Description: Precision micro-machined apertures are fabricated from silicon on insulator (SOI) wafers. Lithographic processing allows great flexibility in the aperture design, enabling precise placement of apertures, through holes, and chip outlines. Optionally, metal can be deposited for low emissivity and multiwall vertically-aligned carbon nanotubes can be grown for high emissivity.

Design, fabrication, and technical measurements leading to the production of this SRI were performed by N. Tomlin, NIST Quantum Electronics and Photonics Division.

Support aspects involved in the issuance of this SRI were coordinated through the NIST Office of Reference Materials.

Specifications: Aperture design is subject to review to ensure it is possible to fabricate. See attached figure for sample aperture design. The side with the aperture is referred to as the front. The following design guidelines are recommended:

- Aperture:
  - Aperture width: 10 µm to 1000 µm
  - Aperture thickness: ~10 µm (may not be able to specify, depends on SOI wafer availability)
- Chip:
  - Length of longest line drawn between any 2 outline points: 63.5 mm
  - Thickness: 350-600 µm (may not be able to specify, depends on SOI wafer availability)
  - Outline minimum feature size: >= 200 µm
- Backside channel width: 200 µm to 2000 µm (must be wider than aperture width)
- Through hole minimum feature size: >= 200 µm
- Dimensions specified in metric units (millimeter or micrometer preferred)
**Standard Configurations:**

6006a  Bare Si, no additional coatings

6006b  Metal coating on one side of chip
   - Metals available: Al, Au, Cu, Ni, PdAu alloy, Ti
   - Thickness: 50 nm to 500 nm
   - Area coverage: blanket or specified area
   - If metal is on back, some edge areas will be missing metal due to shadowing by clamps

6006d  Metal coating and vertically-aligned carbon nanotubes (VACNT) on one side of chip
   - Metal available: Mo (metal not required)
   - Thickness (nanotube length): 50 µm to 2000 µm
   - Area coverage: blanket or specified area
   - VACNT growth may adversely affect aperture properties
   - If metal is on back, some edge areas will be missing metal due to shadowing by clamps

All Si dimensions and thicknesses are best effort basis and not guaranteed. Additionally, coating performance (e.g. reflectance, metal thickness, nanotube height) is best effort basis and not guaranteed.

Apertures are fabricated on a 76.2 mm (3 inch) diameter wafer. If space allows, multiple copies of the aperture chip will be fabricated on one wafer.

The critical feature of the precision micro-machined apertures is the aperture width. The width will be inspected with an optical microscope, which has been calibrated against a NIST-traceable stage micrometer.

Customers will receive a detailed fabrication and calibration report along with the SRI.

**Delivery and Shipping:** NIST will prepare packaging for shipment of the SRI. Shipping costs will be included in each quote. Customers are responsible for all customs duties and import fees (HTC 9002.90.9500).
Users of this SRI should ensure that the Specifications Certificate in their possession is current. This can be accomplished by contacting the Office of Reference Materials: telephone (301) 975-2200; fax (301) 948-3730; e-mail srminfo@nist.gov; or via the Internet at http://www.nist.gov/sri.