

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.

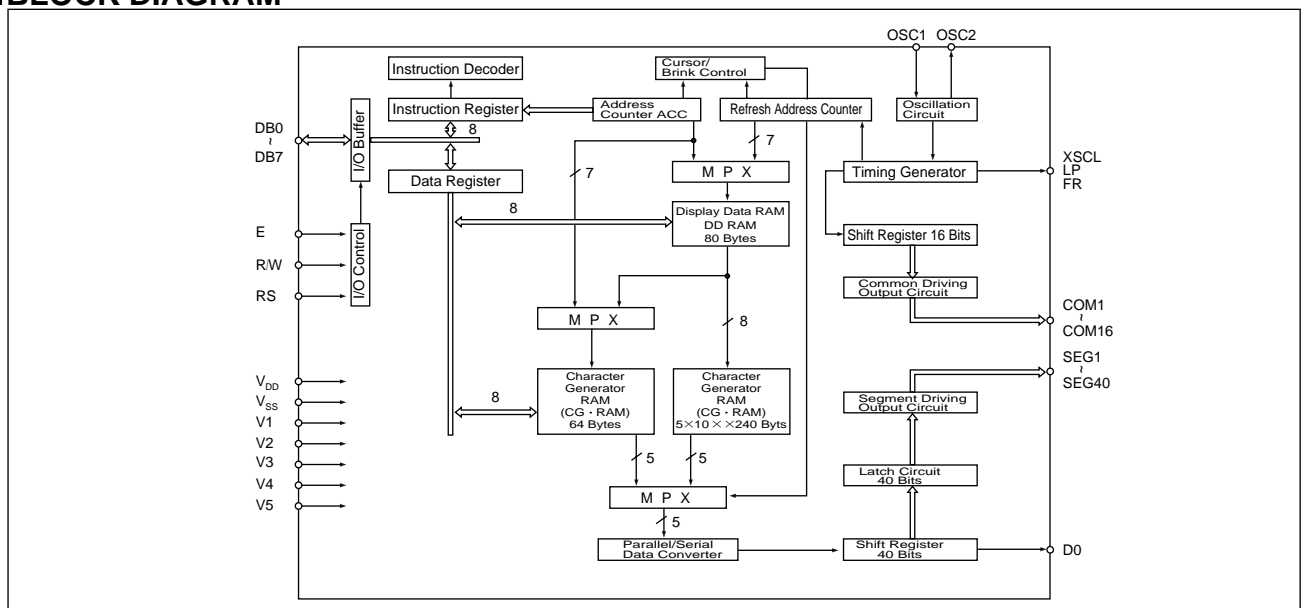
The built-in character generator ROM has an extended capacity of 240 different characters, each being generated in a 5×10 dots font compatible with a 1/11 duty. In addition, the SED1278F/D contains 64 bytes of character generator RAM in which the user can store 8 different characters, each consisting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

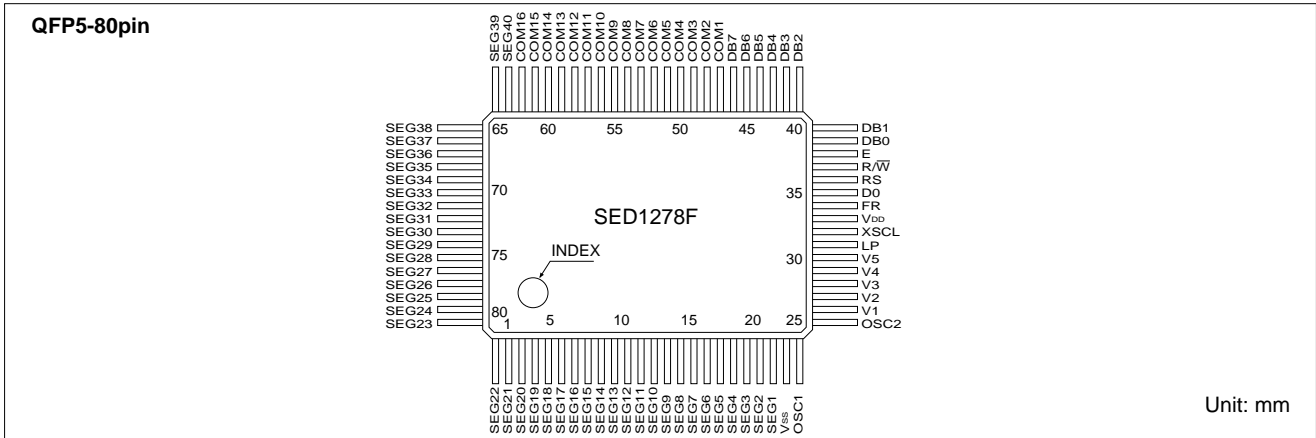
- Display RAM 80 bytes (80 characters)
- Character generator ROM 240 characters (Able to 256 characters)
- Character generator RAM 8 characters
- Built-in CR oscillator, Built-in power-on reset circuit
- Maximim display dimension 40 characters × 2 lines, 80 characters × 1 line
(When accompanied with 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 5 × 7 dots+Cursor line (5 × 8 dots also possible)
5 × 10 dots+Cursor line
- 6 Kinds of character font
- Single power supply 5V±10% (Logic)
- Low LCD driving voltage $V_{DD}-V_5 \geq 3.0V$
- Package SED1278F: QFP5-80pin (plastic)
SED1278D: Die form (Al pad)

BLOCK DIAGRAM



SED1278F/D

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 ($V_5 \cong V_{SS}$)
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, T_a=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	2.0	—	V_{DD}	V
"L" level input voltage (1)	V_{IL1}		RS, R/W, E	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	$k\Omega$
Driver-on resistor (SEG)	R_{SEG}$	|V_{SEG}-V_n|=0.5V$	SEG1~40	—	2.5	10	$k\Omega$
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	t_{rEXTCL}			-	—	0.2	μS
External clock fall time	t_{fEXTCL}			-	—	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/W setup time	t_{AS}		40	—	—	ns
RS, R/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

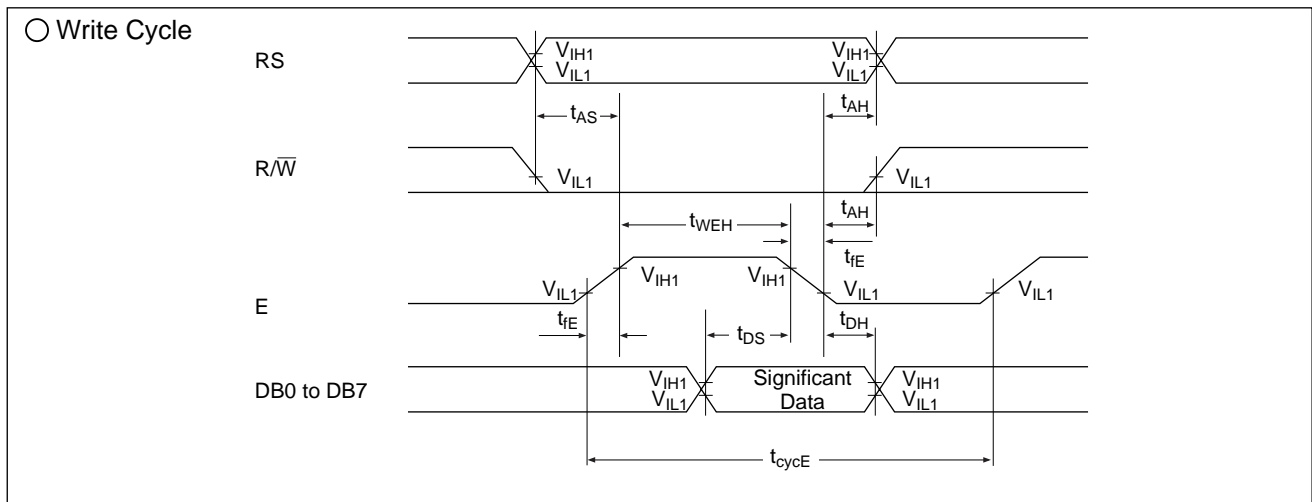
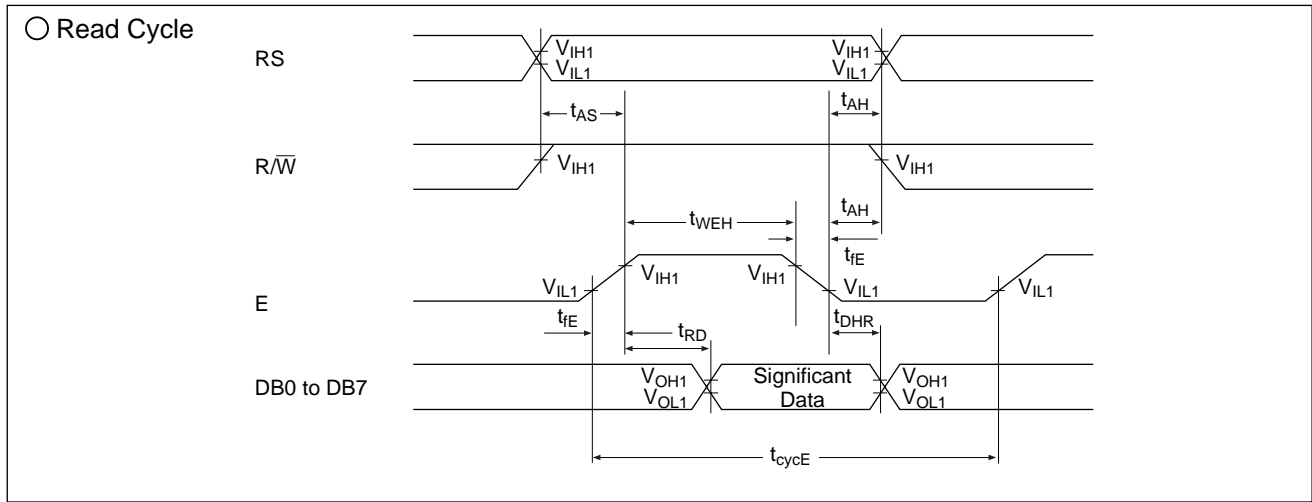
Write Cycle

($V_{DD}=5.0V\pm 10\%$, $V_{SS}=0V$, $T_a=-20$ 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/W setup time	t_{AS}		40	—	—	ns
RS, R/W address hold time	t_{AH}		10	—	—	ns
Data setup time	t_{DS}		60	—	—	ns
Write data hold time	t_{DH}		10	—	—	ns

SED1278F/D

● Timing Chart

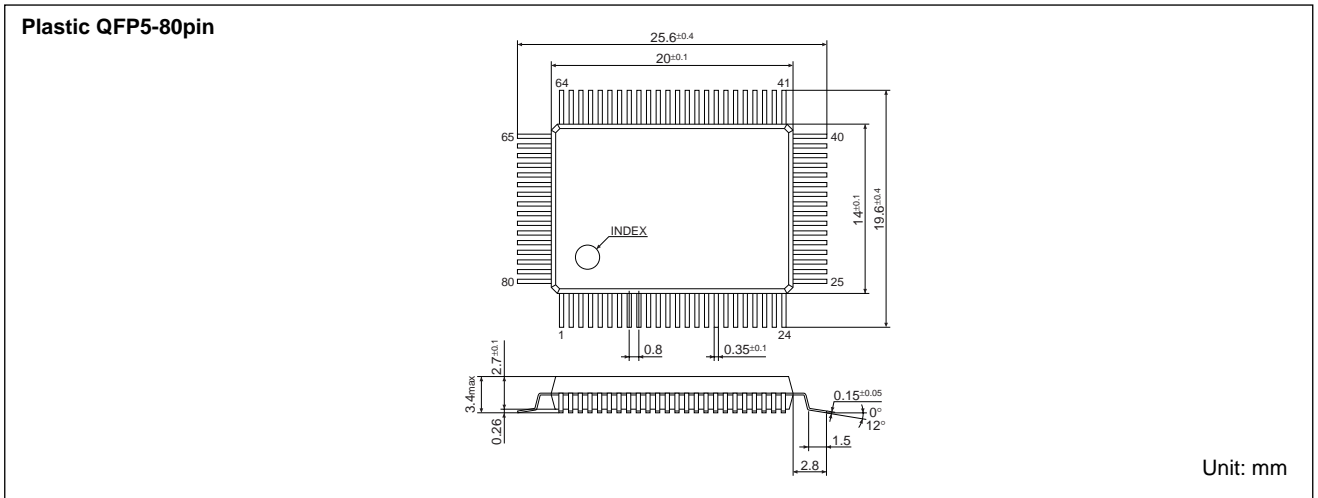


■ DISPLAY COMMAND

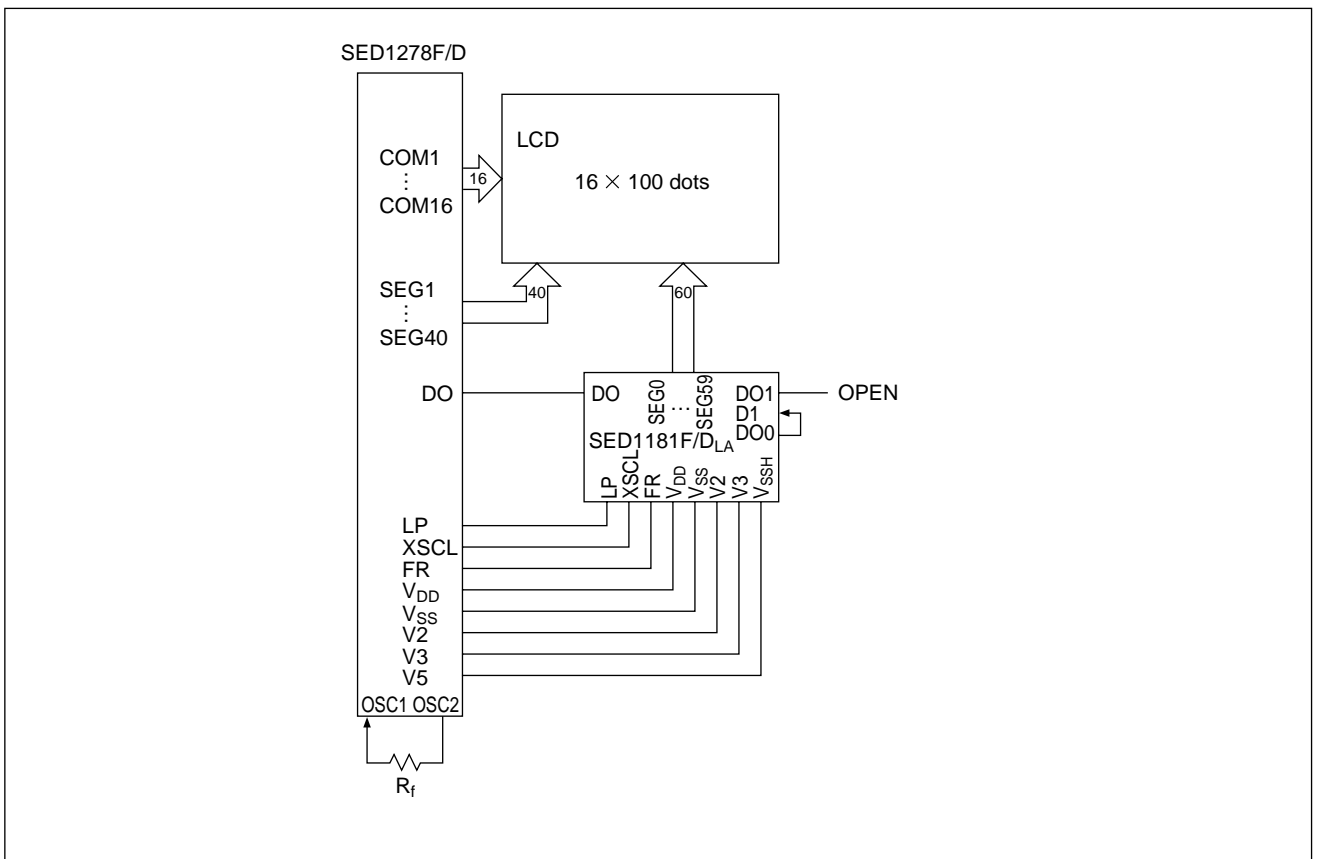
Parameter	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Note
CLEAR DISPLAY	0	0	0	0	0	0	0	0	0	1	
CURSOR HOME	0	0	0	0	0	0	0	0	1	1	
ENTRY MODE SET	0	0	0	0	0	0	0	1	I/D	I/D	DB1=1: Increment, DB1=0: Decrement DB0=1: The display is shifted. DB0=0: The display is not shifted.
DISPLAY ON/OFF	0	0	0	0	0	0	1	D	C	C	DB2=1: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



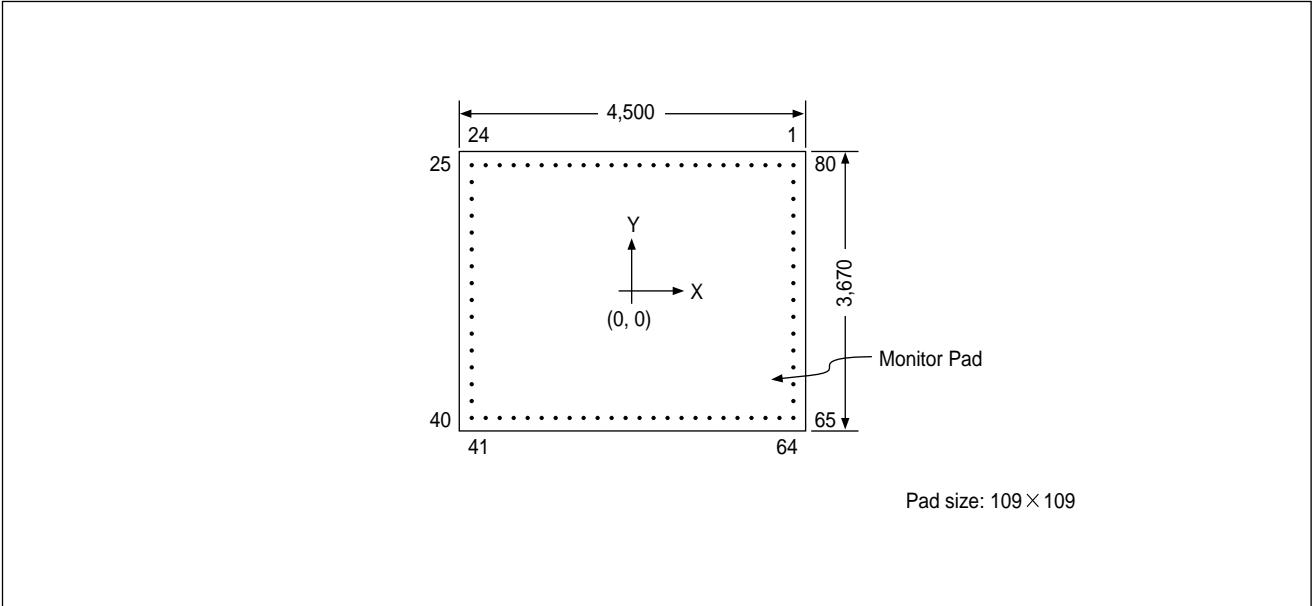
SED1278F/D is usually connected to 8-bit MPU via I/O ports.

SED1278F/D

SED1278D

● PAD LAYOUT

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	V ₃	-2,087	819	55	COM9	452	-1,671
2	SEG21	1,905	↓	29	V ₄	↓	637	56	COM10	633	↓
3	SEG20	1,723	↓	30	V ₅	↓	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	V _{CC}	↓	-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	V ₁	↓	1,183	53	COM7	↓	91	80	SEG23	↓	1,365
27	V ₂	↓	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 4-bit (D0 to D3) of Character Code (Hexadecimal)	0	CG RAM (1)			0	a	P	`	P					-	9	E	o	p	
	1	CG RAM (2)	!	1	A	a	a	a					•	7	+	4	a	q	
	2	CG RAM (3)	"	2	B	R	b	r					ˆ	4	u	x	p	o	
	3	CG RAM (4)	#	3	D	S	s	s					ˆ	9	T	E	s	o	
	4	CG RAM (5)	\$	4	D	T	d	t					ˆ	1	k	p	o		
	5	CG RAM (6)	%	5	E	U	e	u					•	*	*	o	o		
	6	CG RAM (7)	&	6	F	V	v	v					ˆ	9	c	a	p	z	
	7	CG RAM (8)	'	7	a	u	u	u					ˆ	*	*	o	g	o	
	8	CG RAM (1)	(	8	H	X	h	x					ˆ	o	*	o	ˆ	x
	9	CG RAM (2)	)	9	I	Y	i	y					ˆ	7	u	ˆ	y	
	A	CG RAM (3)	*	A	J	Z	j	z					ˆ	o	v	j	ˆ	z	
	B	CG RAM (4)	+	B	K	0	k	(					ˆ	*	o	o	ˆ	z
	C	CG RAM (5)	,	C	L	1	l	1					ˆ	9	o	o	ˆ	z	
	D	CG RAM (6)	-	D	=	N	1	n)					ˆ	z	ˆ	o	ˆ	z
	E	CG RAM (7)	•	E	>	N	ˆ	n	ˆ					ˆ	o	o	ˆ	ˆ	z
	F	CG RAM (8)	/	F	?	0	o	o	ˆ					ˆ	u	ˆ	ˆ	o	ˆ

SED1278F/D

■ SED1278F_{0B/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 4-bit (D0 to D3) of Character Code (Hexadecimal)	0	CG RAM (1)	±		0	0	P	'	P	9	é	á	'	r	R	P	v	
	1	CG RAM (2)	≡	!	1	A	0	a	9	0	a	e	i	"	l	t	y	o
	2	CG RAM (3)	7	"	2	B	R	b	r	e	é	é	é	°	o	é	é	x
	3	CG RAM (4)	¿	#	3	C	S	c	s	á	á	á	'	7	7	e	v	ü
	4	CG RAM (5)	¡	\$	4	D	T	d	t	á	á	á	'	4	n	z	o	
	5	CG RAM (6)	¿	%	5	E	U	e	u	á	á	á	e	t	a	n	7	
	6	CG RAM (7)	¿	&	6	F	V	f	v	á	á	á	h	w	l	o	o	h
	7	CG RAM (8)	¿	'	7	G	W	w	s	á	á	á	x	x	+	A	l	+
	8	CG RAM (1)	¿	(	8	H	X	h	x	á	á	á	+	+	3	K	h	
	9	CG RAM (2)	¿	)	9	I	Y	i	y	á	á	á	i	7	7	7	7	+
	A	CG RAM (3)	¿	*		J	Z	j	z	á	á	á	z	7	7	7	7	7
	B	CG RAM (4)	¿	+		K	C	k	c	á	á	á	l	7	7	7	7	7
	C	CG RAM (5)	¿	,		L	I	l	i	á	á	á	o	7	7	7	7	7
	D	CG RAM (6)	¿	-		M	J	m	j	á	á	á	*	*	7	7	7	7
	E	CG RAM (7)	¿	.		N	K	n	k	á	á	á	7	7	7	7	7	7
	F	CG RAM (8)	¿	/		O	L	o	l	á	á	á	7	7	7	7	7	7

■ 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 4-bit (D0 to D3) of Character Code (Hexadecimal)	0	CG RAM (1)			0	0	P	'	P					e	e	e	|	*
	1	CG RAM (2)	!	1	A	0	a	a					0	a	i	e	0	a
	2	CG RAM (3)	"	2	B	R	b	r					e	R	0	i	0	a
	3	CG RAM (4)	#	3	0	S	s	s					a	0	0	t	,	*
	4	CG RAM (5)	\$	4	0	T	t	t					a	0	R	t	^	*
	5	CG RAM (6)	%	5	E	L	e	u					a	0	N	'	0	t
	6	CG RAM (7)	&	6	F	V	f	v					'	0	a	"	0	a
	7	CG RAM (8)	'	7	a	w	a	w					N	0	0	0	0	R
	8	CG RAM (1)	(	8	H	X	h	x					e	0	0	0	0	R
	9	CG RAM (2)	)	9	I	Y	i	y					e	0	0	Y	0	0
	A	CG RAM (3)	*	A	J	Z	j	z					e	0	0	A	0	e
	B	CG RAM (4)	+	B	K	K	l	l					i	0	0	i	0	0
	C	CG RAM (5)	,	C	L	L	l	l					i	0	0	A	0	0
	D	CG RAM (6)	-	D	M	I	n	)					i	A	i	0	e	+
	E	CG RAM (7)	.	E	N	n	n	+					A	e	0	0	0	
	F	CG RAM (8)	/	F	0	0	0	+					0	0	0	0	0	0

SED1278F/D

■ SED1278F_{OD}/D_{OE} 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 4-bit (D0 to D3) of Character Code (Hexadecimal)	0	CG RAM (1)			0	0	P	'	F								
	1	CG RAM (2)	!	1	A	Q	a	a									
	2	CG RAM (3)	"	2	B	R	b	r									
	3	CG RAM (4)	#	3	C	S	c	s									
	4	CG RAM (5)	\$	4	D	T	d	t									
	5	CG RAM (6)	%	5	E	U	e	u									
	6	CG RAM (7)	&	6	F	V	f	v									
	7	CG RAM (8)	'	7	G	W	g	w									
	8	CG RAM (1)	(	8	H	X	h	x									
	9	CG RAM (2)	)	9	I	Y	i	y									
	A	CG RAM (3)	*	*	J	Z	j	z									
	B	CG RAM (4)	+	+	K	[	k	[
	C	CG RAM (5)	,	<	L	\	l	\									
	D	CG RAM (6)	-	=	M	]n	m)									
	E	CG RAM (7)	.	>	N	^	n	^									
	F	CG RAM (8)	/	?	O	_	o	+									

■ SED1278F_{OG}/D_{OG} 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 4-bit (D0 to D3) of Character Code (Hexadecimal)	0	CG RAM (1)			0	a	P	'	P			ÿ	É	À	À	Ç	Ï
	1	CG RAM (2)	!	1	A	a	a	a			0	a	1	À	Ç	!	!
	2	CG RAM (3)	"	2	B	R	b	r			é	É	ò	×	é	é	É
	3	CG RAM (4)	#	3	C	S	c	s			À	ò	ó	ó	ó	ó	ó
	4	CG RAM (5)	\$	4	D	T	d	t			À	ò	À	ó	ó	ó	ó
	5	CG RAM (6)	%	5	E	U	e	u			À	ò	N	'	ó	ó	ó
	6	CG RAM (7)	&	6	F	V	f	v			'	ò	a	'	ó	ó	ó
	7	CG RAM (8)	'	7	G	W	g	w			N	ò	ò	W	ó	ó	ó
	8	CG RAM (1)	(	8	H	X	h	x			é	é	ç	ç	é	é	é
	9	CG RAM (2)	)	9	I	Y	i	y			é	é	ó	ó	é	é	é
	A	CG RAM (3)	*	*	J	Z	j	z			é	ó	À	L	.	.	é
	B	CG RAM (4)	+	+	K	[	k	[			i	ó	ó	ó	ó	ó	ó
	C	CG RAM (5)	,	<	L	\	l	'			i	ó	ó	ó	ó	ó	ó
	D	CG RAM (6)	-	=	M	]n	]	)			i	ó	ó	ó	ó	ó	ó
	E	CG RAM (7)	.	>	N	^	n	+			À	é	ó	ó	ó	ó	ó
	F	CG RAM (8)	/	?	O	_	o	+			À	ó	ó	ó	ó	ó	ó

SED1278F/D

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

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