3M

Fluorinert™
Electronic Liquid FC-3284

Product Information

Introduction

3M™ Fluorinert™ Electronic Liquid FC-3284 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 (-73°C to 50°C) makes it ideal for a variety of applications such as etchers, ion implanters, testers, rectifiers and others. Because Fluorinert liquid FC-3284 is primarily a single compound, its composition will not shift or fractionate with time. This keeps fluid loss to a minimum and insures that transport properties will not change with time.

Physical Properties

Not for specification purposes

All values determined at 25°C unless otherwise specified

Properties	FC-3284
Appearance	Clear, colorless
Average Molecular Weight	299
Boiling Point (1 atm)	50°C
Pour Point	-73°C
Estimated Critical Temperature	434 K
Vapor Pressure	35.7 x 10^3 pascals
Latent Heat of Vaporization (at normal boiling point)	105 J/g
Liquid Density	1710 kg/m^3
Kinematic Viscosity	0.42 centistokes
Absolute Viscosity	0.71 centipoise
Liquid Specific Heat	1100 J kg^{-1} $°C^{-1}$
Liquid Thermal Conductivity	0.062 W m^{-1} $°C^{-1}$
Coefficient of Expansion	0.0016 $°C^{-1}$
Refractive Index	1.266
Water Solubility	14 ppmw
Solubility in Water	<5 ppmw
Ozone Depletion Potential	0

3M™ Fluorinert™ Electronic Liquid FC-3284 Electrical Properties

Properties	FC-3284
Dielectric Strength	40 kV, 0.1" gap
Dielectric Constant	1.86
Electrical Resistivity	7 x 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-3284 at various temperatures.

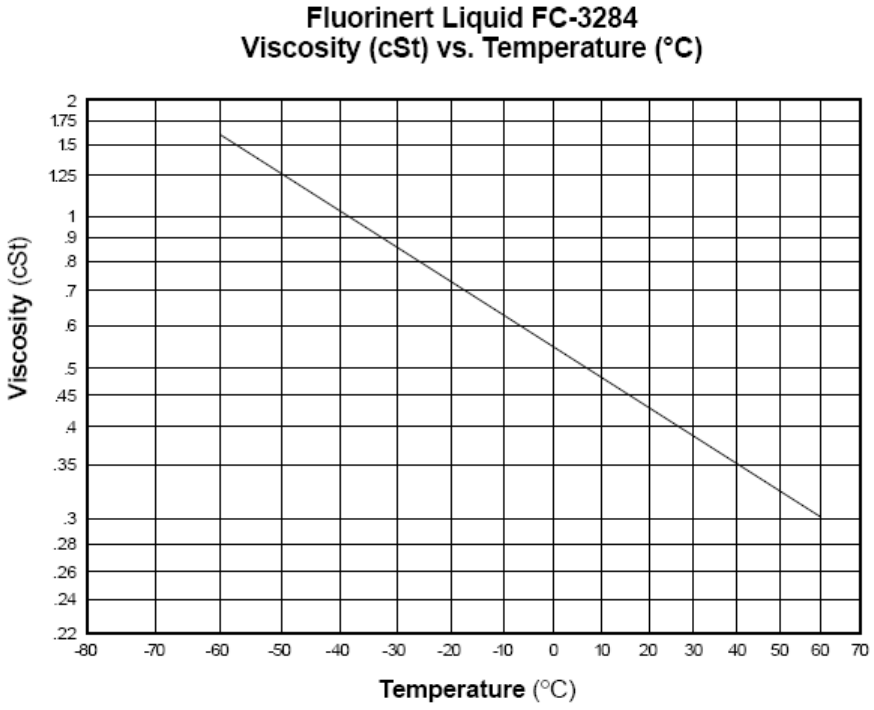
Specific Heat (J kg^{-1} $°C^{-1}$) = 1014 + 1.554 (T, °C)

Thermal Conductivity (W m^{-1} $°C^{-1}$) = 0.065 – 0.00013 (T, °C)

Density (kg/m^3) = 1776 – 2.65 (T, °C)

Log_{10}(Vapor Pressure (pascals)) = 10.062 – (1643/(T, K))

The following graph can be used to determine the viscosity of Fluorinert liquid FC-3284 over the indicated temperature range.



3M™ Fluorinert™ Electronic Liquid FC-3284 Materials Compatibility

3M™ Fluorinert™ Electronic Liquid FC-3284 is compatible with most metals, plastics and elastomers.

Toxicity Profile

Fluorinert liquid FC-3284 is non-irritating to the skin, minimally irritating to the eyes and is practically non-toxic orally. The product also demonstrates very low acute and sub-chronic inhalation toxicity, and is not a cardiac sensitizer. A Material Safety Data Sheet is available upon request.

Safety and Handling

Before using this product, please read the current product Material Safety Data Sheet (available through your 3M sales or technical service representative) and the precautionary statement on the product package. Follow all applicable precautions and directions. Fluorinert liquid FC-3284 is nonflammable, and is highly resistant to thermal breakdown and hydrolysis in storage and during use. Recommended handling procedures are given in the Material Safety Data Sheet.

Environmental Properties

Fluorinert liquid FC-3284 has zero ozone depletion potential. The material is exempt from the U.S. EPA and most State definitions of a volatile organic compound (VOC), and does not contribute to ground-level smog formation.

Fluorinert liquid FC-3284, a perfluorocarbon (PFC), has a high global warming potential and a long atmospheric lifetime. As such, it should be carefully managed so as to minimize emissions.

3M recommends that users of FC-3284 liquid further limit emissions by employing good conservation practices, and by implementing recovery, recycling and/or proper disposal procedures. 3M offers a program for used fluid return.

Environmental Policy

3M will recognize and exercise its responsibility to:

- prevent pollution at the source wherever and whenever possible
- develop products that will have a minimal effect on the environment
- conserve natural resources through the use of reclamation and other appropriate methods
- assure that its facilities and products meet and sustain the regulations of all Federal, State and local environmental agencies
- assist, wherever possible, governmental agencies and other official organizations engaged in environmental activities

3M™ Fluorinert™ Electronic Liquid FC-3284 Used Fluid Return Program

3M offers a program for free pickup and return of used 3M Specialty Materials in the U.S. through Safety-Kleen Corporation. A pre-negotiated handling agreement between users and this service provider offers users broad protection against future liability for used 3M product. The fluid return program is covered by independent third-party financial and environmental audits of treatment, storage and disposal facilities. Necessary documentation is provided. A minimum of 30 gallons of used 3M Specialty Materials is required for participation in this free program.

Safety-Kleen Corporation has a network of 156 branch service centers in the U.S. This large fleet will provide timely, economical fluid disposal service.

For additional information on the 3M Used Fluid Return Program, contact Safety-Kleen Corporation at this toll-free line: 1.888.932.2731.

Resources

3M™ Fluorinert™ Electronic Liquid FC-3284 customers are supported by global sales, technical and customer sales resources, with fully staffed technical service laboratories in the U.S., Europe, Japan, Latin America and Southeast Asia. Users benefit from 3M's broad technology base and continuing attention to product development, performance, safety and environmental issues.

For other 3M global offices and additional information on Fluorinert electronic liquid FC-3284 in the U.S., call 3M Performance Materials, 800.833.5045, or visit our web site at: www.3m.com/fluids

Important Notice to Purchaser: The information in this publication is based on tests that we believe are reliable. Your results may vary due to differences in test types and conditions. You must evaluate and determine whether the product is suitable for your intended application. Since conditions of product use are outside of our control and vary widely, the following is made in lieu of all express or implied warranties (including the warranties of merchantability or fitness for a particular purpose): 3M's only obligation and your only remedy is replacement of product that is shown to be defective when you receive it. In no case will 3M be liable for any special, incidental, or consequential damages based on breach of warranty or contract, negligence, strict tort, or any other theory.

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