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April 1st, 2010
Renesas Electronics Corporation

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RENESAS

Application Note

PHOTOCOUPLERS

Document No. P12602EJ1V0AN00 (1st edition)
Date Published May 1997 N

[MEMO]

CAUTION

Within this device there exists GaAs (Gallium Arsenide) material which is a harmful substance if ingested. Please do not under any circumstances break the hermetic seal.

The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

[MEMO]

CONTENTS

[MEMO]

1. GENERAL

Recently, photocouplers have been supplanting relays and pulse transformers for complete noise elimination, level conversion, and high-potential isolation. Microprocessor systems are requiring more and more photocouplers on the limited area of PC boards for I/O interface and other purposes. For these requirements, NEC has manufactured photocouplers having 4 pins (for one channel) to 16 pins (for four channels).

The photocouplers are divided into PS25xx, PS26xx, PS27xx and PS86xx according to their functions. ("L" suffix designates lead bending type for surface mount applications.)

This manual describes features, structures, and basic characteristics of the photocouplers.

2. FEATURES, PACKAGE DIMENSIONS AND STRUCTURE

2.1 Features

The major feature of photocouplers is very high isolation voltage between input and output.

In addition to high isolation voltage, the photocouplers boast high heat resistance and high humidity resistance. Table 1 to Table 5 list the major features of the NEC PS25xx, PS26xx, PS27xx, PS28xx and PS86xx photocouplers.

Table 1. Features of PS25xx Series

Features / Product name *[1]	Isolation voltage (Vr.m.s.)	Input and output functions	CTR (%)	V_{CEO} (V) MIN.	Response tr, tf (μs) TYP.
PS2501-1, -2, -4 PS2501L-1, -2, -4	5 k	DC input Single Tr. output	80 to 600	80	3, 5
PS2502-1, -2, -4 PS2502L-1, -2, -4		DC input Darlington Tr. output	200 to	40	100, 100
PS2503-1, -2, -4 PS2503L-1, -2, -4		Low current, DC input Single Tr. output	100 to 400	40	20, 30 (R_L = 10 kΩ)
PS2505-1, -2, -4 PS2505L-1, -2, -4		AC input Single Tr. output	80 to 600	80	3, 5
PS2506-1, -2, -4 PS2506L-1, -2, -4		AC input Darlington Tr. output	200 to	40	100, 100
PS2521-1, -2, -4 PS2521L-1, -2, -4		Large forward, DC input Single Tr. output	20 to 80	80	3, 5
PS2525-1, -2, -4 PS2525L-1, -2, -4		Large forward, AC input Single Tr. output	20 to 80	80	3, 5
PS2532-1, -2, -4*[2] PS2532L-1, -2, -4*[2]	5 k 3.75 k*[4]	DC input Darlington Tr. High V_{CEO}	1500 to 6500	300	3, 5
PS2533-1, -2, -4*[2] PS2533L-1, -2, -4*[2]		DC input Darlington Tr. High V_{CEO}	1500 to 6500	350	100, 100
PS2561-1, -2, -4*[3] PS2561L-1, -2, -4*[3]		DC input Single Tr. output	80 to 400	80	3, 5
PS2562-1, -2, -4*[3] PS2562L-1, -2, -4*[3]		DC input Darlington Tr. output	200 to	40	100, 100
PS2565-1, -2, -4*[3] PS2565L-1, -2, -4*[3]		AC input Single Tr. output	80 to 400	80	3, 5
PS2566-1, -2, -4*[3] PS2566L-1, -2, -4*[3]		AC input Darlington Tr. output	200 to	40	100, 100
PS2581L1-1, L2-1	5 k	DC input Single Tr. output	80 to 400	80	3, 5

***1.** "L" suffix designates lead bending type for surface mount applications.

2. VDE0884 Approved

3. Safety standard type (VDE0884, BSI, SEMKO, NEMKO, DEMKO, FIMKO)

4. VDE0884 speck product (option)

Table 2. Features of PS26xx Series

Features / Product name *1	Isolation voltage (Vr.m.s.)	Input and output functions	CTR (%)	V_{CEO} (V) MIN.	Response tr, tf (μs) TYP.
PS2601, PS2601L*2 PS2602, PS2602L*2	5 k	DC input Single Tr. output	80 to 600	80	3, 5
PS2603, PS2603L*2 PS2604, PS2604L		DC input Darlington Tr. output	2000 to	40	100, 100
PS2605, PS2605L*2 PS2606, PS2606L		AC input Single Tr. output	80 to 600	80	3, 5
PS2607, PS2607L*2 PS2608, PS2608L		AC input Darlington Tr. output	200 to	40	100, 100
PS2621, PS2621L*2 PS2622, PS2622L		Large forward, DC input Single Tr. output	20 to 80	80	3, 5
PS2625, PS2625L*2 PS2626, PS2626L		Large forward, DC input Single Tr. output	20 to 80	80	3, 5
PS2631, PS2631L*2		DC input Single Tr. output High V_{CEO}	20 to 80	200	3, 5
PS2633, PS2633L*2 PS2634, PS2634L		DC input Darlington Tr. output High V_{CEO}	1000 to 1500	300	3, 5
PS2651, PS2651L2*2, 3 PS2652, PS2652L2		DC input Single Tr. output	80 to 400	80	3, 5
PS2653, PS2653L2*2, 3 PS2654, PS2654L		DC input Darlington Tr. output	2000 to	40	100, 100

***1.** “L” suffix designates lead bending type for surface mount applications.

2. With base pin type

3. Safety standard type (VDE0884, BSI, SEMKO, NEMKO, DEMKO, FIMKO)

Table 3. Features of PS27xx Series

Features / Product name	Isolation voltage (Vr.m.s.)	Input and output functions	CTR (%)	V_{CEO} (V) MIN.	Response tr, tf (μs) TYP.
PS2701-1, -2, -4***1**	3.75 k	DC input Single Tr. output	50 to 300	40	3, 5
PS2702-1, -2, -4***1**		DC input Darlington Tr. output	200 to	40	100, 100
PS2703-1, -2, -4***1**		Low current, DC input Single Tr. output	50 to 400	120	3, 5
PS2705-1, -2, -4***1**		AC input Single Tr. output	50 to 300	40	3, 5
PS2706-1, -2, -4***1**		AC input Darlington Tr. output	200 to	40	100, 100
PS2707-1, -2, -4***1**		Low current, DC input Single Tr. output	50 to 400	80	3, 5
PS2732-1, -2, -4***1**	2.5 k	DC input Darlington Tr. High V_{CEO}	1500 to	300	3, 5
PS2733-1, -2, -4***1**		DC input Darlington Tr. High V_{CEO}	1500 to	350	100, 100

***1.** VDE0884 Approved

Table 4. Features of PS28xx Series

Features / Product name	Isolation voltage (Vr.m.s.)	Input and output functions	CTR (%)	V_{CEO} (V) MIN.	Response tr, tf (μs) TYP.
PS2801-1, -4	2.5 k	DC input Single Tr. output	80 to 300	80	3, 5
PS2802-1, -4		DC input Darlington Tr. output	200 to	40	100, 100
PS2805-1, -4		AC input Single Tr. output	50 to 300	80	3, 5
PS2806-1, -4		AC input Darlington Tr. output	200 to	40	100, 100

Table 5. Features of PS86xx Series

Features / Product name	Isolation voltage (Vr.m.s.)	Input and output functions	CTR (%)	V_{CEO} (V) MIN.	Response t_{PHL}, t_{PLH} (μs) MAX.
PS8601*1 PS8601L*1	5 k	DC input Photo diode + Tr. output	15 to	35	0.8, 0.8
PS8602*2 PS8602L*2		Dc input Photo diode + Tr. output	15 to	35	0.8, 0.8

***1.** With base pin type

***2.** High CMR ±2 kV/μs

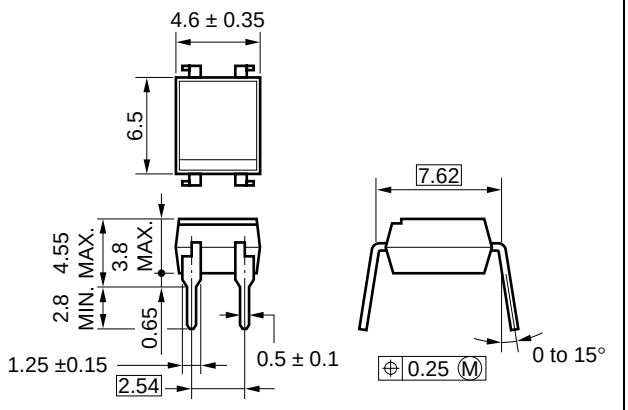
2.2 Package Dimensions

Figure 1 to Figure 5 show the dimensions of photocouplers. The photocouplers are very compact and fit for high-density installation.

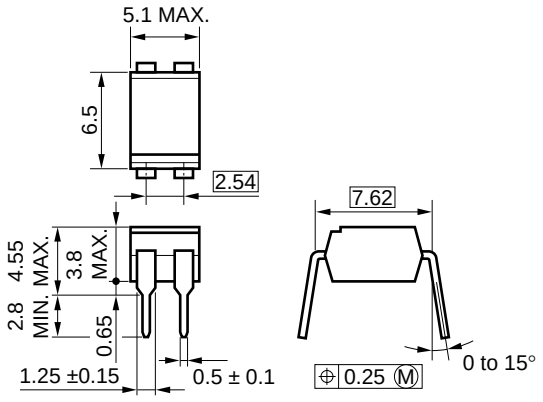
Figure 1. Package Dimensions of PS25xx Series (Unit: mm) (1/2)

(1) 4 to 16 pin DIP (Dual In-line Package)

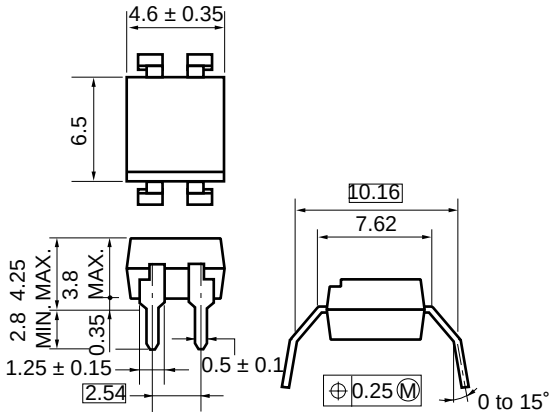
PS25xx-1 (New Package)*1



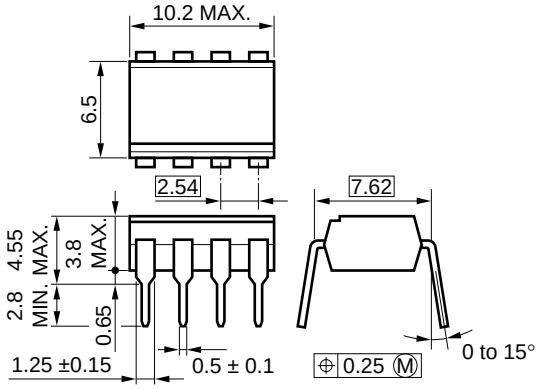
PS25xx-1



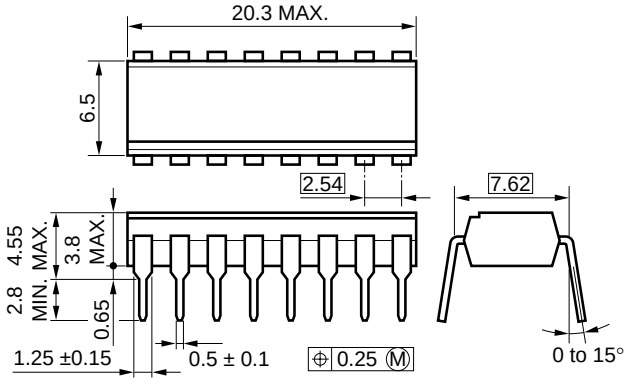
PS2581L1



PS25xx-2



PS25xx-4

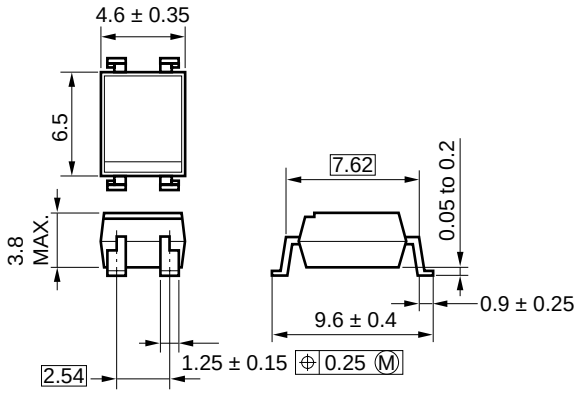


***1.** New Package: PS2501-1, PS2502-1, PS2505-1, PS2561-1

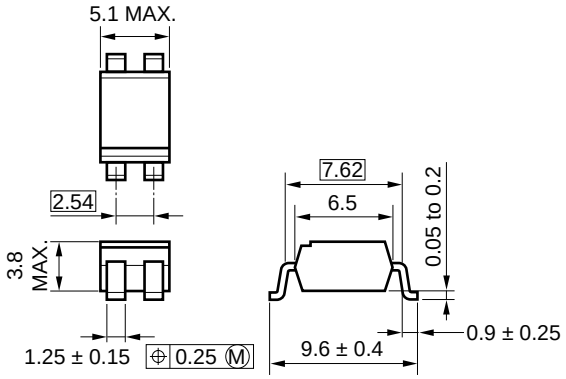
Figure 1. Package Dimensions of PS25xx Series (Unit: mm) (2/2)

(2) 4 to 16 pin Lead Bending type (Gull-wing)

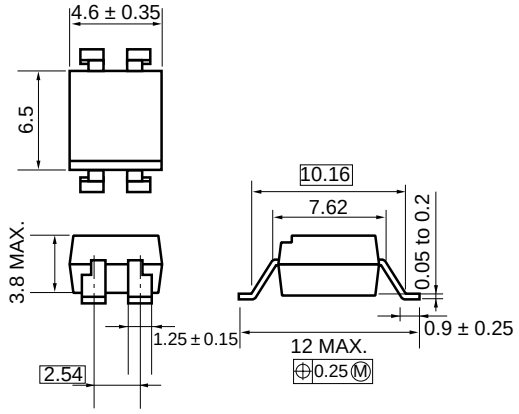
PS250xL-1



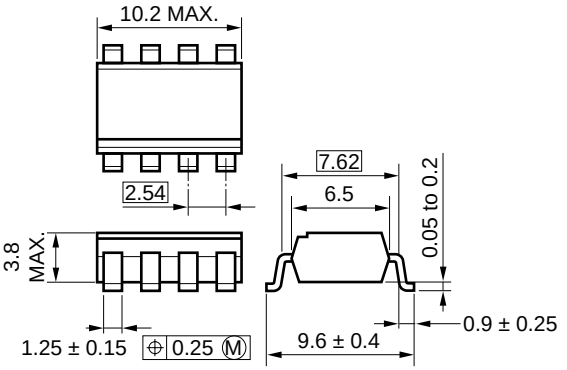
PS25xxL-1



PS2581L2



PS25xxL-2



PS25xxL-4

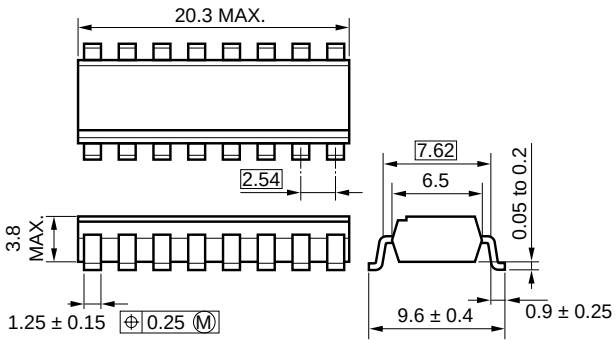
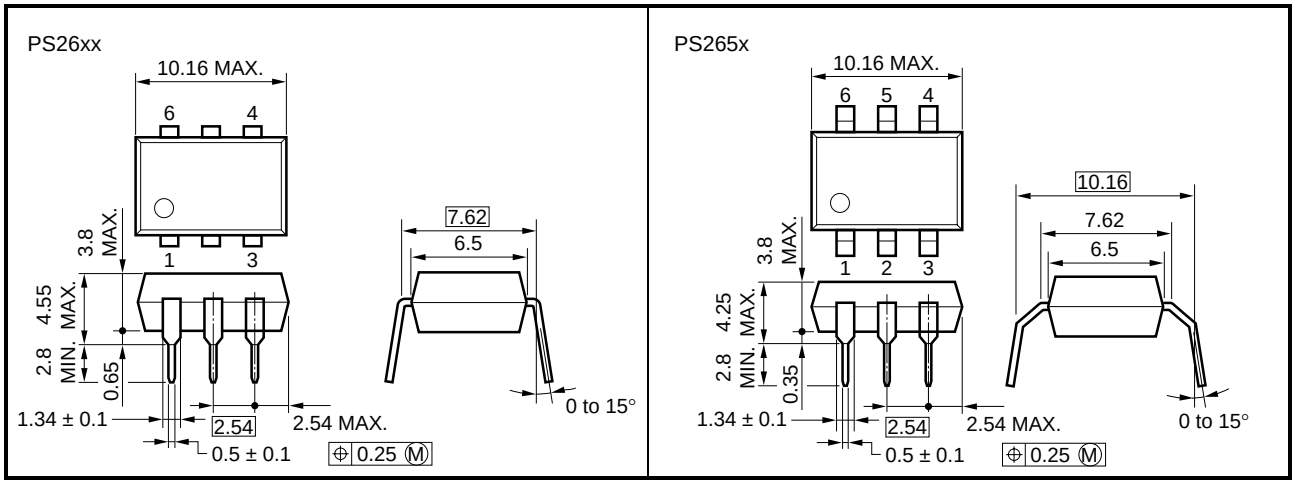


Figure 2. Package Dimensions of PS26xx Series (Unit: mm)

(1) 6 pin DIP (Dual In-line Package)



(2) 6 pin Lead Bending type (Gull-wing)

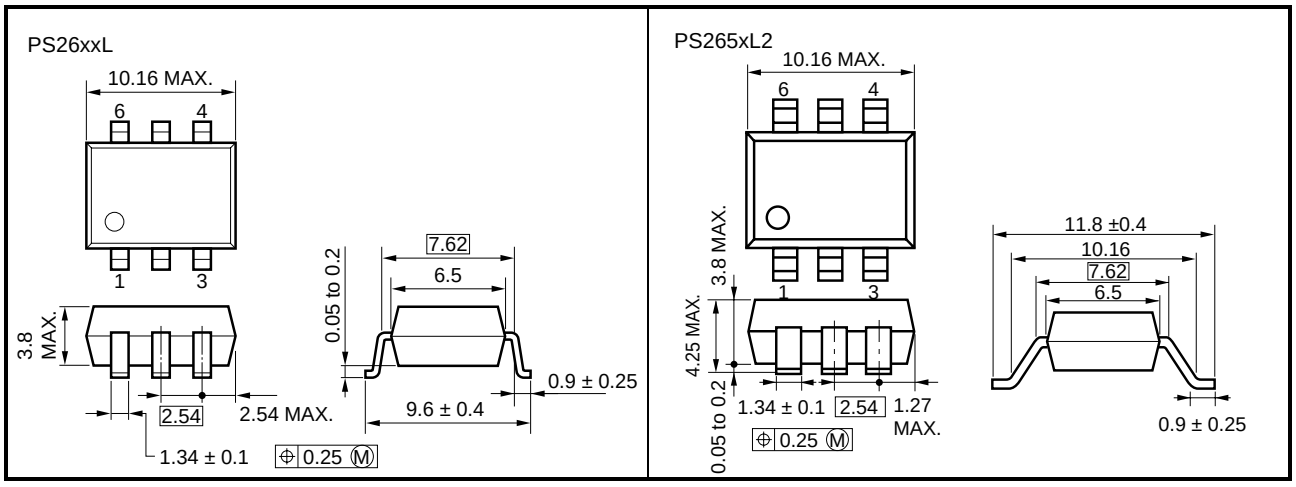


Figure 3. Package Dimensions of PS27xx Series (Unit: mm)

4 to 16 pin SOP (Lead Pitch: 2.54 mm)

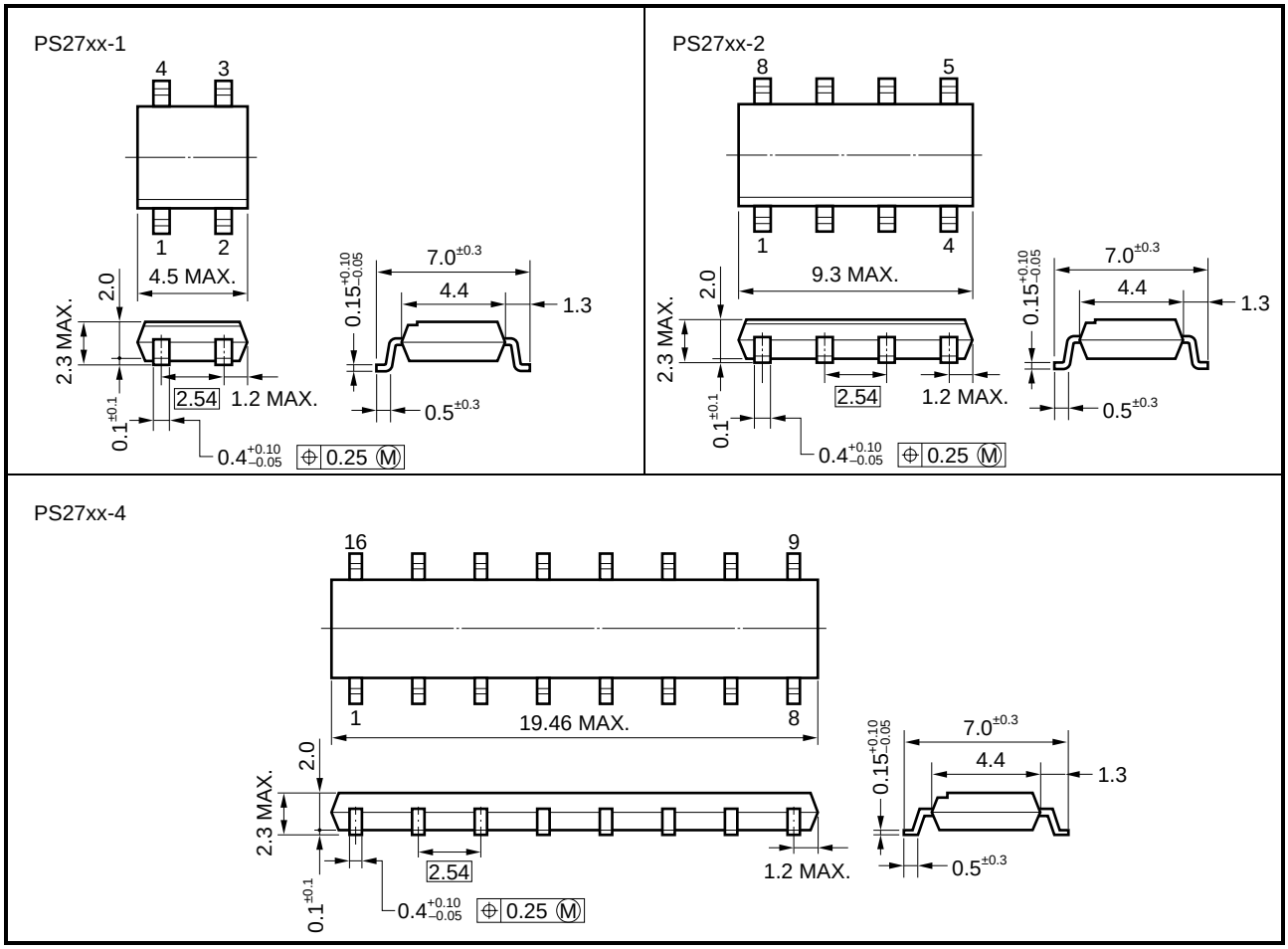


Figure 4. Package Dimensions of PS28xx Series (Unit: mm)

4 to 16 pin SOP (Lead Pitch: 1.27 mm)

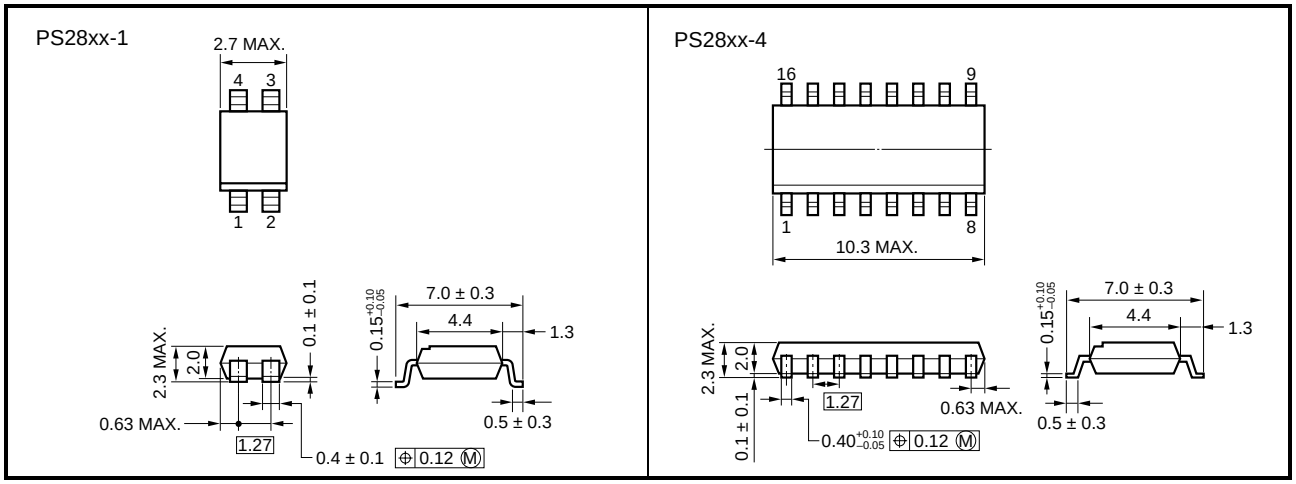
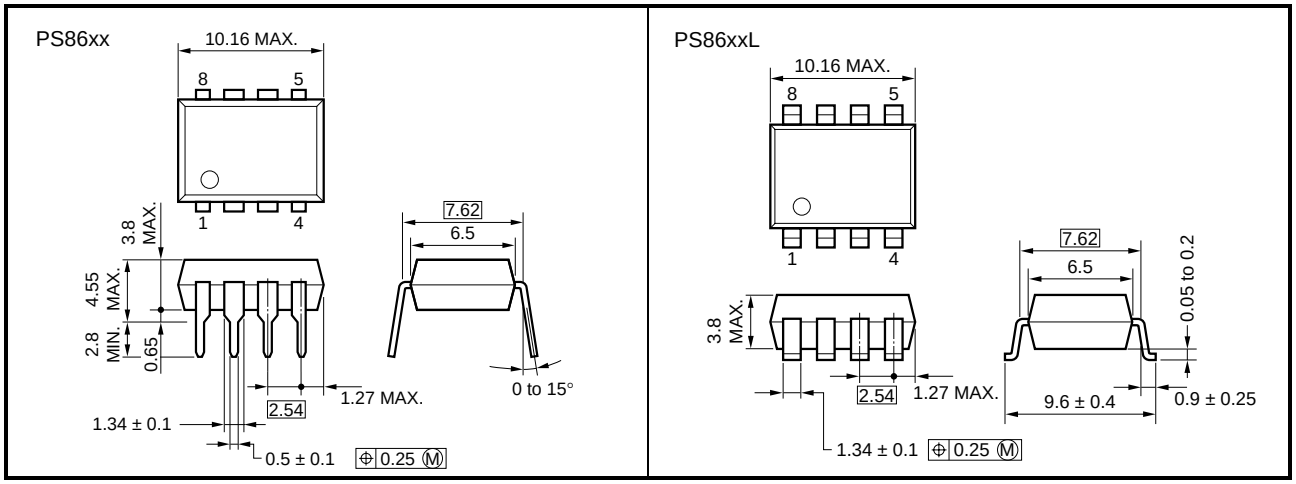


Figure 5. Package Dimensions of PS86xx Series (Unit: mm)

(1) 8 pin DIP (Dual In-line Package) **(2) 8 pin Lead Bending type (Gull-wing)**



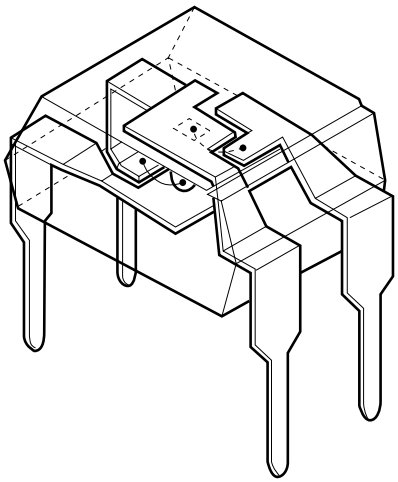
2.3 Structure

Figure 6 shows the internal perspective view of a photocoupler. In a light-tight epoxy resin housing, a light-sensitive element (phototransistor or photo Darlington transistor) with light-transmittable epoxy resin medium between them. A light signal emitted by the LED is transferred to the photosensitive transistor via the internal resin medium.

Both the housing resin and the internal resin have the same expansion coefficient. Namely, the photocoupler elements are molded epoxy resin.

The high isolation voltage is obtained by the long adjacent area of the inner and outer resins and identical expansion coefficient of the inner and outer resins.

Figure 6. Internal Perspective View of Photocoupler



3. CHARACTERISTICS VALUE AND MEASURING CHARACTERISTICS VALUE

3.1 Characteristics Value

Table 6. Photocoupler Characteristics Value

Classification	Symbol	Item	Measuring circuit number
LED	V_F	Forward voltage	1
	I_F	Forward current	1
	V_R	Reverse voltage	2
	I_R	Reverse current	2
	C_t	Input capacitance	3
	P_D	Power dissipation	—
Transistor	BV_{CEO}	Collector to emitter breakdown voltage	4
	I_{CEO}	Collector to emitter current	5
Coupled	CTR	Current transfer ratio	6
	$V_{CE(sat)}$	Collector saturation voltage	7
	R_{I-O}	Isolation resistance	8
	BV	Isolation voltage (AC voltage for 1 minute at T_A = 25 °C, RH = 60 % between input and output).	9
	C_{I-O}	Isolation capacitance	10
	t_{on}	turn-on time	11
	t_{off}	turn-off time	11
	SOA	Safe operation area (DC)	—
	SOA	Safe operation area (pulse)	—

3.2 Measuring Characteristics Value

Table 7. Measuring Photocoupler Characteristics Value (1/3)

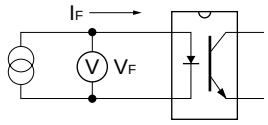
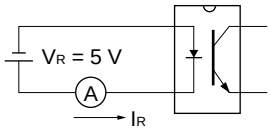
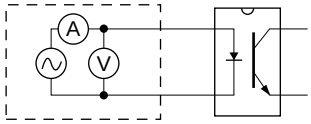
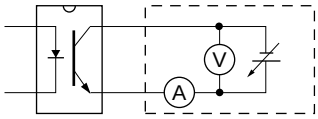
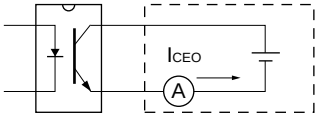
Measuring circuit number	Characteristic value	Measuring method and conditions	Measuring circuit
1	Forward voltage (V_F)	Let a required current flow across control input terminals and measure the voltage. $I_F \equiv 10$ (mA)	(Control input side) 
2	Reverse current (I_R)	Apply a voltage across control input terminals in a direction opposite to normal and measure the current. $V_R \equiv 5$ (V)	
3	Input capacitance (C_t)	Connect an LCR meter to control input terminals and measure the electrostatic capacitance. $V \equiv 0$ (V), $f \equiv 1$ (MHz)	 LCR meter, etc.
4	Collector to emitter breakdown voltage (BV_{CEO})	Step up a voltage slowly across switching terminals and measure the voltage at which a required current begins flowing. $I_L = 1$ mA, $I_B = 0$	 Semiconductor multimeter, etc.
5	Collector to emitter current (I_{CEO})	Apply a required voltage across switching terminals and measure the current. $V_{CEO} \equiv$ Rated voltage (V)	 Semiconductor multimeter, etc.

Table 7. Measuring Photocoupler Characteristics Value (2/3)

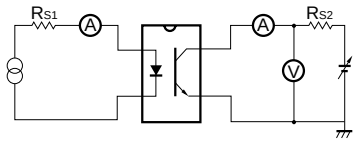
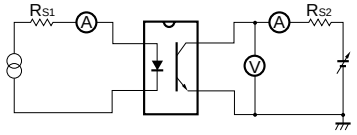
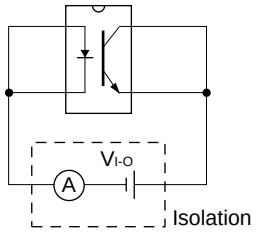
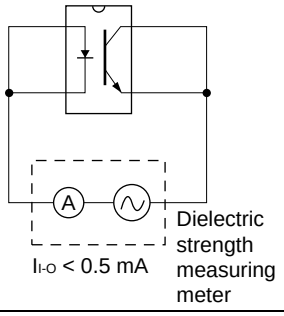
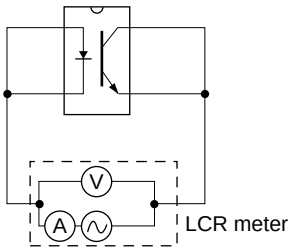
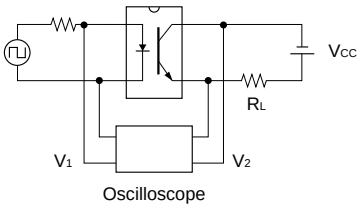
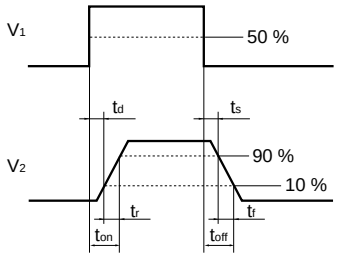
Measuring circuit number	Characteristic value	Measuring method and conditions	Measuring circuit
6	Current transfer ratio (CTR)	Measuring procedure: Apply the regulated collector/emitter voltage (V_{CE}) to the output pin of the specimen photocoupler. Adjust the variable power supply on the output side to measure the collector current (I_{CE}) when the forward current (I_F) becomes the regulated value. Produce the Current Transfer Ratio (CTR) by the following formula. Current Transfer Ratio (CTR) = $\frac{\text{Collector current (A)}}{\text{Forward current (A)}} \times 100$ Measuring conditions which should be regulated. (1) Collector/emitter voltage (V_{CE}) (2) Forward current (I_F) (3) Ambient Temperature (T_A)	
7	Collector saturation voltage ($V_{CE(sat)}$)	Measuring procedure: Flow the regulated forward current (I_F) between the input pins of the specimen photocoupler. Adjust the variable power supply on the output side to flow the regulated collector current (I_{CE}) to the outside. Then measure the voltage between the output pins (collector/emitter saturation voltage ($V_{CE(sat)}$). Measuring conditions which should be regulated. (1) Forward current (I_F) (2) Collector current (I_{CE}) (3) Ambient Temperature (T_A)	
8	Isolation resistance (R_{I-O})	Connect an Isolation resistance meter between control input terminals and switching terminals, apply a required voltage, and measure the resistance. $V_{I-O} \equiv 1$ (kV)	

Table 7. Measuring Photocoupler Characteristics Value (3/3)

Measuring circuit number	Characteristic value	Measuring method and conditions	Measuring circuit
9	Isolation voltage (BV)	AC voltage for 1 minute at T_A = 25 °C, RH = 60 % between input terminals and output terminals.	
10	Isolation capacitance (C_{I-O})	Connect an LCR meter between control input terminals and output terminals and measure the electrostatic capacitance. V ≡ 0 (V), f ≡ 1 (MHz)	
11	turn-on time (t_{on}) turn-off time (t_{off})	Apply a rectangular wave voltage, to cause a required current to flow across control input terminals, and connect a load across output terminals that satisfies a required current and voltage. Measure the waveforms for the voltages across control input terminals and across switching terminals, using a time measuring instrument like an oscilloscope, as shown at the right. I_F ≡ 10 (mA) R_L V_{CC} } (to be defined)	 

4. MAIN CHARACTERISTICS

4.1 Current Transfer Ratio (CTR)

The current transfer ratio (CTR) of a photocoupler is the ratio of the value of output current I_C to the value of input forward current I_F ($I_C/I_F \times 100$ %). The CTR is a parameter equivalent to the DC current amplification factor h_{FE} of a transistor.

The CTR is one of the most significant characteristics of photocouplers as well as isolation voltage. In circuit designing, CTR must be considered first of all because the CTR.

① is dependent upon forward current I_F flowing through the LED.
② is affected by ambient temperature, and
③ varies as time goes by.

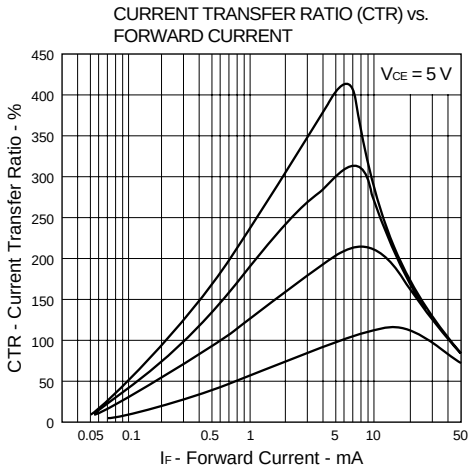
4.1.1 CTR vs. I_F Characteristics (I_F: Forward current flowing through the LED)

The current transfer ratio (CTR) depends upon the magnitude of a forward current (I_F). When I_F goes lower or higher than a proper magnitude, the CTR becomes smaller. Figure 7 to Figure 11 show the CTR vs. I_F characteristics.

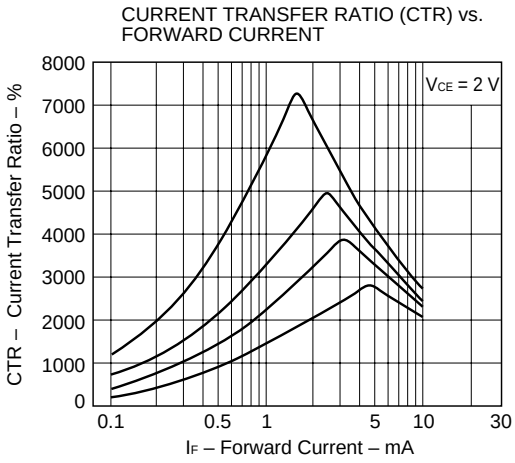
Note that rate changes of CTRs are very different at low I_F magnitude (approx. 5 mA), middle I_F magnitude (approx. 5 mA), and high I_F magnitude (approx. 20 mA). Namely, the CTR depends heavily upon the magnitude of forward current I_F in lower and higher current ranges.

Figure 7. CTR vs. I_F Characteristics of PS25xx Series

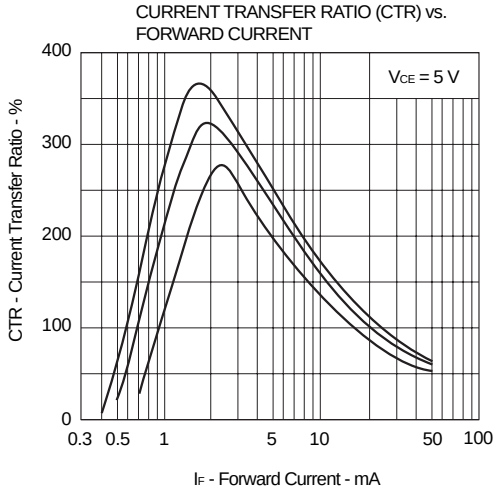
(1) PS2501, PS2505, PS2561, PS2565, PS2581



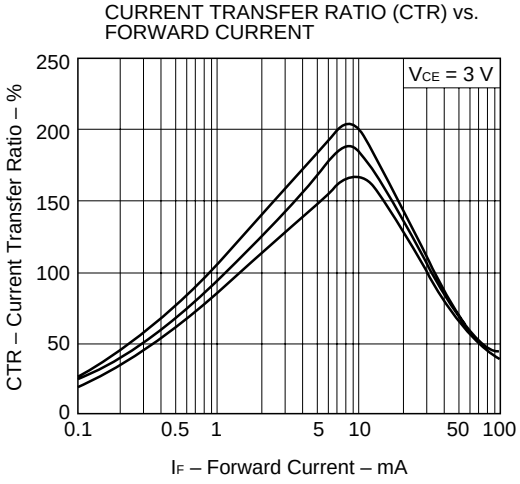
(2) PS2502, PS2506, PS2562, PS2566



(3) PS2503



(4) PS2521, PS2525



(5) PS2532, PS2533

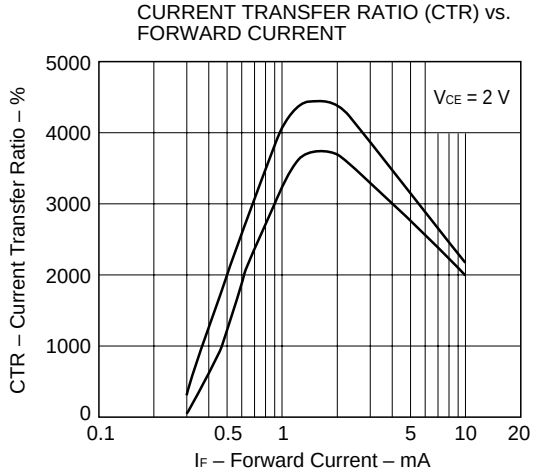
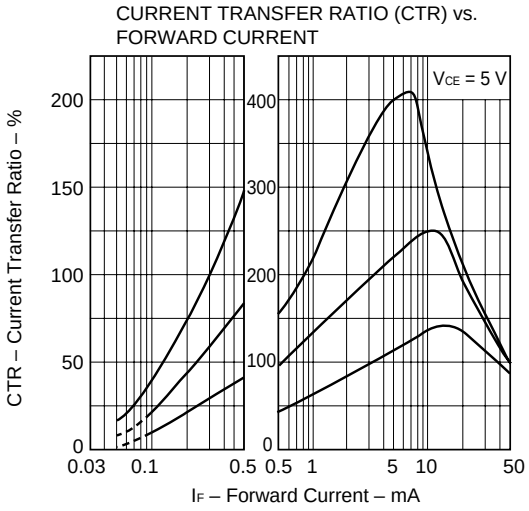
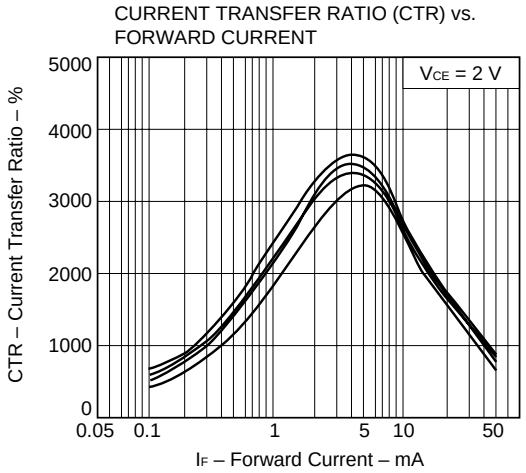


Figure 8. CTR vs. I_F Characteristics of PS26xx Series

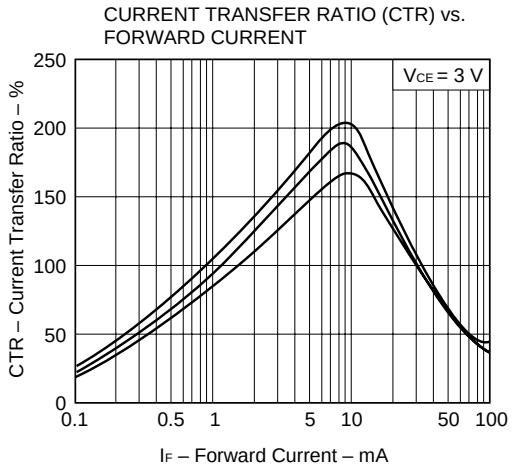
(1) PS2601, PS2602, PS2605, PS2606, PS2651, PS2652



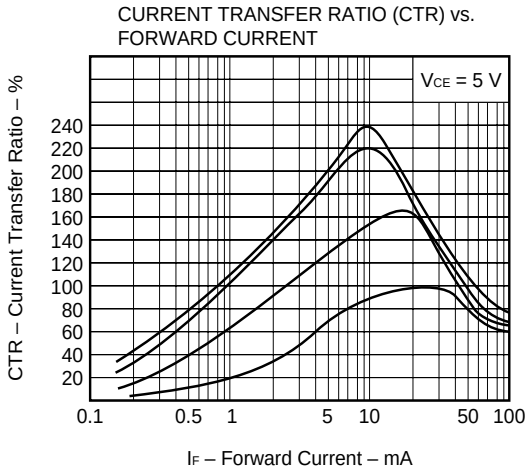
(2) PS2603, PS2604, PS2607, PS2608, PS2653, PS2654



(3) PS2621, PS2622, PS2625, PS2626



(4) PS2631



(5) PS2633, PS2634

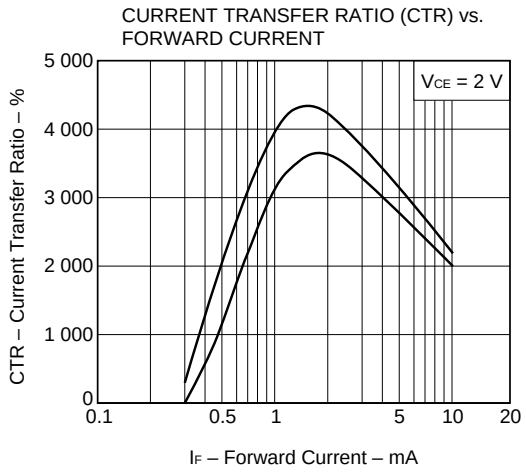
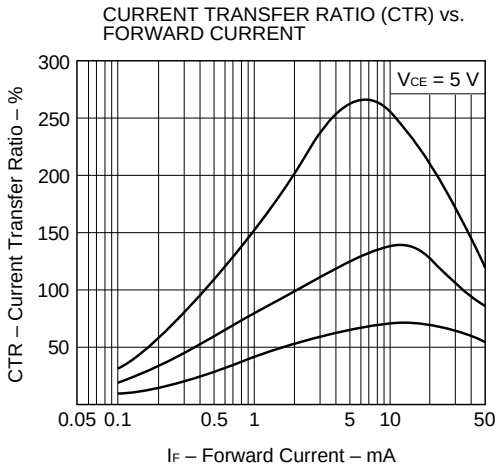
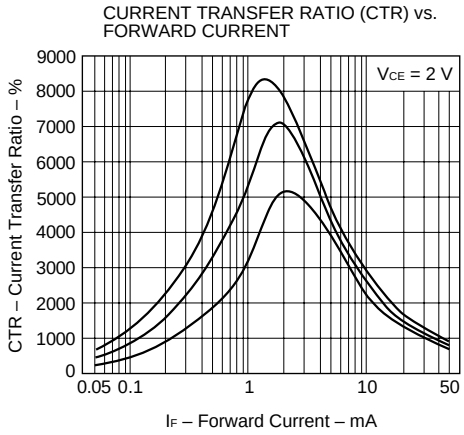


Figure 9. CTR vs. I_F Characteristics of PS27xx Series

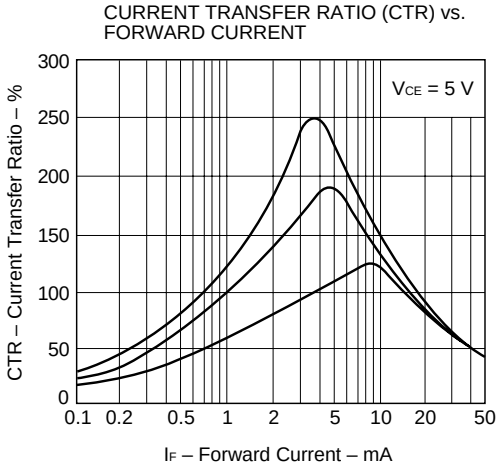
(1) PS2701, PS2705



(2) PS2702, PS2706



(3) PS2703, PS2707



(4) PS2732, PS2733

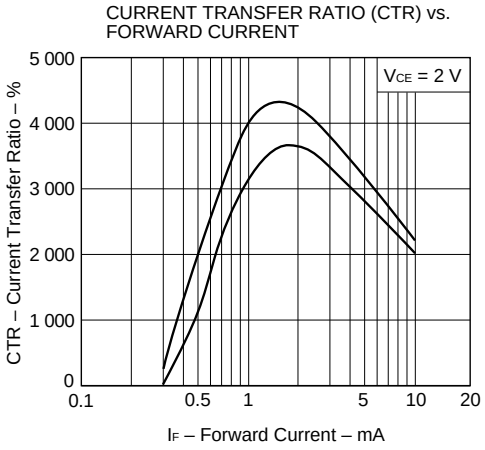
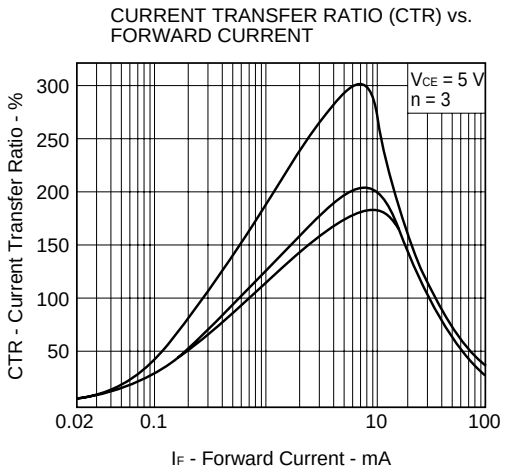


Figure 10. CTR vs. I_F Characteristics of PS28xx Series

(1) PS2801, PS2805



(2) PS2802, PS2806

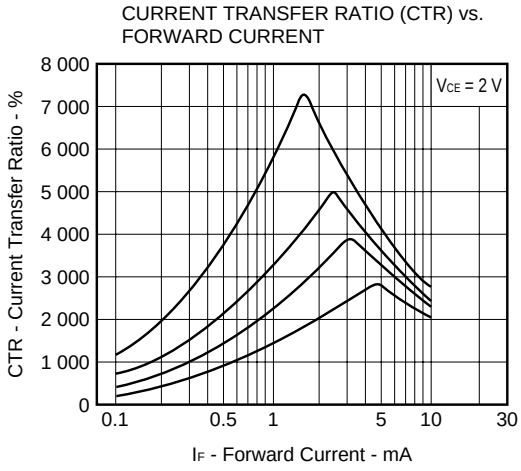
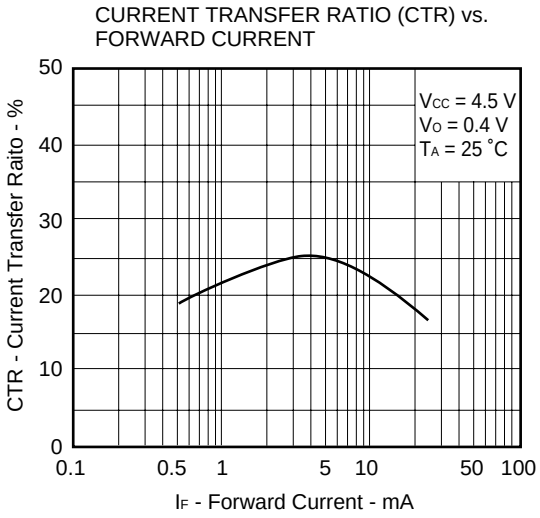


Figure 11. CTR vs. I_F Characteristics of PS86xx Series

PS8601, PS8602



4.1.2 CTR vs. T_A Characteristics (T_A: Ambient temperature)

The CTR-Temperature characteristic is greatly affected by the total characteristics of light-emission efficiency of the LED and h_{FE} of the phototransistor as the light-emission efficiency has a negative temperature coefficient and h_{FE} has a positive temperature coefficient. See Figure 12.

Figure 12. CTR vs. T_A Characteristics

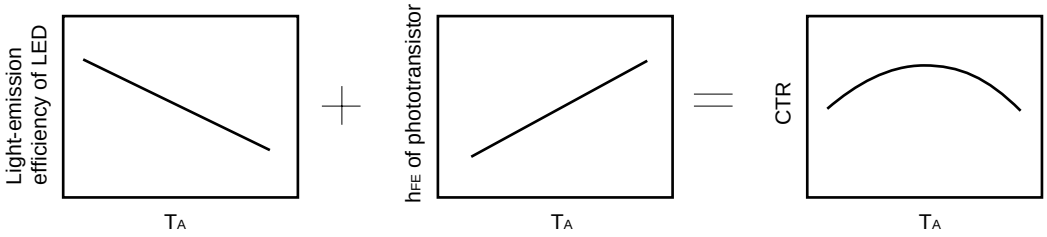
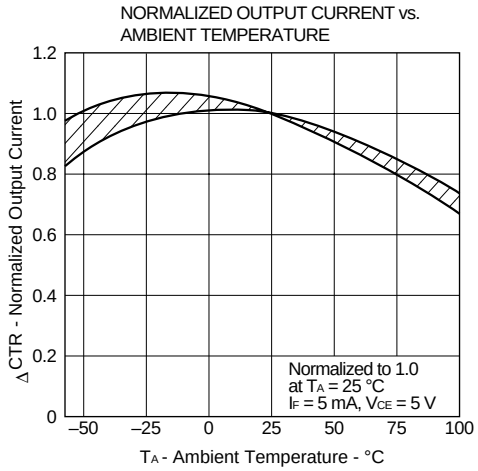


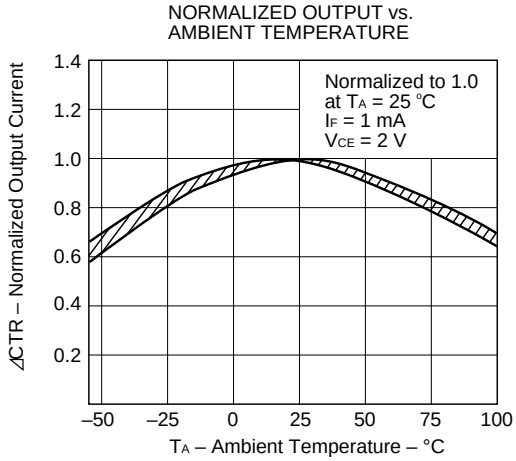
Figure 13 to Figure 17 show CTR vs. T_A characteristics under various conditions.

Figure 13. CTR vs. T_A Characteristics of PS25xx Series

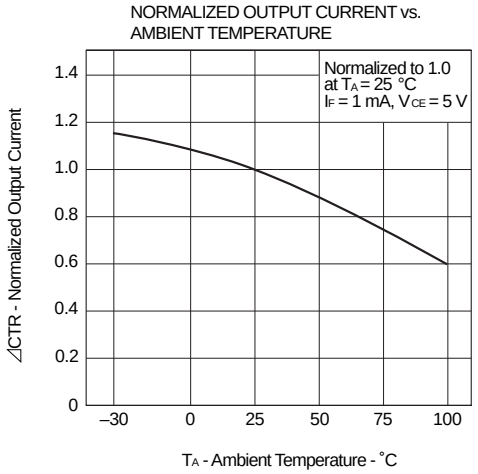
(1) PS2501, PS2505, PS2561, PS2565, PS2581



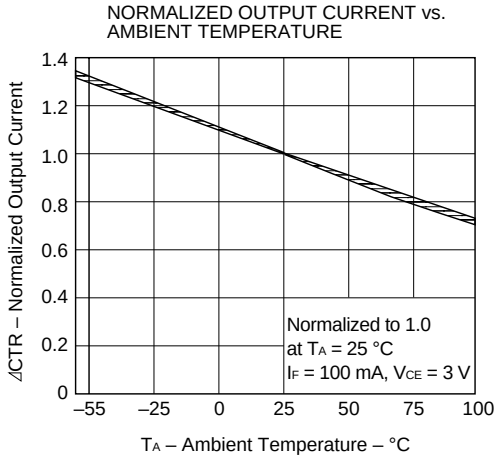
(2) PS2502, PS2506, PS2562, PS2566



(3) PS2503



(4) PS2521, PS2525



(5) PS2532, PS2533

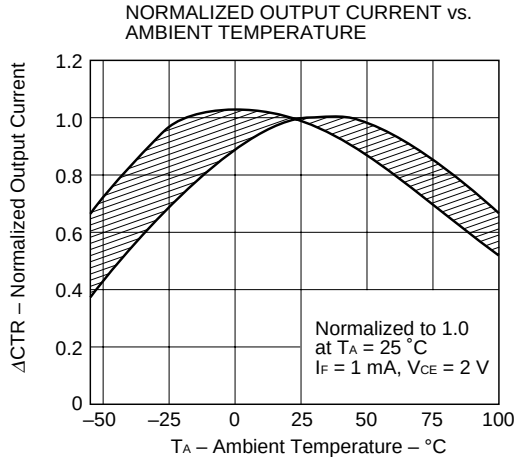
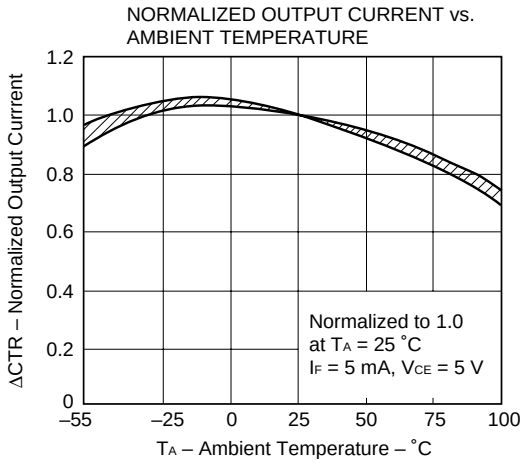
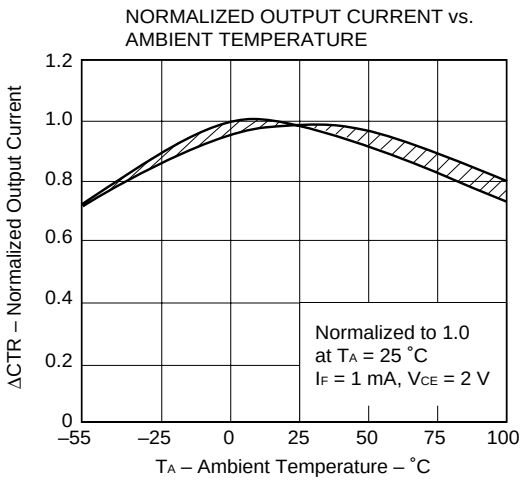


Figure 14. CTR vs. T_A Characteristics of PS26xx Series

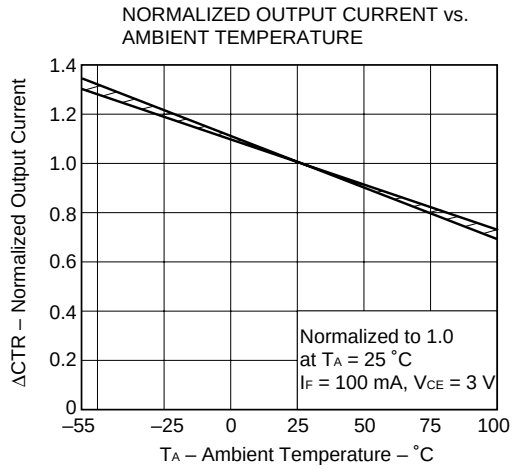
(1) PS2601, PS2602, PS2605, PS2606, PS2651, PS2652



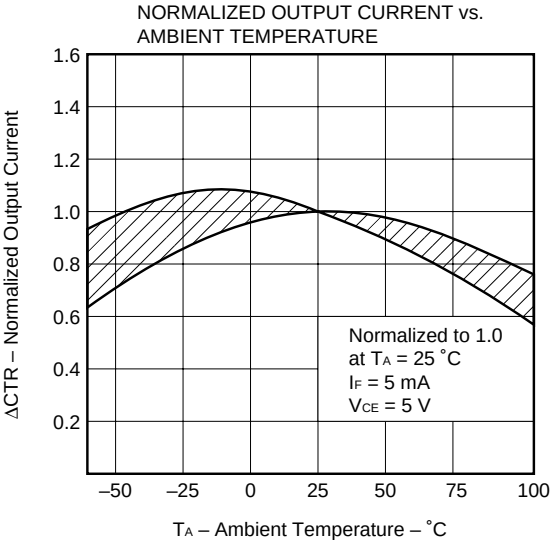
(2) PS2603, PS2604, PS2607, PS2608, PS2653, PS2654



(3) PS2621, PS2622, PS2625, PS2626



(4) PS2631



(5) PS2633, PS2634

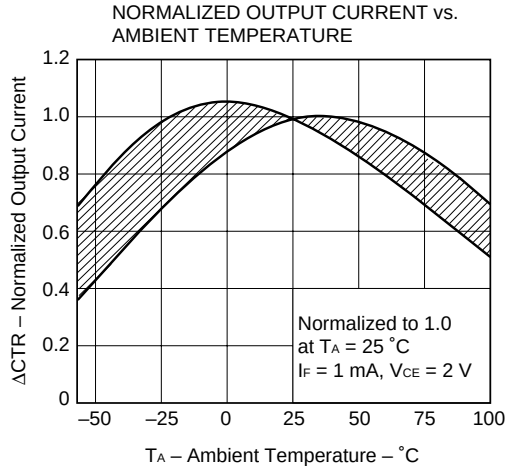
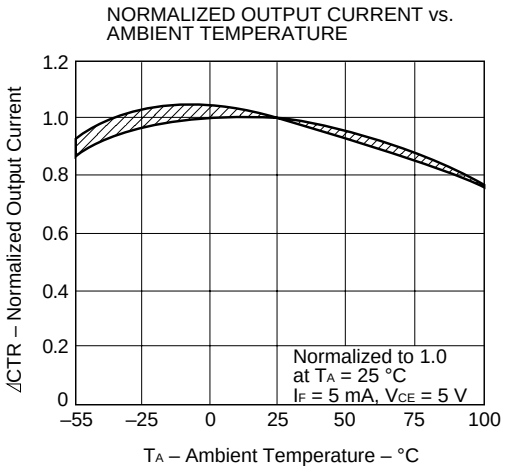
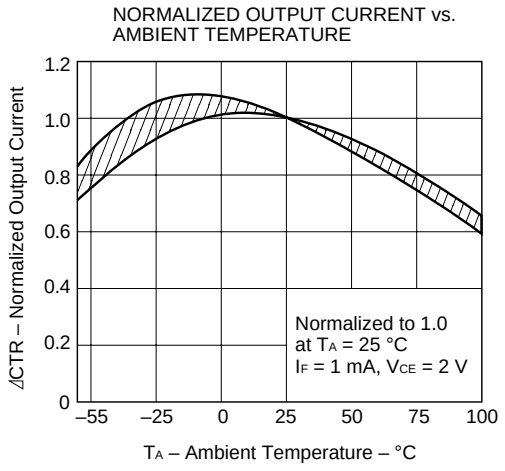


Figure 15. CTR vs. T_A Characteristics of PS27xx Series

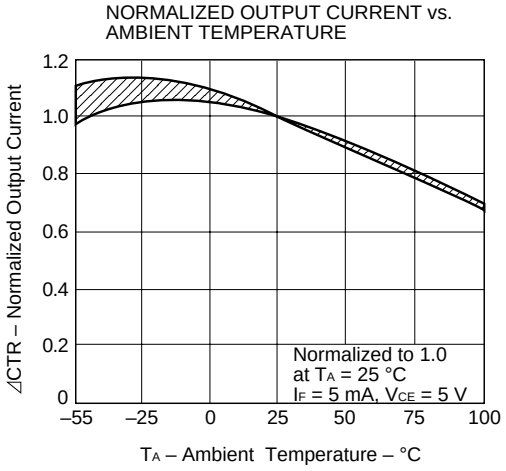
(1) PS2701, PS2705



(2) PS2702, PS2706



(3) PS2703, PS2707



(4) PS2732, PS2733

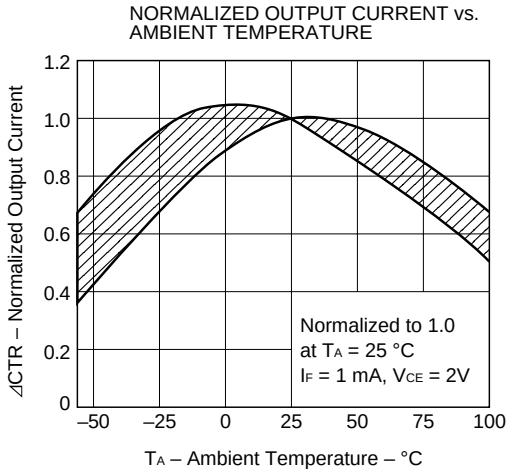
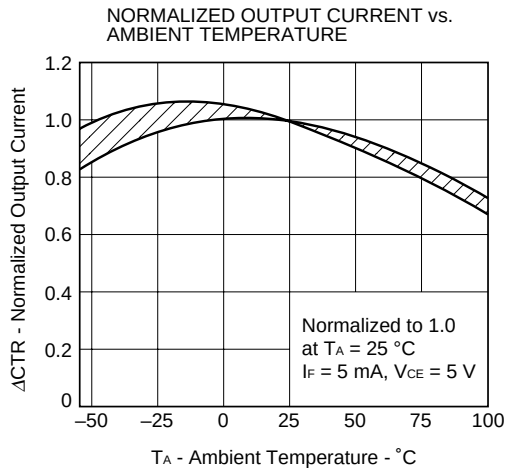


Figure 16. CTR vs. T_A Characteristics of PS28xx Series

(1) PS2801, PS2805



(2) PS2802, PS2806

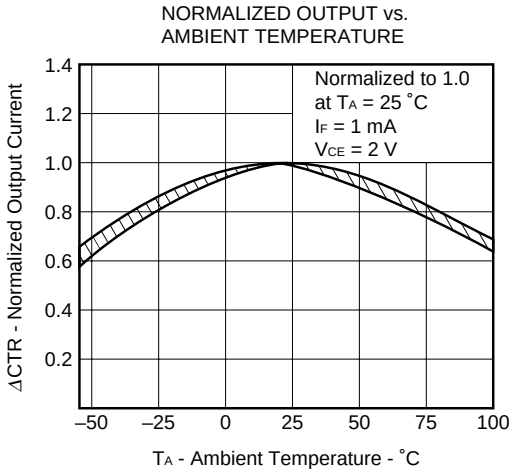
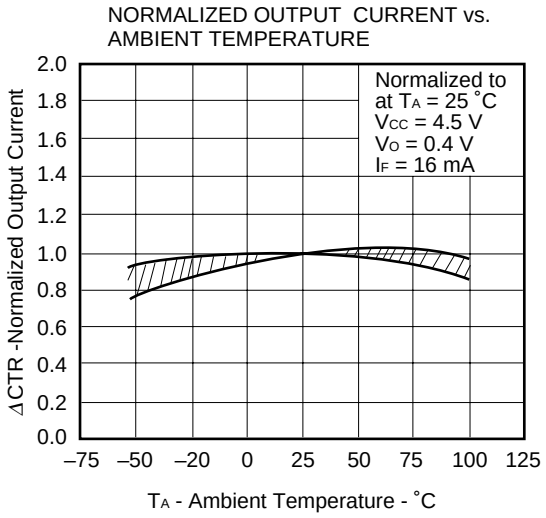


Figure 17. CTR vs. T_A Characteristics of PS86xx Series

PS8601, PS8602



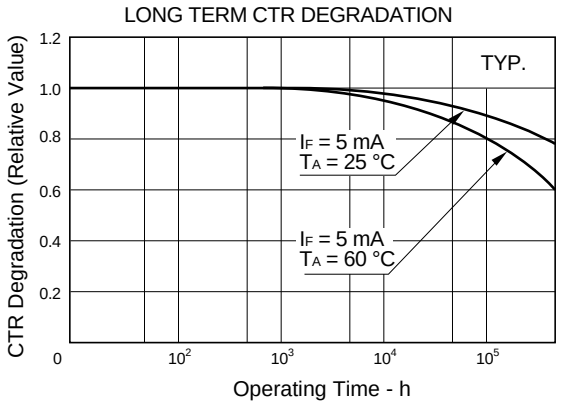
4.1.3 Long Term CTR Degradation

The current transfer ratio (CTR) of a photocoupler is determined by the light-emission efficiency of the LED (emitting infrared light), efficiency of light transmission between the LED and the phototransistor, light sensitivity of the phototransistor, and h_{FE} of the transistor.

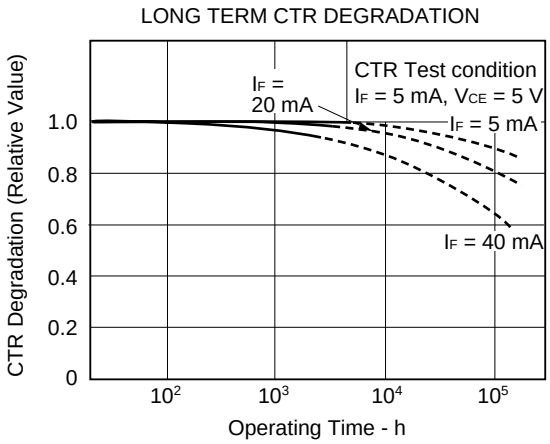
The change of a CTR over time is mainly caused by the reduction of the light-emission efficiency of the LED. Generally, the CTR is reduced to a greater extent as the forward current (I_F) increases or as the operating temperature increase. Figure 18 respectively shows estimated changes of CTRs of PS25xx, PS26xx, PS27xx, PS28xx and PS86xx photocouplers over time.

Figure 18. Long Term CTR Degradation

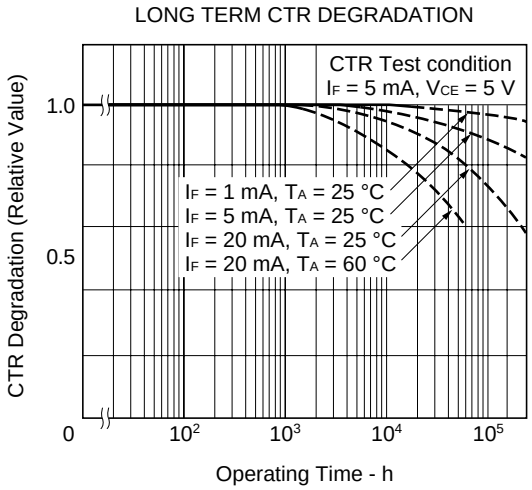
(1) PS25xx Series



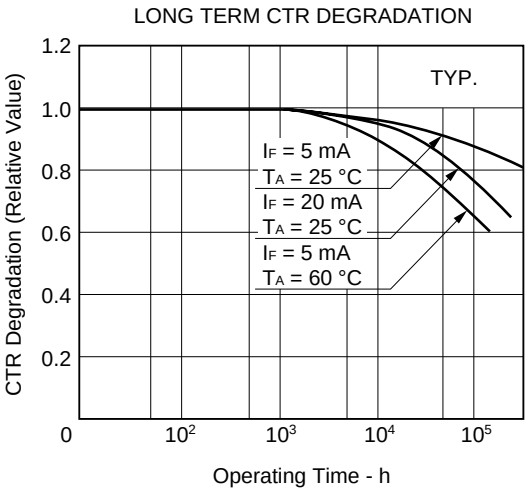
(2) PS26xx Series



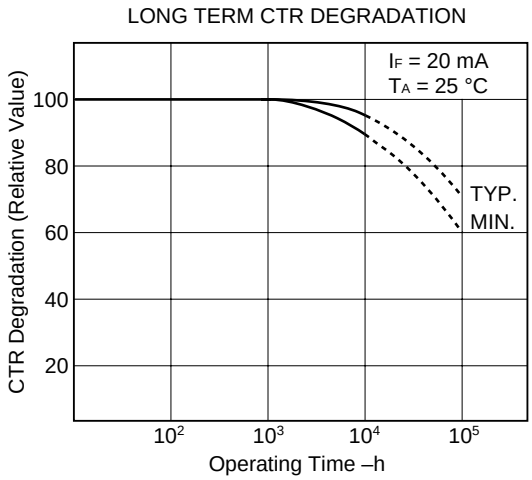
(3) PS27xx Series



(4) PS28xx Series



(5) PS86xx Series



4.2 Response Characteristics

The response characteristics of photocouplers are the same as those of phototransistors. The fall time t_f is expressed by

$$t_f \propto R_L \cdot h_{FE} \cdot C_{CB}$$

R_L : Load resistance

h_{FE} : Amplification factor

C_{CB} : Collector-base capacitance

If R_L is too high, t_f becomes too high to be fit for high-speed signal transmission. Select the proper load resistance for the desired signal rate. Similarly, the collector current must fully satisfy the minimum value of the CTR, CTR vs. T_A characteristics, and CTR vs. time characteristics. Otherwise, the phototransistor will operate unsaturated, causing lower response characteristics and malfunction.

Figure 19. Test Circuit for Response-time

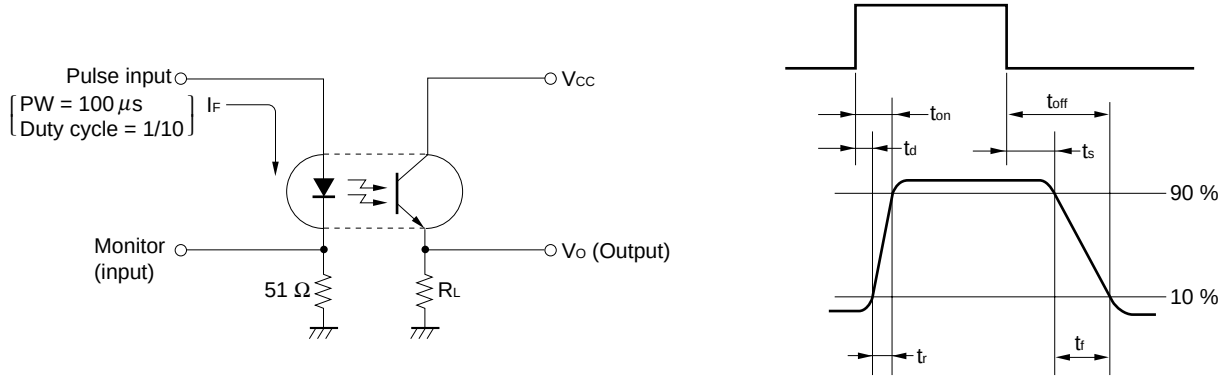
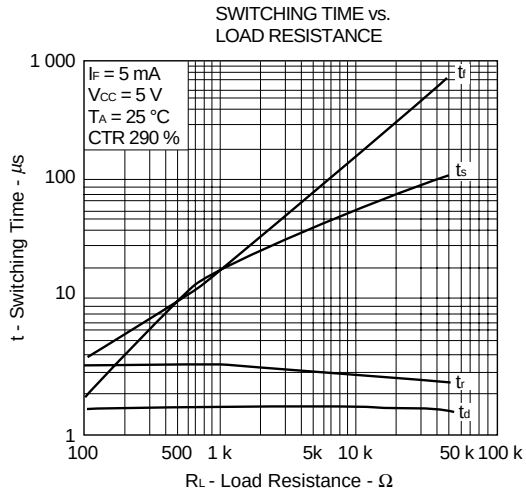
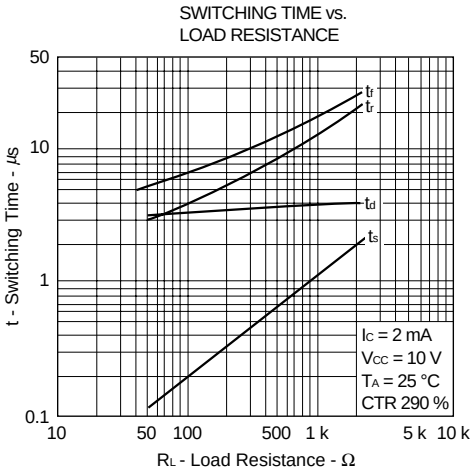


Figure 20 to Figure 24 show the response time vs. the load resistance which show four CTR parameters.

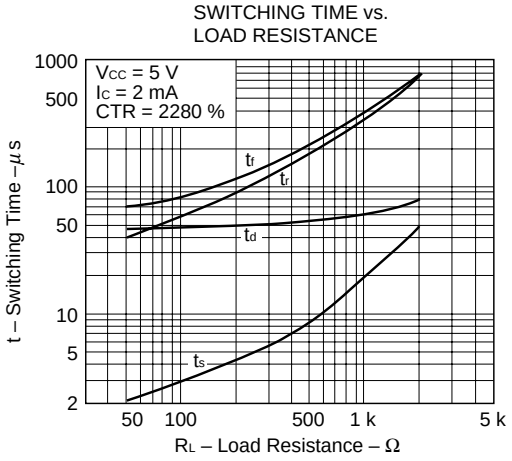
Figure 20. Switching Time vs. R_L Load Resistance of PS25xx Series (1/2)

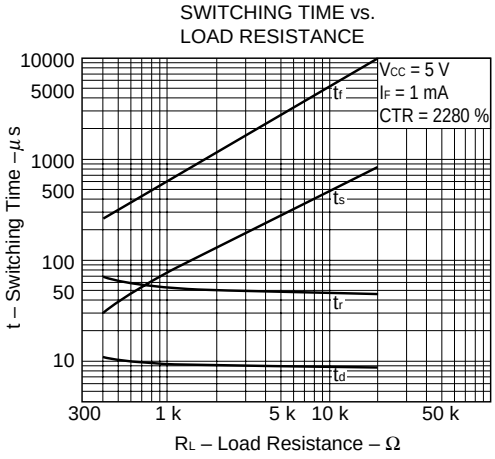
(1) PS2501, PS2505, PS2561, PS2565, PS2581



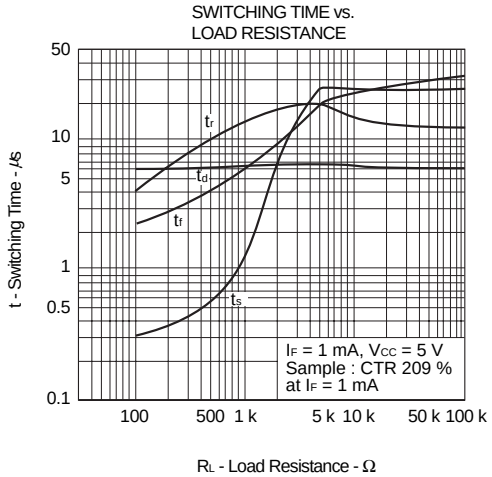


(2) PS2502, PS2506, PS2562, PS2566





(3) PS2503



(4) PS2521, PS2525

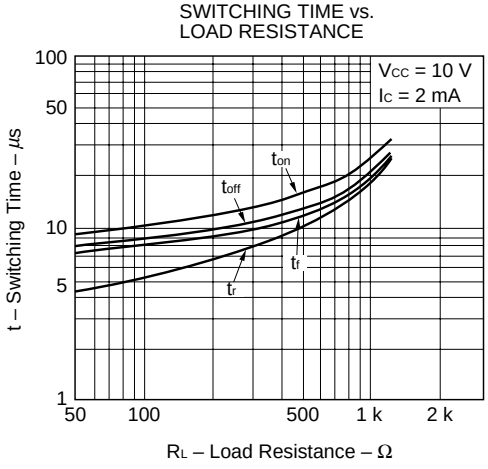


Figure 20. Switching Time vs. R_L Load Resistance of PS25xx Series (2/2)

(5) PS2532, PS2533

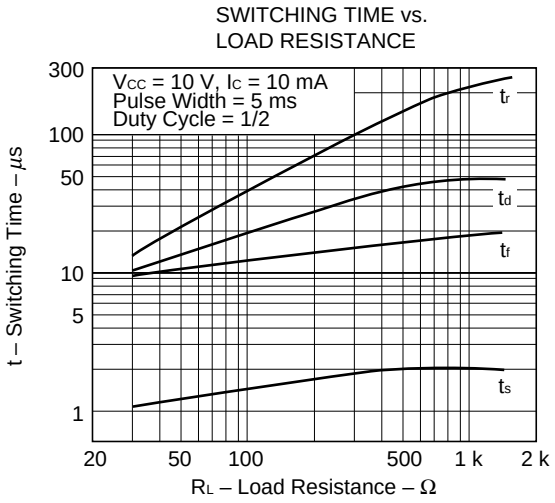
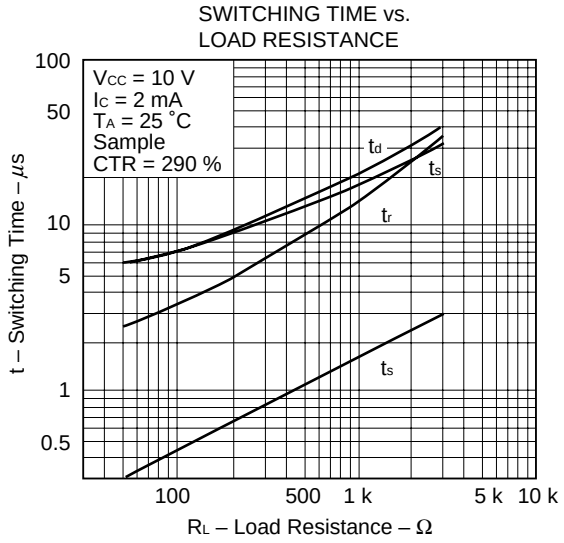
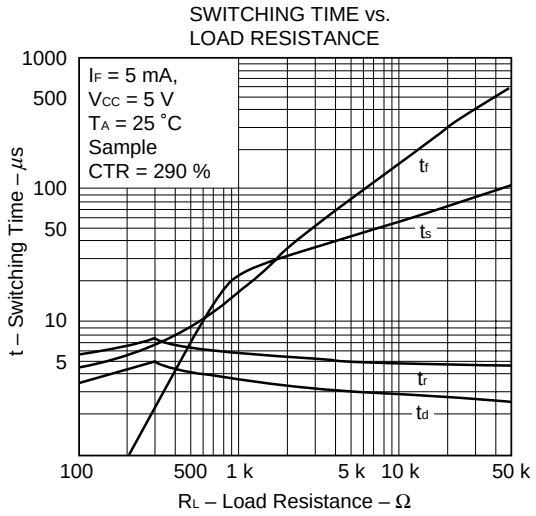


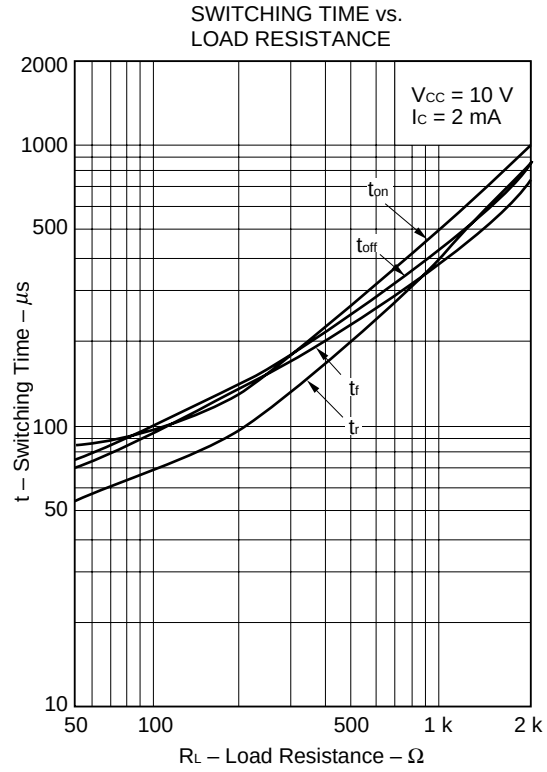
Figure 21. Switching Time vs. R_L Load Resistance of PS26xx Series (1/2)

(1) PS2601, PS2602, PS2605, PS2606, PS2651, PS2652





(2) PS2603, PS2604, PS2607, PS2608, PS2653, PS2654



(3) PS2621, PS2622, PS2625, PS2626

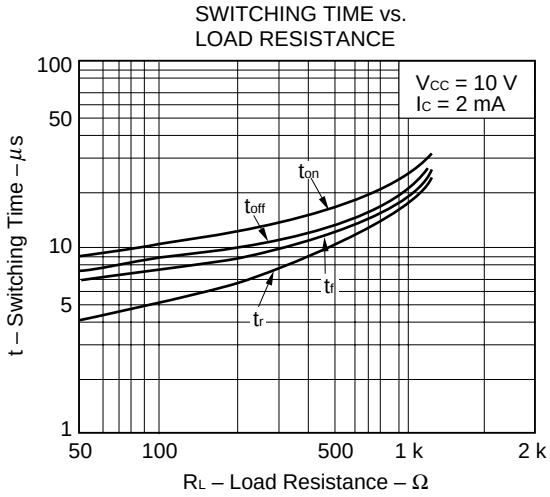
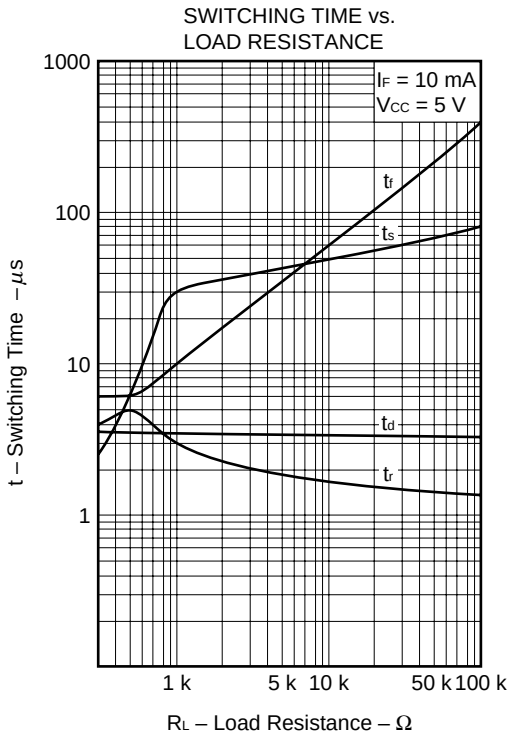


Figure 21. Switching Time vs. R_L Load Resistance of PS26xx Series (2/2)

(4) PS2631



(5) PS2633, PS2634

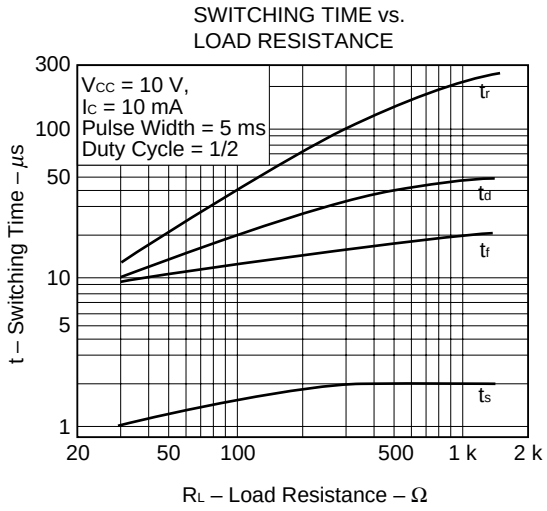
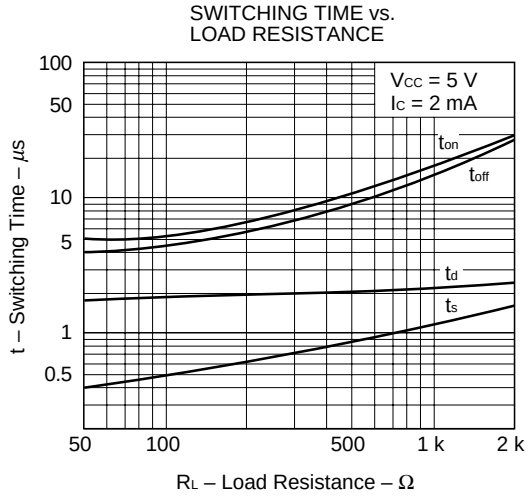
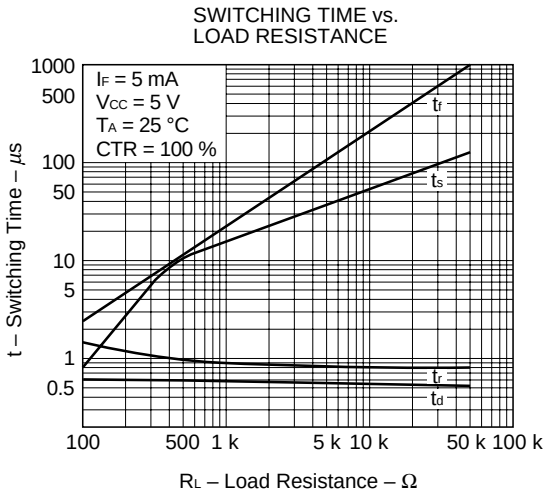


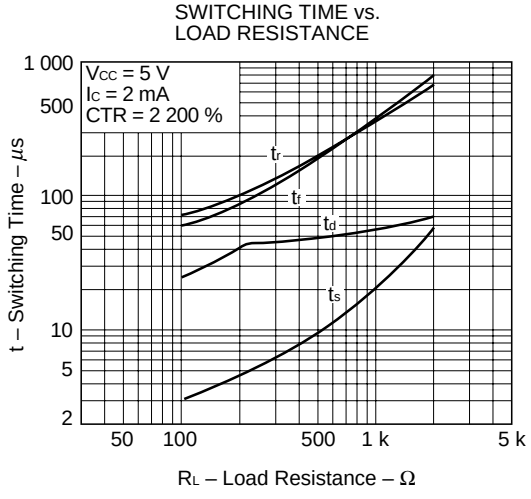
Figure 22. Switching Time vs. R_L Load Resistance of PS27xx Series (1/2)

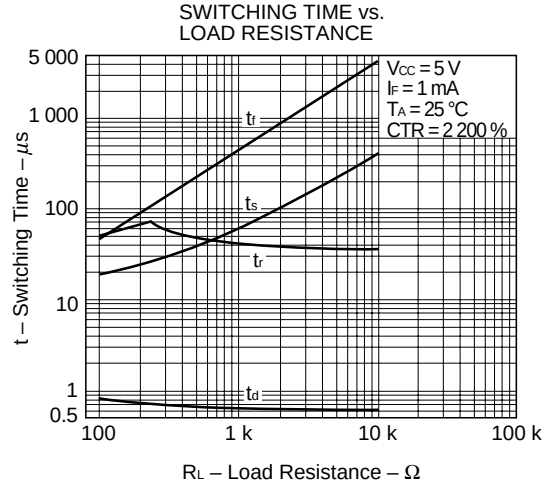
(1) PS2701, PS2705



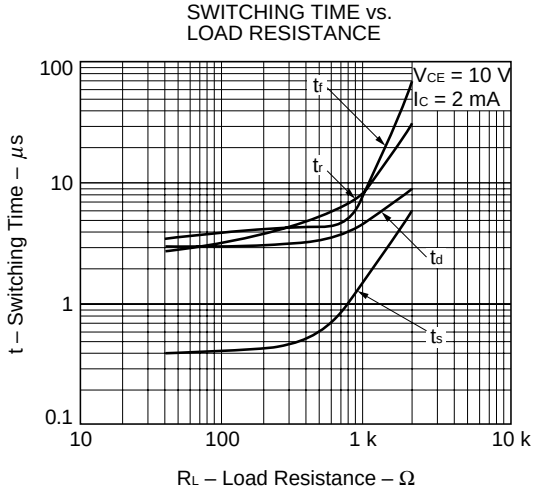


(2) PS2702, PS2706





(3) PS2703, PS2707



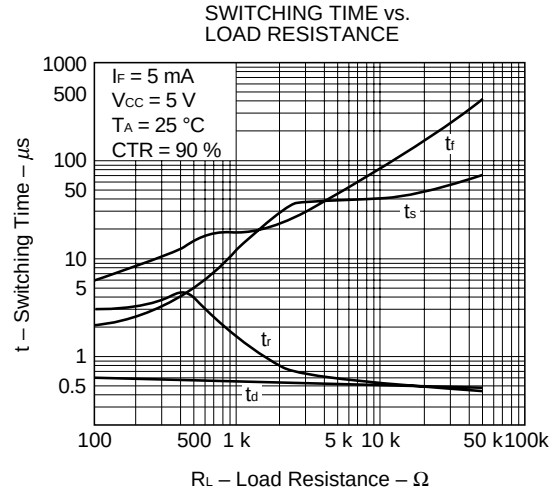


Figure 22. Switching Time vs. R_L Load Resistance of PS27xx Series (2/2)

(4) PS2732, PS2733

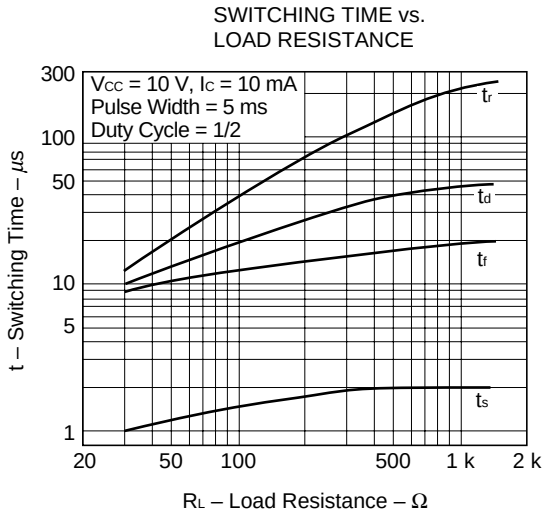
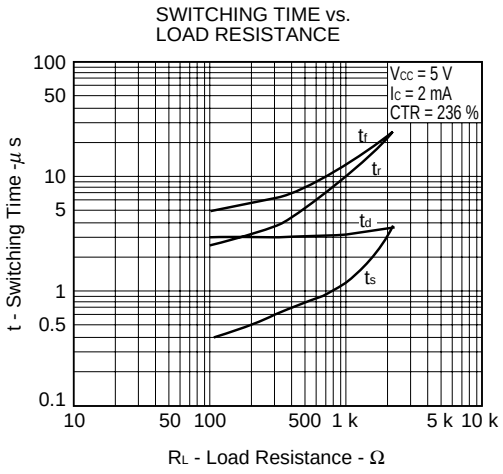
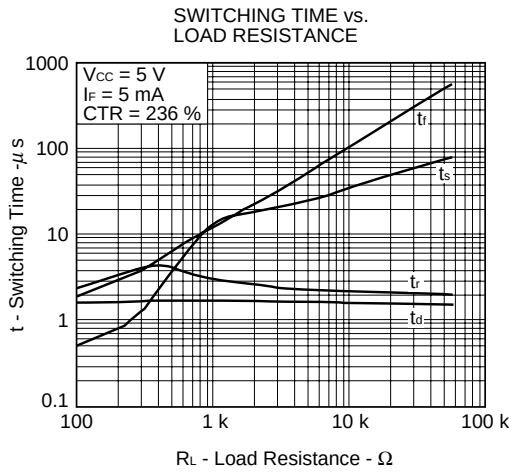


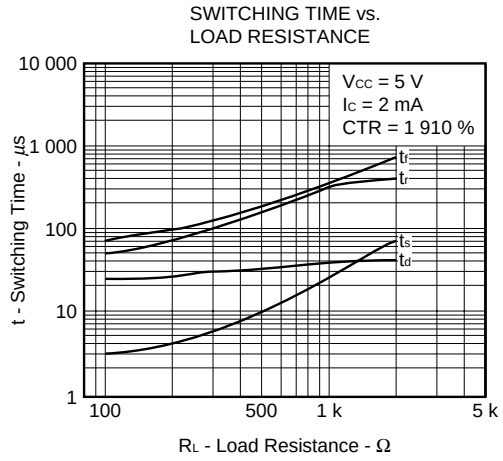
Figure 23. Switching Time vs. R_L Load Resistance of PS28xx Series

(1) PS2801, PS2805





(2) PS2802, PS2806



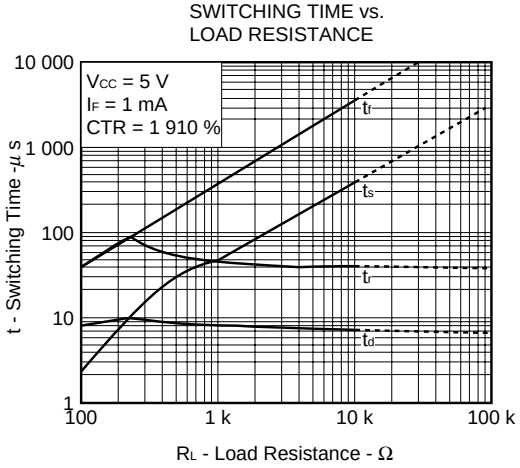
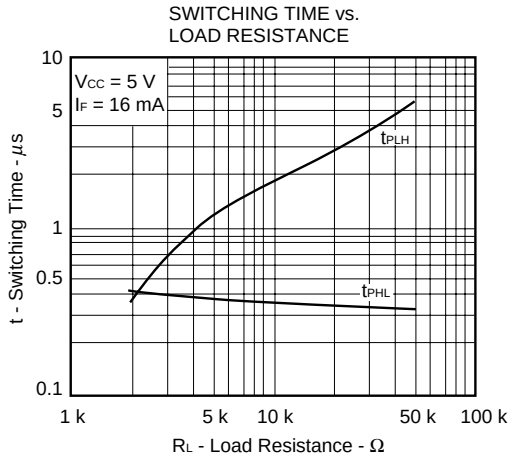


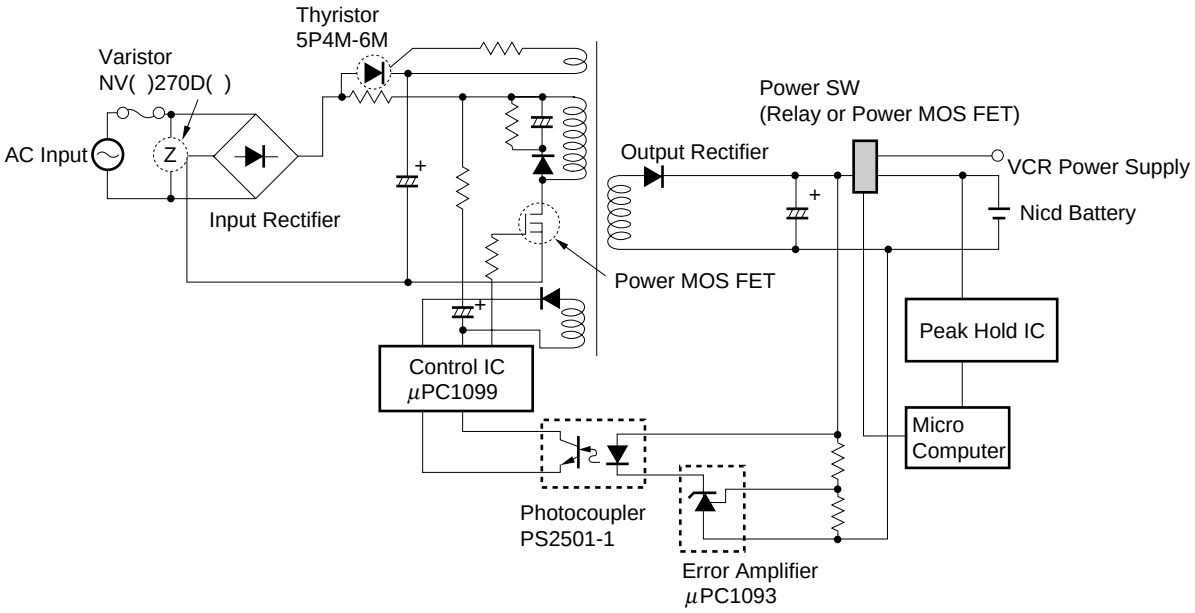
Figure 24. Switching Time vs. R_L Load Resistance of PS86xx Series

PS8601, PS8602



5. APPLICATIONS

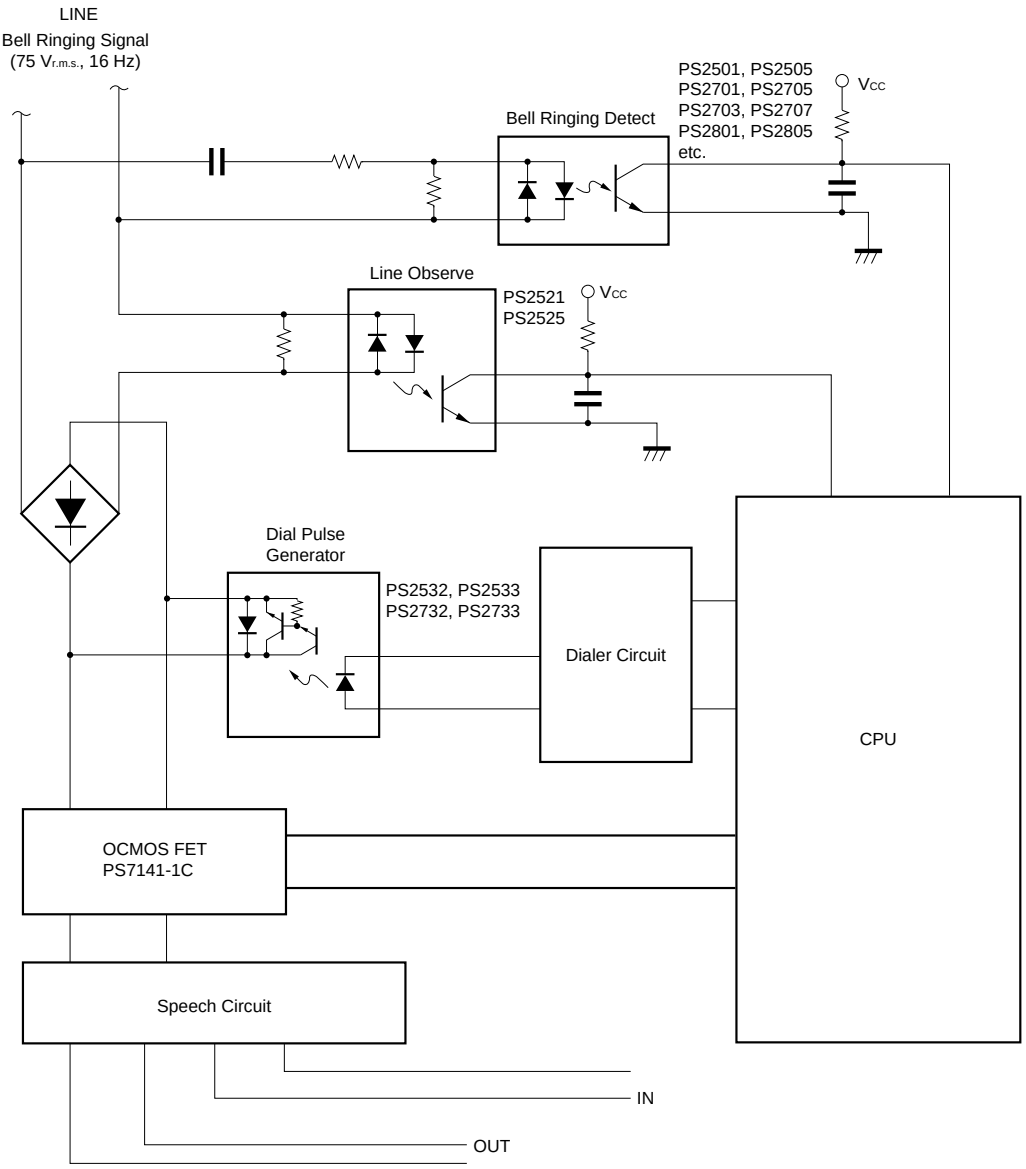
5.1 Power Supply Example



Recommended devices

Part number	Function
PS2501-1 PS2561-1 PS2581L1-1 PS2581L2-1 PS2701-1 PS2703-1 PS2801-1 PS8601 PS8602	Feedback circuit

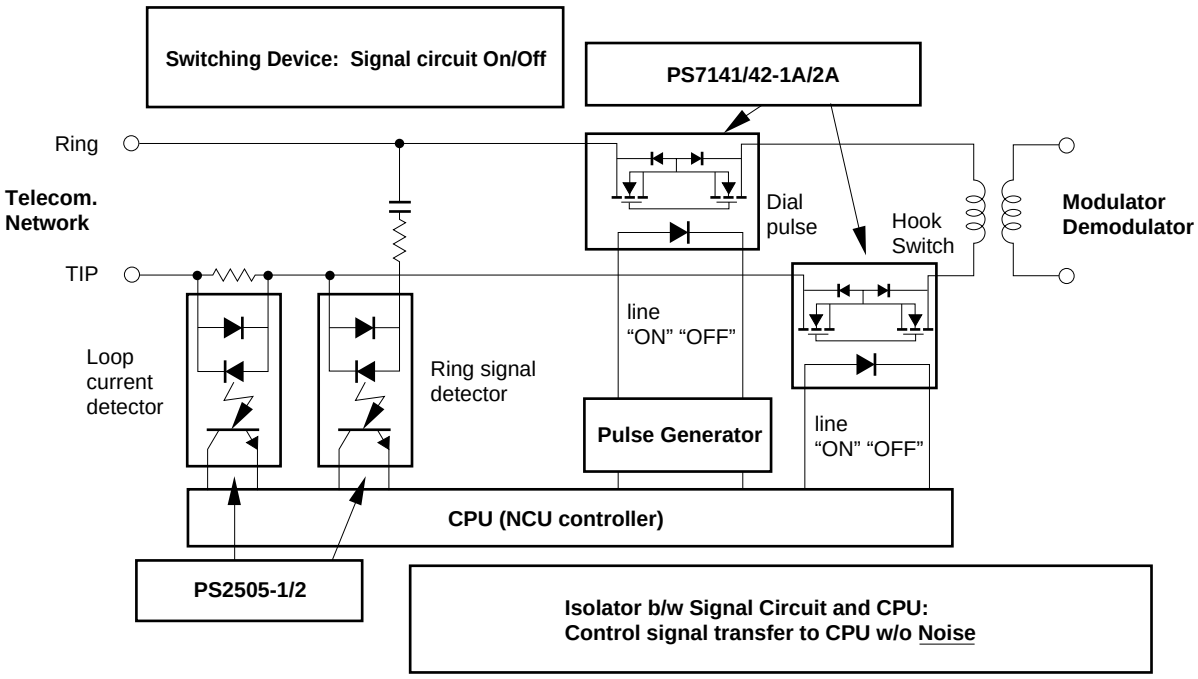
5.2 Telephone Example



Recommended devices

Part number	Function
PS2501-1, PS2505-1 PS2701-1, PS2703-1 PS2705-1, PS2707-1 PS2801-1, PS2805-1	Bell ringing detector
PS2521-1, PS2525-1 PS2621, PS2622 PS2625, PS2626	Line observer
PS2532-1, PS2533-1 PS2633, PS2634 PS2732-1, PS2733-1	Dial pulse generator

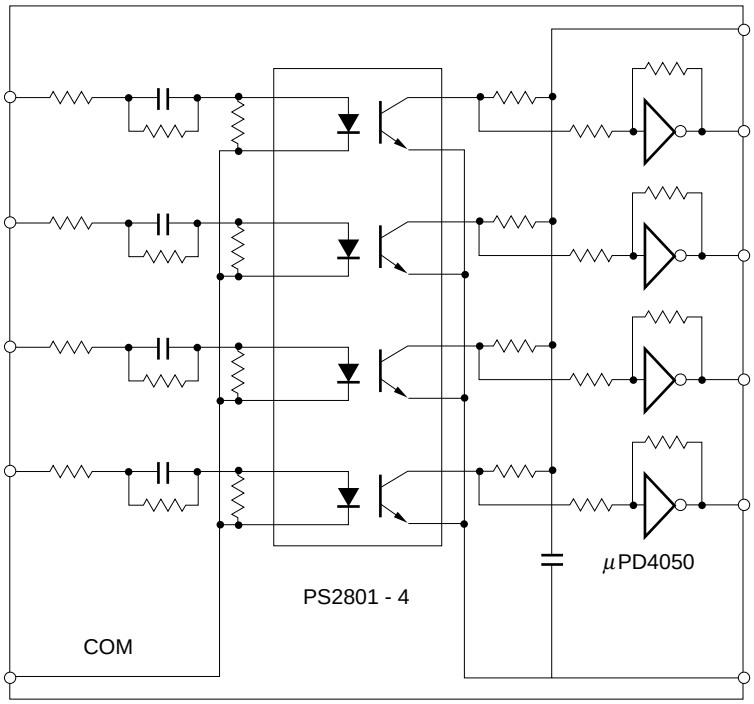
5.3 PC Card/Modem/Facsimile Example



Recommended devices

Part number	Function
PS2501-1, PS2505-1 PS2701-1, PS2703-1 PS2705-1, PS2707-1 PS2801-1, PS2805-1	Bell ringing detector
PS2521-1, PS2525-1 PS2621, PS2625 PS2622, PS2626	Line observer

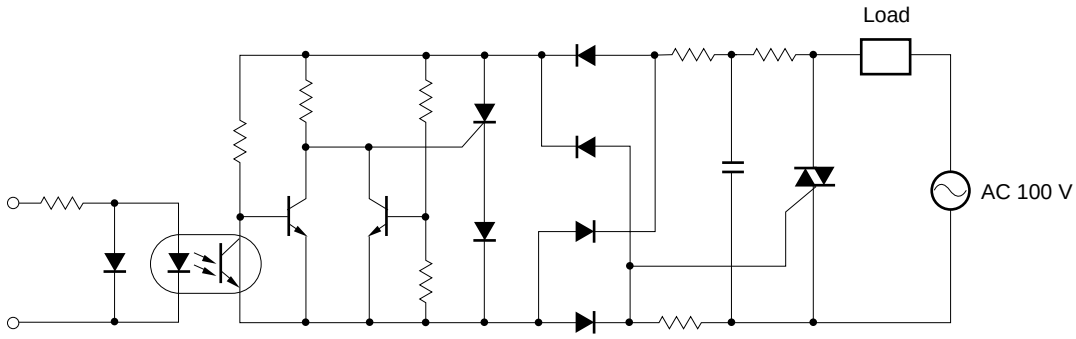
5.4 Programmable Controller Example



Recommended devices

Part number	Function
PS2501-1, -2, -4, PS2502-1, -2, -4 PS2505-1, -2, -4, PS2506-1, -2, -4 PS2701-1, -2, -4, PS2702-1, -2, -4 PS2703-1, -2, -4, PS2705-1, -2, -4 PS2706-1, -2, -4, PS2707-1, -2, -4 PS2801-1, -4, PS2802-1, -4 PS2805-1, -4	Input side isolation
PS2501-1, -2, -4, PS2502-1, -2, -4 PS2701-1, -2, -4, PS2702-1, -2, -4 PS2703-1, -2, -4 PS2801-1, -4, PS2802-1, -4	Output side isolation

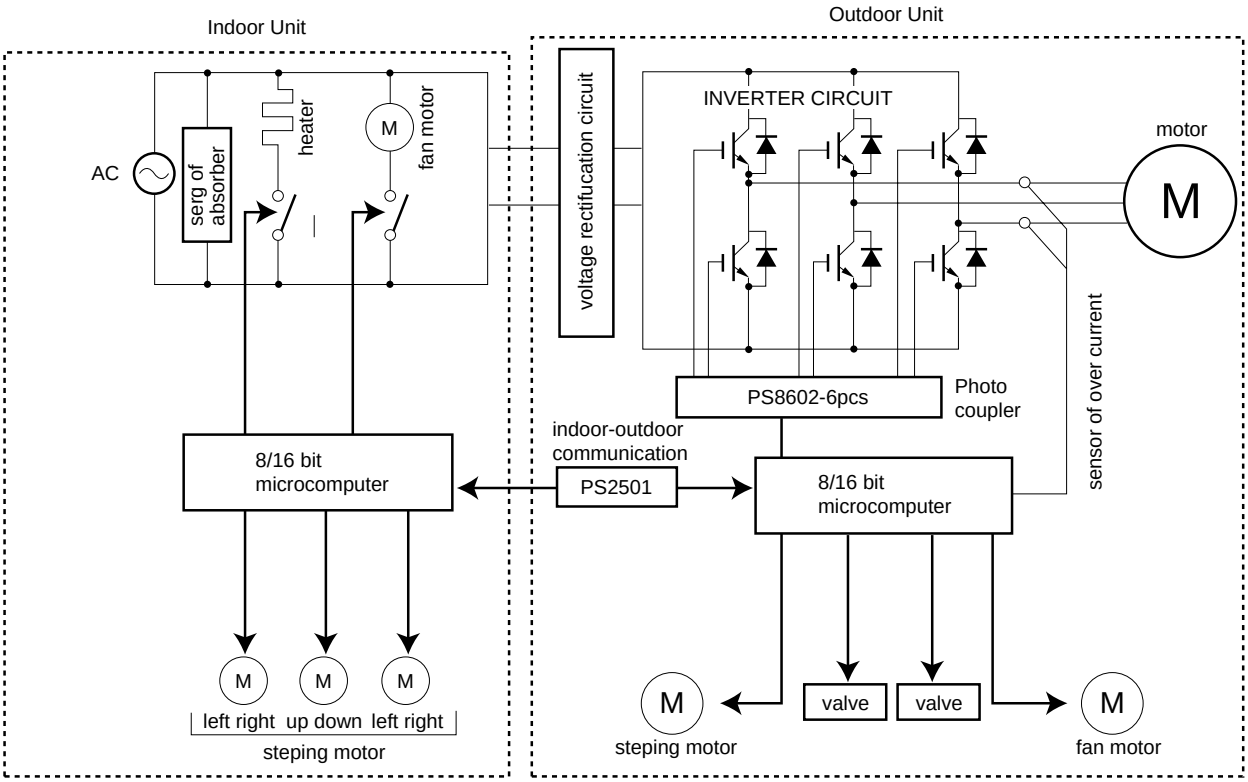
5.5 Solid State Relay Example



Recommended devices

Part number	Function
PS2501-1 PS2601 PS2602 PS2701-1 PS2703-1	Tr. trigger circuit

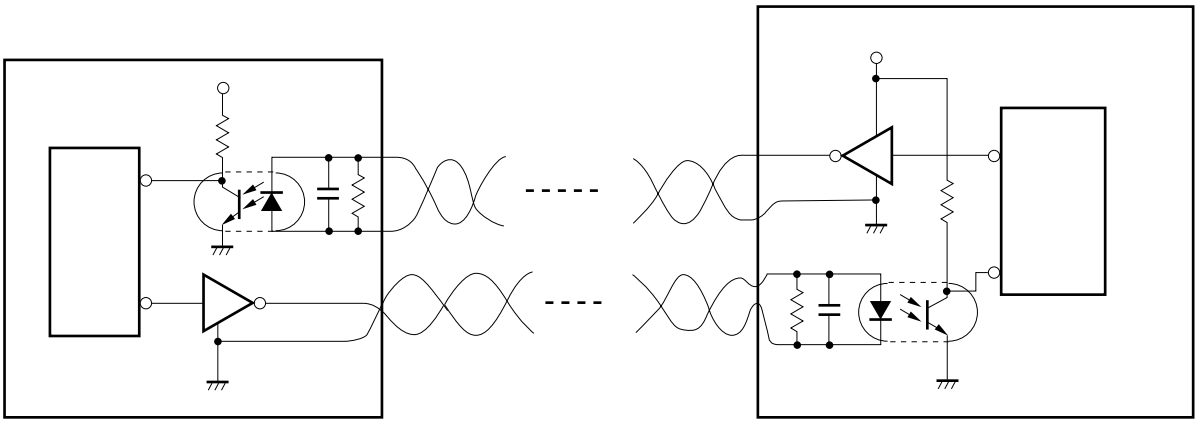
5.6 Inverter Conditioner Example



Recommended devices

Part number	Function
PS2501-1 PS2505-1 PS2701-1 PS2703-1 PS2705-1 PS2706-1	Interface indoor and outdoor units
PS8602	Inverter circuit drives
PS2501-1	IPM Controls

5.7 Computer and Peripheral Equipment Example



CPU　　Peripharal equipment

Recommended devices

Part number	Function
PS2501-1 PS2601 PS8601 PS8602	Noise protection

6. CONCLUSION

Demand for photocouplers featuring higher insulation and noise elimination is steadily increasing. At the same time, various problems (change of characteristics by ambient temperature and time elapse) will occur in their circuit design. We hope this manual will be helpful in solving such problems.

[MEMO]