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Technical Data | September 2019

3M™ Fluorinert™ Electronic Liquid FC-40

Product description

3M™ Fluorinert™ Electronic Liquid FC-40 is a clear, colorless, thermally stable, fully-fluorinated liquid ideal for use in many single-phase heat transfer applications in the semiconductor manufacturing industry. Its liquid range (-57°C to 165°C) makes it ideal for a variety of applications such as etchers, ion implanters, testers and others. Other uses include heat transfer for data centers, high performance computing, power electronics and aviation electronics. Fluorinert liquid FC-40 is also used for electronics testing. Because Fluorinert liquid FC-40 is primarily a single compound, its composition will not shift or fractionate with time. This keeps fluid loss to a minimum enabling transport properties to remain unchanged.

Typical physical properties

Note: The following technical information and data should be considered representative or typical only and should not be used for specification purposes. Final product specifications and testing methods will be outlined in the products Certificate of Analysis (COA) that is shipped with the commercialized product. All values @ 25°C unless otherwise specified.

Properties	3M™ Fluorinert™ Electronic Liquid FC-40
Appearance	Clear, colorless
Average Molecular Weight	650 (g/mol)
Boiling Point (@ 1 atm)	165 °C (329°F)
Pour Point	-57 °C (-70.6°F)
Calculated Critical Temperature	270 (°C)
Calculated Critical Pressure	1.18×10^6 (pa)
Vapor Pressure	287 (pa)
Latent Heat of Vaporization (at normal boiling point)	69 (J/g)
Liquid Density	1855 (kg/m^3)
Kinematic Viscosity	2.2 (cSt)
Absolute Viscosity	4.1 (cP)
Liquid Specific Heat	1100 ($J\ kg^{-1}\ °C^{-1}$)
Liquid Thermal Conductivity	0.065 ($W\ m^{-1}\ °C^{-1}$)
Coefficient of Expansion	0.0012 ($°C^{-1}$)
Surface Tension	16 (dynes/cm)
Refractive Index	1.29
Ozone Depletion Potential	0
Flash Point	None

3M™ Fluorinert™ Electronic Liquid FC-40
Typical electrical properties

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Properties	3M™ Fluorinert™ Electronic Liquid FC-40
Dielectric Strength (0.1" gap)	46 (kV)
Dielectric Constant (@ 1 kHz)	1.9
Electrical Resistivity (ASTM D-257)	4.0×10^{15} (ohm cm)

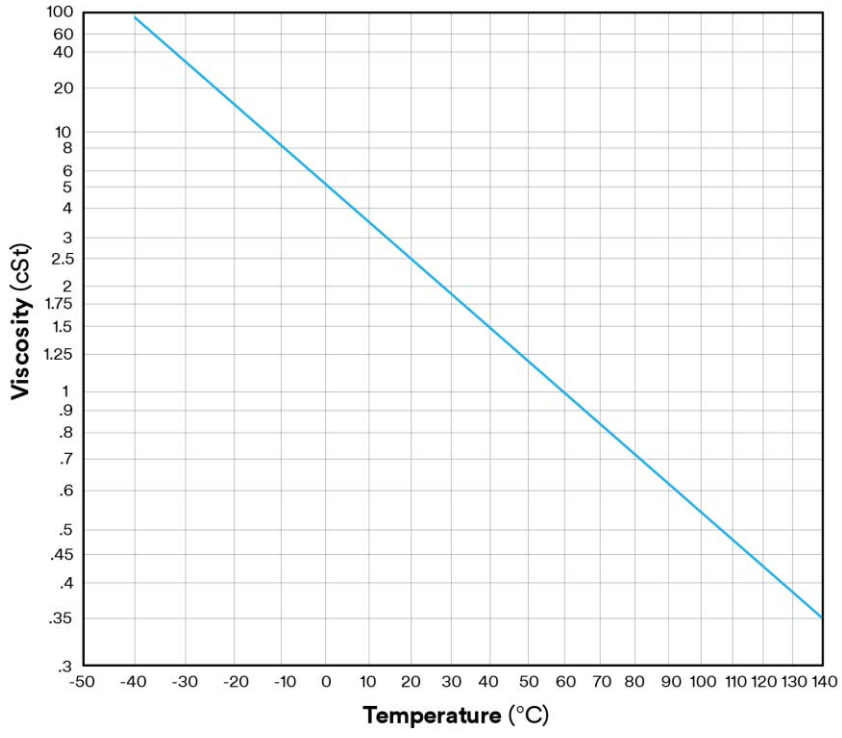
Heat transfer properties

The following formulas can be used to calculate the specific heat, thermal conductivity, density and vapor pressure of 3M™ Fluorinert™ Electronic Liquid FC-40 at various temperatures.

Specific Heat (J kg^{-1} $°C^{-1}$) = 1014 + 1.554 (T, °C)
Thermal Conductivity (W m^{-1} $°C^{-1}$) = 0.067 – 0.000069 (T, °C)
Density (kg/m^3) = 1909 – 2.16 (T, °C)
Log_{10} (Vapor Pressure (pa)) = 10.448 – (2381/(T, K))

The following graph can be used to determine the viscosity of Fluorinert liquid FC-40 over the indicated temperature range.

3M™ Fluorinert™ Electronic Liquid FC-40 Viscosity vs. Temperature



Materials compatibility

Fluorinert liquid FC-40 is compatible with most metals, plastics and elastomers. Contact 3M for more information.

3M™ Fluorinert™ Electronic Liquid FC-40

Storage and shelf life

The shelf life of 3M™ Fluorinert™ Electronic Liquid FC-40 is 60 months from the date of manufacture when stored in the original packaging materials and stored at 21°C (70°F) and 50% relative humidity.

Toxicity profile

Not for specification purposes.

3M Fluorinert liquid FC-40 is virtually non-irritating to the eyes and skin. The product also demonstrates very low toxicity and was not mutagenic in the Ames assay. A Safety Data Sheet (SDS) is available from www.3m.com/SDS.

Safety and handling

Before using this product, please thoroughly read the current product SDS and label, following all applicable safety precautions described therein (e.g., recommended storage and safe handling, appropriate exposure controls and personal protective equipment (PPE), addressing accidental spills, disposal considerations, etc.). 3M™ Fluorinert™ Electronic Liquid FC-40 is nonflammable and is resistant to thermal breakdown and hydrolysis during typical use and storage.

Environmental properties

3M™ Fluorinert™ Electronic Liquid FC-40 has zero ozone depletion potential. Additionally, this product has negligible photochemical reactivity and therefore it does not appreciably contribute to ground-level smog formation. As such, it is not defined or regulated by the U.S. EPA as a volatile organic compound (VOC).

As a perfluorocarbon (PFC), this product has a high global warming potential and a long atmospheric lifetime. As such, its use should be carefully managed to minimize emissions.

3M recommends that users of Fluorinert liquid FC-40 further limit emissions by employing good conservation practices, and by implementing recovery, recycling and/or proper disposal procedures. In general, 3M recommends that Fluorinert-branded liquids be disposed of by incineration at a permitted industrial waste facility capable of handling halogenated materials, in accordance with all applicable local, regional, national, and/or international regulations. See product SDS for further details. 3M also offers a Used Fluid Disposal Program.