AWL9280

802.11b/g/n Power Amplifier,
LNA and TX/RX/BT Switch

DATA SHEET - Rev 2.3

FEATURES

- Fully integrated FEIC including 2.4 GHz Power Amplifier, Low Noise Amplifier with Bypass Mode and SP3T TX/RX/BT Switch
- 3.0% Dynamic EVM @ Pout = +19 dBm with IEEE 802.11g 64 QAM OFDM at 54 Mbps
- Spectral Mask Compliant at Pout = 22.5 dBm with IEEE 802.11b @ 1 Mbps CCK/DSSS
- 26 dB of Linear Power Gain
- 0.7 dB BT Band RF Switch Insertion Loss
- Power Detector with High Accuracy over 3:1 VSWR
- 2.2 dB RX Path Noise Figure with 12.5 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

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

APPLICATIONS

- 802.11b/g/n WLAN for Fixed, Mobile, and Handheld applications

PRODUCT DESCRIPTION

The ANADIGICS AWL9280 is a high performance InGaP HBT FEIC that incorporates power amplifier, low-noise amplifier, RF switch and power detector. The FEIC is designed for WLAN transmit and receive applications in the 2.4 - 2.5 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, WLAN receive, and Bluetooth paths with low loss RF switches. The integrated power detector circuit facilitates accurate power control under varying load conditions. All circuits are biased by a single +3.6V supply and consume ultra-low current in the OFF mode. The PAs exhibit unparalleled linearity and efficiency for IEEE 802.11b, 802.11g and 802.11n WLAN systems under the toughest signal configurations within these standards.

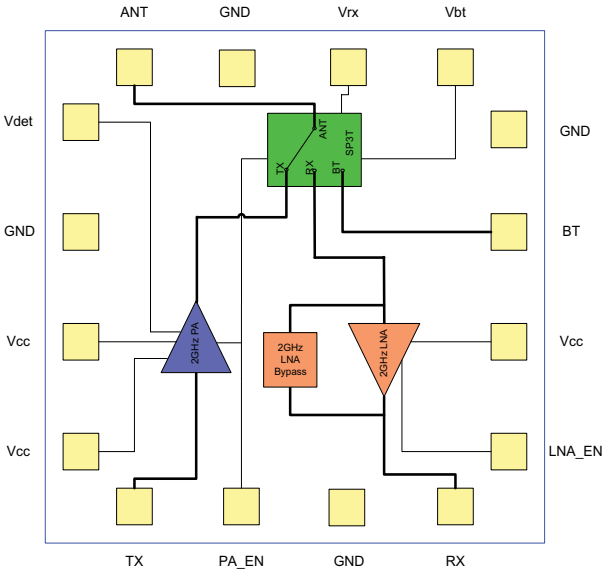

Figure 1: Block Diagram

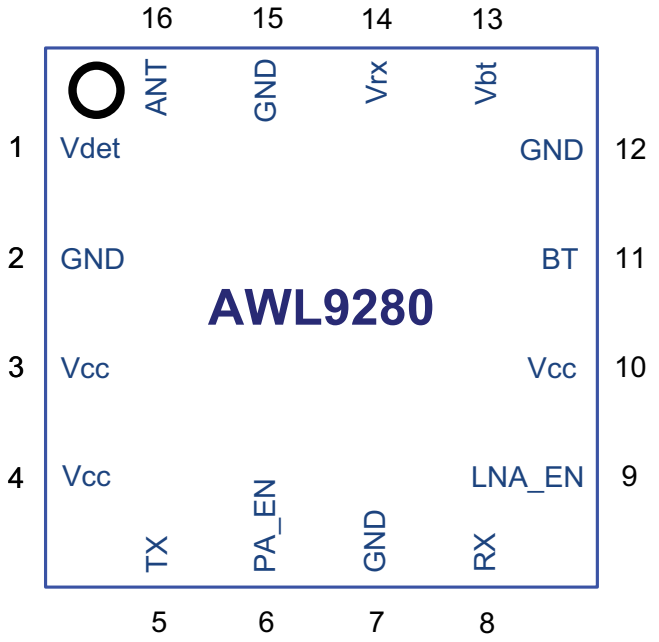

Figure 2: Pinout Diagram

Table 1: Pin Description

PIN	NAME	DESCRIPTION
1	Vdet	Power detector output
2	GND	Ground
3	Vcc	Power Supply. Bias for the transistors in the part.
4	Vcc	Power Supply. Bias for the transistors in the part.
5	TX	RF transmit input port
6	PA_EN	Power Amplifier Enable. On/Off control for the Tx path power amplifier
7	GND	Ground
8	RX	RF receive output port
9	LNA_EN	LNA Enable. On/Off control for the Rx path low noise amplifier
10	Vcc	Power Supply. Bias for the transistors in the part.
11	BT	Bluetooth RF port
12	GND	Ground
13	Vbt	Bluetooth enable. On/Off control for Bluetooth RF path.
14	Vrx	Switch control for receive path
15	GND	Ground
16	ANT	Antenna Port. Common connection for the PA, LNA, and Bluetooth paths

ELECTRICAL CHARACTERISTICS

Table 2: Absolute Minimum and Maximum Ratings

PARAMETER	MIN	MAX	UNIT	COMMENTS
DC Power Supply Voltages (V_{CC})	-	+6.0	V	
RF Input Level, 2.4 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	2400	-	2500	MHz	802.11b/g/n
DC Power Supply Voltage (V_{CC})	+3.0	+3.6	+4.8	V	With RF applied
Control Pin Voltage (PA_EN, LNA_EN, Vbt, 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 - 2.4 GHz TX Mode
(T_C = +25 °C, V_{CC} = +3.6V, PA_EN = +3.2V, Vrx = 0.0V, Vbt = 0.0V) 64 QAM OFDM 54 Mbps

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Operating Frequency	2412		2472	MHz	
Power Gain	24	26	29.5	dB	
Gain Flatness	- -	+/-0.5 +/-0.3	- -	dB dB	Across full band Across any 40 MHz band
Error Vector Magnitude (EVM) (1) Current Consumption	- - -60 140 - - - -	-30 185 -34 170 -36 150 -39.5 105	- - -31 195 -33 - - -	dB mA dB mA dB mA dB mA	P_{OUT} = 19 dBm, Dyn Mode 54 Mbps data rate, Avg during packet P_{OUT} = 18 dBm, Dyn Mode 54 Mbps data rate, Avg during packet P_{OUT} = 16 dBm, Dyn Mode 54 Mbps data rate, Avg during packet P_{OUT} = 5 dBm, Dyn Mode 54 Mbps data rate, Avg during packet
Transmit Mask	- - - -	23 23.5 22 21.5	- - - -	dBm	801.11b DBPSK 1Mbps data rate, Raised Root Cosine filtering A-Offset 801.11b DBPSK 1Mbps data rate, Gaussian filtering A-Offset 802.11n MCS0-HT20 A-Offset 802.11n MCS0-HT40 A-Offsset
PA Noise Figure	-	5	-	dB	
Input Return Loss	-11	-7	-3	dB	50Ω
Output Return Loss	-11	-8	-3	dB	50Ω
Output Spurious Levels - Harmonics 2fo 3fo 4fo	 - - -	 -23 -40 -43	 - - -	 dBm/MHz	 For power levels up to 20 dBm, CCK @ 1 Mbps
Settling Time	-	0.5	-	µs	Within 0.5 dB of final value
Quiescent Current (Icq)	-	85	120	mA	

Note:
(1) EVM includes system noise floor of 0.6% (-44 dB).

Table 5: Electrical Specifications - 5 GHz TX Mode
(T_C = +25°C, V_{CC} = +3.6V, PA_EN = +3.2V, VRX = 0.0V, LNA_EN = 0.0V) 802.11n

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Operating Frequency	2412	-	2472	MHz	
Error Vector Magnitude (EVM)	- -	-35 165	- -	dB mA	P_{OUT} = 18 dBm, MCS7 - HT20
	- -	-36 150	- -	dB mA	P_{OUT} = 17 dBm, MCS7 - HT40
Transmit Mask	Pass	-	-	N/A	802.11n MCS7, HT20 - HT40 at respective power levels noted above

Table 6: Electrical Specifications - 2 GHz TX Mode Power Detector

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Detector Voltage	- - 550 -	230 300 750 950	- - 900 -	mV	P_{OUT} = +5 dBm, CW P_{OUT} = +10 dBm, CW P_{OUT} = +18 dBm, CW P_{OUT} = +22 dBm, CW
Internal Load Impedance	-	1.5	-	kΩ	
Load Accuracy	-	+/- 0.5	-	dB	Output Power variation at 3:1 VSWR over all phases
Detector Directivity	-	19	-	dB	Output power variation at 3:1 VSWR over all phases

Table 7: Electrical Specification - 2 GHz RX LNA Mode
(T_C = +25°C, V_{CC} = +3.6V, LNA_EN = +3.2V, Vrx = +3.2V, Vbt = 0.0V, PA_EN = 0.0V)

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Operating Frequency	2412	-	2472	MHz	
Gain - LNA Mode	10	12.5	14	dB	
Gain Flatness	-	+/-0.25	-	dB	Across any 40 MHz band
Rx Noise Figure	-	2.2	-	dB	
Input Return Loss	-6	-2	-1	dB	
Output Return Loss	-10	-6	-2	dB	
IIP3	-	0	-	dBm	
Settling Time	-	0.5	-	uS	Within 0.5 dB of final value
Rx Current	4.2	9	13	mA	

Table 8: Electrical Specification - 2 GHz RX Bypass Mode
(T_C = +25°C, V_{CC} = +3.6V, Vrx = +3.2V, LNA_EN = 0.0V, Vbt = 0.0V, PA_EN = 0.0V)

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Operating Frequency	2412	-	2472	MHz	
Gain - RX Bypass Mode	-5	-3	-1	dB	
Gain Flatness	-	+/-0.25	-	dB	Across any 40 MHz band
Rx Noise Figure	-	2.2	-	dB	
Input Return Loss	-16	-12	-8	dB	
Output Return Loss	-33	-28	-12	dB	
IIP3	-	+23	-	dBm	
Settling Time	-	0.5	-	uS	Within 0.5 dB of final value

Table 9: Electrical Specifications - Bluetooth Path
(T_C = +25°C, V_{CC} = +3.6V, Vrx = 0.0V, Vbt = +3.2V, PA_EN = 0.0V, LNA_EN = 0.0V)

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Operating Frequency	2412	-	2472	MHz	
Insertion Loss	-2	0.7	0	dB	
Gain Flatness	-	+/-0.25	-	dB	Across any 40 MHz band
Input Return Loss	-18	-14	-10	dB	
Output Return Loss	-18	-13	-9	dB	
BT - RX Isolation	-	20	-	dB	BT to RX
BT - TX Isolation	10	40	100	dB	BT to TX
Settling Time	-	0.5	-	µs	Within 0.5 dB of final value

Table 10: Electrical Specifications - Switch and Control Pin
(T_C = +25 °C, V_{CC} = +3.6 V, Vcontrol pin High = +3.2 V, Vcontrol pin Low = 0.0V)

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Control Pin Steady State Input Current (PA_EN, LNA_EN)		100 0.5		µA	Logic Hi/On Logic Low/Off
Control Pin Steady State Input Current (Vbt, Vrx)		10 0.5		µA	Logic Hi/On Logic Low/Off
Control Pin Input Impedance		>10		kΩ	Logic Hi/On
Leakage Current		3	10	µA	Total from all bias pins. Controls in Off mode, V_{CC} = 3.6 V
TX - RX Isolation		20		dB	

Table 11: Switch Modes of Operation

MODES OF OPERATION	PA_EN	LNA_EN	Vrx	Vbt
TX	**HIGH**	LOW	LOW	LOW
RX	LOW	**HIGH**	**HIGH**	LOW
RX Bypass	LOW	LOW	**HIGH**	LOW
BT	LOW	LOW	LOW	**HIGH**
Power On Reset	LOW	LOW	LOW	LOW

54 Mbps PERFORMANCE DATA

Figure 3: EVM and Icc vs. Output Power Across Frequency (Vcc = +3.3 V, Tc = +25°C)

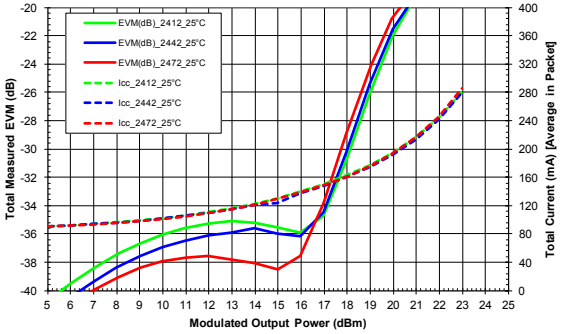

Figure 4: EVM and Icc vs. Output Power Across Frequency (Vcc = +3.6 V, Tc = +25°C)

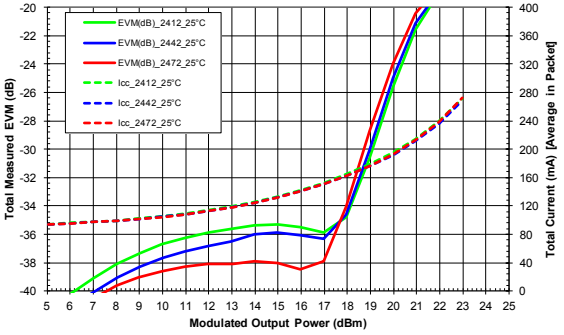

Figure 5: EVM and Icc vs. Output Power Across Temp (Frequency 2.442 GHz, Vcc = +3.6 V)

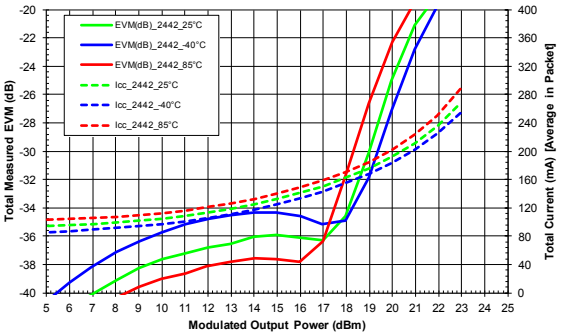

Figure 6: Gain vs. Output Power Across Frequency (Vcc = +3.6 V, Tc = +25°C)

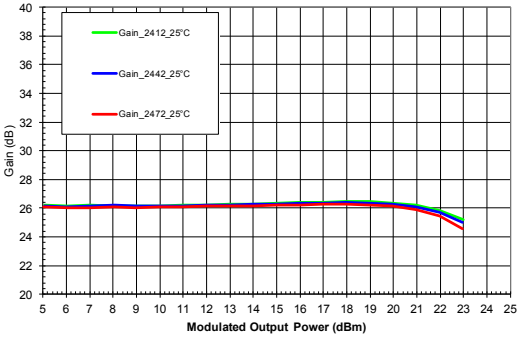

Figure 7: Gain vs. Output Power Across Voltage (Frequency = 2.412 GHz, Tc = +25°C)

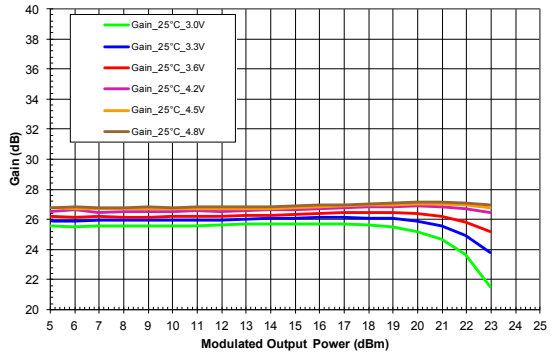

Figure 8: Gain vs. Output Power Across Voltage (Frequency = 2.442 GHz, Tc = +25°C)

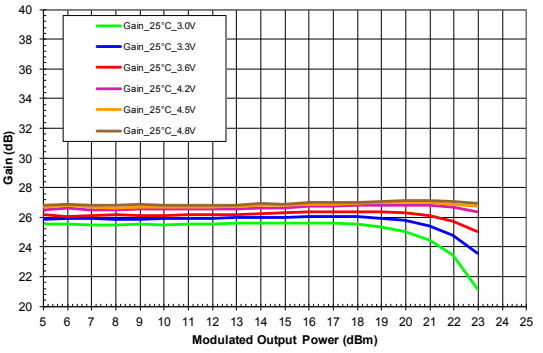

Figure 9: Gain vs. Output Power Across Voltage (Frequency = 2.472 GHz, T_C = +25°C)

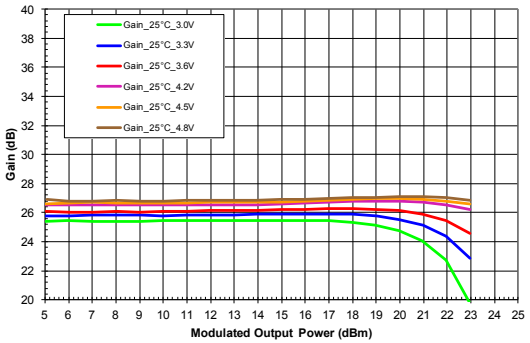

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Figure 10: EVM and Icc vs. Output Power Across Frequency (Vcc = +3.3 V, Tc = +25°C)

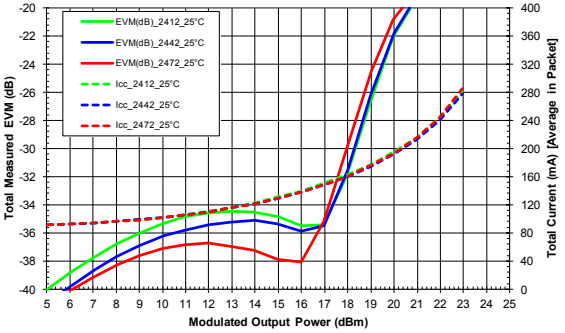


Figure 11: EVM and Icc vs. Output Power Across Frequency (Vcc = +3.6 V, Tc = +25°C)

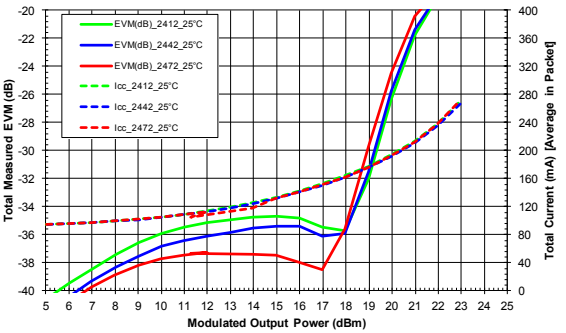


Figure 12: EVM and Icc vs. Output Power Across Temp (Frequency = 2.442 GHz, Vcc = +3.6 V)

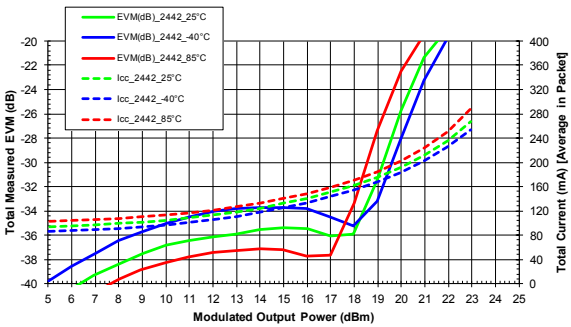


Figure 13: Gain vs. Output Power Across Frequency (Vcc = +3.6 V, Tc = +25°C)

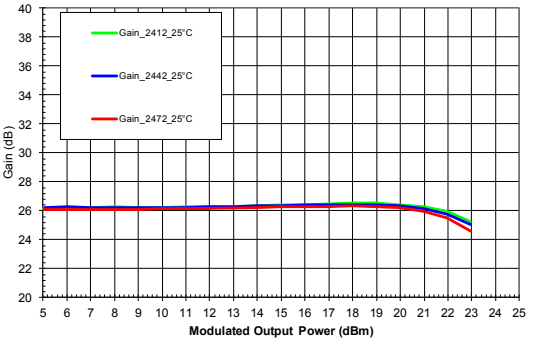


Figure 14: Gain vs. Output Power Across Voltage (Frequency = 2.412 GHz, Tc = +25°C)

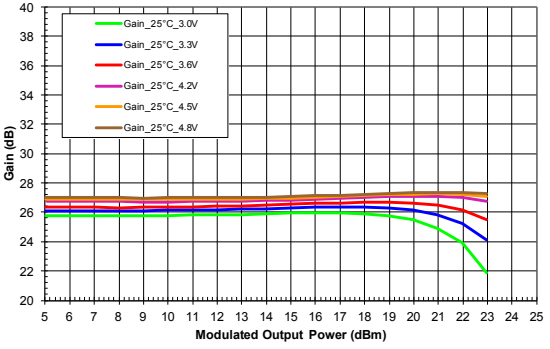


Figure 15: Gain vs. Output Power Across Voltage (Frequency = 2.442 GHz, Tc = +25°C)

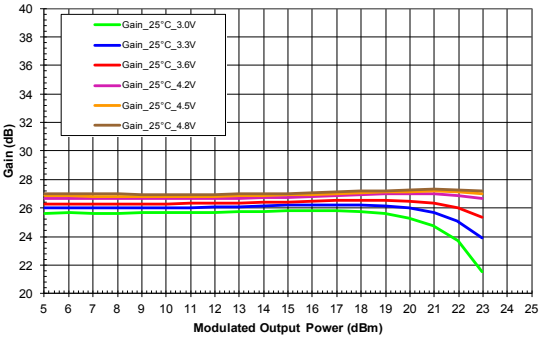
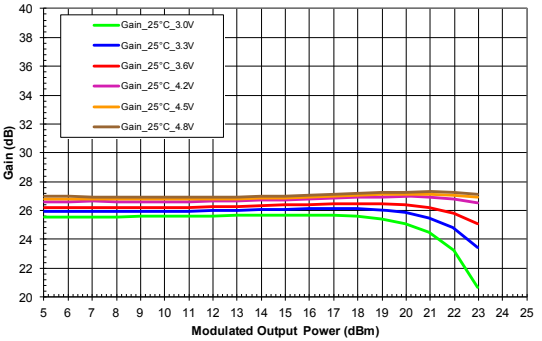


Figure 16: Gain vs. Output Power Across Voltage (Frequency = 2.472 GHz, T_C = +25°C)



MCS7-HT40 PERFORMANCE DATA

Figure 17: EVM and Icc vs. Output Power Across Frequency (Vcc = +3.3 V, Tc = +25°C)

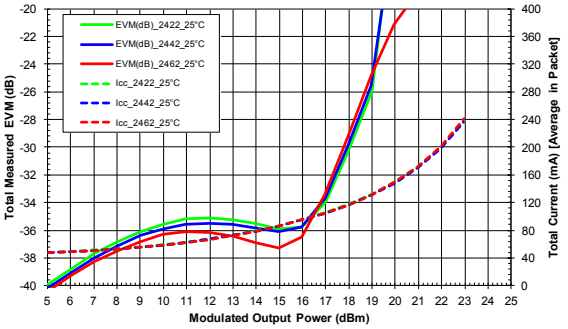


Figure 18: EVM and Icc vs. Output Power Across Frequency (Vcc = +3.6 V, Tc = +25°C)

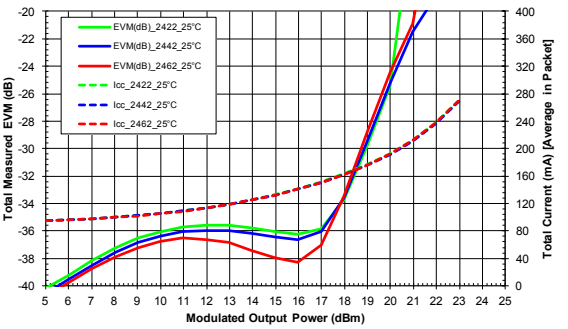


Figure 19: EVM and Icc vs. Output Power Across Temp (Frequency = 2.442 GHz, Vcc = +3.6 V)

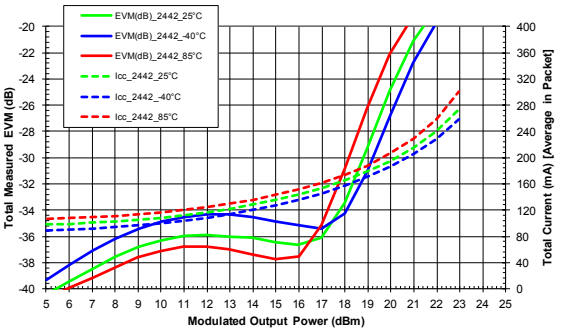


Figure 20: Gain vs. Output Power Across Frequency (Vcc = +3.6 V, Tc = +25°C)

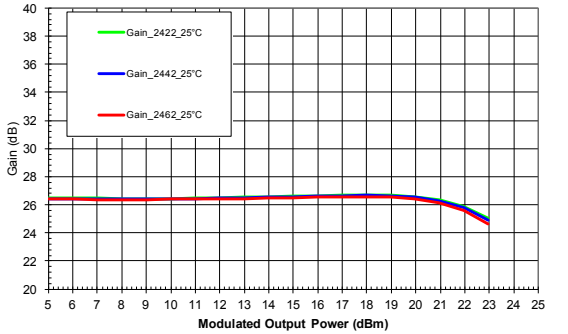


Figure 21: Gain vs. Output Power Across Voltage (Frequency = 2.422 GHz, Tc = +25°C)

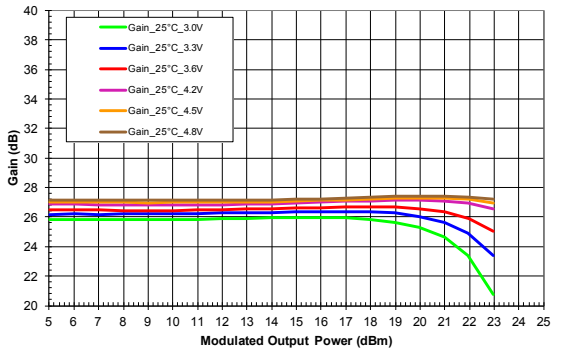


Figure 22: Gain vs. Output Power Across Voltage (Frequency = 2.442 GHz, Tc = +25°C)

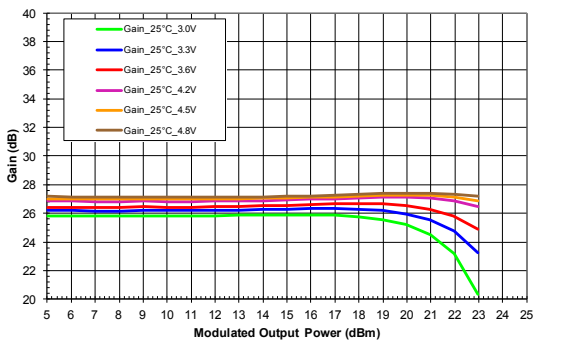
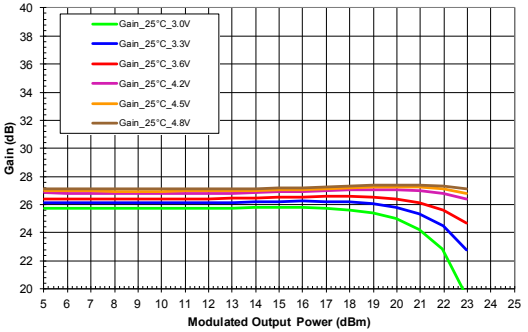


Figure 23: Gain vs. Output Power Across Voltage (Frequency = 2.462 GHz, T_C = +25°C)



RX PERFORMANCE DATA

Figure 24: LNA Gain vs. Frequency Across Voltage (Temp = +25°C)

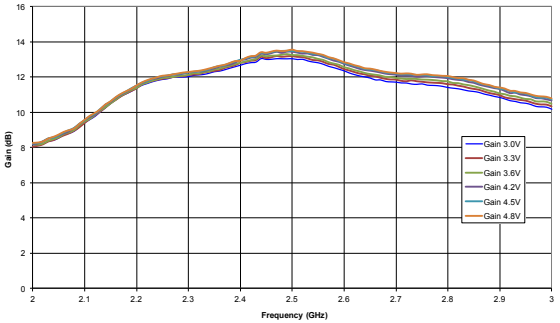
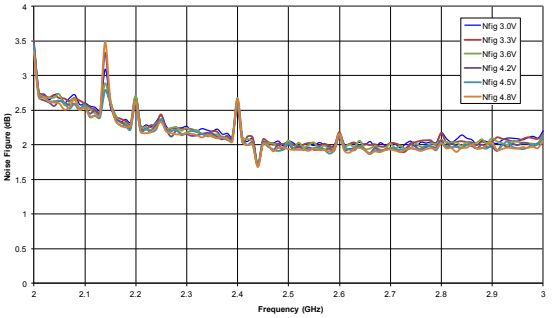


Figure 25: LNA NF vs. Frequency Across Voltage (Temp = +25°C)



APPLICATION SCHEMATIC

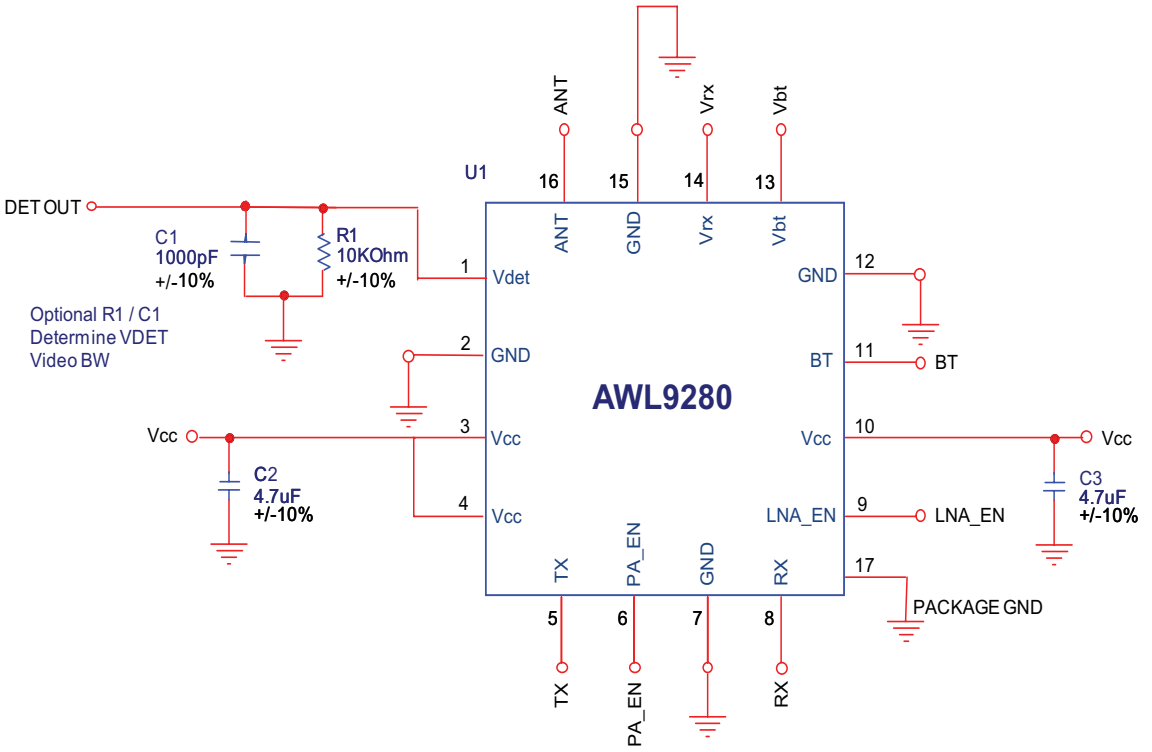
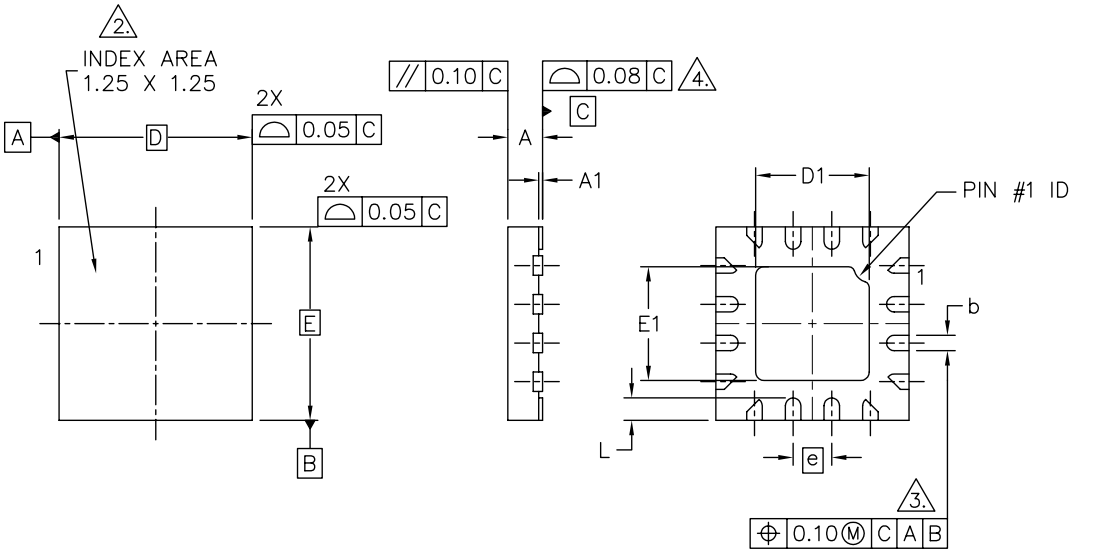


Figure 26: Recommended Application Schematic

PACKAGE OUTLINE



SYMBOL	DIMENSIONS—MM MIN.	NOM.	MAX.	NOTE	SYMBOL	DIMENSIONS—INCHES MIN.	NOM.	MAX.	NOTE
A	–	–	0.40		A			0.016	
A1	0.00	0.02	0.05		A1	0.000	0.001	0.002	
b	0.15	0.20	0.25		b	0.006	0.008	0.010	
D		2.50 BSC			D		0.098 BSC		
D1	1.32	1.47	1.57		D1	0.052	0.058	0.062	
E		2.50 BSC			E		0.098 BSC		
E1	1.32	1.47	1.57		E1	0.052	0.058	0.062	
e		0.50 BSC			e		0.020 BSC		
L	0.19	0.29	0.39		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 27: Outline 16 Pin 2.5 mm x 2.5 mm x 0.40 mm QFN

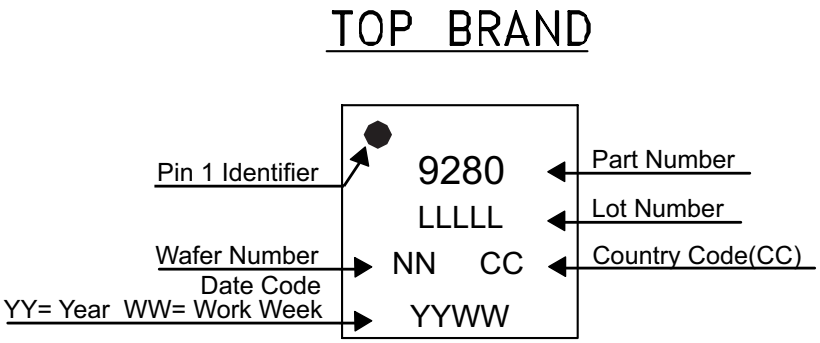
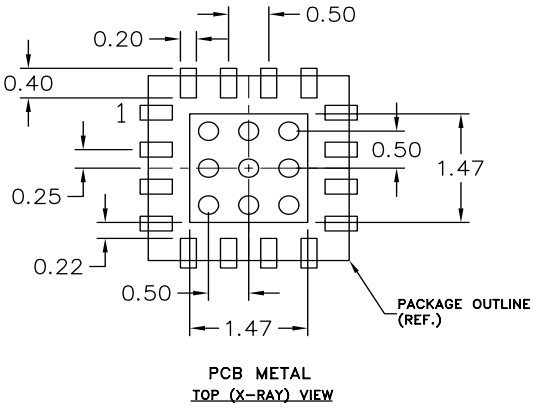


Figure 28: Branding Specification

PCB AND STENCIL DESIGN GUIDELINE



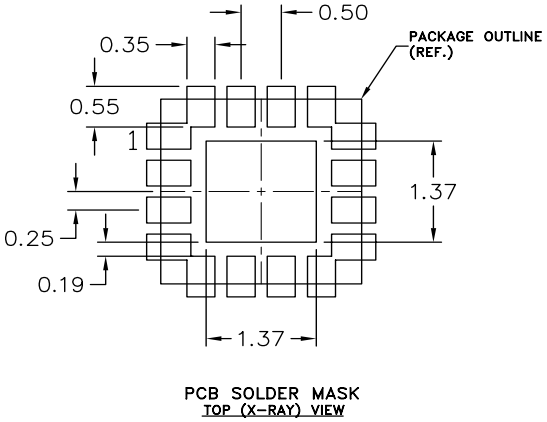
NOTES:
(1) OUTLINE DRAWING REFERENCE: P8002535

(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)



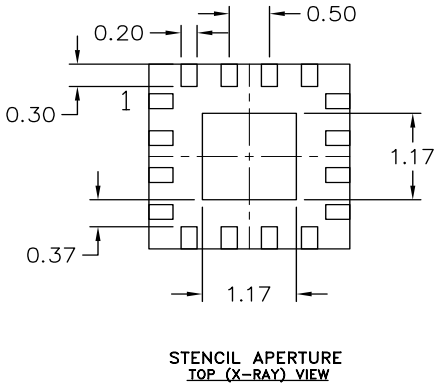


Figure 29: Recommended PCB Layout

ORDERING INFORMATION

ORDER NUMBER	TEMPERATURE RANGE	PACKAGE DESCRIPTION	COMPONENT PACKAGING
AWL9280P7	-40 °C to +80 °C	16 Pin 2.5 x 2.5 x 0.40 mm QFN	Bags
AWL9280P9	-40 °C to +80 °C	16 Pin 2.5 x 2.5 x 0.40 mm QFN	Partial Tape and Reel
AWL9280Q7	-40 °C to +80 °C	16 Pin 2.5 x 2.5 x 0.40 mm QFN	Tape and Reel, 2500 pieces per Reel
EVB9280	-40 °C to +80 °C	Evaluation Board	Evaluation Board

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