

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.

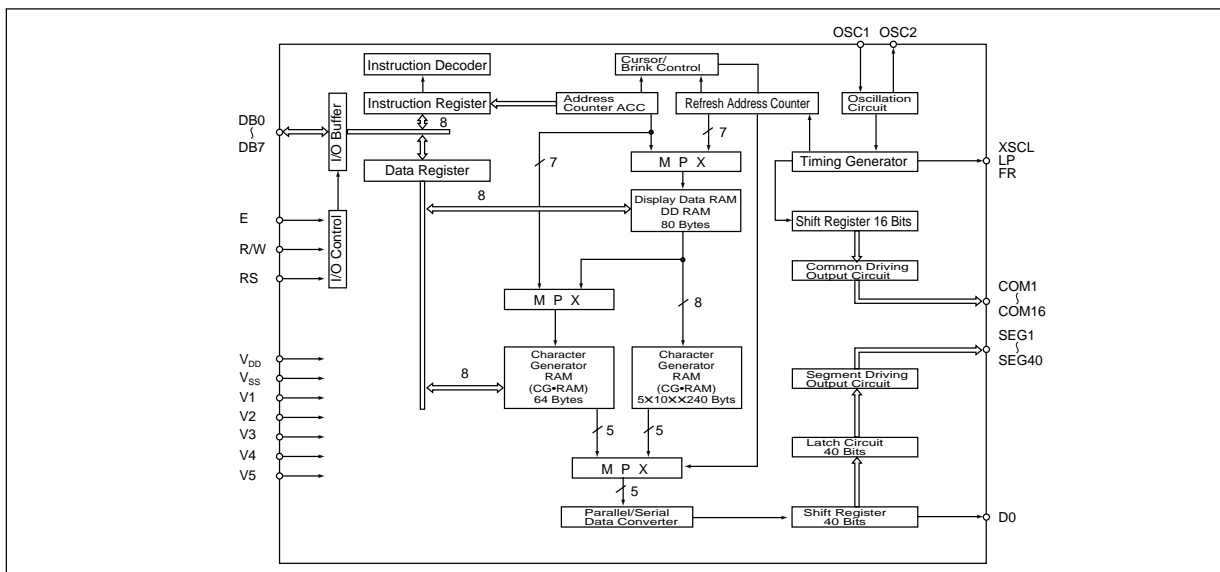
The built-in character generator ROM has an extended capacity of 240 different characters, each being generated in a 5x10 dots font compatible with a 1/11 duty. In addition, the SED1278F/D contains 64 bytes of character generator RAM in which the user can store 8 different characters, each consisting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

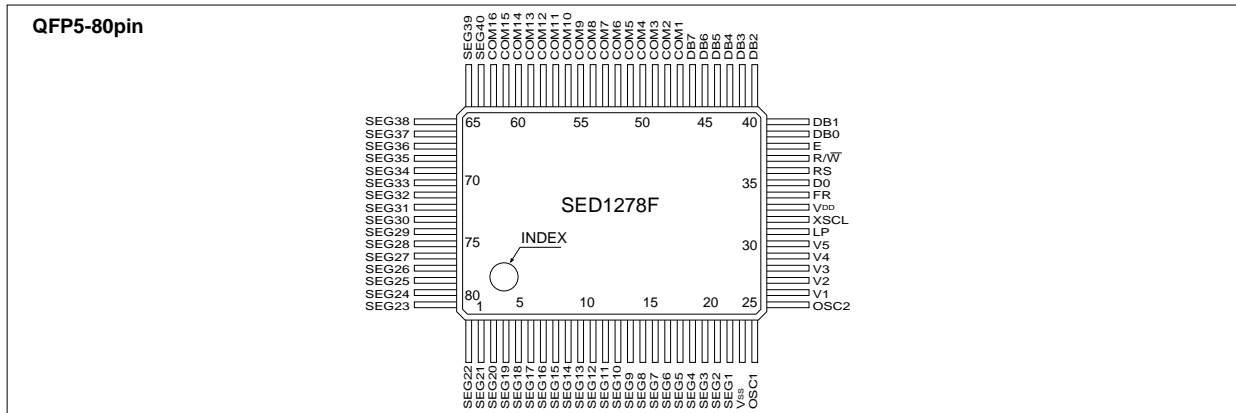
FEATURES

- 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 $V_{DD}-V_5 \geq 0V$
- 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, 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 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	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 $75^\circ C$)

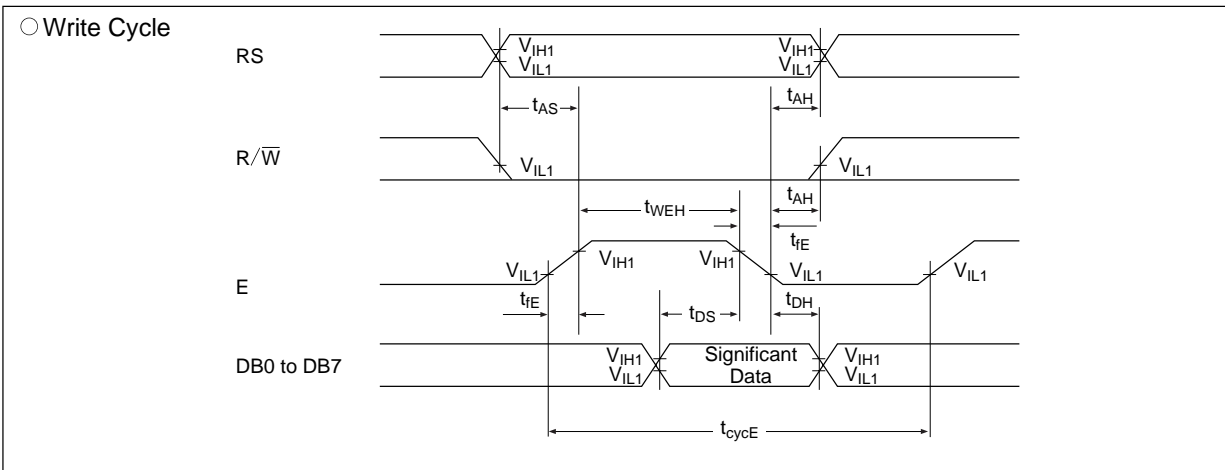
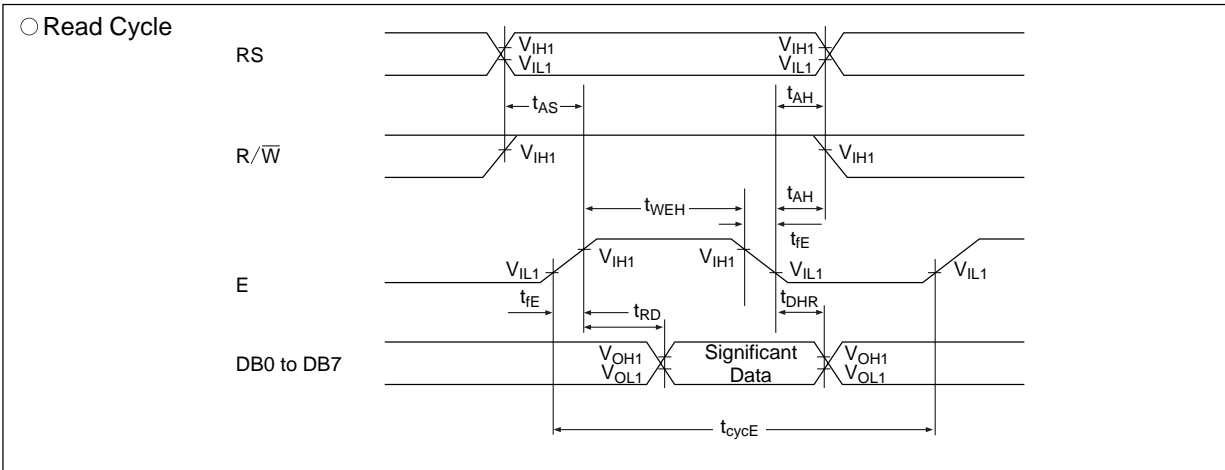
Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Enable cycle time	t_{cycE}		500	—	—	ns
Enable "H" level pulse width	t_{WEH}		220	—	—	ns
Enable rise/fall time	t_{rE} , t_{fE}		—	—	25	ns
RS, R/ \bar{W} setup time	t_{AS}		40	—	—	ns
RS, R/ \bar{W} address hold time	t_{AH}		10	—	—	ns
Read data output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

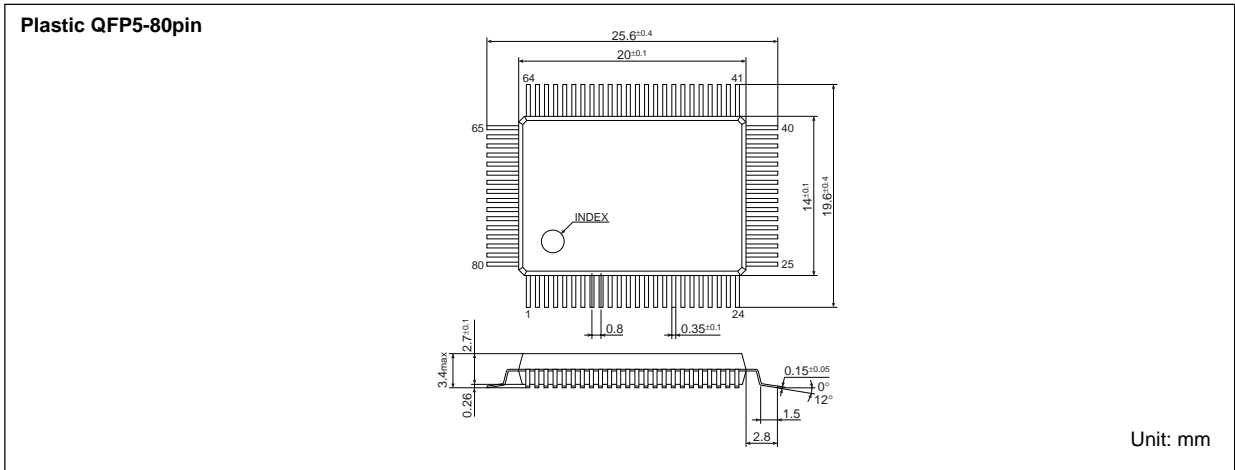


■ DISPLAY COMMAND

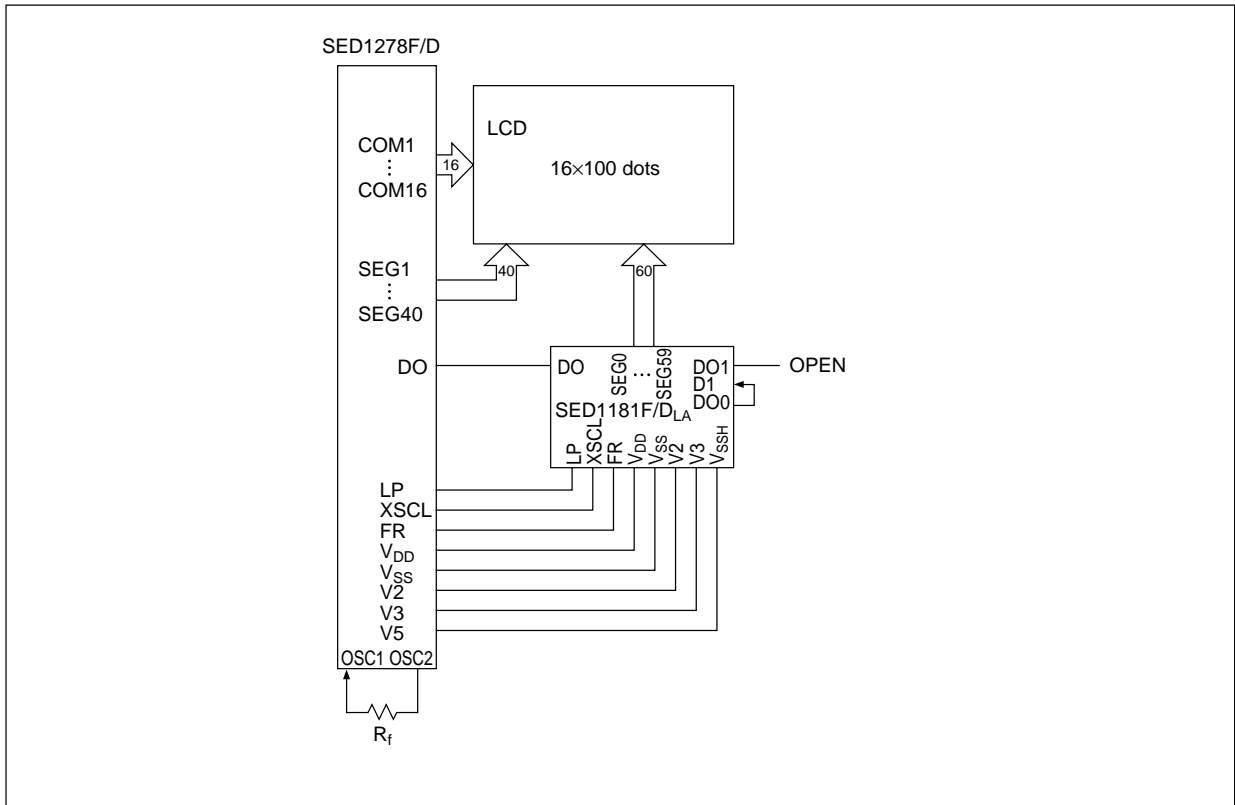
Parameter	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Note
CLEAR DISPLAY	0	0	0	0	0	0	0	0	0	1	
CURSOR HOME	0	0	0	0	0	0	0	0	1	1	
ENTRY MODE SET	0	0	0	0	0	0	0	1	I/D	I/D	DB1 = 1 : Increment, DB1 = 0 : Decrement DB0 = 1 : The display is shifted. DB0 = 0 : The display is not shifted.
DISPLAY ON/OFF	0	0	0	0	0	0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

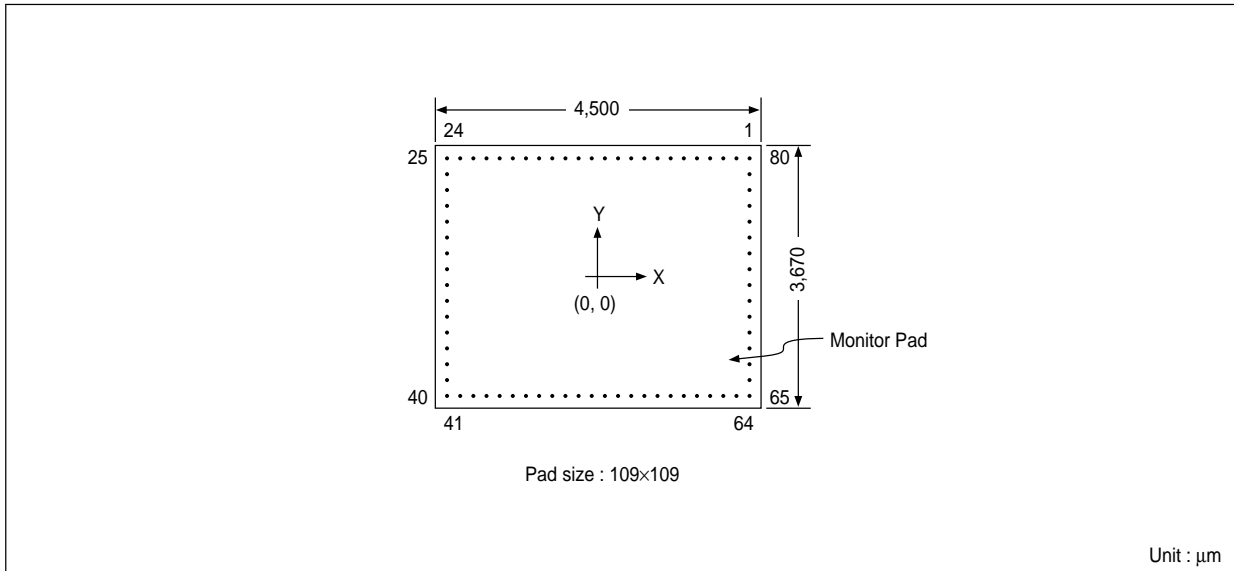


■ LCD PANEL INTERFACE EXAMPLE (2 lines×20 characters)



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	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
	1	CG RAM (2)	!	1	A	Q	a	a													
	2	CG RAM (3)	"	2	R	b	r														
	3	CG RAM (4)	#	3	S	c	s														
	4	CG RAM (5)	\$	4	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	a	w	a	w													
	8	CG RAM (1)	(	8	H	x	h	x													
	9	CG RAM (2)	)	9	I	y	i	y													
	A	CG RAM (3)	*	A	J	z	j	z													
	B	CG RAM (4)	+	B	K	←	k	←													
	C	CG RAM (5)	,	C	L	→	l	→													
	D	CG RAM (6)	-	D	M	↵	m	↵													
	E	CG RAM (7)	.	E	N	↶	n	↶													
	F	CG RAM (8)	/	F	O	↷	o	↷													

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

■ SED1278F_{OC/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	a	p	'	p				e	a	e	i	e
	1	CG RAM (2)	!	1	A	a	a						U	a	e	e	e
	2	CG RAM (3)	"	2	R	b	r						e	e	e	i	e
	3	CG RAM (4)	#	3	S	s	s						a	o	u	i	r
	4	CG RAM (5)	\$	4	T	t	t						a	o	a	i	w
	5	CG RAM (6)	%	5	E	e	e						a	o	N	'	o
	6	CG RAM (7)	&	6	F	f	f						'	o	a	'	o
	7	CG RAM (8)	'	7	a	w	w						N	o	o	o	e
	8	CG RAM (1)	(	8	H	h	h						e	e	e	w	o
	9	CG RAM (2)	)	9	I	i	i						e	e	e	y	a
	A	CG RAM (3)	*	A	J	j	j						e	o	a	a	e
	B	CG RAM (4)	+	B	K	k	k						i	e	a	i	o
	C	CG RAM (5)	,	C	L	l	l						i	o	w	a	e
	D	CG RAM (6)	-	D	M	m	m						i	a	i	e	e
	E	CG RAM (7)	.	E	N	n	n						e	e	e	e	e
	F	CG RAM (8)	/	F	O	o	o						e	e	e	o	e

■ 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)			0	a	p	'	p								
	1	CG RAM (2)	!	1	A	Q	a	a									
	2	CG RAM (3)	"	2	B	R	b	r									
	3	CG RAM (4)	#	3	O	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	a	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	L	\	\	\									
	D	CG RAM (6)	-	D	M]]]									
	E	CG RAM (7)	.	E	N	^	^	^									
	F	CG RAM (8)	/	F	O	_	_	_									

■ SED1278F_{OG/DOG} 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	a	P	'	P				7	e	a	a	G
	1	CG RAM (2)	!	1	A	Q	a	a				U	a	l	a	o	l
	2	CG RAM (3)	"	2	R	b	r	r				e	E	o	x	e	B
	3	CG RAM (4)	#	3	S	c	s	s				a	o	o	y	w	o
	4	CG RAM (5)	\$	4	T	d	t	t				a	o	a	o	w	#
	5	CG RAM (6)	%	5	E	u	e	u				a	o	N	'	o	e
	6	CG RAM (7)	&	6	F	v	f	v				'	o	a	'	e	e
	7	CG RAM (8)	'	7	a	w	a	w				N	o	o	N	e	a
	8	CG RAM (1)	(	8	H	x	h	x				a	e	u	o	e	N
	9	CG RAM (2)	)	9	I	y	i	y				a	e	y	N	o	y
	A	CG RAM (3)	*	A	J	z	j	z				a	o	L	.	e	
	B	CG RAM (4)	+	B	K	z	k	z				i	u	z	i	o	z
	C	CG RAM (5)	,	C	L	z	l	z				i	u	z	.	e	*
	D	CG RAM (6)	-	D	M	n	m	n				i	u	z	e	x	
	E	CG RAM (7)	.	E	N	n	n	n				a	e	t	a	e	l
	F	CG RAM (8)	/	F	O	o	o	o				a	e	z	z	z	z

■ SED1278F_{OH/DOH} 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
	1	CG RAM (2)	!	.	"	#	\$	%	&	'	()	*	+	,	-	.
	2	CG RAM (3)	:	;	<	=	>	?	@	A	B	C	D	E	F	G	H
	3	CG RAM (4)	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
	4	CG RAM (5)	X	Y	Z	[	]	^	_	`	{	}	~	|	~	|	~
	5	CG RAM (6)	~	|	~	|	~	|	~	|	~	|	~	|	~	|	~
	6	CG RAM (7)	~	|	~	|	~	|	~	|	~	|	~	|	~	|	~
	7	CG RAM (8)	~	|	~	|	~	|	~	|	~	|	~	|	~	|	~
	8	CG RAM (1)	~	|	~	|	~	|	~	|	~	|	~	|	~	|	~
	9	CG RAM (2)	~	|	~	|	~	|	~	|	~	|	~	|	~	|	~
	A	CG RAM (3)	~	|	~	|	~	|	~	|	~	|	~	|	~	|	~
	B	CG RAM (4)	~	|	~	|	~	|	~	|	~	|	~	|	~	|	~
	C	CG RAM (5)	~	|	~	|	~	|	~	|	~	|	~	|	~	|	~
	D	CG RAM (6)	~	|	~	|	~	|	~	|	~	|	~	|	~	|	~
	E	CG RAM (7)	~	|	~	|	~	|	~	|	~	|	~	|	~	|	~
	F	CG RAM (8)	~	|	~	|	~	|	~	|	~	|	~	|	~	|	~

*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.

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