



# Improving Surface Mount Packaging Design for mmWave Devices

Kyle Chang, Applications Engineer

IMS 2023

# Presentation Overview

1. Why Package mmWave Devices?
2. Current Packaging Options
3. Challenges with High-Frequency Packaging
4. Improving Packaging for mmWave Applications

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1. **Why Package mmWave Devices?**
2. Current Packaging Solutions
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# Why Package mmWave Devices?

## Scalability

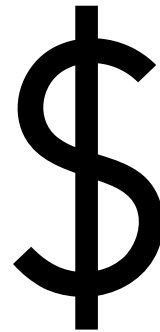


# Why Package mmWave Devices?

## Scalability



## Cost

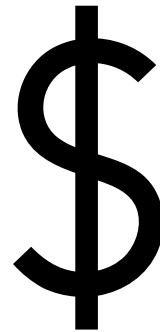


# Why Package mmWave Devices?

## Scalability



## Cost



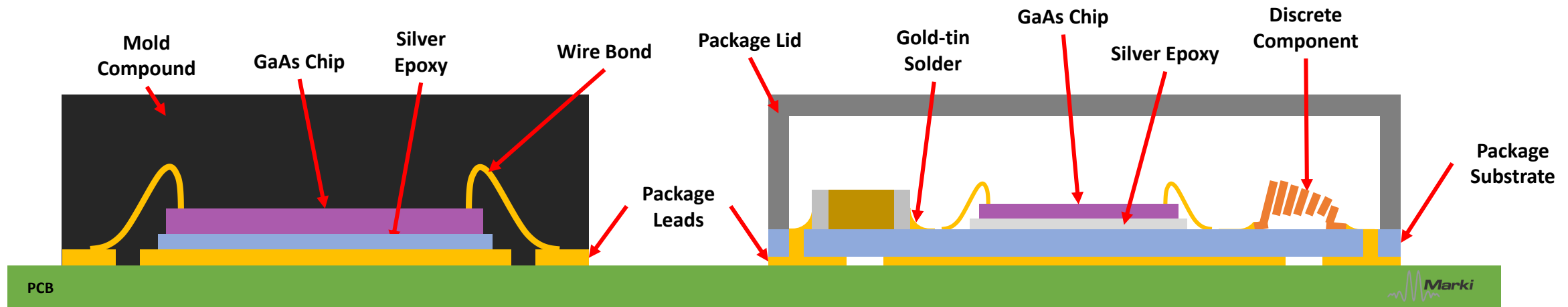
## Accessibility



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# Current Packaging Options

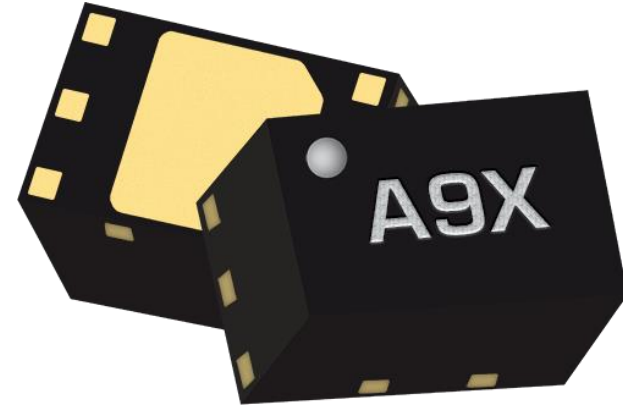
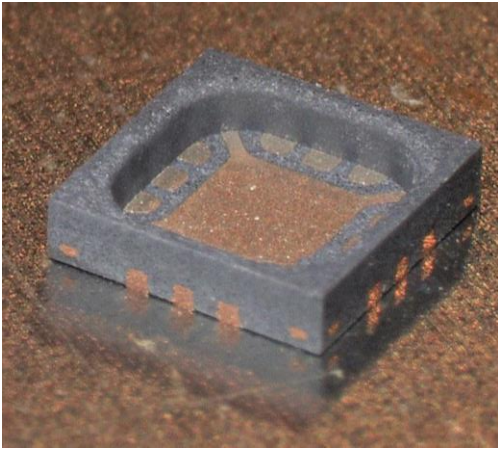


**IC Packaging**

**Hierarchical Packaging**



# Current Packaging Options

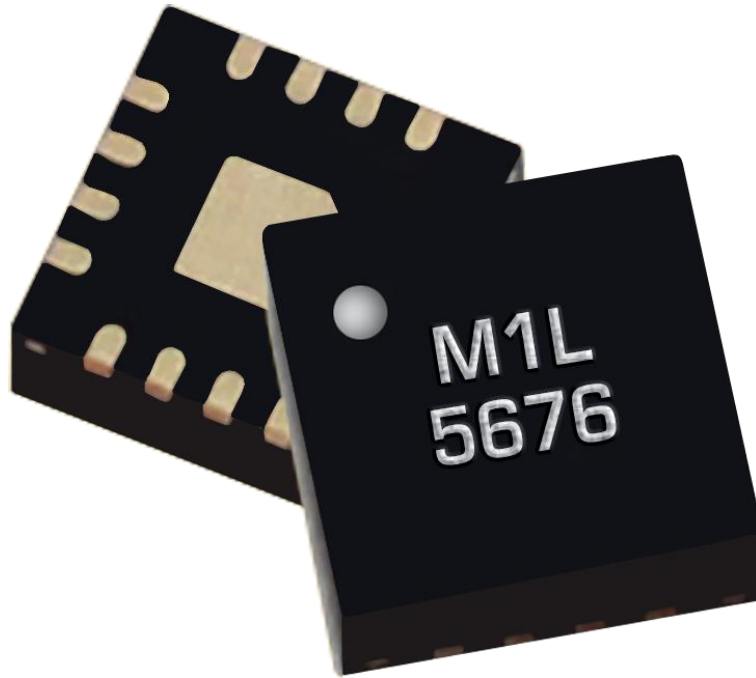


**Air Cavity**



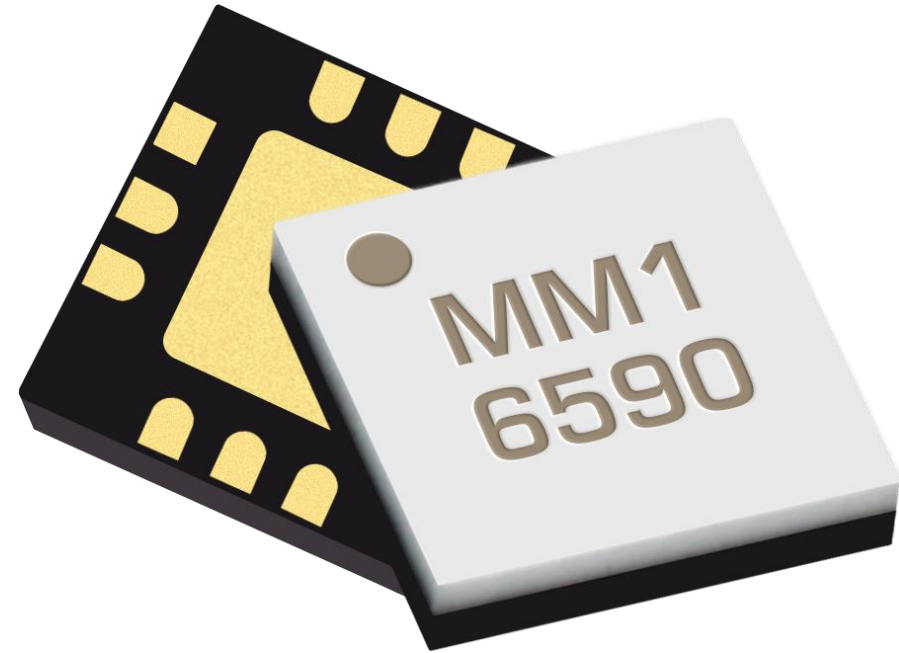
**Plastic Over Mold**

# Current Packaging Options



(MM1-2567LSM)

## Plastic Packaging



(MM1-0832LSM)

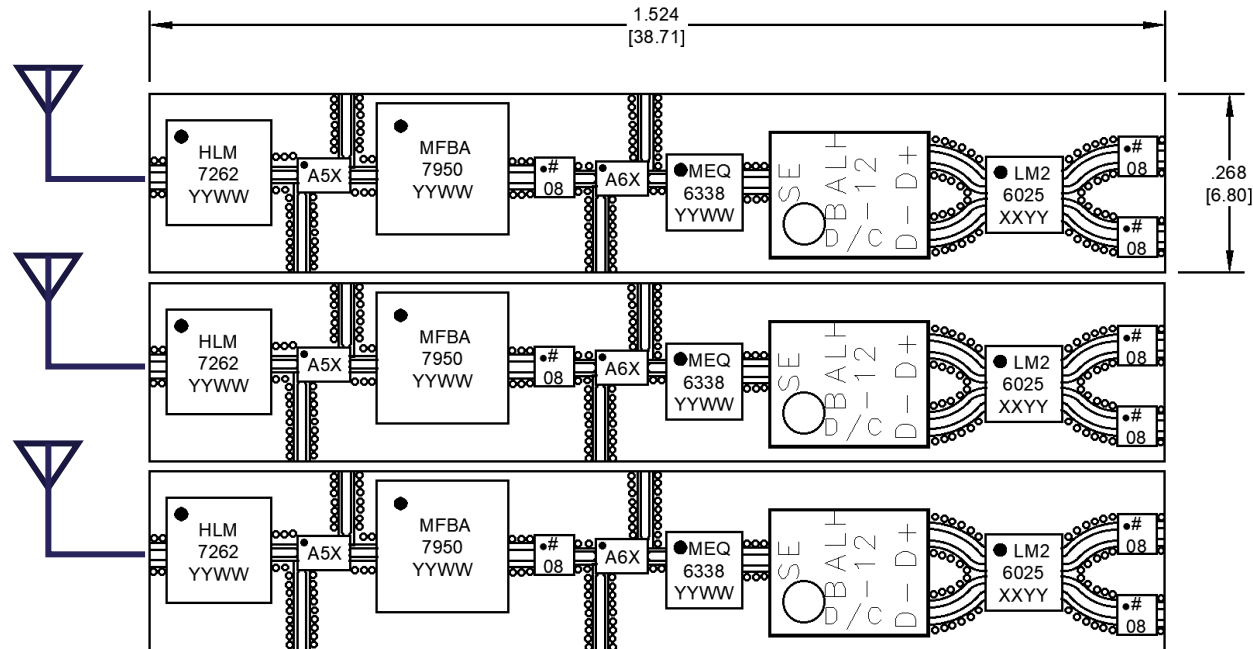
## Ceramic Packaging

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- 3. Challenges with High-Frequency Packaging**
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# Challenges with High-Frequency Packaging

- Meeting SWaP-C demands:
  - High channel density in RF front end
  - Phased array applications
  - Large-scale production testing



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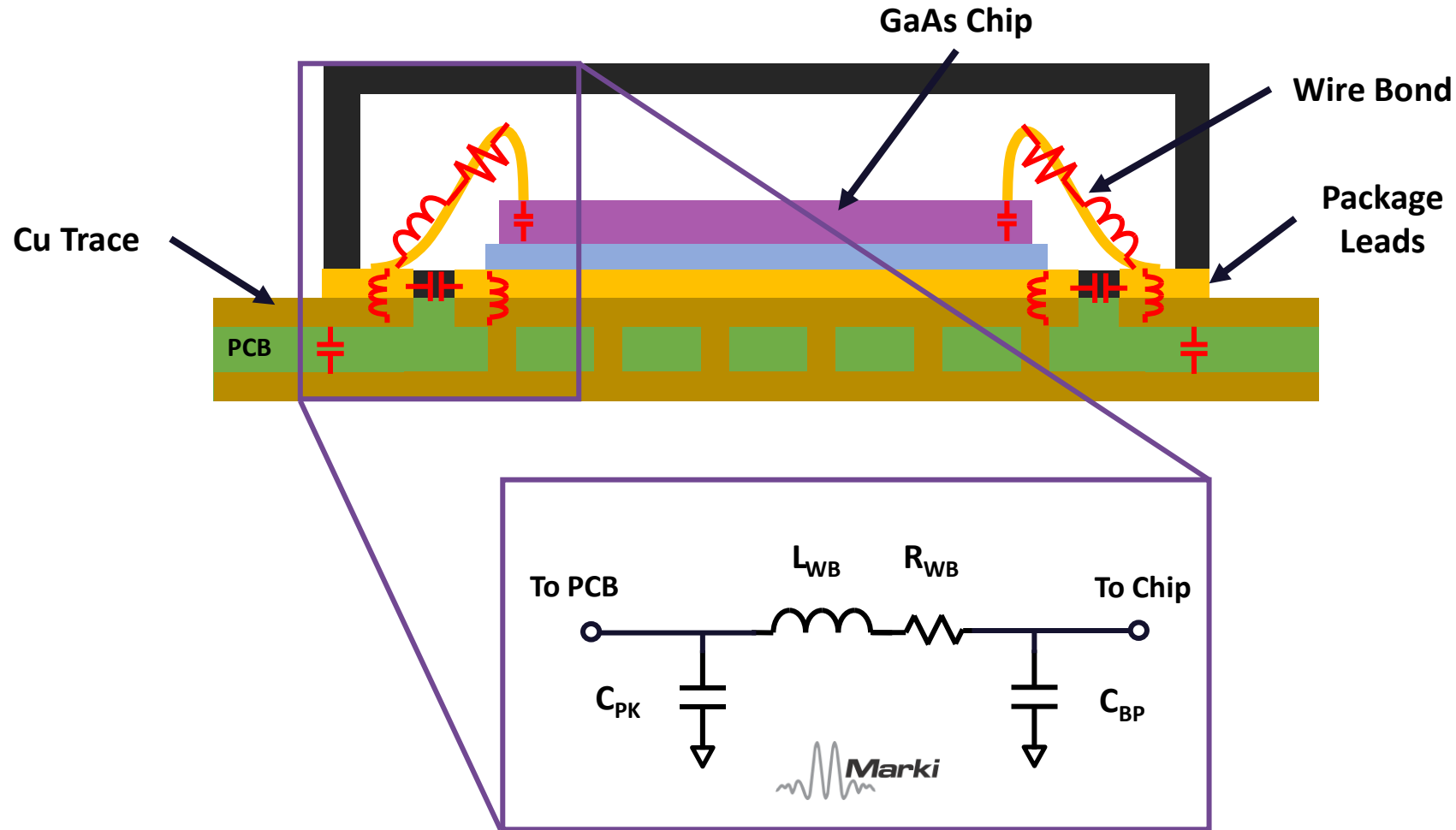
# Challenges with High-Frequency Packaging

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  - Phased array applications
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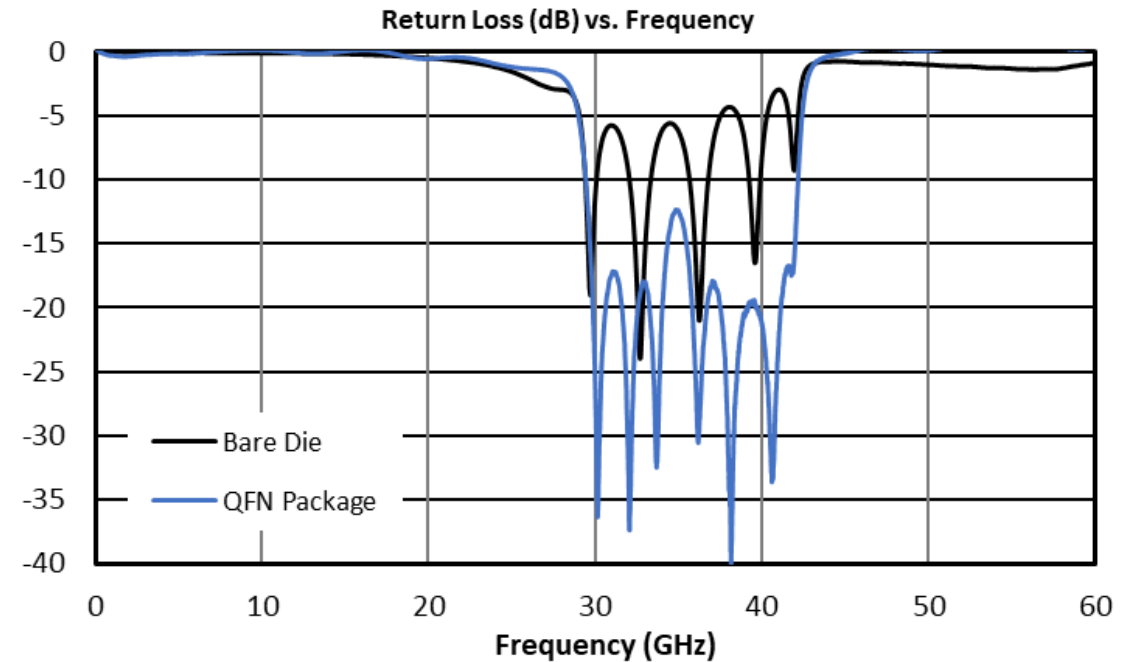
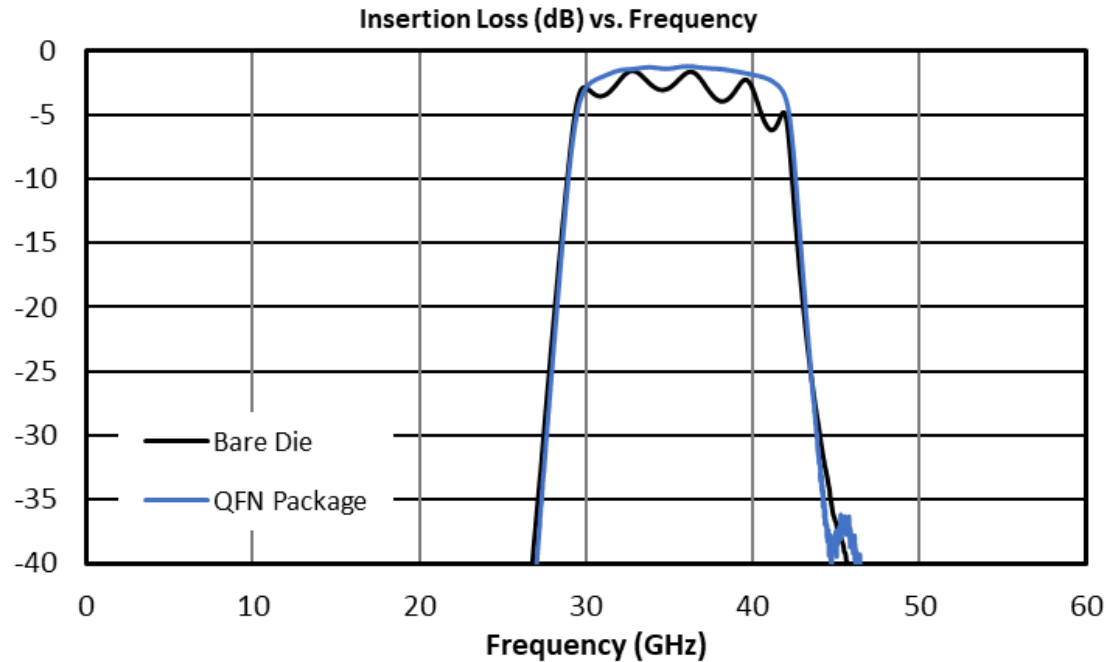
# Challenges with High-Frequency Packaging

- Increased packaging parasitics



# Challenges with High-Frequency Packaging

- Packaging co-design requirement (device dependent)

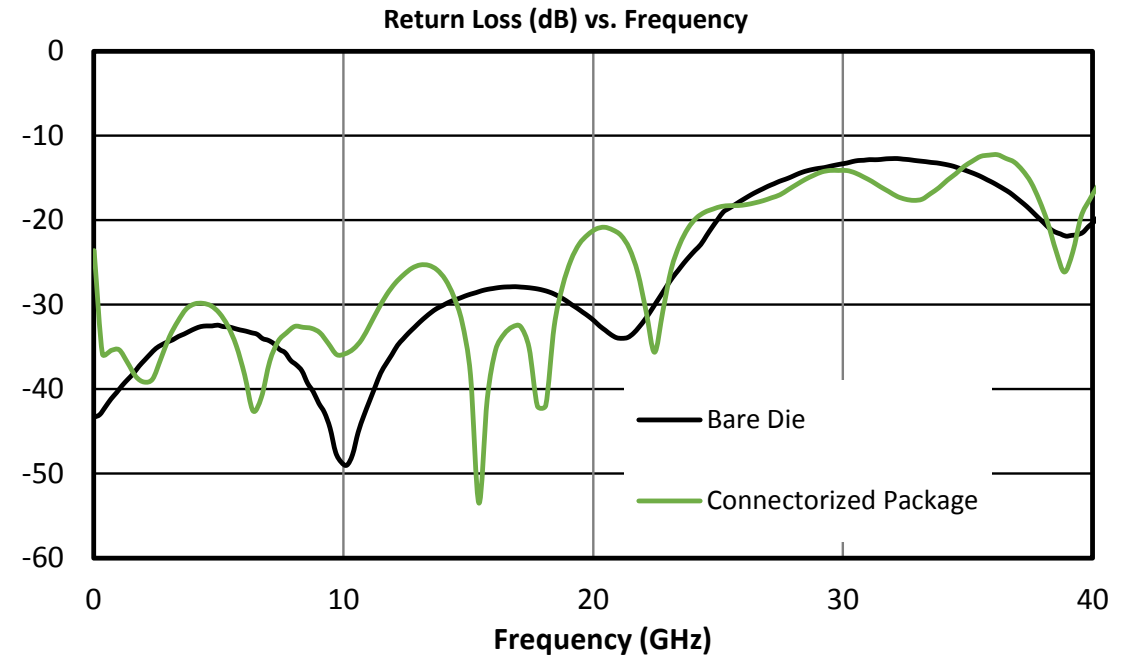
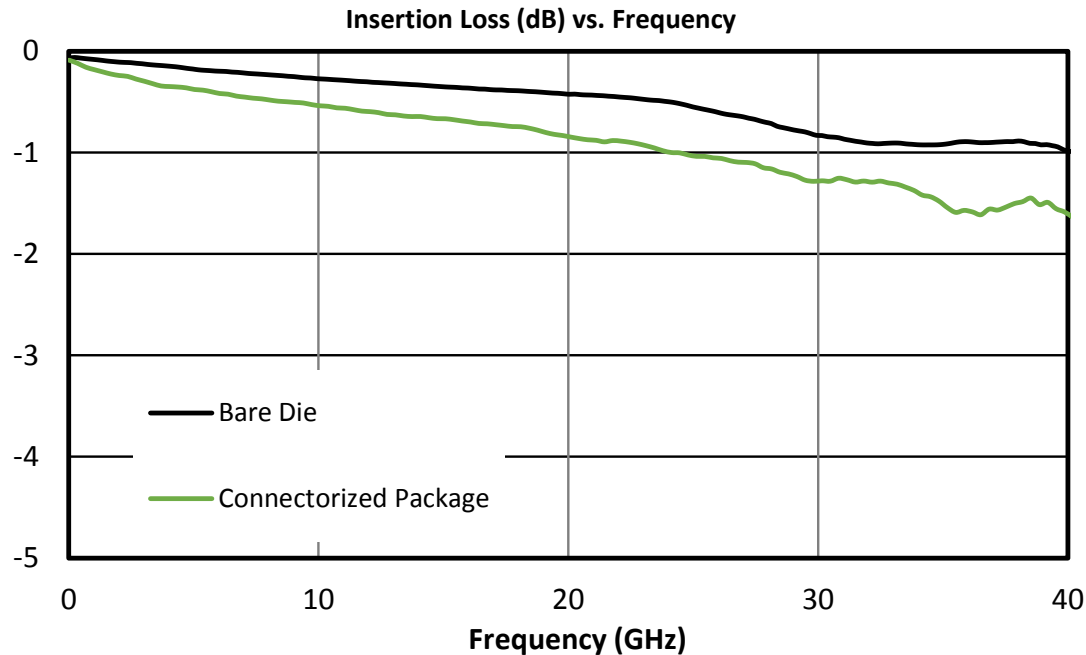


(MFBC-00016PSM)



# Challenges with High-Frequency Packaging

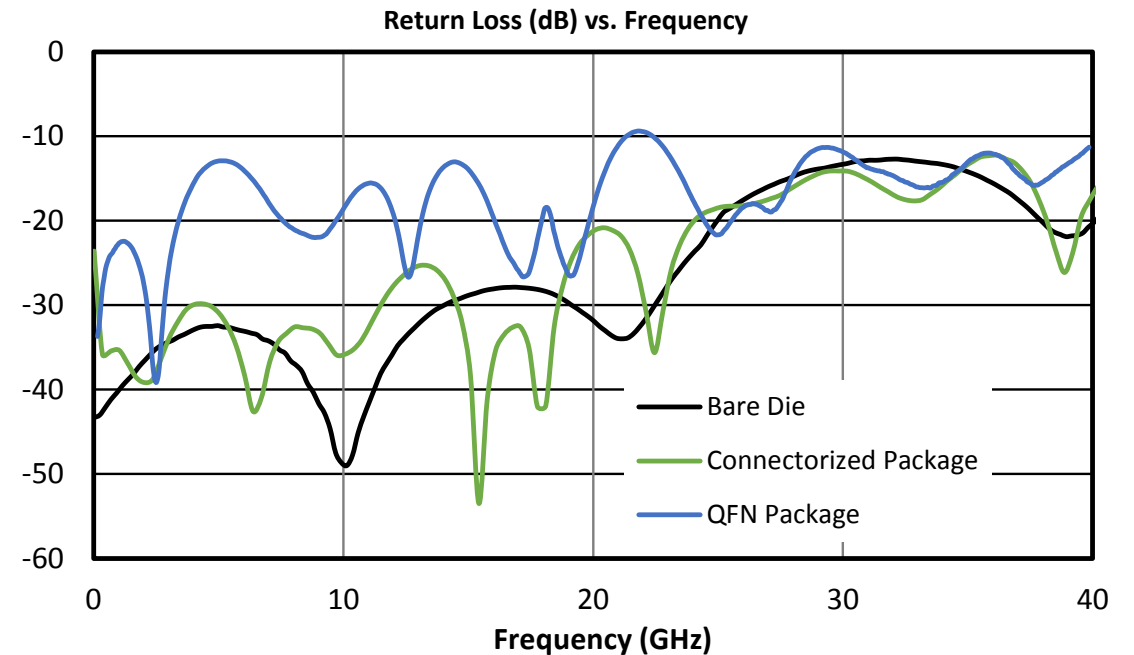
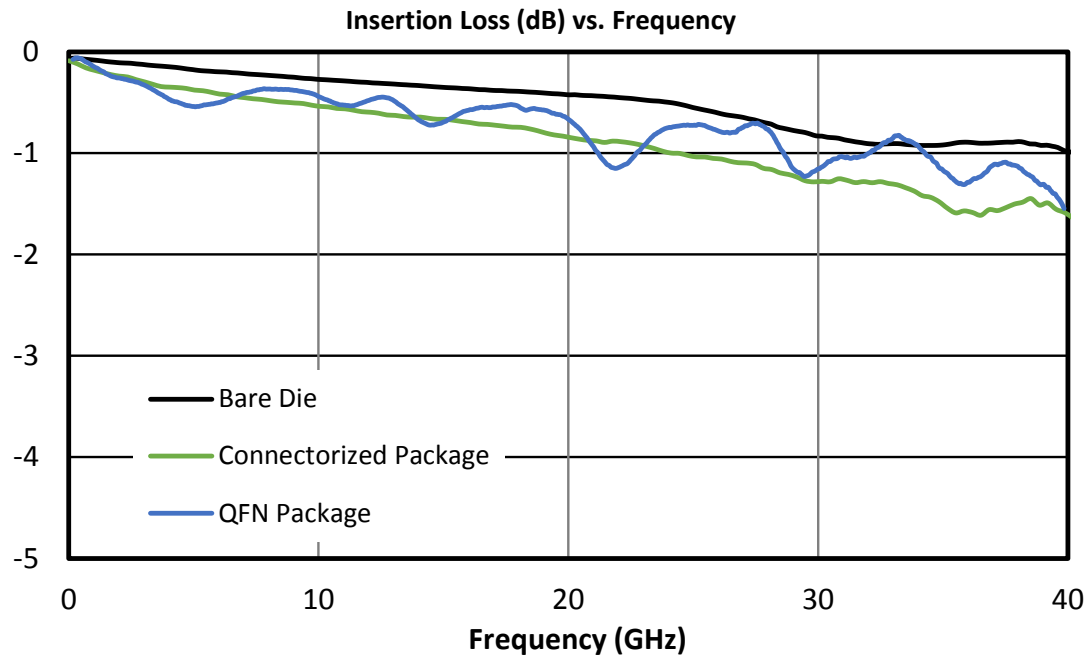
- Packaging co-design requirement (device dependent)



(HLM-40CH, HLM-40U)

# Challenges with High-Frequency Packaging

- Packaging co-design requirement (device dependent)



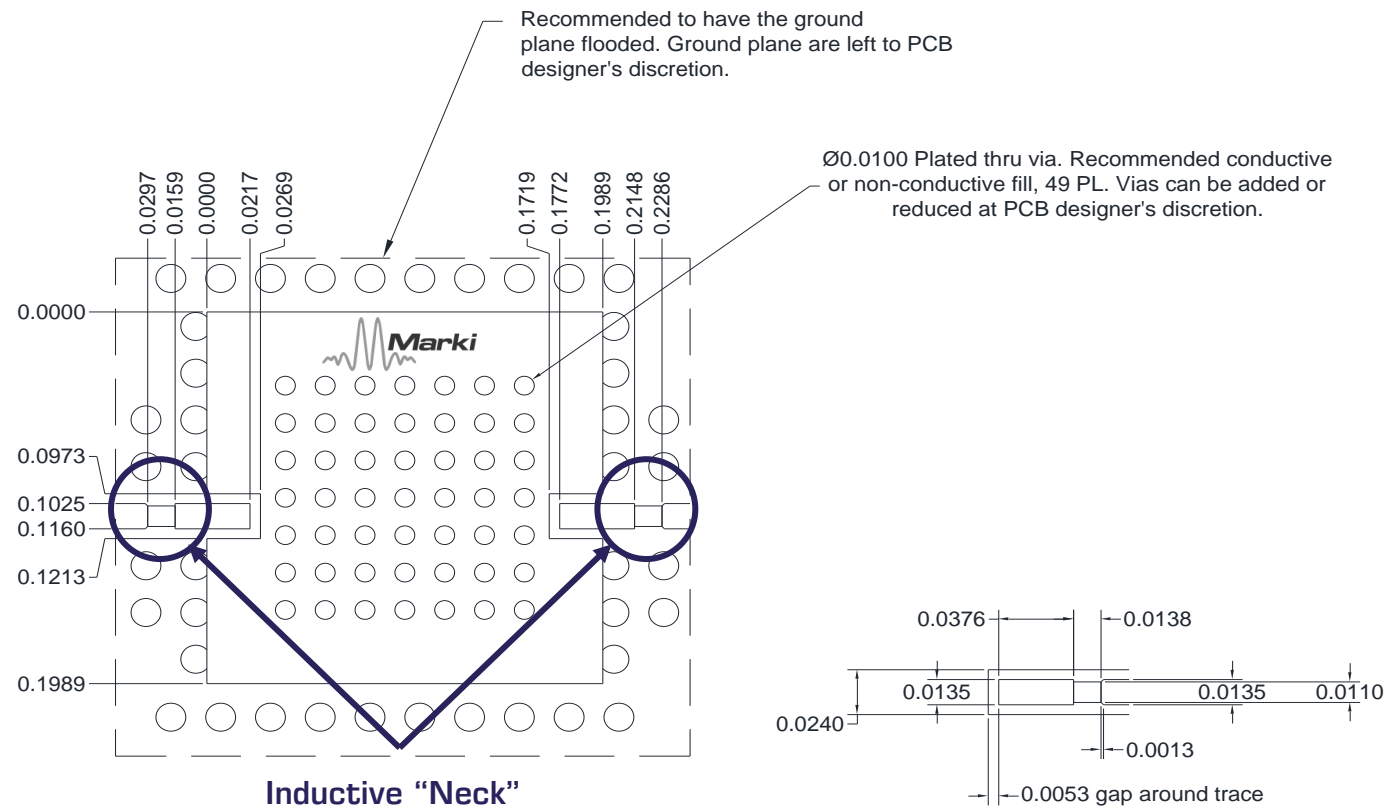
(HLM-40CH, HLM-40U, HLM-40PSM)

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3. Challenges with High-Frequency Packaging
4. **Improving Packaging for mmWave Applications**

# Improving Packaging for mmWave Applications

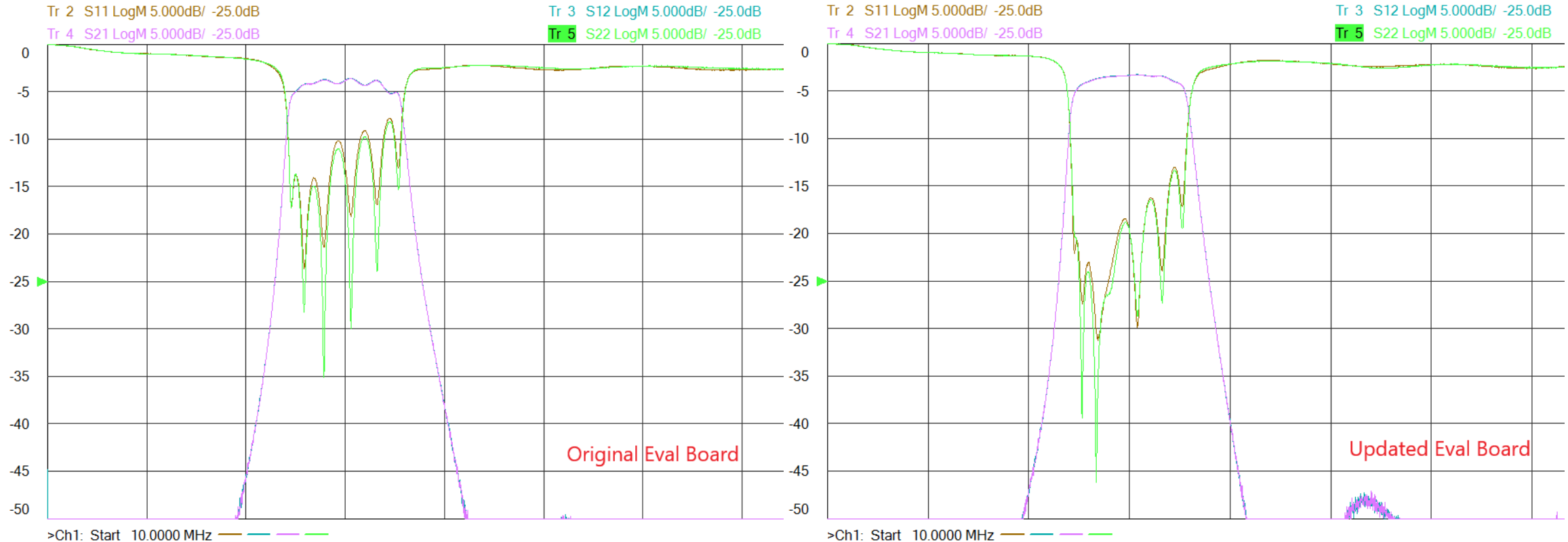
- PCB launch parasitic compensation



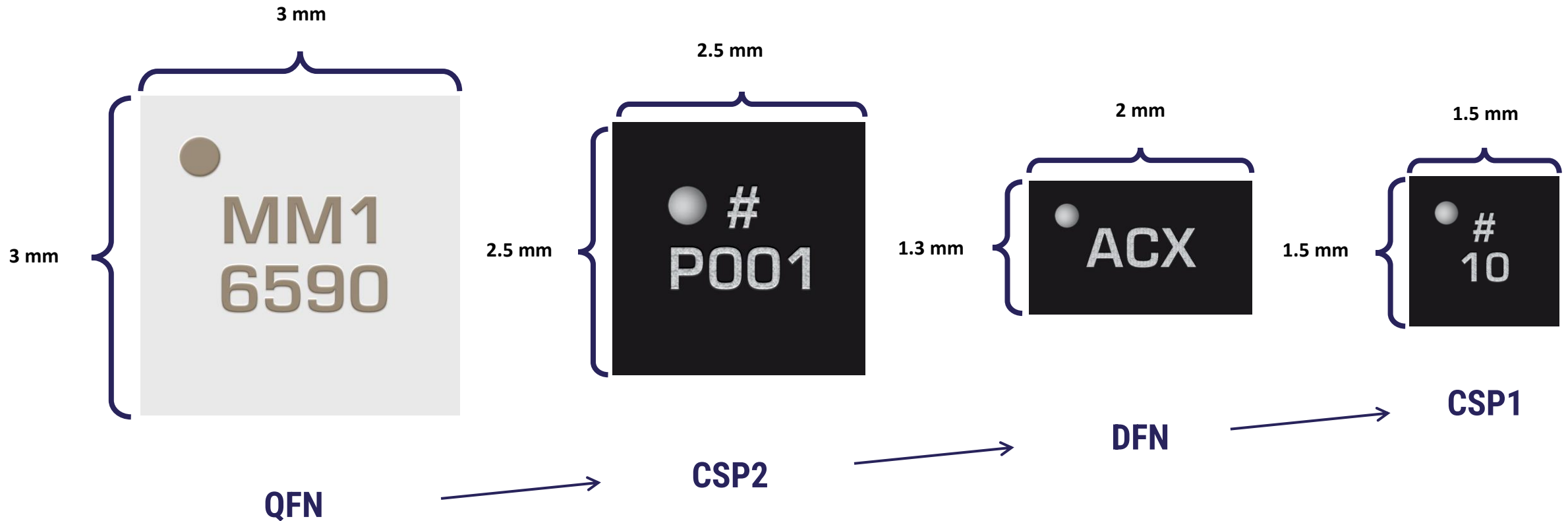
Material Rogers 4003 008"  $\frac{1}{2}$  Oz Cu both sides.

# Improving Packaging for mmWave Applications

- PCB launch parasitic compensation



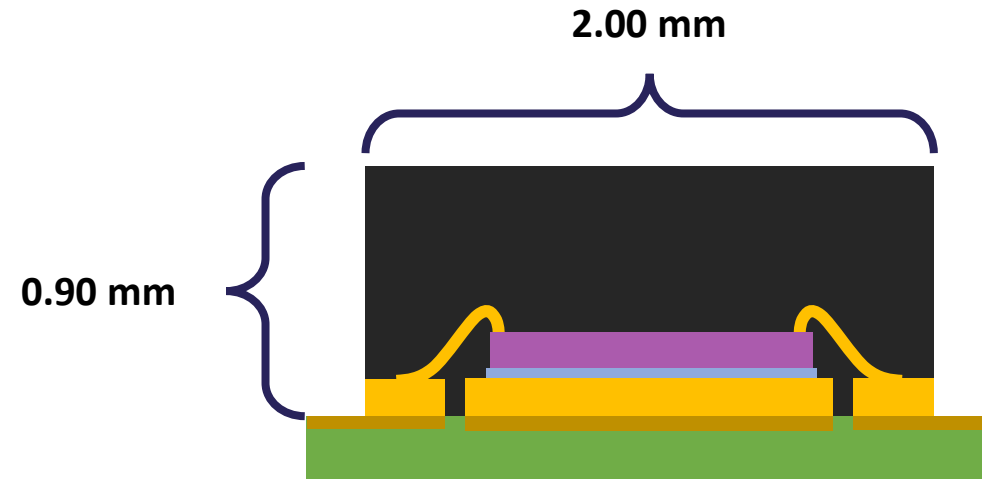
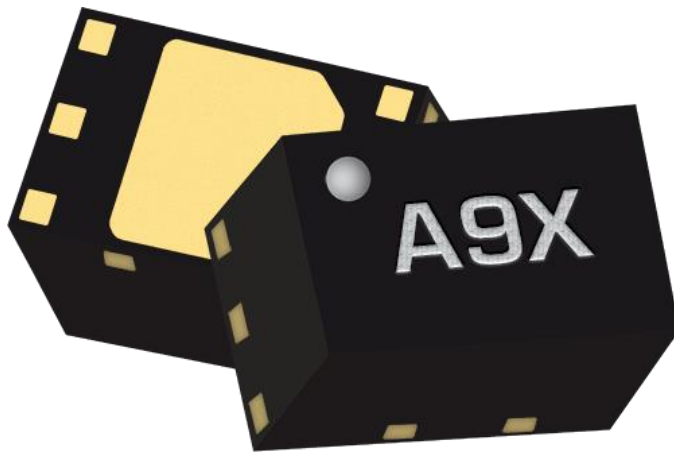
# Improving Packaging for mmWave Applications



# Improving Packaging for mmWave Applications

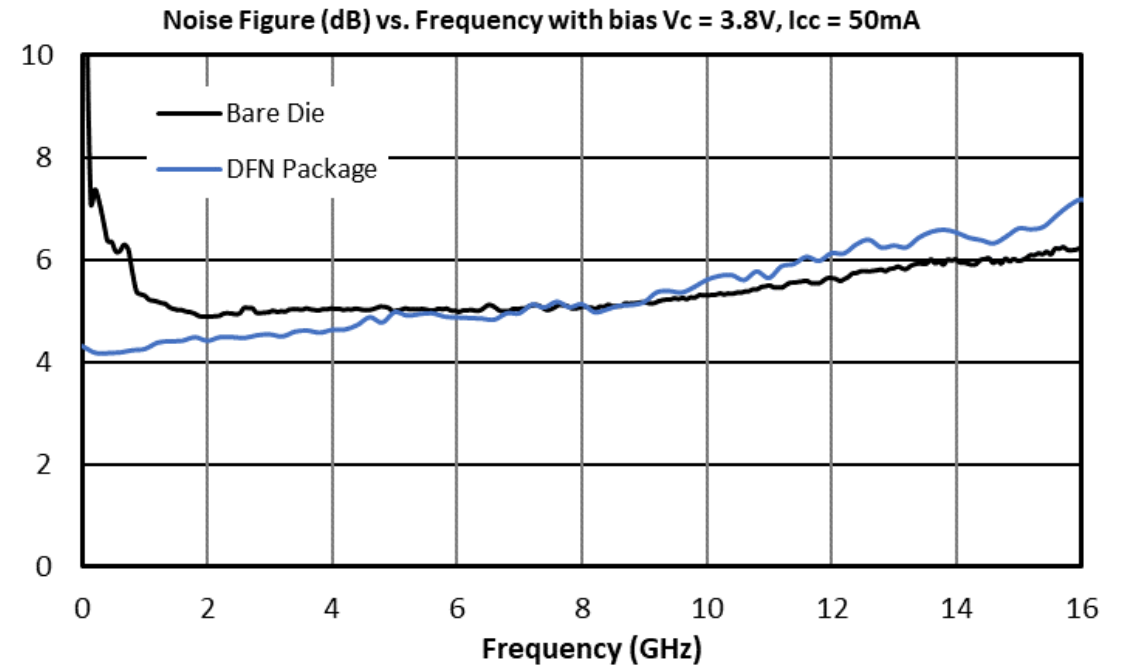
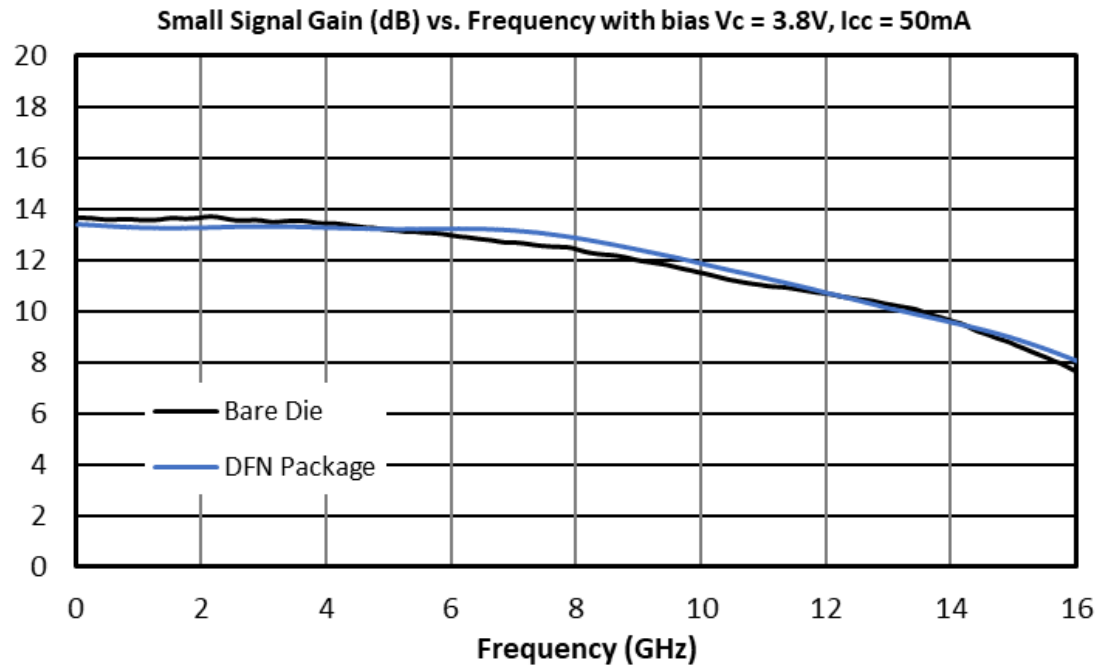
- DFN Packaging

- Standardized package footprint
- Wire-bonded plastic over mold



# Improving Packaging for mmWave Applications

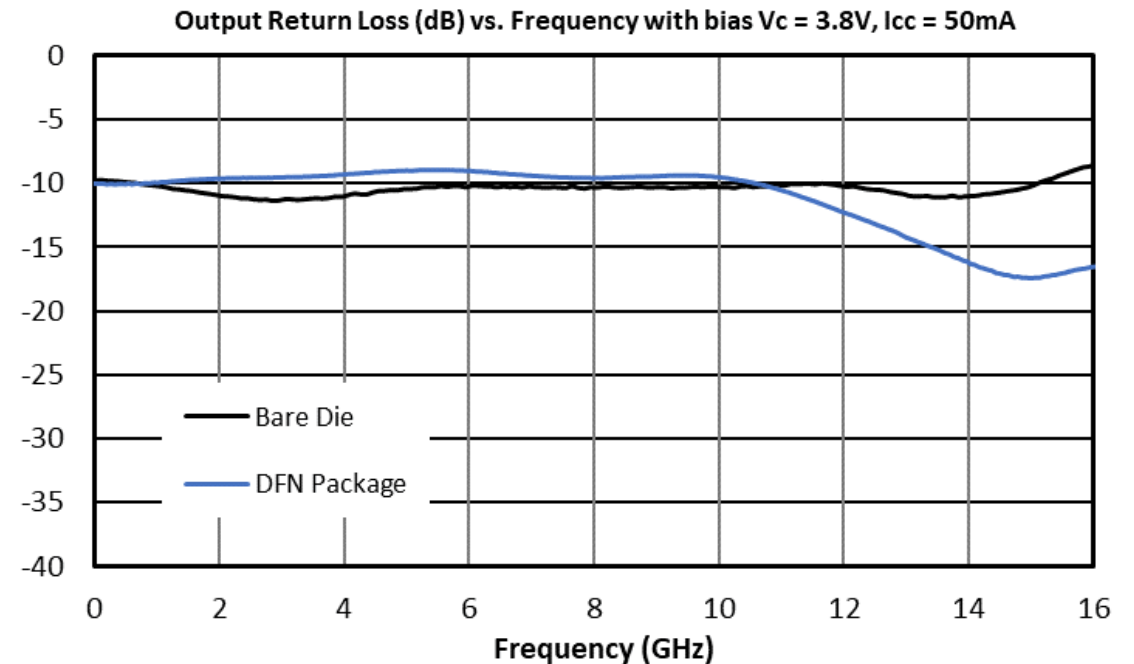
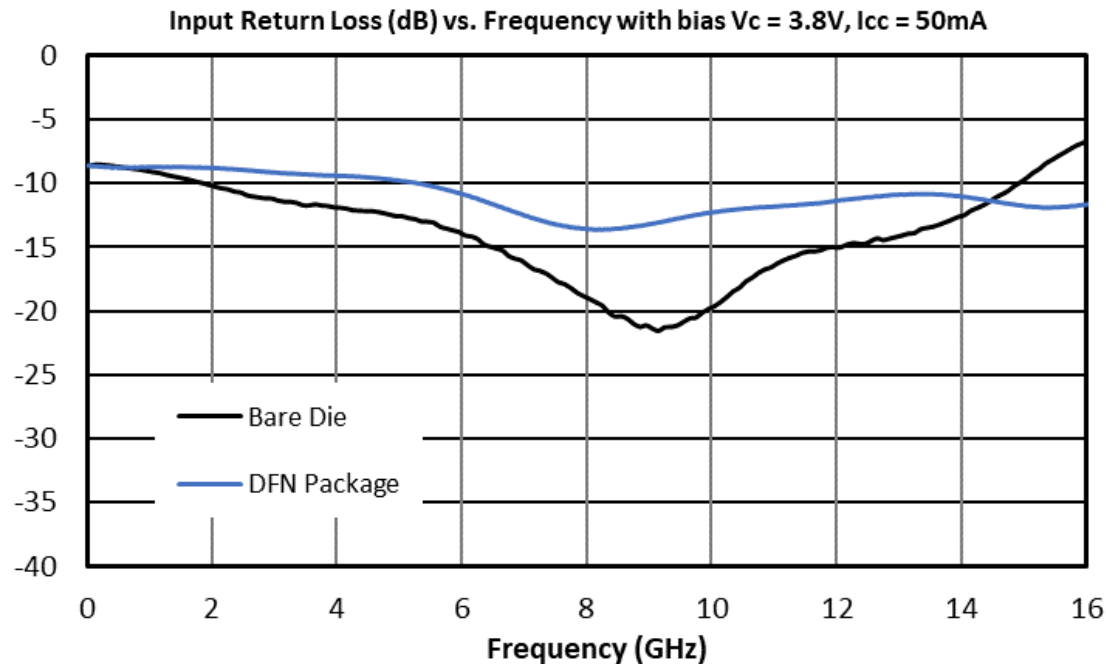
- AKA-1300PSM vs ADA-1300D Performance





# Improving Packaging for mmWave Applications

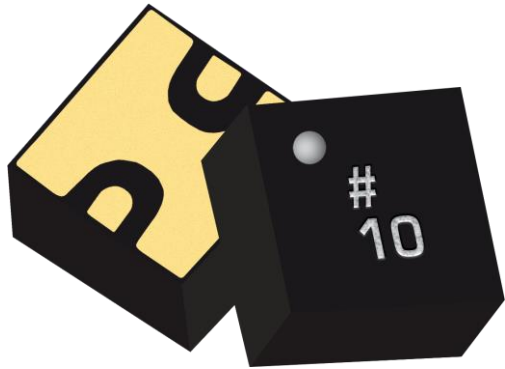
- AKA-1300PSM vs. ADA-1300D Performance



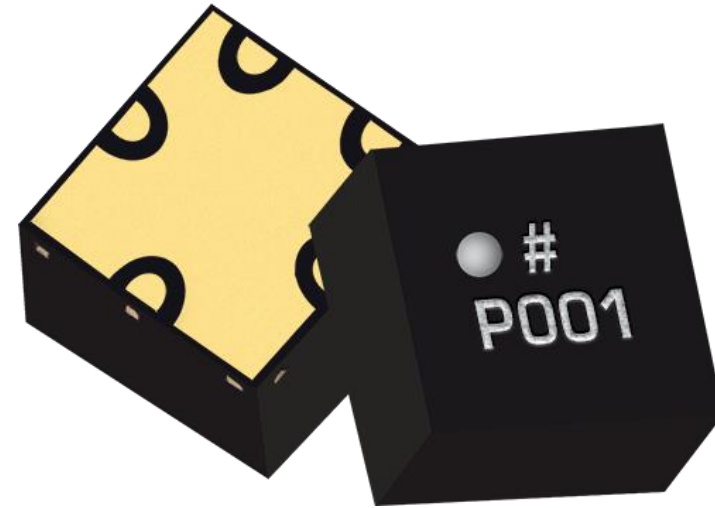
# Improving Packaging for mmWave Applications

- CSP Packaging

- No wire bonds (patent pending)
- Plastic over mold

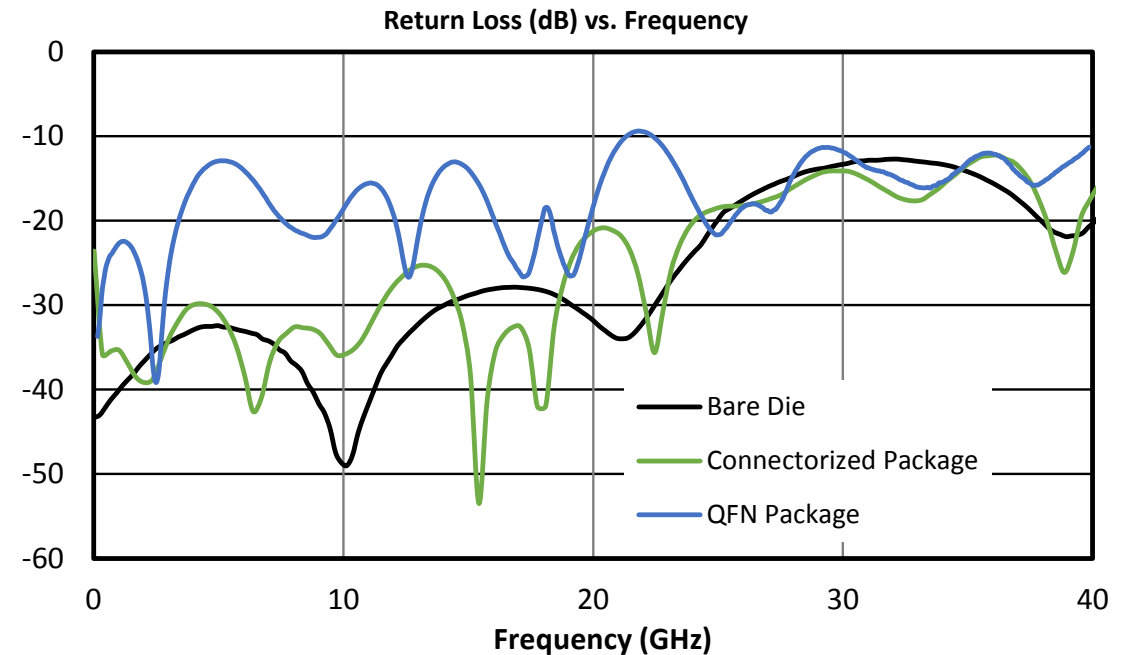
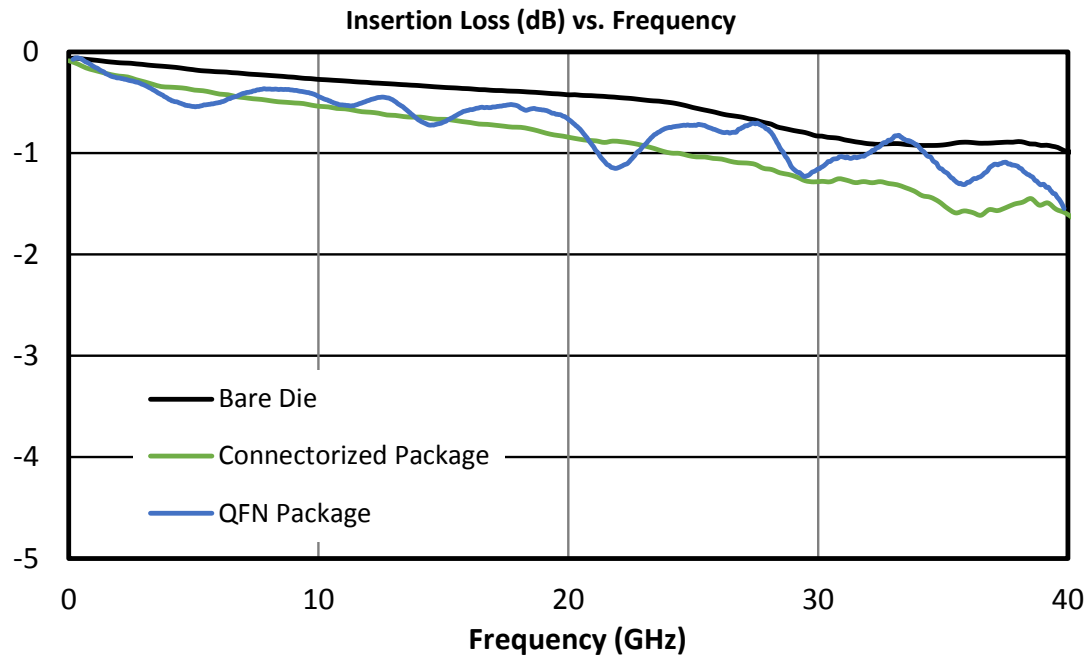


**CSP1**  
(1.5 x 1.5mm)



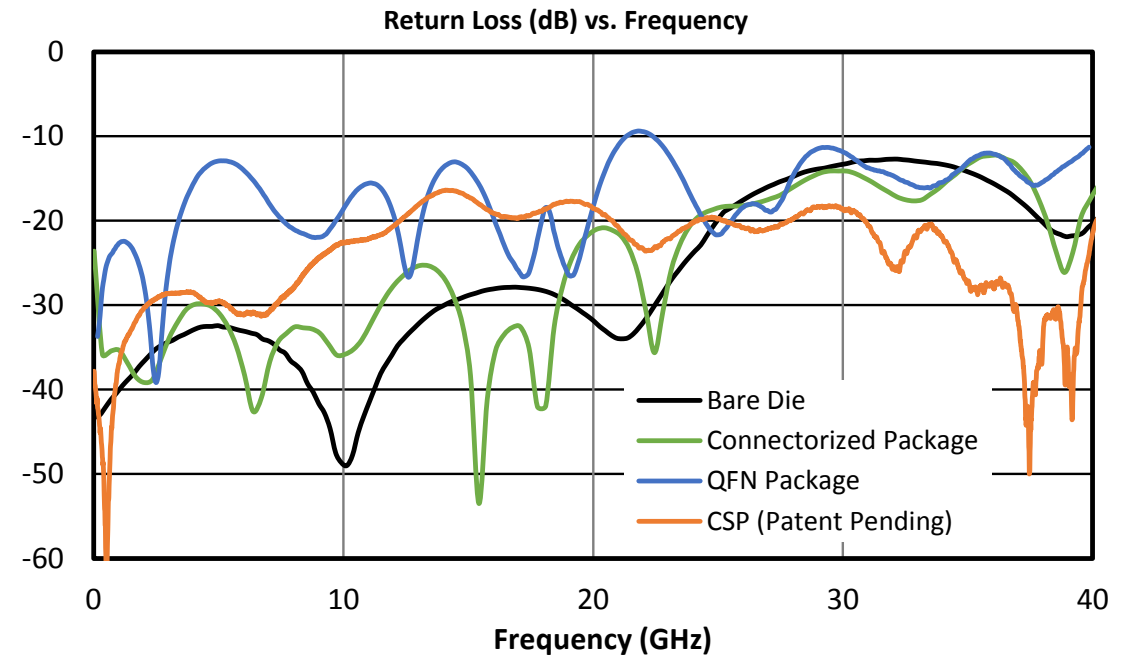
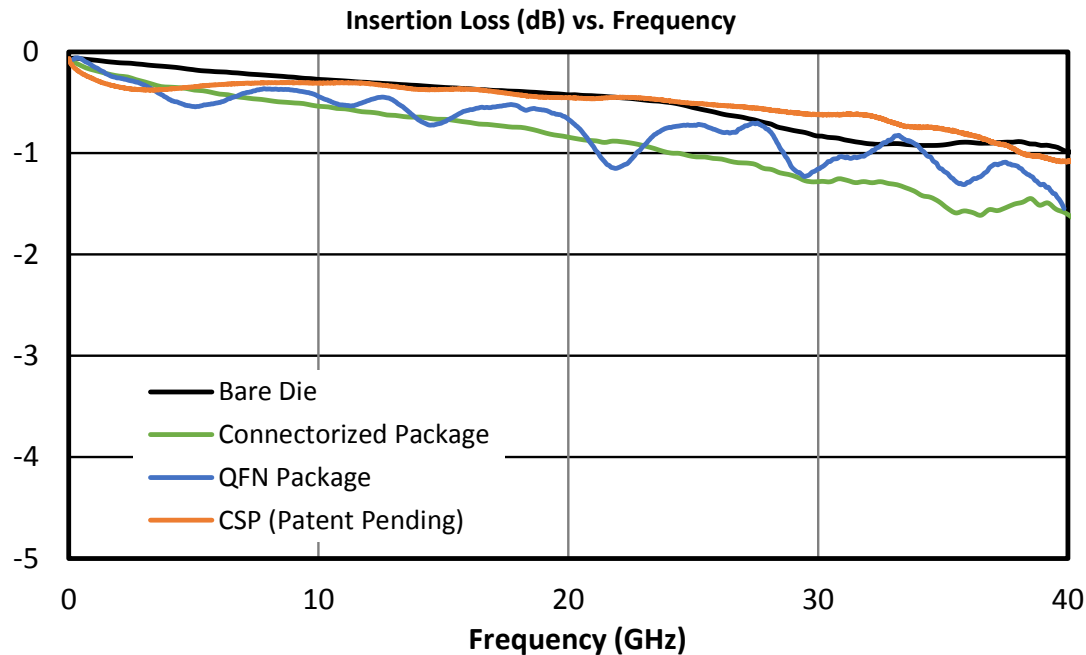
**CSP2**  
(2.5 x 2.5mm)

# Improving Packaging for mmWave Applications



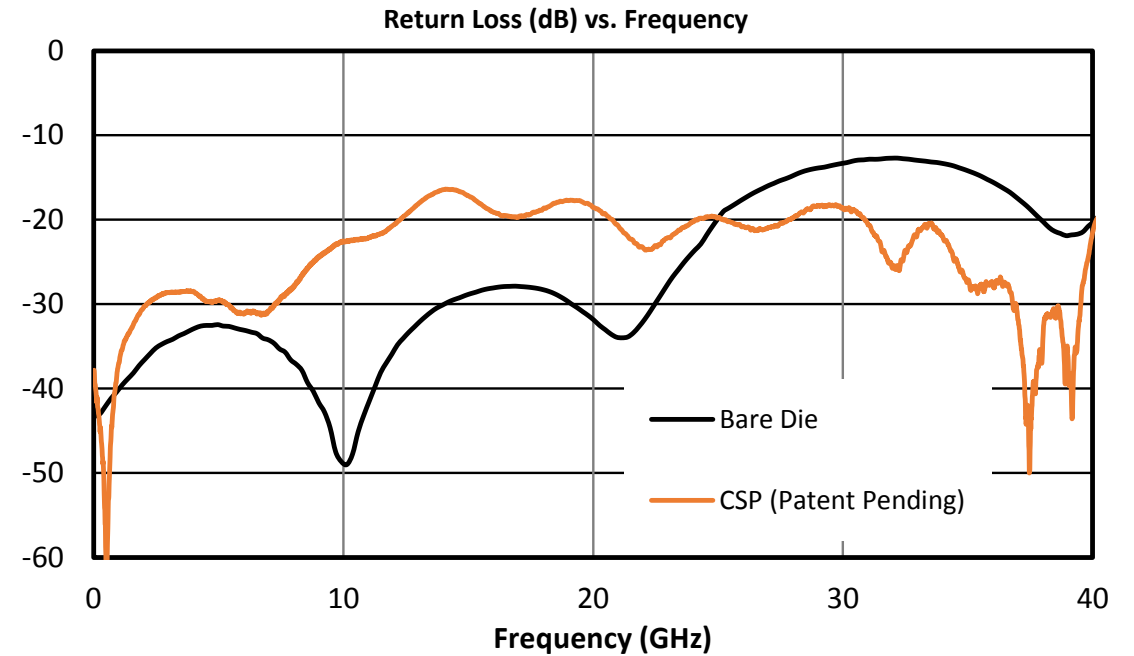
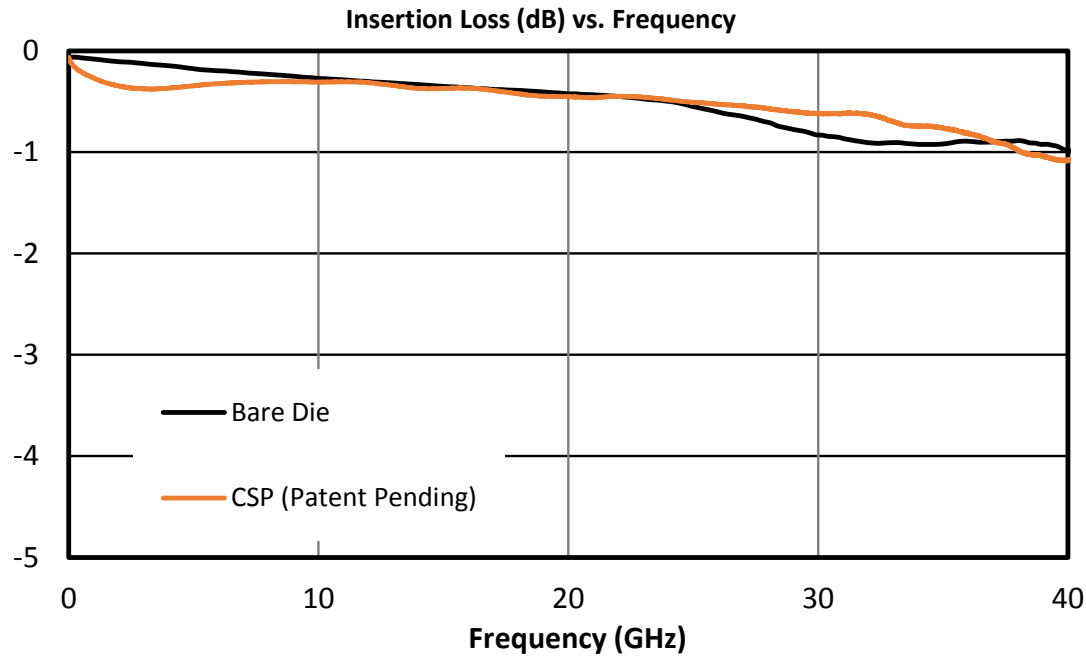
(HLM-40CH, HLM-40U, HLM-40PSM)

# Improving Packaging for mmWave Applications



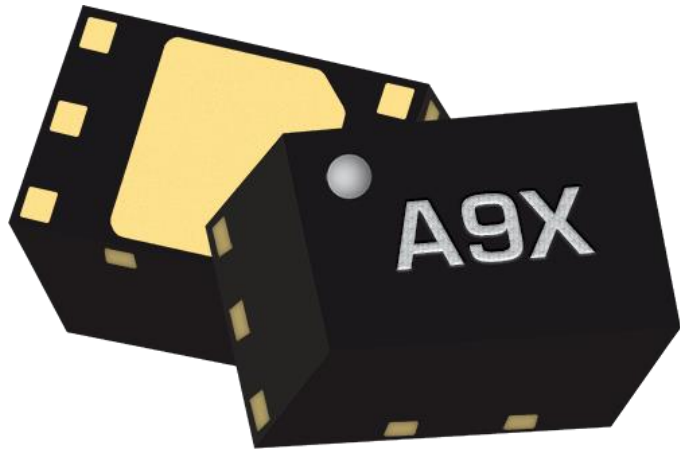
(HLM-40CH, HLM-40U, HLM-40PSM, HLM-8011CSP1)

# Improving Packaging for mmWave Applications

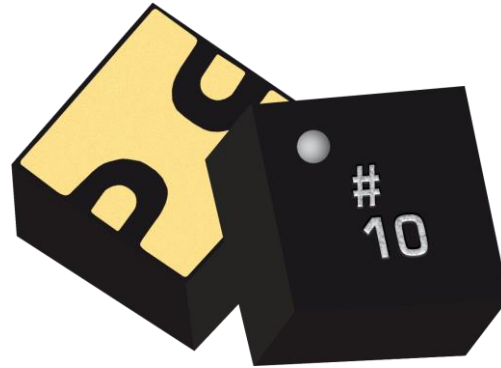


(HLM-40CH, HLM-8011CSP1)

# Improving Packaging for mmWave Applications



**DFN**  
(1.2 x 3.0mm)



**CSP1**  
(1.5 x 1.5mm)



**CSP2**  
(2.5 x 2.5mm)



Questions?



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