

OKI semiconductor

MSM5300/MSM5303

16-DOT LCD DRIVER

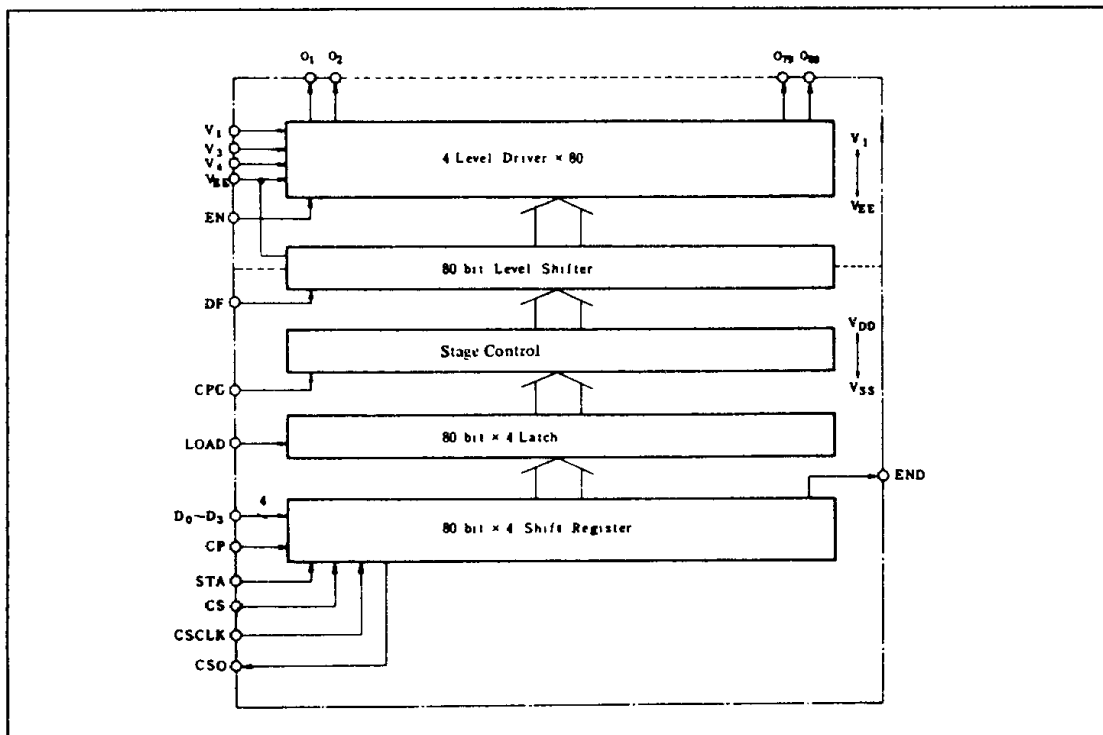
GENERAL DESCRIPTION

The OKI MSM5300GS is an LCD driver LSI installed with 16-stage shift register for driving segments.

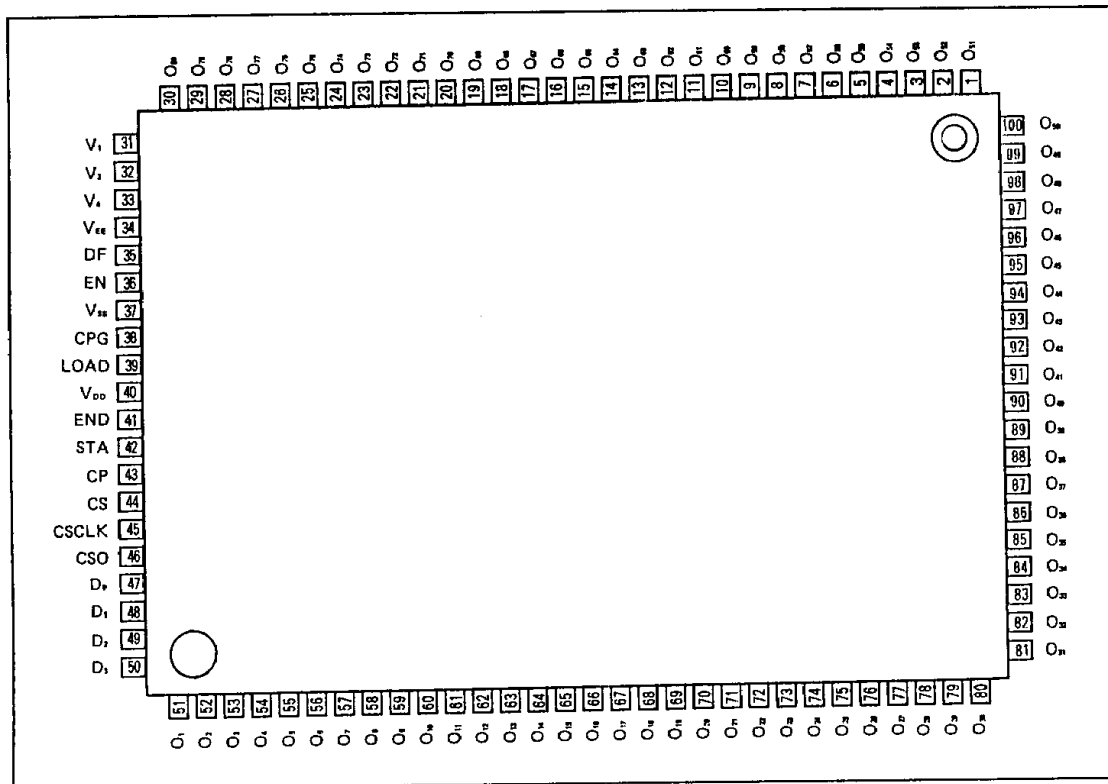
FEATURES

- Integrated 80 bit × 4 latch and shift register
- Capable of a 16-stage dot display
- Maximum input voltage ($V_{DD} - V_{EE}$) 25 V
- MSM5303: Mirror type of MSM5300 GS (Chip form).
- 100 pin Plastic QFP (QFP100-P-1420-K)
- 100 pin Plastic QFP (QFP100-P-1420-L)

BLOCK DIAGRAM



PIN CONFIGURATION



ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Condition	Ratings	Unit
Supply voltage for the logic section	$V_{DD} - V_{SS}$	$T_a = 25^\circ\text{C}$	- 0.3 ~ 6.0	V
Applied voltage for driver section	$V_{DD} - V_{EE}^{*1}$	$T_a = 25^\circ\text{C}$	0 ~ 28	V
Input voltage	V_i	$T_a = 25^\circ\text{C}$	- 0.3 ~ $V_{DD} + 0.3$	V
Storage temperature	T_{stg}	-	- 55 ~ + 150	$^\circ\text{C}$

*1: $V_1 > V_3 > V_4 > V_{EE}$, $V \leq V_{DD}$, $V_{SS} = 0\text{V}$

OPERATING RANGE

Parameter	Symbol	Condition	Ratings	Unit
Supply voltage for the logic section	$V_{DD} - V_{SS}$	-	4.5 ~ 5.5	V
Applied voltage for driver section	$V_{DD} - V_{EE}^{*1}$	-	14 ~ 25	V
Storage temperature	T_{op}	-	- 20 ~ 75	$^\circ\text{C}$

*1: $V_1 > V_3 > V_4 > V_{EE}$, $V \leq V_{DD}$, $V_{SS} = 0\text{V}$

DC CHARACTERISTICS

($V_{DD} = 5V \pm 10\%$, $T_a = -20^\circ\text{C} \sim 70^\circ\text{C}$, $V_{SS} = 0V$)

Parameter	Symbol	Condition	MIN	TYP	MAX	Unit	Corresponding pin
"H" input voltage	V_{IH}		0.8 V_{DD}	-	-	V	DF, STA, CPG, LOAD, D ₀ ~D ₃ , CP, CS, CSCLK, EN
"L" input voltage	V_{IL}		-	-	0.2 V_{DD}	V	
"H" input current	I_{IH}	$V_1 = V_{DD}$	-	-	1	μA	
"L" input current	I_{IL}	$V_1 = 0V$	-	-	-1	μA	
"H" output voltage	V_{OH}	$I_0 = -0.2\text{mA}$	V_{DD} -0.4	-	-	V	END, CSO
"L" output voltage	V_{OL}	$I_0 = 0.2\text{mA}$	-	-	0.4	V	
ON Resistance	R_{ON}	$V_{DD} = V_{EE} = 25V$ $[V_N - V_0] = 0.25V$ *1	-	2	4	$k\Omega$	O ₁ ~O ₈₀
Standby current consumption	I_{DDSBY}	$f_{cp} = 1\text{MHz}$, CS = "L" *2 $V_{DD} - V_{EE} = 25V$ No load	-	-	3	mA	
Current consumption (1)	I_{DD}	$f_{cp} = 1\text{MHz}$, CS = "H" *3 $V_{DD} - V_{EE} = 25V$ No load	-	-	5	mA	
Current consumption (2)	I_{V1}	$f_{cp} = 1\text{MHz}$, *4 $V_{DD} - V_{EE} = 25V$ No load	-	-	200	μA	
Current consumption (3)	I_{V2}	$f_{cp} = 1\text{MHz}$, *5 $V_{DD} - V_{EE} = 25V$ No load	-	-	500	μA	
Input capacity	C_1	$f_{cp} = 1\text{MHz}$	-	5	-	pF	

*1: $V_N = V_{DD} \sim V_{EE}$, $V_3 = V_{DD} - 4.5$, $V_4 = V_{DD} - 20.5$, $V_1 = V_{DD}$

*2: Indicating data F0F0 ···· DF = 40 Hz, Current flow from V_{DD} to V_{SS}

*3: Indicating data F0F0 ···· DF = 40 Hz, Current flow from V_{DD} to V_{SS}

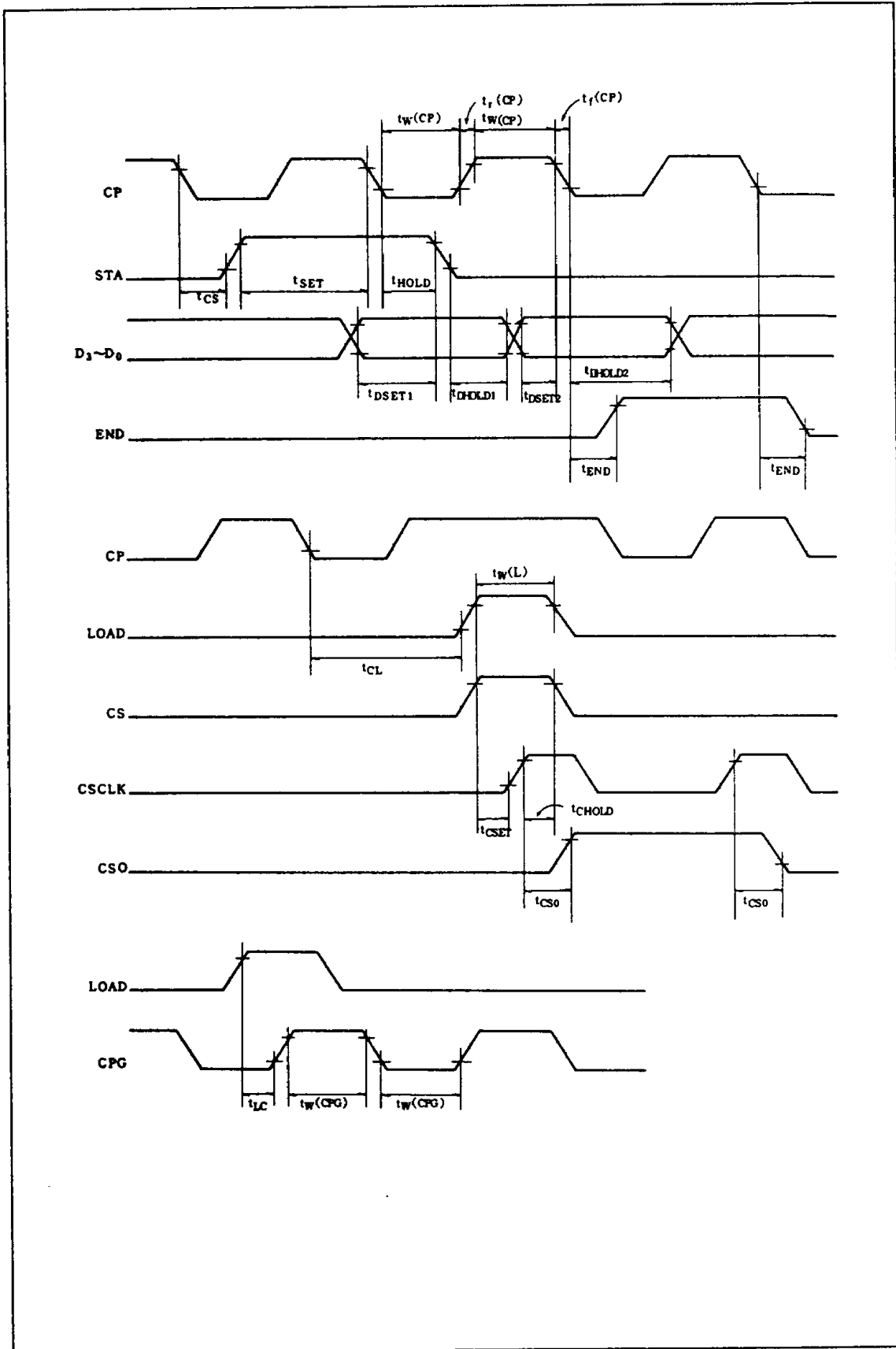
*4: Indicating data F0F0 ···· DF = 40 Hz, Current flow through V_1 , V_3 , V_4

*5: Indicating data F0F0 ···· DF = 40 Hz, Current flow through V_{EE}

SWITCHING CHARACTERISTICS

($V_{DD} = 5V \pm 10\%$, $T_a = -20^\circ\text{C} \sim +75^\circ\text{C}$, $C_L = 15\text{PF}$)

Parameter	Symbol	Condition	MIN	TYP	MAX	Unit
Maximum clock frequency	f_{CPMAX}	Duty 50%	4.0	-	-	MHz
CP Pulse width	$t_{W(CP)}$		80	-	-	ns
CP → STA	t_{CS}		100	-	-	ns
STA set-up time	t_{SET}		120	-	-	ns
STA holding time	t_{HOLD}		50	-	-	ns
D ₃ ~D ₀ set-up time	t_{DSET1}	When starting	100	-	-	ns
D ₃ ~D ₀ holding time	t_{DHOLD1}	When starting	50	-	-	ns
D ₃ ~D ₀ set-up time	t_{DSET2}		100	-	-	ns
D ₃ ~D ₀ holding time	t_{DEST2}		50	-	-	ns
END signal delay time	t_{END}		-	-	150	ns
CP → LOAD	t_{CL}		150	-	-	ns
Load pulse width	$t_{W(L)}$		250	-	-	ns
CS set-up time	t_{CSET}		80	-	-	ns
CS holding time	t_{CHOLD}		50	-	-	ns
CSO delay time	t_{CSO}		-	-	100	ns
LOAD → CPG	t_{LC}		0	-	$t_{W(L)}$	ns
CP rising/falling time	$t_r(CP)$ $t_f(CP)$		30	-	-	ns
CPG pulse width	$t_{W(CPG)}$		300	-	-	ns
CSCLK maximum frequency	$f_{CSCLKMAX}$	Duty 50%	4.0	-	-	MHz
CSCLK pulse width	$t_{W(CSCLK)}$		80			ns



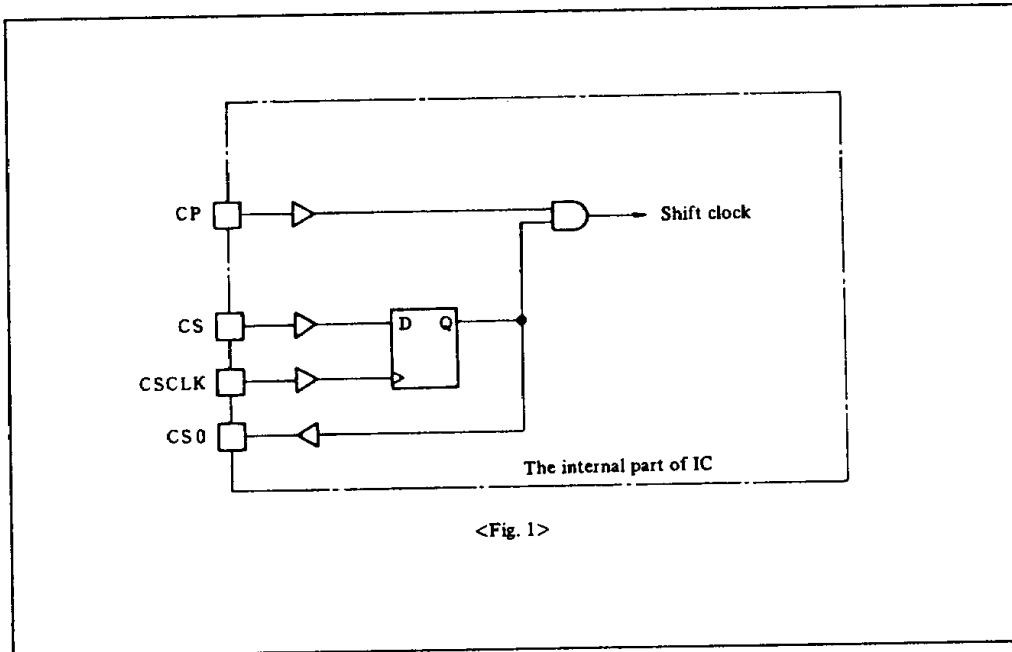
PIN DESCRIPTION

Name	I/O	Function
V ₁	I	$V_1 \leq V_{DD}$ V _{LCD} : LCD maximum voltage
V ₃	I	$V_1 - \frac{2}{a} V_{LCD}$
V ₄	I	$V_1 - (1 - \frac{2}{a}) V_{LCD}$ $a = \sqrt{N} + 1$
V _{EE}	I	$V_1 - V_{LCD}$ (1/N: Common duty)
V _{DD}	I	4.5 ~ 5.5 V
V _{SS}	I	0 V
EN	I	On "H": Normal, on "L" O ₁ ~O ₈₀ become V ₁ level
DF	I	Converted A.C. signal input
CPG	I	Clock pulse input for stage control
LOAD	I	Latch display data used as input. Display data held during high to low transition.
D ₃ ~D ₀	I	Stage data input
CP	I	Shift clock pulse input for shift register
STA	I	Start pulse input for shift register
CS	I	IC internal enable F/F data input
CSCLK	I	Enable F/F clock input for the above mentioned. When rising, enable F/F is shifted.
CSO	O	Connects to CS pin in the next stage when cascade is connected at the above mentioned enable F/F output.
END	O	Connects to STA when cascade is connected at the shift register final stage output.
O ₁ ~O ₈₀	O	4 level data output

FUNCTIONAL DESCRIPTION

● POWER DOWN FUNCTION

When cascade is connected, the enable F/F is installed within IC internal section as shown in the power consumption diagram (refer to Fig. 1). Only the display data of the IC set by this enable F/F is transferred. The IC not set by this enable F/F does not transfer and remains at low current consumption condition.



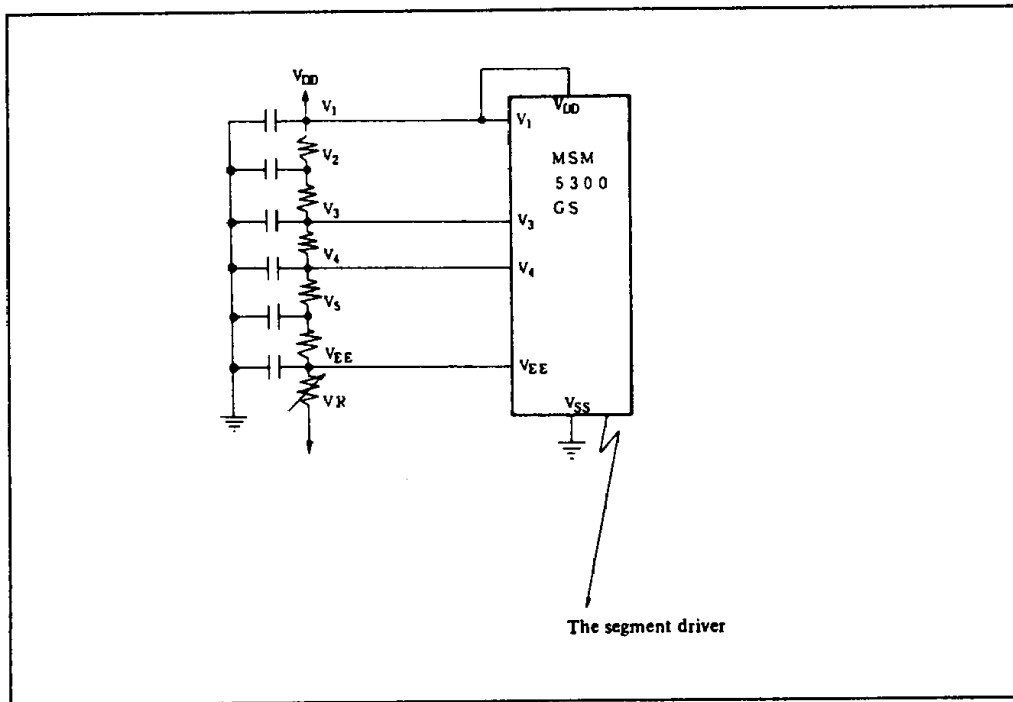
● TRUE VALUE CHART

(0₁ ~ 0₈₀)

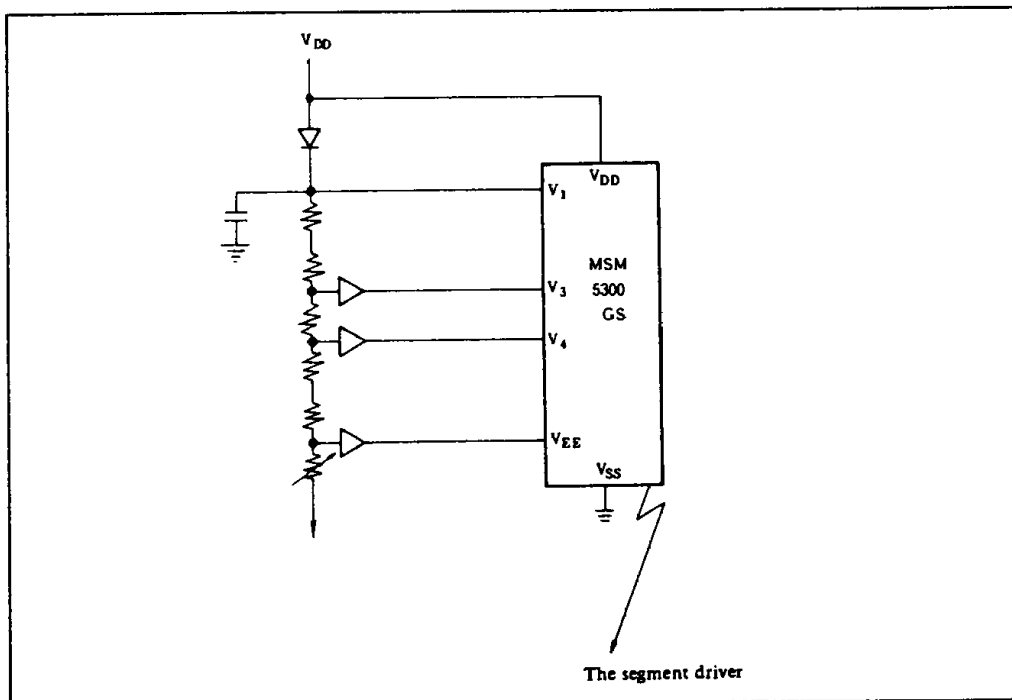
EN	DF	Latch data	Driver output
H	L	L	V ₃
H	L	H	V ₁
H	H	L	V ₄
H	H	H	V _{EE}
L	X	X	V ₁

● Supply to V_1 , V_3 , V_4 , V_{EE} (Example)

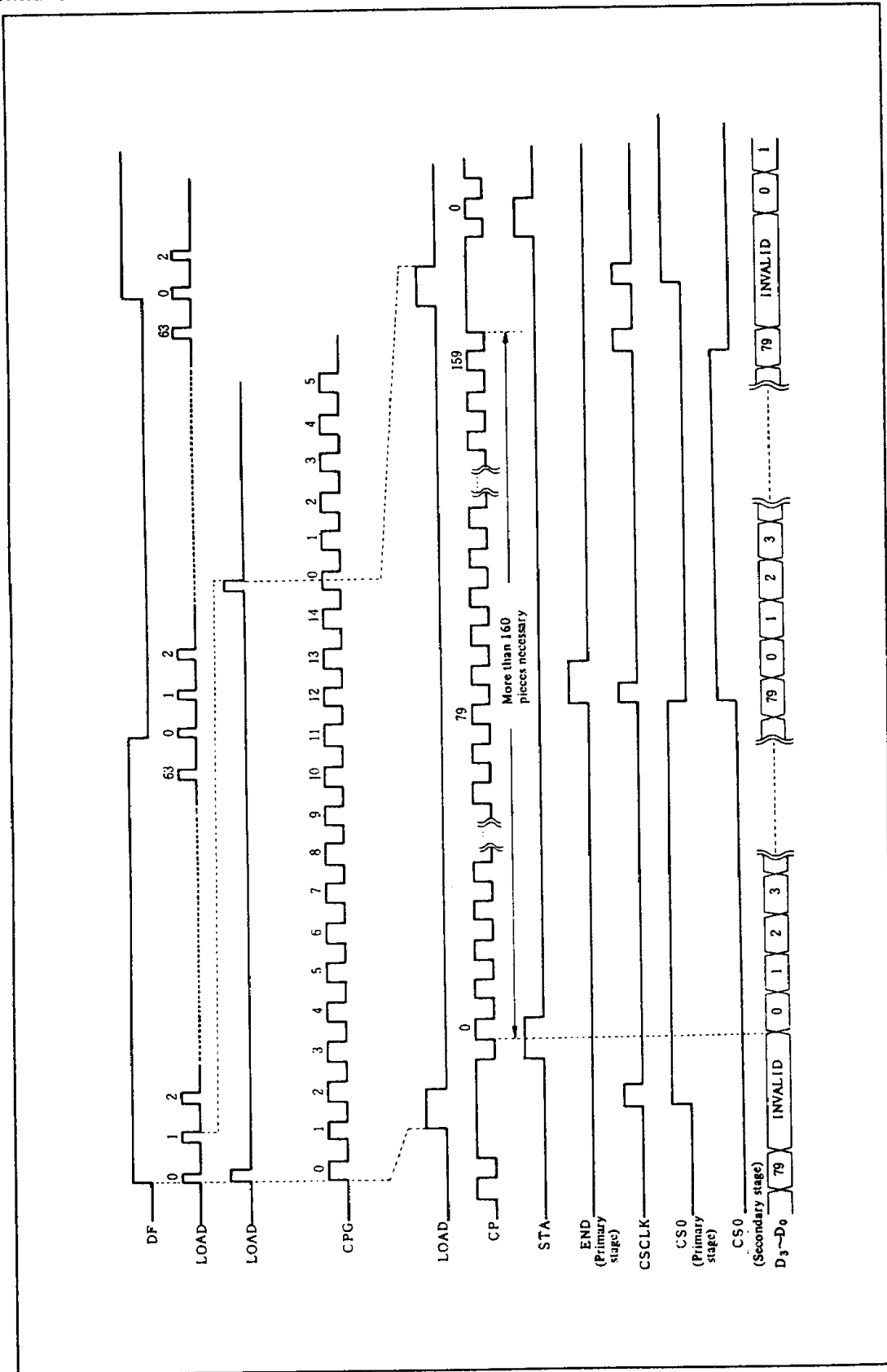
V_1 , V_3 , V_4 , and V_{EE} employ bias power by the general resistance potential.
The following is an example:



Alternatively, bias voltage may be supplied by the operational amplifier as shown below:



TIME CHART



APPLICATION CIRCUIT

