

AZ DISPLAYS, INC.

COMPLETE LCD SOLUTIONS

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

PART NUMBER:

ACM 1602B SERIES

DATE:

August 9, 1999

ACM1602B SERIES LCD MODULE

1.0 MECHANICAL SPECS

1. Overall Module Size	84.0mm(W) x 44.0mm(H) x max 13.5mm(D) for LED backlight version 84.0mm(W) x 44.0mm(H) x max 9.5mm(D) for reflective version
2. Dot Size	0.56mm(W) x 0.61mm(H)
3. Dot Pitch	0.61mm(W) x 0.66mm(H)
4. Duty	1/16
5. Controller IC	KS0066
6. LC Fluid Options	TN, STN
7. Polarizer Options	Reflective, Transflective, Transmissive
8. Backlight Options	LED
9. Temperature Range Options	Standard (0°C ~ 50°C),Wide(-20°C ~ 70°C)

2.0 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min	Typ	Max	Unit
Operating temperature (Standard)	Top	0	-	50	°C
Storage temperature (Standard)	Tst	-10	-	60	°C
Operating temperature (Wide temperature)	Top	-20	-	70	°C
Storage temperature (Wide temperature)	Tst	-30	-	80	°C
Input voltage	Vin	Vss		Vdd	V
Supply voltage for logic	Vdd- Vss	2.7	-	5.5	V
Supply voltage for LCD drive	Vdd- Vo	3.0	4.6	6.5	V

ACM1602B SERIES LCD MODULE

3.0 ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Input voltage (high)	V _{ih}	H level	2.2	-	V _{dd}	V
Input voltage (low)	V _{il}	L level	0	-	0.6	V
Recommended LC Driving Voltage (Standard Temp)	V _{dd} - V _o	0°C	-	4.8	5.4	V
		25°C	4.2	4.6	-	
		50°C	3.9	4.3	-	
Recommended LC Driving Voltage (Wide Temp)	V _{dd} - V _o	-20°C	-	6.4	7.2	V
		0°C	-	4.6	-	
		50°C	-	4.2	-	
		70°C	3.5	4.0	-	
Power Supply Current	I _{dd}	V _{dd} =5.0V, f _{osc} =270kHz	-	0.8	1.8	mA
LED Power Supply Voltage	V _{fled}	R=6.8Ω	-	4.6	5.0	V
LED Power Supply Current	I _{fled}	R=6.8Ω	-	120	300	mA

4.0 OPTICAL CHARACTERISTICS (T_a=25°C, V_{dd}= 5.0V±0.25V, TN LC fluid)

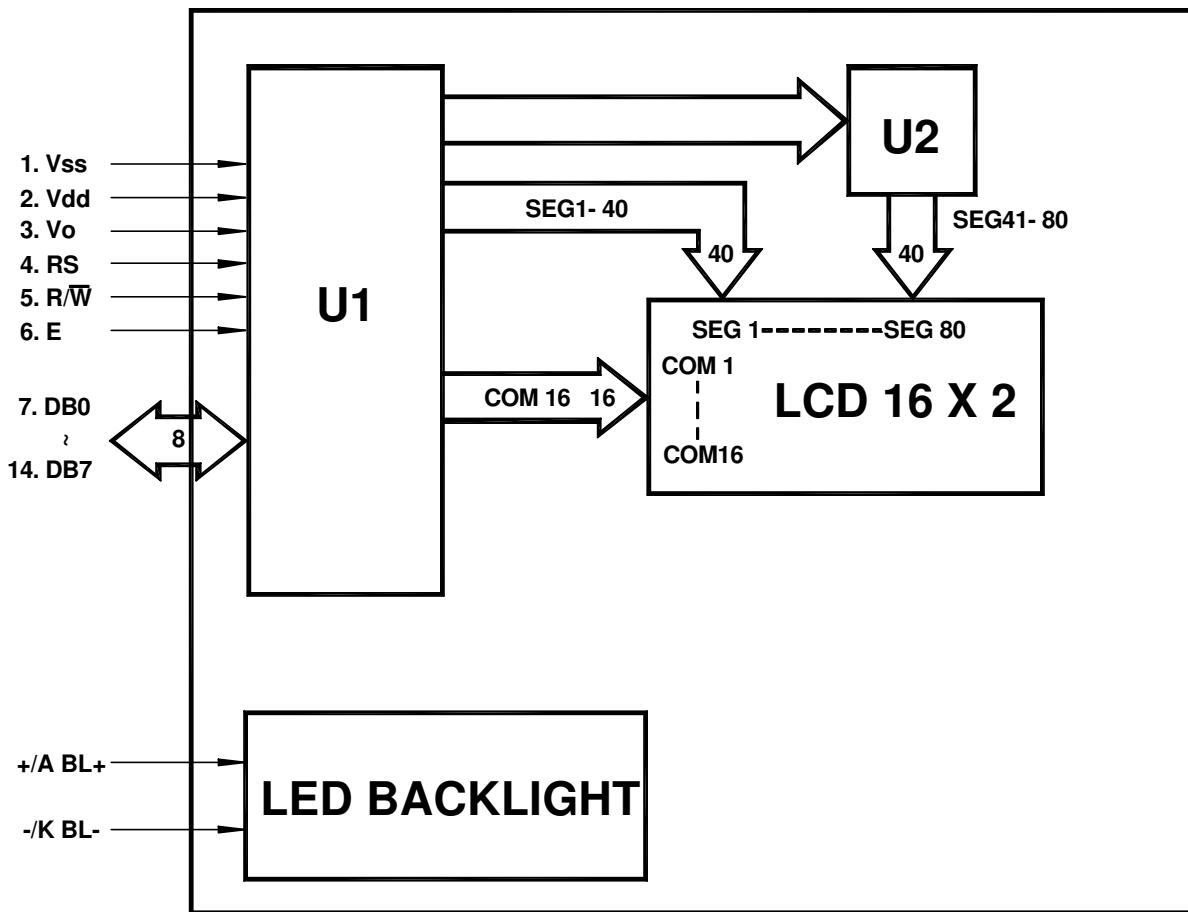
Item	Symbol	Condition	Min	Typ	Max	Unit
Viewing angle (horizontal)	θ	Cr ≥ 4.0	-25	-	-	deg
Viewing angle (vertical)	φ	Cr ≥ 4.0	-30	-	30	deg
Contrast Ratio	Cr	φ=0°, θ=0°	-	2	-	
Response time (rise)	T _r	φ=0°, θ=0°	-	120	150	ms
Response time (fall)	T _f	φ=0°, θ=0°	-	120	150	ms

ACM1602B SERIES LCD MODULE

4.1 OPTICAL CHARACTERISTICS (Ta=25°C, Vdd= 5.0V±0.25V, STN LC fluid)

Item	Symbol	Condition	Min	Typ	Max	Unit
Viewing angle (horizontal)	θ	$Cr \geq 2.0$	-60	-	35	deg
Viewing angle (vertical)	ϕ	$Cr \geq 2.0$	-40	-	40	deg
Contrast Ratio	Cr	$\phi=0^\circ, \theta=0^\circ$	-	6	-	
Response time (rise)	Tr	$\phi=0^\circ, \theta=0^\circ$	-	150	250	ms
Response time (fall)	Tf	$\phi=0^\circ, \theta=0^\circ$	-	150	250	ms

5.0 BLOCK DIAGRAM

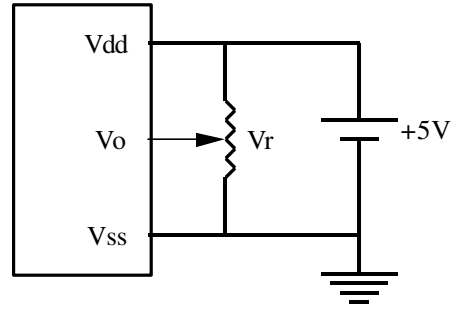


ACM1602B SERIES LCD MODULE

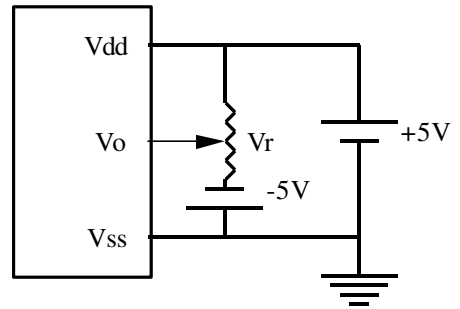
6.0 PIN ASSIGNMENT

Pin No.	Symbol	Function
1	Vss	Ground
2	Vdd	+5V
3	Vo	LCD contrast adjust
4	RS	Register select
5	R/W	Read / write
6	E	Enable
7	DB0	Data bit 0
8	DB1	Data bit 1
9	DB2	Data bit 2
10	DB3	Data bit 3
11	DB4	Data bit 4
12	DB5	Data bit 5
13	DB6	Data bit 6
14	DB7	Data bit 7
-	BL-	Power Supply for BL-
+	BL+	Power Supply for BL+

7.0 POWER SUPPLY



STANDARD TEMP RANGE



WIDE TEMP RANGE

$$V_R = 10K\Omega \sim 20K\Omega$$

8.0 TIMING CHARACTERISTICS

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Enable cycle time	t_c	Fig. a, Fig. b	500	-	-	ns
Enable pulse width	t_w	Fig. a, Fig. b	220	-	-	ns
Enable rise/fall time	t_r, t_f	Fig. a, Fig. b	-	-	25	ns
RS, R/W set up time	t_{SU}	Fig. a, Fig. b	40	-	-	ns
RS, R/W hold time	t_H	Fig. a, Fig. b	10	-	-	ns
Data delay time	t_D	Fig. b	-	-	120	ns
Data set up time	t_{DSU}	Fig. a	60	-	-	ns
Data hold time	t_{DH}	Fig. a, Fig. b	20	-	-	ns

ACM1602B SERIES LCD MODULE

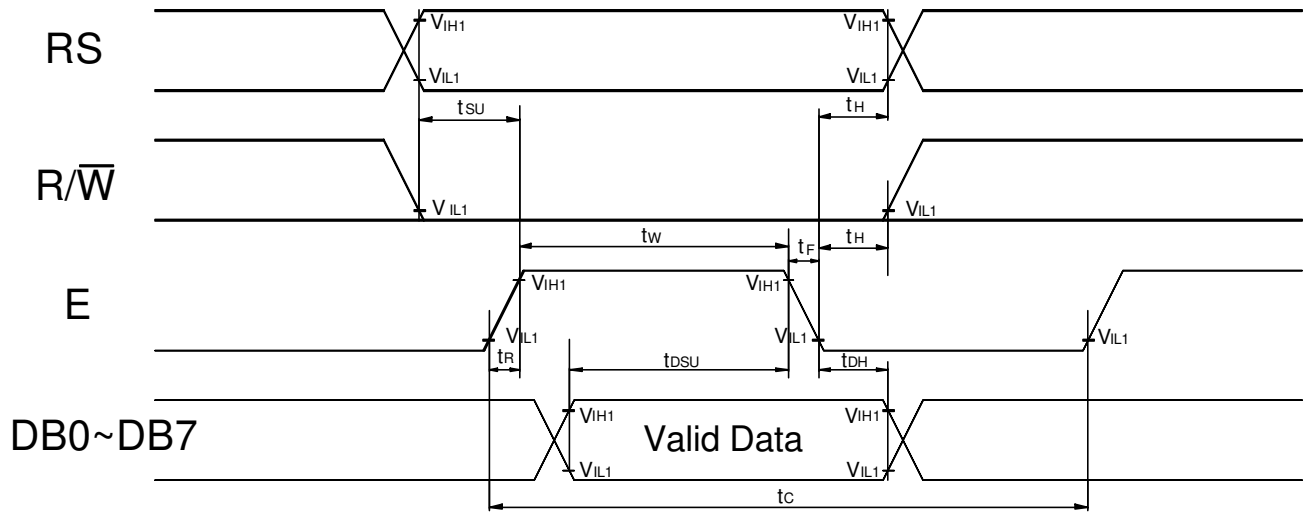


Fig. a Interface timing (data write)

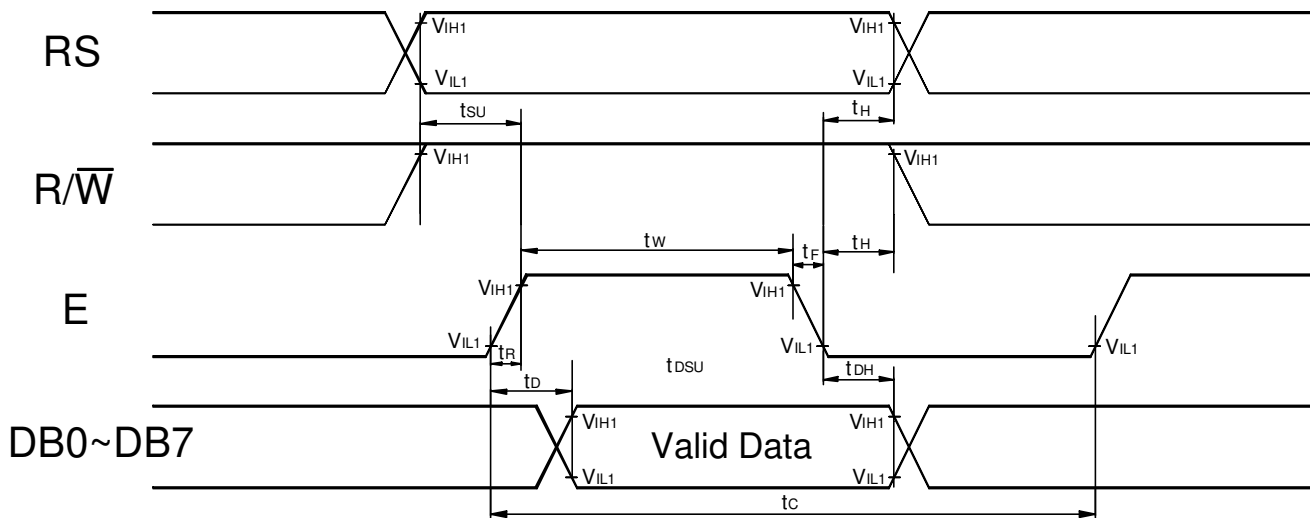
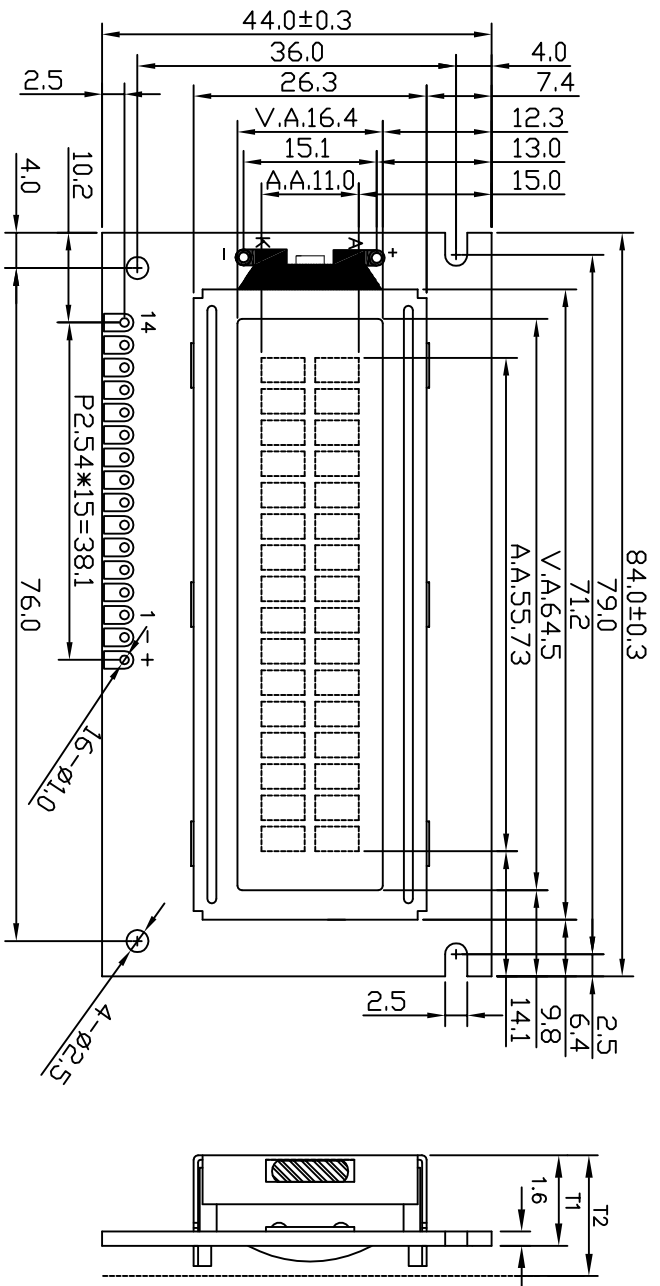
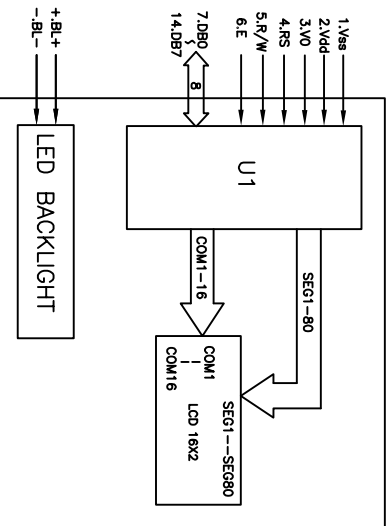


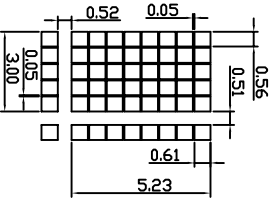
Fig. b Interface timing (data read)



-	BL-
+	BL+
14	DB7
13	DB6
12	DB5
11	DB4
10	DB3
9	DB2
8	DB1
7	DB0
6	E
5	R/W
4	RS
3	V0
2	VDD(GV)
1	VSS
	Pin SYMBOL



ITEM	T1	T2
BACKLIGHT	10.2	13.0
WITHOUT BL	6.2	9.0



THE PART NUMBER IN MASS PRODUCTION

- GRAY OR Y-G STN, TRANSFLECTIVE LCD;Y-G BACKLIGHT;6 O'CLOCK OR 12 O'CLOCK;
- FSTN, TRANSFLECTIVE LCD;BLUE OR WHITE BACKLIGHT;6 O'CLOCK OR 12 O'CLOCK;
- Y-G STN, TRANSFLECTIVE LCD;WHITE BACKLIGHT;6 O'CLOCK;
- Y-G STN, TRANSMISSIVE LCD;Y-G BACKLIGHT;6 O'CLOCK;
- BLUE STN, TRANSMISSIVE NEGATIVE LCD;WHITE BACKLIGHT;6 O'CLOCK OR 12 O'CLOCK;
- GRAY OR Y-G STN, REFLECTIVE LCD;WITHOUT BACKLIGHT;6 O'CLOCK OR 12 O'CLOCK;

ITEM	SELECTABLE CONTENTS
	STN YELLOW MODE
	STN GRAY MODE
	STN BLUE MODE
	FSTN
	REFLECTIVE
	TRANSFLECTIVE
	TRANSMISSIVE, POSITIVE
	TRANSMISSIVE, NEGATIVE

POLARIZER TYPE	TRANSMISSIVE, POSITIVE
	TRANSMISSIVE, NEGATIVE

VIEWING DIRECTION	6 O'CLOCK
	12 O'CLOCK
	WHITE
	Y-G
	RED
	GREEN
	BLUE
	AMBER
	TRI-COLOR

LED BACKLIGHT	AMBER
	BLUE
	GREEN
	RED
	Y-G
	WHITE
	12 O'CLOCK
	6 O'CLOCK

TEMPERATURE RANGE	STANDARD TEMPERATURE
	WIDE TEMPERATURE
CHARACTER PATTERNS	ENGLISH-JAPANESE FONTS
	ENGLISH-EUROPEAN FONTS
	ENGLISH-RUSSIAN FONTS
	CYRILLIC FONTS
	HEBREW FONTS

OPERATING VOLTAGE	5V
LCD DRIVING VOLTAGE	4.5V
LCD DRIVE METHOD	1/16 DUTY 1/5 BIAS
LCD DRIVE IC	ST7066U

NOTE:

- 1.The backlight can be driven by pin +, pin - or pin1, pin2 which is selectable.
- 2.The voltage of backlight is depended on the backlight color and the value of current-limiting resistance.
- 3.The operating voltage can be driven by 3.3v which is selectable.

AZ DISPLAYS

TITLE:	LCM
MODEL NO:	ACM1602B SERIES
PART NO:	
SCALE:	1:1
DRAWN:	
CHECKED:	
APPROVED:	
UNIT	MM
TOLERANCE	X.X = ±0.3
	X.XX = ±0.20
	ANG = -
3RD ANGLE	
DRAWN:	
CHECKED:	
APPROVED:	
REV	A
SH NO	1/1

ACM1602B SERIES LCD MODULE

10.0 RELIABILITY TEST

Storage Condition	Content	Evaluations and Assessment*			
		Current Consumption	Oozing	Contrast	Other Appearances
Operation at high temperature and humidity	40° C,90% RH,240hrs	Twice initial value or less	none	More than 80% of initial value	No abnormality
High temperature storage	60° C, 240hrs	Twice initial value or less	none	More than 80% of initial value	No abnormality
Low temperature storage	-20° C, 240hrs	Twice initial value or less		More than 80% of initial value	No abnormality

*Evaluations and assessment to be made two hours after returning to room temperature (25° C±5° C).

*The LCDs subjected to the test must not have dew condensation.

ACM1602B SERIES LCD MODULE

11.0 DISPLAY INSTRUCTION TABLE

COMMAND	R S	R/ W	DB 7	DB 6	DB 5	DB 4	DB 3	DB 2	DB 1	DB 0	DESCRIPTION	Executing time fosc=250khz
Clear Display	0	0	0	0	0	0	0	0	0	1	Clears Display & Returns to Address 0.	1.64ms
Cursor at Home	0	0	0	0	0	0	0	0	1	x	Returns Cursor to Address 0. Also returns the display being shifted to the original position. DDRAM contents remain unchanged.	1.64ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	I/D: Set Cursor Moving Direction I/D=1: Increment I/D=0: Decrement S: Specify Shift of Display S=1: The display is shifted S=0: The display is not shifted	40µs
Display ON/OFF Control	0	0	0	0	0	0	1	D	C	B	Display D=1: Display on D=0: Display off Cursor C=1: Cursor on C=0: Cursor off Brink B=1: Brink on B=0: Brink off	40µs
Cursor / Display Shift	0	0	0	0	0	1	S/C	R/L	x	x	Moves cursor or shifts the display w/o changing DD RAM contents S/C=0: Cursor Shift (RAM unchanged) S/C=1: Display Shift (RAM unchanged) R/L=1: Shift to the Right R/L=0: Shift to the Left	40µs
Function Set	0	0	0	0	1	DL	N	F	x	x	Sets data bus length (DL), # of display lines (N), and character fonts (F). DL=1: 8 bits F=0: 5x7 dots DL=0: 4 bits F=1: 5x10 dots N=0: 1 line display N=1: 2 lines display	40µs
Set CG RAM Address	0	0	0	1	Character Generator (CG) RAM Address					Sets CG RAM address. CG RAM data is sent and received after this instruction.		40µs
Set DD RAM Address	0	0	1	Display Data (DD) RAM Address / Cursor Address					Sets DD RAM address. DD Ram data is sent and received after this instruction.		40µs	
Busy Flag / Address Read	0	1	B F	Address counter used for both DD & CG RAM address					Reads Busy Flag (BF) and address counter contents.		40µs	
Write Data	1	0	Write Data					Writes data into DDRAM or CGRAM.		46µs		
Read Data	1	1	Read Data					Reads data from DDRAM or CGRAM.		46µs		

x: Don't Care.

ACM1602B SERIES LCD MODULE

12.0 STANDARD CHARACTER PATTERNS

Lower 4 Bits \ Upper 4 Bits	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
xxxx0000	CG RAM (1)			0	a	P	`	P				-	夕	三	⊗	P
xxxx0001	(2)		!	1	A	Q	a	q			。	ア	チ	△	⊗	q
xxxx0010	(3)		"	2	B	R	b	r			「	イ	ツ	×	⊗	⊗
xxxx0011	(4)		#	3	C	S	c	s			」	ウ	テ	⊗	⊗	⊗
xxxx0100	(5)		\$	4	D	T	d	t			、	エ	ト	⊗	⊗	⊗
xxxx0101	(6)		%	5	E	U	e	u			・	オ	ナ	⊗	⊗	⊗
xxxx0110	(7)		&	6	F	V	f	v			ヲ	カ	ニ	ヨ	⊗	⊗
xxxx0111	(8)		'	7	G	W	g	w			ア	キ	ヌ	ラ	⊗	⊗
xxxx1000	(1)		<	8	H	X	h	x			イ	ク	ネ	リ	⊗	⊗
xxxx1001	(2)		>	9	I	Y	i	y			ウ	ケ	ル	⊗	⊗	⊗
xxxx1010	(3)		*	:	J	Z	j	z			エ	コ	ハ	レ	⊗	⊗
xxxx1011	(4)		+	;	K	[k	{			オ	サ	ヒ	ロ	⊗	⊗
xxxx1100	(5)		,	<	L	¥	l	l			カ	シ	フ	ワ	⊗	⊗
xxxx1101	(6)		-	=	M]	m	}			ユ	ヌ	ハ	ン	⊗	⊗
xxxx1110	(7)		.	>	N	^	n	→			ヨ	セ	ホ	⊗	⊗	⊗
xxxx1111	(8)		/	?	O	_	o	←			ウ	ソ	マ	⊗	⊗	⊗

Note: The character generator RAM is the RAM with which the user can rewrite character patterns by program.