

**DISPLAY Elektronik GmbH**

# DATA SHEET

**LCD MODULE**

**DEM 320240D FGH-CW**  
**(4,7" 1/4 -VGA)**

*Product specification*

*Version:3*

**19/May/2005**

# GENERAL SPECIFICATION

---

MODULE NO. :

## DEM 320240D FGH-CW

CUSTOMER P/N

VERSION NO.	CHANGE DESCRIPTION	DATE
0	ORIGINAL VERSION	08/05/2004
1	AMENDED THE FFC THICKNESS	08/06/2004
2	CHANGE FFC THICKNESS AND PITCH	10/07/2004
3	ADDING VERSION	10/05/2005

PREPARED BY: CHJ

DATE: 10.05.2005

APPROVED BY: MH

DATE: 19.05.2005

**CONTENTS**

1. FUNCTIONS & FEATURES ----- 2

2. MECHANICAL SPECIFICATIONS ----- 2

3. BLOCK DIAGRAM ----- 2

4. POWER SUPPLY ----- 3

5. EXTERNAL DIMENSIONS----- 3

6. PIN ASSIGNMENT----- 4

7. MAXIMUM ABSOLUTE LIMIT----- 4

8. ELECTRICAL CHARACTERISTICS ----- 5

    8-1.DC CHARACTERISTICS -----5

    8-2. AC CHARACTERISTICS-----7

9. OPERATION TIMING DIAGRAM ----- 10

    9-1.4-BIT PARALLEL MODE INTERFACE SEGMENT DRIVER -----10

    9-2. SINGLE-TYPE INTERFACE COMMAND DRIVER -----10

10. BACKLIGHT & SWITCH ----- 11

11. QUALITY DESCRIPTION----- 12

12. LCD MODULES HANDLING PRECAUTIONS ----- 13

13. OTHERS ----- 13

**1. FUNCTIONS &FEATURES**

- LCD TYPE:

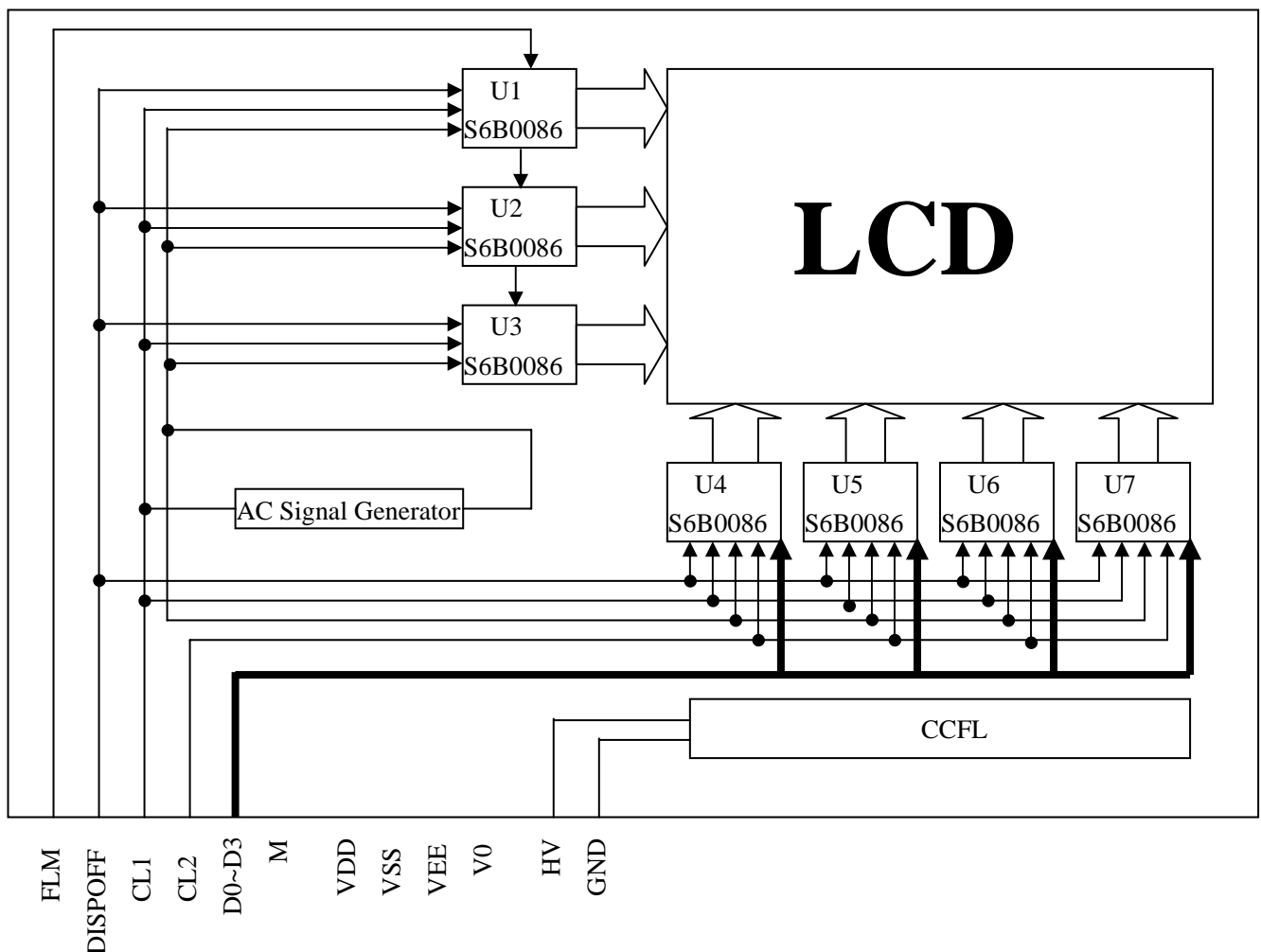
MODULE MODEL	LCD Technology	Polarizer Mode
DEM 320240D FGH-CW	FSTN	Transflective Positive Mode

- Viewing Direction : 6 O'clock
- Driving Scheme : 1/240Duty, 1/13 Bias
- Display Content : 320 x 240 Dots
- Power Supply Voltage : 5.0V (typ.)
- LCD Driving Voltage ( $V_{LCD}=V_{DD}-V_0$ ) : 20.5V (typ.)
- CCFL Backlight Color : White
- Operating Temperature : -20°C~+70°C
- Storage Temperature : -30°C~+85°C

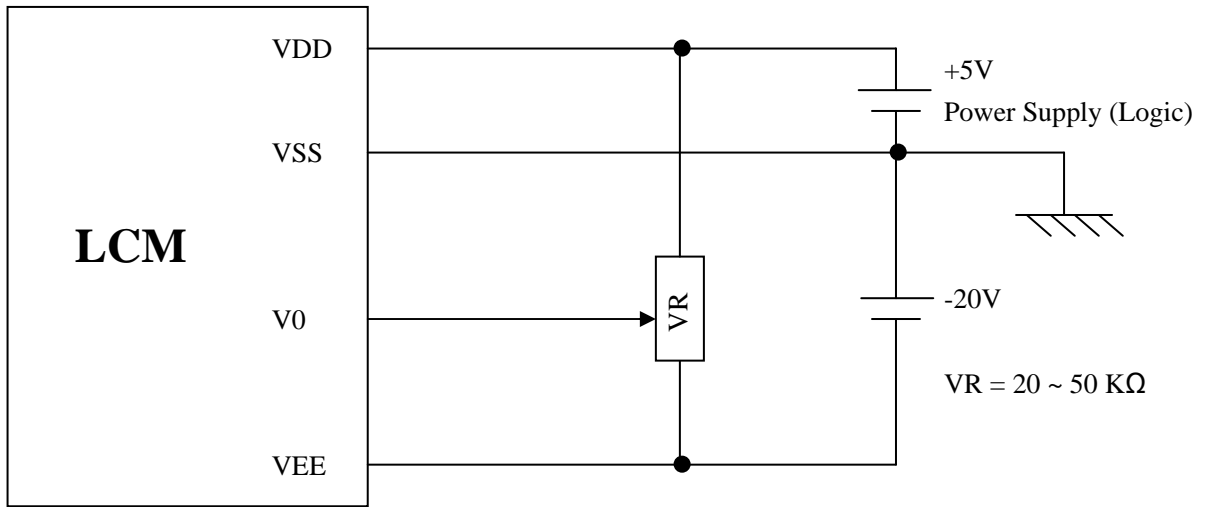
**2. MODULE ARTWORK**

- Module Size : 151.6 (L)mm\*96 (W)mm\*13 (T)mm
- Dot Size : 0.27 (W)mm\*0.27 (H)mm
- Dot Gap : 0.03 mm

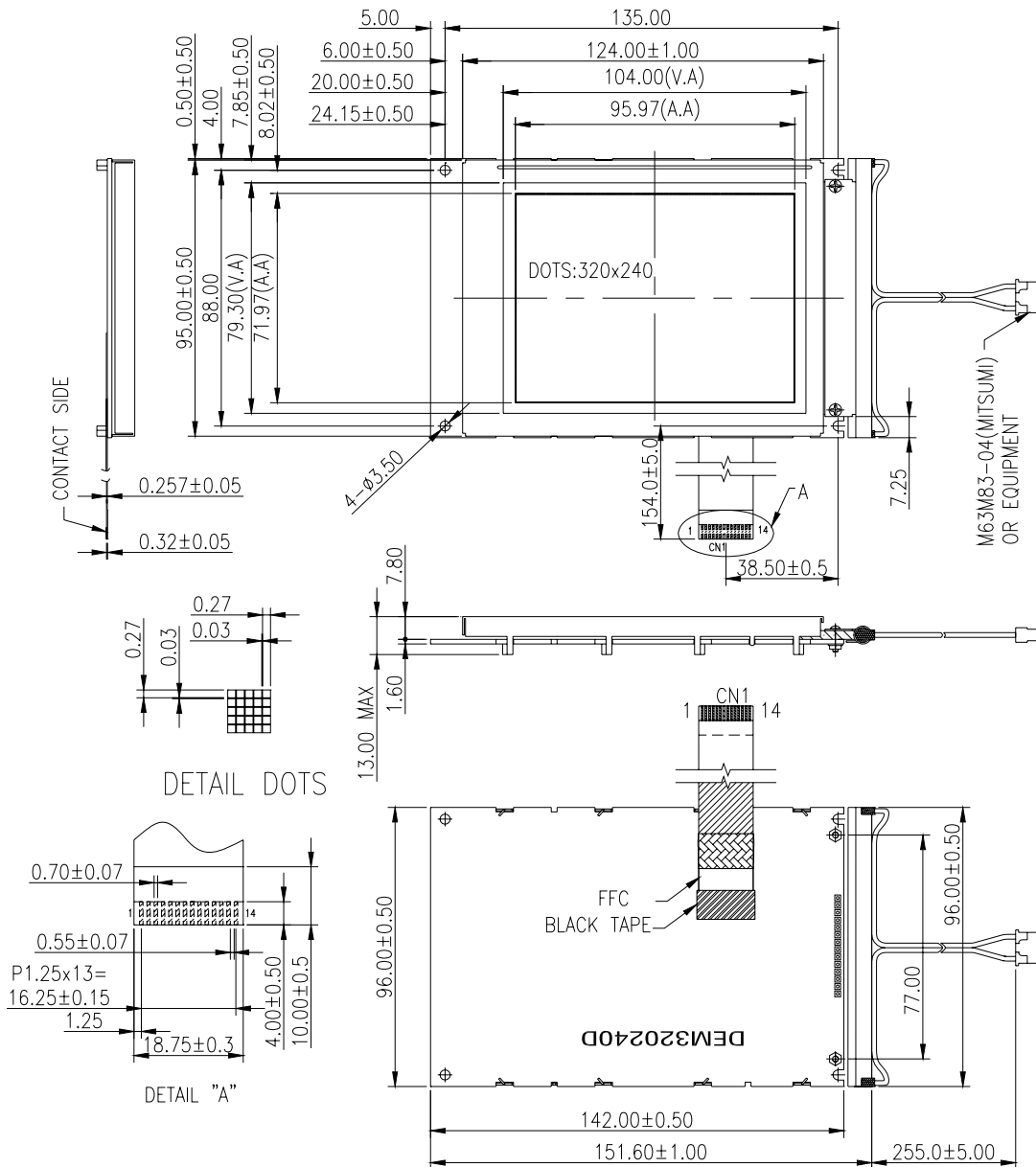
**3. BLOCK DIAGRAM**



4. POWER SUPPLY



5. EXTERNAL DIMENSIONS



## 6. PIN ASSIGNMENT

### Interface Connector

Pin No.	Symbol	Level	Function
1	FLM	H/L	Display cycle clock
2	M	-	Frame modulation signal
3	CL1	H->L	Data latch signal
4	CL2	H->L	Data shift signal
5	DISPOFF	H->L	Display off control signal
6	D0	H/L	Display data line
7	D1		
8	D2		
9	D3		
10	VDD	-	Power supply for logic (+5V)
11	VSS	-	Signal ground (0V)
12	VEE	-	Power supply for LCD
13	V0	-	LCD contrast adjust voltage
14	FG	-	Front panel ground

### CCFL Connector

Pin No.	Symbol	Level	Function
1	HV	-	Power supply voltage for CCFL
2	NC	-	-
3	NC	-	-
4	GND	-	Ground line (from inverter)

## 7. MAXIMUM ABSOLUTE LIMIT

Item	Symbol	Standard value	Unit
Power supply voltage	$V_{DD}$	-0.3~+7.0	V
Driver supply voltage	$V_{LCD}$	0~30	V
Input voltage	$V_{IN}$	-0.3~ $V_{DD}+0.3$	V
Lamp Voltage	VFL	300	V
Operating temperature	$T_{opr}$	-20°C~+70°C	°C
Storage temperature	$T_{stg}$	-30°C~+85°C	°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	5.0	5.5	-	V	
	$V_{LCD}$	6	20.5	28	$V_{IN} = V_{DD} - V_{EE}$		
Input Voltage (1)	$V_{IL}$	0	-	$0.2V_{DD}$	-	V	
	$V_{IH}$	$0.8V_{DD}$	-	$V_{DD}$	-		
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	$I_{ON} = 100 \mu A$	k $\Omega$	
Supply current (5)	$I_{STBY}$	-	-	100	$f_{CL1}=32 \text{ kHz}$ $M=V_{SS}$	$V_{SS}$ pin	uA
	$I_{DD}$	-	-	5	$f_{CL1}=32 \text{ kHz}$	$V_{DD}=5V$	mA
		-	-	2		$V_{DD}=3V$	
$I_{EE}$	-	-	500	$f_M = 80 \text{ kHz}$	$V_{DD}=5V$	uA	

## NOTES:

- Applied to CL1, CL2, ELB, ERB, D1\_SID-D4\_DR, SHL, DISPOFFB, M, CS, AMS, pin
- ELB, ERB pin
- V0, V12, V43, V5 pin
- $V_{LCD}=V_{DD}-V_{EE}$ ,  $V0=V_{DD}=5V$ ,  $5V=V_{EE}=-23V$   
 $V12=V_{DD}-2/n$  (VLCD),  $V43=V_{EE}+2/n$  (VLCD),  $n=17$ (1/256 duty, 1/17 bias)
- $V0=V_{DD}$ ,  $V12=1.71V$ ( $V_{DD}=5V$ ) 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  
 $I_{DD}$ :  $V_{DD}=3V$ ,  $f_{CL2}=4MHz$ , display data pattern=0101  
 $V_{DD}=5V$ ,  $f_{CL2}=5.12MHz$ , display data pattern=0101  
 $I_{EE}$ :  $V_{DD}=5V$ ,  $f_{CL2}=5.12MHz$ , 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 <sub>DD</sub>	2.7	5.0	5.5	-	V	
	V <sub>LCD</sub>	6	20.5	28	V <sub>IN</sub> = V <sub>DD</sub> -V <sub>EE</sub>		
Input Voltage (1)	V <sub>IL</sub>	0	-	0.2V <sub>DD</sub>	-	V	
	V <sub>IH</sub>	0.8V <sub>DD</sub>	-	V <sub>DD</sub>	-		
Output Voltage (3)	V <sub>OL</sub>	-	-	0.4	I <sub>OL</sub> =0.4mA	V	
	V <sub>OH</sub>	V <sub>DD</sub> -0.4	-	-	I <sub>OH</sub> =-0.4mA		
Input Leakage Current1 (1)	I <sub>IL1</sub>	-10	-	10	V <sub>IN</sub> = V <sub>DD</sub> to V <sub>SS</sub>	uA	
Input Leakage Current2 (2)	I <sub>IL2</sub>	-50	-125	-250	V <sub>IN</sub> = 0V, V <sub>DD</sub> =5V		
Input Leakage Current3 (4)	I <sub>IL3</sub>	-25	-	25	V <sub>IN</sub> = V <sub>DD</sub> to V <sub>EE</sub>		
On resistance (5)	R <sub>ON</sub>	-	2	4	I <sub>ON</sub> = 100 uA	kΩ	
Supply current (6)	I <sub>STBY</sub>	-	-	100	f <sub>CL1</sub> =32 kHz	V <sub>SS</sub> pin	uA
	I <sub>DD</sub>	-	-	200	f <sub>CL1</sub> =32 kHz	V <sub>DD</sub> =5V	
		-	-	120		f <sub>M</sub> = 80 kHz	
I <sub>EE</sub>	-	-	150		V <sub>DD</sub> =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=HGH)
- D2\_DL (SHL=HIGH), D4\_DR (SHL=LOW) pin
- V0, V12, V43, V5 pin
- V<sub>LCD</sub>=V<sub>DD</sub>-V<sub>EE</sub>, V0=V<sub>DD</sub>=5V, V5=V<sub>EE</sub>=-23V  
V12=V<sub>DD</sub>-1/n (V<sub>LCD</sub>), V43=V<sub>EE</sub>+1/n (V<sub>LCD</sub>), n=17(1/256 duty, 1/17 bias)
- V0=V<sub>DD</sub>, V12=3.35V (V<sub>DD</sub>=5V) or 1.47V (V<sub>DD</sub>=3V)  
V43=-21.35V (V<sub>DD</sub>=5V) or -21.47V(V<sub>DD</sub>=3V), V5=V<sub>EE</sub>=-23V, no-load condition  
(1/256 duty, 1/17 bias) single-type mode operation: AMS= V<sub>SS</sub>, SHL=V<sub>SS</sub>, DISPOFFB=V<sub>DD</sub>  
D1\_SID=D3\_DM=V<sub>DD</sub>, D4\_DR=OPEN, ELB=ERB=OPEN  
I<sub>STBY</sub>: V<sub>DD</sub>=5V, M=V<sub>SS</sub>, D2\_DL=V<sub>SS</sub>  
I<sub>DD</sub>: f<sub>M</sub>=80Hz, D2\_DL=V<sub>DD</sub>  
V<sub>DD</sub>=3V, display data pattern=10000000.....,01000000.....,00100000....,00010000.....  
V<sub>DD</sub>=5V, display data pattern=10000000.....,01000000.....,00100000....,00010000.....  
I<sub>EE</sub>: f<sub>M</sub>=80Hz, D2\_DL=V<sub>DD</sub>  
V<sub>DD</sub>=5V, current through V<sub>EE</sub> pin, display data pattern=10000000.....,01000000.....,  
00100000....,00010000.....



**8-2 AC CHARACTERISTICS**

**8-2-1 SEGMENT DRIVER APPLICATION**

(V<sub>SS</sub>=0V, Ta= -20 ~ +70 °C)

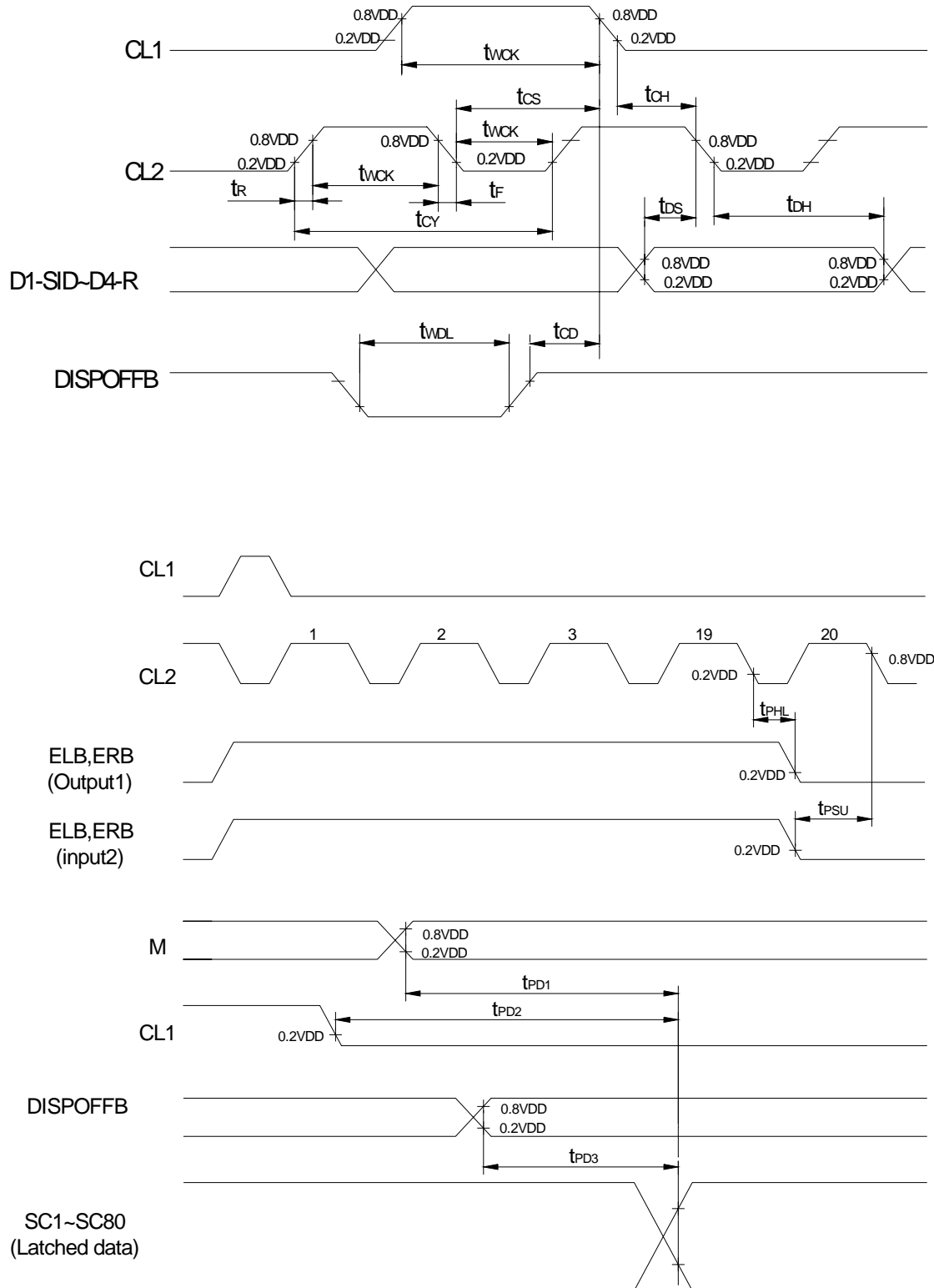
Characteristic	Symbol	Test Condition	(1)V <sub>DD</sub> =5V±10%			(1)V <sub>DD</sub> =3V±10%			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Clock cycle time	t <sub>CY</sub>	Duty = 50%	125	-	-	250	-	-	ns
Clock pulse width	t <sub>WCK</sub>	-	45	-	-	95	-	-	
Clock rise/fall time	t <sub>R</sub> /t <sub>F</sub>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

**8-2-2 COMMON DRIVER APPLICATION**

(V<sub>SS</sub>=0V, Ta= -20 ~ +70 °C)

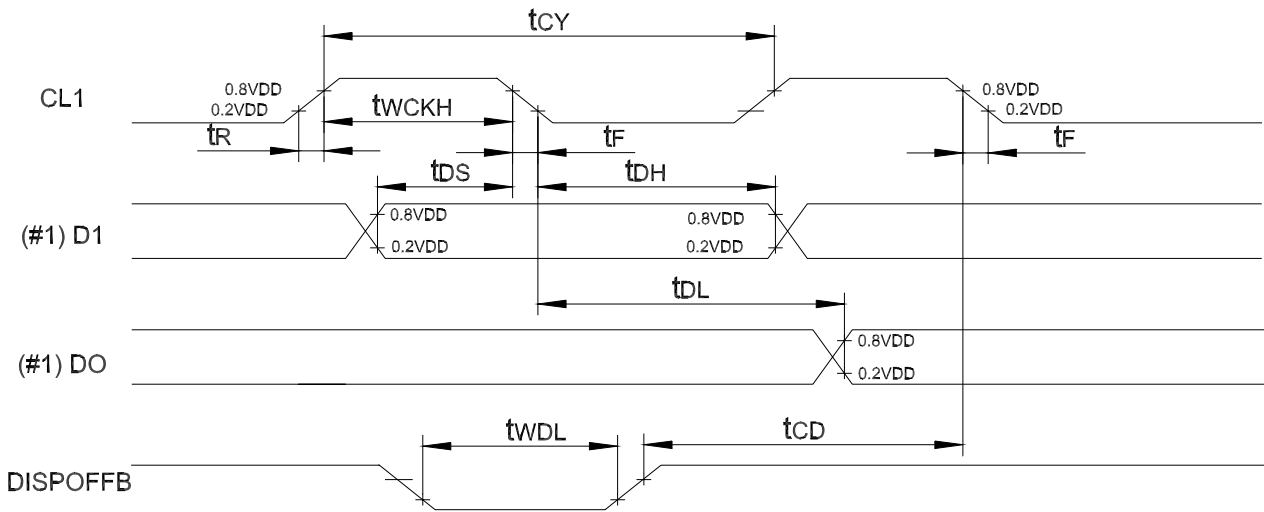
Characteristic	Symbol	Test Condition	(1)V <sub>DD</sub> =5V±10%			(1)V <sub>DD</sub> =3V±10%			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Clock cycle time	t <sub>CY</sub>	Duty = 50%	125	-	-	250	-	-	us
Clock pulse width	t <sub>WCK</sub>	-	45	-	-	95	-	-	
Clock rise/fall time	t <sub>R</sub> /t <sub>F</sub>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

8-2-3 SEGMENT DRIVER APPLICATION TIMING



8-2-4 COMMON DRIVER APPLICATION TIMING

(1) When in single-type interface mode



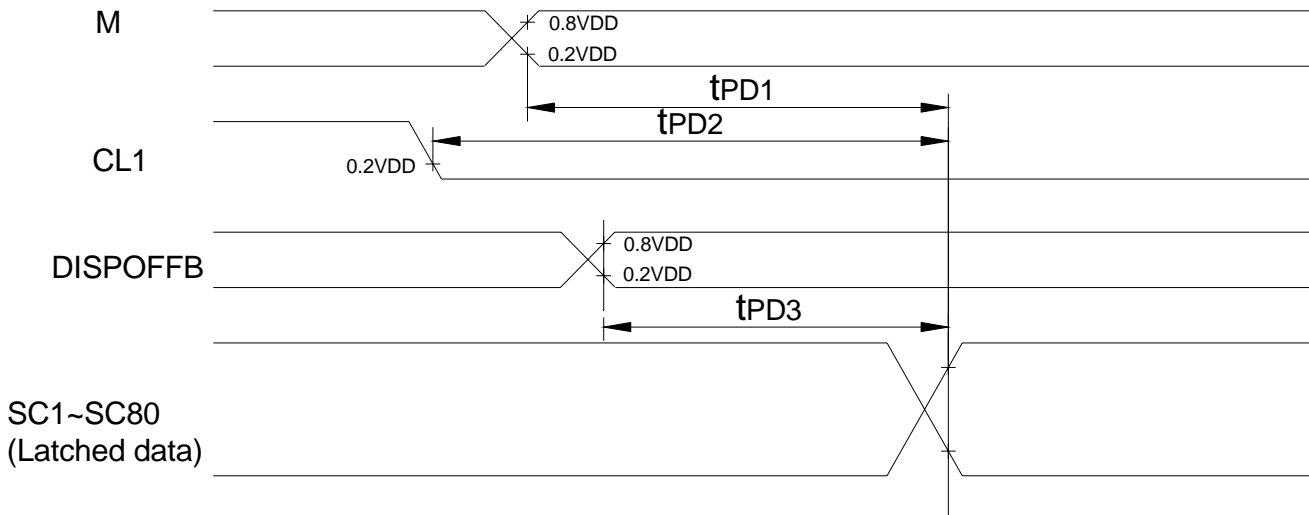
D1 =>D2\_DL (SHL = L), D4\_DR (SHL = H)

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)

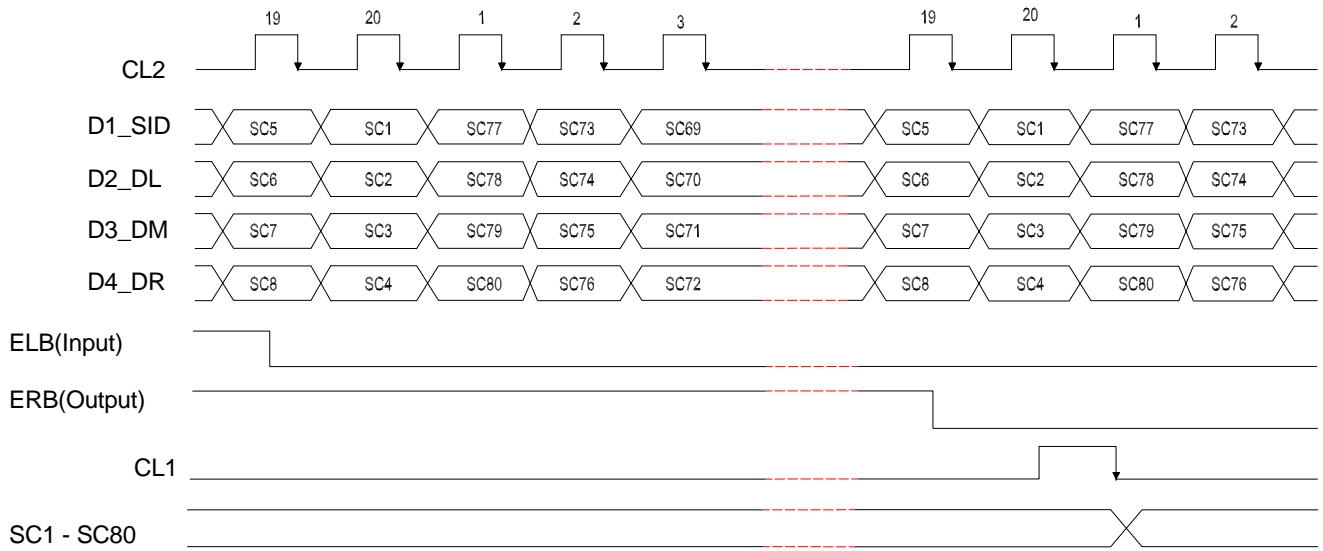
D0 =>D4\_DR (SHL = L), D2\_DL (SHL = H)



9. OPERATION TIMING DIAGRAM

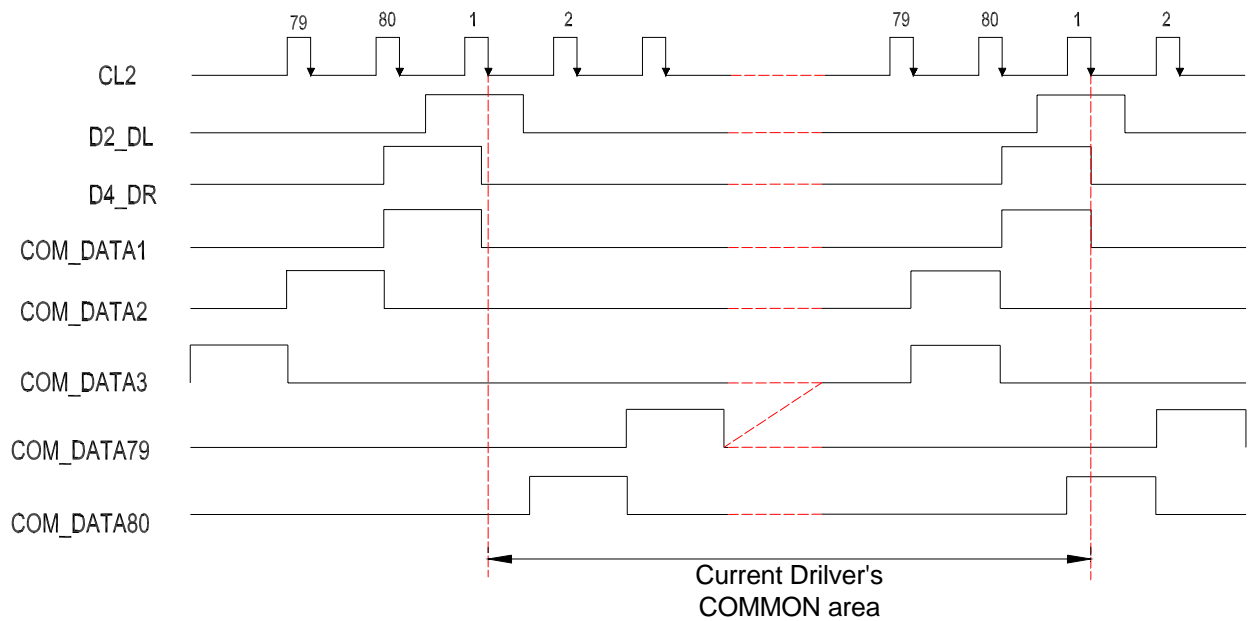
9-1 4bit Parallel mode interface segment driver

- When SHL = "HIGH"



9-2 SINGLE-TYPE INTERFACE COMMAND DRIVER

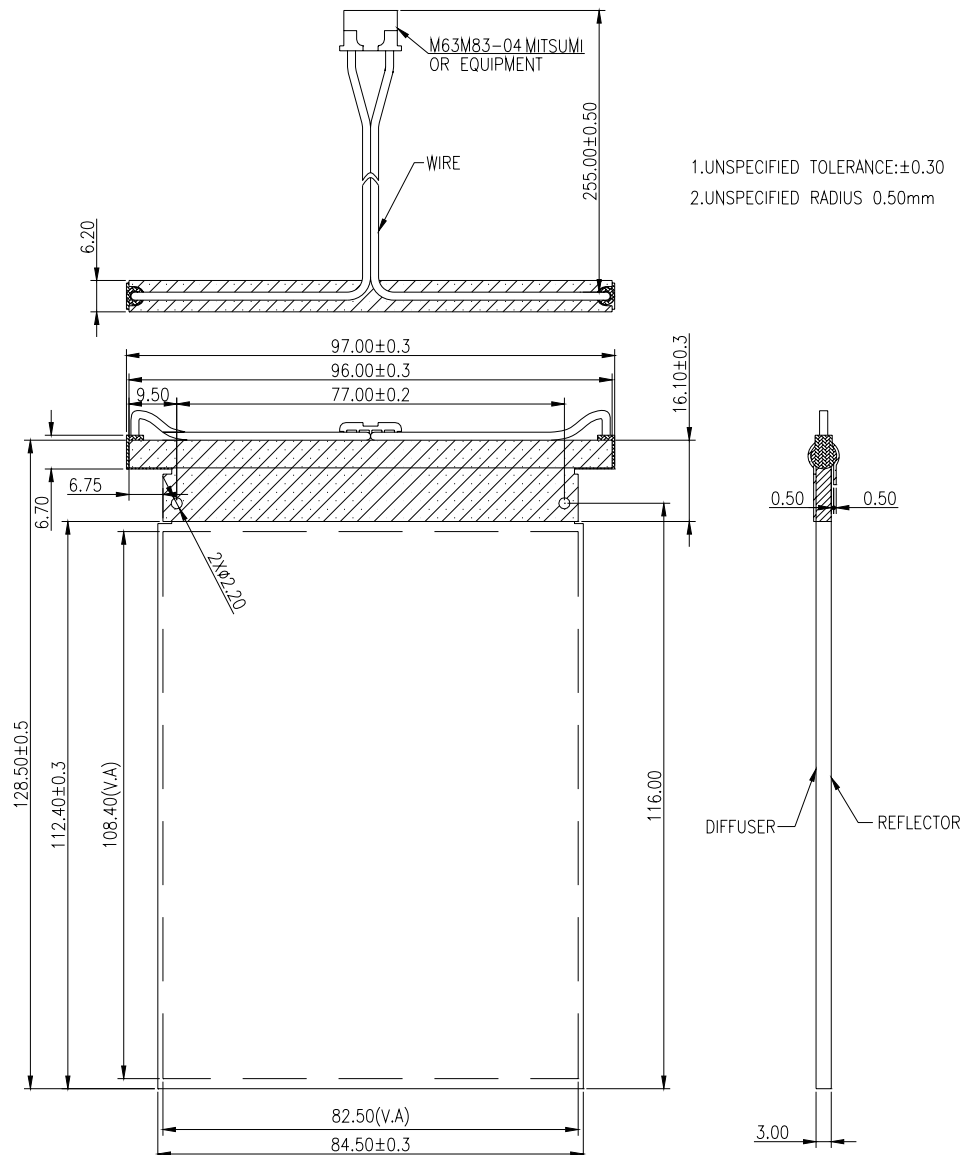
- When SHL = "HIGH"



**10. BACKLIGHT & SWITCH**

Item	Symbol	MIN.	TYP.	MAX.	Unit	Conditions
Lamp Voltage	V			300	V <sub>rms</sub>	If=5mA
Lamp Current	I		5	6	mA	
Power Dissipation	Pd		2.5		W	If=5mA
Lighting Frequency	Fosc		50		kHz	If=5mA
Luminous Intensity	L		1000		cd/m <sup>2</sup>	If=5mA
Spectral Range	Δλ				%	If=5mA
Emission Wavelength	λp					If=5mA

	Symbol	Ratings
Operating temperature	Topr	-20°C~+70°C
	Tsty	-30°C~+85°C
Life Time	Tlife	10,000 Hours (Max.)



**11. LCD MODULES HANDLING PRECAUTIONS**

- Please remove the protection foil of polarizer before using.
- 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 comes 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 polarizer 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.

**12. 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 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