SED2020

CMOS VFD Driver

Technical Manual

S-MOS Systems, Inc.
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Version 1.0 (Preliminary)

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1.0 GENERAL DESCRIPTION

1.1 DESCRIPTION

The SED2020F$_{OA/OB}$ is a CMOS LSI dot-matrix vacuum fluorescent display anode and grid driver. It has 20 high-voltage anode outputs in 2 × 10 blocks.

The SED2020F$_{OA/OB}$ is TTL, LSTTL, CMOS and HSCMOS compatible, allowing direct interface to a wide range of standard devices. It has independent serial inputs and outputs for each 10-element block which feature data transfer rates of up to 4 Mbits/s. All inputs have internal pull-ups and serial outputs have a minimum fanout of one standard TTL load. The serial data transfer system simplifies controller requirements. The SED2020F$_{OA/OB}$ can also be configured for 4-bit parallel data transfer.

SED2020F$_{OA/OB}$ uses a 5V logic supply and a 30 to 70V display supply, and is available in 44- or 46-pin plastic flatpacks.

1.2 FEATURES

- 20 anode or grid output drivers
- 70V, 10mA grid drive capability
- Up to 4 Mbits/s serial data transfer rate
- Daisy-chain data transfer system for cascaded operation
- Can be configured for 4-bit parallel data transfer
- Silicon-gate CMOS technology
- 5V logic supply
- 30 to 70V display supply
- 44- or 46-pin plastic flatpack (QFP2-44pin [F$_{OB}$] and QFP1-46pin [F$_{OA}$])

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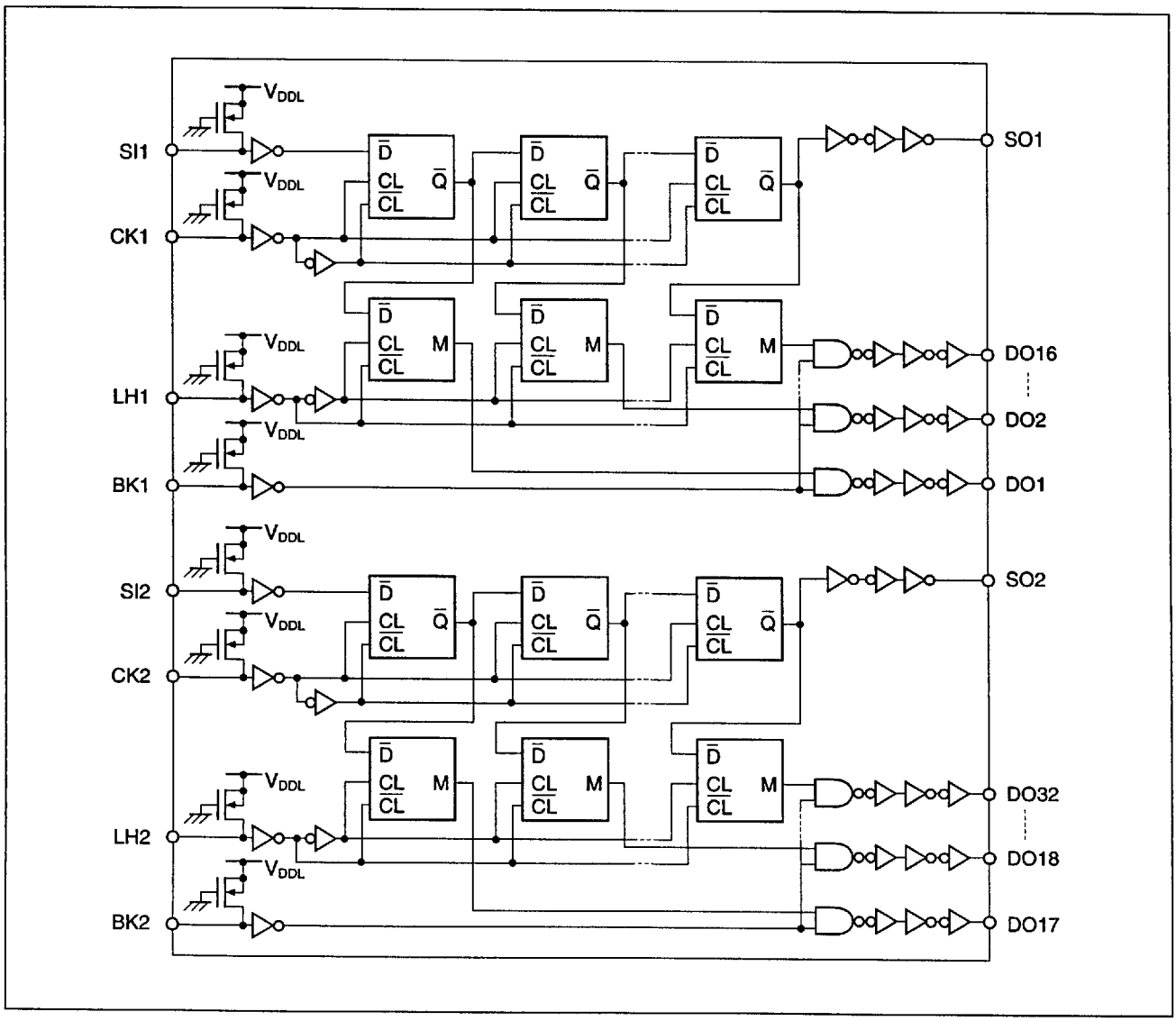
2.0 BLOCK DIAGRAM



2.0 Block Diagram

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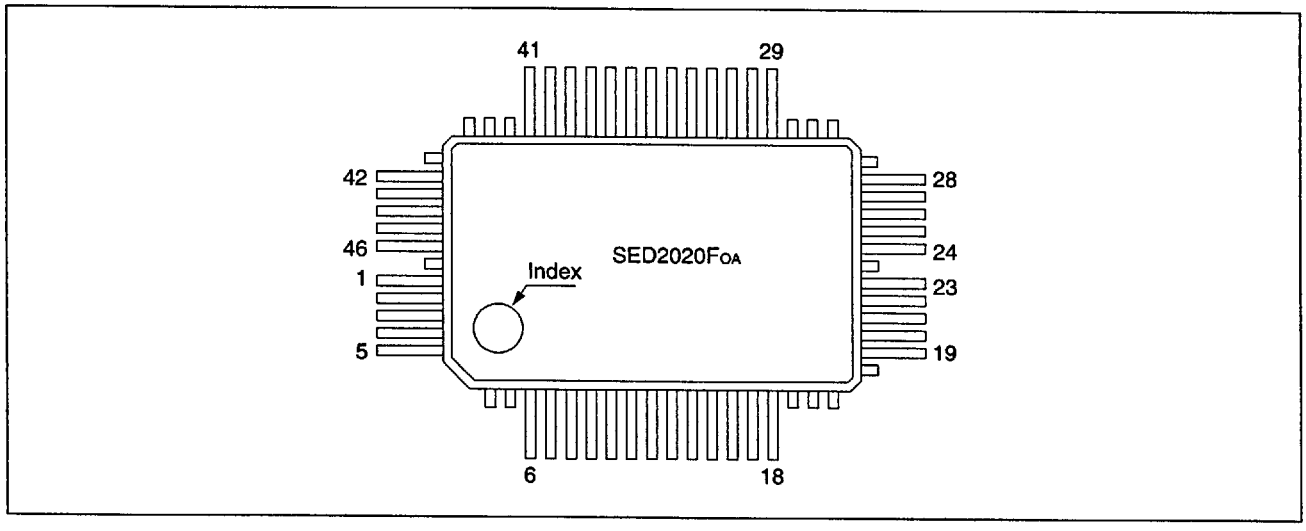
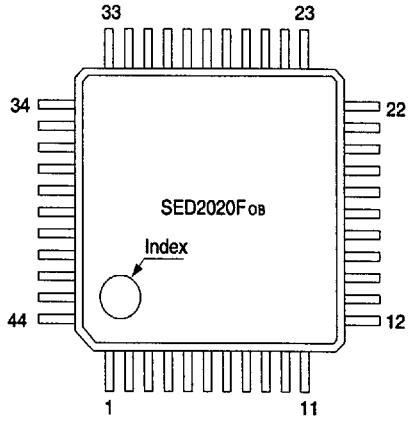
3.0 PIN CONFIGURATION

3.1 SED2020F$_{OA}$



Pin		Pin		Pin		Pin	
Number	Name	Number	Name	Number	Name	Number	Name
1	SI2	13	DO16	25	NC	37	DO3
2	CK2	14	DO17	26	SO1	38	DO2
3	LH2	15	DO18	27	NC	39	DO1
4	V_{DDL}	16	DO19	28	NC	40	NC
5	V_{SS}	17	DO20	29	NC	41	NC
6	V_{DDH}	18	NC	30	DO10	42	BK2
7	NC	19	NC	31	DO9	43	BK1
8	DO11	20	NC	32	DO8	44	LH1
9	DO12	21	SO2	33	DO7	45	CK1
10	DO13	22	NC	34	DO6	46	SI1
11	DO14	23	NC	35	DO5		
12	DO15	24	NC	36	DO4		

3.2 SED2020F$_{OB}$



Pin		Pin		Pin		Pin	
Number	Name	Number	Name	Number	Name	Number	Name
1	V_{DDH}	12	NC	23	DO10	34	BK2
2	DO11	13	NC	24	DO9	35	BK1
3	DO12	14	NC	25	DO8	36	NC
4	DO13	15	SO2	26	DO7	37	LH1
5	DO14	16	NC	27	DO6	38	CK1
6	DO15	17	NC	28	DO5	39	SI1
7	DO16	18	NC	29	DO4	40	SI2
8	DO17	19	NC	30	DO3	41	CK2
9	DO18	20	SO1	31	DO2	42	LH2
10	DO19	21	NC	32	DO1	43	V_{DDL}
11	DO20	22	NC	33	NC	44	V_{SS}

3.3 PIN DESCRIPTION

Number		Name	Description
SED2020F$_{OA}$	SED2020F$_{OB}$		
1	40	SI2	Serial data input 2
2	41	CK2	Serial data input clock 2
3	42	LH2	Active-HIGH data latch input 2
4	43	V_{DDL}	5V logic supply input
5	44	V_{SS}	Ground
6	1	V_{DDH}	30 to 70V output driver supply input. Referenced to V_{SS}
7	36	NC	No connection
8 to 17	2 to 11	DO11 to DO20	Parallel data outputs
18 to 20	12 to 14	NC	No connection
21	15	SO2	Serial data output 2
22 to 25	16 to 19	NC	No connection
26	20	SO1	Serial data output 2
27 to 29	21, 22	NC	No connection
30 to 39	23 to 32	DO10 to DO1	Parallel data outputs
40, 41	33	NC	No connection
42	34	BK2	Active-HIGH blanking input 2. Used to disable output circuitry while parallel data is being latched.
43	35	BK1	Active-HIGH blanking input 1. Used to disable output circuitry while parallel data is being latched.
44	37	LH1	Active-HIGH data latch input 1
45	38	CK1	Serial data input clock 1
46	39	SI1	Serial data input 1

3.0 Pin Configuration

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4.0 ELECTRICAL CHARACTERISTICS

4.1 ABSOLUTE MAXIMUM RATINGS

V_{SS} = 0V, Ta = –10 to 70°C

Parameter	Symbol	Ratings	Unit
Supply voltage (driver)	V_{DDH}	–0.3 to 70	V
Supply voltage (logic)	V_{DDL}	–0.3 to 7	V
Driver output voltage	V_{DO}	V_{SS} – 0.3 to V_{DDH} + 0.3	V
Input/output voltage	$V_{I/O}$	V_{SS} – 0.3 to V_{DDL} + 0.3	V
Driver high level output current	I_{OHDO}	–15 to 0	mA
Driver low level output current	I_{OLDO}	0 to 3	mA
Power dissipation	P_D	0 to 250	mW
Operating temperature	T_{OPR}	–10 to 70	°C
Storage temperature	T_{STG}	–65 to 150	°C
Soldering temperature and time	T_{SOL}	260°C, 10s (at lead)	—

4.2 RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply voltage (driver)	V_{DDH}		30	60	70	V
Supply voltage (logic)	V_{DDL}		4.5	5.0	5.5	V
Input voltage	V_I		0	—	V_{DDL}	V
Input logic level	V_{LL}	TTL input level	—	1.55	—	
Driver high level output current	I_{OHDO}	Grid output	—	–10	—	mA
		Anode output	—	–0.5	—	mA
Clock frequency	fclock	Cascade connection	0	—	4	MHz
Clock pulse width	twclock		125	—	—	ns
Setup time	tsetup		125	—	—	ns
Hold time	thold		0	—	—	ns
Latch pulse width	twlatch		250	—	—	ns

4.3 DC ELECTRICAL CHARACTERISTICS

V_{DDL} = 5V, V_{DDH} = 60V, Ta = 25°C

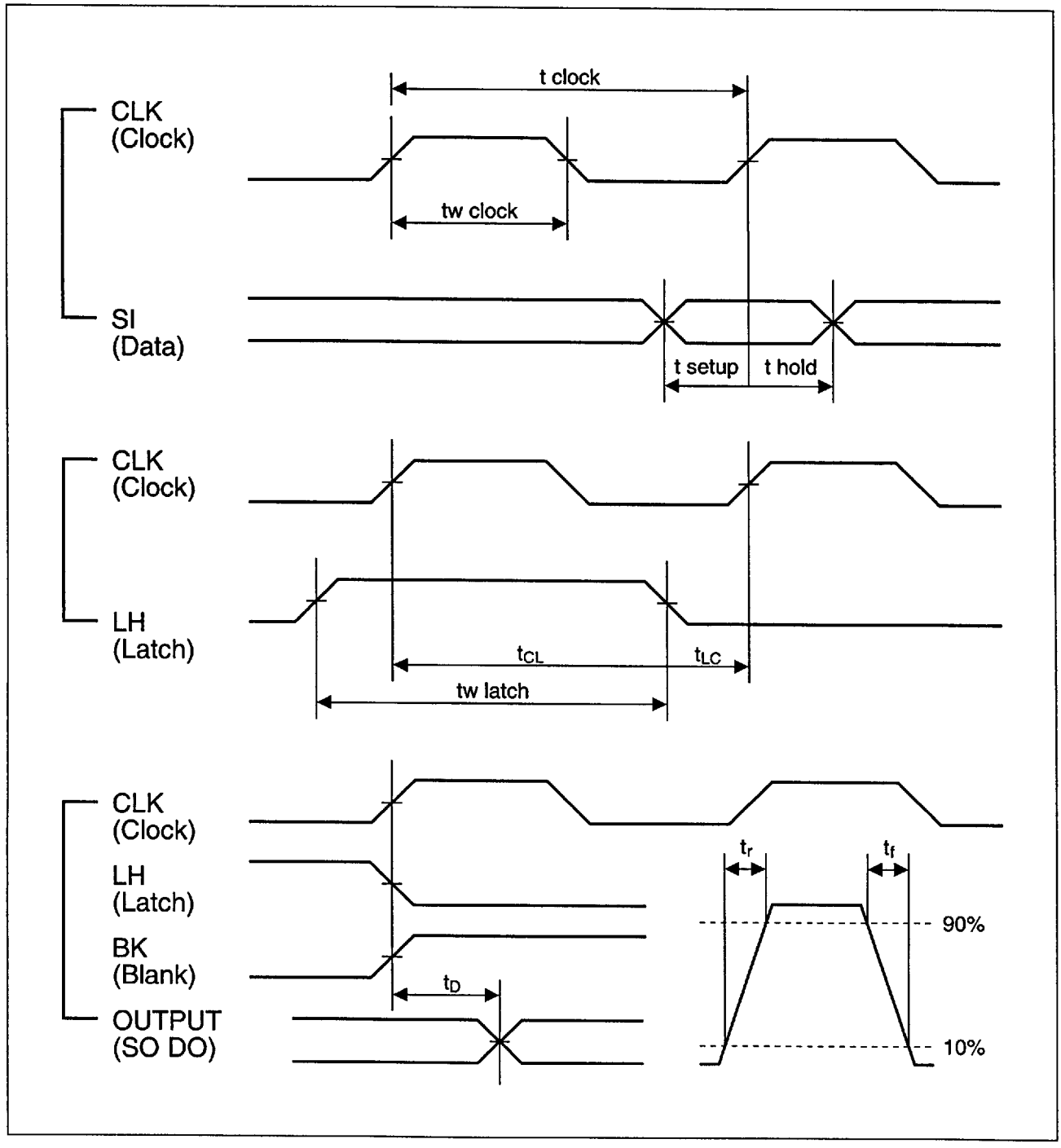
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
High level input voltage	V_{IH}		2.4	—	V_{DDL}	V
Low level input voltage	V_{IL}		0	—	0.7	V
High level input current	I_{IH}	V_{IH} = 5.3V	—	33	100	µA
Low level input current	I_{IL}	V_{IL} = 0V	–160	–100	—	µA
High level output current	I_{OH}(SO)	V_{OH} = 4.6V	—	–1.4	–0.44	mA
Low level output current	I_{OL}(SO)	V_{OL} = 0.4V	1.6	2.1	—	mA
Supply current (V_{DDL})	I_{DDL}	f clock = 4MHz	—	—	5	mA
Supply current (V_{DDH})	I_{DDH}	At all drivers output "H"	—	—	2.0	mA
Driver high level output current	I_{OHDO}	V_{OHDO} = 55V at output "H"	—	—	–10	mA
Driver low level output current	I_{OLDO}	V_{OLDO} = 5V at output "L"	1	—	—	mA

4.4 AC ELECTRICAL CHARACTERISTICS

V_{DDL} = 5V, V_{DDH} = 60V, Ta = 25°C

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Clock latch delay time	tCL	1. Input signal conditions (1) Amplitude: 0–5V (2) Rise/fall time should be 15ns or less. (3) Measuring voltage should be 2.5V. 2. Output signal conditions (1) Standard loads are: 13pF, 10MΩ (2) Measuring voltage should be 2.5V or 1/2 of the amplitude.	125	—	—	ns
Latch clock delay time	tLC		0	—	—	ns
Output(SO) rise time	tr (SO)		—	—	50	ns
Output(SO) fall time	tf (SO)		—	—	50	ns
Clock(SO) delay time	tp (SO)		—	—	125	ns
Output(DO) rise time	tr (DO)		—	—	1	µs
Output(DO) fall time	tf (DO)		—	—	1	µs
BK–DO transfer time	tp (DO)		—	—	2	µs

4.5 TIMING CHART



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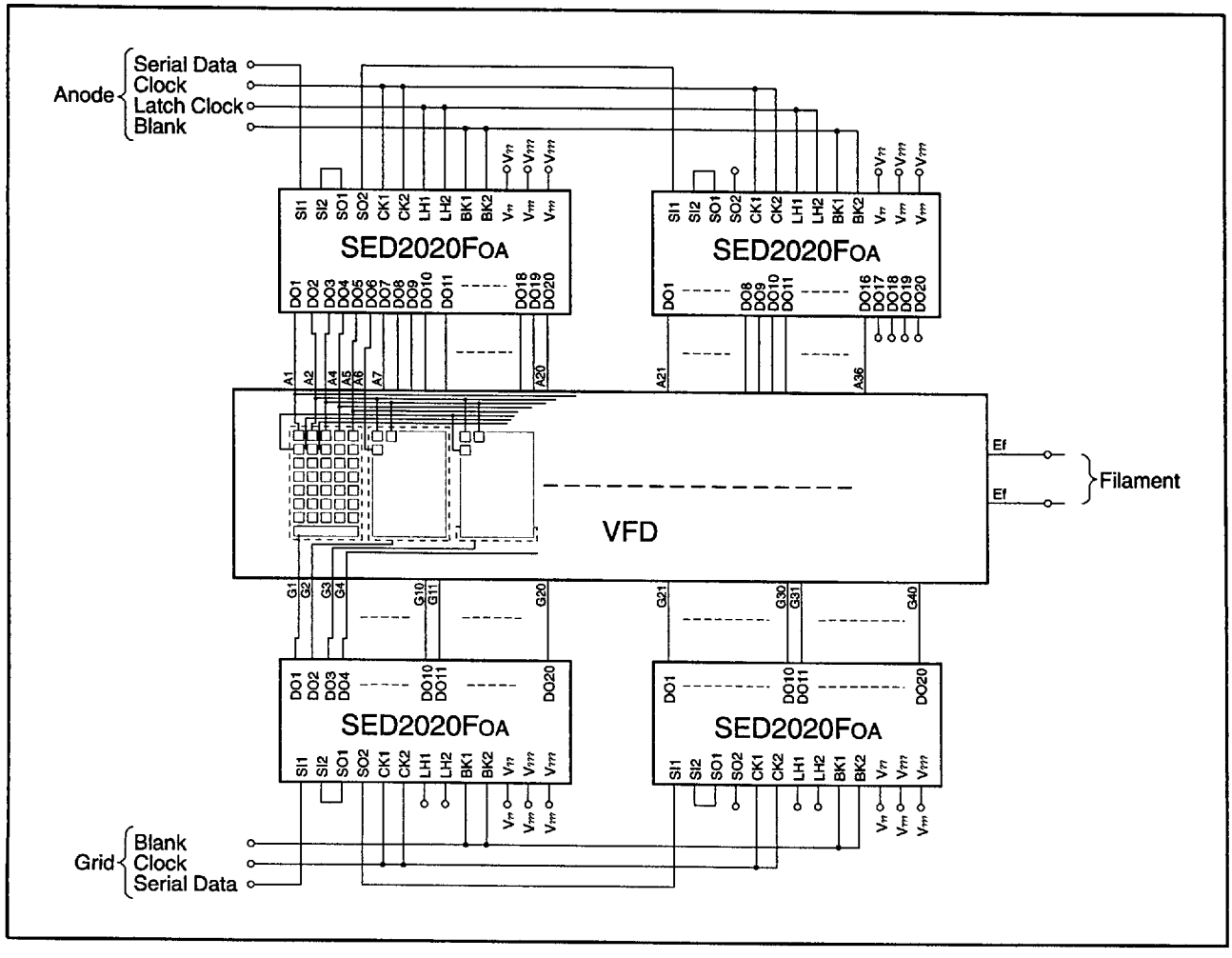
5.0 TYPICAL CONNECTIONS

5.1 EXAMPLE OF CONNECTING SED2020F'S TO VFD (1) <1 BIT SERIAL>



5.2 EXAMPLE OF CONNECTING SED2020F'S TO VFD (2) <4 BITS SERIAL>