

Toggles

Rockers

Pushbuttons

Illuminated PB

Programmable

Keylocks

Rotaries

Slides

Tactiles

Tilt

Touch

Indicators

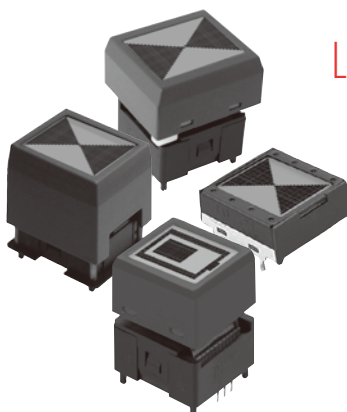
Accessories

Supplement



OLED Pushbuttons, Display & Rocker.....E3

- Frameless OLED Switch with 96 x 64 Programmable Color Display
- OLED Switch with 64 x 48 Programmable Color Display
- OLED Display with 52 x 36 Programmable Color Display
- OLED Rocker Switch with 96 x 64 Programmable Display



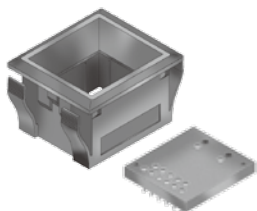
LCD 64 x 32 Pushbuttons, Display, Compact....E21

- Switch with Programmable Display; Short Travel & RGB 64 Colors
- Switch with Programmable Display; Long Travel & RGB 64 Colors
- Display: Programmable with RGB 64 Colors & Long Life LCD
- Compact Switch with Programmable Display; RGB 64 Colors



LCD 36 x 24 Pushbuttons, Display, Compacts....E34

- Switch with Programmable Display; RGB Backlight
- Switch with Programmable Display; Red/Green Backlight
- Display: Programmable with RGB Backlight
- Compact Switch with Programmable Display; RGB Backlight
- Compact Switch with Programmable Display; Red/Green Backlight



Accessories.....E48

Enhance Your Applications

Development Tools & Support

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

OLED SWITCHES & DISPLAY

Frameless OLED Pushbutton

ISF15ACP4

96 x 64 Programmable Color Display
Video Capability; 180° Viewing Angle
High Definition, Excellent Contrast
Page E4



OLED Pushbutton

ISC15ANP4

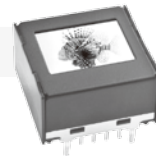
64 x 48 Programmable Color Display
Video Capability; 180° Viewing Angle
High Definition, Excellent Contrast
Page E8



OLED Display

ISC01P

52 x 36 Programmable Color Display
Video Capability; 180° Viewing Angle
High Definition, Excellent Contrast
Page E8



OLED Rocker

IS18WWC1W

96 x 64 Programmable Display
White Monochrome OLED Display
Exceptional Contrast; 180° Viewing Angle; IP64 Rating
Page E15



For OLED Pushbuttons & Display

Handling & Storage Page E14

For OLED Rocker

Handling & Storage Page E20

For Controlling, refer to Application Notes on website for more information.

Toggle

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Pushbuttons

Illuminated PB

E Programmable

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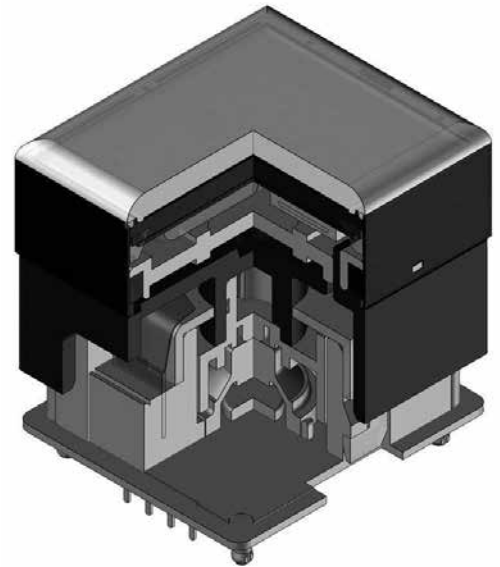
Indicators

Accessories

Supplement

DISTINCTIVE CHARACTERISTICS

- High definition, contrast and resolution of 96RGB x 64 pixels in compact screen and minimal frame
- Range of 65,536 colors in 16 bit mode
- Operating life of 50,000 hours minimum
- Maximum use of display lens with ultra-thin frame provides full screen capacity
- Multiple units easily combine to form one screen, offering flexibility in size and layout
- Smooth, silent operation with short stroke of 0.07" lends to tactile feedback unparalleled to touch panels
- Operated by commands and data supplied via serial communications (SPI)
- Incorporates bitmap display function
- Low energy consumption
- Dust tight construction
- Snap-in standoff for easy, secure mounting and alignment; aids in prevention of dislodging during wave soldering



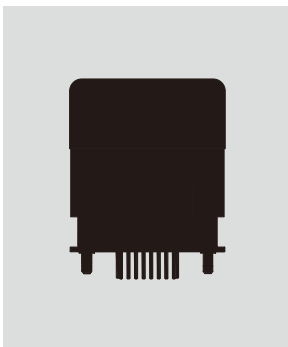
Viewing area: 21.28mm x 18.74mm (horizontal x vertical)

High reliability and long life of one million actuations minimum

Highly reliable gold plated twin contacts

Epoxy sealed straight PC terminals

Actual Size





SWITCH PART NUMBER & DESCRIPTION

Part Number	Switch Description	OLED	Pixel Format
ISF15ACP4	SPST, Momentary ON Gold Contacts Straight PC Terminals	Color OLED Display Module 65,536 Colors	96RGB x 64 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 (resistive circuit)
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	1.7N ± 0.5N
Total Travel	1.8mm (0.07")

OLED SPECIFICATIONS

Characteristics of Display

Display Device	Color OLED display module
Display Mode	Passive matrix
Viewing Area	21.28mm x 18.74mm (horizontal x vertical)
Pixel Format	96RGB x 64 pixels (horizontal x vertical)
Pixel Size	0.222mm x 0.293mm (horizontal x vertical)
Interface	Serial (SPI) interface
Number of Colors	65,536 Colors (16bit: R 5bit/G 6bit/B 5bit) or 256 Colors (8bit: R 2bit/G 3bit/B 3bit)
Operating Temperature Range	-20°C ~ +70°C (-4°F ~ +158°F)
Storage Temperature Range	-30°C ~ +80°C (-22°F ~ +176°F)
Operating Life (Display)	50,000 hours @ 100cd/m ² (based on 40% pixels ON; Ta = 77°F)

Absolute Maximum Ratings

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

Current Consumption

(Temperature at 25°C, V_{DD} = 2.8V, V_{CC} = 15.0V)

Items	Symbols	Min	Typical	Max
All-Pixels-On Mode *Drive System Power Current	I _{CC1}	—	11.0mA	13.2mA
All-Pixels-On Mode *Logic/IF System Power Current	I _{DD1}	—	0.17mA	0.20mA
Sleep Mode **Drive System Power Current	I _{CC2}	—	—	10µA
Sleep Mode **Logic/IF System Power Current	I _{DD2}	—	—	10µA

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

Recommended Operating Conditions

Items	Symbols	Minimum	Typical	Maximum
Supply Voltage for Logic/Interface	V _{DD}	2.4V	2.8V	3.5V
Supply Voltage for Drive	V _{CC}	14.0V	15.0V	16.0V
Input High Level Voltage	V _{IH}	0.8 x V _{DD}	—	—
Input Low Level Voltage	V _{IL}	—	—	0.2 x V _{DD}

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

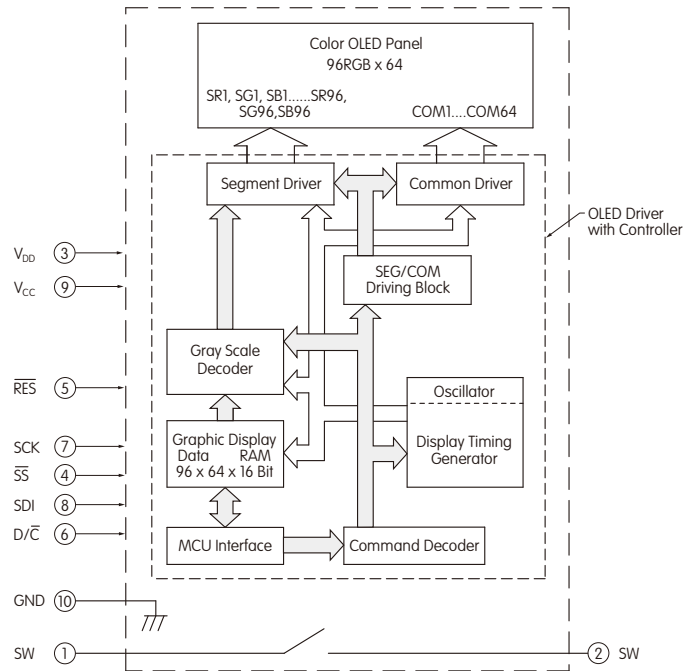
Items	Min	Typical	Max	Unit	Remarks
Luminosity	80	105	130	cd/m ²	White (All pixels on)
White Color Coordinate	(x)	0.26	0.30	0.34	—
	(y)	0.31	0.36	0.41	—
Red Color Coordinate	(x)	0.62	0.66	0.70	—
	(y)	0.30	0.34	0.38	—
Green Color Coordinate	(x)	0.24	0.29	0.33	—
	(y)	0.59	0.63	0.67	—
Blue Color Coordinate	(x)	0.10	0.15	0.19	—
	(y)	0.10	0.17	0.23	—
Contrast Ratio	100	—	—	—	—

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BLOCK DIAGRAM & PIN CONFIGURATIONS

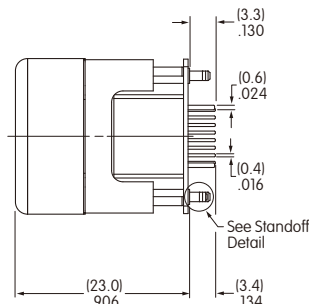
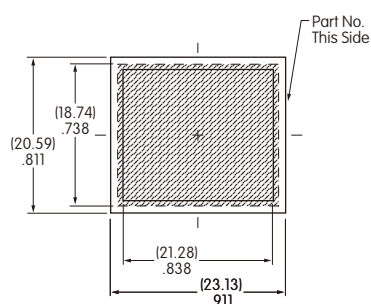


ISF15ACP4

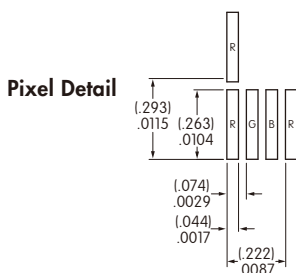
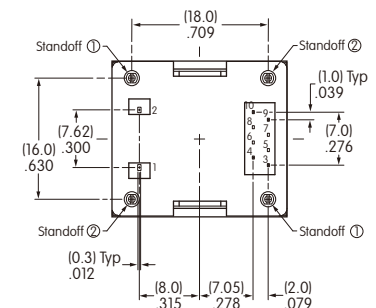


Pin No.	Symbol	Name	Function
①	SW	Terminal of Switch	Normally open
②	SW	Terminal of Switch	Normally open
③	V _{DD}	Power	Power source for logic circuit
④	SS	Slave Select	Slave select for SPI. This line is active low.
⑤	RES	Reset	Reset signal input. When pin is low, initialization of chip is executed.
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 _{CC}	Power	Power source for drive circuit
⑩	GND	Ground	Connect to Ground

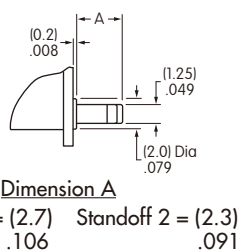
TYPICAL SWITCH DIMENSIONS



Terminal numbers are not on the switch.

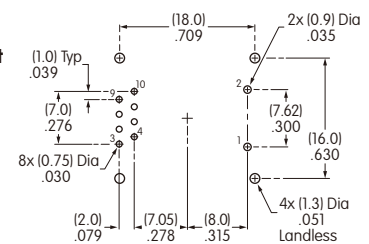


Standoff Detail



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

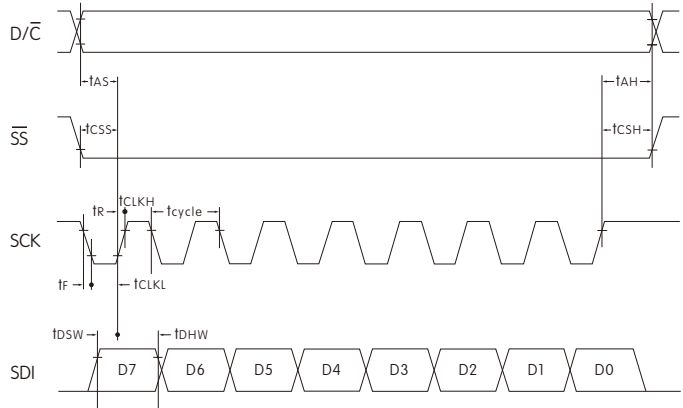
Footprint



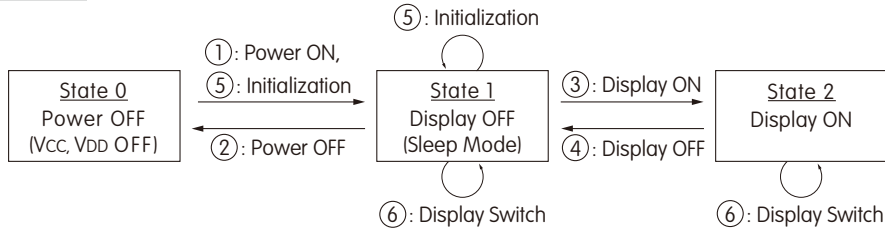
TIMING SPECIFICATIONS

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/ \bar{C} Setup Time	t_{AS}	40ns	—	—
D/ \bar{C} Hold Time	t_{AH}	40ns	—	—
\bar{SS} Setup Time	t_{CSS}	75ns	—	—
\bar{SS} Hold Time	t_{CSH}	60ns	—	—
Write Data Setup Time	t_{DSW}	40ns	—	—
Write Data Hold Time	t_{DHW}	40ns	—	—
SCK Low Time	t_{CLKL}	75ns	—	—
SCK High Time	t_{CLKH}	75ns	—	—
SCK Rise Time	t_R	—	—	15ns
SCK Fall Time	t_F	—	—	15ns

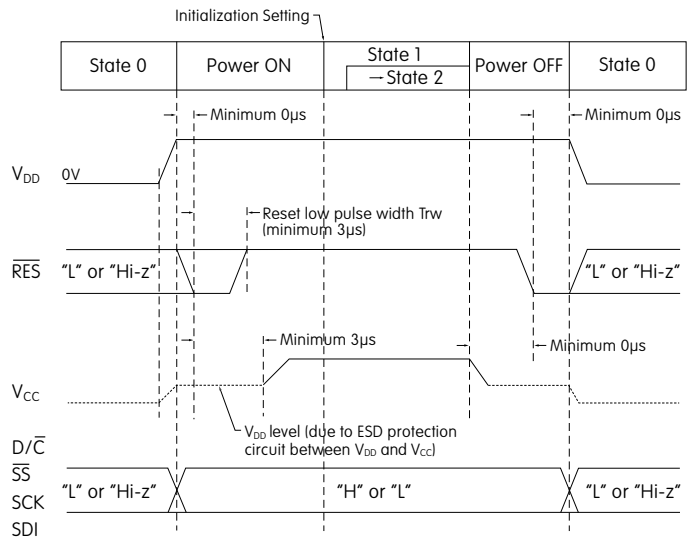


STATE TRANSITION



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

Power ON/OFF Sequence



State Transition	Transition	Index
①	Power ON	Refer to "Power ON/OFF Sequence"
②	Power OFF	
③	Display ON	
④	Display OFF	
⑤	Initialization	Initialize Setting of Command/Data
⑥	Image Rewriting	Send Display Data
	Display Settings	Dimmer, Scroll, etc.

DISTINCTIVE CHARACTERISTICS

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

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

High reliability and long life of three million actuations minimum

High resolution of 64RGB x 48 pixels

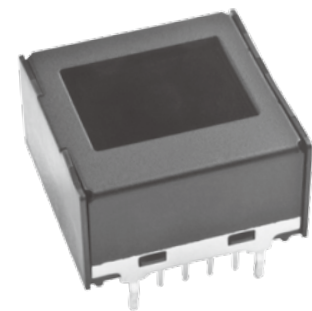
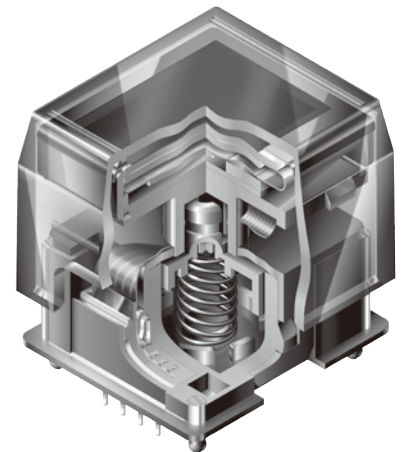
Epoxy sealed straight PC terminals

Snap-in standoff for easy, secure mounting and alignment

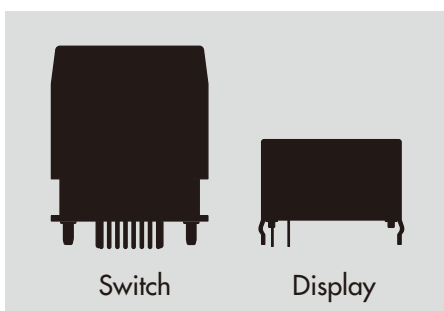
Viewing area: 12.9mm x 9.9mm (horizontal x vertical)

High resolution of 52RGB x 36 pixels

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



Actual Sizes





SWITCH 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	2.0N ± 0.5N
Total Travel	4.5mm (.177")

OLED SPECIFICATIONS

Characteristics of Display

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

Absolute Maximum Ratings

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

Current Consumption

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

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

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

Recommended Operating Conditions

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

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

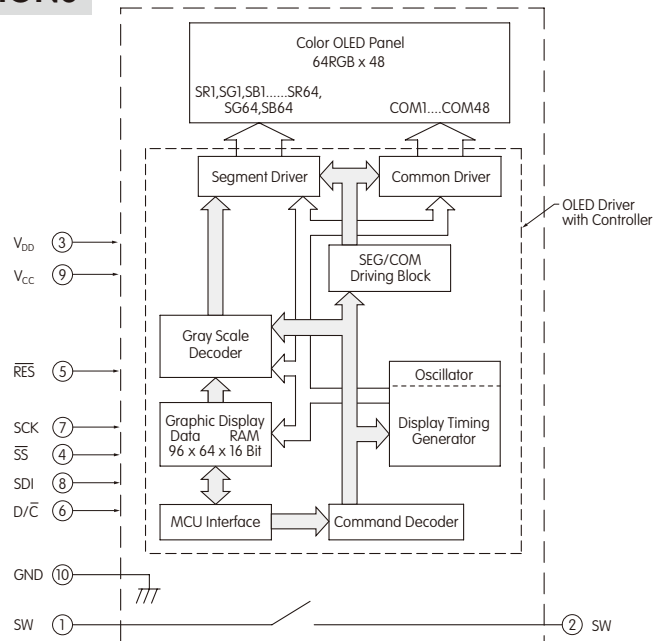
Items	Min	Typical	Max	Unit	Remarks
Luminosity	75	100	125	cd/m ²	White (All pixels on)
White Color Coordinate	(x)	0.26	0.30	0.34	—
	(y)	0.32	0.37	0.42	—
Red Color Coordinate	(x)	0.63	0.67	0.71	—
	(y)	0.29	0.33	0.37	—
Green Color Coordinate	(x)	0.19	0.23	0.27	—
	(y)	0.61	0.65	0.69	—
Blue Color Coordinate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

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Illuminated PB
Programmable
Keylocks
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Slides
Tactiles
Tilt
Touch
Indicators
Accessories
Supplement

SWITCH BLOCK DIAGRAM & PIN CONFIGURATIONS

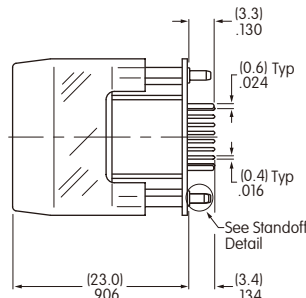
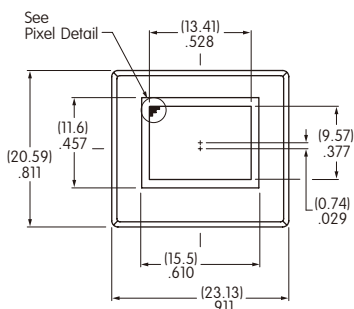


ISC15ANP4

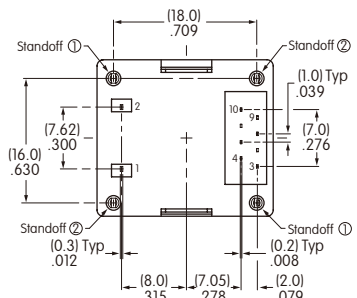


Pin No.	Symbol	Name	Function
①	SW	Terminal of Switch	Normally open
②	SW	Terminal of Switch	Normally open
③	V _{DD}	Power	Power source for logic circuit
④	SS	Slave Select	Slave select for SPI. This line is active low.
⑤	RES	Reset	Reset signal input. When pin is low, initialization of chip is executed.
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 _{CC}	Power	Power source for drive circuit
⑩	GND	Ground	Connect to Ground

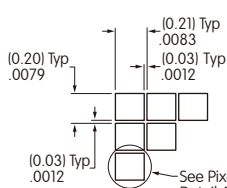
TYPICAL SWITCH DIMENSIONS



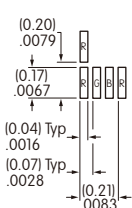
Terminal numbers are not on the switch.



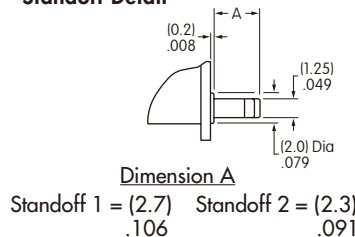
Pixel Detail



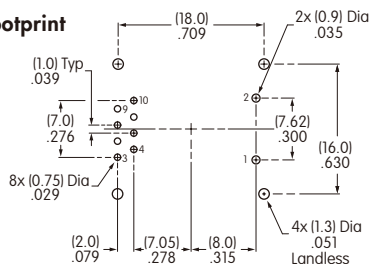
Pixel Detail A



Standoff Detail



Footprint



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 Rockers
 Pushbuttons
 Illuminated PB
Programmable E
 Keylocks
 Rotarys
 Slides
 Tactiles
 Tilt
 Touch
 Indicators
 Accessories
 Supplement



DISPLAY PART NUMBER & DESCRIPTION

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

OLED SPECIFICATIONS

Characteristics of Display

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

Absolute Maximum Ratings

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

Current Consumption

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

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

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

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

Recommended Operating Conditions

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

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

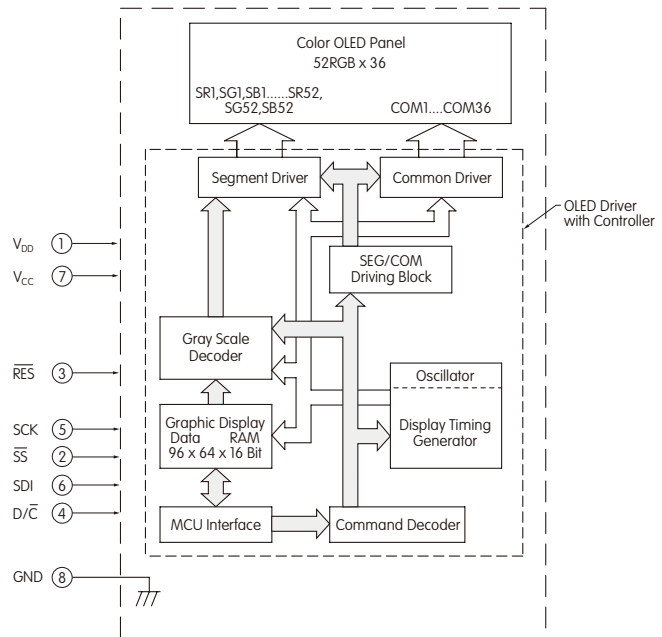
Items	Min	Typical	Max	Unit	Remarks
Luminosity	75	100	125	cd/m ²	White (All pixels on)
White Color Coordinate	(x)	0.25	0.29	0.33	—
	(y)	0.31	0.36	0.41	—
Red Color Coordinate	(x)	0.63	0.67	0.71	—
	(y)	0.29	0.33	0.37	—
Green Color Coordinate	(x)	0.19	0.23	0.27	—
	(y)	0.60	0.64	0.68	—
Blue Color Coordinate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

Toggles
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E Programmable
 Keylocks
 Rotaries
 Slides
 Tactiles
 Tilt
 Touch
 Indicators
 Accessories
 Supplement

DISPLAY BLOCK DIAGRAM & PIN CONFIGURATIONS

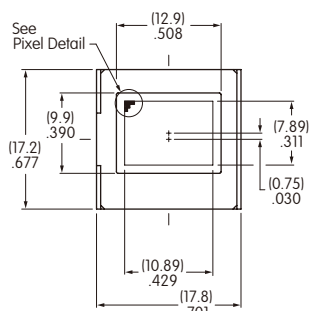


ISCO1P

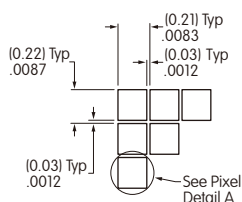


Pin No.	Symbol	Name	Function
①	V _{DD}	Power	Power source for logic circuit
②	SS	Slave Select	Slave select for SPI. This line is active low.
③	RES	Reset	Reset signal input. When pin is low, initialization of chip is executed.
④	D/C	Data/Command	Data/Command Control. When pin is pulled low, data will 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 _{CC}	Power	Power source for drive circuit
⑧	GND	Ground	Connect to Ground

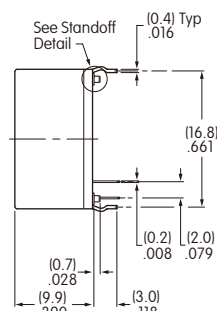
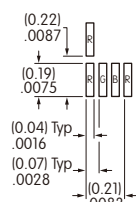
TYPICAL DISPLAY DIMENSIONS



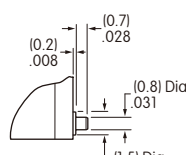
Pixel Detail



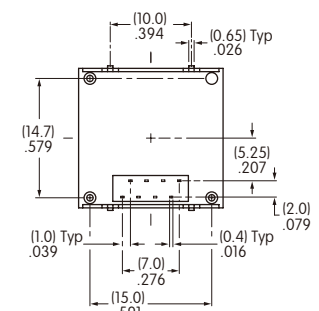
Pixel Detail A



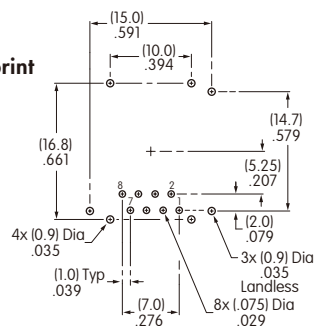
Standoff Detail



Terminal numbers are not on the switch.



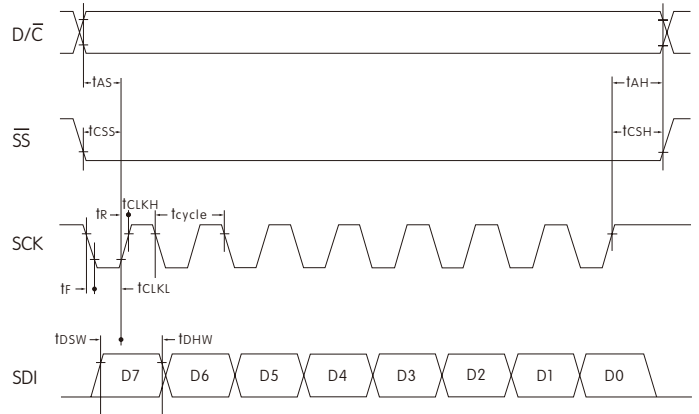
Footprint



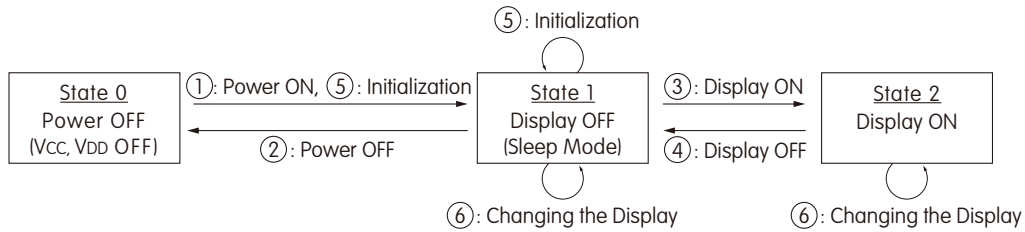
TIMING SPECIFICATIONS FOR SWITCH & DISPLAY

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/ \bar{C} Setup Time	t_{AS}	40ns	—	—
D/ \bar{C} Hold Time	t_{AH}	40ns	—	—
\bar{SS} Setup Time	t_{CSS}	75ns	—	—
\bar{SS} Hold Time	t_{CSH}	60ns	—	—
Write Data Setup Time	t_{DSW}	40ns	—	—
Write Data Hold Time	t_{DHW}	40ns	—	—
SCK Low Time	t_{CLKL}	75ns	—	—
SCK High Time	t_{CLKH}	75ns	—	—
SCK Rise Time	t_R	—	—	15ns
SCK Fall Time	t_F	—	—	15ns



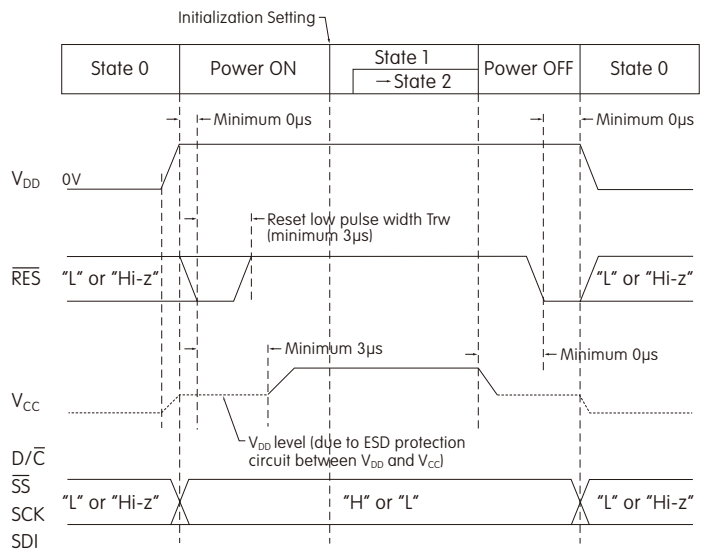
STATE TRANSITION



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

State Transition	Transition	Index
①	Power ON	Refer to "Power ON/OFF Sequence"
②	Power OFF	
③	Display ON	
④	Display OFF	
⑤	Initialization	Initialize Setting of Command/Data
⑥	Image Rewriting	Send Display Data
	Display Settings	Dimmer, Scroll, etc.

Power ON/OFF Sequence



Note: Refer to Application Notes on web site.

PRECAUTIONS FOR HANDLING & STORAGE OF OLED PUSHBUTTONS & DISPLAY

Handling



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

Avoid temperatures exceeding 80°C at the OLED.
 Wave Soldering: see Profile A in Supplement section.
 Manual Soldering: see Profile A in Supplement section.

7. The IS series OLED devices are not process sealed.
8. Pixels acquire diminished brightness over time and use, and those most frequently habituated have greater reduction of brightness than those less used. To minimize this difference, operate OLED unit so that all pixels are used as consistently as possible.
9. For switch, clean cap surface with dry cloth. If further cleaning is needed, wipe with dampened cloth using neutral cleanser and dry with clean cloth. Do not use organic solvent. For display, avoid contact with any flux or detergent. If any liquids spill on display surface, immediately wipe with soft absorbent cloth.
10. Proper serial resistors and buffers for signals should be used to prevent noise problems.

Storage

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

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

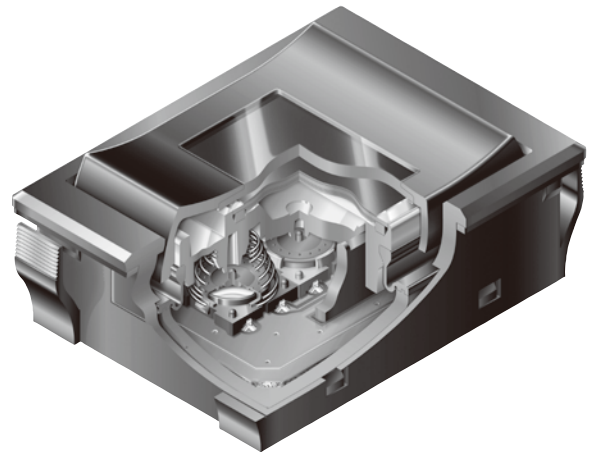
DISTINCTIVE CHARACTERISTICS

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

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

Panel mount with easy, snap-in installation

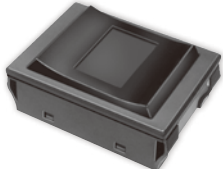
Short 14.6mm (.575") behind-panel height for compact spaces



Actual Size



SMARTSWITCH PART NUMBER & DESCRIPTION

Part Number	Description
<p>IS18WWC1W</p>	<p>OLED Rocker Switch: SP3T Switch Rocker (ON) (ON) (ON) Pushbutton Normally OFF</p> 

SWITCH SPECIFICATIONS

Circuit	Single Pole Three Throw (Momentary)					
Contact Position	Top		Center		Bottom	
	Normal OFF	Down (ON) 9-12	Normal OFF	Down (ON) 10-12	Normal OFF	Down (ON) 11-12
Electrical Capacity (Resistive Load)	3VA maximum DC					
Contact Resistance	200 milliohms maximum					
Insulation Resistance	500 megohms minimum @ 250V DC					
Dielectric Strength	250V AC for 1 minute minimum					
Electrostatic Resisting Pressure	15kV minimum					
Mechanical Endurance	1,000,000 operations minimum					
Electrical Endurance	1,000,000 operations minimum					
Operating Force	5N ± 2N at center of cap; 3.7N ± 1.7N at top and bottom					
Total Travel	1.3±0.5mm (.051"±.020") at center of cap; 1.8±0.6mm (.071"±.024") at top and bottom					

OLED SPECIFICATIONS

Characteristics of Display

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

Absolute Maximum Ratings (Temperature at 25°C)

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

Current Consumption

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

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

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

Recommended Operating Conditions

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

Optical Characteristics

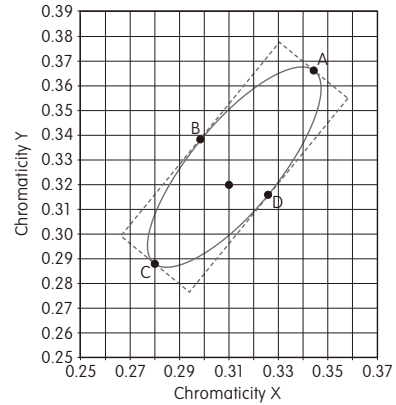
(Temperature at 25°C, Initial Value: depends on initial setting)

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

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

Chromaticity Diagram

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



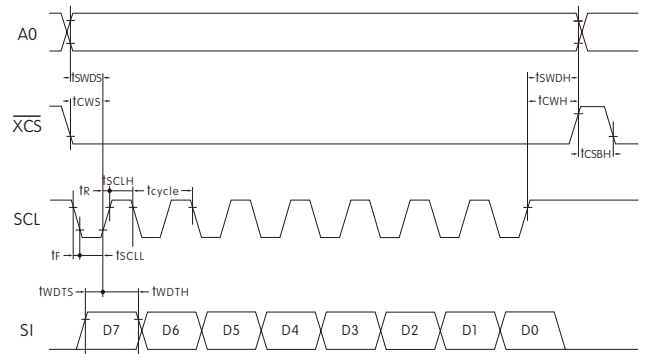
TIMING SPECIFICATIONS

AC Characteristics

(Temperature at -20°C ~ +70°C), VDDA = 2.8V, VAH = 16V

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

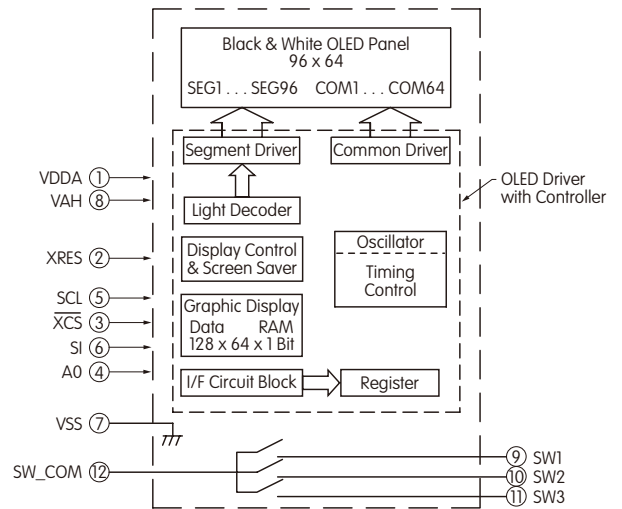
* Requires more than 100ns after resetting software



BLOCK DIAGRAM & PIN CONFIGURATIONS

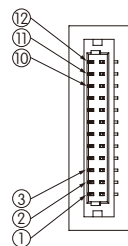
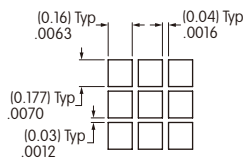
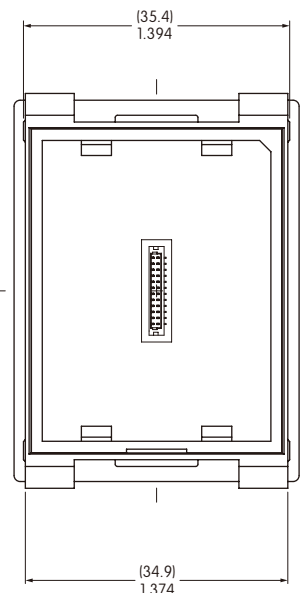
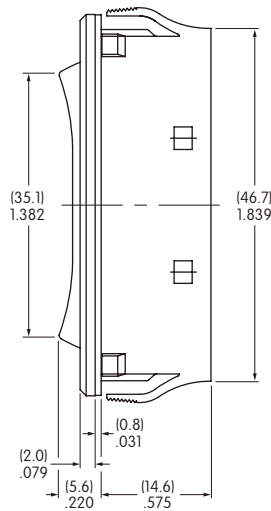
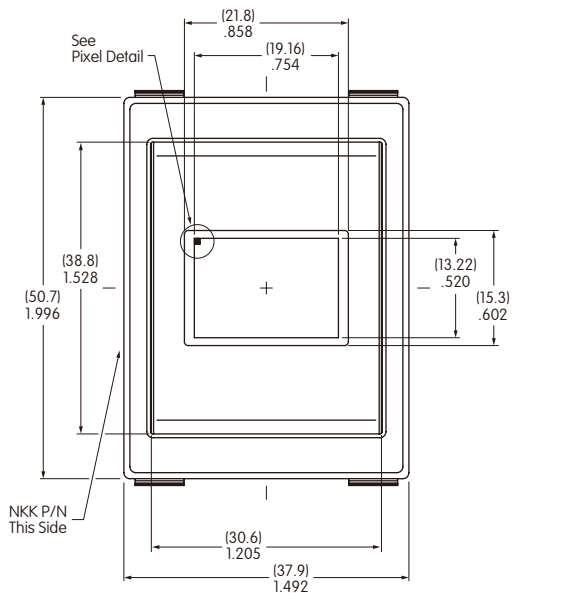


IS18WWC1W



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

SMARTSWITCH TYPICAL DIMENSIONS

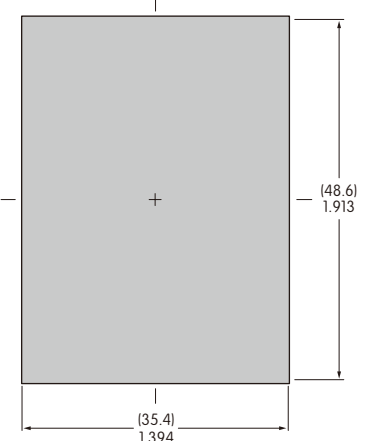


Pixel Detail

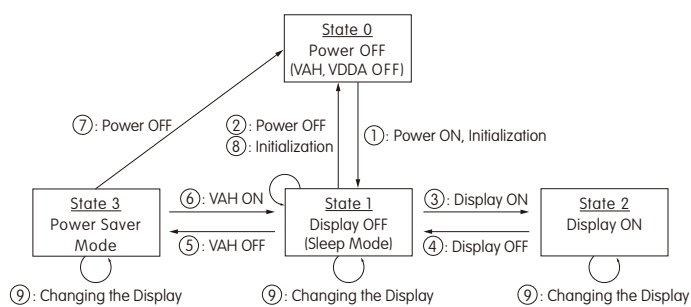
Terminal Connector Detail

Panel Thickness Range

.039 ~ .157"
(1.0mm ~ 4.0mm)

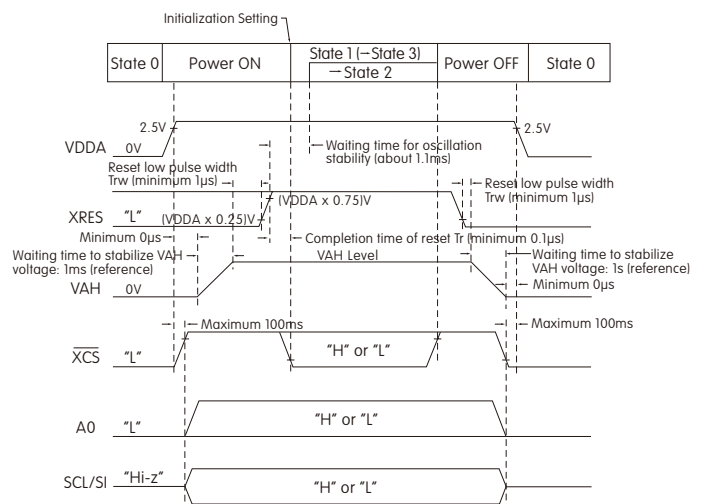


STATE TRANSITION



State Number	State	Display	Sleep	VAH	VDDA	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
3	Power Saver	OFF	ON	OFF	ON	Enable

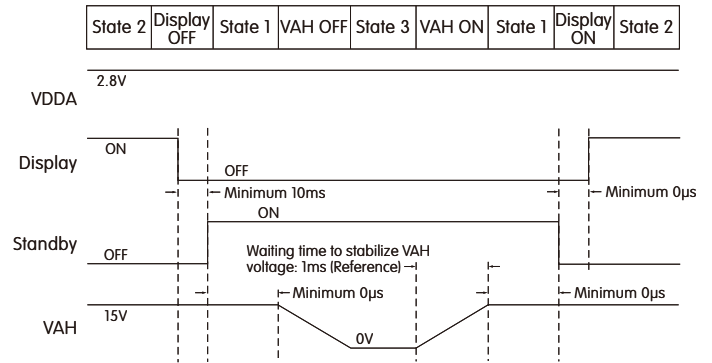
Power ON/OFF Sequence



STATE TRANSITION (CONTINUED)

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

Display ON/OFF Sequence



INITIALIZATION SETTING

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

Notes: 1. Same as default value
2. Do not change setting value

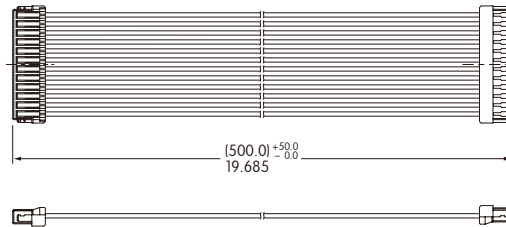
Command Name	Command Address	Parameter (1 or 2Byte)	Remarks
X Axis Reading Start Address	38	00	Note 1
Y Axis Reading Start Address	39	00	Note 1
Reserved 9	48	03	Note 2
Screen Saver Event Timer Setting Command	C3	00	Note 1
Screen Saver Event Timer Setting Command	C4	00	Note 1
One Time, Repeat or Direction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

Notes: 1. Same as default value
2. Do not change setting value

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

ACCESSORIES

AT715 Cable for Connection



PRECAUTIONS FOR HANDLING & STORAGE OF OLED ROCKERS

Handling

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

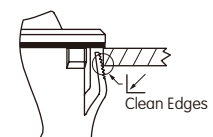
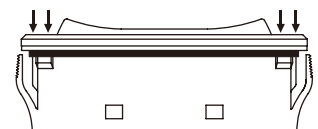
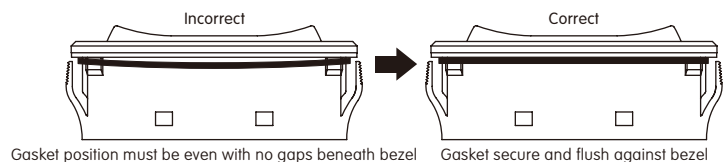


Storage

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

Panel Mounting

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



HIGH RESOLUTION LCDS

Pushbutton • Short Travel

IS15EBFP4RGB-134E

Programmable Display; High Resolution: 64 x 32 Pixels
 Backlight RGB: 64 colors; Black & White LCD
 Up to 4 Lines with 10 Characters Each
 Page E22



Pushbutton • Long Travel

IS15EBFP4RGB

Programmable Display; High Resolution: 64 x 32 Pixels
 Backlight RGB: 64 colors; Black & White LCD
 Up to 4 Lines with 10 Characters Each
 Page E22



Display

IS01EBFRGB

Programmable Display; High Resolution: 64 x 32 Pixels
 Backlight RGB: 64 colors; Black & White LCD
 Up to 4 Lines with 10 Characters Each
 Page E26



Compact Pushbutton

IS15ESBFP4RGB

Programmable Display; High Resolution: 64 x 32 Pixels
 Backlight RGB: 64 colors; Black & White LCD
 Up to 4 Lines with 10 Characters Each
 Page E28



For All LCD 64 x 32 Switches & Displays

Timing Specifications	Page E31
Bitmap	Page E31
Commands & Data	Page E32
Handling & Storage	Page E33

DISTINCTIVE CHARACTERISTICS

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

Viewing areas:

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

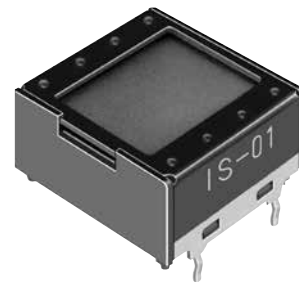
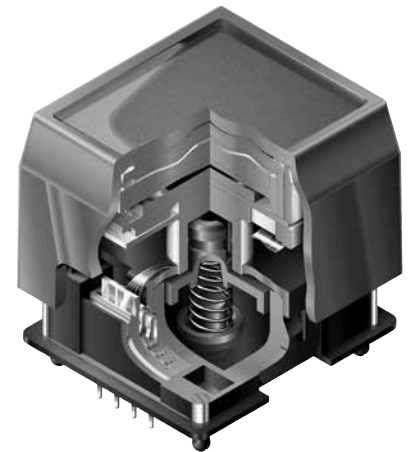
Display - 14.4mm x 11.8mm

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

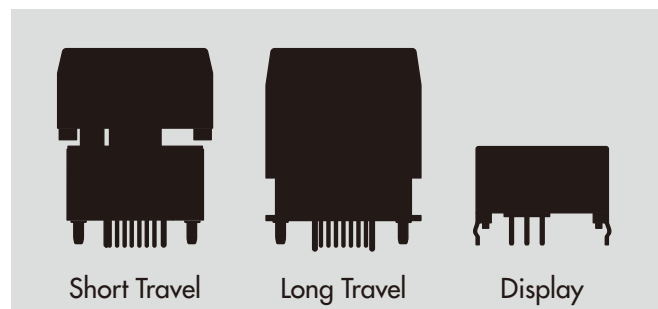
High resolution of 64 x 32 pixels

Epoxy sealed straight PC terminals

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



Actual Sizes of Switches & Display



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



IS15EBFP4RGB-134E
RGB LED Backlight
Black and White LCD
Short Travel

IS15EBFP4RGB
RGB LED Backlight
Black and White LCD
Long Travel



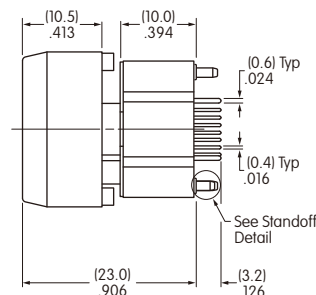
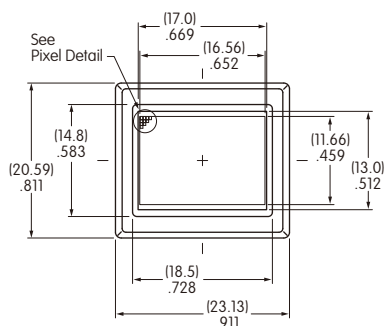
SWITCH PART NUMBERS & DESCRIPTION

Part Numbers	Switch Description	LCD Mode	LED Color
IS15EBFP4RGB-134E IS15EBFP4RGB	SPST Momentary ON Gold Contacts Straight PC Terminals	Black & White FSTN Positive	Red/Green/Blue

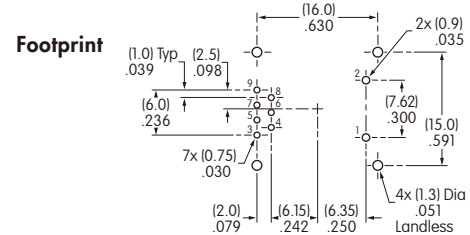
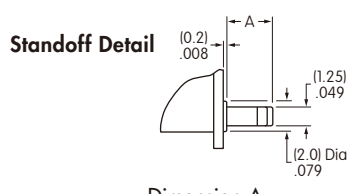
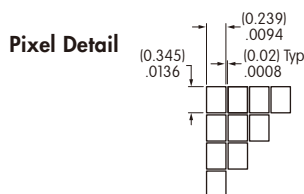
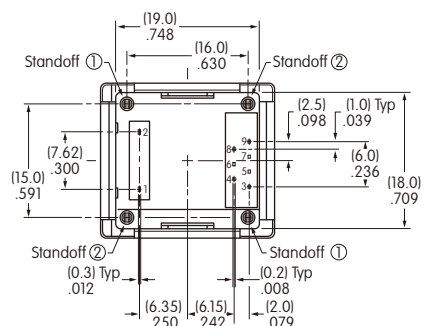
SWITCH SPECIFICATIONS

	Short Travel	Long Travel
Circuit	SPST normally open	SPST normally open
Electrical Capacity (Resistive Load)	100mA @ 12V DC	100mA @ 12V DC
Contact Resistance	200 milliohms maximum @ 20mV 10mA	200 milliohms maximum @ 20mV 10mA
Insulation Resistance	100 megohms minimum @ 100V DC	100 megohms minimum @ 100V DC
Dielectric Strength	125V AC for 1 minute minimum	125V AC for 1 minute minimum
Mechanical Endurance	1,000,000 operations minimum	3,000,000 operations minimum
Electrical Endurance	1,000,000 operations minimum	3,000,000 operations minimum
Operating Force	1.7N ± 0.5N	2.0N ± 0.5N
Total Travel	1.8mm (.071")	4.5mm (.177")

TYPICAL SWITCH DIMENSIONS FOR SHORT TRAVEL



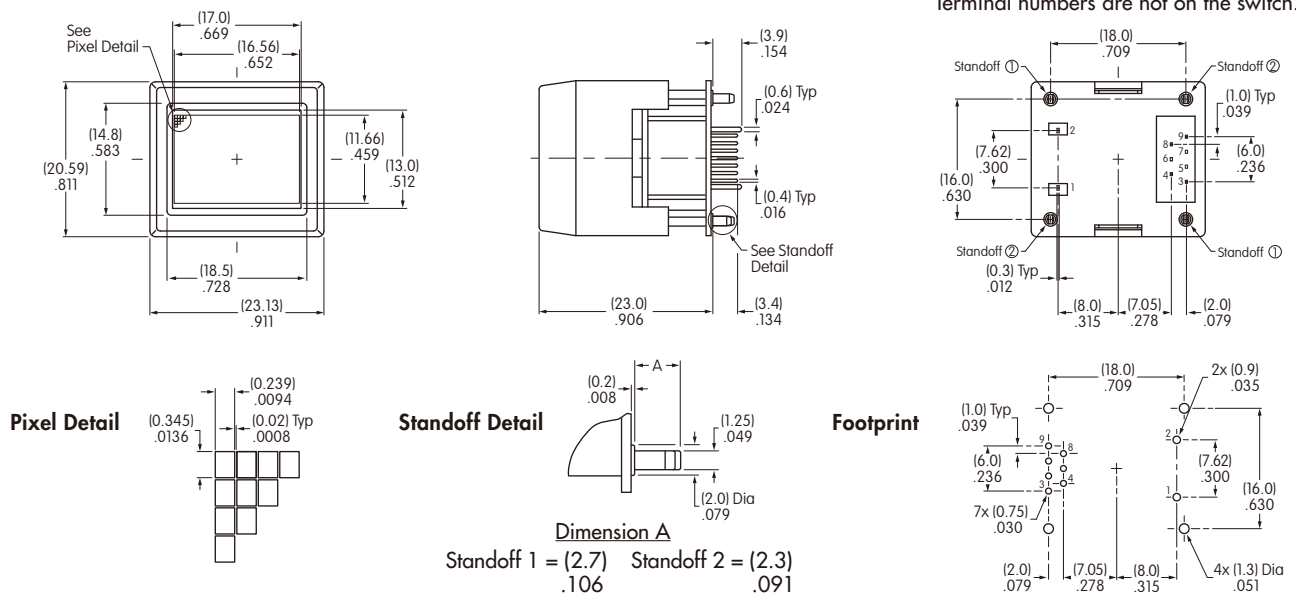
Terminal numbers are not on the switch.



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

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

TYPICAL SWITCH DIMENSIONS FOR LONG TRAVEL



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

LCD SPECIFICATIONS

Characteristics of Display

Display Operation Mode	FSTN positive; background colors, black & white
Display Condition	Transflective with built-in LED backlight
Viewing Angle Direction	6 o'clock
Viewing Area	17.0mm x 13.0mm (horizontal x vertical)
Pixel Format	64 x 32 pixels (horizontal x vertical)
Pixel Size	0.239mm x 0.345mm (horizontal x vertical)
*Operating Temperature Range	-15°C ~ +50°C (+5°F ~ +122°F)
Storage Temperature Range	-20°C ~ +60°C (-4°F ~ +140°F)
Backlight LED	RGB: red/green/blue

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

Absolute Maximum Ratings (Temperature at 25°C)

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

Optical Characteristics (Temperature at 25°C)

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

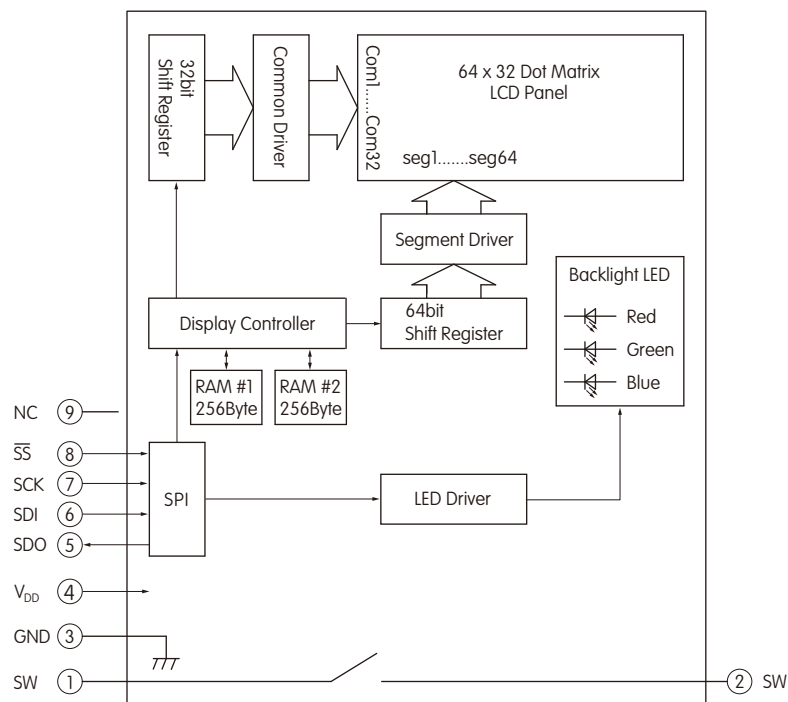
Recommended Operating Conditions (Temperature at 25°C)

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

** 10mA: Backlighting LED is off

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

SWITCH BLOCK DIAGRAM & PIN CONFIGURATIONS



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

DISPLAY PART NUMBER & DESCRIPTION

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

LCD SPECIFICATIONS

Characteristics of Display

Display Operation Mode	FSTN positive; background colors, black & white
Display Condition	Transflective with built-in LED backlight
Viewing Angle Direction	6 o'clock
Viewing Area	14.4mm x 11.8mm (horizontal x vertical)
Pixel Format	64 x 32 pixels (horizontal x vertical)
Pixel Size	0.200mm x 0.285mm (horizontal x vertical)
* Operating Temperature Range	-15°C ~ +50°C (+5°F ~ +122°F)
Storage Temperature Range	-20°C ~ +60°C (-4°F ~ +140°F)
Backlight LED	RGB: red/green/blue
* In a low temperature environment (below 0°C), speed and contrast decrease when image changes. The non-indicator dot may become dense in a high temperature environment (about +50°C). Highest backlight brightness level should not be used for temperatures above +35°C.	

Recommended Operating Conditions (Temperature at 25°C)

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

** 10mA: Backlighting LED is off

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

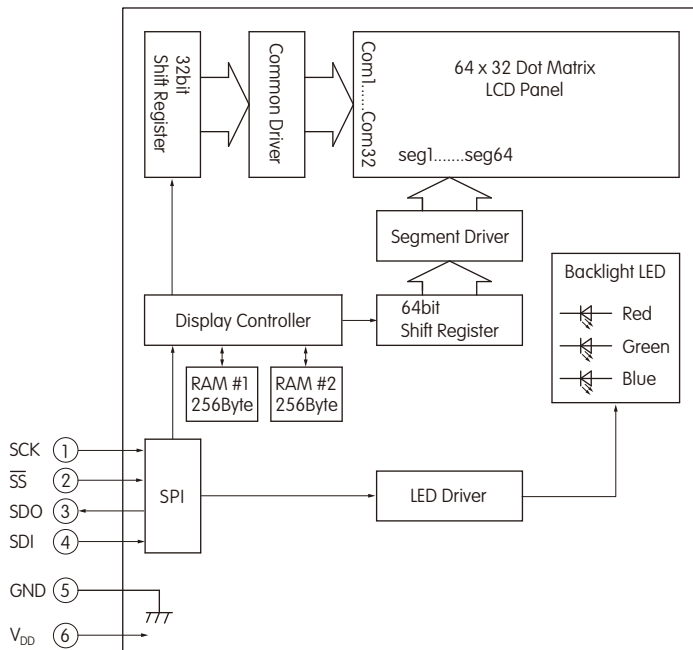
Absolute Maximum Ratings (Temperature at 25°C)

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

Optical Characteristics (Temperature at 25°C)

Items	Symbols	Minimum	Typical	Maximum
Contrast Ratio	C_r	—	3.0	—
Viewing Angle ($C_r \geq 1.1$)	Up & Down	θ	—	90°
	Right & Left	ϕ	—	90°

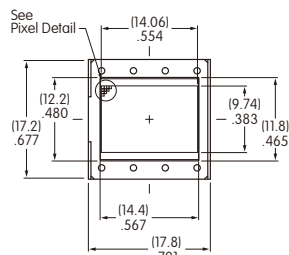
DISPLAY BLOCK DIAGRAM & PIN CONFIGURATIONS



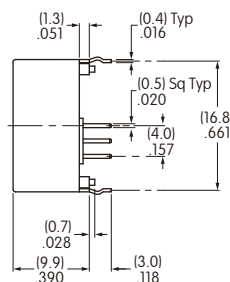
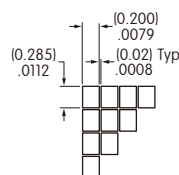
IS01EBFRGB
RGB LED Backlight
Black and White LCD

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

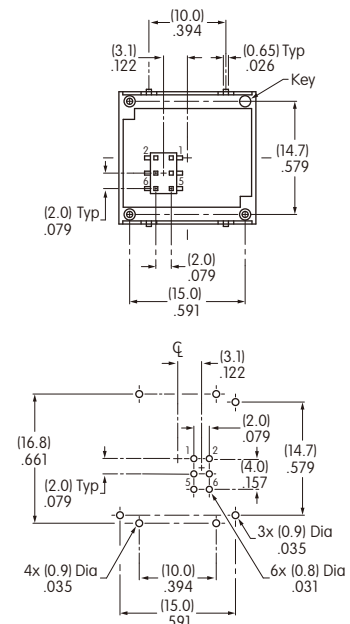
TYPICAL DISPLAY DIMENSIONS



Pixel Detail



Footprint



Terminal numbers are not on the device.

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

DISTINCTIVE CHARACTERISTICS

Compact Size Combined with High Resolution

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

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

Variety of LED backlighting with 64 colors and 8 steps brightness

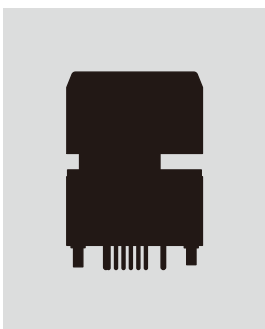
Dome gives crisp tactile feedback to positively indicate circuit transfer

Epoxy sealed straight PC terminals

Snap-in standoff for easy, secure mounting and alignment



Actual Size



PART NUMBER & DESCRIPTION

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

SWITCH SPECIFICATIONS

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

Absolute Maximum Ratings (Temperature at 25°C)

Items	Symbols	Ratings
Supply Voltage	V _{DD}	-0.3V to +7.0V
Input Voltage	V _I	-0.3V to V _{DD} +0.3V
Output Voltage	V _O	-0.3V to V _{DD} +0.3V

Optical Characteristics (Temperature at 25°C)

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

LCD SPECIFICATIONS

Characteristics of Display

Display Operation Mode	FSTN positive; background colors, black & white
Display Condition	Transflective with built-in LED backlight
Viewing Angle Direction	6 o'clock
Viewing Area	14.5mm x 11.8mm (horizontal x vertical)
Pixel Format	64 x 32 pixels (horizontal x vertical)
Pixel Size	0.200mm x 0.285mm (horizontal x vertical)
* Operating Temp Range	-15°C ~ +50°C (+5°F ~ +122°F)
Storage Temp Range	-20°C ~ +60°C (-4°F ~ +140°F)
Backlight LED	RGB: red/green/blue

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

Recommended Operating Conditions (Temperature at 25°C)

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

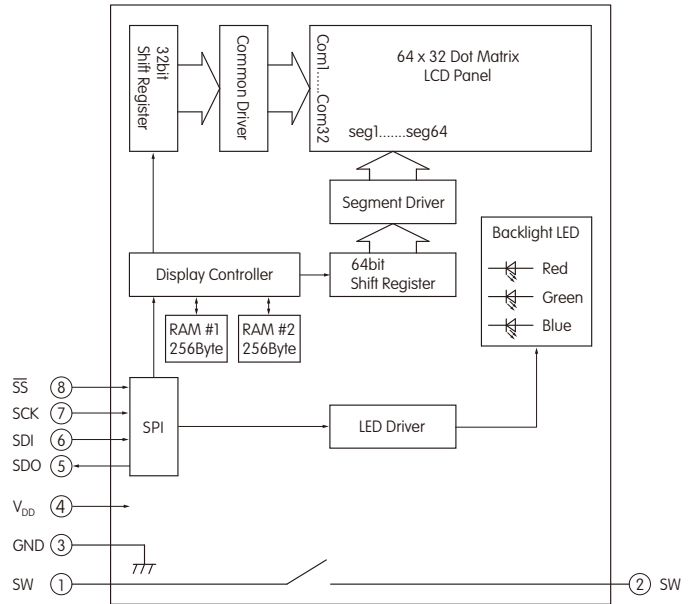
** 10mA: Backlighting LED is off

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

BLOCK DIAGRAM & PIN CONFIGURATIONS

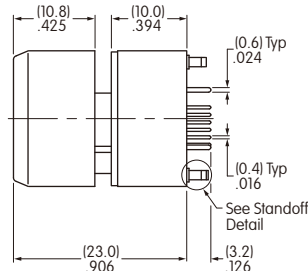
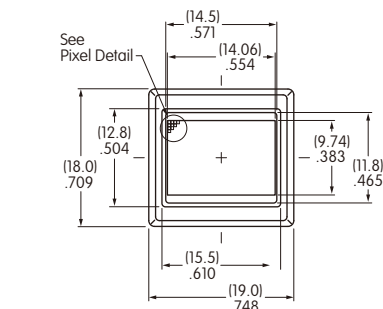


IS15ESBFP4RGB
RGB LED Backlight
Black and White LCD

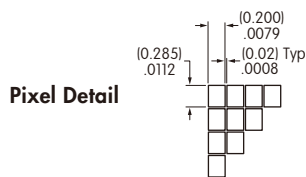
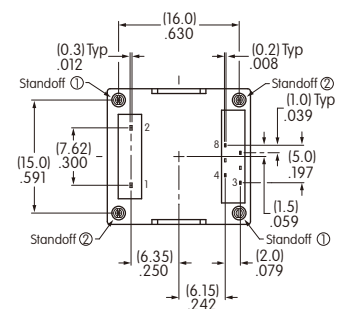


Pin No.	Symbol	Name	Function
①	SW	Terminal of Switch	Normally open
②	SW	Terminal of Switch	Normally open
③	GND	Ground	
④	V _{DD}	Power	Power source for logic circuit and LCD
⑤	SDO	Data Out	Data output line for SPI
⑥	SDI	Data In	Data input line for SPI
⑦	SCK	Serial Clock	Clock line for SPI that synchronizes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

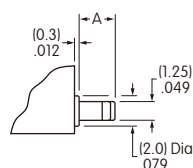
TYPICAL SWITCH DIMENSIONS



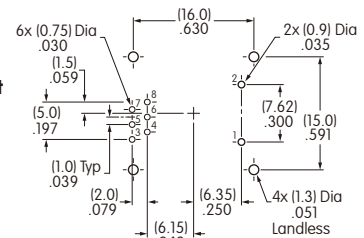
Terminal numbers are not on the switch.



Standoff Detail



Footprint



Dimension A

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

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

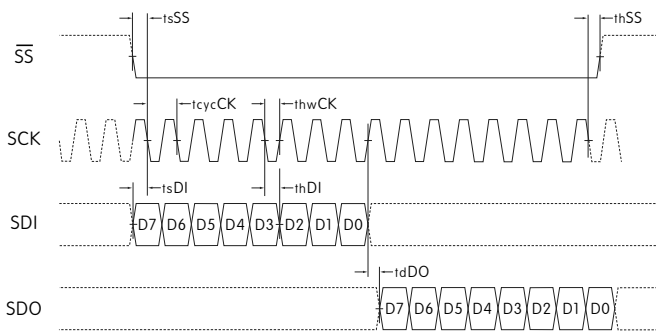
TIMING SPECIFICATIONS FOR SWITCHES & DISPLAY

SPI Characteristics (See Timing Diagram)

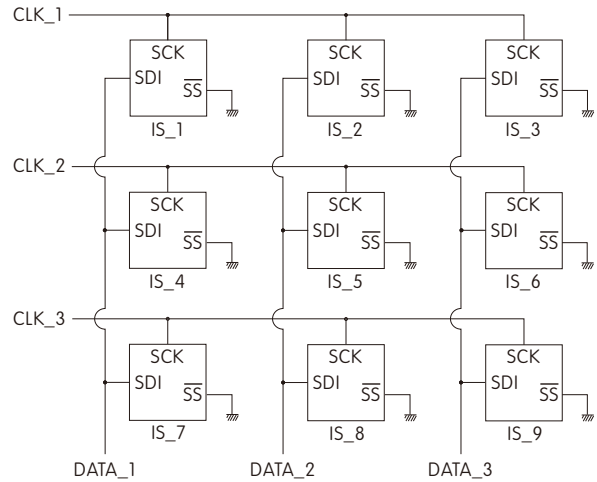
(Temperature at -15°C ~ +50°C and V_{DD} = 5.0V ± 2%)

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	

SPI Timing Chart (\overline{SS} Using)

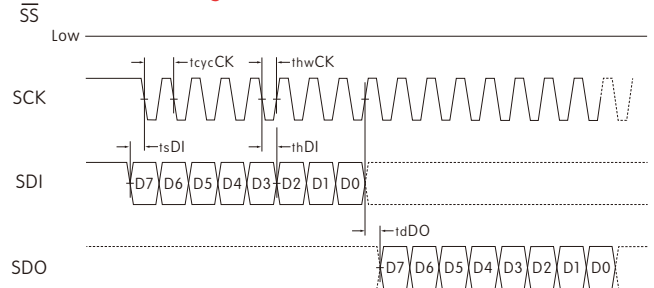


Circuit Example



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

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



SDI and SCK shall be kept high when idle.

BITMAP

Segment	1	2	3	4	5	6	7	8	9	•••	16	•••••	49	•••	56	57	58	59	60	61	62	63	64	
Common	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	
COM2	Byte16								Byte9															
•																								
•																								
•																								
COM32	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.

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

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

PRECAUTIONS FOR HANDLING & STORAGE OF LCD 64 x 32 DEVICES**Handling**

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

Storage

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

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

STANDARD RESOLUTION LCDS

Pushbutton

IS15BBFP4RGB

Programmable Display; Resolution: 36 x 24 Pixels
 Backlight RGB; Black & White LCD
 Up to 3 Lines with 6 Characters Each
 Page E35



Pushbutton

IS15BAFP4CF

Programmable Display; Resolution: 36 x 24 Pixels
 Backlight Red/Green; Black & White LCD
 Up to 3 Lines with 6 Characters Each
 Page E35

Display

IS01BBFRGB

Programmable Display; Resolution: 36 x 24 Pixels
 Backlight RGB; Black & White LCD
 Up to 3 Lines with 6 Characters Each
 Page E39



Compact Pushbutton

IS15BSBFP4RGB

Programmable Display; Resolution: 36 x 24 Pixels
 Backlight RGB; Black & White LCD
 Up to 3 Lines with 6 Characters Each
 Page E41



Compact Pushbutton

IS15BSAFP4CF

Programmable Display; Resolution: 36 x 24 Pixels
 Backlight Red/Green; Black & White LCD
 Up to 3 Lines with 6 Characters Each
 Page E41



For All LCD 36 x 24 Switches & Displays

Switch Specifications	Page E44
LCD Specifications	Page E45 - E46
LED Characteristics	Page E46
Handling & Storage	Page E47

Contact factory for additional options.

DISTINCTIVE CHARACTERISTICS

Standard with Enhanced LED Illumination:

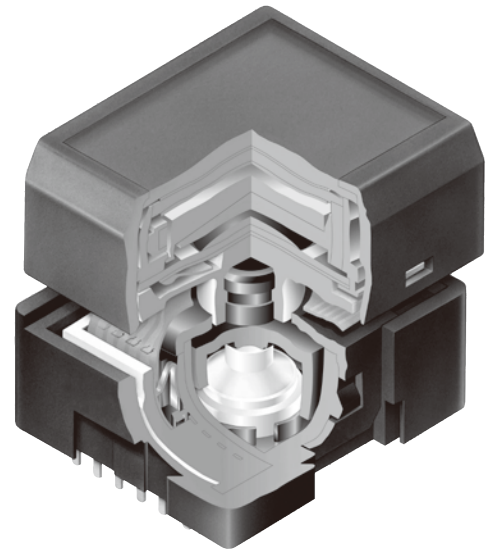
- Broad and even light diffusion
- Consistent backlighting
- Low energy consumption

Programmable LCD

Variety of LED Backlighting Colors

Rubber Dome

Epoxy Sealed Straight PC Terminals



RGB or bicolor red/green 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.

Viewing area for switches 17.0mm x 13.0mm (horizontal x vertical) at 36 x 24 pixels;
Display viewing area 14.4mm x 11.8mm.

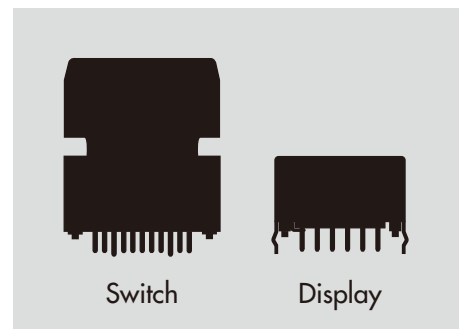
Dome gives crisp tactile feedback to positively indicate circuit transfer.

High reliability and long life of one million actuations minimum.

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

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

Actual Sizes



PART NUMBERS & DESCRIPTIONS

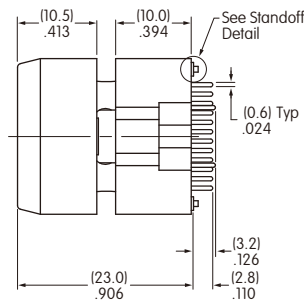
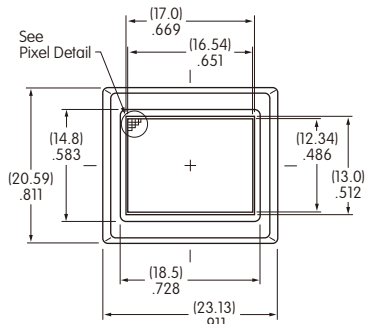
Part Number	Switch Description	LCD Mode	LED Color
IS15BBFP4RGB	SPST Momentary ON Gold Contacts Straight PC Terminals	Black & White FSTN Positive	* Red/Green/Blue
IS15BAFP4CF	SPST Momentary ON Gold Contacts Straight PC Terminals	Black & White FSTN Positive	* Red/Green

* Simultaneous illumination of LEDs achieves infinite colors.

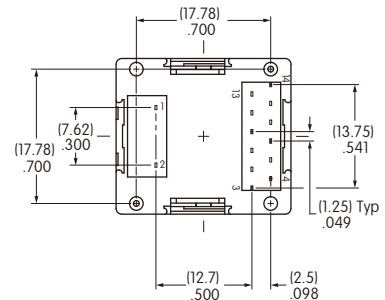
CHARACTERISTICS OF DISPLAY

Viewing Area	17.0mm x 13.0mm (horizontal x vertical)
Pixel Size	0.440mm x 0.495mm (horizontal x vertical)
Backlight LED	RGB: red/green/blue Bicolor: red/green

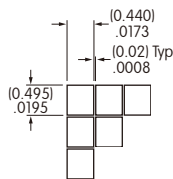
TYPICAL SWITCH DIMENSIONS FOR RGB



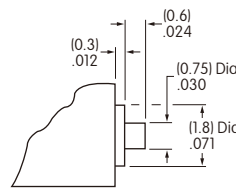
Terminal numbers are not on the switch.



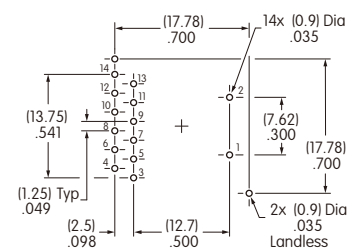
Bottom View: RGB



Pixel Detail

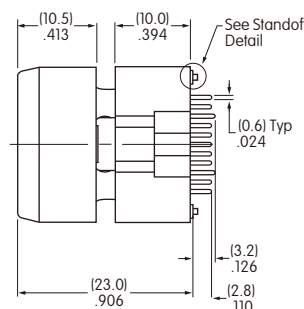
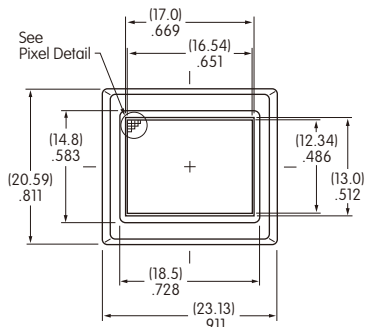


Standoff Detail

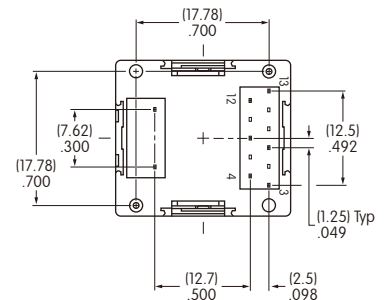


Footprint: RGB

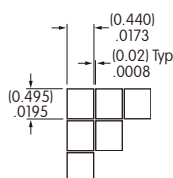
TYPICAL SWITCH DIMENSIONS FOR BICOLOR



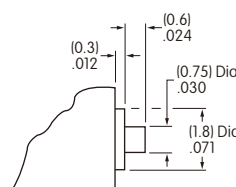
Terminal numbers are not on the switch.



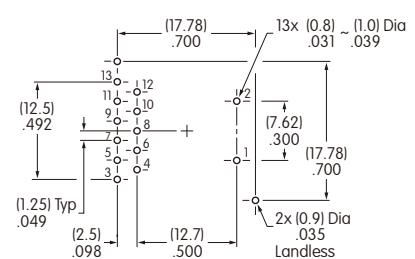
Bottom View: Bicolor Red & Green



Pixel Detail



Standoff Detail



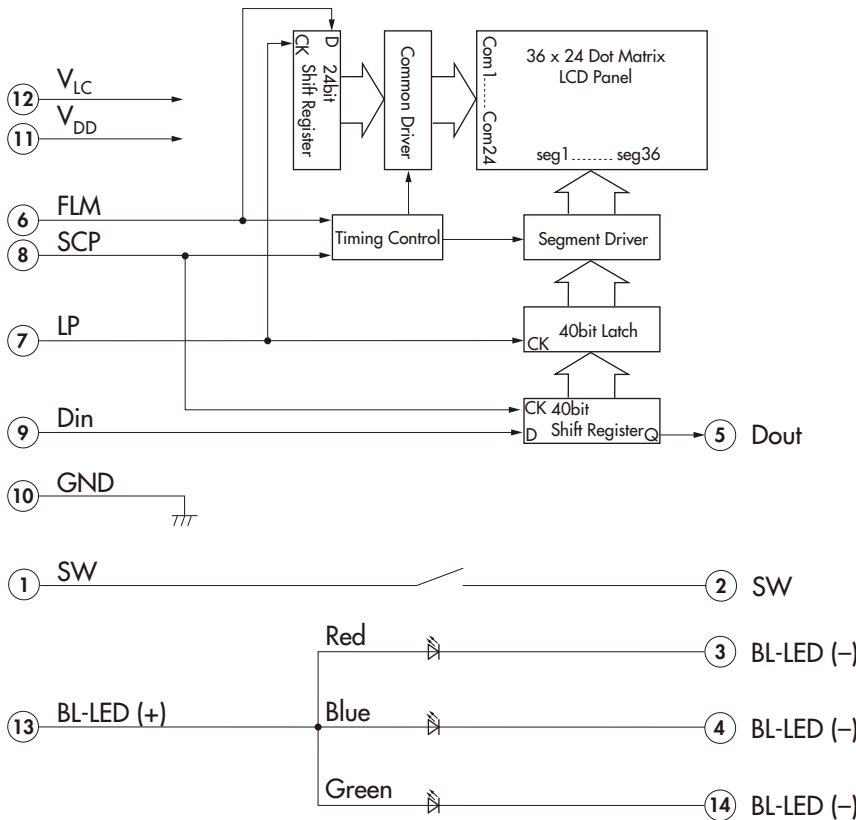
Footprint: Bicolor Red & Green

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

BLOCK DIAGRAM & PIN CONFIGURATIONS FOR RGB



IS15BBFP4RGB
RGB LED Backlight
Black and White LCD

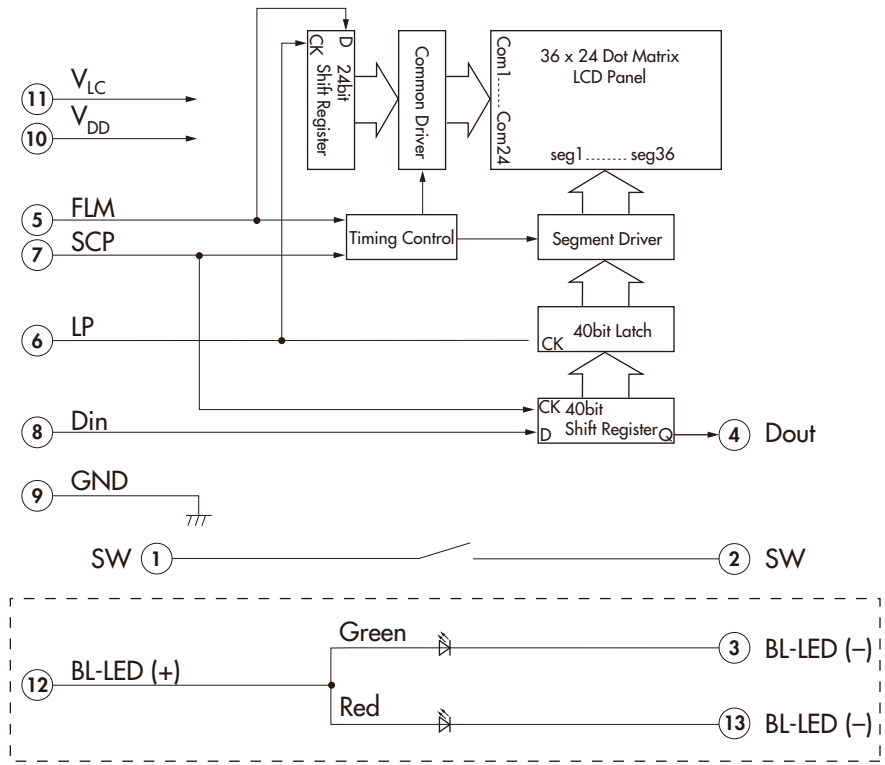


Pin No.	Symbol	Name	Function
①	SW	Terminal of Switch	Normally open
②	SW	Terminal of Switch	Normally open
③	BL-LED (-)	Terminal of Backlight LED	Cathode for red
④	BL-LED (-)	Terminal of Backlight LED	Cathode for blue
⑤	Dout	Data Output	Display serial output. Can be used to connect to Din of the next SMARTSWITCH. As a result, many SMARTSWITCHES can be controlled with one clock and data signal.
⑥	FLM	First Line Marker	The marking signal for the first line data of LCD display. The first line of LCD will be selected by the falling edge of LP signal during the high level (FLM).
⑦	LP	Latch Pulse	Line data latch pulse will latch content of internal 40-bit shift register at falling edge for one line of display. LP will also increment the display line by one.
⑧	SCP	Serial Clock Pulse	Clock used by 40-bit internal shift register of the switch, shifting the display data bit presented at Din at falling edge.
⑨	Din	Data Input	Display serial data bit. Note: to map the display data, because of the difference between the number of internal shift register data (40) and the single line of LCD pixels (36), the first four bits of data shifted will be dummy bits.
⑩	GND	Ground	
⑪	V _{DD}	Power	Power source for logic circuit
⑫	V _{LC}	Power	Power source for LCD drive
⑬	BL-LED (+)	Terminal of Backlight LED	Anode for common
⑭	BL-LED (-)	Terminal of Backlight LED	Cathode for green

BLOCK DIAGRAM & PIN CONFIGURATIONS FOR BICOLOR



IS15BAFP4CF
Red/Green LED Backlight
Black and White LCD



Pin No.	Symbol	Name	Function
①	SW	Terminal of Switch	Normally open
②	SW	Terminal of Switch	Normally open
③	BL-LED (-)	Terminal of Backlight LED	Cathode for green
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.
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⑨	GND	Ground	
⑩	V _{DD}	Power	Power source for logic circuit
⑪	V _{LC}	Power	Power source for LCD drive
⑫	BL-LED (+)	Terminal of Backlight LED	Anode for common
⑬	BL-LED (-)	Terminal of Backlight LED	Cathode for red

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 Supplement

DISTINCTIVE CHARACTERISTICS

Standard with Enhanced Illumination:

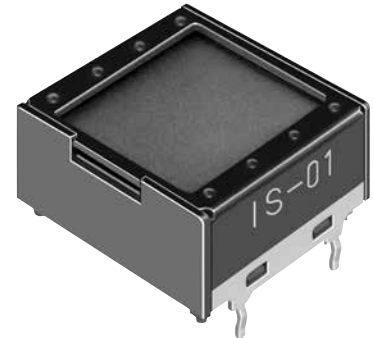
Programmable to display graphics, alphanumeric characters and animated sequences.

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

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

RGB LED provides numerous color variations.

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



PART NUMBER & DESCRIPTION

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

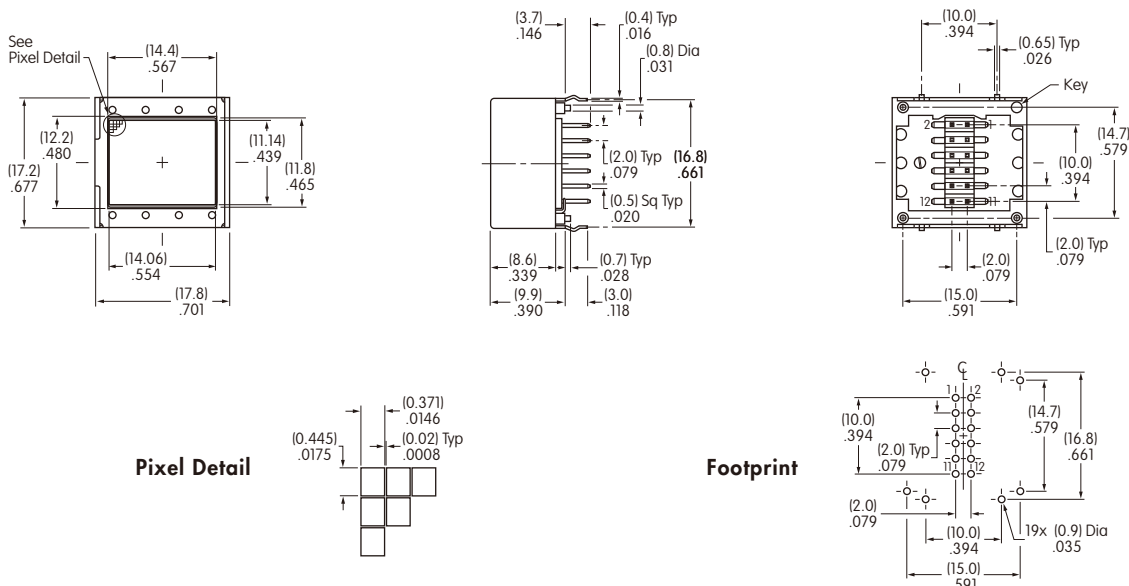
* Simultaneous illumination of LED achieves infinite colors.

CHARACTERISTICS OF DISPLAY

Viewing Area	14.4mm x 11.8mm (horizontal x vertical)
Pixel Size	0.371mm x 0.445mm (horizontal x vertical)
Backlight LED	RGB: red/green/blue

TYPICAL DISPLAY DIMENSIONS FOR RGB LED

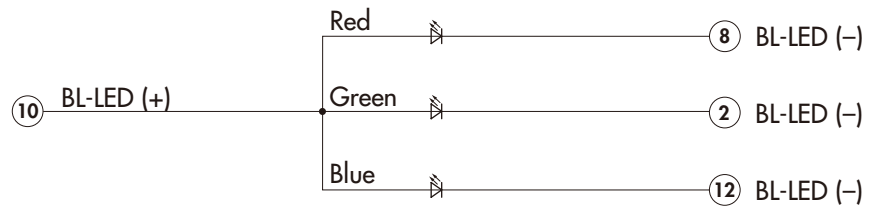
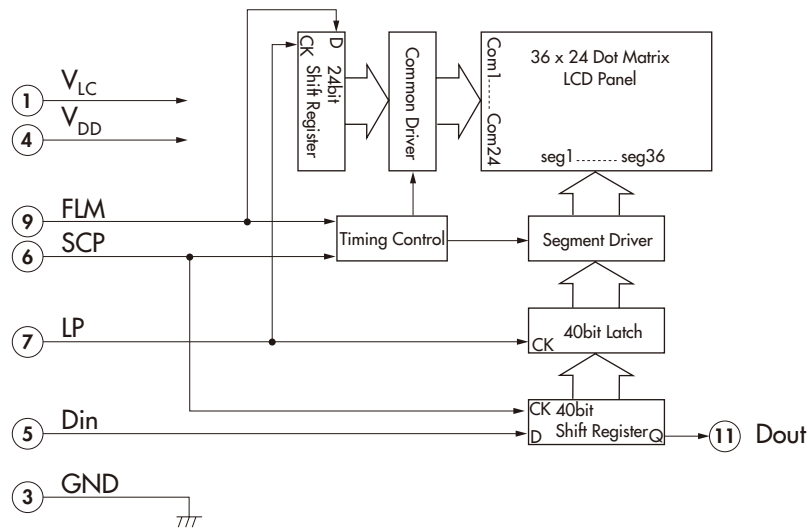
Terminal numbers are not on the device.



BLOCK DIAGRAM & PIN CONFIGURATIONS FOR RGB LEDs



IS01BBFRGB
RGB LED Backlight
Black and White LCD



Pin No.	Symbol	Name	Function
①	V _{LC}	Power	Power source for LCD drive
②	BL-LED (-)	Terminal of Backlight LED	Cathode for green
③	GND	Ground	
④	V _{DD}	Power	Power source for logic circuit
⑤	Din	Data Input	Display serial data bit. Note: to map the display data, because of the difference between the number of internal shift register data (40) and the single line of LCD pixels (36), the first four bits of data shifted will be dummy bits.
⑥	SCP	Serial Clock Pulse	Clock used by 40-bit internal shift register of the switch, shifting the display data bit presented at Din at falling edge.
⑦	LP	Latch Pulse	Line data latch pulse will latch content of internal 40-bit shift register at falling edge for one line of display. LP will also increment the display line by one.
⑧	BL-LED (-)	Terminal of Backlight LED	Cathode 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

DISTINCTIVE CHARACTERISTICS

Compact Size

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

Programmable LCD

Variety of LED Backlighting Colors

Rubber Dome

Epoxy Sealed Straight PC Terminals

Snap-in standoff for easy, secure mounting and alignment



Programmable to display graphics, alphanumeric characters and animated sequences.

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

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

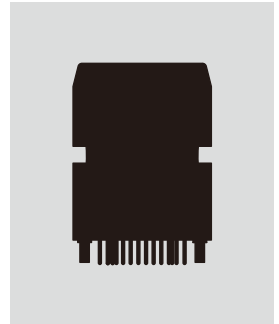
Dome gives crisp tactile feedback to positively indicate circuit transfer.

High reliability and long life of one million actuations minimum.

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

Optional accessories available to simplify production process.

Actual Size



PART NUMBERS & DESCRIPTIONS

Part Number	Switch Description	LCD Mode	LED Color
IS15BSBFP4RGB	SPST Momentary ON Gold Contacts Straight PC Terminals	Black & White FSTN Positive	* Red/Green/Blue
IS15BSAFP4CF	SPST Momentary ON Gold Contacts Straight PC Terminals	Black & White FSTN Positive	* Red/Green

* Simultaneous illumination of LEDs achieves infinite colors.

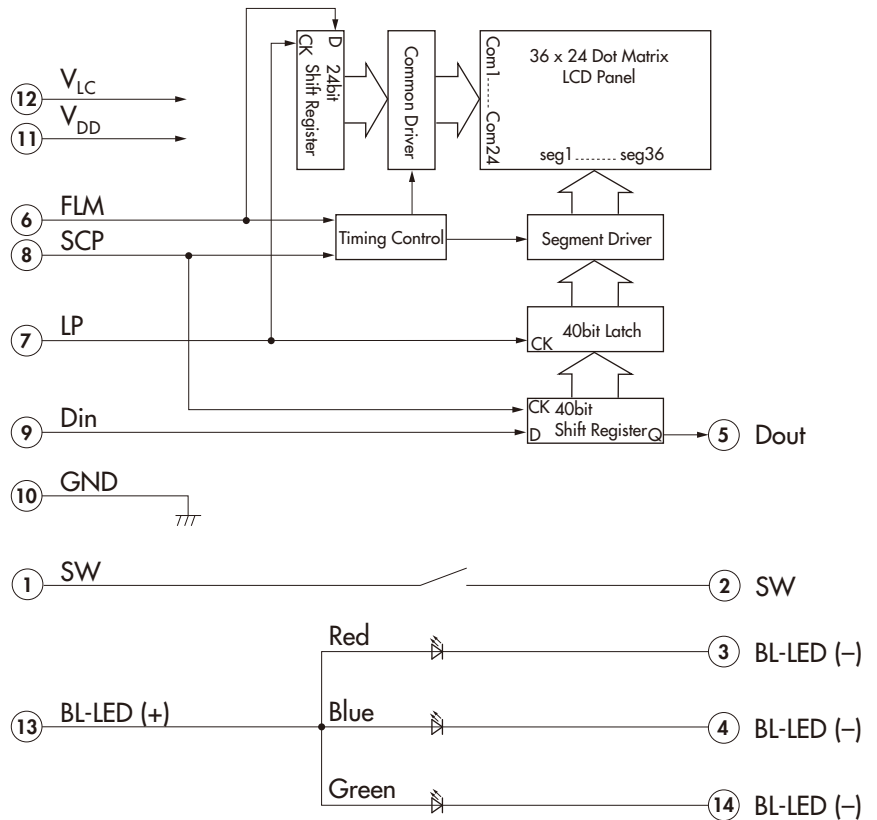
CHARACTERISTICS OF DISPLAY

Viewing Area	14.5mm x 11.8mm (horizontal x vertical)
Pixel Size	0.371mm x 0.445mm (horizontal x vertical)
Backlight LED	RGB: red/green/blue Bicolor: red/green

BLOCK DIAGRAM & PIN CONFIGURATIONS FOR RGB



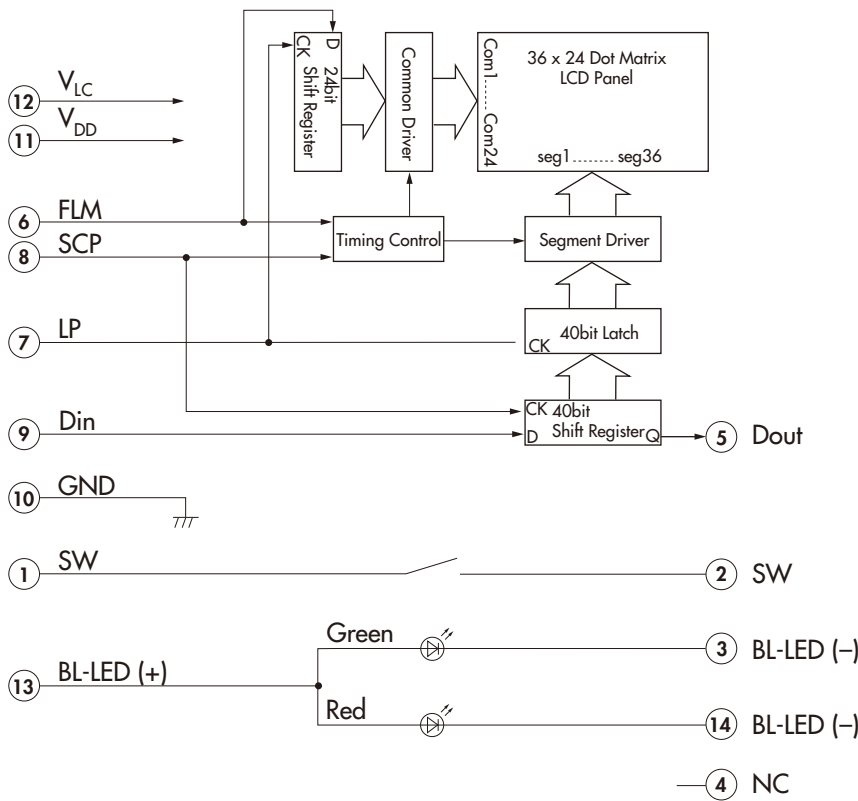
IS15BSBFP4RGB
RGB LED Backlight
Black and White LCD



Pin No.	Symbol	Name	Function
①	SW	Terminal of Switch	Normally open
②	SW	Terminal of Switch	Normally open
③	BL-LED (-)	Terminal of Backlight LED	Cathode for red
④	BL-LED (-)	Terminal of Backlight LED	Cathode for blue
⑤	Dout	Data Output	Display serial output. Can be used to connect to Din of the next SMARTSWITCH. As a result, many SMARTSWITCHES can be controlled with one clock and data signal.
⑥	FLM	First Line Marker	The marking signal for the first line data of LCD display. The first line of LCD will be selected by the falling edge of LP signal during the high level (FLM).
⑦	LP	Latch Pulse	Line data latch pulse will latch content of internal 40-bit shift register at falling edge for one line of display. LP will also increment the display line by one.
⑧	SCP	Serial Clock Pulse	Clock used by 40-bit internal shift register of the switch, shifting the display data bit presented at Din at falling edge.
⑨	Din	Data Input	Display serial data bit. Note: to map the display data, because of the difference between the number of internal shift register data (40) and the single line of LCD pixels (36), the first four bits of data shifted will be dummy bits.
⑩	GND	Ground	
⑪	V _{DD}	Power	Power source for logic circuit
⑫	V _{LC}	Power	Power source for LCD drive
⑬	BL-LED (+)	Terminal of Backlight LED	Anode for common
⑭	BL-LED (-)	Terminal of Backlight LED	Cathode for green

Toggles
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BLOCK DIAGRAM & PIN CONFIGURATIONS FOR BICOLOR

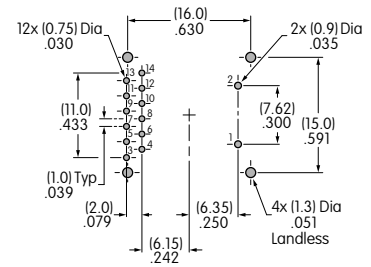
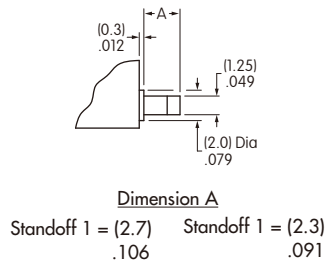
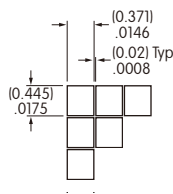
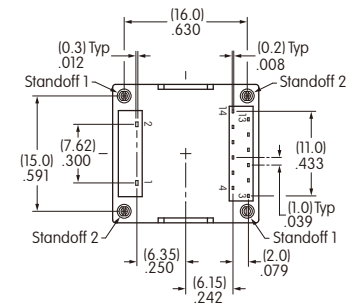
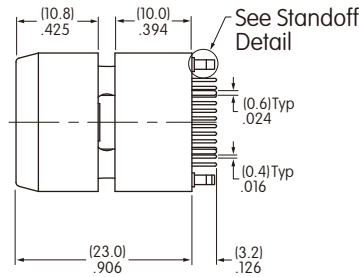
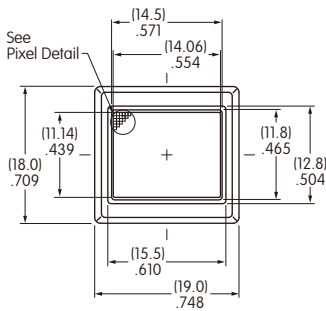


IS15BSAFP4CF
Red/Green LED Backlight
Black and White LCD

Pin No.	Symbol	Name	Function
①	SW	Terminal of Switch	Normally open
②	SW	Terminal of Switch	Normally open
③	BL-LED (-)	Terminal of Backlight LED	Cathode for green
④	NC	None	No connection
⑤	Dout	Data Output	Display serial output. Can be used to connect to Din of the next SMARTSWITCH. As a result, many SMARTSWITCHES can be controlled with one clock and data signal.
⑥	FLM	First Line Marker	The marking signal for the first line data of LCD display. The first line of LCD will be selected by the falling edge of LP signal during the high level (FLM).
⑦	LP	Latch Pulse	Line data latch pulse will latch content of internal 40-bit shift register at falling edge for one line of display. LP will also increment the display line by one.
⑧	SCP	Serial Clock Pulse	Clock used by 40-bit internal shift register of the switch, shifting the display data bit presented at Din at falling edge.
⑨	Din	Data Input	Display serial data bit. Note: to map the display data, because of the difference between the number of internal shift register data (40) and the single line of LCD pixels (36), the first four bits of data shifted will be dummy bits.
⑩	GND	Ground	
⑪	V _{DD}	Power	Power source for logic circuit
⑫	V _{LC}	Power	Power source for LCD drive
⑬	BL-LED (+)	Terminal of Backlight LED	Anode for common
⑭	BL-LED (-)	Terminal of Backlight LED	Cathode for red

TYPICAL COMPACT SWITCH DIMENSIONS

Terminal numbers are not on the switch.



Pixel Detail

Standoff Detail

Footprint

SWITCH SPECIFICATIONS

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

Optical Characteristics (Temperature at 25°C)

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

Toggles
 Rockers
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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 $V_{DD} + 0.3V$

LCD SPECIFICATIONS**Characteristics of Display**

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

Recommended Operating Conditions (Temperature at 25°C)

Items	Symbols	Minimum	Typical	Maximum
Supply Voltage for Logics	V_{DD}	4.5V	5.0V	5.5V
Supply Voltage	V_{LC}	7.1	7.3V	7.5
Input Voltage	V_I	0V	—	V_{DD}
Driving Frequency	f_{FLM}	—	150Hz	—
Clock Operation Frequency	f_{SCP}	—	—	6.0MHz

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

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

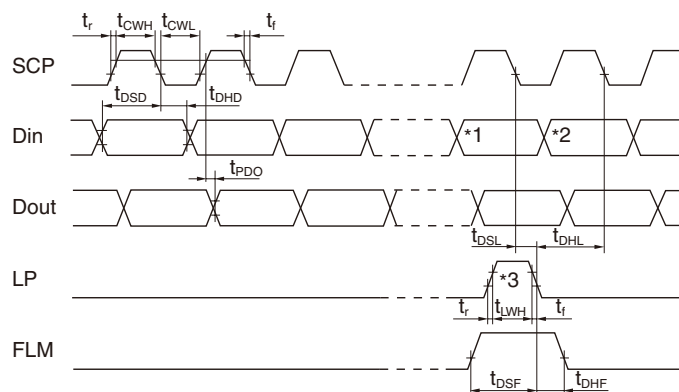
Timing Characteristics of LCD Drive IC

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

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

Timing Diagram

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



LED CHARACTERISTICS

Typical Electrical Characteristics (Temperature at 25°C)

Backlight Color	Symbols	Red	Green	Blue	Red/Green	Unit
Forward Current	I_F	10	8.5	8.0	15/15	mA

ABSOLUTE MAXIMUM FOR LEDS

Electrical Characteristics (Temperature at 25°C)

Backlight Color	Symbols	Red	Green	Blue	Red/Green	Unit
Forward Current	I_F	20	20	20	20	mA
Forward Voltage	V_F	2.0 ($I_F = 10mA$)	2.8 ($I_F = 8.5mA$)	2.8 ($I_F = 8.0mA$)	1.9/1.9	V
Reverse Voltage	V_R	4.0	4.0	4.0	4.0	V
Current Reduction Rate Above 25°C	$\Delta I_F(DC)$	-0.33	-0.33	-0.33	-0.26	mA/°C
*Power Dissipation (LED Overall 115mW)	P_D	40	60	60	130 maximum	mW

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

PRECAUTIONS FOR HANDLING & STORAGE OF LCD 36 x 24 DEVICES**Handling**

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

Storage

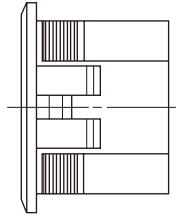
1. Store in original container and away from direct sunlight.
2. Keep away from static electricity.
3. Avoid extreme temperatures, high humidity, gaseous substances, and all forms of chemical contamination.

Toggles
 Rockers
 Pushbuttons
 Illuminated PB
Programmable E
 Keylocks
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 Slides
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OPTIONAL ACCESSORIES

AT548 Panel Mount Housing

Material: Polyamide

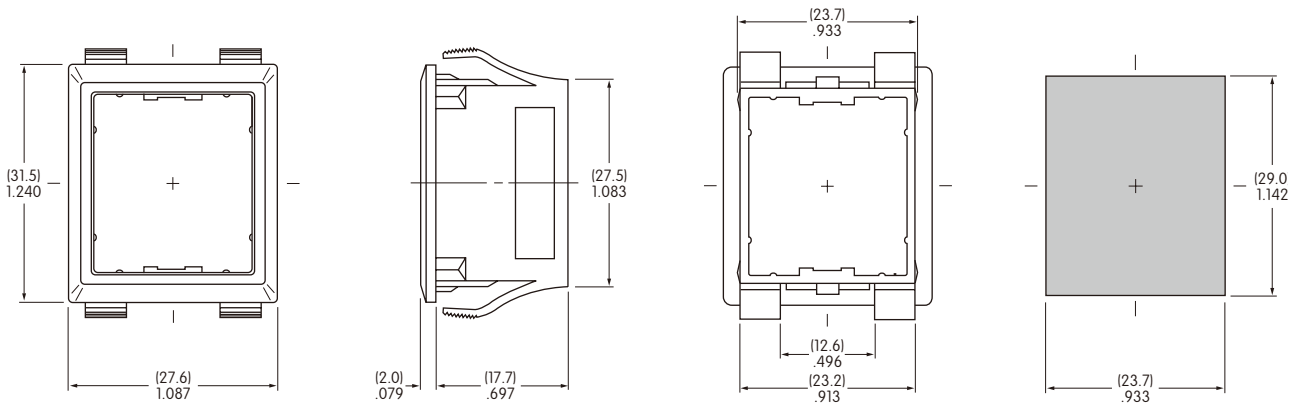


Compatible Part Numbers for AT548

Wide View LCD 36 x 24

IS15BAFP4CF

IS15BBFP4RGB



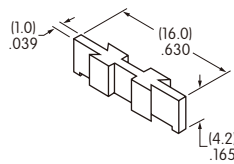
The Panel Mount Housing is available for the LCD 36 x 24 Pushbutton only.

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

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

AT542 Coupler

Material: PBT

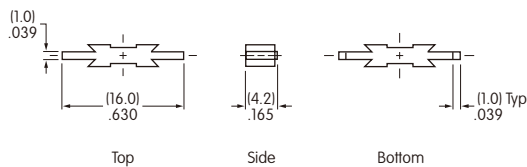


Compatible Part Numbers for AT542

Wide View LCD 36 x 24

IS15BAFP4CF

IS15BBFP4RGB



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

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

OPTIONAL ACCESSORIES

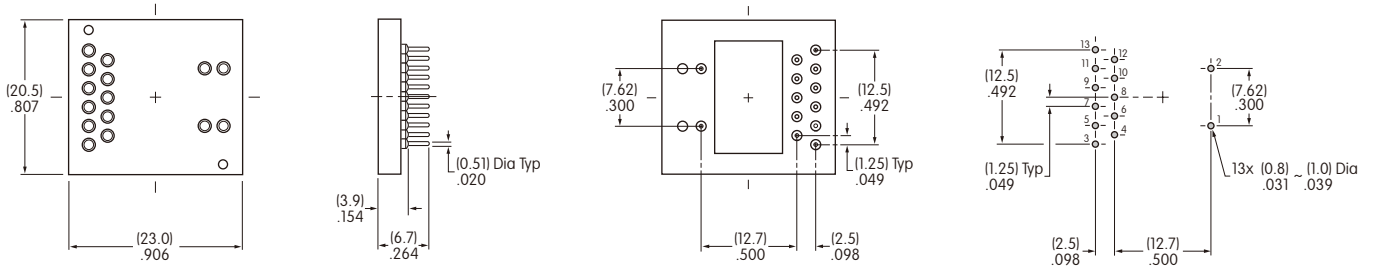
AT9704-02YC Socket for Single and Bicolor LCD 36 x 24 Pushbutton

Materials:

Base - Glass Fiber Reinforced PBT

Terminals - Brass/Beryllium Copper

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



Compatible Part Number for AT9704-02YC

Wide View LCD 36 x 24

IS15BAFP4CF

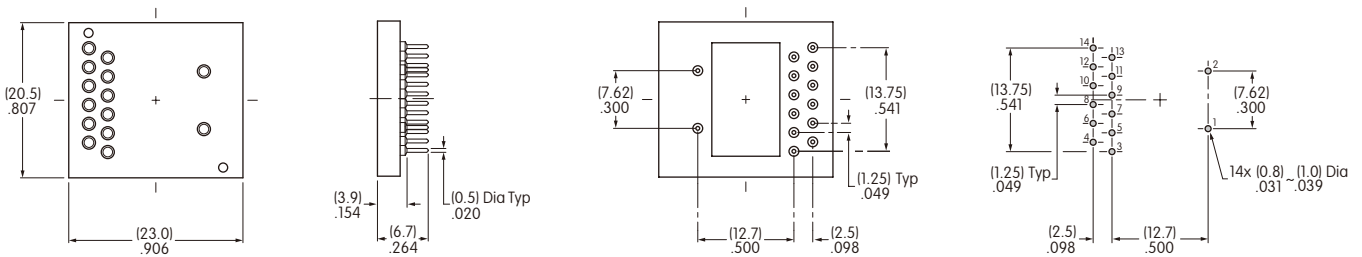
AT9704-065E Socket for RGB LCD 36 x 24 Pushbutton

Materials:

Base - Glass Fiber Reinforced PBT

Terminals - Brass/Beryllium Copper

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



Compatible Part Number for AT9704-065E

Wide View RGB LCD 36 x 24

IS15BBFP4RGB

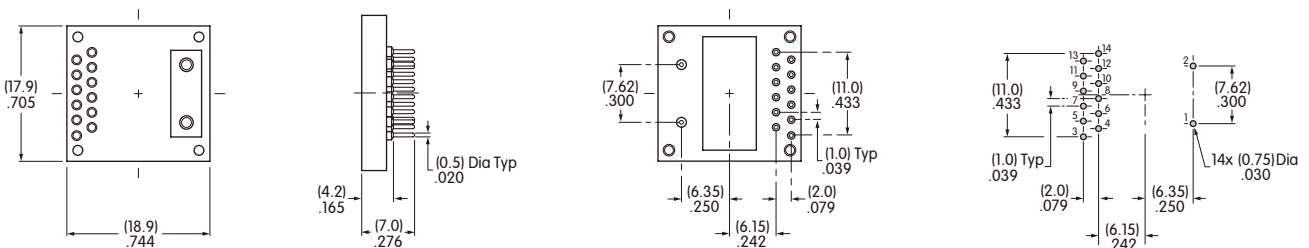
AT9704-065F Socket for Compact Pushbutton (All Models)

Materials:

Base - Glass Fiber Reinforced PBT

Terminals - Brass/Beryllium Copper

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



Compatible Part Numbers for AT9704-065F

Wide View/Short Travel LCD 64 x 32

IS15EBFP4RGB-134E

Wide View LCD 64 x 32 Compact

IS15ESBFP4RGB

Wide View LCD 36 x 24

IS15BAFP4CF

Wide View LCD 36 x 24 Compact

IS15BSBFP4RGB

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

OPTIONAL ACCESSORIES

AT9704-085K Socket for LCD 64 x 32 Pushbutton

Materials:

Base - Glass Fiber Reinforced PBT

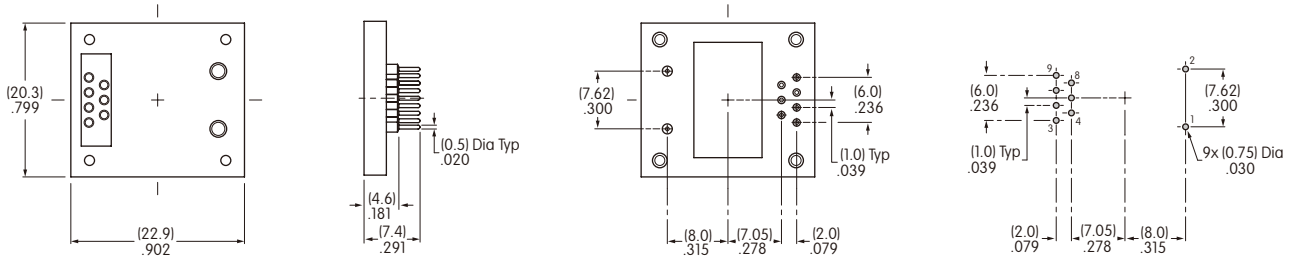
Terminals - Brass/Beryllium Copper

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

Compatible Part Number for AT9704-085K

Wide View LCD 64 x 32

IS15EBFP4RGB



AT9704-085L Socket for OLED Pushbutton

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.

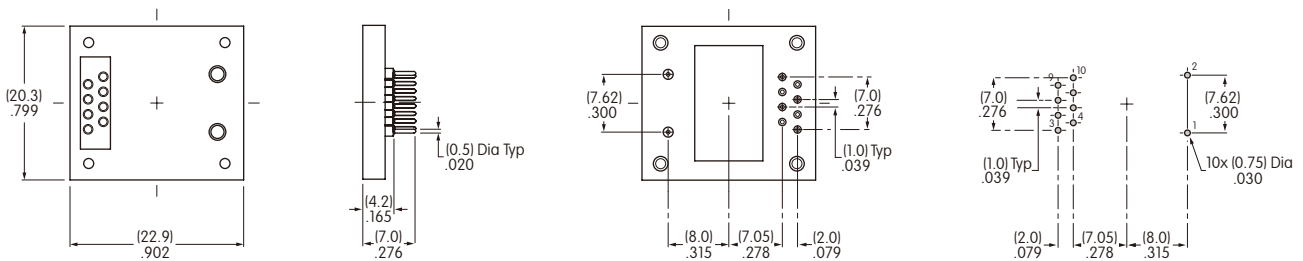
Compatible Part Numbers for AT9704-085L

OLED Pushbutton

Frameless OLED

ISC15ANP4

ISF15ACP4



AT9704-085M Socket for OLED Display

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.

Compatible Part Number for AT9704-085M

OLED Display

ISCO1P

