

DISPLAY ELEKTRONIK GMBH

DATA SHEET

LCD MODULE

DEM 240128B-SERIES

Product specification

Version :2

10/Jan/2003

GENERAL SPECIFICATION

MODULE NO. :

DEM 240128B-SERIES

CUSTOMER P/N

VERSION NO.	CHANGE DESCRIPTION	DATE
0	ORIGINAL VERSION	2002/03/29
1	ADD PCB DRAWING	2002/04/03
2	ADDING VERSION	2003/01/10

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DATE: 2003/01/10
DATE: 2003/07/29

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1. FUNCTIONS & FEATURES

● LCD TYPE:

MODULE MODEL	LCD TYPE	Operating temperature	Storage temperature
DEM 240128B FY-LY	FSTN Transflective Positive Mode	0°C ~ +50°C	-10°C ~ +60°C
DEM 240128B FYH-LY	FSTN Transflective Positive Mode	-20°C ~ +70°C	-25°C ~ +75°C

- Viewing Direction : 12 O'clock
- Driving Scheme : 1/128 Duty, 1/12 Bias
- Display Content : 240 x 128 Dots
- Power Supply Voltage : 5.0V (typ.)
- LCD Driving Voltage ($V_{LCD}=V_{DD}-V_0$) : 17.0V (typ.)
- Back-light Color : Yellow Green (Lightbox)

2. MODULE ARTWORK

- Module Size : 100 x 65 x 12.30 (mm)
- Dot Size : 0.26 x 0.29 (mm)
- Dot Gap : 0.04 (mm)

3. BLOCK DIAGRAM

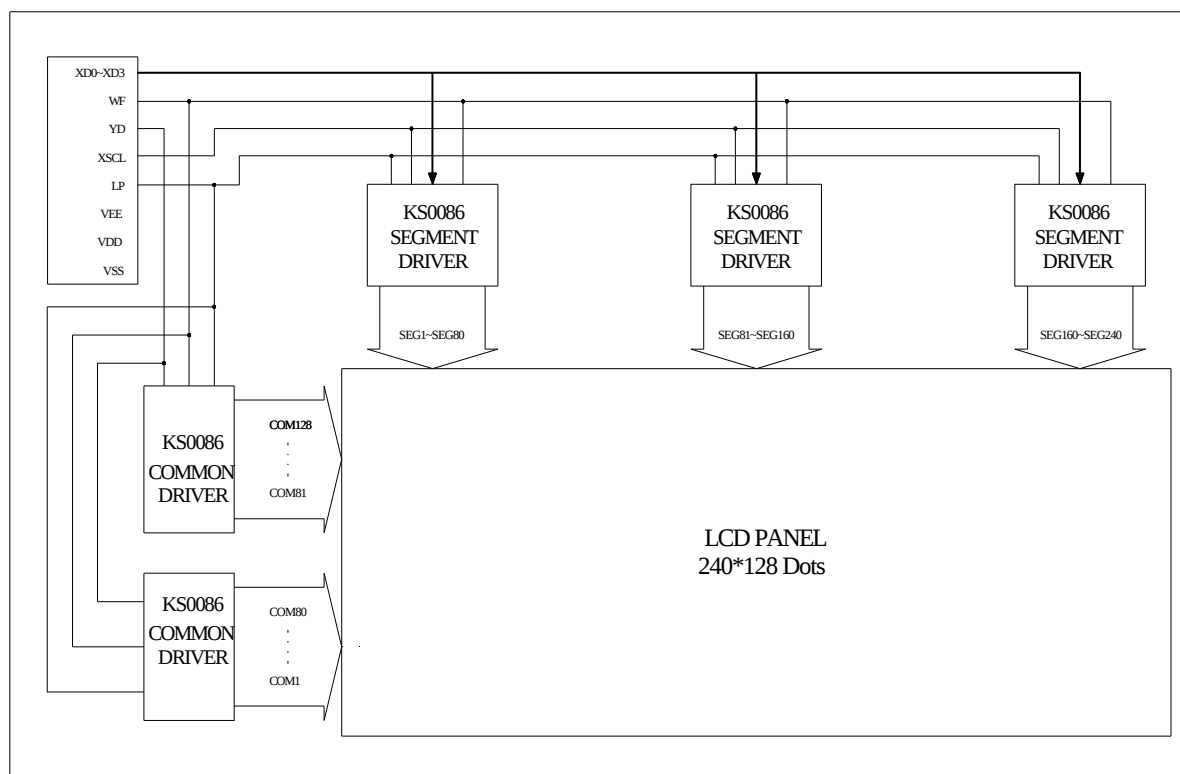


Figure 1.0

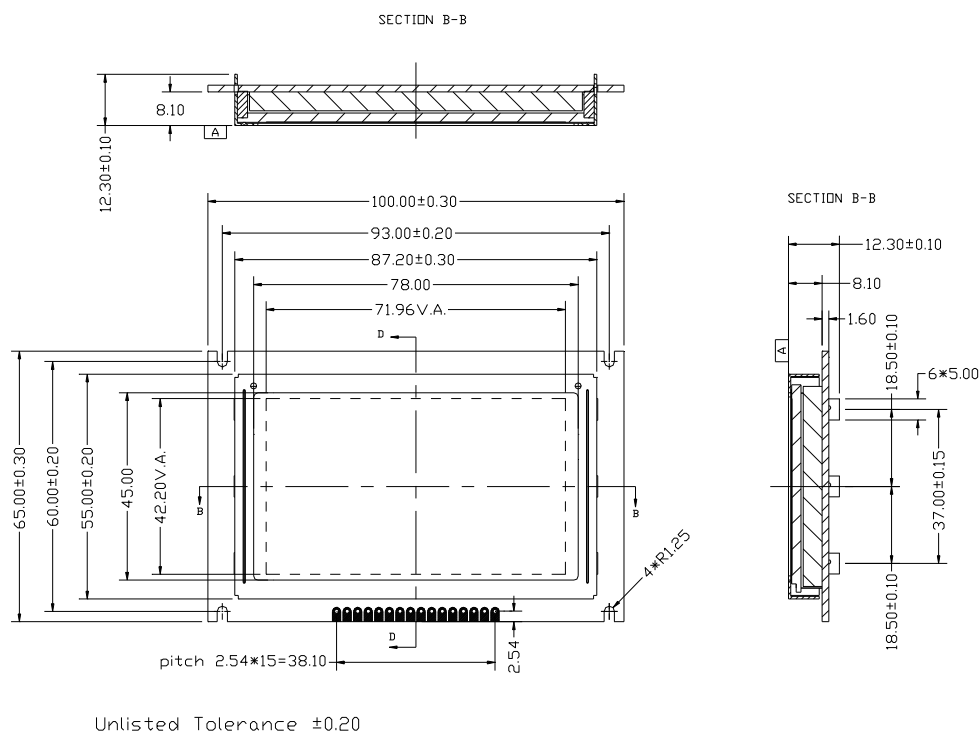
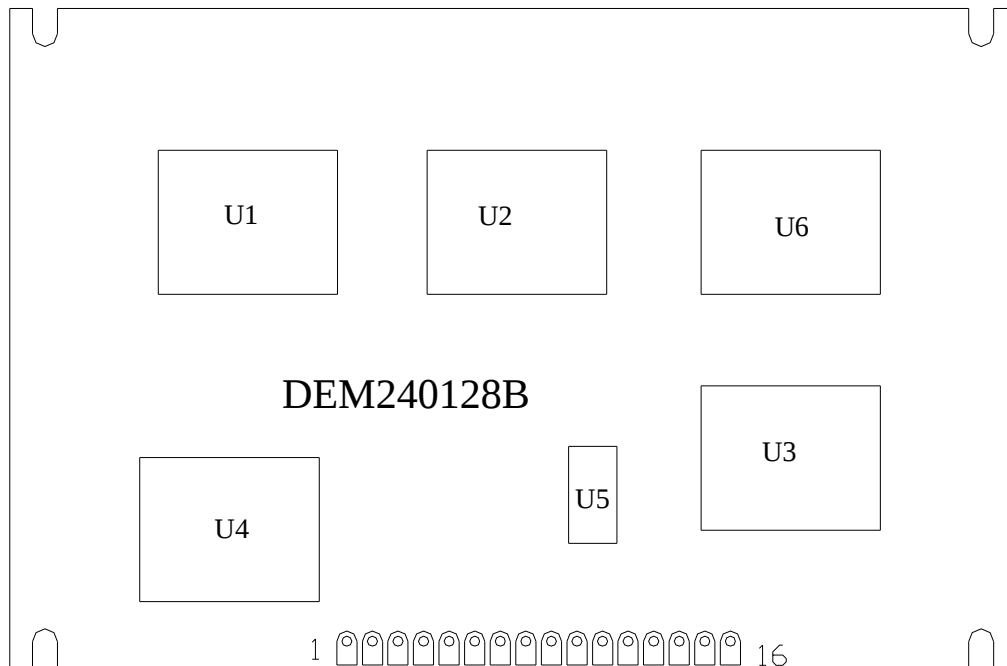
4. EXTERNAL DIMENSIONS


Figure 2.0

5. PIN ASSIGNMENT

Pin No.	Symbol	Level	Function
1	GND	0	Ground
2	GND	0	Ground
3	VDD	5.0V	Supply voltage for logic
4	VEE	-12.0V	Input voltage for LCD
5	WF	L/H	Frame signal
6	YD	L/H	Scan start pulse
7	XSCL	L/H	X-driver data shift clock
8	LP	L/H	Latch pulse
9	XD0	L/H	Data bit 0
10	XD1	L/H	Data bit 1
11	XD2	L/H	Data bit 2
12	XD3	L/H	Data bit 3
13	NC	-	No connection
14	NC	-	No connection
15	LED-	0V	Cathode of Back-light (incl. Rled)
16	LED+	~5V (typ.)	Anode of Back-light (incl. Rled)

6. PCB DRAWING


The Module No. is Printed on the PCB.

7. MAXIMUM ABSOLUTE LIMIT

Item	Symbol	Standard value	Unit	Remark
Power supply voltage	V_{DD}	-0.3 ~ +7.0	V	~5V (typ.)
Driver supply voltage	V_{LCD}	0 ~ 30	V	
Input voltage	V_{IN}	-0.3 ~ $V_{DD}+0.3$	V	
Volt. For BL	V_{LED1}	4.2 ~ 5.0	V	4.2 direct at LED
Operating temperature	T_{opr}	0 ~ +50	°C	VERSION: FY-LY
Storage temperature	T_{stg}	-10 ~ +60	°C	
Operating temperature	T_{opr}	-20 ~ +70	°C	VERSION: FYH-LY
Storage temperature	T_{stg}	-25 ~ +75	°C	

*Voltage greater than above may cause damage to the Circuit.

8.ELECTRICAL CHARACTERISTICS

8-1 DC CHARACTERISTICS

8-1-1 SEGMENT DRIVER APPLICATION

Characteristic	Symbol	Standard Value			Test Condition	Unit
		MIN	TYP	MAX		
Operating Voltage 1	V _{DD}	2.7	-	5.5	-	V
	V _{LCD}	6	-	28	V _{IN} = V _{DD} -V _{EE}	
Input Voltage(1)	V _{IL}	0	-	0.2V _{DD}	-	
	V _{IH}	0.8V _{DD}	-	V _{DD}	-	
Output Voltage (2)	V _{OL}	-	-	0.4	I _{OL} =0.4mA	V
	V _{OH}	V _{DD} -0.4	-	-	I _{OH} =-0.4mA	
Input Leakage Current1(1)	I _{IL1}	-10	-	10	V _{IN} = V _{DD} to V _{SS}	uA
Input Leakage Current2(3)	I _{IL2}	-25	-	25	V _{IN} = V _{DD} to V _{EE}	
On resistance (4)	R _{ON}	-	2	4	I _{ON} = 100 uA	kΩ
Supply current (5)	ISTBY	-	-	100	f _{CL1} =32 kHz M=V _{SS}	V _{SS} pin uA
	IDD	-	-	5	f _{CL1} =32 kHz f _M = 80 kHz	V _{DD} =5V mA
		-	-	2		V _{DD} =3V
	IEE	-	-	500		V _{DD} =5V uA

NOTES:

1. Applied to CL1, CL2, ELB, ERB, D1_SID-D4_DR, SHL, DISPOFFB, M, CS, AMS, pin
2. ELB, ERB pin
3. V0, V12, V43, V5 pin
4. VLCD=V_{DD}-V_{EE}, V0=V_{DD}=5V, 5V=V_{EE}=-23V
V12=V_{DD}-2/n(VLCD), V43=V_{EE}+2/n(VLCD), n=17(1/256 duty, 1/17 bias)
5. V0=V_{DD}, V12=1.71V(V_{DD}=5V) or -0.06V (V_{DD}=3V)
V43=-19.71V(V_{DD}=5V) or -19.94V(V_{DD}=3V), V5=V_{EE}=-23V, no-load condition
(1/256duty, 1/17 bias) 4-bit parallel interface mode
ISTBY: V_{DD}=5V, f_{CL2}=5.12MHz, SHL=V_{SS}, DISPOFFB=V_{DD}, M=V_{SS}, display data pattern=0000
IDD: V_{DD}=3V, f_{CL2}=4MHz, display data pattern=0101
V_{DD}=5V, f_{CL2}=5.12MHz, display data pattern=0101
IEE: V_{DD}=5V, f_{CL2}=5.12MHz, display data pattern=0101, V_{EE} pin

8-1-2 COMMON DRIVER APPLICATION

Characteristic	Symbol	Standard Value			Test Condition	Unit
		MIN	TYP	MAX		
Operating Voltage	V_{DD}	2.7	-	5.5	-	V
	V_{LCD}	6	-	28	$V_{IN} = V_{DD} - V_{EE}$	
Input Voltage(1)	V_{IL}	0	-	$0.2V_D$	-	
	V_{IH}	$0.8V_{DD}$	-	V_{DD}	-	
Output Voltage (3)	V_{OL}	-	-	0.4	$I_{OL}=0.4mA$	V
	V_{OH}	$V_{DD}-0.4$	-	-	$I_{OH}=-0.4mA$	
Input Leakage Current1(1)	I_{IL1}	-10	-	10	$V_{IN} = V_{DD}$ to V_{SS}	uA
Input Leakage Current2(2)	I_{IL2}	-50	-125	-250	$V_{IN} = 0V$, $V_{DD}=5V$	
Input Leakage Current3(4)	I_{IL3}	-25	-	25	$V_{IN} = V_{DD}$ to V_{EE}	
On resistance (5)	R_{ON}	-	2	4	$I_{ON} = 100 \mu A$	k Ω
Supply current (6)	ISTBY	-	-	100	$f_{CL1}=32 \text{ kHz}$ VSS pin	uA
	IDD	-	-	200	$f_{CL1}=32 \text{ kHz}$ VDD=5V	
		-	-	120	$f_{CL1}=32 \text{ kHz}$ VDD=3V	
	IEE	-	-	150	$f_M = 80 \text{ kHz}$ VDD=5V	

NOTES:

- Applied to CL1, D2_CL(SHL=LOW), D4_DR(SHL=HIGH), SHL, DISPOFFB, M, CS, AMS, pin
- Pull-up input pins: CL2, C1_SID, D3_DM(AMS=HIGH), ELB(SHL=LOW), ERB(SHL=HIGH)
- D2_DL(SHL=HIGH), D4_DR(SHL=LOW) pin
- V0, V12, V43, V5 pin
- $V_{LCD}=V_{DD}-V_{EE}$, $V0=V_{DD}=5V$, $V5=V_{EE}=-23V$
 $V12=V_{DD}-1/n(V_{LCD})$, $V43=V_{EE}+1/n(V_{LCD})$, $n=17(1/256 \text{ duty}, 1/17 \text{ bias})$
- $V0=V_{DD}$, $V12=3.35V(V_{DD}=5V)$ or $1.47V(V_{DD}=3V)$
 $V43=-21.35V(V_{DD}=5V)$ or $-21.47V(V_{DD}=3V)$, $V5=V_{EE}=-23V$, no-load condition
(1/256 duty, 1/17 bias) single-type mode operation: AMS= V_{SS} , SHL= V_{SS} , DISPOFFB= V_{DD}
D1_SID=D3_DM= V_{DD} , D4_DR=OPEN, ELB=ERB=OPEN
 I_{STBY} : $V_{DD}=5V$, M= V_{SS} , D2_DL= V_{SS}
 I_{DD} : $f_M=80Hz$, D2_DL= V_{DD}
 $V_{DD}=3V$, display data pattern=10000000....,01000000....,00100000....,00010000....,
 $V_{DD}=5V$, display data pattern=10000000....,01000000....,00100000....,00010000....,
 I_{EE} : $f_M=80Hz$, D2_DL= V_{DD}
 $V_{DD}=5V$, current through V_{EE} pin, display data pattern=10000000....,01000000....,
00100000....,00010000....,

8-2 AC CHARACTERISTICS
8-2-1 SEGMENT DRIVER APPLICATION
 $(V_{SS} = 0V, T_a = -10 \sim +60^{\circ}C)$

Characteristic	Symbol	Test Condition	(1) $V_{DD}=5V \pm 10\%$			(1) $V_{DD}=3V \pm 10\%$			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Clock cycle time	t_{CY}	Duty = 50%	125	-	-	250	-	-	ns
Clock pulse width	t_{WCK}	-	45	-	-	95	-	-	
Clock rise/fall time	t_R/t_F	-	-	-	-	-	-	30	
Data set-up time	t_{DS}	-	30	-	-	65	-	-	
Data hold time	t_{DH}	-	30	-	-	65	-	-	
Clock set-up time	t_{CS}	-	80	-	-	120	-	-	
Clock hold time	t_{CH}	-	80	-	-	120	-	-	
Propagation delay time	t_{PHL}	ELB Output	-	-	60	-	-	125	
		ERB Output	-	-	60	-	-	125	
ELB, ERB set-up time	t_{PSU}	ELB Input	30	-	-	65	-	-	
		ERB Input	30	-	-	65	-	-	
DISPOFFB low pulse width	t_{WDL}	-	1.2	-	-	1.2	-	-	us
DISPOFFB clear time	t_{CD}	-	100	-	-	100	-	-	ns
M - OUT Propagation delay time	t_{PD1}	CL = 15 pF	-	-	1.0	-	-	1.2	us
			-	-		-	-	-	
CL1 - OUT Propagation delay time	t_{PD2}		-	-	1.0	-	-	1.2	
			-	-		-	-	-	
DISPOFFB - OUT Propagation delay time	t_{PD3}		-	-	1.0	-	-	-	
			-	-		-	-	-	

8-2-2 COMMON DRIVER APPLICATION
 $(V_{SS} = 0V, T_a = -10 \sim +60^{\circ}C)$

Characteristic	Symbol	Test Condition	(1) $V_{DD}=5V \pm 10\%$			(1) $V_{DD}=3V \pm 10\%$			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Clock cycle time	t_{CY}	Duty = 50%	125	-	-	250	-	-	us
Clock pulse width	t_{WCK}	-	45	-	-	95	-	-	
Clock rise/fall time	t_R/t_F	-	-	-	-	-	-	30	
Data set-up time	t_{DS}	-	30	-	-	65	-	-	
Data hold time	t_{DH}	-	30	-	-	65	-	-	
DIPOFFB low pulse width	t_{WDL}	-	1.2	-	-	1.2	-	-	
DISPOFFB clear time	t_{CD}	-	100	-	-	100	-	-	ns
Output delay time	t_{DL}	CL = 15 pF	-	-	200	-	-	250	us
M - OUT Propagation delay time	t_{PD1}		-	-	1.0	-	-	1.2	
			-	-		-	-	-	
CL1 - OUT Propagation delay time	t_{PD2}		-	-	1.0	-	-	1.2	
			-	-		-	-	-	
DISPOFFB - OUT Propagation delay time	t_{PD3}		-	-	1.0	-	-	-	
			-	-		-	-	-	

8-2-3 SEGMENT DRIVER APPLICATION TIMING

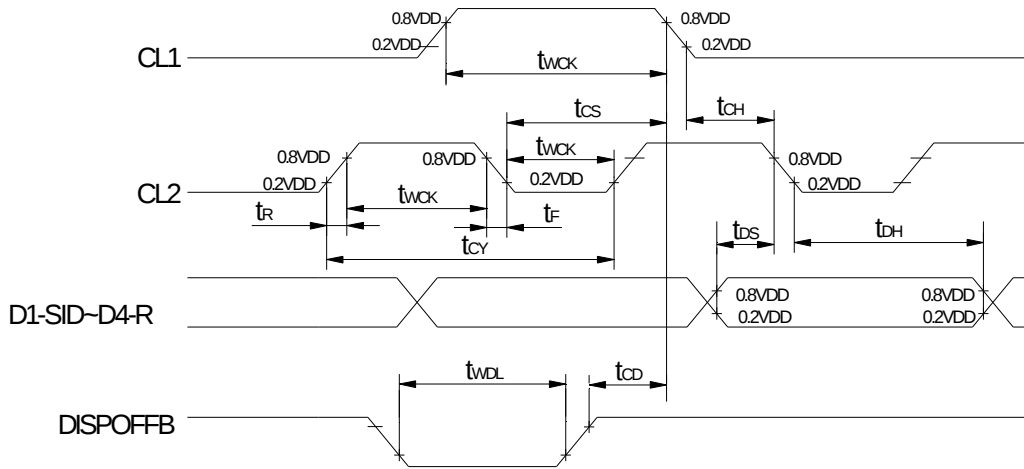


Figure 3.0

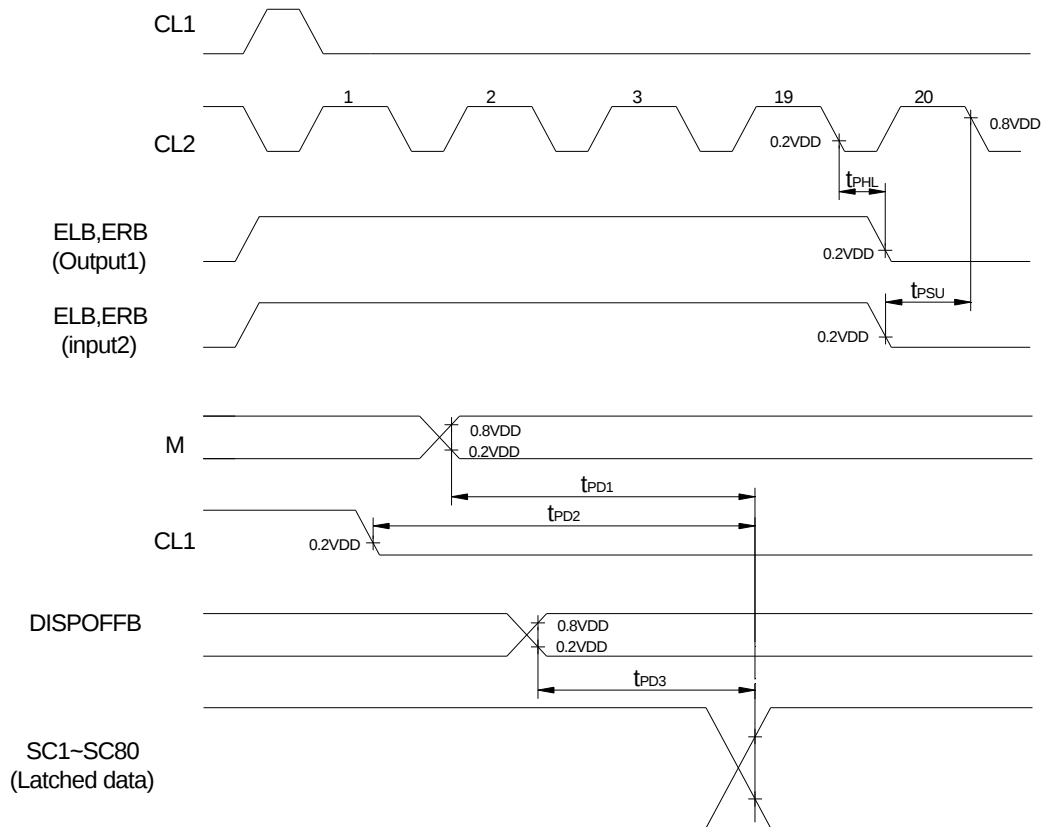


Figure 4.0

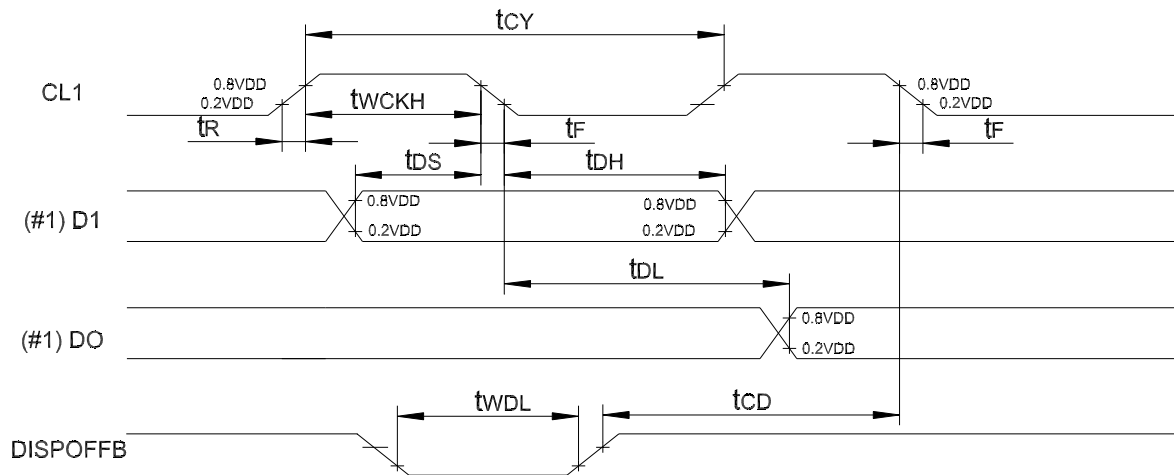
8-2-4 COMMON DRIVER APPLICATION TIMING


Figure5.0

(1) When in single-type interface mode

D1 = >D2_DL (SHL = L), D4_DR (SHL = H)

D0 = >D4_DT (SHL = L), D2_DL (SHL = H)

(2) When in dual-type interface mode

D1 = >D2_DL and D3_DM (SHL = L), D4_DR and D3_DM (SHL = H)

D0 = >D4_DR (SHL = L), D2_DL (SHL = H)

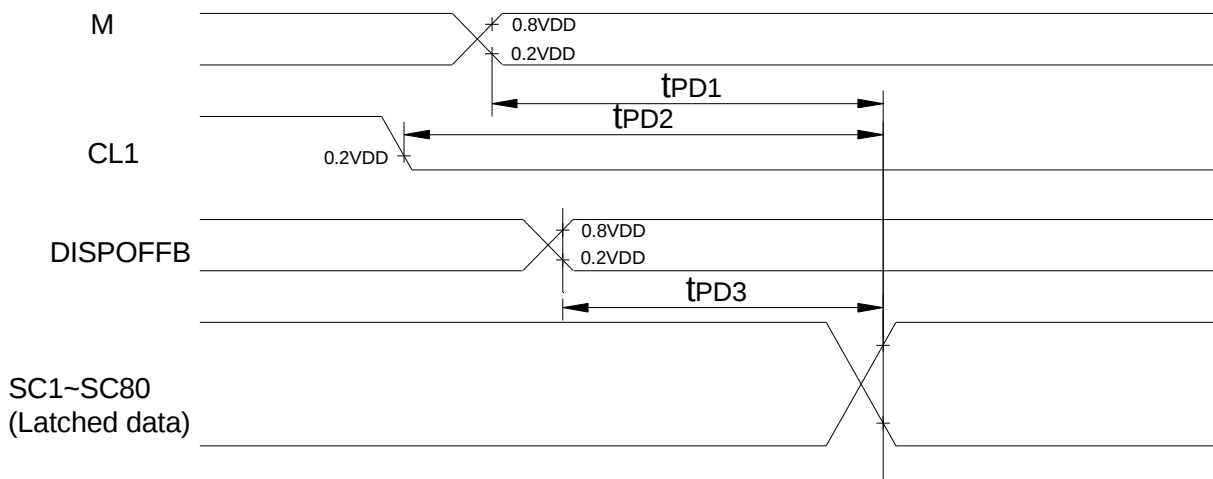


Figure 6.0

9. OPERATION TIMING DIAGRAM

9-1 4bit Parallel mode interface segment driver

- When SHL = "LOW"

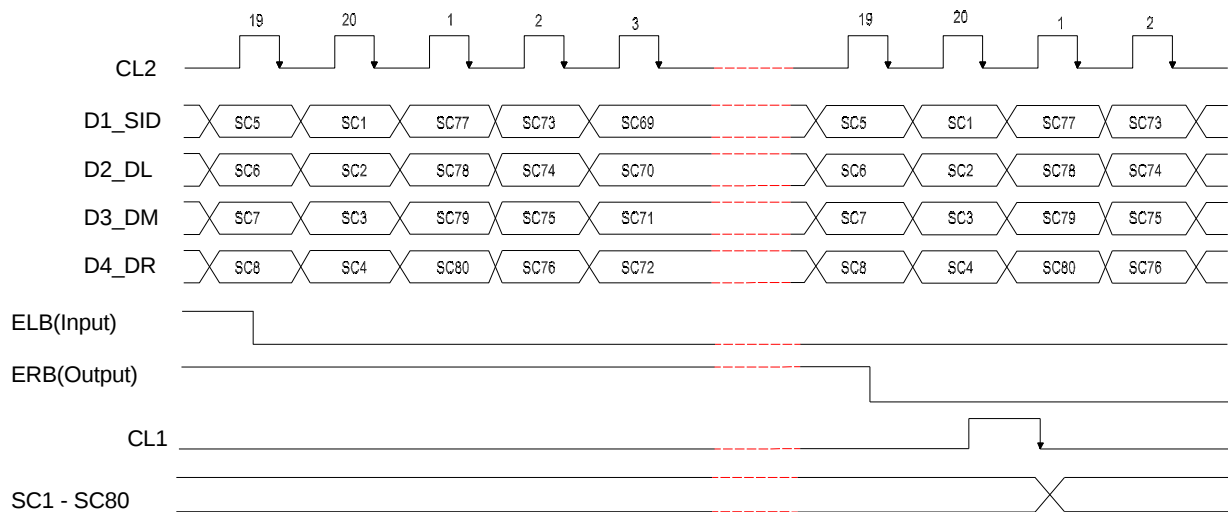


Figure 7.0

- When SHL = "HIGH"

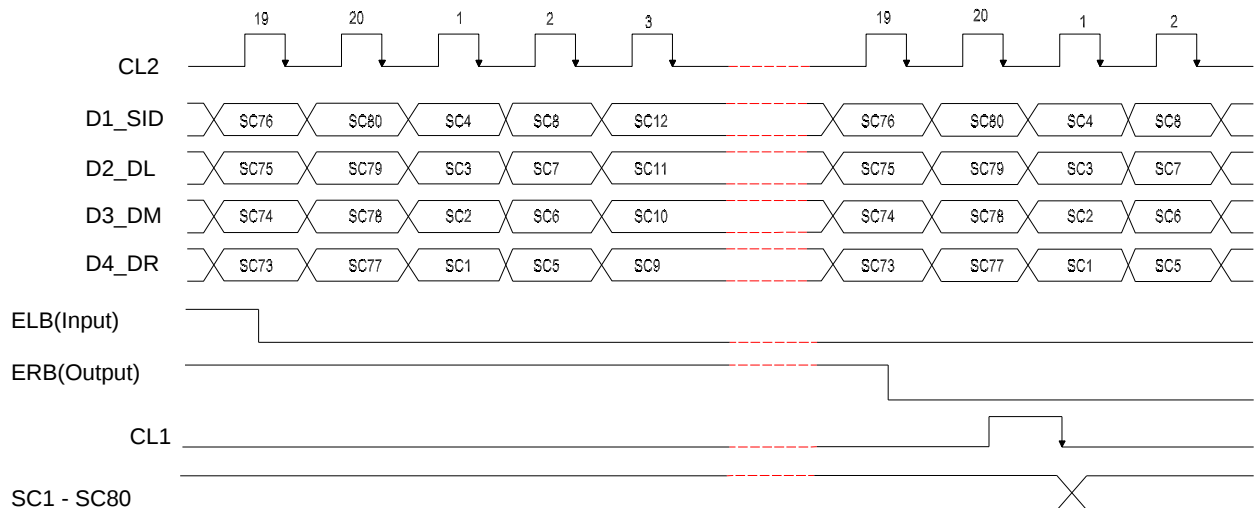


Figure 8.0

9-2 SINGLE-TYPE INTERFACE COMMAND DRIVER

- When SHL = "LOW"

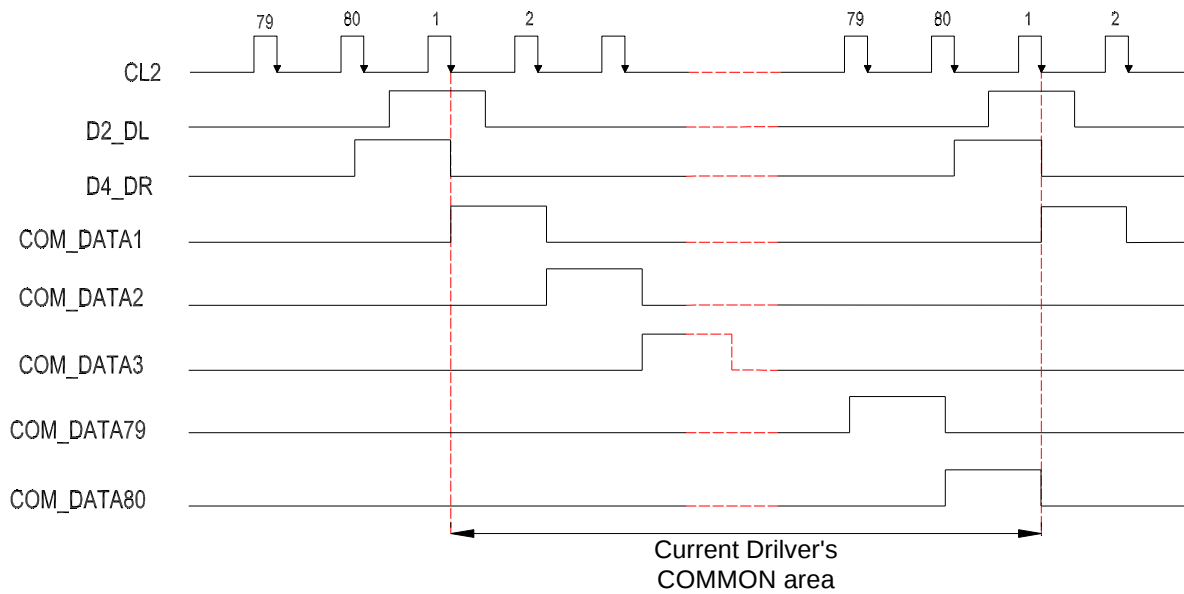


Figure9.0

- When SHL = "HIGH"

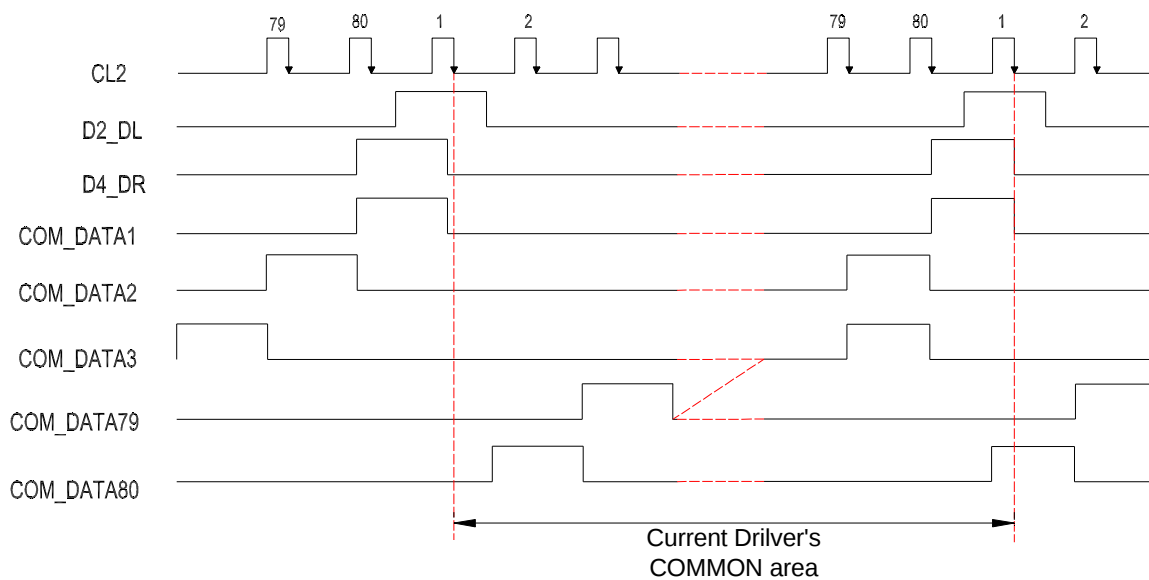


Figure 10.0

10. BACKLIGHT & SWITCH

(Ta = -10 ~ +60°C)

Item	Symbol	Standard Value	Unit	Applicable Terminal
Back-light Voltage	V	5.0 (typ.)	V	LED+ / LED-
Back-light Current	I	~285	mA	

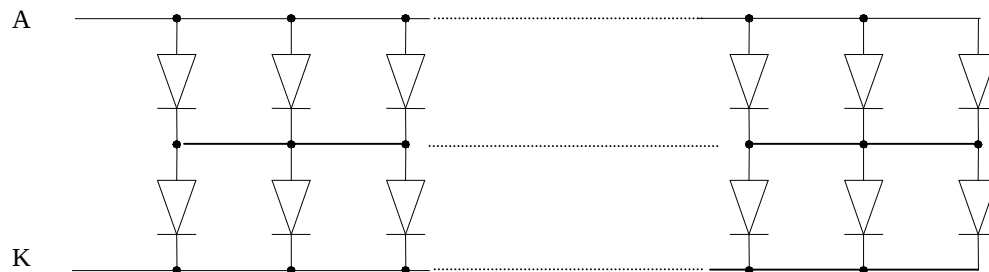
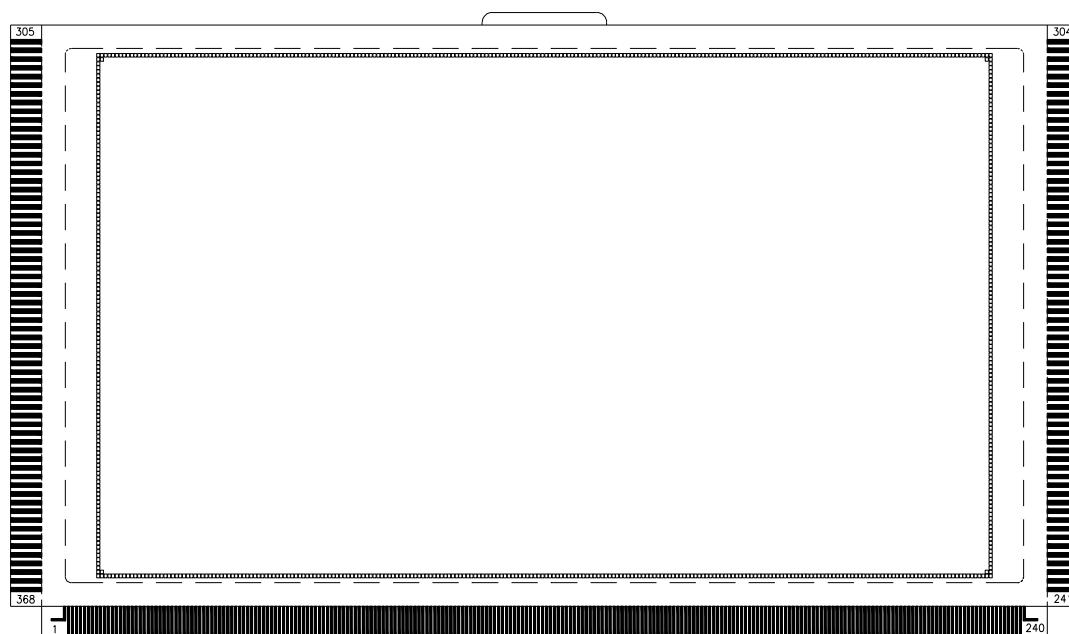


Figure11.0

11. LCD LABELLING



12. LCD Modules Handling Precautions

- The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- If the display panel is damaged and the liquid crystal substance inside it leaks out, do not get any in your mouth. If the substance come into contact with your skin or clothes promptly wash it off using soap and water.
- Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarize carefully.
- To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
 - Be sure to ground the body when handling the LCD module.
 - Tools required for assembly, such as soldering irons, must be properly grounded.
 - To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
 - The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.
- Storage precautions
When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the modules in bags designed to prevent static electricity charging under low temperature / normal humidity conditions (avoid high temperature / high humidity and low temperatures below 0°C).Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

13. Others

- Liquid crystals solidify at low temperature (below the storage temperature range) leading to defective orientation of liquid crystal or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subjected to a strong shock at a low temperature.
- If the LCD modules have been operating for a long time showing the same display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. Abnormal operating status can be resumed to be normal condition by suspending use for some time. It should be noted that this phenomena does not adversely affect performance reliability.
- To minimize the performance degradation of the LCD modules resulting from caused by static electricity, etc. exercise care to avoid holding the following sections when handling the modules:
 - Exposed area of the printed circuit board
 - Terminal electrode sections