

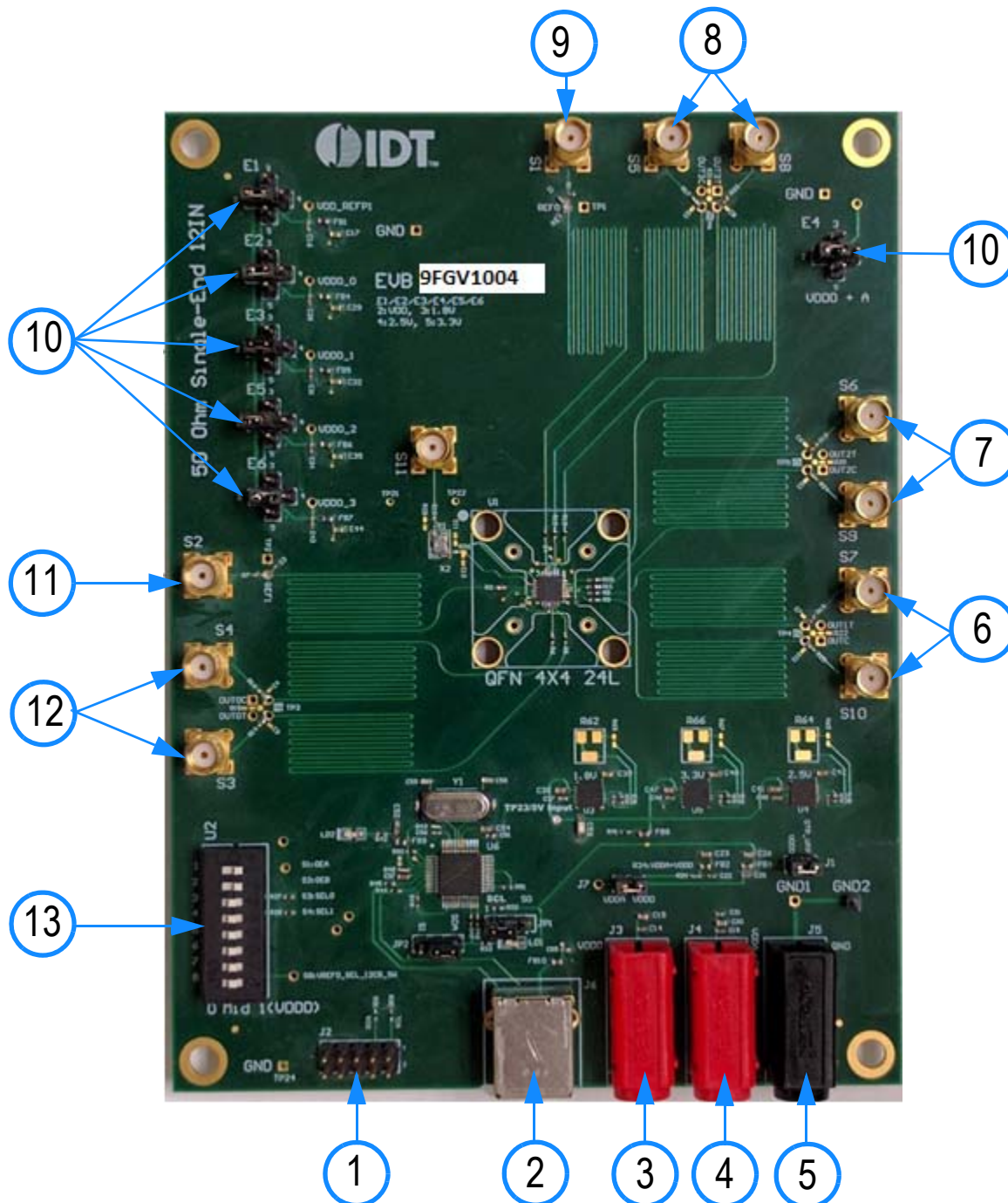
## Introduction

The evaluation board is designed to help the customer evaluate the 9FGV1001, 9FGV1002, and 9FGV1004 devices. When the board is connected to a PC running IDT [Timing Commander™](#) software through USB, the device can be configured and programmed to generate different combinations of frequencies.

## Board Overview

Use [Figure 1](#) and [Table 1](#) to identify: power supply jacks, USB connector, input and output frequency SMA connectors.

**Figure 1. Evaluation Board Overview**



**Table 1. Evaluation Board Pins and Functions**

| Label Number | Name                                 | On-board Connector Label | Function                                                                                                                                                                    |
|--------------|--------------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1            | I <sup>2</sup> C Interface Connector | J2                       | Alternative I <sup>2</sup> C interface connector for Aardvark. IDT Timing Commander can also use Aardvark.                                                                  |
| 2            | USB Connector                        | J6                       | Connect this USB to your PC to run IDT Timing Commander.<br>The board can be powered from the USB port.                                                                     |
| 3            | Output Power Supply Jack             | J3                       | Connect to 1.8V, 2.5V or 3.3V for the output voltage of the device.                                                                                                         |
| 4            | Core Power Supply Jack               | J4                       | Connect to 1.8V, 2.5V or 3.3V for the core voltage of the device.                                                                                                           |
| 5            | Ground Jack                          | J5                       | Connect to ground of power supply.                                                                                                                                          |
| 6            | Differential Output 1                | S7 and S10               | Can be a differential pair, or two single-ended outputs. Available logic types: LVCMOS, LVDS and LP-HCSL.                                                                   |
| 7            | Differential Output 2                | S6 and S9                | Can be a differential pair, or two single-ended outputs. Available logic types: LVCMOS, LVDS and LP-HCSL.                                                                   |
| 8            | Differential Output 3                | S5 and S8                | Can be a differential pair, or two single-ended outputs. Available logic types: LVCMOS, LVDS and LP-HCSL.                                                                   |
| 9            | Reference Output 0                   | S1                       | Reference or buffered output from the crystal.                                                                                                                              |
| 10           | Power Supply Voltage Selector        | E1, E2, E3, E4, E5, E6   | VDD_REFP1, VDDO_0, VDDO_1, four-way headers used to select a power supply voltage. Connect the center pin to one of the 4 surrounding pins to select a voltage or a source. |
| 11           | Reference Output 1                   | S2                       | Reference or buffered output from the crystal.                                                                                                                              |
| 12           | Differential Output 0                | S3 and S4                | Can be a differential pair, or two single-ended outputs. Available logic types: LVCMOS, LVDS and LP-HCSL.                                                                   |
| 13           | DIP Switch                           | U2                       | Used to control certain pins like OEA, OEB, SEL0, SEL1 and I <sup>2</sup> C versus Hardware Select mode.                                                                    |

## Board Power Supply

The evaluation board uses jumpers E1–E6 to set the power supply voltages for various V<sub>DD</sub> pins. The 4-way jumpers can select 3 different voltages from regulators that use power from the USB port. Selection #2 is the jack for connecting a bench power supply.

E1: Power supply for the REF outputs. The E1 voltage also determines the LVCMOS output levels of the REF0 and REF1 outputs.

E2: Power supply for the OUT0 output driver.

E3: Power supply for the OUT1 output driver.

E4: Power supply for the analog (V<sub>DDA</sub>) and digital (V<sub>DD</sub>) core V<sub>DD</sub> pins.

E5: Power supply for the OUT2 output driver.

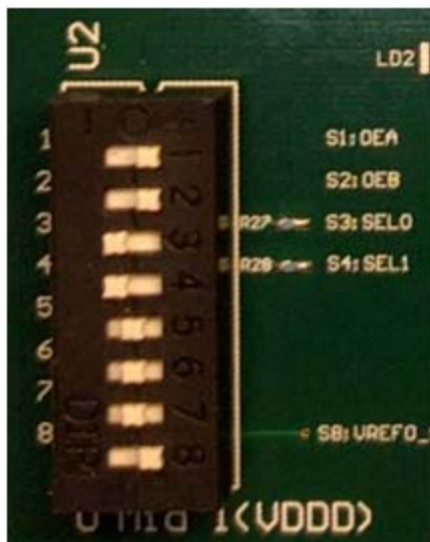
E6: Power supply for the OUT3 output driver.

See *9FGV100x Evaluation Board Schematics* (Figure 5–Figure 8) for detailed information.

## DIP Switch (U2)

Refer to [Figure 2](#) and [Table 2](#) for the DIP switch settings and functions.

**Figure 2. DIP Switch (U2)**



**Table 2. DIP Switch Settings**

| Switch Number | Function                                                                                                              |
|---------------|-----------------------------------------------------------------------------------------------------------------------|
| 1 = OEA       | See datasheet.                                                                                                        |
| 2 = OEB       |                                                                                                                       |
| 3 = SEL0      | Select 1 of 4 pre-programmed configurations when in Hardware Select mode. Also see switch 8.                          |
| 4 = SEL1      |                                                                                                                       |
| 5             | Not used.                                                                                                             |
| 6             | Not used.                                                                                                             |
| 7             | Not used.                                                                                                             |
| 8 = Mode      | Selects operating mode at power-up.<br>“-” or “O” selects I <sup>2</sup> C mode.<br>“+” selects Hardware Select mode. |

## Interfacing with a Computer to Run Timing Commander

As shown in [Figure 3](#), jumpers JP1 and JP2 are installed to use the FTDI chip U6 for connecting to the computer with the USB port J6. The U6 chip translates USB to I<sup>2</sup>C.

When using Aardvark, remove jumpers JP1 and JP2 and connect the Aardvark to connector J2. Default I<sup>2</sup>C device address for the 9FGV100x is 0x68.

Miscellaneous interfaces can connect to J2 pin 1 for the Serial Clock and to J2 pin 3 for the Serial Data signal. J2 pin 2 can be used as ground, but any other ground pin will also work.

When OTP in the 9FGV100x devices is burned with multiple configurations, JP1 and JP2 can be applied in JP3 position respectively to connect the SEL0 and SEL1 switches in U2. Move switch 8 to “+” and power-up the 9FGV100x in Hardware Select mode. This enables changing between 4 configurations with SEL0/1.

A 25MHz crystal is installed on the board and is used as the reference frequency. The board can also be modified to insert an external reference clock into the XIN pin using SMA connector S11. When using an external reference clock, additional components need to be assembled and the crystal needs to be removed.

Each differential output has a pair of SMA connectors to connect to a 50Ω coax. It is recommended to combine the two signals using a balun or splitter/combiner device when measuring jitter or phase noise. The circuit at the SMA connectors is shown in [Figure 4](#).

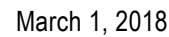
The schematic diagram illustrates the electrical connections for a 10GbE PHY interface. It features two main differential signaling paths, OUT0T and OUT0C, both specified as SE Trace 12 inches/50ohm. The OUT0T path includes a series capacitor C3 (2pF) and a termination resistor R14 (0 NP) connected to a connector S3. The OUT0C path includes a series capacitor C4 (2pF) and a termination resistor R16 (0 NP) connected to a connector S4. Both paths are terminated at the source with resistors R54 and R50 (30 NP) to a common mode (CM0) signal. A support signal, 1VCM0S/PCIEK/LVDS, is connected to the CM0 node. The connectors S3 and S4 are shown with pin configurations and are connected to a common ground (GND). A test point TP3 is also indicated, connected to the OUT0C path.

The circuit is designed for maximum flexibility when testing all possible logic types. Default assembly uses a 0.1μF capacitor in place of R14 and R16, and the short across R14 and R16 is cut. No other devices are assembled. This simple AC-coupled configuration allows for testing phase noise and jitter of all possible logic types. The circuit can be modified for custom tests. TP3 is a position to place a differential FET probe.

## Operating Instructions

1. Set all jumpers for power supply choices (E1–E6), interface choices (JP1 and JP2), and set the U2 switches.
2. Connect an interface: USB or I<sup>2</sup>C.
3. In the case of an I<sup>2</sup>C interface, also connect external power supply to jacks J3, J4 and J5.
4. Start Timing Commander for either USB or Aardvark.
  - a. Start new configuration or load TCS file for existing configuration.
  - b. Choose PhiClock personality.
  - c. For Aardvark, click  to select Aardvark “Connection Interface”.
  - d. For a new configuration, prepare all settings.
  - e. Click  to connect to the 9FGV100x device. Top right should turn green. 
  - f. Click  to write all settings to the 9FGV100x device.
  - g. It should now be possible to measure clocks on outputs.
  - h. While connected, each change to the settings will be written to the 9FGV100x immediately and can be observed at the clock outputs.

**Figure 5. 9FGV100x Evaluation Board Schematic – page 1**



The schematic diagram illustrates the Aardvark board's internal components and the crystal/resistor test setup. Key components include:

- Crystal and Resistor Test Setup:**
  - C11:** 6.8pF NP capacitor.
  - X1:** 25MHz crystal.
  - TP21, TP22:** Test points for the crystal.
  - R26:** 0.1NP resistor.
  - C12:** 6.8pF NP capacitor.
  - S11:** SMA STRAIGHT\_NP connector.
  - R29:** 50\_NP resistor.
  - C13:** 10pF NP capacitor.
- Aardvark Board Components:**
  - I2C Controller:** Connected to the I2C header (JP1).
  - SCL, SDA:** Serial communication lines.
  - SEL:** Selection pins for the I2C controller.
  - HW SEL:** Hardware selection pins.
  - JP2:** Header for the hardware selection pins.
- Notes:**
  - Unpopulate C23 when Crystal is used as input reference.
  - Overlap C23 XIN\_CLKIN with C21 XIN\_CLKIN.

[illegible]

[illegible]

## Ordering Information

| Orderable Part Number | Description                                                |
|-----------------------|------------------------------------------------------------|
| EVK9FGV1001           | Evaluation board with all differential outputs AC coupled. |
| EVK9FGV1002           |                                                            |
| EVK9FGV1004           |                                                            |

## Revision History

| Revision Date | Description of Change |
|---------------|-----------------------|
| March 1, 2018 | Initial release.      |



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