



CMOS LSI

SANYO	No. 4366B	LC79401D
		Dot-Matrix LCD Driver

Overview

The LC79401D is a segment driver LSI for use with large scale dot-matrix LCD displays. The LC79401D latches 80 bits of display data sent from a controller using a 4-bit parallel transfer technique and generates LCD drive signals. When combined as a kit with a common driver, either the LC7943D (QIP80D), the LC79430D (QIP100D), or the LC79431D (QIP100D), the LC79401D can drive large screen LCD panels.

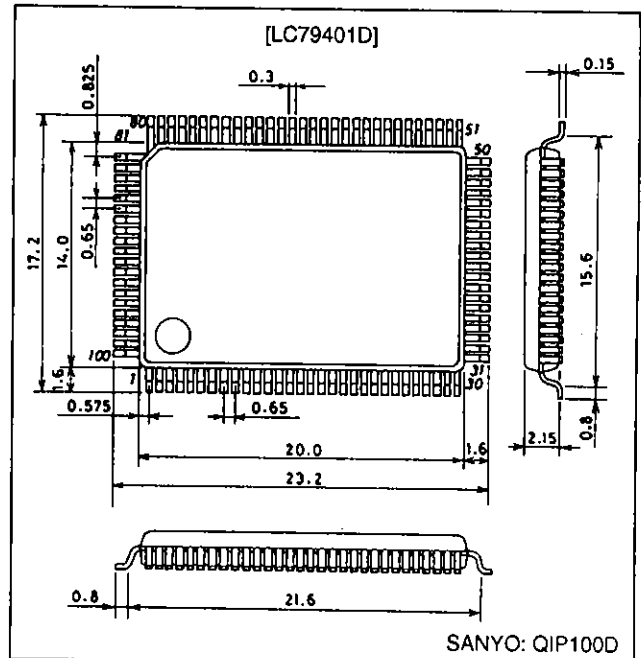
Features

- Incorporates LCD drive circuits for 80 bits of display
- Supports display duties from 1/64 to 1/256
- The provision of a chip disable pin supports power reduction in large-scale panels.
- Allows external provision of the bias power supply
- Operating supply voltage/operating temperature
 V_{DD} (logic block): 5 V $\pm 10\%$ / -20 to +75°C
 $V_{DD}-V_{EE}$ (LCD block): 12 to 32 V / -20 to +75°C
- Data transfer clock: 6.0 MHz (max), bidirectional shifting supported
- Data input: 4-bit parallel input
- CMOS process
- 100-pin flat plastic package

Package Dimensions

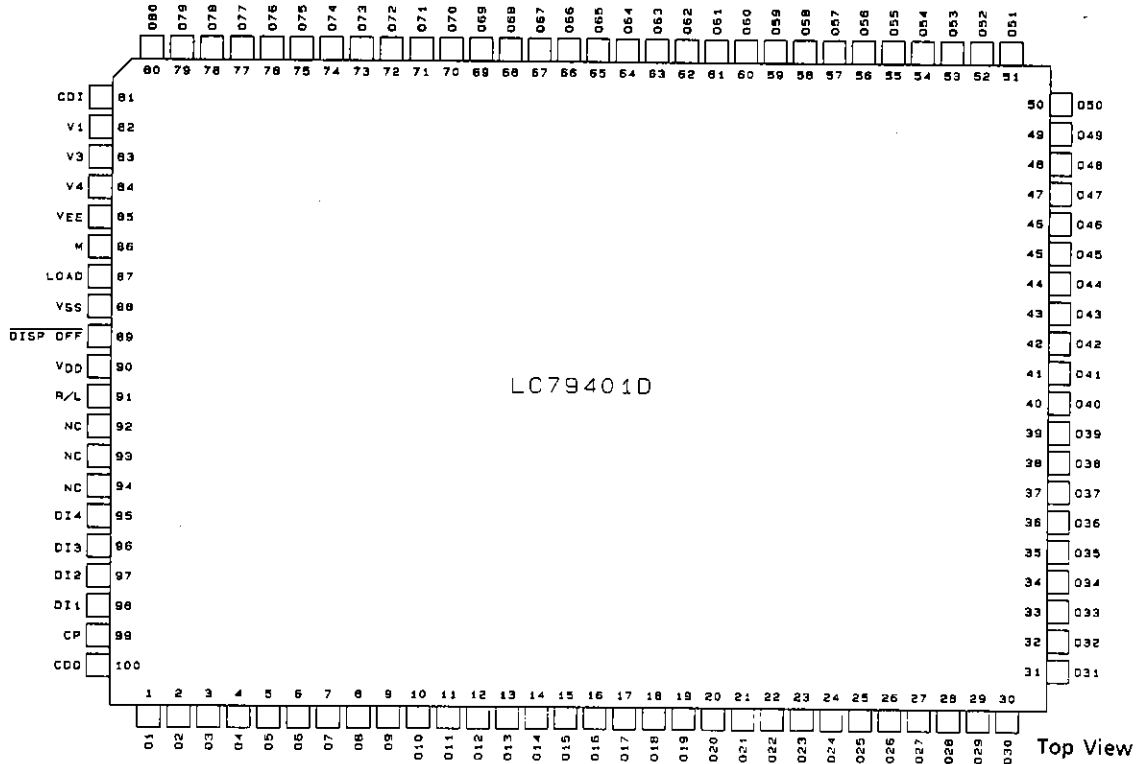
unit: mm

3180-QIP100D

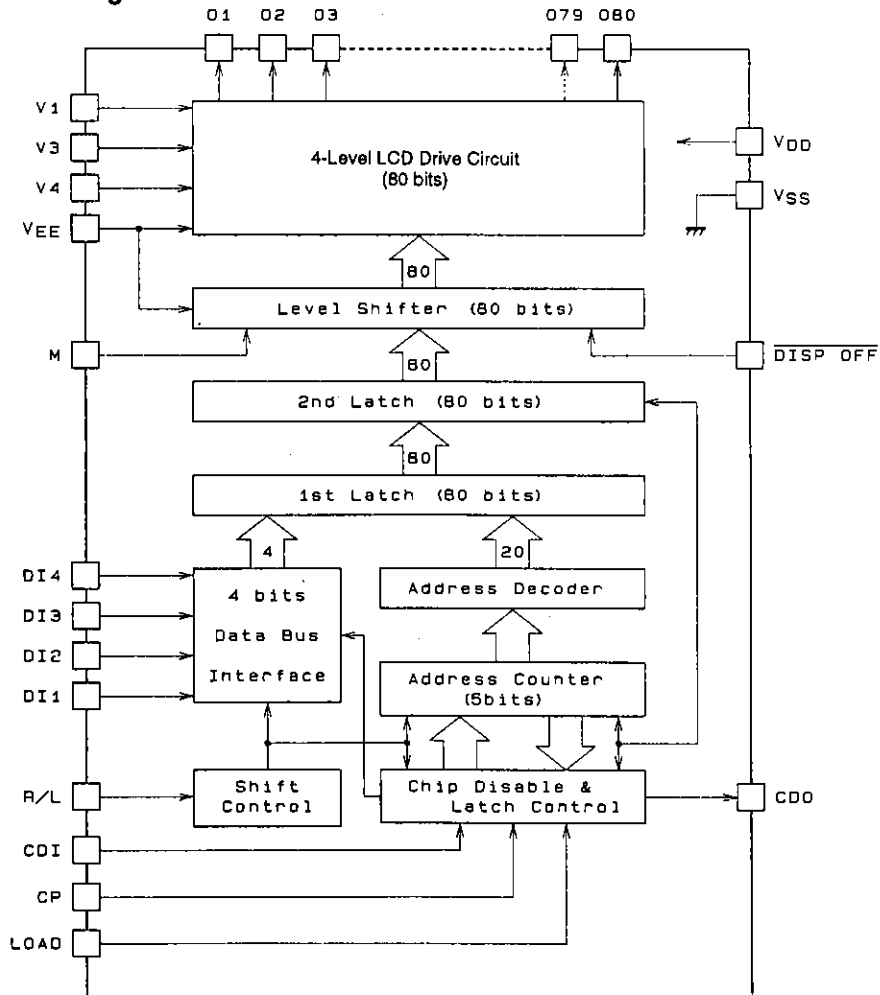


LC79401D

Pin Assignment



Equivalent Circuit Block Diagram



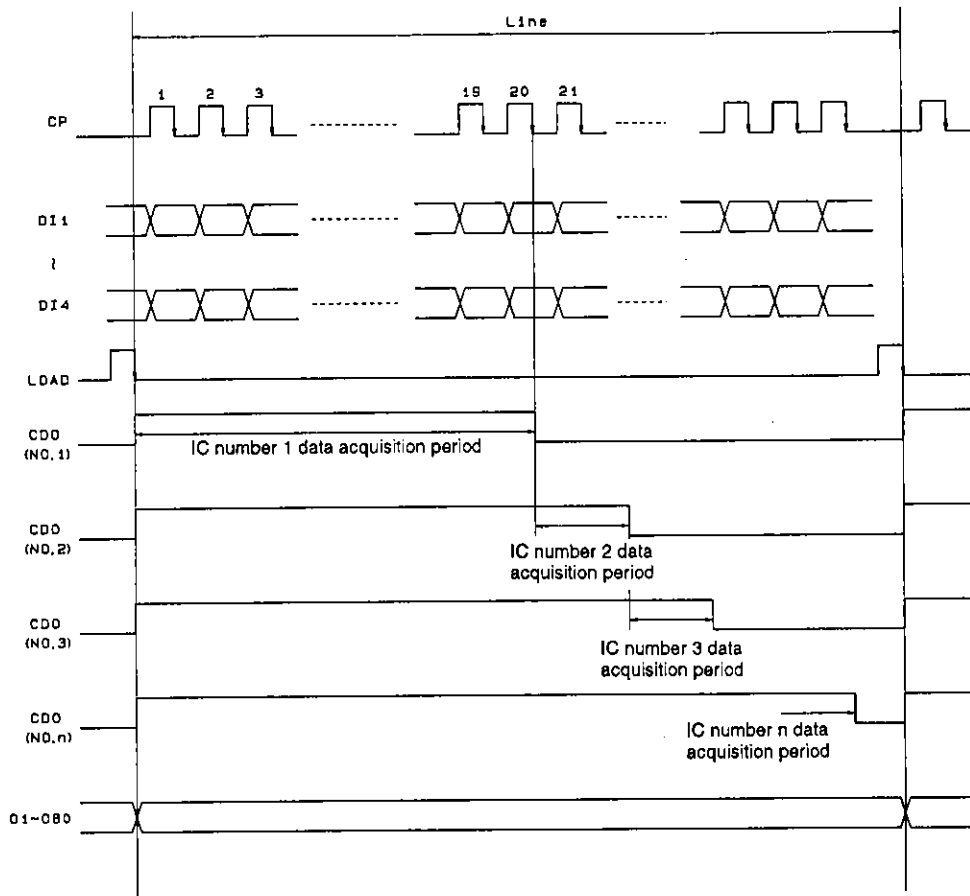
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LC79401D

Pin Functions

Pin No.	Symbol	I/O	Function																								
90 88 85	V _{DD} V _{SS} V _{EE}	Power supply	V _{DD} -V _{SS} : Logic power supply V _{DD} -V _{EE} : LCD drive circuit power supply																								
82 83 84	V1 V3 V4	Power supply	LCD drive level power supply V1, V _{EE} : Selected level V3, V4: Unselected level																								
99	CP	Input	Display data acquisition clock (falling edge trigger)																								
87	LOAD	Input	Display data latch clock (falling edge trigger) The display data LCD drive signal is output on the falling edge.																								
95 96 97 98	DI4 DI3 DI2 DI1	Input	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Display data</th> <th>LCD drive output</th> <th>LCD display</th> </tr> </thead> <tbody> <tr> <td>H</td> <td>Selected level</td> <td>On</td> </tr> <tr> <td>L</td> <td>Unselected level</td> <td>Off</td> </tr> </tbody> </table>	Display data	LCD drive output	LCD display	H	Selected level	On	L	Unselected level	Off															
Display data	LCD drive output	LCD display																									
H	Selected level	On																									
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91	R/L	Input	<p>Control pin that inverts the data output destination</p> <div style="border: 1px solid black; padding: 5px;"> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%; text-align: center;">R/L</td> <td style="text-align: center;">Input data and latch address</td> </tr> <tr> <td style="text-align: center;">L</td> <td> </td> </tr> <tr> <td style="text-align: center;">H</td> <td> </td> </tr> </table> </div>	R/L	Input data and latch address	L		H																			
R/L	Input data and latch address																										
L																											
H																											
86	M	Input	LCD drive output alternation signal																								
81	CDI	Input	Chip disable pin High level: Data is not acquired Low level: Data is acquired.																								
100	CDO	Output	Connect to the CDI pin on the next chip when cascade connection is used.																								
89	$\overline{\text{DISP OFF}}$	Input	Input that controls the O1 to O80 output pins. During periods when this pin is low, the O1 to O80 output pins output the V1 level. See the truth table.																								
1 to 80	O1 to O80	Output	<p>LCD drive outputs The output levels are determined by the combination of the output data, the M signal, and the $\overline{\text{DISP OFF}}$ pin as shown in the table.</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>M</th> <th>Q</th> <th>$\overline{\text{DISP OFF}}$</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>L</td> <td>L</td> <td>H</td> <td>V3</td> </tr> <tr> <td>L</td> <td>H</td> <td>H</td> <td>V1</td> </tr> <tr> <td>H</td> <td>L</td> <td>H</td> <td>V4</td> </tr> <tr> <td>H</td> <td>H</td> <td>H</td> <td>V_{EE}</td> </tr> <tr> <td>*</td> <td>*</td> <td>L</td> <td>V1</td> </tr> </tbody> </table> <p>Note: Don't care (fixed at high or low)</p>	M	Q	$\overline{\text{DISP OFF}}$	Output	L	L	H	V3	L	H	H	V1	H	L	H	V4	H	H	H	V _{EE}	*	*	L	V1
M	Q	$\overline{\text{DISP OFF}}$	Output																								
L	L	H	V3																								
L	H	H	V1																								
H	L	H	V4																								
H	H	H	V _{EE}																								
*	*	L	V1																								
92 93 94	NC	—	Must be left open.																								

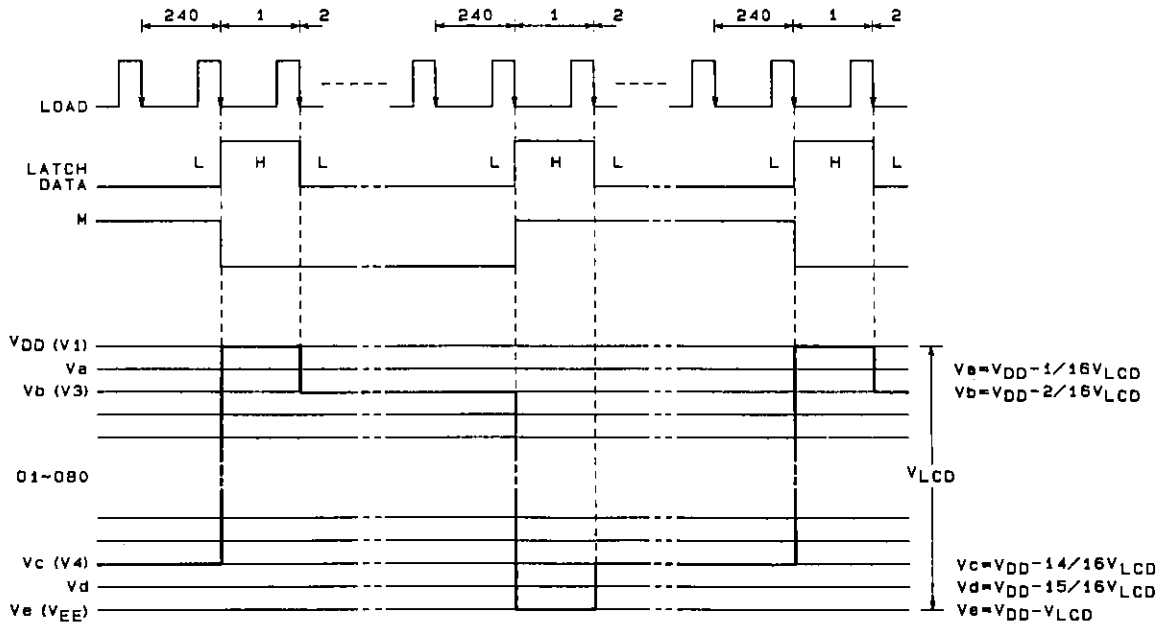
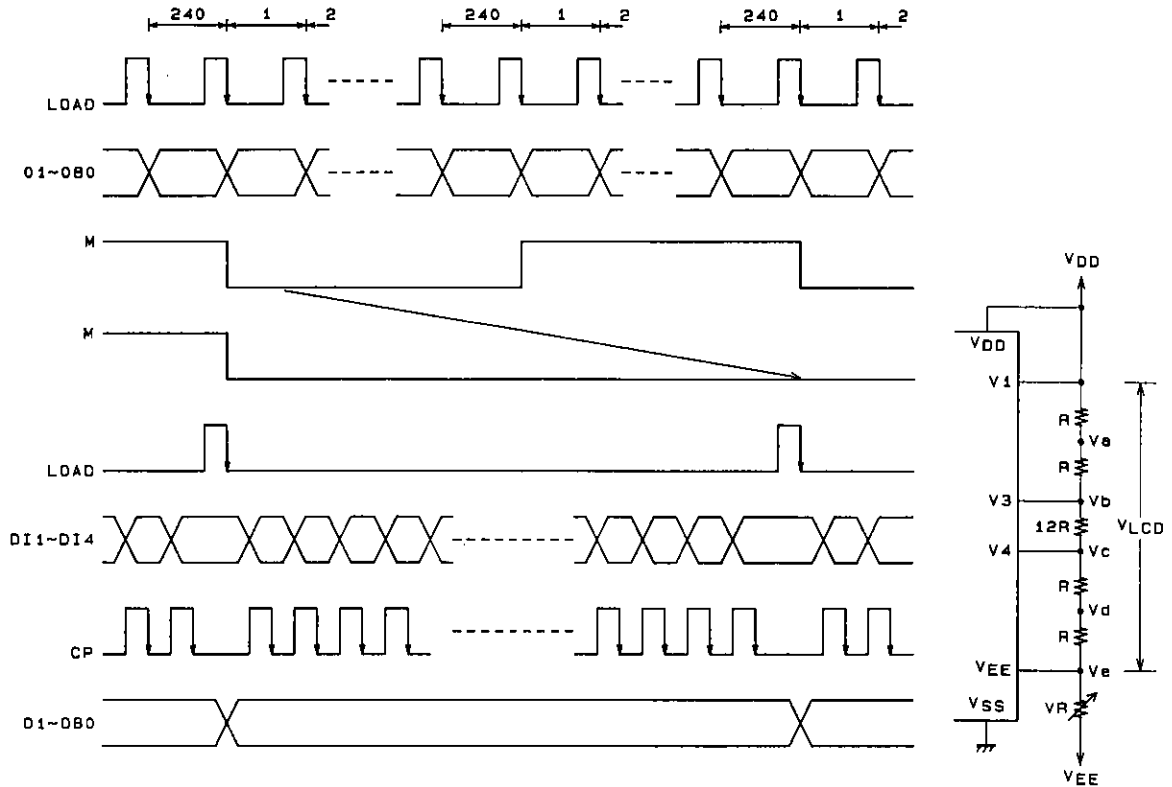
Output Timing



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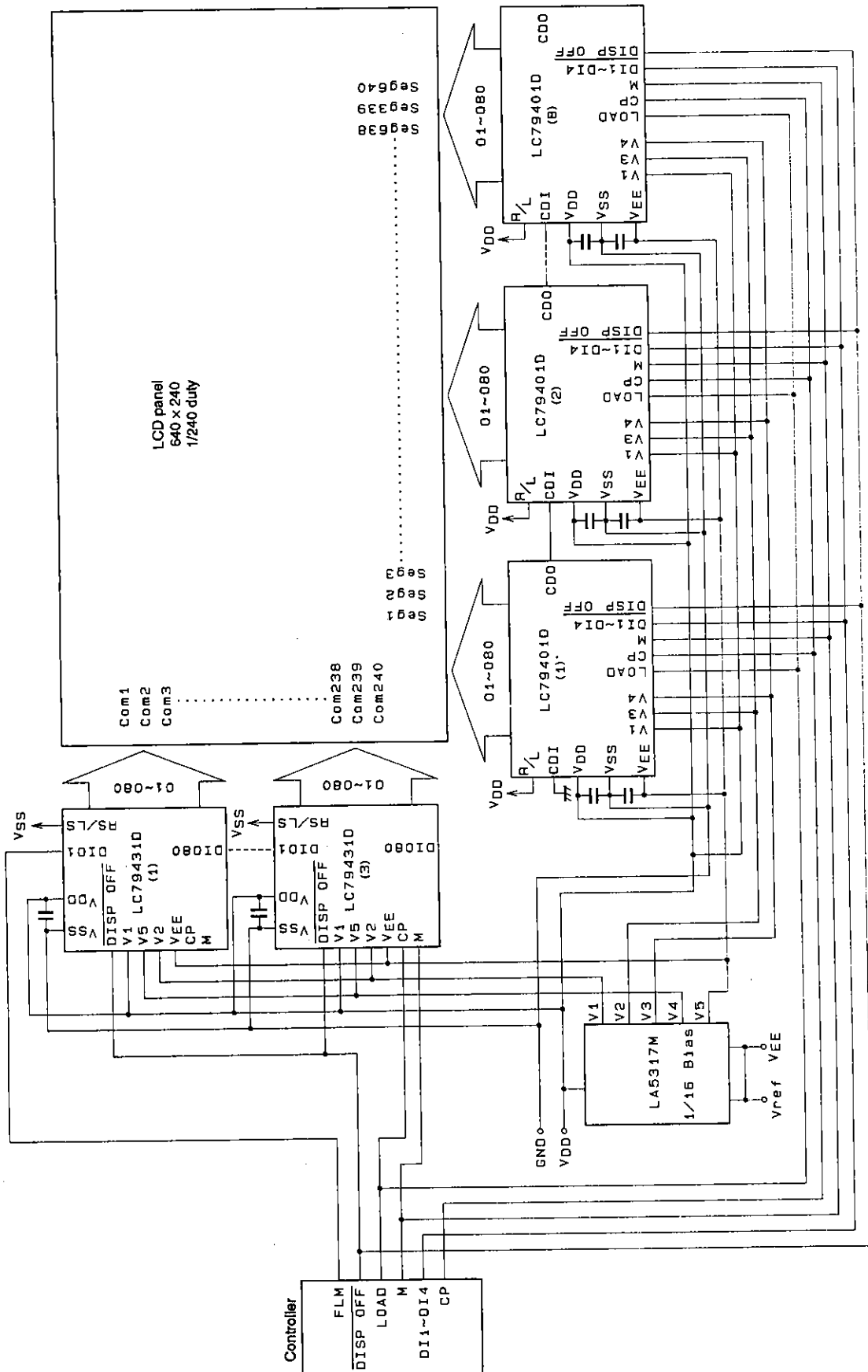
LC79401D

Timing Chart (1/240 duty, 1/16 bias)



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Sample Application Circuit



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LC79401D

Specifications

Absolute Maximum Ratings at $T_a = 25 \pm 2^\circ\text{C}$, $V_{SS} = 0\text{ V}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage (logic)	$V_{DD\text{ max}}$		-0.3 to +7.0	V
Maximum supply voltage (LCD)	$V_{DD-V_{EE\text{ max}}}$ *1		0 to 35	V
Maximum input voltage	$V_I\text{ max}$		-0.3 to $V_{DD} + 0.3$	V
Storage temperature	T_{stg}		-40 to +125	$^\circ\text{C}$

Note: 1. $V_{DD} \geq V_1 > V_3 > V_4 > V_{EE}$

Allowable Operating Ranges at $T_a = -20$ to $+75^\circ\text{C}$, $V_{SS} = 0\text{ V}$

Parameter	Symbol	Conditions	min	typ	max	Unit
Supply voltage (logic)	V_{DD}		4.5		5.5	V
Supply voltage (LCD)	$V_{DD-V_{EE}}$ *2, 3		12		32	V
Input high level voltage	V_{IH}	DI1 to DI4, CP, LOAD, CDI, R/L, M, DISP OFF	$0.8 V_{DD}$			V
Input low level voltage	V_{IL}	DI1 to DI4, CP, LOAD, CDI, R/L, M, DISP OFF			$0.2 V_{DD}$	V
CP (shift clock)	f_{CP}	CP			6.0	MHz
CP pulse width	t_{WC}	CP	50			ns
LOAD pulse width	t_{WL}	LOAD	50			ns
Setup time	t_{SETUP}	DI1 to DI4 \rightarrow CP	30			ns
Hold time	t_{HOLD}	DI1 to DI4 \rightarrow CP	30			ns
CP \rightarrow LOAD	t_{CL}	CP \rightarrow LOAD	80			ns
LOAD \rightarrow CP	t_{LC}	LOAD \rightarrow CP	110			ns
CP and LOAD rise time	t_R	CP, LOAD			*4	ns
CP and LOAD fall time	t_F	CP, LOAD			*4	ns

Note: 2. $V_{DD} \geq V_1 > V_3 > V_4 > V_{EE}$

3. When the power is turned on, either the logic system power must be turned on before the LCD drive system power or else they must both be turned on at the same time. When the power is turned off, either the LCD drive system power must be turned off before the logic system power, or else both must be turned off at the same time.

4. The CP and LOAD rise time (t_R) and the CP and LOAD fall time (t_F) must satisfy equations ① and ② below at the same time.

$$\textcircled{1} \quad t_R, t_F < \frac{1}{2 f_{CP}} - t_{WC}$$

$$\textcircled{2} \quad t_R, t_F < 50 \text{ ns}$$

Electrical Characteristics at $T_a = 25^\circ\text{C} \pm 2^\circ\text{C}$, $V_{DD} = 5\text{ V} \pm 10\%$

Parameter	Symbol	Conditions	min	typ	max	Unit
Input high level current	I_{IH}	$V_{IN} = V_{DD}$: LOAD, CP, CDI, R/L, DI1 to DI4, M, DISP OFF			1	μA
Input low level current	I_{IL}	$V_{IN} = V_{SS}$: LOAD, CP, CDI, R/L, DI1 to DI4, M, DISP OFF	-1			μA
Output high level voltage	V_{OH}	$I_{OH} = -400 \mu\text{A}$: CDO	$V_{DD} - 0.4$			V
Output low level voltage	V_{OL}	$I_{OL} = 400 \mu\text{A}$: CDO			0.4	V
Driver on resistance	R_{ON} (1)	$V_{DD-V_{EE}} = 30\text{ V}$, $ V_{DE}-V_O = 0.5\text{ V}$: O1 to O80*5		1.5	3.0	$\text{k}\Omega$
	R_{ON} (2)	$V_{DD-V_{EE}} = 20\text{ V}$, $ V_{DE}-V_O = 0.5\text{ V}$: O1 to O80*5		2.0	3.5	$\text{k}\Omega$
Standby current drain	I_{ST}	CDI = V_{DD} , $V_{DD-V_{EE}} = 30\text{ V}$, CP = 6.0 MHz, output unloaded: V_{SS}			200	μA
operating current drain	I_{SS} *6	$V_{DD-V_{EE}} = 30\text{ V}$, CP = 6 MHz, LOAD = 14 kHz, M = 35 Hz: V_{SS}			4.0	mA
	I_{EE} *7	$V_{DD-V_{EE}} = 30\text{ V}$, CP = 6 MHz, LOAD = 14 kHz, M = 35 Hz: V_{EE}			0.5	mA
Input capacitance	CI	f = 6.0 MHz: CP		5		pF

Note: 5. V_{DE} = one of V_1, V_3, V_4 or V_{EE} . $V_1 = V_{DD}$, $V_3 = 15/17 (V_{DD}-V_{EE})$, $V_4 = 2/17 (V_{DD} - V_{EE})$

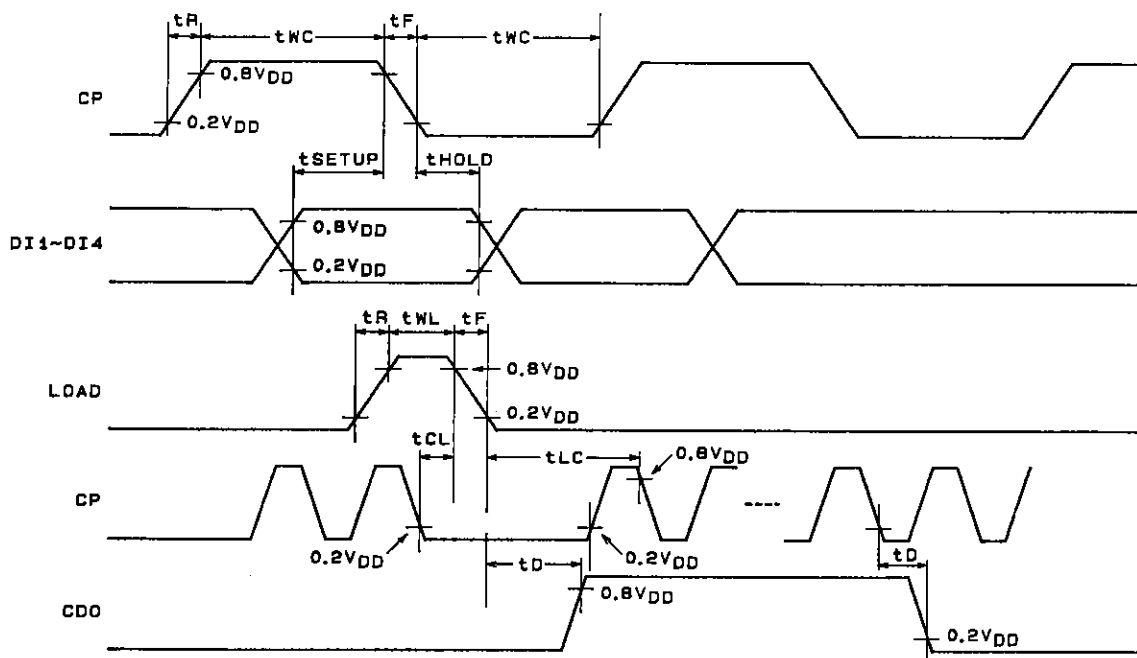
6. I_{SS} is the current flowing from V_{DD} to V_{SS} .

7. I_{EE} is the current flowing from V_{DD} to V_{EE} .

Switching Characteristics at $T_a = 25^\circ\text{C} \pm 2^\circ\text{C}$, $V_{SS} = 0\text{ V}$, $V_{DD} = 5\text{ V} \pm 10\%$

Parameter	Symbol	Conditions	min	typ	max	Unit
Output delay time	t_D	Load = 15 pF: CDO			80	ns

Switching Characteristics Diagram



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