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R8C/25 Group

A/D Key Read

1. Abstract

This document describes a program to perform multiple key inputs via a single analog input using the A/D convertor.

2. Introduction

The application example described in this document applies to the following MCU and parameter(s):

- MCU : R8C/25 Group
- VCC, AVCC/VREF : 5V

This program can be used with other R8C/Tiny Series MCUs which have the same special function registers (SFRs) as the R8C/25 Group. Check the manual for any additions and modifications to functions. Careful evaluation is recommended before using this application note.

3. Application Example Description

The key input and determination specifications are as follows:

(1) The P0_7/AN0 pin is used for analog input. As Figure 3.1 shows, multiple keys and a resistor are connected and configured so that the voltage applied to the P0_7/AN0 pin varies depending on which key is pressed.

(2) One-shot mode is selected as A/D operating mode, f2 is selected as ϕ AD frequency, and 10-bit resolution is selected.

(3) A/D conversion is performed every 5 ms. Timer RA is used to measure 5 ms.

(4) When the A/D conversion value is fixed, the variable ad_fix is used to identify which key is pressed. The key code is fixed when the same key code is identified twice. The key code fixed this time and the one fixed last time (last_ad_key) are compared, and if they match, the matched key code is set into ad_key_code.
Table 3.1 shows the Values and Key Codes for Key Determination.

Table 3.1 Values and Key Codes for Key Determination

Pressed key	None	KEY1	KEY2	KEY3	KEY4	KEY5
Desirable AN0 voltage value	5 V	4 V	3.75 V	3.333 V	2.5 V	0 V
Desirable A/D conversion value	1023	820	769	684	514	0
Determination value	1023 to 921	920 to 794	793 to 726	725 to 599	598 to 257	256 to 0
Key code	0	1	2	3	4	5

This sample program may include operations of unused bit functions for the SFR bit layout. Set these values according to the operating conditions of the user system.

3.1 Pin Usage

Table 3.2 Pin Usage and Function

Pin	I/O	Function
P0_7/AN0	Input	A/D input 0

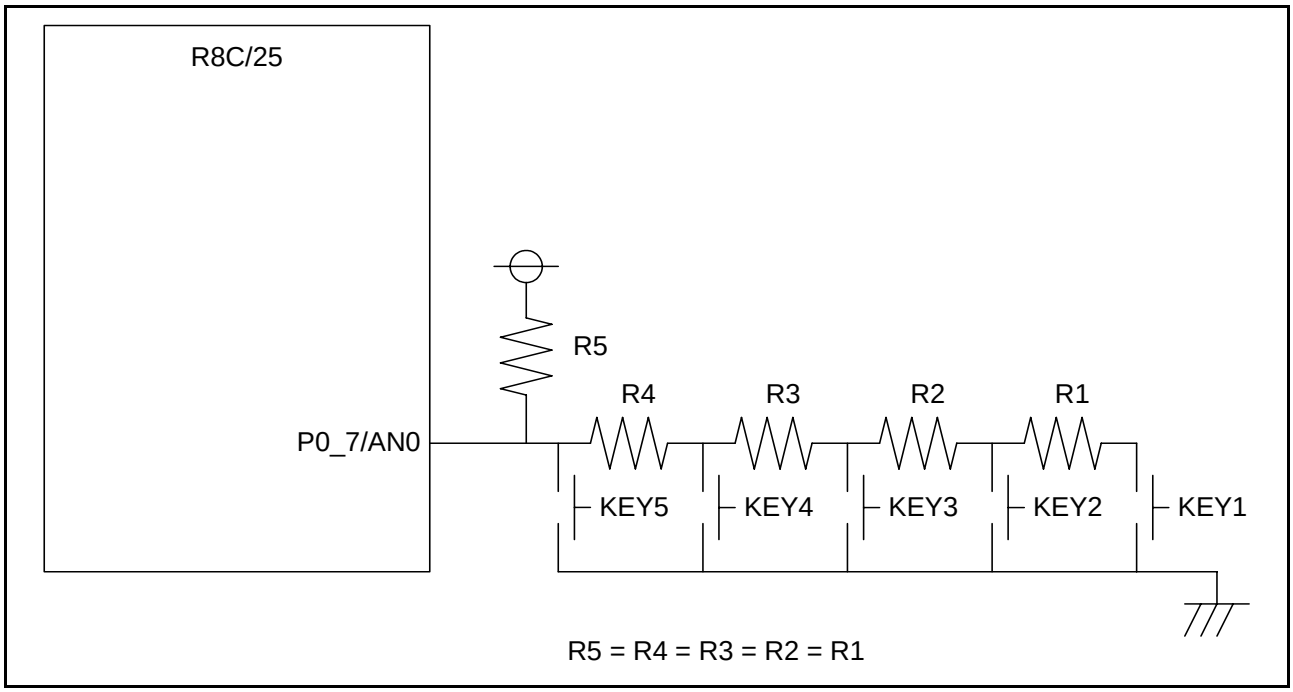


Figure 3.1 Key Input

3.2 Memory Usage

Table 3.3 Memory Usage

Memory Usage	Size	Remark
ROM	495 bytes	In main.c module
RAM	13 bytes	In main.c module
Maximum user stack usage	21 bytes	main function: 3 bytes sfr_init function: 3 bytes ad_in function: 3 bytes ad_keyin function: 18 bytes
Maximum interrupt stack usage	0 bytes	Unused

Memory usage varies depending on the C compiler version and the compile option.
The above applies under the following conditions:

- C compiler: M16C/60, 30, 20, 10, Tiny, R8C/Tiny Series Compiler V.5.40 Release 00
- Compile option: -c -finfo; NOTE: -dir “$(CONFIGDIR)” -R8C

NOTE: Unavailable in the R8C/Tiny-exclusive free version.

Table 3.4 RAM Usage and Definition

Symbol	Type	Size	Content
flag.bit.b_ad_fix	unsigned char: 1	1 bit	A/D value determine flag
ad_sum	unsigned short	2 bytes	Sum of conversion results
ad_cnt	unsigned short	2 bytes	A/D conversion count counter
ad_max	unsigned short	2 bytes	Sampled A/D maximum value
ad_min	unsigned short	2 bytes	Sampled A/D minimum value
ad_fix	unsigned short	2 bytes	A/D fixed value
ad_key_code	unsigned char	1 byte	Fixed key code
last_ad_key	unsigned char	1 byte	Last fixed key code

4. Setup

This section shows the initial setting procedures and values to perform the example described in "**3. Application Example Description**". Refer to the **R8C/25 Group Hardware Manual** for details on individual registers.

A/D Control Register 0

b7							b0
X	X	X	0	X	X	X	X

ADCON0 [Address 00D6h]

ADGSEL0	A/D Input Group Select Bit
	Port P0 group selected (AN0 to AN7)

NOTE: After setting the ADGSEL0 bit, set bits CH0 to CH2.

A/D Control Register 0

b7							b0
1	0	0	0	0	0	0	0

ADCON0 [Address 00D6h]

CH2 to CH0	Analog Input Pin Select Bits
	AN0 selected
MD	A/D Operating Mode Select Bit
	One-shot mode selected
ADGSEL0	A/D Input Group Select Bit
	Port P0 group selected (AN0 to AN7)
ADCAP	A/D Conversion Automatic Start Bit
	Start by software trigger (ADST bit) selected
ADST	A/D Conversion Start Flag
	A/D conversion stop selected
CKS0	Frequency Select Bit 0
	f2 selected

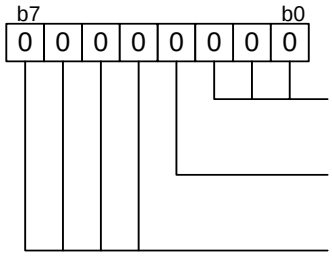
A/D Control Register 0

b7							b0
0	0	1	0	1	0	0	0

ADCON1 [Address 00A7h]

—	Unavailable. Set to 0.
BITS	8/10-Bit Mode Select Bit
	10-bit mode selected
CKS1	Frequency Select Bit 1
	f2 selected
VCUT	Vref Connect Bit
	Vref connection selected
—	Unavailable. Set to 0.

A/D Conversion Interrupt Control Register



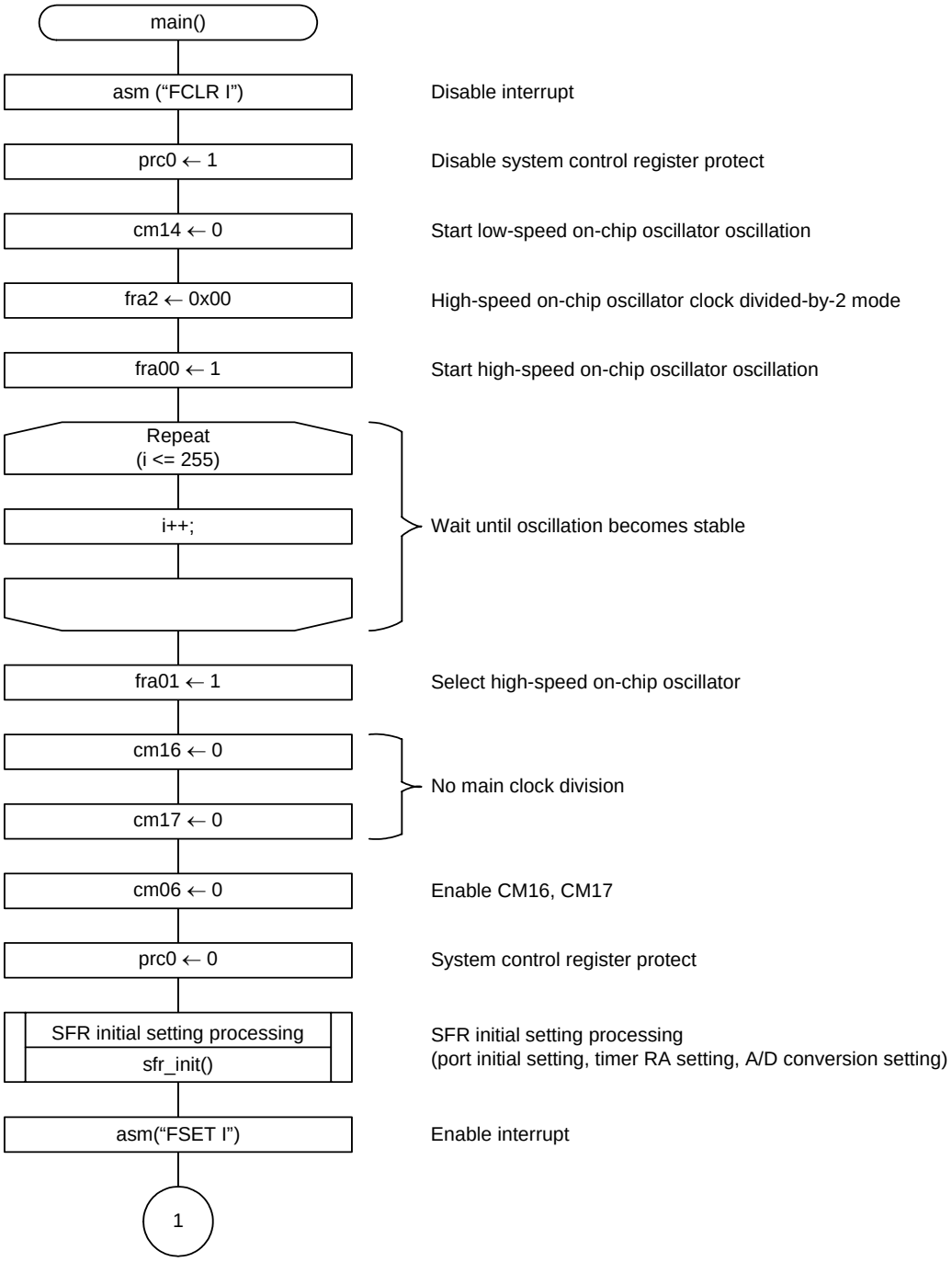
ADIC [Address 004Eh]

ILVL2 to ILVL0	Interrupt Priority Level Select Bits 2 to 0 Level 0 (interrupt disabled) selected
IR	Interrupt Request Bit No interrupt request selected
—	Unavailable. Set to 0.

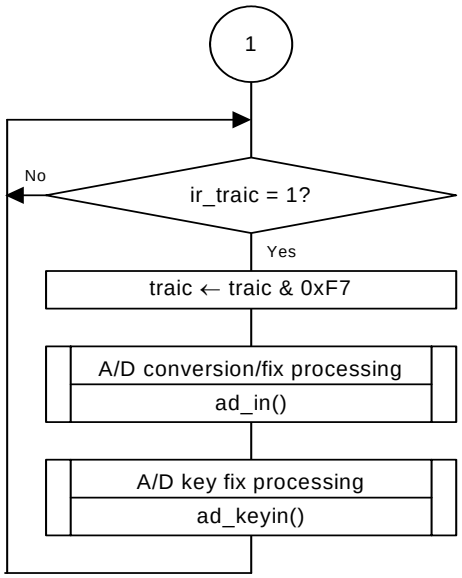
5. Flowchart

5.1 Main Function

5.1.1 Main Function 1



5.1.2 Main Function 2



Timer RA Wait for request (5 ms)

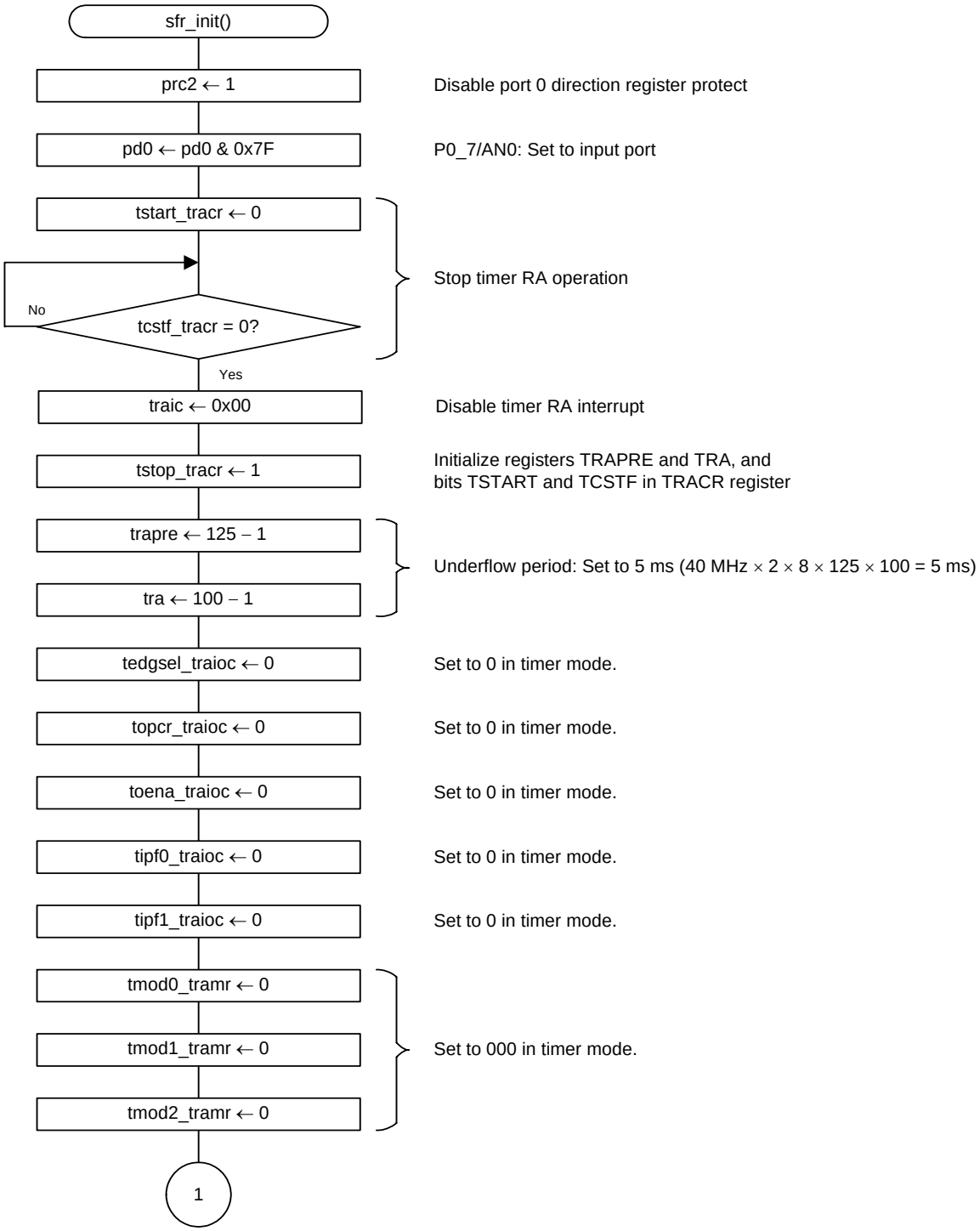
Timer RA Clear interrupt request flag

A/D conversion/fix processing

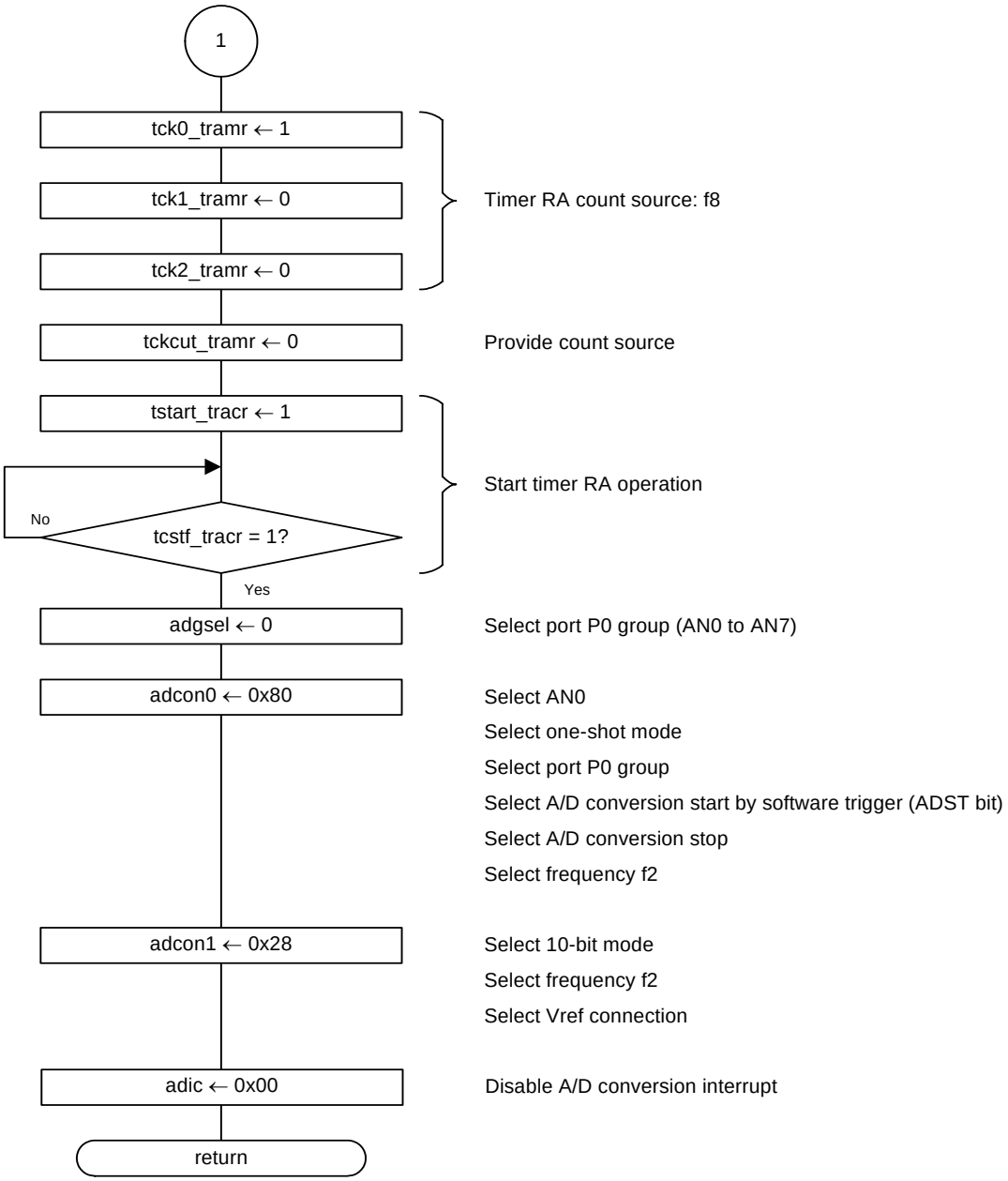
A/D key fix processing

5.2 SFR Initial Setting Processing

5.2.1 SFR Initial Setting Processing 1

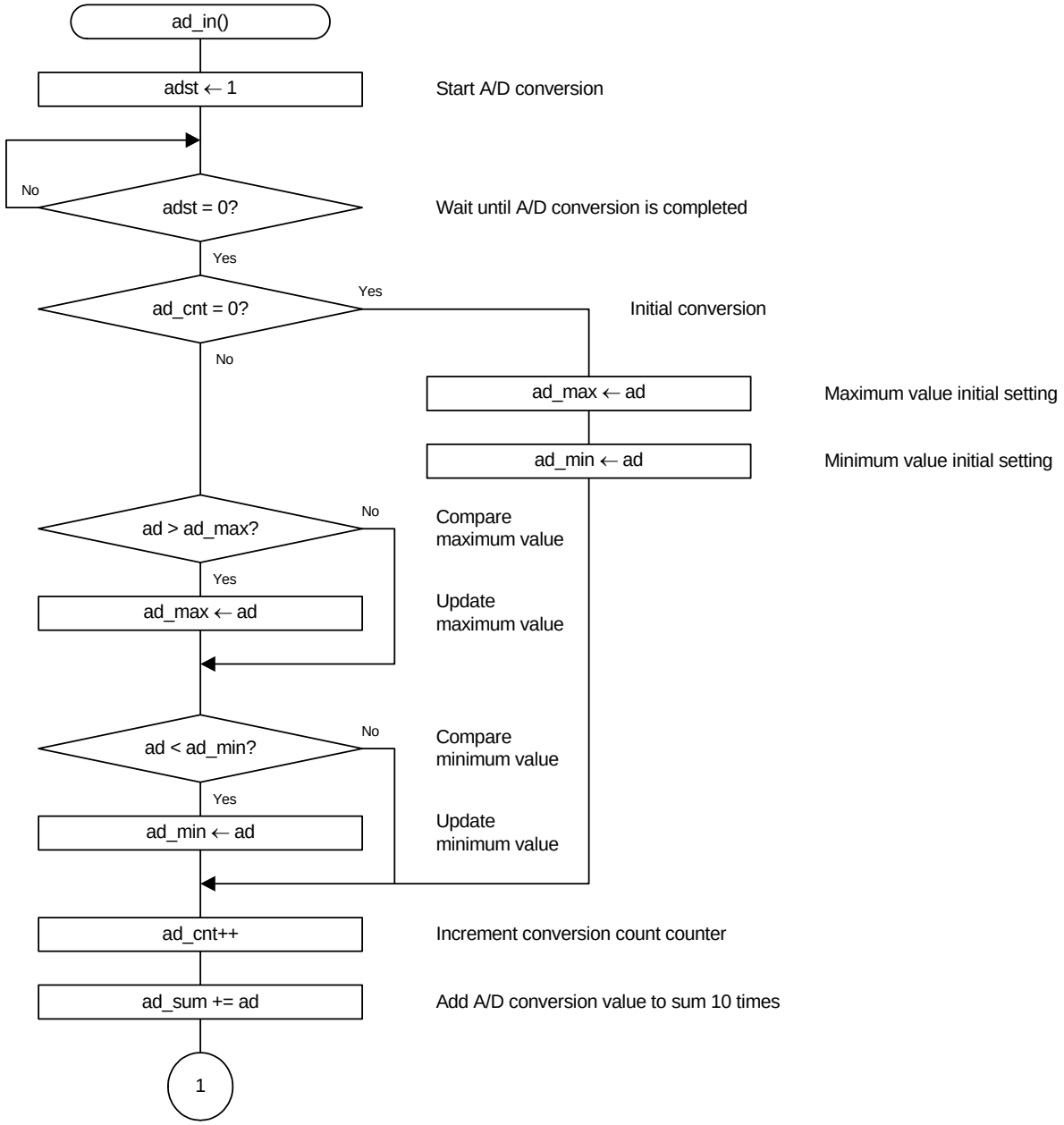


5.2.2 SFR Initial Setting Processing 2

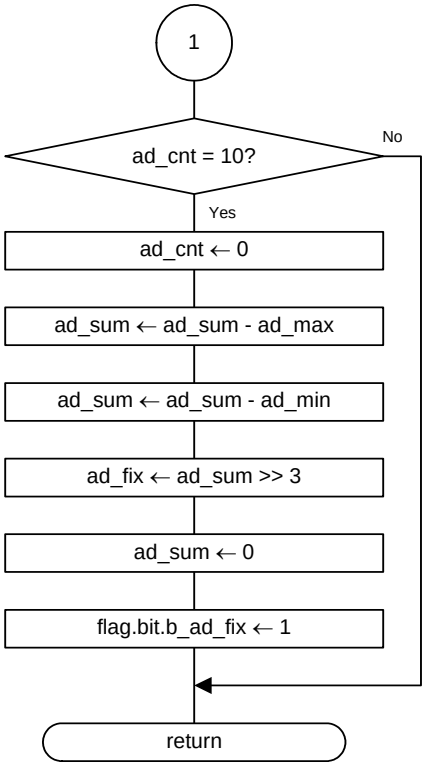


5.3 A/D Conversion/Fix Processing

5.3.1 A/D Conversion/Fix Processing 1



5.3.2 A/D Conversion/Fix Processing 2



Determine whether conversions are completed 10 times

Clear conversion complete counter

10-time sum value – maximum value

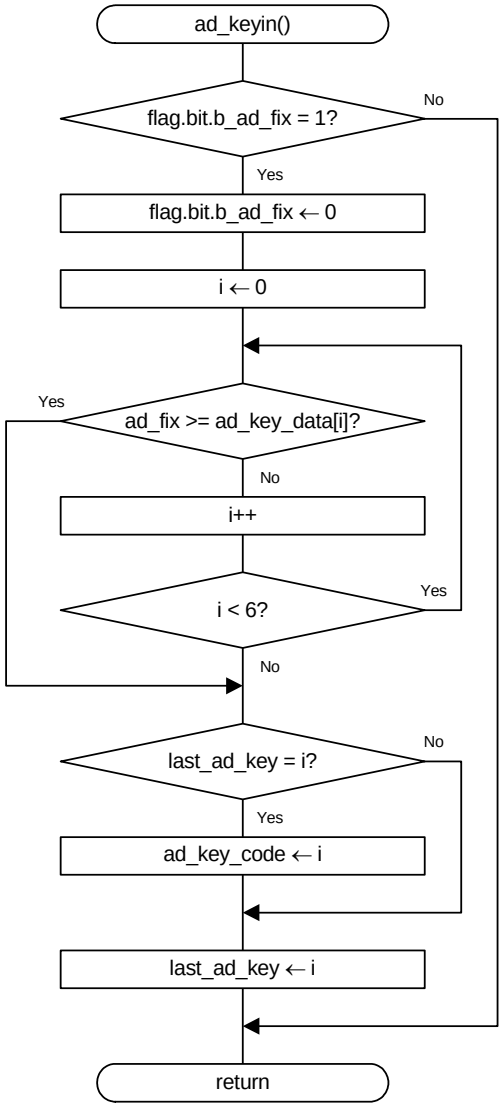
10-time sum value – minimum value

Make1/8 by 3-bit right shift processing

Clear 10-time sum value clear

A/D conversion value fix flag on

5.4 A/D Key Fix Processing



Determine whether A/D value is fixed

Clear A/D fixed value flag

Clear loop counter

Determine whether A/D value is greater than table value

Increment loop counter

Determine whether all key identifications are completed

Determine previous data

Fix A/D key

Store in previous data

6. Sample Programming Code

A sample program can be downloaded from the Renesas Technology website.
To download, click “Application Notes” in the left-hand side menu of the R8C/Tiny Series page.

7. Reference Documents

Hardware Manual
R8C/25 Group Hardware Manual
The latest version can be downloaded from the Renesas Technology website.

Technical Update/Technical News
The latest information can be downloaded from the Renesas Technology website.

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