

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 x 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

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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 ($\text{J kg}^{-1} \text{ } ^\circ\text{C}^{-1}$) = $1014 + 1.554 (T, ^\circ\text{C})$

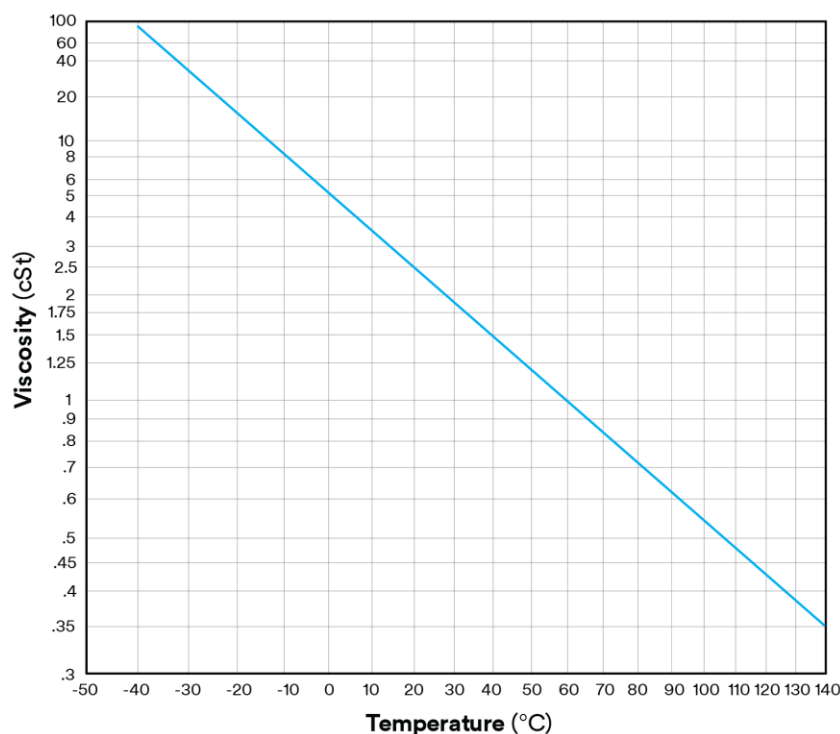
Thermal Conductivity ($\text{W m}^{-1} \text{ } ^\circ\text{C}^{-1}$) = $0.067 - 0.000069 (T, ^\circ\text{C})$

Density (kg/m^3) = $1909 - 2.16 (T, ^\circ\text{C})$

Log₁₀ (Vapor Pressure (pa)) = $10.448 - (2381/(T, \text{K}))$

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.

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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.

Recycle and disposal options

Used Fluid Disposal Program

As part of 3M's commitment to product stewardship and customer service, we offer the 3M Used Fluid Disposal Program for free pickup of used 3M fluids in the U.S. This program is provided through Clean Harbors Environmental Services. Working with Clean Harbors will ensure that your used 3M fluids will be managed properly and responsibly. A minimum of 30 gallons of used 3M fluid is required for participation in this free program. Amounts of less than 30 gallons will be at your own expense and will be determined based upon quantity and approved profile of waste.

For additional information on the 3M Used Fluid Disposal Program, send an email to 3Musedfluid@cleanharbors.com.

Resources

For more information on 3M Fluorinert products or to contact a 3M representative, visit 3M.com/electronics.

3M™ Fluorinert™ Electronic Liquid FC-40

Safety Data Sheet: Consult Safety Data Sheet before use.

Regulatory: For regulatory information about this product, contact your 3M representative.

Technical Information: The technical information, recommendations and other statements contained in this document are based upon tests or experience that 3M believes are reliable, but the accuracy or completeness of such information is not guaranteed.

Product Use: Many factors beyond 3M's control and uniquely within user's control can affect the use and performance of a 3M product in a particular application. Given the variety of factors that can affect the use and performance of a 3M product, user is solely responsible for evaluating the 3M product and determining whether it is fit for a particular purpose and suitable for user's method of application.

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