SED1500 Series

CMOS DOT MATRIX LCD CONTROLLER DRIVER

■ DESCRIPTION

The SED1500 Series is a dot matrix LCD driver CMOS LSI with the ability of alpha-numeric and graphic display. The device stores the parallel data that is sent from the microcomputer in a built-in data RAM and generates a liquid drive signal. The LSI can be connected directly to the 4-bit/8-bit microcomputer. The SED1500 Series is suitable to applications involving low speed, large capacity. The device consumes only a little current because it is operated by a low-frequency clock so that, by combining it with a CMOS microcomputer unit, a battery driven, long life system can be built at low cost.

■ FEATURES

- Low-power CMOS technology
- Direct CPU interface ..... 4/8 bits
- Duty cycle ..... 1/7 to 1/16 (mask option)
- Built-in display data RAM ..... 42 × 2 bytes
  Maximum ..... 672 dots
- On-chip CR oscillation circuit
- Master/slave operation is supported
- LCD voltage .....–3 to –10V
- Single power supply .....3.0 to 6.0V
- Package ..... QFP1-80 pin (FOA)

■ SED1500 Series

The capacity of the SED1500 Series is varied as follows with a duty of LCD multiplex drive.

- **Common-single series**

Duty	Type	No. of COM output	No. of SEG output
1/7	SED1507F	7	42
1/8	SED1500F	8	42
1/10	SED1501F	10	40
1/11	*2	11	39
1/12	*2	12	38
1/13	*2	13	37
1/14	*2	14	36
1/15	*2	15	35
1/16	SED1502F	16	34

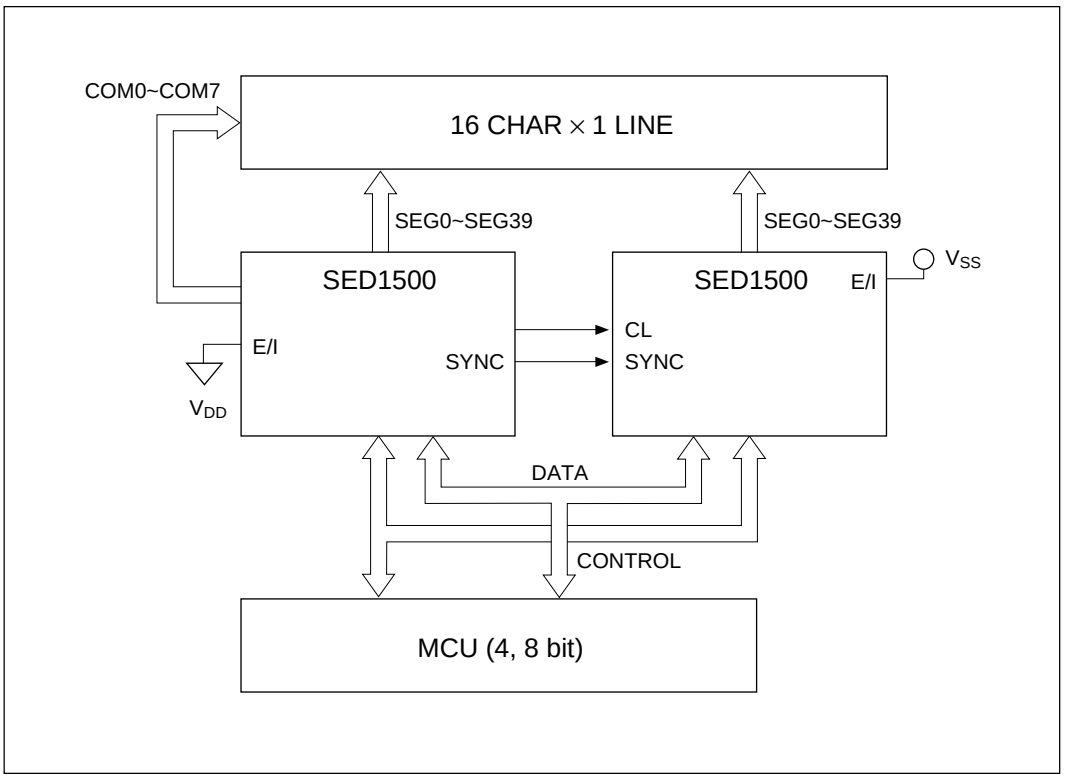
- **Common-multi series**

Duty	Type	No. of COM output	No. of SEG output
1/8	*2	4	42
1/9	*2	5	42
1/10	*2	5	42
1/11	*2	6	42
1/12	*2	6	42
1/13	*2	7	42
1/14	*2	7	42
1/15	*2	8	42
1/16	SED1503F	8	42

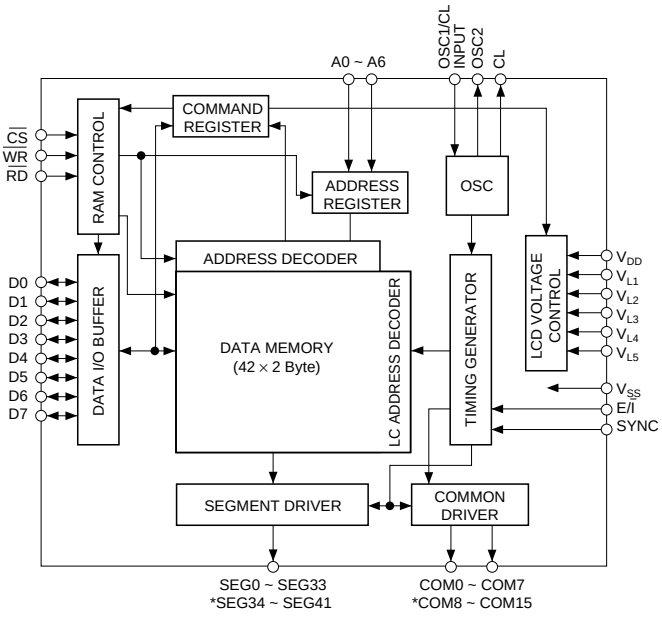
*1. The driver is open-ended by the cascade connection.

*2. Above-mentioned Duties are all available by the mask option. Please consult S-MOS marketing for availability.

■ **SYSTEM BLOCK DIAGRAM**

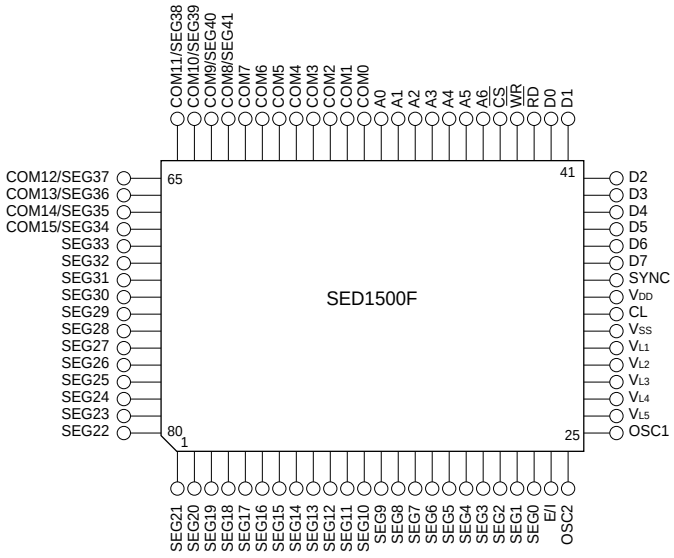


■ BLOCK DIAGRAM



* These terminals can be used as either SEG or COM terminals

■ PIN CONFIGURATION



■ PIN DESCRIPTION

A0 to A6	RAM Address
D0 to D7	Data Input/Output
$\overline{RD}$	Read Enable
$\overline{WR}$	Write Enable
OSC1, OSC2	Oscillation Circuit
$\overline{CS}$	Chip Select Input
CL	Clock Output
E/$\overline{I}$	Master/Slave Selection
SYNC	Slave Synchronous Input/Output

COM0 to COM15	LCD Common (Y) Drive Output
SEG0 to SEG41	LCD Segment (X) Drive Output
V_{L1} to V_{L5}	LCD Drive Power Supply
V_{DD}	Power Supply (+)
V_{SS}	Logic Power Supply (–)

■ ELECTRICAL CHARACTERISTICS

● Absolute Maximum Ratings

(V_{DD} = 0V)

Parameter	Symbol	Ratings	Unit
Supply voltage	V_{SS}	–7.0 to 0.3	V
	V_{L1} to V_{L5}	–13.0 to 0.3	V
Input voltage	V_I	V_{SS}–0.3 to V_{DD}+0.3	V
Operating temperature	T_{opr}	–20 to 75	°C
Storage temperature	T_{stg}	–55 to 125	°C
Soldering temperature and time	T_{sol}	260°C, 10s (at lead)	—

● DC Characteristics

(V_{DD} = 0V)

Parameter	Symbol	Condition	Rating			Unit
			Min	Typ	Max	
Supply voltage	V_{SS}		–3.0	—	–5.5	V
Supply voltage	V_{L5}		–3.0	—	–10	V
Operating dissipation	I_{OP1}	V_{SS}=–5.5V $\overline{CS}$=H V_{L5}=–10.0V R_f=1.0MΩ	—	60	100	µA
Oscillation start voltage	V_{STA}	Rf=1.0MΩ	—	—	–2.0	V
Oscillation stop voltage	V_{STP}	Rf=1.0MΩ	—	—	–2.0	V
Read cycle time	$t_{c(RD)}$	V_{SS}=–5V V_{IH}=V_{OH}=–2.0V V_I=V_{OL}=V_{SS}+0.8V C_L=100pF+1TTL	1,000	—	—	ns
Write cycle time	$t_{c(WR)}$		1,000	—	—	ns
Access time	t_a		—	—	800	ns

● **Timing Characteristics**

○ **Read Operation**

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Read cycle time	t_{RC}		1000	—	—	ns
Access time 1	t_{A1}	$V_{IH} = V_{OH} = V_{DD} - 2.0V$	—	—	800	ns
Read input → valid data output time	t_{RD}	$V_{IL} = V_{DL} = V_{SS} + 0.8V$	—	—	800	ns
Read input → data output time	t_{RX}	C_L = 100 pF + 1 TTL	—	—	150	ns
Output disable time	t_{OTD}		30	—	—	ns
Output hold time	t_{OHA}	V_{SS} = –5V ± 10%	20	_	—	ns
Address set pulse width	t_{AS}	T_a = –20 to +75°C	200	—	—	ns
Address hold time	t_{AH}		100	—	—	ns
Port setup time	t_{PS}		200	—	—	ns

○ **Write Operation**

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Write recovery time	t_{WC}		1000	—	—	ns
Write time	t_W		800	—	—	ns
Port setup time	t_{PS}		200	—	—	ns
Address setup time	t_{AW}	$V_{IN} = V_{OH} = V_{DD} - 2.0V$	0	—	—	ns
Write recovery time	t_{WR}	$V_{IL} = V_{OL} = V_{SS} + 0.8V$	200	—	—	ns
Output disable time	t_{ODW}	C_L = 100 pF + 1 TTL	—	—	0	ns
Data setup time	t_{DS}	V_{SS} = –5V ± 10%	300	—	—	ns
Data hold time	t_{DH}	T_a = –20 to 75°C	100	—	—	ns
Address set pulse width	t_{AS}		200	—	—	ns
Address hold time	t_{AH}		100	—	—	ns

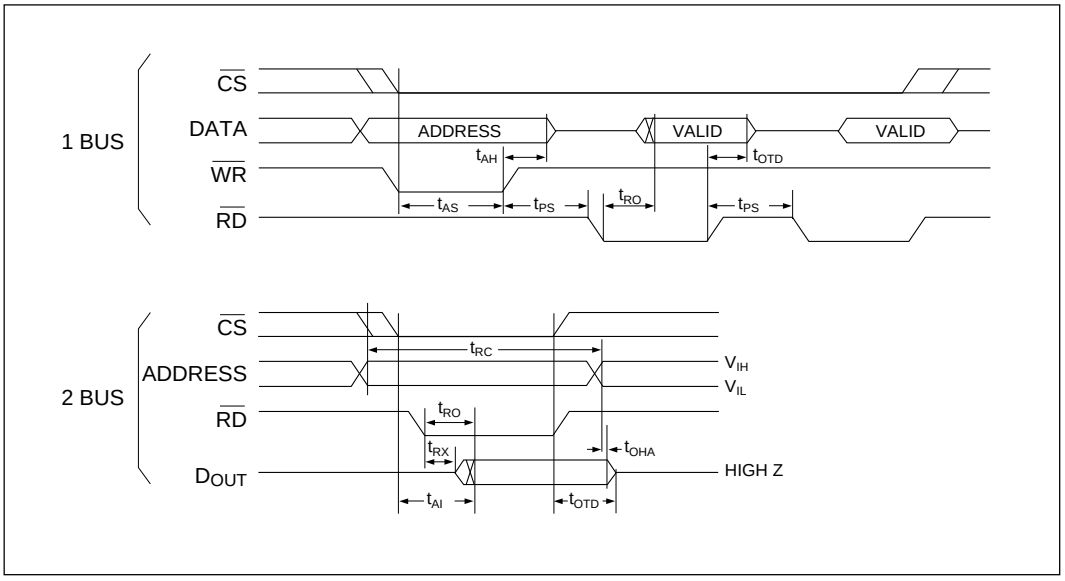
○ **Truth Table**

$\overline{CS}$	$\overline{RD}$	$\overline{WR}$	A_0 to A_3	A_4 to A_6	D_{IN}		D_{OUT}		Mode
					D_0 to D_3	D_4 to D_7	D_0 to D_3	D_4 to D_7	
H	*	*	*	*	*	*	High impedance	High impedance	Standby
L	L	H	Stable	Stable**	High impedance	High impedance	Data output	Data output**	Read cycle
L	H	L	Stable	Stable**	Stable	Stable**	High impedance	High impedance	Write cycle

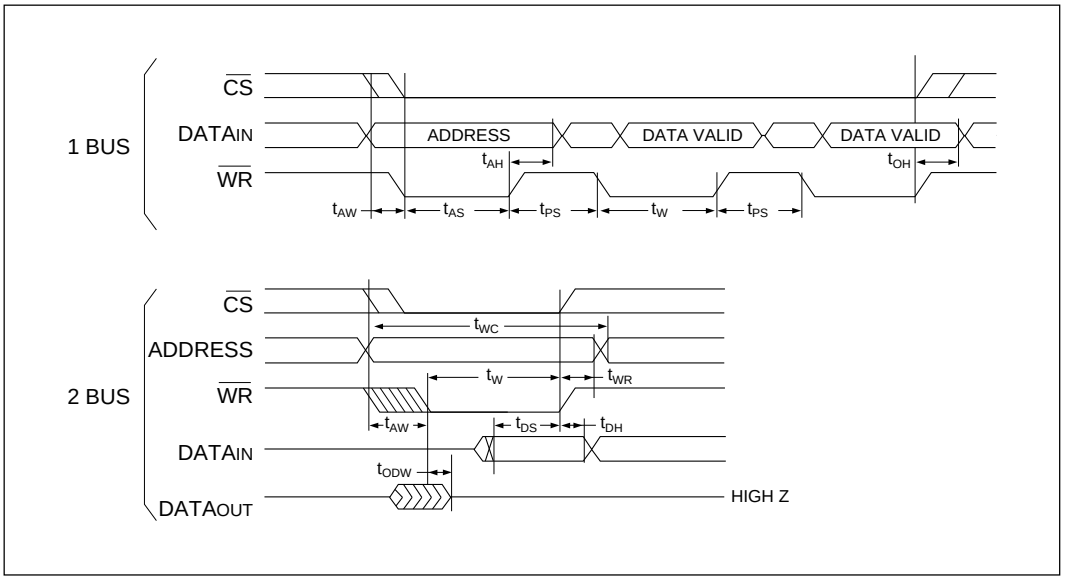
* "H" or "L"

** High impedance in 4-bit mode

- **Timing Diagrams**
  - **Read Operation**

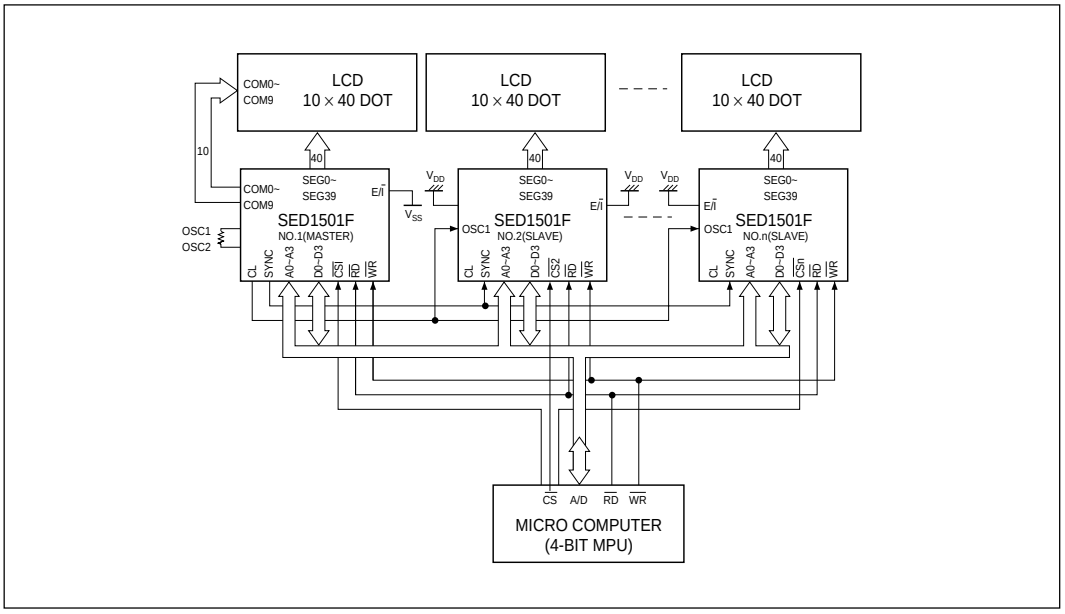


  - **Write Operation**

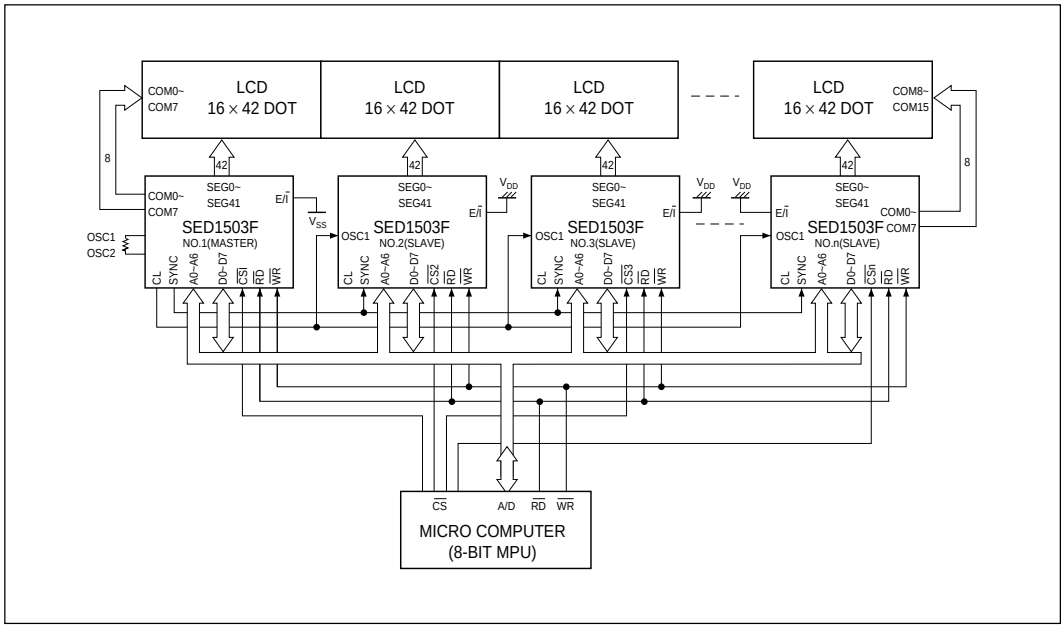


■ EXAMPLE OF APPLICATIONS (Interfacing the SED1500 Series to LCD and MPU)

- **Number of display dots = 10 × 40 × n**
  n = 1–10 (in the case of SED1501F)
  n = number of driver chips



- **Number of display dots = 16 × 42 × n**
  n = 2–10 (in the case of SED1503F)
  n = number of driver chips



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