

**CPC****COOPERATIVE PATENT CLASSIFICATION****B81B**

**MICRO-STRUCTURAL DEVICES OR SYSTEMS, e.g. MICRO-MECHANICAL DEVICES** (piezo-electric, electrostrictive or magnetostrictive elements per se [H01L 41/00](#))

**NOTES**

1. This subclass does not cover:
  - purely electrical or electronic devices per se which are covered by section H, e.g. subclass [H01L](#);
  - purely optical devices per se which are covered by subclasses [G02B](#) or [G02F](#);
  - essentially two-dimensional structures, e.g. layered products which are covered by subclass [B32B](#);
  - chemical or biological structures per se which are covered by section C;
  - structures in atomic scale produced by manipulation of single atoms or molecules, which are covered by group [B82B 1/00](#).
2. Devices or systems classified in this subclass are also classified in appropriate subclasses providing for their structural or functional features, if such features are of interest.
3. Attention is drawn to the following places:
 

[A61K 9/50](#) Microcapsules for medicinal preparations  
[B25J 7/00](#) Micromanipulators [G02B 21/32](#)  
 Micromanipulators combined with microscopes [G11B 5/127](#)  
 Magnetic heads [H01P 3/08](#) Waveguide microstrips.
4. In this subclass, local "residual" subgroups, e.g. [B81B 7/0077](#), are used with the following purpose:
 

When classifying a document which does not fit in any of a set of subgroups with the same dot-level, the document should be classified in the residual group, if present, and not in the group at the hierarchical level one dot above.

In the example, the document shall be classified in [B81B 7/0077](#) and not in [B81B 7/0032](#) as [B81B 7/0077](#) is "residual" to [B81B 7/0035-B81B 7/0074](#)

**B81B 1/00**

**Devices without movable or flexible elements, e.g. micro-capillary devices**

**B81B 1/002**

- . {Holes characterised by their shape, in either longitudinal or sectional plane}

**B81B 1/004**

- . . {Through-holes, i.e. extending from one face to the other face of the wafer}

**B81B 1/006**

- . {Microdevices formed as a single homogeneous piece, i.e. wherein the mechanical function is obtained by the use of the device, e.g. cutters}

**B81B 1/008**

- . . {Microtips}

**B81B 3/00**

**Devices comprising flexible or deformable elements, e.g. comprising elastic tongues or membranes** ([B81B 5/00](#) takes precedence)

**B81B 3/0002**

- . {Arrangements for avoiding sticking of the flexible or moving parts}

**B81B 3/0005**

- . . {Anti-stiction coatings}

**B81B 3/0008**

- . . {Structures for avoiding electrostatic attraction, e.g. avoiding charge accumulation}

B81B 3/001	<ul style="list-style-type: none"> <li>• {Structures having a reduced contact area, e.g. with bumps or with a textured surface}</li> </ul>
B81B 3/0013	<ul style="list-style-type: none"> <li>• {Structures dimensioned for mechanical prevention of stiction, e.g. spring with increased stiffness}</li> </ul>
B81B 3/0016	<ul style="list-style-type: none"> <li>• {Arrangements for avoiding sticking of the flexible or moving parts not provided for in groups <a href="#">B81B 3/0005</a> to <a href="#">B81B 3/0013</a>}</li> </ul>
B81B 3/0018	<ul style="list-style-type: none"> <li>• {Structures acting upon the moving or flexible element for transforming energy into mechanical movement or vice-versa, i.e. actuators, sensors, generators}</li> </ul>
B81B 3/0021	<ul style="list-style-type: none"> <li>• {Transducers for transforming electrical into mechanical energy or vice versa (dynamo-electric machines <a href="#">H02K 57/00</a>; electrostatic machines <a href="#">H02N 1/00</a>; piezo-electric devices <a href="#">H01L 41/00</a>)}</li> </ul>
B81B 3/0024	<ul style="list-style-type: none"> <li>• {Transducers for transforming thermal into mechanical energy or vice versa, e.g. thermal or bimorph actuators (electric motors using thermal effects <a href="#">H02N 10/00</a>)}</li> </ul>
B81B 3/0027	<ul style="list-style-type: none"> <li>• {Structures for transforming mechanical energy, e.g. potential energy of a spring into translation, sound into translation}</li> </ul>
B81B 3/0029	<ul style="list-style-type: none"> <li>• {Transducers for transforming light into mechanical energy or viceversa}</li> </ul>
B81B 3/0032	<ul style="list-style-type: none"> <li>• {Structures for transforming energy not provided for in groups <a href="#">B81B 3/0021</a> to <a href="#">B81B 3/0029</a>}</li> </ul>
B81B 3/0035	<ul style="list-style-type: none"> <li>• {Constitution or structural means for controlling the movement of the flexible or deformable elements}</li> </ul>
B81B 3/0037	<ul style="list-style-type: none"> <li>• {For increasing stroke, i.e. achieve large displacement of actuated parts}</li> </ul>
B81B 3/004	<ul style="list-style-type: none"> <li>• {Angular deflection}</li> </ul>
B81B 3/0043	<ul style="list-style-type: none"> <li>• {Increasing angular deflection}</li> </ul>
B81B 3/0045	<ul style="list-style-type: none"> <li>• {Improve properties related to angular swinging, e.g. control resonance frequency}</li> </ul>
B81B 3/0048	<ul style="list-style-type: none"> <li>• {Constitution or structural means for controlling angular deflection not provided for in groups <a href="#">B81B 3/0043</a> to <a href="#">B81B 3/0045</a>}</li> </ul>
B81B 3/0051	<ul style="list-style-type: none"> <li>• {For defining the movement, i.e. structures that guide or limit the movement of an element (mechanical arrangements for preventing or damping vibration or shock <a href="#">H01H 3/60</a>)}</li> </ul>
B81B 3/0054	<ul style="list-style-type: none"> <li>• {For holding or placing an element in a given position}</li> </ul>
B81B 3/0056	<ul style="list-style-type: none"> <li>• {Adjusting the distance between two elements, at least one of them being movable, e.g. air-gap tuning}</li> </ul>
B81B 3/0059	<ul style="list-style-type: none"> <li>• {Constitution or structural means for controlling the movement not provided for in groups <a href="#">B81B 3/0037</a> to <a href="#">B81B 3/0056</a>}</li> </ul>
B81B 3/0062	<ul style="list-style-type: none"> <li>• {Devices moving in two or more dimensions, i.e. having special features which allow movement in more than one dimension}</li> </ul>
B81B 3/0064	<ul style="list-style-type: none"> <li>• {Constitution or structural means for improving or controlling the physical properties of a device}</li> </ul>
B81B 3/0067	<ul style="list-style-type: none"> <li>• {Mechanical properties}</li> </ul>
B81B 3/007	<ul style="list-style-type: none"> <li>• {For controlling stiffness, e.g. ribs}</li> </ul>
B81B 3/0072	<ul style="list-style-type: none"> <li>• {For controlling internal stress or strain in moving or flexible elements, e.g. stress compensating layers}</li> </ul>
B81B 3/0075	<ul style="list-style-type: none"> <li>• {For improving wear resistance}</li> </ul>

- B81B 3/0078 . . . {Constitution or structural means for improving mechanical properties not provided for in [B81B 3/007](#) to [B81B 3/0075](#)}
- B81B 3/0081 . . {Thermal properties}
- B81B 3/0083 . . {Optical properties}
- B81B 3/0086 . . {Electrical characteristics, e.g. reducing driving voltage, improving resistance to peak voltage}
- B81B 3/0089 . . {Chemical or biological characteristics, e.g. layer which makes a surface chemically active}
- B81B 3/0091 . . {Magnetic properties, e.g. guiding magnetic flux}
- B81B 3/0094 . . {Constitution or structural means for improving or controlling physical properties not provided for in [B81B 3/0067](#) to [B81B 3/0091](#)}
- B81B 3/0097 . {Devices comprising flexible or deformable elements not provided for in groups [B81B 3/0002](#) to [B81B 3/0094](#)}

**B81B 5/00**      **Devices comprising elements which are movable in relation to each other, e.g. comprising slidable or rotatable elements**

**B81B 7/00**      **Micro-structural systems; {Auxiliary parts of micro-structural devices or systems}**

- B81B 7/0003 . {MEMS mechanisms for assembling automatically hinged components, self-assembly devices ([self-assembly processes B81C 1/00007](#))}
- B81B 7/0006 . {Interconnects}
- B81B 7/0009 . {Structural features, others than packages, for protecting a device against environmental influences ([B81C 1/00777 takes precedence](#))}
- B81B 7/0012 . . {Protection against reverse engineering, unauthorised use, use in unintended manner, wrong insertion or pin assignment}
- B81B 7/0016 . . {Protection against shocks or vibrations, e.g. vibration damping}
- B81B 7/0019 . . {Protection against thermal alteration or destruction ([B81B 7/0083 takes precedence](#))}
- B81B 7/0022 . . {Protection against electrostatic discharge ([electrostatic discharge protection for electronic semiconductor circuits H01L 27/0248](#); circuit arrangements for protecting electronic switching circuits used for pulse technique against overcurrent or overvoltage [H03K 17/08](#))}
- B81B 7/0025 . . {Protection against chemical alteration}
- B81B 7/0029 . . {Protection against environmental influences not provided for in groups [B81B 7/0012](#) to [B81B 7/0025](#)}
- B81B 7/0032 . {Packages or encapsulation ([processes for packaging MEMS B81C 1/00261](#); [packaging of smart-MEMS B81C 1/0023](#))}
- B81B 7/0035 . . {for maintaining a controlled atmosphere inside of the chamber containing the MEMS}
- B81B 7/0038 . . . {using materials for controlling the level of pressure, contaminants or moisture inside of the package, e.g. getters}
- B81B 7/0041 . . . {maintaining a controlled atmosphere with techniques not provided for in [B81B 7/0038](#)}
- B81B 7/0045 . . {for reducing stress inside of the package structure}
- B81B 7/0048 . . . {between the MEMS die and the substrate}

- B81B 7/0051 . . . {between the package lid and the substrate}
- B81B 7/0054 . . . {between other parts not provided for in [B81B 7/0048](#) to [B81B 7/0051](#)}
- B81B 7/0058 . . {for protecting against damages due to external chemical or mechanical influences, e.g. shocks or vibrations}
- B81B 7/0061 . . {suitable for fluid transfer from the MEMS out of the package or vice-versa, e.g. transfer of liquid, gas, sound}
- B81B 7/0064 . . {for protecting against electromagnetic or electrostatic interferences}
- B81B 7/0067 . . {for controlling the passage of optical signals through the package}
- B81B 7/007 . . {Interconnections between the MEMS and external electrical signals}
- B81B 7/0074 . . {3D packaging, i.e. encapsulation containing one or several MEMS devices arranged in planes non-parallel to the mounting board}
- B81B 7/0077 . . {Other packages not provided for in groups [B81B 7/0035](#) to [B81B 7/0074](#)}
- B81B 7/008 . {MEMS characterised by an electronic circuit specially adapted for controlling or driving the same ([B81B 7/0087](#) takes precedence; arrangements for starting, regulating, braking, or otherwise controlling an actuator [H02N](#); control arrangements or circuits for visual indicators [G09G 3/00](#))}

#### **NOTES**

1. This group covers: only MEMS with an electronic circuit which is not specific to a particular application.
2. This group does not cover: electronic circuits per se, e.g. for controlling or driving application specific MEMS

- B81B 7/0083 . {Temperature control}
- B81B 7/0087 . . {On-device systems and sensors for controlling, regulating or monitoring}
- B81B 7/009 . . {Maintaining a constant temperature by heating or cooling}
- B81B 7/0093 . . . {by cooling}
- B81B 7/0096 . . . {by heating}
- B81B 7/02 . containing distinct electrical or optical devices of particular relevance for their function, e.g. micro-electro-mechanical systems [MEMS] ([B81B 7/04](#) takes precedence)
- B81B 7/04 . Networks or arrays of similar micro-structural devices

#### **B81B 2201/00 Specific applications of micro-electromechanical systems**

- B81B 2201/01 . Switches
- B81B 2201/012 . . characterised by the shape
- B81B 2201/014 . . . having a cantilever fixed on one side connected to one or more dimples
- B81B 2201/016 . . . having a bridge fixed on two ends and connected to one or more dimples
- B81B 2201/018 . . . Switches not provided for in [B81B 2201/014](#) to [B81B 2201/016](#)
- B81B 2201/02 . Sensors
- B81B 2201/0207 . . Bolometers
- B81B 2201/0214 . . Biosensors; Chemical sensors
- B81B 2201/0221 . . Variable capacitors
- B81B 2201/0228 . . Inertial sensors
- B81B 2201/0235 . . . Accelerometers

B81B 2201/0242	. . . Gyroscopes
B81B 2201/025	. . . Inertial sensors not provided for in <a href="#">B81B 2201/0235</a> to <a href="#">B81B 2201/0242</a>
B81B 2201/0257	. . Microphones or microspeakers
B81B 2201/0264	. . Pressure sensors
B81B 2201/0271	. . Resonators; ultrasonic resonators
B81B 2201/0278	. . Temperature sensors
B81B 2201/0285	. . Vibration sensors
B81B 2201/0292	. . Sensors not provided for in <a href="#">B81B 2201/0207</a> to <a href="#">B81B 2201/0285</a>
B81B 2201/03	. Micro-engines and actuators
B81B 2201/031	. . Thermal actuators
B81B 2201/032	. . Bimorph and unimorph actuators, e.g. piezo and thermo
B81B 2201/033	. . Comb drives
B81B 2201/034	. . Electrical rotating micro-machines
B81B 2201/035	. . Micro-gears
B81B 2201/036	. . Micro-pumps
B81B 2201/037	. . Micro-transmissions
B81B 2201/038	. . Micro-engines and actuators not provided for in <a href="#">B81B 2201/031</a> to <a href="#">B81B 2201/037</a>
B81B 2201/04	. Optical MEMS
B81B 2201/042	. . Micro-mirrors, not used as optical switches
B81B 2201/045	. . Optical switches
B81B 2201/047	. . Optical MEMS not provided for in <a href="#">B81B 2201/042</a> to <a href="#">B81B 2201/045</a>
B81B 2201/05	. Micro-fluidics
B81B 2201/051	. . Micro-mixers, micro-reactors
B81B 2201/052	. . Ink-jet print cartridges
B81B 2201/054	. . Micro-valves
B81B 2201/055	. . Micro-needles
B81B 2201/057	. . Micropipets, dropformers
B81B 2201/058	. . Micro-fluidics not provided for in <a href="#">B81B 2201/051</a> to <a href="#">B81B 2201/054</a>
B81B 2201/06	. Bio-MEMS
B81B 2201/07	. Data storage devices, static or dynamic memories
B81B 2201/10	. Micro-filters, e.g. for gas or fluids
B81B 2201/11	. Read heads, write heads or micro-positioners for hard- or optical disks
B81B 2201/12	. STM or AFM micro-tips
B81B 2201/13	. Mechanical connectors, i.e. not functioning as an electrical connector
<b>B81B 2203/00</b>	<b>Basic micro-electromechanical structures</b>
B81B 2203/01	. Suspended structures, i.e. structures allowing a movement
B81B 2203/0109	. . Bridges
B81B 2203/0118	. . Cantilevers

- B81B 2203/0127 . . Diaphragms, i.e. structures separating two media that can control the passage from one medium to another; Membranes, i.e. diaphragms with filtering function
- B81B 2203/0136 . . Comb structures
- B81B 2203/0145 . . Flexible holders
- B81B 2203/0154 . . . Torsion bars
- B81B 2203/0163 . . . Spring holders
- B81B 2203/0172 . . . Flexible holders not provided for in [B81B 2203/0154](#) to [B81B 2203/0163](#)
- B81B 2203/0181 . . See-saws
- B81B 2203/019 . . characterized by their profile
- B81B 2203/03 . Static structures
- B81B 2203/0307 . . Anchors
- B81B 2203/0315 . . Cavities
- B81B 2203/0323 . . Grooves
- B81B 2203/033 . . . Trenches
- B81B 2203/0338 . . . Channels
- B81B 2203/0346 . . . Grooves not provided for in [B81B 2203/033](#) to [B81B 2203/0338](#)
- B81B 2203/0353 . . Holes
- B81B 2203/0361 . . Tips, pillars
- B81B 2203/0369 . . characterized by their profile
- B81B 2203/0376 . . . rounded profile
- B81B 2203/0384 . . . sloped profile
- B81B 2203/0392 . . . profiles not provided for in [B81B 2203/0376](#) to [B81B 2203/0384](#)
- B81B 2203/04 . Electrodes
- B81B 2203/05 . Type of movement
- B81B 2203/051 . . Translation according to an axis parallel to the substrate
- B81B 2203/053 . . Translation according to an axis perpendicular to the substrate
- B81B 2203/055 . . Translation in a plane parallel to the substrate, i.e. enabling movement along any direction in the plane
- B81B 2203/056 . . Rotation in a plane parallel to the substrate
- B81B 2203/058 . . Rotation out of a plane parallel to the substrate
- B81B 2203/06 . Devices comprising elements which are movable in relation to each other, e.g. slidable or rotatable
  
- B81B 2207/00** **Micro-structural systems or auxiliary parts thereof**
- B81B 2207/01 . comprising a micromechanical device connected to control or processing electronics, i.e. Smart-MEMS
- B81B 2207/012 . . the micromechanical device and the control or processing electronics being separate parts in the same package
- B81B 2207/015 . . the micromechanical device and the control or processing electronics being integrated on the same substrate
- B81B 2207/017 . . Smart-MEMS not provided for in [B81B 2207/012](#) to [B81B 2207/015](#)

- B81B 2207/03 . Electronic circuits for micro-mechanical devices which are not application specific, e.g. for controlling, power supplying, testing, protecting.
- B81B 2207/05 . Arrays
- B81B 2207/053 . . of movable structures
- B81B 2207/056 . . of static structures
- B81B 2207/07 . Interconnects
- B81B 2207/09 . Packages
- B81B 2207/091 . . Arrangements for connecting external electrical signals to mechanical structures inside the package
- B81B 2207/092 . . . Buried interconnects in the substrate or in the lid
- B81B 2207/093 . . . Conductive package seal
- B81B 2207/094 . . . Feed-through, via
- B81B 2207/095 . . . . through the lid
- B81B 2207/096 . . . . through the substrate
- B81B 2207/097 . . . Interconnects arranged on the substrate or the lid, and covered by the package seal
- B81B 2207/098 . . . Arrangements not provided for in groups [B81B 2207/092](#) to [B81B 2207/097](#)
- B81B 2207/11 . Structural features, others than packages, for protecting a device against environmental influences
- B81B 2207/115 . . Protective layers applied directly to the device before packaging
- B81B 2207/99 . Micro-structural systems or auxiliary parts thereof not provided for in [B81B 2207/01](#) to [B81B 2207/115](#)