditions; however, parametric performance is guaranteed only over the conditions defined in the electrical specifications.**

**Table 4: Electrical Specifications - 5GHz TX Mode**  
**(TC = +25°C, VCC = +3.6V, PA\_EN = +3.2V, VRX = 0.0V, LNA\_EN = 0.0V) 64 QAM OFDM 54 Mbps**

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Operating Frequency	5170		5835	MHz	
Power Gain		30		dB	
Gain Flatness		+/-0.25		dB	Over any 80 MHz BW
Error Vector Magnitude (EVM)		-26 215		dB mA	P <sub>OUT</sub> = 20 dBm, Dyn Mode 6 Mbps data rate, Avg during packet
		-35 180		dB mA	P <sub>OUT</sub> = 18 dBm, Dyn Mode 54 Mbps data rate, Avg during packet
		-36 150		dB mA	P <sub>OUT</sub> = 16 dBm, Dyn Mode 54 Mbps data rate, Avg during packet
		-38 95		dB mA	P <sub>OUT</sub> = 5 dBm, Dyn Mode 54 Mbps data rate, Avg during packet
Transmit Mask	Pass			N/A	OFDM, All rate, P <sub>OUT</sub> = 20 dBm
PA Noise Figure		5		dB	
Input Return Loss		10		dB	
Output Return Loss		15		dB	
Output Spurious Levels - Harmonics 2 fo 3 fo 4 fo		-30 -40 -60		dBm/ MHz	For Power levels up to 20 dBm OFDM 6 Mbps
Settling Time		0.5		uS	Within 0.5 dB of final value
Quiescent Current (Icq)		85		mA	

**Table 5: Electrical Specifications - 5GHz Tx Mode**  
**(Tc = +25°C, Vcc = +3.6V, PA\_EN = +3.2V, VRX = 0.0V, LNA\_EN = 0.0V) 802.11n/ac**

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Operating Frequency	5170		5835	MHz	
Error Vector Magnitude (EVM) and Current Consumption		-35 180	-29	dB mA	P <sub>OUT</sub> = 18 dBm, MCS7 - HT20
		-34 160		dB mA	P <sub>OUT</sub> = 17 dBm, MCS7 - HT40
		-35 150		dB mA	P <sub>OUT</sub> = 16 dBm, MCS9 - HT80
Transmit Mask	Pass			N/A	802.11ac MCS7-MCS9, HT20 - HT80 at respective power levels noted above

**Table 6: Electrical Specifications - 5GHz TX Mode Power Detector**  
**(TC = +25°C, VCC = +3.6V, PA\_EN = +3.2V, VRX = 0.0V, LNA\_EN = 0.0V)**

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Detector Voltage		640		mV	P <sub>OUT</sub> = +18 dBm, 54 Mbps, 5170 MHz
		660		mV	P <sub>OUT</sub> = +18 dBm, 54 Mbps, 5500 MHz
		700		mV	P <sub>OUT</sub> = +18 dBm, 54 Mbps, 5825 MHz
Total Internal Load Impedance		3		kΩ	
Load Accuracy		+/-0.5		dB	Output Power variation at 3:1 VSWR all phases
Detector Directivity		19		dB	Output Power variation at 3:1 VSWR all phases

**Table 7: Electrical Specification - 5GHz RX LNA Mode**  
**(TC = +25°C, VCC = +3.6V, LNA\_EN = +3.2V, VRX = +3.2V, PA\_EN = 0.0V)**

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Operating Frequency	4900		5875	MHz	
Gain - LNA Mode		11		dB	
Gain Flatness		+/-0.25		dB	Across any 40 MHz band
Rx Noise Figure		2.8		dB	
Input Return Loss		6		dB	
Output Return Loss		12		dB	
IIP3		0		dBm	
Settling Time		0.5		μS	Within 0.5 dB of final value
Rx Current		9		mA	

**Table 8: Electrical Specification - 5GHz RX Bypass Mode**  
 (TC = +25°C, VCC = +3.6V, VRX = +3.2V, LNA\_EN = 0.0V, PA\_EN = 0.0V)

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Operating Frequency	4900		5875	MHz	
Gain - RX Bypass Mode		-5.5		dB	
Gain Flatness		+/-0.25		dB	Across any 40 MHz band
Rx Noise Figure		5.5		dB	
Input Return Loss		12		dB	
Output Return Loss		8		dB	
IIP3		+23		dBm	
Settling Time		0.5		uS	Within 0.5 dB of final value

**Table 9: Electrical Specifications - Switch and Control Pin**  
 (TC = +25°C, VCC = +3.6V, Vcontrol High = +3.2V, Vcontrol Low = 0.0V)

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Control Pin Steady State Input Current (PA_EN)		10 0.5		uA uA	Logic Hi/On Logic Low/OFF
Control Pin Steady State Input Current (VRX)		10 0.5		uA uA	Logic Hi/On Logic Low/OFF
Control Pin Steady State Input Current (LNA_EN)		580 0.5		uA uA	Logic Hi/On Logic Low/OFF
Idle Current		6		uA	Total from all bias Pins, Controls in OFF mode Vcc = 3.6V
TX-RX Isolation		25		dB	

**Table 10: Switch Modes of Operation**

Mode of Operation	PA_EN	LNA_EN	VRX
TX Mode	HIGH	LOW	LOW
RX LNA Mode	LOW	HIGH	HIGH
RX Bypass Mode	LOW	LOW	HIGH
Power on Reset	LOW	LOW	LOW

**Vcc = +3.0 V to +4.8 V; Logic State LOW = 0 V to +0.4 V;  
 Logic State HIGH = +2.8 V to +4.8 V**

## APPLICATION SCHEMATIC

Although not shown in the schematic, a large value capacitor ( $\sim 10\text{ }\mu\text{F}$ ) should be connected to the voltage supply lines for low frequency decoupling.

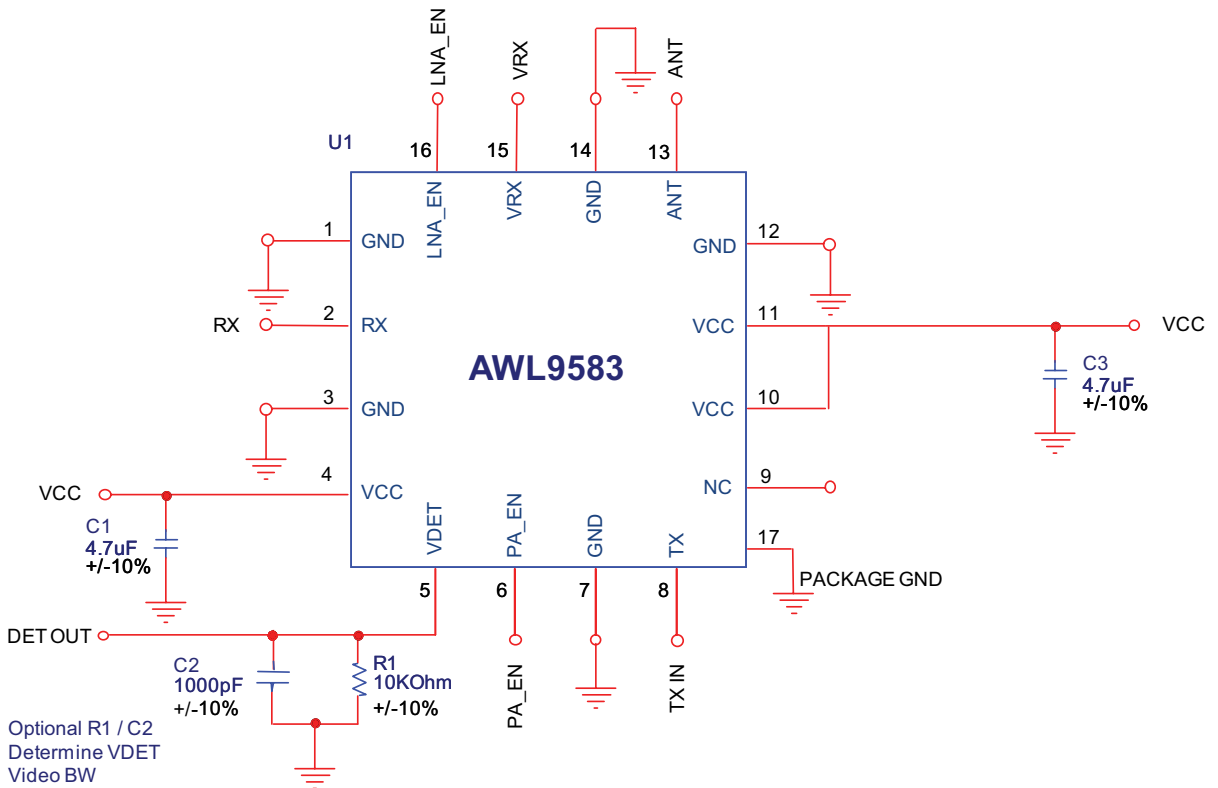


Figure 3: Application Schematic



**Figure 4: Package Outline - 16 Pin, 2.5 x 2.5 x 0.40 mm QFN**

1. ALL DIMENSIONS ARE IN MILLIMETERS.

2. TERMINAL #1 IDENTIFIER AND PAD NUMBERING CONVENTION SHALL CONFORM TO JEDEC 95-1 SPP-012.
3. DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.05 AND 0.10mm FROM TERMINAL TIP.
4. BILATERAL COPLANARITY ZONE APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.
5. DIMENSION SHOWN IS EXCLUDING BURR. MAXIMUM ALLOWABLE BURR IS 0.050 mm IN ALL DIRECTIONS.

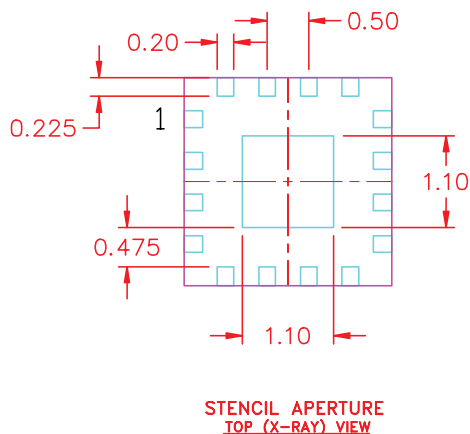
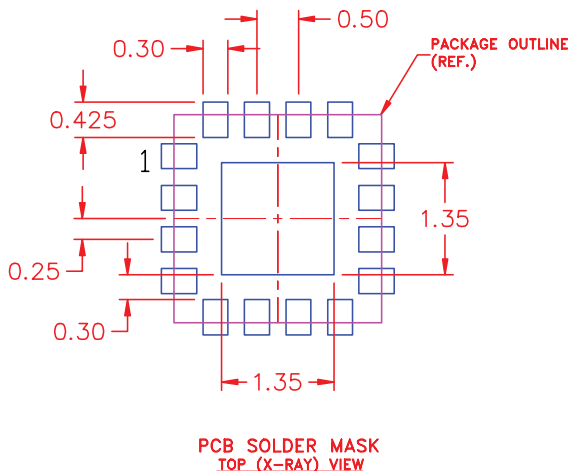
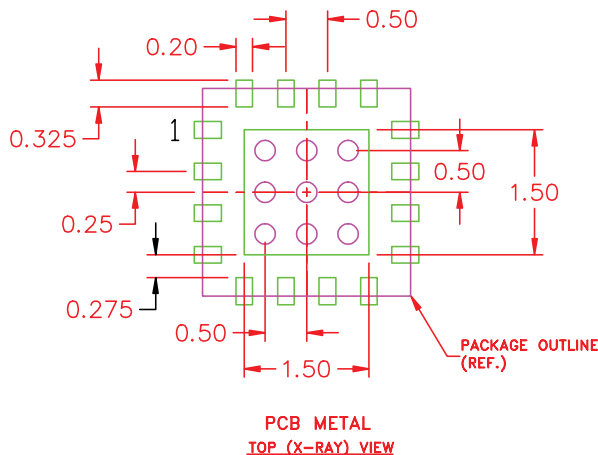
T H O U S A N D S	DIMENSIONS—MM			T H O U S A N D S	T H O U S A N D S	DIMENSIONS—INCHES			T H O U S A N D S
	MIN.	NOM.	MAX.			MIN.	NOM.	MAX.	
A	0.00	0.02	0.05	A	0.000	0.001	0.002	0.016	
B	0.15	0.20	0.25	B	0.006	0.008	0.010	0.016	
D	2.50 BSC			D	0.098 BSC			0.016	
D1	1.25	1.35	1.45	D1	0.049	0.053	0.057	0.016	
E	2.50 BSC			E	0.098 BSC			0.016	
F	1.25	1.35	1.45	F	0.049	0.053	0.057	0.016	
I	0.50 BSC			I	0.020 BSC			0.016	
J	0.125	0.225	0.325	J	0.0049	0.0089	0.0129	0.016	



## PCB AND STENCIL DESIGN GUIDELINE

**NOTES:**

- (1) OUTLINE DRAWING REFERENCE:  
P8002555
- (2) UNLESS SPECIFIED DIMENSIONS  
ARE SYMMETRICAL ABOUT CENTER  
LINES SHOWN.
- (3) DIMENSIONS IN MILLIMETERS.
- (4) VIAS SHOWN IN PCB METAL VIEW  
ARE FOR REFERENCE ONLY.  
NUMBER & SIZE OF THERMAL VIAS  
REQUIRED DEPENDENT ON HEAT  
DISSIPATION REQUIREMENT AND THE  
PCB PROCESS CAPABILITY.
- (5) RECOMMENDED STENCIL THICKNESS:  
APPROX. 0.125mm (5 Mils)

**Figure 5: Recommended PCB Layout**

**ORDERING INFORMATION**

ORDER NUMBER	TEMPERATURE RANGE	PACKAGE DESCRIPTION	COMPONENT PACKAGING
AWL9583V2	-40 °C to +85 °C	16 pin, 2.5 x 2.5 x 0.40 mm Surface Mount Module	Tape and Reel, 5000 pieces per Reel
AWL9583P9	-40 °C to +85 °C	16 pin, 2.5 x 2.5 x 0.40 mm Surface Mount Module	Partial Reel
AWL9583P7	-40 °C to +85 °C	16 pin, 2.5 x 2.5 x 0.40 mm Surface Mount Module	Bags
EVB9583	-40 °C to +85 °C	Evaluation Board	Evaluation Board

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**WARNING**

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