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RENESAS TECHNICAL UPDATE

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Product Category	MPU & MCU		Document No.	TN-RX*-A077A/E	Rev.	1.00
Title	Note on Using Channel-Dedicated Sample-and-Hold Circuits for the 12-Bit A/D Converter (S12AD) in the RX210 Group		Information Category	Technical Notification		
Applicable Product	RX210 Group	Lot No. All	Reference Document	RX210 Group User's Manual: Hardware Rev.1.40 (R01UH0037EJ0140)		

This document describes a note on using channel-dedicated sample-and-hold circuits for the 12-bit A/D converter (S12ADb) in the RX210 Group and the relevant corrections to the manual.

1. Note

When using any of AN000 to AN002 channel-dedicated sample-and-hold circuits (the corresponding bit of the ADSHCR.SHANS[2:0] bits is 1), the input voltage (V_{AN}) for the selected channel is limited to the following range:
$0.25\ V \leq V_{AN} \leq AVCC0 - 0.25\ V$

2. Corrections to the Manual

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Table 42.61 is corrected as follows:

Before correction

Table 42.61 A/D Conversion Characteristics (1)

Conditions: VCC = AVCC0 = 2.7 to 5.5 V, VREFH0 ≥ 2.7 V, AVCC0-0.9 V ≤ VREFH0 ≤ AVCC0*3,
VSS = AVSS0 = VREFL = VREFL0 = 0 V, Ta = -40 to +105°C

Item	Min.	Typ.	Max.	Unit.	Test Conditions
		⋮ *omitted*			
Absolute accuracy	—	±1.25	±5.0	LSB	High-precision channel*4
	—	±1.25	±8.0	LSB	Normal-precision channel
DNL differential nonlinearity error	—	±1.0	—	LSB	*4
INL integral nonlinearity error	—	±1.0	±3.0	LSB	*4

Note: • PCLKD must be set to 40 MHz or lower when HOCO is to be selected as the A/D conversion clock. The characteristics apply when no pin functions other than A/D converter input are used. Absolute accuracy includes quantization errors. Offset error, fullscale error, DNL differential nonlinearity error, and INL integral nonlinearity error do not include quantization errors.
Note 1. The conversion time is the sum of the sampling time and the comparison time. As the test conditions, the number of sampling states is indicated.
Note 2. The value in parentheses indicates the sampling time.
Note 3. When using the temperature sensor, use it when AVCC0 = VREFH0.
Note 4. When using the sample-and-hold circuit, 0.25 ≤ analog input voltage ≤ AVCC - 0.25 V.

After correction

Table 42.61 A/D Conversion Characteristics (1)

Conditions: VCC = AVCC0 = 2.7 to 5.5 V, VREFH0 ≥ 2.7 V, AVCC0-0.9 V ≤ VREFH0 ≤ AVCC0*3,
VSS = AVSS0 = VREFL = VREFL0 = 0 V, Ta = -40 to +105°C

Item	Min.	Typ.	Max.	Unit.	Test Conditions
		⋮ *omitted*			
Absolute accuracy	—	±1.25	±5.0	LSB	High-precision channel
	—	±1.25	±8.0	LSB	Normal-precision channel
DNL differential nonlinearity error	—	±1.0	—	LSB	
INL integral nonlinearity error	—	±1.0	±3.0	LSB	

Note: • PCLKD must be set to 40 MHz or lower when HOCO is to be selected as the A/D conversion clock. The characteristics apply when no pin functions other than A/D converter input are used. Absolute accuracy includes quantization errors. Offset error, fullscale error, DNL differential nonlinearity error, and INL integral nonlinearity error do not include quantization errors.

Note: • When using the channel-dedicated sample-and-hold circuit, use the AN000 to AN002 analog input voltage (V_{AN}) that satisfies all the following conditions: 0.25 V≤ V_{AN} ≤ AVCC0 - 0.25 V, V_{AN} ≤ VREFH0, and AVCC0 ≥ 2.7 V.

Note 1. The conversion time is the sum of the sampling time and the comparison time. As the test conditions, the number of sampling states is indicated.

Note 2. The value in parentheses indicates the sampling time.

Note 3. When using the temperature sensor, use it when AVCC0 = VREFH0.

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The X-axis and title of Figure 42.99 are corrected as follows:

Before correction

- X-axis: AVCC
- Figure title: AVCC to AVREFH Voltage Range

After correction

- X-axis: AVCC0
- Figure title: AVCC0 to VREFH0 Voltage Range

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Table 42.62 is corrected as follows:

Before correction

Table 42.62 Channel Classification for A/D Converter

Classification	Channel	Conditions	
High-precision channel	AN003 to AN007	AVCC0 = 1.62 to 5.5 V	It is disallowed to use pins AN000 to AN007 as digital outputs when the A/D converter is used.
	AN000, AN001, AN002	AVCC0 = 2.7 to 5.5 V, when the sample-and-hold circuit is in use.	
		AVCC0 = 1.62 to 5.5 V, when the ssample-and-hold circuit is not in use.	
Normal-precision channel	AN008 to AN015	AVCC0 = 1.62 to 5.5 V	

After correction

Table 42.62 Channel Classification for A/D Converter

Classification	Channel	Channel-Dedicated Sample-and-Hold Circuit	Conditions	
High-precision channel	AN000 to AN002	Used	AVCC0 = 2.7 to 5.5 V AVCC0 - 0.9 V ≤ VREFH0 ≤ AVCC0 VREFH0 ≥ 2.7 V AVSS0 = VREFL0 = 0 V 0.25 V ≤ V_{AN} ≤ AVCC0 - 0.25 V V_{AN} ≤ VREFH0	It is disallowed to use pins AN000 to AN007 as digital outputs when the A/D converter is used.
		Not used	AVCC0 = 1.62 to 5.5 V When AVCC0 ≥ 1.8 V, AVCC0 - 0.9 V ≤ VREFH0 ≤ AVCC0 VREFH0 ≥ 1.8 V When AVCC0 < 1.8 V, VREFH0 = AVCC0 AVSS0 = VREFL0 = 0 V 0 V ≤ V_{AN} ≤ VREFH0	
	AN003 to AN007	—		
Normal-precision channel	AN008 to AN015	—		

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A note is added to Table 42.64 as follows:

Table 42.64 A/D Conversion Characteristics (2)

Conditions: VCC = AVCC0 = 1.8 to 3.6 V, 1.8 V ≤ VREFH0 ≤ 2.7 V, AVCC0-0.9 V ≤ VREFH0 ≤ AVCC0*3,
VSS = AVSS0 = VREFL = VREFL0 = 0 V, Ta = -40 to +105°C

Item	Min.	Typ.	Max.	Unit.	Test Conditions
⋮ *omitted*					

Note: • The characteristics apply when no pin functions other than A/D converter input are used. Absolute accuracy includes quantization errors. Offset error, full-scale error, DNL differential nonlinearity error, and INL integral nonlinearity error do not include quantization errors.

Note: • When using the channel-dedicated sample-and-hold circuit, use the AN000 to AN002 analog input voltage (V_{AN}) that satisfies all the following conditions: 0.25 V≤ V_{AN} ≤ AVCC0 - 0.25 V, V_{AN} ≤ VREFH0, and AVCC0 ≥ 2.7 V.

Note 1. The conversion time is the sum of the sampling time and the comparison time. As the test conditions, the number of sampling states is indicated.

Note 2. The value in parentheses indicates the sampling time.

Note 3. When using the temperature sensor, use it when AVCC0 = VREFH0.