

**SANYO**

No. 4347

**LC7943D****Dot Matrix LCD Driver**

## Overview

The LC7943D is a large-scale dot matrix LCD common driver LSI. The LC7943D contains an 68-bit bidirectional shift register and is equipped with a 4-level LCD driver. The input/output pins for cascade connection can be used to further increase the IC's number of bits. The LC7943D can be used in conjunction with segment driver LC79400D, LC79401D (QIP100D) to drive a wide-screen LCD panel.

## Features

- On-chip LCD drive circuit (68 bits)
- Display duty selection ranging from 1/64 to 1/256
- On-chip input/output pins support further increases in bit number
- Supports externally supplied bias voltage
- Operating power supply voltage/operating temperature include

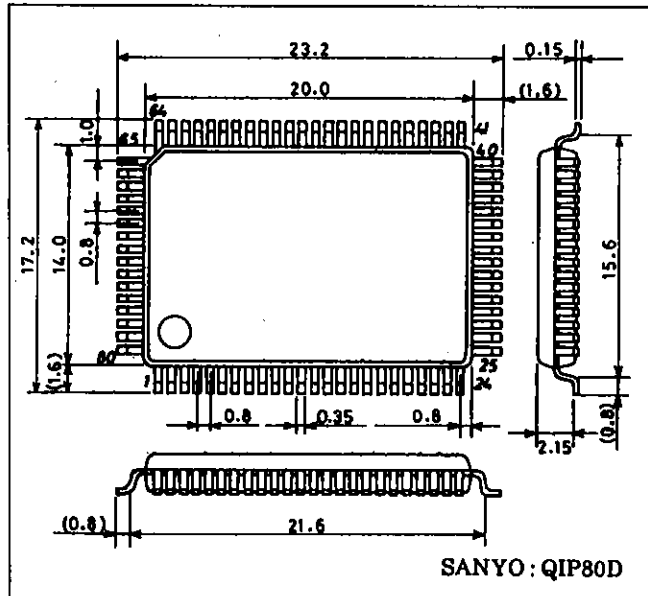
$V_{DD}$  (logic section) : 5 V  $\pm$ 10 % / -20 to +75 °C

$V_{DD}-V_{EE}$  (LCD section) : 12 V to 32 V / -20 to +75°C

- CMOS process

## Package Dimensions

unit : mm

**3177-QIP80D**

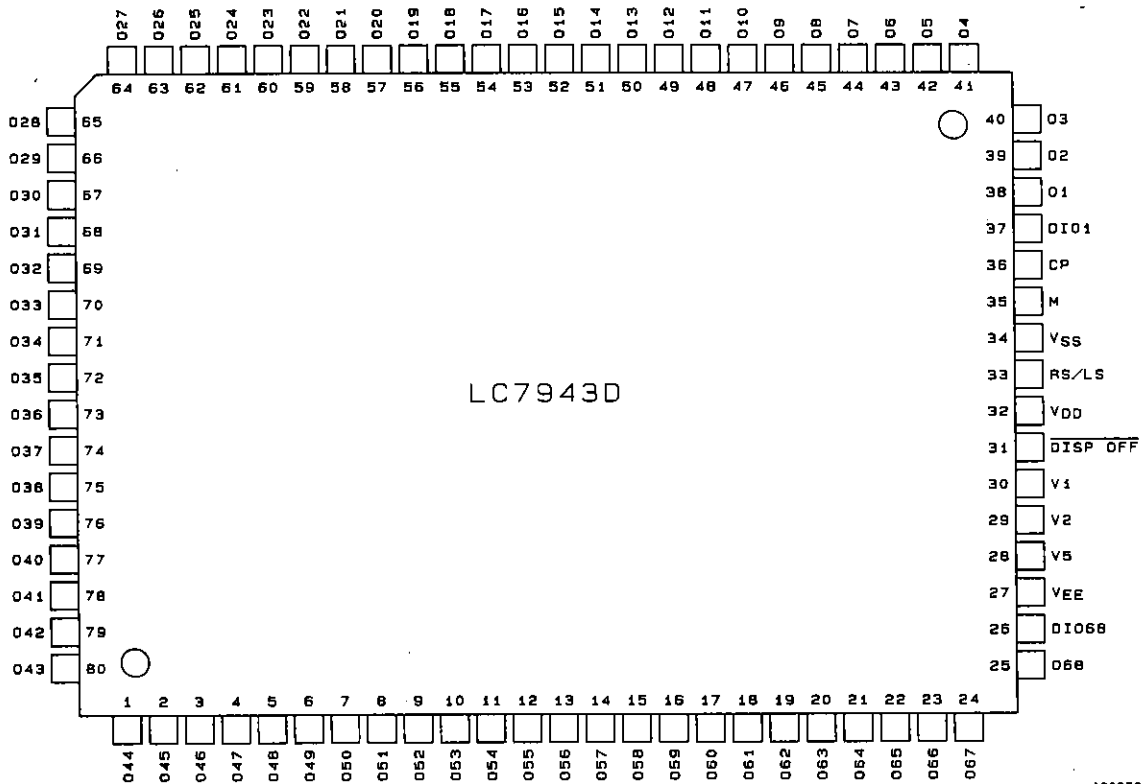
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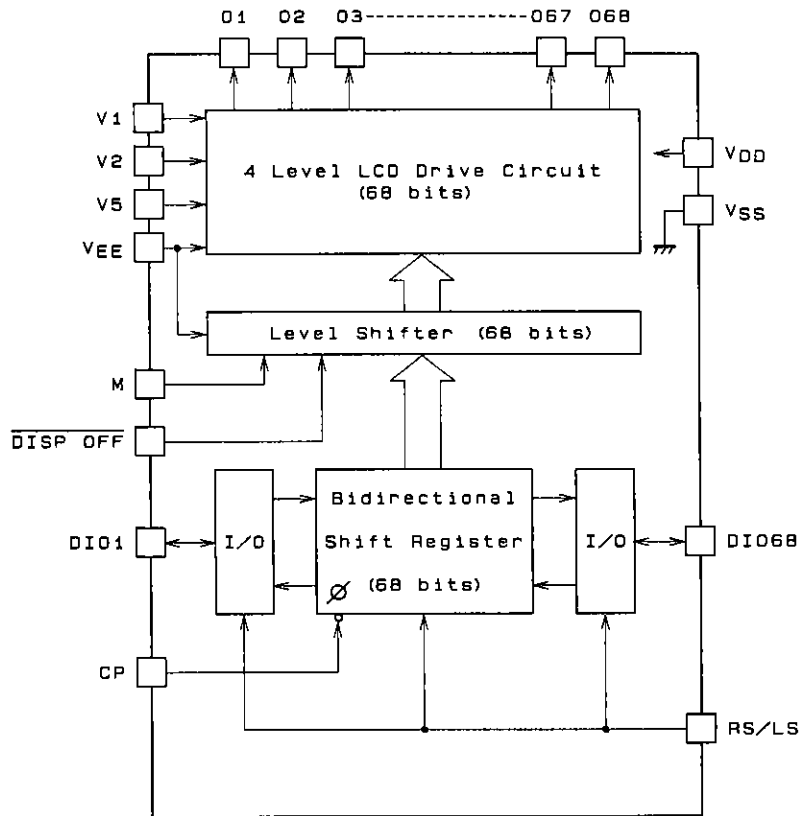
# LC7943D

## Pin Assignment



A00978

## Equivalent Circuit Block Diagram



A00977

# LC7943D

## Pin Descriptions

Pin No	Pin name	Input/Output	Functions																								
32	V <sub>DD</sub>	Power supply	V <sub>DD</sub> and V <sub>SS</sub> : Power supply for logic section																								
34	V <sub>SS</sub>																										
27	V <sub>EE</sub>																										
30	V1	Power supply	V <sub>DD</sub> and V <sub>EE</sub> : Power supply for LCD drive circuit																								
29	V2																										
28	V3																										
36	CP	Input	Bidirectional shift register shift clock (triggering on the trailing edge)																								
37	DIO1	Input/Output	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>RS/LS</th> <th>DIO1</th> <th>DIO68</th> <th>Shift Direction</th> </tr> </thead> <tbody> <tr> <td>L</td> <td>IN</td> <td>OUT</td> <td>O1 → O68</td> </tr> <tr> <td>H</td> <td>OUT</td> <td>IN</td> <td>O68 → O1</td> </tr> </tbody> </table>	RS/LS	DIO1	DIO68	Shift Direction	L	IN	OUT	O1 → O68	H	OUT	IN	O68 → O1												
RS/LS	DIO1	DIO68		Shift Direction																							
L	IN	OUT		O1 → O68																							
H	OUT	IN	O68 → O1																								
26	DIO68	Input																									
33	RS/LS																										
35	M	Input	LCD drive output alternating current (AC) signal																								
31	DISP OFF	Input	O1 to O68 output controlling Input pins																								
38 ⋮ 80 1 ⋮ 25	O1 ⋮ O43 O44 ⋮ O68	Output	<p>LCD drive output</p> <p>As shown in the following table, output levels switch in response to the particular combination of scan data, M and DISP OFF signals.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>M</th> <th>Data</th> <th>DISP OFF</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>L</td> <td>L</td> <td>H</td> <td>V2</td> </tr> <tr> <td>L</td> <td>H</td> <td>H</td> <td>V<sub>EE</sub></td> </tr> <tr> <td>H</td> <td>L</td> <td>H</td> <td>V5</td> </tr> <tr> <td>H</td> <td>H</td> <td>H</td> <td>V1</td> </tr> <tr> <td>•</td> <td>•</td> <td>L</td> <td>V1</td> </tr> </tbody> </table> <p>* Don't care (May be set to either "H" or "L")</p>	M	Data	DISP OFF	Output	L	L	H	V2	L	H	H	V <sub>EE</sub>	H	L	H	V5	H	H	H	V1	•	•	L	V1
M	Data	DISP OFF	Output																								
L	L	H	V2																								
L	H	H	V <sub>EE</sub>																								
H	L	H	V5																								
H	H	H	V1																								
•	•	L	V1																								

## Specifications

### Absolute Maximum Ratings at T<sub>a</sub> = 25±2°C, V<sub>SS</sub> = 0V

			unit
Maximum supply voltage (LOGIC)	V <sub>DD</sub> max	-0.3 to +7.0	V
Maximum supply voltage (LCD)	V <sub>DD</sub> -V <sub>EE</sub> max *1	0 to 35	V
Maximum input voltage	V <sub>1</sub> max	-0.3 to V <sub>DD</sub> +0.3	V
Storage temperature range	T <sub>stg</sub>	-40 to +125	°C

\*1: The following relations between elements should be maintained: V<sub>DD</sub> ≥ V1 > V2 > V5 > V<sub>EE</sub>, V<sub>DD</sub> - V2 ≤ 7V, V5 - V<sub>EE</sub> ≤ 7V.

### Allowable Operating Ranges at T<sub>a</sub> = -20 to +75°C, V<sub>SS</sub> = 0V

			min	typ	max	unit
Supply voltage (LOGIC)	V <sub>DD</sub>		4.5		5.5	V
Supply voltage (LCD)	V <sub>DD</sub> -V <sub>EE</sub>	*2, *3	12		32	V
Input "H" level voltage	V <sub>IH</sub>	DIO1, DIO68, CP, M, RS/LS, DISP OFF	0.8V <sub>DD</sub>			V
Input "L" level voltage	V <sub>IL</sub>	DIO1, DIO68, CP, M, RS/LS, DISP OFF		0.2V <sub>DD</sub>		V
CP (Shift Clock)	f <sub>CP</sub>	CP			1	MHz
CP (Pulse width)	t <sub>WC</sub>	CP	125			ns
Setup time	t <sub>SETUP</sub>	DIO1 → CP, DIO68 → CP	100			ns
Hold time	t <sub>HOLD</sub>	DIO1 → CP, DIO68 → CP	100			ns
CP Rise-Fall Time	t <sub>R</sub>	CP			50	ns
	t <sub>F</sub>	CP			50	ns

\*2 The following relations between elements should be maintained: V<sub>DD</sub> ≥ V1 > V2 > V5 > V<sub>EE</sub>, V<sub>DD</sub> - V2 ≤ 7V, V5 - V<sub>EE</sub> ≤ 7V.

\*3 When the power supply is turned on, power to the LCD drive is turned on after or simultaneously with the turning on of the logic section's power supply. When the power supply is turned off, the logic power supply is turned off after or at the same time the LCD driver power supply is turned off.

# LC7943D

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

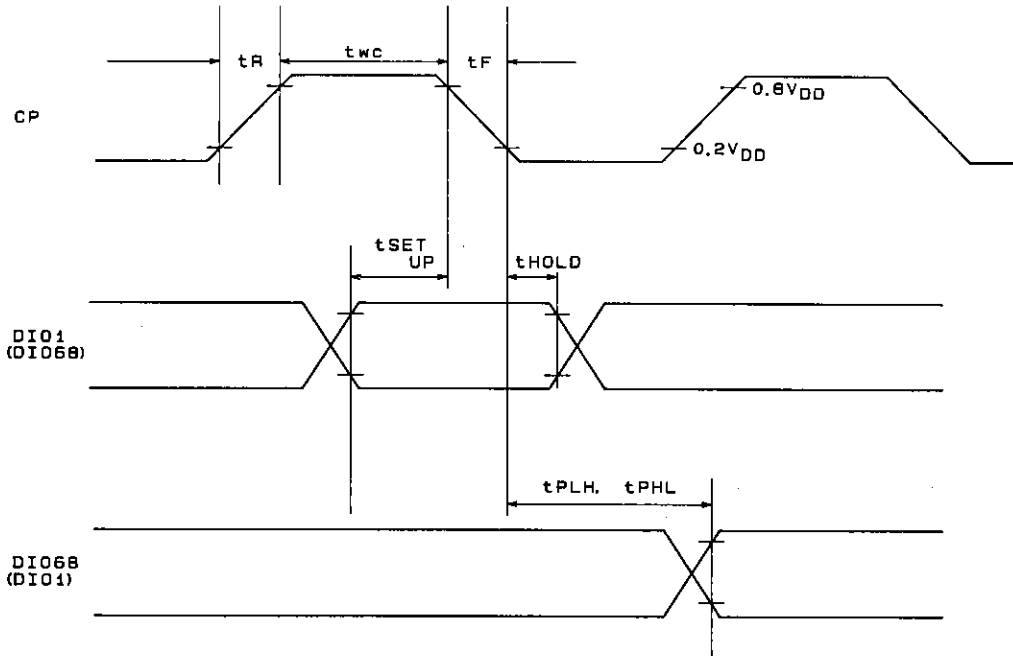
			min	typ	max	unit
Input "H" level current	$I_{IH}$	$V_{IN} = V_{DD}$ , $V_{DD} = 5.5\text{V}$ ; DIO1, DIO68, CP, M, RS/LS, $\overline{\text{DISP OFF}}$			1	$\mu\text{A}$
Input "L" level current	$I_{IL}$	$V_{IN} = V_{SS}$ , $V_{DD} = 5.5\text{V}$ ; DIO1, DIO68, CP, M, RS/LS, $\overline{\text{DISP OFF}}$	-1			$\mu\text{A}$
Output "H" level voltage	$V_{OH}$	$I_{OH} = -0.4\text{mA}$ , $V_{DD} = 4.5\text{V}$ ; DIO1, DIO68	$V_{DD} - 0.4$			V
Output "L" level voltage	$V_{OL}$	$I_{OL} = 0.4\text{mA}$ , $V_{DD} = 4.5\text{V}$ ; DIO1, DIO68			0.4	V
Driver On Resistor	$R_{ON} (1)$	$V_{DD} - V_{EE} = 30\text{V}$ , $ V_{DE} - V_o  = 0.5\text{V}$ , $V_{DD} = 4.5\text{V} * 4$ ; O1 to O68			1.0	$\text{k}\Omega$
	$R_{ON} (2)$	$V_{DD} - V_{EE} = 20\text{V}$ , $ V_{DE} - V_o  = 0.5\text{V}$ , $V_{DD} = 4.5\text{V} * 4$ ; O1 to O68			1.0	$\text{k}\Omega$
Consumable current (1)	$I_{SS}$	$V_{DD} - V_{EE} = 30\text{V}$ , CP = 14kHz, no-load, $V_{DD} = 5.5\text{V}$ ; $V_{SS}$			100	$\mu\text{A}$
Consumable current (2)	$I_{EE}$	$V_{DD} - V_{EE} = 30\text{V}$ , CP = 14kHz, no-load, $V_{DD} = 5.5\text{V}$ ; $V_{EE}$			100	$\mu\text{A}$
Input Capacity	$C_1$	$f = 1\text{MHz}$ ; CP		5		pF

\*4  $V_{DE} = V1$  or  $V2$  or  $V5$  or  $V_{EE}$ ,  $V1 = V_{DD}$ ,  $V2 = 16/17 (V_{DD} - V_{EE})$ ,  $V5 = 1/17 (V_{DD} - V_{EE})$

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

			min	typ	max	unit
Output Delay Time	$t_{PLH}$	CL = 15PF; CP → DIO1, CP → DIO68			250	ns
	$t_{PHL}$	CL = 15PF; CP → DIO1, CP → DIO68			250	ns

### Switching Characteristics



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