

CPU dan Mikrokomputer

TKC210 - Teknik Interface dan Peripheral

Eko Didik Widianto

Sistem Komputer - Universitas Diponegoro

- ▶ Pembahasan tentang:
 - ▶ Antarmuka mikrokontroler 8051 (AT89S51)
 - ▶ Antarmuka mikrokontroler AVR (ATMega32A)
 - ▶ Sumber daya mikrokomputer
 - ▶ Sumber clock
 - ▶ Rangkaian reset
- ▶ Referensi:
 - ▶ MCS@51 Microcontroller Family User's Manual
 - ▶ doc2487: AT89S51 Datasheet
 - ▶ doc8155: ATmega32A Datasheet

Mikrokontroler 8051

Mikrokontroler AT89S51

Antarmuka

Sinyal Port

Mikrokontroler
8051

Mikrokontroler
AVR

Sumber Clock

Kontrol Reset

Mikrokontroler AVR

Mikrokontroler ATmega32A

Antarmuka

Sinyal Port

Sumber Clock

Oscillator Internal

Sumber Clock Eksternal

Kontrol Reset

Reset

Power-On Reset

Mikrokontroler AT89S51

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- ▶ Mikrokontroler 8-bit dari Atmel (kompatibel dengan keluarga MCS-51)
 - ▶ Tegangan supply 4 - 5.5V
 - ▶ Operasi 0 - 33 MHz
- ▶ Memori flash In-System Programmable (ISP) 4KB
- ▶ RAM internal 128 x 8-bit
- ▶ Programmable I/O 32 jalur
- ▶ 2 Buah Timer/Counter 16-bit
- ▶ 6 Buah Sumber Interrupt
- ▶ UART full duplex

Mikrokontroler
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Mikrokontroler AT89S51
Antarmuka
Sinyal Port

Mikrokontroler
AVR

Sumber Clock

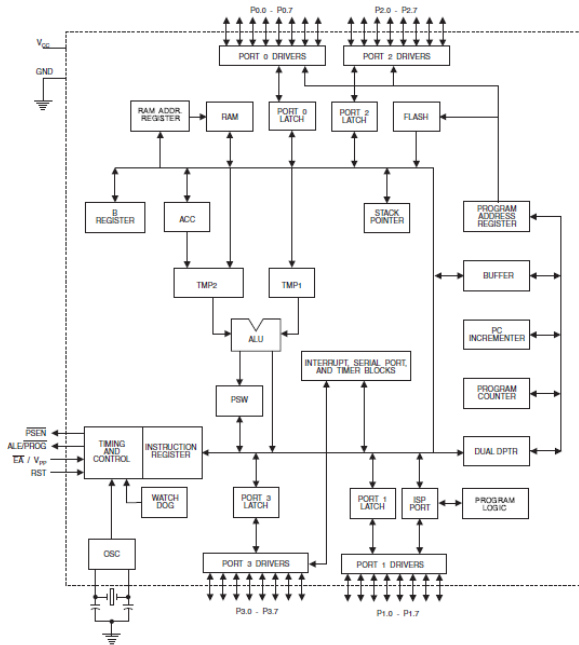
Kontrol Reset

Karakteristik DC

The values shown in this table are valid for $T_A = -40^{\circ}\text{C}$ to 85°C and $V_{CC} = 4.0\text{V}$ to 5.5V , unless otherwise noted.

Symbol	Parameter	Condition	Min	Max	Units
V_{IL}	Input Low Voltage	(Except \overline{EA})	-0.5	$0.2 V_{CC}-0.1$	V
V_{IL1}	Input Low Voltage (\overline{EA})		-0.5	$0.2 V_{CC}-0.3$	V
V_{IH}	Input High Voltage	(Except XTAL1, RST)	$0.2 V_{CC}+0.9$	$V_{CC}+0.5$	V
V_{IH1}	Input High Voltage	(XTAL1, RST)	$0.7 V_{CC}$	$V_{CC}+0.5$	V
V_{OL}	Output Low Voltage ⁽¹⁾ (Ports 1,2,3)	$I_{OL} = 1.6 \text{ mA}$		0.45	V
V_{OL1}	Output Low Voltage ⁽¹⁾ (Port 0, ALE, \overline{PSEN})	$I_{OL} = 3.2 \text{ mA}$		0.45	V
V_{OH}	Output High Voltage (Ports 1,2,3, ALE, \overline{PSEN})	$I_{OH} = -60 \mu\text{A}, V_{CC} = 5\text{V} \pm 10\%$	2.4		V
		$I_{OH} = -25 \mu\text{A}$	$0.75 V_{CC}$		V
		$I_{OH} = -10 \mu\text{A}$	$0.9 V_{CC}$		V
V_{OH1}	Output High Voltage (Port 0 in External Bus Mode)	$I_{OH} = -800 \mu\text{A}, V_{CC} = 5\text{V} \pm 10\%$	2.4		V
		$I_{OH} = -300 \mu\text{A}$	$0.75 V_{CC}$		V
		$I_{OH} = -80 \mu\text{A}$	$0.9 V_{CC}$		V

Diagram Block



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Antarmuka

Sinyal Port

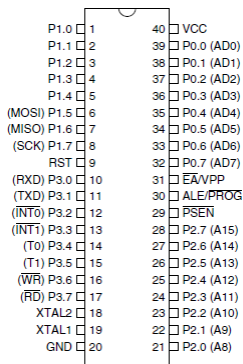
Mikrokontroler
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Sumber Clock

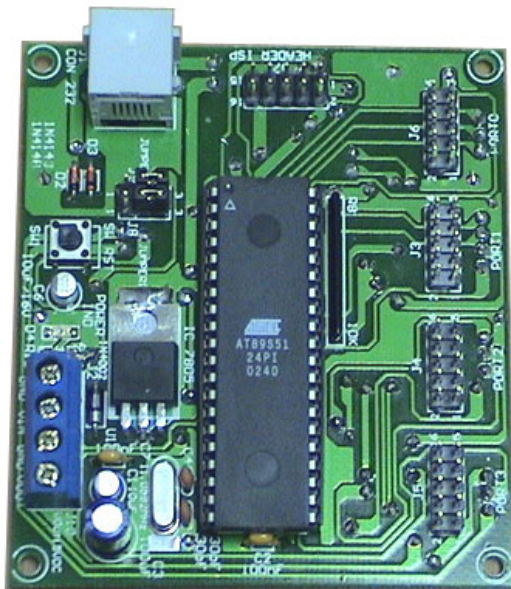
Kontrol Reset

Pin Antarmuka

- ▶ Pin antarmuka yang tersedia di AT89S51:
 1. Power: VCC (4-5.5V), GND
 2. Data I/O: Port 0, 1, 2 dan 3
 3. Pasif: clock (XTAL1, XTAL2)
 4. Kontrol: RST (I), ALE/nPROG(I/O), nPSEN (O) dan nEA/VPP (I)



Contoh Rangkaian



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Kontrol Reset

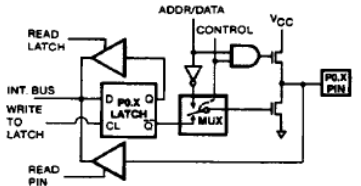
Sinyal Kontrol

$\overline{ALE}/\overline{PROG}$ (I/O), \overline{PSEN} (O) dan \overline{EA}/VPP (I)

- ▶ $\overline{ALE}/\overline{PROG}$ (Address Latch Enable), I/O
 - ▶ Output: latch low-byte alamat saat akses ke memori eksternal
 - ▶ Aktif hanya untuk perintah MOVX atau MOVC
 - ▶ Input: untuk memprogram flash
- ▶ \overline{PSEN} (Program Store Enable), Output
 - ▶ Read strobe untuk memori program eksternal
- ▶ \overline{EA}/VPP (External Access Enable), Input
 - ▶ \overline{EA} dihubungkan ke GND, agar mikrokontroler dapat mengambil kode (fetch) dari lokasi memori eksternal (0 - 0xFFFF)
 - ▶ \overline{EA} dihubungkan ke Vcc untuk eksekusi dari memori program internal

Port 0

I/O, Alamat low-byte, dan Program Flash



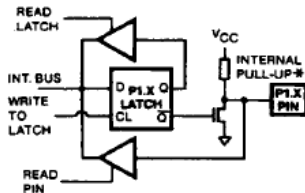
270252-2

A. Port 0 Bit

- ▶ Port I/O (P0.7-P0.0)
 - ▶ Output: dapat mensuplai 8 masukan TTL
 - ▶ Input: masukan high-impedance
- ▶ Alamat low-byte memori (A7-A0)
 - ▶ Untuk akses memori eksternal: program (fetch) dan data (R/W) yang menggunakan 16-bit alamat (MOVX @DPTR)
- ▶ Data untuk flash program (**D7-D0,paralel**)
 - ▶ Input: menerima byte kode saat memprogram flash
 - ▶ Output: menuliskan byte kode saat verifikasi.
 - ▶ **Perlu pull-up external**

Port 1

I/O, paralel flash program, Serial ISP



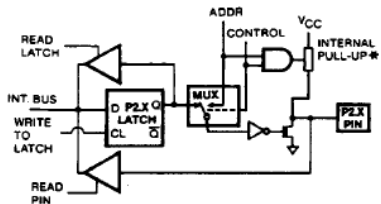
270252-3

B. Port 1 Bit

- ▶ Port I/O (P1.7-P1.0), bidi, internal pull-up
 - ▶ Output: dapat mensuplai 4 masukan TTL
 - ▶ Input: masukan, pulled high
- ▶ Alamat low-byte memori (A7-A0)
 - ▶ Untuk program dan verifikasi flash
- ▶ Serial flash programming/ISP
 - ▶ P1.5: MOSI (input, ISP)
 - ▶ P1.6: MISO (output, ISP)
 - ▶ P1.7: SCK (input, ISP)

Port 2

I/O, Eksternal Memori, Paralel Flash



C. Port 2 Bit

- ▶ Port I/O (P2.7-P2.0), bidi, internal pull-up
 - ▶ Output: dapat mensuplai 4 masukan TTL
 - ▶ Input: masukan, pulled high
- ▶ Alamat high-byte memori (A15-A8)
 - ▶ Untuk akses memori program eksternal program (fetch)
 - ▶ Akses memori data eksternal mode 16-bit, `MOVX @DPTR`
- ▶ Jalur data untuk menuliskan isi SFR (Special Function Register) P2, ***MOVX @RI***
- ▶ Alamat high-byte memori (A15-A8), Input
 - ▶ Untuk program dan verifikasi flash

Port 3

I/O, Paralel Flash, Fungsi Khusus

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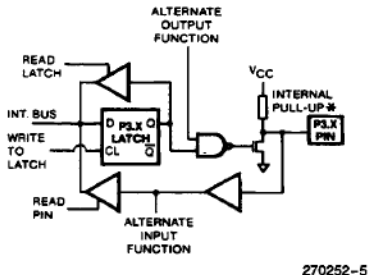
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D. Port 3 Bit

- ▶ Port I/O (P2.7-P2.0), bidi, internal pull-up
 - ▶ Output: dapat mensuplai 4 masukan TTL
 - ▶ Input: masukan, pulled high
- ▶ Jalur kontrol untuk pemrograman dan verifikasi flash
- ▶ Fungsi-fungsi Spesial

Port 3

Fungsi Khusus

Port Pin	Alternate Functions
P3.0	RXD (serial input port)
P3.1	TXD (serial output port)
P3.2	$\overline{\text{INT0}}$ (external interrupt 0)
P3.3	$\overline{\text{INT1}}$ (external interrupt 1)
P3.4	T0 (timer 0 external input)
P3.5	T1 (timer 1 external input)
P3.6	$\overline{\text{WR}}$ (external data memory write strobe)
P3.7	$\overline{\text{RD}}$ (external data memory read strobe)

ATMega32A



Hemat
Daya

RISC

32 register

32KB Flash

1024 Byte
EEPROM

Jtag

On Chip
Debugging

2K Byte
Sram

2 Timer 8-
bit

1 Timer 16-
bit

1 SPI

1 TWI

8 Ch 10-bit
ADC

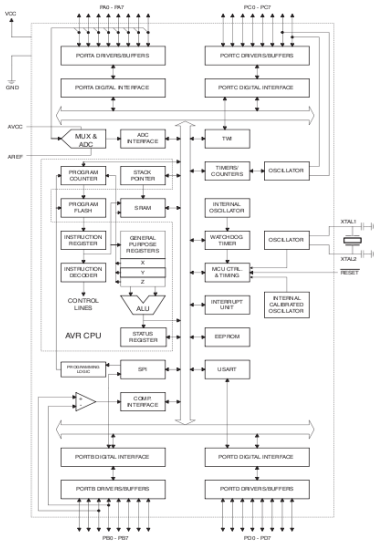
1 USART

Karakteristik DC

$T_A = -40^{\circ}\text{C}$ to 85°C , $V_{CC} = 2.7\text{ V}$ to 5.5 V (Unless Otherwise Noted)

Symbol	Parameter	Condition	Min	Typ	Max	Units
V_{IL}	Input Low Voltage except XTAL1 and RESET pins	$V_{CC} = 2.7 - 5.5$ $V_{CC} = 4.5 - 5.5$	-0.5		$0.2 V_{CC}^{(1)}$	V
V_{IH}	Input High Voltage except XTAL1 and RESET pins	$V_{CC} = 2.7 - 5.5$ $V_{CC} = 4.5 - 5.5$	$0.6 V_{CC}^{(2)}$		$V_{CC} + 0.5$	V
V_{IL1}	Input Low Voltage XTAL1 pin	$V_{CC} = 2.7 - 5.5$	-0.5		$0.1 V_{CC}^{(1)}$	V
V_{IH1}	Input High Voltage XTAL1 pin	$V_{CC} = 2.7 - 5.5$ $V_{CC} = 4.5 - 5.5$	$0.7 V_{CC}^{(2)}$		$V_{CC} + 0.5$	V
V_{IL2}	Input Low Voltage RESET pin	$V_{CC} = 2.7 - 5.5$	-0.5		$0.2 V_{CC}$	V
V_{IH2}	Input High Voltage RESET pin	$V_{CC} = 2.7 - 5.5$	$0.9 V_{CC}^{(2)}$		$V_{CC} + 0.5$	V
V_{OL}	Output Low Voltage ⁽³⁾ (Ports A,B,C,D)	$I_{OL} = 20\text{ mA}$, $V_{CC} = 5\text{ V}$ $I_{OL} = 10\text{ mA}$, $V_{CC} = 3\text{ V}$			0.7 0.5	V V
V_{OH}	Output High Voltage ⁽⁴⁾ (Ports A,B,C,D)	$I_{OH} = -20\text{ mA}$, $V_{CC} = 5\text{ V}$ $I_{OH} = -10\text{ mA}$, $V_{CC} = 3\text{ V}$	4.2 2.2			V V

Diagram Block



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Mikrokontroler ATmega32A

Antarmuka

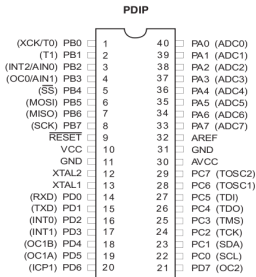
Sinyal Port

Sumber Clock

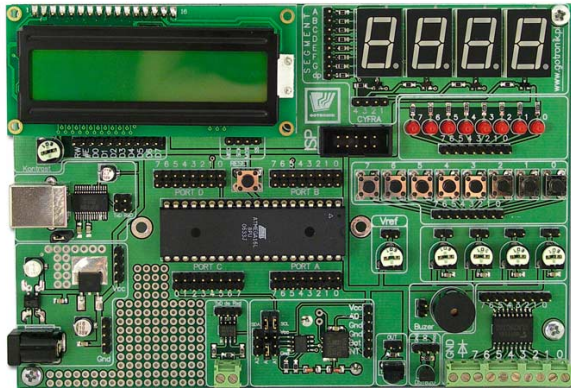
Kontrol Reset

Pin Antarmuka

- ▶ Pin antarmuka yang tersedia di ATmega32A:
 1. Power: VCC (4-5.5V), GND
 2. Data I/O: Port 0, 1, 2 dan 3
 3. Pasif: clock (XTAL1, XTAL2)
 4. Fungsi alternatif: ADC, SPI, USART, TWI, Timer



Contoh Rangkaian



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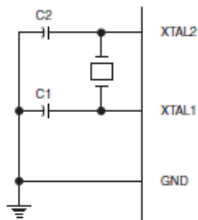
Kontrol Reset

http://programatory.com.pl/allegro/modul_1/modul_atmega_16c.jpg

On-Chip Oscillator

Frekuensi Clock 0 - 33 MHz

- ▶ Memberikan sumber clock untuk semua peripheral on-chip yang ada di mikrokontroler
- ▶ Menggunakan XTAL1 (I) dan XTAL2 (O)



C1, C2 = 30 pF \pm 10 pF for Crystals
= 40 pF \pm 10 pF for Ceramic Resonators

Clock Eksternal

Frekuensi Clock 0 - 33 MHz

- ▶ Menggunakan pin XTAL1 sebagai input

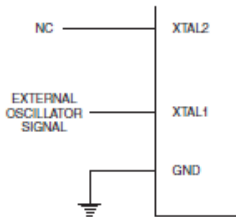
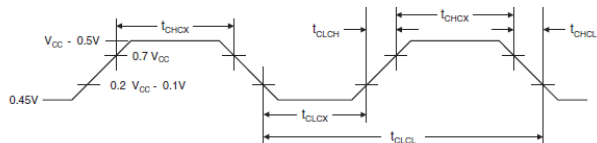


Diagram Pewaktuan Clock Eksternal

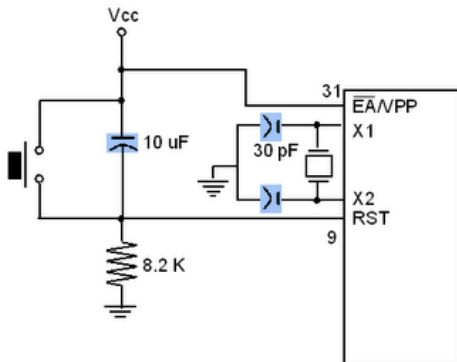


Symbol	Parameter	Min	Max	Units
$1/t_{CLCL}$	Oscillator Frequency	0	33	MHz
t_{CLCL}	Clock Period	30		ns
t_{CHCX}	High Time	12		ns
t_{CLCX}	Low Time	12		ns
t_{CLCH}	Rise Time		5	ns
t_{CHCL}	Fall Time		5	ns

- ▶ Untuk menginisialisasi SFR, terutama PC/program counter
- ▶ Masukan reset disambungkan ke pin RST
 - ▶ Komponen untuk reset berupa push-button yang disambungkan ke VDD
- ▶ Reset akan terjadi dengan menekan push-button (menahan pin RST '1') selama setidaknya 2 cycle mesin (24 periode clock)
- ▶ Sinyal reset adalah asinkron terhadap clock internal

Skematik Rangkaian Reset

Power-on Reset dan Asinkron Reset



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Power-On Reset