LAMPIRAN A : LISTING PROGRAM

```
                ORG     00
                LJMP    START

PORT_A          EQU     0E000H
PORT_B          EQU     0E001H
PORT_C          EQU     0E002H
CP              EQU     0E003H
CW              EQU     82H

INIT_PPI:       MOV     DPTR,#CP
                MOV     A,#CW
                MOVX    @DPTR,A
                RET

DELAY:          MOV     R7,#0FFH
                 DJNZ    R7,$
                RET

DELAY1:         PUSH    A
                MOV     R7,#0EFH
DL1:            MOV     A,R7
                ACALL   DELAY
                MOV     R7,A
                DJNZ    R7,DL1
                POP     A
                RET

INIT_LCD:       MOV     DPTR,#0C000H
                MOV     A,#00111000B
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,#00001100B
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,#00000110B
                MOVX    @DPTR,A
                ACALL   DELAY
                RET

LOGO_1:         MOV     DPTR,#0C001H
                ACALL   DELAY
                MOV     A,#01000100B    ; D
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,#01000001B    ; A
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,#01010110B    ; V
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,#01001001B    ; I
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,#01000100B    ; D
                MOVX    @DPTR,A
```

```
ACALL   DELAY

MOV     A,#11111110B    ;
MOVX    @DPTR,A
ACALL   DELAY
MOV     A,#01000001B    ; A
MOVX    @DPTR,A
ACALL   DELAY
MOV     A,#11111110B    ;
MOVX    @DPTR,A
ACALL   DELAY

MOV     A,#01010011B    ; S
MOVX    @DPTR,A
ACALL   DELAY
MOV     A,#01000001B    ; A
MOVX    @DPTR,A
ACALL   DELAY
MOV     A,#01001110B    ; N
MOVX    @DPTR,A
ACALL   DELAY
MOV     A,#01010100B    ; T
MOVX    @DPTR,A
ACALL   DELAY
MOV     A,#01001111B    ; O
MOVX    @DPTR,A
ACALL   DELAY
MOV     A,#01010011B    ; S
MOVX    @DPTR,A
ACALL   DELAY
MOV     A,#01001111B    ; O
MOVX    @DPTR,A
ACALL   DELAY

MOV     DPTR,#0C000H  ; DDRAM ADDRESS SET(40)
MOV     A,#11000000B
MOVX    @DPTR,A
ACALL   DELAY

MOV     DPTR,#0C001H
ACALL   DELAY

MOV     A,#01001110B    ; N
MOVX    @DPTR,A
ACALL   DELAY
MOV     A,#01010010B    ; R
MOVX    @DPTR,A
ACALL   DELAY
MOV     A,#01010000B    ; P
MOVX    @DPTR,A
ACALL   DELAY
MOV     A,#00111010B    ; :
MOVX    @DPTR,A
ACALL   DELAY
MOV     A,#00110010B    ; 2
```

```
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,#00110011B    ; 3
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,#00110100B    ; 4
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,#00111000B    ; 8
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,#00110101B    ; 5
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,#00110000B    ; 0
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,#00111001B    ; 9
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,#00110100B    ; 4
                MOVX    @DPTR,A
                ACALL   DELAY
                RET

LOGO_2:         ACALL   DELAY
                MOV     DPTR,#0C001H
                MOV     A,#043H         ; C
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,#075H         ; u
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,#072H         ; r
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,#072H         ; r
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,#11111110B    ; SPASI
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,#054H         ; T
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,#065H         ; e
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,#06DH         ; m
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,#070H         ; p
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,#00111010B    ; :
```

```
            MOVX    @DPTR,A
            ACALL   DELAY

            MOV     DPTR,#0C000H    ; DD RAM ADDRESS SET 40H
            MOV     A,#11000000B
            MOVX    @DPTR,A
            ACALL   DELAY

            MOV     DPTR,#0C001H
            MOV     A,#044H         ; D
            MOVX    @DPTR,A
            ACALL   DELAY
            MOV     A,#065H         ; e
            MOVX    @DPTR,A
            ACALL   DELAY
            MOV     A,#073H         ; s
            MOVX    @DPTR,A
            ACALL   DELAY
            MOV     A,#074H         ; t
            MOVX    @DPTR,A
            ACALL   DELAY
            MOV     A,#11111110B    ; SPASI
            MOVX    @DPTR,A
            ACALL   DELAY
            MOV     A,#054H         ; T
            MOVX    @DPTR,A
            ACALL   DELAY
            MOV     A,#065H         ; e
            MOVX    @DPTR,A
            ACALL   DELAY
            MOV     A,#06DH         ; m
            MOVX    @DPTR,A
            ACALL   DELAY
            MOV     A,#070H         ; p
            MOVX    @DPTR,A
            ACALL   DELAY
            MOV     A,#00111010B    ; :
            MOVX    @DPTR,A
            ACALL   DELAY
            RET

CLEAR:      MOV     DPTR,#0C000H
            MOV     A,#01H
            MOVX    @DPTR,A
            ACALL   DELAY
            RET

CURRENT:    MOV     DPTR,#0C000H ; DD RAM ADDRESS SET 0A H
            MOV     A,#10001010B ;
            MOVX    @DPTR,A      ;
            ACALL   DELAY        ;

            MOV     DPTR,#0C001H
```

```
                MOV     A,71H
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,70H
                MOVX    @DPTR,A
                ACALL   DELAY
                RET

DESTINATION:    ACALL   DELAY
                MOV     DPTR,#0C000H ; BLINK [ON]
                MOV     A,#00001101B ;
                MOVX    @DPTR,A      ;
                ACALL   DELAY        ;

                MOV     DPTR,#0C001H
                MOV     A,R1
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,R0
                MOVX    @DPTR,A
                ACALL   DELAY
                RET

*************************************************************
*****           PROGRAM UTAMA                         *****
*************************************************************

START:          ACALL   DELAY
                ACALL   INIT_LCD
                ACALL   DELAY

                ACALL   INIT_PPI

                ACALL   CLEAR
                ACALL   DELAY
                ACALL   LOGO_1
                MOV     R6,#00FH
TAHAN:          ACALL   DELAY1
                DJNZ    R6,TAHAN


                MOV     DPTR,#0C000H ; DISPLAY SHIFTS TO THE LEFT
                MOV     A,#00011011B ;
                MOV     R6,#0EH      ;
GESER:          MOVX    @DPTR,A      ;
                ACALL   DELAY1       ;
                ACALL   DELAY1       ;
                ACALL   DELAY1       ;
                DJNZ    R6,GESER     ;

                ACALL   CLEAR
                ACALL   DELAY
                ACALL   LOGO_2
                ACALL   DELAY
```

```
                MOV     R2,#019H
                MOV     R1,#032H
                MOV     R0,#035H

                ACALL   DELAY
                MOV     DPTR,#0C000H
                MOV     A,#00001101B
                MOVX    @DPTR,A
                ACALL   DELAY

                MOV     DPTR,#0C001H
                MOV     A,R1            ; 2
                MOVX    @DPTR,A
                ACALL   DELAY
                MOV     A,R0            ; 5
                MOVX    @DPTR,A
                ACALL   DELAY

CHECK:          MOV     R5,#0FFH
LOOP1:          MOV     A,P1
                ACALL   DELAY
                DJNZ    R5,LOOP1

*****************************************************************
KEY1:           CJNE    A,#11111110B,KEY2
                CJNE    R1,#020H,DOWN
                CJNE    R0,#030H,DOWN
                AJMP    CHECK
DOWN:           CJNE    R0,#030H,DN2
                MOV     R0,#3AH
                CJNE    R1,#031H,DN1
                MOV     R1,#020H
                AJMP    DN2
DN1:            DEC     R1
DN2:            DEC     R0
                DEC     R2
                AJMP    PRINT

KEY2:           CJNE    A,#11111101B,KEY3
                CJNE    R1,#032H,UP
                CJNE    R0,#035H,UP
                AJMP    CHECK
UP:             CJNE    R0,#039H,UP2
                MOV     R0,#02FH
                CJNE    R1,#020H,UP1
                MOV     R1,#030H
UP1:            INC     R1
UP2:            INC     R0
                INC     R2
                AJMP    PRINT

PRINT:          ACALL   DELAY
                ACALL   DELAY
                ACALL   DELAY
                MOV     DPTR,#0C000H        ; DD RAM ADDRESS SET 4AH
```

```
                MOV     A,#11001010B
                MOVX    @DPTR,A
                ACALL   DELAY
                ACALL   DESTINATION
                AJMP    CHECK
*****************************************************************
KEY3:           CJNE    A,#11111011B,KEY30
                AJMP    KEY31
KEY30:          AJMP    KEY4
KEY31:          MOV     DPTR,#0C000H ; BLINK [OFF]
                MOV     A,#00001100B ;
                MOVX    @DPTR,A      ;
                ACALL   DELAY        ;

KEY32:          MOV     7FH,R2       ; 7F BERISI Vinput
                MOV     7AH,R2       ; 7A BERISI Vinput

                MOV     DPTR,#0C000H ; DD RAM ADDRESS SET 4F H
                MOV     A,#11001111B ;
                MOVX    @DPTR,A      ;
                ACALL   DELAY
                MOV     DPTR,#0C001H ; SPACE
                MOV     A,#020H      ;
                MOVX    @DPTR,A      ;
                ACALL   DELAY

K31:            MOV     R6,#0FFH

K311:           MOV     DPTR,#PORT_B ; INPUT DARI ADC
                MOVX    A,@DPTR      ;
                CJNE    A,7FH,K317
;---------------------------------------------------------------
;-----   jika V aktual = V input   ----------------------------
                ACALL   DELAY
                MOV     DPTR,#PORT_A ; KOMPRESOR[ON]+VALVE[ON]
                MOV     A,#00000011B ;
                MOVX    @DPTR,A      ;

                MOV     DPTR,#0C000H ; DD RAM ADDRESS SET 4F H
                MOV     A,#11001111B ;
                MOVX    @DPTR,A      ;
                ACALL   DELAY
                MOV     DPTR,#0C001H ; *
                MOV     A,#02AH      ;
                MOVX    @DPTR,A      ;

CK:             MOV     R5,#0FFH     ; ADA TOMBOL YG DITEKAN?
LP1:            MOV     A,P1         ;
                CJNE    A,#0FFH,K312 ;
                DJNZ    R5,LP1       ;
                AJMP    K313
K312:           LJMP    CHECK
K313:           MOV     DPTR,#PORT_B ; INPUT DARI ADC
                MOVX    A,@DPTR      ;
                CJNE    A,7AH,STABIL1
```

```
                AJMP    CK
STABIL1:        DEC     7AH
                CJNE    A,7AH,STABIL2
                AJMP    CK
STABIL2:        INC     7AH
                INC     7AH
                CJNE    A,7AH,KEY32
                AJMP    CK

;-----------------------------------------------------------------
;-----   jika V aktual <> V input   --------------------------
K317:           DJNZ    R6,K311

K32:            CJNE    A,7FH,KECIL
                AJMP
KECIL:          JC      NAIK
BESAR:          AJMP    TURUN

NAIK:           MOV     DPTR,#PORT_A  ; KOMPRESOR[OFF]+VALVE[ON]
                MOV     A,#00000001B  ;
                MOVX    @DPTR,A       ;
                AJMP    SUHU_ACT      ;

TURUN:          MOV     DPTR,#PORT_A  ; KOMPRESOR[ON]+VALVE[OFF]
                MOV     A,#00000010B  ;
                MOVX    @DPTR,A       ;
                AJMP    SUHU_ACT      ;


SUHU_ACT:       MOV     DPTR,#PORT_B  ;INPUT DARI ADC
                MOVX    A,@DPTR       ;

USA1:           CJNE    A,#01EH,KECIL1
                AJMP    BESAR1
KECIL1:         JC      USA2
BESAR1:         MOV     71H,#032H
                MOV     70H,#039H
                MOV     72H,#027H
PERIKSA1:       CJNE    A,72H,TURUN1
                ACALL   CURRENT
                AJMP    K34
TURUN1:         DEC     72H
                DEC     70H
                AJMP    PERIKSA1

USA2:           CJNE    A,#014H,KECIL2
                AJMP    BESAR2
KECIL2:         JC      USA3
BESAR2:         MOV     71H,#032H
                MOV     70H,#039H
                MOV     72H,#01DH
PERIKSA2:       CJNE    A,72H,TURUN2
                ACALL   CURRENT
                AJMP    K34
TURUN2:         DEC     72H
```

```
                DEC     70H
                AJMP    PERIKSA2

USA3:           CJNE    A,#0AH,KECIL3
                AJMP    BESAR3
KECIL3:         JC      USA4
BESAR3:         MOV     71H,#031H
                MOV     70H,#039H
                MOV     72H,#013H
PERIKSA3:       CJNE    A,72H,TURUN3
                ACALL   CURRENT
                AJMP    K34
TURUN3:         DEC     72H
                DEC     70H
                AJMP    PERIKSA3

USA4:           CJNE    A,#00H,KECIL4
                AJMP    BESAR4
KECIL4:         JC      USA5
BESAR4:         MOV     71H,#020H
                MOV     70H,#039H
                MOV     72H,#009H
PERIKSA4:       CJNE    A,72H,TURUN4
                ACALL   CURRENT
                AJMP    K34
TURUN4:         DEC     72H
                DEC     70H
                AJMP    PERIKSA4

USA5:           MOV     71H,#02AH       ; OUT OF RANGE
                MOV     70H,#02AH       ;
                ACALL   CURRENT         ;
                AJMP    K34
K34:            MOV     R6,#0FFH        ; ADA TOMBOL YG DITEKAN?
LP2:            MOV     A,P1            ;
                CJNE    A,#0FFH,K36     ;
                DJNZ    R6,LP2          ;
                AJMP    K37
K36:            LJMP    CHECK
K37:            AJMP    K31


*****************************************************************
KEY4:           CJNE    A,#11110111B,KEY5
                ACALL   DELAY
                MOV     DPTR,#PORT_A
                MOV     A,#00000000B
                MOVX    @DPTR,A
                ACALL   DELAY
                AJMP    CHECK
*****************************************************************
KEY5:           CJNE    A,#11101111B,KEY6
                ACALL   DELAY
                MOV     DPTR,#PORT_A
                MOV     A,#11111111B
```

```
                MOVX    @DPTR,A
                ACALL   DELAY
                AJMP    CHECK

*********************************************************************
KEY6:           CJNE    A,#11011111B,K61
                MOV     R6,#05H
                MOV     DPTR,#PORT_A
K60:            MOV     A,#00000001B
                MOVX    @DPTR,A
                ACALL   DELAY1
                MOV     A,#00000010B
                MOVX    @DPTR,A
                ACALL   DELAY1
                DJNZ    R6,K60
                MOV     A,#00000000B
                MOVX    @DPTR,A
K61:            AJMP    CHECK

                END     START
```

LAMPIRAN B : TEMPERATURE SENSOR LM 355

National Semiconductor Corporation

LM135/LM235/LM335, LM135A/LM235A/LM335A Precision Temperature Sensors

General Description

The LM135 series are precision, easily-calibrated, integrated circuit temperature sensors. Operating as a 2-terminal zener, the LM135 has a breakdown voltage directly proportional to absolute temperature at +10 mV/°K. With less than 1Ω dynamic impedance the device operates over a current range of 400 μA to 5 mA with virtually no change in performance. When calibrated at 25°C the LM135 has typically less than 1°C error over a 100°C temperature range. Unlike other sensors the LM135 has a linear output.

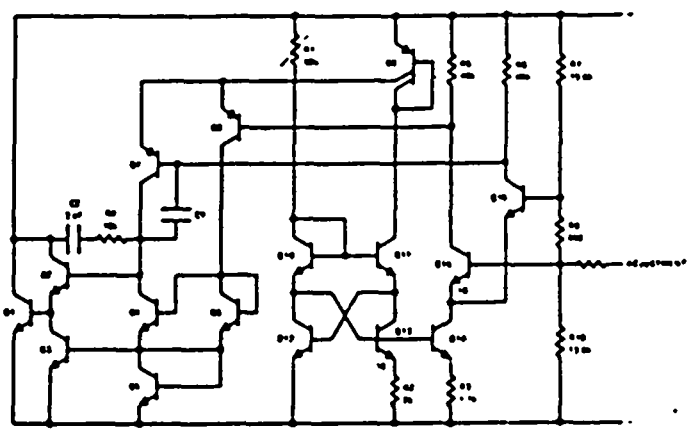
Applications for the LM135 include almost any type of temperature sensing over a −55°C to +150°C temperature range. The low impedance and linear output make interfacing to readout or control circuitry especially easy.

The LM135 operates over a −55°C to +150°C temperature range while the LM235 operates over a −40°C to +125°C temperature range. The LM335 operates from −40°C to +100°C. The LM135/LM235/LM335 are available packaged in hermetic TO-46 transistor packages while the LM335 is also available in plastic TO-92 packages.

Features

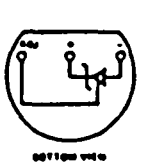
- Directly calibrated in °Kelvin
- 1°C initial accuracy available
- Operates from 400 μA to 5 mA
- Less than 1Ω dynamic impedance
- Easily calibrated
- Wide operating temperature range
- 200°C overrange
- Low cost

Schematic Diagram



Connection Diagrams

TO-92
Plastic Package



Order Number LM335Z or LM335AZ
See NS Package Number Z03A

TO-46
Metal Can Package*

Order Number LM135H, LM235H, LM335H, LM135AH, LM235AH or LM335AH
See NS Package Number H03H

If Military/Aerospace specified devices are required, contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

(Note 4)

Reverse Current	15 mA
Forward Current	10 mA
Storage Temperature	
TO-46 Package	−60°C to +180°C
TO-92 Package	−60°C to +150°C

Specified Operating Temp. Range

	Continuous	Intermittent (Note 2)
LM135, LM135A	−55°C to +150°C	150°C to 200°C
LM235, LM235A	−40°C to +125°C	125°C to 150°C
LM335, LM335A	−40°C to +100°C	100°C to 125°C

Lead Temp. (Soldering, 10 seconds)

TO-92 Package	260°C
TO-46 Package	300°C

Temperature Accuracy LM135/LM235, LM135A/LM235A (Note 1)

Parameter	Conditions	LM135A/LM235A			LM135/LM235			Units
		Min	Typ	Max	Min	Typ	Max	
Operating Output Voltage	T_C = 25°C, I_R = 1 mA	2.97	2.98	2.99	2.95	2.98	3.01	V
Uncalibrated Temperature Error	T_C = 25°C, I_R = 1 mA		0.5	1		1	3	°C
Uncalibrated Temperature Error	$T_{MIN} \le T_C \le T_{MAX}$, I_R = 1 mA		1.3	2.7		2	5	°C
Temperature Error with 25°C Calibration	$T_{MIN} \le T_C \le T_{MAX}$, I_R = 1 mA		0.3	1		0.5	1.5	°C
Calibrated Error at Extended Temperatures	$T_C = T_{MAX}$ (Intermittent)		2			2		°C
Non-Linearity	I_R = 1 mA		0.3	0.5		0.3	1	°C

Temperature Accuracy LM335, LM335A (Note 1)

Parameter	Conditions	LM335A			LM335			Units
		Min	Typ	Max	Min	Typ	Max	
Operating Output Voltage	T_C = 25°C, I_R = 1 mA	2.95	2.98	3.01	2.92	2.98	3.04	V
Uncalibrated Temperature Error	T_C = 25°C, I_R = 1 mA		1	3		2	6	°C
Uncalibrated Temperature Error	$T_{MIN} \le T_C \le T_{MAX}$, I_R = 1 mA		2	5		4	9	°C
Temperature Error with 25°C Calibration	$T_{MIN} \le T_C \le T_{MAX}$, I_R = 1 mA		0.5	1		1	2	°C
Calibrated Error at Extended Temperatures	$T_C = T_{MAX}$ (Intermittent)		2			2		°C
Non-Linearity	I_R = 1 mA		0.3	1.5		0.3	1.5	°C

Electrical Characteristics (Note 1)

Parameter	Conditions	LM135/LM235 LM135A/LM235A			LM335 LM335A			Units
		Min	Typ	Max	Min	Typ	Max	
Operating Output Voltage Change with Current	400 µA ≤ I_R ≤ 5 mA At Constant Temperature		2.5	10		3	14	mV
Dynamic Impedance	I_R = 1 mA		0.5			0.6		Ω
Output Voltage Temperature Coefficient			+10			+10		mV/°C
Time Constant	Still Air		80			80		sec
	100 ft/Min Air		10			10		sec
	Stirred Oil		1			1		sec
Time Stability	T_C = 125°C		0.2			0.2		°C/kHr

Note 1: Accuracy measurements are made in a well stirred oil bath. For other conditions, self heating must be considered.

Note 2: Continuous operation at these temperatures for 10,000 hours for H package and 5,000 hours for Z package may decrease the expectancy of the device.

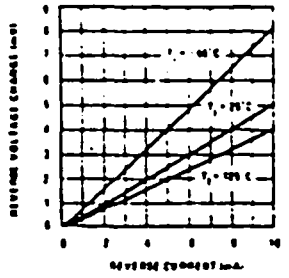
Note 3: Thermal Resistance

	TO-92	TO-46
θ_{JA} (junction to ambient)	202°C/W	400°C/W
θ_{JC} (junction to case)	170°C/W	N/A

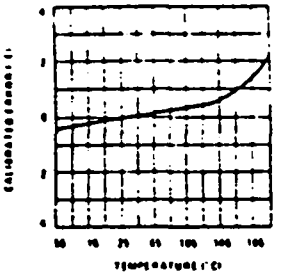
Note 4: Refer to RETS135H for military specifications.

Typical Performance Characteristics

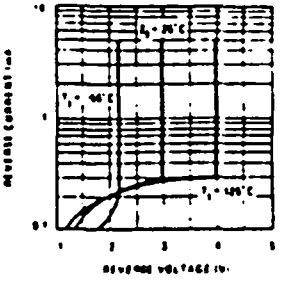
Reverse Voltage Change



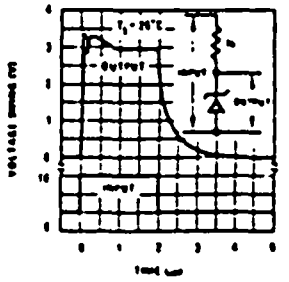
Calibrated Error



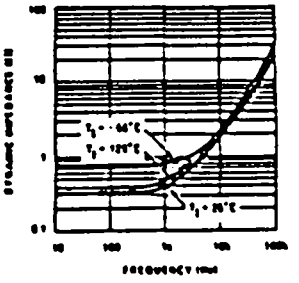
Reverse Characteristics



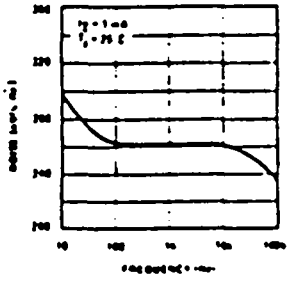
Response Time



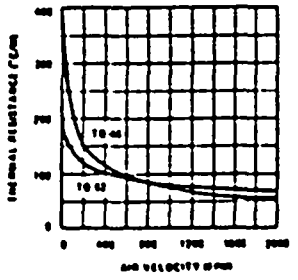
Dynamic Impedance



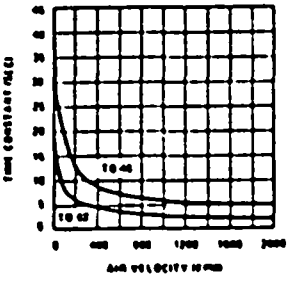
Noise Voltage



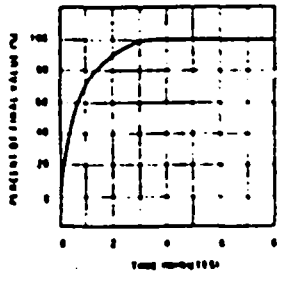
Thermal Resistance Junction to Air



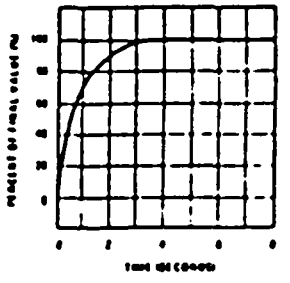
Thermal Time Constant



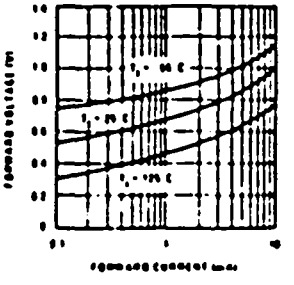
Thermal Response In Still Air



Thermal Response In Stirred Oil Bath



Forward Characteristics



LAMPIRAN C : PROGRAMMABLE PERIPHERAL INTERFACE 8255

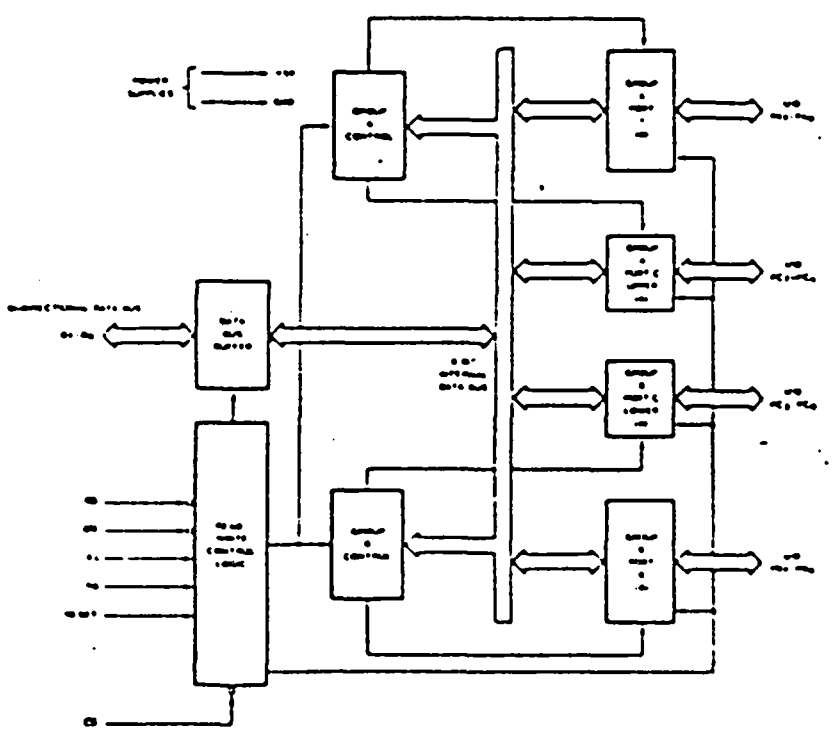
intel

8255A/8255A-5
PROGRAMMABLE PERIPHERAL INTERFACE

- MCS-85™ Compatible 8255A-5
- 24 Programmable I/O Pins
- Completely TTL Compatible
- Fully Compatible with Intel *Microprocessor Families*
- Improved Timing Characteristics
- Direct Bit Set/Reset Capability Easing *Control Application Interface*
- Reduces System Package Count
- Improved DC Driving Capability
- Available in EXPRESS
  - Standard Temperature Range
  - Extended Temperature Range
- 40 Pin DIP Package or 44 Lead PLCC

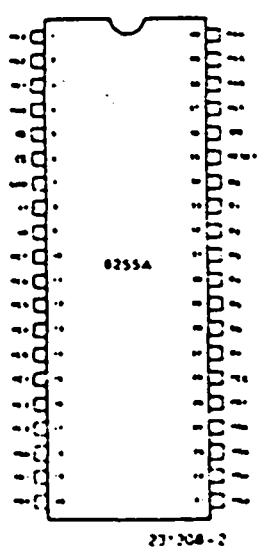
(See Intel Packaging Order Number 231369)

The Intel 8255A is a general purpose programmable I/O device designed for use with Intel microprocessors. It has 24 I/O pins which may be individually programmed in 2 groups of 12 and used in 3 major modes of operation. In the first mode (MODE 0), each group of 12 I/O pins may be programmed in sets of 4 to be input or output. In MODE 1, the second mode, each group may be programmed to have 8 lines of input or output. Of the remaining 4 pins, 3 are used for handshaking and interrupt control signals. The third mode of operation (MODE 2) is a bidirectional bus mode which uses 8 lines for a bidirectional bus, and 5 lines, borrowing one from the other group, for handshaking.



231308-1

Figure 1. 8255A Block Diagram



231308-2

Figure 2. Pin Configuration

8255A FUNCTIONAL DESCRIPTION

General

The 8255A is a programmable peripheral interface (PPI) device designed for use in Intel microcomputer systems. Its function is that of a general purpose I/O component to interface peripheral equipment to the microcomputer system bus. The functional configuration of the 8255A is programmed by the system software so that normally no external logic is necessary to interface peripheral devices or structures.

Data Bus Buffer

This 3-state bidirectional 8-bit buffer is used to interface the 8255A to the system data bus. Data is transmitted or received by the buffer upon execution of input or output instructions by the CPU. Control words and status information are also transferred through the data bus buffer.

Read/Write and Control Logic

The function of this block is to manage all of the internal and external transfers of both Data and Control or Status words. It accepts inputs from the CPU Address and Control busses and in turn, issues commands to both of the Control Groups.

($\overline{CS}$)

Chip Select. A "low" on this input pin enables the communication between the 8255A and the CPU.

($\overline{RD}$)

Read. A "low" on this input pin enables the 8255A to send the data or status information to the CPU on the data bus. In essence, it allows the CPU to "read from" the 8255A.

($\overline{WR}$)

Write. A "low" on this input pin enables the CPU to write data or control words into the 8255A.

(A_0 and A_1)

Port Select 0 and Port Select 1. These input signals, in conjunction with the RD and WR inputs, control the selection of one of the three ports or the control word registers. They are normally connected to the least significant bits of the address bus (A_0 and A_1).

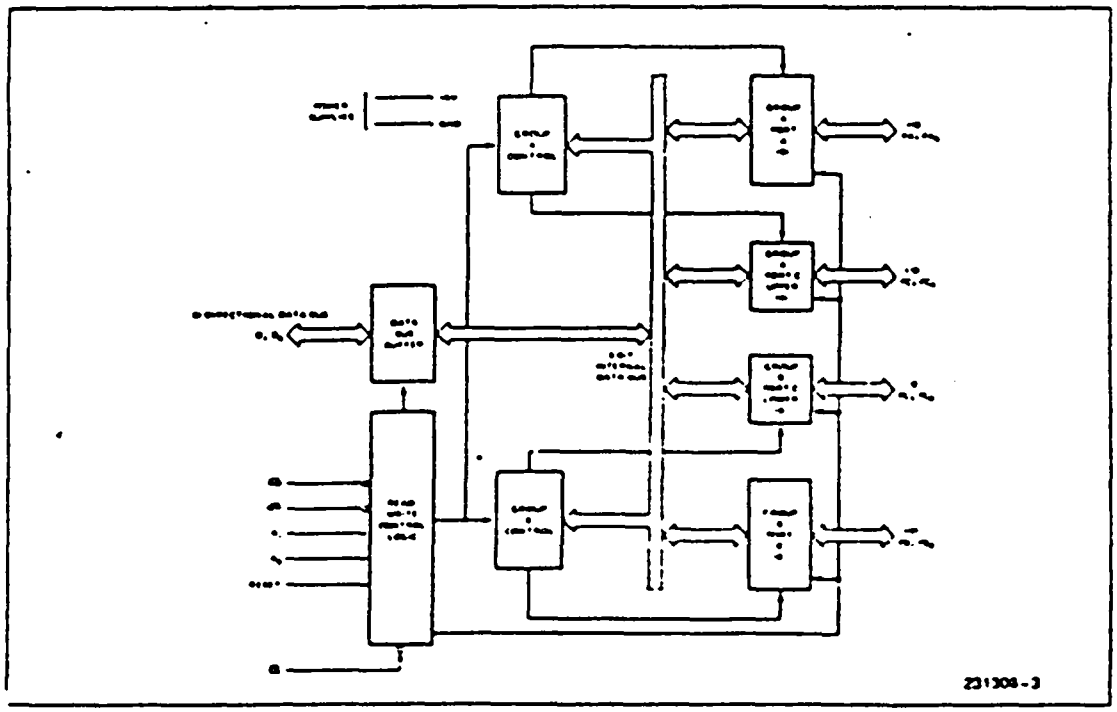


Figure 3. 8255A Block Diagram Showing Data Bus Buffer and Read/Write Control Logic Functions

Mode 0—Basic Input/Output

Mode 1—Strobed Input/Output

Mode 2—Bi-Directional Bus

When the reset input goes "high" all ports will be set to the input mode (i.e., all 24 lines will be in the high impedance state). After the reset is removed the 8255A can remain in the input mode with no additional initialization required. During the execution of the system program any of the other modes may be selected using a single output instruction. This allows a single 8255A to service a variety of peripheral devices with a simple software maintenance routine.

The modes for Port A and Port B can be separately defined, while Port C is divided into two portions as required by the Port A and Port B definitions. All of the output registers, including the status flip-flops, will be reset whenever the mode is changed. Modes may be combined so that their functional definition can be "tailored" to almost any I/O structure. For instance; Group B can be programmed in Mode 0 to monitor simple switch closings or display computational results, Group A could be programmed in Mode 1 to monitor a keyboard or tape reader on an interrupt-driven basis.

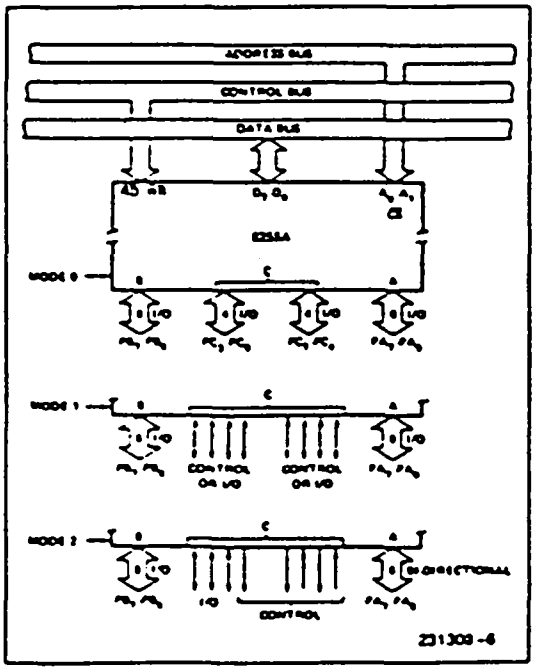


Figure 5. Basic Mode Definitions and Bus Interface

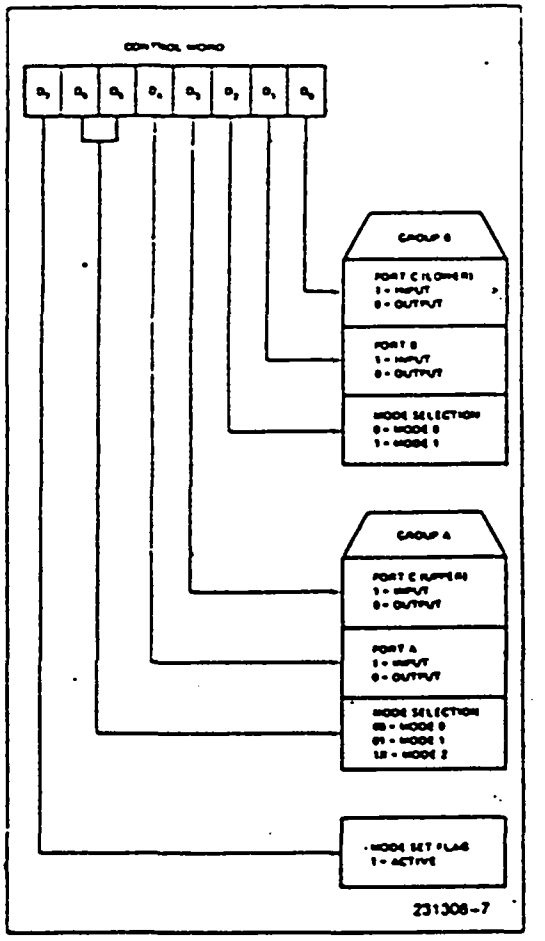


Figure 6. Mode Definition Format

The mode definitions and possible mode combinations may seem confusing at first but after a cursory review of the complete device operation a simple, logical I/O approach will surface. The design of the 8255A has taken into account things such as efficient PC board layout, control signal definition vs PC layout and complete functional flexibility to support almost any peripheral device with no external logic. Such design represents the maximum use of the available pins.

Single Bit Set/Reset Feature

Any of the eight bits of Port C can be Set or Reset using a single OUTput instruction. This feature reduces software requirements in Control-based applications.

LAMPIRAN D : MICROCONTROLLER 8031

8031AH/8051AH/8053AH

Single-Chip 8-Bit Microcontroller

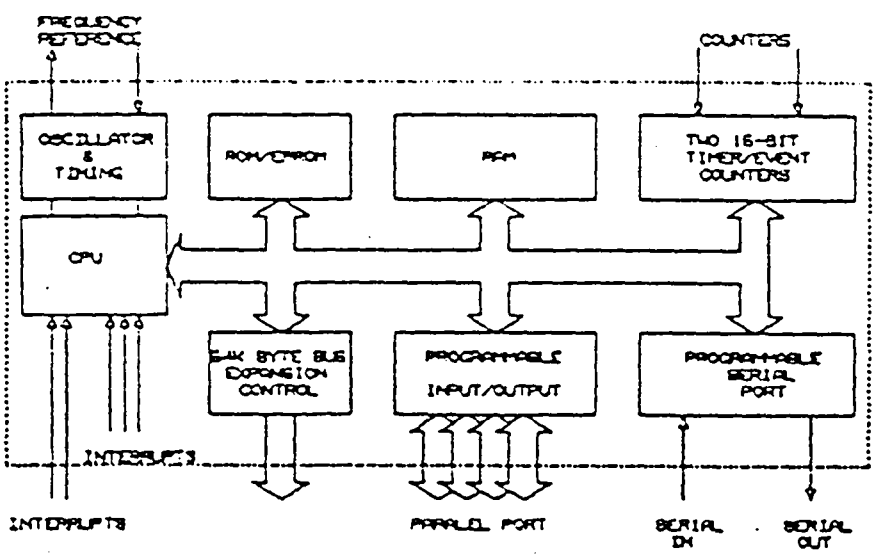
DISTINCTIVE CHARACTERISTICS

- 4K x 8 ROM (8051 only)
- 8K x 8 ROM (8053 only)
- 128 x 8 RAM
- Four 8-bit ports: 32 I/O lines
- Two 16-bit timer/event counters
- 64K addressable Program Memory
- All versions are pin compatible
- Boolean processor
- Programmable Serial Port
- Five interrupt sources/two priority levels
- On-chip Oscillator/Clock Circuit
- 64K addressable Data Memory

GENERAL DESCRIPTION

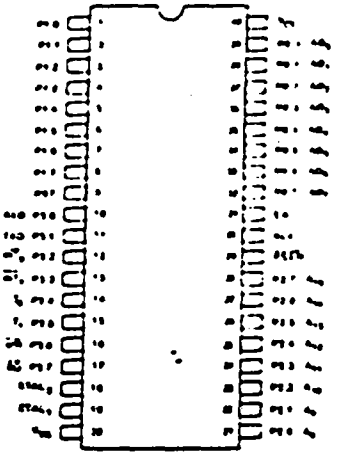
The 8051 Family is optimized for control applications. Byte processing and numerical operations on small data structures are facilitated by a variety of fast addressing modes for accessing the internal RAM. The instruction set provides a convenient menu of 8-bit arithmetic instructions, including multiply and divide instructions. Extensive on-chip support is provided for 1-bit variables as a separate data type. This allows direct bit manipulation and testing in control and logic systems that require Boolean processing. Efficient use of program memory results from an instruction set consisting of 44% 1-byte, 41% 2-byte, and 15% 3-byte instructions. With a 12 MHz crystal, 58% of the instructions execute in 1 µs, 40% in 2 µs, and multiply and divide require only 4 µs.

BLOCK DIAGRAM

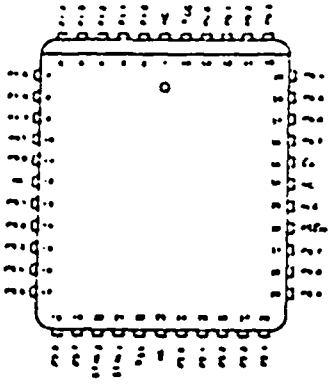


CONNECTION DIAGRAMS
Top View

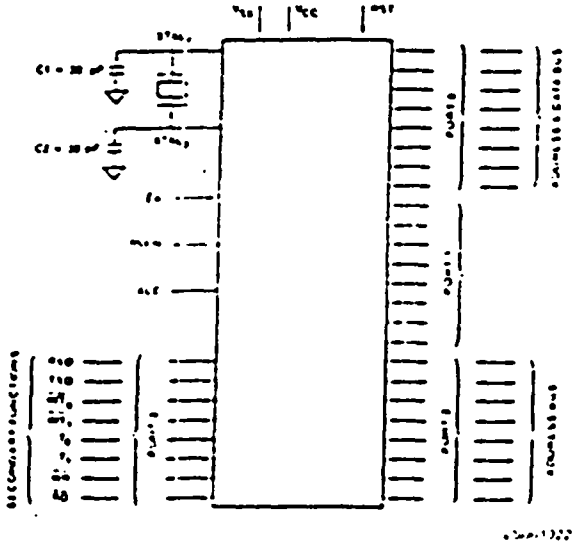
DIPS



PLCC



LOGIC SYMBOL



ABSOLUTE MAXIMUM RATINGS

Storage Temperature	-65 to +150°C
Voltage on Any Pin with Respect to Ground	-0.5 to +7.0 V
Power Dissipation	1 W

Stresses above those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent device failure. Functionality at or above these limits is not implied. Exposure to absolute maximum ratings for extended periods may affect device reliability.

OPERATING RANGES

Commercial (C) Devices

Temperature (T_A)	0 to +70°C
Supply Voltage (V_{CC})	+4.5 to +5.5 V
Ground (V_{SS})	0 V

Industrial (I) Devices (8031AH only)

Temperature (T_A)	-40 to +85°C
Supply Voltage (V_{CC})	+4.5 to +5.5 V
Ground (V_{SS})	0 V

Operating ranges define those limits between which the functionality of the device is guaranteed.

DC CHARACTERISTICS over operating ranges unless otherwise specified

Parameters	Description		Test Conditions	Min	Max.	Units
V_{IL}	Input LOW Voltage			-0.5	0.8	V
V_{IH}	Input HIGH Voltage (Except RST/V_{PD} and XTAL2)			2.0	V_{CC} +0.5	V
V_{IH1}	Input HIGH Voltage to RST/V_{PD}, XTAL2		XTAL1 = V_{SS}	2.5	V_{CC} +0.5	V
V_{PD}	Power-Down Voltage to RST/V_{PD}		V_{CC} = 0 V	4.5	5.5	V
V_{OL}	Output LOW Voltage, Ports 1, 2, 3 (Note 1)		I_{OL} = 1.6 mA		0.45	V
V_{OL1}	Output LOW Voltage, Port 0, ALE, PSEN (Note 1)		I_{OL} = 3.2 mA		0.45	V
V_{OH}	Output HIGH Voltage, Ports 1, 2, 3		I_{OH} = -80 µA	2.4		V
V_{OH1}	Output HIGH Voltage, Port 0, ALE, PSEN		I_{OH} = -400 µA	2.4		V
I_{IL}	Logical 0 Input Current, Ports 1, 2, 3		V_{IL} = 0.45 V		-500	µA
I_{IL2}	Logical 0 Input Current for XTAL2		XTAL1 = V_{SS} V_{IL} = 0.45 V		-3.2	mA
I_{IH1}	Input HIGH Current to RST/V_{PD} for Reset		V_{IN} = (V_{CC} - 1.5 V)		500	µA
I_{LI}	Input Leakage Current to Port 0, EA		0.45 < V_{IN} < V_{CC}		±10	µA
I_{CC}	Power-Supply Current	8051AH, 8031AH / 8052AH	EA = V_{CC} All Outputs Disconnected		125 [illegible]	mA
I_{PD}	Power-Down Current		V_{CC} = 0 V, V_{PD} = 5.0 V		10	mA
C_{IO}	Capacitance of I/O Buffer		f_C = 1 MHz		10	pF

Notes: 1. Capacitive load on Ports 0 and 2 may cause spurious noise pulses to be superimposed on the V_{OL}s of ALE and Ports 1 and 3. The noise is due to external bus capacitance discharging into the Port 0 and Port 2 pins when these pins make 1-to-0 transitions during bus operations. In the worst cases (capacitive loading > 100 pF), the noise pulse on the ALE line may exceed 0.8 V. In such cases it may be desirable to qualify ALE with a Schmitt Trigger, or use an address latch with a Schmitt Trigger STROBE input.

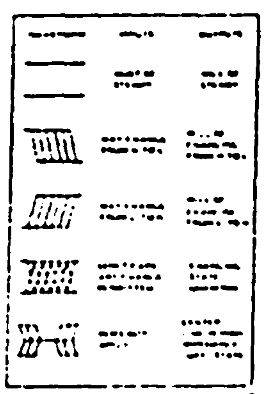
SWITCHING CHARACTERISTICS over operating ranges unless otherwise specified (Load Capacitance for Port 0, ALE, and $\overline{PSEN}$ = 100 pF, Load Capacitance for all other outputs = 80 pF)

Parameter Symbol	Parameter Description	12 MHz Clock Min.	12 MHz Clock Max.	18 MHz Clock (Note 1) Min.	18 MHz Clock (Note 1) Max.	Variable Clock Min	Variable Clock Max.	Units
TCY 1/TCLCL	Oscillator Frequency					1.2	18	MHz
TLHLL	ALE Pulse Width	127		71		2TCLCL-40		ns
TAVLL	Address Setup to ALE	43		15		TCLCL-40		ns
TLLAX	Address Hold After ALE	48		20		TCLCL-35		ns
TLLIV	ALE to Valid Instruction In		233		122		4TCLCL-100	ns
TLLPL	ALE to $\overline{PSEN}$	58		30		TCLCL-25		ns
TPLPH	$\overline{PSEN}$ Pulse Width	215		131		3TCLCL-35		ns
TPLIV	$\overline{PSEN}$ to Valid Instruction In		125		41		3TCLCL-125	ns
TPXIX	Input Instruction Hold After $\overline{PSEN}$	0		0		0		ns
TPXIZ	Input Instruction Float After $\overline{PSEN}$		63		35		TCLCL-20	ns
TPXAV	Address Valid After $\overline{PSEN}$	75		47		TCLCL-8		ns
TAVIV	Address to Valid Instruction In		302		162		5TCLCL-115	ns
TPLAZ	Address Float After $\overline{PSEN}$		20		20		20	ns
TRLRH	$\overline{RD}$ Pulse Width	400		233		6TCLCL-100		ns
TWLWH	$\overline{WR}$ Pulse Width	400		233		6TCLCL-100		ns
TRLDV	$\overline{RD}$ to Valid Data In		250		112		5TCLCL-165	ns
TRHDX	Data Hold After $\overline{RD}$	0		0		0		ns
TRHDZ	Data Float After $\overline{RD}$		97		41		2TCLCL-70	ns
TLLDV	ALE to Valid Data In		517		294		8TCLCL-150	ns
TAVDV	Address to Valid Data In		585		334		9TCLCL-165	ns
TLLWL	ALE to $\overline{WR}$ or $\overline{RD}$	200	300	116	216	3TCLCL-50	3TCLCL+50	ns
TAVWL	Address to $\overline{WR}$ or $\overline{RD}$	203		92		4TCLCL-130		ns
TQVWX	Data Valid to $\overline{WR}$ Transition	23		0		TCLCL-60		ns
TQVWH	Data Setup Before $\overline{WR}$	433		238		7TCLCL-150		ns
TWHQX	Data Hold After $\overline{WR}$	33		5		TCLCL-50		ns
TRLAZ	Address Float After $\overline{RD}$		20		20		20	ns
TWHLH	$\overline{WR}$ or $\overline{RD}$ High to ALE High	43	123	16	96	TCLCL-40	TCLCL+40	ns

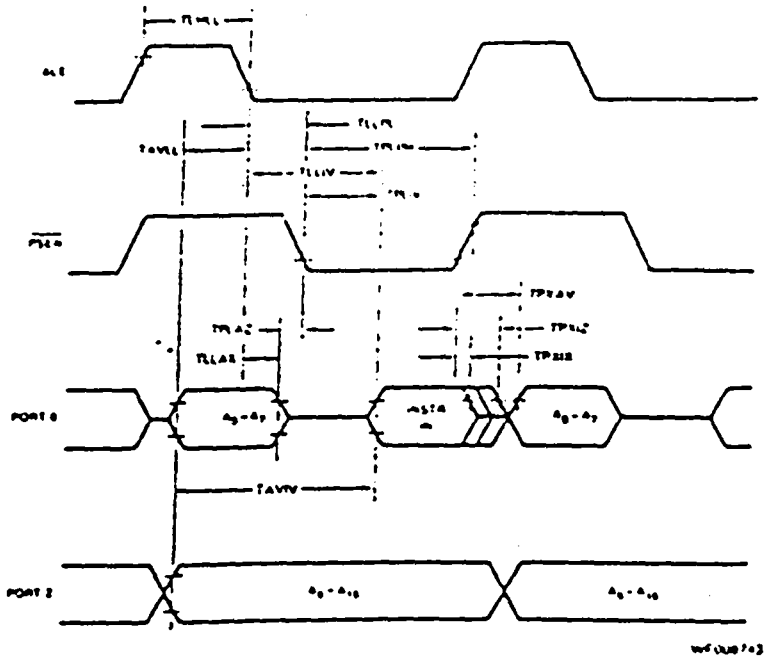
Notes: 1. 18 MHz clock pertains only to 8031AH in the Commercial operating range

SWITCHING WAVEFORMS

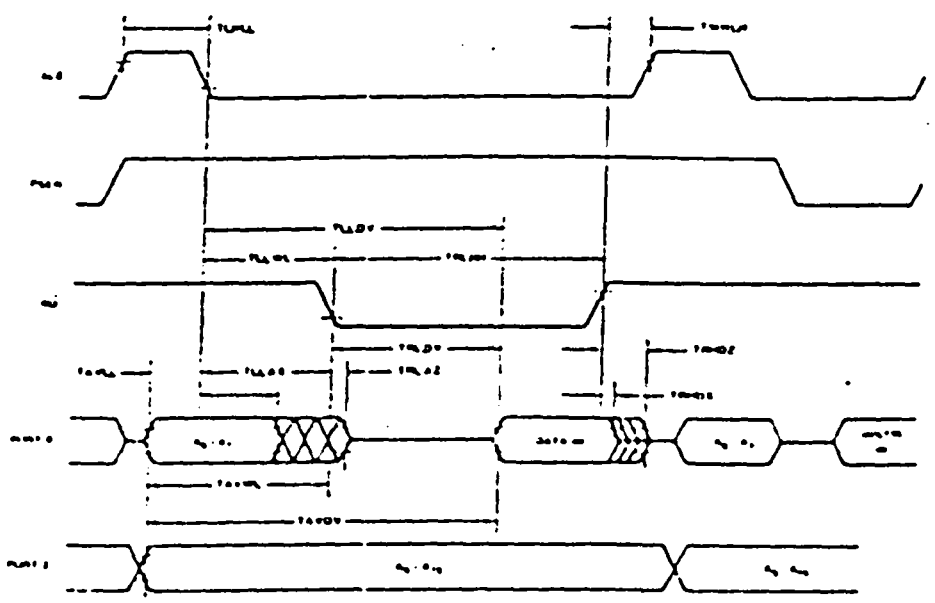
KEY TO SWITCHING WAVEFORMS



SWITCHING WAVEFORMS (Cont'd.)

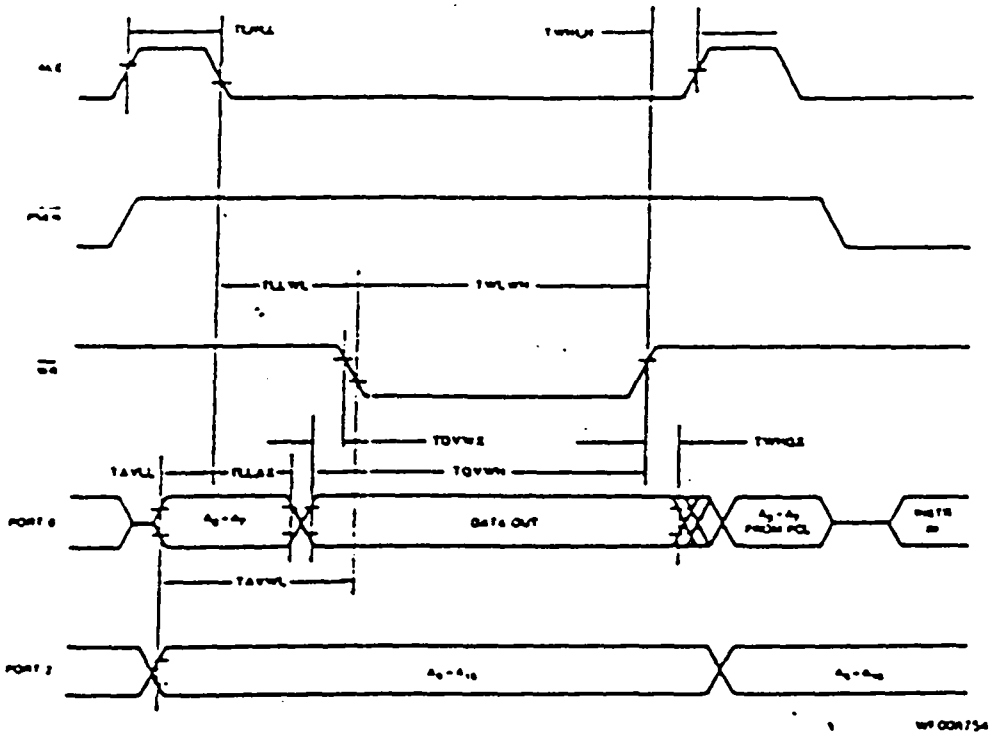


External Program Memory Read Cycle

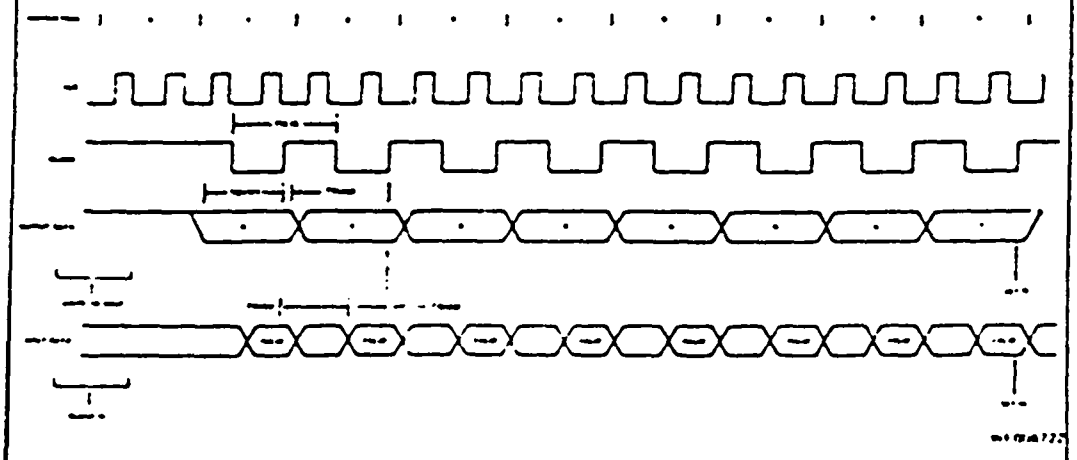


External Data Memory Read Cycle

SWITCHING WAVEFORMS (Cont'd)



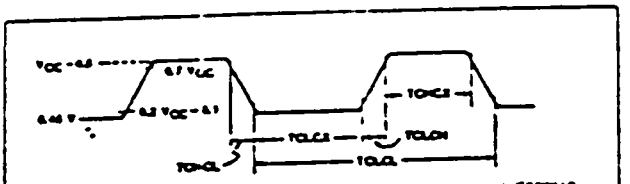
External Data Memory Write Cycle



Shift Register Timing Waveforms

EXTERNAL CLOCK DRIVE

Parameter Symbol	Parameter Description	Min.	Max	Units
1/TCLCL	Oscillator Frequency	1.2	12	MHz
TCHCX	High Time	20		ns
TCLCX	LOW Time	20		ns
TCLCH	Rise Time		20	ns
TCHCL	Fall Time		20	ns



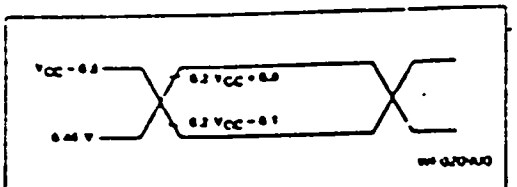
External Clock Drive Waveform

SERIAL PORT TIMING — SHIFT REGISTER MODE

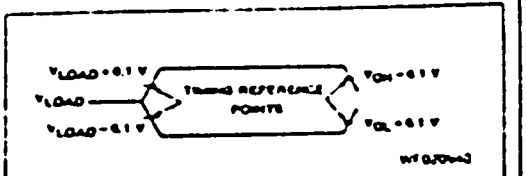
(Load Capacitance = 80 pF)

Parameter Symbol	Parameter Description	12 MHz Osc.		Variable Oscillator		Units
		Min.	Max.	Min.	Max.	
TXLXL	Serial Port Clock Cycle Time	1.0		12TCLCL		μs
TQVXH	Output Data Setup to Clock Rising Edge	700		10TCLCL - 133		ns
TXHQX	Output Data Hold After Clock Rising Edge	50		2TCLCL - 117		ns
TXHQX	Input Data Hold After Clock Rising Edge	0		0		ns
TXHQV	Clock Rising Edge to Input Data Valid		700		10TCLCL - 133	ns

AC Testing



Input/Output Waveform



Float Waveform

FAKULTAS TEKNIK
JURUSAN TEKNIK ELEKTRO
UNIVERSITAS KRISTEN PETRA
SURABAYA

USULAN TUGAS AKHIR

Dosen Pembimbing : Ir. Bunawi Gunawidjaja

Nama Mahasiswa : David Agus Santoso

Bidang Studi : Sistem Tenaga

NIRM/NRP : 8570023107107642/234855094

Judul Tugas Akhir: PERENCANAAN DAN PEMBUATAN ALAT PENDINGIN AIR YANG DAPAT DIATUR PADA SUHU 15 SAMPAI 20° C DENGAN MENGGUNAKAN MICROCONTROLLER

Lampiran Tugas Akhir meliputi :

1. Latar belakang pemilihan judul
2. Ruang lingkup pembahasan
3. Tujuan
4. Metode yang digunakan
5. Mata kuliah penunjang
6. Uraian Singkat
7. Jadual kegiatan
8. Relevansi

Surabaya, 11 Agustus 1995

Kepala Bidang Studi

(Ir. Bunawi Gunawidjaja)

Dosen Pembimbing I

(Ir. Bunawi Gunawidjaja)

Ketua Jurusan

(Ir. Bunawi Gunawidjaja)

PERENCANAAN DAN PEMBUATAN ALAT PENDINGIN AIR YANG DAPAT DIATUR PADA SUHU 15-20° C DENGAN MENGGUNAKAN MICROCONTROLLER

1. LATAR BELAKANG PEMILIHAN JUDUL

Seiring dengan perjalanan waktu, pemenuhan kebutuhan hidup manusia semakin beragam dan kompleks. Dan untuk mendapatkan kesejahteraan maka kualitas kehidupan selalu diperbaiki dan ditingkatkan.

Indonesia terletak di garis katulistiwa yang beriklim tropis, dimana suhu udara relatif panas. Suhu udara yang panas ini akan semakin terasa pada siang hari dimana aktivitas kesibukan sangat tinggi, sehingga menimbulkan rasa lelah dan haus.

Air minum merupakan salah satu pokok kebutuhan menusia yang paling vital untuk mengembalikan cairan tubuh yang hilang. Dan untuk mendapatkan air minum yang segar dibutuhkan kondisi air dengan suhu tertentu. Kondisi air minum dengan suhu tertentu ini dapat menambah rasa nyaman dan segar bagi tubuh.

Hal tersebut diatas mendorong saya untuk merancang dan membuat alat pendingin air. Alat ini berfungsi untuk mengatur penyediaan air minum yang dingin dan segar dengan temperatur yang diinginkan.

2. RUANG LINGKUP PEMBAHASAN

Alat pendingin air minum direncanakan dengan batasan kemampuan maksimum mendinginkan 3 liter air.

Batasan masalah yang dibahas :

- Minimum System Microcontroller 8031
- Input Sensor Temperatur
- Control Power & Delay Pengaman
- Sistim Pendingin
- Output Temperatur

3. TUJUAN

Untuk memperoleh air minum dingin dengan suhu air yang dapat diatur sesuai dengan keinginan.

4. METODE YANG DIGUNAKAN

- Studi Literatur
- Pengumpulan dan Analisa Data
- Perencanaan Alat
- Pembuatan Alat
- Pengujian Alat
- Pengerjaan Naskah

5. MATA KULIAH PENUNJANG

- Thermodinamika
- Elektronika
- Dasar Pemrograman Komputer
- Organisasi Komputer
- Microprocessor

6. URAIAN SINGKAT

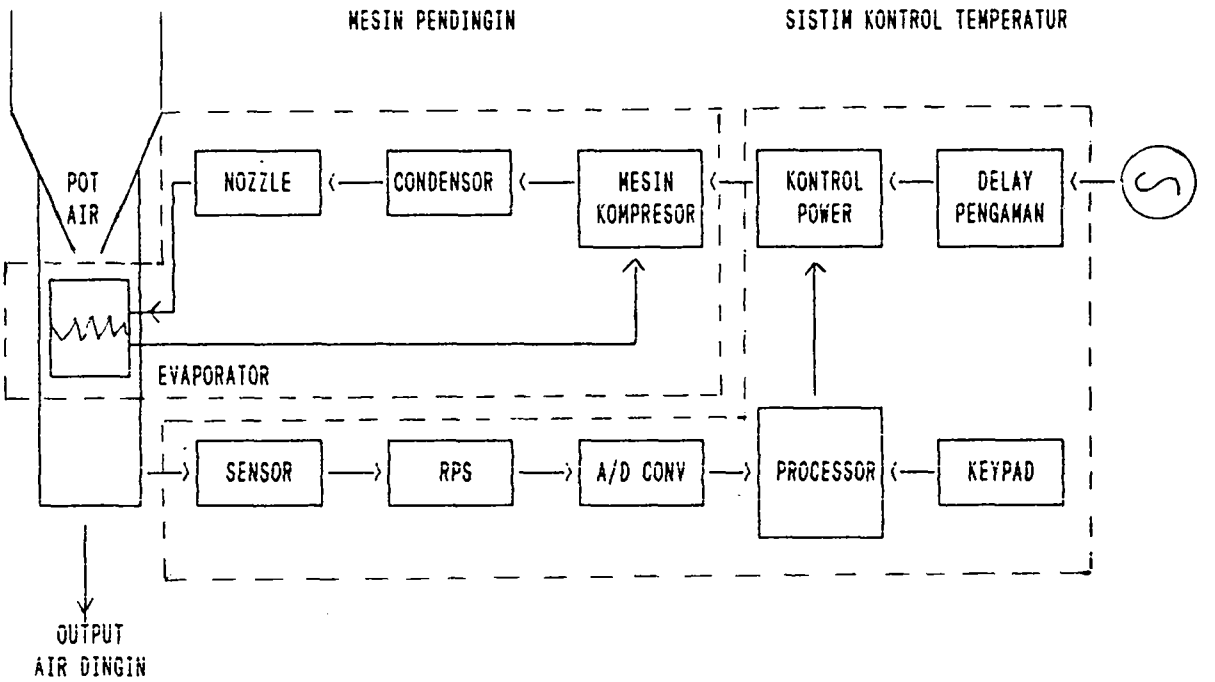


DIAGRAM BLOCK

Mesin Pendingin :

Media pendingin yang dipakai adalah gas freon, dimana gas dikompresi oleh mesin kompresor sehingga menjadi cair. Pada proses tersebut akan terjadi panas dan panas ini dibuang ke lingkungan udara sekitar melalui condensor. Gas yang cair dengan tekanan tinggi tersebut dikabutkan oleh Nozzle dengan merubah tekanan menjadi sangat rendah. Proses ini menyebabkan gas menjadi sangat dingin kemudian gas yang dingin ini dimanfaatkan untuk menyerap panas dari air di dalam pot melalui saluran evaporator.

Sistim Kontrol Temperatur :

Suhu yang diinginkan diinputkan melalui keypad sebagai setting point yang akan diteruskan oleh microcontroller untuk mengontrol mesin kompresor agar bekerja mendinginkan suhu air didalam pot air.

Melalui sensor temperatur yang diletakkan didalam pot air, suhu air yang diinginkan akan disensor dan data yang diperoleh setelah dikonversikan lewat A/D converter akan diteruskan ke microcontroller sehingga dapat diatur pendinginan suhu air oleh kerja mesin pendingin. Dan bila suhu yang diinginkan tercapai maka kontrol power akan mematikan mesin kompresor. Proses ini berlangsung terus menerus dengan mempertahankan temperatur air pada suhu yang diinginkan.

Untuk pengaman mesin kompresor perlu ditambahkan rangkaian pengaman untuk menghadapi gangguan listrik yang temporer. Bila mesin pendingin ini dalam keadaan bekerja normal dan tiba-tiba terjadi gangguan listrik padam sesaat lalu hidup kembali maka alat ini akan bekerja kembali dengan normal setelah beberapa waktu kemudian. Hal tersebut dapat menghindarkan kerusakan mesin kompresor dari power electricity shock.

7. JADUAL KEGIATAN

BULAN / KEGIATAN	I	II	III	IV	V	VI
STUDI PUSTAKA	*					
PENGUMPULAN DATA	*					
EVALUASI DATA	*	*				
PERENCANAAN ALAT		*				
PEMBUATAN ALAT		*	*	*		
PENGUJIAN ALAT				*	*	
KESIMPULAN					*	
PEMBUATAN NASKAH					*	*

8. RELEVANSI

Air minum yang dingin dan segar pada suhu yang sesuai akan menambah kenyamanan dan kesegaran tubuh.

Alat kontrol temperatur ini dapat dipakai dan diterapkan pada sistim kontrol pendingin lainnya, misal : refrigerator, freezer, air conditioner, dan lain-lain.