



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.

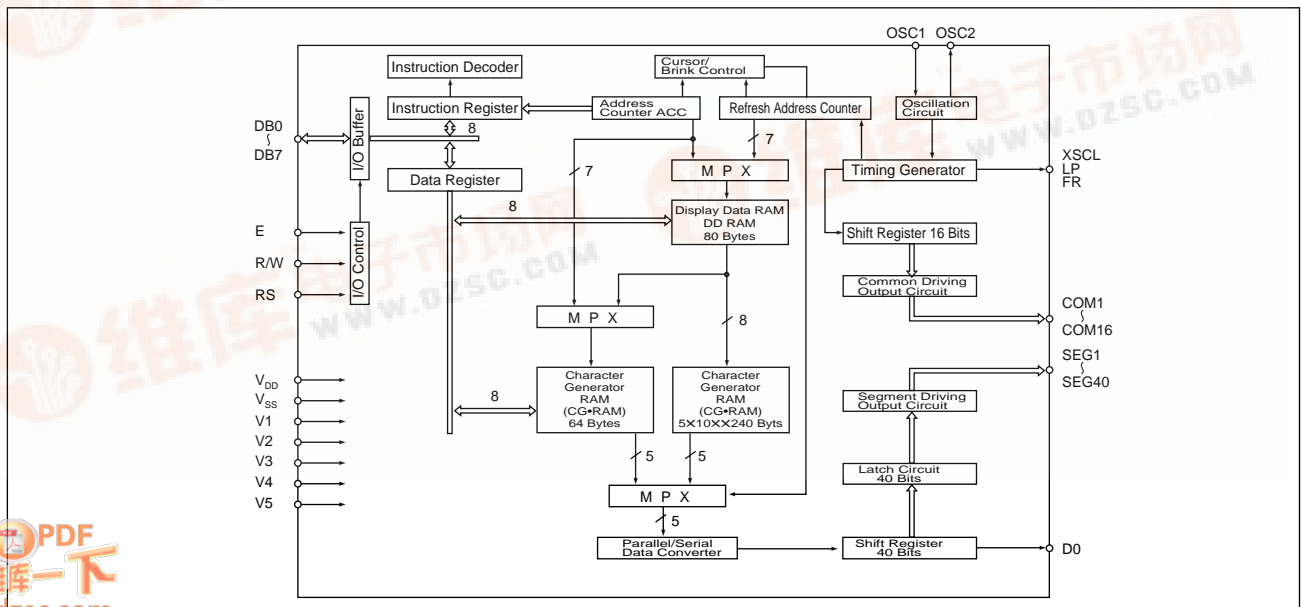
The built-in character generator ROM has an extended capacity of 240 different characters, each being generated in a 5x10 dots font compatible with a 1/11 duty. In addition, the SED1278F/D contains 64 bytes of character generator RAM in which the user can store 8 different characters, each consisting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

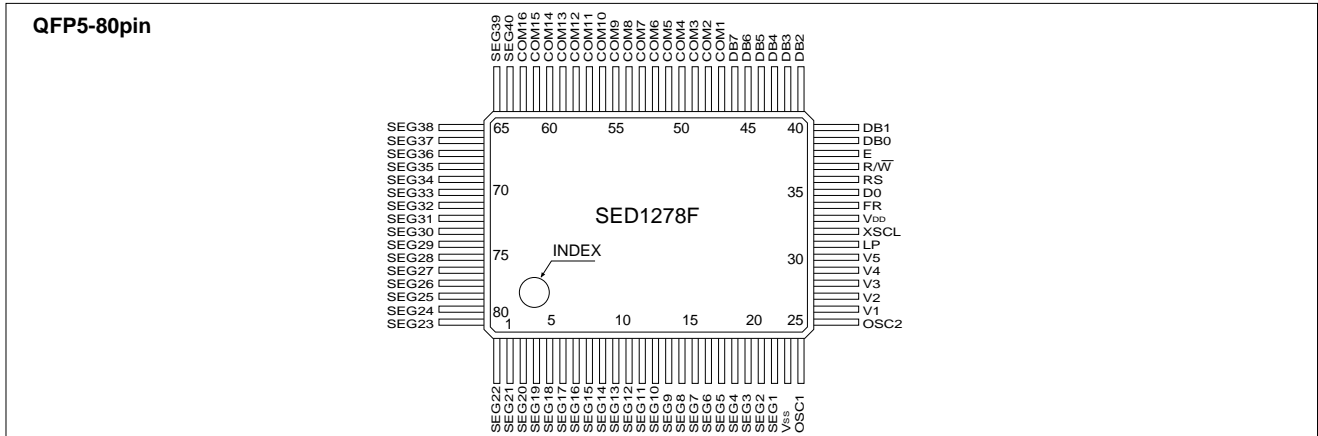
FEATURES

- 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 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}—V₅≥.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 $75^\circ C$)

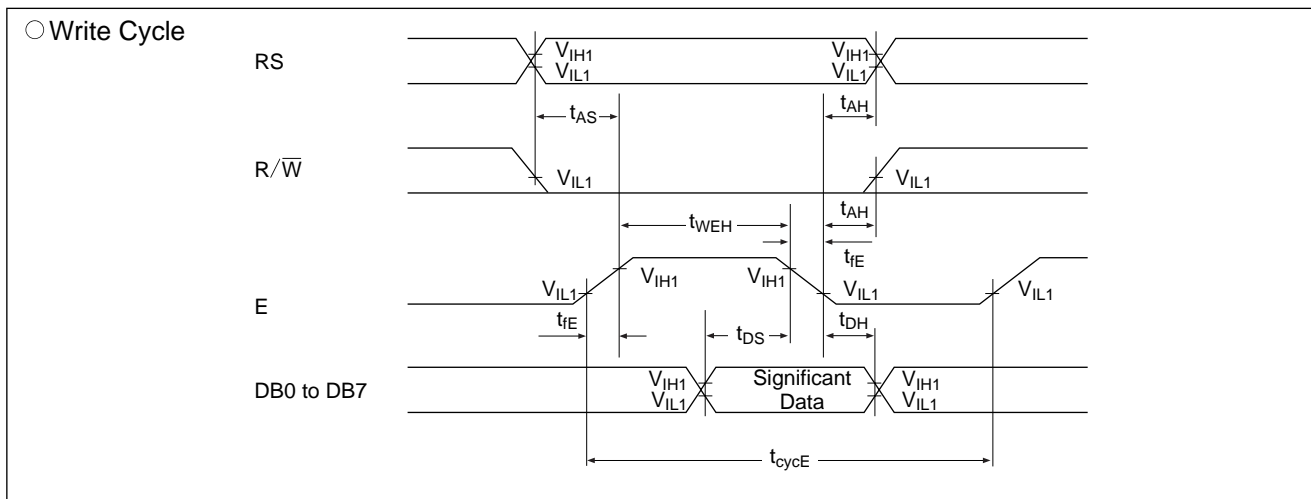
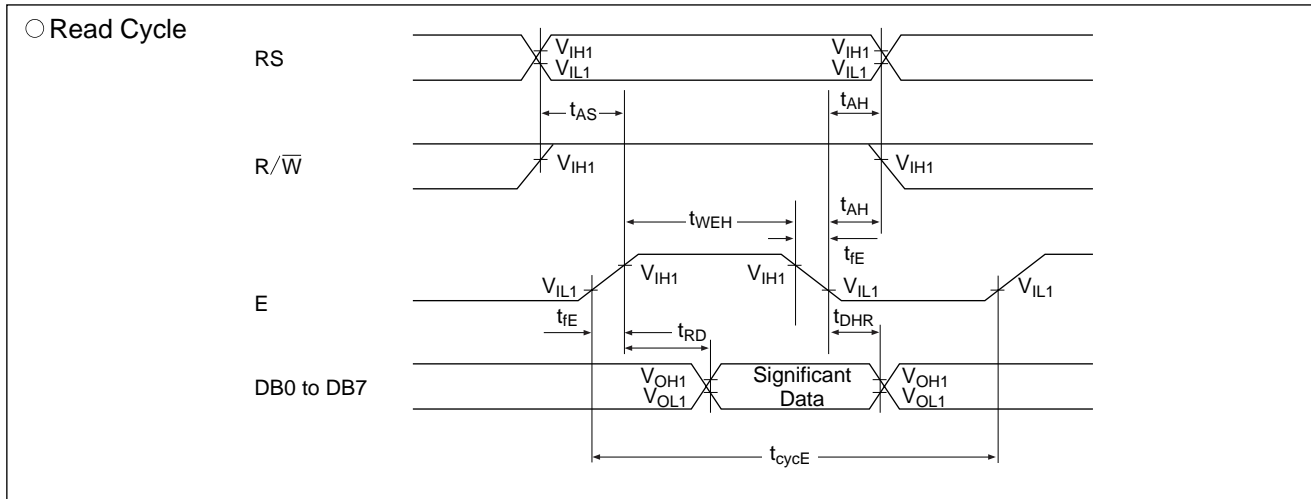
Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Enable cycle time	t_{cycE}		500	—	—	ns
Enable "H" level pulse width	t_{WEH}		220	—	—	ns
Enable rise/fall time	t_{rE}, t_{fE}		—	—	25	ns
RS, R/W setup time	t_{AS}		40	—	—	ns
RS, R/W address hold time	t_{AH}		10	—	—	ns
Read data output delay	t_{RD}	$C_L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

● Timing Chart



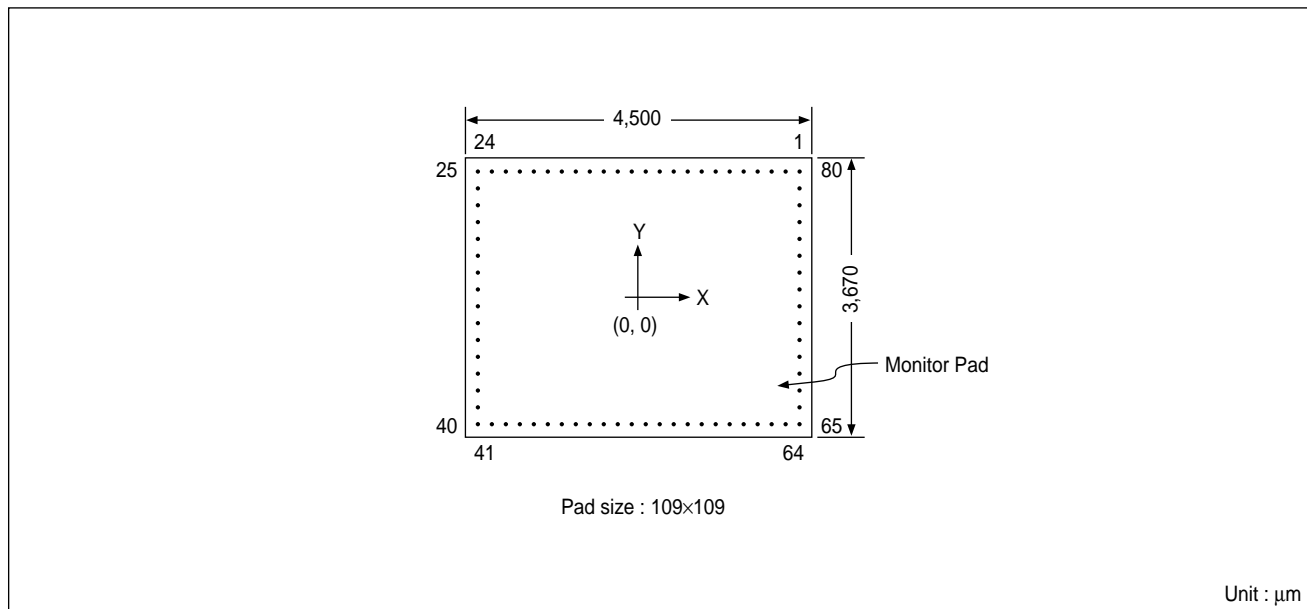
■ DISPLAY COMMAND

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	ACG					The address length that can be set is 64 addresses.	
SET DDRAM ADDRESS	0	0	1	ADD					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

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

■ SED1278FoB/DoB 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	7	0	a	1			J	+	y	0			
	2	CG RAM (3)	7	"	2	B	R	b	r	a	B	6			'	o	8	8	x		
	3	CG RAM (4)	L	#	3	C	S	c	s	a	B	U			'	P	7	6	v		
	4	CG RAM (5)	7	@	4	D	T	d	t	a	B	t			'	4	r	z	o		
	5	CG RAM (6)	7	%	5	E	U	e	u	a	B	a			'	5	t	a	n		
	6	CG RAM (7)	7	&	6	F	V	f	v	a	B	o			'	u	w	0	0		
	7	CG RAM (8)	7	'	7	G	W	w	g	a	B	x			'	x	→	A	U		
	8	CG RAM (1)	7	(	8	H	X	x	a	B	9				'	←	z	k			
	9	CG RAM (2)	7	)	9	I	Y	y	a	B	0				'	z	7	7	A		
	A	CG RAM (3)	7	*		J	Z	z	a	B	1				'	z	7	z	U		
	B	CG RAM (4)	7	+		K	C	c	a	B	2				'	z	7	z	U		
	C	CG RAM (5)	7	,		L	l	l	a	B	3				'	z	7	z	U		
	D	CG RAM (6)	7	-		M	m	m	a	B	4				'	z	7	z	U		
	E	CG RAM (7)	7	.		N	n	n	a	B	5				'	z	7	z	U		
	F	CG RAM (8)	7	/		0	o	o	a	B	6				'	z	7	z	U		

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

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

■ SED1278F_{0H}/D_{0H} 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	2	3	4	5	6	7	8	9	A	B	C	D	E	F		
	2	CG RAM (3)		"	2	3	4	5	6	7	8	9	A	B	C	D	E	F			
	3	CG RAM (4)		#	3	4	5	6	7	8	9	A	B	C	D	E	F				
	4	CG RAM (5)		\$	4	5	6	7	8	9	A	B	C	D	E	F					
	5	CG RAM (6)		%	5	6	7	8	9	A	B	C	D	E	F						
	6	CG RAM (7)		&	6	7	8	9	A	B	C	D	E	F							
	7	CG RAM (8)		'	7	8	9	A	B	C	D	E	F								
	8	CG RAM (1)		(	8	9	A	B	C	D	E	F									
	9	CG RAM (2)		)	9	A	B	C	D	E	F										
	A	CG RAM (3)		*	A	B	C	D	E	F											
	B	CG RAM (4)		+	B	C	D	E	F												
	C	CG RAM (5)		,	C	D	E	F													
	D	CG RAM (6)		-	D	E	F														
	E	CG RAM (7)		.	E	F															
	F	CG RAM (8)		/	F																

*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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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>

