



40-Channel Segment / Common Driver For Dot Matrix LCD

Introduction

The NT7065B is a LCD driver IC which is fabricated by low power CMOS technology. Basically this IC consists of 20 x 2 bit bi-directional shift register, 20 x 2 bit data latch and 20 x 2 bit driver. This IC can be used as common or segment driver.

Function

- Dot matrix LCD driver with 40 channel output.
 - Selects function to use common/segment drivers simultaneously.
 - Input / Output signal.
 - Output: 20 x 2 channel waveform for LCD driving
 - Input: Serial display data and control signal from the controller LSI.
- Bias voltage (V1-V6)

Features

- Display driving bias: static~1/5
- Power supply voltage: 2.7~5.5V
- Supply voltage for display: 3~10V ($V_{LCD}=V_{DD}-V_{EE}$)
- Interface: (Controller NT7066U, NT7070B, NT7076U)
- CMOS Process
- Bare chip available



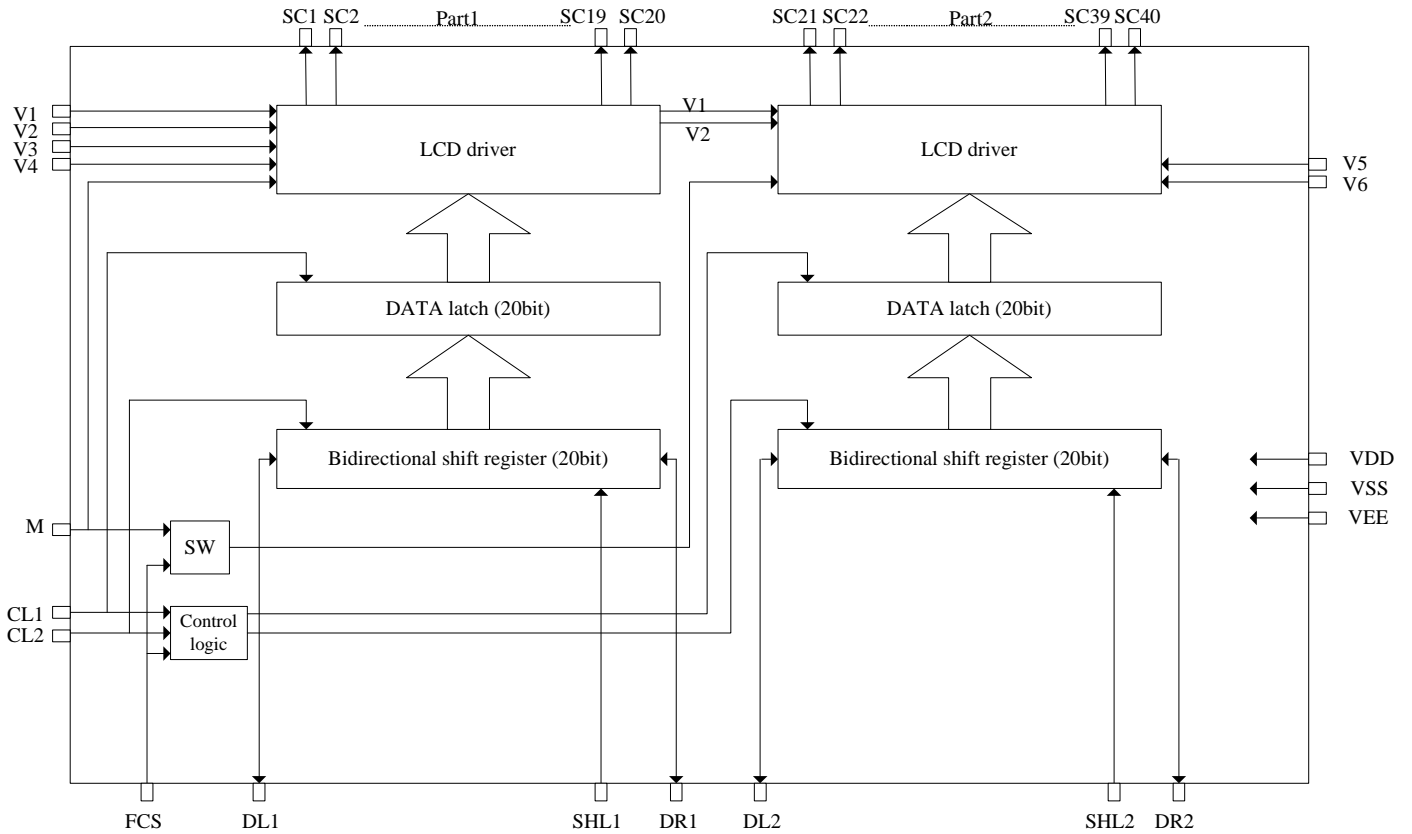
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NT7065B

Block Diagram



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**NT7065B****Pin Description**

| PIN | INPUT/ OUTPUT | NAME | DESCRIPTION | INTERFACE | | | | | | | | | | | | | | | | | | | | | |
|-----------------|------------------|--|---|---|------------------------|--|-----------------|------------|------------|-----|-----|-------------|-------------|---|-----------------|--|--|---|-----|-------------|-------------|---|-----------------|--|--|
| V _{DD} | Power | Operating Voltage | For logical circuit (2.7~5.5V) | Power Supply | | | | | | | | | | | | | | | | | | | | | |
| GND | | | 0V(GND) | | | | | | | | | | | | | | | | | | | | | | |
| V _{EE} | | Negative Supply Voltage | For LCD driver circuit | | | | | | | | | | | | | | | | | | | | | | |
| V1,V2 | Input | Bias Voltage | Bias voltage level for LCD driver (select level) | Power | | | | | | | | | | | | | | | | | | | | | |
| SC1~SC20 | Output | LCD Driver | LCD driver output | LCD | | | | | | | | | | | | | | | | | | | | | |
| V3,V4 | Input | | Bias Voltage | Bias voltage level for LCD drive (non-select level) | Power | | | | | | | | | | | | | | | | | | | | |
| SHL1 | Input | | Part1 | Data Interface | V _{DD} or GND | | | | | | | | | | | | | | | | | | | | |
| | | | | | | Selection of the shift direction of part1 shift register | | | | | | | | | | | | | | | | | | | |
| | | | <table border="1"> <tr> <td>SHL1</td> <td>DL1</td> <td>DR1</td> </tr> <tr> <td>V_{DD}</td> <td>out</td> <td>in</td> </tr> <tr> <td>GND</td> <td>in</td> <td>out</td> </tr> </table> | SHL1 | DL1 | DR1 | V _{DD} | out | in | GND | in | out | | | | | | | | | | | | | |
| SHL1 | DL1 | DR1 | | | | | | | | | | | | | | | | | | | | | | | |
| V _{DD} | out | in | | | | | | | | | | | | | | | | | | | | | | | |
| GND | in | out | | | | | | | | | | | | | | | | | | | | | | | |
| DL1,DR1 | Input/ Output | | Data input/output of part1 shift register | Controller or NT7065B | | | | | | | | | | | | | | | | | | | | | |
| SC21~SC40 | Output | LCD Driver | LCD driver output | LCD | | | | | | | | | | | | | | | | | | | | | |
| V5,V6 | Input | | Bias Voltage | Bias voltage level for LCD drive (non-select level) | Power | | | | | | | | | | | | | | | | | | | | |
| SHL2 | Input | | Part2 | Data Interface | V _{DD} or GND | | | | | | | | | | | | | | | | | | | | |
| | | | | | | Selection of the shift direction of part2 shift register | | | | | | | | | | | | | | | | | | | |
| | | | <table border="1"> <tr> <td>SHL2</td> <td>DL2</td> <td>DR2</td> </tr> <tr> <td>V_{DD}</td> <td>out</td> <td>in</td> </tr> <tr> <td>GND</td> <td>in</td> <td>out</td> </tr> </table> | SHL2 | DL2 | DR2 | V _{DD} | out | in | GND | in | out | | | | | | | | | | | | | |
| SHL2 | DL2 | DR2 | | | | | | | | | | | | | | | | | | | | | | | |
| V _{DD} | out | in | | | | | | | | | | | | | | | | | | | | | | | |
| GND | in | out | | | | | | | | | | | | | | | | | | | | | | | |
| DL2,DL2 | Input/ Output | | Data input/output of part2 shift register | Controller or NT7065B | | | | | | | | | | | | | | | | | | | | | |
| M | Input | Alternated signal for LCD drive output | | Controller | | | | | | | | | | | | | | | | | | | | | |
| CL1,CL2 | Input | Data shift/latch clock | | | | | | | | | | | | | | | | | | | | | | | |
| FCS | Input | Mode selection | <table border="1"> <tr> <td>PART</td> <td>FCS</td> <td>CL1</td> <td>CL2</td> <td>M polarity</td> </tr> <tr> <td rowspan="2">1</td> <td>GND</td> <td>Latch clock</td> <td>Shift clock</td> <td rowspan="2">M</td> </tr> <tr> <td>V_{DD}</td> <td></td> <td></td> </tr> <tr> <td rowspan="2">2</td> <td>GND</td> <td>Latch clock</td> <td>Shift clock</td> <td rowspan="2">M</td> </tr> <tr> <td>V_{DD}</td> <td></td> <td></td> </tr> </table> | | PART | FCS | CL1 | CL2 | M polarity | 1 | GND | Latch clock | Shift clock | M | V _{DD} | | | 2 | GND | Latch clock | Shift clock | M | V _{DD} | | |
| | | | PART | | FCS | CL1 | CL2 | M polarity | | | | | | | | | | | | | | | | | |
| 1 | GND | Latch clock | Shift clock | M | | | | | | | | | | | | | | | | | | | | | |
| | V _{DD} | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | GND | Latch clock | Shift clock | M | | | | | | | | | | | | | | | | | | | | | |
| | V _{DD} | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Shift/latch clock of display data and polarity of M signal are changed by FCS signal. By setting FCS to V _{DD} level, user can select the function that use part1 as segment driver and part2 as common driver simultaneously. | | | | | | | | | | | | | | | | | | | | | | |

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**NT7065B****Maximum Absolute Limit** (Ta=25°C)

| Characteristic | Symbol | Value | Unit |
|-------------------------|------------------|--|------|
| Power supply voltage | V _{DD} | -0.3~+7.0 | V |
| Driver supply voltage | V _{LCD} | V _{DD} -10.5~V _{DD} +0.3 | V |
| Input voltage 1 | V _{IN1} | -0.3~V _{DD} +0.3 | V |
| Input voltage 2 (V1~V6) | V _{IN2} | V _{DD} +0.3~V _{EE} -0.3 | V |
| Operating temperature | Topr | -30~+85 | °C |
| Storage temperature | Tstg | -55~+125 | °C |

- Voltage greater than above may damage to the circuit
- VEE connect a protection resistor (220Ω ±5%)

Electrical CharacteristicsDC characteristics (V_{DD}=2.7~5.5V, V_{DD}-V_{EE}=3~10V, Ta=+25°C)

| Characteristic | Symbol | Test condition | Min | Max | Unit | Applicable pin |
|-----------------------|------------------|--|----------------------|--------------------|------|---|
| Operating current* | I _{DD} | f _{CL2} =400KHz | - | 1 | mA | - |
| Supply current* | I _{EE} | f _{CL1} =1KHz | - | 10 | μA | |
| Input high voltage | V _{IH} | - | 0.7V _{DD} | V _{DD} | V | CL1,CL2,DL1, DL2,DR1,DR2, SHL1,SHL2,M, FCS |
| Input low voltage | V _{IL} | | 0 | 0.3V _{DD} | | |
| Input leakage current | I _{LKG} | V _{IN} =0~V _{DD} | -5 | 5 | μA | |
| Output high voltage | V _{OH} | I _{OH} =-0.4mA | V _{DD} -0.4 | - | V | |
| Output low voltage | V _{OL} | I _{OL} =+0.4mA | - | 0.4 | | |
| Voltage descending | V _{D1} | I _{ON} =0.1mA for one of SC1~SC40 | - | 1.1 | | |
| | V _{D2} | I _{ON} =0.05mA for one of SC1~SC40 | - | 1.5 | | V(V1~V6)-SC(SC1~SC40) |
| Leakage current | I _V | V _{IN} =V _{DD} ~V _{EE} (output SC1~SC40 : floating) | -10 | 10 | μA | V1~V6 |

*Input/Output current is excluded; When input at the intermediate level with CMOS, excessive current flows through the input circuit to the power supply, To avoid this, input level must be fixed at "H" or "L".



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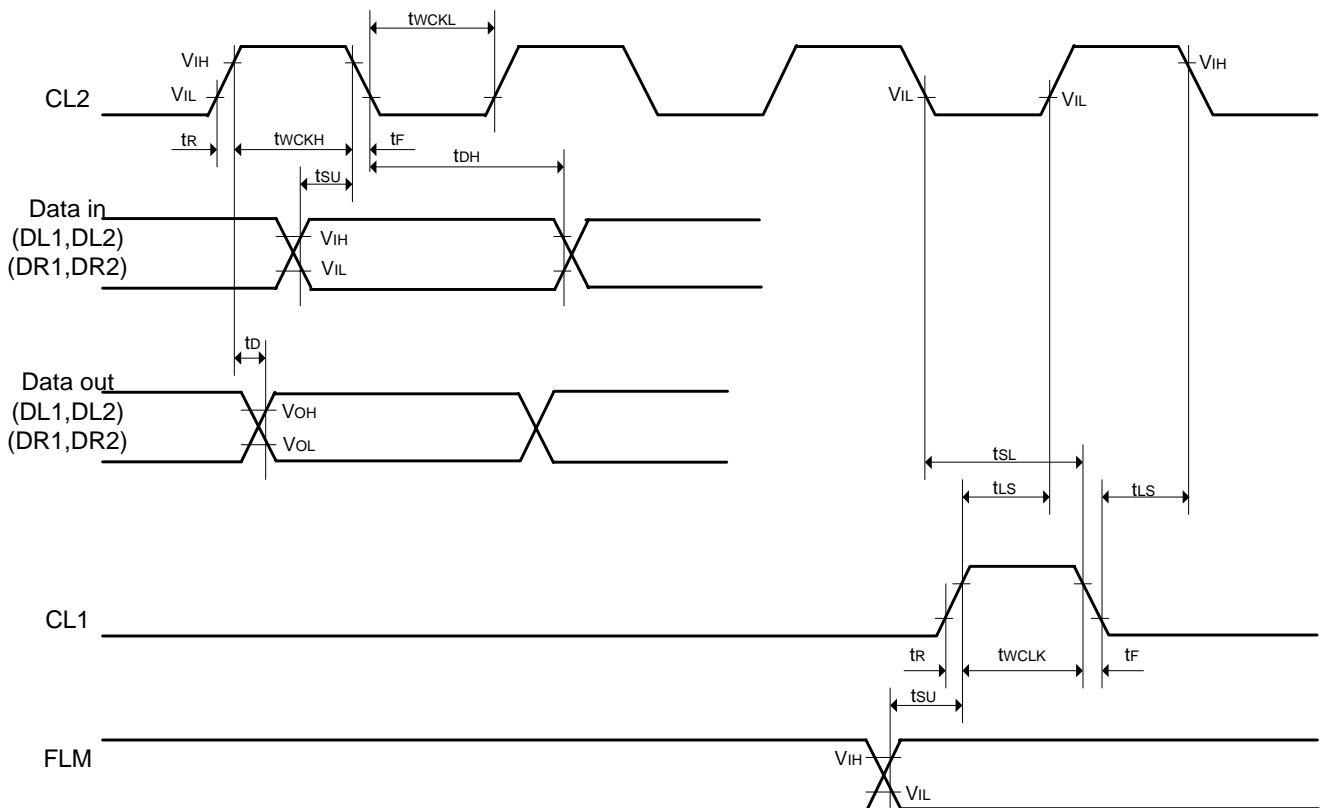


NT7065B

AC characteristics ($V_{DD}=2.7\sim 5.5V$, $V_{DD}-V_{EE}=3\sim 10V$, $T_a=+25^\circ C$)

| Characteristic | Symbol | Test condition | Min | Max | Unit | Applicable pin |
|------------------------|------------|-----------------|-----|-----|------|----------------------|
| Data shift frequency | f_{CL} | - | - | 400 | KHz | CL2 |
| Clock high level width | t_{WCKH} | - | 800 | - | nS | CL1, CL2 |
| Clock low level width | t_{WCKL} | - | 800 | - | | CL2 |
| Clock set-up time | t_{SL} | From CL2 to CL1 | 500 | - | | CL1, CL2 |
| | t_{LS} | From CL1 to CL2 | 500 | - | | |
| Clock rise/fall time | t_R/t_F | - | - | 200 | | |
| Data set-up time | t_{SU} | - | 300 | - | | DL1,DL2,DR1, DR2,FLM |
| Data hold time | t_{DH} | - | 300 | - | | DL1,DL2,DR1, DR2 |
| Data delay time | t_D | CL=15pF | - | 500 | | |

Timing Characteristics





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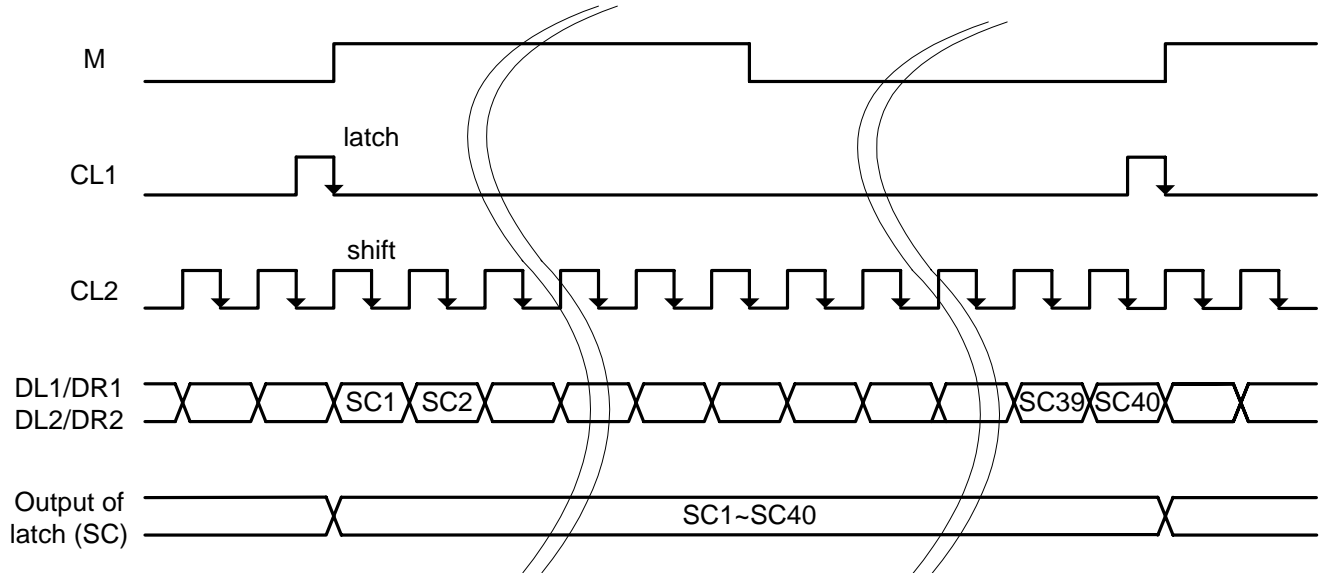


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Functional Description

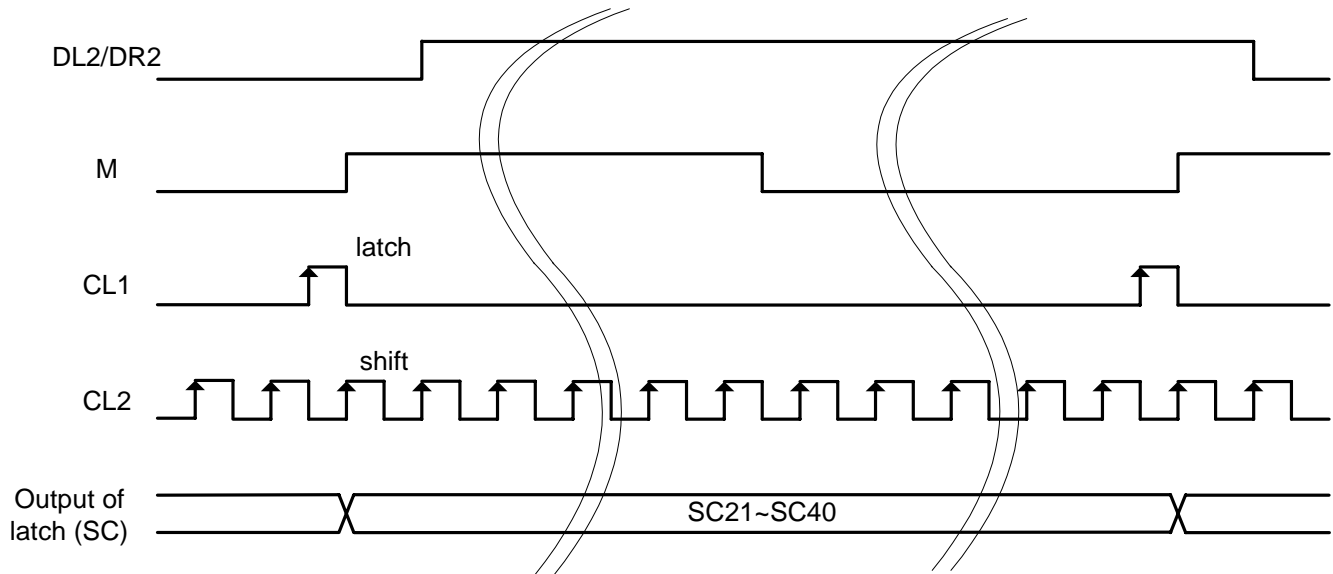
1) To drive segment type

When the FCS is connected to GND, NT7065B (SC1~SC40) is operated as segment driver.



2) To drive common type

When the FCS is connected to V_{DD} , only part2 (SC21~SC40) of NT7065S is operated as common driver.





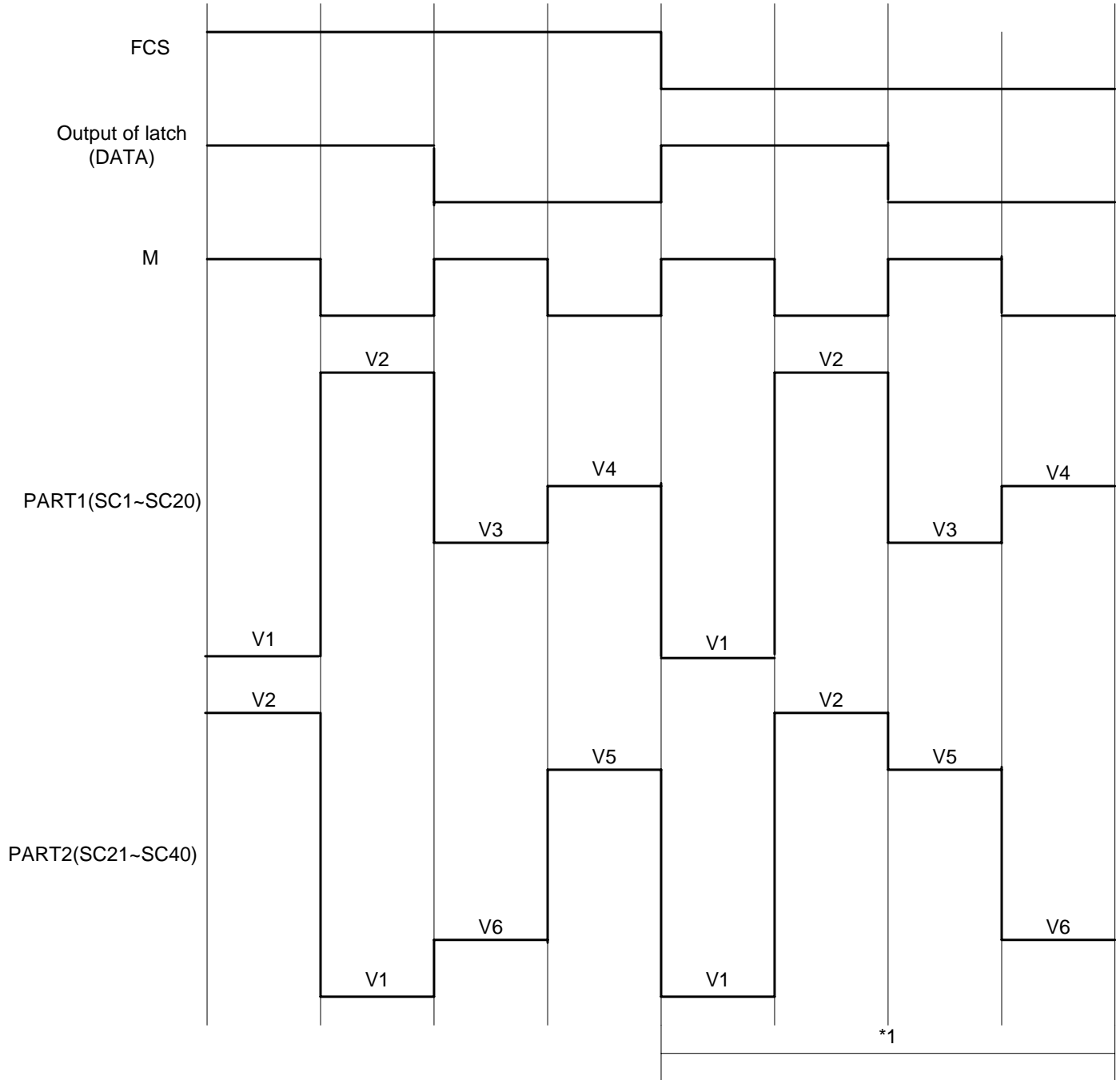
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LCD Output Waveforms



*1: To use for same function of part1 and part2, V3 and V5, V4 and V6 of power supply for LCD driver are short circuited respectively.



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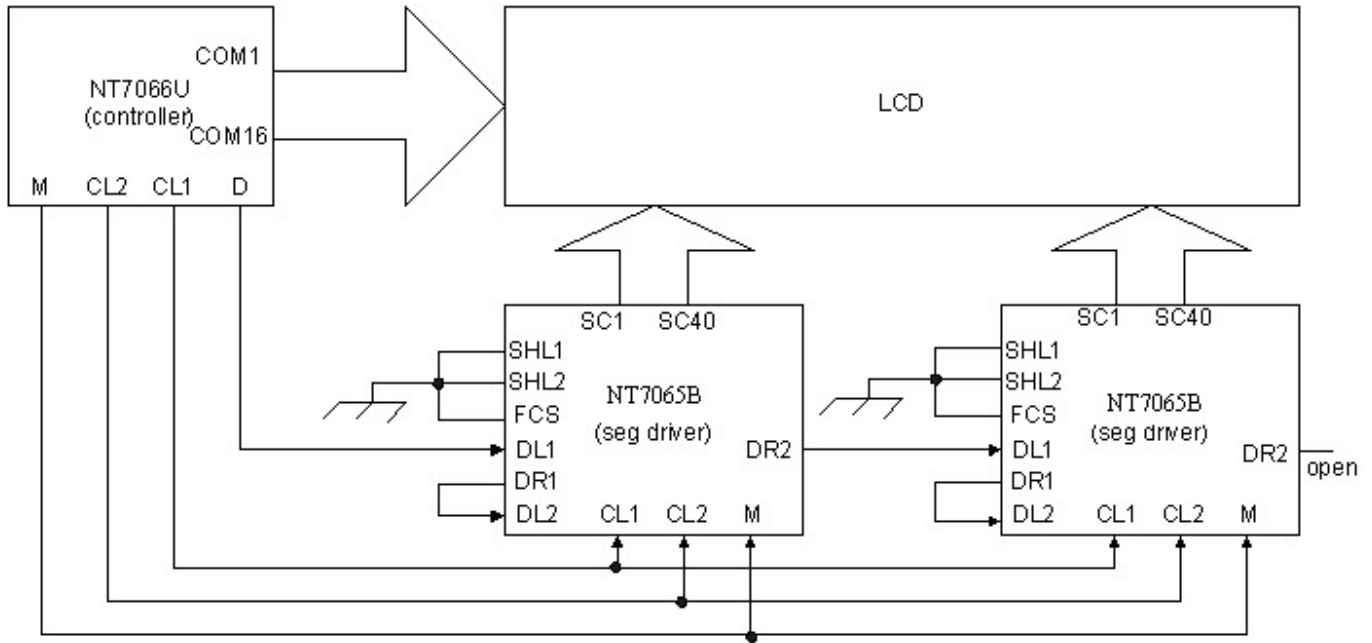
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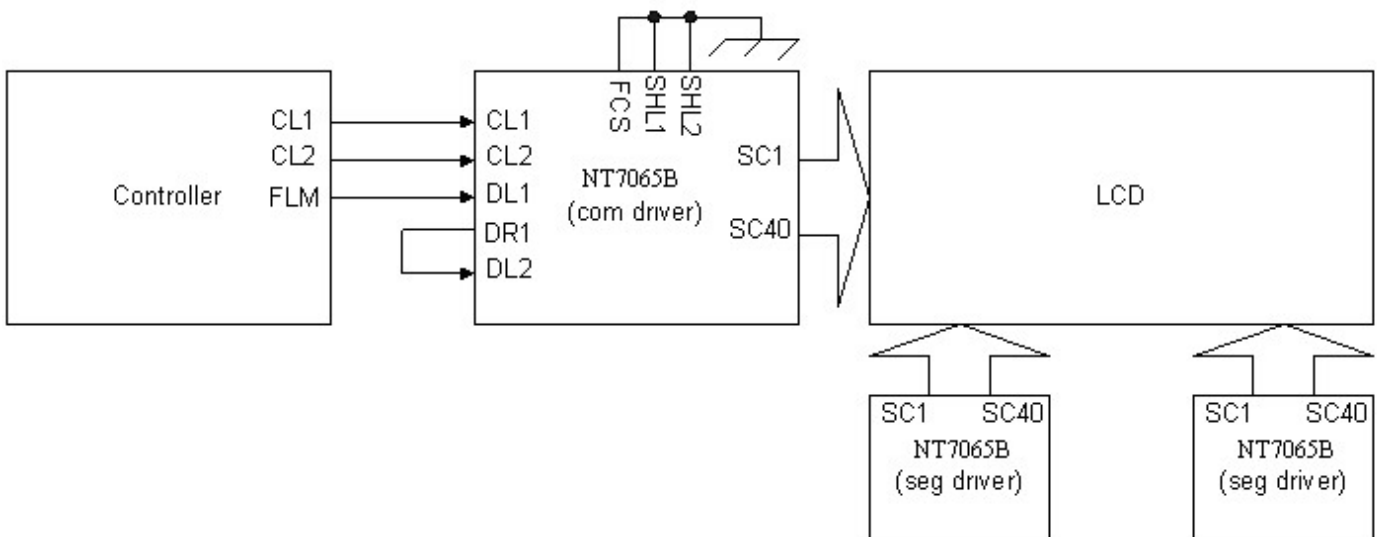
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Application circuit

1) Segment driver



2) Common driver





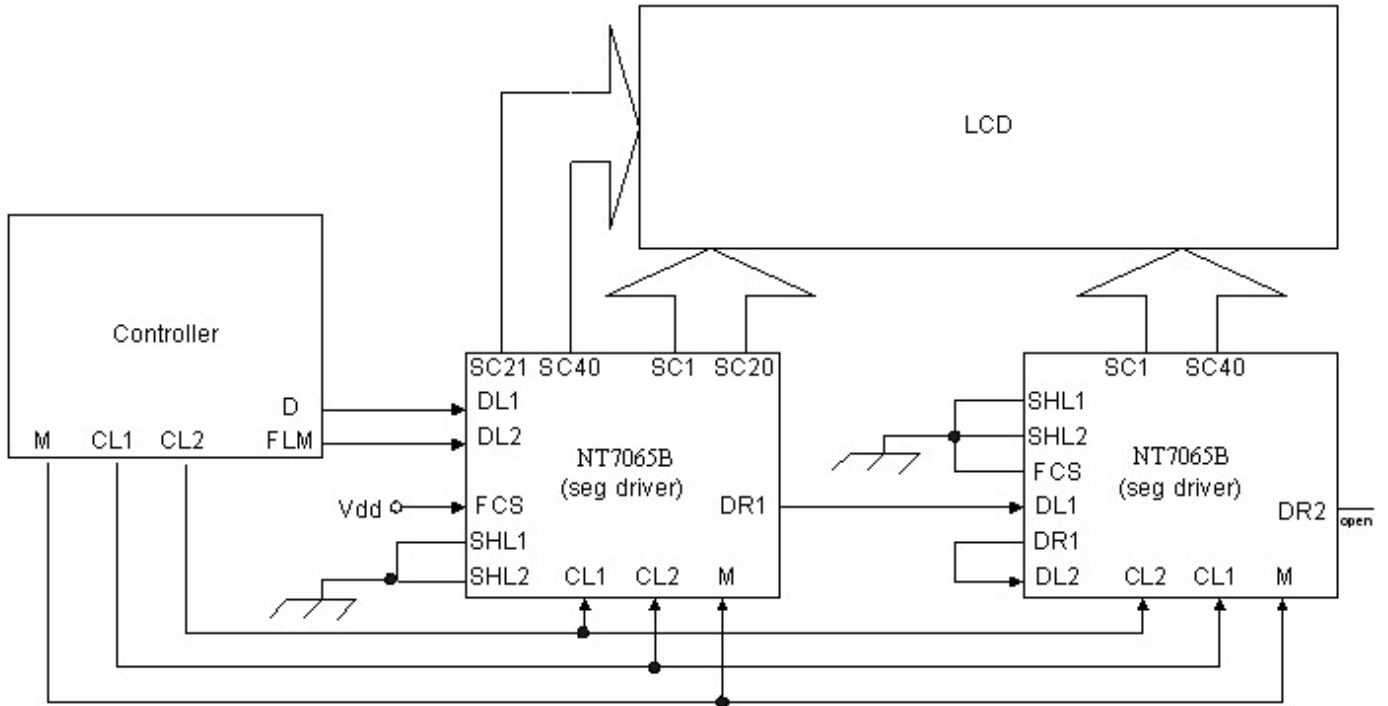
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3) Segment/Common driver





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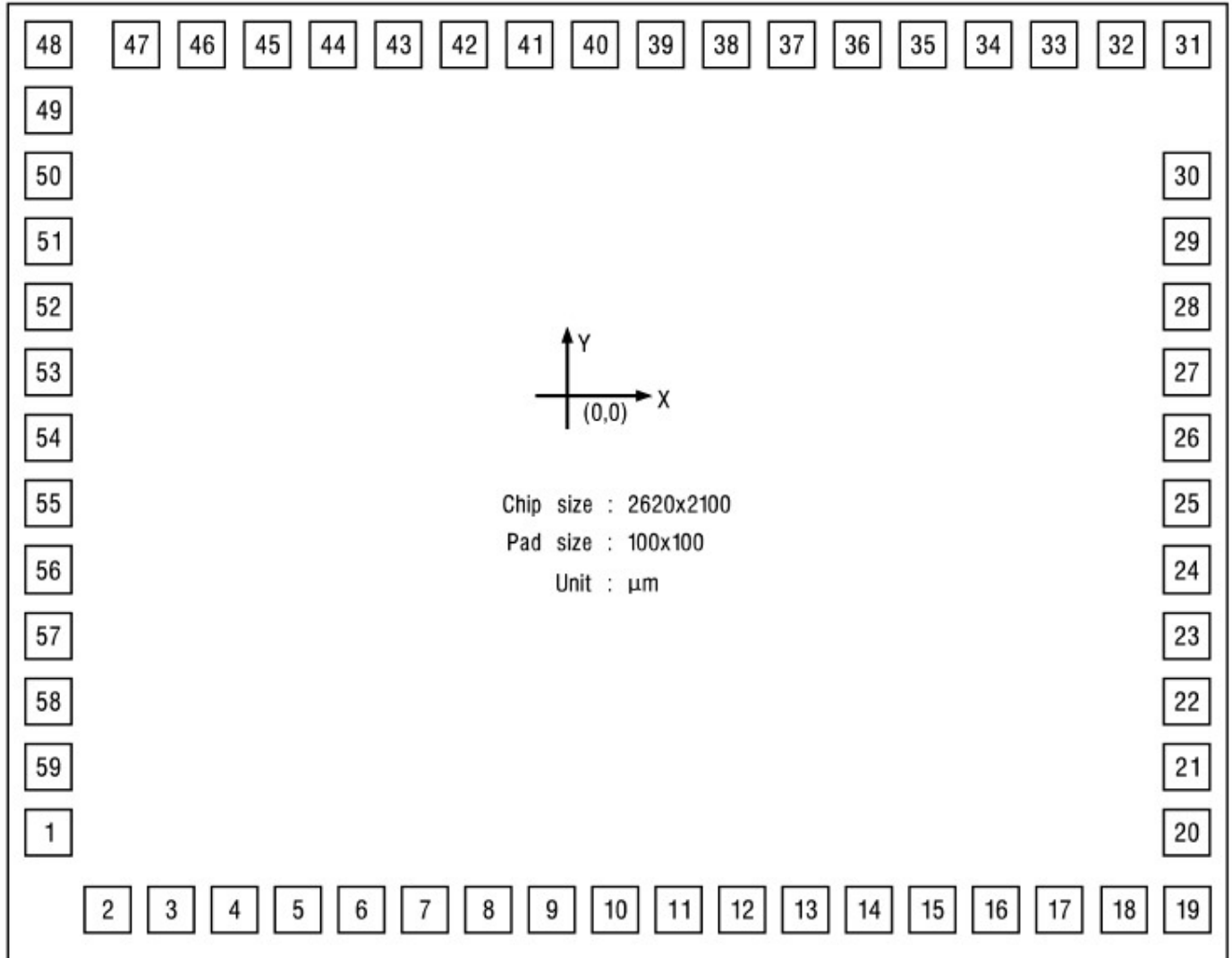
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Pad Diagram

Note: Please connects the substrate to V_{DD} or floating



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**NT7065B****Pad Location****Note:** (0,0) is center in the chip

| Pad | | Coordinates | | Pad | | Coordinates | |
|-----|------|-------------|---------|-----|------|-------------|---------|
| NO. | Name | X | Y | NO. | Name | X | Y |
| 1 | VEE | -1120.20 | -642.50 | 31 | SC28 | 1117.50 | 865.20 |
| 2 | CL1 | -1062.50 | -865.20 | 32 | SC27 | 992.50 | 865.20 |
| 3 | CL2 | -937.50 | -865.20 | 33 | SC26 | 867.50 | 865.20 |
| 4 | GND | -812.50 | -865.20 | 34 | SC25 | 742.50 | 865.20 |
| 5 | DL1 | -687.50 | -865.20 | 35 | SC24 | 617.50 | 865.20 |
| 6 | DR1 | -562.50 | -865.20 | 36 | SC23 | 492.50 | 865.20 |
| 7 | DL2 | -437.50 | -865.20 | 37 | SC22 | 367.50 | 865.20 |
| 8 | DR2 | -312.50 | -865.20 | 38 | SC21 | 242.50 | 865.20 |
| 9 | M | -187.50 | -865.20 | 39 | SC20 | 117.50 | 865.20 |
| 10 | SHL1 | -62.50 | -865.20 | 40 | SC19 | -7.50 | 865.20 |
| 11 | SHL2 | 62.50 | -865.20 | 41 | SC18 | -132.50 | 865.20 |
| 12 | FCS | 187.50 | -865.20 | 42 | SC17 | -257.50 | 865.20 |
| 13 | V1 | 332.50 | -865.20 | 43 | SC16 | -382.50 | 865.20 |
| 14 | V2 | 457.50 | -865.20 | 44 | SC15 | -507.50 | 865.20 |
| 15 | V3 | 582.50 | -865.20 | 45 | SC14 | -632.50 | 865.20 |
| 16 | V4 | 707.50 | -865.20 | 46 | SC13 | -757.50 | 865.20 |
| 17 | V5 | 832.50 | -865.20 | 47 | SC12 | -882.50 | 865.20 |
| 18 | V6 | 957.50 | -865.20 | 48 | SC9 | -1120.20 | 857.20 |
| 19 | SC40 | 1082.50 | -865.20 | 49 | SC10 | -1120.20 | 732.50 |
| 20 | SC39 | 1120.20 | -627.50 | 50 | SC11 | -1120.20 | 607.50 |
| 21 | SC38 | 1120.20 | -502.50 | 51 | SC8 | -1120.20 | 482.50 |
| 22 | SC37 | 1120.20 | -377.50 | 52 | SC7 | -1120.20 | 357.50 |
| 23 | SC36 | 1120.20 | -252.50 | 53 | VDD | -1120.20 | 232.50 |
| 24 | SC35 | 1120.20 | -127.50 | 54 | SC6 | -1120.20 | 107.50 |
| 25 | SC30 | 1120.20 | -2.50 | 55 | SC5 | -1120.20 | -17.50 |
| 26 | SC31 | 1120.20 | 122.50 | 56 | SC4 | -1120.20 | -142.50 |
| 27 | SC32 | 1120.20 | 247.50 | 57 | SC3 | -1120.20 | -267.50 |
| 28 | SC33 | 1120.20 | 372.50 | 58 | SC2 | -1120.20 | -392.50 |
| 29 | SC34 | 1120.20 | 479.50 | 59 | SC1 | -1120.20 | -517.50 |
| 30 | SC29 | 1120.20 | 622.50 | | | | |