INTRODUCTION

The S6B2104 is a LCD driver IC, which is fabricated by low power CMOS high voltage process technology. This device consists of 80-bit bi-directional shift register, 80-bit data latch and 80 bit driver.

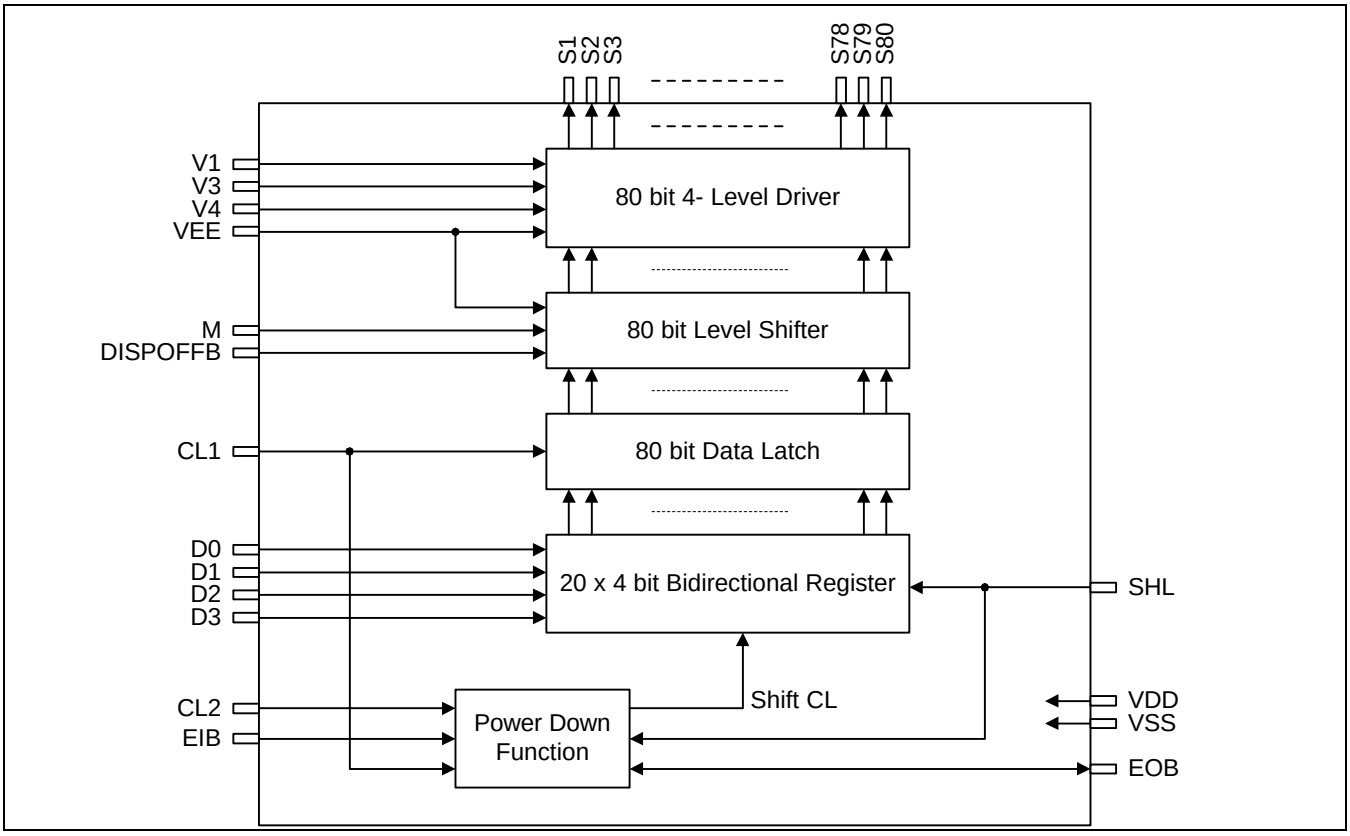
FEATURES

- Power supply voltage: +5V ± 10%, +3V ± 10%
- Supply voltage for display: 6 to 28V (VDD-VEE)
- Parallel data processing (4 bit)
- Applicable LCD duty: 1/64 to 1/256
- Interface

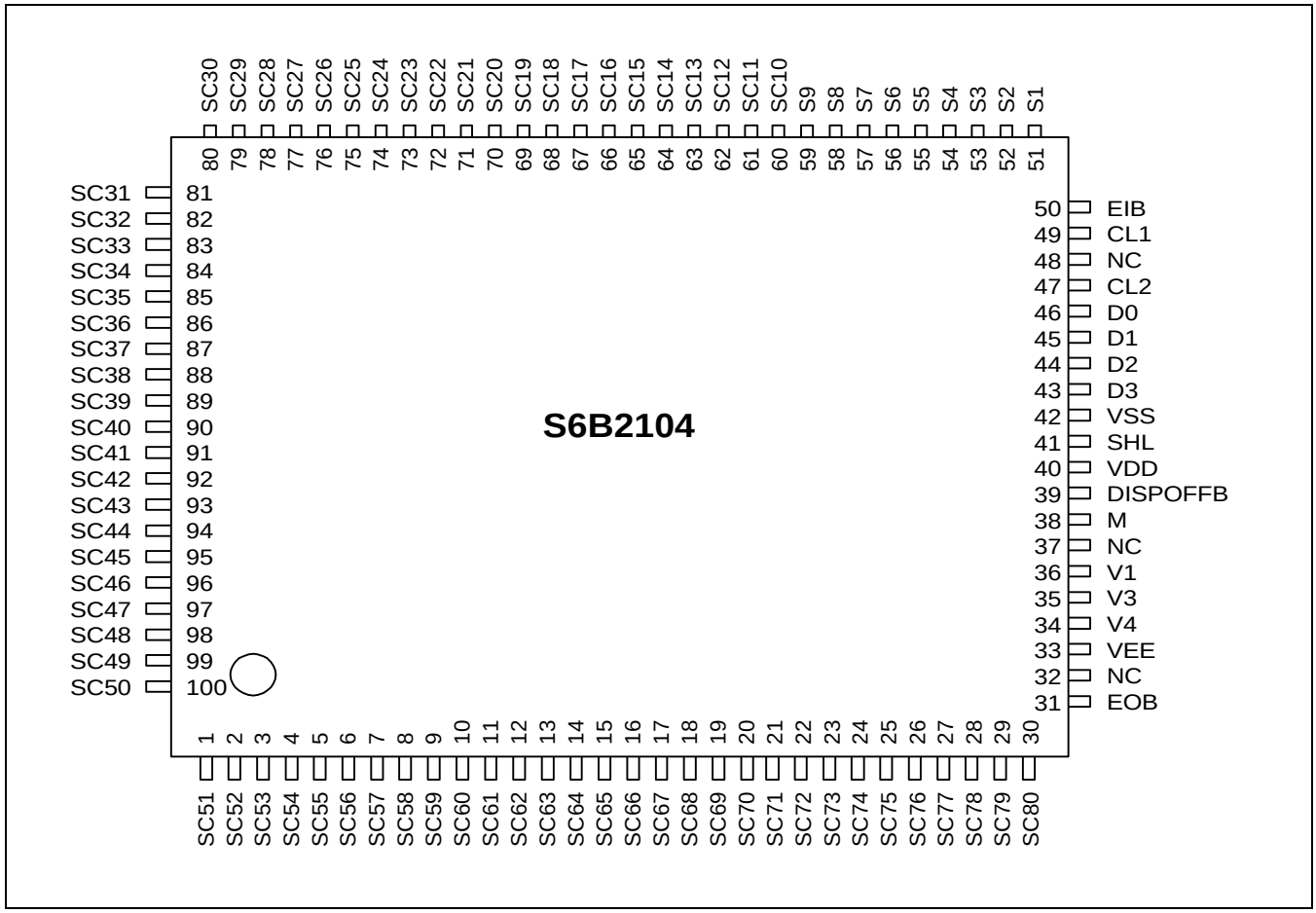
Drivers	
COM	SEG (cascade)
S6B0086	Other S6B2104

- High voltage CMOS process
- 100 QFP or bare chip available

BLOCK DIAGRAM



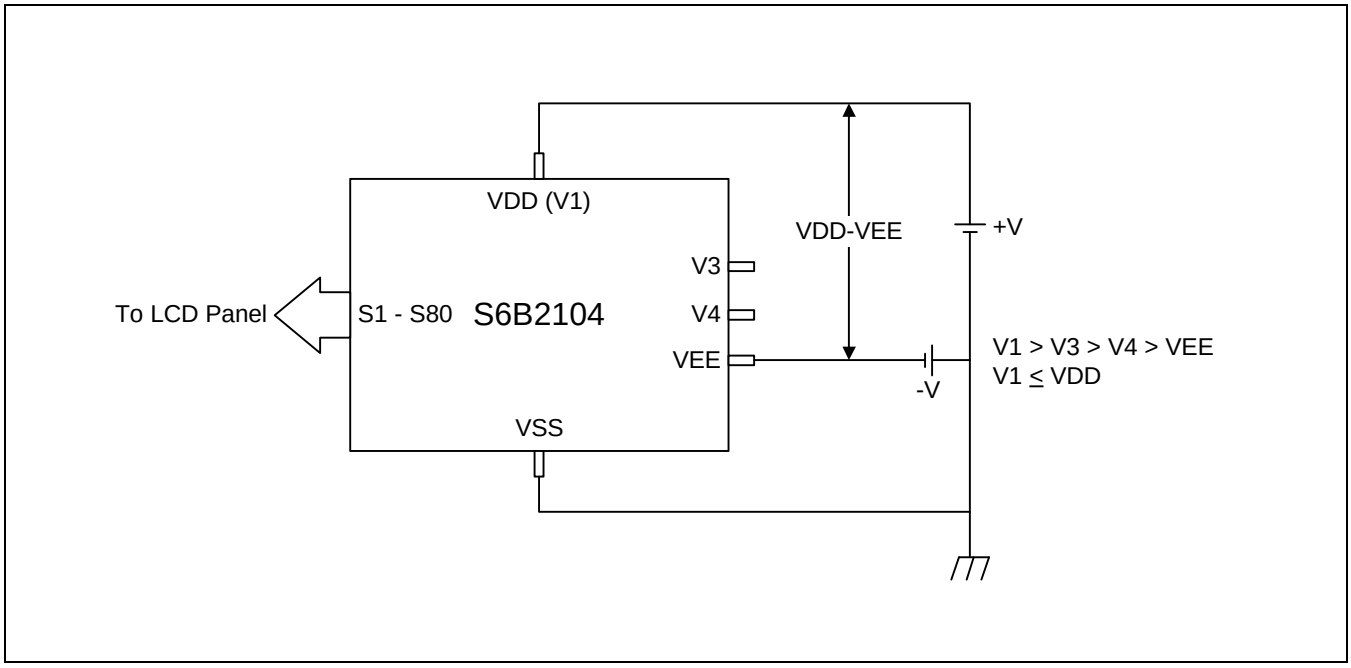
PIN CONFIGURATION



MAXIMUM ABSOLUTE LIMIT

Characteristic	Symbol	Value	Unit
Operating voltage	V_{DD}	-0.3 - 6.0	V
Driver supply voltage	V_{LCD}	0 - 30	
Input voltage	V_{IN}	-0.3 - VDD +0.3	
Operating temperature	T_{OPR}	-30 - +85	°C
Storage temperature	T_{STG}	-55 - +150	

Voltage greater than above may result in damage to the circuit.



ELECTRICAL CHARACTERISTICS

DC Characteristics

(VDD = 2.7 to 5.5V, VSS = 0V, Ta = -30 to +85°C, C_L = 15pF)

Characteristics	Symbol	Condition		Min	Typ	Max	Unit
Operating voltage	V_{DD}	-		2.7	-	5.5	V
Driver supply voltage	V_{LCD}	V_{LCD} = VDD - VEE		6	-	28	
Input voltage (1)	V_{IH}	-		0.8VDD	-	-	
	V_{IL}	-		0	-	0.2VDD	
Output voltage (2)	V_{OH}	I_{OH} = -0.4mA		VDD-0.4	-	-	V
	V_{OL}	I_{OL} = 0.4mA		-	-	0.4	
Input leakage current 1 (1)	I_{IL1}	V_{IN} = VDD to VSS		-1	-	1	µA
Input leakage current 2 (3)	I_{IL2}	V_{IN} = VDD to VEE		-25	-	25	
On resistance (4)	R_{ON}	I_{ON} = 100µA		-	2	4	kΩ
Supply current	I_{STB}	fCL2 = 1MHz,	VDD = 5.5V (5)	-	-	200	µA
	I_{DD}	fCL2 = 19.2kHz,	VDD = 5.5V (6)	-	-	3	mA
		fM = 40Hz, VLCD = 26V	VDD = 2.7V (6)	-	-	1	mA
	I_{EE}	No Load	VDD = 5.5V (7)	-	150	500	µA

NOTES:

1. Applied to CL1, CL2, EIB, EOB, D0 to D3, SHL, DISPOFFB, M pin.
2. EIB, EOB pin
3. V1, V3, V4 pin
4. VDD-VEE = 26V(VDD = 3V), VEE = 28V(VDD = 5V), V1 = VDD, V3 = VDD-2/10(VDD-VEE), V4 = VEE+2/10(VDD-VEE), S1 to S80 pin
5. Display data pattern: 0000, Current from VDD to VSS when the display data is not processing (SHL = VSS, D0 to D3 = VSS, DISPOFFB = VDD, M = VSS)
6. Display data pattern: 1010, Current from VDD to VSS when the display data is processing
7. Display data pattern: 1010, Current on VEE pin

AC Characteristics

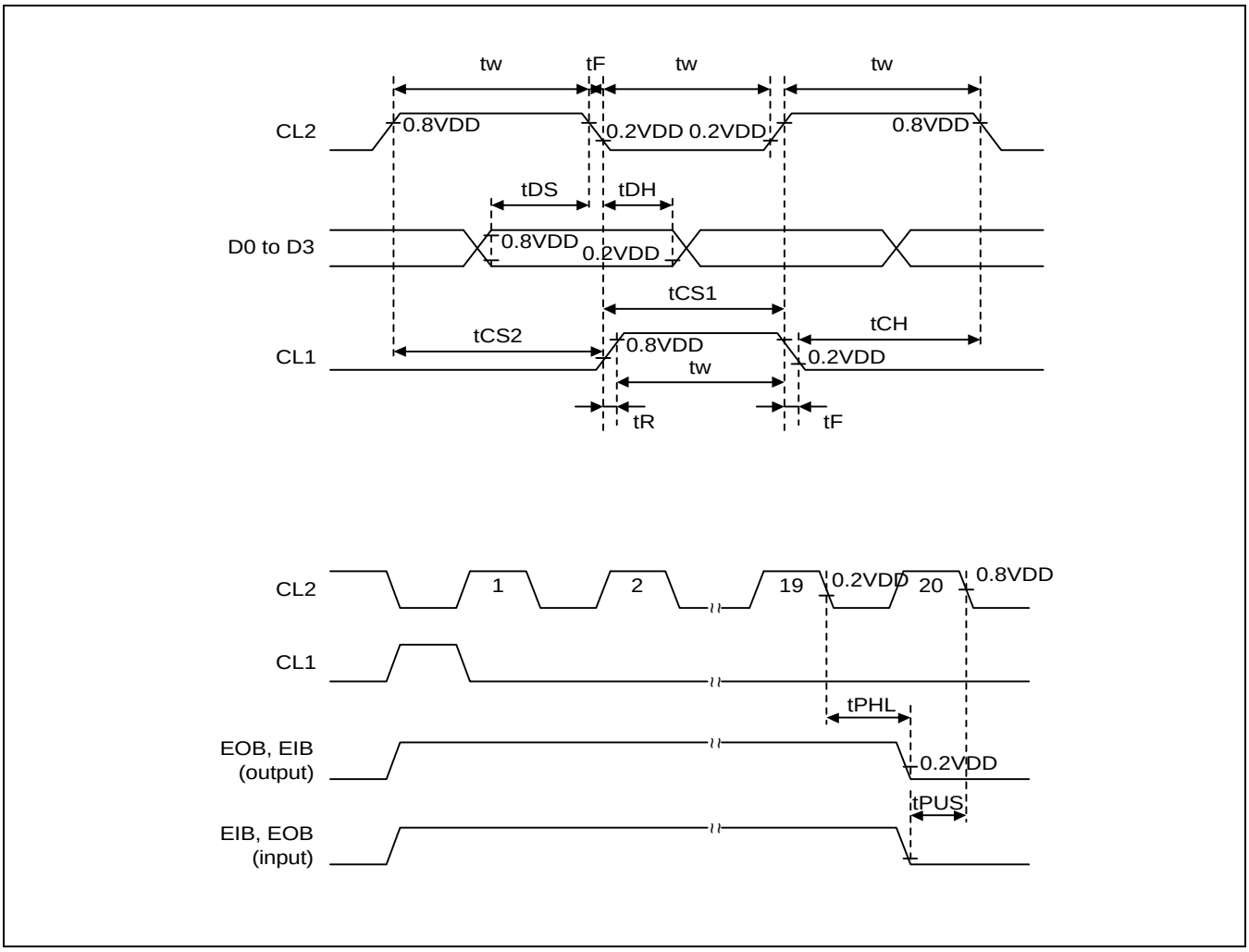
(VDD = +5V ± 10%, VSS = 0V, Ta = -30 to +85 °C, C_L = 15pF)

Characteristic	Symbol	Condition	Min	Typ	Max	Unit
Clock cycle time	t_{CYC}	Duty = 50%	125	-	-	ns
Clock pulse width	t_W	-	45	-	-	
Clock rise/fall time	t_R/t_F	-	-	-	30	
Data set-up time	t_{DS}	-	30	-	-	
Data hold time	t_{DH}	-	30	-	-	
Clock set-up time1	T_{CS1}	-	80	-	-	
Clock set-up time2	T_{CS2}	-	10	-	-	
Clock hold time	t_{CH}	-	80	-	-	
Propagation delay time	t_{PHL}	EOB output	-	-	80	
		EIB output			80	
EIB, EOB set-up time	t_{PSU}	EOB input	30	-	-	
		EIB input	30			

(VDD = +3V ± 10%, VSS = 0V, Ta = -30 to +85°C, C_L = 15pF)

Characteristic	Symbol	Condition	Min	Typ	Max	Unit
Clock cycle time	t_{CYC}	Duty = 50%	250	-	-	ns
Clock pulse width	t_W	-	95	-	-	
Clock rise/fall time	t_R/t_F	-	-	-	30	
Data set-up time	t_{DS}	-	50	-	-	
Data hold time	t_{DH}	-	50	-	-	
Clock set-up time1	T_{CS1}	-	80			
Clock set-up time2	t_{CS2}	-	15	-	-	
Clock hold time	t_{CH}	-	120	-	-	
Propagation delay time	t_{PHL}	EOB output	-	-	155	
		EIB output			155	
EIB, EOB set-up time	t_{PSU}	EOB input	65	-	-	
		EIB input	65			

Timing Characteristics

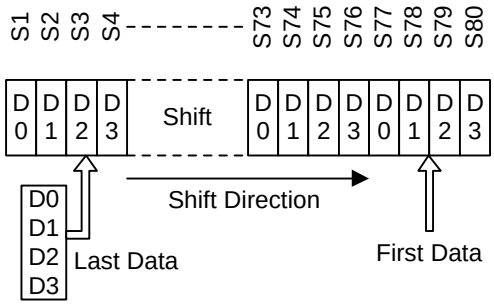
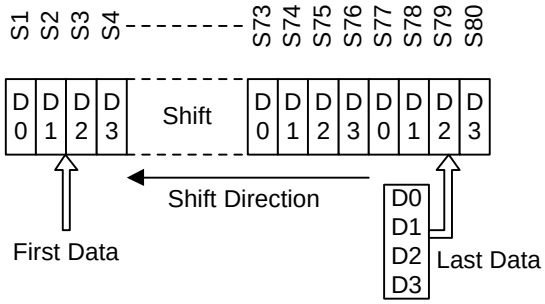


PIN DESCRIPTION

Table 1. Pin Description

Pin No	I/O	Name	Function	Interface
VDD (40)	Power	Operating voltage	For logical circuit (+5V ± 10%, +3V ± 10%)	Power Supply
VSS (42)			0V (GND)	
VEE (33)		Negative supply voltage	For LCD drive circuit	
V1, V3, V4 (34-36)	I	LCD driver output voltage level	Bias supply voltage terminals to drive the LCD. Bias voltage divided by the resistance is usually used as supply voltage source. (refer to note 1)	Power
S1-S80 (1-30, 51-100)	O	LCD driver output	Display data output pin which corresponds to the respective latch contents. One of V1, V3, V4 and VEE is selected as a display driving voltage source according to the combination of the latched data level and M signal (refer to note 2)	LCD
CL2 (47)	I	Data shift clock	Clock pulse input for the 4 bit parallel shift register. The data is shifted to 80 bit shift register at the falling edge of the clock pulse. The clock pulse, which was input when the enable bit (EIB/EOB) is not active condition, is invalid.	Controller
M (38)	I	Alternate signal for LCD driver output	Alternate signal input pin for LCD driving. Normal frame inversion signal is input	Controller
CL1 (49)	I	Data latch clock	The signal for latching the shift register contents is input to this terminal. CL1 pulse "H" level initializes power-down function block.	Controller
DISPOFFB (39)	I	Output level control (Display off)	Control input pin for display data output level (S1-S80). V1 level is output from S1-S80 terminal during "L" level input. LCD becomes non-selected by V1 level output from every output of segment drivers and every output of common drivers.	Controller
SHL (41)	I	Data shift control	EOB and EIB can be used as either input terminal or output terminal according to the condition of SHL. The shifting direction of each data, D0-D3, the I/O condition of EOB and EIB, and the condition of SHL are described in the table below. (refer to note 3).	VDD/VSS

Table 1. Pin Description (Continued)

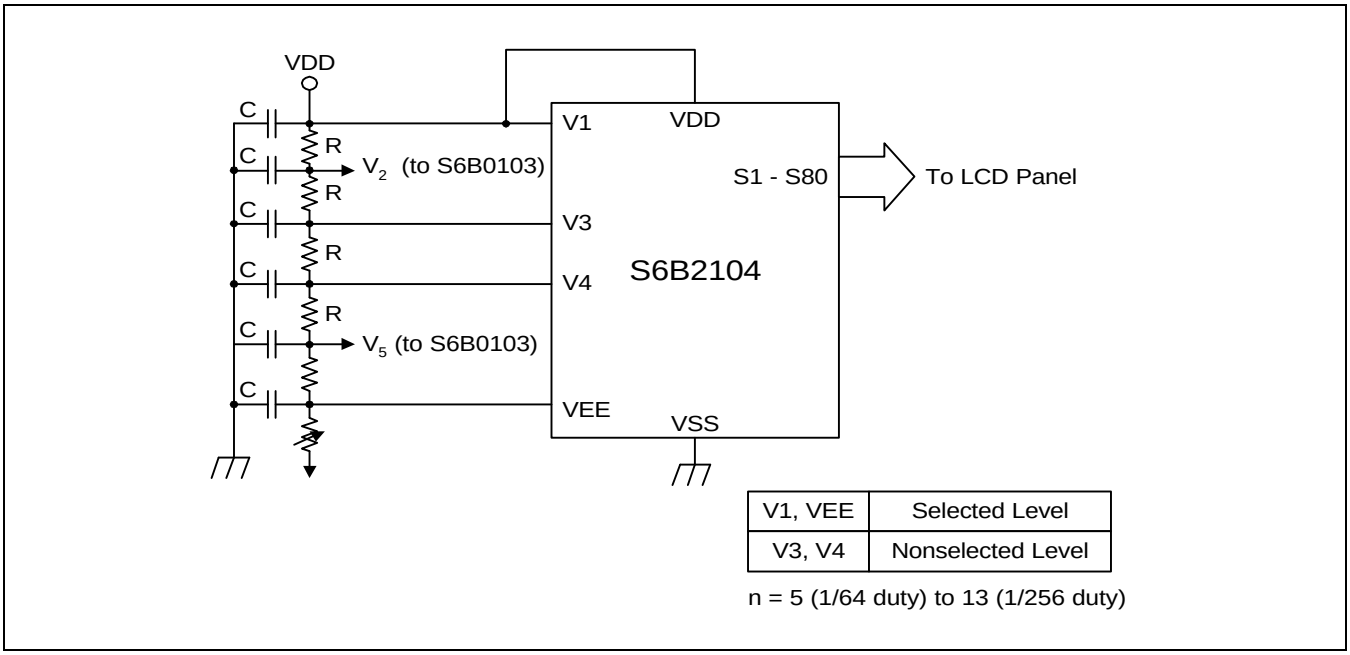
<table>
<tr><th>Pin No</th><th>I/O</th><th>Name</th><th colspan="3">Function</th><th>Interface</th></tr>
<tr><td rowspan="5">EOB,EIB
(31,50)</td><td rowspan="5">I/O</td><td>Pin</td><td>I/O</td><td>SHL</td><td>Display data shift direction</td><td>Description</td></tr>
<tr><td>EOB</td><td>I</td><td>L</td><td rowspan="2">D0: S1→S5.→S77
D1: S2→S6.→S78
D2: S3→S7.→S79
D3: S4→S8.→S80</td><td>Enable input terminal of S6B2104.</td></tr>
<tr><td>EIB</td><td>O</td><td>Enable output terminal of S6B2104. EIB is connected to next S6B2104's EOB when the S6B2104's are connected in series (cascade connection).</td></tr>
<tr><td>EIB</td><td>I</td><td>H</td><td rowspan="2">D0: 80→S76.→S4
D1: 79→S75.→S3
D2: 78→S74.→S2
D3: 77→S73.→S1</td><td>Enable input terminal of S6B2104.</td></tr>
<tr><td>EOB</td><td>O</td><td>Enable output terminal of S6B2104. EOB is connected to next S6B2104's EIB when the S6B2104's are connected in series (cascade connection)</td></tr>
<tr><td>D0-D3
(43-46)</td><td>I</td><td>EOB</td><td>I</td><td>L</td><td colspan="2"> 
</td></tr>
<tr><td></td><td>EIB</td><td>O</td><td colspan="3"></td></tr>
<tr><td></td><td>EIB</td><td>I</td><td>H</td><td colspan="2"> 
</td></tr>
<tr><td></td><td>EOB</td><td>O</td><td colspan="3"></td></tr>
</table>

		Display data input	Display data input pins for 4 bit parallel shift register and it is input synchronized with the clock pulse. The combination of D0-D3 level, M signal, display data output level and the display on the LCD panel is described on the table below. (DISPOFFB = H)	Controller

D0-D3	M	Display Data Output Level	Display on the LCD
L	L	V3	OFF
H	L	V1	ON
L	H	V4	OFF
H	H	VEE	ON

NOTES:

1.



V1, VEE	Selected Level
V3, V4	Nonselected Level

n = 5 (1/64 duty) to 13 (1/256 duty)

2.

M	Latched Data	DISPOFFB	Output level (S1- S80)
L	L	H	V3
L	H	H	V1
H	L	H	V4
H	H	H	VEE
X	X	L	V1

X: Dont care.

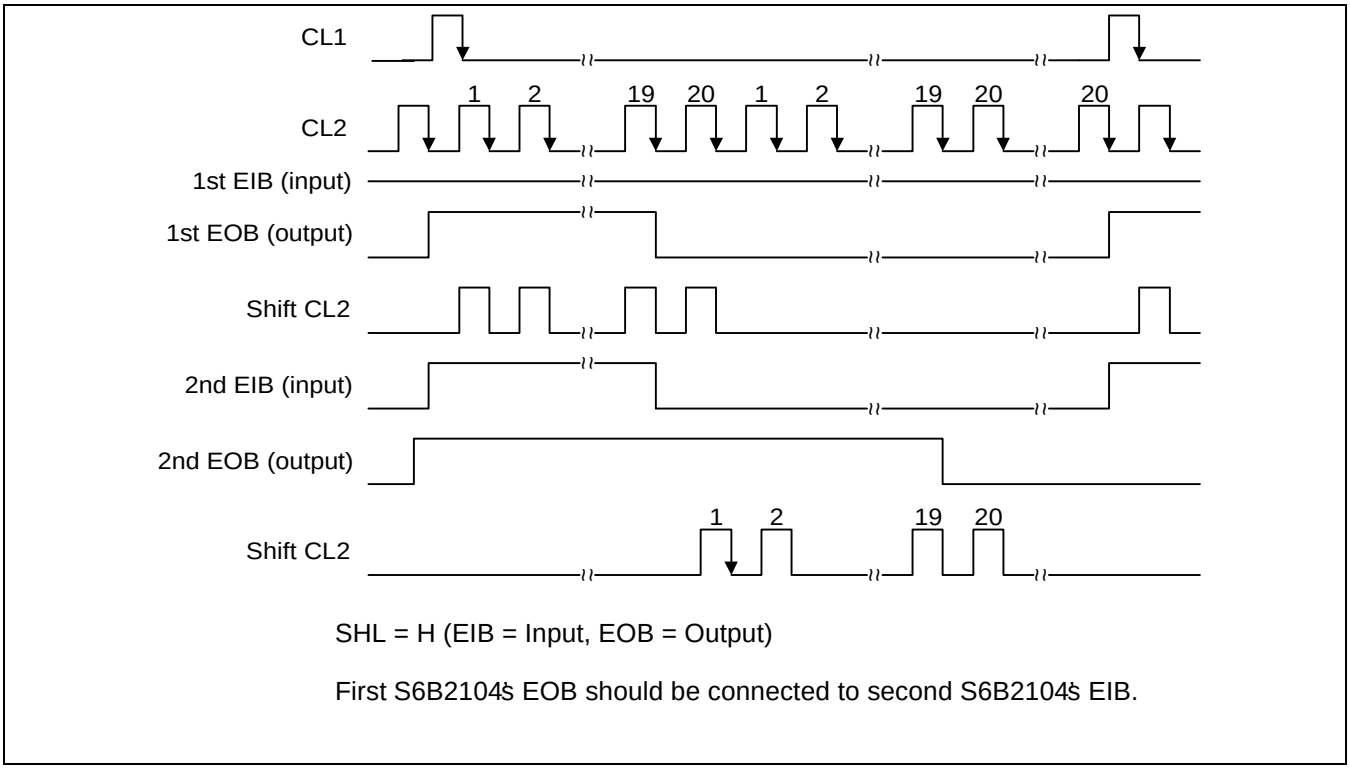
SAMSUNG ELECTRONICS

3. - EOB and EIB pins works as input terminals.
   ENABLE F/F stops display data at "H" level input. ENABLE F/F starts display data at "L" level input.
   - EOB and EIB pins work as output terminals. These terminals are set to the "H" level immediately after ENABLE F/F is initialized by the load pulse. Upon completion of 80-bit serial/parallel conversion using the shift clock input from the CL2 terminal, these terminals are then set to the "L" level.
   - The operation of ENABLE F/F is terminated and held unchanged until the next load pulse is detected. (For cascade connection, refer to the application circuit drawing)

POWER DOWN FUNCTION

In order to reduce the power consumption, in case of cascade connection, S6B2104 has a "power down function".

EIB	Enable input	Enable	L
		Disable	H
EOB	Enable output	EOB of Nth driver is connected to EIB of (N+1)th driver S6B2104	



SHL = H (EIB = Input, EOB = Output)

First S6B2104's EOB should be connected to second S6B2104's EIB.

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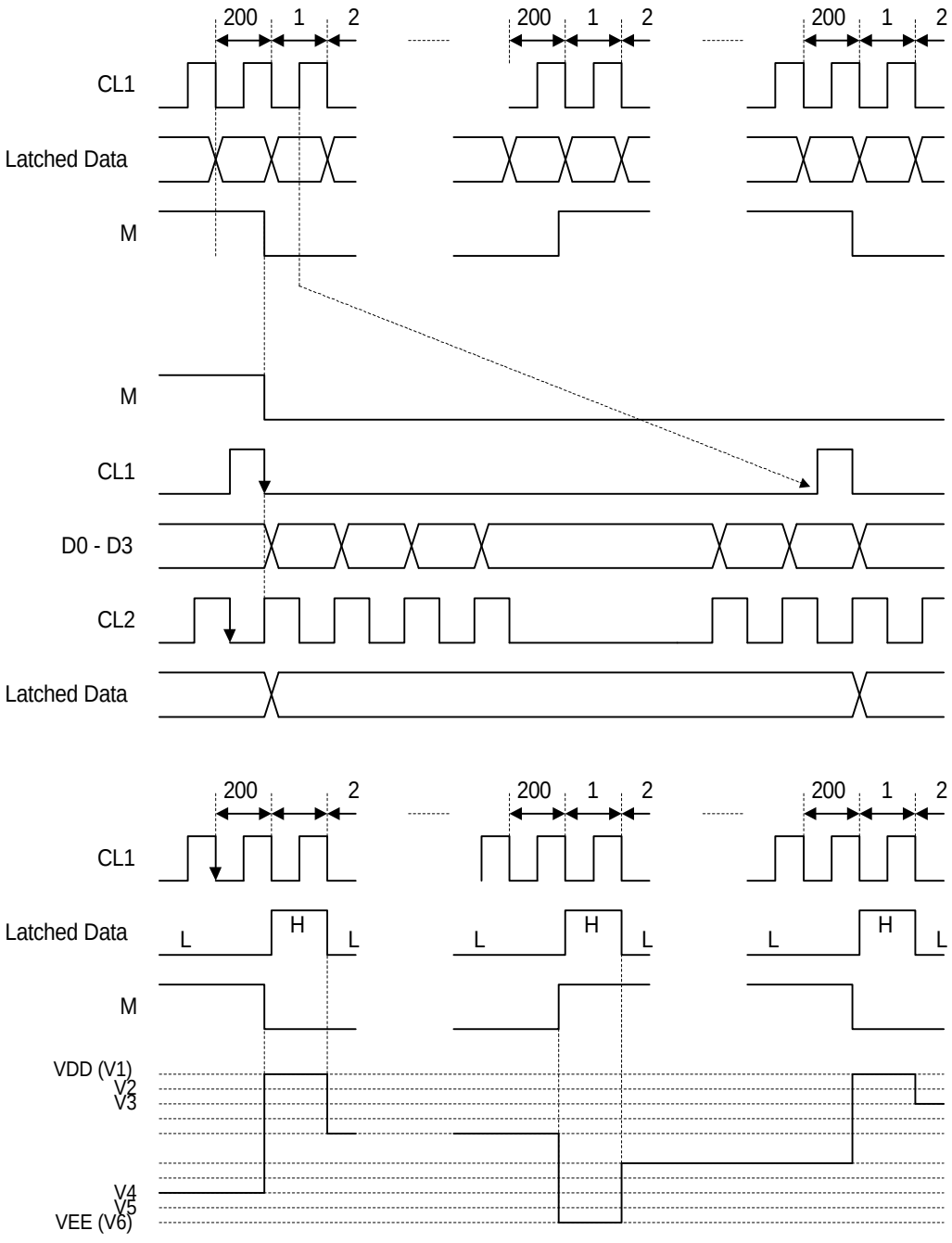
Timing Chart - 1/200 Duty, 1/15 Bias



V1 = VDD
V2 = VDD-1/10V $_{LCD}$
V3 = VDD-2/10V $_{LCD}$
V4 = VDD-8/10V $_{LCD}$
V5 = VDD-9/10V $_{LCD}$
V_{LCD} = VDDVEE