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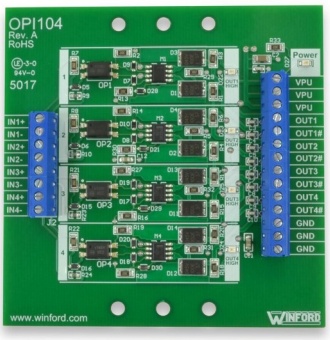
OPI104 Datasheet

Product Revision: Rev A



OPI104-FT shown

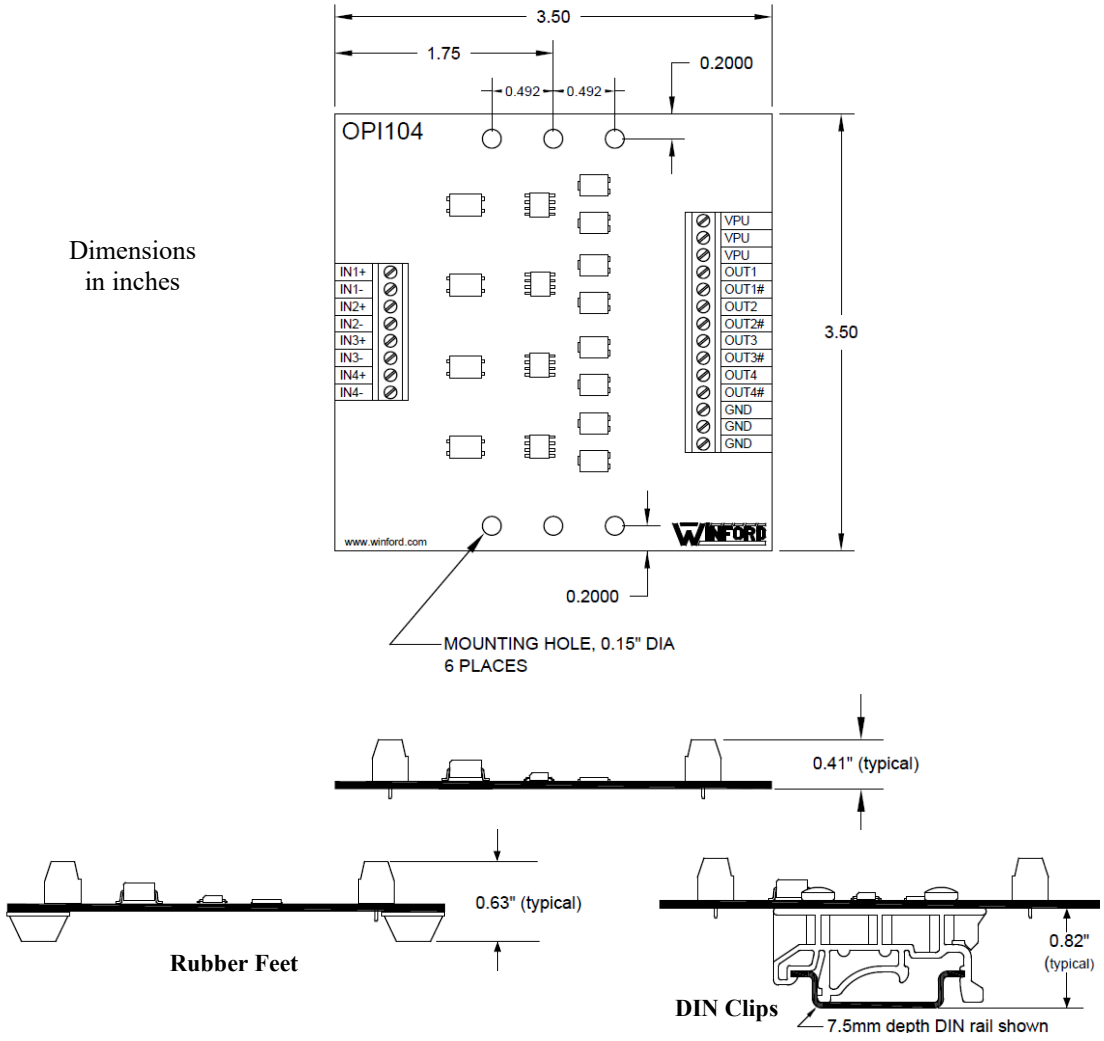
Overview

The OPI104 provides four channels of optical isolation with both a non-inverting output and an inverting output for each channel. Both the input side and the output side are designed to interface with equipment using logic voltages of anywhere from 3.3V to 24V. This robust design includes protected low-side output drivers that provide significant sink current capability. Reverse-polarity protection on inputs and outputs is also included. Terminal blocks provide easy access to the signals. Also see the OPI104-HS variation (separate datasheet) which has fewer protections, but higher speed.

Note that on the output side, the pull-up voltage (VPU) and ground reference (GND) are common to all four channels. On the input-side, the four channels are completely independent.

Drawing

Dimensions in inches



Part Number Ordering Information

OPI104	-	
		1

1. Mounting Option

- **FT** Rubber Feet on bottom side of PCB
- **DIN** DIN Rail Mounting Clips

OPI104 Stocked Part Numbers

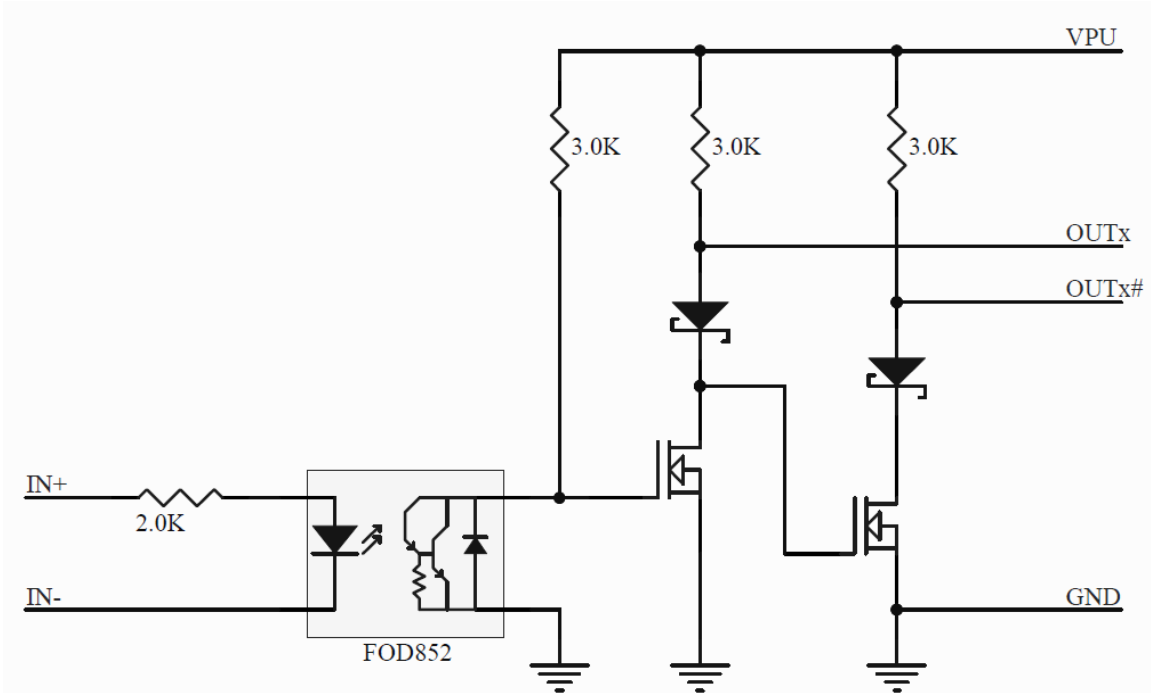
The following part numbers represent standard options that are normally stocked:

- OPI104-FT
- OPI104-DIN

Note: The following additional options are stocked; these boards utilize a high-speed output stage. See the OPI104-HS datasheet for details.

- OPI104-HS-FT (high-speed outputs)
- OPI104-HS-DIN (high-speed outputs)

Simplified Schematic Drawing (one channel)



Note that VPU and GND (output side) are common to all four channels.

Operating Conditions

Ambient Temperature Range	–30°C to 85°C
Relative Humidity Range - not icing or condensing	5% to 85% RH

Absolute Maximum Ratings

Specification	Symbol	Min	Typ	Max	Unit
Input Signal Voltage (INx+ relative to INx-)	INx			28	V
Output Pull-Up Voltage (relative to GND)	VPU			30	V
Max rated sink current @ -30 degC VPU = 3.3V VPU = 5.0V VPU = 12V VPU = 24V	IOUTx, IOUTx#			 1.5 1.7 1.8 1.8	 A A A A
Max rated sink current @ 25 degC VPU = 3.3V VPU = 5.0V VPU = 12V VPU = 24V	IOUTx, IOUTx#			 1.0 1.3 1.5 1.5	 A A A A
Max rated sink current @ 85 degC VPU = 3.3V VPU = 5.0V VPU = 12V VPU = 24V	IOUTx, IOUTx#			 0.5 0.8 1.0 1.0	 A A A A

Electrical Performance and Recommended Operating Conditions (at 25 degC)

Specification / Conditions	Min	Typ	Max	Unit
INx Input Voltage for guaranteed logic low	0.0		0.8	V
INx Input Voltage for guaranteed logic high	3.2		25	V
Typical INx logic switching threshold		2.0		V
Input current, INx = 3.3V		1.0		mA
Input current, INx = 5.0V		2.0		mA
Input current, INx = 12V		5.3		mA
Input current, INx = 24V		11		mA
VPU (output-side pullup voltage) recommended operating range	3.2		25	V
VPU supply current draw (no external loading)		15	20	mA

Specification / Conditions	Min	Typ	Max	Unit
Non-inverting output OUTx Voltage, Low State (FET active) INx = Logic Low VPU = 3.3V				
RLOAD = 2.7 Ohms		0.60	0.85	V
RLOAD = not present		0.15	0.30	V
Inverting output OUTx# Voltage, Low State (FET active) INx = Logic High VPU = 3.3V				
RLOAD = 2.7 Ohms		0.60	0.85	V
RLOAD = not present		0.15	0.30	V
Non-inverting output OUTx Voltage, Low State (FET active) INx = Logic Low VPU = 5.0V				
RLOAD = 3.5 Ohms		0.57	0.80	V
RLOAD = not present		0.15	0.30	V
Inverting output OUTx# Voltage, Low State (FET active) INx = Logic High VPU = 5.0V				
RLOAD = 3.5 Ohms		0.57	0.80	V
RLOAD = not present		0.15	0.30	V
Non-inverting output OUTx Voltage, Low State (FET active) INx = Logic Low VPU = 12.0V				V
RLOAD = 7.7 Ohms		0.55	0.80	
RLOAD = not present		0.17	0.32	
Inverting output OUTx# Voltage, Low State (FET active) INx = Logic High VPU = 12.0V				V
RLOAD = 7.7 Ohms		0.55	0.80	
RLOAD = not present		0.17	0.32	
Non-inverting output OUTx Voltage, Low State (FET active) INx = Logic Low VPU = 24.0V				V
RLOAD = 16 Ohms		0.55	0.80	
RLOAD = not present		0.17	0.35	
Inverting output OUTx# Voltage, Low State (FET active) INx = Logic High VPU = 24.0V				V
RLOAD = 16 Ohms		0.55	0.80	
RLOAD = not present		0.17	0.35	
Non-inverting output OUTx Voltage, High State INx = Logic High VPU = 3.2V to 25V No external loading	VPU – 0.3			V

Specification / Conditions	Min	Typ	Max	Unit
Inverting output OUTx# Voltage, High State INx = Logic Low VPU = 3.2V to 25V No external loading	VPU – 0.3			V

Optocoupler Isolation Performance*

Specification	Symbol	Value	Unit
Maximum Working Insulation Voltage (continuous) *(assumes no contamination on the PCB)*	V_{IORM}	850	V_{peak}
Highest Allowable Over-voltage (transient) *(assumes no contamination on the PCB)*	V_{IOTM}	6000	V_{peak}

*Refer to the optocoupler datasheet for additional information. Optocoupler manufacturer and part number are listed in the Component Details section of this document.

Screw Terminal Wire Sizes

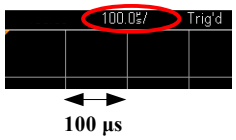
- All Signals and Power: 16-26 AWG

Component Details

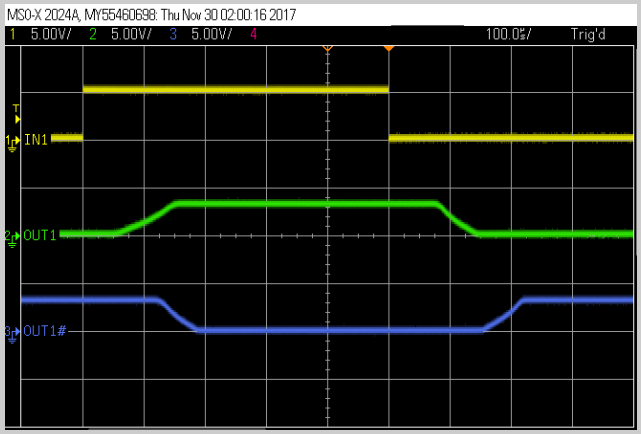
Component	Manufacturer	Manuf. Part Number
Optocoupler	ON Semiconductor	FOD852
Input Resistor	(any)	2.0 kΩ
Output Pull-up Resistor	(any)	3.0 kΩ
Output Low-Side Driver, Dual	ON Semiconductor	NCV8402AD
Output Diode (reverse-polarity protection)	Nexperia	PMEG045V100EPD

Timing Performance

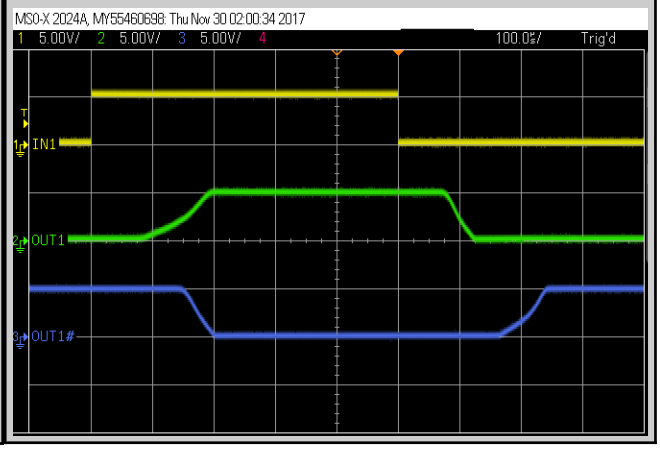
Typical signal timing is provided below (for a single channel). Due to limitations associated with the protected output driver, this product is designed for relatively low-speed applications. As the input signal frequency increases, the delays and the asymmetry between the non-inverting and inverting output become more significant. All plots below use a time scale of 100 µs (microseconds) per division:



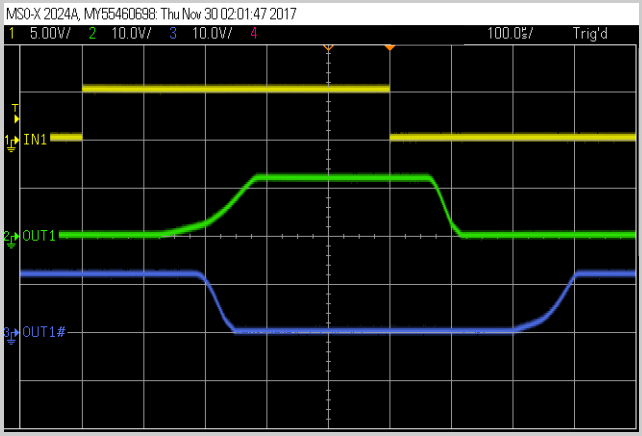
VPU = 3.3V, No External Loading



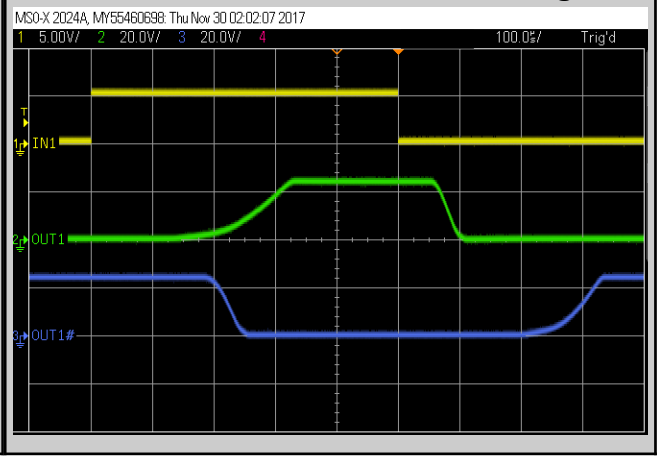
VPU = 5.0V, No External Loading



VPU = 12V, No External Loading

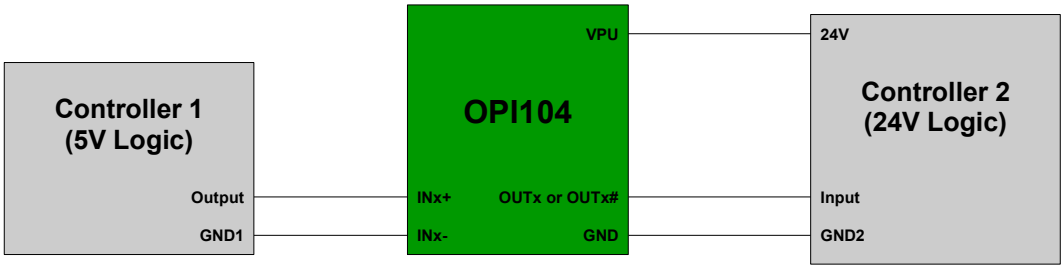


VPU = 24V, No External Loading

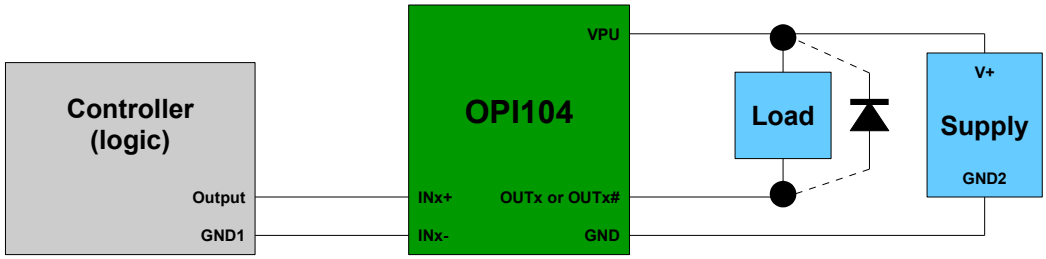


Applications

This product allows a digital signal to be sent from one circuit to another while maintaining isolation between the two circuits. This is useful when the two circuits are operating at different ground potentials by design, as well as the case in which there may be a ground shift between the two circuits due to a common-impedance condition in which the ground line is shared with a high-current load. In addition, this product provides a method to perform logic level translation since it allows the two circuits to use different logic voltages.



This product is also suitable for use as an isolated low-side driver for a small DC motor, solenoid, relay coil, bulb, or similar. For this type of application in which the low-side output driver sinks additional current beyond the current flowing thru the output pull-up resistor, the user should note the electrical performance characteristics table in which max rated sink current is specified for various conditions. It is also advisable to include external clamping for inductive loads (e.g., diode placed across the load, as shown below).



This product provides both a non-inverting output and an inverting output on each channel. Note that both outputs (non-inverting and inverting) are open-drain outputs. That is, each of the outputs is able to sink a significant amount of current, but can only source current thru its output pull-up resistor.

For a thorough understanding of the protection features included in the output driver, please refer to the ON Semiconductor datasheet for device NCV8402AD.

If there are additional questions about using this product in a particular application, please contact Winford Engineering for more information.

Changes

Date	Description
06/22/2022	• Updated boilerplate items in data sheet • Added reference to OPI104-HS option
06/08/2023	• Added clarification indicating that VPU and GND are common to all 4 channels (output side)

Notices

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