MN863584-D

1. TYPE

Gate driver IC with 244-pin output for TFT LCD

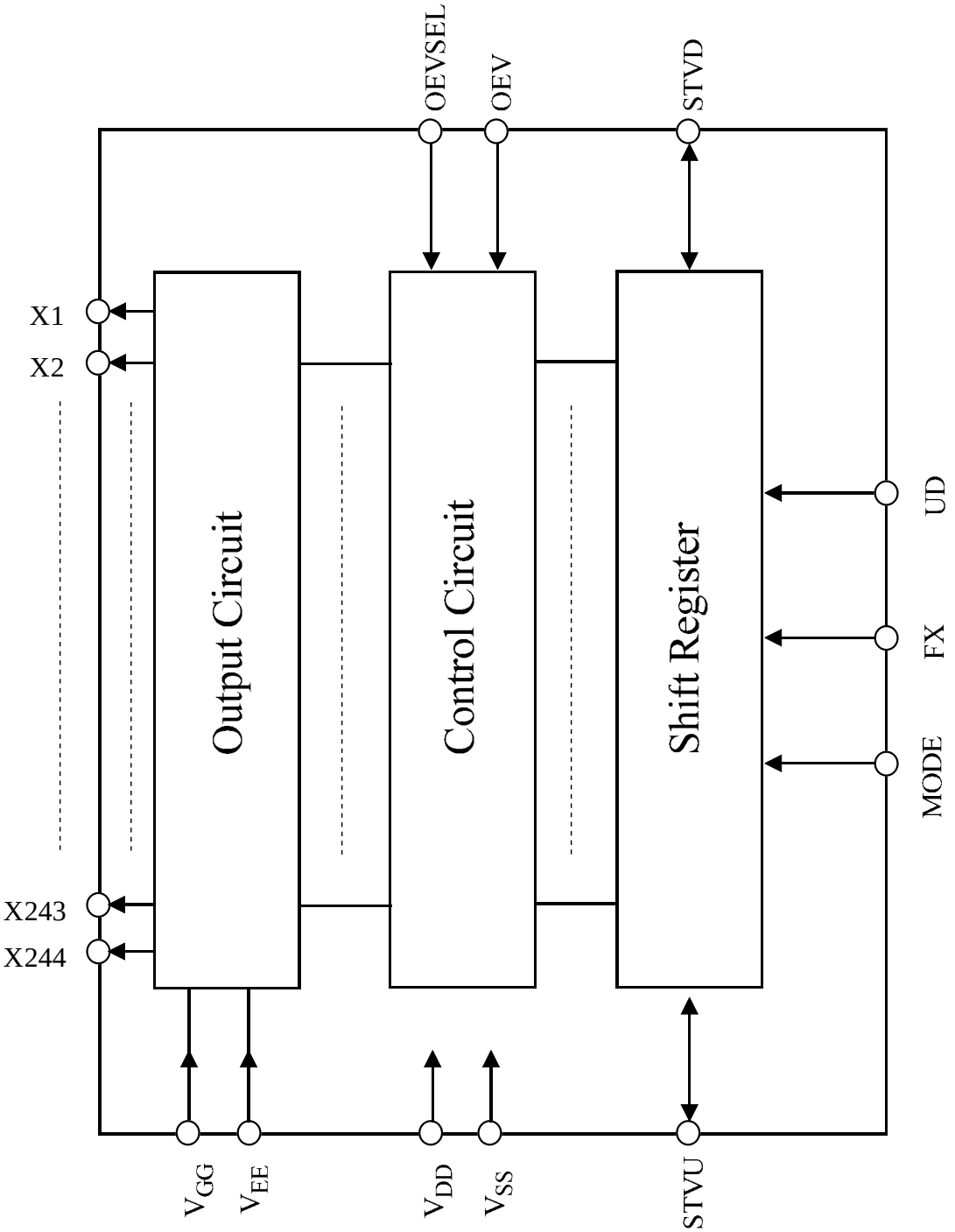
2. OVERVIEW

* Number of output channels	:	244 outputs
* Driver operating frequency	:	500 kHz max.
* LCD drive voltage	:	V_{EE} +40 V max.
* Driver output level	:	Binary

3. FEATURE

❍ Incorporating a bidirectional shift register function.

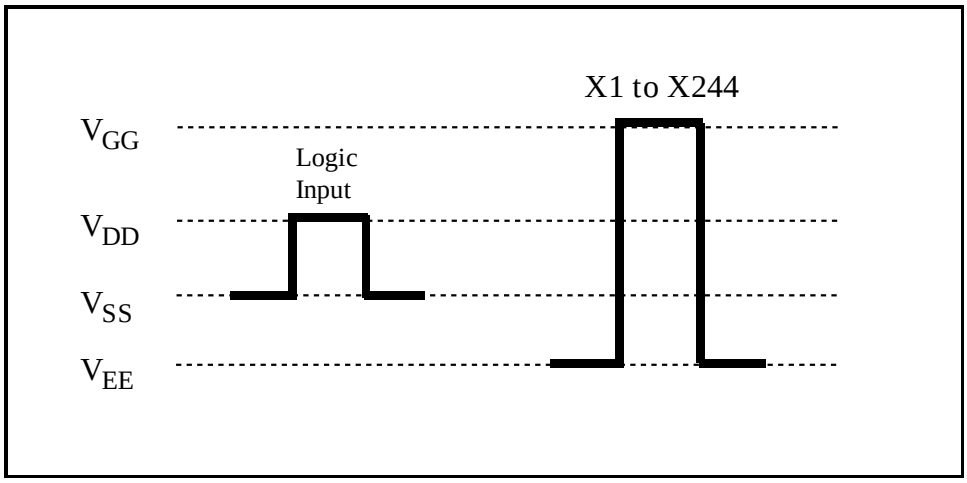
4. BLOCK DIAGRAM



5. FUNCTIONS

5-1) LCD Drive Voltage

Negative LCD drive voltage output is possible on the basis of the logic ground voltage, V_{SS}.



5-2) Operation Mode Selection

MODE="H": Positive Logic

The start pulse is fetched at the FX rising edge and the data is shifted.

The carry pulse synchronizes with the FX falling edge.

The high-level start pulse corresponds to the V_{GG} display voltage.

MODE="L": Negative Logic

The start pulse is fetched at the FX falling edge and the data is shifted at the rising edge.

The display voltage will be output only when the FX level is high.

The carry pulse synchronizes with the FX rising edge.

The low-level start pulse corresponds to the V_{GG} display voltage.

5-3) Selection of Shift Direction and Number of Outputs

The shift direction can be set with UD input.

244-output mode

UD	Start Pulse	Data Shift Direction	Carry Pulse
UD="H"	STVD	X1 → 1X2 → X3 ··· X242 → X243 → X244	STVU
UD="L"	STVU	X244 → X243 → X242 ··· X3 → X2 → X1	STVD

5-4) Non-Display Function

OEVSEL \ OEV	OEV="H"	OEV="L"
OEVSEL="H"	ALL V_{EE} output	Normal output
OEVSEL="L"	Normal output	ALL V_{EE} output

Set the OEVSEL to high level and apply high-level input to the OEV. Alternatively, set the OEVSEL to low level and apply low-level input to the OEV. Then all the outputs will be set to non-display level regardless of the data in the shift register. This function operates without being synchronized with the FX.

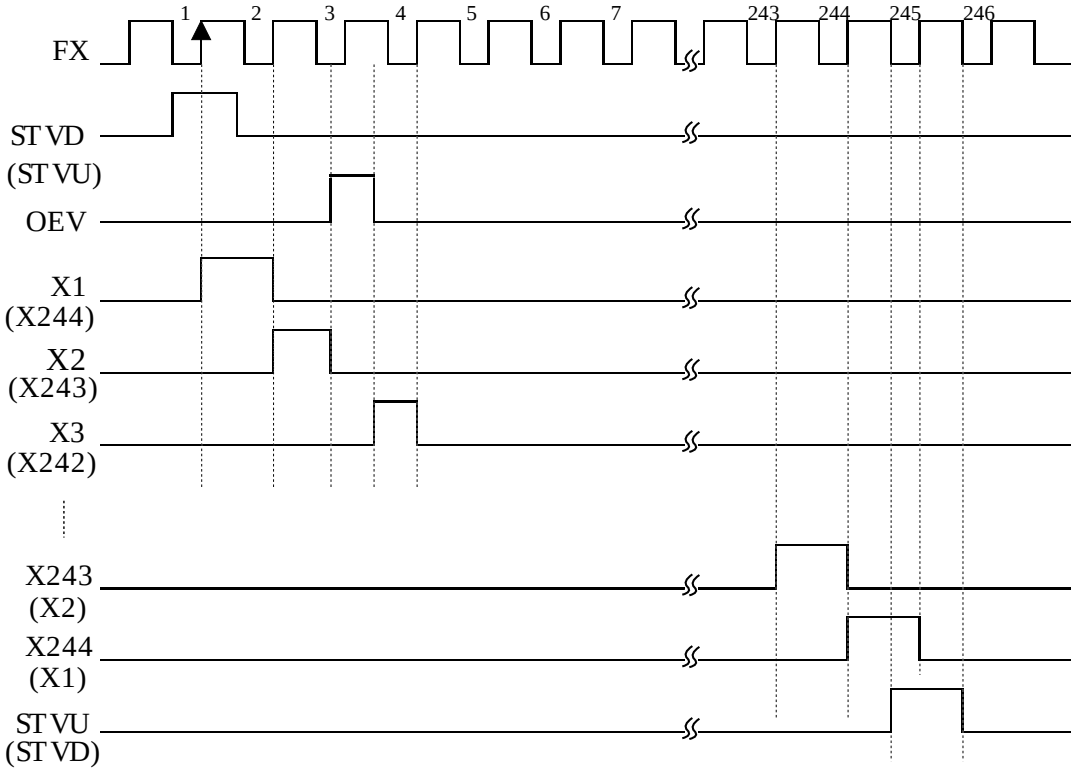
The above will not reset the shift data.

6. PIN DESCRIPTIONS

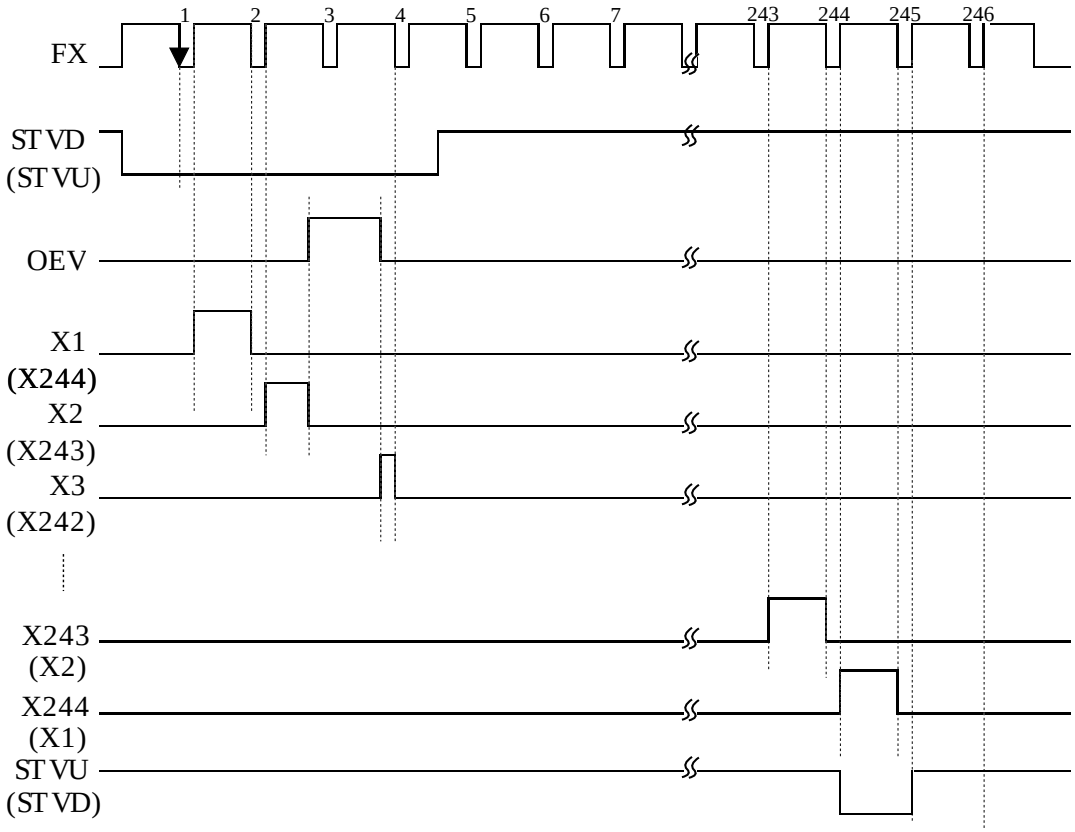
<table>
<tr><th>Pin Name</th><th>I/O</th><th>Function</th><th>Description</th></tr>
<tr><td>FX</td><td>I</td><td>Shift register clock input pin</td><td>Shift clock of the internal shift register</td></tr>
<tr><td>UD</td><td>I</td><td>Input pin for selecting the right shift or left shift direction</td><td>UD="H" : X1 → X244
UD="L" : X244 → X1</td></tr>
<tr><td>STVD / STVU</td><td>I/O</td><td>Start pulse input and carry pulse output pins</td><td><table><tr><td></td><td>STVD</td><td>STVU</td></tr><tr><td>UD="H"</td><td>Input</td><td>Output</td></tr><tr><td>UD="L"</td><td>Output</td><td>Input</td></tr></table></td></tr>
<tr><td>OEVSEL</td><td>I</td><td>Input pin for selecting OEV</td><td>OEVSEL="H" : OEV=Active high
OEVSEL="L" : OEV=Active low</td></tr>
<tr><td>OEV</td><td>I</td><td>Input pin for selecting input polarity</td><td>When OEVSEL and OEV pins are set to high level or low level, the corresponding LCD drive output pins will be at the level of OFF-potential (V_{EE}) without being synchronized with the FX regardless of the contents of the data in the shift register. Not reset.</td></tr>
<tr><td>MODE</td><td>I</td><td>Input pin for selecting MODE</td><td>MODE="H" : Positive-logic operation
MODE="L" : Negative-logic operation</td></tr>
<tr><td>X1 to X244</td><td>O</td><td>LCD drive output pins</td><td>V_{GG} or V_{EE} voltage level is output according to OEV, OEVSEL, and FX inputs and the data in the shift register.</td></tr>
<tr><td>V_{GG}</td><td>Power supply</td><td>LCD drive output power supply
LCD drive power supply 1</td><td>Power supply for the level shifter and output buffer
This power supply drives LCD.</td></tr>
<tr><td>V_{EE}</td><td>Power supply</td><td>V_{GG} system ground
LCD drive power supply 2</td><td>Ground
Provides this pin with LCD drive voltage.</td></tr>
<tr><td>V_{DD}</td><td>Power supply</td><td>Logic power supply</td><td>Power supply for the logic circuit</td></tr>
<tr><td>V_{SS}</td><td>Power supply</td><td>V_{DD} system ground</td><td>Low level reference voltage for logic</td></tr>
<tr><td>COM1 to COM4</td><td></td><td>Through wiring pins</td><td>Pins which have same name at the input side and output side are connected.
They are not connected to a circuit.</td></tr>
<tr><td>dummy1 to dummy8</td><td></td><td>Dummy pads</td><td>Dummy pads only located.
They are not connected to a circuit.</td></tr>
</table>

7. BASIC WAVEFORM

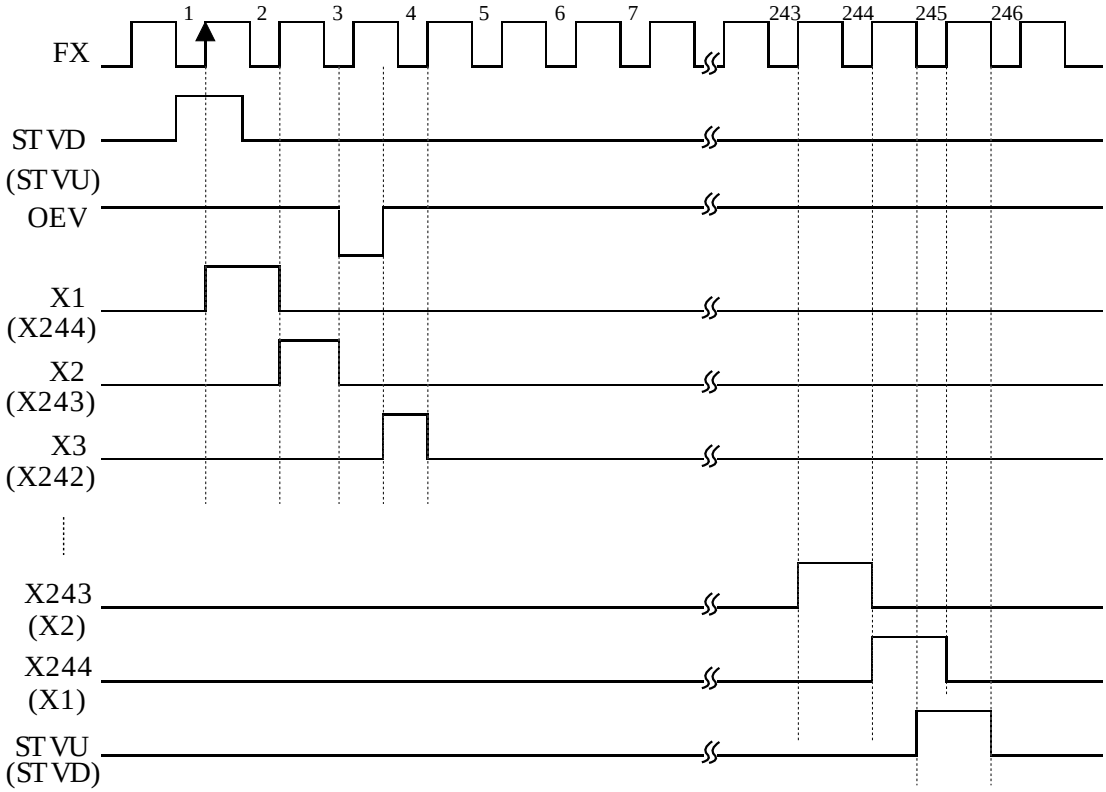
When MODE="H," OEVSEL="H," and UD="H" ( ): UD="L"



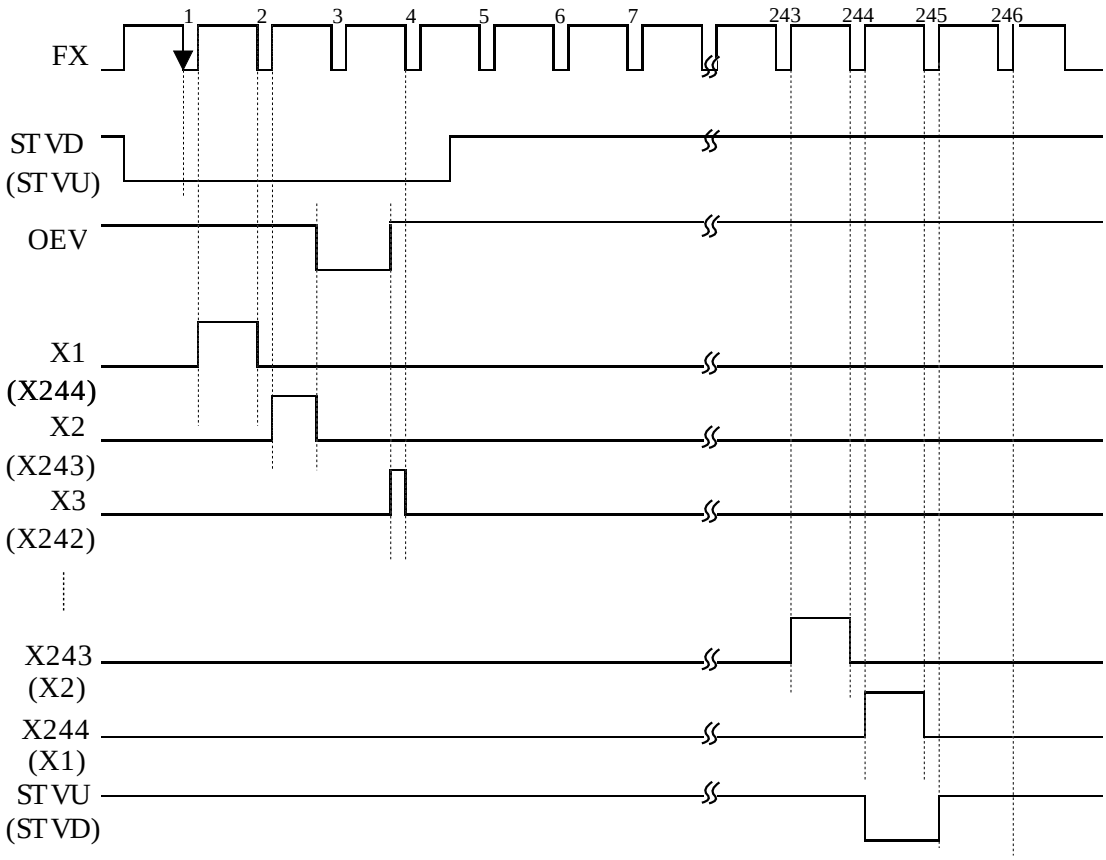
When MODE="L," OEVSEL="H," and UD="H" ( ): UD="L"



When MODE="H," OEVSEL="L," and UD="H" ( ): UD="L"



When MODE="L," OEVSEL="L," and UD="H" ( ): UD="L"



PRODUCT STANDARDS

A. ABSOLUTE MAXIMUM RATINGS

V_{SS}=0 V

Parameter		Symbol	Rating	Unit
A1	Supply voltage 1	V_{DD}	-0.3 to +7.0	V
A2	Supply voltage 2	V_{GG}	-0.3 to +44	V
A3	Supply voltage 3	V_{EE}	V_{GG}-44 to +0.3	V
A4	Digital input voltage	V_I	-0.3 to V_{DD}+0.3	V
A5	Operating storage temperature	T_{opr}	-30 to +85	°C
A6	Operating ambient temperature	T_a	-20 to +75	°C
A7	Storage temperature	T_{stg}	-55 to +120	°C

Note 1) The absolute maximum ratings are the limit values beyond which the IC may be broken. They don't assure operation.

Note 2) The operating storage temperature is the temperature range beyond which the IC may be broken. They don't assure operation.

Note 3) The values specified in the *Product Standards* are guaranteed on condition that the IC is applied to the manufacturer's standard packages.

Note 4) Set the drive voltage to satisfy the following condition when the IC is turned on and turned off and while the IC is operating.

$V_{EE} \leq V_{GG}$

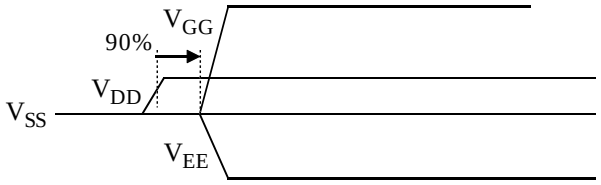
Note 5) If voltage is improperly applied to the IC when the IC is turned on, a high current may flow to the IC, and the IC may be totally broken.

When turning on the IC, apply V_{DD} first. Then apply V_{EE}, V_{GG}, and the logic signal after V_{DD} has risen to 90% of the set value.

The V_{GG} input, V_{EE} input, and logic signal input can be turned on in any order, provided that the following conditions are satisfied for the protection of the V_{GG} power supply.

A) The IC is in normal operation at the rising edge of V_{GG} (i.e., the V_{GG} output is selected for only a single output) or all the outputs are in V_{EE} output condition.

B) All the inputs are not open and are grounded by a low impedance path until each power supply and the logic signal rise.



Note 6) Activate the OEV, however, if the V_{DD}, V_{EE}, and V_{GG} power supplies are turned on simultaneously.

B. OPERATING CONDITIONS

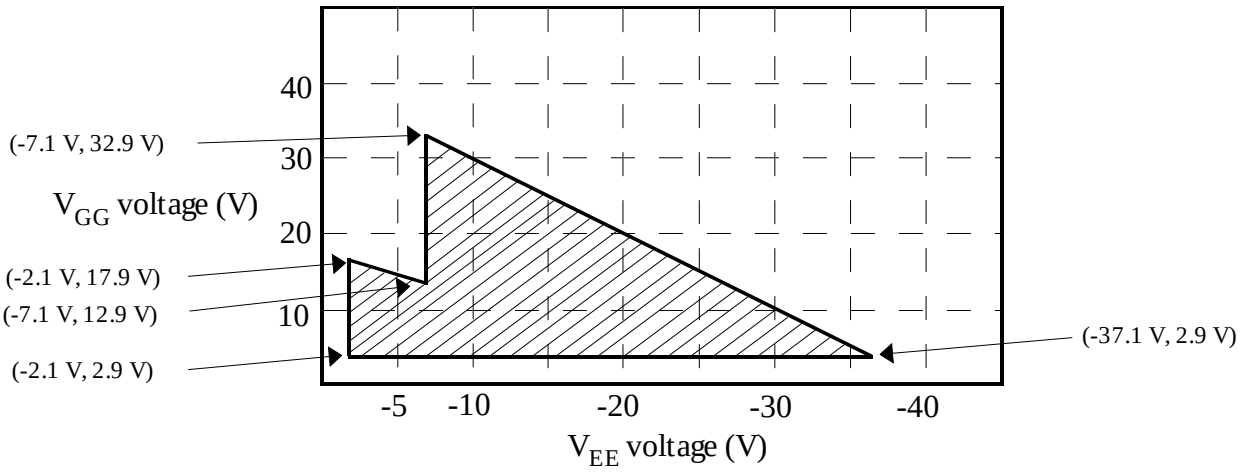
T_a= -20°Cto +75°C V_{SS}= 0 V

Parameter		Symbol	Condi-tions	Rating			Unit
				Min	Typ	Max	
B1	Operating supply voltage 1	V_{DD}		2.6	2.9	3.6	V
B2	Operating supply voltage 2	V_{GG}-V_{EE}		10		40	V
B3	Operating supply voltage 3	V_{GG}		V_{DD}		V_{EE}+40	V
B4	Operating supply voltage 4	V_{EE}		V_{GG}-40		V_{DD}-10	V

* The delay time of driving output is not guaranteed in the following conditions.

Symbol	Rating			Unit
	Min	Typ	Max	
V_{DD}	2.6	2.9	3.6	V
V_{GG}	V_{DD}		V_{EE}+20	V
V_{EE}	V_{GG}-10		V_{DD}-5	V

Operating voltage range of V_{EE} and V_{GG} when V_{DD}= 2.9 V



- The values specified in the *Product Standards* are guaranteed on condition that the IC is applied to the manufacturer's standard packages.

C. DC CHARACTERISTICS

(1) DC Characteristics

T_a= 25 °C V_{SS}= 0 V

Parameter		Symbol	Conditions	Rating			Unit
				Min	Typ	Max	
C1	Operating supply current (V_{DD})	I_{DD}	f_{FX} = 20.0 kHz V_{DD} = 3.3 V V_{EE} = -15 V V_{GG} = 15 V No-load output			50	µA
C2	Operating supply current (V_{GG})	I_{GG}				300	µA
C3	Quiescent supply current (V_{DD})	I_{DS}	In standby mode, V_{DD} = 3.3 V V_{EE} = -15 V V_{GG} = 15 V			10	µA
C4	Quiescent supply current (V_{GG})	I_{GS}				10	µA

T_a= 25 °C V_{SS}= 0 V

Parameter		Symbol	Condi-tions	Rating			Unit
				Min	Typ	Max	
1) Input pins (RL, FX, OEV, OEVSEL, MODE)							
C5	High-level input voltage	V_{IH1}		0.8 ×1.65		V_{DD}	V
C6	Low-level input voltage	V_{IL1}		0		0.2 ×1.65	V
C7	Input leakage current	I_{LI1}		-10		10	µA
2) I/O pins (STVD, STVU)							
C8	High-level input voltage	V_{IH3}		0.8 ×1.65		V_{DD}	V
C9	Low-level input voltage	V_{IL3}		0		0.2 ×1.65	V
C10	High-level output voltage	V_{OH}	-100 µA	V_{DD}-0.4			V
C11	Low-level output voltage	V_{OL}	100 µA			0.4	V

- The values specified in the *Product Standards* are guaranteed on condition that the IC is applied to the manufacturer's standard packages.

T_a= 25 °C V_{SS}= 0 V

Parameter		Symbol	Conditions	Rating			Unit
				Min	Typ	Max	
3) LCD drive output pins (X1 to X244)							
C12	Output leakage current	V_{LO1}		-50		50	µA
C13	Output ON-state resistance	R_{ON}-V_{GG}	V_{GG}=15 V V_{EE}=-15 V V_{OM}=V_{GG}-0.5 V V_{OM} is the voltage that is applied to X1 to X244 pins.		600	1000	Ω
		R_{ON}-V_{OFF}	V_{GG}=15 V V_{EE}=-15 V V_{OM}=V_{EE}+0.5 V V_{OM} is the voltage that is applied to X1 to X244 pins.		400	1000	Ω
4) Through wiring (COM1 to COM4)							
C14	wiring resistance	R_{com}				10	Ω

- The values specified in the *Product Standards* are guaranteed on condition that the IC is applied to the manufacturer's standard packages.

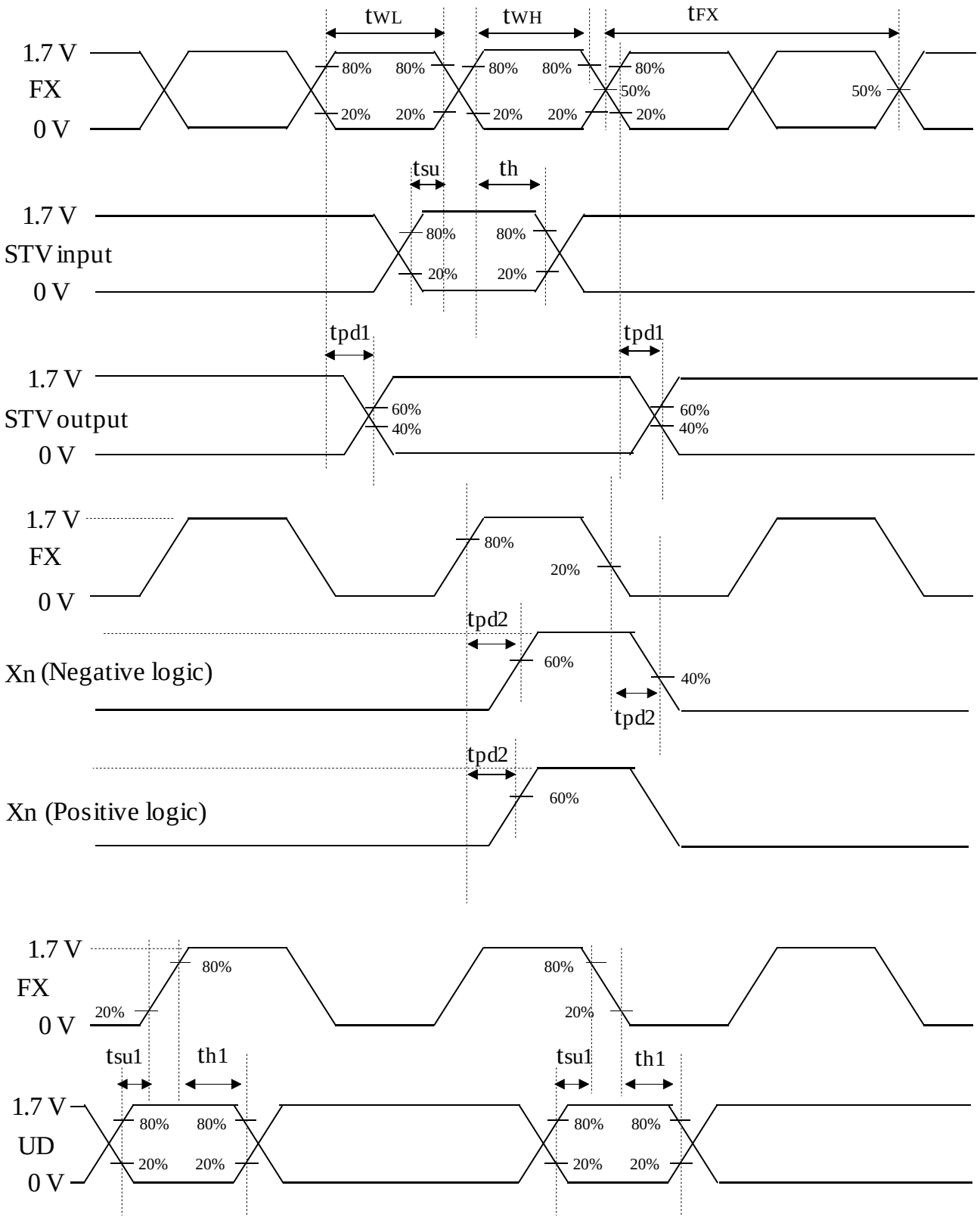
(2) AC Characteristics

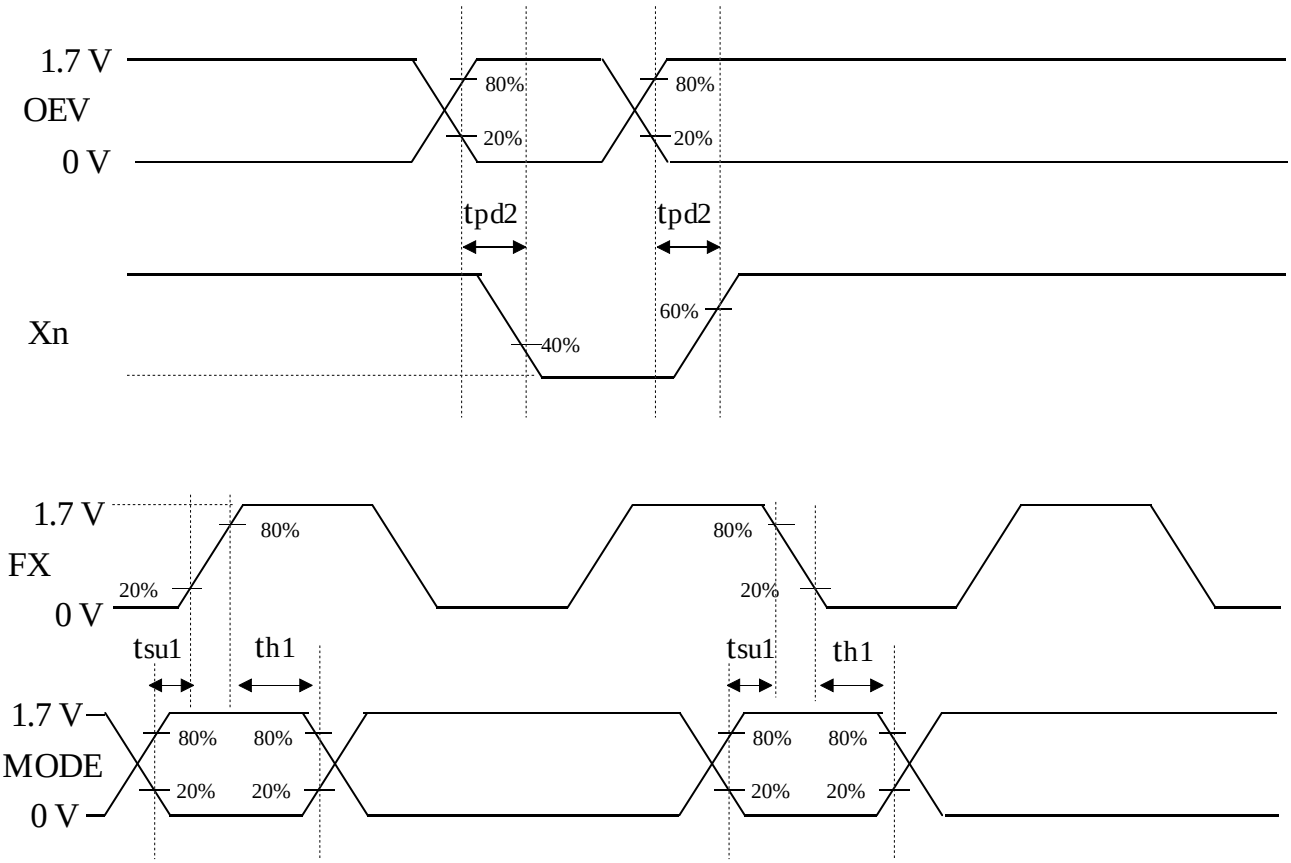
T_a= 25°C V_{SS}= 0 V

Parameter		Symbol	Conditions	Rating			Unit
				Min	Typ	Max	
C15	Clock cycle	t_{FX}		2			µs
C16	Clock high-level pulse width	t_{WH}		500			ns
C17	Clock low-level pulse width	t_{WL}		500			ns
C18	STV data setup time	t_{su}		100			ns
C19	STV data hold time	t_h		300			ns
C20	UD setup time	t_{su1}		100			ns
C21	UD hold time	t_{h1}		300			ns
C22	MODE setup time	t_{su1}		300			ns
C23	MODE hold time	t_{h1}		300			ns
C24	STV output delay time	t_{pd1}	C_L=50 pF			350	ns
C25	Xn output delay time	t_{pd2}	C_L=500 pF			1	µs

- The values specified in the *Product Standards* are guaranteed on condition that the IC is applied to the manufacturer's standard packages.

AC Characteristics Timing Chart




1.7 V
OEV
0 V
80%
20%
80%
20%
tpd2
tpd2
Xn
60%
40%
1.7 V
FX
0 V
80%
20%
80%
20%
tsu1
th1
tsu1
th1
1.7 V
MODE
0 V
80%
80%
20%
20%
80%
80%
20%
20%

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