CAPTIVATE-EMC Getting Started Guide

This getting started guide provides a brief overview of the CAPTIVATE-EMC capacitive touch evaluation board for the CapTIvate™ development ecosystem.

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1 Introduction

The CAPTIVATE-EMC is an evaluation board that lets you easily evaluate the electromagnetic compatibility performance of CapTIvate technology relative to your design requirements. The EVM features the MSP430FR2676 CapTIvate MCU with hardware accelerated frequency hopping and oversampling. This EVM demonstrates how to design hardware and software that can pass challenging system-level tests for conducted RF immunity, electrical fast transient and burst immunity, electrostatic discharge immunity, and radiated immunity.

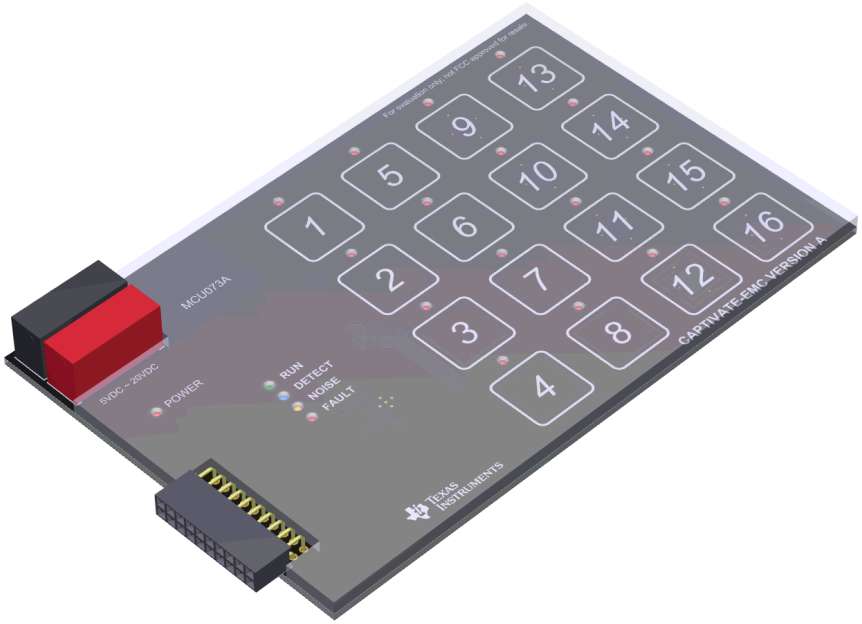

Figure 1. CAPTIVATE-EMC Board

Free software development tools are also available, such as TI's Eclipse-based Code Composer Studio™ IDE (CCS) and IAR Embedded Workbench® IDE.

1.1 Scope

This getting started guide provides a brief overview of how to use the CAPTIVATE-EMC. The full EVM user's guide is available in the CapTIvate Design Center integrated documentation. The latest version of the user's guide is also available online with the CapTIvate Technology Guide.

1.2 Key Features

The CAPTIVATE-EMC supports the following features:

- 16 capacitive touch sensing buttons
  - One MSP430FR2676 microcontroller
  - 8 self-capacitance buttons and 8 mutual-capacitance buttons
- EMC noise immunity
  - IEC 61000-4-2 electrostatic discharge tolerance
  - IEC 61000-4-3 RF noise tolerance
  - IEC 61000-4-4 electrical fast transient and burst tolerance
  - IEC 61000-4-6 conducted noise tolerance
- Onboard LED feedback
  - Sensor state LEDs to indicate a touch event
  - System status LEDs to indicate system status

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- Onboard audio feedback
  - Plays different tones for different events
- Two power options for touch evaluation
  - Power from CAPTIVATE-PGMR for quick bring up and debug
  - Power from standard banana jack connector when running EMC test
- 20-pin debug connector
  - Supports UART communication interface to CapTIvate Design Center
  - Supports Spy-Bi-Wire debug interface

1.3 What's Included

The CAPTIVATE-EMC comes with the following hardware and software:

Kit Contents

- 1 CAPTIVATE-EMC evaluation board
- 1 quick start guide

Software Examples

The following software example is available to run on the MSP430FR2676 MCU on the CAPTIVATE-EMC:

- CAPTIVATE-EMC-Demo: The out-of-box demonstration (factory programmed on a new CAPTIVATE-EMC).

2 Required Tools

The following tools are required to use CAPTIVATE-EMC:

- A CAPTIVATE-EMC evaluation board programmed with the CAPTIVATE-EMC-Demo firmware example
- A CAPTIVATE-PGMR MCU programmer
- A CAPTIVATE-ISO communication isolation board
- A DC power supply that can output 12 VDC at 1 A. The CAPTIVATE-EMC accepts 5-V to 20-V DC power supply input.
- A PC running the latest CapTIvate Design Center
- A micro-USB cable to connect the CAPTIVATE-PGMR to the host PC

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3 Hardware

The following sections describe the CAPTIVATE-EMC hardware (see Figure 2). For a detailed description of the hardware, see the CAPTIVATE-EMC hardware description in the CapTIvate Technology Guide.

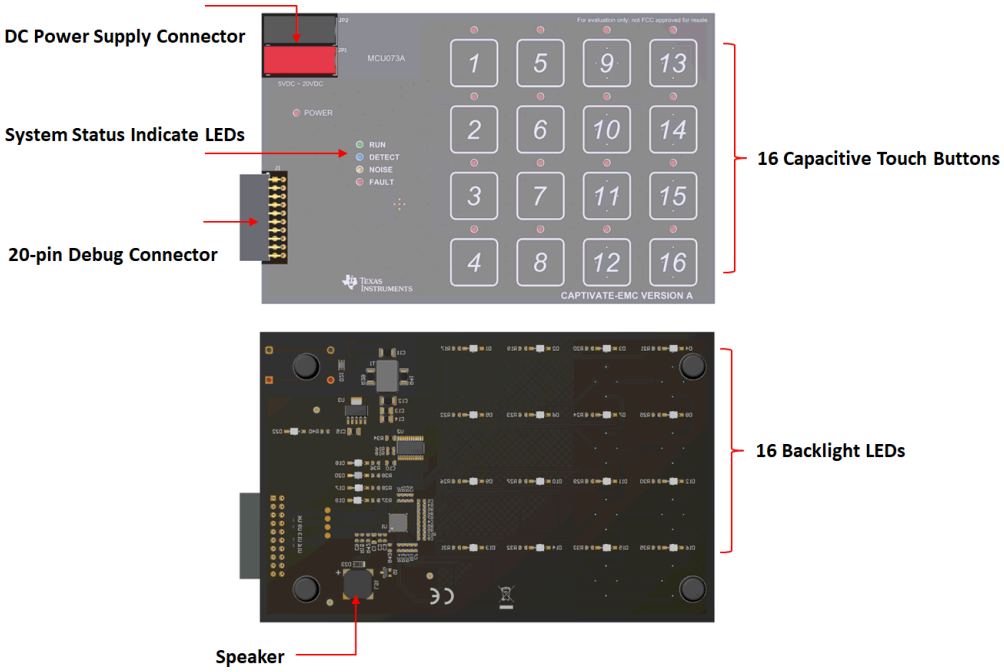

Figure 2. CAPTIVATE-EMC Overview

3.1 Functional Block Diagram

Figure 3 shows the CAPTIVATE-EMC functional block diagram.

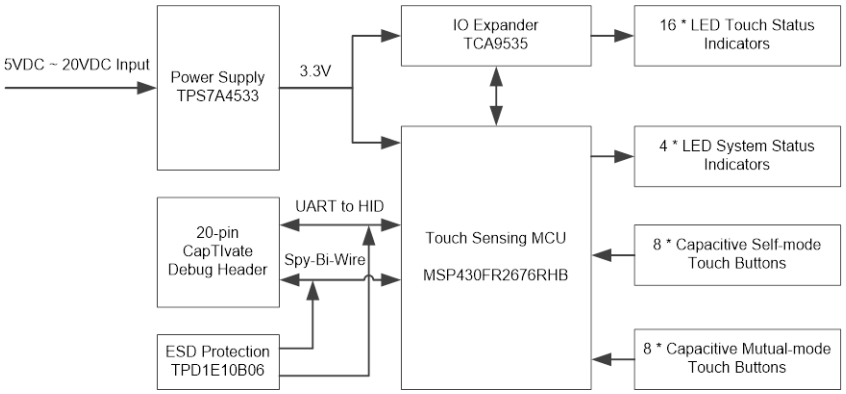

Figure 3. CAPTIVATE-EMC Block Diagram

3.2 Connectors

There are two connectors on the CAPTIVATE-EMC board:

- DC power supply connector
- 20-pin debug connector

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3.3 Power Supply

There are two power supply options for CAPTIVATE-EMC board (see Figure 4):

- 5 V to 20 V DC power through connectors JP1 and JP2. The color of the connectors shows the polarity, red for positive and black for negative. A TI TPS7A4533 +3.3-V 1.5-A LDO provides power for all the devices on the CAPTIVATE-EMC.
- The CAPTIVATE-PGMR board also can provide 3.3-V power supply to the CAPTIVATE-EMC through connector J1.

Figure 4. CAPTIVATE-EMC Power Supply Options

NOTE: Do not connect the CAPTIVATE-PGMR directly to the CAPTIVATE-EMC when a DC power supply is enabled.

3.4 Debug Connector

The 20-pin debug connector J1 is for interfacing to the CAPTIVATE-PGMR board. This connector provides power, Spy-Bi-Wire, and UART connectivity with the CAPTIVATE-PGMR module.

The Spy-Bi-Wire port lets the user download and debug their own code or the demo code to the MSP430FR2676 MCU on the CAPTIVATE-EMC board.

The MSP430FR2676 MCU communicates with a dedicated USB HID Bridge MCU located on the CAPTIVATE-PGMR module using UART to send sensor data and status to the CapTIvate Design Center as part of the sensor design and tuning process.

4 Getting Started

To get started with the CAPTIVATE-EMC, see the *CAPTIVATE-EMC Getting Started* section of the CapTIvate Technology Guide.

An easy way to get started with the EVM is by using its preprogrammed out-of-box code. This code demonstrates some key features of the EVM.

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4.1 Setting up the Hardware

CAPTIVATE-EMC is designed to accommodate various powering methods, including through the 20-pin connector from CAPTIVATE-PGMR and a banana jack connector from a DC power supply.

CAUTION

Do not enable both power supplies at the same time because this can damage the CAPTIVATE-PGMR board.

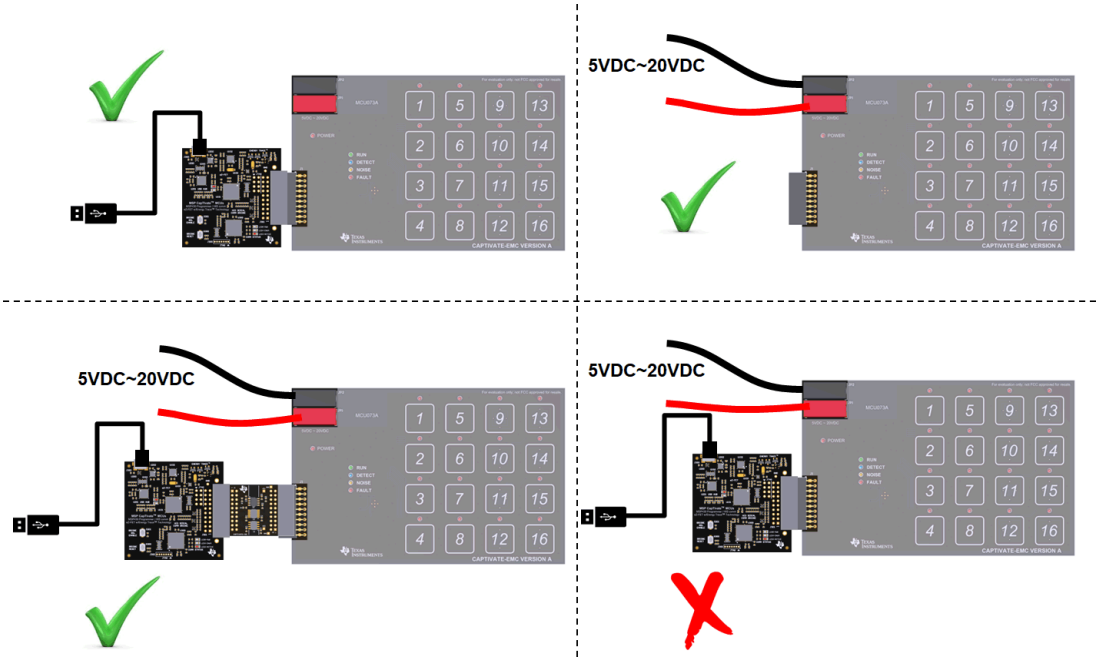

Figure 5. Hardware Setup

4.2 Running the Out-of-Box Demo

By default after power up, the CAPTIVATE-EMC development kit runs system initialization and capacitive touch calibration. When this initialization is finished, the POWER LED illuminates, the RUN LED blinks, all other LEDs are off, and the beeper is off. Touch a button on the CAPTIVATE-EMC panel to turn on or turn off the indicator LED above that button. The DETECT LED illuminates and the speaker beeps when a button is touched.

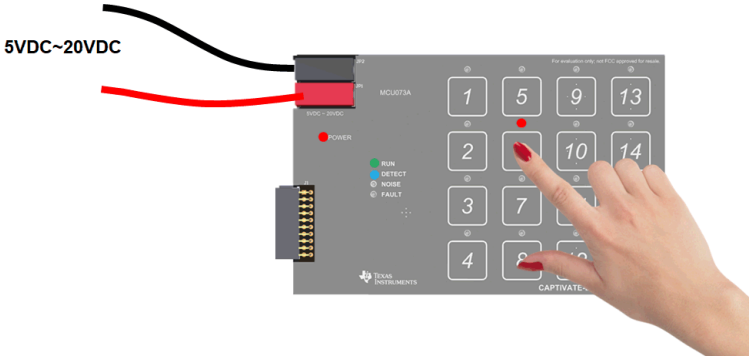

Figure 6. Out-of-Box Demonstration

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4.3 Using CapTIvate Design Center

Figure 7 shows the options for connecting the CAPTIVATE-EMC to a host computer:

- Connect the CAPTIVATE-EMC to a host computer with the CAPTIVATE-PGMR and remove the connection from the DC power supply.
- Keep the DC power supply and connect the CAPTIVATE-EMC to a host computer with CAPTIVATE-PGMR and CAPTIVATE-ISO.

Open CapTIvate Design Center on the host computer.

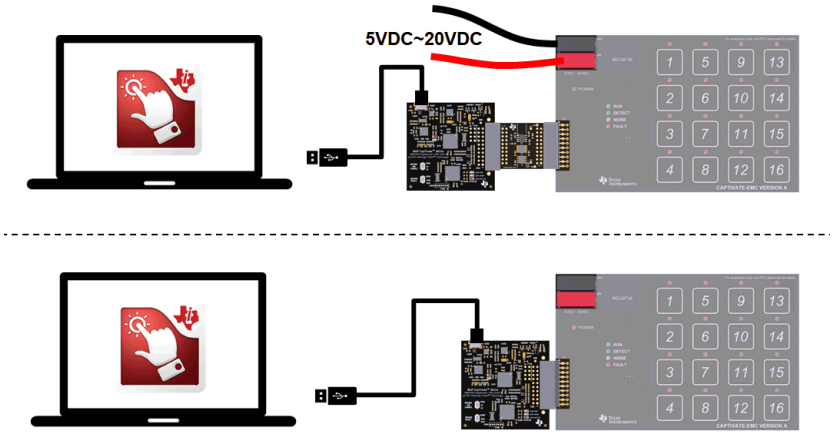

Figure 7. Connection to CapTIvate Design Center

Open the FR2676_CAPTIVATE-EMC example project in CapTIvate Design Center. Select Communications → Connect from the menu bar in CapTIvate Design Center to enable target communications. When the user touches a button, the button status is reflected in CapTIvate Design Center (see Figure 8).

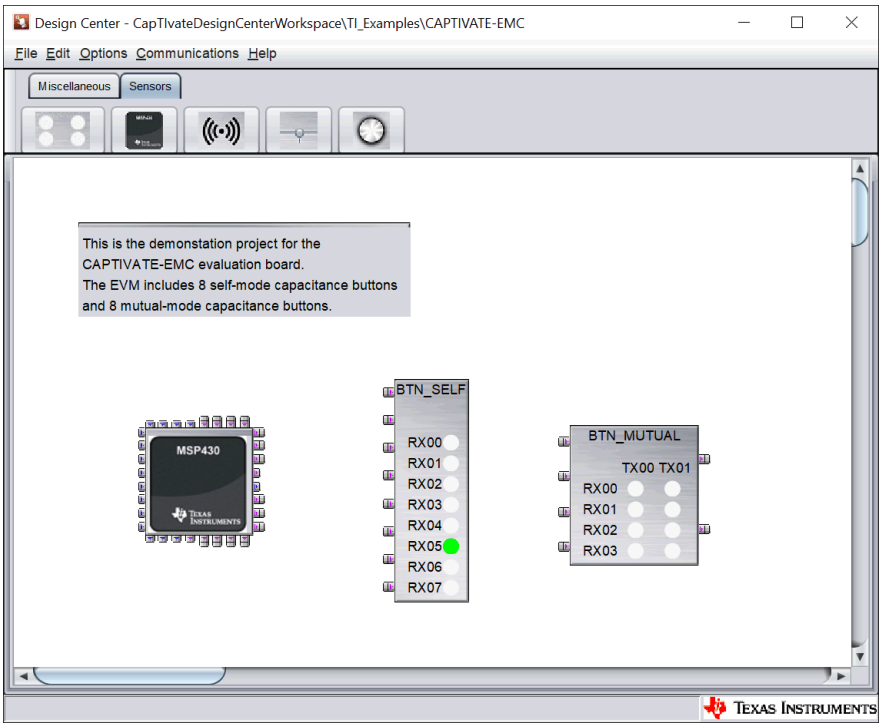

Figure 8. CAPTIVATE-EMC Project Canvas

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5 Test Certification

TA Technology (Shanghai) Co., Ltd. in Shanghai, China validated the internal test findings of the CAPTIVATE-EMC. Detailed test reports are available in *Enabling Noise Tolerant Capacitive Touch HMIs With MSP CapTIvate™ Technology*.

6 REACH Compliance

In compliance with the Article 33 provision of the EU REACH regulation, we are notifying you that this EVM includes component(s) containing at least one Substance of Very High Concern (SVHC) above 0.1%. These uses from Texas Instruments do not exceed 1 ton per year. The SVHCs are:

Component Manufacturer	Component type	Component Part Number	SVHC Substance	SVHC CAS (When Available)
Hirschmann Automation and Controls GmbH	Test socket, PCB, 4 mm, red	973 582-101	Lead	7439-92-1
Hirschmann Automation and Controls GmbH	Test socket, PCB, 4 mm, black	973 582-100	Lead	7439-92-1

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