CITIZEN

User's Manual

CBM-202PC-04

Thermal Printer
Mechanical Control LSI

Rev 1.00 Newly Issued on 13.July.1998

Japan CBM Corporation
Information Systems Div.

<CAUTIONS>

1. Prior to using the printer, read this manual thoroughly for correct operation. After reading the manual, keep it carefully at hand for your future reference.
2. The information herein is subject to change without prior notice due to technical improvements. Upon actual use of the printer, inquire for the up-to-date specifications.
3. It is strictly prohibited to copy part or all of the information contained in this manual without our prior permission.
4. If you have any question about the information herein or notice any clerical error or omission, please contact us.
5. We will not be responsible for the effects from the results of operating the printer, regardless of Section 4.
6. We cannot guarantee that the information herein does not infringe upon the industrial property, etc. of a third party, except when there is a written agreement to that effect.

CONTENTS

1. OUTLINE

This LSI is designed to control the line thermal printer LT-286 by using our Gate Array. It has the following features.

(1) Capable of providing high-quality printing by detecting a temperature and automatically correcting printing density.
(2) Capable of providing high-quality printing by detecting a voltage and automatically correcting printing density.
(3) Capable of selecting the parallel or serial interface.
(4) Capable of selecting printing density via a function selection terminal.
(5) Capable of printing a bar code.
(6) Capable of printing double-width/height characters, bit images, and so on by various commands.

1.1 Applicable Printer

LSI Name	Applicable Mechanism
CBM-202PC-04	LT-286

2. MAINTENANCE AND SERVICE

For the information on maintenance and service, please contact our dealer or at the following address.

Northern America
CBM America Corporation
Service Center
365 Van Ness Way
Suit 510
Torrance, CA 90501, U.S.A

TEL 310-781-1460
FAX 310-781-9157

Other Areas
Japan CBM Corporation
Information Systems Division
1-1-7 Okubo Shinjuku-ku,
Tokyo 169-8553 Japan

TEL 03-3200-6970
FAX 03-3200-6297

3. BASIC SPECIFICATIONS

3.1 Shape and Dimensions(Refer to the "8. SPECIFICATIONS OF PACKAGE".)

100-pin flat package

3.2 Structure

C-MOS LSI

3.3 Data Transfer Method

Parallel transfer or serial transfer (Selectable)

(1) 8-bit parallel transfer (CENTRONICS based)

(2) Asynchronous serial transfer (Selectable)

1,200, 2,400, 4,800, 9,600, or 19,200 bps

Parity: Odd, Even, or None parity; 8 bits

3.4 Printing Function

(1) Printing columns and printing speed

Model	Digits	Total Dots	Character Size (mm)	Printing Speed (m/s)
LT-286	32	384	1.25 x3.00(Font A)	50
	42		0.88 x3.00(Font B)	

Note) The printing speed above applies when the thermal printer is driven in the following environment:

- Drive voltage(VH) = 7.2 V
- Thermal head temperature = 30ºC or more
- Simultaneous power-on(print) dots = Within 64 dots

3.5 Operating Voltage and Power Consumption

- Voltage : 5V DC ±5 %
- Current consumption : 80mA at maximum

3.6 Operating Frequency

- 16 MHz

4. HARDWARE SPECIFICATIONS

4.1 Absolute Maximum Ratings

Item	Symbol	Rating
Supply voltage	Vcc	-0.3 ~ +7.0V
Input voltage	Vi	-0.3 ~ Vcc+0.3V
Reference supply voltage	V_{REF}	-0.3 ~ AVcc+0.3V
Analog supply voltage	AVcc	-0.3 ~ +7V
Analog input voltage	V_{AN}	-0.3 ~ AVcc+0.3V
Operating temperature	Topr	-20 ~ +75ºC
Storage temperature	Tstg	-55 ~ +125ºC

4.2 Electrical Characteristics

Item		Symbol	MIN	MAX	Unit	Condition
Input "HIGH" Level	RES,STBY,NM1 MD0,MD1,MD2	V_{IH}	Vcc-0.7	Vcc+0.3	V	
	EXTAL		Vcc X0.7	Vcc+0.3	V	
	THEM		2.0	AVcc+0.3	V	
	Others		2.0	Vcc+0.3	V	
Input "LOW" level	All input terminals	V_{IL}	-0.3	0.5	V	
Output "HIGH" level	All output terminals	V_{0H}	3.5	–	V	I_{OH}=-1$_{mA}$
Output "LOW" level	RESO	V_{0L}	–	0.4	V	I_{OH}=2.6$_{mA}$
	LEDER,LEDPE		–	1.0	V	I_{OL}=10$_{mA}$
	Others			0.4	V	I_{OL}=1.6$_{mA}$

4.3 Terminal Layout and Functions

Pin No.	Signal	I/O	Function	Logic
1	VCC	-	VCC	-
2	LFSW	Input	LF switch input	LOW
3	LEDER	Output	Error LED output	LOW
4	LEDPE	Output	Paper end LED output	LOW
5	NC	-	NC	-
6	LATCH	Output	Head latch signal	LOW
7	PAPER	Input	Paper end input NC	HIGH
8	DRQ	Input	DMA request	LOW
9	NC	-	NC	-
10	RES0	Output	Watchdog output	LOW
11	VSS	-	GND	-
12	DTR	Output	Serial DTR (RS-232C)	HIGH
13	TXD	Output	Serial TXD (RS-232C)	HIGH
14	DI	Input	Print head output data	HIGH
15	RXD	Input	Serial RXD (RS-232C)	HIGH
16	CP	Input	Print head clock	HIGH
17	NC	-	NC	-
18	CTSW	Input	Cutter switch input	LOW
19	NC	-	NC	-
20	NC	-	NC	-
21	NU	-	RESERVED	-
22	VSS	-	GND	-
23	MOTORA	Output	Motor A	-
24	MOTORB	Output	Motor B	-
25	MOTOR$\overline{A}$	Output	Motor$\overline{A}$	-

Note) For notation of the signals whose logic is "LOW"(Negative), a representation of $\overline{XXX}$(Upper line) will be omitted for the subsequent notations.

Pin No.	Signal	I/O	Function	Logic
26	MOTOR$\overline{B}$	Output	Motor $\overline{B}$	-
27	D0	I/O	D0	HIGH
28	D1	I/O	D1	HIGH
29	D2	I/O	D2	HIGH
30	D3	I/O	D3	HIGH
31	D4	I/O	D4	HIGH
32	D5	I/O	D5	HIGH
33	D6	I/O	D6	HIGH
34	D7	I/O	D7	HIGH
35	VCC	-	VCC	-
36	A0	Output	A0	HIGH
37	A1	Output	A1	HIGH
38	A2	Output	A2	HIGH
39	A3	Output	A3	HIGH
40	A4	Output	A4	HIGH
41	A5	Output	A5	HIGH
42	A6	Output	A6	HIGH
43	A7	Output	A7	HIGH
44	VSS	-	GND	-
45	A8	Output	A8	HIGH
46	A9	Output	A9	HIGH
47	A10	Output	A10	HIGH
48	A11	Output	A11	HIGH
49	A12	Output	A12	HIGH
50	A13	Output	A13	HIGH

Pin No.	Signal	I/O	Function	Logic
51	A14	Output	A14	HIGH
52	A15	Output	NC	-
53	A16	Output	NC	-
54	A17	Output	NC	-
55	A18	Output	NC	-
56	A19	Output	NC	-
57	VSS	-	GND	-
58	P60	Output	NC	-
59	P61	Output	NC	-
60	P62	Output	NC	-
61	Ø	Output	Clock output	HIGH
62	STBY	Input	(Pull up to VCC at 10k)	LOW
63	RES	Input	Reset input	LOW
64	NMI	Input	(Pull up to VCC at 10k)	LOW
65	VSS	-	GND	-
66	EXTAL	-	EXTAL (16MHz)	-
67	XTAL	-	XTAL (16MHz)	-
68	VCC	-	VCC	-
69	P63	Output	NC	-
70	RD	Output	RD	LOW
71	HRW	Output	HRW	LOW
72	P66	Output	NC	-
73	MD0	Input	(Pull up to VCC at 10k)	HIGH
74	MD1	Input	(Pull down to GND at 10k)	LOW
75	MD2	Input	(Pull up to VCC at 10k)	HIGH

Pin No.	Signal	I/O	Function	Logic
76	AVCC	-	VCC	-
77	VREF	-	VCC	-
78	THERM	Input	Head temperature detection terminal	-
79	NC	Input	(Pull down to GND at 10k)	-
80	DETECV	Input	Voltage detection terminal	-
81	NC	Input	(Pull down to GND at 10k)	-
82	NC	Input	(Pull down to GND at 10k)	-
83	NC	Input	(Pull down to GND at 10k)	-
84	NC	Input	(Pull down to GND at 10k)	-
85	NC	Input	(Pull down to GND at 10k)	-
86	AVSS	-	GND	-
87	STB	Input	Parallel data interrupt	LOW
88	HEADUP	Input	Head up detection terminal	LOW
89	CS2	Output	Gate Array chip select	LOW
90	CS1	Output	RAM chip select	LOW
91	CS0	Output	Kanji ROM chip select	LOW
92	VSS	-	GND	-
93	NC	Output	NC	-
94	STRB1	Output	Head strobe 1	HIGH
95	STRB2	Output	Head strobe 2	HIGH
96	STRB3	Output	Head strobe 3	HIGH
97	STRB4	Output	Head strobe 4	HIGH
98	STRB5	Output	Head strobe 5	HIGH
99	STRB6	Output	Head strobe 6	HIGH
100	DSR	Input	Serial DSR (RS-232C)	HIGH

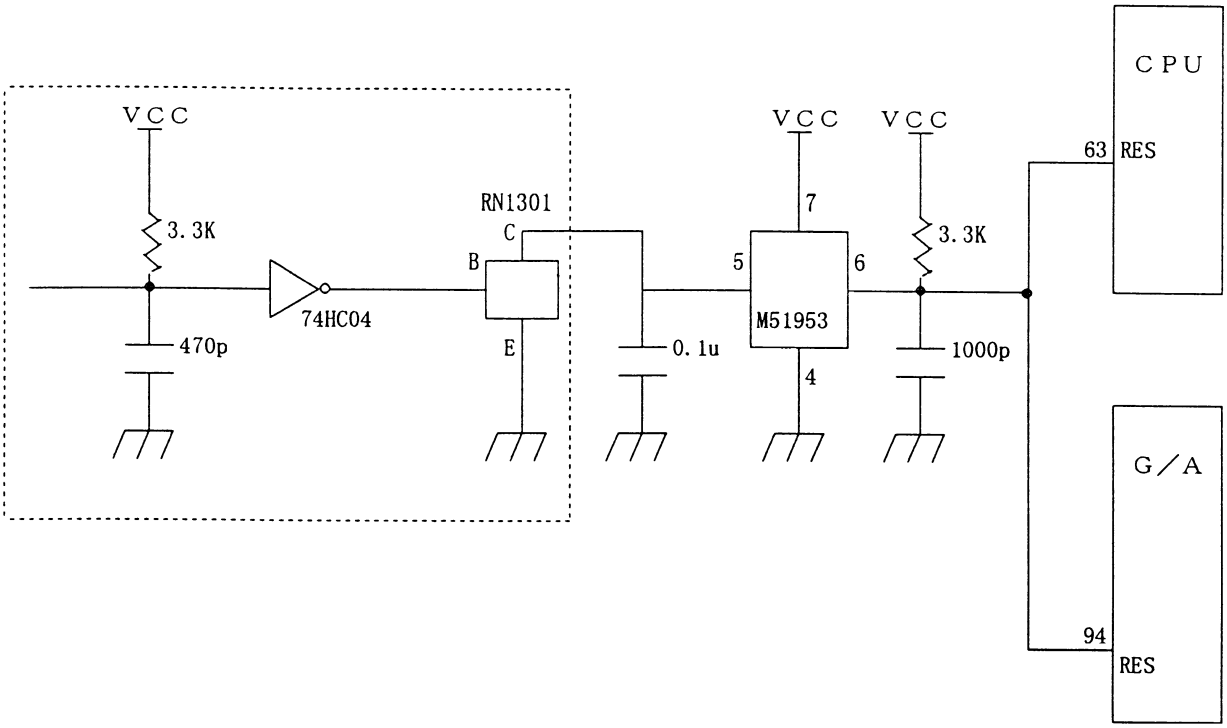
4.4 Gate Array (CBM202LA) Terminal Layout and Functions

Pin No.	Signal	I/O	Function	Logic
44	D7	Input	Parallel input data D7	HIGH
45	D6	Input	Parallel input data D6	HIGH
46	D5	Input	Parallel input data D5	HIGH
47	D4	Input	Parallel input data D4	HIGH
48	D3	Input	Parallel input data D3	HIGH
49	D2	Input	Parallel input data D2	HIGH
50	D1	Input	Parallel input data D1	HIGH
51	D0	Input	Parallel input data D0	HIGH
52	STROBE	Input	Parallel STROBE	LOW
55	BUSY	Output	Parallel BUSY	HIGH
58	PAO7	Output	NC	-
59	ACK	Output	Parallel ACK	-
61	PE	Output	Parallel paper end	HIGH
62	FAULT	Output	Parallel FAULT	LOW
63	CUTTERA	Output	Cutter A	-
64	CUTTERB	Output	Cutter B	-
65	CUTTERC	Output	Cutter C	-
67	CUTTERD	Output	Cutter D	-

4.5 Reset Circuit

The reset state is effectuated by setting the RES terminal to "Low." To surely reset, it is necessary to set it to "Low" at least for 20ms at power-on and for 625ns while operating.

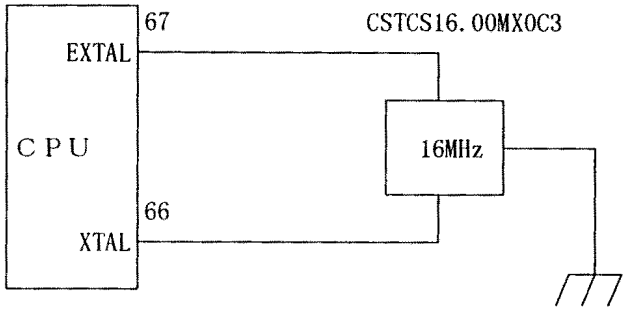
If an external reset is not used, the parts enclosed by dotted lines are not required.

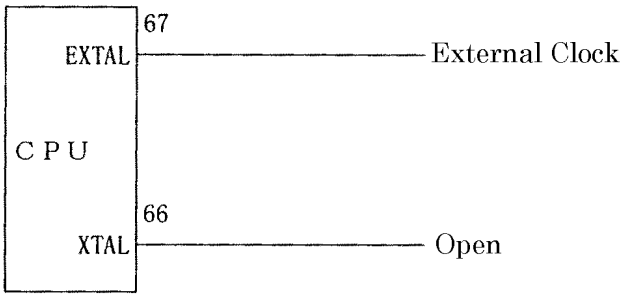


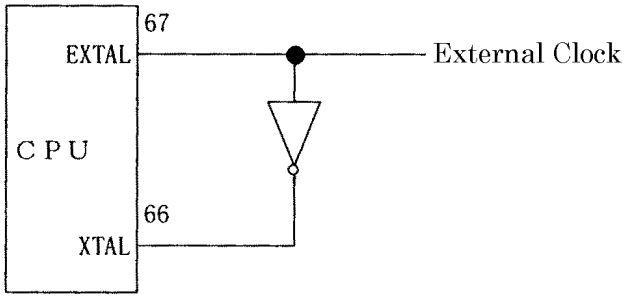
4.6 Oscillation Circuit

The oscillation circuit incorporates a clock oscillator which generates a system clock and an internal clock. There are two methods to supply a clock; one is to connect a ceramic oscillator, and the other is to input an external clock.

When using the ceramic oscillator, we recommend the CSTCS16.00MXOC3 (With capacitor) made by MURATA. When inputting the external clock, you may either open the XTAL terminal or input an antiphase clock to the XTAL terminal.



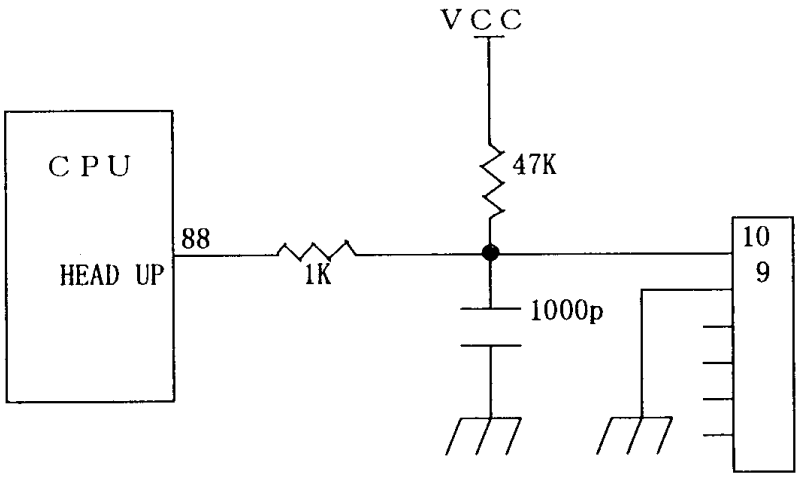




4.7 Head-up Detection Circuit

Print head up/down is detected by a head-up sensor built in the printer so that the printer will not be energized on with the head up. The circuit is "opened" when the print head is up, and "closed" when down.

When the print head is up, HEADUP (Pin 88) of the CPU is turned to "High," and if the printer is printing, it will immediately stop printing and output an error. It resumes printing when the print head is down.

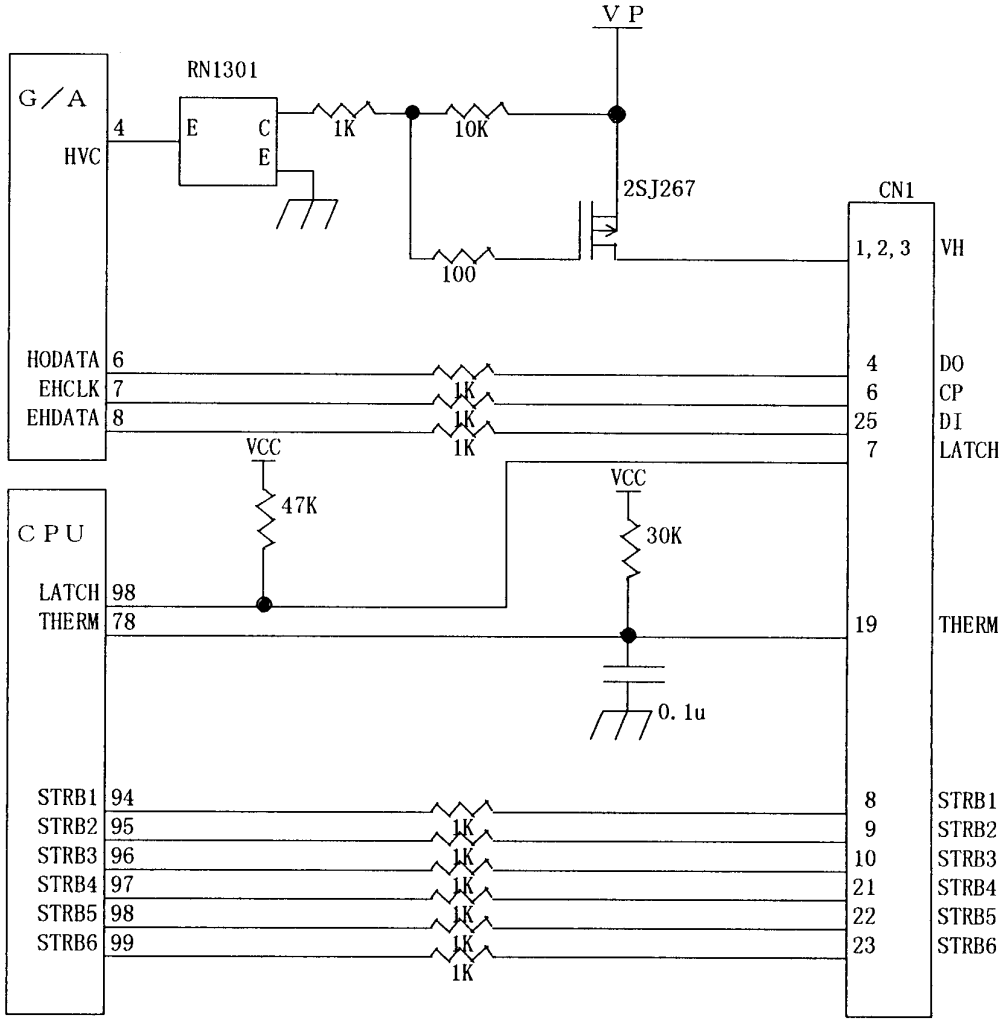


4.8 Head Control Circuit

VP is controlled in order to prevent electrolytic corrosion of the printing head. HVC(Pin-4) of the Gate Array is turned to "HIGH" when turning on VP, and turned to "LOW" when turning it off.

A temperature detection circuit is provided in order to prevent deterioration of the printing quality or breakage of the printing head due to a temperature. This function detects a temperature by means of a thermistor included in the printer and determines according to that temperature how much energy should be applied to the printing head. If a temperature of the printing head exceeds 60ºC, it will stop printing to prevent breakage of the printing head.

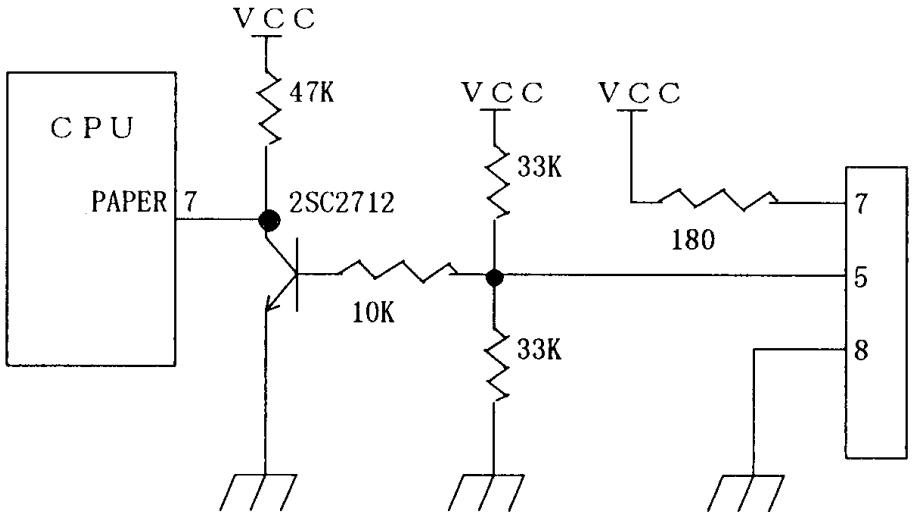
As a protection when the CPU crashes, connect in such a manner that the Gate Array will be reset by an output from the watchdog timer of the CPU. The CPU itself has been set so that it will be reset. So that the head strobe will not be turned to ON at that time, be sure to insert one pull-up resistor into STRB1 through STRB3, respectively.



4.9 Paper End Detection Circuit

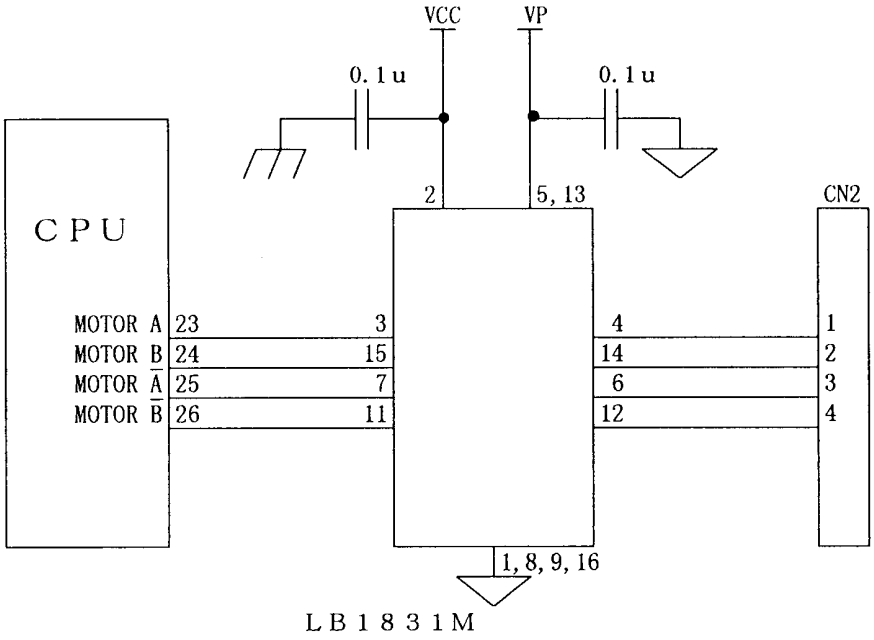
A paper sensor built in the printer detects whether there is the printing paper, so that the printer will not be turned on when it has no paper.

When the printer has no paper, PAPER (Pin 7) of the CPU is turned to "HIGH." If printing is under way, it will stop after printing that line, and output an error. When the paper is set, printing is automatically resumed.



4.10 Motor Control Circuit

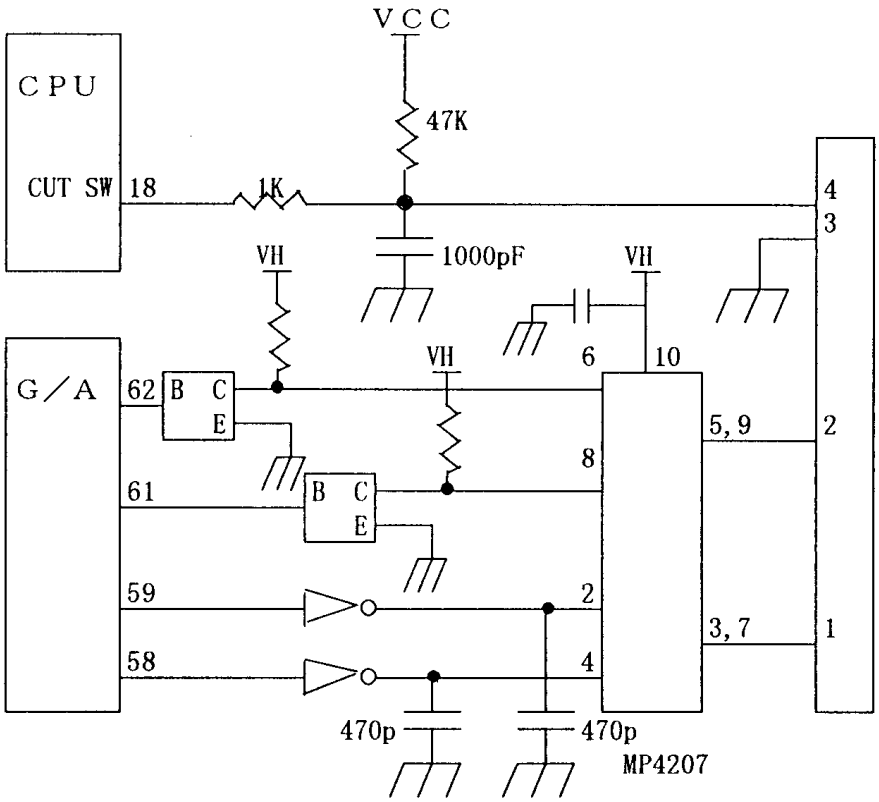
Avoid running the motor continuously for 15 minutes or more.



4.11 Auto Cutter Control Circuit

This CPU has a function to control the auto cutter, using the Pin 33 of the Gate Array.

When the auto cutter is not used, set the Pin 33 of the Gate Array to "HIGH." If set to "LOW," the printer will not function properly, resulting in an alarm.

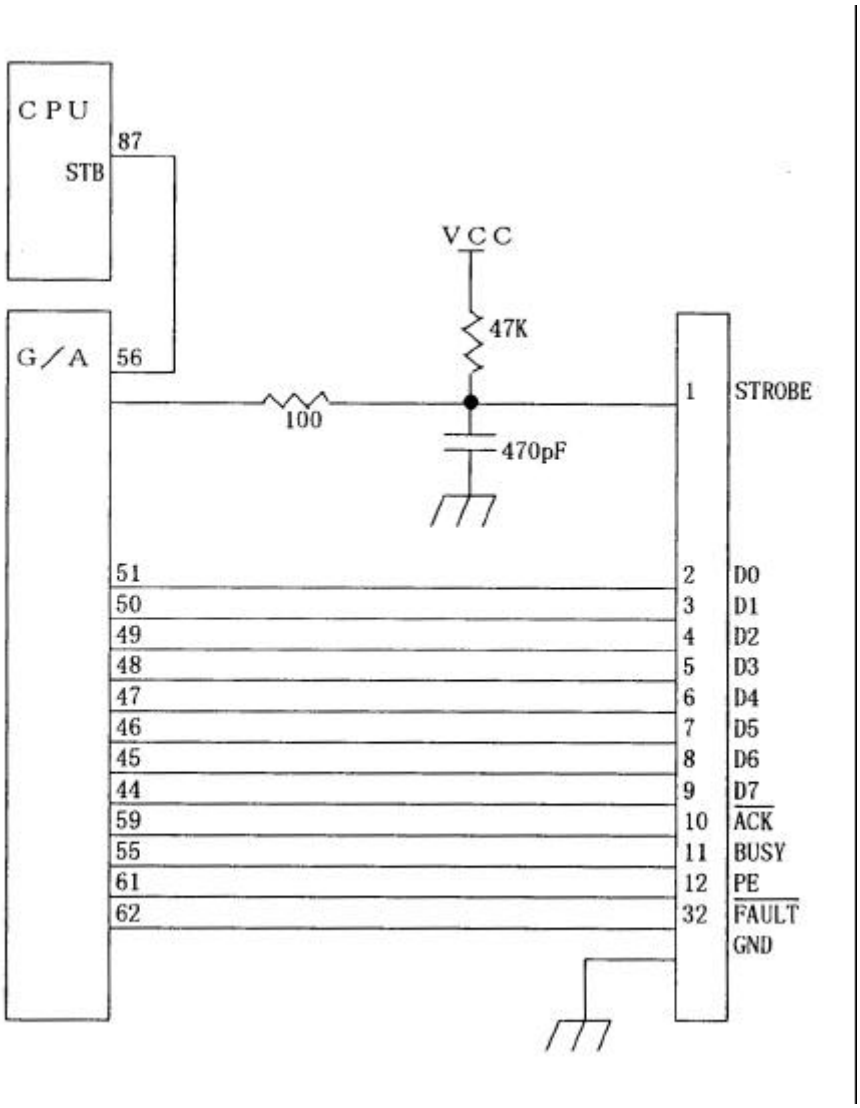


4.12 Parallel Interface Circuit

The Gate Array ports are mainly used to provide an 8-bit parallel interface.

When the parallel interface is not used, pull up STB(Pin 52) of the Gate Array with a 10k resistor. STB(Pin 87) of the CPU should be connected to INTR(Pin 56) of the Gate Array or pulled up with a 10k resistor.

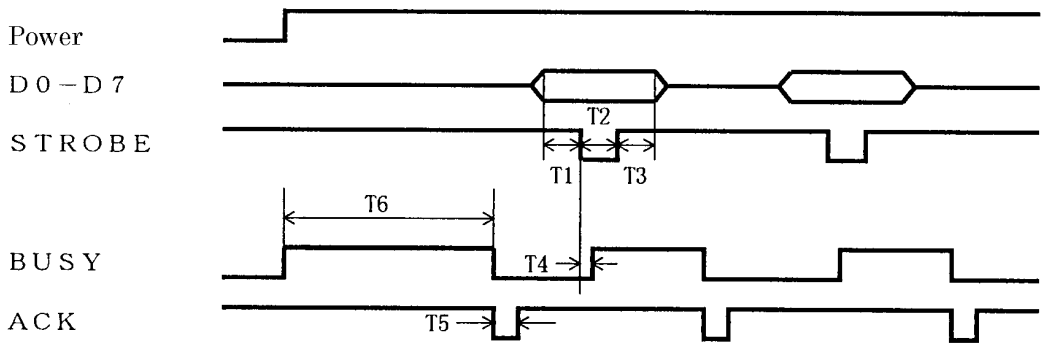
1) Circuit



2) Gate Array Signals and Their Functions

Signal	Pin No.	I/O	Function
STROBE	52	Input	A signal to read in the data.(Negative logic)
D0	51	Input	Input data (Positive logic)
D1	50		
D2	49		
D3	48		
D4	47		
D5	46		
D6	45		
D7	44		
ACK	59	Output	A signal to indicate that the data has been read. (Negative logic)
BUSY	55	Output	A signal to indicate that the data cannot be received. (Positive logic) Send the data when at "LOW."
PE	61	Output	A signal to be output when the paper runs out. (Positive logic)
FAULT	62	Output	A signal to indicate a printer error. (Negative logic)
GND			

3) Timing chart

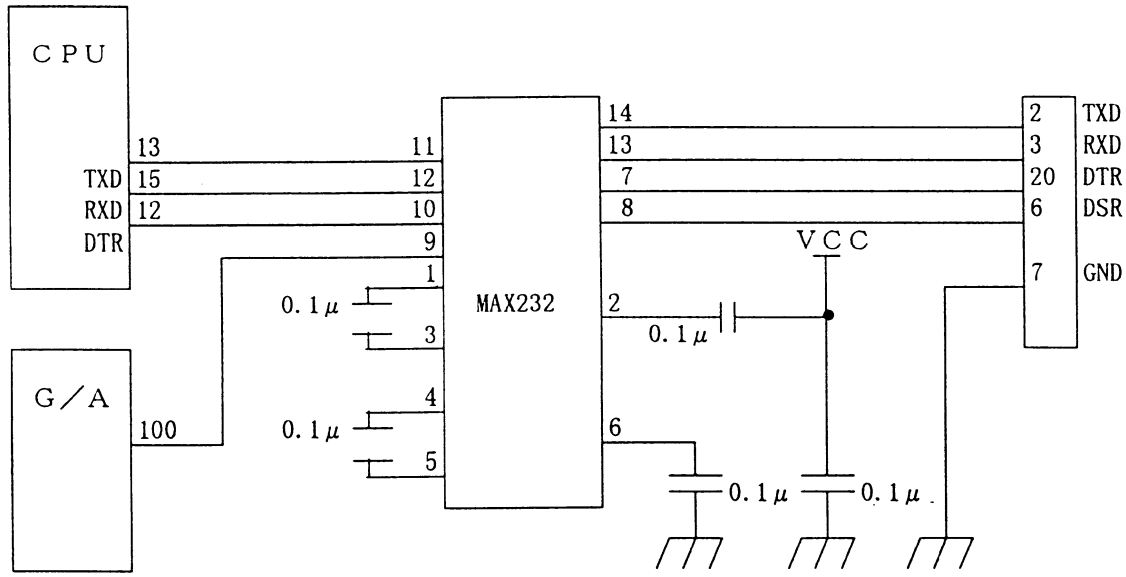


T1, T2, T3 : 0.5 µs MIN
T4 : 270 ns MAX
T5 : 2.3 µs TYP
T6 : 500 ms MIN

4.13 Serial Interface Circuit

A serial interface is an asynchronous serial system. When the serial interface is not used, pull up RXD (Pin 15) and DSR (Pin 100) of the CPU with a 47k resistor.

1) Circuit

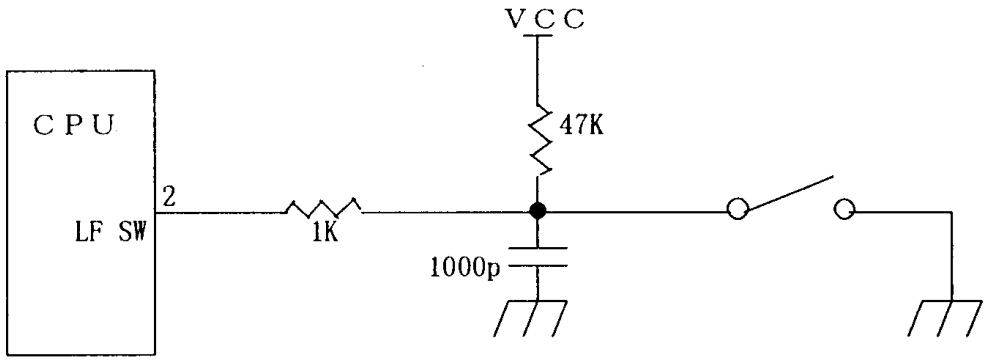


2) Signal names and their functions

Signal Name	Pin No.	Input/Output	Function
TXD	13	Output	Transmits the status. If data reception is disabled when XON/XOFF is selected, XOFF(13H) will be transmitted, and if data reception is enabled, XON(11H) will be transmitted.
RXD	15	Input	Received data signal. If a framing error or parity error occurs, the relevant data will be printed "?".
DSR	100	Input	With DTR/DSR selected, if this signal is "LOW," the data will be transmitted from the CPU. If "HIGH," the data will be transmitted after the signal is turned to "LOW."
DTR	12	Output	Transmit the data when this signal is "LOW." If written when it is "HIGH," an overrun error will result, ignoring the data.

4.14 Switch Circuit

The printer has a switch input function for paper feed. Also provided is a function to perform self-printing, using this switch. (Turn on the power while holding down this switch, or apply a reset with this switch held down when the power has been already turned on. The printer automatically starts self-printing and returns to the normal waiting state after printing is completed.)

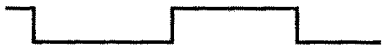


4.15 Error Output Circuit

The printer has two kinds of error outputs. (Up to a current of 10mA is available in order to mainly indicate with the LEDs. If this limit is exceeded, the CPU may be destroyed. Select the current control resistors, LEDs, etc. carefully.)

LEDPE(Pin 4) of the CPU is a paper error exclusive output. "LOW" is output when the printing paper runs out, and "HIGH" is output when new printing paper is set. LEDER(Pin 3) of the CPU outputs other errors in the following patterns.

1) Error output pattern

Error	Display Pattern	Description
Memory error		Blinks at intervals of 200 ms
Cutter lock (Cutter error)		Blinks at intervals of 150 ms(6 times) and 500 ms(1 time) as one cycle.
Head-up		Illuminated until the error is reset.
VH voltage error		Illuminated until the error is reset.
Head temperature error		Blinks at intervals of 1 sec.
Macro execution wait		Blinks at intervals of 500 ms

2) Error descriptions

Error	Description
Head-up	The head-up lever has been shifted up.
VH voltage error	When the VH voltage is beyond an allowable range(4.2~8.5V)
Head temperature error	When a head temperature is less than 0ºC or 65ºC or more
Cutter lock (ASC-220-5V)	When the cutter is locked due to an external factor(Paper jam, etc.) at cutter drive time

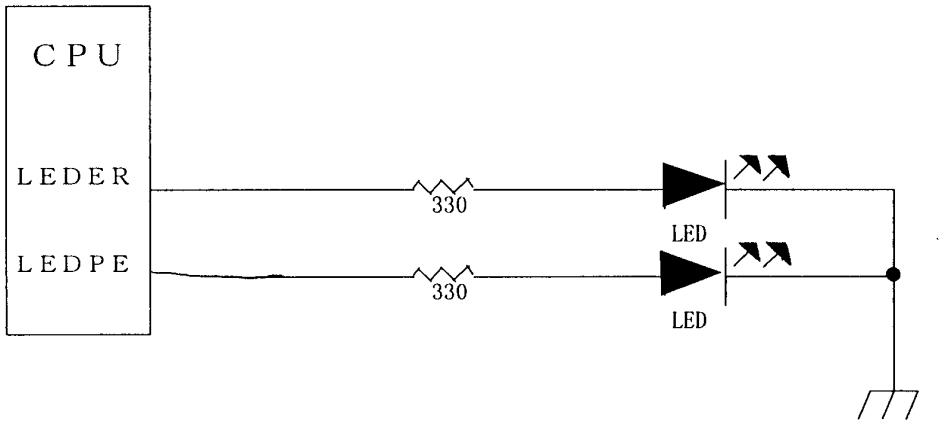
Note) The upper-limit voltage of 8.5V for the VH voltage error is a voltage assumed only immediately after charging the battery when the battery power is used and cannot be normally used. A maximum normal voltage is 7.2V.

3) Resetting methods

Error	Resetting Method
No-paper	Set the paper. See Note 1.
Head-up	Shift down the head-up lever.
VH voltage error	Set the VH voltage to within the allowable range(4.2~8.5 V) and turn on the power again, or set the LFSW(Pin-2) of the CPU to Active. See Note 2.
Head temperature error	At the lower limit(Less than 0ºC), printing is enabled at 0ºC or more. At the upper limit(65ºC or more), printing is enabled at 60 C or less.
Cutter lock(ACS-220-5v)	Eliminate the paper jam and set LFSW(Pin-2) of the CPU to Active or turn on the power again.

Note)

1. If auto loading has not been selected with the function selection J4(Jumper), set the paper manually. If it has been selected, the auto loading function will be enabled to facilitate paper replacement.
2. The upper-limit voltage of 8.5V for the VH voltage error is a voltage assumed only immediately after charging the battery when the battery power is used and cannot be normally used. A maximum normal voltage is 7.2V.



4.16 Function Selection Circuit

The input port of the Gate Array has function selecting terminals. When connecting the DIP switch, and so on, connect them as they are. When fixing with a Jumper, and so on, only the terminals you want to set to "LOW" should be connected to GND.

Gate Array		Function	"LOW"	"HIGH"
Pin No.	Signal			
33	PAI0	Auto cutter	Enabled	Disabled
32	PAI1	CR change	LF operation	Ignored
31	PAI2	Printing density	See Table (3)	
30	PAI3	DTR/XON–XOFF	XON–XOFF	DTR/DSR
29	PAI4	Interface	See Table (1)	
28	PAI5			
27	PAI6			
26	PAI7			

PAI3 is valid only when the serial interface is used.

Gate Array		Function	"LOW"	"HIGH"
Pin No.	Signal			
43	PBI0	International characters selection	See Table (2)	
42	PBI1			
39	PBI2			
38	PBI3	Auto loading	Enabled	Disabled
37	PBI4	Drive system	Dynamic drive	Fixed division
36	PBI5	Printing density	See Table (3)	
35	PBI6	Unused	-	-
34	PBI7	Unused	-	-

PAI6 is valid only when the serial interface is used.

(1) Interface

Input System	Parity	Baud Rate	PAI7	PAI6	PAI5	PAI4
Parallel	-	-	HIGH	HIGH	HIGH	HIGH
Serial	None	1200	HIGH	HIGH	HIGH	LOW
		2400	HIGH	HIGH	LOW	HIGH
		4800	HIGH	HIGH	LOW	LOW
		9600	HIGH	LOW	HIGH	HIGH
		19200	HIGH	LOW	HIGH	LOW
	Odd	1200	HIGH	LOW	LOW	HIGH
		2400	HIGH	LOW	LOW	LOW
		4800	LOW	HIGH	HIGH	HIGH
		9600	LOW	HIGH	HIGH	LOW
		19200	LOW	HIGH	LOW	HIGH
	Even	1200	LOW	HIGH	LOW	LOW
		2400	LOW	LOW	HIGH	HIGH
		4800	LOW	LOW	HIGH	LOW
		9600	LOW	LOW	LOW	HIGH
		19200	LOW	LOW	LOW	LOW

(2) International characters

International Characters	PBI2	PBI1	PBI0
Japan (JIS)	HIGH	HIGH	HIGH
Japan (Shift JIS)	HIGH	HIGH	LOW
Sweden	HIGH	LOW	HIGH
Denmark I	HIGH	LOW	LOW
U.K.	LOW	HIGH	HIGH
Germany	LOW	HIGH	LOW
France	LOW	LOW	HIGH
U.S.A.	LOW	LOW	LOW

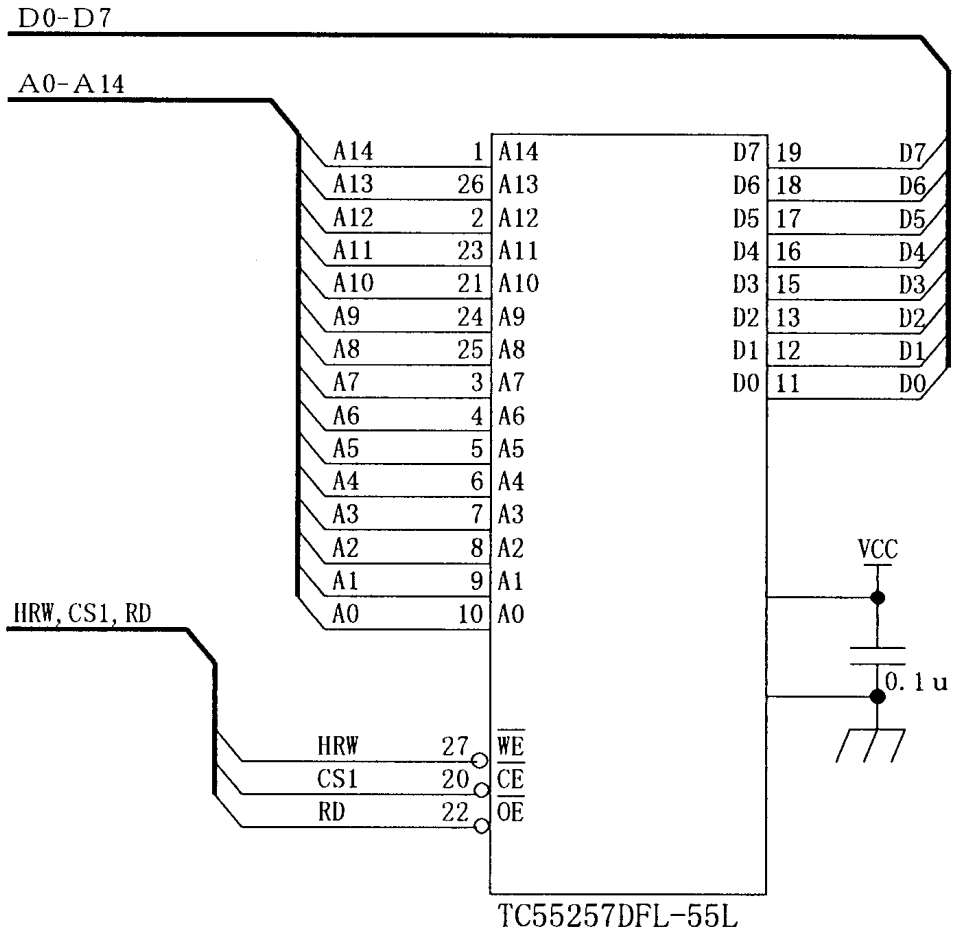
(3) Printing density

Printing Density	PAI2	PBI5
Light	HIGH	HIGH
Standard	HIGH	LOW
Slightly dark	LOW	HIGH
Dark	LOW	LOW

4.17 External RAM Interface

A 32 KB external SRAM is always required for printing. The printer does not function properly unless the external RAM is connected.

1) Circuit

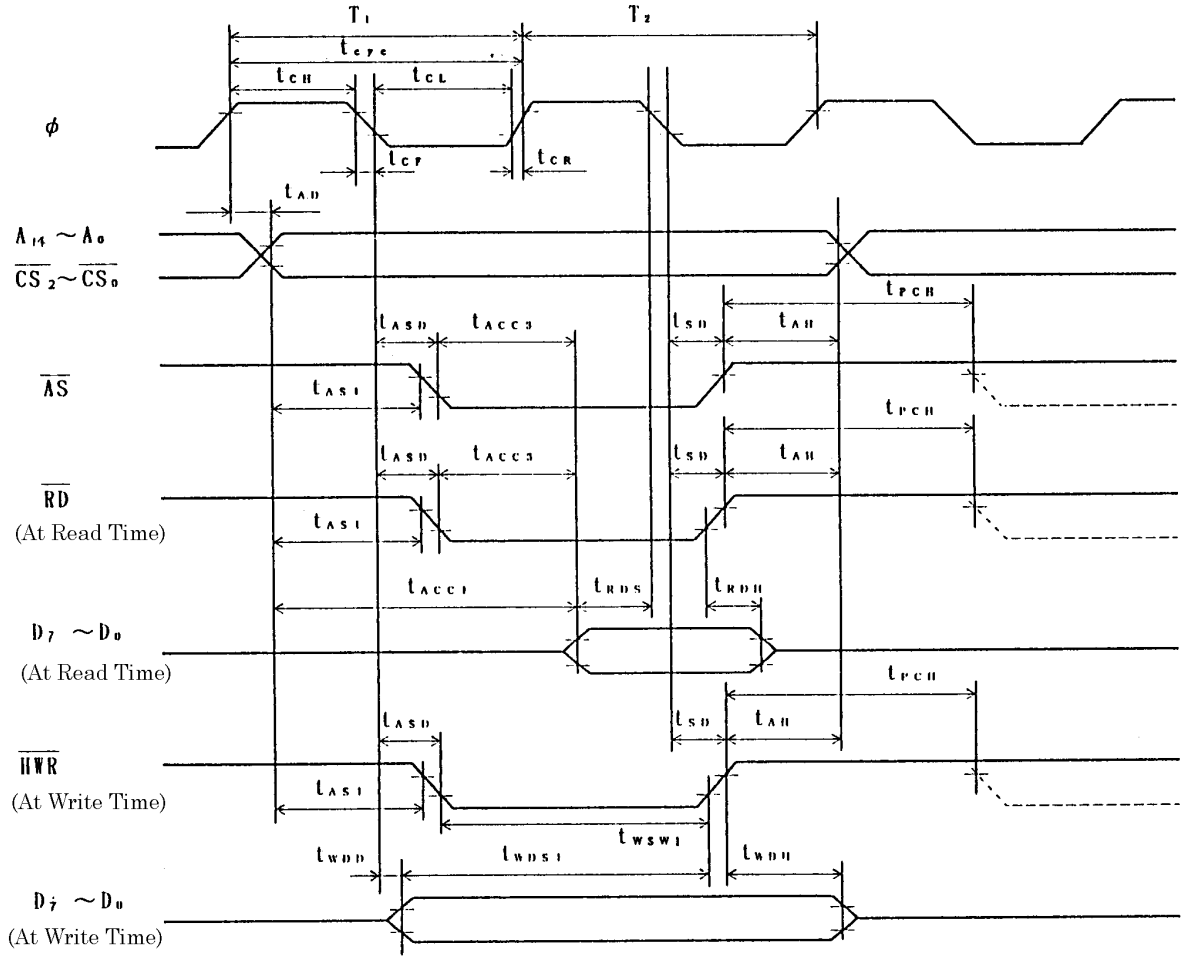


2) Bus Timing

VCC=5.0V±10%, AVCC=5.0V±10%, VREF=4.5V~AVCC, VSS=AVSS=0V, Ø=2~16MHz, TA=-20~+75ºC

Item	Symbol	MIN	MAX
Clock cycle time	t cyc	62.5	500
Clock pulse width "LOW" level time	t_{CL}	20	-
Clock pulse width "HIGH" level time	t_{CH}	20	-
Clock rise time	t_{CR}	-	10
Clock fall time	t_{CF}	-	10
Address delay time	t_{AD}	-	30
Address hold time	t_{AH}	10	-
Address strobe delay time	t_{ASD}	-	30
Write strobe delay time	t_{WSD}	-	30
Strobe delay time	t_{SD}	-	30
Write data strobe pulse width 1	t_{WSW1}	35	-
Write data strobe pulse width 2	t_{WSW2}	65	-
Address setup time 1	t_{AS1}	10	-
Address setup time 2	t_{AS2}	40	-
Read data setup time	t_{RDS}	20	-
Read data hold time	t_{RDH}	0	-
Write data delay time	t_{WDD}	-	60
Write data setup time 1	t_{WDS1}	35	-
Write data setup time 2	t_{WDS2}	5	-
Write data hold time	t_{WDH}	20	-
Read data access time 1	t_{ACC1}	-	55
Read data access time 2	t_{ACC2}	-	115

Unit : ns


T1
T2
tcyc
tCH
tCL
φ
tCF
tCR
tAD
A14 ~ A0
CS2 ~ CS0
tPCH
tASD
tACC3
tSD
tAH
AS
tAS1
RD
(At Read Time)
tACC1
tRDS
tRDH
D7 ~ D0
(At Read Time)
HWR
(At Write Time)
tWSW1
tWDD
tWDS1
tWDH
D7 ~ D0
(At Write Time)

5. PRINTER MECHANISM CONTROL SYSTEM

5.1 Head Drive

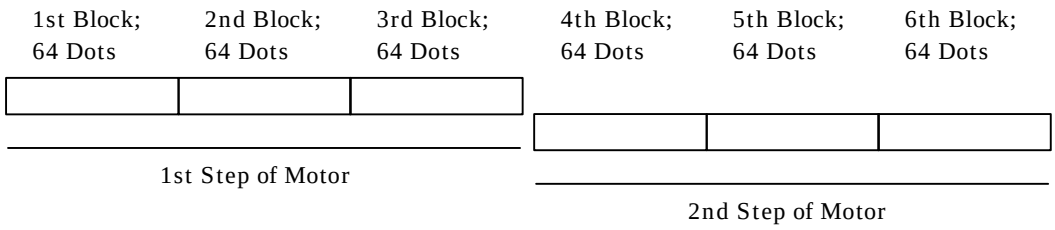
5.1.1 Thermal Head Control System

The LT-286 is driven by this LSI has a 1-line printing head divided into 6 blocks of 64 dots each. With this LSI, you can choose either a Fixed Division Number System which drives the printing head by always dividing it into 6 blocks of 64 dots each or a Variable Division Number System which simultaneously drives it by consolidating several blocks according to the number of activate head dots. This selection is made with a function selection terminal or command.
For selecting with the function selecting terminal, see "4.16 Function Selection Circuit." For selecting with the command, see "10.2 Command Details."

(1) Fixed Division Number System

The blocks of the printing head to be simultaneously driven have been determined in advance. Printing is performed, dividing into 6 blocks of 64 dots each from the left corner of the printing surface of the printing paper. Since the printing head is always driven in the same order, this method can assure high-quality printing.
In the Fixed Division Number System, the blocks of the printing head driven in the 1st and 2nd steps of the motor have been determined as shown in Fig. 5.1.

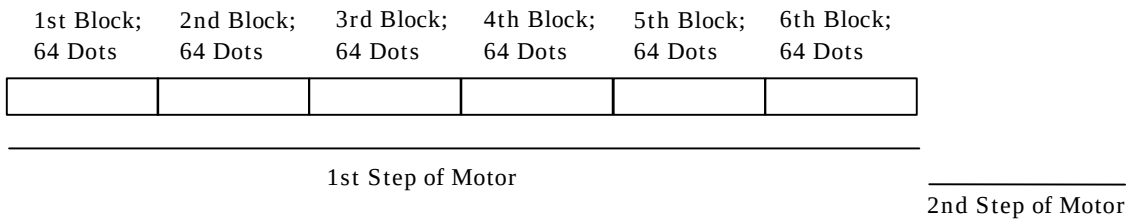
Fig. 5.1



(2) Variable Division Number System

This method counts the number of printing dots for each block of each printing head in the printing dot line and drives the blocks collectively in such a manner not to exceed the maximum number of driving dots(64 dots).
Fig. 5.2 shows an example when the number of printing dots in every block of 1 to 6 is 64 dots or less.

Fig. 5.2



Different from the Fixed Division Number System, this method drives all the printing heads in the 1st step of the motor and simply feeds the paper in the 2nd step of the motor.

5.1.2 Thermal Head Application Energy

This LSI automatically controls the energy applied to the thermal head according to a temperature and Vp voltage.

With the function selection terminal, print density can be set to the following 4 kinds of ranks listed in Fig. 5.3.

Fig. 5.3

Gate Array Pin-31	Gate Array Pin-36	Print Density	Level	Print Density Rate
LOW	LOW	Light	0	80 %
LOW	HIGH	Standard	1	100 %
HIGH	LOW	Slightly dark	2	120 %
HIGH	HIGH	Dark	3	150 %

5.2 Motor Drive

There are the following features:

1) Prevents heat generation of the motor and restrains current consumption through PWM control.
2) Controls acceleration at start time.
3) Capable of providing fine control according to a voltage(VH) applied to the motor to realize optimum paper feed.

Table 5.1 lists the maximum drive speeds at major voltages.

Table 5.1

VH Voltage	Max. Drive Speed	At Auto Loading
5 V	300 pps	75 pps
6 V	490 pps	122 pps
7.2 V	800 pps	200 pps

Notes)

- The maximum drive speed may slightly differ depending on the actual processing time or voltage detection accuracy.
- If the head drive time becomes longer than the 1-step time of the motor during printing, the motor will be driven after the head. During printing, therefore, the drive speed will be slowed down due to the head divided driving method.
- The drive speed at auto loading time is 1/4 of the maximum drive speed at each VH voltage.

5.3 Auto Loading

Auto loading is a function to facilitate replacement of the printing paper.
It is enabled by setting the function selection terminal(Gate Array Pin 38) to "LOW."

Functioning:

1) Make the PE sensor detect PE once.
2) Insert the printing paper into the printing paper insertion slot until the PE sensor detects the paper again. When this is done, the paper should be inserted at a right angle to the insertion slot; insert it until it comes to the end.
3) When this is done, if the head-up lever is shifted down, auto loading will be performed. If the head-up lever is shifted up, shift it down. Then, auto loading will be performed.
4) See Table 5.1 for the drive speed.

6. SELF-PRINTING

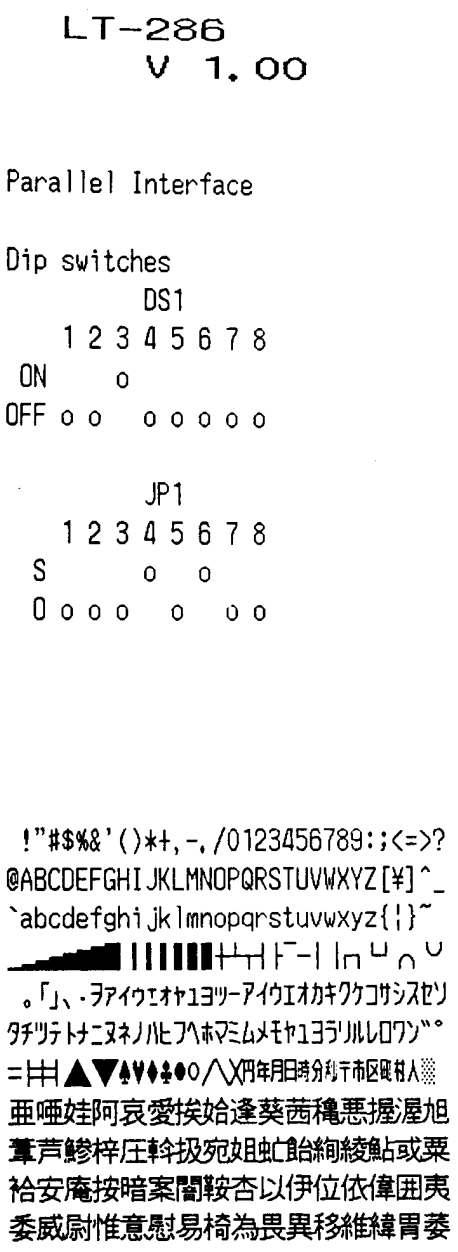
This LSI displays the setting of the function selection terminal and has a test print function to print Kanji when printing the half-size characters or using the specified Kanji ROM(CBM-202KG-01).

The procedure is as follows:

1) Turn on the power, setting LFSW(Pin 2) of the CPU to "LOW." Turn on both Vcc and VH almost simultaneously, or turn on Vcc, followed by VH(Within 500ms after Vcc).

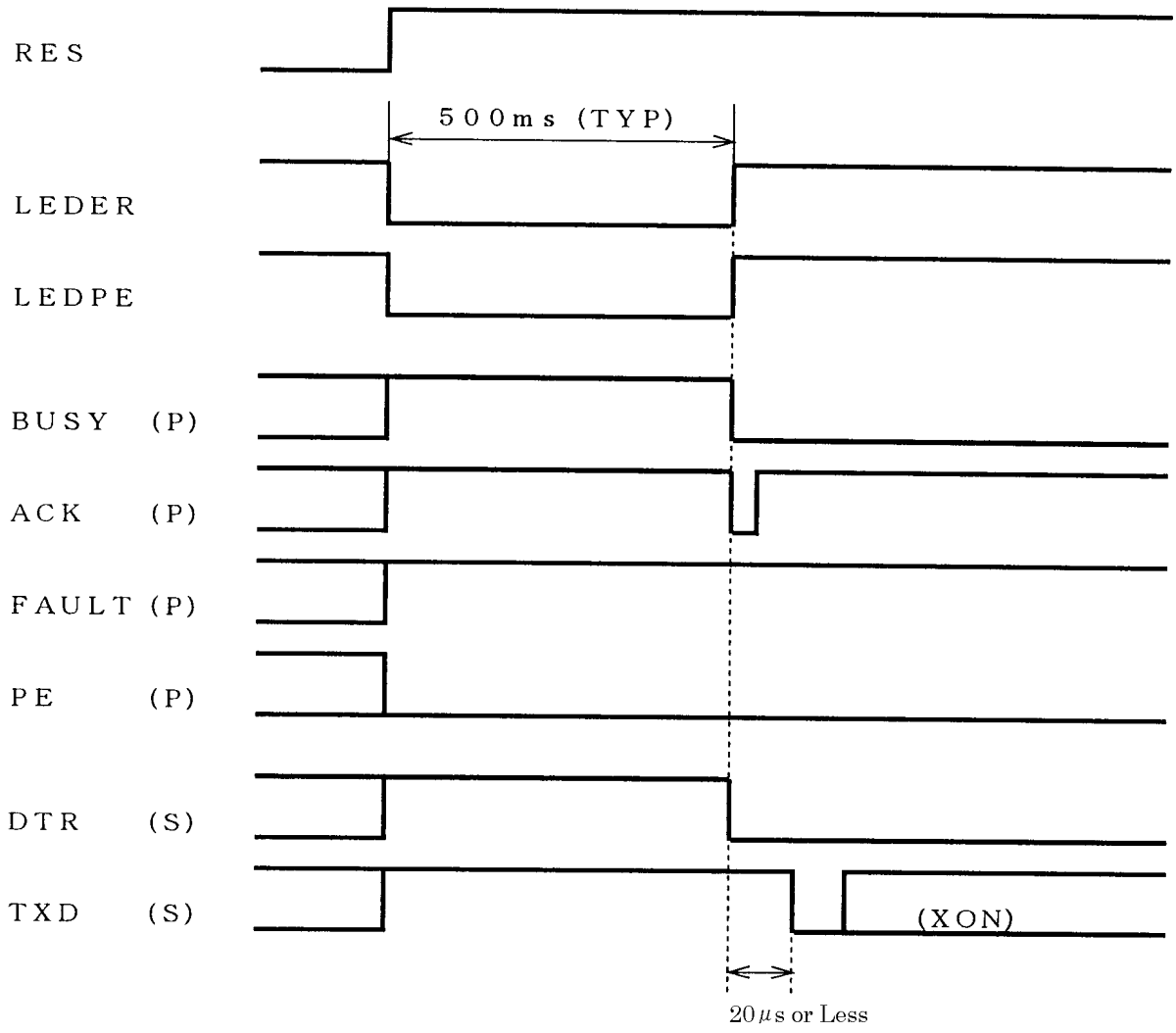
Fig. 6.1 shows a print sample(A print differs from actual dimensions).

Fig. 6.1

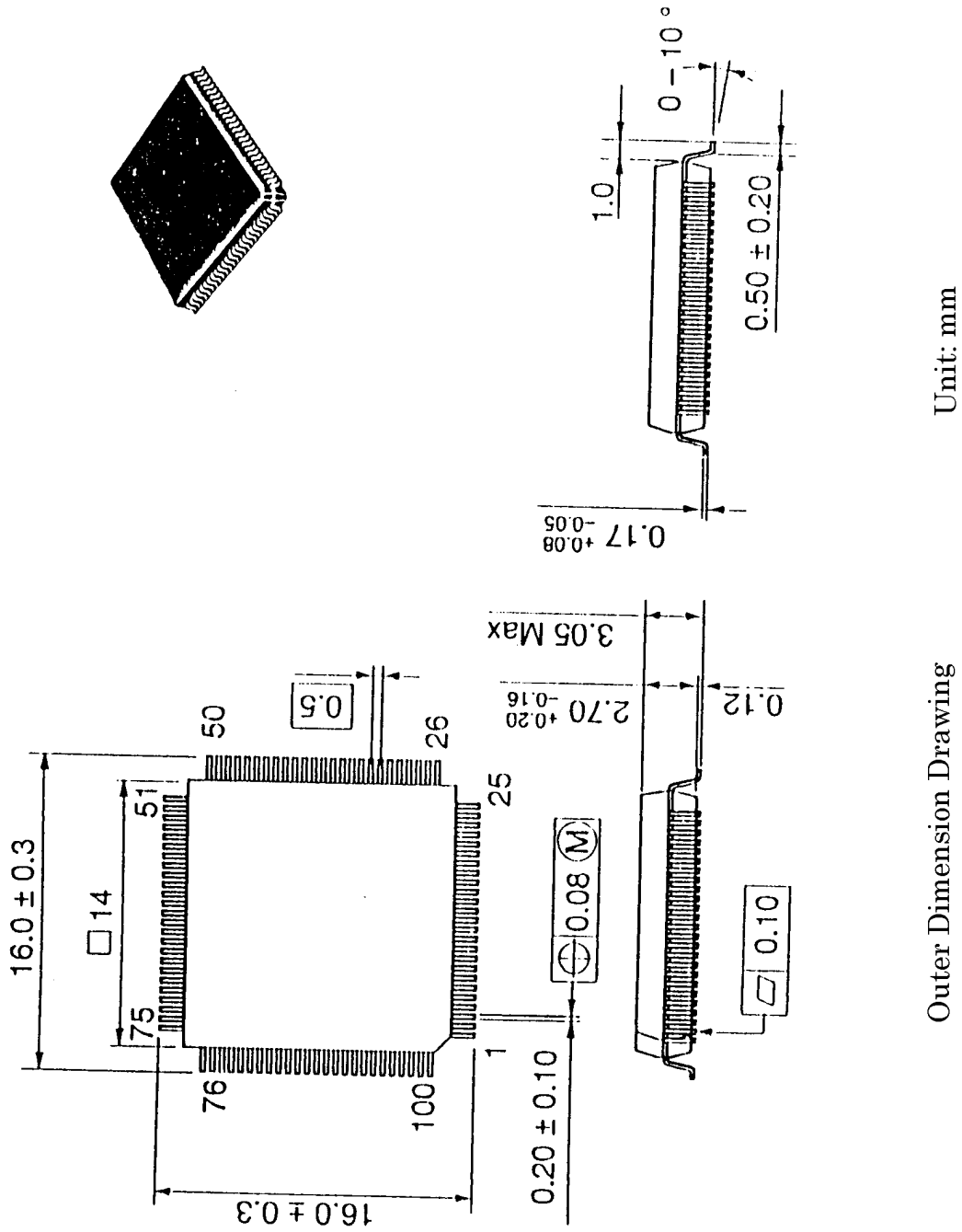


7. OPERATION TIMINGS

The following shows operation timings after resetting this CPU.



8. SPECIFICATIONS OF PACKAGE



9. PRECAUTIONS FOR MOUNTING

9.1 Precautions

If a relative humidity drops, the LSI will be electrified with static electricity more easily. The surface mounting package must be stored in a dry atmosphere to prevent humidity absorption, but while it is being stored, it will not be electrified because it will not have friction, etc. When handling or mounting it onto the PCB where friction or electric discharge may be expected, the relative humidity is desired to be 45~75% from a viewpoint of prevention of electrification.

9.2 Reflow Mounting

Using the screen printing method, etc., apply a constant amount of solder paste to the pattern on the PCB, which was formed into the specified shape required for soldering the lead pins to a package mounting section, and mount the package onto it. It will be temporarily fixed by the surface tension of the solder paste. Then, if the solder is melted(reflow) again, the leads of the package and the pattern of the PCB will be matched by a self-alignment effect through the surface tension of the molten solder.

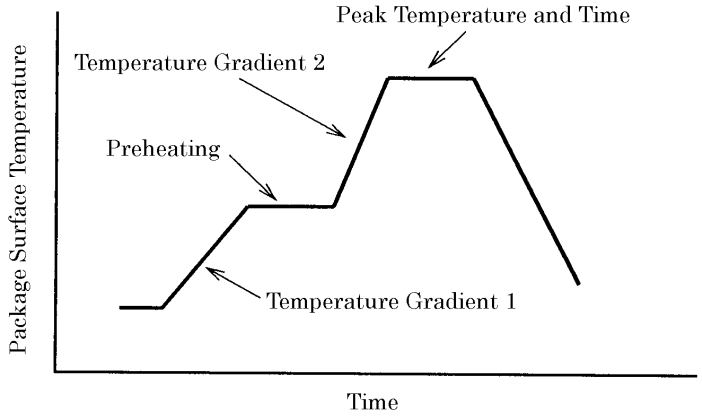
Although the lead joint pattern design values of the PCB depend on the solder paste material used, reflow condition, etc., they should be preferably 1.1~1.3 times larger than a soldered lead pin width.

9.3 Recommended Conditions for Different Mounting Methods

The most common mounting methods employed for the surface mounting devices are the infrared reflow method, vapor phase reflow method, and flow solder method. As all of those mounting methods must heat the entire package and apply a strong thermal stress, they require you to manage not only a temperature at the solder joints, but that on the package surface, from a viewpoint of maintenance of reliability. Therefore, the recommended mounting conditions are given in terms of the package surface temperature for the reflow method, and in terms of solder temperature and immersion time for the flow solder method.

The following describes the concepts of the recommended conditions, using Fig. 9.1.

Fig. 9.1



1) Temperature gradient 1
   If a temperature rises abruptly, each joint of the surface mounting device to the package will have different temperature. As a result, the package may warp due to a difference in the thermal expansion factor of the material, thus damaging the chip. Therefore, it is necessary to heed the upper limit of an ascending rate. The lower limit depends on the activity rate of the reflow unit.
2) Preheating
   The temperature of the parts and PCB is adjusted under the melting temperature of the solder to stabilize soldering and ease a thermal shock. Generally, set to near the rated temperature of the surface mounting device.
3) Temperature gradient 2
   The upper limit of the ascending temperature is the same as in 1). The lower limit is determined by necessity to contain the peak temperature and time mentioned in 4) within the specified ranges.
4) Peak temperature and time
   In order to minimize damages on the package, the peak temperature and time must be most heeded. Since the peak time has a direct effect on a drop of package strength and a steam pressure in the package, it is desired to be kept as low as possible. The peak time is required to be minimized because the steam pressure increases along with a lapse of time. The conditions mentioned here are provided at a coincident point of the above-mentioned allowable range and a solderable range. As they are represented by upper-limit values, not average values, care should be taken not to exceed the upper-limit values when setting the conditions. Fig. 6.2 and Fig. 6.3 shows the recommended conditions for the different mounting methods.

Fig. 9.2 Infrared Reflow and Air Reflow Recommended Conditions

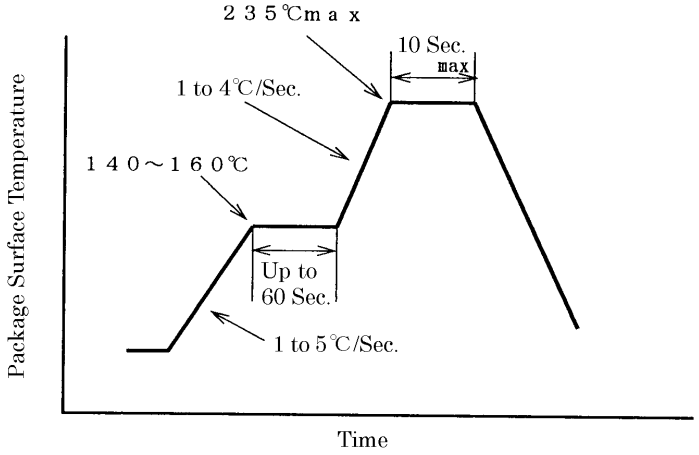
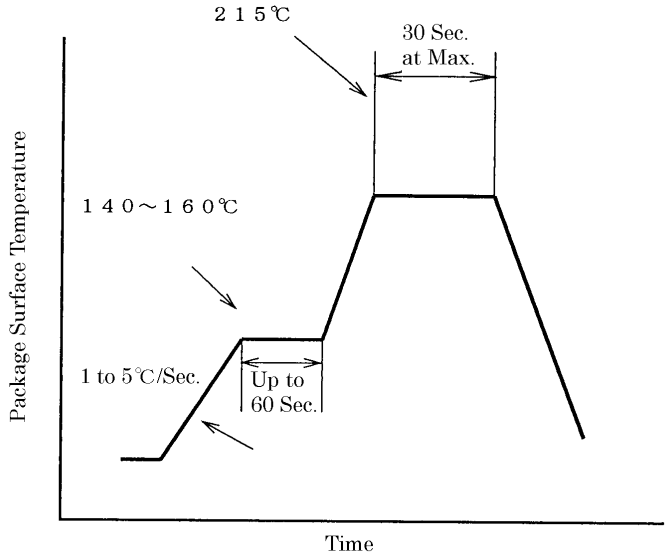


Fig. 9.3 Vapor Phase Reflow Recommended Conditions



6.4 Cleaning Method

After soldering, eliminate/clean remaining flux off the PCB because it affects reliability of the parts and PCB wiring, as a rule.

As an example, ultrasonic cleaning is employed under the following conditions. In order to prevent destruction of the device, pay attention to an applied frequency, electric power(particularly peak power), time and resonance of the device.

- Frequency ----- 28~29kHz (The device should not resonate)
- Ultrasonic output ----- 15W/each time
- Time ----- 30sec or less
- Others ----- The device and PCB should not directly touch a vibration source.

6.5 Storage Method

The epoxy resin used for the plastic package cannot resist absorbing moisture when it is stored in a high-humidity place. If more moisture is absorbed, it will be abruptly vaporized at the time of soldering and cause exfoliation of the resin/lead frame interface, resulting in the cracks of the package in the worst case. As it is important to store in a dry atmosphere(preferably normal temperature and humidity; 5~35ºC and 45~75 % RH as guides), the package is packed damp-proof. After unpacking it, store it under a prescribed environment in order to minimize moisture absorption, and perform reflow mounting as quickly as possible. When you re-store it in damp-proof packing, put moisture-free silica gel in it and seal again. When you want to eliminate moisture absorbed during transportation, storage, or handling, it is recommended to dry(At 125ºC) for 16~24 hours.

The external terminals should be stored unprocessed. This is to avoid a soldering failure due to occurrence of rust at the time of mounting.

10. PRINT CONTROL FUNCTIONS

10.1 Commands List

	Control Code	Function	Code	Page
1	HT	Horizontal tab command	09H	45
2	LF	Printing and paper feed	0DH	45
3	CR	Print command	0DH	46
4	ESC SP	Setting the right space amount of the character	1BH 20H n	46
5	ESC !	Collective specifying printing mode	1BH 21H n	47
6	ESC %	Specifying/canceling download character set	1BH 25Hn	49
7	ESC &	Defining download characters	1BH 26H 5 n m[a p1	50
8	ESC *	Specifying the bit image mode	1BH 2AH mn1n2[d]k	52
9	ESC –	Specifying/canceling underline	1BH 2DH n	54
10	ESC 2	Specifying 1/6-inch line feed rate	1BH 32H	54
11	ESC 3	Setting line feed rate of minimum pitch	1BH 33H n	55
12	ESC =	Data input control	1BH 3DH n	56
13	ESC @	Initializing the Printer	1BH 40H	57
14	ESC D	Setting horizontal tab position	1BH 44H [n]k00H	58
15	ESC E	Specifying/canceling highlighting	1BH 45H n	59
16	ESC G	Specifying/canceling double printing	1BH 47H n	60
17	ESC J	Printing and feeding paper n/203 inch	1BH 4AH n	60
18	ESC R	Selecting the international character set	1BH 52H n	61
19	ESC V	Specifying/Canceling 90º-right- turned Characters	1BH 56H n	62
20	ESC a	Aligning the characters	1BH 61H n	63
21	ESC c3	NOP		
22	ESC c4	NOP		
23	ESC c5	Enabling/disabling the panel switches	1BH 63H 35H n	64
24	ESC d	Printing and feeding the paper by n lines	1BH 64H n	64
25	ESC i	Activating auto cutter (Full cut)	1BH 69H	65
26	ESC m	Activating auto cutter (Partial cut)	1BH 6DH	66
27	ESC p	NOP		
28	ESC t	Selecting the character code table	1BH 74H n	67
29	ESC u	NOP		
30	ESC v	Transmitting the printer status (Serial type)	1BH 76H n	68
31	ESC {	Specifying/canceling the inverted characters	1BH 7BH n	69
32	ESC $	Specifying the absolute positions	1BH 24H n1 n2	70
33	ESC ¥	Specifying the relative positions	1BH 5C n1 n2	71
34	GS k	Printing the bar code	1DH 6BH n ["d"]k00H	72
35	GS w	Selecting the horizontal size (scale factor) of bar code	1DH 77H n	76
36	GS h	Selecting the height of the bar code	1DH 68H n	77
37	GS H	Selecting of print position of HRI code	1DH 48H n	78
38	GS f	Selecting the font of HRI code	1DH 66H n	79
39	GS *	Defining the download bit image	1DH2An1n2[d]n1xn2x	80
40	GS /	Printing the download bit image	1DH 2FH m	82
41	GS :	Starting/ending macro definition	1DH 3AH	83
42	GS ^	Executing the macro	1DH 5E n1n2 n3	84

43	DC2 A	Selecting the Print drive system	12H 41H n	85

Notes: 1. In the table n, n1, n2, n3, m, a, s, p, and d denote the parameters for each command.

2. In the table, [ ]k denotes a repeat count of k-times.

3. In the table, ' ' denotes an ASCII character.

10.2 Command Details

10.2.1 Description of Items

XXXX ALL

[Function] Command Function

[Code] A sequence of code constituting a command is represented in hexadecimal number for < >H, binary number for < >B, and decimal number for < >, respectively; [ ]k represents a repeat count of k-times.

[Range] Describes an argument value(Setting range) for the command.

[Outline] Describes a command outline.

[Caution] Describes a caution as required.

[Default] Describes an initial value for the command when accompanied by an argument.

[See Also] Describes the associated commands for use.

[Sample Program] Describes a coding example in the Q-BASIC sample program.

** This example is only for your reference and differs depending on the language used, version, and so on. For details, see the manual for the language used.

10.2.2 Details

HT

[Function] Horizontal Tab Command

[Code] <09>H

[Outline] Shifts the printing position to the next horizontal tab position.

• Ignored when the next horizontal tab position has not been set.

[Caution] • The horizontal tab position is set by ESC D.

• Initial setting of the horizontal tab position is each 8 characters in 9th, 17th, 25th, columns.

[See Also] ESC D

[Sample Program]

```
LPRINT "012345678901234567890 1" ;
LPRINT CHR$ (&HA) ;
LPRINT CHR$ (&H9) + "AAA" ;
LPRINT CHR$ (&H9) + "BBB" ;
LPRINT CHR$ (&HA);
LPRINT CHR$ (&H1B) + "D" ;
LPRINT CHR$ (3) + CHR$ (7) + CHR$ (14) + CHR$ (0) ;
LPRINT CHR$ (&H9) + "AAA" ;
LPRINT CHR$ (&H9) + "BBB" ;
LPRINT CHR$ (&H9) + "CCC" + CHR$ (&HA) ;
```

[Print Results]

```
012345678901234567890 1
        AAA     BBB      <------ Initially set horizontal tab
    AAA BBB     CCC      <------ When set to the 4th, 8th, and 15th digits
```

LF

[Function] Printing and Paper Feed

[Code] <0A>H

[Outline] Prints data inside the input buffer and feeds lines based on the line feed amount having been set.

• The head of the line becomes the next print starting position.

[See Also] ESC 2, ESC 3

[Sample Program]

```
LPRINT "AAA" + CHR$ (&HA) ;
LPRINT "BBB" + CHR$ (&HA) ;
LPRINT CHR$ (&HA) ;
LPRINT "CCC" + CHR$ (&HA) ;
```

[Print Results]

```
AAA   <------ Print and line feed
BBB   <------ Print and line feed
      <------ Line feed only
CCC   <------ Print and line feed
```

CR

[Function] Print Command

[Code] <0D>H

[Outline] 1) When the function selecting terminal(Gate Array Pin 32) is HIGH. This command is ignored.

2) When the function selecting terminal(Gate Array Pin 32) is LOW. With data held inside the internal print buffer, printing and line feed are performed.
Without data inside the internal print buffer, however, no printing is performed.

[See Also] LF

[Sample Program]

```
LPRINT "AAA" + CHR$ (&HD) ;
LPRINT "BBB" + CHR$ (&HD) ;
LPRINT CHR$ (&HD) ;
LPRINT "CCC" + CHR$ (&HD) ;
```

[Print Results]

```
AAA  <-- Print and line feed
BBB  <-- Print and line feed
     <-- Line feed only
CCC  <-- Print and line feed
```

ESC SP n

[Function] Setting the right space amount of the character

[Code] <1B>H<20>H<n>

[Range] {0 n 20} Data is described in Hex code.

[Outline] The rightward space amount is set in dot unit (1/203 inch unit). In the initial value, it is n=0.

[Caution] The rightward space amount in double wide mode is made double of the set volume.

[Default] n = 0

[Sample Program]

```
LPRINT CHR$ (&H1B) + "  " + CHR$ (0) ;
LPRINT "AAAAA" + CHR$ (&HA) ;
LPRINT CHR$ (&H1B) + "  " + CHR$ (1) ;
LPRINT "AAAAA" + CHR$ (&HA) ;
LPRINT CHR$ (&H1B) + "  " + CHR$ (12) ;
LPRINT "AAAAA" + CHR$ (&HA) ;
```

[Print Results]

```
AAAAA  <-------- 0-dot space
A A A A A  <-------- 1-dot space
A  A  A  A  A  <-- 12-dot space
```

ESC ! n

[Function] Collective Specifying Printing Mode

[Code] <1B>H<21>H<n>

[Range] {0 n FF} Data is described in Hex code.

[Outline] Printing mode is assigned. Each n bit indicates the following:

Bit	Function	Value	
		0	1
0	Character Font	Font A	Font B
1	Undefined		
2	Undefined		
3	High-lighting	Canceled	Specified
4	Double height	Canceled	Specified
5	Double width	Canceled	Specified
6	Undefined		
7	Underline	Canceled	Specified

[Caution]
- With double height and double width being specified simultaneously, double wide and double high characters are consisted.
- An underline is attached to the full character width, which, however, is not attached to the part having been skipped by the horizontal tab. Neither is it attached to 90º-right-turned characters.
- The underline width is as having been specified by <ESC - >. (The default setting is 1 dot width.)
- Specification with this command is invalid to Kanji, except specification and cancellation of highlighting
- In case that double height character and normal character exist in same one line, the layout of underline is consistent one.

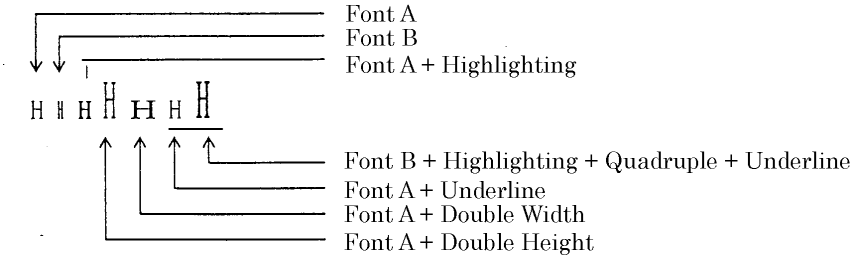
[Default] n = 0

[See Also] ESC E, ESC –

[Sample Program]

```
LPRINT CHR$ (&H1B) + " ! " + CHR$ (&H00) + "H" ;
LPRINT CHR$ (&H1B) + " ! " + CHR$ (&H01) + "H";
LPRINT CHR$ (&H1B) + " ! " + CHR$ (&H08) + "H";
LPRINT CHR$ (&H1B) + " ! " + CHR$ (&H10) + "H";
LPRINT CHR$ (&H1B) + " ! " + CHR$ (&H20) + "H";
LPRINT CHR$ (&H1B) + " ! " + CHR$ (&H80) + "H";
LPRINT CHR$ (&H1B) + " ! " + CHR$ (&HB9) + "H";
LPRINT CHR$ (&HA) ;
```

[Print Results]



ESC % n

[Function] Specifying/Canceling Download Character Set

[Code] <1B>H<25>H<n>

[Range] {0 n FF} data is described in Hex code.

[Outline] Specifying/canceling download characters.

Further, only the lowest bit (n0) is valid for n.

The lowest bit (n0) indicates the following.

n0	Function
0	Canceling download character set
1	Specifying download character set

[Caution] Download characters and download bit images can not be defined simultaneously.

[Default] n = 0

[See Also] ESC &

[Sample Program]

```
GOSUB SETCHR                                  DATA  6
LPRINT CHR$ (&H1B) + "%" + CHR$ (0) ;         DATA  &HFF, &H80, &H00
LPRINT "@A" + CHR$ (&HA) ;                    DATA  &H80, &H80, &H00
LPRINT CHR$ (&H1B) + "%" + CHR$ (1) ;         DATA  &H80, &H80, &H00
LPRINT "@A" + CHR$ (&HA) ;                    DATA  &H80, &H80, &H00
END                                           DATA  &HFF, &HFF, &HFF
SETCHR :                                      DATA  &HFF, &HFF, &HFF
LPRINT CHR$ (&H1B) + "&" ;                    DATA  12
LPRINT CHR$ (3) + "@" + "A" ;                 DATA  &HFF, &HFF, &HFF
 FOR J=1 TO 2                                 DATA  &H80, &H07, &HF9
 READ REP                                     DATA  &H80, &HFF, &HF9
 LPRINT CHR$ (REP) ;                          DATA  &H87, &HFE, &H01
  FOR I=1 TO REP*3                            DATA  &H9F, &H06, &H01
   READ D                                     DATA  &HF8, &H06, &H01
   LPRINTCHR$ (D) ;                           DATA  &HF8, &H06, &H01
  NEXT I                                      DATA  &H9F, &H06, &H01
 NEXT J                                       DATA  &H87, &HFE, &H01
RETURN                                        DATA  &H80, &HFF, &HF9
                                              DATA  &H80, &H07, &HF9
                                              DATA  &HFF, &HFF, &HFF
```

[Print Results]

@A ←—— Internal Character Set

ㄱㅁ ←—— Download Character

ESC & s n m [a [p] s X a] m – n +1

[Function] Defining Download Character

[Code] <1B>H<26>H<s><n><m> [<a><p1><p2>• •<psXa>]m-n+1

[Range] {s = 03}

{20 (Hex) n m 7E (Hex)}

{0 a 0C(Hex)} (Font A)

{0 a 0A(Hex)} (Font B)

[Outline] Defines the font of download characters of alphanumeric characters.

- "s" indicates the number of bytes in vertical direction.
- "n" indicates the start character code and m the end character code. To define only one character, set n=m.
- Character codes definable includes 95 ASCII codes in total between <20>H~<7E>H.
- "a" indicates the number of dots in horizontal direction for definition.
- "p" is the data to be defined, which indicate a pattern equal to "a" dot in horizontal direction from the left end. The rest of the pattern on the right side is filled with space.

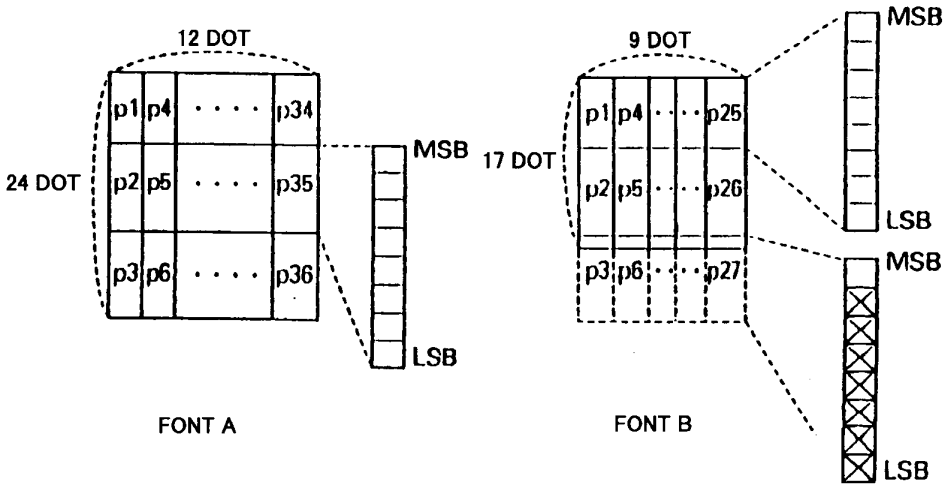
  The rest of data to be defined is s x a.
- Download characters thus defined remain valid until redefinition, ESC @ execution, GS * execution, or power OFF is practiced.

[Caution] Download characters and download bit images can not be defined simultaneously.

Running this command clears the definition of the download bit image.

[Default] Same as the internal character set

[Example]



Create each data bit by setting "1" for a printed dot and "0" for an unprinted dot.

[Sample Program] [Print Results]

See Sample Program and Print Results for ESC % on Page 49.

ESC * m n1 n2 [d] k

[Function] Specifying the Bit Image Mode

[Code] <1B>H<2A>H<m><n1><n2> [<d>] k

[Range] {m= 0, 1, 32, 33 bit image mode (See the table below.)}
{0 n1 FF(Hex)}
{0 n2 03(Hex)}
{0 d FF(Hex)}
{k = n1 + FF(Hex) X n2 (m = 0, 1)
{k = (n1+ FF(Hex) X n2) X 3} (m = 32, 33)

[Outline] According to the number of dots specified in n1, n2, specify the bit image of mode n.

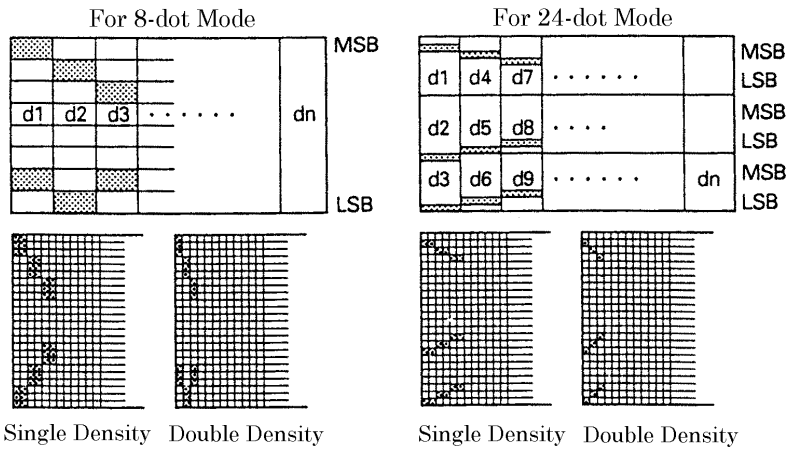
- The No. of dots printed is divided by 256, whose quotient is taken as n2 and residualas n1.
- The total no. of dots printed in the bit image is equal to n1 + (256 x n2).
- When bit image data have been input in excess of dot position of one line(448 dots) , the excess data are discarded.
- d is bit image data, the bits subject to printing are taken as "1" and those not as "0".
- The bit image modes specified by m are shown as follows:

m(Hex)	Mode	Vertical Direction		Horizontal Direction	
		No. of Dots	Dot Density	Dot Density	Max. No. of Dots
0	8-dot single density	8	67 DPI	101 DPI	192
1	8-dot double density	8	67 DPI	203 DPI	384
32	24-dot single density	24	203 DPI	101 DPI	192
33	24-dot double density	24	203 DPI	203 DPI	384

[Caution]

- When the values set in m (Bit image mode) are out of the above range, the data following after n1 is processed as normal printing data.
- After completion of bit image printing, printer returns to normal data processing mode.

[Example]

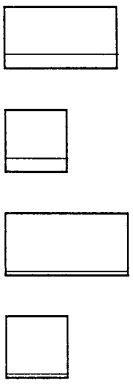


[Sample Program]

```
LPRINT CHR$ (&H1B) + "*" ;
LPRINT CHR$ (0) + CHR$ (20) + CHR$ (0) ;
GOSUB IMG1
LPRINT CHR$ (&HA) ;
LPRINT CHR$ (&H1B) + "*" ;
LPRINT CHR$ (1) + CHR$ (20) + CHR$ (0) ;
GOSUB IMG1
LPRINT CHR$ (&HA) ;
LPRINT CHR$ (&H1B) + "*" ;
LPRINT CHR$ (32) + CHR$ (20) + CHR$ (0) ;
GOSUB IMG2
LPRINT CHR$ (&HA) ;
LPRINT CHR$ (&H1B) + "*" ;
LPRINT CHR$ (33) + CHR$ (20) + CHR$ (0) ;
GOSUB IMG2
LPRINT CHR& (&HA) ;
END
```

```
IMG1 :
LPRINT   CHR$ (&HFF) ;
FOR I=1 TO 18
   LPRINT CHR$ (&H85) ;
NEXT I
 LPRINT   CHR$ (&HFF) ;
RETURN
IMG2 ;
 LPRINT   CHR$ (&HFF) ;
 LPRINT   CHR$ (&HFF) ;
 LPRINT   CHR$ (&HFF) ;
 FOR I=1 TO 18
    LPRINTCHR$ (&H80) ;
    LPRINTCHR$ (&H00) ;
     LPRINTCHR$ (&H05) ;
NEXT I
LPRINT   CHR$ (&HFF) ;
LPRINT   CHR$ (&HFF) ;
LPRINT   CHR$ (&HFF) ;
RETURN
```

[Print Results]



ESC – n

[Function] Specifying/ Canceling Underline

[Code] <1B>H<2D>H<n>

[Range] {0 n 02} data is described in Hex code.

[Outline] Specifying/canceling an underline.

• Types of underlines by n value are shown below:

n (Hex)	Type
0	Canceling an underline.
1	Specifying an underline for 1-dot width.
2	Specifying an underline for 2-dots width.

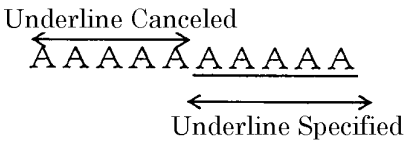
[Caution]
• An underline is attached to the full character width. It is, however, not attached to the part having been skipped by horizontal tab command.
• An underline is not attached to a 90º - right-turned characters.
• Specification/cancellation with this command is invalid to Kanji.

[See Also] ESC !, FS –

[Sample Program]

```
LPRINT CHR$ (&H1B) + "–" + CHR$ (0) ;
LPRINT "AAAAA" ;
LPRINT CHR$ (&H1B) + "–" + CHR$ (1) ;
LPRINT "AAAAA" + CHR$ (&HA) ;
```

[Print Results]



ESC 2

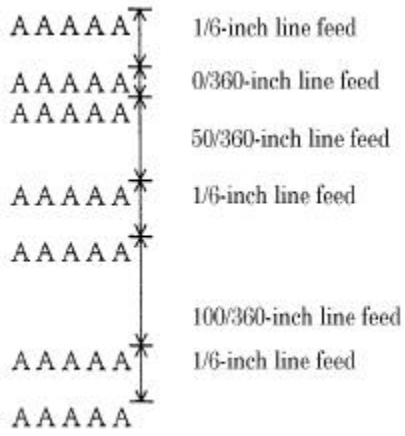
[Function] Specifying 1/6 inch line feed rate

[Code] <1B>H<32>H

[Outline] The line feed rate per line is specified by 1/6 inch.

[Sample Program] [Print Results]

```
LPRINT "AAAAA" + CHR$ (&HA) ;
LPRINT CHR$ (&H1B) + "3" + CHR$ (0) ;
LPRINT "AAAAA" + CHR$ (&HA) ;
LPRINT CHR$ (&H1B) + "3" + CHR$ (50) ;
LPRINT "AAAAA" + CHR$ (&HA) ;
LPRINT CHR$ (&H1B) + "2" ;
LPRINT "AAAAA" + CHR$ (&HA) ;
LPRINT "AAAAA" ;
LPRINT CHR$ (&H1B) + "J" + CHR$ (100) ;
LPRINT "AAAAA" + CHR$ (&HA) ;
LPRINT "AAAAA" + CHR$ (&HA) ;
```



ESC 3 n

[Function] Setting line feed rate of minimum pitch

[Code] <1B>H<33>H<n>

[Range] {0 n FF} Data is described in Hex code.

[Outline] The line feed rate per line is specified by n/360 inch.
Since an actual mechanical pitch is 1/203 inch, it is internally converted approximate to the value specified with this command.

[Default] • The initial value is n = 60 (1/6 inch) (18H), being 4.23 mm line feed rate.

[Sample Program] [Print Results]

See Sample Program and Print Results for ESC 2 on Page 54.

ESC = n

[Function] Data Input Control

[Code] <1B>H<3D>H<n>

[Range] {0 n FF} Data is described in Hex code.

[Outline] Selecting equipment in which data input from the host is effective.

• Each bit of n indicates as follows:

Bit	Equipment	Value	
		0	1
0	Printer	Invalid	Valid
1	Not defined		
2	Not defined		
3	Not defined		
4	Not defined		
5	Not defined		
6	Not defined		
7	Not defined		

• When the printer has not been selected, this printer abandons all the received data until it is selected by this command.

[Caution]
• Even when the printer has not been selected, it can become BUSY state through printer operation.
• When the printer is deselected, this printer discards all the data until it is selected with this command.

[Default]
• The initial value of n is "1".

[Sample Program]

```
LPRINT "AAAAA" ;
LPRINT CHR$ (&H1B) + "=" + CHR$ (0) ;
LPRINT "aaaaa" + CHR$ (&HA) ;
LPRINT CHR$ (&H1B) + "=" + CHR$ (1) ;
LPRINT "AAAAA" + CHR$ (&HA) ;
```

[Print Results]

```
A A A A A A A A A A
      ↑
  a a a a a  is not printed
```

ESC @

[Function] Initializing the Printer

[Code] <1B>H<40>H

[Range] Clears data stored in the print buffer and brings various settings to the initial state (Default state).

[Caution]
- Data inside the internal input buffer are not cleared.
- Dip switches setting are red once again.

[Sample Program]

```
LPRINT CHR$ (&H1B) + " ! " + CHR$ (&H30) ;
LPRINT CHR$ (&H1B) + "V" + CHR$ (1) ;
LPRINT "AAA" + CHR$ (&HA) ;
LPRINT CHR$ (&H1B) + "@" ;
LPRINT "AAA" + CHR$ (&HA) ;
```

[Print Results]

ESC D [n] k NUL

[Function] Setting Horizontal Tab Position

[Code] <1B>H<44>H [<n>] k<00>H

[Range] {0 n FFH} Data is described in Hex code.
{0 k 20H} Data is described in Hex code.

[Outline] Specifying a horizontal tab position.
- "n" indicates the no. of columns from the beginning to the horizontal tab position. At this time, n= set position– 1 is to be specified. For example, to set the position at 9th column, n=8 is to be specified.
- k denotes the number of horizontal tab positions you want to set.
- The tab position is set at position where it is "character width x n" from the line beginning. The character width, at this time, includes the rightward space amount. In double wide characters, it is made double of the ordinary case.
- Tab positions can be specified are maximum 32. Specifying exceeding this is ignored.
- <n> k, which denotes a setting position, is input in the increasing order and ends at <00> H.
- ESC D NUL clears all the set tab positions. Following clearing, horizontal tab command is ignored.

[Caution] When the data, <n> k, is equal to or smaller than its preceding data, <n> k-1, it is assumed that tab setting is finished. If this is the case, the next data onward will be processed as normal data.
When the data, <n> k, exceeds a 1-line print area, set the horizontal tab position, assuming "Set column position = Maximum print column + 1."
The horizontal tab position does not change even if the character width is altered after setting the horizontal tab position.

[Default] • Initial value is specified for each eight characters(9^{th}.17^{th}.25^{th} column) of ANK characters.

[See Also] HT

[Sample Program] [Print Results]

See Sample Program and Print Results for HT on Page 45.

ESC E n

[Function] Specifying/canceling highlighting

[Code] <1B>H<45>H<n>

[Range] {0 n FF} Data is described in Hex code.

[Outline] Specifying/canceling the highlighting characters.

- "n" is valid only for the lowest bit (n0).
- Control by the lowest bit (n0) is shown as follows:

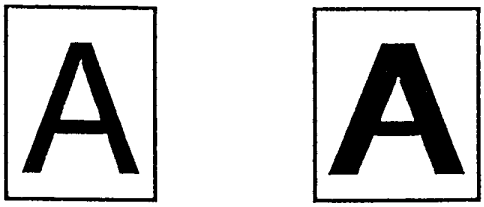
n0	Type
0	Canceling highlighting.
1	Specifying highlighting.

- This is effective to all characters.
- Dot configuration of a highlighted character includes one extra dot added at its side.

[Caution]
- The print result of Double printing and highlight character printing is completely same.

[See Also] ESC !

[Example]



[Sample Program]

```
LPRINT CHR$ (&H1B) + "E" + CHR$ (0) ;
LPRINT "AAABBB" + CHR$ (&HA) ;
LPRINT CHR$ (&H1B) + "E" + CHR$ (1) ;
LPRINT "AAABBB" + CHR$ (&HA) ;
```

[Print Results]

AAABBB ← Highlighting canceled

AAABBB ← Highlighting canceled

ESC G n

[Function] Specifying/canceling Double Printing

[Code] <1B>H<47>H<n>

[Range] {0 n FF} Data is described in Hex code.

[Outline] Specifying/canceling the double printing.

- "n" is valid only for the lowest bit (n0).
- Control by n is shown as follows.

n0	Type
0	Canceling double printing.
1	Specifying double printing.

This is effective to all characters.

[Caution]
- The print result of Double printing and highlight character printing is completely same.

[See Also] ESC E

[Sample Program]

```
LPRINT CHR$ (&H1B) + "G" + CHR$ (0) ;
LPRINT "AAABBB" + CHR$ (&HA) ;
LPRINT CHR$ (&H1B) + "G" + CHR$ (1) ;
LPRINT "AAABBB" + CHR$ (&HA) ;
```

[Print Results]

AAABBB ← Highlighting canceled

AAABBB ← Highlighting canceled

ESC J n

[Function] Printing and feeding paper n/203 inch

[Code] <1B>H<4A>H<n>

[Range] {0 n FF} Data is described in Hex code.

[Outline] Prints data inside the print buffer and feeds paper by n/360 inch. Since an actual mechanical pitch is 1/203 inch, it is internally converted approximate to the value specified with this command.

- Specified volume does not remain.
- The beginning of the line is to be considered as the next printing start position.
- Initial value is not defined.

[Sample Program] [Print Results]

See Sample Program and Print Results for ESC 2 on Page 54.

ESC R n

[Function] Selecting the International Character Set

[Code] <1B>H<52>H<n>

[Range] {0 n 0A) Data is described in Hex code.

[Outline] Depending on the value of n, following character sets are specified.

n(Hex)	Character Set
0	U.S.A.
1	France
2	Germany
3	U.K.
4	Denmark I
5	Sweden
6	Italy
7	Spain
8	Japan
9	Norway
A	Denmark II

[Default] • The initial value of n indicates the character set specified by the function selecting terminal(Gate Array Pin 39,42,43).

[See Also] Character Code Table (International Character Set)

[Sample Program]

```
FOR I=0 TO 10
LPRINT CHR$ (&H1B) + "R" + CHR$ (I) ;
LPRINT " #$@[¥]^" ;
LPRINT CHR$ (&H60) + "{¥}~" ;
LPRINT "n=" + STR$ (I) ;
LPRINT CHR$ (&HA) ;
NEXT I
```

[Print Results]

```
#$@[\]^`{|}~  n = 0
#$à°ç§^`éùè¨  n = 1
#$§ÄÖÜ^`ä¦öüß  n = 2
£$@[\]^`{|}~  n = 3
#$@ÆØÅ^`æøå~  n = 4
#¤ÉÄÖÅÜéä¦åü  n = 5
#$@°\é^ùà¦èì  n = 6
₧$@¡Ñ¿^`¨ñ}~  n = 7
#$@[¥]^`{|}~  n = 8
#¤ÉÆØÅÜéæøåü  n = 9
#$ÉÆØÅÜéæøåü  n = 10
```

ESC V n

[Function] Specifying/Canceling 90º-right- turned Characters

[Code] <1B>H<56>H<n>

[Range] {0 n 1} Data is described in Hex code.

[Outline] Specifying/canceling characters 90º-right- turned character.

• "n" means the followings.

n (Hex)	Condition
0	Canceling 90ºright- turned Characters
1	Specifying 90º-right- turned Characters

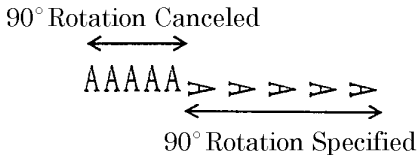
[Caution] • No underlines are attached to 90º-right- turned characters .

[Default] • The initial value of n is "0".

[Sample Program]

```
LPRINT CHR$ (&H1B) + "V" + CHR$ (0) ;
LPRINT "AAAAA" ;
LPRINT CHR$ (&H1B) + "V" + CHR$ (1) ;
LPRINT "AAAAA" + CHR$ (&HA) ;
```

[Print Results]



ESC a n

[Function] Aligning the characters

[Code] <1B>H<61>H<n>

[Range] {0 n 2} Data is described in Hex code.

[Outline] All the printed data within one line are aligned in the specified position.

- Depending on n value, positional alignment is carried out as in the table below:

n (Hex)	Position
0	Left end alignment
1	Centering
2	Right end alignment

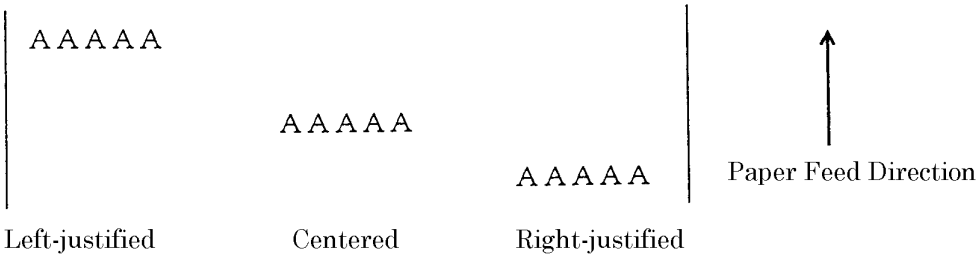
[Caution]

- This is valid only when n is inputted at the beginning of line.
- The initial value of n is "0".

[Sample Program]

```
LPRINT CHR$ (&H1B) + "a" + CHR$ (0) ;
LPRINT "AAAAA" + CHR$ (&HA) ;
LPRINT CHR$ (&H1B) + "a" + CHR$ (1) ;
LPRINT "AAAAA" + CHR$ (&HA) ;
LPRINT CHR$ (&H1B) + "a" + CHR$ (2) ;
LPRINT "AAAAA" + CHR$ (&HA) ;
```

[Print Results]



ESC c5 n

[Function] Enabling/Disabling the Panel Switches

[Code] <1B>H<63>H<35>H<n>

[Range] {0 n FF} Data is described in Hex code.

[Outline] Selecting the LF switch valid/invalid by LFSW(Pin 2).

- "n" is valid only in the lowest bit (n0).
- "n" bit means the followings.

n0	Condition
0	LF SW valid.
1	LF SW invalid.

[Caution] When the panel switch is disabled with this command, the LF switch is disabled. Therefore, the paper cannot be fed by operating the LF switch.

[Default] • The initial value of n is "0".

[Sample Program]

```
LPRINT CHR$ (&H1B) + "c5" + CHR$ (0) ; ••••••• When enabling the LF switch
LPRINT CHR$ (&H1B) + "c5" + CHR$ (1) ; ••••••• When disabling the LF switch
```

ESC d n

[Function] Printing and Feeding the paper by n lines

[Code] <1B>H<64>H<n>

[Range] * {0 n FF} Data is described in Hex code.

[Outline] Prints data inside the buffer and feeds paper by n lines.

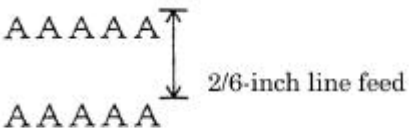
- Specified line does not remain.
- The beginning of the line is to be considered as the next printing start position.

[Default] • The initial value is not defined.

[Sample Program]

```
LPRINT "AAAAA"
LPRINT CHR$ (&H1B) + "d" + CHR$ (2) ;
LPRINT "AAAAA" + CHR$ (&HA) ;
```

[Print Results]



ESC i (When Using Auto Paper Cutter)

[Function] Full Cut

[Code] <1B>H<69>H

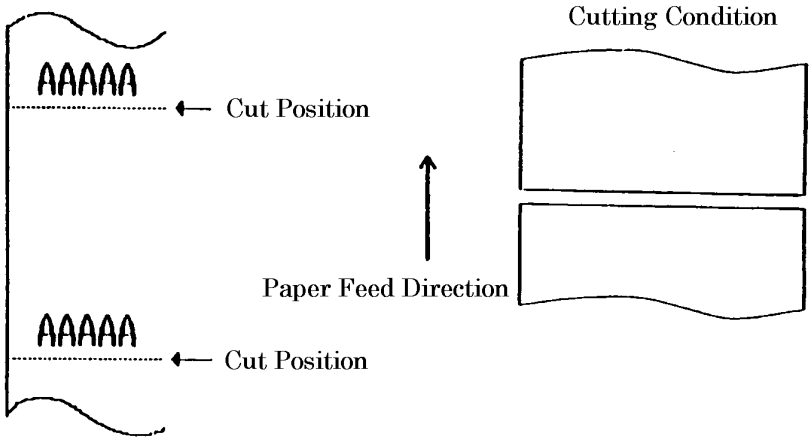
[Outline] Activating auto cutter unit (Full cut)

[Caution]
- This is valid only when n is inputted at the beginning of line.
- Prior to cutting the paper, feed the paper from the printing position to beyond the paper cutting position of the cutter. Otherwise, the character just after print will remain on this side of the cutter.

[Sample Program]

```
LPRINT "AAAAA" ;
LPRINT CHR$ (&H1B) + "J" ;
LPRINT CHR$ (150) ;
LPRINT CHR$ (&H1B) + "i" ;
LPRINT "AAAAA" ;
LPRINT CHR$ (&H1B) + "J" ;
LPRINT CHR$ (150) ;
LPRINT CHR$ (&H1B) + "i" ;
```

[Print Results]



ESC m (When Using Auto Paper Cutter)

[Function] Partial Cut

[Code] <1B>H<6D>H

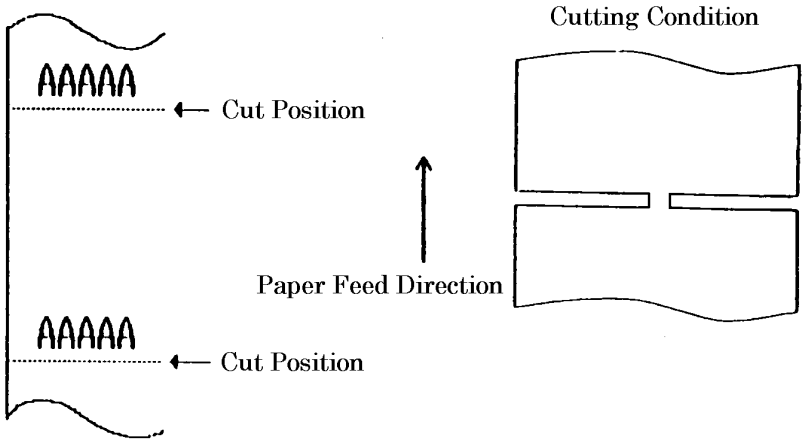
[Outline] Activating auto cutter unit (Partial cut)

[Caution]
- This is valid only when n is inputted at the beginning of line.
- Prior to cutting the paper, feed the paper from the printing position to beyond the paper cutting position of the cutter. Otherwise, the character just after print will remain on this side of the cutter.

[Sample Program]

```
LPRINT "AAAAA" ;
LPRINT CHR$ (&H1B) + "J" ;
LPRINT CHR$ (150) ;
LPRINT CHR$ (&H1B) + "m" ;
LPRINT "AAAAA" ;
LPRINT CHR$ (&H1B) + "J" ;
LPRINT CHR$ (150) ;
LPRINT CHR$ (&H1B) + "m" ;
```

[Print Results]



ESC t n

[Function] Selecting the Character Code Table

[Code] <1B>H<74>H<n>

[Range] {0 n 1} Data is described in Hex code.

[Outline] Selecting Page n on the character code table:

The character code table is selected depending on the value of n.

"n" means the followings.

n (Hex)	Condition
0	Page 0(IBM Character #2)
1	Page 1(Domestic Character)

[Default] The initial value of n is subject to the character set for the country specified by the function selecting terminal (Gate Array Pin 39,42,43).

- When Japan is selected: Domestic characters
- When non-Japan is selected: IBM characters #2

[See Also] Character Code Table

[Sample Program]

```
LPRINT CHR$ (&H1B) + "t" + CHR$ (0) ;
LPRINT " n=0" ;
FOR C=&HB1 TO &HB5
LPRINT CHR$ (C) ;
NEXT C
LPRINT CHR$ (&HA) ;
LPRINT CHR$ (&H1B) + "t" + CHR$ (1) ;
LPRINT " n=1" ;
FOR C=&HB1 TO &HB5
LPRINT CHR$ (C) ;
NEXT C
LPRINT CHR$ (&HA) ;
```

[Print Results]

n = 0 ▒|┼┤ ← Page 0

n = 1 ｱｲｳｴｵ ← Page 1

ESC v (Serial Interface Only)

[Function] Transmitting the printer status(Serial type)

[Code] <1B>H<76>H

[Outline] Current printer status is transmitted..

[Caution]
- Status sent out consists of 1 byte whose content is as in the table below.
- In DTR/DSR control, after receptible state of the host (DSR signal being in SPACE state) is confirmed, only 1 byte is transmitted.
  In XON/XOFF control, DSR signal state not being confirmed, only 1 byte is transmitted.
- In DTR/DSR control, when the host is in unreceptible state(DSR signal being in MARK state), it waits until receptible state is created.
- In paper end (paper near end) status, this command may be unreceptible state due to BUSY state.
  Remarks. This command is valid only for serial interface model.

Bit	Function	Value	
		0	1
0	Not defined		
1	Not defined		
2	Paper end	With paper	Without paper
3	Not defined		
4	Not used	Fixed to 0	–
5	Not defined		
6	Not defined		
7	Not defined		

[Sample Program]

```
OPEN "COM1:N81NN" AS #1 ;
PRINT #1, CHR$ (&H1B) + "v" ;
A$ = INPUT$ (1, #1) ;
CLOSE #1
```

ESC { n

[Function] Specifying/Canceling the Inverted Characters

[Code] <1B>H<7B>H<n>

[Range] {0 n FF} Data is described in Hex code.

[Outline] Specifying/canceling inverted characters.

- "n" is valid only for the lowest bit (n0).
- Bit n (n0) means the followings.

n0	Condition
0	Canceling inverted characters.
1	Specifying inverted characters.

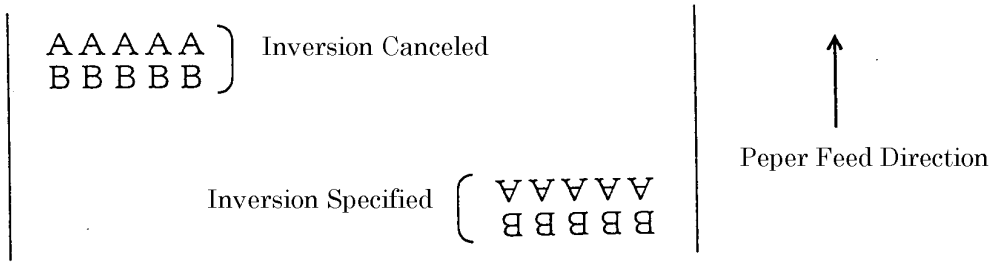
[Caution]
- Inverted printing means printing the line at 180°turned.
- This is valid only when this is specified at the beginning of a line.

[Default]
- The initial value of n is "0".

[Sample Program]

```
LPRINT CHR$ (&H1B) + "{" + CHR$ (0) ;
LPRINT "AAAAA" + CHR$ (&HA) ;
LPRINT "BBBBB" + CHR$ (&HA) ;
LPRINT CHR$ (&H1B) + "{" + CHR$ (1) ;
LPRINT "AAAAA" + CHR$ (&HA) ;
LPRINT "BBBBB" + CHR$ (&HA) ;
```

[Print Results]



ESC $ n1 n2

[Function] Specifying the Absolute Positions

[Code] <1B>H<24>H<n1><n2>

[Range] {0 n1 FF}

{0 n2 1} Data is described in Hex code.

[Outline] The printing start position is specified in the number of dots (1/203 inch unit) from the beginning of line.

- The number of dots is divided by 256, whose quotient is taken as n2 and the residual as n1.
- Therefore, the printing start position is equal to n1 + n2 x 256 from the beginning of line..

[Caution]
- Specifying beyond the end of line is ignored.

[Default]
- The initial value is not specified.

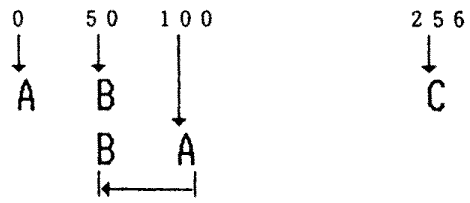
[See Also] ESC ¥

[Sample Program]

```
LPRINT CHR$ (&H1B) + "$" ;
LPRINT CHR$ (0) + CHR$ (0) + "A" ;
LPRINT CHR$ (&H1B) + "$" ;
LPRINT CHR$ (50) + CHR$ (0) + "B" ;
LPRINT CHR$ (&H1B) + "$" ;
LPRINT CHR$ (0) + CHR$ (1) + "C" ;
LPRINT CHR$ (&HA) ;
LPRINT CHR$ (&H1B) + "$" ;
LPRINT CHR$ (100) + CHR$ (0) + "A" ;
LPRINT CHR$ (&H1B) + "¥" ;
LPRINT CHR$ (&HC2) + CHR$ (&HFF) + "B" ;
LPRINT CHR$ (&HA) ;
```

[Print Results]

Absolute Position Specified



Relative Position Specified – 62

ESC ¥ n1 n2

[Function] Specifying the Relative Positions

[Code] <1B>H<5C>H<n1>< n2>

[Range] {0 n1 FF}

{0 n2 FF} Data is described in Hex code.

[Outline] The printing start position is specified in the number of dots(1/203 inch unit) from the current position.

- Rightward direction is taken as plus and leftward direction as minus.
- To specify N dot in minus (left) direction, use a complement of N for assignment.

  –N dots = 65536 – N
- The number of dots is divided by 256, whose quotient is taken as n2 and the residual as n1.

[Caution]
- Specifying exceeding the top of line or the end of line is ignored.

[Default]
- The initial value is not specified.

[See Also] ESC $

[Sample Program] [Print Results]

See Sample Program and Print Results for ESC $ on Page 70.

GS k n [d] k NUL

[Function] Printing the Bar Code

[Code] <1D>H<6B>H<n> [< d>] k <00>H

[Range] {0 n 7} Data are described in Hex code.

[Outline] Specifying a type of bar code and printing bar codes.

- The beginning of line is considered as the next printing start position.
- Depending on the value of n, the following bar code can be selected. d indicates a character code to be printed and k indicates the number of character to be printed.

n (Hex)	Bar Code System	Maximum Columns
0	UPC-A	---
1	UPC-E	---
2	JAN13 (EAN)	---
3	JAN 8 (EAN)	---
4	CODE 39	13
5	ITF	22
6	CODABAR (NW-7)	17
7	CODE 128	15

[Caution]

- When data being held in the print buffer, this command is ignored.
- Regardless of the specified feed pitch, this command feeds the paper to be required to print a bar code.
- If the character code d cannot be printed in the respective bar code system, the bar code so far will be printed, processing the subsequent data as normal data.
- When a bar code whose number of characters to be printed is fixed has been selected, the number of characters k have to be always made equal to the number of characters to be printed. (The bar code is not printed when not matching.)
- When the horizontal direction exceeds one line length, the excess part is not printed.

[Default]

- The initial value is not specified.

[Description of Bar Codes] <For print examples, see Page 75.>

UPC-A This bar code, consisting of numerals only, has a fixed length of 12 columns; a 11 columns number entered from the host or application software plus a check column(12th column) automatically calculated inside the printer. If the 12th-column numeral is sent from the host, the entire bar code will be printed as it is.

UPC-E This bar code, consisting of numerals only, has a fixed length of 8 columns; the first number system character is "0" stationary. A 12 columns numeral entered from the host or application software is compressed to 8 columns with a check column and printed. The 12th-column check column is automatically calculated inside the printer and sent from the host, the entire bar code will be printed, compressed to 8 columns.

JAN-13(EAN) This bar code, consisting of numerals only, has a fixed length of 13 columns; a 12 columns number entered from the host or application software plus a check column(13th column) automatically calculated inside the printer. If the 13th-column numeral is sent from the host, the entire bar code will be printed as it is.

JAN-8(EAN) This bar code, consisting of numerals only, has a fixed length of 8 columns; a 7-columns number entered from the host or application software plus a check column(8th column) automatically calculated inside the printer. If the 8th-column numeral is sent from the host, the entire bar code will be printed as it is.

CODE39 This bar code, consisting of uppercase alphabets and numerals, has a variable length of column. A start/stop code "*" is automatically added by the printer. Available characters include a space and "$, %, *, +, -, •, /, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9," and uppercase alphabets.

ITF This bar code, consisting of numerals only, has a variable length of even columns. If an odd-column code is transferred, nothing will be printed.

CODABAR (NW-7)

This bar code, consisting of alphanumerals, has a variable length of column. Available characters include "0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, D, D, $, +, -, ., /, :." A start/stop code is required; any one of A, B, C, and D is used.

CODE128

- This bar code consists of all of 128 ASCII code characters and has a variable length of column. This printer supports the code subsets A, B, and C. By prefixing a transfer code with any one character of A, B, and C, you can select the code subset to start from. If not prefixed with A, B, or C, the code subset B will be selected.
- The code subset A is the bar code consisting of standard uppercase alphabets, numerals, symbols, and special codes.
- The code subset B is the bar code consisting of standard uppercase/lowercase alphabets, numerals, symbols, control codes, and special codes.
- The code subset C is the bar code consisting of special characters and 100 kinds of numbers ranging from 00 to 99.

- The check column automatically calculated inside the printer is added to the end of the entered digits to be printed.
- Processing of the special characters
  The characters above the ASCII code number 96 are considered special characters. The following lists the converted characters for entering these characters.

ASCII Code	Converted Character	Subset Code	Subset Code B	Subset Code C
96	80h	FNC 3	FNC 3	-N/A-
97	81h	FNC 2	FNC 2	-N/A-
98	82h	SHIFT	SHIFT	-N/A-
99	83h	CODE C	CODE C	-N/A-
100	84h	CODE B	FNC 4	CODE B
101	85h	FNC 4	CODE A	CODE A
102	86h	FNC 1	FNC 1	FNC 1

The following exemplifies a selection of the code subset as a method to utilize the special characters.

<Selection of Code Subset>

- Initial selection: Enter any one character of A, B, and C.
- Conversion on the way: Enter any one character of 82h through 85h

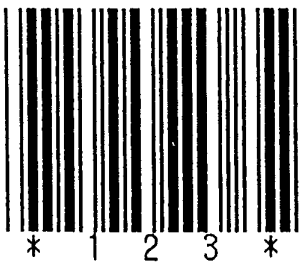
Example) When initially testing with the code subset B, and then, printing the bar code, "123," with the code subset A

- Input code : B TEST <85> 123
- Bar code data : <CODE B>TEST<CODE A>123

[Sample Program]

```
LPRINT CHR$ (&H1D) + "H" + CHR$ (2) ;
LPRINT CHR$ (&H1D) + "k" ;
LPRINT CHR$ (4) ;
LPRINT "123" + CHR$ (0) ;
```

[Print Results]



When the data "123" is printed with the code 39

[Description of Bar Codes]

UPC-A, UPC-E, JAN-13 (EAN), JAN-8 (EAN), CODE39, ITF, CODABAR, CODE128

Type	Print Sample	Outline of Symbol	Max. Columns
UPC-A		12-columns fixed-length bar code consisting of numerals only	-
UPC-E		8-columns fixed-length bar code consisting of numerals only. Abbreviated version of UPC-A	-
JAN-13		13-columns fixed-length bar code consisting of numerals only	-
JAN-8		8-columns fixed-length bar code consisting of numerals only	-
CODE39		Variable-length bar code consisting of alphabets and numerals. The start/stop code "*" is automatically added.	13
ITF		Even-column variable-length bar code consisting of numerals only	22
CODABAR (NE-7)		Variable-length bar code consisting of alphanumerals. Any one of A, B, C, and D is required as the start/stop code.	17
CODE128		Variable -length bar code consisting of all 128 ASCII code characters.	15

Printing is done depending on bar code specification type, number of print columns, bar code height, width(Magnification), visible code presence, and bar code data specification.

GS w n

[Function] Selecting the width of the Bar Code

[Code] <1D>H <77>H<n>

[Range] {2 n 4} Data is described in Hex code.

[Outline] Selecting bar code width.

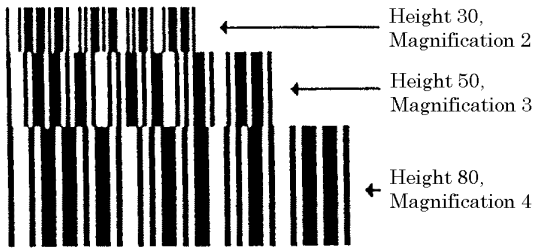
n denotes the number of dots in fine element width.

[Default] • The initial value of this width is "3".

[Sample Program]

```
LPRINT CHR$ (&H1D) + "h" + CHR$ (30) ;
LPRINT CHR$ (&H1D) + "w" + CHR$ (2) ;
GOSUB BC
LPRINT CHR$ (&H1D) + "h" + CHR$ (50) ;
LPRINT CHR$ (&H1D) + "w" + CHR$ (3) ;
GOSUB BC
LPRINT CHR$ (&H1D) + "h" + CHR$ (80) ;
LPRINT CHR$ (&H1D) + "w" + CHR$ (4) ;
GOSUB BC
END
BC :
LPRINT CHR$ (&H1D) + "k" ;
LPRINT CHR$ (4) ;
LPRINT "12" + CHR$ (0) ;
RETURN
```

[Print Results]



GS h n

[Function] Selecting the Height of the Bar Code

[Code] <1D>H<68>H<n>

[Range] {1 n FF} Data is described in Hex code.

[Outline] Selecting bar code height.
n denotes the number of dots in the vertical direction.

[Default] • The initial value of n is "162".

[Sample Program] [Print Results]

See Sample Program and Print Results for GS w on page 76.

GS H n

[Function] Selecting the Printing Position of HRI Code

[Code] <1D>H<48>H<n>

[Range] {0 n 3} Data is described in Hex code.

[Outline] Selecting printing position of HRI codes in printing bar codes.

• "n" means the followings.

n (Hex)	Printing Position
0	No printing
1	Above the bar code
2	Below the bar code
3	Both above and below the bar code

The HRI code refers to the bar code-turned characters so that you can read them.

[Caution] The HRI code is printed in the font selected with GS f. Specify before the GS k command.

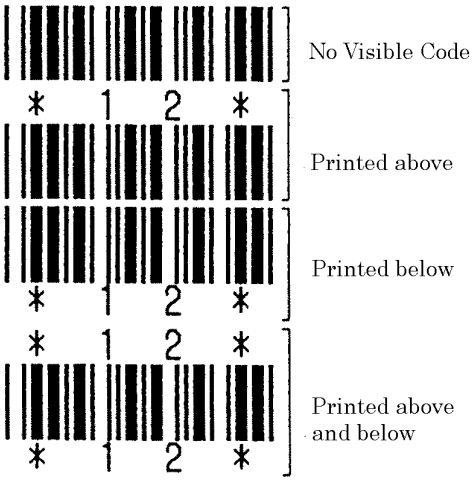
[Default] • The initial value of n is "0".

[See Also] GS f

[Sample Program]

```
LPRINT CHR$ (&H1B) + "3" + CHR$ (5) ;
LPRINT CHR$ (&H1D) + "h" + CHR$ (50) ;
LPRINT CHR$ (&H1D) + "H" + CHR$ (0) ;
GOSUB BC
LPRINT CHR$ (&H1D) + "H" + CHR$ (1) ;
GOSUB BC
LPRINT CHR$ (&H1D) + "H" + CHR$ (2) ;
GOSUB BC
LPRINT CHR$ (&H1D) + "H" + CHR$ (3) ;
GOSUB BC
END
BC :
LPRINT CHR$ (&H1D) + "k" ;
LPRINT CHR$ (4) ;
LPRINT "12" + CHR$ (0) ;
LPRINT CHR$ (&HA) ;
RETURN
```

[Print Results]



GS f n

[Function] Selecting the font of HRI code

[Code] <1D>H<66>H<n>

[Range] n = 0, 1

[Outline] Selecting the font of HRI code in printing bar code.

The type of font can be printed by selecting n is as follows.

n	Font
0	Font A
1	Font B

The HRI code refers to the bar code-turned characters so that you can read them.

[Caution] The HRI code is printed at the position specified with GS h.

[Default] The initial value of n is "0".

[See Also] GS H

[Sample Program]

```
LPRINT CHR$ (&H1D) + "h" + CHR$ (50) ;
LPRINT CHR$ (&H1D) + "H" + CHR$ (2) ;
LPRINT CHR$ (&H1D) + "f" + CHR$ (0) ;
GOSUB BC
LPRINT CHR$ (&H1D) + "f" + CHR$ (1) ;
GOSUB BC
END
BC :
LPRINT CHR$ (&H1D) + "k" ;
LPRINT CHR$ (4) ;
LPRINT "123" + CHR$ (0) ;
LPRINT CHR$ (&HA) ;
RETURN
```

[Print Results]

GS * n1 n2 [d] n1 X n2 X 8

[Function] Defining the Download Bit Image

[Code] <1D>H<2A>H<n1><n2> [< d >] n1 X n2 X 8

[Range] {1 n1 FF}

{1 n2 30}

{n1 X n2 51F} Data is described in Hex code.

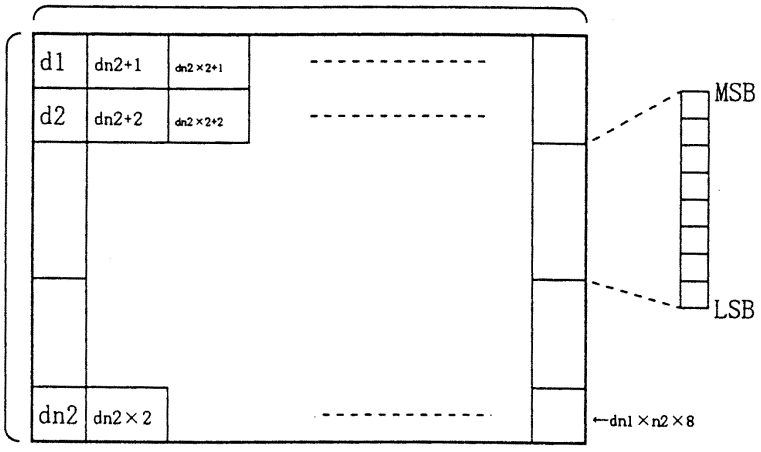
[Outline] Defines downloading bit images of the number of dots specified by n1/n2.

- The numbers of dots are n1 x 8 in horizontal direction and n2 x 8 in vertical direction.
- d indicates bit image data.
- The download bit image thus defined remains effective until redefinition, ESC @ execution, ESC &, or power OFF takes place.

[Caution]

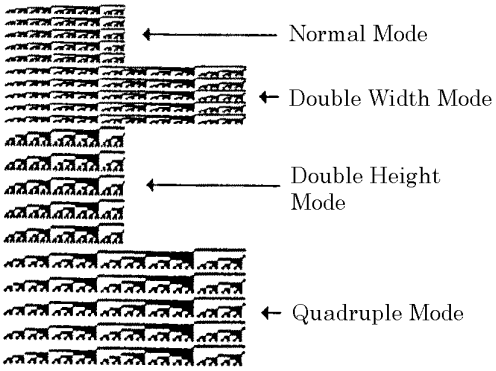
- A download character and a download bit image can not be defined simultaneously.
  With this command executed, defined content of a download character is cleared.
- Relations between the bit image data and the dot defined are shown below:

[See Also] GS /



[Sample Program] [Print Results]

```
    GOSUB IMG
    LPRINT CHR$ (&H1D) + "/" + CHR$ (0) ;
    LPRINT CHR$ (&H1D) + "/" + CHR$ (1) ;
    LPRINT CHR$ (&H1D) + "/" + CHR$ (2) ;
    LPRINT CHR$ (&H1D) + "/" + CHR$ (3) ;
    END
IMG :
    n 1 = 10 : n 2= 5
    LPRINT CHR$ (&H1D) + "*" ;
    LPRINT CHR$ (n1) + CHR$ (n2) ;
    FOR J=1 TO n1*8
       FOR I=1 TO n2
            LPRINT CHR$ (J) ;
       NEXT I
    NEXT J
    RETURN
```



GS / m

[Function] Printing the Download, Bit Image

[Code] <1D>H<2F>H<m>

[Range] {0 m 03} Data is described in Hex code.

[Outline] Prints download bit image in a mode specified by m.

• Modes can be selected by m are shown below.

m	Mode Name	Dot Density in Vertical Direction	Dot Density in Horizontal Direction
0	Normal mode	203 DPI	203 DPI
1	Double wide mode	203 DPI	101 DPI
2	Double height mode	101 DPI	203 DPI
3	Double wide/double height mode	101 DPI	101 DPI

[Caution]
- When data exist inside the print buffer, this command is ignored.
- When a download bit image has not been defined, this command is ignored.
- A portion of a download bit image exceeding one line length is not printed.
- A download character and a download bit image cannot be defined simultaneously.

[Default]
- The initial value is not specified.

[See Also] GS *

[Sample Program] [Print Results]

See Sample Program and Print Results for GS * on Page 80.

GS :

[Function] Starting / Ending Macro Definition

[Code] <1D>H<3A>H

[Outline] Specifying starting / ending macro definition.
Means termination when received while defining a macro.

[Caution] Maximum content available for macro definition is 2048 bytes. A portion exceeding 2048 bytes is not defined.

- Even with ESC @ (Initialization of the printer) having been executed, defined content is not cleared. Therefore, it is possible to include ESC @ into the content of macro definition.
- Normal printing operation is carried out even while in macro definition

[Default]

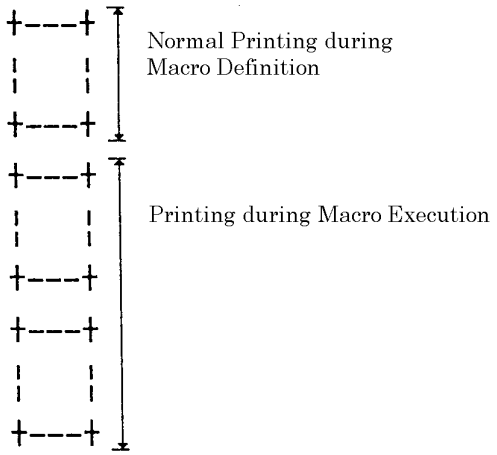
- Initially, Macro is not specified.

[See Also] GS ^

[Sample Program]

```
LPRINT CHR$ (&H1D) + ":" ;
LPRINT "+ – – – +" + CHR$ (&HA)
LPRINT "|       |" + CHR$ (&HA) ;
LPRINT "+ – – – +" + CHR$ (&HA)
LPRINT CHR$ (&H1D) + ":" ;
LPRINT CHR$ (&H1D) + "^" ;
LPRINT CHR$ (2) + CHR$ (10) ;
LPRINT CHR$ (0) ;
```

[Print Results]



GS ^ n1 n2 n3

[Function] Executing the Macro

[Code] <1D>H<5E>H<n1><n2><n3>

[Range] {0 n1 FF}

{0 n2 FF}

{0 3 1} Data is described in Hex code.

[Outline] Executing contents defined in macro.

• "n1~n3" indicate as follows:

n1 : The number of times of macro execution

n2 : Waiting time on macro execution
Waiting time of n2 x 100ms is given for every execution.

n3 : Macro execution mode

n3	Mode
0	Continuous execution
1	Execution by LFSW(Pin 2)

Continuous execution: The Macro is executed n1 times continuously at the time intervals specified by n2.

Execution by LFSW: After waiting for lapse of time specified by n2, the Alarm LED flickers and the LF switch is waited to be pressed. When it is pressed, the macro is executed once. This action is repeated n1 times.

[Caution]
• When this command is received while in macro definition, suspension of macro definition is indicated. At this time, the defined content is cleared.
• No execution takes place when macro is held undefined or n1=0.
• While in macro execution with n3=1, paper feed with the LFSW(Pin 2) is not available.

[Default] • Initially, this command is not specified.

[See Also] GS :

[Sample Program] [Print Results]

See Sample Program and Print Results for GS : on Page 83.

DC2 A n

[Function] Selecting the Print drive system

[Code] <12>H<41>H<n>

[Range] {0 n FF}

[Outline] Selecting the Fixed division system or the Variable division system.

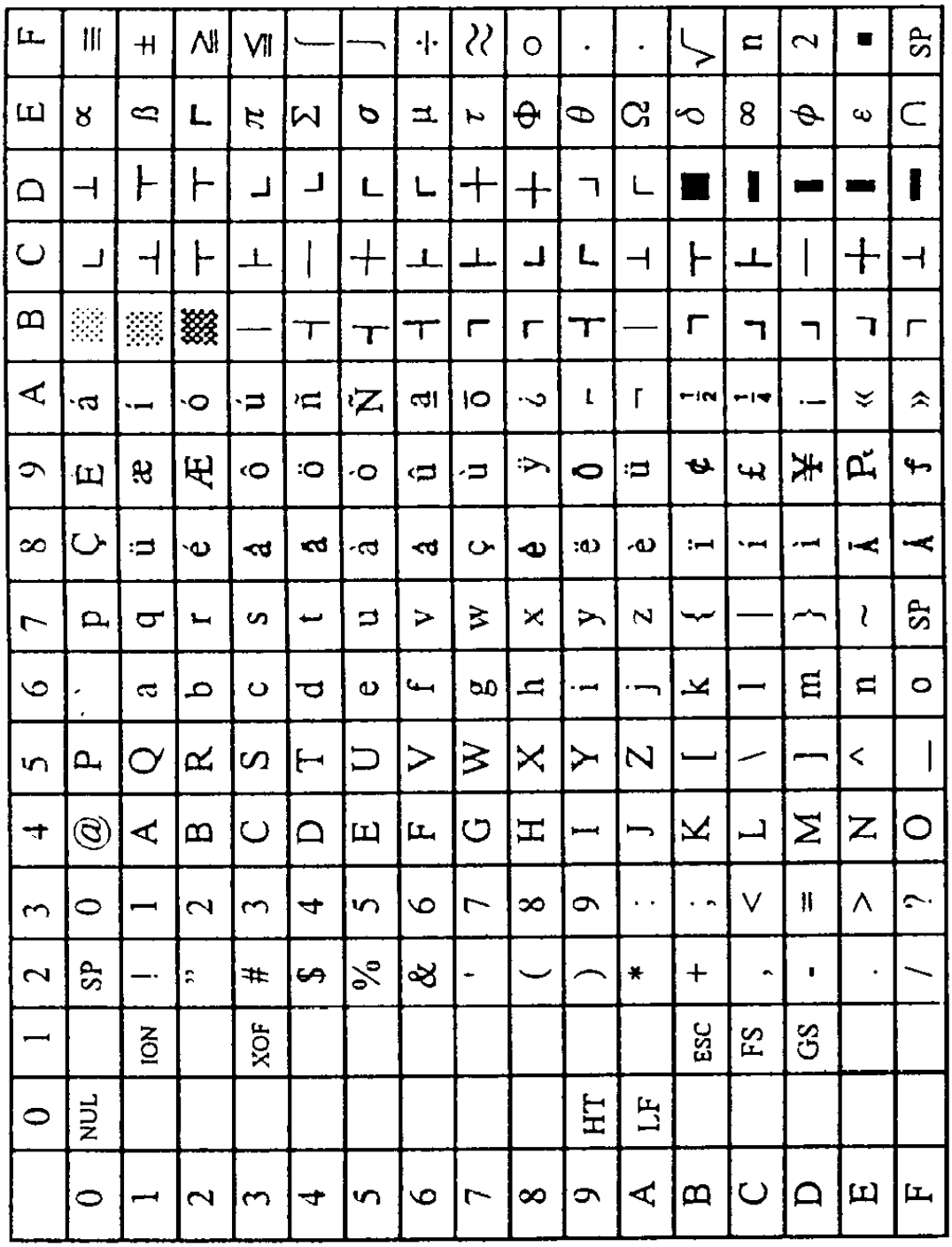
• "n" is valid only for the lowest bit (n0).

n0	Print Drive System
0	Fixed Division Number System
1	Variable Division Number System

[Default] The initial value of n is specified by the function selecting terminal (Gate Array Pin37).

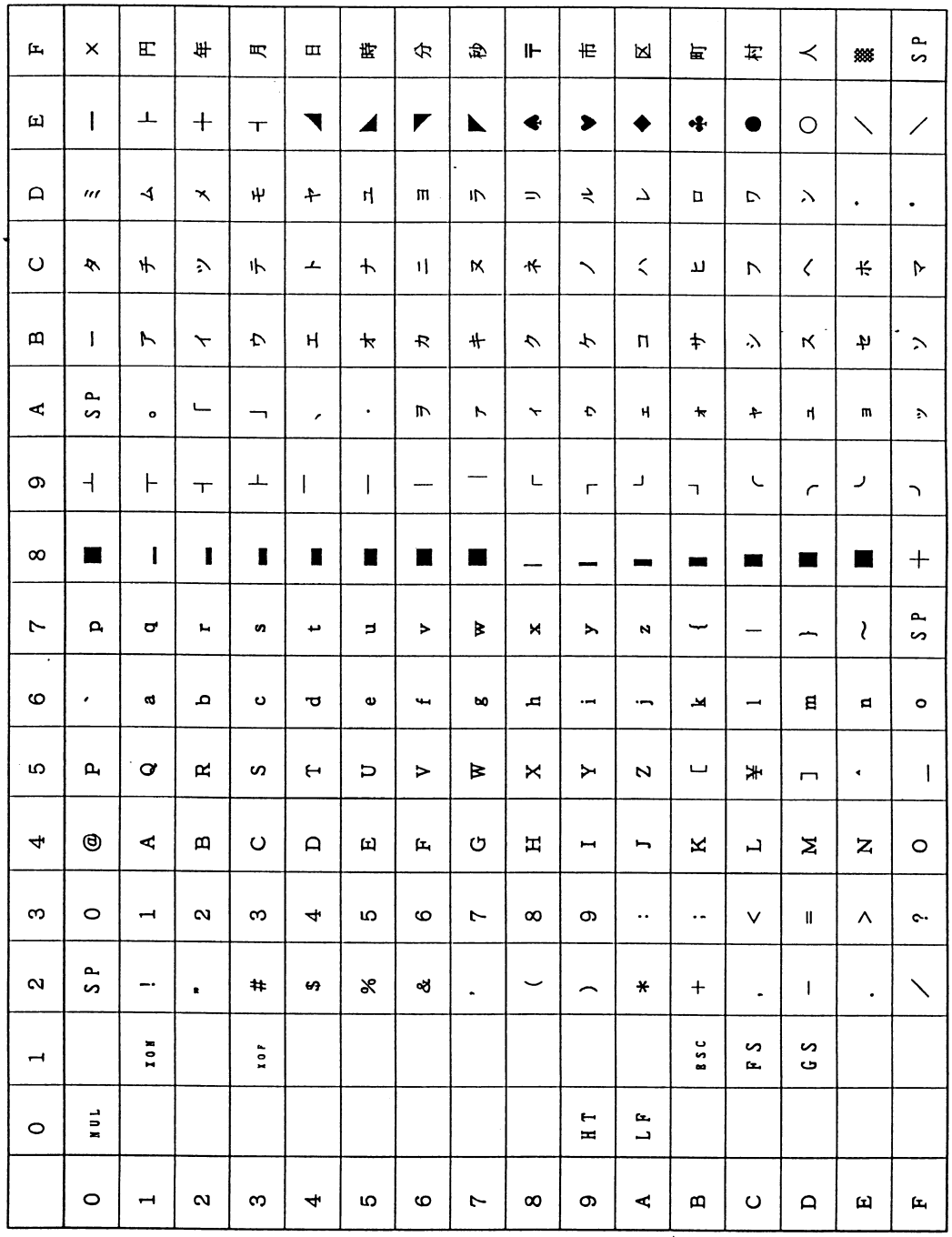
11. CHARACTER CODE TABLE

11.1 International



	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL		SP	0	@	P	`	p	Ç	É	á	▒	└	┴	α	≡
1		ION	!	1	A	Q	a	q	ü	æ	í	▒	┴	┬	ß	±
2			"	2	B	R	b	r	é	Æ	ó	▓	┬	├	Γ	≥
3		XOF	#	3	C	S	c	s	â	ô	ú	─	┴	└	π	≤
4			$	4	D	T	d	t	ä	ö	ñ	┤	┼	┌	Σ	⌠
5			%	5	E	U	e	u	à	ò	Ñ	╡	├	┐	σ	⌡
6			&	6	F	V	f	v	å	û	ª	╢	┬	│	μ	÷
7			'	7	G	W	g	w	ç	ù	º	╖	┐	┤	τ	≈
8			(	8	H	X	h	x	ê	ÿ	¿	╕	┘	┼	Φ	°
9			)	9	I	Y	i	y	ë	Ö	⌐	╣	┌	┘	θ	·
A	LF		*	:	J	Z	j	z	è	Ü	¬	║	└	┌	Ω	·
B		ESC	+	;	K	[	k	{	ï	¢	½	╗	┬	┬	δ	√
C		FS	,	<	L	\	l	|	î	£	¼	╝	└	┴	∞	n
D		GS	-	=	M	]	m	}	ì	¥	¡	╜	┬	┤	φ	2
E			.	>	N	^	n	~	Ä	₧	«	╛	┼	┐	ε	■
F			/	?	O	_	o	SP	Å	ƒ	»	┐	┴	┌	∩	SP

11.2 Domestic



	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL		SP	0	@	P	`	p	■	┴	SP	ー	タ	ミ	ー	×
1		IOW	!	1	A	Q	a	q	ー	┬	。	ア	チ	ム	上	円
2			"	2	B	R	b	r	▬	┼	「	イ	ツ	メ	十	年
3		IOF	#	3	C	S	c	s	▬	┼	」	ウ	テ	モ	十	月
4			$	4	D	T	d	t	■	―	、	エ	ト	ヤ	◥	日
5			%	5	E	U	e	u	■	―	・	オ	ナ	ユ	◢	時
6			&	6	F	V	f	v	■	―	ヲ	カ	ニ	ヨ	◤	分
7			'	7	G	W	g	w	■	―	ァ	キ	ヌ	ラ	◣	秒
8			(	8	H	X	h	x	▏	⌐	ィ	ク	ネ	リ	♠	干
9	HT		)	9	I	Y	i	y	▌	¬	ゥ	ケ	ノ	ル	♥	市
A	LF		*	:	J	Z	j	z	▮	└	ェ	コ	ハ	レ	◆	区
B		BSC	+	;	K	[	k	{	■	┘	ォ	サ	ヒ	ロ	♣	町
C		FS	,	<	L	¥	l	|	■	┌	ャ	シ	フ	ワ	●	村
D		GS	−	=	M	]	m	}	■	┐	ュ	ス	ヘ	ン	○	人
E			.	>	N	^	n	~	■	└	ョ	セ	ホ	゛	／	▒
F			／	?	O	_	o	SP	+	┘	ッ	ソ	マ	゜	＼	SP

11.3 International Character Set

	国名	23	24	40	5B	5C	5D	5E	60	7B	7C	7D	7E
0	U.S.A.	#	$	@	[	\	]	^	`	{	|	}	~
1	France	#	$	à	°	Ç	§	^	`	é	ù	è	¨
2	Germany	#	$	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß
3	U.K.	£	$	@	[	\	]	^	`	{	|	}	~
4	Denmark I	#	$	@	Æ	Ø	Å	^	`	æ	ø	å	~
5	Sweden	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
6	Italy	#	$	@	°	\	é	^	ù	à	ò	è	ì
7	Spain	₧	$	@	¡	Ñ	¿	^	`	¨	ñ	}	~
8	Japan	#	$	@	[	¥	]	^	`	{	|	}	~
9	Norway	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
10	Denmark II	#	$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü