

Single-chip 4-bit microcontroller for CD-DA

BU34440

The BU34440 is a single-chip 4-bit microcontroller designed for CD-DA and contains parallel I/O, serial I/O, timer / counter and all other functions required for CD control in a single compact package.

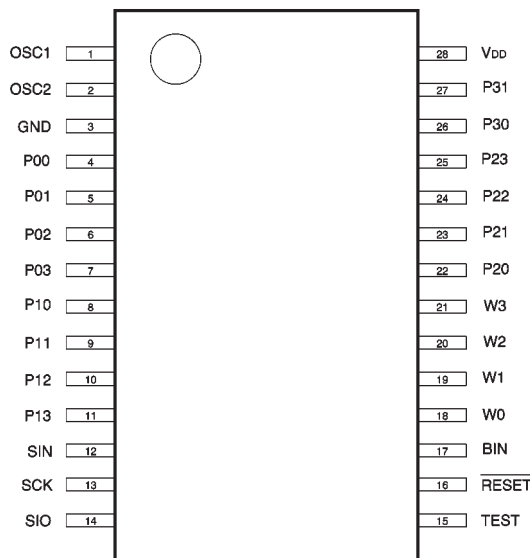
●Applications

Portable CD-DA devices, portable CD stereos

●Features

- 1) Low-voltage, high-speed operation ($V_{DD}=2.3 \sim 5.5V$ at 4.4MHz).
- 2) 4k byte ROM, 256 nibble RAM.
- 3) Internal 8-bit SIO (LSB first).
- 4) 14 programmable pull-up input / outputs.
- 5) 5 programmable pull-up inputs.

●Pin assignments



●Absolute maximum ratings (Ta = 25°C)

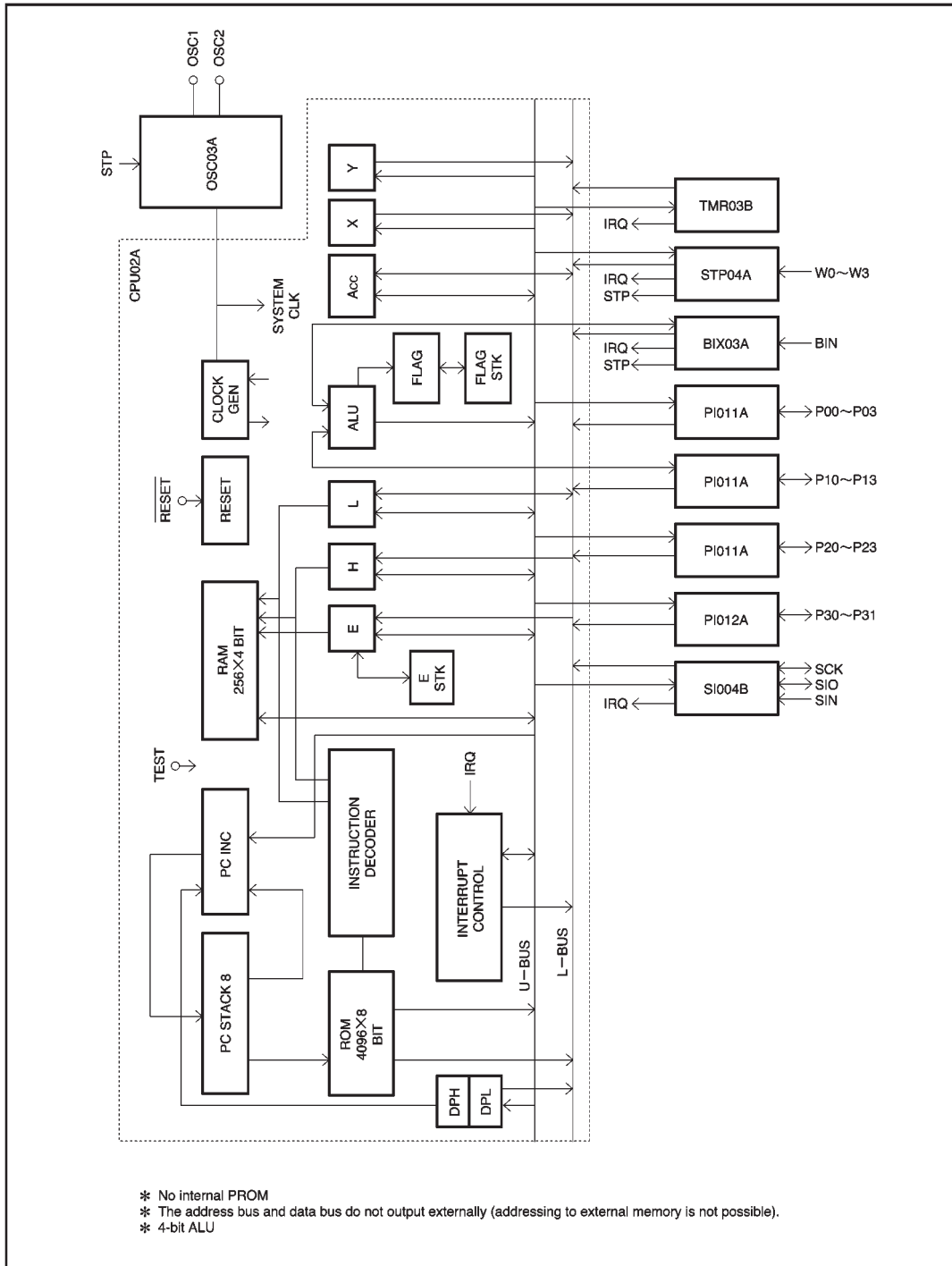
Parameter	Symbol	Limits	Unit
Power supply voltage	V_{DD}	$-0.3 \sim +7.0$	V
Power dissipation	P_d	500*	mW
Operating temperature	T_{opr}	$-25 \sim +75$	°C
Storage temperature	T_{stg}	$-55 \sim +125$	°C

* Reduced by 5.0 mW for each increase in Ta of 1°C over 25°C.

●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power supply voltage	V_{DD}	2.3	—	5.5	V
Input high level voltage (without hysteresis)	V_{IH}	$0.7V_{DD}$	—	V_{DD}	V
Input low level voltage (without hysteresis)	V_{IL}	0	—	$0.3V_{DD}$	V
Input high level voltage (with hysteresis)	V_{IHS}	$0.75V_{DD}$	—	V_{DD}	V
Input low level voltage (with hysteresis)	V_{ILS}	0	—	$0.25V_{DD}$	V

● Block diagram



- * No internal PROM
- * The address bus and data bus do not output externally (addressing to external memory is not possible).
- * 4-bit ALU

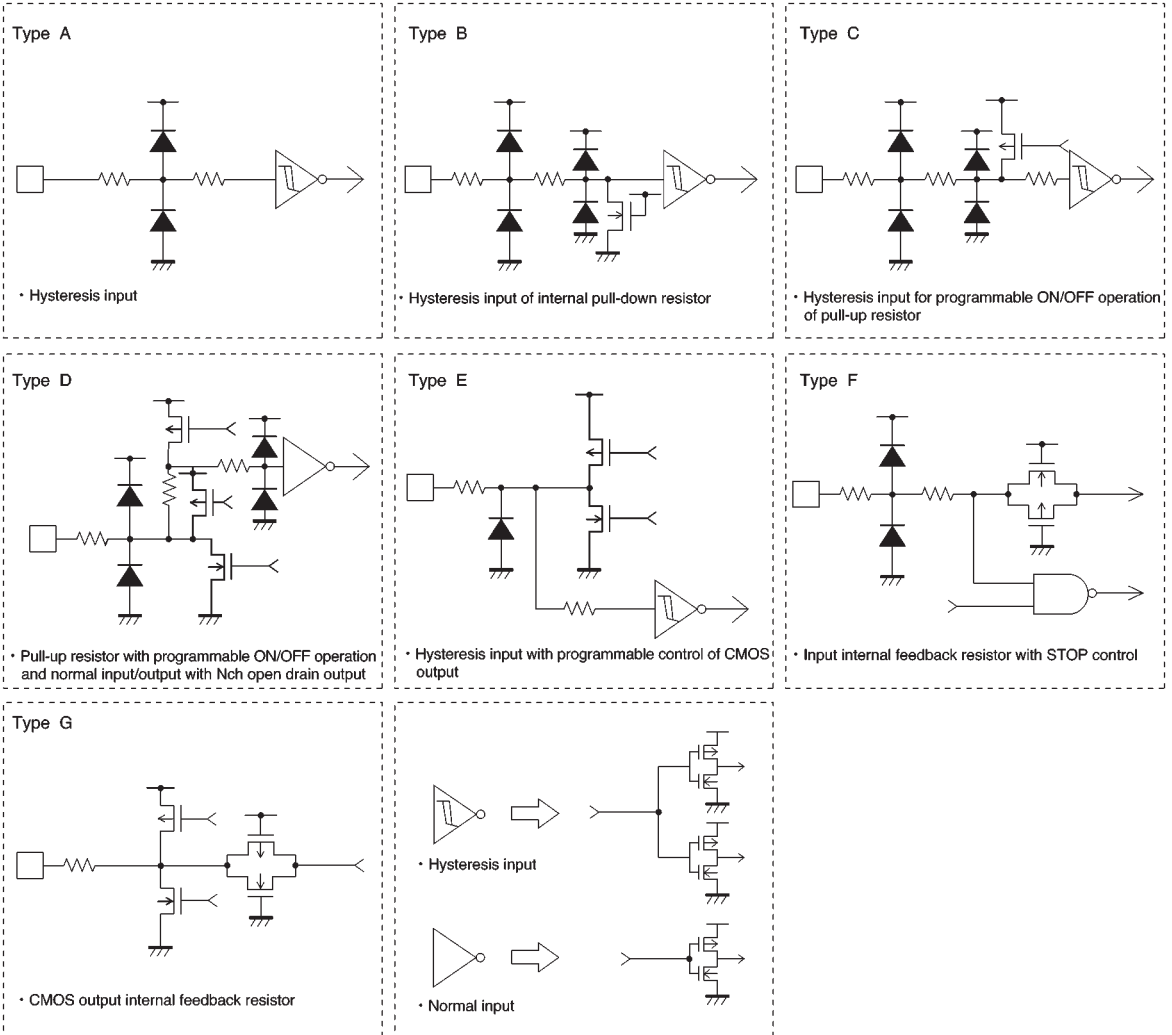
● Pin descriptions

Pin No.	Pin name	I/O	Function	Type
4~7 8~11 22~25	P00~P03 P10~P13 P20~P23 (block PI011A)	I/O	<ul style="list-style-type: none"> • 4-bit input and output. • Each bit is programmable for input or output (open drain output N-channel). • Pull-up resistor ON/OFF operation is programmable (each bit can be set separately). • Resetting turns the pull-up resistors off via input. 	D
26~27	P30~P31 (block PI012)	I/O	<ul style="list-style-type: none"> • 2-bit input and output. • Each bit is programmable for input or output (open drain output N-channel). • Pull-up resistor ON/OFF operation is programmable (each bit can be set separately). • Resetting turns the pull-up resistors off via input. * 1 	D
18~21	W0~W3 (block STP04A)	I	<ul style="list-style-type: none"> • Standard 4-bit input. • Programmable for stop cancel input or interrupt request signal output (each bit can be set separately). • Pull-up resistor ON/OFF operation is programmable (each bit can be set separately). • Resetting turns the pull-up resistors off. 	C
17	BIN (block BIX03A)	I	<ul style="list-style-type: none"> • Standard 1-bit input. • Programmable for stop cancel input or interrupt request signal output. • Pull-up resistor ON/OFF operation is programmable. • Resetting turns the pull-up resistors off. 	C
12	SIN	I	<ul style="list-style-type: none"> • 8-bit serial data input. 	A
14	SIO	I/O	<ul style="list-style-type: none"> • 8-bit serial data input/output. • Programmable selection of input/output. 	E
13	SCK (block SI004B)	I/O	<ul style="list-style-type: none"> • Clock input/output for sending and receiving serial data. • Programmable selection from among 3 int. clocks and 1 ext. clock. 	E
1	OSC1	I	<ul style="list-style-type: none"> • Oscillator input. • External clock input. 	F
2	OSC2 (block OSC03A)	O	<ul style="list-style-type: none"> • Oscillator output. 	G
15	TEST	I	<ul style="list-style-type: none"> • Test input (This is a chip test pin that contains an internal pull-down resistor and so should normally remain open.) 	B
16	RESET	I	<ul style="list-style-type: none"> • Reset input (Setting this pin to LOW resets the CPU.) 	A
28	V _{DD}	—	<ul style="list-style-type: none"> • Power supply pin. 	—
3	GND	—	<ul style="list-style-type: none"> • Ground pin. 	—

Type: Refer to "Input and output equivalent circuits."

*1 Because these pins reach high impedance immediately after resetting, some applications may require pin processing.

● Input / output circuits



●Electrical characteristics (unless otherwise noted, Ta = 25°C, V_{DD} = 5V)

Parameter	Symbol	Pin	Min.	Typ.	Max.	Unit	Conditions
STOP circuit current	I _{DDST}		—	—	1	μA	• STOP mode
HALT circuit current	I _{DDHT}		—	1	—	mA	• HALT mode • f _{OSC} = 4.4MHz
Operating supply current	I _{DDOP}		—	4	—	mA	• f _{OSC} = 4.4MHz
Clock frequency	f _{OSC}	OSC1, OSC2	2	—	4.4	MHz	
Input high level voltage 1	V _{IH1}	P00~P03, P10~P13, P20~P23, P30~P31	3.5	—	—	V	• Pxx = input
Input high level voltage 2	V _{IH2}	W0~W3, BIN, SIN, SIO, SCK, TEST, RESET	3.75	—	—	V	• Hysteresis input • SIO, SCK = input
Input high level voltage 3	V _{IH3}	OSC1	3.9	—	—	V	• External clock input
Input low level voltage 1	V _{IL1}	P00~P03, P10~P13, P20~P23, P30~P31	—	—	1.5	V	• Pxx = input
Input low level voltage 2	V _{IL2}	W0~W3, BIN, SIN, SIO, SCK, TEST, RESET	—	—	1.25	V	• Hysteresis input • SIO, SCK = input
Input low level voltage 3	V _{IL3}	OSC1	—	—	1.1	V	• External clock input
Input high level current 1	I _{IH1}	P00~P03, P10~P13, P20~P23, P30~P31, W0~W3, BIN, SIN, SIO, SCK, RESET	—	—	1	μA	• No pull-down resistor • Pxx, SIO, SCK=input • V _{IN} = V _{DD}
Input high level current 2	I _{IH2}	TEST	35	70	140	μA	• Internal pull-down resistor • V _{IN} = V _{DD}
Input low level current 1	I _{IL1}	P00~P03, P10~P13, P20~P23, P30~P31, W0~W3, BIN, SIN, SIO, SCK, RESET, TEST	—	—	-1	μA	• No pull-up resistor • Pxx, SIO, SCK=input • V _{IN} = GND
Input low level current 2	I _{IL2}	P00~P03, P10~P13, P20~P23, P30~P31, W0~W3, BIN	-90	-125	-160	μA	• Internal pull-up resistor • V _{IN} = GND
Output high level voltage 1	V _{OH1}	SIO, SCK	4.5	—	—	V	• SIO, SCK = output • I _{OH} = -500 μA
Output low level voltage 1	V _{OL1}	P00~P03, P10~P13, P20~P23, P30~P31, SIO, SCK	—	—	0.4	V	• Pxx, SIO, SCK = output • I _{OL} = 1.6mA
Output leakage current	I _L	P00~P03, P10~P13, P20~P23, P30~P31	—	—	1	μA	• Pxx = high-impedance output
OSC feedback current	I _{FO}	OSC1, OSC2	-4.0	-10	-14	μA	• Approx. 500 kΩ

*1 machine cycle = 1/6 oscillation frequency

●Electrical characteristics (unless otherwise noted, Ta = 25°C, V_{DD} = 3V)

Parameter	Symbol	Pin	Min.	Typ.	Max.	Unit	Conditions
STOP circuit current	I _{DDST}		—	—	1	μA	• STOP mode
HALT circuit current	I _{DDHT}		—	0.4	—	mA	• HALT mode • f _{osc} =4.4MHz
Operating supply current	I _{DDOP}		—	1.5	—	mA	• f _{osc} =4.4MHz
Clock frequency	f _{osc}	OSC1, OSC2	2	—	4.4	MHz	
Input high level voltage 1	V _{IH1}	P00~P03, P10~P13, P20~P23, P30~P31	2.1	—	—	V	• Pxx = input • ADC = digital input
Input high level voltage 2	V _{IH2}	W0~W3, BIN, SIN, SIO, SCK, TEST, RESET	2.25	—	—	V	• Hysteresis input • SIO, SCK = input
Input high level voltage 3	V _{IH3}	OSC1	2.4	—	—	V	• External clock input
Input low level voltage 1	V _{IL1}	P00~P03, P10~P13, P20~P23, P30~P31	—	—	0.9	V	• Pxx = input • ADC = digital input
Input low level voltage 2	V _{IL2}	W0~W3, BIN, SIN, SIO, SCK, TEST, RESET	—	—	0.75	V	• Hysteresis input • SIO, SCK = input
Input low level voltage 3	V _{IL3}	OSC1	—	—	0.65	V	• External clock input
Input high level current 1	I _{IH1}	P00~P03, P10~P13, P20~P23, P30~P31, W0~W3, BIN, SIN, SIO, SCK, RESET	—	—	1	μA	• No pull-down resistor • Pxx, SIO, SCK=input • V _{IN} =V _{DD}
Input high level current 2	I _{IH2}	TEST	10	20	35	μA	• Internal pull-down resistor • V _{IN} =V _{DD}
Input low level current 1	I _{IL1}	P00~P03, P10~P13, P20~P23, P30~P31, W0~W3, BIN, SIN, SIO, SCK, RESET, TEST	—	—	-1	μA	• No pull-up resistor • Pxx, SIO, SCK=input • V _{IN} =GND
Input low level current 2	I _{IL2}	P00~P03, P10~P13, P20~P23, P30~P31, W0~W3, BIN	-20	-40	-60	μA	• Internal pull-up resistor • V _{IN} =GND
Output high level voltage 1	V _{OH1}	SIO, SCK	2.5	—	—	V	• SIO, SCK = output • I _{OH} =-500 μA
Output low level voltage 1	V _{OL1}	P00~P03, P10~P13, P20~P23, P30~P31, SIO, SCK	—	—	0.6	V	• Pxx, SIO, SCK = output • I _{OL} =1.6mA
Output leakage current	I _L	P00~P03, P10~P13, P20~P23, P30~P31	—	—	1	μA	• Pxx = high-impedance output
OSC feedback current	I _{Fo}	OSC1, OSC2	-1.5	-3	-5	μA	• Approx. 1 MΩ

*1 machine cycle = 1 / 6 oscillation frequency

● Hardware descriptions

- (1) Operates on a single power supply ($V_{DD}=2.3 \sim 5.5V$).
- (2) Memory size
 - ROM: 4096×8 bits
 - RAM: 256×4 bits
- (3) Instruction execution time (1 cycle instruction)
 - 1.5 μ sec: (at 4MHz)
- (4) Subroutine nesting : 8 levels
- (5) Interrupts: 4 factors
 - External: 2 factors
 - Internal (timer / counter, serial I / O) : 2 factors
- (6) ROM data table function (data table area : 4kB)
- (7) Two energy-saving modes (STOP / HALT)
- (8) Internal 8-bit timer counter
- (9) Internal serial I / O, simplifying interface with attached LSIs (LSB first)
- (10) 14 programmable pull-up input / outputs
- (11) 5 programmable pull-up inputs

● External dimensions (Units: mm)

