

# SMARTSWITCH™

ACTIVATIONS MADE SIMPLE







**NKK**®  
**SWITCHES**  
[www.nkksmartswitch.com](http://www.nkksmartswitch.com)

Programmable  
Switches & Displays

## Programmable Switches for Displaying Text & Graphics

- **OLED & LCD**
- **Engineering Support**
- **Wide Product Variety**
- **Custom Solutions Available**

Product & Page Number	Special Features
 <b>OLED SMARTSWITCH™ &amp; SMARTDISPLAY™</b> .....4	<ul style="list-style-type: none"> <li>• 180° Viewing Angle</li> <li>• Controller on Board</li> <li>• View Videos</li> </ul>
 <b>High Resolution SMARTSWITCH™ &amp; SMARTDISPLAY™</b> ..... 10	<ul style="list-style-type: none"> <li>• Display Up to 4 Lines Text</li> <li>• Controller on Board</li> <li>• Low Energy Consumption</li> </ul>
 <b>Compact High Resolution SMARTSWITCH™</b> ..... 17	<ul style="list-style-type: none"> <li>• Display Up to 4 Lines Text</li> <li>• Controller on Board</li> <li>• Low Energy Consumption</li> </ul>
<b>Standard SMARTSWITCH™ &amp; SMARTDISPLAY™</b> .....21	<ul style="list-style-type: none"> <li>• Single, Bicolor or RGB</li> <li>• Driver on Board</li> <li>• Low Energy Consumption</li> </ul>
<b>Compact SMARTSWITCH™</b> .....34	<ul style="list-style-type: none"> <li>• Single, Bicolor or RGB</li> <li>• Driver on Board</li> <li>• Low Energy Consumption</li> </ul>
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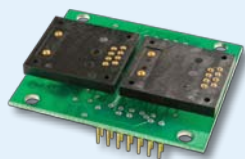




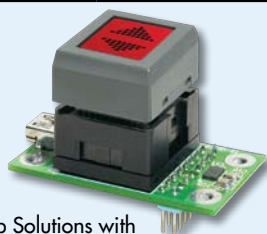
## IS Products

- **OLED SMARTSWITCH & SMARTDISPLAY**
- **High Resolution SMARTSWITCH & SMARTDISPLAY**
- **Compact High Resolution SMARTSWITCH**

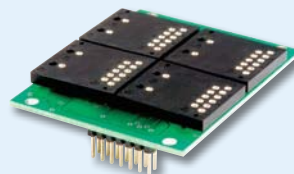
	Dimensions	Pixels	LED Backlight	Other Features
OLED	<b>Switch:</b> 23.13 x 20.59 x 23mm (H x V x Above PCB)  <b>Display:</b> 17.8 x 17.2 x 9.9mm (H x V x Above PCB)	<b>Format Switch:</b> 64RGB x 48 (H x V)  <b>Display:</b> 52RGB x 36 (H x V)	N/A	65K Colors Greater Contrast than LCD Graphic Generation Commands Screen Saver Low Energy Consumption
High Resolution	<b>Switch:</b> 23.13 x 20.59 x 23mm (H x V x Above PCB)  <b>Display:</b> 17.8 x 17.2 x 9.9mm (H x V x Above PCB)	<b>Format Switch:</b> 64 x 32 (H x V)  <b>Display:</b> 64 x 32 (H x V)	64 Colors  Red/Green/Blue	Programmable LCD Black and White FSTN Positive
Compact High Resolution	<b>Switch:</b> 19 x 18 x 23mm (H x V x Above PCB)	<b>Format Switch:</b> 64 x 32 (H x V)	64 Colors  Red/Green/Blue	Programmable LCD Black and White FSTN Positive
Standard	<b>Switch:</b> 23.13 x 20.59 x 23mm (H x V x Above PCB)  <b>Display:</b> 17.8 x 17.2 x 9.9mm (H x V x Above PCB)	<b>Format Switch:</b> 36 x 24 (H x V)  <b>Display:</b> 36 x 24 (H x V)	<b>Single Color</b> <b>Bicolor</b> <b>Red/Green/Blue</b> (Simultaneous RGB illumination achieves infinite colors)	Programmable LCD Yellow STN Positive
Compact	<b>Switch:</b> 19 x 18 x 23mm (H x V x Above PCB)	<b>Format Switch:</b> 36 x 24 (H x V)	<b>Single Color</b> <b>Bicolor</b> <b>Red/Green/Blue</b> (Simultaneous RGB illumination achieves infinite colors)	Programmable LCD <b>Single:</b> Black & White; FSTN Positive <b>Bicolor:</b> Yellow STN Positive <b>Red/Green/Blue:</b> Black & White; FSTN Positive



Two Switch Logic Board for OLED SMARTSWITCH



Develop Solutions with Demonstration Kit



Four Switch Logic Board for Standard SMARTSWITCH



Development Kit for High Resolution

## DISTINCTIVE CHARACTERISTICS

- Organic LED technology
- 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 previous 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)
- Dust tight construction
- Stylish, translucent black housing design

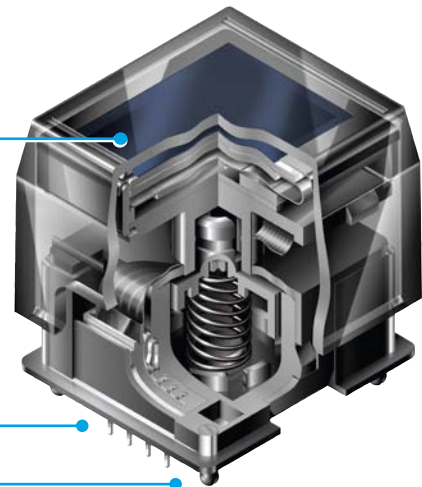
Viewing area: 15.5mm x 11.6mm (horizontal x vertical)

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



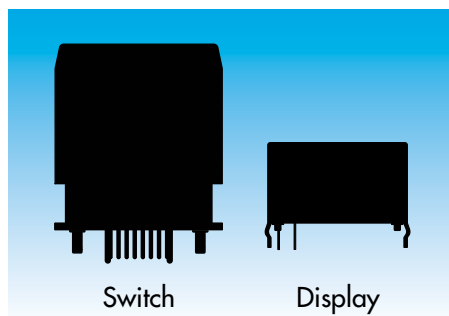
Viewing area: 12.9mm x 9.9mm (horizontal x vertical)

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 Time (Display)	15,000 hours (at 40% pixels ON)

### Absolute Maximum Ratings

Items	Symbols	Ratings
Supply Voltage for Logic/Interface	V <sub>DD</sub>	-0.3V to +4.0V
Supply Voltage for Drive	V <sub>CC</sub>	-0.0V to +19.0V
Input Voltage	V <sub>I</sub>	-0.3V to V <sub>DD</sub> +0.3V

### Current Consumption

(Temperature at 25°C, V<sub>DD</sub> = 2.8V, V<sub>CC</sub> = 16.0V)

Items	Symbols	Min	Typical	Max
All-Pixels-On Mode *Drive System Power Current	I <sub>CC1</sub>	—	5.5mA	7.0mA
All-Pixels-On Mode *Logic/IF System Power Current	I <sub>DD1</sub>	—	0.16mA	0.2mA
Sleep Mode **Drive System Power Current	I <sub>CC2</sub>	—	—	10µA
Sleep Mode **Logic/IF System Power Current	I <sub>DD2</sub>	—	—	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 <sub>DD</sub>	2.4V	2.8V	3.5V
Supply Voltage for Drive	V <sub>CC</sub>	15.0V	16.0V	17.0V
Input High Level Voltage	V <sub>IH</sub>	0.8 x V <sub>DD</sub>	—	—
Input Low Level Voltage	V <sub>IL</sub>	—	—	0.2V x V <sub>DD</sub>

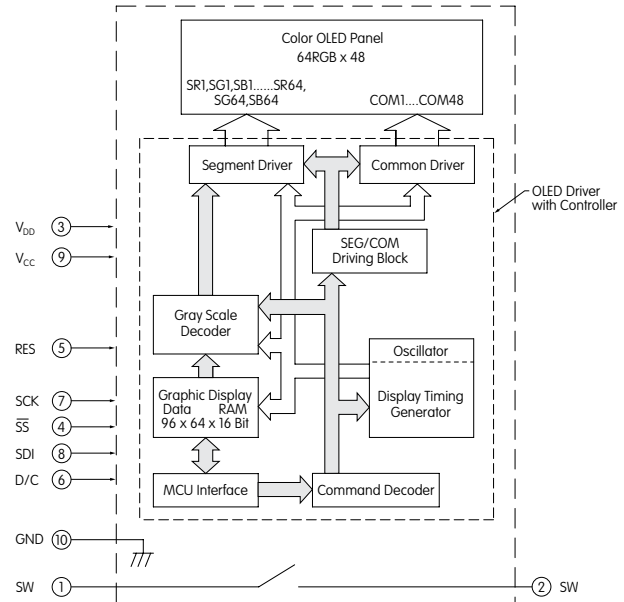
### Optical Characteristics (Temperature at 25°C, Initial Value: 87 x 0F)

Items	Min	Typical	Max	Unit	Remarks
Luminosity	75	100	125	cd/m <sup>2</sup>	White (All pixels on)
White Color Coordinate	(x)	0.27	0.31	0.35	—
	(y)	0.30	0.35	0.40	—
Red Color Coordinate	(x)	0.60	0.64	0.68	—
	(y)	0.31	0.35	0.39	—
Green Color Coordinate	(x)	0.26	0.30	0.34	—
	(y)	0.59	0.63	0.67	—
Blue Color Coordinate	(x)	0.10	0.14	0.18	—
	(y)	0.12	0.18	0.24	—
Contrast Ratio	100	—	—	—	—

## SWITCH BLOCK DIAGRAM & PIN CONFIGURATIONS

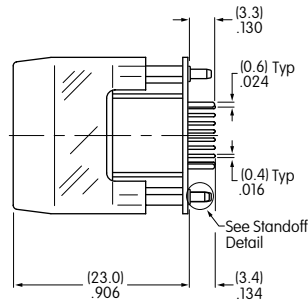
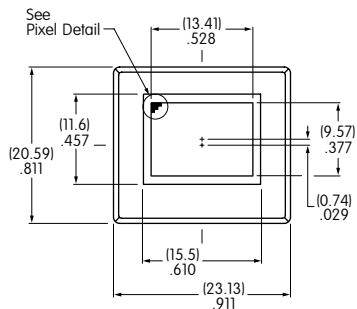


ISC15ANP4

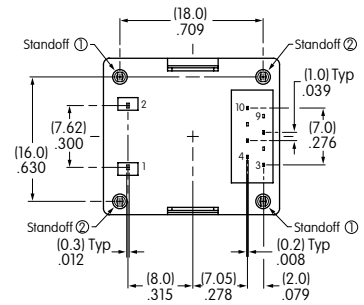


Pin No.	Symbol	Name	Function
①	SW	Terminal of Switch	Normally open
②	SW	Terminal of Switch	Normally open
③	V <sub>DD</sub>	Power	Power source for logic circuit
④	SS	Slave Select	Slave select for SPI. This line is active low.
⑤	RES	Reset	Reset signal input. When pin is low, initialization of chip is executed.
⑥	D/C	Data/Command	Data/Command Control. When pin is pulled low, data will be interpreted as Command; when pulled high, data will be interpreted as Data.
⑦	SCK	Serial Clock	Clock line for SPI that synchronizes command and data
⑧	SDI	Serial Data In	Data input line for SPI
⑨	V <sub>CC</sub>	Power	Power source for drive circuit
⑩	GND	Ground	Connect to Ground

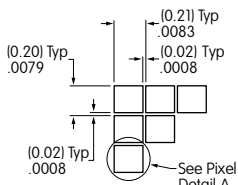
## TYPICAL SWITCH DIMENSIONS



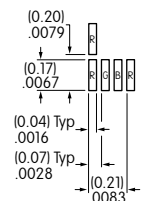
Terminal numbers are not on the switch.



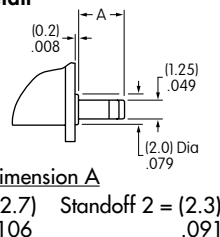
Pixel Detail



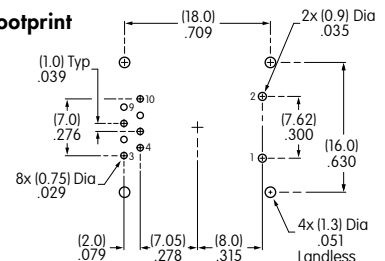
Pixel Detail A



Standoff Detail



Footprint



## 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 Time (Display)	15,000 hours (40% pixels ON)

### Absolute Maximum Ratings

Items	Symbols	Ratings
Supply Voltage for Logic/Interface	V <sub>DD</sub>	-0.3V to +4.0V
Supply Voltage for Drive	V <sub>CC</sub>	0.0V to +19.0V
Input Voltage	V <sub>I</sub>	-0.3V to V <sub>DD</sub> +0.3V

### Current Consumption

(Temperature at 25°C, V<sub>DD</sub> = 2.8V, V<sub>CC</sub> = 16.0V)

Items	Symbols	Min	Typical	Max
All-Pixels-On Mode *Drive System Power Current	I <sub>CC1</sub>	—	3.5mA	4.5mA
All-Pixels-On Mode *Logic/IF System Power Current	I <sub>DD1</sub>	—	0.16mA	0.2mA
Sleep Mode **Drive System Power Current	I <sub>CC2</sub>	—	—	10μA
Sleep Mode **Logic/IF System Power Current	I <sub>DD2</sub>	—	—	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 <sub>DD</sub>	2.4V	2.8V	3.5V
Supply Voltage for Drive	V <sub>CC</sub>	15.0V	16.0V	17.0V
Input High Level Voltage	V <sub>IH</sub>	0.8 x V <sub>DD</sub>	—	—
Input Low Level Voltage	V <sub>IL</sub>	—	—	0.2V x V <sub>DD</sub>

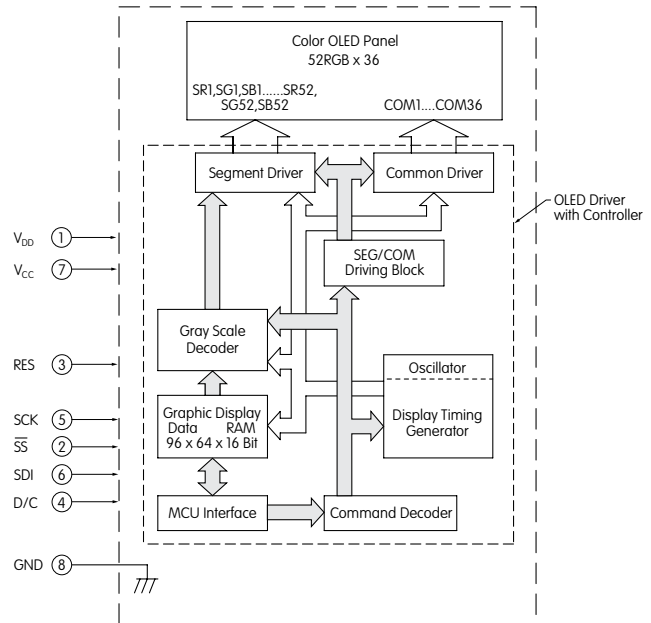
### Optical Characteristics (Temperature at 25°C, Initial Value: 87 x 0F)

Items	Min	Typical	Max	Unit	Remarks
Luminosity	75	100	125	cd/m <sup>2</sup>	White (All pixels on)
White Color Coordinate	(x)	0.27	0.31	0.35	—
	(y)	0.30	0.35	0.40	—
Red Color Coordinate	(x)	0.60	0.64	0.68	—
	(y)	0.31	0.35	0.39	—
Green Color Coordinate	(x)	0.26	0.30	0.34	—
	(y)	0.59	0.63	0.67	—
Blue Color Coordinate	(x)	0.10	0.14	0.18	—
	(y)	0.12	0.18	0.24	—
Contrast Ratio	100	—	—	—	—

## DISPLAY BLOCK DIAGRAM & PIN CONFIGURATIONS

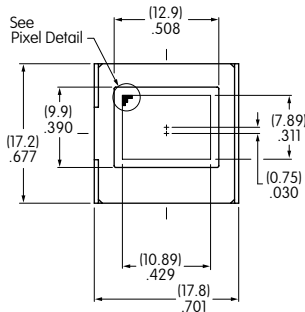


ISCO1P

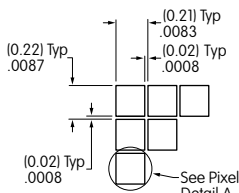


Pin No.	Symbol	Name	Function
①	V <sub>DD</sub>	Power	Power source for logic circuit
②	SS	Slave Select	Slave select for SPI. This line is active low.
③	RES	Reset	Reset signal input. When pin is low, initialization of chip is executed.
④	D/C	Data/Command	Data/Command Control. When pin is pulled low, data will be interpreted as Command; when pulled high, data will be interpreted as Data.
⑤	SCK	Serial Clock	Clock line for SPI that synchronizes command and data
⑥	SDI	Serial Data In	Data input line for SPI
⑦	V <sub>CC</sub>	Power	Power source for drive circuit
⑧	GND	Ground	Connect to Ground

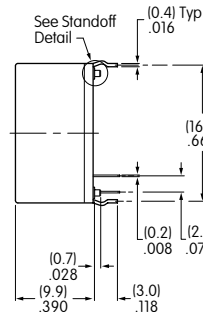
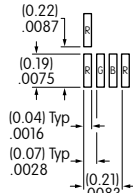
## TYPICAL DISPLAY DIMENSIONS



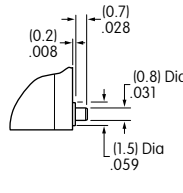
Pixel Detail



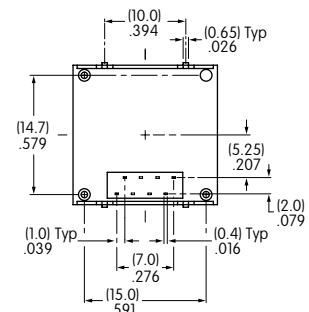
Pixel Detail A



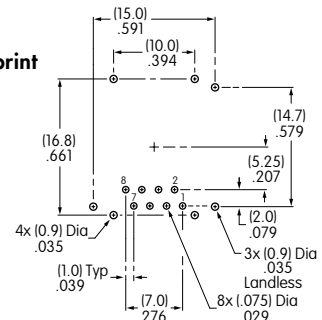
Standoff Detail



Terminal numbers are not on the switch.



Footprint

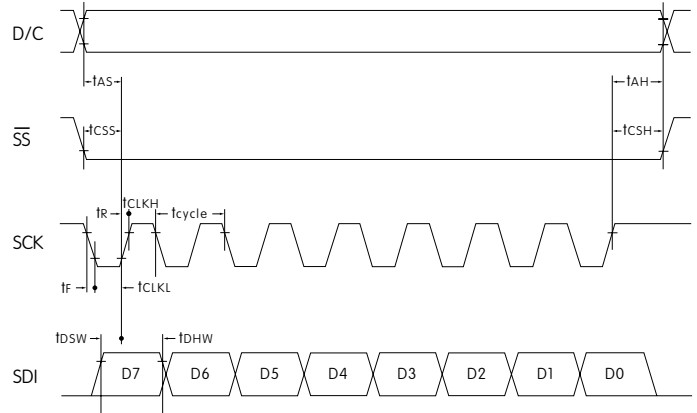




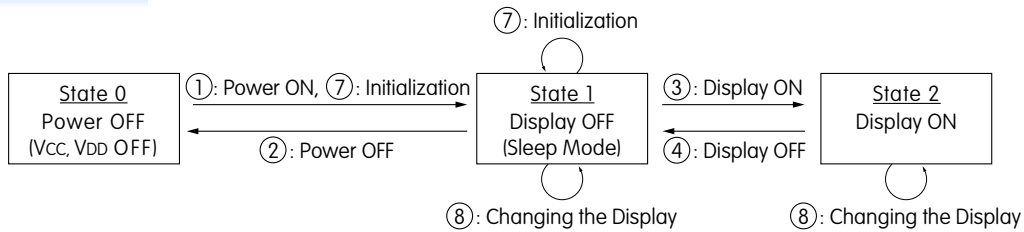
## TIMING SPECIFICATIONS FOR SWITCH & DISPLAY

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	$t_R$	—	—	1.5ns
SCK Fall Time	$t_F$	—	—	1.5ns



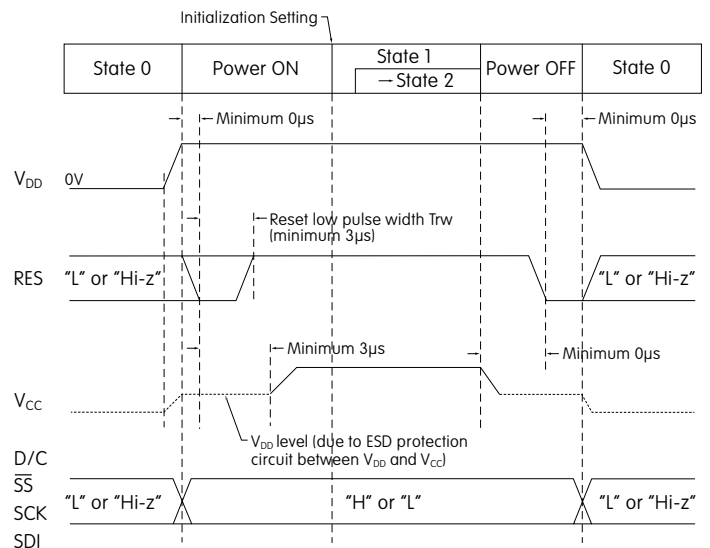
## STATE TRANSITION



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.

## DISTINCTIVE CHARACTERISTICS

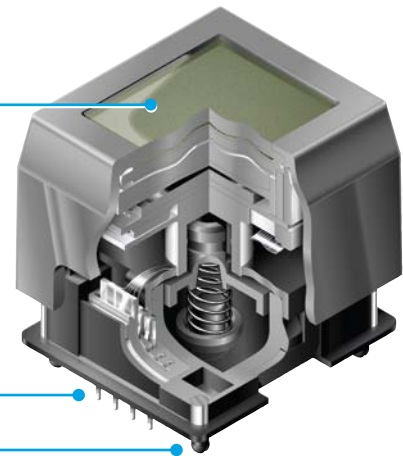
- High resolution of 64 x 32 pixels
- 64 colors of backlighting can be controlled dynamically
- Pushbutton switch or display with LCD, RGB LED backlighting
- General brightness of backlight is dynamically controlled in eight steps from dark to bright
- Operated by commands and data supplied via serial 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

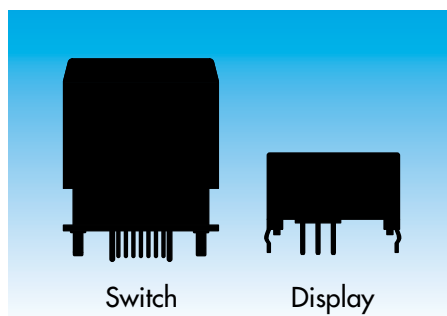


Viewing area: 13.9mm x 10.6mm (horizontal x vertical)


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



Actual Sizes



## SWITCH PART NUMBER & DESCRIPTION

Part Number	Switch Description	LCD Mode	LED Color	LCD/LED
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).

### Absolute Maximum Ratings

Items	Symbols	Ratings
Supply Voltage	V <sub>DD</sub>	-0.3V to +7.0V
Input Voltage	V <sub>I</sub>	-0.3V to V <sub>DD</sub> +0.3V
Output Voltage	V <sub>O</sub>	-0.3V to V <sub>DD</sub> +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	□	90°	—
	Right & Left	□	90°	—

### Recommended Operating Conditions

Items	Symbols	Minimum	Typical	Maximum
Supply Voltage	V <sub>DD</sub>	4.9V	5.0V	5.1V
Input Voltage	V <sub>I</sub>	0V	—	V <sub>DD</sub>
SPI Clock Frequency	f <sub>SCK</sub>	—	—	8MHz
Current Consumption	I <sub>DD</sub>	** 10mA	—	*** 50mA

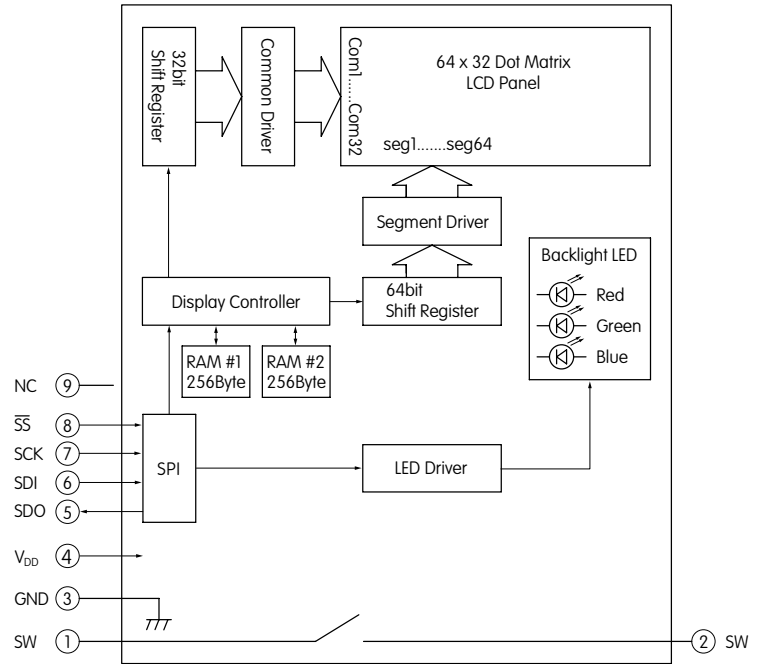
\*\* 10mA: Backlighting LED is off

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

## SWITCH BLOCK DIAGRAM & PIN CONFIGURATIONS

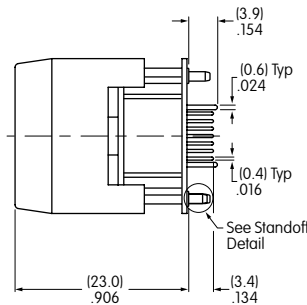
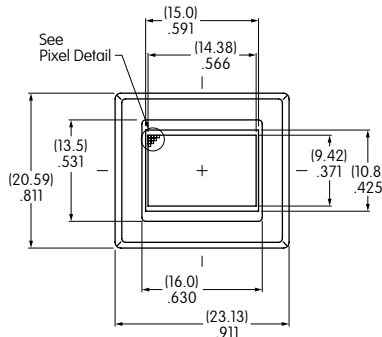


**IS15DBFP4RGB**  
with RGB LED and  
Black and White LCD Mode

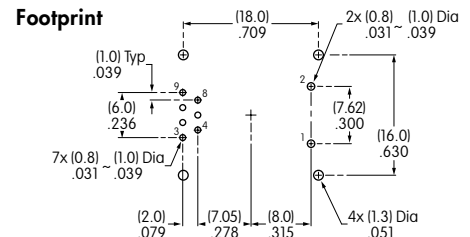
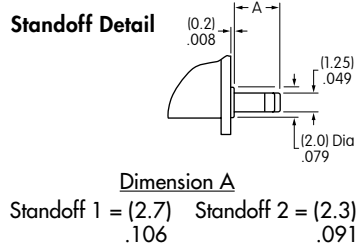
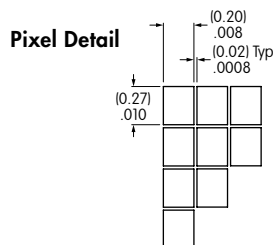
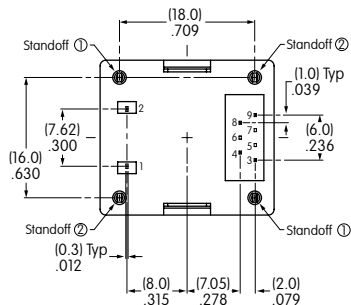


Pin No.	Symbol	Name	Function
①	SW	Terminal of Switch	Normally open
②	SW	Terminal of Switch	Normally open
③	GND	Ground	
④	V <sub>DD</sub>	Power	Power source for logic circuit and LCD
⑤	SDO	Data Out	Data output line for SPI
⑥	SDI	Data In	Data input line for SPI
⑦	SCK	Serial Clock	Clock line for SPI that 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



Terminal numbers are not on the switch.



## DISPLAY PART NUMBER & DESCRIPTION

Part Number	Terminals	LCD Mode	LED Color	LCD/LED
IS01DBFRGB	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).

### Absolute Maximum Ratings

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	□	90°	—
	Right & Left	□	90°	—

### Recommended Operating Conditions

Items	Symbols	Minimum	Typical	Maximum
Supply Voltage	$V_{DD}$	4.9V	5.0V	5.1V
Input Voltage	$V_i$	0V	—	$V_{DD}$
SPI Clock Frequency	$f_{SCK}$	—	—	8MHz
Current Consumption	$I_{DD}$	** 10mA	—	*** 50mA

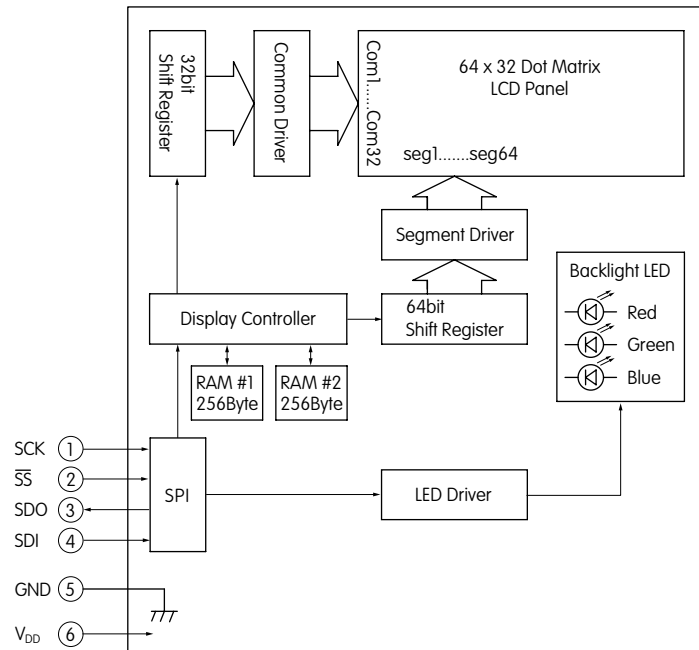
\*\* 10mA: Backlighting LED is off

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

## DISPLAY BLOCK DIAGRAM & PIN CONFIGURATIONS

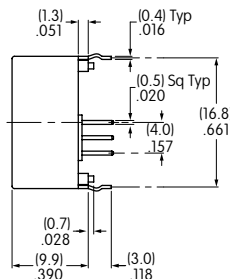
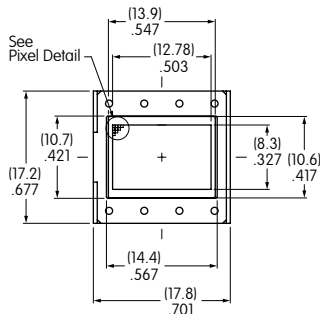


**ISO1DBFRGB**  
with RGB LED and  
Black and White LCD Mode

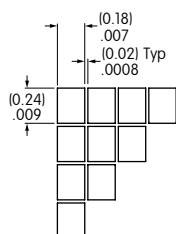
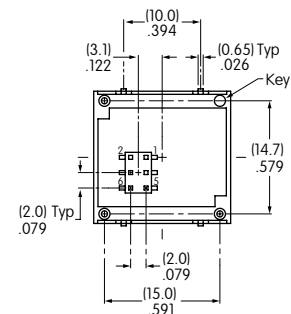


Pin No.	Symbol	Name	Function
①	SCK	Serial Clock	Clock line for SPI that synchronizes commands and data
②	$\overline{SS}$	Slave Select	Chip select for SPI; line is active low
③	SDO	Data Out	Data output line for SPI
④	SDI	Data In	Data input line for SPI
⑤	GND	Ground	
⑥	V <sub>DD</sub>	Power	Power source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

## TYPICAL DISPLAY DIMENSIONS

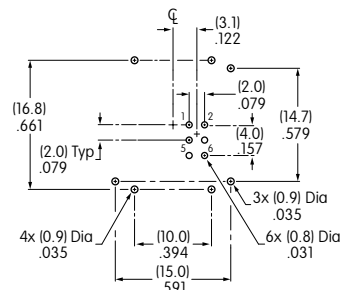


Terminal numbers are not on the device.



Pixel Detail

Footprint



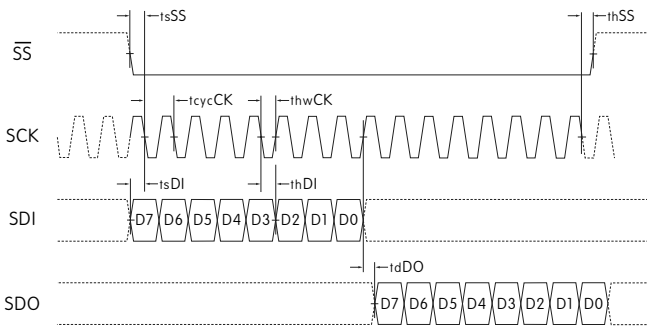
## TIMING SPECIFICATIONS FOR SWITCH & DISPLAY

### SPI Characteristics (See Timing Diagram)

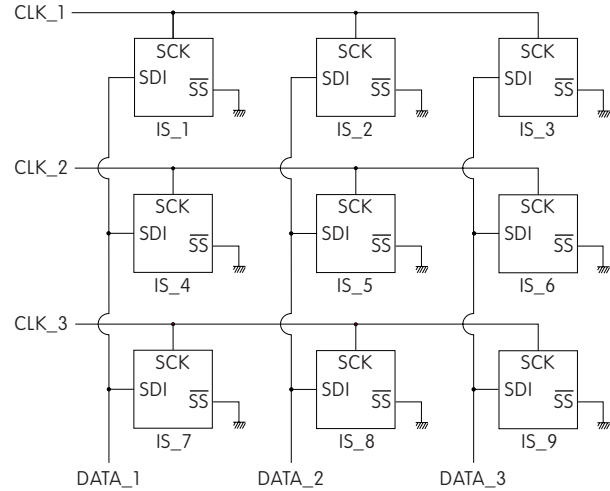
(Temperature at -15°C ~ +50°C and  $V_{DD} = 5.0V \pm 2\%$ )

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	

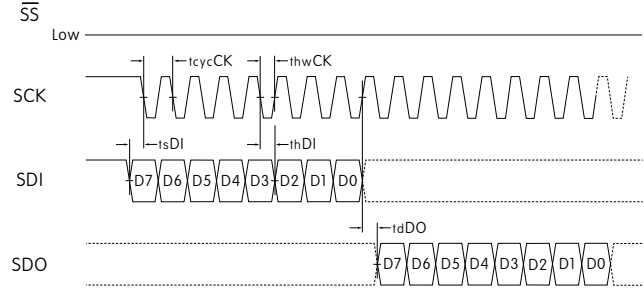
SPI Timing Chart ( $\overline{SS}$  Using)



Circuit Example



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



SDI and SCK shall be kept high when idle.

## BITMAP

### Segment

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

### Transferring Display Data/Displaying LCD Command and Data Sequence

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

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

## COMMANDS & DATA 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 below 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            100 = 1/3 (dark)                101 = 1/2 001 = 1/10            110 = 2/3 010 = 1/7              111 = full 011 = 1/5              (bright)

### Reset (Returning to Initial Status at Power Activation)

Command		Data	Remarks
Hex	Binary		
0 x 5E	01011110	0000011	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

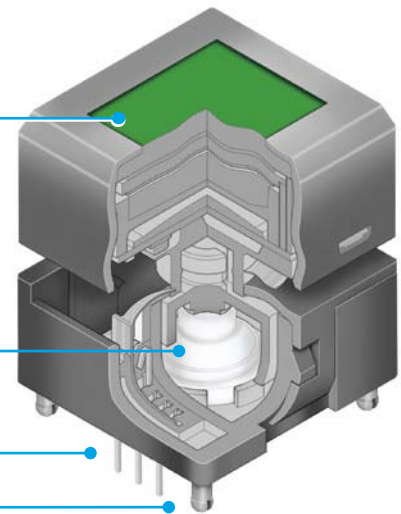
Viewing area: 13.0mm x 10.7mm (horizontal x vertical)

Variety of LED backlighting with 64 colors and 8 steps brightness

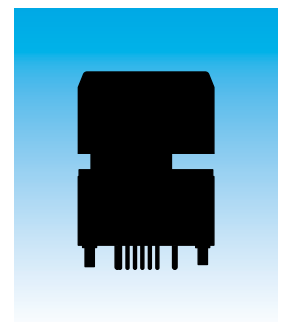
Dome gives crisp tactile feedback to positively indicate circuit transfer

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	LCD/LED
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

Items	Symbols	Ratings
Supply Voltage	V <sub>DD</sub>	-0.3V to +7.0V
Input Voltage	V <sub>I</sub>	-0.3V to V <sub>DD</sub> +0.3V
Output Voltage	V <sub>O</sub>	-0.3V to V <sub>DD</sub> +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	□	90°	—
	Right & Left	□	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).

### Recommended Operating Conditions

Items	Symbols	Min	Typical	Max
Supply Voltage	V <sub>DD</sub>	4.9V	5.0V	5.1V
Input Voltage	V <sub>I</sub>	0V	—	V <sub>DD</sub>
SPI Clock Frequency	f <sub>SCK</sub>	—	—	8MHz
Current Consumption	I <sub>DD</sub>	** 10mA	—	*** 50mA

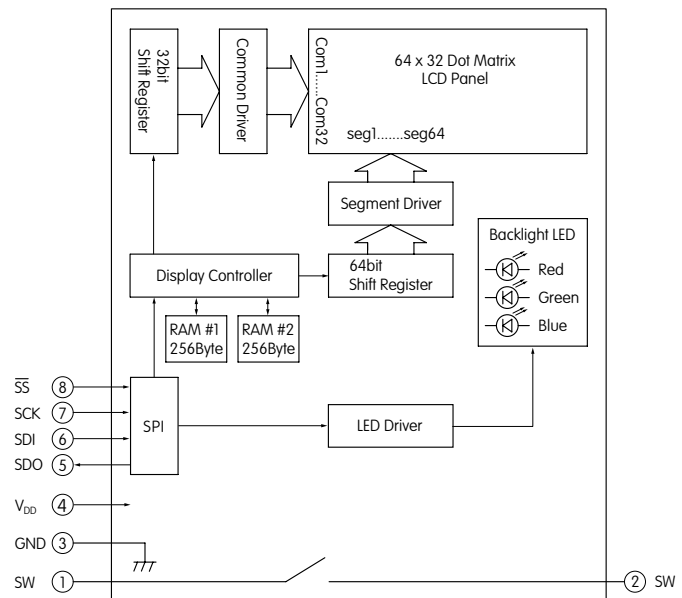
\*\* 10mA: Backlighting LED is off

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

## BLOCK DIAGRAM & PIN CONFIGURATIONS

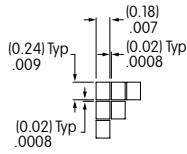
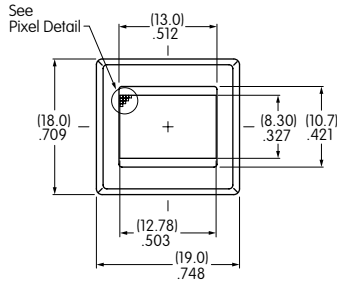


IS15DSBFP4RGB  
with RGB LED and  
Black and White LCD Mode

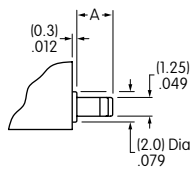
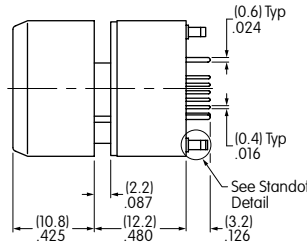


Pin No.	Symbol	Name	Function
①	SW	Terminal of Switch	Normally open
②	SW	Terminal of Switch	Normally open
③	GND	Ground	
④	V <sub>DD</sub>	Power	Power source for logic circuit and LCD
⑤	SDO	Data Out	Data output line for SPI
⑥	SDI	Data In	Data input line for SPI
⑦	SCK	Serial Clock	Clock line for SPI that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

## TYPICAL SWITCH DIMENSIONS



Pixel Detail

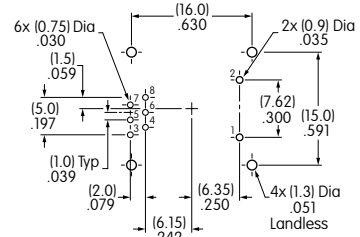
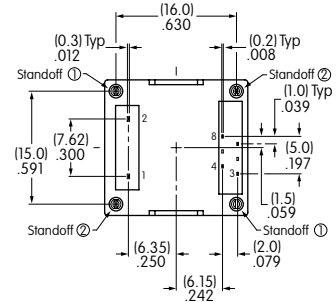


Standoff Detail

**Dimension A**

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

Terminal numbers are not on the switch.



Footprint

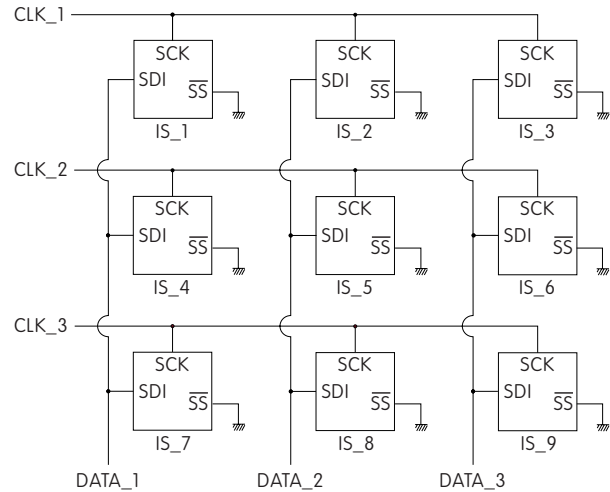
## TIMING SPECIFICATIONS

### SPI Characteristics (See Timing Diagram)

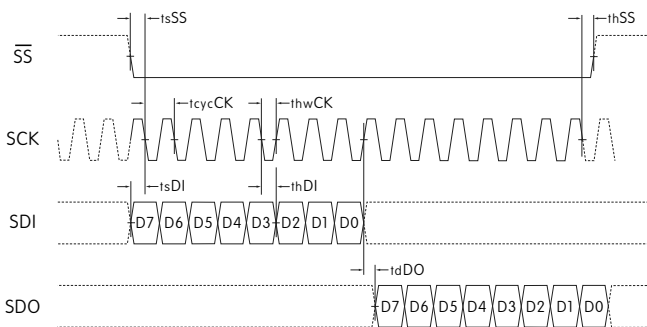
(Temperature at -15°C ~ +50°C and V<sub>DD</sub> = 5.0V ± 2%)

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	

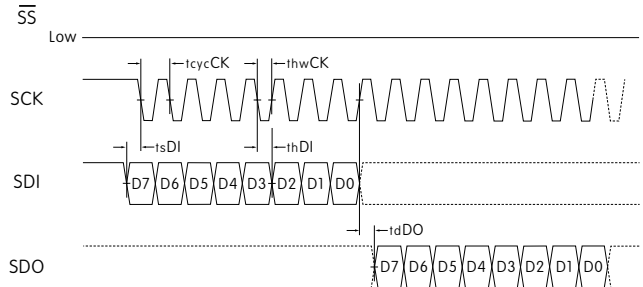
### Circuit Example



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



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



SDI and SCK shall be kept high when idle.

## BITMAP

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

### Transferring Display Data/Displaying LCD Command and Data Sequence

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

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

## COMMANDS & DATA

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

### Transferring Display Data/Displaying on LCD

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

### LED (Backlight) Color Set

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

### LED (Backlight) Brightness Set

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

### Reset (Returning to Initial Status at Power Activation)

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

**DISTINCTIVE CHARACTERISTICS**

**Standard with Enhanced LED Illumination:**

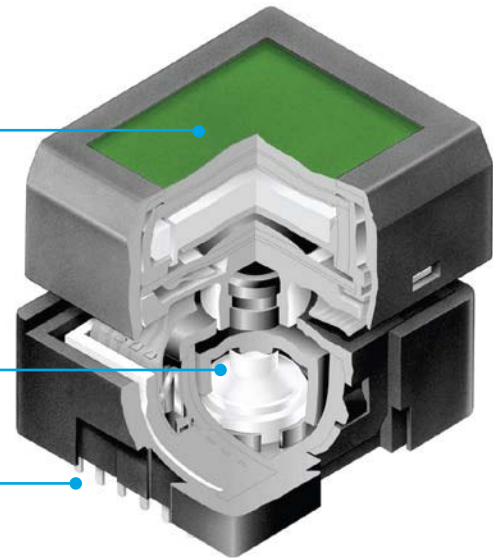
- Broad and even light diffusion
- Consistent backlighting
- Low energy consumption

Programmable LCD

Variety of LED Backlighting

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.

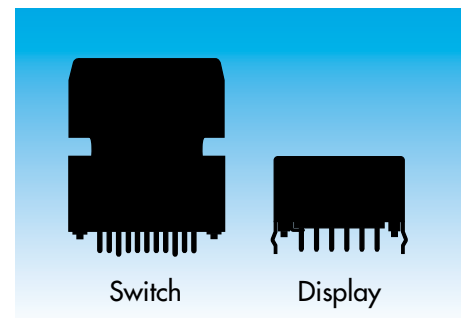
Dome gives crisp tactile feedback to positively indicate circuit transfer.

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	LCD/LED
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	LCD/LED
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	LCD/LED
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	0°C ~ +40°C (+32°F ~ +104°F); contact factory for wide temperature range options
Storage Temperature Range	-10°C ~ +60°C (+14°F ~ +140°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	0.36mm x 0.36mm (horizontal x vertical)
Backlight LED	<b>Single color:</b> yellow, white <b>Bicolor:</b> red/green, yellow/green, yellow/blue <b>RGB:</b> red, green, blue

### Absolute Maximum Ratings (Temperature at 25°C)

Items	Symbols	Ratings
Supply Voltage for Logics	V <sub>DD</sub>	-0.3V to +7.0V
Supply Voltage for LCD	V <sub>LC</sub>	-0.3V to +12.0V
Input Voltage	V <sub>I</sub>	-0.3V to V <sub>DD</sub> +0.3V
Output Voltage	V <sub>O</sub>	-0.3V to V <sub>DD</sub> +0.3V

### Recommended Operating Conditions (Temperature at 25°C)

Items	Symbols	Minimum	Typical	Maximum
Supply Voltage for Logics	V <sub>DD</sub>	4.5V	5.0V	5.5V
Supply Voltage Yellow	V <sub>LC</sub>	—	7.4V	—
Supply Voltage Blue	V <sub>LC</sub>	—	7.5V	—
Supply Voltage Black/White	V <sub>LC</sub>	—	7.3V	—
Input Voltage	V <sub>I</sub>	0V	—	V <sub>DD</sub>
Driving Frequency	f <sub>FLM</sub>	—	64Hz: yellow/blue 150Hz: black/white	—

### DC Characteristics of LCD Drive (Temperature at 0°C to 40°C and V<sub>DD</sub> = 5.0V ±10%)

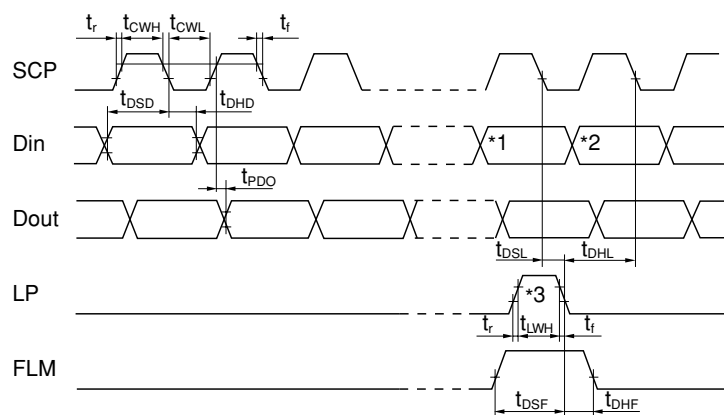
Items	Symbols	Test Conditions	Minimum	Typical	Maximum	Unit
High Level Input Voltage	V <sub>IH</sub>		0.7V <sub>DD</sub>		V <sub>DD</sub>	V
Low Level Input Voltage	V <sub>IL</sub>		0		0.3V <sub>DD</sub>	V
High Level Input Leakage Current	I <sub>IH</sub>	V <sub>I</sub> = V <sub>DD</sub>			10	μA
Low Level Input Leakage Current	I <sub>IL</sub>	V <sub>I</sub> = 0V			-10	μA
High Level Output Voltage	V <sub>OH</sub>	I <sub>OH</sub> = -500μA	V <sub>DD</sub> -0.5			V
Low Level Output Voltage	V <sub>OL</sub>	I <sub>OL</sub> = 500μA			0.5	V
High Level Output Leakage Current	I <sub>LOH</sub>	V <sub>O</sub> = V <sub>DD</sub>			10	μA
Low Level Output Leakage Current	I <sub>LOL</sub>	V <sub>O</sub> = 0V			-10	μA
Supply Current	I <sub>DD</sub>	f <sub>SCP</sub> = 1.0MHz			500	μA
LCD Drive Current	I <sub>LC</sub>	f <sub>LP</sub> = 2.4Hz V <sub>LC</sub> = 7.3V ~ 7.5V		500	2,000	μA

### Timing Characteristics of LCD Drive IC

(Temperature at 0°C to 40°C and V<sub>DD</sub> = 5.0V ±10%)

Items	Symbols	Minimum	Maximum
Clock Operation Frequency	f <sub>SCP</sub>		6.0MHz
Latch Pulse Frequency	f <sub>LP</sub>		50kHz
Clock High Level Pulse Width	t <sub>CWH</sub>	70ns	
Clock Low Level Pulse Width	t <sub>CWL</sub>	70ns	
Data Setup Time	t <sub>DSD</sub>	45ns	
Data Hold Time	t <sub>DHD</sub>	50ns	
Data Output Delay Time	t <sub>PDO</sub>		25ns
Latch Setup Time	t <sub>DSL</sub>	50ns	
Latch Hold Time	t <sub>DHL</sub>	50ns	
Latch High Level Width	t <sub>LWH</sub>	200ns	
FLM Setup Time	t <sub>DSF</sub>	50ns	
FLM Hold Time	t <sub>DHF</sub>	50ns	
SCP, LP Rise/Fall Time	t <sub>r</sub> /t <sub>f</sub>		15ns

### Timing Diagram

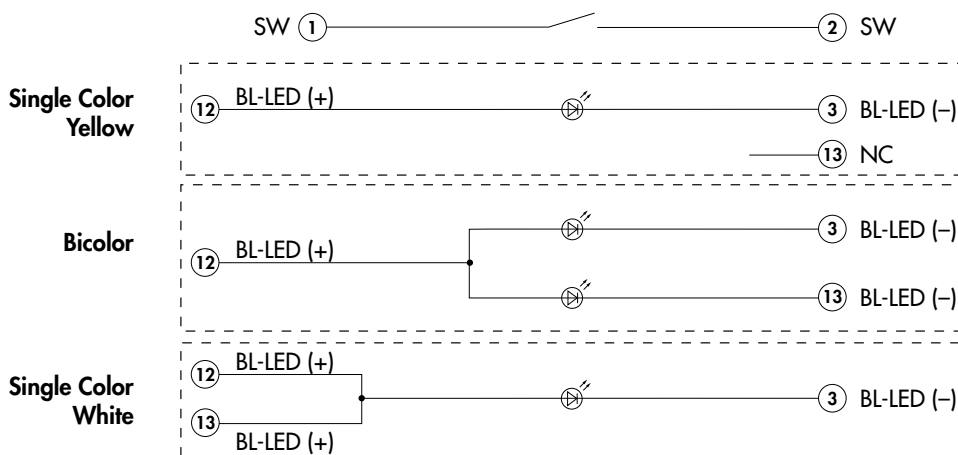
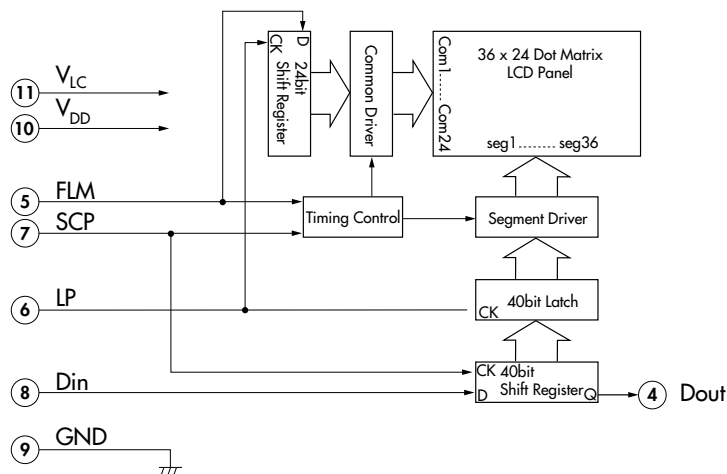


- \*1 Last data on first line
- \*2 Beginning data on second line
- \*3 Location of LP signal on first line

## BLOCK DIAGRAM & PIN CONFIGURATIONS FOR STANDARD OR SUPER BRIGHT LEDs



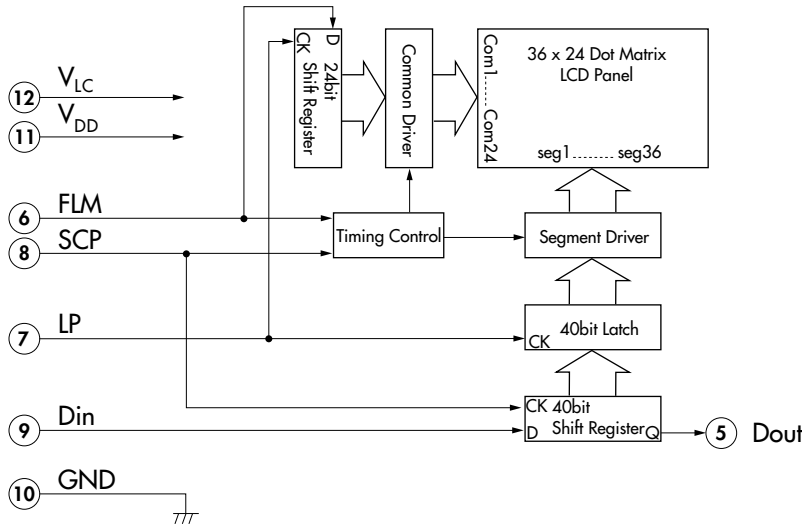
IS15ABCP4CF  
with Yellow LCD Mode



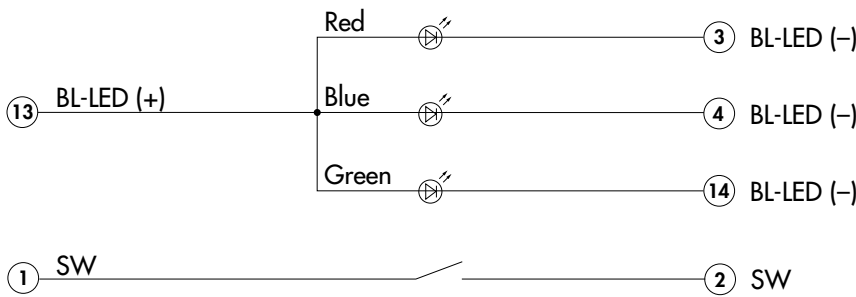
Pin No.	Symbol	Name	Function
①	SW	Terminal of Switch	Normally open
②	SW	Terminal of Switch	Normally open
③	BL-LED (-)	Terminal of Backlight LED	Cathode: <b>standard bicolor</b> - green for red/green. <b>super bright bicolor</b> - red for red/green; yellow for yellow/green or yellow/blue.
④	Dout	Data 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 <sub>DD</sub>	Power	Power source for logic circuit
⑪	V <sub>LC</sub>	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**  
with RGB LED Option and  
Black and White 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 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 <sub>DD</sub>	Power	Power source for logic circuit
⑫	V <sub>LC</sub>	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

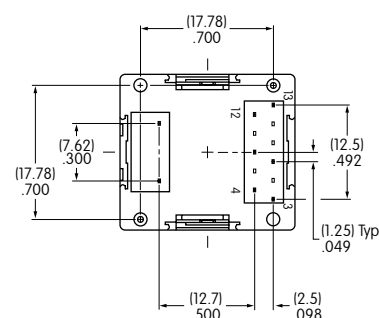
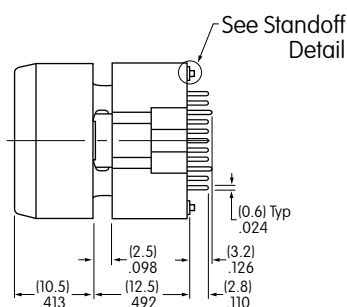
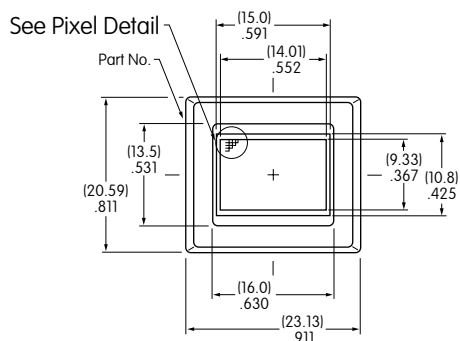
## ABSOLUTE MAXIMUM FOR ALL STANDARD OR SUPER BRIGHT LEDs

Electrical Characteristics (Temperature at 25°C)

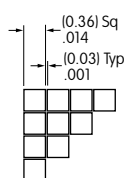
Backlight Color	Symbols	White	All Others	Unit
Forward Current	$I_F$	30	20	mA
Reverse Voltage	$V_R$	5.0	4.0	V
Current Reduction Rate Above 25°C	$\Delta I_F(\text{DC})$	-0.50	-0.26	mA/°C
*Power Dissipation	$P_D$	120	130	mW

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

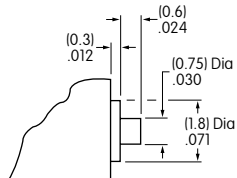
## TYPICAL SWITCH DIMENSIONS WITH STANDARD OR SUPER BRIGHT LEDs



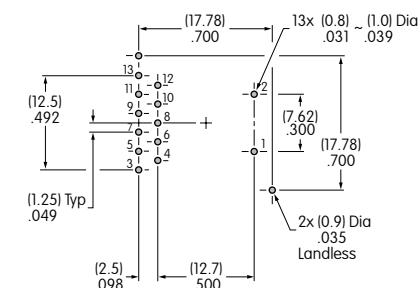
Terminal numbers are not on the switch.



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	$V_F$	2.1	3.3	3.3	V

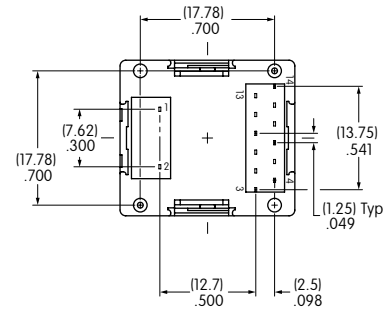
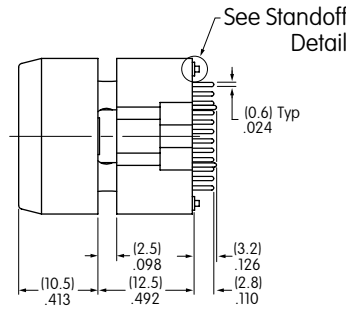
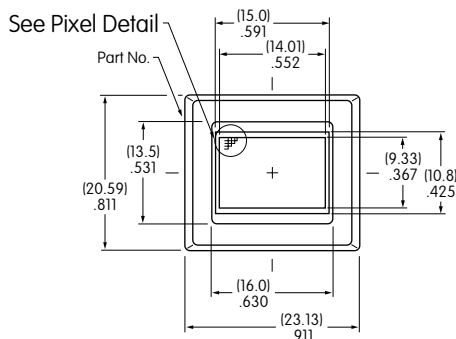
## ABSOLUTE MAXIMUM FOR RGB LED

Electrical Characteristics (Temperature at 25°C)

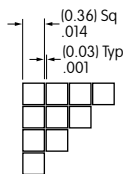
Backlight Color	Symbols	Red/Green/Blue	Unit
Forward Current	$I_F$	20	mA
Reverse Voltage	$V_R$	4.0	V
Current Reduction Rate Above 25°C	$\Delta I_F(\text{DC})$	-0.27	mA/°C
*Power Dissipation	$P_D$	135	mW

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

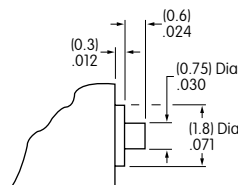
## TYPICAL SWITCH DIMENSIONS WITH RGB LED



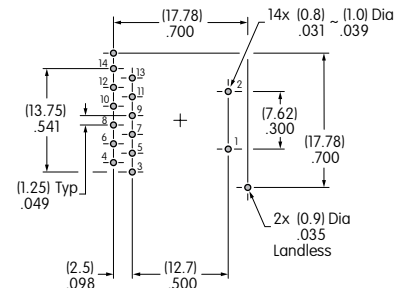
Terminal numbers are not on the switch.



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	LCD/LED
IS01BCCF	Straight PC	Yellow STN Positive	* Red/Green	  
IS01BCE	Straight PC	Yellow STN Positive	Yellow	
IS01BCEF	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	LCD/LED
IS01BFRGB	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	0.32mm x 0.32mm (horizontal x vertical)
Operating Temperature Range	0°C through 40°C (32°F through 104°F)
Storage Temperature Range	-10°C through 60°C (14°F through 140°F)
Backlight LED	<b>Single color:</b> yellow; <b>Bicolor:</b> red/green, yellow/green; <b>RGB:</b> 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 $V_{DD} = 5.0V \pm 10\%$ )

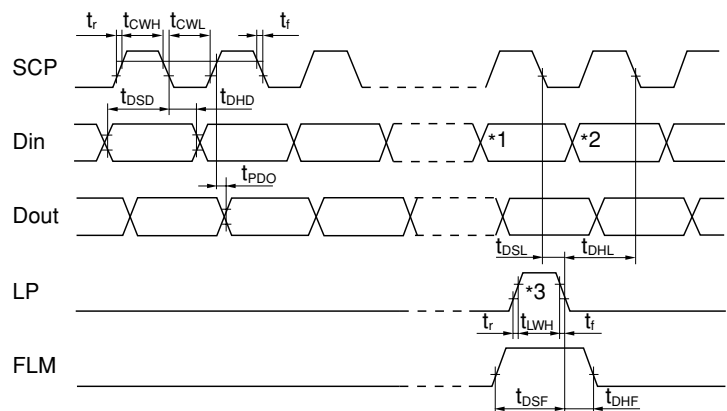
Items	Symbols	Test Conditions	Minimum	Typical	Maximum	Unit
High Level Input Voltage	$V_{IH}$		$0.7V_{DD}$		$V_{DD}$	V
Low Level Input Voltage	$V_{IL}$		0		$0.3V_{DD}$	V
High Level Input Leakage Current	$I_{LIH}$	$V_I = V_{DD}$			10	$\mu A$
Low Level Input Leakage Current	$I_{LIL}$	$V_I = 0V$			-10	$\mu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

### 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

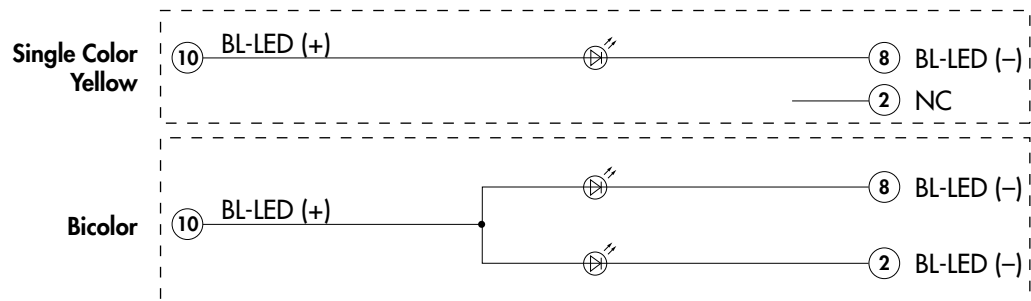
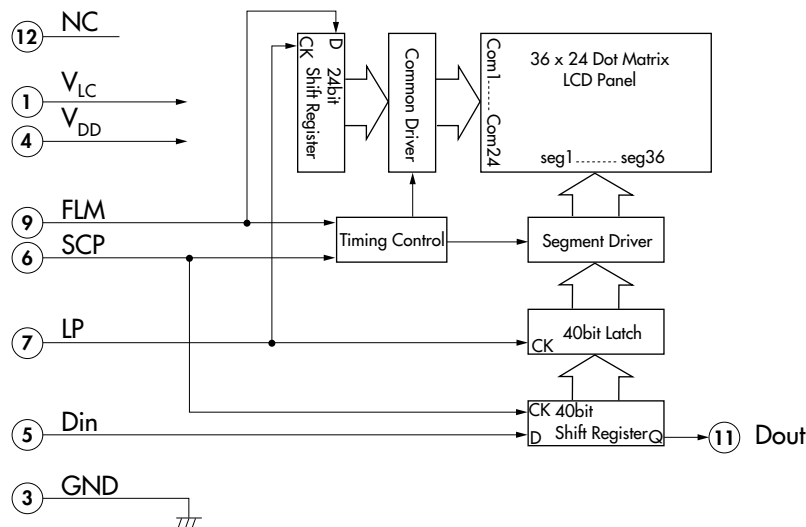


- \*1 Last data on first line
- \*2 Beginning data on second line
- \*3 Location of LP signal on first line

## BLOCK DIAGRAM & PIN CONFIGURATIONS FOR SUPER BRIGHT LEDs

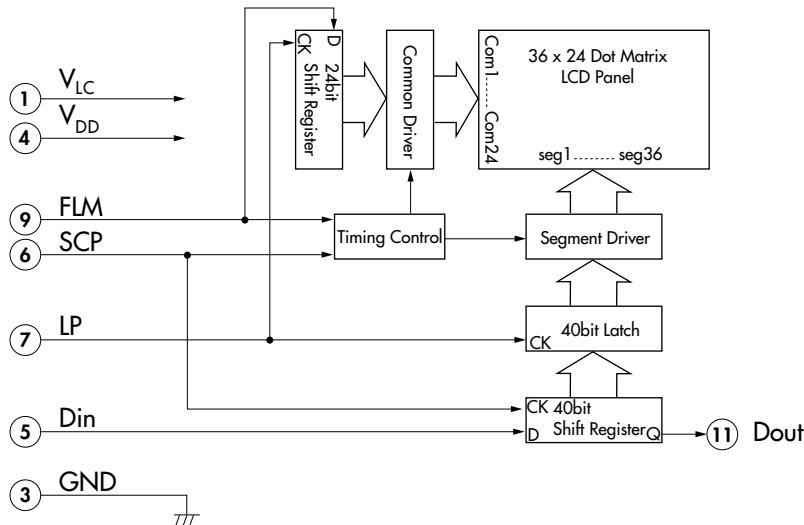


ISO1BCE  
with Yellow LCD Mode

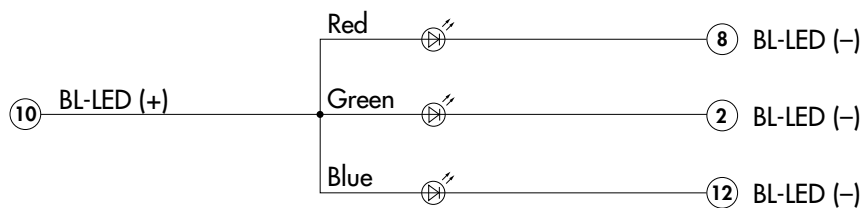


Pin No.	Symbol	Name	Function
①	V <sub>LC</sub>	Power	Power source for LCD drive
②	NC	None	No connection for single color
	BL-LED (-)	Terminal of Backlight LED	Cathode for bicolor
③	GND	Ground	
④	V <sub>DD</sub>	Power	Power source for logic circuit
⑤	Din	Data Input	Display serial data bit. Note: to map 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: <b>super bright bicolor</b> - 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

## BLOCK DIAGRAM & PIN CONFIGURATIONS FOR RGB LEDS



**ISO1BFRGB**  
with RGB LED Option and  
Black and White LCD Mode



Pin No.	Symbol	Name	Function
①	V <sub>LC</sub>	Power	Power source for LCD drive
②	BL-LED (-)	Terminal of Backlight LED	Cathode for green
③	GND	Ground	
④	V <sub>DD</sub>	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 for red
⑨	FLM	First Line Marker	The marking signal for the first line data of LCD display. The first line of LCD will be selected by the falling edge of LP signal during the high level (FLM).
⑩	BL-LED (+)	Terminal of Backlight LED	Anode for common
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	BL-LED (-)	Terminal of Backlight LED	Cathode for blue

## 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

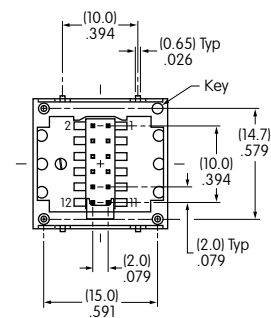
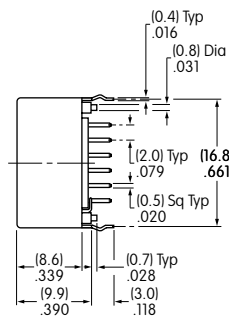
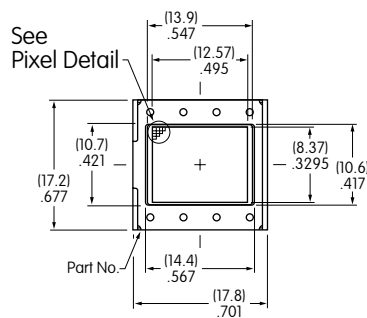
## ABSOLUTE MAXIMUM FOR SUPER BRIGHT LEDS

Electrical Characteristics (Temperature at 25°C)

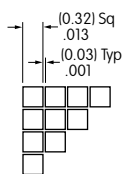
Backlight Color	Symbols	All	Unit
Forward Current	$I_F$	20	mA
Reverse Voltage	$V_R$	4.0	V
Current Reduction Rate Above 25°C	$\Delta I_F(\text{DC})$	-0.26	mA/°C
Power Dissipation*	$P_D$	130	mW

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

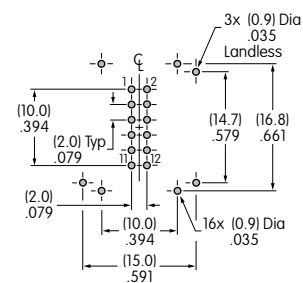
## TYPICAL DISPLAY DIMENSIONS



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	$V_F$	2.1	3.3	3.3	V

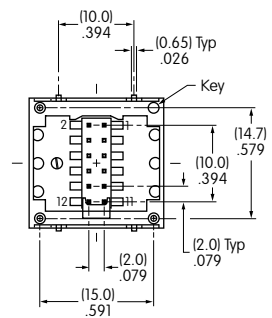
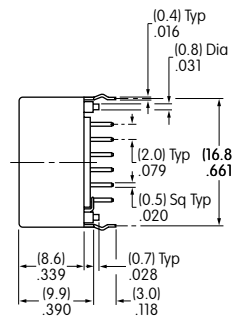
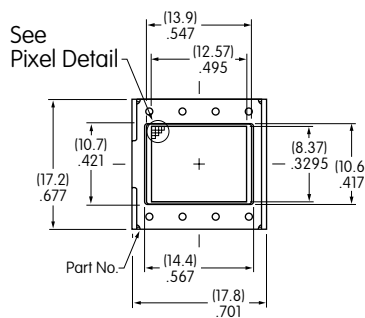
## ABSOLUTE MAXIMUM FOR RGB LED

Electrical Characteristics (Temperature at 25°C)

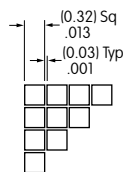
Backlight Color	Symbols	Red/Green/Blue	Unit
Forward Current	$I_F$	20	mA
Reverse Voltage	$V_R$	4.0	V
Current Reduction Rate Above 25°C	$\Delta I_F(\text{DC})$	-0.27	mA/°C
*Power Dissipation	$P_D$	135	mW

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

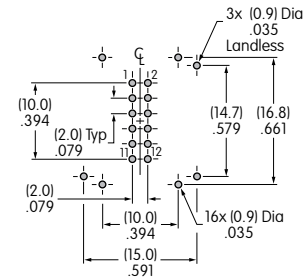
## TYPICAL DISPLAY DIMENSIONS WITH RGB LED



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

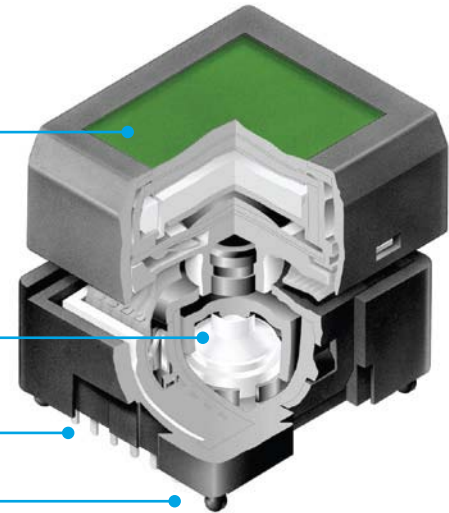
Programmable LCD

Variety of LED Backlighting

Rubber Dome

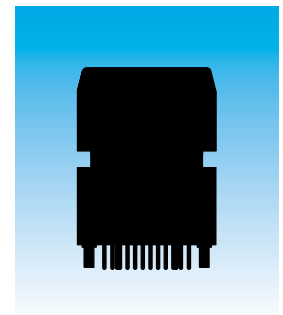
Epoxy Sealed Straight PC Terminals

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	LCD/LED		
IS15SACP4CF	SPST Momentary ON Gold Contacts Straight PC Terminals	Yellow STN Positive	* Red/Green Standard			
IS15SBP4CF		Yellow STN Positive	* Red/Green Super Bright			
IS15SBP4EF		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 Endurance	1,000,000 operations minimum
Electrical Capacity (Resistive Load)	100mA @ 12V DC	Operating Force	2.2 ± 0.5 Newtons
Contact Resistance	200 milliohms maximum @ 20mV 10mA	Total Travel	1.8mm (.071")
Insulation Resistance	100 megohms minimum @ 100V DC	Operating Temperature Range	0°C ~ +40°C (+32°F ~ +104°F)
Dielectric Strength	125V AC for 1 minute minimum	Storage Temperature Range	-10°C ~ +60°C (+14°F ~ +140°F)
Mechanical Endurance	1,000,000 operations minimum		

## 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	0.32mm x 0.32mm (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 <sub>DD</sub>	-0.3V to +7.0V
Supply Voltage for LCD	V <sub>LC</sub>	-0.3V to +12.0V
Input Voltage	V <sub>I</sub>	-0.3V to V <sub>DD</sub> +0.3V
Output Voltage	V <sub>O</sub>	-0.3V to V <sub>DD</sub> +0.3V

### Recommended Operating Conditions (Temperature at 25°C)

Items	Symbols	Minimum	Typical	Maximum
Supply Voltage for Logics	V <sub>DD</sub>	4.5V	5.0V	5.5V
Supply Voltage	V <sub>LC</sub>	—	7.3V	—
Input Voltage	V <sub>I</sub>	0V	—	V <sub>DD</sub>
Driving Frequency	f <sub>FLM</sub>	—	150Hz	—

### DC Characteristics of LCD Drive IC (Temperature at 0°C to 40°C and V<sub>DD</sub> = ±10%)

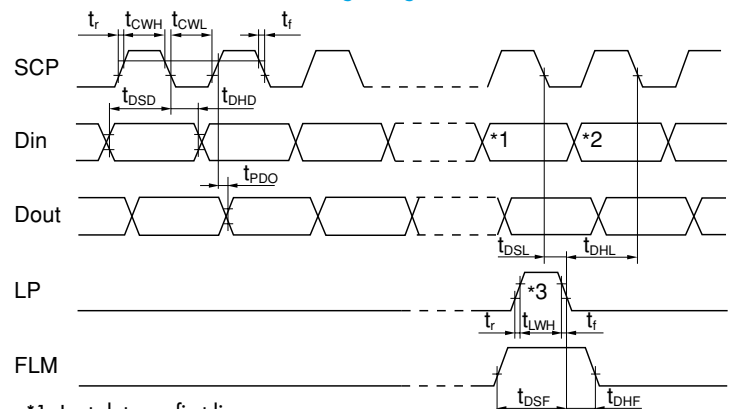
Items	Symbols	Test Conditions	Minimum	Typical	Maximum	Unit
High Level Input Voltage	V <sub>IH</sub>		0.7 V <sub>DD</sub>		V <sub>DD</sub>	V
Low Level Input Voltage	V <sub>IL</sub>		0		0.3 V <sub>DD</sub>	V
High Level Input Leakage Current	I <sub>LIH</sub>	V <sub>I</sub> = V <sub>DD</sub>			10	μA
Low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

### Timing Characteristics of LCD Drive IC

(Temperature at 0°C to 40°C and V<sub>DD</sub> = 5.0V ±10%)

Items	Symbols	Minimum	Maximum
Clock Operation Frequency	f <sub>SCP</sub>		6.0MHz
Latch Pulse Frequency	f <sub>LP</sub>		50kHz
Clock High Level Pulse Width	t <sub>CWH</sub>	70ns	
Clock Low Level Pulse Width	t <sub>CWL</sub>	70ns	
Data Setup Time	t <sub>DSD</sub>	45ns	
Data Hold Time	t <sub>DHD</sub>	50ns	
Data Output Delay Time	t <sub>PDO</sub>		25ns
Latch Setup Time	t <sub>DSL</sub>	50ns	
Latch Hold Time	t <sub>DHL</sub>	50ns	
Latch High Level Width	t <sub>LWH</sub>	200ns	
FLM Setup Time	t <sub>DSF</sub>	50ns	
FLM Hold Time	t <sub>DHF</sub>	50ns	
SCP, LP Rise/Fall Time	t <sub>r</sub> /t <sub>f</sub>		15ns

### Timing Diagram

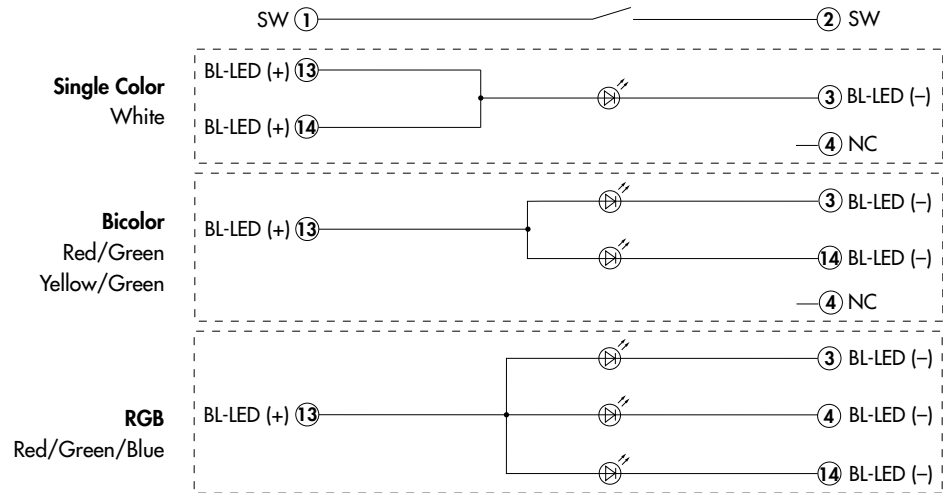
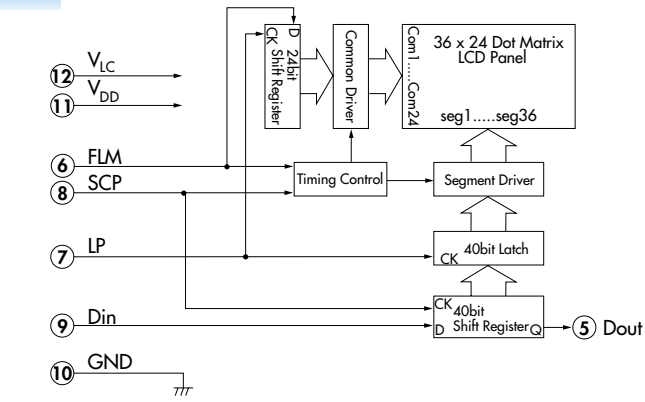


- \*1 Last data on first line
- \*2 Beginning data on second line
- \*3 Location of LP signal on first line

## BLOCK DIAGRAM & PIN CONFIGURATIONS



**IS15SBCP4CF**  
with 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: <b>single color</b> - white; <b>standard bicolor</b> - green for red/green; <b>super bright bicolor</b> - red for red/green; yellow for yellow/green; <b>RGB</b> - red
④	NC	None	No connection for single color white. No connection for bicolor.
	BL-LED (-)	Terminal of Backlight LED	Cathode: <b>RGB</b> - 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 <sub>DD</sub>	Power	Power source for logic circuit
⑫	V <sub>LC</sub>	Power	Power source for LCD drive
⑬	BL-LED (+)	Terminal of Backlight LED	Anode for common
⑭	BL-LED (+)	Terminal of Backlight LED	Anode: <b>single color</b> - white
	BL-LED (-)	Terminal of Backlight LED	Cathode: <b>standard bicolor</b> - red for red/green; <b>super bright bicolor</b> - green for red/green; green for yellow/green; <b>RGB</b> - 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	$V_F$	2.1	3.3	3.3	V

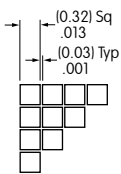
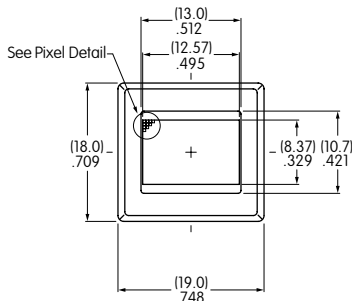
## ABSOLUTE MAXIMUM FOR ALL LEDs

Electrical Characteristics (Temperature at 25°C)

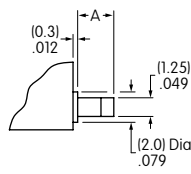
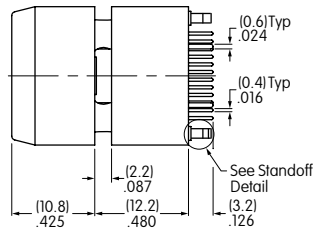
Backlight Color	Symbols	White	Bicolor	RGB	Unit
Forward Current	$I_F$	30	20	20	mA
Reverse Voltage	$V_R$	5.0	4.0	4.0	V
Current Reduction Rate Above 25°C	$\Delta I_F(\text{DC})$	-0.50	-0.26	-0.27	mA/°C
*Power Dissipation	$P_D$	120	130	135	mW

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

## TYPICAL SWITCH DIMENSIONS



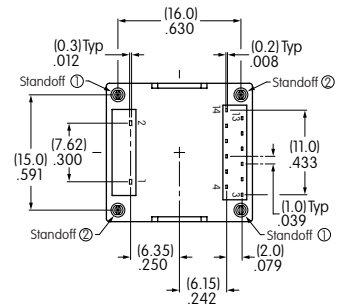
Pixel Detail



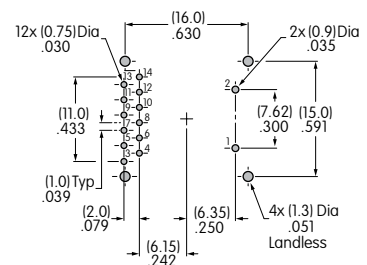
Standoff Detail

Dimension A

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



Terminal numbers are not on the switch.

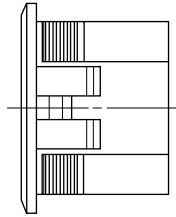


Footprint

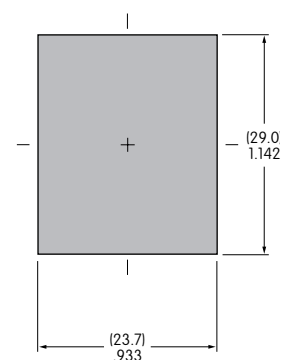
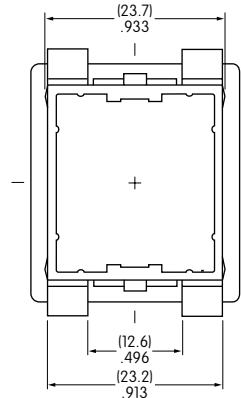
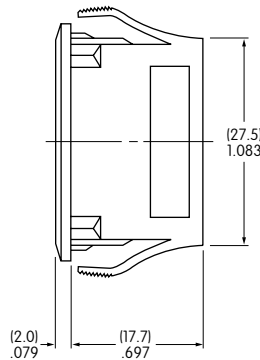
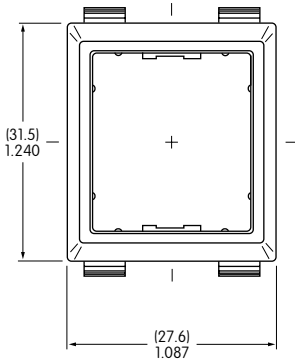
## OPTIONAL ACCESSORIES

### AT548 Panel Mount Housing

Material: Polyamide



Panel mount housing allows the Standard SMARTSWITCH™ 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 Standard SMARTSWITCH™ on an existing panel.

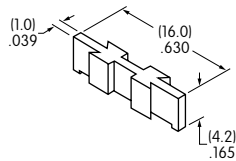


The Panel Mount Housing is available for the Standard SMARTSWITCH™ only.

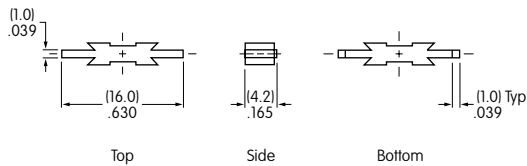
Panel Thickness Range:  
(1.5 ~ 4.0mm) .059 ~ .157"

### AT542 Coupler

Material: PBT



This coupler is for connecting the Standard SMARTSWITCH™ into precise, tight groupings that maintain an even distance from PCB to top of the actuator.



The Coupler is available for the Standard SMARTSWITCH™ only.

## OPTIONAL ACCESSORIES

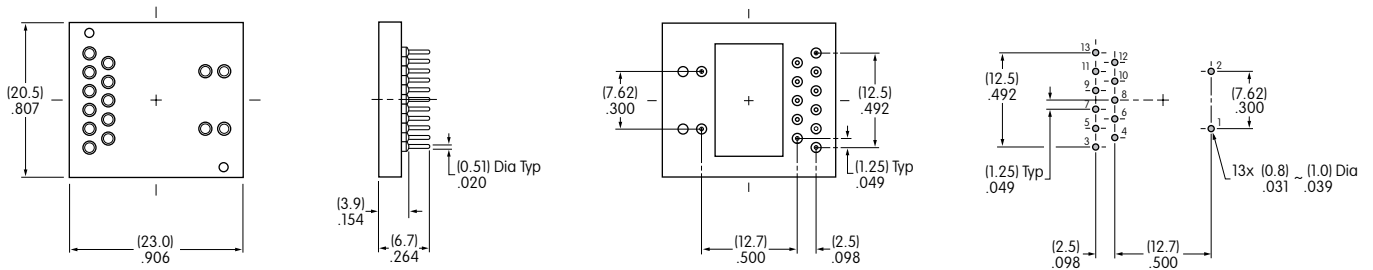
### AT9704-02YC Socket for Standard Single and Bicolor SMARTSWITCH™

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.



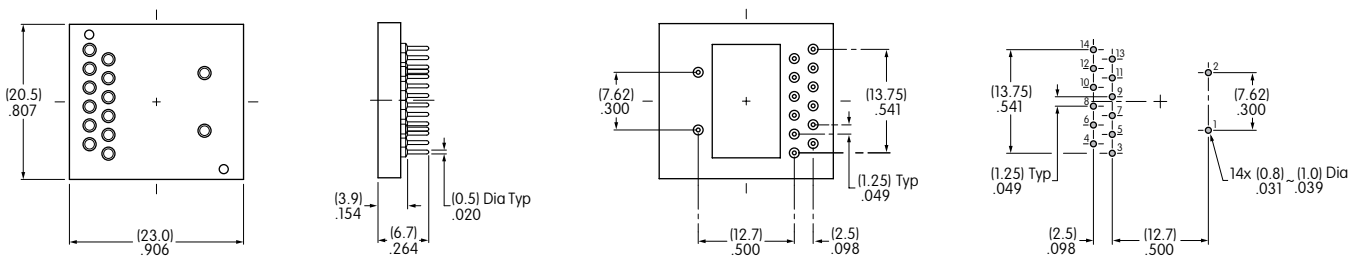
### AT9704-065E Socket for Standard RGB SMARTSWITCH™

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.



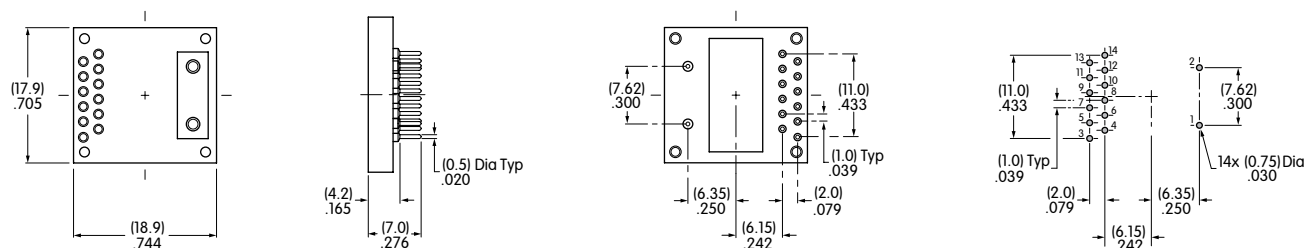
### AT9704-065F Socket for Compact SMARTSWITCH™ (All Models)

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.



Note: AT9704-065F Socket may be used with the Compact High Resolution SMARTSWITCH™ by removing pins 3, 4, 11, 12, 13 and 14.

## OPTIONAL ACCESSORIES

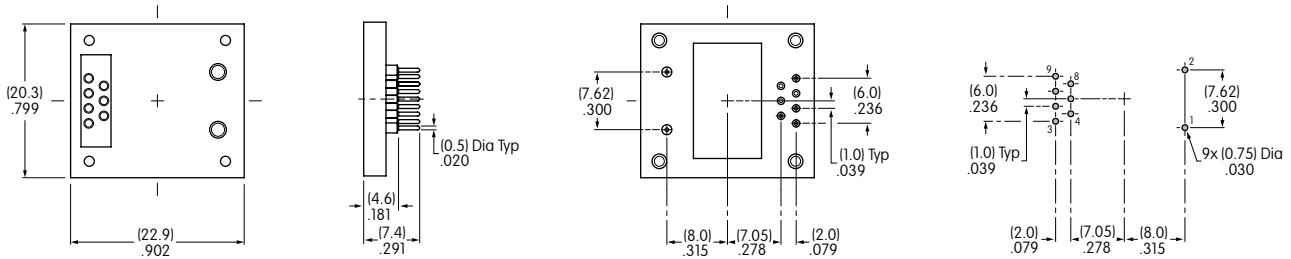
### AT9704-085K Socket for High Resolution SMARTSWITCH™ ← NEW

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.



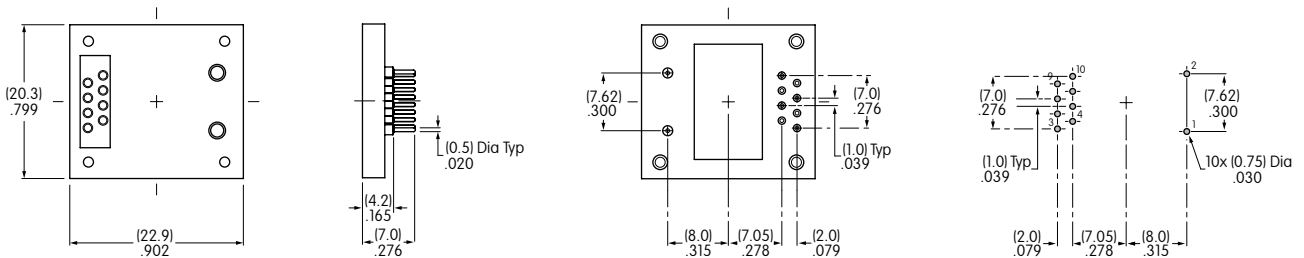
### AT9704-085L Socket for OLED SMARTSWITCH™ ← NEW

Materials:

Base - Glass Fiber Reinforced PBT

Terminals - Brass/Beryllium Copper

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



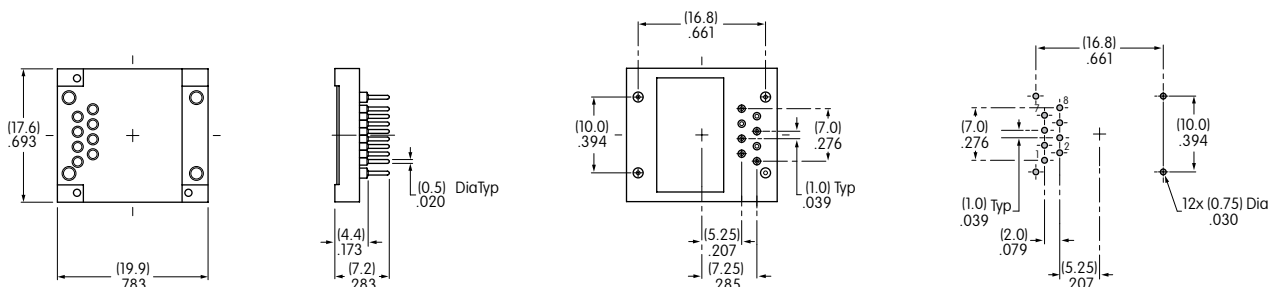
### AT9704-085M Socket for OLED SMARTDISPLAY™ ← NEW

Materials:

Base - Glass Fiber Reinforced PBT

Terminals - Brass/Beryllium Copper

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





## PROGRAMMING TOOLS

NKK Switches has a variety of development tools for the SMARTSWITCH line. These helpful tools are available on CD or downloaded from [www.nkksmartswitch.com](http://www.nkksmartswitch.com).

In addition to standard configurations, NKK Switches can provide custom solutions for the most complex design challenges. Contact the factory for information and support regarding your custom applications.

## DEVELOPMENT KITS

These Development Kits provide a full set of tools for designs using one or two switches. The kits enable rapid prototype designs so that feedback is easily obtained. Each of NKK's IS Development Kits have been designed to facilitate the creation, testing and displaying of images with software downloaded from [www.nkksmartswitch.com](http://www.nkksmartswitch.com). Click on "Download Software."

**OLED Switch Kit**  
IS-DEV KIT-7



**Standard RGB Compact Switch Kit**  
IS-DEV KIT-4



**Standard RGB Switch Kit**  
IS-DEV KIT-5



**High Resolution Switch Kit**  
IS-DEV KIT-6



- Notes: 1. IS Development Kits 4, 5 and 6 use same on-board controller  
2. IS Development Kits come with serial cable and power supply

**One Switch System**  
IS-S0108



**Display Development Kit**  
IS-DEV KIT-1



**Two Switch Development Kit**  
IS-DEV KIT-2



## DEMONSTRATION KITS

IS Demonstration Kits may be used to display as many as 64 bitmaps created via the user's PC with a USB, or serial interface via software. Once downloaded, the bitmaps may be displayed and advanced by employing the address control lines without use of a PC.

The Dem Kits may be incorporated into the user's end product, as the PCB design allows for standoffs.

The LCD module is interchangeable to meet the user's specific color application.

IS Dem Kits are available for single or bicolor switch designs for the SMARTSWITCH or SMARTDISPLAY. The kits are equipped with corresponding support hardware and operating manuals. The various kits, multiple options, and software downloads are just a few of the tools featured at [www.nkksmartswitch.com](http://www.nkksmartswitch.com).

The battery box is a valuable tool in final download of bitmaps. It allows for portability to test anywhere in the field.



Kit for Standard SMARTSWITCH IS-DEM KIT-1



Kit for Standard SMARTDISPLAY IS-DEM KIT-2

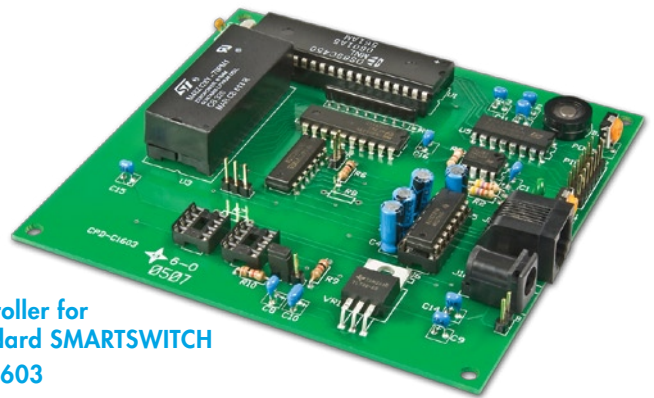


Battery Box for Standard SMARTSWITCH AT9946

## CONTROLLERS

Our full line of modules aids in designing numerous system requirements, including controllers that drive as many as 16 switches. These solutions include the following benefits:

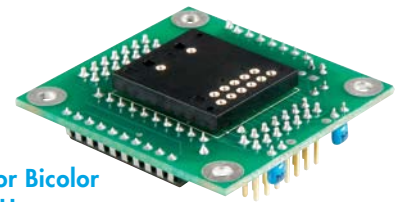
- Reduction of time to create designs
- Conservation of development resources
- Fully programmable utilizing NKK's software



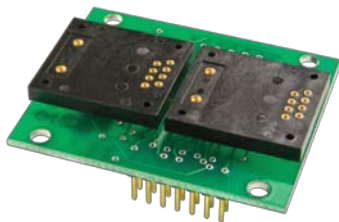
Controller for Standard SMARTSWITCH IS-C1603

## LOGIC BOARDS

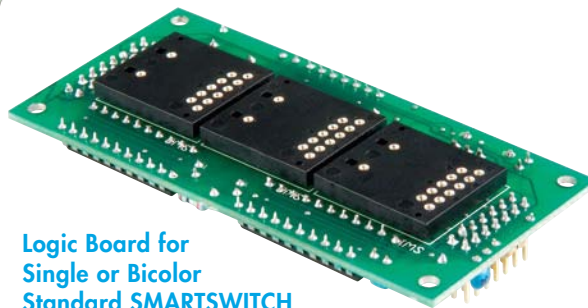
NKK has a logic board design to meet your needs, including those which support multiple switch configurations. Contact us with your configuration challenges and our engineers will assist you.



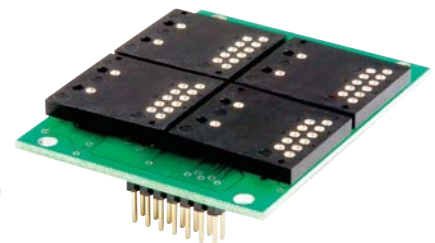
Logic Board for Single or Bicolor Standard SMARTSWITCH IS-L0103-C



Logic Board for OLED SMARTSWITCH IS-L02L1 or for High Resolution SMARTSWITCH IS-L02A1



Logic Board for Single or Bicolor Standard SMARTSWITCH IS-L0301-C



Logic Board for Single or Bicolor Standard SMARTSWITCH IS-L0401-C

## 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:  
11 seconds maximum @ 270°C maximum; avoid temperatures exceeding 80°C at the OLED.
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.

## PRECAUTIONS FOR HANDLING & STORAGE OF LCD 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: 5 seconds maximum @ 270°C maximum
7. Do not exceed 60°C at the LCD level.

### 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.

There are virtually endless applications for the SMARTSWITCH™. The IS Series programmable devices can be used alone or in conjunction with electromechanical switches. Complex switching can be attained when the switches are grouped together to facilitate unlimited functions.

### Typical Markets Include:

**Industrial Controls**

**Broadcasting**

**Telecommunications**

**Simulation Instrumentation**

**Medical**

**Military**

**Financial**

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