



# A96T418

## Touch Algorithm Implementation

### Application Note

Version 1.02

## Contents

1	Introduction .....	3
2	Basic touch algorithm .....	4
2.1	Touch algorithm flow .....	4
2.2	Raw data .....	5
2.3	Baseline .....	5
2.4	Diff .....	5
3	Noise filter .....	6
3.1	IIR filter (Infinite Impulse Response filter) .....	6
3.2	Average filter .....	7
3.3	Min-Max filter .....	8
4	Debounce .....	9
4.1	Detect debounce .....	9
4.2	Release debounce .....	9
	Revision history .....	10

## List of figures

Figure 1.	Touch Algorithm Flow .....	4
Figure 2.	Raw Data, Baseline, Diff, Threshold .....	5
Figure 3.	IIR Filter Sequence .....	6
Figure 4.	IIR Filter Data Comparison [IIR_GAIN=3] .....	6
Figure 5.	Average Filter Sequence .....	7
Figure 6.	Min-Max Filter Sequence .....	8
Figure 7.	Min-Max Filter Data Comparison .....	8
Figure 8.	Detect Debounce .....	9
Figure 9.	Release Debounce .....	9

## 1 Introduction

This application note introduces a method how to implement the touch software on the development board focusing on various features of the touch.

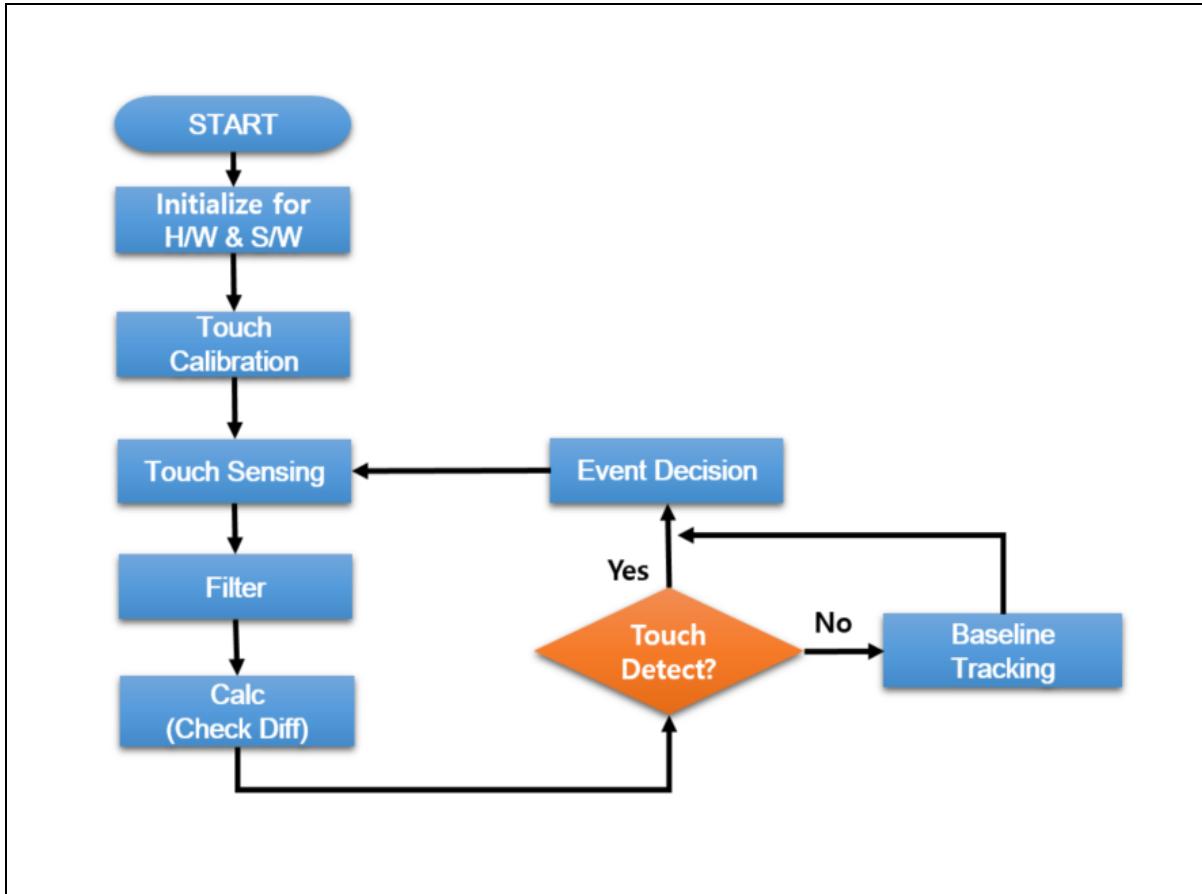
Through this document, users can learn main features of the touch algorithm and implement the software on the development board.

All information in this document will be described in the order listed below:

1. Touch algorithm Flow
  - A. Baseline
  - B. Diff
2. Noise Filter
  - A. IIR Filter
  - B. Average Filter
  - C. Min-Max Filter
3. Debounce
  - A. Detect Debounce
  - B. Release Debounce

## 2 Basic touch algorithm

### 2.1 Touch algorithm flow



**Figure 1. Touch Algorithm Flow**

1. Initialize (HW & SW):
  - Initializes Hardware (port) settings: Timer settings and other peripheral settings
  - Initializes Software settings: Variable declaration, value and register settings
2. Touch calibration: Calculates External  $C_{TOTAL}$  value of touch sensing channel.
3. Touch sensing: Reads current raw data value. The raw data is primary data collected from the touch IP.
4. Filter : Nose-removing filter
5. Calc: Calculates the difference between the baseline and the raw data.
6. Baseline tracking: The baseline tracking is the process of updating the base for the raw data during untouched status.

## 2.2 Raw data

The raw data is primary data collected from the touch IP.

## 2.3 Baseline

The baseline is the reference line for raw data during untouched status.

## 2.4 Diff

The difference data is the difference between the baseline and the raw data. The touch detection depends on the threshold and difference data. If the diff. data exceeds the threshold, the touch is resulted as 'detected.'

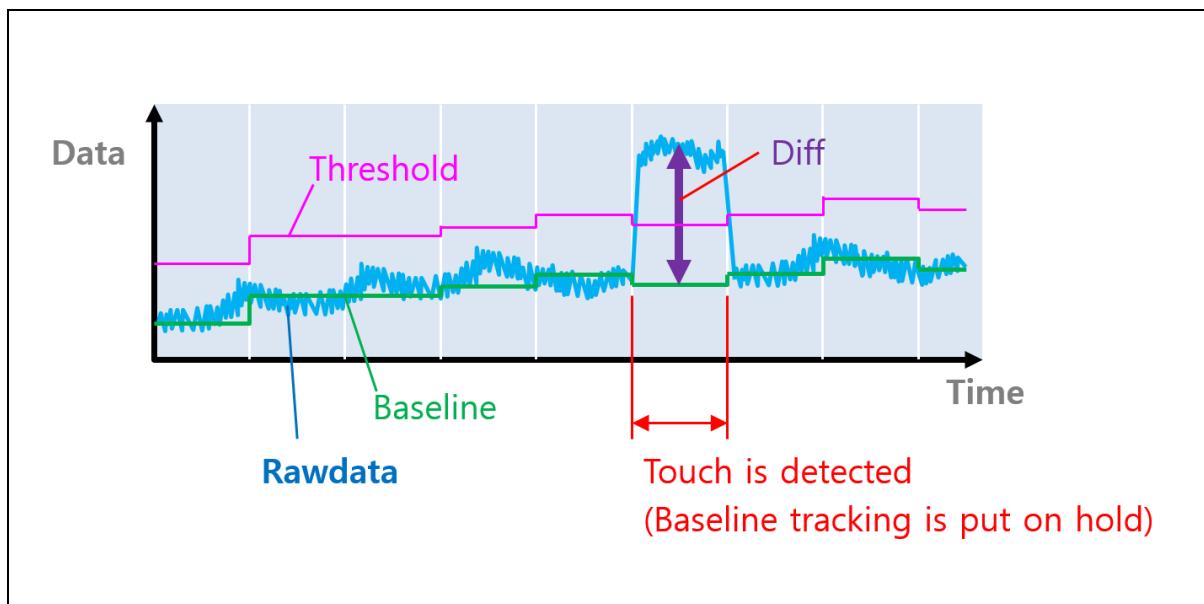


Figure 2. Raw Data, Baseline, Diff, Threshold

### 3 Noise filter

#### 3.1 IIR filter (Infinite Impulse Response filter)

IIR filter is a digital filter that depends linearly on a finite number of input samples and a finite number of previous filter outputs. In other words, its (new) output value is calculated using both the input and old values of the output as a recursive digital filter.

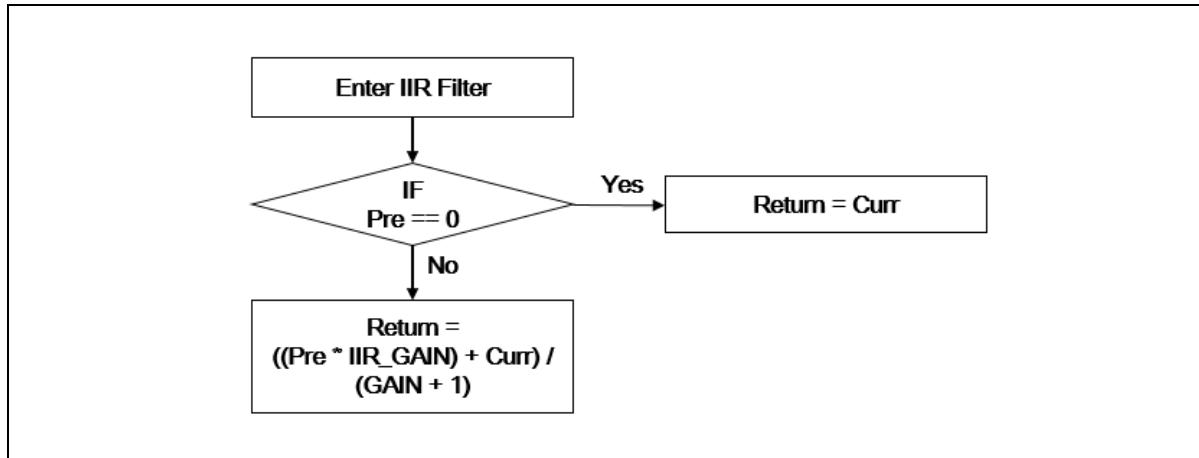


Figure 3. IIR Filter Sequence

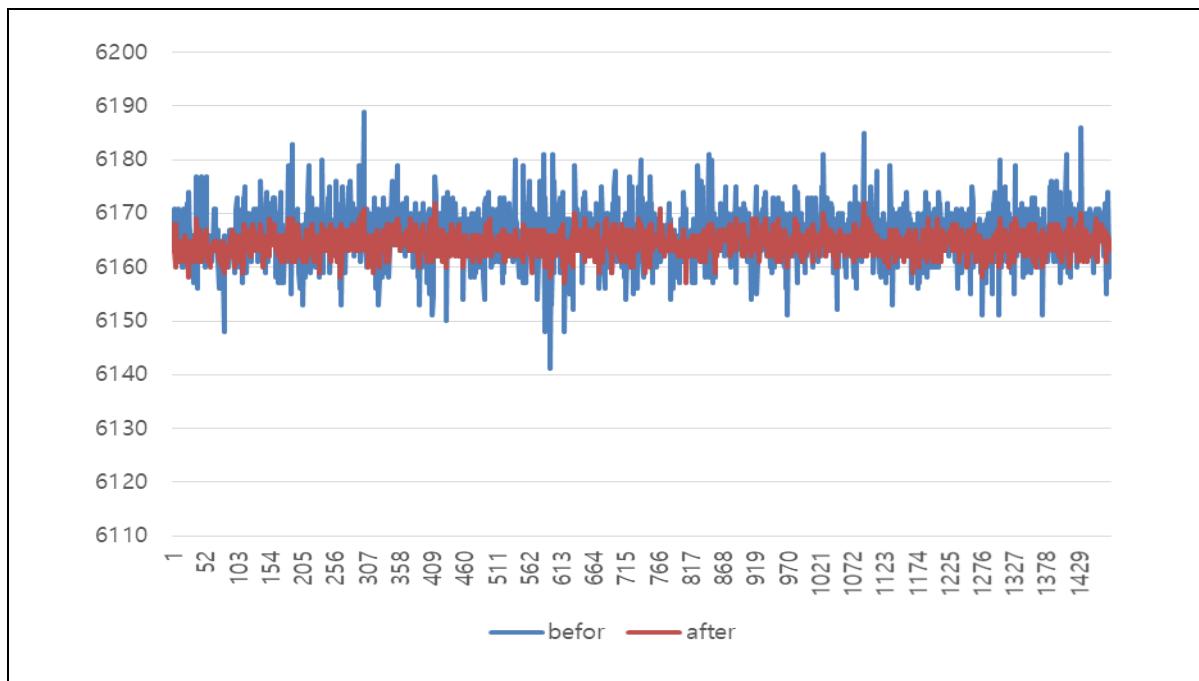


Figure 4. IIR Filter Data Comparison [IIR\_GAIN=3]

### 3.2 Average filter

Average filter operates based on FIR filter (Finite Impulse Response filter) and calculates its outputs using the average from a finite number of input signals. The average filter accumulates the raw data by the buffer size and calculates the mean value of the accumulated data.

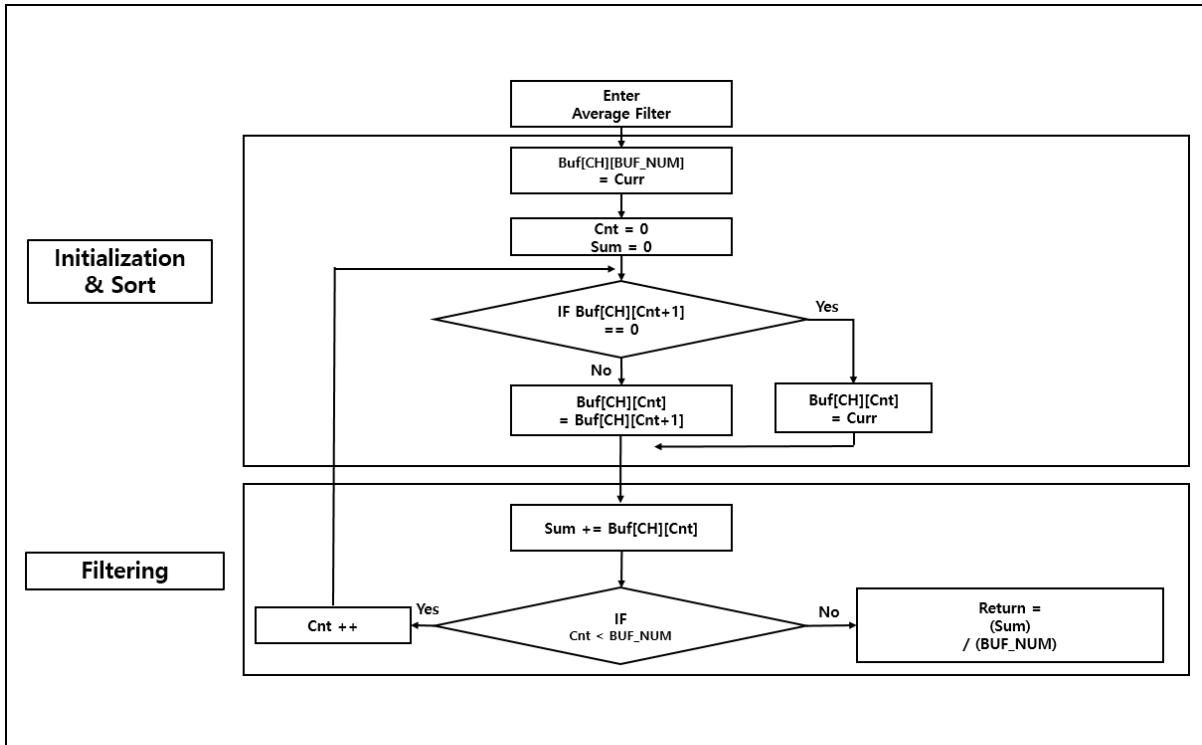


Figure 5. Average Filter Sequence

### 3.3 Min-Max filter

Min-Max filter operates based on FIR filter (Finite Impulse Response filter). It accumulates the raw data by the buffer size and calculates the mean value of the accumulated data after excluding the maximum value and the minimum value.

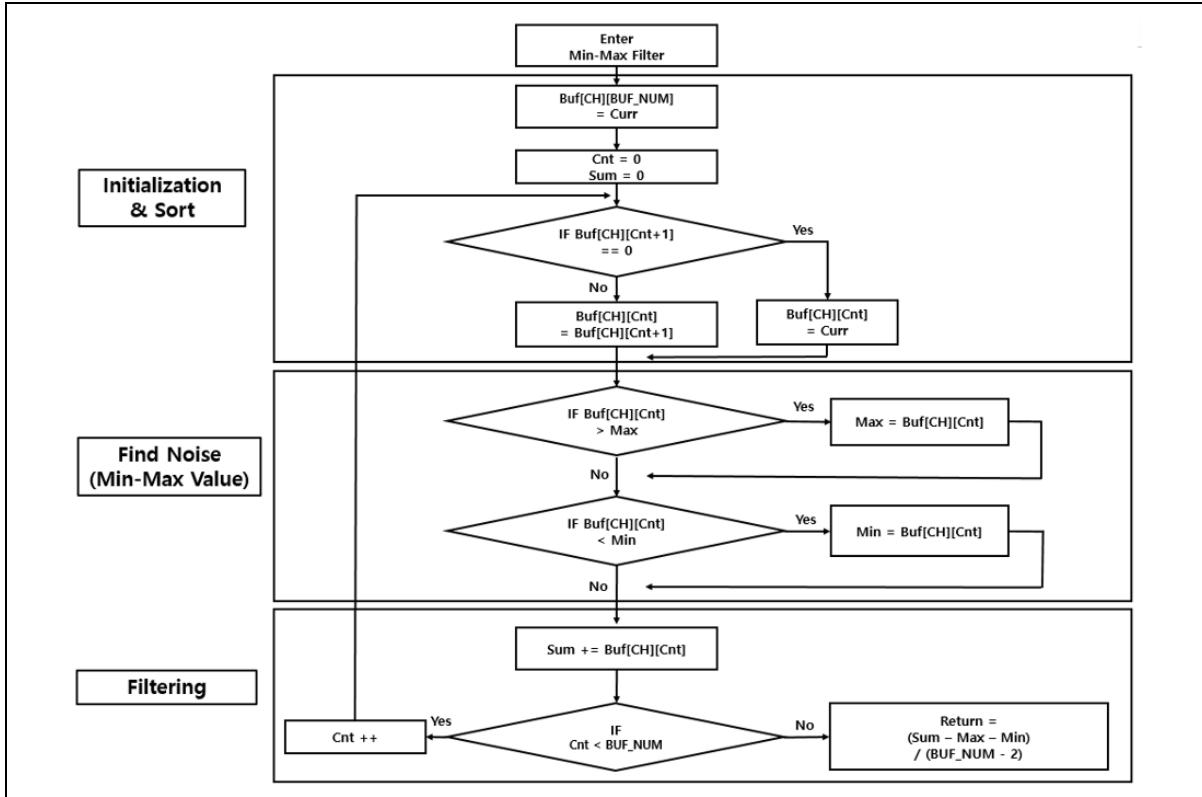


Figure 6. Min-Max Filter Sequence

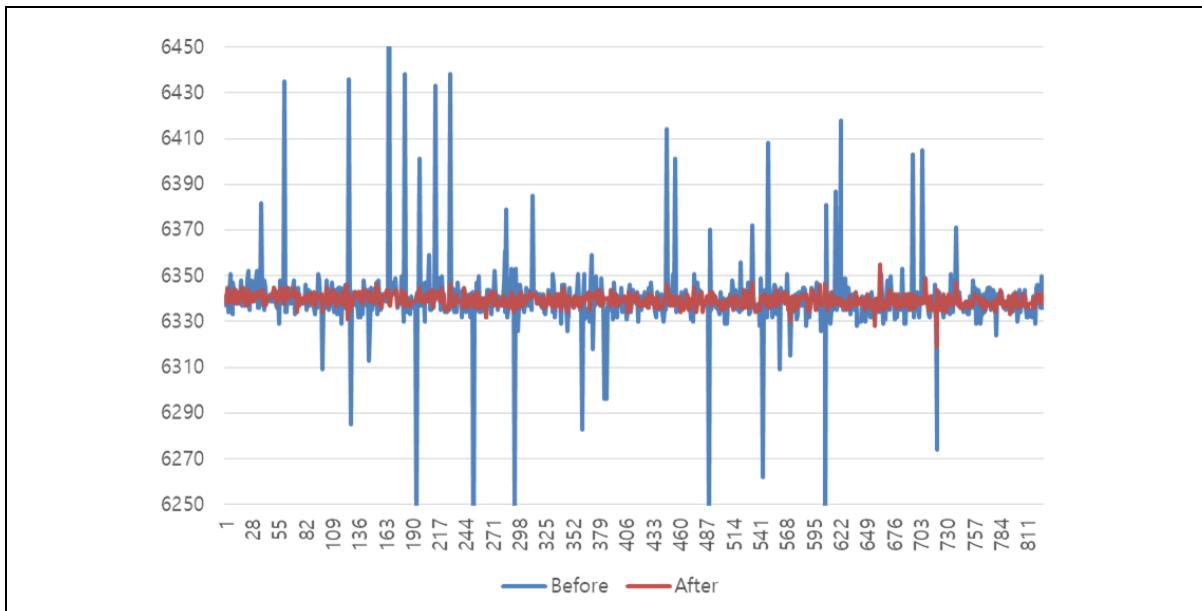


Figure 7. Min-Max Filter Data Comparison

## 4 Debounce

Debounce algorithm prevents certain functions such as Touch Detect and Release from being repeated by external noise.

### 4.1 Detect debounce

When the Diff exceeds the Detect Threshold in No Touch state, if this current state is maintained for set time, Detect Debounce algorithm determines Touch Detect.

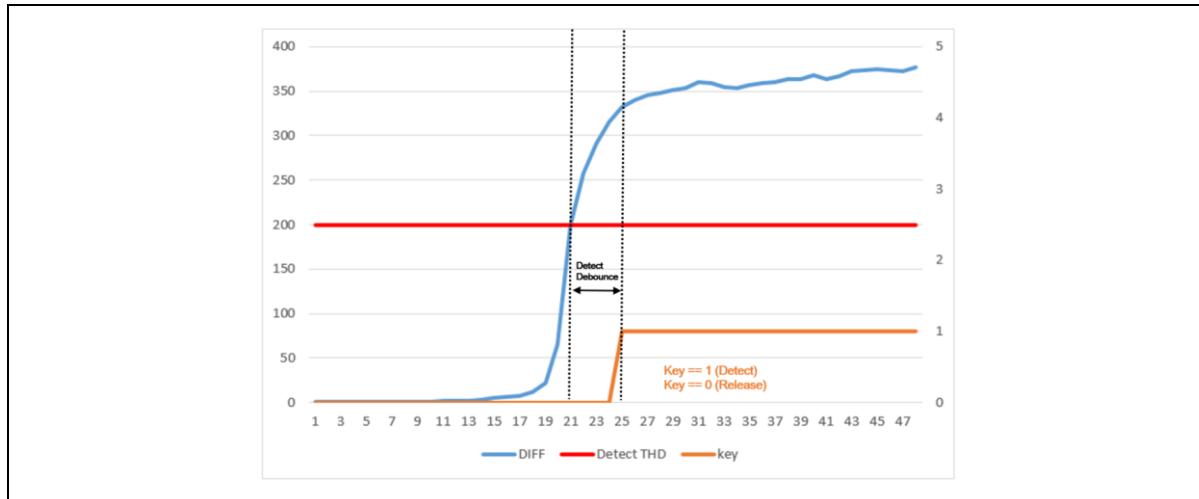


Figure 8. Detect Debounce

### 4.2 Release debounce

When the Diff doesn't exceed the Release Threshold in Touch Detect state, if this current state is maintained for set time, Release Debounce algorithm determines Touch Release.

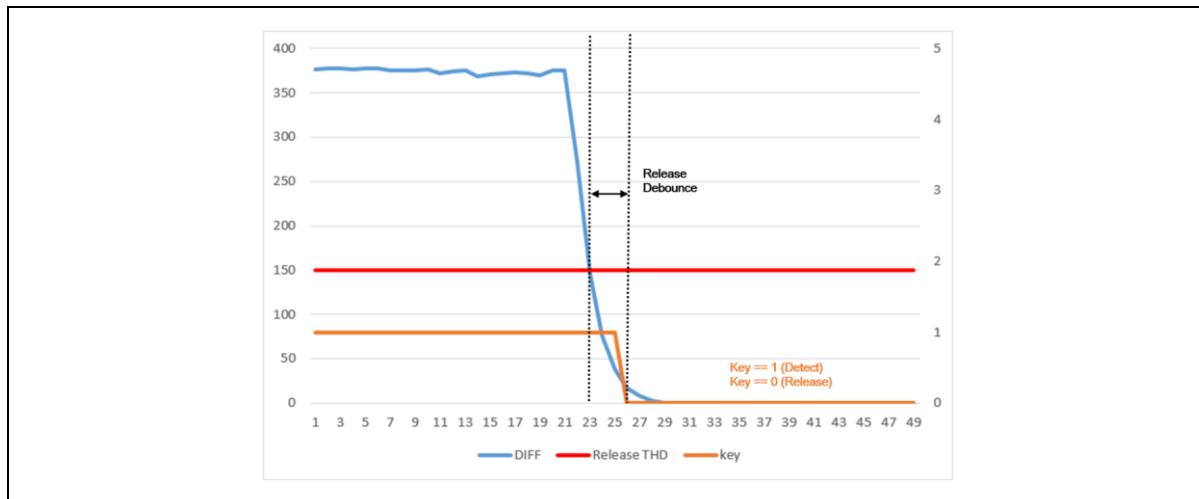


Figure 9. Release Debounce

## Revision history

Date	Version	Description
20.04.08	1.00	Initial preliminary version created
22.11.01	1.01	Revised the font of this document
21.12.02	1.02	Updated the disclaimer.

**Korea****Regional Office, Seoul**

R&D, Marketing & Sales  
8th Fl., 330, Yeongdong-daero,  
Gangnam-gu, Seoul,  
06177, Korea

Tel: +82-2-2193-2200

Fax: +82-2-508-6903

[www.abovsemi.com](http://www.abovsemi.com)

**HQ, Ochang**

R&D, QA, and Test Center  
93, Gangni 1-gil, Ochang-eup,  
Cheongwon-gun,  
Chungcheongbuk-do,  
28126, Korea

Tel: +82-43-219-5200

Fax: +82-43-217-3534

[www.abovsemi.com](http://www.abovsemi.com)

**Domestic Sales Manager**

Tel: +82-2-2193-2206

Fax: +82-2-508-6903

Email: [sales\\_kr@abov.co.kr](mailto:sales_kr@abov.co.kr)

**Global Sales Manager**

Tel: +82-2-2193-2281

Fax: +82-2-508-6903

Email: [sales\\_gl@abov.co.kr](mailto:sales_gl@abov.co.kr)

**China Sales Manager**

Tel: +86-755-8287-2205

Fax: +86-755-8287-2204

Email: [sales\\_cn@abov.co.kr](mailto:sales_cn@abov.co.kr)

**ABOV Disclaimer****IMPORTANT NOTICE – PLEASE READ CAREFULLY**

ABOV Semiconductor (“ABOV”) reserves the right to make changes, corrections, enhancements, modifications, and improvements to ABOV products and/or to this document at any time without notice. **ABOV DOES NOT GIVE WARRANTIES AS TO THE ACCURACY OR COMPLETENESS OF THE INFORMATION INCLUDED HEREIN.** Purchasers should obtain the latest relevant information of ABOV products before placing orders. Purchasers are entirely responsible for the choice, selection, and use of ABOV products and ABOV assumes no liability for application assistance or the design of purchasers' products. **NO LICENSE, EXPRESS OR IMPLIED, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY ABOV HEREIN.** ABOV DISCLAIEMS ALL EXPRESS AND IMPLIED WARRANTIES AND SHALL NOT BE RESPONSIBLE OR LIABLE FOR ANY INJUIRES OR DAMAGES RELATED TO USE OF ABOV PRODUCTS IN SUCH UNAUTHORIZED APPLICATIONS. ABOV and the ABOV logo are trademarks of ABOV. For additional information about ABOV trademarks, please refer to [https://www.abov.co.kr/en/about/corporate\\_identity.php](https://www.abov.co.kr/en/about/corporate_identity.php). All other product or service names are the property of their respective owners. Information in this document supersedes and replaces the information previously supplied in any former versions of this document.

© 2020 ABOV Semiconductor – All rights reserved