AWL9293

802.11b/g/n/ac Power Amplifier, LNA and Tx/Rx/BT Switch

PRELIMINARY DATA SHEET - Rev 1.2

FEATURES

- Supports emerging 802.11ac high-data rate standard
- Fully integrated FEIC including 2GHz Power Amplifier, Low Noise Amplifier with Bypass mode and SP3T TX/RX/BT Switch
- 1.8% Dynamic EVM @ P_{OUT} = +18dBm with IEEE 802.11ac, MCS8-HT20 Waveform
- 28 dB of Linear Power Gain
- 0.5 dB BT Band RF Switch Insertion Loss
- Power Detector with High Accuracy over 3:1 VSWR
- 2.2 dB RX Path Noise Figure with 15 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/ac WLAN for Fixed, Mobile and Handheld applications

PRODUCT DESCRIPTION

The ANADIGICS AWL9293 is a high performance InGaP HBT FEIC that incorporates a 2.4 GHz 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 with low loss switches. The integrated power 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 802.11b/g/n/ac WLAN systems under the toughest signal conditions within these standards.

The AWL9293 is manufactured using advanced InGaP HBT technology that offers state-of-the-art performance, reliability, temperature stability and ruggedness.

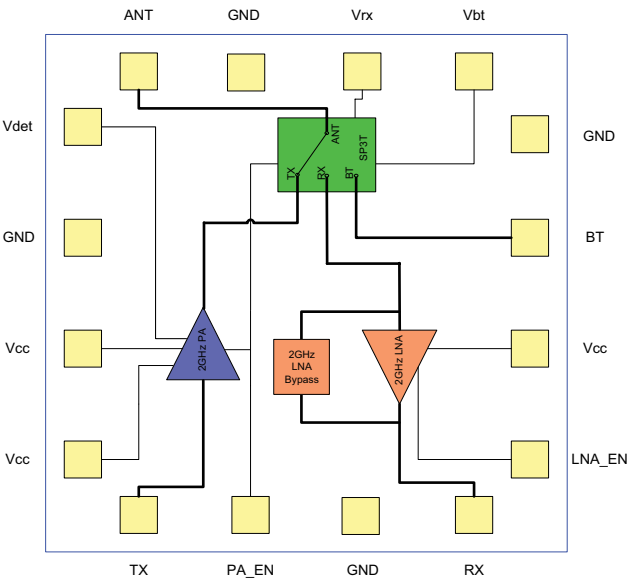


Figure 1: Block Diagram

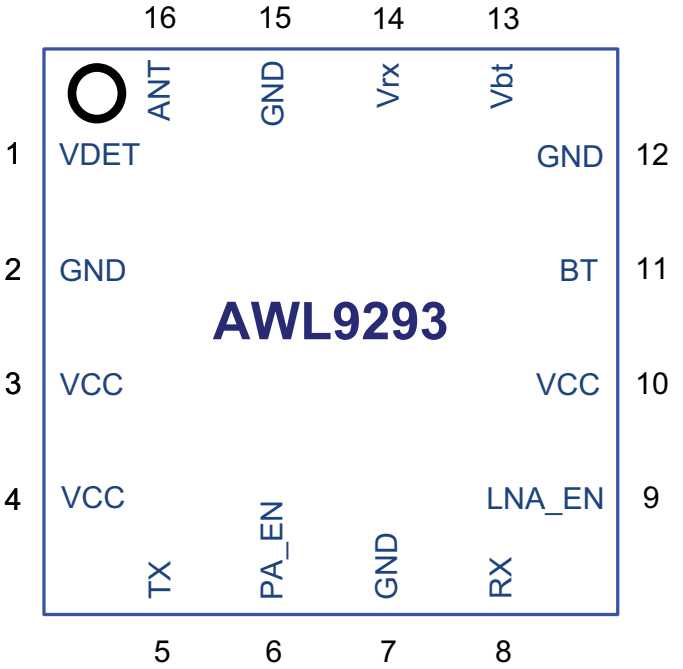


Figure 2: Pinout Diagram

Table 1: Pin Description

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	-	+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/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, Vbt)	+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 - 2GHz TX Mode
(T_C = +25°C, V_{CC} = +3.6V, PA_EN = +3.2V, Vrx = 0.0V, Vbt = 0.0V, LNA_EN = 0.0V)
64 QAM OFDM 54 Mbps

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Operating Frequency	2400		2500	MHz	
Power Gain		28		dB	
Gain Flatness		+/-0.25		dB	
Error Vector Magnitude (EVM) (1)		-28 210		dB mA	P_{OUT} = 20 dBm, Dyn Mode 54 Mbps data rate, Avg during packet
		-36 160		dB mA	P_{OUT} = 16 dBm, Dyn Mode 54 Mbps data rate, Avg during packet
		-39 130		dB mA	P_{OUT} = 5 dBm, Dyn Mode 54 Mbps data rate, Avg during packet
Transmit Mask		22.5 24 20.5 20		dBm	802.11b DBPSK 1 Mbps data rate, Raised Root Cosine filtering. 802.11b DBPSK 1 Mbps data rate, Gaussian filtering. 802.11n MCS0-HT20 802.11n MCS0-HT40
PA Noise Figure		5		dB	
Input Return Loss		12		dB	
Output Return Loss		12		dB	
Output Spurious Levels - Harmonics 2 f_O 3 f_O 4 f_O		 -20 -40 -40		dBm/ MHz	For Power levels up to 22 dBm 1 Mbps CCK
Settling Time		0.5		uS	Within 0.5 dB of final value
Quiescent Current (Icq)		120		mA	

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

Table 5: Electrical Specifications - 2GHz Tx Mode
(T_C = +25°C, V_{CC} = +3.6V, PA_EN = +3.2V, Vrx = 0.0V, Vbt = 0.0V, LNA_EN = 0.0V) 802.11n/ac

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Operating Frequency	2400		2500	MHz	
Error Vector Magnitude (EVM) (1) and Current Consumption		-34 195		dB mA	P_{OUT} = 19 dBm, MCS7 - HT20
		-35 180		dB mA	P_{OUT} = 18 dBm, MCS8 - HT20
		-38 170		dB mA	P_{OUT} = 17 dBm, MCS9 - HT40
Transmit Mask	Pass			N/A	802.11n, 802.11ac at respective modulation and power levels noted above

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

Table 6: Electrical Specifications - 2GHz TX Mode Power Detector
(T_C = +25°C, V_{CC} = +3.6V, PA_EN = +3.2V, Vrx = 0.0V, Vbt = 0.0V, LNA_EN = 0.0V)

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
Detector Voltage		200 300 750 950		mV	P_{OUT} = 0 dBm P_{OUT} = 10 dBm P_{OUT} = 18 dBm P_{OUT} = 22 dBm
Total Internal Load Impedance		1.5		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 - 2GHz 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	2400		2500	MHz	
Gain - LNA Mode		14.5		dB	
Gain Flatness		+/-0.25		dB	Across any 40 MHz band
Rx Noise Figure		2.2		dB	
Input Return Loss		5		dB	
Output Return Loss		12		dB	
IIP3		-1		dBm	
Settling Time		0.5		uS	Within 0.5 dB of final value
Rx Current		9		mA	

Table 8: Electrical Specification - 2GHz 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	2400		2500	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		11		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	2400	-	2500	MHz	
Insertion Loss	-	0.5	-	dB	
Gain Flatness	-	+/-0.25	-	dB	Across any 40 MHz band
Input Return Loss	-	10	-	dB	
Output Return Loss	-	10	-	dB	
BT - RX Isolation	-	20	-	dB	BT to RX
BT - TX Isolation	-	30	-	dB	BT to TX
Settling Time	-	0.5	1.0	µs	

Table 10: Electrical Specifications - Switch and Control Pin
(T_C = +25°C, V_{CC} = +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 (Vbt, Vrx)		10 0.5		uA uA	Logic Hi/On Logic Low/OFF
Control Pin Steady State Input Current (LNA_EN)		300 0.5		uA uA	Logic Hi/On Logic Low/OFF
Leakage Current		3		uA	Total from all bias Pins, Controls in OFF mode Vcc = 3.6V
TX-RX Isolation		36		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

APPLICATION Schematic

Although not shown in the schematic, a large value capacitor (~ 10 uF) should be connected to the voltage supply lines for low frequency decoupling.

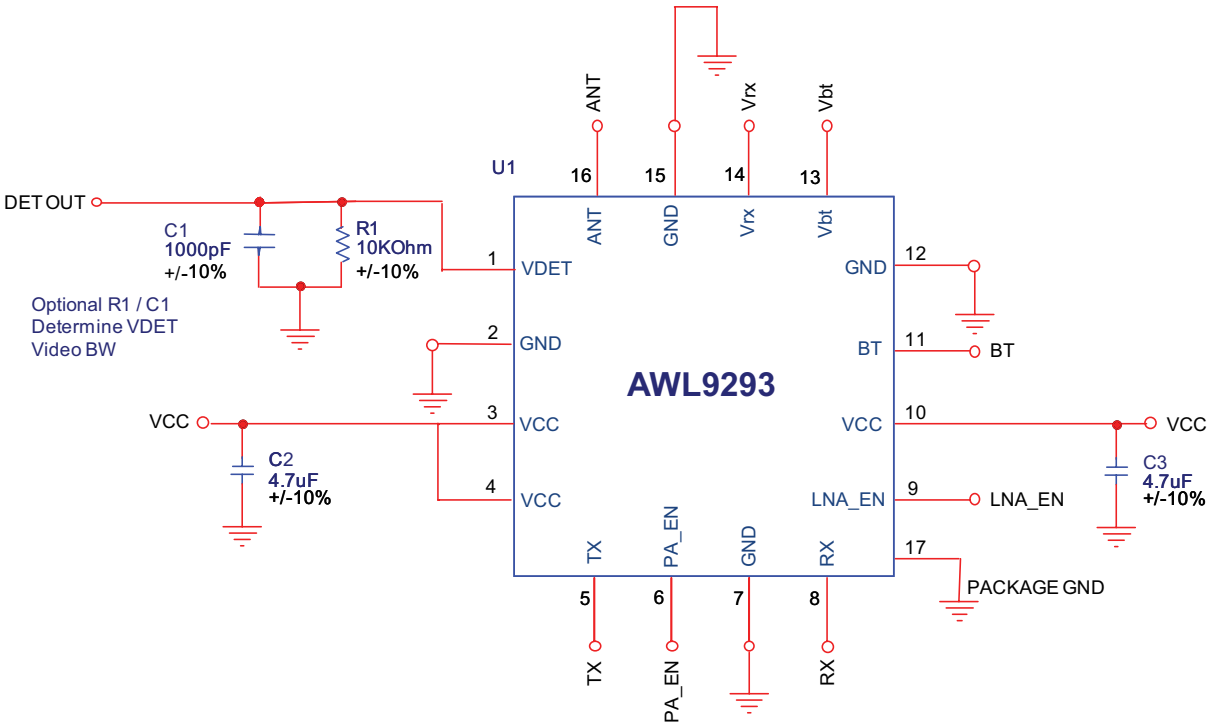
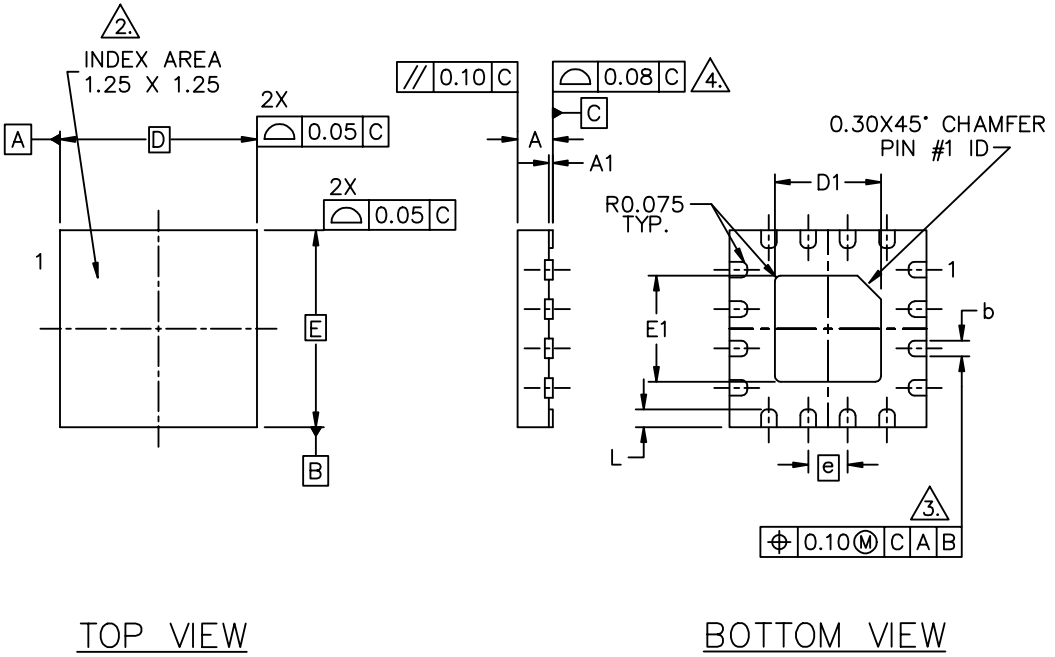


Figure 3: Recommended Application Schematic

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	1.25	1.35	1.45		D1	0.049	0.053	0.057	
E		2.50 BSC			E		0.098 BSC		
E1	1.25	1.35	1.45		E1	0.049	0.053	0.057	
e		0.50 BSC			e		0.020 BSC		
L	0.125	0.225	0.325		L	0.0049	0.0089	0.0128	

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 0.05 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.

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

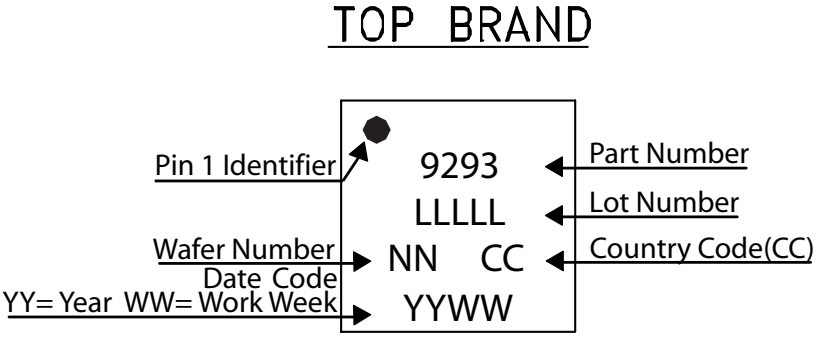
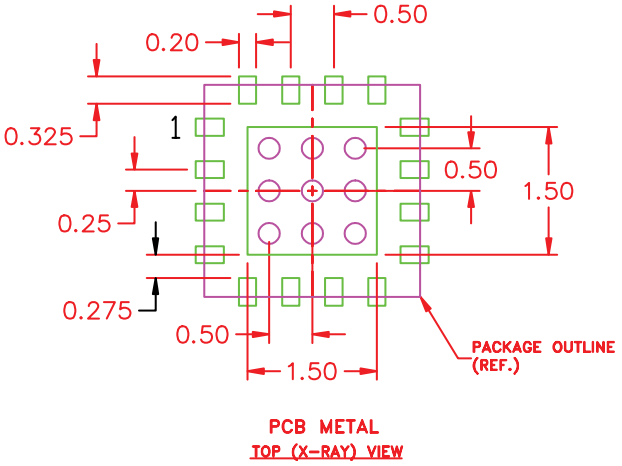


Figure 5: Branding Specification

PCB AND STENCIL DESIGN GUIDELINE



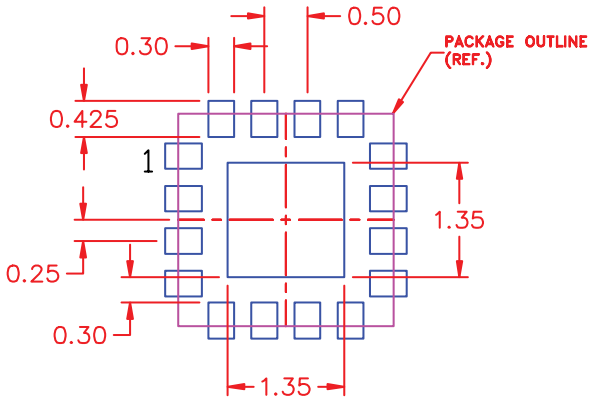
NOTES:
(1) OUTLINE DRAWING REFERENCE: P8002555

(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)



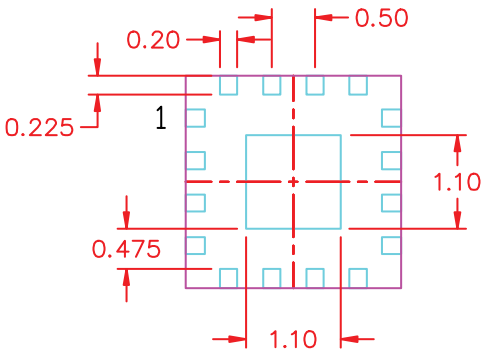
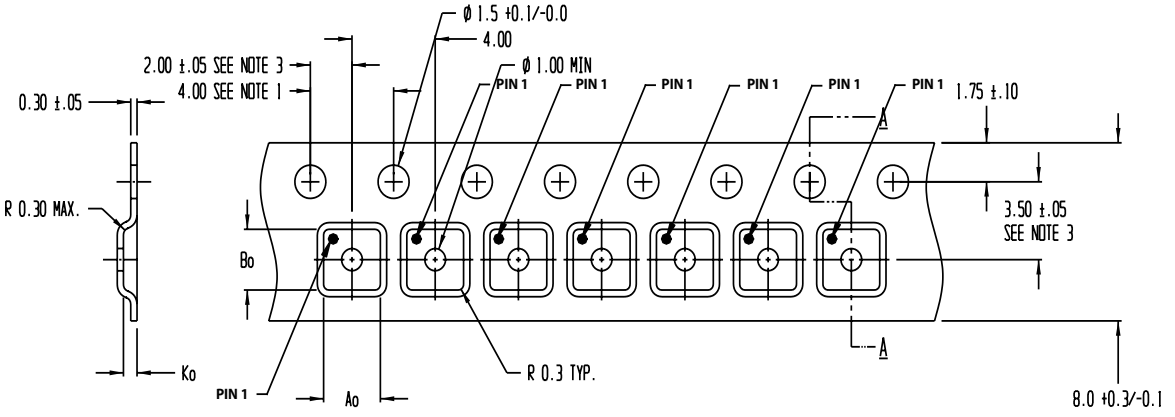


Figure 6: Recommended PCB Layout

COMPONENT PACKAGING



Ao = 2.73 ± 0.05
Bo = 2.73 ± 0.05
Ko = 0.65

Notes:
(1) 10 Sprocket hole pitch cumulative tolerance ± 0.2
(2) Camber in compliance with EIA 481.
(3) Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.

Figure 7: Carrier Tape

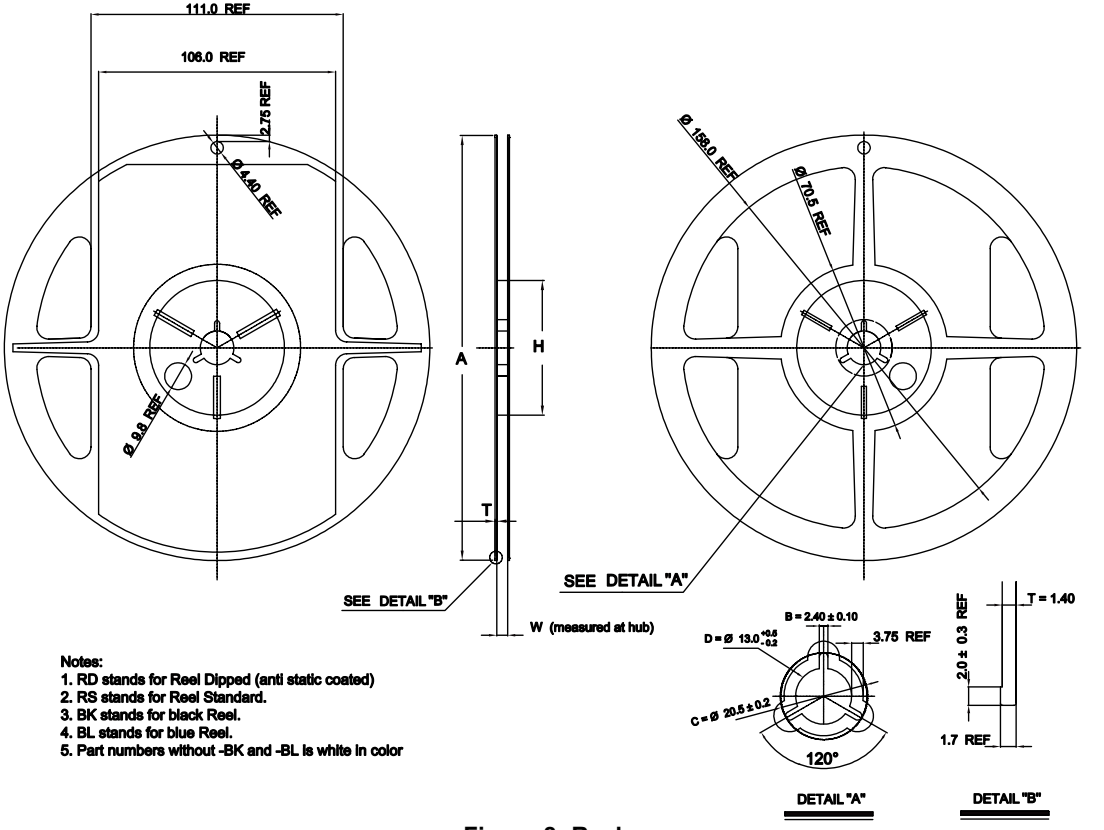


Figure 8: Reel

ORDERING INFORMATION

ORDER NUMBER	TEMPERATURE RANGE	PACKAGE DESCRIPTION	COMPONENT PACKAGING
AWL9293P7	-40 °C to +85 °C	16 pin, 2.5 x 2.5 x 0.40 mm Surface Mount Module	Bags
AWL9293P9	-40 °C to +85 °C	16 pin, 2.5 x 2.5 x 0.40 mm Surface Mount Module	Partial Reel
AWL9293V2	-40 °C to +85 °C	16 pin, 2.5 x 2.5 x 0.40 mm Surface Mount Module	5000 piece T/R
EVB9293	-40 °C to +85 °C	Evaluation Board	Evaluation Board

ANADIGICS, Inc.
141 Mount Bethel Road
Warren, New Jersey 07059, U.S.A.
Tel: +1 (908) 668-5000
Fax: +1 (908) 668-5132

URL: http://www.anadigics.com