

# GH5R41KA3C

## High Power Output Hologram Laser for MAX. X40 Speed CD-R Drive

### ■ Features

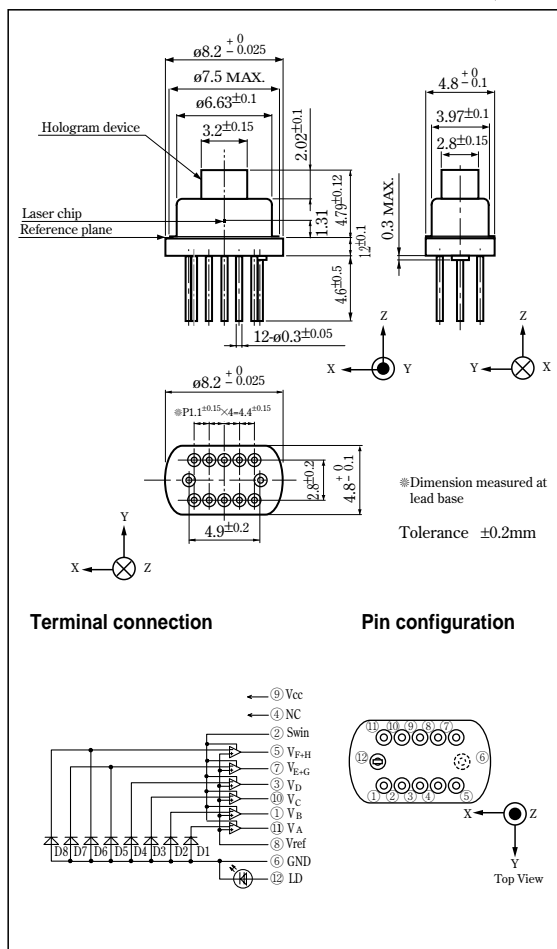
- (1) High power output (pulse MAX. 162mW)
  - (2) For MAX. X40 speed CD-R, X40 speed CD-ROM  
(With built-in MIN. 45MHz OPIC\*)
  - (3) High coupling efficiency  
The ellipticity ( $\theta_L/\theta_{//}$ ) is close to 1.
  - (4)  $\phi 4.8$ mm thickness package
  - (5) With built-in beam splitter and diffraction grating
- \*OPIC : (Optical IC) is a trademark of SHARP Corporation.  
An OPIC consists of a light-detecting element and a signal-processing circuit integrated onto a single chip.

### ■ Applications

- (1) CD-R drives
- (2) CD-RW drives

### ■ Outline Dimensions

(Unit : mm)



### ■ Absolute Maximum Ratings

(T<sub>C</sub>=25°C)

Parameter	Symbol	Rating	Unit
*1 Optical power output	P <sub>HC</sub>	108	mW
*2 Optical power output (pulse)	P <sub>HP</sub>	162	mW
Reverse voltage	V <sub>R</sub>	2	V
OPIC supply voltage	V <sub>CC</sub>	6	V
*3.4 Operating temperature	T <sub>opr</sub>	0 to +70	°C
*3 Storage temperature	T <sub>stg</sub>	-40 to +85	°C
*5 Soldering temperature	T <sub>sold</sub>	260	°C

- \*1 Output power from hologram laser Equivalent to 120mW (CW) from cap  
 \*2 Output power from hologram laser Equivalent to 180mW (pulse) from cap (pulse width : 0.5 $\mu$ s, Duty : 50%)  
 \*3 Case temperature \*4 Pulse operation, CW operation \*5 At the position of 1.6mm from the lead base (Within 5s)

**SHARP**

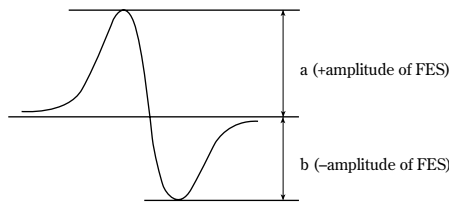
## ■ Electro-optical Characteristics

(Tc=25°C)

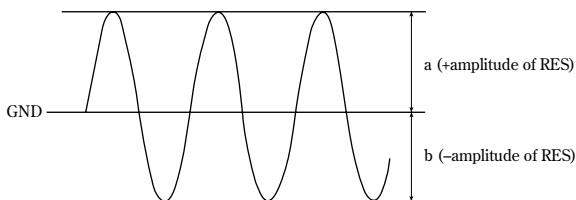
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
#1 Focal offset	DEF	Collimated lens output power 1.5mW, High gain	-0.7	-	+0.7	μm
#2 Focal error symmetry	BFES	Collimated lens output power 1.5mW, High gain	-25	-	+25	%
#3 Radial error balance	BRES	Collimated lens output power 1.5mW, High gain	-25	-	+25	%
#4 RF output amplitude	V <sub>RFH</sub>	Collimated lens output power 1.5mW, High gain	0.65	1.0	1.6	V
#5 FES output amplitude	V <sub>FES</sub>	Collimated lens output power 1.5mW, High gain	0.3	0.59	0.94	V
#6 RES output amplitude	V <sub>RES</sub>	Collimated lens output power 1.5mW, High gain	0.09	0.19	0.3	V
#7 Main spot balance	MSB	Collimated lens output power 1.5mW, High gain	80	(100)	120	%
#8 Sub spot balance	SSB	Collimated lens output power 1.5mW, High gain	80	(100)	120	%
Jitter	JIT	Collimated lens output power 1.5mW, High gain	-	-	23	ns
#9 Strain of RF signal shape	RF <sub>h</sub>	Collimated lens output power 1.5mW, High gain	-	-	300	%

#1 Distance between FES=0 and jitter minimum point

#2  $(a-b) / (a+b)$



#3  $\frac{a-b}{2 \times (a+b)}$



#4 Amplitude of V<sub>A</sub>+V<sub>B</sub>+V<sub>C</sub>+V<sub>D</sub> (focal servo ON, radial servo ON)

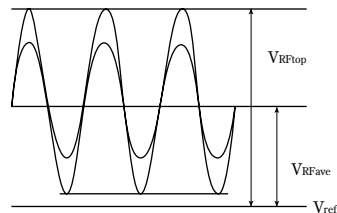
#5 V<sub>B</sub>-V<sub>A</sub> (Focal vibration)

#6 Amplitude of  $(V_C-V_D)-k1(V_E+G-V_F+H)$ .  $k1=(V_C+V_D)/(V_E+G+V_F+H)=1$   
When tracking servo is ON,  $(V_C-V_D)-k1(V_E+G-V_F+H)+\alpha$  should be 0.

#7  $(V_A+V_B) / (V_C+V_D)$

#8 V<sub>C</sub>/V<sub>D</sub>

#9 V<sub>RFtop</sub>/V<sub>RFave</sub>



## ■ Electro-optical Characteristics of Laser Diode

(T<sub>C</sub>=25°C)

Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit	
Threshold current		I <sub>th</sub>	-	-	30	40	mA	
Operating current		I <sub>op</sub>	Po=100mW	-	141	167	mA	
Operating voltage		V <sub>op</sub>	Po=100mW	-	2.2	2.5	V	
Wavelength		λ <sub>p</sub>	Po=100mW	773	784	797	nm	
Differential efficiency		η <sub>d</sub>	$\frac{90\text{mW}}{I(100\text{mW})-I(10\text{mW})}$	0.75	0.9	1.15	mW/mA	
Stability of differential efficiency		Δη <sub>d</sub>	Po=10 to 180mW	-	-	40	%	
Half intensity angle		Parallel	Po=100mW	8.0	9	10.2	°	
		Perpendicular		14.5	16.0	17.5	°	
Emission characteristics		Parallel		-2	-	+2	°	
		Perpendicular		-3	-	+3	°	
Beam shift		Δθ//		θ//(100mW)-θ//(3mW)	-1	-	+1	°
Kink		K-LI1		Po=10 to 180mW	0.988	-	-	%
		K-LI2	P1=36mW, P2=108mW, P3=180mW	-	-	15	%	

## ■ Electro-optical Characteristics of OPIC for Signal Detection<sup>\*10</sup>

(T<sub>C</sub>=25°C, V<sub>CC</sub>=5V, V<sub>ref</sub>=2.1V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit	<sup>*11</sup> Segment
Supply current	I <sub>CC1</sub>	High gain, Gain switching SW=H	-	25	32	mA	
	I <sub>CC2</sub>	Low gain, Gain switching SW=L	-	30	35	mA	
<sup>*12</sup> Output offset voltage	V <sub>od</sub>	Common to high/low gain, No light	-25	2	+25	mV	A, B
Offset voltage difference, Gain switching	ΔV <sub>od</sub>	Common to high/low gain	-30	-	+30	mV	A, B

<sup>\*9</sup> 0.1μF or more capacitor should be added between OPIC power supply terminal and GND, V<sub>ref</sub> terminal and GND. (at the position of 10mm or less from the lead base)

<sup>\*10</sup> Applicable divisions correspond to output terminals .

A : V<sub>A</sub>, V<sub>B</sub>, V<sub>C</sub>, V<sub>D</sub>

B : V<sub>E+G</sub>, V<sub>F+H</sub>

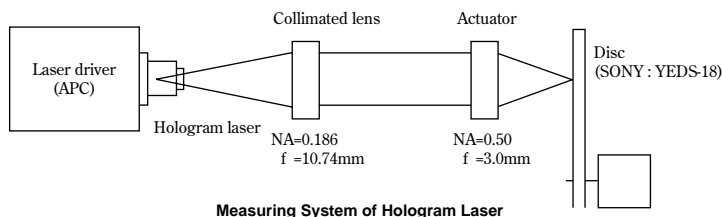
<sup>\*11</sup> Difference from V<sub>ref</sub>

## ■ Electro-optical Characteristics of Hologram Laser (Design Standard)<sup>\*1</sup>

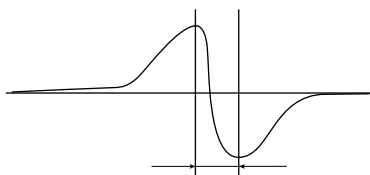
(T<sub>C</sub>=25°C)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
<sup>*2</sup> Focal error signal capture range	-	-	-	14	-	μm
Focal error signal sensitivity	-	-	-	13	-	%/μm

<sup>\*1</sup>



<sup>\*2</sup>



\* These parameters are not guaranteed performance, but general specifications of each optical element which makes up a hologram laser.

## ■ Optical Characteristics of Hologram Device (Design Standard\*)

(T<sub>C</sub>=25°C)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Hologram diffraction efficiency	0 th	$\lambda=780\text{nm}$	(79)	(83)	-	%
	$\pm 1\text{st}$		(5.5)	(6.9)	(8.5)	%
Hologram diffraction angle	D1, D2	$\lambda=780\text{nm}$	-	20.7	-	°
	Except D1, D2		-	26.3	-	°
Grating diffraction efficiency	-	0:1	6.7	9	12.4	-
Grating diffraction angle	-	$\lambda=780\text{nm}$	-	2.72	-	°

## ■ Electro-optical Characteristics of Laser Diode (Design Standard\*)

(T<sub>C</sub>=25°C)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Misalignment position	$\Delta x$	-	-80	-	+80	$\mu\text{m}$
	$\Delta y$		-80	-	+80	$\mu\text{m}$
	$\Delta z$		-80	-	+80	$\mu\text{m}$
*3 Reflectivity of LD rear facet	R <sub>r</sub>	-	85	-	%	

## ■ Electro-optical Characteristics of OPIC for Signal Detection (Design Standard\*)

(T<sub>C</sub>=25°C, V<sub>CC</sub>=5V, V<sub>ref</sub>=2.1V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit	*4 Segment	
Supply voltage	V <sub>CC</sub>	-	4.5	5	5.5	V		
Reference voltage	V <sub>ref</sub>	-	2.00	2.1	2.21	V		
Output terminal current	I <sub>o</sub>	Common to high/low gain	-0.03	0.01	0.3	mA	A, B	
Reference voltage terminal current	I <sub>ref</sub>	Common to high/low gain, No light	-0.5	1	2	mA		
*6,7,8,9 Response frequency	f <sub>cm</sub>	Main amp, Common to high/low gain, -3dB	45	60	-	MHz	A	
	f <sub>cs</sub>	Sub amp, Common to high/low gain, -3dB	1	2	-	MHz	B	
*5,6,8,9 Peaking level	V <sub>pk2</sub>	Common to high/low gain f=0.1 to 45MHz	-	-	3	dB	A	
*9 Noise level	f <sub>nm</sub>	Hign gain, 50 $\Omega$ end BW=30kHz, f=36MHz	-	-74	-68	dBm	A	
Sensitivity 1	R <sub>m1</sub>	Main amp, Hign gain	18	24	30	mV/ $\mu\text{W}$	A	
Sensitivity 2	R <sub>m2</sub>	Main amp, Low gain	0.72	0.96	1.2	mV/ $\mu\text{W}$	A	
Sensitivity 3	R <sub>m3</sub>	Sub amp, Hign gain	72	96	120	mV/ $\mu\text{W}$	B	
Sensitivity 4	R <sub>m4</sub>	Sub amp, Low gain	2.88	3.84	4.8	mV/ $\mu\text{W}$	B	
Thermal drift of sensitivity	R <sub>sm</sub> /T	Common to high/low gain	-	4 200	-	ppm/°C	A, B	
Thermal drift of offset voltage	V <sub>od</sub> /T	Common to high/low gain, No light	-	300	-	$\mu\text{V}/^\circ\text{C}$	A, B	
Thermal drift of offset voltage 1	V <sub>os1</sub> /T	Main amp, Hign gain, No light	-	30	-	$\mu\text{V}/^\circ\text{C}$	A	
Thermal drift of offset voltage 2	V <sub>os2</sub> /T	Main amp, Low gain, No light	-	15	-	$\mu\text{V}/^\circ\text{C}$	A	
Thermal drift of offset voltage 3	V <sub>os3</sub> /T	Sub amp, Hign gain, No light	-	30	-	$\mu\text{V}/^\circ\text{C}$	B	
Thermal drift of offset voltage 4	V <sub>os4</sub> /T	Sub amp, Low gain, No light	-	15	-	$\mu\text{V}/^\circ\text{C}$	B	
Thermal drift of offset voltage 5	V <sub>os5</sub> /T	Between main-sub amp, Hign gain, No light	-	100	-	$\mu\text{V}/^\circ\text{C}$	A-B	
Thermal drift of offset voltage 6	V <sub>os6</sub> /T	Between main-sub amp, Low gain, No light	-	45	-	$\mu\text{V}/^\circ\text{C}$	A-B	
Over/undershoot at gain switching	t <sub>str1</sub>	Common to high/low gain, Integral value of the first overshoot/undershoot peak value and overshoot/undershoot time	-	200	-	$\mu\text{s} \times \text{mV}$	A, B	
Stabilization time at gain switching	t <sub>str2</sub>	Common to high/low gain, time for $\pm 3\text{mV}$	-	-	25	$\mu\text{s}$	A, B	
Settling time	t <sub>est</sub>	Output voltage 500mV $\rightarrow$ 5mV	f=6.9MHz	-	30	-	ns	A
		Low gain, fall time						
Maximum output voltage	V <sub>omax</sub>	Common to high/low gain, V <sub>ref</sub> reference	1	-	-	V	A, B	

\*3 Sampling rate is 1pc./reflection membrane formation process lot

\*4 Applicable divisions correspond to output terminals.

A : V<sub>A</sub>, V<sub>B</sub>, V<sub>C</sub>, V<sub>D</sub>

B : V<sub>E+G</sub>, V<sub>F+H</sub>

\*5 Difference from V<sub>ref</sub>

\*6 Light source is a laser diode of  $\lambda=780\text{nm}$ .

\*7 -3dB level (0dB level is taken for output level when f=0.1MHz)

\*8 10 $\mu\text{W}$  of DC light is applied to the center of each photodiode, and 4 $\mu\text{W}$  of AC light is irradiated. BW=10kHz

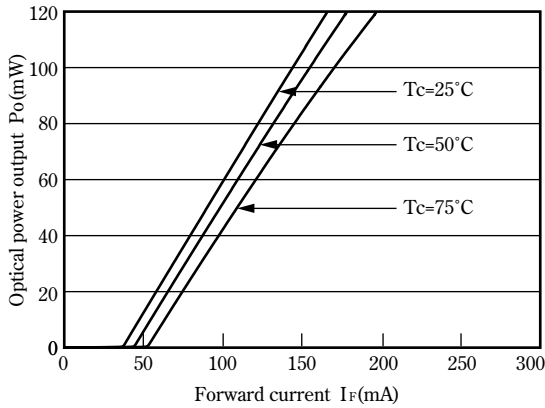
\*9 5k $\Omega$  of resistor and 10pF of capacitor should be connected in parallel between output terminal and V<sub>ref</sub> terminal.

\* These parameters are not guaranteed performance, but general specifications of each optical element which makes up a hologram laser.

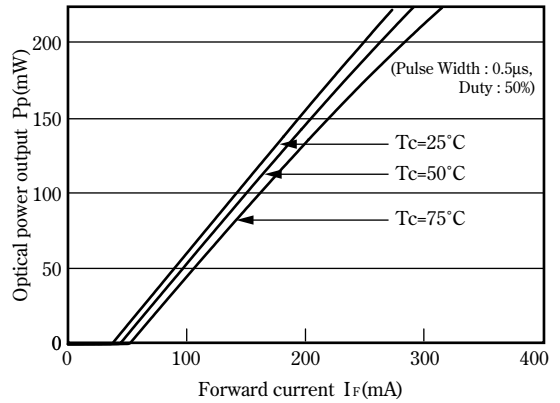
• Please refer to the chapter "Handling Precautions"

### SHARP

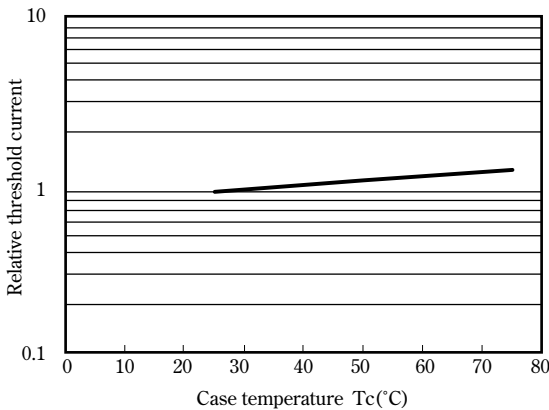
Optical power output - Forward current [CW]



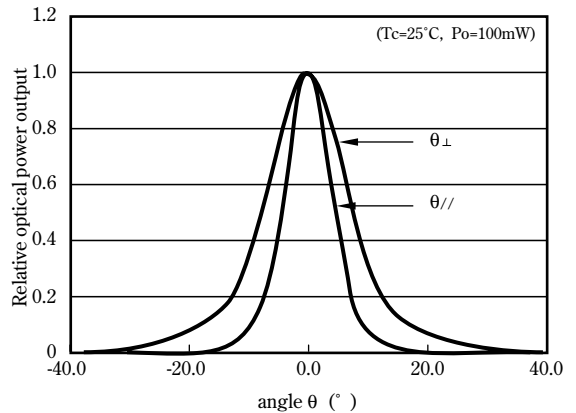
Optical power output - Forward current [Pulse]



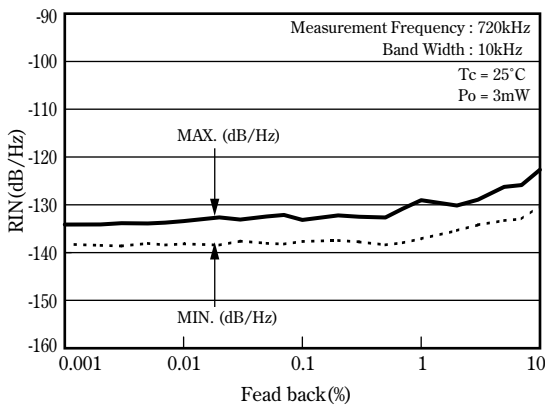
Case temperature dependence of threshold current [CW]



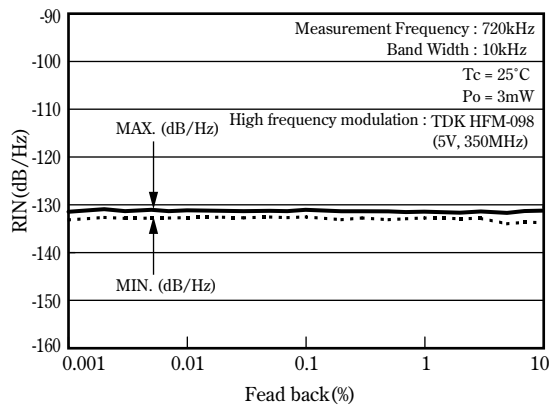
Far field pattern



Relative intensity noise (RIN) [without high frequency modulation]

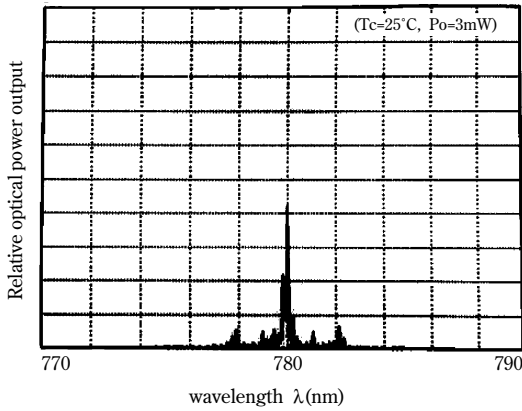


Relative intensity noise (RIN) [with high frequency modulation]

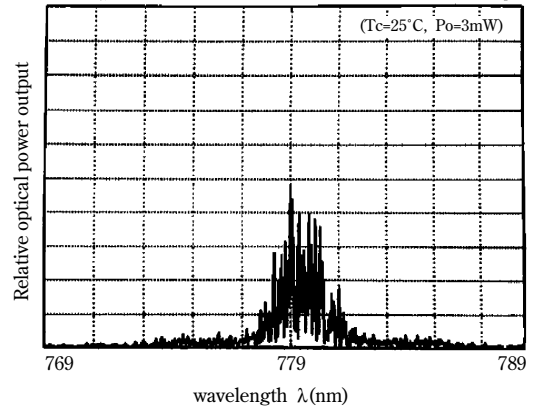


Note) Characteristics shown in diagrams are typical values. (not assurance value)

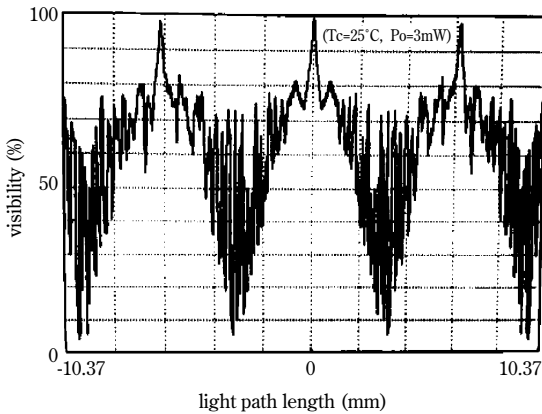
Lasing spectrum [without high frequency modulation]



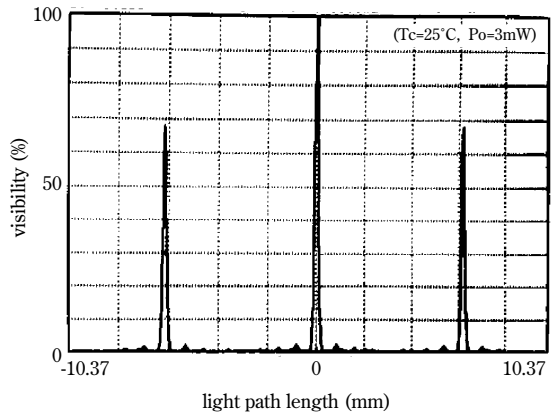
Lasing spectrum [with high frequency modulation]



Visibility [without high frequency modulation]



Visibility [with high frequency modulation]



Note) Characteristics shown in diagrams are typical values. (not assurance value)

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