

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.

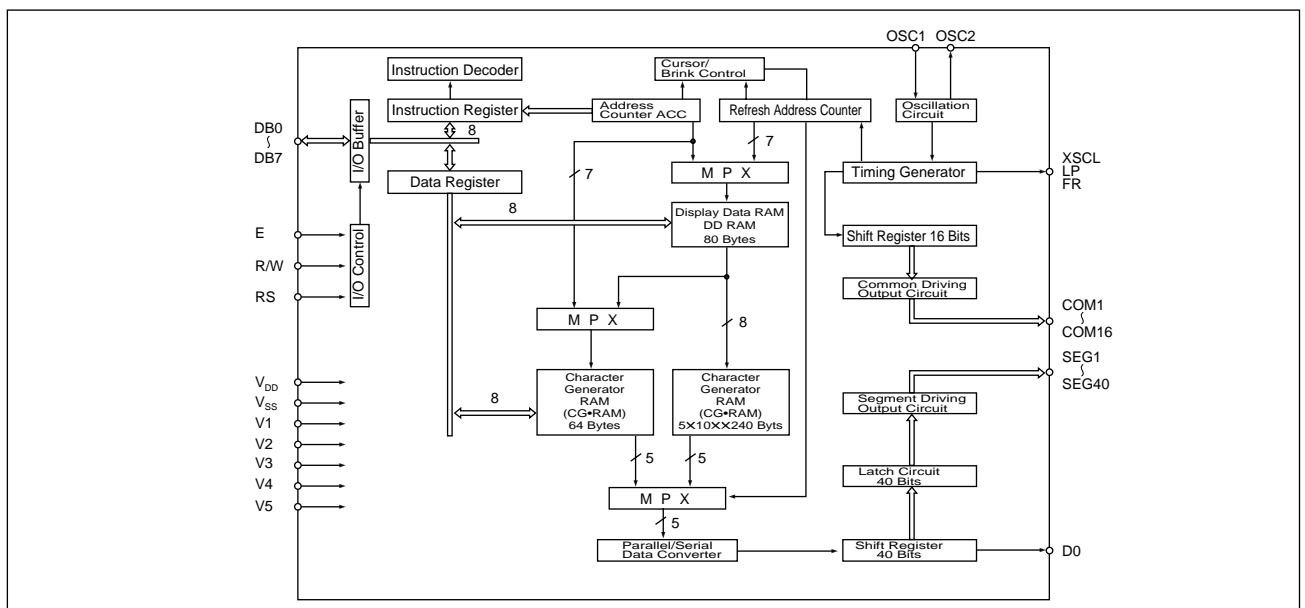
The built-in character generator ROM has an extended capacity of 240 different characters, each being generated in a 5x10 dots font compatible with a 1/11 duty. In addition, the SED1278F/D contains 64 bytes of character generator RAM in which the user can store 8 different characters, each consisting 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.

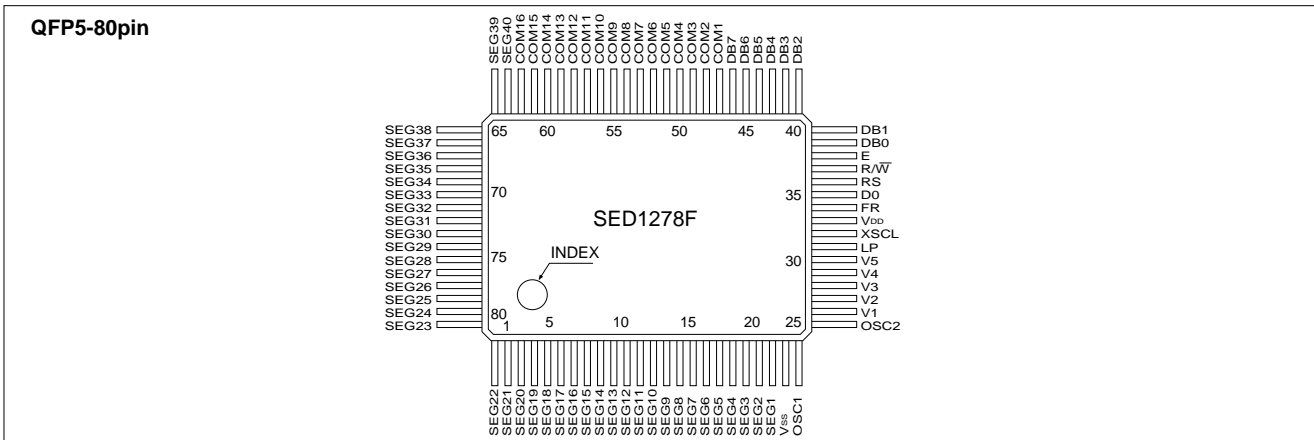
FEATURES

- 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 SED1181FLA/DLA, SED1681FOA/DOA)
- 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 $V_{DD}-V_5 \geq 0.0V$
- Package SED1278F: QFP5-80pin (plastic)
SED1278D: Die form (Al pad)

BLOCK DIAGRAM



■ PIN CONFIGURATION



■ PIN DESCRIPTION

Symbol	No. of signals	Function
RS	1	Register select signal
R/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} ≥ V₁ ≥ V₂ ≥ V₃ ≥ V₄ ≥ V₅

■ ELECTRICAL CHARACTERISTICS

● DC Characteristics

($V_{DD} = 5.0V \pm 10\%$, $V_{SS} = 0V$, $T_a = -20$ to $75^\circ C$)

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}$	|V_{COM}-V_n| = 0.5V$	COM1~16	—	2	10	k Ω
Driver-on resistor (SEG)	R_{SEG}$	|V_{SEG}-V_n| = 0.5V$	SEG1~40	—	2.5	10	k Ω
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 $V_{DD} = 5V$, $f_{osc} = f_{CP} = 270kHz$	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}	$R_f = 91K\Omega \pm 2\%$		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

($V_{DD} = 5.0V \pm 10\%$, $V_{SS} = 0V$, $T_a = -20$ to $75^\circ C$)

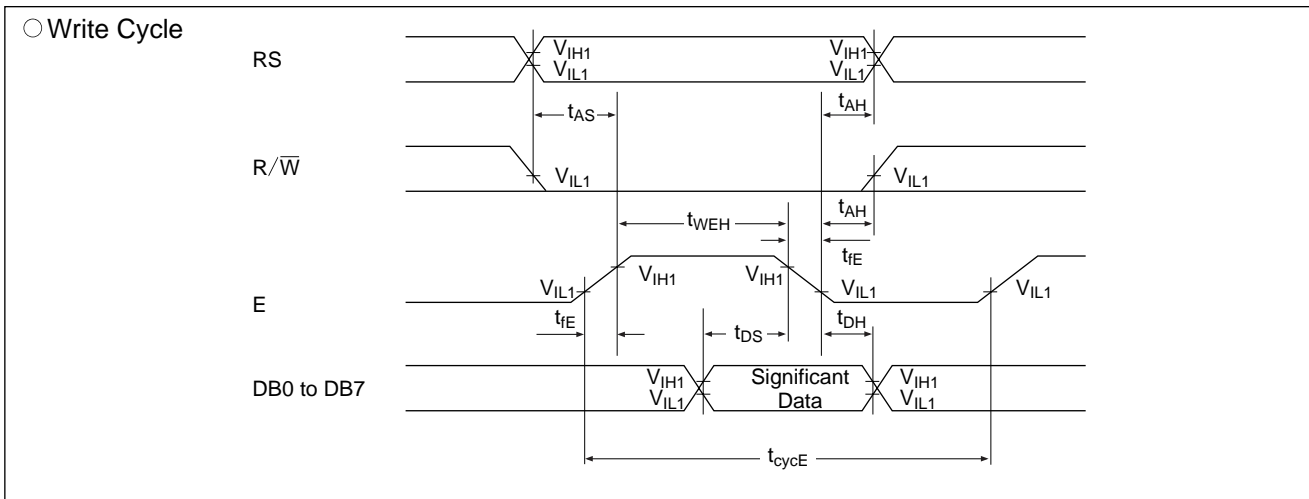
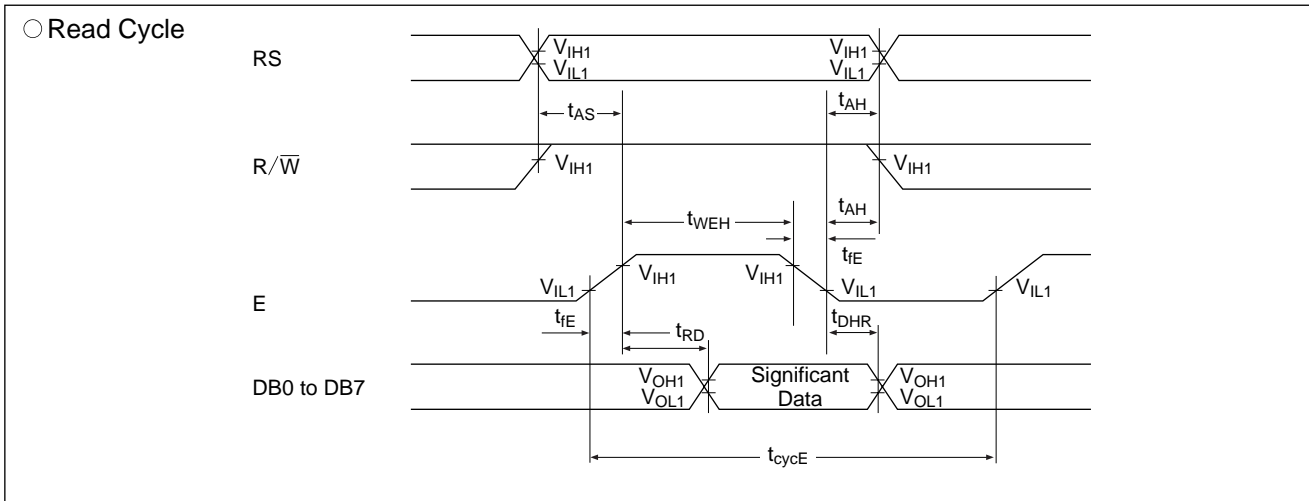
Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Enable cycle time	t_{cycE}		500	—	—	ns
Enable "H" level pulse width	t_{WEH}		220	—	—	ns
Enable rise/fall time	t_{rE}, t_{fE}		—	—	25	ns
RS, R/ \bar{W} setup time	t_{AS}		40	—	—	ns
RS, R/ \bar{W} address hold time	t_{AH}		10	—	—	ns
Read data output delay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

○ Write Cycle

($V_{DD} = 5.0V \pm 10\%$, $V_{SS} = 0V$, $T_a = -20$ to $75^\circ C$)

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/ \bar{W} setup time	t_{AS}		40	—	—	ns
RS, R/ \bar{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

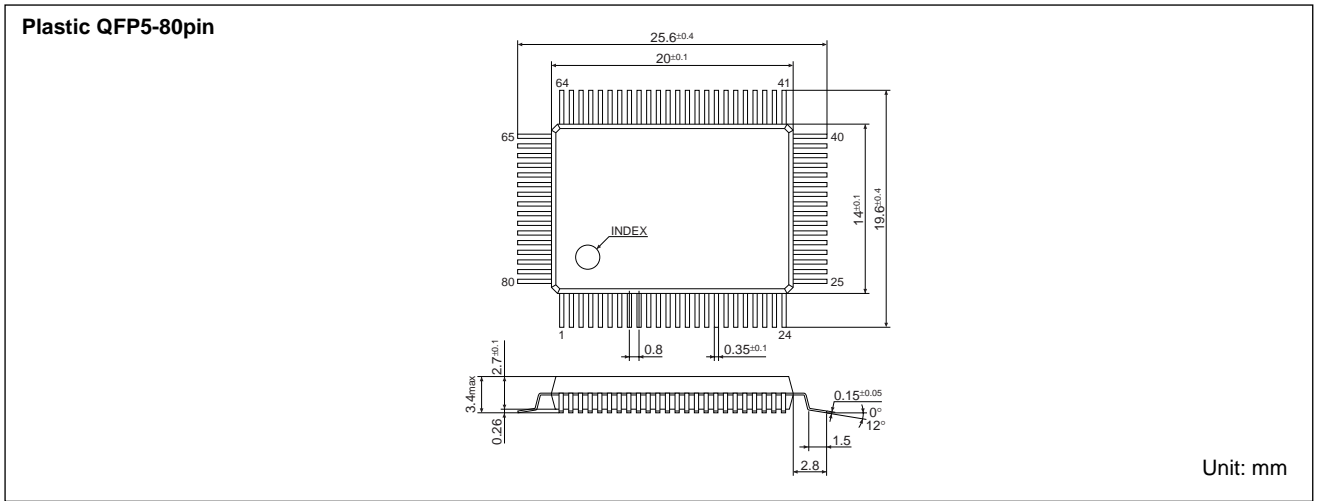


■ DISPLAY COMMAND

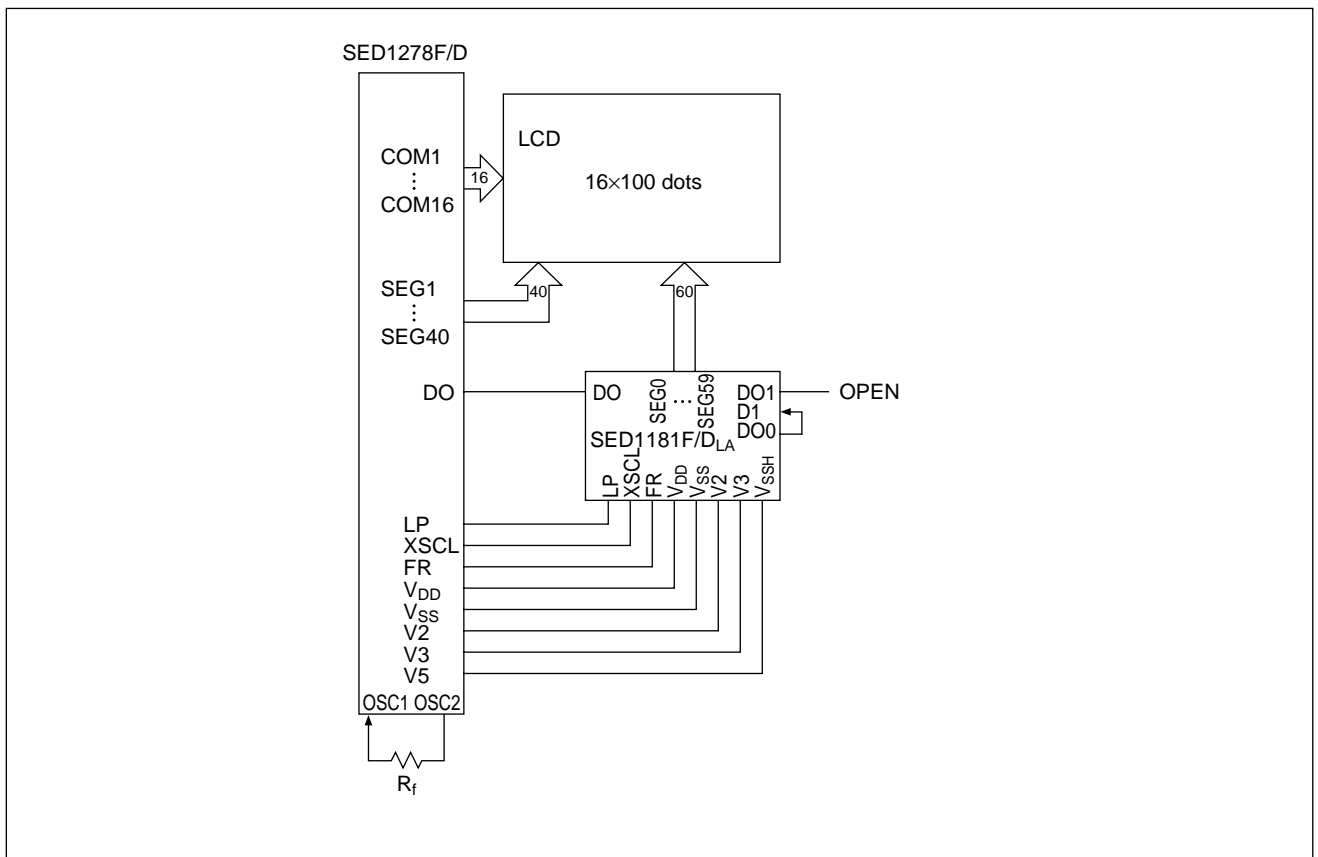
Parameter	RS	R/ \bar{W}	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Note
CLEAR DISPLAY	0	0	0	0	0	0	0	0	0	1	
CURSOR HOME	0	0	0	0	0	0	0	0	1	1	
ENTRY MODE SET	0	0	0	0	0	0	0	1	I/D	I/D	DB1 = 1 : Increment, DB1 = 0 : Decrement DB0 = 1 : The display is shifted. DB0 = 0 : The display is not shifted.
DISPLAY ON/OFF	0	0	0	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



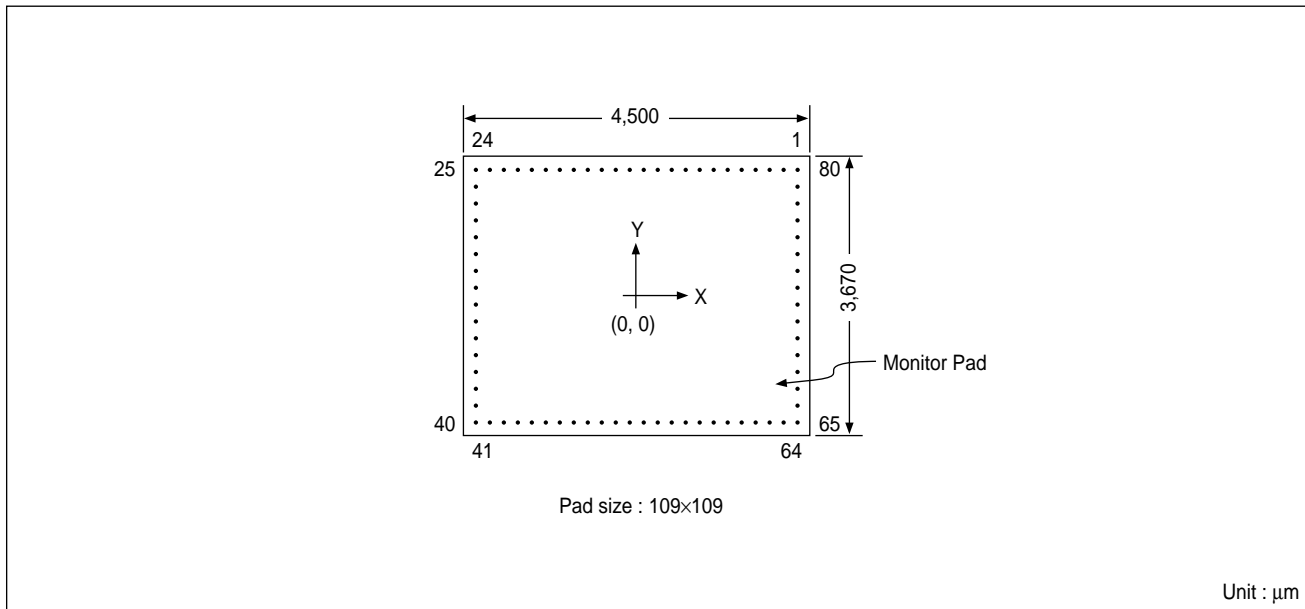
■ LCD PANEL INTERFACE EXAMPLE (2 lines×20 characters)



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

■ SED1278D

● PAD LAYOUT



● PAD 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_{0A} CHARACTER FONT

		Higher 4-Bit (D4 to D7) of Character Code (Hexadecimal)																	
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F		
Lower 4Bit (D0 to D3) of Character Code(Hexadecimal)	0	CG RAM (1)				0	P	'	P					—	9	3	0	P	
	1	CG RAM (2)		!	1	A	Q	a	a					•	7	*	4	a	Q
	2	CG RAM (3)		"	2	B	R	b	r					"	4	W	X	P	B
	3	CG RAM (4)		#	3	C	S	c	s					•	7	*	e	e	s
	4	CG RAM (5)		\$	4	D	T	d	t					√	1	T	P	U	D
	5	CG RAM (6)		%	5	E	U	e	u					•	*	*	1	E	U
	6	CG RAM (7)		&	6	F	V	f	v					•	*	*	3	P	Z
	7	CG RAM (8)		'	7	G	W	g	w					•	*	*	7	G	W
	8	CG RAM (1)		(	8	H	X	h	x					•	*	*	U	X
	9	CG RAM (2)		)	9	I	Y	i	y					•	*	*	U	Y
	A	CG RAM (3)		*	A	J	Z	j	z					•	*	*	V	J	
	B	CG RAM (4)		+	B	K	[	k	[					•	*	*	U	K
	C	CG RAM (5)		,	C	L	]	l	]					•	*	*	U	L
	D	CG RAM (6)		—	D	M	^	m	^					•	*	*	U	M	
	E	CG RAM (7)		•	E	N	_	n	_					•	*	*	U	N	
	F	CG RAM (8)		/	F	O	~	o	~					•	*	*	U	O	

■ SED1278F_{0B}/D_{0B} CHARACTER FONT

		Higher 4-Bit (D4 to D7) of Character Code (Hexadecimal)															
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Lower 4Bit (D0 to D3) of Character Code (Hexadecimal)	0	CG RAM (1)	+	0	P	'	P	9	6	'	N	0	0				
	1	CG RAM (2)	=	!	1	A	0	a	9	0	a	'	J	t	y		
	2	CG RAM (3)	7	"	2	R	R	r	a	R	6	'	o	s	z		
	3	CG RAM (4)	L	#	3	C	S	c	s	a	6	'	P	7	e		
	4	CG RAM (5)	7	@	4	T	t	a	t	a	6	'	4	r	z		
	5	CG RAM (6)	7	%	5	E	U	e	U	a	6	'	2	n	7		
	6	CG RAM (7)	7	6	F	V	v	a	0	*	U	W	0	0	0		
	7	CG RAM (8)	7	'	7	G	w	a	w	S	U	R	X	X	A		
8	CG RAM (1)	7	0	H	X	x	a	6	'	+	+	+	+	+			
9	CG RAM (2)	7	9	I	Y	i	w	0	i	2	7	7	7	7			
A	CG RAM (3)	*	*	8	J	Z	z	a	U	R	2	7	2	7			
B	CG RAM (4)	7	+	8	K	K	C	i	R	3	*	L	7	7			
C	CG RAM (5)	=	.	<	L	\	l	i	a	6	*	U	6	z			
D	CG RAM (6)	w	-	=	M	m	D	i	a	6	*	.	7	7			
E	CG RAM (7)	8	.	>	N	n	Y	a	0	0	7	0	0	0			
F	CG RAM (8)	8	/	?	O	o	A	a	C	0	'	0	0	0			

■ SED1278Foc/Doc CHARACTER FONT

		Higher 4-Bit (D4 to D7) of Character Code (Hexadecimal)																		
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F			
Lower 4Bit (D0 to D3) of Character Code(Hexadecimal)	0	CG RAM (1)			0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	1	CG RAM (2)	!	1	A	0	a	a							0	a	e	e	0	a
	2	CG RAM (3)	"	2	B	R	R	r							e	e	0	i	0	a
	3	CG RAM (4)	#	3	C	S	c	s							a	a	0	i	,	a
	4	CG RAM (5)	\$	4	D	T	d	t							a	a	0	i	W	a
	5	CG RAM (6)	%	5	E	U	e	u							a	a	0	N	0	e
	6	CG RAM (7)	&	6	F	V	f	v							'	0	a	"	0	a
	7	CG RAM (8)	'	7	G	W	g	w							W	0	0	0	0	a
	8	CG RAM (1)	(	8	H	X	h	x							e	e	0	0	0	a
	9	CG RAM (2)	)	9	I	Y	i	y							e	e	0	0	0	a
	A	CG RAM (3)	*	A	J	Z	j	z							e	0	0	0	0	e
	B	CG RAM (4)	+	B	K	Y	k	y							i	0	0	0	0	a
	C	CG RAM (5)	,	C	L	X	l	x							i	0	0	0	0	a
	D	CG RAM (6)	-	D	M	Y	m	y							i	0	0	0	0	e
	E	CG RAM (7)	.	E	N	X	n	x							A	e	0	0	0	a
	F	CG RAM (8)	/	F	O	Y	o	y							0	0	0	0	0	a

■ SED1278F_{0D}/D_{0E} CHARACTER FONT

		Higher 4-Bit (D4 to D7) of Character Code (Hexadecimal)															
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Lower 4Bit (D0 to D3) of Character Code(Hexadecimal)	0	CG RAM (1)				O	P	'	P								
	1	CG RAM (2)		!	1	A	Q	a	a								
	2	CG RAM (3)		"	2	B	R	r	r								
	3	CG RAM (4)		#	3	C	S	s	s								
	4	CG RAM (5)		\$	4	D	T	t	t								
	5	CG RAM (6)		%	5	E	U	u	u								
	6	CG RAM (7)		&	6	F	V	v	v								
	7	CG RAM (8)		'	7	G	W	w	w								
	8	CG RAM (1)		(	8	H	X	x	x								
	9	CG RAM (2)		)	9	I	Y	y	y								
	A	CG RAM (3)		*	A	J	Z	z	z								
	B	CG RAM (4)		+	B	K	[[[
	C	CG RAM (5)		,	C	\]]]								
	D	CG RAM (6)		-	D	^	~	~	~								
	E	CG RAM (7)		.	E	_	`	`	`								
	F	CG RAM (8)		/	F	~	~	~	~								

■ SED1278F_{0G}/D_{0G} CHARACTER FONT

		Higher 4-Bit (D4 to D7) of Character Code (Hexadecimal)															
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Lower 4Bit (D0 to D3) of Character Code(Hexadecimal)	0	CG RAM (1)				O	P	'	F				z	e	a	o	i
	1	CG RAM (2)		!		1	A	a	a				o	a	a	o	!
	2	CG RAM (3)		"		2	R	R	r				e	e	o	z	e
	3	CG RAM (4)		#		3	S	s	s				a	o	o	z	a
	4	CG RAM (5)		\$		4	T	t	t				a	o	o	o	'
	5	CG RAM (6)		%		5	U	u	u				a	o	N	'	o
	6	CG RAM (7)		&		6	V	v	v				'	o	a	'	o
	7	CG RAM (8)		'		7	W	w	w				N	o	N	#	a
	8	CG RAM (1)		(		8	X	x	x				e	o	o	o	N
	9	CG RAM (2)		)		9	Y	y	y				e	o	z	N	o
	A	CG RAM (3)		*		A	Z	z	z				a	o	a	L	,
	B	CG RAM (4)		+		B	K	k	k				i	o	N	o	o
	C	CG RAM (5)		,		C	L	l	l				i	o	N	-	o
	D	CG RAM (6)		-		D	M	m	m				i	o	o	o	N
	E	CG RAM (7)		.		E	N	n	n				a	e	o	a	!
	F	CG RAM (8)		/		F	O	o	o				a	o	o	o	o

■ SED1278F_{OH}/D_{OH} CHARACTER FONT

		Higher 4-Bit (D4 to D7) of Character Code (Hexadecimal)															
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Lower 4Bit (D0 to D3) of Character Code(Hexadecimal)	0	CG RAM (1)			G	A	P	'	F			B	M	4	.	J	K
	1	CG RAM (2)	.	!	1	A	Q	a	a			7	a	w	.	U	K
	2	CG RAM (3)	"		2	B	R	b	r			E	E	w	u	W	K
	3	CG RAM (4)	#		3	C	S	c	s			W	B	w	u	a	K
	4	CG RAM (5)	\$		4	D	T	d	t			3	r	e	>	o	K
	5	CG RAM (6)	%		5	E	U	e	u			N	e	a	x	y	'
	6	CG RAM (7)	&		6	F	V	f	v			Q	w	w	>	w	K
	7	CG RAM (8)	'		7	G	W	g	w			J	a	a	I	'	E
	8	CG RAM (1)	(		8	H	X	h	x			n	w	e	l	'	*
	9	CG RAM (2)	)		9	I	Y	i	y			y	w	e	t	'	*
	A	CG RAM (3)	*		A	J	Z	j	z			o	k	e	t	e	*
	B	CG RAM (4)	+		B	K	Z	k	z			4	a	r	n	e	*
	C	CG RAM (5)	,		C	L	l	e	l			u	w	n	n	o	*
	D	CG RAM (6)	-		D	M	m	n	s			b	w	e	n	e	*
	E	CG RAM (7)	.		E	N	n	e				b	w	s	>	o	*
	F	CG RAM (8)	/		F	O	o	e				o	t	e	.	o	*

*Character codes (00H-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

No part of this material may be reproduced or duplicated in any form or by any means without the written permission of Seiko Epson. Seiko Epson reserves the right to make changes to this material without notice. Seiko Epson does not assume any liability of any kind arising out of any inaccuracies contained in this material or due to its application or use in any product or circuit and, further, there is no representation that this material is applicable to products requiring high level reliability, such as, medical products. Moreover, no license to any intellectual property rights is granted by implication or otherwise, and there is no representation or warranty that anything made in accordance with this material will be free from any patent or copyright infringement of a third party. This material or portions thereof may contain technology or the subject relating to strategic products under the control of the Foreign Exchange and Foreign Trade Control Law of Japan and may require an export license from the Ministry of International Trade and Industry or other approval from another government agency.

All product names mentioned herein are trademarks and/or registered trademarks of their respective companies.

©Seiko Epson Corporation 1998 All rights reserved.

SEIKO EPSON CORPORATION**ELECTRONIC DEVICES MARKETING DIVISION****Electronic Device Marketing Department
IC Marketing & Engineering Group**

421-8, Hino, Hino-shi, Tokyo 191-8501, JAPAN
Phone: +81-(0)42-587-5816 Fax: +81-(0)42-587-5624

ED International Marketing Department I (Europe & U.S.A.)

421-8, Hino, Hino-shi, Tokyo 191-8501, JAPAN
Phone: +81-(0)42-587-5812 Fax: +81-(0)42-587-5564

ED International Marketing Department II (Asia)

421-8, Hino, Hino-shi, Tokyo 191-8501, JAPAN
Phone: +81-(0)42-587-5814 Fax: +81-(0)42-587-5110

Electric Device Information of EPSON WWW server

<http://www.epson.co.jp>

