



Droplet Junction Chips

Product Datasheet

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Dolomite Microfluidics is a brand of Blacktrace

Registered office: The Dolomite Centre Ltd. 27 Jarman Way, Royston, SG8 5HW, UK

Reg in England No. 04257809





Part Name	Part Number
Droplet Junction Chip (50µm etch depth)	3201048
Droplet Junction Chip (50µm etch depth) - Hydrophobic	3201049
Droplet Junction Chip (50µm etch depth) - Fluorophilic	3201050
Droplet Junction Chip (100 µm etch depth)	3000158
Droplet Junction Chip (100 µm etch depth) - Hydrophobic	3000301
Droplet Junction Chip (100 µm etch depth) - Fluorophilic	3200512
Droplet Junction Chip (190 µm etch depth)	3000436
Droplet Junction Chip (190 µm etch depth) - Hydrophobic	3000437
Droplet Junction Chip (190 µm etch depth) - Fluorophilic	3200506
Droplet Junction Chip with Header (100 µm etch depth)	3200089
Droplet Junction Chip with Header (100 µm etch depth) - Hydrophobic	3200090
Droplet Junction Chip with header (100 µm etch depth) - Fluorophilic	3200505
Droplet Junction Chip (140µm etch depth)	3201045
Droplet Junction Chip (140µm etch depth) - Hydrophobic	3201046
Droplet Junction Chip (140µm etch depth) - Fluorophilic	3201047
Droplet Junction Chip with Header (190 µm etch depth)	3200091
Droplet Junction Chip with Header (190 µm etch depth) - Hydrophobic	3200092
Quartz Droplet Junction Chip (100 µm etch depth)	3200130
Quartz Droplet Junction Chip (100 µm etch depth) - Hydrophobic	3200131
Quartz Droplet Junction Chip (100 µm etch depth) - Fluorophilic	3200738
Quartz Droplet Junction Chip (190 µm etch depth)	3200132
Quartz Droplet Junction Chip (190 µm etch depth) - Hydrophobic	3200133
Droplet Junction Chip (275 µm etch depth)	3200822
Droplet Junction Chip (275 µm etch depth) - Hydrophobic	3200823
Droplet Junction Chip (275 µm etch depth) - Fluorophilic	3200824



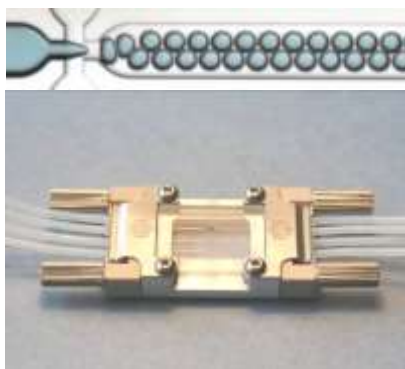
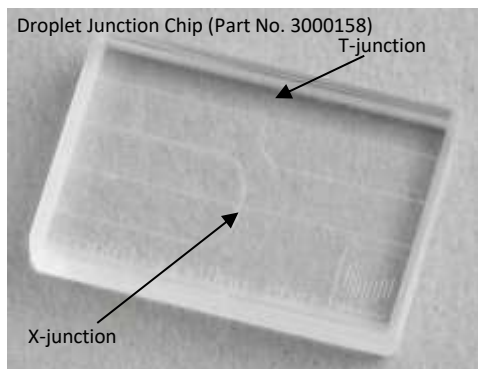
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1 Description

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

2 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 and fluorophilic coatings
- Quartz version for improved optical transmission
- Wide temperature and pressure range
- Excellent chemical compatibility

3 Specification

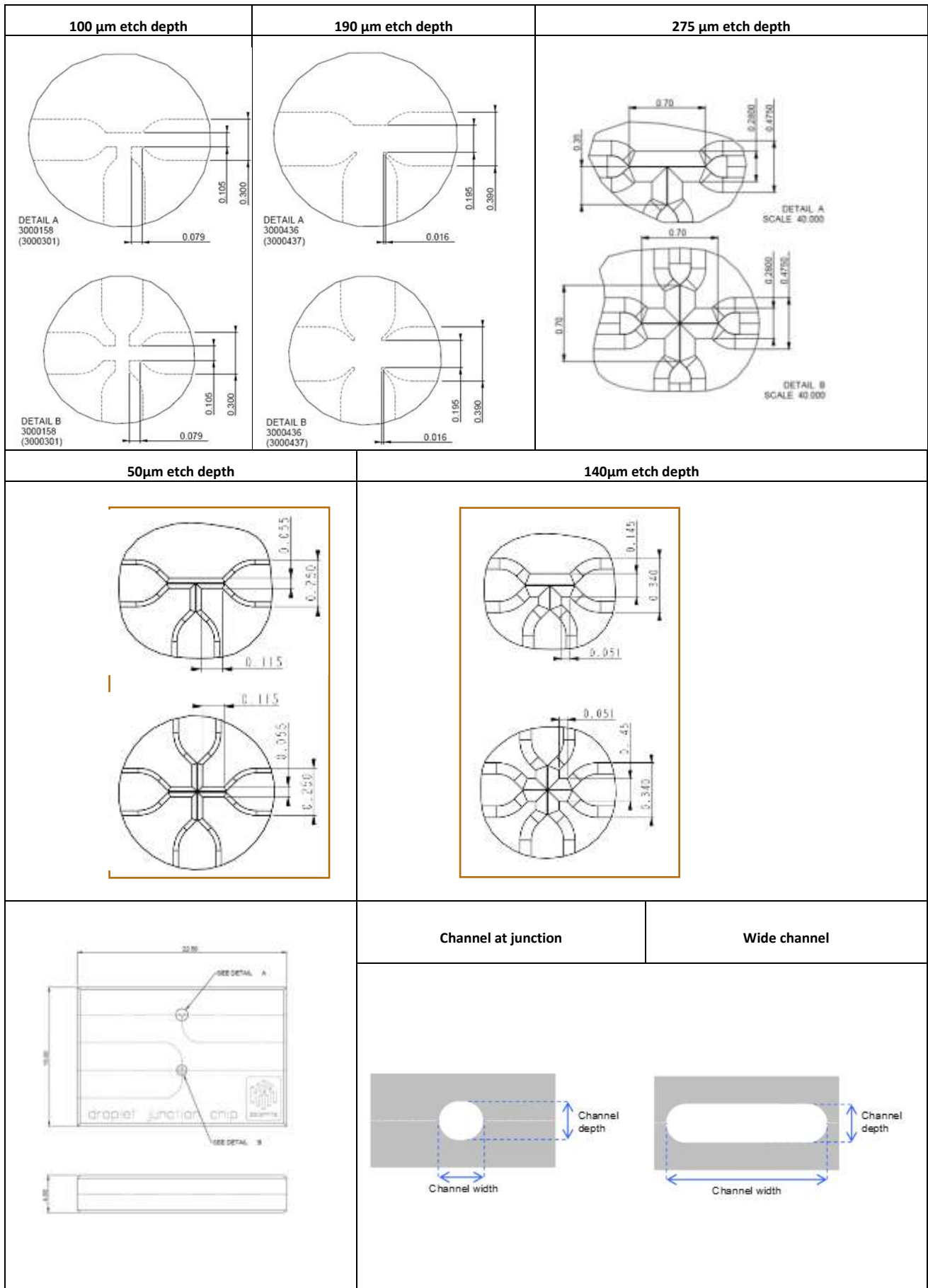
Specification	Droplet Junction Chip (50µm etch depth)			Droplet Junction Chip (100 µm etch depth)		
	3201048	3201049	3201050	3000158 3200089 3200130	3000301 3200090 3200131	3200512 3200505 3200738
Channel cross-section at junction (depth x width)	50µm x 55µm			100µm x 105µm		
Wide channel cross-section (depth x width)	50µm x 250µm			100µm x 300µm		
Volume of channel after junction	0.14 µl			0.31 µl		
Surface coating	Hydrophilic	Hydrophobic	Fluorophilic	Hydrophilic	Hydrophobic	Fluorophilic
T-junction channel format	2 inputs, 1 output					
X-junction channel format	3 inputs, 1 output					
Chip size (length x width x thickness)	22.5mm x 15.0mm x 4mm					
Chip top and base layer thickness	2.0mm					
Channel length after junction	11.5mm					
Back pressure with 100µl/min flow of water	0.2 bar			0.02 bar		
Surface roughness of channels (R _a)	5nm					
Max. operating pressure	up to 30bar					
Material	Glass			Glass and Quartz		
Fabrication	HF etching and thermal bonding					

Specification	Droplet Junction Chip (140µm etch depth)			Droplet Junction Chip (190 µm etch depth)		
	3201045	3201046	3201047	3000436 3200091 3200132	3000437 3200092 3200133	3200506
Channel cross-section at junction (depth x width)	140µm x 145µm			190µm x 195µm		
Wide channel cross-section (depth x width)	140 µm x 340 µm			190 µm x 390 µm		
Volume of channel after junction	0.48 µl			0.74 µl		
Surface coating	Hydrophilic	Hydrophobic	Fluorophilic	Hydrophilic	Hydrophobic	Fluorophilic
T-junction channel format	2 inputs, 1 output					
X-junction channel format	3 inputs, 1 output					
Chip size (length x width x thickness)	22.5mm x 15.0mm x 4mm					
Chip top and base layer thickness	2.0mm					
Channel length after junction	11.5mm					
Back pressure with 100µl/min flow of water	0.01 bar			0.002 bar		
Surface roughness of channels (R _a)	5nm					
Max. operating pressure	up to 30bar					
Material	Glass			Glass and Quartz		
Fabrication	HF etching and thermal bonding					

Specification	Droplet Junction Chip (275µm etch depth)		
	3200822	3200823	3200824
Channel cross-section at junction (depth x width)	275 µm x 280 µm		
Wide channel cross-section (depth x width)	275 µm x 475 µm		
Volume of channel after junction	1.35 µl		
Surface coating	Hydrophilic	Hydrophobic	Fluorophilic
T-junction channel format	2 inputs, 1 output		
X-junction channel format	3 inputs, 1 output		
Chip size (length x width x thickness)	22.5mm x 15.0mm x 4mm		
Chip top and base layer thickness	2.0mm		
Channel length after junction	11.5mm		
Back pressure with 100µl/min flow of water	<0.001 bar		
Surface roughness of channels (R _a)	5nm		
Max. operating pressure	up to 30bar		
Material	Glass		
Fabrication	HF etching and thermal bonding		

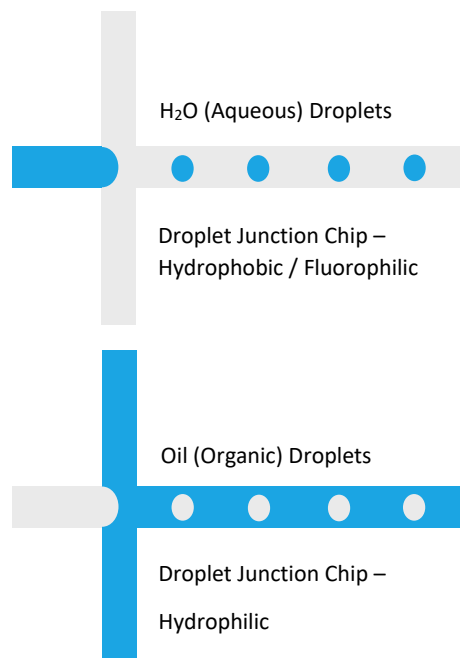
** The standard hydrophobic coating is not optimised for use with fluorocarbon oils. If fluorocarbon oils are used we suggest using a fluorophilic coating on the channel surface.*

4 Geometry



5 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.

6 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, fluorophilic or hydrophilic coating on channel walls
- Total Flow rate and relative flow rate of each fluid
- Flow stability

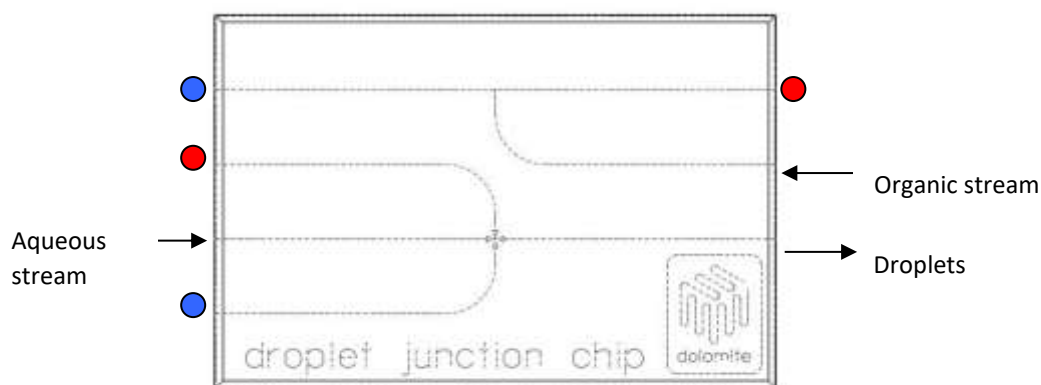
The MitoS P-Pump (Part No. 3200016) has been designed to provide stable, pulse-free flow for droplet formation. In combination with the Droplet Junction Chip it is possible to generate droplets with extremely consistent diameters (monodispersed).

The standard Droplet Junction Chip (Part No. 3000158, 3000301, 3200512) typically forms droplets of around 20 – 150 μm in diameter. The 190 μm Droplet Junction Chip (Part No. 3000436, 3000437, 3200506) 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.

7 Pipe Connection to the X-Junction

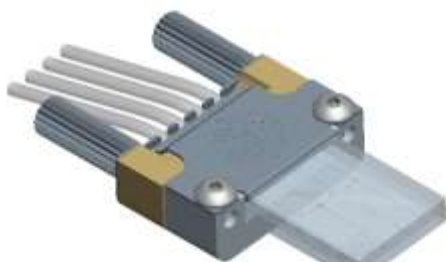
The X-junction can be fed using one central stream and two outside streams. It is possible to use the T-junction to feed the X-junction. The connections shown in fig. 4 below should be made. Connect red – red and blue – blue with equal lengths of tubing to ensure equal flow rates of the 2 organic streams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

8 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.



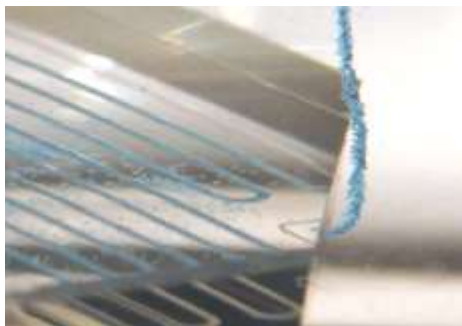
Droplet Junction Chip with Header (3200089) with Linear Connector 4-way (3000024)



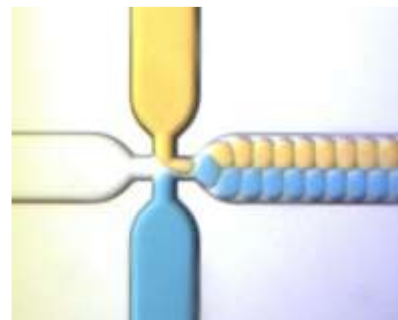
Mito Droplet Collection Module (3200112)

9 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

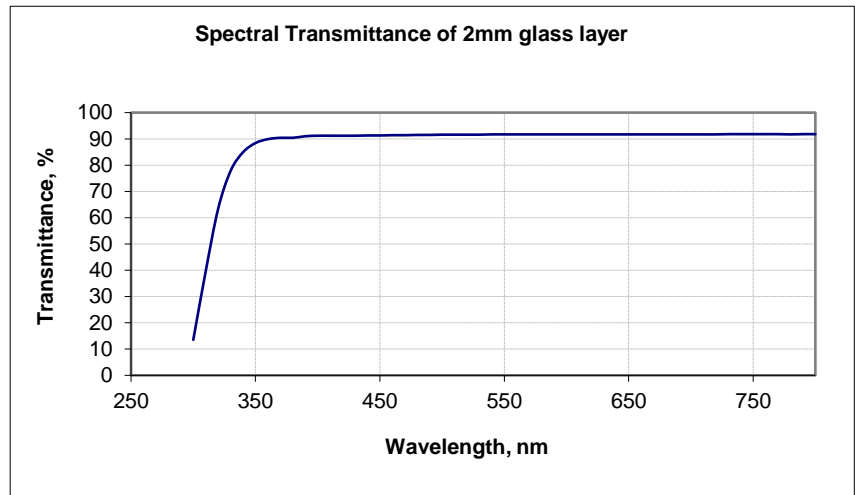


This image shows a droplet chip with a diced edge submerged in water. This allows a flow of oil droplets into the water.

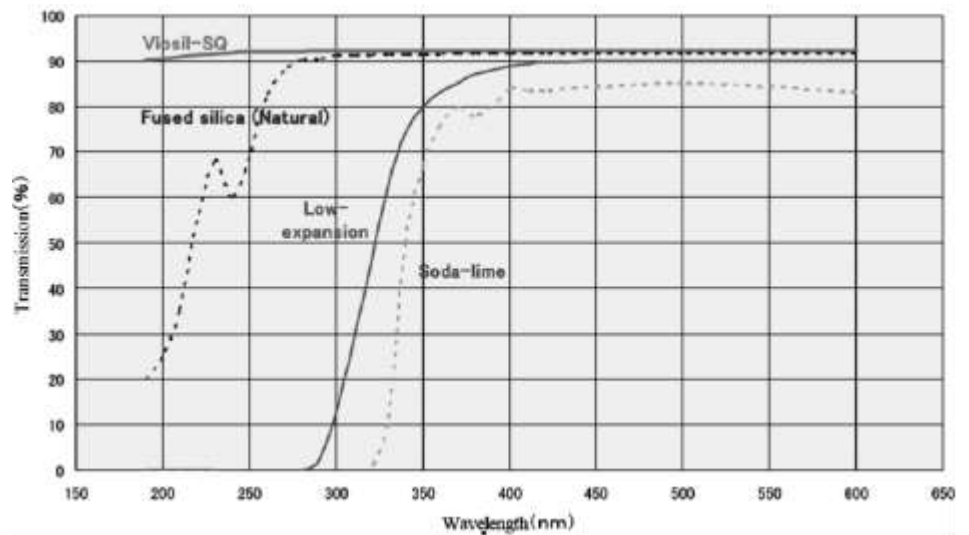


This image shows two aqueous droplet streams being generated simultaneously with a surfactant to prevent coalescence

10 Optical Transmission



Optical transmission of glass (standard material)



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

11 IP License

Dolomite is a licensee of Japan Science and Technology Agency ("JST") under JST's microdroplet generation technology. Please see our website for further details.