AWL9592C

802.11a/n/ac Power Amplifier, LNA and Tx/Rx Switch

ADVANCED PRODUCT INFORMATION - Rev 0.1

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 @ POUT = 16 dBm with 802.11ac MCS9-HT80 waveform
- 30 dB of Linear Power Gain
- 2.8 dB RX Path Noise Figure with 13 dB Gain LNA Mode
- Single 3.0 to 4.8 V Supply Voltage
- 50 Ω-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 AWL9592C is a high performance InGaP HBT FEIC that incorporates a 5GHz Power Amplifier, Low Noise Amplifier and RF Switch. 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.

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.

The AWL9592C is manufactured using advanced InGaP HBT technology that offers state-of-the-art performance, reliability, temperature stability and ruggedness.

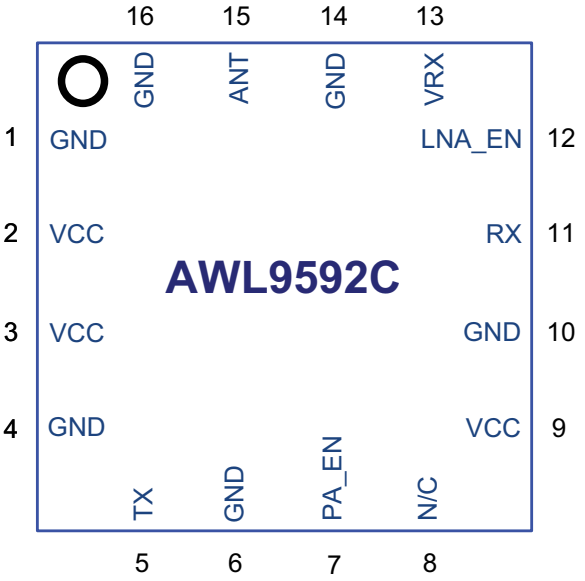


Figure 1: Pinout Diagram

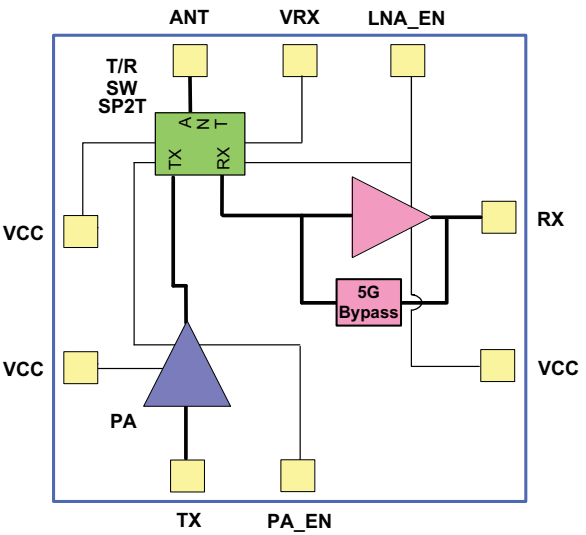


Figure 2: Block Diagram

Table 1: Pin Description Table

PIN	NAME	DESCRIPTION	PIN	NAME	DESCRIPTION
1	GND	Ground	9	VCC	DC Power Supply Connection
2	VCC	DC Power Supply Connection	10	GND	Ground
3	VCC	DC Power Supply Connection	11	RX	Receive Output
4	GND	Ground	12	LNA_EN	LNA Enable (On/Off Control Voltage for LNA)
5	TX	Transmit Input	13	VRX	Switch control receive path
6	GND	Ground	14	GND	Ground
7	PA_EN	PA Enable (Control Voltage to turn on PA)	15	ANT	5GHz Antenna Port
8	N/C	No Connection	16	GND	Ground

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)
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	-	5875	MHz	802.11a/n/ac
DC Power Supply Voltage (V_{CC})	+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 = +3.2V, 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	POUT = 20 dBm, Dyn Mode 6 Mbps data rate, Avg during packet
		-35 180		dB mA	POUT = 18 dBm, Dyn Mode 54 Mbps data rate, Avg during packet
		-36 150		dB mA	POUT = 16 dBm, Dyn Mode 54 Mbps data rate, Avg during packet
		-38 95		dB mA	POUT = 5 dBm, Dyn Mode 54 Mbps data rate, Avg during packet
Transmit Mask	Pass			N/A	OFDM, All rate, POUT = 20 dBm
PA Noise Figure		5		dB	
Input Return Loss		8		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 = +3.2V, 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		dB mA	POUT = 18 dBm, MCS7 - HT20
		-34 160		dB mA	POUT = 17 dBm, MCS7 - HT40
		-35 150		dB mA	POUT = 16 dBm, MCS9 - HT80
Transmit Mask	Pass			N/A	802.11ac MCS7-MCS9, HT20 - HT80 at respective power levels noted above

Table 6: Electrical Specification - 5GHz RX LNA Mode
(TC = +25°C, VCC = +3.6V, LNA_EN = +3.2V, VRX = 0.0V, PA_EN = 0.0V)

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Operating Frequency	4900		5875	MHz	
Gain - LNA Mode		13		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		uS	Within 0.5 dB of final value
Rx Current		9		mA	

Table 7: Electrical Specification - 5GHz RX Bypass Mode
(TC = +25°C, VCC = +3.6V, VRX = 0.0V, 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

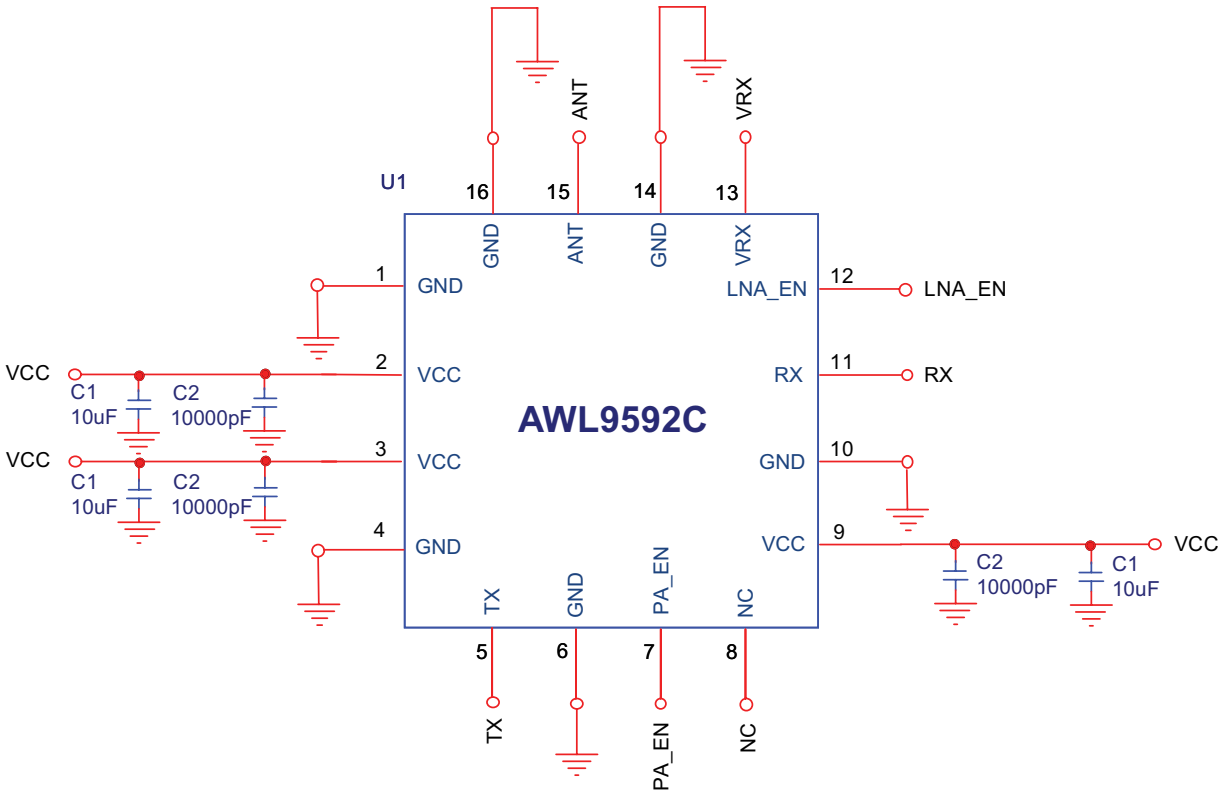
Table 8: Electrical Specifications - Switch and Control Pin
(TC = +25°C, VCC = +3.6V, Vcontrol High = +3.2V, Vcontrol Low = 0.0V)

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 9: Switch Modes of Operation

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

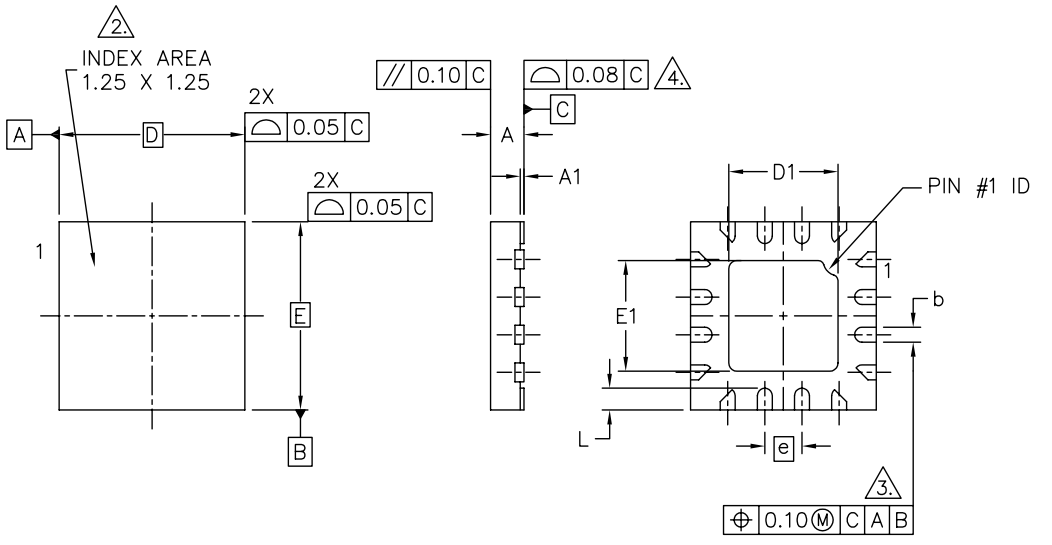
V_{CC} = +3.0 V to +4.8 V; Logic State LOW = 0 V to +0.4 V;
Logic State HIGH = +2.8 V to +4.8 V



Notes:
(1) PA_EN: Internal pull-down resistor.
LNA_EN: Internal pull-down resistor.
VRX: No internal pull-up/down resistor.
(2) External pull-up/down resistors are not required on any control lines to maintain or limit idle current.
(3) A "low" voltage state (0.0V to +0.4V) should be applied on the Vrx control line to avoid possible EVM degradation in transmit mode. If this low logic level cannot be maintained in transmit mode and it "floats", we recommend using a pull down resistor external to our part on the Vrx pins.

Figure 3: Evaluation Board Schematic

PACKAGE OUTLINE



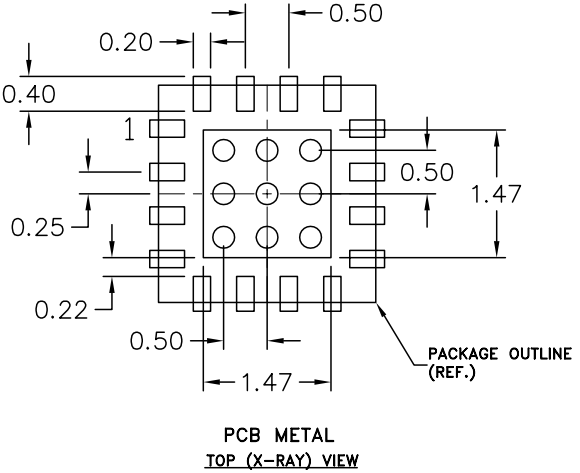
SYMBOL	DIMENSIONS–MM			NOTE
	MIN.	NOM.	MAX.	
A	–	–	0.40	
A1	0.00	0.02	0.05	
b	0.15	0.20	0.25	
D		2.50 BSC		
D1	1.32	1.47	1.57	
E		2.50 BSC		
E1	1.32	1.47	1.57	
e		0.50 BSC		
L	0.19	0.29	0.39	

SYMBOL	DIMENSIONS–INCHES			NOTE
	MIN.	NOM.	MAX.	
A			0.016	
A1	0.000	0.001	0.002	
b	0.006	0.008	0.010	
D		0.098 BSC		
D1	0.052	0.058	0.062	
E		0.098 BSC		
E1	0.052	0.058	0.062	
e		0.020 BSC		
L	0.0075	0.011	0.015	

NOTES :

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. TERMINAL #1 IDENTIFIER AND PAD NUMBERING CONVENTION SHALL CONFORM TO JESD 95–1 SPP–012.
3. DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30mm FROM TERMINAL TIP.
4. BILATERAL COPLANARITY ZONE APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

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



PCB METAL
TOP (X-RAY) VIEW

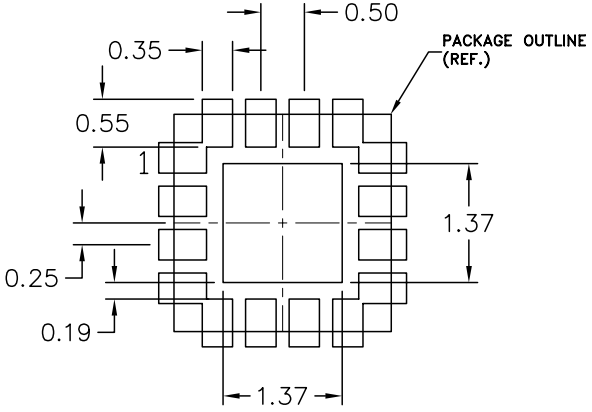
NOTES:
(1) OUTLINE DRAWING REFERENCE: P8002535

(2) UNLESS SPECIFIED DIMENSIONS ARE SYMMETRICAL ABOUT CENTER LINES SHOWN.

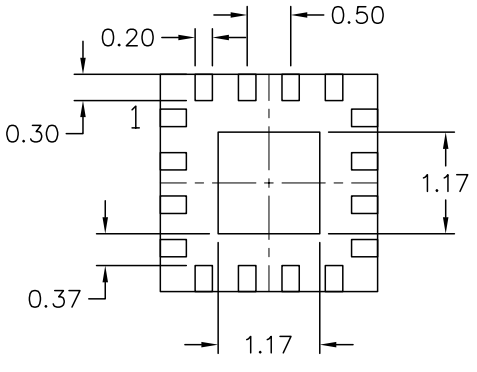
(3) DIMENSIONS IN MILLIMETERS.

(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)



PCB SOLDER MASK
TOP (X-RAY) VIEW



STENCIL APERTURE
TOP (X-RAY) VIEW

Figure 5: Recommended PCB Layout

ORDERING INFORMATION

ORDER NUMBER	TEMPERATURE RANGE	PACKAGE DESCRIPTION	COMPONENT PACKAGING
AWL9592CP7	-40 °C to +85 °C	16 pin, 2.5 x 2.5 x 0.40 mm Surface Mount Module	Bags
AWL9592CP9	-40 °C to +85 °C	16 pin, 2.5 x 2.5 x 0.40 mm Surface Mount Module	Partial Reel
AWL9592CV2	-40 °C to +85 °C	16 pin, 2.5 x 2.5 x 0.40 mm Surface Mount Module	5000 piece T/R
EVB9592C	-40 °C to +85 °C	Evaluation Board	Evaluation Board

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