

# 行政院國家科學委員會專題研究計畫 期中進度報告

## 100-170 GHz 毫米波單晶積體電路研製(1/3)

計畫類別：個別型計畫

計畫編號：NSC92-2213-E-002-069-

執行期間：92年08月01日至93年07月31日

執行單位：國立臺灣大學電信工程學研究所

計畫主持人：王暉

計畫參與人員：趙世峰、王多柏、林宗良、卓宜賢、羅玠旻

報告類型：精簡報告

處理方式：本計畫可公開查詢

中 華 民 國 93 年 4 月 28 日

# 九十二學年度研究計畫執行進度報告

## 一. 計畫名稱：100-170 GHz 毫米波單晶積體電路研製(1/3)

Research and Development of 100-170 GHz of Millimeter-wave Monolithic  
Integrated Circuits (2/3)

計畫編號：NSC 92-2213-E-002-069

執行期限：92 年 8 月 1 日至 93 年 7 月 31 日

主持人：王 暉

執行單位：國立台灣大學電信工程學研究所

學 門：微波工程

## 二. 計畫摘要

本計畫的目標為：研發 100-120 GHz 無線收發模組中之各項微波積體電路，以提升國內微波單晶積體電路之技術。

本研究的內容包括：設計用等效電路模型的建立，電路之設計及實作，並以量測結果驗證設計理念，進而建立國內此項高頻電路之技術。

## 三. 預期完成之工作項目

本計畫擬於三年內，設計、研製、並分析 100-170 GHz 之毫米波積體電路，其分年之研究子題如下：

第一年：研製 100-120 GHz 之單晶微波積體電路，  
第二年：研製 120-140 GHz 之單晶微波積體電路，  
第三年：研製 140-170 GHz 之單晶微波積體電路。  
每一年度擬完成項目如下：

1. 100-120 GHz 電路單晶片之設計，
2. 元件模型之驗證及改進。

#### 四. 第一年 (92.8.1-93.7.31) 研究項目執行進度

1. 各項 100-120 GHz 晶片設計及佈局 (已完成)
2. 晶片目前送至代工廠製作 (進行中)
3. 元件等效電路之驗證及改進 (進行中)
4. 實驗系統建立與量測 (近完成階段)
5. 撰寫報告 (準備階段)

#### 五. 具體成果

本年度已完成下列相關論文

- [1] Kun-You Lin, Yu-Jiu Wang, Dow-Chi Niu, and Huei Wang, "Millimeter-wave monolithic SPDT passive HEMT switches using impedance transformation networks," *IEEE Trans. on Microwave Theory and Tech.*, vol. 51, no. 4, pp. 1076-1085, April, 2003. (ME 89-E-FA06-2-4, NSC 90-2219-E-002-007, and NSC 89-2213-E-002-178)
- [2] Kuo-Liang Deng and Huei Wang, "A miniature broadband PHEMT MMIC balanced distributed doubler," *IEEE Trans. on Microwave Theory and Tech.*, vol. 51, no. 4, pp.1257-1261, April, 2003. (ME 89-E-FA06-2-4, NSC 90-2219-E-002-007, and NSC 89-2213-E-002-178)
- [3] Hong-Yeh Chang, Huei Wang, Michael Yu, and Yonghui Shu, "A 77-GHz MMIC power amplifier for automotive radar applications," *IEEE Microwave and Wireless Component Letters*, vol. 13, no. 4, pp. 143-145, April, 2003. (ME 89-N-FA01-1-1, ME 89-E-FA06-2-4, NSC 90-2219-E-002-007, and NSC 89-2213-E-002-178)
- [4] Kuo-Liang Deng, Tian-Wei Huang, and Huei Wang, "Design and analysis of novel high-gain and broadband GaAs PHEMT MMIC distributed amplifiers with traveling-wave gain stage," *IEEE Trans. on Microwave Theory and Tech.*, vol. 51, no. 11, pp. 2188-2196, Nov., 2003. (ME 89-E-FA06-2-4, NSC 90-2219-E-002-007, and NSC 89-2213-E-002-178)
- [5] I-Jen Chen, Huei Wang, and Powen Hsu, "A V-band quasi-optical GaAs HEMT monolithic integrated antenna and receiver front-end," *IEEE Trans. on Microwave Theory and Tech.*, vol. 51, no. 12, pp. 2461-2468, Dec., 2003.
- [6] Hong-Yeh Chang, Tian-Wei Huang, Huei Wang, Yu-Chi Wang, Pane-Chane Chao and Chung-Hsu Chen, "Broadband HBT BPSK and IQ modulator MMICs and millimeter-wave vector signal characterization,"

- IEEE Trans. on Microwave Theory and Tech*, vol. 52, no. 3, pp. 908-919, March 2004. (NSC 89-2213-E-002-178, NSC 89-2219-E-002-042 and ME-89-E-FA06-2-4-6)
- [7] Kun-You Lin, Wen-Hua Tu, Ping-Yu Chen, Hong-Yeh Chang, Huei Wang, and Ruey-Beei Wu, "Millimeter-wave MMIC passive HEMT switches using traveling-wave concept," to appear in *IEEE Trans. on Microwave Theory and Tech*. (NSC 89-2213-E-002-178, NSC 89-2219-E-002-042 and ME-89-E-FA06-2-4-6)
- [8] Hong-Yeh Chang, Tian-Wei Huang, Huei Wang, Yu-Chi Wang, Pane-Chane Chao and Chung-Hsu Chen, "A broadband HBT MMIC IQ modulator and millimeter-wave vector signal characterization," *2003 IEEE MTT-S International Microwave Symposium Digest*, vol. 1, pp. 99-102, Philadelphia, PA, June, 2003. (NSC 89-2213-E-002-178, NSC 89-2219-E-002-042 and ME-89-E-FA06-2-4-6)
- [9] I-Jen Chen, Huei Wang, and Powen Hsu, "A V-Band GaAs HEMT uniplanar monolithic integrated antenna and receiver front end," *2003 IEEE MTT-S International Microwave Symposium Digest*, vol. 3, pp. 2023-2026, Philadelphia, PA, June, 2003.
- [10] Chi-Hsueh Wang, Yo-Shen Lin, Huei Wang, and Chun-Hsiung Chen, "A Q-band uniplanar MMIC diode mixer with lumped-element coplanar waveguide-to-slot transition," *2003 IEEE MTT-S International Microwave Symposium Digest*, vol. 1, pp. 103-106, Philadelphia, PA, June, 2003.
- [11] Ping-Yu Chen, Zou-Min Tsai, Shey-Shi Lu, and Huei Wang, "An ultra low phase noise W-Band GaAs-based PHEMT MMIC CPW VCO," *33rd European Microwave Conference Proceedings*, vol. 2, pp. 503-507, Munich, German, Oct., 2003. (NSC 89-2213-E-002-178, NSC 89-2219-E-002-042 and ME-89-E-FA06-2-4-6)
- [12] Hong-Yeh Chang, Tian-Wei Huang, and Huei Wang, "Vector Signal Characterization for a HEMT IQ modulator MMIC at 94 GHz," *2003 Asia Pacific Microwave Conference Technical Digest*, vol. 3, pp. 1684-1687, Seoul, Korea, Nov., 2003. (NSC 89-2213-E-002-178, NSC 90-2219-E-002-007, NSC 92-2213-E-002-068 and ME 89-E-FA06-2-4-6)
- [13] Ren-Chieh Liu, Hong-Yeh Chang, Chi-Hsueh Wang, and Huei Wang, "A 63-GHz VCO using a standard 0.25- $\mu$ m CMOS process," *2004 International Solid-State Circuit Conference (ISSCC)*, pp. 446-447, San Francisco, Feb., 2004. (NSC 89-2213-E-002-178 and ME 89-E-FA06-2-4-6)
- [14] Ming-Fong Lei, Pei-Si Wu, Tian-Wei Huang, and Huei Wang, "Design and analysis of a miniature W-Band MMIC sub-harmonically pumped resistive mixer," *2004 IEEE MTT-S International Microwave Symposium Digest*, vol. 1, pp. xx, Dallas, Texas, June, 2004. (NSC 91-2219-E-002-014, NSC 91-2213-E-002-019 and ME 89-E-FA06-2-4-6)
- [15] 鄧國樑, 王暉, "寬頻之二倍頻器", 國家晶片系統設計中心年度晶片製作成果發表會, 新竹, 台灣, 2003年4月 (ME 89-E-FA06-2-4, NSC 90-2219-E-002-007, and NSC 89-2213-E-002-178)
- [16] 陳一仁, 許博文, 王暉, "60-GHz 天線整合混頻器", 國家晶片系統設計中心年度晶片製作成果發表會, 新竹, 台灣, 2003年4月 (ME 89-E-FA06-2-4, NSC 90-2219-E-002-007, and NSC 89-2213-E-002-178)
- [17] 劉仁傑, 王暉, "60 GHz CMOS 壓控振盪器", 國家晶片系統設計中心年度晶片製作成果發表會, 新竹, 台灣, 2004年4月 (ME 89-E-FA06-2-4, NSC 90-2219-E-002-007, and NSC 89-2213-E-002-178)
- [18] 雷明峰, 王暉, "77 GHz 阻抗式諧波混頻器", 國家晶片系統設計中心年度晶片製作成果發表會, 新竹, 台灣, 2004年4月 (ME 89-E-FA06-2-4, NSC 90-2219-E-002-007, and NSC 89-2213-E-002-178)