

1 • SDEC LCD MODULE NUMBERING SYSTEM

LM	C	—	S	T	C	2	E	16	D	L	Y	Y	—	
[1]	[2]		[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]		[13]

LM	G	—	S	S		12	A	64	U	E	G	W	—	
[1]	[2]		[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]		[13]

2 • SDEC LCD MODULE VARIATION LIST

NO	ITEM	DESCRIPTION			
[1]	LCD MODULE	LIQUID CRYSTAL DISPLAY MODULE			
[2]	LCM MODUEL	C	CHARACTER MODEL	G	GRAPHIC MODEL
[3]	LCM OF FUNCTION	B	BIG SIZE TYPE	S	SMALL/NORMAL TYPE
		P	PAGER TYPE	M	MODULE TYPE
[4]	LCD MODEL	T	TN LCD	S	STN LCD
		F	FSTN LCD		
[5]	IC PACKING		PACKAGE TYPE	C	CHIP TYPE
[6]	LCD OF FUNCTION	CHARACTER MODEL: NUMBER OF LINES			
		GRAPHIC MODEL: WIDE SIDE OF DOTS			
[7]	LCM TYPE				
[8]	LCD OF FUNCTION	CHARACTER MODEL: NUMBER OF CHARACTERS			
		GRAPHIC MODEL:HIGH SIDE OF DOTS			
[9]	VIEWING ANGLE	B	6 O'CLOCK	U	12 O'CLOCK
[10]	BACKLIGHT	R	WITHOUT BACKLIGHT	E	EL (TRANSFLECTIVE)
		L	LED (TRANSFLECTIVE)	F	FL (TRANSMISSIVE)
[11]	POLARIZER COLOR	G	GRAY	Y	YELLOW GREEN
		N	NEGATIVE STN TYPE : BLUE		
			NEGATIVE FSTN TYPE : BLACK		
[12]	BACKLIGHT COLOR	B	BLUE	G	GREEN
		O	ORANGE	R	RED
		W	WHITE	Y	YELLOW GREEN
[13]	TEMPERATURE		NORMAL TEMPERATURE	H	WIDE TEMPERATURE

2.1 LMC-SERIES:

CHAR.×LINE	MODEL NUMBER	MODULE SIZE W×H×D(mm)	VIEWING AREA W×H (mm)	CHAR. SIZE W×H (mm)	DUTY	POWER SUPPLY VDD(V)
16×1	ST(S)C1C16	80.0×36.0×9.5	65.0×13.8	3.07×6.56	1/16	+5.0
	ST(S)C1D16	80.0×36.0×9.0	65.0×16.0	3.07×6.56	1/16	+5.0
	BT(S)C1A16	122.0×33.0×10.0	99.0×13.0	4.85×9.66	1/16	+5.0
	BS1B16	151.0×40.0×10.5	120.0×23.0	6.00×14.54	1/16	+5.0
16×2	ST(S)C2A16	85.0×30.0×9.0	65.0×16.0	2.78×4.89	1/16	+5.0
	ST(S)C2B16	80.0×36.0×9.0	65.0×16.0	2.78×4.89	1/16	+5.0
	ST(S)C2C16	85.0×35.0×9.0	65.0×18.0	2.96×5.56	1/16	+5.0
	ST(S)C2D16	85.0×36.0×9.0	65.0×18.0	2.96×5.56	1/16	+5.0
	ST(S)C2E16	84.0×44.0×9.0	65.0×18.0	2.96×5.56	1/16	+5.0
	ST(S)C2F16	85.0×32.6×9.0	65.0×16.0	2.96×5.56	1/16	+5.0
	BT(S)C2A16	122.0×44.0×9.5	99×24.0	4.48×9.66	1/16	+5.0
	BT(S)C2B16	106.5×43.5×9.5	99×24.0	4.48×9.66	1/16	+5.0
20×2	ST(S)C2A20	115.0×36.0×10.5	83.0×18.6	3.20×5.55	1/16	+5.0
	ST(S)C2C20	115.0×36.0×10.5	83.0×18.6	3.20×5.55	1/16	+5.0
	BS2A20	180.0×40.0×10.5	149.0×23.0	6.00×9.66	1/16	+5.0
	BS2B20	190.0×54.0×10.0	149.0×33.0	6.00×13.95	1/16	+5.0
24×2	ST(S)C2A24	118.0×36.0×10.5	94.5×17.8	3.20×5.55	1/16	+5.0
	BS(F)2A24	190.0×54.0×10.0	147.0×29.5	4.85×10.75	1/16	+5.0
12×4	SSC4A12	63.2×55.0×8.0	55.0×36.0	3.70×6.75	1/16	+5.0
16×4	SSC4A16	87.0×60.0×9.5	62.0×25.0	2.95×4.75	1/16	+5.0
20×4	SSC4A20	98.0×60.0×10.0	76.0×25.0	2.95×4.75	1/16	+5.0
	BS(F)4A20	144.0×85.0×10.5	121.0×57.7	4.85×11.55	1/16	+5.0
24×4	BS(F)4A24	180.0×65.0×11.0	147.0×46.0	4.85×9.55	1/16	+5.0
40×2	SS2A40	182.0×33.5×10.5	153.6×16.2	3.20×5.55	1/16	+5.0
40×4	SS4A40	190.0×54.0×10.0	147.0×29.5	2.80×4.91	1/16	+5.0

IC PACKING	BUILT-IN	LCDTYPE			BACKLIGHT TYPE			VIEWING		POLAR- IZER COLOR (STN)	BACKL- IGHT COLOR EL/LED	OPERATING TEMP (°C)	BACK- LIGHT INVERTER
	CONTROL IC	TN	STN	FSTN	EL	LED	FL	6H	12H				
CHIP	NT3881	0	0		0	0		0	0	G	B/Y	0~+50	I001A
CHIP	NT3881	0	0		0	0		0	0	G	B/Y	0~+50	I001A
CHIP	NT3881	0	0		0	0		0	0	Y	Y	0~+50	I001A
PACKAGE	HD44780		0		0	0		0	0	Y	Y	0~+50	I002A
CHIP	NT3881	0	0		0	0		0	0	G	B/Y	0~+50	I001A
CHIP	NT3881	0	0		0	0		0	0	G	B/Y	0~+50	I001A
CHIP	NT3881	0	0		0	0		0	0	G	B/Y	0~+50	I001A
CHIP	NT3881	0	0		0	0		0	0	Y	B/Y	0~+50	I001A
CHIP	NT3881	0	0		0	0		0	0	Y	B/Y	0~+50	I001A
CHIP	NT3881	0			0	0		0	0	G	B/Y	0~+50	I001A
CHIP	NT3881	0	0		0	0		0	0	G	B/Y	0~+50	I002A
CHIP	NT3881	0	0					0	0	G	Y	0~+50	
CHIP	NT3881	0	0		0	0		0	0	Y	B/Y	0~+50	I002A
CHIP	NT3881	0	0		0	0		0	0	Y	B/Y	0~+50	I002A
PACKAGE	HD44780		0			0		0	0	Y	Y	-10~+70	
PACKAGE	SED1278		0	*0		0	0	0	0	G	Y	-10~+70	FL001
CHIP	NT3881	0	0		0	0		0	0	G	B/Y	0~+50	I002A
PACKAGE	SED1278		*0	*0		0	0	0	0	G	Y	-10~+70	FL001
CHIP	KS0073		0		0	0		0	0	Y	W/Y	0~+50	I001B
CHIP	NT3881		0			0		0	0	Y	Y	0~+50	
CHIP	SED1278		0			0		0	0	G	Y	0~+50	
PACKAGE	SED1278		*0	*0		0	0	0	0	G	Y	-10~+70	FL001
PACKAGE	SED1278		*0	*0		0	0	0	0	Y	Y	-10~+70	FL001
PACKAGE	HD44780		0		0	0		0	0	Y	Y	0~+50	I002A
PACKAGE	HD44780		0			0	0	0	0	G	Y	0~+50	FL001

* production in the near future

2.2 LMG-SERIES:

DOT NUMBER W×H(DOTS)	MODEL NUMBER	MODULE SIZE W×H×D(mm)	VIEWING AREA W×H (mm)	DOT SIZE W×H (mm)	DUTY	POWER SUPPLY	
						VDD(V)	VEE
122×32	MSC12A32	84.0×44.0×9.5	60.0×18.0	0.40×0.45	1/32	+5.0	
	MPC12A32	84.0×44.0×9.5	60.0×18.0	0.40×0.45	1/32	+5.0	
128×64	SS12A64	93.0×70.0×9.5	72.0×39.0	0.48×0.48	1/64	+5.0	
	SF12A64	93.0×70.0×9.5	72.0×39.0	0.48×0.48	1/64	+5.0	
	SS12A64	93.0×70.0×9.5	72.0×39.0	0.48×0.48	1/64	+5.0	
	SF12A64	93.0×70.0×9.5	72.0×39.0	0.48×0.48	1/64	+5.0	
	SS12C64	113.0×65.0×9.5	73.4×38.8	0.48×0.48	1/64	+5.0	-10.0
	SF12C64	113.0×65.0×9.5	73.4×38.8	0.48×0.48	1/64	+5.0	-10.0
	SS12E64	70.2×55.0×10.0	59.0×32.0	0.40×0.40	1/64	+5.0	
	SF12E64	70.2×55.0×10.0	59.0×32.0	0.40×0.40	1/64	+5.0	
160×80	SS16A80	93.0×70.0×9.5	72.0×39.0	0.39×0.39	1/80	+5.0	
	SF16A80	93.0×70.0×9.5	72.0×39.0	0.39×0.39	1/80	+5.0	
	SS16B80	100.0×54.0×9.5	72.0×39.0	0.39×0.39	1/80	+5.0	
	SF16B80	100.0×54.0×9.5	72.0×39.0	0.39×0.39	1/80	+5.0	
240×64	SS24A64	180.0×65.0×11.0	132.0×39.0	0.49×0.49	1/64	+5.0	
	SF24A64	180.0×65.0×11.0	132.0×39.0	0.49×0.49	1/64	+5.0	
	SS24B64	180.0×65.0×11.0	132.0×39.0	0.49×0.49	1/64	+5.0	-5.0
	SF24B64	180.0×65.0×11.0	132.0×39.0	0.49×0.49	1/64	+5.0	-5.0
240×128	SS24A12	144.0×104.0×10.5	114.0×61.0	0.40×0.40	1/128	+5.0	-10.0
	SF24A12	144.0×104.0×10.5	114.0×61.0	0.40×0.40	1/128	+5.0	-10.0
	SS24B12	144.0×104.0×10.5	114.0×61.0	0.40×0.40	1/128	+5.0	-10.0
	SF24B12	144.0×104.0×10.5	114.0×61.0	0.40×0.40	1/128	+5.0	-10.0

2.3 SDEC INVERTER SERIES:

ITEM	BACKLIGHT	DIMENSIONS W×H×D(mm)	INPUT VOLTAGE (DC)	LOAD RANGE (cm ²)	INPUT CURRENT (ma)
I001A	EL	15.0×15.0×16.5	+5.0V	9~15	20~30
I001B	EL	22.0×20.0×6.0	+5.0V	10~25	70~100
I002A	EL	24.0×17.5×20.0	+5.0V	45~70	30~40
I003A	EL	22.0×22.0×21.0	+5.0V	70~100	65~85
I005A	EL	30.5×21.0×9.0	+5.0V	20~50	50~70
FL001(5A)	CCFL	49.0×21.0×15.0	+5.0V		230

IC PACKING	BUILT-IN		LCD TYPE		BACKLIGHT TYPE			VIEWING		POLA- RIZER COLOR	BACK- LIGHT COLOR (LED)	OPERATING TEMP (°C)	BACK- LIGHT INVERTER
	CONVE- RTER	CONTROL LSI	STN	FSTN	EL	LED	FL	6H	12H				
CHIP		SED1520	0		0	0		0	0	G	Y	0~+50	EL:
CHIP		SED1520		* 0	0	0		0	0	G	Y	0~+50	1001B
PACKAGE	0	KS0108	0		0	0		0	0	G	Y	0~+50	EL:
PACKAGE	0	KS0108		* 0	0	0		0	0	G	Y	0~+50	1002A
CHIP	0	KS0108	0		0	0		0	0	G	Y	0~+50	FL:
CHIP	0	KS0108		* 0	0	0		0	0	G	Y	0~+50	FL001
PACKAGE			0			0		0	0	G	Y	-10~+70	EL:
PACKAGE				* 0		0		0	0	G	Y	-10~+70	1002A
CHIP	0	KS0108	0		0	0		0	0	Y	Y	0~+50	EL:
CHIP	0	KS0108		* 0	0	0		0	0	Y	Y	0~+50	1001B
PACKAGE	0	LC7981	0		0	0		0	0	G	Y	0~+50	1002A
PACKAGE	0	LC7981		* 0	0	0		0	0	G	Y	0~+50	FL001
PACKAGE	0	LC7981	0		0	0		0	0	G	Y	0~+50	EL:
PACKAGE	0	LC7981		* 0	0	0		0	0	G	Y	0~+50	1002A
PACKAGE	0	LC7981	0		0	0	0	0	0	G	Y	-10~+70	EL:
PACKAGE	0	LC7981		* 0	0	0	0	0	0	G	Y	-10~+70	1003A
PACKAGE	0	T6963C	0		0	0	0	0	0	G	Y	-10~+70	FL:
PACKAGE	0	T6963C		* 0	0	0	0	0	0	G	Y	-10~+70	FL001
PACKAGE	0	LC7981	0		0	0	0	0	0	Y	Y	-10~+70	EL:
PACKAGE	0	LC7981		* 0	0	0	0	0	0	Y	Y	-10~+70	1003A
PACKAGE	0	T6963C	0		0	0	0	0	0	Y	Y	-10~+70	FL:
PACKAGE	0	T6963C		* 0	0	0	0	0	0	Y	Y	-10~+70	FL001

* production in the near future

OUTPUT VOLTAGE (AC)	OSC FREQUENCY (Hz)	OPERATING TEMPERATURE (°C)	STORAGE TEMPERATURE (°C)	LIFE(HRS)	NOTE
70~110V	420~600	-10~+60	-20~+70	25,000	
60~70V	1.85K~2.3K	-10~+60	-20~+70	25,000	
100~130V	400~700	-10~+60	-20~+70	25,000	
100~130V	400~700	-10~+60	-20~+70	25,000	
70~100V	700~1K	-10~+60	-20~+70	25,000	
1000V	30K	-10~+60	-20~+70	25,000	

3. BACKLIGHTS FOR LCD MODULES

EL, COLD Cathode Fluorescent lamp and LED etc. are available as backlight for LCD Module upon your choice, your request.

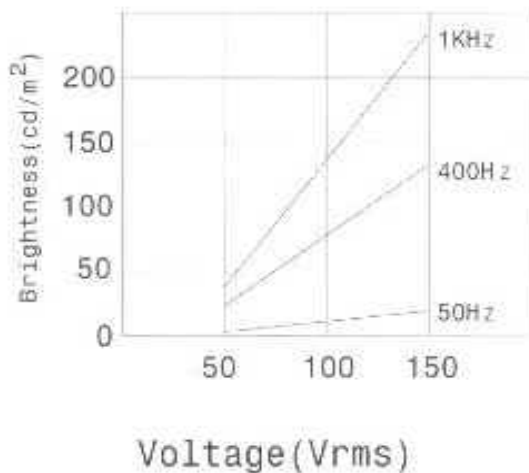
3.1 EL BACKLIGHT

■ Features

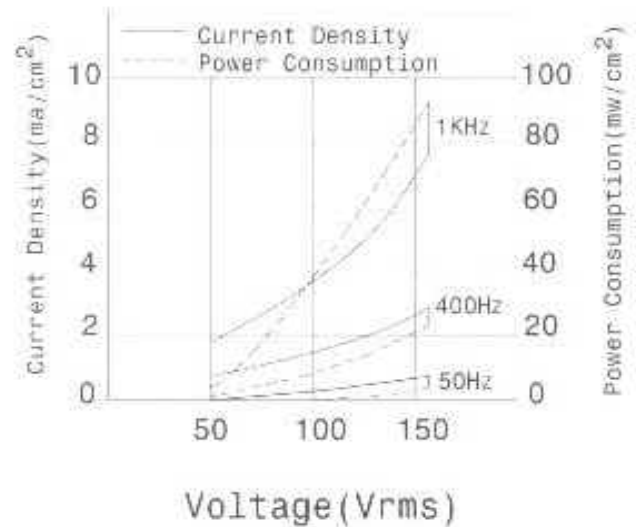
- Max 1.3mm thickness (Max 1.5mm for lead portion).
- Wide driving condition of 60~1,000Hz and 150V AC Max. With inverter, step-up voltage from 5.0V battery is available.
- Emitted colors are blue-green and white.
- Operating characteristics.

■ Electrical Characteristics

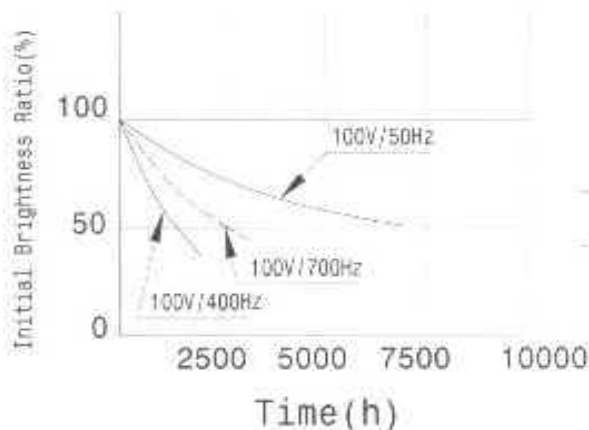
• Voltage V.S. Brightness



• Voltage V.S. Current Density



■ Life Characteristics



Ambient Condition: 50°C 90% RH

- Constant Voltage/Frequency Drive
- - - Inverter Drive

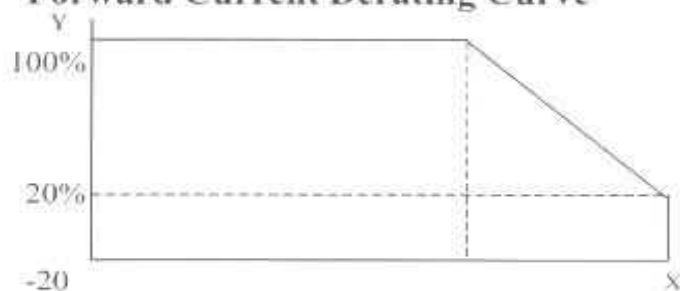
3.2 LED BACKLIGHT

■ Features

- ☐ Low voltage driving (DC) is available without inverter.
- ☐ Long life time 100,000 hours (average).
- ☐ No noise occurrence.
- ☐ Various color of yellow-green, red and orange etc.
- ☐ Operating characteristics.

■ Electrical characteristics (Reference Data)

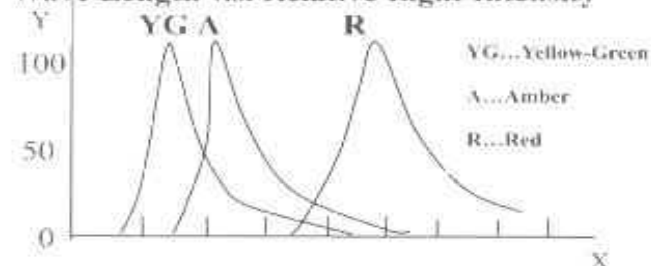
☐ Forward Current Derating Curve



Y : Forward Current(IF)

Note: The above spec. are only for reference.

Wave Length v.s. Relative Light Intensity



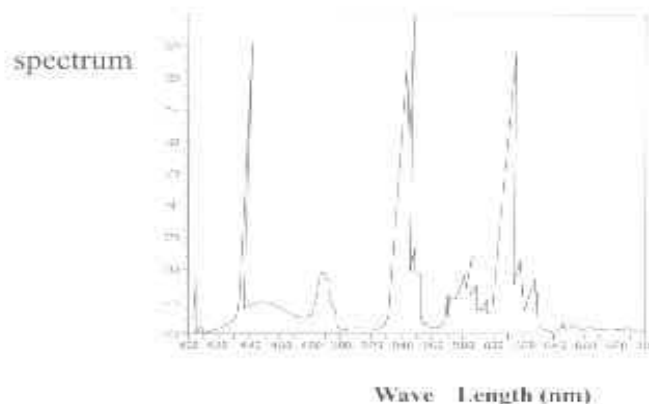
Y: RELATIVE LIGHT INTENSITY(%)

3.3 Cold Cathode Fluorescent Lamp

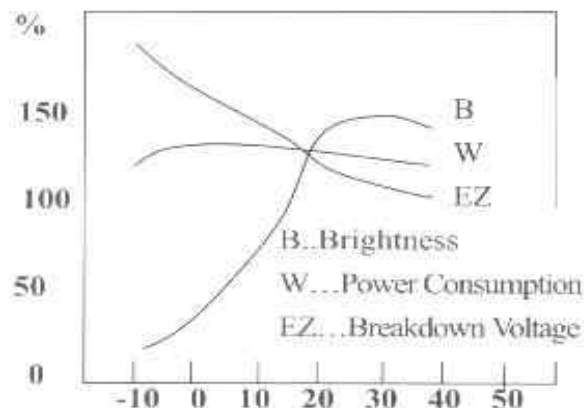
■ Features

- ☐ High brightness of 3,000-4,000cd/m²m.
- ☐ OE lamp and AE lamp show good result for color enhancement
- ☐ Life time 20,000 hours
- ☐ Low heat generation when operated at rated lamp current of 5-20mA.
- ☐ Operating characteristics

■ Electrical Characteristics(Reference Data)



Temperature
characteristics
curve

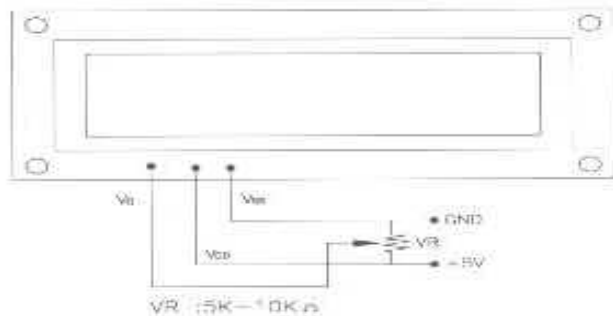


■ CCFL Backlight

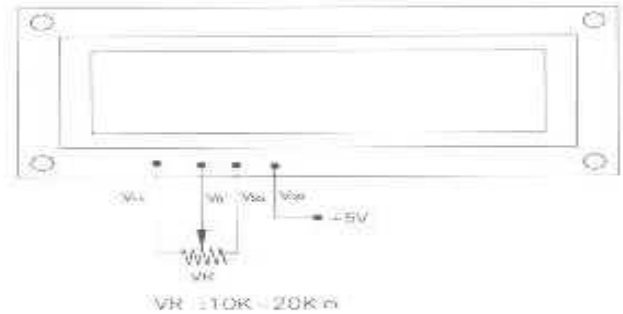
The CCFL backlight provides two to three times the luminance of the EL backlight. In comparison to the EL backlight, which is used as an auxiliary device to backlight the LCD unit in dark places, the CCFL backlight enhances the readability of LCD unit in offices with even brighter service environments.

4 • EXAMPLE FOR POWER SUPPLY

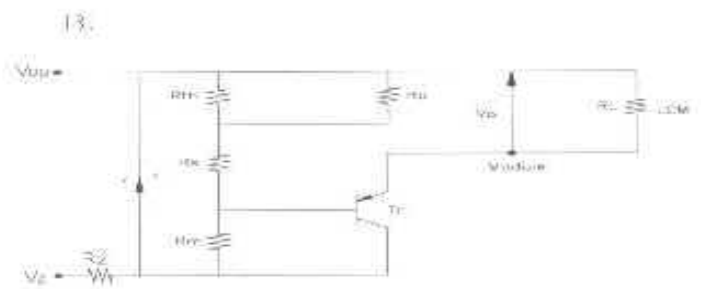
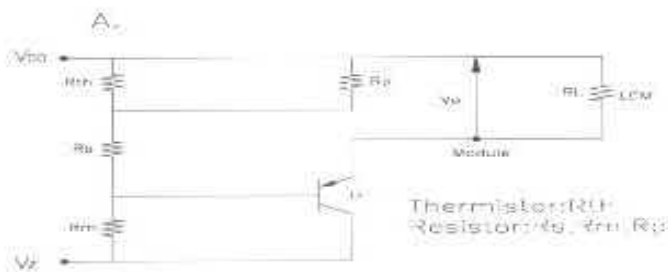
For Single Power (CHARACTER Type)



For Dual Power (GRAPHIC Type)

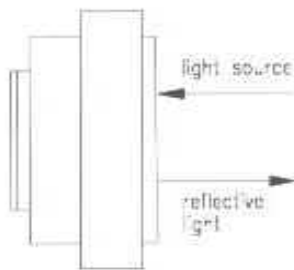


Examples of Temperature Compensation Circuits For Extended Temperature LCM.
(Reference Data)

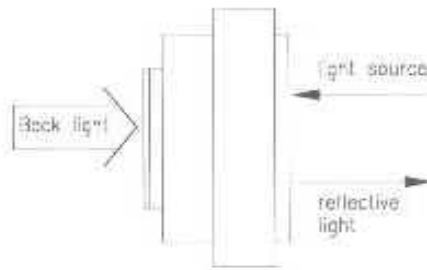


5 • POLARIZER FLUID

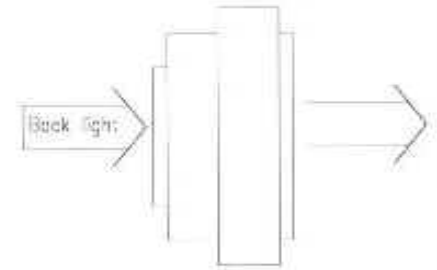
Reflective type



Transflective type

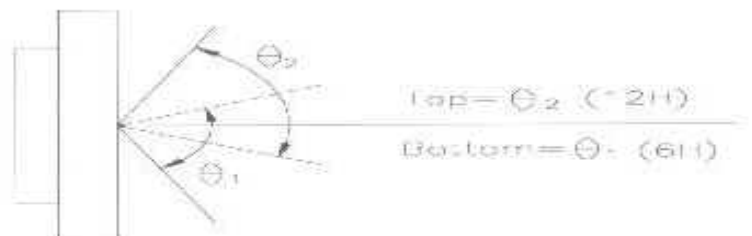


Transmissive type



6 • DEFINITION OF VIEW DIRECTION

	θ°	TN	SIN
6H	θ_1	35°	55°
	θ_2	15°	35°
12H	θ_1	15°	35°
	θ_2	35°	55°



6.1 TN TYPE

(VDD=+5.0V, VSS=0V, Ta=0 ~ +50)

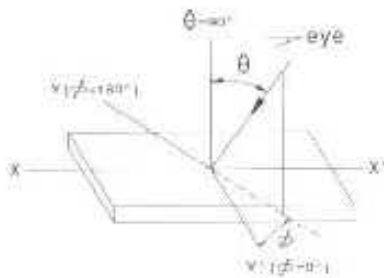
Item	Symbol	Condition	MIN	TYP	MAX	Unit	Note
Viewing angle	θ	K=1.4	10	—	30	deg	1,2
	ϕ		-30	—	30	deg	1,2
Contrast Ratio	k	—	—	3	—	—	3
Response time (rise)	Tr	—	—	150	250	ms	4
Response time (fall)	Tf	—	—	150	250	ms	4

6.2 STN TYPE

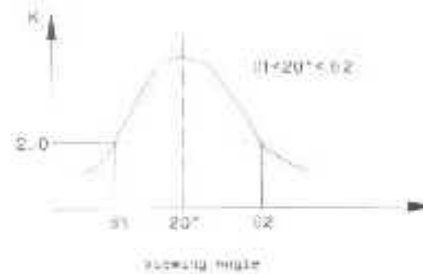
(VDD=+5.0V, VSS=0V, Ta=0 ~ +50)

Item	Symbol	Condition	MIN	TYP	MAX	Unit	Note
Viewing angle	θ	K=2.0	10	—	40	deg	1,2
	ϕ		-30	—	30	deg	1,2
Contrast Ratio	k	—	—	5	—	—	3
Response time (rise)	Tr	—	—	150	300	ms	4
Response time (fall)	Tf	—	—	150	300	ms	4

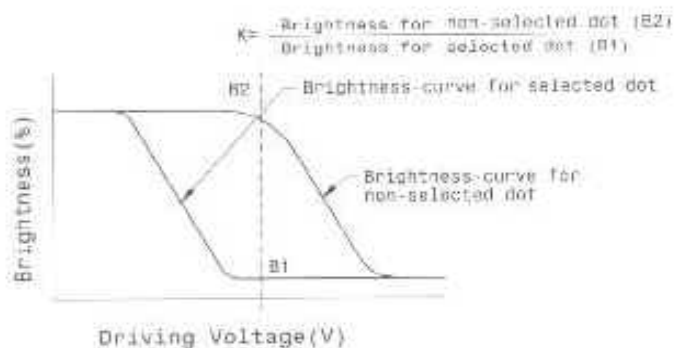
NOTE1. Definition of angle θ & ϕ



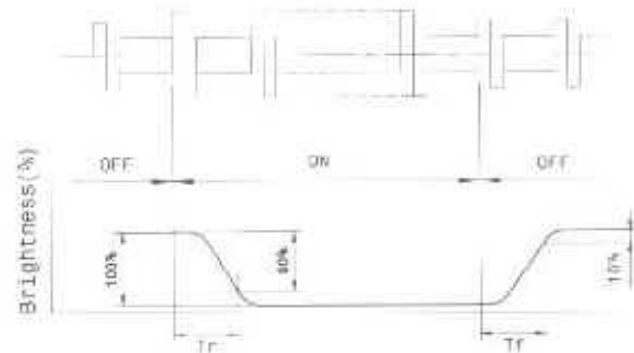
NOTE2. Definition of viewing angle θ_1 and θ_2



NOTE3. Definition of contrast "K"



NOTE4. Definition of optical response



6.3 RELIABILITY CONDITION

		TN Type		STN Type		
		Normal Temperature	Wide Temperature	Normal Temperature	Wide Temperature	
VIEWING ANGLE	Horizontal Φ	+30°	+30°	±30°	+30°	
	Vertical (min)	10° to 30°	10° to 30°	-10° to 40°	-10° to 40°	
Operating Temperature		0℃ to 50℃	-25℃ to 80℃	0℃ to 50℃	-10℃ to 70℃	
Storage temperature		-10℃ to 60℃	-35℃ to 90℃	-10℃ to 60℃	-20℃ to 80℃	
High Temperature (Power Off)		240Hours@70℃	240Hours@90℃	240Hours@65℃	240Hours@75℃	
Low Temperature (Power Off)		240Hours@-20℃	240Hours@-35℃	240Hours@-15℃	240Hours@-25℃	
High Temperature (Power On)		240Hours@70℃	240Hours@80℃	240Hours@60℃	240Hours@70℃	
Low Temperature (Power On)		240Hours@-10℃	240Hours@-25℃	240Hours@-10℃	240Hours@-20℃	
High Temperature & High Humidity		55℃/90%RH 240Hours	75℃/90%RH 240Hours	45℃/90%RH 240Hours	65℃/90%RH 240Hours	
Thermal shock 5 Cycles		A	60Min@-20℃	60 Min@-35℃	60 Min@-20℃	60 Min@-30℃
		B	5 Min@25℃	5 Min@25℃	5 Min@25℃	5 Min@25℃
		C	60 Min@70℃	60 Min@90℃	60 Min@70℃	60 Min@80℃
Expected Life		50,000Hours	50,000Hours	50,000Hours	50,000Hours	

7. CHARACTER LCD MODULES

7.1 PIN ASSIGNMENT

PIN NO.	SYMBOL	LEVEL	FUNCTION		PIN NO.	SYMBOL	LEVEL	FUNCTION
1	VSS	—	Power Supply	0V(GND)	5	R/W	H/L	H:Data Read (Module→MPU) L:Data Write (Module←MPU)
2	VDD	—		+5V	6	E	H/L→L	Enable signal
3	Vo	—		for LCD Drive	7~ 14	DB0~DB7	H/L	Data Bus Line
4	RS	H/L	Register Select Signal Register H:Data Input Select L:Instruction Input					

※ Interface between Data Bus Line and 4-bit or 8-bit MPU is available. Data transfer are made in twice in case of 4-bit MPU, and once in case of 8-bit MPU.

7.2 TIMING CHART

Item	Symbol	Measuring Condition	Standard Value			Unit
			min.	typ.	max.	
Enable Cycle Time	t _{cyE}	Figs. 1, 2	1000	—	—	ns
Enable Pulse Width, High Level	PWEH	Figs. 1, 2	450	—	—	ns
Enable Rise and Decay Time	t _{Er} , t _{Er}	Figs. 1, 2	—	—	25	ns
Address Setup Time, RS, R/W-E	t _{As}	Figs. 1, 2	140	—	—	ns
Data Delay Time	t _{DDR}	Figs. 2	—	—	320	ns
Data Setup Time	t _{DSW}	Figs. 1	195	—	—	ns
Data Hold Time (Write Operation)	t _H	Figs. 1	10	—	—	ns
Data Hold Time (Read Operation)	t _{DHR}	Figs. 2	20	—	—	ns
Address Hold Time	t _{AH}	Figs. 1, 2	10	—	—	ns

※ V_{cc}=5.0V±10%, GND=0V, T_a= -20 °C +70 °C

FIG1. WRITE OPERATION

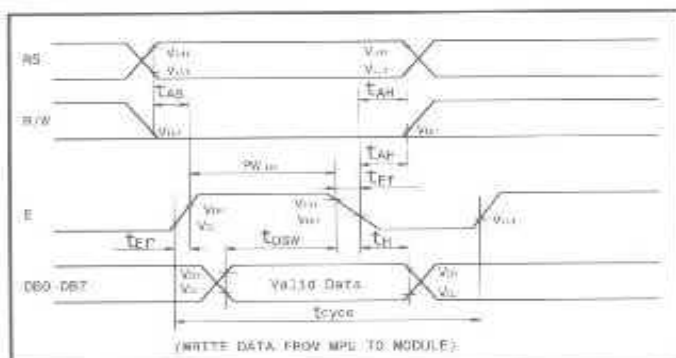
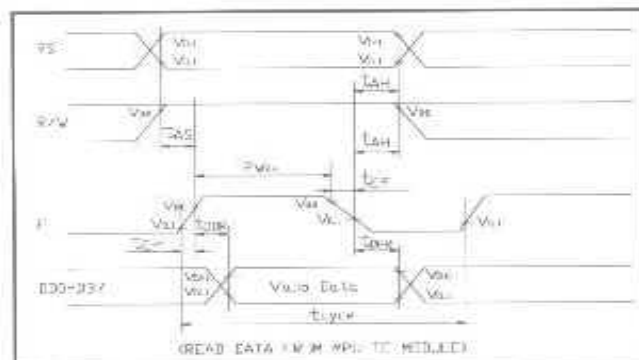


FIG2. READ OPERATION



7.3 CHARACTER LCD MODULES

CHARACTER FONT TABLE (1)

		Uper 4-bit (D4 to D7) of Character Code (Hexadecimal)															
		0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
Lower 4-bit (D0 to D3) of Character Code (Hexadecimal)	xxxx0000	CG RAM (1)															
	xxxx0001	(2)															
	xxxx0010	(3)															
	xxxx0011	(4)															
	xxxx0100	(5)															
	xxxx0101	(6)															
	xxxx0110	(7)															
	xxxx0111	(8)															
	xxxx1000	(1)															
	xxxx1001	(2)															
	xxxx1010	(3)															
	xxxx1011	(4)															
	xxxx1100	(5)															
	xxxx1101	(6)															
	xxxx1110	(7)															
	xxxx1111	(8)															

NOTE 1. CG RAM is character generator RAM having a character pattern storage function ,which enables the user to change easily .

7.4 CHARACTER LCD MODULES

CHARACTER FONT TABLE (2)

		Upper 4-bit (D4-D7) of Character Code (Hexadecimal)															
		0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
Lower 4-bit (D0-D3) of Character Code (Hexadecimal)	xxxx0000	CG RAM (1)	±		0	1	P	'	F	S	e	a	'	r	3	D	τ
	xxxx0001	(2)	≡	!	1	A	Q	a	9	C	æ	£	"	J	+	Y	U
	xxxx0010	(3)	7	"	2	B	R	b	r	e	ne	o	°	o	8	8	Σ
	xxxx0011	(4)	Δ	#	3	C	S	c	s	B	o	C	'	7	7	≡	4
	xxxx0100	(5)	f	*	4	D	T	d	t	ä	e	e	'	+	7	z	o
	xxxx0101	(6)	l	%	5	E	U	e	u	ä	o	e	'	+	Δ	η	7
	xxxx0110	(7)	l	&	6	F	V	f	v	ä	o	*	4	+	8	8	4
	xxxx0111	(8)	l	'	7	B	W	g	w	S	C	R	x	+	Δ	L	4
	xxxx1000	(1)	l	<	8	H	X	h	x	e	9	*	÷	+	3	x	8
	xxxx1001	(2)	l	>	9	I	Y	i	y	e	0	i	Δ	7	7	Δ	4
	xxxx1010	(3)	*	*	*	J	Z	j	z	e	0	a	Δ	7	Δ	4	7
	xxxx1011	(4)	J	+	*	K	C	k	c	R	a	*	L	7	7	7	7
	xxxx1100	(5)	=	.	<	L	\	l	l	ä	R	e	*	l	*	Σ	0
	xxxx1101	(6)	o	-	=	M	J	m	j	ä	a	o	*	.	7	π	-
	xxxx1110	(7)	a	.	>	N	^	n	~	ä	o	e	7	8	8	p	8
	xxxx1111	(8)	a	/	?	O	_	o	Δ	ä	o	*	-	8	o	o	8

NOTE 1. CG RAM is character generator RAM having a character pattern storage function, which enables the user to change easily.

7.5 CHARACTER LCD MODULES

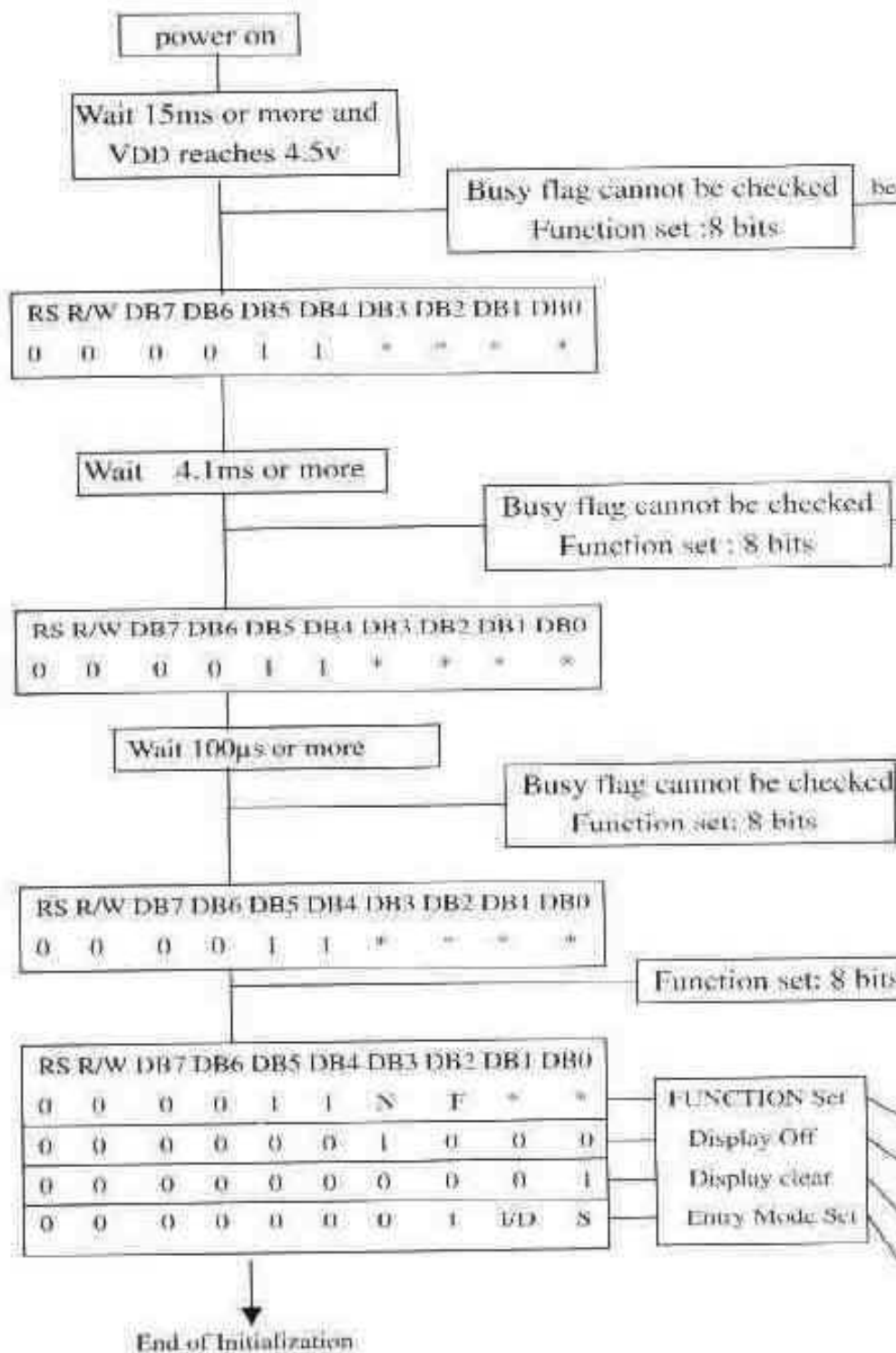
INSTRUCTIONS

Instruction	Code										Description	Execution Time(max) (when fcp or fosc is 250 KHz)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Clears entire display and sets DD RAM address 0 in address counter.	1.64ms
Return Home	0	0	0	0	0	0	0	0	0	*	Sets DD RAM address 0 in address counter. Also returns display being shifted to original position. DD RAM contents remain unchanged.	1.64ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction and specifies shift of display. These operations are performed during data write and read.	40 μ s
Display ON/OFF Control	0	0	0	0	0	0	1	D	C	B	Sets ON/OFF of entire display (D), cursor ON/OFF (C), and blink of cursor position character(B).	40 μ s
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	*	*	Moves cursor and shifts display without changing DD RAM contents.	40 μ s
Function Set	0	0	0	0	1	DL	N	F	*	*	Sets interface data length(DL) number of display lines(L) and character font(F)	40 μ s
Set CG RAM Address	0	0	0	1	ACG						Sets CG RAM address. CG RAM data is sent and received after this setting.	40 μ s
Set DD RAM Address	0	0	1	ADD						Sets DD RAM address. DD RAM data is sent and received after this setting.	40 μ s	
Read Busy Flag Address	0	1	BF	AC						Read Busy Flag(BF) indicating internal operation is being performed and reads address counter contents.	40 μ s	
Write Data to CG or DD RAM	1	0	Write Data								Write Data into DD RAM or CG RAM.	40 μ s
Read Data From CG or DD RAM	1	1	Read Data								Read Data From DD RAM or CG RAM.	40 μ s
	I/D=1:Increment I/D=0:Decrement S=1:Accompanies display shift S/C=1:Display shift S/C=0:Cursor move R/L=1:Shift to the right R/L=0:Shift to the left DL=1:8 bits,DL=0:4 bits N=1:2 lines, N=0:1 line F=1:5 $\times$ 10 dots, F=0:5 $\times$ 8 dots BF=1:Internally operating BF=0:Can accept instruction										DD RAM:Display data RAM CG RAM:Character generator RAM ACG:CG RAM address ADD:DD RAM address: corresponds to cursor address. AC:Address counter used for both DD and CG RAM address.	Execution Time changes when frequency changes. Example: When fcp or fosc is 270 KHz: $40 \mu s \times \frac{250}{270} = 37 \mu s$

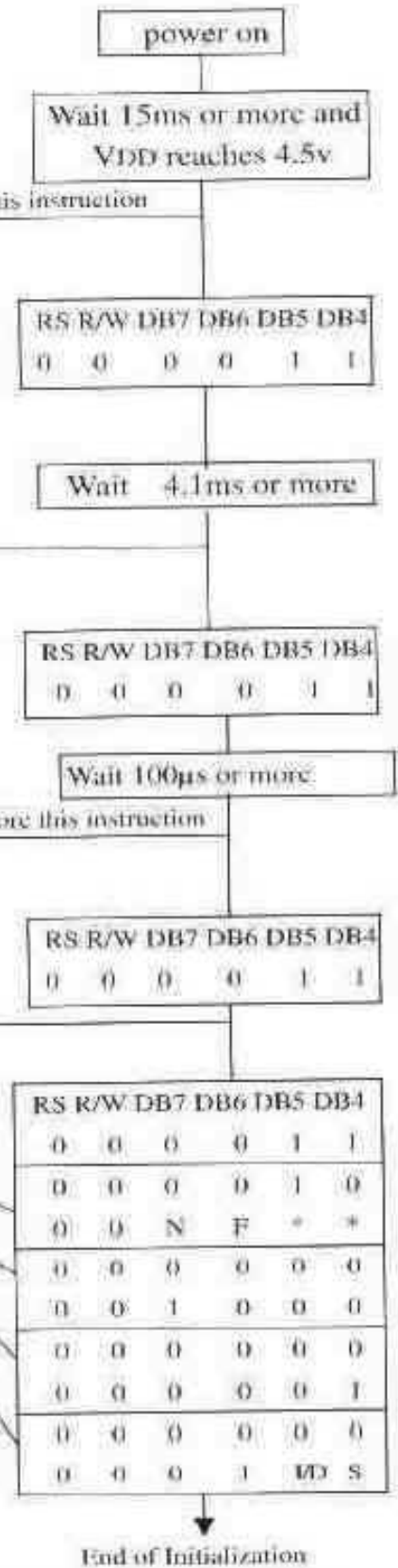
* No Effect

7.6 INITIALIZATION BY INSTRUCTION

1) 8 bit Interface

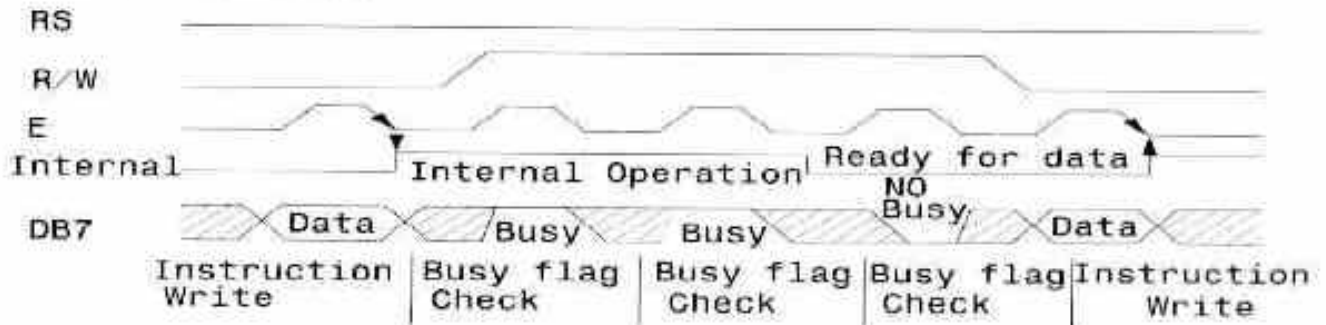


2) 4 Bit Interface

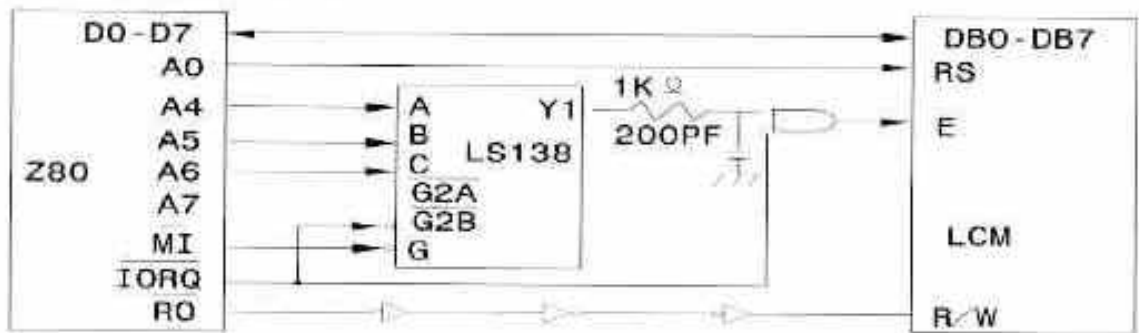


* Busy flag is checked after instructions are completed. If busy flag is not checked the waiting time between instructions should be longer than the execution time of these instructions.

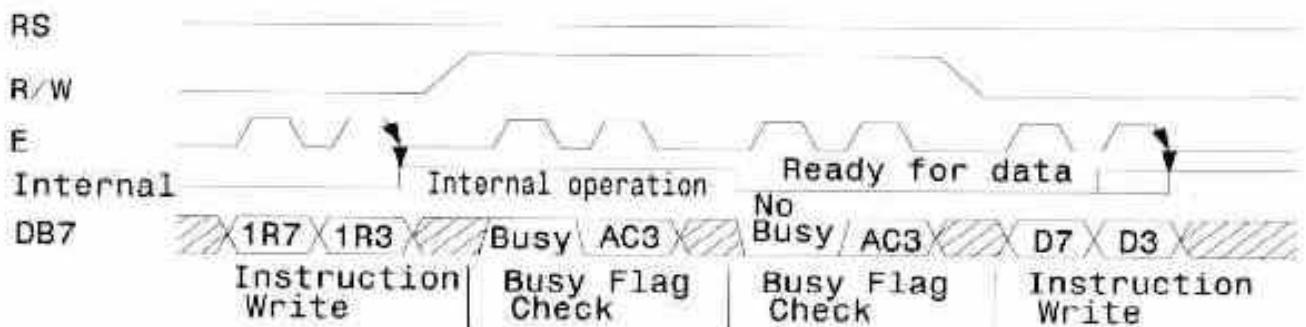
8.1 Interface to 8-bit MPU



• Connection to Z80



8.2 Interface to 4-bit MPU



Note: 1R7, 1R3: Instruction 7th bit, 3rd bit
AC3: Address Counter 3rd bit

• Connection to HMCS43C

