**Title:** NONVOLATILE MEMORY AND THREE-STATE FETS USING CLADDED QUANTUM DOT GATE STRUCTURE

**Abstract:** The present invention discloses a device structure and method of fabricating cladded quantum dot gate nonvolatile memory and three-state field-effect transistor device that can be scaled down to sub-22nm dimensions and embedded along side with other function circuits. Another innovation is the design of transport channel, which comprises an asymmetric coupled well channel comprising two or more wells. This structure enhances the retention time in nonvolatile memory by increasing the effective separation between channel charge and the quantum dots located in the floating gate. The cladded quantum dot gate FETs can be designed in Si, InGaAs-InP and other material systems. The 3-state FET devices form the basis of novel digital circuits using multiple valued logic and advanced analog circuits. One or more layers of SiOx-cladded Si quantum dots can also be used as high-k dielectric layer forming the gate insulator over the transport channel of a sub-22nm FET.
## INTERNATIONAL SEARCH REPORT

### INTERNATIONAL SEARCH REPORT

**Classification of Subject Matter**
- IPC(8) - G02F 3/00, G06N 1/00, H01L 29/12, B82B 1/00, B82B 3/00 (2008.04)
- USPC - 257/13; 257/E29.071, 977/759

**Minimum documentation searched**
- USPC 257/13, 257/E29 071, 977/759

**Documentation searched other than minimum documentation**
- USPC 257/13, 257/E29 071, 977/759 (text searched)

**Electronic data base consulted during the international search**
- PUBLWEST (USPTO, PQIP, EPAB, JPAB), Google Scholar

**Search Terms**
- FET, quantum dot, Si, cladded, floating gate, quantum well, strain, coupled, asymmetrical

### DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>US 6,984,842 B1 (Nayfeh et al.) 10 January 2006 (10 01 2006), entire document, especially Fig 7, col 6, In 35-45, col 6, In 23-26</td>
<td>1-29</td>
</tr>
<tr>
<td>Y</td>
<td>US 6,573,527 B1 (Sugiyama et al.) 03 June 2003 (03 06 2003), entire document, especially Fig 20, col 15, In 21-25</td>
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**Date of the actual completion of the international search**
- 12 April 2008

**Date of mailing of the international search report**
- 16 May 2008

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