

Description

The ALND-WB-0015-Q is an AEC-Q100 automotive ultra-low noise amplifier (LNA) from 1164 MHz to 1610 MHz for high-precision GNSS, it provides simultaneous, uncompromised performance across all frequency bands of all major constellations including GPS, GLONASS, Beidou, Galileo with a single, simple matching network. The device is housed in an ultra-compact: 1.6 x 1.6 x 0.83 mm 6-Lead DFN (Dual Flat No-Lead) package, provides 0.75 dB noise figure with current as low as 5.5 mA for 1.5V to 5.5V operation. ALND-WB-0015-Q has integrated ESD protection on all pins and requires only one external inductor and capacitor for conventional GNSS bands from 1164 to 1610 MHz.



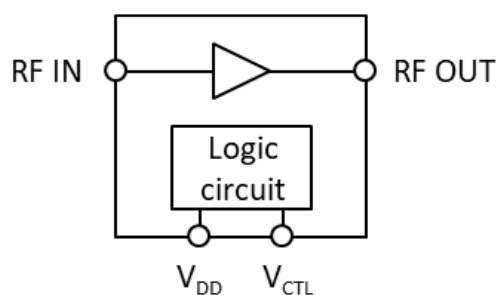
Key Features

- AEC-Q100 automotive GNSS Low-Noise Amplifier
- GNSS L1/L2/L5/L6 support: 1164 - 1610 MHz
- Low noise figure: 0.75 dB
- Power gain: 17.5 dB
- $P_{-1\text{dB(in)}}$: -10 dBm typ.
- IIP3: 0 dBm typ.
- Low supply current 5.5 mA typ.
- Integrated ESD for 2KV HBM & 1KV CDM
- DFN-1616 package: 1.6 x 1.6 x 0.83 mm

Typical Applications

- High-precision GNSS modules
- GNSS for smart watches, wearables
- UAVs and drones
- Robotics and autonomous driving
- Real-Time Kinematic (RTK)
- Intelligent transportation
- Precision land survey positioning

Functional Block Diagram



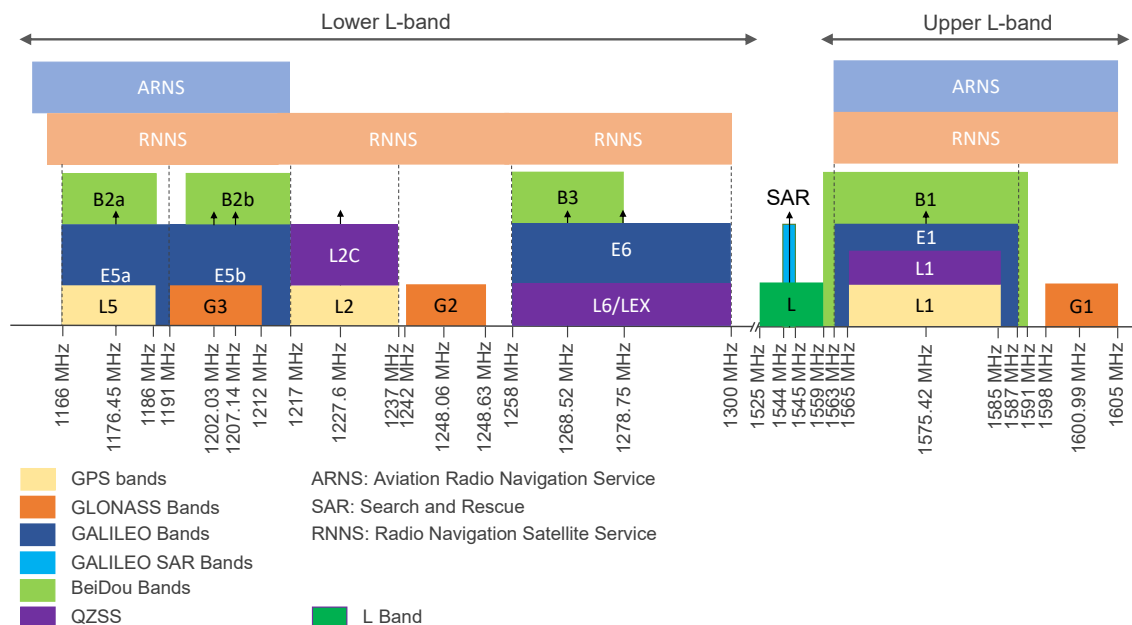
Ordering Information

Part No.	Description
ALND-WB-0015-Q	Automotive GNSS L1/L2/L5/L6 Low-Noise Amplifier on Cut Tape
ALND-WB-0015-Q-T	Automotive GNSS L1/L2/L5/L6 Low-Noise Amplifier on Tape & Reel

Additional Resources

- [Download STEP File, Package Drawing, 3D PDF](#)

GNSS Frequency Bands Covered				
GPS	L1 1575.42MHz	L2 1227.6MHz	L5 1176.45MHz	
	■	■	■	
GLONASS	G1 1598.06-1609.31MHz	G2 1242.93-1251.68MHz	G3 1202.025MHz	
	■	■	■	
Galileo	E1 1575.42MHz	E5a 1176.45MHz	E5b 1201.5MHz	E6 1278.75MHz
	■	■	■	■
BeiDou	B1I 1561MHz	B2 1207.14MHz	B3 1268.52MHz	
	■	■	■	
QZSS	L1 1575.42MHz	L2 1227.6MHz	L5 1176.45MHz	L6 1278.75MHz
	■	■	■	■
IRNSS/NAVIC			L5 1176.45MHz	
			■	
SBAS	L1/E1/B1 1575.42MHz		L5/B2a/E5a 1176.45MHz	
	■		■	



Frequency allocation: GNSS systems, upper L bands and lower L bands

Absolute Maximum Ratings

Parameter	Symbol	Absolute Maximum			Unit
Supply Voltage	V _{DD}	6.0			V
Control Voltage	V _{CTL}	6.0			V
Max Input Power	P _{IN, MAX}	15			dBm
Power Dissipation	P _D	1100			mW
Junction Temperature	T _J	150			°C
Operating Temperature	T _{OP}	-40	-	+105	°C
Storage Temperature	T _{STG}	-55	-	+150	°C
Moisture Sensitivity Level	-	MSL1			-
ESD capability all pins	V _{ESD_HBM}	-2000	-	+2000	V
	V _{ESD_CDM}	-1000	-	+1000	V

Operation of this device outside the parameter ranges given above may cause permanent damage.

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	V _{DD}	1.5	3.3	5.5	V
Control Voltage (High)	V _{CTL(H)}	1.5	1.8	5.5	V
Control Voltage (Low)	V _{CTL(L)}	0	0	0.3	V

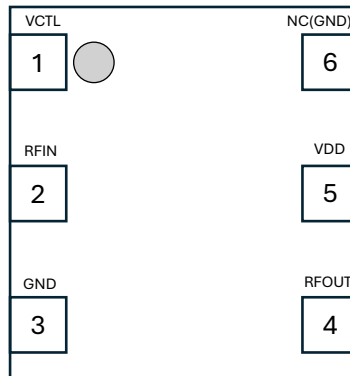
Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

Electrical Specifications

Parameters		Condition	Specification			Unit
			Minimum	Typical	Maximum	
DC ELECTRICAL CHARACTERISTICS						
F _O	Operating frequency	-	1164	-	1610	MHz
V _{DD}	Operating voltage	-	1.5	3.3	5.5	V
I _{DD}	Operating Current	V _{CTL} = 1.8 V	-	5.5	8.0	mA
		V _{CTL} = 0 V	-	0.1	3.0	uA
I _{CTL}	Control Current	V _{CTL} = 1.8 V	-	5	20	uA
V _{CTL(H)}	Digital Input-logic high	-	1.5	1.8	5.5	V
V _{CTL(L)}	Digital Input-logic low	-	0	0	0.3	V
AC ELECTRICAL CHARACTERISTICS						
G _P	Power gain	L1 / L2 / L5 / L6 band	15.0	17.5	19.0	dB
ISL	Reverse isolation	L1 / L2 / L5 / L6 band	32.0	35.0	-	dB
NF	Noise figure	L1 / L2 / L5 / L6 band	-	0.75	1.10	dB
IP _{-1dB}	In band input 1dB gain compression point	L1 / L2 / L5 / L6 band	-15.0	-10.0	-	dBm
IIP ₃	Input 3rd-order intercept point	f1 = 1176 / 1227 / 1278 / 1575 MHz, f2 = f1 + 1 MHz, Pin = -30 dBm	-5.0	0	-	dBm

Note 1: Input is matched to 50 Ω using a high-Q 9.5 nH RF inductor.

Pin Configuration

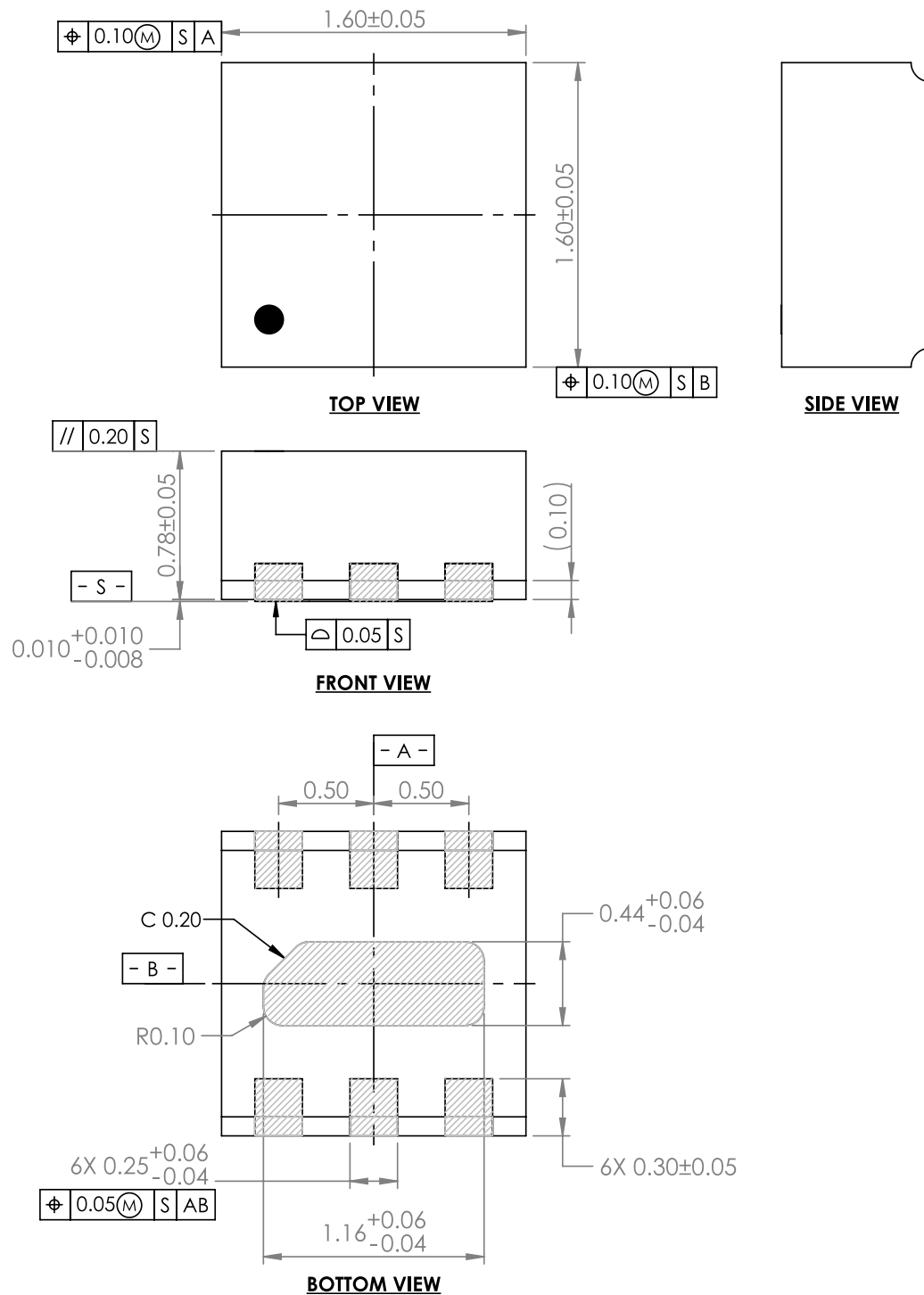


Pin	Name	Description
1	VCTL	Control signal input terminal
2	RFIN	RF input terminal
3	GND	Ground terminal
4	RFOUT	RF output terminal
5	VDD	Operating voltage supply terminal
6	NC (GND)	No connected terminal (connect to ground)
-	Exposed pad	Ground terminal

Control Logic

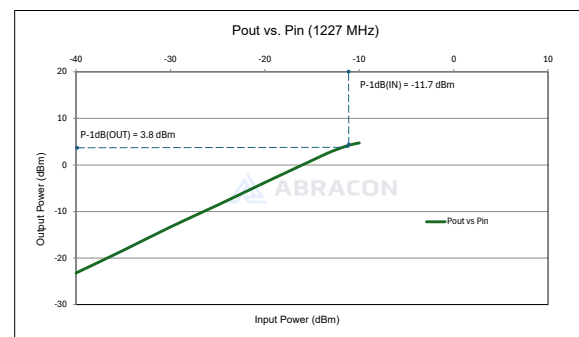
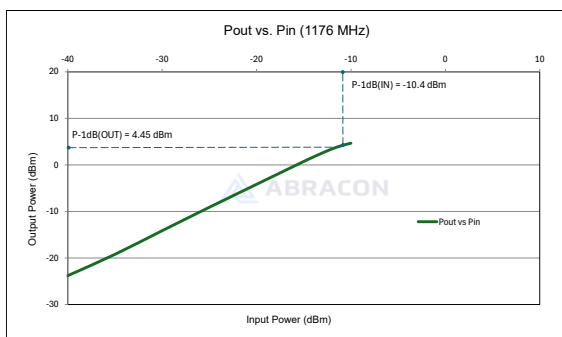
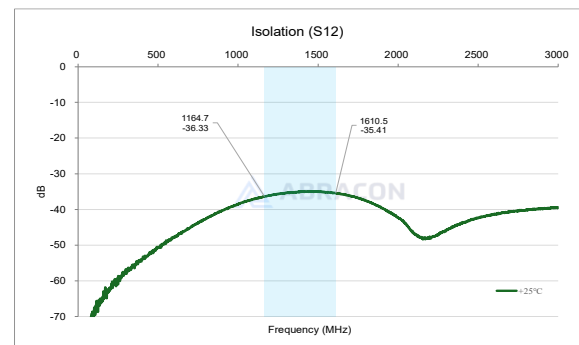
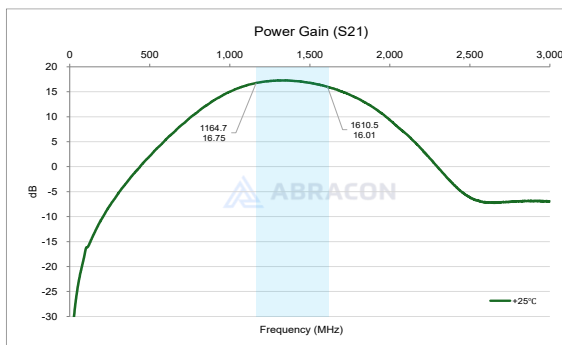
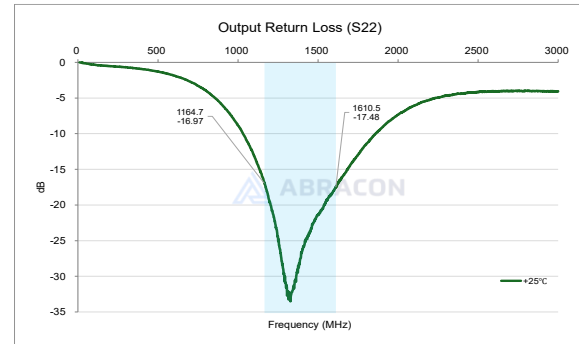
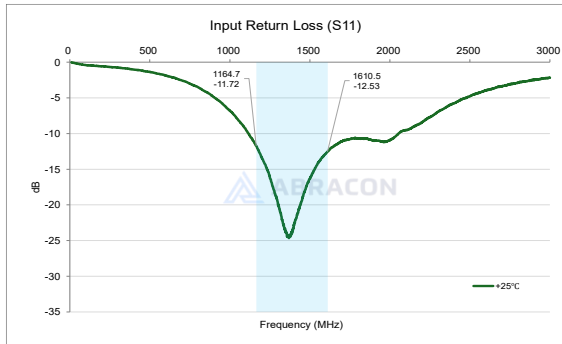
V _{CTL}	Mode
H	Active mode
L	Stand-by mode

Product Dimensions

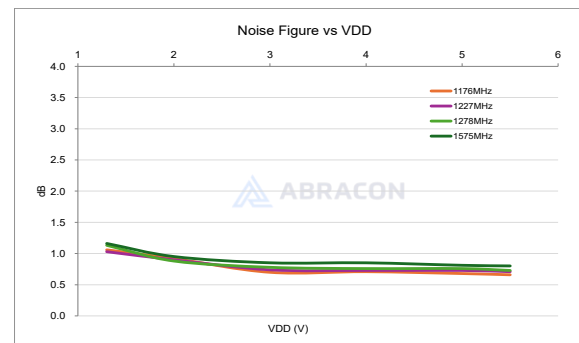
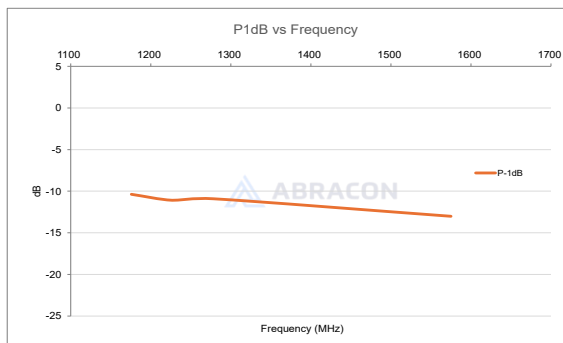
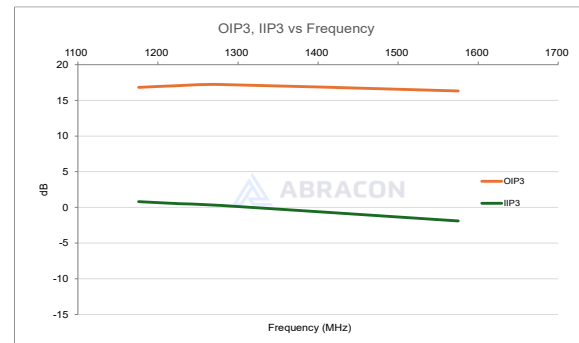
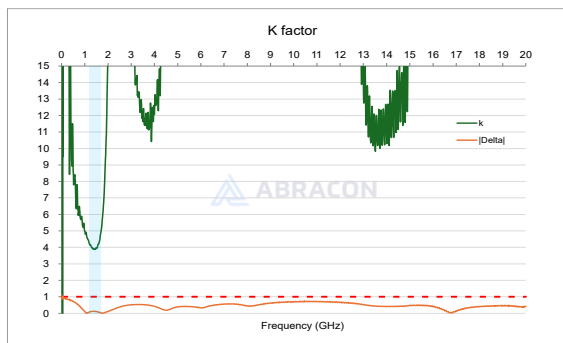
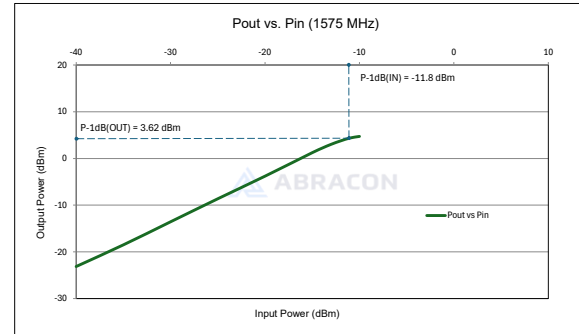
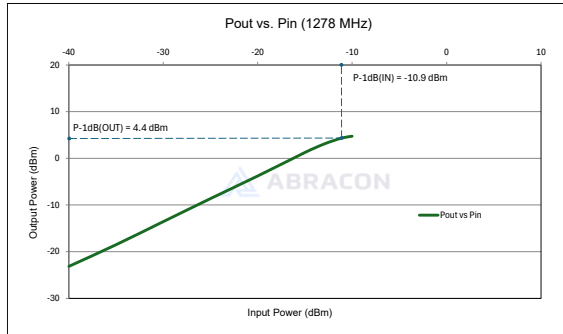


Unit: mm

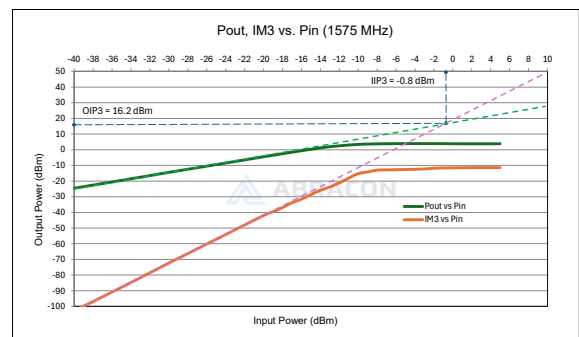
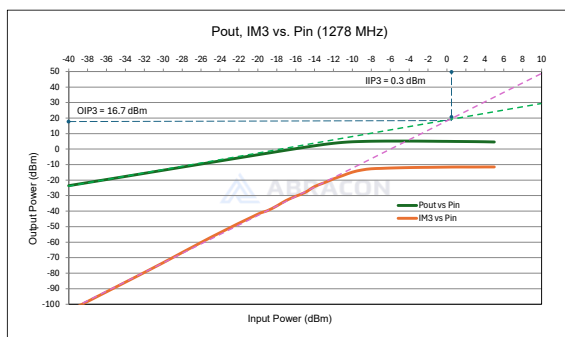
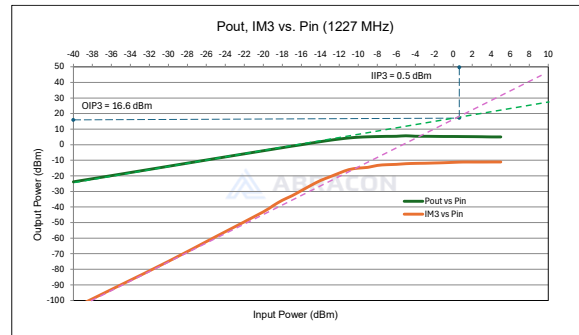
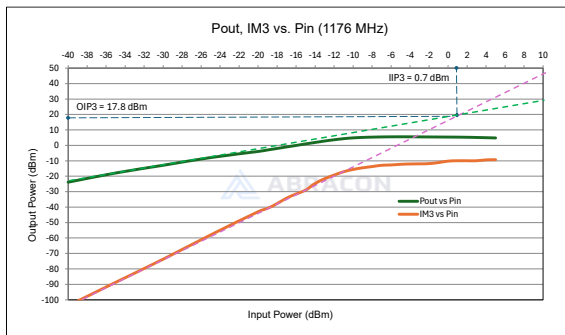
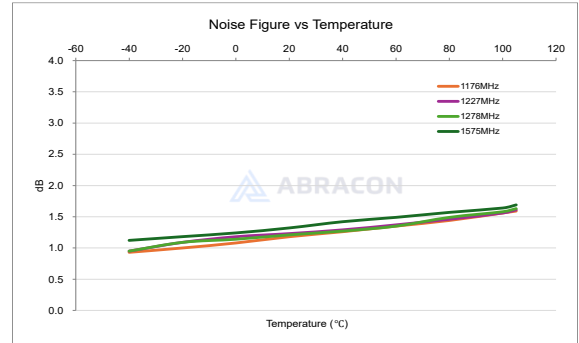
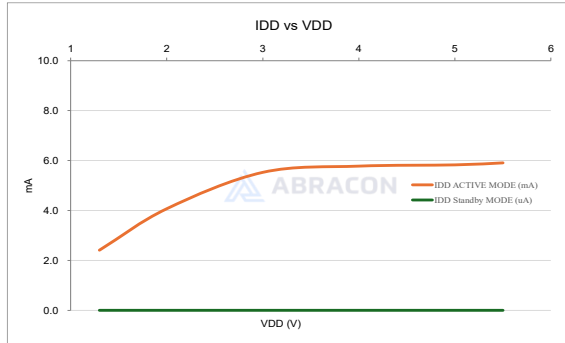
Performance Plots



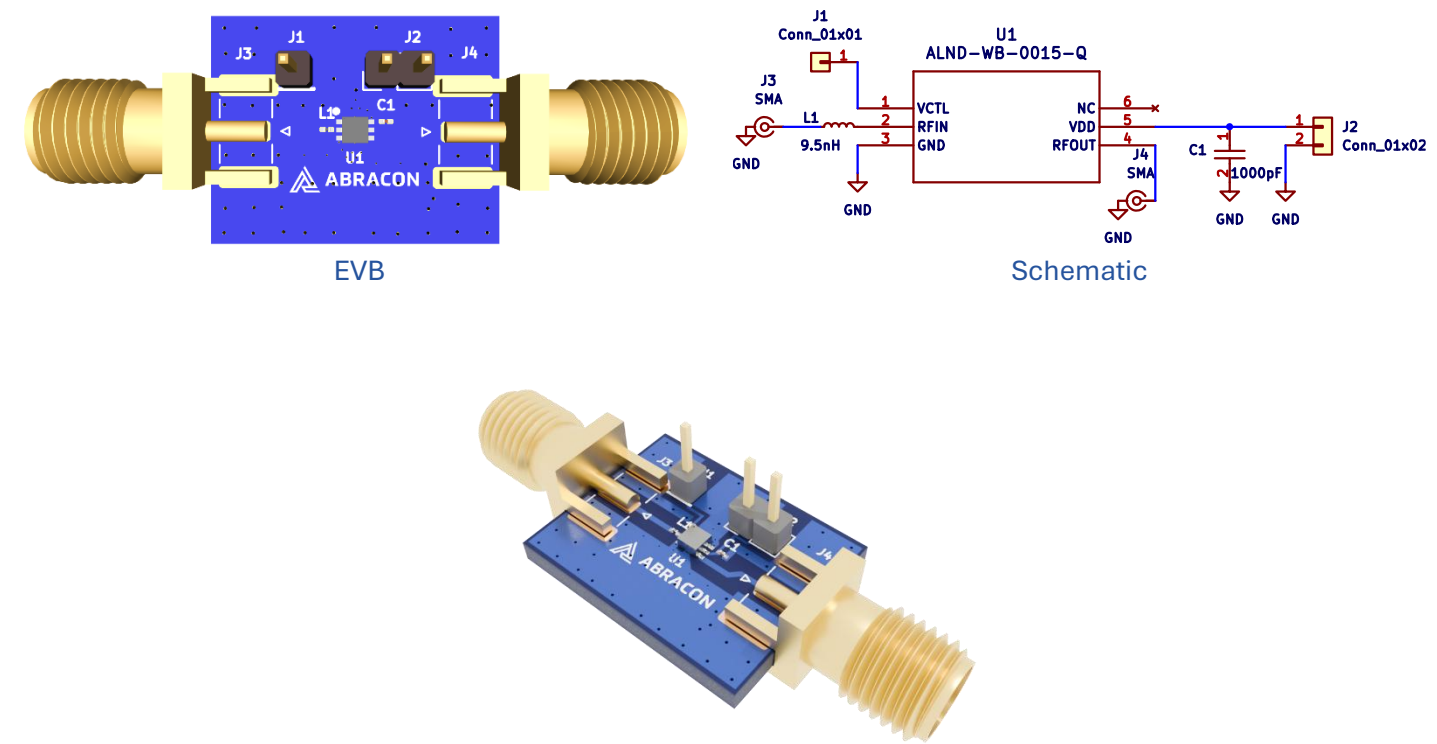
Performance Plots



Performance Plots



Recommended Matching Circuits



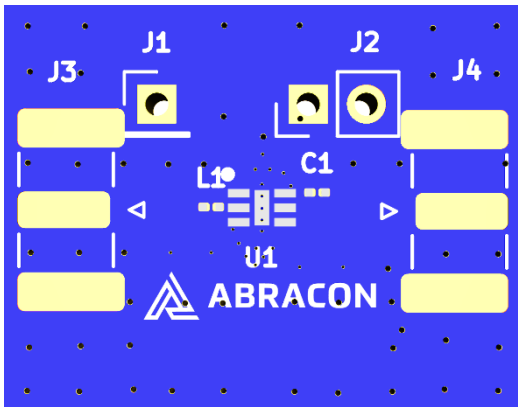
Bill of Material

Component	Description	Manufacturer	Manufacturer Part	QTY
U1	Automotive GNSS L1/L2/L5/L6 Low-Noise Amplifier	Abracon	ALND-WB-0015-Q	1
L1	9.5nH	Murata	LQW15AN_00 series	1
C1	1000pF	Murata	GRM03 series	1

Transmission Line

The transmission line should be kept as short as possible and be designed to have a characteristic impedance of 50Ω. Abracon recommends using a Co-Planar Waveguide with Ground (CPWG), which dimensions can be derived by any trusted calculator, using the correct input for PCB materials and layer stack-up.

Layout Guide



PCB: FR-4, t=0.2mm
Capacitor Size: 0402 (1005 Metric) (1 x 0.5 mm)
Strip Line Width: 0.4 mm
PCB Size: 14.0 x 17.8 mm
Through Hole Diameter: 0.2 mm

EVB Stack up

Number	Name	Type	Material	Thickness (mm)	Weight (oz)	Dk	Orientation	Copper Orientation
	Top Overlay	Overlay						
	Top Solder	Solder Mask	Solder Resist	0.01		3.3		
1	Top Layer	Signal		0.035	1		Top	Above
	Dielectric 1	PrePreg	FR-4	0.2		4.5		
2	Inner Layer 1	Signal		0.035	1		Top	Above
	Dielectric 1	Core	FR-4	1.14		4.5		
3	Inner Layer 1	Signal		0.035	1		Top	Above
	Dielectric 1	PrePreg	FR-4	0.1		4.5		
4	Bottom Layer	Signal		0.035	1		Bottom	Below
	Bottom Solder	Solder Mask	Solder Resist	0.01		3.3		
	Bottom Overlay	Overlay						



Unit: mm

Reflow Profile [JEDEC J-STD-020]

Solder paste: Sn/3.0Ag/0.5Cu

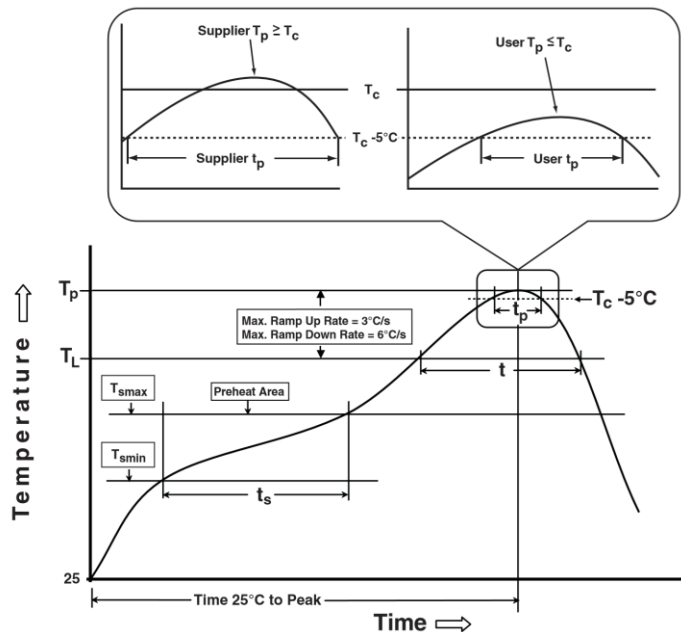


Table 1

SnPb Eutectic Process Classification Temperatures (T_c)		
Package Thickness	Volume mm^3 <350	Volume mm^3 ≥ 350
<2.5mm	235°C	220°C
$\geq 2.5\text{mm}$	220°C	220°C

Table 2

Pb-Free Process Classification Temperatures (T_c)			
Package Thickness	Volume mm^3 <350	Volume mm^3 350-2000	Volume mm^3 >2000
<1.6mm	260°C	260°C	260°C
1.6mm - 2.5mm	260°C	250°C	245°C
>2.5mm	250°C	245°C	245°C

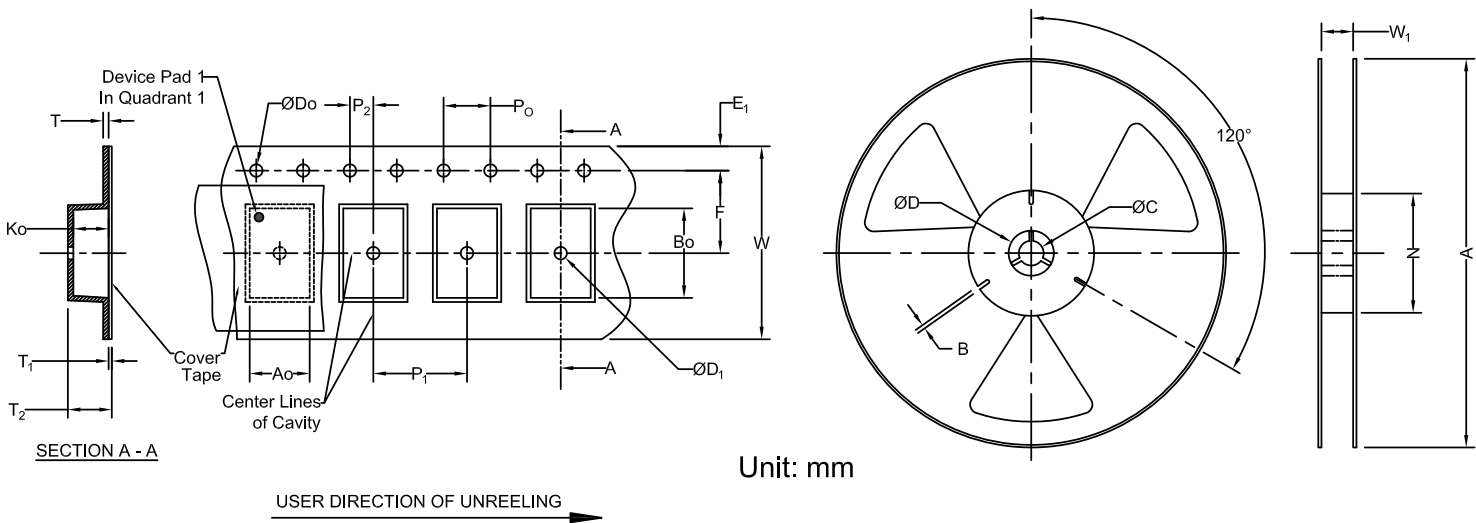
Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat / soak		
Temperature minimum (T_{smin})	100°C	150°C
Temperature maximum (T_{smx})	150°C	200°C
Time (T_{smin} to T_{smx}) (t_s)	60 – 120 sec.	60 – 120 sec.
Average ramp-up rate (T_{smin} to T_p)	3°C/sec. max	3°C/sec. max
Liquidous temperature (T_L)	183°C	217°C
Time at Liquidous (T_L)	60 – 90 sec.	60 – 90 sec.
Peak package body temperature (T_p)*	See Table 1	See Table 2
Time (T_p)** within 5°C of the specified classification temperature (T_c)	20 sec.	10 sec.
Ramp-down rate (T_p to T_{smx})	3°C/sec. max	3°C/sec. max
Time 25°C to peak temperature	6 min. max	8 min. max
Reflow cycles	2 max	2 max

*Tolerance for peak profile temperature (T_p) is defined as a supplier minimum and a user maximum.

**Tolerance for time at peak profile temperature (t_p) is defined as a supplier minimum and a user maximum.

Packaging

Tape & Reel Dimension



Carrier Tape Specifications (mm)												
E1	D0	D1	P0	P2	F	P1	W	A0	B0	K ₀	T	Reel Qty
1.75 ± 0.1	1.5 ± 0.1/0	1.5 ± 0.1/0	4.0 ± 0.1	2.0 ± 0.05	3.5 ± 0.05	4.0 ± 0.1	8.0 +0.3/- 0.1	1.8 ± 0.05	1.8 ± 0.05	1.28	0.25 ± 0.05	3,000

Reel Specifications (mm)					
A	W ₁	N	B	C	D
180 Max.	9 ± 0.3/0	60	2 ± 0.5	13 ± 0.2	21 ± 0.8