

**1 Mbps, OPEN COLLECTOR OUTPUT, FOR GATE DRIVE INTERFACE  
INTELLIGENT POWER MODULE  
5-PIN SOP PHOTOCOUPLER**

–NEPOC™ Series–

**DESCRIPTION**

The PS9713 is an optically coupled isolator containing a GaAlAs LED on the input side and a photo diode and a signal processing circuit on the output side on one chip.

**FEATURES**

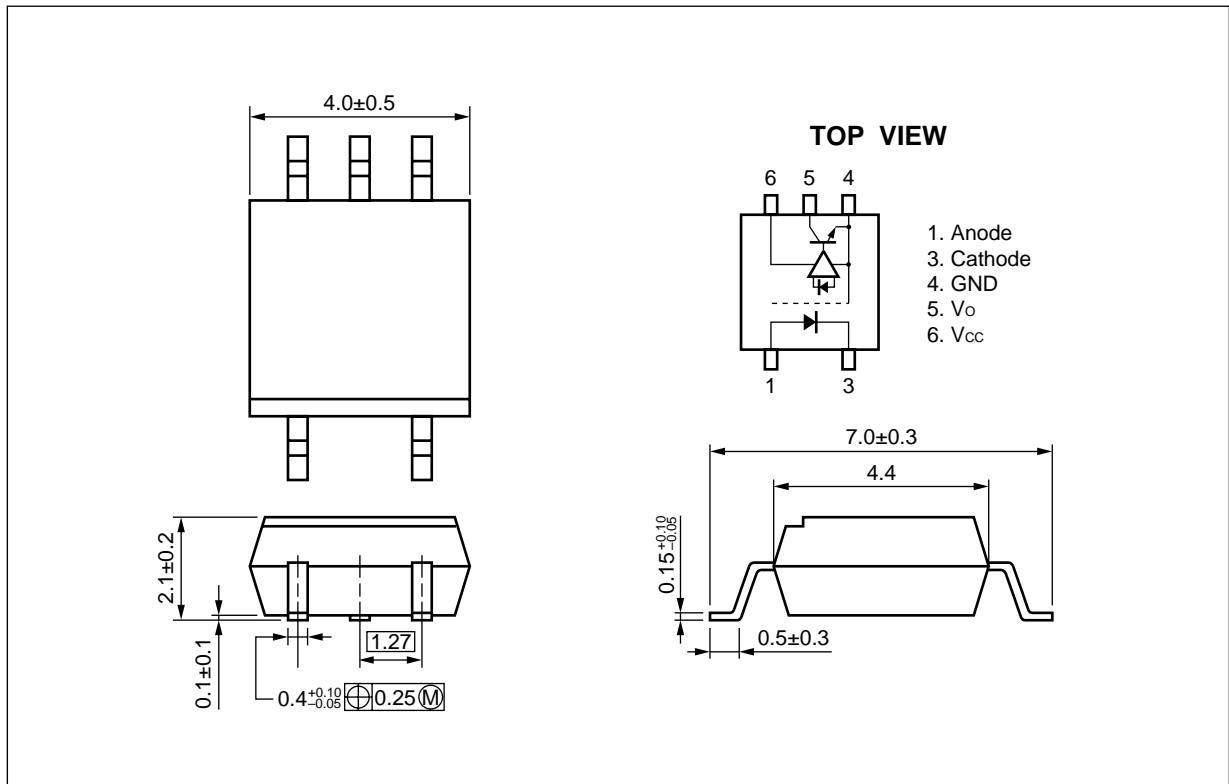
- High instantaneous common mode rejection voltage ( $CM_H, CM_L = \pm 15 \text{ kV}/\mu\text{s}$  MIN.)
- Small package (5-pin SOP)
- High-speed response ( $t_{PHL} = 500 \text{ ns}$  MAX.,  $t_{PLH} = 750 \text{ ns}$  MAX.)
- Maximum propagation delays ( $t_{PLH} - t_{PHL} = 270 \text{ ns}$  TYP.)
- Pulse width distortion ( $|t_{PHL} - t_{PLH}| = 270 \text{ ns}$  TYP.)
- Ordering number of taping product: PS9713-F3, F4: 3 500 pcs/reel
- UL approved: File No. E72422 (S)
- VDE0884 approved (Option)

**APPLICATIONS**

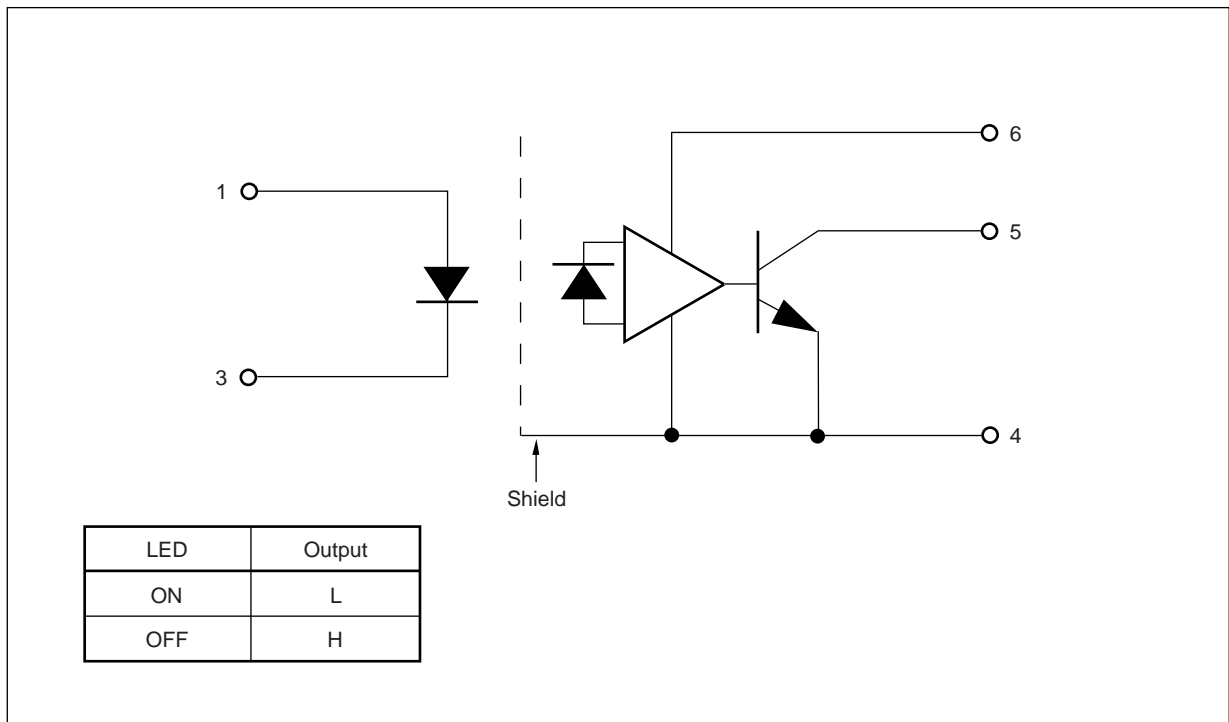
- IPM Driver
- General purpose inverter

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PACKAGE DIMENSIONS (in millimeters)



FUNCTIONAL DIAGRAM



**ORDERING INFORMATION**

Part Number	Package	Packing Style	Safety Standards Approval	Application Part Number <sup>*1</sup>
PS9713	5-pin SOP	Magazine case 100 pcs	UL approved	PS9713
PS9713-F3		Embossed Tape 3 500 pcs/reel		
PS9713-F4			VDE0884 approved	
PS9713-V		Magazine case 100 pcs		
PS9713-V-F3		Embossed Tape 3 500 pcs/reel		
PS9713-V-F4				

\*1 For the application of the Safety Standard, following part number should be used.

**ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25 °C, unless otherwise specified)**

Parameter		Symbol	Ratings	Unit
Diode	Forward Current	I <sub>F</sub>	25	mA
	Reverse Voltage	V <sub>R</sub>	3.0	V
Detector	Supply Voltage	V <sub>CC</sub>	-0.5 to +35	V
	Output Voltage	V <sub>O</sub>	-0.5 to +35	V
	Output Current	I <sub>O</sub>	15	mA
	Power Dissipation	P <sub>C</sub>	100	mW
Isolation Voltage <sup>*1</sup>		BV	2 500	Vr.m.s.
Operating Ambient Temperature		T <sub>A</sub>	-40 to +100	°C
Storage Temperature		T <sub>stg</sub>	-55 to +125	°C

\*1 AC voltage for 1 minute at T<sub>A</sub> = 25 °C, RH = 60 % between input and output.

**RECOMMENDED OPERATING CONDITIONS**

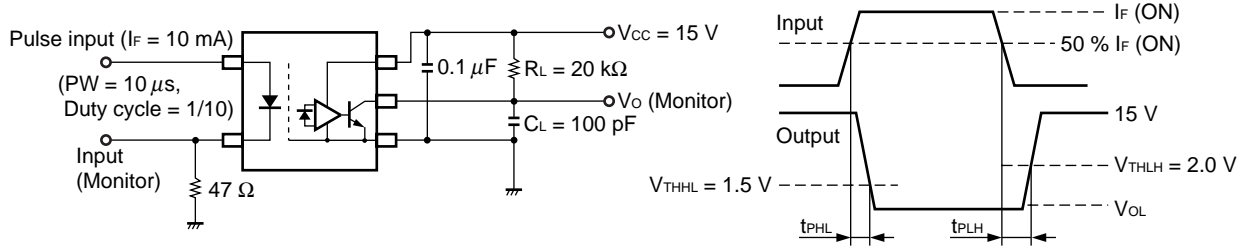
Parameter	Symbol	MIN.	TYP.	MAX.	Unit
High Level Input Current	I <sub>FH</sub>	10		20	mA
Output Voltage	V <sub>O</sub>	0		30	V
Supply Voltage	V <sub>CC</sub>	4.5		30	V
LED Off Voltage	V <sub>F</sub>	0		0.8	V

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = -40 to +100 °C, V<sub>CC</sub> = 15 V, unless otherwise specified)**

Parameter		Symbol	Conditions	MIN.	TYP. <sup>1)</sup>	MAX.	Unit
Diode	Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 10 mA	1.3	1.65	2.1	V
	Reverse Current	I <sub>R</sub>	V <sub>R</sub> = 3 V			200	μA
	Terminal Capacitance	C <sub>t</sub>	V = 0 V, f = 1 MHz, T <sub>A</sub> = 25 °C		30		pF
Detector	Low Level Output Voltage	V <sub>OL</sub>	I <sub>F</sub> = 10 mA, V <sub>CC</sub> = 5 V, I <sub>O</sub> = 2.4 mA		0.13	0.6	V
	High Level Output Current	I <sub>OH</sub>	V <sub>CC</sub> = 30 V, V <sub>F</sub> = 0.8 V		1.0	50	μA
	High Level Supply Current	I <sub>CCH</sub>	V <sub>CC</sub> = 30 V, V <sub>F</sub> = 0.8 V, V <sub>O</sub> = open		0.6	1.3	mA
	Low Level Supply Current	I <sub>CCL</sub>	V <sub>CC</sub> = 30 V, I <sub>F</sub> = 10 mA, V <sub>O</sub> = open		0.6	1.3	mA
Coupled	Threshold Input Current (H → L)	I <sub>FHL</sub>	V <sub>O</sub> = 0.8 V, I <sub>O</sub> = 0.75 mA		1.5	5.0	mA
	Current Transfer Ratio (I <sub>C</sub> /I <sub>F</sub> )	CTR	I <sub>F</sub> = 10 mA, V <sub>O</sub> = 0.6 V	44	110		%
	Isolation Resistance	R <sub>I-O</sub>	V <sub>I-O</sub> = 1 kV <sub>DC</sub> , RH = 40 to 60 %, T <sub>A</sub> = 25 °C	10 <sup>11</sup>			Ω
	Isolation Capacitance	C <sub>I-O</sub>	V = 0 V, f = 1 MHz, T <sub>A</sub> = 25 °C		0.6		pF
	Propagation Delay Time (H → L) <sup>2)</sup>	t <sub>PHL</sub>	I <sub>F</sub> = 10mA, R <sub>L</sub> = 20 kΩ, C <sub>L</sub> = 100 pF, V <sub>THHL</sub> = 1.5 V, V <sub>THLH</sub> = 2.0 V		250	500	ns
	Propagation Delay Time (L → H) <sup>2)</sup>	t <sub>PLH</sub>			520	750	
	Maximum Propagation Delays	t <sub>PLH</sub> -t <sub>PHL</sub>		-200	270	650	
	Pulse Width Distortion (PWD) <sup>2)</sup>	t <sub>PHL</sub> -t <sub>PLH</sub>			270	650	
	Instantaneous Common Mode Rejection Voltage (Output: High) <sup>3)</sup>	CM <sub>H</sub>		T <sub>A</sub> = 25 °C, I <sub>F</sub> = 0 mA, V <sub>O</sub> > 3.0 V, V <sub>CM</sub> = 1.5 kV, R <sub>L</sub> = 20 kΩ, C <sub>L</sub> = 100 pF	15		
	Instantaneous Common Mode Rejection Voltage (Output: Low) <sup>3)</sup>	CM <sub>L</sub>	T <sub>A</sub> = 25 °C, I <sub>F</sub> = 10 mA, V <sub>O</sub> < 1.0 V, V <sub>CM</sub> = 1.5 kV, R <sub>L</sub> = 20 kΩ, C <sub>L</sub> = 100 pF	15			kV/μs

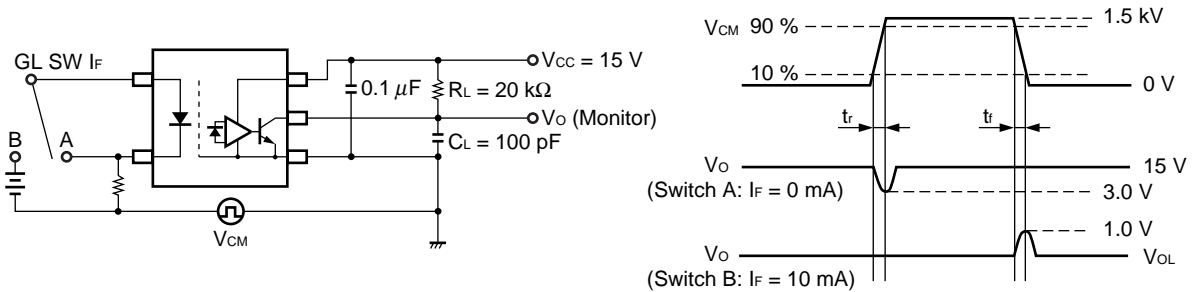
\*1 Typical values at  $T_A = 25\text{ }^\circ\text{C}$ .

\*2 Test circuit for propagation delay time



$C_L$  is approximately which includes probe and stray wiring capacitance.

\*3 Test circuit for common mode transient immunity

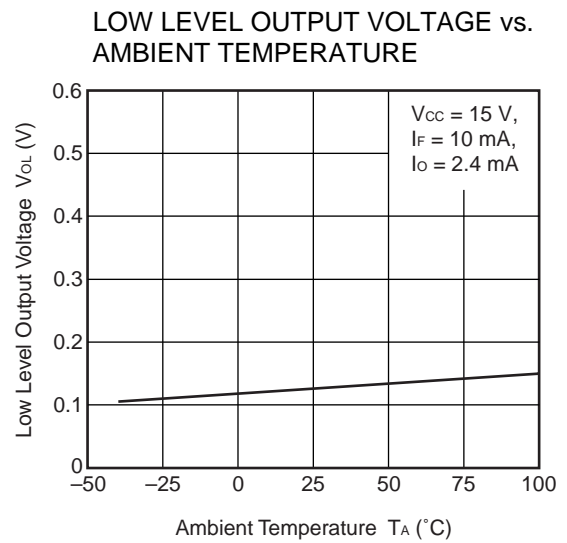
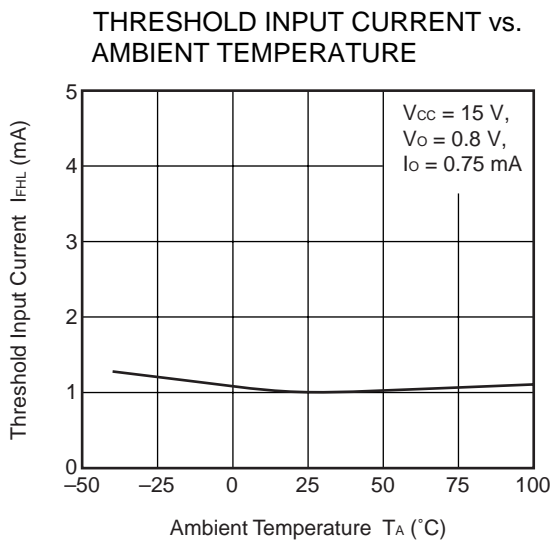
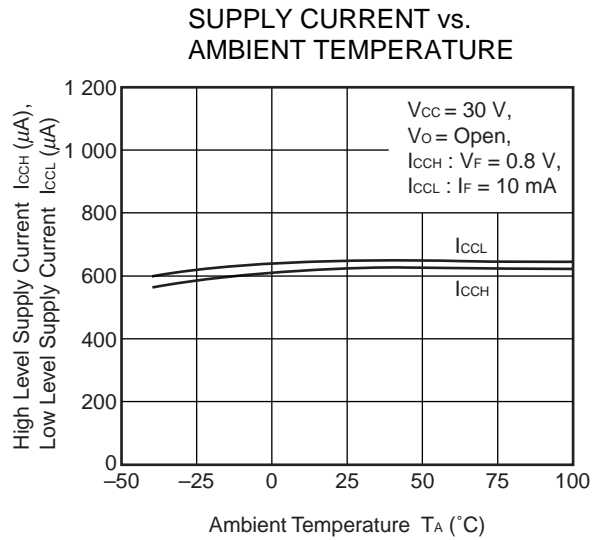
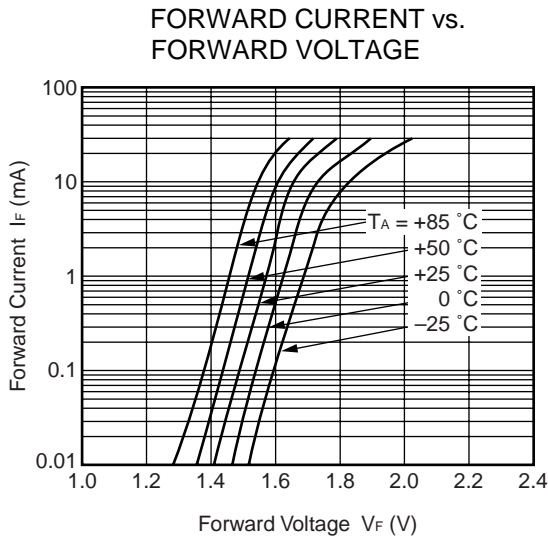
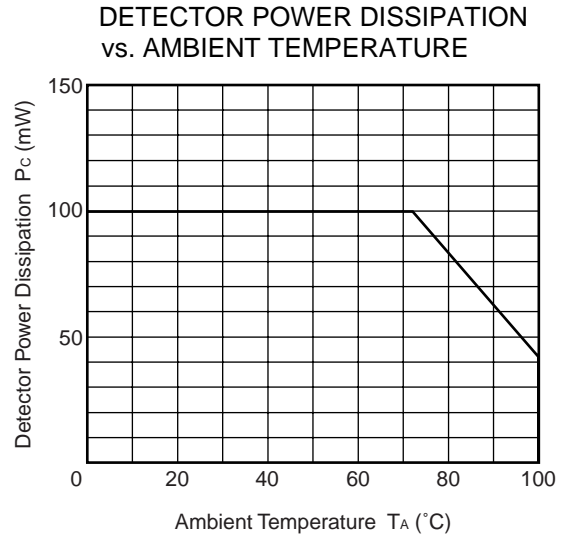
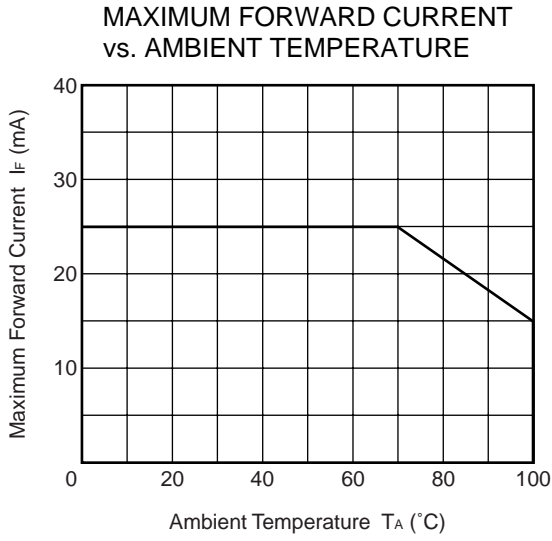


$C_L$  is approximately which includes probe and stray wiring capacitance.

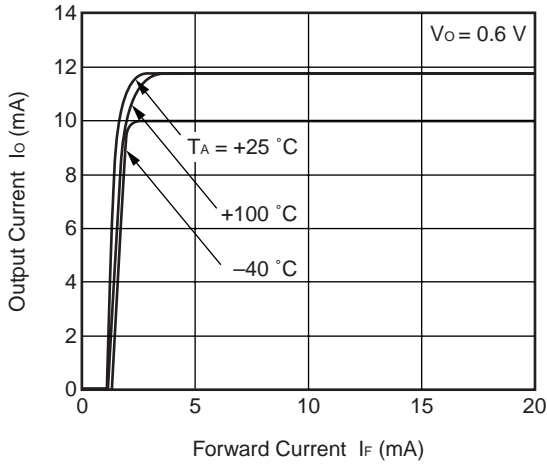
**USAGE CAUTION**

By-pass capacitor of more than  $0.1\text{ }\mu\text{F}$  is used between  $V_{CC}$  and GND near device. Also, ensure that the distance between the leads of the photocoupler and capacitor is no more than 10 mm.

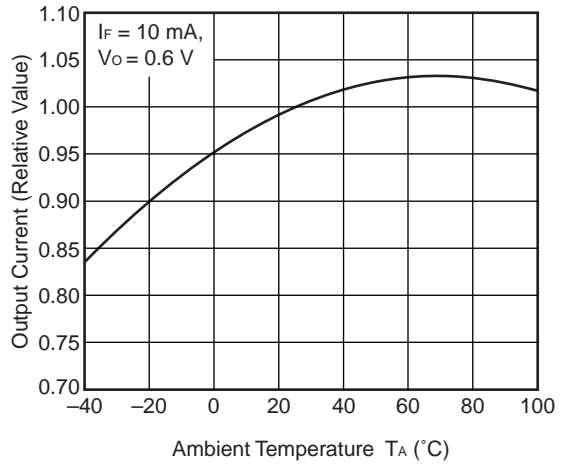
**TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C, unless otherwise specified)**



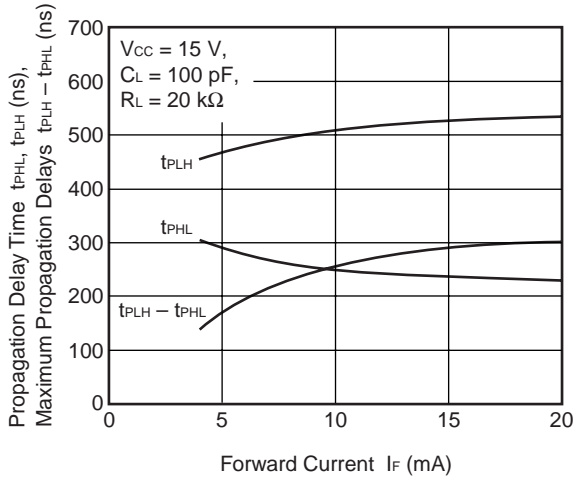
OUTPUT CURRENT vs. FORWARD CURRENT



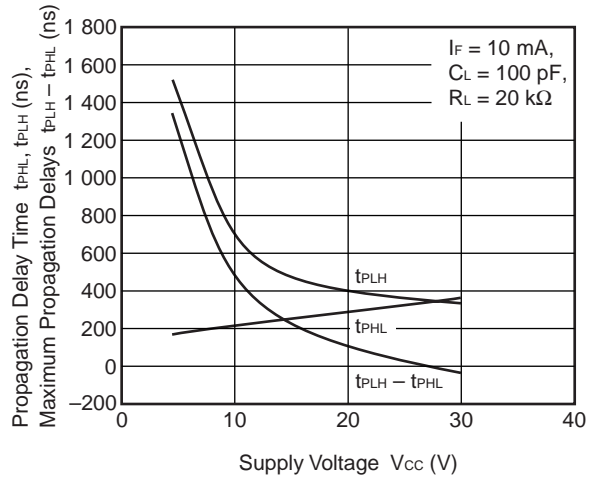
OUTPUT CURRENT vs. AMBIENT TEMPERATURE



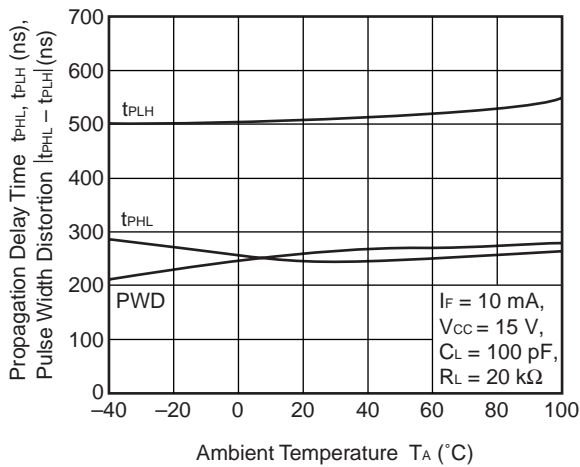
PROPAGATION DELAY TIME, MAXIMUM PROPAGATION DELAYS vs. FORWARD CURRENT



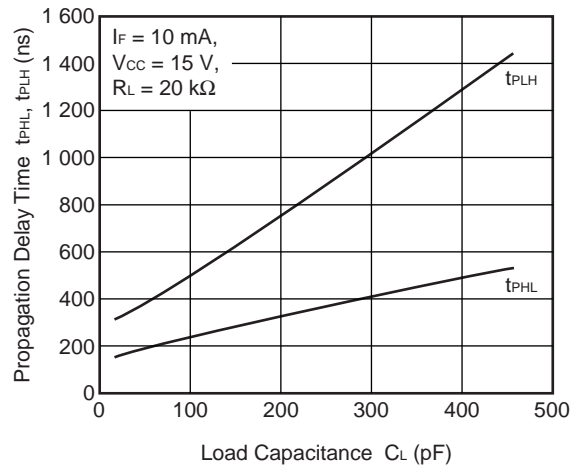
PROPAGATION DELAY TIME, MAXIMUM PROPAGATION DELAYS vs. SUPPLY VOLTAGE



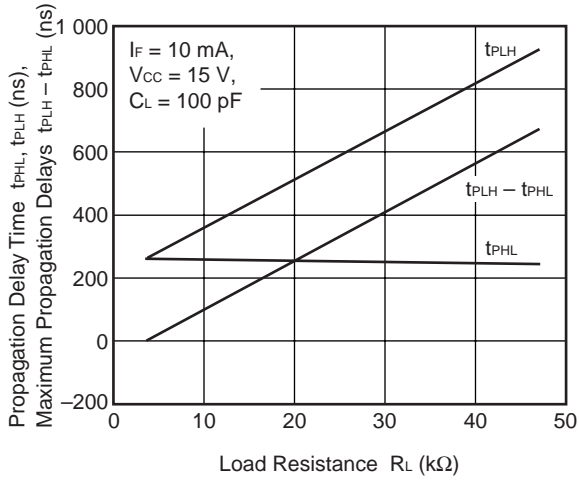
PROPAGATION DELAY TIME, PULSE WIDTH DISTORTION vs. AMBIENT TEMPERATURE



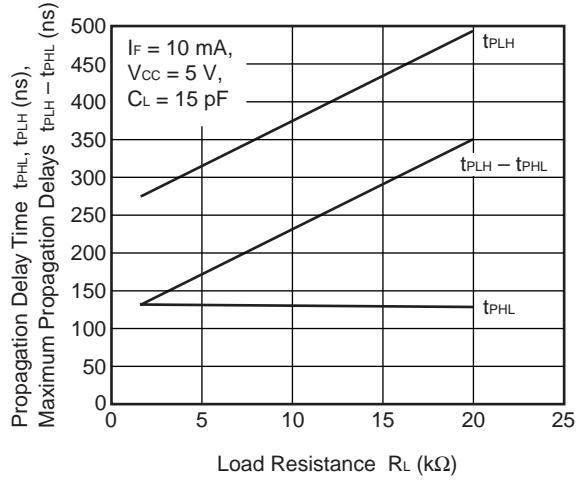
PROPAGATION DELAY TIME vs. LOAD CAPACITANCE



PROPAGATION DELAY TIME,  
MAXIMUM PROPAGATION DELAYS  
vs. LOAD RESISTANCE



PROPAGATION DELAY TIME,  
MAXIMUM PROPAGATION DELAYS  
vs. LOAD RESISTANCE

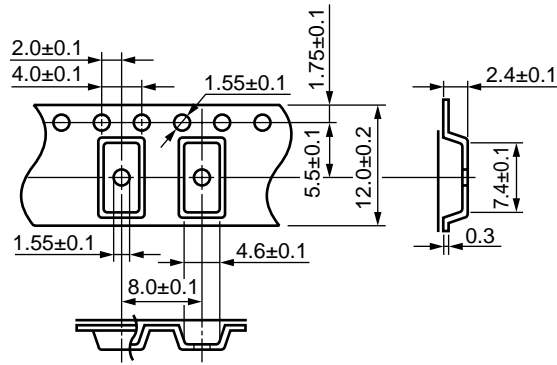


**Remark** The graphs indicate nominal characteristics.

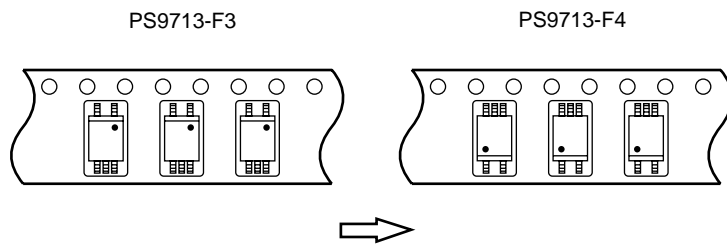


TAPING SPECIFICATIONS (in millimeters)

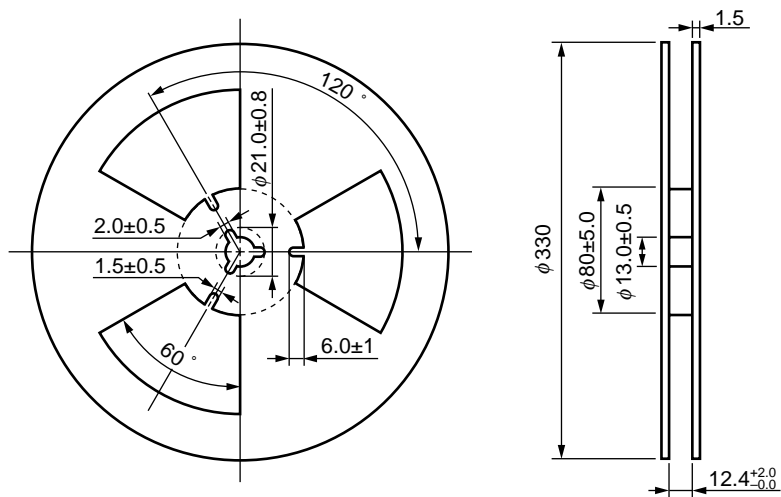
Outline and Dimensions (Tape)



Tape Direction



Outline and Dimensions (Reel)



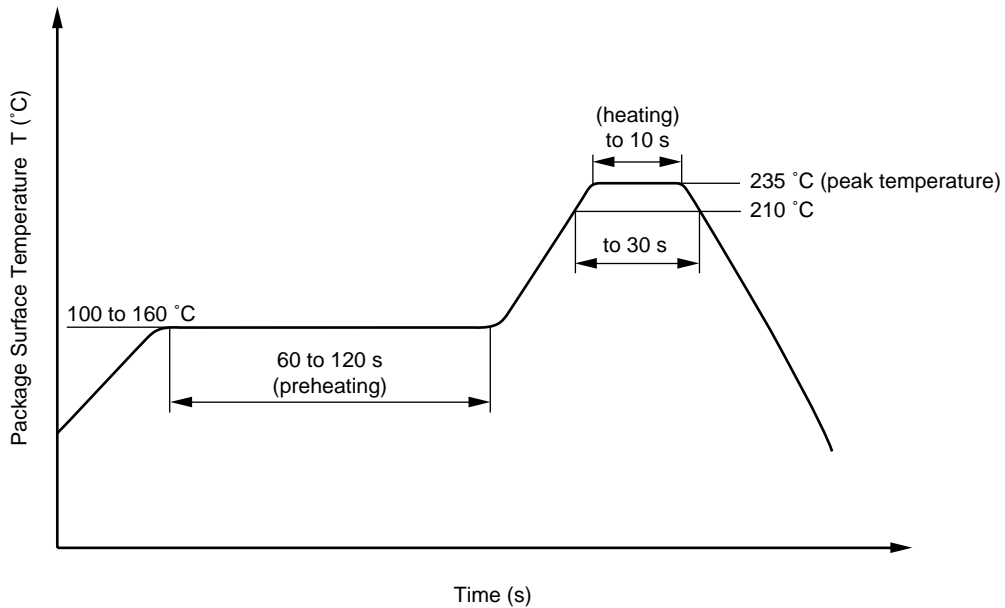
Packing: 3 500 pcs/reel

**RECOMMENDED SOLDERING CONDITIONS**

**(1) Infrared reflow soldering**

- 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
- Flux Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt % is recommended.)

Recommended Temperature Profile of Infrared Reflow



**(2) Dip soldering**

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

**(3) Cautions**

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

**CAUTION**

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

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