

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

### PS9713

#### FEATURES

- **HIGH INSTANTANEOUS COMMON MODE REJECTION VOLTAGE**  
CMH, CML =  $\pm 15$  kV/ $\mu$ s MIN
- **HIGH SPEED RESPONSE**  
tPHL= 500 ns MAX, tPLH = 750 ns MAX
- **MAXIMUM PROPAGATION DELAYS**  
tPLH- tPHL = 270 ns TYP
- **PULSE WIDTH DISTORTION**  
| tPHL- tPLH | = 270 ns TYP
- **SMALL THIN PACKAGE**  
5-pin SOP
- **TAPING PRODUCT NUMBER**  
PS9713-F3, F4: 3,500 pcs/reel

#### DESCRIPTION

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.

#### APPLICATIONS

- IPM DRIVER
- GENERAL PURPOSE INVERTER

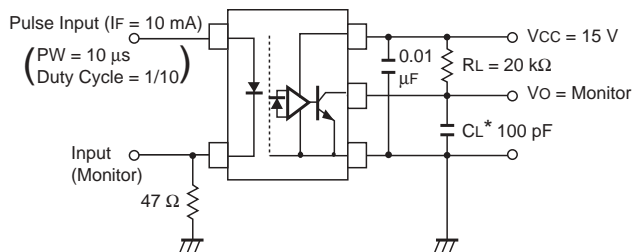
#### ELECTRICAL CHARACTERISTICS<sup>1</sup> (TA = -40 to +100°C, Vcc = 15 V unless otherwise specified)

		PART NUMBER	PS9713			
	SYMBOL	PARAMETERS	UNITS	MIN	TYP	MAX
Diode	V <sub>F</sub>	Forward Voltage, I <sub>F</sub> = 10 mA	V	1.3	1.65	2.1
	I <sub>R</sub>	Reverse Current, V <sub>R</sub> = 3 V	$\mu$ A			200
	C <sub>t</sub>	Terminal Capacitance, V = 0 V, f = 1 MHz, T <sub>A</sub> = 25°C	pF		30	
Detector	V <sub>OL</sub>	Low Level Output Voltage I <sub>F</sub> = 10 mA, V <sub>CC</sub> = 5 V, I <sub>O</sub> = 2.4 mA	V		0.13	0.6
	I <sub>OH</sub>	High Level Output Current V <sub>CC</sub> = 30 V, V <sub>F</sub> = 0.8 V	$\mu$ A		1.0	50
	I <sub>CCH</sub>	High Level Supply Current, V <sub>CC</sub> = 30 V, V <sub>F</sub> = 0.8 V, V <sub>O</sub> = open	mA		0.6	1.3
	I <sub>CCL</sub>	Low Level Supply Current, V <sub>CC</sub> = 30 V, I <sub>F</sub> = 10 mA, V <sub>O</sub> = open	mA		0.6	1.3
Coupled	I <sub>FHL</sub>	Threshold Input Current (High $\rightarrow$ Low), V <sub>O</sub> = 0.8 V, I <sub>O</sub> = 0.75 mA	mA		1.5	5.0
	CTR	Current Transfer Ratio, I <sub>F</sub> = 10 mA, V <sub>O</sub> = 0.6 V	%	44	110	
	R <sub>I-O</sub>	Isolation Resistance, V <sub>I-O</sub> = 1 k V <sub>DC</sub> , R <sub>H</sub> = 40 to 60%, T <sub>A</sub> = 25°C	$\Omega$	10 <sup>11</sup>		
	C <sub>I-O</sub>	Isolation Capacitance, V = 0, f = 1 MHz, T <sub>A</sub> = 25°C	pF		0.6	
	t <sub>PHL</sub>	Propagation Delay Time <sup>2</sup> , High $\rightarrow$ Low I <sub>F</sub> = 10 mA, R <sub>L</sub> = 20 k $\Omega$ , C <sub>L</sub> = 100 pF, V <sub>THHL</sub> = 1.5 V, V <sub>THLH</sub> = 2.0 V	ns		250	500
	t <sub>PLH</sub>	Propagation Delay Time <sup>2</sup> , High $\rightarrow$ Low I <sub>F</sub> = 10 mA, R <sub>L</sub> = 20 k $\Omega$ , C <sub>L</sub> = 100 pF, V <sub>THHL</sub> = 1.5 V, V <sub>THLH</sub> = 2.0 V	ns		520	750
	t <sub>PLH-t<sub>PHL</sub></sub>	Maximum Propagation Delays I <sub>F</sub> = 10 mA, R <sub>L</sub> = 20 k $\Omega$ , C <sub>L</sub> = 100 pF, V <sub>THHL</sub> = 1.5 V, V <sub>THLH</sub> = 2.0 V	ns	-200	270	650
	t <sub>PLH-t<sub>PHL</sub></sub>	Pulse Width Distortion (PWD) <sup>2</sup> I <sub>F</sub> = 10 mA, R <sub>L</sub> = 20 k $\Omega$ , C <sub>L</sub> = 100 pF, V <sub>THHL</sub> = 1.5 V, V <sub>THLH</sub> = 2.0 V	ns		270	650
	CMH	Instantaneous Common Mode Rejection Voltage (Output:High) <sup>3</sup> 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 k $\Omega$ , C <sub>L</sub> = 100 pF	kV/ $\mu$ s	15		
CML	Instantaneous Common Mode Rejection Voltage (Output:High) <sup>3</sup> 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 k $\Omega$ , C <sub>L</sub> = 100 pF	kV/ $\mu$ s	15			

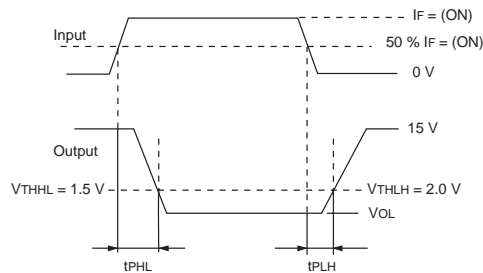
Notes: See Next Page

Notes:

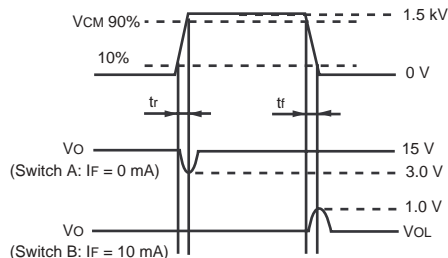
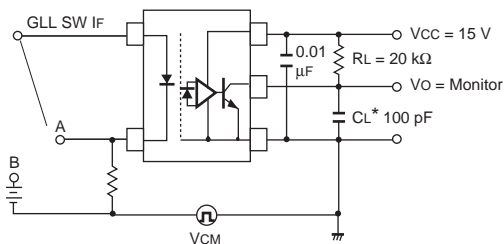
1. Typical values at  $T_A = 25\text{ }^\circ\text{C}$ .
2. Test Circuit for Propagation delay time



\*CL includes probe and stray wiring capacitance.



3. Test circuit for common mode transient immunity



**USAGE CAUTION**

Bypass capacitor of more than 0.1  $\mu\text{F}$  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.

**ABSOLUTE MAXIMUM RATINGS<sup>1</sup>** ( $T_A = 25\text{ }^\circ\text{C}$ )

SYMBOLS	PARAMETERS	UNITS	RATINGS
Diode			
$I_F$	Forward Current	mA	25
$V_R$	Reverse Voltage	V	3.0
Detector			
$V_{CC}$	Supply Voltage	V	-0.5 to +35
$V_O$	Output Voltage	V	-0.5 to +35
$I_O$	Output Current	mA	15
$P_C$	Power Dissipation	mW	100
Coupler			
$B_V$	Isolation Voltage <sup>2</sup>	$V_{r.m.s.}$	2500
$T_A$	Operating Ambient Temp.	$^\circ\text{C}$	-40 to +100
$T_{STG}$	Storage Temperature	$^\circ\text{C}$	-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  $T_A = 25\text{ }^\circ\text{C}$ ,  $RH = 60\%$  between input and output.

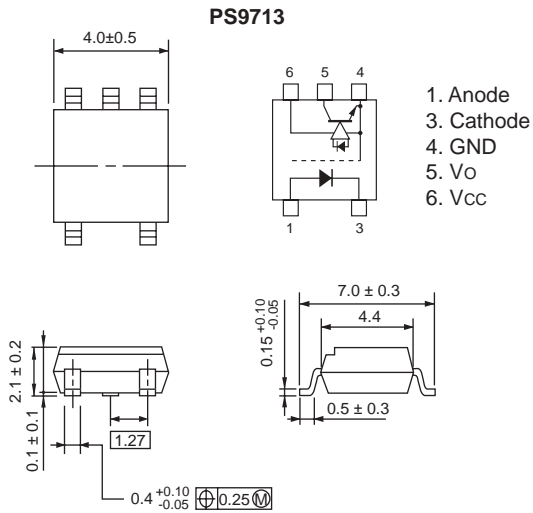
**RECOMMENDED OPERATING CONDITIONS**

PART NUMBER			PS9713		
SYMBOLS	PARAMETERS	UNITS	MIN	TYP	MAX
$I_{FH}$	High Level Input Current	mA	10		20
$V_O$	Output Voltage	V	0		30
$V_{CC}$	Supply Voltage	V	4.5		30
$V_F$	LED off Voltage	V	0		0.8

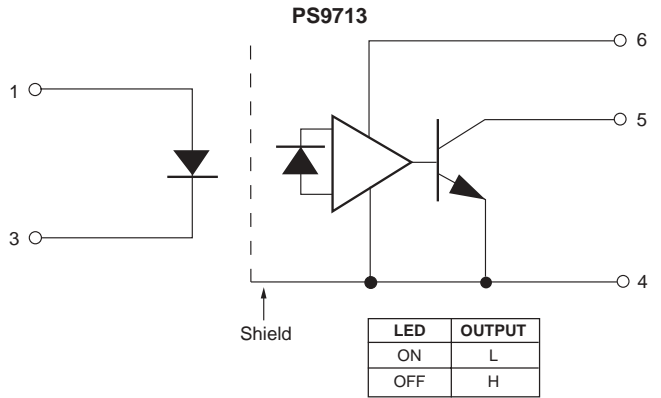
**ORDERING INFORMATION**

PART NUMBER	PACKAGE	PACKING STYLE
PS9713	5-pin SOP	Magazine case 100 pcs
PS9713-F3		Embossed Tape 3500 pcs/reel
PS9713-F4	5-pin SOP	Magazine case 100 pcs
PS9713-V		
PS9713-V-F3		

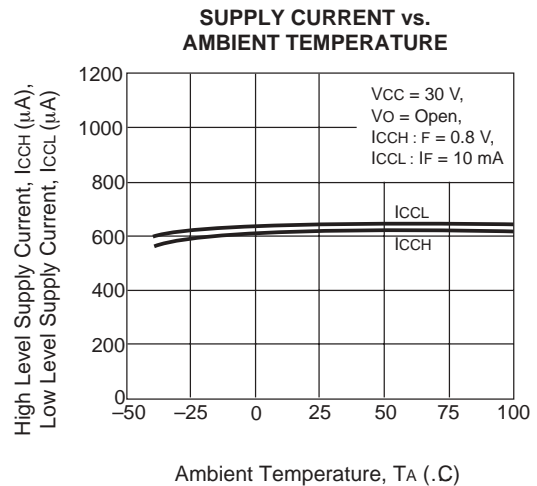
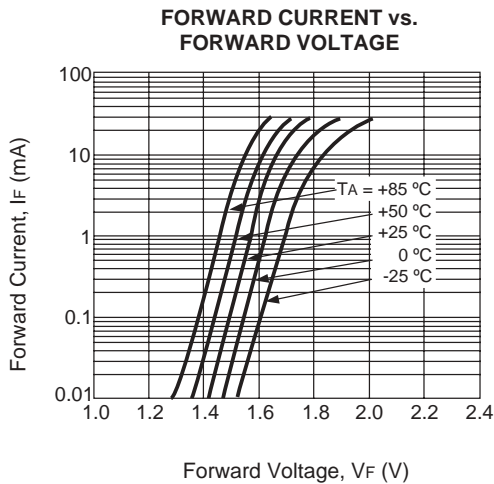
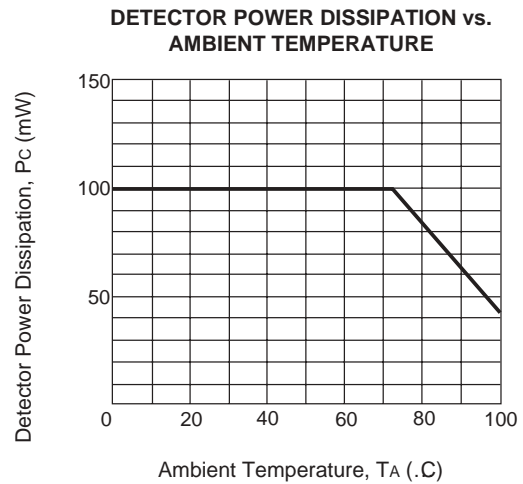
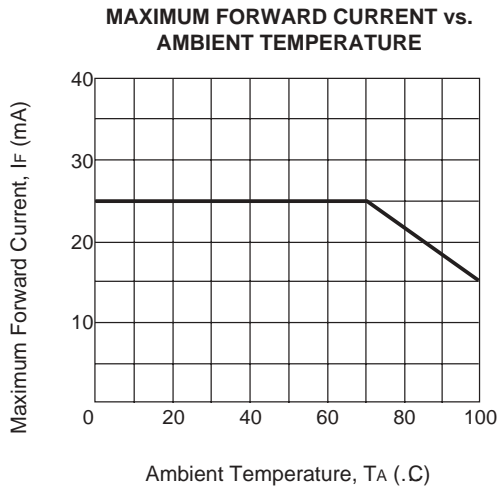
**OUTLINE DIMENSIONS** (Units in mm)



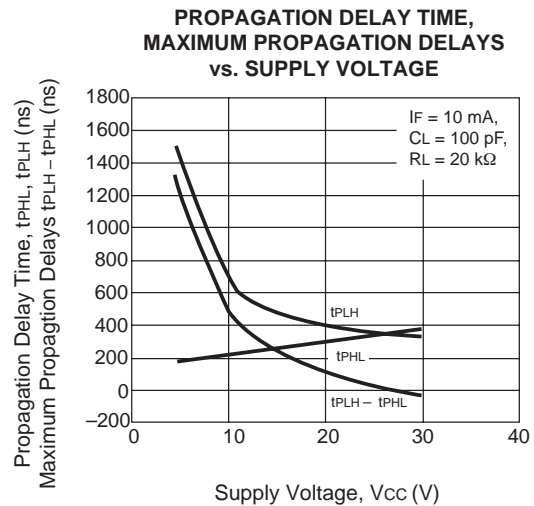
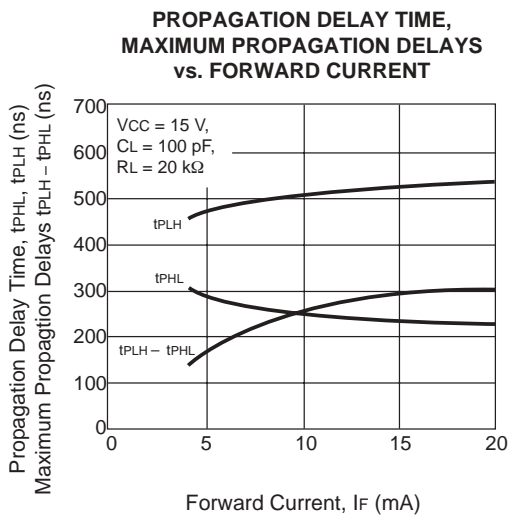
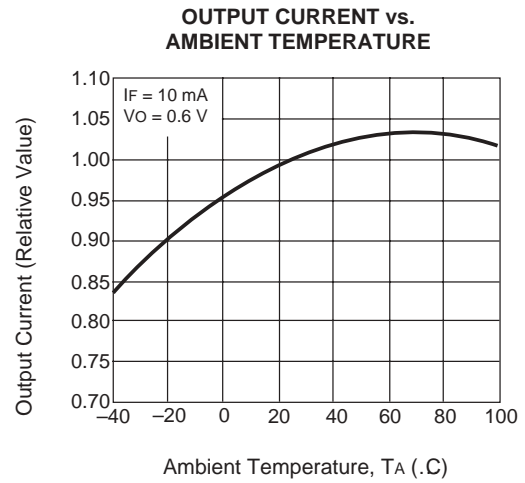
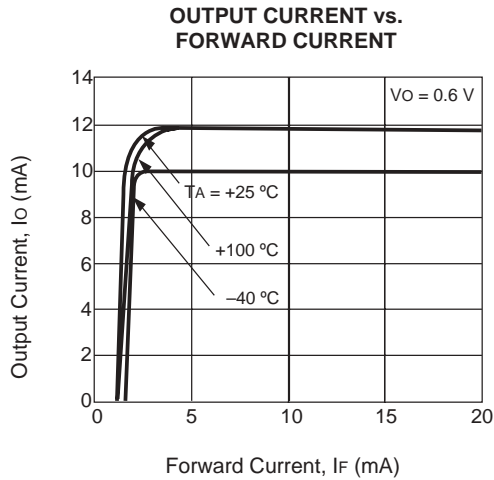
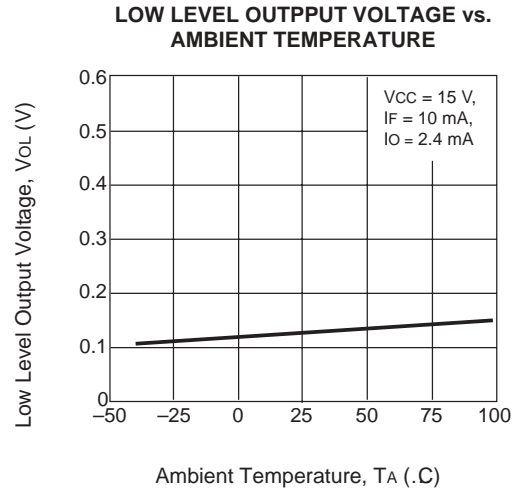
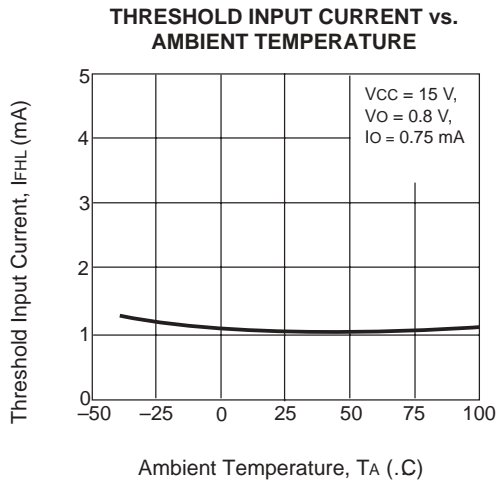
**FUNCTIONAL DIAGRAM**



**TYPICAL PERFORMANCE CURVES** (TA = 25°C, unless otherwise specified)

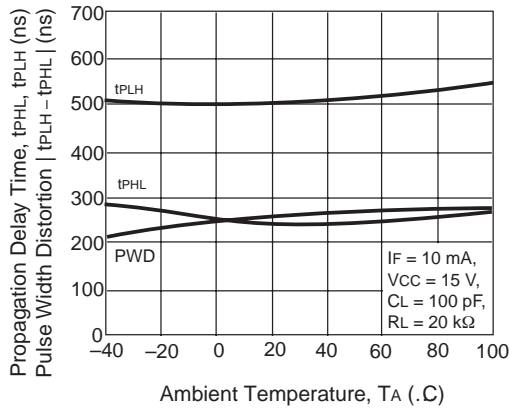


**TYPICAL PERFORMANCE CURVES** ( $T_A = 25^\circ\text{C}$ , unless otherwise specified)

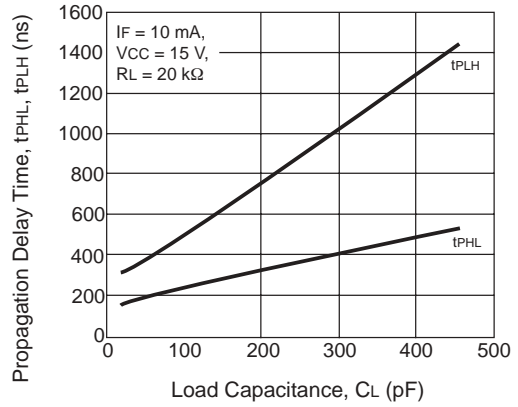


TYPICAL PERFORMANCE CURVES (TA = 25°C)

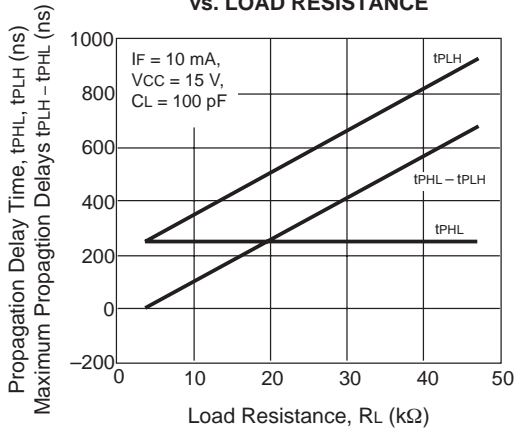
PROPAGATION DELAY TIME,  
PULSE WIDTH DISTORTION  
vs. AMBIENT TEMPERATURE



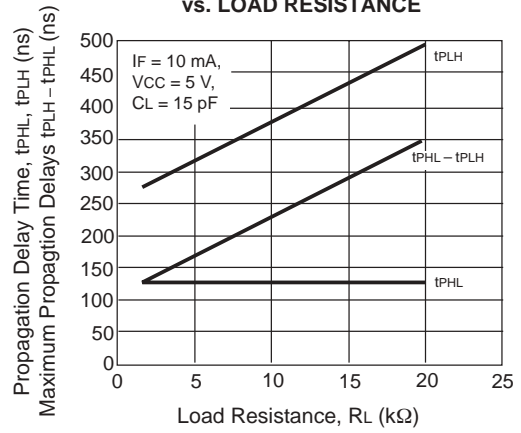
PROPAGATION DELAY TIME vs.  
LOAD CAPACITANCE



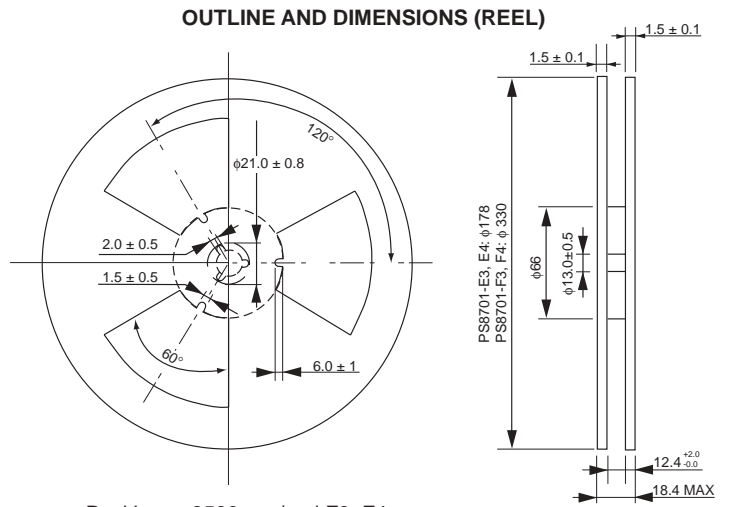
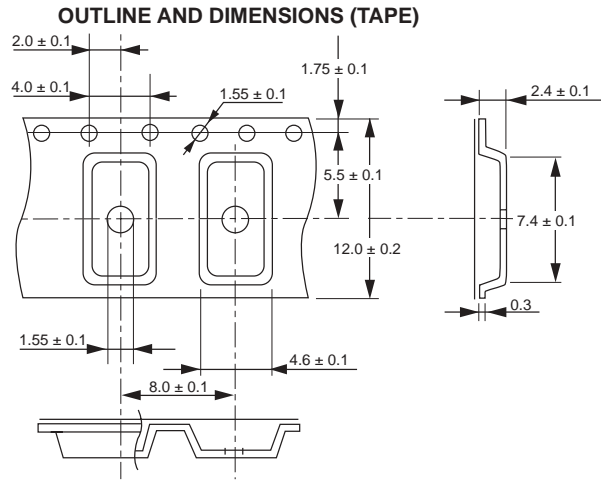
PROPAGATION DELAY TIME,  
MAXIMUM PROPAGATION DELAYS  
vs. LOAD RESISTANCE



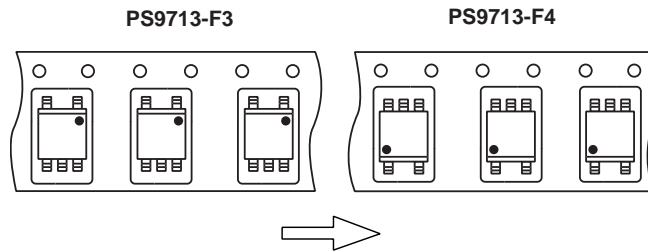
PROPAGATION DELAY TIME,  
MAXIMUM PROPAGATION DELAYS  
vs. LOAD RESISTANCE



**TAPING SPECIFICATIONS** (Units in mm)



**TAPE DIRECTION**

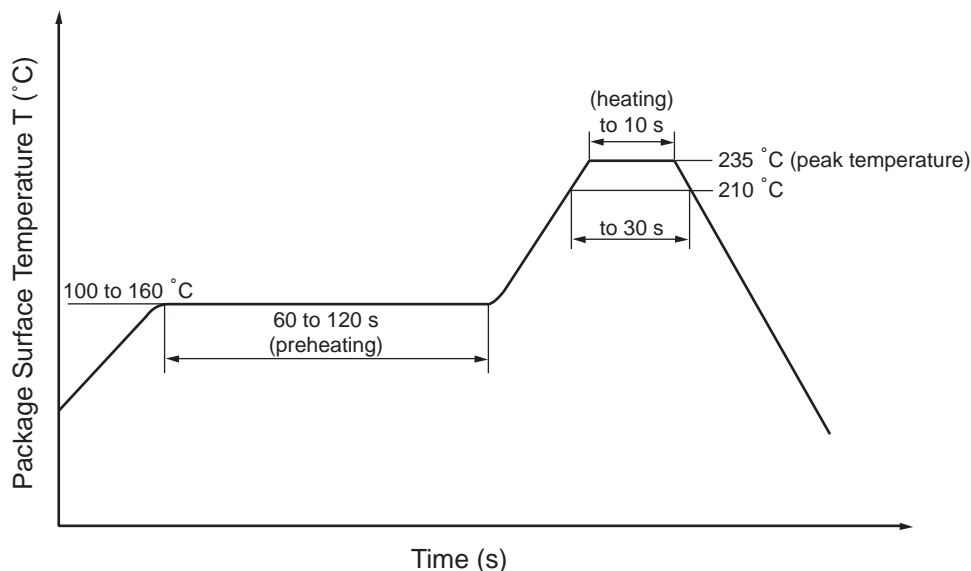


## RECOMMENDED SOLDERING CONDITIONS

### (1) Infrared reflow soldering

- **Peak reflow temperature** 235 °C (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 max. 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 max. chlorine content of 0.2 Wt % is recommended.)

### (3) Cautions

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