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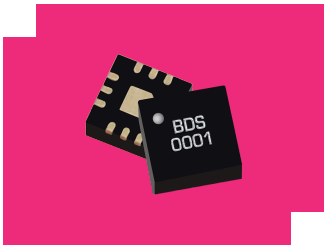
ABDS-10170PSM

30 GHz Differential to Single Ended Active Balun

DEVICE OVERVIEW

General Description

The ABDS-10170PSM is a GaAs active MMIC balun in a 3mm QFN surface mount package. It offers 3 dB differential to single ended gain from low frequencies (limited by DC block) to 30 GHz. The 3mm QFN package is a lead free, RoHS compliant package compatible with standard leaded and lead-free solder reflows. Connectorized evaluation packages are available. The ABDS-10170PSM is an excellent choice for converting digital to analog converter differential outputs to single ended.



Download s-parameters here

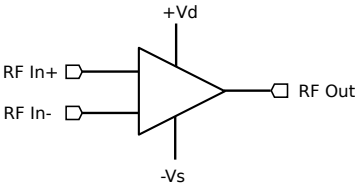
Features

- 2:1 Impedance Ratio
- 30 GHz Active Balun (Differential to Single Ended Mode Conversion)
- Designed for Optimal Phase/Amplitude Balance
- 3 dB Differential to Single Ended Gain
- RoHS Compliant

Applications

- High-Speed Data
- Digital to Analog Converters

Functional Block Diagram



Part Ordering Options

Part Number	Description	Package	Green Status	Product Lifecycle	Export Classification
ABDS-10170PSM	30 GHz Differential to Single Ended Active Balun	QFN	REACH RoHS	Released	EAR99
EVB-ABDS-10170P	Evaluation Board	EVB	REACH RoHS	Released	EAR99

Table Of Contents

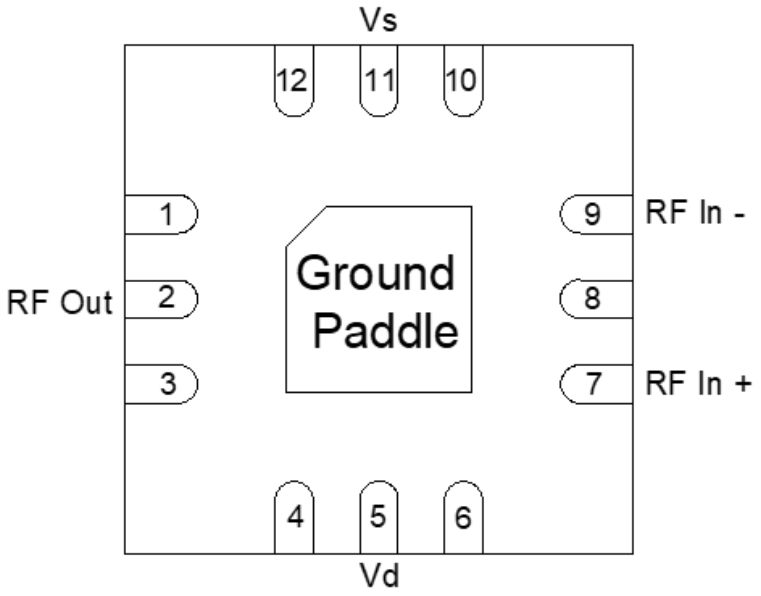
Revision History

Revision Code	Revision Date	Comment
-	2025-06-24	Initial Release

Port Configuration and Functions

Port Diagram

Below is the port diagram for the ABDS-10170PSM. The diagram is shown as an x-ray view from the top down.



Port Functions

Port	Function	Description	DC Equivalent Circuit
11	Vs	Pin 11 is the negative DC supply voltage for the device.	-
1,3,4,6,8,10 and 12	Non-connect (NC)	These pins are not connected internally. Datasheet performance is tested with NC pins grounded.	-
2	RF Output	Pin 2 is the RF output of the device. This pin is internally RF matched to 50 Ohms and is DC coupled. This pin requires an external DC blocking capacitor if DC is present on the input line. If the line is DC ground or floating, an external DC blocking capacitor is unnecessary.	-
5	Vd	Pin 5 is the positive DC supply voltage for the device.	-
7	RF In +	Pin 7 is the positive RF input of the device. This pin is internally RF matched to 50 Ohms and is DC coupled. This pin requires an external DC blocking capacitor.	-
9	RF In -	Pin 9 is the negative RF input of the device. This pin is internally RF matched to 50 Ohms and is DC coupled. This pin requires an external DC blocking capacitor.	-
Paddle	Ground	Ground pad should be connected to RF/DC ground with low electrical and thermal resistance.	-

Specifications

Absolute Maximum Ratings

The Absolute Maximum Ratings indicate limits beyond which damage may occur to the device. If these limits are exceeded, the device may be inoperable or have a reduced lifetime. This device is designed and characterized in a 50Ω system (100Ω differential output), and operation in a reflective environment can cause performance degradation.

Parameter	Maximum Rating	Unit
Drain Current (Id) (No RF Applied) [1]	84	mA
Maximum Operating Temperature	85	°C
Maximum Storage Temperature	150	°C
Minimum Operating Temperature	-40	°C
Minimum Storage Temperature	-65	°C
RF Input Power	10	dBm
Source Current (Is) no RF applied	-84	mA
Total DC Supply Voltage (Vd-Vs)	9.5	V

[1] Max current density across TFR

Package Information

Parameter	Details	Rating
ESD	< 50 Volts	HBM 0Z
Dimensions	-	3 x 3 mm
Moisture Sensitivity Level	-	MSL 1

Recommended Operating Conditions

Parameter	Min	Nominal	Max	Unit
Negative DC Voltage (Vs)	-3	-4	-4	V
Positive DC Voltage (Vd)	3	4	4	V
Negative DC Current (Is) (No RF Input)	-67	-67	-50	mA
Positive DC Current (Id) (No RF Input)	50	67	67	mA

Electrical Specifications

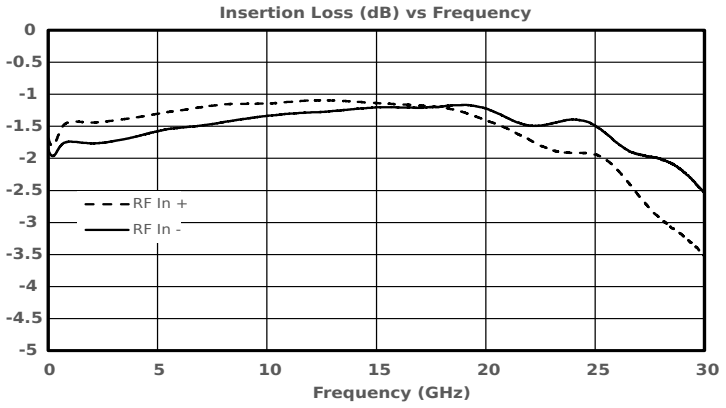
Specifications guaranteed for +25°C, measured in a 50Ω system. Measured data was taken on an evaluation board and de-embedded to surface mount launch unless otherwise noted.

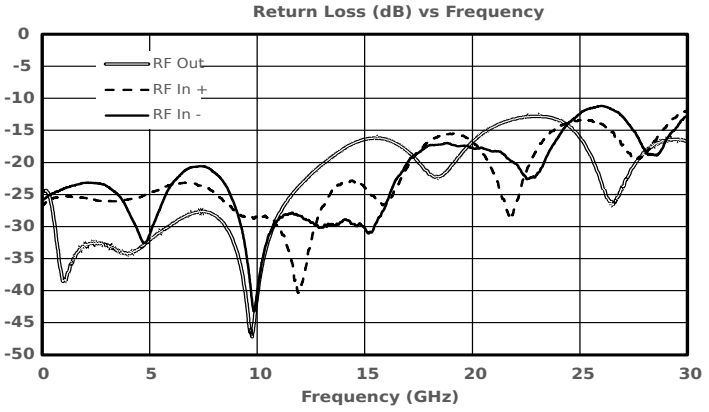
Parameter	Test Conditions	Minimum Frequency (GHz)	Maximum Frequency (GHz)	Min	Typ	Max	Unit
Single-Ended Gain	Vd=4V, Vs=-4V	0	30	-	-1.5	-	dB
Output IP3 [1]	Vd=4V, Vs=-4V	0	30	-	18	-	dBm
Common Mode Rejection	Vd=4V, Vs=-4V	0	30	-	33	-	dB
Impedance Ratio	-	-	-	-	2:1	-	
Amplitude Balance	Vd=4V, Vs=-4V	0	30	-	0.2	-	dB
DC Supply Quiescent Current (Idq)	Vd=4V, Vs=-4V	-	-	-	67	-	mA
Differential Power Gain	Vd=4V, Vs=-4V	0	30	-	1.5	-	dB
HD2	Vd=4V, Vs=-4V, differential input power=0dBm	0	15	-	48	-	dBc
HD3	Vd=4V, Vs=-4V, differential input power=0dBm	0	15	-	44	-	dBc
Input Return Loss	Vd=4V, Vs=-4V	0	30	-	22	-	dB
Noise Figure [2]	Vd=4V, Vs=-4V	0.1	30	-	8.2	-	dB
Nominal Phase Shift [3]	Vd=4V, Vs=-4V	0	30	-	180	-	°
Output IP2 [4]	Vd=4V, Vs=-4V	0	15	-	50	-	dBm
Output Return Loss	Vd=4V, Vs=-4V	0	30	-	23	-	dB
Phase Balance [5]	Vd=4V, Vs=-4V	0	30	-	2	-	°
Reverse Isolation	Vd=4V, Vs=-4V	0	30	-	37	-	dB

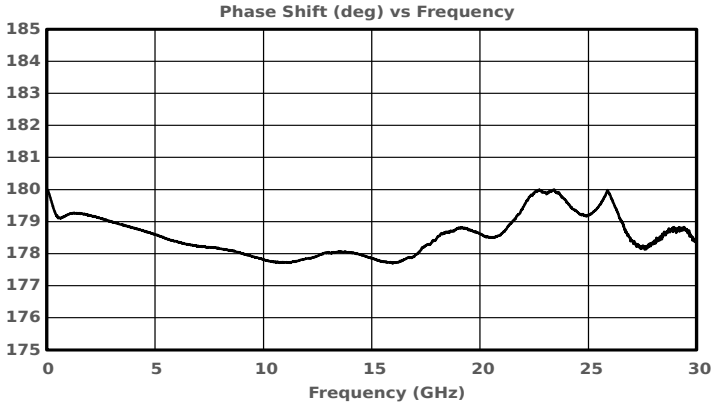
[1][4] Measured with 10MHz offset differential tones at input, differential input power=-7dBm per tone
[2] Measured using a balun at the input to produce a differential signal. The external balun and associated losses are de-embedded from the measurement. EVB trace and connector losses are still present in the data.
[3][5] Measured single-ended with connector and evb effects de-embedded.

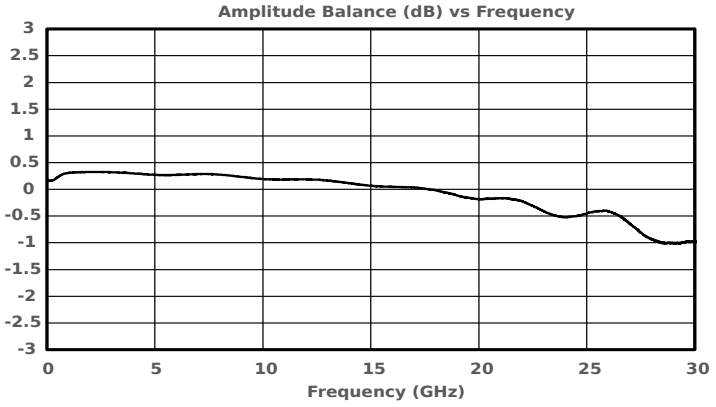
Typical Performance Plots

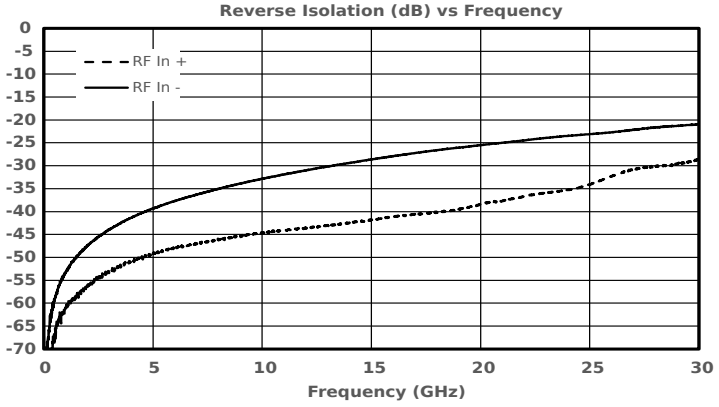
Three-port scattering parameters measured as three single-ended 50Ω ports unless otherwise noted. Small signal gain, return losses and reverse isolation have evb and connector effects de-embedded.

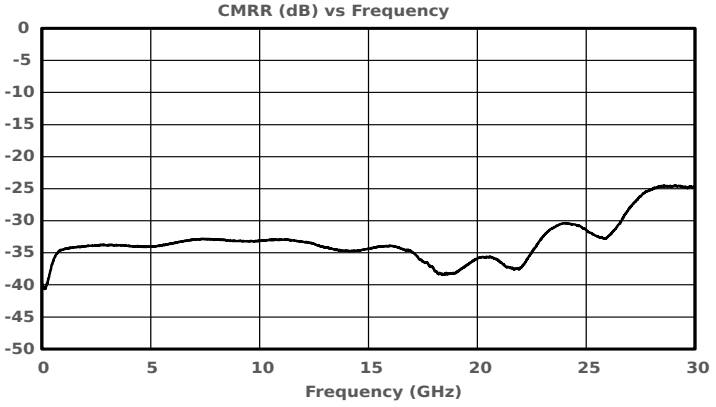






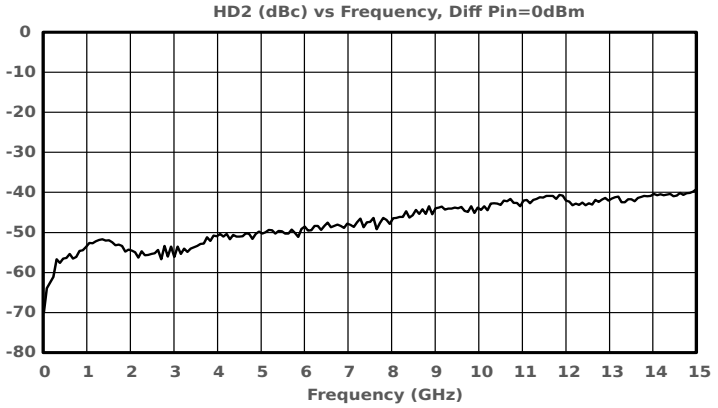


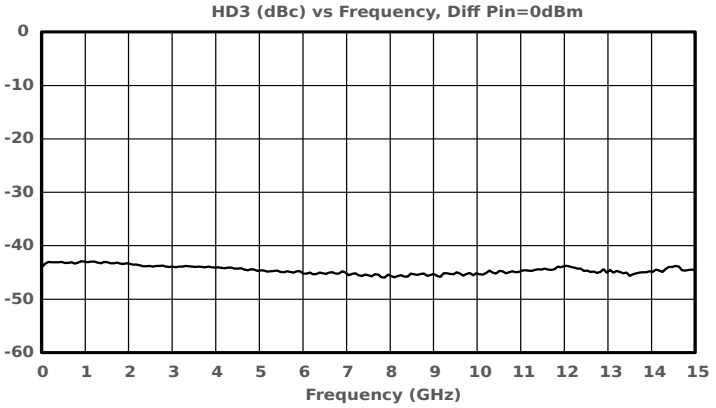


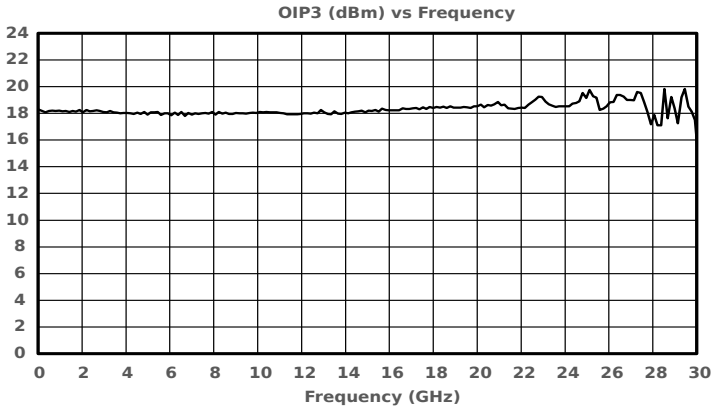


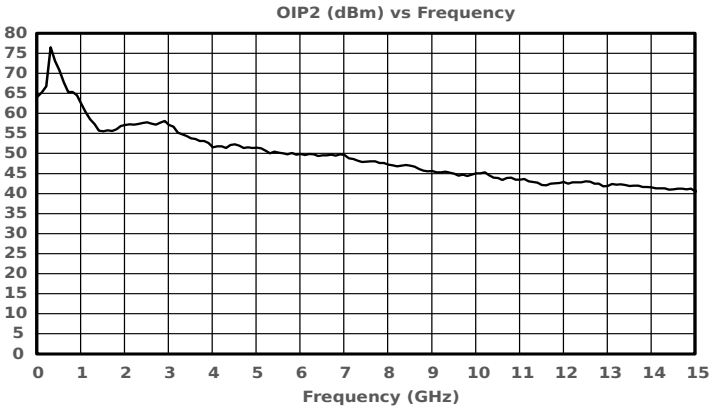
Differential Linearity

Measurements are with 50-Ω single-ended input, and 100-Ω differential output. EVB and connector effects are included in these measurements. All plots are with respect to input frequency.



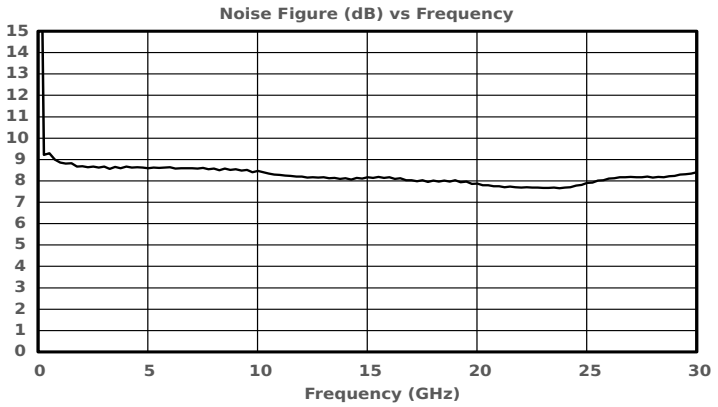






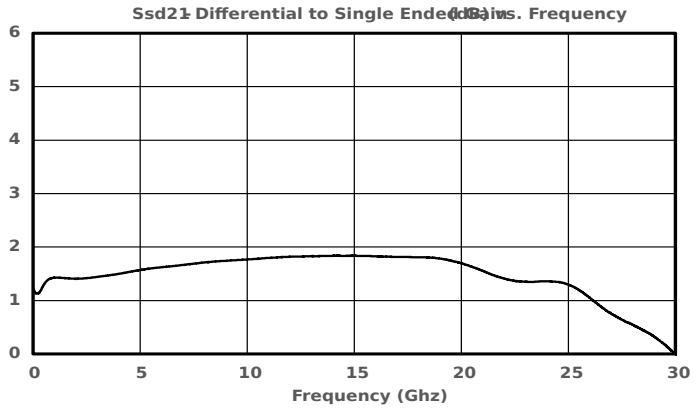
Differential Noise Figure

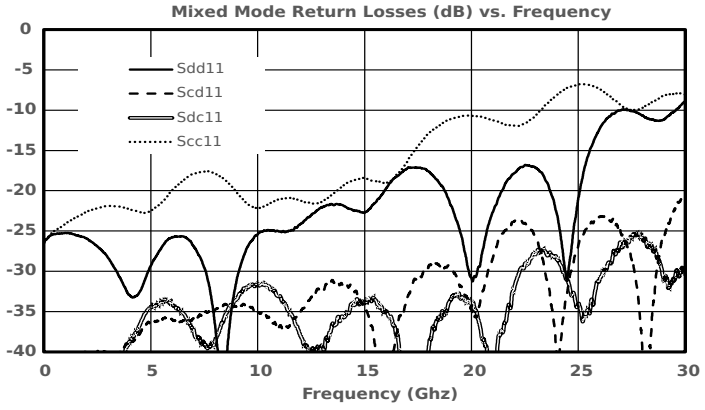
Measured differentially and includes EVB and connector noise contributions.

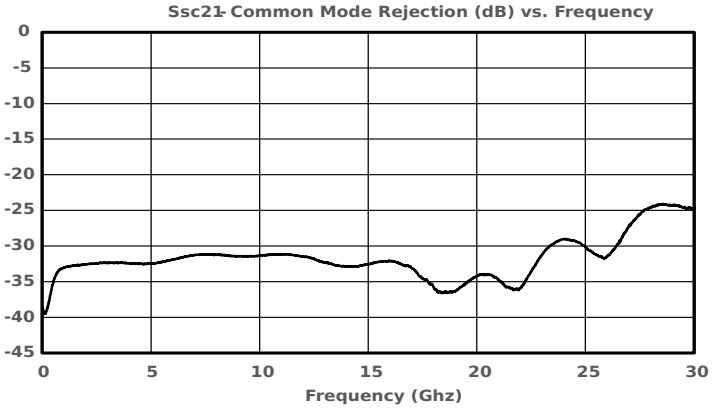


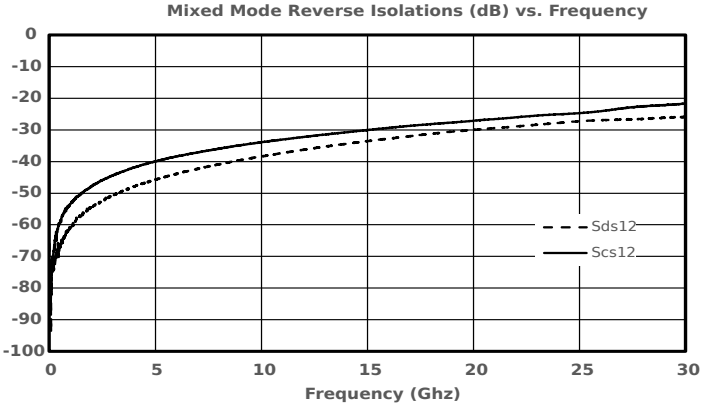
Mixed Mode Scattering Parameters

Mixed mode scattering parameters are used to characterize differential circuits. For baluns, this means that the 0° and 180° ports become a single 100Ω differential port and the common port remains the same 50Ω common port. The two-port s-parameters of the balun are then characterized based on differential (d), common mode (c), or single-ended (s) signals. For example: Sds12 is the single ended to differential reverse isolation of the active balun. Sdc11 is the return loss measured as ratio of differential reflect to common mode incident signal on the input port.

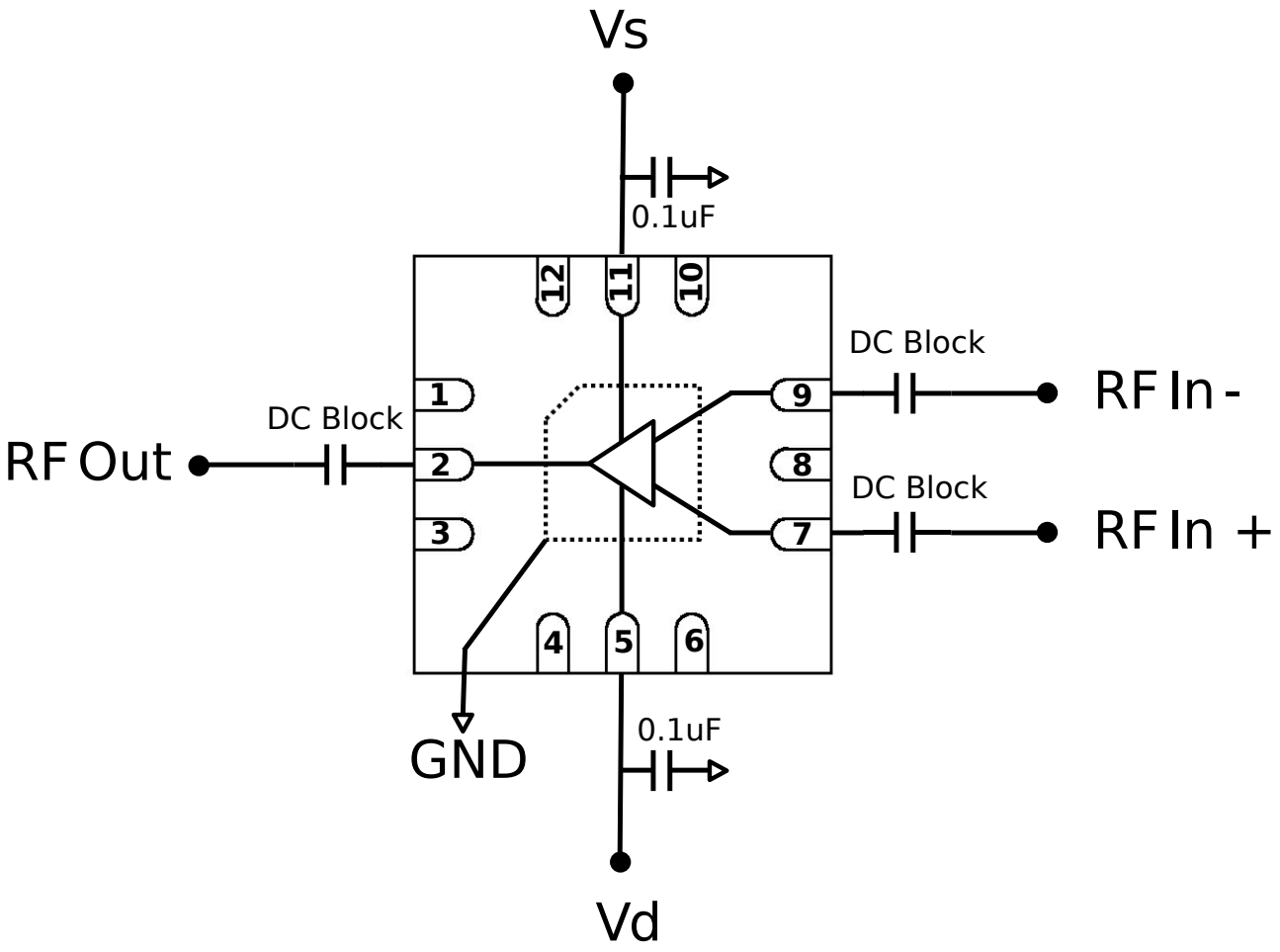








Application Circuit



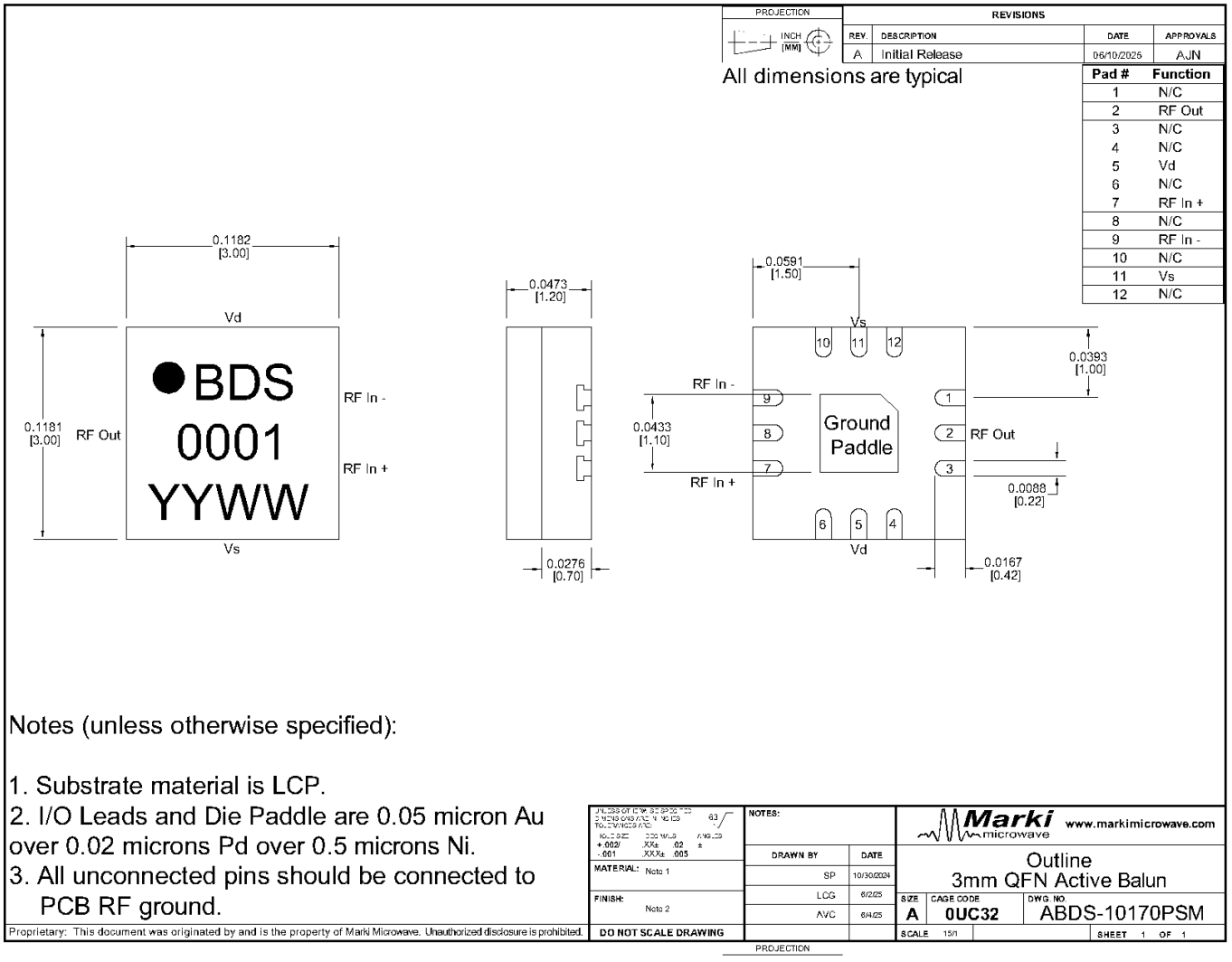
Application Circuit Description

The application circuit for the ABDS-10170PSM is shown above. This part requires DC blocking capacitors at all RF pins (2,7 and 9). DC power is supplied via Vd (5) and Vs (11) pins. Positive DC voltage is applied to Vd and negative DC voltage is applied to Vs. It is recommended to provide 0.1uF bypass capacitors on the Vd and Vs supply lines. NC pins are not internally connected but should be grounded. The paddle of the QFN should be connected to GND via a low thermal and electrical resistance.

Mechanical Data

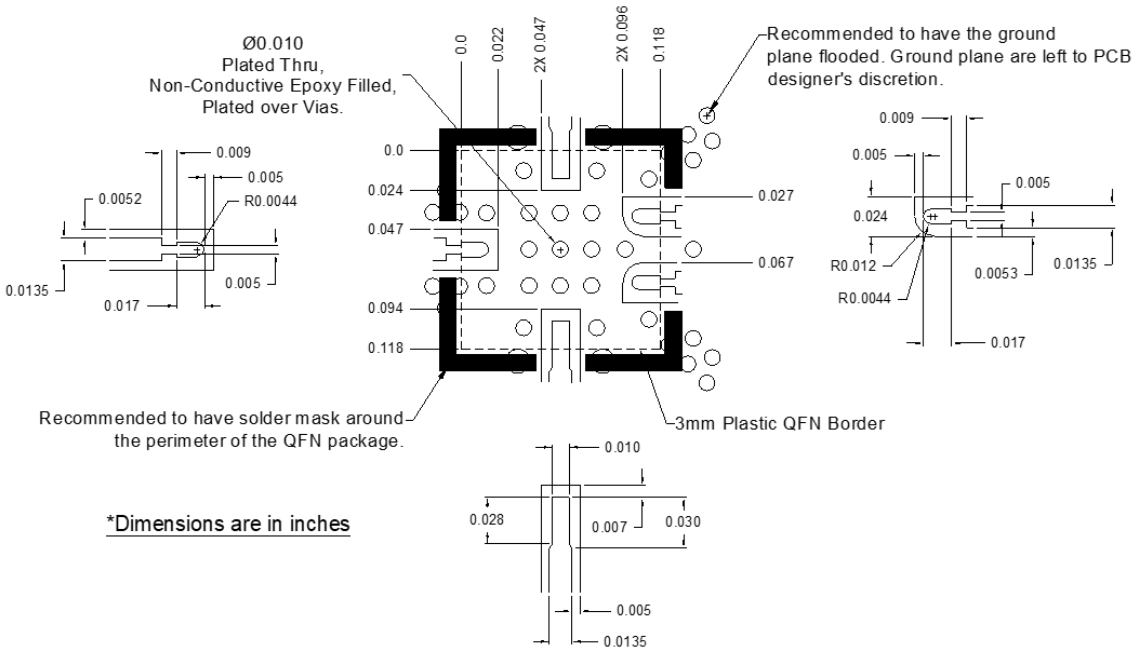
Outline Drawing

Download : Outline 2D Drawing | Outline 3D Drawing | Outline 3D STP



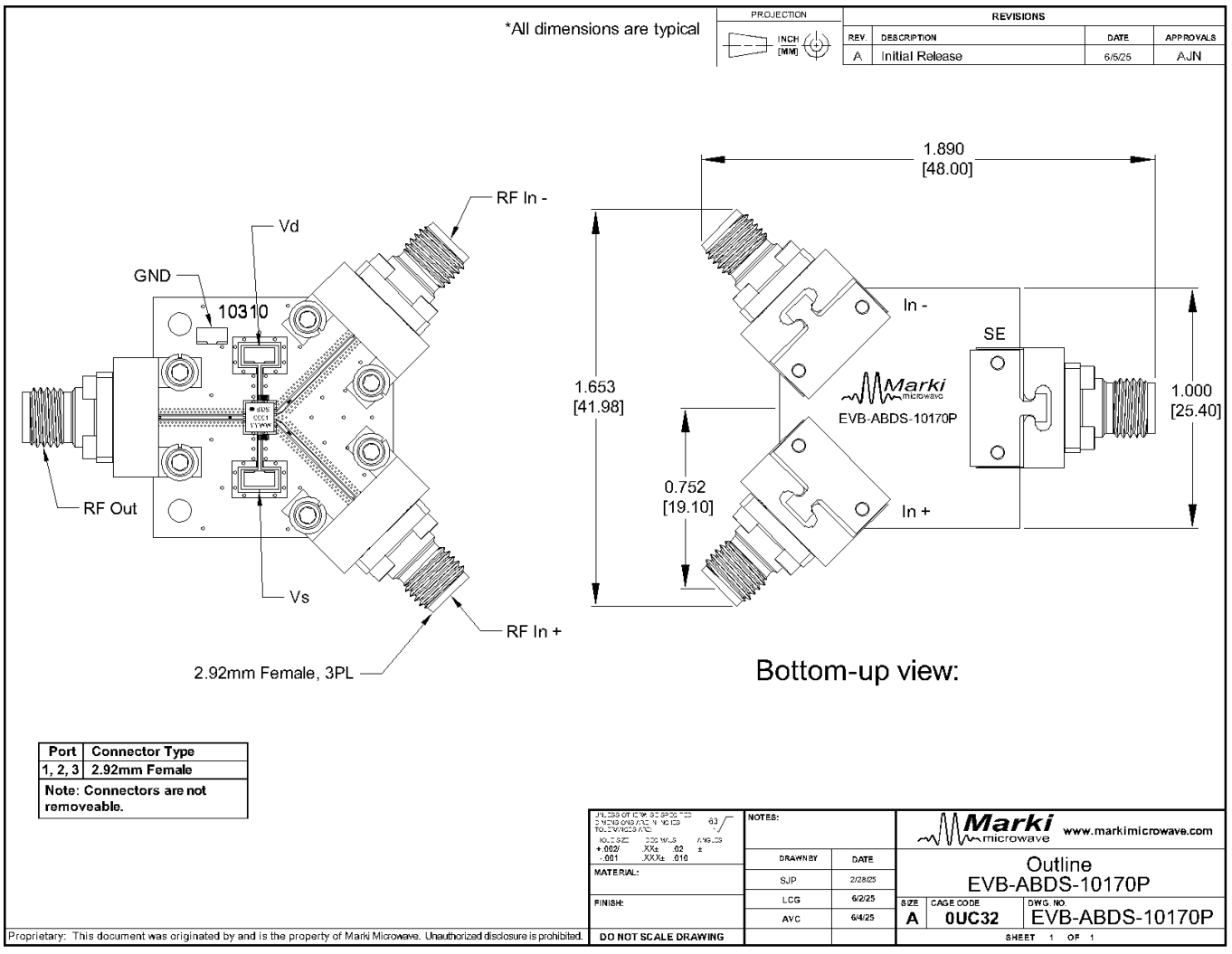
Footprint Image

Download : Footprint Drawing



The landing pattern is to be used on Rogers 4003, 0.008" thick, $\frac{1}{2}$ Oz Cu both sides.

Evaluation Board - Outline Drawing



Notes

The RF transitions on the input and output traces of the recommended footprint are specific to the material type and thickness used on the Marki evaluation board. They are currently designed for single-ended 50 Ohm transmission line. They will need to be re-designed for pcb stackups using different materials and or different transmission line impedances.

DISCLAIMER