NEC

HIGH ISOLATION VOLTAGE HIGH SPEED PHOTOCOUPLER

PS9601 PS9601L

FEATURES

- **HIGH ISOLATION VOLTAGE**
  BV: 5 k $V_{r.m.s.}$ MIN
- **HIGH PROPAGATION DELAY TIME**
  t_{PHL}, t_{PLH}: 50 ns TYP
- **LOW INPUT CURRENT**
  I_{FHL}: 2.5 mA TYP
- **CAN BE SOLDERED BY INFRARED REFLOW SOLDERING**
- **TAPING PRODUCT NUMBER PS9601L-E3, E4**


ESD SENSITIVE

DESCRIPTION

PS9601 and PS9601L are optically coupled isolators containing a GaAlAs LED on the light emitting side (input side), and a photodiode and a signal processing circuit on the light receiving side (output side), on one chip. PS9601 is in a plastic DIP (Dual In-Line Package) and PS9601L is in a lead bending type (Gull-wing) for surface mount.

APPLICATIONS

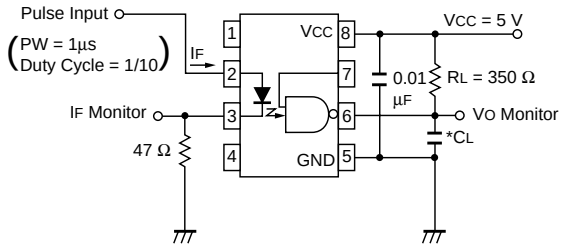
- **COMPUTER AND PERIPHERAL MEMORY**
- **ELECTRONIC INSTRUMENT**
- **AUDIO-VISUAL**

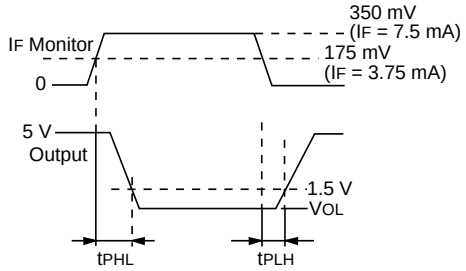
ELECTRICAL CHARACTERISTICS (T_A = -40 to +85 °C)

PART NUMBER				PS9601, PS9601L		
	SYMBOLS	PARAMETERS	UNITS	MIN	TYP	MAX
Diode	V_F	Forward Voltage, I_F = 10 mA, T_A = 25 °C	V	1.4	1.65	1.9
	I_R	Reverse Current, V_R = 5 V, T_A = 25 °C	μA			10
	C_t	Capacitance, V = 0, f = 1 MHz, T_A = 25 °C	pF		60	
Detector	I_{OH}	High Level Output Current V_{CC} = V_O = 5.5 V, I_F = 250 μs, V_E = 2 V	μA		2	250
	V_{OL}	Low Level Output Voltage V_{CC} = 5.5 V, I_F = 5 mA, V_E = 2 V, I_O = 13 mA	V		0.2	0.6
	I_{CCH}	High Level Supply Current, V_{CC} = 5.5 V, V_E = 0.5 V, I_F = 0	mA	5	7	10
	I_{CCL}	Low Level Supply Current, V_{CC} = 5.5 V, V_E = 2 V, I_F =10 mA	mA	10	13	18
	I_{EH}	High Level Enable Current, V_{CC} = 5.5 V, V_{EH} = 2 V	mA	-0.7	-1	-1.5
	I_{EL}	Low Level Enable Current, V_{CC} = 5.5 V, V_{EL} = 0.5 V	mA	-1	-1.4	-2
Coupled	I_{FHL}	Threshhold Input Current, High → Low V_{CC} = 5 V, V_E = 2 V, T_A = -40 to +85 °C, Vo = 0.8 V, R_L = 350 Ω	mA	0.5	2.5	5
	R_{1-2}	Isolation Resistance, V_{in-out} = 1 k V_{DC}, RH 40 to 60 %	Ω	10^{11}		
	C_{1-2}	Isolation Capacitance, V = 0, f = 1 MHz	pF		0.6	
	t_{PHL}	Propagation Delay Time[1], High → Low, Vcc = 5 V, I_F = 7.5 mA, R_L = 350 Ω, C_L= 15 pF	ns		50	75
	t_{PLH}	Propagation Delay Time[1], Low → High, Vcc = 5 V, I_F = 7.5 mA, R_L = 350 Ω, C_L= 15 pF	ns		50	75
	t_r	Rise Time, Vcc = 5 V, I_F = 7.5 mA, R_L = 350 Ω, C_L= 15 pF	ns		20	
	t_f	Fall Time, Vcc = 5 V, I_F = 7.5 mA, R_L = 350 Ω, C_L= 15 pF	ns		10	
	t_{EHL}	Enable Propagation[2], Delay Time, High → Low V_{CC} = 5 V, I_F = 7.5 mA, V_{EH} = 3 V, V_{EL} = 0.5 V, R_L = 350 Ω, C_L = 15 pF	ns		10	
	t_{ELH}	Enable Propagation[2], Delay Time, Low → High V_{CC} = 5 V, I_F = 7.5 mA, V_{EH} = 3 V, V_{EL} = 0.5 V, R_L = 350 Ω, C_L = 15 pF	ns		25	

Notes: See Next Page

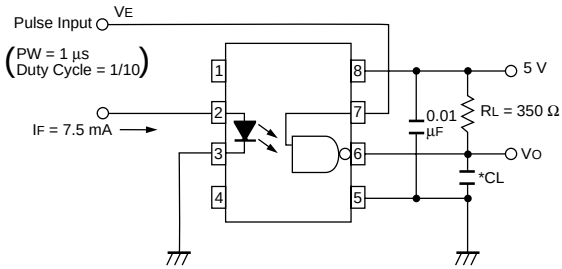
1. Test Circuit for Propagation delay time

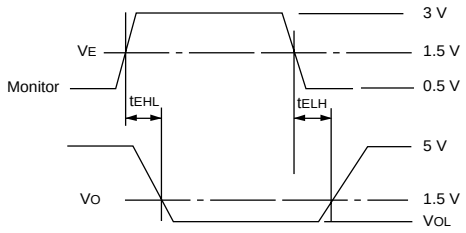




*CL is approximately 15 pF, which includes probe and stray wiring capacitance

2. Test Circuit for enable Propagation delay time





ABSOLUTE MAXIMUM RATINGS[1] (T_A = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
Diode			
I_F	Forward Current	mA	30
V_R	Reverse Voltage	V	5
P_D	Power Dissipation	mW	60
Detector			
V_{CC}	Supply Voltage	V	7
V_O	Output Voltage	V	7
I_O	Output Current	mA	50
V_E	Enable Voltage	V	5.5
P_C	Power Dissipation	mW	85
BV	Isolation Voltage[2]	$V_{r.m.s.}$	5000
T_{OP}	Operating Temperature	°C	-40 to +85
T_{STG}	Storage Temperature	°C	-55 to +125

Notes:
1. Operation in excess of any one of these parameters may result in permanent damage.
2. AC voltage for 1 minute at T_A = 25 °C, RH = 60 % between input and output.

TRUTH TABLE

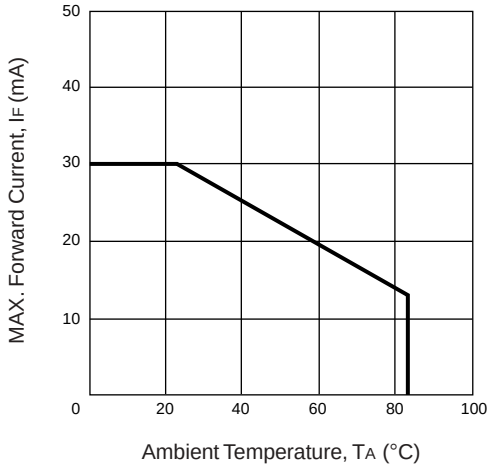
LED	ENABLE	OUT
ON	H	L
OFF	H	H
ON	L	H
OFF	L	H
ON	N/C	L
OFF	N/C	H

RECOMMENDED OPERATING CONDITIONS (T_A = 25°C)

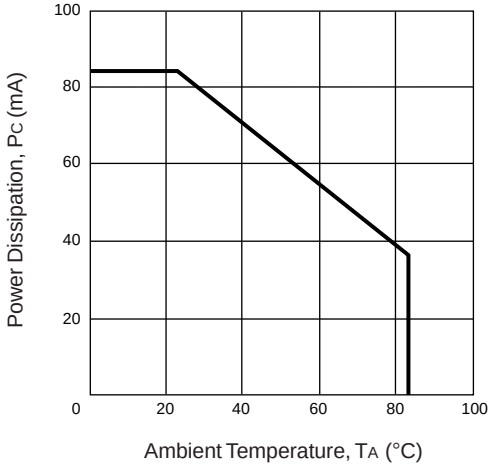
PART NUMBER			PS9601,PS9601L		
SYMBOLS	PARAMETERS	UNITS	MIN	TYP	MAX
I_{FL}	Low Level Input Current	µA	0		250
I_{FH}	High Level Input Current	mA	7	10	15
V_{EH}	High Level Enable Voltage	V	2		Vcc
V_{EL}	High Level Enable Voltage	V	0		0.8
V_{CC}	Supply Voltage	V	4.5	5	5.5
T_{OP}	Operating Temperature	°C	0	25	70

TYPICAL PERFORMANCE CURVES (T_A = 25 °C)

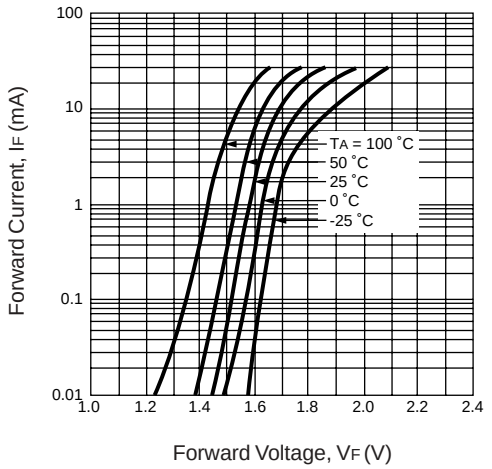
MAX. FORWARD CURRENT vs. AMBIENT TEMPERATURE



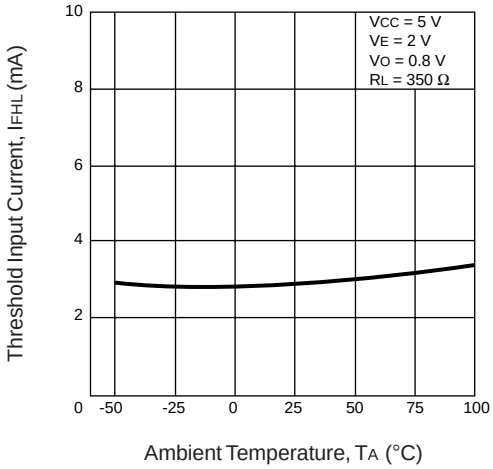
POWER DISSIPATION vs. AMBIENT TEMPERATURE



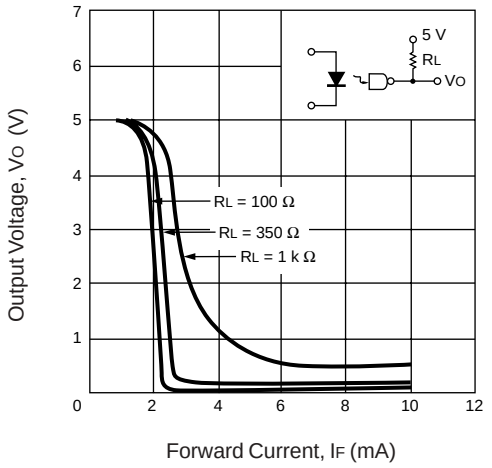
FORWARD CURRENT vs. FORWARD VOLTAGE



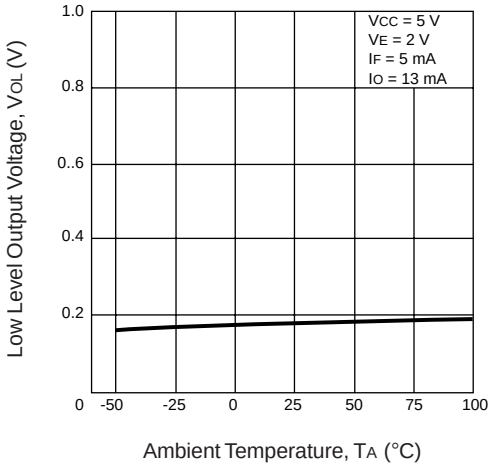
THRESHOLD CURRENT vs. AMBIENT TEMPERATURE



OUTPUT VOLTAGE vs. FORWARD VOLTAGE

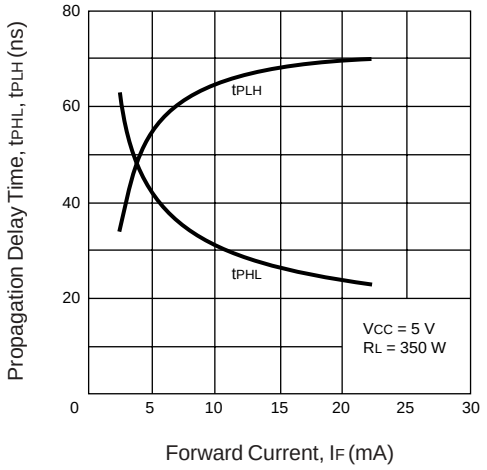


LOW LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE

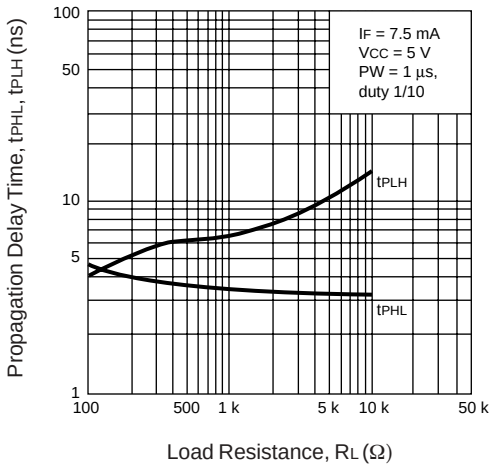


TYPICAL PERFORMANCE CURVES (T_A = 25 °C)

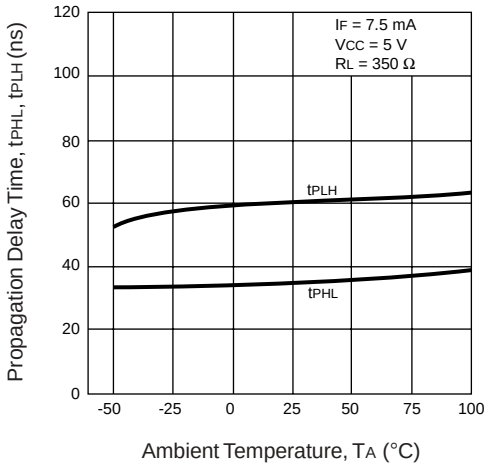
PROPAGATION DELAY TIME vs. FORWARD CURRENT



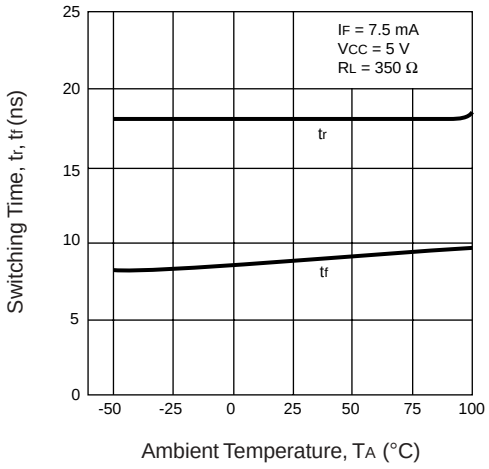
PROPAGATION DELAY TIME vs. LOAD RESISTANCE



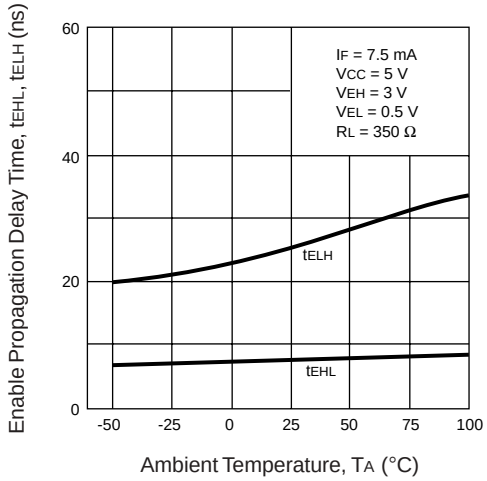
PROPAGATION DELAY TIME vs. AMBIENT TEMPERATURE



SWITCHING TIME vs. AMBIENT TEMPERATURE

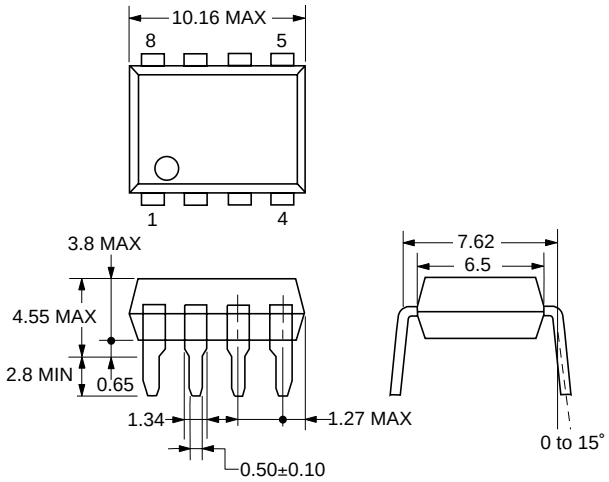


ENABLE PROPAGATION DELAY TIME vs. AMBIENT TEMPERATURE

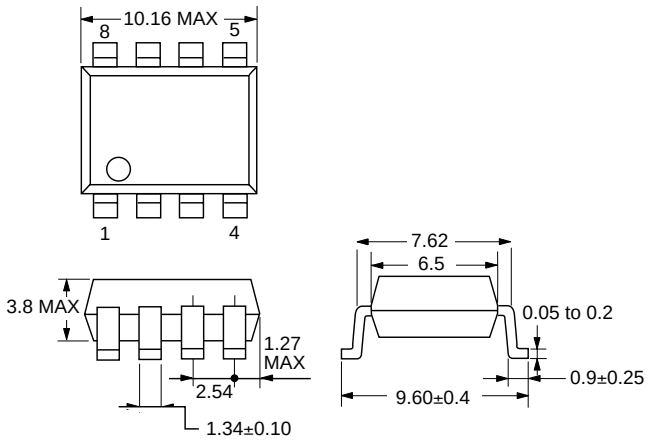


OUTLINE DIMENSIONS (Units in mm)

PS9601

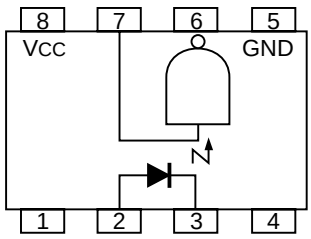


PS9601L



PIN CONNECTION (Top View)

PS9601



	PIN	Function
INPUT	1.	NC
	2.	Anode
	3.	Cathode
	4.	NC
OUTPUT	5.	GND
	6.	V_O
	7.	V_E*
	8.	V_{CC}

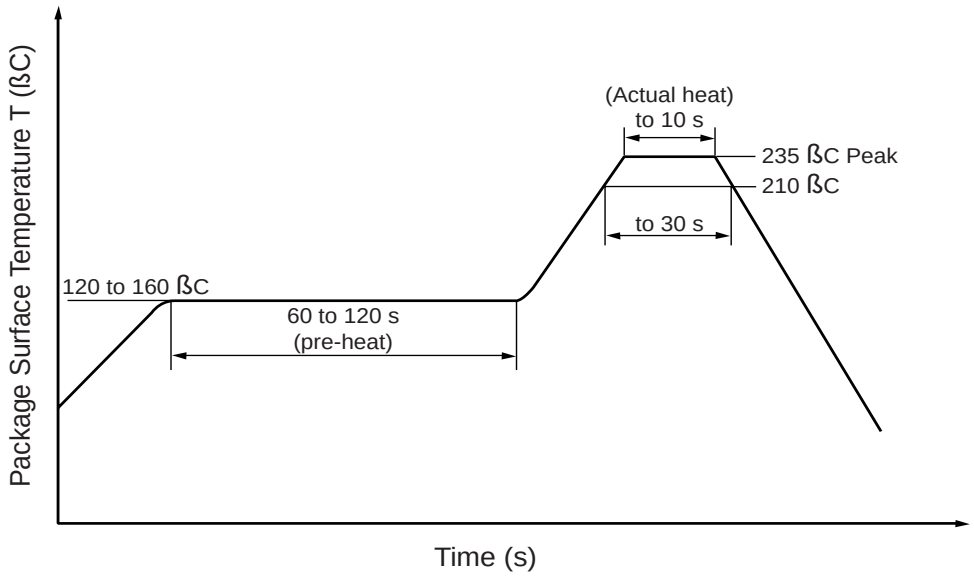
*V_E is pulled - up to enable operation

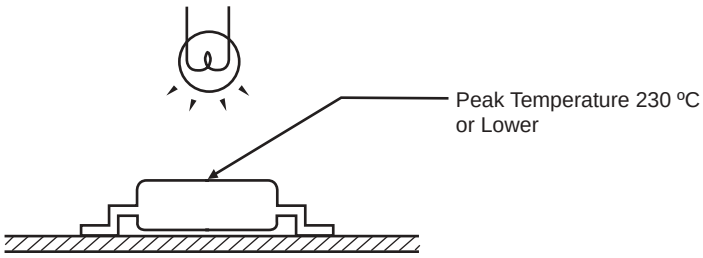
RECOMMENDED SOLDERING CONDITIONS

(1) Precautions in mounting the devices by infrared reflow soldering

- **Peak reflow temperature**
  235 ˚C or below (plastic surface temperature)
- **Reflow time**
  30 seconds or less (Time period during which the plastic surface temperature is 210 ˚C
- **Number of reflows Processes**
  One
- **Flux**
  Rosin flux containing small amount of chlorine (The flux with a max. chlorine content of 0.2 Wt % is recommended.)

INFRARED RAY REFLOW TEMPERATURE PROFILE





(2) Precautions in mounting the devices in solder dip method

- **Temperature**
  260 ˚C or below
- **Time**
  10 seconds or less
- **Flux**
  Rosin group flux, where the amount of chloride component is small.