

DISTINCTIVE CHARACTERISTICS

Enhanced LED Illumination with:

- Broad and even light distribution
- Consistent bright backlighting
- Lower energy consumption

Programmable to display graphics, alphanumeric characters and animated sequences.

SMARTDISPLAY can be used alone or in conjunction with electromechanical switches.

Integrated liquid crystal display provides wide viewing angle with high contrast and clarity.

Viewing area 13.9mm x 10.6mm (horizontal x vertical) at 36 x 24 pixels.

Epoxy sealed terminals prevent entry of solder flux and other contaminants.

Optional accessories available to enhance panel design and simplify production process.

Built-in red/green LED backlighting enhances display and enables multifunctional uses.



PRECAUTIONS FOR HANDLING & STORAGE



Handling

- The VLC voltage should not be applied before logic voltage. If VLC voltage is present before logic voltage, it may cause the driver logic to freeze and damage the LCD, and the driver logic itself may become damaged.
- 2. The IS Series devices are electrostatic sensitive.
- 3. Recommended soldering time and temperature limits are 5 seconds maximum @ 270°C maximum.
- 4. Do not exceed 60°C at the LCD level.
- 5. The IS series devices are not process sealed.
- 6. If the LCD is accidentally broken, avoid contact with the liquid and wash off any liquid spills to the skin or clothing.
- 7. Clean cap surface with dry cloth. If further cleaning is needed, wipe with dampened cloth using neutral cleanser and dry with clean cloth. Do not use organic solvent.

Storage

- 1. Store away from direct sunlight.
- 2. Keep away from static electricity.
- 3. Avoid extreme temperatures, high humidity, gaseous substances, and all forms of chemical contamination.

SMARTDISPLAYTM



LCD SPECIFICATIONS

Characteristics of Display

Display Operation Mode	STN positive
Display Condition	Transflective with built-in LED backlight
Viewing Angle	Adjustable
Driving Method	1/24 duty. 1/5 bias (built-in driving circuit)
Viewing Area	13.9mm x 10.6mm (horizontal x vertical)
Pixel Format	36 x 24 dots (horizonal x vertical)
Pixel Size	0.32mm x 0.32mm (horizontal x vertical)
Operating Temperature Range	0°C through 40°C (32°F through 104°F)
Storage Temperature Range	-10°C through 60°C (14°F through 140°F)
Backlight LED	Red/Green



Red/Green Bicolor LED with Yellow LCD Mode

Absolute Maximum Ratings (Temperature at 25°C)

Items	Symbols	Ratings
Supply Voltage for Logics	V_{DD}	-0.3V to $+7.0V$
Supply Voltage for LCD	V_{LC}	-0.3V to $+12.0V$
Input Voltage	V_{l}	$-0.3V$ to $V_{DD} + 0.3V$
Output Voltage	Vo	$-0.3V$ to V_{DD} +0.3V

Recommended Operating Conditions (Temperature at 25°C)

Items	Symbols	Minimum	Typical	Maximum
Supply Voltage for Logics	V_{DD}	4.5V	5.0V	5.5V
Supply Voltage LCD	V_{LC}		7.3V	
Input Voltage	V_{l}	0V	_	V_{DD}
Driving Frequency	f _{FLM}		1 <i>5</i> 0Hz	_

DC Characteristics of LCD Drive IC (Temperature at 0°C to 40°C and V_{DD} = 5.0V ±10%)

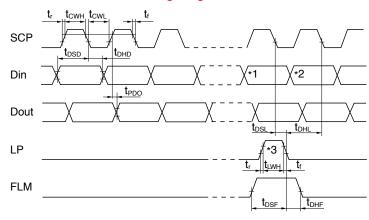
Items	Symbols	Test Conditions	Minimum	Typical	Maximum	Unit
High Level Input Voltage	V _{IH}		0.7V _{DD}		V _{DD}	٧
Low Level Input Voltage	V _{IL}		0		0.3 V _{DD}	٧
High Level Input Leakage Current	I _{LIH}	$V_I = V_{DD}$			10	μA
Low Level Input Leakage Current	I _{IIL}	V ₁ = 0 V			-10	μA
High Level Output Voltage	V _{OH}	I _{OH} = -500μA	V _{DD} -0.5			٧
Low Level Output Voltage	V _{OL}	I _{OL} = 500μA			0.5	٧
High Level Output Leakage Current	I _{LOH}	$V_O = V_{DD}$			10	μA
Low Level Output Leakage Current	I _{LOL}	V ₀ = 0 V			-10	μA
Supply Current	I _{DD}	$f_{SCP} = 1.0MHz$			500	μA
LCD Drive Current	I _{LC}	$f_{LP} = 2.4 \text{kHz} \ V_{LC} = 7.3$	3V	500	2,000	μA

Timing Characteristics of LCD Drive IC

(Temperature at 0°C to 40°C and V_{DD} = 5.0V ±10%)

Items	Symbols	Minimum	Maximum		
Clock Operation Frequency	$f_{\sf SCP}$		6.0MHz		
Latch Pulse Frequency	f_{LP}		50kHz		
Clock High Level Pulse Width	t _{cwh}	70ns			
Clock Low Level Pulse Width	t_{CWL}	70ns			
Data Setup Time	t _{DSD}	45ns			
Data Hold Time	t _{DHD}	50ns			
Data Output Delay Time	t _{PDO}		25ns		
Latch Setup Time	t _{DSL}	50ns			
Latch Hold Time	t _{DHL}	50ns			
Latch High Level Width	t _{LWH}	200ns			
FLM Setup Time	† _{DSF}	50ns			
FLM Hold Time	t _{DHF}	50ns			
SCP, LP Rise/Fall Time	t _r /t _f		15ns		

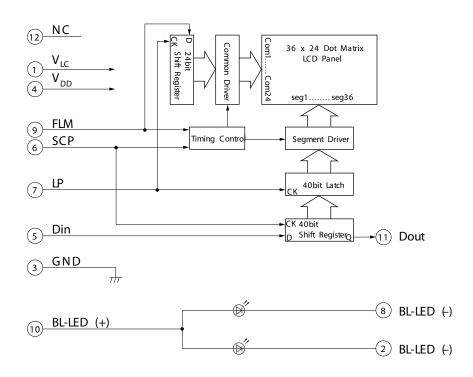
Timing Diagram



- *1 Last data on first line
- *2 Beginning data on second line
- *3 Location of LP signal on first line



BLOCK DIAGRAM & PIN CONFIGURATIONS



Pin No.	<u>Symbol</u>	<u>Name</u>	<u>Function</u>
1	V_{LC}	Power	Power source for LCD drive
2	BL-LED (-)	Terminal of Backlight LED	Cathode: green
3	GND	Ground	
4	$V_{\scriptscriptstyle DD}$	Power	Power source for logic circuit
(5)	Din	Data Input	Display serial data bit. Note: to map the display data, because of the difference between the number of internal shift register data (40) and the single line of LCD pixels (36), the first four bits of data shifted will be dummy bits.
6	SCP	Serial Clock Pulse	Clock used by 40-bit internal shift register of the switch, shifting the display data bit presented at Din at falling edge.
7	LP	Latch Pulse	Line data latch pulse will latch content of internal 40-bit shift register at falling edge for one line of display. LP will also increment the display line by one.
8	BL-LED (-)	Terminal of Backlight LED	Cathode: red
9	FLM	First Line Marker	The marking signal for the first line data of LCD display. The first line of LCD will be selected by the falling edge of LP signal during the high level (FLM).
10	BL-LED (+)	Terminal of Backlight LED	Anode for common
\bigcirc	Dout	Data Output	Display serial output. Can be used to connect to Din of the next SMARTDISPLAY. As a result, many SMARTDISPLAYS can be controlled with one clock and data signal.
12	NC	None	No connection



SUPER BRIGHT LED SPECIFICATIONS

Typical Electrical Characteristics (Temperature at 25°C)

Backlight Color	Symbols	Red/Green	Unit	
Forward Current	I _F	15/15	mA	
Forward Voltage	V_{F}	2.1/3.3	٧	

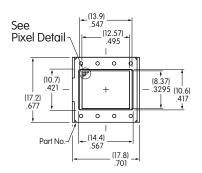
ABSOLUTE MAXIMUM FOR LEDS

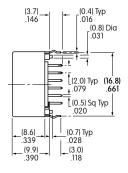
Electrical Characteristics (Temperature at 25°C)

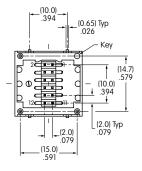
Symbols	Red/Green	Unit
I _F	20	mA
V_R	4.0	٧
$\Delta I_{F}(DC)$	-0.26	mA/°C
P_D	130 maximum	mW
	I _F	$\begin{array}{cccccccccccccccccccccccccccccccccccc$

^{*}For uniform light emission, Power Dissipation should not exceed the Absolute Maximum Rating.

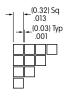
TYPICAL DISPLAY DIMENSIONS



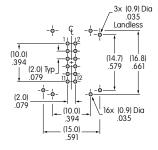




Terminal numbers are not on the device.



Pixel Detail



Footprint

AMEYA360 Components Supply Platform

Authorized Distribution Brand:

























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