DESIGN GROUP 設計組

D9-076

作品名稱	**應用於SoC晶片之嵌入式多點溫度監測系統** An Embedded All Digital Multi-Point Temperature Monitor System for SoC Application
隊伍名稱	**ES915**
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作品摘要

近年來隨著深次微米製程的進步晶片面積縮小電路密度增加，與系統晶片日趨複雜，因功率密度增加引起的溫度問題已造成晶片電路的損害。為了有效監控系統晶片各區塊電路溫度與避免過高的溫度對系統晶片誤動作甚至造成損害，高效能的嵌入式多點偵測溫度感測器系統將會成為重要的電路，以確保系統晶片運作正常。

本論文以小面積、低功率的環形振盪溫度感測器原理為基礎，改善傳統延遲線溫度感測器電路面積大的問題，並利用具有良好供應電壓雜訊免疫力的差動式架構，取代傳統單點偵測嵌入式溫度感測器減少供應電壓雜訊干擾。同時，藉由“環形振盪器”在溫度感測的應用上可以達高取樣率的優點，提升整體電路效能，設計出一個適用於嵌入式多點偵測的差動式環形振盪溫度感測器。

測試晶片電路實現於TSMC 0.13μm CMOS 1P8M SALICIDE 1.2V/2.5V 製程，具16點掃瞄式溫度偵測之溫度感測器電路包含：溫度至數位轉換器與控制電路，面積僅0.0063mm2，解析度為0.15OC、誤差為±0.15 OC，溫度範圍為-40 OC～130 OC，取樣率50 samples/Sec.時，僅1μW。

Abstract

With the progressing of deep sub-micron technology and shrinking of die size in recent years, circuit density has increased and system chip became more complex. The large system chip may be damages fatally by the fact of power density, the increasing temperature. For effective monitoring the system chip temperature of each functional block and avoiding the irrecoverable damage to system chip by high temperature, the embedded multi-point detection temperature sensor system will play the important role, to ensure system chip is working well.

This thesis propose to use a differential ring oscillator temperature sensor, having the features of small area, low-power and high noise immunity, to replace traditional delay-line based single-point embedded temperature sensors. Particularly, the power supply noise can be reduced easily in this differential structure, besides the sampling rate can be promoted by the oscillation based structure.

A test chip, having 16-point scanning temperature sensor, temperature to digital converter and control circuits, has been fabricated in TSMC 0.13μm CMOS 1P8M SALICIDE 1.2V/2.5V technology. The new temperature sensor features: 0.0063mm2 layout size, 0.15OC resolution, and temperature sensing range from -40 OC to 130 OC. When sampling temperature at rate of 50K samples/sec., is only 1μW.