# Capacitive Touch

Last updated 6/17/19

Capacitive Touch

- Capacitive Touch IO
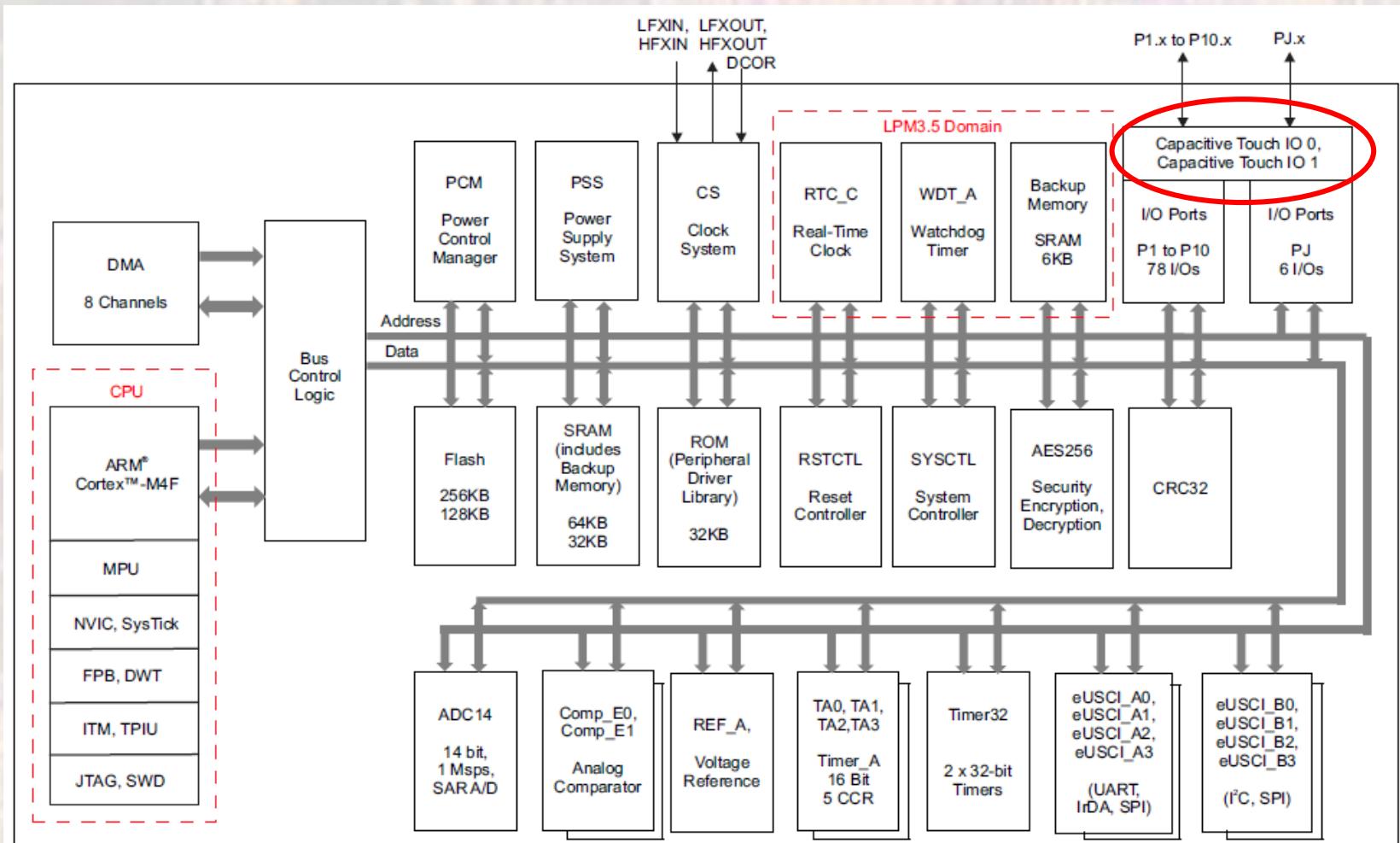
Capacitive Touch

- ## MSP432 Cap Touch

  - ### Hardware Configuration

  - ### All Ports
  - ### All Port Pins
  - ### 2 sensors

  - ### Utilize 2 timers

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$$C = C1 \mathbin{||} C2 = C1 + C2$$

C1

C1

C2
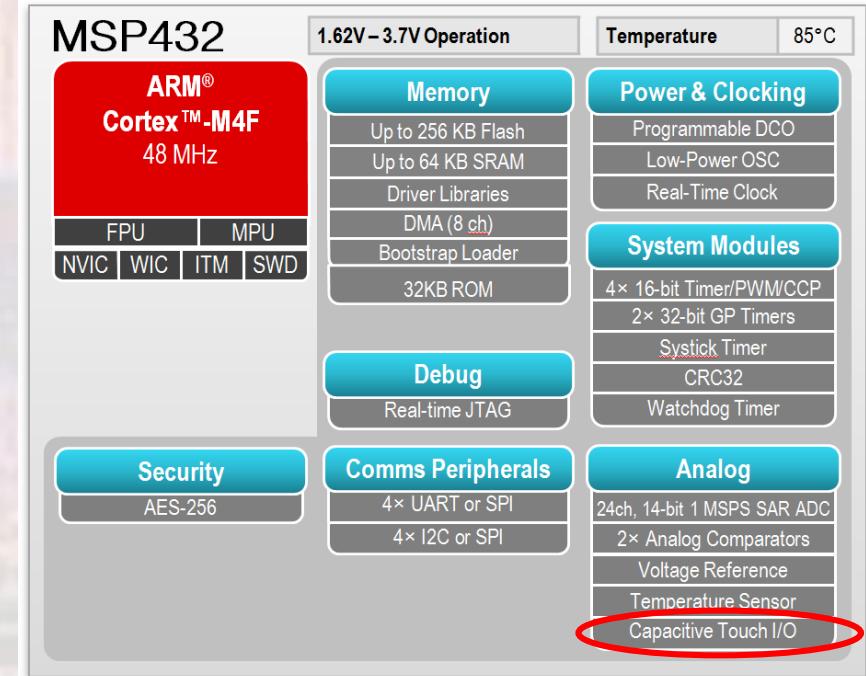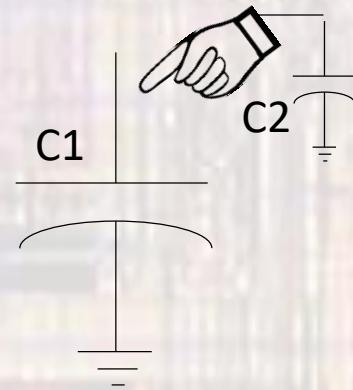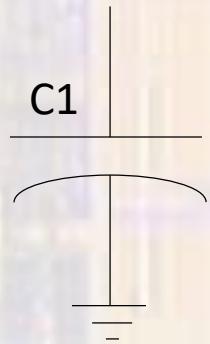
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No port programming required
Port configured by enabling Cap Touch
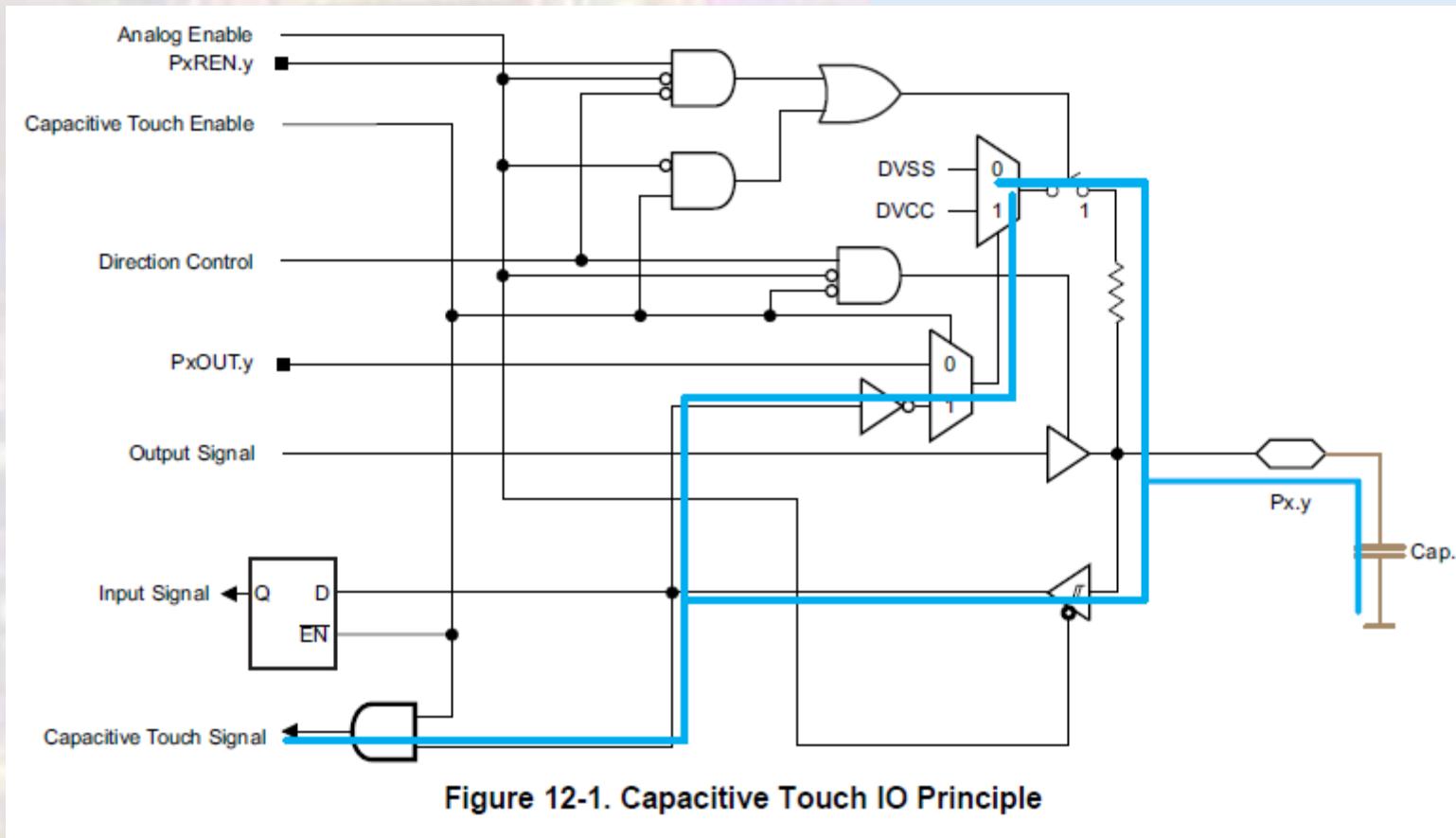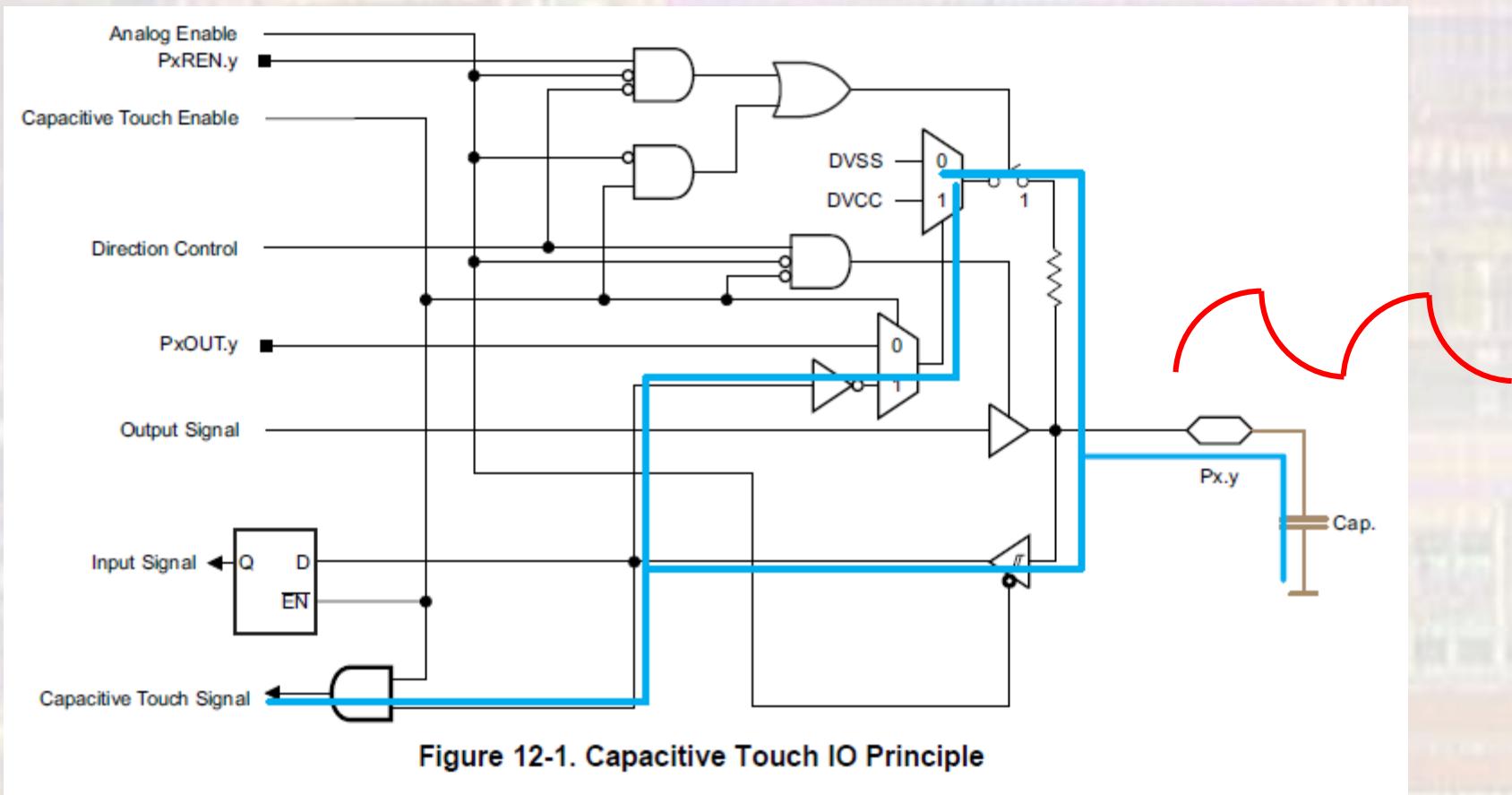
Figure 12-1. Capacitive Touch IO Principle

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Figure 12-1. Capacitive Touch IO Principle

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$$C = C1 \;||\; C2 = C1 + C2$$

C1

C1   C2

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Figure 1. Relaxation Oscillator Measurement
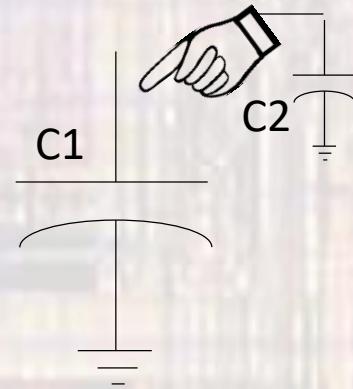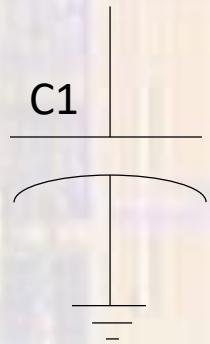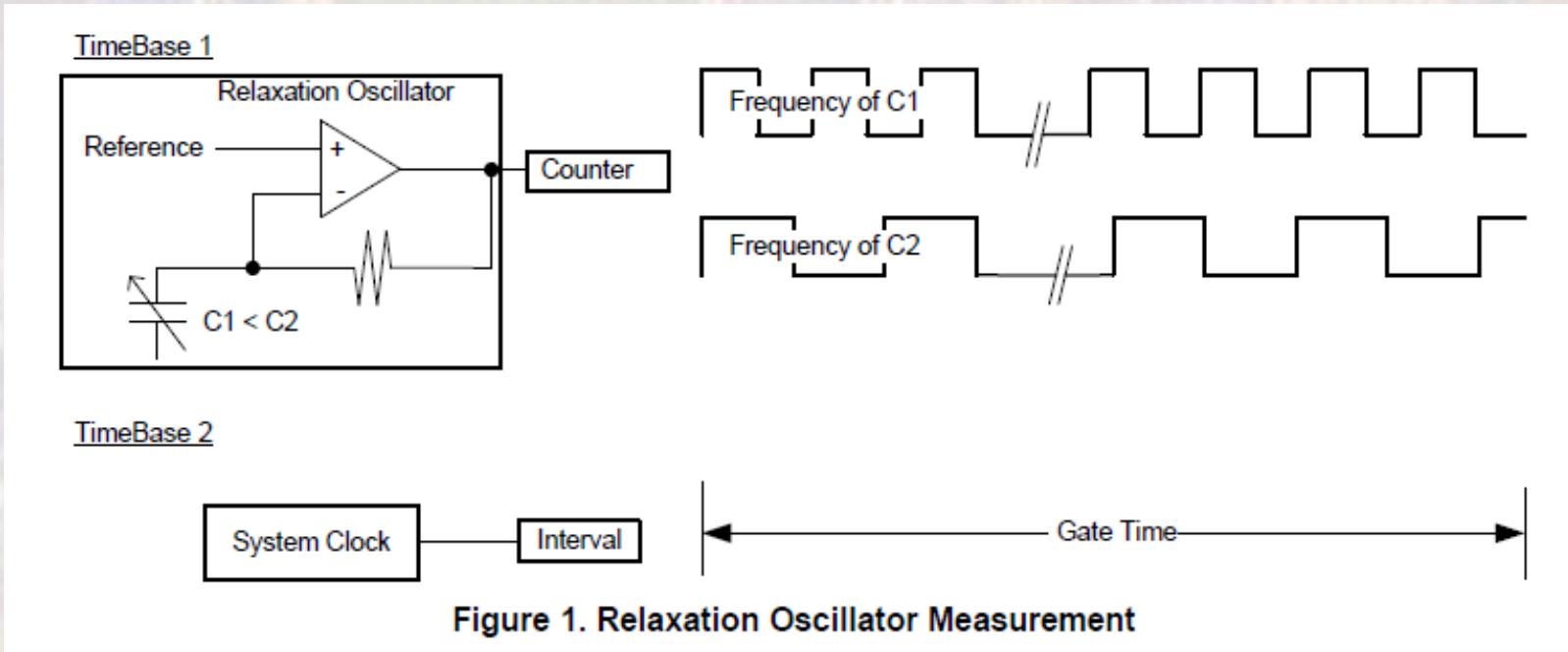
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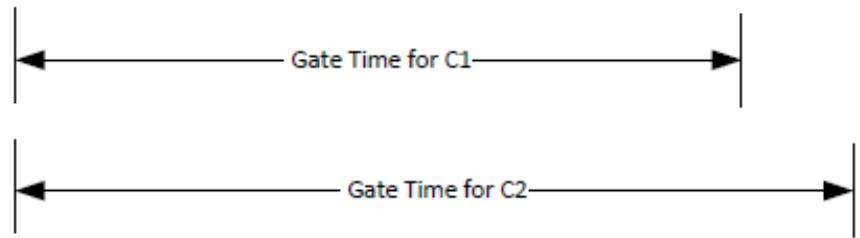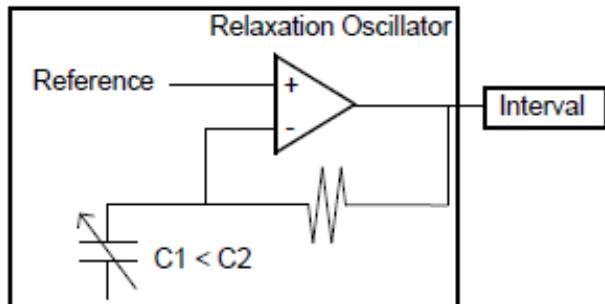
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Figure 2. Fast Scan RO Measurement

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- ## MSP432 Cap Touch
  - ## Comparison between two approaches

	RO_CTIO_TA0_WDTA			fRO_CTIO_TA2_TA3		
	Gate Time (10-kHz VLO, WDTA, 64)	Counter (RO)	Counts	Gate Time (280 RO cycles)	Counter (SMCLK)	Counts
Touched	6.4 ms	1 MHz	6400	280 / 1 MHz = 280 µs	24 MHz	6720
Untouched	6.4 ms	1.1 MHz	7040	280 / 1.1 MHz = 254 µs	24 MHz	6096
Difference			640			624

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Figure 12-3. CAPTIOxCTL Register

15	14	13	12	11	10	9	8
Reserved						CAPTIO	CAPTIOEN
r0	r0	r0	r0	r0	r0	r-0	rw-0
7	6	5	4	3	2	1	0
CAPTIOPOSELx				CAPTIOPISELx			Reserved
rw-0	rw-0	rw-0	rw-0	rw-0	rw-0	rw-0	r0

Table 12-2. CAPTIOxCTL Register Description

Bit	Field	Type	Reset	Description
15-10	Reserved	R	0h	Reserved. Always reads 0.
9	CAPTIO	R	0h	Capacitive Touch IO state. Reports the current state of the selected Capacitive Touch IO. Reads 0, if Capacitive Touch IO disabled. 0b = Current state 0 or Capacitive Touch IO is disabled 1b = Current state 1
8	CAPTIOEN	RW	0h	Capacitive Touch IO enable 0b = All Capacitive Touch IOs are disabled. Signal towards timers is 0. 1b = Selected Capacitive Touch IO is enabled
7-4	CAPTIOPOSELx	RW	0h	Capacitive Touch IO port select. Selects port Px. Selecting a port pin that is not available on the device in use gives unpredictible results. 0000b = Px = PJ 0001b = Px = P1 0010b = Px = P2 1110b = Px = P14 1111b = Px = P15
3-1	CAPTIOPISELx	RW	0h	Capacitive Touch IO pin select. Selects the pin within selected port Px (see CAPTIOPOSELx). Selecting a port pin that is not available on the device in use gives unpredictible results. 000b = Px.0 001b = Px.1 010b = Px.2 011b = Px.3 100b = Px.4 101b = Px.5 110b = Px.6 111b = Px.7
0	Reserved	R	0h	Reserved. Always reads 0.

CAPTIO0->CTL
CAPTIO1->CTL

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Table 6-48. TA2 Signal Connections

DEVICE INPUT PIN OR INTERNAL SIGNAL	MODULE INPUT SIGNAL	MODULE BLOCK	MODULE OUTPUT SIGNAL	DEVICE OUTPUT PIN OR INTERNAL SIGNAL
P4.2/ACLK/TA2CLK/A11	TACLK	Timer	N/A	N/A
ACLK (internal)	ACLK			
SMCLK (internal)	SMCLK			
From Capacitive Touch I/O 0 (internal)	INCLK			
P6.7/TA2.4/UCB3SOMI/UCB3SCL/C1.0	CCI4A	CCR4	TA4	P6.7/TA2.4/UCB3SOMI/UCB3SCL/C1.0 TA2_C4 (internal)
From Capacitive Touch I/O 0 (internal)	CCI4B			
DV$_{SS}$	GND			
DV$_{CC}$	V$_{CC}$			

Table 6-49. TA3 Signal Connections

DEVICE INPUT PIN OR INTERNAL SIGNAL	MODULE INPUT SIGNAL	MODULE BLOCK	MODULE OUTPUT SIGNAL	DEVICE OUTPUT PIN OR INTERNAL SIGNAL
P8.3/TA3CLK/A22	TACLK	Timer	N/A	N/A
ACLK (internal)	ACLK			
SMCLK (internal)	SMCLK			
From Capacitive Touch I/O 1 (internal)	INCLK			
P9.3/TA3.4	CCI4A	CCR4	TA4	P9.3/TA3.4 TA3_C4 (internal)
From Capacitive Touch I/O 1 (internal)	CCI4B			
DV$_{SS}$	GND			
DV$_{CC}$	V$_{CC}$			

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```c
/*
 * cap_touch.c
 *
 *  Created on: Aug 12, 2019
 *      Author: johnsontimoj
 */
/////////////////////////////////
//
// Cap Touch Example
//
// input none
//
// output - cap touch pin 5.5
//
// watch RC sawtooth with varying cap loads
//
/////////////////////////////////

// includes
#include <stdio.h>
#include "msp432.h"
#include "msoe_lib_all.h"

void cap_touch_setup(void);
```

```c
int main(void){
    //
    // setup pin
    // No pin setup required - done by cap sense block

    // Setup cap touch
    cap_touch_setup();

    // Hang out
    while(1){
        Delay_3MHz_ms(1000);
    }

    return 0;
} // end main

void cap_touch_setup(void){
    // Cap Touch Setup
    // Captio 1
    // port 5, pin 5
    //
    // CAPTIO1 CTL
    //            en  port 5  pin 5
    // xxxxxx x   1   0101    101   x
    // 015A
    CAPTIO1->CTL = 0x015A;

    return;
}   // end cap_touch_setup
```

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- ## MSP432 Cap Touch

Analog Discovery Only
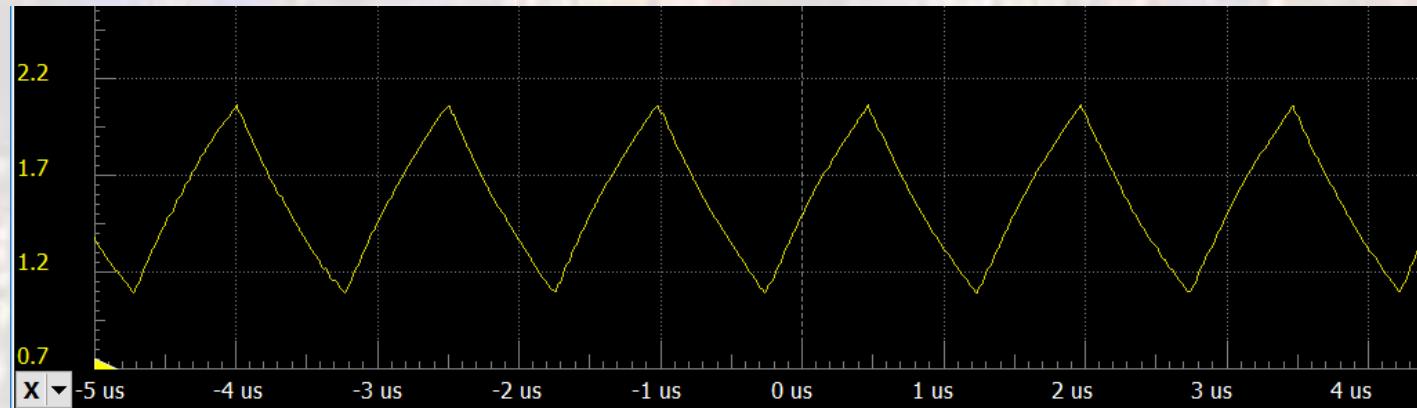
Analog Discovery + Finger Touch