CORERIVER
Total Solution of MCU

ATOM120

4-bit Turbo Microcontroller

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1 ATOM120 Overview

1.1 General Description

ATOM120 is a 4-bit reduced 8051 Microcontroller.

ATOM120 has 17 or 13 programmable I/O ports, Watchdog timer, POR (Power-On Reset), built-in I.R. LED Driver, and LVD (Low Voltage Detector) as peripherals. In addition, it contains an internal precision oscillator, which can generate the 3.64 MHz system clock signal instead of a crystal oscillator.

ATOM120 operates over the extended -20℃ to +70℃ temperature range, and is available in the 20-pin SOP, 20-pin TSSOP, 16-pin TSSOP package.

1.2 Features

- CPU
  - ✓ 4-bit reduced 8051 architecture
  - ✓ Continuous program addressing, not paged.
  - ✓ 51 instructions including push, pop and logic inst.
  - ✓ Instruction cycle : $F_{SYS}/6$
  - ✓ Multi-level subroutine nesting with RAM based stack.
- Program Memory (MTP)
  - ✓ 4K Bytes (4,096 X 8 bits)
  - ✓ Multi-programmable by 1K Bytes, 2K Bytes or 4K Bytes
  - ✓ ISP (In System Programming) of MTP
- Data RAM : 48 nibbles (including stack)
- I/O Ports
  - ✓ P0 : 4-bit parallel input
  - ✓ P1 : 2-bit parallel input, 2-bit parallel I/O
  - ✓ P2 : 4-bit parallel I/O, Bit-selectable output
  - ✓ P3 : 2-bit parallel I/O, Bit-selectable output
  - ✓ P4 : 3-bit Parallel/bit-selectable Output

- REM output (Remote control transmitter)
  - ✓ Built-in Transistor for I.R. LED Drive
  - ✓ I_{OL}= 250 mA (Max.) at V_{DD} = 3V and V_O = 0.3V
- Carrier Pulse Generation : 8 types
- Built-in Oscillator
  - ✓ Crystal/Ceramic resonator (for 1.2V application)
  - ✓ Internal Precision Oscillator : 3.64 MHz (Max. ± 2%, Typ. ± 1%)
- Built-in Reset
  - ✓ Power-on Reset, Power-fail Reset
  - ✓ WDT (Watch-Dog Timer) Reset
  - ✓ Clock switching reset
- Power Management
  - ✓ Power-down (stop) mode
  - ✓ Release stop by input changes
- Power Consumption (TBD)
  - ✓ Stop mode : 1 uA (Typ.) at 3.0V
  - ✓ Normal mode : 400 uA (Typ.) at 2.0V, F_{OSC} = 4 MHz
- Operating frequency vs. voltage
  - ✓ Max. F_{SYS} = 4 MHz (1.8 V ≤ V_{DD} ≤ 3.6V)
  - ✓ Max. F_{SYS} = 0.5 MHz (1.2 V ≤ V_{DD} ≤ 1.8V)
- Operating temperature : -20 °C ~ 70 °C
- ESD protection
  - ✓ HBM : 2,000V (JESD22-A114E)
  - ✓ MM : 200V (JESD22-A115-A)
  - ✓ CDM : 800V (JESD22-C101-C)
- Latch-up protection up to ±200mA
- Package
  - ✓ 20-pin SOIC (JEDEC)
  - ✓ 20-pin TSSOIC
  - ✓ 16-pin TSSOIC

1.3 Applications

- Remote Controller

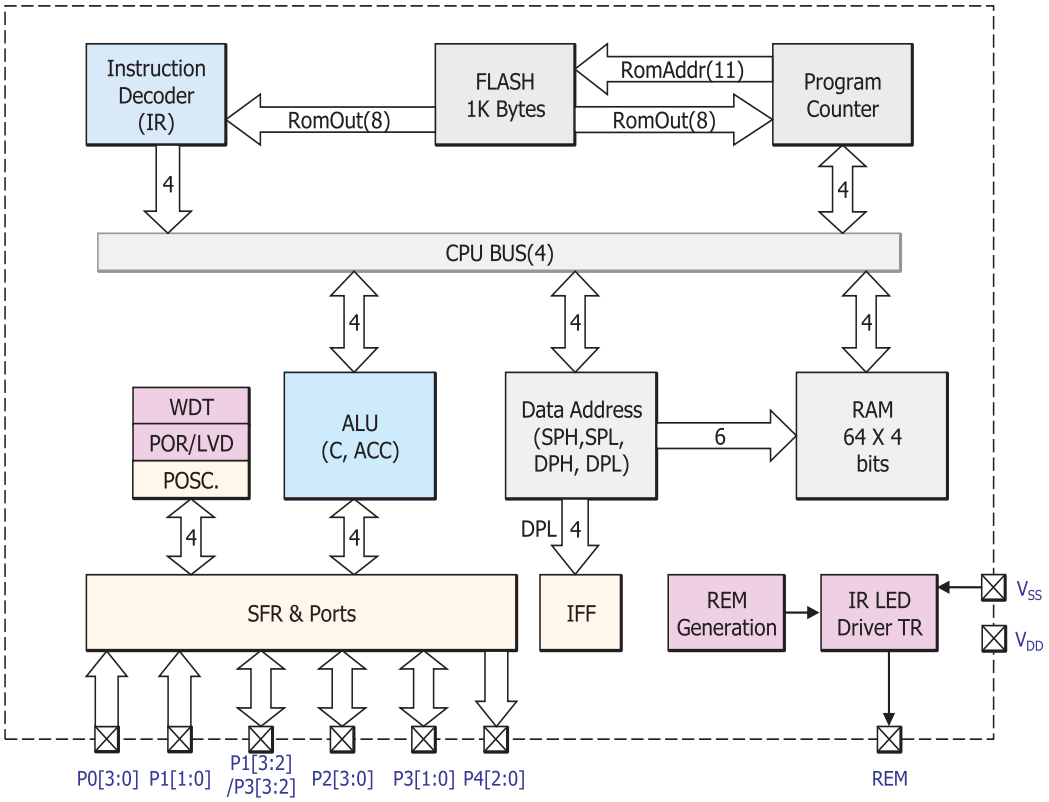
1.4 Product Family Guide

Product	Mask-ROM [Byte]	EPROM [Byte]	RAM [Nibble]	I/O Pins	Package	Other Peripherals
ATOM120	**-**	**4k**	**48**	**17** **17** **13**	20-SOP 20-TSSOP 16-TSSOP	WDT ISP LVD POR POSC I.R. LED Driver

2 Block Diagram

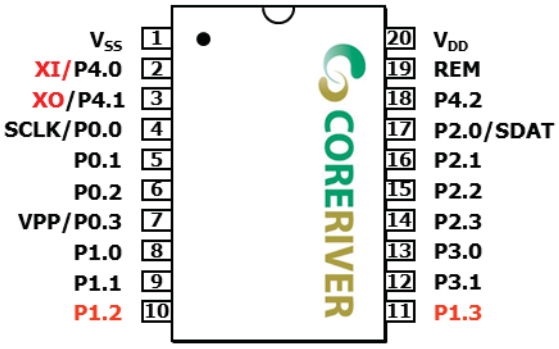
Figure shows the block diagram of ***ATOM120***. Programs reside in the internal program memory (Embedded Flash Memory). Data are read from or written to data memory (SRAM) or special function registers (SFRs).

The internal registers of ***ATOM120*** are configured as part of the on-chip RAM: therefore each register has an address.



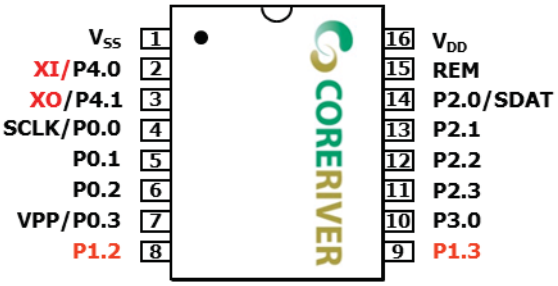
3 Pin Configuration

[20-SOP, 20-TSSOP]

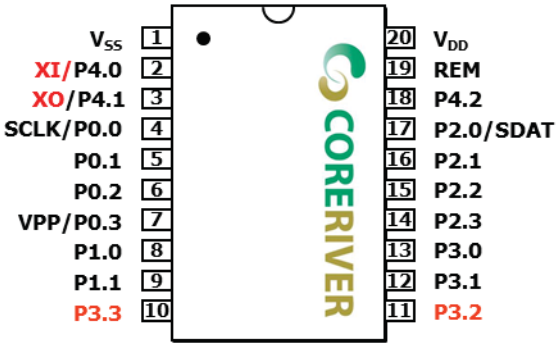


IOCFG[2] == 1 (Default)

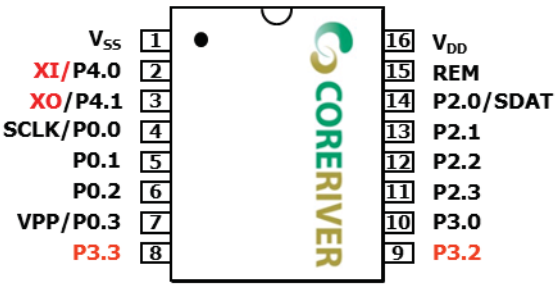
[16-TSSOP]



IOCFG[2] == 1 (Default)



IOCFG[2] == 0



IOCFG[2] == 0

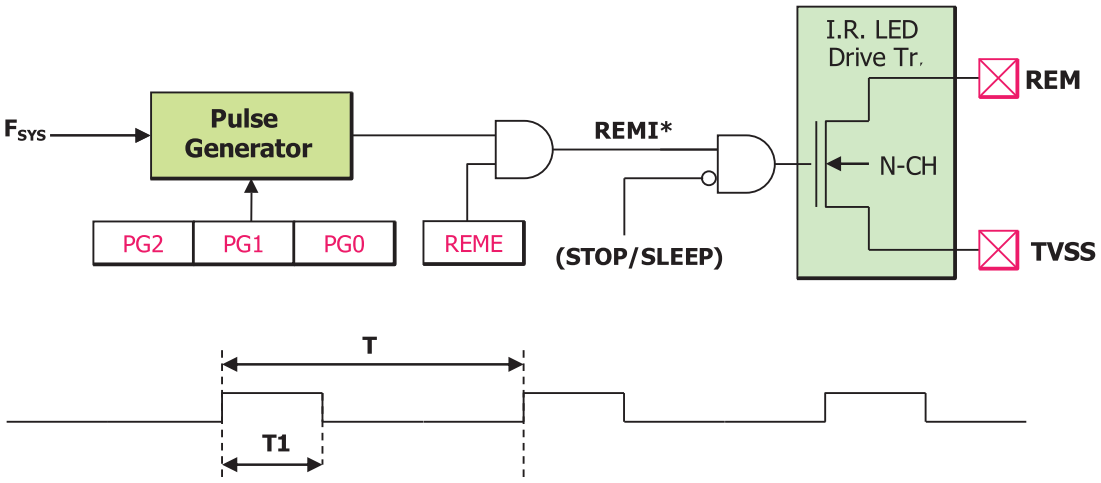
20-pin & 16-pin Package Diagram

4 Pin Description

Symbol	Direction	Description	Remark
V_{DD}	Power	Power Supply	
V_{SS}	Power	Ground	
REM	Output	Output for IR LED drive Transistor. The transistor is n-channel device.	
P4[2:0]	Output	Parallel open-drain Output port. If configured, P4[1:0] is used as XTAL oscillator PADs.	P4.0 : XI P4.1 : XO
P0[3:0]	Input	Parallel Input port with internal pull-up TR. The STOP mode is released by "L" input of each pin. P0[0] and P0[3] are also used for ISP of OTP memory.	P0.0 : SCLK P0.3 : VPP
P1[1:0]	Input	Parallel Input port with internal pull-up TR. The STOP mode is released by "L" input of each pin.	
P1[3:2]	Input/Output	Parallel Input/Output port. (If IOCFG[2] is set. Default I/O map.) Schmitt Trigger input and open-drain output with internal pull-up TR. The STOP mode is released by "L" input of each pin while the port register contains “H”.	
P2[3:0]	Input/Output	Parallel Input/Output port. Each bit can be individually set or cleared. Schmitt Trigger input and open-drain output with internal pull-up TR. P2[0] is also used for ISP of OTP memory.	P2.0 : SDAT
P3[1:0]	Input/Output	Parallel Input/Output port. Each bit can be individually set or cleared. Schmitt Trigger input and open-drain output with internal pull-up TR.	
P3[3:2]	Input/Output	Parallel Input/Output port. (If IOCFG[2] is cleared.) Schmitt Trigger input and open-drain output with internal pull-up TR.	

5 Carrier frequency generation

The ATOM1.1 family can drive an IR LED for remote controller application. It supports 7 carrier frequencies for data transmission. The REMC register is used for control of the IR LED driver and the carrier frequency.



IR LED driver control

The IR LED driver is a n-channel MOS transistor. The REM ouput is the inverse of the REMI* signal. The IR LED is turned on when REMI* is high.

REME	PG2	PG1	PG0	Transmission Control (REMI)
0	X	X	X	0 (Disable)
1	0	0	0	1/T = F_{OSC}/12, T1/T = 1/3
1	0	0	1	1/T = F_{OSC}/8, T1/T = 1/2
1	0	1	0	1/T = F_{OSC}/12, T1/T = 1/4
1	0	1	1	1 (No carrier)
1	1	0	0	1/T = F_{OSC}/12, T1/T = 1/2
1	1	0	1	1/T = F_{OSC}/8, T1/T = 1/4
1	1	1	0	1/T = F_{OSC}/11, T1/T = 4/11
1	1	1	1	1/T = F_{OSC}/92, T1/T = 1/2

Carrier frequency selection

6 Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
V_{DD}	DC supply voltage	-0.5 to V_{DD} + 0.5	V
V_{IN}	DC input voltage	-0.5 to V_{DD} + 0.5	V
V_{OUT}	DC output Voltage	-0.5 to V_{DD} + 0.5	V
I_{OH}	DC outpur high current	One I/O pin active: -25	mA
		All I/O pins active: -100	mA
I_{OL}	DC output low current	One I/O pin active: 30	mA
		All I/O pins active: 150	mA
T_{STG}	Storage temperature	-55 to 125	°C

7 Recommended Operating Conditions

Symbol	Parameter	Rating	Unit
V_{DD}	DC supply voltage	1.8 to 3.6	V
T_A	Industrial temperature range	-20 to 70	°C

8 DC Characteristics

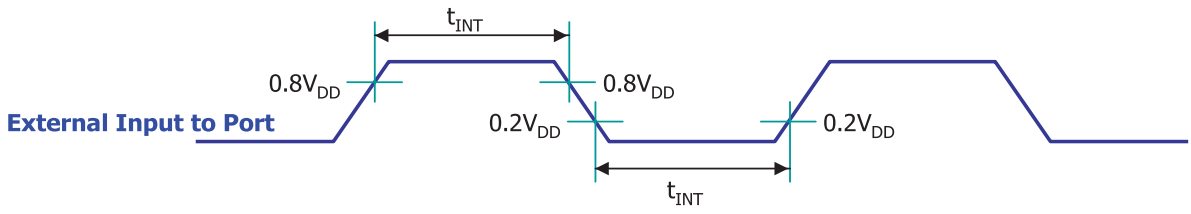
(T_A= -20°C ~ +70°C, V_{DD}=1.2V ~ 3.6V unless otherwise specified)

Parameter	Symbol	Pin	Conditions	Value			Unit
				Min.	Typ.	Max.	
Input low voltage	V_{IL1}	P0, P1, P2, P3	V_{DD}=1.2V~3.6V	-0.5	-	$0.2V_{DD}$ - 0.1	V
Input high voltage	V_{IH1}	P0, P1, P2, P3	V_{DD}=1.2V~3.6V	$0.2V_{DD}$ + 1.0	-	V_{DD}+0.5	V
Input high leakage current	I_{IH}	All pins except XI, XO	V_{IN} = V_{DD}	-1	-	+1	uA
Output low voltage	V_{OL}	P1[3:2],P2,P3,P4	I_{OL}=20mA @V_{DD}=3.6V (I_{OL}=3mA @V_{DD}=1.8V)	-	-	$0.3V_{DD}$	V
Output low voltage	V_{OL2}	REM	I_{OL}=250mA @V_{DD}=3V	-	-	0.3	V
Output high voltage	V_{OH}	P2 (push-pull output)	I_{OH}=-15mA @V_{DD}=5V	$0.7V_{DD}$	-	-	V
Output high voltage	V_{OHP}	Pull-up current	I_{OHP}=-40uA @V_{DD}=3.6V (I_{OHP}=-15uA @V_{DD}=1.8V)	$0.7V_{DD}$	-	-	V
Pin capacitance	C_{IO}	All	V_{DD} = 3.6V	-	10	-	pF

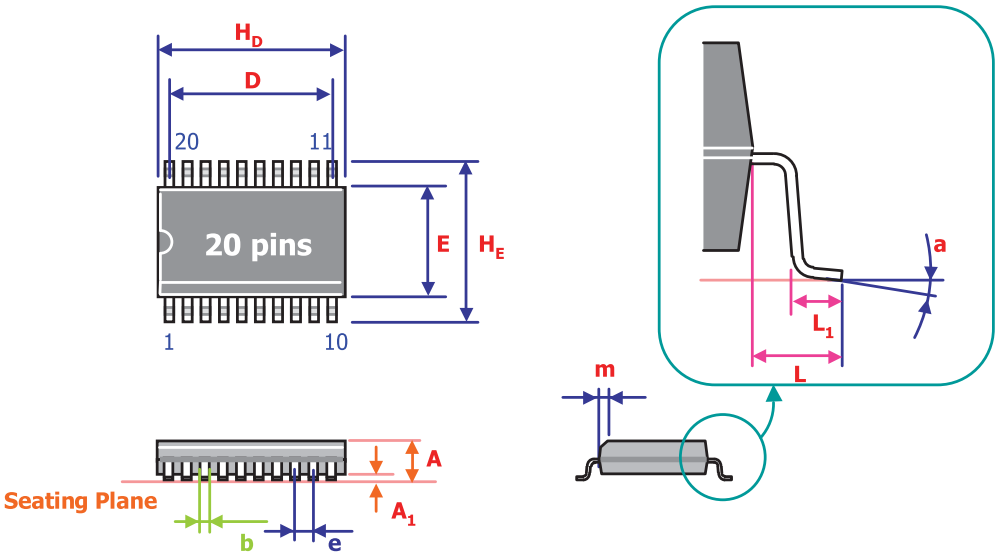
9 AC Characteristics

(T_A=-20°C ~ +70°C unless otherwise specified)

Parameter	Symbol	Pin	Conditions	Value			Unit
				Min.	Typ.	Max.	
Operating Frequency (Internal Clock)	F_{OSC}		1.8V ≤V_{DD}≤3.6V	-	3.64	-	MHz
			1.2V ≤V_{DD}≤1.8V	-	-	-	
Operating Frequency (External Clock)	F_{OSC}	XI, XO	1.8V ≤V_{DD}≤3.6V	-	-	4	MHz
			1.2V ≤V_{DD}≤1.8V	-	-	0.5	
System Frequency	F_{SYS}		1.2V ≤V_{DD}≤3.6V	1/8	-	1	F_{OSC}
External Input Width	t_{INT}	P0, P1, P2, P3	1.2V ≤V_{DD}≤3.6V	12	-	-	F_{SYS}



10 20-pin SOIC Package Dimension

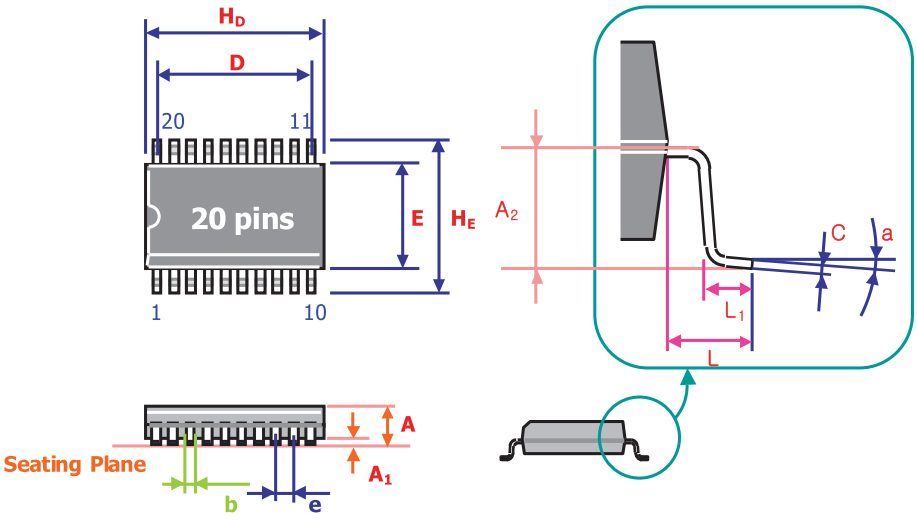


Symbol	Dimension in Inches			Dimension in mm		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	0.106	-	-	2.7
A_1	0.004	-	-	0.1	-	-
b	0.013	0.016	0.020	0.324	0.4	0.51
E	0.264	0.295	0.324	6.71	7.5	8.23
H_D	0.495	0.504	0.512	12.57	12.8	13
H_E	0.394	0.406	0.419	10.0	10.3	10.643
L	0.016	-	0.052	0.406	-	1.32
a	0°	-	8°	0°	-	8°
e	0.050 BSC			1.27 BSC		

Notes:

1. **Dimension D & E include mold mismatch and are determined at the mold parting line.**
2. **General appearance spec. should be based on final visual inspection spec.**

11 20-pin TSSOIC Package Dimension

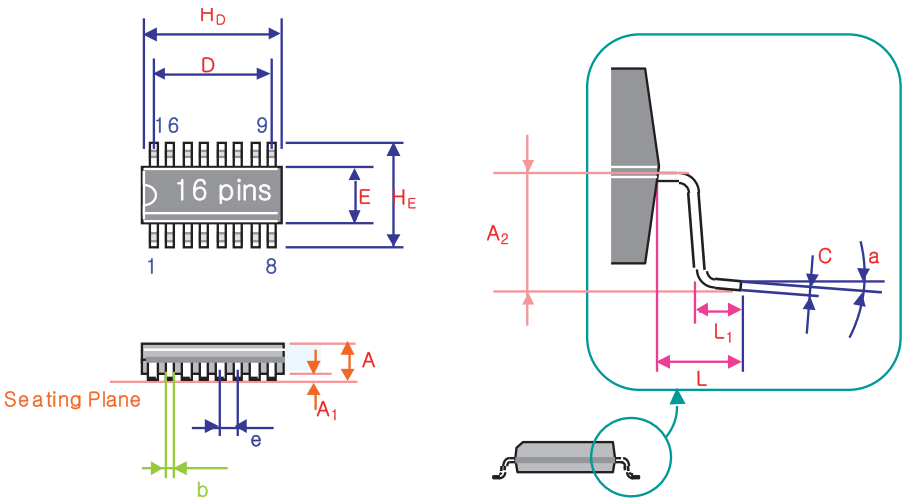


Symbol	Dimension in Inches			Dimension in mm		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	0.043	-	-	1.1
A_1	0.001	-	0.006	0.020	-	0.150
A_2	0.026	0.028	0.030	0.65	0.7	0.75
b	0.007	-	0.012	0.190	-	0.300
C	0.004	0.006	0.008	0.09	0.145	0.20
D	-	0.234	-	-	5.850	-
E	0.169	0.174	0.177	4.300	4.400	4.500
H_D	0.252	0.254	0.259	6.400	6.500	6.600
H_E	0.246	0.252	0.258	6.250	6.400	6.550
L	0.038	0.039	0.040	0.975	1.000	1.025
L_1	0.020	0.024	0.028	0.500	0.600	0.700
a	1°	-	7°	1°	-	7°
e	0.026 BSC			0.65 BSC		

Notes:

1. **Dimension D & E include mold mismatch and are determined at the mold parting line.**
2. **General appearance spec. should be based on final visual inspection spec.**

12 16-pin TSSOIC Package Dimension

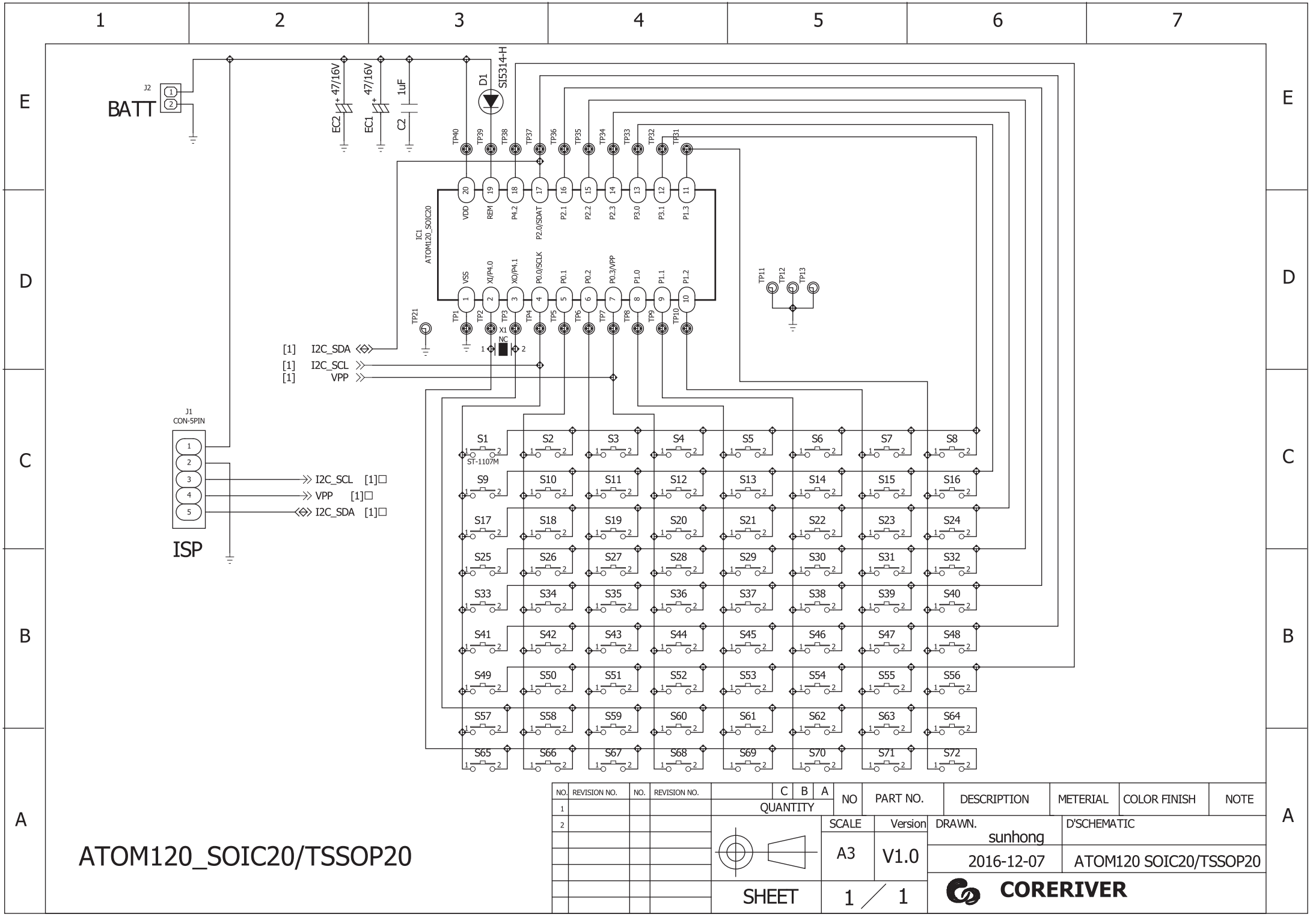


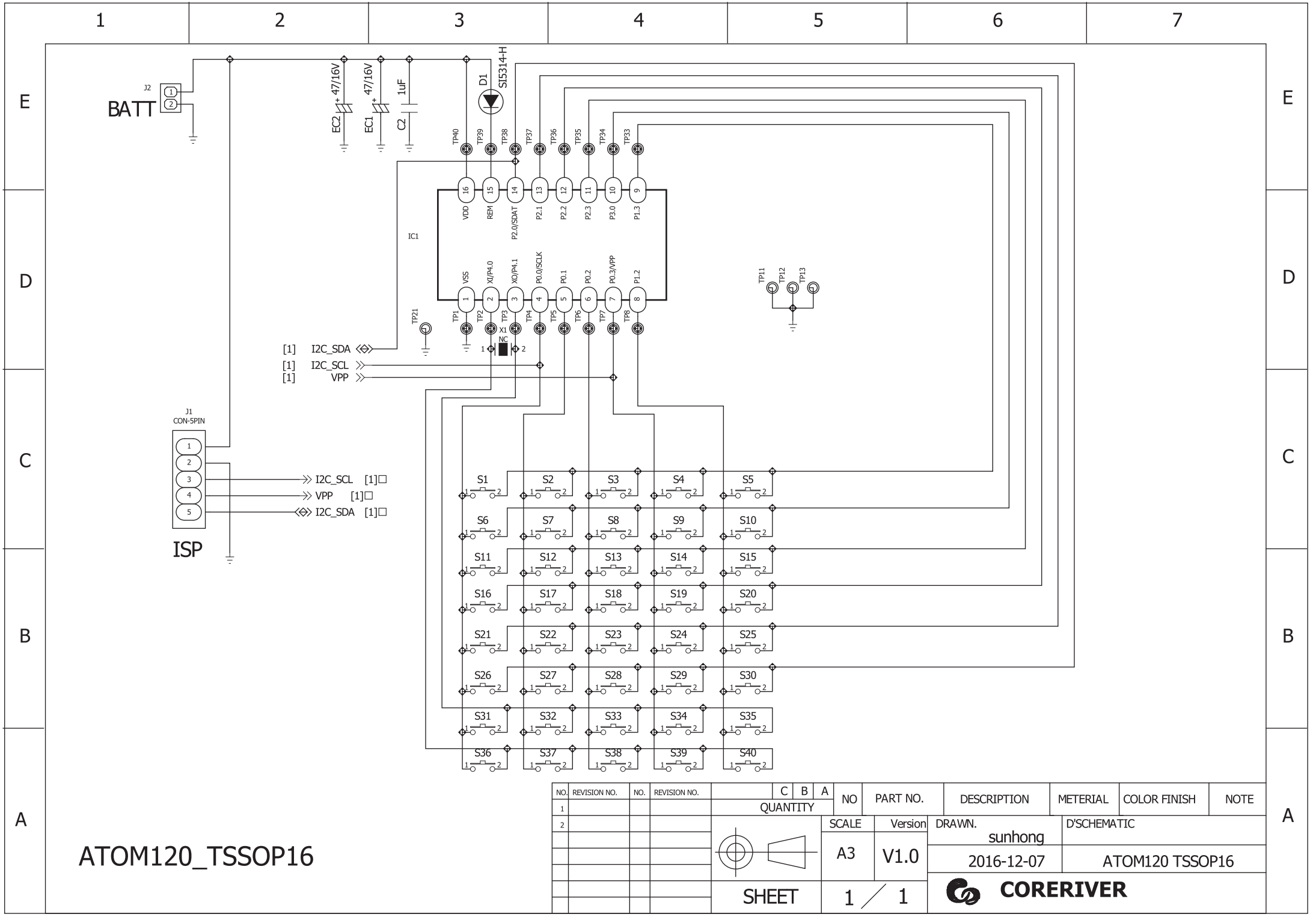
Symbol	Dimension in Inches			Dimension in mm		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.037	0.039	0.041	0.95	1.00	1.05
A_1	0.015	0.017	0.019	0.3865	0.4365	0.4865
A_2	0.026	0.028	0.030	0.65	0.7	0.75
b	0.008	0.009	0.009	0.20	0.22	0.24
C	0.004	0.006	0.008	0.09	0.145	0.20
D	0.176	0.179	0.182	4.47	4.55	4.63
E	0.171	0.173	0.175	4.35	4.4	4.45
H_D	0.200	0.202	0.204	5.077	5.127	5.177
H_E	0.248	0.252	0.256	6.30	6.40	6.50
L	0.033	0.037	0.041	0.85	0.95	1.05
L_1	0.020	0.024	0.028	0.50	0.60	0.70
a	1°	3°	5°	1°	3°	5°
e	0.026 BSC			0.65 BSC		

Notes:

1. Dimension D & E include mold mismatch and are determined at the mold parting line.

2. General appearance spec. should be based on final visual inspection spec.


BATT
J2
EC2 47/16V
EC1 47/16V
C2 1uF
D1 SI5314-H
IC1 ATOM120_SOIC20
VDD REM P4.2 P2.0/SDAT P2.1 P2.2 P2.3 P3.0 P3.1 P1.3
VSS X1/P4.0 X0/P4.1 P0.0/SCLK P0.1 P0.2 P0.3/VPP P1.0 P1.1 P1.2
[1] I2C_SDA
[1] I2C_SCL
[1] VPP
J1 CON-5PIN
I2C_SCL [1]
VPP [1]
I2C_SDA [1]
ISP
ST-1107M
ATOM120_SOIC20/TSSOP20
SHEET 1 / 1
SCALE A3
Version V1.0
DRAWN. sunhong
2016-12-07
D'SCHEMATIC
ATOM120 SOIC20/TSSOP20
CORERIVER


BATT
J2
EC2 47/16V
EC1 47/16V
C2 1uF
D1 SI5314-H
IC1
VDD REM P2.0/SDAT P2.1 P2.2 P2.3 P3.0 P1.3
VSS X1/P4.0 X0/P4.1 P0.0/SCLK P0.1 P0.2 P0.3/VPP P1.2
[1] I2C_SDA
[1] I2C_SCL
[1] VPP
J1
CON-5PIN
I2C_SCL [1]
VPP [1]
I2C_SDA [1]
ISP
S1 S2 S3 S4 S5
S6 S7 S8 S9 S10
S11 S12 S13 S14 S15
S16 S17 S18 S19 S20
S21 S22 S23 S24 S25
S26 S27 S28 S29 S30
S31 S32 S33 S34 S35
S36 S37 S38 S39 S40
ATOM120_TSSOP16
SCALE A3
Version V1.0
DRAWN. sunhong
2016-12-07
D'SCHEMATIC ATOM120 TSSOP16
SHEET 1 / 1
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