



## 附件四、技術說明表

### 三維超接面結構與製造方式

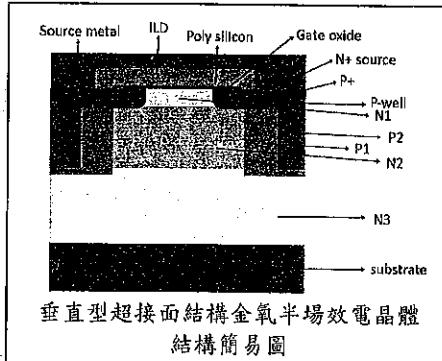
(以下內容一頁為限，不可揭露關鍵技術內容；填表完成後請刪除此行)

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**簡 歷：**(可列出相關連結，例如系所、研究室網頁)

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#### 市場及需求：

再生能源及電動車之電力系統需要能在高壓、高溫下穩定運作的功率元件，來提高能源轉換效率，降低功率損耗。高功率元件的需求隨著科技發展越來越高，元件的效率也逐漸受重視，高崩潰電壓及低導通電阻都是高功率元件發展的重點之一。因此，提高元件的崩潰電壓及降低導通電阻是設計的主要目標。

#### 技術摘要(含成果)：

本專利技術「三維超接面結構與製造方式」，具如下特色：

1. P-pillar 濃度在垂直與水平方向皆可變
2. 半柱式設計，製程較整柱式容易
3. P-pillar 水平濃度漸變，可以有效降低導通電阻
4. 不需要增加額外光罩費用即可製作而成

#### 優勢：

1. 崩潰電壓提升
2. 製程容忍度提高
3. 產品良率提升
4. 導通電阻下降
5. 電能轉換效率提升

#### 競爭產品：

傳統的超接面電晶體，利用 P-pillar 的結構，將漂移區可以水平與垂直地空乏，使空乏區可以伸展出去達到高的崩潰電壓。此專利將傳統的整柱式 P-pillar 改成半柱式，使製程成本得以降低，時間成本也會跟著減少。P-pillar 濃度在水平方向與垂直方向皆調整，也可以使 P-pillar 濃度在水平方向做漸變，能更有效地達到降低導通電阻的效果。

#### 專利現況：

此專利利用 P-pillar 濃度在水平方向做漸變，降低導通電阻，可以比美國專利 POWER SEMICONDUCTOR DEVICE HAVING RESURF LAYER(United States Patent, US 6,693,338 B2) 中的阻值更低。

#### 聯絡方式(請不用填)：

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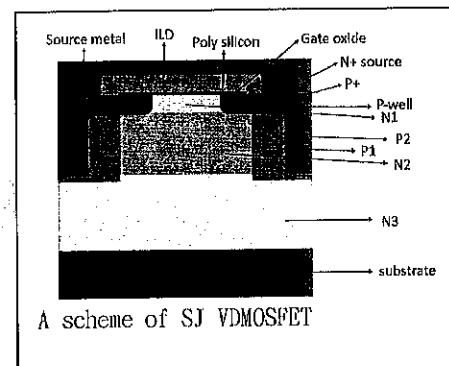
# Structures and Processes of Three-dimensional Super Junction

(Below is limited to 1-page only; be careful not to disclose vital technology content. Please delete these words when the document is finished)

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## Experience:

<https://ntuhpdcweb.wixsite.com/hpdc>



## Market Demand:

To enhance the transmission efficiency in power systems, power devices have to be performed stably under both high reverse bias and high temperature conditions. The demand of power devices is increasing with the advanced technology development. Therefore, increasing the breakdown voltage and reducing the specific on-resistance are the major targets of the power devices design.

## Our Technology:

To summary our technology:

1. The concentration of P-pillar is varied vertically and horizontally.
2. The fabrication of half-pillar SJ is more achievable compared with the full-pillar SJ.
3. The lateral concentration gradient of P-pillar makes the lower specific on-resistance.
4. The photo mask cost of fabrication remains the same.

## Strength:

1. Higher breakdown voltage
2. Wide process tolerance
3. High product yield
4. Lower specific on-resistance
5. High transmission efficiency

## Competing Products:

The conventional super-junction structure, which utilizes the P-pillar to deplete the drift region vertically and horizontally, makes the depletion region spread out well to achieve higher breakdown voltage. In this patent, the device replaces full-pillar with half-pillar, so that the process cost can be reduced and the time cost will also be reduced. The concentration of P-pillar is varied vertically and horizontally, so that the lateral concentration gradient of P-pillar can reduce specific on-resistance effectively.

## Intellectual Properties:

In this patent, the concentration of P-pillar is graded horizontally to make the specific on-resistance smaller. The lateral concentration gradient of P-pillar makes the lower specific on-resistance than United States Patent , US 6,693,338 B2.

## Contact (do not need to fill out):

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