

SPEC.No.

LH15306

ISSUE

Mar.13,2015

SYSTEM DEVICE DIVISION III  
ELECTRONIC COMPONENTS AND DEVICES GROUP  
SHARP CORPORATION

**DRAFT**

## SPECIFICATION

DEVICE SPECIFICATION FOR

Laser Diode

MODEL No.

**GH04W10A2GC \***

Development Dept., I  
Lighting Device Division  
Electronic Components And Devices Group  
SHARP CORPORATION

\*

Product name : Laser Diode

Model No. : G H 0 4 W 1 0 A 2 G C \*

1. These specification sheets include materials protected under the copyright of Sharp Corporation ("Sharp"). Please do not reproduce or cause anyone to reproduce them without Sharp's consent.
2. When using this product, please observe the absolute maximum ratings and the instructions for use outlined in these specification sheets, as well as the precautions mentioned below. Sharp assumes no responsibility for any damage resulting from use of the product which does not comply with the absolute maximum ratings and the instructions included in these specification sheets, and the precautions mentioned below.

(Precautions)

- (1) Please do verify the validity of this part after assembling it in customer's products, when customer wants to make catalogue and instruction manual based on the specification sheet of this part.

- (2) This products is designed for use in the following application areas;

<ul style="list-style-type: none"> <li>* OA equipment   * Audio visual equipment   * Home appliance</li> <li>* Telecommunication equipment (Terminal)   * Measuring equipment</li> <li>* Tooling machines   * Computers</li> </ul>	
--	--

If the use of the product in the above application areas is for equipment listed in paragraphs (3) or (4), please be sure to observe the precautions given in those respective paragraphs.

- (3) Appropriate measures, such as fail-safe design and redundant design considering the safety design of the overall system and equipment, should be taken to ensure reliability and safety when this product is used for equipment which demands high reliability and safety in function and precision, such as ;

<ul style="list-style-type: none"> <li>* Transportation control and safety equipment (aircraft, train, automobile etc.)</li> <li>* Traffic signals   * Gas leakage sensor breakers   * Rescue and security equipment</li> <li>* Other safety equipment</li> </ul>	
---	--

- (4) Please do not use this product for equipment which require extremely high reliability and safety in function and precision, such as ;

<ul style="list-style-type: none"> <li>* Space equipment   * Telecommunication equipment (for trunk lines)</li> <li>* Nuclear power control equipment   * Medical equipment</li> </ul>	
--	--

- (5) Please contact and consult with a Sharp sales representative if there are any questions regarding interpretation of the above four paragraphs.

3. Please contact and consult with a Sharp sales representative for any questions about this product.

Spec No. LH15306

## 1. Scope

This specification covers the appearance and characteristics of blue violet Laser Diode,  
Model No. GH04W10A2GC

## 【Outline of this product】

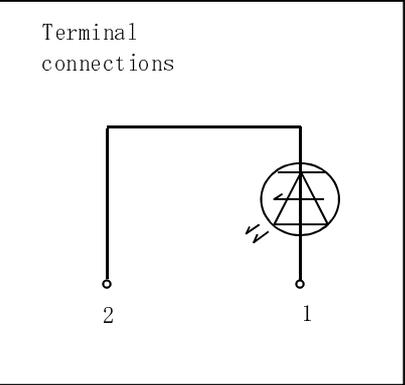
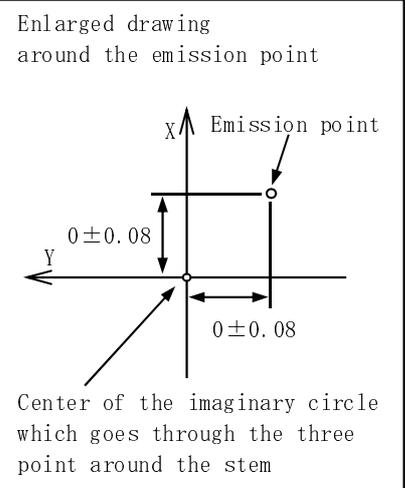
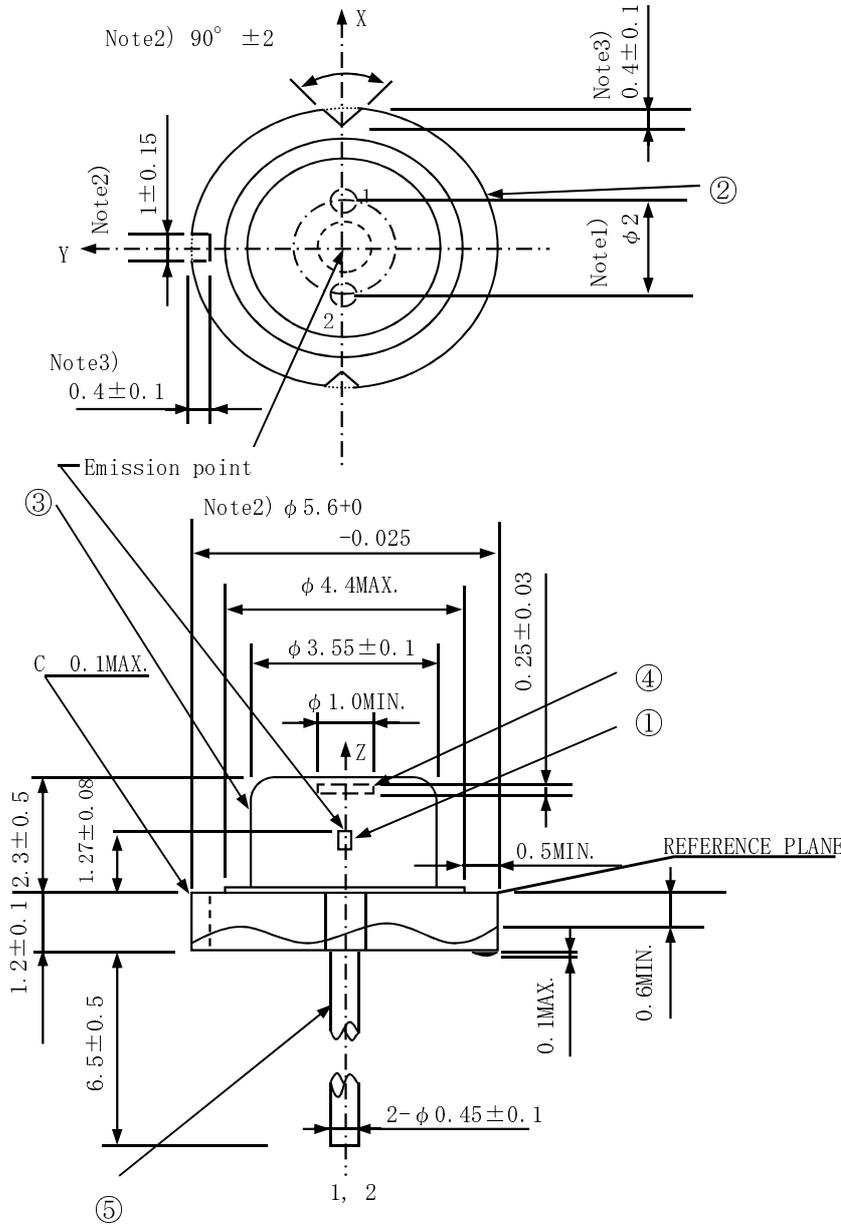
This product is equipped with an InGaN multiple quantum well blue violet laser diode .

Oscillating transverse mode of this model is TE.

Oscillating transverse mode of this model is multi-mode.

- |  |  |
|--|--|
| 2. Outline Dimensions and Terminal Connections | described in page 3  |
| 3. Ratings and Characteristics                 | described in page 4  |
| 4. Reliability                                 | described in page 5  |
| 5. Quality level                               | described in page 6  |
| 6. Supplements                                 |  |
| 6-1. ODS materials                             | described in page 6  |
| 6-2. RoHS compliant product.                   | described in page 6  |
| 6-3. Information relating to China RoHS.       | described in page 6  |
| 6-4. Packing                                   | described in page 7  |
| 6-5. Production place                          | described on the labels, which are on the clean bag and on the packing case. |
| 7. Operating and handling precautions          | described in page 8  |

2. Outline dimensions and Terminal connections



Mass of the product :  
0.32g (reference value)

Note 1) Dimension of the bottom of leads.

Note 2) These dimensions are valid only in the range of 0 ~ 0.6mm below from the reference plane.

Note 3) These dimensions are defined from the imaginary circle which goes through the three points around the stem to the bottom of cut off parts.

GENERAL TOLERANCES ± 0.2

UNIT:mm

No.	Component	Material	Finish
①	Laser Diode Chip	InAlGaN	-
②	Stem	Fe, Cu	Gold-plated
③	Cap	Kovar	Nickel-plated
④	Window glass	Borosilicated glass	-
⑤	Lead pins	Kovar	Gold-plated

Spec No. LH15306

## 3. Ratings and Characteristics

## 3-1 Absolute Maximum Ratings

(Tc=25°C (Note 1))

Parameter	Symbol	Value	Unit	
Optical power output	CW (Note 2)	Po	350	mW
	Pulse (Note 3)	Pp	1,100	mW
Reverse voltage	Laser diode	Vr1	2	V
Operating temperature (Case temperature)	CW (Note 2)	Topc(c)	0 ~ +50	°C
	Pulse (Note 3)	Topp(c)	0 ~ +50	°C
Storage temperature	Tstg	-40 ~ +85	°C	
Soldering temperature (Note 4)	Tsld	350	°C	

(Note 1) Tc : Case temperature

(Note 2) CW : Continuous Wave Operation

(Note 3) Pulse : Pulse Operation(Pulse Width 0.2 μs Duty:50%)

(Note 4) Soldering temperature means soldering iron tip temperature while soldering.

Soldering position is 1.6mm apart from bottom edge of the case. (Immersion time: ≤3s)

## 3-2 Electro-optical Characteristics (Note 1)

(Tc=25°C (Note 2))

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Threshold current	Ith	-	-	140	200	mA
Operating current	Iop	Po=300mW	250	325	400	mA
Operating voltage	Vop		-	4.5	5.5	V
Wavelength	λp		400	406	414	nm
1/e <sup>2</sup> Intensity Angle(Parallel) (Note 3, 5)	θ // (1/e <sup>2</sup> )		8	14	20	°
1/e <sup>2</sup> Intensity Angle(Perpendicular) (Note 3, 5)	θ ⊥ (1/e <sup>2</sup> )		36	41	46	°
Misalignment angle (Parallel) (Note 4, 5)	Δθ // (1/e <sup>2</sup> )		-3	-	3	°
Misalignment angle (Perpendicular) (Note 4, 5)	Δθ ⊥ (1/e <sup>2</sup> )		-4	-	4	°
Slope efficiency	ηd		$\frac{120\text{mW}}{I(300\text{mW}) - I(180\text{mW})}$	1.4	1.8	2.2
Polarization Angle (Note 6)	-	Po=50mW NA=0.13	-5	-	5	°
Polarization Ratio (Note 6)	P1		100	-	-	-
Pulse operating current (Note 7)	PIop	Pp=1,000mW	-	-	1,000	mA
Difference rate of ηp (Note 8)	Δηp	Pp=50~1,000mW	-	-	100	%

(Note 1) Initial value, Continuous Wave Operation

(Note 2) Tc:Case temperature

(Note 3) Full angle of 13.5%(≠1/e<sup>2</sup>) peak intensity(Note 4) Misalignment angle of 13.5%(≠1/e<sup>2</sup>) peak intensity(Note 5) Parallel to the junction plane(X-Z plane)  
Perpendicular to the junction plane(Y-Z plane)

(Note 6) Reference Standards : JIS-C-5943

(Note 7) Pulse Operation(Pulse Width 0.2 μs Duty:50%)

(Note 8) Difference rate of ηp

Pulse Operation(Pulse Width 0.2 μs Duty:50%)

$$\Delta \eta p = \frac{\eta p_{\text{Max}} - \eta p_{\text{Min}}}{\eta p} \times 100 \quad (\%)$$

$$\eta p = \frac{950\text{mW}}{I_{\text{op}}(1,000\text{mW}) - I_{\text{op}}(50\text{mW})}$$

ηpMax, ηpMin : maximum value and minimum value of the ηp data measured between Pp=50mW to Pp=1,000mW(Iop increment of 5mA).

## 4. Reliability

4-1 The reliability of products satisfy all the items listed below.

Confidence level : 90%

No.	Test	Test Conditions	Samples:n	Defective:C	LTPD(%)	Failure criteria No. [4-2]
1	Solderability (Note 1)	Soldering temperature: 230±5°C (Flux used) Immersion time: 5±0.5s Solder and Flux : Senju Metal Industry M705 and ESR-250	11	0	20	4
2	Resistance to soldering (Note 1)	Soldering iron tip temperature: 350±5°C 20W Immersion time: 3+0/-1s	11	0	20	1, 2, 3
3	Terminal strength (Tensile test)	Load: 5N Duration: 5±1s Once for each terminal	11	0	20	5
4	Terminal strength (Bending test)	Load: 2.5N 0° ~ 90° ~ 0° ~ -90° ~ 0° Once for each terminal	11	0	20	5
5	Mechanical shock	Acceleration: 1000m/s <sup>2</sup> Pulse width: 6ms Direction: ±X, ±Y and ±Z Three times for each direction	11	0	20	1, 2, 3
6	Variable frequency vibration	Acceleration: 100m/s <sup>2</sup> or Amplitude: 1.5mm Frequency: 10~500~10Hz 15min reciprocation Direction: X, Y and Z 2 h for each direction	11	0	20	1, 2, 3
7	Temperature cycling	Lower temperature: -40°C Higher temperature: +85°C Duration: 30min each, 30 times	11	0	20	1, 2, 3
8	airtightness	He leak test 5×10 <sup>-3</sup> Pa·cm <sup>3</sup> /s	11	0	20	6
9	High temperature storage	Storage temperature: 85°C t=500 h	11	0	20	1, 2, 3
10	Low temperature storage	Storage temperature: -40°C t=500 h	11	0	20	1, 2, 3
11	High temperature Humid atmosphere storage	Storage temperature: 60°C (Note 2) humidity: 90%RH t=500h	11	0	20	1, 2, 3

Reference Standards : JIS

(Note 1) Soldering position is 1.6mm apart from bottom edge of the case.

(Note 2) To be measured after 72 hours exposure to the room atmosphere.

## 4-2 Parameters to be measured and Failure criteria

No.	Parameters	Failure judgment criteria
1	Threshold current	I <sub>th</sub> > initial value ×1.3
2	Operating current	I <sub>op</sub> > initial value ×1.3
3	Operating voltage	V <sub>op</sub> > initial value ×1.2
4	Solderability	95% or more is covered with solder.
5	Terminal strength	It is defective if there are breaking and loosening.
6	airtightness	Amount of leak > 5×10 <sup>-3</sup> Pa·cm <sup>3</sup> /s

## 4-3 Target Lifetime

The target mean time to failure (MTTF) of this product is more than 2,000 h.

MTTF is confirmed by performing the operating test under the following conditions in time of development or change process related to the reliability of this product.

Samples tested should have a laser diode chip with the same structure of this model.

Conditions	Failure judgment criteria
T <sub>c</sub> =50°C, P <sub>p</sub> =1,000mW, 500 hours (Note 2)	Failure is defined as the time under the operating power under the conditions in the left changes 30% of the initial (12 h) value. (Note 1) As for the samples which do not fail within 500 hours, their life time is calculated by extrapolating operating power data of between 400 and 500 hours. MTTF is estimated by plotting each life time in Weibull function worksheet. (Note 1)

(Note 1) Defective samples caused by surge current is rejected.

(Note 2) ACC pulse Operation (Pulse Width 0.2 μs Duty:50%)

Spec No. LH15306

5. Quality level

5-1 Inspection standards ISO 2859 single sampling plan  
 5-2 Method and level extraction Single sampling plan S-2 normal inspection

5-3 AQL

5-3-1 Definition of the lot the day shipping the product

5-3-2 Characteristics

AQL(%)	Parameter	Failure judgment criteria
1.0	Ith, Iop, Vop, $\eta d$ , $\lambda p$ , $\theta //$ , $\theta \perp$ , $\Delta \theta //$ , $\Delta \theta \perp$	Not conforming to the specifications

(Note1) Inspection is performed after blowing.

5-3-3 Appearance

AQL(%)	Failure judgment criteria
1.0	Crack is found on the window glass. Bent lead can not be restored. Impurity or dust its size is over $50 \mu m \times 50 \mu m$ is found within $1mm \phi$ to the center of the surface of the window glass.
2.5	There must not be impurity its size is over $50 \mu m \times 50 \mu m$ that influences the electro-optical characteristics described in specifications. Diameter of stem is not conforming the specification

(Note2) Inspection is performed after blowing.

6. Supplements

6-1 ODS materials

This product shall not contain the following materials. Also, the following materials shall not be used in the production process for this product.

Materials for ODS : CFCs, Halon, Carbon tetrachloride, 1.1.1-Trichloroethane (Methyl chloroform)

6-2 RoHS compliant product

This product complies with the RoHS Directive (2011/65/EU) and manufactured in accordance with Sharp's Green Device Guidelines.

6-3 Chemical substance information in the product

Product Information Notification based on Chinese law, Management Methods for Controlling Pollution by Electronic Information Products.

Names and Contents of the Toxic and Hazardous Substances or Elements in the Product

Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr(VI))	Polybrominated Biphenyls (PBB)	Polybrominated Diphenyl Ethers (PBDE)
○	○	○	○	○	○
<p>○ : indicates that the content of the toxic and hazardous substance in all the homogeneous materials of the part is below the concentration limit requirement as described in SJ/T 11363-2006.</p> <p>× : indicates that the content of the toxic and hazardous substance in at least one homogeneous material of the part exceeds the concentration limit requirement as described in SJ/T 11363-2006 standard.</p>					

Spec No. LH15306

6-4. Packing

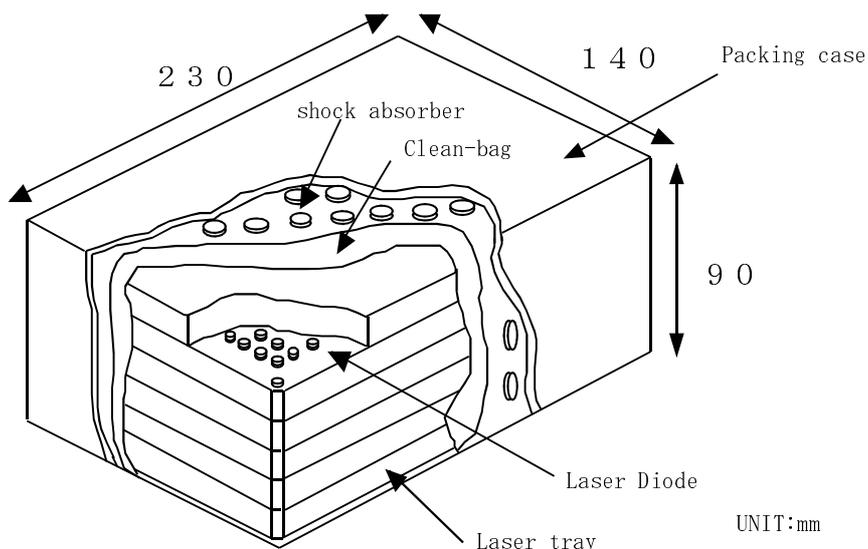
6-4-1. Packing method

- (1) Laser diodes are arranged in a tray.
- (2) One tray can accommodate 400 lasers maximum.
- (3) A vacant tray is stacked as a cover on the tray wherein the laser diodes are arranged. Stacked trays including a cover are bound with adhesive tape.
- (4) The above bound trays are stuffed into a clean-bag. The bag is sealed by dissolving thermally.
- (5) The trays in the bag are put into a packing case. One packing case can accommodate 2,000 lasers maximum, which is the minimum unit of packing. A Label where in the model number ,quantity and lot number are printed is stuck on both of the bag and the case(Refer to 6-4-4).

6-4-2. Materials for packing

No.	Component parts	Material
1	Laser tray	conductive polystyrene resin
2	Clean-bag	anti - static plastic
3	Packing case	cardboard
4	shock absorber	anti - static Polyethylene

6-4-3. External appearance of packing



Mass of regular packing(2,000 pcs) : 1.66kg(reference value)

6-4-4. Label

(1)A label on the clean-bag

(2)A label on the packing case

SHIPMENT TABLE	
PART No.	Model No. (Note 2)
QUANTITY.	Quantity
LOT No.	
Product Lot No.	
<b>SHARP</b>	
MADE IN ****(Note 1)	

TYPE	Model No. (Note 2)
Q'TY	Quantity
LOT	Lot No. (Rank) (the day shipping the product)
<b>SHARP</b> CORPORATION <b>R.C.</b> (Note 3) MADE IN ****(Note 1)	

(Note 1) \*\*\*\*:Production country

(Note 2) A management number in the factory is written in ( ), if the product produced in a factory except Japan.

(Note 3) This identification mark shows the settlement product for RoHS

designed by using a green material based on our green device guideline.

\*

Spec No. LH15306

## 7. Operating and handling precautions

- (1) This product has its life. The product life which is described in "Reliability" should be taken into account when using it.
- (2) This product will be damaged by electrostatic discharge(ESD). Following precautions should be taken to avoid ESD damage.
  - ⇒ Workers, workbenches and other equipment should always be grounded. Workers should always wear an antistatic wrist strap and an antistatic smock on them.
  - ⇒ When handling this product, workers should always wear antistatic gloves or finger covers.
  - ⇒ A stable DC power supply which is free from electrical transients should always be used when operating this product. A slow starter circuit should always be inserted between the power supply and this product in order to protect it from DC power surges.
  - ⇒ Optical power output of this product should be set with a highly reliable and high quality variable resistance.
  - ⇒ This product should always be connected to the driving circuit by soldering directly or through highly reliable connectors.
  - ⇒ While this product is being operated, be sure to avoid touching the driving circuit or the terminals of this product with electrical probes from a synchroscope or a voltmeter.
  - ⇒ An antistatic package should be used when storing this product.  
The recommended preservation is stored in the tray and the clean-bag in an environmental condition dry at normal temperature (0~40°C)
  - ⇒ This product should be processed in the rooms where relative humidity is kept at 50-70%RH.
- (3) Because the adhesion of garbage and dust to the window glass might disarrange an optical characteristic of this product, maintain the work room to cleanness so as not generate dust, please.
- (4) In this Product, generation of heat happens in the laser chip because of operating. The case temperature rises by this generation of heat. Because the rise of the case temperature becomes a factor to shorten the lifetime of this product, a sufficient heat sink should be attached to this product when operating so that its case temperature is to be maintained at the same level as that of the surrounding.
- (5) Even if the drive current supply has an automatic power control (APC), automatic current control (ACC), or both, be sure to monitor the optical power output with an optical power meter while setting it. Never estimate the optical power output only from the drive current because it is likely to be decreased by temperature rise of the surrounding.
- (6) When dirt adheres to the window glass of this product, please wipe lightly with the cotton bud that adheres the ethanol.
- (7) This product consists of a hermetic package, in which the blue violet laser diode chip is mounted. The blue violet laser diode chip will be easily damaged by air, moisture or etc. So when the package dose not keep hermetically, the lifetime of this product will be remarkably shorten.  
Following precautions should be taken to avoid destroying the hermetic package.
  - ⇒ The window glass cracks easily because it is thin. Therefore, please do not give the mechanical shock such as falls, and please avoid applying the stress to the cap, for example clumping, tightening hard, or fixing to the treatment device.
  - ⇒ Because applying the overstress to the lead pin or repeating to bend the lead pin at its bottom, will destroy the hermetic seal. Please do not apply the overstress to the base part of lead pin.
  - ⇒ When a large stress is applied to the package, please confirm whether the package is kept hermetically before using this product.
- (8) Although the beam emitted by this laser diodes will be harmful to the human eyes. So the following precautions should be taken.
  - ⇒ When this product is being operated, the emitting surface of a chip should not be viewed either directly or through a lens, microscope or optical fibers.
  - ⇒ When operating this product, wear safety glasses.
- (9) When soldering this product, heat lead pins only using a soldering iron in short time. Avoid heat the whole package using pre-heat or reflow soldering.