Contents

(Click on any of the headings below to jump to that section)

Figures

Introduction

The 8T49N241i and 8T49N242i evaluation boards are designed to help the customer evaluate the 8T49N241i and 8T49N242i devices, respectively. For the sake of simplicity this User Guide will refer to the 8T49N242i evaluation board though all statements also apply to the 8T49N241i evaluation board. When the board is connected to a PC running IDT Timing Commander™ Software through USB, the device can be configured and programmed to generate frequencies with best-in-class performances.

Requirements

1. PC Requirements:

    • IDT Timing Commander Software Installed.

    • USB 2.0 or 3.0 interface.

    • Windows XP SP3 or later.

    • Processor: Minimum 1GHz.

    • Memory: Minimum 512MB, recommended 1GB.

    • Available Disk Space: Min 600MB (1.5GB 64bit), recommended 1GB (2GB 64bit)

    • Network access during installation if the .NET framework is not currently installed on the system

2. Power Supply with 3.3V and 1000mA rating.

3. Four banana plug cables to connect the power supply to the board.

Quick Start: Powering Up the Board

1. Set 3.3V supply current limit to 500mA.
2. Remove all output terminations.
3. Set Dip Switch selectors to the middle position.
4. Connect a cable from a PC to the USB port.
5. Connect VEE to the GND jack.
6. Connect 3.3V to Vcc_J, Vcca_J, and Vcco_J jacks.
7. Power on the Power Supply.
8. Press the Reset Button.

Once correct operation is verified, set the power supply limit for the number of outputs to be active.

⚠️ The USB port must be powered by the PC in order to have the correct I^2C bus voltage levels.

Default Power-Up Condition

The board ships with a 38.88MHz surface-mount crystal populated on the top of the board at location I. If a different crystal frequency is needed, this part must be removed. See the Section entitled "Crystal Interface" for details.

All outputs should be off and the current should measure ~236mA with 3.3V on Vcc_J, Vcca_J, and Vcco_J.

When evaluating performance with the default hardware configuration, it is recommended that all active outputs be terminated 50ohms to VEE by either terminator plugs or an instrument.

Board Overview

Use the following diagram to identify and locate: power supply jacks, USB connector, input and output SMA connectors, reset button, EEPROM, etc.

Figure 1. Evaluation Board Overview
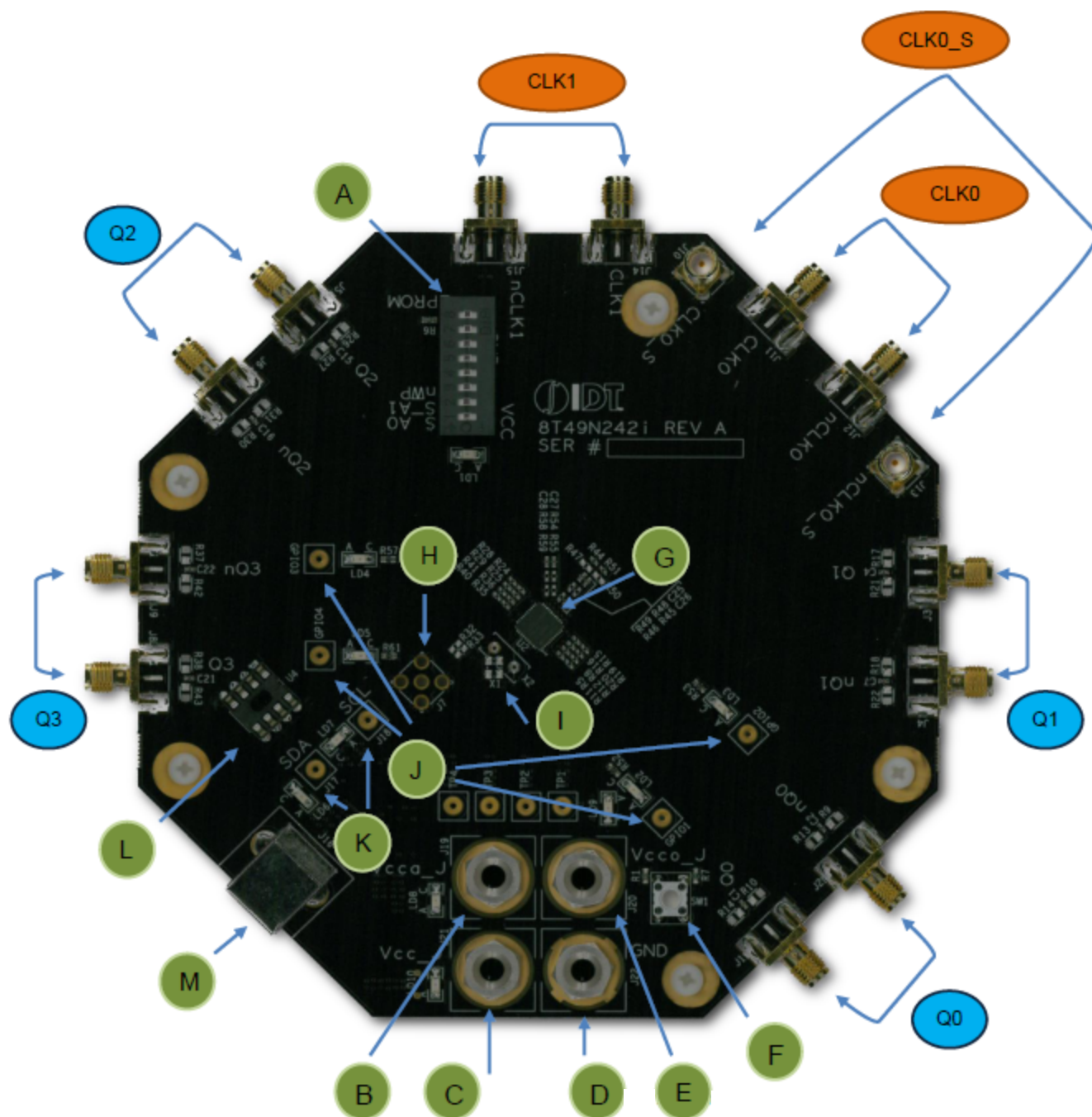
Legend–Evaluation Board

Inputs

CLK0_S   Clock 0 sense lines.

CLK0   Clock 0 input lines. Can be configured for differential or single-ended input.

CLK1   Clock 1 input lines. Can be configured for differential or single-ended input.

Outputs

Q0   Output Q0. Can be a differential pair or two individual single-ended outputs.

Q1   Output Q1. Can be a differential pair or two individual single-ended outputs

Q2   Output Q2. Can be a differential pair or two individual single-ended outputs.

Q3   Output Q3. Can be a differential pair or two individual single-ended outputs.

### Other

A   Dip Switch for DC control signals (EEPROM_WP, S_A0/1, nWP)

B   Vcca_J

C   Vcc_J

D   GND

E   Vcco_J

F   RESET

G   IDT8T49N24x- the device to be evaluated

H   OSCI crystal overdrive connector (not installed by default)

I   Crystal connectors (HC49/US through-hole socket and 3.2x2.5 SMD footprint)

J   GPIO test points

K   I2C test points

L   EEPROM socket (AT24C04C)

M   USB connector

Software GUI Overview

The 8T49N241 and 8T49N241 devices are programmed using IDT's Timing Commander software, which provides an interactive and intuitive Graphical User Interface to program and adjust the many settings that are available for the devices. Timing Commander is the generic platform upon which many devices' GUIs run on. Each GUI has a file called a "personality" that is loaded by Timing Commander so that it can interface with the supported devices. Timing Commander installation and personality files, as well as tutorials and support are available at http://www.idt.com/products/clocks-timing/timing-commander-software-download-resource-guide. The GUI for the 8T49N24x devices is shown below.

Figure 2. Timing Commander 8T49N24x GUI
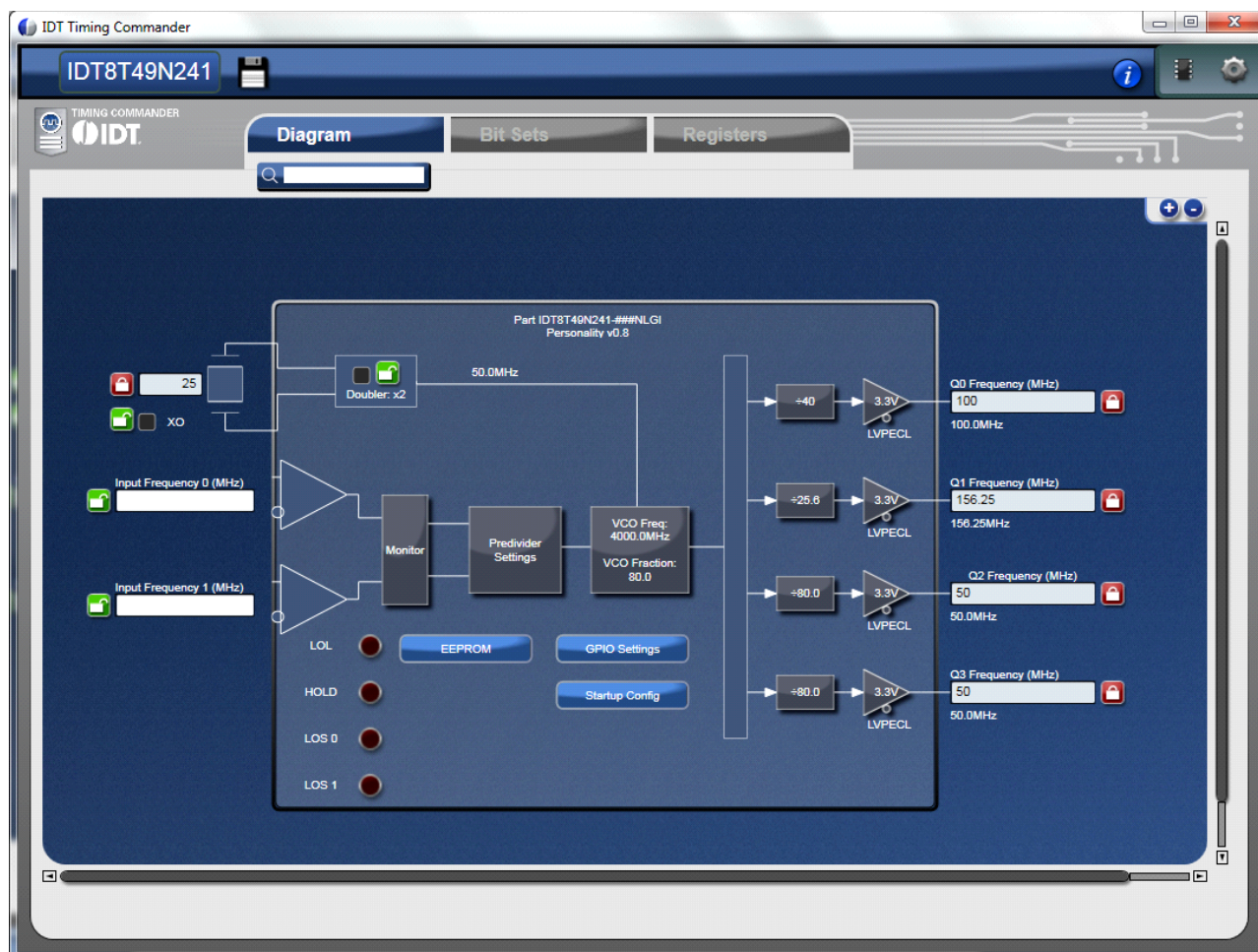
Schematics

The following figures are schematics that are applicable to specific sections of this User Guide. The complete schematics are available in a separate document.
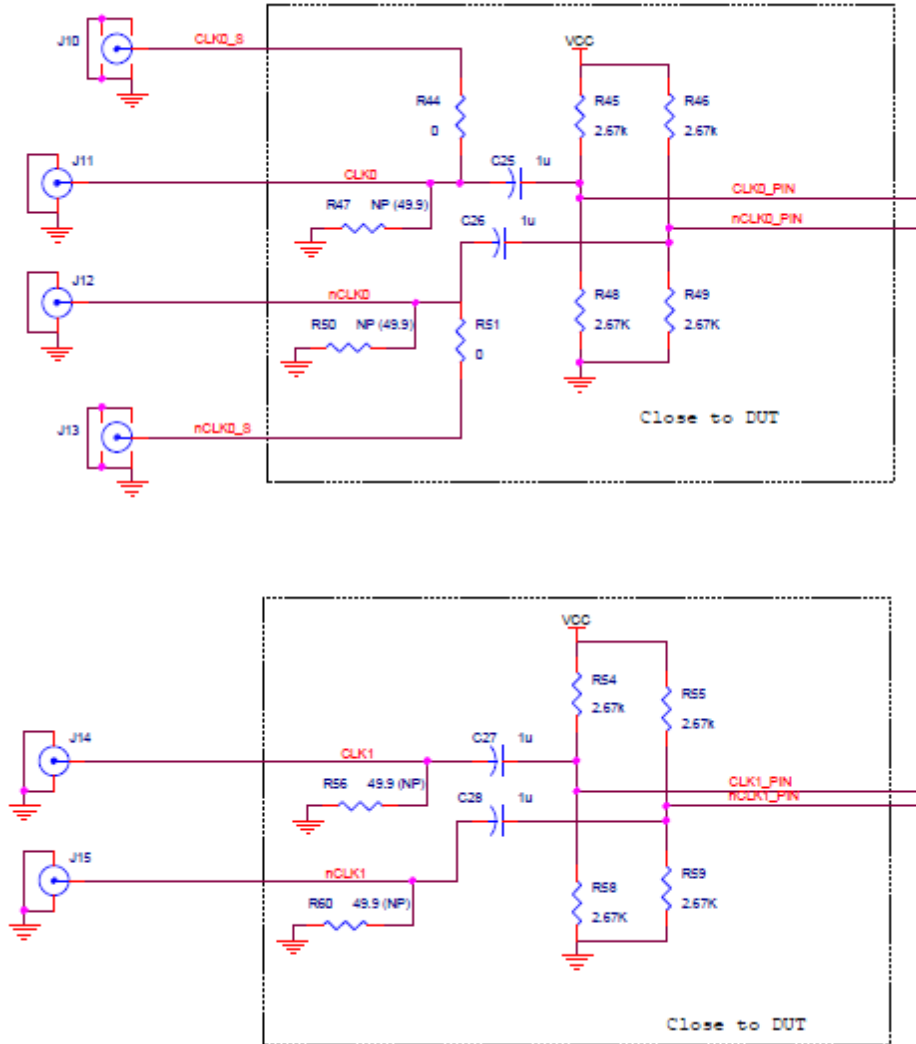
Figure 3.   Inputs Schematic

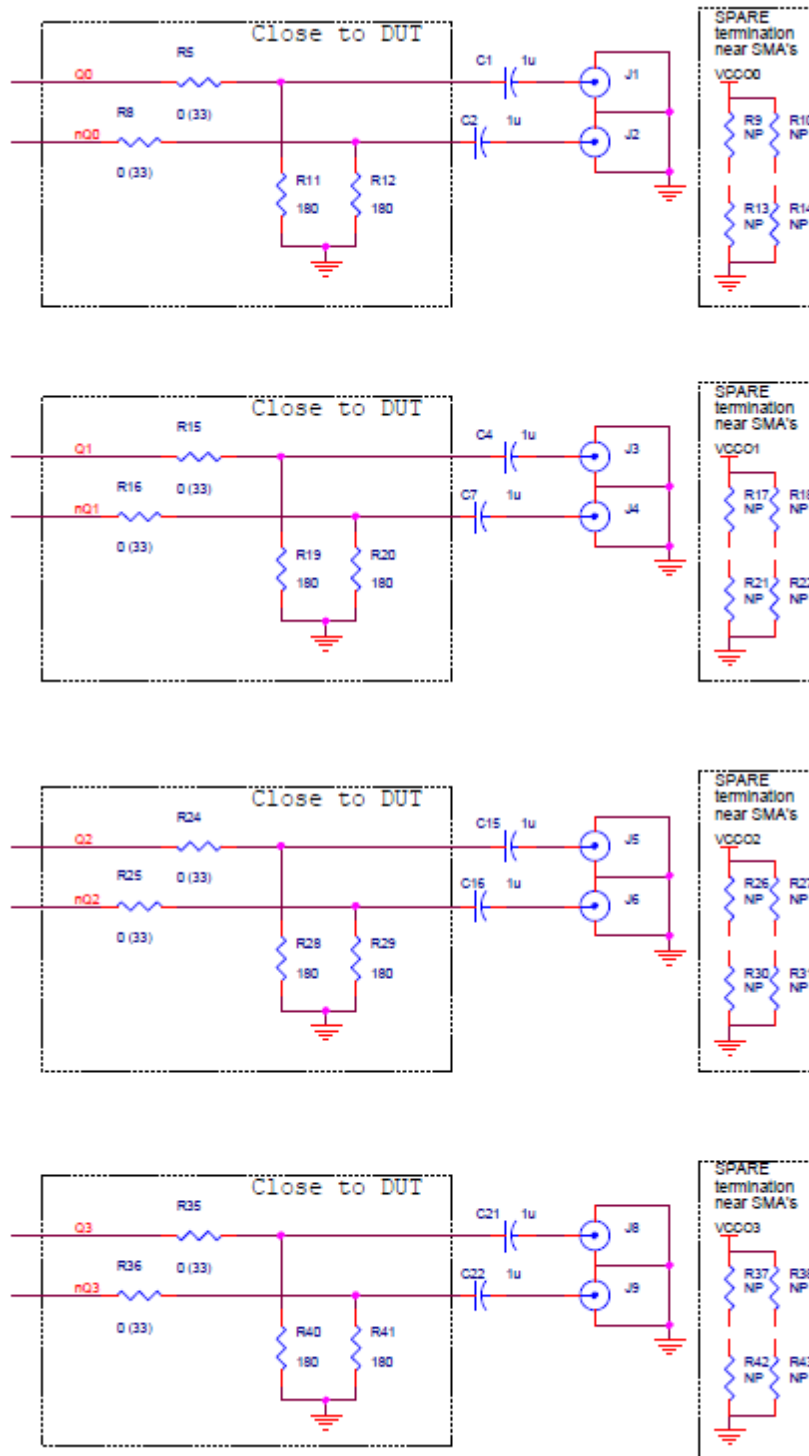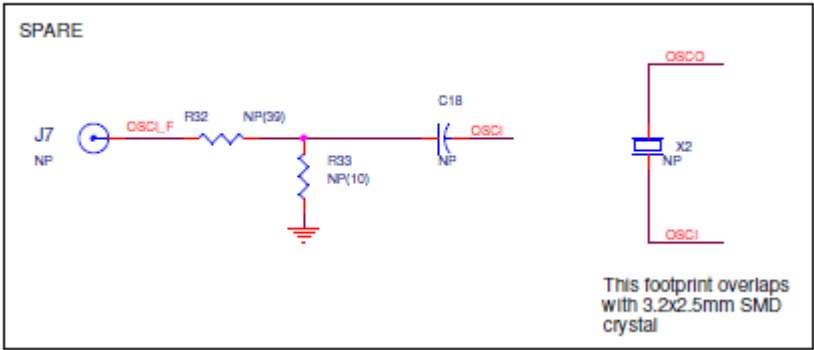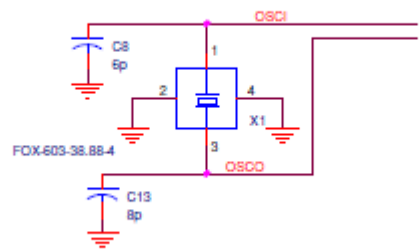# Figure 4. Output Termination Schematic

Figure 5. Crystal Interface Schematic

Crystal Interface

C8
6p

OSCI

1
2   4
       X1
3
OSCO

FOX-603-38.88-4

C13
8p

SPARE

J7
NP

OSCI_F   R32
          NP(39)

C18

OSCI

R33
NP(10)

OSCO

X2
NP

OSCI

This footprint overlaps
with 3.2x2.5mm SMD
crystal

Figure 6.   EEPROM/I2C Schematic

Note: if booting from EEPROM
in a system, then use the following
values: R66=1K, R65=1K,
R63=0ohm , LD7= No Populate

![IDT logo]

Figure 7. DC Control Schematic

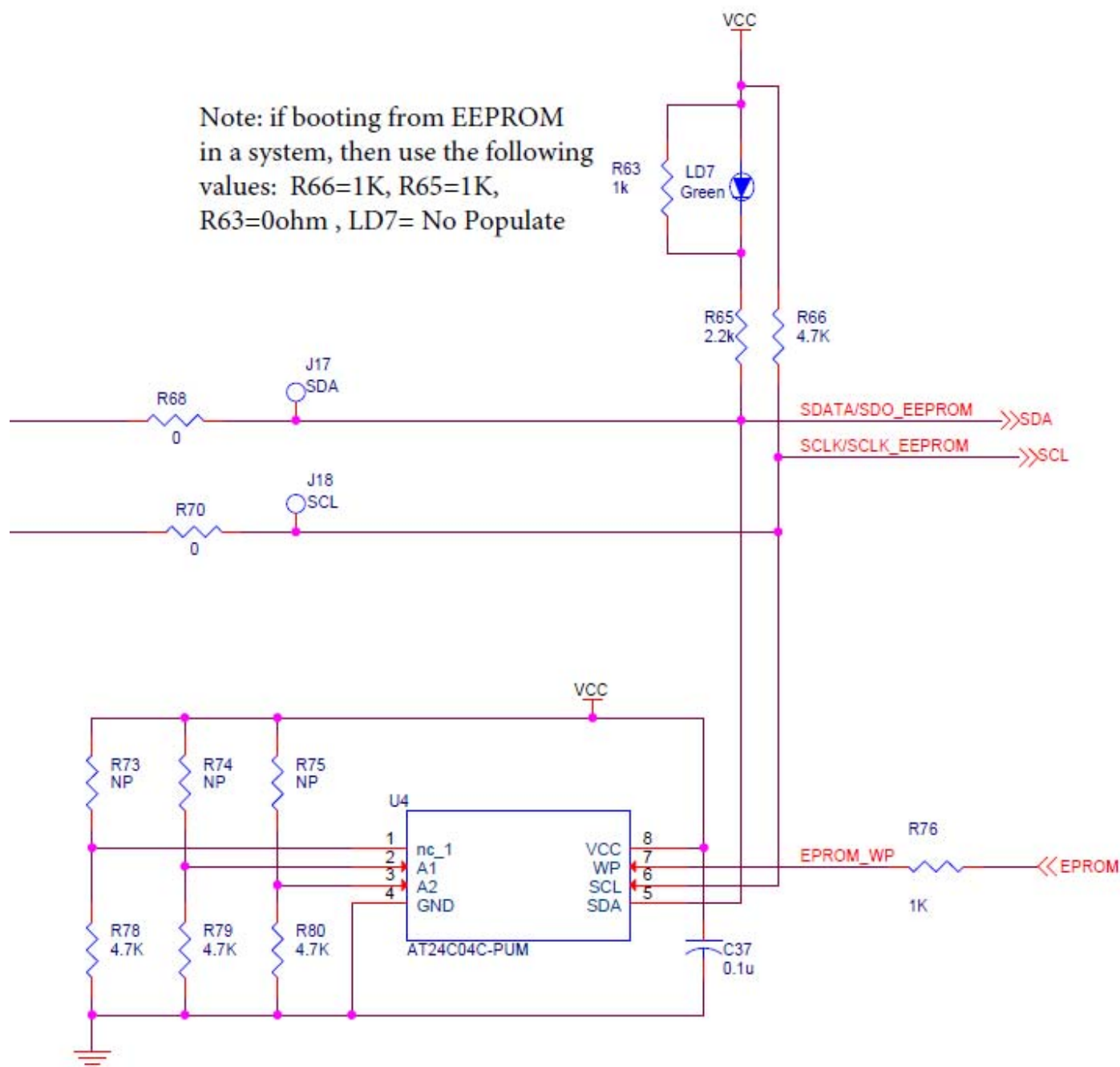
Figure 8. GPIOs Schematic

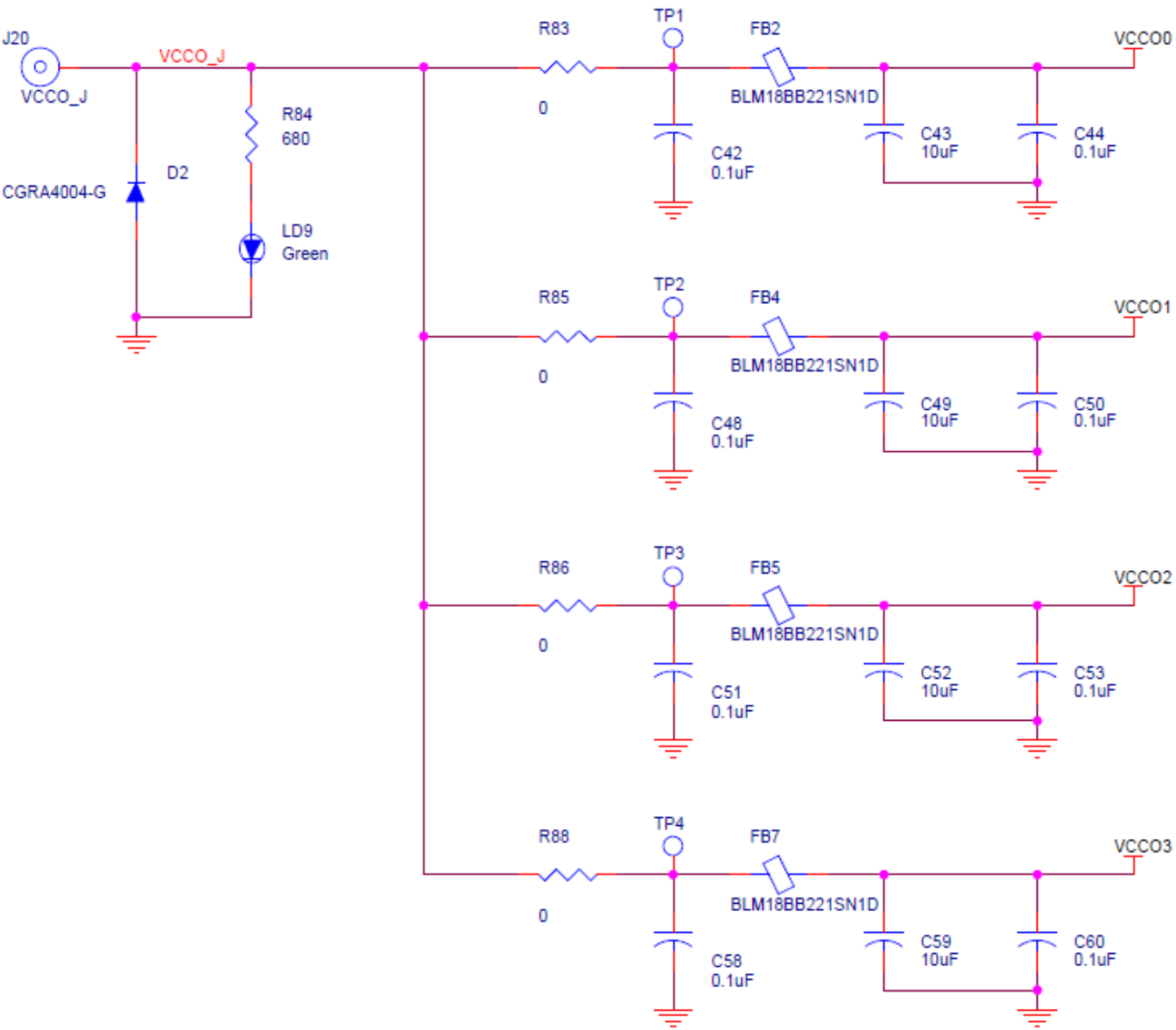**Figure 9. VCCO Power Filtering Schematic**
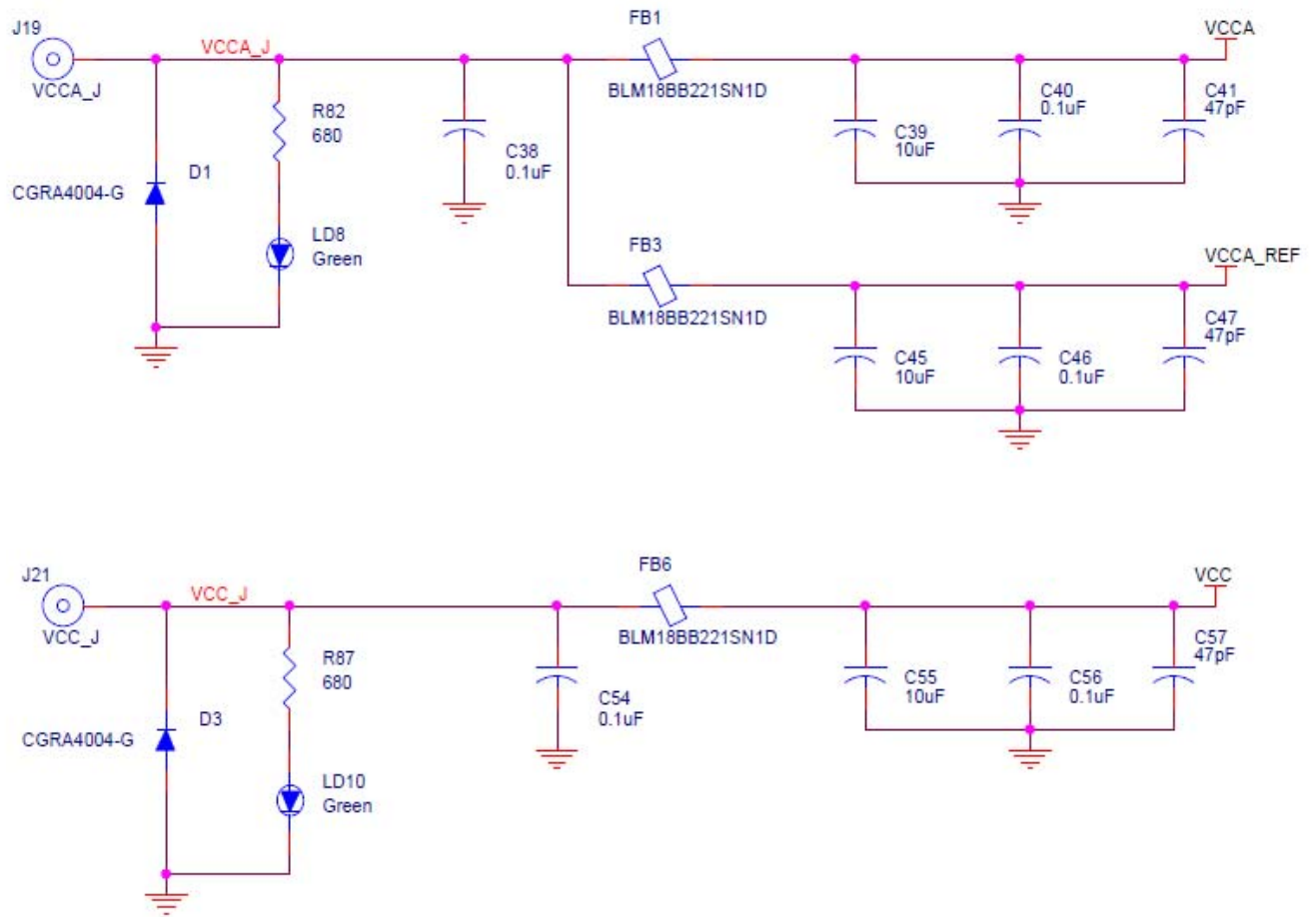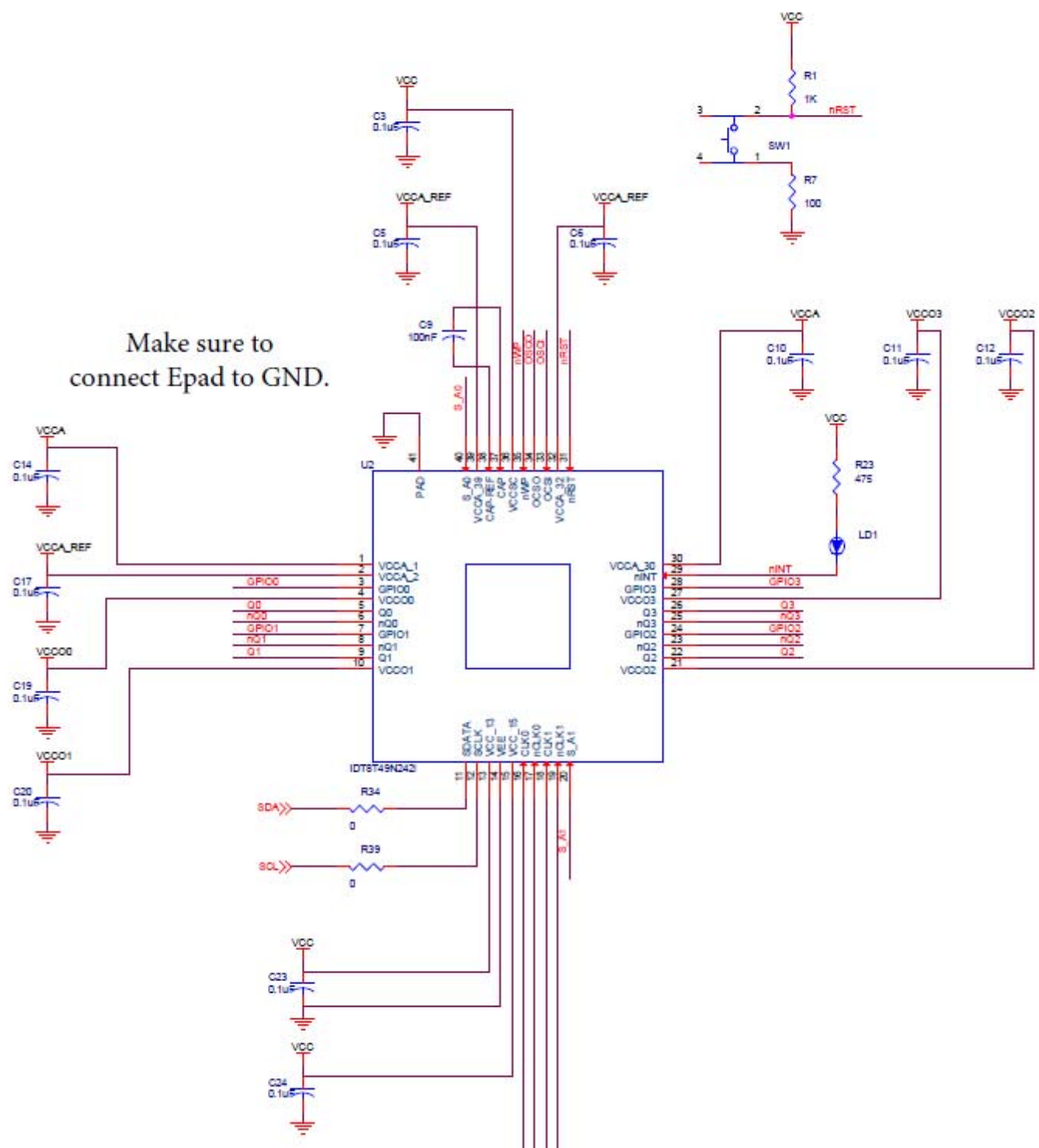
Figure 10. VCC Power Filtering Schematic

Figure 11. 8T49N24x and Bypassing Schematic

Board Power Supply

Core voltages

The core voltage includes a digital supply voltage VCC and an analog supply voltage VCCA. The digital supply voltage is powered by an external bench power supply connected to J19 (VCCA_J). The analog supply voltage is powered by an external bench power supply connected to J21 (VCC_J). See Figure 9 for details.

Output Voltages

VDDO_J (J1) supplies the global voltage for the outputs and can be biased by the external power supply at 1.8V (using LVCMOS for all outputs), 2.5V, or 3.3V.

Mixed Voltage Operation

This board provides the option to operate the outputs with a mixed combination of output voltages. Refer to Figure 8 for a complete view of the VCCO schematic. Each VCCOx has a 0Ω resistor that connects it to the global VCCO_J power rail. This resistor can be removed and the voltage can be provided using the test point. For example, the schematic below can be configured so that Q0 (VCCO0) operates at 2.5V and Q1 (VCCO1) operates at LVCMOS 1.8V as follows:

1. Connect 2.5V to J20 (VCCO_J).
2. Remove R85. This isolates VCCO1 from global VCCO_J.
3. Solder a wire onto test point TP2 and bias with a 1.8V supply.

Figure 12. Mixed Output Voltage Operation
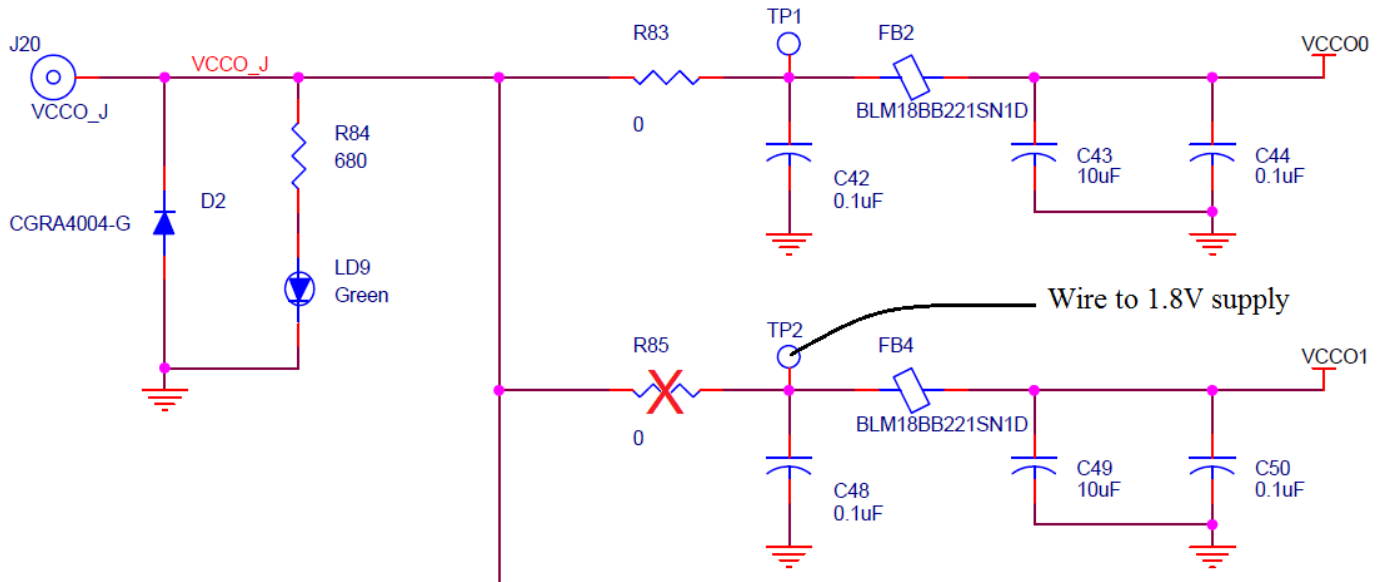
Input Configuration

The inputs are configured with an AC-coupling termination scheme. This scheme allows flexibility for either differential or single-ended inputs. The default configuration is as follows:

Table 1: Default Input Configuration

Input	Default Termination	Sense Lines
CLK0	Unterminated, AC-coupled into the device and terminated via sense line connector to equipment or termination connector.	Use SMAs J10/J13 for observation of the input signal and termination of the input signal
CLK1	Terminated, AC-coupled into the device	Not available

Differential Input

Connect the input signal to CLKx and nCLKx. For CLK0, the CLK0_S and nCLK0_s sense lines are available for observation of the signal. They can be connected with 50ohm impedance cables to an oscilloscope with 50ohm termination, otherwise, they should be terminated with 50ohm plugs in order prevent reflections. The CLK1 input is 50ohm terminated to ground.

Single-ended Input

Connect the input signal to CLKx and float nCLKx. For CLK0, connect CLK0_S with a 50ohm impedance cable to an oscilloscope with 50ohm termination or terminate with a 50ohm plug.

Input Signals below 1MHz

For slow-frequency signals below 1MHz, we recommend that the AC-coupling capacitors for the corresponding input be replaced with zero-ohm resistors and that the signal input DC-offset be set so that it meets the device's Vcmr requirements. Refer to Figure 3 to locate the components listed below.

Table 2: Input Termination Schemes

Signal Frequency	AC-coupling capacitors: CLK0 (C25, C26); CLK1 (C27,C28)	Input Signal DC Offset
>1MHz	1uF	Don't care
<1MHz	$0\,\Omega$	Must meet datasheet Vcmr specs

Output Configuration

The outputs are AC-coupled, allowing for maximum flexibility for observation of the output whether configured for LVPECL, LVDS, LVCMOS, or HCSL levels. The default termination scheme can be used to measure any of the three output level-types but is not optimal. The optimal termination circuits are tabulated below. Refer to Figure 4 to locate the components listed below.

Table 3: Termination Outputs for Q0

Signal Type	Source resistors: R5, R8	180ohm pull-down: R11, R12	Series capacitors: C1,C2	Spare Resistors: R9, R10, R13, R14
LVPECL (Default)	0ohm	Installed	1uF	Not Installed
LVCMOS	33ohm	Not Installed	1uF	Not Installed
LVDS	0ohm	Not Installed	1uF	Not Installed
HCSL	33ohm	Not Installed	1uF	Not Installed

Table 4: Termination Outputs for Q1

Signal Type	Source resistors: R15, R16	180ohm pull-down: R19, R20	Series capacitors: C4,C7	Spare Resistors: R17, R18, R21, R22
LVPECL (Default)	0ohm	Installed	1uF	Not Installed
LVCMOS	33ohm	Not Installed	1uF	Not Installed
LVDS	0ohm	Not Installed	1uF	Not Installed
HCSL	33ohm	Not Installed	1uF	Not Installed

Table 5: Termination Outputs for Q2

Signal Type	Source resistors: R24, R25	180ohm pull-down: R28, R29	Series capacitors: C15,C16	Spare Resistors: R26, R27, R30, R31
LVPECL (Default)	0ohm	Installed	1uF	Not Installed
LVCMOS	33ohm	Not Installed	1uF	Not Installed
LVDS	0ohm	Not Installed	1uF	Not Installed
HCSL	33ohm	Not Installed	1uF	Not Installed

Table 6: Termination Outputs for Q3

Signal Type	Source resistors: R35, R36	180ohm pull-down: R40, R41	Series capacitors: C21,C22	Resistor Network: R37,R38, R42, R43
LVPECL (Default)	0ohm	Installed	1uF	Not Installed
LVCMOS	33ohm	Not Installed	1uF	Not Installed
LVDS	0ohm	Not Installed	1uF	Not Installed
HCSL	33ohm	Not Installed	1uF	Not Installed

Table 7: Spare Resistor Termination for LVPECL for Q0

| Signal Type	Source resistors: R5, R8	180ohm pull-down: R11, R12	Series capacitors: C1,C2	Spare Resistors: R9, R10, R13, R14
LVPECL (Default)	0ohm	Not Installed	0ohm	R9=R10=125ohm R13=R14=84ohm
HCSL	33ohm	Not Installed	0ohm	R9=R10=Not Installed R13=R14=50ohm

Output Signals below 1MHz

For output signals below 1MHz we recommend that the 1uF AC-coupling capacitors be replaced with 0ohm resistors and that the correct terminations be provided at the receiver.

EEPROM Boot

The evaluation board ships with an IDT8T49N24x-998 device, which will attempt to boot from the EEPROM at power-up. If an EEPROM is not present, the device registers will need to be set by Timing Commander. The EEPROM must have at least 85 bytes, have an I2C address of 0xA0, use 1-byte addressing, and conform to the 8-DIP package shown in Figures 1 (symbol "L") and Figure 6. An AT24C04 is typically used. The EEPROM is programmed through Timing Commander. Once connected to the chip using the "Connect to the chip" button in the top-right corner of the window, a button for "Write All" will appear that is used to write all registers to either the IDT8T49N24x device or the EEPROM.

Figure 13. EEPROM Programming
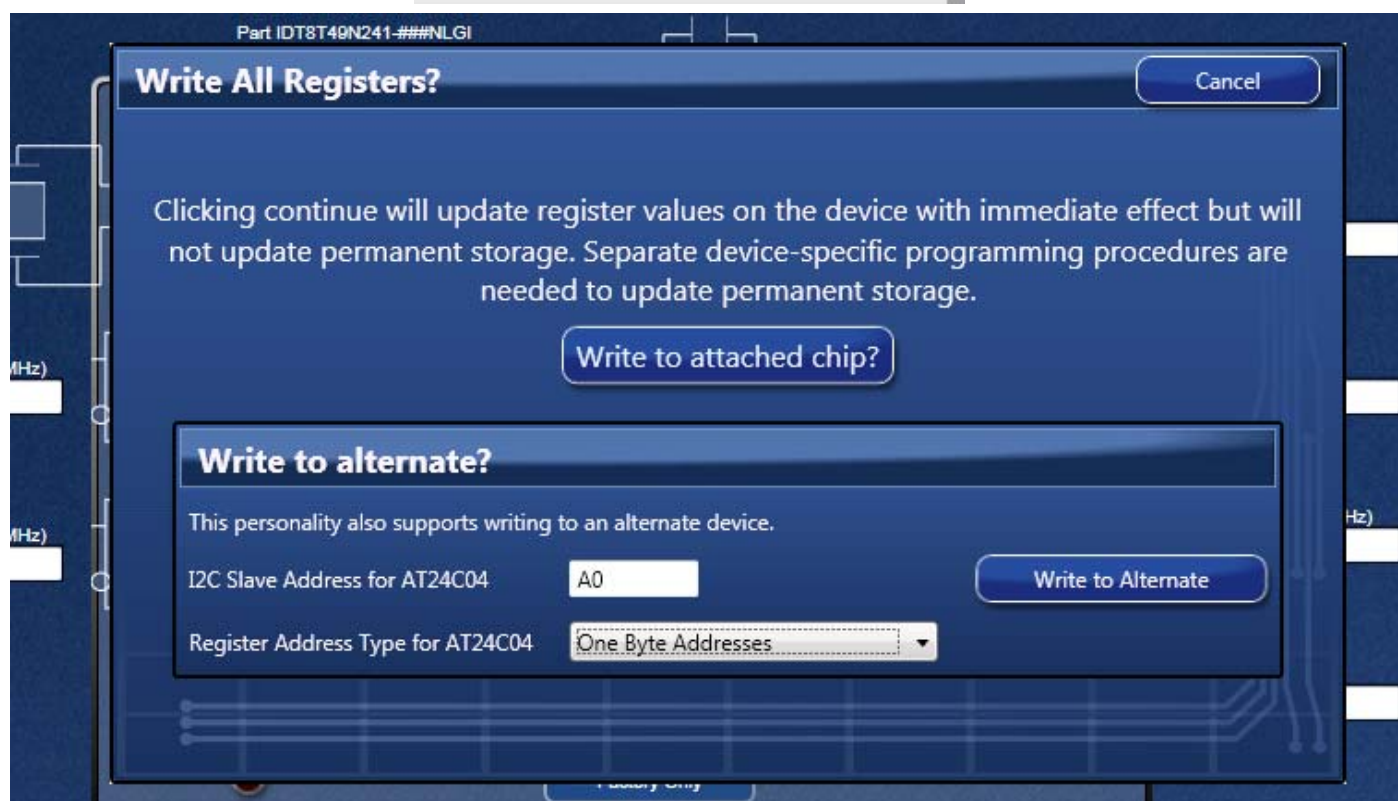
To write to the EEPROM, make sure the I2C slave address is set to 0xA0 and the address type is set to "One Byte Addresses", then click "Write to Alternate". A confirmation message box will appear when the write is completed.

DC Controls

The DIP switch has three settings: 0V, Float, and VCC. This board ships with all switches in the Float (middle) position. Refer to Figure 1, label "A" for the location of the DIP Switch. The functions for the switches are:

S1: 8T49N24x I2C slave address bit 0

S2: 8T49N24x I2C slave address bit 1

S3: 8T49N24x nWP, 0=Registers write protected, 1=Normal operation

Crystal Interface

The board supports three types of crystals that can be used for the local reference oscillator of the device. If overdriving the crystal oscillator with an external signal, an optional extra connector must be attached to allow this. The board ships with a 38.88MHz surface-mount crystal populated in X1. If a different crystal is desired, or if overdriving the crystal oscillator externally, this part must be removed. See Figure 1, label "I". Crystal load capacitors support a 12pF crystal. If a crystal with a different load capacitance is used, C8 and C13 may need to be modified. These capacitors are on the bottom side of the board, next to the through-hole crystal socket (See Figure 14).

Figure 14. Crystal Load Capacitors
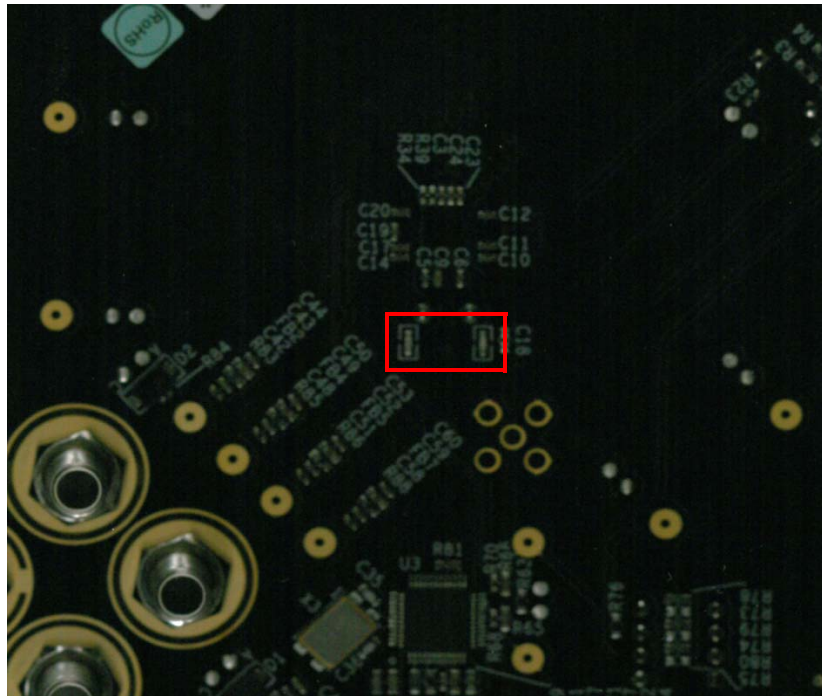
1. Through-hole crystal. With this option, the device can be evaluated with different crystals without the need to solder each time the crystal is replaced. Insert the crystal into the socket labeled X2 on the board (See Figure 1, label "I").

2. Surface-mount crystal. With this option, a 3.2x2.5 SMD crystal may be soldered onto the footprint labeled X1 on the board (See Figure 1, label "I"). The board ships with a 38.88MHz crystal installed here.

3. External Crystal Overdrive. With this option, the device can be evaluated using an external source, such as a frequency generator, XO, or other device. The following modifications are needed for this option (refer to Figure 1 and Figure 4 for identification and location of the components):

    a. Populate SMA J7 (See Figure 1, label "H").

    b. Solder a 1uF capacitor onto C18. Note: The input must be AC-coupled.

    c. R33 may be populated with a 50ohm resistor for input sources requiring such termination.

    d. Populate R32 with either a 0ohm or 33ohm (LVCMOS) resistor.

Application Notes and Resources

Design guidelines and resources may be found online for both the 8T49N241 and 8T49N242 devices, at the following addresses:

8T49N241:
http://www.idt.com/8T49N241

8T49N242:
http://www.idt.com/8T49N242

The site contains a wealth of information, including:

- Device datasheets and errata
- Package and dash-code options and ordering guide
- Evaluation board resources, including guides and schematics
- Cadence schematic symbols and footprints
- IBIS simulation models
- Application notes, including power-up configuration, frequency programming, EEPROM programming, output termination guidelines, and more
- Timing Commander installation and 8T49N24x personality files to allow programming of settings and creation of settings files used to create new dash-codes from a PC
- Example settings files and phase noise plots
- Tutorial videos for Timing Commander and the 8T49N24x evaluation boards

For more questions or support, please submit a technical support request.

Corporate Headquarters
6024 Silver Creek Valley Road
San Jose, CA 95138 USA

Sales
1-800-345-7015 or 408-284-8200
Fax: 408-284-2775
www.IDT.com

Tech Support
www.idt.com/support/technical-support