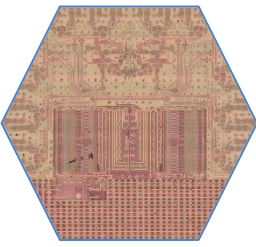
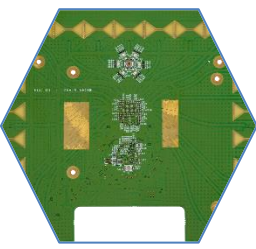




Vayyar VYR2401 4D UWB Radar Imaging SoC

Deep dive analysis of Vayyar's 4D UWB Radar Imaging System-on-Chip from the Walabot Home Fall Detection System.



Title: Vayyar VYR2401 4D UWB Radar Imaging SoC

Pages: 105

Date: September 2020

Format: PDF & Excel file

Price: EUR 3,990

Reference: SP20561

Historically, radar technology has been applied to industrial and defense applications. In 2020, this field still claim 75 % of the market; automotive applications started before 2010, and the market has maintained a 16% growth rate. Vayyar, a startup company has seen the potential of a new market in medical and consumer applications, currently with 0.13 % share. The Ultra-Wide Band (UWB) Radio Frequency (RF) System-on-Chip (SoC) from the company was introduced onto the market in 2013. Having first developed radar technology in medical applications such as breath-based cancer detection and fall detection the company is now diversifying into in-cabin monitoring and ultra-short-range radar in automotive. This report analyses the UWB 4D Imaging RF Radar SoC, VYR2401, extracted from the Walabot Home system that detects falls using the C and X bands.

Walabot is the consumer brand from Vayyar that offers UWB 4D imaging systems. The company built all its systems from the RF SoC manufactured by Vayyar. The first SoC developed by the company was the VYR2401, analyzed in this report. This chip is used in a smartphone add-on device that detects pipes and cables and behind walls and in a fall detection system torn down in this report.

The attraction of the Vayyar solution is the simplicity of integration of the system. The

RF SoC features an on-chip Digital Signal Processor (DSP) that processes the data from the transceiver. With an external Microcontroller Unit (MCU), it became understandable by any processor with machine learning features on the market like a Snapdragon from Qualcomm.

The report includes a full investigation of the component and its integration in the Walabot Home System. It features a detailed study of the structure of the RF board and the Monolithic Microwave Integrated Circuit (MMIC), including die analysis, process, and a Printed Circuit Board (PCB) cross-section. It contains a complete cost analysis and a selling price estimation of the RF SoC. Finally, it features a technical and cost comparison with the radar chipset from Infineon integrated in the Google Pixel 4 XL and the Antenna-on-Package system from Texas Instruments, model AWR1843AoP.

COMPLETE TEARDOWN WITH

- Detailed photos and cross-sections
- Precise measurements
- Material analysis
- Manufacturing process flow
- Supply chain evaluation
- Manufacturing cost analysis
- Estimated sales price
- Comparison with Infineon/Google Soli Project Radar and Texas Instrument Radar Chipset

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AUTHORS

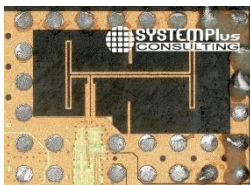


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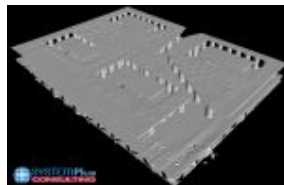


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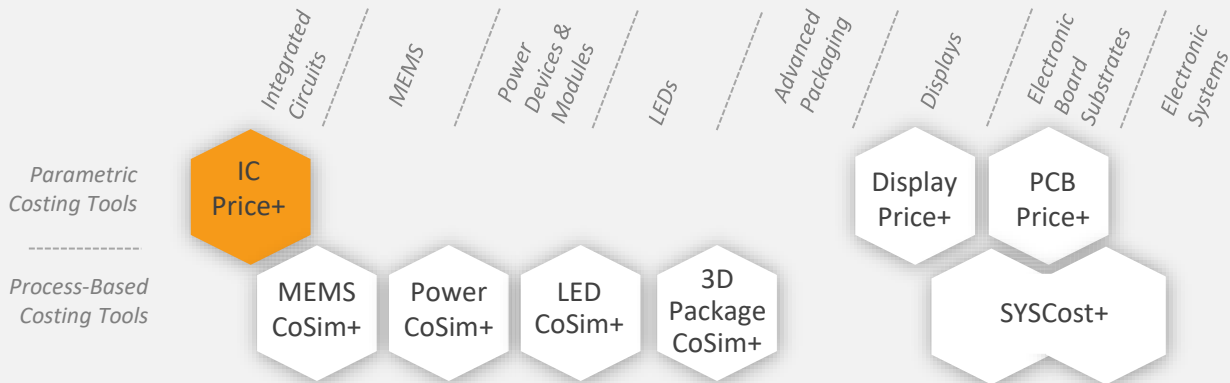


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1.2 This agreement becomes valid and enforceable between the Contracting Parties after clear and non-equivocal consent by any duly authorized person representing the Buyer. For these purposes, the Buyer accepts these conditions of sales when signing the purchase order which mentions "I hereby accept Yole Développement's Terms and Conditions of Sale". This results in acceptance by the Buyer.

1.3 Orders are deemed to be accepted only upon written acceptance and confirmation by the Seller, within [7 days] from the date of order, to be sent either by email or to the Buyer's address. In the absence of any confirmation in writing, orders shall be deemed to have been accepted.

2. MAILING OF THE PRODUCTS

2.1 Products are sent by email to the Buyer:

- Within a few days from the order for Products already released and paid; or
- Within a reasonable time for Products ordered prior to their effective release. In this case, the Seller shall use its best endeavours to inform the Buyer of an indicative release date and the evolution of the work in progress.

2.2 The Seller shall by no means be responsible for any delay in respect of article 2.1 above, and including in cases where a new event or access to new contradictory information would require for the analyst extra time to compute or compare the data in order to enable the Seller to deliver a high quality Products.

2.3 The mailing of the Product will occur only upon payment by the Buyer, in accordance with the conditions contained in article 3.

2.4 The mailing is operated through electronic means either by email via the sales department or automatically online via an email/password. If the Product's electronic delivery format is defective, the Seller undertakes to replace it at no charge to the Buyer provided that it is informed of the defective formatting within 90 days from the date of the original download or receipt of the Product.

2.5 The person receiving the Products on behalf of the Buyer shall immediately verify the quality of the Products and their conformity to the order. Any claim for apparent defects or for non-conformity shall be sent in writing to the Seller within 8 days of receipt of the Products. For this purpose, the Buyer agrees to produce sufficient evidence of such defects.

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3.1 Prices are given in the orders corresponding to each Product sold on a unit basis or corresponding to annual subscriptions. They are expressed to be inclusive of all taxes (except for France where VAT will be added). The prices are re-evaluated from time to time. The effective price is deemed to be the one applicable at the time of the order.

3.2 Payments due by the Buyer shall be sent by cheque payable to Yole Développement, credit card or by electronic transfer to the following account:

HSBC, 1 place de la Bourse 69002 Lyon France

Bank code: 30056

Branch code: 00170

Account n°: 0170 200 1565 87

BIC or SWIFT code: CCFRFRPP

IBAN: FR76 3005 6001 7001 7020 0156 587

To ensure the payments, the Seller reserves the right to request down payments from the Buyer. In this case, the need of down payments will be mentioned on the order.

3.4 Payment is due by the Buyer to the Seller within 30 days from invoice date, except in the case of a particular written agreement. If the Buyer fails to pay within this time and fails to contact the Seller, the latter shall be entitled to invoice interest in arrears based on the annual rate Refi of the «BCE» + 7 points, in accordance with article L. 441-6 of the French Commercial Code. Our publications (report, database, tool...) are delivered only after reception of the payment.

3.5 In the event of termination of the contract, or of misconduct, during the contract, the Seller will have the right to invoice at the stage in progress, and to take legal action for damages.

4. LIABILITIES

4.1 The Buyer or any other individual or legal person acting on its behalf, being a business user buying the Products for its business activities, shall be solely responsible for choosing the Products and for the use and interpretations he makes of the documents it purchases, of the results he obtains, and of the advice and acts it deduces therefrom.

4.2 The Seller shall only be liable for (i) direct and (ii) foreseeable pecuniary loss, caused by the Products or arising from a material breach of this agreement

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4.7 The deadlines that the Seller is asked to state for the mailing of the Products are given for information only and are not guaranteed. If such deadlines are not met, it shall not lead to any damages or cancellation of the orders, except for non-acceptable delays exceeding [3] months from the stated deadline, without information from the Seller. In such case only, the Buyer shall be entitled to ask for a reimbursement of its first down payment to the exclusion of any further damages.

4.8 The Seller does not make any warranties, express or implied, including, without limitation, those of sale ability and fitness for a particular purpose, with respect to the Products. Although the Seller shall take reasonable steps to screen Products for infection of viruses, worms, Trojan horses or other codes containing contaminating or destructive properties before making the Products available, the Seller cannot guarantee that any Product will be free from infection.

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The Seller shall not be liable for any delay in performance directly or indirectly caused by or resulting from acts of nature, fire, flood, accident, riot, war, government intervention, embargoes, strikes, labour difficulties, equipment failure, late deliveries by suppliers or other difficulties which are beyond the control, and not the fault of the Seller.

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Any notices under these Terms and Conditions shall be given in writing. They shall be effective upon receipt by the other Party.

The Seller may, from time to time, update these Terms and Conditions and the Buyer, is deemed to have accepted the latest version of these terms and conditions, provided they have been communicated to him in due time.

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9.2 French law shall govern the relation between the Buyer and the Seller, in accordance with these Terms and Conditions.