LCD 36 x 24 Pushbuttons & Display

SMARTDISPLAY

Toggles

Rockers

Pushbuttons

Illuminated PB

E Programmable

Keylocks

Rotaries

Slides

Tactiles

Tilt

Touch

Indicators

Accessories

Supplement

DISTINCTIVE CHARACTERISTICS

### Standard with Enhanced LED Illumination:
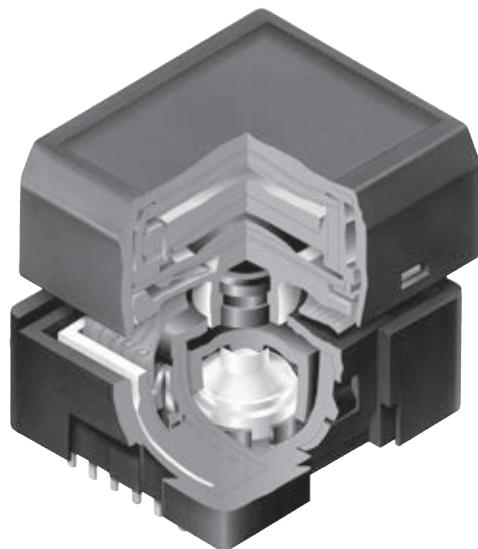
- Broad and even light diffusion
- Consistent backlighting
- Low energy consumption

Programmable LCD

Variety of LED Backlighting Colors

Rubber Dome

Epoxy Sealed Straight PC Terminals

RGB 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.
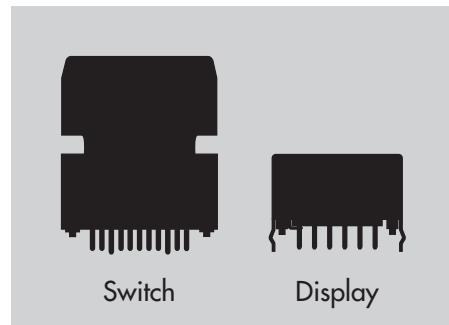
Dome gives crisp tactile feedback to positively indicate circuit transfer.

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

Switch   Display

## 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.

Toggles

Rockers

Pushbuttons

Illuminated PB

Programmable **E**

Keylocks

Rotaries

Slides

Tactiles

Tilt

Touch

Indicators

Accessories

Supplement

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
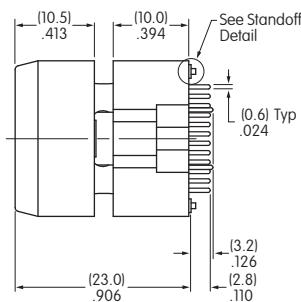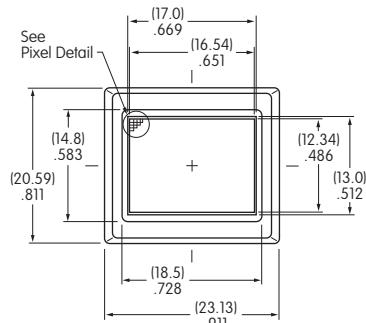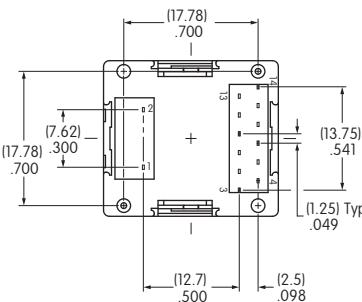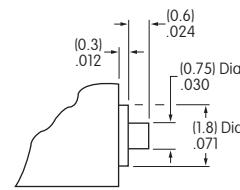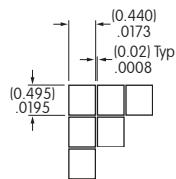
TYPICAL SWITCH DIMENSIONS FOR RGB

Terminal numbers are not on the switch.

Pixel Detail

Standoff Detail
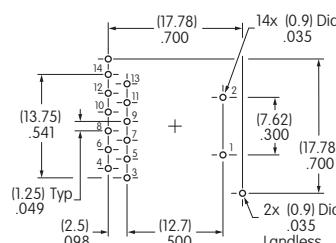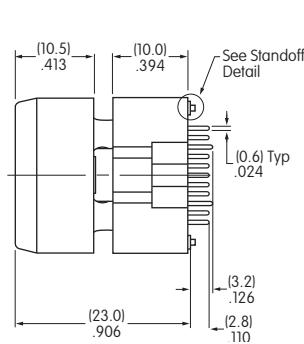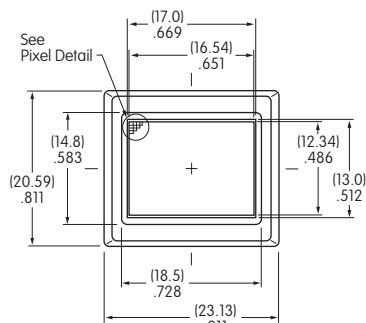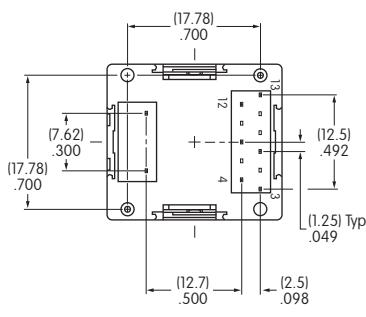
**Bottom View: RGB**
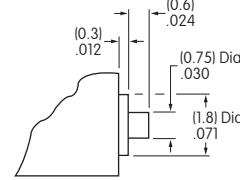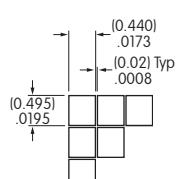
Footprint: RGB

TYPICAL SWITCH DIMENSIONS FOR BICOLOR

Terminal numbers are not on the switch.

Pixel Detail

Standoff Detail
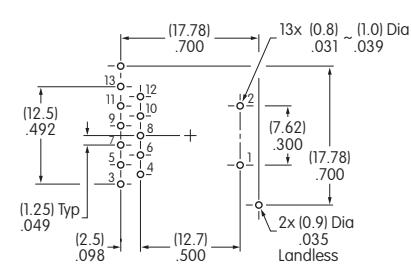
Bottom View: Bicolor Red & Green

Footprint: Bicolor Red & Green

NKK SWITCHES

BLOCK DIAGRAM & PIN CONFIGURATIONS FOR BICOLOR
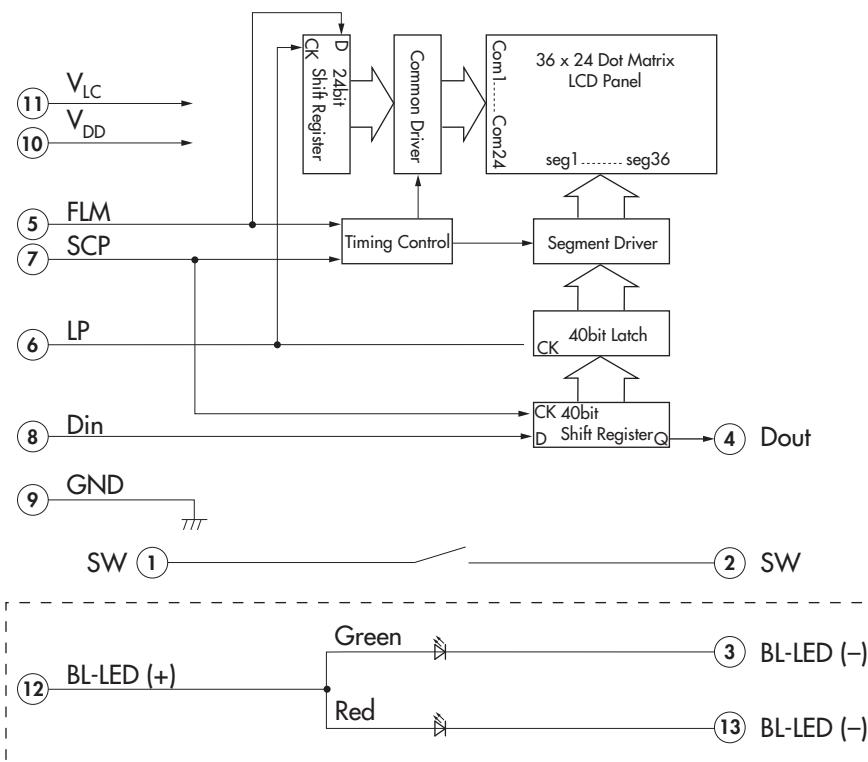
IS15BAFP4CF
Red/Green LED Backlight
Black and White LCD

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 SWITCH. As a result, many SWITCHES can be controlled with one clock and data signal.
5	FLM	First Line Marker	The marking signal for the first line data of LCD display. The first line of LCD will be selected by the falling edge of LP signal during the high level (FLM).
6	LP	Latch Pulse	Line data latch pulse will latch content of internal 40-bit shift register at falling edge for one line of display. LP will also increment the display line by one.
7	SCP	Serial Clock Pulse	Clock used by 40-bit internal shift register of the switch, shifting the display data bit presented at Din at falling edge.
8	Din	Data Input	Display serial data bit. Note: to map the display data, because of the difference between the number of internal shift register data (40) and the single line of LCD pixels (36), the first four bits of data shifted will be dummy bits.
9	GND	Ground	
10	V_{DD}	Power	Power source for logic circuit
11	V_{LC}	Power	Power source for LCD drive
12	BL-LED (+)	Terminal of Backlight LED	Anode for common
13	BL-LED (–)	Terminal of Backlight LED	Cathode for red

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

E

SMART DISPLAY LCD 36 x 24 Pushbuttons, Display & Compacts
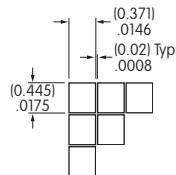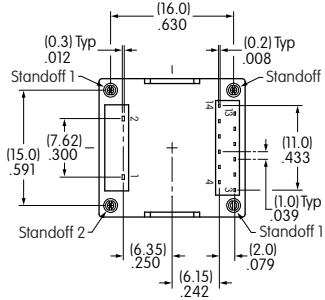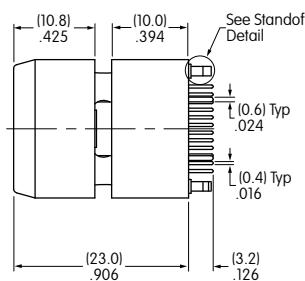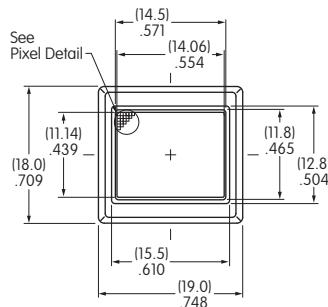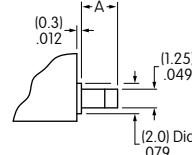
TYPICAL COMPACT SWITCH DIMENSIONS
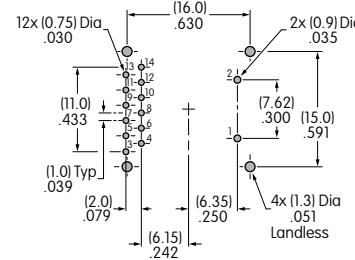
Terminal numbers are not on the switch.

Pixel Detail

Standoff Detail

Dimension A

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

Footprint

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°	—

SMARTDISPLAY

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}	3.0V	—	5.5V
Supply Voltage	V_{LC}	—	* 7.3V	—
Input Voltage	V_I	0V	—	V_{DD}
Driving Frequency	f_{FLM}	—	150Hz	—
Clock Operation Frequency	f_{SCP}	—	—	8.0MHz

  * LCD voltage (V_{LC}) level depends on refreshing frequency and temperature. The optimal V_{LC} can differ slightly from the stated typical value.

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

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

Toggles

Rockers

Pushbuttons

Illuminated PB

E Programmable

Keylocks

Rotaries

Slides

Tactiles

Tilt

Touch

Indicators

Accessories

Supplement

Toggles
Rockers
Pushbuttons
Illuminated PB
Programmable E
Keylocks
Rotaries
Slides
Tactiles
Tilt
Touch
Indicators
Accessories
Supplement
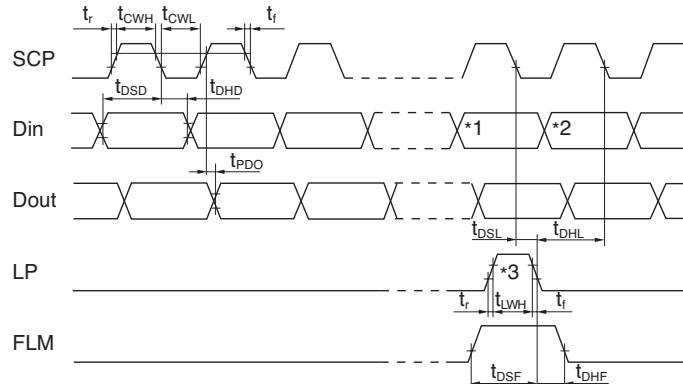
## Timing Characteristics of LCD Drive IC

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

Items	Symbols	Minimum	Maximum
Clock Operation Frequency	f_{SCP}		8.0MHz
Latch Pulse Frequency	f_{LP}		50kHz
Clock High Level Pulse Width	t_{CWH}	50ns	
Clock Low Level Pulse Width	t_{CWL}	50ns	
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}	50ns	
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	ΔI_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.

NKK SWITCHES

PRECAUTIONS FOR HANDLING & STORAGE OF LCD 36 x 24 DEVICES

Handling

ATTENTION
ELECTROSTATIC
SENSITIVE DEVICES

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.
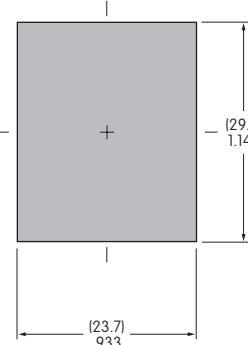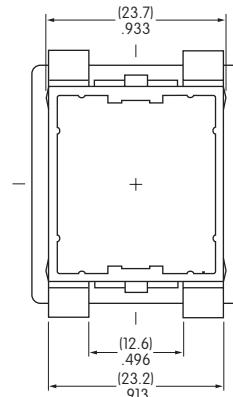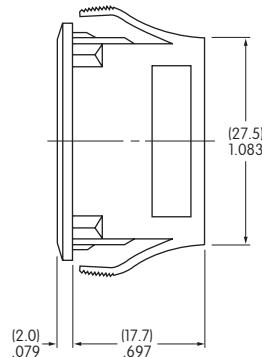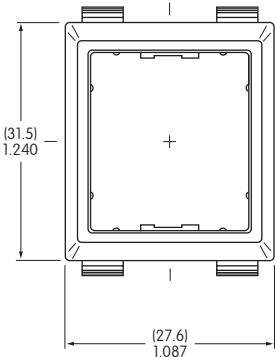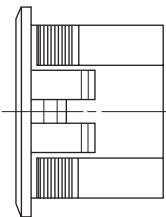
Storage

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
Rotaries
**Slides**
Tactiles
Tilt
Touch
Indicators
Accessories
Supplement

OPTIONAL ACCESSORIES

AT548 Panel Mount Housing

Material: Polyamide

| Compatible Part Numbers for AT548 |
| --- |
| **LCD 36 x 24** |
| IS15BAFP4CF |
| IS15BBFP4RGB |
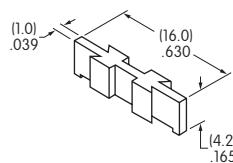
The Panel Mount Housing is available for the LCD 36 x 24 Pushbutton only.

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
LCD 36 x 24
IS15BAFP4CF
IS15BBFP4RGB
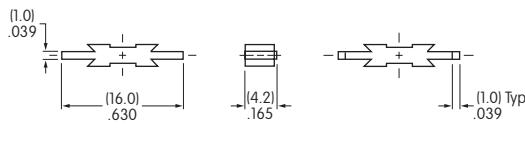
This coupler is for connecting the LCD 36 x 24 Pushbutton into precise, tight groupings that maintain an even distance from PCB to top of the actuator.

Top   Side   Bottom

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

NKK SWITCHES

SMARTDISPLAY

Toggles

Rockers

Pushbuttons

Illuminated PB

E Programmable

Keylocks

Rotaries

Slides

Tactiles

Tilt

Touch

Indicators

Accessories

Supplement

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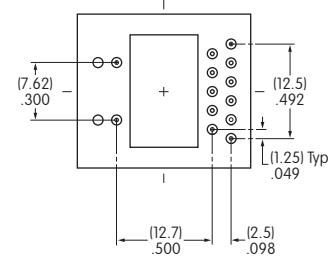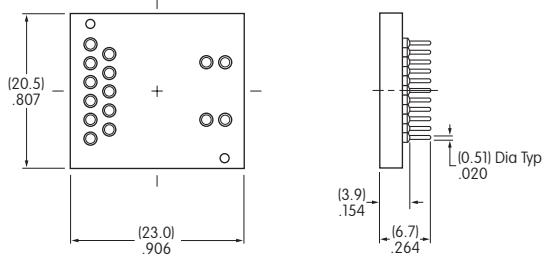
AT9704-02YC Socket for Single and Bicolor LCD 36 x 24 Pushbutton

Materials:

Base - Glass Fiber Reinforced PBT
Terminals - Brass/Beryllium Copper
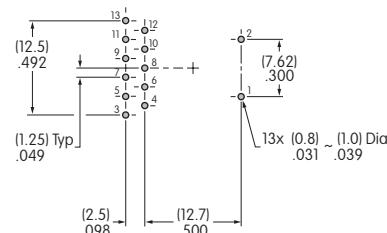
- The socket permits the SmartDisplay to be plugged in after automated processing.

- Use of the socket enables easy field replacement of the device.

| Compatible Part Number for AT9704-02YC |
|---|
| **LCD 36 x 24** |
| IS15BAFP4CF |
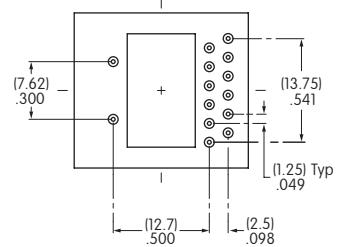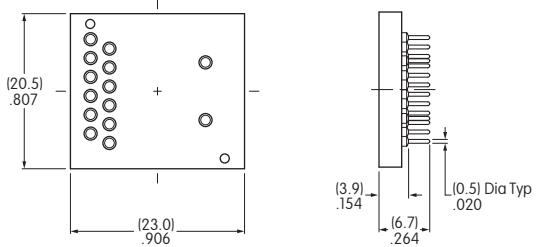
AT9704-065E Socket for RGB LCD 36 x 24 Pushbutton

Materials:

Base - Glass Fiber Reinforced PBT
Terminals - Brass/Beryllium Copper

- The socket permits the RGB SmartDisplay to be plugged in after automated processing.

- Use of the socket enables easy field replacement of the device.
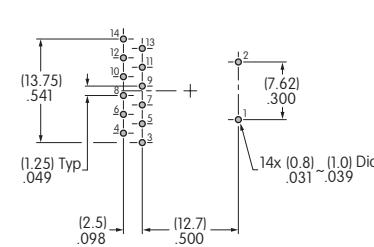
| Compatible Part Numbers for AT9704-065E |
|---|
| **RGB LCD 36 x 24** |
| IS15BBFP4RGB |
| **Bicolor LCD 36 x 24** |
| * IS15BAFP4CF |

* AT9704-065E Socket may be used with IS15BAFP4CF by removing pin 3.
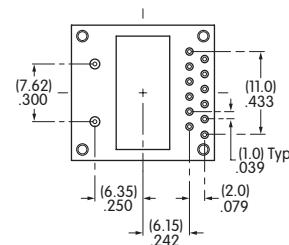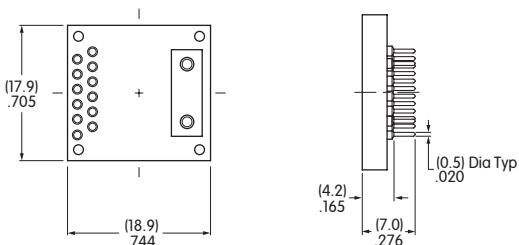
AT9704-065F Socket for Compact Pushbutton (All Models)

Materials:

Base - Glass Fiber Reinforced PBT
Terminals - Brass/Beryllium Copper

- The socket permits the Compact SmartDisplay to be plugged in after automated processing.

- Use of the socket enables easy field replacement of the device.

Compatible Part Numbers for AT9704-065F
LCD 64 x 32
IS15EBFP4RGB-09YN
LCD 64 x 32 Compact
IS15ESBFP4RGB
LCD 36 x 24
IS15BAFP4CF
LCD 36 x 24 Compact
IS15BSBFP4RGB
IS15BSAFP4CF
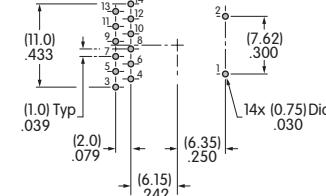
Note: AT9704-065F Socket may be used with the LCD 64 x 32 SmartDisplay by removing pins 3, 4, 11, 12, 13 and 14.