LD3811

Dot Matrix LCD Controller and Driver

Ver. 1.1 / July. 2013

LDT Inc. WE bldg. 5F, 126-33 Han-dle 1ro, Seobuk-gu, Cheonan, Chungnam, korea, 331-220
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Overview

LD3811 is 1/8 to 1/10 duty dot matrix LCD display controller/drivers that supports the display of characters, numbers, and symbols. In addition to generating dot matrix LCD drive signals based on data transferred serially from a microcontroller.

Also LD3811 provides on-chip character display ROM and RAM to allow display systems to be implemented easily.

Features

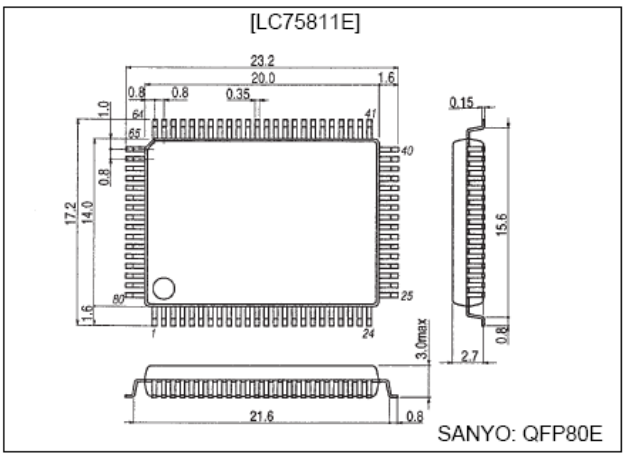
- **Controls and drives a 5 X 7, 5 X 8, or 5 X 9 dot matrix LCD.**
- **Supports accessory display segment drive (up to 60 segments)**
- **Display technique: 1/8 duty 1/4 bias drive (5 X 7 dots),**
  1/9 duty 1/4 bias drive (5 X 8 dots)
  1/10 duty 1/4 bias drive (5 X 9 dots)
- **Display digits: 12 digits X 1 line (5 X 7 dots),**
  11 digits X 1 line (5 X 8 or 5 X 9 dots)
- **Display control memory CGROM: 240 characters (5 X 7, 5 X 8, or 5 X 9 dots)**
  CGRAM: 16 characters (5 X 7, 5 X 8, or 5 X 9 dots)
  ADRAM: 12 X 5 bits
  DCRAM: 48 X 8 bits
- **Instruction function : Display on/off control / Display shift function**
- **Provides a backup function based on low power modes.**
- **Serial data communication with the system controller.**
- **Independent LCD drive block power supply VLCD**
- **Provides a RES pin for LSI internal initialization**
- **RC oscillator circuit**
- **Pb free applied**

Package Dimensions

80 QFP unit: mm

unit: mm

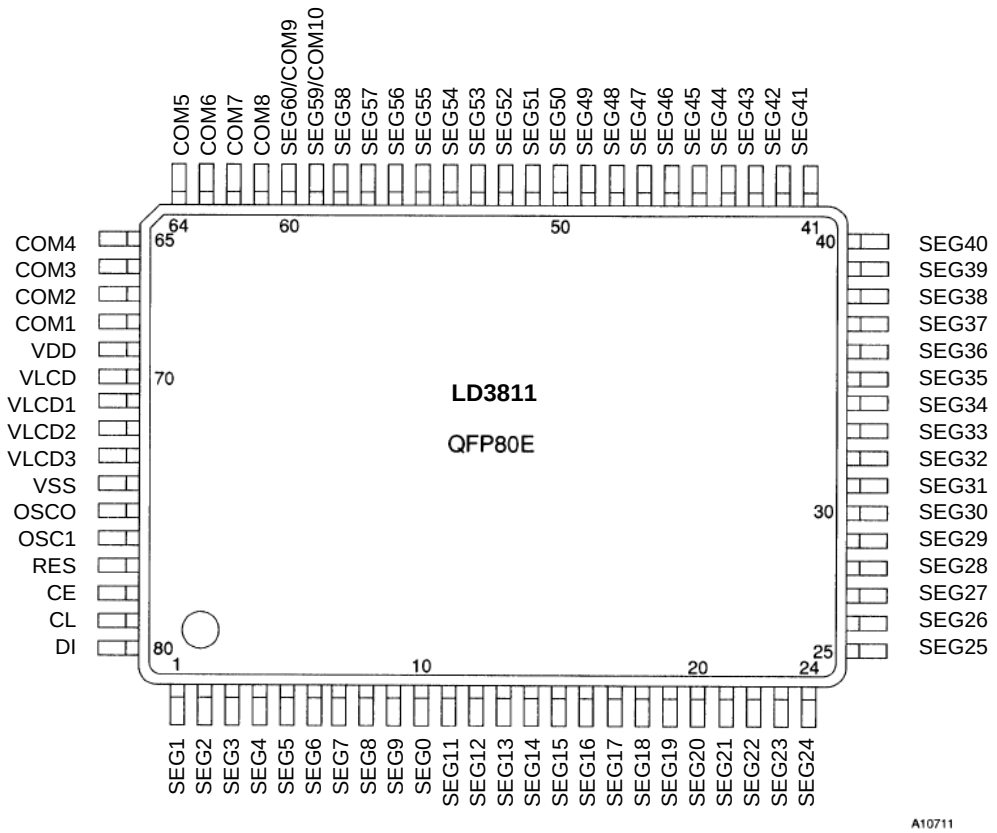
3174-QFP80E



ORDERING INFORMATION

PART NUMBER	PACKAGE	Ta
LD3811 - QFP	80 QFP	-40°C to 85 °C

Pin Assignments (Top View)



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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 +11.0	V
Input voltage	VIN1	CE, CL, DI, $\overline{RES}$	–0.3 to +7.0	V
	VIN2	OSCI	–0.3 to VDD + 0.3	V
	VIN3	VLCD1, VLCD2, VLCD3	–0.3 to VLCD + 0.3	V
Output voltage	VOUT1	OSCO	–0.3 to VDD + 0.3	V
	VOUT2	SEG1 to SEG60, COM1 to COM10	–0.3 to VLCD + 0.3	V
Output current	IOUT1	SEG1 to SEG60	300	µA
	IOUT2	COM1 to COM10	3	µA
Allowable power dissipation	Pd max	Ta = 85°C	200	mW
Operating temperature	Topr		–40 to +85	°C
Storage temperature	Tstg		–55 to +125	°C

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

Parameter	Symbol	Conditions	Ratings			Unit
			Min	typ	max	
Supply voltage	VDD	VDD				
	VLCD	VLCD				
Input voltage	VLCD1	VLCD1				
	VLCD2	VLCD2				
	VLCD3	VLCD3				
Input high level voltage	VIH1	CE, CL, DI, RES	0.8 VDD		6.0	V
	VIH2	OSCI	0.7 VDD		VDD	V
Input low level voltage	VIL1	CE, CL, DI, RES	0		0.2 VDD	V
	VIL2	OSCI	0		0.3 VDD	V
Recommended external resistance	ROSC	OSCI, OSCO		33		k½
Recommended external capacitance	COSC	OSCI, OSCO		220		pF
Guaranteed oscillation range	fOSC	OSC	150	300	600	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	tøH	CL: Figure 2	160			ns
Low level clock pulse width	tøL	CL: Figure 2	160			ns
Minimum reset pulse width	tWRES	RES: Figure 3	1			µs

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Electrical Characteristics in the Allowable Operating Ranges

Parameter	Symbol	Conditions	Ratings			Unit
			Min	typ	max	
Hysteresis	VH	CE, CL, DI, RES		0.1 VDD		V
Input high level current	IIH	CE, CL, DI, RES, OSCI: VI = 6.0 V			5.0	µA
Input low level current	IIL	CE, CL, DI, RES, OSCI: VI = 0 V	–5.0			µA
Output high level voltage	VOH1	SEG1 to SEG60: IO = –20 µA	VLCD – 0.6			V
	VOH2	OM1 to COM10: IO = –100 µa	VLCD – 0.6			V
	VOH3	OSCO: IO = –500 µA	VDD – 1.0			V
Output low level voltage	VOL1	SEG1 to SEG60: IO = 20 µa			0.6	V
	VOL2	COM1 to COM10: IO = 100 µA			10.6	V
	VOL3	OSCO: IO = 500 µA			1.0	V
Output middle level voltage*1	VMID1	SEG1 to SEG60: IO ±20 µA	2/4 VLCD – 0. 6		2/4 VLCD + 0.6	V
Oscillator frequency	fOSC	OSCI, OSCO: ROSC = 33 k½, COSC = 220 pF	210	300	390	kHz
Current drain	IDD1	VDD: power saving mode			5	µA
	IDD2	VDD: VDD = 6.0 V, output open, fOSC = 300 kHz		450	900	µA
	ILCD1	VLCD: power saving mode			5	µA
	ILCD2	VLCD: VLCD = 10.0 V, output open, fOSC = 300 kHz		200	400	µA

Note *1: Excluding the bias voltage generation divider resistor built into the VLCD1, VLCD2, and VLCD3. (See figure 1.)

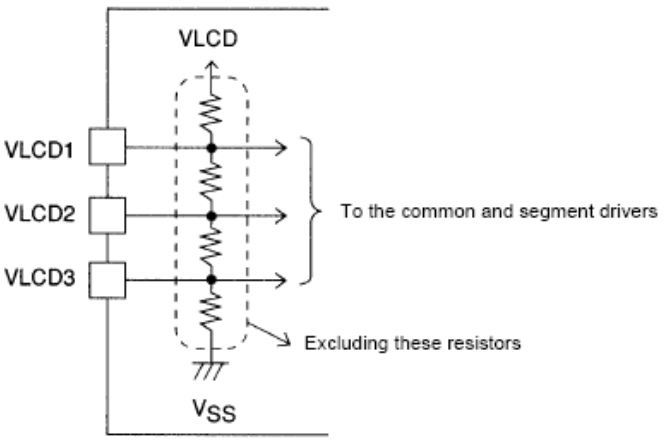

Figure 1

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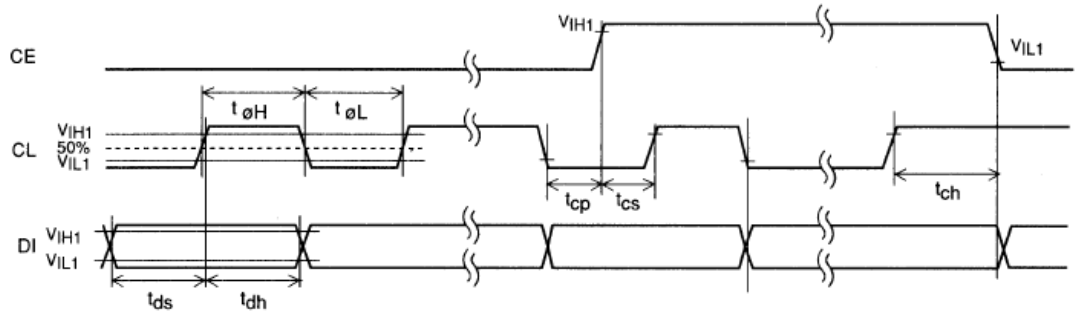
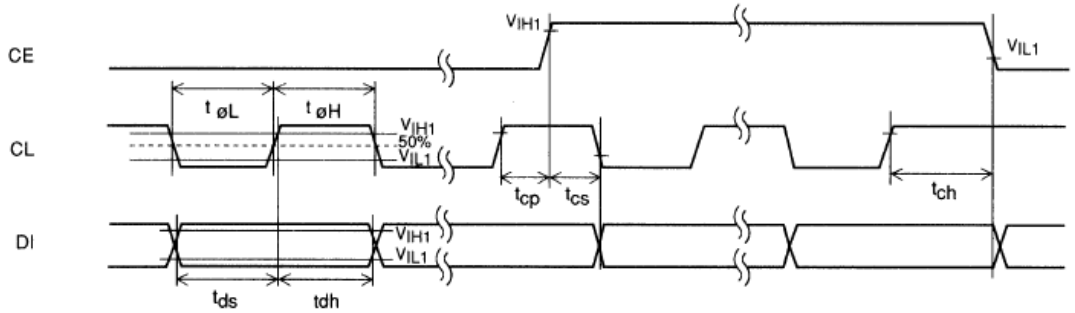
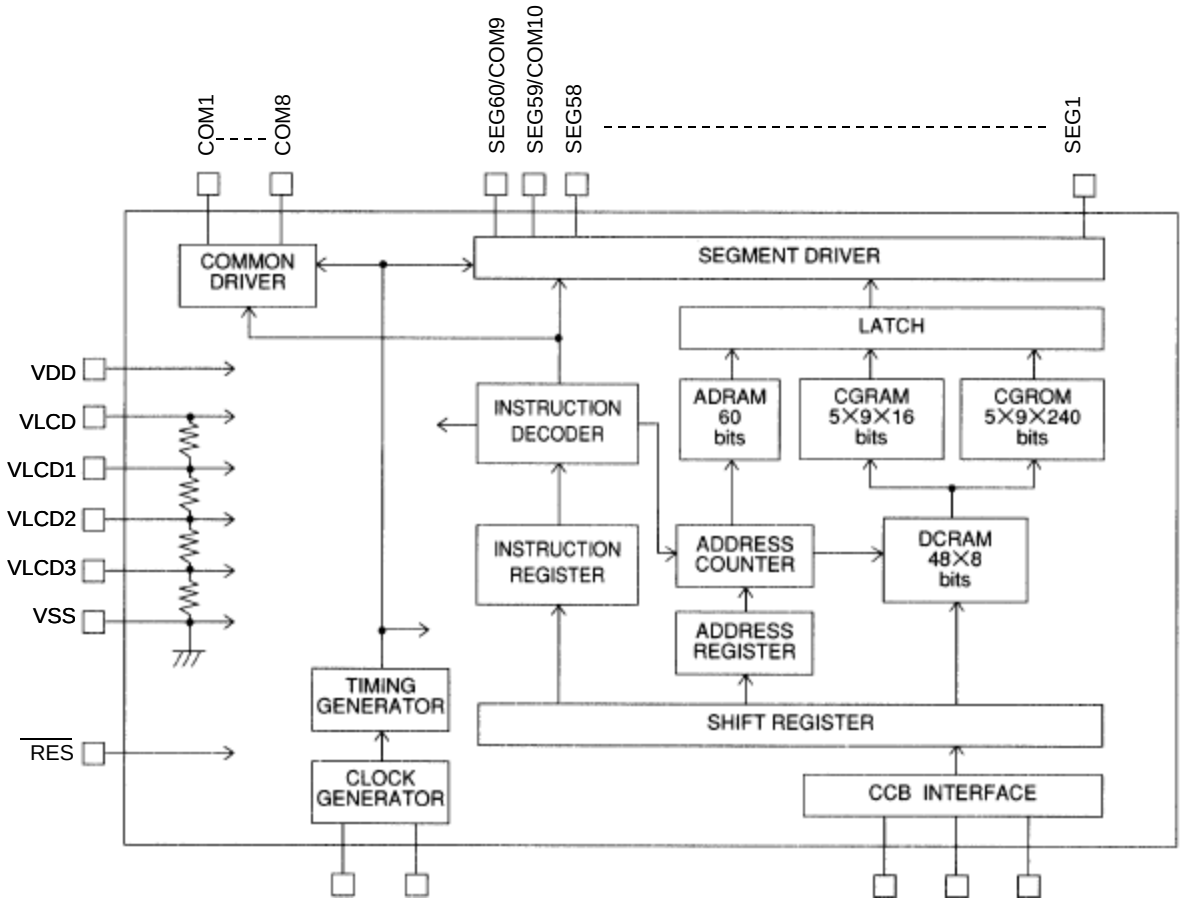
• **When CL is stopped at the low level**



• **When CL is stopped at the high level**



Diagram



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Pin Functions

Pin	Pin No. LC75811E	Pin No. LD75811W	Function	Active	I/O	Handling when unused
SEG1 to SEG58 **SEG59/COM10** **SEG60/COM9**	1 to 58 59 60	79, 80 1 to 56 57 58	**Segment driver outputs.** **The SEG59/COM10 and SEG60/COM9 pins can be used as common driver outputs under the "set display Technique"instruction.**	-	O	OPEN
COM1 to COM8	68 to 61	66 to 59	Common driver outputs.	-	O	OPEN
OSCI	76	74	Oscillator connections. An oscillator circuit is formed by connecting an external resistor and capacitor at these pins.	-	I	GND
OSCO	75	73		-	O	OPEN
CE	78	76	Serial data transfer inputs. These pins are connected to the microcontroller. CE: Chip enable CL: Synchronization clock DI: Transfer data	H	I	GND
CL	79	77			I	
DI	80	78		-	I	
$\overline{\text{RES}}$	77	75	Reset signal input. • When RES is low (VSS): • Display off SEG1 to SEG58 = "L" (Vss) SEG59/COM10 and SEG60/COM9 = "L" (Vss) COM1 to COM8 = "L" (VSS). • Serial data transfer is disabled. • The OSCI/OSCO pin oscillator is stopped. • When RES is high (VDD): • Display on after a "display on/off control" (display on state setting) instruction is executed. • Serial data transfers are enabled. • The OSCI/OSCO pin oscillator operates.	L	I	GND
VLCD1	71	69	Used for applying the LCD drive 3/4 bias voltage externally.	-	I	OPEN
VLCD2	72	70	Used for applying the LCD drive 2/4 bias voltage externally.	-	I	OPEN
VLCD3	73	71	Used for applying the LCD drive 1/4 bias voltage externally.	-	I	OPEN
VDD	69	69	Logic block power supply connection. Provide a voltage of between 2.7 and 6.0 V.	-	-	-
VLCD	70	68	LCD driver block power supply connection. Provide a voltage of between 4.5 and 10.0 V.	-	-	-
VSS	74	72	Power supply connection. Connect to ground.	-	-	-

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Block Functions

- **AC (address counter)**
  AC is a counter that provides the addresses used for DCRAM and ADRAM.
  The address is automatically modified internally, and the LCD display state is retained.
- **DCRAM (data control RAM)**
  DCRAM is RAM that is used to store display data expressed as 8-bit character codes. (These character codes are converted to 5 ´ 7, 5 ´ 8, or 5 ´ 9 dot matrix character patterns using CGROM or CGRAM.)
  DCRAM has a capacity of 48 ´ 8 bits, and can hold 48 characters. The table below lists the correspondence between the 6-bit DCRAM address
  loaded into AC and the display position on the LCD panel.

• When the DCRAM address loaded into AC is 00H.

Display digit	1	2	3	4	5	6	7	8	9	10	11	12
DCRAM address (hexadecimal)	00	01	02	03	04	05	06	07	08	09	0A	0B

However, when the display shift is performed by specifying MDATA, the DCRAM address shifts as shown below.

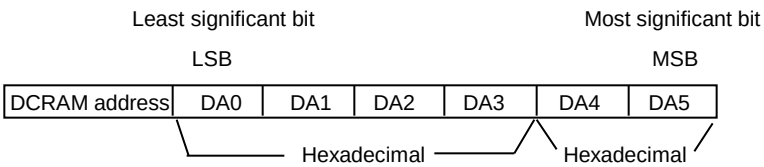
Display digit	1	2	3	4	5	6	7	8	9	10	11	12
DCRAM address (hexadecimal)	01	02	03	04	05	06	07	08	09	0A	0B	0C

(Left shift)

Display digit	1	2	3	4	5	6	7	8	9	10	11	12
DCRAM address (hexadecimal)	2F	00	01	02	03	04	05	06	07	08	09	0A

(Right shift)

Note:*2. The DCRAM addresses are expressed in hexadecimal.



Example: When the DCRAM address is 2EH.

DA0	DA1	DA2	DA3	DA4	DA5
0	1	1	1	0	1

Note:*3. 5 X 7 dots ... 12-digit display 5X 7 dots
5 X 8 dots ... 12-digit display 4X 8 dots
5 X 9 dots ... 12-digit display 3X 9 dots

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• ADRAM (Additional data RAM)

ADRAM is RAM used to store the ADATA display data. ADRAM has a capacity of 12 ´ 5 bits, and the stored display data is displayed directly without the use of CGROM or CGRAM. The table below lists the correspondence between the 4-bit ADRAM address loaded into AC and the display position on the LCD panel.

• When the ADRAM address loaded into AC is 0H. (Number of digit displayed: 12)

Display digit	1	2	3	4	5	6	7	8	9	10	11	12
ADRAM address (hexadecimal)	0	1	2	3	4	5	6	7	8	9	A	B

However, when the display shift is performed by specifying ADATA, the ADRAM address shifts as shown below.

Display digit	1	2	3	4	5	6	7	8	9	10	11	12
ADRAM address (hexadecimal)	1	2	3	4	5	6	7	8	9	A	B	0

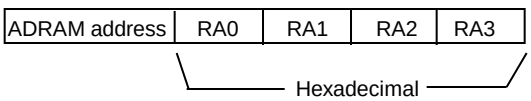
(Left shift)

Display digit	1	2	3	4	5	6	7	8	9	10	11	12
ADRAM address (hexadecimal)	B	0	1	2	3	4	5	6	7	8	9	A

(Right shift)

Note: *4. The ADRAM addresses are expressed in hexadecimal.

Least significant bit Most significant bit



Example: When the ADRAM address is AH

RA0	RA1	RA2	RA3
0	1	0	1

Note: *5. 5 ´ 7 dots ... 12-digit display 5 dots
5 ´ 8 dots ... 12-digit display 4 dots
5 ´ 9 dots ... 12-digit display 3 dots

• CGROM (Character generator ROM)

CGROM is ROM used to generate the 240 kinds of 5 x 7, 5 x 8, or 5 x 9 dot matrix character patterns from the 8-bit character codes. CGROM has a capacity of 240 ´ 45 bits. When a character code is written to DCRAM, the character pattern stored in CGROM corresponding to the character code is displayed at the position on the LCD corresponding to the DCRAM address loaded into AC.

• CGRAM (Character generator RAM)

CGRAM is RAM to which user programs can freely write arbitrary character patterns. Up to 16 kinds of 5 x 7, 5 x 8, or 5 x 9 dot matrix character patterns can be stored. CGRAM has a capacity of 16 x 45 bits.

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Reset Function

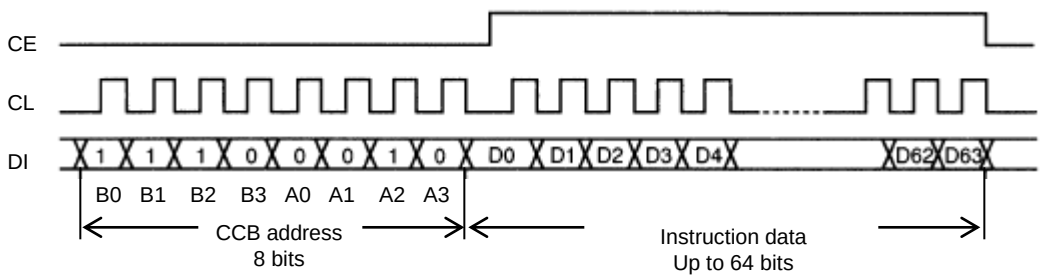
**The LD3811 are reset when a low level is applied to the RES pin at power on and, in normal mode.
On a reset the LD3811 create a display with all LCD panels turned off. However, after a reset applications must set the contents of DCRAM, ADRAM, and CGRAM before turning on display with a "display on/off control" instruction since the contents of these memories are undefined. That is, applications must execute the following instructions.**

- **Set display technique**
- **DCRAM data write**
- **ADRAM data write (If ADRAM is used.)**
- **CGRAM data write (If CGRAM is used.)**
- **Set AC address**

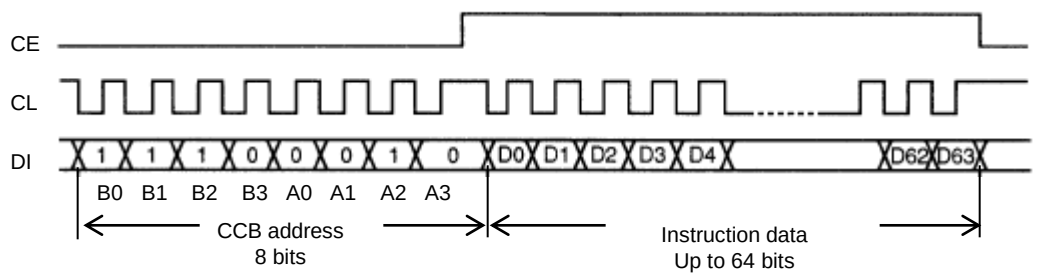
**After executing the above instructions, applications must turn on the display with a "display on/off control" instruction.
Note that when applications turn off in the normal mode, applications must turn off the display with a "display on/off control" instruction. (See the detailed instruction descriptions.)**

Serial Data Transfer Format

- **When CL is stopped at the low level**



- **When CL is stopped at the high level**



- **CCB address: 47H**
- **D0 to D63: Instruction data**

The data is acquired on the rising edge of the CL signal and latched on the falling edge of the CE signal. When transferring instruction data from the microcontroller, applications must assure that the time from the transfer of one set of instruction data until the next instruction data transfer is significantly longer than the instruction execution time.

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Instruction Table

Instruction	D0	D1...D39	D40	D41	D42	D43	D44	D45	D46	D47	D48	D49	D50	D51	D52	D53	D54	D55	D56	D57	D58	D59	D60	D61	D62	D63	Execution time *8
Set display technique																			DT1	DT2	X	X	0	0	0	1	0 µs
Display on/off control			DG1	DG2	DG3	DG4	DG5	DG6	DG7	DG8	DG9	DG10	DG11	DG12	X	X	X	X	M	A	SC	BU	0	0	1	0	0 µs/27 µs *9
Display shift																			M	A	R/L	X	0	0	1	1	27 µs
Set AC address											DA0	DA1	DA2	DA3	DA4	DA5	X	X	RA0	RA1	RA2	RA3	0	1	0	0	27 µs
DCRAM data write *6			AC0	AC1	AC2	AC3	AC4	AC5	AC6	AC7	DA0	DA1	DA2	DA3	DA4	DA5	X	X	IM	X	X	X	0	1	0	1	27 µs
ADRAM data write *7			AD1	AD2	AD3	AD4	AD5	X	X	X	RA0	RA1	RA2	RA3	X	X	X	X	IM	X	X	X	0	1	1	0	27 µs
CGRAM data write	CD1	CD2...CD40	CD41	CD42	CD43	CD44	CD45	X	X	X	CA0	CA1	CA2	CA3	CA4	CA5	CA6	CA7	X	X	X	X	0	1	1	1	27 µs

Notes:*6.The data format differs when the "DCRAM data write" instruction is executed in the increment mode (IM = 1).
(See detailed instruction descriptions .)
***7.The data format differs when the "ADRAM data write" instruction is executed in the increment mode (IM = 1).**
(See detailed instruction descriptions.)
***8.The execution times listed here apply when fosc = 300 kHz. The execution times differ when the oscillator frequency fosc differs.**

Example: When fosc = 210 kHz
300
27 µs ´ ——= 39 µs
210
***9.When the power saving mode (BU = 1) is set, the execution time is 27 µs (when fosc = 300 kHz).**

Detailed Instruction Descriptions

• Set display technique ... <Sets the display technique>

		Code					
D56	D57	D58	D59	D60	D61	D62	D63
DT1	DT2	X	X	0	0	0	1

DT1, DT2: Setting the display technique

DT1	DT2	Display technique	Output pins	
			SEG60/COM9	SEG59/COM10
0	0	1/8 duty, 1/4 bias drive	**SEG60**	**SEG59**
1	0	1/9 duty, 1/4 bias drive	COM9	**SEG59**
0	1	1/10 duty, 1/4 bias drive	COM9	COM10

Note: *10. Sn (n = 59, 60): Segment outputs
COMn (n = 9, 10): Common outputs

• Display on/off control ... <Turns the display on or off>

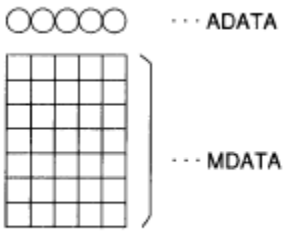
Code																							
D40	D41	D42	D43	D44	D45	D46	D47	D48	D49	D50	D51	D52	D53	D54	D55	D56	D57	D58	D59	D60	D61	D62	D63
DG1	DG2	DG3	DG4	DG5	DG6	DG7	DG8	DG9	DG10	DG11	DG12	X	X	X	X	M	A	SC	BU	0	0	1	0

M, A: Specifies the data to be turned on or off.

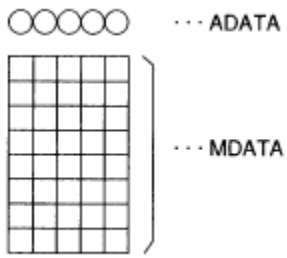
M	A	Display operating state
0	0	Both MDATA and ADATA are turned off (The display is forcibly turned off regardless of the DG1 to DG12 data.)
0	1	Only ADATA is turned on (The ADATA of display digits specified by the DG1 to DG12 data are turned on.)
1	0	Only MDATA is turned on (The MDATA of display digits specified by the DG1 to DG12 data are turned on.)
1	1	Both MDATA and ADATA are turned on (The MDATA and ADATA of display digits specified by the DG1 to DG12 data are turned on.)

Note: *11. MDATA, ADATA

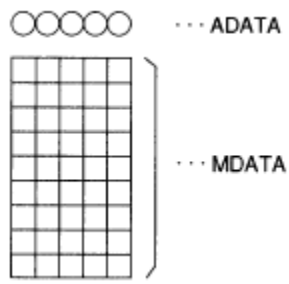
5 X 7 dot matrix display



5 X 8 dot matrix display



5 X 9 dot matrix display



DG1 to DG12: Specifies the display digit

Display digit	1	2	3	4	5	6	7	8	9	10	11	12
Display digit data	DG1	DG2	DG3	DG4	DG5	DG6	DG7	DG8	DG9	DG10	DG11	DG12

For example, if DG1 to DG6 are 1, and DG7 to DG12 are 0, then display digits 1 to 6 will be turned on, and display digits 7 to 12 will be turned off (blanked

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SC: Controls the common and segment output pins.

SC	Common and segment output pin states
0	Output of LCD drive waveforms
1	Fixed at the VSS level (all segments off)

Note: *12. When SC is 1, the SEG1 to SEG60 and COM1 to COM10 output pins are set to the VSS level, regardless of the M, A, and DG1 to DG12 data.

BU: Controls the normal mode and power saving mode.

BU	Mode
0	Normal mode
1	Power saving mode (In this mode, the OSCI and OSCO pins oscillator is stopped, and the common and segment pins are set to the VSS level. In this mode, instructions other than the “display on/off control” instruction cannot be executed. Thus applications must set the LSI to normal mode before executing any of the other instructions.)

• Display shift ... <Shifts the display>

Code							
D56	D57	D58	D59	D60	D61	D62	D63
M	A	R/L	X	0	0	1	1

M, A: Specifies the data to be shifted

M	A	Shift operating state
0	0	Neither MDATA nor ADATA is shifted
0	1	Only ADATA is shifted
1	0	Only MDATA is shifted
1	1	Both MDATA and ADATA are shifted

R/L: Shift direction specification

R/L	Shift direction
0	Left shift
1	Right shift

• Set AC address... <Specifies the DCRAM and ADRAM address for AC>

Code															
D48	D49	D50	D51	D52	D53	D54	D55	D56	D57	D58	D59	D60	D61	D62	D63
DA0	DA1	DA2	DA3	DA4	DA5	X	X	RA0	RA1	RA2	RA3	0	1	0	0

DA0 to DA5: DCRAM address

DA0	DA1	DA2	DA3	DA4	DA5

LSB
Least significant bit

MSB
Most significant bit

RA0 to RA3: ADRAM address

RA0	RA1	RA2	RA3

LSB
Least significant bit

MSB
Most significant bit

This instruction loads the 6-bit DCRAM address DA0 to DA5 and the 4-bit ADRAM address RA0 to RA3 into the AC.

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• DCRAM data write ... <Specifies the DCRAM address and stores data at that address>

Code																							
D40	D41	D42	D43	D44	D45	D46	D47	D48	D49	D50	D51	D52	D53	D54	D55	D56	D57	D58	D59	D60	D61	D62	D63
AC0	AC1	AC2	AC3	AC4	AC5	AC6	AC7	DA0	DA1	DA2	DA3	DA4	DA5	X	X	IM	X	X	X	0	1	0	1

DA0 to DA5: DCRAM address

DA0	DA1	DA2	DA3	DA4	DA5
LSB					MSB
Least significant bit					Most significant bit

AC0 to AC7: DCRAM data (character code)

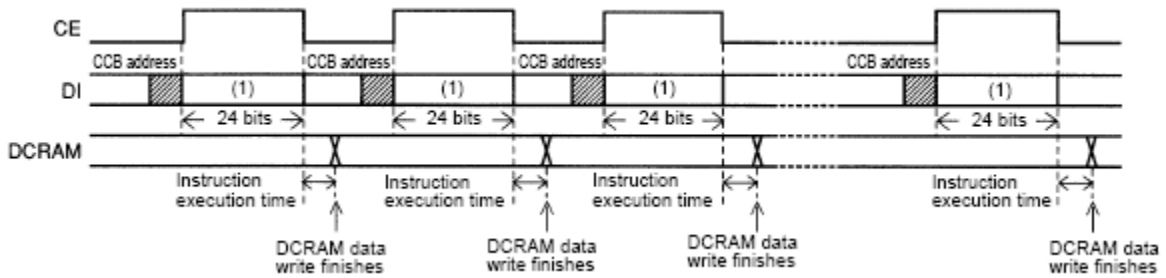
AC0	AC1	AC2	AC3	AC4	AC5	AC6	AC7
LSB							MSB
Least significant bit							Most significant bit

This instruction writes the 8 bits of data AC0 to AC7 to DCRAM. This data is a character code, and is converted to a 5 X 7, 5 X 8, or 5 X 9 dot matrix display data using CGROM or CGRAM.

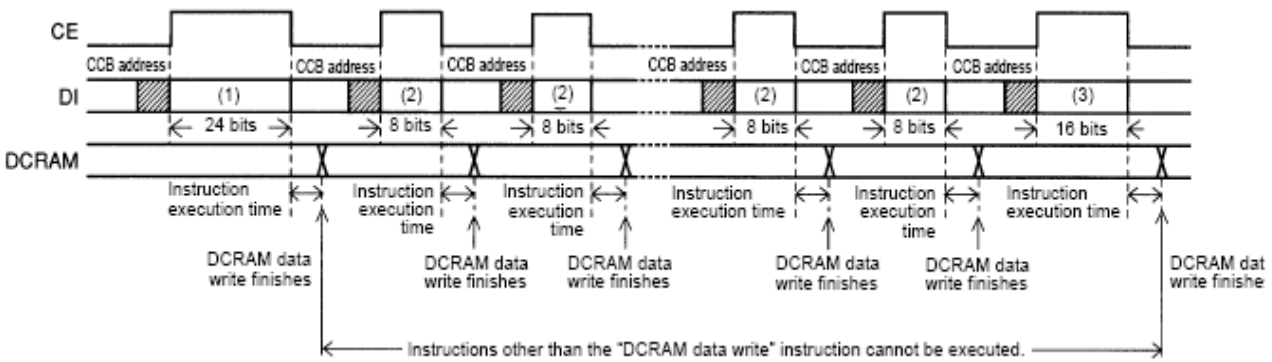
IM: Setting the method of writing data to DCRAM

IM	DCRAM data write method
0	Normal DCRAM data write (Specifies the DCRAM address and writes the DCRAM data.).
1	Increment mode DCRAM data write (Increments the DCRAM address by +1 each time data is written to DCRAM.)

Notes: *13.
· DCRAM data write method when IM = 0



· DCRAM data write method when IM = 1 (Instructions other than the "DCRAM data write" instruction cannot be executed.)



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Data format at (1) (24 bits)

Code																							
D40	D41	D42	D43	D44	D45	D46	D47	D48	D49	D50	D51	D52	D53	D54	D55	D56	D57	D58	D59	D60	D61	D62	D63
AC0	AC1	AC2	AC3	AC4	AC5	AC6	AC7	DA0	DA1	DA2	DA3	DA4	DA5	X	X	IM	X	X	X	0	1	0	1

Data format at (2) (8 bits)

Code							
D56	D57	D58	D59	D60	D61	D62	D63
AC0	AC1	AC2	AC3	AC4	AC5	AC6	AC7

Data format at (3) (16 bits)

Code															
D48	D49	D50	D51	D52	D53	D54	D55	D56	D57	D58	D59	D60	D61	D62	D63
AC0	AC1	AC2	AC3	AC4	AC5	AC6	AC7	0	X	X	X	0	1	0	1

- **ADRAM data write ... <Specifies the ADRAM address and stores data at that address>**

Code																							
D40	D41	D42	D43	D44	D45	D46	D47	D48	D49	D50	D51	D52	D53	D54	D55	D56	D57	D58	D59	D60	D61	D62	D63
AD1	AD2	AD3	AD4	AD5	X	X	X	RA0	RA1	RA2	RA3	X	X	X	X	IM	X	X	X	0	1	1	0

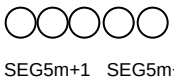
RA0 to RA3: ADRAM address

RA0	RA1	RA2	RA3

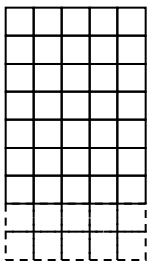
LSB
Least significant bit

MSB
Most significant bit

AD1 to AD5: ADATA display data
In addition to the 5 X 7, 5 X 8, or 5 X 9 dot matrix display data (MDATA), this LSI supports direct display of the five accessory display segments provided in each digit as ADATA. This display function does not use CGROM or CGRAM. The figure below shows the correspondence between the data and the display. When ADn = 1 (where n is an integer between 1 and 5) the segment corresponding to that data will be turned on.



SEG5m+1 SEG5m+5 (m is an integer between 0 and 11)



ADATA	Corresponding output pin
AD1	SEG5m +1 (m is an integer 0 - 11)
AD2	SEG5m + 2
AD3	SEG5m + 3
AD4	SEG5m + 4
AD5	SEG5m + 5

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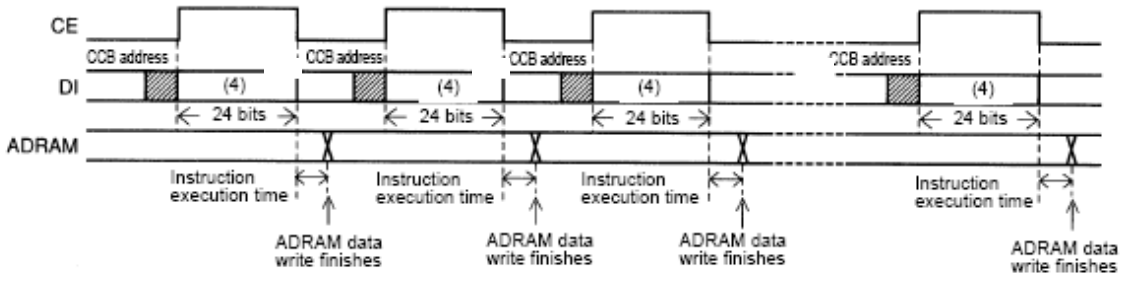
IM: Setting the method of writing data to ADRAM

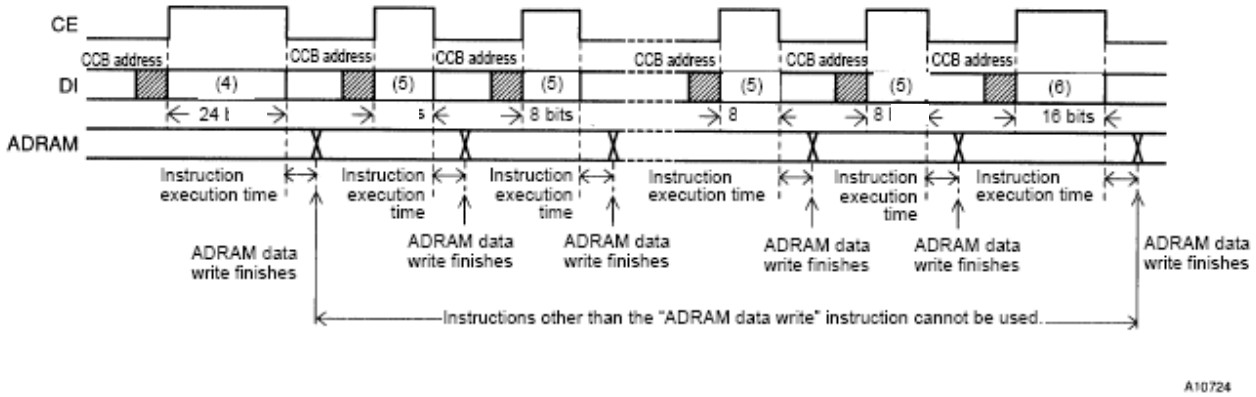
IM	ADRAM data write method
0	Normal ADRAM data write (Specifies the ADRAM address and writes the ADRAM data.)
1	Increment mode ADRAM data write (Increments the ADRAM address by +1 each time data is written to ADRAM.)

Notes: *14.

· ADRAM data write method when IM = 0



· ADRAM data write method when IM = 1 (Instructions other than the "ADRAM data write" instruction cannot be used.)



Data format at (4) (24 bits)

Code																							
D40	D41	D42	D43	D44	D45	D46	D47	D48	D49	D50	D51	D52	D53	D54	D55	D56	D57	D58	D59	D60	D61	D62	D63
AD1	AD2	AD3	AD4	AD5	X	X	X	RA0	RA1	RA2	RA3	X	X	X	X	IM	X	X	X	0	1	1	0

X: don't care

Data format at (5) (8 bits)

Code							
D56	D57	D58	D59	D60	D61	D62	D63
AD1	AD2	AD3	AD4	AD5	X	X	X

X: don't care

Data format at (6) (16 bits)

Code															
D48	D49	D50	D51	D52	D53	D54	D55	D56	D57	D58	D59	D60	D61	D62	D63
AD1	AD2	AD3	AD4	AD5	X	X	X	0	X	X	X	0	1	1	0

X: don't care

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• CGRAM data write ... <Specifies the CGRAM address and stores data at that address>

Code															
D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
CD1	CD2	CD3	CD4	CD5	CD6	CD7	CD8	CD9	CD10	CD11	CD12	CD13	CD14	CD15	CD16

Code															
D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28	D29	D30	D31
CD17	CD18	CD19	CD20	CD21	CD22	CD23	CD24	CD25	CD26	CD27	CD28	CD29	CD30	CD31	CD32

Code															
D32	D33	D34	D35	D36	D37	D38	D39	D40	D41	D42	D43	D44	D45	D46	D47
CD33	CD34	CD35	CD36	CD37	CD38	CD39	CD40	CD41	CD42	CD43	CD44	CD45	X	X	X

Code															
D48	D49	D50	D51	D52	D53	D54	D55	D56	D57	D58	D59	D60	D61	D62	D63
CA0	CA1	CA2	CA3	CA4	CA5	CA6	CA7	X	X	X	X	0	1	1	1

X: don't care

CA0 to CA7: CGRAM address

CA0	CA1	CA2	CA3	CA4	CA5	CA6	CA7

LSB
Least significant bit

MSB
Most significant bit

CD1 to CD45: CGRAM data (5 × 7, 5 × 8, or 5 × 9 dot matrix display data)
The bit CDn (where n is an integer between 1 and 45) corresponds to the 5 × 7, 5 × 8, or 5 × 9 dot matrix display data. The figure below shows that correspondence. The dots for which the corresponding data CDn is 1 will be turned on.

CD1	CD2	CD3	CD4	CD5
CD6	CD7	CD8	CD9	CD10
CD11	CD12	CD13	CD14	CD15
CD16	CD17	CD18	CD19	CD20
CD21	CD22	CD23	CD24	CD25
CD26	CD27	CD28	CD29	CD30
CD31	CD32	CD33	CD34	CD35
CD36	CD37	CD38	CD39	CD40
CD41	CD42	CD43	CD44	CD45

Note:*15. CD1 to CD35: 5 × 7 dot matrix display data
CD1 to CD40: 5 × 8 dot matrix display data
CD1 to CD45: 5 × 9 dot matrix display data

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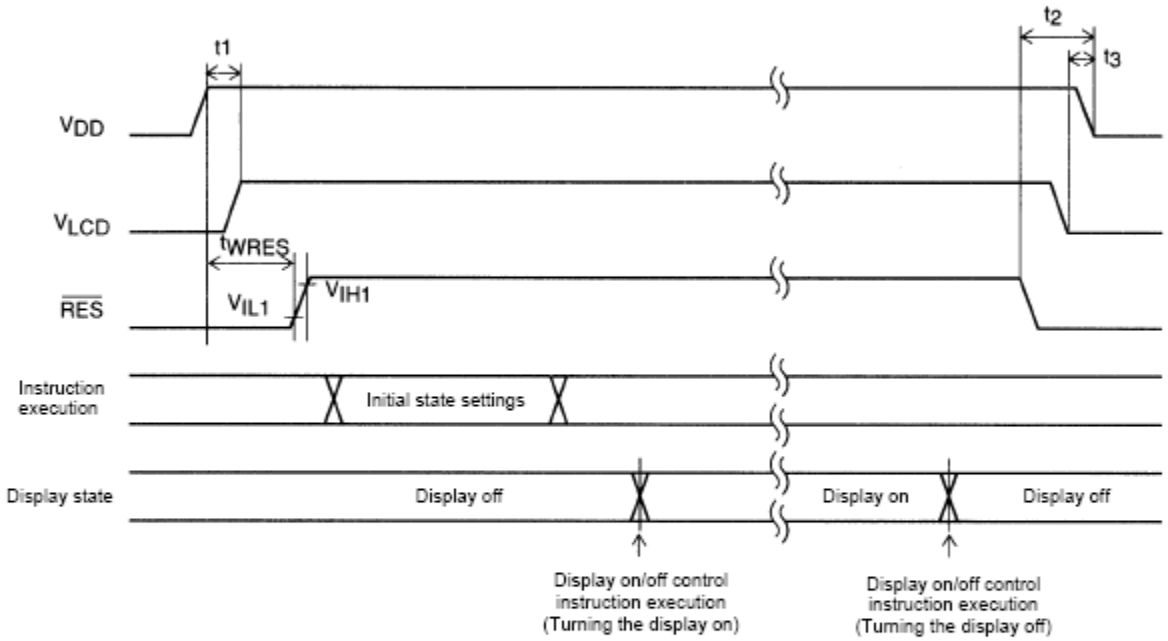
Notes on the Power On and Power Off Sequences

- At power on: Logic block power supply (V_{DD}) on → LCD driver block power supply (V_{LCD}) on
- At power off: LCD driver block power supply (V_{LCD}) off → Logic block power supply (V_{DD}) off

However, if the logic and LCD driver block use a shared power supply, then the power supplies can be turned on and off at the same time.



Initial state settings

- $t1 \geq 0$
- $t2 > 0$
- $t3 \geq 0$ ($t2 > t3$)
- t_{WRES}.....1 µs min

- Set display technique
- DCRAM data write
- ADRAM data write (If ADRAM is used.)
- CGRAM data write (If CGRAM is used.)
- Set AC address

Figure 3

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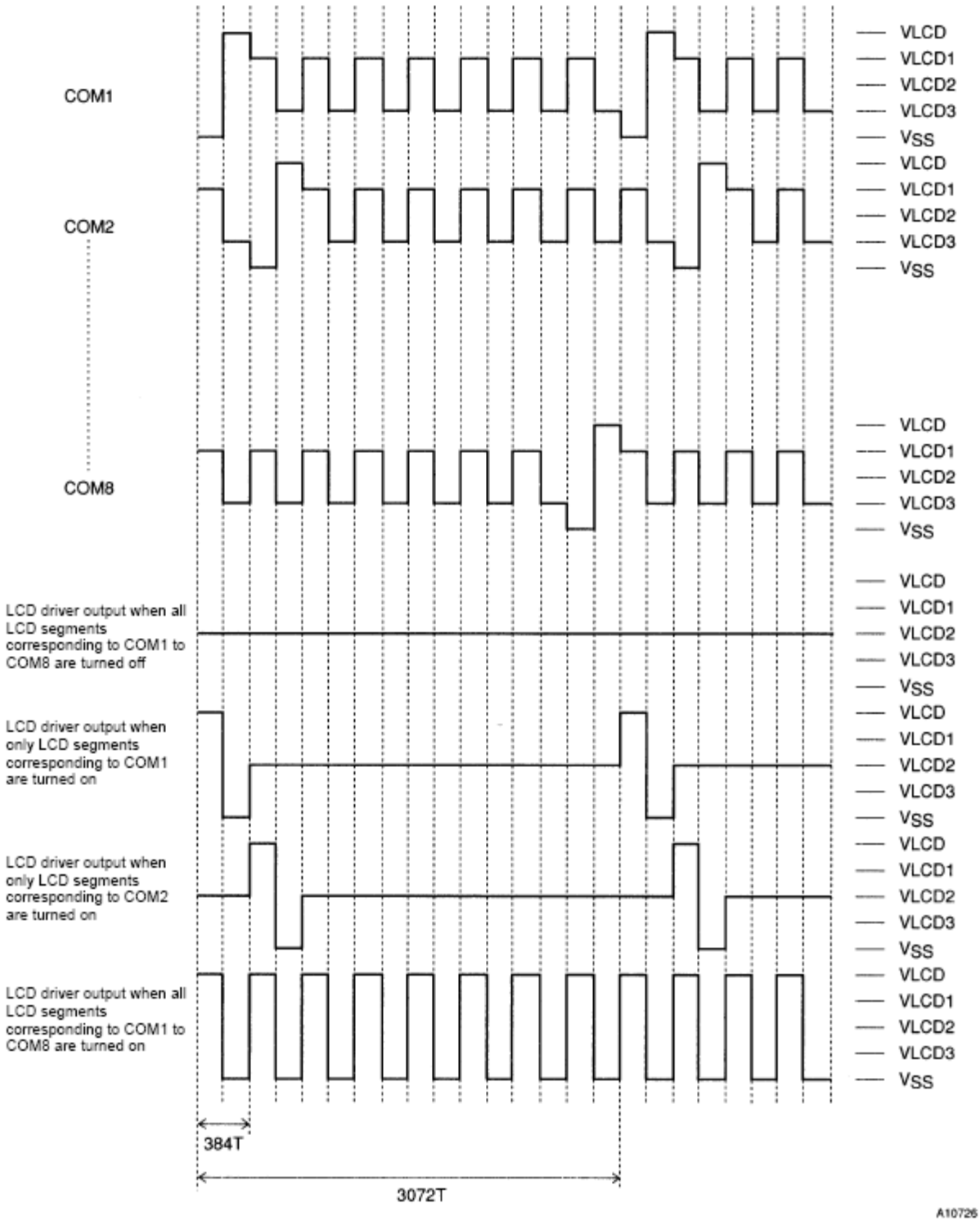
1/8 Duty, 1/4 Bias Drive Technique



$$T = \frac{1}{fosc}$$

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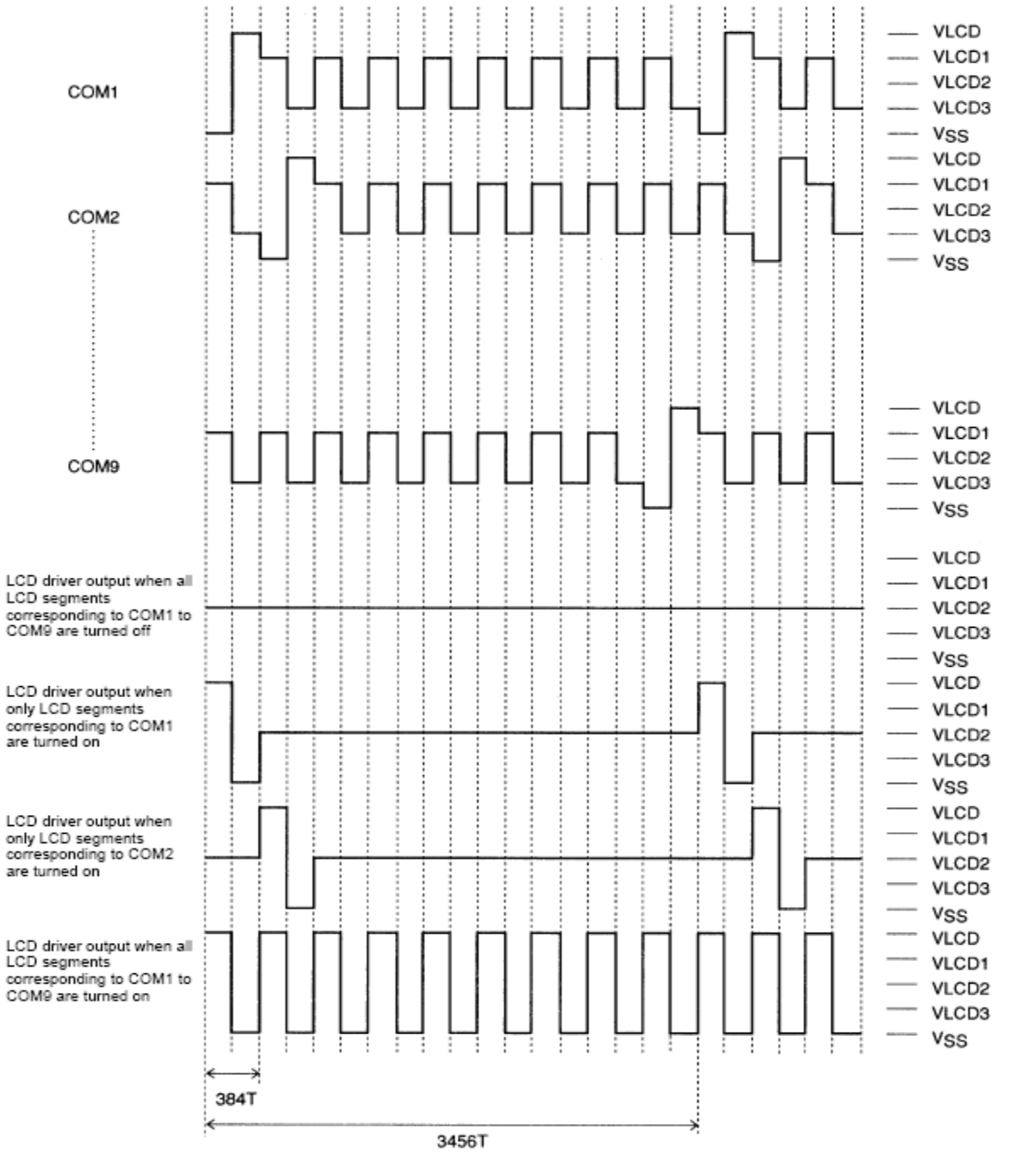
1/9 Duty, 1/4 Bias Drive Technique



$$T = \frac{1}{fosc}$$

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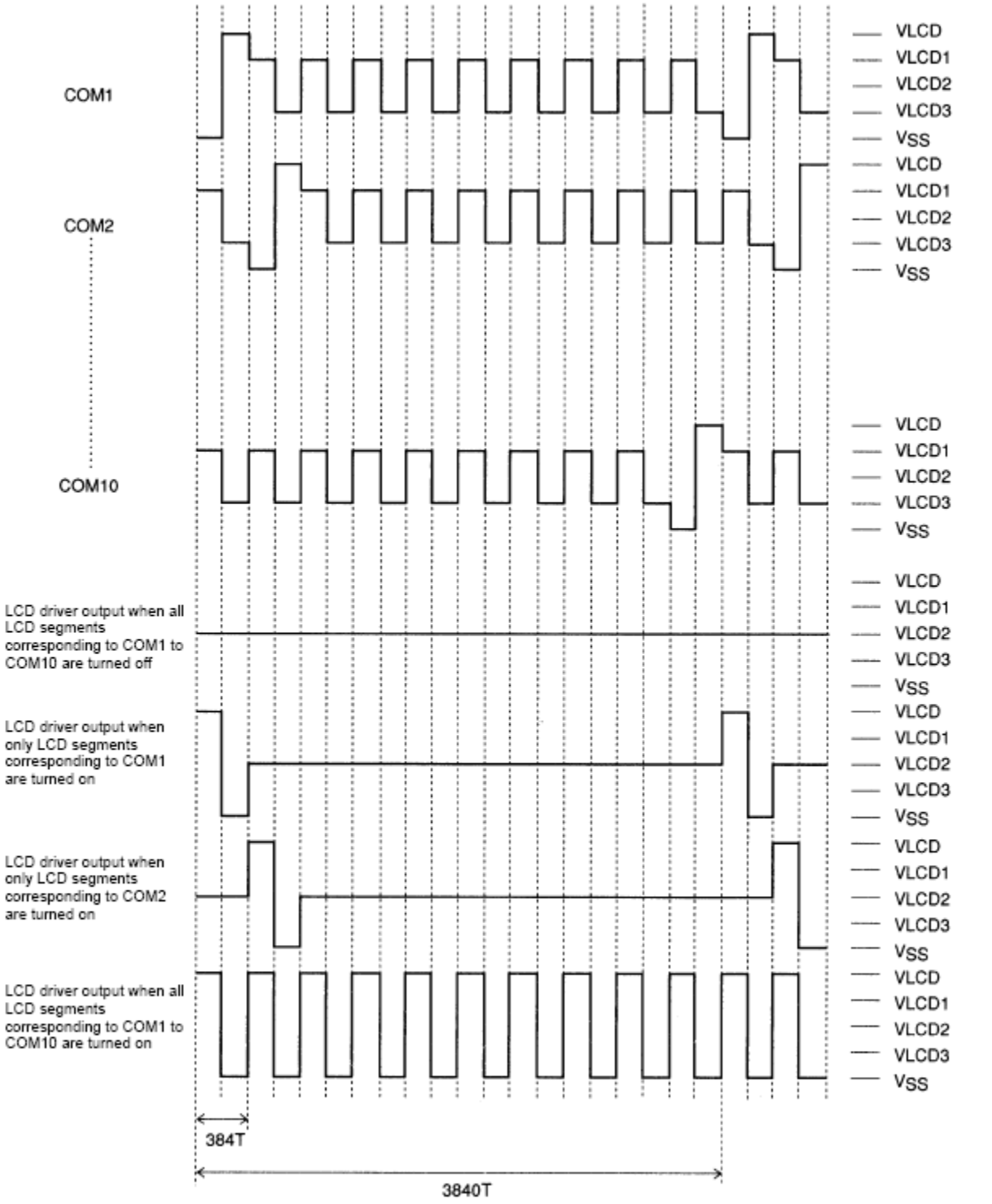
1/10 Duty, 1/4 Bias Drive Technique



$$T = \frac{1}{fosc}$$

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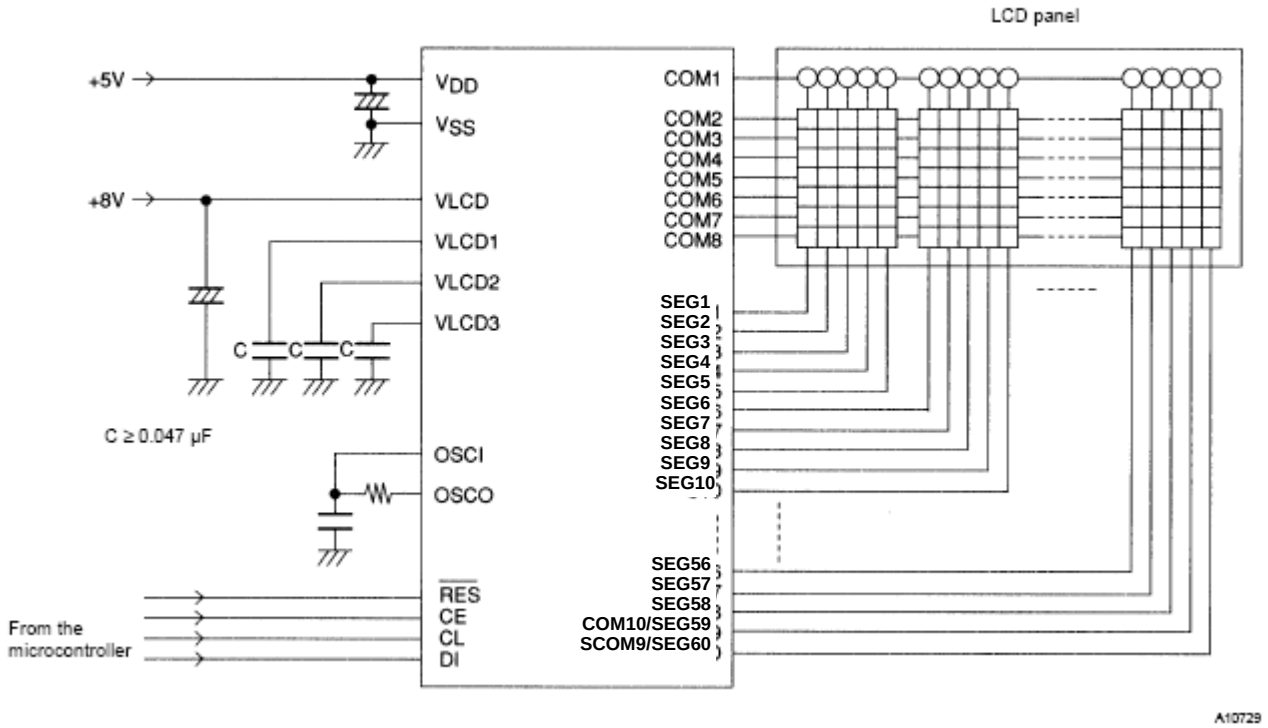
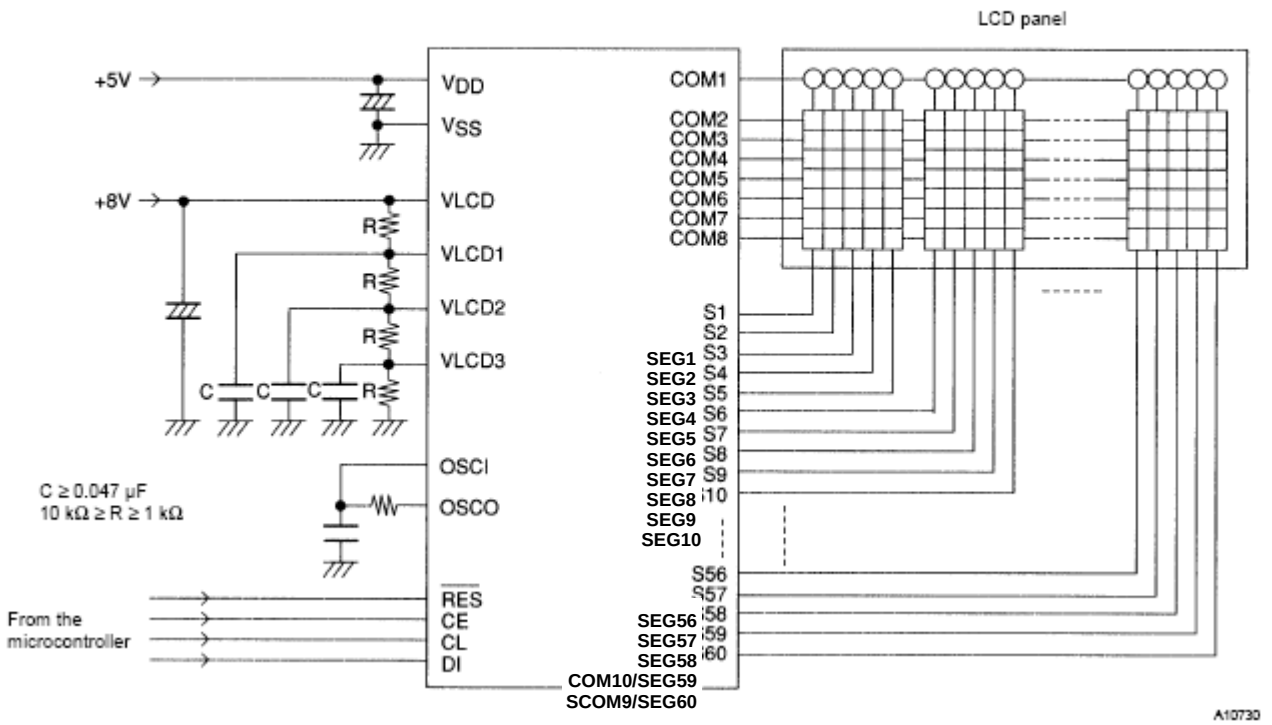
Sample Application Circuit 1

1/8 Duty, 1/4 Bias Drive (For use with normal panels)



Sample Application Circuit 2

1/8 Duty, 1/4 Bias Drive (For use with large panels)



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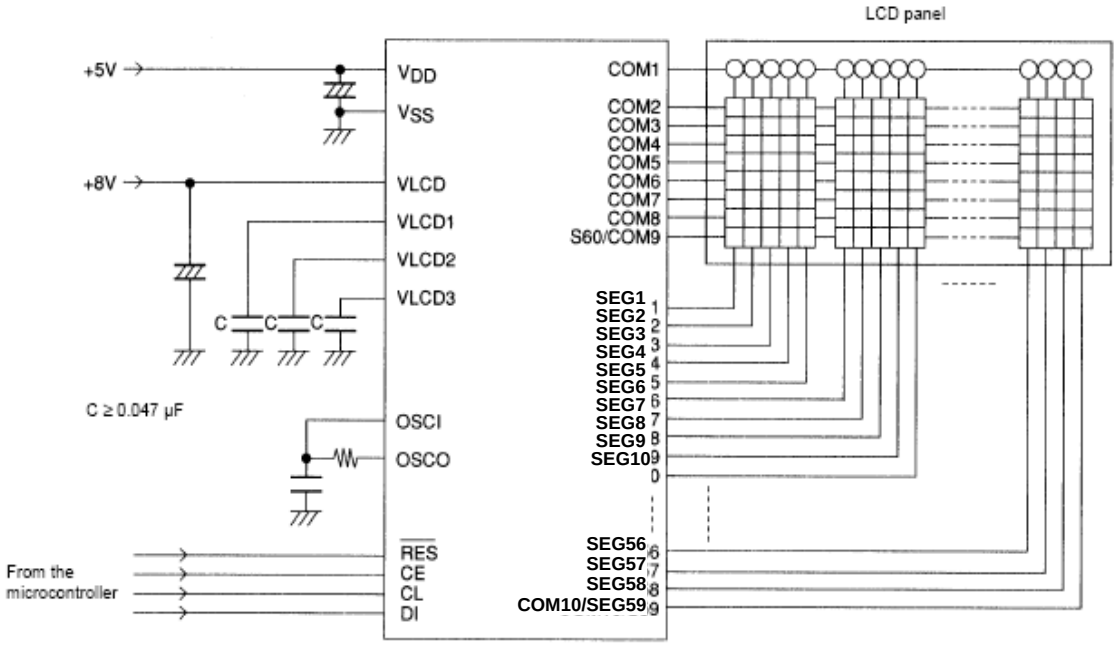
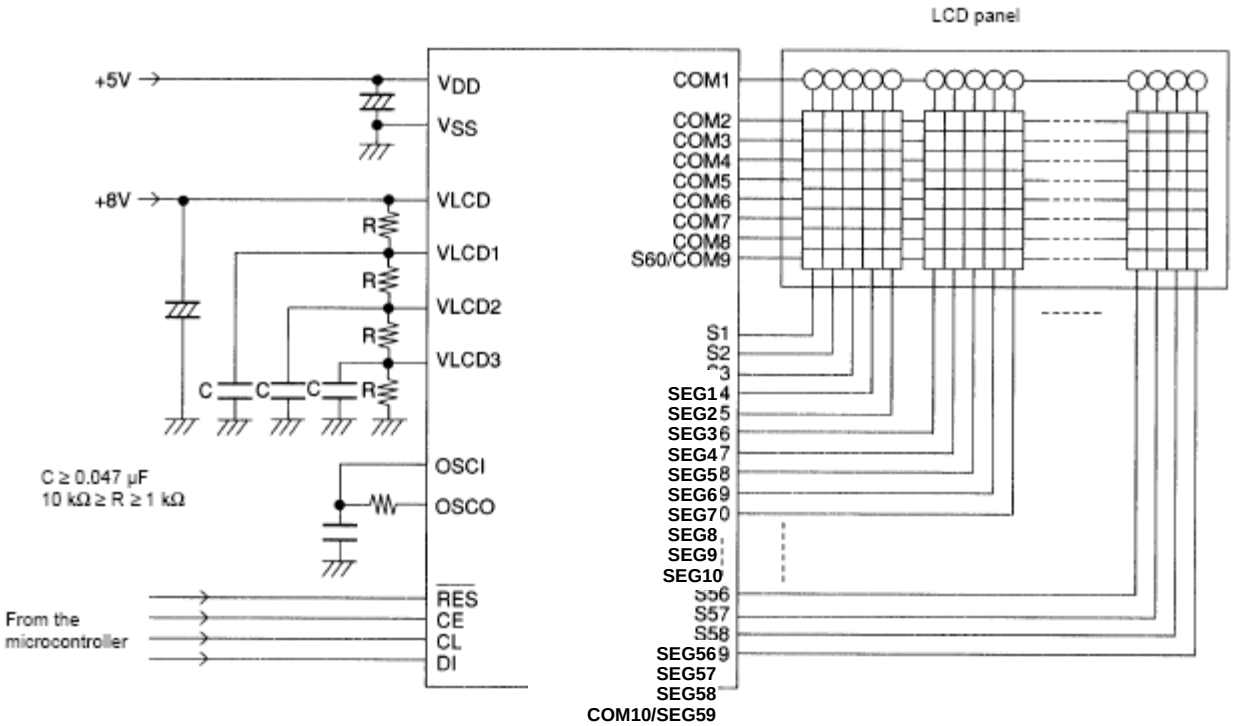
Sample Application Circuit 3

1/9 Duty, 1/4 Bias Drive (For use with normal panels)



Sample Application Circuit 4

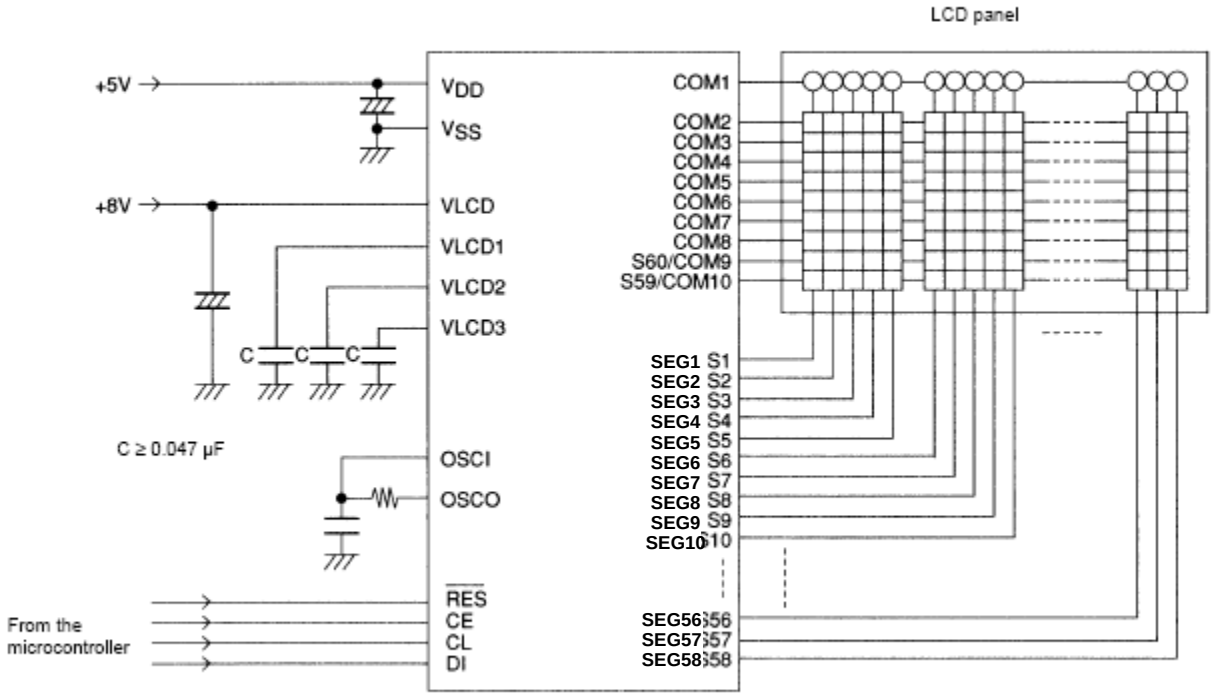
1/9 Duty, 1/4 Bias Drive (For use with large panels)



A10732

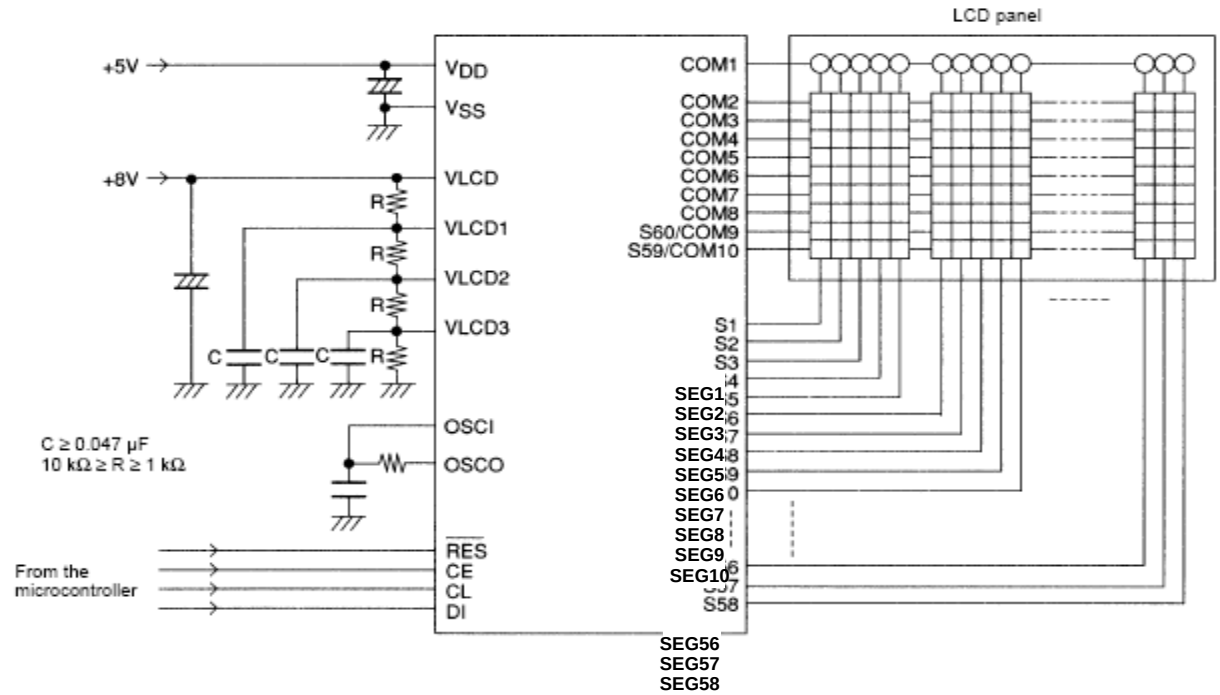
Sample Application Circuit 5

1/10 Duty, 1/4 Bias Drive (For use with normal panels)



Sample Application Circuit 6

1/10 Duty, 1/4 Bias Drive (For use with large panels)



A10734

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Sample Correspondence between Instructions and the Display

No.	Instruction (hexadecimal) LSB D40 to D43	D44 to D47	D48 to D51	D52 to D55	D56 to D59	MSB D60 to D63	Display	Operation
1	Power application (Initialization with the $\overline{RES}$ pin.)							Initializes the IC. The display is in the off state.
2	Set display technique				0	8		Sets to 1/8 duty 1/4 bias display drive technique
3	DCRAM data write (increment mode)							
	0	2	0	0	1	A		Writes the display data " " to DCRAM address 00H
4	DCRAM data write (increment mode)				3	5		Writes the display data "S" to DCRAM address 01H
5	DCRAM data write (increment mode)				1	4		Writes the display data "A" to DCRAM address 02H
6	DCRAM data write (increment mode)				E	4		Writes the display data "N" to DCRAM address 03H
7	DCRAM data write (increment mode)				9	5		Writes the display data "Y" to DCRAM address 04H
8	DCRAM data write (increment mode)				F	4		Writes the display data "O" to DCRAM address 05H
9	DCRAM data write (increment mode)				0	2		Writes the display data " " to DCRAM address 06H
10	DCRAM data write (increment mode)				C	4		Writes the display data "L" to DCRAM address 07H
11	DCRAM data write (increment mode)				3	5		Writes the display data "S" to DCRAM address 08H
12	DCRAM data write (increment mode)				9	4		Writes the display data "I" to DCRAM address 09H
13	DCRAM data write (increment mode)				0	2		Writes the display data " " to DCRAM address 0AH
14	DCRAM data write (increment mode)				0	2		Writes the display data " " to DCRAM address 0BH
15	DCRAM data write (increment mode)				C	4		Writes the display data "L" to DCRAM address 0CH
16	DCRAM data write (increment mode)				3	4		Writes the display data "C" to DCRAM address 0DH
17	DCRAM data write (increment mode)				7	3		Writes the display data "7" to DCRAM address 0EH
18	DCRAM data write (increment mode)				5	3		Writes the display data "5" to DCRAM address 0FH
19	DCRAM data write (increment mode)				8	3		Writes the display data "8" to DCRAM address 10H
20	DCRAM data write (increment mode)				1	3		Writes the display data "1" to DCRAM address 11H
21	DCRAM data write (increment mode)							
		1	3	0	A			Writes the display data "1" to DCRAM address 12H

Continued on next page.

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Continued from preceding page.

No.	Instruction (hexadecimal) LSB D40 to D43	D44 to D47	D48 to D51	D52 to D55	D56 to D59	MSB D60 to D63	Display	Operation
22	Set AC address		0	0	0	2		Loads the DCRAM address 00H and the ADRAM address 0H into AC
23	Display on/off control						S A N Y O L S I	Turns on the LCD for all digits (12 digits) in MDATA
	F	F	F	X	1	4		
24	Display shift				1	C	S A N Y O L S I L	Shifts the display (MDATA only) to the left
25	Display shift				1	C	A N Y O L S I L C	Shifts the display (MDATA only) to the left
26	Display shift				1	C	N Y O L S I L C 7	Shifts the display (MDATA only) to the left
27	Display shift				1	C	Y O L S I L C 7 5	Shifts the display (MDATA only) to the left
28	Display shift				1	C	O L S I L C 7 5 8	Shifts the display (MDATA only) to the left
29	Display shift				1	C	L S I L C 7 5 8 1	Shifts the display (MDATA only) to the left
30	Display shift				1	C	L S I L C 7 5 8 1 1	Shifts the display (MDATA only) to the left
31	Display on/off control							Set to power saving mode, turns off the LCD for all digits
	0	0	0	X	8	4		
32	Display on/off control						L S I L C 7 5 8 1 1	Turns on the LCD for all digits (12 digits) in MDATA
	F	F	F	X	1	4		
33	Set AC address		0	0	0	2	S A N Y O L S I	Loads the DCRAM address 00H and the ADRAM address 0H into AC

Note: *16. This example above assumes the use of 12 digits 5 × 7 dot matrix LCD. CGRAM and ADRAM are not used. X: don't care

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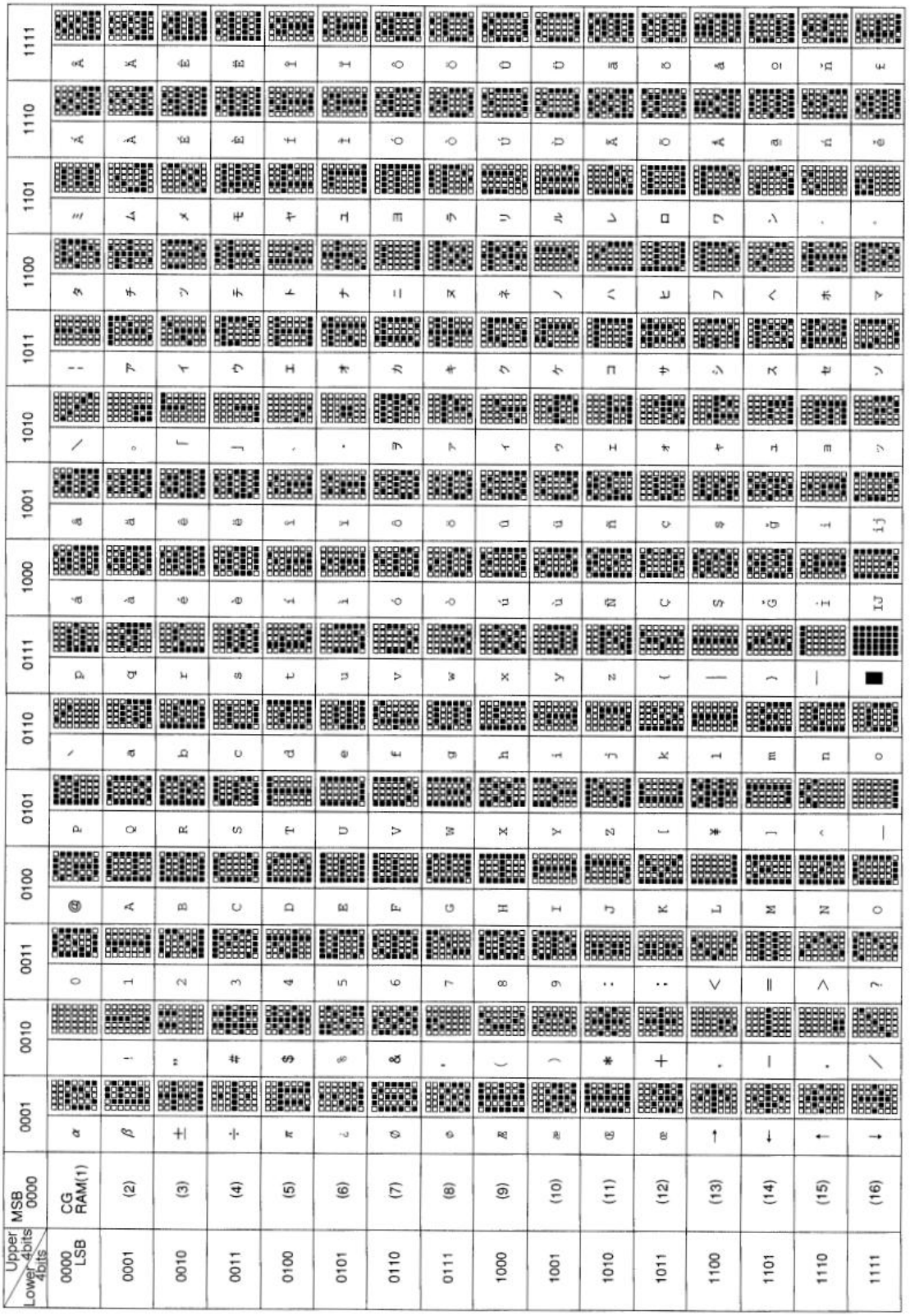
LD3811 Character Font (Standard)



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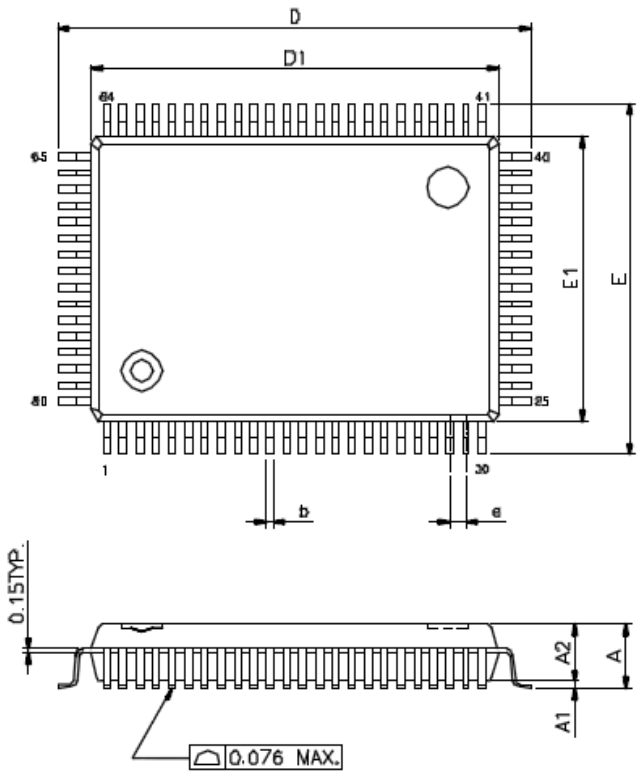
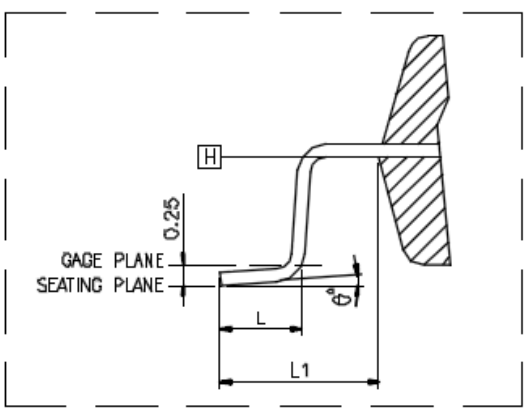
PACKAGE INFORMATION

80 QFP

Unit : mm





SYMBOLS	MIN.	NOM	MAX.
A	–	–	3.40
A1	0.25	–	0.50
A2	2.50	2.70	2.90
b	0.29	–	0.45
D		23.20 BASIC	
D1		20.00 BASIC	
e		0.8 BASIC	
E		17.20 BASIC	
E1		14.00 BASIC	
L	0.73	0.88	1.03
L1		1.60 REF.	
θ°	0	3.5	7

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