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What is "[Embedded - Microcontrollers](#)"?

"[Embedded - Microcontrollers](#)" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

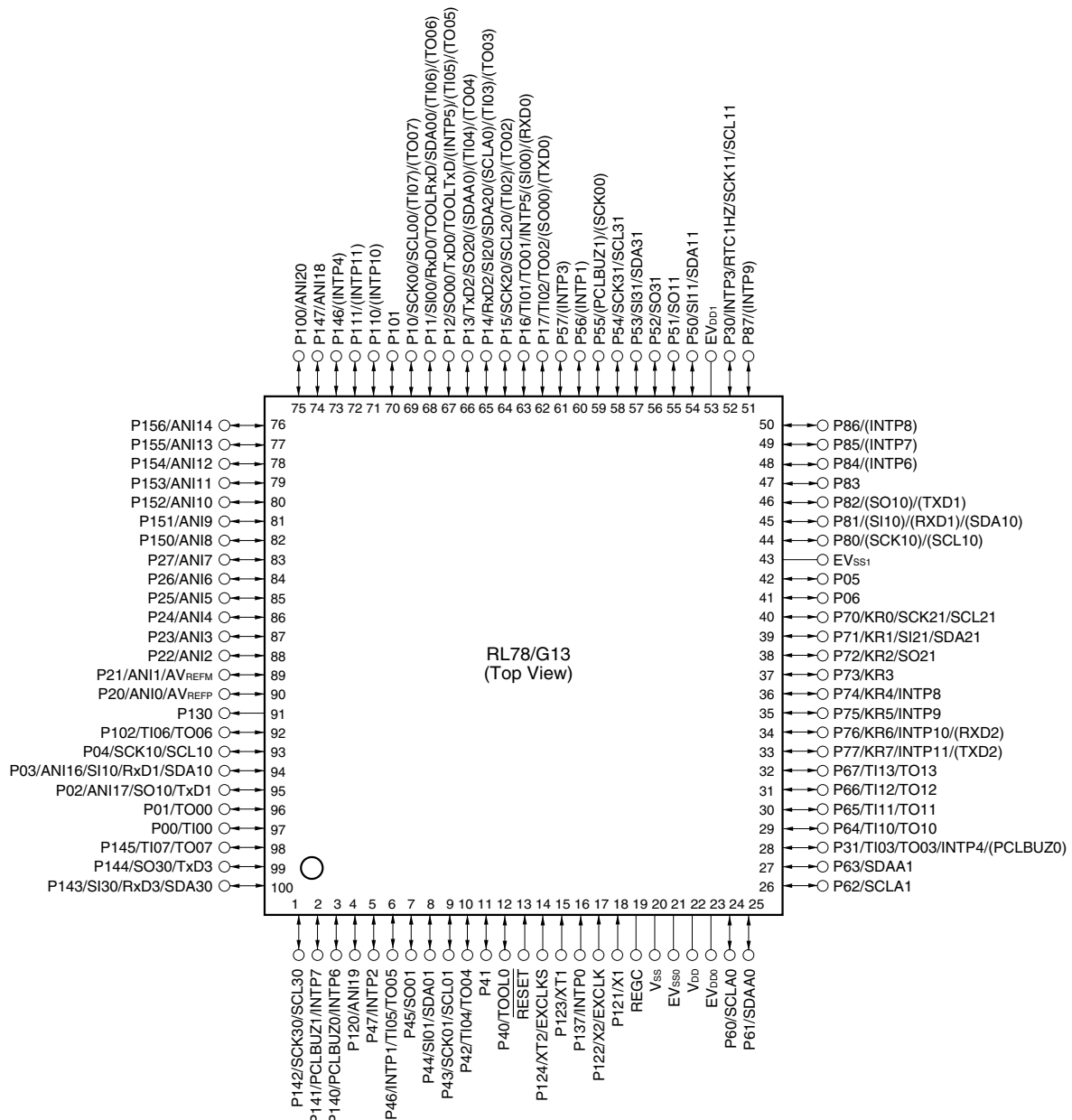
Applications of "[Embedded - Microcontrollers](#)"

Details

Product Status	Discontinued at Digi-Key
Core Processor	RL78
Core Size	16-Bit
Speed	32MHz
Connectivity	CSI, I ² C, LINbus, UART/USART
Peripherals	DMA, LVD, POR, PWM, WDT
Number of I/O	34
Program Memory Size	64KB (64K x 8)
Program Memory Type	FLASH
EEPROM Size	4K x 8
RAM Size	4K x 8
Voltage - Supply (Vcc/Vdd)	1.6V ~ 5.5V
Data Converters	A/D 10x8/10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	48-LQFP
Supplier Device Package	48-LFQFP (7x7)
Purchase URL	https://www.e-xfl.com/product-detail/renesas-electronics-america/r5f100gedfb-30

1.3.13 100-pin products

- 100-pin plastic LQFP (14 × 14 mm, 0.5 mm pitch)

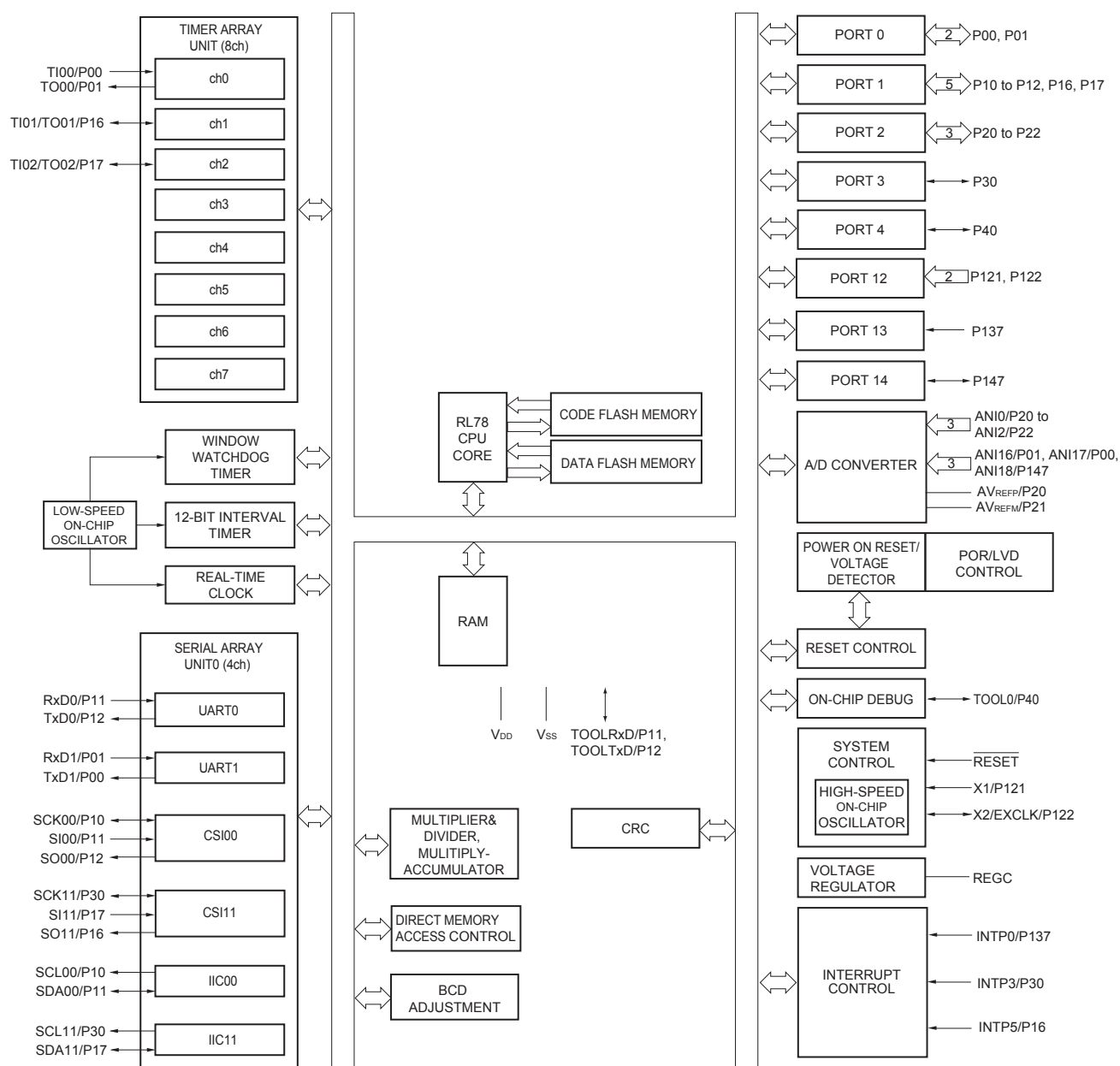


- Cautions**
1. Make EV_{SS0}, EV_{SS1} pins the same potential as V_{SS} pin.
 2. Make V_{DD} pin the potential that is higher than EV_{DD0}, EV_{DD1} pins (EV_{DD0} = EV_{DD1}).
 3. Connect the REGC pin to V_{SS} via a capacitor (0.47 to 1 μ F).

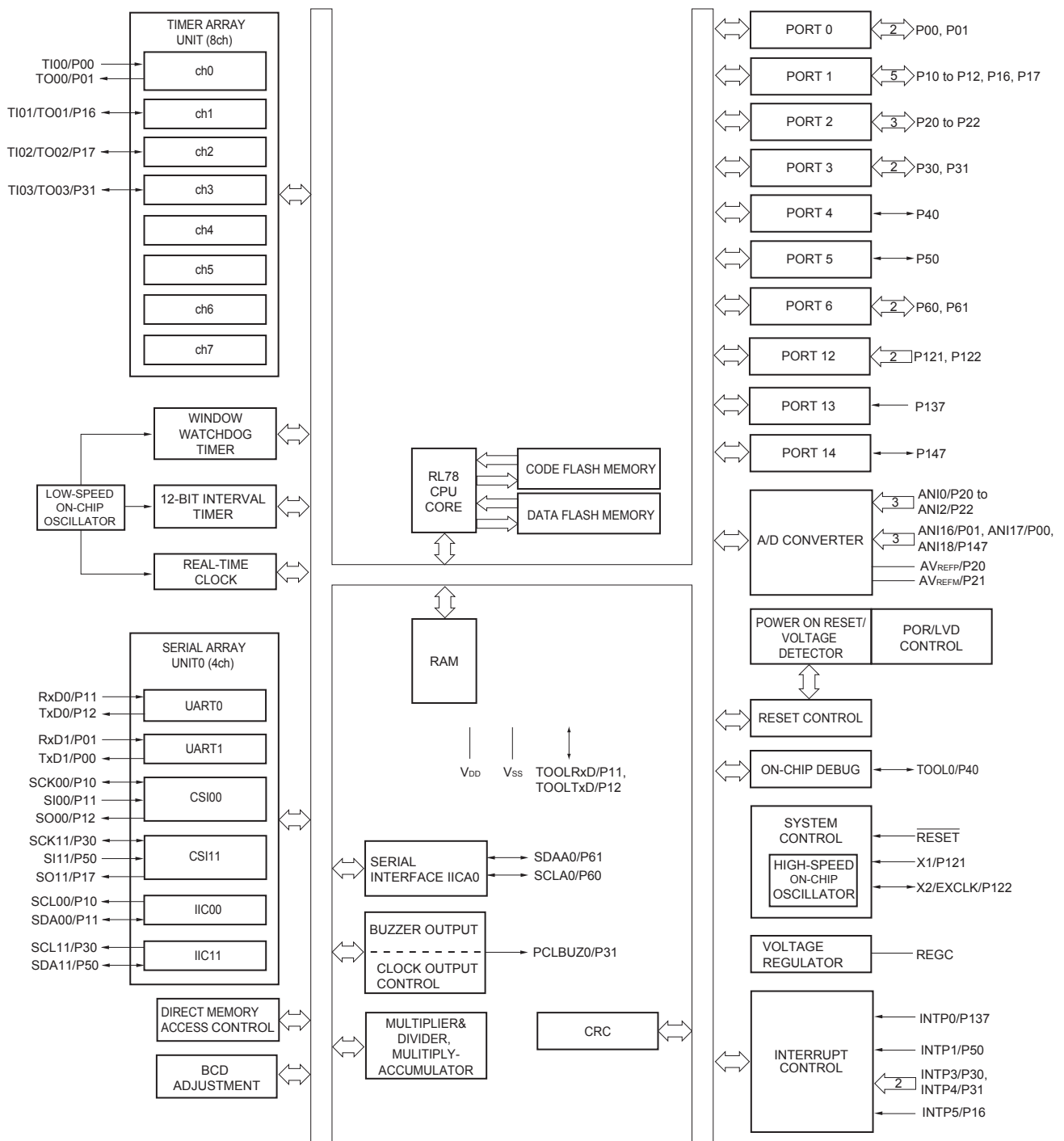
- Remarks**
1. For pin identification, see 1.4 Pin Identification.
 2. When using the microcontroller for an application where the noise generated inside the microcontroller must be reduced, it is recommended to supply separate powers to the V_{DD}, EV_{DD0} and EV_{DD1} pins and connect the V_{SS}, EV_{SS0} and EV_{SS1} pins to separate ground lines.
 3. Functions in parentheses in the above figure can be assigned via settings in the peripheral I/O redirection register (PIOR). Refer to **Figure 4-8 Format of Peripheral I/O Redirection Register (PIOR)** in the RL78/G13 User's Manual.

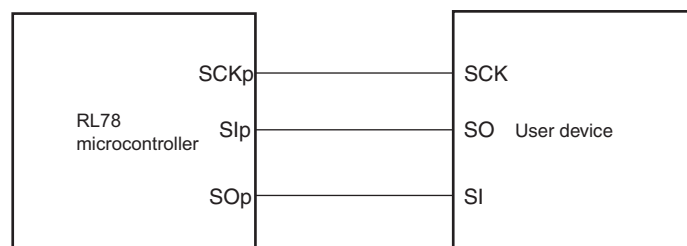
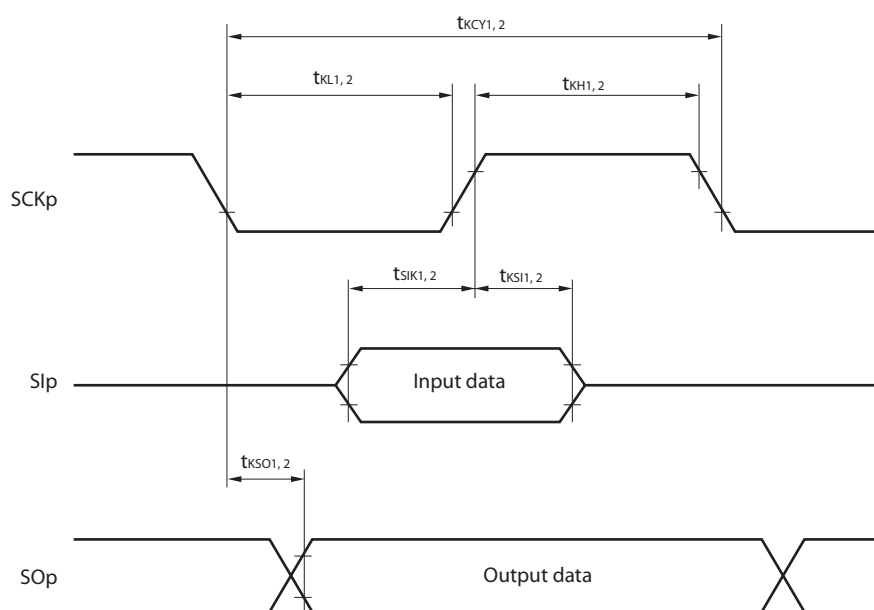
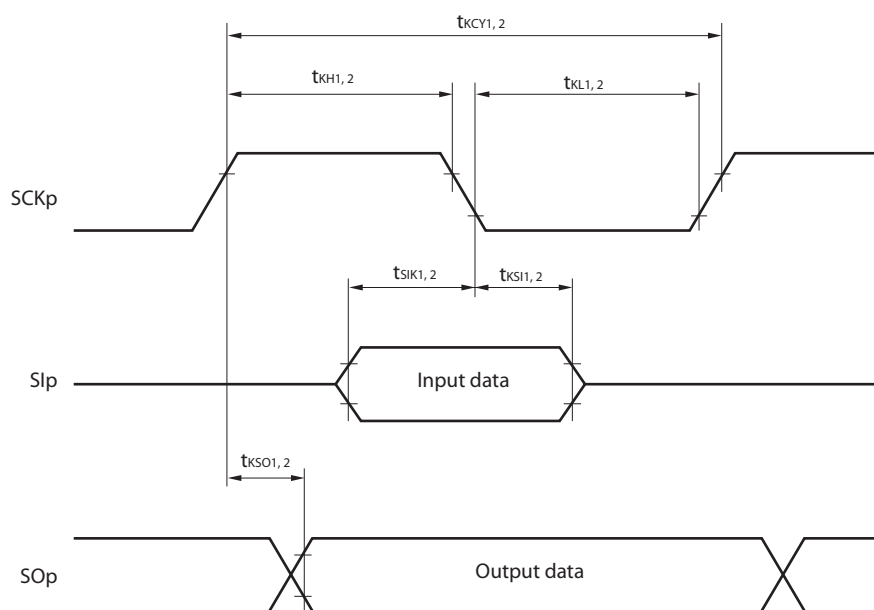
1.5 Block Diagram

1.5.1 20-pin products

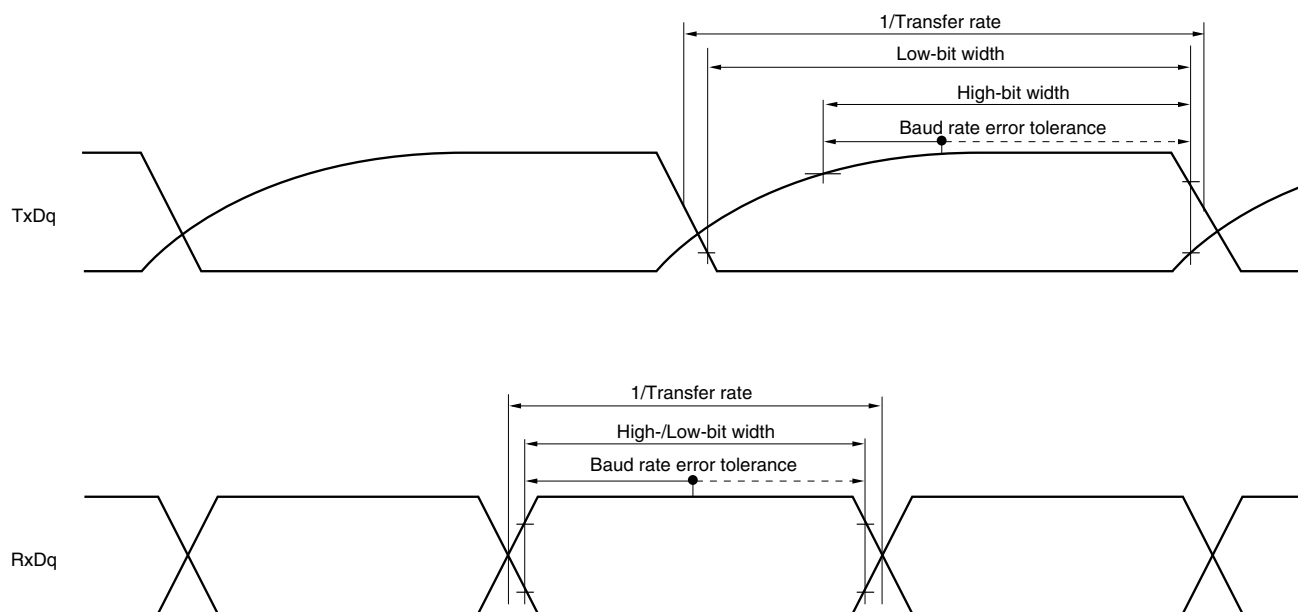


1.5.2 24-pin products



CSI mode connection diagram (during communication at same potential)**CSI mode serial transfer timing (during communication at same potential)
(When DAPmn = 0 and CKPmn = 0, or DAPmn = 1 and CKPmn = 1.)****CSI mode serial transfer timing (during communication at same potential)
(When DAPmn = 0 and CKPmn = 1, or DAPmn = 1 and CKPmn = 0.)**

- Remarks**
1. p: CSI number (p = 00, 01, 10, 11, 20, 21, 30, 31)
 2. m: Unit number, n: Channel number (mn = 00 to 03, 10 to 13)

UART mode bit width (during communication at different potential) (reference)

- Remarks**
1. $R_b[\Omega]$: Communication line (TxDq) pull-up resistance,
 $C_b[F]$: Communication line (TxDq) load capacitance, $V_b[V]$: Communication line voltage
 2. q: UART number (q = 0 to 3), g: PIM and POM number (g = 0, 1, 8, 14)
 3. f_{MCK} : Serial array unit operation clock frequency
 (Operation clock to be set by the CKSmn bit of serial mode register mn (SMRmn).
 m: Unit number, n: Channel number (mn = 00 to 03, 10 to 13))
 4. UART2 cannot communicate at different potential when bit 1 (PIOR1) of peripheral I/O redirection register (PIOR) is 1.

(8) Communication at different potential (1.8 V, 2.5 V, 3 V) (CSI mode) (master mode, SCKp... internal clock output)
(2/3)**(T_A = -40 to +85°C, 1.8 V ≤ EV_{DD0} = EV_{DD1} ≤ V_{DD} ≤ 5.5 V, V_{SS} = EV_{SS0} = EV_{SS1} = 0 V)**

Parameter	Symbol	Conditions	HS (high-speed main) Mode		LS (low-speed main) Mode		LV (low-voltage main) Mode		Unit
			MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
Slp setup time (to SCKp↑) ^{Note 1}	t _{SIK1}	4.0 V ≤ EV _{DD0} ≤ 5.5 V, 2.7 V ≤ V _b ≤ 4.0 V, C _b = 30 pF, R _b = 1.4 kΩ	81		479		479		ns
		2.7 V ≤ EV _{DD0} < 4.0 V, 2.3 V ≤ V _b ≤ 2.7 V, C _b = 30 pF, R _b = 2.7 kΩ	177		479		479		ns
		1.8 V ≤ EV _{DD0} < 3.3 V, 1.6 V ≤ V _b ≤ 2.0 V ^{Note 2} , C _b = 30 pF, R _b = 5.5 kΩ	479		479		479		ns
Slp hold time (from SCKp↑) ^{Note 1}	t _{KSH1}	4.0 V ≤ EV _{DD0} ≤ 5.5 V, 2.7 V ≤ V _b ≤ 4.0 V, C _b = 30 pF, R _b = 1.4 kΩ	19		19		19		ns
		2.7 V ≤ EV _{DD0} < 4.0 V, 2.3 V ≤ V _b ≤ 2.7 V, C _b = 30 pF, R _b = 2.7 kΩ	19		19		19		ns
		1.8 V ≤ EV _{DD0} < 3.3 V, 1.6 V ≤ V _b ≤ 2.0 V ^{Note 2} , C _b = 30 pF, R _b = 5.5 kΩ	19		19		19		ns
Delay time from SCKp↓ to SOp output ^{Note 1}	t _{KSO1}	4.0 V ≤ EV _{DD0} ≤ 5.5 V, 2.7 V ≤ V _b ≤ 4.0 V, C _b = 30 pF, R _b = 1.4 kΩ		100		100		100	ns
		2.7 V ≤ EV _{DD0} < 4.0 V, 2.3 V ≤ V _b ≤ 2.7 V, C _b = 30 pF, R _b = 2.7 kΩ		195		195		195	ns
		1.8 V ≤ EV _{DD0} < 3.3 V, 1.6 V ≤ V _b ≤ 2.0 V ^{Note 2} , C _b = 30 pF, R _b = 5.5 kΩ		483		483		483	ns

- Notes**
1. When DAP_{mn} = 0 and CKP_{mn} = 0, or DAP_{mn} = 1 and CKP_{mn} = 1.
 2. Use it with EV_{DD0} ≥ V_b.

Caution Select the TTL input buffer for the Slp pin and the N-ch open drain output (V_{DD} tolerance (When 20- to 52-pin products)/EV_{DD} tolerance (When 64- to 128-pin products)) mode for the SOp pin and SCKp pin by using port input mode register g (PIMg) and port output mode register g (POMg). For V_{IH} and V_{IL}, see the DC characteristics with TTL input buffer selected.

(Remarks are listed on the page after the next page.)

(10) Communication at different potential (1.8 V, 2.5 V, 3 V) (simplified I²C mode) (1/2)(T_A = -40 to +85°C, 1.8 V ≤ EV_{DD0} = EV_{DD1} ≤ V_{DD} ≤ 5.5 V, V_{SS} = EV_{SS0} = EV_{SS1} = 0 V)

Parameter	Symbol	Conditions	HS (high-speed main) Mode		LS (low-speed main) Mode		LV (low-voltage main) Mode		Unit
			MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	
SCLr clock frequency	f _{SCL}	4.0 V ≤ EV _{DD0} ≤ 5.5 V, 2.7 V ≤ V _b ≤ 4.0 V, C _b = 50 pF, R _b = 2.7 kΩ		1000 Note 1		300 Note 1		300 Note 1	kHz
		2.7 V ≤ EV _{DD0} < 4.0 V, 2.3 V ≤ V _b ≤ 2.7 V, C _b = 50 pF, R _b = 2.7 kΩ		1000 Note 1		300 Note 1		300 Note 1	kHz
		4.0 V ≤ EV _{DD0} ≤ 5.5 V, 2.7 V ≤ V _b ≤ 4.0 V, C _b = 100 pF, R _b = 2.8 kΩ		400 Note 1		300 Note 1		300 Note 1	kHz
		2.7 V ≤ EV _{DD0} < 4.0 V, 2.3 V ≤ V _b ≤ 2.7 V, C _b = 100 pF, R _b = 2.7 kΩ		400 Note 1		300 Note 1		300 ote 1	kHz
		1.8 V ≤ EV _{DD0} < 3.3 V, 1.6 V ≤ V _b ≤ 2.0 V ^{Note 2} , C _b = 100 pF, R _b = 5.5 kΩ		300 Note 1		300 Note 1		300 Note 1	kHz
Hold time when SCLr = "L"	t _{LOW}	4.0 V ≤ EV _{DD0} ≤ 5.5 V, 2.7 V ≤ V _b ≤ 4.0 V, C _b = 50 pF, R _b = 2.7 kΩ	475		1550		1550		ns
		2.7 V ≤ EV _{DD0} < 4.0 V, 2.3 V ≤ V _b ≤ 2.7 V, C _b = 50 pF, R _b = 2.7 kΩ	475		1550		1550		ns
		4.0 V ≤ EV _{DD0} ≤ 5.5 V, 2.7 V ≤ V _b ≤ 4.0 V, C _b = 100 pF, R _b = 2.8 kΩ	1150		1550		1550		ns
		2.7 V ≤ EV _{DD0} < 4.0 V, 2.3 V ≤ V _b ≤ 2.7 V, C _b = 100 pF, R _b = 2.7 kΩ	1150		1550		1550		ns
		1.8 V ≤ EV _{DD0} < 3.3 V, 1.6 V ≤ V _b ≤ 2.0 V ^{Note 2} , C _b = 100 pF, R _b = 5.5 kΩ	1550		1550		1550		ns
Hold time when SCLr = "H"	t _{HIGH}	4.0 V ≤ EV _{DD0} ≤ 5.5 V, 2.7 V ≤ V _b ≤ 4.0 V, C _b = 50 pF, R _b = 2.7 kΩ	245		610		610		ns
		2.7 V ≤ EV _{DD0} < 4.0 V, 2.3 V ≤ V _b ≤ 2.7 V, C _b = 50 pF, R _b = 2.7 kΩ	200		610		610		ns
		4.0 V ≤ EV _{DD0} ≤ 5.5 V, 2.7 V ≤ V _b ≤ 4.0 V, C _b = 100 pF, R _b = 2.8 kΩ	675		610		610		ns
		2.7 V ≤ EV _{DD0} < 4.0 V, 2.3 V ≤ V _b ≤ 2.7 V, C _b = 100 pF, R _b = 2.7 kΩ	600		610		610		ns
		1.8 V ≤ EV _{DD0} < 3.3 V, 1.6 V ≤ V _b ≤ 2.0 V ^{Note 2} , C _b = 100 pF, R _b = 5.5 kΩ	610		610		610		ns

2.6 Analog Characteristics

2.6.1 A/D converter characteristics

Classification of A/D converter characteristics

Input channel	Reference Voltage		
	Reference voltage (+) = AV _{REFP} Reference voltage (-) = AV _{REFM}	Reference voltage (+) = V _{DD} Reference voltage (-) = V _{SS}	Reference voltage (+) = V _{BGR} Reference voltage (-) = AV _{REFM}
ANI0 to ANI14	Refer to 2.6.1 (1).	Refer to 2.6.1 (3).	Refer to 2.6.1 (4).
ANI16 to ANI26	Refer to 2.6.1 (2).		
Internal reference voltage Temperature sensor output voltage	Refer to 2.6.1 (1).		—

(1) When reference voltage (+) = AV_{REFP}/ANI0 (ADREFP1 = 0, ADREFP0 = 1), reference voltage (-) = AV_{REFM}/ANI1 (ADREFM = 1), target pin : ANI2 to ANI14, internal reference voltage, and temperature sensor output voltage

(T_A = -40 to +85°C, 1.6 V ≤ AV_{REFP} ≤ V_{DD} ≤ 5.5 V, V_{SS} = 0 V, Reference voltage (+) = AV_{REFP}, Reference voltage (-) = AV_{REFM} = 0 V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Resolution	RES		8		10	bit
Overall error ^{Note 1}	AINL	10-bit resolution AV _{REFP} = V _{DD} ^{Note 3}	1.8 V ≤ AV _{REFP} ≤ 5.5 V	1.2	±3.5	LSB
			1.6 V ≤ AV _{REFP} ≤ 5.5 V ^{Note 4}	1.2	±7.0	LSB
Conversion time	t _{CONV}	10-bit resolution Target pin: ANI2 to ANI14	3.6 V ≤ V _{DD} ≤ 5.5 V	2.125	39	μs
			2.7 V ≤ V _{DD} ≤ 5.5 V	3.1875	39	μs
			1.8 V ≤ V _{DD} ≤ 5.5 V	17	39	μs
			1.6 V ≤ V _{DD} ≤ 5.5 V	57	95	μs
		10-bit resolution Target pin: Internal reference voltage, and temperature sensor output voltage (HS (high-speed main) mode)	3.6 V ≤ V _{DD} ≤ 5.5 V	2.375	39	μs
			2.7 V ≤ V _{DD} ≤ 5.5 V	3.5625	39	μs
			2.4 V ≤ V _{DD} ≤ 5.5 V	17	39	μs
Zero-scale error ^{Notes 1, 2}	E _{ZS}	10-bit resolution AV _{REFP} = V _{DD} ^{Note 3}	1.8 V ≤ AV _{REFP} ≤ 5.5 V		±0.25	%FSR
			1.6 V ≤ AV _{REFP} ≤ 5.5 V ^{Note 4}		±0.50	%FSR
Full-scale error ^{Notes 1, 2}	E _{FS}	10-bit resolution AV _{REFP} = V _{DD} ^{Note 3}	1.8 V ≤ AV _{REFP} ≤ 5.5 V		±0.25	%FSR
			1.6 V ≤ AV _{REFP} ≤ 5.5 V ^{Note 4}		±0.50	%FSR
Integral linearity error ^{Note 1}	ILE	10-bit resolution AV _{REFP} = V _{DD} ^{Note 3}	1.8 V ≤ AV _{REFP} ≤ 5.5 V		±2.5	LSB
			1.6 V ≤ AV _{REFP} ≤ 5.5 V ^{Note 4}		±5.0	LSB
Differential linearity error ^{Note 1}	DLE	10-bit resolution AV _{REFP} = V _{DD} ^{Note 3}	1.8 V ≤ AV _{REFP} ≤ 5.5 V		±1.5	LSB
			1.6 V ≤ AV _{REFP} ≤ 5.5 V ^{Note 4}		±2.0	LSB
Analog input voltage	V _{AIN}	ANI2 to ANI14	0		AV _{REFP}	V
		Internal reference voltage (2.4 V ≤ V _{DD} ≤ 5.5 V, HS (high-speed main) mode)	V _{BGR} ^{Note 5}			V
		Temperature sensor output voltage (2.4 V ≤ V _{DD} ≤ 5.5 V, HS (high-speed main) mode)	V _{TMPS25} ^{Note 5}			V

(Notes are listed on the next page.)

- Notes**
1. Excludes quantization error ($\pm 1/2$ LSB).
 2. This value is indicated as a ratio (%FSR) to the full-scale value.
 3. When $AV_{REFP} < V_{DD}$, the MAX. values are as follows.
Overall error: Add ± 1.0 LSB to the MAX. value when $AV_{REFP} = V_{DD}$.
Zero-scale error/Full-scale error: Add $\pm 0.05\%$ FSR to the MAX. value when $AV_{REFP} = V_{DD}$.
Integral linearity error/ Differential linearity error: Add ± 0.5 LSB to the MAX. value when $AV_{REFP} = V_{DD}$.
 4. Values when the conversion time is set to $57\ \mu\text{s}$ (min.) and $95\ \mu\text{s}$ (max.).
 5. Refer to **2.6.2 Temperature sensor/internal reference voltage characteristics**.

(2) When reference voltage (+) = AV_{REFP}/ANI0 (ADREFP1 = 0, ADREFP0 = 1), reference voltage (-) = AV_{REFM}/ANI1 (ADREFM = 1), target pin : ANI16 to ANI26

(T_A = -40 to +85°C, 1.6 V ≤ EV_{DD0} = EV_{DD1} ≤ V_{DD} ≤ 5.5 V, 1.6 V ≤ AV_{REFP} ≤ V_{DD} ≤ 5.5 V, V_{SS} = EV_{SS0} = EV_{SS1} = 0 V, Reference voltage (+) = AV_{REFP}, Reference voltage (-) = AV_{REFM} = 0 V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Resolution	RES		8		10	bit
Overall error ^{Note 1}	AINL	10-bit resolution EV _{DD0} = AV _{REFP} = V _{DD} ^{Notes 3, 4}	1.8 V ≤ AV _{REFP} ≤ 5.5 V		±5.0	LSB
			1.6 V ≤ AV _{REFP} ≤ 5.5 V ^{Note 5}	1.2	±8.5	LSB
Conversion time	t _{CONV}	10-bit resolution Target ANI pin : ANI16 to ANI26	3.6 V ≤ V _{DD} ≤ 5.5 V	2.125	39	μs
			2.7 V ≤ V _{DD} ≤ 5.5 V	3.1875	39	μs
			1.8 V ≤ V _{DD} ≤ 5.5 V	17	39	μs
			1.6 V ≤ V _{DD} ≤ 5.5 V	57	95	μs
Zero-scale error ^{Notes 1, 2}	E _{ZS}	10-bit resolution EV _{DD0} = AV _{REFP} = V _{DD} ^{Notes 3, 4}	1.8 V ≤ AV _{REFP} ≤ 5.5 V		±0.35	%FSR
			1.6 V ≤ AV _{REFP} ≤ 5.5 V ^{Note 5}		±0.60	%FSR
Full-scale error ^{Notes 1, 2}	E _{FS}	10-bit resolution EV _{DD0} = AV _{REFP} = V _{DD} ^{Notes 3, 4}	1.8 V ≤ AV _{REFP} ≤ 5.5 V		±0.35	%FSR
			1.6 V ≤ AV _{REFP} ≤ 5.5 V ^{Note 5}		±0.60	%FSR
Integral linearity error ^{Note 1}	ILE	10-bit resolution EV _{DD0} = AV _{REFP} = V _{DD} ^{Notes 3, 4}	1.8 V ≤ AV _{REFP} ≤ 5.5 V		±3.5	LSB
			1.6 V ≤ AV _{REFP} ≤ 5.5 V ^{Note 5}		±6.0	LSB
Differential linearity error ^{Note 1}	DLE	10-bit resolution EV _{DD0} = AV _{REFP} = V _{DD} ^{Notes 3, 4}	1.8 V ≤ AV _{REFP} ≤ 5.5 V		±2.0	LSB
			1.6 V ≤ AV _{REFP} ≤ 5.5 V ^{Note 5}		±2.5	LSB
Analog input voltage	V _{AIN}	ANI16 to ANI26	0		AV _{REFP} and EV _{DD0}	V

Notes 1. Excludes quantization error (±1/2 LSB).

2. This value is indicated as a ratio (%FSR) to the full-scale value.

3. When AV_{REFP} < V_{DD}, the MAX. values are as follows.

Overall error: Add ±1.0 LSB to the MAX. value when AV_{REFP} = V_{DD}.

Zero-scale error/Full-scale error: Add ±0.05%FSR to the MAX. value when AV_{REFP} = V_{DD}.

Integral linearity error/ Differential linearity error: Add ±0.5 LSB to the MAX. value when AV_{REFP} = V_{DD}.

4. When AV_{REFP} < EV_{DD0} ≤ V_{DD}, the MAX. values are as follows.

Overall error: Add ±4.0 LSB to the MAX. value when AV_{REFP} = V_{DD}.

Zero-scale error/Full-scale error: Add ±0.20%FSR to the MAX. value when AV_{REFP} = V_{DD}.

Integral linearity error/ Differential linearity error: Add ±2.0 LSB to the MAX. value when AV_{REFP} = V_{DD}.

5. When the conversion time is set to 57 μs (min.) and 95 μs (max.).

2.6.2 Temperature sensor/internal reference voltage characteristics

(T_A = -40 to $+85^\circ\text{C}$, $2.4\text{ V} \leq V_{DD} \leq 5.5\text{ V}$, $V_{SS} = 0\text{ V}$, HS (high-speed main) mode)

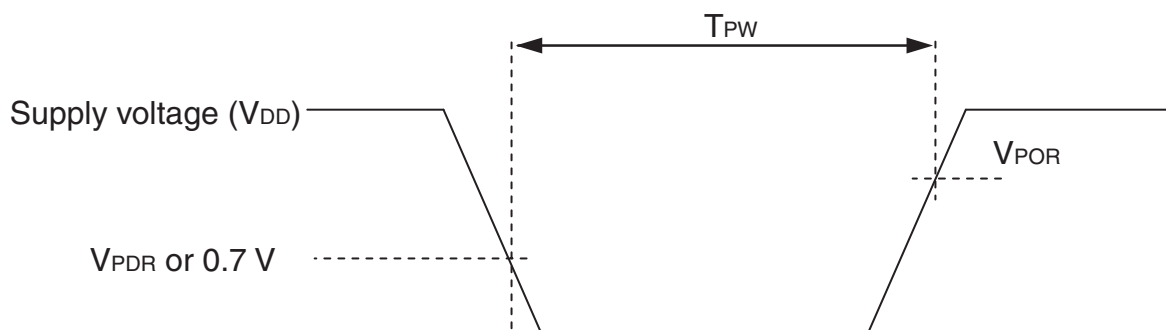
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Temperature sensor output voltage	V_{TMPS25}	Setting ADS register = 80H, $T_A = +25^\circ\text{C}$		1.05		V
Internal reference voltage	V_{BGR}	Setting ADS register = 81H	1.38	1.45	1.5	V
Temperature coefficient	F_{VTMPS}	Temperature sensor that depends on the temperature		-3.6		mV/ $^\circ\text{C}$
Operation stabilization wait time	t_{AMP}		5			μs

2.6.3 POR circuit characteristics

(T_A = -40 to $+85^\circ\text{C}$, $V_{SS} = 0\text{ V}$)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Detection voltage	V_{POR}	Power supply rise time	1.47	1.51	1.55	V
	V_{PDR}	Power supply fall time	1.46	1.50	1.54	V
Minimum pulse width ^{Note}	T_{PW}		300			μs

Note Minimum time required for a POR reset when V_{DD} exceeds below V_{PDR} . This is also the minimum time required for a POR reset from when V_{DD} exceeds below 0.7 V to when V_{DD} exceeds V_{POR} while STOP mode is entered or the main system clock is stopped through setting bit 0 (HIOSSTOP) and bit 7 (MSTOP) in the clock operation status control register (CSC).



Remark The electrical characteristics of the products G: Industrial applications ($T_A = -40$ to $+105^\circ\text{C}$) are different from those of the products “A: Consumer applications, and D: Industrial applications”. For details, refer to 3.1 to 3.10.

3.1 Absolute Maximum Ratings

Absolute Maximum Ratings ($T_A = 25^\circ\text{C}$) (1/2)

Parameter	Symbols	Conditions	Ratings	Unit
Supply voltage	V_{DD}		-0.5 to $+6.5$	V
	EV_{DD0} , EV_{DD1}	$EV_{DD0} = EV_{DD1}$	-0.5 to $+6.5$	V
	EV_{SS0} , EV_{SS1}	$EV_{SS0} = EV_{SS1}$	-0.5 to $+0.3$	V
REGC pin input voltage	V_{IREGC}	REGC	-0.3 to $+2.8$ and -0.3 to $V_{DD} + 0.3$ ^{Note 1}	V
Input voltage	V_{I1}	P00 to P07, P10 to P17, P30 to P37, P40 to P47, P50 to P57, P64 to P67, P70 to P77, P80 to P87, P90 to P97, P100 to P106, P110 to P117, P120, P125 to P127, P140 to P147	-0.3 to $EV_{DD0} + 0.3$ and -0.3 to $V_{DD} + 0.3$ ^{Note 2}	V
	V_{I2}	P60 to P63 (N-ch open-drain)	-0.3 to $+6.5$	V
	V_{I3}	P20 to P27, P121 to P124, P137, P150 to P156, EXCLK, EXCLKS, RESET	-0.3 to $V_{DD} + 0.3$ ^{Note 2}	V
Output voltage	V_{O1}	P00 to P07, P10 to P17, P30 to P37, P40 to P47, P50 to P57, P60 to P67, P70 to P77, P80 to P87, P90 to P97, P100 to P106, P110 to P117, P120, P125 to P127, P130, P140 to P147	-0.3 to $EV_{DD0} + 0.3$ and -0.3 to $V_{DD} + 0.3$ ^{Note 2}	V
	V_{O2}	P20 to P27, P150 to P156	-0.3 to $V_{DD} + 0.3$ ^{Note 2}	V
Analog input voltage	V_{AI1}	ANI16 to ANI26	-0.3 to $EV_{DD0} + 0.3$ and -0.3 to $AV_{REF(+)} + 0.3$ ^{Notes 2, 3}	V
	V_{AI2}	ANI0 to ANI14	-0.3 to $V_{DD} + 0.3$ and -0.3 to $AV_{REF(+)} + 0.3$ ^{Notes 2, 3}	V

Notes 1. Connect the REGC pin to V_{SS} via a capacitor (0.47 to 1 μF). This value regulates the absolute maximum rating of the REGC pin. Do not use this pin with voltage applied to it.

2. Must be 6.5 V or lower.

3. Do not exceed $AV_{REF(+)} + 0.3$ V in case of A/D conversion target pin.

Caution Product quality may suffer if the absolute maximum rating is exceeded even momentarily for any parameter. That is, the absolute maximum ratings are rated values at which the product is on the verge of suffering physical damage, and therefore the product must be used under conditions that ensure that the absolute maximum ratings are not exceeded.

Remarks 1. Unless specified otherwise, the characteristics of alternate-function pins are the same as those of the port pins.

2. $AV_{REF}(+)$: + side reference voltage of the A/D converter.

3. V_{SS} : Reference voltage

Absolute Maximum Ratings ($T_A = 25^{\circ}\text{C}$) (2/2)

Parameter	Symbols	Conditions		Ratings	Unit
Output current, high	I _{OH1}	Per pin	P00 to P07, P10 to P17, P30 to P37, P40 to P47, P50 to P57, P64 to P67, P70 to P77, P80 to P87, P90 to P97, P100 to P106, P110 to P117, P120, P125 to P127, P130, P140 to P147	−40	mA
		Total of all pins −170 mA	P00 to P04, P07, P32 to P37, P40 to P47, P102 to P106, P120, P125 to P127, P130, P140 to P145	−70	mA
			P05, P06, P10 to P17, P30, P31, P50 to P57, P64 to P67, P70 to P77, P80 to P87, P90 to P97, P100, P101, P110 to P117, P146, P147	−100	mA
	I _{OH2}	Per pin	P20 to P27, P150 to P156	−0.5	mA
		Total of all pins		−2	mA
	Output current, low	I _{OL1}	Per pin	P00 to P07, P10 to P17, P30 to P37, P40 to P47, P50 to P57, P60 to P67, P70 to P77, P80 to P87, P90 to P97, P100 to P106, P110 to P117, P120, P125 to P127, P130, P140 to P147	40
Total of all pins 170 mA			P00 to P04, P07, P32 to P37, P40 to P47, P102 to P106, P120, P125 to P127, P130, P140 to P145	70	mA
			P05, P06, P10 to P17, P30, P31, P50 to P57, P60 to P67, P70 to P77, P80 to P87, P90 to P97, P100, P101, P110 to P117, P146, P147	100	mA
I _{OL2}		Per pin	P20 to P27, P150 to P156	1	mA
		Total of all pins		5	mA
Operating ambient temperature		T _A	In normal operation mode		−40 to +105
	In flash memory programming mode				
Storage temperature	T _{stg}			−65 to +150	°C

Caution Product quality may suffer if the absolute maximum rating is exceeded even momentarily for any parameter. That is, the absolute maximum ratings are rated values at which the product is on the verge of suffering physical damage, and therefore the product must be used under conditions that ensure that the absolute maximum ratings are not exceeded.

Remark Unless specified otherwise, the characteristics of alternate-function pins are the same as those of the port pins.

($T_A = -40$ to $+105^\circ\text{C}$, $2.4\text{ V} \leq \text{EV}_{\text{DD0}} = \text{EV}_{\text{DD1}} \leq \text{V}_{\text{DD}} \leq 5.5\text{ V}$, $\text{V}_{\text{SS}} = \text{EV}_{\text{SS0}} = \text{EV}_{\text{SS1}} = 0\text{ V}$) (5/5)

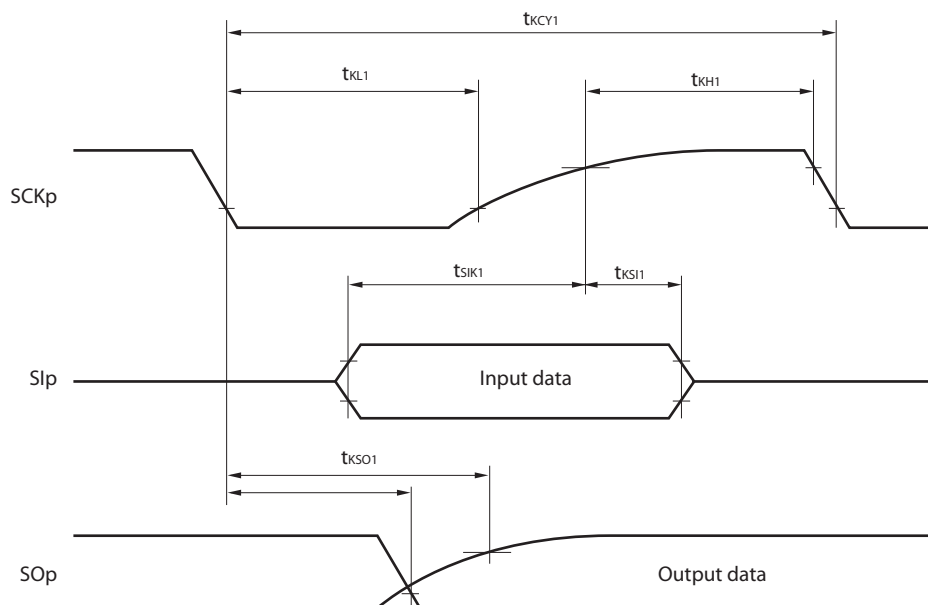
Items	Symbol	Conditions	MIN.	TYP.	MAX.	Unit		
Input leakage current, high	I _{LH1}	P00 to P07, P10 to P17, P30 to P37, P40 to P47, P50 to P57, P60 to P67, P70 to P77, P80 to P87, P90 to P97, P100 to P106, P110 to P117, P120, P125 to P127, P140 to P147	V _I = EV _{DD0}		1	μA		
	I _{LH2}	P20 to P27, P137, P150 to P156, RESET	V _I = V _{DD}		1	μA		
	I _{LH3}	P121 to P124 (X1, X2, XT1, XT2, EXCLK, EXCLKS)	V _I = V _{DD}	In input port or external clock input	1	μA		
				In resonator connection	10	μA		
Input leakage current, low	I _{LIL1}	P00 to P07, P10 to P17, P30 to P37, P40 to P47, P50 to P57, P60 to P67, P70 to P77, P80 to P87, P90 to P97, P100 to P106, P110 to P117, P120, P125 to P127, P140 to P147	V _I = EV _{SS0}		−1	μA		
	I _{LIL2}	P20 to P27, P137, P150 to P156, RESET	V _I = V _{SS}		−1	μA		
	I _{LIL3}	P121 to P124 (X1, X2, XT1, XT2, EXCLK, EXCLKS)	V _I = V _{SS}	In input port or external clock input	−1	μA		
				In resonator connection	−10	μA		
On-chip pll-up resistance	R _U	P00 to P07, P10 to P17, P30 to P37, P40 to P47, P50 to P57, P64 to P67, P70 to P77, P80 to P87, P90 to P97, P100 to P106, P110 to P117, P120, P125 to P127, P140 to P147	V _I = EV _{SS0} , In input port		10	20	100	kΩ

Remark Unless specified otherwise, the characteristics of alternate-function pins are the same as those of the port pins.

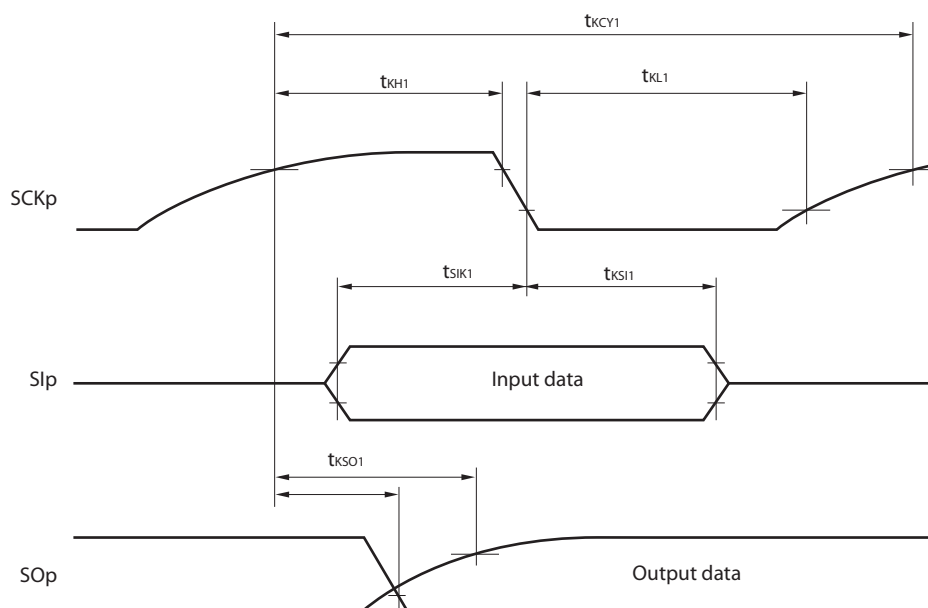
- Notes**
1. Total current flowing into V_{DD} and EV_{DD0} , including the input leakage current flowing when the level of the input pin is fixed to V_{DD} , EV_{DD0} or V_{SS} , EV_{SS0} . The values below the MAX. column include the peripheral operation current. However, not including the current flowing into the A/D converter, LVD circuit, I/O port, and on-chip pull-up/pull-down resistors and the current flowing during data flash rewrite.
 2. When high-speed on-chip oscillator and subsystem clock are stopped.
 3. When high-speed system clock and subsystem clock are stopped.
 4. When high-speed on-chip oscillator and high-speed system clock are stopped. When $AMPHS1 = 1$ (Ultra-low power consumption oscillation). However, not including the current flowing into the RTC, 12-bit interval timer, and watchdog timer.
 5. Relationship between operation voltage width, operation frequency of CPU and operation mode is as below.
 HS (high-speed main) mode: $2.7\text{ V} \leq V_{DD} \leq 5.5\text{ V}$ @ 1 MHz to 32 MHz
 $2.4\text{ V} \leq V_{DD} \leq 5.5\text{ V}$ @ 1 MHz to 16 MHz

- Remarks**
1. f_{MX} : High-speed system clock frequency (X1 clock oscillation frequency or external main system clock frequency)
 2. f_{IH} : High-speed on-chip oscillator clock frequency
 3. f_{SUB} : Subsystem clock frequency (XT1 clock oscillation frequency)
 4. Except subsystem clock operation, temperature condition of the TYP. value is $T_A = 25^{\circ}\text{C}$

CSI mode serial transfer timing (master mode) (during communication at different potential)
(When DAPmn = 0 and CKPmn = 0, or DAPmn = 1 and CKPmn = 1.)



CSI mode serial transfer timing (master mode) (during communication at different potential)
(When DAPmn = 0 and CKPmn = 1, or DAPmn = 1 and CKPmn = 0.)



- Remarks**
1. p: CSI number (p = 00, 01, 10, 20, 30, 31), m: Unit number (m = 00, 01, 02, 10, 12, 13), n: Channel number (n = 0, 2), g: PIM and POM number (g = 0, 1, 4, 5, 8, 14)
 2. CSI01 of 48-, 52-, 64-pin products, and CSI11 and CSI21 cannot communicate at different potential. Use other CSI for communication at different potential.

(2) When reference voltage (+) = $AV_{REFP}/ANI0$ ($ADREFP1 = 0$, $ADREFP0 = 1$), reference voltage (–) = $AV_{REFM}/ANI1$ ($ADREFM = 1$), target pin : ANI16 to ANI26

($T_A = -40$ to $+105^\circ\text{C}$, $2.4\text{ V} \leq EV_{DD0} = EV_{DD1} \leq V_{DD} \leq 5.5\text{ V}$, $2.4\text{ V} \leq AV_{REFP} \leq V_{DD} \leq 5.5\text{ V}$, $V_{SS} = EV_{SS0} = EV_{SS1} = 0\text{ V}$, Reference voltage (+) = AV_{REFP} , Reference voltage (–) = $AV_{REFM} = 0\text{ V}$)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Resolution	RES		8		10	bit
Overall error ^{Note 1}	AINL	10-bit resolution $EV_{DD0} \leq AV_{REFP} = V_{DD}$ Notes 3, 4	$2.4\text{ V} \leq AV_{REFP} \leq 5.5\text{ V}$	1.2	± 5.0	LSB
Conversion time	t_{CONV}	10-bit resolution Target pin : ANI16 to ANI26	$3.6\text{ V} \leq V_{DD} \leq 5.5\text{ V}$	2.125	39	μs
			$2.7\text{ V} \leq V_{DD} \leq 5.5\text{ V}$	3.1875	39	μs
			$2.4\text{ V} \leq V_{DD} \leq 5.5\text{ V}$	17	39	μs
Zero-scale error ^{Notes 1, 2}	E _{ZS}	10-bit resolution $EV_{DD0} \leq AV_{REFP} = V_{DD}$ Notes 3, 4	$2.4\text{ V} \leq AV_{REFP} \leq 5.5\text{ V}$		± 0.35	%FSR
Full-scale error ^{Notes 1, 2}	E _{FS}	10-bit resolution $EV_{DD0} \leq AV_{REFP} = V_{DD}$ Notes 3, 4	$2.4\text{ V} \leq AV_{REFP} \leq 5.5\text{ V}$		± 0.35	%FSR
Integral linearity error ^{Note 1}	ILE	10-bit resolution $EV_{DD0} \leq AV_{REFP} = V_{DD}$ Notes 3, 4	$2.4\text{ V} \leq AV_{REFP} \leq 5.5\text{ V}$		± 3.5	LSB
Differential linearity error ^{Note 1}	DLE	10-bit resolution $EV_{DD0} \leq AV_{REFP} = V_{DD}$ Notes 3, 4	$2.4\text{ V} \leq AV_{REFP} \leq 5.5\text{ V}$		± 2.0	LSB
Analog input voltage	V _{AIN}	ANI16 to ANI26	0		AV_{REFP} and EV_{DD0}	V

Notes 1. Excludes quantization error ($\pm 1/2$ LSB).

2. This value is indicated as a ratio (%FSR) to the full-scale value.

3. When $AV_{REFP} < V_{DD}$, the MAX. values are as follows.

Overall error: Add ± 1.0 LSB to the MAX. value when $AV_{REFP} = V_{DD}$.

Zero-scale error/Full-scale error: Add $\pm 0.05\%$ FSR to the MAX. value when $AV_{REFP} = V_{DD}$.

Integral linearity error/ Differential linearity error: Add ± 0.5 LSB to the MAX. value when $AV_{REFP} = V_{DD}$.

4. When $AV_{REFP} < EV_{DD0} \leq V_{DD}$, the MAX. values are as follows.

Overall error: Add ± 4.0 LSB to the MAX. value when $AV_{REFP} = V_{DD}$.

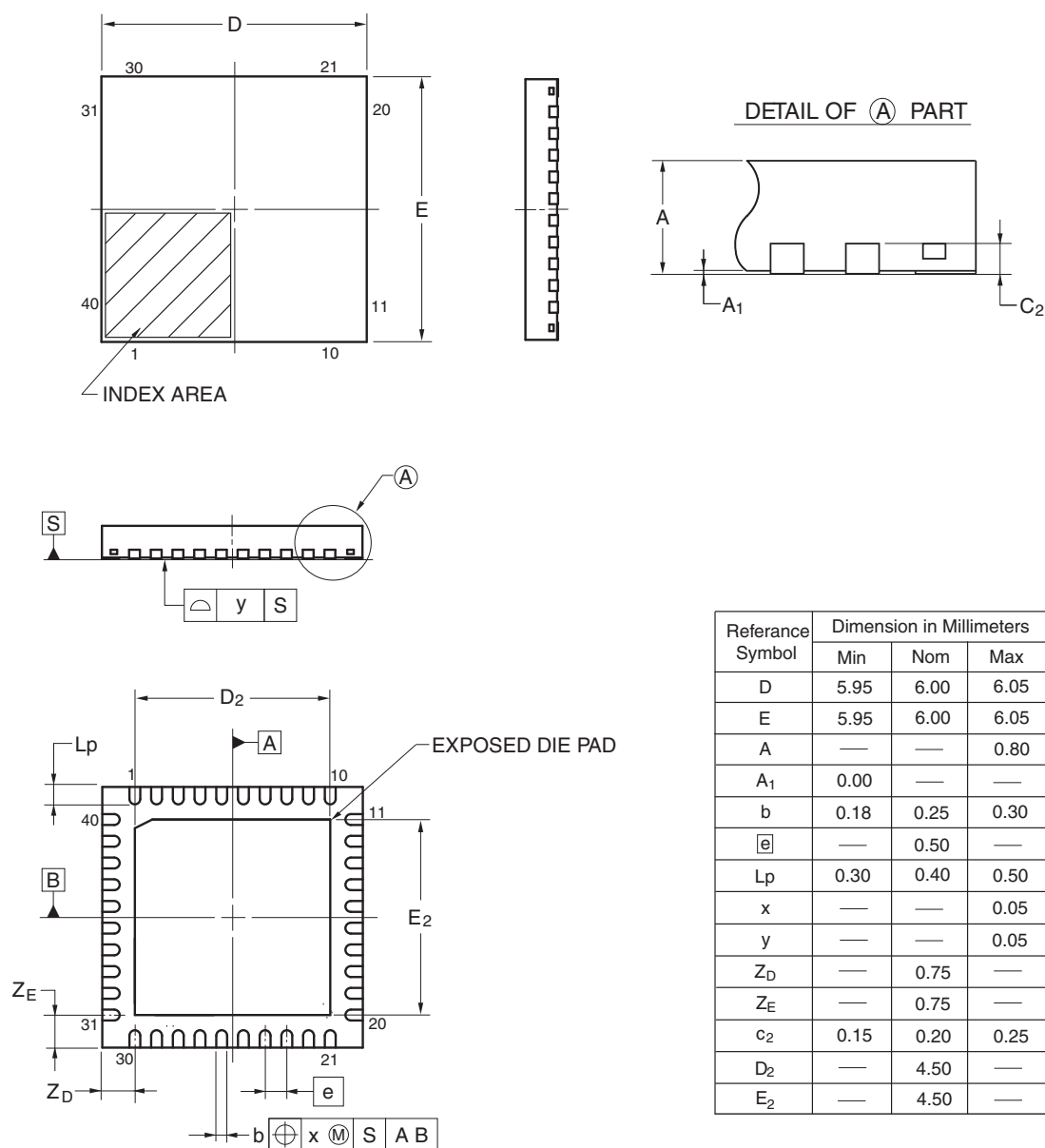
Zero-scale error/Full-scale error: Add $\pm 0.20\%$ FSR to the MAX. value when $AV_{REFP} = V_{DD}$.

Integral linearity error/ Differential linearity error: Add ± 2.0 LSB to the MAX. value when $AV_{REFP} = V_{DD}$.

4.7 40-pin Products

R5F100EAANA, R5F100ECANA, R5F100EDANA, R5F100EEANA, R5F100EFANA, R5F100EGANA, R5F100EHANA
 R5F101EAANA, R5F101ECANA, R5F101EDANA, R5F101EEANA, R5F101EFANA, R5F101EGANA, R5F101EHANA
 R5F100EADNA, R5F100ECDNA, R5F100EDDNA, R5F100EEDNA, R5F100EFDNA, R5F100EGDNA,
 R5F100EHDNA
 R5F101EADNA, R5F101ECDNA, R5F101EDDNA, R5F101EEDNA, R5F101EFDNA, R5F101EGDNA,
 R5F101EHDNA
 R5F100EAGNA, R5F100ECGNA, R5F100EDGNA, R5F100EEGNA, R5F100EFGNA, R5F100EGGNA,
 R5F100EHGNA

JEITA Package code	RENESAS code	Previous code	MASS (TYP.) [g]
P-HWQFN40-6x6-0.50	PWQN0040KC-A	P40K8-50-4B4-5	0.09

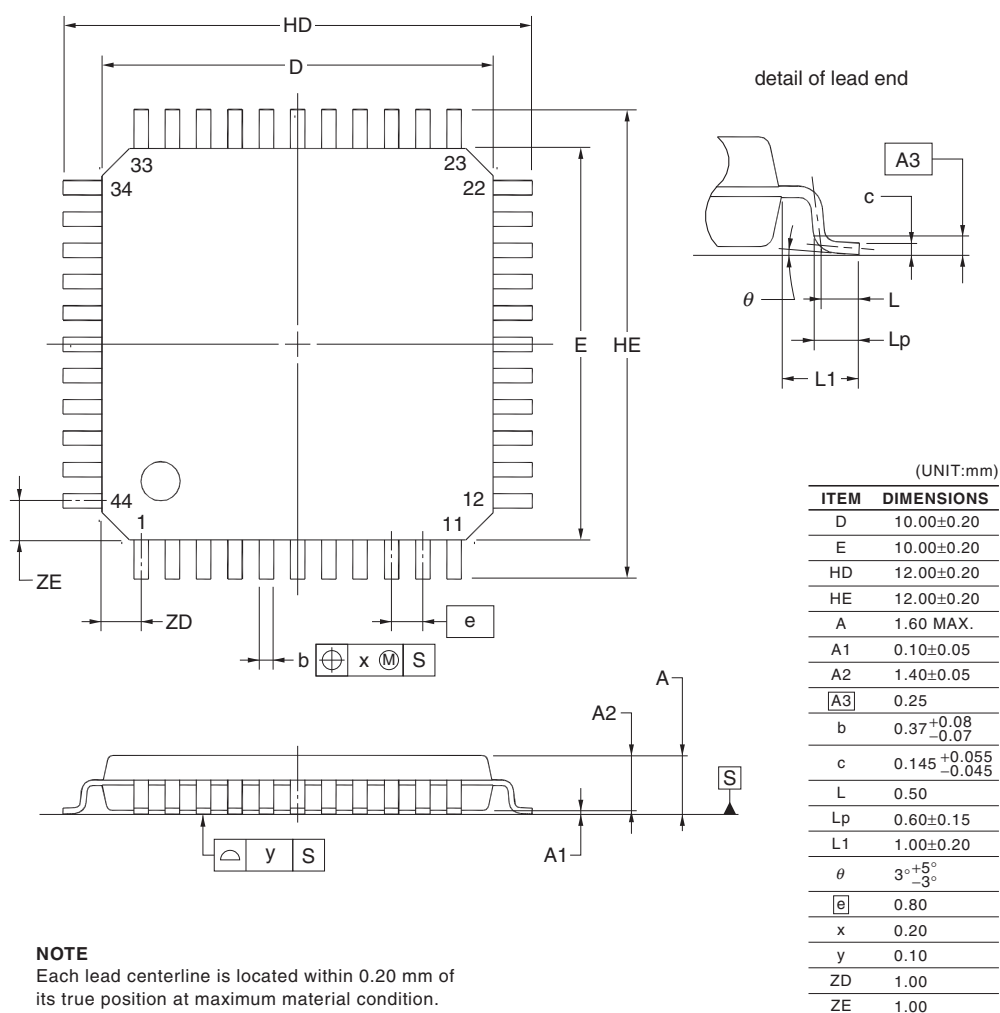


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4.8 44-pin Products

R5F100FAAFP, R5F100FCAFP, R5F100FDAFP, R5F100FEAFP, R5F100FFAFP, R5F100FGAFP,
 R5F100FHAFP, R5F100FJAFP, R5F100FKAFP, R5F100FLAFP
 R5F101FAAFP, R5F101FCAFP, R5F101FDAFP, R5F101FEAFP, R5F101FFAFP, R5F101FGAFP,
 R5F101FHAFP, R5F101FJAFP, R5F101FKAFP, R5F101FLAFP
 R5F100FADFP, R5F100FCDFP, R5F100FDDFP, R5F100FEDFP, R5F100FFDFP, R5F100FGDFP,
 R5F100FHDFP, R5F100FJDFP, R5F100FKDFP, R5F100FLDFP
 R5F101FADFP, R5F101FCDFP, R5F101FDDFP, R5F101FEDFP, R5F101FFDFP, R5F101FGDFP,
 R5F101FHDFP, R5F101FJDFP, R5F101FKDFP, R5F101FLDFP
 R5F100FAGFP, R5F100FCGFP, R5F100FDGFP, R5F100FEGFP, R5F100FFGFP, R5F100FGGFP,
 R5F100FHGFP, R5F100FJGFP

JEITA Package Code	RENESAS Code	Previous Code	MASS (TYP.) [g]
P-LQFP44-10x10-0.80	PLQP0044GC-A	P44GB-80-UES-2	0.36



R5F100PFAFA, R5F100PGAFA, R5F100PHAFA, R5F100PJFAFA, R5F100PKAFA, R5F100PLAFA
 R5F101PFAFA, R5F101PGAFA, R5F101PHAFA, R5F101PJFAFA, R5F101PKAFA, R5F101PLAFA
 R5F100PFDFA, R5F100PGDFA, R5F100PHDFA, R5F100PJDFA, R5F100PKDFA, R5F100PLDFA
 R5F101PFDFA, R5F101PGDFA, R5F101PHDFA, R5F101PJDFA, R5F101PKDFA, R5F101PLDFA
 R5F100PFGFA, R5F100PGGFA, R5F100PHGFA, R5F100PJGFA

JEITA Package Code	RENESAS Code	Previous Code	MASS (TYP.) [g]
P-LQFP100-14x20-0.65	PLQP0100JC-A	P100GF-65-GBN-1	0.92

