# LDS6104/6124

## PureTouch™* Capacitive Touch Sensor IC Configuration Registers
### Detailed Register Information and Default Values

**Purpose:**
The purpose of this document is to provide detail on the registers available for configuration and performance optimization of the LDS6104 and 6124 devices

**Scope:**
This register document covers the LDS6104 (8-channel touch controller) and the LDS6124 (8-channel touch controller with integrated LED drivers). ***The other members of the LDS61xx family have their own Detailed Register documents as the relevant bit locations vary by device.***

**Required Initialization:**
Not all registers need to be initialized under normal usage conditions, as the default conditions may be appropriate and certain functions and features may not be used in the application.

However, the following registers should be initialized in all cases, as their proper configuration is necessary for fundamental operation.

- **0x00A: DCM configuration**
  - Pin C3/DCM7 is set as a DCM pin by default. It must be reset during initialization if not used as a DCM pin
- **0x041 and 0x042: Touch Sensor Enable**
  - Only those channels to be used as sensor input should be set to the "1" state. All other bits in these registers (including reserved/unused bits) should be set to "0"
- **0x043 and 0x044: Touch Interrupt Enable**
  - To enable proper interrupt operation, these registers should be configured identically to the Touch Sensor Enable registers 0x041 and 0x042
- **0x061-0x072 (non-contiguous, memory page 1): Touch Threshold Levels**
  - Sets the touch threshold levels which affect the sensitivity of each sensor.
  - ***Register 0x05F should be set to Memory Page 1 prior to writing to these registers***

If using Low Power/Sleep mode, the following registers should be initialized:

- **0x055: Idle Configuration**
  - Set value to 24 (dec) to enable sleep period configuration (0x056) in 1ms increments using default 1024 decimation rate
- **0x056: Sleep Period Configuration**
  - Sets the sleep period between scan cycles. See the LDS61xx AN1 application note for more information
- **0x003: Sleep Wait**
  - Sets the time the device will wait after the last touch before reverting back to Low Power mode

# PureTouch™* Capacitive Touch Sensor IC Configuration Registers

## Detailed Register Information and Default Values

### Recommended Initialization:

The following registers are recommended to be initialized for optimized operation.

- **0x04E: SELC_Unit Configuration**
  - Determines SELC unit steps utilized during calibration process. Use of adaptive SELC algorithm will accelerate calibration process. Recommended register setting: 5000h.
- **0x051: Ambient Calibration**
  - Determines how quickly ambient calibration occurs when no-touch value drifts above/below the plus/minus noise region. Recommended register setting: 0A1Fh.
- **0x052: Recalibration Configuration**
  - Sets the delay before a recalibration is initiated when capacitive signal is above the ambient threshold and below the touch threshold. The default IC value (99 decimal) results in a delay of "0.8s x # of active sensor channels". When few sensor channels are utilized, this may result in too short a delay. This delay should be at least 4-5s to avoid calibrating out an approaching finger.
- **0x053: Stuck Touch**
  - Determines how quickly forced recalibration occurs when touch persists for abnormally long length of time. Optimal setting depends upon usage model.
- **0x061-0x072 (non-contiguous, memory page 0): Initial SELC**
  - Sets the starting value for SELC for each sensor. Loading initial SELC values for each sensor will result in faster recalibration times. Recommended setting determined during prototype stage.
- **0x075: Touch Hysteresis**
  - Sets the amount of capacitance value units below Touch Threshold to still be considered a continuation of current/active touch. Recommended register setting: 0005h to 000Ah.

**By default, the INTB (Interrupt) pin is configured as an active-low CMOS output, with a fixed duration of 2us when a touch or untouch event occurs.** INTB may also be configured as active high (0x008 bit 15 = 1) and as an open drain output requiring a pull-up or pull-down resistor (0x008 bit 3 = 1), depending upon system requirements.

**Finally, INTB may also be configured in "Read Reset" mode (0x008 bit 1 = 1), in which case Touch Status Register 0x045 must be read in order to release/reset the INTB pin. Read Reset mode corresponds to the default INTB mode of operation of IDT's LDS60xx family of products.**

# PureTouch™* Capacitive Touch Sensor IC Configuration Registers
## Detailed Register Information and Default Values

### Functional Groupings

| Function | Register | Description |
|---|---|---|
| RESET | 0x000<br>0x001 | Cold Reset<br>Software Reset |
| POWER | 0x002<br>0x055<br>0x056<br>0x003 | Normal Operation, Low Power Mode, Shutdown<br>Idle Time - For Low Power Mode<br>Sleep Configuration<br>Sleep Wait |
| INTERRUPT | 0x008<br>0x043-0x044 | INTERRUPT Configuration<br>Touch Interupt Enable |
| GPIO | 0x009 | GPIO Config |
| DCM | 0x00A | DCM Mode |
| MANUFACTURER ID | 0x01F | Manufacturer/Product Family ID |
| TOUCH CONFIGURATION | 0x040<br>0x041 - 0x042<br>0x05F | Touch mode - All touches reported, Strongest Touch, Dual Strongest Touches<br>Touch Sensor Enable<br>Touch Parameter Memory Page Selection |
| TOUCH STATUS | 0x045 - 0x046<br>0x084 - 0x0C9<br>(non-contiguous) | Touch Status<br><br>Cap Value (Read Only) |
| THRESHOLD SETTING (SENSITIVITY) | 0x05F<br>0x061 - 0x072 | Touch Parameter Memory Page Selection - Touch threshold conditions<br>Touch Threshold Value (Memory Page 1) |
| LED CONFIGURATION | 0x021-0x02F<br>(non-contiguous)<br>0x031-0x038<br>(non-contiguous)<br>0x03E<br>0x03F | LEDx - Min Current, Max Current, Assignment; Latency; Effect Selection<br><br>LEDx Effect Configuration<br>LED Manual Mode Configuration<br>LED Driver Enable Configuration |
| BUILT-IN SLIDER/SCROLL | 0x04B<br>0x074 | Slider/Scroll Position and Direction Reading<br>Slider/Scroll Enable |
| CALIBRATION & SELC | 0x04E<br>0x050<br>0x051<br>0x052<br>0x053<br>0x05F<br>0x061 - 0x072<br>(non-contiguous)<br>0x084 - 0x0C9<br>(non-contiguous) | SELC Step Size, Ambient Calibration Enable, Calibration Status<br>Calibration Timeout<br>Ambient Calibration<br>Recalibration Configuration<br>Stuck Touch (Forced Recalibration)<br>Touch Paramater Page Selection<br><br>Calibration Parameters (Memory Pages 0, 2, 3, and 4)<br><br>SELC Value (Read Only) |
| STRONGEST TOUCH CONFIGURATION | 0x040<br>0x057<br>0x075 | Strongest Touch Enable<br>Strongest Touch Replacement Time<br>Strongest Touch Hysteresis |
| RELATIVE STRONGEST\ TOUCH | 0x076 | Relative Strongest Touch Mode Enable |
| UNDEBOUNCE | 0x076 | # of consecutive scan cycles required before untouch is recognized |
| DEBOUNCE | 0x057 | Debounce time criteria |
| HYSERESIS | 0x075 | Touch Hysteresis Value + Strongest Touch Hysteresis |
| GUARD/SUPPRESS CHANNEL | 0x07C-0x07D<br>0x07E-0x07F | Guard Channel Enable<br>Guard Channel Mask |
| NOISE IMMUNITY | 0x077 | Set to 8001 (hex) for optimal noise filtering. |

## Detailed Register Information and Default Values

| | Reset | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x000 | W | Cold Reset | | | | | | | | | | | | | | | |
| 0x001 | W | Software Reset | | | | | | | | | | | | | | | |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| COLD RESET | | Hardware reset | Any value invokes HW reset (all configuration registers revert to default) | |
| SOFT RESET | | Software reset | Any value invokes SW reset (keeps user settings, but recalibrates) | |

| | POWER | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x002 | R/W | | | | | | | Internal | Internal | | | | | | | LP | SHUTDOWN |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| LP | [1] | power saving mode | 0 : Normal mode, 1 : Low Power Mode | |
| SHUTDOWN | [0] | shutdown mode | 0 : Normal mode, 1 : Shutdown mode (only Serial I/F bus active) | |

| | SLEEP WAIT | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x003 | R/W | SLEEP WAIT | | | | | | | | | | | | | | | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| SLEEP WAIT | [15:0] | Full Power to Low Power wait time | Wait time = SLEEP WAIT x Scan Cycle Time<br>(Scan Cycle Time = ~2ms x # of active sensors) | |

| | INTB Config | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x008 | R/W | INT_POL | Internal | | | | | | | | | | INTB DRIVE | | | INTB MODE | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| INT_POL | [15] | interrupt polarity | 0 : active Low, 1: active High | |
| INTB DRIVE | [4:3] | interupt drive | 0x0 : CMOS output<br>0x1 : OPEN-DRAIN output (pull up resistor required) | |
| INTB MODE | [1:0] | interupt signaling type | 00: Fixed Duration Mode (INTB pin drives for 2us Fixed Duration)<br>01: Internal mode<br>1x: Read Reset Mode (INTB pin drives until Register 0x045 is read) | |

| | GPIO Config | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x009 | R/W | | | | | | | | | | | | GPIO Input Config | | | GPI/O | |
| Default Values | 0002h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| GPIO Input Config | [4:2] | GPIO input configuration | 0x0 : not used<br>0x1 : negative level-sensitive<br>0x2 : positive level-sensitive<br>0x3 : not used<br>0x4 : not used<br>0x5 : negative edge-triggered<br>0x6 : positive edge-triggered<br>0x7 : both edge-triggered | |
| GPI/O | [1:0] | GPIO state | 0x0 : not used<br>0x1 : input<br>0x2 : active low output<br>0x3 : active high output | |

## Detailed Register Information and Default Values

| | DCM Config | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x00A | R/W | | | | | | | Internal | DCM7 | Internal | | | | DCM6-DCM4 | | | Internal |
| Default Values | 0100h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| DCM Enable | [8], [3:1] | DCM Function Enable | 0 : disable, 1: enable | |

| | MID | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x01F | R | Internal | | | | | | | | Manufacturer ID | | | | Device ID | | | |
| Default Values | 00F2h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| Manufacturer ID | [7:4] | IDT PureTouch | IDT PureTouch = 1111 | |
| Device Family ID | [3:0] | LDS61xx Family | LDS61xx Family = 0010 | |

| | LED_LED0 | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x021 | R/W | LED0 Max Current | | | | | LED0 Min Current | | | | | | LED0 Assignment | | | | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | LED_LED1 | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x022 | R/W | LED1 Max Current | | | | | LED1 Min Current | | | | | | LED1 Assignment | | | | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | LED_LED2 | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x023 | R/W | LED2 Max Current | | | | | LED2 Min Current | | | | | | LED2 Assignment | | | | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | LED_LED3 | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x028 | R/W | LED3 Max Current | | | | | LED3 Min Current | | | | | | LED3 Assignment | | | | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| LED Max Current | [15:11] | LED Maximum Current Drive | Driving Current = Register Value * 0.25 [mA] | |
| LED Min Current | [10:6] | LED Minimum Current Drive | Driving Current = Register Value * 0.25 [mA] | |
| LED Assignment | [4:0] | Touch Sensor Association | Touch Sensor Number - **SEE LOOKUP TABLE** | |

### LDS6124 Touch Sensor Assignment Lookup Table

| Touch Sensor# | Bit [4:0] Assignment |
|---|---|
| C0 | 00001 |
| C1 | 00010 |
| C2 | 00011 |
| C3 | 01000 |

| Touch Sensor# | Bit [4:0] Assignment |
|---|---|
| C4/LED0 | 01011 |
| C5/LED1 | 01100 |
| C6/LED2 | 01101 |
| C7/LED3 | 10010 |

| | LED Driver Latency Config | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x02E | R/W | | | | | | | | | LED Driver Latency Time | | | | | | | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| LATENCY_TIME | [7:0] | Latency time in 5ms increments | LED Driver Delay time = Value * 5 [ms] | |

| | LED Effect Waveform Config | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x02F | R/W | EN_DOFF | EN_DON | Internal | | | | | | LED Active/Period 2 Timer | | | | | | | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| EN_DOFF | [15] | Dimming off enable | 0 : disable, 1: enable | |
| EN_DON | [14] | Dimming on enable | 0 : disable, 1: enable | |
| ACTIVE_TIME | [7:0] | LED Active/Period 2 Timer | Time = ACTIVE_TIME * 5ms | |

## Detailed Register Information and Default Values

| | LED0 Effect Configuration (Period 1/3) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x031 | R/W | LED0 Effect | | | | LED0 Period 1 | | | | | | LED0 Period 3 | | | | | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | LED1 Effect Configuration (Period 1/3) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x032 | R/W | LED1 Effect | | | | LED1 Period 1 | | | | | | LED1 Period 3 | | | | | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | LED2 Effect Configuration (Period 1/3) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x033 | R/W | LED2 Effect | | | | LED2 Period 1 | | | | | | LED2 Period 3 | | | | | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | LED3 Effect Configuration (Period 1/3) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x038 | R/W | LED3 Effect | | | | LED3 Period 1 | | | | | | LED3 Period 3 | | | | | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Register Name** | **Position** | **Description** | **Function** | **Remark** |
|---|---|---|---|---|
| LEDx Effect | [15:14] | LED driver operation mode | 0 : Linear (Dimming) mode<br>1 : Pulsate mode<br>2: Flash Mode<br>3 : Reserved | |
| LEDx Period 1 | [11:6] | Period 1 Timer (see LED effect diagram for Period 1 significance) | Timer Value = value * 5ms * # of steps<br>** # of steps = (max current - min current) / 0.25 | |
| LEDx Period 3 | [5:0] | Period 3 Timer (see LED effect diagram for Period 1 significance) | Timer Value = value * 5ms * # of steps<br>** # of steps = (max current - min current) / 0.25 | |

| | LED Manual Mode Config | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x03E | R/W | EN_MAN | Gang | | | | | Internal | LED3 | Internal | | | | LED Manual Control (LED2-LED0) | | | Internal |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Register Name** | **Position** | **Description** | **Function** | **Remark** |
|---|---|---|---|---|
| EN_MAN | [15] | LED manual mode enable | 0 : disable, 1: enable manual control, MAN_CTRL controls each LED channel | |
| GANG | [14] | LED gang mode | 0 : normal mode, 1: Single LED event results in all LED turning on | |
| MAN_CTRL | [8], [3:1] | Manual LED on/off control for each LED channel | 0 : manual LED off, 1 : manual LED on | |

| | LED Driver Enable Configuration | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x03F | R/W | | | | | | | Internal | LED3 | Internal | | | | LED Driver Enable (LED2-LED0) | | | Internal |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

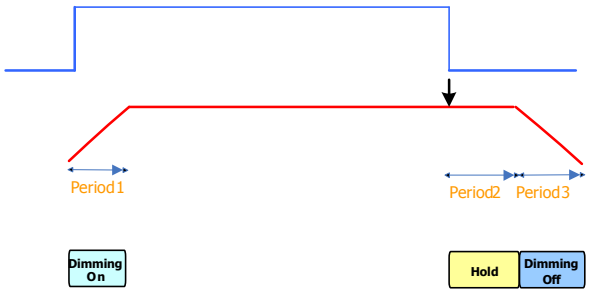
| **Register Name** | **Position** | **Description** | **Function** | **Remark** |
|---|---|---|---|---|
| LED_ENABLE | [8], [3:1] | LED driver enable | 0 : Disable<br>1 : Enable (LED enable bit dominates over Touch Sensor Enable in 0x042) | |

| | TOUCH CONFIG | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x040 | R/W | TCH_ENABLE | Internal | | | | | BUTTON_MODE | | | | Internal | | READY | Decimation | | |
| Default Values | 8030h | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |

| **Register Name** | **Position** | **Description** | **Function** | **Remark** |
|---|---|---|---|---|
| TCH_ENABLE | [15] | Touch Function Enable | 0 : Touch function in idle state, 1: Touch function in active state | |
| BUTTON_MODE | [9:8] | Touch Preference Mode<br>(Strongest Touch Modes) | 0x0 : Unrestricted mode, All touches reported<br>0x1 : Strongest Touch Mode<br>0x2 : Two Strongest Touches Mode<br>0x3 : reserved | |
| DEVICE_READY | [3] | Device Ready | 0 : Self initialization state, 1: OK for host communication<br>If DEVICE_READY=0, all bits except DEVICE_READY should be ignored. | Read Only Bit |
| Decimation | [2:0] | CDC decimation | **0x0 : 1024 (default)**<br>0x1 : 512<br>0x2 : 256<br>0x3 : 128<br>0x4 : 2048 | Consult IDT representative if decimation is changed from 1024 default |

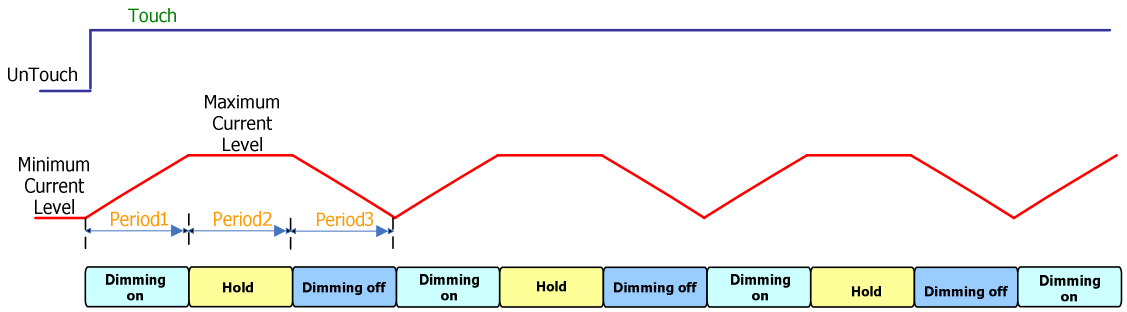
## LED Effect Diagrams

### Dimming Effect



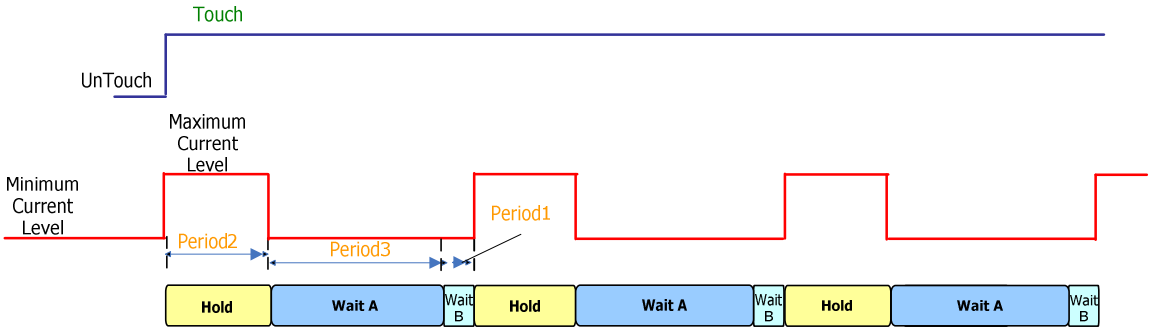

**Dimming Effect Timers:**
**Period 1*: Dimming On Time**
**Period 2**: Active/Hold Time (After Touch is Removed)**
**Period 3*: Dimming Off Time**
*: Individual Timer per LED
**: Universal Timer for All LEDs

### Pulsate Effect:




**Pulsate Effect Timers:**
**Period 1*: Dimming On Time**
**Period 2**: Hold Time at Max Current**
**Period 3*: Dimming Off Time**
*: Individual Timer per LED
**: Universal Timer for All LEDs

### Flash Effect:




**Flash Effect Timers:**
**Period 1*: Second Wait Time (Wait B)**
**Period 2**: Hold Time at Max Current**
**Period 3*: First Wait Time (Wait A)**
*: Individual Timer per LED
**: Universal Timer for All LEDs

## Detailed Register Information and Default Values

| | Touch Sensor Enable (Channels 0-3) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x041 | R/W | | | | | | | Internal | C3 | Internal | | | | C2-C0 | | | Internal |
| Default Values | 000Eh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 |

| | Touch Sensor Enable (Channels 4-7) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x042 | R/W | | | | | | | Internal | C7 | Internal | | | | C6-C4 | | | Internal |
| Default Values | 0100h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Register Name** | **Position** | **Description** | **Function** | **Remark** |
|---|---|---|---|---|
| TOUCH_ENBL | [8], [3:1] | Touch enable for each channel | 0 : Channel disabled as touch sensor<br>1 : Channel enabled as touch sensor (may be overridden by LED Enable)<br>DCM register 0x00A has priority over 0x041 in case of dual assignment | |

| | INTERRUPT ENABLE (Channels 0-3) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x043 | R/W | | | | | | | Internal | C3 | Internal | | | | INT Enable (C2-C0) | | | Internal |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | INTERRUPT ENABLE (Channels 4-7) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x044 | R/W | | | | | | | Internal | C7 | Internal | | | | INT Enable (C6-C4) | | | Internal |
| Default Values | 0100h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Register Name** | **Position** | **Description** | **Function** | **Remark** |
|---|---|---|---|---|
| TOUCH_INT_EN | [8], [3:1] | Touch interrupt enable for each channel | 0 : disable<br>1 : enable | |

| | TOUCH STATUS (Channels 0-3) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x045 | R | | | | | | | Internal | C3 | Internal | | | | Touch Status (C2-C0) | | | Internal |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | TOUCH STATUS (Channels 4-7) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x046 | R | GPI_INT | | | | | | Internal | C7 | Internal | | | | Touch Status (C6-C4) | | | Internal |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Register Name** | **Position** | **Description** | **Function** | **Remark** |
|---|---|---|---|---|
| GPI_INT | [15] | GPI interrupt status | 0 : no GPI interrupt, 1 : GPI interrupt<br>(Used if GPIO is configured as input via Register 0x009) | |
| TOUCH_INT_STS | [8], [3:1] | Touch interrupt status for each channel | Indicates which touch sensor channel was activated by a touch when INTB signal is triggered | |

| | SCROLL STATUS | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x04B | R/W | Internal | Internal | | | | | | | SCROLL_INT | DIR_ENBL | SCROLL_DIR | POSITION_ID | | | | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| **Register Name** | **Position** | **Description** | **Function** | **Remark** |
|---|---|---|---|---|
| SCROLL_INT | [7] | Scroll/Slider Touch Interrupt | 0 : Not Touched<br>1 : Position Interrupt Status | Read Only |
| DIR_ENBL | [6] | Scroll/Slider Touch Direction Enable(Active) Status | 0 : Not movement<br>1 : Direction Enable(Active) | |
| SCROLL_DIR | [5] | Scroll/Slider Touch Direction Status | 0 : Low/Left/CCW Direction<br>1 : High/Right/CW Direction | Read Only |
| POSITION_ID | [4:0] | Scroll/Slider Touch Position ID | - Value : 0 (Not Used for Scroll/Slider Input Type)<br>- Value : 1~8 (Scroll/Slider Touch Position ID) | Read Only |

## Detailed Register Information and Default Values

| | SELC CONFIG and CALIBRATION STATUS | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x04E | R/W | Internal | ACTIVE | AMB_DIS | Internal | | | | | | | | | SELC_UNIT | | | |
| Default Values | 0002h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| ACTIVE | [14] | touch calibration status | 0 : in calibration state<br>1 : calibration finished | Read Only Bit |
| AMB_DIS | [13] | ambient calibration disable | 0 : ambient calibration active<br>1 : disable ambient calibration | Optional disabling of ambient cal |
| SELC_UNIT | [3:0] | SELC change amount during calibration | 0 : adaptive SELC tracking algorithm used<br>others : During tracking, SELC changes its value by the amount of SELC_UNIT | Refer to 6100 AN2 App Note |

| | CALIBRATION TIMEOUT | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x050 | R/W | Internal | Internal | | | | | | | CALIB_TIMEOUT | | | | | | | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| CALIB_TIMEOUT | [7:0] | calibration timeout limit | 0x0 : infinite<br>0x1 : when calibration iteration reaches CALIB_TIMEOUT, tracking is done. | |

| | AMBIENT CALIBRATION | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x051 | R/W | CNT_DEC_LIMIT | | | | | | | | CNT_INC_LIMIT | | | | | | | |
| Default Values | 1F1Fh | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| CNT_DEC_LIMIT | [15:8] | Value determines how quickly ambient calibration is triggered (negative side) | 0x0 : INVALID<br>others : count limit | |
| CNT_INC_LIMIT | [7:0] | Value determines how quickly ambient calibration is triggered (posative side) | 0x0 : INVALID<br>others : count limit | |

| | RECALIBRATION CONFIGURATION | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x052 | R/W | | | | | | RECAL_DELAY | | | | | | | | | | |
| Default Values | 0063h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| RECAL_DELAY | [10:0] | Wait time prior to forced recalibration when cap value above ambient threshold but below touch threshold (i.e. not an actual touch) | wait time = (RECAL_DELAY+1) * single round time * 4<br>Max time = 16.4s (1 ch) to 131s (8ch) | Default is 0.8s x # of active ch with 1024 decimation |

| | STUCK TOUCH | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x053 | R/W | | | | | | CNT_TOUCH_LIMIT | | | | | | | | | | |
| Default Values | 0063h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| CNT_TOUCH_LIMIT | [10:0] | Wait time prior to forced recalibration when cap value is above threshold level (stuck touch scenario) | wait time = (CNT_TOUCH_LIMIT+1) * single round period * 4<br>Max time = 16.4s (1 ch) to 131s (8ch) | Default is 0.8s x # of active ch with 1024 decimation |

## Detailed Register Information and Default Values

| | IDLE CONFIG | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x055 | R/W | MAX_DEACT_IDLE | | | | | | | | | | | | | | | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| MAX_DEACT_IDLE | [15:0] | staying IDLE time during inactive touch channel selected | Idle time = (MAX_DEACT_IDLE+1) * OSC period (2us)<br>All channels treated as inactive during Sleep Period | Init file must set this to 24(dec) to enable 1ms increments of SLEEP_TIME with 1024 decimation |

| | SLEEP CONFIG | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x056 | R/W | SLEEP TIME | | | | | | | | | | | | | | | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| SLEEP_TIME | [15:0] | # of ms of desired sleep time | Determines duty cycle between active (full power) and sleep (reduced power) that determines average current consumption in low power mode | Init file must set 0x055 to 24(dec) to enable 1ms increments of SLEEP_TIME with 1024 decimation |

| | DEBOUNCE AND STRONGEST TOUCH CONFIGURATION | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x057 | R/W | DEBOUNCE | | | | REPLACEMENT_TIME | | | | | | | | | | | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| DEBOUNCE | [15:12] | # of consecutive scan cycles required before first touch is recognized | Debounce time criteria required to register first touch<br>Time = DEBOUNCE x scan cycle time, where scan cycle time is equal to 2ms x # of active sensors | |
| REPLACEMENT_TIME | [11:0] | # of consecutive scan cycles required for new touch with strongest signal to replace current strongest touch | Strongest Touch Mode (Absolute or Relative) option to minimize frequent toggling between two touches of comparable strength<br>Time = REPLACEMENT_TIME x scan cycle time, where scan cycle time is equal to 2ms x # of active sensors | Set to "0" for Two Strongest Touch |

## Detailed Register Information and Default Values

| | TOUCH PARAMETER PAGE SELECTION | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x05F | R/W | 0:initial SELC, 1: touch threshold, 2:ambient threshold, 3:minus noise level, 4:plus noise level | | | | | | | | | | | | | | PAGE | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| PAGE | [2:0] | indirect memory access address | 0 : Initial SELC (May be used to accelerate calibration times)<br>Please refer to 6100 AN2 app note for detaills<br>1 : Touch Threshold (# capacitive units above baseline to activate touch)<br>2 : Ambient Threshold (Defines region, along with touch threshold, within which recalibration is delayed by RECAL_DELAY 0x052)<br>3 : Minus Noise Level (Defines - region within which baseline may vary without triggering an ambient recalibration)<br>4 : Plus Noise Level (Defines + region within which baseline may vary without triggering an ambient recalibration) | Refer to 6100 AN2 App Note |

| | TOUCH PARAMETERS | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x061 | W | | | | | | Touch0 PARAM[10:0] | | | | | | | | | | |
| 0x062 | W | | | | | | Touch1 PARAM[10:0] | | | | | | | | | | |
| 0x063 | W | | | | | | Touch2 PARAM[10:0] | | | | | | | | | | |
| 0x068 | W | | | | | | Touch3 PARAM[10:0] | | | | | | | | | | |
| 0x06B | W | | | | | | Touch4 PARAM[10:0] | | | | | | | | | | |
| 0x06C | W | | | | | | Touch5 PARAM[10:0] | | | | | | | | | | |
| 0x06D | W | | | | | | Touch6 PARAM[10:0] | | | | | | | | | | |
| 0x072 | W | | | | | | Touch7 PARAM[10:0] | | | | | | | | | | |
| Default Values (PAGE=0) | 00B8h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| Default Values (PAGE=1) | 0028h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| Default Values (PAGE=2) | 000Ah | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| Default Values (PAGE=3) | 0003h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| Default Values (PAGE=4) | 0003h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| Touch PARAM | [10:0] | multiplexed touch parameter | 0 : Initial SELC (May be used to accelerate calibration times)<br>Please refer to 6100 AN2 app note for detaills<br>1 : Touch Threshold (# capacitive units above baseline to activate touch)<br>2 : Ambient Threshold (Defines region, along with touch threshold, within which recalibration is delayed by RECAL_DELAY 0x052)<br>3 : Minus Noise Level (Defines - region within which baseline may vary without triggering an ambient recalibration)<br>4 : Plus Noise Level (Defines + region within which baseline may vary without triggering an ambient recalibration) | Refer to 6100 AN2 App Note |

| | SCROLL/SLIDER CHANNEL ENABLE | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x074 | R/W | INT_SEL | Internal | | | | | | SCE C3 | Internal | | | | Scroll Channel Enable (C2-C0) | | | Internal |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| INT_SEL | [15] | SCROLL/SLIDER Touch channel Interrupt Enable | 0 : disable, 1: enable | |
| SCROLL_CH[3] | [8] | channel 3 Scroll/Slider Touch Enable | 0 : disable, 1: enable | |
| SCROLL_CH[2] | [3] | channel 2 Scroll/Slider Touch Enable | 0 : disable, 1: enable | |
| SCROLL_CH[1] | [2] | channel 1 Scroll/Slider Touch Enable | 0 : disable, 1: enable | |
| SCROLL_CH[0] | [1] | channel 0 Scroll/Slider Touch Enable | 0 : disable, 1: enable | |

## Detailed Register Information and Default Values

| | TOUCH HYSTERESIS | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x075 | R/W | STR_HYSTERESIS[15:8] | | | | | | | | HYSTERESIS[7:0] | | | | | | | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| STR_HYSTERESIS | [15:8] | Strongest Touch Hysteresis value | Extra/additional capacitance value required for new strongest touch to replace current strongest touch. For example, if STR_HYSTERESIS is set to a value of 15 (decimal), the capacitance value required to displace the current strongest touch must be at least 15 capacitance units higher than the current value of the current strongest touch. | |
| HYSTERESIS | [7:0] | Touch Hysteresis Value (# of cap value units permitted to decrease below Touch Threshold while still maintaining touch status) | Value range : 0~255<br>Example: Assuming baseline value of 510 and Touch Threshold setting of 40, capacitive value above 550 triggers an initial touch event. If HYSTERESIS value is set to "15", then the sensor capacitive value may go as low as 535 (550-35) and still be considered as original touch. | |

| | RELATIVE STRONGEST AND UNDEBOUNCE | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x076 | R/W | RELATIVE_EN | INTERNAL | | | | | | | | | | | UN_DEBOUNCE [3:0] | | | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| RELATIVE_EN | [15] | Relative Strongest Touch Mode | 0 : disable, 1: enable | |
| UN_DEBOUNCE | [3:0] | # of consecutive scan cycles required before UNtouch is recognized | Debounce time required for UNtouch event to be recognized<br>Time = DEBOUNCE x scan cycle time, where scan cycle time is equal to 2ms x # of active sensors | |

| | NOISE IMMUNITY ENABLE | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x077 | R/W | NI_ENBL | INTERNAL | | | NI_OPTION | | | | | | | | | | | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| Noise Immunity EN | [15] | Enable Noise Immunity | 0 : disable, 1: enable. ***Recommended Value = 1*** | Set to "1" |
| Noise Immunity Option | [11:0] | Noise Immunity Option | Setting Options. ***Recommended Value = 1*** | Set to "1" |

| | Guard Channel Enable Register [C0~C6] | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x07C | R/W | Internal | | GUARD_CH[6:4] | | | Internal | | GC3 | Internal | | | | GUARD_CH[2:0] | | | INTERNAL |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| GUARD_CH[6] | [13] | channel 6 guard channel enable | 0 : disable, 1: enable | |
| GUARD_CH[5] | [12] | channel 5 guard channel enable | 0 : disable, 1: enable | |
| GUARD_CH[4] | [11] | channel 4 guard channel enable | 0 : disable, 1: enable | |
| GUARD_CH[3] | [8] | channel 3 guard channel enable | 0 : disable, 1: enable | |
| GUARD_CH[2] | [3] | channel 2 guard channel enable | 0 : disable, 1: enable | |
| GUARD_CH[1] | [2] | channel 1 guard channel enable | 0 : disable, 1: enable | |
| GUARD_CH[0] | [1] | channel 0 guard channel enable | 0 : disable, 1: enable | |

| | Guard Channel Enable Register [C7] | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x07D | R/W | | | | | | | | | | | | | INTERNAL | GC7 | Internal | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| GUARD_CH[7] | [2] | channel 7 guard channel enable | 0 : disable, 1: enable | |

## Detailed Register Information and Default Values

| | Guard Channel Mask Register [C0-C6] | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x07E | R/W | Internal | | GUARD_MSK[6:4] | | | Internal | | G_MSK3 | Internal | | | | GUARD_MSK[2:0] | | | INTERNAL |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| GUARD_MSK[6] | [13] | channel 6 guard mask enable | 0 : disable, 1: enable | |
| GUARD_MSK[5] | [12] | channel 5 guard mask enable | 0 : disable, 1: enable | |
| GUARD_MSK[4] | [11] | channel 4 guard mask enable | 0 : disable, 1: enable | |
| GUARD_MSK[3] | [8] | channel 3 guard mask enable | 0 : disable, 1: enable | |
| GUARD_MSK[2] | [3] | channel 2 guard mask enable | 0 : disable, 1: enable | |
| GUARD_MSK[1] | [2] | channel 1 guard mask enable | 0 : disable, 1: enable | |
| GUARD_MSK[0] | [1] | channel 0 guard mask enable | 0 : disable, 1: enable | |

| | Guard Channel Mask Register [C7] | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x07F | R/W | | | | | | | | | | | | | INTERNAL | G_MSK7 | Internal | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Register Name | Position | Description | Function | Remark |
|---|---|---|---|---|
| GUARD_MSK[7] | [2] | channel 7 guard mask enable | 0 : disable, 1: enable | |

| | Cap Value and SELC Value | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Register Address** | **Direction** | **Bit 15** | **Bit 14** | **Bit 13** | **Bit 12** | **Bit 11** | **Bit 10** | **Bit 9** | **Bit 8** | **Bit 7** | **Bit 6** | **Bit 5** | **Bit 4** | **Bit 3** | **Bit 2** | **Bit 1** | **Bit 0** |
| 0x084 | R | | | | | | Touch0 Cap | | | | | | | | | | |
| 0x085 | R | Touch0 SELP | | | | | Touch0 SELC | | | | | | | | | | |
| 0x088 | R | | | | | | Touch1 Cap | | | | | | | | | | |
| 0x089 | R | Touch1 SELP | | | | | Touch1 SELC | | | | | | | | | | |
| 0x08C | R | | | | | | Touch2 Cap | | | | | | | | | | |
| 0x08D | R | Touch2 SELP | | | | | Touch2 SELC | | | | | | | | | | |
| 0x0A0 | R | | | | | | Touch3 Cap | | | | | | | | | | |
| 0x0A1 | R | Touch3 SELP | | | | | Touch3 SELC | | | | | | | | | | |
| 0x0AC | R | | | | | | Touch4 Cap | | | | | | | | | | |
| 0x0AD | R | Touch4 SELP | | | | | Touch4 SELC | | | | | | | | | | |
| 0x0B0 | R | | | | | | Touch5 Cap | | | | | | | | | | |
| 0x0B1 | R | Touch5 SELP | | | | | Touch5 SELC | | | | | | | | | | |
| 0x0B4 | R | | | | | | Touch6 Cap | | | | | | | | | | |
| 0x0B5 | R | Touch6 SELP | | | | | Touch6 SELC | | | | | | | | | | |
| 0x0C8 | R | | | | | | Touch7 Cap | | | | | | | | | | |
| 0x0C9 | R | Touch7 SELP | | | | | Touch7 SELC | | | | | | | | | | |
| Default Values | 0000h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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