

SMC621A

CMOS 4-BIT SINGLE CHIP MICROCOMPUTER

■ DESCRIPTION

SMC621A is a CMOS 4-bit microcomputer using an SMC6200A as its core processor. The SMC62P1A is a one-time programmable (OTP) version of the SMC621A. Features include ROM/RAM, LCD driver circuit, remote control carrier output circuit, time base counter, analog comparator, and a watchdog timer, all combined on a single chip. The SMC621A provides an excellent solution for battery-powered devices, such as an LCD game, a schedule reminder, Smartcard, or an infrared remote controller with an LCD display.

■ FEATURES

- 4k x 12 ROM / 208 x 4 RAM
- Twin Clock Operation (32 kHz/455 kHz)
- Analog Comparator
- LCD Driver (32 segments x 3 or 4 commons)
- Low Current Consumption (2 μ A at 3V)
- SVD (supply voltage detect) Circuit
- Watchdog Timer

■ AVAILABLE MODELS

Model	Supply Voltage	Current consumption (RUN)	
SMC621A	3.0V (2.2 to 3.5V)	9 μ A (32 kHz)	130 μ A (455 kHz)
*SMC62P1A	3.0V (2.4 to 3.5V)	16 μ A (32 kHz)	200 μ A (455 kHz)

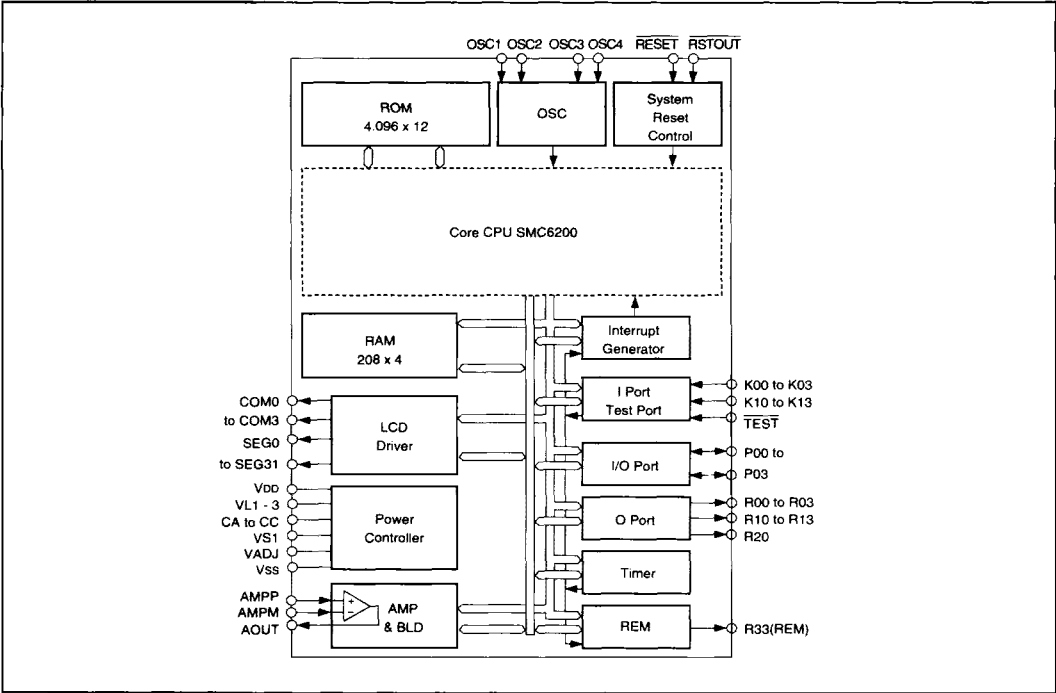
* Preliminary

■ FUNCTIONS

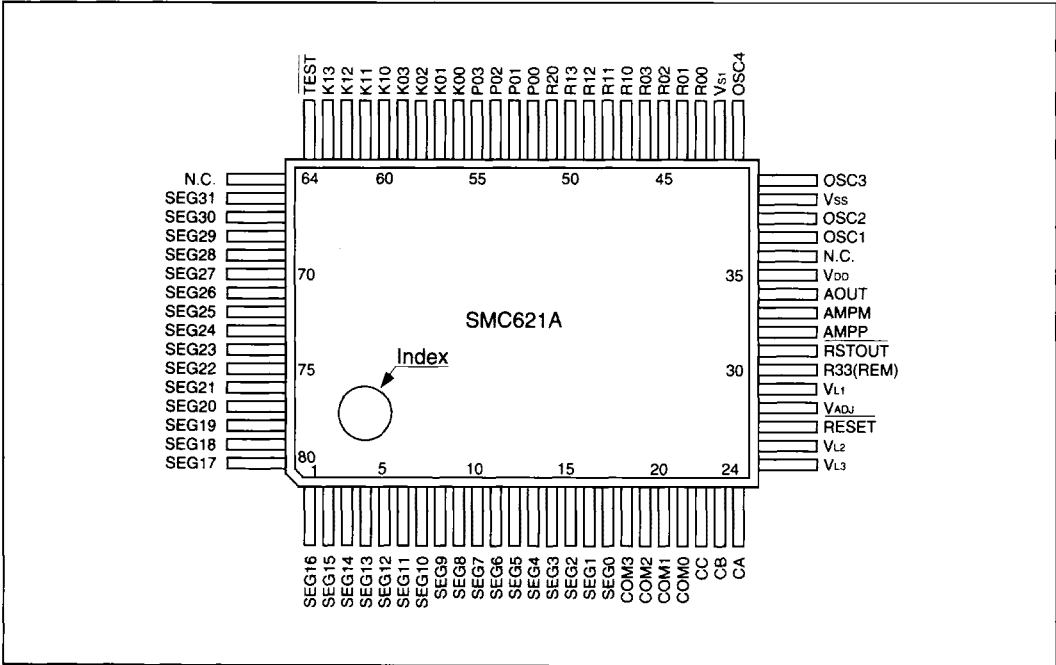
Low power CMOS LSI technology

Twin clock	32.768 kHz (typ)/455 kHz (typ) (software-selectable)
Instruction set	100 instructions
Instruction cycle time	32 kHz clock: 153 μ sec, 214 μ sec, or 366 μ sec 455 kHz clock: 11 μ sec, 15 μ sec, or 26 μ sec
ROM	4096 x 12 bits
RAM	208 x 4 bits
Inputs	8 (pull-up resistors selectable using a mask option)
Outputs	9 (clock, buzzer, complimentary outputs or N-channel open drain outputs, selectable using a mask option)
I/O	4 lines
REM output (remote control output circuit)	1 line (hardware timer or software-selectable timer)
LCD driver	32 segments x 3 or 4 commons
LCD power supplies	Voltage regulator, voltage doubler, and voltage tripler
SVD (supply voltage detect) circuit	2.3V $\pm$ 0.1V
Analog comparator	Slew rate of 0.06 V/ μ s
Watchdog timer	Can be disabled using a mask option
Interrupts	External: 2 input interrupts Internal: 3 timer interrupts, 1 REM interrupt
Supply voltage	3.0V (2.2V to 3.5V)
Current consumption	32 kHz clock: 2 μ A (typ) (HALT), 9 μ A (typ) (100% run) 455 kHz clock: 130 μ A (typ) (100% run)
Temperature Range	-20°C to 70°C
Package	80-pin QFP (plastic) Also available in die form
SMC62P1A Programming	Adaptor available for interface to standard EPROM programmer such as Data I/O Model 288. Software operates on XT, AT or compatible PC

■ BLOCK DIAGRAM



■ PIN CONFIGURATION



PIN DESCRIPTION

Pin name	Functions	Pin name	Functions
V _{DD}	Power supply (+)	SEG0 to 31	LCD segment output (DC output available by using mask option)
V _{SS}	Power supply (-)		
V _{S1}	Power supply for oscillator (generated internally)	AMPP	Analog comparator non-reverse input pin
V _{L1}	Power supply for LCD driver (generated internally)	AMPM	Analog comparator reverse input pin
V _{L2}	Power supply for LCD driver (doubled V _{L1})	AOUT	Analog comparator output pin
V _{L3}	Power supply for LCD driver (tripled V _{L1})	TEST	Test input pin
CA to CC	Capacitor connection pins for LCD booster	RESET	System reset input pin
V _{ADJ}	V _L adjusting input pin	K00 to 03	Input ports
OSC1	Crystal oscillation input pin	K10 to 13	Input ports
OSC2	Crystal oscillation output pin (containing CD)	P00 to 03	Input / Output ports
OSC3	Ceramic or CR oscillation input pin (selectable by using mask option)	R00 to 03	Output ports • DC output, FOUT output and $\overline{BZ}$ output selectable at R12 by using mask option) • DC output and $\overline{BZ}$ output selectable at R13 by using mask option)
		R10 to 13	
OSC4	Ceramic or CR oscillation output pin (selectable by using mask option)	R20	Remote-control output pin
		R33 (REM)	
COM0 to 3	LCD common output (1/3 or 1/4 duty selectable by using mask option)	RSTOUT	System reset output pin

ABSOLUTE MAXIMUM RATINGS

(V_{DD} = 0V)

Item	Symbol	Ratings	Unit
Supply voltage	V _{SS}	-5.2 to 0.5	V
Input voltage	V _I	V _{SS} -0.3 to 0.3	V
	V _{IOSC}	V _{SL} -0.3 to 0.3	V
Operating temperature	T _{opr}	-20 to 70	°C
Storage temperature	T _{stg}	-65 to 150	°C
Soldered temperature and time	T _{sol}	260°C, 10 sec (at leads)	—
Power dissipation	P _D	250	mW

RECOMMENDED OPERATING CONDITIONS

(T_a = -20°C to 70°C)

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply voltage	V _{SS}	V _{DD} = 0V	-3.5	-3.0	-2.2	V
Oscillation frequency	fosc1	—	—	32.768	—	kHz
	fosc3	duty: 50 ± 5%	50	455	500	kHz
Power supply voltage for LCD driver	V _{L1}	—	-1.6	-1.03	—	V
CR OSC EXT R	RCR	—	100	140	500	kΩ

■ ELECTRICAL CHARACTERISTICS

● DC Electrical Characteristics

 $V_{DD} = 0V$, $V_{SS} = -2.2$ to $-3.5V$, $V_{L3} = -3.0V$, $T_a = -20$ to $70^\circ C$

Item	Symbol	Condition	Min	Typ	Max	Unit
High level input voltage (1)	V_{IH1}	K00–K03, P00–P03	$0.2V_{SS}$		0	V
Low level input voltage (1)	V_{IL1}	K00–K03, P00–P03	V_{SS}		$0.8V_{SS}$	V
High level input voltage (2)	V_{IH2}	RESET	$0.1V_{SS}$		0	V
Low level input voltage (2)	V_{IL2}	RESET	V_{SS}		$0.9V_{SS}$	V
High level input current	I_{IH}	$V_{IH} = V_{DD}$			1	μA
Low level input current	I_{IL1}	$V_{IL1} = V_{SS}$ No pull up, K00–K13	-1			μA
	I_{IL2}	$V_{IL2} = V_{SS}$ Pull up, K00–K13	-5		-0.35	μA
	I_{IL3}	$V_{IL3} = V_{SS}$ RESET pin	-5		-0.35	μA
	I_{IL4}	$V_{IL4} = 0.2V_{SS}$ Pull up, K00–K13	-30			μA
	I_{IL5}	$V_{IL5} = 0.2V_{SS}$ RESET pin	-40			μA
	I_{IL6}	$V_{IL6} = V_{SS}$ P00–P03 *	-15		-2	μA
High level output current (1)	I_{OH1}	$V_{OH1} = 0.1V_{SS}$ R00–R03, R10–R13, RSTOUT			-250	μA
Low level output current (1)	I_{OL1}	$V_{OL1} = 0.9V_{SS}$ R00–R03, R10–R13, RSTOUT	1.0			mA
High level output current (2)	I_{OH2}	$V_{OH2} = 0.1V_{SS}$ R20			-1.8	mA
Low level output current (2)	I_{OL2}	$V_{OL2} = 0.9V_{SS}$ R20	1.0			mA
High level output current (3)	I_{OH3}	$V_{OH3} = 0.1V_{SS}$ P00–P03			-250	μA
Low level output current (3)	I_{OL3}	$V_{OL3} = 0.9V_{SS}$ P00–P03	1.0			mA
High level output current (4)	I_{OH4}	$V_{OH4} = 0.1V_{SS}$ R33 (REM)			-1.8	mA
Low level output current (4)	I_{OL4}	$V_{OL4} = 0.9V_{SS}$ R33 (REM)	1.0			mA
Common output current	I_{OH5}	$V_{OH5} = -0.05V$			-3.0	μA
	I_{OL5}	$V_{OL5} = V_{L3} + 0.05V$ (COM0–COM3)	3.0			μA
Segment output current (in LCD output mode)	I_{OH6}	$V_{OH6} = -0.05V$			-3.0	μA
	I_{OL6}	$V_{OL6} = V_{L3} + 0.05V$ (SEG0–SEG31)	3.0			μA
Segment output current (in DC output mode)	I_{OH7}	$V_{OH7} = 0.1V_{SS}$			-50	μA
	I_{OL7}	$V_{OL7} = 0.9V_{SS}$ (SEG0–SEG31)	70			μA

* Only at read cycle using internal program

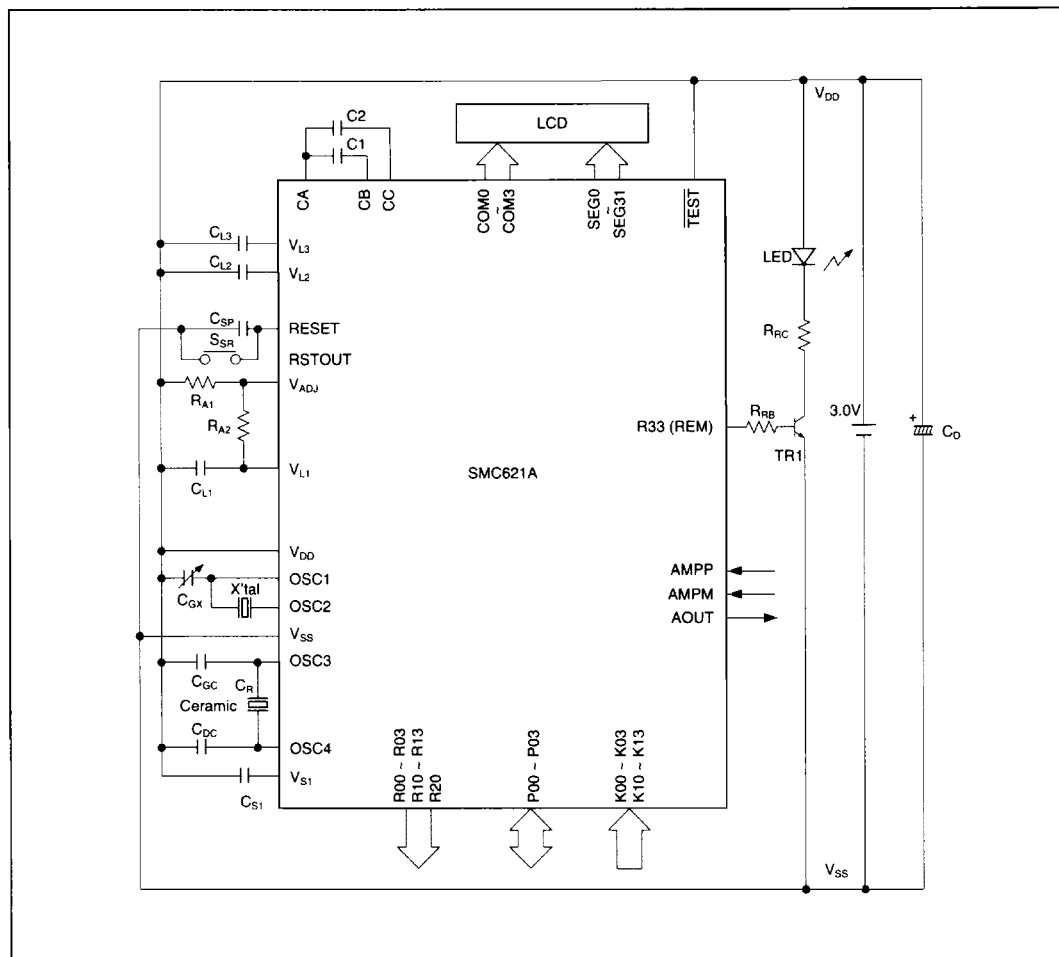
● AC Electrical Characteristics

 $V_{DD} = 0V$, $V_{SS} = -2.2$ to $-3.5V$, $V_{L3} = -3.0V$, $T_a = 25^\circ C$

Item	Symbol	Condition	Min	Typ	Max	Unit
Internal voltage	V_{L1}	$V_{ADJ} = V_{L1}$, $I_{L1} = 5 \mu A$	-1.11	-1.03	-0.95	V
	V_{L2}	1 M Ω load connected between V_{DD} and V_{L2}	$2V_{L1}$		$2V_{L1} + 0.1$	V
	V_{L3}	1 M Ω load connected between V_{DD} and V_{L3}	$3V_{L1}$		$3V_{L1} + 0.3$	V
SVD voltage	V_{SVD}		-2.4	-2.3	-2.2	V
Response time	t_{sd}				100	μs
AMP		$V_{SS} = -3.0V$				
Maximum output voltage amplitude	V_{PP}	AMP operation			2.4	V
Through rate	SR		0.06			V/ μs
Offset voltage	V_{OF}	Comparator operation [Condition Area] $V_{OF} : V_I = V_{DD} - 0.9V$ to $V_{SS} + 0.3V$			10	mV
Response time	t_{Ad}	$t_{Ad} : V_{AMPP} = -1.5V$ $V_{AMPP} = V_{AMPP} \pm 15mV$			2.0	ms
High level output current	I_{OHA}	$I_{OHA} : V_{OHA} = -3.0V$			-4.0	μA
Low level output current	I_{OLA}	$I_{OLA} : V_{OLA} = -2.7V$	0.1			mA
Current consumption	I_{OP}	HALT mode *1		2	5	μA
		OSC1 mode *1		9	18	μA
		OSC3 mode *2		130	250	μA

*1 OSC3 mode: Ceramic oscillation (455 kHz) or CR oscillation (R = 140 k Ω)

TYPICAL EXTERNAL CONNECTION



X'tal	Crystal Oscillator	32.768 kHz Cl(max)=35k Ω
C _{GX}	Trimmer capacitor	5–25 pF
C _R	Ceramic oscillator	455 kHz
C _{GC}		100 pF
C _{DC}		100 pF
C _{SR}		0.33 μ F
R _{A1}		2 M Ω
R _{A2}		1 M Ω

C _{L1}		0.1 μ F
C _{L2}		0.1 μ F
C _{L3}		0.1 μ F
C ₁		0.1 μ F
C ₂		0.1 μ F
C _{S1}		0.1 μ F
C _D		6.8 μ F

Note: The values given above are examples only, and do not guarantee system operation.

■ PACKAGE DIMENSIONS

