



asia

fast, clean, safe  
flow chemistry

technical note

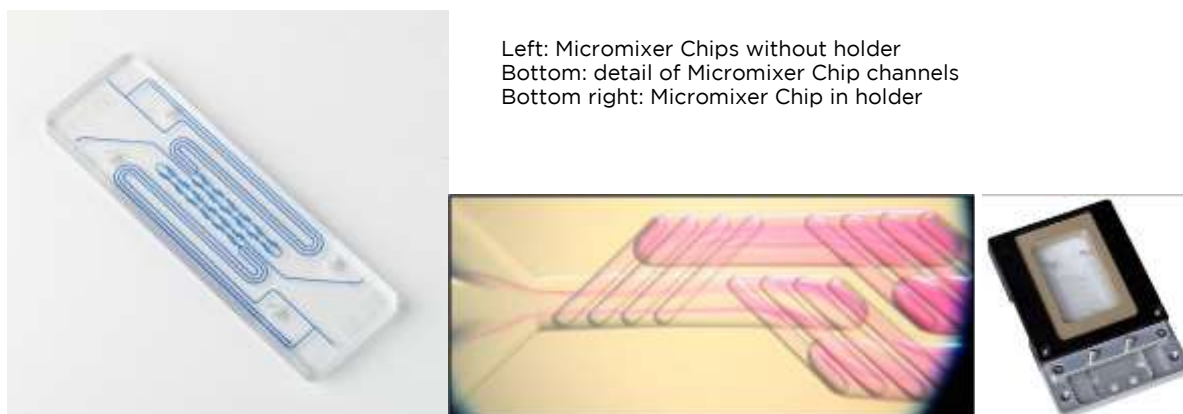
System :	Asia
Module :	Micromixer Chip
Version :	1.0
Date :	1 <sup>st</sup> March 2012
Created/ Revised by :	Maxime Drobot

## Asia Micromixer Chip Datasheet

This document provides specifications and information for Syrris Asia Micromixer Chip.

### 1. Description

The Micromixer Chip is a glass microfluidic device designed for millisecond mixing of two fluid streams. Fast mixing times are required for the study of reaction kinetics, sample dilution, improving reaction selectivity, rapid crystallisation and nanoparticle synthesis. The chips are supplied in a chip holder that are compatible with the Asia Chip Climate Controller (part number 2200526) and the Asia Heater (part number 2200527). A chip header is also available (part number 2100147) allowing quick connection to 1/16" fluid pipes.



### Benefits

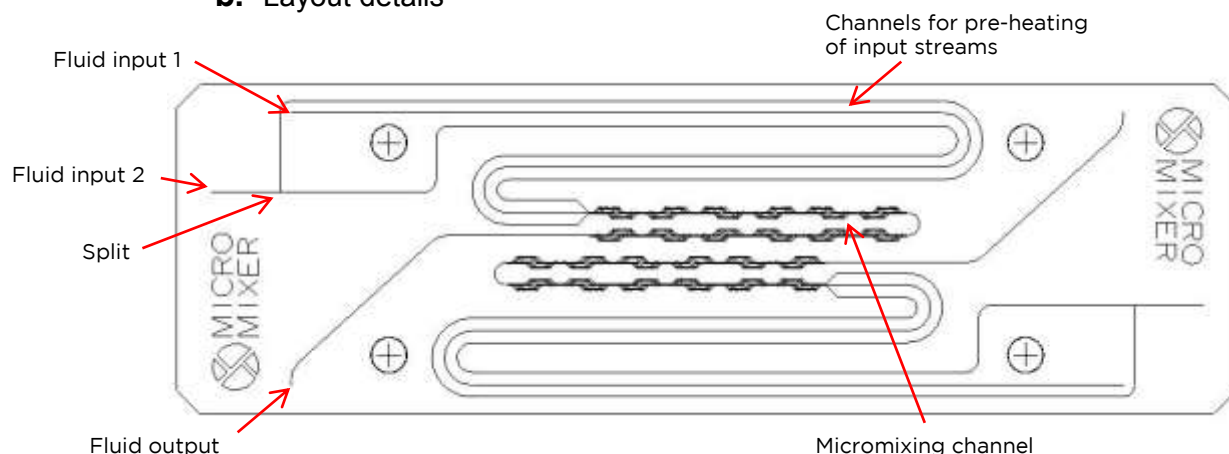
- Ultra-fast mixing across a range of flow rates
- High visibility (excellent access for optics)
- Low dead volume
- Quick connect/disconnect
- Pre-mix heating and cooling of fluid
- Wide temperature and pressure range
- Excellent chemical compatibility

## 2. Technical information for Asia Micromixer Chip

### a. General specification

	Specification	Value
1	Number of inputs	2
2	Number of outputs	1
3	Total reaction volume	26 $\mu$ l
4	Volume of mixing stage	0.35 $\mu$ l
5	Internal main channel cross section	125 x 350 $\mu$ m (depth x width)
6	Internal mixing channel cross section	50 x 125 $\mu$ m (depth x width)
7	Outside diameter of connection tubing	1.6 mm (1/16 inch)
8	Inside diameter of connection tubing	0.5 mm
9	Connection tubing material	PTFE, FEP
10	Surface roughness of channels ( $R_a$ )	5 nm
11	Chip size	90 mm x 28 mm
12	Chip thickness	4.5 mm
13	Back pressure with 100 $\mu$ l/min flow (water)	0.15 Bar
14	Max operating pressure	30 Bar
15	Max operating temperature	150 $^{\circ}$ C
16	Pre-heating of the input streams	Yes
17	Material	Glass
18	Fabrication process	HF etching and thermal bonding

### b. Layout details



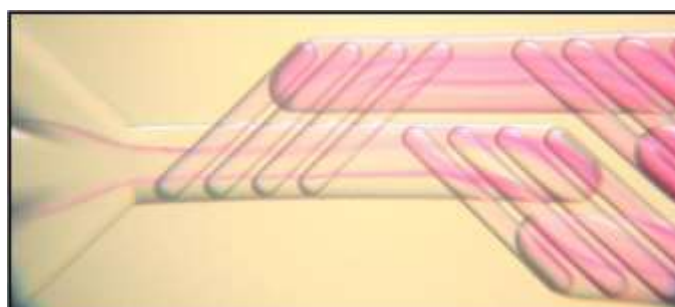
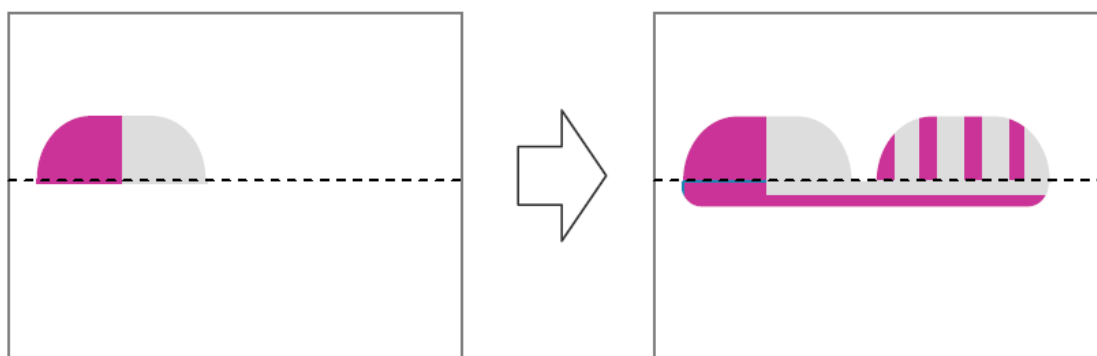
To reduce diffusion distance and improve mixing time, input stream 2 splits into two streams and recombines either side of input stream 1.

Input streams 1 and 2 have some residence time on the chip before being combined at the mixing junction, allowing fluids to be pre-heated to the reaction temperature before mixing. This allows reactants to reach reaction temperature before mixing. Our heat transfer model predicts that this will work at total flow rates <1.5ml/min. At flow rates >1.5ml/min it is recommended that both inputs are preheated before entering the chip.

The Micromixer Chip has two copies of the channel structure. It is possible to disassemble the chip holder and rotate the chip by 180° to access the second micromixing path. This minimises the downtime in case of a blockage.

**c. Mixing mechanism**

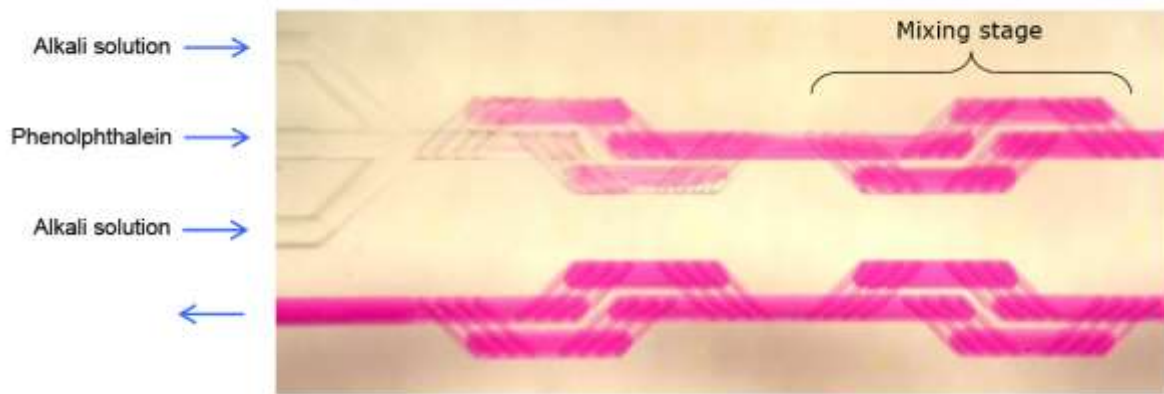
The Syrris Asia Micromixer chip is a static mixer, which at low flow rates creates lamination of the flow streams as shown in the diagram below:



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.

**d. Micromixer Chip performance**

To measure mixing performance a transparent phenolphthalein pH indicator was mixed with an alkali solution to produce a bright pink colour. Complete mixing was recorded when a constant colour was observed across the channel.



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

3. List of part numbers

<b>Part description</b>	<b>Syrris part number</b>
Asia Micromixer Chip	2101411
Chip Header	2100147
Chip Header FFKM Seals (Pack of 10)	2110721
Chip Header Blanking Plug	2100210

*If you require assistance or further explanation, please contact [support@syrris.com](mailto:support@syrris.com).*