EPSON

Micro MINI S1C60N05

4-bit Single Chip Microcomputer

Low Voltage Operation Products

- S1C6200B Core CPU
- Low Voltage and Low Power
- Built-in LCD Driver
- Built-in A/D Converter (2ch.)

■ INTRODUCTION

Each member of the S1C60N05 Series of single chip microcomputers feature a 4-bit S1C6200B core CPU, 1,536 words of ROM (12 bits per word), 80 words of RAM (4 bits per word), an LCD driver, 4 bits for input ports (K00–K03), 4 bits for output ports (R00–R03), one 4-bit I/O port (P00–P03), clock timer and A/D converter. Because of their low voltage operation and low power consumption, the S1C60N05 Series are ideal for a wide range of applications.

■ CONFIGURATION

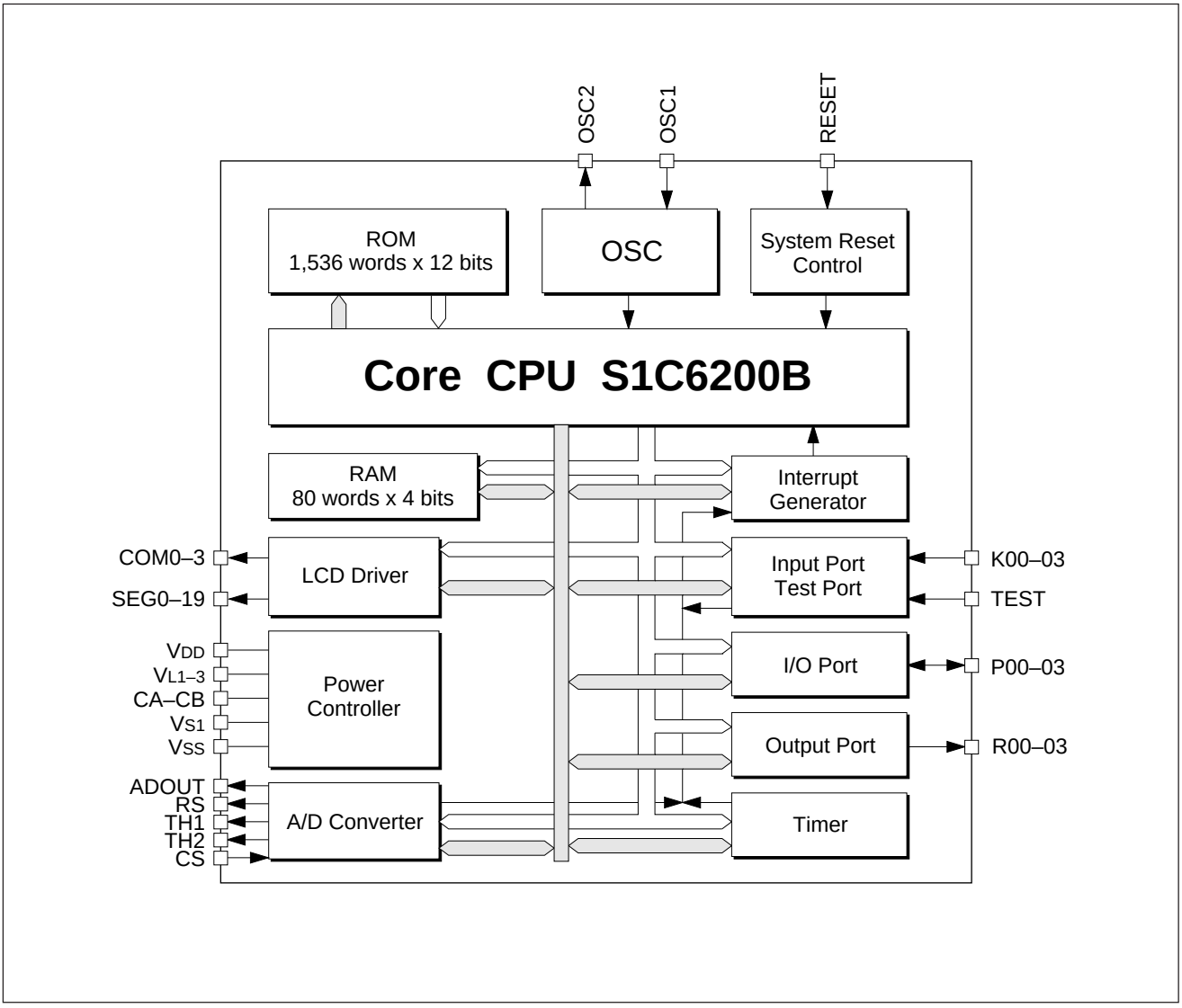
The S1C60N05 Series are configured as follows, depending on the supply voltage.

Model	Supply voltage	Oscillation circuits
S1C60N05	1.8–3.5 V	Crystal or CR
S1C60L05	1.2–2.0 V	Crystal or CR

■ FEATURES

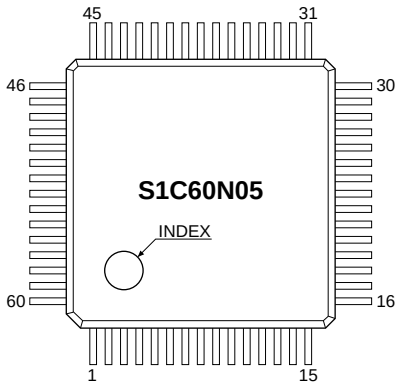
- Core CPU S1C6200B
- Built-in oscillation circuit ..... Crystal or CR oscillation circuit, 32,768 Hz (typ.)
- nstruction set ..... 100 instructions
- ROM capacity ..... 1,536 words × 12 bits
- RAM capacity (data RAM) ..... 80 words × 4 bits
- Input port ..... 4 bits (Supplementary pull-down resistors may be used)
- Output port ..... 4 bits (Piezo buzzer and programmable frequency output can be driven directry by mask option)
- Input/output port ..... 4 bits
- LCD driver ..... 20 segments × 4 common duty (or 3 and 2 common duty)
- Timer ..... Clock timer
- A/D converter ..... CR oscillation type A/D converter built-in (2 channels)
- Interrupts:
  - External interrupt ..... Input port interrupt 1 system
  - Internal interrupt ..... Timer interrupt 1 system
  - A/D converter interrupt 1 system
- Supply voltage ..... 1.5 V (1.2–2.0 V) S1C60L05 (During A/D conversion)
  3.0 V (1.8–3.5 V) S1C60N05
- Current consumption (typ.) ..... 0.8 µA (Crystal oscillation CLK = 32,768 Hz, when halted)
  1.5 µA (Crystal oscillation CLK = 32,768 Hz, when executing)
- Supply form ..... QFP6-60pin (plastic) or chip

■ BLOCK DIAGRAM



■ PIN CONFIGURATION

QFP6-60pin



Pin No.	Pin name	Pin No.	Pin name	Pin No.	Pin name	Pin No.	Pin name
1	N.C.	16	N.C.	31	TEST	46	V_{L3}
2	N.C.	17	ADOUT	32	RESET	47	V_{L2}
3	K00	18	SEG0	33	SEG12	48	V_{L1}
4	K01	19	SEG1	34	SEG13	49	CA
5	K02	20	SEG2	35	SEG14	50	CB
6	K03	21	SEG3	36	SEG15	51	V_{SS}
7	R00	22	SEG4	37	SEG16	52	V_{DD}
8	R01	23	SEG5	38	SEG17	53	OSC1
9	R02	24	SEG6	39	SEG18	54	OSC2
10	R03	25	SEG7	40	SEG19	55	V_{S1}
11	RS	26	SEG8	41	COM0	56	P00
12	TH1	27	SEG9	42	COM1	57	P01
13	TH2	28	SEG10	43	COM2	58	P02
14	CS	29	SEG11	44	COM3	59	P03
15	N.C.	30	N.C.	45	N.C.	60	N.C.

N.C. : No Connection

■ PIN DESCRIPTION

Pin name	Pin No.	In/Out	Function
V_{DD}	52	(I)	Power source (+) terminal
V_{SS}	51	(I)	Power source (-) terminal
V_{S1}	55	O	Oscillation and internal logic system regulated voltage output terminal
V_{L1}	48	O	LCD system regulated voltage output terminal
V_{L2}	47	O	LCD system booster output terminal
V_{L3}	46	O	LCD system booster output terminal
CA, CB	49, 50	–	Booster capacitor connecting terminal
OSC1	53	I	Crystal or CR oscillation input terminal
OSC2	54	O	Crystal or CR oscillation output terminal
K00–K03	3–6	I	Input terminal
P00–P03	56–59	I/O	I/O terminal
R00–R03	7–10	O	Output terminal
SEG0–19	18–29 33–40	O	LCD segment output terminal (convertible to DC output terminal by mask option)
COM0–3	41–44	O	LCD common output terminal
CS	14	I	A/D converter CR oscillation input terminal
RS	11	O	A/D converter CR oscillation output terminal
TH1, TH2	12, 13	O	A/D converter CR oscillation output terminal
ADOUT	17	O	A/D converter oscillation frequency output terminal
RESET	32	I	Initial setting input terminal
TEST	31	I	Test input terminal

■ OPTION LIST

1. DEVICE TYPE AND LCD VOLTAGE

☐ 1. E0C6005 (Normal Type <S1C60N05>) LCD 3 V
☐ 2. E0C6005 (Normal Type <S1C60N05>) LCD 4.5 V
☐ 3. E0C60L05 (Low Power Type <S1C60L05>) LCD 3 V
☐ 4. E0C60L05 (Low Power Type <S1C60L05>) LCD 4.5 V

2. MULTIPLE KEY ENTRY RESET

• COMBINATION ..... ☐ 1. Not Use
☐ 2. Use K00, K01
☐ 3. Use K00, K01, K02
☐ 4. Use K00, K01, K02, K03

3. INTERRUPT NOISE REJECTOR

• K00–K03 ..... ☐ 1. Use ☐ 2. Not Use

4. INPUT PORT PULL DOWN RESISTOR

• K00 ..... ☐ 1. With Resistor ☐ 2. Gate Direct
• K01 ..... ☐ 1. With Resistor ☐ 2. Gate Direct
• K02 ..... ☐ 1. With Resistor ☐ 2. Gate Direct
• K03 ..... ☐ 1. With Resistor ☐ 2. Gate Direct

5. R00 SPECIFICATION

• OUTPUT TYPE ..... ☐ 1. DC Output
☐ 2. Buzzer Inverted Output (Control bit is R00)
☐ 3. Buzzer Inverted Output (Control bit is R01)
☐ 4. FOUT Output

• FOUT OUTPUT SPACIFICATION

F1 ..... ☐ 1. 256[Hz] F2 ..... ☐ 1. 1.512[Hz]
☐ 2. 512[Hz] ☐ 2. 1,024[Hz]
☐ 3. 1,024[Hz] ☐ 3. 2,048[Hz]
☐ 4. 2,048[Hz] ☐ 4. 4,096[Hz]
☐ 5. 4,096[Hz] ☐ 5. 8,192[Hz]

F3 ..... ☐ 1. 1,024[Hz] F4 ..... ☐ 1. 2,048[Hz]
☐ 2. 2,048[Hz] ☐ 2. 4,096[Hz]
☐ 3. 4,096[Hz] ☐ 3. 8,192[Hz]
☐ 4. 8,192[Hz] ☐ 4. 16,384[Hz]
☐ 5. 16,384[Hz] ☐ 5. 32,768[Hz]

• OUTPUT SPECIFICATION ..... ☐ 1. Complementary ☐ 2. Pch-OpenDrain

6. R01 SPECIFICATION
• OUTPUT TYPE ..... ☐ 1. DC Output ☐ 2. Buzzer Output
• OUTPUT SPECIFICATION ..... ☐ 1. Complementary ☐ 2. Pch-OpenDrain

7. OUTPUT SPECIFICATION (R02, R03)
• R02 ..... ☐ 1. Complementary ☐ 2. Pch-OpenDrain
• R03 ..... ☐ 1. Complementary ☐ 2. Pch-OpenDrain

8. I/O PORT SPECIFICATION
• P00 ..... ☐ 1. Complementary ☐ 2. Pch-OpenDrain
• P01 ..... ☐ 1. Complementary ☐ 2. Pch-OpenDrain
• P02 ..... ☐ 1. Complementary ☐ 2. Pch-OpenDrain
• P03 ..... ☐ 1. Complementary ☐ 2. Pch-OpenDrain

9. LCD COMMON DUTY AND BIAS
☐ 1. 1/4 Duty 1/3 Bias
☐ 2. 1/3 Duty 1/3 Bias
☐ 3. 1/2 Duty 1/3 Bias
☐ 4. 1/4 Duty 1/2 Bias
☐ 5. 1/3 Duty 1/2 Bias
☐ 6. 1/2 Duty 1/2 Bias

10.OSC1 SYSTEM CLOCK
☐ 1. Crystal
☐ 2. CR

■ ELECTRICAL CHARACTERISTICS

● Absolute Maximum Ratings

(V_{DD}=0V)

Rating	Symbol	Value	Unit
Power voltage	V_{SS}	-5.0 to 0.5	V
Input voltage (1)	V_I	V_{SS} - 0.3 to 0.5	V
Input voltage (2)	V_{IOSC}	V_{SS} - 0.3 to 0.5	V
Operating temperature	Topr	-20 to 70	°C
Storage temperature	Tstg	-65 to 150	°C
Soldering temperature / Time	Tsol	260°C, 10sec (lead section)	–
Allowable dissipation *1	P_D	250	mW

*1: In case of plastic package (QFP6-60pin).

● Recommended Operating Conditions

S1C60N05

(Ta=-20 to 70°C)

Condition	Symbol	Remark	Min.	Typ.	Max.	Unit
Power voltage	V_{SS}	V_{DD}=0V	-3.5	-3.0	-1.8	V
Oscillation frequency	f_{OSC1}	Crystal oscillation		32.768		kHz
	f_{OSC2}	CR oscillation, R=420kΩ		65	80	kHz
Booster capacitor	C_1		0.1			µF
Capacitor between V_{DD} and V_{S1}	C_2		0.1			µF

S1C60L05

(Ta=-20 to 70°C)

Condition	Symbol	Remark	Min.	Typ.	Max.	Unit
Power voltage	V_{SS}	V_{DD}=0V *1	-2.0	-1.5	-1.2	V
Oscillation frequency	f_{OSC1}	Crystal oscillation		32.768		kHz
	f_{OSC2}	CR oscillation, R=420kΩ		65	80	kHz
Booster capacitor	C_1		0.1			µF
Capacitor between V_{DD} and V_{S1}	C_2		0.1			µF

*1: When there is no software control during CR oscillation or crystal oscillation.

● DC Characteristics

S1C60N05

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-3.0V, f_{OSC}=32.768kHz, Ta=25°C, V_{S1}/V_{L1}–V_{L3} are internal voltage, C_1=C_2=0.1µF)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
High level input voltage (1)	V_{IH1}		K00–K03, P00–P03	0.2•V_{SS}		0	V
High level input voltage (2)	V_{IH2}		RESET, TEST	0.15•V_{SS}		0	V
Low level input voltage (1)	V_{IL1}		K00–K03, P00–P03	V_{SS}		0.8•V_{SS}	V
Low level input voltage (2)	V_{IL2}		RESET, TEST	V_{SS}		0.85•V_{SS}	V
High level input current (1)	I_{IH1}	V_{IH1}=0V, No pull down resistor	K00–K03, P00–P03	0		0.5	µA
High level input current (2)	I_{IH2}	V_{IH2}=0V, With pull down resistor	K00–K03	10		40	µA
High level input current (3)	I_{IH3}	V_{IH3}=0V, With pull down resistor	P00–P03 RESET, TEST	30		100	µA
Low level input current	I_{IL}	V_{IL}=V_{SS}	K00–K03, P00–P03 RESET, TEST	-0.5		0	µA
High level output current (1)	I_{OH1}	V_{OH1}=0.1•V_{SS}	R02, R03, P00–P03			-1.0	mA
High level output current (2)	I_{OH2}	V_{OH2}=0.1•V_{SS} (built-in protection resistance)	R00, R01			-1.0	mA
High level output current (3)	I_{OH3}	V_{OH3}=-1.0V	ADOUT			-1.0	mA
Low level output current (1)	I_{OL1}	V_{OL1}=0.9•V_{SS}	R02, R03, P00–P03	3.0			mA
Low level output current (2)	I_{OL2}	V_{OL2}=0.9•V_{SS} (built-in protection resistance)	R00, R01	3.0			mA
Low level output current (3)	I_{OL3}	V_{OL3}=-2.0V	ADOUT	3.0			mA
Common output current	I_{OH4}	V_{OH4}=-0.05V	COM0–COM3			-3	µA
	I_{OL4}	V_{OL4}=V_{L3}+0.05V		3			µA
Segment output current	I_{OH5}	V_{OH5}=-0.05V	SEG0–SEG19			-3	µA
(during LCD output)	I_{OL5}	V_{OL5}=V_{L3}+0.05V		3			µA
Segment output current	I_{OH6}	V_{OH6}=0.1•V_{SS}	SEG0–SEG19			-300	µA
(during DC output)	I_{OL6}	V_{OL6}=0.9•V_{SS}		300			µA

S1C60L05

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-1.5V, f_{OSC}=32.768kHz, Ta=25°C, V_{S1}/V_{L1}–V_{L3} are internal voltage, C_1=C_2=0.1µF)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
High level input voltage (1)	V_{IH1}		K00–K03, P00–P03	0.2•V_{SS}		0	V
High level input voltage (2)	V_{IH2}		RESET, TEST	0.15•V_{SS}		0	V
Low level input voltage (1)	V_{IL1}		K00–K03, P00–P03	V_{SS}		0.8•V_{SS}	V
Low level input voltage (2)	V_{IL2}		RESET, TEST	V_{SS}		0.85•V_{SS}	V
High level input current (1)	I_{IH1}	V_{IH1}=0V, No pull down resistor	K00–K03, P00–P03	0		0.5	µA
High level input current (2)	I_{IH2}	V_{IH2}=0V, With pull down resistor	K00–K03	5.0		20	µA
High level input current (3)	I_{IH3}	V_{IH3}=0V, With pull down resistor	P00–P03 RESET, TEST	9.0		100	µA
Low level input current	I_{IL}	V_{IL}=V_{SS}	K00–K03, P00–P03 RESET, TEST	-0.5		0	µA
High level output current (1)	I_{OH1}	V_{OH1}=0.1•V_{SS}	R02, R03, P00–P03			-200	µA
High level output current (2)	I_{OH2}	V_{OH2}=0.1•V_{SS} (built-in protection resistance)	R00, R01			-200	µA
High level output current (3)	I_{OH3}	V_{OH3}=-0.5V	ADOUT			-200	µA
Low level output current (1)	I_{OL1}	V_{OL1}=0.9•V_{SS}	R02, R03, P00–P03	700			µA
Low level output current (2)	I_{OL2}	V_{OL2}=0.9•V_{SS} (built-in protection resistance)	R00, R01	700			µA
Low level output current (3)	I_{OL3}	V_{OL3}=-1.0V	ADOUT	700			µA
Common output current	I_{OH4}	V_{OH4}=-0.05V	COM0–COM3			-3	µA
	I_{OL4}	V_{OL4}=V_{L3}+0.05V		3			µA
Segment output current	I_{OH5}	V_{OH5}=-0.05V	SEG0–SEG19			-3	µA
(during LCD output)	I_{OL5}	V_{OL5}=V_{L3}+0.05V		3			µA
Segment output current	I_{OH6}	V_{OH6}=0.1•V_{SS}	SEG0–SEG19			-100	µA
(during DC output)	I_{OL6}	V_{OL6}=0.9•V_{SS}		130			µA

● Analog Circuit Characteristics and Current Consumption

S1C60N05 (Normal Operating Mode)

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-3.0V, f_{OSC}=32.768kHz, Ta=25°C, C_G=25pF, V_{S1}/V_{L1}–V_{L3} are internal voltage, C_1=C_2=0.1µF
<During A/D conversion: R_S=49.8kΩ, TH=50kΩ, C_{AD}=2,200pF>)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
Internal voltage	V_{L1}	Connect 1MΩ load resistor between V_{DD} and V_{L1} (without panel load)		1/2•V_{L2} -0.1		1/2•V_{L2} ×0.9	V
	V_{L2}	Connect 1MΩ load resistor between V_{DD} and V_{L2} (without panel load)			V_{SS}		V
	V_{L3}	Connect 1MΩ load resistor between V_{DD} and V_{L3} (without panel load)		3/2•V_{L2} -0.1		3/2•V_{L2} ×0.9	V
Power current consumption	I_{OP}	During HALT	Without panel load		0.8	1.4	µA
		During execution			1.5	5.0	µA
		During A/D conversion (HALT)			30	40	µA

S1C60N05 (Heavy Load Protection Mode)

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-3.0V, f_{OSC}=32.768kHz, Ta=25°C, C_G=25pF, V_{S1}/V_{L1}–V_{L3} are internal voltage, C_1=C_2=0.1µF
<During A/D conversion: R_S=49.8kΩ, TH=50kΩ, C_{AD}=2,200pF>)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
Internal voltage	V_{L1}	Connect 1MΩ load resistor between V_{DD} and V_{L1} (without panel load)		1/2•V_{L2} -0.1		1/2•V_{L2} ×0.85	V
	V_{L2}	Connect 1MΩ load resistor between V_{DD} and V_{L2} (without panel load)			V_{SS}		V
	V_{L3}	Connect 1MΩ load resistor between V_{DD} and V_{L3} (without panel load)		3/2•V_{L2} -0.1		3/2•V_{L2} ×0.85	V
Power current consumption	I_{OP}	During HALT	Without panel load		2.0	5.5	µA
		During execution			5.5	10.0	µA
		During A/D conversion (HALT)			31	41.5	µA

S1C60L05 (Normal Operating Mode)

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-1.5V, f_{OSC}=32.768kHz, Ta=25°C, C_G=25pF, V_{S1}/V_{L1}–V_{L3} are internal voltage, C_1=C_2=0.1µF
<During A/D conversion: R_S=49.8kΩ, TH=50kΩ, C_{AD}=2,200pF>)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
Internal voltage	V_{L1}	Connect 1MΩ load resistor between V_{DD} and V_{L1} (without panel load)			V_{SS}		V
	V_{L2}	Connect 1MΩ load resistor between V_{DD} and V_{L2} (without panel load)		2•V_{L1} -0.1		2•V_{L1} ×0.9	V
	V_{L3}	Connect 1MΩ load resistor between V_{DD} and V_{L3} (without panel load)		3•V_{L1} -0.1		3•V_{L1} ×0.9	V
Power current consumption	I_{OP}	During HALT	Without panel load		0.8	1.4	µA
		During execution			1.5	5.0	µA
		During A/D conversion (HALT)			30	40	µA

S1C60L05 (Heavy Load Protection Mode)

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-1.5V, f_{OSC}=32.768kHz, Ta=25°C, C_G=25pF, V_{S1}/V_{L1}–V_{L3} are internal voltage, C_1=C_2=0.1µF
<During A/D conversion: R_S=49.8kΩ, TH=50kΩ, C_{AD}=2,200pF>)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
Internal voltage	V_{L1}	Connect 1MΩ load resistor between V_{DD} and V_{L1} (without panel load)			V_{SS}		V
	V_{L2}	Connect 1MΩ load resistor between V_{DD} and V_{L2} (without panel load)		2•V_{L1} -0.1		2•V_{L1} ×0.85	V
	V_{L3}	Connect 1MΩ load resistor between V_{DD} and V_{L3} (without panel load)		3•V_{L1} -0.1		3•V_{L1} ×0.85	V
Power current consumption	I_{OP}	During HALT	Without panel load		2.0	5.5	µA
		During execution			5.5	10.0	µA
		During A/D conversion (HALT)			31	41.5	µA

S1C60N05 (CR, Normal Operating Mode)

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-3.0V, f_{OSC}=65kHz, Ta=25°C, C_G=25pF, V_{S1}/V_{L1}–V_{L3} are internal voltage, C_1=C_2=0.1µF
Recommended external resistance for CR oscillation=420kΩ <During A/D conversion: R_S=49.8kΩ, TH=50kΩ, C_{AD}=2,200pF>)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
Internal voltage	V_{L1}	Connect 1MΩ load resistor between V_{DD} and V_{L1} (without panel load)		1/2•V_{L2} -0.1		1/2•V_{L2} ×0.9	V
	V_{L2}	Connect 1MΩ load resistor between V_{DD} and V_{L2} (without panel load)			V_{SS}		V
	V_{L3}	Connect 1MΩ load resistor between V_{DD} and V_{L3} (without panel load)		3/2•V_{L2} -0.1		3/2•V_{L2} ×0.9	V
Power current consumption	I_{OP}	During HALT	Without panel load		8.0	15.0	µA
		During execution			15.0	20.0	µA
		During A/D conversion (HALT)			37	52.5	µA

S1C60N05 (CR, Heavy Load Protection Mode)

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-3.0V, f_{OSC}=65kHz, Ta=25°C, C_G=25pF, V_{S1}/V_{L1}–V_{L3} are internal voltage, C_1=C_2=0.1µF
Recommended external resistance for CR oscillation=420kΩ <During A/D conversion: R_S=49.8kΩ, TH=50kΩ, C_{AD}=2,200pF>)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
Internal voltage	V_{L1}	Connect 1MΩ load resistor between V_{DD} and V_{L1} (without panel load)		1/2•V_{L2} -0.1		1/2•V_{L2} ×0.85	V
	V_{L2}	Connect 1MΩ load resistor between V_{DD} and V_{L2} (without panel load)			V_{SS}		V
	V_{L3}	Connect 1MΩ load resistor between V_{DD} and V_{L3} (without panel load)		3/2•V_{L2} -0.1		3/2•V_{L2} ×0.85	V
Power current consumption	I_{OP}	During HALT	Without panel load		16.0	30.0	µA
		During execution			30.0	40.0	µA
		During A/D conversion (HALT)			45	57.5	µA

S1C60L05 (CR, Normal Operating Mode)

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-1.5V, f_{OSC}=65kHz, Ta=25°C, C_G=25pF, V_{S1}/V_{L1}–V_{L3} are internal voltage, C_1=C_2=0.1µF
Recommended external resistance for CR oscillation=420kΩ <During A/D conversion: R_S=49.8kΩ, TH=50kΩ, C_{AD}=2,200pF>)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
Internal voltage	V_{L1}	Connect 1MΩ load resistor between V_{DD} and V_{L1} (without panel load)			V_{SS}		V
	V_{L2}	Connect 1MΩ load resistor between V_{DD} and V_{L2} (without panel load)		2•V_{L1} -0.1		2•V_{L1} ×0.9	V
	V_{L3}	Connect 1MΩ load resistor between V_{DD} and V_{L3} (without panel load)		3•V_{L1} -0.1		3•V_{L1} ×0.9	V
Power current consumption	I_{OP}	During HALT	Without panel load		8.0	15.0	µA
		During execution			15.0	20.0	µA
		During A/D conversion (HALT)			37	52.5	µA

S1C60L05 (CR, Heavy Load Protection Mode)

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-1.5V, f_{OSC}=65kHz, Ta=25°C, C_G=25pF, V_{S1}/V_{L1}–V_{L3} are internal voltage, C_1=C_2=0.1µF
Recommended external resistance for CR oscillation=420kΩ <During A/D conversion: R_S=49.8kΩ, TH=50kΩ, C_{AD}=2,200pF>)

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
Internal voltage	V_{L1}	Connect 1MΩ load resistor between V_{DD} and V_{L1} (without panel load)			V_{SS}		V
	V_{L2}	Connect 1MΩ load resistor between V_{DD} and V_{L2} (without panel load)		2•V_{L1} -0.1		2•V_{L1} ×0.85	V
	V_{L3}	Connect 1MΩ load resistor between V_{DD} and V_{L3} (without panel load)		3•V_{L1} -0.1		3•V_{L1} ×0.85	V
Power current consumption	I_{OP}	During HALT	Without panel load		16.0	30.0	µA
		During execution			30.0	40.0	µA
		During A/D conversion (HALT)			45	57.5	µA

● Oscillation Characteristics

Oscillation characteristics will vary according to different conditions (elements used, boad pattern). Use the following characteristics are as reference values.

S1C60N05

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-3.0V, Crystal: Q13MC146, C_G=25pF, C_D=built-in, Ta=25°C)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation start voltage	Vsta	tsta≤5sec (V_{SS})	-1.8			V
Oscillation stop voltage	Vstp	tstp≤10sec (V_{SS})	-1.8			V
Built-in capacitance (drain)	C_D	Including the parasitic capacity inside the IC		20		pF
Frequency/voltage deviation	∂f/∂V	V_{SS}=-1.8 to -3.5V			5	ppm
Frequency/IC deviation	∂f/∂IC		-10		10	ppm
Frequency adjustment range	∂f/∂C_G	C_G=5 to 25pF	40			ppm
Harmonic oscillation start voltage	V_{hho}	C_G=5pF (V_{SS})			-3.6	V
Allowable leak resistance	R_{leak}	Between OSC1 and V_{DD}, and between V_{SS} and OSC1	200			MΩ

S1C60L05

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-1.5V, Crystal: Q13MC146, C_G=25pF, C_D=built-in, Ta=25°C)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation start voltage	Vsta	tsta≤5sec (V_{SS})	-1.2			V
Oscillation stop voltage	Vstp	tstp≤10sec (V_{SS})	-1.2			V
Built-in capacitance (drain)	C_D	Including the parasitic capacity inside the IC		20		pF
Frequency/voltage deviation	∂f/∂V	V_{SS}=-1.2 to -2.0V (-0.9) *1			5	ppm
Frequency/IC deviation	∂f/∂IC		-10		10	ppm
Frequency adjustment range	∂f/∂C_G	C_G=5 to 25pF	40			ppm
Harmonic oscillation start voltage	V_{hho}	C_G=5pF (V_{SS})			-2.0	V
Allowable leak resistance	R_{leak}	Between OSC1 and V_{DD}, and between V_{SS} and OSC1	200			MΩ

*1: Items enclosed in parentheses ( ) are those used when operating at heavy load protection mode.

S1C60N05 (CR)

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-3.0V, R_{CR}=480kΩ, Ta=25°C)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation frequency dispersion	f_{OSC}		-20	65kHz	20	%
Oscillation start voltage	Vsta		-1.8			V
Oscillation start time	tsta	V_{SS}=-1.8 to -3.5V		3		mS
Oscillation stop voltage	Vstp		-1.8			V

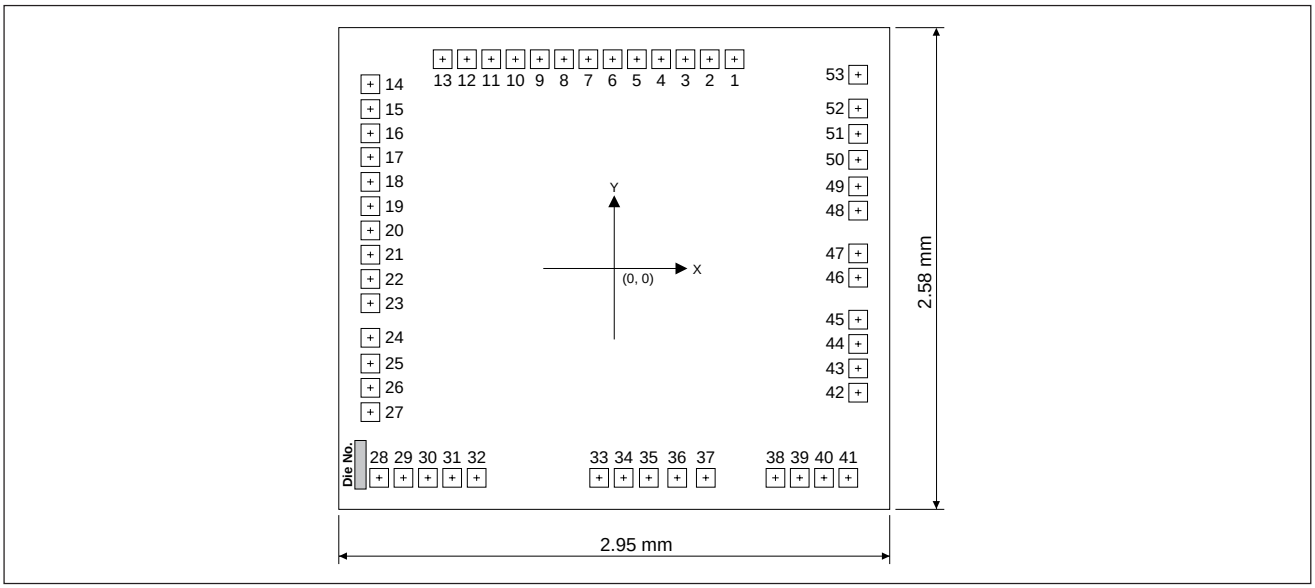
S1C60L05 (CR)

(Unless otherwise specified: V_{DD}=0V, V_{SS}=-1.5V, R_{CR}=480kΩ, Ta=25°C)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Oscillation frequency dispersion	f_{OSC}		-20	65kHz	20	%
Oscillation start voltage	Vsta		-1.2			V
Oscillation start time	tsta	V_{SS}=-1.2 to -2.0V		3		mS
Oscillation stop voltage	Vstp		-1.2			V

■ PAD LAYOUT

● Diagram of Pad Layout



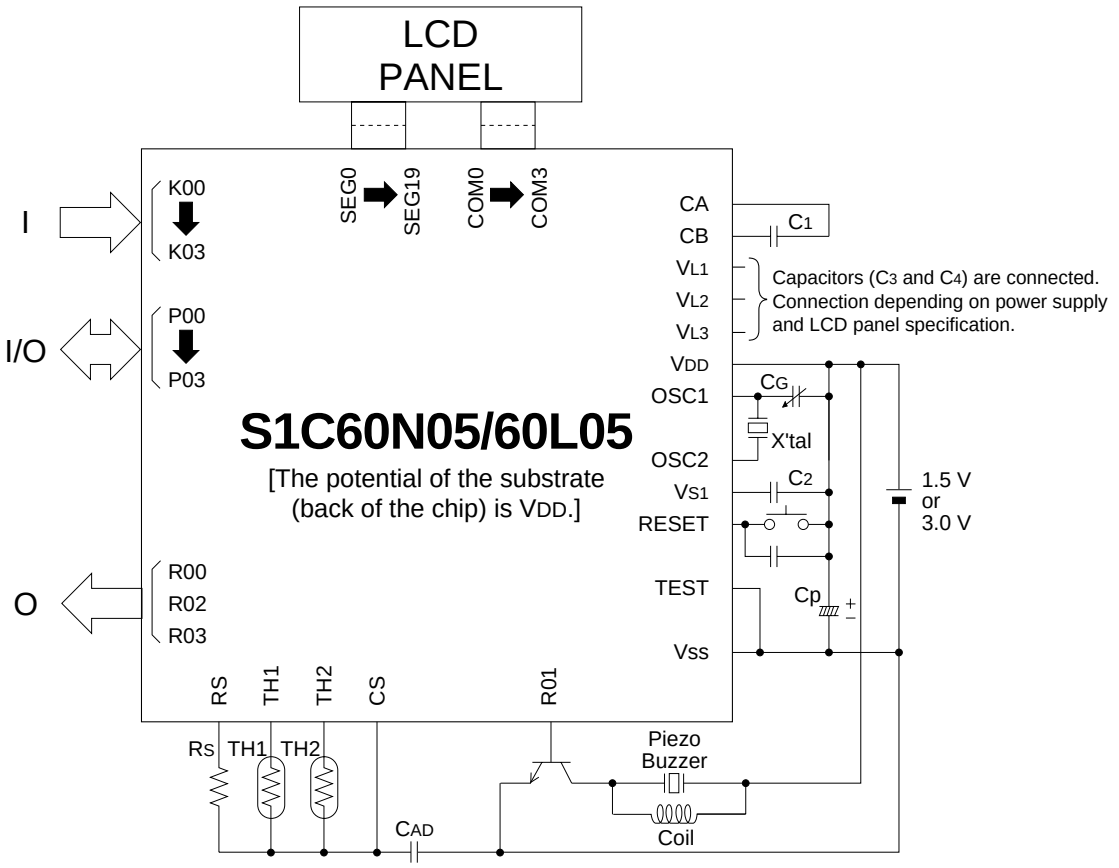
● Pad Coordinates

Pad No.	Pad name	X	Y	Pad No.	Pad name	X	Y
1	ADOUT	644	1,121	28	V_{L3}	-1,259	-1,121
2	SEG0	511	1,121	29	V_{L2}	-1,129	-1,121
3	SEG1	381	1,121	30	V_{L1}	-998	-1,121
4	SEG2	251	1,121	31	CA	-868	-1,121
5	SEG3	121	1,121	32	CB	-737	-1,121
6	SEG4	-9	1,121	33	V_{SS}	-81	-1,121
7	SEG5	-139	1,121	34	V_{DD}	50	-1,121
8	SEG6	-269	1,121	35	OSC1	185	-1,121
9	SEG7	-399	1,121	36	OSC2	337	-1,121
10	SEG8	-529	1,121	37	V_{S1}	490	-1,121
11	SEG9	-659	1,121	38	P00	863	-1,121
12	SEG10	-789	1,121	39	P01	993	-1,121
13	SEG11	-919	1,121	40	P02	1,123	-1,121
14	TEST	-1,306	987	41	P03	1,253	-1,121
15	RESET	-1,306	854	42	K00	1,306	-665
16	SEG12	-1,306	724	43	K01	1,306	-535
17	SEG13	-1,306	597	44	K02	1,306	-404
18	SEG14	-1,306	464	45	K03	1,306	-274
19	SEG15	-1,306	334	46	R00	1,306	-49
20	SEG16	-1,306	204	47	R01	1,306	81
21	SEG17	-1,306	74	48	R02	1,306	310
22	SEG18	-1,306	-56	49	R03	1,306	440
23	SEG19	-1,306	-186	50	RS	1,306	582
24	COM0	-1,306	-371	51	TH1	1,306	721
25	COM1	-1,306	-509	52	TH2	1,306	857
26	COM2	-1,306	-639	53	CS	1,306	1,038
27	COM3	-1,306	-769				

(Unit: μm)

■ BASIC EXTERNAL CONNECTION DIAGRAM

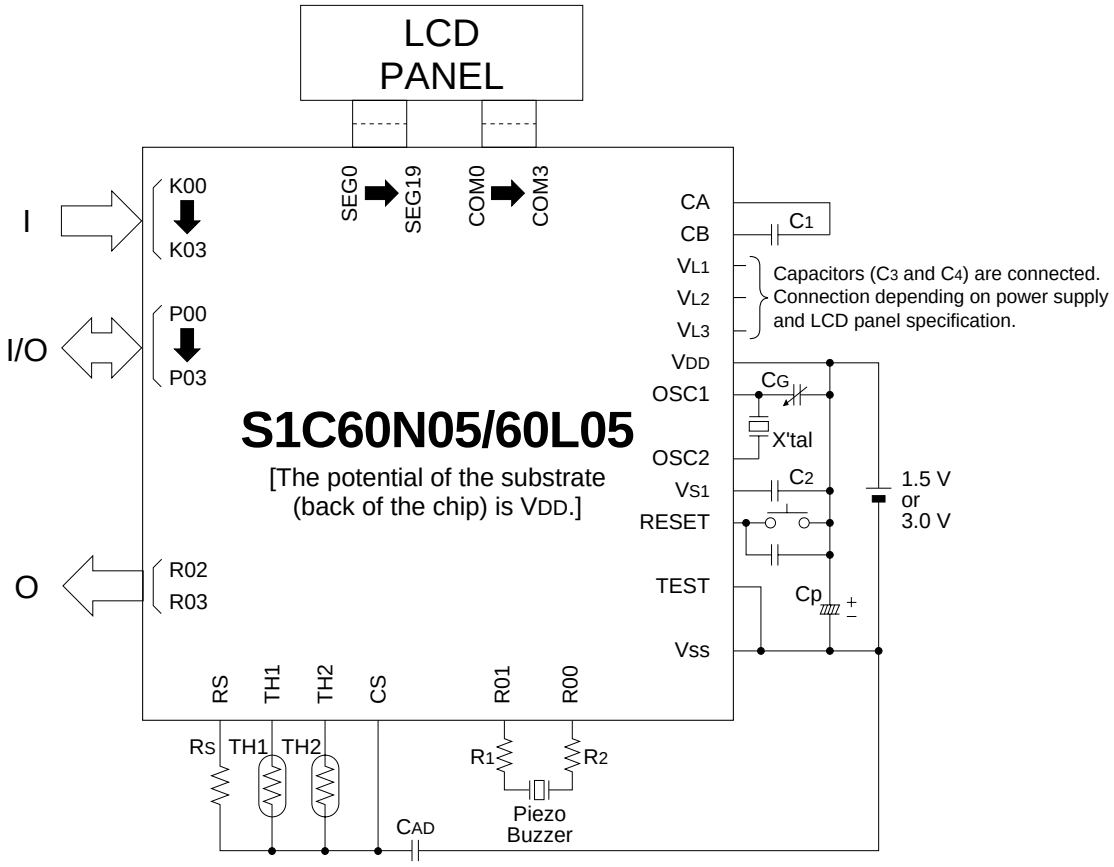
Piezo Buzzer Single Terminal Driving



X'tal	Crystal oscillator	32,768 Hz CI(MAX) = 35 kΩ
C_G	Trimmer capacitor	5–25 pF
C_1, C_2, C_3, C_4	Capacitor	0.1 µF
Cp	Capacitor	3.3 µF
TH1, TH2	Thermistor	50 kΩ
R_S	Resistor	49.8 kΩ
C_{AD}	Capacitor	2,200 pF

Note: The above table is simply an example, and is not guaranteed to work.

Piezo Buzzer Direct Driving

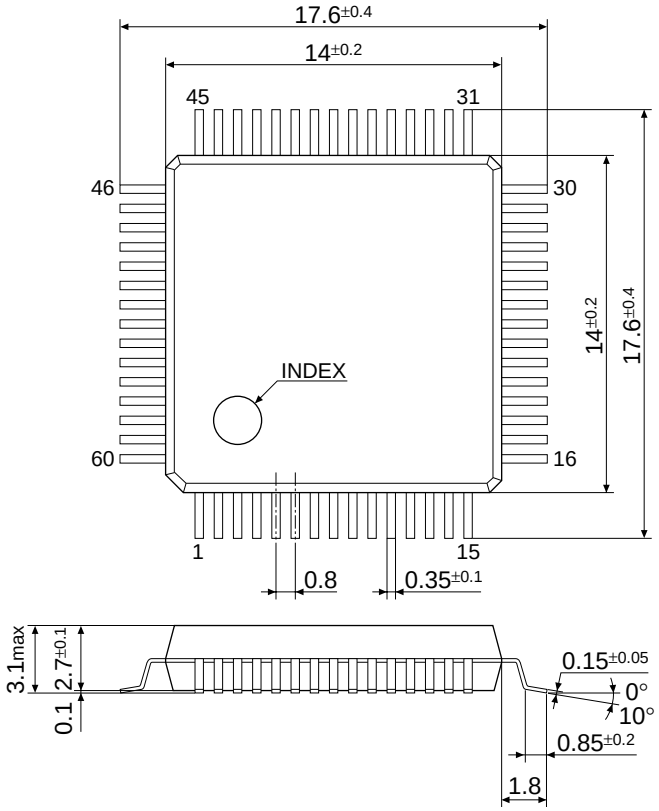


X'tal	Crystal oscillator	32,768 Hz CI(MAX) = 35 kΩ
C_G	Trimmer capacitor	5–25 pF
C_1, C_2, C_3, C_4	Capacitor	0.1 µF
Cp	Capacitor	3.3 µF
TH1, TH2	Thermistor	50 kΩ
R_S	Resistor	49.8 kΩ
R_1, R_2	Resistor	100 Ω
C_{AD}	Capacitor	2,200 pF

Note: The above table is simply an example, and is not guaranteed to work.

■ PACKAGE

Plastic QFP6-60pin



(Unit: mm)

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