

32*4 LCD Controller & Driver

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. General Description:

The IC is for LCD controller. It is the most cost performance for “MCU + TTP802” application.

. Features:

- ✧ Operating voltage 2.4V-5.5V
- ✧ System clock:
 - Built-in RC oscillator(256Khz) with internal resistor and capacitor
 - External 32768Hz crystal oscillator
 - External clock source 256Khz input (from OSCI pin input)
- ✧ Provide 3 pins interface with MCU(RDB/ WRB/ DATA)
- ✧ Provide Buzzer frequency output
- ✧ Provide Time base timer and watch dog timer function
- ✧ LCD driver is 32 SEG/4 COM
- ✧ LCD duty is 1/2 duty, 1/3 duty or 1/4 duty
- ✧ LCD bias is 1/2 bias or 1/3 bias
- ✧ Provide internal reset function
- ✧ Provide 28-SDIP/ 48-SSOP / 48-PDIP / 48-LQFP package

. Application:

- LCD controller
- DVD player
- DVR player
- VCD player
- Car Display
- Instrument LCD display
- Home application LCD display
- Telecom LCD display
- MCU + LCD Driver
- LCD module

. Pin Assignments

SEG7	1	48
SEG6	2	47
SEG5	3	46
SEG4	4	45
SEG3	5	44
SEG2	6	43
SEG1	7	42
SEG0	8	41
TEST	9	40
RDB	10	39
WRB	11	38
DATA	12	37
VSS	13	36
OSCO	14	35
OSCI	15	34
VLCD	16	33
VDD	17	32
IRQB	18	31
BZ	19	30
BZB	20	29
COM0	21	28
COM1	22	27
COM2	23	26
COM3	24	25

48SSOP-A
48PDIP-B

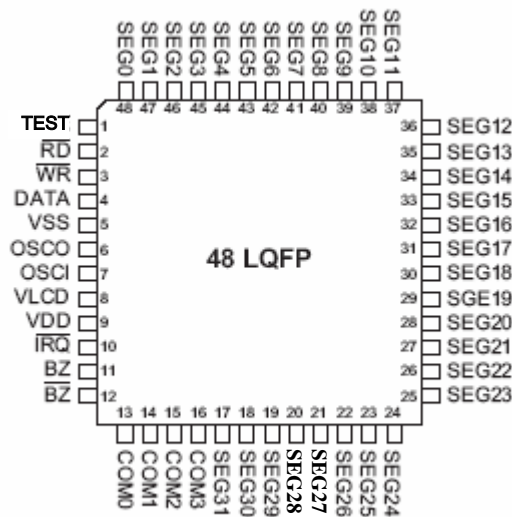
SEG8
SEG9
SEG10
SEG11
SEG12
SEG13
SEG14
SEG15
SEG16
SEG17
SEG18
SEG19
SEG20
SEG21
SEG22
SEG23
SEG24
SEG25
SEG26
SEG27
SEG28
SEG29
SEG30
SEG31

SEG6	1	28
SEG4	2	27
SEG2	3	26
SEG0	4	25
RDB	5	24
WRB	6	23
DATA	7	22
VSS	8	21
VLCD	9	20
VDD	10	19
IRQB	11	18
BZ	12	17
COM0	13	16
COM1	14	15

28 SKINNY-DIP-C

SEG8
SEG10
SEG12
SEG14
SEG16
SEG18
SEG20
SEG22
SEG24
SEG26
SEG28
SEG30
COM3
COM2

LCD324-7

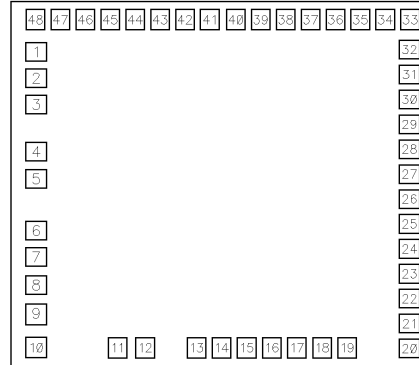


48 LQFP-D

. Order Information

- a. Package form : TTP802A(48SSOP)/ TTP802B(48PDIP)/ TTP802C(28SDIP)/ TTP802D(48LQFP)
- b. Chip form : TCP802
- c. Wafer base : TDP802

. PAD Location



Chip size : 1920um X 1690 um

SUBSTRATE floating(recommend) or VDD

```
*****
NO      NAME      X=      Y=
*****
1       TEST      -809.700  582.400
2       RDB       -809.700  466.400
3       WRB       -809.700  350.400
4       DATA     -809.700  141.300
5       VSS       -809.700  21.300
6       OSCO      -809.700  -207.700
7       OSC I    -809.700  -322.700
8       VLCD     -809.700  -447.100
9       VDD       -809.700  -577.900
10      IRQB     -809.700  -723.600
11      BZ       -450.300  -724.600
12      BZB      -328.300  -724.600
13      COMO     -101.600  -724.600
14      COM1      9.400    -724.600
15      COM2     120.400  -724.600
16      COM3     231.400  -724.600
17      SEG31    342.400  -724.600
18      SEG30    453.400  -724.600
19      SEG29    564.400  -724.600
20      SEG28    839.300  -727.600
21      SEG27    839.300  -617.600
22      SEG26    839.300  -507.600
23      SEG25    839.300  -397.600
24      SEG24    839.300  -287.600
25      SEG23    839.300  -177.600
26      SEG22    839.300  -67.600
27      SEG21    839.300  42.400
28      SEG20    839.300  152.400
29      SEG19    839.300  262.400
30      SEG18    839.300  372.400
31      SEG17    839.300  482.400
32      SEG16    839.300  592.400
33      SEG15    842.300  724.400
34      SEG14    732.300  724.400
35      SEG13    622.300  724.400
36      SEG12    512.300  724.400
37      SEG11    402.300  724.400
38      SEG10    292.300  724.400
39      SEG9     182.300  724.400
40      SEG8     72.300   724.400
41      SEG7     -42.700  724.400
42      SEG6     -152.700 724.400
43      SEG5     -262.700 724.400
44      SEG4     -372.700 724.400
45      SEG3     -482.700 724.400
46      SEG2     -592.700 724.400
47      SEG1     -702.700 724.400
48      SEG0     -812.700 724.400
*****
```

. Pin Description

Name	I/O	Description
RDB	I	Interface pin,low active,with internal pull high resistor 50Kohm@3V
WRB	I	Interface pin,low active,with internal pull high resistor 50Kohm@3V
DATA	I/O	Interface pin,low active,with internal pull high resistor 50Kohm@3V
GND	P	Ground
VLCD	P	LCD power
VDD	P	Positive power
COM0-COM3	O	LCD common pin
SEG31-0	O	LCD segment pin
TEST	I	No use, floating or connect to VDD
BZ/ BZB	O	Buzzer frequency output
IRQB	O	Timer output,NMOS open drain
OSCI	I	32768Hz crystal oscillator pin or external 256Khz clock input
OSCO	O	32768Hz crystal oscillator pin

. AC / DC Characteristics

1 Absolutely max. ratings

ITEM	SYMBOL	RATING	UNIT
Operating Temperature	Top	-20 - +70	
Storage Temperature	Tsto	-50 - +125	
Supply Voltage	VDD	5.5	V
Voltage to input terminal	Vin	Vss-0.3 to Vdd+0.3	V

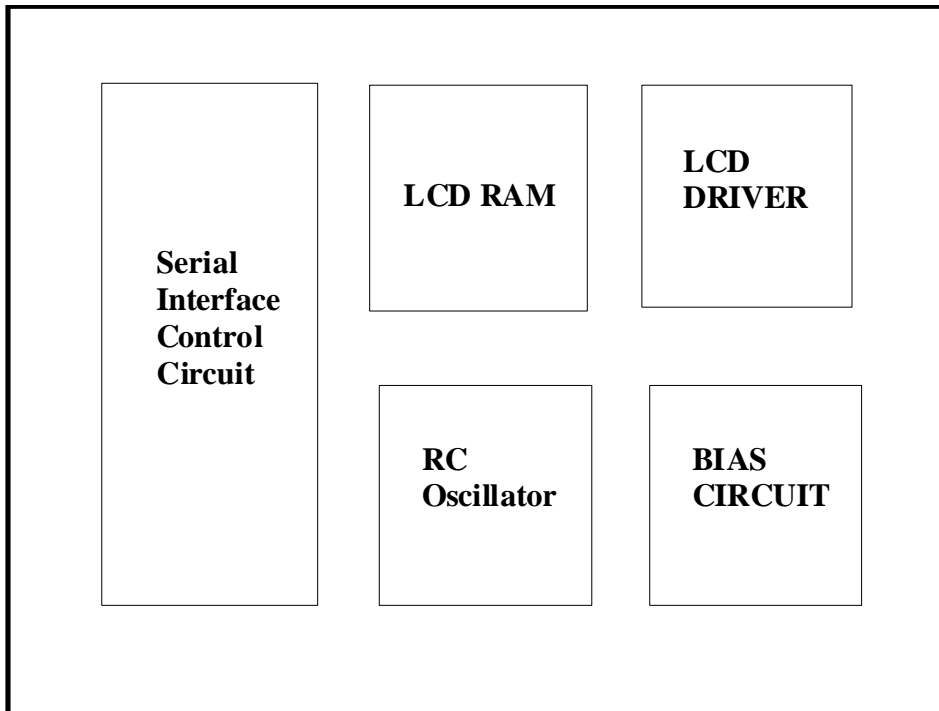
2 D.C. Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	unit
Operating voltage	VDD		2.4	3	5.5	V
Power consumption current	I _{OPR1}	3V	Internal RC oscillator on, LCD on, no load	125	250	uA
		5V		250	500	
Power consumption current	I _{OPR2}	3V	Internal RC oscillator on, LCD off, no load	40	80	uA
		5V		100	200	
Power consumption current	I _{OPR3}	3V	External Crystal oscillator on, LCD on, no load	90	125	uA
		5V		160	250	
stand by current	I _{st}	3V	System halt, No load, oscillator off, LCD off	1	2	uA
		5V		2	5	
Input low voltage for input pin	V _{IL1}	3V	RDB/ WRB/ DATA	0	0.6	V
		5V		0	1.0	
Input high voltage for input pin	V _{IH1}	3V	RDB/ WRB/ DATA	2.4	3	V
		5V		4.0	5	
Segment output 'H'	I _{SOH}	3V		-100	-150	uA
		5V		-200	-300	
Segment output 'L'	I _{SOL}	3V		60	120	uA
		5V		120	200	
Common output 'H'	I _{COH}	3V		-100	-150	uA
		5V		-200	-300	
Common output 'L'	I _{COL}	3V		200	250	uA
		5V		400	500	

3 A.C. Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	unit
System clock	f _{SYS}	RC oscillator @3v (256Khz)		256		KHz
LCD frame frequency	F _{LCD1}	1/2 duty		64		HZ
	F _{LCD2}	1/3 duty		86		
	F _{LCD3}	1/4 duty		64		
Serial interface WRB pin	F _{CKWB}	@3V,Clock duty 50%			150	KHz
		@5V,Clock duty 50%			300	
Serial interface RDB pin	F _{CKRB}	@3V,Clock duty 50%			75	KHz
		@5V,Clock duty 50%			150	

. Block Diagram



LCD324-2

. Function Description

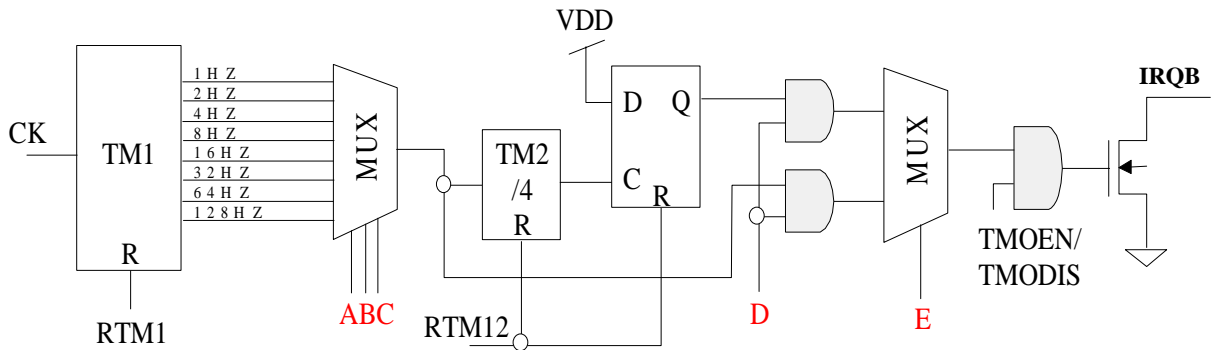
1 Control register format table

Function	Pre-code	Mode Code	Control code	
			Address	Data
Command	1	00	C7C6C5C4--C3C2C1C0--x	
Write	1	01	x-A4A3A2A1A0	B0B1B2B3
Read	1	10	x-A4A3A2A1A0	B0B1B2B3

	Function name	Control code C7C6C5C4--C3C2C1C0--x	Function description	Initial State
System initial	RTC	0001—01xx—x	Select 32768Hz crystal oscillator	
	INOSC	0001—10xx—x	Select internal RC oscillator(256Khz)	V
	EXOSC	0001—11xx—x	Select external clock input (256Khz)	
	L2B2D	0010—00x0—x	Select 1/2 bias,1/2 duty	
	L2B3D	0010—01x0—x	Select 1/2 bias,1/3 duty	
	L2B4D	0010—10x0—x	Select 1/2 bias,1/4 duty	
	L3B2D	0010—00x1—x	Select 1/3 bias,1/2 duty	
	L3B3D	0010—01x1—x	Select 1/3 bias,1/3 duty	
	L3B4D	0010—10x1—x	Select 1/3 bias,1/4 duty	
	BZ4K	010x—xxxx—x	Select buzzer frequency is 4Khz	
BZ2K	011x—xxxx—x	Select buzzer frequency is 2Khz		
System control	SysOff	0000—0000—x	Disable system oscillator OFF & LCD circuit OFF	V
	SysOn	0000—0001—x	Enable system oscillator ON	
	LCDoff	0000—0010—x	LCD circuit OFF	V
	LCDon	0000—0011—x	LCD circuit ON	
	BZdis	0000—1000—x	Disable Buzzer output	V
	BZen	0000—1001—x	Enable Buzzer output	
	TMOdis	100x—0xxx—x	Disable IRQB output	V
TMOen	100x—1xxx—x	Enable IRQB output		
Others	No used	1110—0000—x	Don't use	
	Default	1110—0011—x	Don't use	V

	Function name	Control code C7C6C5C4--C3C2C1C0--x	Function description		Initial State	
IRQB Output control	TMS	0000—01DE—x				
		DE=00	TM1 off			
		DE=01	TM2 off			
		DE=10	TM1 on			
		DE=11	TM2 on			
	RTM1	0000—11xx—x	Reset TM1 Counter			
	RTM12	0000—111x—x	Reset TM2 Counter			
	TMP	101x—xABC—x	TM1 on (pulse output)	TM2 on (one shot output)		
		ABC=000	IRQB=1HZ	IRQB=0 after 4s		
		ABC=001	IRQB=2HZ	IRQB=0 after 2s		
		ABC=010	IRQB=4HZ	IRQB=0 after 1s		
		ABC=011	IRQB=8HZ	IRQB=0 after 500ms		
		ABC=100	IRQB=16HZ	IRQB=0 after 250ms		
		ABC=101	IRQB=32HZ	IRQB=0 after 125ms		
ABC=110		IRQB=64HZ	IRQB=0 after 62.5ms			
ABC=111		IRQB=128HZ	IRQB=0 after 31.25ms			

* IRQB output pulse width is 8 system clock(TM1) and edge output(TM2).



2 LCD RAM Mapping

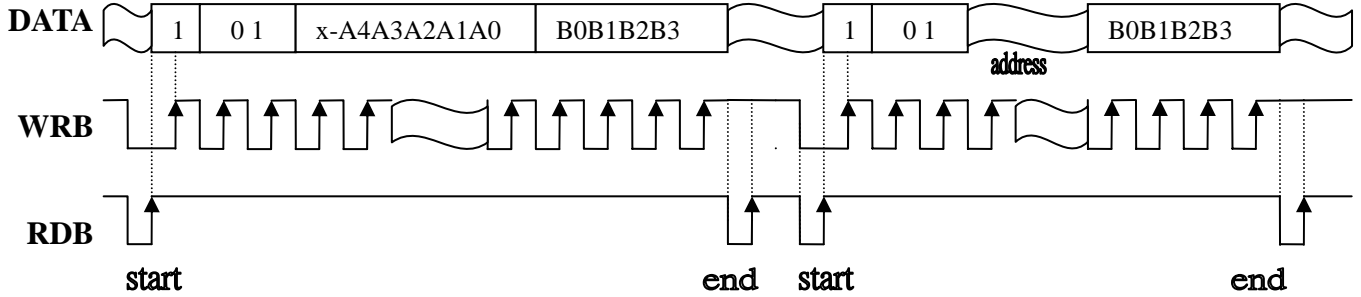
A4A3A2A1A0	COM0	COM1	COM2	COM3
	Bit0	Bit1	Bit2	Bit3
00 _H	SEG0			
01 _H	SEG1			
02 _H	SEG2			
03 _H	SEG3			
04 _H	SEG4			
05 _H	SEG5			
06 _H	SEG6			
07 _H	SEG7			
08 _H	SEG8			
09 _H	SEG9			
0A _H	SEG10			
0B _H	SEG11			
0C _H	SEG12			
0D _H	SEG13			
0E _H	SEG14			
0F _H	SEG15			
10 _H	SEG16			
11 _H	SEG17			
12 _H	SEG18			
13 _H	SEG19			
14 _H	SEG20			
15 _H	SEG21			
16 _H	SEG22			
17 _H	SEG23			
18 _H	SEG24			
19 _H	SEG25			
1A _H	SEG26			
1B _H	SEG27			
1C _H	SEG28			
1D _H	SEG29			
1E _H	SEG30			
1F _H	SEG31			

3 Serial interface format

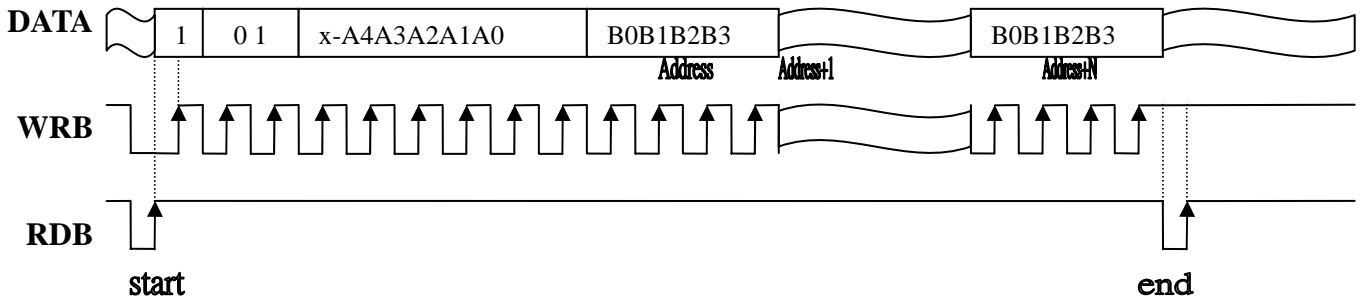
A. Write mode

Function	Pre-code	Mode Code	Address	Data
Write	1	01	x-A4A3A2A1A0	B0B1B2B3

Single step write mode:



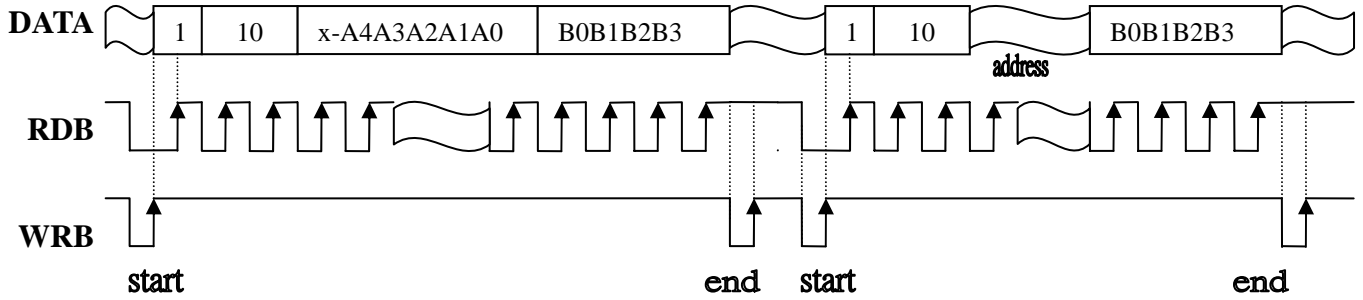
Continuing write mode:



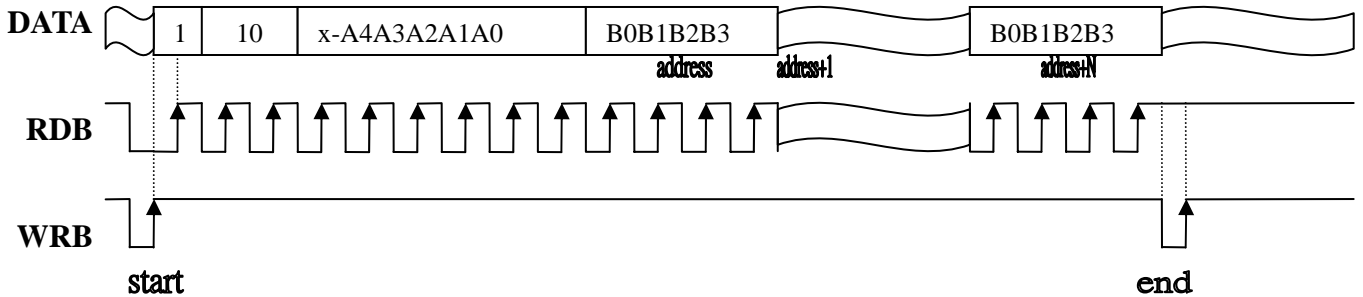
B. Read mode

Function	Pre-code	Mode Code	Address	Data
Read	1	10	x-A4A3A2A1A0	B0B1B2B3

Single step read mode:



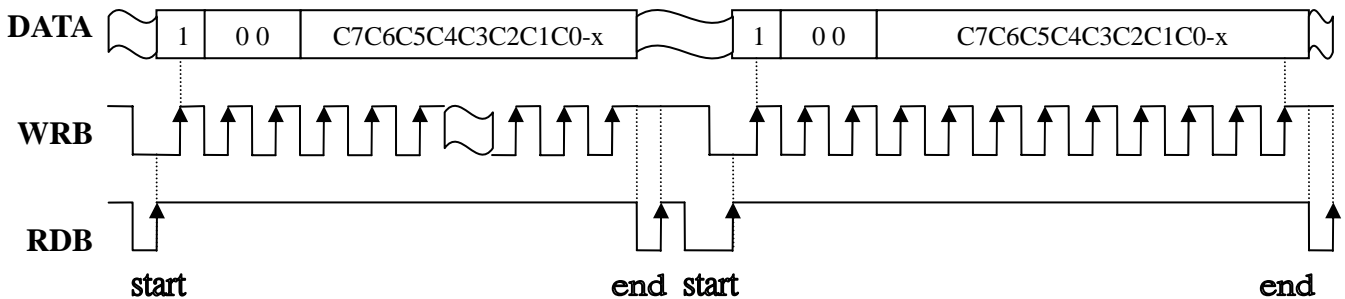
Continuing read mode:



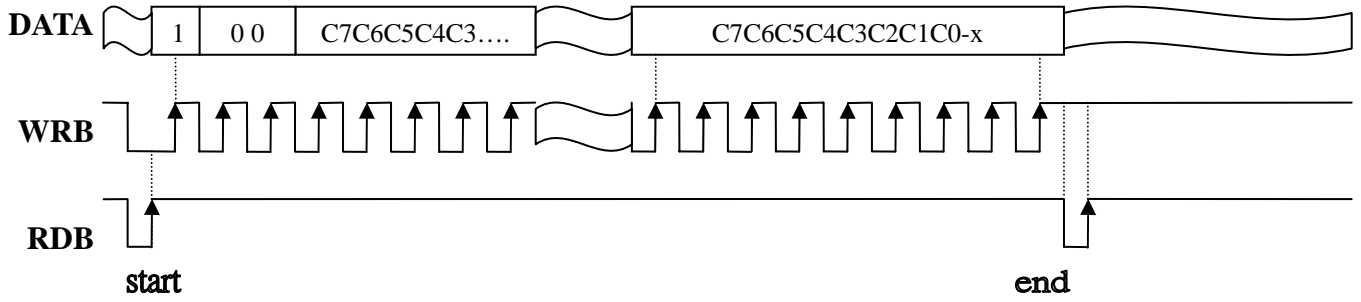
C. Command format

Function	Pre-code	Mode Code	Command code
Command	1	00	C7C6C5C4-C3C2C1C0-x

Single step command mode:

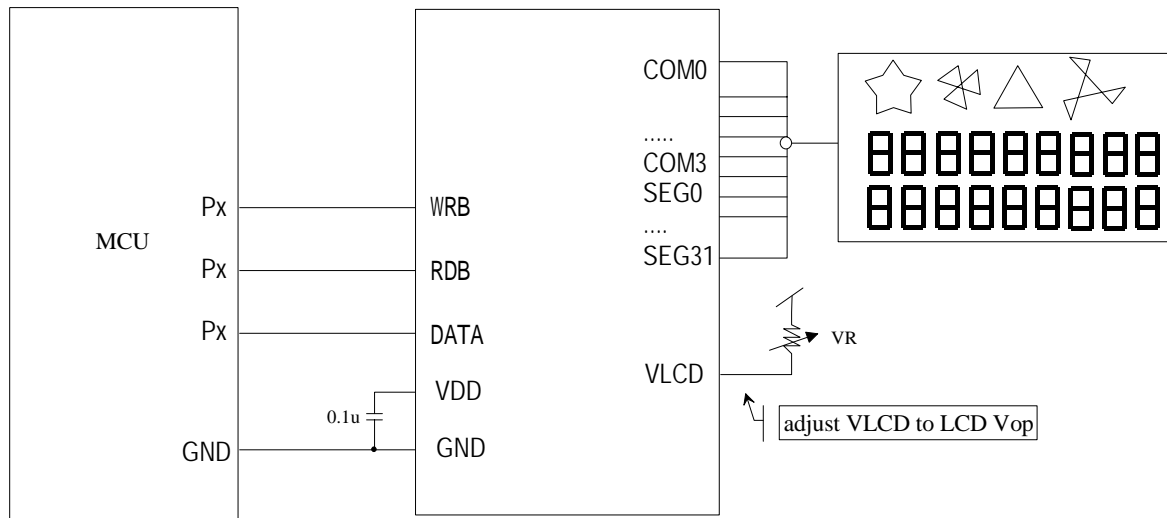


Continuing command mode:



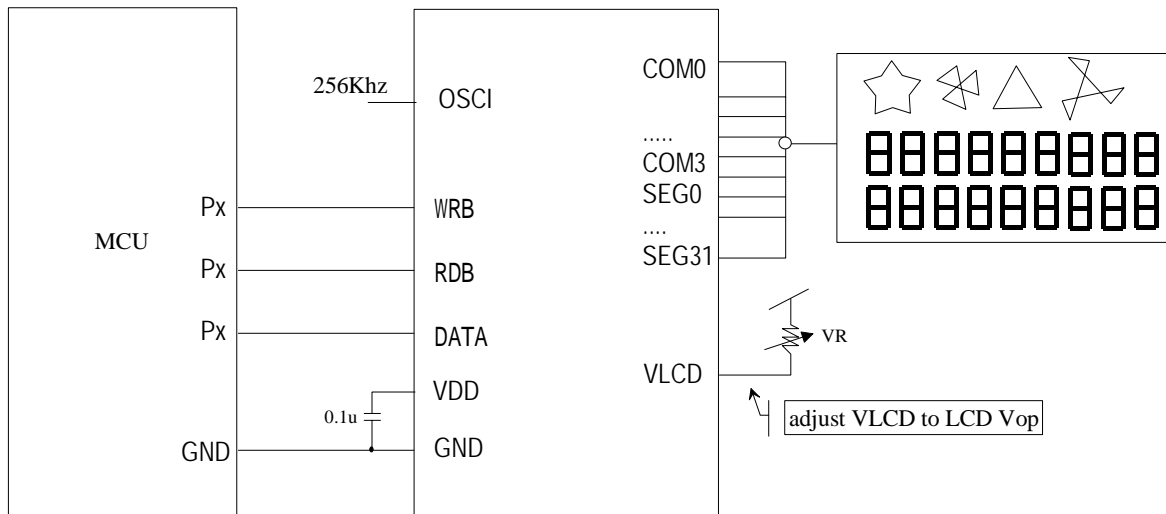
. Application circuit

(Internal RC Oscillator)



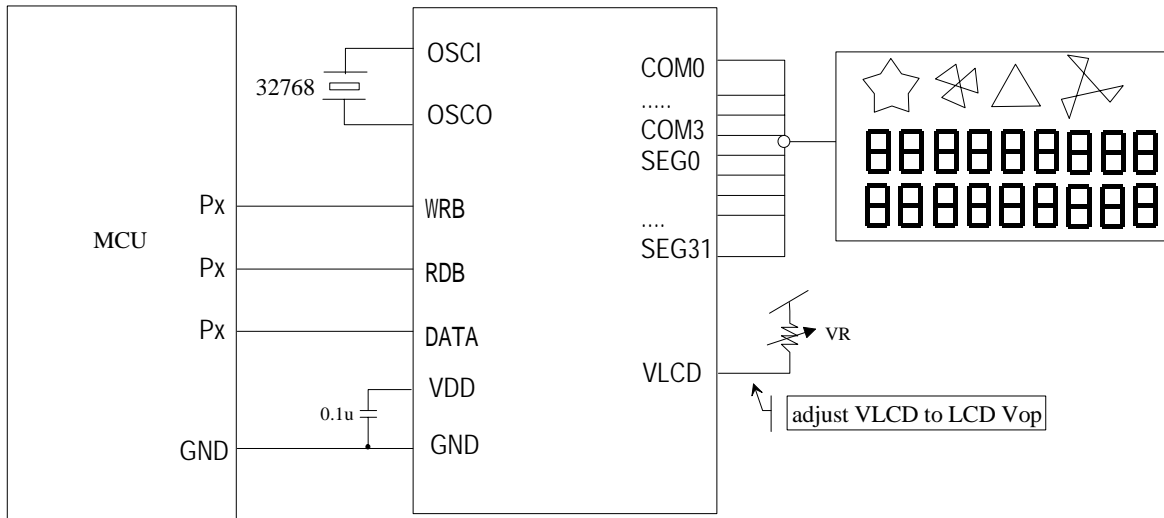
LCD324-4

(External 256Khz input)



LCD324-41

(External 32768Hz Crystal Oscillator)



LCD324-42

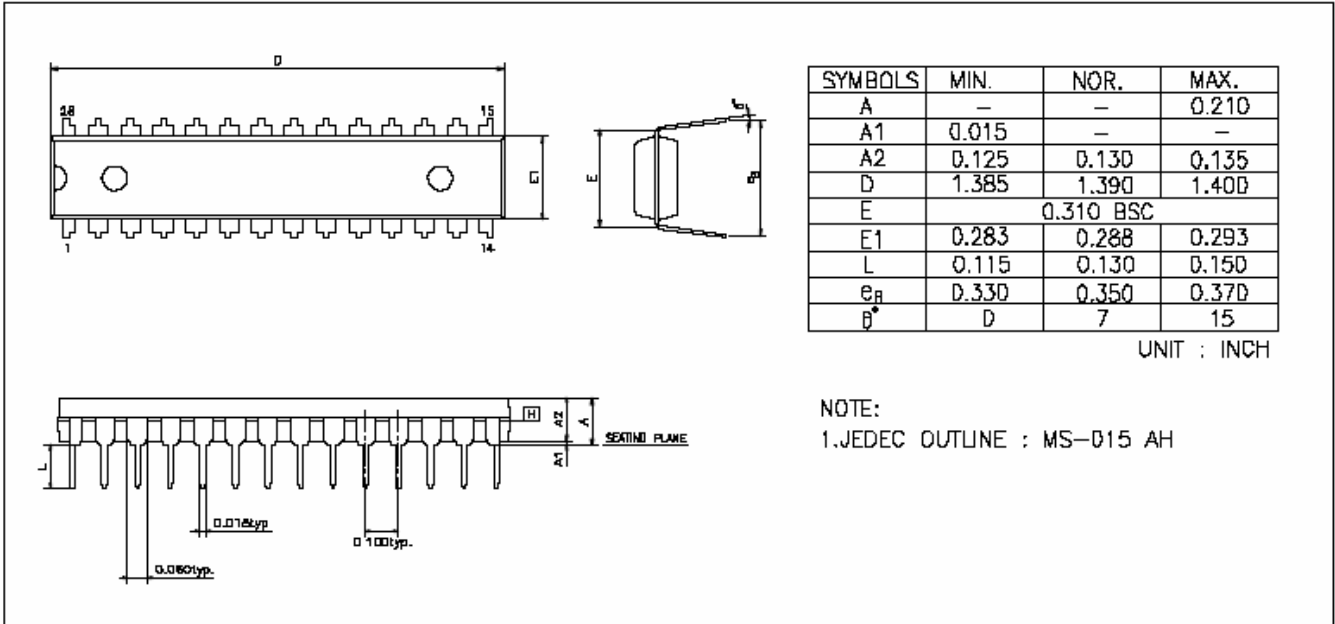
VR Suggest:

- At VDD=5V and VLCD = 3.0V then VR = 24k ohm
- At VDD=5V and VLCD = 4.5V then VR = 4k ohm

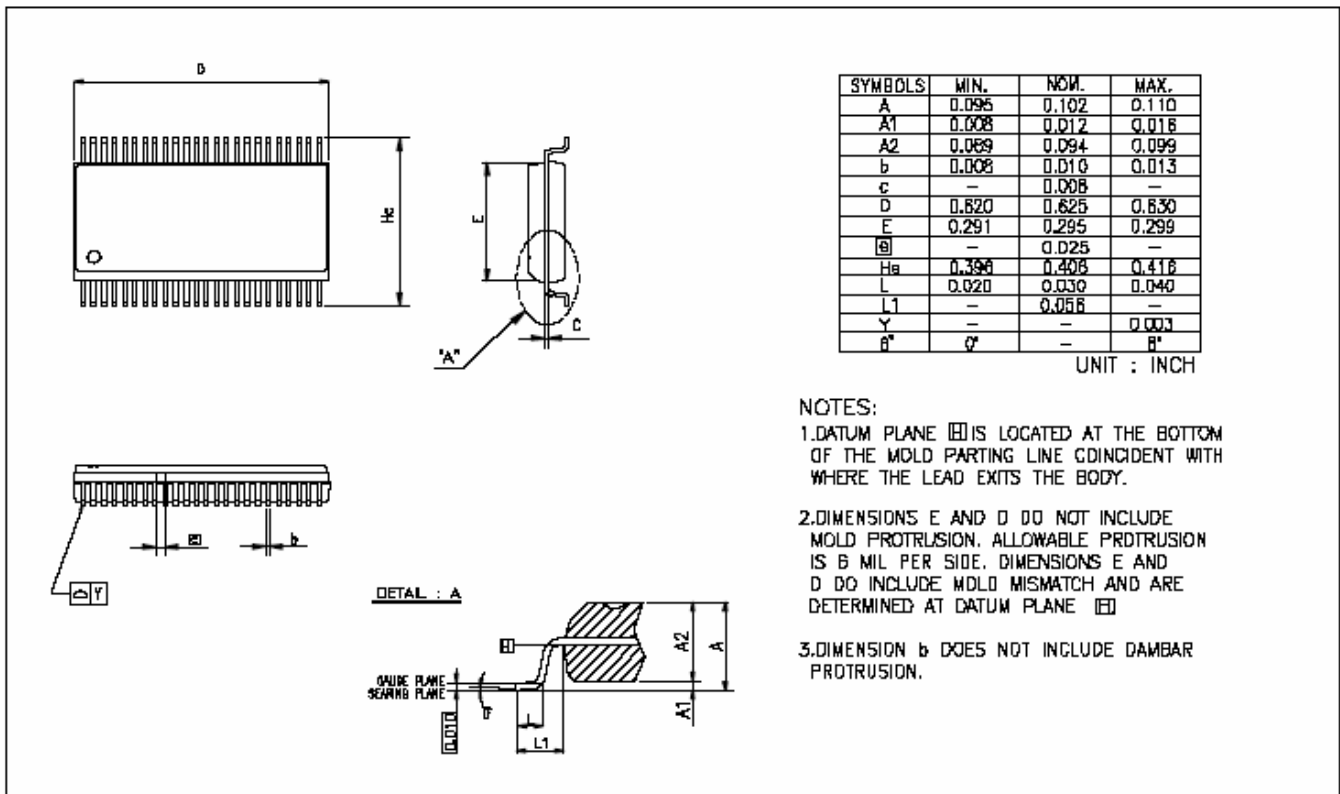
Application note: The 0.1uF capacitor is between VDD and GND. Its PCB layout must be very closed to TTP802 pin to be sure the anti-noise capability.

. Package Information

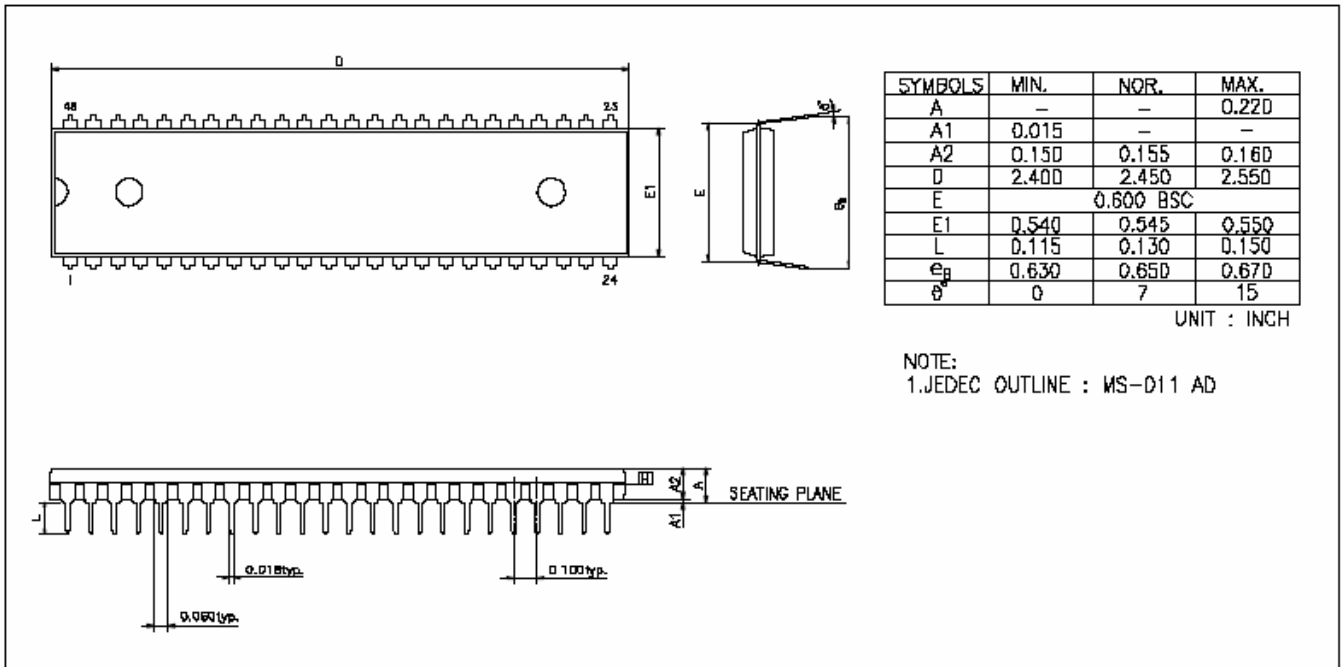
(28-SDIP)



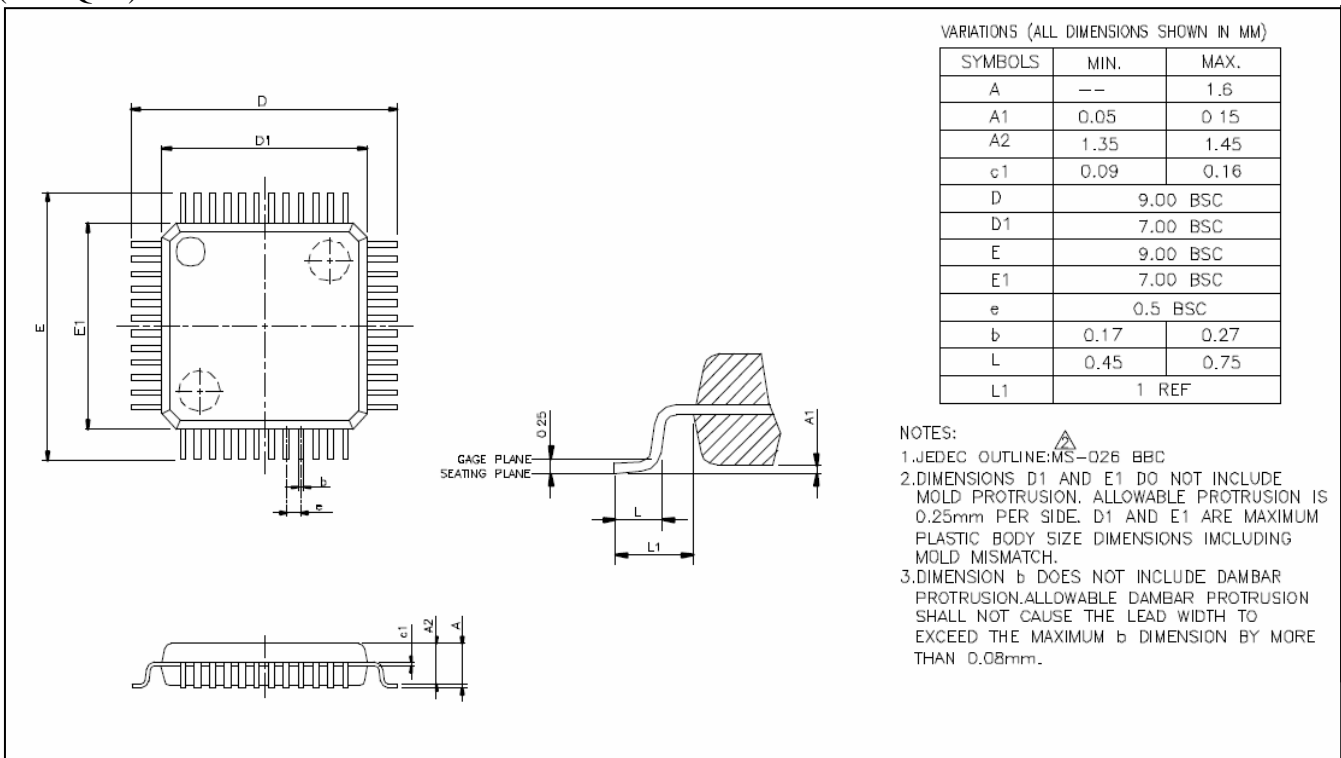
(48-SSOP)



(48-DIP)



(48-LQFP)



. Revise History

1. 2011/06 – 1st ver.