

Toggles

Rockers

Pushbuttons

Illuminated PB

Programmable
E

Keylocks

Rotaries

Slides

Tactiles

Tilt

Touch

Indicators

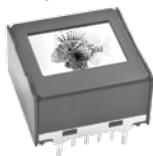
Accessories

Supplement



OLED Pushbutton.....E4

Switch with 64 x 48 Programmable Color Display
Video Capability; 180° Viewing Angle; High Contrast



OLED Display.....E7

52 x 36 Programmable Color Display
Video Capability; 180° Viewing Angle; High Contrast



OLED Rocker.....E11

Switch with 96 x 64 Programmable Display
White Monochrome OLED Display; 180° Viewing Angle; IP64



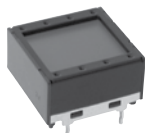
Wide View LCD 64 x 32 Pushbutton.....E17

Switch with Programmable Display; Short & Long Travel Options
RGB 64 Colors; Long Life LCD; up to 4 Lines with 10 Characters Each

← **NEW**

Wide View LCD 64 x 32 Display.....E22

Programmable Display
RGB 64 Colors; Long Life LCD; up to 4 Lines with 10 Characters Each



← **NEW**

Wide View Compact LCD 64 x 32 Pushbutton..E26

Switch with Programmable Display
RGB 64 Colors; Long Life LCD; up to 4 Lines with 10 Characters Each



← **NEW**

Wide View LCD 36 x 24 Pushbutton.....E31

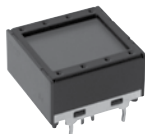
Switch with Programmable Display
RGB Backlight; Long Life LCD; up to 3 Lines with 6 Characters Each



← **NEW**

Wide View LCD 36 x 24 Display.....E35

Programmable Display
RGB Backlight; Long Life LCD; up to 3 Lines with 6 Characters Each



← **NEW**

Wide View Compact LCD 36 x 24 Pushbutton..E39

Switch with Programmable Display
RGB Backlight; Long Life LCD; up to 3 Lines with 6 Characters Each



← **NEW**



LCD 64 x 32 Pushbutton.....E44

* Switch with Programmable Display

RGB 64 Colors; Long Life LCD; up to 4 Lines with 10 Characters Each



LCD 64 x 32 Display.....E47

* Programmable Display

RGB 64 Colors; Long Life LCD; up to 4 Lines with 10 Characters Each



Compact LCD 64 x 32 Pushbutton.....E51

* Switch with Programmable Display; 28% Smaller than Standard Size

RGB 64 Colors; Long Life LCD; up to 4 Lines with 10 Characters Each



LCD 36 x 24 Pushbutton.....E56

* Switch with Programmable Display

Single, Bicolor or RGB Backlight; up to 3 Lines with 6 Characters Each



LCD 36 x 24 Display.....E63

* Programmable Display

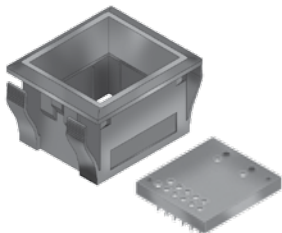
Single, Bicolor or RGB Backlight; up to 3 Lines with 6 Characters Each



Compact LCD 36 x 24 Pushbutton.....E69

* Switch with Programmable Display; 28% Smaller than Standard Size

Single, Bicolor or RGB Backlight; up to 3 Lines with 6 Characters Each



Accessories.....E74

Enhance Your Applications

Development Tools & Support

NKK provides numerous development tools to get any SmartSwitch project started easily. Please visit our web site or contact a sales representative.

* These switches and displays will be available until March 31, 2015.

DISTINCTIVE CHARACTERISTICS

- Organic LED technology
- Life 30,000 hours @ 100cd/m² (based on 40% pixels on) or 60,000 hours @ 50cd/m² (based on 40% pixels on)
- Power consumption only 3.8mA (30% less than previous product)
- Range of 65,536 colors in 16 bit mode, 256 colors in 8 bit mode
- Full viewing angle of 180°
- Exceptional contrast: 50 times greater than LCD products
- Four times more enhanced resolution
- High resolution provides sharp, clear images of very small characters
- Operated by commands and data supplied via serial communications (SPI)
- Distinct, long travel of 4.5mm (same as KP01 series pushbuttons)
- Dust tight construction
- Stylish, translucent black housing design

Viewing area: 15.5mm x 11.6mm (horizontal x vertical)

High reliability and long life of three million actuations minimum

High resolution of 64RGB x 48 pixels

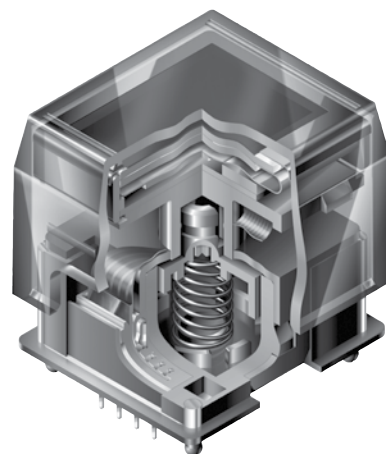
Epoxy sealed straight PC terminals

Snap-in standoff for easy, secure mounting and alignment

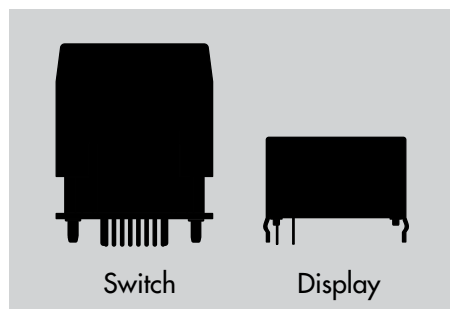
Viewing area: 12.9mm x 9.9mm (horizontal x vertical)

High resolution of 52RGB x 36 pixels

Bracket has crimped legs to ensure secure PC mounting and prevent dislodging during wave soldering



Actual Sizes



Switch

Display

SWITCH PART NUMBER & DESCRIPTION



Part Number	Switch Description	OLED	Pixel Format
ISC15ANP4	SPST, Momentary ON Gold Contacts Straight PC Terminals	Color OLED Display Module 65,536 Colors	64RGB x 48 Pixels Horizontal x Vertical

SWITCH SPECIFICATIONS

Circuit	SPST normally open
Contact Position	Leave actuator: ① – ② OFF Push actuator: ① – ② ON
Electrical Capacity (Resistive Load)	100mA @ 12V DC
Contact Resistance	200 milliohms maximum @ 20mV 10mA
Insulation Resistance	100 megohms minimum @ 100V DC
Dielectric Strength	125V AC for 1 minute minimum
Mechanical Endurance	3,000,000 operations minimum
Electrical Endurance	3,000,000 operations minimum
Operating Force	2.0 ± 0.5 Newtons
Total Travel	4.5mm (.177")

OLED SPECIFICATIONS

Characteristics of Display

Display Device	Color OLED display module
Display Mode	Passive matrix
Viewing Area	15.5mm x 11.6mm (horizontal x vertical)
Pixel Format	64RGB x 48 pixels (horizontal x vertical)
Pixel Size	0.21mm x 0.20mm (horizontal x vertical)
Interface	Serial (SPI) interface
Number of Colors	65,536 Colors (16bit: R 5bit/G 6bit/B 5bit) or 256 Colors (8bit: R 2bit/G 3bit/B 3bit)
Operating Temperature Range	-20°C ~ +70°C (-4°F ~ +158°F)
Storage Temperature Range	-30°C ~ +80°C (-22°F ~ +176°F)
Operating Life (Display)	30,000 hours @ 100cd/m ² (based on 40% pixels ON) 60,000 hours @ 50cd/m ² (based on 40% pixels ON)

Absolute Maximum Ratings

Items	Symbols	Ratings
Supply Voltage for Logic/Interface	V _{DD}	-0.3V to +4.0V
Supply Voltage for Drive	V _{CC}	-0.0V to +19.0V
Input Voltage	V _I	-0.3V to V _{DD} +0.3V

Current Consumption

(Temperature at 25°C, V_{DD} = 2.8V, V_{CC} = 16.0V)

Items	Symbols	Min	Typical	Max
All-Pixels-On Mode *Drive System Power Current	I _{CC1}	—	3.8mA	4.6mA
All-Pixels-On Mode *Logic/IF System Power Current	I _{DD1}	—	0.16mA	0.19mA
Sleep Mode **Drive System Power Current	I _{CC2}	—	—	10µA
Sleep Mode **Logic/IF System Power Current	I _{DD2}	—	—	10µA

* All pixels shall be turned on with the maximum level gray scale

** All pixels shall be turned off (while chip is operating)

Recommended Operating Conditions

Items	Symbols	Minimum	Typical	Maximum
Supply Voltage for Logic/Interface	V _{DD}	2.4V	2.8V	3.5V
Supply Voltage for Drive	V _{CC}	15.0V	16.0V	17.0V
Input High Level Voltage	V _{IH}	0.8 x V _{DD}	—	—
Input Low Level Voltage	V _{IL}	—	—	0.2 x V _{DD}

Optical Characteristics (Temperature at 25°C, Initial Value: 87 x 0F)

Items	Min	Typical	Max	Unit	Remarks
Luminosity	75	100	125	cd/m ²	White (All pixels on)
White Color Coordinate	(x)	0.26	0.30	0.34	—
	(y)	0.32	0.37	0.42	—
Red Color Coordinate	(x)	0.63	0.67	0.71	—
	(y)	0.29	0.33	0.37	—
Green Color Coordinate	(x)	0.19	0.23	0.27	—
	(y)	0.61	0.65	0.69	—
Blue Color Coordinate	(x)	0.10	0.14	0.18	—
	(y)	0.14	0.20	0.26	—
Contrast Ratio	100	—	—	—	—

Toggles



Pushbuttons

Programmable

Keylocks



DISPLAY PART NUMBER & DESCRIPTION



Part Number	Display Description	OLED	Pixel Format
ISC01P	Straight PC Terminals	Color OLED Display Module 65,536 Colors	52RGB x 36 Pixels Horizontal x Vertical

OLED SPECIFICATIONS

Characteristics of Display

Display Device	Color OLED display module
Display Mode	Passive matrix
Viewing Area	12.9mm x 9.9mm (horizontal x vertical)
Pixel Format	52RGB x 36 pixels (horizontal x vertical)
Pixel Size	0.21mm x 0.22mm (horizontal x vertical)
Interface	Serial (SPI) interface
Number of Colors	65,536 Colors (16bit: R 5bit/G 6bit/B 5bit) or 256 Colors (8bit: R 2bit/G 3bit/B 3bit)
Operating Temperature Range	-20°C ~ +70°C (-4°F ~ +158°F)
Storage Temperature Range	-30°C ~ +80°C (-22°F ~ +176°F)
Operating Life (Display)	30,000 hours @ 100cd/m ² (based on 40% pixels ON) 60,000 hours @ 50cd/m ² (based on 40% pixels ON)

Absolute Maximum Ratings

Items	Symbols	Ratings
Supply Voltage for Logic/Interface	V _{DD}	-0.3V to +4.0V
Supply Voltage for Drive	V _{CC}	0.0V to +19.0V
Input Voltage	V _I	-0.3V to V _{DD} +0.3V

Current Consumption

(Temperature at 25°C, V_{DD} = 2.8V, V_{CC} = 16.0V)

Items	Symbols	Min	Typical	Max
All-Pixels-On Mode *Drive System Power Current	I _{CC1}	—	2.4mA	2.9mA
All-Pixels-On Mode *Logic/IF System Power Current	I _{DD1}	—	0.15mA	0.18mA
Sleep Mode **Drive System Power Current	I _{CC2}	—	—	10μA
Sleep Mode **Logic/IF System Power Current	I _{DD2}	—	—	10μA

*All pixels shall be turned on with the maximum level gray scale

**All pixels shall be turned off (while chip is operating)

Recommended Operating Conditions

Items	Symbols	Minimum	Typical	Maximum
Supply Voltage for Logic/Interface	V _{DD}	2.4V	2.8V	3.5V
Supply Voltage for Drive	V _{CC}	15.0V	16.0V	17.0V
Input High Level Voltage	V _{IH}	0.8 x V _{DD}	—	—
Input Low Level Voltage	V _{IL}	—	—	0.2 x V _{DD}

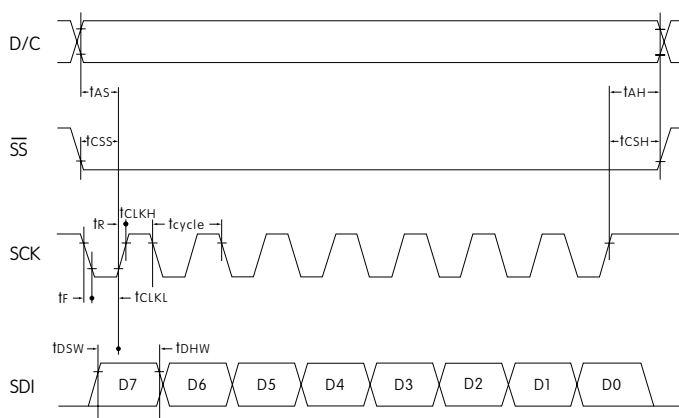
Optical Characteristics (Temperature at 25°C, Initial Value: 87 x 0F)

Items	Min	Typical	Max	Unit	Remarks
Luminosity	75	100	125	cd/m ²	White (All pixels on)
White Color Coordinate	(x)	0.25	0.29	0.33	—
	(y)	0.31	0.36	0.41	—
Red Color Coordinate	(x)	0.63	0.67	0.71	—
	(y)	0.29	0.33	0.37	—
Green Color Coordinate	(x)	0.19	0.23	0.27	—
	(y)	0.60	0.64	0.68	—
Blue Color Coordinate	(x)	0.10	0.14	0.18	—
	(y)	0.14	0.20	0.26	—
Contrast Ratio	100	—	—	—	—

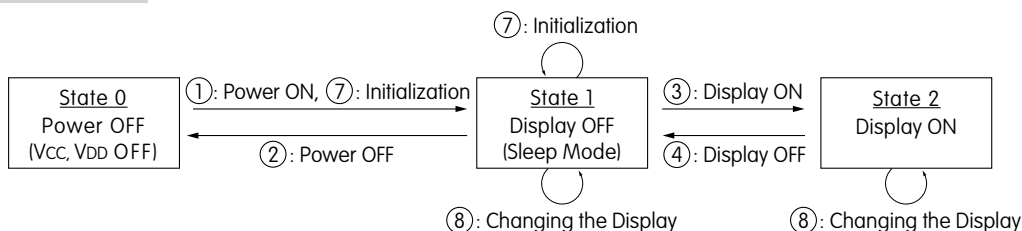
TIMING SPECIFICATIONS FOR SWITCH & DISPLAY

AC Characteristics (Temperature at 25°C), $V_{DD} = 2.4V \sim 3.5V$

Items	Symbols	Minimum	Typical	Maximum
Clock Cycle Time	t_{cycle}	150ns	—	—
D/C Setup Time	t_{AS}	40ns	—	—
D/C Hold Time	t_{AH}	40ns	—	—
$\overline{SS}$ Setup Time	t_{CSS}	75ns	—	—
$\overline{SS}$ Hold Time	t_{CSH}	60ns	—	—
Write Data Setup Time	t_{DSW}	40ns	—	—
Write Data Hold Time	t_{DHW}	40ns	—	—
SCK Low Time	t_{CLKL}	75ns	—	—
SCK High Time	t_{CLKH}	75ns	—	—
SCK Rise Time	t_R	—	—	15ns
SCK Fall Time	t_F	—	—	15ns



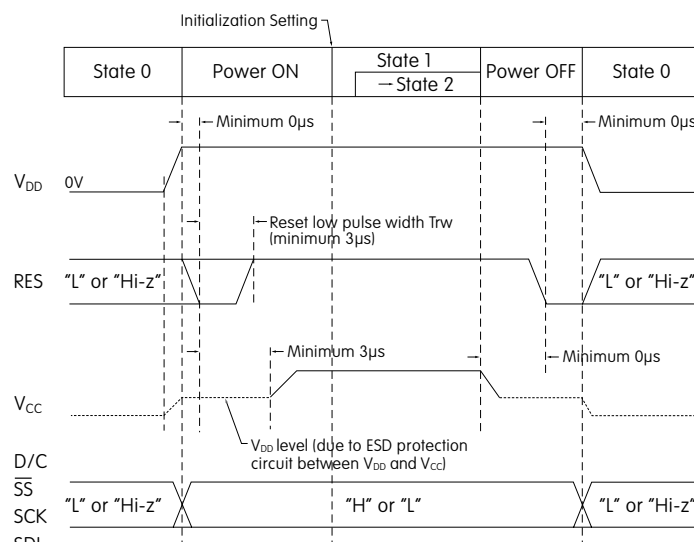
STATE TRANSITION



State Number	State	Display	Sleep	V_{CC}	V_{DD}	Changing the Display
0	Power OFF	OFF	—	OFF	OFF	Disable
1	Display OFF	OFF	ON	ON	ON	Enable
2	Display ON	ON	OFF	ON	ON	Enable

State Transition	Transition	Index
①	Power ON	Refer to "Power ON/OFF Sequence"
②	Power OFF	
③	Display ON	
④	Display OFF	
⑦	Initialization	Initialize Setting of Command/Data
⑧	Image Rewriting	Send Display Data
	Display Settings	Dimmer, Scroll, etc.

Power ON/OFF Sequence



Note: Refer to Application Notes on web site.

PRECAUTIONS FOR HANDLING & STORAGE OF OLED DEVICES

Handling

1. The IS Series OLED devices are electrostatic sensitive. To avoid damage to IC, do not touch terminals unless properly isolated from static electricity.
2. Signal input under conditions not recommended may cause damage to the OLED unit or deterioration of the display. Follow directions regarding supply sequences of power and signal voltages.
3. If the OLED panel is broken, avoid touching the contents. Wash off any contact to the skin or clothing.
4. Limit operating force to switch keytop to 100.0N maximum, as excessive pressure may damage the OLED.
5. For OLED display, it is necessary for bracket legs to be Grounded.
6. Recommended soldering time and temperature limits for OLED switch or display:

Avoid temperatures exceeding 80°C at the OLED.

Wave Soldering: see Profile A in Supplement section.

Manual Soldering: see Profile A in Supplement section.

7. The IS series OLED devices are not process sealed.
8. Pixels acquire diminished brightness over time and use, and those most frequently habituated have greater reduction of brightness than those less used. To minimize this difference, operate OLED unit so that all pixels are used as consistently as possible.
9. For switch, 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. For display, avoid contact with any flux or detergent. If any liquids spill on display surface, immediately wipe with soft absorbent cloth.

Storage

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



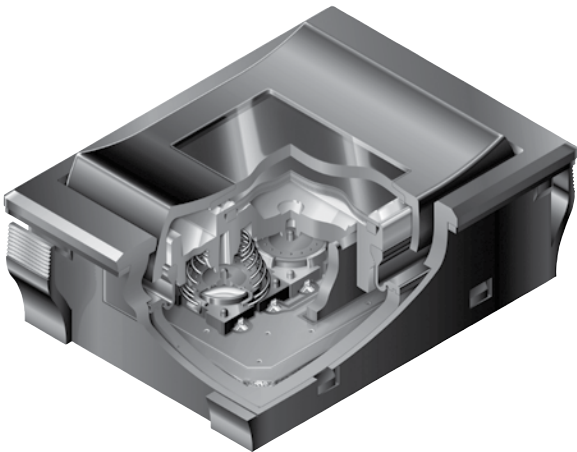
DISTINCTIVE CHARACTERISTICS

- Organic LED technology in display rocker (patent pending)
- Multifunction programmable device: select with rocker, push for activation
- Replaces multiple switches and displays with one device in a small package
- Broad display aids in navigation, both forward and reverse and up and down, in structured menus
- Wide viewing angle of 180° and large 0.92" display with exceptional contrast
- Conforms to IP64 of IEC60529 Standards on panel surface; dust tight construction of switch prevents entry of dust and improves contact reliability
- Commands and data supplied via serial communications protocol (SPI)
- Long life OLED with 52,000 hours at 30% illumination
- High reliability and long mechanical and electrical life of one million actuations minimum
- Stylish black housing design with matte finish complements any application

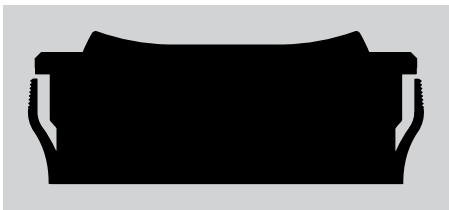
Monochrome OLED featuring sharp contrast and high resolution with 96 x 64 pixels

Panel mount with easy, snap-in installation

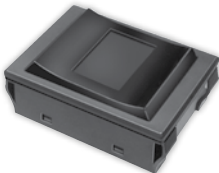
Short 14.6mm (.575") behind-panel height for compact spaces



Actual Size



SMARTSWITCH PART NUMBER & DESCRIPTION

Part Number	Description
IS18WWC1W	OLED Rocker Switch: SP3T Switch Rocker (ON) (ON) (ON) Pushbutton Normally OFF 

SWITCH SPECIFICATIONS

Circuit	Single Pole Three Throw (Momentary)					
Contact Position	Top		Center		Bottom	
	Normal	Down	Normal	Down	Normal	Down
	OFF	(ON) 9-12	OFF	(ON) 10-12	OFF	(ON) 11-12
Electrical Capacity (Resistive Load)	3VA maximum DC					
Contact Resistance	200 milliohms maximum					
Insulation Resistance	500 megohms minimum @ 250V DC					
Dielectric Strength	250V AC for 1 minute minimum					
Electrostatic Resisting Pressure	15kV minimum					
Mechanical Endurance	1,000,000 operations minimum					
Electrical Endurance	1,000,000 operations minimum					
Operating Force	5±2 Newtons at center of cap; 3.7±1.7 Newtons at top and bottom					
Total Travel	1.3±0.5mm (.051"±.020") at center of cap; 1.8±0.6mm (.71"±.024") at top and bottom					

OLED SPECIFICATIONS

Characteristics of Display

Display Device	Single color OLED display
Display Mode	Passive matrix
Pixel Format	96 x 64 pixels (horizontal x vertical)
Pixel Size	0.16mm x 0.177mm (horizontal x vertical)
Interface	Serial (SPI) interface
Color	White/Black (normally White)
Splash & Dust Proof	Conforms to IP64 of IEC60529 standards on panel surface
Operating Temperature Range	-20°C ~ +70°C (-4°F ~ +158°F)
Storage Temperature Range	-25°C ~ +80°C (-13°F ~ +176°F)
Operating Life Time (Display)	52,000 hours (30% brightness); 15,600 hours (100% brightness)

Absolute Maximum Ratings (Temperature at 25°C)

Items	Symbols	Ratings
Supply Voltage for Logic/Interface	VDDA	-0.3V to +3.6V
Supply Voltage for Drive	VAH	-0.3V to +18.0V
Input Voltage	Vin	-0.3V to VDDA +0.3V

Current Consumption

(Temperature at 25°C, VDDA = 2.8V, VAH = 15.0V)

Items	Symbols	Min	Typical	Max
All-Pixels-On Mode *Drive System Power Current	I _{H1}	—	11.0mA	13.2mA
All-Pixels-On Mode *Logic/IF System Power Current	I _{DD1}	—	0.58mA	0.72mA
Sleep Mode **Drive System Power Current	I _{H2}	—	—	10µA
Sleep Mode **Logic/IF System Power Current	I _{DD2}	—	—	10µA

* All pixels shall be turned on with the maximum level gray scale
 ** All pixels shall be turned off (while chip is operating)

Recommended Operating Conditions

Items	Symbols	Minimum	Typical	Maximum
Supply Voltage for Logic/Interface	VDDA	2.7V	2.8V	2.9V
Supply Voltage for Drive	VAH	14.5V	15.0V	15.5V
Input High Level Voltage	V _{IH}	0.75 x VDDA	—	VDDA
Input Low Level Voltage	V _{IL}	0.0	—	0.25V x VDDA

Optical Characteristics

(Temperature at 25°C, Initial Value: depends on initial setting)

Items	Minimum	Typical	Maximum
Brightness	75 cd/m ²	100 cd/m ²	125 cd/m ²
Chromaticity	(x)	*1	*1
	(y)	*1	*1
Contrast	100	—	—

* Chromaticity range is the area of the ellipse. (See Chromaticity Diagram next page) The ellipse passes through points A, B, C and D and designates the center of each side of the quadrangle.

Chromaticity Diagram

Point	Chromaticity X	Chromaticity Y
A	0.3441	0.3663
B	0.2983	0.3384
C	0.2799	0.2881
D	0.3257	0.3160

TIMING SPECIFICATIONS

AC Characteristics

(Temperature at $-20^{\circ}\text{C} \sim +70^{\circ}\text{C}$), $V_{DDA} = 2.8\text{V}$, $V_{AH} = 16\text{V}$

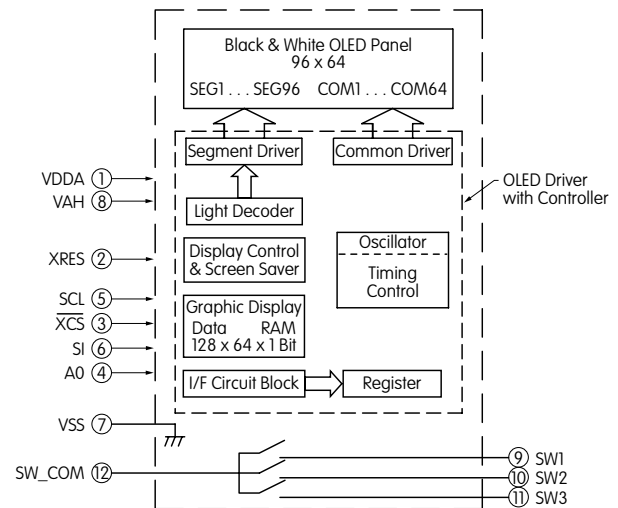
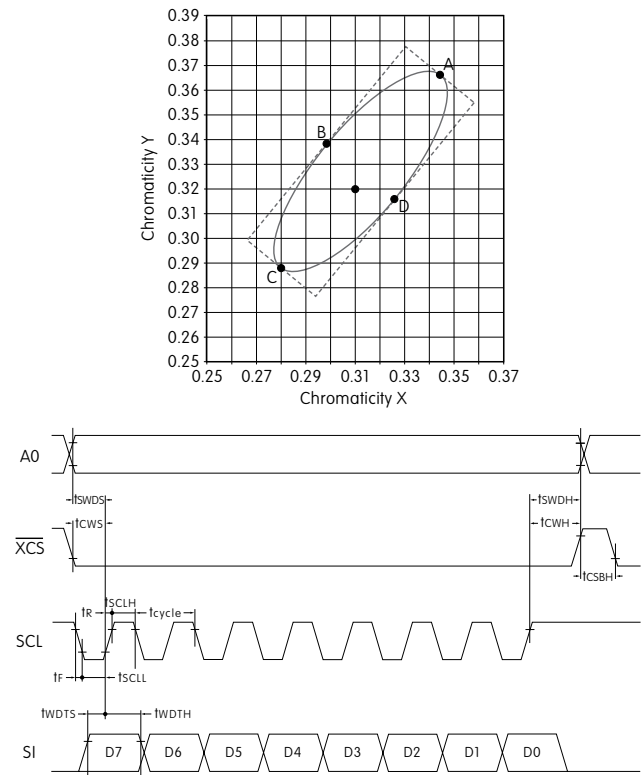
Items	Symbols	Minimum	Typical	Maximum
Clock Cycle Time	t_{cycle}	100ns	—	—
A0 Setup Time	t_{SWDS}	65ns	—	—
A0 Hold Time	t_{SWDH}	35ns	—	—
$\overline{\text{XCS}}$ Setup Time	t_{CWS}	65ns	—	—
$\overline{\text{XCS}}$ Hold Time	t_{CWH}	95ns	—	—
High Level $\overline{\text{XCS}}$ Pulse Width	t_{CSBH}	*10ns	—	—
Write Data Setup Time	t_{WDTS}	10ns	—	—
Write Data Hold Time	t_{WDTH}	20ns	—	—
SCL Low Time	t_{SCLL}	45ns	—	—
SCL High Time	t_{SCLH}	45ns	—	—
SCL Rise Time	t_r	—	—	15ns
SCL Fall Time	t_f	—	—	15ns

* Requires more than 100ns after resetting software

BLOCK DIAGRAM & PIN CONFIGURATIONS



IS18WWC1W



Pin No.	Symbol	Name	Function
①	VDDA	Logic Type Power Source	
②	XRES	Reset	Terminal to initialize IC built-in logic; initializes with low level
③	$\overline{\text{XCS}}$	Chip Select	Slave select for SPI. This line is active low.
④	A0	Address	Terminal to input control signals of command/parameter Set low at time of command input and high level at the time of parameter input.
⑤	SCL	Serial Clock	Read command/parameter at time of SCL signal standing up
⑥	SI	Serial Data Input	Terminal to input command/parameter by SPI
⑦	VSS	Ground	
⑧	VAH	Drive Type Power Source	
⑨	SW1	Switch Terminal 1	N/O
⑩	SW2	Switch Terminal 2	N/O
⑪	SW3	Switch Terminal 3	N/O
⑫	SW_COM	Switch Common Terminal	

Loggles



Rotaries

Slides



Terminal Connector Detail

Tilt



Accessories

STATE TRANSITION (CONTINUED)

State Transition	Transition	Reference or Setting Procedure
①	Power ON	Refer to "Power ON/OFF Sequence" → Refer to "Initialization Setting"
②	Power OFF	Refer to "Power ON/OFF Sequence"
③	Display ON	Refer to "Display ON/OFF Sequence"
④	Display OFF	
⑤	VAH OFF	Wait until VAH becomes stable
⑥	VAH ON	
⑦	Power OFF	Refer to "Power ON/OFF Sequence"
⑧	Initialization	Refer to "Initialization Setting"
⑨	Display Change	Image Rewriting 96 x 64 Image Data Sending
	Display Settings	Dimmer/Screen Saver/Indication 180° Reversal

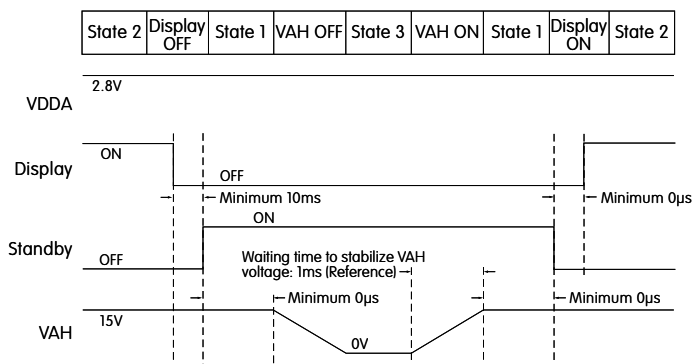
INITIALIZATION SETTING

Command Name	Command Address	Parameter (1 or 2Byte)	Remarks
Software Reset	01		
Dot Matrix Display ON/OFF	02	00	Note 1
Read/Write Operation Wetting	07	00	Note 1
Display Direction Set Command	09	00	Note 1
Reserved 1	10	03	Note 2
Reserved 2	12	63	Note 2
Reserved 3	13	00	Note 2
Dot Matrix Display Standby ON/OFF	14	00	
Reserved 4	16	00	Note 2
Reserved 5	17	00	Notes 1 & 2
Reserved 6	18	09	Note 2
Reserved 7	1A	04	Notes 1 & 2
Reserved 8	1C	00	Notes 1 & 2
Graphic Memory Writing Direction	1D	00	Note 1
Setting Column Output Range	30	005F	Note 1
Setting Row Output Range	32	003F	Note 1
X Axis Reading/Writing Start Point	34	00	Note 1
X Axis Reading/Writing End Point	35	0B	Note 1
Y Axis Reading/Writing Start Point	36	00	Note 1
Y Axis Reading/Writing End Point	37	3F	Note 1

Notes: 1. Same as default value

2. Do not change setting value

Display ON/OFF Sequence



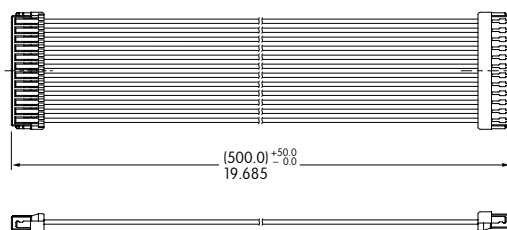
Command Name	Command Address	Parameter (1 or 2Byte)	Remarks
X Axis Reading Start Address	38	00	Note 1
Y Axis Reading Start Address	39	00	Note 1
Reserved 9	48	03	Note 2
Screen Saver Event Timer Setting Command	C3	00	Note 1
Screen Saver Event Timer Setting Command	C4	00	Note 1
One Time, Repeat or Direction Setting for Screen Saver	CC	00	Note 1
Start/Stop Setting for Screen Saver	CD	00	Note 1
System Clock Division Ratio Setting	D0	80	Note 2
Setting the STBY Pin	D2	00	Notes 1 & 2
DACA Setting	D4	00	Note 2
DACB Setting	D5	00	Note 2
DACC Setting	D6	00	Note 2
DACD Setting	D7	00	Note 2
Reserved 10	D9	00	Notes 1 & 2
Dimmer Setting	DB	0F	Note 1
Reserved 11	DD	88	Note 2
Image Writing	08	Image data	

Notes: 1. Same as default value

2. Do not change setting value

ACCESSORIES

AT715 Cable for Connection



PRECAUTIONS FOR HANDLING & STORAGE

Handling

1. OLED devices are electrostatic sensitive.
2. Signal input under conditions not recommended may cause damage to the OLED unit or deterioration of the display. Follow directions regarding supply sequences of power and signal voltages.
3. If the OLED panel is broken, avoid touching the contents. Wash off in case of contact to the skin or clothing.
4. Limit operating force to 100.0N maximum, as excessive pressure may damage the display.
5. Under certain actuation conditions, one side of the rocker and the center switch can both send actuation signals.
6. Pixels acquire diminished brightness over time and use, and those most frequently habituated have greater reduction of brightness than those less used. To minimize this difference, operate OLED unit so that all pixels are used as consistently as possible.
7. Clean actuator 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.

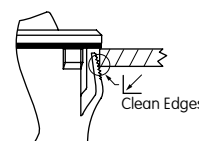
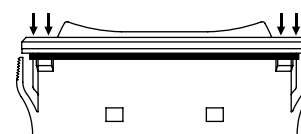
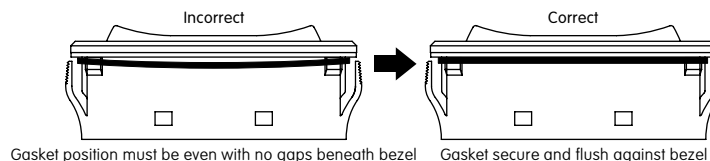


Storage

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

Panel Mounting

- Before snapping a switch into the panel, align the gasket evenly under the bezel of the switch.
- When mounting into a panel, apply equal pressure to sides of bezel and insert parallel to the panel.
- After mounting, be sure there are no gaps between switch and panel. Lightly push into panel.
- After installing into panel, do not apply excessive force.
- After panel installation and wiring is completed, do not apply force horizontally or vertically from behind panel.
- Behind the panel, cut area should be squared. If front of panel is painted, do not allow any paint to collect in corners of cutout to prevent level mounting.
- Avoid reinstalling a switch once it has been mounted into panel. This may cause deterioration of panel sealability.



DISTINCTIVE CHARACTERISTICS

- Same outer dimensions of switch and footprint, enabling ease of replacement with current switches
- Programmable display graphics for alphanumeric characters and animated sequences
- 64 colors of backlighting can be controlled dynamically
- Pushbutton switch 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: Short travel of 1.8mm, or long travel of 4.5mm (same as KP01 Series)
- Low energy consumption
- Dust tight construction

Viewing area: 17.0mm x 13.0mm (horizontal x vertical)

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

High resolution of 64 x 32 pixels

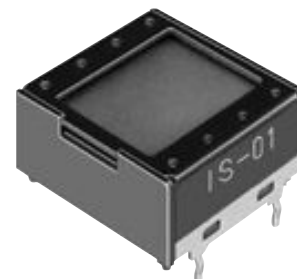
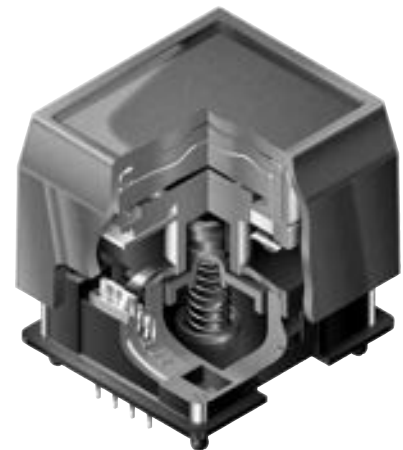
Epoxy sealed straight PC terminals

Snap-in standoff legs ensure secure mounting and alignment, and prevents dislodging during wave soldering.

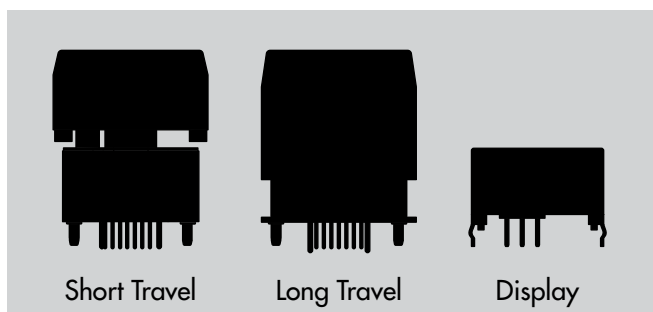
Viewing area: 14.4mm x 11.8mm (horizontal x vertical)

High resolution of 64 x 32 pixels

Bracket has crimped legs to ensure secure PC mounting and prevent dislodging during wave soldering



Actual Sizes of Switches & Display



SmartSwitch™ NEW → Wide View/Short Travel LCD 64 x 32 Pushbutton



IS15EBFP4RGB-09YN
RGB LED Backlight
Black and White LCD
Short Travel

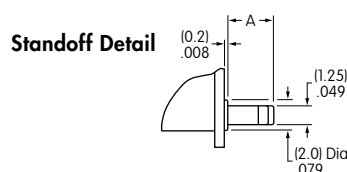
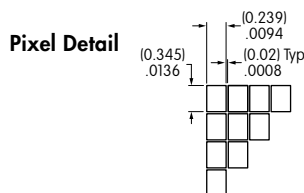
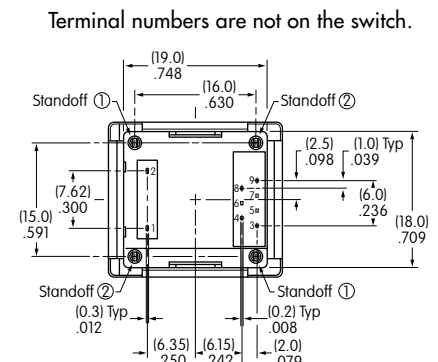
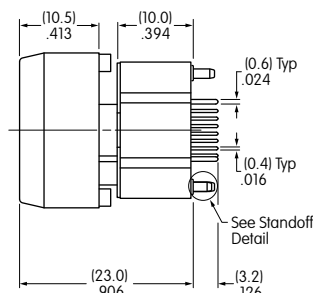
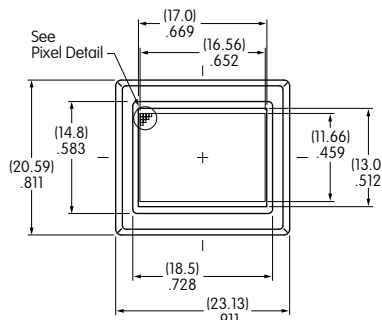
SWITCH PART NUMBER & DESCRIPTION

Part Number	Switch Description	LCD Mode	LED Color
IS15EBFP4RGB-09YN	SPST Momentary ON Gold Contacts Straight PC Terminals	Black & White FSTN Positive	Red/Green/Blue

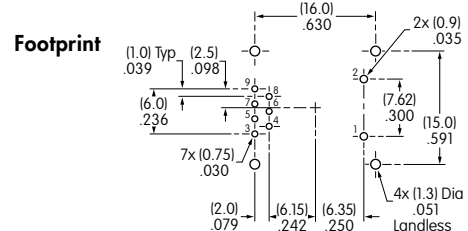
SWITCH SPECIFICATIONS

Circuit	SPST normally open
Electrical Capacity (Resistive Load)	100mA @ 12V DC
Contact Resistance	200 milliohms maximum @ 20mV 10mA
Insulation Resistance	100 megohms minimum @ 100V DC
Dielectric Strength	125V AC for 1 minute minimum
Mechanical Endurance	1,000,000 operations minimum
Electrical Endurance	1,000,000 operations minimum
Operating Force	1.7 ± 0.5 Newtons
Total Travel	1.8mm (.071")

TYPICAL SWITCH DIMENSIONS



Dimension A
Standoff 1 = (2.7) .106
Standoff 2 = (2.3) .091



The Wide View Compact LCD 64 x 32 Pushbutton may utilize the same footprint as the Wide View/Short Travel LCD 64 x 32 Pushbutton.

IS15EBFP4RGB
RGB LED Backlight
Black and White LCD
Long Travel



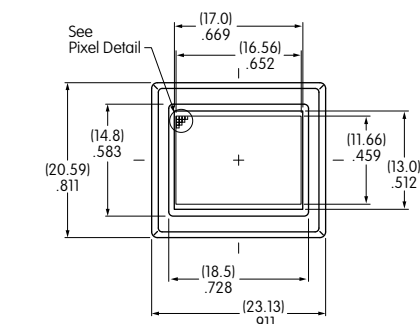
SWITCH PART NUMBER & DESCRIPTION

Part Number	Switch Description	LCD Mode	LED Color
IS15EBFP4RGB	SPST Momentary ON Gold Contacts Straight PC Terminals	Black & White FSTN Positive	Red/Green/Blue

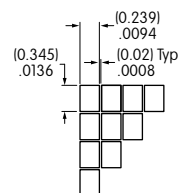
SWITCH SPECIFICATIONS

Circuit	SPST normally open
Electrical Capacity (Resistive Load)	100mA @ 12V DC
Contact Resistance	200 milliohms maximum @ 20mV 10mA
Insulation Resistance	100 megohms minimum @ 100V DC
Dielectric Strength	125V AC for 1 minute minimum
Mechanical Endurance	3,000,000 operations minimum
Electrical Endurance	3,000,000 operations minimum
Operating Force	2.0 ± 0.5 Newtons
Total Travel	4.5mm (.177")

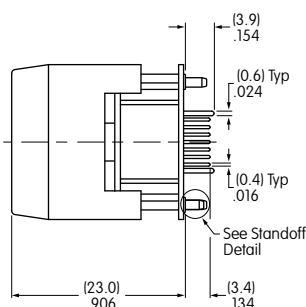
TYPICAL SWITCH DIMENSIONS



Pixel Detail



Standoff Detail

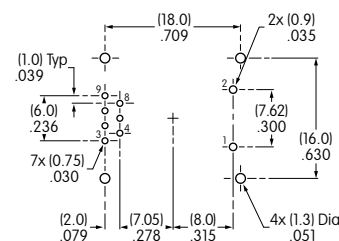
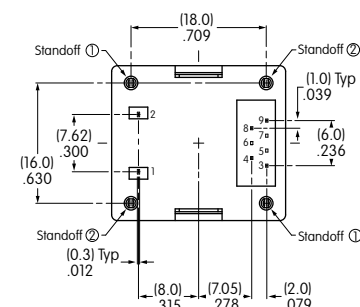


Dimension A

Standoff 1 = (2.7) .106
Standoff 2 = (2.3) .091

Footprint

Terminal numbers are not on the switch.



The following pages for Wide View LCD 64 x 32 Pushbuttons apply to the both Short Travel and Long Travel LCD 64 x 32 Pushbuttons.

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	17.0mm x 13.0mm (horizontal x vertical)
Pixel Format	64 x 32 pixels (horizontal x vertical)
Pixel Size	0.239mm x 0.345mm (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.	

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	Min	Typical	Max
Contrast Ratio		Cr	—	3.0	—
Viewing Angle (Cr ≥ 1.1)	Up & Down	θ	—	90°	—
	Right & Left	ϕ	—	90°	—

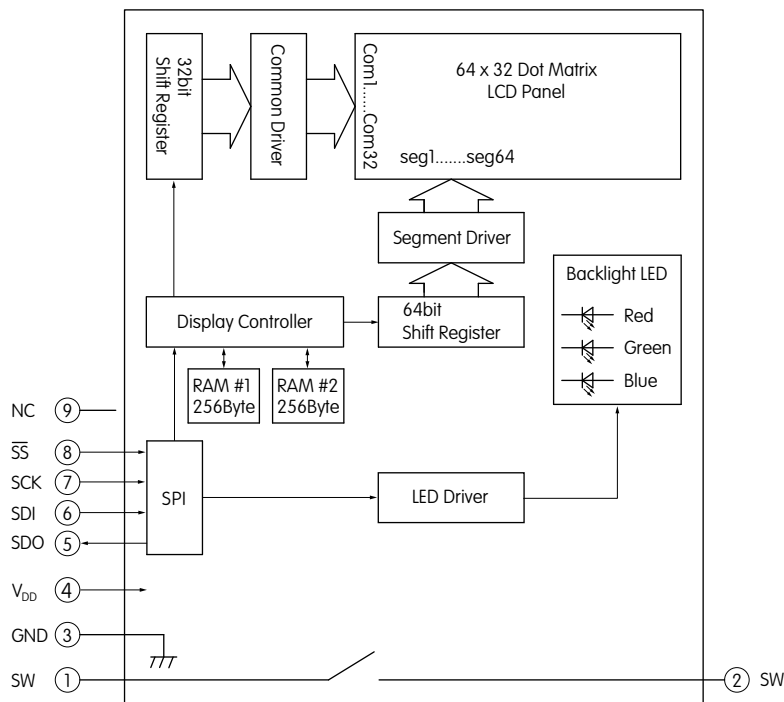
Recommended Operating Conditions (Temperature at 25°C)

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

SWITCH BLOCK DIAGRAM & PIN CONFIGURATIONS



Pin No.	Symbol	Name	Function
①	SW	Terminal of Switch	Normally open
②	SW	Terminal of Switch	Normally open
③	GND	Ground	
④	V _{DD}	Power	Power source for logic circuit and LCD
⑤	SDO	Data Out	Data output line for SPI
⑥	SDI	Data In	Data input line for SPI
⑦	SCK	Serial Clock	Clock line for SPI that synchronizes commands and data
⑧	SS	Slave Select	Chip select for SPI; line is active low
⑨	NC	None	No connection

DISPLAY PART NUMBER & DESCRIPTION

Part Number	Terminals	LCD Mode	LED Color
ISO1EBFRGB	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.

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	Min	Typical	Max
Contrast Ratio	Cr	—	3.0	—
Viewing Angle (Cr ≥ 1.1)	Up & Down θ	—	90°	—
	Right & Left ϕ	—	90°	—

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

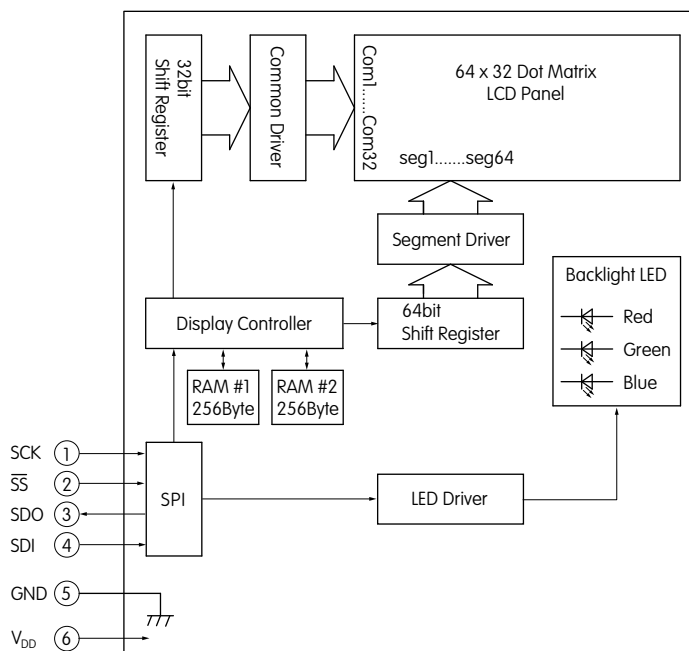
** 10mA: Backlighting LED is off

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

DISPLAY BLOCK DIAGRAM & PIN CONFIGURATIONS



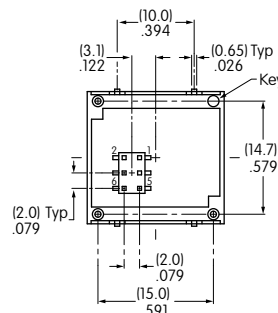
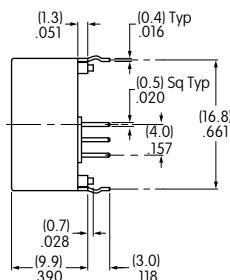
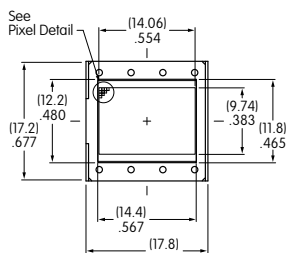
IS01EBFRGB
RGB LED Backlight
Black and White LCD



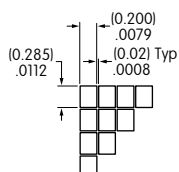
Pin No.	Symbol	Name	Function
①	SCK	Serial Clock	Clock line for SPI that synchronizes commands and data
②	$\overline{SS}$	Slave Select	Chip select for SPI; line is active low
③	SDO	Data Out	Data output line for SPI
④	SDI	Data In	Data input line for SPI
⑤	GND	Ground	
⑥	V _{DD}	Power	Power source for logic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

TYPICAL DISPLAY DIMENSIONS

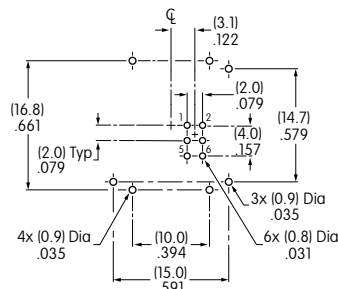
Terminal numbers are not on the device.



Pixel Detail



Footprint



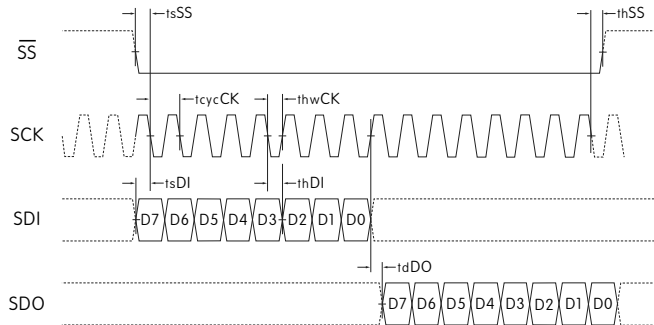
TIMING SPECIFICATIONS FOR SWITCH & DISPLAY

SPI Characteristics (See Timing Diagram)

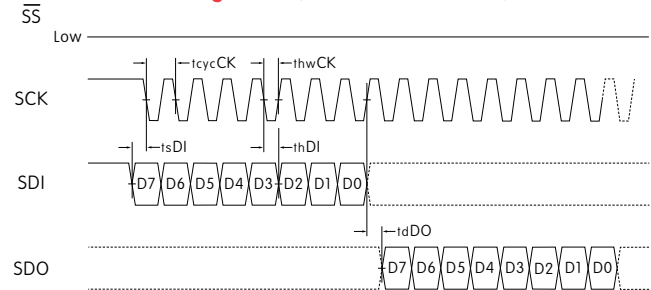
(Temperature at -15°C ~ +50°C and $V_{DD} = 5.0V \pm 2\%$)

Items	Symbols	Minimum	Maximum
SPI $\overline{SS}$ Set Up Time	t_{sSS}	10ns	
SPI $\overline{SS}$ 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 ($\overline{SS}$ Using)



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



It is recommended that all $\overline{SS}$ 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 $\overline{SS}$ line resets the communication.

SDI and SCK shall be kept high when idle.

BITMAP

Segment																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
Common	1	2	3	4	5	6	7	8	9	•	•	•	•	16	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

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 the data to be displayed next. The screens are changed when the second area is fully stored.

COMMANDS & DATA FOR SWITCH & DISPLAY

- 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 previous page 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

DISTINCTIVE CHARACTERISTICS

Compact Size Combined with High Resolution

- High resolution of 64 x 32 pixels
- 64 colors of backlighting can be controlled dynamically
- Pushbutton switch 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)
- Can display as many as four lines of text with ten characters each
- Incorporates bitmap display function
- Programmable display graphics for alphanumeric characters and animated sequences
- Dual image VRAM for quick change of displayed images
- Low energy consumption
- Dust tight construction

Viewing area: 14.5mm x 11.8mm (horizontal x vertical)

Variety of LED backlighting with 64 colors and 8 steps brightness

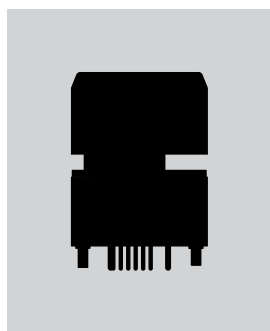
Dome gives crisp tactile feedback to positively indicate circuit transfer

Epoxy sealed straight PC terminals

Snap-in standoff for easy, secure mounting and alignment



Actual Size



PART NUMBER & DESCRIPTION

Part Number	Switch Description	LCD Mode	LED Color
IS15ESBFP4RGB	SPST Momentary ON Gold Contacts Straight PC Terminals	Black & White FSTN Positive	Red/Green/Blue

SWITCH SPECIFICATIONS

Circuit	SPST normally open
Electrical Capacity (Resistive Load)	100mA @ 12V DC
Contact Resistance	200 milliohms maximum @ 20mV 10mA
Insulation Resistance	100 megohms minimum @ 100V DC
Dielectric Strength	125V AC for 1 minute minimum
Mechanical Endurance	1,000,000 operations minimum
Electrical Endurance	1,000,000 operations minimum
Operating Force	1.7 ± 0.5 Newtons
Total Travel	1.8mm (.071")

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	Min	Typical	Max
Contrast Ratio		Cr	—	3.0	—
Viewing Angle (Cr ≥ 1.1)	Up & Down	θ	—	90°	—
	Right & Left	φ	—	90°	—

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	14.5mm 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 Temp Range	-15°C ~ +50°C (+5°F ~ +122°F)
Storage Temp 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	Min	Typical	Max
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}	—	—	0.2V _{DD}
SPI Clock Frequency	f _{SCK}	—	—	8MHz
Current Consumption	I _{DD}	** 10mA	—	*** 60mA

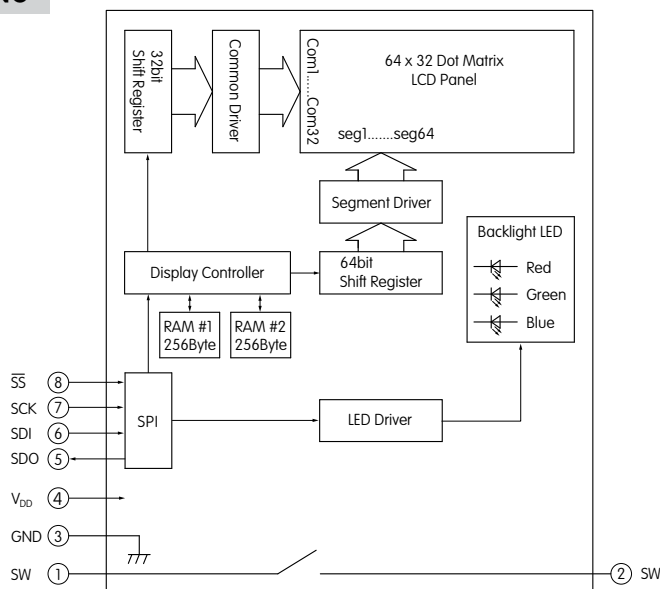
** 10mA: Backlighting LED is off

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

BLOCK DIAGRAM & PIN CONFIGURATIONS

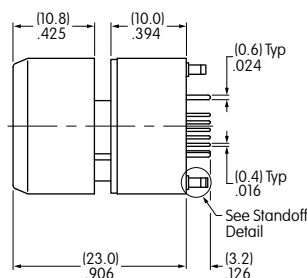
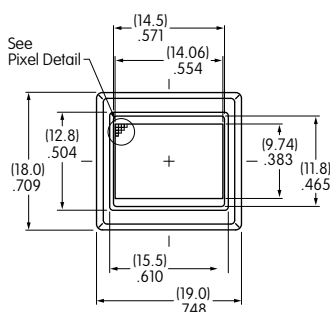


IS15ESBFP4RGB
RGB LED Backlight
Black and White LCD

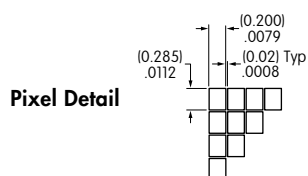
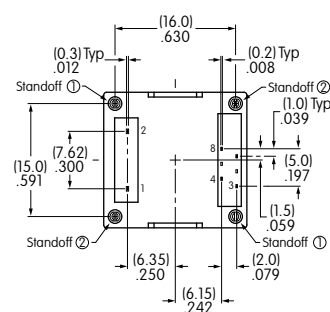


Pin No.	Symbol	Name	Function
①	SW	Terminal of Switch	Normally open
②	SW	Terminal of Switch	Normally open
③	GND	Ground	
④	V _{DD}	Power	Power source for logic circuit and LCD
⑤	SDO	Data Out	Data output line for SPI
⑥	SDI	Data In	Data input line for SPI
⑦	SCK	Serial Clock	Clock line for SPI that synchronizes commands and data
⑧	SS	Slave Select	Chip select for SPI; line is active low

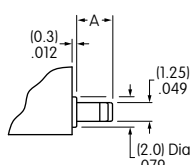
TYPICAL SWITCH DIMENSIONS



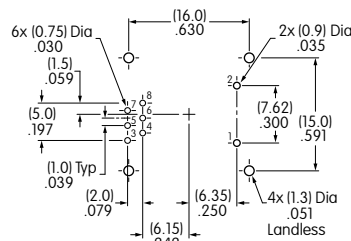
Terminal numbers are not on the switch.



Standoff Detail



Footprint



Dimension A

Standoff 1 = (2.7) .106 Standoff 2 = (2.3) .091

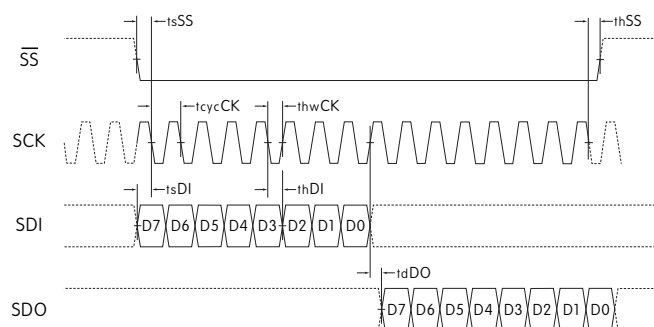
TIMING SPECIFICATIONS

SPI Characteristics (See Timing Diagram)

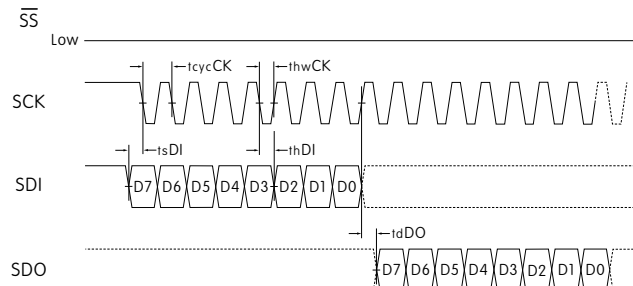
(Temperature at -15°C ~ +50°C and $V_{DD} = 5.0V \pm 2\%$)

Items	Symbols	Minimum	Maximum
SPI $\overline{SS}$ Set Up Time	t_{sSS}	10ns	
SPI $\overline{SS}$ 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 ($\overline{SS}$ Using)

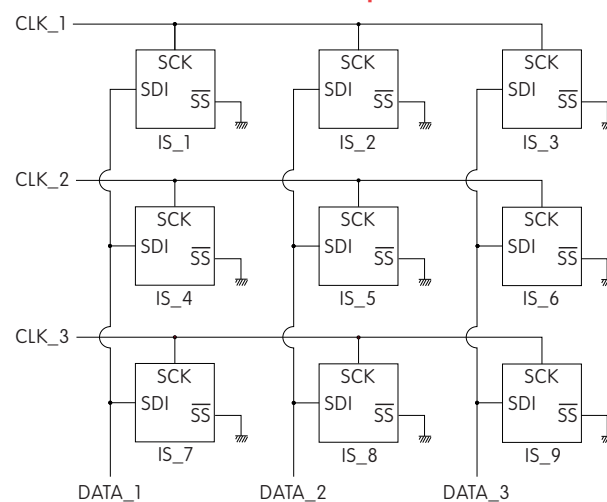


SPI Timing Chart ($\overline{SS}$ Low Level Fixed)



SDI and SCK shall be kept high when idle.

Circuit Example



It is recommended that all $\overline{SS}$ 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 $\overline{SS}$ line resets the communication.

Bockers

Pushbuttons

Eliminated PR

E

Keylocks

Rotaries

- slides

Tactiles

Tilt

Touch

indicators

Accessories

Supplement

NIKK
SWITCHES

PRECAUTIONS FOR HANDLING & STORAGE OF LCD 64 x 32 DEVICES

Handling

1. The IS Series devices are electrostatic sensitive.
2. Limit operating force to keytop to 100.0N maximum, as excessive pressure may damage the LCD device.
3. The IS series devices are not process sealed.
4. If the LCD is accidentally broken, avoid contact with the liquid and wash off any liquid spills to the skin or clothing.
5. 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.
6. Recommended soldering time and temperature limits:
Do not exceed 60°C at the LCD level.
Wave Soldering: see Profile B in Supplement section.
Manual Soldering for Switch: see Profile A in Supplement section.
Manual Soldering for Display: see Profile B in Supplement section.
7. Excessive images may result after the same image is emitted continuously for an extended period of time.
8. The highest backlight brightness level should not be used for temperatures above +35°C.



Storage

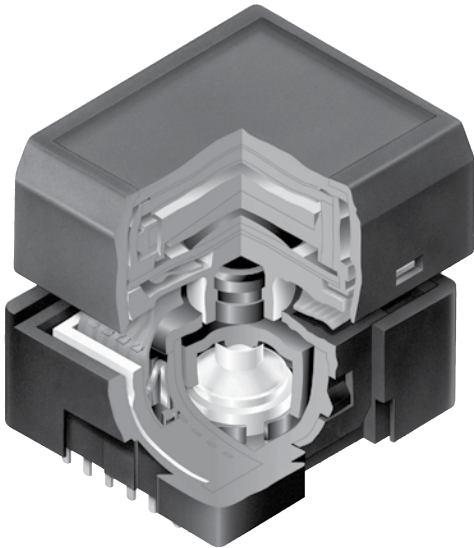
1. Store in original container and away from direct sunlight.
2. Keep away from static electricity.
3. Avoid extreme temperatures, high humidity, gaseous substances, and all forms of chemical contamination.

DISTINCTIVE CHARACTERISTICS

Standard with Enhanced LED Illumination:

- Broad and even light diffusion
- Consistent backlighting
- Low energy consumption

- Programmable LCD
- Variety of LED Backlighting Colors
- Rubber Dome
- Epoxy Sealed Straight PC Terminals



RGB backlighting provides infinite color availability.

Programmable to display graphics, alphanumeric characters and animated sequences.

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

Wider viewing area for switch 17.0mm x 13.0mm (horizontal x vertical) at 36 x 24 pixels;

Display viewing area 14.4mm x 11.8mm.

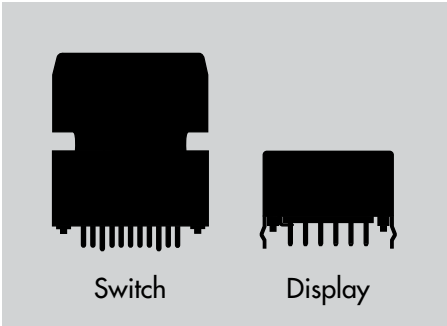
Dome gives crisp tactile feedback to positively indicate circuit transfer.

High reliability and long life of one million actuations minimum.

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

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

Actual Sizes



RGB LED BACKLIGHTING

Part Number	Switch Description	LCD Mode	LED Color
IS15BBFP4RGB	SPST Momentary ON Gold Contacts Straight PC Terminals	Black & White FSTN Positive	* Red/Green/Blue

* Simultaneous RGB illumination achieves infinite colors.

SWITCH SPECIFICATIONS

Circuit	SPST normally open
Electrical Capacity (Resistive Load)	100mA @ 12V DC
Contact Resistance	200 milliohms max @ 20mV 10mA
Insulation Resistance	100 megohms min @ 100V DC
Dielectric Strength	125V AC for 1 minute minimum
Mechanical Endurance	1,000,000 operations minimum
Electrical Endurance	1,000,000 operations minimum
Operating Force	2.2 ± 0.5 Newtons
Total Travel	1.8mm (.071")
Operating Temp. Range	-20°C ~ +60°C (-4°F ~ +140°F)
Storage Temp. Range	-30°C ~ +70°C (-22 °F ~ +158°F)

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 _I	-0.3V to V _{DD} +0.3V
Output Voltage	V _O	-0.3V to V _{DD} +0.3V

DC Characteristics of LCD Drive (Temperature at -20°C to +60°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}	V
Low Level Input Voltage	V _{IL}		0		0.3V _{DD}	V
High Level Input Leakage Current	I _{LIH}	V _I = V _{DD}			10	μA
Low Level Input Leakage Current	I _{LIL}	V _I = 0V			-10	μA
High Level Output Voltage	V _{OH}	I _{OH} = -500μA	V _{DD} -0.5			V
Low Level Output Voltage	V _{OL}	I _{OL} = 500μA			0.5	V
High Level Output Leakage Current	I _{LOH}	V _O = V _{DD}			10	μA
Low Level Output Leakage Current	I _{LOL}	V _O = 0V			-10	μA
Supply Current	I _{DD}	f _{SCP} = 1.0MHz			500	μA
LCD Drive Current	I _{LC}	f _{LP} = 2.4kHz V _{LC} = 7.3V		500	2,000	μA

Timing Characteristics of LCD Drive IC

(Temperature at -20°C to +60°C and V_{DD} = 5.0V ±10%)

Items	Symbols	Minimum	Maximum
Clock Operation Frequency	f _{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 _{DS}	45ns	
Data Hold Time	t _{DH}	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	t _{DSF}	50ns	
FLM Hold Time	t _{DHF}	50ns	
SCP, LP Rise/Fall Time	t _r /t _f		15ns

LCD SPECIFICATIONS

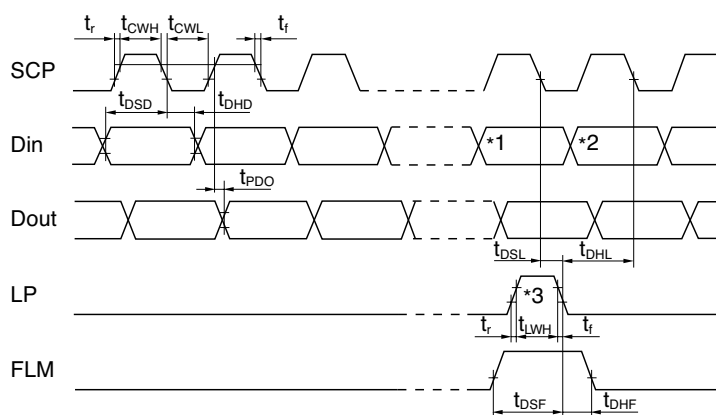
Characteristics of Display

Display Operation Mode	FSTN positive
Display Condition	Transflective with built-in LED backlight
Viewing Angle	6 o'clock
Driving Method	1/24 duty, 1/5 bias (built-in driving circuit)
Viewing Area	17.0mm x 13.0mm (horizontal x vertical)
Pixel Format	36 x 24 pixels (horizontal x vertical)
Pixel Size	0.440mm x 0.495mm (horizontal x vertical)
Backlight LED	RGB: red/green/blue

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 Black/White	V _{LC}	7.1V	7.3V	7.5V
Input Voltage	V _I	0V	—	V _{DD}
Driving Frequency	f _{FLM}	—	150Hz: black/white	—

Timing Diagram



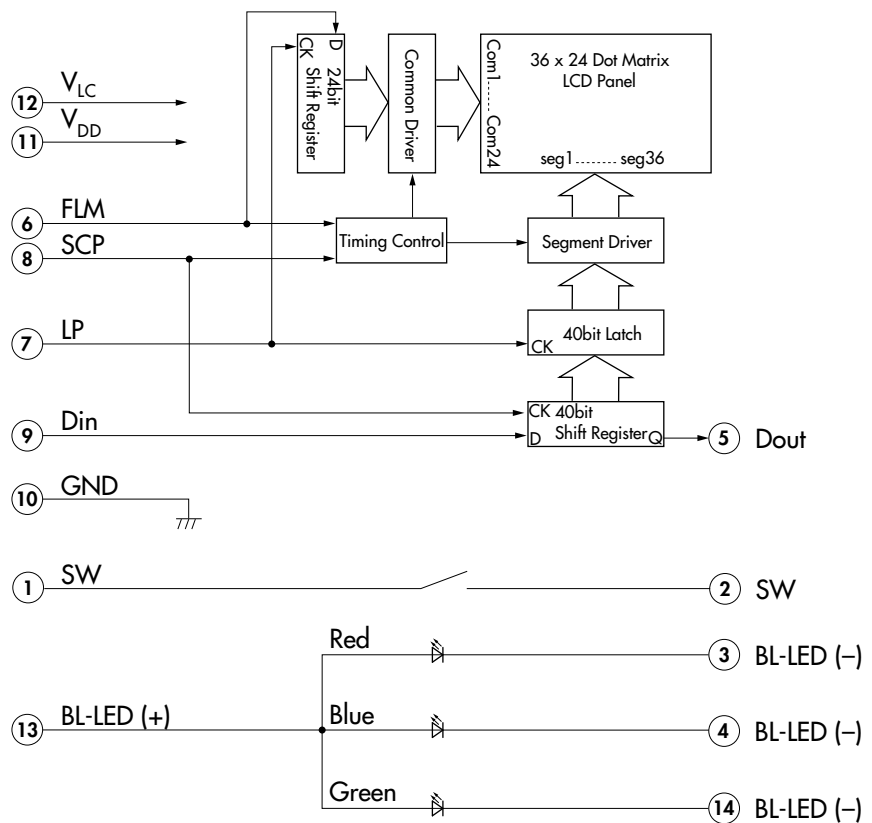
*1 Last data on first line

*2 Beginning data on second line

*3 Location of LP signal on first line

BLOCK DIAGRAM & PIN CONFIGURATIONS FOR RGB LEDs

IS15BBFP4RGB
RGB LED Backlight
Black and White LCD



Pin No.	Symbol	Name	Function
①	SW	Terminal of Switch	Normally open
②	SW	Terminal of Switch	Normally open
③	BL-LED (-)	Terminal of Backlight LED	Cathode for red
④	BL-LED (-)	Terminal of Backlight LED	Cathode for blue
⑤	Dout	Data Output	Display serial output. Can be used to connect to Din of the next SMARTSWITCH. As a result, many SMARTSWITCHES can be controlled with one clock and data signal.
⑥	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).
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	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.
⑨	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.
⑩	GND	Ground	
⑪	V _{DD}	Power	Power source for logic circuit
⑫	V _{LC}	Power	Power source for LCD drive
⑬	BL-LED (+)	Terminal of Backlight LED	Anode for common
⑭	BL-LED (-)	Terminal of Backlight LED	Cathode for green

SUPER BRIGHT RGB LED SPECIFICATIONS

Typical Electrical Characteristics (Temperature at 25°C)

Backlight Color	Symbols	Red	Green	Blue	Unit
Forward Current	I_F	10	8.5	8.0	mA
Forward Voltage	V_F	2.0	2.8	2.8	V

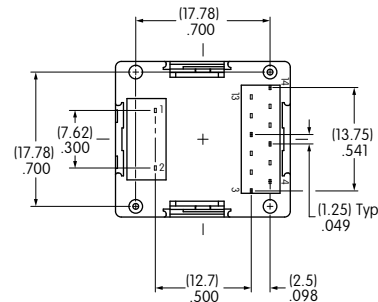
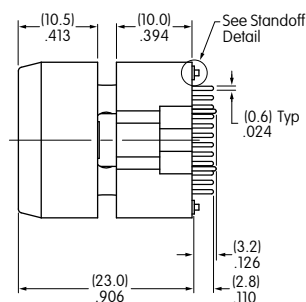
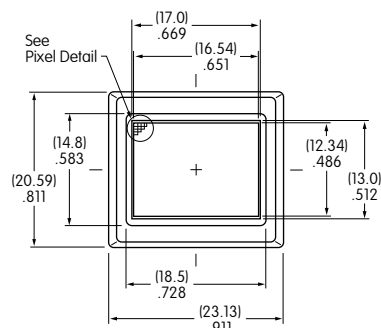
ABSOLUTE MAXIMUM FOR RGB LED

Electrical Characteristics (Temperature at 25°C)

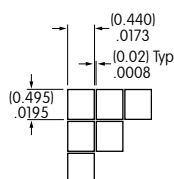
Backlight Color	Symbols	Red	Green	Blue	Unit
Forward Current	I_F	20	20	20	mA
Forward Voltage	V_F	2.0 ($I_F = 10\text{mA}$)	2.8 ($I_F = 8.5\text{mA}$)	2.8 ($I_F = 8.0\text{mA}$)	V
Reverse Voltage	V_R	4.0	4.0	4.0	V
Current Reduction Rate Above 25°C	$\Delta I_F(\text{DC})$	-0.33	-0.33	-0.33	mA/°C
*Power Dissipation (LED Overall 115mW)	P_D	40	60	60	mW

*For uniform light emission, Power Dissipation should not exceed the Absolute Maximum Rating, and the Forward Current should not exceed the derated Absolute Forward Current.

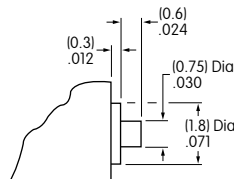
TYPICAL SWITCH DIMENSIONS WITH RGB LED



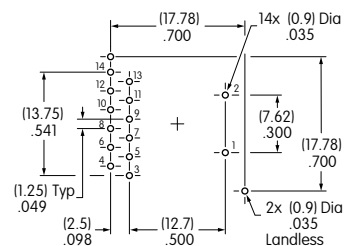
Terminal numbers are not on the switch.



Pixel Detail



Standoff Detail



Footprint

DISTINCTIVE CHARACTERISTICS

Standard with Enhanced Illumination:

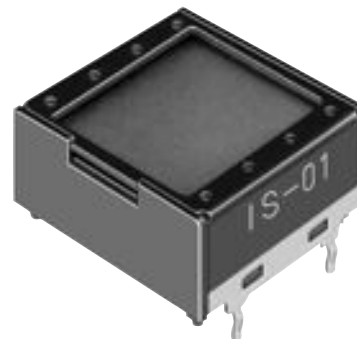
Programmable to display graphics, alphanumeric characters and animated sequences.

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

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

RGB LED provides numerous color variations.

Viewing area 14.4mm x 11.8mm (horizontal x vertical) at 36 x 24 pixels.



RGB LED BACKLIGHTING

Part Number	Terminals	LCD Mode	LED Color
ISO1BBFRGB	Straight PC	Black & White FSTN Positive	* Red/Green/Blue

* Simultaneous RGB illumination achieves infinite colors.

LCD & LED SPECIFICATIONS

Characteristics of Display

Display Operation Mode	STN positive, FSTN positive
Display Condition	Transflective with built-in LED backlight
Viewing Angle	6 o'clock
Driving Method	1/24 duty, 1/5 bias (built-in driving circuit)
Viewing Area	14.4mm x 11.8mm (horizontal x vertical)
Pixel Format	36 x 24 pixels (horizontal x vertical)
Pixel Size	0.371mm x 0.445mm (horizontal x vertical)
Operating Temp. Range	-20°C ~ +60°C (-4°F ~ +140°F)
Storage Temp. Range	-30°C ~ +70°C (-22°F ~ +158°F)
Backlight LED	RGB: red/green/blue

LCD Absolute Maximum Ratings (Temperature at 25°C)

Items	Symbols	Ratings
Supply Voltage for Logistics	V _{DD}	-0.3V to +7.0V
Supply Voltage for LCD	V _{LC}	-0.3V to +12.0V
Input Voltage	V _I	-0.3V to V _{DD} +0.3V
Output Voltage	V _O	-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}	7.1V	7.3V	7.5V
Input Voltage	V _I	0V	—	V _{DD}
Driving Frequency	f _{FLM}	—	150Hz	—

LED Absolute Maximum Ratings (Temperature at 25°C)

Items	Symbols	Ratings
Forward Current	I _F	20mA
Power Dissipation	P _d	mW
Color	Red/Green/Blue	
	Red	Blue
Unicolor	40mW	60mW
LED Overall	115mW	

LCD & LED SPECIFICATIONS

DC Characteristics of LCD Drive IC (Temperature at -20°C to +60°C and $V_{DD} = 5.0V \pm 10\%$)

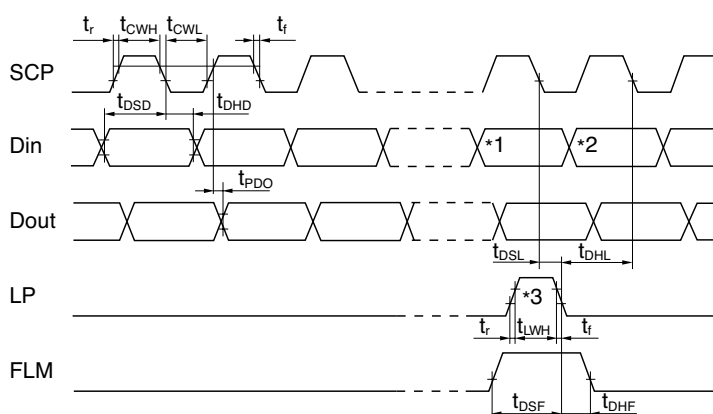
Items	Symbols	Test Conditions	Minimum	Typical	Maximum	Unit
High Level Input Voltage	V_{IH}		$0.7V_{DD}$		V_{DD}	V
Low Level Input Voltage	V_{IL}		0		$0.3V_{DD}$	V
High Level Input Leakage Current	I_{LH}	$V_I = V_{DD}$			10	μA
Low Level Input Leakage Current	I_{LIL}	$V_I = 0V$			-10	μA
High Level Output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

Timing Characteristics of LCD Drive IC

(Temperature at -20°C to +60°C and $V_{DD} = 5.0V \pm 10\%$)

Items	Symbols	Minimum	Maximum
Clock Operation Frequency	f_{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	t_{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

Display Electrical Characteristics

Items			Symbols	Test Condition	Minimum	Typical	Maximum
LCD	Supply Voltage	Logic Circuit	V _{DD}		4.5	5.0	5.5
		LCD Circuit	V _{LC}		7.1	7.3	7.5
	Input Voltage	H	V _{IH}		0.7V _{DD}	—	V _{DD}
		L	V _{IL}		0	—	0.3 V _{DD}
	Output Voltage	H	V _{OH}	D _{OUT} , I _{OH} = 500 μA	V _{DD} -0.5	—	—
		L	V _{OL}	D _{OUT} , I _{OL} = 500 μA	—	—	0.5
	Power	Logic Circuit	I _{DD}	f _{scp} = 1.0MHz	—	—	500
		LCD Circuit	I _{LC}	f _{LP} = 2.4kHz V _{LC} = 7.3V	—	500	2,000
Items			Symbols	Test Condition	Red/Green/Blue		
LED	Forward Current		I _F		Red	Green	Blue
					10mA	8.5mA	8mA
	Forward Voltage		V _F	I _F = Forward Current Ta = 25°C	Red	Green	Blue
					2.0V	2.8V	2.8V
	Current Reduction Rate		ΔI _F (DC)	Ta = 25°C above	-0.33mA/°C		

Toggles



Rocks

Illuminated PB

SUPER BRIGHT RGB LED SPECIFICATIONS

Typical Electrical Characteristics (Temperature at 25°C)

Backlight Color	Symbols	Red	Green	Blue	Unit
Forward Current	I_F	10	8.5	8.0	mA
Forward Voltage	V_F	2.0	2.8	2.8	V

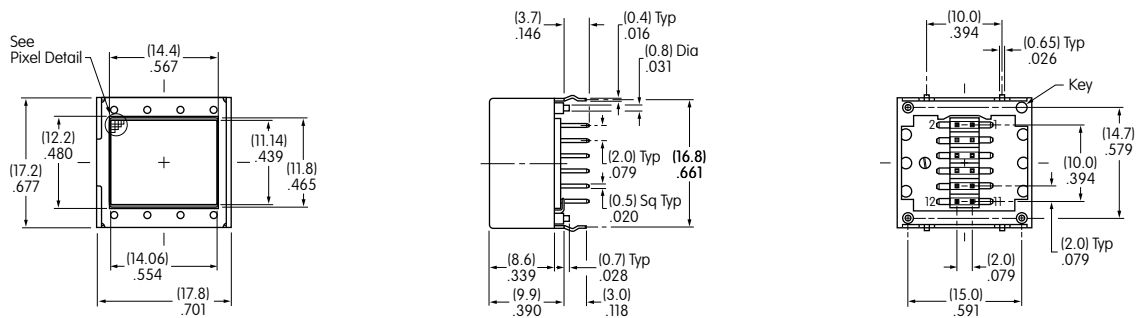
ABSOLUTE MAXIMUM FOR RGB LED

Electrical Characteristics (Temperature at 25°C)

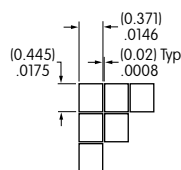
Backlight Color	Symbols	Red	Green	Blue	Unit
Forward Current	I_F	20	20	20	mA
Forward Voltage	V_F	2.0 ($I_F = 10\text{mA}$)	2.8 ($I_F = 8.5\text{mA}$)	2.8 ($I_F = 8.0\text{mA}$)	V
Reverse Voltage	V_R	4.0	4.0	4.0	V
Current Reduction Rate Above 25°C	$\Delta I_F(\text{DC})$	-0.33	-0.33	-0.33	mA/°C
*Power Dissipation (LED Overall 115mW)	P_D	40	60	60	mW

*For uniform light emission, Power Dissipation should not exceed the Absolute Maximum Rating, and the Forward Current should not exceed the derated Absolute Forward Current.

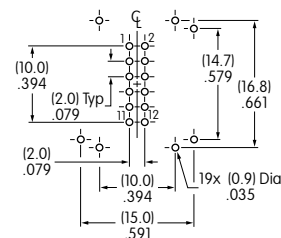
TYPICAL DISPLAY DIMENSIONS WITH RGB LED



Terminal numbers are not on the device.



Pixel Detail



Footprint

DISTINCTIVE CHARACTERISTICS

Compact Size

- Perfect for rack mount router and other applications with space limitations.
Compact body size: 19.0mm (.748") x 18.0mm (.709") compared to
Standard body size: 23.13mm (.911") x 20.59mm (.811")
- Vibrant Illumination
- Low Energy Consumption

Programmable LCD

Variety of LED Backlighting Colors

Rubber Dome

Epoxy Sealed Straight PC Terminals

Snap-in standoff for easy, secure mounting and alignment



Programmable to display graphics, alphanumeric characters and animated sequences.

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

Viewing area 14.5mm x 11.8mm (horizontal x vertical) at 36 x 24 pixels.

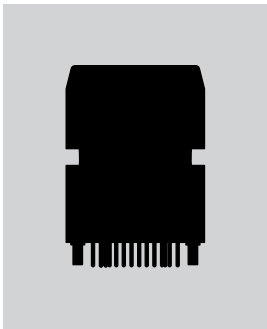
Dome gives crisp tactile feedback to positively indicate circuit transfer.

High reliability and long life of one million actuations minimum.

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

Optional accessories available to simplify production process.

Actual Size



PART NUMBER & DESCRIPTION

Part Number	Switch Description	LCD Mode	LED Color
IS15BSBFP4RGB	SPST Momentary ON Gold Contacts Straight PC Terminals	Black & White FSTN Positive	* Red/Green/Blue RGB

* Simultaneous RGB illumination achieves infinite colors.
Note: Contact factory for additional options.

SWITCH SPECIFICATIONS

Circuit	SPST normally open
Electrical Capacity (Resistive Load)	100mA @ 12V DC
Contact Resistance	200 milliohms maximum @ 20mV 10mA
Insulation Resistance	100 megohms minimum @ 100V DC
Dielectric Strength	125V AC for 1 minute minimum
Mechanical Endurance	1,000,000 operations minimum
Electrical Endurance	1,000,000 operations minimum
Operating Force	2.2 ± 0.5 Newtons
Total Travel	1.8mm (.071")

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 _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	Min	Typical	Max
Contrast Ratio		Cr	—	3.0	—
Viewing Angle (Cr ≥ 1.1)	Up & Down	θ	—	90°	—
	Right & Left	φ	—	90°	—

DC Characteristics of LCD Drive IC (Temperature at -20°C to +60°C and V_{DD} = 5V ±10%)

Items	Symbols	Test Conditions	Minimum	Typical	Maximum	Unit
High Level Input Voltage	V _{IH}		0.7 V _{DD}		V _{DD}	V
Low Level Input Voltage	V _{IL}		0		0.3 V _{DD}	V
High Level Input Leakage Current	I _{LIH}	V _I = V _{DD}			10	μA
Low Level Input Leakage Current	I _{LIL}	V _I = 0V			10	μA
High Level Output Voltage	V _{OH}	I _{OH} = -500μA	V _{DD} -0.5			V
Low Level Output Voltage	V _{OL}	I _{OL} = 500μA			0.5	V
High Level Output Leakage Current	I _{LOH}	V _O = V _{DD}			10	μA
Low Level Output Leakage Current	I _{LOL}	V _O = 0V			10	μA
Supply Current	I _{DD}	f _{SCP} = 1.0MHz			500	μA
LCD Drive Current	I _{LC}	f _{LP} = 2.4kHz V _{LC} = 7.3V		500	2,000	μA

Timing Characteristics of LCD Drive IC

(Temperature at -20°C to +60°C and V_{DD} = 5.0V ±10%)

Items	Symbols	Minimum	Maximum
Clock Operation Frequency	f _{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 _{DS}	45ns	
Data Hold Time	t _{DH}	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	t _{DSF}	50ns	
FLM Hold Time	t _{DHF}	50ns	
SCP, LP Rise/Fall Time	t _r /t _f		15ns

LCD SPECIFICATIONS

Characteristics of Display

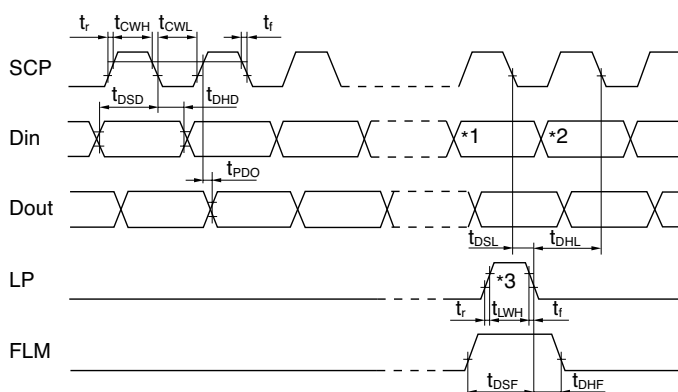
Display Operation Mode	FSTN positive
Display Condition	Transflective with built-in LED backlight
Viewing Angle Direction	6 o'clock
Driving Method	1/24 duty, 1/5 bias (built-in driving circuit)
Viewing Area	14.5mm x 11.8mm (horizontal x vertical)
Pixel Format	36 x 24 pixels (horizontal x vertical)
Pixel Size	0.371mm x 0.445mm (horizontal x vertical)
* Operating Temperature Range	-20°C ~ +60°C (-4°F ~ +140°F)
Storage Temperature Range	-30°C ~ +70°C (-22°F ~ +158°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).

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	V _{LC}	7.1	7.3V	7.5
Input Voltage	V _I	0V	—	V _{DD}
Driving Frequency	f _{FLM}	—	150Hz	—
Clock Operation Frequency	f _{SCP}	—	—	6.0MHz

Timing Diagram



*1 Last data on first line

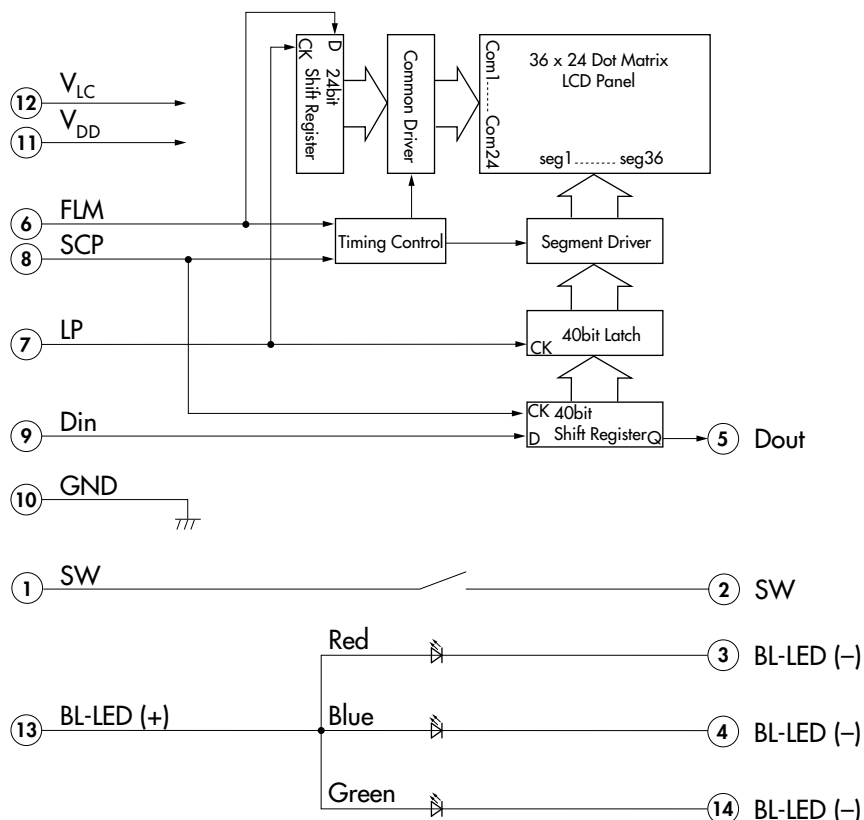
*2 Beginning data on second line

*3 Location of LP signal on first line

BLOCK DIAGRAM & PIN CONFIGURATIONS



IS15BSBFP4RGB
RGB LED Backlight
Black and White LCD



Pin No.	Symbol	Name	Function
①	SW	Terminal of Switch	Normally open
②	SW	Terminal of Switch	Normally open
③	BL-LED (-)	Terminal of Backlight LED	Cathode for red
④	BL-LED (-)	Terminal of Backlight LED	Cathode for blue
⑤	Dout	Data Output	Display serial output. Can be used to connect to Din of the next SMARTSWITCH. As a result, many SMARTSWITCHES can be controlled with one clock and data signal.
⑥	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).
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	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.
⑨	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.
⑩	GND	Ground	
⑪	VDD	Power	Power source for logic circuit
⑫	VLC	Power	Power source for LCD drive
⑬	BL-LED (+)	Terminal of Backlight LED	Anode for common
⑭	BL-LED (-)	Terminal of Backlight LED	Cathode for green

RGB LED CHARACTERISTICS

Typical Electrical Characteristics (Temperature at 25°C)

Backlight Color	Symbols	Red	Green	Blue	Unit
Forward Current	I_F	10	8.5	8.0	mA
Forward Voltage	V_F	2.0	2.8	2.8	V

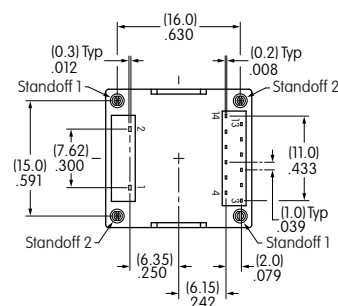
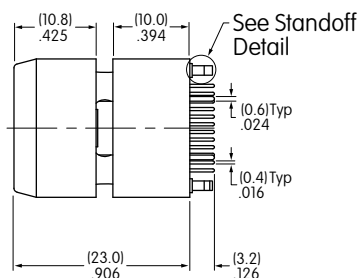
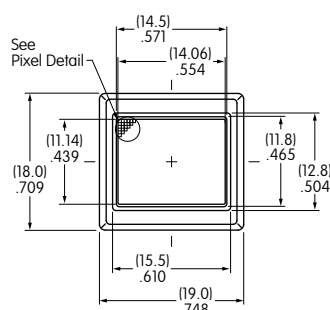
ABSOLUTE MAXIMUM FOR LEDs

Electrical Characteristics (Temperature at 25°C)

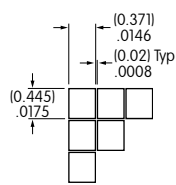
Backlight Color	Symbols	Red	Green	Blue	Unit
Forward Current	I_F	20	20	20	mA
Forward Voltage	V_F	2.0 ($I_F = 10\text{mA}$)	2.8 ($I_F = 8.5\text{mA}$)	2.8 ($I_F = 8.0\text{mA}$)	V
Reverse Voltage	V_R	4.0	4.0	4.0	V
Current Reduction Rate Above 25°C	$\Delta I_F(\text{DC})$	-0.33	-0.33	-0.33	mA/°C
*Power Dissipation (LED Overall 115mW)	P_D	40	60	60	mW

*For uniform light emission, Power Dissipation should not exceed the Absolute Maximum Rating, and the Forward Current should not exceed the derated Absolute Forward Current.

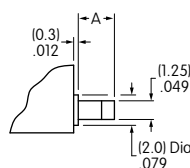
TYPICAL SWITCH DIMENSIONS



Terminal numbers are not on the switch.



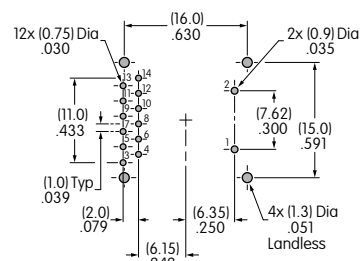
Pixel Detail



Standoff Detail

Dimension A

Standoff 1 = (2.7) .106 Standoff 2 = (2.3) .091



Footprint

PRECAUTIONS FOR HANDLING & STORAGE OF LCD 36 x 24 DEVICES

Handling



1. The IS Series devices are electrostatic sensitive.
2. Limit operating force to keytop to 100.0N maximum, as excessive pressure may damage the LCD device.
3. The IS series devices are not process sealed.
4. If the LCD is accidentally broken, avoid contact with the liquid and wash off any liquid spills to the skin or clothing.
5. 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.
6. Recommended soldering time and temperature limits:
Do not exceed 70°C at the LCD level.
Wave Soldering: see Profile B in the Supplement section.
Manual Soldering for Switch: see Profile A in the Supplement section.
Manual Soldering for Display: see Profile B in the Supplement section.
7. Recommendation for backlight color uniformity: Use constant current driver. For current limiting resistor method, the power source should be at least twice the backlight LED forward voltage.
8. 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 may become damaged.
9. Backlight Forward Current should not exceed the derated Absolute Maximum Forward Current based on the temperature.
10. Excessive images may result after the same image is emitted continuously for an extended period of time.

Storage

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

Toggles

Rockers

Pushbuttons

Illuminated PB

E Programmable

Keylocks

Rotaries

Slides

Tactiles

Tilt

Touch

Indicators

Accessories

Supplement

DISTINCTIVE CHARACTERISTICS

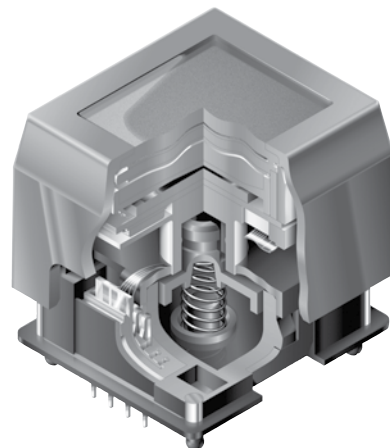
- High resolution of 64 x 32 pixels
- 64 colors of backlighting can be controlled dynamically
- Pushbutton switch or display with LCD, RGB LED backlighting
- General brightness of backlight is dynamically controlled in eight steps from dark to bright
- Operated by commands and data supplied via serial communications (SPI)
- Can display as many as four lines of text with ten characters each
- Incorporates bitmap display function
- Programmable display graphics for alphanumeric characters and animated sequences
- Dual image VRAM for quick change of displayed images
- Distinct, long travel of 4.5mm (same as KP01 Series)
- Low energy consumption
- Dust tight construction

Viewing area: 15.0mm x 10.8mm (horizontal x vertical)

High reliability and long life of three million actuations minimum

Epoxy sealed straight PC terminals

Snap-in standoff for easy, secure mounting and alignment

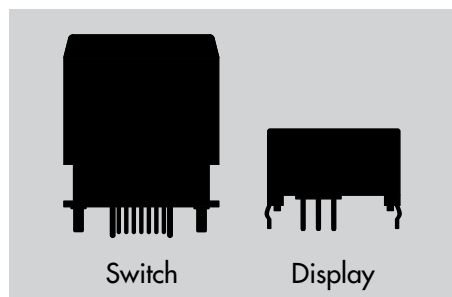


Viewing area: 13.9mm x 10.6mm (horizontal x vertical)

Bracket has crimped legs to ensure secure PC mounting and prevent dislodging during wave soldering



Actual Sizes



Switch

Display

SWITCH PART NUMBER & DESCRIPTION

Part Number	Switch Description	LCD Mode	LED Color
IS15DBFP4RGB	SPST Momentary ON Gold Contacts Straight PC Terminals	Black & White FSTN Positive	Red/Green/Blue

SWITCH SPECIFICATIONS

Circuit	SPST normally open
Electrical Capacity (Resistive Load)	100mA @ 12V DC
Contact Resistance	200 milliohms maximum @ 20mV 10mA
Insulation Resistance	100 megohms minimum @ 100V DC
Dielectric Strength	125V AC for 1 minute minimum
Mechanical Endurance	3,000,000 operations minimum
Electrical Endurance	3,000,000 operations minimum
Operating Force	2.0 ± 0.5 Newtons
Total Travel	4.5mm (.177")

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	15.0mm x 10.8mm (horizontal x vertical)
Pixel Format	64 x 32 pixels (horizontal x vertical)
Pixel Size	0.20mm x 0.27mm (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.

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	Min	Typical	Max
Contrast Ratio	Cr	—	3.0	—
Viewing Angle (Cr ≥ 1.1)	Up & Down θ	—	90°	—
	Right & Left φ	—	90°	—

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}	—	—	0.2V _{DD}
SPI Clock Frequency	f _{CLK}	—	—	8MHz
Current Consumption	I _{DD}	** 10mA	—	*** 50mA

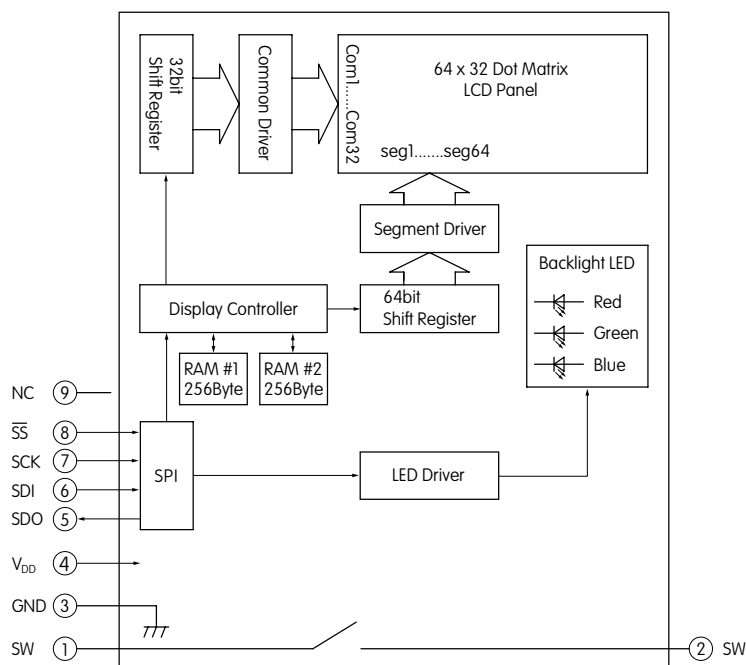
** 10mA: Backlighting LED is off

*** 50mA: Backlighting LEDs (Red, Green, Blue) are maximum brightness

SWITCH BLOCK DIAGRAM & PIN CONFIGURATIONS

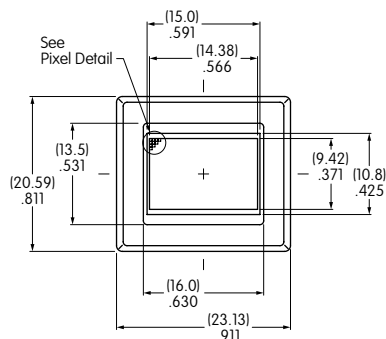


IS15DBFP4RGB
RGB LED Backlight
Black and White LCD

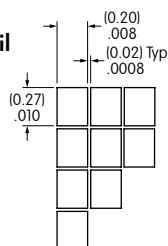


Pin No.	Symbol	Name	Function
①	SW	Terminal of Switch	Normally open
②	SW	Terminal of Switch	Normally open
③	GND	Ground	
④	V _{DD}	Power	Power source for logic circuit and LCD
⑤	SDO	Data Out	Data output line for SPI
⑥	SDI	Data In	Data input line for SPI
⑦	SCK	Serial Clock	Clock line for SPI that synchronizes commands and data
⑧	$\overline{SS}$	Slave Select	Chip select for SPI; line is active low
⑨	NC	None	No connection

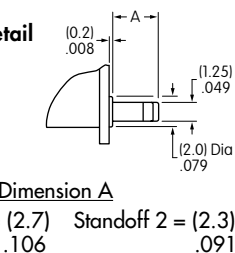
TYPICAL SWITCH DIMENSIONS



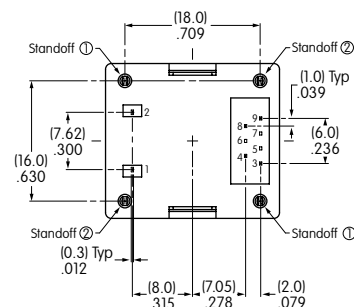
Pixel Detail



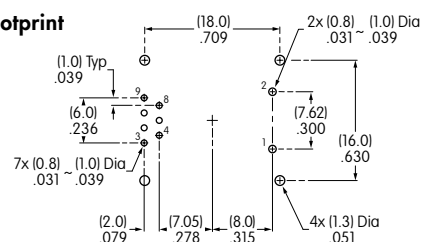
Standoff Detail



Terminal numbers are not on the switch.



Footprint



DISPLAY PART NUMBER & DESCRIPTION

Part Number	Terminals	LCD Mode	LED Color
ISO1DBFRGB	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	13.9mm x 10.6mm (horizontal x vertical)
Pixel Format	64 x 32 pixels (horizontal x vertical)
Pixel Size	0.18mm x 0.24mm (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.

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	Min	Typical	Max
Contrast Ratio	Cr	—	3.0	—
Viewing Angle (Cr ≥ 1.1)	Up & Down θ	—	90°	—
	Right & Left ϕ	—	90°	—

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	—	*** 50mA

** 10mA: Backlighting LED is off

*** 50mA: Backlighting LEDs (Red, Green, Blue) are maximum brightness

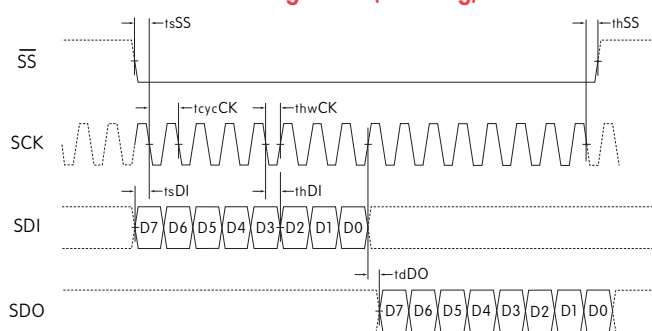
TIMING SPECIFICATIONS FOR SWITCH & DISPLAY

SPI Characteristics (See Timing Diagram)

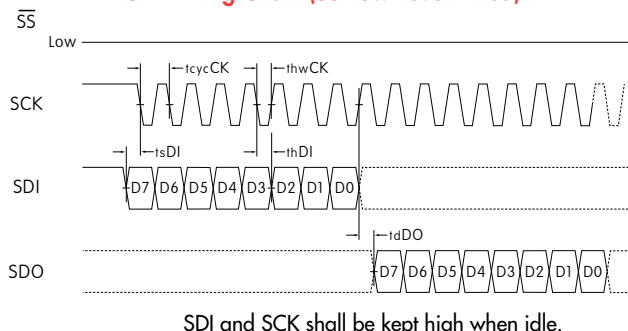
(Temperature at -15°C ~ +50°C and $V_{DD} = 5.0V \pm 2\%$)

Items	Symbols	Minimum	Maximum
SPI_SS Set Up Time	t_{sSS}	10ns	
SPI_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 (SS Using)



SPI Timing Chart (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	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

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	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 FOR SWITCH & DISPLAY

- 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 previous page 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 = 1/2 (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

DISTINCTIVE CHARACTERISTICS

Compact Size Combined with High Resolution

- High resolution of 64 x 32 pixels
- 64 colors of backlighting can be controlled dynamically
- Pushbutton switch 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)
- Can display as many as four lines of text with ten characters each
- Incorporates bitmap display function
- Programmable display graphics for alphanumeric characters and animated sequences
- Dual image VRAM for quick change of displayed images
- Low energy consumption
- Dust tight construction

Viewing area: 13.0mm x 10.7mm (horizontal x vertical)

Variety of LED backlighting with 64 colors and 8 steps brightness

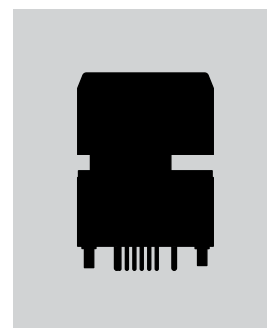
Dome gives crisp tactile feedback to positively indicate circuit transfer

Epoxy sealed straight PC terminals

Snap-in standoff for easy, secure mounting and alignment



Actual Size



PART NUMBER & DESCRIPTION

Part Number	Switch Description	LCD Mode	LED Color
IS15DSBFP4RGB	SPST Momentary ON Gold Contacts Straight PC Terminals	Black & White FSTN Positive	Red/Green/Blue

SWITCH SPECIFICATIONS

Circuit	SPST normally open
Electrical Capacity (Resistive Load)	100mA @ 12V DC
Contact Resistance	200 milliohms maximum @ 20mV 10mA
Insulation Resistance	100 megohms minimum @ 100V DC
Dielectric Strength	125V AC for 1 minute minimum
Mechanical Endurance	1,000,000 operations minimum
Electrical Endurance	1,000,000 operations minimum
Operating Force	1.7 ± 0.5 Newtons
Total Travel	1.8mm (.071")

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	Min	Typical	Max
Contrast Ratio	Cr	—	3.0	—
Viewing Angle (Cr ≥ 1.1)	Up & Down	θ	90°	—
	Right & Left	φ	90°	—

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	13.0mm x 10.7mm (horizontal x vertical)
Pixel Format	64 x 32 pixels (horizontal x vertical)
Pixel Size	0.18mm x 0.24mm (horizontal x vertical)
* Operating Temp Range	-15°C ~ +50°C (+5°F ~ +122°F)
Storage Temp 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	Min	Typical	Max
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}	—	—	0.2V _{DD}
SPI Clock Frequency	f _{SCK}	—	—	8MHz
Current Consumption	I _{DD}	** 10mA	—	*** 50mA

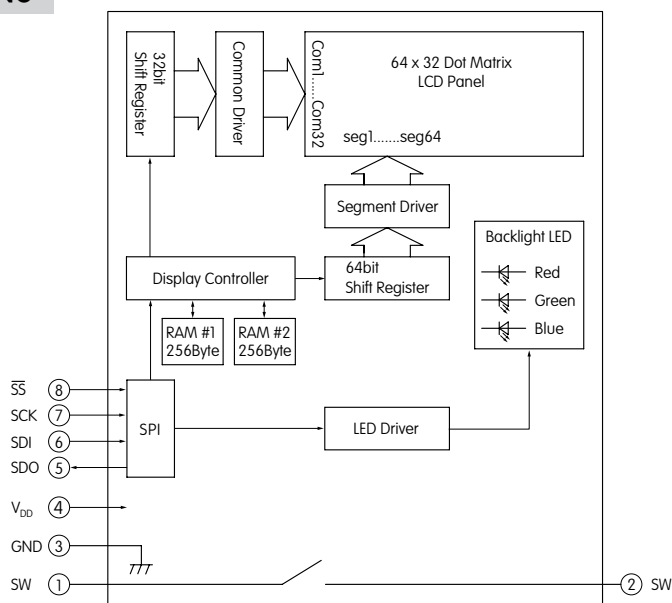
** 10mA: Backlighting LED is off

*** 50mA: Backlighting LEDs (Red, Green, Blue) are maximum brightness

BLOCK DIAGRAM & PIN CONFIGURATIONS

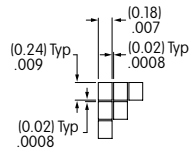
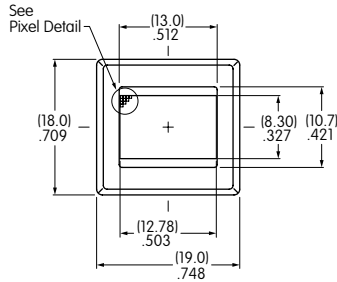


IS15DSBFP4RGB
RGB LED Backlight
Black and White LCD

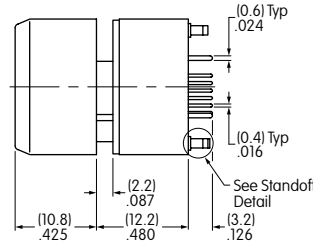


Pin No.	Symbol	Name	Function
①	SW	Terminal of Switch	Normally open
②	SW	Terminal of Switch	Normally open
③	GND	Ground	
④	V _{DD}	Power	Power source for logic circuit and LCD
⑤	SDO	Data Out	Data output line for SPI
⑥	SDI	Data In	Data input line for SPI
⑦	SCK	Serial Clock	Clock line for SPI that synchronizes commands and data
⑧	SS	Slave Select	Chip select for SPI; line is active low

TYPICAL SWITCH DIMENSIONS



Pixel Detail

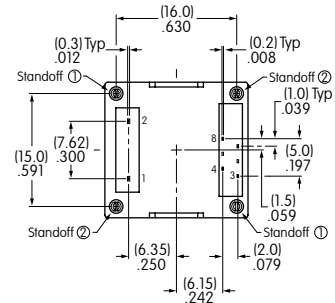


Standoff Detail

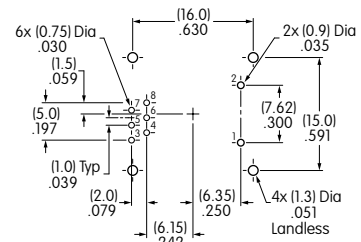
Dimension A

$$\text{Standoff 1} = \frac{(2.7)}{.106} \quad \text{Standoff 2} = \frac{(2.3)}{.091}$$

Terminal numbers are not on the switch.



Footprint



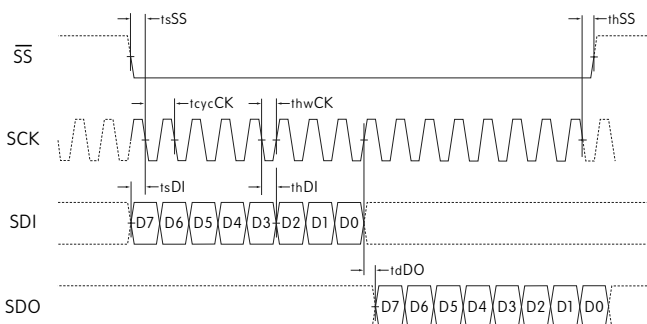
TIMING SPECIFICATIONS

SPI Characteristics (See Timing Diagram)

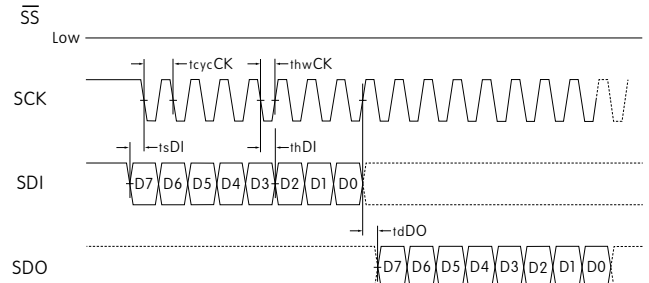
(Temperature at $-15^{\circ}\text{C} \sim +50^{\circ}\text{C}$ and $V_{\text{DD}} = 5.0\text{V} \pm 2\%$)

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)



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



SDI and SCK shall be kept high when idle.

PRECAUTIONS FOR HANDLING & STORAGE OF LCD 64 x 32 DEVICES

Handling



- 1. The IS Series devices are electrostatic sensitive.
- 2. Limit operating force to keytop to 100.0N maximum, as excessive pressure may damage the LCD device.
- 3. The IS series devices are not process sealed.
- 4. If the LCD is accidentally broken, avoid contact with the liquid and wash off any liquid spills to the skin or clothing.
- 5. 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.
- 6. Recommended soldering time and temperature limits:
Do not exceed 60°C at the LCD level.
Wave Soldering: see Profile B in Supplement section.
Manual Soldering for Switch: see Profile A in Supplement section.
Manual Soldering for Display: see Profile B in Supplement section.
- 7. Excessive images may result after the same image is emitted continuously for an extended period of time.
- 8. The highest backlight brightness level should not be used for temperatures above +35°C.

Storage

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

Toggles
Rockers
Pushbuttons
Illuminated PB
Programmable
Keylocks
Rotaries
Slides
Tactiles
Tilt
Touch
Indicators
Accessories
Supplement

DISTINCTIVE CHARACTERISTICS

Standard with Enhanced LED Illumination:

- Broad and even light diffusion
- Consistent backlighting
- Low energy consumption

Programmable LCD

Variety of LED Backlighting Colors

Rubber Dome

Epoxy Sealed Straight PC Terminals



RGB backlighting provides infinite color availability.

Programmable to display graphics, alphanumeric characters and animated sequences.

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

Wide viewing area 15.0mm x 10.8mm (horizontal x vertical) at 36 x 24 pixels.

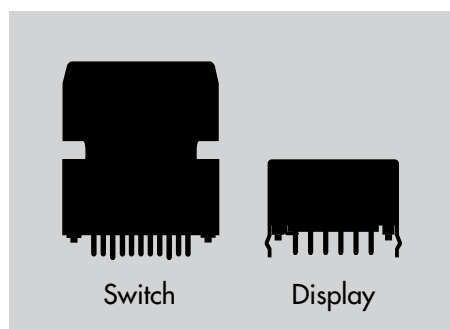
Dome gives crisp tactile feedback to positively indicate circuit transfer.

High reliability and long life of one million actuations minimum.

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

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

Actual Sizes



STANDARD LED BACKLIGHTING

Part Number	Switch Description	LCD Mode	LED Color
IS15AACP4CF	SPST Momentary ON Gold Contacts Straight PC Terminals	Yellow STN Positive	* Red/Green

* Simultaneous illumination of both colors achieves third color.

SUPER BRIGHT LED BACKLIGHTING

Part Number	Switch Description	LCD Mode	LED Color
IS15ABCP4CF	SPST Momentary ON Gold Contacts Straight PC Terminals	Yellow STN Positive	* Red/Green
IS15ABCP4E		Yellow STN Positive	Yellow
IS15ABCP4EF		Yellow STN Positive	* Yellow/Green
IS15ABDP4E		Blue STN Negative	Yellow
IS15ABDP4EG		Blue STN Negative	* Yellow/Blue
IS15ABDP4B		Blue STN Negative	White
IS15ABFP4B		Black & White FSTN Positive	White

* Simultaneous illumination of both colors achieves third color.

RGB LED BACKLIGHTING

Part Number	Switch Description	LCD Mode	LED Color
IS15ABFP4RGB	SPST Momentary ON Gold Contacts Straight PC Terminals	Black & White FSTN Positive	* Red/Green/Blue

* Simultaneous RGB illumination achieves infinite colors.

SWITCH SPECIFICATIONS

Circuit	SPST normally open
Electrical Capacity (Resistive Load)	100mA @ 12V DC
Contact Resistance	200 milliohms maximum @ 20mV 10mA
Insulation Resistance	100 megohms minimum @ 100V DC
Dielectric Strength	125V AC for 1 minute minimum
Mechanical Endurance	1,000,000 operations minimum
Electrical Endurance	1,000,000 operations minimum
Operating Force	2.2 ± 0.5 Newtons
Total Travel	1.8mm (.071")
Operating Temperature Range	-20°C ~ +60°C (-4°F ~ +140°F); contact factory for wide temperature range options
Storage Temperature Range	-30°C ~ +70°C (-22°F ~ +158 °F); contact factory for wide temperature range options

LCD SPECIFICATIONS

Characteristics of Display

Display Operation Mode	STN positive, STN negative, FSTN 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	15.0mm x 10.8mm (horizontal x vertical)
Pixel Format	36 x 24 pixels (horizontal x vertical)
Pixel Size	0.37mm x 0.37mm (horizontal x vertical)
Backlight LED	Single color: yellow, white Bicolor: red/green, yellow/green, yellow/blue RGB: red/green/blue

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_I	-0.3V to V_{DD} +0.3V
Output Voltage	V_O	-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 Yellow	V_{LC}	—	7.3V	—
Supply Voltage Blue	V_{LC}	—	7.5V	—
Supply Voltage Black/White	V_{LC}	—	7.3V	—
Input Voltage	V_I	0V	—	V_{DD}
Driving Frequency	f_{FLM}	—	64Hz: yellow/blue 150Hz: black/white	—

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

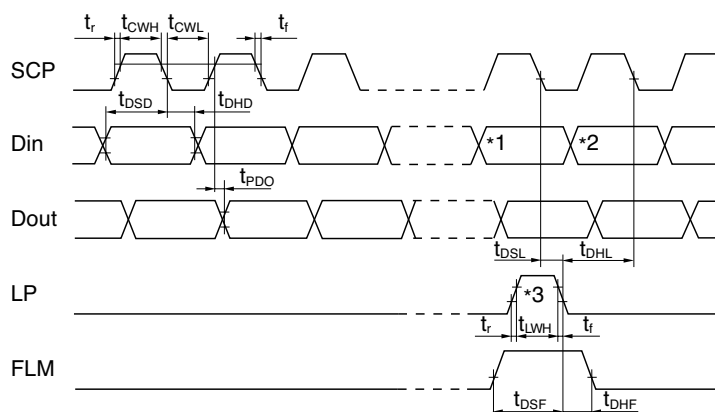
Items	Symbols	Test Conditions	Minimum	Typical	Maximum	Unit
High Level Input Voltage	V_{IH}		$0.7V_{DD}$		V_{DD}	V
Low Level Input Voltage	V_{IL}		0		$0.3V_{DD}$	V
High Level Input Leakage Current	I_{LIH}	$V_I = V_{DD}$			10	μA
Low Level Input Leakage Current	I_{LIL}	$V_I = 0V$			-10	μA
High Level Output Voltage	V_{OH}	$I_{OH} = -500\mu A$	$V_{DD} - 0.5$			V
Low Level Output Voltage	V_{OL}	$I_{OL} = 500\mu A$			0.5	V
High Level Output Leakage Current	I_{LOH}	$V_O = V_{DD}$			10	μA
Low Level Output Leakage Current	I_{LOL}	$V_O = 0V$			-10	μA
Supply Current	I_{DD}	$f_{SCP} = 1.0MHz$			500	μA
LCD Drive Current	I_{LC}	$f_{LP} = 2.4kHz$ $V_{LC} = 7.3V \sim 7.5V$		500	2,000	μA

Timing Characteristics of LCD Drive IC

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

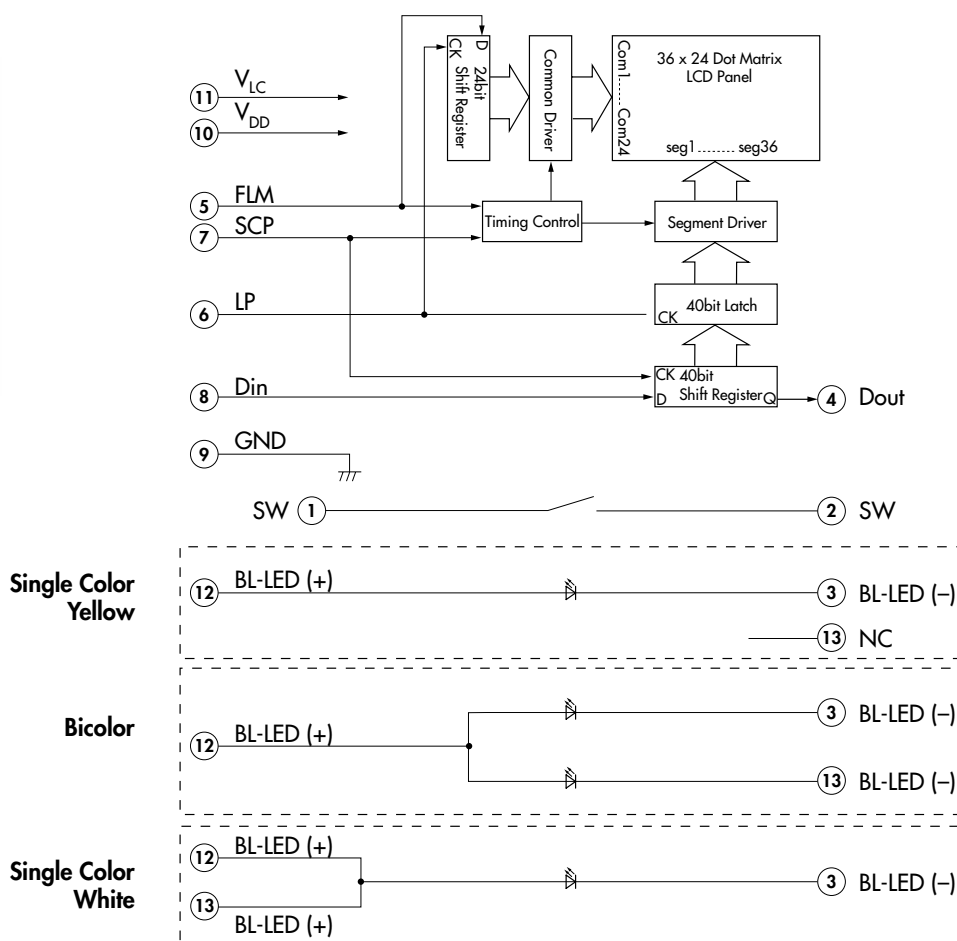
Items	Symbols	Minimum	Maximum
Clock Operation Frequency	f_{SCP}		6.0MHz
Latch Pulse Frequency	f_{LP}		50kHz
Clock High Level Pulse Width	t_{CWH}	70ns	
Clock Low Level Pulse Width	t_{CWL}	70ns	
Data Setup Time	t_{DSD}	45ns	
Data Hold Time	t_{DHD}	50ns	
Data Output Delay Time	t_{PDO}		25ns
Latch Setup Time	t_{DSL}	50ns	
Latch Hold Time	t_{DHL}	50ns	
Latch High Level Width	t_{LWH}	200ns	
FLM Setup Time	t_{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 FOR STANDARD OR SUPER BRIGHT LEDs

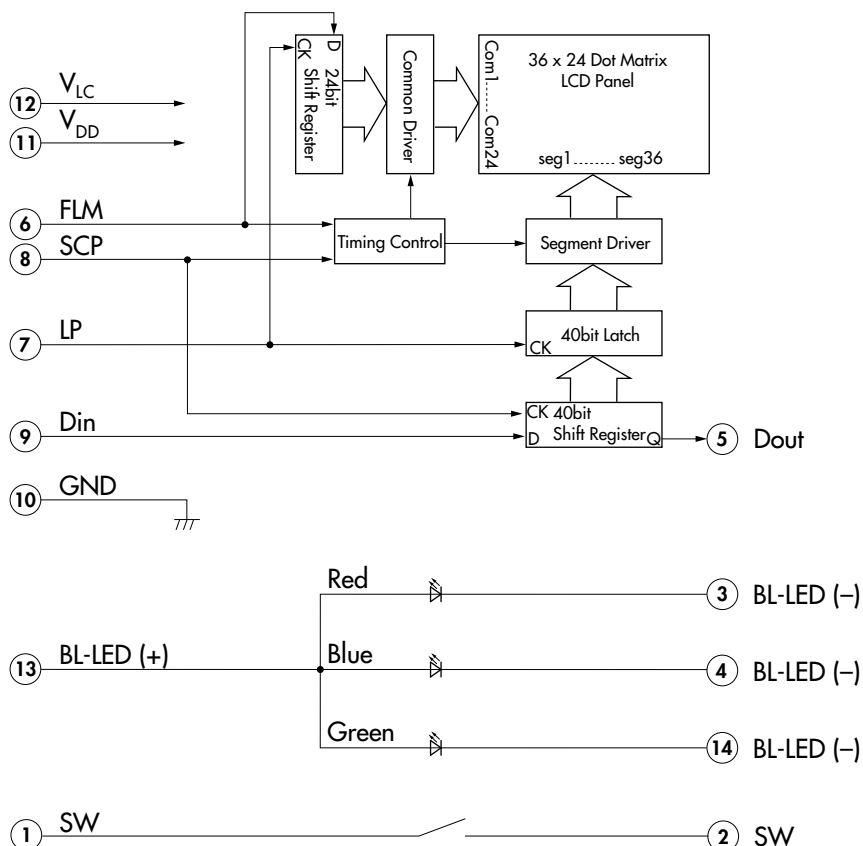
IS15ABCP4CF
Yellow LCD

Pin No.	Symbol	Name	Function
①	SW	Terminal of Switch	Normally open
②	SW	Terminal of Switch	Normally open
③	BL-LED (-)	Terminal of Backlight LED	Cathode: standard bicolor - green for red/green. super bright bicolor - red for red/green; yellow for yellow/green or yellow/blue.
④	Dout	Data Output	Display serial output. Can be used to connect to Din of the next SMARTSWITCH. As a result, many SMARTSWITCHES can be controlled with one clock and data signal.
⑤	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).
⑥	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.
⑦	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.
⑧	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.
⑨	GND	Ground	
⑩	V _{DD}	Power	Power source for logic circuit
⑪	V _{LC}	Power	Power source for LCD drive
⑫	BL-LED (+)	Terminal of Backlight LED	Anode for common
⑬	NC	None	No connection for single color yellow
	BL-LED (-)	Terminal of Backlight LED	Cathode for bicolor
	BL-LED (+)	Terminal of Backlight LED	Anode for single color white

BLOCK DIAGRAM & PIN CONFIGURATIONS FOR RGB LEDs



IS15ABFP4RGB
RGB LED Backlight
Black and White LCD



Pin No.	Symbol	Name	Function
①	SW	Terminal of Switch	Normally open
②	SW	Terminal of Switch	Normally open
③	BL-LED (-)	Terminal of Backlight LED	Cathode for red
④	BL-LED (-)	Terminal of Backlight LED	Cathode for blue
⑤	Dout	Data Output	Display serial output. Can be used to connect to Din of the next SMARTSWITCH. As a result, many SMARTSWITCHES can be controlled with one clock and data signal.
⑥	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).
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	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.
⑨	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.
⑩	GND	Ground	
⑪	V _{DD}	Power	Power source for logic circuit
⑫	V _{LC}	Power	Power source for LCD drive
⑬	BL-LED (+)	Terminal of Backlight LED	Anode for common
⑭	BL-LED (-)	Terminal of Backlight LED	Cathode for green

STANDARD 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	2.1/2.2	V

SUPER BRIGHT LED SPECIFICATIONS

Typical Electrical Characteristics (Temperature at 25°C)

Backlight Color	Symbols	Red/Green	Yellow/Green	Yellow	Yellow/Blue	White	Unit
Forward Current	I_F	15/15	15/15	15	15/15	20	mA
Forward Voltage	V_F	2.1/3.3	2.2/3.3	2.2	2.2/3.4	3.6	V

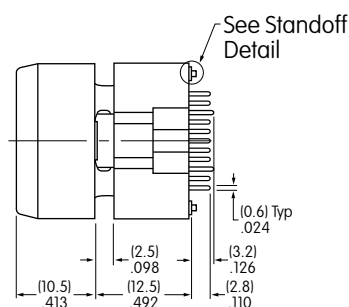
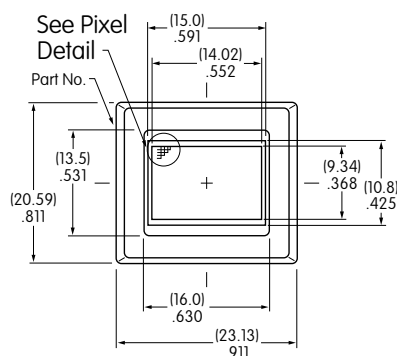
ABSOLUTE MAXIMUM FOR ALL STANDARD OR SUPER BRIGHT LEDs

Electrical Characteristics (Temperature at 25°C)

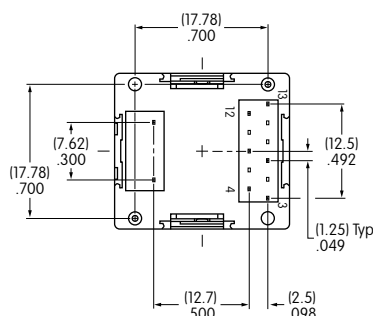
Backlight Color	Symbols	White	All Others	Unit
Forward Current	I_F	30	20	mA
Reverse Voltage	V_R	5.0	4.0	V
Current Reduction Rate Above 25°C	$\Delta I_F(\text{DC})$	-0.50	-0.26	mA/°C
*Power Dissipation	P_D	120	130	mW

*For uniform light emission, Power Dissipation should not exceed the Absolute Maximum Rating, and the Forward Current should not exceed the derated Absolute Forward Current.

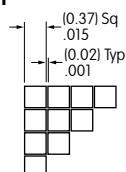
TYPICAL SWITCH DIMENSIONS WITH STANDARD OR SUPER BRIGHT LEDs



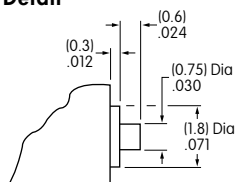
Terminal numbers are not on the switch.



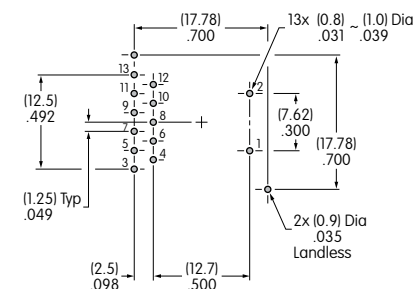
Pixel Detail



Standoff Detail



Footprint



SUPER BRIGHT RGB LED SPECIFICATIONS

Typical Electrical Characteristics (Temperature at 25°C)

Backlight Color	Symbols	Red	Green	Blue	Unit
Forward Current	I_F	10	10	10	mA
Forward Voltage	V_F	2.0	2.8	2.8	V

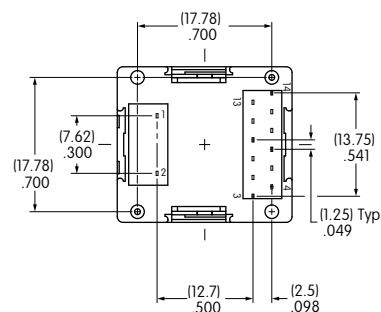
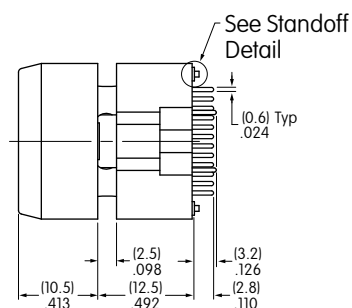
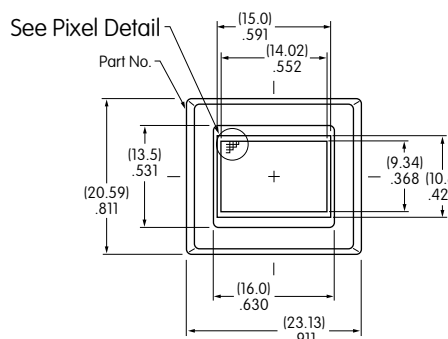
ABSOLUTE MAXIMUM FOR RGB LED

Electrical Characteristics (Temperature at 25°C)

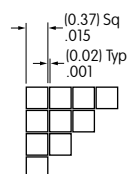
Backlight Color	Symbols	Red/Green/Blue	Unit
Forward Current	I_F	20	mA
Reverse Voltage	V_R	4.0	V
Current Reduction Rate Above 25°C	$\Delta I_F(\text{DC})$	-0.33	mA/°C
*Power Dissipation	P_D	115	mW

*For uniform light emission, Power Dissipation should not exceed the Absolute Maximum Rating, and the Forward Current should not exceed the derated Absolute Forward Current.

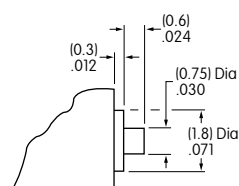
TYPICAL SWITCH DIMENSIONS WITH RGB LED



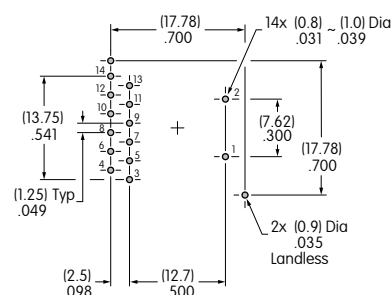
Terminal numbers are not on the switch.



Pixel Detail



Standoff Detail



Footprint

DISTINCTIVE CHARACTERISTICS

Standard with Enhanced Illumination:

Programmable to display graphics, alphanumeric characters and animated sequences.

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

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

Built-in single or bicolor LED backlighting enhances display and enables multifunctional uses. RGB LED provides numerous color variations.

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



SUPER BRIGHT LED BACKLIGHTING

Part Number	Terminals	LCD Mode	LED Color
ISO1BCCF	Straight PC	Yellow STN Positive	* Red/Green
ISO1BCE	Straight PC	Yellow STN Positive	Yellow
ISO1BCEF	Straight PC	Yellow STN Positive	* Yellow/Green

* Simultaneous illumination of both colors achieves third color.

RGB LED BACKLIGHTING

Part Number	Terminals	LCD Mode	LED Color
ISO1BFRGB	Straight PC	Black & White FSTN Positive	** Red/Green/Blue

** Simultaneous RGB illumination achieves infinite colors.

LCD SPECIFICATIONS

Characteristics of Display

Display Operation Mode	STN positive, FSTN 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 pixels (horizontal x vertical)
Pixel Size	0.33mm x 0.33mm (horizontal x vertical)
Operating Temperature Range	-20°C ~ +60°C (-4°F ~ +140°F)
Storage Temperature Range	-30°C ~ +70°C (-22°F ~ +158°F)
Backlight LED	Single color: yellow; Bicolor: red/green, yellow/green; RGB: red/green/blue

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_I	-0.3V to $V_{DD}+0.3V$
Output Voltage	V_O	-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_I	0V	—	V_{DD}
Driving Frequency	f_{FLM}	—	150Hz	—

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

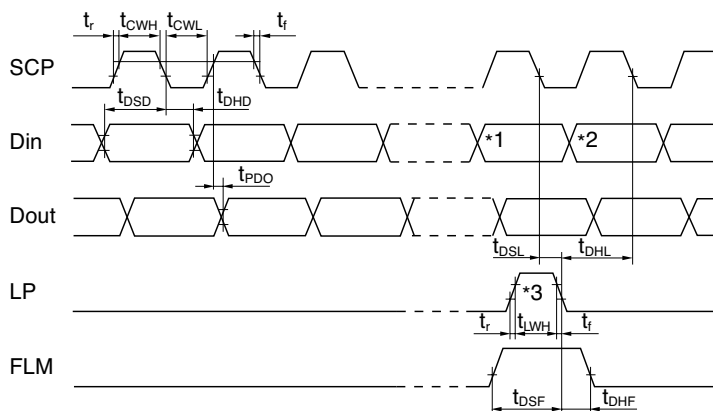
Items	Symbols	Test Conditions	Minimum	Typical	Maximum	Unit
High Level Input Voltage	V_{IH}		$0.7V_{DD}$		V_{DD}	V
Low Level Input Voltage	V_{IL}		0		$0.3V_{DD}$	V
High Level Input Leakage Current	I_{LH}	$V_I = V_{DD}$			10	μA
Low Level Input Leakage Current	I_{LIL}	$V_I = 0V$			-10	μA
High Level Output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

Timing Characteristics of LCD Drive IC

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

Items	Symbols	Minimum	Maximum
Clock Operation Frequency	f_{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	t_{DSF}	50ns	
FLM Hold Time	t_{DHF}	50ns	
SCP, LP Rise/Fall Time	t_r/t_f		15ns

Timing Diagram

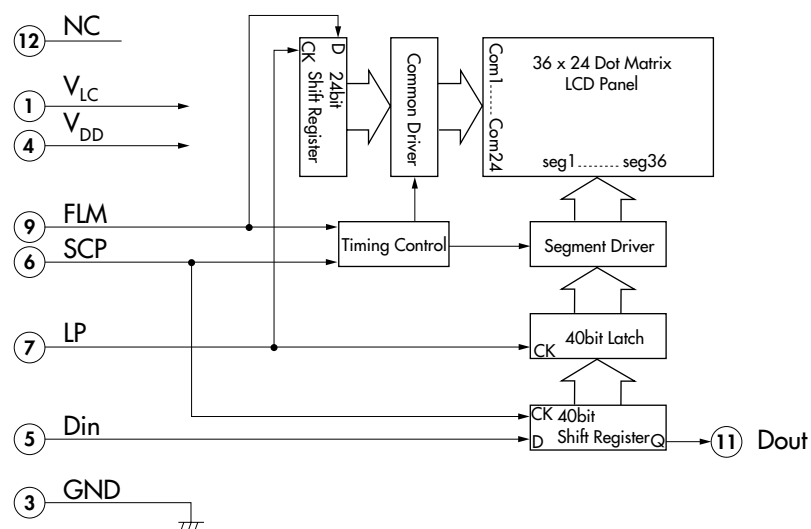
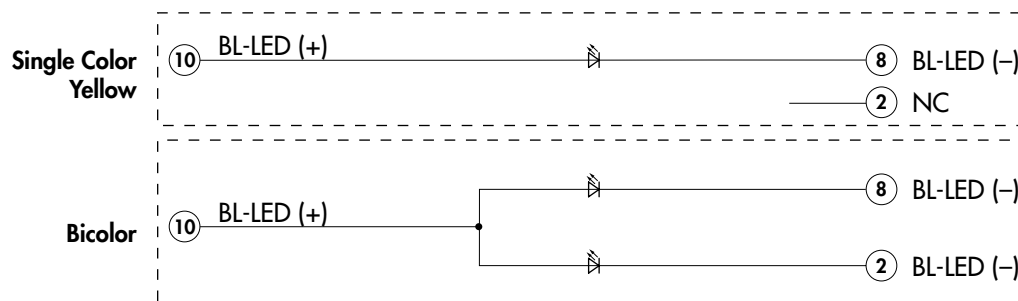


*1 Last data on first line

*2 Beginning data on second line

*3 Location of LP signal on first line

BLOCK DIAGRAM & PIN CONFIGURATIONS FOR SUPER BRIGHT LEDs

ISO1BCCF
Yellow LCD Mode

Pin No.	Symbol	Name	Function
①	V _{LC}	Power	Power source for LCD drive
②	NC	None	No connection for single color
	BL-LED (-)	Terminal of Backlight LED	Cathode for bicolor
③	GND	Ground	
④	V _{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: super bright bicolor - red for red/green or yellow for yellow/green
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
⑪	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	Yellow	Yellow/Green	Unit
Forward Current	I_F	15/15	15	15/15	mA
Forward Voltage	V_F	2.1/3.3	2.2	2.2/3.3	V

ABSOLUTE MAXIMUM FOR SUPER BRIGHT LEDs

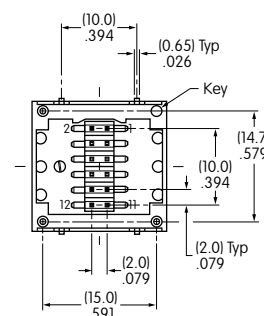
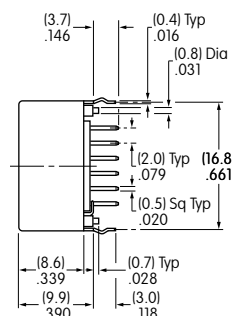
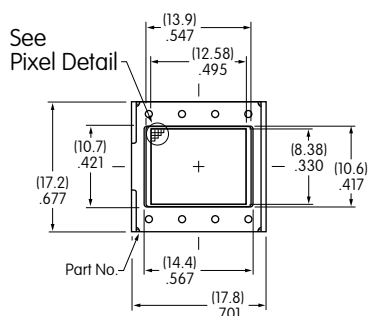
Electrical Characteristics (Temperature at 25°C)

Backlight Color	Symbols	All	Unit
Forward Current	I_F	20	mA
Reverse Voltage	V_R	4.0	V
Current Reduction Rate Above 25°C	$\Delta I_F(\text{DC})$	-0.26	mA/°C
Power Dissipation*	P_D	130	mW

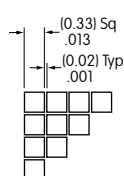
*For uniform light emission, Power Dissipation should not exceed the Absolute Maximum Rating, and the Forward Current should not exceed the derated Absolute Forward Current.

TYPICAL DISPLAY DIMENSIONS

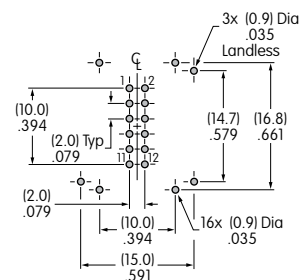
Terminal numbers are not on the device.



Pixel Detail



Footprint



SUPER BRIGHT RGB LED SPECIFICATIONS

Typical Electrical Characteristics (Temperature at 25°C)

Backlight Color	Symbols	Red	Green	Blue	Unit
Forward Current	I_F	10	10	10	mA
Forward Voltage	V_F	2.0	2.8	2.8	V

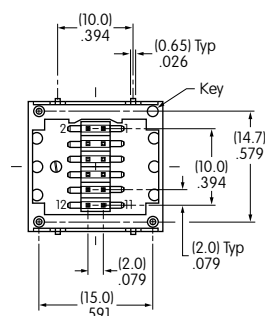
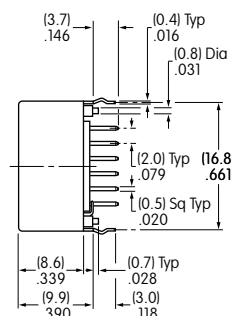
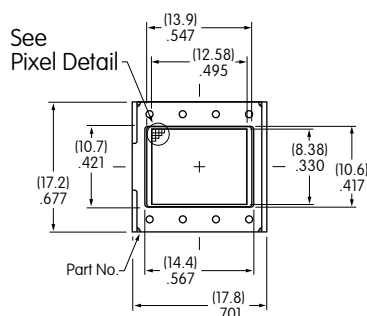
ABSOLUTE MAXIMUM FOR RGB LED

Electrical Characteristics (Temperature at 25°C)

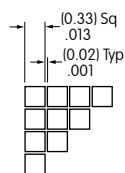
Backlight Color	Symbols	Red/Green/Blue	Unit
Forward Current	I_F	20	mA
Reverse Voltage	V_R	4.0	V
Current Reduction Rate Above 25°C	$\Delta I_F(\text{DC})$	-0.33	mA/°C
*Power Dissipation	P_D	115	mW

*For uniform light emission, Power Dissipation should not exceed the Absolute Maximum Rating, and the Forward Current should not exceed the derated Absolute Forward Current.

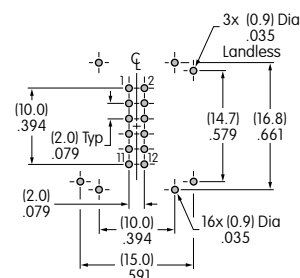
TYPICAL DISPLAY DIMENSIONS WITH RGB LED



Terminal numbers are not on the device.



Pixel Detail



Footprint

DISTINCTIVE CHARACTERISTICS

Compact Size

- Perfect for rack mount router and other applications with space limitations.
Compact body size: 19.0mm (.748") x 18.0mm (.709") compared to
Standard body size: 23.13mm (.911") x 20.59mm (.811")
- Vibrant Illumination
- Low Energy Consumption

Programmable LCD

Variety of LED Backlighting Colors

Rubber Dome

Epoxy Sealed Straight PC Terminals

Snap-in standoff for easy, secure mounting and alignment



Programmable to display graphics, alphanumeric characters and animated sequences.

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

Viewing area 13.0mm x 10.7mm (horizontal x vertical) at 36 x 24 pixels.

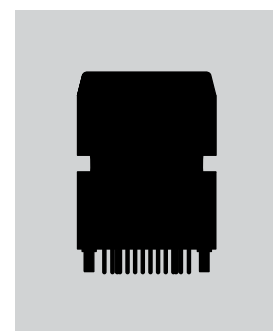
Dome gives crisp tactile feedback to positively indicate circuit transfer.

High reliability and long life of one million actuations minimum.

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

Optional accessories available to simplify production process.

Actual Size



PART NUMBER & DESCRIPTION

Part Number	Switch Description	LCD Mode	LED Color
IS15SACP4CF	SPST Momentary ON Gold Contacts Straight PC Terminals	Yellow STN Positive	* Red/Green Standard
IS15SBCP4CF		Yellow STN Positive	* Red/Green Super Bright
IS15SBCP4EF		Yellow STN Positive	* Yellow/Green Super Bright
IS15SBFP4B		Black & White FSTN Positive	White Super Bright
IS15SBFP4RGB		Black & White FSTN Positive	** Red/Green/Blue RGB

* Simultaneous illumination of both colors achieves third color. ** Simultaneous RGB illumination achieves infinite colors.

Note: Contact factory for additional options.

SWITCH SPECIFICATIONS

Circuit	SPST normally open
Electrical Capacity (Resistive Load)	100mA @ 12V DC
Contact Resistance	200 milliohms maximum @ 20mV 10mA
Insulation Resistance	100 megohms minimum @ 100V DC
Dielectric Strength	125V AC for 1 minute minimum
Mechanical Endurance	1,000,000 operations minimum

Electrical Endurance	1,000,000 operations minimum
Operating Force	2.2 ± 0.5 Newtons
Total Travel	1.8mm (.071")
Operating Temperature Range	-20°C ~ +60°C (-4°F ~ +140°F)
Storage Temperature Range	-30°C ~ +70°C (-22°F ~ +158°F)

LCD SPECIFICATIONS

Characteristics of Display

Display Operation Mode	STN positive, FSTN 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	13.0mm x 10.7mm (horizontal x vertical)
Pixel Format	36 x 24 pixels (horizontal x vertical)
Pixel Size	0.33mm x 0.33mm (horizontal x vertical)
Backlight LED	Single color: white. Bicolor: red/green, yellow/green. RGB: red/green/blue

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 _I	-0.3V to V _{DD} +0.3V
Output Voltage	V _O	-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	V _{LC}	—	7.3V	—
Input Voltage	V _I	0V	—	V _{DD}
Driving Frequency	f _{FLM}	—	150Hz	—

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

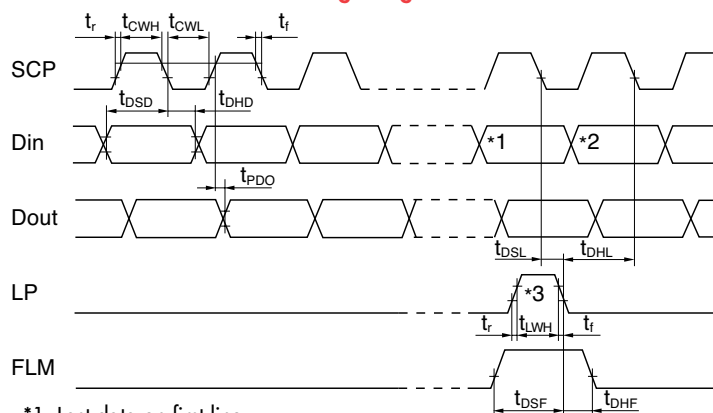
Items	Symbols	Test Conditions	Minimum	Typical	Maximum	Unit
High Level Input Voltage	V _{IH}		0.7 V _{DD}		V _{DD}	V
Low Level Input Voltage	V _{IL}		0		0.3 V _{DD}	V
High Level Input Leakage Current	I _{LIH}	V _I = V _{DD}			10	μA
Low Level Input Leakage Current	I _{LIL}	V _I = 0V			-10	μA
High Level Output Voltage	V _{OH}	I _{CH} = -500μA	V _{DD} -0.5			V
Low Level Output Voltage	V _{OL}	I _{OL} = 500μA			0.5	V
High Level Output Leakage Current	I _{LOH}	V _O = V _{DD}			10	μA
Low Level Output Leakage Current	I _{LOL}	V _O = 0V			-10	μA
Supply Current	I _{DD}	f _{SCP} = 1.0MHz			500	μA
LCD Drive Current	I _{LC}	f _{LP} = 2.4kHz V _{LC} = 7.3V		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 _{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 _{DSF}	45ns	
Data Hold Time	t _{DHF}	50ns	
Data Output Delay Time	t _{DSF}		25ns
Latch Setup Time	t _{DSL}	50ns	
Latch Hold Time	t _{DHL}	50ns	
Latch High Level Width	t _{LWH}	200ns	
FLM Setup Time	t _{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

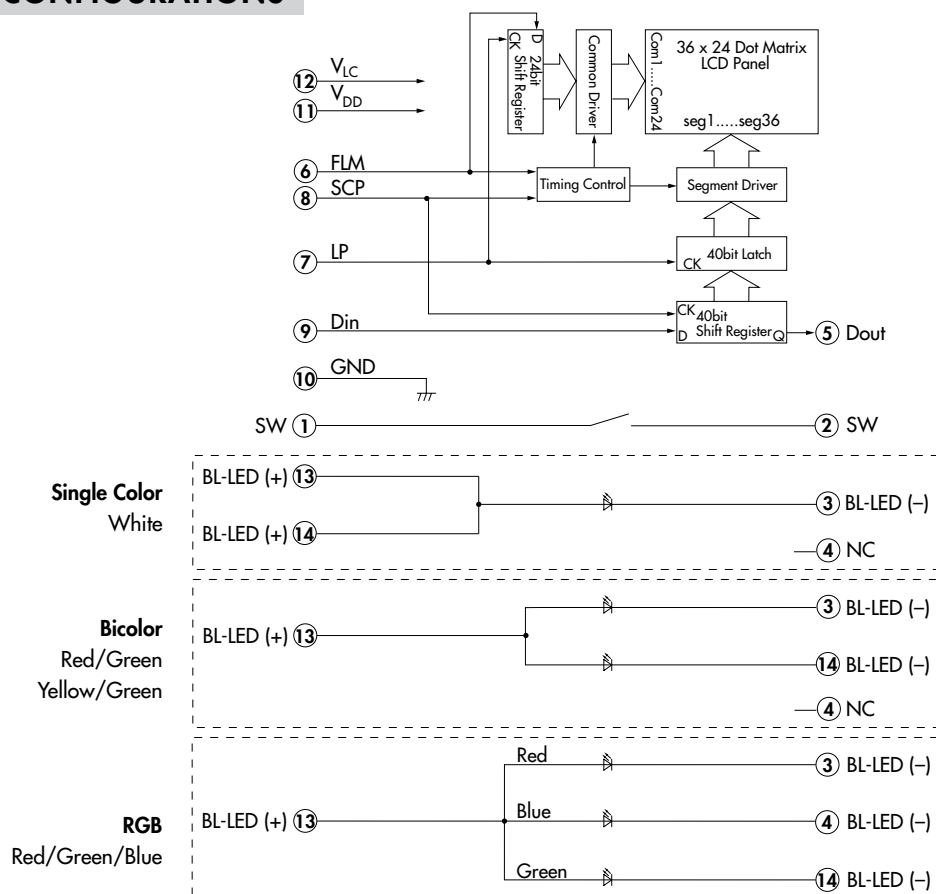
*2 Beginning data on second line

*3 Location of LP signal on first line

BLOCK DIAGRAM & PIN CONFIGURATIONS



IS15SBCP4CF
Yellow LCD Mode



Pin No.	Symbol	Name	Function
①	SW	Terminal of Switch	Normally open
②	SW	Terminal of Switch	Normally open
③	BL-LED (-)	Terminal of Backlight LED	Cathode: single color - white; standard bicolor - green for red/green; super bright bicolor - red for red/green; yellow for yellow/green; RGB - red
④	NC	None	No connection for single color white. No connection for bicolor.
④	BL-LED (-)	Terminal of Backlight LED	Cathode: RGB - blue
⑤	Dout	Data Output	Display serial output. Can be used to connect to Din of the next SMARTSWITCH. As a result, many SMARTSWITCHES can be controlled with one clock and data signal.
⑥	FLM	First Line Marker	The marking signal for the first line data of LCD display. The first line of LCD will be selected by falling edge of LP signal during the high level (FLM).
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	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.
⑨	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.
⑩	GND	Ground	
⑪	V _{DD}	Power	Power source for logic circuit
⑫	V _{LC}	Power	Power source for LCD drive
⑬	BL-LED (+)	Terminal of Backlight LED	Anode for common
⑭	BL-LED (+)	Terminal of Backlight LED	Anode: single color - white
⑭	BL-LED (-)	Terminal of Backlight LED	Cathode: standard bicolor - red for red/green; super bright bicolor - green for red/green; green for yellow/green; RGB - green

STANDARD 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	2.1/2.2	V

SUPER BRIGHT LED SPECIFICATIONS

Typical Electrical Characteristics (Temperature at 25°C)

Backlight Color	Symbols	Red/Green	Yellow/Green	White	Unit
Forward Current	I_F	15/15	15/15	20	mA
Forward Voltage	V_F	2.1/3.3	2.2/3.3	3.6	V

RGB LED CHARACTERISTICS

Typical Electrical Characteristics (Temperature at 25°C)

Backlight Color	Symbols	Red	Green	Blue	Unit
Forward Current	I_F	10	10	10	mA
Forward Voltage	V_F	2.0	2.8	2.8	V

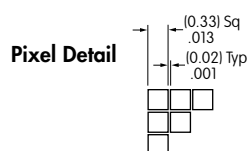
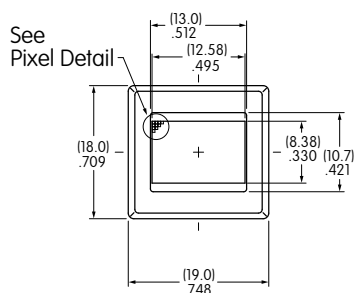
ABSOLUTE MAXIMUM FOR ALL LEDS

Electrical Characteristics (Temperature at 25°C)

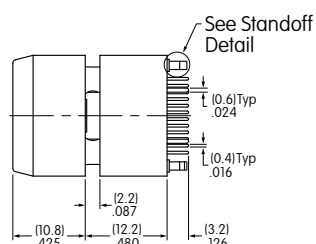
Backlight Color	Symbols	White	Bicolor	RGB	Unit
Forward Current	I_F	30	20	20	mA
Reverse Voltage	V_R	5.0	4.0	4.0	V
Current Reduction Rate Above 25°C	$\Delta I_F(\text{DC})$	-0.50	-0.26	-0.33	mA/°C
*Power Dissipation	P_D	120	130	115	mW

*For uniform light emission, Power Dissipation should not exceed the Absolute Maximum Rating, and the Forward Current should not exceed the derated Absolute Forward Current.

TYPICAL SWITCH DIMENSIONS



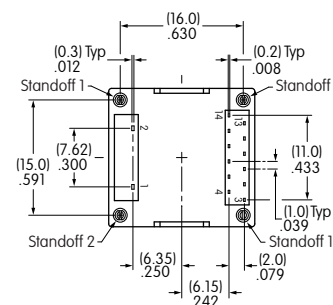
Standoff Detail



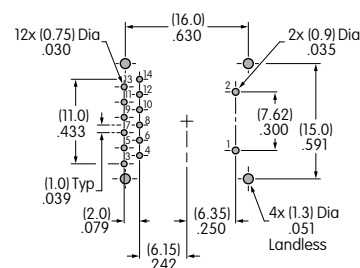
Dimension A

Standoff 1 = (2.7) .106 Standoff 2 = (2.3) .091

Terminal numbers are not on the switch.



Footprint



PRECAUTIONS FOR HANDLING & STORAGE OF LCD 36 x 24 DEVICES

Handling



1. The IS Series devices are electrostatic sensitive.
2. Limit operating force to keytop to 100.0N maximum, as excessive pressure may damage the LCD device.
3. The IS series devices are not process sealed.
4. If the LCD is accidentally broken, avoid contact with the liquid and wash off any liquid spills to the skin or clothing.
5. 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.
6. Recommended soldering time and temperature limits:
 Do not exceed 70°C at the LCD level.
 Wave Soldering: see Profile B in the Supplement section.
 Manual Soldering for Switch: see Profile A in the Supplement section.
 Manual Soldering for Display: see Profile B in the Supplement section.
7. Recommendation for backlight color uniformity: Use constant current driver. For current limiting resistor method, the power source should be at least twice the backlight LED forward voltage.
8. 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 may become damaged.
9. Backlight Forward Current should not exceed the derated Absolute Maximum Forward Current based on the temperature.
10. Excessive images may result after the same image is emitted continuously for an extended period of time.

Storage

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

Toggles

Rockers

Pushbuttons

Illuminated PB

E Programmable

Keylocks

Rotaries

Slides

Tactiles

Tilt

Touch

Indicators

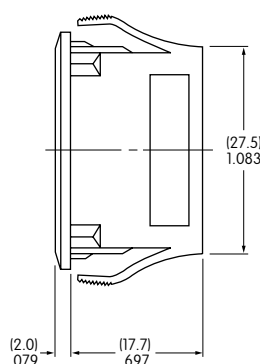
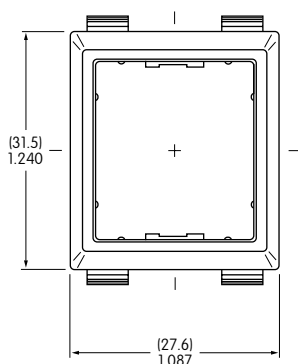
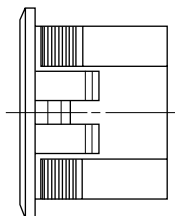
Accessories

Supplement

OPTIONAL ACCESSORIES

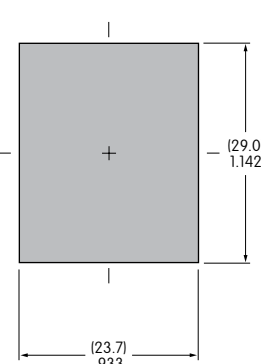
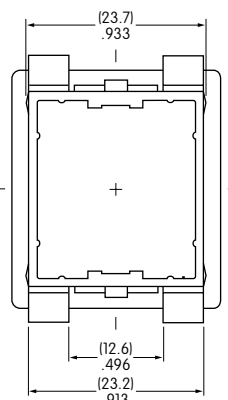
AT548 Panel Mount Housing

Material: Polyamide



Compatible Part Numbers for AT548

Wide View LCD 36 x 24	LCD 36 x 24	
IS15BAFP4CF	IS15AACP4CF	IS15ABDP4E
IS15BBFP4RGB	IS15ABCP4CF	IS15ABDP4EG
	IS15ABCP4EF	IS15ABFP4B
	IS15ABDP4B	IS15ABFP4RGB



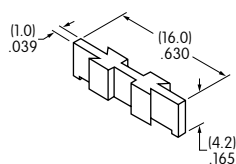
The Panel Mount Housing is available for the LCD 36 x 24 Pushbutton only.

Panel Thickness Range:
(1.5 ~ 4.0mm) .059 ~ .157"

Panel mount housing allows the LCD 36 x 24 Pushbutton to be snapped into a panel cutout for quick, secure mounting. It gives flexibility in locating the devices anywhere on the panel. It also allows using the LCD 36 x 24 Pushbutton on an existing panel.

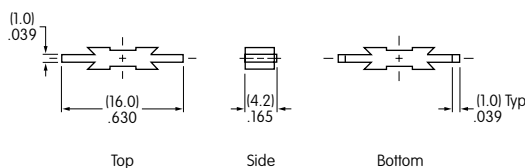
AT542 Coupler

Material: PBT



Compatible Part Numbers for AT542

Wide View LCD 36 x 24	LCD 36 x 24	
IS15BAFP4CF	IS15AACP4CF	IS15ABDP4E
IS15BBFP4RGB	IS15ABCP4CF	IS15ABDP4EG
	IS15ABCP4EF	IS15ABFP4B
	IS15ABDP4B	IS15ABFP4RGB



This coupler is for connecting the LCD 36 x 24 Pushbutton into precise, tight groupings that maintain an even distance from PCB to top of the actuator.

The Coupler is available for the LCD 36 x 24 Pushbutton only.

OPTIONAL ACCESSORIES

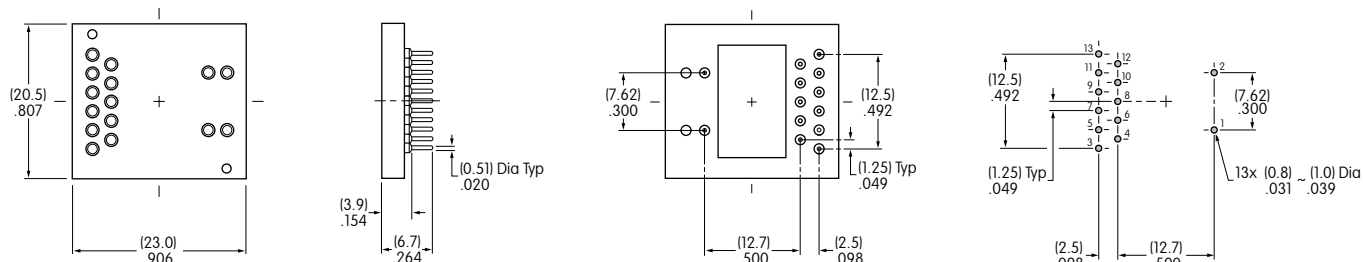
AT9704-02YC Socket for Single and Bicolor LCD 36 x 24 Pushbutton

Materials:

Base - Glass Fiber Reinforced PBT

Terminals - Brass/Beryllium Copper

- The socket permits the SMARTSWITCH™ to be plugged in after automated processing.
- Use of the socket enables easy field replacement of the device.



Compatible Part Numbers for AT9704-02YC

Single & Bicolor LCD 36 x 24

IS15AACP4CF	IS15ABCP4EF	IS15ABDP4EG
IS15ABCP4CF	IS15ABDP4B	IS15ABFP4B
IS15ABCP4E	IS15ABDP4E	

Wide View LCD 36 x 24

IS15BAFP4CF

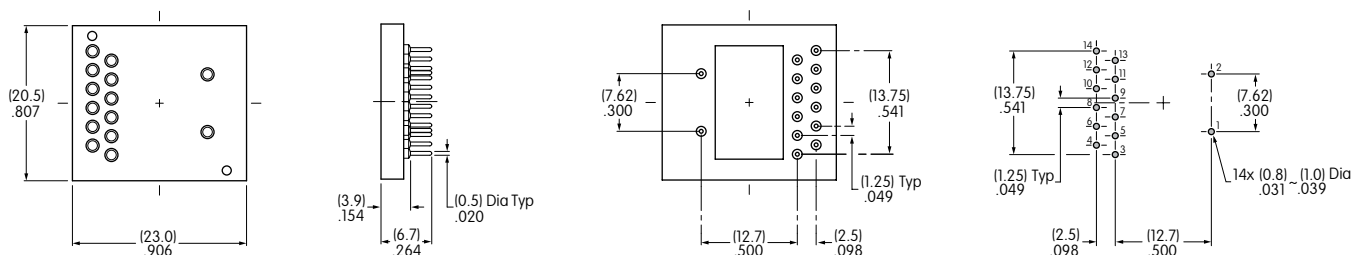
AT9704-065E Socket for RGB LCD 36 x 24 Pushbutton

Materials:

Base - Glass Fiber Reinforced PBT

Terminals - Brass/Beryllium Copper

- The socket permits the RGB SMARTSWITCH™ to be plugged in after automated processing.
- Use of the socket enables easy field replacement of the device.



Compatible Part Numbers for AT9704-065E

RGB LCD 36 x 24

IS15ABFP4RGB	IS15BBFP4RGB
--------------	--------------

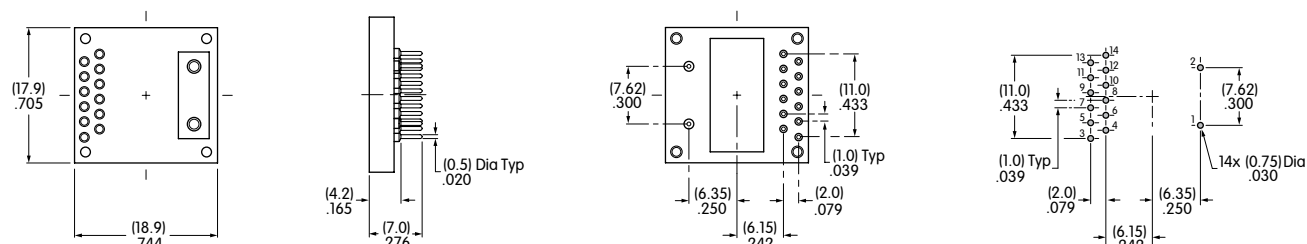
AT9704-065F Socket for Compact Pushbutton (All Models)

Materials:

Base - Glass Fiber Reinforced PBT

Terminals - Brass/Beryllium Copper

- The socket permits the Compact SMARTSWITCH™ to be plugged in after automated processing.
- Use of the socket enables easy field replacement of the device.



Compatible Part Numbers for AT9704-065F

Wide View/Short Travel LCD 64 x 32	LCD 36 x 24 Compact
IS15EBFP4RGB-09YN	IS15SACP4CF
Wide View LCD 64 x 32 Compact	IS15SBCP4CF
IS15ESBFP4RGB	IS15SBCP4EF
Short Travel LCD 64 x 32	IS15SBFP4B
IS15SDBFP4RGB-09YN	IS15SBFP4RGB
LCD 64 x 32 Compact	Wide View LCD 36 x 24 Compact
IS15DSBFP4RGB	IS15BSBFP4RGB

Note: AT9704-065F Socket may be used with the LCD 64 x 32 SMARTSWITCH™ by removing pins 3, 4, 11, 12, 13 and 14.

OPTIONAL ACCESSORIES

AT9704-085K Socket for LCD 64 x 32 Pushbutton

Materials:

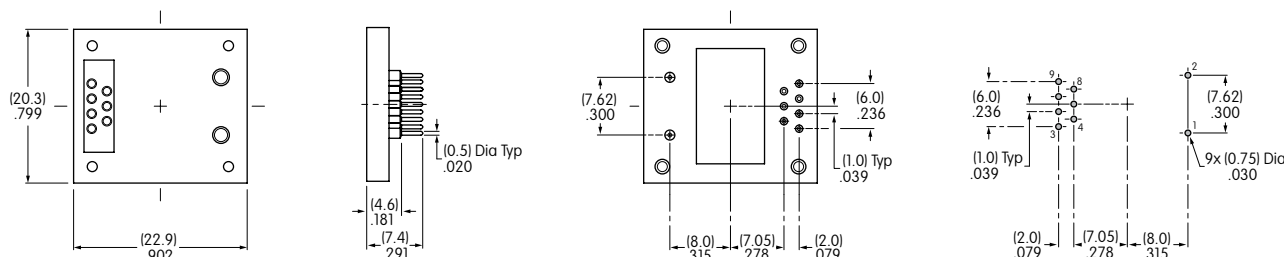
Base - Glass Fiber Reinforced PBT

Terminals - Brass/Beryllium Copper

Compatible Part Numbers for AT9704-085K

Wide View LCD 64 x 32	LCD 64 x 32
IS15EBFP4RGB	IS15DBFP4RGB

- The socket permits the SMARTSWITCH™ to be plugged in after automated processing.
- Use of the socket enables easy field replacement of the device.



AT9704-085L Socket for OLED Pushbutton

Materials:

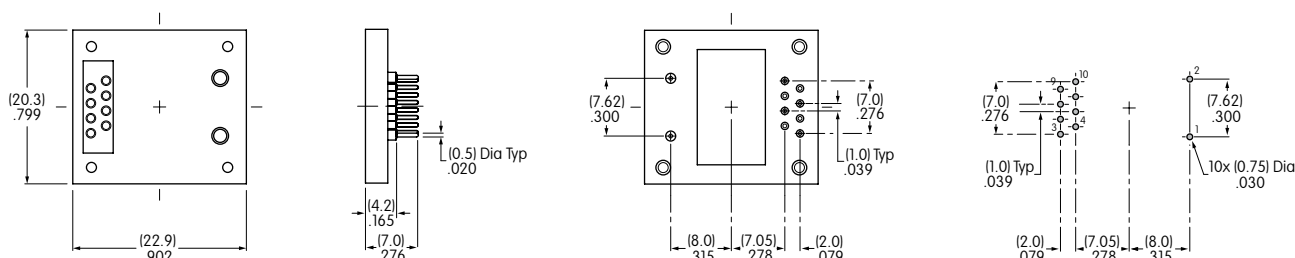
Base - Glass Fiber Reinforced PBT

Terminals - Brass/Beryllium Copper

Compatible Part Numbers for AT9704-085L

OLED Pushbutton
ISC15ANP4
ISF15ACP4

- The socket permits the OLED SMARTSWITCH™ to be plugged in after automated processing.
- Use of the socket enables easy field replacement of the device.



AT9704-085M Socket for OLED Display

Materials:

Base - Glass Fiber Reinforced PBT

Terminals - Brass/Beryllium Copper

Compatible Part Number for AT9704-085M

OLED Display
ISC01P

- The socket permits the OLED SMARTDISPLAY™ to be plugged in after automated processing.
- Use of the socket enables easy field replacement of the device.

