# Vehicle-to-Vehicle (V2V) Communication Implementation

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***Abstract*—Vehicle-to-vehicle (V2V) allows communication between vehicles, promoting driver awareness and potentially reducing the number of collisions. Existing V2V implementations (cellular vehicle-to-everything, C-V2X) rely on cloud data, whereas the implementation shown in this paper does true V2V between vehicles. A mockup utilizing two ESP32 with a time-of-flight (ToF) sensor and accelerometer communicate using UDP to illustrate V2V.**

***Index Terms*—V2V, vehicles, driver, awareness, C, ESP32, UDP**

## I. Introduction

As society moves towards utilizing more autonomous driving systems, vehicles can act as a network to promote efficient and safe driving. This network is referred to as vehicle-to-vehicle (V2V). Automotive vehicles should communicate with each other through V2V to increase driver awareness and reduce the number of collisions.

The current state of V2V is nonexistent. The closest thing on the market to V2V is the Safety Cloud for Chrysler Vehicles, which is implemented through a cellular network to create C-V2X (cellular vehicle-to-everything) [**?**]. While this is fairly close to V2V, passing through a cloud does not exhibit true V2V. Ideally the cars would communicate directly to each other, which is what is covered by the implementation discussed in this paper.

V2V will be illustrated using an ESP32 paired with time-of-flight (ToF) sensor and accelerometer. Each ESP32 represents a simplified car, and communicate with each other using UDP. UDP was chosen as the protocol to allow ad hoc car networks to be formed as well as allow dropped packets once a car leaves the network.



## II. Wafer Setup

## III. Front-End-of-Line

*a) LTH Mand:* After low-temperature hydrogenation [1], the resist layer will be etched and expose the SiARC underneath. This results in the stack from Fig. 1. TODO: Explain what we use this for.

*b) RIE Mand:* Reactive ion etching (RIE) [2] is used to cut the SiARC layer, exposing the ODL underneath.

## IV. Middle-of-Line

Explanation on MOL.

## V. Extract Devices

Explanation on extracting devices.

## VI. Conclusion

Lots of things happen in the 14 nm process flow.

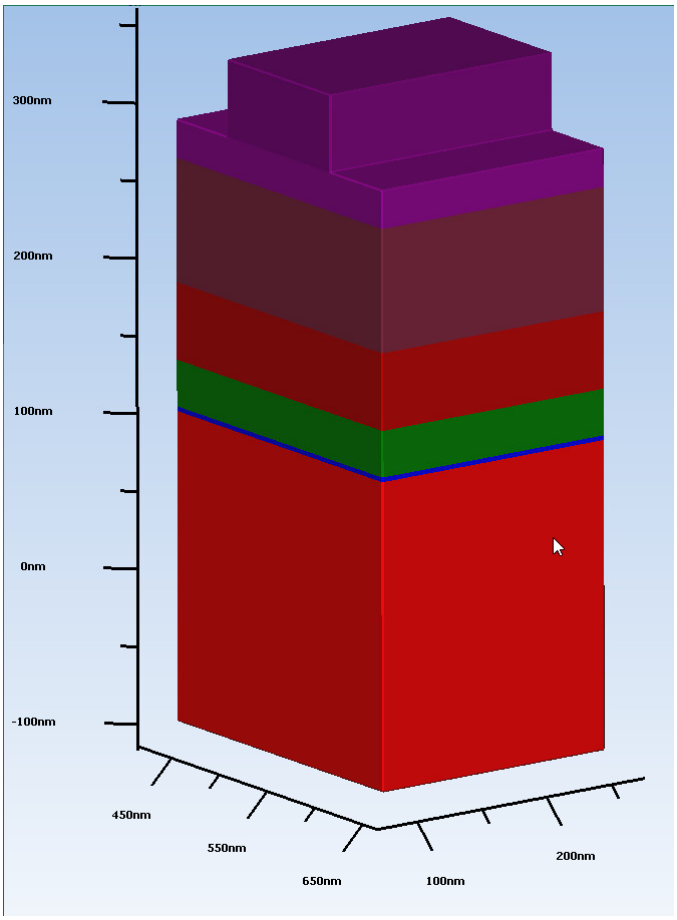


Fig. 1. The silicon stack after LTH Mand.

## REFERENCES


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[2] L. Ephrath, "Reactive ion etching for vlsi," *IEEE Transactions on Electron Devices*, vol. 28, no. 11, pp. 1315–1319, 1981.