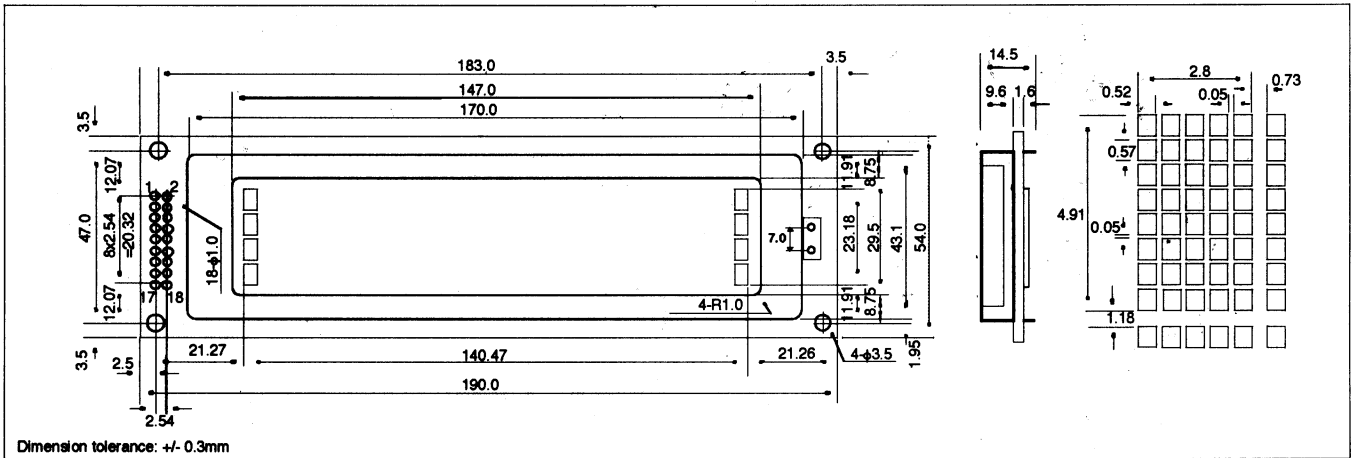


HDM40416L-4

Dimensional Drawing

40 Character x 4 Lines, LED Backlight



Features

Character Format 5x7 Dots with Cursor
 Backlight LED
 Options: TN/Gray STN/Yellow STN, 12 o'Clock/6 o'Clock View
 Normal/Extended Temperature
 Normal/Negative Displays

Physical Data

Module Size 190.0W x 54.0H x 14.5T mm
 Viewing Area Size 147.0W x 29.5H mm
 Weight 150g

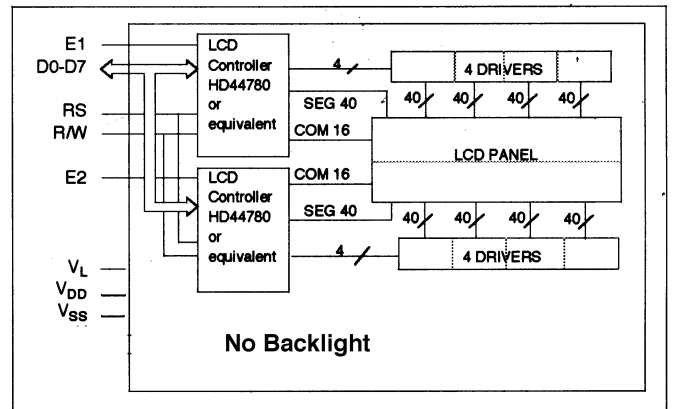
Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN	MAX	UNIT
SUPPLY VOLTAGE	$V_{DD}-V_{SS}$	0	7.0	V
SUPPLY VOLTAGE FOR LCD	$V_{DD}-V_L$	0	13.5	V
INPUT VOLTAGE	V_{IN}	V_{SS}	V_{DD}	V
OPERATING TEMPERATURE	T_{OP}	0	50	°C
STORAGE TEMPERATURE	T_{STG}	-20	70	°C
LED FORWARD CURRENT	I_f	-	600	mA
LED REVERSE VOLTAGE	V_R	-	8	V
LED POWER CONSUMPTION	P_D	-	2700	mW

Electrical Characteristics (VDD=5.0±0.25V 25°C)

PARAMETER	SYM	CONDITION	MIN	TYP	MAX	UNIT
INPUT HIGH VOLTAGE	V_{IH}	-	2.2	-	-	V
INPUT LOW VOLTAGE	V_{IL}	-	-	-	0.6	V
OUTPUT HIGH VOLTAGE	V_{OH}	$I_{OH}=0.2mA$	2.4	-	-	V
OUTPUT LOW VOLTAGE	V_{OL}	$I_{OL}=1.2mA$	-	-	0.4	V
POWER SUPPLY CURRENT	I_{DD}	$V_{DD}=5.0V$	-	3.0	5.0	mA
POWER SUPPLY FOR LCD	$V_{DD}-V_L$	$I_A=25°C$	4.3	-	4.7	V
LED FORWARD VOLTAGE	V_f	$I_f=150mA$	-	4.1	4.5	V
BRIGHTNESS	L	$I_f=150mA$	60	80	-	NIT
DRIVE METHOD		1/16 Duty				

Block Diagram



Pin Connections

PIN NO.	SYMBOL	LEVEL	FUNCTION
1	D7	H/L	Data bus
2	D6	H/L	
3	D5	H/L	
4	D4	H/L	
5	D3	H/L	
6	D2	H/L	
7	D1	H/L	
8	D0	H/L	
9	E1	H,H→L	Enable
10	RW	H/L	H: Data read L: Data write
11	RS	H/L	H: Data input L: Instruction input
12	V_L	-	Operating voltage for LC
13	V_{SS}	0V	Ground
14	V_{DD}	5V	Power supply for logic
15	E2	H,H→L	Enable
16	N/C	-	No-connection
17	A	-	Anode for LED backlight
18	K	-	Cathode for LED backlight

OPTIONS & SELECTION GUIDES

TN (Twisted Nematic)

STN (Super Twisted Nematic)

- STN type offers high contrast and wide viewing angle.
- STN type is available with different background colors;
- Yellow-green w/black characters
- Silver-gray w/dark blue characters
- Dark blue w/white characters

FSTN (Film STN)

- Black and white STN with very high contrast ratio for large graphic panels.

BACK LIGHT

EL (Electro- luminescent)

- Power efficient

LED with a choice of colors

- Bright and even back lighting
- Long life expectancy, more than 100,000 hours
- Simple to drive. Needs +5 volts only
- Brightness can be easily adjusted

CCFL (Cold Cathode Florescent Light)

- Paper white, best for large graphic displays
- Less power consumption than LED's

TEMPERATURE RANGE

	OPERATION (°C)	STORAGE (°C)
STANDARD	0 ~ +50	-20 ~ +70
EXTENDED	-20 ~ +70	-30 ~ +80

DISPLAY TYPE

- Positive image (Dark dots on light background)
- Negative image (Light dots on dark background)

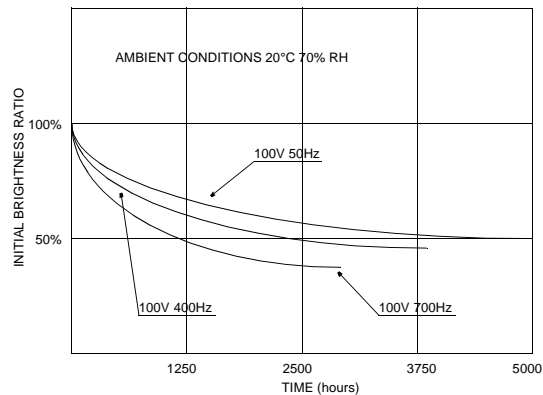
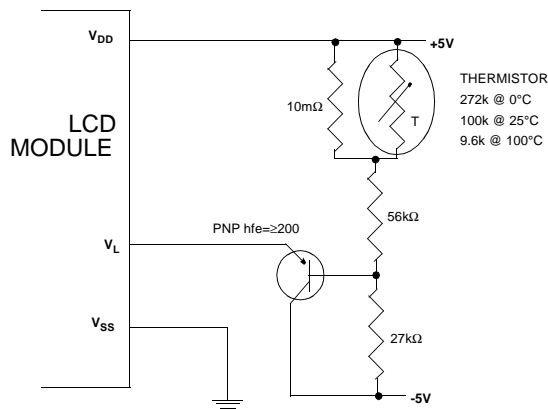
VIEWING ANGLE

- 12:00 (Top) Display is below eye level
- 6:00 (Bottom) Display is above eye level

SELECTION GUIDE

DISPLAY/POLARIZER	DISPLAY DESCRIPTION	OUTDOORS	OFFICE LIGHT	SUBDUED LIGHT	VERY LOW LIGHT	COMMENTS
REFLECTIVE POSITIVE	DARK CHARACTERS ON A LIGHT GREY OR YELLOW BACKGROUND	EXCELLENT	VERY GOOD	POOR	UNUSABLE	CAN'T BE BACK LIT
TRANSFLECTIVE POSITIVE	DARK CHARACTERS ON A LIGHT GREY OR YELLOW BACKGROUND	EXCELLENT	VERY GOOD	VERY GOOD	EXCELLENT	BEST CHOICE FOR GENERAL USE
TRANSMISSIVE NEGATIVE	LIGHT CHARACTERS ON A DARK BACKGROUND	POOR	GOOD	VERY GOOD	EXCELLENT	MUST BE USED WITH A BACK-LIGHT
TRANSMISSIVE POSITIVE	DARK CHARACTERS ON A LIGHT GRAY OR YELLOW BACKGROUND	GOOD	VERY GOOD	EXCELENT	EXCELLENT	HIGH CONTRAST DISPLAY

TEMPERATURE COMPENSATION & EL LIFE TIME



COMMANDS FOR CHARACTER MODULES

Command	Code										Description	Execution Time	
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0			
Clear Display	0	0	0	0	0	0	0	0	0	0	1	Clears the display and returns the cursor to the home position (address 0).	82µs~1.64ms
Return Home	0	0	0	0	0	0	0	0	0	1	*	Returns the cursor to the home position (address 0). Also returns a shifted display to the home position. DD RAM contents remain unchanged.	40µs~1.64ms
Entry Mode Set	0	0	0	0	0	0	0	0	1	I/D	S	Sets the cursor move direction and enables/disables the display.	40µs
Display ON/OFF Control	0	0	0	0	0	0	0	1	D	C	B	Turns the display ON/OFF (D), or the cursor ON/OFF (C), and blink of the character at the cursor position (B).	40µs
Cursor & Display Shift	0	0	0	0	0	0	1	S/C	R/L	*	*	Moves the cursor and shifts the display without changing the DD RAM contents.	40µs
Function Set	0	0	0	0	0	1	DL	N\$	RE	*	#	Sets the data width (DL), the number of lines in the display (L), and the character font (F).	40µs
Set CG RAM Address	0	0	0	0	1	A _{CG}					Sets the CG RAM address. CG RAM data can be read or altered after making this setting.	40µs	
Set DD RAM Address	0	0	0	1	A _{DD}					Sets the DD RAM address. Data may be written or read after making this setting.	40µs		
Read Busy Flag & Address	0	1	BF	AC					Reads the BUSY flag (BF) indicating that an internal operation is being performed and reads the address counter contents.	1µs			
Write Data to CG or DD RAM	1	0	Write Data					Writes data into DD RAM or CG RAM.	46µs				
Read Data from CG or DD RAM	1	1	Read Data					Reads data from DD RAM or CG RAM.	46µs				
	I/D = 1: Increment I/D = 0: Decrement S = 1: Accompanies display shift. S/C = 1: Display shift S/C = 0: cursor move R/L = 1: Shift to the right. R/L = 0: Shift to the left. DL = 1: 8 bits DL = 0: 4 bits N = 1: 2 lines N = 0: 1 line RE = 1: Ext. Reg. Ena. F = 0: 5 x 7 dots BF = 1: Busy BF = 0: Can accept data # Set to 1 on 24x4 modules \$ With KS0072 is Address Mode.										DD RAM: Display data RAM CG RAM: Character generator RAM A _{CG} : CG RAM Address A _{DD} : DD RAM Address Corresponds to cursor address. AC: Address counter Used for both DD and CG RAM address.	Execution times are typical. If transfers are timed by software and the busy flag is not used, add 10% to the above times.	

CHARACTER MODULE INITIALIZATION

Internal Reset Circuit

The module is automatically initialized when the power is applied. The following commands are executed during initialization. The busy flag is kept in the busy state until initialization is complete. The busy state lasts for 10 ms after V_{DD} reaches 4.5 volts.

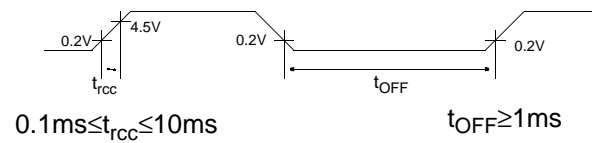
- 1) Clear Display
- 2) Function set
 - DL=1.....8-bit data length for interface
 - N=0.....Single-line display
 - F=0.....5x7 dot matrix character font
- 3) Display ON/OFF Control
 - D=0.....Display OFF
 - C=0.....Cursor OFF
 - B=0.....Blink function OFF
- 4) Entry Mode Set
 - I/D=1.....Increment Mode
 - S=0.....Display shift OFF

NOTE:

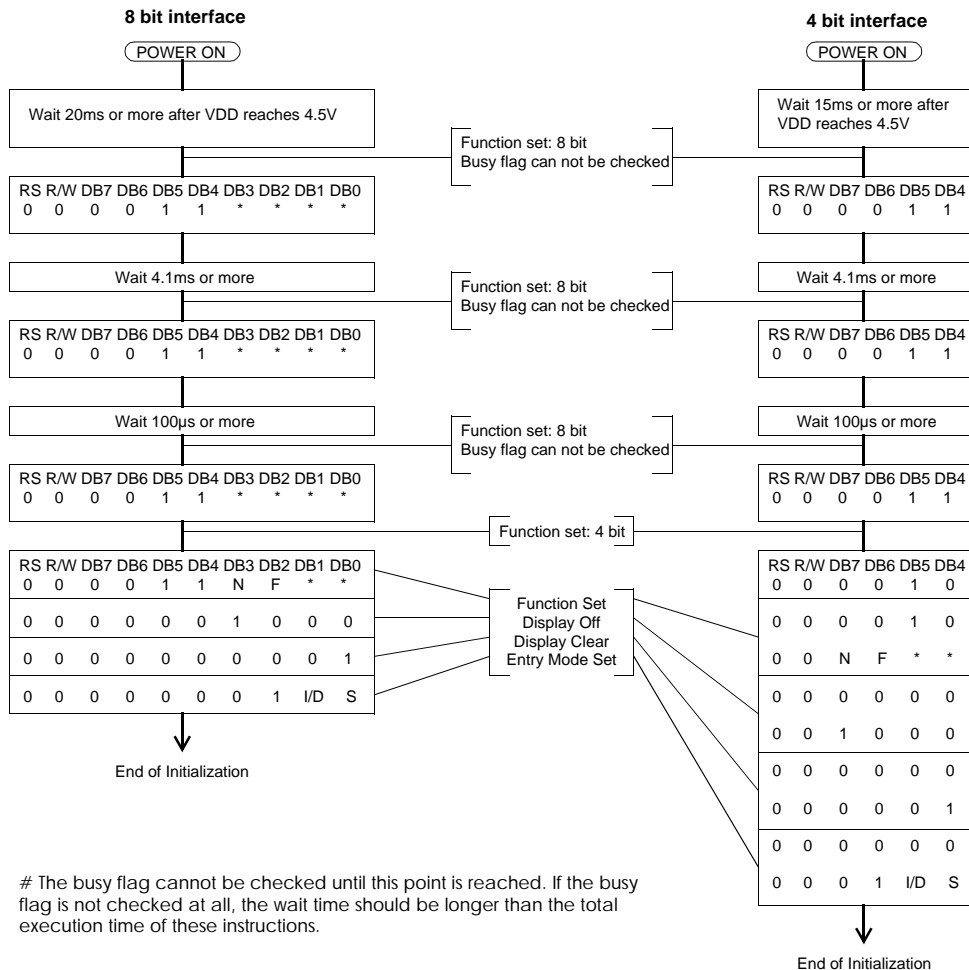
If the following power conditions are not satisfied, the internal reset circuit does not function properly. In this case, the initialization should be executed by the series of instructions from outside the MPU (Software Initialization).

Power Conditions for Internal Reset

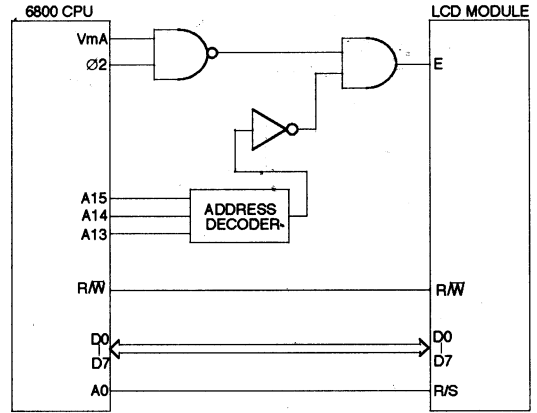
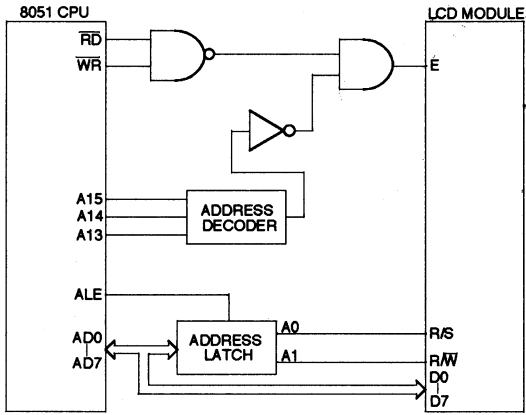
ITEM	SYMBOL	MIN	TYP	MAX	UNIT
Power Supply Rise Time	t_{rcc}	0.1	-	10	ms
Power Supply Off Time	t_{OFF}	1.0	-	-	ms



Software Initialization



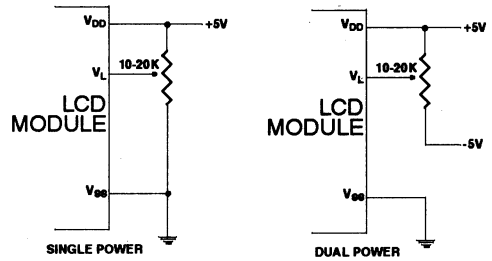
PROCESSOR INTERFACING



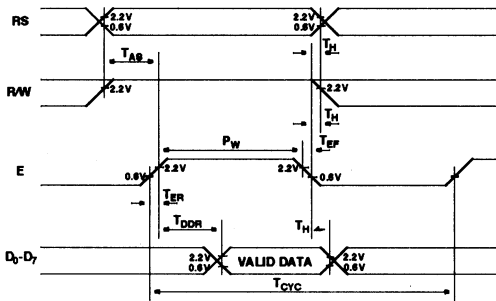
TIMING CHARACTERISTICS

ITEM	SYMBOL	MAX.	MIN.	UNIT
ENABLE CYCLE TIME	T_{CYC}		500	nS
ENABLE PULSE WIDTH	P_W		230	nS
ENABLE RISE/FALL TIME	T_{ER}, T_{EF}	20		nS
RS, R/W SET UP TIME	T_{AS}		40	nS
DATA DELAY TIME	T_{DDR}	360		nS
DATA SETUP TIME	T_{DSW}		60	nS
HOLD TIME	T_H		10	nS

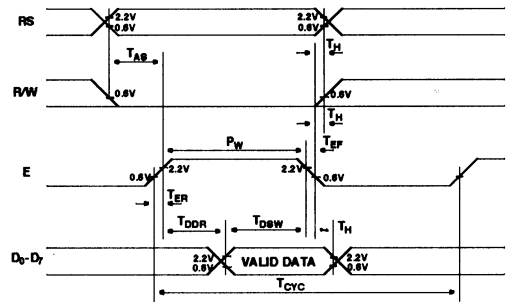
POWER SUPPLY EXAMPLES



DATA READ



DATA WRITE



DISPLAY CHARACTER POSITION AND CHARACTER ADDRESS

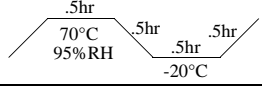
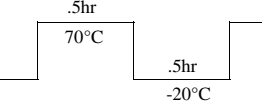
14) 40 x 4: HDM40416H-5, HDM40416L-4

1	2	3	4	5	6	7		37	38	39	40	DISPLAY POSITION
00	01	02	03	04	05	06	---	24	25	26	27	←
40	41	42	43	44	45	46	---	64	65	66	67	←
00	01	02	03	04	05	06	---	24	25	26	27	←
40	41	42	43	44	45	46	---	64	65	66	67	←

DD RAM ADDRESS

RELIABILITY DATA

SUMMARY: LIFETIME AND ENVIRONMENTAL TESTS

TEST ITEMS	TEST CONDITIONS	TEST TIME	NUMBR OF UNITS TESTED	FAILURE RATE (%)
TEMPERATURE LIFETIME	60°C, 5V, 32Hz 30°C, 5V, 32Hz	7,000hr 7,000hr	50 50	0 0
HIGH TEMPERATURE	70°C 95°C 60°C	1,000hr 100hr 5,000hr	300 300 300	0 0 0
LOW TEMPERATURE	-40°C -30°C	100hr 1,000hr	300 300	0 0
HIGH TEMPERATURE AND HUMIDITY	70°C, 95%RH 40°C, 95%RH	100hr 500hr	300 300	0 0
TEMPERATURE AND HUMIDITY CYCLE		25 CYCLES	50	0
POLARIZER AND REFLECTOR RELIABILITY	70°C, DRY 90°C, DRY	1,000hr 100hr	300 300	0 0
ULTRAVIOLET LIGHT	OUTDOOR EXPOSURE	5,000hr	50	0
HEAT SHOCK		25 CYCLES	50	0
VIBRATION	10 - 50Hz, 1g, X,YX,Z DIRECTIONS 51 - 300Hz, 0.5g, X,Y,Z DIRECTIONS	1hr	50	0
MECHANICAL	50g 15ms ± X,Y,Z	3 TIMES EACH	50	0

SUMMARY: LIFE EXPECTANCY

COMPONENT	TYPICAL LIFETIME
LCD DISPLAY (GLASS ASSEMBLY)	50,000hr (5.7yr)
LCD ELECTRONICS	100,000hr (12yr) min
EL BACK LIGHT	5,000hr (7mo) ^{1, 2}
CCFL BACK LIGHT	15,000hr (20mo) ²
LED BACKLIGHT	100,000hr (12yr) min

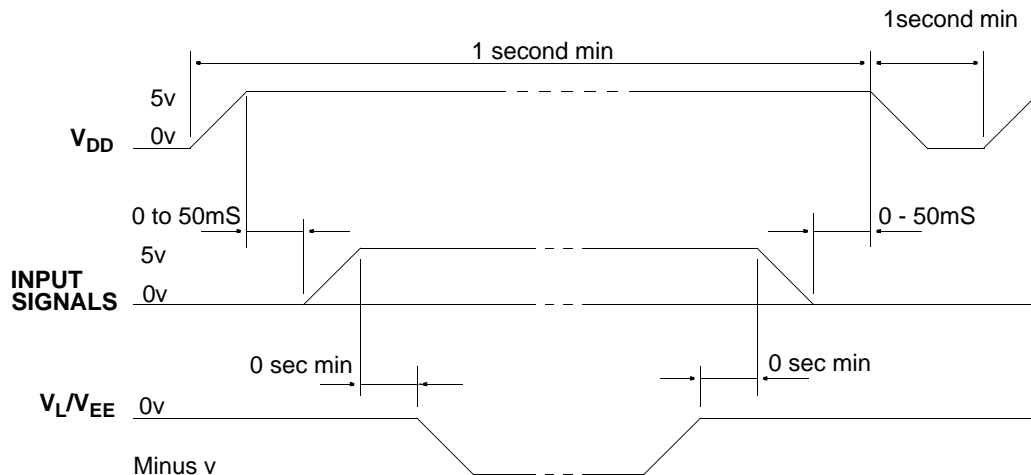
NOTES:

1. It is recommended that the product be designed so that the EL back light is not left on continuously. This will greatly extend the life of the back light element.

2. Usable lifetime of the back light is reached when the light output reaches 50% of the original brightness.

POWER SUPPLY SEQUENCING (Graphics Modules Only)

The power supply voltages should be sequenced according to the following timing diagram. This will insure that the internal electronics have time to begin operation before the negative voltage is applied. The sequence of events should be as follows: Apply V_{DD} first. When V_{DD} is stable at 5v, apply the input signals and then apply V_L/V_{EE} . The shut down sequence is exactly the opposite. **Failure to follow this procedure may result in permanent damage to the LCD fluid or to the CMOS electronics on the module.**



NOTICE:

Specifications in this catalog are subject to change without notice. Some mechanical specifications may vary slightly from those listed in this catalog due to changes and improvements made to the product. The most current specifications are maintained on our Web site at: www.hantronix.com.

CHARACTER MODULE FONT TABLE (Standard font)

Character modules with built in controllers and Character Generator (CG) ROM & RAM will display 96 ASCII and special characters in a dot matrix format. Then first 16 locations are occupied by the character generator RAM. These locations can be loaded with the user designed symbols and then displayed along with the characters stored in the CG ROM.

CHARACTER FONT TABLE

UPPER 4 BITS LOWER 4 BITS	0000	0010	0011	0100	0101	0110	0111	1010	1011	1100	1101	1110	1111
0000	CG RAM (1)		0	a	P	`	P		-	9	E	α	p
0001	(2)	!	1	A	Q	a	q	•	7	7	4	ä	q
0010	(3)	"	2	B	R	b	r	Γ	イ	ウ	×	β	θ
0011	(4)	#	3	C	S	c	s	┘	ウ	7	E	ε	∞
0100	(5)	\$	4	D	T	d	t	√	工	ト	ト	μ	Ω
0101	(6)	%	5	E	U	e	u	•	オ	ナ	1	ε	Ü
0110	(7)	&	6	F	V	f	v	ヲ	カ	ニ	ヨ	ρ	Σ
0111	(8)	'	7	G	W	g	w	7	キ	ヌ	ウ	g	π
1000	(1)	(	8	H	X	h	x	イ	ウ	ホ	リ	7	又
1001	(2)	)	9	I	Y	i	y	ウ	ケ	リ	ル	´	y
1010	(3)	*	:	J	Z	j	z	エ	コ	ン	ル	j	*
1011	(4)	+	;	K	L	k	l	オ	サ	ヒ	ロ	°	5
1100	(5)	,	<	L	*	l	l	ホ	シ	フ	ワ	φ	π
1101	(6)	-	=	M	I	m	)	ユ	ズ	ノ	ト	±	÷
1110	(7)	.	>	N	^	n	→	ヨ	セ	ホ	´	ñ	
1111	(8)	/	?	O	_	o	←	ウ	ウ	マ	°	ö	■