DUPLEX LCD DRIVER

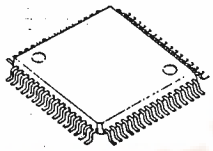
■ GENERAL DESCRIPTION

The NJU6432B is a duplex LCD driver to drive segment type LCD panel.

2-common and 53-segment drivers can drive up to 104 segments.

The NJU6432B is useful for the Digital Tuning System or others segment type display driver.

■ PACKAGE OUTLINE

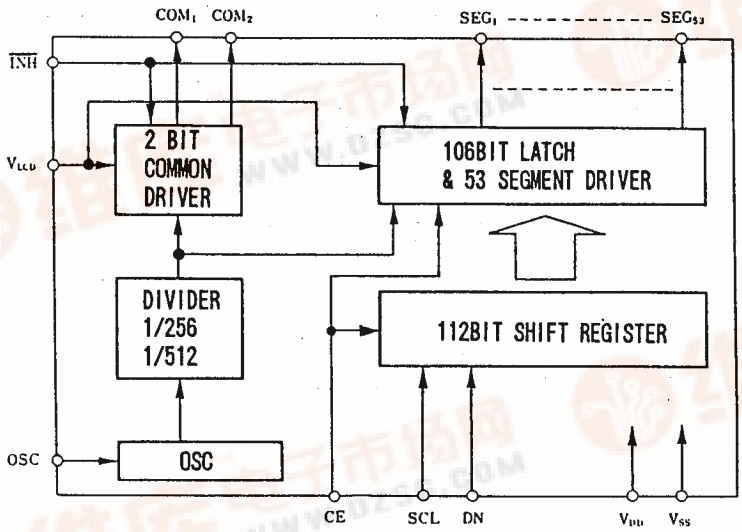


NJU6432BF

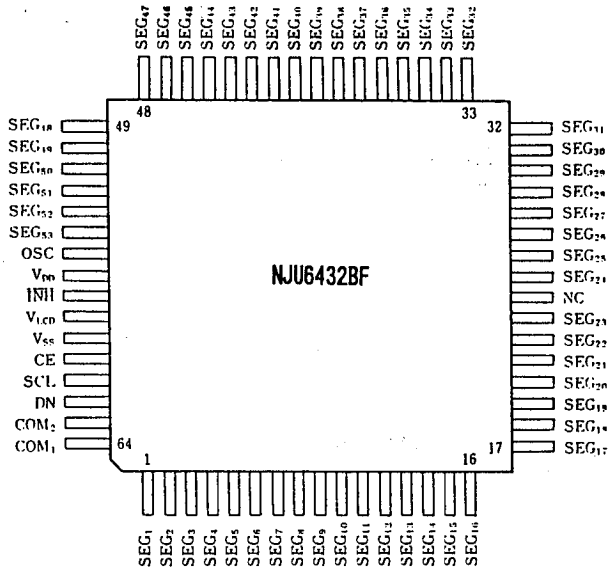
■ FEATURES

- 53 Segment Drivers
- Duty Ratio 1/2 ;104-Segment Drive
- Serial Data Transmission (Shift Clock 2MHz max.)
- Display Off Function ($\overline{INH}$ Terminal)
- Operating Voltage --- 6.5V Max.
- Package Outline --- QFP 64
- C-MOS Technology

■ BLOCK DIAGRAM



■ PIN CONFIGURATION



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■ TERMINAL DESCRIPTION

NO.	SYMBOL	F U N C T I O N
1~23 25~53	SEG_1 ~ SEG_{23} SEG_{24}~ SEG_{43}	Segment Output Terminal
54	SEG_{53}	Normally On Segment Output Terminal(When the "L" level input to the $\overline{INH}$ terminal, this segment also turns off.)
55	OSC	Oscillating Terminal
56,59	V_{DD}, V_{SS}	Power Supply
57	$\overline{INH}$	Display-Off Control Terminal: When "L" level input to this terminal, all of the display turns off including SEG_{53}.
58	V_{LCD}	Power Supply for LCD Driving
60	CE	Chip Enable Terminal
61	SCL	Serial Data Transmission Clock Terminal
62	DN	Serial Data Input Terminal
63 64	COM_2 COM_1	Common Output Terminal.
24	NC	Non Connection

■ FUNCTIONAL DESCRIPTION

(1) Operation of each block

(1-1)Oscillation Circuits

Oscillation by connecting external resistor and capacitor.
This circuits supply the basical clock signal to other circuits like as common driver and segment driver.

(1-2)Driving Circuits

This circuit divide the oscillating frequency by 1/256 and 1/512, and generate the common and segment output timing signals.

(1-3)Shift-Register

During the CE signal is "H", the data input to this shift-register by synchronizing the shift clock.

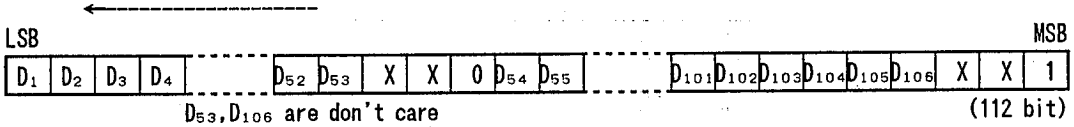
(1-4)Latch and Segment Driver

During the CE signal is "L", the data in the shift-register transfer to the latch and the segment driver output the LCD driving waveform according to the latched data.

(2) Data Input Format (The Data Correspond to the Output)

(2-1)Data Input Format

Transmission Direction



(2-2)Input Data Correspond to Segment Status

Data Dxxx	Segment Status
"H"	ON
"L"	OFF

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(2-3)Input Data Correspond to Segment Terminals

Segment	Data	COM_1	COM_2
SEG_1	D_1	○	
	D_2		○
SEG_2	D_3	○	
	D_4		○
SEG_3	D_5	○	
	D_6		○
⋮	⋮	⋮	⋮
SEG_{26}	D_{51}	○	
	D_{52}		○
SEG_{27}	D_{54}	○	
	D_{55}		○
⋮	⋮	⋮	⋮
SEG_{49}	D_{98}	○	
	D_{99}		○
SEG_{50}	D_{100}	○	
	D_{101}		○
SEG_{51}	D_{102}	○	
	D_{103}		○
SEG_{52}	D_{104}	○	
	D_{105}		○
SEG_{53}	ON	○	
	ON		○

■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNIT
Operating Voltage	V_{DD}	- 0.3 ~ + 7.0	V
Operating Voltage	V_{LCD}	- 0.3 ~ V_{DD}+0.3	V
Input Voltage (1)	V_{IN}	- 0.3 ~ + 7.0	V
Input Voltage (2)	V_{IN}	- 0.3 ~ V_{DD}+0.3	V
Output Voltage (2)	V_O	- 0.3 ~ V_{DD}+0.3	V
Output Current (3)	I_O	100	μA
Output Current (4)	I_O	1.0	mA
Power Dissipation	P_D	300	mW
Operating Temperature	Topr	- 30 ~ + 85	℃
Storage Temperature	Tstg	- 40 ~ + 125	℃

* 1) CE, SCL, DN Terminals
* 2) OSC Terminal during OFF-output
* 3) SEG_1~SEG_{53} Terminals
* 4) COM_1,COM_2 Terminals

■ ELECTRICAL CHARACTERISTICS

DC Characteristics

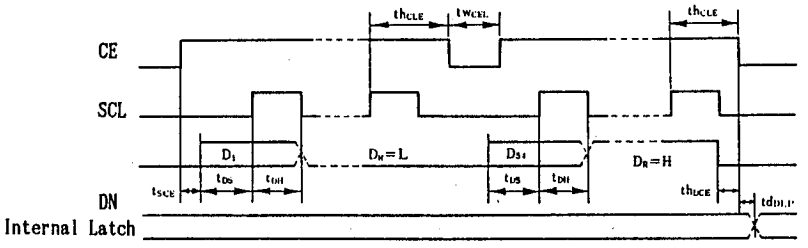
(Ta=-30～+85℃, V_{DD}=6.5V, V_{SS}=0V)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Supply Voltage	V_{DD}	V_{DD} Terminal	2.5		6.5	V
Supply Voltage	V_{LCD}	V_{LCD} Terminal	2.5		V_{DD}	V
Operating Current	I_{DD}	V_{DD} Terminal			1	mA
Operating Current	I_{LCD}	V_{LCD} Terminal			2	mA
"H" Input Voltage	V_{IH}	$\overline{TNH}$ Terminal	0.7V_{DD}		6.5	V
"L" Input Voltage	V_{IL}	$\overline{TNH}$ Terminal	0		0.3V_{DD}	V
"H" Input Voltage	V_{IH}	CE,SCL,DN Terminals	0.8V_{DD}		6.5	V
"L" Input Voltage	V_{IL}	CE,SCL,DN Terminals	0		0.2V_{DD}	V
Oscillator Resistor	R_{osc}	OSC Terminal		51		kΩ
Oscillator Capacitor	C_{osc}	OSC Terminal		680		pF
Oscillator Frequency	f_{osc}	OSC Terminal	25	50	100	kHz
"H" Input Current	I_{IH}	V_{IN}=6.5V, CE, SCL,DN,$\overline{TNH}$ Terminals			5	μA
"L" Input Current	I_{IL}	V_{IN}=0V, CE, SCL,DN,$\overline{TNH}$ Terminals			5	μA
"H" Output Voltage	V_{OH}	I_O=-10μA SEG_1～SEG_{53} Terminals	V_{LCD}-1.0			V
"L" Output Voltage	V_{OL}	I_O=10μA SEG_1～SEG_{53} Terminals			1.0	V
"H" Output Voltage	V_{OH}	I_O=-100μA COM_1,COM_2 Terminals	V_{LCD}-0.6			V
"L" Output Voltage	V_{OL}	I_O=100μA COM_1,COM_2 Terminals			0.6	V
Middle Level Voltage	V_{MID}	I_O=±100μA,V_{LCD}=6.5V	2.65	3.25	3.85	V
		I_O=±100μA,V_{LCD}=3.0V	0.9	1.5	2.1	
Hysteresis Voltage	V_H	VDD=5V, CE,SCL,DN Terminals	0.3			V

AC Characteristics (Ta=-30～+85℃, V_{DD}=6.5V, V_{SS}=0V)

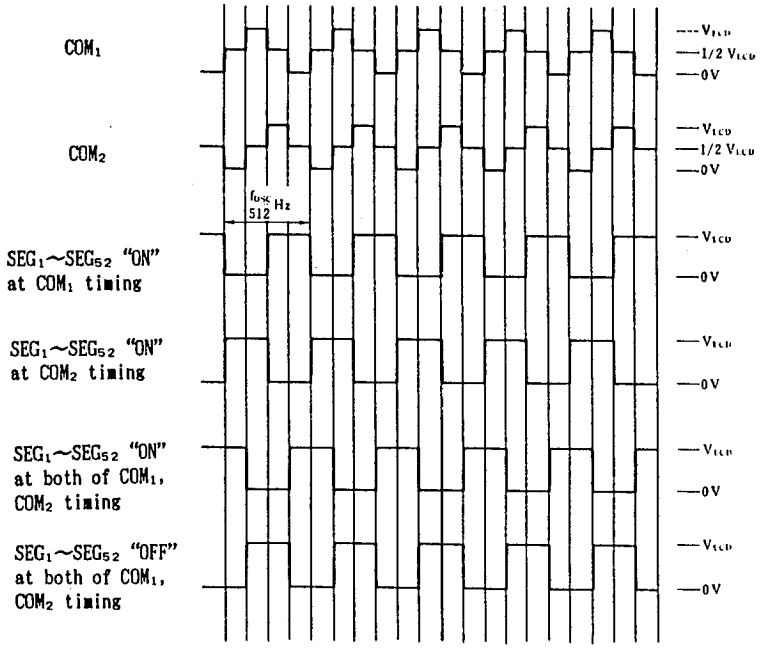
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
"L" Clock Pulse Width	t_{WCLL}	SCL Terminal	0.25			μs
"H" Clock Pulse Width	t_{WCLH}	SCL Terminal	0.25			μs
Data Set-up Time	t_{DS}	SCL, DN Terminals	0.25			μs
Data Hold Time	t_{DH}	SCL, DN Terminals	0.25			μs
CE Set-up Time	t_{SCE}	CE, DN Terminals	1			μs
CE Hold Time (1)	t_{HDCE}	CE, DN Terminals	1			μs
CE Hold Time (2)	t_{HCLE}	CE, SCL Terminals	1.25			μs
Data Latch Delay Time	t_{DDLP}				1	μs
"L" Clock Enable Pulse Width	t_{WCEL}	CE Terminal	4			μs

- Input Timing Characteristics



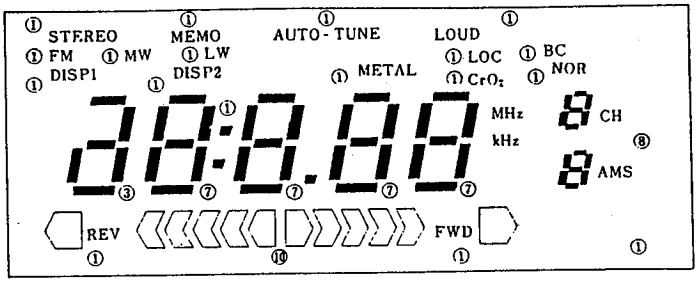
The data is latched at D_R=H and falling edge of the CE signal condition.

- Output Timing Characteristics



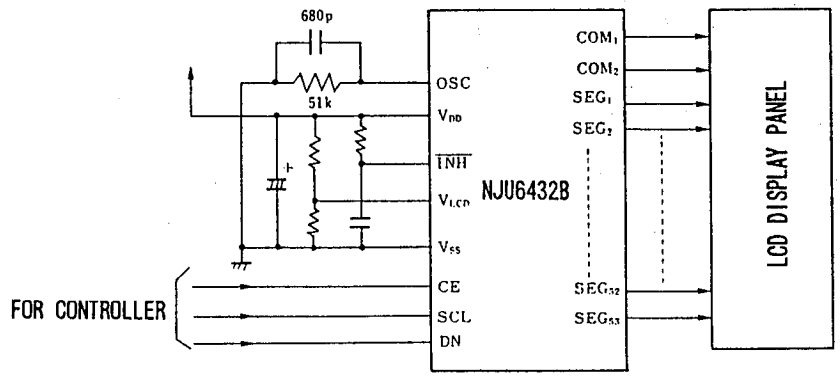
■ DISPLAY EXAMPLE

Example: 71 segments(MAX. 104 segments)

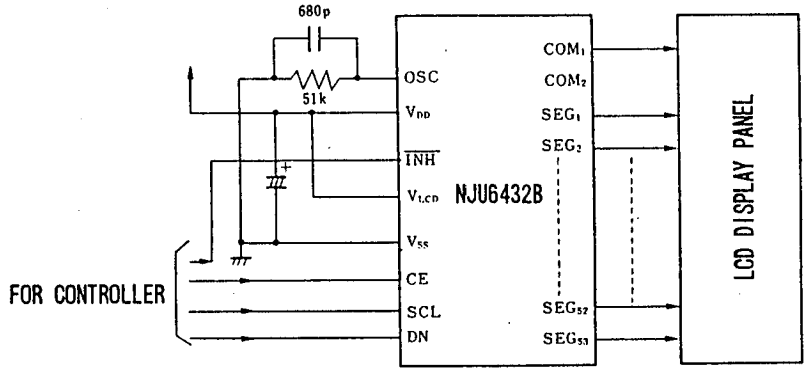


■ APPLICATION CIRCUITS

① In case of $V_{LCD}<V_{DD}$



② In case of $V_{LCD}=V_{DD}$



(Note) After rising edge of V_{DD} voltage, the display data is not guaranteed and which blinking is meaningless display. Therefore, keep $\overline{INH}$ terminal to Low Level by the display data transferred is needed.

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MEMO