Tektronix DPO Demo 2 Board

Instruction Manual

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Tektronix

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Tektronix DPO Demo 2 Board

The Tektronix DPO Demo 2 board provides signals you can use to demonstrate features of Tektronix oscilloscopes.

Connections

Plug a USB cable between your computer and the Demo 2 board. When you apply power to the board, a green LED on the board turns on.

Signals

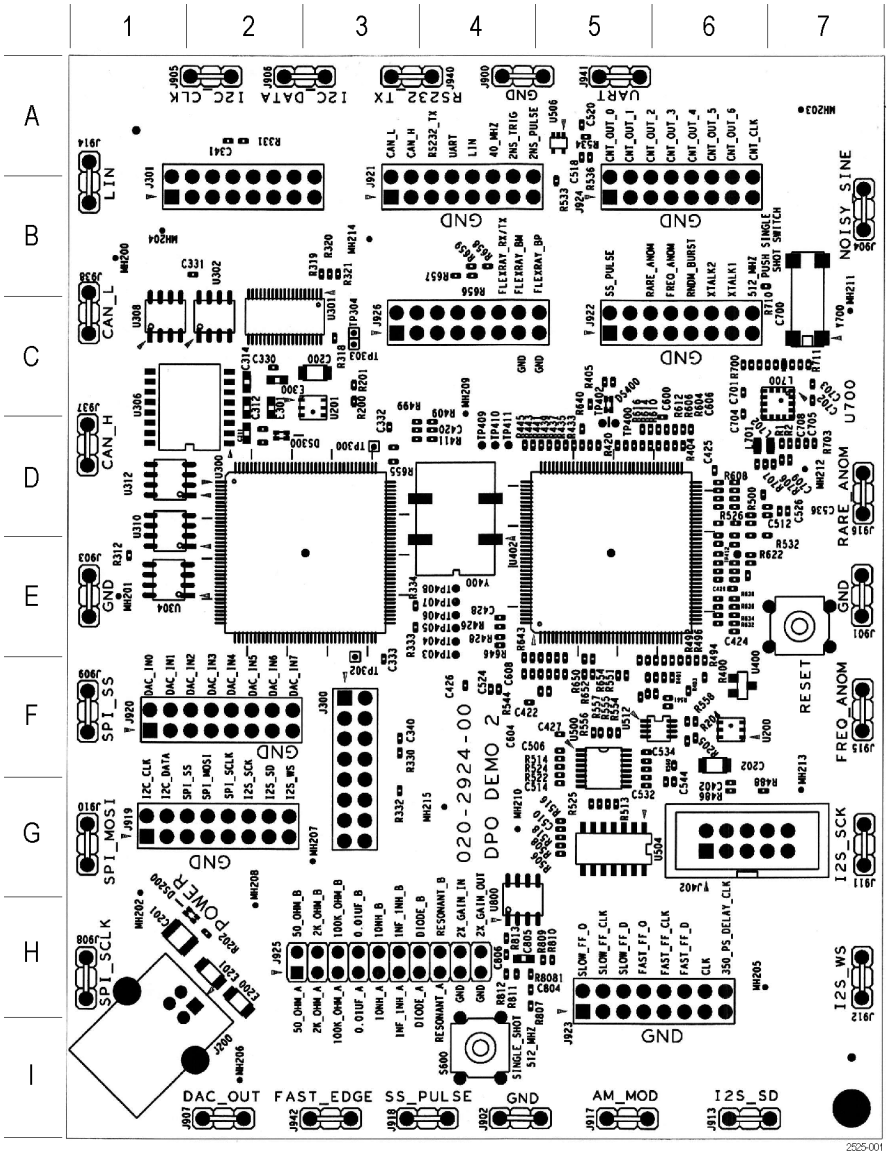

Figure 1: Tektronix Demo 2 board and locator grid

The diagram includes a grid to help you locate signal pins on connectors and on headers. To find the desired signal on the diagram, look up the grid location in the signal description, and then use the grid to find that location on the diagram and on the board. (See Figure 1.)

Noisy Sine

Board label. NOISY SINE

Connector grid location. B7

Description. The Noisy Sine signal is an audio frequency (1.25 kHz) sine wave with power supply switching noise style spikes (156 kHz), and of very high frequency noise (20 MHz pseudorandom) caused by a micro-controller/DSP system.

I²C Bus

Board label. I2C CLK, I2C DATA

Connector grid location. A2, G1

Description. These are the I²C (Inter-IC Communication) bus signals between the μC and a serial EEPROM.

There are several different types of data packets.

The clock rate is a 100 kHz, 0 to 5 volt signal.

SPI Bus

Board label. SPI SCLK, SPI SS, SPI MOSI

Connector grid location. F1, G1, G2, H1

Description. These are the SPI (Serial Peripheral Interface) serial bus signals. (See Figure 2.)

The SPI bus works as follows:

- SCLK rising edge latch,
- Active Low SS,
- Active High MOSI

This is the beginning of the mixed signal chain. See the descriptions of these signals: DAC Input, Parallel and DAC Output.

Packets occur approximately every 5 ms. The SPI packet contents are transferred to the Parallel DAC Input bus at the end of the packet. The Parallel DAC Input bus then changes the voltage output of the DAC.

The resulting DAC output is a sine wave with an amplitude 0 to 3 volts, and a period of 310 ms.

The clock rate is a 100 kHz, 0 to 5 volt signal.

DAC Input, Parallel

Board label. DAC IN0: DAC IN7

Connector grid location. F1, F2

Description. These are the 8-bit parallel output signals of the port expander in the middle of the mixed signal chain. The sine wave data from the SPI bus is converted to 8 parallel bits to drive the DAC. DAC IN0 is the LSB. (See Figure 2.)

See the previous SPI Bus description for packet details.

DAC Output

Board label. DAC OUT

Connector grid location. I2

Description. This is the output of the DAC at the end of the mixed signal chain. The DAC is driven from the port expander. The DAC output is a sine wave. Since the output is not filtered, the digitizing levels are obvious in the output waveform. (See Figure 2.)

The resulting DAC voltage is a sine wave with an amplitude 0 to 3 volts, and a period of 310 ms.

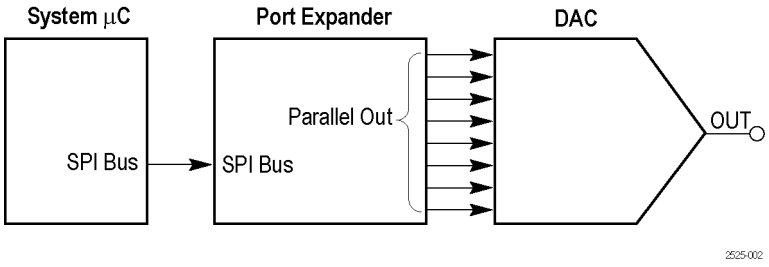

Figure 2: Mixed signal chain block diagram

I2S (Inter-IC Sound) Bus

Board label. I2S SCK, I2S WS, I2S SD

Connector grid location. G2, G7, H7, I6

Description. This is an I2S (Inter-IC sound) serial bus.

The clock rate is 2.5 MHz.

CAN Bus

Board label. CAN_H, CAN_L

Connector grid location. B3, C1, D1

Description. These are the CAN (Controller Area Network) bus signals between two CAN transceivers.

The bit rate of the data packet is 500 kbps.

LIN Bus

Board label. LIN

Connector grid location. B1, B4

Description. This is the LIN (Local Interconnect Network) bus signal between two LIN transceivers.

The bus speed is 19.2 kbaud. It contains a mix of version 1.x and 2.x frames.

RS232 UART, Transmit

Board label. RS232 UART, RS232 TX

Connector grid location. A3, A5, B4

Description. The UART signal is the logic level input to the RS-232 UART from the μC. The transmit signal (TX) is the RS-232 voltage level serial bus signal.

The decoded data packets display the ASCII string: Tektronix, Enabling Innovation.

There are no matching receive or data flow control signals.

The baud rate is 9600. The data format is 1 start bit, and 8 data bits with no parity.

2 ns Pulse

Board label. 2NS PULSE

Connector grid location. B4

Description. This signal is a 2 ns to 3 ns, 2.5 V pulse at a 3.3 ms repetition rate. Use this signal to demonstrate the minimum pulse width capture specification of an instrument's digital acquisition system.

2 ns Pulse Trigger

Board label. 2NS TRIG

Connector grid location. B4

Description. This is the trigger edge signal for the 2 ns pulse. A falling edge on this signal occurs approximately 1 ns before the 2 ns pulse.

Crosstalk

Board label. XTALK1, XTALK2

Connector grid location. C6

Description. These two signals have significant crosstalk between them. Use them to demonstrate MagniVu.

Fast Edge

Board label. FAST EDGE

Connector grid location. I3

Description. This is a 156 kHz capacitively coupled square wave signal with a 3 ns rise and fall time.

Fast FF Clock

Board label. FAST FF CLK

Connector grid location. H5

Description. This is the 1.25 MHz clock input signal to a fairly fast flip-flop.

Fast FF Data

Board label. FAST FF D

Connector grid location. H6

Description:

This is the 1.25 MHz data input signal to a fairly fast flip-flop that is asynchronous to the clock input.

Fast FF Q Output

Board label. FAST FF Q

Connector grid location. H6

Description. This is the Q output signal of the fairly fast flip-flop. This signal shows metastable behavior infrequently.

Slow FF Clock

Board label. SLOW FF CLK

Connector grid location. H5

Description. This is the 1.25 MHz clock input signal to a slow flip-flop.

Slow FF Data

Board label. SLOW FF D

Connector grid location. H5

Description:

This is the 1.25 MHz data input signal to a slow flip-flop that is asynchronous to the clock input.

Slow FF Q Output

Board label. SLOW FF D

Connector grid location. H5

Description. This is the Q output signal of the slow flip-flop. This signal shows metastable behavior frequently.

Counter Clock

Board label. CNT CLK

Connector grid location. B6

Description. This is the 1.25 MHz clock signal for the 7-bit Counter Output described next.

Counter Output Bits

Board label. CNT OUT0: CNT OUT6

Connector grid location. B5, B6

Description. These are the 7-bits of the binary counter. The LSB is CNT OUT0 at 625 KHz, that is, half of the counter input clock. There are random setup and hold time changes of 500 ps on bits 2 (CNT OUT1) and 4 (CNT OUT3) of this bus. Use these signals to demonstrate setup time and hold time bus triggering using MagniVu.

The Counter Output Bits and the Counter Clock signals are on eight adjacent sets of header pins for easy connection to a digital probe.

350 ps Delayed Clock

Board label. CLK, 350 PS DELAY

Connector grid location. H6

Description. This is a 156 kHz square wave signal and a delayed copy. Use the nominal 350 ps delay to demonstrate the 60.6 ps timing resolution of the MSO4000.

Random Burst

Board label. RNDM BURST

Connector grid location. C6

Description. This is the signal that produces Bursts of 100 ns wide logic pulses every 6.6 ms. The pattern is a pseudorandom bit sequence that repeats every 128 bursts and has a 6.32 µs duration.

Frequent Anomaly

Board label. FREQ ANOM

Connector grid location. C6, F7

Description. There are two frequently occurring anomalies in this pulse train.

A half height runt signal occurs approximately every 104.8 ms. Use a Runt trigger to isolate the signal.

A 50 ns (narrow) pulse appears approximately every 104.8 ms. Use a Pulse Width trigger to isolate the signal.

The pulse train is a repeating group of three pulses. The three pulses are 100 ns, 200 ns, and 100 ns wide, with a 100 ns low between. The group repeats at a 1.6 µs rate.

The anomaly is a group of four pulses. The four pulses are 100 ns, 50 ns (narrow), 100 ns (runt), and 100 ns wide, with a 100 ns low between, except for a 50 ns low before the runt.

Rare Anomaly

Board label. RARE ANOM

Connector grid location. C5, D7

Description. There are two less-frequent anomalies in this pulse train that can show up with DPO on DPO3000, DPO4000, and MSO4000 instruments.

A half-height runt signal occurs approximately every 838.8 ms. Use a Runt trigger to isolate the signal.

A 50 ns (narrow) pulse appears in approximately 838.8 ms. Use a Pulse Width trigger to isolate the signal.

The pulse train is a repeating group of three pulses. The three pulses are 100 ns, 200 ns, and 100 ns wide, with a 100 ns low between each pulse. The group repeats at a 1.6 µs rate.

The anomaly is a group of four pulses. The four pulses are 100 ns, 50 ns (narrow), 100 ns (runt), and 100 ns wide, with a 100 ns low between each pulse, except for a 50 ns low before the runt.

40 MHz

Board label. 40 MHZ

Connector grid location. A4

Description. This is a 40 MHz square wave signal.

AM Modulation

Board label. AM MOD

Connector grid location. I5

Description. This is a 1.25 MHz carrier amplitude signal modulated by a 1.25 kHz sine wave signal.

The AM Mod signal is centered around ground.

Set the oscilloscope trigger level to either the top or bottom of the waveform to stabilize it on the display.

Single Shot Pulse

Board label. SS PULSE

Connector grid location. C5, I4

Description. This is a 200 ns wide positive pulse that is initiated by the SINGLE SHOT push button (grid location I4). The Demo 2 board provides one pulse per button push.

The button serves as single-shot initiator and enables the 512 MHz signal.

512 MHz

Board label. 512 MHZ

Connector grid location. C6

Description. This is a 512 MHz, 600 mV peak-to-peak sine wave signal.

The SINGLE SHOT button serves as single-shot initiator and enables the 512 MHz signal.

FlexRay

Board label. FLEXRAY_BP, FLEXRAY_BM, FLEXRAY_TX/RX

Connector grid location. C4, C5

Description. These FlexRay signals consist of the following test points:

- FlexRay_BP, the positive half of a differential FlexRay bus
- FlexRay_BM, the negative half of a differential FlexRay bus
- FlexRay_Tx/Rx, the single-ended logic signal between the controller and the transceiver

The data rate is at 10 Mb/s. The swing is 0 to 3.3 V. Tri-state is at 1.65 V (BP and BM only). There are 15 individual 198-bit long frames.

Reset Button

Board label. RESET

Grid location. E7

Description. Press the **RESET** button to start RS-232 signals from a common start point.

Single Shot Button

Board label. SINGLE SHOT

Grid location. I4

Description. Press the **SINGLE SHOT** button to initiate a 200 ns pulse, and enable the 512 MHz signal.