

DISTINCTIVE CHARACTERISTICS

- Programmable display graphics for alphanumeric characters and animated sequences
- 64 colors of backlighting can be controlled dynamically
- Pushbutton switches or display with LCD, RGB LED backlighting
- General brightness of backlight is dynamically controlled in eight steps from dark to bright
- Operated by commands and data supplied via serial communications (SPI)
- Incorporates bitmap display function
- Dual image VRAM for quick change of displayed images
- Travel options: Standard travel of 1.8mm, or long travel of 4.5mm (same as KP01 Series)
- Low energy consumption
- Dust tight construction

Viewing areas:

Switches - 17.0mm x 13.0mm (horizontal x vertical)

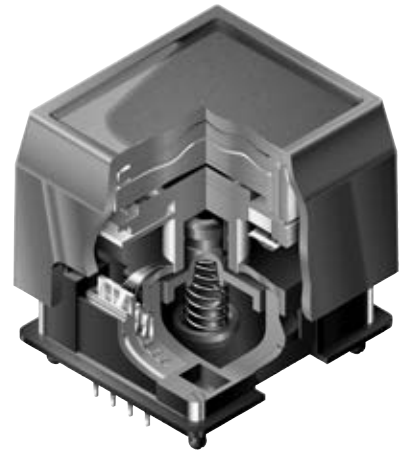
Display - 14.4mm x 11.8mm

High reliability and long life of one million (short travel) or three million (long travel) actuations

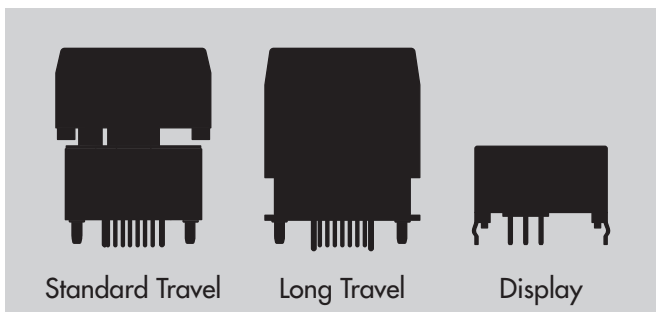
High resolution of 64 x 32 pixels

Epoxy sealed straight PC terminals

Snap-in standoff legs on the switches, or display's bracket with crimped legs, ensure secure mounting and alignment and prevent dislodging during wave soldering.



Actual Sizes of Switches & Display



Standard Travel

Long Travel

Display

DISPLAY PART NUMBER & DESCRIPTION

Part Number	Terminals	LCD Mode	LED Color
IS01EBFRGB	Straight PC	Black & White FSTN Positive	Red/Green/Blue

LCD SPECIFICATIONS

Characteristics of Display

Display Operation Mode	FSTN positive; background colors, black & white
Display Condition	Transflective with built-in LED backlight
Viewing Angle Direction	6 o'clock
Viewing Area	14.4mm x 11.8mm (horizontal x vertical)
Pixel Format	64 x 32 pixels (horizontal x vertical)
Pixel Size	0.200mm x 0.285mm (horizontal x vertical)
* Operating Temperature Range	-15°C ~ +50°C (+5°F ~ +122°F)
Storage Temperature Range	-20°C ~ +60°C (-4°F ~ +140°F)
Backlight LED	RGB: red/green/blue

* In a low temperature environment (below 0°C), speed and contrast decrease when image changes. The non-indicator dot may become dense in a high temperature environment (about +50°C). Highest backlight brightness level should not be used for temperatures above +35°C.

Recommended Operating Conditions (Temperature at 25°C)

Items	Symbols	Minimum	Typical	Maximum
Supply Voltage	V_{DD}	4.9V	5.0V	5.1V
High Level Input Voltage	V_{IH}	0.8 V_{DD}	—	—
Low Level Input Voltage	V_{IL}	—	—	0.2 V_{DD}
SPI Clock Frequency	f_{SCK}	—	—	8MHz
Current Consumption	I_{DD}	** 10mA	—	*** 60mA

** 10mA: Backlighting LED is off

*** 60mA: Backlighting LEDs (Red, Green, Blue) are maximum brightness

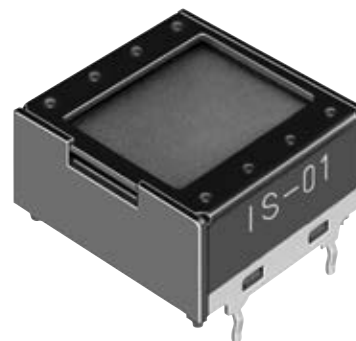
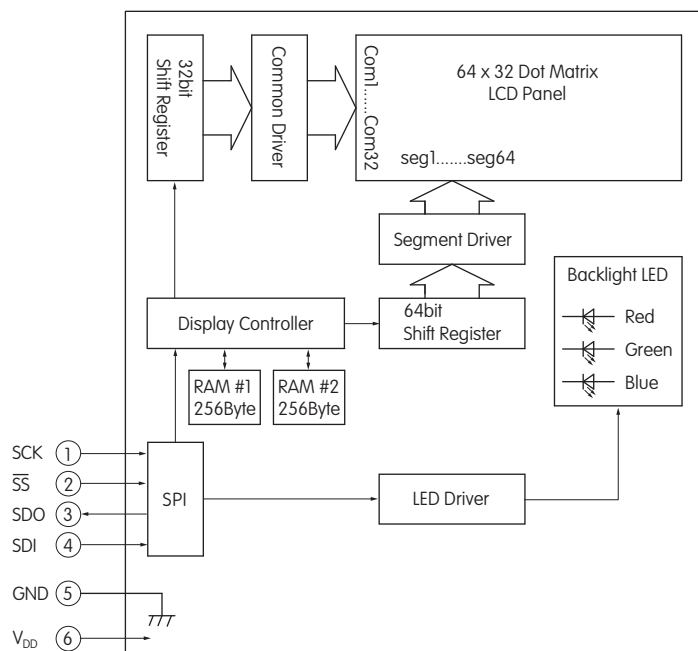
Absolute Maximum Ratings (Temperature at 25°C)

Items	Symbols	Ratings
Supply Voltage	V_{DD}	-0.3V to +7.0V
Input Voltage	V_I	-0.3V to $V_{DD} + 0.3V$
Output Voltage	V_O	-0.3V to $V_{DD} + 0.3V$

Optical Characteristics (Temperature at 25°C)

Items	Symbols	Minimum	Typical	Maximum
Contrast Ratio	Cr	—	3.0	—
Viewing Angle (Cr ≥ 1.1)	Up & Down	—	90°	—
	Right & Left	—	90°	—

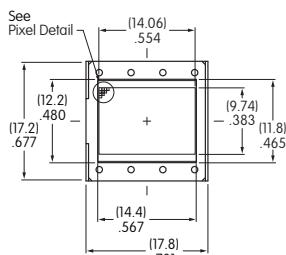
DISPLAY BLOCK DIAGRAM & PIN CONFIGURATIONS



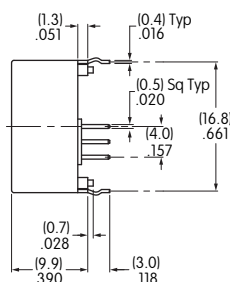
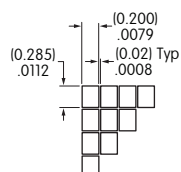
ISO1EBFRGB
RGB LED Backlight
Black and White LCD

Pin No.	Symbol	Name	Function
①	SCK	Serial Clock	Clock line for SPI that synchronizes commands and data
②	$\overline{SS}$	Slave Select	Chip select for SPI; line is active low
③	SDO	Data Out	Data output line for SPI
④	SDI	Data In	Data input line for SPI
⑤	GND	Ground	
⑥	V _{DD}	Power	Power source for logic circuit and LCD

TYPICAL DISPLAY DIMENSIONS

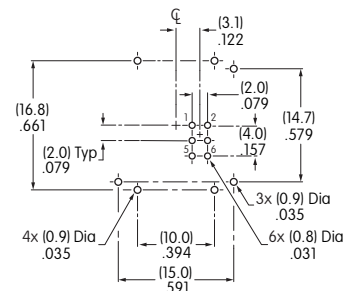
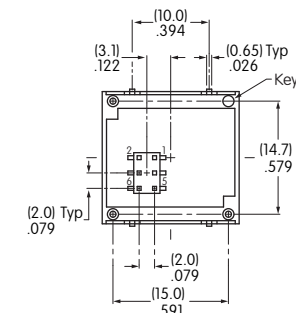


Pixel Detail



Footprint

Terminal numbers are not on the device.

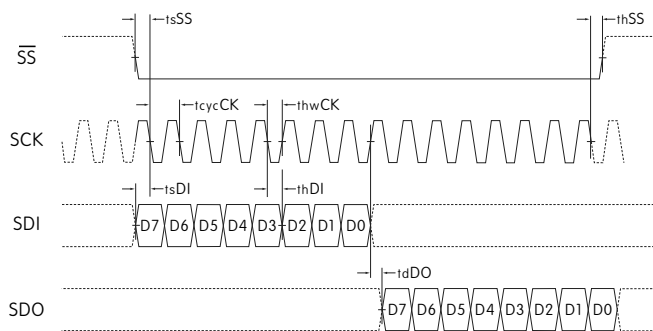


TIMING SPECIFICATIONS FOR SWITCHES & DISPLAY

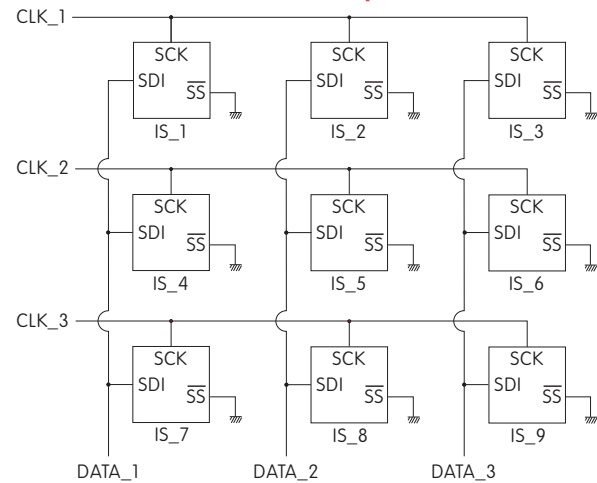
SPI Characteristics (See Timing Diagram)

(Temperature at $-15^{\circ}\text{C} \sim +50^{\circ}\text{C}$ and $V_{\text{DD}} = 5.0\text{V} \pm 2\%$)

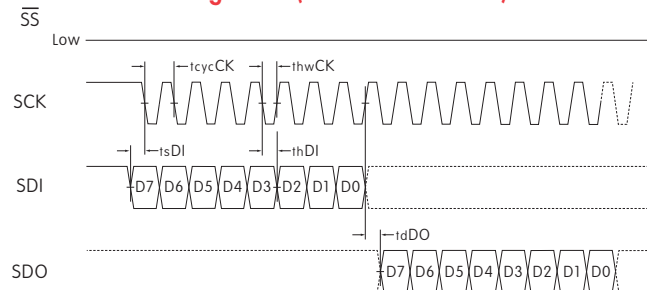
Items	Symbols	Minimum	Maximum
SPI $\overline{\text{SS}}$ Set Up Time	t_{SS}	10ns	
SPI $\overline{\text{SS}}$ Hold Time	t_{HSS}	10ns	
SPI_CLK Cycle	t_{CYCCK}		8MHz
SPI_CLK Width	t_{HWCK}	10ns	
SPI_DI Set Up Time	t_{SDI}	10ns	
SPI_DI Hold Time	t_{HDI}	10ns	
SPI_DO Delay Time	t_{DDO}	10ns	

SPI Timing Chart ($\overline{\text{SS}}$ Using)

Circuit Example



It is recommended that all $\overline{\text{SS}}$ pins be connected to a controller pin instead of ground. A clock glitch during power up could cause the communication to fall out of sync. Toggling the $\overline{\text{SS}}$ line resets the communication.

SPI Timing Chart ($\overline{\text{SS}}$ Low Level Fixed)

SDI and SCK shall be kept high when idle.

BITMAP

	Segment																																								
Common	1	2	3	4	5	6	7	8	9	•	•	•	16	•	•	•	•	49	•	•	•	56	57	58	59	60	61	62	63	64											
COM1	Byte8								Byte7							• • • •							Byte2							Byte1											
	D0	D1	D2	D3	D4	D5	D6	D7	D0	•	•	•	D7	•	•	•	D0	•	•	•	D7	D0	D1	D2	D3	D4	D5	D6	D7												
	Byte16																Byte9																								
COM2	D0	D1	D2	D3	D4	D5	D6	D7																										D0	D1	D2	D3	D4	D5	D6	D7
•									•																					•											
•									•																					•											
•									•																					•											
COM32	Byte256								• • •							• • •							Byte249																		
	D0	D1	D2	D3	D4	D5	D6	D7																										D0	D1	D2	D3	D4	D5	D6	D7

Transferring Display Data/Displaying LCD Command and Data Sequence

Command	Data (256 Bytes)
0 x 55	Byte1 Byte2 ... Byte255 Byte256
0 1 0 1 0 1 0 1	D7 D6 D5 D4 D3 D2 D1 D0 D7 D6 ... D1 D0 D7 D6 D5 D4 D3 D2 D1 D0

Notes: Display RAM has two screen areas. The first area is for the display on current LCD; the second area is for the data to be displayed next. The screens are changed when the second area is fully stored.

COMMANDS & DATA

- Transferring display data/displaying on LCD: command (1 Byte) + data (256 Bytes)
- Others: command (1 Byte) + data (1 Byte)
- Commands can be accepted only when all bits coincide; otherwise, they are not acknowledged
- Additional commands will not be received until the communication of commands (1 Byte) and data (256 or 1 Byte) is completed
- There is no time limit from the beginning to end of data receipt
- Commands may be executed consecutively (no need to wait between commands)
- Irregular commands or data are not recognized
- Initial status at power activation: LCD display off, LED off (brightness 1/20, color off)

Transferring Display Data/Displaying on LCD

Command		Data	Remarks
Hex	Binary		
0 x 55	01010101	256 Bytes (64 x 32 = 2,048 bits)	See above for details of bitmap data

LED (Backlight) Color Set

Command		Data	Remarks
Hex	Binary		
0 x 40	01000000	R R G G B B 1 1 2 bits x 3	For each of RGB: 00 = off 10 = 1/2 01 = 1/4 11 = full

LED (Backlight) Brightness Set

Command		Data	Remarks
Hex	Binary		
0 x 41	01000001	* * * 1 1 1 1 1 3 bits	For leading 3bits: 000 = 1/20 (dark) 100 = 1/3 001 = 1/10 101 = 1/2 010 = 1/7 110 = 2/3 011 = 1/5 111 = full (bright)

Reset (Returning to Initial Status at Power Activation)

Command		Data	Remarks
Hex	Binary		
0 x 5E	01011110	00000011	Returning to initial status at power activation

