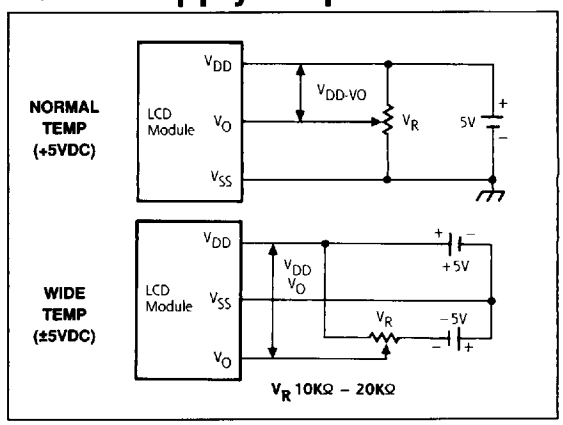
Pin Function Chart

Pin Name	I/O	Function
V_{SS}	—	Ground; OV
V_{DD}	—	+5V
V_O	—	Power supply for LC driving
RS	I	Signal to select registers "0": Instruction register (for write) Busy flag; address counter (for read) "1": Data register (for read and write)
R/W	I	Signal to select read (R) and write (W) "0". Write MPU → LCD Module "1": Read MPU ← LCD Module
E	I	Operation start signal for data read or write
DB0 thru DB3	I/O	Data Bus of lower order 4 lines having bidirectional tri-state. Used for data transfer between the MPU and the module These four are not used furing 4-bit operation.
DB4 thru DB7	I/O	Data bus of higher order 4 lines having bidirectional tri-state. Used for data transfer between the MPU and the module. DB7 can be used as a BUSY flag.

NOTE: In the module, the data can be sent in either 4-bit 2-sequence operation or 8-bit single-operation so that it can interface to both 4 and 8-bit MPU's

Power Supply Requirements



Absolute Maximum Ratings

Item		Symbol	Min.	Max.	Unit
Logic Circuit Power Supply Voltage		V_{DD}-V_{SS}	0	7.0	V
LC Driver Circuit Supply Voltage		V_{DD}-V_O	0	13.5	V
Input Voltage		V_I	V_{SS}	V_{DD}	V
Operating Temperature	Normal	t_{op}	0°C	+50°C	°C
	Wide		-20°C	+70°C	
Storage Temperature	Normal	t_{stg}	-20°C	+70° C	°C
	Wide		-30°C	+80°C	

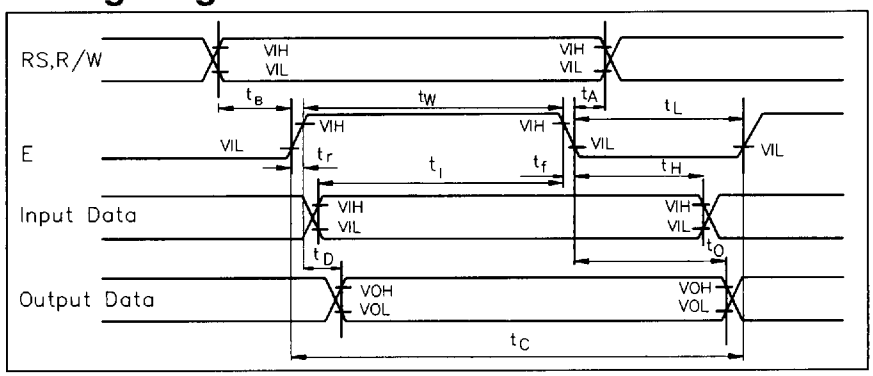
Electrical Specifications

Item	Symbol	Condition	Min.	Max.	Unit
High Input Level Voltage	V_{IH}	—	2.2	—	V
Low Input Level Voltage	V_{IL}	—	—	0.6	V
High Output Level Voltage	V_{OH}	$-I_{OH}$=0.2 mA	2.4	—	V
Low Output Level Voltage	V_{OL}	I_{OH}=1.2 mA	—	0.4	V
Power Current	I_{DD}	V_{DD}=5.0 V	—	2.0	mA

Timing Characteristics

Parameters		nS
Enable Cycle Time	tC (min)	1000
Enable Pulse Width		
High Level	tW (min)	450
Low Level	tL (min)	450
E Raise Time	tr (max)	25
E Fall Time	tf (max)	25
Set-up Time	tB (min)	140
Data Set-up Time	tI (min)	195
Data Delay Time	tD (max)	320
Address Hold Time	tA (max)	10
Hold Time		
Input Data	tH (min)	10
Output Data	tO (min)	20

Timing Diagram



Command Instructions

Instruction	Code										Description	Executed Time (max.) fosc=250KHz
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Clears all display and returns the cursor to the home position (Address 0)	1 64mS
Cursor At Home	0	0	0	0	0	0	0	0	1	*	Returns the cursor to the home position (Address 0) Also returns the display being shifted to the original position DDRAM contents remain unchanged	1 64mS
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Sets the cursor move direction and specifies or not to shift the display These operations are performed during data write and read	40µS
Display On/Off Control	0	0	0	0	0	0	1	D	C	B	Sets ON/OFF of all display (D) cursor ON/OFF (C), and blink of cursor position charact character (B).	40µS
Cursor/Display Shift	0	0	0	0	0	1	S/C	R/L	*	*	Moves the cursor and shifts the display without changing DDRAM contents.	40µS
Function Set	0	0	0	0	1	DL	N	F	*	*	Sets interface data length (DL) number of display lines (N) and character font (F)	40µS
CGRAM Address Set	0	0	0	1	A_{CG}						Sets the CGRAM address. CGRAM data is sent and received after this setting	40µS
DDRAM Address Set	0	0	1	A_{DD}							SETS the DDRAM address. DGRAM data is sent and received after this setting	40µS
Busy Flag/ Address Read	0	1	BF	AC							Reads Busy flag (FB) indicating internal operation is being performed and reads address counter contents.	0µS
CGRAM/DDRAM Data Write	1	0	W_{RITE} D_{ATA}								Writes data into DDRAM or CGRAM.	40µS
CGRAM/DDRAM Data Read	1	1	R_{EAD} D_{ATA}								Reads data from DDRAM or CGRAM	40µS

Code		Description	Executed Time (max.)
I/D=1: Increment I/D=0: Decrement S=1: With display shift S/C=1 Display shift S/C=0. Cursor movement R/L=1· Shift to the right R/L=0· Shift to the left DL=1. 8-bit	DL=0 4-bit N=1 2 lines N=0 1 lines F=1 5 x 10 dots F=0· 5 x 7 dots BF=1: Internal operation is being performed BF=0· Instruction acceptable	DDRAM. Display Data RAM CGRAM Character Generator RAM ACG· CGRAM Address ADD: DDRAM Address corresponds to cursor address AC· Address Counter, used for both DDRAM and CGRAM *. Invalid	fcp or fosc=250kHz However, when frequency changes, execution time also changes Ex If fcp or fosc is 270kHz, $40\mu S \times \frac{250}{270} = 37\mu S$

SELECTION CHART

Model	Display Format Char x Line	Font Matrix WxH Pix	Character Size Incl. Cursor WxH mm	Frame Viewing Area WxH mm	Driving Duty Cycle	PCB Size WxH mm	TN Type Temp. Range		STN Type Temp. Range		Backlight Options		Connection	
							Nrml	Wide	Nrml	Wide	EL	LED	Style	Edge Location
TC081S	8 X 1	5 X 8	6.45 X 10.75	61.0 X 15.8	1/8	84.0 X 44.0	⊙	⊙	–	–	⊙	⊙	SIL	BTM
TC122A	12 X 2	5 X 8	2.65 X 5.50	46.7 X 17.5	1/16	55.7 X 32.0	⊙	⊙	⊙	⊙	–	⊙	SIL	BTM
TC161C	16 X 1	5 X 8	2.37 X 5.41	45.0 X 12.0	1/16	61.0 X 30.0	⊙	⊙	⊙	⊙	⊙	⊙	SIL	TOP
TC161D			3.20 X 5.95	64.5 X 13.8		80.0 X 36.0	⊙	⊙	⊙	⊙	⊙	⊙	SIL	TOP
TC161F			3.20 X 5.95	64.5 X 13.8	1/8	80.0 X 36.0	⊙	⊙	⊙	⊙	⊙	⊙	SIL	TOP
TC161V	16 X 1	5 X 8	3.15 X 6.30	61.0 X 9.6	1/16	80.0 X 25.0	⊙	⊙	–	–	⊙	⊙	SIL	TOP
TC161S			3.15 X 6.30	61.0 X 15.8		80.0 X 36.0	⊙	⊙	⊙	–	⊙	⊙	SIL	TOP
TC161A			4.84 X 8.06	99.0 X 13.0		122.2 X 33.2	⊙	⊙	⊙	–	⊙	⊙	SIL	TOP
TC161E	16 X 1	5 X 8	4.84 X 8.06	99.0 X 13.0	1/8	122.2 X 33.2	⊙	⊙	⊙	–	⊙	⊙	SIL	TOP
TC161T			4.15 X 9.50	80.0 X 20.5	1/16	100.0 X 42.0	⊙	⊙	⊙	–	⊙	⊙	SIL	TOP
TC161B			7.20 X 14.54	120.0 X 23.0	1/8	151.0 X 40.0	⊙	⊙	⊙	⊙	⊙	⊙	DIL	END
TC162G	16 X 2	5 X 8	3.65 X 4.35	64.5 X 13.8	1/16	80.0 X 36.0	⊙	⊙	⊙	⊙	⊙	⊙	SIL	TOP
TC162S			2.95 X 5.55	61.0 X 15.8		80.0 X 36.0	⊙	⊙	⊙	–	⊙	⊙	SIL	TOP
TC162W	16 X 2	5 X 8	2.95 X 5.55	61.0 X 15.8	1/16	84.0 X 44.0	⊙	⊙	⊙	–	⊙	⊙	SIL	BTM
TC162E			2.95 X 5.55	60.0 X 16.0		84.0 X 44.0	⊙	⊙	⊙	⊙	⊙	⊙	SIL	BTM
TC162C	16 X 2	5 X 8	2.96 X 5.56	62.0 X 16.0	1/16	85.0 X 30.0	⊙	–	⊙	–	⊙	⊙	DIL	END
TC162U			2.95 X 5.55	61.0 X 15.8		85.0 X 32.5	⊙	⊙	⊙	–	⊙	⊙	DIL	END
TC162F	16 X 2	5 X 8	3.55 X 5.55	62.0 X 16.0	1/16	85.0 X 36.0	⊙	⊙	⊙	⊙	⊙	⊙	DIL	END
TC162X			4.07 X 7.76	80.0 X 20.5		100.0 X 42.0	⊙	⊙	⊙	–	⊙	⊙	SIL	TOP
TC162B	16 X 2	5 X 8	4.84 X 8.06	99.0 X 24.0	1/16	122.0 X 44.0	⊙	⊙	⊙	⊙	⊙	⊙	SIL	BTM
TC162D			4.84 X 9.66	99.0 X 24.0		130.6 X 38.0	⊙	⊙	⊙	⊙	⊙	⊙	DIL	END
TC162T	16 X 2	5 X 8	5.05 X 9.55	99.0 X 24.0	1/16	122.0 X 44.0	⊙	⊙	⊙	–	⊙	⊙	SIL	BTM
TC162H			6.00 X 9 63	120.0 X 23.0		151.0 X 40.0	–	–	⊙	⊙	⊙	⊙	DIL	END
TC164A	16 X 4	5 X 8	2.95 X 4.75	61.8 X 25.2	1/16	87.0 X 60.0	⊙	⊙	⊙	⊙	⊙	⊙	SIL	TOP
TC201S	20 X 1	5 X 8	6.70 X 11.50	155.1 X 16.0	1/8	182.0 X 33.5	⊙	⊙	–	–	⊙	⊙	DIL	END
TC201B			7.20 X 14.54	149.0 X 23.0		180.0 X 40.0	–	–	⊙	⊙	⊙	⊙	DIL	END
TC202U	20 X 2	5 X 8	3.70 X 4.85	80.0 X 20.5	1/16	100.0 X 38.8	–	–	⊙	–	–	⊙	SIL	TOP
TC202A			3.20 X 5.55	83.0 X 18.6		116.0 X 37.0	⊙	⊙	⊙	⊙	⊙	⊙	DIL	END
TC202T	20 X 2	5 X 8	4.90 X 8.30	123.2 X 23.0	1/16	146.0 X 43.0	⊙	⊙	⊙	–	–	–	SIL	TOP
TC202B			6.00 X 9.63	149.0 X 23.0		180.0 X 40.0	–	–	⊙	⊙	⊙	⊙	DIL	END
TC204C	20 X 4	5 X 8	2.29 X 4.02	58.6 X 21.1	1/16	77.0 X 47.0	⊙	⊙	⊙	–	⊙	⊙	SIL	TOP
TC204A			2.95 X 4.75	76.0 X 25.5		98.8 X 60.2	⊙	⊙	⊙	⊙	⊙	⊙	SIL	TOP
TC204B			5.66 X 9.80	143.0 X 57.0		191.0 X 86.0	–	–	⊙	⊙	–	⊙	DIL	END
TC242T	24 X 2	5 X 8	3.20 X 5.55	80.0 X 20.5	1/16	100.0 X 38.8	⊙	⊙	⊙	–	–	⊙	SIL	TOP
TC242A			3.20 X 5.55	93.5 X 15.8		118.0 X 36.0	⊙	⊙	⊙	⊙	⊙	⊙	DIL	END
TC242D *	24 X 2	5 X 8	3.20 X 5.55	93.5 X 15.8	1/16	118.0 X 36.0	⊙	⊙	⊙	⊙	–	⊙	DIL	END
TC242B			6.00 X 9.63	178.0 X 23.0		208.0 X 40.0	–	–	⊙	⊙	⊙	⊙	DIL	END
TC402C	40 X 2	5 X 8	2.67 X 4.60	130.8 X 13.2	1/16	149.4 X 27.0	⊙	⊙	–	–	⊙	⊙	SIL	TOP
TC402A			3.20 X 5.55	152.2 X 16.5		182.0 X 33.6	⊙	⊙	⊙	⊙	⊙	⊙	DIL	END
TC404A	40 X 4	5 X 8	2.78 X 4.89	147.0 X 29.5	1/16	190.0 X 54.0	⊙	⊙	⊙	⊙	⊙	⊙	DIL	END
TC404B			5.20 X 14.58	244.0 X 68.0		280.0 X 88.0	–	–	⊙	⊙	⊙	⊙	SIL	END

* Dual Color (Red/Green) LED Backlight

⊙ : Available / – : Unavailable

LCDM Part Number and Ordering Information

XX XXXX X - X X X X - XX

SERIES IDENTIFIER

Type	Code
Character	TC
Graphic	TG

DISPLAY FORMAT

Char/Line	Code
8	08
12	12
16	16
20	20
24	24
32	32
40	40
80	80

Char Lines	Code
1	1
2	2
4	4

Config.
A-Z (No I/O)

HEADERS/CUSTOM DESIGN

Header Type (PCB Back)	Code #
St. Box Header	SB
Rt. Angle Box Header	RB
St Pin Header	SP
Rt. Angle Pin Header	RP
St Socket	SS
Rt. Angle Socket	RS
Custom Designs	01-99

Use code only if needed, otherwise leave blank

VIEWING ANGLE/TEMP. RANGE

Operating Temperature	Viewing angle	Code
Normal 0 - 50°C (STN or TN)	6H - Bottom	B
	12H - Top	T
Extended -20 - 70°C (STN or TN)	6H - Under	U
	12H - Above	A

LCD TYPE/COLOR

Type	Background	Character	Code
TN	Grey	Black	T
	Black	Back Lite Color	E*
STN	Yellow	Dk. Blue	S
	Blue	Back Lite Color	B*
	Gray	Dk. Blue	G

* Negative Image Only

IMAGE MODE/POLARIZER

Image	Polarizer	Code
Positive Image	Reflective	R
	Transflective	F
	Transmissive	P
Negative Image	Transmissive	N*

* Can only be used with STN code B or TN code E

BACK LIGHT/COLOR

Type		Color	Code
None		- - -	N
EL		Blue/Green	B
		White	W
LED	SMT	Yellow/Green	Y
	EDGE	Yellow/Green	L
	SMT	Red	R
Fluorescent		White	F

Handling Instructions

Safety
- If the LCD panel breaks, do not allow the liquid crystal to get in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately with soap and water.

Handling
- Keep static electricity away from the CMOS LSI. (LCD module)
- Since the LCD panel is made of plate glass, do not apply mechanical shocks or press hard on it.
- The polarizer on the font of the display is easily scratched. Handle with care.
- Do not remove the panel or frame from the liquid crystal display module. (LCD module)
- Do not soil or damage LCD panel terminals.
- Keep the display surface clean. Do not touch it with your skin.

Storage
- Store in a dark place at 25°C ± 10°C and 65% RH maximum.
- Do not store where there are organic solvents or corrosive gases.
- Do not crush, vibrate or jolt the module or its components.

Cleaning the Panel
- Do not wipe with a dry cloth, as it may scratch the polarizer.
- Wipe gently with a soft cloth soaked in a petroleum benzine.
- Do not use ketone (methylethyl ketone acetone) or aromatic (toluene, xylene) solvents, as they dissolve or damage the polarizer.

Installation
- Use a grounded soldering iron when soldering module connectors or terminals.
- The assembler should be properly grounded and observe anti-static assembly procedures.
- Never route EL lamp leads across ICs or PC board.

Operation
- Never install or disconnect the module assembly while power is on.
- Never disconnect the EL lamp from the inverter while power is on.
- Always operate modules within the prescribed temperature limits. Lower temperatures will cause the blinking speed to decrease while higher temperatures will cause the entire display face to turn black.
- Adjust voltage (Vo) to obtain optimum display contrast.

OKAYA

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