

Droplet Junction Chips

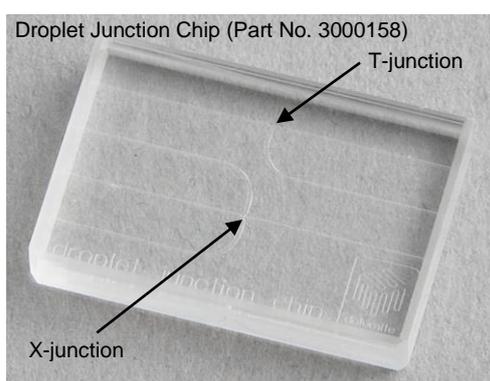


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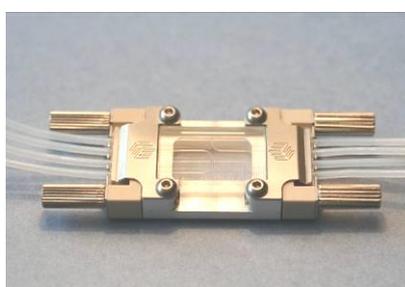
Part name	Part number
Droplet Junction Chip	3000158
Droplet Junction Chip – Hydrophobic	3000301
Droplet Junction Chip – 190µm	3000436
Droplet Junction Chip – 190µm – Hydrophobic	3000437
Droplet Junction Chip with Header	3200089
Droplet Junction Chip with Header – Hydrophobic	3200090
Droplet Junction Chip with Header – 190µm	3200091
Droplet Junction Chip with Header – 190µm – Hydrophobic	3200092
Quartz Droplet Junction Chip	3200130
Quartz Droplet Junction Chip – Hydrophobic	3200131
Quartz Droplet Junction Chip – 190µm	3200132
Quartz Droplet Junction Chip – 190µm – Hydrophobic	3200133

Description

The Droplet Junction Chip is a glass microfluidic device designed for generating droplets. On the chip there are 2 separate droplet junctions, which can be used in combination as described below. Applications include monodispersed droplet formation and emulsion formation. The Droplet Junction Chip is compatible with Chip Interface H (Part No. 3000155) for fluidic connection.



Droplet formation at X-junction



Chip Interface H (Part No. 3000155) with Chip

Benefits

- Simple geometry is easy to use
- High droplet production rate
- Extremely consistent droplet size
- Quick connection when used with Chip Interface H
- High visibility
- Hydrophobic coatings
- Quartz version for improved optical transmission
- Wide temperature and pressure range
- Excellent chemical compatibility

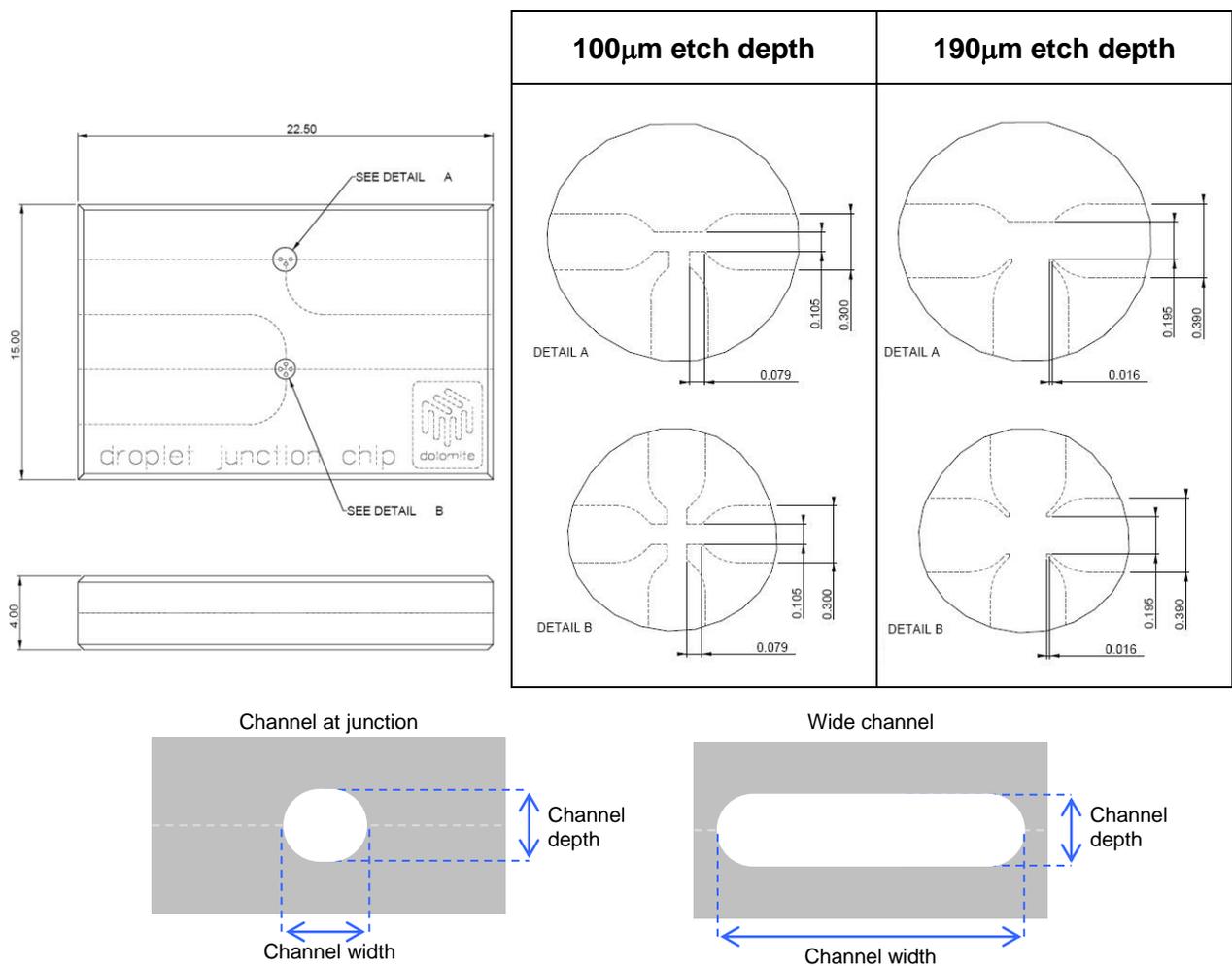
Specifications

Specification	Droplet Junction Chips 100µm etch depth		Droplet Junction Chips 190µm etch depth	
	3000158, 3200089, 3200130	3000301, 3200090, 3200131	3000436, 3200091, 3200132	3000437, 3200092, 3200133
T-junction channel format	2 inputs, 1 output			
X-junction channel format	3 inputs, 1 output			
Channel cross-section at junction (depth x width)	100µm x 105µm		190µm x 195µm	
Wide channel cross-section (depth x width)	100µm x 300µm		190µm x 390µm	
Channel length after junction	11.25mm			
Volume of channel after junction	0.31µl		0.74µl	
Back pressure with 100µl/min flow (water)	0.02Bar		0.002Bar	
Surface roughness of channels (R _a)	5nm			
Chip size (length x width x thickness)	22.5mm x 15.0mm x 4mm			
Chip top layer thickness	2.0mm			
Chip base layer thickness	2.0mm			
Operating pressure	30Bar			

Material	Glass			
Fabrication process	HF etching and thermal bonding			
Channel coating	None (Hydrophilic)	Hydrophobic*	None (Hydrophilic)	Hydrophobic*

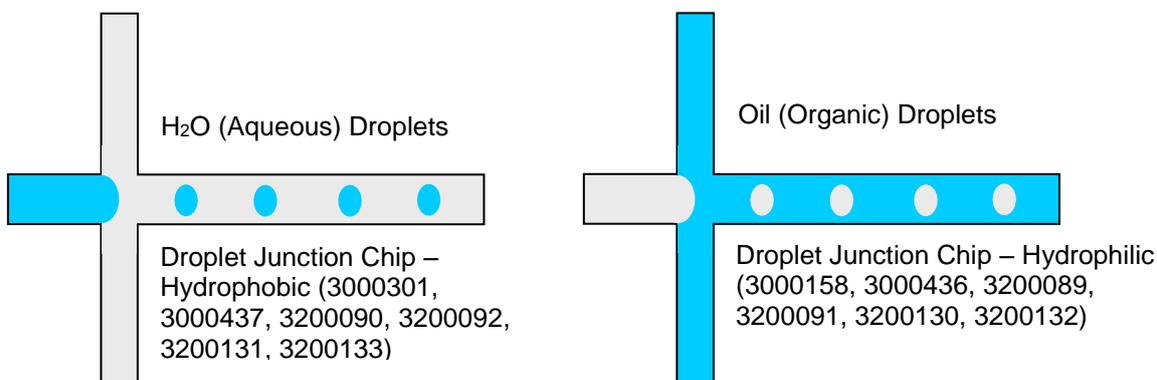
*The standard hydrophobic coating is not optimised for use with Picosurf 1 and 2 (fluorocarbon oils). If Picosurf is to be used we suggest using a fluorophilic coating on the channel surface.

Geometry



Surface Coatings

The glass channel surface is naturally hydrophilic. This will form organic droplets in an aqueous carrier phase. To form aqueous droplets in an organic phase, a hydrophobic coating is required. Part numbers for the two chip types are shown below:



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.

Droplet Formation

The size, consistency, and production rate of droplet formation is a function of several physical parameters, including:

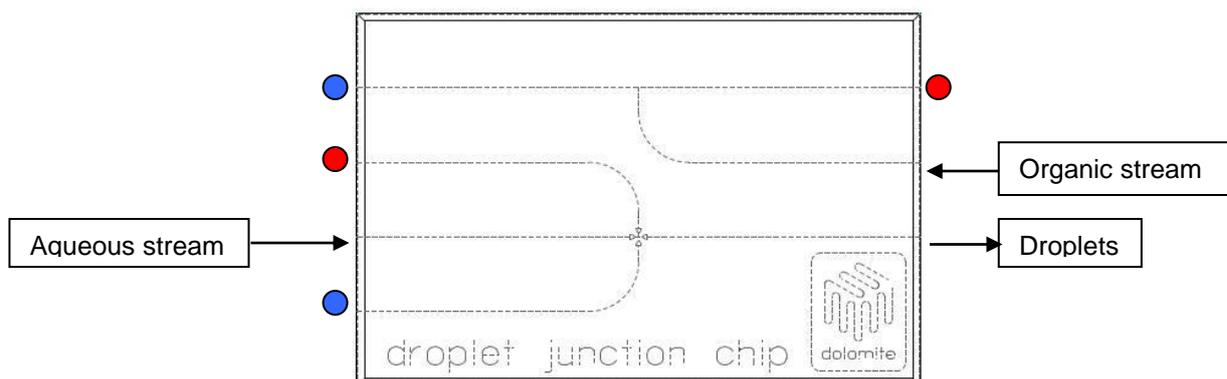
- Channel size
- Viscosity and surface tension of the various fluids
- Presence of surfactants
- Miscibility of the fluids
- Use of hydrophobic or hydrophilic coating on channel walls
- Total Flow rate and relative flow rate of each fluid
- Flow stability

The MitoS P-Pump (Part No. 3200016) has been designed to provide stable, pulse-free flow for droplet formation. In combination with the Droplet Junction Chip it is possible to generate droplets with extremely consistent diameters (monodispersed).

The standard Droplet Junction Chip (Part No. 3000158, 3000301) typically forms droplets of around 20 – 150µm in diameter. The 190µm Droplet Junction Chip (Part No. 3000436, 3000437) forms larger droplets. Droplet production rates up to 12,000 droplets per second have been produced in a single channel. Dolomite has worked on many droplet forming projects, so please contact us for advice.

Pipe Connection to the X-Junction

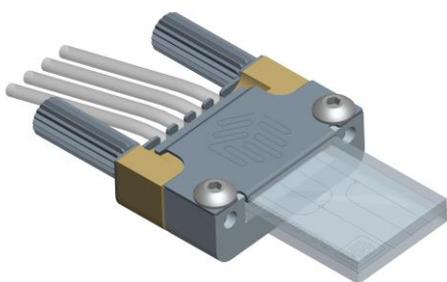
The X-junction can be fed using one central stream and two outside streams. It is possible to use the T-junction to feed the X-junction. The connections shown in fig. 4 below should be made. Connect red – red and blue – blue with equal lengths of tubing to ensure equal flow rates of the 2 organic streams into the flow junction. Using this format, aqueous droplets will be formed in the carrier organic stream.



Alternatively a T-connector (Part No. 3000397) for splitting streams can be supplied by Dolomite.

Droplet Junction Chips with Headers

The Droplet Junction Chip is available with attached header for ejection of droplets into a bulk liquid. This is useful for generation of emulsions since it reduces the likelihood of droplet coalescence, which can be an issue with some fluids on transfer from chip to tubing. In this configuration, the Droplet Junction Chip with Header is used with Linear Connector 4-way (Part No. 3000024) to generate droplets on the X-junction and eject from the edge of the chip. Droplets can be collected using the Droplet Collection Module (Part No. 3200112). An additional benefit of this collection method is that droplets can be cured with UV light immediately after generation.



Droplet Junction Chip with Header (3200089) with Linear Connector 4-way (3000024)

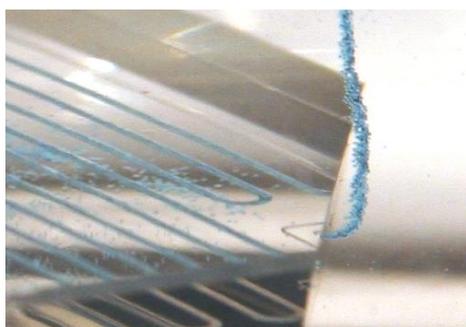


Mitos Droplet Collection Module (3200112)

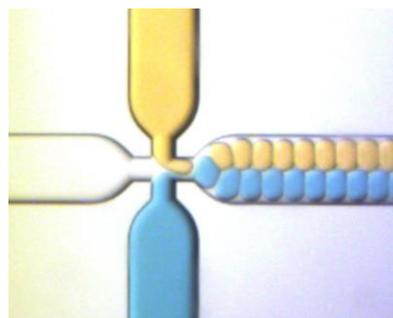
Hydrophobic and deep etch (190 μ m) versions of the Droplet Junction Chip with Header are available. With the hydrophobic version, the exit face of the chip is also treated with hydrophobic coating to prevent droplet adhesion to the surface.

Custom Options

Dolomite can also offer additional customisation, for example, the top layer or base layer can be left un-etched giving a semi-circular channel cross-section or etched to different depths.

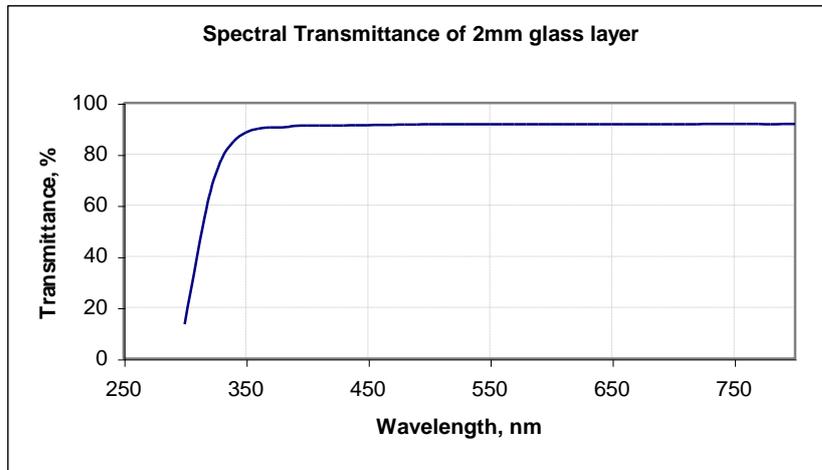


This image shows a droplet chip with a diced edge submerged in water. This allows a flow of oil droplets into the water.

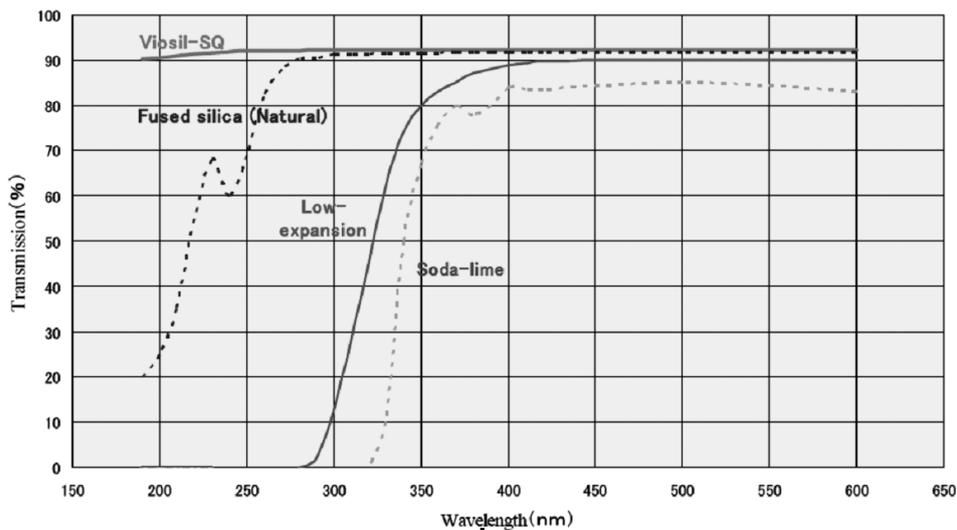


This image shows two aqueous droplet streams being generated simultaneously with a surfactant to prevent coalescence

Optical transmission



Optical transmission of glass (standard material)



Optical transmission of synthetic quartz – Viosil-SQ (3200130 – 3200133)

IP license

Dolomite is a licensee of Japan Science and Technology Agency (“JST”) under JST’s microdroplet generation technology. This enables our customers to purchase and use our droplet chips for R&D purposes without any restriction from this comprehensive IP family. Contact us for more information about licensing this IP for your custom application or chip design.



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