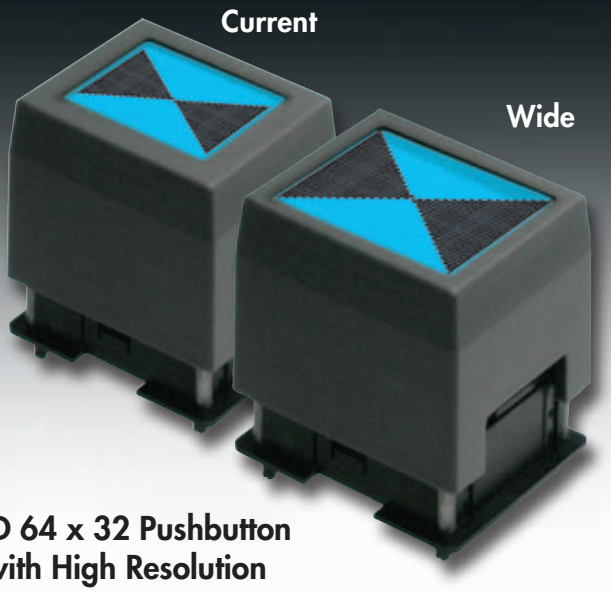
Change Notice

CN-0219

IS Series
Wide Viewing Area

High Resolution, High Resolution Compact, & Standard SmartSwitch Pushbuttons & Displays

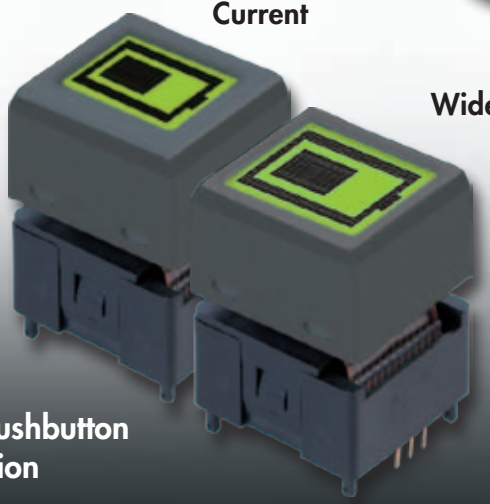
Larger Screen, Narrow Frame, Superior Visibility



LCD 64 x 32 Pushbutton
with High Resolution



LCD 36 x 24 Pushbutton
Standard



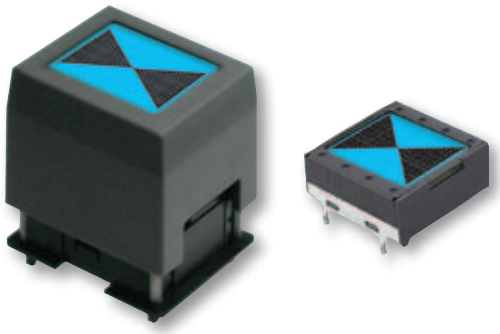
LCD 64 x 32 Compact Pushbutton
with High Resolution

2013-06-14 Rev 2014-10-28

NKK SWITCHES

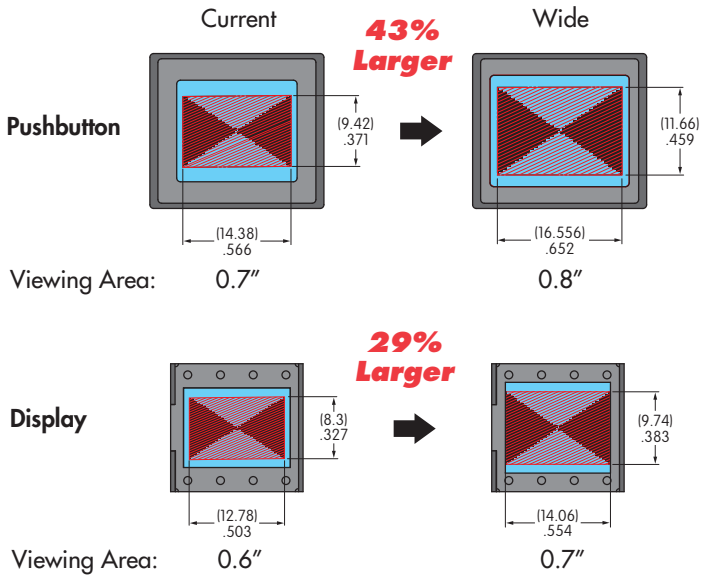
Wide Viewing Area Features & Specifications

LCD 64 x 32 Pushbutton with High Resolution



Viewing Areas
Pushbutton: 0.8″ Display: 0.7″

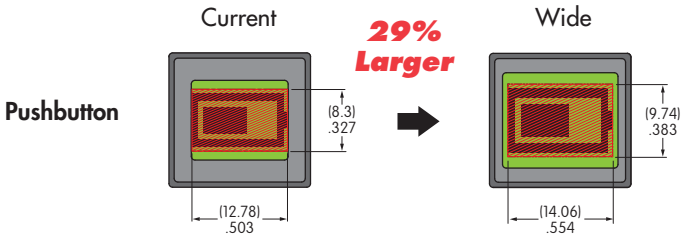
Viewing Area Comparisons



LCD 64 x 32 Compact Pushbutton with High Resolution



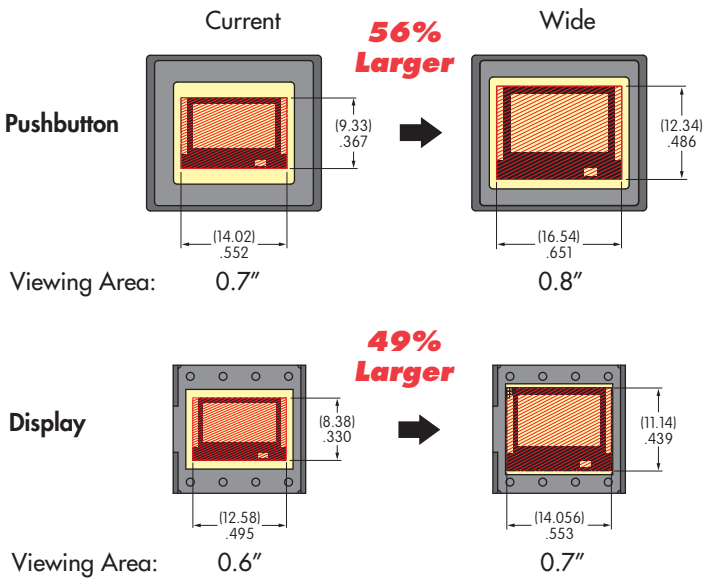
Viewing Area
Pushbutton: 0.7″



LCD 36 x 24 Pushbutton Standard

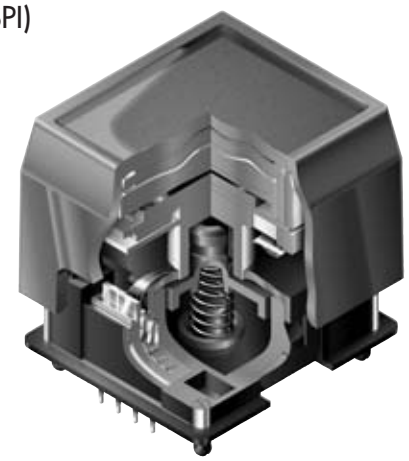


Viewing Areas
Pushbutton: 0.8″ Display: 0.7″



DISTINCTIVE CHARACTERISTICS

- High resolution of 64 x 32 pixels
- Same outer dimensions of switch and footprint, enabling ease of replacement with current switches
- Programmable display graphics for alphanumeric characters and animated sequences
- 64 colors of backlighting can be controlled dynamically
- Pushbutton switch or display with LCD, RGB LED backlighting
- General brightness of backlight is dynamically controlled in eight steps from dark to bright
- Operated by commands and data supplied via serial communications (SPI)
- Incorporates bitmap display function
- Dual image VRAM for quick change of displayed images
- Distinct, long travel of 4.5mm (same as KP01 Series)
- Low energy consumption
- Dust tight construction
- High reliability and long life of three million actuations
- Epoxy sealed straight PC terminals
- Snap-in standoff for easy, secure mounting and alignment
- Standoff legs ensure secure mounting and prevent dislodging during wave soldering.



TYPICAL SWITCH ORDERING EXAMPLE

IS | 1 | 5 | E | S | B | F | P4 | RGB

Poles

1	SPDT

Circuits

5	OFF	(ON)
( ) = Momentary		

Outside Dimensions

No Code	Standard - 23.13 x 20.59mm
S	** Compact - 19.0 x 18.0mm

Contacts & Terminals

P4	Gold Contacts Straight PC Terminals

Viewing Area / Resolution

B	0.8″ (23.13 x 20.59mm)	Standard 36 x 24 Pixels
E	0.8″ (23.13 x 20.59mm) 0.7″ (19.0 x 18.0mm)	High Resolution 64 x 32 Pixels

LED Backlighting

A	* Standard
B	Super Bright

LCD Mode

F	Black & White

* 36 x 24 Pixels
** 64 x 32 Pixels

LED Colors

CF	* Red/Green
EF	* Yellow/Green
RGB	Red/Green/Blue

TYPICAL DISPLAY ORDERING EXAMPLE

IS | 01 | E | B | F | RGB

Outside Dimensions

01	(17.8 x 17.2)mm

Viewing Area / Resolution

B	0.7″	Standard 36 x 24 Pixels
E	0.7″	High Resolution 64 x 32 Pixels

LED Backlighting

B	Super Bright

LCD Mode

F	Black & White

* 36 x 24 Pixels

LED Colors

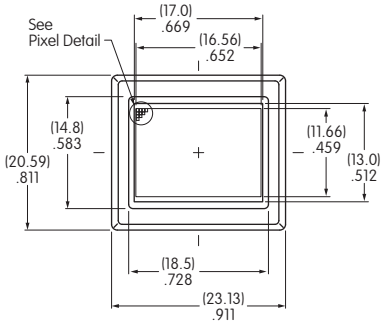
EF	* Yellow/Green
RGB	Red/Green/Blue

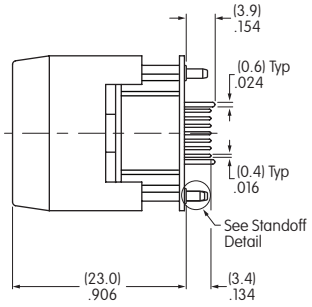
TYPICAL SWITCH DIMENSIONS

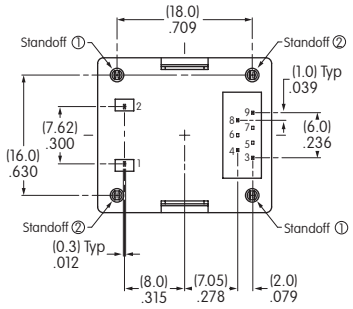
Terminal numbers are not on the switch.



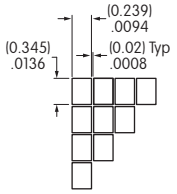
IS15EBFP4RGB
RGB LED and
Black and White LCD Mode



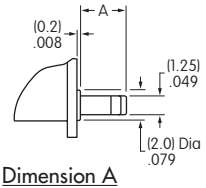




Pixel Detail



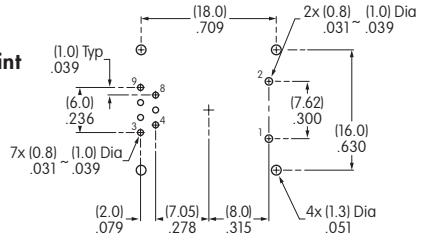
Standoff Detail



Dimension A

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

Footprint

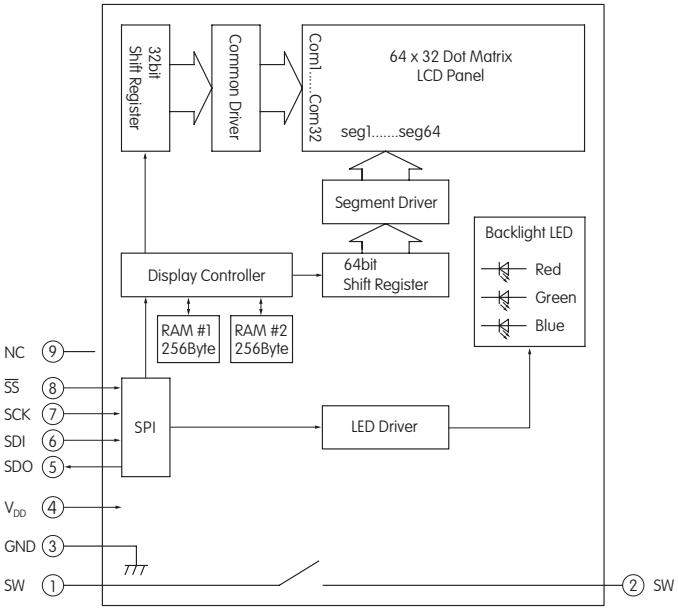


SWITCH SPECIFICATIONS

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	3,000,000 operations minimum
Electrical Endurance	3,000,000 operations minimum
Operating Force	2.0 ± 0.5 Newtons
Total Travel	4.5mm (.177")

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



LCD SPECIFICATIONS

Characteristics of Display

Display Operation Mode	FSTN positive; background, 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 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 low temperatures (below 0°C), speed and contrast decrease when image changes. The non-indicator dot may become dense in high temperatures (about +50°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	—	*** 50mA

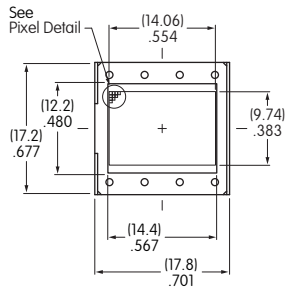
** 10mA: Backlighting LED is off
*** 50mA: Backlighting LEDs (Red, Green, Blue) at maximum brightness

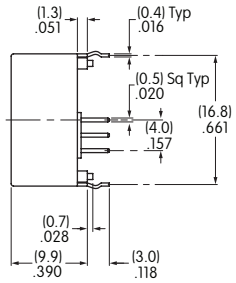
SWITCH BLOCK DIAGRAM & PINS

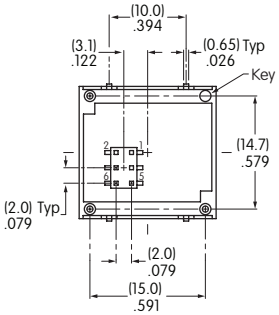
Pin	Symbol	Name	Function
1	**SW**	Terminal of Switch	Normally open
2	**SW**	Terminal of Switch	Normally open
3	**GND**	Ground	
4	**V_{DD}**	Power	Power source for logic circuit and LCD
5	**SDO**	Data Out	Data output line for SPI
6	**SDI**	Data In	Data input line for SPI
7	**SCK**	Serial Clock	Clock line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

TYPICAL DISPLAY DIMENSIONS

Terminal numbers are not on the device.



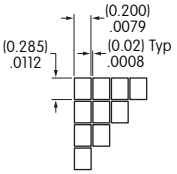




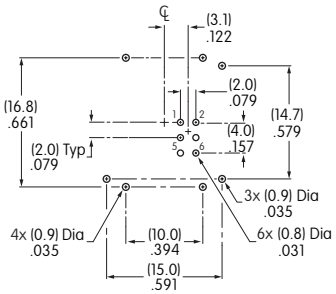


IS01EBFRGB
RGB LED and
Black and White LCD Mode

Pixel Detail



Footprint



LCD SPECIFICATIONS

Characteristics of Display

Display Operation Mode	FSTN positive; background, 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 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 low temperatures (below 0°C), speed and contrast decrease when image changes. The non-indicator dot may become dense in high temperatures (about +50°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

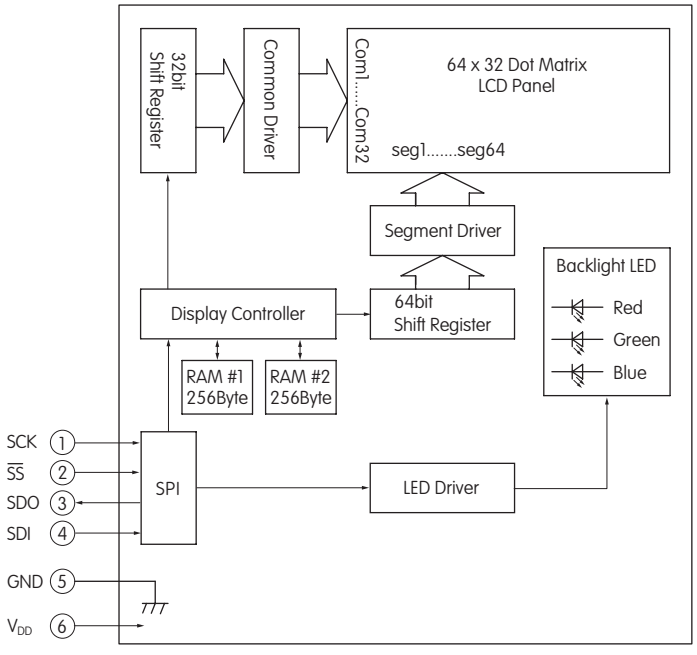
Recommended Operating Conditions (Temperature at 25°C)

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	—	*** 50mA

** 10mA: Backlighting LED is off
*** 50mA: Backlighting LEDs (Red, Green, Blue) at maximum brightness

DISPLAY BLOCK DIAGRAM & PINS

Pin	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

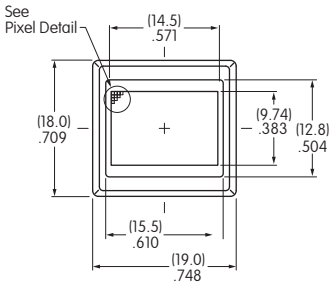


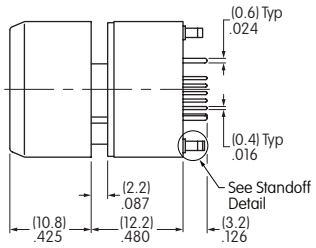
TYPICAL SWITCH DIMENSIONS

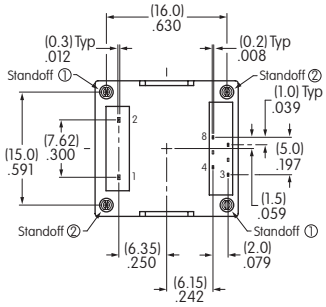
Terminal numbers are not on the switch.



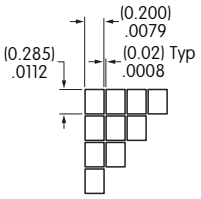
IS15ESBFP4RGB
RGB LED and
Black and White LCD Mode



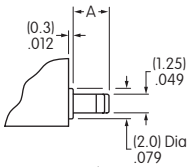




Pixel Detail

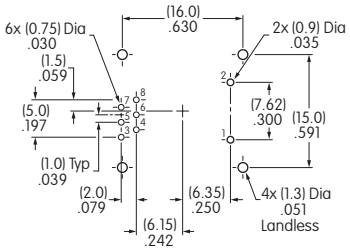


Standoff Detail



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

Footprint

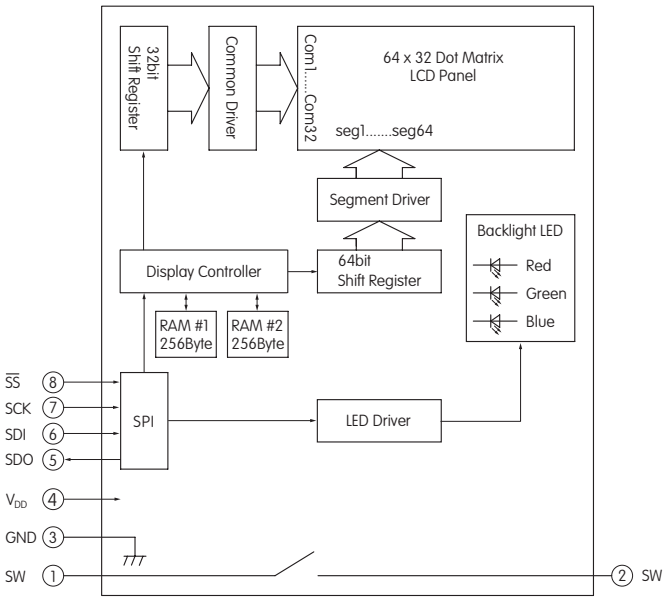


SWITCH SPECIFICATIONS

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	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



LCD SPECIFICATIONS

Characteristics of Display

Display Operation Mode	FSTN positive; background & 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 low temperatures (below 0°C), speed and contrast decrease when image changes. The non-indicator dot may become dense in high temperatures (about +50°C).

Recommended Operating Conditions (Temperature at 25°C)

Items	Symbols	Min	Typical	Max
Supply Voltage	V_{DD}	4.9V	5.0V	5.1V
High Level Input Voltage	V_{IH}	0.8 V_{DD}	—	—
Low Level Input Voltage	V_{IL}	—	—	0.2V_{DD}
SPI Clock Frequency	f_{SCK}	—	—	8MHz
Current Consumption	I_{DD}	** 10mA	—	*** 50mA

** 10mA: Backlighting LED is off
*** 50mA: Backlighting LEDs (Red, Green, Blue) at maximum brightness

SWITCH BLOCK DIAGRAM & PINS

Pin	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; commands and data
8	**$\overline{SS}$**	Slave Select	Chip select for SPI; line is active low

COMMANDS & DATA FOR SWITCH & DISPLAY

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

Transferring Display Data/Displaying on LCD

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

LED (Backlight) Color Set

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

LED (Backlight) Brightness Set

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

Reset (Returning to Initial Status at Power Activation)

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

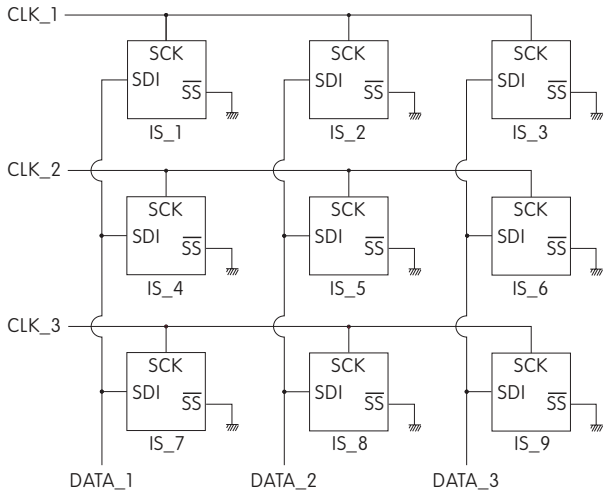
TIMING SPECIFICATIONS FOR SWITCH & DISPLAY

SPI Characteristics (See Timing Diagram)

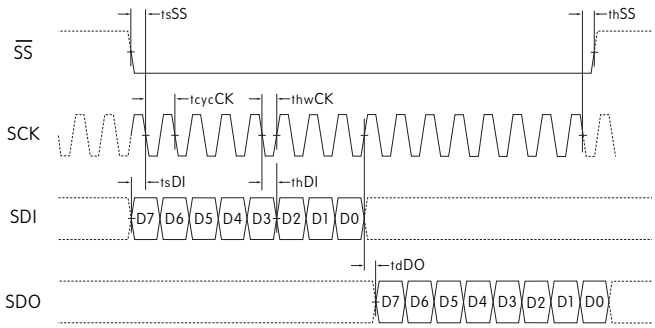
(Temperature at −15°C ~ +50°C and V_{DD} = 5.0V ± 2%)

Items	Symbols	Minimum	Maximum
SPI_$\overline{SS}$ Set Up Time	tsSS	10ns	
SPI_$\overline{SS}$ Hold Time	thSS	10ns	
SPI_CLK Cycle	tcycCK		8MHz
SPI_CLK Width	thwCK	10ns	
SPI_DI Set Up Time	tsDI	10ns	
SPI_DI Hold Time	thDI	10ns	
SPI_DO Delay Time	tdDO	10ns	

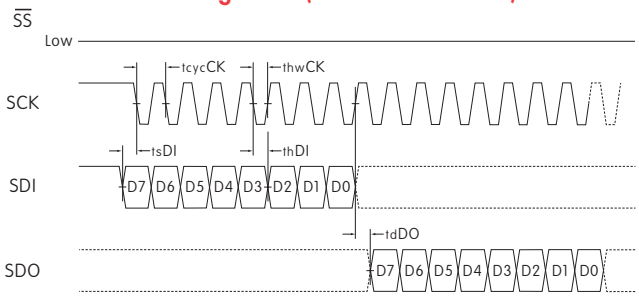
Circuit Example



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



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



SDI and SCK shall be kept high when idle.

BITMAP

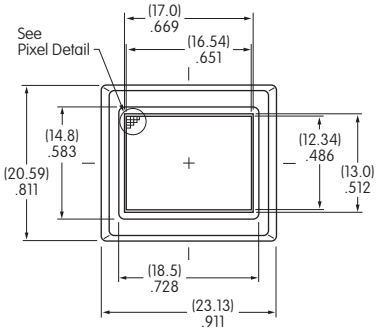
	Segment				
Common	**1 2 3 4 5 6 7 8**	**9 • • • 16**	**• • • • •**	**49 • • • 56**	**57 58 59 60 61 62 63 64**
	Byte8	Byte7	• • •	Byte2	Byte1
COM1	D0 D1 D2 D3 D4 D5 D6 D7	D0 • • • D7	• • •	D0 • • • D7	D0 D1 D2 D3 D4 D5 D6 D7
	Byte16				Byte9
COM2	D0 D1 D2 D3 D4 D5 D6 D7				D0 D1 D2 D3 D4 D5 D6 D7
•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

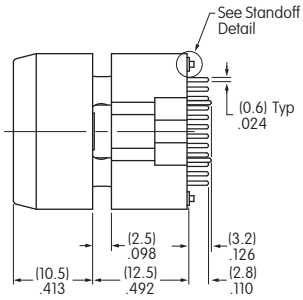
Transferring Display Data/Displaying LCD Command and Data Sequence

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

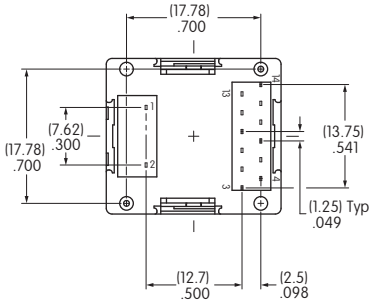
Notes: Display RAM has two screen areas. The first area is for the display on current LCD; the second area is for the data to be displayed next. The screens are changed when the second area is fully stored.

TYPICAL SWITCH DIMENSIONS





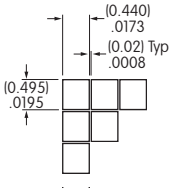
Terminal numbers are not on the switch.



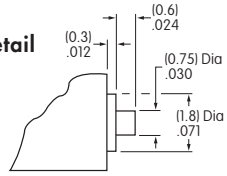


IS15BBFP4RGB
RGB LED Option and Black and White LCD Mode

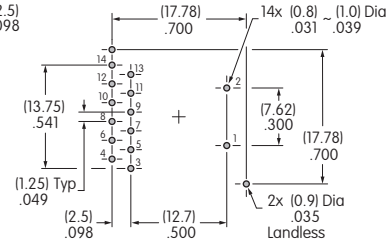
Pixel Detail



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)

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

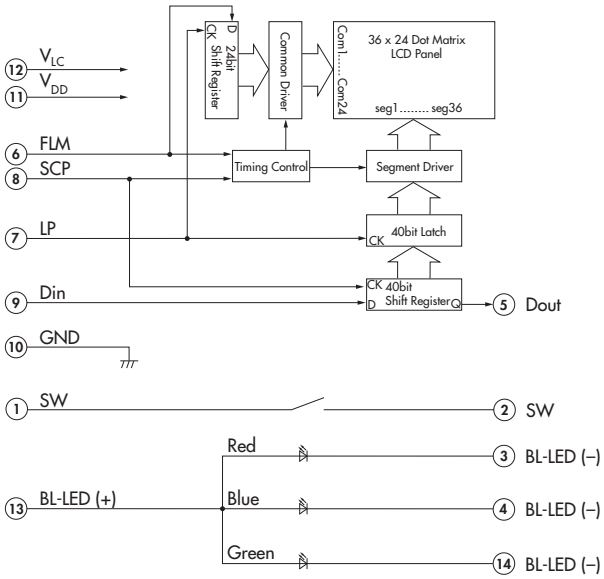
Display Operation Mode	STN positive, STN negative, FSTN positive
Display Condition	Transflective with built-in LED backlight
Viewing Angle	6 o'clock
Driving Method	1/24 duty. 1/5 bias (built-in driving circuit)
Viewing Area	17.0mm x 13.0mm (horizontal x vertical)
Pixel Format	36 x 24 pixels (horizontal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

Recommended Operating Conditions (Temperature at 25°C)

Items	Symbols	Min	Typical	Max
Supply Voltage for Logics	V_{DD}	4.5V	5.0V	5.5V
Supply Voltage Yellow	V_{LC}	—	7.4V	—
Supply Voltage Blue	V_{LC}	—	7.5V	—
Supply Voltage Black/White	V_{LC}	—	7.3V	—
Input Voltage	V_I	0V	—	V_{DD}
Driving Frequency	f_{FLM}	—	150Hz	—

SWITCH BLOCK DIAGRAM & PINS

Pin	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	
6	**FLM**	First Line Marker	Input signal frame
7	**LP**	Latch Pulse	Input display latch signal
8	**SCP**	Serial Clock Pulse	Input display shift clock
9	**Din**	Data Input	
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

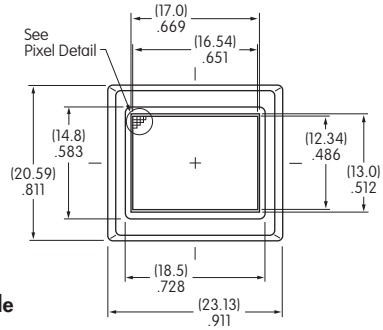


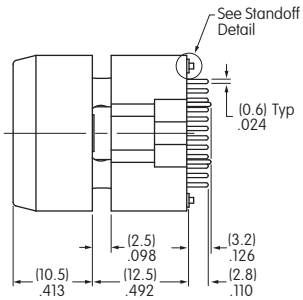
TYPICAL SWITCH DIMENSIONS

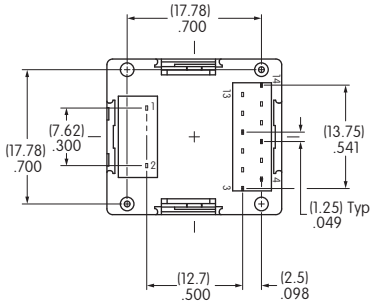
Terminal numbers are not on the switch.



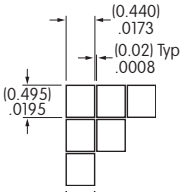
IS15BAFP4CF
Black and White LCD Mode



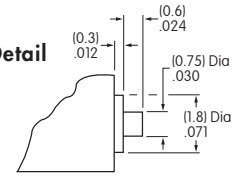




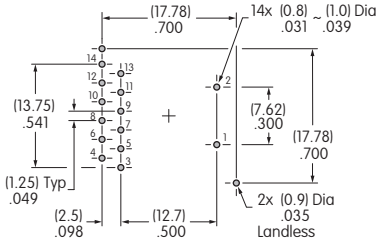
Pixel Detail



Standoff Detail



Footprint



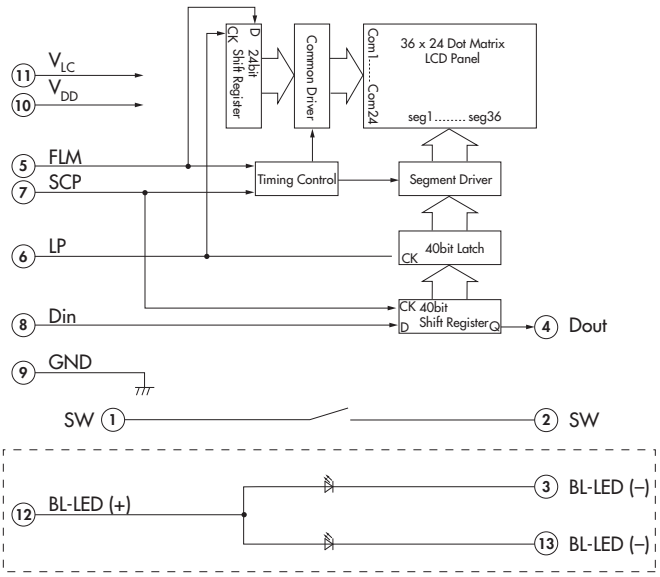
SWITCH SPECIFICATIONS

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	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

SWITCH BLOCK DIAGRAM & PINS



LCD SPECIFICATIONS

Characteristics of Display

Display Operation Mode	FSTN positive; background & 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	36 x 24 pixels (horizontal x vertical)
Pixel Size	0.440mm x 0.495mm (horizontal x vertical)
*** Operating Temp Range**	–20°C ~ +60°C (–4°F ~ +140°F)
Storage Temp Range	–30°C ~ +70°C (–22°F ~ +158°F)
Backlight LED	**RGB:** red/green/blue

* In low temperatures (below 0°C), speed and contrast decrease when image changes. The non-indicator dot may become dense in high temperatures (about +50°C).

Recommended Operating Conditions (Temperature at 25°C)

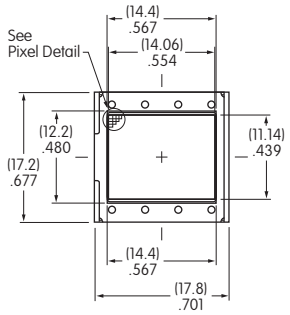
Items	Symbols	Min	Typical	Max
Supply Voltage	V_{DD}	4.9V	5.0V	5.1V
High Level Input Voltage	V_{IH}	0.8 V_{DD}	—	—
Low Level Input Voltage	V_{IL}	—	—	0.2V_{DD}
SPI Clock Frequency	f_{SCK}	—	—	8MHz
Current Consumption	I_{DD}	** 10mA	—	*** 50mA

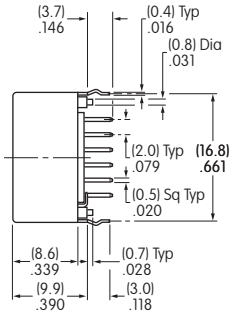
** 10mA: Backlighting LED is off
*** 50mA: Backlighting LEDs (Red, Green, Blue) at maximum brightness

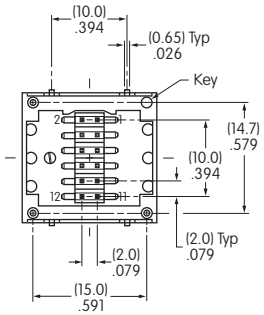
Pin	Symbol	Name	Function
1	**SW**	Terminal of Switch	Normally open
2	**SW**	Terminal of Switch	Normally open
3	**BL-LED (–)**	Terminal of Backlight LED	Cathode: **super bright** - yellow; **standard** - green
4	**Dout**	Data Output	
5	**FLM**	First Line Marker	Input signal frame
6	**LP**	Latch Pulse	Input display latch signal
7	**SCP**	Serial Clock Pulse	Input display shift clock
8	**Din**	Data Input	
9	**GND**	Ground	
10	**V_{DD}**	Power	
11	**V_{LC}**	Power	
12	**BL-LED (+)**	Terminal of Backlight LED	Anode
13	**BL-LED (–)**	Terminal of Backlight LED	Cathode: **super bright** - green; **standard** - red

TYPICAL DISPLAY DIMENSIONS

Terminal numbers are not on the device.



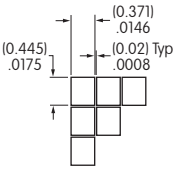




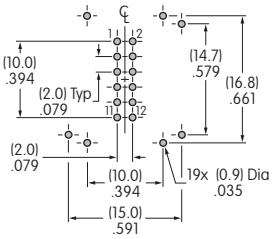


IS01BBFRGB Super Bright RGB
IS01BBFEF Super Bright Yellow/Green

Pixel Detail



Footprint



LCD SPECIFICATIONS

Characteristics of Display

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

Absolute Maximum Ratings (Temperature at 25°C)

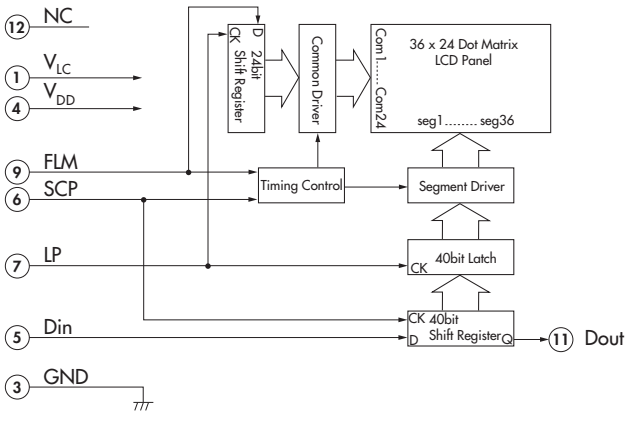
Items	Symbols	Ratings
Supply Voltage for Logics	V_{DD}	–0.3V to +7.0V
Supply Voltage LCD	V_{LC}	–0.3V to +12.0V
Input Voltage	V_I	–0.3V to V_{DD} +0.3V
Output Voltage	V_O	–0.3V to V_{DD}+0.3V

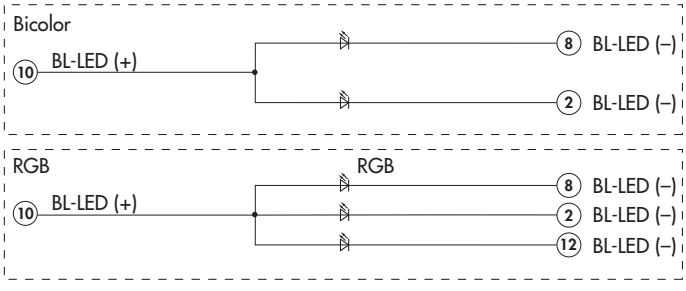
Recommended Operating Conditions (Temperature at 25°C)

Items	Symbols	Min	Typical	Max
Supply Voltage for Logics	V_{DD}	4.5V	5.0V	5.5V
Supply Voltage LCD	V_{LC}	7.1V	7.3V	7.5V
Input Voltage	V_I	0V	—	V_{DD}
Driving Frequency	f_{FLM}	—	150Hz	—

SWITCH BLOCK DIAGRAM & PINS

Pin	Symbol	Name	Function
1	V_{LC}	Power	Power source for LCD drive
2	**BL-LED (–)**	Terminal of Backlight LED	Cathode: **super bright bicolor** - green; **RGB** - green
3	**GND**	Ground	
4	V_{DD}	Power	Power source for logic circuit
5	**Din**	Data Input	
6	**SCP**	Serial Clock Pulse	Input display shift clock
7	**LP**	Latch Pulse	Input display latch signal
8	**BL-LED (–)**	Terminal of Backlight LED	Cathode: **super bright bicolor** - yellow; **RGB** - red
9	**FLM**	First Line Marker	Input signal frame
10	**BL-LED (+)**	Terminal of Backlight LED	Anode for common
11	**Dout**	Data Output	
12	**BL-LED (–)**	Terminal of Backlight LED	Bicolor: no connection; cathode for RGB: blue





LCD & LED SPECIFICATIONS

Absolute Maximum Ratings (Temperature at 25°C)

	Items	Symbols	Ratings
LCD	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
LED	Forward Current	I_F	20mA
	Power Dissipation	P_d	mW

LED Absolute Maximum Ratings (Temperature at 25°C)

	Super Bright					Standard	
Color	Yellow/Green		Red/Green/Blue			Red/Green	
	Yellow	Green	Red	Green	Blue	Red	Green
Unicolor	50mW	80mW	40mW	60mW	60mW	50mW	50mW
LED Overall	130mW		115mW			100mW	

Display Electrical Characteristics

Items			Symbols	Test Condition	Minimum	Typical	Maximum
LCD	Supply Voltage	Logic Circuit	V_{DD}		4.5	5.0	5.5
		LCD Circuit	V_{LC}		7.1	7.3	7.5
	Input Voltage	H	V_{IH}		0.7V_{DD}	—	V_{DD}
		L	V_{IL}		0	—	0.3 V_{DD}
	Output Voltage	H	V_{OH}	D_{OUT}, I_{OH} = 500 μ A	V_{DD} −0.5	—	—
		L	V_{OL}	D_{OUT}, I_{OL} = 500 μ A	—	—	0.5
	Power	Logic Circuit	I_{DD}	f_{scp} = 1.0MHz	—	—	500
		LCD Circuit	I_{LC}	f_{LP} = 2.4kHz V_{LC} = 7.3V	—	500	2,000

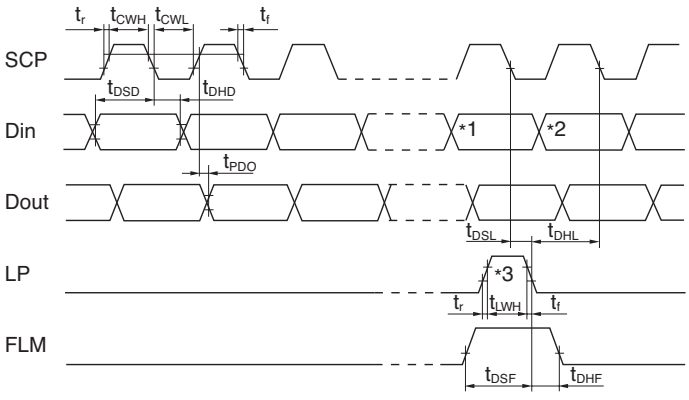
Items		Symbols	Test Condition	LED Colors						
				Super Bright					Standard	
				Yellow/Green		Red/Green/Blue			Red/Green	
LED	Forward Current	I_F		15mA		Red 10mA	Green 8.5mA	Blue 8mA	15mA	
	Forward Voltage	V_F	I_F = Forward Current Ta = 25°C	Yellow 1.9V	Green 3.2V	Red 2.0V	Green 2.8V	Blue 2.8V	Red 1.9V	Green 1.9V
	Current Reduction Rate	ΔI_F(DC)	Ta = 25°C above	−0.26mA/°C		−0.33mA/°C			−0.26mA/°C	

Timing Characteristics of LCD Drive IC

(Temperature at 0°C to +40°C and V_{DD} = 5.0V ± 10%)

Items	Symbols	Minimum	Maximum
Clock Operation Frequency	f_{SCP}		6.0MHz
Latch Pulse Frequency	f_{LP}		50kHz
Clock High Level Pulse Width	t_{CWH}	70ns	
Clock Low Level Pulse Width	t_{CWL}	70ns	
Data Setup Time	t_{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

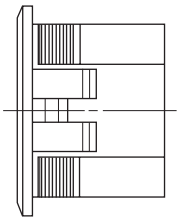


*1 Last data on first line
*2 Beginning data on second line
*3 Location of LP signal on first line

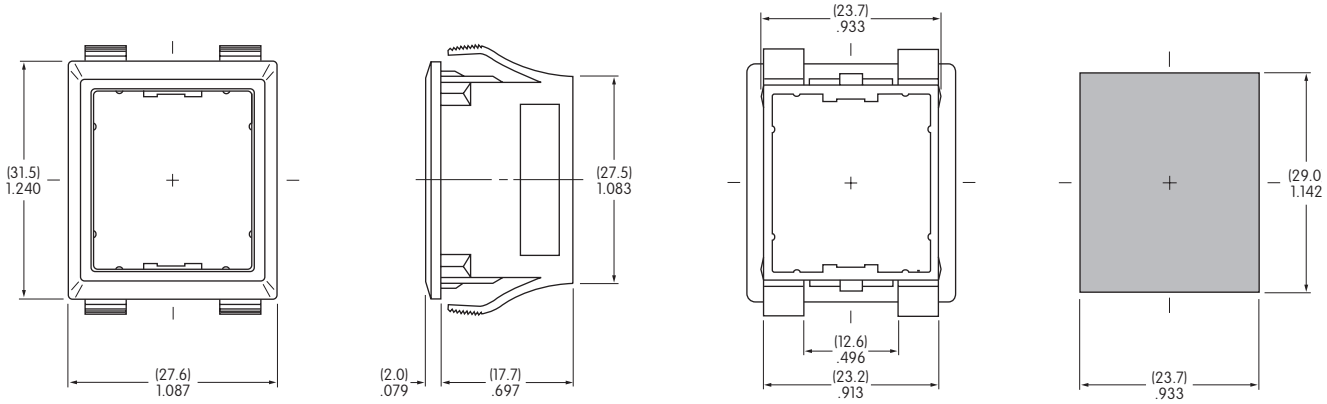
OPTIONAL ACCESSORIES

AT548 Panel Mount Housing

Material: Polyamide



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.

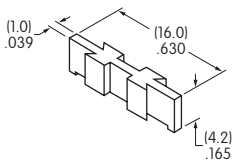


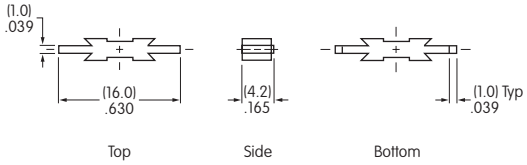
The Panel Mount Housing is available for the LCD 36 x 24 Pushbutton only.

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

AT542 Coupler

Material: PBT





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.

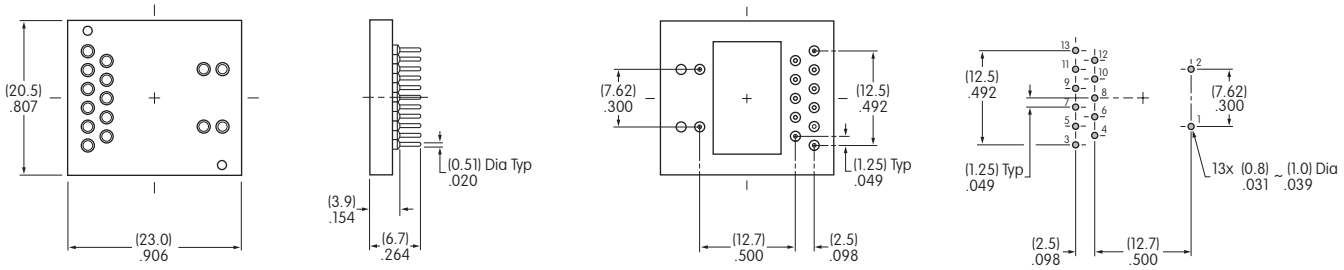
The Coupler is available for the LCD 36 x 24 Pushbutton only.

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.

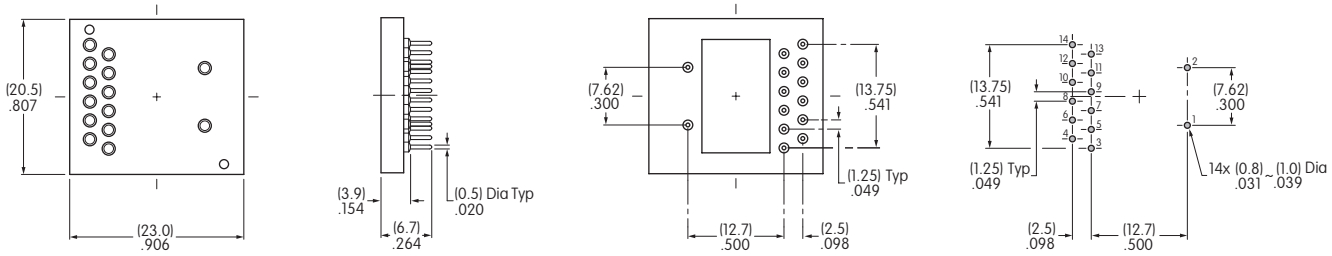


OPTIONAL ACCESSORIES

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

Materials: Base - Glass Fiber Reinforced PBT; Terminals - Brass/Beryllium Copper

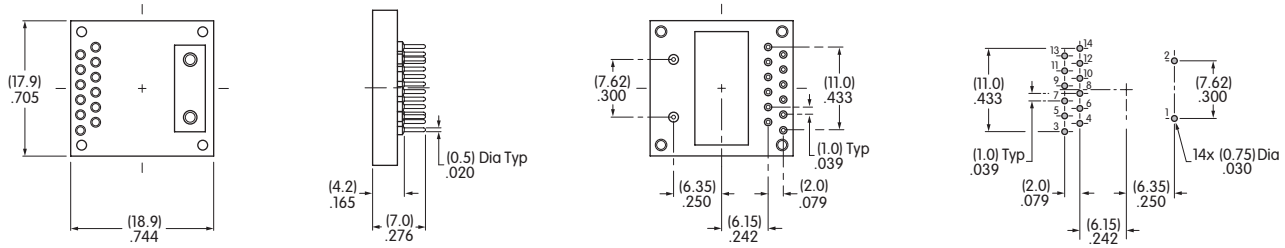
- The socket permits the RGB SMARTSWITCH™ to be plugged in after automated processing.
- Use of the socket enables easy field replacement of the device.



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.

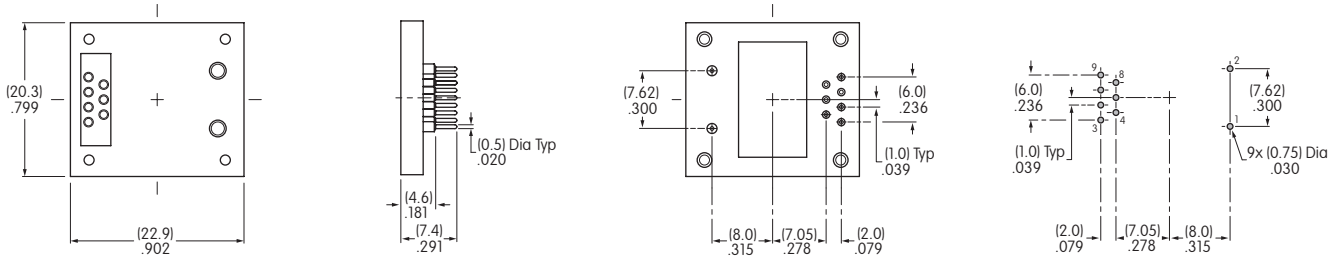


Note: AT9704-065F Socket may be used with the Compact 64 x 32 SMARTSWITCH™ by removing pins 3, 4, 11, 12, 13 and 14.

AT9704-085K Socket for LCD 64 x 32 Pushbutton

Materials: Base - Glass Fiber Reinforced PBT; Terminals - Brass/Beryllium Copper

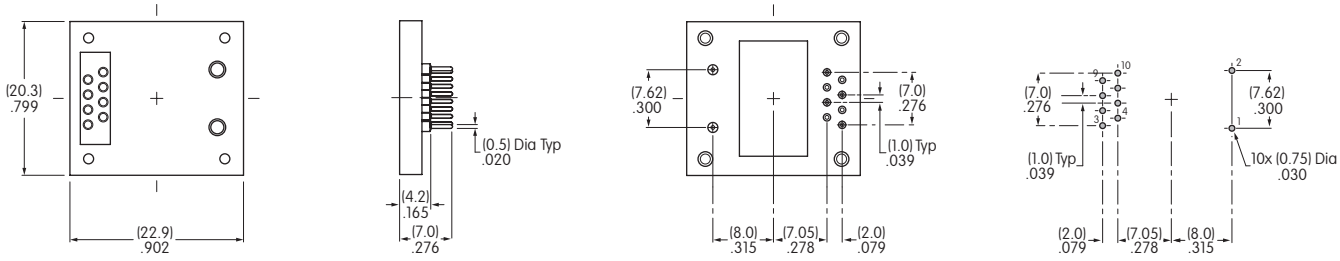
- The socket permits the SMARTSWITCH™ to be plugged in after automated processing.
- Use of the socket enables easy field replacement of the device.



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.

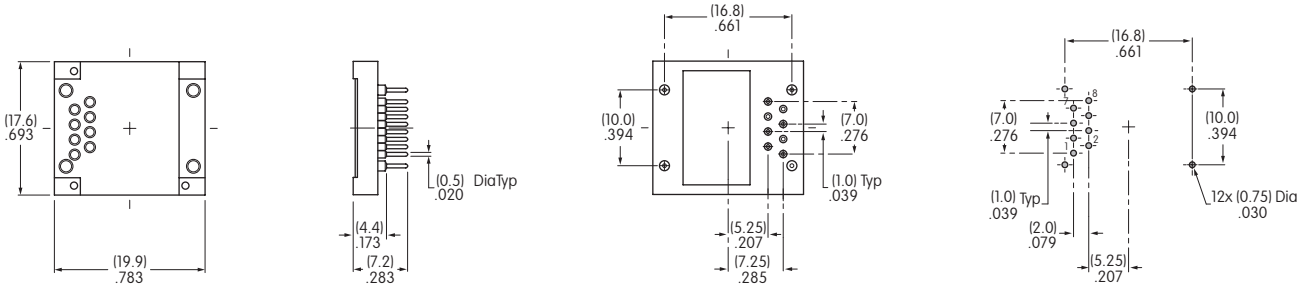


OPTIONAL ACCESSORIES

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.



GENERAL PRECAUTIONS FOR HANDLING & STORAGE

ATTENTION
ELECTROSTATIC
SENSITIVE DEVICES

1. The IS Series devices are electrostatic sensitive. Use care and preventative measures as with any devices that are susceptible to static electricity.
2. Limit operating force to keytop to 100.0N maximum, as excessive pressure may damage the LCD device.
3. Under fixed conditions and over an extended period of time, an afterimage may appear in the viewing area.
4. To avoid damage to the , do not touch terminals unless properly insulated from static electricity.
5. For the display, it is necessary for the bracket legs to be grounded.
6. The IS series devices are not process sealed. Do not allow devices to become exposed to any liquids. A transparent material may be used as protective cover if devices are in area that may be susceptible to splashing.
7. If the LCD is accidentally broken, avoid contact with the liquid and wash off any liquid spills to the skin or clothing.
8. 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.
9. Store in original container, away from static electricity, and away from direct sunlight.
10. Avoid extreme temperatures, high humidity, gaseous substances, and all forms of chemical contamination.

Precautions for Handling LED 64 x 32 Devices

1. Recommended soldering time and temperature limits: Wave Soldering: see Profile B in Supplement section of NKK's Switch Guide. Do not exceed 60°C at the LCD level.
2. Do not use below 0°C at the LED level, as it may cause slow response in the display switching speed or contrast. Using above 50°C may cause non-display pixels to appear darker.
3. Proper serial resistors and buffers for signals should be used to prevent noise problems.
4. Do not send any commands other than those on the specification sheet.

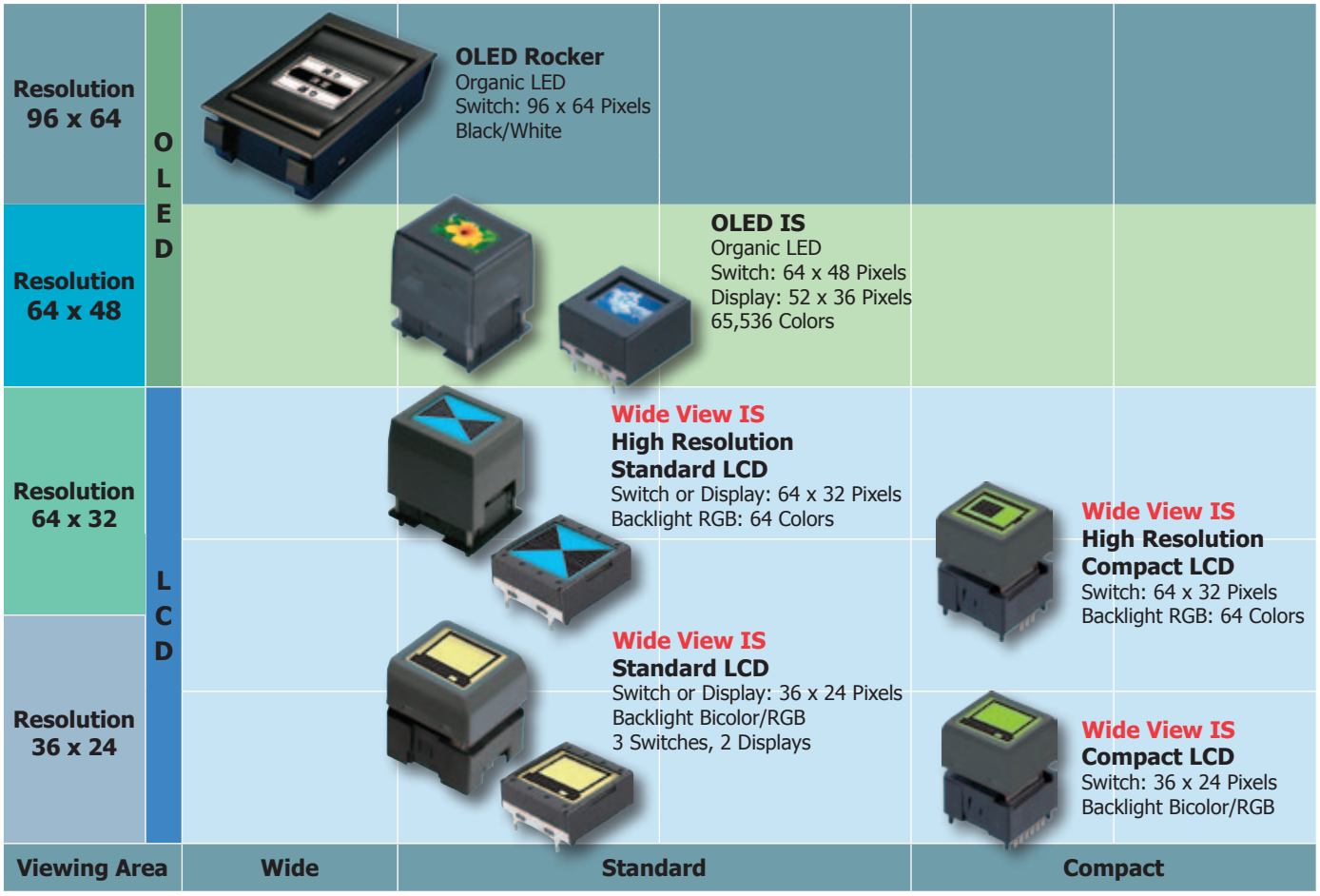
Precautions for Handling LED 36 x 24 Devices

1. Recommended soldering time and temperature limits: Wave Soldering: see Profile B in Supplement section of NKK's Switch Guide. Do not exceed 70°C at the LCD level.
2. Do not use below 0°C at the LED level, as it may cause slow response in the display switching speed or contrast. Using above 50°C may cause non-display pixels to appear darker.
3. Avoid exposing LCD to DC voltage.
4. More than twice the power voltage than the forward voltage for the LED is recommended.

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Comparative Guide for Current to New Part Numbers

Resolution	Switch/Display	LCD	Super Bright Backlight	Current Part No.	New Part No.	Notes
64 x 32 Pixels (Horizontal x Vertical)	Switch	Black/White	Red/Green/Blue	IS15DBFP4RGB	IS15EBFP4RGB	—
	Switch (Compact)	Black/White	Red/Green/Blue	IS15DSBFP4RGB	IS15ESBFP4RGB	—
	Display	Black/White	Red/Green/Blue	IS01DBFRGB	IS01EBFRGB	—
36 x 24 Pixels (Horizontal x Vertical)	Switch	Yellow	Yellow/Green	IS15ABCP4EF	IS15BBFP4EF	Black & White mode LCD; Replace yellow/green backlight
			Yellow	IS15ABCP4E		
			Red/Green	IS15ABCP4CF	IS15BBFP4RGB	Black & White mode LCD; Replace RGB backlight
			Red/Green	IS15AACP4CF	IS15BAFP4CF	Black & White mode LCD; Replace red/green backlight
		Black & White	White	IS15ABFP4B	IS15BBFP4RGB	Replace RGB backlight
		Blue	Yellow	IS15ABDP4E	No alternative part numbers	Contact factory for details
			Yellow/Blue	IS15ABDP4EG		
			White	IS15ABDP4B		
	Display	Yellow	Yellow/Green	IS01BCEF	IS01BBFEF	Black & White mode LCD; Replace yellow/green backlight
			Yellow	IS01BCE		
			Red/Green	IS01BCCF	IS01BBFRGB	Black & White mode LCD; Replace RGB backlight

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ООО «НИОКР СИТЕМС»
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Телефон: 8 (495) 268-14-82
Email: n@nsistems.ru

ИНН: 7735154786
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