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NEC

NEPOC SERIES PHOTOCOUPLER AND OPTICAL COUPLED MOS FET SELECTION GUIDE



November 2002

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CONTENTS

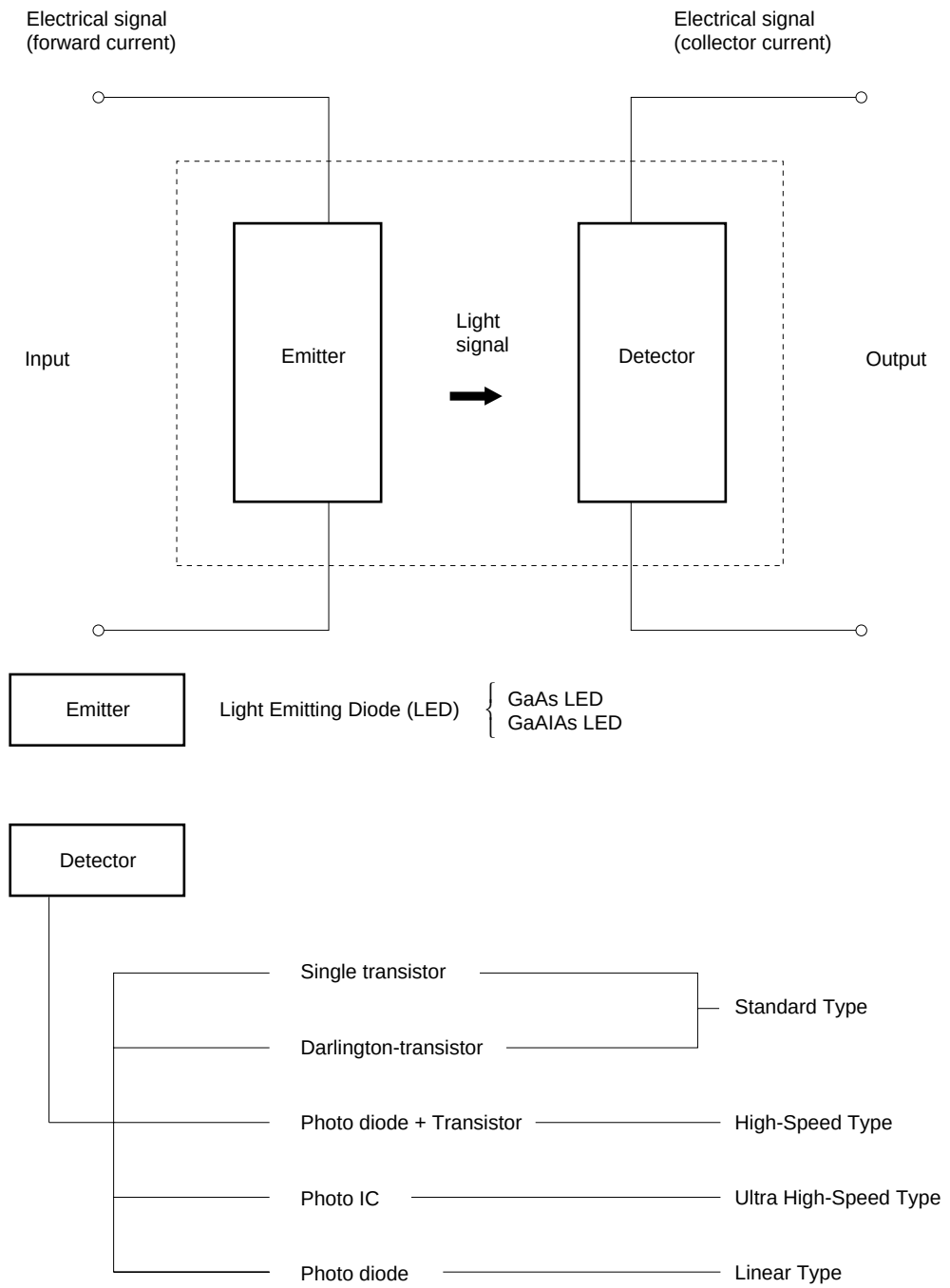
1. PHOTOCOUPLER CONFIGURATION	9
2. PHOTOCOUPLER PRODUCT CLASSIFICATION CHART	10
3. PHOTOCOUPLER CLASSIFICATION CHART (BY FUNCTION).....	12
3.1 Tr. OUTPUT TYPE · STANDARD TYPE (SINGLE Tr.)	12
3.2 Tr. OUTPUT TYPE · STANDARD TYPE (HIGH CTR).....	13
3.3 Tr. OUTPUT TYPE · STANDARD TYPE (DARLINGTON Tr.)	14
3.4 Tr. OUTPUT TYPE · AC INPUT TYPE (SINGLE Tr.)	14
3.5 Tr. OUTPUT TYPE · AC INPUT TYPE (HIGH CTR).....	15
3.6 Tr. OUTPUT TYPE · AC INPUT TYPE (DARLINGTON Tr.).....	15
3.7 Tr. OUTPUT TYPE · HIGH COLLECTOR TO EMITTER VOLTAGE TYPE.....	16
3.8 Tr. OUTPUT TYPE · LARGE INPUT CURRENT TYPE (DC INPUT/SINGLE Tr.)	18
3.9 Tr. OUTPUT TYPE · LARGE INPUT CURRENT TYPE (AC INPUT/SINGLE Tr.)	18
3.10 Tr. OUTPUT TYPE · SAFETY STANDARD TYPE (SINGLE Tr./DARLINGTON Tr.)	19
3.11 IC OUTPUT TYPE · HIGH-SPEED TYPE (200 kbps, ANALOG OUTPUT)	20
3.12 IC OUTPUT TYPE · HIGH-SPEED TYPE (1 Mbps, ANALOG OUTPUT)	21
3.13 IC OUTPUT TYPE · HIGH-SPEED TYPE (1 Mbps, DIGITAL OUTPUT)	21
3.14 IC OUTPUT TYPE · HIGH-SPEED TYPE (10 Mbps, OPEN COLLECTOR OUTPUT)	22
3.15 IC OUTPUT TYPE · HIGH-SPEED TYPE (10 Mbps, TOTEM POLE OUTPUT)	22
3.16 DIODE OUTPUT TYPE · HIGH LINEARITY	23
4. OPTICAL COUPLED MOS FET CONFIGURATION AND OPERATING PRINCIPLE.....	24
4.1 OPTICAL COUPLED MOS FET STRUCTURE	25
4.2 OPTICAL COUPLED MOS FET FEATURES	26
4.3 OPTICAL COUPLED MOS FET NUMBERING SYSTEM	27
4.4 OPTICAL COUPLED MOS FET MAIN CLASSIFICATION CHART	27
4.5 OPTICAL COUPLED MOS FET PRODUCT MAP.....	28
4.5.1 Continuous Load Current vs. Break Down Voltage.....	28
4.5.2 On-State Resistance vs. Break Down Voltage.....	28
4.6 OPTICAL COUPLED MOS FET CHARACTERISTIC TABLE	29
4.7 OPTICAL COUPLED MOS FET CLASSIFICATION CHART.....	30
4.7.1 Standard Normally Open a Type DIP	30
4.7.2 Standard Normally Close b Type DIP	32
4.7.3 Standard 1c Type (1a + 1b) DIP	33
4.7.4 Standard Normally Open a Type SOP	34
4.7.5 Standard Normally Open a Type/Normally Close b Type/Transfer 1c Type (1a + 1b) SOP	36
4.7.6 High Isolation Voltage Normally Open a Type/Normally Close b Type DIP	37
5. OPTICAL COUPLED MOS FET PIN CONNECTIONS.....	38
6. PHOTOCOUPLER AND OPTICAL COUPLED MOS FET PACKAGE DIMENSIONS	39
6.1 PHOTOCOUPLER STANDARD (DIP)	39
6.2 PHOTOCOUPLER STANDARD (SOP)	41
6.3 PHOTOCOUPLER STANDARD (Small SOP)	42
6.4 PHOTOCOUPLER SURFACE MOUNT TYPE FOR LONG CLEARANCE (DIP)	43

6.5	OPTICAL COUPLED MOS FET STANDARD (DIP).....	45
6.6	OPTICAL COUPLED MOS FET STANDARD (SOP)	46
6.7	OPTICAL COUPLED MOS FET STANDARD (Small SOP).....	46
7.	PHOTOCOUPLER AND OPTICAL COUPLED MOS FET PACKING INFORMATIONS.....	47
7.1	MAGAZINE CASE.....	47
7.1.1	4, 6, 8-pin DIP	47
7.1.2	4, 6, 8-pin Surface Mount Type.....	47
7.1.3	4, 8-pin SOP.....	47
7.1.4	5-pin SOP.....	48
7.2	TAPING PACKING SPECIFICATIONS.....	49
7.2.1	Taping Specifications.....	49
7.2.2	Reel Specifications.....	50
8.	PHOTOCOUPLER AND OPTICAL COUPLED MOS FET MARKING EXAMPLE.....	51
8.1	PHOTOCOUPLER MARKING EXAMPLE.....	51
8.2	OPTICAL COUPLED MOS FET MARKING EXAMPLE.....	54
9.	PHOTOCOUPLER AND OPTICAL COUPLED MOS FET SAFETY STANDARDS	56
9.1	SAFETY STANDARDS	56
9.1.1	Photocoupler Safety Standard Approval List (As of November 2002)	56
9.1.2	Optical Coupled MOS FET Safety Standard Approval List (As of November 2002)	60
9.1.3	Photocoupler List of Constructional Parameters.....	62
9.1.4	Construction	63
9.1.5	List of Product Name During Application for Safety Standard.....	63
10.	PHOTOCOUPLER AND OPTICAL COUPLED MOS FET USAGE CAUTIONS.....	64
10.1	SOLDERING INFORMATIONS.....	64
10.1.1	Infrared Reflow Soldering (IR260).....	64
10.1.2	Infrared Reflow Soldering (IR235).....	65
10.1.3	Dip Soldering.....	65
10.1.4	Cautions	66
10.1.5	Post-installation Cleaning.....	66
10.2	CAUTIONS REGARDING NOISE.....	67
10.3	OPTICAL COUPLED MOS FET USAGE CAUTIONS.....	67
10.3.1	Optical Coupled MOS FET Driving Conditions.....	67
10.3.2	Load Connections: PS7x Series (AC/DC Switching Version)	69
10.3.3	Handling Precautions	69
10.4	FAILURE RATE.....	70
10.4.1	Concept of Failure Rate	70
10.4.2	Calculating the Failure Rate	71
10.5	MOUNT PAD DIMENSIONS	73
10.5.1	Mount Pad Dimensions	73
10.5.2	Mount Pad Dimensions (PS2911-1, PS2913-1, PS2932-1, PS2933-1).....	74
10.5.3	Mount Pad Dimensions (PS7801-1A, PS7802-1A).....	75
11.	PHOTOCOUPLER AND OPTICAL COUPLED MOS FET APPLICATION FIELDS.....	76

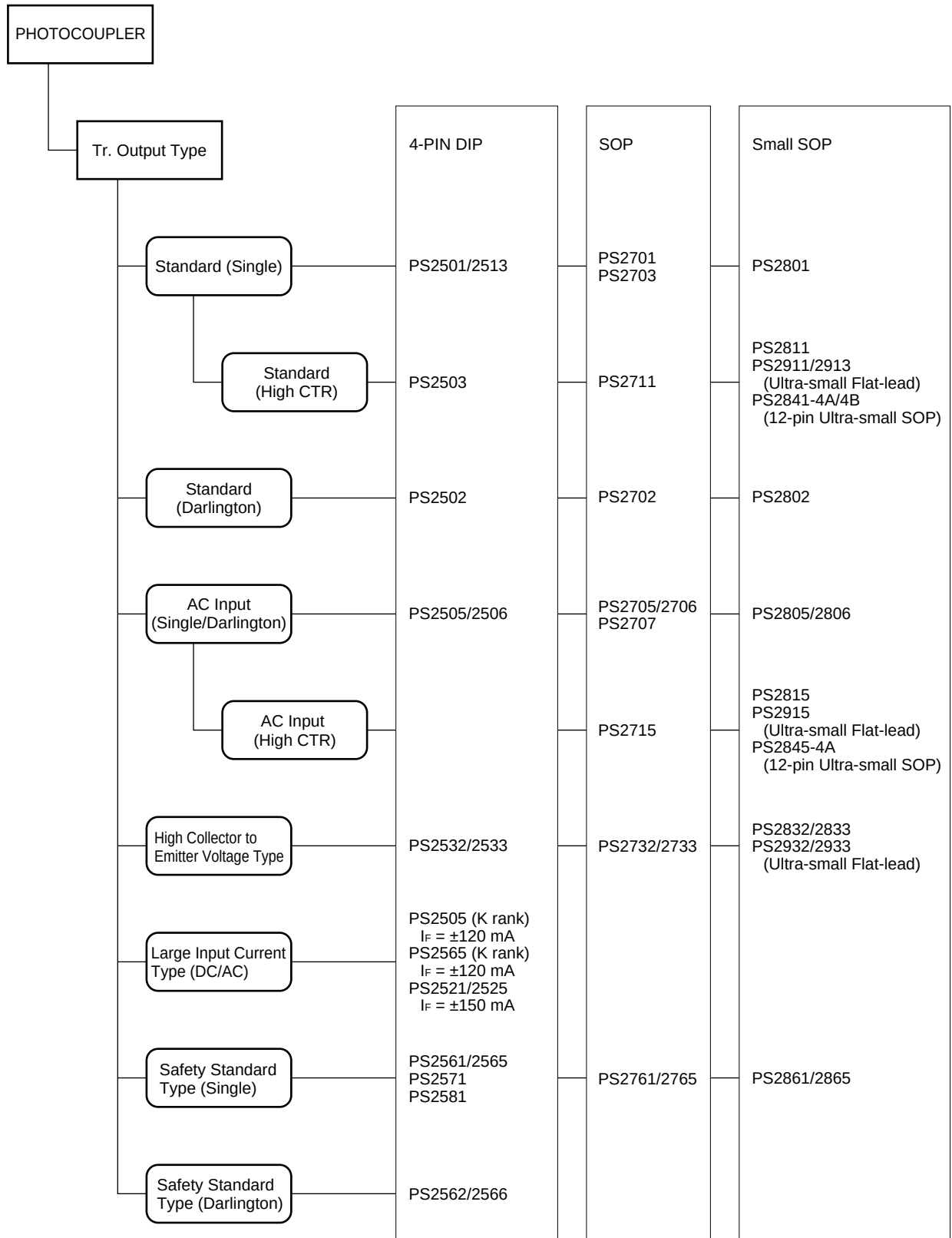
12. PHOTOCOUPLER APPLICATION EXAMPLES	76
12.1 PROGRAMMABLE LOGIC CONTROLLER APPLICATION OF PHOTOCOUPLER.....	76
12.2 SWITCHING POWER SUPPLIES APPLICATION OF PHOTOCOUPLER.....	77
12.3 APPLICATION FOR COLOR PDP DRIVING CIRCUIT	77
12.4 INVERTER APPLICATION	78
12.5 HIGH-SPEED SWITCHING POWER MOS GATE DRIVING CIRCUIT	78
12.6 MODEM, FAX, STB (SET TOP BOX)	79
13. OPTICAL COUPLED MOS FET APPLICATION CHART.....	80
13.1 PLC OUTPUT IC	80
13.2 IC TESTER, APPLICATION OF OPTICAL COUPLED MOS FET	81
13.3 ELECTRONIC INSTRUMENTS/TESTER DATA LOGGER, RECORDER/ TEMPERATURE CONTROLLERS	81
14. CROSS-REFERENCE	82
14.1 PHOTOCOUPLER CROSS-REFERENCE	82
14.2 OPTICAL COUPLED MOS FET CROSS-REFERENCE	83
15. WEB SITE INFORMATION	84

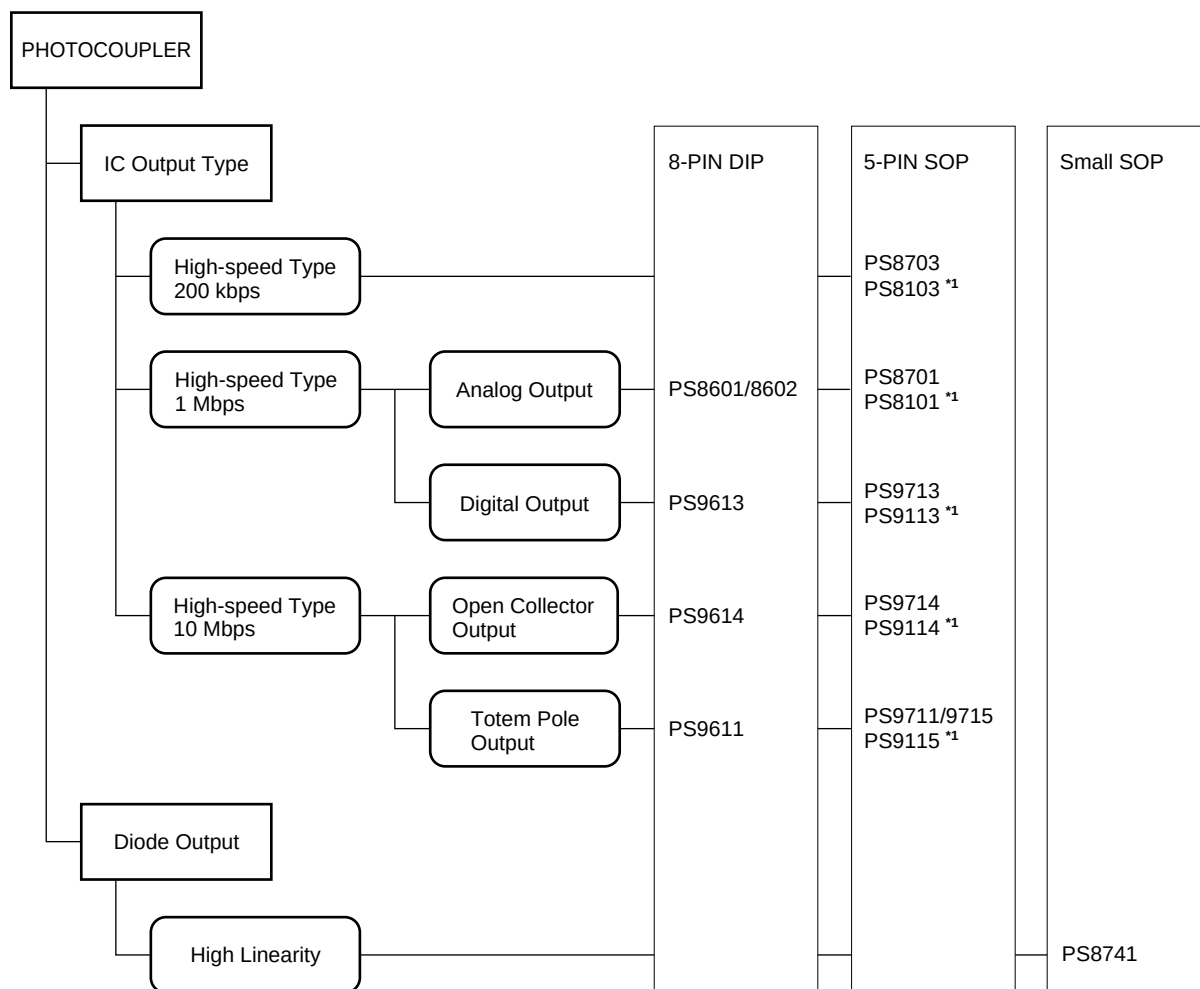
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1. PHOTOCOUPLER CONFIGURATION



2. PHOTOCOUPLER PRODUCT CLASSIFICATION CHART

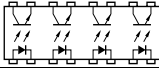
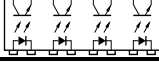




*1 Under development

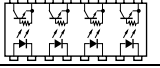
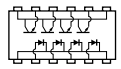
3. PHOTOCOUPLER CLASSIFICATION CHART (BY FUNCTION)

3.1 Tr. OUTPUT TYPE · STANDARD TYPE (SINGLE Tr.)

Part Number	Pin Connections	Features	Absolute Maximum Ratings			Electrical Characteristics	
			BV (kVr.m.s.)	V _{CEO} (V)	I _C (mA)	CTR ^{*1} (%)	t _r , t _f (μs) TYP.
PS2501-1 PS2501L-1		High isolation voltage High V _{CEO} UL approved 4-pin DIP	5	80	50	80 to 600	3, 5 (R _L = 100 Ω)
PS2501-2 PS2501L-2							
PS2501-4 PS2501L-4							
PS2513-1 PS2513L-1		High isolation voltage High V _{CEO} (120 V) Guaranteed maximum switching speed UL approved	5	120	30	50 to 200	t _{on} , t _{off} (μs) MAX.
							60 (R _L = 1.9 kΩ)
PS2701-1		UL, VDE (Option), BSI approved 4-pin SOP	3.75	40	80	50 to 300	3, 5 (R _L = 100 Ω)
PS2703-1		High CTR UL, VDE (Option), BSI approved 4-pin SOP		120	30	50 to 400	10, 10 (R _L = 1 kΩ)
PS2801-1		Pin pitch: 1.27 mm UL, VDE (Option), BSI approved 4, 16-pin Small SOP	2.5	80	50	80 to 600	3, 5 (R _L = 100 Ω)
PS2801-4							

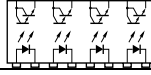
*1 I_F = 5 mA, V_{CE} = 5 V, unless otherwise specified

3.2 Tr. OUTPUT TYPE · STANDARD TYPE (HIGH CTR)

Part Number	Pin Connections	Features	Absolute Maximum Ratings			Electrical Characteristics	
			BV (kVr.m.s.)	V _{CEO} (V)	I _C (mA)	CTR ^{*1} (%)	t _r , t _f (μs) TYP.
PS2503-1 PS2503L-1		High isolation voltage High CTR UL, CSA approved 4, 8, 16-pin DIP	5	40	30	100 to 400 (I _F = 1 mA)	20, 30 (R _L = 10 kΩ)
PS2503-2 PS2503L-2							
PS2503-4 PS2503L-4							
PS2711-1		High CTR UL, VDE (Option) approved 4-pin SOP	3.75	120	40	50 to 200 (I _F = 1 mA)	4, 5 (R _L = 100 Ω)
PS2811-1		Pin pitch: 1.27 mm High CTR UL approved 4-pin Small SOP	2.5				5, 10 (R _L = 100 Ω)
PS2911-1		High CTR Insulation thickness: 0.4 mm UL, VDE (Option), BSI (Insulation supplementary) approved 4-pin Small SOP					
PS2913-1							
PS2841-4A		Pin pitch: 0.8 mm High CTR 12-pin Small SOP Cathode, Collector common UL approved	1.5	70	20	100 to 400 (I _F = 1 mA, V _{CE} = 0.4 V)	t _{on} , t _{off} (μs) TYP.
PS2841-4B		Pin pitch: 0.8 mm High CTR 12-pin Small SOP Anode, Collector common UL approved					20, 110 (R _L = 5 kΩ)

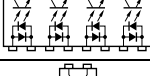
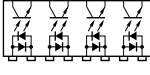
*1 I_F = 5 mA, V_{CE} = 5 V, unless otherwise specified

3.3 Tr. OUTPUT TYPE · STANDARD TYPE (DARLINGTON Tr.)

Part Number	Pin Connections	Features	Absolute Maximum Ratings			Electrical Characteristics		
			BV (kVr.m.s.)	V _{CEO} (V)	I _C (mA)	CTR ¹ (%)	t _r , t _f (μs) TYP.	
PS2502-1 PS2502L-1		High isolation voltage High CTR UL approved 4, 8, 16-pin DIP	5	40	200	200 or above (I _F = 1 mA)	100, 100 (R _L = 100 Ω)	
PS2502-2 PS2502L-2					160			
PS2502-4 PS2502L-4								
PS2702-1		High CTR UL, VDE (Option), BSI approved 4-pin SOP	3.75	40	200		200, 200 (R _L = 100 Ω)	
PS2802-1		Pin pitch: 1.27 mm UL, VDE (Option), BSI approved 4, 16-pin Small SOP	2.5		90			
PS2802-4					100			

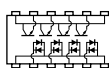
*1 I_F = 5 mA, V_{CE} = 5 V, unless otherwise specified

3.4 Tr. OUTPUT TYPE · AC INPUT TYPE (SINGLE Tr.)

Part Number	Pin Connections	Features	Absolute Maximum Ratings			Electrical Characteristics	
			BV (kVr.m.s.)	V _{CEO} (V)	I _C (mA)	CTR ^{*1} (%)	t _r , t _f (μs) TYP.
PS2505-1 PS2505L-1		High isolation voltage AC input High V _{CEO} UL approved 4, 8, 16-pin DIP	5	80	50	80 to 600	3, 5 (R _L = 100 Ω)
PS2505-2 PS2505L-2							
PS2505-4 PS2505L-4							
PS2705-1		AC input UL, VDE (Option), BSI approved 4-pin SOP	3.75	40	80	50 to 300	10, 10 (R _L = 1 kΩ)
PS2707-1				120	30	50 to 400	
PS2805-1		Pin pitch: 1.27 mm AC input UL, VDE (Option), BSI approved 4, 16-pin Small SOP	2.5	80	50	80 to 600	3, 5 (R _L = 100 Ω)
PS2805-4							

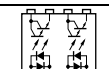
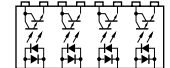
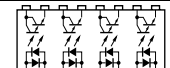
*1 I_F = 5 mA, V_{CE} = 5 V, unless otherwise specified

3.5 Tr. OUTPUT TYPE · AC INPUT TYPE (HIGH CTR)

Part Number	Pin Connections	Features	Absolute Maximum Ratings			Electrical Characteristics	
			BV (kVr.m.s.)	V _{CEO} (V)	I _c (mA)	CTR ¹ (%)	t _r , t _f (μs) TYP.
PS2715-1		High CTR UL, VDE (Option) approved 4-pin SOP	3.75	40	40	100 to 400 (I _F = 1 mA)	4, 5 (R _L = 100 Ω)
PS2815-1		Pin pitch: 1.27 mm High CTR UL approved 4-pin Small SOP	2.5				
PS2915-1		High CTR Insulation thickness: 0.4 mm UL, VDE (Option), BSI (Insulation supplementary) approved 4-pin Small SOP					
PS2845-4A		Pin pitch: 0.8 mm High CTR Anode, Cathode, Collector common 12-pin Small SOP	1.5	70	20	100 to 400 (I _F = 1 mA, V _{CE} = 0.4 V)	t _{on} , t _{off} (μs) TYP. 20, 110 (R _L = 5 kΩ)

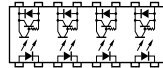
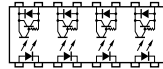
*1 I_F = 5 mA, V_{CE} = 5 V, unless otherwise specified

3.6 Tr. OUTPUT TYPE · AC INPUT TYPE (DARLINGTON Tr.)

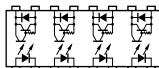
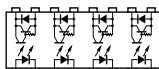
Part Number	Pin Connections	Features	Absolute Maximum Ratings			Electrical Characteristics		
			BV (kVr.m.s.)	V _{CEO} (V)	I _c (mA)	CTR ¹ (%)	t _r , t _r (μs) TYP.	
PS2506-1 PS2506L-1		High isolation voltage AC input	5	40	200	200 or above (I _F = ±1 mA)	100, 100 (R _L = 100 Ω)	
PS2506-2 PS2506L-2		High CTR UL approved 4, 8, 16-pin DIP			160			
PS2506-4 PS2506L-4								
PS2706-1		High CTR AC input UL, VDE (Option), BSI approved 4-pin SOP	3.75		200		200, 200 (R _L = 100 Ω)	
PS2806-1		Pin pitch: 1.27 mm AC input	2.5		90			
PS2806-4		UL, VDE (Option), BSI approved 4, 16-pin Small SOP			100			

*1 I_F = 5 mA, V_{CE} = 5 V, unless otherwise specified

3.7 Tr. OUTPUT TYPE · HIGH COLLECTOR TO EMITTER VOLTAGE TYPE

Part Number	Pin Connections	Features	Absolute Maximum Ratings			Electrical Characteristics	
			BV (kVr.m.s.)	V _{CEO} (V)	I _C (mA)	CTR ¹ (%)	t _r , t _f (μs) TYP.
PS2532-1 PS2532L-1		High isolation voltage High V _{CEO} (300 V) Darlington Tr.	5	300	150	1 500 to 6 500 (I _F = 1 mA)	100, 100 (R _L = 100 Ω)
PS2532-2 PS2532L-2		UL, VDE (Option), CSA, BSI, SEMKO, FIMKO, NEMKO, DEMKO approved					
PS2532-4 PS2532L-4		4, 8, 16-pin DIP					
PS2533-1 PS2533L-1		High isolation voltage High V _{CEO} (350 V) Darlington Tr.		350			
PS2533-2 PS2533L-2		UL, VDE (Option), CSA, BSI, SEMKO, FIMKO, NEMKO, DEMKO approved					
PS2533-4 PS2533L-4		4, 8, 16-pin DIP					
PS2732-1		High isolation voltage High V _{CEO} (300 V) Darlington Tr. UL, VDE (Option), BSI approved 4-pin SOP	2.5	300		1 500 or above (I _F = 1 mA)	
PS2733-1		High isolation voltage High V _{CEO} (350 V) Darlington Tr. UL, VDE (Option), BSI approved 4-pin SOP		350			

*1 I_F = 5 mA, V_{CE} = 5 V, unless otherwise specified

Part Number	Pin Connections	Features	Absolute Maximum Ratings			Electrical Characteristics	
			BV (kVr.m.s.)	V _{CEO} (V)	I _C (mA)	CTR ^{*1} (%)	t _r , t _f (μs) TYP.
PS2832-1		High isolation voltage High V _{CEO} (300 V) Darlington Tr.	2.5	300	60	400 to 4 500 (I _F = 1 mA)	20, 5 (R _L = 100 Ω)
PS2832-4		UL, VDE (Option), BSI approved 4, 16-pin Small SOP					
PS2833-1		High isolation voltage High V _{CEO} (350 V) Darlington Tr.		350			
PS2833-4		UL approved 4, 16-pin Small SOP					
PS2932-1		High isolation voltage Insulation thickness: 0.4 mm High V _{CEO} (300 V) Darlington Tr. UL, VDE (Option), BSI (Insulation supplementary) approved 4-pin Small SOP		300			
PS2933-1		High isolation voltage Insulation thickness: 0.4 mm High V _{CEO} (350 V) Darlington Tr. UL, VDE (Option), BSI (Insulation supplementary) approved 4-pin Small SOP		350			

*1 I_F = 5 mA, V_{CE} = 5 V, unless otherwise specified

3.8 Tr. OUTPUT TYPE · LARGE INPUT CURRENT TYPE (DC INPUT/SINGLE Tr.)

Part Number	Pin Connections	Features	Absolute Maximum Ratings			Electrical Characteristics	
			BV (kVr.m.s.)	V _{CEO} (V)	I _C (mA)	CTR ^{*1} (%)	t _r , t _f (μs) TYP.
PS2521-1 PS2521L-1		High isolation voltage Large input current (I _F = 150 mA) UL, CSA approved 4, 8, 16-pin DIP	5	80	50	20 to 80 (I _F = 100 mA)	3, 5 (R _L = 100 Ω)
PS2521-2 PS2521L-2							
PS2521-4 PS2521L-4							

*1 I_F = 5 mA, V_{CE} = 5 V, unless otherwise specified

3.9 Tr. OUTPUT TYPE · LARGE INPUT CURRENT TYPE (AC INPUT/SINGLE Tr.)

Part Number	Pin Connections	Features	Absolute Maximum Ratings			Electrical Characteristics									
			BV (kVr.m.s.)	V _{CEO} (V)	I _c (mA)	CTR ^{*1} (%)	t _r , t _f (μs) TYP.								
PS2525-1 PS2525L-1		High isolation voltage Large input current (I _F = ±150 mA) AC input UL, CSA approved 4, 8, 16-pin DIP	5	80	50	20 to 80 (I _F = ±100 mA)	3, 5 (R _L = 100 Ω)								
PS2525-2 PS2525L-2															
PS2525-4 PS2525L-4															
PS2505-1 PS2505L-1		High isolation voltage Large input current (I _F = ±120 mA) AC input UL approved 4, 8, 16-pin DIP				5		80	50	80 to 600 (K rank)					
PS2505-2 PS2505L-2															
PS2505-4 PS2505L-4															
PS2565-1 PS2565L-1		High isolation voltage Large input current (I _F = ±120 mA) AC input UL, VDE (Option), CSA, BSI, SEMKO, FIMKO, NEMKO, DEMCO approved 4, 8, 16-pin DIP								5		80	50	80 to 400 (K rank)	
PS2565-2 PS2565L-2															
PS2565-4 PS2565L-4															

*1 I_F = 5 mA, V_{CE} = 5 V, unless otherwise specified

3. 10 Tr. OUTPUT TYPE · SAFETY STANDARD TYPE (SINGLE Tr./DARLINGTON Tr.)

Part Number	Pin Connections	Features	Absolute Maximum Ratings			Electrical Characteristics	
			BV (kVr.m.s.)	V _{CEO} (V)	I _c (mA)	CTR ^{*1} (%)	t _r , t _f (μs) TYP.
PS2561-1 PS2561L-1		High isolation voltage UL, VDE (Option), CSA, BSI, SEMKO, FIMKO, NEMKO, DEMKO approved 4, 8-pin DIP	5	80	50	80 to 400	3, 5 (R _L = 100 Ω)
PS2561-2 PS2561L-2							
PS2562-1 PS2562L-1		High isolation voltage UL, VDE (Option), CSA, BSI, SEMKO, FIMKO, NEMKO, DEMKO approved 4, 8-pin DIP		40	200	200 or above (I _F = 1 mA)	100, 100 (R _L = 100 Ω)
PS2562-2 PS2562L-2					160		
PS2565-1 PS2565L-1		High isolation voltage AC input UL, VDE (Option), CSA, BSI, SEMKO, FIMKO, NEMKO, DEMKO approved 4, 8-pin DIP		80	50	80 to 400	3, 5 (R _L = 100 Ω)
PS2565-2 PS2565L-2							
PS2566-1 PS2566L-1		High isolation voltage AC input UL, VDE (Option), CSA, BSI, SEMKO, FIMKO, NEMKO, DEMKO approved 4, 8-pin DIP		40	200	200 or above (I _F = ±1 mA)	100, 100 (R _L = 100 Ω)
PS2566-2 PS2566L-2					160		
PS2581L1 PS2581L2		High isolation voltage Outer creepage distance: 8 mm UL, VDE (Standard), CSA, BSI, SEMKO, FIMKO, NEMKO, DEMKO approved 4-pin DIP		80	50	80 to 400	3, 5 (R _L = 100 Ω)
PS2571-1 PS2571L-1		High isolation voltage UL, VDE (Option), CSA, BSI, SEMKO, FIMKO, NEMKO, DEMKO approved 4-pin DIP		40	40		

*1 I_F = 5 mA, V_{CE} = 5 V, unless otherwise specified

- Remarks 1.** Refer to **9. 1 SAFETY STANDARD APPROVAL LIST** for safety standard approval list.
- 2.** Refer to **6. 4 PHOTOCOUPLER SURFACE MOUNT TYPE FOR LONG CLEARANCE** for available product list for long clearance (L1, L2 type).

Part Number	Pin Connections	Features	Absolute Maximum Ratings			Electrical Characteristics	
			BV (kVr.m.s.)	V _{CEO} (V)	I _C (mA)	CTR ^{*1} (%)	t _r , t _f (μs) TYP.
PS2761-1		Insulation thickness: 0.4 mm UL, BSI (Insulation supplementary), VDE (Option), SEMKO, FIMKO, NEMKO, DEMKO approved 4-pin SOP	3.75	40	40	50 to 400	4, 5 (R _L = 100 Ω)
PS2765-1		AC input Insulation thickness: 0.4 mm UL, BSI (Insulation supplementary), VDE (Option), SEMKO, FIMKO, NEMKO, DEMKO approved 4-pin SOP					
PS2861-1		Insulation thickness: 0.4 mm UL, VDE (Option), BSI (Insulation supplementary) approved 4-pin Small SOP					
PS2865-1		AC input Insulation thickness: 0.4 mm UL, VDE (Option), BSI (Insulation supplementary) approved 4-pin Small SOP					

*1 I_F = 5 mA, V_{CE} = 5 V, unless otherwise specified

3. 11 IC OUTPUT TYPE · HIGH-SPEED TYPE (200 kbps, ANALOG OUTPUT)

Part Number	Pin Connections	Features	Absolute Maximum Ratings			Electrical Characteristics	
			BV (kVr.m.s.)	V _{CC} (V)	I _O (mA)	CTR ^{*1} (%)	t _{PLH} , t _{PHL} (μs) MAX.
PS8703 PS8103 ^{*2}		UL, VDE (Option) approved 5-pin SOP	2.5	15	8	10 to 30 (I _F = 16 mA, V _{CC} = 4.5 V, V _O = 0.4 V)	5 (R _L = 4.1 kΩ)

*1 I_F = 5 mA, V_{CE} = 5 V, unless otherwise specified

*2 Under development

3.12 IC OUTPUT TYPE · HIGH-SPEED TYPE (1 Mbps, ANALOG OUTPUT)

Part Number	Pin Connections	Features	Absolute Maximum Ratings			Electrical Characteristics	
			BV (kVr.m.s.)	V _{CC} (V)	I _O (mA)	CTR ^{*1} (%)	t _{PLH} , t _{PHL} (μs) MAX.
PS8601 PS8601L		8-pin DIP base connection UL, VDE (Option), BSI approved	5	35	8	15 or above (I _F = 16 mA, V _{CC} = 4.5 V, V _O = 0.4 V)	0.8 (R _L = 1.9 kΩ)
PS8602 PS8602L		8-pin DIP High CMR (2 kV/μs) UL, VDE (Option), BSI approved					
PS8701 PS8101 ^{*2}		5-pin SOP High CMR (10 kV/μs) UL, VDE (Option) approved	2.5			15 to 35 (I _F = 16 mA, V _{CC} = 4.5 V, V _O = 0.4 V)	1.2/0.8 (R _L = 2.2 kΩ)

*1 I_F = 5 mA, V_{CE} = 5 V, unless otherwise specified

*2 Under development

3.13 IC OUTPUT TYPE · HIGH-SPEED TYPE (1 Mbps, DIGITAL OUTPUT)

Part Number	Pin Connections	Features	Absolute Maximum Ratings			Electrical Characteristics	
			BV (kVr.m.s.)	V _{CC} (V)	I _O (mA)	CM _H , CM _L (kV/μs) MIN.	t _{PLH} , t _{PHL} (μs) MAX.
PS9613 PS9613L		8-pin DIP IPM driver High CMR (15 kV/μs) UL, VDE (Option) approved	5	35	15	15	0.75/0.5 (R _L = 20 kΩ)
PS9713 PS9113 ^{*1}		5-pin SOP IPM driver High CMR (15 kV/μs) UL, VDE (Option) approved	2.5				

*1 Under development

3. 14 IC OUTPUT TYPE · HIGH-SPEED TYPE (10 Mbps, OPEN COLLECTOR OUTPUT)

Part Number	Pin Connections	Features	Absolute Maximum Ratings			Electrical Characteristics	
			BV (kVr.m.s.)	V _{CC} (V)	I _O (mA)	I _{FHL} (mA) MAX.	t _{PLH} , t _{PHL} (ns) MAX.
PS9614 PS9614L		8-pin DIP Open collector output type High CMR (10 kV/μs) UL, VDE (Option) approved	3.75	7	25	5.0	75 (R _L = 350 Ω)
PS9714 PS9114 ^{*1}		5-pin SOP Open collector output type High CMR (10 kV/μs) UL, VDE (Option) approved	2.5				

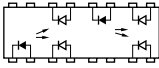
*1 Under development

3. 15 IC OUTPUT TYPE · HIGH-SPEED TYPE (10 Mbps, TOTEM POLE OUTPUT)

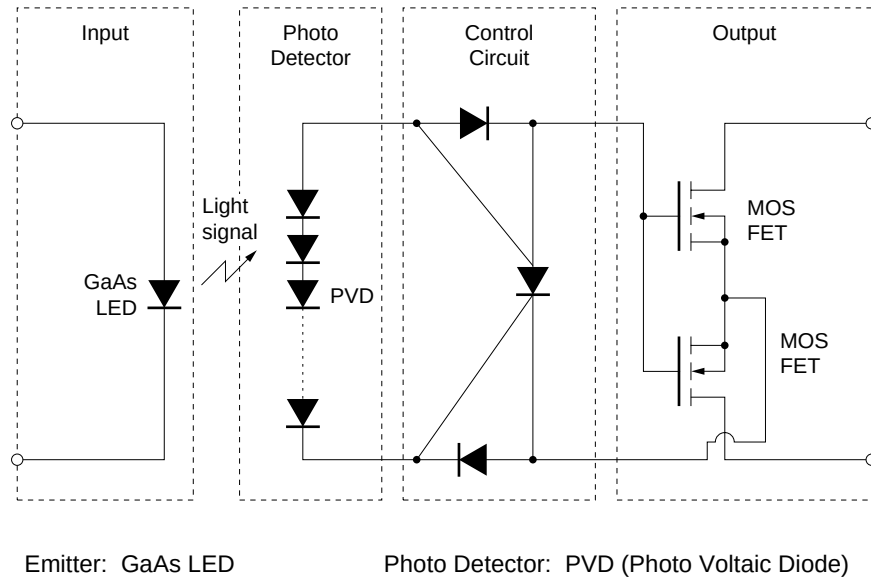
Part Number	Pin Connections	Features	Absolute Maximum Ratings			Electrical Characteristics	
			BV (kVr.m.s.)	V _{CC} (V)	I _O (mA)	I _{FHL} (mA) MAX.	t _{PLH} , t _{PHL} (ns) MAX.
PS9611 PS9611L		8-pin DIP Totem pole output type High CMR (1 kV/μs) UL, VDE (Option) approved	3.75	7	25	5.0	65
PS9711		5-pin SOP Totem pole output type High CMR (1 kV/μs) UL, VDE (Option), BSI approved	2.5		13		
PS9715 PS9115 ^{*1}		5-pin SOP Totem pole output type High CMR (10 kV/μs) UL approved					

*1 Under development

3. 16 DIODE OUTPUT TYPE · HIGH LINEARITY

Part Number	Pin Connections	Features	Absolute Maximum Ratings			Electrical Characteristics	
			BV (kVr.m.s.)	V _R (Diode) (V)	V _R (Photo Diode) (V)	K ₁ , K ₂ (%)	K ₃
PS8741		16-pin Small SOP base connection High Linearity UL, BSI (Insulation supplementary) approved	1.5	3	20	0.3 to 1.0 to 1.8	0.75 to 1.0 to 1.25

4. OPTICAL COUPLED MOS FET CONFIGURATION AND OPERATING PRINCIPLE



Operating Principle of Optical Coupled MOS FET (Typical Example of Normally Open)

- Turn-on

If the forward current is applied to the input block LED, the PVD in the optical receiving block generates a photovoltaic voltage responsive to the optical power output. The photovoltaic voltage charges the electric charges in the output block MOS FET flow the control block and turns on the MOS FET.

- Turn-off

If the LED forward current is cut, the optical power output becomes 0 and decrease of the PVD photovoltaic voltage results in the generation of a difference in potential between the PVD and MOS FET gate. Consequently, the thyristor in the control block is activated and MOS FET is turned off instantly.

NEC Compound Semiconductor Devices Optical Coupled MOS FETs realize a high-speed operation even with a low forward current by using a thyristor drive.

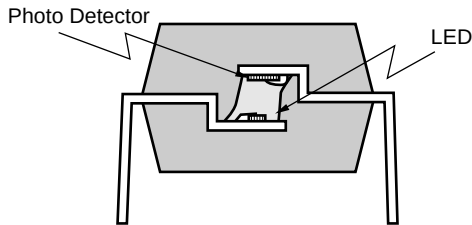
4.1 OPTICAL COUPLED MOS FET STRUCTURE

Compared with a mechanical relay, the input and output sections, made up of the LED and PVD in the Optical Coupled MOS FET, corresponds to the coil in the mechanical relay. They isolate the input from output and generate an output control signal on receipt of an input signal.

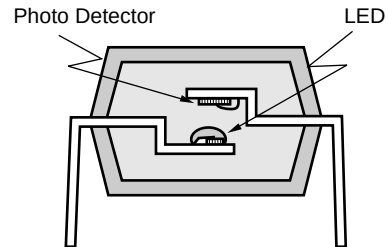
Moreover, NEC Compound Semiconductor Devices MOS FETs enable bidirectional current and linear current-voltage characteristics. Optical Coupled MOS FETs also support a wide load voltage range from small signal control to high-voltage loads.

NEC Compound Semiconductor Devices original discharge circuits achieve high-sensitivity characteristics and high-speed operation through the use of high-reliability dielectric separation technology, high-efficiency photodetectors, and monolithic integration technology.

- Standard type
PS71xx, PS72xx



- High isolation voltage type
PS73xx



4.2 OPTICAL COUPLED MOS FET FEATURES

- Optical coupling realizes complete electric isolation between input and output
- Low power dissipation and high sensitivity

Optical Coupled MOS FETs offer lower power dissipation, which makes them suitable for devices that need low power dissipation due to their limited battery power supplies, such as notebook PCs and portable information terminals. Moreover, NEC Compound Semiconductor Devices Optical Coupled MOS FETs is 1/20 high sensitivity compared with a mechanical relay (LED operating current ≈ 2 mA), so that they can be driven directly from the CPU. A lineup of NEC Compound Semiconductor Devices products that realize such high sensitivity characteristics in a broad range of temperature is available.
- Small size, slim, and light weight

NEC Compound Semiconductor Devices Optical Coupled MOS FETs feature a 2.1-mm thickness that cannot be realized in the case of mechanical relays. This makes them ideal for sets that emphasize a small size and a light weight, such as card MODEMs and notebook PCs.
- AC and DC switching supported

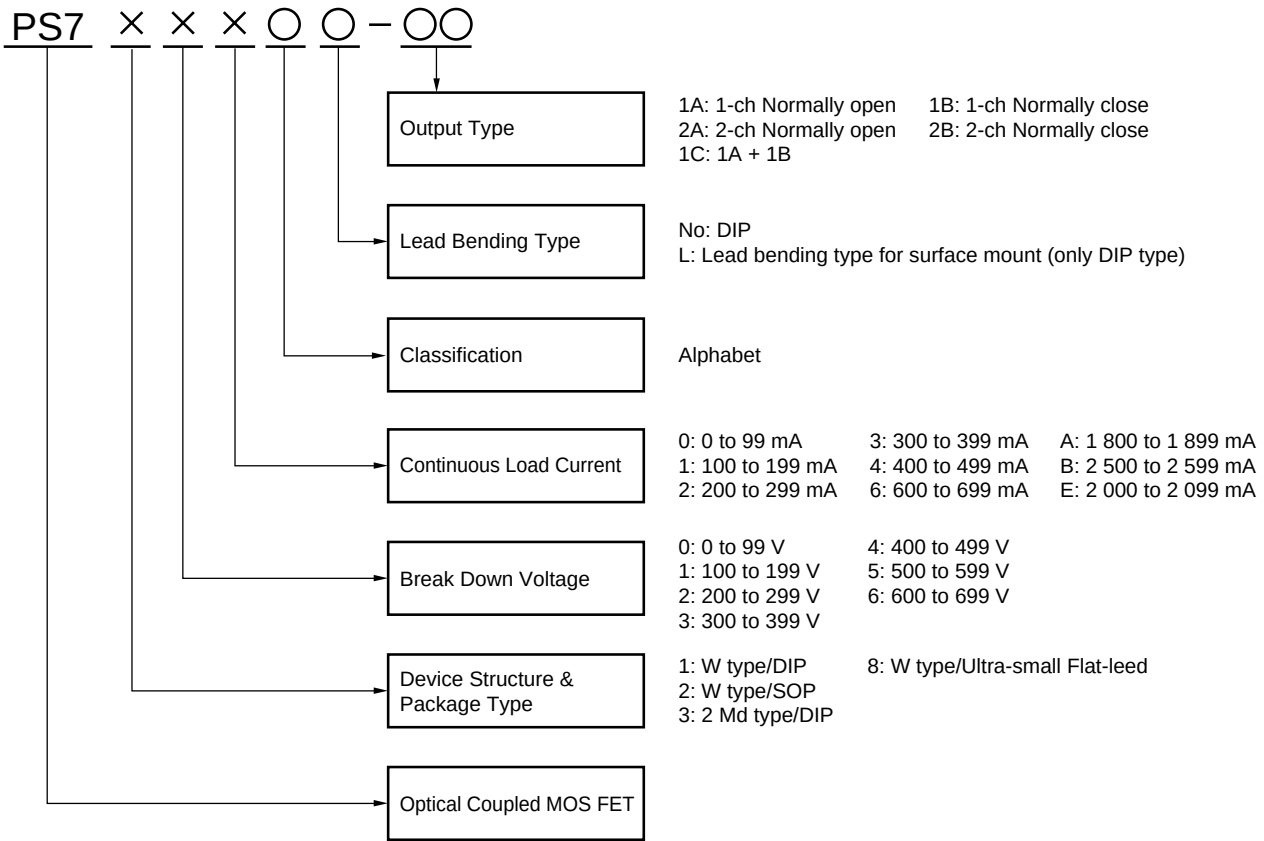
Use of bidirectional MOS FETs supports AC and DC switching. Also, can control a high voltage compared to photocouplers.
- MOS FET driving current not required

Optical Coupled MOS FETs are driven directly by a TTL or CMOS, so that no power supply is required simplifying circuit design.
- Wide variety of output circuits

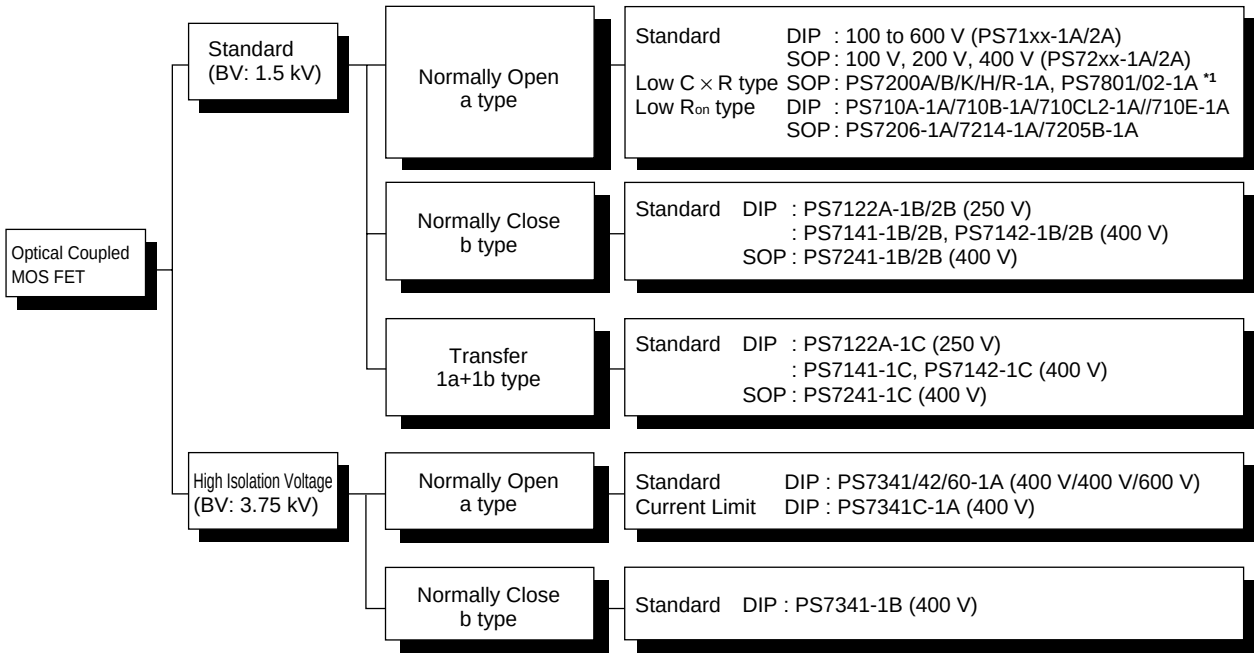
Normally open outputs as well as normally closed outputs for MOS FETs are available.
- High-reliability

Optical Coupled MOS FETs are semiconductor relays in which signals are controlled by light and not connected, and therefore do not exhibit the characteristic degradation caused by the wearing down of the mechanical section or the contacts, as seen in mechanical relays.

4.3 OPTICAL COUPLED MOS FET NUMBERING SYSTEM



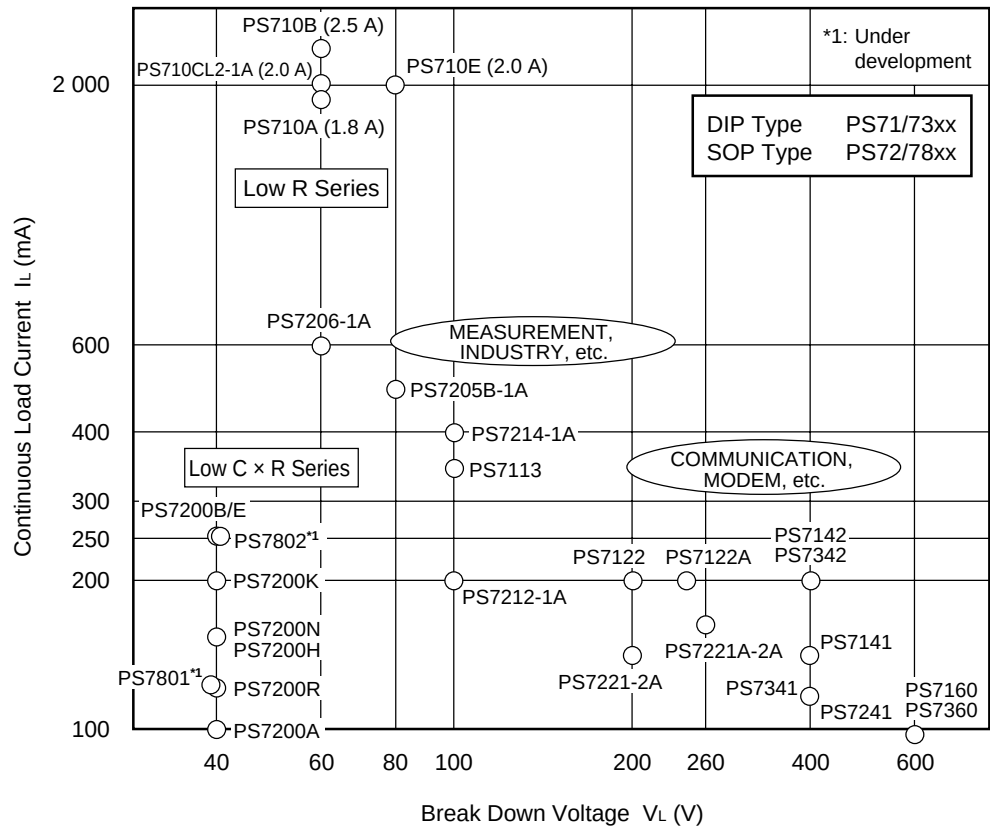
4.4 OPTICAL COUPLED MOS FET MAIN CLASSIFICATION CHART



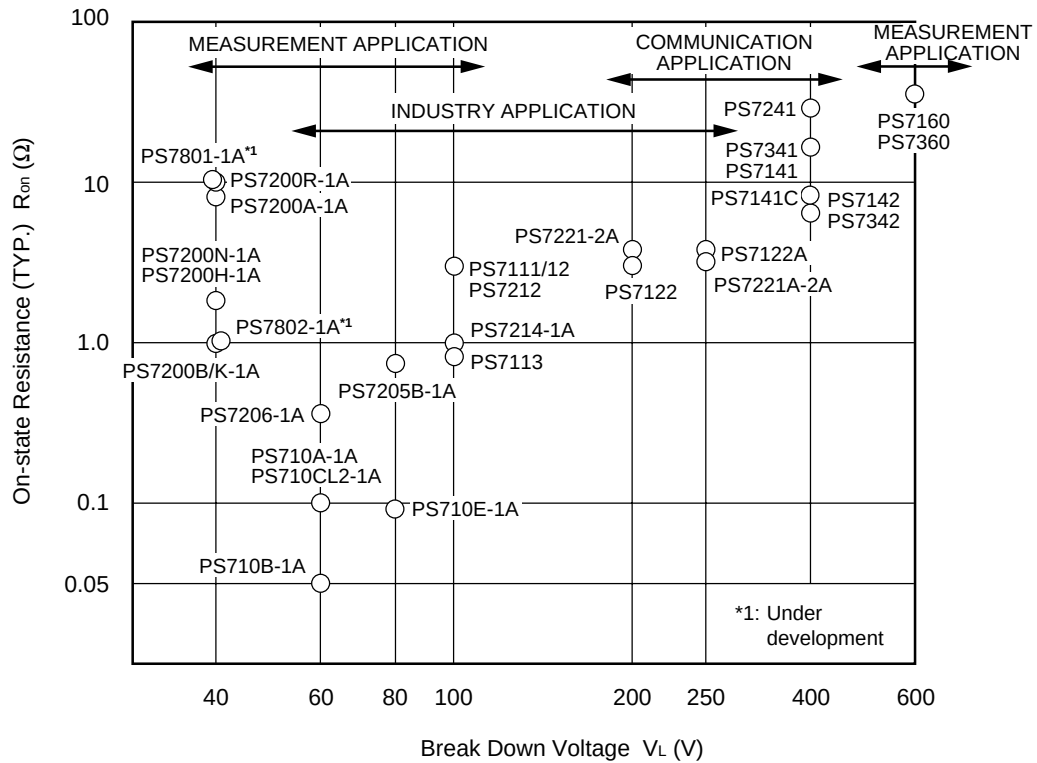
*1 Under development

4. 5 OPTICAL COUPLED MOS FET PRODUCT MAP

4. 5. 1 Continuous Load Current vs. Break Down Voltage



4. 5. 2 On-State Resistance vs. Break Down Voltage



4.6 OPTICAL COUPLED MOS FET CHARACTERISTIC TABLE

DIP	PS710A	PS710B	PS710E	PS710C	PS7113	PS7122	PS7122A	PS7141	PS7142	PS7160	PS7341	PS7342	PS7360
High Break Down Voltage ($V_L \geq 400$ V)								●	●	●	●	●	●
High Continuous Load Current ($I_L \geq 200$ mA)	●	●	●	●	●	●	●		●			●	
Low On-state Resistance	$R_{on} \leq 10 \Omega$				●	●	●		●			●	
	$R_{on} \leq 1 \Omega$	●	●	●	●								
High Isolation Voltage (BV)											●	●	●
Normally Close b type							●	●	●		●		
Transfer c type							●	●	●				
Current Limit								●			●		
2-ch type					●	●	●	●	●	●			

SOP	PS7200A	PS7200B	PS7200E	PS7200H	PS7200K	PS7200N	PS7200R	PS7205B	PS7206	PS7214	PS7221	PS7221A	PS7241
High Break Down Voltage ($V_L \geq 400$ V)													●
High Continuous Load Current ($I_L \geq 200$ mA)		●	●		●			●	●	●			
Low On-state Resistance	$R_{on} \leq 10 \Omega$	●	●		●	●	●			●	●	●	
	$R_{on} \leq 1 \Omega$			●				●	●				
Low $C \times R$	●	●	●	●	●	●	●						
Low Output Capacitance	●			●		●	●						
Normally Close b type													●
Transfer c type													●
Current Limit													
2-ch type											●	●	●

Small SOP	PS7801	PS7802
High Break Down voltage ($V_L \geq 400$ V)		
High Continuous Load Current ($I_L \geq 200$ mA)		●
Low On-state Resistance	$R_{on} \leq 10 \Omega$	●
	$R_{on} \leq 1 \Omega$	
Low $C \times R$	●	●
Low Output Capacitance	●	
Normally Close b type		
Transfer c type		
Current Limit		
2-ch type		

4.7 OPTICAL COUPLED MOS FET CLASSIFICATION CHART

4.7.1 Standard Normally Open a Type DIP (1/2)

Part Number			PS710A -1A	PS710B -1A	PS710 CL2-1A	PS710E -1A	PS7113 -1A	PS7122 -1A	PS7122 A-1A	PS7141 -1A	PS7142 -1A	PS7160 -1A		
Package			6-pin DIP											
Output Type			Normally Open 1a											
MOS FET	Break Down Voltage		V _L	60 V			80 V	100 V	200 V	250 V	400 V		600 V	
	Continuous Load Current	Connection A	I _L	1.8 A	2.5 A	2.0 A		350 mA	200 mA		150 mA	200 mA	90 mA	
		Connection B		2.0 A	3.5 A	–	3.0 A	450 mA	350 mA		200 mA	250 mA	130 mA	
		Connection C		3.6 A	5.0 A	–	4.0 A	700 mA	500 mA		300 mA	400 mA	200 mA	
	Pulse Load Current ^{*1}		I _{LP}	3.6 A	5.0A	4.0 A		600 mA	400 mA		300 mA	400 mA	250 mA	
	On-state Resistance (TYP.)		R _{on}	0.1 Ω	0.05 Ω	0.1 Ω	0.083 Ω	0.9 Ω	3.0 Ω	4.5 Ω	20.0 Ω	6.0 Ω	42.0 Ω	
	On-state Resistance (MAX.)			0.2 Ω	0.1 Ω	0.15 Ω	0.15 Ω	2.5 Ω	5.0 Ω	8.0 Ω	30.0 Ω	10.0 Ω	50.0 Ω	
	Output Capacitance		C _{out}	320 pF	500 pF	320 pF	480 pF	250 pF	165 pF	120 pF	65 pF	225 pF	110 pF	
	Off-state Leakage Current		I _{Loff}	1 μA MAX.	0.5 μA MAX.	1 μA MAX.	0.5 μA MAX.	1 μA MAX.						
	Power Dissipation		P _D	560 mW MAX.	625 mW MAX.	600 mW MAX.		560 mW MAX.						
Coupled	Turn-on Time (MAX.)		t _{on}	3.0 ms	5.0 ms	3.0 ms	2.0 ms	3.0 ms	2.0 ms	1.5 ms	1.0 ms	5.0 ms	1.5 ms	
	Turn-off Time (MAX.)		t _{off}	1.0 ms	0.2 ms	1.0 ms	0.2 ms							
Diode	LED On-state Current		I _{Fon}	2 mA MAX.										
	Recommended LED Off voltage		V _F	0.5 V MAX.										
	Forward Voltage		V _F	1.4 V MAX.*2										
	Reverse Current		I _R	5 μA MAX.										
	Maximum Forward Current		I _{F(MAX.)}	50 mA MAX.										
	Power Dissipation		P _D	50 mW MAX.										
Isolation Voltage*3			BV	1 500 Vr.m.s.										
Operating Ambient Temperature			T _A	–40 to +85°C					–40 to +80°C					
Storage Temperature			T _{stg}	–40 to +100°C										

*1 PW = 100 ms, 1 shot

*2 I_F = 10 mA

*3 AC voltage for 1 minute at T_A = 25°C, RH = 60% between input and output

4. 7. 1 Standard Normally Open a Type DIP (2/2)

Part Number			PS7141C-2A	PS7113-2A	PS7122-2A	PS7122A-2A	PS7141-2A	PS7142-2A	PS7160-2A
Package			8-pin DIP						
Output Type			Normally Open 2a						
MOS FET	Break Down Voltage	V _L	400 V	100 V	200 V	250 V	400 V		600 V
	Continuous Load Current	I _L	120 mA	350 mA	200 mA		150 mA	200 mA	90 mA
	Pulse Load Current ¹	I _{LP}	120 mA	600 mA	400 mA		300 mA	400 mA	250 mA
	On-state Resistance (TYP.)	R _{on}	7.5 Ω	0.9 Ω	3.0 Ω	4.5 Ω	20.0 Ω	7.5 Ω	42.0 Ω
	On-state Resistance (MAX.)		12 Ω	2.5 Ω	5.0 Ω	8.0 Ω	30.0 Ω	12.0 Ω	50.0 Ω
	Output Capacitance	C _{out}	140 pF/ch	250 pF/ch	165 pF/ch	120 pF/ch	65 pF/ch	140 pF/ch	110 pF/ch
	Off-state Leakage Current	I _{Loff}	1 μA MAX.						
	Power Dissipation	P _D	375 mW/ch MAX.						
Coupled	Turn-on Time (MAX.)	t _{on}	2.0 ms	3.0 ms	2.0 ms	1.5 ms	1.0 ms	2.0 ms	1.5 ms
	Turn-off Time (MAX.)	t _{off}	0.2 ms						
	Limit Current	I _{LMT}	170 to 250 mA	—					
Diode	LED On-state Current	I _{Fon}	2 mA MAX.						
	Recommended LED Off voltage	V _F	0.5 V MAX.						
	Forward Voltage	V _F	1.4 V MAX. ²						
	Reverse Current	I _R	5 μA MAX.						
	Maximum Forward Current	I _{F(MAX.)}	50 mA MAX.						
	Power Dissipation	P _D	50 mW/ch MAX.						
Isolation Voltage ³		BV	1 500 Vr.m.s.						
Operating Ambient Temperature		T _A	−40 to +80°C						
Storage Temperature		T _{stg}	−40 to +100°C						

*1 PW = 100 ms, 1 shot

*2 I_F = 10 mA

*3 AC voltage for 1 minute at T_A = 25°C, RH = 60% between input and output

4. 7. 2 Standard Normally Close b Type DIP

Part Number			PS7122A-1B	PS7141-1B	PS7142-1B	PS7122A-2B	PS7141-2B	PS7142-2B	
Package			6-pin DIP			8-pin DIP			
Output Type			Normally Close 1b			Normally Close 2b			
MOS FET	Break Down Voltage		V _L	250 V	400 V		250 V	400 V	
	Continuous Load Current	Connection A	I _L	200 mA	150 mA	200 mA		150 mA	200 mA
		Connection B		350 mA	200 mA	250 mA	–		
		Connection C		500 mA	300 mA	400 mA	–		
	Pulse Load Current ^{*1}		I _{LP}	400 mA	300 mA	400 mA		300 mA	400 mA
	On-state Resistance (TYP.)		R _{on}	4.5 Ω	20.0 Ω	7.0 Ω	4.5 Ω	20.0 Ω	7.0 Ω
	On-state Resistance (MAX.)			8.0 Ω	30.0 Ω	12.0 Ω	8.0 Ω	30.0 Ω	12.0 Ω
	Output Capacitance		C _{out}	340 pF	185 pF	360 pF	340 pF/ch	185 pF/ch	430 pF/ch
	Off-state Leakage Current		I _{Loff}	1 μA MAX.					
	Power Dissipation		P _D	560 mW MAX.			375 mW/ch MAX.		
Coupled	Turn-on Time (MAX.)		t _{on}	0.2 ms					
	Turn-off Time (MAX.)		t _{off}	1.5 ms	1.0 ms	5.0 ms	1.5 ms	1.0 ms	2.0 ms
Diode	LED Off-state Current		I _{Foff}	2 mA MAX.					
	Recommended LED Off voltage		V _F	0.5 V MAX.					
	Forward Voltage		V _F	1.4 V MAX. ^{*2}					
	Reverse Current		I _R	5 μA MAX.					
	Maximum Forward Current		I _{F(MAX)}	50 mA MAX.					
	Power Dissipation		P _D	50 mW/ch MAX.					
Isolation Voltage ^{*3}			BV	1 500 Vr.m.s.					
Operating Ambient Temperature			T _A	–40 to +80 °C					
Storage Temperature			T _{stg}	–40 to +100 °C					

*1 PW = 100 ms, 1 shot

*2 I_F = 10 mA

*3 AC voltage for 1 minute at T_A = 25°C, RH = 60% between input and output

4. 7. 3 Standard 1c Type (1a + 1b) DIP

Part Number			PS7122A-1C		PS7141-1C		PS7142-1C						
			N.O.	N.C.	N.O.	N.C.	N.O.	N.C.					
Package			8-pin DIP										
Output Type			1a + 1b										
MOS FET	Break Down Voltage		V _L	250 V		400 V							
	Continuous Load Current	Connection A	I _L	200 mA		150 mA		200 mA					
		Connection B											
		Connection C											
	Pulse Load Current ¹		I _{LP}	400 mA		300 mA		400 mA					
	On-state Resistance (TYP.)		R _{on}	4.5 Ω		20.0 Ω		24.0 Ω		8.0 Ω		7.0 Ω	
	On-state Resistance (MAX.)			8.0 Ω		30.0 Ω		12.0 Ω					
	Output Capacitance		C _{out}	120 pF	340 pF	65 pF	185 pF	140 pF	430 pF				
	Off-state Leakage Current		I _{Loff}	1 μA MAX.									
	Power Dissipation		P _D	375 mW/ch MAX.									
Coupled	Turn-on Time (MAX.)		t _{on}	1.5 ms	0.2 ms	1.0 ms	0.2 ms	2.0 ms	0.2 ms				
	Turn-off Time (MAX.)		t _{off}	0.2 ms	1.5 ms	0.2 ms	1.0 ms	0.2 ms	2.0 ms				
Diode	LED On-state Current		I _{Fon}	2 mA MAX.	–	2 mA MAX.	–	2 mA MAX.	–				
	LED Off-state Current		I _{Foff}	–	2 mA MAX.	–	2 mA MAX.	–	2 mA MAX.				
	Recommended LED Off voltage		V _F	0.5 V MAX.									
	Forward Voltage		V _F	1.4 V MAX. ²									
	Reverse Current		I _R	5 μA MAX.									
	Maximum Forward Current		I _{F(MAX)}	50 mA MAX.									
	Power Dissipation		P _D	50 mW/ch MAX.									
Isolation Voltage ³			BV	1 500 Vr.m.s.									
Operating Ambient Temperature			T _A	–40 to +80°C									
Storage Temperature			T _{stg}	–40 to +100°C									

*1 PW = 100 ms, 1 shot

*2 I_F = 10 mA

*3 AC voltage for 1 minute at T_A = 25°C, RH = 60% between input and output

4. 7. 4 Standard Normally Open a Type SOP (1/2)

Part Number			PS7200A-1A	PS7200B-1A	PS7200E-1A	PS7200H-1A	PS7200K-1A	PS7200N-1A	PS7200R-1A
Package			4-pin SOP						
Output Type			Normally Open 1a						
MOS FET	Break Down Voltage	V _L	40 V						
	Continuous Load Current	I _L	100 mA	250 mA		160 mA	200 mA	160 mA	120 mA
	Pulse Load Current ^{*1}	I _{LP}	200 mA	500 mA		320mA	400 mA	320 mA	240 mA
	On-state Resistance (TYP.)	R _{on}	9.3 Ω	1.0 Ω	0.8 Ω	2.2 Ω	1.1 Ω	1.8 Ω	10 Ω
	On-state Resistance (MAX.)		12.0 Ω	1.5 Ω	1.6 Ω	3.5 Ω	2.0 Ω	2.5 Ω	12.5 Ω
	Output Capacitance	C _{out}	3.0 pF	32 pF	33.5 pF	4.2 pF	9.6 pF	9.0 pF	1.1 pF
	Off-state Leakage Current	I _{Loff}	100 nA MAX.		10 nA MAX.			1.0 nA MAX.	10 nA MAX.
	Power Dissipation	P _D	100 mW MAX.						
Coupled	Turn-on Time (MAX.)	t _{on}	0.5 ms	1.0 ms		0.5 ms	1.0 ms	0.5 ms	
	Turn-off Time (MAX.)	t _{off}	0.2 ms		0.5 ms	1.0 ms			
Diode	LED On-state Current	I _{Fon}	2 mA MAX.						
	Recommended LED Off voltage	V _F	0.5 V MAX.						
	Forward Voltage	V _F	1.4 V MAX. ^{*2}						
	Reverse Current	I _R	5 μA MAX.						
	Maximum Forward Current	I _{F(MAX)}	50 mA MAX.						
	Power dissipation	P _D	50 mW/ch MAX.						
Isolation Voltage ^{*3}		BV	1 500 Vr.m.s.						
Operating Ambient Temperature		T _A	−40 to +85°C					−40 to +80°C	−40 to +85°C
Storage Temperature		T _{stg}	−40 to +100°C						

*1 PW = 100 ms, 1 shot

*2 I_F = 10 mA

*3 AC voltage for 1 minute at T_A = 25°C, RH = 60% between input and output

4. 7. 4 Standard Normally Open a Type SOP (2/2)

Part Number			PS7206-1A	PS7205B-1A	PS7214-1A	PS7241-1A	PS7801-1A ^{*4}	PS7802-1A ^{*4}
Package			4-pin SOP					
Output Type			Normally Open 1a					
MOS FET	Break Down Voltage	V _L	60 V	80 V	100 V	400 V	40 V	
	Continuous Load Current	I _L	600 mA	500 mA	400 mA	120 mA	100 mA	250 mA
	Pulse Load Current ^{*1}	I _{LP}	1 200 mA	1 000 mA	800 mA	240 mA	200 mA	500 mA
	On-state Resistance (TYP.)	R _{on}	0.6 Ω	0.86 Ω	1.0 Ω	18.0 Ω	10.5 Ω	1.1 Ω
	On-state Resistance (MAX.)		0.8 Ω	1.2 Ω	1.2 Ω	30.0 Ω	14 Ω	1.6 Ω
	Output Capacitance	C _{out}	70 pF	30 pF	120 pF	54 pF	1.2 pF	11.5 pF
	Off-state Leakage Current	I _{Loff}	1 μA MAX.	5 nA MAX.	1 μA MAX.		10 nA MAX.	
	Power Dissipation	P _D	300 mW MAX.				200 mW MAX.	100 mW MAX.
Coupled	Turn-on Time (MAX.)	t _{on}	2.0 ms	0.5 ms	2.0 ms		0.5 ms	
	Turn-off Time (MAX.)	t _{off}	0.5 ms		1.0 ms	0.2 ms	1.0 ms	0.5 ms
Diode	LED On-state Current	I _{Fon}	2 mA MAX.					
	Recommended LED Off voltage	V _F	0.5 V MAX.					
	Forward Voltage	V _F	1.4 V MAX. ^{*2}					
	Reverse Current	I _R	5 μA MAX.					
	Maximum Forward Current	I _{F(MAX)}	50 mA MAX.					
	Power dissipation	P _D	50 mW/ch MAX.					
Isolation Voltage ^{*3}		BV	1 500 Vr.m.s.				500 Vr.m.s.	
Operating Ambient Temperature		T _A	−40 to +85°C			−40 to +80°C	−40 to +85°C	
Storage Temperature		T _{stg}	−40 to +100°C					

*1 PW = 100 ms, 1 shot

*2 I_F = 10 mA

*3 AC voltage for 1 minute at T_A = 25°C, RH = 60% between input and output

*4 Under development

4. 7. 5 Standard Normally Open a Type/Normally Close b Type/Transfer 1c Type (1a + 1b) SOP

Part Number			PS7221-2A	PS7221A-2A	PS7241-2A	PS7241-1B	PS7241-2B	PS7241-1C	
								N.O.	N.C.
Package			8-pin SOP			4-pin SOP		8-pin SOP	
Output Type			Normally Open 2a			Normally Close 1b		Normally Close 2b	1a + 1b
MOS FET	Break Down Voltage	V _L	200 V	260 V	400 V				
	Continuous Load Current	I _L	150 mA	170 mA	120 mA				
	Pulse Load Current ^{*1}	I _{LP}	400 mA	300 mA	200 mA	240 mA	200 mA		
	On-state Resistance (TYP.)	R _{on}	4.0 Ω	3.4 Ω	21.0 Ω	24.0 Ω	21.0 Ω		
	On-state Resistance (MAX.)		8.0 Ω	10 Ω	30.0 Ω	35.0 Ω	30.0 Ω		
	Output Capacitance	C _{out}	88 pF/ch	122 pF/ch	65 pF/ch	170 pF	185 pF/ch	65 pF	185 pF
	Off-state Leakage Current	I _{Loff}	1 μA MAX.						
	Power Dissipation	P _D	180 mW/ch MAX.			300 mW MAX.	180 mW/ch MAX.		
Coupled	Turn-on Time (MAX.)	t _{on}	1.0 ms			0.2 ms		1.0 ms	0.2 ms
	Turn-off Time (MAX.)	t _{off}	0.2 ms			2.0 ms	1.0 ms	0.2 ms	1.0 ms
Diode	LED On-state Current	I _{Fon}	2 mA MAX.	1 mA MAX.	2 mA MAX.	—		2 mA MAX.	—
	LED Off-state Current	I _{Foff}	—			2 mA MAX.		—	2 mA MAX.
	Recommended LED Off voltage	V _F	0.5 V MAX.						
	Forward Voltage	V _F	1.4 V MAX.* ²						
	Reverse Current	I _R	5 μA MAX.						
	Maximum Forward Current	I _{F(MAX)}	50 mA MAX.						
	Power dissipation	P _D	50 mW/ch MAX.						
Isolation Voltage* ³		BV	1 500 Vr.m.s.						
Operating Ambient Temperature		T _A	−40 to +80°C						
Storage Temperature		T _{stg}	−40 to +100°C						

*1 PW = 100 ms, 1 shot

*2 I_F = 10 mA

*3 AC voltage for 1 minute at T_A = 25°C, RH = 60% between input and output

4. 7. 6 High Isolation Voltage Normally Open a Type/Normally Close b Type DIP

Part Number			PS7341-1A	PS7341C-1A	PS7341-1B	PS7342-1A	PS7360-1A	
Package			6-pin DIP					
Output Type			Normally Open 1a		Normally Close 1b	Normally Open 1a		
MOS FET	Break Down Voltage		V _L	400 V				600 V
	Continuous Load Current	Connection A	I _L	150 mA	120 mA	150 mA	200 mA	90 mA
		Connection B		200 mA	120 mA	200 mA	250 mA	130 mA
		Connection C		300 mA	240 mA	300 mA	400 mA	200 mA
	Pulse Load Current ^{*1}		I _{LP}	300 mA	120 mA	300 mA	400 mA	250 mA
	On-state Resistance (TYP.)		R _{on}	20.0 Ω	27.0 Ω	20.0 Ω	6.0 Ω	41.0 Ω
	On-state Resistance (MAX.)			30.0 Ω	35.0 Ω	30.0 Ω	10.0 Ω	50.0 Ω
	Output Capacitance		C _{out}	65 pF	63 pF	185 pF	225 pF	110 pF
	Off-state Leakage Current		I _{Loff}	1 μA MAX.		10 μA MAX.	1 μA MAX.	
	Power Dissipation		P _D	560 mW MAX.				
Coupled	Turn-on Time (MAX.)		t _{on}	1.0 ms		0.2 ms	2.5 ms	2.0 ms
	Turn-off Time (MAX.)		t _{off}	0.2 ms	1.0 ms	1.5 ms	0.2 ms	
	Limit Current		I _{LMT}	–	125 to 250 mA	–		
Diode	LED On-state Current		I _{Fon}	2 mA MAX.		–	2 mA MAX.	
	LED Off-state Current		I _{Foff}	–		2 mA MAX.	–	
	Recommended LED Off Voltage		V _F	0.5 V MAX.				
	Forward Voltage		V _F	1.4 V MAX. ^{*2}				
	Reverse Current		I _R	5 μA MAX.				
	Maximum Forward Current		I _{F(MAX.)}	50 mA MAX.				
	Power dissipation		P _D	50 mW/ch MAX.				
Isolation Voltage ^{*3}			BV	3 750 Vr.m.s.				
Operating Ambient Temperature			T _A	–40 to +85°C				
Storage Temperature			T _{stg}	–40 to +125°C				

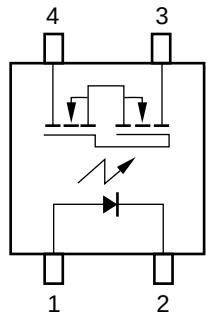
*1 PW = 100 ms, 1 shot

*2 I_F = 10 mA

*3 AC voltage for 1 minute at T_A = 25°C, RH = 60% between input and output

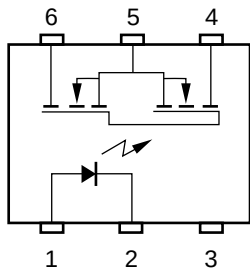
5. OPTICAL COUPLED MOS FET PIN CONNECTIONS

(1) 4-pin SOP



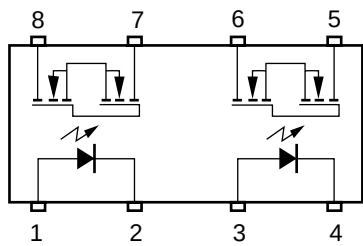
- 1. LED Anode
- 2. LED Cathode
- 3. MOS FET
- 4. MOS FET

(2) 6-pin DIP



- 1. LED Anode
- 2. LED Cathode
- 3. NC
- 4. MOS FET Drain
- 5. MOS FET Source
- 6. MOS FET Drain

(3) 8-pin DIP/SOP



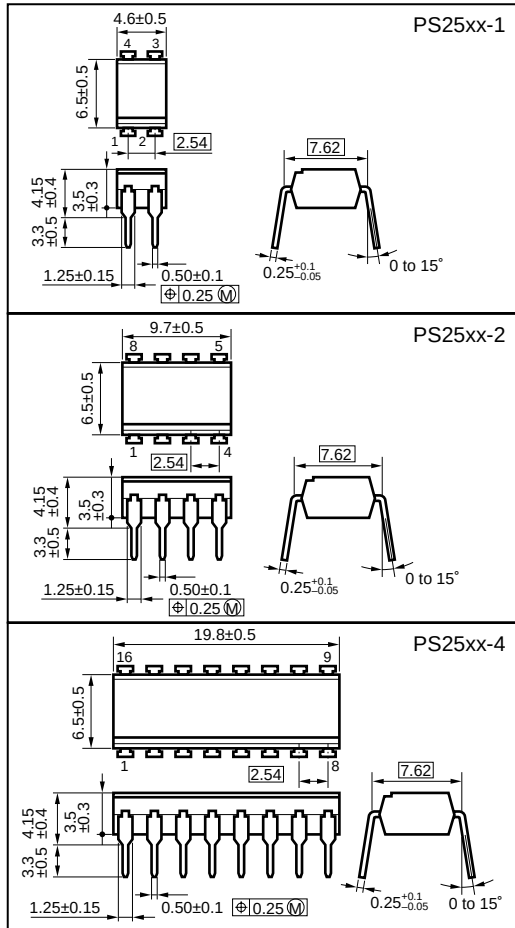
2a/2b Output	1a+1b Output
1. LED Anode	1. LED Anode
2. LED Cathode	2. LED Cathode
3. LED Anode	3. LED Anode
4. LED Cathode	4. LED Cathode
5. MOS FET	5. MOS FET (N.O.)
6. MOS FET	6. MOS FET (N.O.)
7. MOS FET	7. MOS FET (N.C.)
8. MOS FET	8. MOS FET (N.C.)

6. PHOTOCOUPLER AND OPTICAL COUPLED MOS FET PACKAGE DIMENSIONS

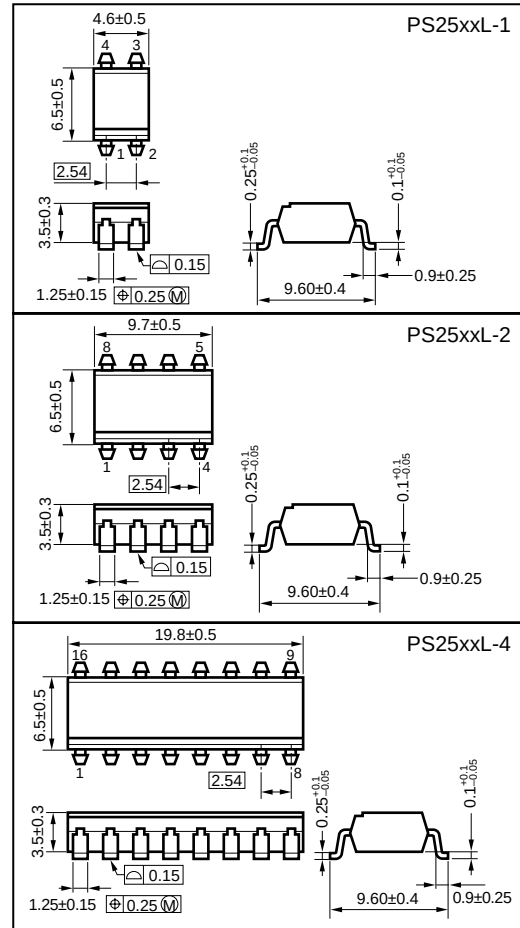
6.1 PHOTOCOUPLER STANDARD (DIP)

(1) 4-pin based multi-channel DIP type (Unit: mm)

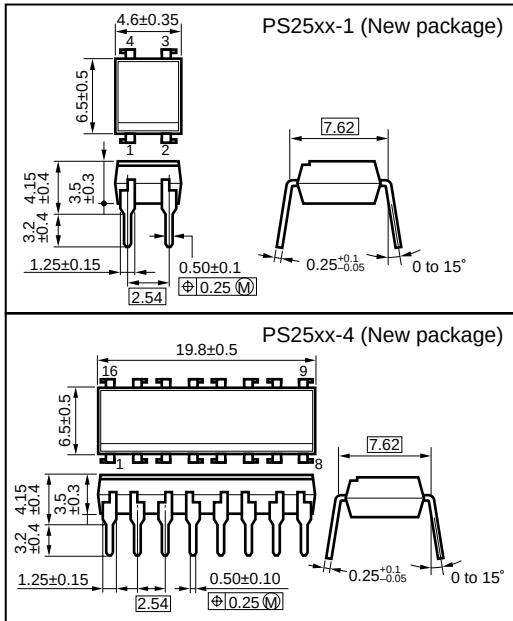
DIP



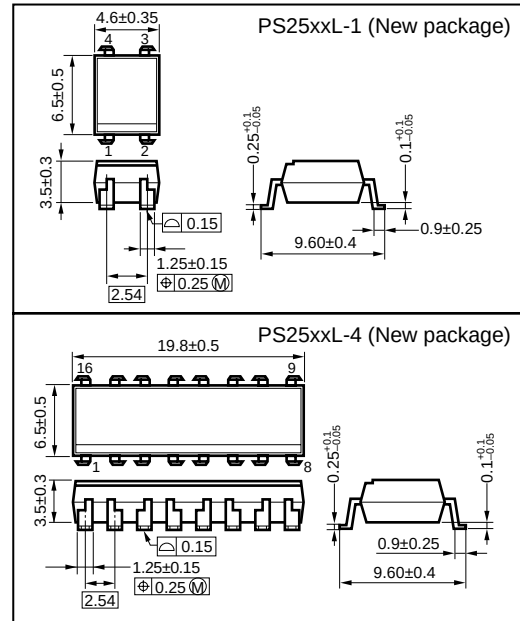
Surface mount type



DIP (New package)

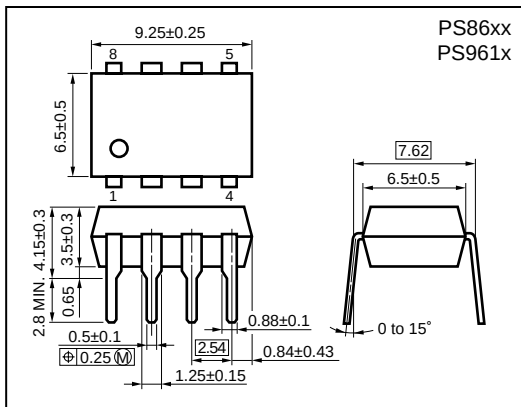


Surface mount type (New package)

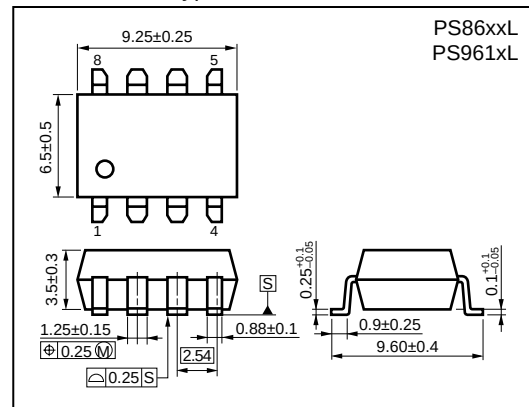


(2) 8-pin DIP type (Unit: mm)

DIP

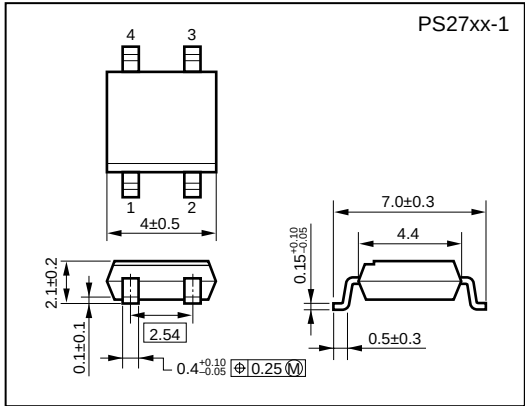


Surface mount type



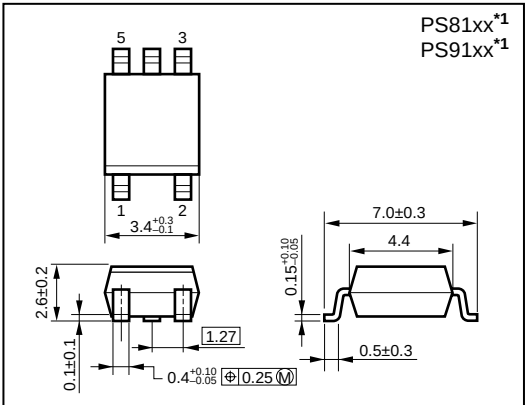
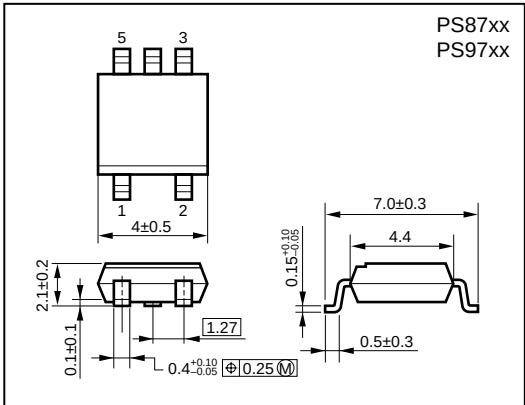
6. 2 PHOTOCOUPLER STANDARD (SOP)

(1) 4-pin SOP type (Unit: mm)



(2) 5-pin SOP type (Unit: mm)

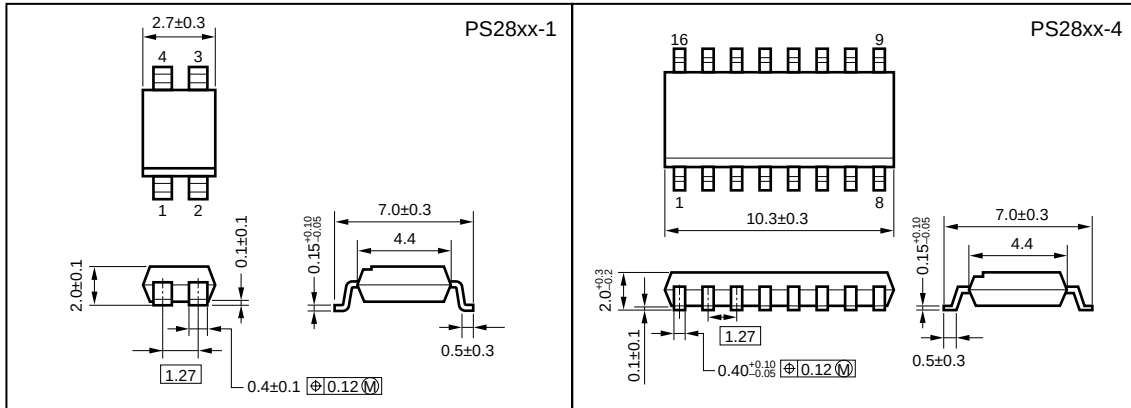
High-speed photocopier



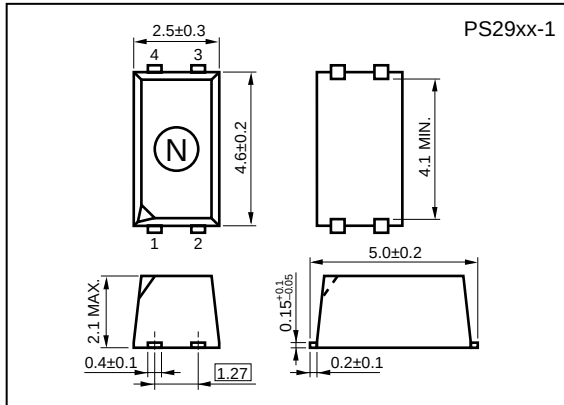
*1 Under development

6.3 PHOTOCOUPER STANDARD (Small SOP)

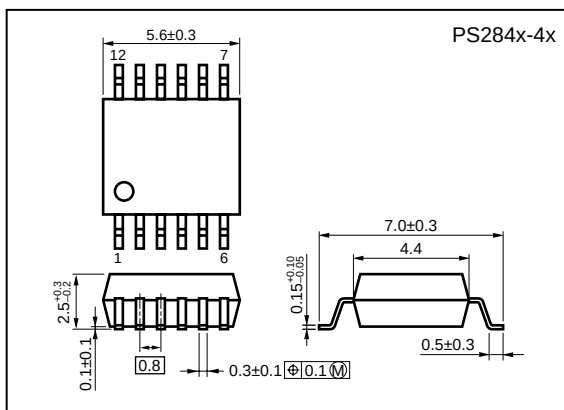
(1) 4-pin based multi-channel small SOP type (Unit: mm)



(2) 4-pin ultra-small flat-lead type (Unit: mm)



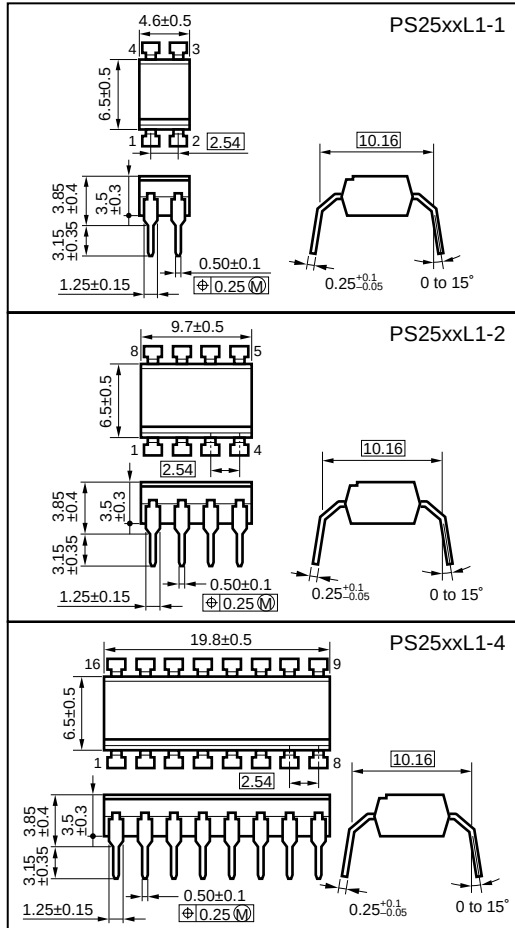
(3) 12-pin ultra-small SOP (Unit: mm)



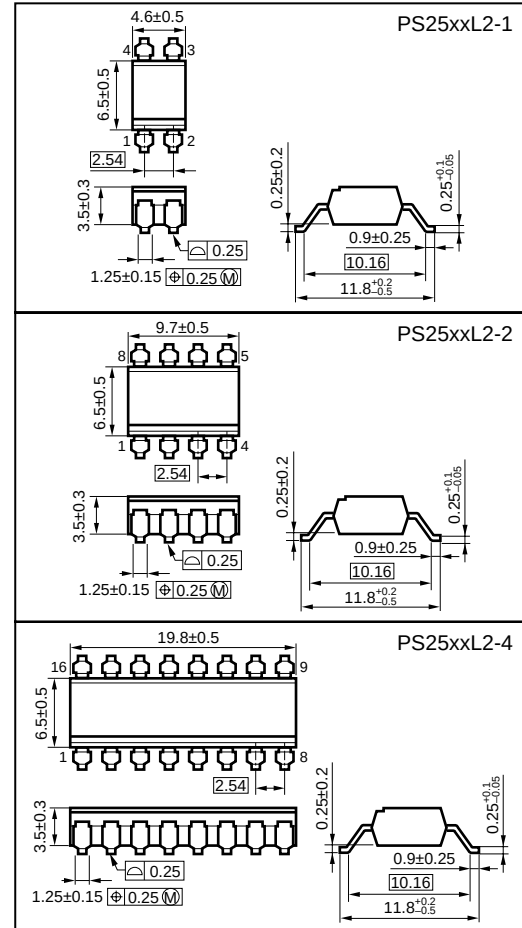
6.4 PHOTOCOUPER SURFACE MOUNT TYPE FOR LONG CLEARANCE^{*1} (DIP)

(1) 4-pin based multi-channel DIP type (Unit: mm)

Long clearance distance



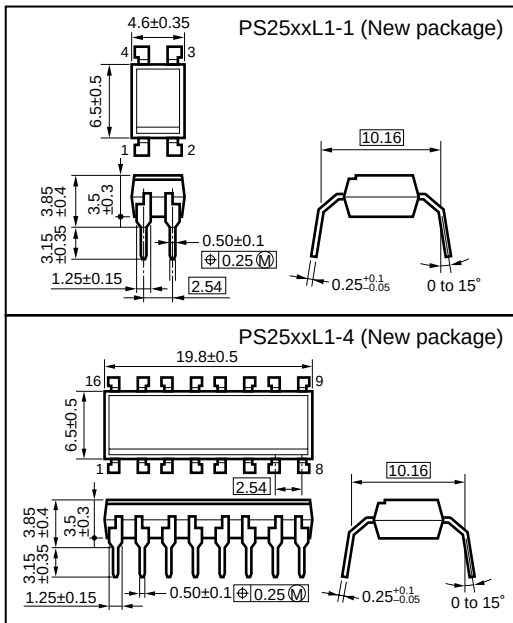
Long clearance distance surface mount



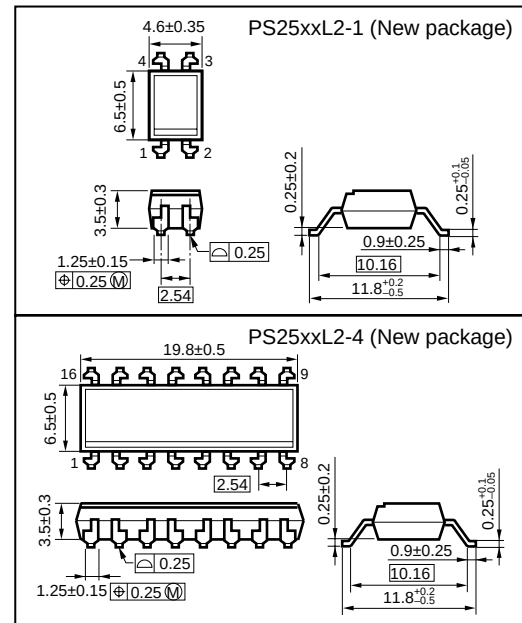
*1 Surface mount type for long clearance is available in the following products:

4-pin based multi-channel photocoupler, 8-pin DIP.

Long clearance distance (New package)

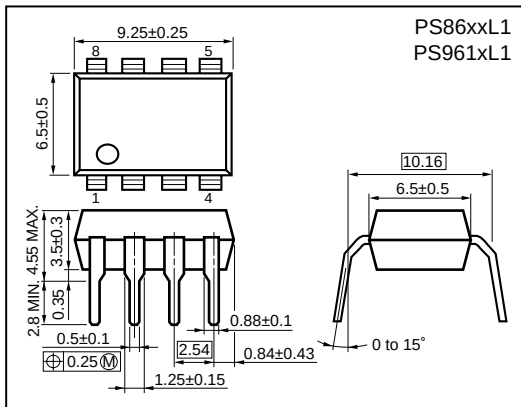


Long clearance distance surface mount (New package)

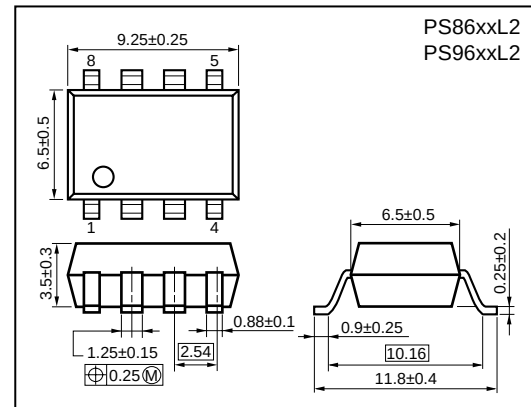


(2) 8-pin DIP type (Unit: mm)

Long clearance distance



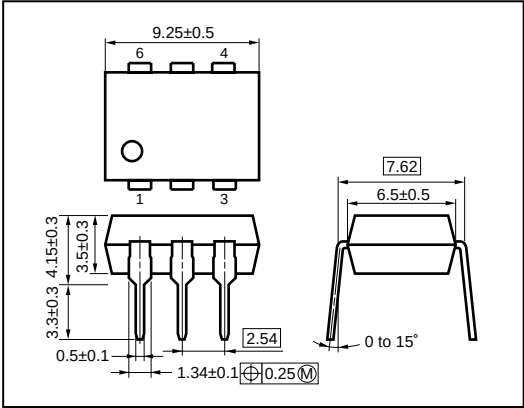
Long clearance distance surface mount



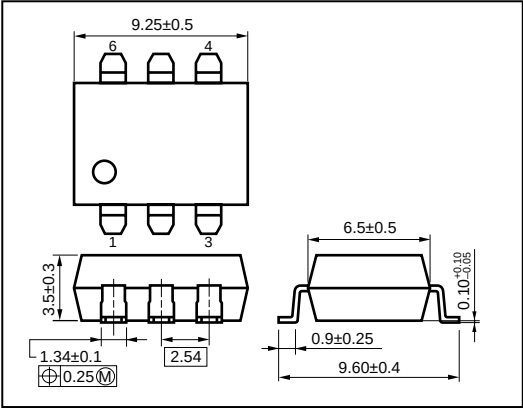
6. 5 OPTICAL COUPLED MOS FET STANDARD (DIP)

(1) 6-pin DIP (Unit: mm)

DIP

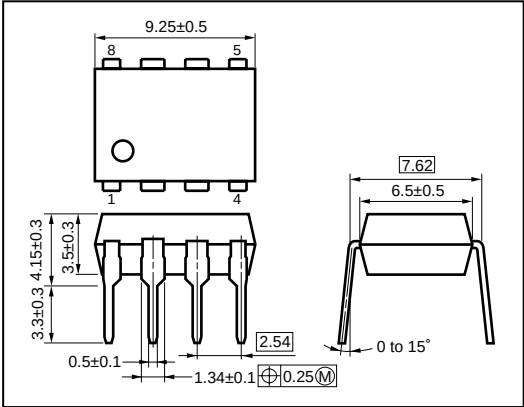


Surface mount type

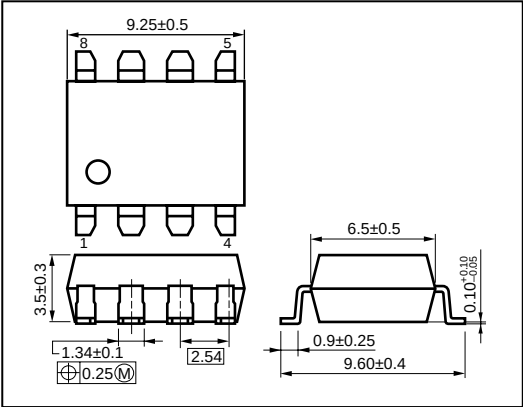


(2) 8-pin DIP (Unit: mm)

DIP

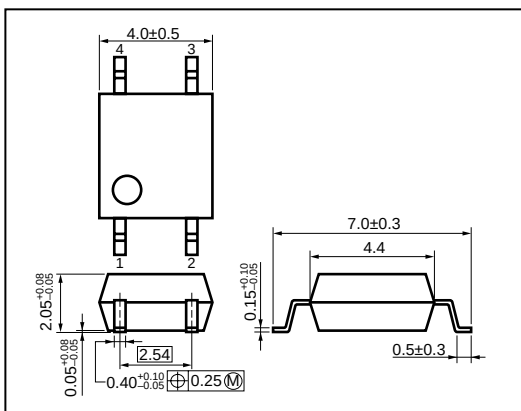


Surface mount type

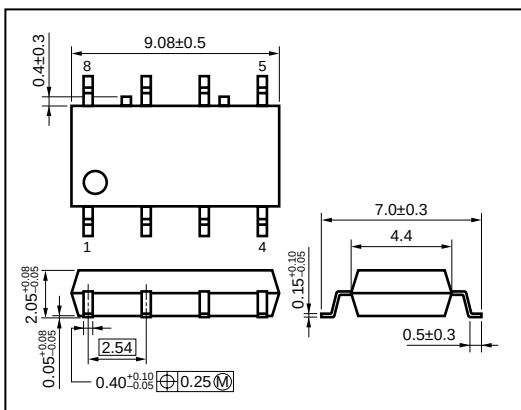


6.6 OPTICAL COUPLED MOS FET STANDARD (SOP)

(1) 4-pin SOP (Unit: mm)

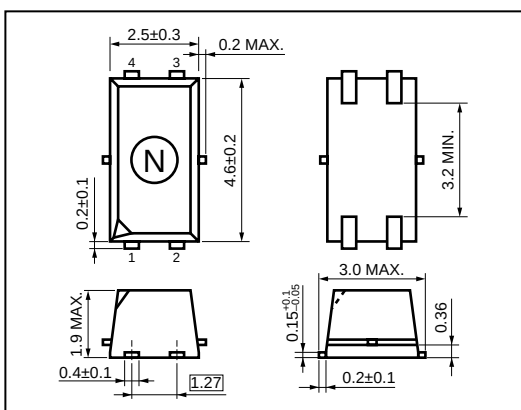


(2) 8-pin SOP (Unit: mm)



6.7 OPTICAL COUPLED MOS FET STANDARD (Small SOP)

(1) 4-pin ultra-small flat-lead^{*1} (Unit: mm)

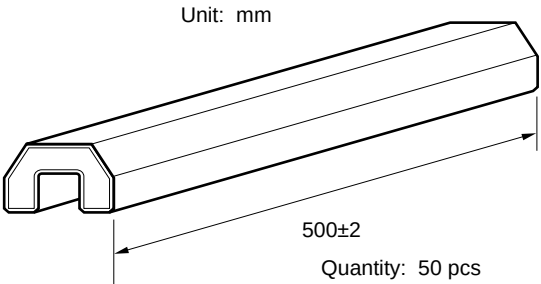
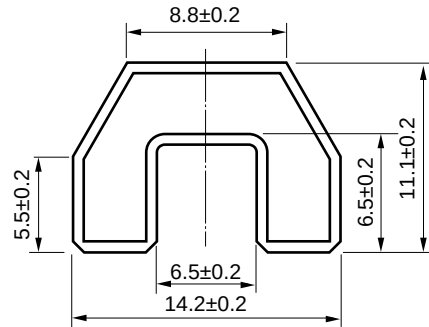


***1** Under development

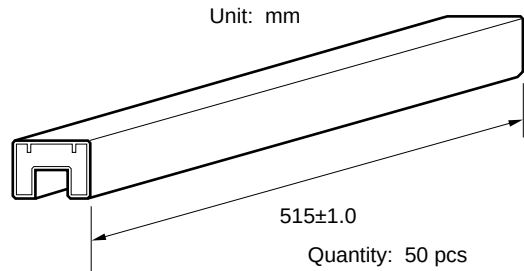
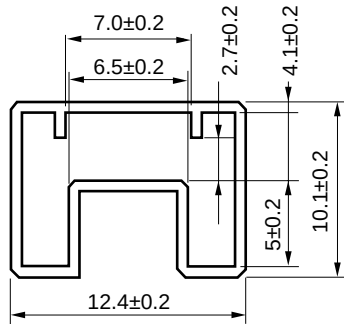
7. PHOTOCOUPLER AND OPTICAL COUPLED MOS FET PACKING INFORMATIONS

7.1 MAGAZINE CASE

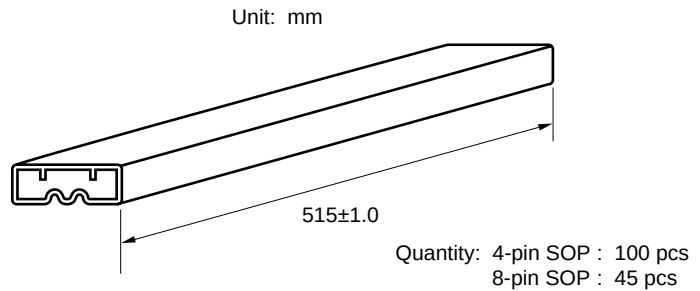
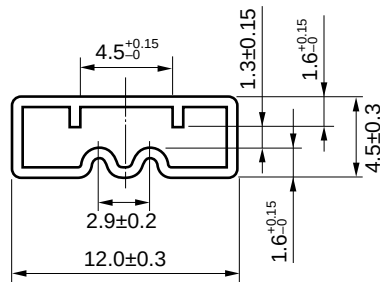
7.1.1 4, 6, 8-pin DIP



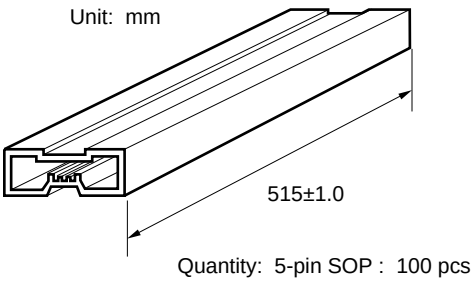
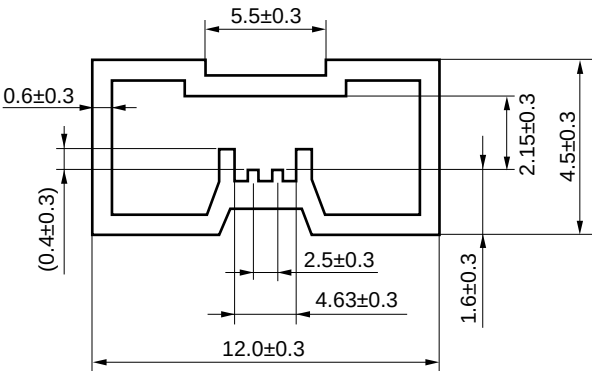
7.1.2 4, 6, 8-pin DIP Surface Mount Type



7.1.3 4, 8-pin SOP

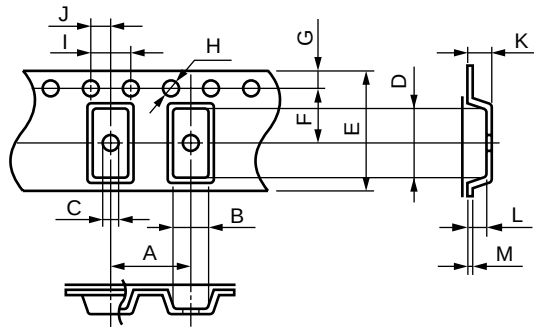


7. 1. 4 5-pin SOP



7.2 TAPING PACKING SPECIFICATIONS

7.2.1 Taping Specifications (Unit: mm)



(1) Photocoupler

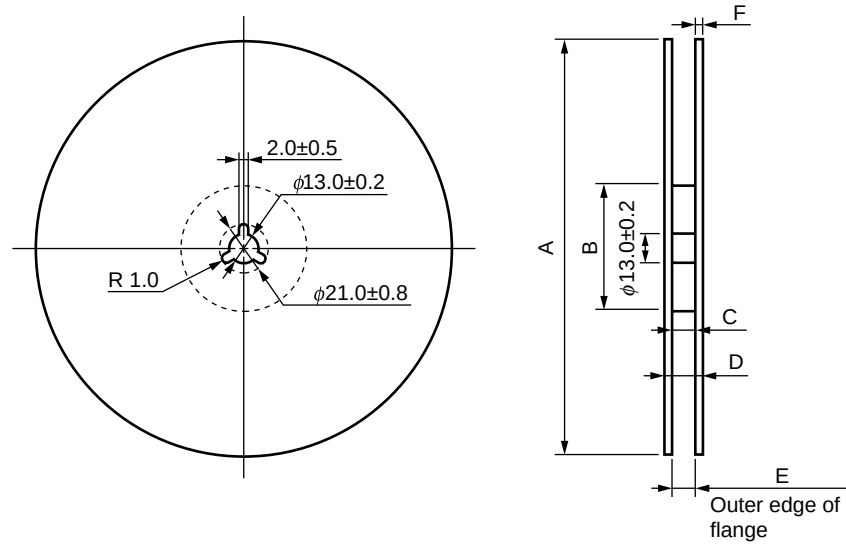
Package Category	4-pin DIP L (2ch) 8-pin L	4-pin L	4-pin SOP 5-pin SOP (PS87, 97xx)	Small SOP-1ch (PS28xx-1)	Small SOP-4ch (PS28xx-4, PS8741)	Small SOP-1ch (PS29xx-1)	Small SOP-4ch (PS284x-4x)	5-pin SOP (PS81, 91xx) ^{*1}
Taping Name	E3, E4	E3, E4, F3, F4	F3, F4					
Size (See Figure)	A	12.0±0.1	8.0±0.1	4.0±0.1	12.0±0.1	4.0±0.1	8.0±0.1	
	B	10.4±0.1	5.3±0.1	4.6±0.1	2.85±0.1	8.3±0.1	2.9±0.1	6.0±0.1
	C		1.55±0.1				1.55±0.05	1.55±0.1
	D	10.3±0.1	7.4±0.1	7.55±0.1	10.7±0.1	5.3±0.1	7.4±0.1	
	E	16.0±0.3	12.0±0.2	16.0±0.3			12.0±0.2	
	F	7.5±0.1	5.5±0.05	7.5±0.1		5.5±0.05		5.5±0.1
	G		1.75±0.1					
	H		1.5 ^{+0.1} ₋₀					
	I		4.0±0.1					
	J	2.0±0.1	2.0±0.05	2.0±0.1		2.0±0.05		
	K	4.5 MAX.	2.9 MAX.	2.8 MAX.		2.9 MAX.	3.05 MAX.	3.45 MAX.
	L	4.0±0.1	2.4±0.1	2.3±0.1		2.4±0.1	2.85±0.1	3.0±0.1
	M	0.3	0.4	0.3				0.3±0.05

*1 Under development

(2) Optical coupled MOS FET

Package Category	6, 8-pin DIP L	SOP-1ch	SOP-2ch	Small SOP-1ch
Taping Name	E3, E4	E3, E4, F3, F4	F3, F4	
Size (See Figure)	A	12.0±0.1	8.0±0.1	12.0±0.1
	B	10.4±0.1	4.6±0.1	7.6±0.1
	C		1.55±0.1	1.55±0.05
	D	10.3±0.1	7.4±0.1	9.6±0.1
	E	16.0±0.3	12.0±0.2	16.0±0.2
	F	7.5±0.1	5.5±0.05	7.5±0.1
	G		1.75±0.1	
	H		1.5 ^{+0.1} ₋₀	
	I		4.0±0.1	
	J	2.0±0.1	2.0±0.05	2.0±0.1
	K	4.5 MAX.	2.9 MAX.	2.8 MAX.
	L	4.0±0.1	2.4±0.1	2.3±0.1
	M		0.3	

7. 2. 2 Reel Specifications (Unit: mm)



(1) Photocoupler

Package Category	4-pin DIP L (2ch) 8-pin L	4-pin L	4-pin L	Small SOP-1ch (PS28xx-1)	Small SOP-4ch (PS28xx-4, PS8741)	Small SOP-1ch (PS29xx-1) 4-pin SOP 5-pin SOP (PS87, 97xx)	Small SOP-4ch (PS284x-4x) 5-pin SOP (PS81, 91xx) ^{*1}
Taping Name	E3, E4			F3, F4			
Packing	1 000 pcs/reel			2 000 pcs/reel	3 500 pcs/reel	2 500 pcs/reel	2 500 pcs/reel
Size (See Figure)	A	$\phi 330 \pm 2.0$	$\phi 254 \pm 2.0$	$\phi 330 \pm 2.0$			
	B	100 ± 1.0	80 ± 1.0	100 ± 1.0			
	C	17.5 ± 1.0					13.5 ± 1.0
	D	21.5 ± 1.0					17.5 ± 1.0
	E	$15.9 - 19.4$					$11.9 - 15.4$
	F	2.0 ± 0.5					

*1 Under development

(2) Optical coupled MOS FET

Package Category	6, 8-pin L	SOP-1ch	SOP-2ch	SOP-1ch Small SOP-1ch
Taping Name	E3, E4		F3, F4	
Packing	1 000 pcs/reel	900 pcs/reel	1 500 pcs/reel	3 500 pcs/reel
Size (See Figure)	A	$\phi 330 \pm 2.0$	$\phi 180^{+0}_{-1.5}$	$\phi 330 \pm 2.0$
	B	100 ± 1.0	60^{+1}_{-0}	100 ± 1.0
	C	17.5 ± 1.0	13.5 ± 1.0	17.5 ± 1.0
	D	21.5 ± 1.0	17.5 ± 1.0	21.5 ± 1.0
	E	$15.9 - 19.4$	$11.9 - 15.4$	$15.9 - 19.4$
	F	2.0 ± 0.5		

8. PHOTOCOUPLER AND OPTICAL COUPLED MOS FET MARKING EXAMPLE

8.1 PHOTOCOUPLER MARKING EXAMPLE

(1) PS25xx-1, PS2581 Series

No. 1 pin Mark

NEC
2501
ND503

← Type Number*1
← Assembly Lot

*1. Applicable type numbers are listed below

2501	2532
2502	2533
2503	2561
2505	2562
2506	2565
2513	2566
2521	2571
2525	2581

N D 5 03

Week Assembled
(Last 1 Digit)
In-house Code
CTR Rank Code

Package	Made in Japan	Made in Taiwan
Standard PKG	①	③
New PKG	②	④

(2) PS25xx-2, 4 Series

No. 1 pin Mark

NEC JAPAN
PS2501-2
ND503

← Country Assembled
← Type Number*1
← Assembly Lot

*1. Applicable type numbers are listed below

PS2501-2, 4	PS2532-2, 4
PS2502-2, 4	PS2533-2, 4
PS2503-2, 4	PS2561-2, 4
PS2505-2, 4	PS2562-2, 4
PS2506-2, 4	PS2565-2, 4
PS2521-2, 4	PS2566-2, 4
PS2525-2, 4	PS2571-4

N D 5 03

Week Assembled
(Last 1 Digit)
In-house Code
CTR Rank Code

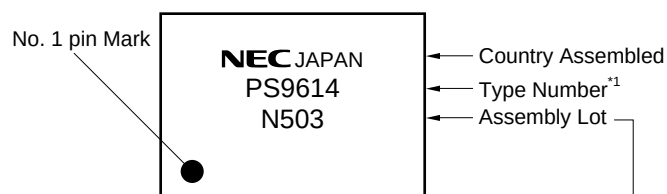
PS2501-4, PS2505-4 only

Package	Made in Japan	Made in Taiwan
Standard PKG	①	③
New PKG	②	

Table

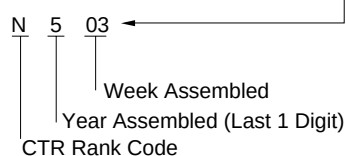
	①	②	③	④
PS2501-1	D	E	F	H
PS2502-1	D	E	F	H
PS2503-1	Blank			
PS2505-1	D	E	F	H
PS2506-1	D	E		
PS2513-1		E		
PS2521-1	Blank			
PS2525-1	Blank			
PS2532-1	Blank	E	F	
PS2533-1	Blank	E	F	
PS2561-1	Blank	E	F	H
PS2562-1	Blank	E		
PS2565-1	Blank	E	F	H
PS2566-1	Blank	E		
PS2571-1	Blank	E	F	
PS2581		E		
PS2501-2	D		F	
PS2502-2	D		F	
PS2503-2	Blank			
PS2505-2	D		F	
PS2506-2	D			
PS2521-2	Blank			
PS2525-2	Blank			
PS2532-2	Blank		F	
PS2533-2	Blank		F	
PS2561-2	Blank		F	
PS2562-2	Blank			
PS2565-2	Blank		F	
PS2566-2	Blank			
PS2501-4	D	E	F	
PS2502-4	D		F	
PS2503-4	Blank			
PS2505-4	D	E	F	
PS2506-4	D			
PS2521-4	Blank			
PS2525-4	Blank			
PS2532-4	Blank		F	
PS2533-4	Blank		F	
PS2561-4	Blank		F	
PS2562-4	Blank			
PS2565-4	Blank		F	
PS2566-4	Blank			
PS2571-4	Blank	E	F	

(3) PS86xx, PS96xx Series

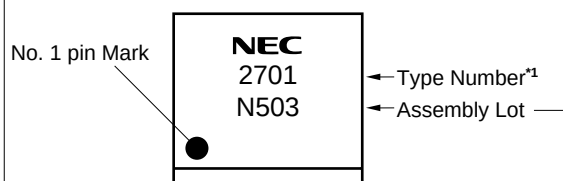


*1. Applicable type numbers are listed below

PS8601
PS8602
PS9611
PS9613
PS9614

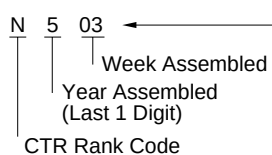


(4) PS27xx-1, PS87xx, PS97xx Series

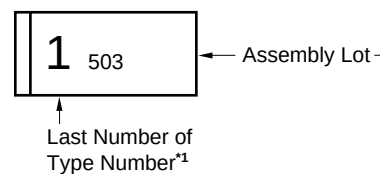


*1. Applicable type numbers are listed below

2701	2733
2702	2761
2703	2765
2705	8701
2706	8741
2707	9711
2711	9713
2715	9714
2732	9715

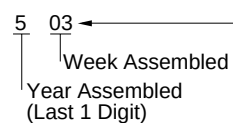


(5) PS280x-1 Series

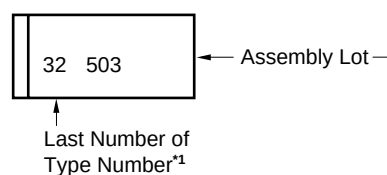


*1. Applicable type numbers are listed below

PS2801-1
PS2802-1
PS2805-1
PS2806-1



(6) PS28xx-1 Series



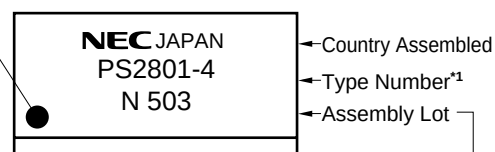
*1. Applicable type numbers are listed below

PS2811-1
PS2815-1
PS2832-1
PS2833-1
PS2861-1
PS2865-1

5 03
 Week Assembled
 Year Assembled
 (Last 1 Digit)

(7) PS28xx-4 Series

No. 1 pin Mark

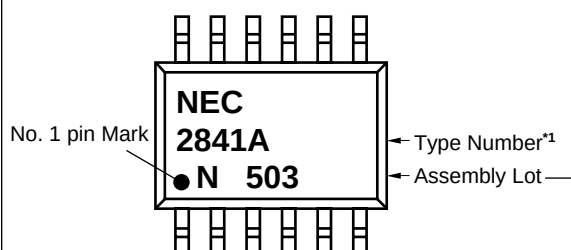


*1. Applicable type numbers are listed below

PS2801-4
PS2802-4
PS2805-4
PS2806-4
PS2811-4
PS2815-4
PS2832-4
PS2833-4

N 5 03
 CTR Rank Code
 Week Assembled
 Year Assembled
 (Last 1 Digit)

(8) PS284x Series

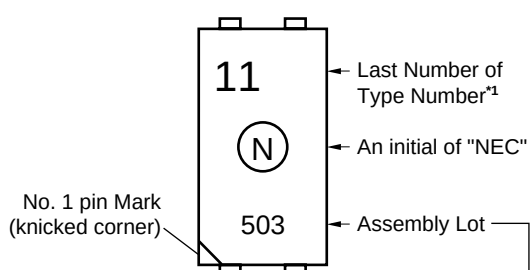


*1. Applicable type numbers are listed below

PS2841-4A
PS2841-4B
PS2845-4A

N 5 03
 CTR Rank Code
 Week Assembled
 Year Assembled
 (Last 1 Digit)

(9) PS29xx-1 Series



*1. Applicable type numbers are listed below

PS2911-1
PS2913-1
PS2915-1
PS2932-1
PS2933-1

5 03
 Week Assembled
 Year Assembled
 (Last 1 Digit)

8. 2 OPTICAL COUPLED MOS FET MARKING EXAMPLE

(1) PS71/3xx-1x Series

No. 1 pin Mark

NEC JAPAN

PS7141-1A

NE503

Country Assembled

Type Number*1

Assembly Lot

*1. Applicable type numbers are listed below

PS71xx-1A

PS71xx-1B

PS710A-1A

PS710B-1A

PS710E-1A

PS71xxA-1A

PS71xxA-1B

PS71xxxC-1A

PS73xx-1A

PS73xx-1B

PS73xxC-1A

N

5

03

Rank Code

Week Assembled

Year Assembled (Last 1 Digit)

In-house Code

Nothing

Solder dipping

E

Solder plating

(2) PS71xx-2x/1C Series

No. 1 pin Mark

NEC JAPAN

PS7122-2A

N 503

Country Assembled

Type Number*1

Assembly Lot

*1. Applicable type numbers are listed below

PS71xx-2A

PS71xx-2B

PS71xx-1C

PS71xxA-2A

PS71xxA-2B

PS71xxA-1C

N

5

03

Rank Code

Week Assembled

Year Assembled (Last 1 Digit)

In-house Code

Nothing

Solder dipping

E

Solder plating

(3) PS72xx-1x Series

NEC

200A

503

NEC

41-A

N 503

Type Number*1

Assembly Lot

No.1 pin Mark

*1. Applicable type numbers are underlined below

PS7200A-1A

PS7200B-1A

PS7200E-1A

PS7200H-1A

PS7200K-1A

PS7200N-1A

PS7200R-1A

PS72xx-1A

PS7205B-1A

PS72xx-1B

N

5

03

Rank Code

Week Assembled

Year Assembled (Last 1 Digit)

Nothing

Ink marking

E

Laser marking

(4) PS72xx-2x/1C Series

No. 1 pin Mark

NEC JAPAN

PS7241-2A

N 503

Country Assembled

Type Number*1

Assembly Lot

*1. Applicable type numbers are listed below

PS72xx-2A

PS72xx-2B

PS72xx-1C

PS72xxA-2A

N

5

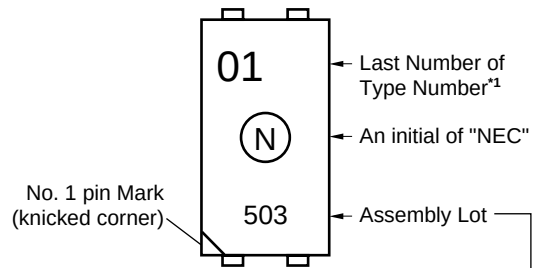
03

Rank Code

Week Assembled

Year Assembled (Last 1 Digit)

(5) PS78xx-1x Series (Under development)



*1. Applicable type numbers are listed below

PS7801-1A
PS7802-1A

5 03
| |
Year Assembled Week Assembled
(Last 1 Digit)

9. PHOTOCOUPLER AND OPTICAL COUPLED MOS FET SAFETY STANDARDS

9.1. SAFETY STANDARDS

9.1.1 Photocoupler Safety Standard Approval List (As of November 2002)

Part Number	UL 				CSA 			BSI 		
	UL1577 E72422 (S) Single/Double Protection				CA101391			BS/EN60065(BS415)+IEC65 BS/EN60950(BS7002)+IEC950		
	Single	Double	Made in Japan	Made in Taiwan		Made in Japan	Made in Taiwan		Made in Japan	Made in Taiwan
PS2501-1, -2, -4 /PS2501L-1, -2, -4	●	●	●	●						
PS2502-1, -2, -4 /PS2502L-1, -2, -4	●	●	●	●						
PS2503-1, -2, -4 /PS2503L-1, -2, -4	●		●	●	●	●	●			
PS2505-1, -2, -4 /PS2505L-1, -2, -4	●	●	●	●						
PS2506-1, -2, -4 /PS2506L-1, -2, -4	●	●	●	●						
PS2513-1/PS2513L-1	●	●	●							
PS2521-1, -2, -4 /PS2521L-1, -2, -4	●		●	●	●	●	●			
PS2525-1, -2, -4 /PS2525L-1, -2, -4	●		●	●	●	●	●			
PS2532-1, -2, -4 /PS2532L-1, -2, -4	●		●	●	●	●	●	●B	●	
PS2533-1, -2, -4 /PS2533L-1, -2, -4	●		●	●	●	●	●	●B	●	
PS2561-1, -2 /PS2561L-1, -2	●	●	●	●	●	●	●	●R	●	●
PS2562-1, -2 /PS2562L-1, -2	●	●	●	●	●	●	●	●R	●	●
PS2565-1, -2 /PS2565L-1, -2	●	●	●	●	●	●	●	●R	●	●
PS2566-1, -2 /PS2566L-1, -2	●	●	●	●	●	●	●	●R	●	●
PS2571-1, 4/PS2571L-1, 4	●	●	●	●	●	●	●	●R	●	●
PS2581L1/PS2581L2	●	●	●		●	●		●R	●	

Remark ●: Approved △: Awaiting Approval

R: Insulation Reinforced S: Insulation Supplementary B: Insulation Basic

(1/2)

VDE			SEMKO			NEMKO			FIMKO			DEMKO		
														
VDE0884			EN 60065/IEC60065 EN 60950/IEC60950			EN 60065 + EN 60950			EN 60065 + EN 60950			EN 60065/IEC60065 EN 60950/IEC60950		
Made in Japan	Made in Taiwan		Made in Japan	Made in Taiwan		Made in Japan	Made in Taiwan		Made in Japan	Made in Taiwan		Made in Japan	Made in Taiwan	
△	△													
●	●		●R	●	●	●	●	●	●	●	●	●R	●	●
●	●		●R	●	●	●	●	●	●	●	●	●R	●	●
●	●	●	●R	●	●	●	●	●	●	●	●	●R	●	●
●	●	●	●R	●		●	●		●	●		●R	●	
●	●	●	●R	●	●	●	●	●	●	●	●	●R	●	●
●	●	●	●R	●		●	●		●	●		●R	●	
●	●	●	●R	●		●	●		●	●		●R	●	
●	●		●R	●		●	●		●	●		●R	●	
●	●		●R	●		●	●		●	●		●R	●	

Part Number	UL 				CSA 			BSI 		
	UL1577 E72422 (S) Single/Double Protection				CA101391			BS/EN60065(BS415)+IEC65 BS/EN60950(BS7002)+IEC950		
	Single	Double	Made in Japan	Made in Taiwan		Made in Japan	Made in Taiwan		Made in Japan	Made in Taiwan
PS2701-1	●		●					●B	●	
PS2702-1	●		●					●B	●	
PS2703-1	●		●					●B	●	
PS2705-1	●		●					●B	●	
PS2706-1	●		●					●B	●	
PS2707-1	●		●					●B	●	
PS2711-1	●		●							
PS2715-1	●		●							
PS2732-1	●		●					●B	●	
PS2733-1	●		●					●B	●	
PS2761-1	●		●		△			●S	●	
PS2765-1	●		●		△			●S	●	
PS2801-1, -4	●		●					●B	●	
PS2802-1, -4	●		●					●B	●	
PS2805-1, -4	●		●					●B	●	
PS2806-1, -4	●		●					●B	●	
PS2811-1, -4	●		●							
PS2815-1, -4	●		●							
PS2832-1, -4	●		●					●B	●	
PS2833-1, -4	●		●							
PS2841-4A	●		●							
PS2841-4B	●		●							
PS2845-4A	●		●							
PS2861-1	●		●		△			●S	●	
PS2865-1	●		●		△			●S	●	
PS2911-1	●		●					●S	●	
PS2913-1	●		●					●S	●	
PS2915-1	●		●					●S	●	
PS2932-1	●		●					●S	●	
PS2933-1	●		●					●S	●	
PS8601/PS8601L	●		●					●B	●	
PS8602/PS8602L	●		●					●B	●	
PS8701	●		●							
PS8703	●		●							
PS8741	●		●		△			●S	●	
PS9611/PS9611L	●		●							
PS9613/PS9613L	●		●							
PS9614/PS9614L	●		●							
PS9711	●		●					●B	●	
PS9713	●		●							
PS9714	●		●							
PS9715	●		●							

Remark ●: Approved △: Awaiting Approval

R: Insulation Reinforced S: Insulation Supplementary B: Insulation Basic

VDE 			SEMKO 			NEMKO 			FIMKO 			DEMKO 		
VDE0884			EN 60065/IEC60065 EN 60950/IEC60950			EN 60065 + EN 60950			EN 60065 + EN 60950			EN 60065/IEC60065 EN 60950/IEC60950		
	Made in Japan	Made in Taiwan		Made in Japan	Made in Taiwan		Made in Japan	Made in Taiwan		Made in Japan	Made in Taiwan		Made in Japan	Made in Taiwan
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9. 1. 2 Optical Coupled MOS FET Safety Standard Approval List (As of November 2002)

(1/2)

Part Number	UL		VDE	BSI	CSA	SEMKO	NEMKO	FIMKO	DEMKO
									
	UL1577		VDE0884	BS/EN60065 (BS415) +IEC65 BS/EN60950 (BS7002) +IEC950	CA 101391	EN 60065/ IEC60065 EN 60950/ IEC60950	EN 60065 + EN 60950	EN 60065 + EN 60950	EN 60065/ IEC60065 EN 60950/ IEC60950
	Single	Double							
PS710A-1A, PS710AL-1A	●		△	●S	△				
PS710B-1A, PS710BL-1A	△								
PS710E-1A, PS710EL-1A	△								
PS7113-1A, PS7113L-1A	●		△	●S	●				
PS7113-2A, PS7113L-2A	●		△	●S	●				
PS7122-1A, PS7122L-1A	●		△	●S	●				
PS7122-2A, PS7122L-2A	●		△	●S	●				
PS7122A-1A, PS7122AL-1A	●		△	●S	●				
PS7122A-1B, PS7122AL-1B	●		△	●S	●				
PS7122A-1C, PS7122AL-1C	●		△	●S	△				
PS7122A-2A, PS7122AL-2A	●		△	●S	●				
PS7122A-2B, PS7122AL-2B	●		△	●S	●				
PS7141-1A, PS7141L-1A	●		△	●S	●				
PS7141-1B, PS7141L-1B	●		△	●S	●				
PS7141-1C, PS7141L-1C	●		△	●S	●				
PS7141-2A, PS7141L-2A	●		△	●S	●				
PS7141-2B, PS7141L-2B	●		△	●S	●				
PS7141C-2A, PS7141CL-2A	●			●S					
PS7142-1A, PS7142L-1A	●		△	●S	●				
PS7142-2A, PS7142L-2A	●		△	●S	●				
PS7142-1B, PS7142L-1B	●		△	●S	△				
PS7142-2B, PS7142L-2B	●		△	●S	△				
PS7142-1C, PS7142L-1C	●		△	●S	△				
PS7160-1A, PS7160L-1A	●		△	●S	●				
PS7160-2A, PS7160L-2A	●		△	●S	●				

●: Approved, △: Awaiting approval, S: Insulation Supplementary, R: Insulation Reinforced

Part Number	UL		VDE	BSI	CSA	SEMKO	NEMKO	FIMKO	DEMKO
									
	UL1577		VDE0884	BS/EN60065 (BS415) +IEC65 BS/EN60950 (BS7002) +IEC950	CA 101391	EN 60065/ IEC60065 EN 60950/ IEC60950	EN 60065 + EN 60950	EN 60065 + EN 60950	EN 60065/ IEC60065 EN 60950/ IEC60950
	Single	Double							
PS7200A-1A	●		△	●S	●				
PS7200B-1A	●		△	●S	●				
PS7200E-1A	△								
PS7200H-1A	△								
PS7200K-1A	●		△	●S	●				
PS7200N-1A	●			●S					
PS7200R-1A	●		△	●S	△				
PS7206-1A	●		△	●S	△				
PS7211-2A	●		△	●S	●				
PS7212-1A	●		△	●S	△				
PS7214-1A	●		△	●S	△				
PS7221-2A	●		△	●S	●				
PS7221A-2A	●		△	●S	△				
PS7241-1A	●		●	●S	●				
PS7241-1B	●		●	●S	●				
PS7241-1C	●		●	●S	●				
PS7241-2A	●		△	●S	●				
PS7241-2B	●		△	●S	●				
PS7341-1A, PS7341L-1A	●	●	●	●R	●	●R	●	●	●
PS7341-1B, PS7341L-1B	●	●	●	●R	●	●R	●	●	●
PS7341C-1A, PS734CL-1A	●	●	●	●R	●	●R	●	●	●
PS7342-1A, PS7342L-1A	●	●	●	●R	●	●R	●	●	●
PS7360-1A, PS7360L-1A	●	●	●	●R	●	●R	●	●	●
PS7801-1A	△								
PS7802-1A	△								

●: Approved, △: Awaiting approval, S: Insulation Supplementary, R: Insulation Reinforced

9. 1. 3 Photocoupler List Constructional Parameters

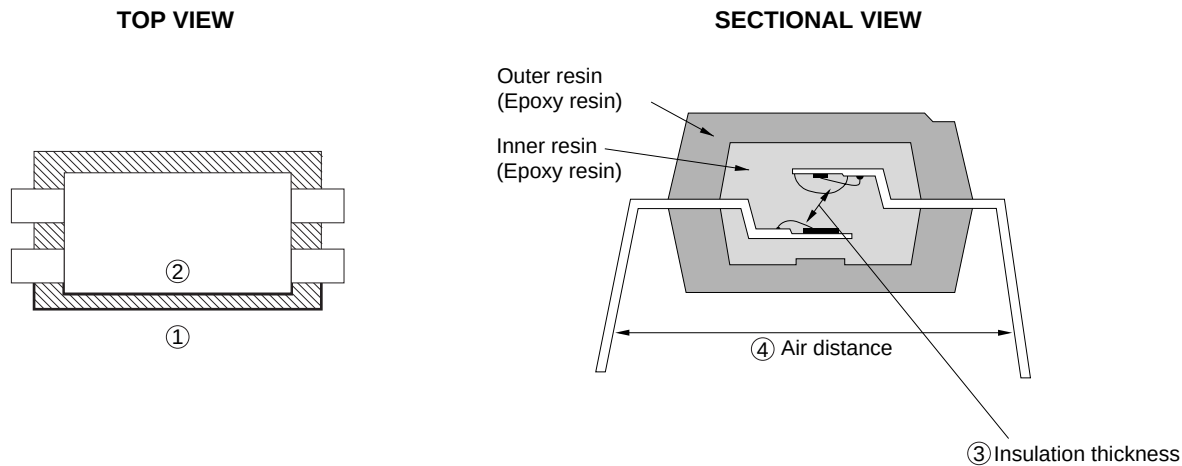
Part Number	Parameters ^{*1}				
	Air Distance	Creepage Distance		Insulation Thickness	Isolation Voltage
		Outer Creepage Distance	Inner Creepage Distance		
PS250x-1, -2, -4 /PS250xL-1, -2, -4	7.0 mm	7.0 mm	3.5 mm	0.3 mm	5 kVr.m.s.
PS252x-1, -2, -4 /PS252xL-1, -2, -4			4.0 mm	0.4 mm	
PS253x-1, -2, -4 /PS253xL-1, -2, -4					
PS256x-1, -2 /PS256xL-1, -2					
PS2581L1/PS2581L2	8.0 mm	8.0mm			
PS270x-1	5.0 mm	5.0 mm	2.5 mm	0.3 mm	3.75 kVr.m.s.
PS271x-1					
PS273x-1					
PS276x-1				0.4 mm	3.75 kVr.m.s.
PS280x-1, -4	4.5 mm	4.5 mm	2.5 mm	0.1 mm	2.5 kVr.m.s.
PS281x-1, -4					
PS283x-1, -4					
PS286x-1				0.4 mm	
PS29xx-1	4.0 mm	4.0 mm	2.5 mm		1.5 kVr.m.s.
PS284x-4x					
PS860x/PS860xL	7.0 mm	7.0 mm	3.5 mm	0.3 mm	5 kVr.m.s.
PS870x	5.0 mm	5.0 mm	2.5 mm	0.2 mm	2.5 kVr.m.s.
PS8741		4.5 mm	4.5 mm	0.4 mm	1.5 kVr.m.s.
PS9611/PS9611L	7.0 mm	7.0 mm	3.5 mm	0.2 mm	3.75 kVr.m.s.
PS9613/PS9613L				0.3 mm	5 kVr.m.s.
PS9614/PS9614L				0.2 mm	3.75 kVr.m.s.
PS97xx	5.0 mm	5.0 mm	2.5 kVr.m.s.		
PS81, 91xx ^{*2}	4.0 mm	4.0 mm			

*1 Refer to **9. 1. 4 Construction**

*2 Under development

9. 1. 4 Construction

- ① Outer Creepage Distance
Over-surface spacing between input and output
- ② Inner Creepage Distance
Internal thickness spacing
- ③ Insulation Thickness
Through air spacing between input and output



9. 1. 5 List of Product Name During Application for Safety Standard

When applying for a safety standard, use the basic product name without the type number indicating the lead shape (L, L1, L2).

Product Name	Product Name During Application
PS2xxx-x PS2xxxL-x PS2xxxL1-x PS2xxxL2-x	PS2xxx-x

ex) PS2561

Product Name	Product Name During Application
PS2561-1 PS2561L-1 PS2561L1-1 PS2561L2-1	PS2561-1
PS2561-2 PS2561L-2 PS2561L1-2 PS2561L2-2	PS2561-2

10. PHOTOCOUPLER AND OPTICAL COUPLED MOS FET USAGE CAUTIONS

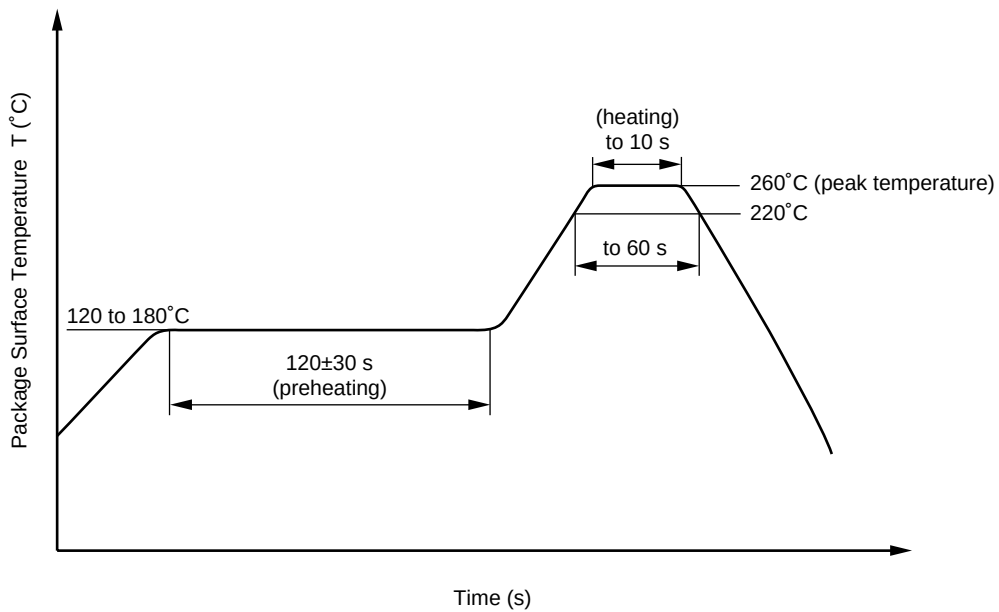
10. 1 SOLDERING INFORMATION

10. 1. 1 Infrared Reflow Soldering (IR260)

Applicable type numbers: PS25xx, 27xx, 28xx, 29xx, 71xx, 72xx, 78xx, PS81xx ^{*1}, PS91xx ^{*1}

- Peak reflow temperature 260°C or below (package surface temperature)
- Time of temperature higher than 220 °C 60 seconds or less
- 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



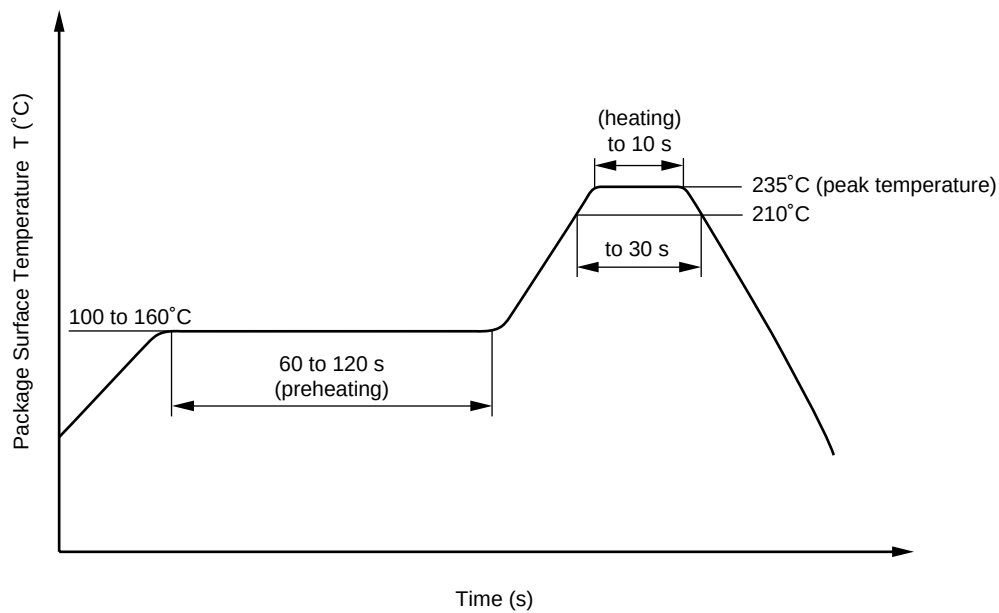
*1 Under development

10. 1. 2 Infrared Reflow Soldering (IR235)

Applicable type numbers: PS87xx, 97xx, 73xx

- Peak reflow temperature 235°C or below (package surface temperature)
- Time of temperature higher than 210 °C 30 seconds or less
- Number of reflows Three (PS8741 and PS73xx: one)
- 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

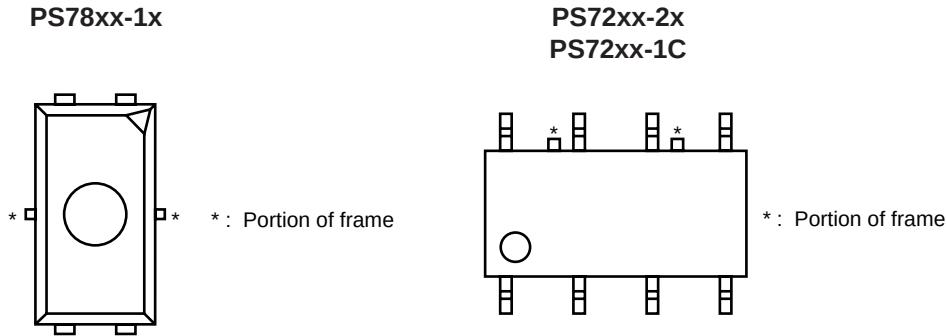


10. 1. 3 Dip Soldering

- Temperature 260°C or below (molten solder temperature)
- Time 10 seconds or less
- Number of times One (Except PS8741, PS97xx, PS7xxx)
- Flux Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt% is recommended.)

10. 1. 4 Cautions

- Fluxes
Avoid removing the residual flux with freon-based and chlorine-based cleaning solvent.
- Products in dry pack
After opening the dry pack, solder the products within the valid storage period specified on the label on the dry pack.
- Avoid shorting between portion of frame and leads.



10. 1. 5 Post-installation Cleaning

Observe the following cleaning requirements for Photocoupler and Optical Coupled MOS FET mounted on a PC board:

Cleaning method	Yes/No
Steam	Yes ^{*1}
Ultrasonic	Yes ^{*1}
Solvent bath	Yes ^{*1}

***1** Cleaning method

Steam Cleaning

Steam temperature: 45°C or under, Duration: 3 minutes or less

Ultrasonic Cleaning

Ultrasound output: 15 W/liter or under, Duration: 30 seconds or less

Solvent temperature: Maintain low temperature of approx. 40°C

Frequency: 28 kHz

Solvent Bath

Solvent temperature: 45°C or under, Duration: 3 minutes or less

	Recommended	Not recommended
Cleaning solvent	Isopropyl alcohol Ethyl alcohol Methyl alcohol P3 cold cleaner Pinealpha ST-100S Bioact EC-7/EC-7R Clean through 700 Series Pure water	Trichloroethylene Toluene Xylene

10.2 CAUTIONS REGARDING NOISE

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

10.3 OPTICAL COUPLED MOS FET USAGE CAUTIONS

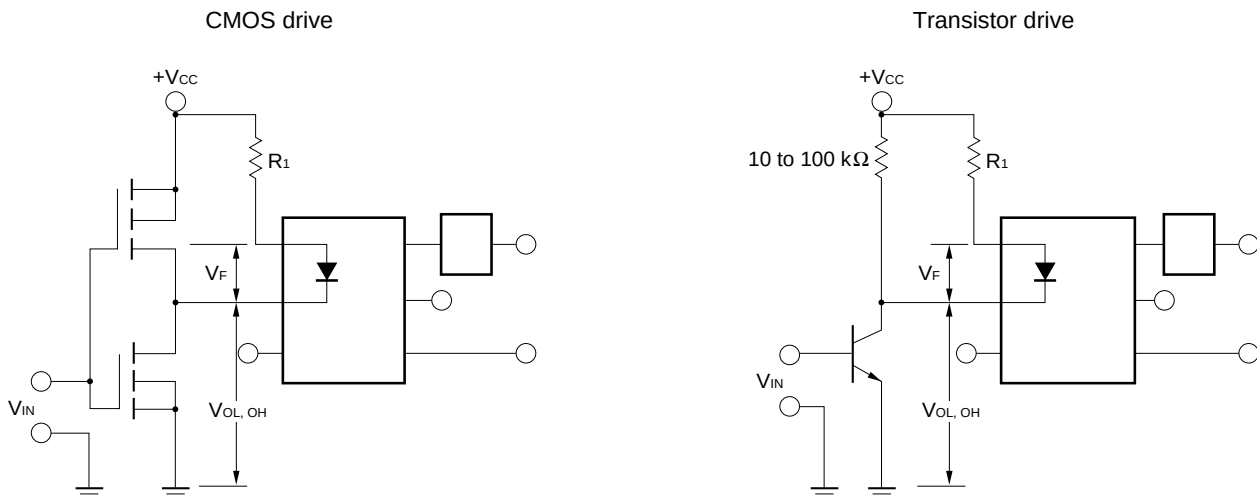
10.3.1 Optical Coupled MOS FET Driving Conditions

To assure normal turn-on and turn-off actions of the relay, use the following driving conditions:

Parameter	Symbol	MIN.*1	TYP.	MAX.	Unit
LED Operating Current	I_F	2	10	20	mA
LED Off Voltage	V_F	0		0.5	V

*1 For the conditions above, the on-state resistance, load current, turn-on time, and some other parameters differ from those provided in the standard specifications.

(1) Typical optical coupled MOS FET driving circuits



- How to Determine LED Current-Limiting Resistance Needed to Assure Turn-On Action:

$$\text{Current limiting resistance: } R_1 = \frac{V_{CC} - V_{OL} - V_F(\text{on})}{2 \text{ to } 20 \text{ mA}}$$

- How to Determine LED Forward Voltage Needed to Assure Turn-Off Action:

$$\text{Turn-off voltage (forward LED voltage): } V_F(\text{off}) = V_{CC} - V_{OH} < 0.5 \text{ V}$$

(2) Untimely turn-off action

A sudden drop in LED drive current can cause untimely turn-off action of the Optical Coupled MOS FET when it is in on-state.

(3) Misoperation due to impulsive input current in off-state

If a large, impulsive current flows into the Optical Coupled MOS FET's control input when it is in off-state, the Optical Coupled MOS FET may momentarily misoperate. The relay will return to off-state when the pulse current is removed, however. To prevent such misoperation, use a pulse current with the product of its peak value (IP) with pulse width (Δt) not exceeding 700×10^{-9} (ampere second).

(4) MOS FET's electrostatic capacity

In the off-state, the output MOS FETs have a capacitance of several to several hundred picofarads. Note, therefore, that, if the load voltage suddenly changes, a transient charging/ discharging current flows through the load circuit even when the MOS FET output is off-state.

(5) Note on continuous, high-speed switching

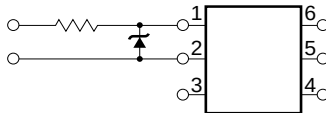
Relay's maximum response speed (frequency) depends on the input current intensity:

e.g. 1 000 Hz MAX. at $I_F = 10$ mA
500 Hz MAX. at $I_F = 5$ mA

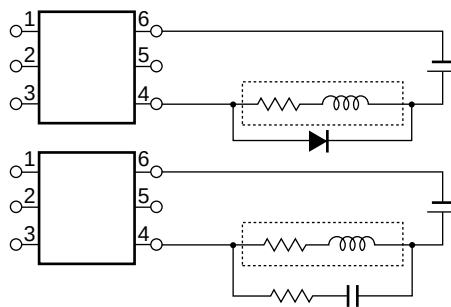
(6) Surge protection

If a reverse surge voltage is expected across the control inputs, use a Zener diode across the input pins to suppress surge voltages exceeding 5 V. If large spikes exceeding the device's absolute maximum ratings are expected at the output from an inductive load, use a C/R snubber or clamping diode in parallel with the load to suppress such spikes.

- Surge Protection for Control Inputs



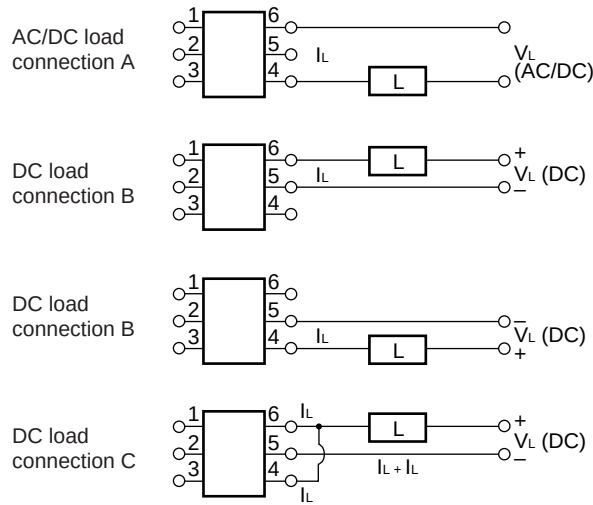
- Spike Protections for Output Circuit



10. 3. 2 Load Connections: PS7x Series (AC/DC Switching Version)

The following four types of load connections are available.

Choose one or more depending on your application purpose.



- Input-Output Short Circuit

If an input pin is shorted to an output pin while the Optical Coupled MOS FET is active, it may cause permanent damage to the internal circuitry. Take care never to short one to the other.

10. 3. 3 Handling Precautions

(1) Electrostatic damage to optical coupled MOS FET

The output MOS FET has a pin-to-pin electrostatic destruction voltage of 2 000 V (test condition: 100 pF, 1.5 k ohms).

Care must be taken to protect the device from static electricity exceeding this value.

(2) Lead strength

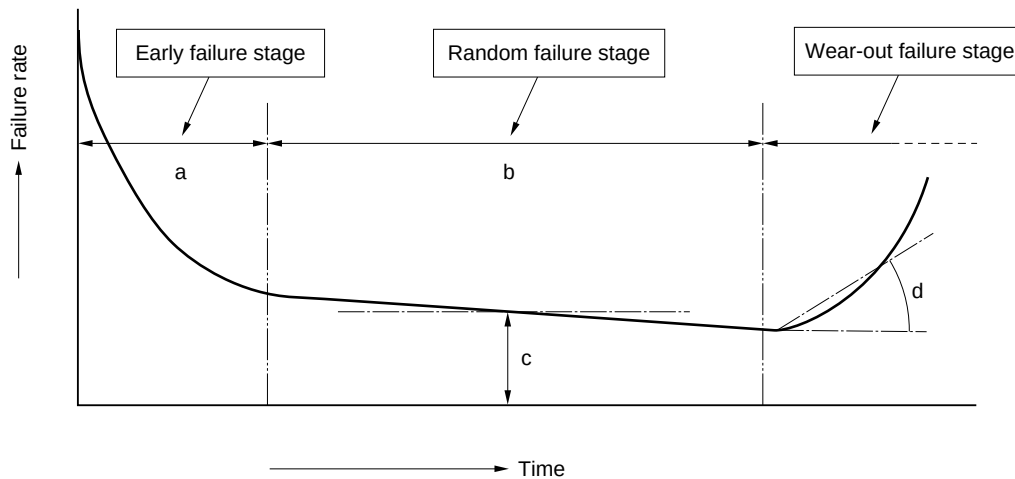
Never apply a bend stress of more than 500 grams to any lead as it may cause damage to the Optical Coupled MOS FET package and mar the device's performance and/or reliability.

10. 4 FAILURE RATE

10. 4. 1 Concept of Failure Rate

The failure rate is a widely used indicator of reliability in semiconductors. It describes the rate of failure in a given time period. The failure rate changes over time, as is shown in Figure 10-1. The symbols (a to d) in Figure 10-1 are also noted in parentheses below.

Figure 10-1. Time-related Changes in Failure Rate



- **Early failure stage:** During this stage, failures occur at a high rate following the initial operation of semiconductor devices. Latent causes of failure that were not detected during previous screening tend to become apparent soon after the device is initially put into operation. Since these failures are mainly due to manufacturing defects or material defects, they occur very soon and thus the failure rate declines rapidly over time. Advances in manufacturing process control technologies have helped to reduce the failure rate during the early failure stage.
In addition, screening has enabled failures that occur during the early failure stage (a) to be experienced as part of the manufacturing process, which has also helped to lower the failure rate once the manufactured devices begin operating.
- **Random failure stage:** During this stage, various failures that were not screened out occur with random frequency. The failure rate during this period remains fairly constant since failures that occur during this period are sporadic (random) and are due to complex factors, such as design quality and the use environment. Methods to suppress the failure rate (c) and to increase the life of semiconductors before they reach their wear-out failure stage, include building an extra reliability margin into the semiconductor's design and establishing a safety margin in the semiconductor's use conditions.
- **Wear-out failure stage:** During this stage, failures occur with increasingly frequency over time and are caused by age-related wear and fatigue. Such failures are often seen in products that have outlived their useful life. In devices whose components can be replaced to extend useful life (called repairable system), analyzing the start of their wear-out failure stage as the sum of (a) and (b) and the manner in which wear-out failures occur (d) can make it possible to implement preventive maintenance whereby certain components are replaced before they fail.

10. 4. 2 Calculating the Failure Rate

The semiconductor failure rate (λ) is determined from the reliability of a device inherent in its design and the conditions under which it is used by the customer. For the former parameter, the basic failure rate is $Ea = 0.7$, λ_b (fit) = 10. For the latter parameter, the conditions include the temperature at which the device is used, and for transistors and FETs, the applied voltage. (All other conditions are those that comply with the recommended condition specifications in NEC Compound Semiconductor Devices data sheets and data books).

(1) Calculation procedure

- (a) Determine the basic failure rate (λ_b) of the relevant product.
- (b) Calculate the parameters (πT , πV) from the customer's product usage conditions.
- (c) Insert the value calculated in (b) above into the failure rate estimation formula to determine the failure rate (λ). (Refer to the following page for (b) and (c).)

(2) Calculation formula

The device's failure rate (λ) is determined based on the device-specific basic failure rate (λ_b) and the use conditions. After considering the hypothetical use environment, the failure rate can be calculated via the following steps.

- Failure rate estimation formula (λ) (failure rate during random failure period)

$$\lambda = \lambda_b \times \pi T \times \pi V \quad (\text{fit})$$

(b) Power supply voltage parameter

Applicable only for silicon transistors, FETs, and transistors with internal resistor

($\pi V = 1$ for products other than above)

(a) Temperature parameter

Basic failure rate (10 Fit)

(a) Temperature parameter (πT)

$$\pi T = \exp \left(11600 \times E_a \times \left(\frac{1}{273 + 55} - \frac{1}{273 + T_a(j)} \right) \right)$$

E_a : Activation energy (0.7)

T_a : Ambient temperature during use (for IC)

T_j : Junction temperature during use (for discrete device)

Expressed as $T_a(j)$ in above formula

πT Reference Chart (when $E_a = 0.7$ eV)

$T_a(j)$	40	45	50	55	60	65	70	75	80	85	90	95	100	110
πT	0.31	0.46	0.68	1	1.45	2.08	2.95	4.14	5.77	7.96	10.88	14.74	19.85	34.99

(b) Power supply voltage parameter (πV) – Applicable only for silicon transistors, FETs, and transistors with internal resistor

$$S = \frac{\text{Used power supply voltage (} V_{CE} \text{ or } V_{DS} \text{)}}{\text{Absolute maximum rated voltage (} V_{CEO} \text{ or } V_{DSS} \text{)}}$$

When $S > 0.2$, $\pi V = \exp(2.86 \times S - 2.29)$

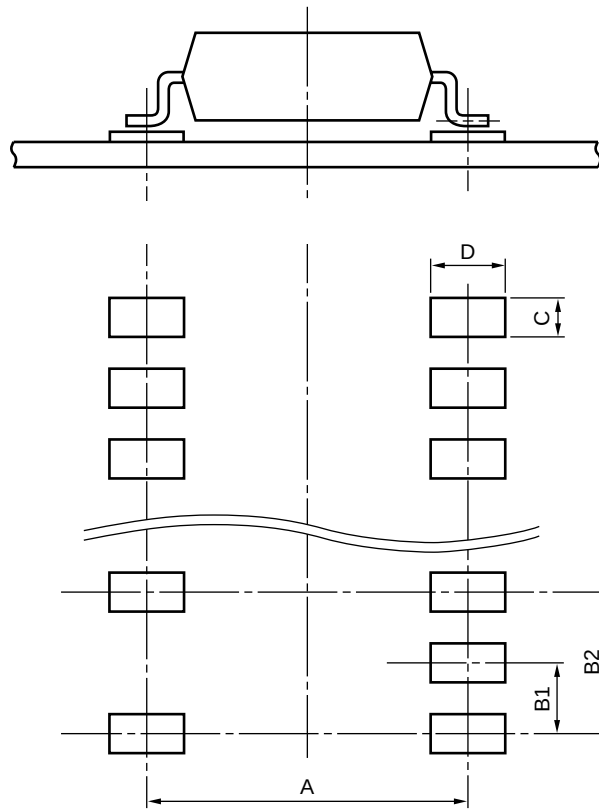
When $S \leq 0.2$, $\pi V = 0.18$

(Calculation standard)

- Reliability level: 60%
- Basic temperature = 55°C
- Used under recommended conditions

10.5 MOUNT PAD DIMENSIONS

10.5.1 Mount Pad Dimensions

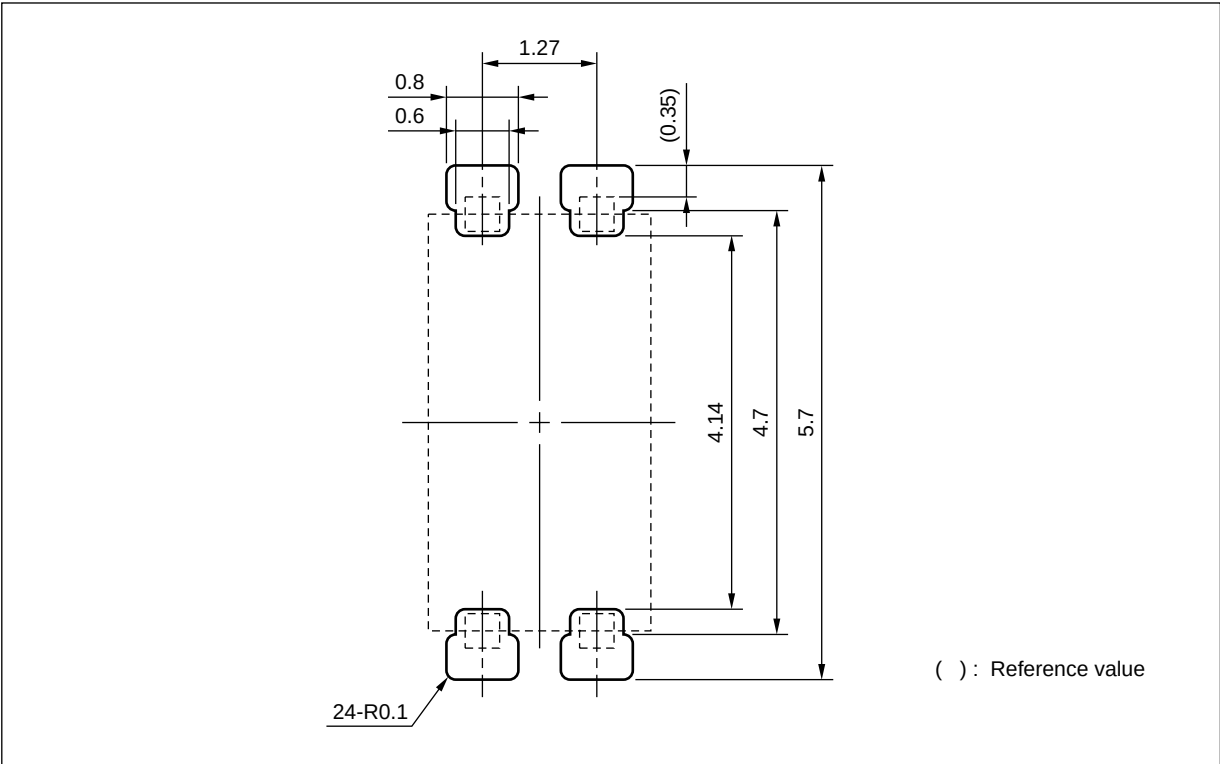


Mount pad dimensions

(Unit: mm)

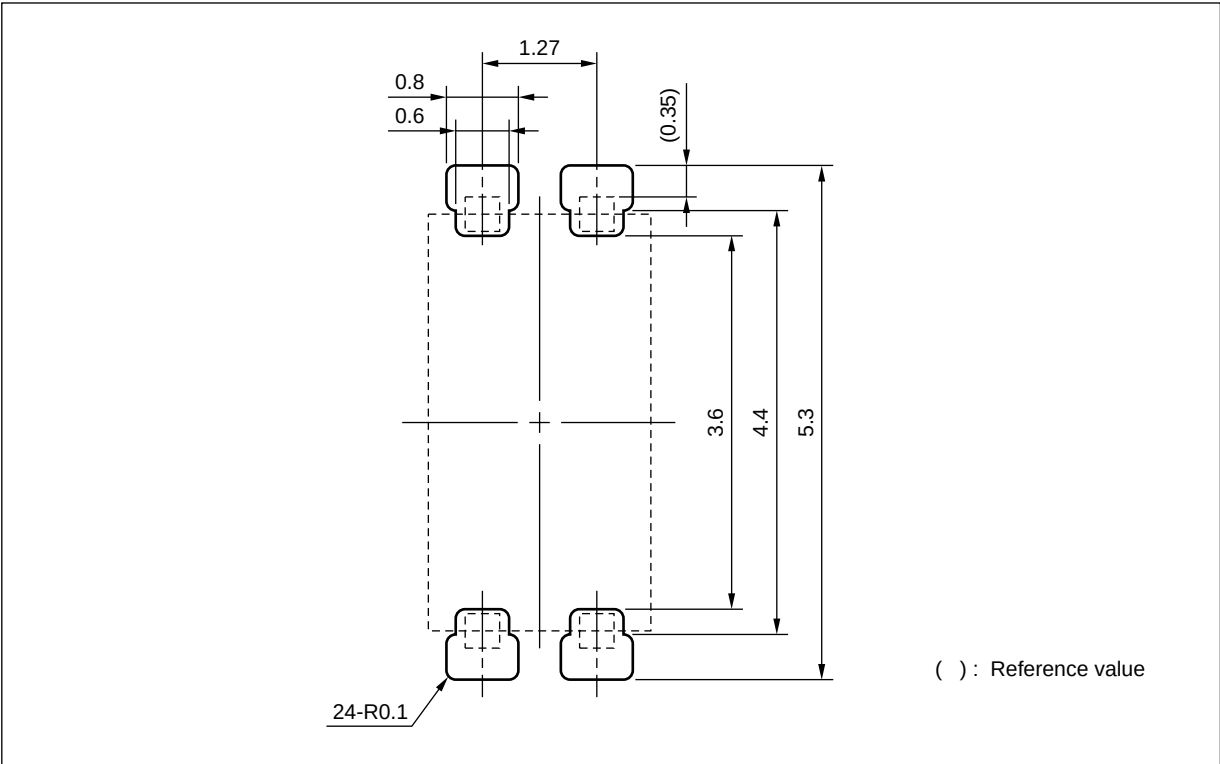
Part Number	A	B1	B2	C	D
DIP (Surface mount type) 4, 6, 8, 12, 16-pin type PS2501L-1, PS7141L-1A etc.	8.2	–	2.54	1.7	2.2
DIP (Surface mount type) 4, 6, 8-pin type PS2561L2-1, etc.	10.2	–	2.54	1.7	2.2
SOP 4, 8, 16-pin type PS2701-1, PS72xx Series etc.	6.25	–	2.54	0.8	1.45
SOP 5-pin type PS9711 etc.	6.25	1.27	2.54	0.8	1.45
Small SOP (pin pitch: 1.27 mm) 4, 16-pin type PS2801-1 etc.	6.25	–	1.27	0.8	1.45
Small SOP (pin pitch: 0.8 mm) 12-pin type PS2841-4A etc.	6.25	–	0.8	0.5	1.45

10. 5. 2 Mount Pad Dimensions (PS2911-1, PS2913-1, PS2932-1, PS2933-1)



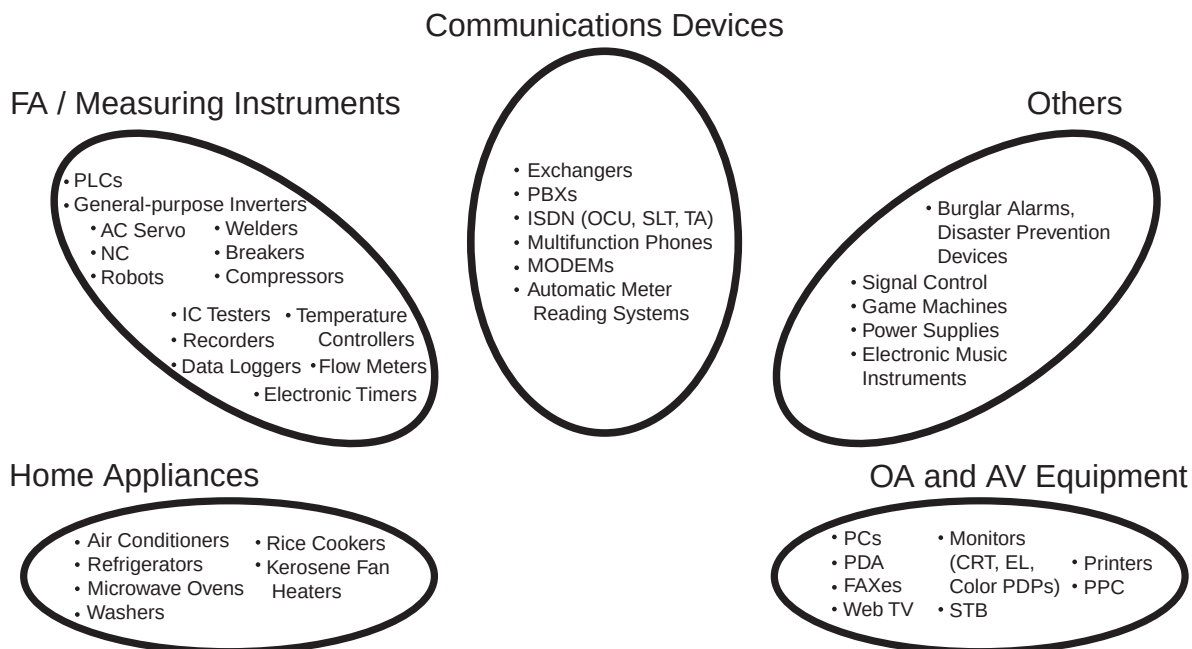
Remark This drawing is considered to meet air and outer creepage distance 4.0 mm minimum. All dimensions in this figure must be evaluated before use.

10. 5. 3 Mount Pad Dimensions (PS7801-1A, PS7802-1A)



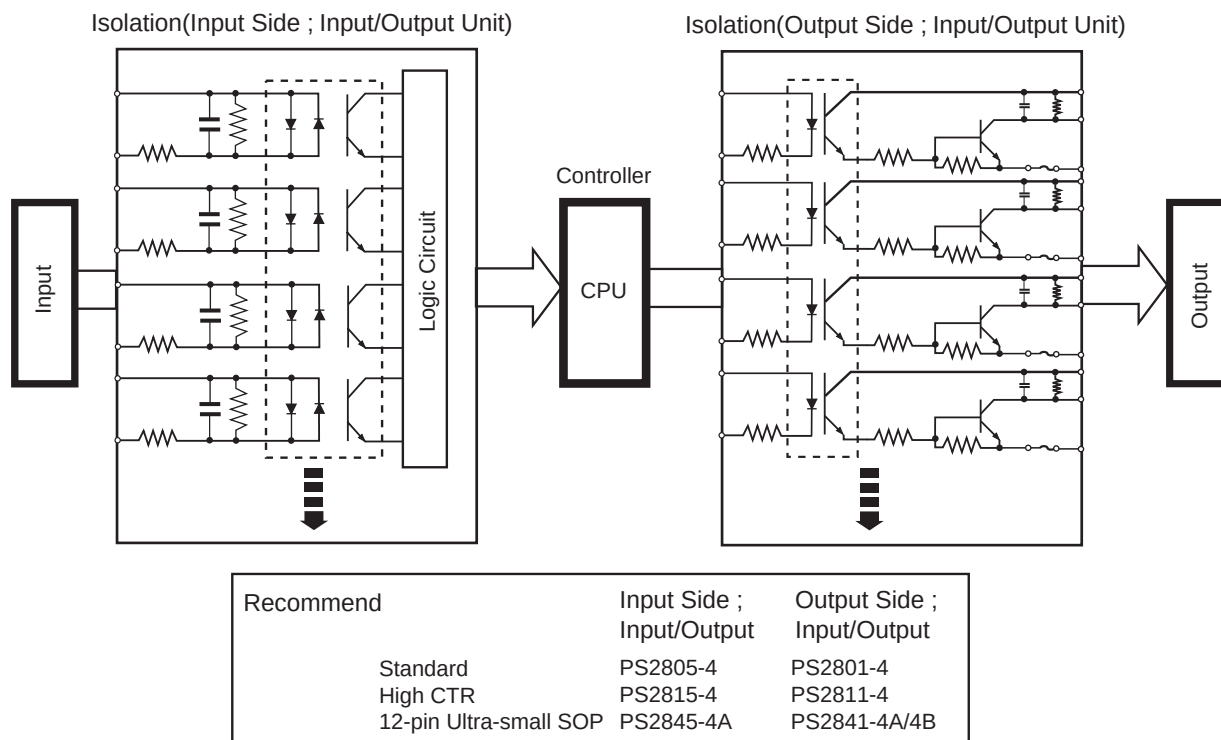
Remark This drawing is considered to meet air and outer creepage distance 4.0 mm minimum. All dimensions in this figure must be evaluated before use.

11. PHOTOCOUPLER AND OPTICAL COUPLED MOS FET APPLICATION FIELDS

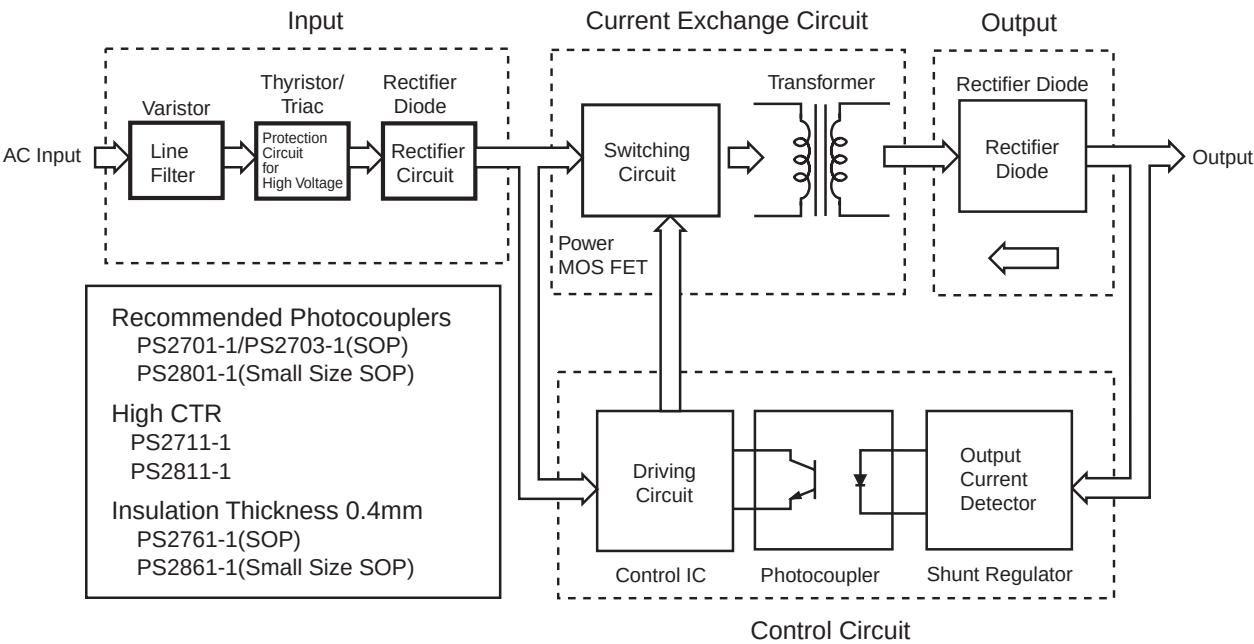


12. PHOTOCOUPLER APPLICATION EXAMPLES

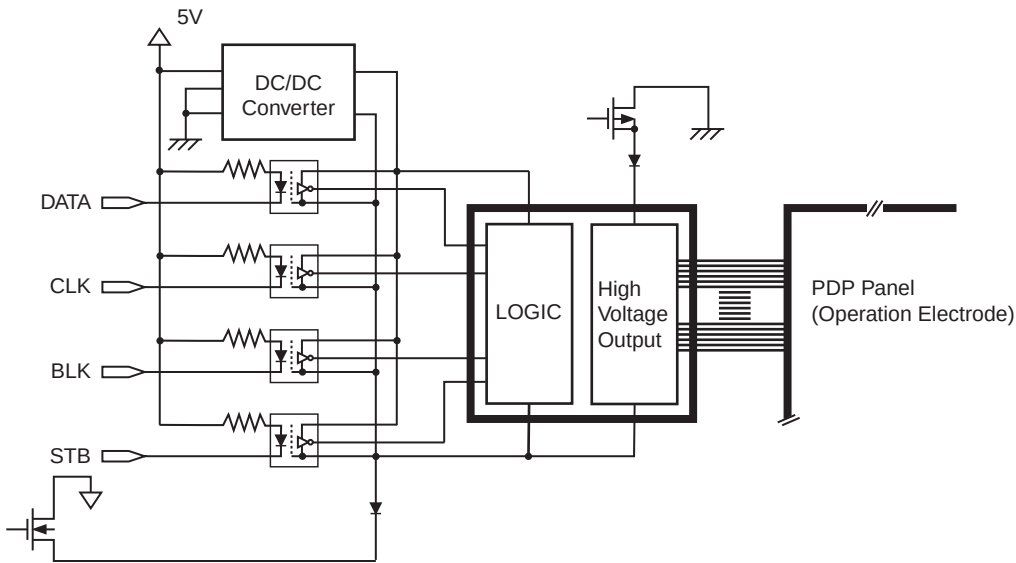
12.1 PROGRAMMABLE LOGIC CONTROLLER APPLICATION OF PHOTOCOUPLER



12.2 SWITCHING POWER SUPPLIES APPLICATION OF PHOTOCOUPLER



12.3 APPLICATION FOR COLOR PDP DRIVING CIRCUIT

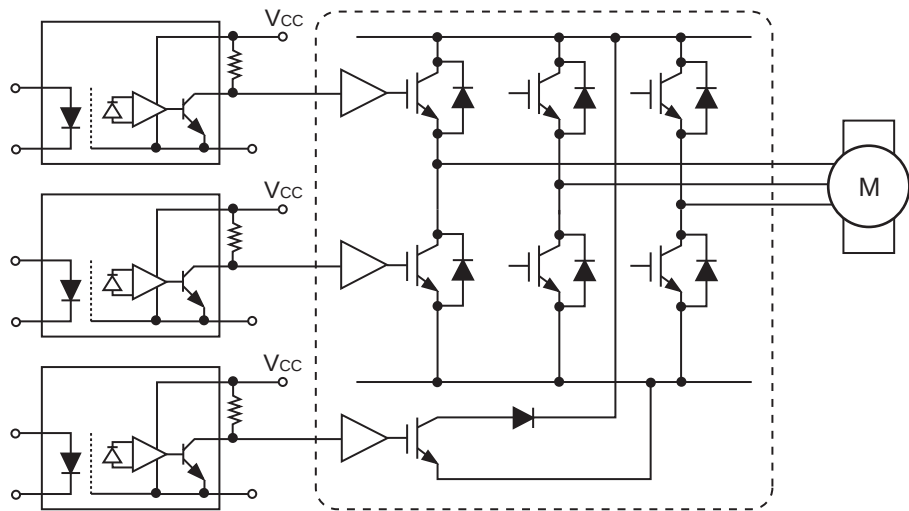


Recommended Devices

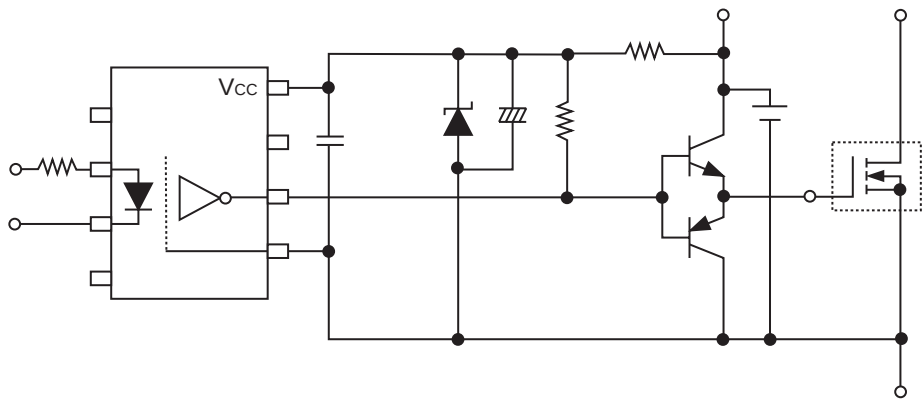
Function	Recommend	Features
Horizontal Signal Controller	PS9714 5-pin SOP	High Speed 10 Mbps
	PS9114 5-pin SOP *1	High CMR 10 kV/μs
	PS9715 5-pin SOP	
	PS9115 5-pin SOP *1	

*1 Under development

12. 4 INVERTER APPLICATION



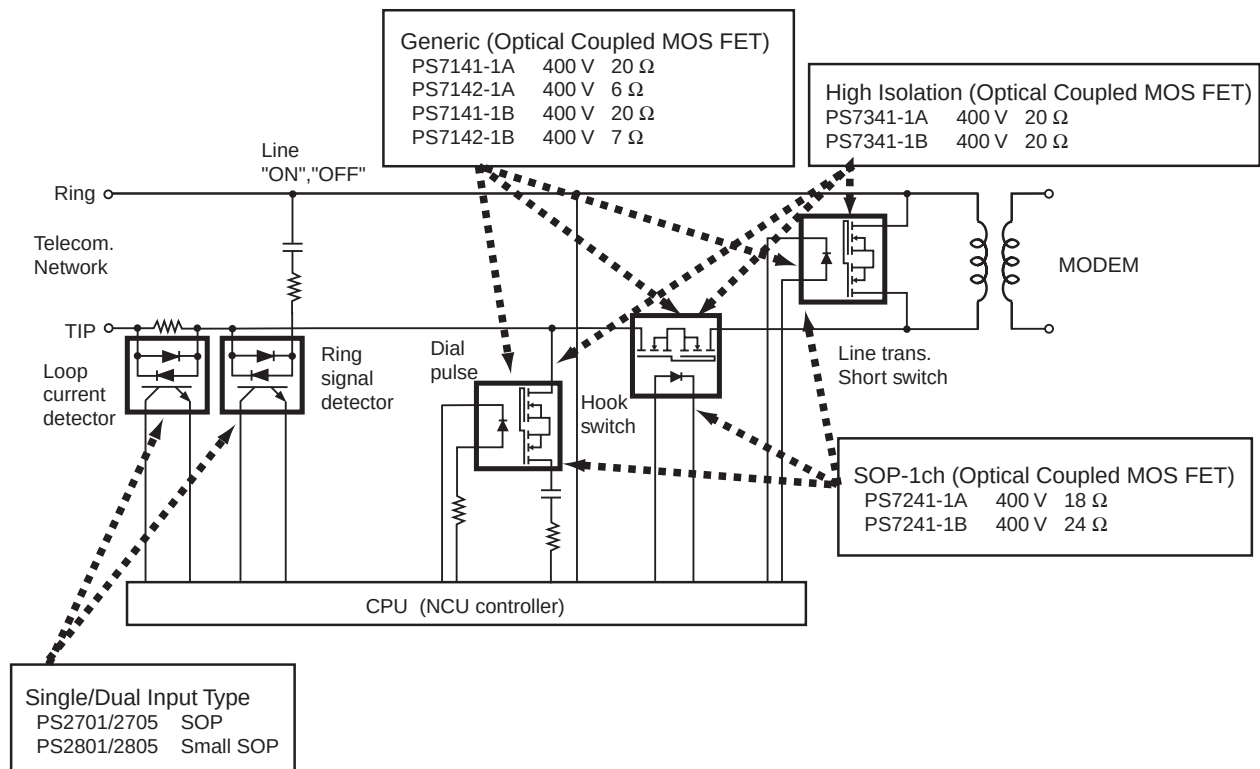
12. 5 HIGH-SPEED SWITCHING POWER MOS GATE DRIVING CIRCUIT



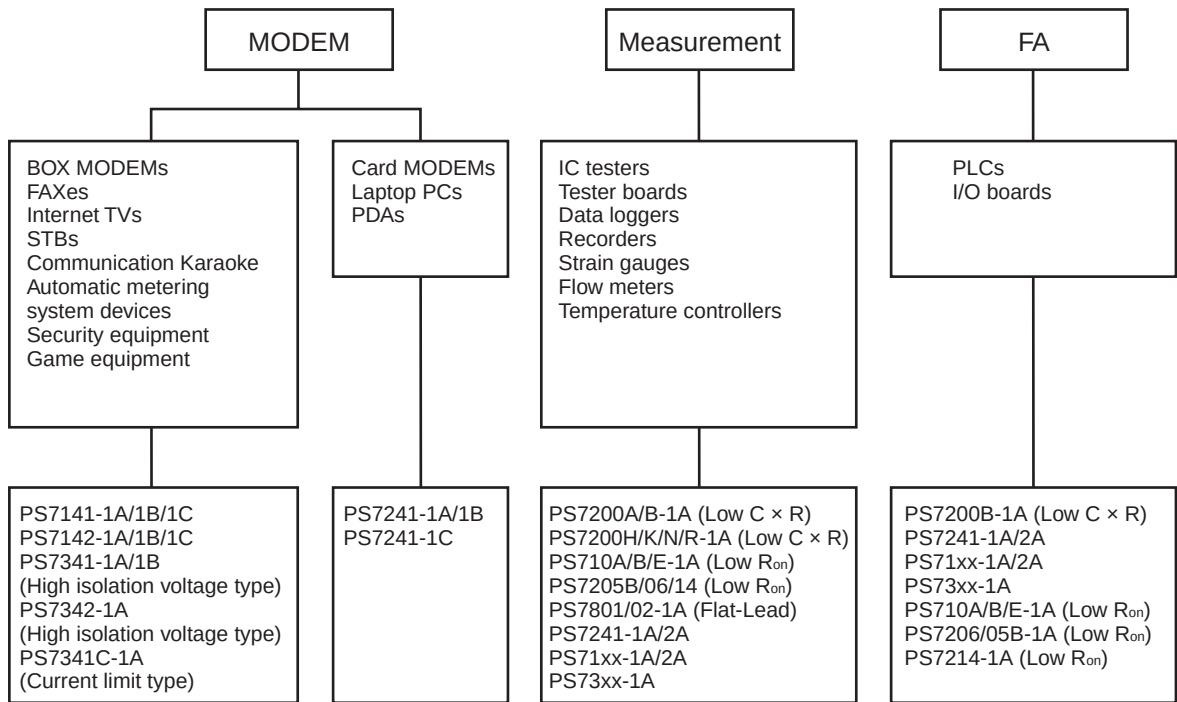
Application Circuit	Recommend
IPM	PS9613/PS9713
MOS Gate Driver	PS9614/PS9714
	PS9715
	PS9113 ^{*1} /PS9114 ^{*1} /PS9115 ^{*1}

^{*1} Under development

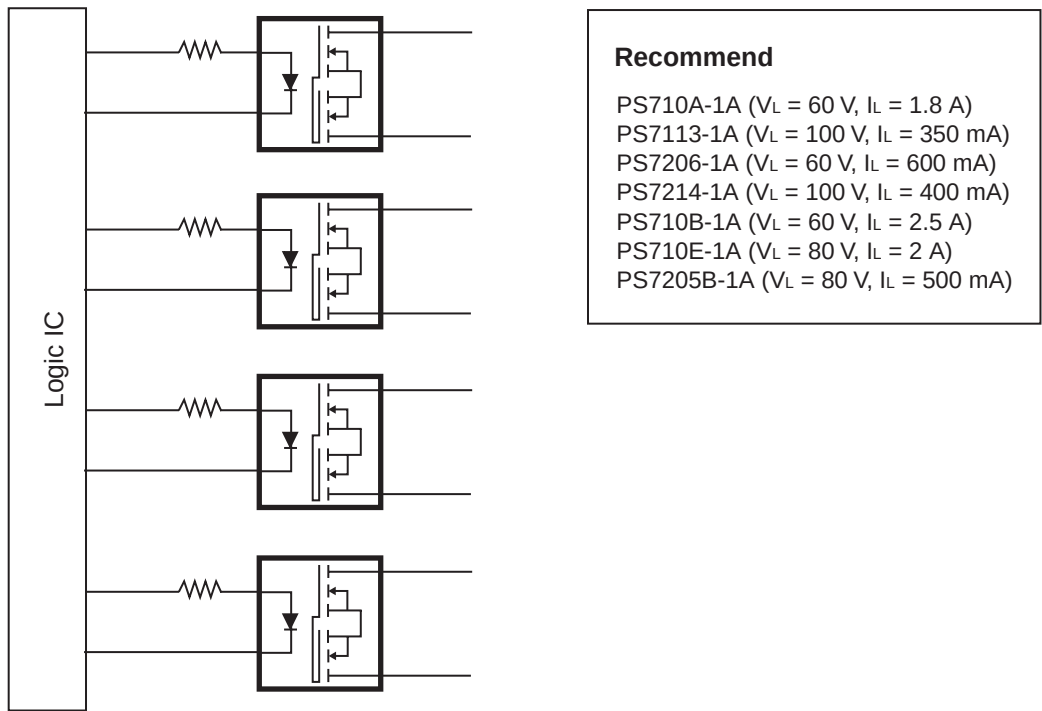
12. 6 MODEM, FAX, STB (SET TOP BOX)



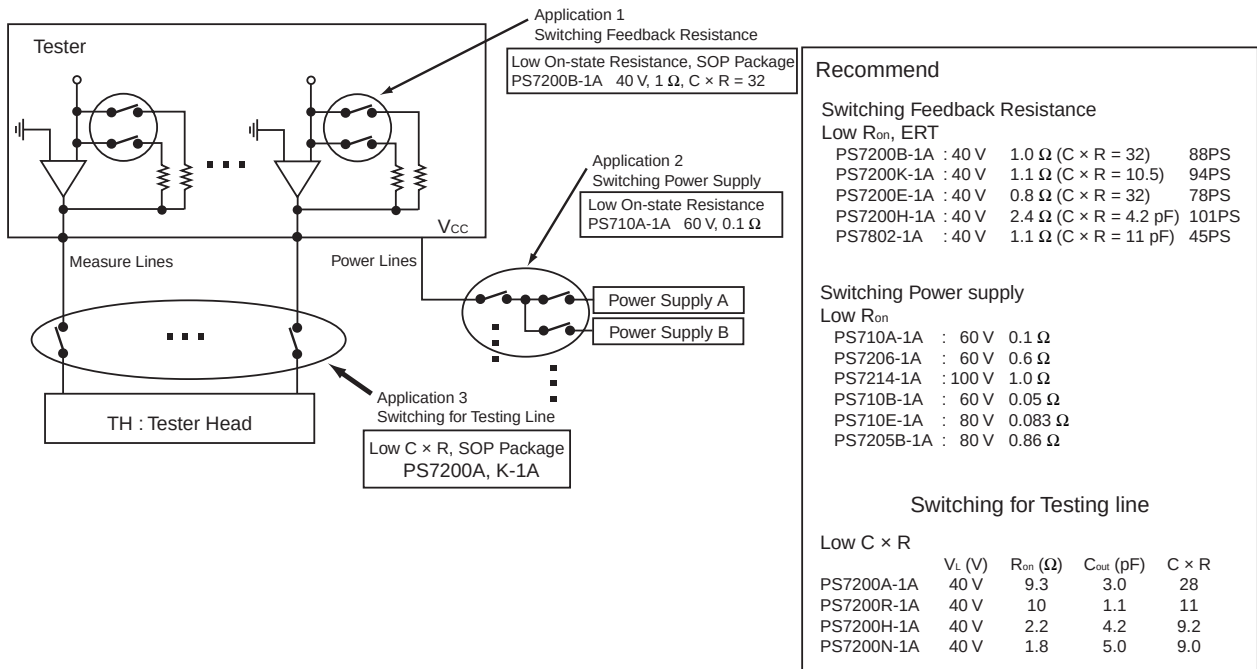
13. OPTICAL COUPLED MOS FET APPLICATION CHART



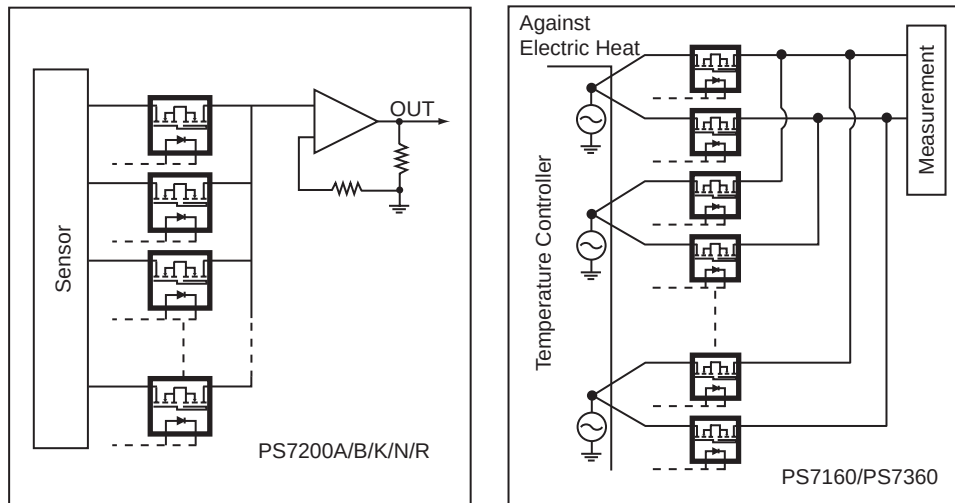
13.1 PLC OUTPUT IC



13.2 IC TESTER, APPLICATION OF OPTICAL COUPLED MOS FET



13.3 ELECTRONIC INSTRUMENTS/TESTER DATA LOGGER, RECORDER/TEMPERATURE CONTROLLERS



Recommend

Function Port

Semiconductor Tester Input Sensing Circuit
Switching Operation Amp. Gain

Part Number

PS7200A-1A
PS7200B-1A
PS7200K-1A
PS7200N-1A
PS7200R-1A

Features

Low Output Capacitance (C_{out} : 3.0 pF)
Low On-state Resistance (R_{on} : 1 Ω)
Low On-state Resistance (R_{on} : 1.1 Ω)
Low On-state Resistance (R_{on} : 1.8 Ω)
Low Output Capacitance (C_{out} : 1.1 pF)

14. CROSS-REFERENCE

14.1 PHOTOCOUPLER CROSS-REFERENCE

Part Number	CROSS			Package
	SHARP	TOSHIBA	HP	
PS2501-1, 2, 4	PC816/817	TLP521/421	–	DIP
PS2502-1, 2, 4	PC815	TLP523	–	DIP
PS2505-1, 2, 4	PC814	TLP520	–	DIP
PS2532/3-1, 2, 4	PC852/853H	TLP627	–	DIP
PS2561/L/L1/L2-1	PC123	TLP421 (D4), TLP621 (D4), TLP721 (D4)	–	DIP
PS2571/L/L1/L2-1		LF1/LF2/LF4	–	DIP
PS2581L1/L2	PC123F	TLP421F (D4), TLP721F (D4), LF2/LF4	–	DIP
PS2701-1	PC357N	TLP181	–	SOP
PS2702-1, 2, 4	PC355N	–	–	SOP
PS2705-1	PC354N	TLP180	–	SOP
PS2706-1, 2, 4	PC365	–	–	SOP
PS2711-1	PC367	TLP124	–	SOP
PS2715-1	PC364	TLP126	–	SOP
PS2732/3-1, 2, 4	PC452	TLP127	–	SOP
PS2761-1	–	TLP181 (V4)	–	SOP
PS2801-1, 4	PC3H7/3Q62	TLP281/-4	–	Small SOP
PS2802-1, 4	PC3H5/3Q65	–	–	Small SOP
PS2805-1, 4	PC3H4/3Q64Q	TLP280/-4	–	Small SOP
PS2811-1	PC3H71xNIP	–	–	Small SOP
PS2815-1	PC3H41xNIP	–	–	Small SOP
PS2832/3-1, 2, 4	PC4H520NIP	–	–	Small SOP
PS2861-1	–	TLP281 (V4)	–	Small SOP
PS8602	PC917	TLP559/759	HCPL4503	DIP
PS9611	PC912	TLP555	HCPL-2201/2211	DIP
PS9613	PC956LONSZ	TLP559/759 (IGM)	HCPL-4504/4506	DIP
PS9614	PC910LONSZ	TLP552/554	HCPL-2601/2611	DIP
PS8701	PC417/457LONIP	TLP112A/114A	HCPL-M453	SOP
PS9713	PC456LONIP	TLP114A (IGM)	HCPL-M454/456	SOP
PS9714	PC410LONIP	TLP115A	HCPL-M601/611	SOP

14.2 OPTICAL COUPLED MOS FET CROSS-REFERENCE

Part Number	CROSS		Package
	MATSUSHITA	TOSHIBA	
PS710A-1A	AQY272	–	DIP
PS710B-1A	–	TLP3540 (8-PIN DIP)	DIP
PS710E-1A	–	TLP3120 (6-PIN SOP)	DIP
PS7113-1A	AQV215/255	TLP596A/B	DIP
PS7122-1A	AQV217/257	–	DIP
PS7122A-1A	AQV253	–	DIP
PS7141-1A	AQV210/214	TLP596G/597GA	DIP
PS7142-1A	AQV254	TLP595G	DIP
PS7160-1A	AQV216	–	DIP
PS7113-2A	AQW215	TLP598A/B	DIP
PS7122-2A	AQW217/257	–	DIP
PS7122A-2A	AQW103/253	–	DIP
PS7141-2A	AQW210/214	TLP227GA-2	DIP
PS7142-2A	AQW254	–	DIP
PS7160-2A	AQW216	–	DIP
PS7122A-1B	AQV453	–	DIP
PS7141-1B	AQV414	TLP4597G	DIP
PS7141-2B	AQW414	TLP4227G-2	DIP
PS7142-2B	AQW454	–	DIP
PS7141-1C	AQW614	TLP4006G	DIP
PS7341-1A	AQV214H/254H	TLP797GA	DIP
PS7341-1B	AQV454H	–	DIP
PS7342-1A	–	TLP798G	DIP
PS7341C-1A	–	TLP594G	DIP
PS7200A-1A	AQY221N1S	–	SOP
PS7200H-1A	–	TLP3114	SOP
PS7200K-1A	AQY221R2S	TLP3115	SOP
PS7200R-1A	AQY221N2S	TLP3116	SOP
PS7206-1A	AQY212GS	TLP176A	SOP
PS7214-1A	AQY215S (6PIN SOP)	TLP176D	SOP
PS7241-1A	AQV210S/214S	TLP176	SOP
PS7241-2A	AQW210S/214S	TLP206G	SOP
PS7241-1B	AQV414S/410S	TLP4176G	SOP
PS7241-2B	AQW610S	TLP4206G	SOP
PS7221-2A	–	TLP200D	SOP
PS7241-1C	–	TLP4026G	SOP

15. WEB SITE INFORMATION

The Opto-Electronics homepage has many documents available for viewing or download. Please see our web site at <http://www.csd-nec.com/opto/index.html>

NEC Compound Semiconductor Devices

[Home](#) [What's New](#) [Company](#) [Opto](#) [RF and Micro](#) [Site Map](#)

Last Updated: 2002.11.14
[Japanese page](#)

Company Profile ▶

Operation ▶

Optical Device Business ▶

Microwave Device Business ▶

Product Information ▶

Opto-Electronics ▶

RF and Microwave ▶

Documents ▶

Opto-Electronics ▶

RF and Microwave ▶

Exhibition ▶

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Press Releases ▶

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NEC NEC Compound Semiconductor Devices, Ltd.

NEC Compound Semiconductor Devices, Ltd. was spun out as an independent company from NEC Corporation (NEC) in October 2001.

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▶ [Operation](#)



▶ **What's New?**

"Discrete Products" from Cross-reference, etc. in [RF and Microwave Devices](#) updated. (November 14)

• [Opto-Electronics Devices](#) updated. (November 13)

• ["Establishment of NEC Electronics Corporation as Our Company's New Parent Company"](#) added to [Press Releases](#). (November 1)

▶ **Notices**

• [World-first! A SPICE parameter design kit available on the web.](#)

84

Selection Guide PN10183EJ01V0PF

► **Business issue**

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