EPSON

SED1278F/D

Dot Matrix LCD Controller Driver

- **1/8, 1/11 or 1/16 Duty Dot Matrix Drive**
- **Built-in Character Generator ROM and RAM (ROM 240 characters / RAM 8 characters)**
- **Maximum Simultaneous Display of 80 Characters (With extension LCD driver)**

■ DESCRIPTION

The SED1278F/D is a dot matrix LCD controller/driver which is dedicated to character display. It is capable of displaying up to 80 characters under 4-bit/8-bit MPU control.

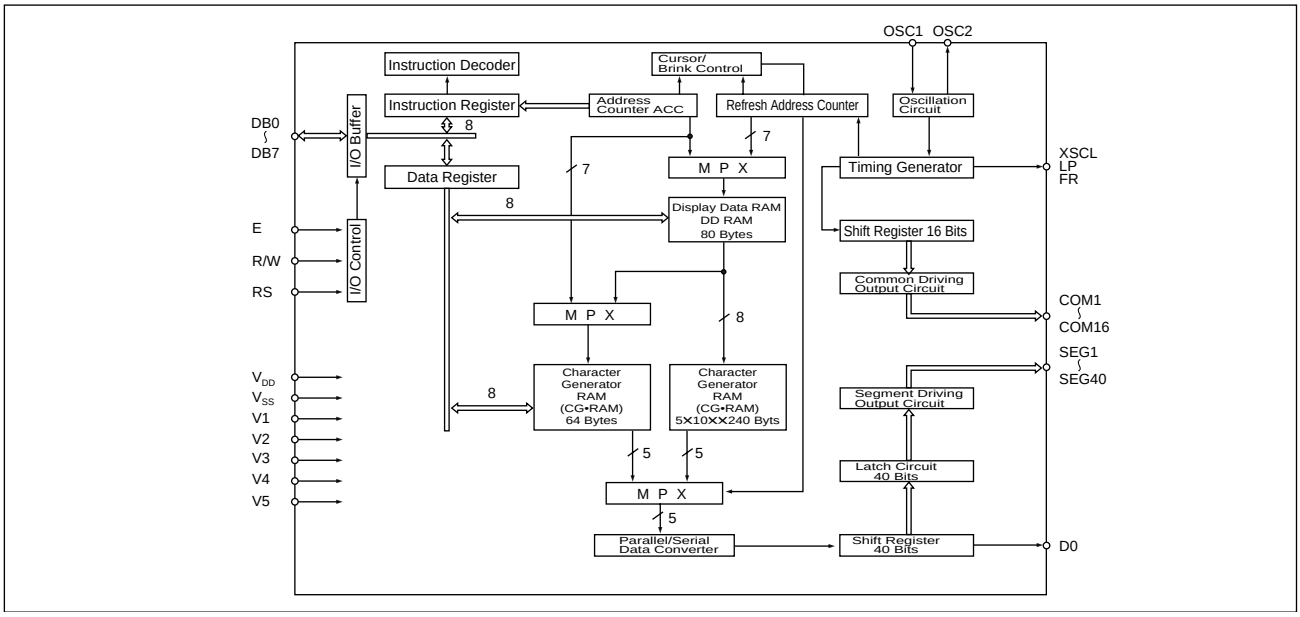
The built-in character generator ROM has an extended capacity of 240 different characters, each being generated in a 5×10 dots font compatible with a 1/11 duty. In addition, the SED1278F/D contains 64 bytes of character generator RAM in which the user can store 8 different characters, each consisting of 558 dots. These memory features offer high flexibility in character display.

The guaranteed minimum LCD driving voltage is 3V, and this makes the SED1278F/D suitable for driving low voltage LCDs.

■ FEATURES

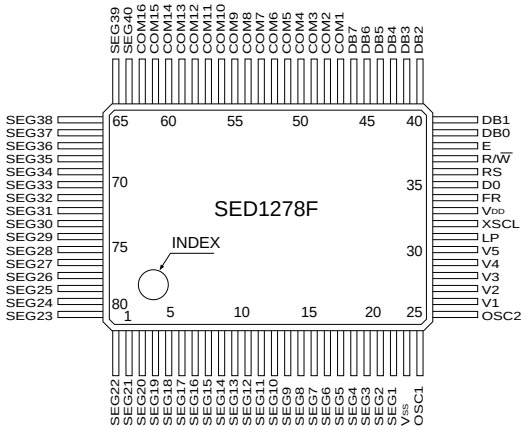
- Display RAM ..... 80 bytes (80 characters)
- Character generator ROM..... 240 characters (Able to 256 characters)
- Character generator RAM ..... 8 characters
- Built-in CR oscillator, Built-in power-on reset circuit
- Maximim display dimension ..... 40 characters52 lines, 80 characters51 line
  (When accompanied with SED1181F$_{LA}$/D$_{LA}$, SED1681F$_{OA}$/D$_{OA}$)
- 1/8, 1/11 or 1/16 duty matirx drive (fixed by command)
- 2 flame AC wave-form drive
- High-speed bus interface with 4-bit/8-bit MPU
- Powerful display control instructions
- Character ..... 5X7 dots+Cursor line (5X8 dots also possible)
  5X10 dots+Cursor line
- 6 Kinds of character font
- Single power supply ..... 5V±10% (Logic)
- Low LCD driving voltage ..... V_{DD}—V_5≥.0V
- Package ..... SED1278F: QFP5-80pin (plastic)
  SED1278D: Die form (Al pad)

■ BLOCK DIAGRAM



■ PIN CONFIGURATION

QFP5-80pin



■ PIN DESCRIPTION

Symbol	No. of signals	Function	
RS	1	Register select signal	∗1
R/$\overline{W}$	1	Read/write select signal	
E	1	Read/write execute signal	
DB0 to DB7	8	Data bus	
LP	1	Data latching pulse	
XSCL	1	Data transfer clock	
FR	1	LCD AC driving signal	
DO	1	Serial data	
COM 1 to COM16	16	Common outputs COM9 to COM16: non-select for 1/8 duty COM12 to COM16: non-select for 1/11 duty	
SEG1 to SEG40	40	Segment outputs	
V1 to V5	5	LCD driving power ($V_5 \geq V_{SS}$)	
V_{DD}	1	+5V	
V_{SS}	1	0V (GND)	
OSC1		Used to connect resistor (typ. 91K-ohms) for oscillation;	
OSC2	2	OSC1 is for external clock input.	

∗1

RS	R/W	E	Operation
0	0	⎍	Instruction write cycle
0	1	1	Busy flag read cycle Address counter read cycle
1	0	⎍	DD RAM or CG RAM data write cycle
1	1	1	DD RAM or CG RAM data read cycle

■ ABSOLUTE MAXIMUM RATINGS

(V_{SS} = 0V, Ta = 25°C)

Rating	Symbol	Value	Unit
Supply voltage (1)	V_{DD}	–0.3 to 7.0	V
Supply voltage (2)	V_1 to V_5	–0.3 to V_{DD}+0.3	V
Input voltage	V_I	–0.3 to V_{DD}+0.3	V
Output voltage	V_O	–0.3 to V_{DD}+0.3	V
Power dissipation	P_D	300	mW
Operating temperature	T_{opr}	–20 to 75	°C
Storage temperature	T_{stg}	–65 to 150	°C
Soldering temperature and time	T_{sol}	260°C•10s (at lead)	—

Note: The following condition must always hold true: $V_{DD} \geq V_1 \geq V_2 \geq V_3 \geq V_4 \geq V_5$

■ ELECTRICAL CHARACTERISTICS

● DC Characteristics

(V_{DD} = 5.0V±10%, V_{SS} = 0V, Ta = –20 to 75°C)

Characteristic	Symbol	Condition	Applicable Pin	Min.	Typ.	Max.	Unit
"H" level input voltage (1)	V_{IH1}		DB0~DB7 RS, R/W, E	2.0	—	V_{DD}	V
"L" level input voltage (1)	V_{IL1}			V_{SS}	—	0.8	V
"H" level input voltage (2)	V_{IH2}		OSC1	V_{DD}—1.0	—	V_{DD}	V
"L" level input voltage (2)	V_{IL2}			V_{SS}	—	1.0	V
"H" level output voltage (1)	V_{OH1}	I_{OH} = –0.205mA	DB0~DB7	2.4	—	—	V
"L" level output voltage (1)	V_{OL1}	I_{OL} = 1.6mA		—	—	0.4	V
"H" level output voltage (2)	V_{OH2}	I_{OH} = –0.04mA	XSCL LP DO	0.9V_{DD}	—	—	V
"L" level output voltage (2)	V_{OL2}	I_{OL} = 0.04mA		—	—	0.1V_{DD}	V
Driver-on resistor (COM)	R_{COM}	$\lvert V_{COM}—V_n \rvert$ =0.5V	COM1~16	—	2	10	kΩ
Driver-on resistor (SEG)	R_{SEG}	$\lvert V_{SEG}—V_n \rvert$ =0.5V	SEG1~40	—	2.5	10	kΩ
I/O leakage current	I_{IL}	V_I = 0 to V_{DD}		—	—	1	µA
Pull-up MOS current	—I_P	V_{DD} = 5V		50	125	250	µA
Supply current	I_{OP}	Rf oscillation, from external clock V_{DD} = 5V, fosc = f_{CP} = 270kHz	V_{DD}	—	0.5	0.8	mA
External clock operation							
External clock operating frequency	f_{EXTCL}			125	250	350	kHz
External clock duty	Duty			45	50	55	%
External clock rise time	tr_{EXTCL}			—	—	0.2	µS
External clock fall time	tf_{EXTCL}			—	—	0.2	µS
Internal clock operation (Rf oscillation)							
Oscillation frequency	f_{OSC}	R_f = 91KΩ ±2%		190	270	350	kHz
Internal clock operation (Ceramic filter oscillation)							
Oscillation frequency	f_{OSC}	Ceramic filter		245	250	255	kHz
LCD driving voltage	V_{LCD}	V_{DD}—V_5		3.0	—	V_{DD}	V

● AC Characteristics

❍ Read Cycle

(V_{DD} = 5.0V±10%, V_{SS} = 0V, Ta = –20 to 75°C)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Enable cycle time	t_{cycE}		500	—	—	ns
Enable "H" level pulse width	t_{WEH}		220	—	—	ns
Enable rise/fall time	t_{rE}, t_{fE}		—	—	25	ns
RS, R/$\overline{W}$ setup time	t_{AS}		40	—	—	ns
RS, R/$\overline{W}$ address hold time	t_{AH}		10	—	—	ns
Read data output delay	t_{RD}	C_L = 100pF	—	—	120	ns
Read data hold time	t_{DHR}		20	—	—	ns

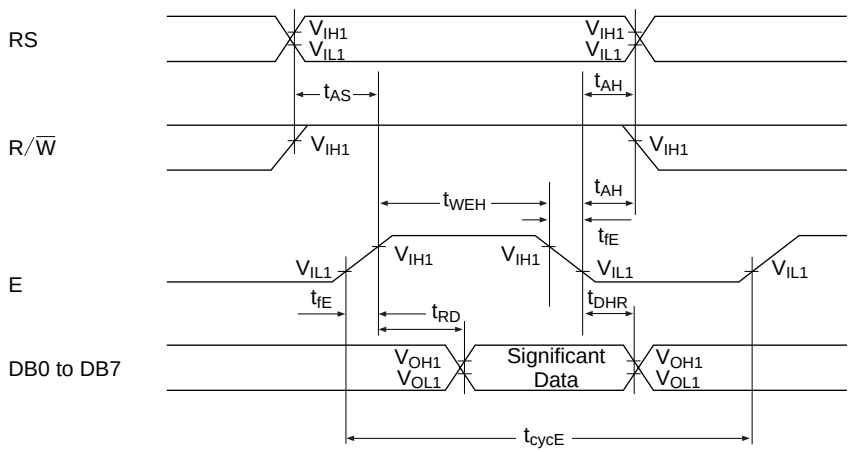
❍ Write Cycle

(V_{DD}=5.0V±10%, V_{SS}=0V, Ta=–20 to 75°C)

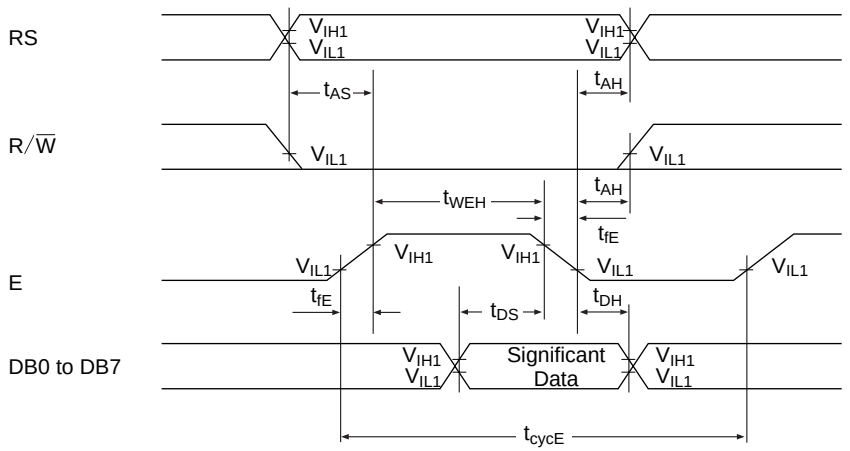
Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Enable cycle time	t_{cycE}		500	—	—	ns
Enable "H" level pulse width	t_{WEH}		220	—	—	ns
Enable rise/fall time	t_{rE}, t_{fE}		—	—	25	ns
RS, R/$\overline{W}$ setup time	t_{AS}		40	—	—	ns
RS, R/$\overline{W}$ address hold time	t_{AH}		10	—	—	ns
Data setup time	t_{DS}		60	—	—	ns
Write data hold time	t_{DH}		10	—	—	ns

● Timing Chart

○ Read Cycle



○ Write Cycle



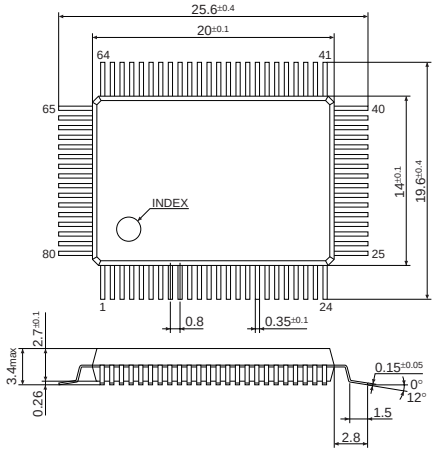
■ DISPLAY COMMAND

Parameter	RS	R/$\overline{W}$	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Note
CLEAR DISPLAY	0	0	0	0	0	0	0	0	0	1	
CURSOR HOME	0	0	0	0	0	0	0	0	1	1	
ENTRY MODE SET	0	0	0	0	0	0	0	1	I/D	I/D	DB1 = 1 : Increment, DB1 = 0 : Decrement DB0 = 1 : The display is shifted. DB0 = 0 : The display is not shifted.
DISPLAY ON/OFF	0	0	0	0	0	0	1	D	C	C	DB2 = 1 : Display on DB2 = 0 : Display off DB1 = 1 : Cursor on DB1 = 0 : Cursor off DB0 = 1 : Brinking on DB0 = 0 : Brinking off
CURSOR/DISPLAY SHIFT	0	0	0	0	0	1	S/C	R/L	*	*	DB3 = 1 : Shifts display one character DB2 = 1 : Right shift, DB2 = 0 : Left shift
SYSTEM SET	0	0	0	0	1	DL	N	F	*	*	DB4 = 1 : 8 bits, DB4 = 0 : 4 bits DB3 = 1 : 2 lines display (1/16 duty), DB3 = 0 : 1 line display (DB2 = 1 : 5×10 dots, 1/11 duty DB2 = 0 : 5×7 dots, 1/8 duty)
SET CGRAM ADDRESS	0	0	0	1	A_{CG}						The address length that can be set is 64 addresses.
SET DDRAM ADDRESS	0	0	1	A_{DD}							The address length that can be set is 80 addresses.
READ BUSY FLUG/ ADDRESS COUNTER	0	1	BF	AC							DB7 = 1 : Busy (instruction not accepted) DB7 = 0 : Ready (instruction accepted)
WRITE DATA	1	0	Write Data								
READ DATA	1	1	Read Data								

*Don't care

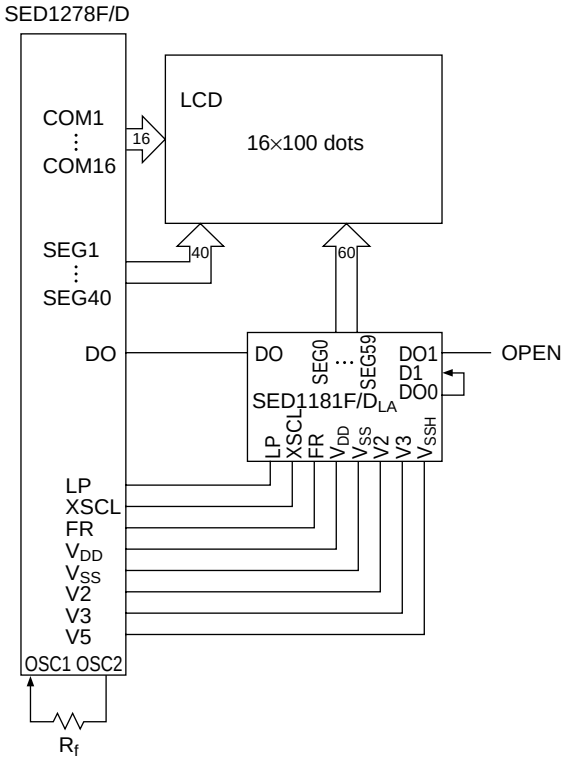
■ PACKAGE DIMENSIONS

Plastic QFP5-80pin



Unit: mm

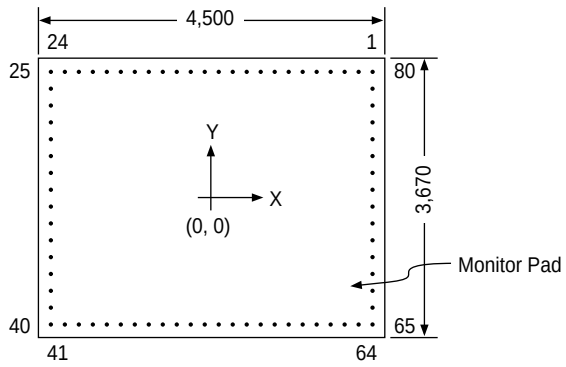
■ LCD PANEL INTERFACE EXAMPLE (2 lines×20 characters)



SED1278F/D is usually connected to 8-bit MPU via I/O ports.

■ SED1278D

● PAD LAYOUT



Pad size : 109×109

Unit : µm

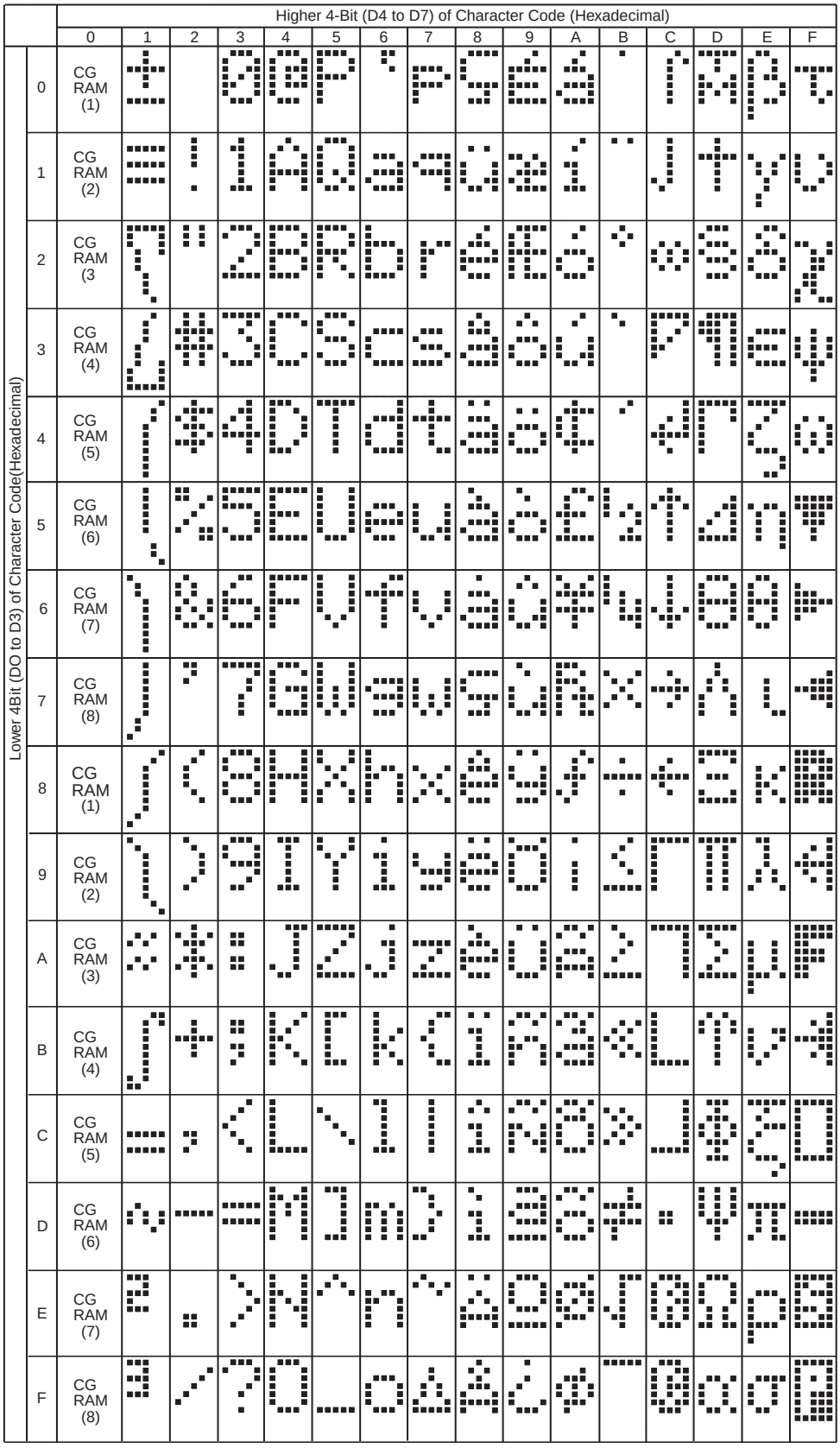
● PAD COORDINATION

Unit : µm

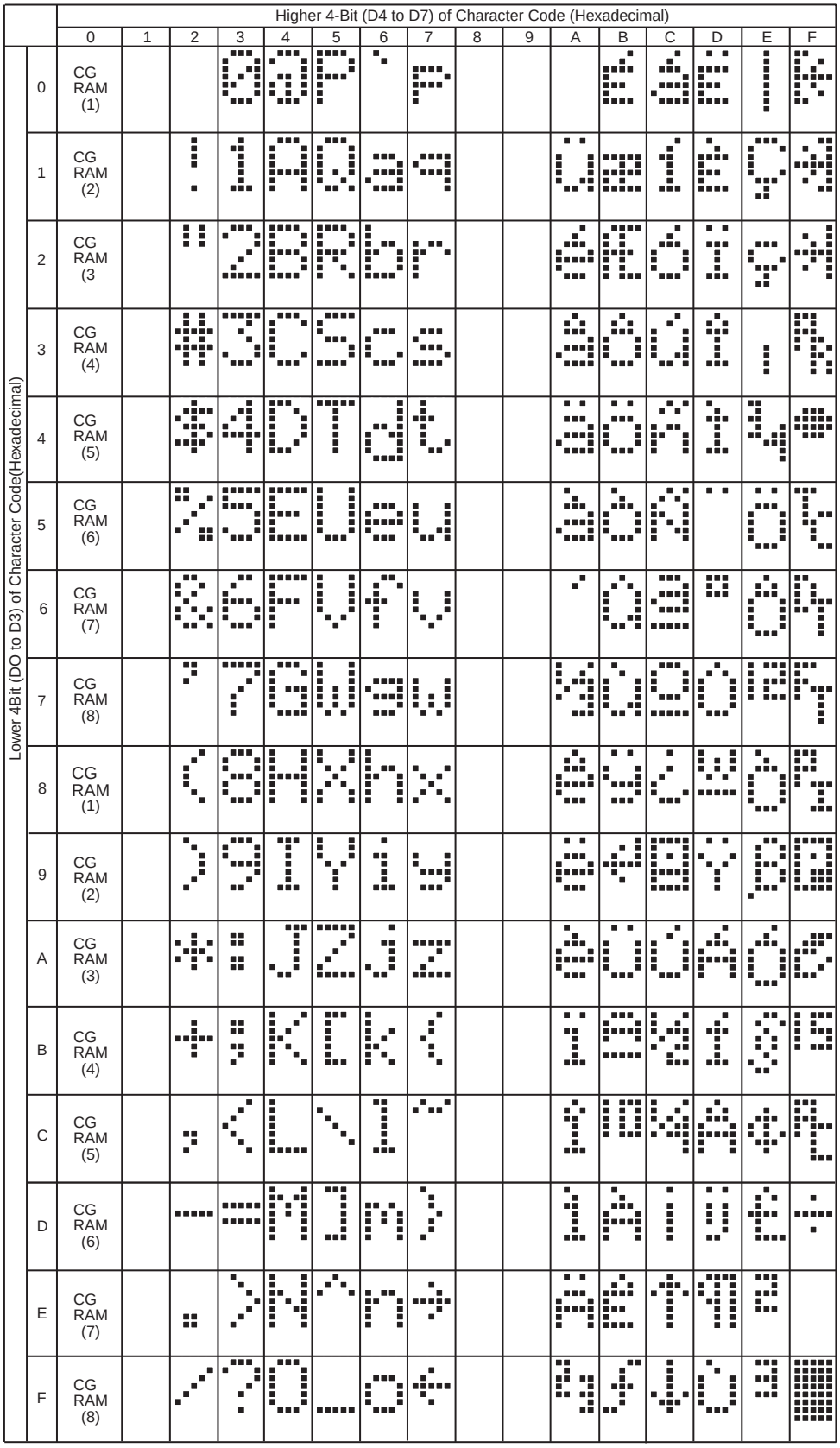
Pad No.	Pad Name	X	Y	Pad No.	Pad Name	X	Y	Pad No.	Pad Name	X	Y
1	SEG22	2,087	1,671	28	V3	–2,087	819	55	COM9	452	–1,671
2	SEG21	1,905		29	V4		637	56	COM10	633	
3	SEG20	1,723		30	V5		455	57	COM11	814	
4	SEG19	1,541		31	LP		273	58	COM12	995	
5	SEG18	1,359		32	XSCL		91	59	COM13	1,177	
6	SEG17	1,177		33	VCC		–91	60	COM14	1,359	
7	SEG16	995		34	FR		–273	61	COM15	1,541	
8	SEG15	814		35	DO		–455	62	COM16	1,723	
9	SEG14	633		36	RS		–637	63	SEG40	1,905	
10	SEG13	452		37	R/W		–819	64	SEG39	2,087	
11	SEG12	272		38	E		–1,001	65	SEG38		–1,365
12	SEG11	91		39	DB0		–1,183	66	SEG37		–1,183
13	SEG10	–91		40	DB1		–1,365	67	SEG36		–1,001
14	SEG9	–272		41	DB2		–1,671	68	SEG35		–819
15	SEG8	–452		42	DB3	–1,905		69	SEG34		–637
16	SEG7	–633		43	DB4	–1,723		70	SEG33		–455
17	SEG6	–814		44	DB5	–1,541		71	SEG32		–273
18	SEG5	–995		45	DB6	–1,359		72	SEG31		–91
19	SEG4	–1,177		46	DB7	–1,177		73	SEG30		91
20	SEG3	–1,359		47	COM1	–995		74	SEG29		273
21	SEG2	–1,541		48	COM2	–814		75	SEG28		455
22	SEG1	–1,723		49	COM3	–633		76	SEG27		637
23	GND	–1,905		50	COM4	–452		77	SEG26		819
24	OSC1	–2,087		51	COM5	–272		78	SEG25		1,001
25	OSC2		1,365	52	COM6	–91		79	SEG24		1,183
26	V1		1,183	53	COM7	91		80	SEG23		1,365
27	V2		1,001	54	COM8	272					

■ SED1278D$_{OA}$ CHARACTER FONT

■ SED1278F$_{OB}$/D$_{OB}$ CHARACTER FONT



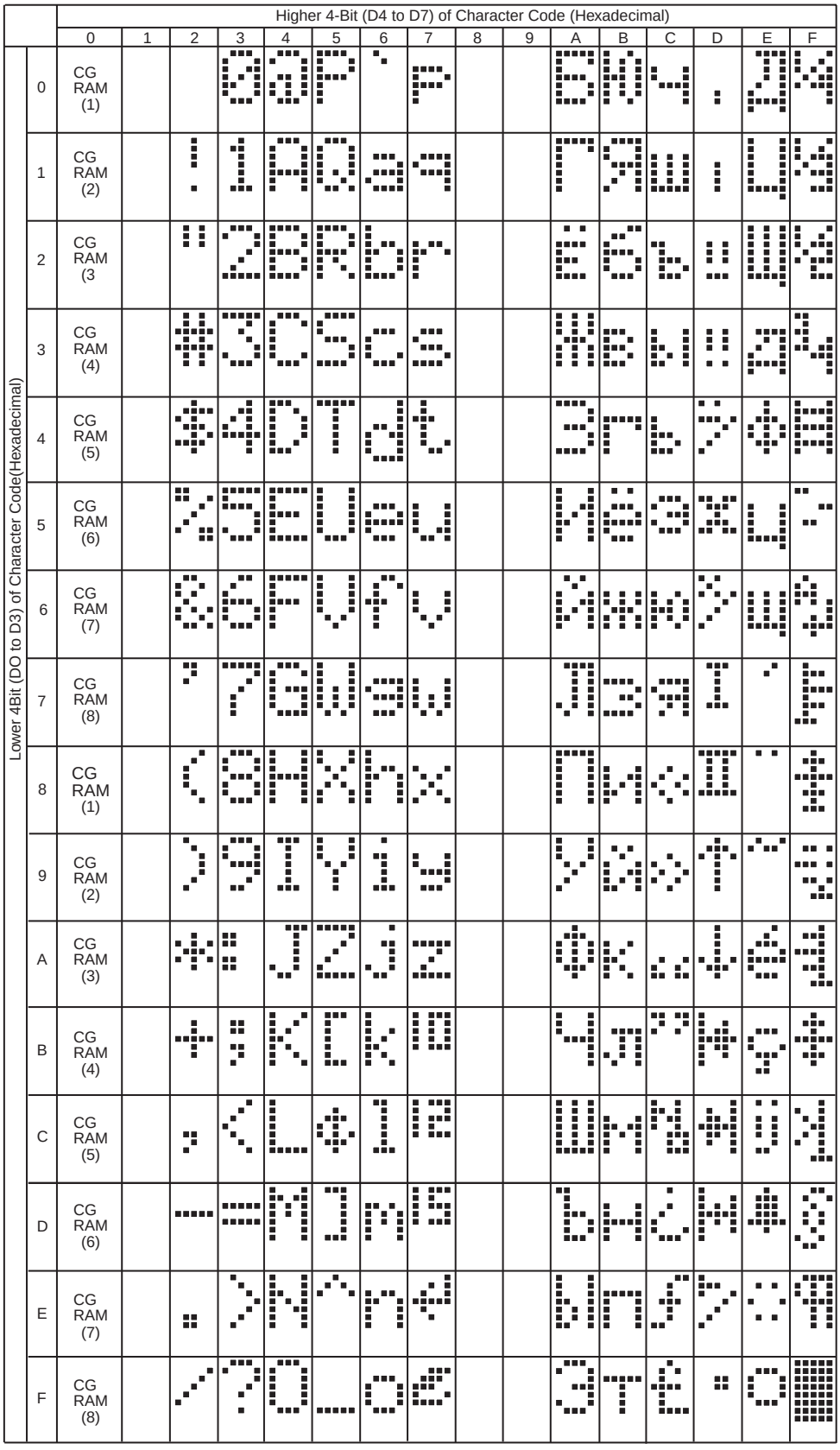
■ SED1278Foc/Doc CHARACTER FONT



■ SED1278F$_{OD}$/D$_{OE}$ CHARACTER FONT

■ SED1278F$_{OG}$/D$_{OG}$ CHARACTER FONT

■ SED1278F$_{OH}$/D$_{OH}$ CHARACTER FONT



*Character codes (0OH-0FH) of SED1278F are assigned to the area of character generator RAM (CG RAM). The CG ROM of the SED1278F is masked; if you wish to have your own CG ROM, consult Seiko Epson Marketing Department for conversion of the masked ROM.

NOTICE

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