

# AZ DISPLAYS, INC.

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*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

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## 3.0 ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Input voltage (high)	Vih	H level	2.2	-	Vdd	V
Input voltage (low)	Vil	L level	0	-	0.6	V
Recommended LC Driving Voltage (Standard Temp)	Vdd - Vo	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)	Vdd -Vo	-20°C	-	6.4	7.2	V
		0°C	-	4.6	-	
		50°C	-	4.2	-	
		70°C	3.5	4.0	-	
Power Supply Current	Idd	Vdd=5.0V, fosc=270kHz	-	0.8	1.8	mA
LED Power Supply Voltage	Vfled	R=6.8Ω	-	4.6	5.0	V
LED Power Supply Current	Ifled	R=6.8Ω	-	120	300	mA

## 4.0 OPTICAL CHARACTERISTICS (Ta=25°C, Vdd= 5.0V±0.25V, TN LC fluid)

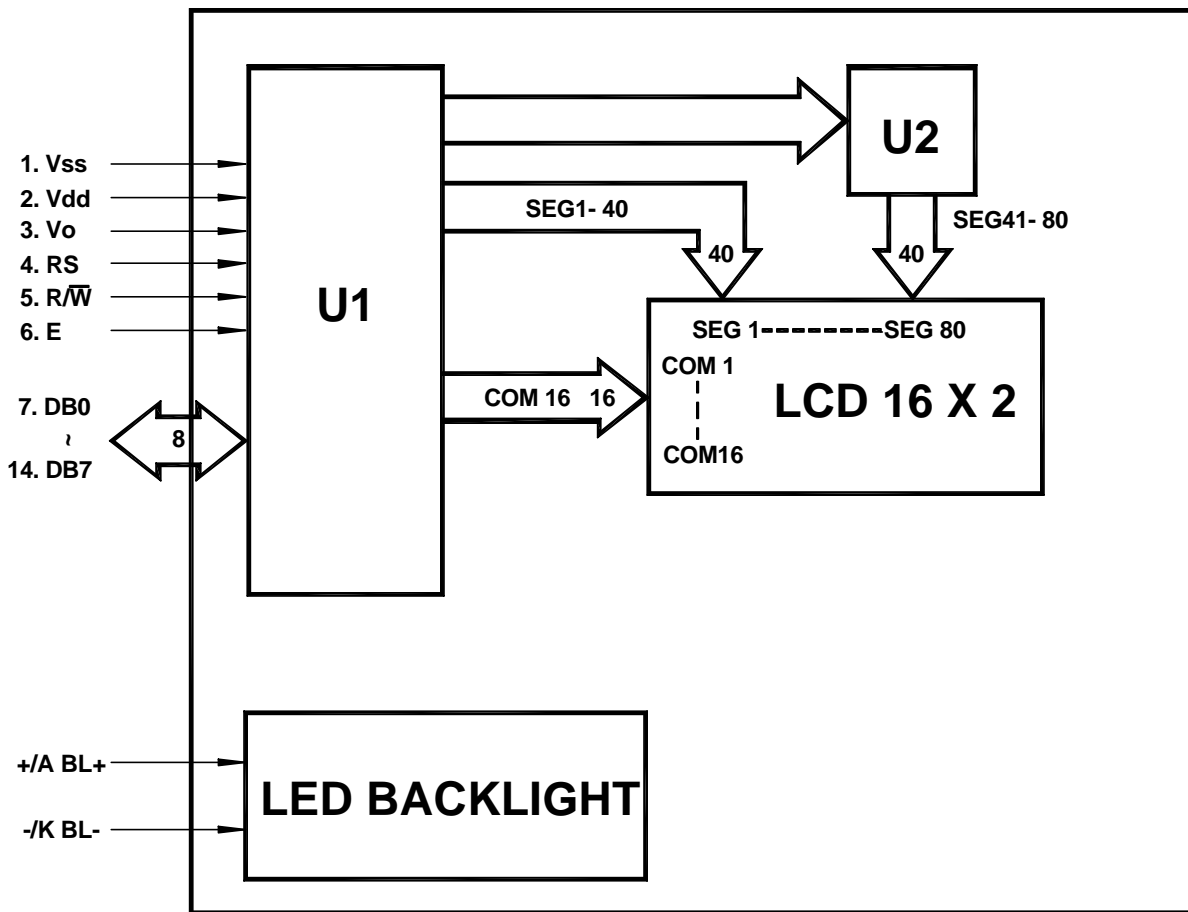
Item	Symbol	Condition	Min	Typ	Max	Unit
Viewing angle (horizontal)	θ	Cr ≥ 4.0	-25	-	-	deg
Viewing angle (vertical)	φ	Cr ≥ 4.0	-30	-	30	deg
Contrast Ratio	Cr	φ=0°, θ=0°	-	2	-	
Response time (rise)	Tr	φ=0°, θ=0°	-	120	150	ms
Response time (fall)	Tf	φ=0°, θ=0°	-	120	150	ms

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## 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)	$\theta$	$Cr \geq 2.0$	-60	-	35	deg
Viewing angle (vertical)	$\phi$	$Cr \geq 2.0$	-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

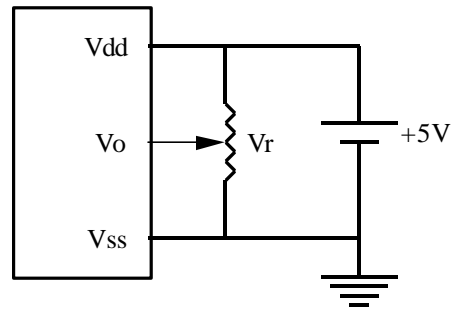


# ACM1602B SERIES LCD MODULE

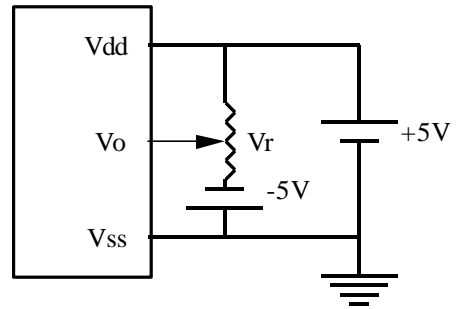
## 6.0 PIN ASSIGNMENT

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

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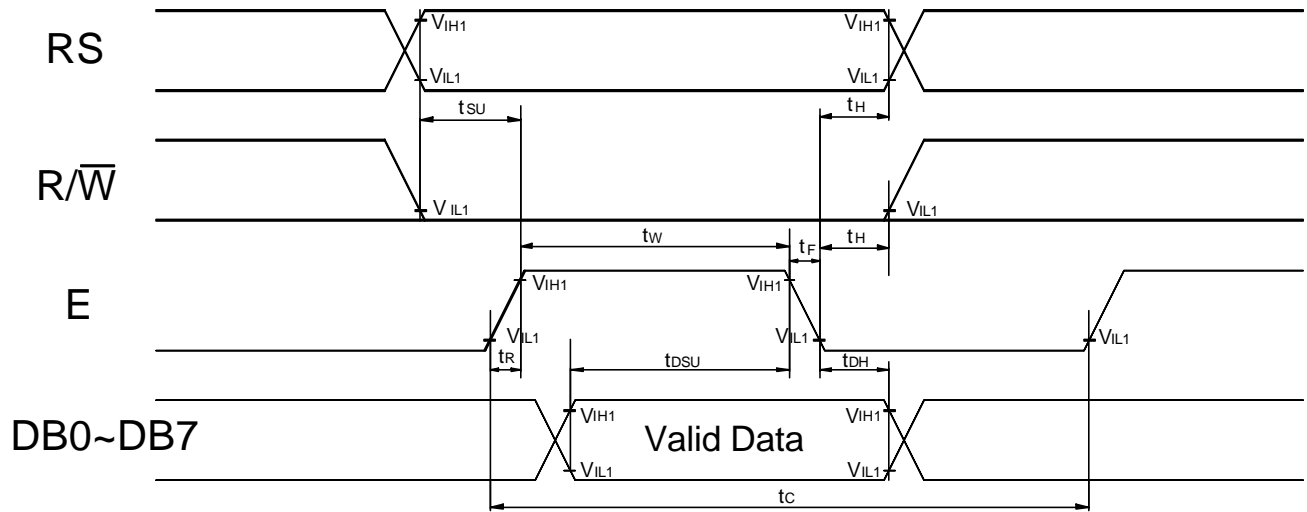


Fig. a Interface timing (data write)

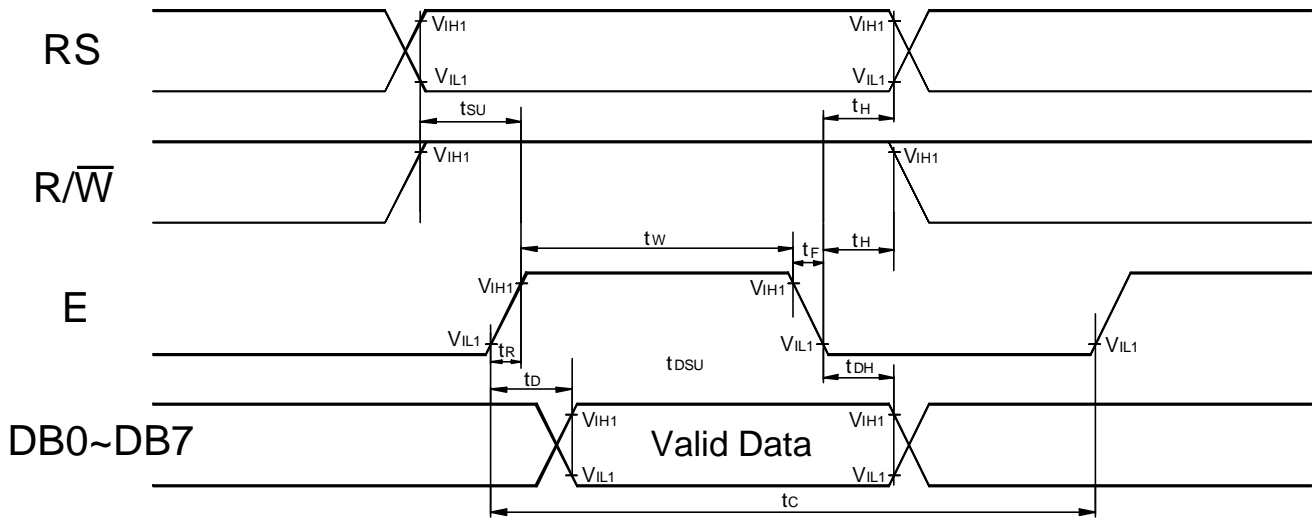
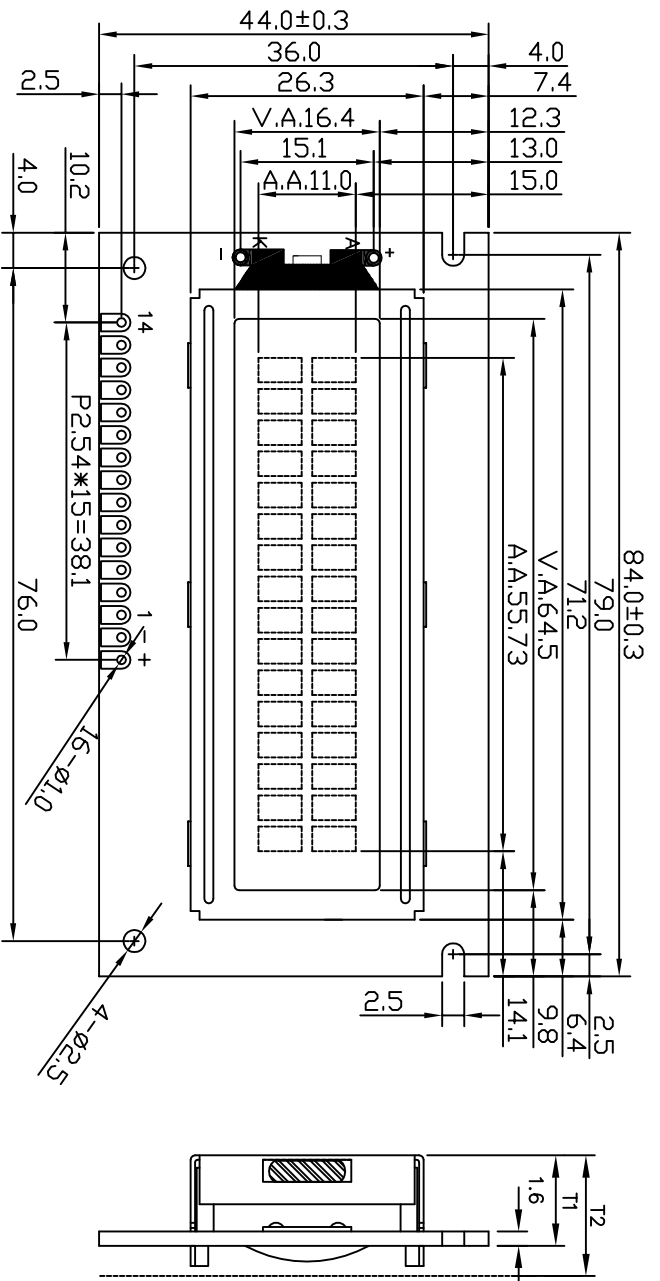
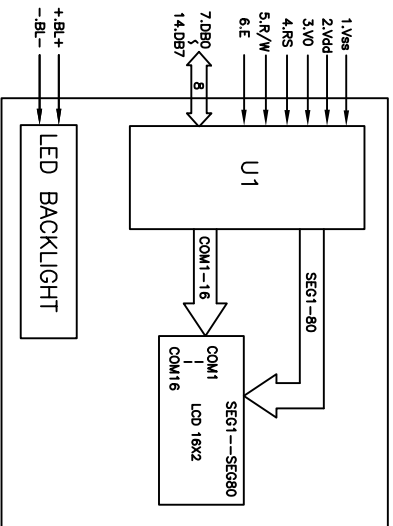


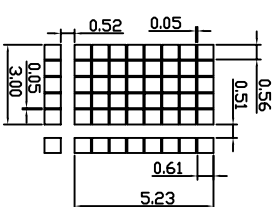
Fig. b Interface timing (data read)



-	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



ITEM	SELECTABLE CONTENTS
DISPLAY MODE	STN YELLOW MODE STN GRAY MODE STN BLUE MODE
POLARIZER TYPE	REFLECTIVE TRANSMISSIVE, POSITIVE TRANSMISSIVE, NEGATIVE
VIEWING DIRECTION	6 O'CLOCK 12 O'CLOCK
LED BACKLIGHT	WHITE Y-G RED GREEN BLUE AMBER TRI-COLOR
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.

THE PART NUMBER IN MASS PRODUCTION

- 1.GRAY OR Y-G STN, TRANSFLECTIVE LCD; Y-G BACKLIGHT; 6 O'CLOCK OR 12 O'CLOCK;
- 2.FSTN, TRANSFLECTIVE LCD; BLUE OR WHITE BACKLIGHT; 6 O'CLOCK OR 12 O'CLOCK;
- 3.Y-G STN, TRANSFLECTIVE LCD; WHITE BACKLIGHT; 6 O'CLOCK;
- 4.Y-G STN, TRANSMISSIVE LCD; Y-G BACKLIGHT; 6 O'CLOCK;
- 5.BLUE STN, TRANSMISSIVE NEGATIVE LCD; WHITE BACKLIGHT; 6 O'CLOCK OR 12 O'CLOCK;
- 6.GRAY OR Y-G STN, REFLECTIVE LCD; WITHOUT BACKLIGHT; 6 O'CLOCK OR 12 O'CLOCK;

UNIT	M/M	TOLERANCE
3RD ANGLE	X.XX = ±0.3 X.XX = ±0.20	
SCALE:	1:1	
DRAWN:		
CHECKED:		
APPROVED:		

TITLE: LCM	
MODEL NO: ACM1602B SERIES	
PART NO:	REV A
SH NO 1/1	A

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## 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.



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## 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.

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## 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	⊗	⊗	⊗
xxxx1100	(5)		,	<	L	¥	l	l			カ	シ	フ	⊗	⊗	⊗
xxxx1101	(6)		-	=	M	]	m	}			ユ	ヌ	ハ	⊗	⊗	⊗
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.