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DESCRIPTION

The IS480P High Speed Photocoupler contains a AlGaAs LED and Photo detector with built-in Schmitt Trigger to provide logic-compatible waveforms, eliminating the need for additional wave shaping.

The totem pole output eliminates the need for a pull up resistor and allows for direct Intelligent Power Module Drive or Gate Drive. Minimized Propagation Delay difference between devices makes this photocoupler excellent solutions for improving inverter efficiency through reduced switching dead time.

The device is in Stretched SO6 package.

FEATURES

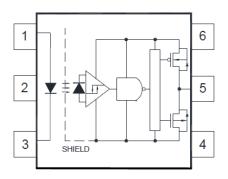
- Totem Pole Output
- Wide Operating Voltage Range V_{cc} 4.5V to 30V
- Operating Temperature Range - 40°C to +105°C
- Performance specified for Common IPM Applications over Industrial Temperature range.
- Maximum Propagation Delays t_{PLH} / t_{PHL}: 200ns / 220ns
- Propagation Delay Difference Min / Max : -210ns / 210ns
- Maximum Pulse Width Distortion PWD: 120ns
- Hysteresis
- 20kV/µs Minimum Common Mode Rejection at V_{CM} 1500V
- Lead Free and RoHS Compliant
- Safety Approvals Pending

APPLICATIONS

- Isolated IGBT/MOSFET Gate Drive
- IPM Interface Isolation
- Industrial Inverters
- AC Brushless and DC Motor Drives
- **Digital Isolation**

ORDER INFORMATION

Supply in Tape & Reel



- Anode
- NC
- Cathode
- **GND** 4
- 5 V_0

 V_{CC}

A 0.1µF bypass Capacitor must be connected between Pins 6 and 4.

ABSOLUTE MAXIMUM RATINGS $(T_A = 25^{\circ}C)$

Stresses exceeding the absolute maximum ratings can cause permanent damage to the device.

Exposure to absolute maximum ratings for long periods of time can adversely affect reliability.

Input

Forward Current	10mA
Forward Peak Current (Pulse Width < 1µs, 300pps)	1.0A
Reverse Voltage	5V

Output

Output Current	50mA
Output Voltage	-0.5V to 35V
Supply Voltage	35V

Total Package

Isolation Voltage	$5000V_{\text{RMS}}$
Total Power Dissipation	145mW
Operating Temperature	-40 to 105 °C
Storage Temperature	-55 to 125 °C
Lead Soldering Temperature (10s)	260°C

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Truth Table

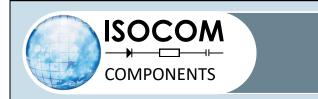
LED	Vo
ON	HIGH
OFF	LOW

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Operating Temperature	T_A	- 40	105	°C
Supply Voltage	V_{CC}	4.5	30	V
Input Current (ON)	$I_{F(ON)}$	1.6	5	mA
Input Voltage (OFF)	V _{F(OFF)}		0.8	V

Note:

- 1: Photo Detector requires a V_{CC} of 4.5 V or higher for stable operation as output might be unstable if V_{CC} is lower than 4.5 V.
- 2: The initial switching threshold is 1.6 mA or less. It is recommended that 2.2 mA be used to permit a guard band.



ELECTRICAL CHARACTERISTICS (Over Recommended Operating Conditions, $V_{CC} = 4.5V$ to 30V, $I_{F(ON)} = 1.6mA$ to 5mA, $V_{F(OFF)} = 0V$ to 0.8V, $T_A = -40^{\circ}C$ to 105°C, unless otherwise specified. Typical Values at $T_A = 25^{\circ}C$)

INPUT

Parameter	Symbol	Test Condition	Min	Тур.	Max	Unit
Forward Voltage	V_{F}	$I_F = 5mA$	1.2	1.33	1.6	V
Forward Voltage Temperature Coefficient	$\Delta V_F/\Delta T$	$I_F = 5 \text{mA}$		-1.237		mV/°C
Reverse Voltage	V_R	$I_R = 10 \mu A$	5			V
Input Threshold Current (Low to High)	I_{FLH}			0.7	1.5	mA
Input Threshold Voltage (High to Low)	$ m V_{FHL}$		0.8			V
Input Capacitance	C_{IN}	$V_F = 0V, f = 1MHz$		33		pF

OUTPUT

Parameter	Symbol	Test Condition	Min	Тур.	Max	Unit
High Level Supply Current	I_{CCH}	$V_{CC} = 5.5V$, $I_F = 5mA$ $I_O = 0mA$			3.0	mA
		$V_{CC} = 30V$, $I_F = 5mA$ $I_O = 0mA$		1.9	3.0	
Low Level Supply Current	I_{CCL}	$V_{CC} = 5.5V, V_F = 0V$ $I_O = 0mA$			3.0	mA
		$V_{CC} = 30V, V_F = 0V$ $I_O = 0mA$		2.0	3.0	
High Level Short Circuit Output Current	I_{OSH}	$V_{CC} = 5.5 \text{V}, I_F = 5 \text{mA}, V_O = G \text{ND}$ Duration $< 500 \mu \text{s}$			-160	mA
		$V_{CC} = 20V, I_F = 5mA, V_O = GND$ Duration $< 500 \mu s$			-200	
Low Level Short Circuit Output Current	I_{OSL}	$V_{\rm O} = V_{\rm CC} = 5.5 {\rm V}, V_{\rm F} = 0 {\rm V}$ Duration $< 500 \mu {\rm s}$	160			mA
		$V_{O} = V_{CC} = 20V, V_{F} = 0V$ Duration $< 500 \mu s$	200			
High Level Output Voltage	V_{OH}	$I_{OH} = -6.5 \text{mA}$	V _{CC} - 0.5	V _{CC} - 0.025		V
Low Level Output Voltage	V_{OL}	$I_{OL} = 6.5 \text{mA}$		0.015	0.5	V



ELECTRICAL CHARACTERISTICS (Over Recommended Operating Conditions,

 V_{CC} = 4.5V to 30V, $I_{F(ON)}$ = 1.6mA to 5mA, $V_{F(OFF)}$ = 0V to 0.8V, T_A = -40°C to 105°C, unless otherwise specified. Typical Values at T_A = 25°C)

SWITCHING

Parameter	Symbol	Test Condition	Min	Тур.	Max	Unit
Propagation Delay Time to High Output Level	$t_{\rm PLH}$	$V_F = 0V \rightarrow I_{F(ON)} = 1.6mA$ $C_L = 100pF$		120	200	ns
Propagation Delay Time to Low Output Level	$t_{ m PHL}$	$I_{F(ON)} = 1.6 \text{mA} \rightarrow V_F = 0V$ $C_L = 100 \text{pF}$		130	220	
Pulse Width Distortion t _{PHL} - t _{PLH} for any given device	PWD	$C_L = 100pF$			120	
Propagation Delay Difference (t _{PHL} - t _{PLH}) between any two devices	PDD	$C_L = 100pF$	-210		210	
Output Rise Time (10% to 90%)	t_{r}			35		
Output Fall Time (90% to 10%)	t _f			35		
Common Mode Transient Immunity at High Output Level	CM_{H}	$I_{F} = 6.0 \text{mA}$ $V_{CC} = 5 \text{V}$ $V_{CM} = 1500 \text{V}$ $T_{A} = 25^{\circ}\text{C}$	20			kV/μs
Common Mode Transient Immunity at Low Output Level	CM _L	$V_{F} = 0V$ $V_{CC} = 5V$ $V_{CM} = 1500V$ $T_{A} = 25^{\circ}C$	20			kV/μs

Note:

- 1. A 0.1uF or bigger bypass capacitor must be connected across pin 6 and pin 4.
- 2. t_{PLH} propagation delay is measured from the 50% point on the leading edge of the input pulse to the 1.3 V point on the leading edge of the output pulse.
 t_{PHL} propagation delay is measured from the 50% point on the trailing edge of the input pulse to the 1.3 V point on the trailing edge of the output pulse.
- 3. PDD is the difference of t_{PHL} and t_{PLH} between any two devices under same test conditions.
- CM_H, Common Mode Transient Immunity in High stage is the maximum tolerable slew rate of the common mode impulse signal, V_{CM}, to assure that the output will remain high (V₀ > 2V). Equal value split resistors must be used at both ends of the LED.
- 5. CM_L, Common Mode Transient Immunity in Low stage is the maximum tolerable slew rate of the common mode impulse signal, V_{CM} , to assure that the output will remain low ($V_0 < 0.8V$). Equal value split resistors must be used at both ends of the LED.



ELECTRICAL CHARACTERISTICS (Over Recommended Operating Conditions, $T_A = -40^{\circ}\text{C}$ to 105°C, unless otherwise specified. Typical Values at $T_A = 25^{\circ}\text{C}$)

ISOLATION

Parameter	Symbol	Test Condition	Min	Тур.	Max	Unit
Insulation Voltage	$ m V_{ISO}$	$RH \le 50\%, t = 1 \text{ min}, T_A = 25^{\circ}C$	5000			V_{RMS}
Input - Output Resistance	R _{I-O}	$V_{\text{I-O}} = 500 \text{VDC}$		10 ¹²		Ω
Input - Output Capacitance	C _{I-O}	$f = 1MHz$, $T_A = 25$ °C		1.0		pF



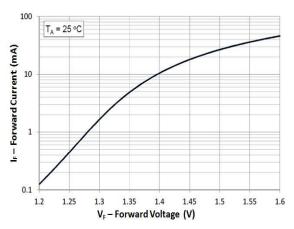


Fig 1 Forward Current vs Forward Voltage

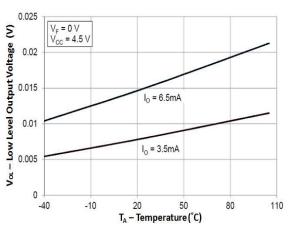


Fig 3 Low Level Output Voltage vs Ambient Temperature

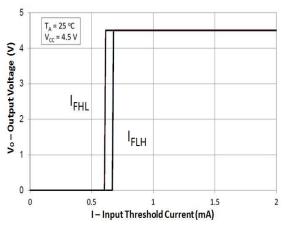


Fig 5 Hysteresis -Output Voltage vs Input Threshold Current

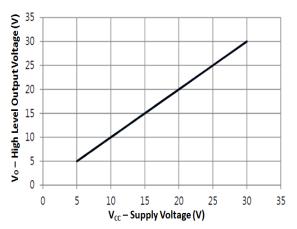


Fig 2 High Level Output Voltage vs Supply Voltage

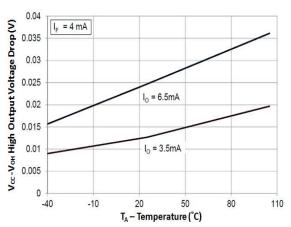


Fig 4 High Level Output Voltage Drop vs Ambient temperature

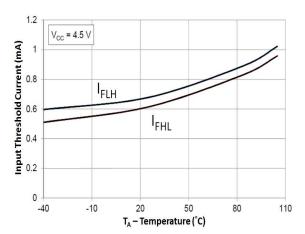


Fig 6 Input Threshold Current vs Ambient Temperature



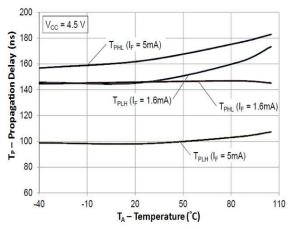


Fig 7 Propagation Delay vs Ambient Temperature at V_{CC} 4.5V

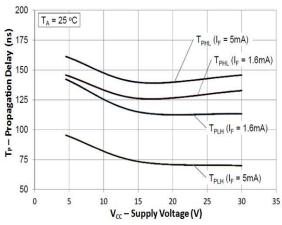


Fig 9 Propagation Delay vs Supply Voltage

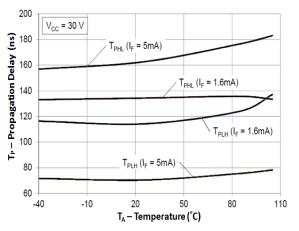
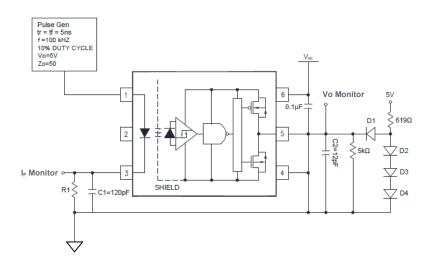
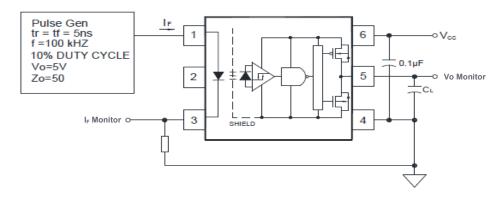
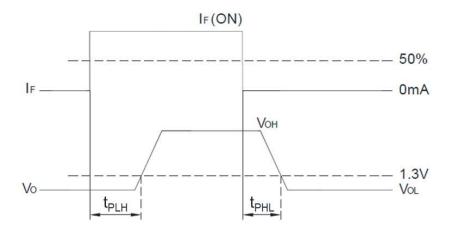


Fig 8 Propagation Delay vs Ambient Temperature at $V_{\rm CC}\,30V$



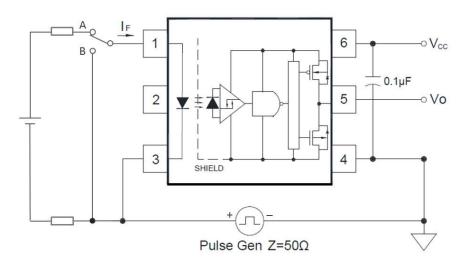




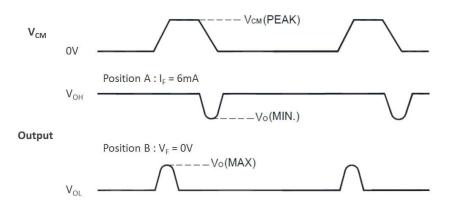


 $t_{r},\,t_{f},\,t_{PLH}$ and t_{PHL} Test Circuit and Waveform

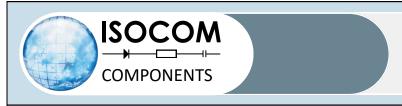




Equal value split resistors must be used at both ends of the LED.



CMR Test Circuit and Waveform



ORDER INFORMATION

IS480P				
After PN	PN	Description	Packing quantity	
None	IS480P	Stretched SO6	1000 pcs per reel	

DEVICE MARKING



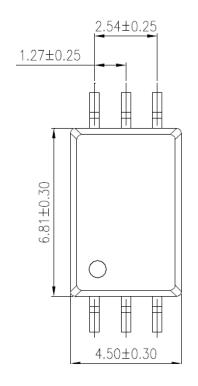
480P denotes Device Part Number

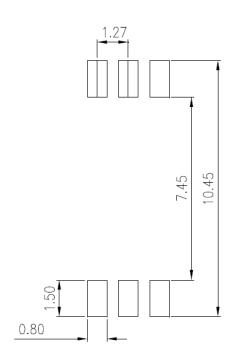
YY denotes 2 digit Year code

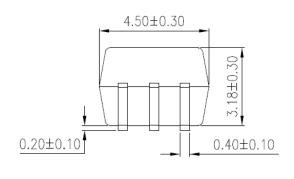
WW denotes 2 digit Week code

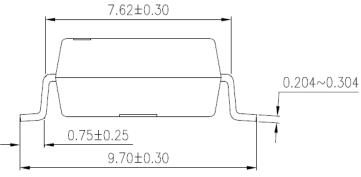


PACKAGE DIMENSIONS and Recommended PCB Pad Layout in mm (inch)



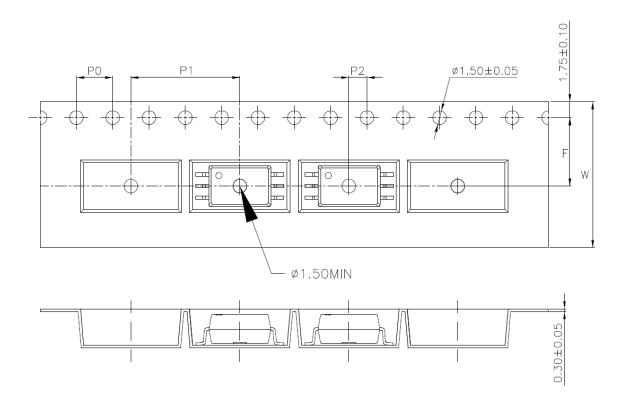








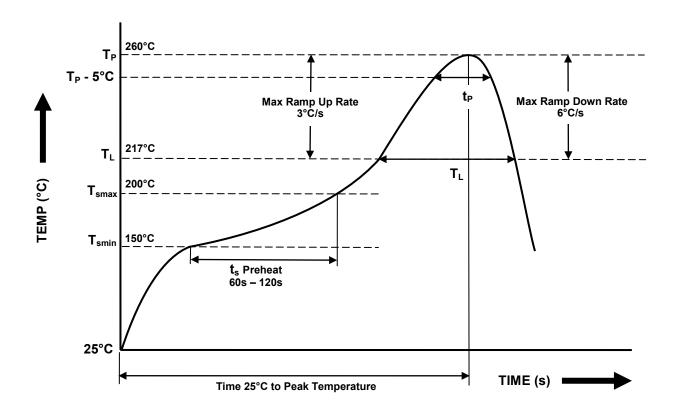
TAPE AND REEL PACKAGING



Description	Symbol	Dimension mm (inch)
Tape Width	W	16 ± 0.3 (0.63)
Pitch of Sprocket Holes	P ₀	4 ± 0.1 (0.16)
Distance of Compartment to Sprocket Holes	F	7.5 ± 0.1 (0.3)
Distance of Compartment to Sprocket Flores	P ₂	2 ± 0.1 (0.079)
Distance of Compartment to Compartment	P ₁	12 ± 0.1 (0.47)



IR REFLOW SOLDERING TEMPERATURE PROFILE (One Time Reflow Soldering is Recommended)

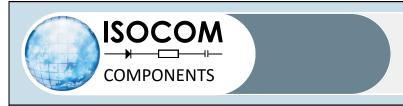


Profile Details	Conditions
$ \begin{array}{l} \textbf{Preheat} \\ \textbf{- Min Temperature } (T_{SMIN}) \\ \textbf{- Max Temperature } (T_{SMAX}) \\ \textbf{- Time T}_{SMIN} \ to T_{SMAX} \left(t_s \right) \\ \end{array} $	150°C 200°C 60s - 120s
$\begin{tabular}{lll} \textbf{Soldering Zone} \\ &- \mbox{Peak Temperature } (T_P) \\ &- \mbox{Time at Peak Temperature} \\ &- \mbox{Liquidous Temperature } (T_L) \\ &- \mbox{Time within } 5^{\circ}\mbox{C of Actual Peak Temperature } (T_P - 5^{\circ}\mbox{C}) \\ &- \mbox{Time maintained above } T_L (t_L) \\ &- \mbox{Ramp Up Rate } (T_L \mbox{ to } T_P) \\ &- \mbox{Ramp Down Rate } (T_P \mbox{ to } T_L) \\ \end{tabular}$	260°C 10s max 217°C 30s max 60s - 100s 3°C/s max 6°C/s max
Average Ramp Up Rate (T _{smax} to T _P)	3°C/s max
Time 25°C to Peak Temperature	8 minutes max



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