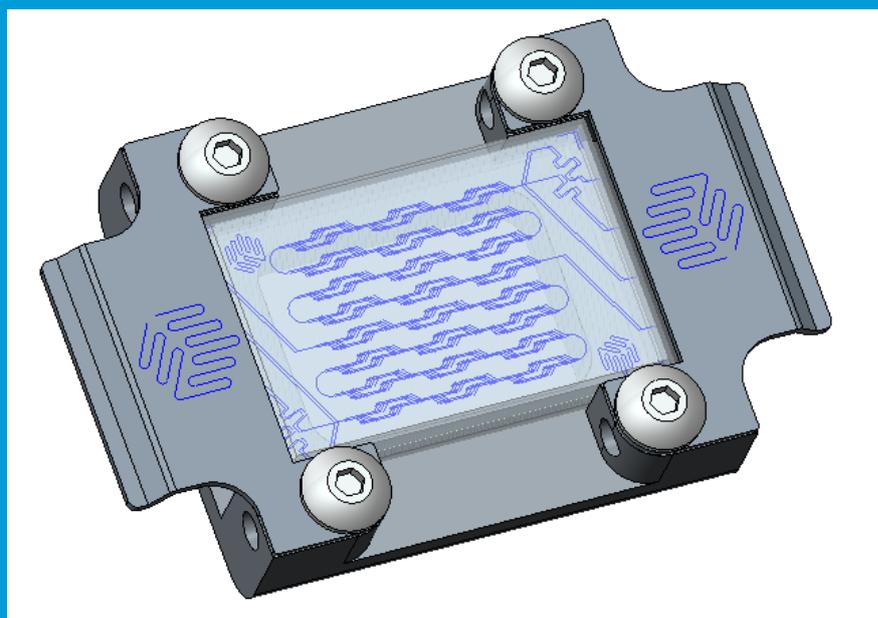


Micromixer Chips

Part Name	Part number
Micromixer Chip	3200401
Micro Mixer Chip - Hydrophobic	3200736

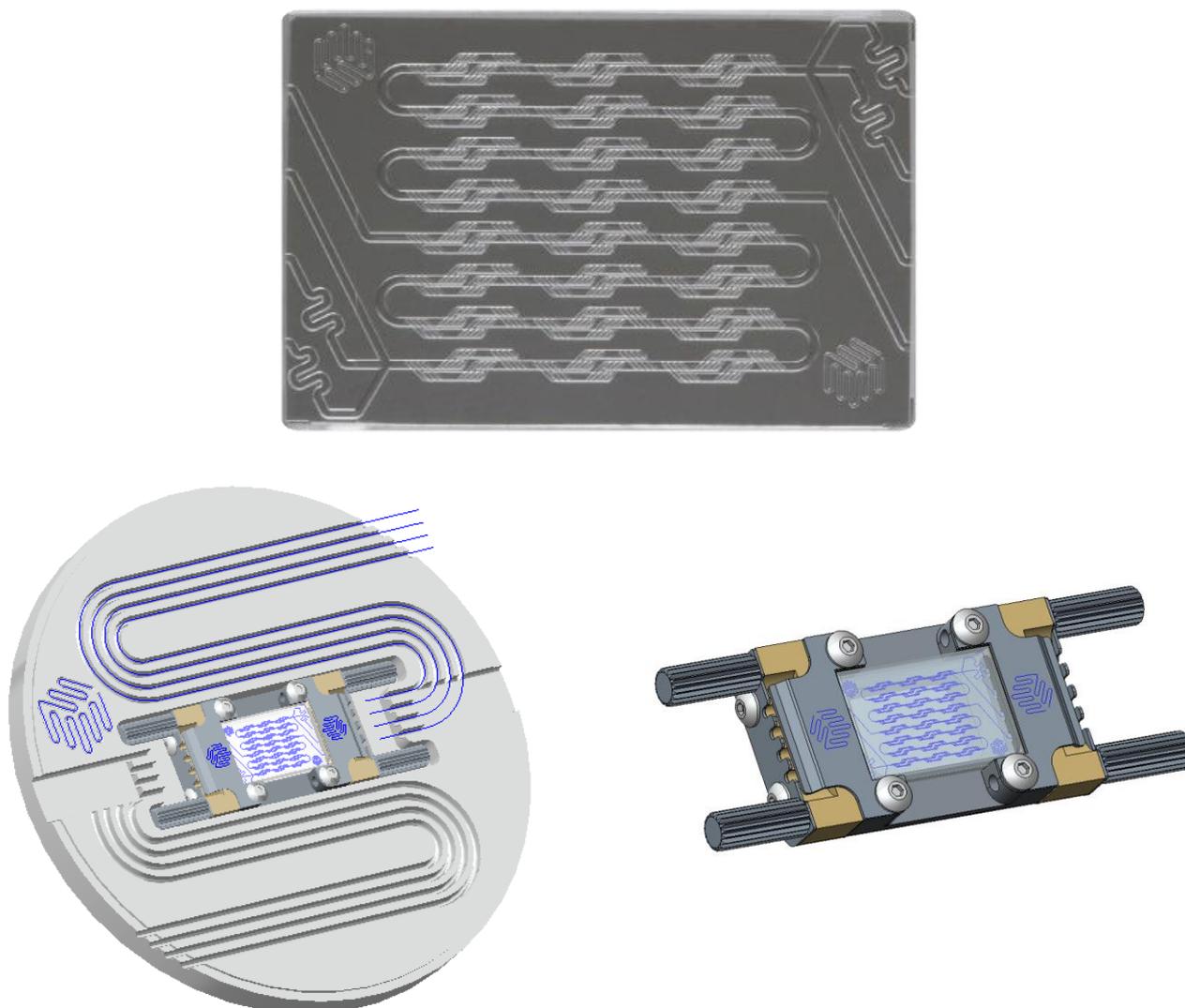


product datasheet	page
Description	2
Benefits	3
Specifications	3
Micromixer Performance	4
Micromixer Chip Channel Layout	4
Mixing Mechanism	5

Description

The Micromixer Chip is a glass microfluidic device designed for rapid mixing of two or three fluid streams. Fast mixing times are required for the study of reaction kinetics, sample dilution, improving reaction selectivity, rapid crystallisation and nanoparticle synthesis. The Micromixer chip is available in both hydrophilic (Part No. 3000024) and hydrophobic (Part No. 3200736) versions. The hydrophobic coating is resistant to organic solvents. It can be removed using acidic or basic solutions, for example a 0.1M Sodium Hydroxide for 24 hours.

There are two independent micromixer channels on the chip (with 12 mixing stages each). Tubing can be attached to the chip via the H Interface (Part No. 3000155) and two Linear Connector 4-way (Part No. 3000024) and temperature can be controlled using a Hotplate Adaptor (Part No. 3200111).



Top: Detail of the geometry of the Micromixer Chip (Part No. 3200401)

Bottom left: Temperature control of the Micromixer Chip controlled using the Hotplate Adaptor (Part No. 3200111).

Bottom right: Micromixer Chip (Part No. 3200401) with H Interface (Part No. 3000155) and two Linear Connector 4-way (Part No. 3000024)

Benefits

- Extremely rapid mixing across a range of flow rates
- Low dead volume
- High visibility (excellent access for optics)
- Quick connect / disconnect
- Wide temperature and pressure range
- Excellent chemical compatibility

Specifications

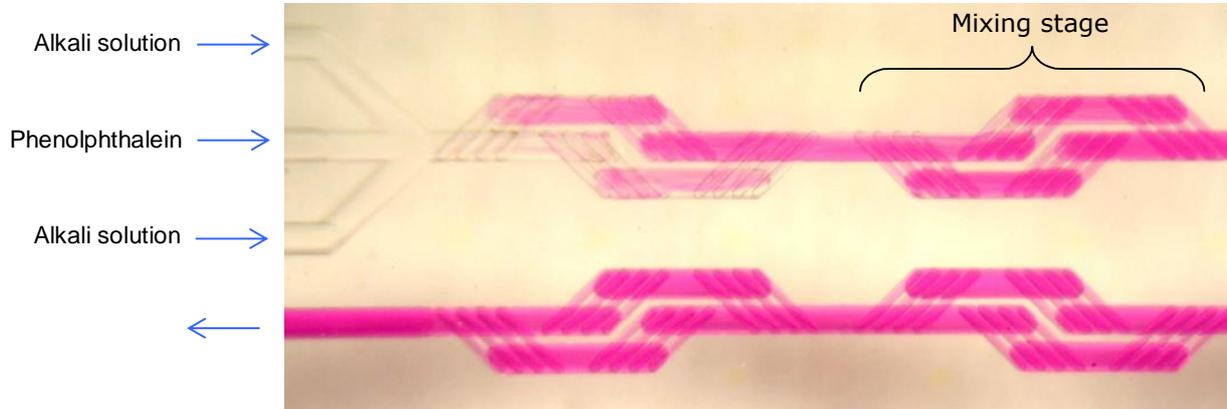
Specification	Value
Number of inputs	3
Number of outputs	1
Internal channel cross section	125µm x 350µm and 50µm x 125µm (depth x width)
Internal volume of micromixer	4.64µl
Internal volume of a single mixing stage	0.37µl
Back pressure with 100µl/min flow (water)	0.1bar
Outside diameter of connection tubing	1.6mm (1/16 inch)
Inside diameter of connection tubing	0.25mm provided as standard
Connection tubing material	PTFE, FEP
Surface roughness of channels (R _a)	5nm
Chip size	22.5mm x 15mm
Chip top layer thickness	2mm
Chip base layer thickness	2mm
Operating pressure	30 Bar *
Operating temperature	150 °C **
Material	Glass
Fabrication process	HF etching and thermal bonding

* Based on tests at 21°C

** See specification for connector

Micromixer Performance

To measure mixing performance a transparent phenolphthalein pH marker was mixed with an alkali solution to produce a bright pink colour. This is shown in the image below.

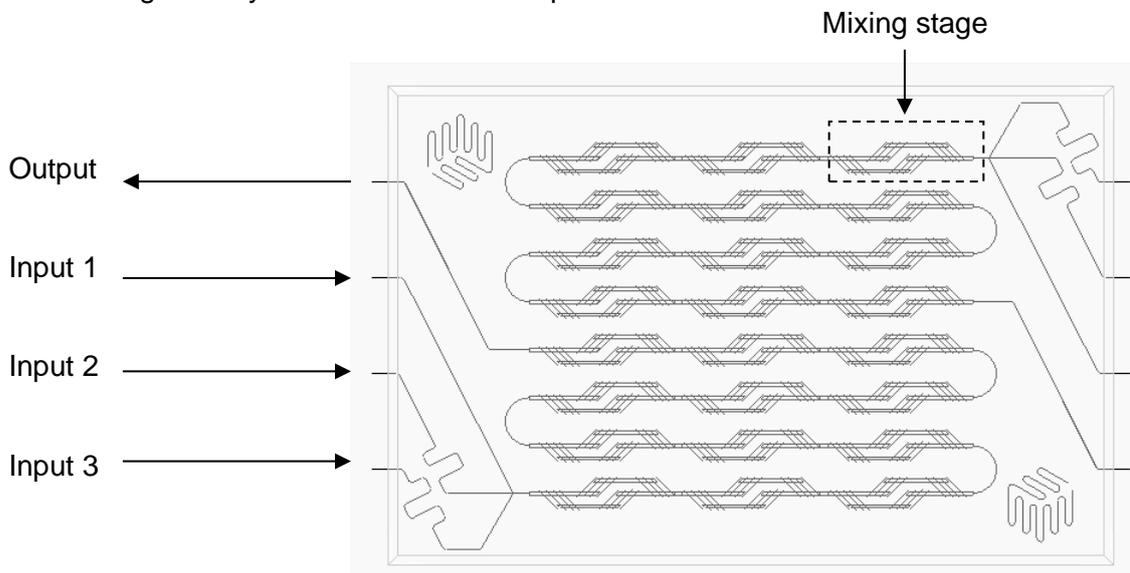


The mixing time was measured across a range of total flow rates from 5µl/min to 5000µl/min. This was done by counting the number of mixing stages required to achieve complete mixing, as shown in the table below. Mixing time was then calculated by dividing the volume of the required mixing stages by the volumetric flow rate. The volumetric flow rate ratio between the two input streams was 1:1 in all cases.

Flow rate (µl/min)	5	10	20	40	80	160	320	640	1200	2000	3000	4000	5000
Number of stages required for complete mixing to occur	1	1	2	4	6	7	7	4	4	3	3	2	2
Mixing time (milliseconds)	4200	2100	2100	2100	1575	919	459	131	70	32	21	11	8

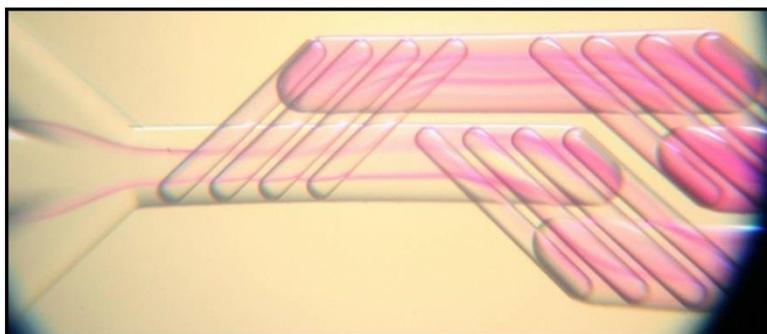
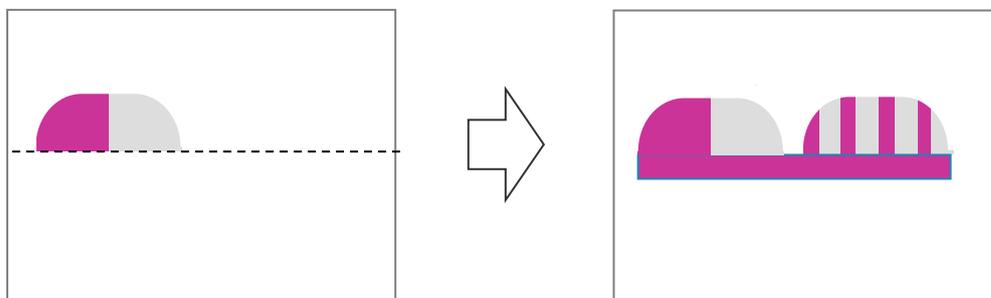
Micromixer Chip Channel Layout

The channel geometry of the Micromixer Chip is shown below:



Mixing Mechanism

The Micromixer Chip is a static mixer (no moving parts), which at low flow rates creates lamination of the flow streams as shown in the diagram below:



The lamination of the streams reduces diffusion distances and hence improves mixing time. At high flow rates swirling occurs in the flow streams, reducing mixing time further.

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