DATA SHEET

NEC

PHOTOCOUPLER
PS9122

1 Mbps OPEN COLLECTOR OUTPUT TYPE 5-PIN SOP (SO-5) HIGH-SPEED PHOTOCOUPLER

–NEPOC Series–

DESCRIPTION

The PS9122 is an optical coupled high-speed, active low type isolator containing a GaAlAs LED on the input side and a photodiode and a signal processing circuit on the output side on one chip.

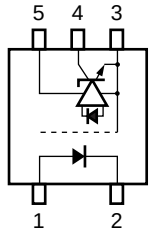
The PS9122 is a high-speed digital output type photocoupler designed specifically for low circuit current.

The PS9122 is in 5-pin plastic SOP (Small Outline Package) and is suitable for high density application.

FEATURES

- Supply Voltage
  N rank: V_{CC} = 3.3 V
  L rank: V_{CC} = 5 V
- Pulse width distortion ($|t_{PHL} - t_{PLH}|$ = 200 ns MAX.)
- Small package (SO-5)
- High-speed (1 Mbps)
- High isolation voltage (BV = 3 750 Vr.m.s.)
- Open collector output
- Ordering number of taping product: PS9122-F3: 2 500 pcs/reel
- Pb-Free product
- Safety standards
  - UL approved: File No. E72422
  - DIN EN60747-5-2 (VDE0884 Part2) approved No.40008902 (option)

PIN CONNECTION
(Top View)



1. Anode
2. Cathode
3. GND
4. V_O
5. V_{CC}

TRUTH TABLE

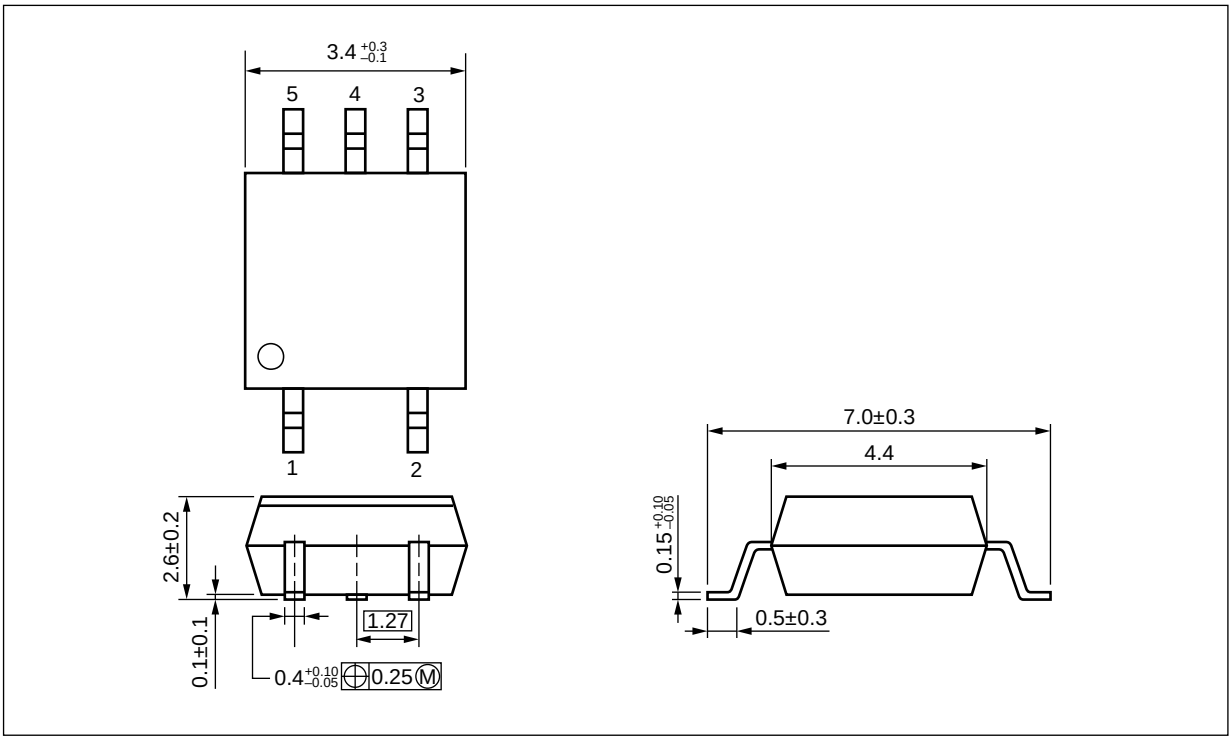
LED	Output
ON	L
OFF	H

APPLICATIONS

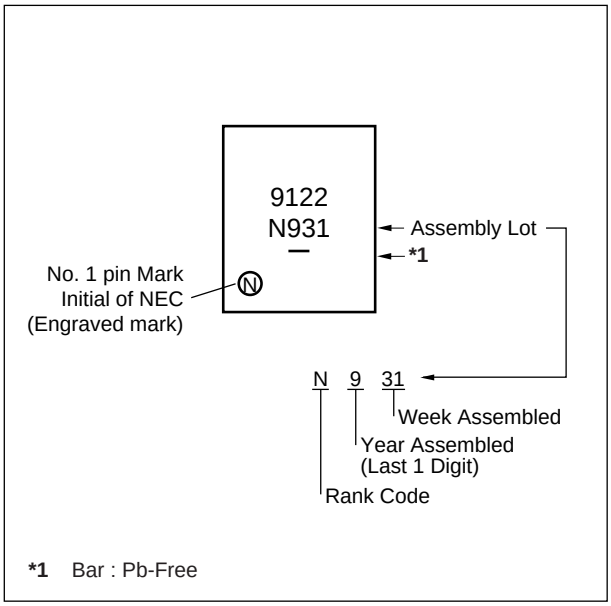
- PoE (Power over Ethernet)
- Measurement equipment
- FA Network

Document No.
Date Published Dec. 2009
Printed in Japan

PACKAGE DIMENSIONS (UNIT: mm)



MARKING EXAMPLE



ORDERING INFORMATION

Part Number	Order Number	Rank	Solder Plating Specification	Packing Style
PS9122	PS9122-AX	N*1	Pb-Free	20 pcs (Tape 20 pcs cut)
		L*2		
PS9122-F3	PS9122-F3-AX	N*1		Embossed Tape 2 500 pcs/reel
		L*2		

***1** N rank: V_{CC} = 3.3 V

***2** L rank: V_{CC} = 5 V

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C, unless otherwise specified)

Parameter		Symbol	Ratings	Unit
Diode	Forward Current*1	I_F	25	mA
	Reverse Voltage	V_R	5	V
Detector	Supply Voltage	V_{CC}	7	V
	Output Voltage	V_O	7	V
	Output Current	I_O	20	mA
	Power Dissipation*2	P_C	40	mW
Isolation Voltage*3		BV	3 750	Vr.m.s.
Operating Ambient Temperature		T_A	−40 to +100	°C
Storage Temperature		T_{stg}	−55 to +125	°C

***1** Reduced to 0.17 mA/°C at T_A = 25°C or more.

***2** Applies to output pin V_O (collector pin). Reduced to 1.5 mW/°C at T_A = 80°C or more.

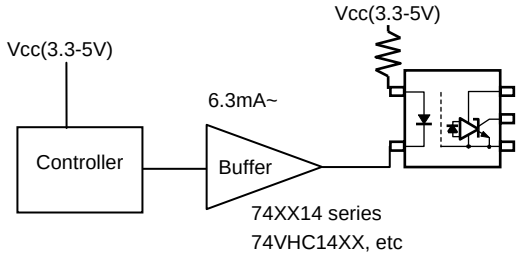
***3** AC voltage for 1 minute at T_A = 25°C, RH = 60% between input and output.
Pins 1-2 shorted together, 3-5 shorted together.

RECOMMENDED OPERATING CONDITIONS

Parameter		Symbol	MIN.	TYP.	MAX.	Unit
Low Level Input Voltage		V_{FL}	0		0.8	V
High Level Input Current		I_{FH}	6.3	10	12.5	mA
Supply Voltage	N rank	V_{CC}	2.7	3.3	3.6	V
	L rank		4.5	5.0	5.5	
TTL (R_L = 1 kΩ, loads)		N			3	
Pull-up Resistor		R_L	330		4 k	Ω

Driver circuit

It is recommended to use some buffer for low output current controller, especially in the case of low Vcc, otherwise to confirm that enough input current is supplied from controller.



ELECTRICAL CHARACTERISTICS: N rank (T_A = –40 to +100°C, unless otherwise specified)

Parameter		Symbol	Conditions	MIN.	TYP.*1	MAX.	Unit
Diode	Forward Voltage	V_F	I_F = 10 mA, T_A = 25°C		1.6	1.8	V
	Reverse Current	I_R	V_R = 3 V, T_A = 25°C			10	μA
	Terminal Capacitance	C_t	V = 0 V, f = 1 MHz, T_A = 25°C		30		pF
Detector	High Level Output Current	I_{OH}	V_{CC} = V_O = 3.3 V, V_F = 0.8 V		1	100	μA
	Low Level Output Voltage*2	V_{OL}	V_{CC} = 3.3 V, I_F = 5 mA, I_{OL} = 10 mA		0.2	0.6	V
	High Level Supply Current	I_{CCH}	V_{CC} = 3.3 V, I_F = 0 mA, V_O = Open			2	mA
	Low Level Supply Current	I_{CCL}	V_{CC} = 3.3 V, I_F = 10 mA, V_O = Open			3	
Coupled	Threshold Input Current (H → L)	I_{FHL}	V_{CC} = 3.3 V, V_O = 0.8 V, R_L = 350 Ω		2	5	mA
	Isolation Resistance	R_{I-O}	V_{I-O} = 1 kV_{DC}, RH = 40 to 60%, T_A = 25°C	10^{11}			Ω
	Isolation Capacitance	C_{I-O}	V = 0 V, f = 1 MHz, T_A = 25°C		0.6		pF
	Propagation Delay Time (H → L)	t_{PHL}	V_{CC} = 3.3 V, R_L = 350 Ω, I_F = 7.5 mA, V_{THHL} = V_{THLH} = 1.5 V			500	ns
	Propagation Delay Time (L → H)	t_{PLH}				700	
	Pulse Width Distortion (PWD)	$\lvert t_{PHL}-t_{PLH} \rvert$	V_{CC} = 3.3 V, R_L = 350 Ω, I_F = 7.5 mA, V_{THHL} = V_{THLH} = 1.5 V			200	ns
	Common Mode Transient Immunity at High Level Output	CMH	IF = 0mA, Vcc = 3.3V, Vo > 2.0V, RL = 350Ω, VCM = 1.0kV, TA = 25℃	15	20		kV/us
	Common Mode Transient Immunity at Low Level Output	CML	IF = 7.5mA, Vcc = 3.3V, Vo < 0.8V, RL = 350Ω, VCM = 1.0kV, TA = 25℃	15	20		kV/us

***1** Typical values at T_A = 25°C

***2** Because V_{OL} of 2 V or more may be output when LED current input and when output supply of V_{CC} = 2 V more or less, it is important to confirm the characteristics (operation with the power supply on and off) during design, before using this device.

ELECTRICAL CHARACTERISTICS: L rank (T_A = –40 to +100°C, unless otherwise specified)

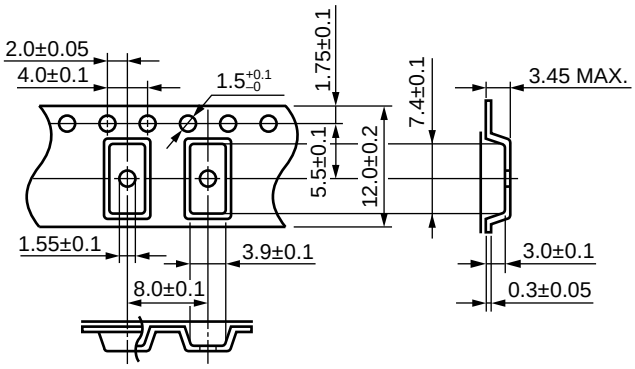
Parameter		Symbol	Conditions	MIN.	TYP.*1	MAX.	Unit
Diode	Forward Voltage	V_F	I_F = 10 mA, T_A = 25°C		1.6	1.8	V
	Reverse Current	I_R	V_R = 3 V, T_A = 25°C			10	μA
	Terminal Capacitance	C_t	V = 0 V, f = 1 MHz, T_A = 25°C		30		pF
Detector	High Level Output Current	I_{OH}	V_{CC} = V_O = 5 V, V_F = 0.8 V		1	100	μA
	Low Level Output Voltage*2	V_{OL}	V_{CC} = 5 V, I_F = 5 mA, I_{OL} = 13 mA		0.2	0.6	V
	High Level Supply Current	I_{CCH}	V_{CC} = 5 V, I_F = 0 mA, V_O = Open			2.5	mA
	Low Level Supply Current	I_{CCL}	V_{CC} = 5 V, I_F = 10 mA, V_O = Open			3.5	
Coupled	Threshold Input Current (H → L)	I_{FHL}	V_{CC} = 5 V, V_O = 0.8 V, R_L = 350 Ω		2	5	mA
	Isolation Resistance	R_{I-O}	V_{I-O} = 1 kV_{DC}, RH = 40 to 60%, T_A = 25°C	10^{11}			Ω
	Isolation Capacitance	C_{I-O}	V = 0 V, f = 1 MHz, T_A = 25°C		0.6		pF
	Propagation Delay Time (H → L)	t_{PHL}	V_{CC} = 5 V, R_L = 350 Ω, I_F = 7.5 mA, V_{THHL} = V_{THLH} = 1.5 V			500	ns
	Propagation Delay Time (L → H)	t_{PLH}				700	
	Pulse Width Distortion (PWD)	$\lvert t_{PHL}-t_{PLH} \rvert$	V_{CC} = 5 V, R_L = 350 Ω, I_F = 7.5 mA, V_{THHL} = V_{THLH} = 1.5 V			200	ns
	Common Mode Transient Immunity at High Level Output	CMH	IF = 0mA, Vcc = 5V, Vo > 2.0V, RL = 350Ω, VCM = 1.0kV, TA = 25℃	15	20		kV/us
	Common Mode Transient Immunity at Low Level Output	CML	IF =7.5mA, Vcc = 5V, Vo < 0.8V, RL = 350, VCM = 1.0kV, TA = 25℃	15	20		kV/us

***1** Typical values at T_A = 25°C

***2** Because V_{OL} of 2 V or more may be output when LED current input and when output supply of V_{CC} = 2 V more or less, it is important to confirm the characteristics (operation with the power supply on and off) during design, before using this device.

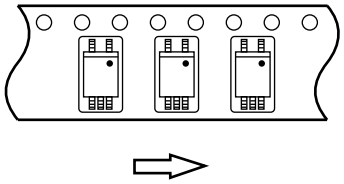
TAPING SPECIFICATIONS (UNIT: mm)

Outline and Dimensions (Tape)

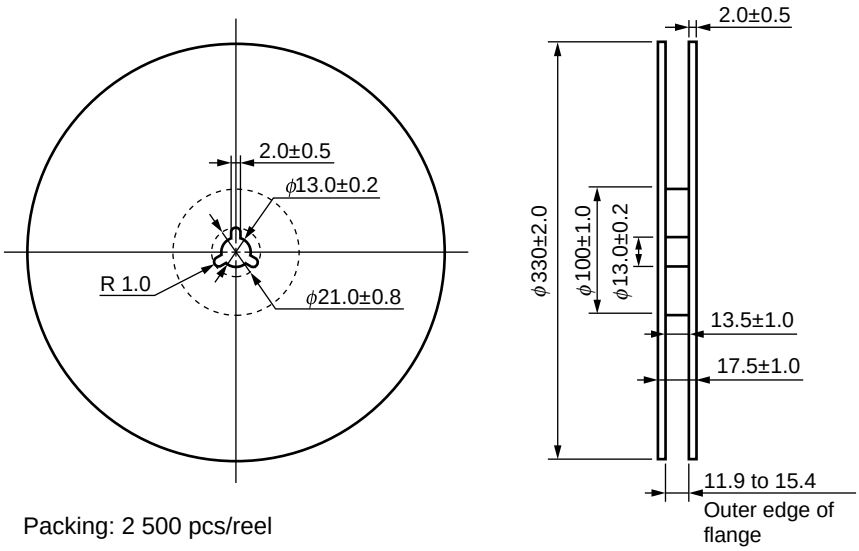


Tape Direction

PS9122-F3



Outline and Dimensions (Reel)



Packing: 2 500 pcs/reel

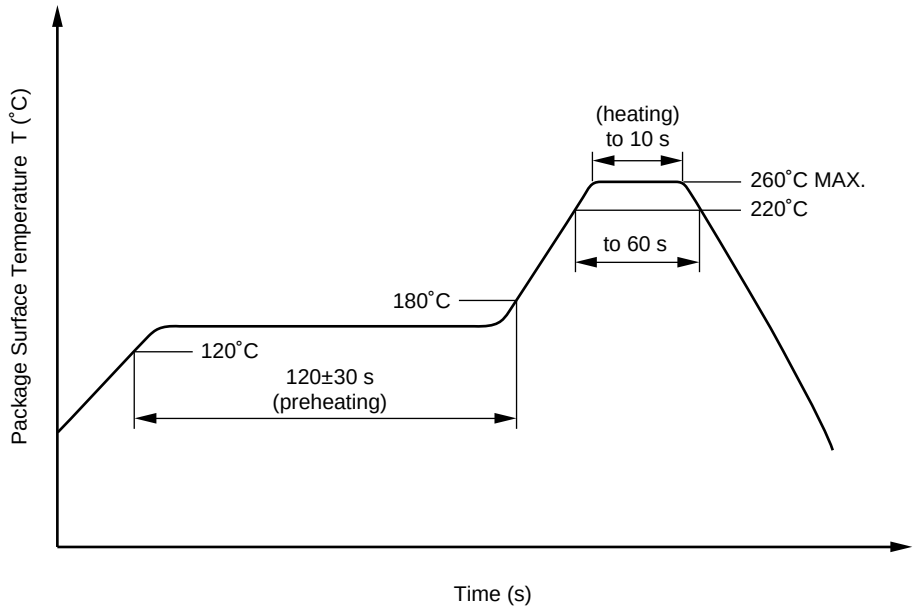
NOTES ON HANDLING

1. Recommended soldering conditions

(1) Infrared reflow soldering

- Peak reflow temperature — 260°C or below (package surface temperature)
- Time of peak reflow temperature — 10 seconds or less
- Time of temperature higher than 220°C — 60 seconds or less
- Time to preheat temperature from 120 to 180°C — 120±30 s
- Number of reflows — Three
- Flux — Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt% is recommended.)

Recommended Temperature Profile of Infrared Reflow



(2) Wave soldering

- Temperature — 260°C or below (molten solder temperature)
- Time — 10 seconds or less
- Preheating conditions — 120°C or below (package surface temperature)
- Number of times — One (Allowed to be dipped in solder including plastic mold portion.)
- Flux — Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt% is recommended.)

(3) Soldering by Soldering Iron

- Peak Temperature (lead part temperature) — 350°C or below
- Time (each pins) — 3 seconds or less
- Flux — Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt% is recommended.)

(a) Soldering of leads should be made at the point 1.5 to 2.0 mm from the root of the lead

(b) Please be sure that the temperature of the package would not be heated over 100°C

(4) Cautions

• Fluxes

Avoid removing the residual flux with freon-based and chlorine-based cleaning solvent.

2. Cautions regarding noise

Be aware that when voltage is applied suddenly between the photocoupler's input and output or between collector-emitters at startup, the output transistor may enter the on state, even if the voltage is within the absolute maximum ratings.

USAGE CAUTIONS

1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
2. By-pass capacitor of 0.1 μF is used between V_{CC} and GND near device. Also, ensure that the distance between the leads of the photocoupler and capacitor is no more than 10 mm.
3. Avoid storage at a high temperature and high humidity.

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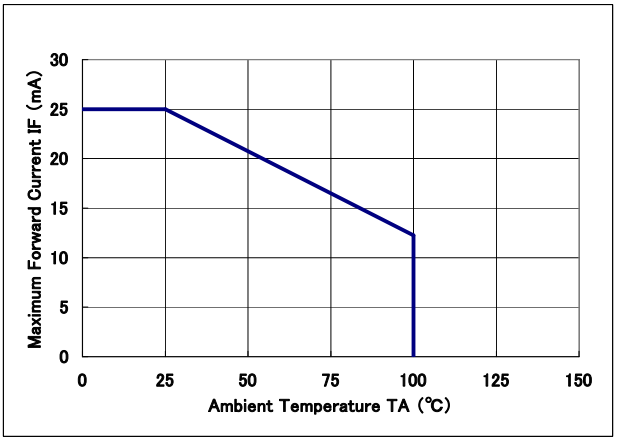
M8E 02. 11-1

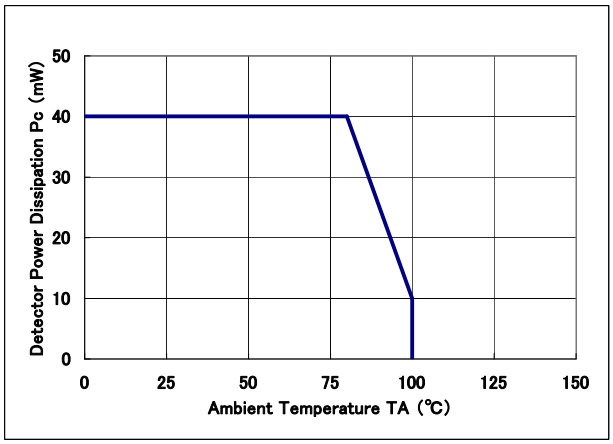
Caution GaAs Products	This product uses gallium arsenide (GaAs). GaAs vapor and powder are hazardous to human health if inhaled or ingested, so please observe the following points. • Follow related laws and ordinances when disposing of the product. If there are no applicable laws and/or ordinances, dispose of the product as recommended below. 1. Commission a disposal company able to (with a license to) collect, transport and dispose of materials that contain arsenic and other such industrial waste materials. 2. Exclude the product from general industrial waste and household garbage, and ensure that the product is controlled (as industrial waste subject to special control) up until final disposal. • Do not burn, destroy, cut, crush, or chemically dissolve the product. • Do not lick the product or in any way allow it to enter the mouth.

TYPICAL CHARACTERISTICS (TA=25℃, unless otherwise specified)

MAXIMUM FORWARD CURRENT vs. AMBIENT TEMPERATURE

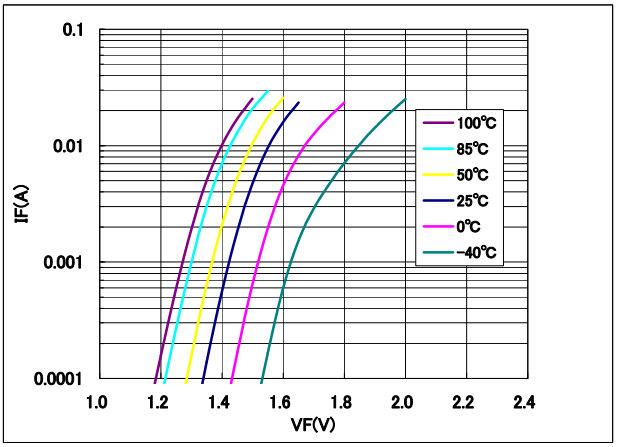


DETECTOR POWER DISSIPATION* vs. AMBIENT TEMPERATURE

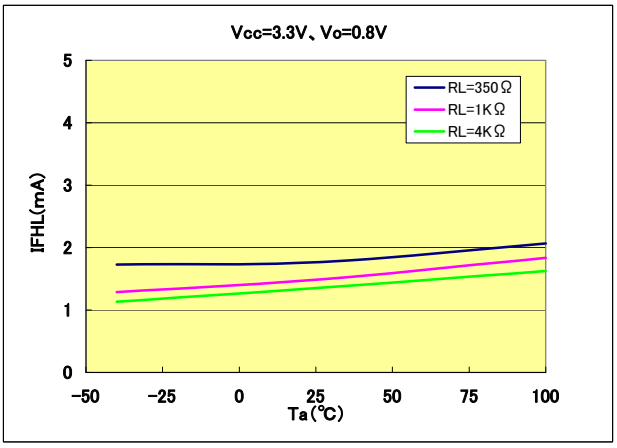


*Applies to output pin Vo (collector pin).

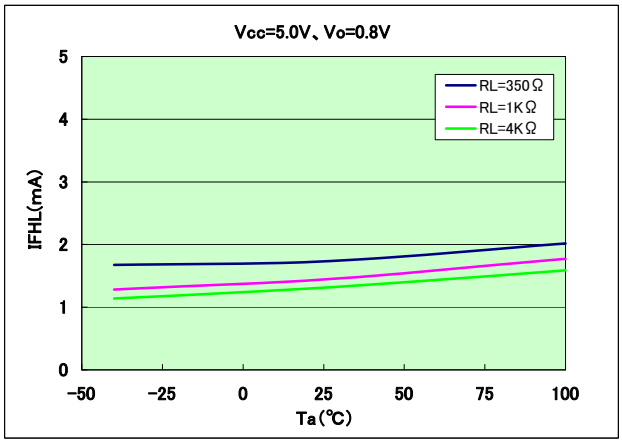
FORWARD CURRENT vs. FORWARD VOLTAGE



THRESHOLD INPUT CURRENT vs. AMBIENT TEMPERATURE



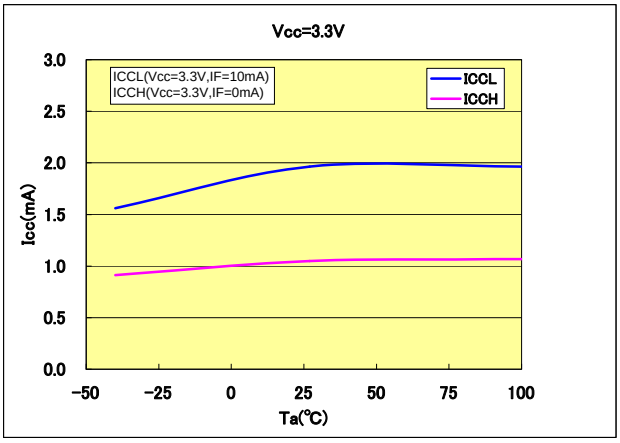
THRESHOLD INPUT CURRENT vs. AMBIENT TEMPERATURE



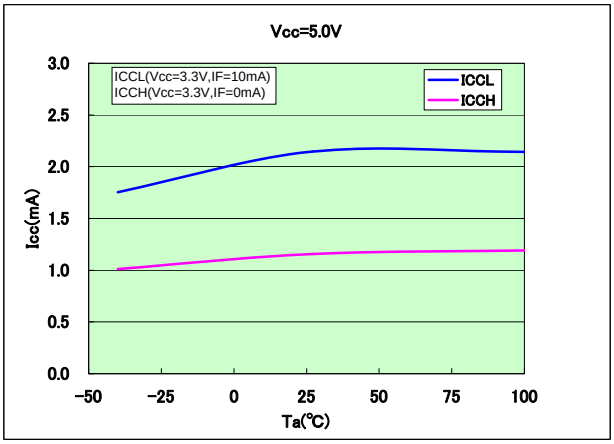
Remark The graphs indicate nominal characteristics.

TYPICAL CHARACTERISTICS (TA=25℃, unless otherwise specified)

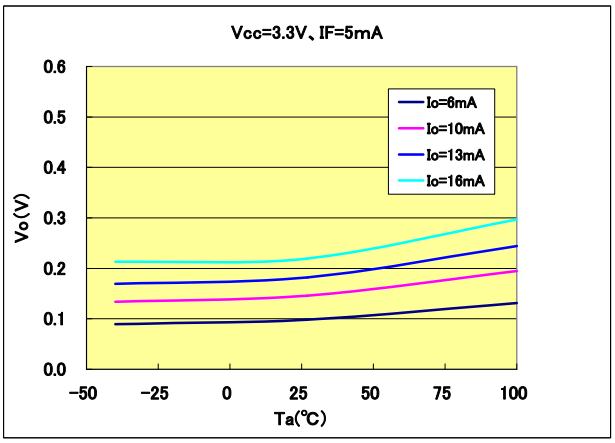
SUPPLY CURRENT vs. AMBIENT TEMPERATURE



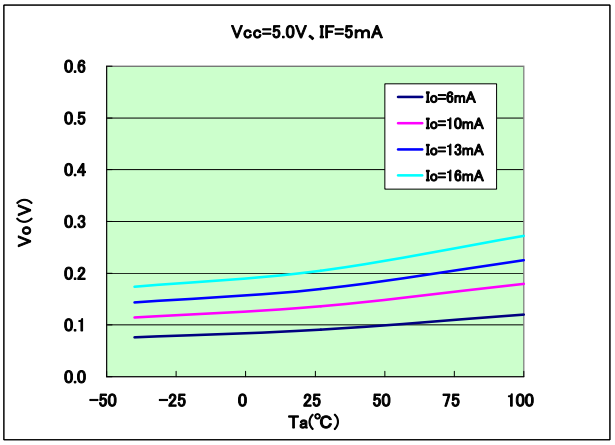
SUPPLY CURRENT vs. AMBIENT TEMPERATURE



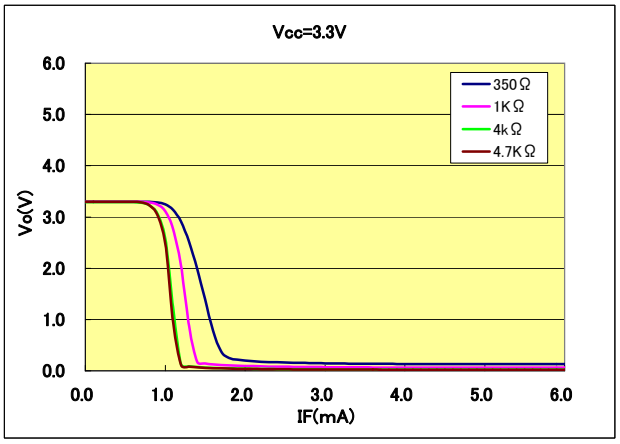
LOW LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE



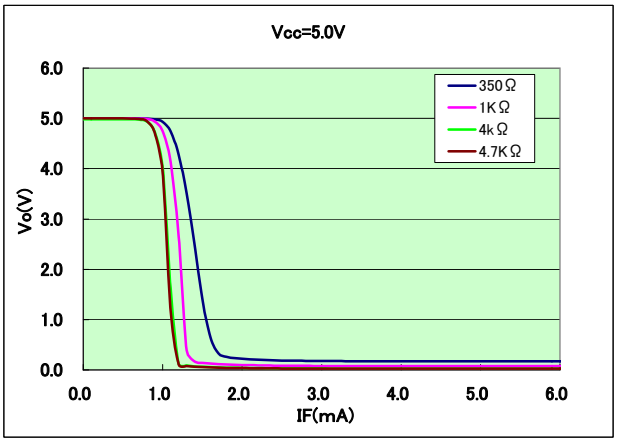
LOW LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE



OUTPUT VOLTAGE vs. FORWARD CURRENT



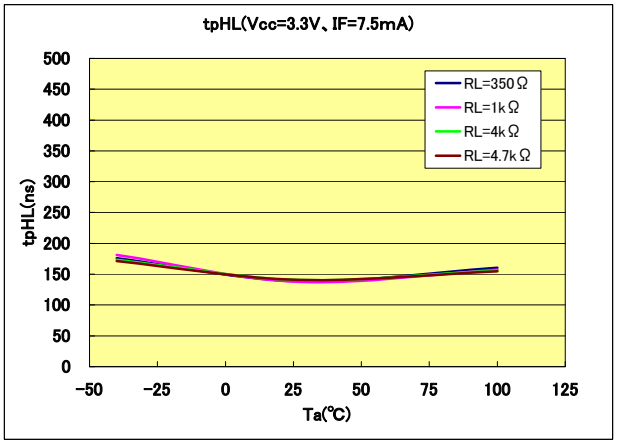
OUTPUT VOLTAGE vs. FORWARD CURRENT



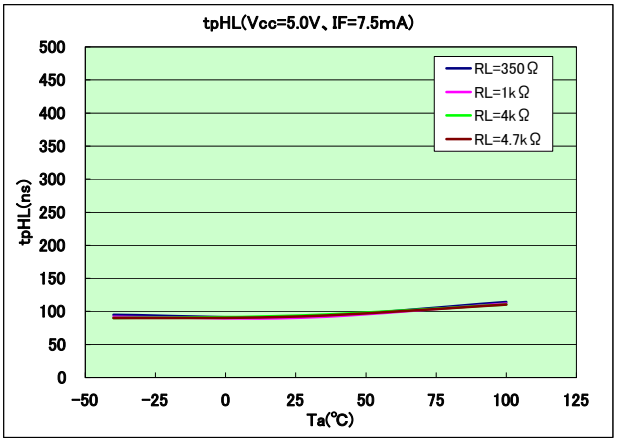
Remark The graphs indicate nominal characteristics.

TYPICAL CHARACTERISTICS (TA=25℃, unless otherwise specified)

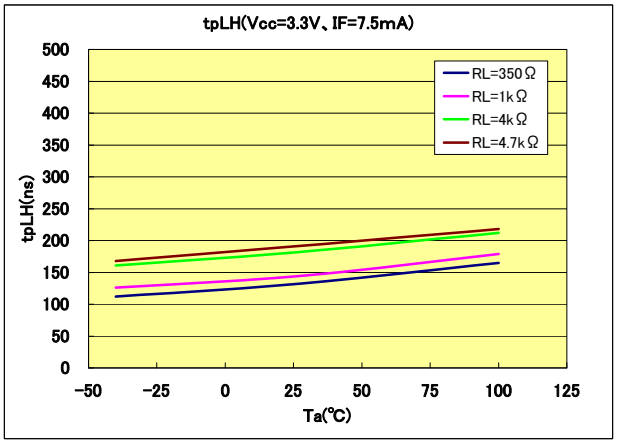
PROPAGATION DELAY TIME vs. AMBIENT TEMPERATURE



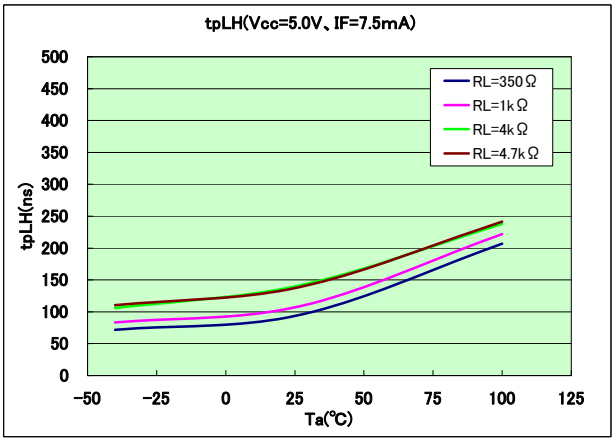
PROPAGATION DELAY TIME vs. AMBIENT TEMPERATURE



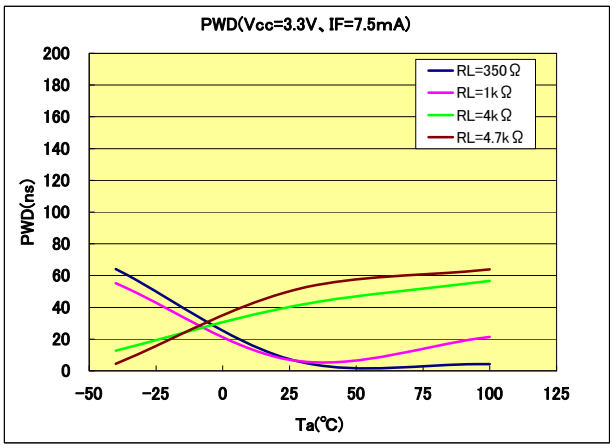
PROPAGATION DELAY TIME vs. AMBIENT TEMPERATURE



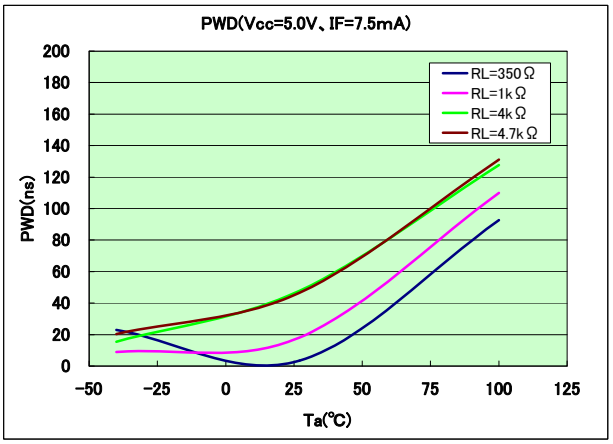
PROPAGATION DELAY TIME vs. AMBIENT TEMPERATURE



PULSE WIDTH DISTORTION vs. AMBIENT TEMPERATURE



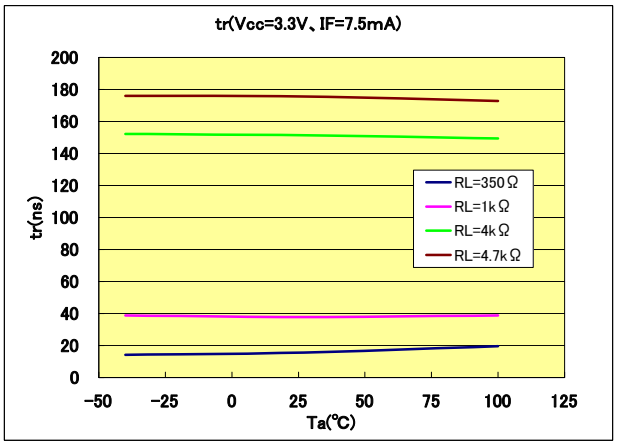
PULSE WIDTH DISTORTION vs. AMBIENT TEMPERATURE



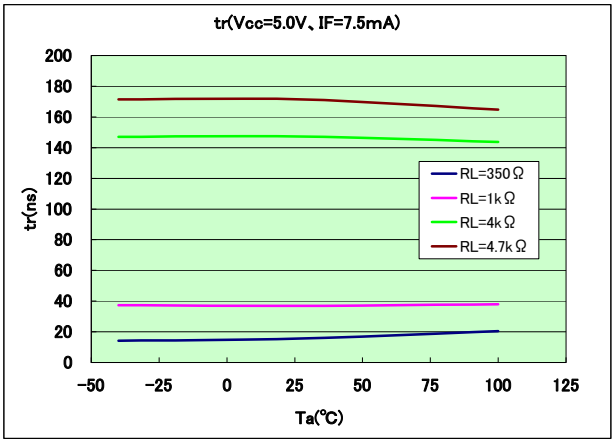
Remark The graphs indicate nominal characteristics.

TYPICAL CHARACTERISTICS (TA=25℃, unless otherwise specified)

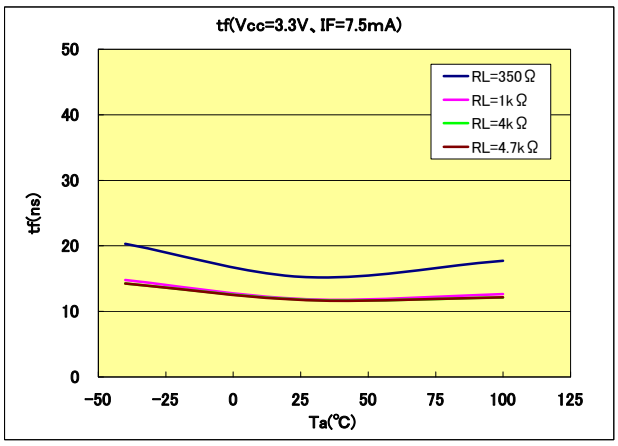
RISE TIME vs. AMBIENT TEMPERATURE



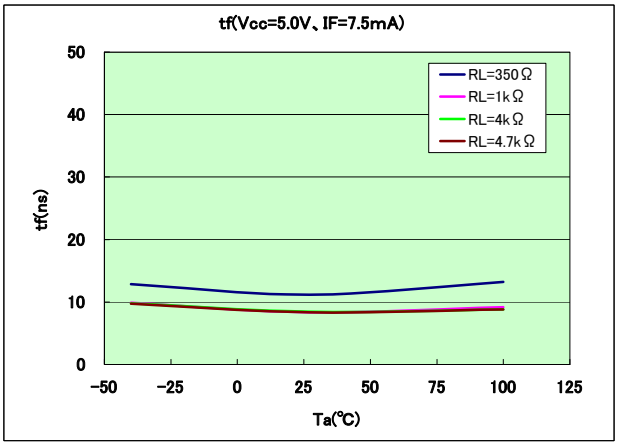
RISE TIME vs. AMBIENT TEMPERATURE



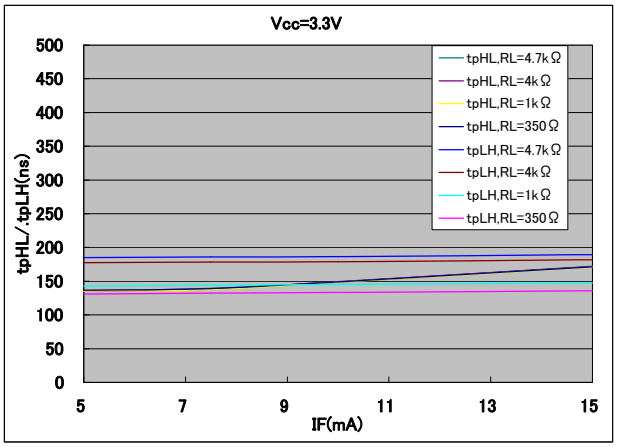
FALL TIME vs. AMBIENT TEMPERATURE



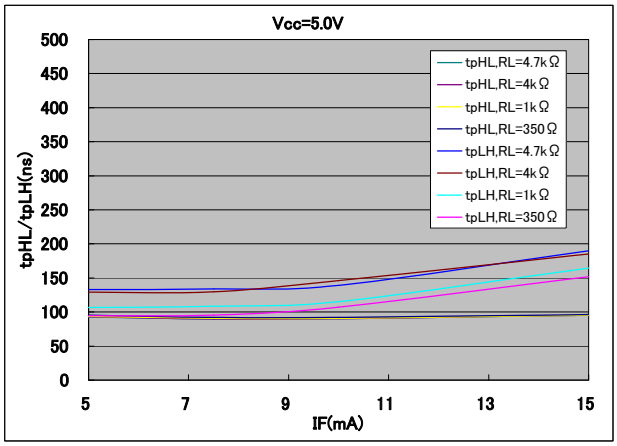
FALL TIME vs. AMBIENT TEMPERATURE



PROPAGATION DELAY TIME vs. FORWARD CURRENT



PROPAGATION DELAY TIME vs. FORWARD CURRENT



Remark The graphs indicate nominal characteristics.