Data sheet	
status	Product specification
date of issue	July 1990

LTN211
Liquid crystal display

T-41-39

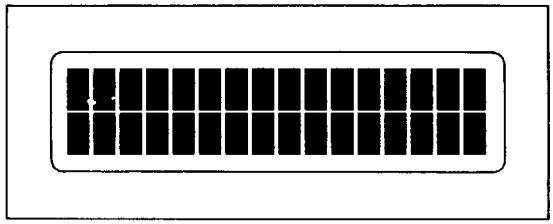
MODULE DESCRIPTION

The LTN211 is a 5 x 7 dot, 16-character, 2-line dot matrix LCD module, with driver and controller LSI IC mounted on a single printed circuit board. The LSI controller incorporates a ROM-based character generator with a 160 characters and RAM display data with 8 characters. The module is capable of generating 160 fixed and 8 write by programme characters. The LTN211 operates from an extensive instruction set: display clear, cursor home, display ON/OFF, cursor ON/OFF, character blink, cursor shift and display shift.

QUICK REFERENCE DATA

Outline dimensions	84 x 44 x 12 mm
Viewing area	61.0 x 15.8 mm
Character format	5 x 7 dots and cursor
Character size	2.96 x 5.56 mm
Dot size (spacing 0.04 mm)	0.56 x 0.66 mm
Mass	≈ 25 g
Drive method	MUX 1:16
Supply voltage	+5 V
Power consumption	7.5 mW
Illumination mode	reflective/transflective
Front surface	glossy
Character generator	built in
Data interface	parallel 4 or 8 bits

DISPLAY MODE



7Z22324

Fig.1 16-character, 2-line LCD module.

TYPE DEPENDENT DATA

TYPE	ILLUMINATION MODE	VIEWING DIRECTION	TO BE USED WITH EL BACKLIGHT
LTN211R-10	reflective	6 o'clock	-
LTN211F-10	transflective	6 o'clock	LXL211-G
LTN211R-50	reflective	12 o'clock	-
LTN211F-50	transflective	12 o'clock	LXL211-G

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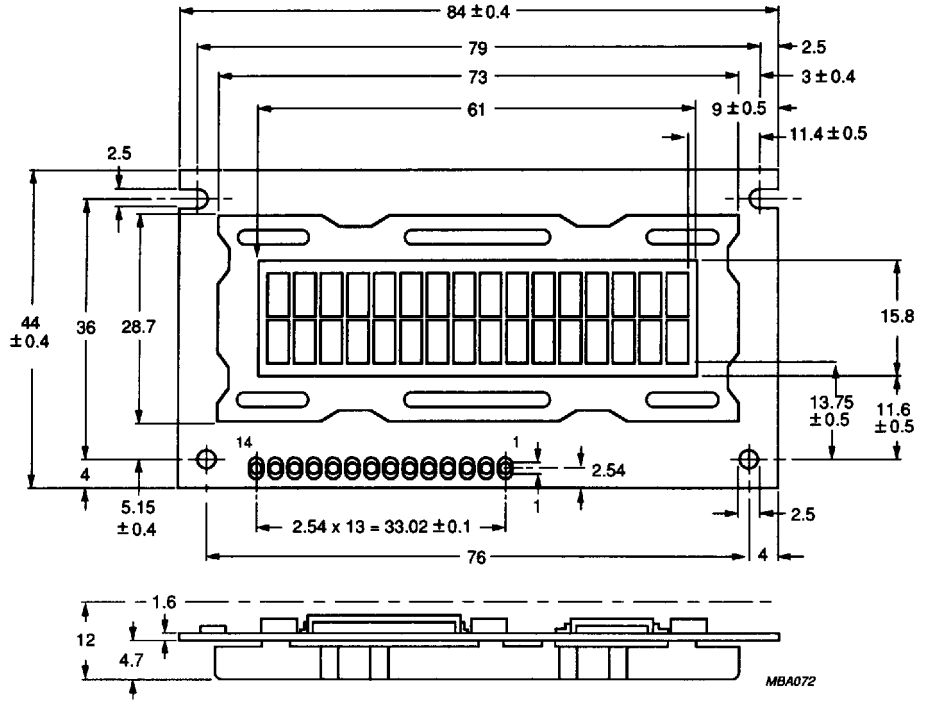
MECHANICAL DATA



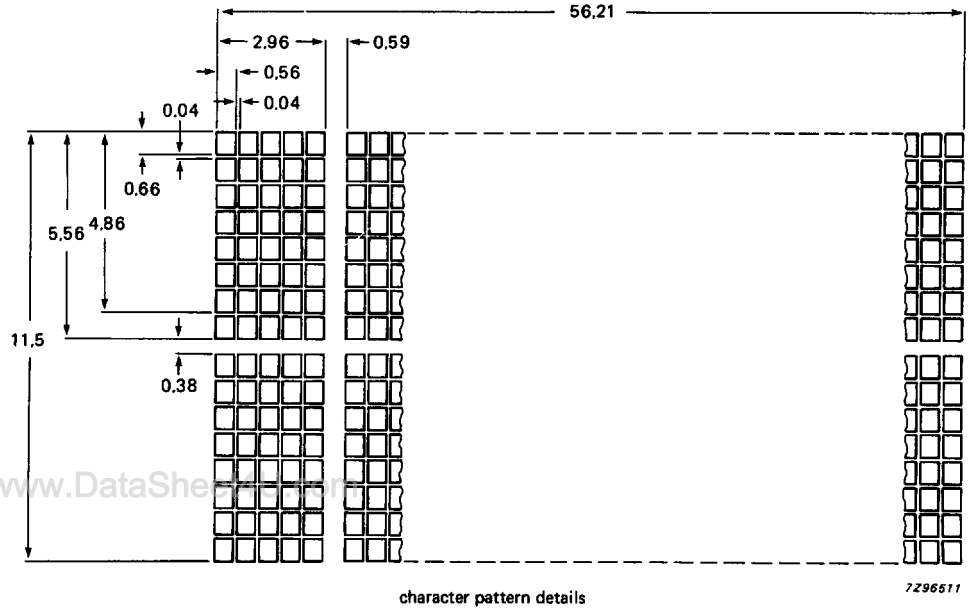


Fig.2 Outline dimensions.

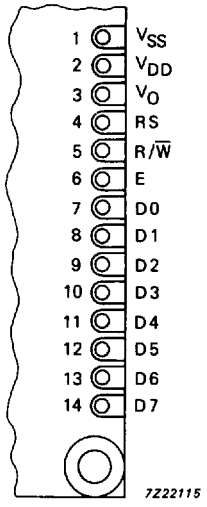


Fig.3 Pin configuration.

PIN DESCRIPTION

PIN NO.	SYMBOL	NAME AND FUNCTION
1	V_{SS}	ground
2	V_{DD}	power supply (logic)
3	V_O	contrast adjustment voltage
4	RS	register select
5	R/W	read/write
6	E	enable
7	D0	I/O data LSB
8	D1	I/O data 2nd bit
9	D2	I/O data 3rd bit
10	D3	I/O data 4th bit
11	D4	I/O data 5th bit
12	D5	I/O data 6th bit
13	D6	I/O data 7th bit
14	D7	I/O data MSB

Notes to pin description

1. Contrast is adjusted by varying the voltage V_O between 0 and 5 V.
2. D7 doubles as busy flag.
3. When the module is interfaced with a microprocessor with 4-bit parallel outputs, pins D0 to D3 are not used.

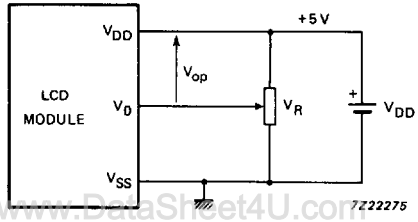


Fig.4 Power supply.

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RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage	V_{DD}	−0.3	–	7.0	V
LCD drive voltage (V_{DD}-V_O)	V_{op}	0	–	9.0	V
Input voltage	V_I	−0.3	–	V_{DD}+0.3	V
Storage temperature	T_{stg}	−25	–	+70	°C
Operating ambient temperature	T_{amb}	0	–	+50	°C

OPERATING CHARACTERISTICS

T_{amb} = 25 °C; V_{DD} = 5 V; all voltages refer to V_{SS}; unless otherwise specified

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage (logic)	V_{DD}-V_{SS}	4.75	5.0	5.25	V
Contrast adjustment voltage	V_O	–	0.6	–	V
Temperature compensation of V_O	TC	–	−14	–	mV/°C
LOW level input voltage	V_{IL}	−0.3	–	0.6	V
HIGH level input voltage	V_{IH}	2.2	–	V_{DD}	V
LOW level output voltage -I_{OL} = 1.2 mA	V_{OL}	–	–	0.4	V
HIGH level output voltage -I_{OH} = 0.205 mA	V_{OH}	2.4	–	–	V
Input leakage current	I_I	–	–	1.0	µA
Internal oscillating frequency	f_{OSC}	–	250	–	kHz
Supply current (logic)	I_{DD}	–	1.5	2.2	mA
Power dissipation	P_d	–	7.5	11.0	mW

TIMING CHARACTERISTICS

T_{amb} = 0 to 50 °C, V_{DD} = 5 V +/− 5%, unless otherwise specified.

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Enable cycle time	t_{cyc}	1000	–	–	ns
Enable pulse width	t_W	450	–	–	ns
Rise time	t_r	–	–	25	ns
Fall time	t_f	–	–	25	ns
Register select set-up time	t_{rsu}	140	–	–	ns
Read and write set-up time	t_{su}	140	–	–	ns
Data set-up time	t_{dsu}	195	–	–	ns
Data delay time	t_d	–	–	320	ns
Address hold time	t_{AH}	10	–	–	ns
Data hold time write	t_{WH}	10	–	–	ns
Data hold time read	t_{RH}	20	–	–	ns

ELECTRO-OPTICAL CHARACTERISTICS

T_{amb} = 25 °C, $V_{DD} = V_{DD\ typ}$, α = 10°, $\phi = \phi_{opt}$. unless otherwise specified

PARAMETER	SYMBOL	CONDITIONS	TYP.	MAX.	UNIT
Response times	t_{on}	T_{amb} = 0 °C	380	760	ms
		T_{amb} = 25 °C	110	220	ms
		T_{amb} = 50 °C	45	90	ms
	t_{off}	T_{amb} = 0 °C	470	940	ms
		T_{amb} = 25 °C	110	220	ms
		T_{amb} = 50 °C	45	90	ms
Viewing Angles (contrast ratio CR > 3)	α_{opt}	reflective types	30	–	o
	α_2-α_1		30	–	o
	α_{opt}	transflective types	30	–	o
	α_2-α_1	reflective operation	25	–	o
	$\alpha_o$pt	transflective types	30	–	o
	α_2-α_1	transmissive operation	20	–	o

For definitions of response times, viewing angles and contrast ratio refer to notes 1 to 3

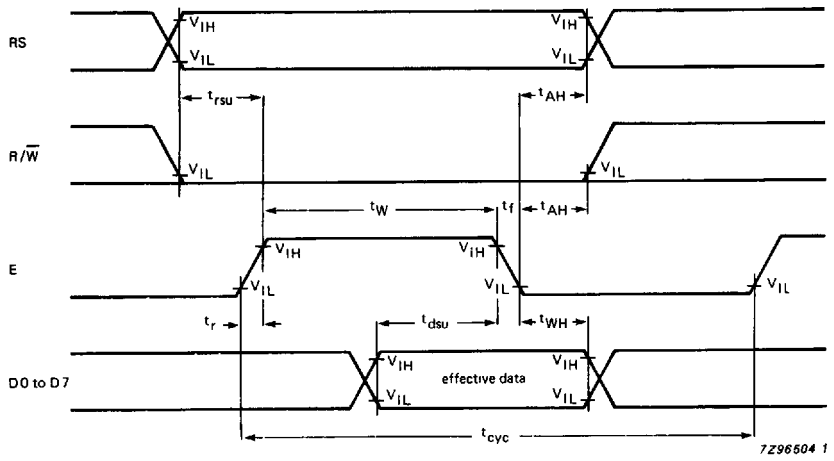

Fig.5 Timing waveforms (write operation).

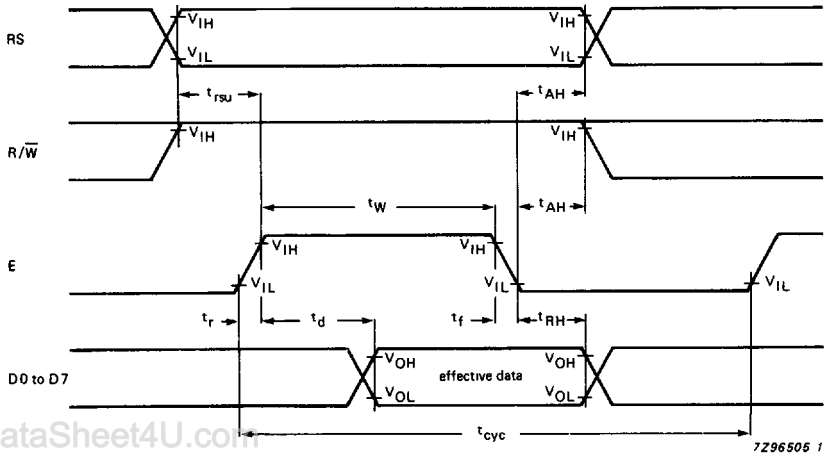

Fig.6 Timing waveforms (read operation).

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Table 1 Instruction set

INSTRUCTION \ ADDRESSES	RS	R/W	D7	D6	D5	D4	D3	D2	D1	D0
Display clear	0	0	0	0	0	0	0	0	0	1
Cursor home	0	0	0	0	0	0	0	0	1	*
Entry mode set	0	0	0	0	0	0	0	1	I/D	S
Display on/off control	0	0	0	0	0	0	1	D	C	B
Cursor display shift	0	0	0	0	0	1	S/C	R/L	*	*
Function set	0	0	0	0	1	DL	1	0	*	*
CG RAM address set	0	0	0	1	A_{CG}					
DD RAM address set	0	0	1	A_{DD}						
Busy flag/address read	0	1	BF	AC						
CG RAM/DD RAM data write	1	0	write data							
CG RAM/DD RAM data read	1	1	read data							

Notes:

I/D	= 1:increment	I/D	= 0:decrement
S	= 1:display shift	S	= 0:display freeze
D	= 1:display on	D	= 0:display off
C	= 1:cursor on	C	= 0:cursor off
B	= 1:character at cursor position blinks	B	= 0:character at cursor position does not blink
S/C	= 1:display shift	S/C	= 0:cursor move
R/L	= 1:right shift	R/L	= 0:left shift
DL	= 1:8 bits	DL	= 0:4 bits
BF	= 1:during internal operation	BF	= 0:end of internal operation

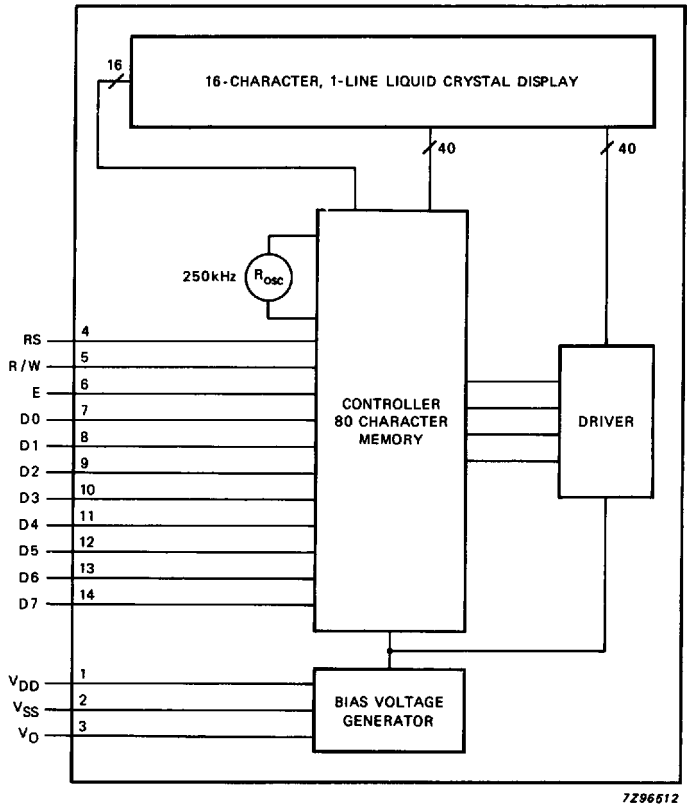
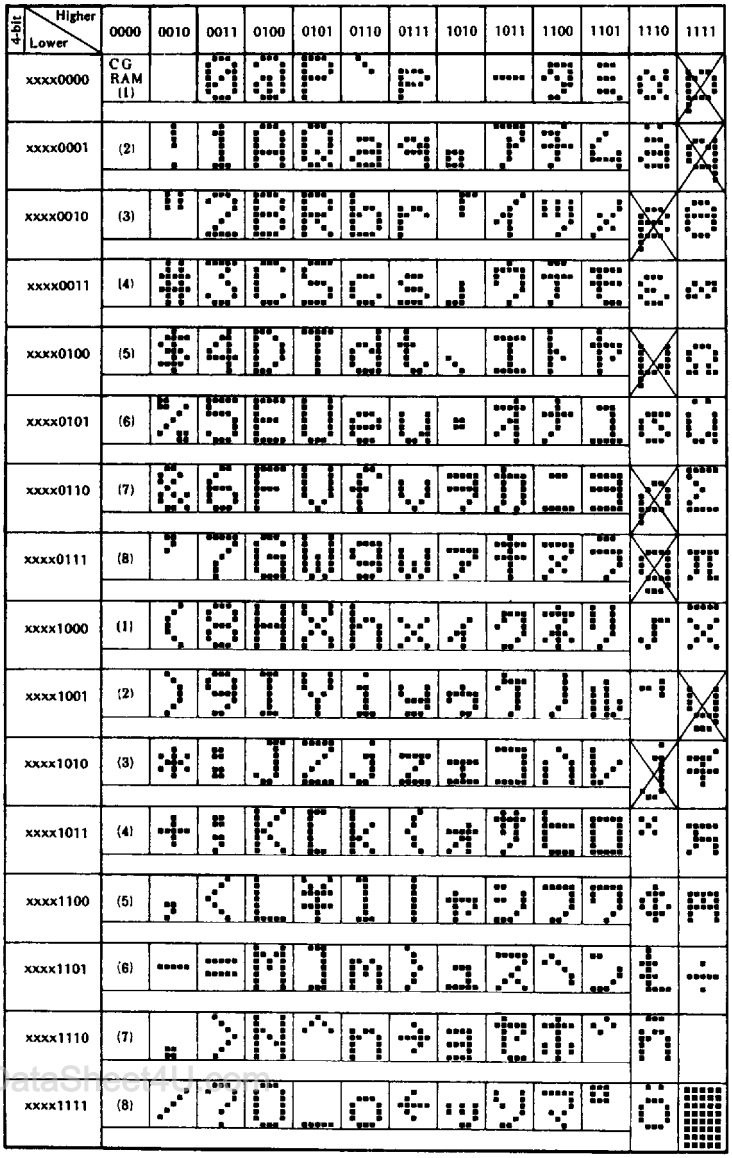


Fig.7 Functional block diagram.

Table 2 Display position and DD RAM address (HEX)

Digit	1	2	3	4	5	6	7	8	9		16
Line 1	00_H	01_H	02_H	03_H	04_H	05_H	06_H	07_H	08_H	.....	$0F_H$
Line 2	40_H	41_H	42_H	43_H	44_H	45_H	46_H	47_H	48_H	.....	$4F_H$

Table 3 Input codes vs character pattern



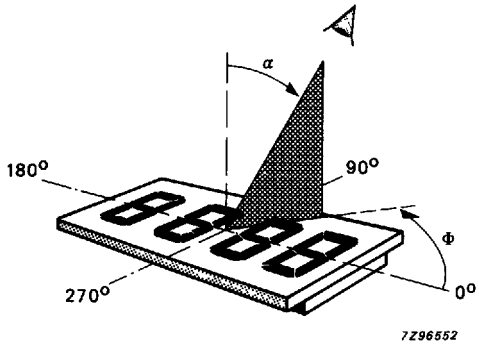
Note 1 Definition of contrast ratio (C_R).

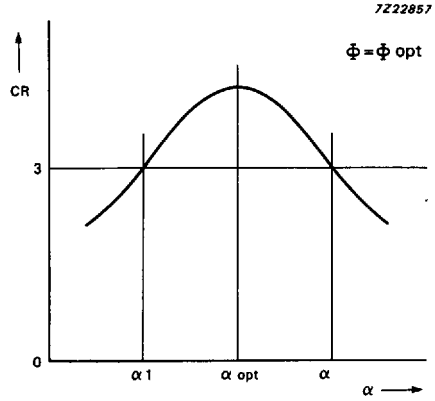
$$\text{in positive image mode: } CR = \frac{B_{off}}{B_{on}}$$

$$\text{in negative image mode: } CR = \frac{B_{on}}{B_{off}}$$

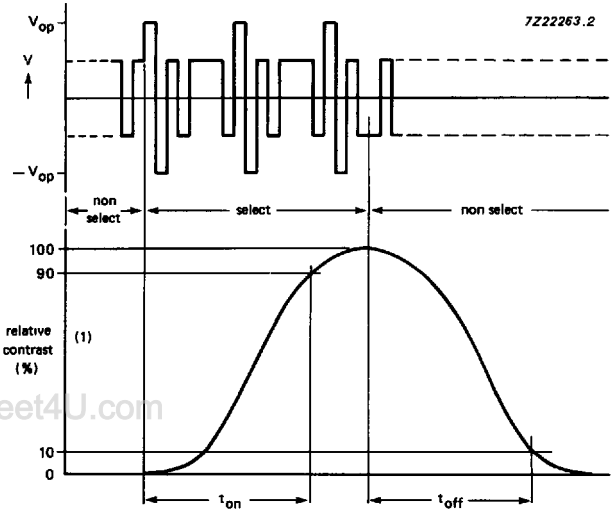
B_{on} is the brightness of selected segments
B_{off} is the brightness of non-selected segments

Note 2 Definition of viewing angles α and ϕ.





Note 3 Definition of response times.



1) measured at $\alpha = 10°$