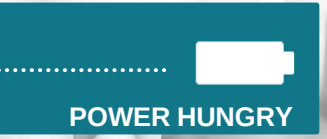
MSP430 CapTIvate™

The easiest-to-use capacitive touch MCU

Challenges of designing with traditional capacitive touch

Noise triggers false touch detections

Industrial designs are driving the need for more advanced interfaces



“Always-on” capacitive touch technology drains power

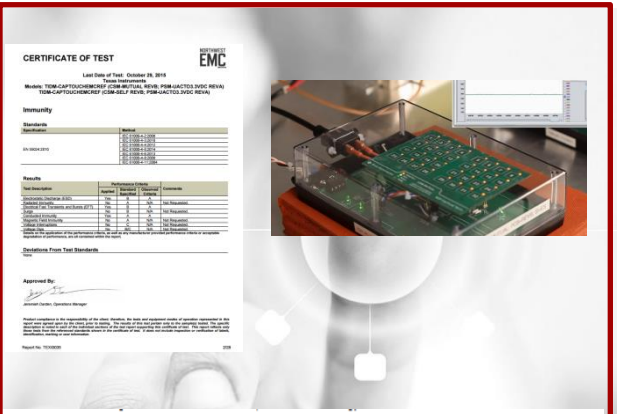
Limited application designs due to sensitivity and resolution

Spend months designing and optimizing capacitive touch solutions

Revolutionize your design with CapTIvate™ technology

Reliability

IEC61000-4-x certified touch solutions for noise immunity



Test	Pass criteria	TIDM-CAPTOUCHEMCREF (CSM-SELF REVB, PSM-UACT03.3VDC)	TIDM-CAPTOUCHEMCREF (CSM-MUTUAL REVB, PSM-UACT03.3VDC)
Conducted immunity (IEC 61000-4-6) sweep for touch detection	Class A	10 V_{rms}	3 V_{rms}
Conducted immunity (IEC 61000-4-6) dwell at vulnerable frequencies for touch detection	Class A	10 V_{rms}	3 V_{rms}
Conducted immunity (IEC 61000-4-6) sweep for no false detects	Class B	10 V_{rms}	
Electrical fast transient/burst immunity (IEC 61000-4-4)	Class B	± 4 kV	
Electrostatic discharge immunity (IEC 61000-4-2)	Class B	± 8 kV / 15 kV contact / air	

Sixty to 70 percent of capacitive touch solutions will require IEC61000-4-x certification

- Hardware: Frequency hopping and zero crossing sync techniques in-silicon provide robust detection
- Software: Oversampling, de-bounce, AC noise filtering minimize false detects
- System: Comprehensive reference designs to meet EMC compliance

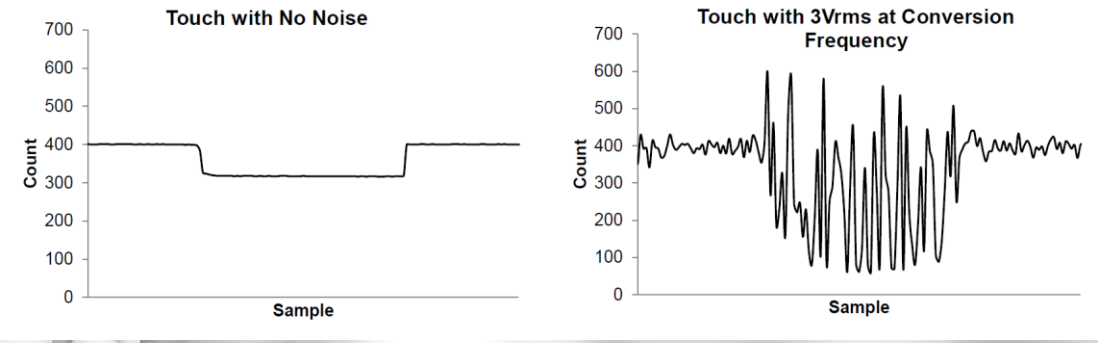
Avoid false detects in presence of moisture

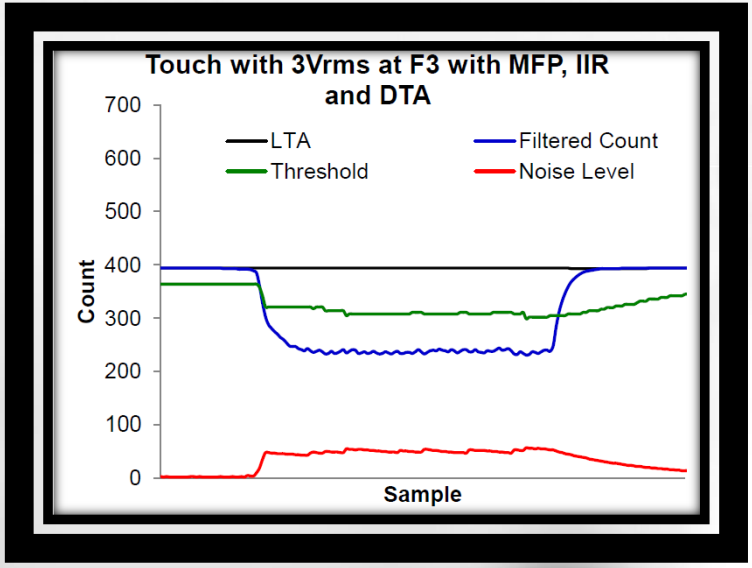
- Moisture rejection using guard channel techniques helps system differentiate between a touch and moisture
- Make designs waterproof using metal overlays for outdoor or wet environments

CapTIvate™ technology can also reduce emissions

Reliability

Improving noise immunity

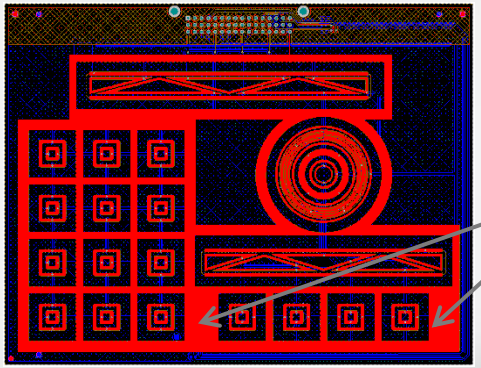




1) Multi-frequency scan from 4 frequencies
2) Spread spectrum modulation to reduce amplitude
3) Multi-frequency processing: 4 inputs, single result
4) IIR Filtering
5) Dynamic threshold adjustment

Reliability

Moisture and palm rejection



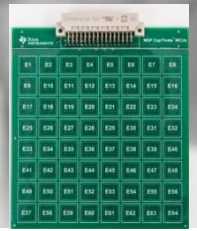
Guard Channel Connected to CapTIvate IO

- Guard channel serves allows for palm rejection and moisture rejection
- Guard channel reaching a certain threshold masks all other channels

Versatility

Metal touch, 3D gesture, glove friendly and the most configurable solutions

16 IOs =
32 buttons +
4 sliders +
4 wheels+
1 prox



16 IOs =
64 buttons

Differentiate your solution with metal touch

- Seamlessly integrate your sensors with stainless steel or metal panels
- Increase functionality with multi-touch and force-touch
- Also supports glass and plastic overlays

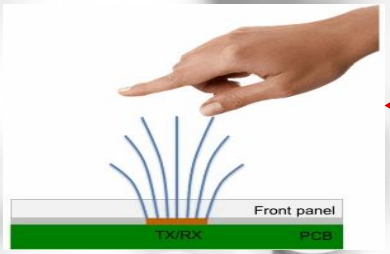
Most configurable button, slider and wheel combinations

- Design up to 64 buttons with just 16 IOs to simplify designs and reduce cost
- Concurrently measure mutual and self-capacitance

Proximity and 3D gesture sensing is also possible with CapTIvate™ Technology

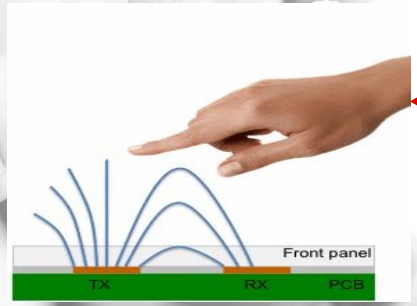
Versatility

CapTIvate™ technology supports self and mutual capacitance in the same design



Self capacitance:

- Electrode = single plate, 16 CapTIvate Touch IOs = 16 Electrodes
- Ultra **high resolution sliders & wheels** (> 10-bit) . Eg. 12" slider = 4 electrodes
- proximity sensors resulting in **higher distances**



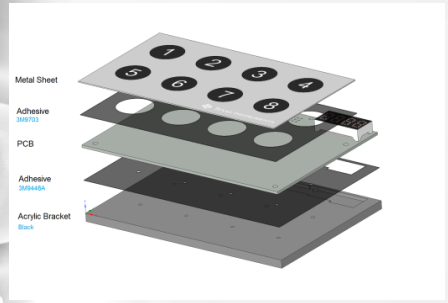
Mutual capacitance:

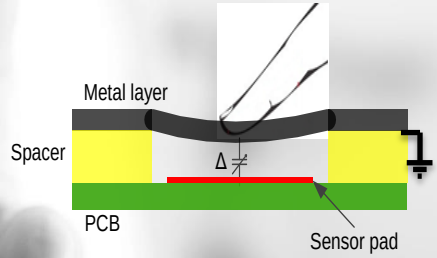
- Electrode is made up of two plates (one Tx, one Rx)
- Allows for up to **64 buttons** with 16 CapTIvate Touch IOs (8Tx, 8Rx)
- Allows for tightly packed buttons with low cross talk
- Allows **multi-touch** matrix implementations.

Hybrid solutions= concurrent self and mutual capacitance

- Self capacitance for proximity/guard channel detection eg. keypad illumination
- Use mutual capacitance for multiple buttons eg. keypad

Versatility
Metal Touch





Advantages:

- Waterproof
- Dustproof
- Wear resistance

Requires an actuation force:

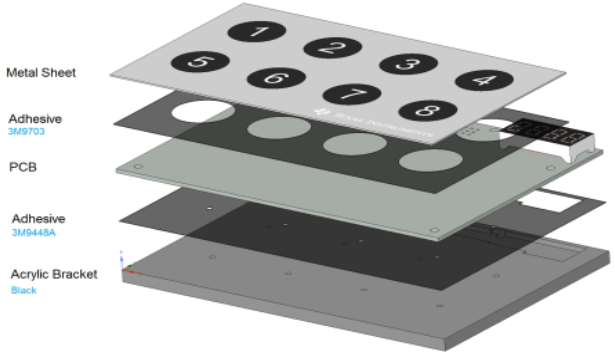
- Touch with gloves
- Soft touch and hard touch (force touch)

High noise immunity:

- RF noise immunity

Touch on Metal Evaluation Module – Available Now

CAPTIVATE-METAL

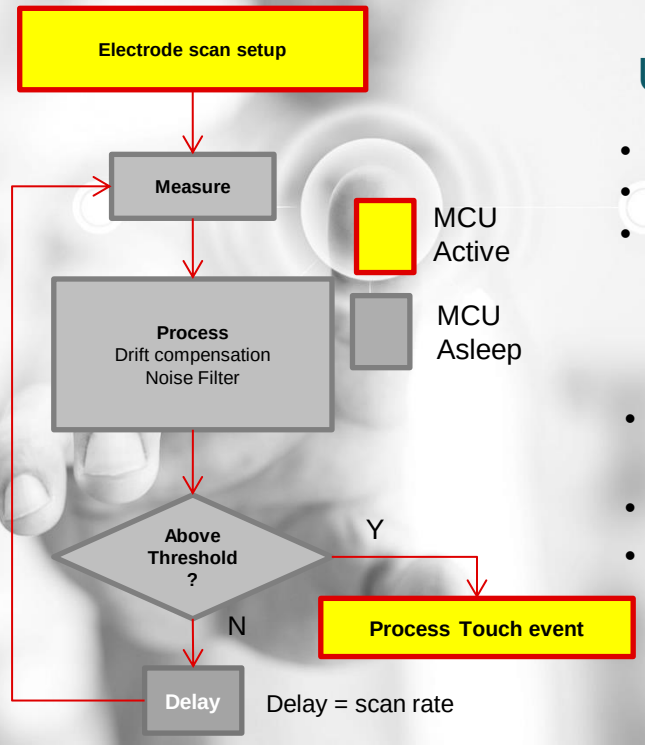


- 8 metal buttons
- Four digit 7 segment display
- Standard CapTIvate connector for use with MCU & Programmer board
- Demo single touch, composite touch and force touch

LINK

Low-power

The world's lowest-power FRAM capacitive touch microcontroller



Up to 90 percent lower power than other solutions

- Scan up to four buttons at 0.9 µA per button with the CPU completely turned off
- Autonomous peripherals enable you to do more with less power
- Experience up to 15 years of battery life on a single coin cell battery

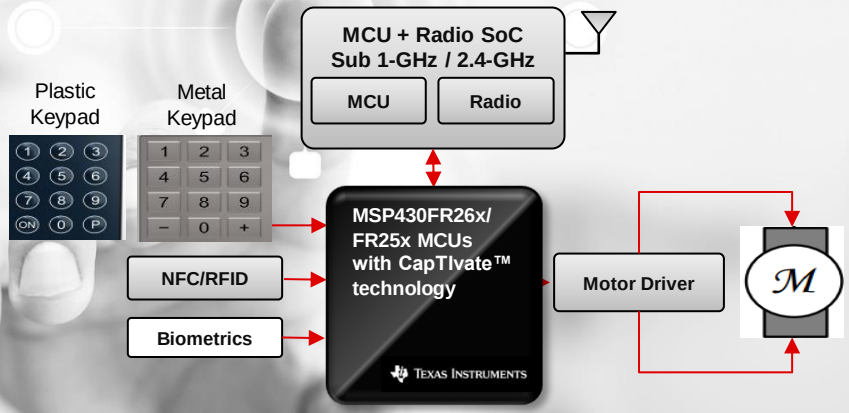
World's only FRAM MCU with CapTIvate™ technology

- FRAM and CapTIvate technology on the same device allows for HMI applications with ultra-low-power datalogging and state retention capabilities
- 10^{15} write endurance
- 100x faster and 250x lower energy writes than other non-volatile technology

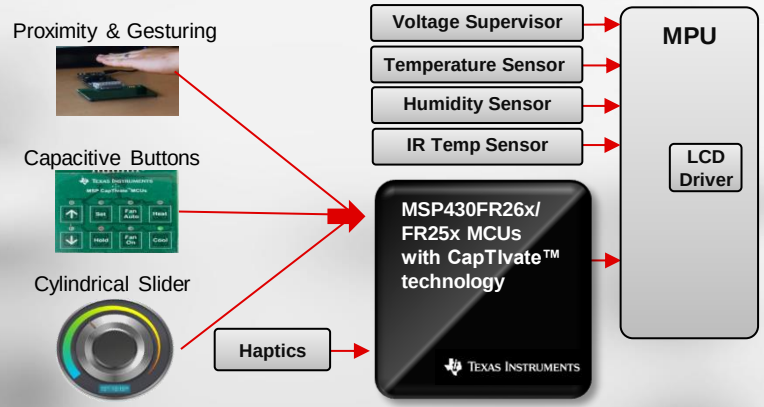
CapTIvate™ technology + FRAM MCUs: A perfect pair

Write endurance, speed and power of FRAM allow you to:

Add data logging to electronic locks

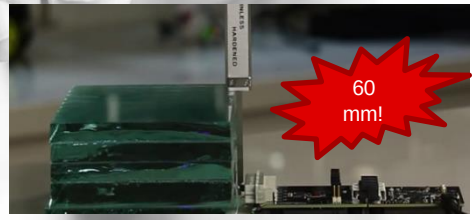


Add intelligence to your Thermostat



High Resolution

Industry’s highest resolution sliders and wheels



Sense through 60mm thick glass

Support low-power 3D gesture recognition

- Scans four sensors simultaneously within 500 µsec to enable advanced gesture features
- Higher proximity distances (up to 30cm)

Industry’s highest resolution slider and wheels

- Thirty centimeter slider with 0.029 cm resolution and only four sensors
- High resolution allows for high degree of linearity in sliders

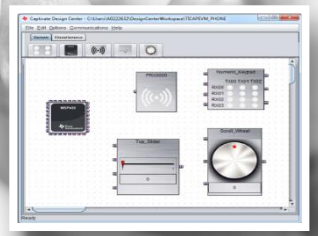
Create designs with thicker glass and plastic overlays

- Detect change as low as 10 Femtofarads
- Minimize effect of parasitic capacitance for more robust designs and flexibility

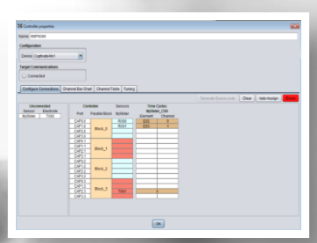
Ease-of-use

Set-up your design in five minutes or less with CapTIvate Design Center

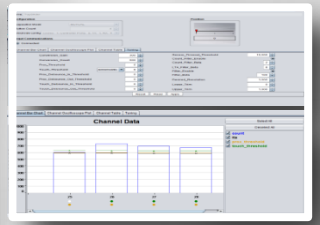
- Simplify and accelerate touch design with CapTIvate Design Center - one stop shop for tools, software and documentation
- Intuitive GUI tools for creating, configuring touch sensors and tuning them in real time
- Tune buttons, sliders, wheels and proximity sensors for sensitivity, noise performance and power consumption
- Automated generation of complete source code projects for Code Composer Studio™ IDE and IAR® IDEs



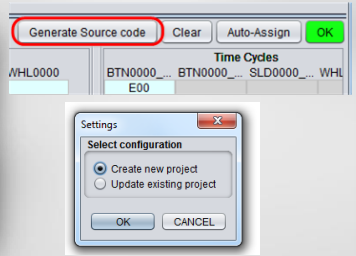
Drag & Drop



Configure



Real-time tuning

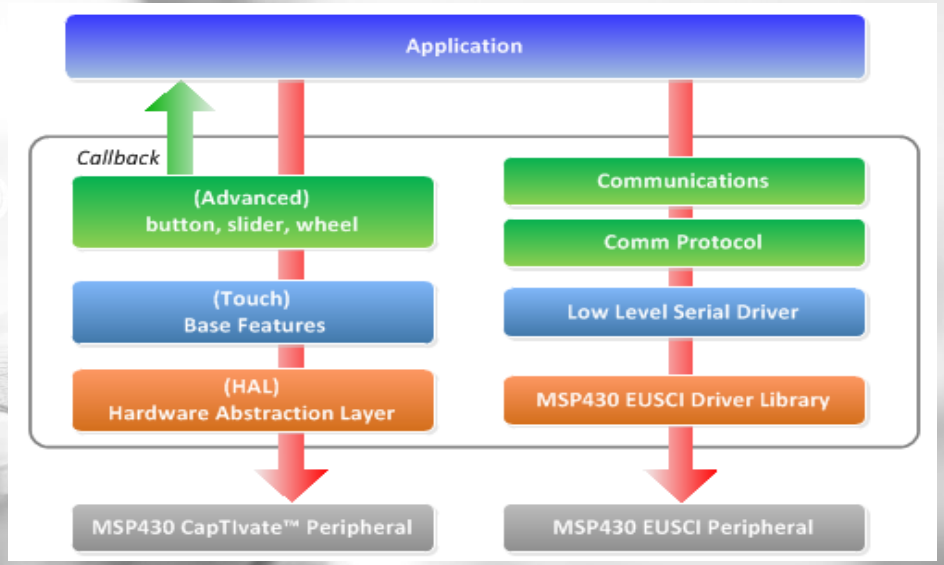


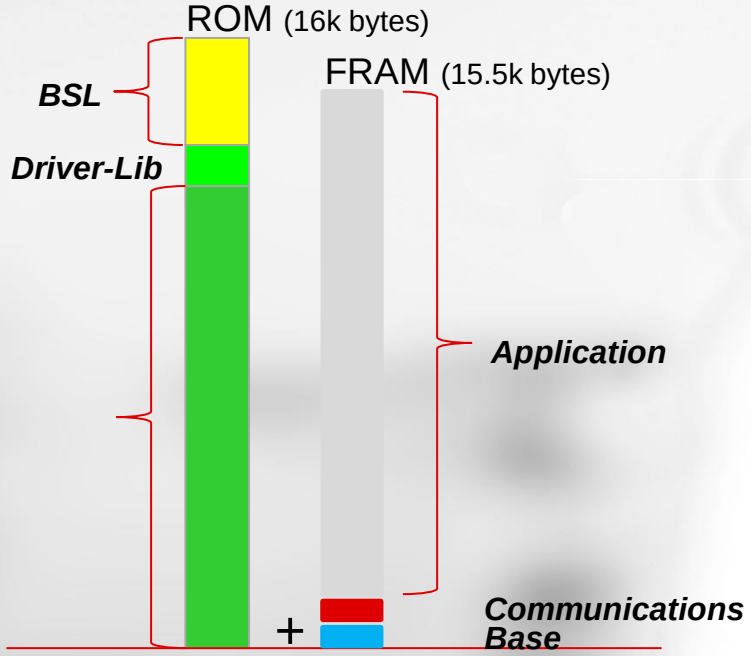
Generate

Build

Ease-of-use

Do more with Software Library in ROM





CapTIvate™ techonology library code footprint

All the tools and support to get developers started today

MSP CapTIvate Development Kit (MSP-CAPT-FR2633)

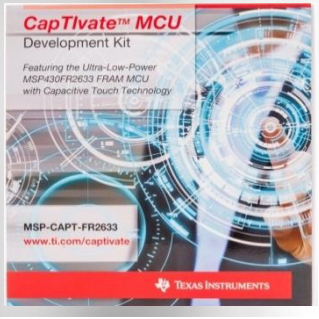
- Based on MSP430FR2633 MCU includes Sensor PCBs demonstrating mutual, self and proximity sensing. Available on TI Store for USD $99.

CapTIvate™ touch MCU+ haptic evaluation

- Part of CapTIvate MCU development Kit with haptic feedback provided by TI's DRV2605L haptic driver + Linear Resonant Actuator (LRA).
- Haptics technology enhances capacitive button, slider and wheel solution by providing mechanical (tactile) feedback to reduce user error, improve user experience and create differentiated products.

CAPTIVATE-PHONE Mutual Capacitance

CAPTIVATE-proximity Proximity & Gestures



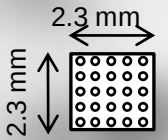
Agenda

- What is capacitive touch and proximity sensing?
- Designing with CapTIvate™ technology
- MSP430FR2633 – FRAM based MCU with CapTIvate technology
- MSP430FR2522 – New Product Overview
- Summary

CapTIvate Portfolio Overview

	MSP430FR2512	MSP430FR2522	MSP430FR2532	MSP430FR2632	MSP430FR2533	MSP430FR2633
FRAM / RAM	7.5K / 2K	7.5K / 2K	8.5K / 1K	8.5K / 2K	15.5K / 2K	15.5K / 4K
CapTIvate IO Channels	4	8	8	8	16	16
CaTIvate Blocks	1	2	4	4	4	4
# Buttons	Self-capacitance: up to 4 Mutual-capacitance: up to 4	Self-capacitance: up to 8 Mutual-capacitance: up to 16	Self-capacitance: up to 8 Mutual-capacitance: up to 8	Self-capacitance: up to 8 Mutual-capacitance: up to 16	Self-capacitance: up to 16 Mutual-capacitance: up to 16	Self-capacitance: up to 16 Mutual-capacitance: up to 64
Recommended for Slider	No	No	Yes	Yes	Yes	Yes
10-Bit ADC, # channels	8	8	8	8	8	8
Timers	2 x 16-bit with 3 × CCR	2 x 16-bit with 3 × CCR	2 x 16-bit with 3 × CCR 2 x 16-bit with 2 × CCR	2 x 16-bit with 3 × CCR 2 x 16-bit with 2 × CCR	2 x 16-bit with 3 × CCR 2 x 16-bit with 2 × CCR	2 x 16-bit with 3 × CCR 2 x 16-bit with 2 × CCR
eUSCI_A (UART / IrDA / SPI)	1	1	2	2	2	2
eUSCI_B (I2C / SPI)	1	1	1	1	1	1
Package	20-VQFN 16-TSSOP	20-VQFN 16-TSSOP	24-VQFN	24-VQFN 24-DSBGA	32-TSSOP 24-VQFN	32-pin TSSOP 24-VQFN 24-DSBGA
1K Price (lowest cost package)	$0.69	$0.89	$0.95	$1.43	$1.71	$1.90

NEW



MSP430FR2633
24-pin DSBGA

MSP430™ FR253x/263x

Features/Benefits

IEC61000-4-x certified touch solutions for noise immunity

Metal touch, 3D gesture, glove friendly and the most configurable solutions

< 4 uA Wake on touch with 4 sensors.

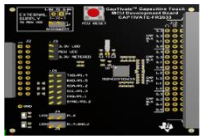
30 cm slider, 1/250th cm resolution, Just 4 IOs

Set-up your design in five minutes or less with CapTIvate Design Center

Touch library in ROM

Self and mutual capacitance in the same design - Upto 64 buttons

Tools



CAPTIVATE-FR2633

CAPTIVATE-BSWP

CAPTIVATE-PHONE

CAPTIVATE-PROXIMITY

Software

- CapTIvate Touch Software Library (in ROM)
- CapTIvate Design Center – Configure, Tune sensors in real time, auto generate code

MSP430FR253x/263x

Temperatures	-40°C to 85°C

MSP430FR2(5/6)3x
16-bit
Up to 16 MHz

System Module
MPY32

Data Protection
CRC16

Serial Interface
2 × UART + IrDA or SPI
1× I²C or SPI

Analog
1 × 10 bit SAR ADC
on-chip bandgap for
battery voltage monitor. On-chip
temperature sensor (up to 8 ch)

Packages
32-pin QFN/TSSOP
24-pin QFN
24-pin DSBGA (TBD)

Memory
Up to 16KB FRAM (with segment protections for code/data)
Up to 4KB SRAM
16KB ROM

Debug
Embedded Emulation
Real-time JTAG/SBW
Bootstrap Loader

Timers
Watchdog Timer
2× 16 bit TA w/ 3CC regs
2 × 16 bit pure TA
Real-Time Clock (Counter only)

Power & Clocking
PMM with BOR, POR,PUC &SVS
LFXT
DCO
FLL
REFO
VLO

GPIO
Up to 17 GPIOs with 8 CapTIvate IOs

CapTIvate Touch
Up to16 CapTIvate IOs, 64 buttons
Wake-on-Prox , zero CPU State Machine
Dedicated 16MHz Oscillator
Dedicated 16-bit Timer

	FR2532	FR2632	FR2533	FR2633
FRAM/RAM	8K/1K	8K/2K	16K/2K	16K/4K

Target Applications

- Thermostats
- Electronic access control
- Lighting control
- Electronic Locks
- White goods
- Small appliances
- Personal electronics

Texas Instruments

CapTIvate DSBGA: MSP430FR2633IYQWR

Features & Benefits

Fully programmable with ULP MSP430 core

IEC61000-4-x certified touch solutions for noise immunity

Supports metal touch and glove friendly designs

< 4 uA Wake on touch with 2 sensors

Easily configure capacitive sensors with CapTIvate Design Center

Touch library in ROM allows more application space in FRAM

Self and mutual capacitance in the same design – Up to 16 buttons

Target Applications

Small appliance & power tools

Factory automation: Sensor designs

Personal electronics: Virtual assistants, BT speakers, headsets, earbuds, shavers, toothbrushes, stylus

Schedule

Volume Production NOW!

Size

2.3mm x 2.3mm

Tools & Collateral

CapTIvate Development Kit

Touch Software Lib (ROM)

CapTIvate Technology Guide

DSBGA Use Cases White Paper

DSBGA in Smart Wearables

Code Composer Studio & IAR

CapTIvate Design Center

Example Videos Coming Soon!

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MSP430™ FR25x2

Features/Benefits

Fully programmable FRAM based MSP430

IEC61000-4-x certified touch solutions for noise immunity

Supports metal touch and glove friendly designs

< 4 uA Wake on touch with 2 sensors

Easily configure capacitive sensors with CapTIvate Design Center

Touch library in ROM allows more application space in FRAM

Self & mutual capacitance in the same design – Up to 16 buttons (FR2522)

Tools

BOOSTXL-CAPKEYPAD

Software

- CapTIvate Touch Software Library (in ROM)
- CapTIvate Design Center – Configure, Tune sensors in real time, auto generate code

MSP430FR25x2

Temperatures	-40°C to 85°C

MSP430F25x2
16-bit
Up to 16 MHz

System Module
MPY32

Data Protection
CRC16

Serial Interface
1 × I2C/SPI
1x UART /SPI

Analog
1 × 10 bit SAR ADC

Packages
PW16- TSSOP16
RHL VQFN20

Memory
7.5KB FRAM ((with segment protections for code/data)
2KB SRAM
16KB ROM

Debug
Embedded Emulation
Real-time JTAG/SBW
Bootstrap Loader

Timers
Watchdog Timer
2× 16 bit TA w/ 3CC regs
Real-Time Clock (Counter only)

Power & Clocking
PMM with BOR, POR,PUC &SVS
LFXT
DCO
FLL
REFO
VLO

GPIO
Up to 15 GPIOs

CapTIvate Touch
Up to 8 CapTIvate IOs, 16 buttons
Wake-on-Prox , zero CPU State Machine
Dedicated 16MHz Oscillator
Dedicated 16-bit Timer

Target Applications

- Thermostats
- Electronic access control
- Set top box
- Grid Infrastructure
- Electronic Locks
- White goods
- Small appliances
- Personal electronics

CapTIvate™ BoosterPack

BOOSTXL-CAPKEYPAD

Features

- 12 button numeric keypad enabled by 4x3 mutual capacitance matrix
- Proximity sensor for system wakeup
- Guard channel for palm or moisture rejection
- I2C slave interface and interrupt for host communication
- 3 jumpers for prototyping external sensors
- Integrated LP3943 LED driver for backlighting

Benefits

- Enable a sleek capacitive touch interface for users
- Extend battery life with wake-on-proximity
- Prevent false touch events when cleaning the keypad
- Interface with SimpleLink™ and MSP430 LaunchPads
- Develop and evaluate your own sensors
- Provide direct visual feedback for a touch event

Tools & Resources

- CapTIvate Development Kit
- CapTIvate Design Center
- Code Composer Studio
- IAR

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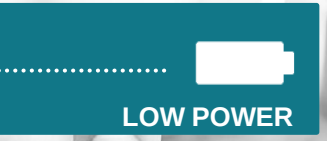
CapTIvate™ technology revolutionizes capacitive touch

IEC61000-4-6 certified touch solutions for noise immunity

Metal touch, 3D gesture, glove friendly and the most configurable solutions



The world's lowest-power FRAM capacitive touch microcontroller

Industry's highest resolution sliders and wheels

Set-up your design in five minutes or less with CapTIvate Design Center

Resources

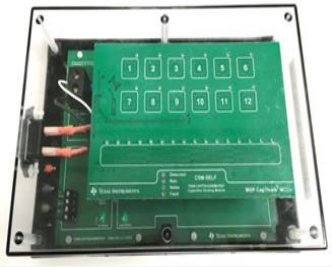
Website: www.ti.com/CapTIvate

Videos:

Part 1: Introducing MSP MCUs featuring CapTIvate Technology
Part 2: The MSP CapTIvate MCU Development Kit
Part 3: Tune Capacitive Sensors in 5 Minutes or Less with the CapTIvate Design Center
Part 4: Low-power Features of MSP MCUs featuring CapTIvate Technology
Part 5: Capacitive Button, Slider and Wheel Interfaces
Part 6: Proximity Sensing and 3D Gestures
Part 7: Moisture Rejection in Capacitive Touch Designs
Part 8: Noise Immunity in Capacitive Touch Designs

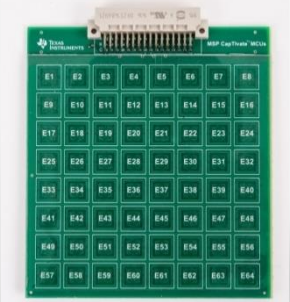
TI Designs:
Capacitive Touch Thermostat User Interface Reference Design
64-Button Capacitive Touch Panel With TI Microcontroller With CapTIvate Technology Reference Design
Touch Through Glass with Sharp ® LCD Reference Design
Noise Tolerant Capacitive Touch HMI Reference Design

Deep Dive trainings:
https://training.ti.com/captivate-training-series
Fundamental PCB Layout and Design Guidelines
Introduction to EMC Challenges and Design with CapTIvate™ MCUs



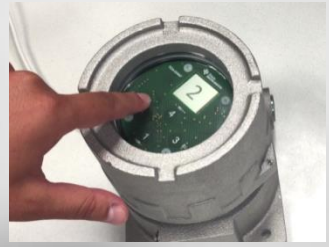
TIDM-CAPTOUCHEMCREF

TIDM-CAPTIVATE-THERMOSTAT-UI



TIDM-CAPTIVATE-64-BUTTON

E-lock TID- Coming soon



TIDA-00494

Remote control TID- Coming soo

BACKUP

CapTIvate Wearable Design

Features

- MSP430 CapTIvate technology based wearable design
- Features 3 mutual cap buttons, 2 self cap buttons, and a high resolution slider
- MCU package size of 2.2mm x 2.3mm
- Sensor size as small as 5mm x 1.5mm
- < 3uA operating current

Benefits

- Enables tiny slider and button configurations
- Longer life on applications with small batteries

Target Applications

- Wearables
- Sensor transmitters
- PE accessories (stylus, etc.)
- Personal health (toothbrush, etc.)

Tools & Resources

Wearable Design Demo Video

CapTIvate ITO Thermostat Design

Features

- MSP430 CapTIvate technology based ITO thermostat design
- ITO film allows for implementation for transparent capacitive sensors
- Features backlit display configured to wake-on-proximity
- Features 3 buttons, 1 proximity sensor, and 1 slider
- MSP430 MCU for CapTIvate, MSP432 wireless host MCU and CC3120 Wi-Fi MCU

Benefits

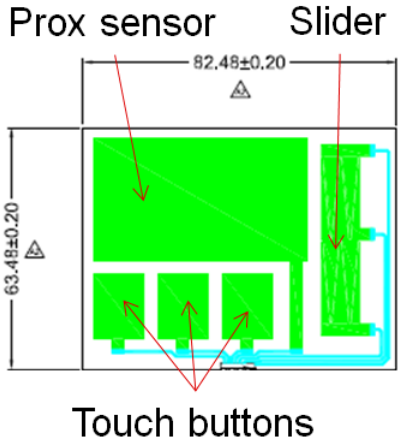
- Longer battery life with wake-on-proximity
- Sleek touchscreen interface for users

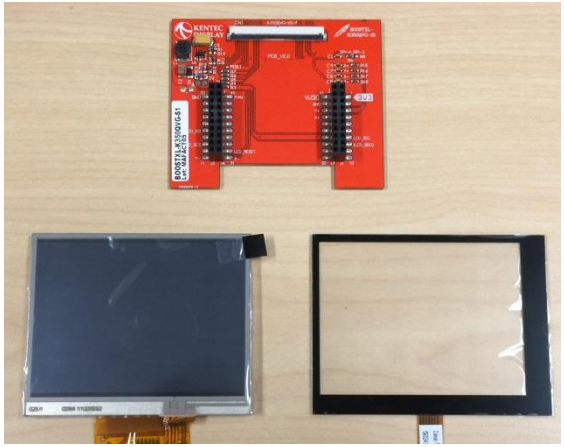
Target Applications

- Thermostats
- Electronic locks
- Security keypads

Tools & Resources

ITO Design Demo Video





Touch Sensing EMC Ref. Design *TIDM-CAPTOUCHEMCREF*

TIDesigns

Features

- MSP430FR2633 MCU for noise-tolerant capacitive touch sensing with CapTIvate™ technology
- System level ESD, EFT/B, and conducted noise tolerance
- Mutual and self capacitive sensing modules
- Universal AC and 12V DC power supply modules
- Isolated communications port for debug and test

Benefits

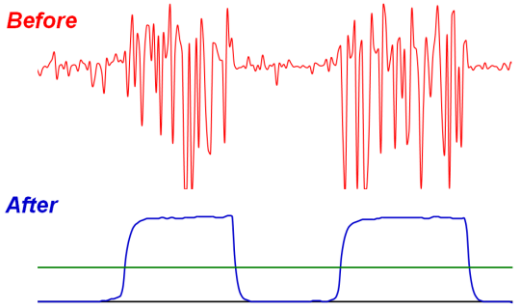
- Demonstrates how to meet product EMC requirements with a robust, flexible, high-performance capacitive touch interface

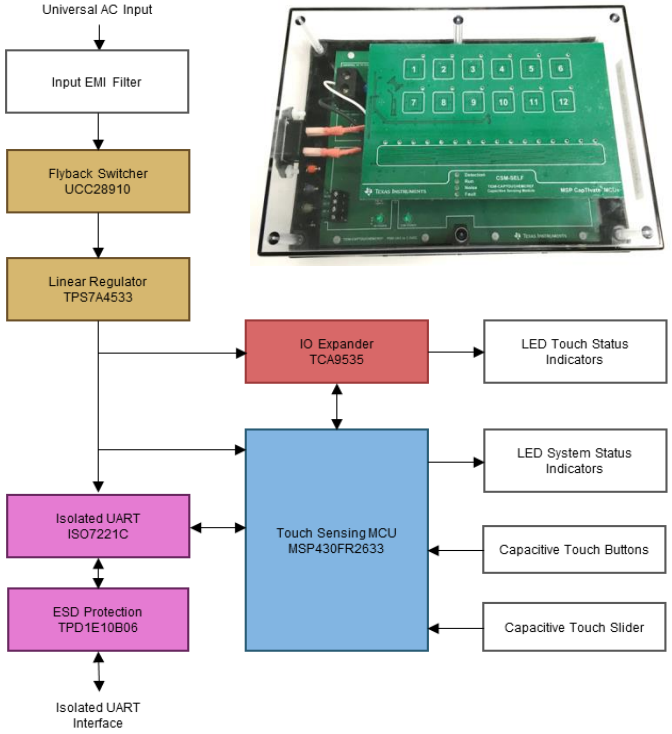
Target Applications

- Appliances and White Goods
- Industrial Control Panels
- TV, AV, and Set Top Box Interfaces
- Building Automation User Interfaces

Tools & Resources

Coming Soon – Early 2Q16





Video: Noise Immunity in Capacitive Touch Designs

64-Button Capacitive Touch Panel *TIDM-CAPTIVATE-64-BUTTON*

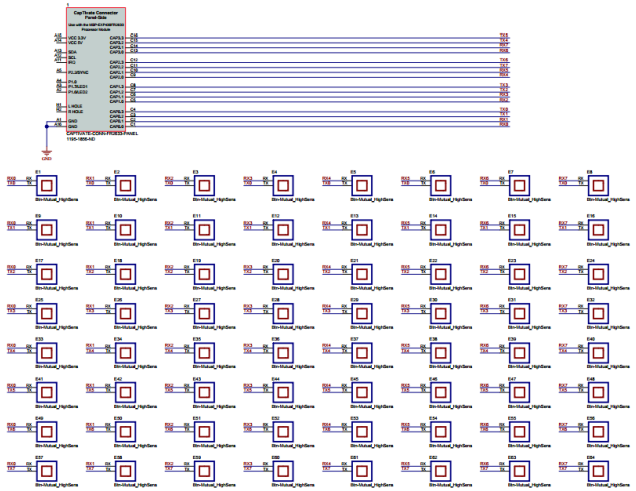
TI Designs

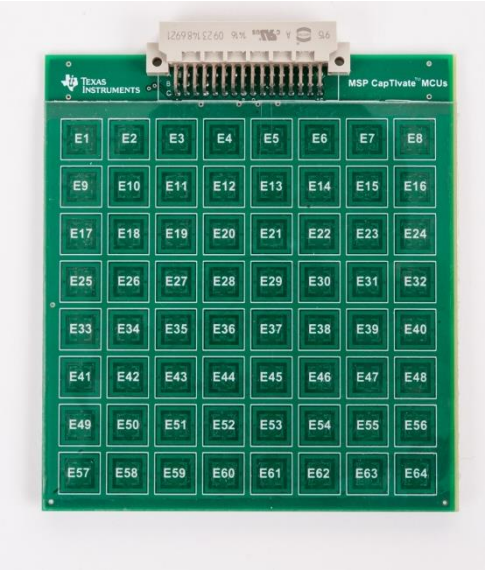
Features

- Single touch and multi-touch detection
- Mutual capacitance technology enables 64-buttons with only 16 pins
- More than 100 samples-per-second and 15-ms typical response time
- 0.23-µA-per-button average current with wake-on-touch mode

Benefits

- Demonstrates use of CapTIvate to support large number of buttons in a low power system





Video:CapTIvate 64 Button Panel

Target Applications

- Appliances and White Goods
- Industrial Control Panels
- TV, AV, and Set Top Box Interfaces
- Building Automation User Interfaces

Tools & Resources

Schematics, Design files
Released at TI.com

HMI - Low Power Touch Through Glass Reference Design

In Design

TI Designs Number: TIDA-00343

TIDesigns

Design Features

- Single and multi-step button press
- Three or more robust buttons option implemented
- Three LEDs feedback
- Easy to use
- Variable air gap between buttons and glass
- Low power: 1.7uA/Button
- Temperature range: -40°C to 85°C

Design Benefits

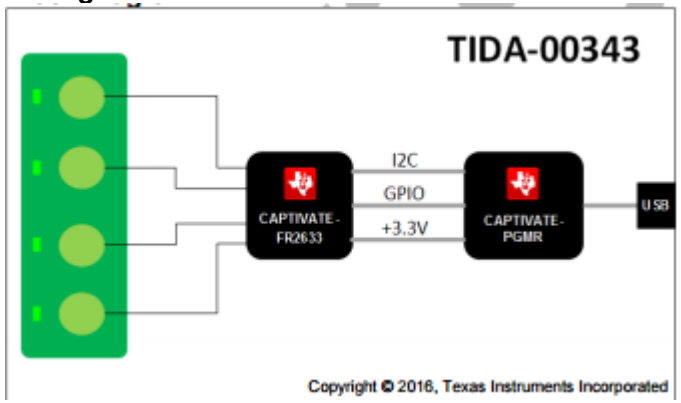
- Finger detection through tick glass (8 – 12 mm)
- Work with gloves and in harsh environment (water, oil, dust)
- No calibration

Tools & Resources

Board Image

- **TIDA-00343 Tools Folder**
- **Design Guide**
- **Design Files:** Schematics, BOM, Gerbers, Software, and more
- **Device Datasheets:**
  - MSP430 capTIvate

Block Diagram



Video: Low Power Touch through Glass TI Design

Capacitive Touch Thermostat UI

TIDM-CAPTIVATE-THERMOSTAT-UI

Features

- MSP430 CapTIvate technology based thermostat UI design
- 8 buttons with only 6 IOs and visual feedback
- < 50 uA Avg power
- FRAM NVM technology:10^{15} write endurance, 100x faster and 250x lower energy writes

Benefits

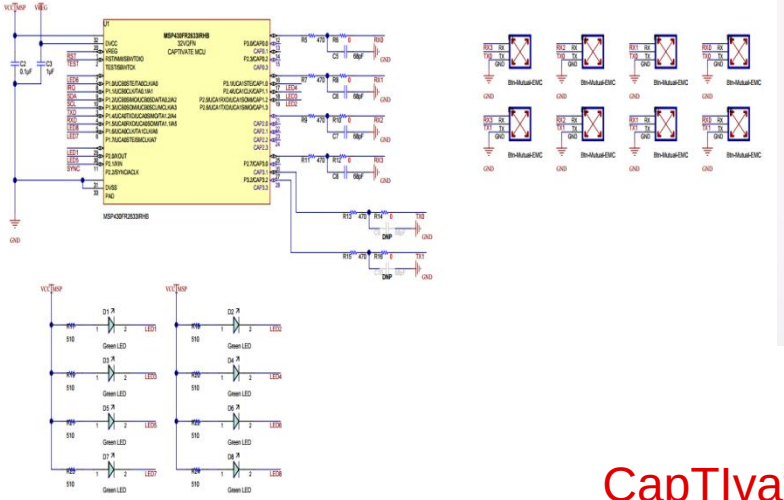
- 2 years battery life on AAA
- Save States on FRAM memory

Target Applications

- Thermostat

Tools & Resources

TI Design at TI.com



CapTIvate Thermostat Video

CapTIvate Elock: *TIDM-CAPTIVATE-ELOCK*

Features

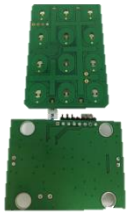
- CapTIvate Capacitive Touch functions
  - 12x Touch Buttons
  - 1x Proximity Sensor for system wake up
- 12 LEDs to indicate touch operation
- Wake-on touch with ultra-low power standby mode
- Haptics available
- Beep indicate touch feedback and lock status
- Moto drive circuitry available
- 2 x AAA or 4 x AAA reference power circuitry

Target Applications

- Smart Entrance
- Control Panel

Tools & Resources

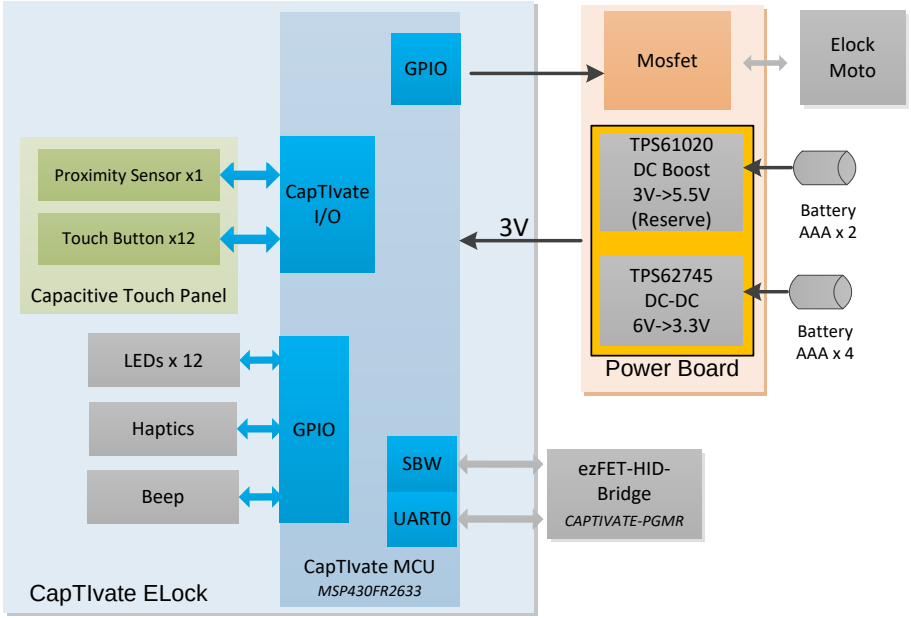
Board Image



- **TI Design User Guide**
- **Design Files:**
  - Schematics
  - BOM
  - Gerbers
  - Software
- **Device :**
  - MSP430FR2633
  - TPS6275
  - TPS61020

Benefits

- Ultra Low power in active and standby modes extends battery life



CapTIvate Remote Control : TIDM-CAPTIVATE-REMOTECONTROL

Features

- CapTIvate Capacitive Touch functions
  - 8x Touch Buttons
  - 1x Touch Slider for volume control
  - 1x GesturePad for slide and tap gestures
  - 1x Proximity Sensor for grip detection
- 2 LEDs to indicate power status and touch operation
- Wake-on grip detection with ultra-low power standby mode
- PC GUI for demo of remote control capabilities
- I2C & UART communication interface
- Bluetooth connectivity to PC through Bluetooth EVM CC2650EM-7ID
- Haptic circuitry available

Target Applications

- Smart TV & SET-TOP Box remotes
- Sound system remotes

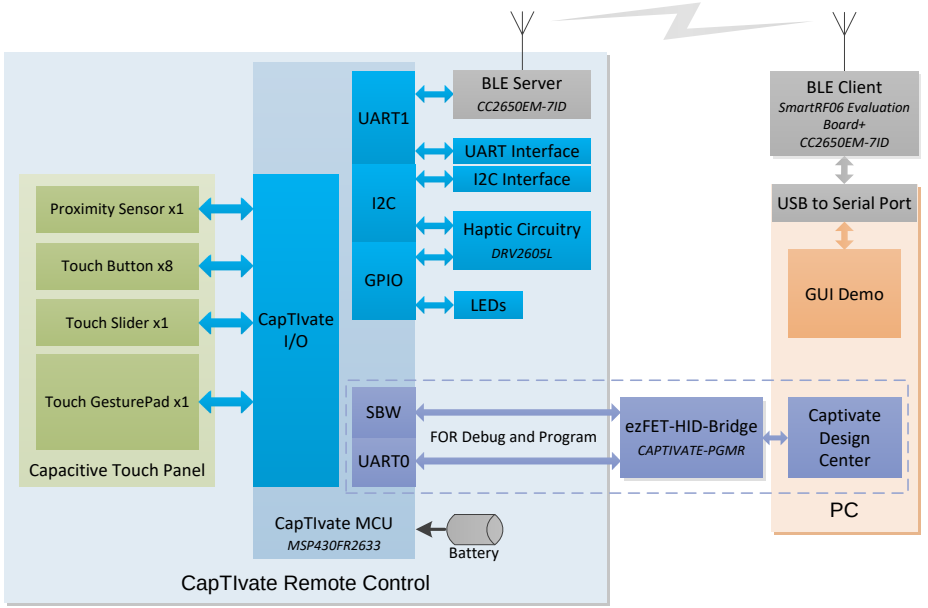
Tools & Resources

Board Image

- TIDM-CAPTIVATE-REMOTECONTROL Design Folder
- **TI Design User Guide**
- **Design Files:**
  - Schematics
  - BOM
  - Gerbers
  - Software
- **Device Datasheets:**
  - MSP430FR2633
  - DRV2605L
  - CC2650EM-7ID

Benefits

- Multifunctional capacitive touch panel for remote control with Buttons, Slider and GesturePad functions
- Low power in active and standby modes extends battery life
- Various communication interfaces available for future application extension



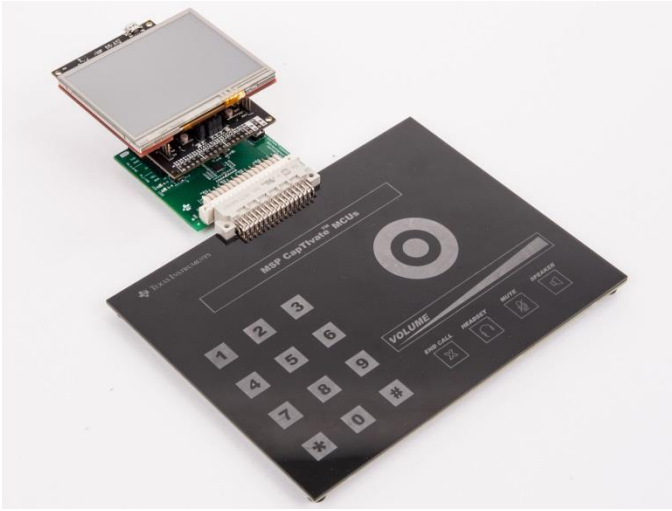
https://www.youtube.com/watch?v=OHrNvz7x1Rs

MSP432 + CapTIvate Demo

TIDesigns

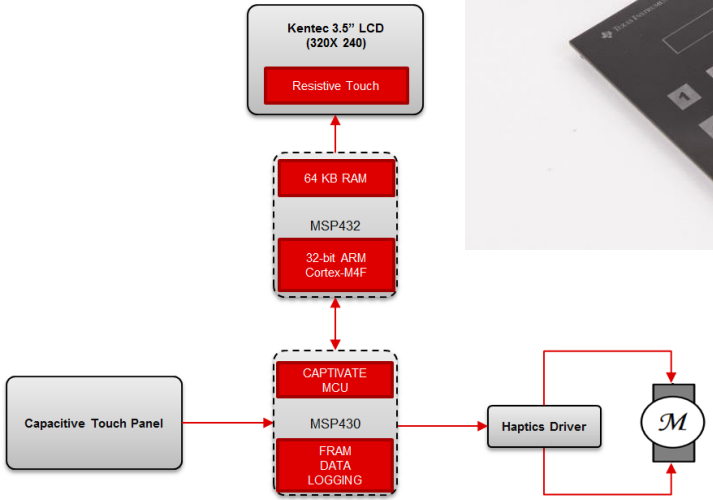
Features

- Single touch and multi-touch detection
- Mutual capacitance technology enables 17 buttons, 2 sliders, 1 wheel, and 1 proximity/guard channel with only 16 pins
- Supports both UART and I2C interfaces
- >20 ms touch-to-display worst-case response time



Benefits

- Demonstrates use of CapTIvate MCU as a dedicated HMI controller with external host
- Haptic feedback controlled by CapTIvate MCU provides better user experience



Target Applications

- IP Phone Panels
- Industrial Control Panels
- Building Automation User Interfaces
- Appliances and White Goods

Versatility
Metal Touch

Advantages:

- Waterproof
- Dustproof
- Wear resistance

Requires an actuation force:

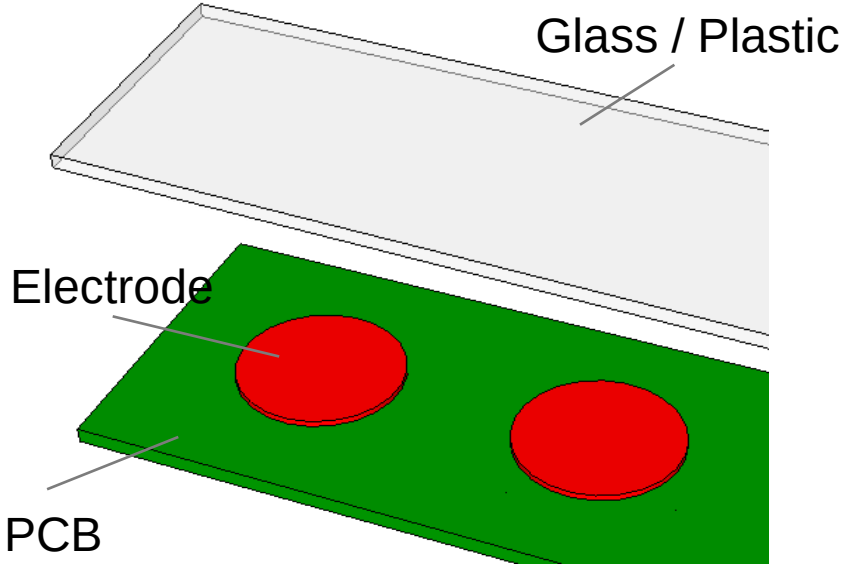
- Touch with gloves
- Soft touch and hard touch (force touch)

High noise immunity:

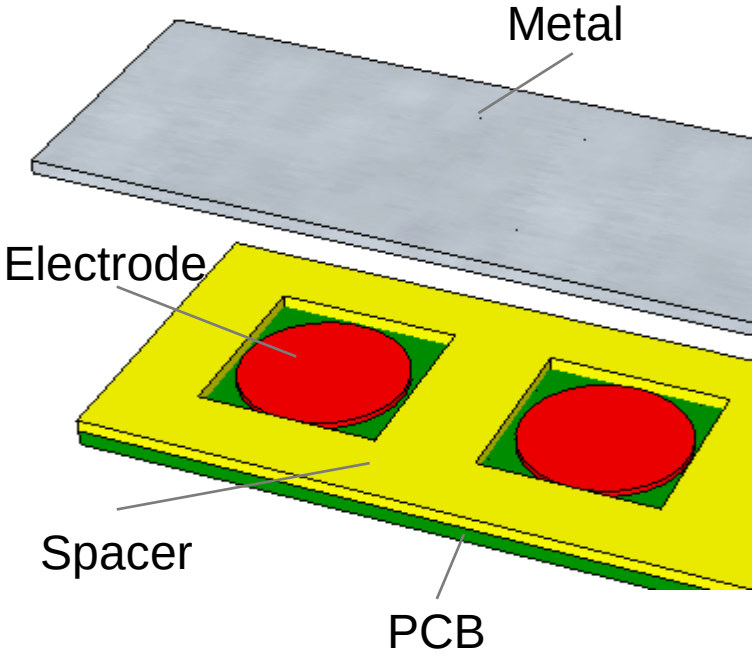
- RF noise immunity

Metal touch - Stack-up

Common Cap Touch



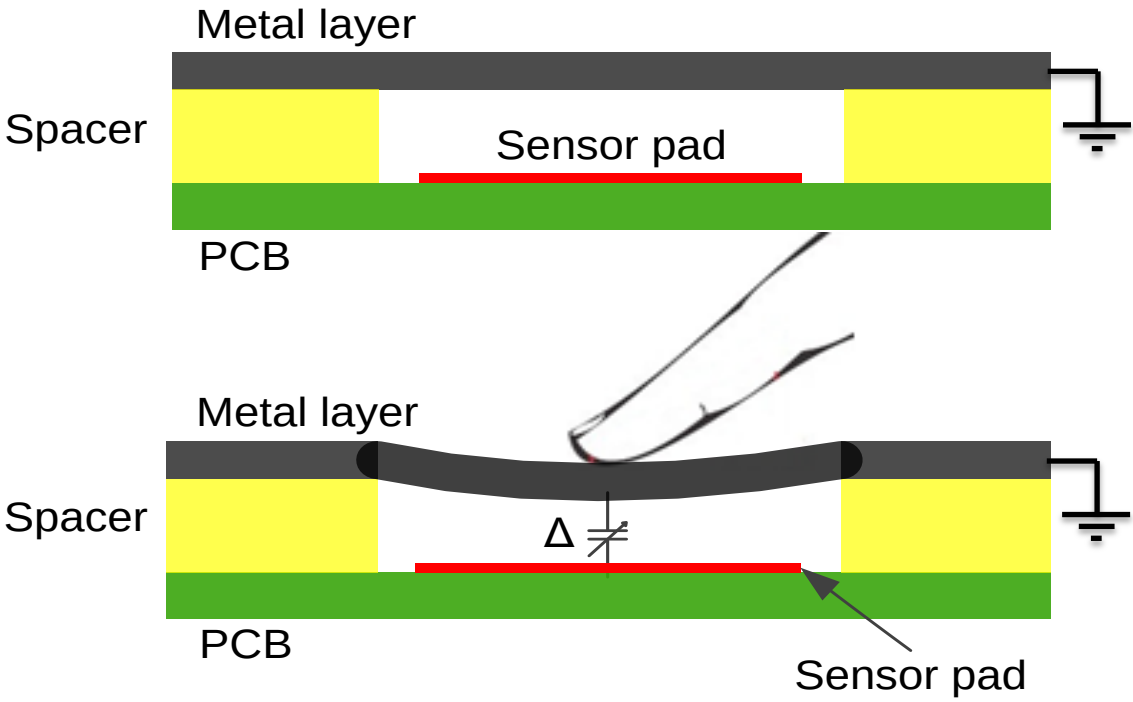
Metal Touch



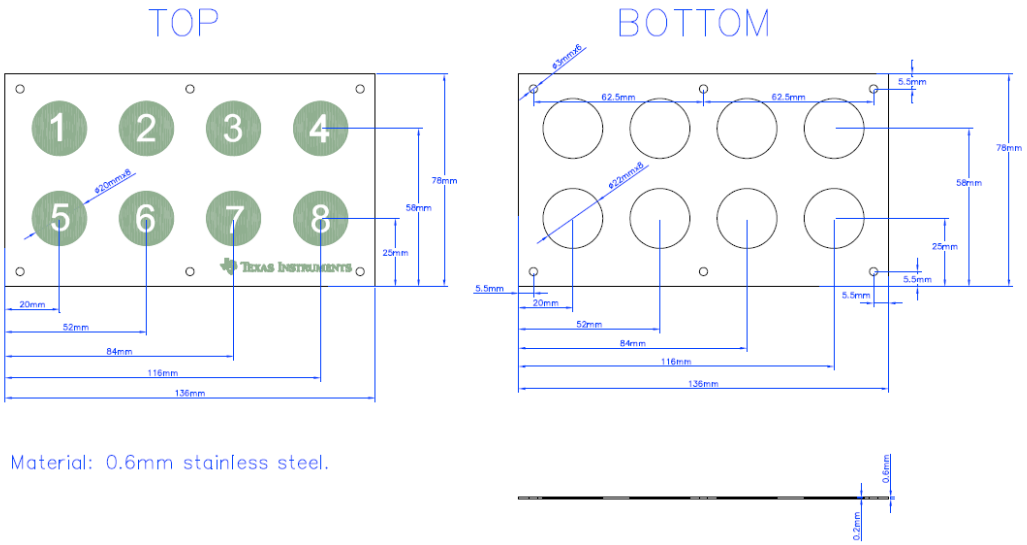
Metal touch - Theory of Operation

1. User press on metal layer causing deformation
2. Metal layer moves towards sensor pad
3. The decrease of the distance increase the capacitance

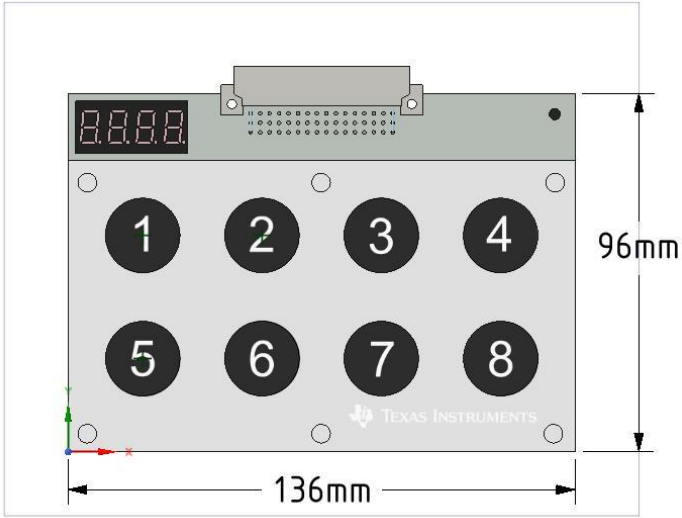
$$C = \varepsilon_r \varepsilon_0 \frac{A}{d}$$



Metal touch dimensions

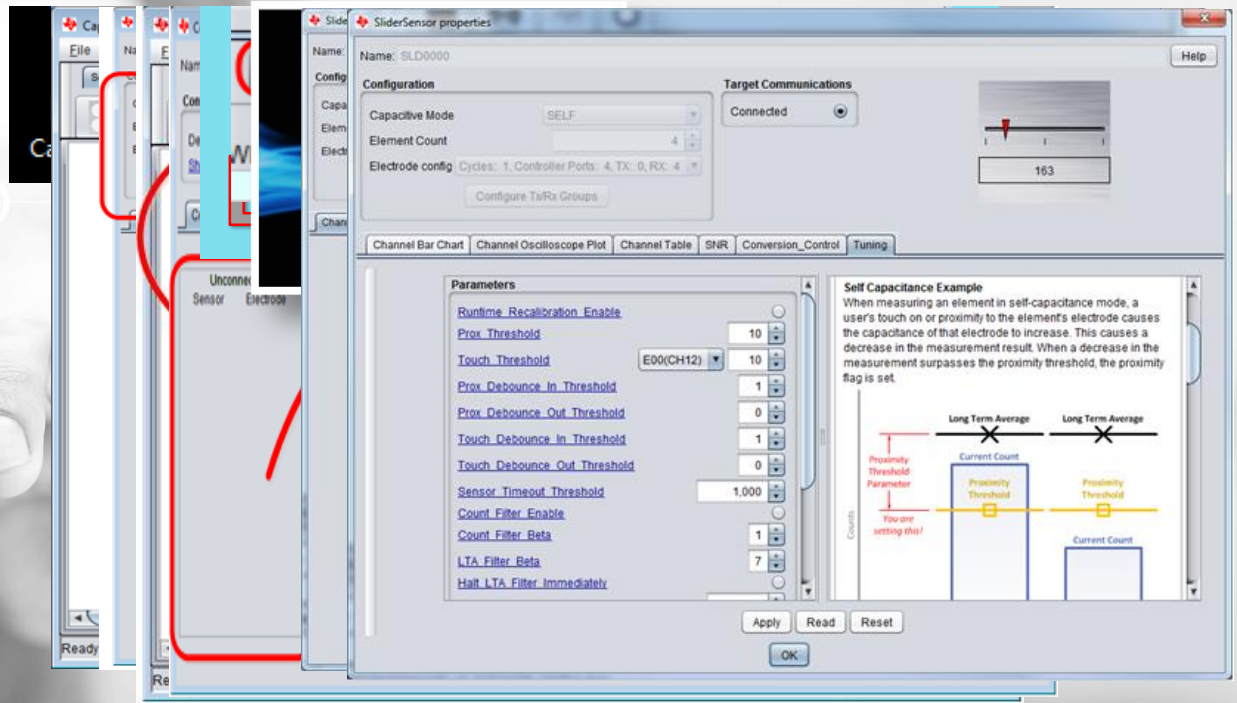


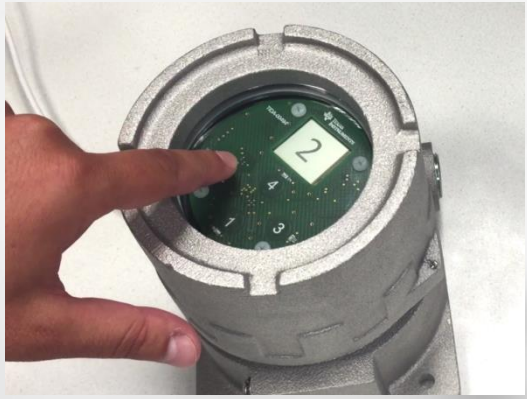
Material: 0.6mm stainless steel.



Ease-of-use

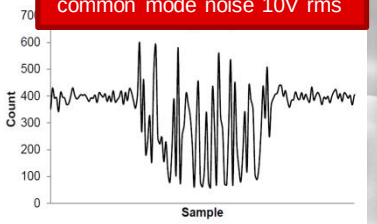
Set-up your design in five minutes or less with CapTIvate Design Center



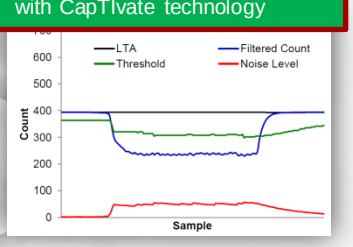

2

Elevator Panels with MSP430 with CapTIvate touch technology

Capacitive measurement with common mode noise 10V rms

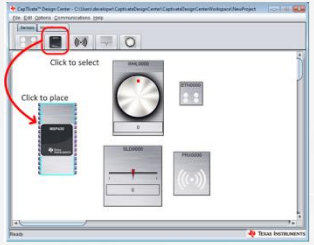


Capacitive measurement filtered with CapTIvate technology

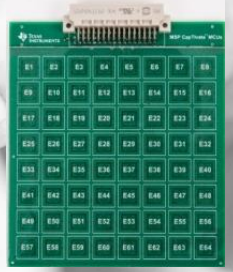


IEC61000-4-6 certified touch solutions for noise immunity

Fully Programmable Microcontroller with FRAM NVM memory

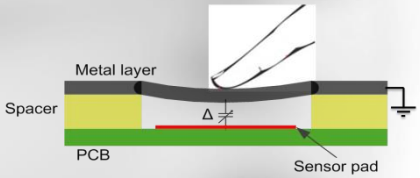


Drag & Drop tools for tuning buttons



Upto 64 buttons on one device with just 16 IOs.

Proximity sensing and 3D gestures at 10cm



Support for Metal overlay Buttons and sliders

CapTIvate in Building Automation

Electronic Locks/Keypad

Captivate benefits:
- <3uA Avg power => Years of battery life
- Moisture rejection capability
- Plastic/glass or metal overlay
- FRAM for state/passcode retention

Featured Collateral
TIDA-00343 (Touch through glass)

Coming soon
TIDM-CAPTIVATE-ELOCK

Thermostat

Captivate benefits:
- Low power => Use with energy stealing
- Replace resistive with captouch
- Support for ITO (transparent sensors)
- FRAM for user profile retention

Featured Collateral
TIDM-CAPTIVATE-THERMOSTAT-UI

CapTIvate in Building Automation

Security Panel

Captivate benefits:
- <3uA => Years of battery life
- Use 3D gestures
- Upto 64 buttons with mutual capacitance
- Upto 10cm prox sensing for back light
- Gesture pad for more complex HMI

Featured Collateral
TIDM-CAPTIVATE-64-BUTTON

Coming soon
TIDM-CAPTIVATE-REMOTECONTROL (gesture pad)

Light Switches

Captivate benefits:
- Immune to power line noise
- Design flexibility with Plastic, glass, wood, metal overlay
- FRAM for user profile retention

Featured Collateral
TIDM-CAPTOUCHEMCREF
TIDM-CAPTIVATE-THERMOSTAT-UI

CapTIvate in Building Automation

Elevator Panels

Captivate benefits:
- Immune to power line noise
- Support for metal touch
- 64 buttons on a single device

Featured Collateral

TIDM-CAPTIVATE-64-BUTTON
TIDM-CAPTOUCHEMCREF

Coming soon
Touch on metal reference design

MSP430 CapTIvate touch technology

CapTIvate Applications

Appliances

E-Lock

Security panel

Consumer

16 IOs = 64 buttons

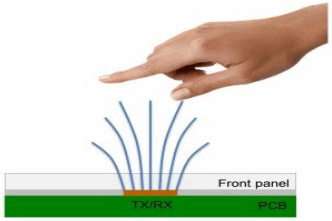
Sense through 60mm thick glass

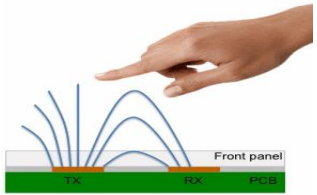
Moisture rejection

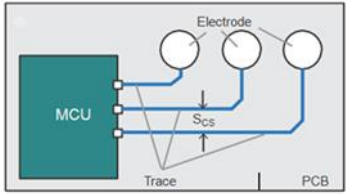
30 cm slider , 4 sensors, 10-bit resolution

Works with Metal overlay

3mmx5mm sensors



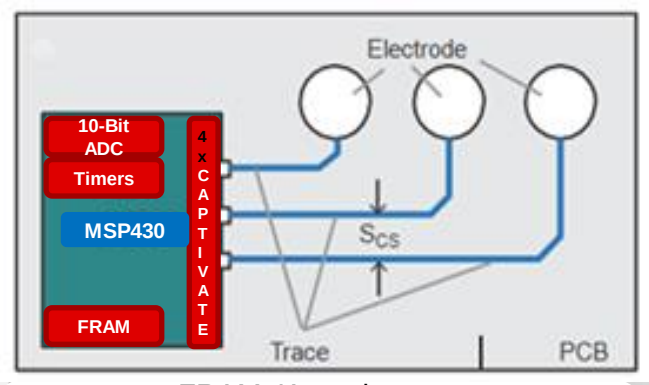


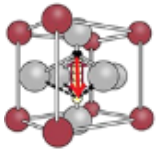


Benefits

- Autonomous peripheral in MSP430 FRAM MCU
- IEC61000-4-6 certified solutions for noise immunity
- Metal touch, 3D gesture, glove friendly designs
- Industry's highest resolution sliders and wheels
- Set-up design in five minutes with CapTIvate Design Center

Industry's lowest power captouch MCU

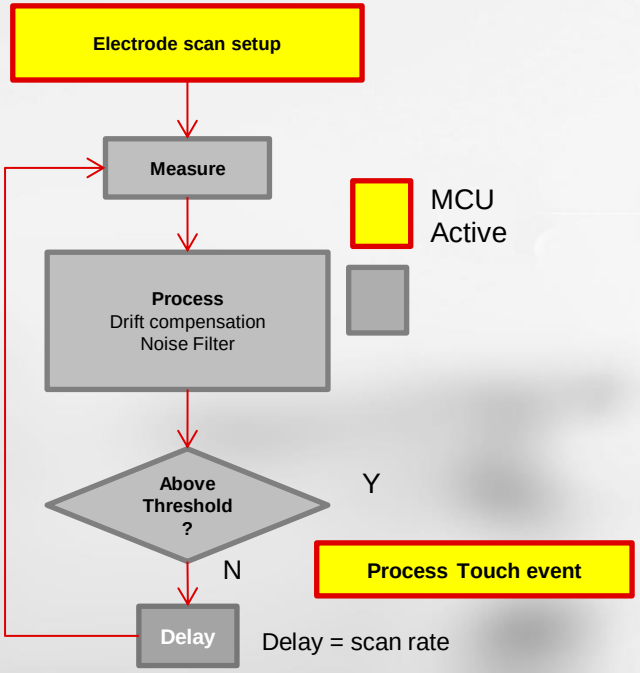




FRAM Key advantages

- 10^{15} write endurance
- 100x faster and 250x lower energy writes than other non-volatile technology
- ultra-low-power datalogging and state retention capabilities

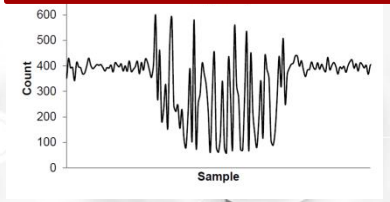
Programmable MCU with CapTIvate and FRAM technologies



< 5uA Avg Power Consumption 4 concurrent sensor scans

Highly Robust Capacitive touch solutions

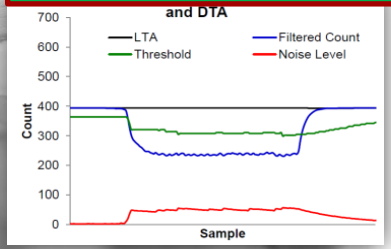
Capacitive measurement with common mode noise 10V rms



IEC61000-4-4 EFT at 4KV

IEC61000-4-2 ESD at 16KV

Measurement filtered with CapTIvate technology

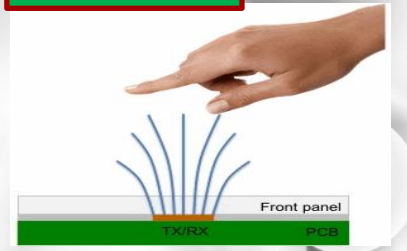


IEC61000-4-6 certified touch solutions for noise immunity

Moisture resistant designs

CapTIvate offers ultimate flexibility

Self Cap



Mutual Cap

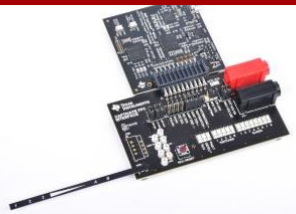
Self cap and Mutual Cap on the same design

16 IO = 64 sensors

30 cm slider, 10-bit resolution, 4 sensors

60 mm glass overlay

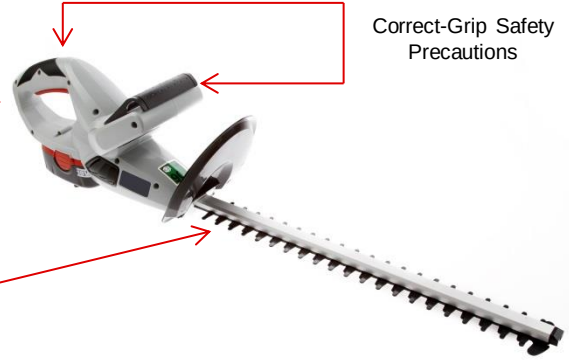
Tiny sensors (3x5mm^2)



Metal Overlay

Trackpad and buttons with 1 chip

Some Grip Detection Applications



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