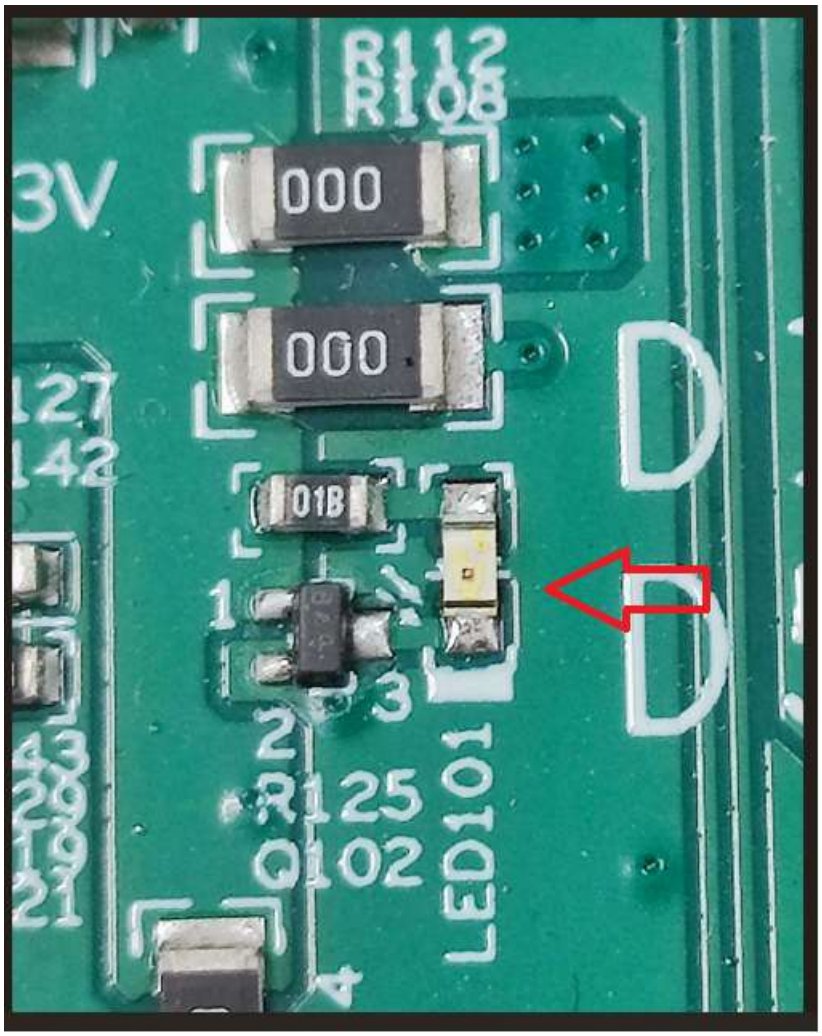


設計驗證
工程課
2024 -12- 25
發行

# 承　　認　　書

# APPROVAL　SHEET

| | |
|---|---|
| **客戶名稱：** | 鈺緯科技開發股份有限公司 |
| **客戶料號：** | 3DLEDGG226Y (D0171) |
| **零件敘述：** | Top View 0603,0.35mm,GREEN |
| **零件料號：** | LTST C193KGKT 5A |
| **零件廠牌：** | LITEON |
| **承認日期：** | 2024.12.16 |

| 客戶認可章 | 晨昕公司發行章 |
|---|---|
| 設計驗證 工程課 2024 -12- 25 發行 鈺緯科技開發股份有限公司 | 晨昕 發行章 |

SRT 晨昕科技股份有限公司
SUNRISETEK CO., LTD.

TEL:02-2226-7955　FAX:02-2221-3858

LITEON®
OPTOELECTRONICS



# SMD LED
# Product Data Sheet
# LTST-C193KGKT-5A

Spec No. :DS22-2007-0094
Effective Date: 03/05/2020
Revision: C

LITE-ON DCC

RELEASE

BNS-OD-FC001/A4

LITE-ON Technology Corp. / Optoelectronics
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Tel: 886-2-2222-6181 Fax: 886-2-2221-1948 / 886-2-2221-0660
http://www.liteon.com/opto

# SMD LED
# LTST-C193KGKT-5A

## 1. Description

SMD LED lamps from Lite-On are available in miniature sizes and special configurations for automated PC board assembly and space-sensitive applications. These SMD LED lamps are suitable for use in a wide variety of electronic equipment, including cordless and cellular phones, notebook computers, network systems, home appliances, and indoor signboard applications.

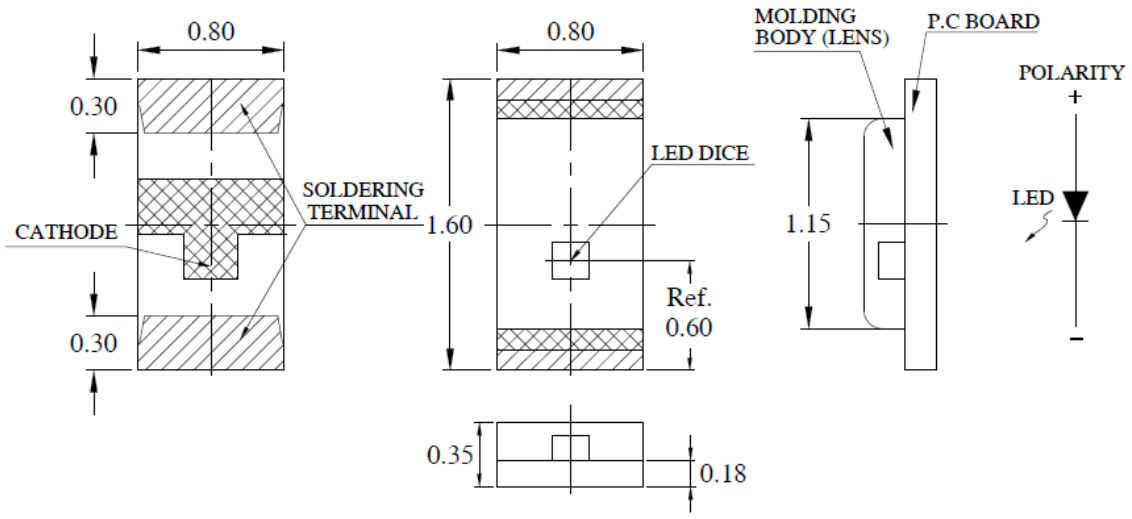
### 1.1 Features

- Meet RoHS
- Extra thin (0.35 mm) Chip LED
- Ultra bright AlInGaP Chip LED
- Package in 8mm tape on 7" diameter reels.
- EIA STD package
- I.C. compatible
- Compatible with automatic placement equipment
- Compatible with infrared reflow solder process

### 1.2 Applications

- Telecommunication, Office Automation, Home Appliances, Industrial Equipment
- Keypad/Keyboard Backlighting
- Status Indicator
- Microdisplays
- Signal and Symbol Luminary

## 2. Package Dimensions




| Part No. | Lens Color | Source Color |
|---|---|---|
| LTST-C193KGKT-5A | Water Clear | AlInGaP Green |

**Notes:**

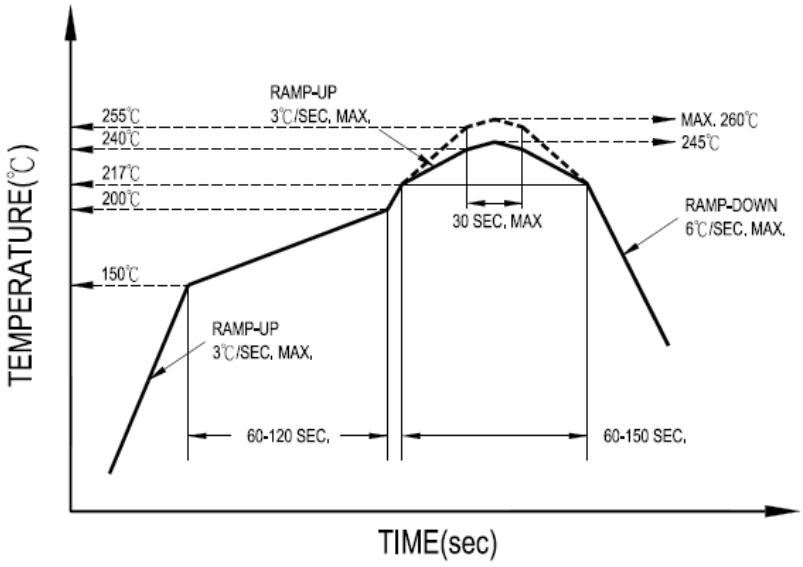
1. All dimensions are in millimeters (inches).
2. Tolerance is ±0.1 mm (.004") unless otherwise noted.

## 3. Rating and Characteristics

### 3.1 Absolute Maximum Ratings at Ta=25℃

| Parameter | LTST-C193KGKT-5A | Unit |
|---|---|---|
| Power Dissipation | 50 | mW |
| Peak Forward Current<br>(1/10 Duty Cycle, 0.1ms Pulse Width) | 40 | mA |
| DC Forward Current | 20 | mA |
| Reverse Voltage | 5 | V |
| Operating Temperature Range | -30ºC to + 85 ºC | |
| Storage Temperature Range | -40 ºC to + 85 ºC | |
| Infrared Soldering Condition | 260 ℃ For 10 Seconds | |

### 3.2 Suggest IR Reflow Condition For Pb Free Process:



### 3.3 Electrical / Optical Characteristics at Ta=25℃

| Parameter | Symbol | LTST-C193KGKT-5A | | | Unit | Test Condition |
|---|---|---|---|---|---|---|
| | | MIN. | TYP. | MAX. | | |
| Luminous Intensity | IV | 4.5 | - | 28 | mcd | IF = 5 mA<br>Note 1 |
| Viewing Angle | $2\theta_{1/2}$ | | 130 | | deg | Note 2 (Fig.5) |
| Peak Emission Wavelength | λP | | 574.0 | | nm | Measurement @Peak (Fig.1) |
| Dominant Wavelength | λd | 567.5 | - | 576.5 | nm | IF = 5 mA<br>Note 3 |
| Spectral Line Half-Width | Δλ | | 15 | | nm | |
| Forward Voltage | VF | 1.7 | - | 2.3 | V | IF = 5 mA |
| Reverse Current | IR | | | 10 | μA | VR = 5V |

**Notes:**

1. Luminous intensity is measured with a light sensor and filter combination that approximates the CIE eye-response curve.
2. θ1/2 is the off-axis angle at which the luminous intensity is half the axial luminous intensity.
3. The dominant wavelength, λd is derived from the CIE chromaticity diagram and represents the single wavelength which defines the color of the device.
4. Caution in ESD:

   Static Electricity and surge damages the LED. It is recommend to use a wrist band or anti-electrostatic glove when handling the LED. All devices, equipment and machinery must be properly grounded.

# 4. Bin Rank

## 4.1 Bin code list

■ **VF Rank**

| Forward Voltage | Color : Green , Unit : V @5mA | |
|---|---|---|
| Bin Code | Min. | Max. |
| E2 | 1.7 | 1.9 |
| E3 | 1.9 | 2.1 |
| E4 | 2.1 | 2.3 |

Tolerance on each Forward Voltage bin is +/-0.1 volt

■ **IV Rank**

| Luminous Intensity | Color : Green , Unit : mcd @5mA | |
|---|---|---|
| Bin Code | Min. | Max. |
| J | 4.5 | 7.1 |
| K | 7.1 | 11.2 |
| L | 11.2 | 18.0 |
| M | 18.0 | 28.0 |

Tolerance on each Luminous Intensity bin is +/- 15%

■ **Hue Rank**

| Dominant Wavelength | Color : Green , Unit : nm @5mA | |
|---|---|---|
| Bin Code | Min. | Max. |
| C | 567.5 | 570.5 |
| D | 570.5 | 573.5 |
| E | 573.5 | 576.5 |

Tolerance for each Dominate Wavelength bin is +/- 1nm

## 5. Typical Electrical / Optical Characteristics Curves.

(25℃ Ambient Temperature Unless Otherwise Noted)

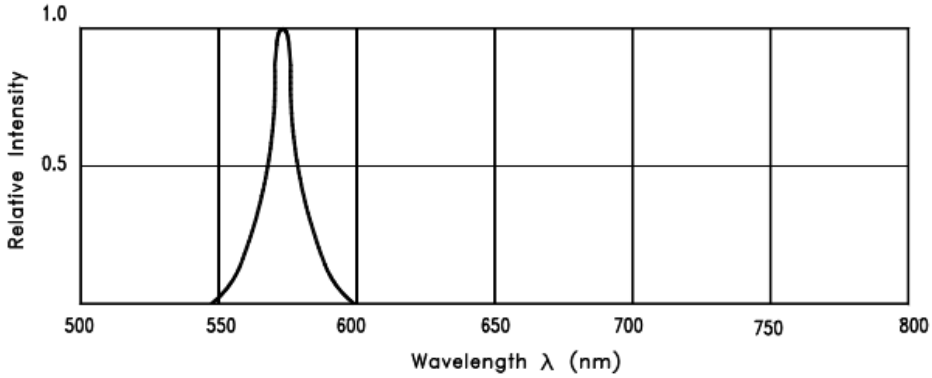



Fig.1 RELATIVE INTENSITY VS. WAVELENGTH




Fig.2 Forward Current vs. Forward Voltage

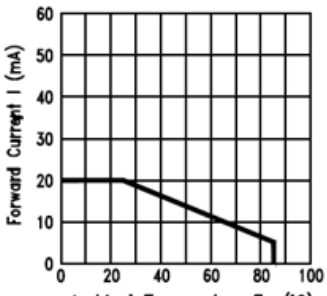



Fig.3 Forward Current Derating Curve

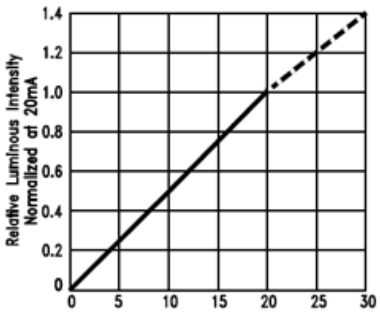



Fig.4 Relative Luminous Intensity vs. Forward Current

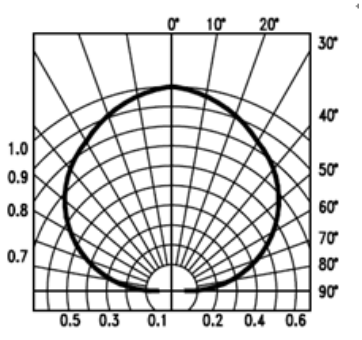


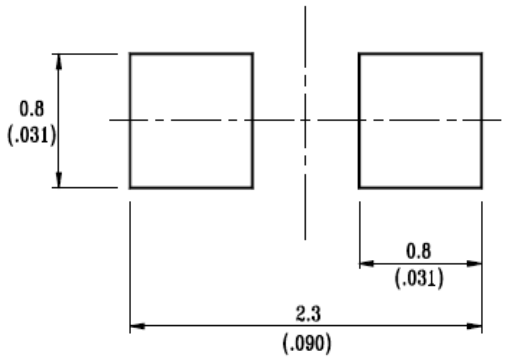

Fig.5 Spatial Distribution

# 6. User Guide

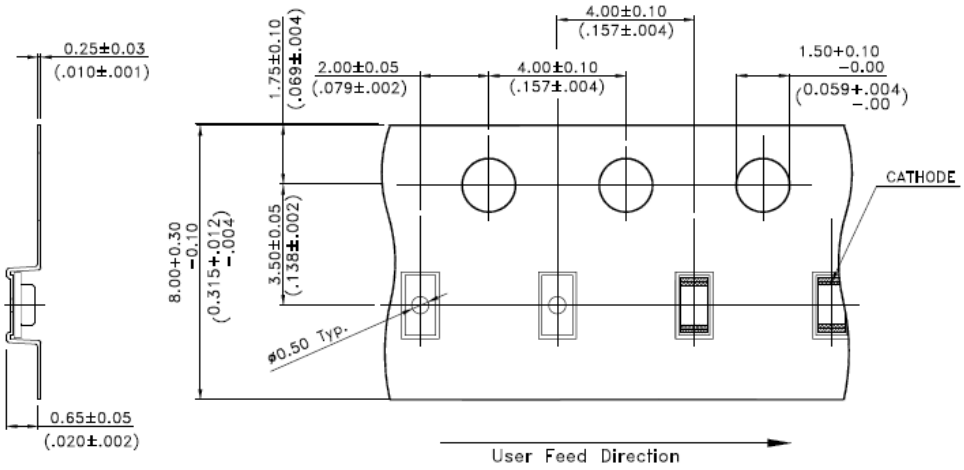
## 6.1 Cleaning

Do not use unspecified chemical liquid to clean LED they could harm the package.
If clean is necessary, immerse the LED in ethyl alcohol or in isopropyl alcohol at normal temperature for less one minute.

## 6.2 Recommend Printed Circuit Board Attachment Pad



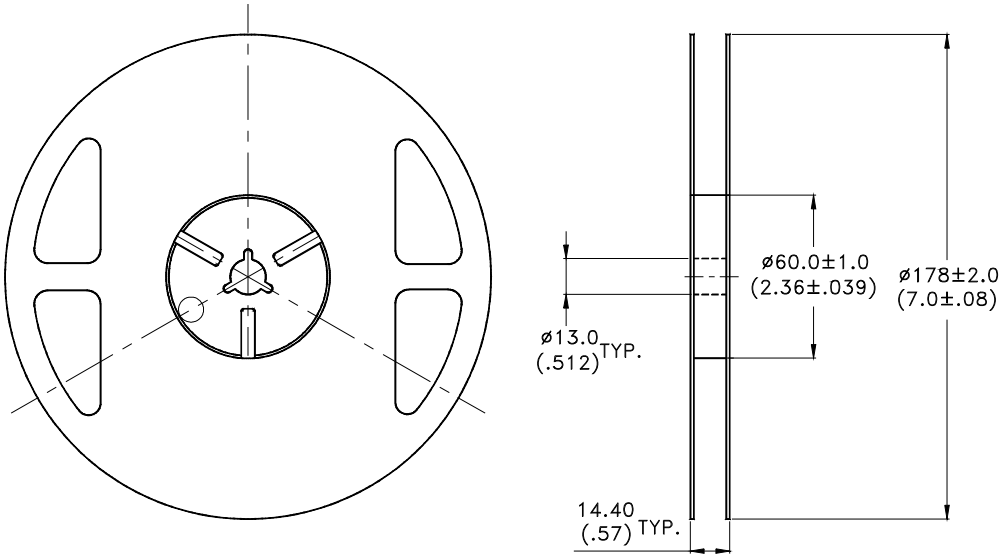

## 6.3 Package Dimensions Of Tape And Reel




**Note:**

1. All dimensions are in millimeters (inches).

## 6.4 Package Dimensions of Reel




**Notes:**

1. Empty component pockets sealed with top cover tape.
2. 7 inch reel-5000 pieces per reel.
3. Minimum packing quantity is 500 pieces for remainders.
4. The maximum number of consecutive missing lamps is two.
5. In accordance with ANSI/EIA 481 specifications.

# 7. Cautions

## 7.1 Application

The LEDs described here are intended to be used for ordinary electronic equipment (such as office equipment, communication equipment and household applications).Consult Liteon's Sales in advance for information on applications in which exceptional reliability is required, particularly when the failure or malfunction of the LEDs may directly jeopardize life or health (such as in aviation, transportation, traffic control equipment, medical and life support systems and safety devices).

## 7.2 Storage

The package is sealed:
The LEDs should be stored at 30℃ or less and 90%RH or less. And the LEDs are limited to use within one year, while the LEDs is packed in moisture-proof package with the desiccants inside.
The package is opened:
The storage ambient for the LEDs should not exceed 30℃ temperature or 60% relative humidity.
It is recommended that LEDs out of their original packaging are IR-reflowed within 672 hours.(MSL 2a)
For extended storage out of their original packaging, it is recommended that the LEDs be stored in a sealed container with appropriate desiccant, or in a desiccators with nitrogen ambient.
LEDs stored out of their original packaging for more than 672 hours should be baked at about 60 deg C for at least 20 hours before solder assembly.

## 7.3 Cleaning

Use alcohol-based cleaning solvents such as isopropyl alcohol to clean the LED if necessary.

## 7.4 Soldering

Recommended soldering conditions:

| Reflow soldering | | Soldering iron | |
|---|---|---|---|
| Pre-heat | 150~200℃ | Temperature | 300℃ Max. |
| Pre-heat time | 120 sec. Max. | Soldering time | 3 sec. Max. |
| Peak temperature | 260℃ Max. | | (one time only) |
| Soldering time | 10 sec. Max.(Max. two times) | | |

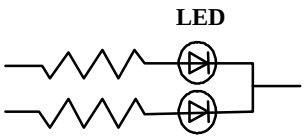
**Notes:**

Because different board designs use different number and types of devices, solder pastes, reflow ovens, and circuit boards, no single temperature profile works for all possible combinations.
However, you can successfully mount your packages to the PCB by following the proper guidelines and PCB-specific characterization.
LITE-ON Runs both component-level verification using in-house **KYRAMX98** reflow chambers and board-level assembly. The results of this testing are verified through post-reflow reliability testing. Profiles used at LITE-ON are based on JEDEC standards to ensure that all packages can be successfully and reliably surface mounted.
Figure on page3 shows a sample temperature profile compliant to JEDEC standards. You can use this example as a generic target to set up your reflow process. You should adhere to the JEDEC profile limits as well as specifications and recommendations from the solder paste manufacturer to avoid damaging the device and create a reliable solder joint.

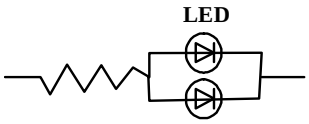
## 7.5 Drive Method

A LED is a current-operated device. In order to ensure intensity uniformity on multiple LEDs connected in parallel in an application, it is recommended that a current limiting resistor be incorporated in the drive circuit, in series with each LED as shown in Circuit A below.

**Circuit model A**




**Circuit model B**




(A) Recommended circuit.
(B) The brightness of each LED might appear different due to the differences in the I-V characteristics of those LEDs.

## 7.6 ESD (Electrostatic Discharge)

Static Electricity or power surge will damage the LED.
Suggestions to prevent ESD damage:

- Use of a conductive wrist band or anti-electrostatic glove when handling these LEDs.
- All devices, equipment, and machinery must be properly grounded.
- Work tables, storage racks, etc. should be properly grounded.
- Use ion blower to neutralize the static charge which might have built up on surface of the LED's plastic lens as a result of friction between LEDs during storage and handling.

ESD-damaged LEDs will exhibit abnormal characteristics such as high reverse leakage current, low forward voltage, or " no lightup " at low currents.
To verify for ESD damage, check for " lightup " and Vf of the suspect LEDs at low currents.
The Vf of " good " LEDs should be >2.0V@0.1mA for InGaN product and >1.4V@0.1mA for AlInGaP product.

## 8. Reliability Test

| Classification | Test Item | Test Condition | Reference Standard |
|---|---|---|---|
| Endurance Test | Operation Life | Ta= Under Room Temperature As Per Data Sheet Maximum Rating<br>*Test Time= 1000HRS (-24HRS,+72HRS) | MIL-STD-750D:1026<br>MIL-STD-883D:1005<br>JIS C 7021:B-1 |
| | High Temperature High Humidity Storage | Ta= 65±5ºC,RH= 90～95%<br>*Test Time= 240HRS±2HRS | MIL-STD-202F:103B<br>JIS C 7021:B-11 |
| | High Temperature Storage | Ta= 105±5 ºC<br>*Test Time = 1000HRS (-24HRS,+72HRS) | MIL-STD-883D:1008<br>JIS C 7021:B-10 |
| | Low Temperature Storage | Ta= -55±5 ºC<br>*Test Time=1000HRS (-24HRS,+72HRS) | JIS C 7021:B-12 |
| Environmental Test | Temperature Cycling | 105 ºC ～ 25 ºC ～ -55 ºC ～ 25 ºC<br>30mins 5mins 30mins 5mins<br>10 Cycles | MIL-STD-202F:107D<br>MIL-STD-750D:1051<br>MIL-STD-883D:1010<br>JIS C 7021:A-4 |
| | Thermal Shock | IR-Reflow In-Board, 2 Times<br>85 ± 5 ºC ～ -40 ºC ± 5 ºC<br>10mins 10mins 10Cycles | MIL-STD-202F:107D<br>MIL-STD-750D:1051<br>MIL-STD-883D:1011 |
| | Solder Resistance | T.sol= 260 ± 5 ºC<br>Dwell Time= 10 ± 1secs | MIL-STD-202F:210A<br>MIL-STD-750D:2031<br>JIS C 7021:A-1 |
| | IR-Reflow | Ramp-up rate(217 ºC to Peak) +3 ºC / second max<br>Temp. maintain at 175(±25) ºC 180 seconds max<br>Temp. maintain above 217 ºC 60-150 seconds<br>Peak temperature range 260 ºC +0/-5 ºC<br>Time within 5℃ of actual Peak Temperature (tp)<br>10-30 seconds<br>Ramp-down rate +6 ºC /second max | MIL-STD-750D:2031.2<br>J-STD-020D |
| | Solder ability | T.sol= 235 ± 5 ºC<br>Immersion time 2±0.5 sec<br>Immersion rate 25±2.5 mm/sec<br>Coverage ≧95% of the dipped surface | MIL-STD-202F:208D<br>MIL-STD-750D:2026<br>MIL-STD-883D:2003<br>IEC 68 Part 2-20<br>JIS C 7021:A-2 |

## 9. Others

The appearance and specifications of the product may be modified for improvement without prior notice.

## 10. Suggested Checking List

Training and Certification

1. Everyone working in a static-safe area is ESD-certified?
2. Training records kept and re-certification dates monitored?

Static-Safe Workstation & Work Areas

1. Static-safe workstation or work-areas have ESD signs?
2. All surfaces and objects at all static-safe workstation and within 1 ft measure less than 100V?
3. All ionizer activated, positioned towards the units?
4. Each work surface mats grounding is good?

Personnel Grounding

1. Every person (including visitors) handling ESD sensitive (ESDS) items wears wrist strap, heel strap or conductive shoes with conductive flooring?
2. If conductive footwear used, conductive flooring also present where operator stand or walk?
3. Garments, hairs or anything closer than 1 ft to ESD items measure less than 100V*?
4. Every wrist strap or heel strap/conductive shoes checked daily and result recorded for all DLs?
5. All wrist strap or heel strap checkers calibration up to date?

Note: *50V for InGaN LED.

Device Handling

1. Every ESDS items identified by EIA-471 labels on item or packaging?
2. All ESDS items completely inside properly closed static-shielding containers when not at static-safe workstation?
3. No static charge generators (e.g. plastics) inside shielding containers with ESDS items?
4. All flexible conductive and dissipative package materials inspected before reuse or recycles?

Others

1. Audit result reported to entity ESD control coordinator?
2. Corrective action from previous audits completed?
3. Are audit records complete and on file?

# Test Report

No.: ETR23C01463 Date: 21-Dec-2023 

EPISTAR CORPORATION
21, LI-HSIN RD., HSINCHU SCIENCE PARK, HSINCHU 300, TAIWAN, R.O.C.

**The following sample(s) was/were submitted and identified by the applicant as:**

| | | |
|---|---|---|
| Sample Submitted By | : | EPISTAR CORPORATION |
| Sample Name | : | GaAs SUBSTRATE BASED LIGHT EMITTING DIODE CHIP/WAFER |
| Style/Item No. | : | AlGaInP-HB (5**/7**/0**/DATA LINK) (ITO TOP) SERIES |

==========

| | | |
|---|---|---|
| Sample Receiving Date | : | 08-Dec-2023 |
| Testing Period | : | 08-Dec-2023 to 15-Dec-2023 |

**Test Requested** :

(1) As specified by client, with reference to RoHS 2011/65/EU Annex II and amending Directive (EU) 2015/863 to determine Cadmium, Lead, Mercury, Cr(VI), PBBs, PBDEs, DBP, BBP, DEHP, DIBP contents in the submitted sample(s).

(2) Please refer to next pages for the other item(s).

**Test Results** : Please refer to following pages.

**Conclusion** :

(1) Based on the performed tests on submitted sample(s), the test results of Cadmium, Lead, Mercury, Cr(VI), PBBs, PBDEs, DBP, BBP, DEHP, DIBP comply with the limits as set by RoHS Directive (EU) 2015/863 amending Annex II to Directive 2011/65/EU.

Troy Chang / Department Manager
Signed for and on behalf of
SGS TAIWAN LTD.
Chemical Laboratory - Taipei

CHECK REPORT

PIN CODE: 641DBB17

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EPISTAR CORPORATION
21, LI-HSIN RD., HSINCHU SCIENCE PARK, HSINCHU 300, TAIWAN, R.O.C.

**Test Part Description**

No.1 : CHIP / WAFER

**Test Result(s)**

| Test Item(s) | Method | Unit | MDL | Result | Limit |
|---|---|---|---|---|---|
| | | | | No.1 | |
| Cadmium (Cd) | With reference to IEC 62321-5: 2013, analysis was performed by ICP-OES. | mg/kg | 2 | n.d. | 100 |
| Lead (Pb) | With reference to IEC 62321-5: 2013, analysis was performed by ICP-OES. | mg/kg | 2 | n.d. | 1000 |
| Mercury (Hg) | With reference to IEC 62321-4: 2013+ AMD1: 2017, analysis was performed by ICP-OES. | mg/kg | 2 | n.d. | 1000 |
| Hexavalent Chromium Cr(VI) | With reference to IEC 62321-7-2: 2017, analysis was performed by UV-VIS. | mg/kg | 8 | n.d. | 1000 |
| Monobromobiphenyl | With reference to IEC 62321-6: 2015, analysis was performed by GC/MS. | mg/kg | 5 | n.d. | - |
| Dibromobiphenyl | | mg/kg | 5 | n.d. | - |
| Tribromobiphenyl | | mg/kg | 5 | n.d. | - |
| Tetrabromobiphenyl | | mg/kg | 5 | n.d. | - |
| Pentabromobiphenyl | | mg/kg | 5 | n.d. | - |
| Hexabromobiphenyl | | mg/kg | 5 | n.d. | - |
| Heptabromobiphenyl | | mg/kg | 5 | n.d. | - |
| Octabromobiphenyl | | mg/kg | 5 | n.d. | - |
| Nonabromobiphenyl | | mg/kg | 5 | n.d. | - |
| Decabromobiphenyl | | mg/kg | 5 | n.d. | - |
| **Sum of PBBs** | | mg/kg | - | n.d. | 1000 |
| Monobromodiphenyl ether | | mg/kg | 5 | n.d. | - |
| Dibromodiphenyl ether | | mg/kg | 5 | n.d. | - |
| Tribromodiphenyl ether | | mg/kg | 5 | n.d. | - |
| Tetrabromodiphenyl ether | | mg/kg | 5 | n.d. | - |
| Pentabromodiphenyl ether | | mg/kg | 5 | n.d. | - |
| Hexabromodiphenyl ether | | mg/kg | 5 | n.d. | - |
| Heptabromodiphenyl ether | | mg/kg | 5 | n.d. | - |
| Octabromodiphenyl ether | | mg/kg | 5 | n.d. | - |
| Nonabromodiphenyl ether | | mg/kg | 5 | n.d. | - |
| Decabromodiphenyl ether | | mg/kg | 5 | n.d. | - |
| **Sum of PBDEs** | | mg/kg | - | n.d. | 1000 |

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EPISTAR CORPORATION
21, LI-HSIN RD., HSINCHU SCIENCE PARK, HSINCHU 300, TAIWAN, R.O.C.

| Test Item(s) | Method | Unit | MDL | Result | Limit |
|---|---|---|---|---|---|
| | | | | No.1 | |
| Butyl benzyl phthalate (BBP) | With reference to IEC 62321-8: 2017, analysis was performed by GC/MS. | mg/kg | 50 | n.d. | 1000 |
| Dibutyl phthalate (DBP) | With reference to IEC 62321-8: 2017, analysis was performed by GC/MS. | mg/kg | 50 | n.d. | 1000 |
| Di-(2-ethylhexyl) phthalate (DEHP) | With reference to IEC 62321-8: 2017, analysis was performed by GC/MS. | mg/kg | 50 | n.d. | 1000 |
| Diisobutyl phthalate (DIBP) | With reference to IEC 62321-8: 2017, analysis was performed by GC/MS. | mg/kg | 50 | n.d. | 1000 |
| Diisodecyl phthalate (DIDP) (CAS No.: 26761-40-0, 68515-49-1) | With reference to IEC 62321-8: 2017, analysis was performed by GC/MS. | mg/kg | 50 | n.d. | - |
| Diisononyl phthalate (DINP) (CAS No.: 28553-12-0, 68515-48-0) | With reference to IEC 62321-8: 2017, analysis was performed by GC/MS. | mg/kg | 50 | n.d. | - |
| Di-n-octyl phthalate (DNOP) (CAS No.: 117-84-0) | With reference to IEC 62321-8: 2017, analysis was performed by GC/MS. | mg/kg | 50 | n.d. | - |
| Di-n-hexyl phthalate (DNHP) (CAS No.: 84-75-3) | With reference to IEC 62321-8: 2017, analysis was performed by GC/MS. | mg/kg | 50 | n.d. | - |
| 1,2-Benzenedicarboxylic acid, di-C6-8-branched alkyl esters, C7-rich (DIHP) (CAS No.: 71888-89-6) | With reference to IEC 62321-8: 2017, analysis was performed by GC/MS. | mg/kg | 50 | n.d. | - |
| 1,2-Benzenedicarboxylic acid, di-C7-11-branched and linear alkyl esters (DHNUP) (CAS No.: 68515-42-4) | With reference to IEC 62321-8: 2017, analysis was performed by GC/MS. | mg/kg | 50 | n.d. | - |
| Bis(2-methoxyethyl) phthalate (DMEP) (CAS No.: 117-82-8) | With reference to IEC 62321-8: 2017, analysis was performed by GC/MS. | mg/kg | 50 | n.d. | - |
| Diisopentyl phthalate (DIPP) (CAS No.: 605-50-5) | With reference to IEC 62321-8: 2017, analysis was performed by GC/MS. | mg/kg | 50 | n.d. | - |
| 1,2-Benzenedicarboxylic acid, dipentylester, branched and linear (DPP) (CAS No.: 84777-06-0) | With reference to IEC 62321-8: 2017, analysis was performed by GC/MS. | mg/kg | 50 | n.d. | - |
| N-pentyl iso-pentyl phthalate (NPIPP) (CAS No.: 776297-69-9) | With reference to IEC 62321-8: 2017, analysis was performed by GC/MS. | mg/kg | 50 | n.d. | - |
| 1,2-Benzenedicarboxylic acid, dihexyl ester, branched and linear (DHP) (CAS No.: 68515-50-4) | With reference to IEC 62321-8: 2017, analysis was performed by GC/MS. | mg/kg | 50 | n.d. | - |

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21, LI-HSIN RD., HSINCHU SCIENCE PARK, HSINCHU 300, TAIWAN, R.O.C.

| Test Item(s) | Method | Unit | MDL | Result | Limit |
|---|---|---|---|---|---|
| | | | | No.1 | |
| Hexabromocyclododecane (HBCDD) and all major diastereoisomers identified (α- HBCDD, β- HBCDD, γ- HBCDD) (CAS No.: 25637-99-4, 3194-55-6 (134237-51-7, 134237-50-6, 134237-52-8)) | With reference to IEC 62321: 2008, analysis was performed by GC/MS. | mg/kg | 5 | n.d. | - |
| Tetrabromobisphenol A (TBBP-A) (CAS No.: 79-94-7) | With reference to RSTS-E&E-121, analysis was performed by LC/MS. | mg/kg | 10 | n.d. | - |
| Medium Chain Chlorinated Paraffins(C14-C17) (MCCP) (CAS No.: 85535-85-9) | With reference to ISO 18219-2: 2021, analysis was performed by GC/MS. | mg/kg | 50 | n.d. | - |
| Fluorine (F) (CAS No.: 14762-94-8) | With reference to BS EN 14582: 2016, analysis was performed by IC. | mg/kg | 50 | n.d. | - |
| Chlorine (Cl) (CAS No.: 22537-15-1) | With reference to BS EN 14582: 2016, analysis was performed by IC. | mg/kg | 50 | n.d. | - |
| Bromine (Br) (CAS No.: 10097-32-2) | With reference to BS EN 14582: 2016, analysis was performed by IC. | mg/kg | 50 | n.d. | - |
| Iodine (I) (CAS No.: 14362-44-8) | With reference to BS EN 14582: 2016, analysis was performed by IC. | mg/kg | 50 | n.d. | - |
| PFOS and its salts (CAS No.: 1763-23-1 and its salts) | With reference to CEN/TS 15968: 2010, analysis was performed by LC/MS/MS. | mg/kg | 0.01 | n.d. | - |
| PFOA and its salts (CAS No.: 335-67-1 and its salts) | With reference to CEN/TS 15968: 2010, analysis was performed by LC/MS/MS. | mg/kg | 0.01 | n.d. | - |
| Antimony (Sb) (CAS No.: 7440-36-0) | With reference to US EPA 3052: 1996, analysis was performed by ICP-OES. | mg/kg | 2 | n.d. | - |
| Antimony trioxide ($Sb_2O_3$) (CAS No.: 1309-64-4) | Calculated from the result of Antimony. | mg/kg | 2▲ | n.d. | - |
| Beryllium (Be) (CAS No.: 7440-41-7) | With reference to US EPA 3052: 1996, analysis was performed by ICP-OES. | mg/kg | 2 | n.d. | - |
| Polyvinyl chloride (PVC) | With reference to ASTM E1252: 2021, analysis was performed by FT-IR and Flame Test. | ** | - | Negative | - |

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**Note：**

1. mg/kg = ppm ; 0.1wt% = 0.1% = 1000ppm
2. MDL = Method Detection Limit
3. n.d. = Not Detected ( Less than MDL)
4. "-" = Not Regulated
5. **= Qualitative analysis (No Unit)
6. Negative = Undetectable ; Positive = Detectable
7. ▲ : The MDL was evaluated for element / tested substance.
   Conversion Formula：AX = A × F

| AX | A | F |
|---|---|---|
| Antimony trioxide ($Sb_2O_3$) | Antimony | 1.1971 |

   Parameter Conversion Table： https://eecloud.sgs.com/Region_TW/DocDownload.aspx?name=Others
8. Unless otherwise stated , the decision rule for conformity reporting is based on Binary Statement for Simple Acceptance Rule (w=0) stated in ILAC-G8:09/2019. According to this rule, the judgement of conformity is based on the comparing test results with limits.

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**PFAS Remark：**

The quantitative technology of PFAS is to analyze the specific structure of PFAS substances. However, PFAS acid and its salts with the same carbon number group have the same specific structure that can be identified. The tested results of the analyzed specific structure cannot be distinguished to identify the contribution from PFAS acid or its salts. Therefore, the tested results display the sum of concentrations of PFAS acids and its salts with the same carbon number group. The concentration of PFAS substances in the below table have been included in the tested results, please refer to the table for relevant information: (The listed PFAS substances are examples only, it do not include all PFAS salts with the same carbon number group.)

| Group Name | Substance Name | CAS No. |
|---|---|---|
| PFOS, its salts & derivatives | PFOS | 1763-23-1 |
| | Potassium perfluorooctanesulfonate (PFOS-K) | 2795-39-3 |
| | Perfluorooctanesulfonic acid, lithium salt (PFOS-Li) | 29457-72-5 |
| | Perfluorooctanesulfonic acid, ammonium salt (PFOS-$NH_4$) | 29081-56-9 |
| | Perfluorooctane sulfonate diethanolamine salt (PFOS-$NH(OH)_2$) | 70225-14-8 |
| | Perfluorooctanesulfonic acid,tetraethylammonium salt (PFOS-$N(C_2H_5)_4$) | 56773-42-3 |
| | N-decyl-N,N-dimethyldecan-1-aminium 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluorooctane-1-sulfonate (PFOS-DDA) | 251099-16-8 |
| | Perfluorooctane sulfonyl fluoride (POSF) | 307-35-7 |
| | Perfluorooctanesulfonic acid, magnesium salt (PFOS-Mg) | 91036-71-4 |
| | Perfluorooctanesulfonic acid, sodium salt (PFOS-Na) | 4021-47-0 |
| | Piperidine 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-heptadecafluorooctanesulfonate | 71463-74-6 |
| PFOA, its salts & derivatives | PFOA | 335-67-1 |
| | Sodium perfluorooctanoate (PFOA-Na) | 335-95-5 |
| | Potassium perfluorooctanoate (PFOA-K) | 2395-00-8 |
| | Silver perfluorooctanote (PFOA-Ag) | 335-93-3 |
| | Perfluorooctanoyl fluoride (PFOA-F) | 335-66-0 |
| | Ammonium pentadecafluorooctanoate (APFO) | 3825-26-1 |
| | Lithium perfluorooctanoate (PFOA-Li) | 17125-58-5 |

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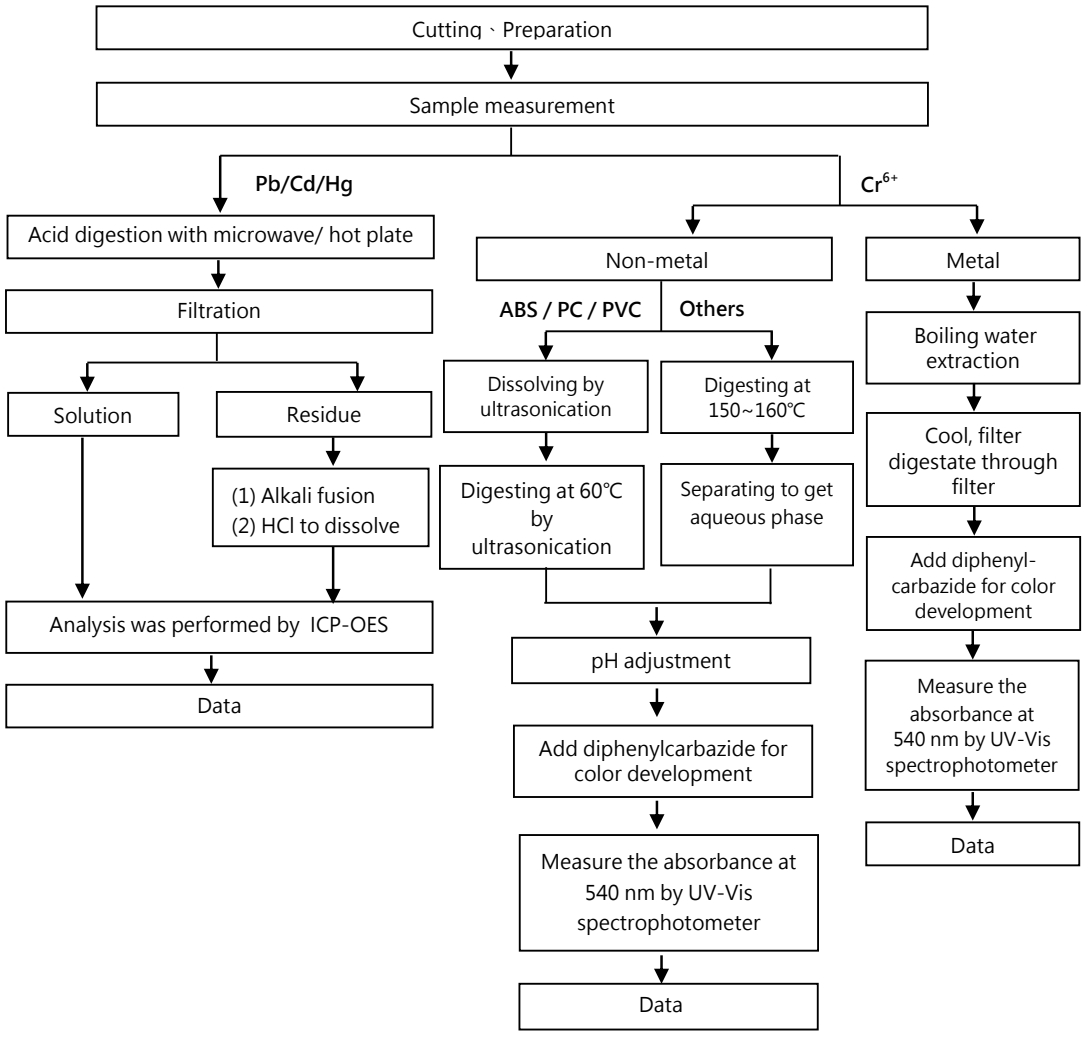
## Analytical flow chart of heavy metal

These samples were dissolved totally by pre-conditioning method according to below flow chart.

( $Cr^{6+}$ test method excluded )

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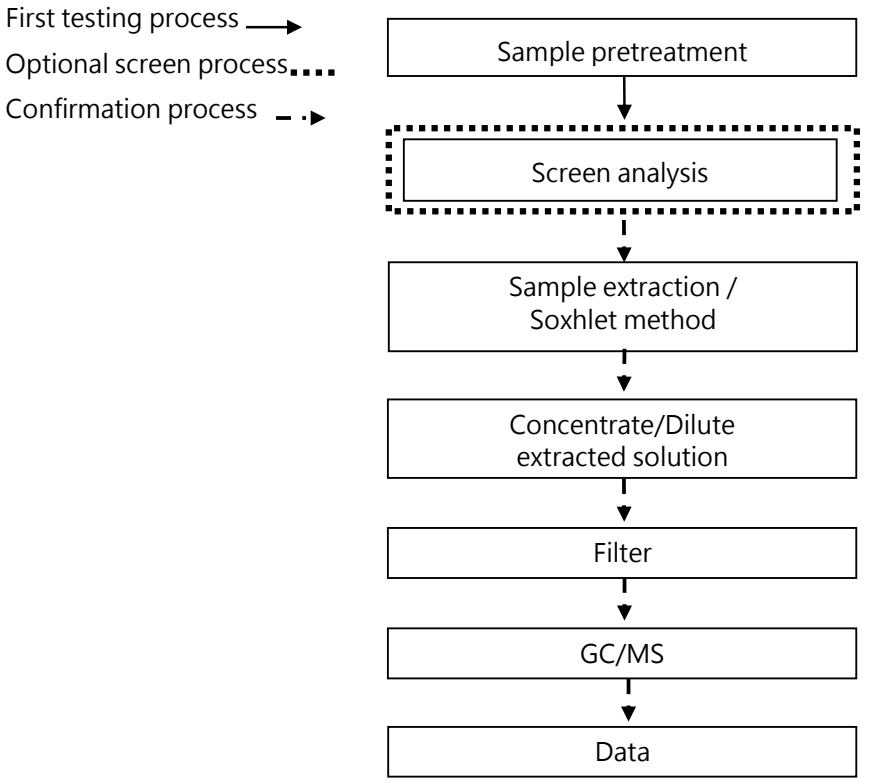
**Analytical flow chart – PBBs / PBDEs**

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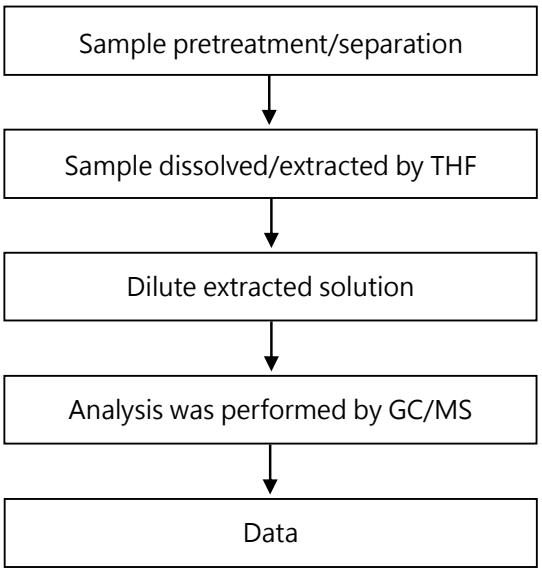
**Analytical flow chart - Phthalate**

**【Test method: IEC 62321-8】**

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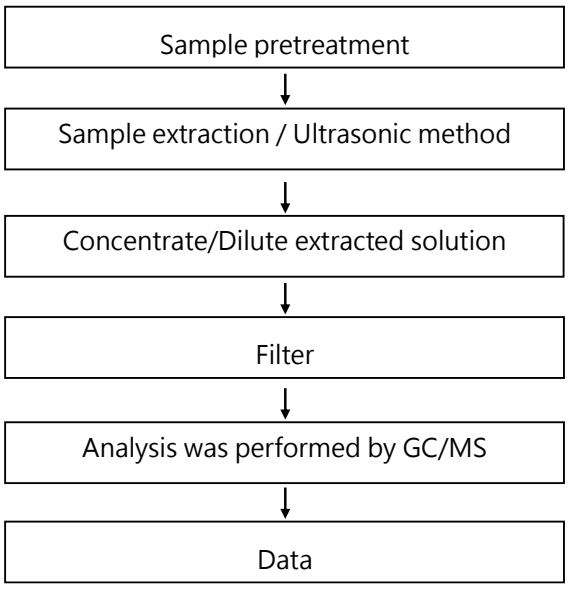
**Analytical flow chart - HBCDD**

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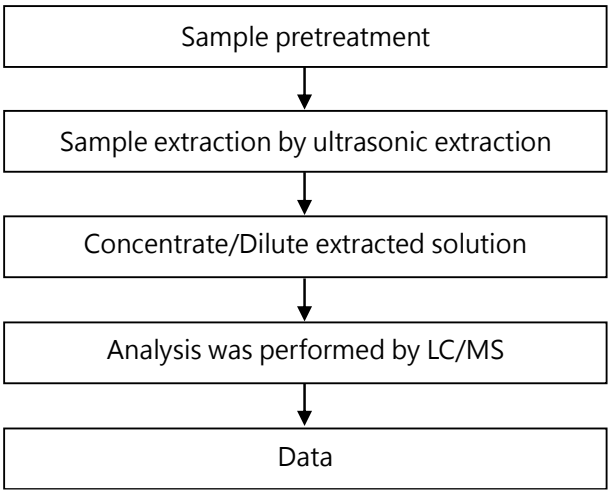
**Analytical flow chart - TBBP-A**

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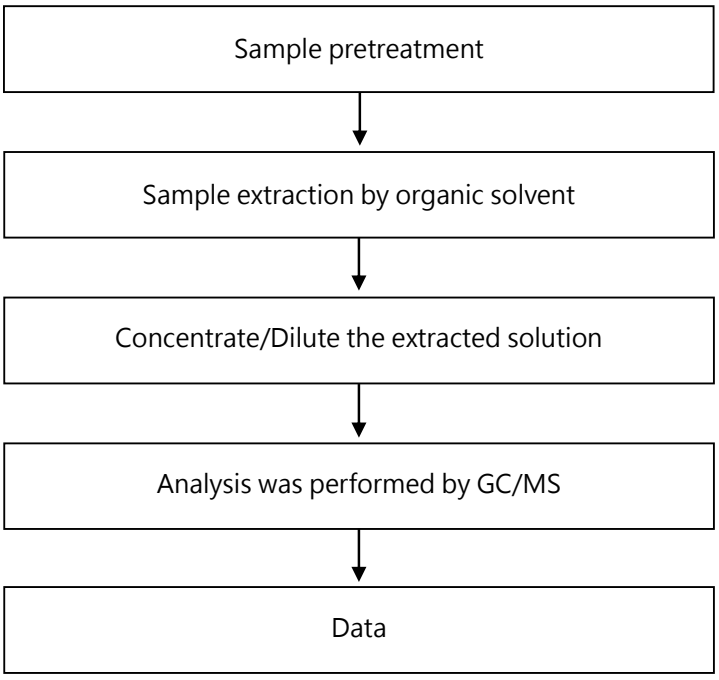
**Analytical flow chart**

* Apply to: PCBs, PCNs, PCTs, Mirex, Chlorinated Paraffins, DBBT

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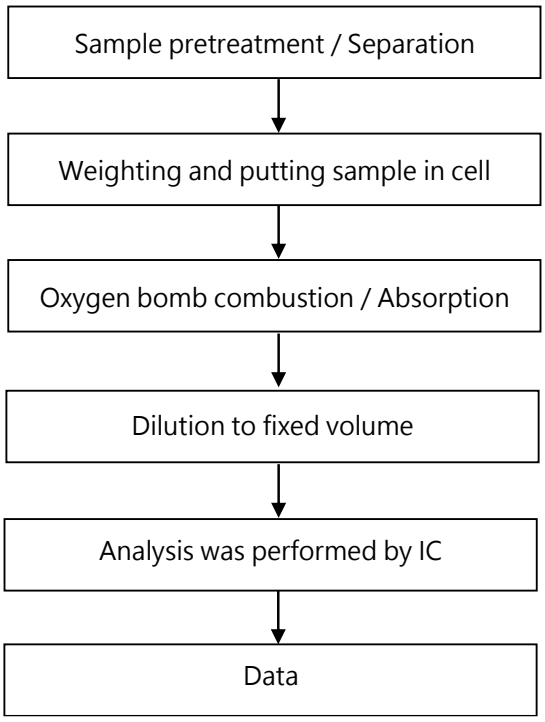
**Analytical flow chart - Halogen**

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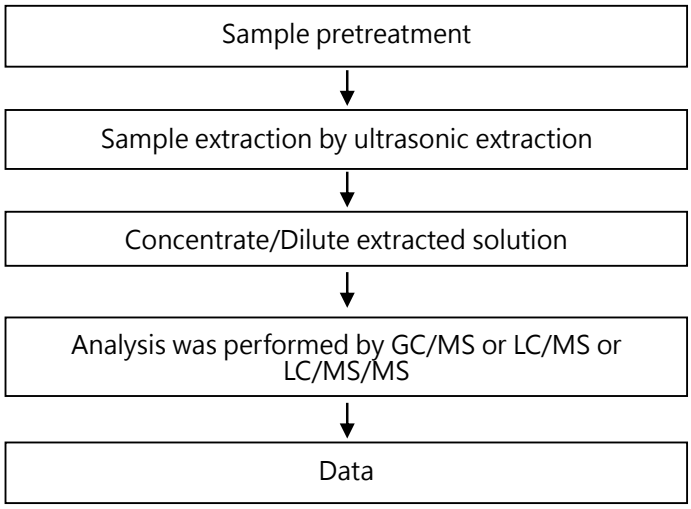
**Analytical flow chart – PFAS (including PFOA/PFOS/its related compound, etc.)**

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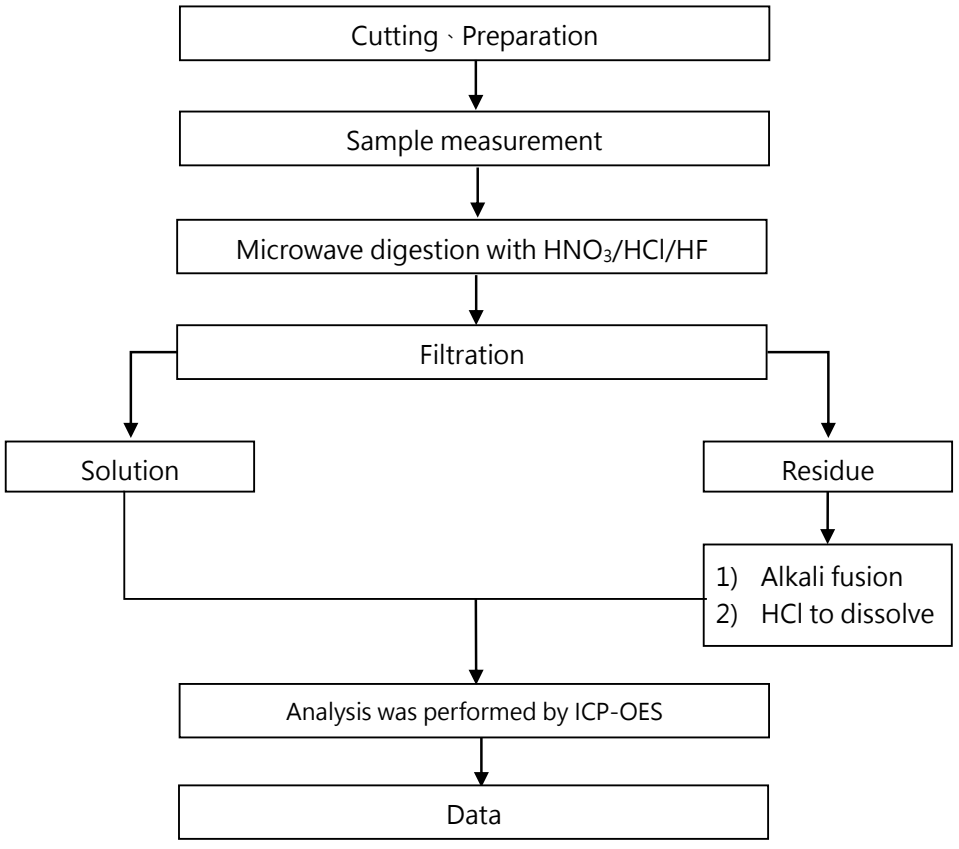
**Analytical flow chart of elements (Heavy metal included)**

These samples were dissolved totally by pre-conditioning method according to below flow chart.

【Reference method：US EPA 3051A、US EPA 3052】




* US EPA 3051A method does not add HF.

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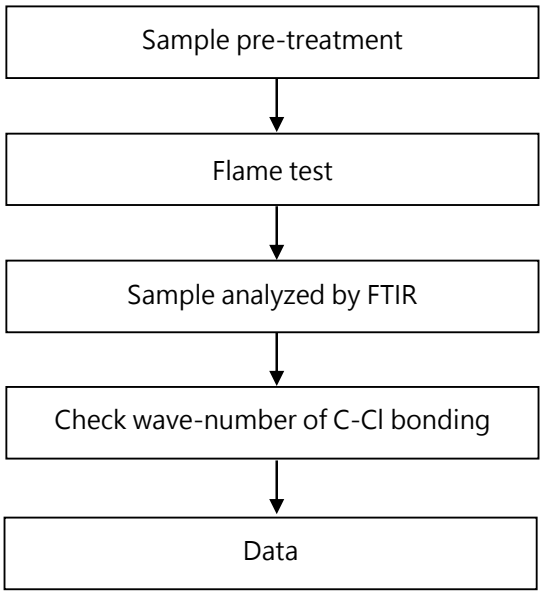
**Analysis flow chart - PVC**

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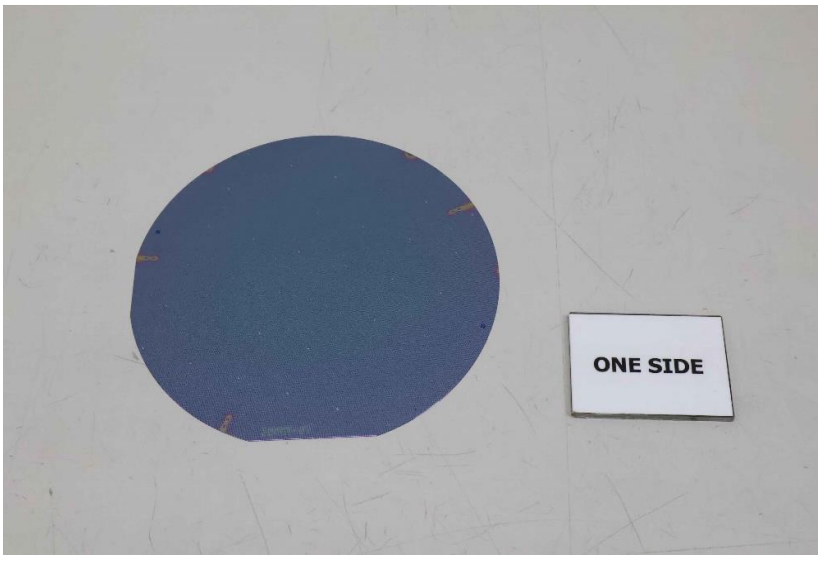
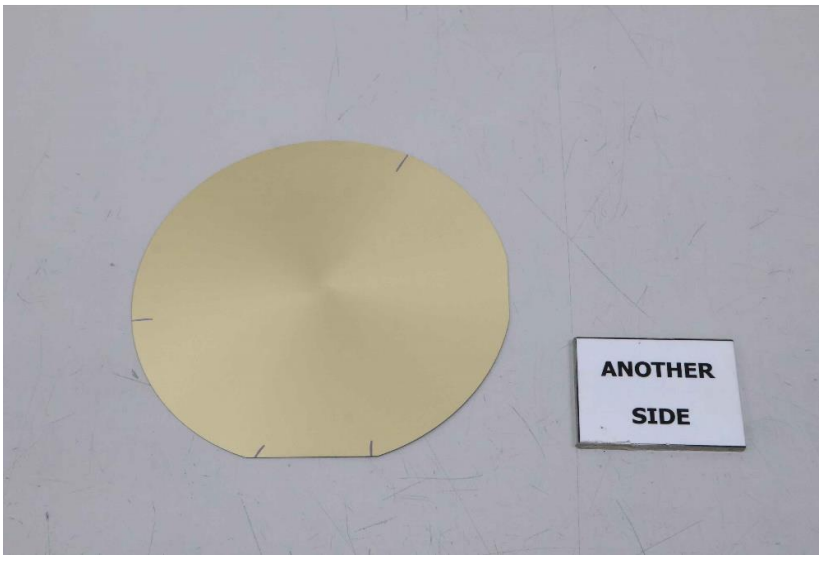
*** The tested sample / part is marked by an arrow if it's shown on the photo. ***

**ETR23C01463**




**ETR23C01463**




** End of Report **

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