

LC75838W

1/8 to 1/10-Duty General-Purpose LCD Driver



ON Semiconductor®

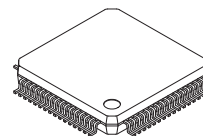
www.onsemi.com

Overview

The LC75838W is 1/8 to 1/10 duty general-purpose LCD display driver used for character and graphics display. This product operates under the control of a microcontroller and can directly drive an LCD with up to 380 segments. It can also control up to 3 general-purpose output ports.

Features

- 1/8duty-1/4bias, 1/9duty-1/4bias, and 1/10duty-1/4bias drive schemes can be controlled from serial data.
 - 1/8duty-1/4bias: up to 320 segments
 - 1/9duty-1/4bias: up to 351 segments
 - 1/10duty-1/4bias: up to 380 segments
- Serial data input supports CCB* format communication with the system controller.
- Serial data control of the power-saving mode based backup function and all the segments forced off function.
- Direct display of display data without the use of a decoder provides high generality.
- Built-in display contrast adjustment circuit.
- Up to 3 general-purpose output ports are included.
- Independent LCD driver block power supply V_{LCD} .
- The INH pin is provided. This pin turns off the display and forces the general-purpose output ports to the low level.
- RC oscillator circuit



SPQFP64 10x10 / SQFP64

* Computer Control Bus (CCB) is an ON Semiconductor's original bus format and the bus addresses are controlled by ON Semiconductor.

ORDERING INFORMATION

See detailed ordering and shipping information on page 36 of this data sheet.

LC75838W

Specifications

Absolute Maximum Ratings at Ta = 25°C, VSS = 0 V

| Parameter | Symbol | Conditions | Ratings | Unit |
|-----------------------------|----------|-------------------------------------|------------------|---------------|
| Maximum supply voltage | VDD max | VDD | -0.3 to +7.0 | V |
| | VLCD max | VLCD | -0.3 to +12.0 | |
| Input voltage | VIN1 | CE, CL, DI, $\overline{\text{INH}}$ | -0.3 to +7.0 | V |
| | VIN2 | OSC | -0.3 to VDD+0.3 | |
| | VIN3 | VLCD1, VLCD2, VLCD3, VLCD4 | -0.3 to VLCD+0.3 | |
| Output voltage | VOOUT1 | OSC, P1 to P3 | -0.3 to VDD+0.3 | V |
| | VOOUT2 | VLCD0, S1 to S40, COM1 to COM10 | -0.3 to VLCD+0.3 | |
| Output current | IOOUT1 | S1 to S40 | 300 | μA |
| | IOOUT2 | COM1 to COM10 | 3 | mA |
| | IOOUT3 | P1 to P3 | 5 | |
| Allowable power dissipation | Pd max | Ta = 85°C | 200 | mW |
| Operating temperature | Topr | | -40 to +85 | °C |
| Storage temperature | Tstg | | -55 to +125 | °C |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

Allowable Operating Ranges at Ta = -40 to +85°C, VSS = 0 V

| Parameter | Symbol | Conditions | Ratings | | | unit |
|--|------------|--|---------------|--|--------|---------------|
| | | | min | typ | max | |
| Supply voltage | VDD | VDD | 2.7 | | 6.0 | V |
| | VLCD | VLCD, When the display contrast adjustment circuit is used | 7.0 | | 11.0 | |
| | VLCD | VLCD, When the display contrast adjustment circuit is not used | 4.5 | | 11.0 | |
| Output voltage | VLCD0 | VLCD0 | VLCD4 +4.5 | | VLCD | V |
| Input voltage | VLCD1 | VLCD1 | | $\frac{3}{4}(\text{VLCD0} - \text{VLCD4})$ | VLCD0 | V |
| | VLCD2 | VLCD2 | | $\frac{2}{4}(\text{VLCD0} - \text{VLCD4})$ | VLCD0 | |
| | VLCD3 | VLCD3 | | $\frac{1}{4}(\text{VLCD0} - \text{VLCD4})$ | VLCD0 | |
| | VLCD4 | VLCD4 | 0 | | 1.5 | |
| Input high level voltage | VIH | CE, CL, DI, $\overline{\text{INH}}$ | 0.8VDD | | 6.0 | V |
| Input low level voltage | VIL | CE, CL, DI, $\overline{\text{INH}}$ | 0 | | 0.2VDD | V |
| Recommended external resistance | ROSC | OSC | | 43 | | k Ω |
| Recommended external capacitance | COSC | OSC | | 680 | | pF |
| Guaranteed oscillation range | fOSC | OSC | 25 | 50 | 100 | kHz |
| Data setup time | tds | CL, DI [Figure 2] | 160 | | | ns |
| Data hold time | tdh | CL, DI [Figure 2] | 160 | | | ns |
| CE wait time | tcp | CE, CL [Figure 2] | 160 | | | ns |
| CE setup time | tcs | CE, CL [Figure 2] | 160 | | | ns |
| CE hold time | tch | CE, CL [Figure 2] | 160 | | | ns |
| High level clock pulse width | t ϕ H | CL [Figure 2] | 160 | | | ns |
| Low level clock pulse width | t ϕ L | CL [Figure 2] | 160 | | | ns |
| $\overline{\text{INH}}$ switching time | tc | $\overline{\text{INH}}$, CE [Figure 3], [Figure 4], [Figure 5] | 10 | | | μs |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

LC75838W

Electrical Characteristics for the Allowable Operating Ranges

| Parameter | Symbol | Pins | Conditions | Ratings | | | unit |
|--------------------------------|------------|------------------------------|--|--|-------------|--|---------------|
| | | | | min | typ | max | |
| Hysteresis | V_H | CE, CL, DI, \overline{INH} | | | $0.1V_{DD}$ | | V |
| Input high level current | I_{IH} | CE, CL, DI, \overline{INH} | $V_I = 6.0\text{ V}$ | | | 5.0 | μA |
| Input low level current | I_{IL} | CE, CL, DI, \overline{INH} | $V_I = 0\text{ V}$ | -5.0 | | | μA |
| Output high level voltage | V_{OH1} | S1 to S40 | $I_O = -20\ \mu\text{A}$ | $V_{LCD0-0.6}$ | | | V |
| | V_{OH2} | COM1 to COM10 | $I_O = -100\ \mu\text{A}$ | $V_{LCD0-0.6}$ | | | |
| | V_{OH3} | P1 to P3 | $I_O = -1\text{ mA}$ | $V_{DD}-1.0$ | | | |
| Output low level voltage | V_{OL1} | S1 to S40 | $I_O = 20\ \mu\text{A}$ | | | $V_{LCD4}+0.6$ | V |
| | V_{OL2} | COM1 to COM10 | $I_O = 100\ \mu\text{A}$ | | | $V_{LCD4}+0.6$ | |
| | V_{OL3} | P1 to P3 | $I_O = 1\text{ mA}$ | | | 1.0 | |
| Output middle level voltage *1 | V_{MID1} | S1 to S40 | $I_O = \pm 20\ \mu\text{A}$ | $\frac{2}{4}(V_{LCD0} - V_{LCD4}) - 0.6$ | | $\frac{2}{4}(V_{LCD0} - V_{LCD4}) + 0.6$ | V |
| | V_{MID2} | COM1 to COM10 | $I_O = \pm 100\ \mu\text{A}$ | $\frac{3}{4}(V_{LCD0} - V_{LCD4}) - 0.6$ | | $\frac{3}{4}(V_{LCD0} - V_{LCD4}) + 0.6$ | |
| | V_{MID3} | COM1 to COM10 | $I_O = \pm 100\ \mu\text{A}$ | $\frac{1}{4}(V_{LCD0} - V_{LCD4}) - 0.6$ | | $\frac{1}{4}(V_{LCD0} - V_{LCD4}) + 0.6$ | |
| Oscillator frequency | fosc | OSC | Rosc = 43 k Ω , Cosc = 680 pF | 40 | 50 | 60 | kHz |
| Current drain | I_{DD1} | V_{DD} | Power saving mode | | | 5 | μA |
| | I_{DD2} | V_{DD} | $V_{DD} = 6.0\text{ V}$, outputs open, fosc = 50 kHz | | 200 | 400 | |
| | I_{LCD1} | V_{LCD} | Power saving mode | | | 5 | |
| | I_{LCD2} | V_{LCD} | $V_{LCD} = 11.0\text{ V}$, outputs open, fosc = 50 kHz When the display contrast adjustment circuit is used. | | 500 | 1000 | |
| | I_{LCD3} | V_{LCD} | $V_{LCD} = 11.0\text{ V}$, outputs open, fosc = 50 kHz When the display contrast adjustment circuit is not used. | | 250 | 500 | |

Note: *1 Excluding the bias voltage generation divider resistor built into V_{LCD0} , V_{LCD1} , V_{LCD2} , V_{LCD3} , and V_{LCD4} . (See Figure 1.)

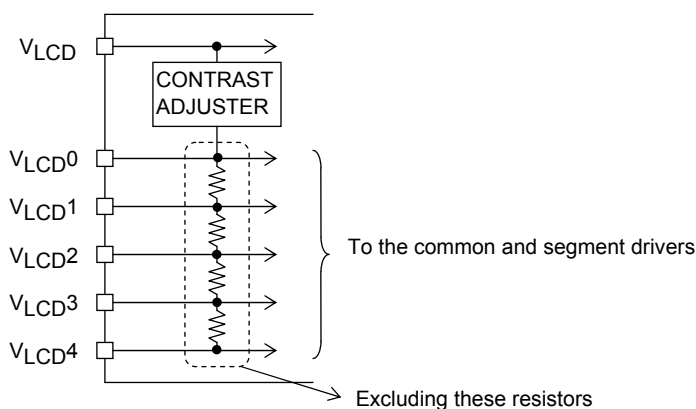
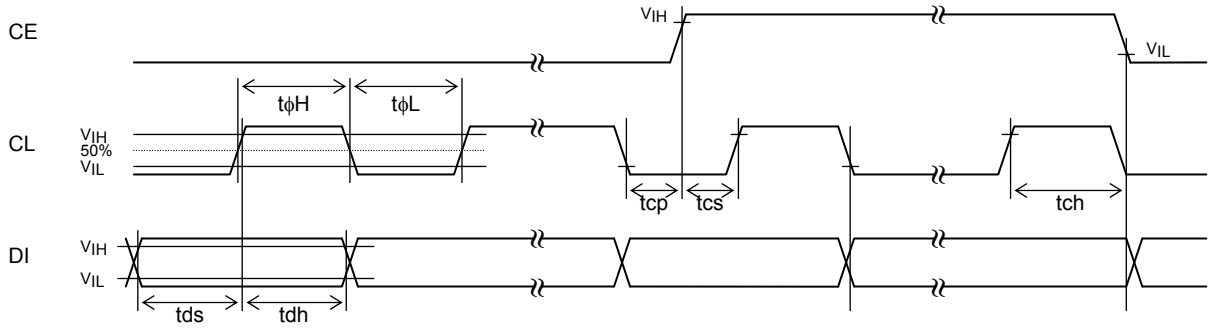


Figure 1

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

LC75838W

1. When CL is stopped at the low level



2. When CL is stopped at the high level

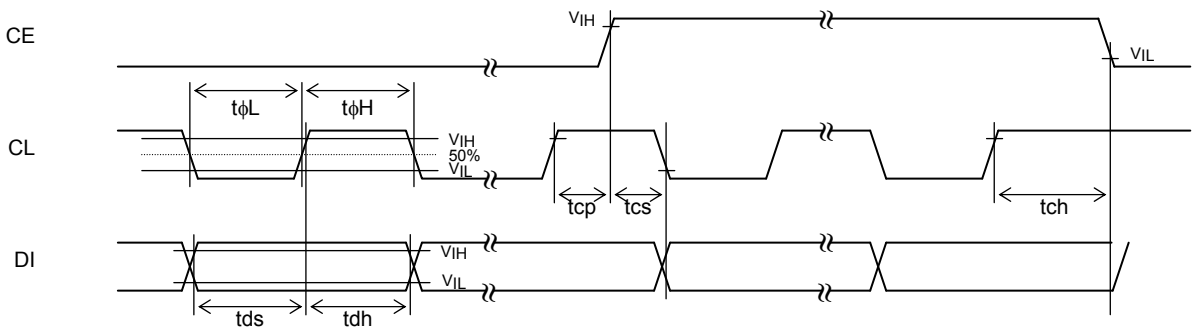


Figure 2

LC75838W

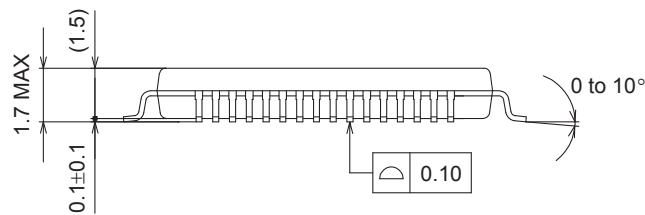
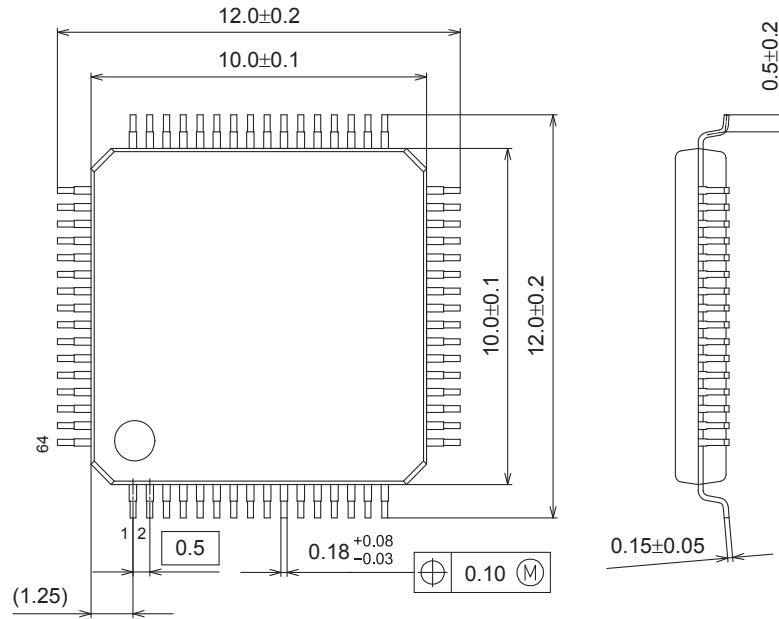
Package Dimensions

unit : mm

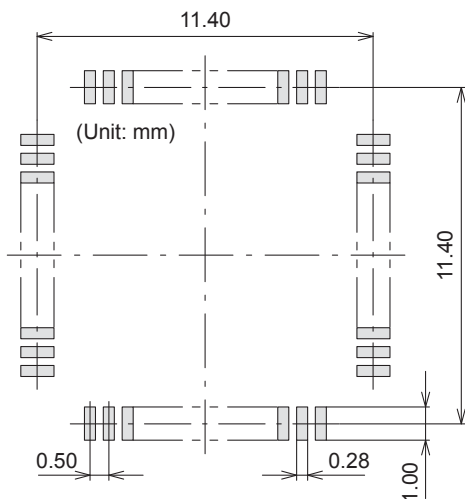
SPQFP64 10x10 / SQFP64

CASE 131AK

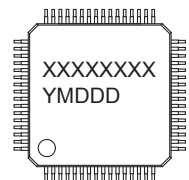
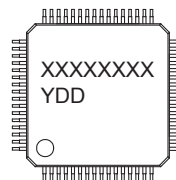
ISSUE A



SOLDERING FOOTPRINT*



GENERIC MARKING DIAGRAM*



XXXXX = Specific Device Code
Y = Year
DD = Additional Traceability Data

XXXXX = Specific Device Code
Y = Year
M = Month
DDD = Additional Traceability Data

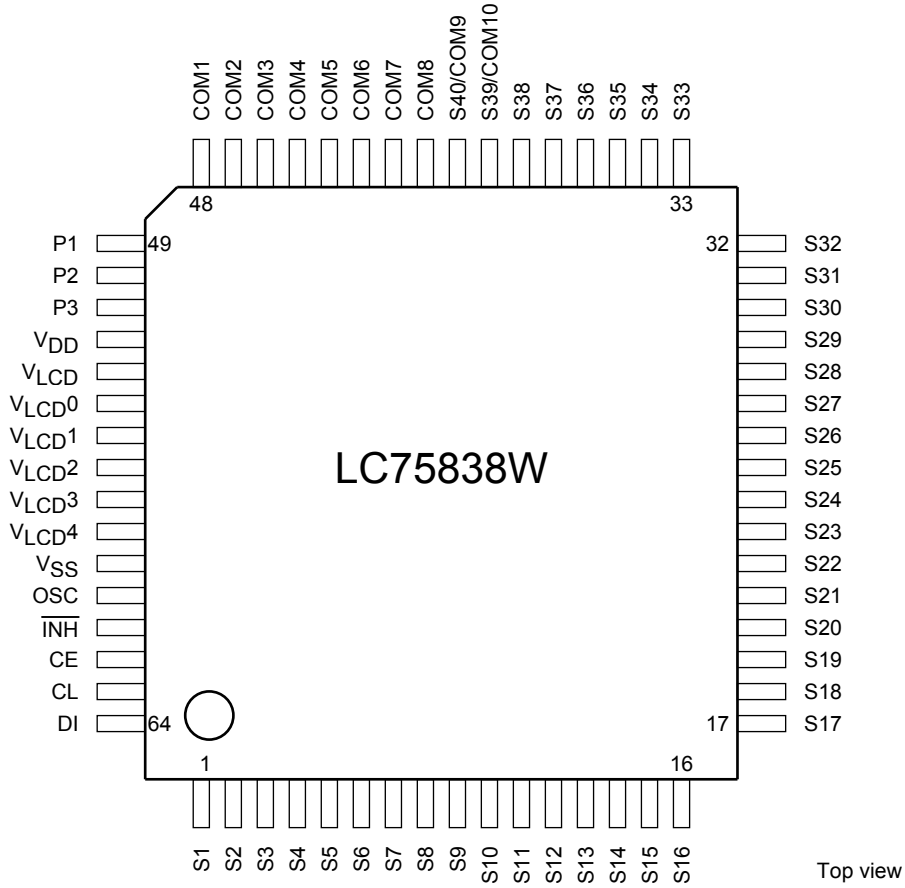
*This information is generic.
Pb-Free indicator, "G" or microdot "▪",
may or may not be present.

NOTE: The measurements are not to guarantee but for reference only.

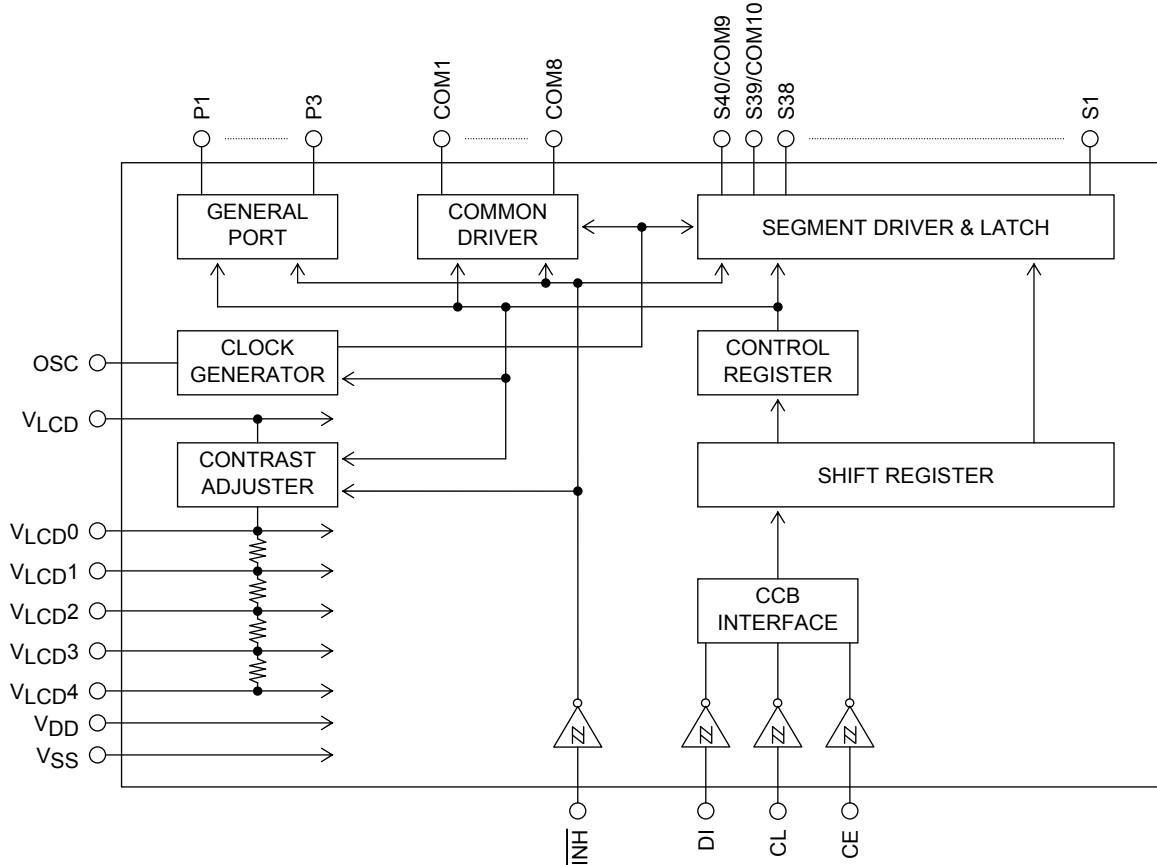
*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

LC75838W

Pin Assignment




Block Diagram



LC75838W

Pin Functions

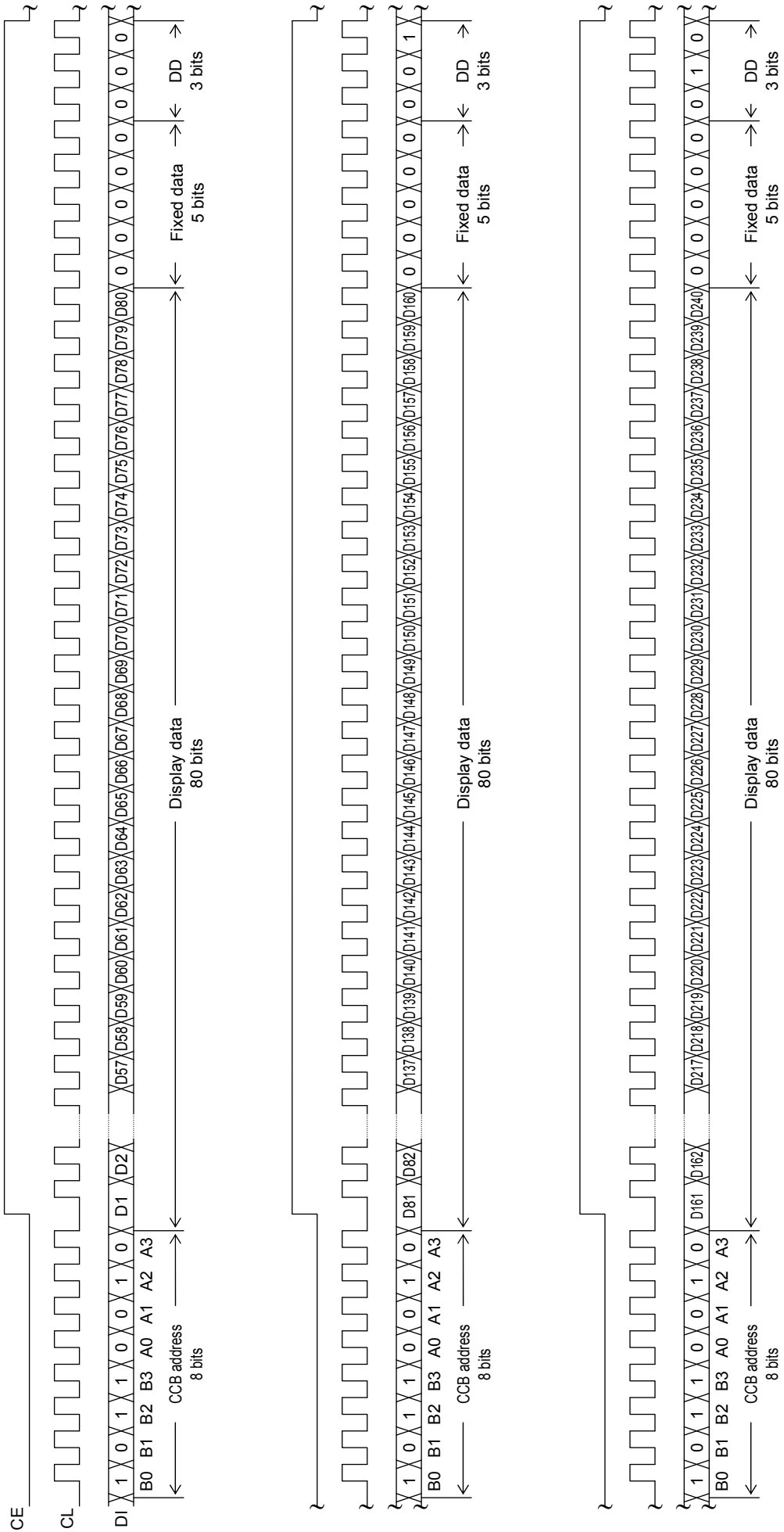
| Symbol | Pin No. | Function | Active | I/O | Handling when unused |
|------------------------------------|---------------------|---|---|-----|----------------------|
| S1 to S38 S39/COM10 S40/COM9 | 1 to 38 39 40 | Segment driver outputs. The S39/COM10 and S40/COM9 pins can be used as common driver outputs under the control data DT1, DT2. | - | O | OPEN |
| COM1 to COM8 | 48 to 41 | Common driver outputs. | - | O | OPEN |
| P1 to P3 | 49 to 51 | General-purpose output ports. | - | O | OPEN |
| OSC | 60 | Oscillator connection. An oscillator circuit is formed by connecting an external resistor and capacitor at this pin. | - | I/O | V _{DD} |
| CE | 62 | Serial data transfer inputs. These pins are connected to the microcontroller. CE: Chip enable CL: Synchronization clock DI: Transfer data | H | I | GND |
| CL | 63 | |  | I | |
| DI | 64 | | - | I | |
| $\overline{\text{INH}}$ | 61 | Input that turns the display off and forces the general-purpose output ports low. • When $\overline{\text{INH}}$ is low (V _{SS}) • Display off S1 to S38 = "L" (V _{LCD4}). S39/COM10, S40/COM9 = "L" (V _{LCD4}) COM1 to COM8 = "L" (V _{LCD4}). • General-purpose output ports P1 to P3 = low (V _{SS}) • When $\overline{\text{INH}}$ is high (V _{DD}) • Display on • The states of the general-purpose output ports can be set by the PC1 to PC3 control data. However, serial data can be transferred when the $\overline{\text{INH}}$ pin is low. | L | I | GND |
| V _{LCD0} | 54 | LCD drive 4/4 bias voltage (high level) supply pin. The level on this pin can be changed by the display contrast adjustment circuit. However, (V _{LCD0} - V _{LCD4}) must be greater than or equal to 4.5 V. Also, external power must not be applied to this pin since the pin circuit includes the display contrast adjustment circuit. | - | O | OPEN |
| V _{LCD1} | 55 | LCD drive 3/4 bias voltage (middle level) supply pin. This pin can be used to supply the 3/4 (V _{LCD0} - V _{LCD4}) voltage level externally. | - | I | OPEN |
| V _{LCD2} | 56 | LCD drive 2/4 bias voltage (middle level) supply pin. This pin can be used to supply the 2/4 (V _{LCD0} - V _{LCD4}) voltage level externally. | - | I | OPEN |
| V _{LCD3} | 57 | LCD drive 1/4 bias voltage (middle level) supply pin. This pin can be used to supply the 1/4 (V _{LCD0} - V _{LCD4}) voltage level externally. | - | I | OPEN |
| V _{LCD4} | 58 | LCD drive 0/4 bias voltage (low level) supply pin. Fine adjustment of the display contrast can be implemented by connecting an external variable resistor to this pin. However, (V _{LCD0} - V _{LCD4}) must be greater than or equal to 4.5 V, and V _{LCD4} must be in the range 0V to 1.5 V, inclusive. | - | I | GND |
| V _{DD} | 52 | Logic block power supply connection. Provide a voltage of between 2.7 and 6.0 V. | - | - | - |
| V _{LCD} | 53 | LCD driver block power supply connection. Provide a voltage of between 7.0 and 11.0 V when the display contrast adjustment circuit is used and provide a voltage of between 4.5 and 11.0 V when the circuit is not used. | - | - | - |
| V _{SS} | 59 | Power supply connection. Connect to ground. | - | - | - |

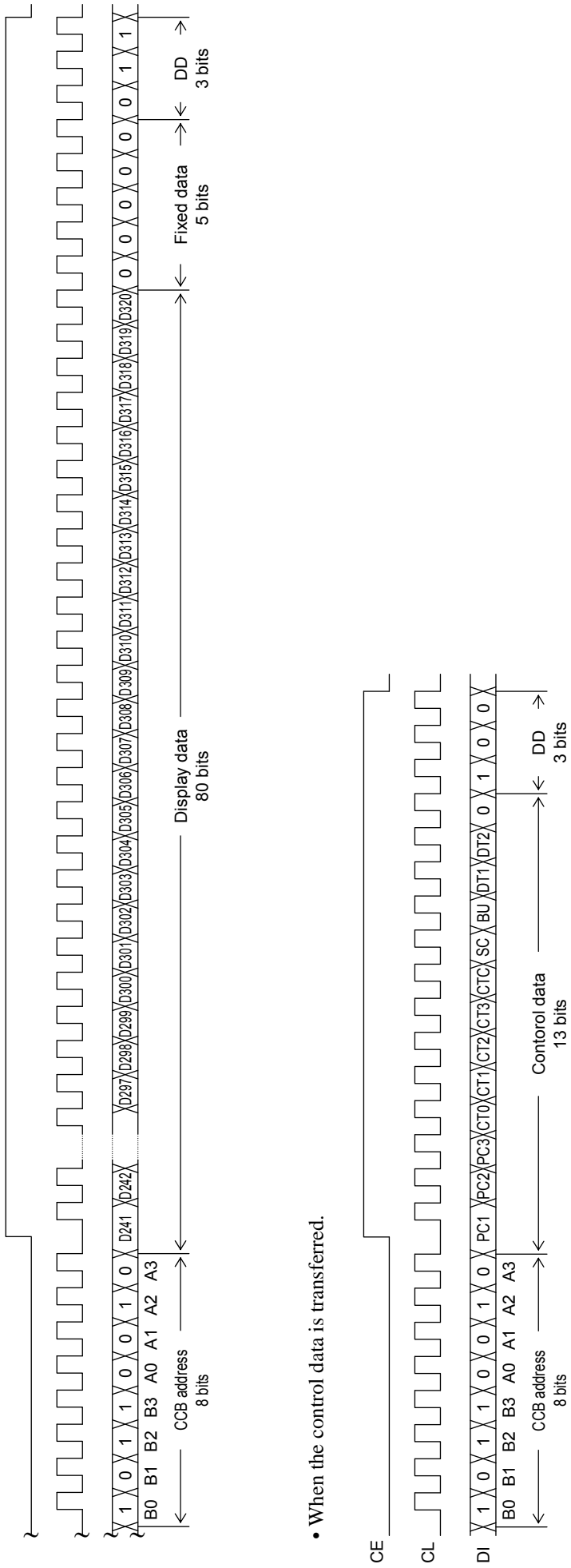
Serial Data Transfer Format

1. 1/8 duty

(1) When CL is stopped at the low level

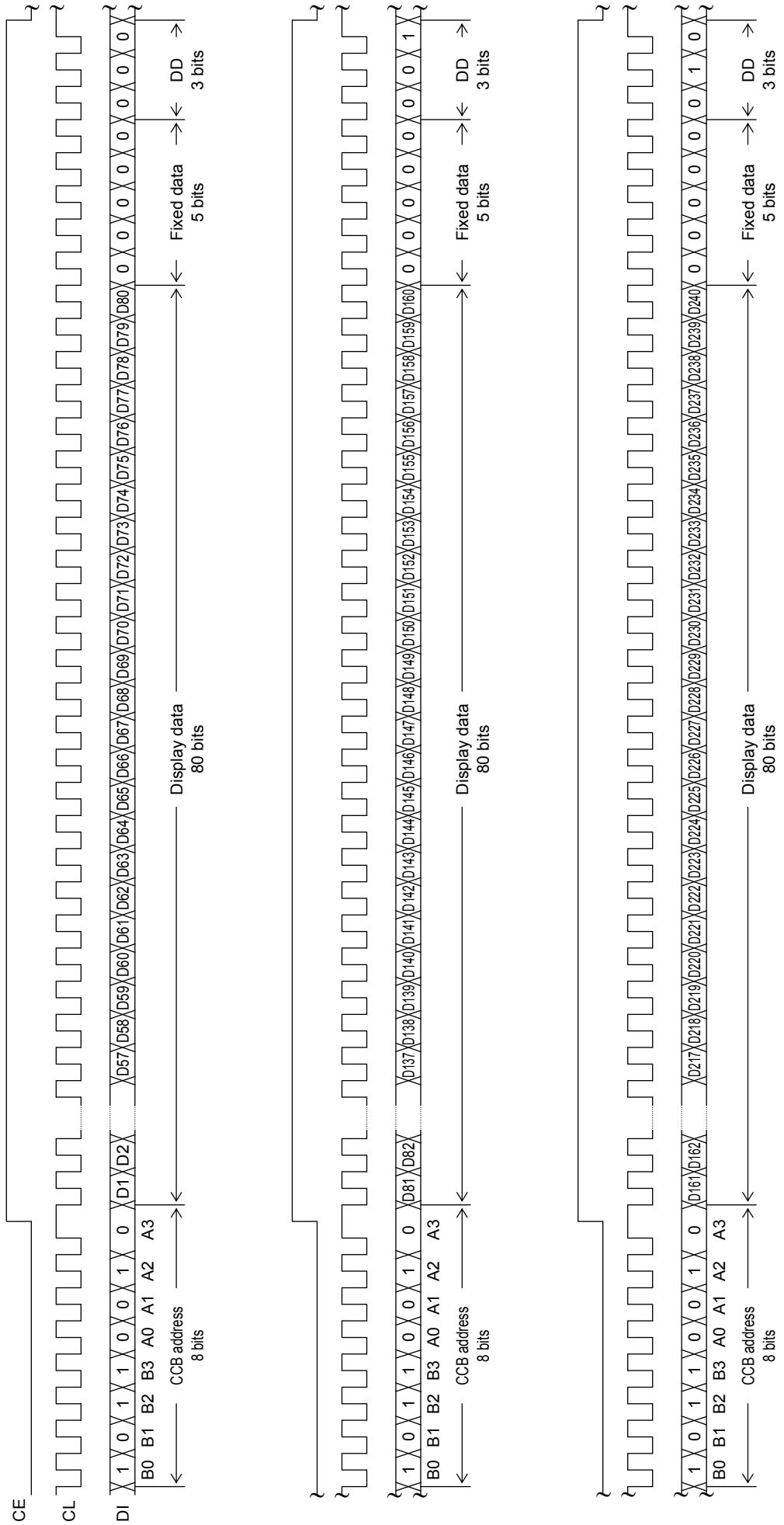
- When the display data is transferred.

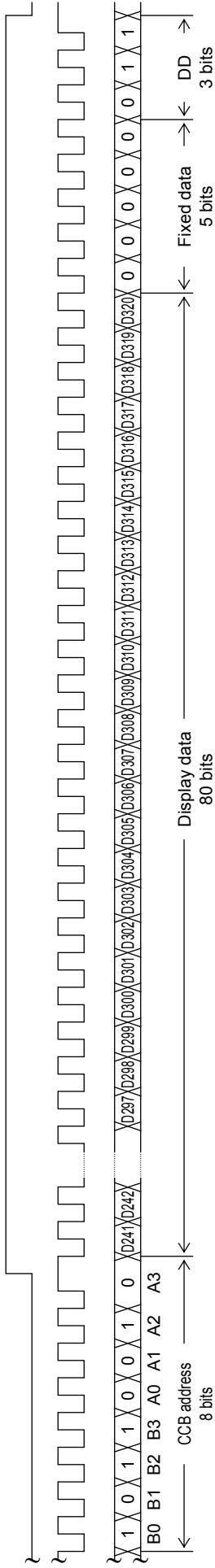




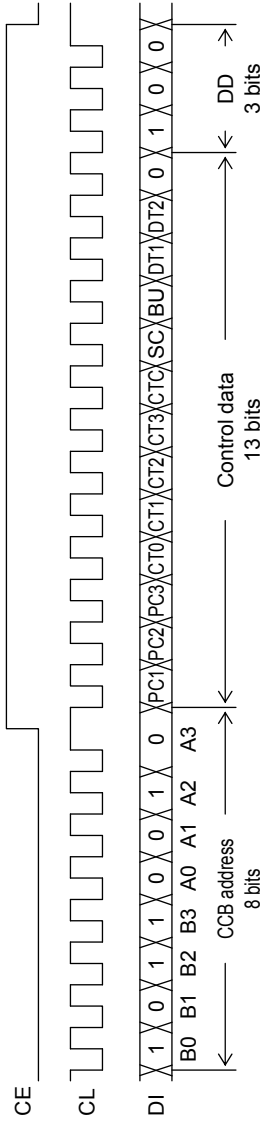
Note: B0 to B3, A0 to A3 CCB address
 DD..... Direction data

- (2) When CL is stopped at the high level
- When the display data is transferred.





• When the control data is transferred.



Note: B0 to B3, A0 to A3 CCB address

DD Direction data

• CCB address: 4DH

• D1 to D320: Display data

• PC1 to PC3: General-purpose output port state setting data

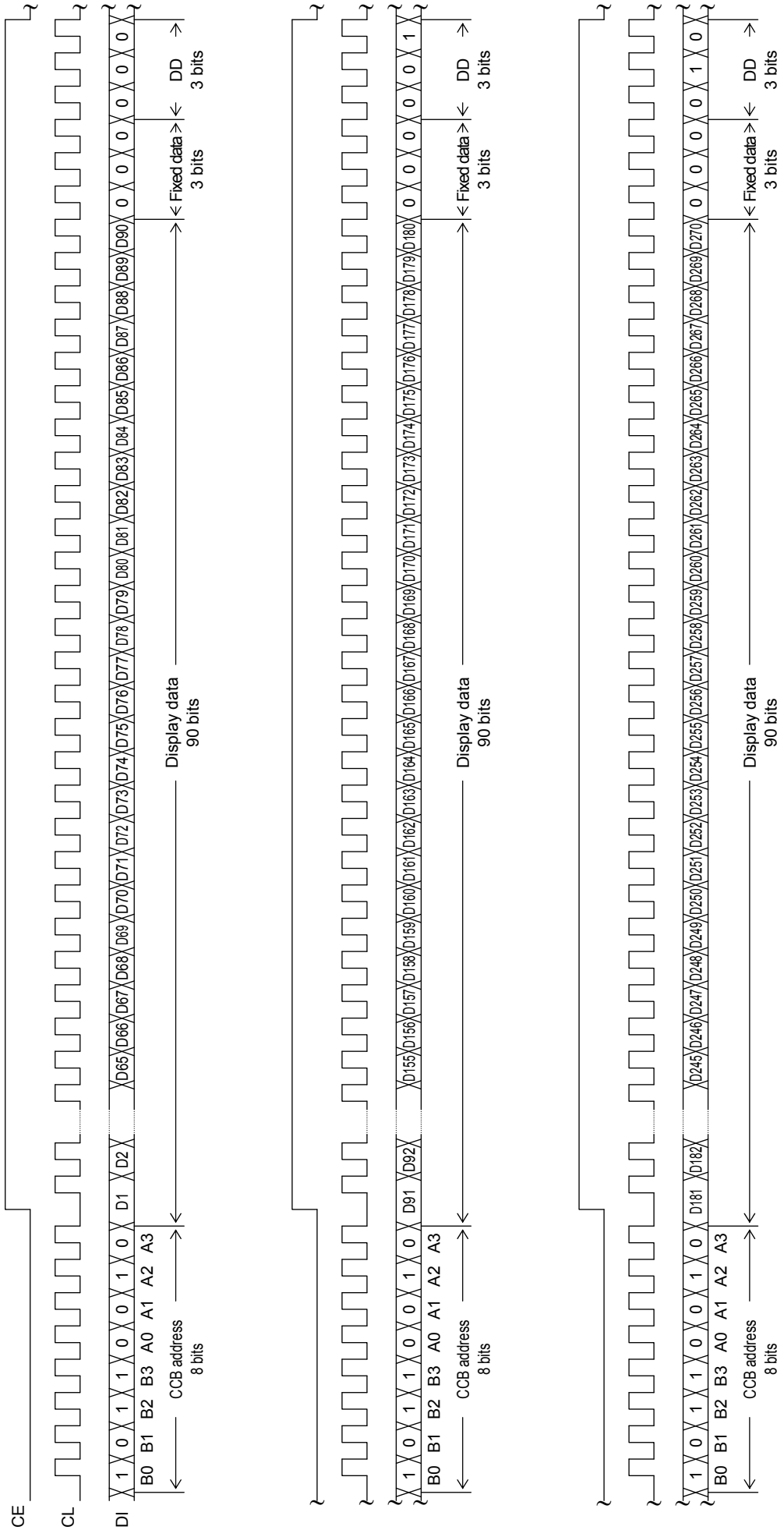
• CT0 to CT3, CTC: Display contrast setting data

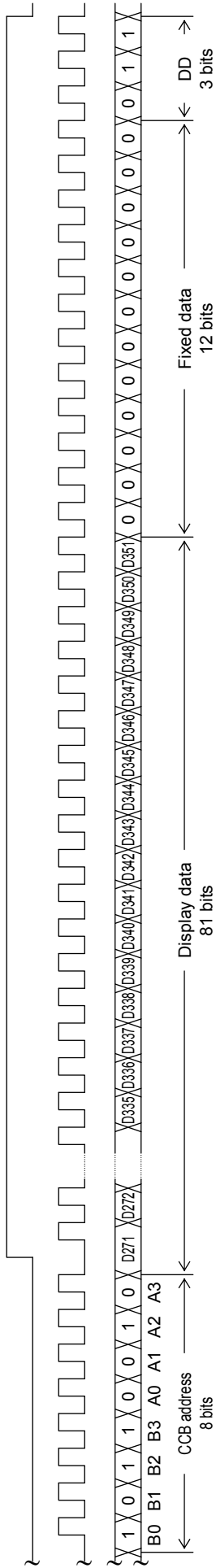
• SC: Segment on/off control data

• BU: Normal mode/power saving mode control data

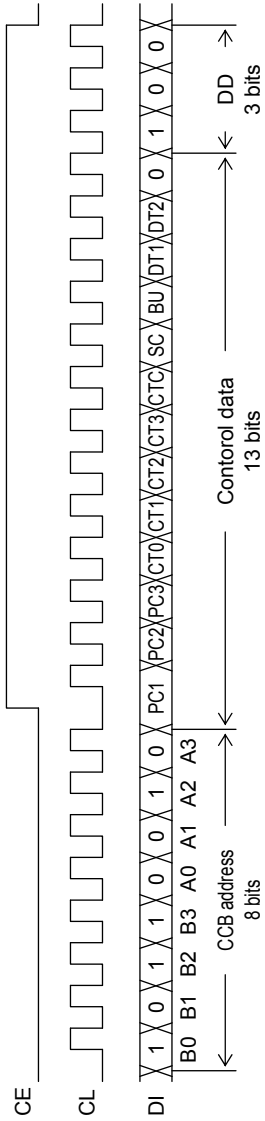
• DT1, DT2: Display technique setting data

2. 1/9 duty
 (1) When CL is stopped at the low level
 • When the display data is transferred.



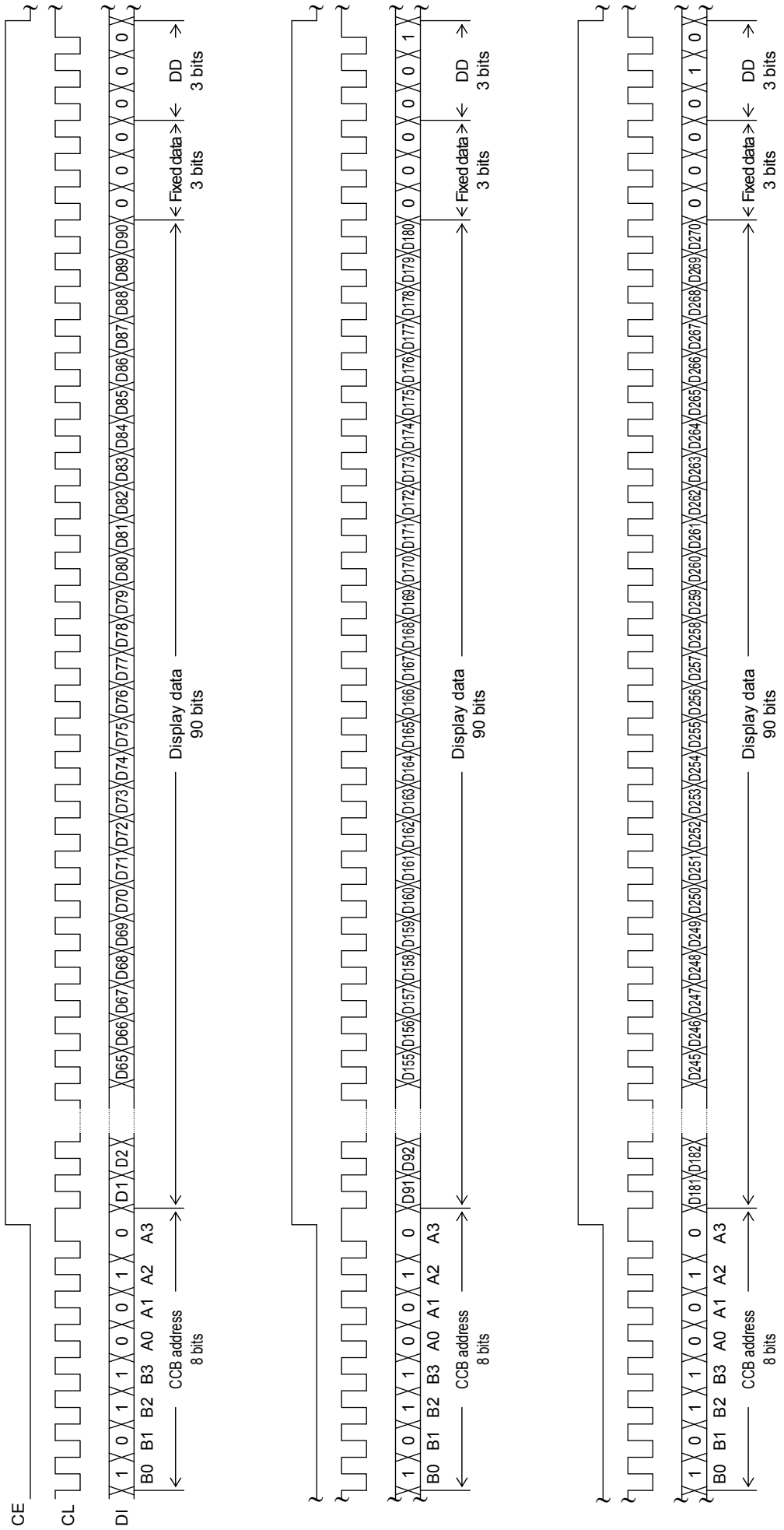


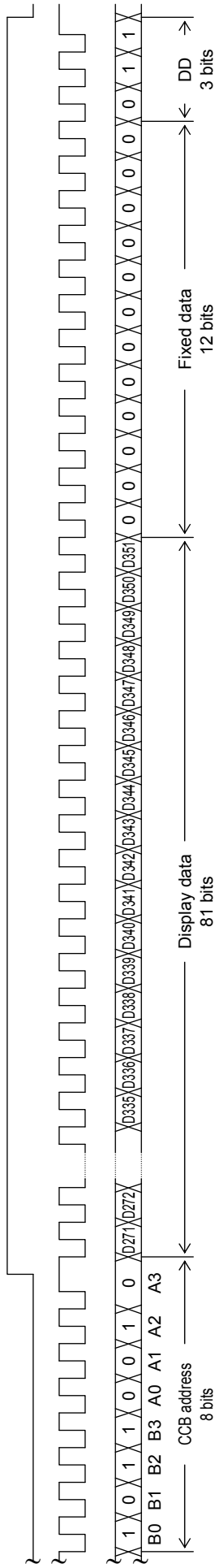
- When the control data is transferred.



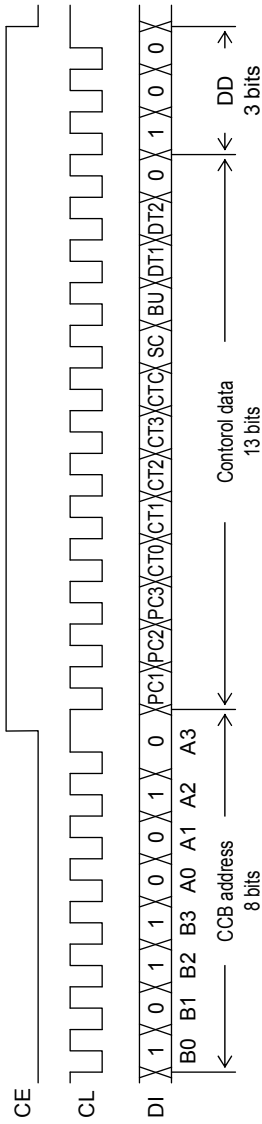
Note: B0 to B3, A0 to A3 CCB address
 DD Direction data

- (2) When CL is stopped at the high level
- When the display data is transferred.





• When the control data is transferred.



Note: B0 to B3, A0 to A3 CCB address

DD Direction data

• CCB address: 4DH

• D1 to D351: Display data

• PC1 to PC3: General-purpose output port state setting data

• CT0 to CT3, CTC: Display contrast setting data

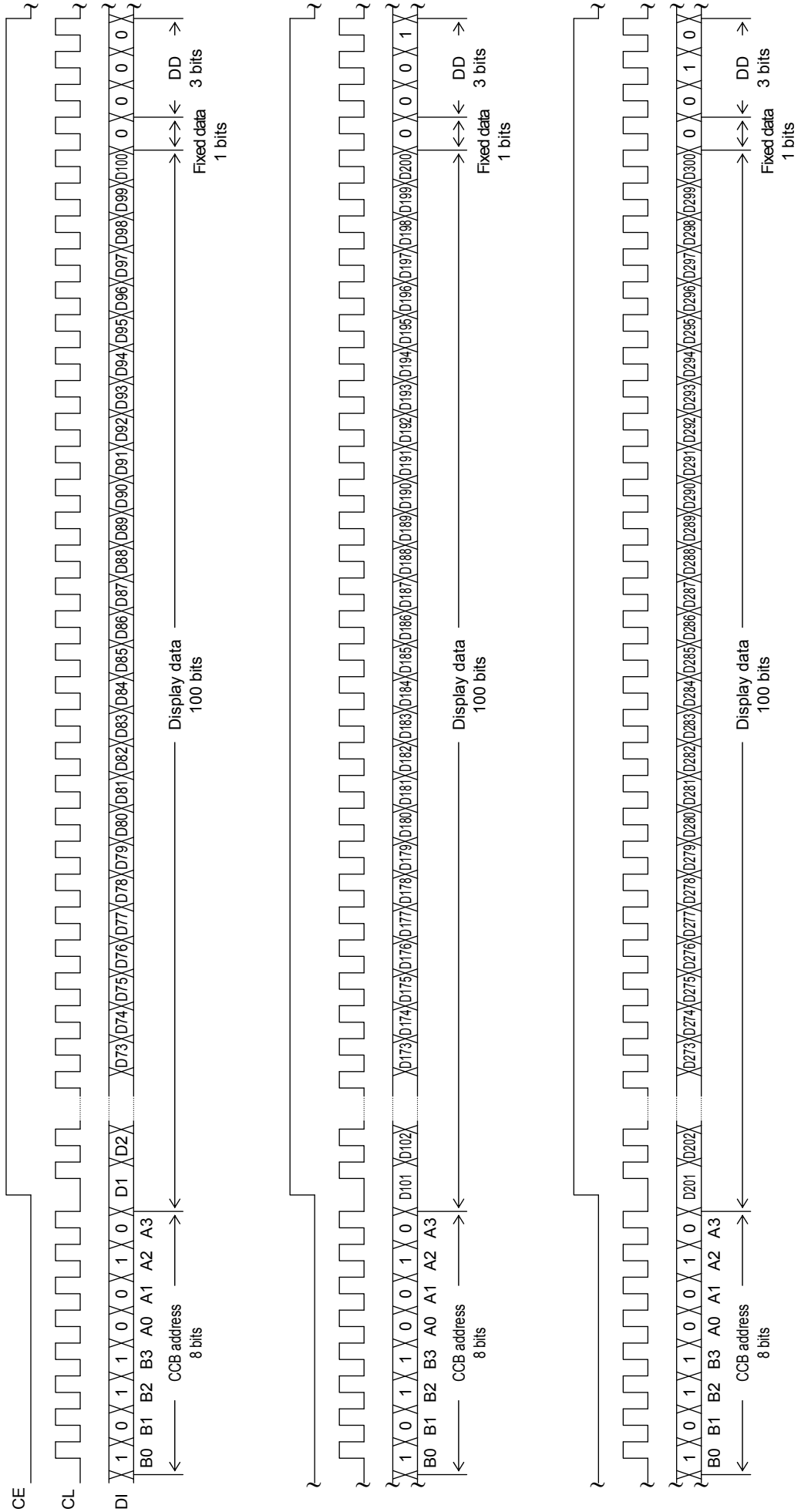
• SC: Segment on/off control data

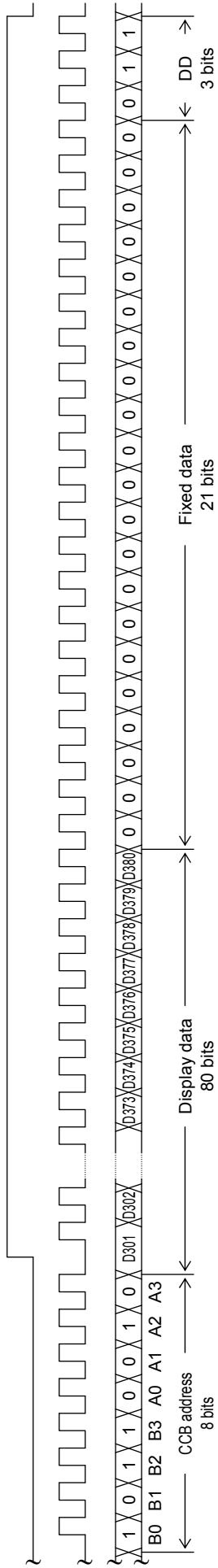
• BU: Normal mode/power saving mode control data

• DT1, DT2: Display technique setting data

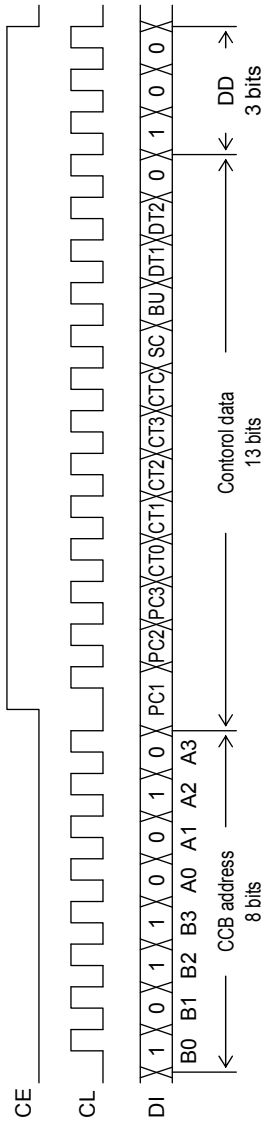
3. 1/10 duty

- (1) When CL is stopped at the low level
- When the display data is transferred.



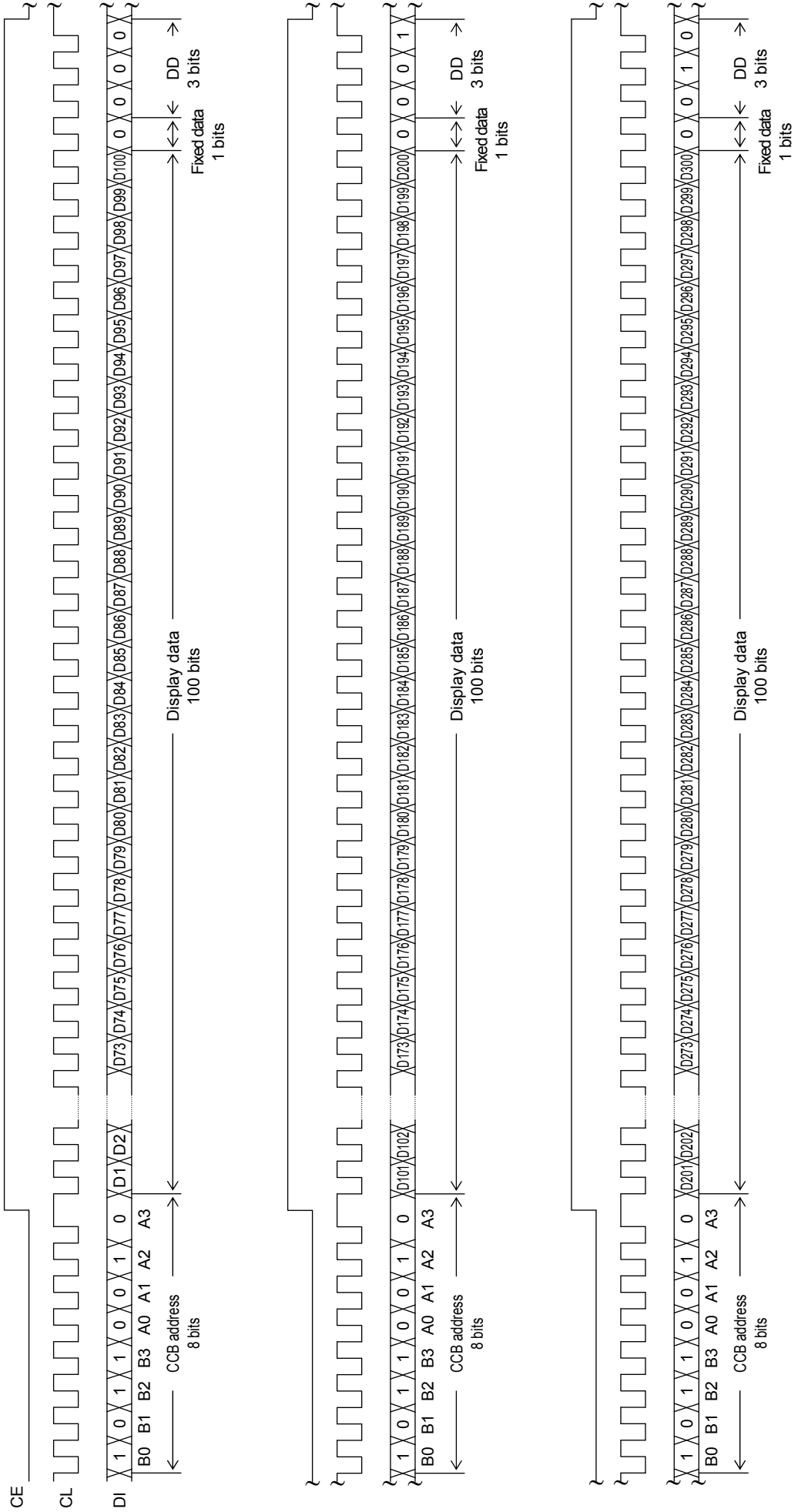


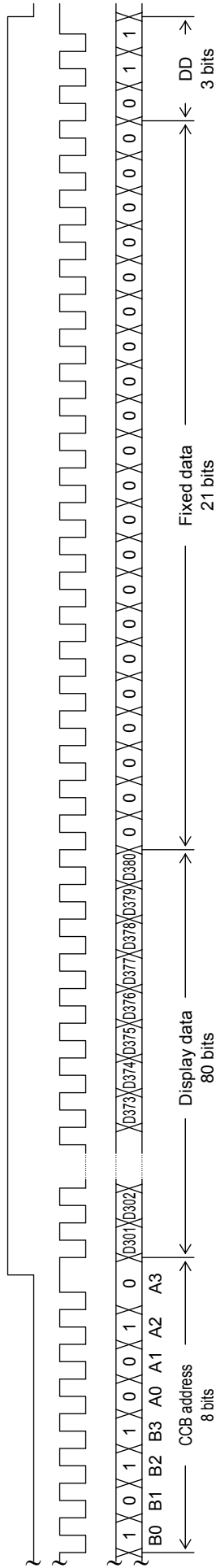
- When the control data is transferred.



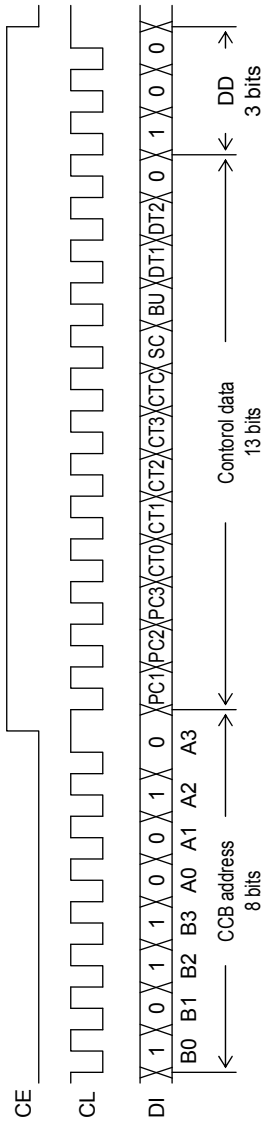
Note: B0 to B3, A0 to A3 CCB address
 DD..... Direction data

- (2) When CL is stopped at the high level
- When the display data is transferred.





• When the control data is transferred.



- Note: B0 to B3, A0 to A3 CCB address
 DD Direction data
 • CCB address: 4DH
 • D1 to D380: Display data
 • PC1 to PC3: General-purpose output port state setting data
 • CT0 to CT3, CTC: Display contrast setting data
 • SC: Segment on/off control data
 • BU: Normal mode/power saving mode control data
 • DT1, DT2: Display technique setting data

Control Data Functions

1. PC1 to PC3: General-purpose output port state setting data

These control data bits set the states of the general-purpose output ports P1 to P3.

| Output pin | P1 | P2 | P3 |
|--|-----|-----|-----|
| General-purpose output port state setting data | PC1 | PC2 | PC3 |

For example, if PC1 and PC2 are set to 1, and PC3 is set to 0, then the output pins P1 and P2 will output high levels (V_{DD}) and the output pin P3 will output low level (V_{SS}).

2. CT0 to CT3, CTC: Display contrast setting data

These control data bits set the display contrast.

CT0 to CT3: Display contrast setting (11 steps)

| CT0 | CT1 | CT2 | CT3 | LCD drive 4/4 bias voltage supply V_{LCD0} level |
|-----|-----|-----|-----|--|
| 0 | 0 | 0 | 0 | $0.94V_{LCD}=V_{LCD}-(0.03V_{LCD}\times 2)$ |
| 1 | 0 | 0 | 0 | $0.91V_{LCD}=V_{LCD}-(0.03V_{LCD}\times 3)$ |
| 0 | 1 | 0 | 0 | $0.88V_{LCD}=V_{LCD}-(0.03V_{LCD}\times 4)$ |
| 1 | 1 | 0 | 0 | $0.85V_{LCD}=V_{LCD}-(0.03V_{LCD}\times 5)$ |
| 0 | 0 | 1 | 0 | $0.82V_{LCD}=V_{LCD}-(0.03V_{LCD}\times 6)$ |
| 1 | 0 | 1 | 0 | $0.79V_{LCD}=V_{LCD}-(0.03V_{LCD}\times 7)$ |
| 0 | 1 | 1 | 0 | $0.76V_{LCD}=V_{LCD}-(0.03V_{LCD}\times 8)$ |
| 1 | 1 | 1 | 0 | $0.73V_{LCD}=V_{LCD}-(0.03V_{LCD}\times 9)$ |
| 0 | 0 | 0 | 1 | $0.70V_{LCD}=V_{LCD}-(0.03V_{LCD}\times 10)$ |
| 1 | 0 | 0 | 1 | $0.67V_{LCD}=V_{LCD}-(0.03V_{LCD}\times 11)$ |
| 0 | 1 | 0 | 1 | $0.64V_{LCD}=V_{LCD}-(0.03V_{LCD}\times 12)$ |

CTC: Display contrast adjustment circuit state setting

| CTC | Display contrast adjustment circuit state |
|-----|---|
| 0 | The display contrast adjustment circuit is disabled, and the V_{LCD0} pin level is forced to the V_{LCD} level. |
| 1 | The display contrast adjustment circuit operates and the display contrast is adjusted. |

Note that although the display contrast can be adjusted by operating the built-in display contrast adjustment circuit, it is also possible to apply fine adjustments to the contrast by connecting an external variable resistor to the V_{LCD4} pin and modifying the V_{LCD4} pin voltage. However, the following conditions must be met: $(V_{LCD0} - V_{LCD4}) \geq 4.5V$, and $1.5V \geq V_{LCD4} \geq 0V$.

3. SC: Segment on/off control data

This control data bit controls the on/off state of the segments.

| SC | Display state |
|----|---------------|
| 0 | On |
| 1 | Off |

However, note that when the segments are turned off by setting SC to 1, the segments are turned off by outputting segment off waveforms from the segment output pins.

4. BU: Normal mode/power saving mode control data

This control data bit controls the normal mode and power saving mode.

| BU | Mode |
|----|---|
| 0 | Normal mode |
| 1 | Power-saving mode. The common and segment pins go to the V_{LCD4} level and the oscillator on the OSC pin is stopped. Note that the states of the general-purpose output ports P1 to P3 are set by PC1 to PC3 in the control data during power saving mode as well as normal mode. |

5. DT1, DT2: Display technique setting data

This control data bits set the display technique.

| DT1 | DT2 | Display technique | Output pins | |
|-----|-----|--------------------------|-------------|-----------|
| | | | S40/COM9 | S39/COM10 |
| 0 | 0 | 1/8 duty 1/4 bias drive | S40 | S39 |
| 1 | 0 | 1/9 duty 1/4 bias drive | COM9 | S39 |
| 0 | 1 | 1/10 duty 1/4 bias drive | COM9 | COM10 |

Notes: Sn (n = 39, 40): Segment outputs

COMn (n = 9 or 10): Common outputs

LC75838W

Display Data and Output Pin Correspondence

• 1/8 duty

| Output Pin | COM1 | COM2 | COM3 | COM4 | COM5 | COM6 | COM7 | COM8 |
|------------|------|------|------|------|------|------|------|------|
| S1 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 |
| S2 | D9 | D10 | D11 | D12 | D13 | D14 | D15 | D16 |
| S3 | D17 | D18 | D19 | D20 | D21 | D22 | D23 | D24 |
| S4 | D25 | D26 | D27 | D28 | D29 | D30 | D31 | D32 |
| S5 | D33 | D34 | D35 | D36 | D37 | D38 | D39 | D40 |
| S6 | D41 | D42 | D43 | D44 | D45 | D46 | D47 | D48 |
| S7 | D49 | D50 | D51 | D52 | D53 | D54 | D55 | D56 |
| S8 | D57 | D58 | D59 | D60 | D61 | D62 | D63 | D64 |
| S9 | D65 | D66 | D67 | D68 | D69 | D70 | D71 | D72 |
| S10 | D73 | D74 | D75 | D76 | D77 | D78 | D79 | D80 |
| S11 | D81 | D82 | D83 | D84 | D85 | D86 | D87 | D88 |
| S12 | D89 | D90 | D91 | D92 | D93 | D94 | D95 | D96 |
| S13 | D97 | D98 | D99 | D100 | D101 | D102 | D103 | D104 |
| S14 | D105 | D106 | D107 | D108 | D109 | D110 | D111 | D112 |
| S15 | D113 | D114 | D115 | D116 | D117 | D118 | D119 | D120 |
| S16 | D121 | D122 | D123 | D124 | D125 | D126 | D127 | D128 |
| S17 | D129 | D130 | D131 | D132 | D133 | D134 | D135 | D136 |
| S18 | D137 | D138 | D139 | D140 | D141 | D142 | D143 | D144 |
| S19 | D145 | D146 | D147 | D148 | D149 | D150 | D151 | D152 |
| S20 | D153 | D154 | D155 | D156 | D157 | D158 | D159 | D160 |
| S21 | D161 | D162 | D163 | D164 | D165 | D166 | D167 | D168 |
| S22 | D169 | D170 | D171 | D172 | D173 | D174 | D175 | D176 |
| S23 | D177 | D178 | D179 | D180 | D181 | D182 | D183 | D184 |
| S24 | D185 | D186 | D187 | D188 | D189 | D190 | D191 | D192 |
| S25 | D193 | D194 | D195 | D196 | D197 | D198 | D199 | D200 |
| S26 | D201 | D202 | D203 | D204 | D205 | D206 | D207 | D208 |
| S27 | D209 | D210 | D211 | D212 | D213 | D214 | D215 | D216 |
| S28 | D217 | D218 | D219 | D220 | D221 | D222 | D223 | D224 |
| S29 | D225 | D226 | D227 | D228 | D229 | D230 | D231 | D232 |
| S30 | D233 | D234 | D235 | D236 | D237 | D238 | D239 | D240 |
| S31 | D241 | D242 | D243 | D244 | D245 | D246 | D247 | D248 |
| S32 | D249 | D250 | D251 | D252 | D253 | D254 | D255 | D256 |
| S33 | D257 | D258 | D259 | D260 | D261 | D262 | D263 | D264 |
| S34 | D265 | D266 | D267 | D268 | D269 | D270 | D271 | D272 |
| S35 | D273 | D274 | D275 | D276 | D277 | D278 | D279 | D280 |
| S36 | D281 | D282 | D283 | D284 | D285 | D286 | D287 | D288 |
| S37 | D289 | D290 | D291 | D292 | D293 | D294 | D295 | D296 |
| S38 | D297 | D298 | D299 | D300 | D301 | D302 | D303 | D304 |
| S39/COM10 | D305 | D306 | D307 | D308 | D309 | D310 | D311 | D312 |
| S40/COM9 | D313 | D314 | D315 | D316 | D317 | D318 | D319 | D320 |

Note: Applies when the S39/COM10 and S40/COM9 output pins are set to their segment output function.

LC75838W

For example, the table below lists the segment output states for the S11 output pin.

| Display data | | | | | | | | Output pin state (S11) |
|--------------|-----|-----|-----|-----|-----|-----|-----|---|
| D81 | D82 | D83 | D84 | D85 | D86 | D87 | D88 | |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | The LCD segments for COM1 to COM8 are off |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | The LCD segment for COM1 is on |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | The LCD segment for COM2 is on |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | The LCD segment for COM3 is on |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | The LCD segment for COM4 is on |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | The LCD segment for COM5 is on |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | The LCD segment for COM6 is on |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | The LCD segment for COM7 is on |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | The LCD segment for COM8 is on |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | The LCD segments for COM1 to COM8 are on |

LC75838W

• 1/9 duty

| Output Pin | COM1 | COM2 | COM3 | COM4 | COM5 | COM6 | COM7 | COM8 | COM9 |
|------------|------|------|------|------|------|------|------|------|------|
| S1 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 |
| S2 | D10 | D11 | D12 | D13 | D14 | D15 | D16 | D17 | D18 |
| S3 | D19 | D20 | D21 | D22 | D23 | D24 | D25 | D26 | D27 |
| S4 | D28 | D29 | D30 | D31 | D32 | D33 | D34 | D35 | D36 |
| S5 | D37 | D38 | D39 | D40 | D41 | D42 | D43 | D44 | D45 |
| S6 | D46 | D47 | D48 | D49 | D50 | D51 | D52 | D53 | D54 |
| S7 | D55 | D56 | D57 | D58 | D59 | D60 | D61 | D62 | D63 |
| S8 | D64 | D65 | D66 | D67 | D68 | D69 | D70 | D71 | D72 |
| S9 | D73 | D74 | D75 | D76 | D77 | D78 | D79 | D80 | D81 |
| S10 | D82 | D83 | D84 | D85 | D86 | D87 | D88 | D89 | D90 |
| S11 | D91 | D92 | D93 | D94 | D95 | D96 | D97 | D98 | D99 |
| S12 | D100 | D101 | D102 | D103 | D104 | D105 | D106 | D107 | D108 |
| S13 | D109 | D110 | D111 | D112 | D113 | D114 | D115 | D116 | D117 |
| S14 | D118 | D119 | D120 | D121 | D122 | D123 | D124 | D125 | D126 |
| S15 | D127 | D128 | D129 | D130 | D131 | D132 | D133 | D134 | D135 |
| S16 | D136 | D137 | D138 | D139 | D140 | D141 | D142 | D143 | D144 |
| S17 | D145 | D146 | D147 | D148 | D149 | D150 | D151 | D152 | D153 |
| S18 | D154 | D155 | D156 | D157 | D158 | D159 | D160 | D161 | D162 |
| S19 | D163 | D164 | D165 | D166 | D167 | D168 | D169 | D170 | D171 |
| S20 | D172 | D173 | D174 | D175 | D176 | D177 | D178 | D179 | D180 |
| S21 | D181 | D182 | D183 | D184 | D185 | D186 | D187 | D188 | D189 |
| S22 | D190 | D191 | D192 | D193 | D194 | D195 | D196 | D197 | D198 |
| S23 | D199 | D200 | D201 | D202 | D203 | D204 | D205 | D206 | D207 |
| S24 | D208 | D209 | D210 | D211 | D212 | D213 | D214 | D215 | D216 |
| S25 | D217 | D218 | D219 | D220 | D221 | D222 | D223 | D224 | D225 |
| S26 | D226 | D227 | D228 | D229 | D230 | D231 | D232 | D233 | D234 |
| S27 | D235 | D236 | D237 | D238 | D239 | D240 | D241 | D242 | D243 |
| S28 | D244 | D245 | D246 | D247 | D248 | D249 | D250 | D251 | D252 |
| S29 | D253 | D254 | D255 | D256 | D257 | D258 | D259 | D260 | D261 |
| S30 | D262 | D263 | D264 | D265 | D266 | D267 | D268 | D269 | D270 |
| S31 | D271 | D272 | D273 | D274 | D275 | D276 | D277 | D278 | D279 |
| S32 | D280 | D281 | D282 | D283 | D284 | D285 | D286 | D287 | D288 |
| S33 | D289 | D290 | D291 | D292 | D293 | D294 | D295 | D296 | D297 |
| S34 | D298 | D299 | D300 | D301 | D302 | D303 | D304 | D305 | D306 |
| S35 | D307 | D308 | D309 | D310 | D311 | D312 | D313 | D314 | D315 |
| S36 | D316 | D317 | D318 | D319 | D320 | D321 | D322 | D323 | D324 |
| S37 | D325 | D326 | D327 | D328 | D329 | D330 | D331 | D332 | D333 |
| S38 | D334 | D335 | D336 | D337 | D338 | D339 | D340 | D341 | D342 |
| S39/COM10 | D343 | D344 | D345 | D346 | D347 | D348 | D349 | D350 | D351 |

Note: Applies when the S39/COM10 output pin is set to its segment output function.

LC75838W

For example, the table below lists the segment output states for the S11 output pin.

| Display data | | | | | | | | | Output pin state (S11) |
|--------------|-----|-----|-----|-----|-----|-----|-----|-----|---|
| D91 | D92 | D93 | D94 | D95 | D96 | D97 | D98 | D99 | |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | The LCD segments for COM1 to COM9 are off |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | The LCD segment for COM1 is on |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | The LCD segment for COM2 is on |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | The LCD segment for COM3 is on |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | The LCD segment for COM4 is on |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | The LCD segment for COM5 is on |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | The LCD segment for COM6 is on |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | The LCD segment for COM7 is on |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | The LCD segment for COM8 is on |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | The LCD segment for COM9 is on |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | The LCD segments for COM1 to COM9 are on |

LC75838W

• 1/10 duty

| Output Pin | COM1 | COM2 | COM3 | COM4 | COM5 | COM6 | COM7 | COM8 | COM9 | COM10 |
|------------|------|------|------|------|------|------|------|------|------|-------|
| S1 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 |
| S2 | D11 | D12 | D13 | D14 | D15 | D16 | D17 | D18 | D19 | D20 |
| S3 | D21 | D22 | D23 | D24 | D25 | D26 | D27 | D28 | D29 | D30 |
| S4 | D31 | D32 | D33 | D34 | D35 | D36 | D37 | D38 | D39 | D40 |
| S5 | D41 | D42 | D43 | D44 | D45 | D46 | D47 | D48 | D49 | D50 |
| S6 | D51 | D52 | D53 | D54 | D55 | D56 | D57 | D58 | D59 | D60 |
| S7 | D61 | D62 | D63 | D64 | D65 | D66 | D67 | D68 | D69 | D70 |
| S8 | D71 | D72 | D73 | D74 | D75 | D76 | D77 | D78 | D79 | D80 |
| S9 | D81 | D82 | D83 | D84 | D85 | D86 | D87 | D88 | D89 | D90 |
| S10 | D91 | D92 | D93 | D94 | D95 | D96 | D97 | D98 | D99 | D100 |
| S11 | D101 | D102 | D103 | D104 | D105 | D106 | D107 | D108 | D109 | D110 |
| S12 | D111 | D112 | D113 | D114 | D115 | D116 | D117 | D118 | D119 | D120 |
| S13 | D121 | D122 | D123 | D124 | D125 | D126 | D127 | D128 | D129 | D130 |
| S14 | D131 | D132 | D133 | D134 | D135 | D136 | D137 | D138 | D139 | D140 |
| S15 | D141 | D142 | D143 | D144 | D145 | D146 | D147 | D148 | D149 | D150 |
| S16 | D151 | D152 | D153 | D154 | D155 | D156 | D157 | D158 | D159 | D160 |
| S17 | D161 | D162 | D163 | D164 | D165 | D166 | D167 | D168 | D169 | D170 |
| S18 | D171 | D172 | D173 | D174 | D175 | D176 | D177 | D178 | D179 | D180 |
| S19 | D181 | D182 | D183 | D184 | D185 | D186 | D187 | D188 | D189 | D190 |
| S20 | D191 | D192 | D193 | D194 | D195 | D196 | D197 | D198 | D199 | D200 |
| S21 | D201 | D202 | D203 | D204 | D205 | D206 | D207 | D208 | D209 | D210 |
| S22 | D211 | D212 | D213 | D214 | D215 | D216 | D217 | D218 | D219 | D220 |
| S23 | D221 | D222 | D223 | D224 | D225 | D226 | D227 | D228 | D229 | D230 |
| S24 | D231 | D232 | D233 | D234 | D235 | D236 | D237 | D238 | D239 | D240 |
| S25 | D241 | D242 | D243 | D244 | D245 | D246 | D247 | D248 | D249 | D250 |
| S26 | D251 | D252 | D253 | D254 | D255 | D256 | D257 | D258 | D259 | D260 |
| S27 | D261 | D262 | D263 | D264 | D265 | D266 | D267 | D268 | D269 | D270 |
| S28 | D271 | D272 | D273 | D274 | D275 | D276 | D277 | D278 | D279 | D280 |
| S29 | D281 | D282 | D283 | D284 | D285 | D286 | D287 | D288 | D289 | D290 |
| S30 | D291 | D292 | D293 | D294 | D295 | D296 | D297 | D298 | D299 | D300 |
| S31 | D301 | D302 | D303 | D304 | D305 | D306 | D307 | D308 | D309 | D310 |
| S32 | D311 | D312 | D313 | D314 | D315 | D316 | D317 | D318 | D319 | D320 |
| S33 | D321 | D322 | D323 | D324 | D325 | D326 | D327 | D328 | D329 | D330 |
| S34 | D331 | D332 | D333 | D334 | D335 | D336 | D337 | D338 | D339 | D340 |
| S35 | D341 | D342 | D343 | D344 | D345 | D346 | D347 | D348 | D349 | D350 |
| S36 | D351 | D352 | D353 | D354 | D355 | D356 | D357 | D358 | D359 | D360 |
| S37 | D361 | D362 | D363 | D364 | D365 | D366 | D367 | D368 | D369 | D370 |
| S38 | D371 | D372 | D373 | D374 | D375 | D376 | D377 | D378 | D379 | D380 |

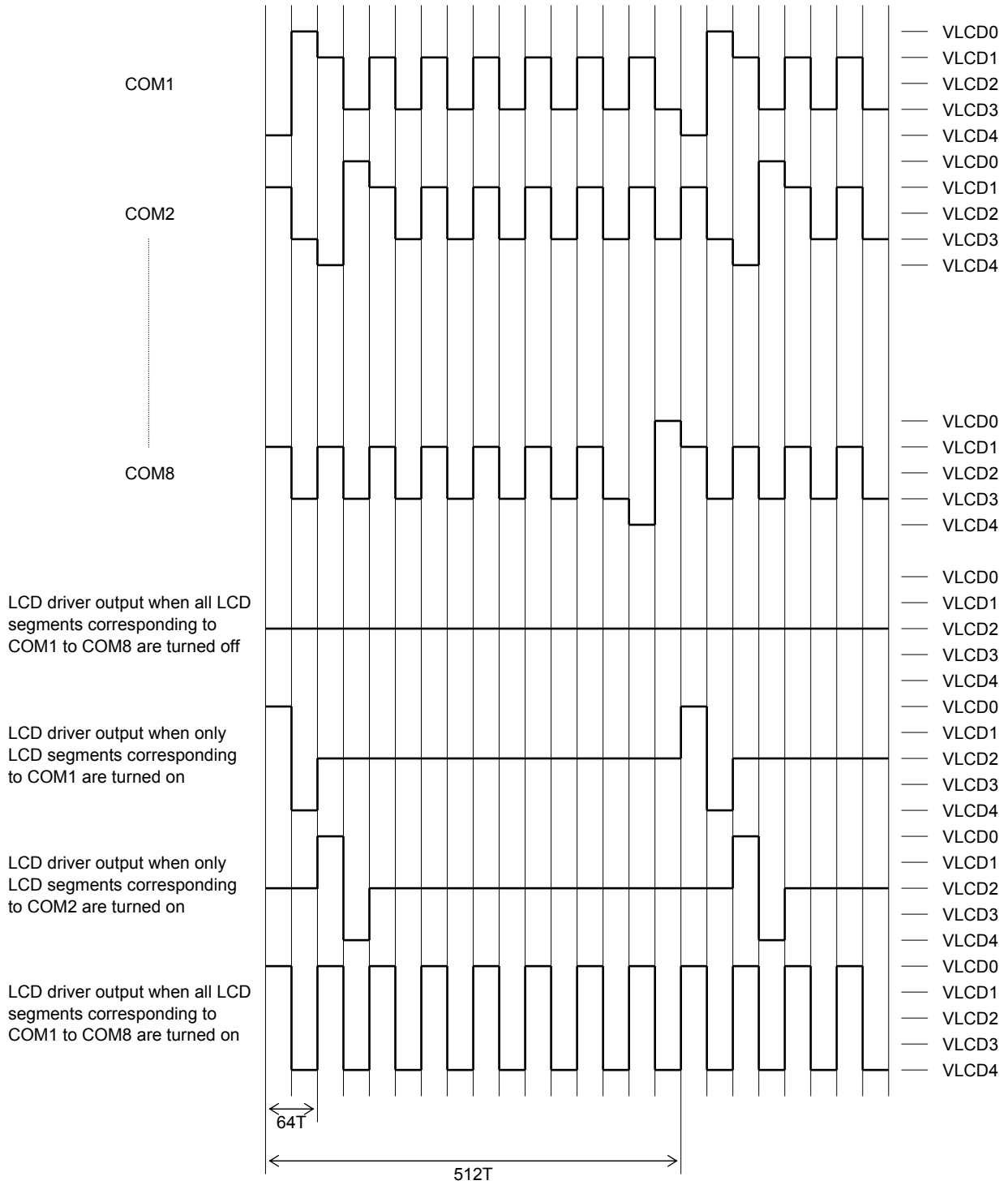
LC75838W

For example, the table below lists the segment output states for the S11 output pin.

| Display data | | | | | | | | | | Output pin state (S11) |
|--------------|------|------|------|------|------|------|------|------|------|--|
| D101 | D102 | D103 | D104 | D105 | D106 | D107 | D108 | D109 | D110 | |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | The LCD segments for COM1 to COM10 are off |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | The LCD segment for COM1 is on |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | The LCD segment for COM2 is on |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | The LCD segment for COM3 is on |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | The LCD segment for COM4 is on |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | The LCD segment for COM5 is on |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | The LCD segment for COM6 is on |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | The LCD segment for COM7 is on |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | The LCD segment for COM8 is on |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | The LCD segment for COM9 is on |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | The LCD segment for COM10 is on |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | The LCD segments for COM1 to COM10 are on |

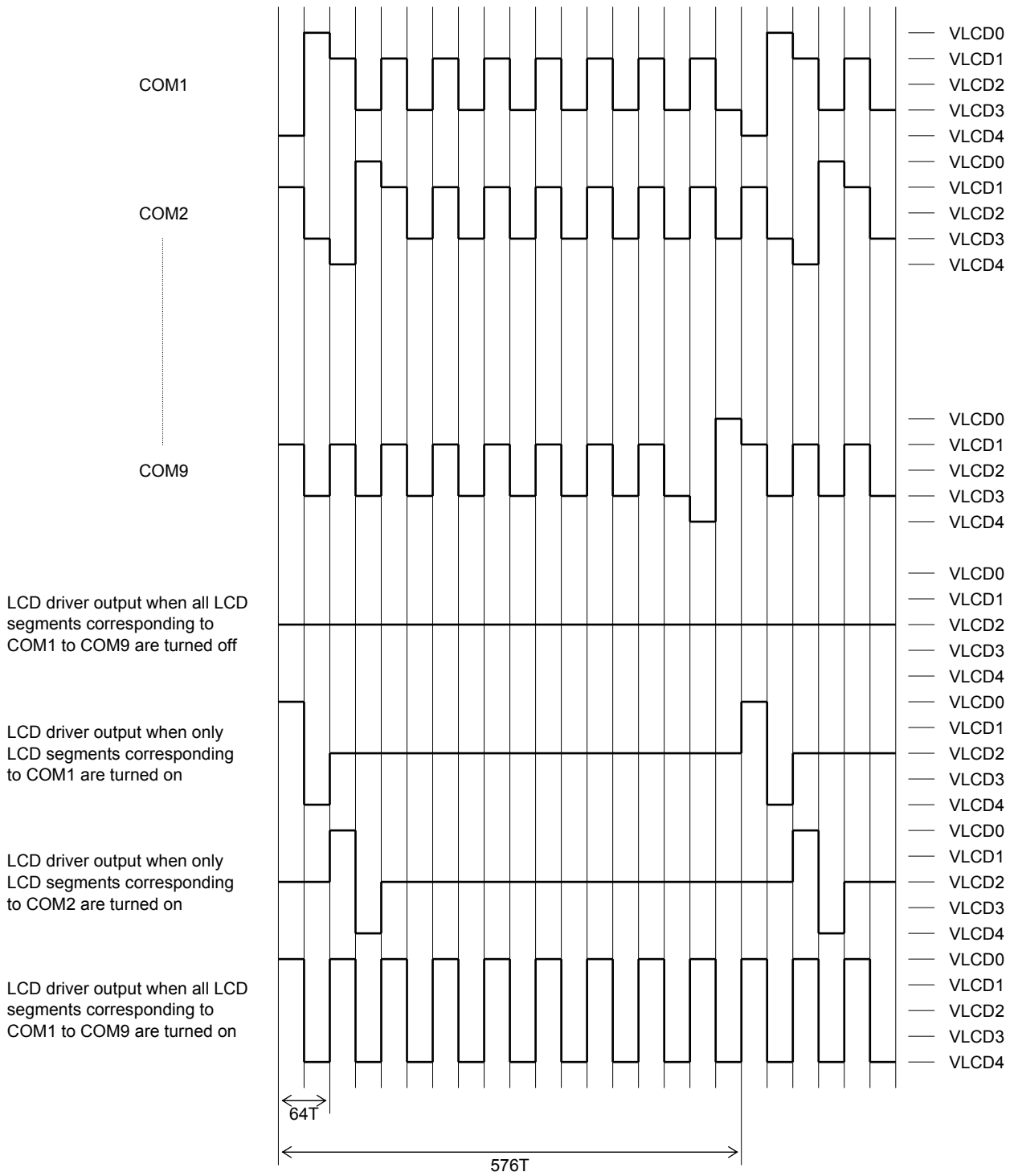
LC75838W

1/8 Duty, 1/4 Bias Drive Technique

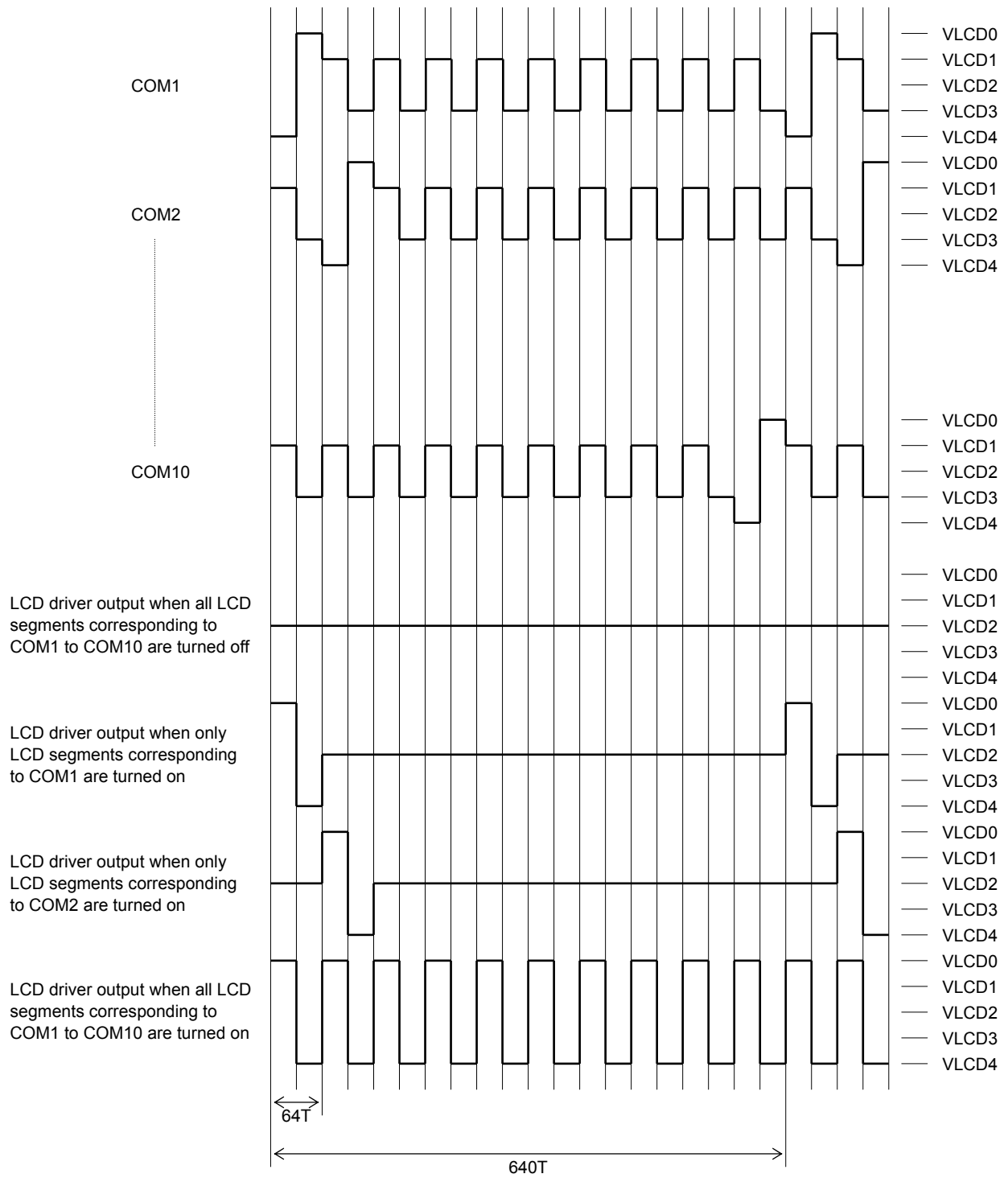


$$T = \frac{1}{f_{osc}}$$

1/9 Duty, 1/4 Bias Drive Technique



1/10 Duty, 1/4 Bias Drive Technique



The $\overline{\text{INH}}$ Pin and Display Control

Since the IC internal data (the display data and the control data) is undefined when power is first applied, applications should set the $\overline{\text{INH}}$ pin low at the same time as power is applied to turn off the display (This sets the S1 to S38, S39/COM10, S40/COM9, and COM1 to COM8 to the V_{LCD4} level and the P1 to P3 to the V_{SS} level.) and during this period send serial data from the controller. The controller should then set the $\overline{\text{INH}}$ pin high after the data transfer has completed. This procedure prevents meaningless displays at power on. (See figures 3, 4, and 5.)

Power Supply Sequence

The following sequences must be observed when power is turned on and off. (See figures 3, 4, and 5.)

- Power on: Logic block power supply (V_{DD}) on \rightarrow LCD driver block power supply (V_{LCD}) on
 - Power off: LCD driver block power supply (V_{LCD}) off \rightarrow Logic block power supply (V_{DD}) off
- However, if the logic and LCD driver blocks use a shared power supply, then the power supplies can be turned on and off at the same time.

- 1/8 duty

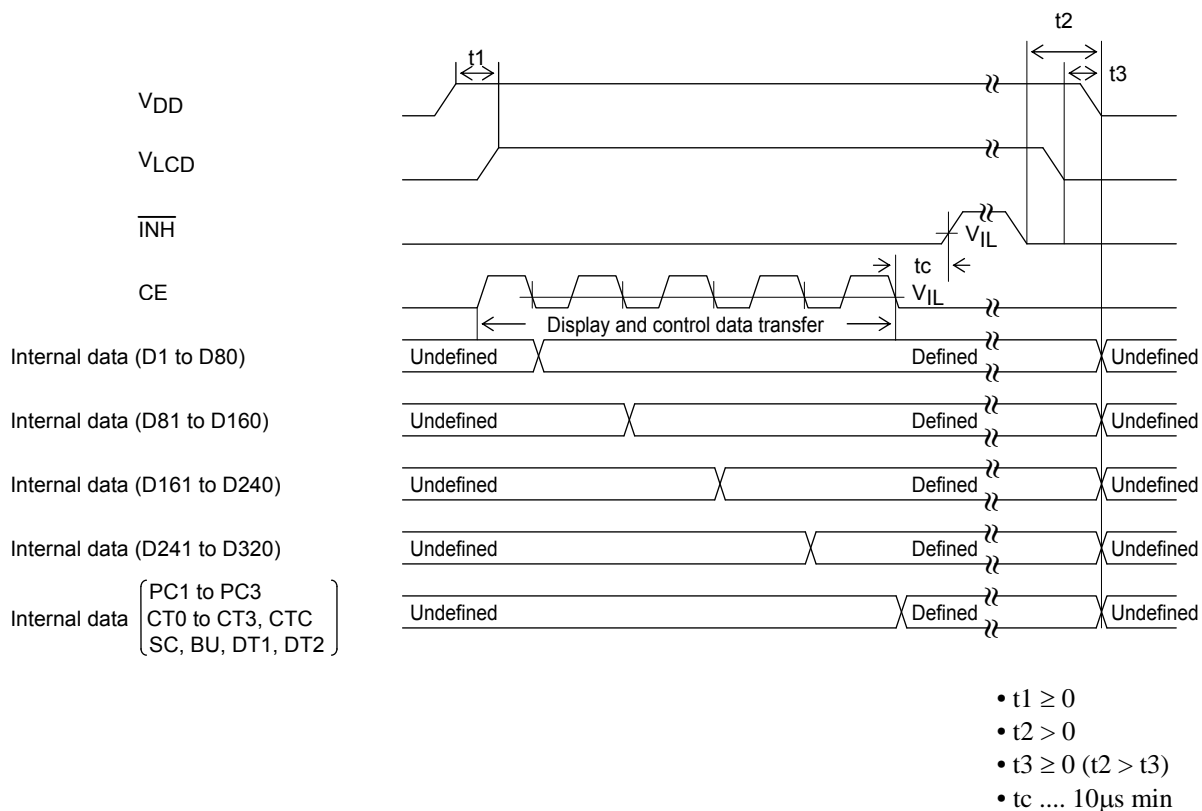


Figure 3

LC75838W

• 1/9 duty

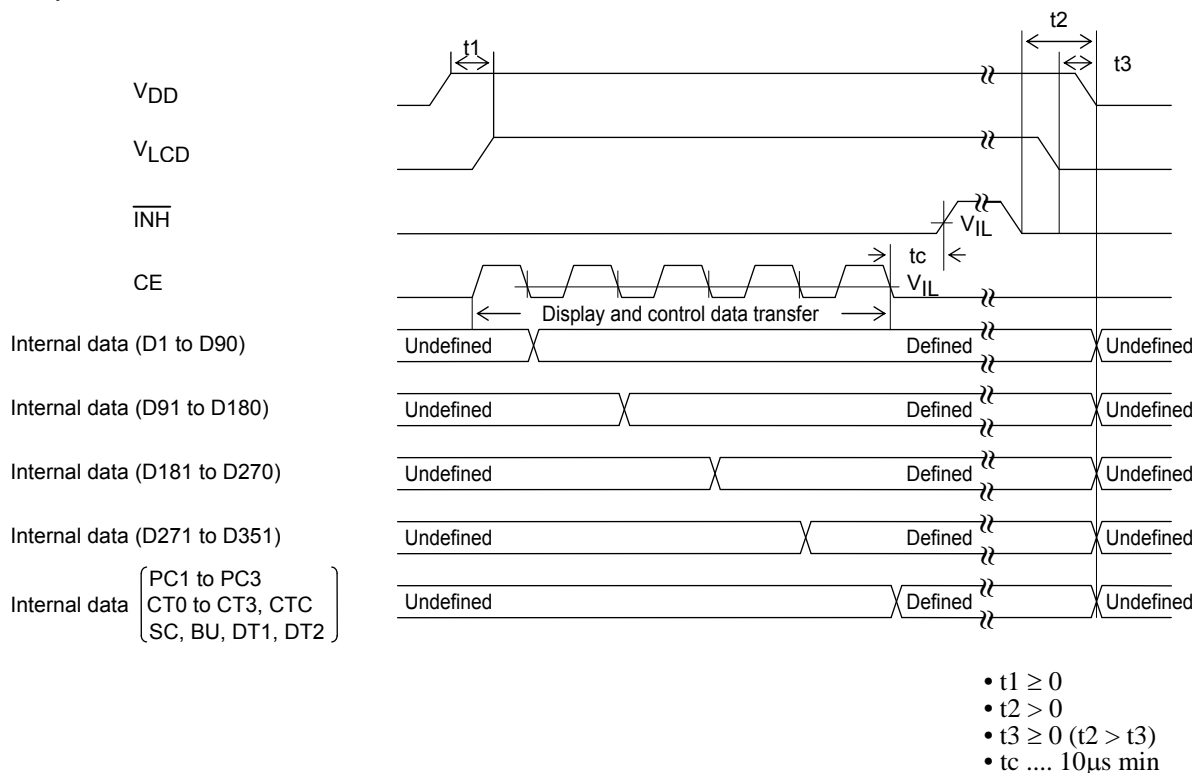


Figure 4

• 1/10 duty

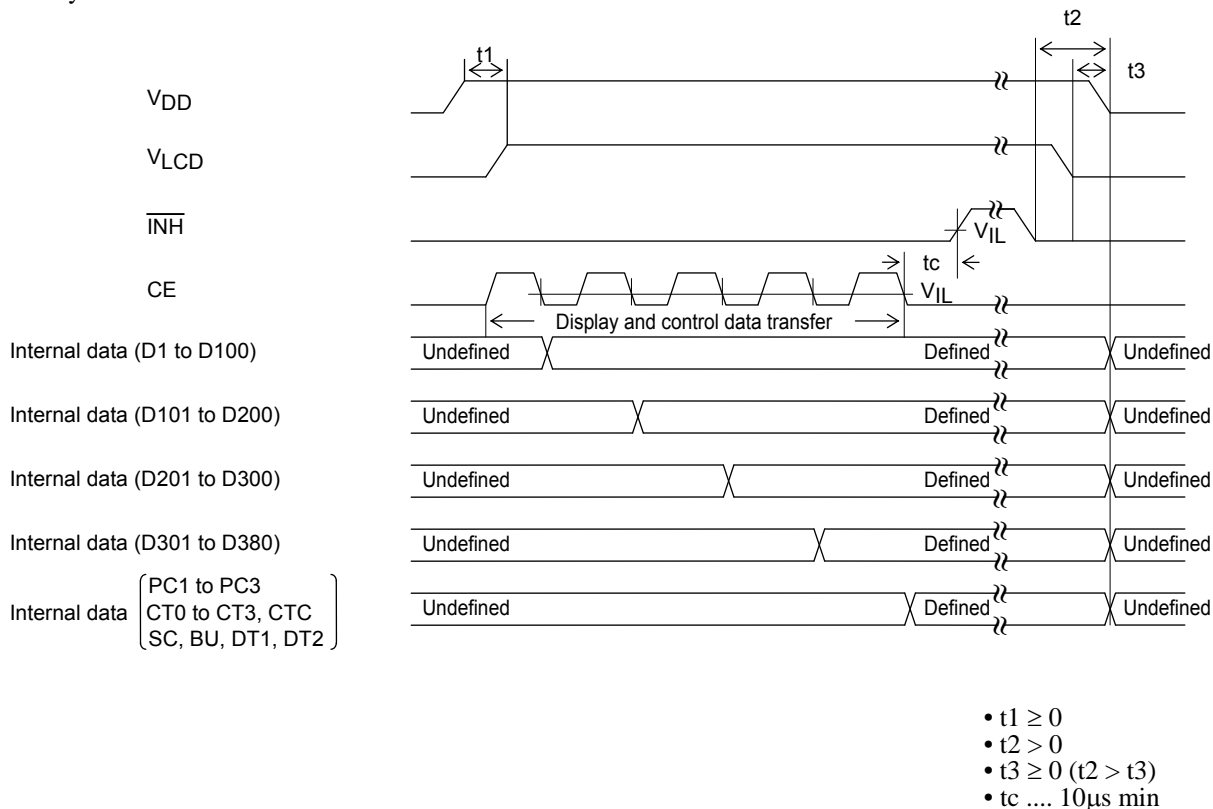


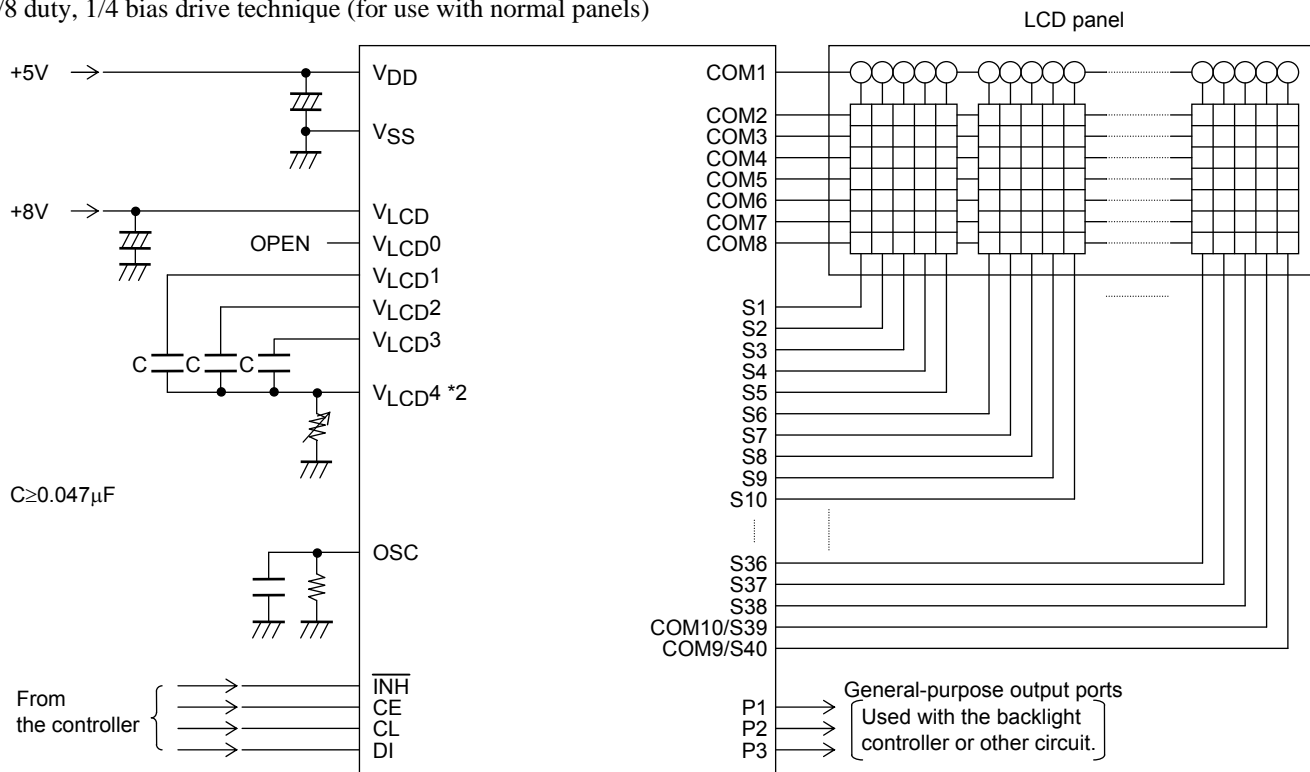
Figure 5

Notes on Transferring Display Data from the Controller

The display data is transferred to the LC75838W in four operations. All of the display data should be transferred within 30 ms to maintain the quality of the displayed image.

Sample Application Circuit 1

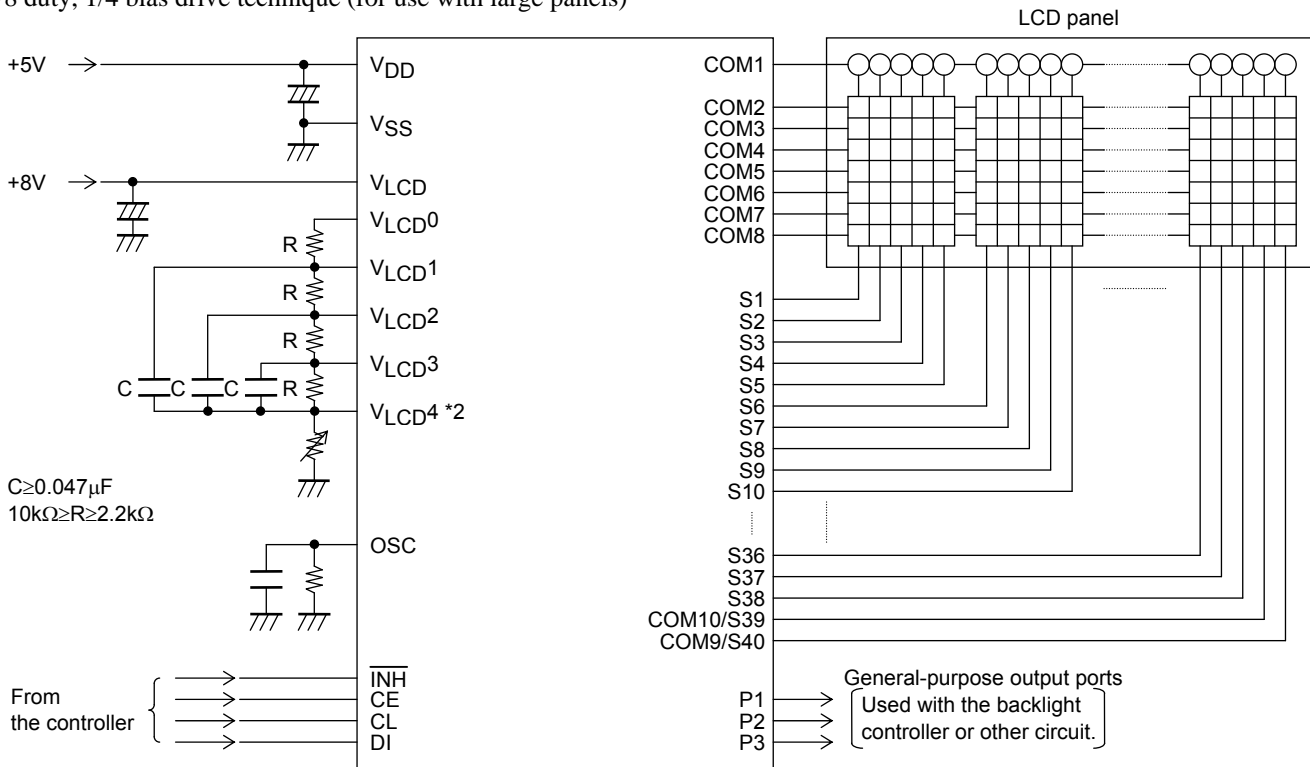
1/8 duty, 1/4 bias drive technique (for use with normal panels)



Note: *2. If a variable resistor is not used for display contrast fine adjustment, the VLCD4 pin must be connected to ground.

Sample Application Circuit 2

1/8 duty, 1/4 bias drive technique (for use with large panels)

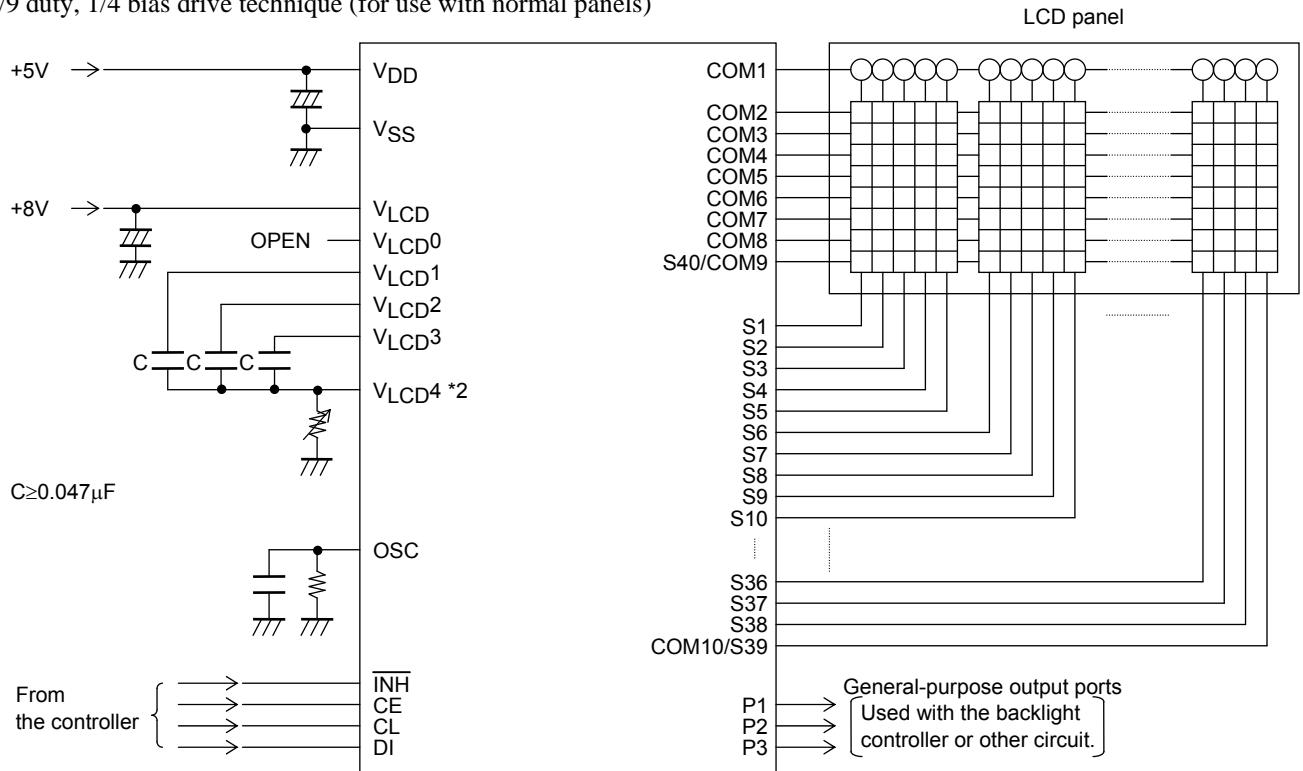


Note: *2. If a variable resistor is not used for display contrast fine adjustment, the VLCD4 pin must be connected to ground.

LC75838W

Sample Application Circuit 3

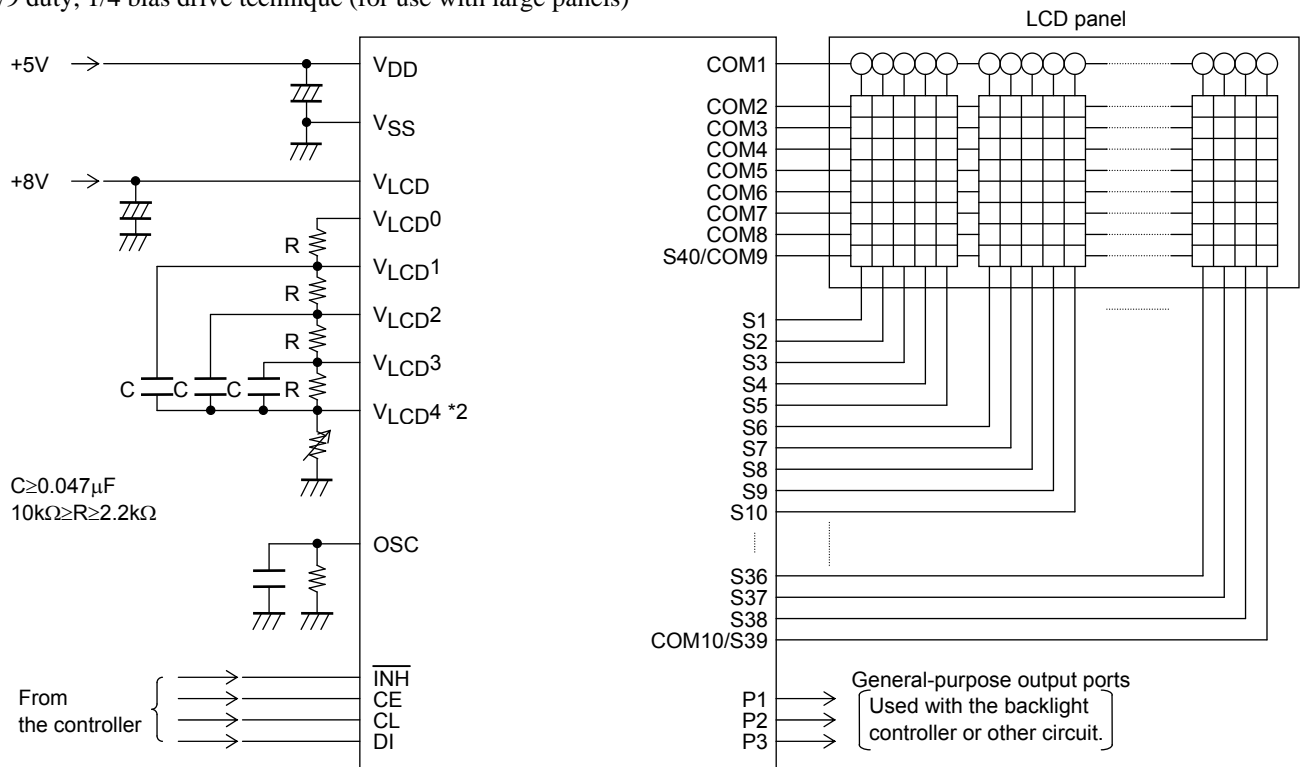
1/9 duty, 1/4 bias drive technique (for use with normal panels)



Note: *2. If a variable resistor is not used for display contrast fine adjustment, the V_{LCD4} pin must be connected to ground.

Sample Application Circuit 4

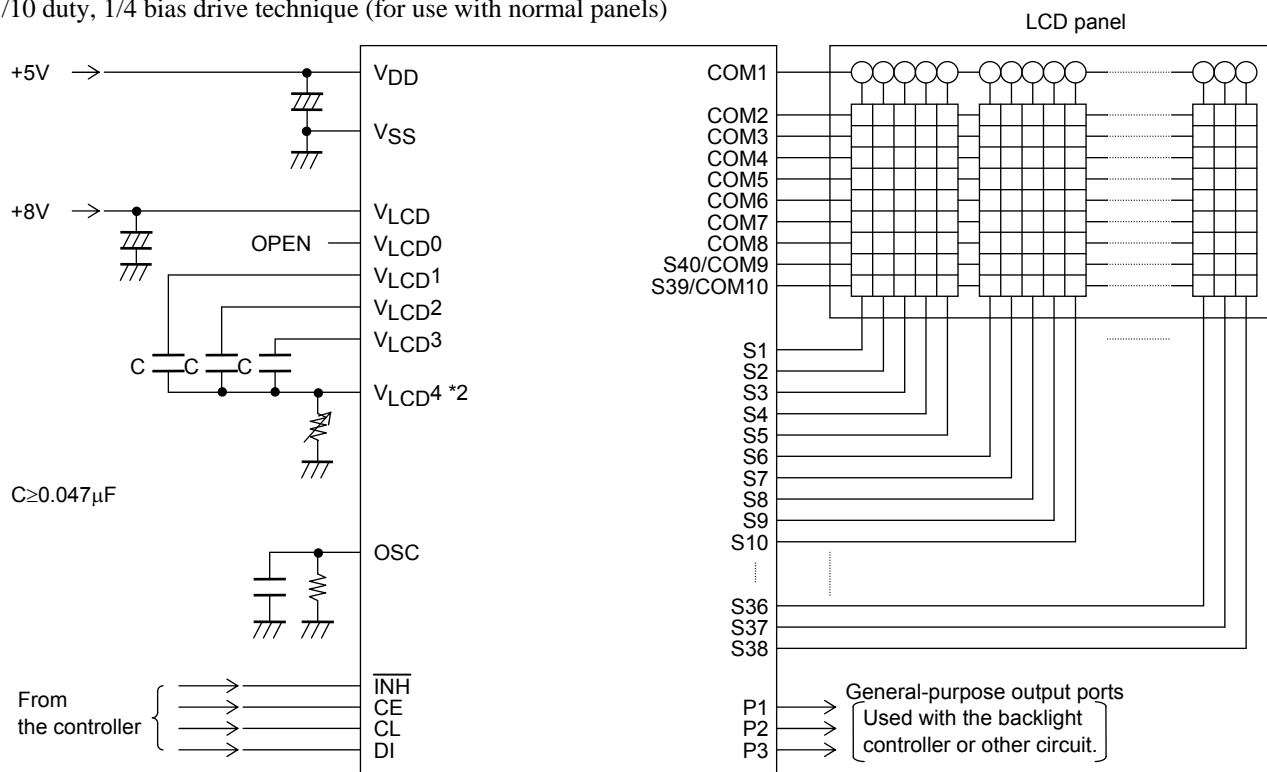
1/9 duty, 1/4 bias drive technique (for use with large panels)



Note: *2. If a variable resistor is not used for display contrast fine adjustment, the V_{LCD4} pin must be connected to ground.

Sample Application Circuit 5

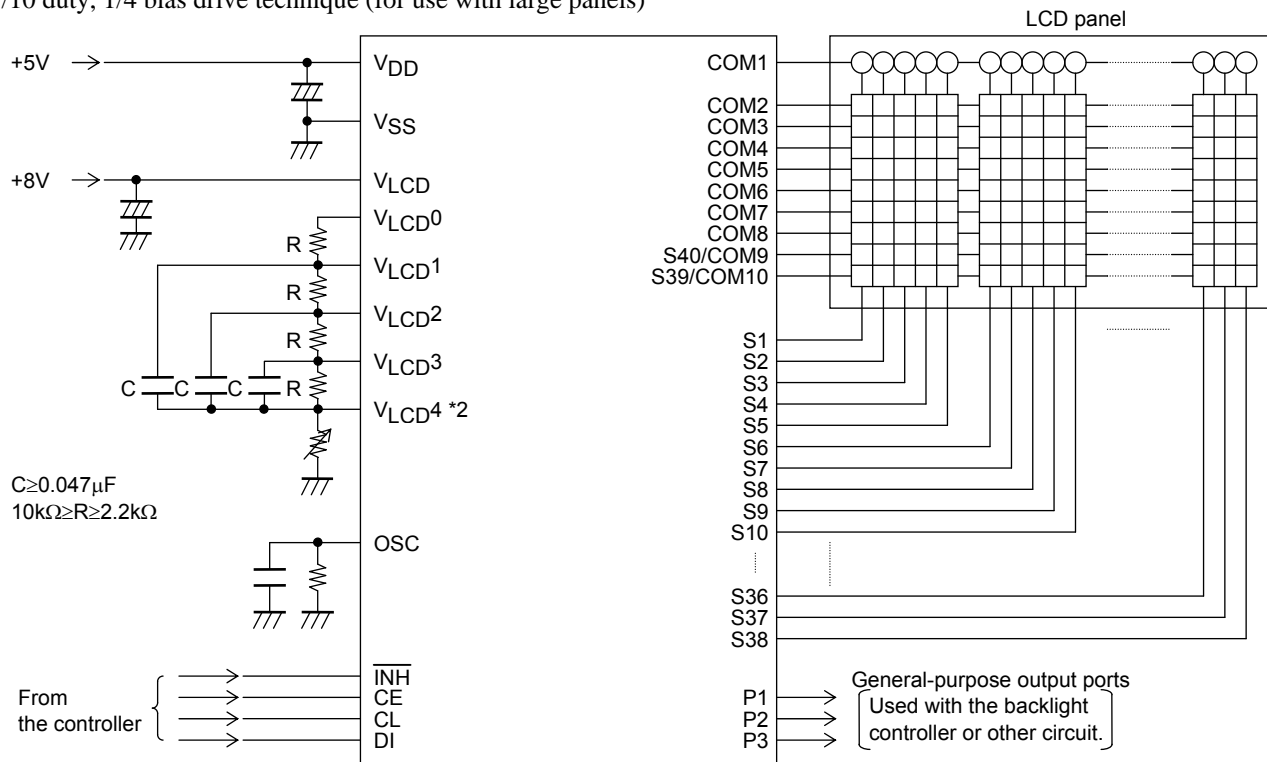
1/10 duty, 1/4 bias drive technique (for use with normal panels)



Note: *2. If a variable resistor is not used for display contrast fine adjustment, the VLCD4 pin must be connected to ground.

Sample Application Circuit 6

1/10 duty, 1/4 bias drive technique (for use with large panels)



Note: *2. If a variable resistor is not used for display contrast fine adjustment, the VLCD4 pin must be connected to ground.

LC75838W

ORDERING INFORMATION

| Device | Package | Shipping (Qty / Packing) |
|-------------|----------------------------------|--------------------------|
| LC75838W-E | SPQFP64 10x10 / SQFP64 (Pb-Free) | 800 / Tray JEDEC |
| LC75838WS-E | SPQFP64 10x10 / SQFP64 (Pb-Free) | 800 / Tray JEDEC |

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

X-ON Electronics

Largest Supplier of Electrical and Electronic Components

Click to view similar products for [LCD Drivers](#) category:

Click to view products by [ON Semiconductor](#) manufacturer:

Other Similar products are found below :

[874390R](#) [NJU6432BFH1](#) [LC75821WHS-E](#) [LC75827W-E](#) [LC75827WS-E](#) [LC75829PE-H](#) [LC75832WS-TBM-E](#) [LC75836WH-E](#)
[LC75874WHS-SH-E](#) [LC75890W-NH](#) [LC75897PW-E](#) [LC75829PEH-TLA-H](#) [LC75829PW-H](#) [LC75832E-E](#) [LC75832W-E](#) [LC75835W-TBM-](#)
[E](#) [LC75852W-E](#) [LC75853NEHS-E](#) [LC75874W-E](#) [LC79430KNE-E](#) [LC79431KNE-E](#) [FAN7317BMX](#) [MAX8795AGCJ/V+](#)
[MAX16929AGUI/V+](#) [MAX16929DGUI/V+](#) [PCF8578T/1,112](#) [PCF8533U/2/F2,026](#) [LC75839PW-H](#) [LC75853NW-E](#) [MAX16928BGUP/V+](#)
[LC75884W-E](#) [LC75832EH-E](#) [LC75890W-2H](#) [LC75847T-E](#) [LC75832WS-E](#) [LC75814VS-TLM-E](#) [MAX8726EUE+](#) [MAX8570ELT+T](#)
[FP7720FE9](#) [TPS65132T6YFFT](#) [TPS65132WRVCT](#) [BU97501KV-E2](#) [BU9795AFV-E2](#) [BU9799KV-E2](#) [ICL7136CMH+D](#)
[ICM7211AMIQH+TD](#) [ICL7116CQH+D](#) [AP5727WG-7](#) [FAN7318AMX](#) [BD8153EFV-E2](#)