

Transmitter/receiver photo IC for optical link

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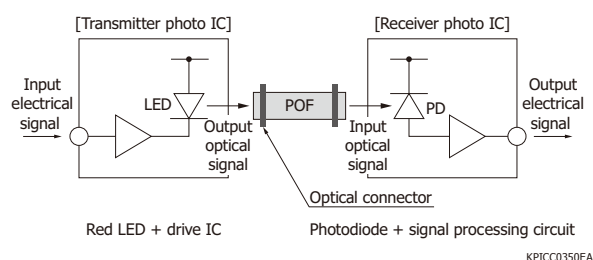
1. Overview

Optical fiber communication using plastic optical fibers (POF) features insusceptibility to external noise, high-speed data communication capability, and the like and is used in in-vehicle, FA, and consumer electronic optical networks.

Transmitter/receiver photo ICs for optical link are devices for POF optical communication.

The transmitter photo IC combines a red LED and a drive IC. The receiver photo IC monolithically integrates a photodiode and signal processing circuit to realize a digital output that is compatible with CMOS.

[Figure 1-1] Configuration example of optical communication using POF



We provide transmitter/receiver photo ICs for optical link shown in Table 1-1.

[Table 1-1] Hamamatsu transmitter/receiver photo ICs for optical link

Type no.		Data rate (Mbps)	Operating supply voltage (V)	Input/output level
Transmitter photo IC	L12422-01SR	DC to 10	3.135 to 3.465	TTL
	L12557-01SR	DC to 10	4.75 to 5.25	
Receiver photo IC	S13174-01SR	DC to 10	3.135 to 3.465	CMOS
	S12423-01SR	DC to 10	3.135 to 3.465	

2. Features

- ▶ Transmitter photo IC and receiver photo IC are available.
- ▶ Monolithic structure (receiver photo IC)

Receiver photo ICs integrate the photodiode and signal processing circuit into a monolithic structure to reduce effects from external electromagnetic noise.

- ▶ Wide dynamic range (receiver photo IC)

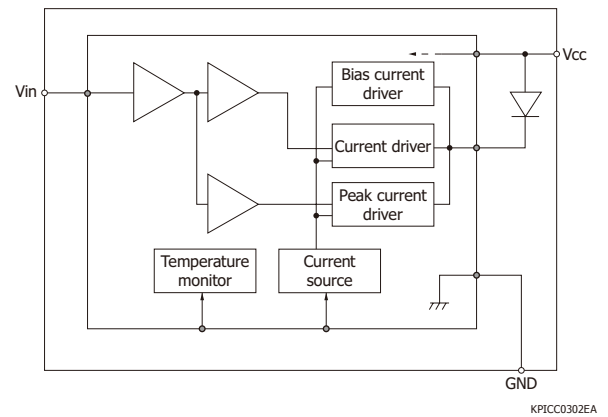
3. Structure

Figure 3-1 (a) shows a block diagram of the transmitter photo IC. When an electrical signal is input, the LED emits light.

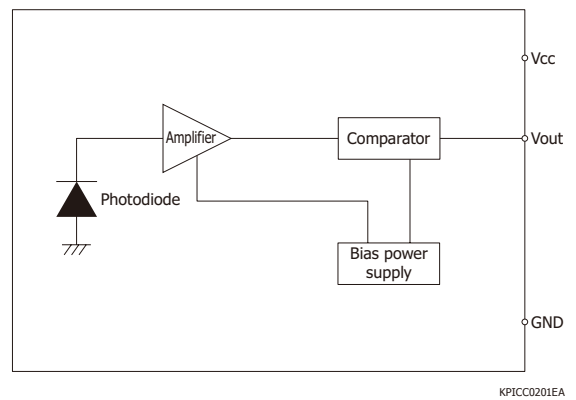
Figure 3-1 (b) shows a block diagram of the receiver photo IC. When an optical signal is input to the photodiode, an amplifier converts the current into voltage and amplifies the signal. Then, a comparator converts the signal into CMOS digital output.

[Figure 3-1] Block diagram

(a) Transmitter photo IC



(b) Receiver photo IC

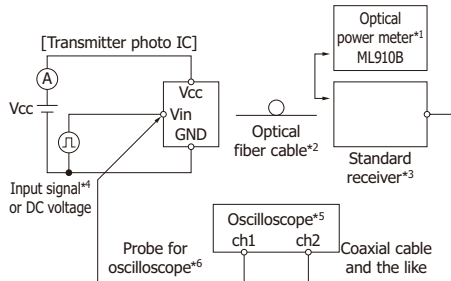


4. Measurement method

Figure 4-1 shows a measurement circuit for transmitter/receiver photo ICs for optical link.

[Figure 4-1] Measurement circuit

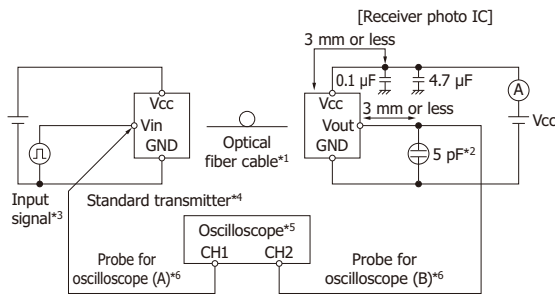
(a) Transmitter photo IC



- *1: Anritsu ML910B (MA9802A) or equivalent
- *2: Mitsubishi Chemical GH4001 (POF, 1 m) or equivalent
- *3: Hamamatsu APD module C5668 ($f_c=1$ GHz) or equivalent
- *4: NRZ signal in transmission band (1 Mbps or 10 Mbps)
 $V_{(hi)} \geq 2.0$ V, $V_{(lo)} \leq 0.4$ V, $t_r, t_f \leq 1$ ns
- *5: Frequency bandwidth of 400 MHz or higher
- *6: 1 MHz, 1 pF or lower

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(b) Receiver photo IC



- *1: Mitsubishi Rayon GH4001 (POF, 1 m) or equivalent
- *2: Includes parasitic capacitance such as a probe connector evaluation circuit
- *3: NRZ signal in the transmission band (1 Mbps or 10 Mbps)
 $V_{(hi)} \geq 2.0$ V, $V_{(lo)} \leq 0.4$ V, $t_r, t_f \leq 1$ ns
- *4: Performance as shown in the table below

Parameter	Symbol	Typical value
Rise time	t_r	1 ns
Fall time	t_f	1 ns
Pulse width distortion	ΔT	-0.5 ns
Jitter	Δt_j	-0.5 ns or less

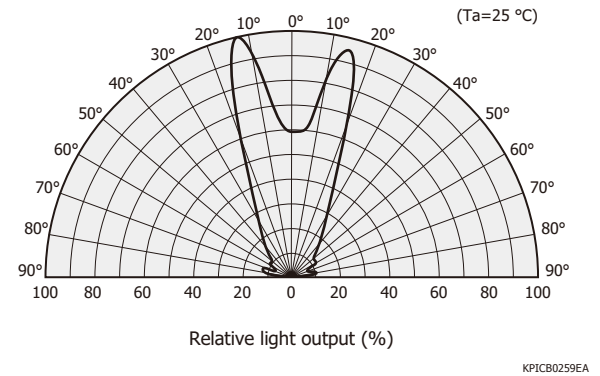
- *5: Frequency bandwidth of 400 MHz or higher
- *6: 1 MHz, 1 pF or lower

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5. Characteristics

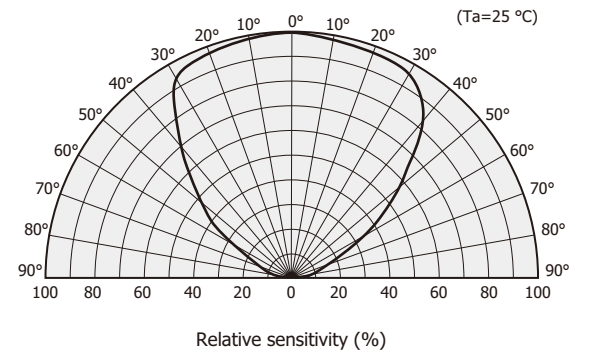
[Figure 5-1] Directivity (typical example)

(a) Transmitter photo IC



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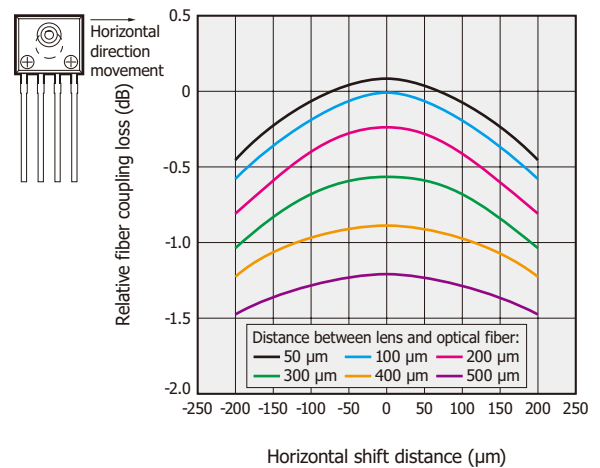
(b) Receiver photo IC



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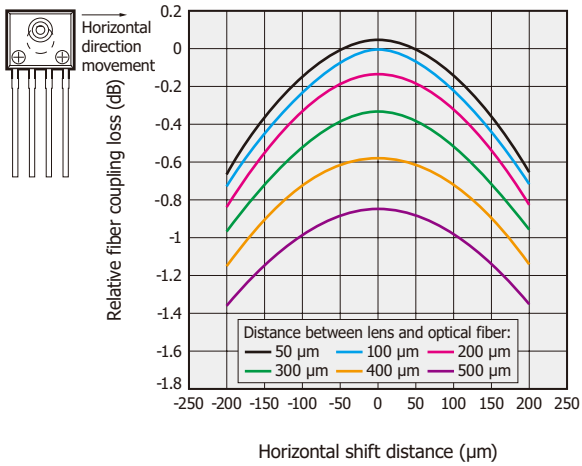
[Figure 5-2] Fiber coupling efficiency (typical example)

(a) Transmitter photo IC



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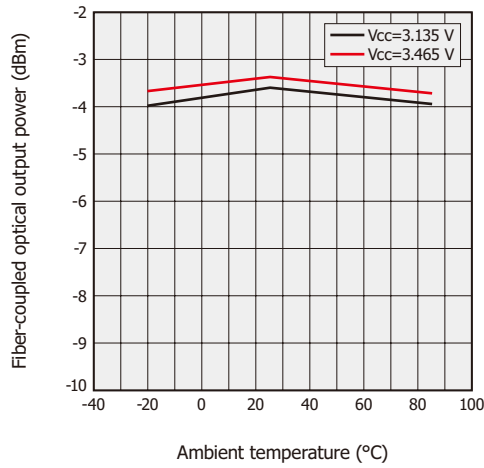
(b) Receiver photo IC



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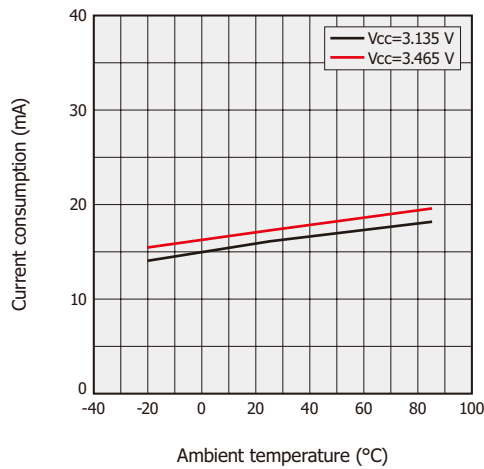
[Figure 5-3] Temperature characteristics
(transmitter photo IC: L12422-01SR, typical example)

(a) Fiber-coupled optical output power



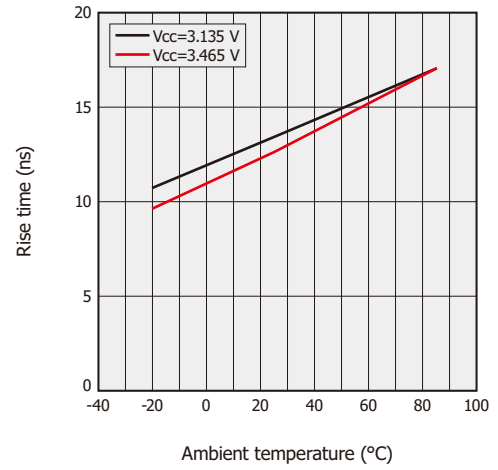
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(b) Current consumption



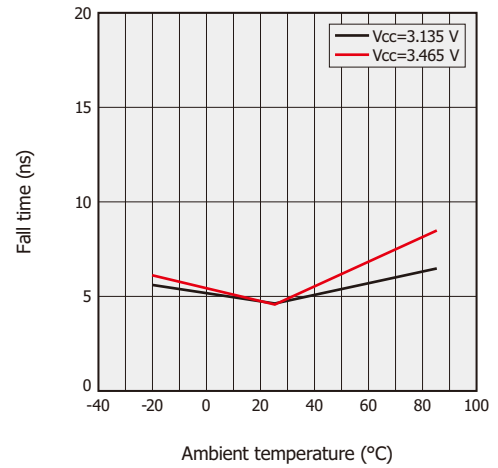
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(c) Rise time



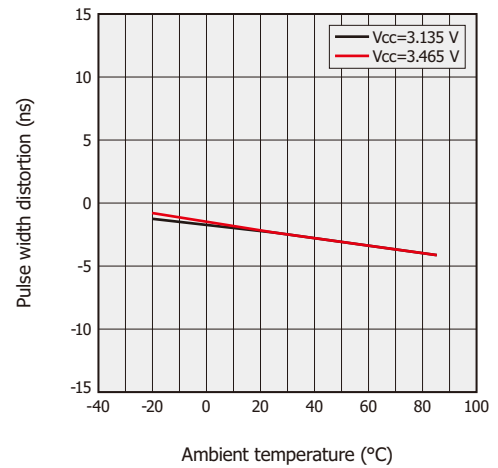
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(d) Fall time



KPICB0266EB

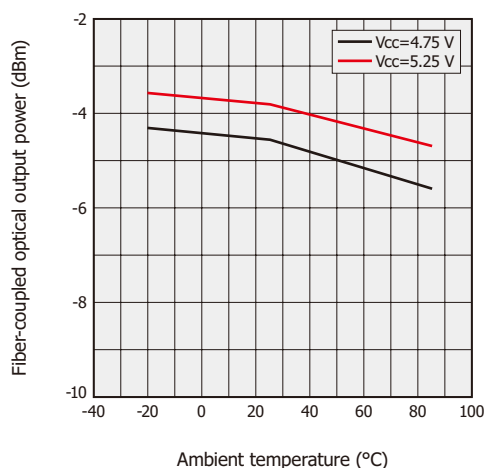
(e) Pulse width distortion



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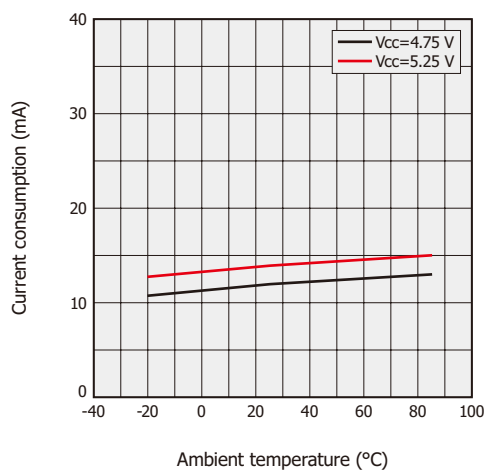
[Figure 5-4] Temperature characteristics
(transmitter photo IC: L12557-01SR, typical example)

(a) Fiber-coupled optical output power



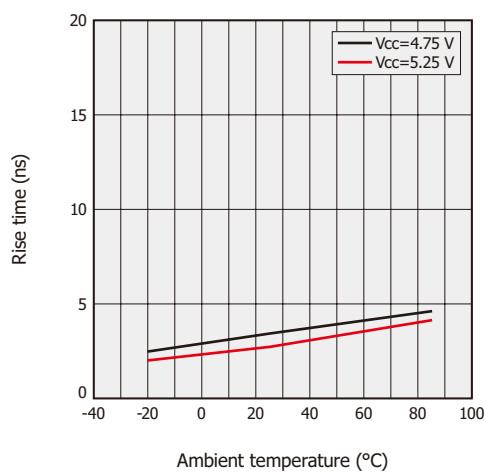
KPICB0328EA

(b) Current consumption



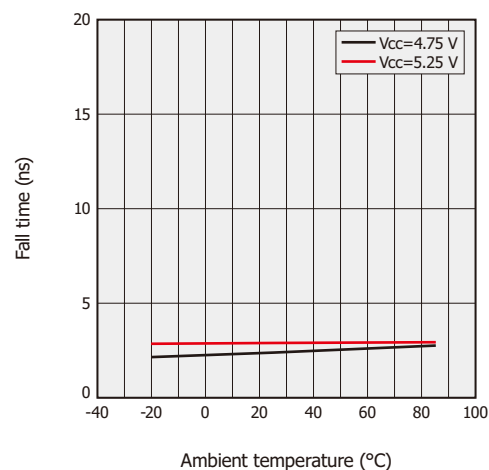
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(c) Rise time



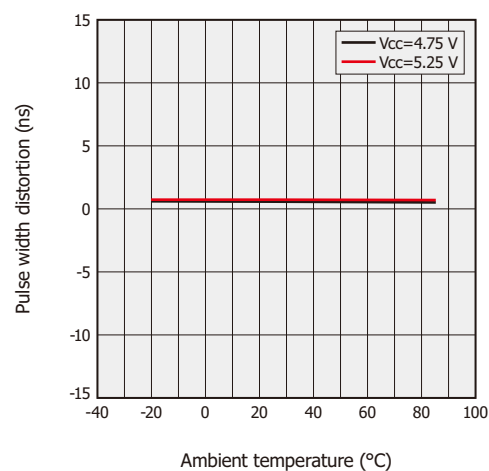
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(d) Fall time



KPICB0331EA

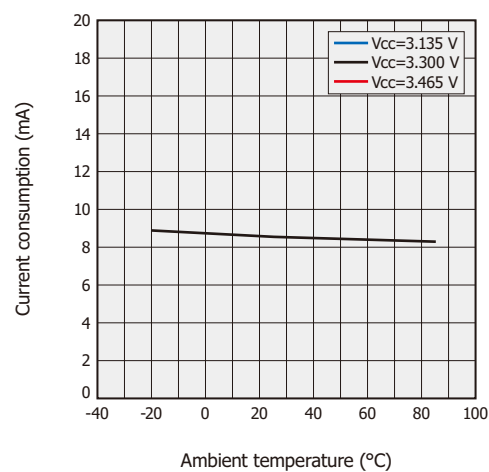
(e) Pulse width distortion



KPICB0332EA

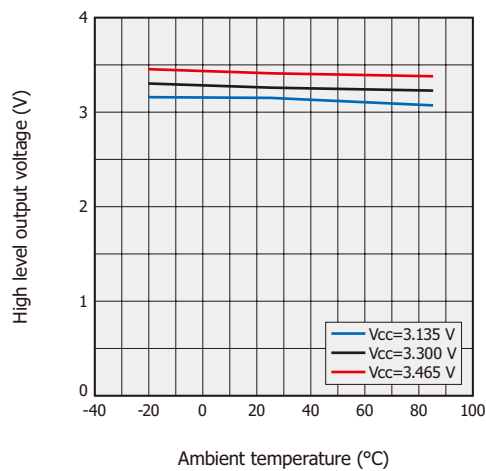
[Figure 5-5] Temperature characteristics
(receiver photo IC: S13174-01SR, typical example)

(a) Current consumption



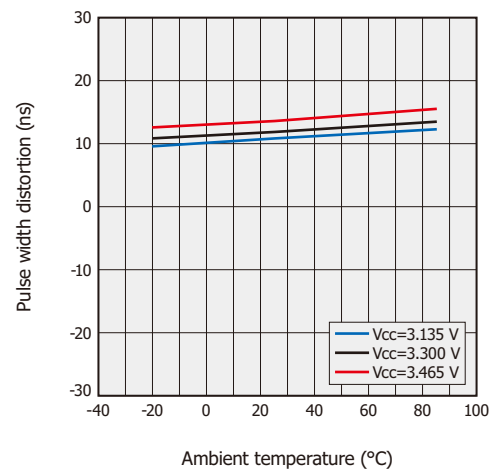
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(b) High level output voltage



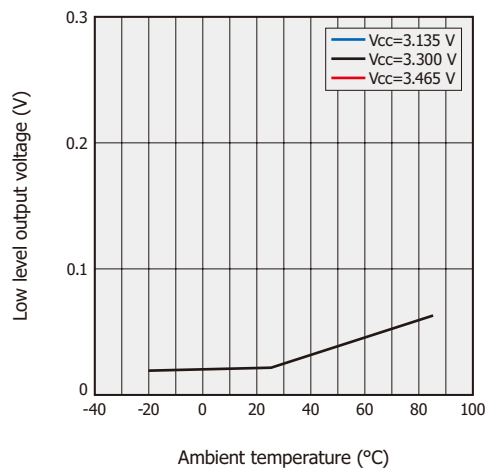
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(e) Pulse width distortion (Pin=0 dBm)



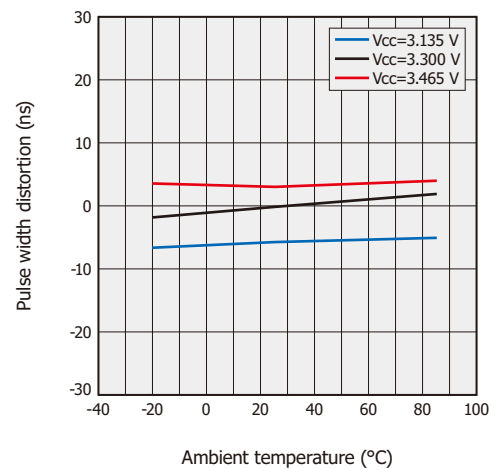
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(c) Low level output voltage



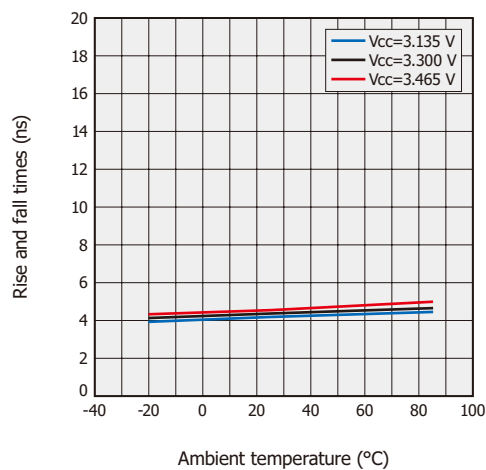
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(f) Pulse width distortion (Pin=-24 dBm)



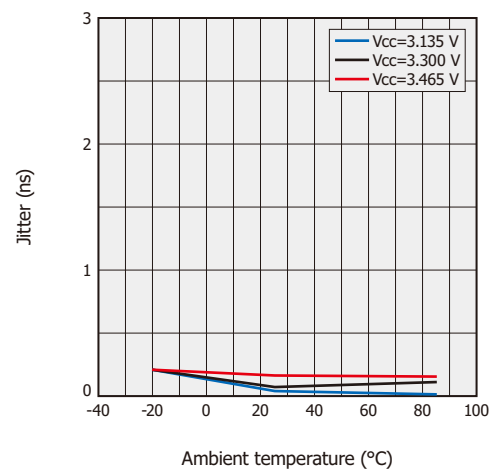
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(d) Rise and fall times



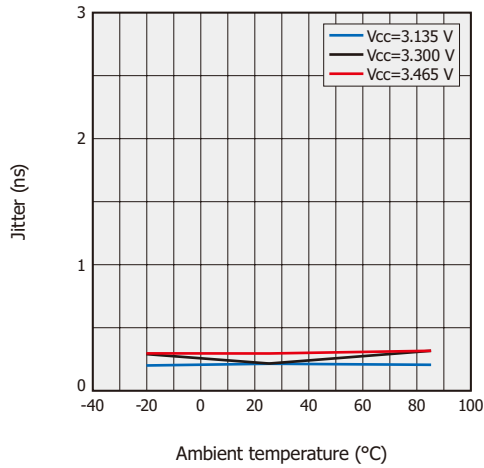
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(g) Jitter (Pin=0 dBm)



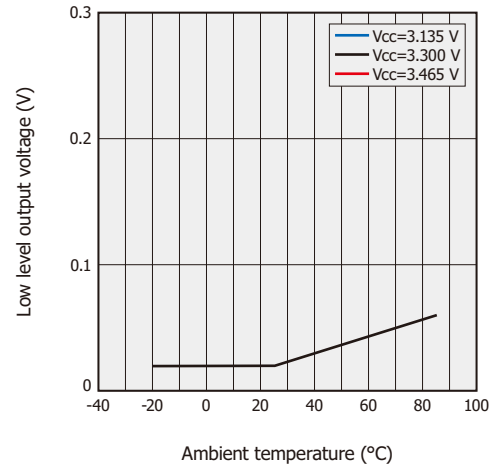
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(h) Jitter (Pin=-24 dBm)



KPICB0283EA

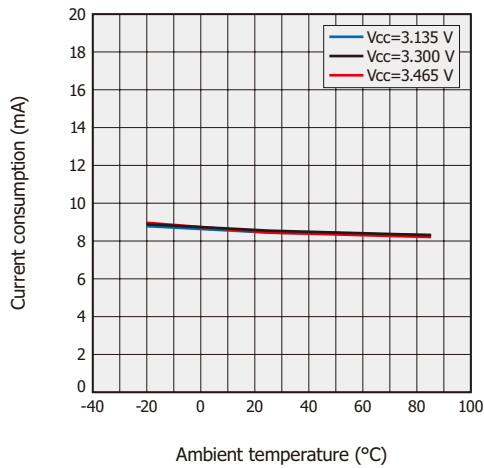
(c) Low level output voltage



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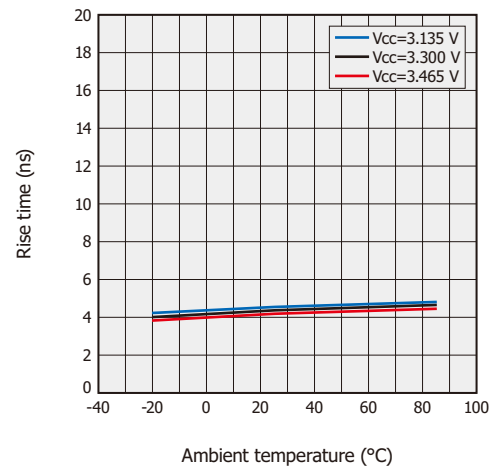
[Figure 5-6] Temperature characteristics
(S12423-01SR, typical example)

(a) Current consumption



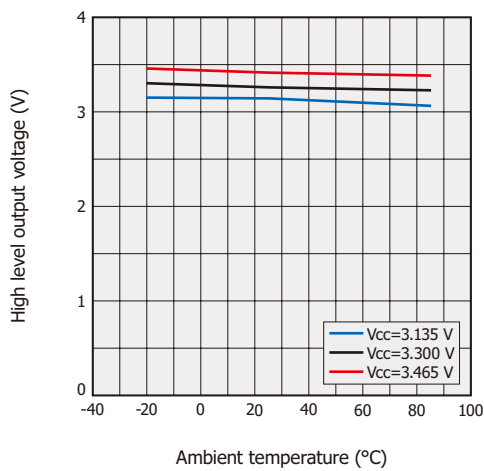
KPICB0333EA

(d) Rise time



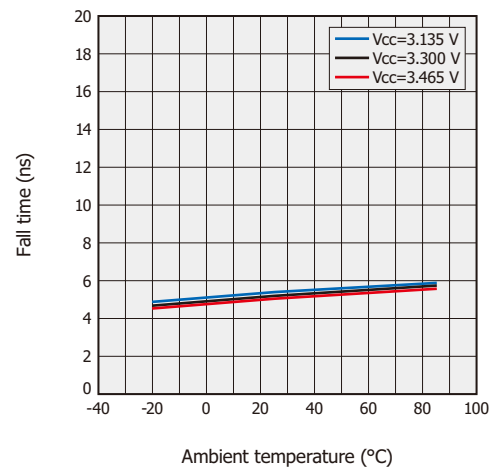
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(b) High level output voltage



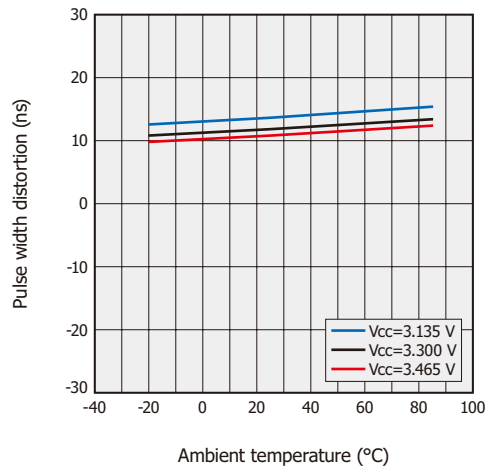
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(e) Fall time



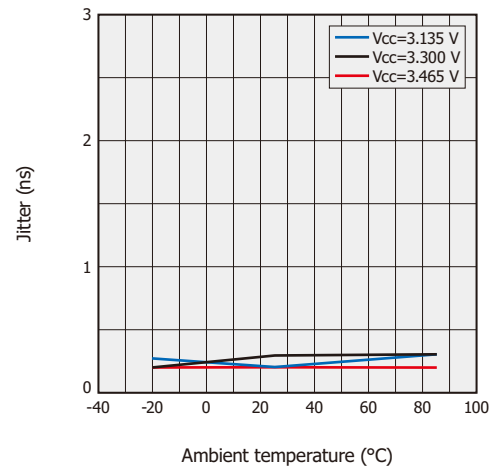
KPICB0337EA

(f) Pulse width distortion (Pin=-2 dBm)



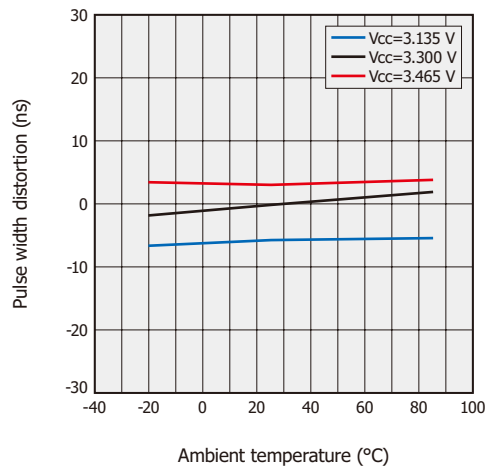
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(i) Jitter (Pin=-20 dBm)



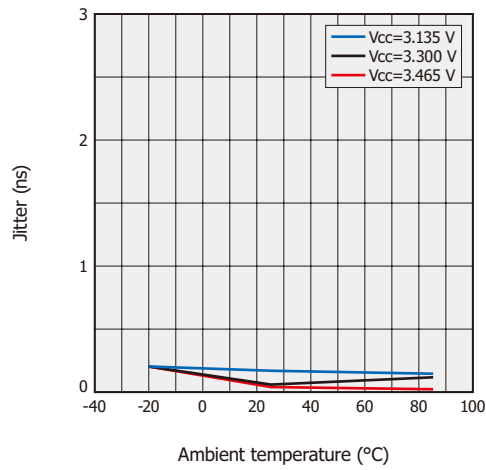
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(g) Pulse width distortion (Pin=-20 dBm)



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(h) Jitter (Pin=-2 dBm)



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6. Q&A

(1) The power supply voltage is 3.3 V. Can I use it with 5 V?

It cannot be used with 5 V (cannot withstand 5 V).

(2) The transmitter photo IC has two GND terminals, and the receiver photo IC has two Vcc terminals. Explain the connection for the two terminals.

Each of the two terminals is connected inside the package, so it is only necessary to connect one of the terminals to GND or Vcc.

(3) What is the packing state?

100 pieces per tray.

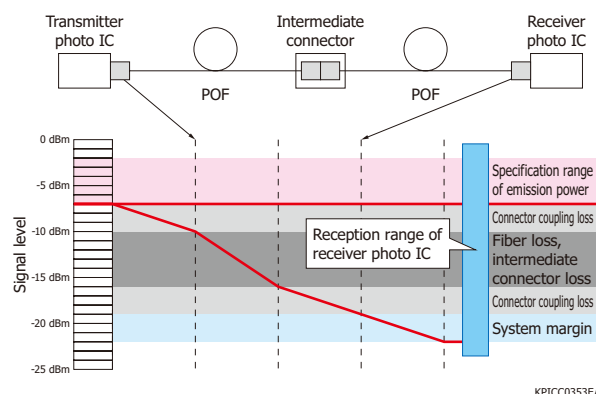
(4) What kind of problems will there be if there is a poor connection with the fiber?

Light output from the transmitter photo IC may decrease, and the sensitivity of the receiver photo IC may decrease.

(5) Explain the power budget.

It is necessary to consider attenuation for each component [Figure 6-1].

[Figure 6-1] Power budget example



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Information described in this material is current as of March 2025.

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HAMAMATSU

www.hamamatsu.com

HAMAMATSU PHOTONICS K.K., Solid State Division

1126-1 Ichino-cho, Chuo-ku, Hamamatsu City, 435-8558 Japan, Telephone: (81)53-434-3311, Fax: (81)53-434-5184

U.S.A.: HAMAMATSU CORPORATION: 360 Foothill Road, Bridgewater, NJ 08807, U.S.A., Telephone: (1)908 231 0960, Fax: (1)908 231 1218

Germany: HAMAMATSU PHOTONICS DEUTSCHLAND GMBH: Arzbergerstr. 10, 82211 Herrsching am Ammersee, Germany, Telephone: (49)8152 375 0, Fax: (49)8152 265 8 E mail: info@hamamatsu.de

France: HAMAMATSU PHOTONICS FRANCE S.A.R.L.: 19 Rue du Saule Trapu, Parc du Moulin de Massy, 91882 Massy Cedex, France, Telephone: (33)1 69 53 71 00, Fax: (33)1 69 53 71 10 E mail: infos@hamamatsu.fr

United Kingdom: HAMAMATSU PHOTONICS UK LIMITED: 2 Howard Court, 10 Tewin Road, Welwyn Garden City, Hertfordshire, AL7 1BW, UK, Telephone: (44)1707 294888, Fax: (44)1707 325777 E mail: info@hamamatsu.co.uk

North Europe: HAMAMATSU PHOTONICS NORDEN AB: Torshamnsgatan 35, 16440 Kista, Sweden, Telephone: (46)8 509 031 00, Fax: (46)8 509 031 01 E mail: info@hamamatsu.se

Italy: HAMAMATSU PHOTONICS ITALIA S.R.L.: Strada della Moia, 1 int. 6 20044 Arese (Milano), Italy, Telephone: (39)02 93 58 17 33, Fax: (39)02 93 58 17 41 E mail: info@hamamatsu.it

China: HAMAMATSU PHOTONICS (CHINA) CO., LTD.: 1201, Tower B, Jiaoning Center, 27 Dongsanhuan Beilu, Chaoyang District, 100020 Beijing, P.R. China, Telephone: (86)10 6586 6006, Fax: (86)10 6586 2866 E mail: hpc@hamamatsu.com.cn

Taiwan: HAMAMATSU PHOTONICS TAIWAN CO., LTD.: 13F 1, No.101, Section 2, Gongdao 5th Road, East Dist., Hsinchu City, 300046, Taiwan(R.O.C) Telephone: (886)3 659 0080, Fax: (886)3 659 0081 E mail: info@hamamatsu.com.tw

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