

**1 Mbps, OPEN COLLECTOR OUTPUT
HIGH CMR, INTELLIGENT POWER MODULE
5-PIN SOP PHOTOCOUPLER**

–NEPOC Series–

DESCRIPTION

The PS9113 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.

PS9113 is specified high CMR, high CTR and pulse width distortion with operating temperature. It is suitable for IPM drive.

FEATURES

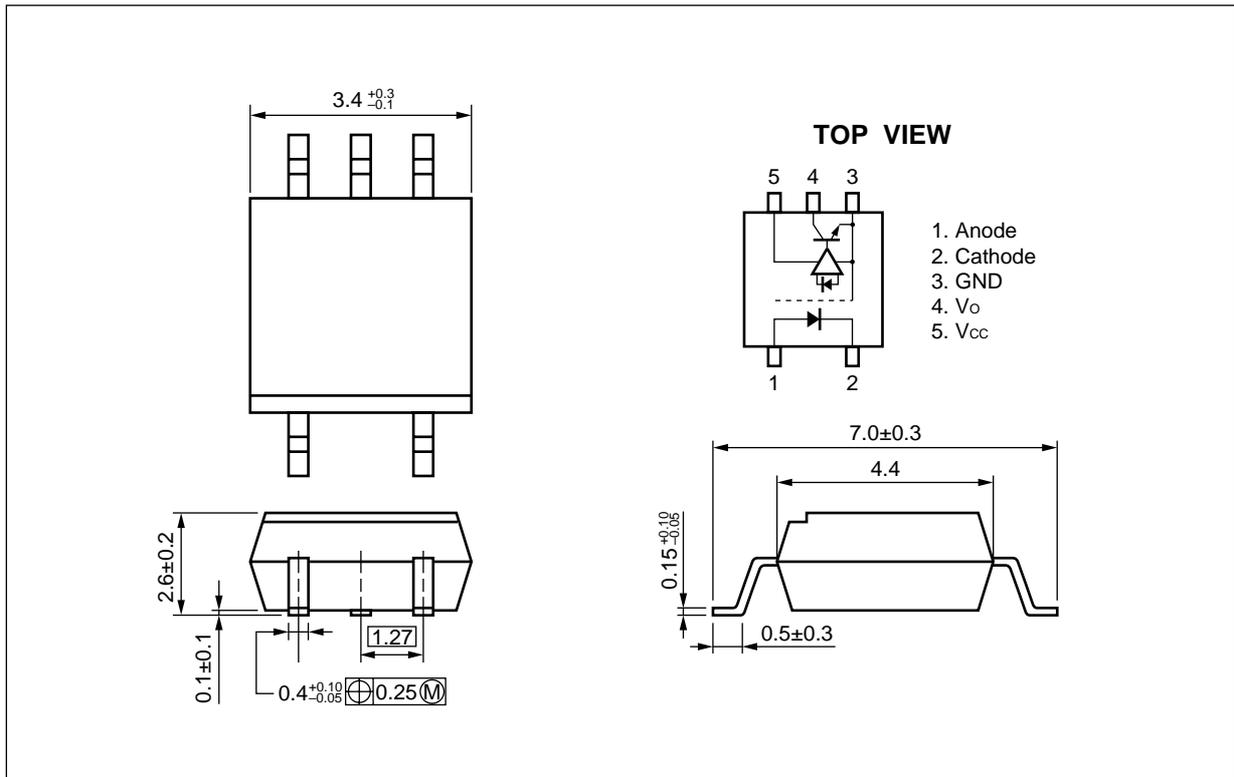
- Wave soldering (260°C, 10 s, One)
- High instantaneous common mode rejection voltage ($CM_H, CM_L = \pm 15 \text{ kV}/\mu\text{s MIN.}$)
- High-speed response ($t_{PHL} = 500 \text{ ns MAX.}, t_{PLH} = 750 \text{ ns MAX.}$)
- Maximum propagation delays ($t_{PLH} - t_{PHL} = 270 \text{ ns TYP.}$)
- Pulse width distortion ($|t_{PHL} - t_{PLH}| = 270 \text{ ns TYP.}$)
- Ordering number of taping product: PS9113-F3, F4: 2 500 pcs/reel

APPLICATIONS

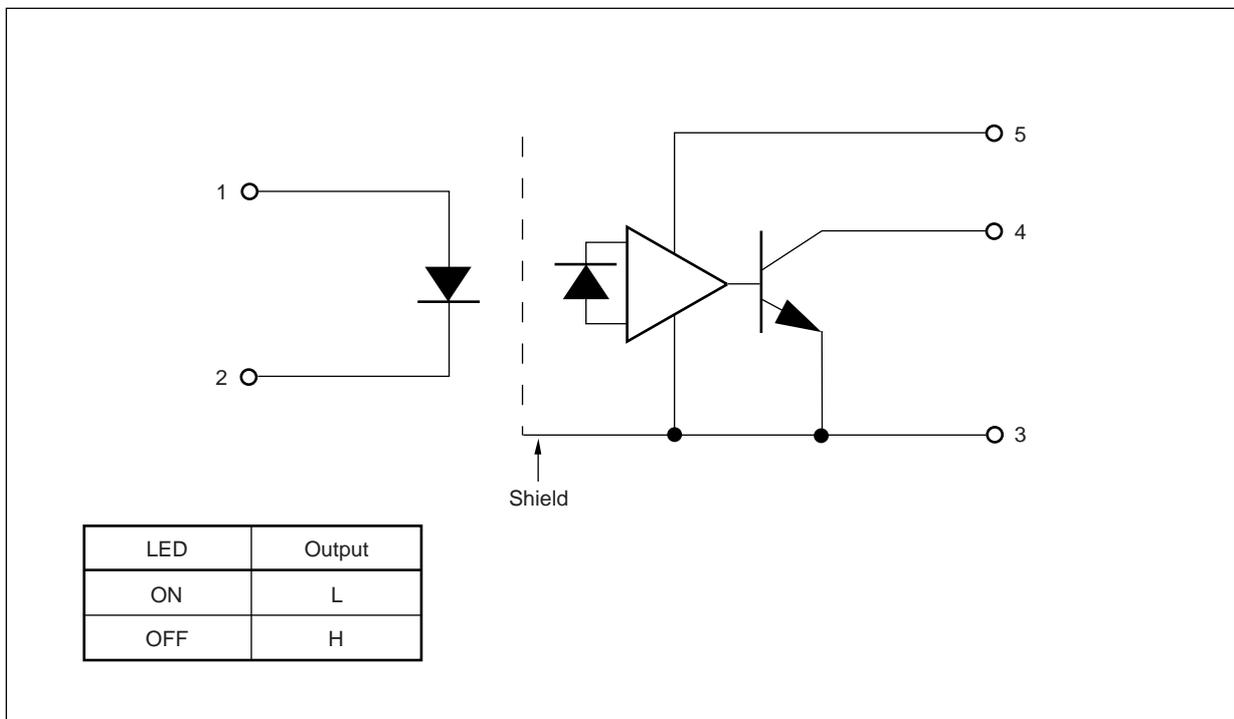
- IPM Driver
- General purpose inverter

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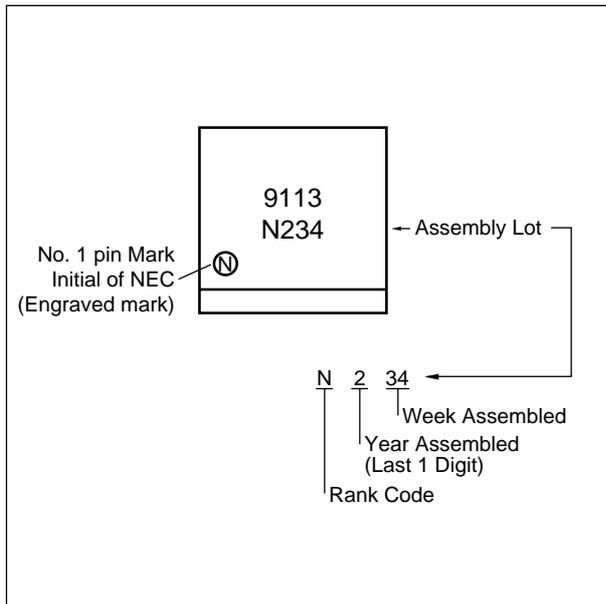
PACKAGE DIMENSIONS (UNIT: mm)



FUNCTIONAL DIAGRAM



MARKING EXAMPLE



ORDERING INFORMATION

Part Number	Package	Packing Style	Application Part Number ^{*1}
PS9113	5-pin SOP	20 pcs (Tape 20 pcs cut)	PS9113
PS9113-F3		Embossed Tape 2 500 pcs/reel	
PS9113-F4			

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

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C, unless otherwise specified)

Parameter		Symbol	Ratings	Unit
Diode	Forward Current ^{*1}	I _F	25	mA
	Reverse Voltage	V _R	5	V
Detector	Supply Voltage	V _{CC}	-0.5 to +35	V
	Output Voltage	V _O	-0.5 to +35	V
	Output Current	I _O	15	mA
	Power Dissipation ^{*2}	P _C	100	mW
Isolation Voltage ^{*3}		BV	2 500	Vr.m.s.
Operating Ambient Temperature		T _A	-40 to +100	°C
Storage Temperature		T _{stg}	-55 to +125	°C

*1 Reduced to 0.33 mA/°C at T_A = 70°C or more.

*2 Reduced to 1.9 mW/°C at T_A = 70°C or more.

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

RECOMMENDED OPERATING CONDITIONS

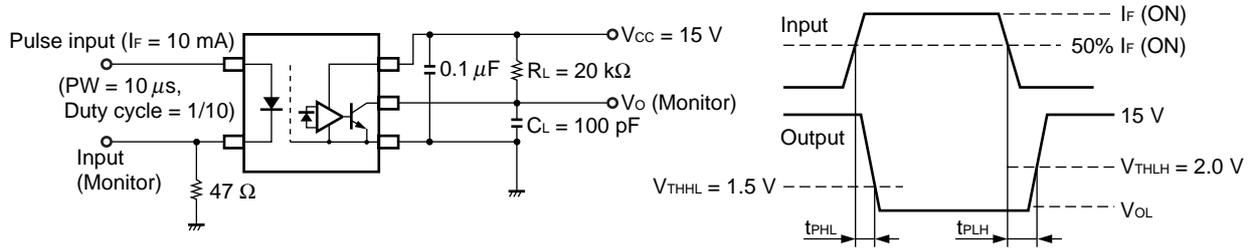
Parameter	Symbol	MIN.	TYP.	MAX.	Unit
High Level Input Current	I _{FH}	10		20	mA
Output Voltage	V _O	0		30	V
Supply Voltage	V _{CC}	4.5		30	V
LED Off Voltage	V _F	0		0.8	V

ELECTRICAL CHARACTERISTICS (T_A = -40 to +100°C, V_{CC} = 15 V, unless otherwise specified)

Parameter		Symbol	Conditions	MIN.	TYP. ¹⁾	MAX.	Unit
Diode	Forward Voltage	V _F	I _F = 10 mA	1.3	1.65	2.1	V
	Reverse Current	I _R	V _R = 3 V			200	μA
	Terminal Capacitance	C _t	V = 0 V, f = 1 MHz, T _A = 25°C		30		pF
Detector	Low Level Output Voltage	V _{OL}	I _F = 10 mA, I _{OL} = 2.4 mA		0.13	0.6	V
	High Level Output Current	I _{OH}	V _{CC} = V _O = 30 V, V _F = 0.8 V		0.01	50	μA
	High Level Supply Current	I _{CCH}	V _{CC} = 30 V, V _F = 0.8 V, V _O = open		0.6	1.3	mA
	Low Level Supply Current	I _{CCL}	V _{CC} = 30 V, I _F = 10 mA, V _O = open		0.6	1.3	mA
Coupled	Threshold Input Current (H → L)	I _{FHL}	V _O = 0.8 V, I _O = 0.75 mA		1.5	5.0	mA
	Current Transfer Ratio (I _C /I _F)	CTR	I _F = 10 mA, V _O = 0.6 V	44	110		%
	Isolation Resistance	R _{I-O}	V _{I-O} = 1 kV _{DC} , R _H = 40 to 60%, T _A = 25°C	10 ¹¹			Ω
	Isolation Capacitance	C _{I-O}	V = 0 V, f = 1 MHz, T _A = 25°C		0.6		pF
	Propagation Delay Time (H → L) ²⁾	t _{PHL}	I _F = 10mA, R _L = 20 kΩ, C _L = 100 pF, V _{THHL} = 1.5 V, V _{THLH} = 2.0 V		250	500	ns
	Propagation Delay Time (L → H) ²⁾	t _{PLH}			520	750	
	Maximum Propagation Delays	t _{PLH} -t _{PHL}		-200	270	650	
	Pulse Width Distortion (PWD) ²⁾	t _{PHL} -t _{PLH}			270	650	
	Common Mode Transient Immunity at High Level Output ³⁾	CM _H	T _A = 25°C, I _F = 0 mA, V _O > 3.0 V, V _{CM} = 1.5 kV, R _L = 20 kΩ, C _L = 100 pF	15			kV/μs
Common Mode Transient Immunity at Low Level Output ³⁾	CM _L	T _A = 25°C, I _F = 10 mA, V _O < 1.0 V, V _{CM} = 1.5 kV, R _L = 20 kΩ, C _L = 100 pF	15			kV/μs	

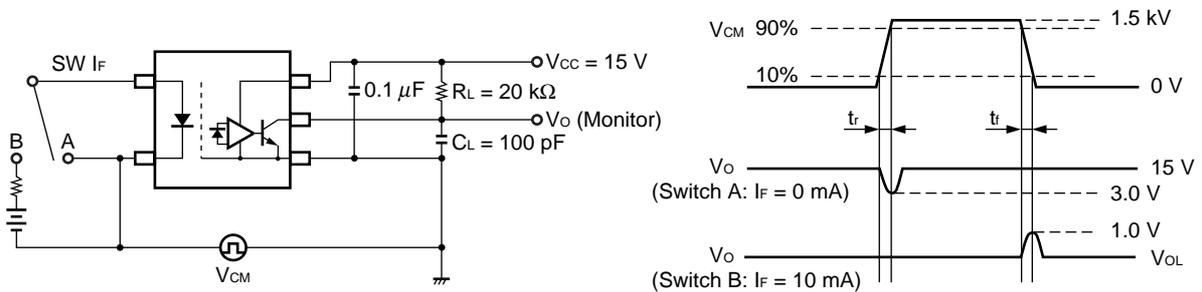
*1 Typical values at $T_A = 25^\circ\text{C}$.

*2 Test circuit for propagation delay time



C_L includes probe and stray wiring capacitance.

*3 Test circuit for common mode transient immunity

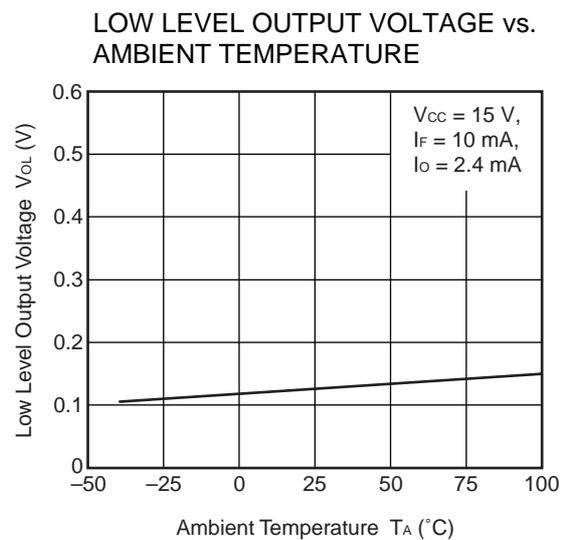
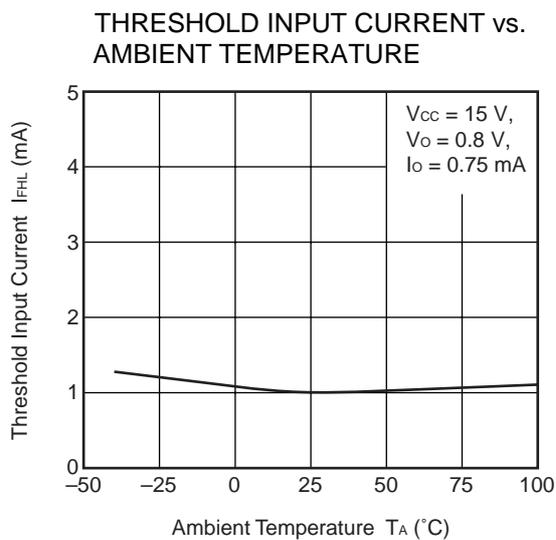
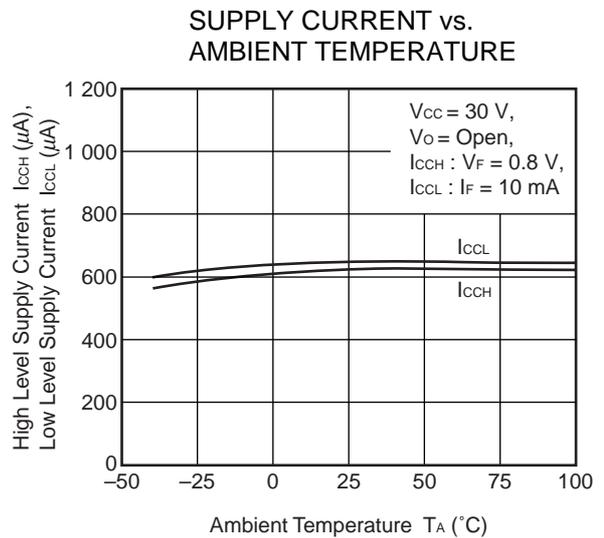
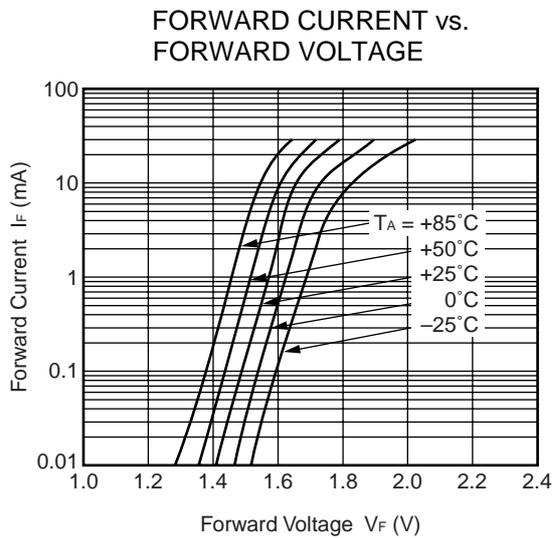
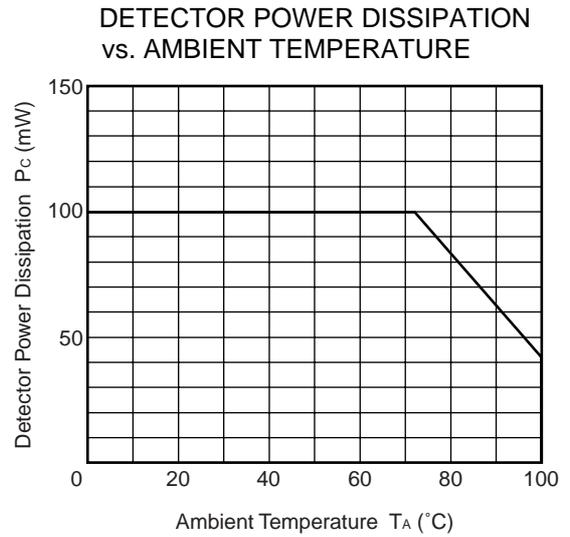
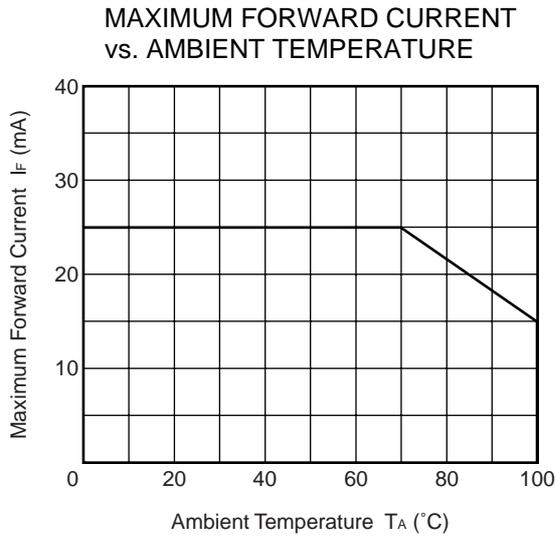


C_L includes probe and stray wiring capacitance.

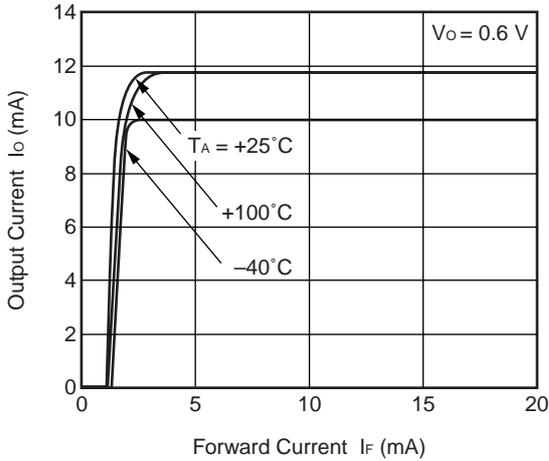
USAGE CAUTIONS

1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
2. By-pass capacitor of $0.1 \mu\text{F}$ 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.
3. Avoid storage at a high temperature and high humidity.

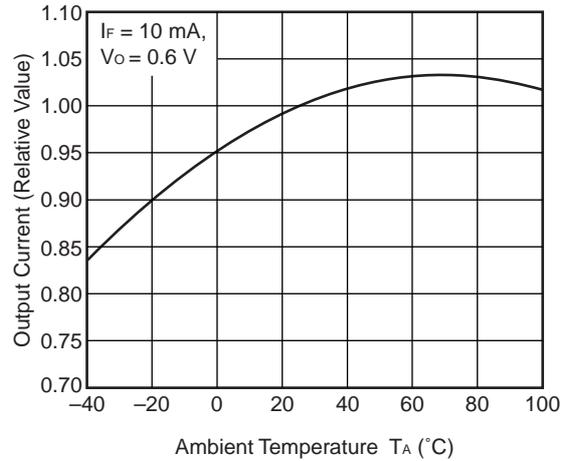
TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, unless otherwise specified)



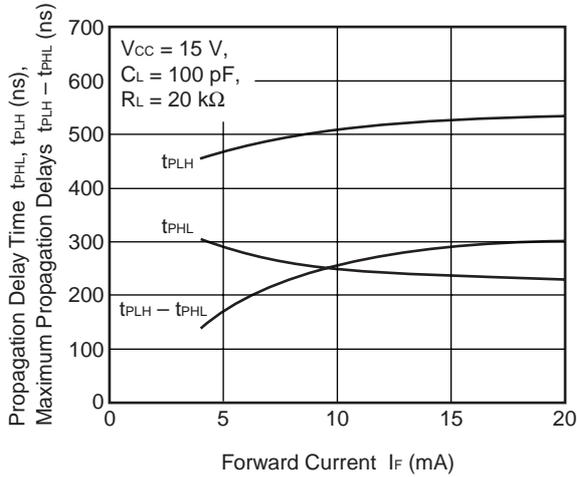
OUTPUT CURRENT vs. FORWARD CURRENT



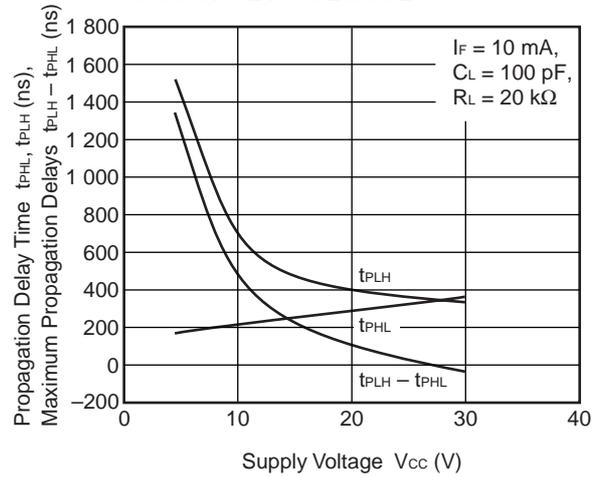
OUTPUT CURRENT vs. AMBIENT TEMPERATURE



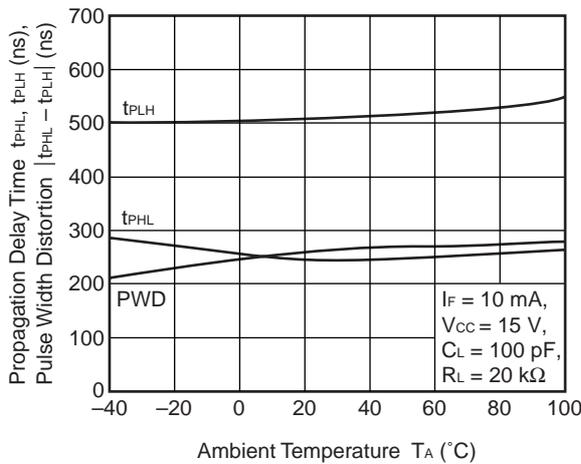
PROPAGATION DELAY TIME, MAXIMUM PROPAGATION DELAYS vs. FORWARD CURRENT



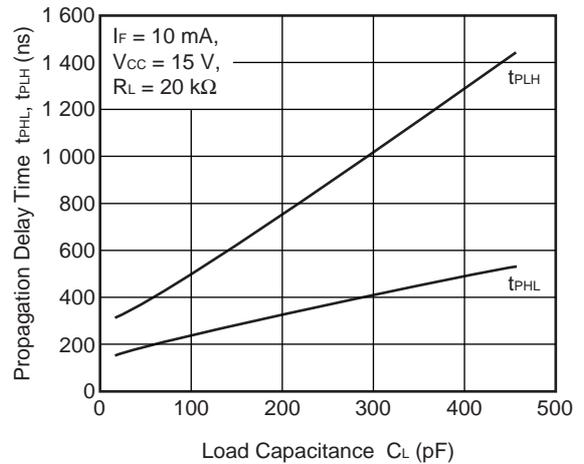
PROPAGATION DELAY TIME, MAXIMUM PROPAGATION DELAYS vs. SUPPLY VOLTAGE



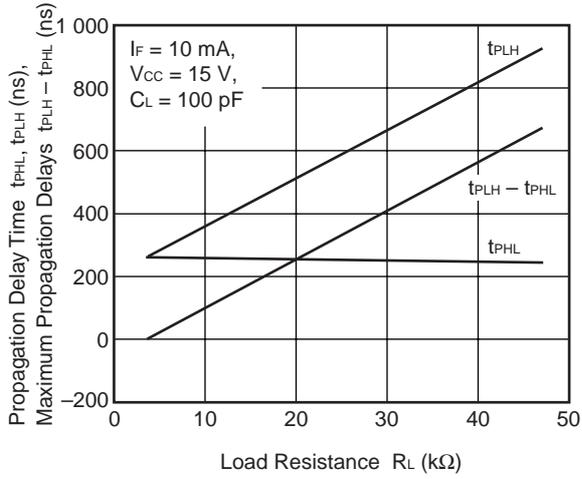
PROPAGATION DELAY TIME, PULSE WIDTH DISTORTION vs. AMBIENT TEMPERATURE



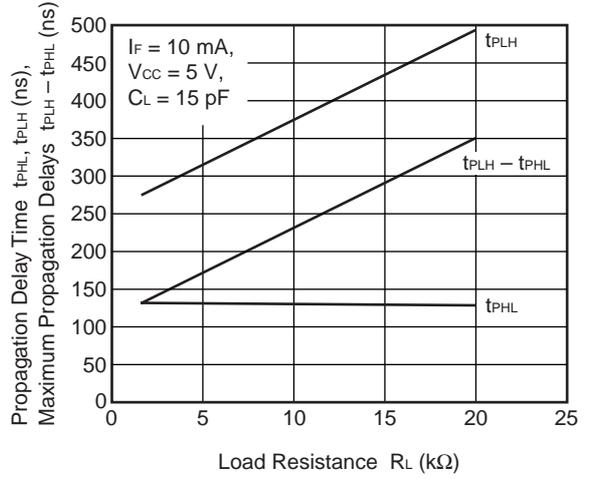
PROPAGATION DELAY TIME vs. LOAD CAPACITANCE



PROPAGATION DELAY TIME,
MAXIMUM PROPAGATION DELAYS
vs. LOAD RESISTANCE



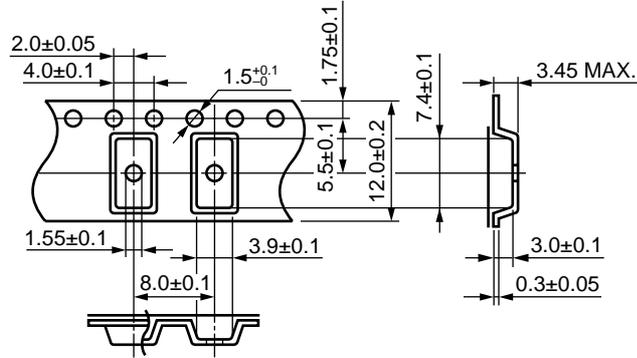
PROPAGATION DELAY TIME,
MAXIMUM PROPAGATION DELAYS
vs. LOAD RESISTANCE



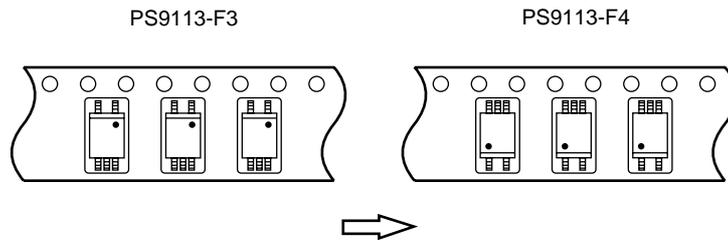
Remark The graphs indicate nominal characteristics.

TAPING SPECIFICATIONS (UNIT: mm)

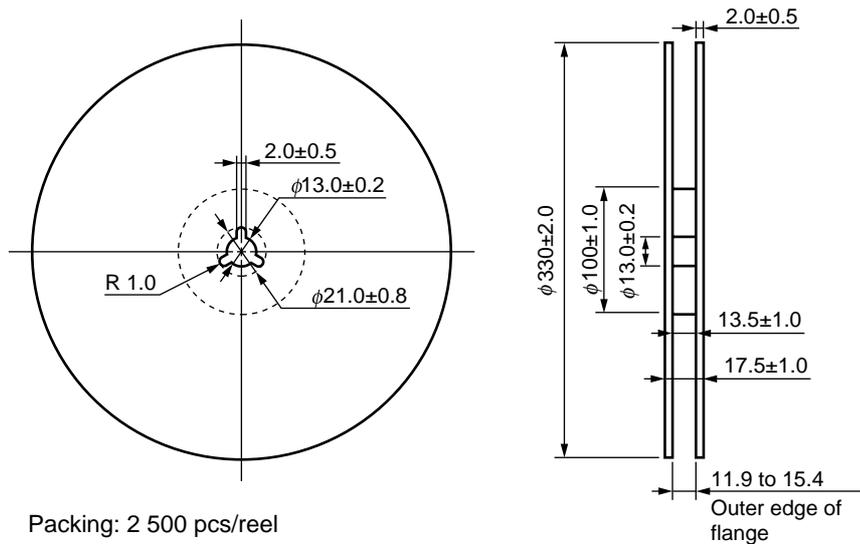
Outline and Dimensions (Tape)



Tape Direction



Outline and Dimensions (Reel)



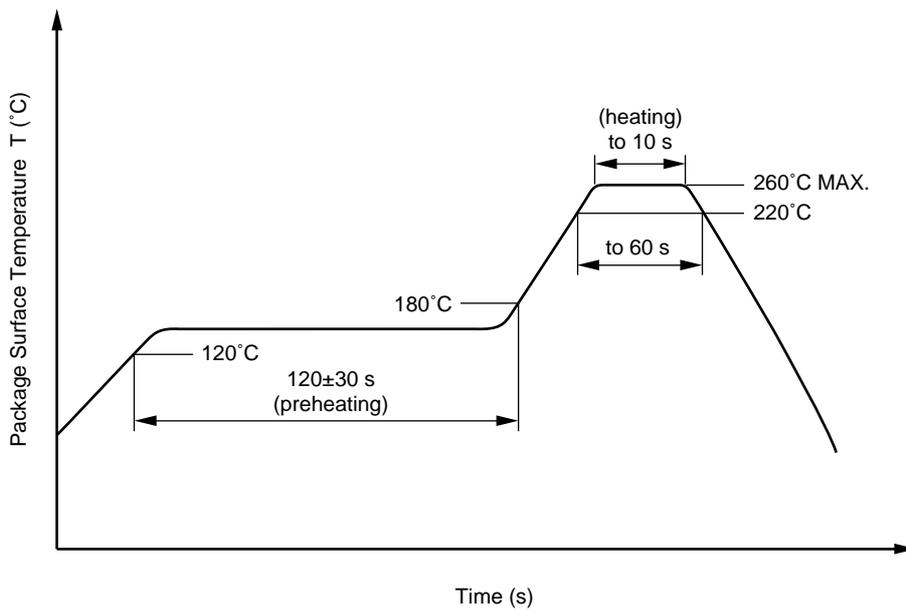
NOTES ON HANDLING

1. Recommended soldering conditions

(1) Infrared reflow soldering

- Peak reflow temperature 260°C or below (package surface temperature)
- Time of peak reflow temperature 10 seconds or less
- Time of temperature higher than 220°C 60 seconds or less
- Time to preheat temperature from 120 to 180°C 120±30 s
- 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) Wave soldering

- Temperature 260°C or below (molten solder temperature)
- Time 10 seconds or less
- Preheating conditions 120°C or below (package surface temperature)
- 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.

2. Cautions regarding noise

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

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M8E 00.4-0110

SAFETY INFORMATION ON THIS PRODUCT

<p>Caution</p>	<p>GaAs Products</p>	<p>The product contains gallium arsenide, GaAs. GaAs vapor and powder are hazardous to human health if inhaled or ingested.</p> <ul style="list-style-type: none"> • Do not destroy or burn the product. • Do not cut or cleave off any part of the product. • Do not crush or chemically dissolve the product. • Do not put the product in the mouth. <p>Follow related laws and ordinances for disposal. The product should be excluded from general industrial waste or household garbage.</p>
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