# SmartSwitch™

# OLED Programmable Rocker Switch

NKK SWITCHES

## SWITCH SPECIFICATIONS

| | | | | | | |
|---|---|---|---|---|---|---|
| Circuit | Single Pole Three Throw (Momentary) | | | | | |
| Contact Position | Top | | Center | | Bottom | |
| | Normal | Down | Normal | Down | Normal | Down |
| | OFF | (ON) 9-12 | OFF | (ON) 10-12 | OFF | (ON) 11-12 |
| Electrical Capacity (Resistive Load) | 3VA maximum DC | | | | | |
| Contact Resistance | 200 milliohms maximum | | | | | |
| Insulation Resistance | 500 megohms minimum @ 250V DC | | | | | |
| Dielectric Strength | 250V AC for 1 minute minimum | | | | | |
| Electrostatic Resisting Pressure | 15kV minimum | | | | | |
| Mechanical Endurance | 1,000,000 operations minimum | | | | | |
| Electrical Endurance | 1,000,000 operations minimum | | | | | |
| Operating Force | 6.0 Newtons at center of cap | | | | | |
| Total Travel | 1.4mm (.055") at center of cap | | | | | |

## OLED SPECIFICATIONS

### Characteristics of Display

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

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

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

### 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 |

### 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)

### Optical Characteristics

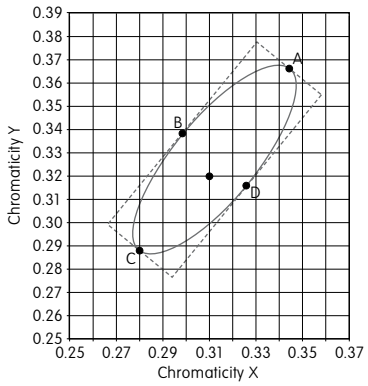
(Temperature at 25°C, Initial Value: depends on initial setting)

| Items | | Minimum | Typical | Maximum |
|---|---|---|---|---|
| Brightness | | 75 cd/m² | 100 cd/m² | 125 cd/m² |
| Chromaticity | (x) | *1 | 0.310 | *1 |
| | (y) | *1 | 0.320 | *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 |



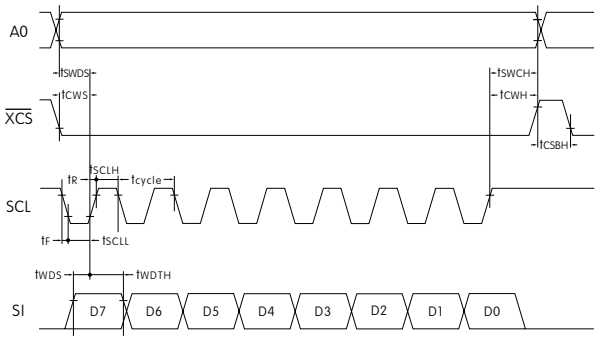

## TIMING SPECIFICATIONS

### AC Characteristics

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

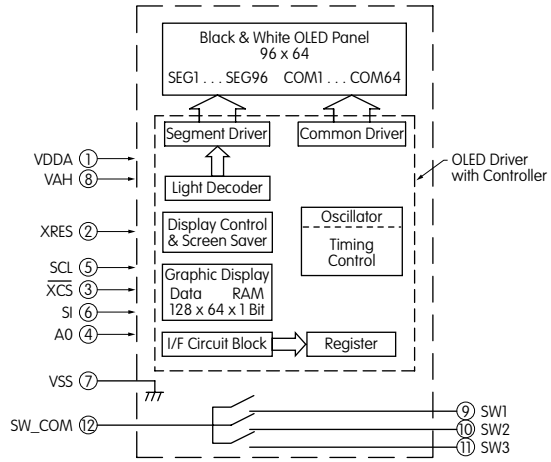
| Items | Symbols | Minimum | Typical | Maximum |
|---|---|---|---|---|
| Clock Cycle Time | $t_{cycle}$ | 100ns | — | — |
| A0 Setup Time | $t_{SWDS}$ | 65ns | — | — |
| A0 Hold Time | $t_{SWDN}$ | 35ns | — | — |
| $\overline{XCS}$ Setup Time | $t_{CWS}$ | 65ns | — | — |
| $\overline{XCS}$ Hold Time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

* Requires more than 100ns after resetting software



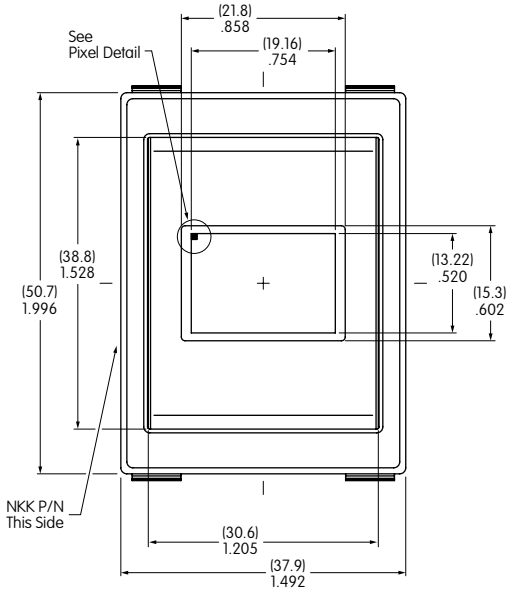

## BLOCK DIAGRAM & PIN CONFIGURATIONS

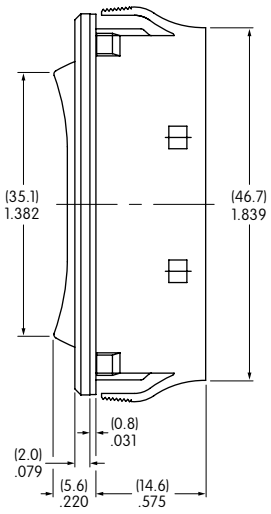
IS18WWC1W

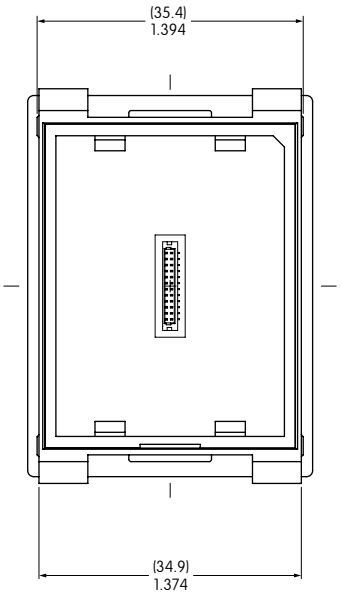


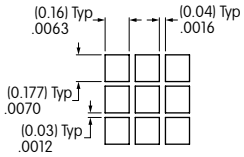

| Pin No. | Symbol | Name | Function |
|---|---|---|---|
| 1 | VDDA | Logic Type Power Source | |
| 2 | XRES | Reset | Terminal to initialize IC built-in logic; initializes with low level |
| 3 | $\overline{XCS}$ | Chip Select | Slave select for SPI. This line is active low. |
| 4 | A0 | Address | Terminal 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

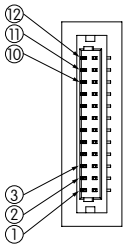


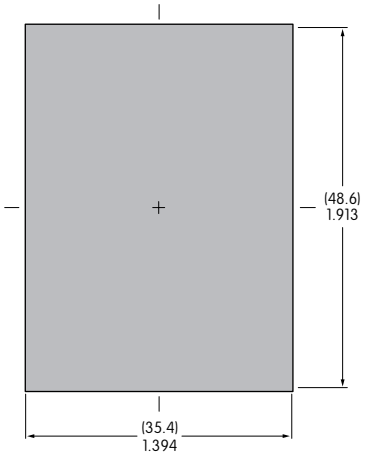

Pixel Detail



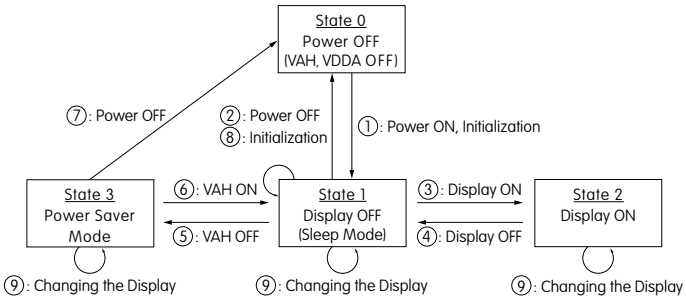

Terminal Connector Detail

Panel Thickness Range

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

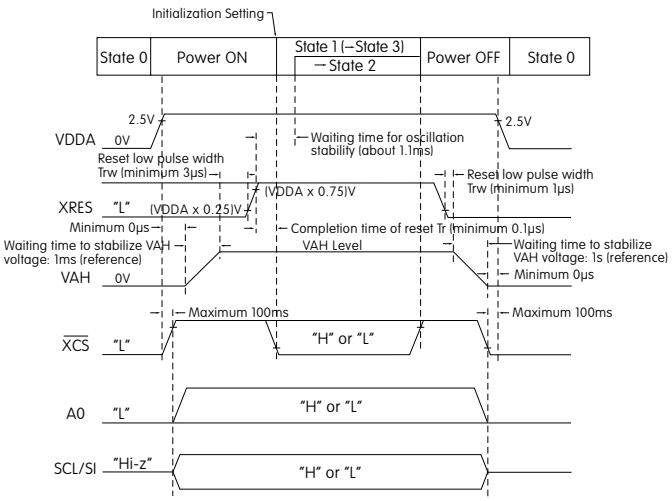



## STATE TRANSITION




| 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 |

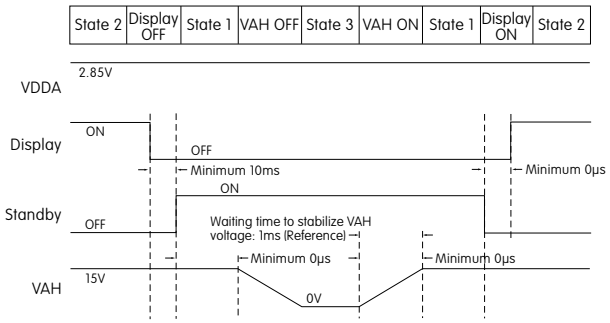
Power ON/OFF Sequence



## 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




## INITIALIZITION 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 | 0F | Note 1 |
| Y Axis Reading/WritingStart 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 | Notes 1 & 2 |
| DACB Setting | D5 | 00 | Notes 1 & 2 |
| DACC Setting | D6 | 00 | Notes 1 & 2 |
| DACD Setting | D7 | 00 | Notes 1 & 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

## DEVELOPMENT TOOLS

NKK Switches offers a variety of development tools. These tools include software that may be downloaded from www.nkksmartswitch.com.

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

Development Kits provide a full set of tools for designs. The Dev Kits enable rapid prototype designs so that feedback is easily obtained. NKK's Development Kits have been designed to facilitate the creation, testing and displaying of images with software downloaded from www.nkksmartswitch.com. Click on "Download Software."

## PRECAUTIONS FOR HANDLING & STORAGE

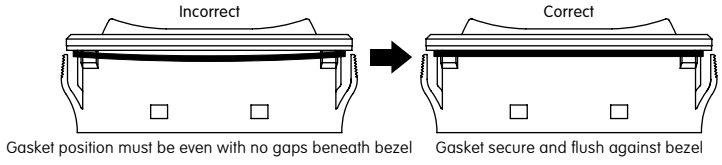
### Handling

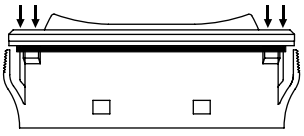
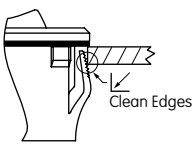
1. OLED devices are electrostatic sensitive.
2. Signal input under conditions not recommended may cause damage to the OLED unit or deterioration of the display. Follow directions regarding supply sequences of power and signal voltages.
3. If the OLED panel is broken, avoid touching the contents. Wash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

### Storage

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

### Panel Mounting




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