SAFETY DATA SHEET
This SDS complies with HazCom 2012 OSHA 29CFR 1910.1200

Section 1: Chemical Product and Company Identification

1.1 Product identifiers
PRODUCT NAMES: X-23-7783D
FORMULA: Preparation/Mixture

1.2 Relevant identified uses of the substance or mixture and uses advised against
PRODUCT USE: This product is used as a thermal interface material. All other uses advised against.

1.3 Details of the supplier of the safety data sheet
CHEMICAL SUPPLIER COMPANY NAME    Contact Information
Shin-Etsu MicroSi, Inc.      Information: (480) 893-8898
10028 South 51st Street      Fax: (480) 893-8637
Phoenix, AZ 85044       Customer Service csteam@microsi.com

MANUFACTURER’S NAME: Shin-Etsu Chemical Co., Ltd.
ADDRESS: 6-1, 2-Chome, Ohtemachi, Chiyodaku, Tokyo, 100-0004, Japan
TELEPHONE NUMBER: 81-3-3246-5346 Tokyo, Japan
                    81-25-545-5811 Niigata, Japan
                    31-20-662-1359 Shin Etsu International Europe B.V., Amsterdam, The Netherlands

1.4 Emergency telephone number
Chemtrec 24 hrs: 800-424-9300
Chemtrec International: 703-527-3887

Section 2: Hazards Identification

2.1 Classification of the substance or mixture
Classification according to HazCom 2012
Not classified as a hazardous substance or mixture.

2.2 Label elements
Not classified as a hazardous substance or mixture.

2.3 Hazards not otherwise classified (HNOC)
None.
<10 % of mixture consists of ingredients of unknown acute toxicity.

NFPA Rating:

<table>
<thead>
<tr>
<th>Component</th>
<th>Health (Blue)</th>
<th>Flammability (Red)</th>
<th>Reactivity (Yellow)</th>
<th>Special (White)</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-23-7783D</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>--</td>
</tr>
</tbody>
</table>

Section 3: Composition / Information on Ingredients

<table>
<thead>
<tr>
<th>PRODUCT COMPOSITION</th>
<th>APPROX %</th>
<th>CAS NO.</th>
<th>EC/EINECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
<td>&lt; 75</td>
<td>7429-90-5</td>
<td>231-072-3</td>
</tr>
<tr>
<td>Zinc Oxide**</td>
<td>&lt; 25</td>
<td>1314-13-2</td>
<td>215-222-5</td>
</tr>
<tr>
<td>Siloxanes and Silicones</td>
<td>&lt; 10</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Alkanes</td>
<td>&lt; 5</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

*Trade Secret. Some items on this SDS may be designated as trade secrets. Bonafide requests for disclosure of trade secret information to medical personnel must be made in accordance with the provisions contained in 29 CFR 1910.1200 1 1-13.
**Lead is a natural occurring impurity in zinc oxide and is not physically added during the manufacture of zinc oxide. The percentage of lead in this product is <0.001%.

**Section 4: First Aid Measures**

4.1 Description of First Aid Measures

Inhalation: Remove to fresh air. If not breathing, provide CPR (cardio pulmonary resuscitation) and get immediate medical attention.

Skin Contact: Immediately flush skin with plenty of soap and water for at least 15 minutes. Remove contaminated clothing.

Eye Contact: Immediately flush eyes with plenty of water for at least 15 minutes. Get immediate medical attention.

Ingestion: If swallowed do not induce vomiting, give large quantities of water to drink. Never give anything to an unconscious person. Get immediate medical attention.

4.2 Most important symptoms and effects, both acute and delayed

<table>
<thead>
<tr>
<th>Ingestion:</th>
<th>No information available.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhalation:</td>
<td>No information available.</td>
</tr>
<tr>
<td>Skin Contact:</td>
<td>May cause skin irritation.</td>
</tr>
<tr>
<td>Eye Contact:</td>
<td>May cause eye irritation. Symptoms may include discomfort or pain, excess blinking and tear production, with possible redness and swelling.</td>
</tr>
</tbody>
</table>

4.3 Indication of any immediate medical attention and special treatment needed

Symptoms may not appear immediately. In case of accident or if you feel unwell, seek medical advice immediately.

**Section 5: Fire-fighting Measures**

5.1 Suitable extinguishing media

Use foam, dry chemical powder, carbon dioxide, or dry sand.

5.2 Special hazards arising from the substance or mixture

No data available.

5.3 Protective actions fire-fighters

Wear standard protective equipment and self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

Use water spray to cool unopened containers.

**Section 6: Accidental Release Measures**

6.1 Personal precautions, protective equipment, and emergency procedures

Wear proper personal protective equipment. For personal protection see section 8.

6.2 Environmental precautions

Prevent spilled material from entering sewers or waterways.

6.3 Methods and materials for containment and cleaning up

Use appropriate materials such as towels or wipes to clean up grease. Scrape up material and place in waste container. For disposal see section 13.

**Section 7: Handling and Storage**

7.1 Precautions for safe handling

Wear proper protective equipment when handling this material. Avoid contact with skin, eyes, or clothing. Wash hands and face after handling this material.
7.2 Conditions for safe storage, including any incompatibilities
Store in a cool place at temperatures (32 – 85 °F).
Keep container closed when not in use.
Keep away from heat and flame.
Utilize chemical segregation.
Follow all applicable local regulations for handling and storage.

7.3 Specific uses
This product is intended to aid in the thermal management of electronic devices.

Section 8: Exposure Controls/Personal Protection

8.1 Control Parameters

<table>
<thead>
<tr>
<th>PRODUCT COMPOSITION</th>
<th>ACGIH TLV (TWA)</th>
<th>OSHA PEL (TWA)</th>
<th>NIOSH REL (TWA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
<td>1 mg/m³ Respirable fraction (Excursion NTE 3x TLV)</td>
<td>10 mg/m³ Total dust</td>
<td>5 mg/m³ Respirable fraction</td>
</tr>
<tr>
<td>Zinc Oxide</td>
<td>2 mg/m³ Respirable fraction</td>
<td>15 mg/m³ Total dust</td>
<td>5 mg/m³ Respirable fraction</td>
</tr>
</tbody>
</table>

8.2 Exposure Controls
Ventilation: Always provide good general, mechanical room ventilation where this chemical is used.
Special Ventilation Controls: Use this material inside totally enclosed equipment, or use it with local exhaust ventilation at points where vapors can be released into the workspace air.
Respiratory Protection: Use an NIOSH-approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.
Protective Gloves: Wear chemical impervious gloves at all times while working with this product. Recommended glove types include: Laminate Film, Nitrile, or Tri-polymer. Check with your company’s glove supplier to ensure chemical resistance.
Eye Protection: Safety Glasses, chemical goggles, face shield.
Protective Clothing: Wear suitable protective clothing to prevent skin contact.
Other Equipment: Make safety shower, eyewash stations, and hand washing equipment available in the work area.
Work/Hygiene Practices: Avoid breathing fumes. Avoid contact with eyes. Wash hands after handling.

Section 9: Physical and Chemical Properties

<table>
<thead>
<tr>
<th>PRODUCT CRITERIA</th>
<th>APPEARANCE - COLOR:</th>
<th>PHYSICAL STATE:</th>
<th>ODOR:</th>
<th>ODOR THRESHOLD</th>
<th>pH</th>
<th>INITIAL BOILING POINT AND BOILING RANGE:</th>
<th>FLAMMABILITY (Solid, gas)</th>
<th>UPPER/LOWER FLAMMABILITY OR EXPLOSIVE LIMITS</th>
<th>VAPOUR PRESSURE (25°C)</th>
<th>VAPOUR DENSITY (AIR = 1)</th>
<th>RELATIVE DENSITY (25°C):</th>
<th>SOLUBILITY(IES)</th>
<th>OXIDIZING PROPERTIES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gray</td>
<td>Grease / Paste</td>
<td>Slight odor</td>
<td>No data available</td>
<td>No data available</td>
<td>No data available</td>
<td>No data available</td>
<td>Not measured</td>
<td>Negligible</td>
<td>&lt;1 (Butyl Acetate = 1)</td>
<td>Insoluble</td>
<td>No data available</td>
<td></td>
</tr>
</tbody>
</table>
**PARTITION COEFFICIENT:** n-octanol/water  No data available

**AUTO IGNITION TEMPERATURE**  No data available

**DECOMPOSITION TEMPERATURE**  No data available

**VISCOSITY (25°C)**  200 Pa·s

---

### Section 10: Stability and Reactivity

10.1 Reactivity: Not reactive.
10.2 Chemical Stability: Stable under recommended conditions.
10.3 Possibility of Hazardous Reactions: Will not occur under normal temperatures and pressures.
10.4 Conditions to Avoid: None.
10.5 Incompatibility (Materials to Avoid): None.
10.6 Hazardous Decomposition Products: Not available for product.

---

### Section 11: Toxicological Information

There is no toxicological information available for the product mixture.

11.1 Likely routes of exposure
Inhalation, dermal, skin and eye contact.

11.2 Symptoms related to the physical, chemical and toxicological characteristics
May cause skin or eye irritation. Symptoms may include discomfort or pain, excess blinking and tear production, with possible redness or swelling.

11.3 Delayed and immediate effects and also chronic effects from short- and long-term exposure
Symptoms may not appear immediately. In case of accident or if you feel unwell, seek medical advice immediately.

<table>
<thead>
<tr>
<th>GHS Required Criteria</th>
<th>Toxicity Criteria</th>
<th>Toxicity Information</th>
<th>Comments</th>
<th>Chemical Constituent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acute Toxicity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LD50 (Oral/Rat)</td>
<td>&gt;15900 mg/kg</td>
<td>No mortality</td>
<td></td>
<td>Aluminum</td>
</tr>
<tr>
<td>LC50 (Inhalation/Rat)</td>
<td>&gt;10 mg/m³</td>
<td>Mild acute inflammatory response – No mortality</td>
<td>Aluminum</td>
<td></td>
</tr>
<tr>
<td>LD50 (Oral/Mouse)</td>
<td>&gt;500 mg/kg</td>
<td>No mortality</td>
<td></td>
<td>Zinc Oxide</td>
</tr>
<tr>
<td>LD50 (Oral/Rat)</td>
<td>&gt;5000 mg/kg</td>
<td>No mortality</td>
<td></td>
<td>Zinc Oxide</td>
</tr>
<tr>
<td>LC50 4 hours (Inhalation/Rat)</td>
<td>&gt;5.7 mg/L</td>
<td>No mortality</td>
<td></td>
<td>Zinc Oxide</td>
</tr>
<tr>
<td>Skin Corrosion/Irritation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 % w/v zinc oxide was found to be non-irritating to guinea-pig skin.</td>
<td></td>
<td></td>
<td></td>
<td>Zinc Oxide</td>
</tr>
<tr>
<td>Serious Eye Damage / Eye Irritation</td>
<td>50 μL bulk volume, 90 min exposure, 18 hr observation on human cornea tissue</td>
<td></td>
<td>Not irritating</td>
<td>Zinc Oxide</td>
</tr>
<tr>
<td>Respiratory or Skin Sensitization</td>
<td>Skin sensitization</td>
<td>Not sensitizing</td>
<td>锌 Oxide</td>
<td></td>
</tr>
<tr>
<td>Germ Cell Mutagenicity</td>
<td>Bacterial reverse mutation assay was found to be non-mutagenic to <em>S. typhimurium</em> strains.</td>
<td></td>
<td></td>
<td>Zinc Oxide</td>
</tr>
<tr>
<td>Carcinogenicity</td>
<td>IARC</td>
<td>No data available.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reproductive Toxicity</td>
<td>Not classifiable.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STOT -- Single Exposure</td>
<td>Not classifiable.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STOT – Repeated Exposure</td>
<td>Not classifiable.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspiration Hazard</td>
<td>May be fatal if swallowed and enters airways</td>
<td></td>
<td></td>
<td>Siloxanes and Silicones, Alkanes</td>
</tr>
</tbody>
</table>

---

Printed in the USA
Section 12: Ecological Information

<table>
<thead>
<tr>
<th>Toxicity:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NOEC Lepomis cyanellus (Green Sunfish) &gt; 50 mg/L, 96hr. – No Mortality</td>
<td>Aluminum</td>
<td></td>
</tr>
<tr>
<td>LC50 Ceriodaphnia dubia (water flea) 5.7 – 52 µg/L @pH 6, depending on the hardness and dissolved organic carbon.</td>
<td>Aluminum</td>
<td></td>
</tr>
<tr>
<td>LC50 Danio rerio (Zebrafish) = 3.31 mg/L, 96hr.</td>
<td>Zinc Oxide</td>
<td></td>
</tr>
<tr>
<td>LC50 Daphnia magna (water flea) = 1.55 mg/L, 48hr.</td>
<td>Zinc Oxide</td>
<td></td>
</tr>
<tr>
<td>72-hour EC50=0.17mg/L (zinc-oxide concentration equivalent: 0.21mg/L) of algae (Selenastrum) (EHC221, 2001)</td>
<td>Zinc Oxide</td>
<td></td>
</tr>
<tr>
<td>EC/IC50: &gt;100 mg/L. 72-hour Growth inhibition of Green Algae (Pseudokirchneriella subcapitata)</td>
<td>Test data for X23-7783D (Comparable product)</td>
<td></td>
</tr>
<tr>
<td>EC/IC50: &gt;100 mg/L. 48-hour Immobilization of Daphnia magna</td>
<td>Test data for X23-7783D (Comparable product)</td>
<td></td>
</tr>
<tr>
<td>LC50: &gt;100 mg/L. 98-hour Survival of Rainbow Trout (Oncorhynchus Mykiss)</td>
<td>X23-7783D (Comparable product)</td>
<td></td>
</tr>
</tbody>
</table>

Persistence and degradability: No data available.
Bioaccumulative potential: No data available.
Mobility in soil: No data available.
PBT and vPvB assessment: PBT/vPvB assessment not available as chemical assessment not required/not conducted
Other adverse effects: No data available.

Shin-Etsu MicroSi contracted with Maxxim Analytical Services on July 28, 2011, to conduct aquatic testing on a comparable Thermal Grease product. The results of the aquatic testing are included in the above table.

The acute toxicity/inhibition of Thermo Grease X-23-7783D (test item) to three aquatic organisms was assessed using the following methods:


Section 13: Disposal Considerations

Waste from residues/unused products: Follow the waste disposal requirements of your federal, state, or local authorities.

Contaminated packaging: Contaminated packaging material should be disposed of as stated above for residues and unused product.

Rinsate: Do not dispose of rinse water containing product in a sanitary sewer system or stormwater drainage system.

Section 14: Transport Information

14.1 – 14.5: Regulatory note: Laboratory testing has confirmed that this product does not meet the criteria of an “Environmentally hazardous substance”, UN 3077. Upon request, the testing results will be provided. Also, reference Section 12.

DOT TRANSPORT: Not Regulated
ADR: International Carriage of Dangerous Goods by Road Not Regulated
SEA TRANSPORT: IMDG Not Regulated
AIR TRANSPORT: IATA/ICAO Not Regulated

14.6 Special precautions for user: Not applicable

14.7 Transport in bulk according to Annex II of Marpol and the IBC Code: Not Applicable
Section 15: Regulatory Information

15.1 Safety, health, and environmental regulations / legislation specific for the substance or mixture

TOXIC SUBSTANCES CONTROL ACT (TSCA) STATUS:
This product is in compliance with the rules, regulations, and/or orders of TSCA and should be used in accordance with the LVE (Low Volume Exemption) regulations of TSCA.

SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (SARA) TITLE III SECTION 313 SUPPLIER NOTIFICATION:
This regulation requires submission of annual reports of toxic chemical(s) that appear in section 313 of the Emergency Planning and Community Right to Know Act of 1986 and 40 CFR 372.
The toxic chemicals contained in this product are: Aluminum, Zinc

CALIFORNIA PROPOSITION 65:
“WARNING: This product can expose you to chemicals including Lead, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.”
Lead is a naturally occurring impurity in Zinc Oxide.
Lead: No Significant Risk Level (NSRL) for carcinogens = 15 µg/day (Oral)
Lead: Maximum Allowable Dose Level (MADL) for reproductive toxicants = 0.5 µg/day

STATE RIGHT-TO-KNOW TOXIC SUBSTANCE OR HAZARDOUS SUBSTANCE LIST:
- Massachusetts: Aluminum, Zinc Oxide
- New Jersey: Aluminum, Zinc Oxide
- Pennsylvania: Aluminum, Zinc Oxide

CANADA:
WHMIS-2015: This SDS is in compliance with WHMIS 2015 (HPR / new HPA).

This product does not meet the criteria of the 10 categories of electrical and electronic equipment listed in Annex 1A of Directive 2002/96/EC. Shin-Etsu MicroSi hereby certifies that this product is exempt from WEEE. Packaging materials were not considered for this certification.

Shin-Etsu MicroSi hereby certifies that this product complies with the RoHS Directive 2011/65/EU and Directive (EU) 2015/863 that restricts the use of the ten listed chemicals. Packaging materials were not considered for this certification.

15.2 Chemical Safety assessment: Not applicable

Section 16: Other Information

Abbreviation:
- PEL = Permissible Exposure Limit
- STOT = Specific Target Organ Toxicity
- TLV = Threshold Limit Value
- TWA = Time Weighted Average

Initial issue date: October 31, 2012
Final revision date: April 5, 2018
Revision Number: 7
Revision explanation: New format
Information Sources: RTECS, ECHA, REACH, NITE, TOXNET, OSHA 29CFR 1910.1200

Printed in the USA
FOR INDUSTRIAL USE ONLY

THIS SAFETY DATA SHEET IS OFFERED SOLELY FOR YOUR INFORMATION, CONSIDERATION, AND INVESTIGATION. THE DATA DESCRIBED IN THIS SDS CONSIST OF DATA ON LITERATURE, OUR ACQUISITIONAL DATA, AND ANALOGICAL INFERENCE BY DATA OF SIMILAR CHEMICAL SUBSTANCES OR PRODUCTS. SHIN-ETSU CHEMICAL CO. LTD. PROVIDES NO WARRANTIES, EITHER EXPRESSED OR IMPLIED, AND ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OR COMPLETENESS OF THE DATA CONTAINED HEREIN.

ADDITIONAL INFORMATION

THIS DATA IS OFFERED IN GOOD FAITH AS TYPICAL VALUES AND NOT AS A PRODUCT SPECIFICATION. NO WARRANTY, EITHER EXPRESSED OR IMPLIED, IS MADE. THE RECOMMENDED HANDLING PROCEDURES ARE BELIEVED TO BE GENERALLY APPLICABLE.