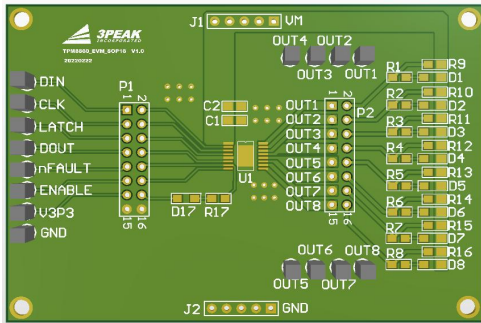


TPM8860 Driver EVM User's Guide



Key Features

- 8-Channel Smart Low-side Driver Array
 - 40-V Max Operating voltage, 48-V ABS Max Voltage
 - 500-mΩ Low- $R_{DS(ON)}$ with Maximum 1.5-A Driver Capability
 - Integrated Free-wheeling Diodes for Inductive Loads
- 10-MHz High-speed 16-bit Shift Register Interface
 - Input Noise Filtering with Daisy Chain Communication
- Diagnostics and Protection
 - Over-Current Protection
 - Short-Circuit Protection
 - Over-Temperature Protection
 - Open-drain Fault Alarm

DESCRIPTIONS

The TPM8860 provides an 8-ch low-side driver with channel independent protection and diagnostics. It has low $R_{DS(ON)}$ MOSFET array with free-wheeling diodes to support all kinds of loads, resistive, inductive and capacitive. It supports single high-voltage supply.

It supports high-speed shift register interface with daisy-chain individually control each channel. Over-current protection, short-circuit and open-circuit allows controller to protect the system from faulty loads.

APPLICATIONS

- Relays, Solenoids, Unipolar Stepper Motors
- Electric Expansion Valves, Linear Valves
- LEDs and Heaters
- PLC Digital Outputs

Revision History

Revise Date	Version	Reason/Issue
2024-11-28	A0	First Issue

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1. Performance Specification

A summary of the TPM8860 EVM performance specifications is provided in Table.1. Specifications are given for VM=12V, unless otherwise specified. The ambient temperature is 25 °C for all measurements, unless otherwise noted.

Table.1 TPM8860 EVM Performance Specification

PARAMETER	TEST CONDITIONS	MIN	Type	Max	UNITS
INPUT CHARACTERISTICS					
Power Supply Voltage, VM		5		40	V
Logic Input Voltage		0		5.5	V
OUTPUT CHARACTERISTICS					
Output voltage, Voutx		0		40	V
Open Drain Output Voltage		0		5.5	V
Output current range, Ioutx				1.5	A

2. EVM Documentation

2.1 Schematic

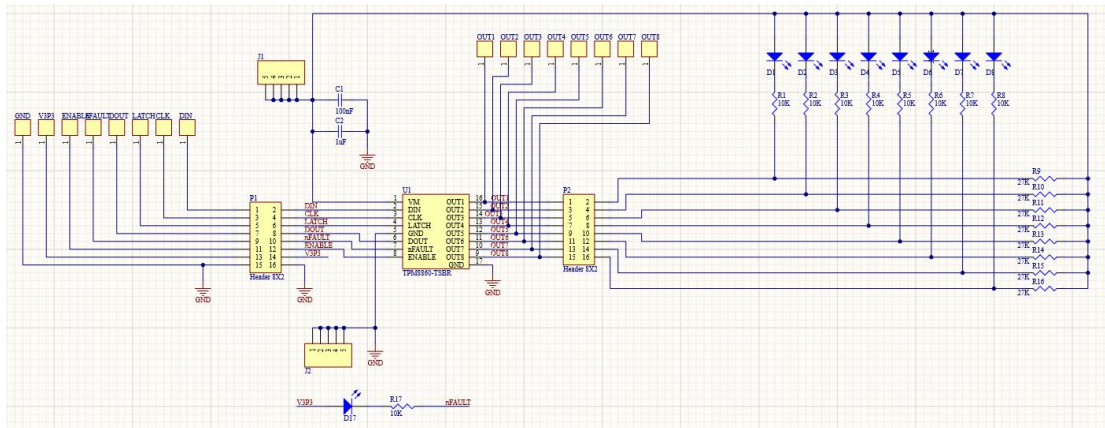


Fig. 1 TPM8860 EVM Schematic

2.2 Bill of Material

Table.2 TPM8860 EVM Bill of Materials

Designator	Qty	Value	Description	Package	MFR
C1	1	100nF	CAP, 100nF, 100V X7R	0805	Murata
C2	1	1uF	CAP, 1uF, 100V X7R	0805	Murata
D1, D2, D3, D4, D5, D6, D7, D8, D17	9		LED, Green	1206	Togjaled
J1, J2	2		Header, 100mil, 1*3	HDR1X5	
P1, P2	2		Header, 100mil, 2*8	HDR2X8	
R1, R2, R3, R4, R5, R6, R7, R8, R17	9	10k	Res,1%,0.125W	0805	Yageo
R9, R10, R11, R12, R13, R14, R15, R16	8	27k	Res,1%,0.125W	0805	Yageo
U1	1		8-CH Low-Side Driver	TSSOP16	3PEAK
CLK, DIN, DOUT, ENABLE, LATCH, nFAULT, OUT1, OUT2, OUT3, OUT4, OUT5, OUT6, OUT7, OUT8, V3P3, GND	16		Test Point	SIP	

2.3 PCB Layout

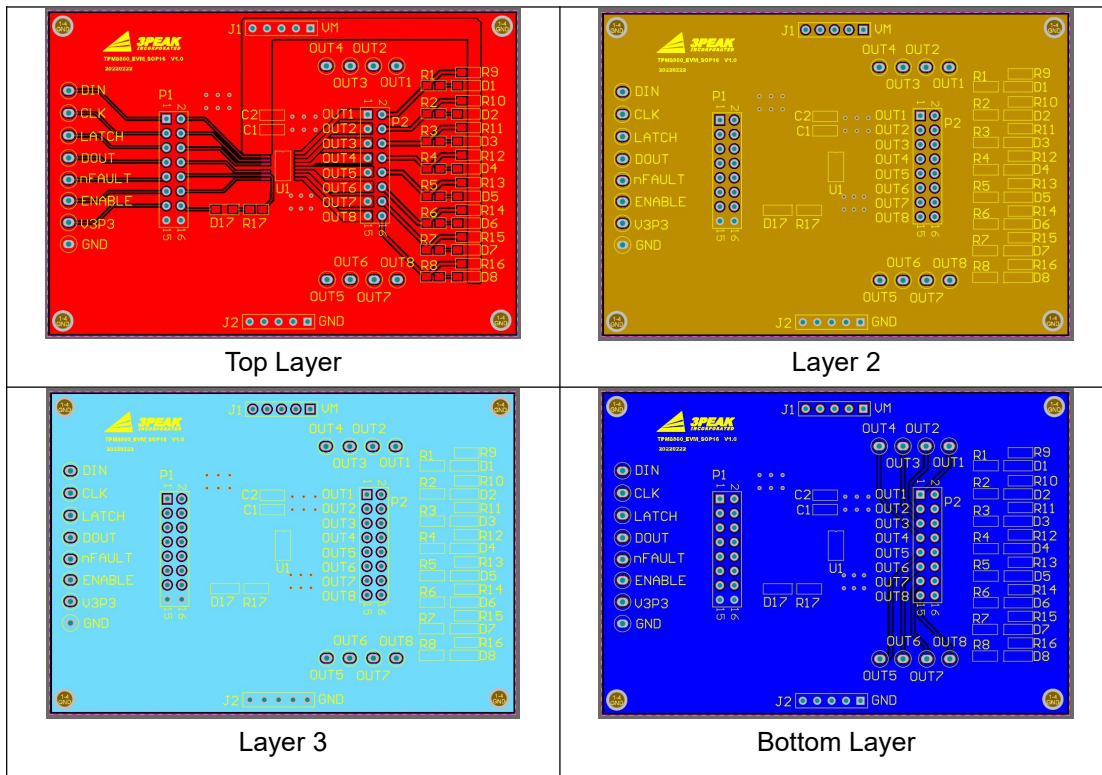


Fig. 2 TPM8860 EVM PCB Layout

3. Test Setup and Procedure

3.1 Test Setup

The TPM8860 EVM is provided with input/output connectors and test points as shown in Table.3.

Table.3 TPM8860 EVM Connections

Designator	Name	Description
J1	VM	Input voltage connection
J2	GND	GND connection
P1	Signal Jumper	Digital input signal jumper
P2	OUT Jumper	OUTx to LED jumper
OUT1	OUT1 Sense	Voltage sense pin of OUT1
OUT2	OUT2 Sense	Voltage sense pin of OUT2
OUT3	OUT3 Sense	Voltage sense pin of OUT3
OUT4	OUT4 Sense	Voltage sense pin of OUT4
OUT5	OUT5 Sense	Voltage sense pin of OUT5
OUT6	OUT6 Sense	Voltage sense pin of OUT6
OUT7	OUT7 Sense	Voltage sense pin of OUT7
OUT8	OUT8 Sense	Voltage sense pin of OUT8

Referring to Table.3, the recommended connections to evaluate TPM8860-EVM is shown in Fig.3.

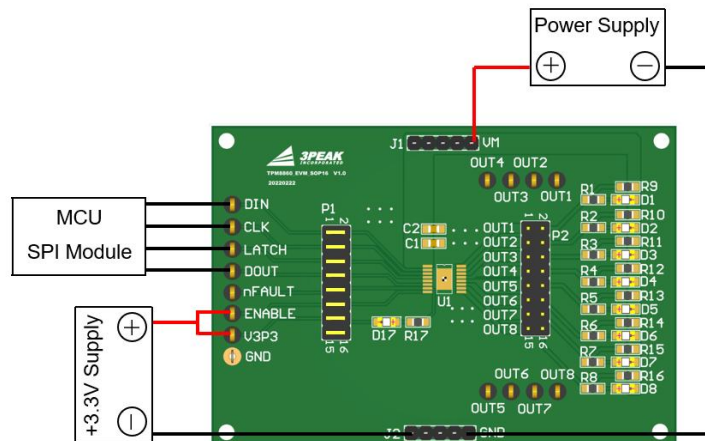


Fig. 3 EVM Test Setup

3.2 Test Equipment

Table.4 is the equipment used by 3PEAK, can also use other model of instruments which can support the voltage, current and power level of this EVM test. Multimeters are used as voltage or current meters which measure the voltage and current of input and output.

Table.4 Test Equipment Used by 3PEAK

Instruments	Model	Vender
DC Source	GPD3303S	GWINSTEK
DC Source	DP832	RIGOL
Oscilloscope	EXR058A	Keysight
Multimeter	34461A	Keysight

3.3 Test Procedure

- Set up the EVM as described in Fig.3.
- Set the input power VM supply to 12V and adjust the current limit to 0.5A.
- Set the input power V3P3 supply to 3.3V and adjust the current limit to 0.1A.
- Enable or disable the output of TPM8860 via SPI.
- Multimeters are used as voltage measurement and current measurement.
- Oscilloscope is used to capture waveform like input voltage and others.

4. Test Results and Performance Evaluation

4.1 Output Rising Edge

Below shows the rising edge of the OUT voltage. By pulling down the EN, the LS MOS is turned off, and the OUT voltage rises from 0 to VM. The VM is set at 24V and the Iout is set at 500mA.

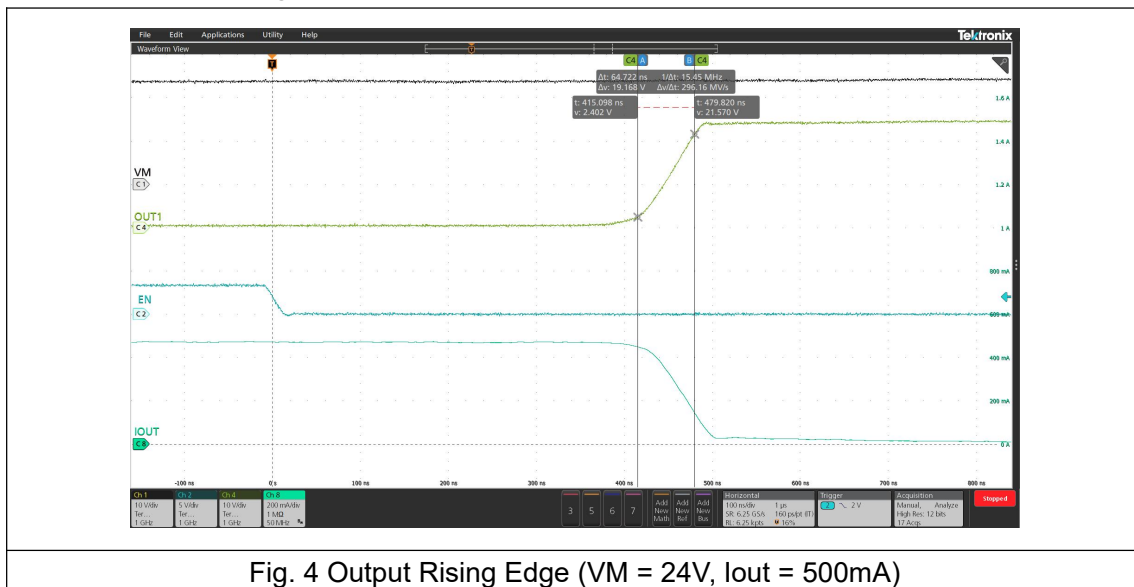


Fig. 4 Output Rising Edge (VM = 24V, Iout = 500mA)

4.2 Output Falling Edge

Below shows the Falling edge of the OUT voltage. By pulling up the EN, the LS MOS is turned on, and the OUT voltage falls from VM to 0. The VM is set at 24V and the Iout is set at 500mA.

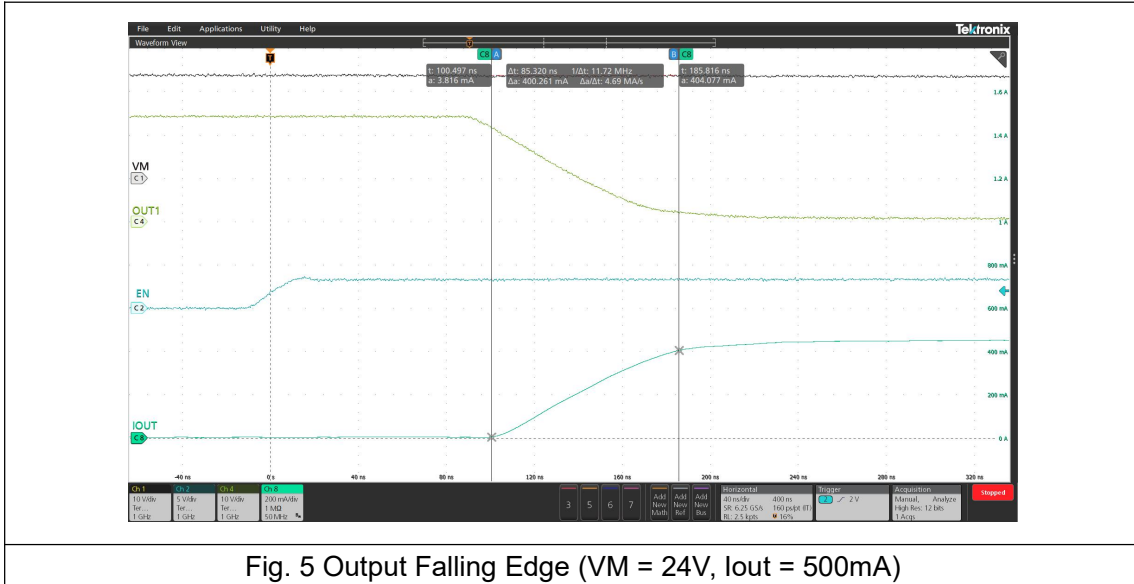


Fig. 5 Output Falling Edge (VM = 24V, Iout = 500mA)

4.3 Short Circuit Protection

Input Voltage is set to 24V and Output is short at the Output Jumper and VM Connector by a short wire. Iout current is captured in waveform. After the OCP is triggered, the LS MOS is turned off and nFAULT is pulled down.

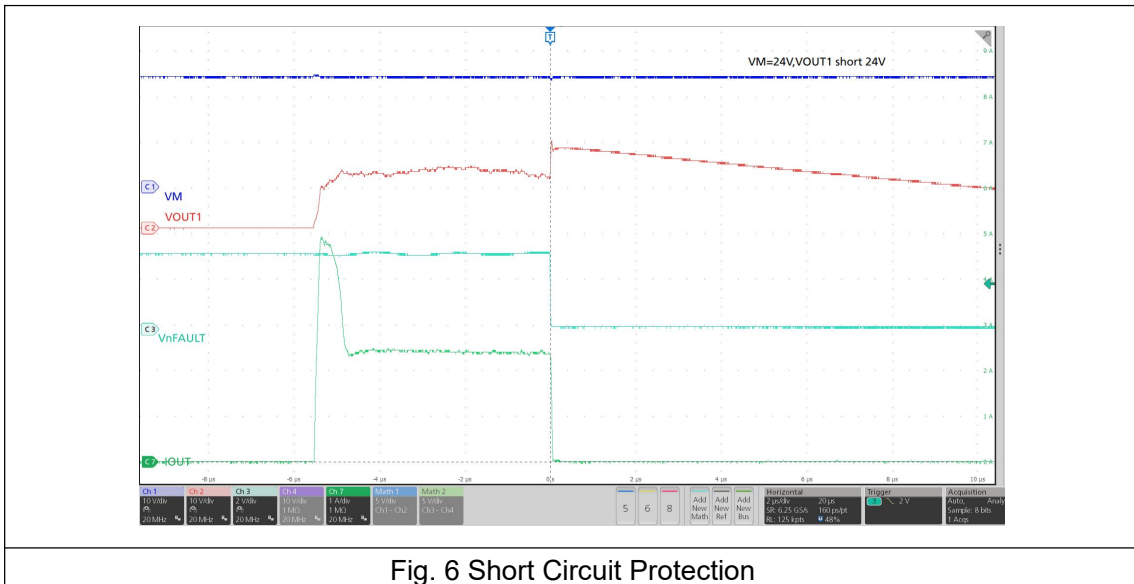


Fig. 6 Short Circuit Protection

4.4 Open-Load Protection

Below shows the MOSFET is turned off when the LATCH signal is pulled high through SPI configuration. If the chip detects that the OUT voltage drops below V_{OL_TH} and remains in this state for a duration exceeding T_{OL_deg} , it will trigger an OLD fault and pull the nFAULT pin down.

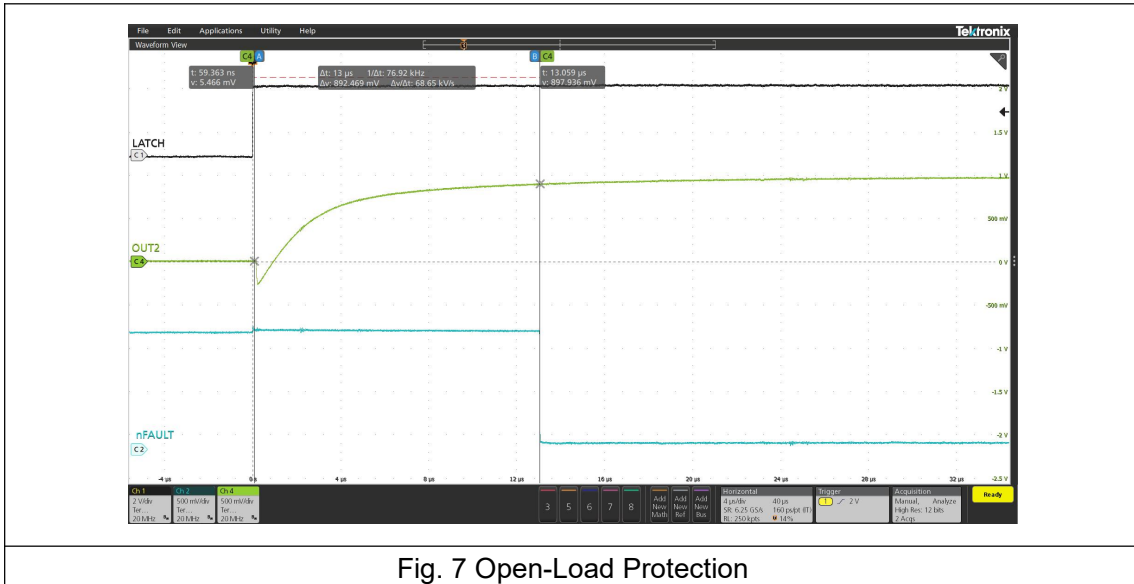


Fig. 7 Open-Load Protection

4.5 Serial Interface Read

The TPM8860 is designed for digital output control in appliance and industrial applications. It features an SPI communication interface provide reliable output control. Through the SPI interface, the main controller can send commands to TPM8860 to control the on/off state of each channel. Below shows the SPI read operation. For more information, please refer to the datasheet.

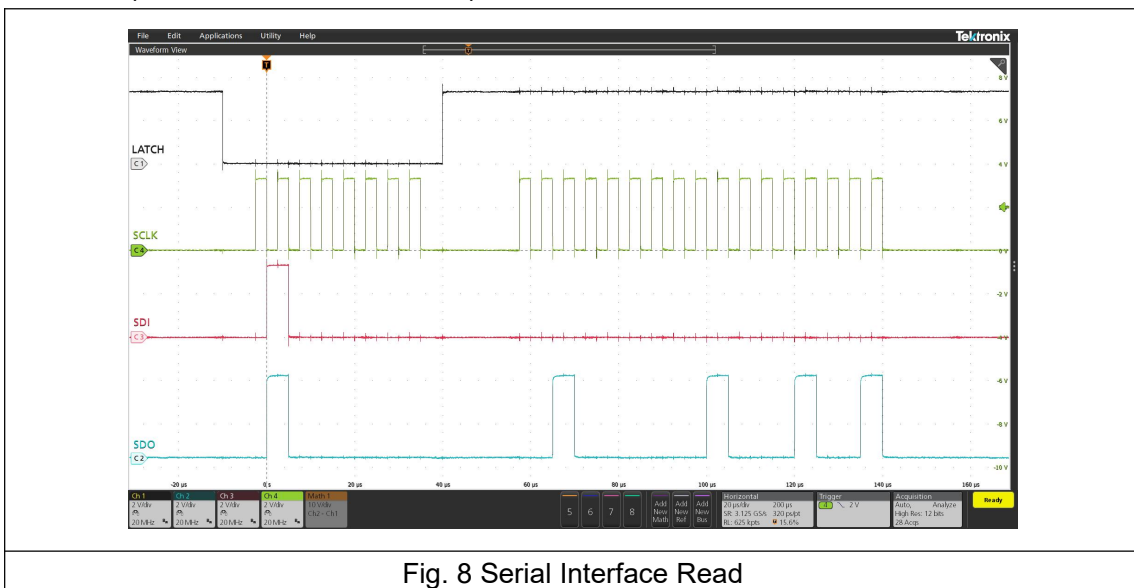
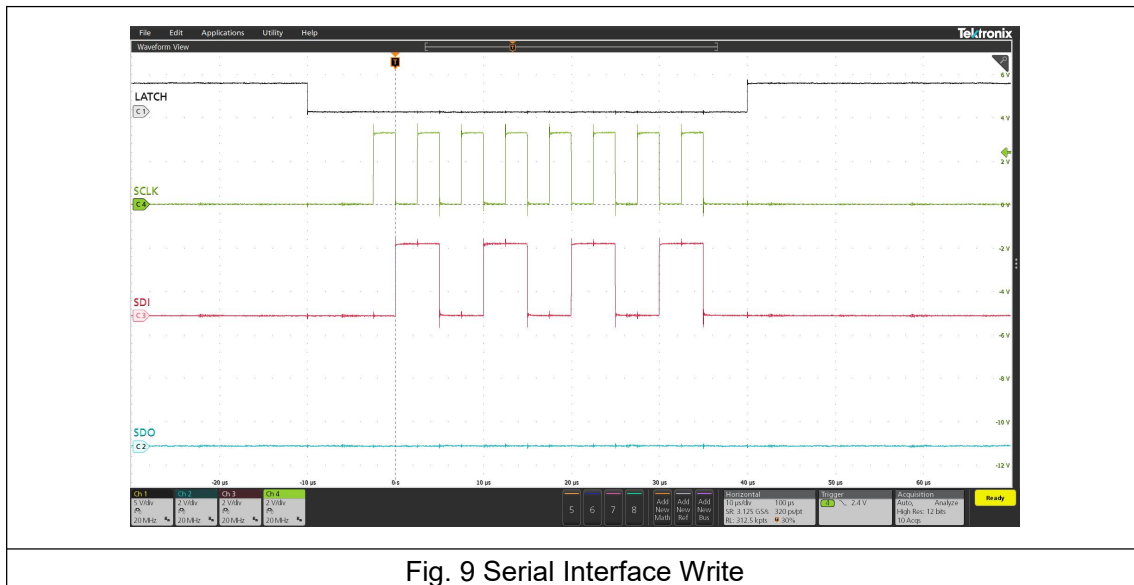


Fig. 8 Serial Interface Read

4.6 Serial Interface Write

Below shows the SPI write operation. For more information, please refer to the datasheet.



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