國立臺灣大學技術行銷表

台大案號:_____(由產學合作中心填寫)

產學合作中心聯絡人：　　電話：　　e-mail：

產品/技術名稱	抑制能量洩漏與耦合之傳輸線結構
發明人/單位	陳如弘, 陳士元, 許博文 /台大電信所電波組
產品/技術說明	將與信號線相鄰的接地面形狀改成週期性結構的形式，或將信號線與接地面形狀一起改成週期性結構的形式，進而達到降低能量自信號線到接地面的洩漏與耦合的特性。此技術得使用在微帶線(microstrip line)或背覆金屬共面波導(CBCPW)饋入之傳輸線或天線結構。
應用範圍	微波電路(MMIC)設計 積體電路(IC)晶片設計 印刷電路版(PCB)製程 天線(Antenna)設計 電磁相容(EMC)設計

產品/技術優勢	達到具有抑制能量洩漏與耦合功能之背覆金屬共面波導(CBCPW)的方法主要有以下數種習知技術: (1)NLC (Non-leaky coplanar waveguide) and Backside Grooving (2)EBG (Electro-magnetic band gap) and UC-PBG (Uni-planar compact photonic band gap) (3)Via Loaded CBCPW 其中 (1)藉由增加額外一層介質版使共面波導模態的速度低於主要平行版模態的速度去形成無洩漏共面波導(NLC)或在介質版背面製造空氣溝槽。然而，額外的介質版會使結構複雜化並且使成本增加。 (2)使用數量甚多的週期結構鋪滿接地面，其分佈式的電感與電容值所形成的止帶(stop-band)的效果有助於抑制平行板模態的傳遞。然而，除了結構形狀複雜之外，龐大的週期結構除了佔用巨大的接地面面積之外，在電磁模擬上也相當耗時費時間。 (3)使用金屬聯通柱(via)佈滿信號線兩側的接地面進而製造類似金屬合成波導(SIW)的效果，已被證實能有效地減少自信號線到接地面的能量耦合，目前廣泛地被使用在微波電路應用上。然而製造金屬聯通柱本身就需要額外的光罩以及製程，進而提高了製作成本。 運用本發明除了能夠同樣達到上述各項習知技術的功效(抑制能量洩漏與耦合)，更重要的是本發明無須使用到多層特製介質版、週期結構的數目大幅減少。另外，更重要的是本發明無須使用金屬聯通柱，因此能夠大幅簡化製程以及降低成本。由於背覆金屬共面波導可以視做數條耦合微帶線的組合，因此本發明也能同樣適用於微帶線。
市場潛力	若以一個 PCB 製作的廠商接片量 100,000 片，平均每片製造 100 個以金屬聯通柱(via)來看，以 via 製作的成本(NT$ 0.05/each)來估算。假設利用這項技術能減少 50%的 via 使用量，那麼一個 PCB 廠等於就減少了 NT$250,000 的製作成本。依此類推，這項技術用在 IC 晶片上面，能夠節省的成本將更為可觀。若能推廣，以臺灣電子產業每年製造的數千萬個電路板甚至數億顆的 IC 來看，本發明能為所有廠商降低更多的成本進而提高產業競爭優勢。 除了成本的考量，減化製程就等於減少污染，本發明更是符合目前全球各國正在積極提倡的節能減碳環保的趨勢。

產品/技術 智財權保護方式	（由產學合作中心填寫）

Marketing Abstract of NTU's Invention Disclosure

NTU's docket no:_____(由產學合作中心填寫)

CIAC contact：_____Tel：_____e-mail：_____

Title	Leakage and coupling reduced transmission line structure
Inventor (s)	Ju-Hung Chen, Shih-Yuan Chen, and Powen Hsu
Brief Description	To reduce the leakage and coupling from the signal line to the side ground plane, we place the periodic structures on the side ground plane and in the proximity region of the signal line. This technology could be used in the microstrip lines and conductor-backed coplanar waveguide.
Fields of Application	MMIC design IC design PCB process Antenna design EMC design

Advantages	There are several methods for achieving the leakage and coupling reduced CBCPW which are listed as following: (1)NLC (Non-leaky coplanar waveguide) and Backside Grooving (2)EBG (Electro-magnetic band gap) and UC-PBG (Uni-planar compact photonic band gap) (3)Via Loaded CBCPW The first method is to make the CPW mode slower than the dominant parallel-plate TEM mode by adding a dielectric layer to form the non-leaky coplanar waveguide (NLC) or grooving the substrate geometry. However, it becomes more complicated and expensive due to the additional dielectric layer. The second method with only one dielectric layer utilizes the uni-planar compact photonic-bandgap (UC-PBG) structure, which is formed by a very compact PBG lattice and has a distinctive stop-band characteristic. This structure could be modeled by a distributed *LC* network on the side planes showing the effectiveness of suppressing the power leakage. Nevertheless, this PBG periodic structure occupies a large area and needs more time for simulation. The last method is periodically placing via holes alongside the CBCPW feed-line. However, via holes need extra fabrication process leading to higher cost. This invention could provide the leakage and coupling reduced characteristics without the need of multi-layered substrate, large occupied area, and via holes. This largely reduces the complexity of fabrication and total cost. Besides, since the CBCPW could be viewed as coupled microstrip lines, this invention could also apply to the microstrip lines.

Market Potential	We assume the amount of products from one PCB factory is 100,000 with average 100 via holes per product and the cost of via holes is NT$ 0.05/each. If the amount of via holes could be reduced by 50 %, this PCB factory could save NT$ 250,000 by this invention. If we consider all the electronic industry in Taiwan, several million PCB boards and IC chips are fabricated and sold each year. This invention could help them to save more and enhance their ability for competition. Beyond the cost, reducing the fabrication process is equivalent to reduce the pollution. Therefore, this invention could help all the electronic industry to save energy and reduce carbon.
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