TE6432

Small Footprint, RGB-backlit, inverse DFSTN LCD Keyswitch with Multi Segment Color™

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General Description

The T-Series is a small-footprint series of **RGB**-backlit, transmissive inverse DFSTN LCD keyswitches with Multi-Segment Color™. All T-Series keyswitches use the same electronics package as the SC/SD/SE switch family.

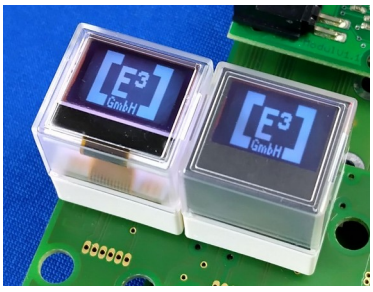
The TE6432 is the initial switch variant of the T-Series of switches. The TE6432 display has an inverse matrix with black pixels and displays background color-on-black text. The LCD's active pixels matrix can be inverted (Positive Mode) to show black text on color background using the Set Mode command.

(For more details see Commands and Command Example sections.

The TE6432 integrates a graphical 64 by 32 pixel liquid crystal display with **RGB** backlighting in a keyswitch. The TE6432 keys are controlled via a command driven serial interface to the integrated MSC electronics, which control the interface, display and backlighting. TE6432 keys self-initialise without external setup commands. Data only needs to be transmitted when a change is made to the display or background colors.

Only six contact terminals are used to provide power, clock and data lines as well as switch contacts. The contact pins of the internal switch are isolated from the internal electronics.

The TE6432 are available with clear (TE6432-C left) or black frame insert (TE6432-B right).



Improvements and Innovations

- **Small footprint 19.6 x 17.6 mm**
- **Multi Segment Color™**
- **Standard and Positive Mode command**

- **NEW - extended input voltage range of 4.5 – 5.5 Volt**
- **IMPROVED - contrast ratio**
- **IMPROVED - viewing angle**
- **IMPROVED – reduced power consumption**

Compatibility

The TE6432 switches have new form factor and pin-out compared to the S-Series switches.

The MSC™ electronics in the T-Series switches are identical to the SC, SD and SE switches and, therefore, command compatible to all other RGB-backlit LCD switches from [E³].

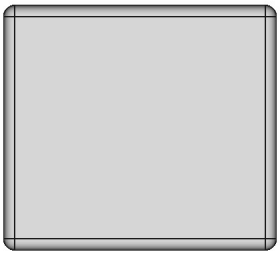
Note: **Mixed installation of SA/SB/SI/SM and SC/SE/TE switches in the same key matrix is NOT recommended since the different AT and MSC™ electronics packages may cause unintended timing and communications issues.**

Mixed installation of SC/SD/SE and TE switches is possible.

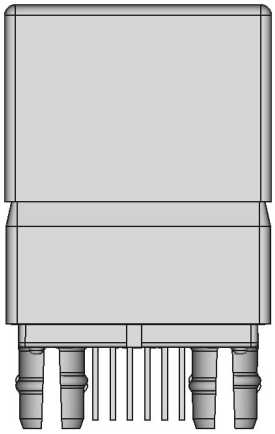
PRODUCT FEATURES

Feature	Description
Resolution	64 x 32 pixels
RGB Colors	more than 1 million **RGB** background colors
Multi-Segment Color MSC™	Allows for the use of two different **RGB** background colors in upper and lower segment of LCD instead of standard single background color.
Color Calibration	Improved color calibration results in maximum uniformity across **RGB** color spectrum based on ***MSC*** electronics.
Self-Initialisation	All keys self-initialise. No external setup commands required.
Low Power Consumption	Less than 35mA maximum current is needed when bright white backlighting is selected. Typical value is less than 20mA.
Interfaces	Synchronous 8-bit serial interfaces (custom protocols available upon request)
External clock	128 kHz up to 4MHz
Maximum speed	up to 4 Mbaud
Operating supply	4.5V - 5.5V
Keyswitch type	tactile, 2.0 mm travel with over-travel protection
Keyswitch life time	> 3.0 million cycles
Contact resistance	< 200 Ohm
Operating temperature	0°C to +55°C
Storage temperature	-20°C to +65°C

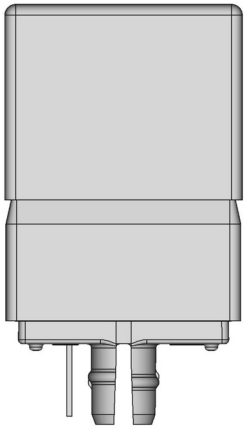
MECHANICAL CHARACTERISTICS



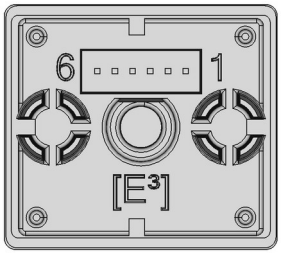
Top View



Front View

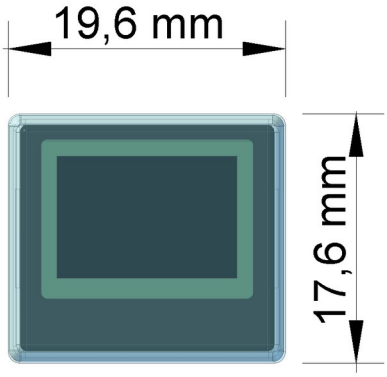


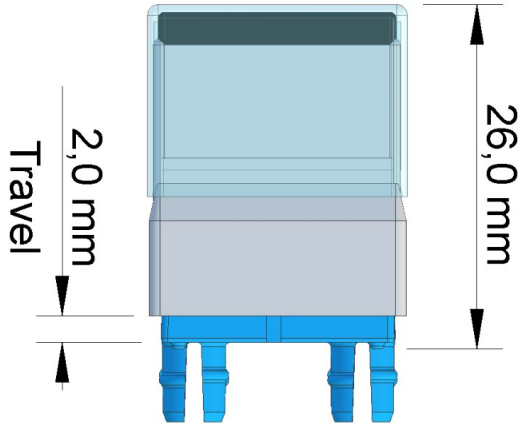
Side View



Bottom View

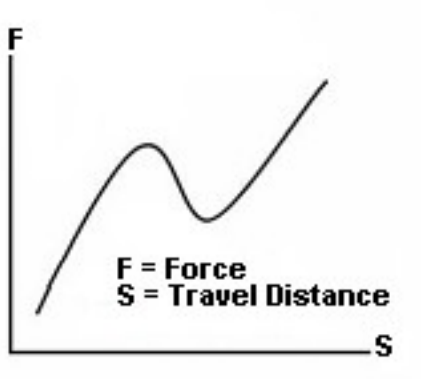
Dimensions





Keyswitch

KeyswitchKey stroke	2.0 mm +/- 0.1 mm; tactile
Operation force:	1.3 N +/- 0.2 N
Over travel protection:	yes
Lifetime:	> 3 million cycles

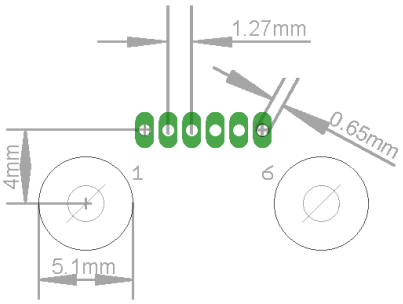


Tactile Force Curve

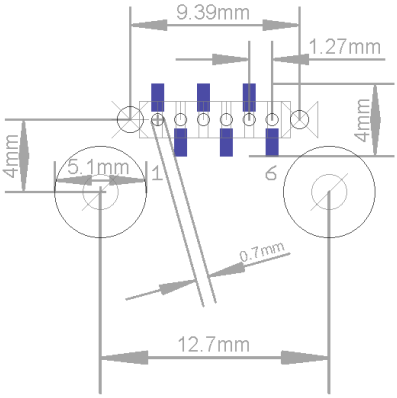
Mounting Options

The TE6432 switches may be either direct through-hole mounted onto the PCB to be hand or wave soldered or use a reverse mounted socket pin connector SP0601 for socket mounting.

Direct Mount vs. Socket Mount



Top View



Top View

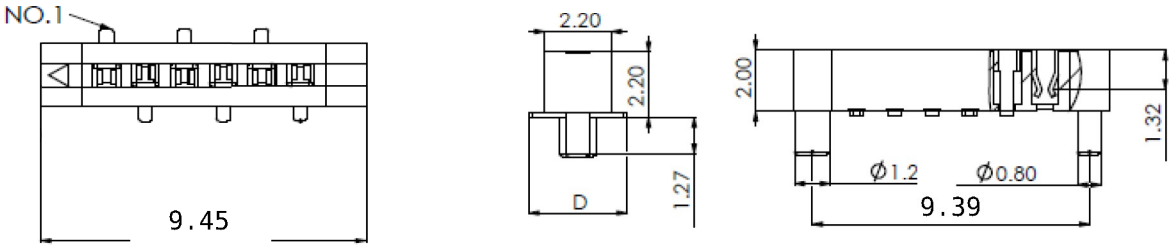
The TE6432 switches are through-hole mounted directly to PCBs with 1.6 or 2.0mm thickness.

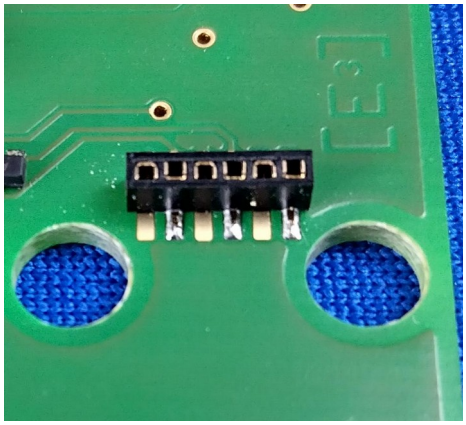
The reverse of the PCB requires a bottom-entry 6 socket pin connector (SP0601), if the switches are to be socket mounted and not soldered into the PCB.

Optional socket mounted on reverse of PCB

Socket Pin Connector

The optional bottom entry socket pin Connector SP0601 is required for socket mounting. It is to be SMD mounted on the reverse of the PCB.





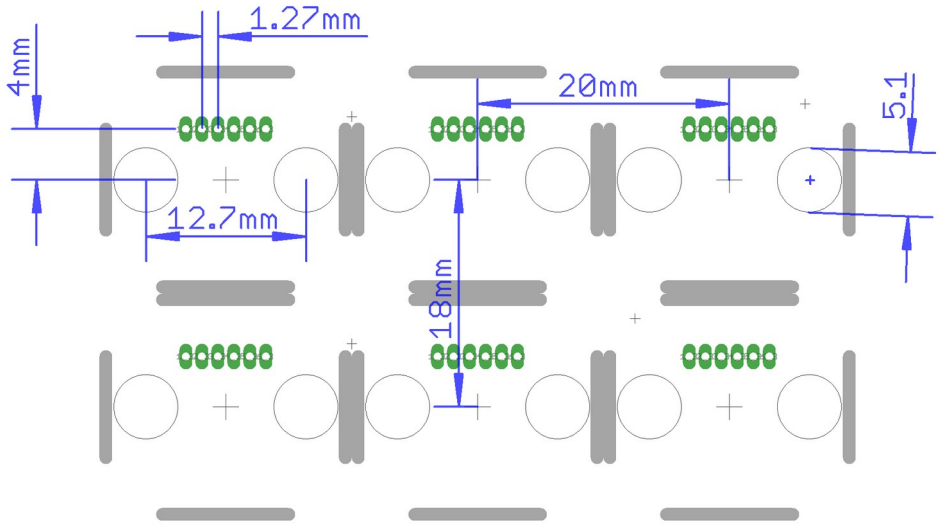
Reverse of PCB shown

Soldering Specifications

Manual soldering: max. 350° C for max. 3.5 seconds per pin

PCB Drill Masks

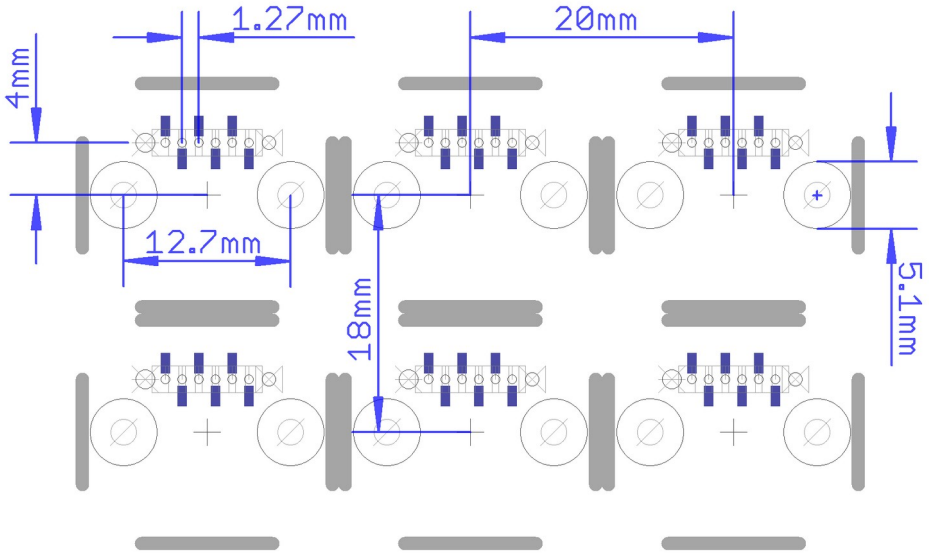
Manual Soldering



Minimum distance for array assembly is 0,4mm in X and Y direction between each key as shown in drill mask.

The drill diameter for the 6 contacts is 0,65mm.

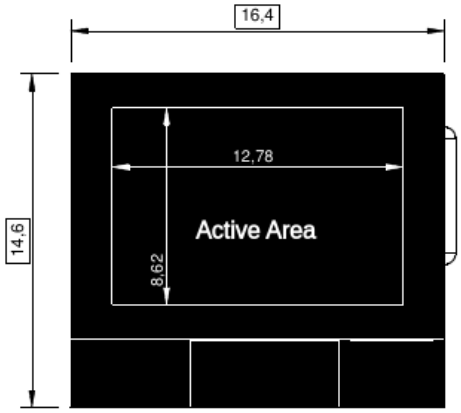
Socket Mount (optional)

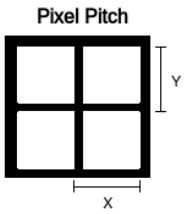


Liquid Crystal Display

LCD Specifications

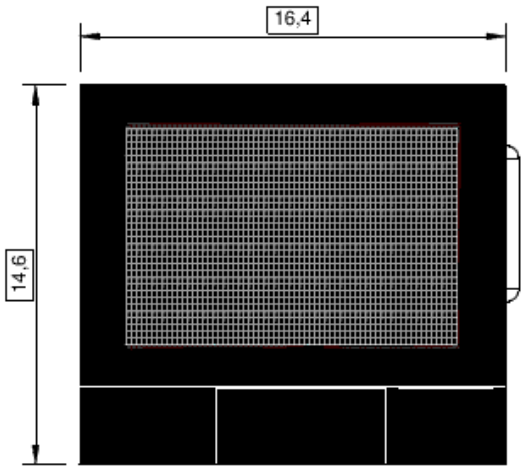
LCD type	DFSTN transmissive negative
Resolution	64 x 32 pixel
Active Area Size (X x Y)	12.78 mm x 8.62 mm
Pixel Size (X x Y)	0.19 x 0.26 mm
Pixel Spacing	0.01 mm
Pixel Pitch (X x Y)	0.20 x 0.27 mm
Viewing Direction	6 o'clock

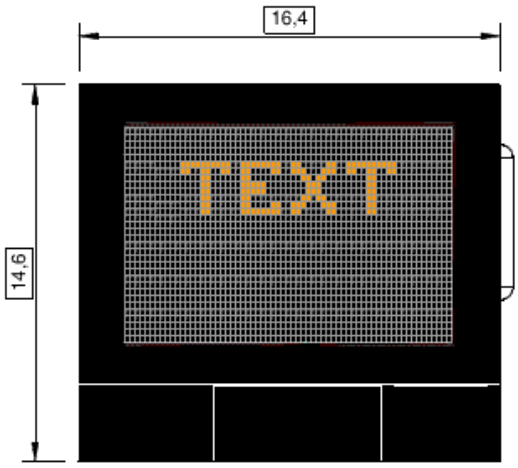




Standard Mode vs. Positive Mode

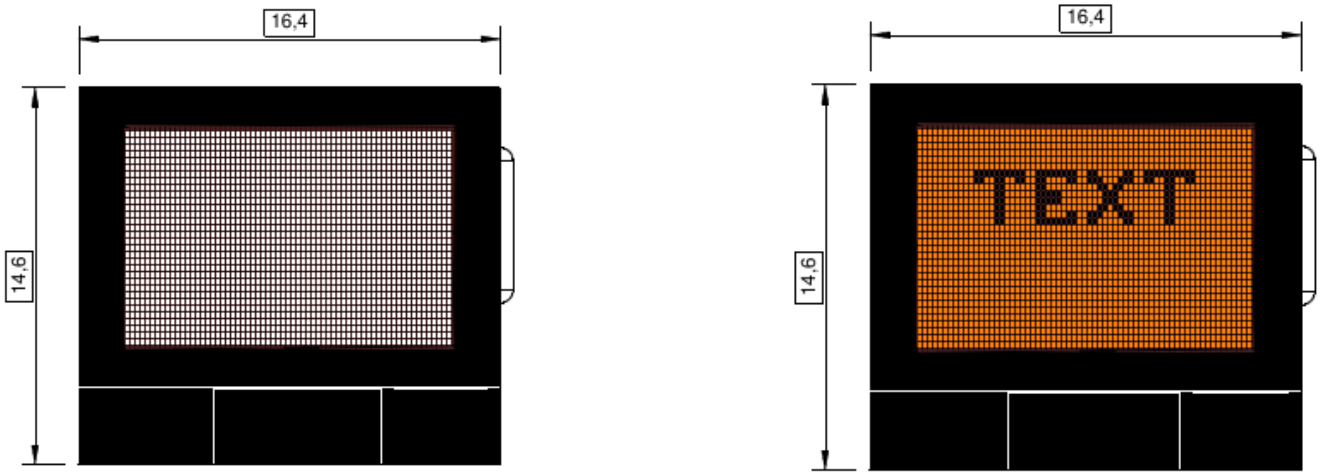
The TE6432 uses a transmissive inverse DFSTN LCD. In **Standard Mode** and on Power ON or RESET, all pixels are black and text is displayed in the selected background color as shown in the drawings below.





Positive Mode inverts the active area to make the pixels transmissive and shows black text on color background as shown in the drawings below.

You may switch between Standard and Positive Mode by using the Set Mode command 0x47 as described on pages 20 and 22.



NOTE: On Power OFF or RESET the setting will NOT be retained and the switches will revert to Standard Mode on Power ON.

TE6432 in Standard inverse Mode (top) and Positive Mode (bottom) with MSC™ colors.

RGB Backlighting

The TE6432 switches feature quad RGB LEDs for uniform backlighting in over 1 million colors. The background colors are set using the 0x41, 0x42 and 0x48 color commands described below.

Our production calibration system measures each of the color channels for each RGB LED and adjusts them for uniformity across large panels.

For more details see the Commands section on pages 19 and 20.

RGB Color Commands

The 0x41 and 0x42 commands are used to create a uniform background color. The 0x41 command uses 1 byte for color resolution, while the 0x42 command uses 3 bytes (1 byte resolution per color channel).

TE6432 with MSC™ colors (top) and RGB colors (bottom)

Multi-Segment Color MSC™

With the SE6432 and TE6432 Series we introduced Multi-Segment Color MSC™, which allows two different colors in the upper and lower segments to enable key grouping by color, while also using a different color for status indication.

MSC™ colors on control panel. Note the dynamic text in the MIC settings below using custom fonts.

Environmental Specifications

Operating temperature	0°C to 55°C
Humidity	up to 75% relative humidity at 65°C

Electrical Specifications

Operating voltage	4.5V to 5.5 V
Current consumption	max. 35 mA; typ. < 20 mA; min. 12 mA (backlite off)
Contact resistance	< 200 Ohm
Insulating resistance	> 100 MOhm

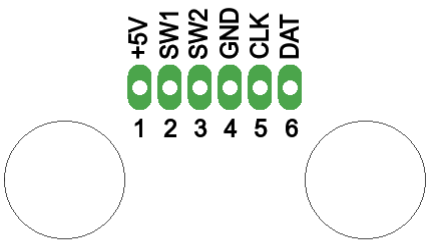
Symbol	*Parameter*	*Min.*	*Typ.*	*Max.*	*Unit*
V_{DD}*	Operating voltage	4.5		5.5	V
I_{DD}	Supply current	12	<20	35	mA
V_{IN}	Input voltage on any pin			V_{SS} -0.3 - V_{DD} +0.3	V
I_{DIO}	Output data current sunk/source			+/- 5	mA
I_{CIO}	Output clock current sunk/source			+/- 5	mA
V_{IL}	Input low level voltage	V_{SS} -0.3		0.3 x V_{DD}	V
V_{IH}	Input high level voltage	0.7 x V_{DD}		V_{DD} + 0.3	V

* Display contrast is hardware controlled and does not depend on the operating voltage

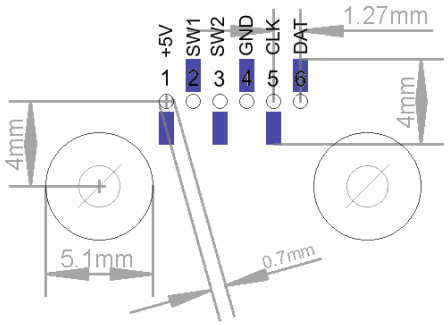
INTERFACING

Contact Terminals

Pin	Symbol	Description	Comment
1	+ 5V	positive power terminal	+4.5 V – +5.5 V
2	SW1	switch contact	contact resistance < 200 Ohm
3	SW2	switch contact	contact resistance < 200 Ohm
4	GND	negative (ground) power terminal	0.0 V
5	CLOCK	clock line to synchronize data write and for internal use	128 kHz – 4 Mhz HIGH when inactive
6	DATA	command and data line to internal *MSC* electronics	HIGH when inactive; see data format for details



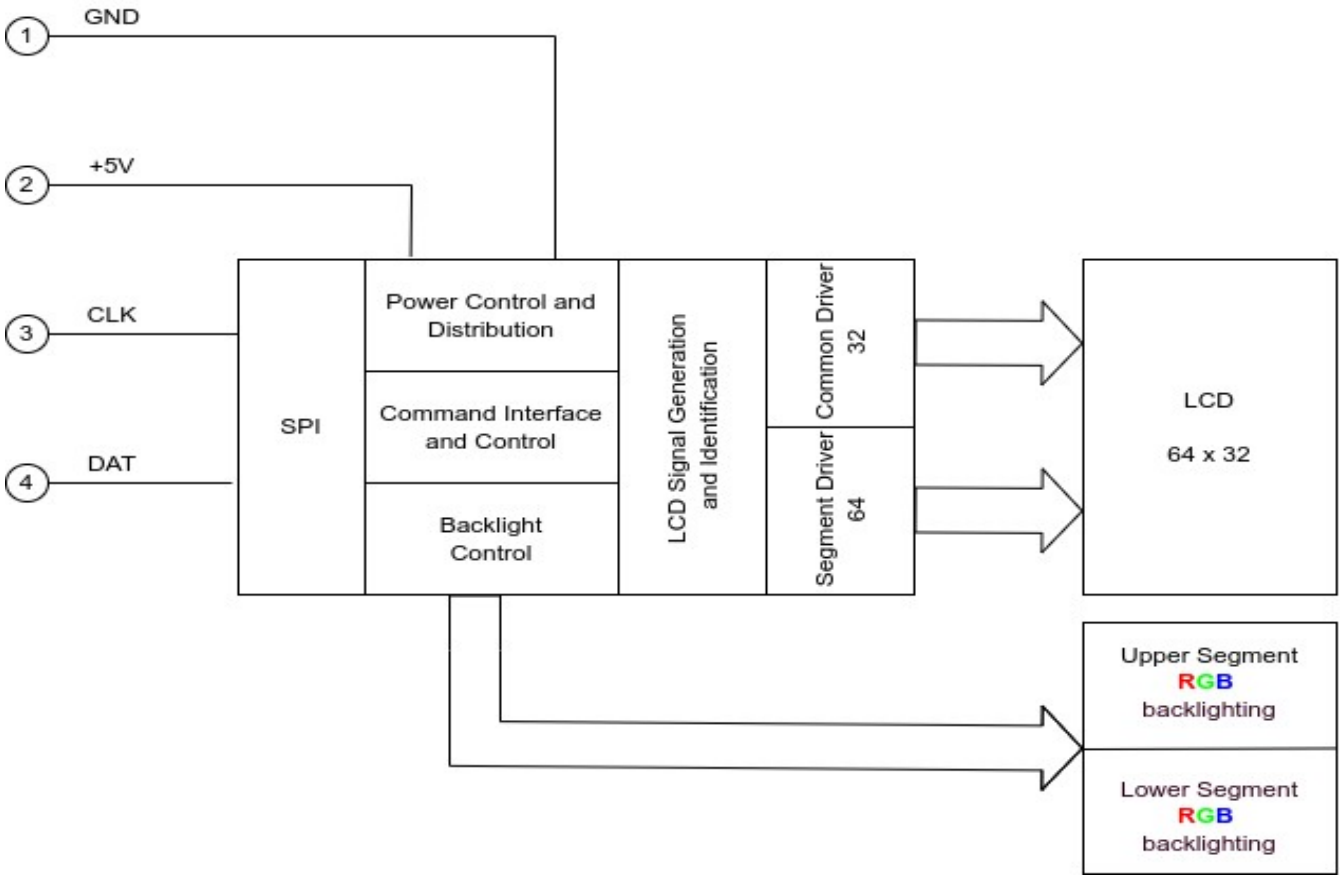
Top view on PCB



Top view Socket Mount (optional)

NOTE: **Six contact bottom entry socket pin connector SP0601 required on reverse of PCB, if the switches are to be socket mounted and not soldered onto PCB.**

Block Diagram

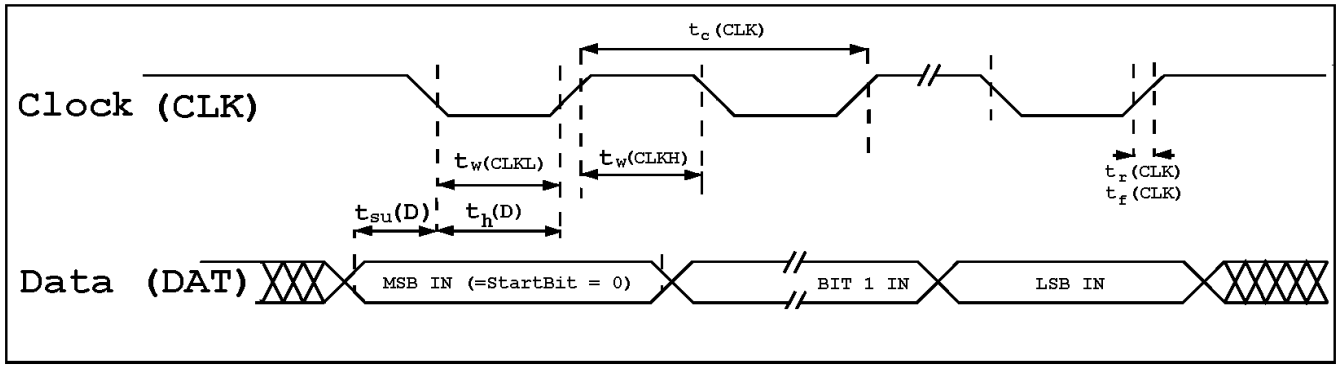


Serial Protocols

The TE6432 keyswitches are connected to the controlling central processing unit (host system) by a 2-wire SPI connection using a conventional synchronous protocol. A permanently applied clock is not necessary.

Legacy Mode™ is not supported in the TE6432 switches.

Timing Diagram



Symbol	Parameter	Min	Max	Unit
t_c(CLK)	SPI Clock frequency	0.128	4	MHz
t_w(CLKH)	Clock high time	45		ns
t_w(CLKL)	Clock low time	45		ns
t_{su}(D)	Data input setup time	10		ns
t_h(D)	Data input hold time	10		ns

COMMAND SET

Synchronous Protocol

The The 8-bit serial protocol supports the following commands:

- **Write Data to the LCD Display**
- **Set Backlight Color**
- **Extended Command Set**

The first two commands imply the required data and do not expect a return value from the key. The Read Keyswitch ID and Read Serial Number commands in the Extended Command set request information to be returned by the key. In this case, the ***MSC***™ electronics will generate their own clock signal for the data transmission.

For details on this scenario, see the **FAQ Section** on our website www.e3-keys.com/faqs.html.

Commands

Command Data	Command Name / Description	Comments
0x40	**Set Display Address & Write Display Data**	All writes to the display must be initiated by this command. Address pointer is auto-incremented by data transmission. The command expects min. 4 data words to follow: $0000000A_8$ $0000A_7A_6A_5A_4$ $0000A_3A_2A_1A_0$ $0000D_3D_2D_1D_0$ **Multiple Data Bytes may follow without additional addressing in one sequence since the controller will perform auto-increment.** Command can be terminated with 0x43 command (see below) Details are found in the Bit/Pixel Mapping Table on page 24.
0x41	**Set Color**	There is one data word to follow: $00R_1R_0G_1G_0B_1B_0$ The 2 bits for each color intensity have the following values: **00 = off 01 = low 10 = medium 11 = high**
0x42	**Set RGB Color**	There are 3 data bytes to follow: $0D_6D_5D_4D_3D_2D_1D_0$ $0D_6D_5D_4D_3D_2D_1D_0$ $0D_6D_5D_4D_3D_2D_1D_0$ ***Note:* The lower 10 values for each color brightness value should only be used for single color applications due to restrictions in the color calibration.**
0x43	**End Transmission**	Ends data transmission to keys and awaits next command sequence. Transmitted commands are processed and displayed. **This command should be placed at the end of a sequence.** ***Note:* The key will not respond to any command issued within 50µs after this command.**
0x44	**Read Keyswitch ID** THIS COMMAND FORCES THE KEYSWITCH TO ANSWER ON THE CLOCK AND DATA LINE.	The answer is consisting of ASCII characters representing the Keyswitch ID and is terminated with CR (0x0D): ***TE6432*** ***Note: Care should be taken when implementing this command since the clock signal is generated by the TE6432 switch!***

Command Data	Command Name / Description	Comments
0x45	**Read Serial Number** THIS COMMAND FORCES THE KEYSWITCH TO ANSWER ON THE CLOCK AND DATA LINE.	The answer is consisting of 4 Bytes which give the serial Number in the following format and is terminated with CR (0x0D): **SNYYWW#####** Year (04-99) - Week (01-52) - Number (00000 .. 99999) ***Note: Care should be taken when implementing this command since the clock signal is generated by the TE6432 switch.***
0x47 0x00	**Extended command,** **NOOP**	No Operation
0x47 0x01 0xXX 01000111 00000001 $D_7D_6D_5D_4D_3D_2D_1D_0$	**SetMode***	The display and/or backlight is enabled/disabled and or the display is inverted into Positive or Standard Mode while the bitmap data is maintained. All mode settings can be combined in the same command. D_7 = 1 set Group* / = 0 select Group D_6 = 1 Display ON* / = 0 Display OFF D_5 = 1 Backlite ON* / = 0 Backlite OFF D_4 = 1 set Display to Positive Mode* / = 0 set Display to Standard Mode $D_{3..0}$ = Group Number ***Note[1]:*** **D_7 = 1 not only specifies group, but executes command as well** ***Note[2]:*** **Please allow for 2µsec pause as this command has to be performed immediately** *** Mode settings will be lost after Power OFF**
0x47 0x7F 0xFF 256 x $D_7D_6D_5D_4D_3D_2D_1D_0$ 01000111 01111111 11111111 256 x Pixel Bytes	**Write Display Data**	The display is completely rewritten. 256 bytes of pixel data must follow. First byte is written to Pixel Position 0. **$D_7D_6D_5D_4D_3D_2D_1D_0$** **Note[1]: The amount of Data Bytes must exactly match 256.** **Note[2]: status of display on/off is unaffected.**
0x48 0xXX 0xXX 0xXX 0xXX 0xXX 0xXX 0x00 0x00 0x00	**Multi Segment Color MSC™**	Sets the RGB colors for Multi Segment Color™ in up to 3 segments (= 9 RGB color values) with color values of 0x00 to 0x7F for each color chan1nel. **0xXX 0xXX 0xXX (RGB colors for segment 1)** **0xXX 0xXX 0xXX (RGB colors for segment 2)** **0x00 0x00 0x00 (RGB colors for segment 3*)** *** Multi Segment Color MSC™ *in TE6432 switches available only for segments 1 and 2. Segment 3 RGB color values will be ignored and should be set to 0x00 0x00 0x00.***

Command Examples

Command Data	Comments
`0x40 0x00 0x00 0x00`	Set display address with 512 bytes of data following

```
0x06 0x00 0x00 0x00 0x00 0x00 0x00 0x00 ;* -                ##            :-   DC.B  0x06, 0x00, 0x00, 0x00
0x06 0x00 0x00 0x00 0x00 0x00 0x00 0x00 ;* -                ##            :-   DC.B  0x06, 0x00, 0x00, 0x00
0x06 0x00 0x00 0x00 0x00 0x00 0x00 0x00 ;* -                ##            :-   DC.B  0x06, 0x00, 0x00, 0x00
0x06 0x00 0x00 0x00 0x00 0x00 0x00 0x06 ;* -              ##  ##            :-   DC.B  0x06, 0x00, 0x00, 0x60
0x06 0x00 0x00 0x00 0x00 0x0F 0x00 0x06 ;* -     ####     ##  ##            :-   DC.B  0x06, 0x00, 0xF0, 0x60
0x06 0x00 0x00 0x00 0x08 0x0F 0x03 0x06 ;* -    #######   ##  ##            :-   DC.B  0x06, 0x00, 0xF8, 0x63
0x06 0x00 0x00 0x00 0x08 0x01 0x07 0x06 ;* -    ##   ###  ##  ##            :-   DC.B  0x06, 0x00, 0x18, 0x67
0x06 0x00 0x00 0x00 0x08 0x01 0x0C 0x06 ;* -    ##     ## ##  ##            :-   DC.B  0x06, 0x00, 0x18, 0x6C
0x06 0x00 0x00 0x00 0x08 0x01 0x08 0x07 ;* -    ##      ####  ##            :-   DC.B  0x06, 0x00, 0x18, 0x78
0x06 0x00 0x0C 0x05 0x08 0x01 0x00 0x07 ;* -    ##       ###  ##       ### #  :-   DC.B  0x06, 0x5C, 0x18, 0x70
0x06 0x00 0x0E 0x09 0x00 0x03 0x00 0x06 ;* -     ##       ##  ##      ####  # :-   DC.B  0x06, 0x9E, 0x30, 0x60
0x06 0x00 0x02 0x09 0x00 0x00 0x00 0x00 ;* -                 ##      #  #  # :-   DC.B  0x06, 0x92, 0x00, 0x00
0x06 0x00 0x02 0x09 0x00 0x00 0x00 0x00 ;* -                 ##      #  #  # :-   DC.B  0x06, 0x92, 0x00, 0x00
0x06 0x00 0x0E 0x0F 0x00 0x00 0x00 0x00 ;* -                 ##      ####### :-   DC.B  0x06, 0xFE, 0x00, 0x00
0x06 0x00 0x0C 0x07 0x00 0x0F 0x0C 0x03 ;* -     ####  ####  ##       #####  :-   DC.B  0x06, 0x7C, 0xF0, 0x3C
0x06 0x00 0x00 0x00 0x08 0x0F 0x0F 0x07 ;* -    ############ ##             :-   DC.B  0x06, 0x00, 0xF8, 0x7F
0x06 0x00 0x00 0x00 0x08 0x01 0x03 0x06 ;* -    ##   ##   ## ##             :-   DC.B  0x06, 0x00, 0x18, 0x63
0x06 0x00 0x02 0x07 0x08 0x01 0x03 0x06 ;* -    ##   ##   ## ##      #  ###  :-   DC.B  0x06, 0x72, 0x18, 0x63
0x06 0x00 0x0A 0x0F 0x08 0x01 0x03 0x06 ;* -    ##   ##   ## ##      # ##### :-   DC.B  0x06, 0xFA, 0x18, 0x63
0x06 0x00 0x0E 0x09 0x08 0x01 0x03 0x06 ;* -    ##   ##   ## ##      ####  # :-   DC.B  0x06, 0x9E, 0x18, 0x63
0x06 0x00 0x0C 0x08 0x00 0x03 0x00 0x03 ;* -     ##      ##  ##       ##   # :-   DC.B  0x06, 0x8C, 0x30, 0x30
0x06 0x00 0x00 0x00 0x00 0x00 0x00 0x00 ;* -                 ##            :-   DC.B  0x06, 0x00, 0x00, 0x00
0x06 0x00 0x02 0x00 0x00 0x00 0x00 0x00 ;* -                 ##      #     :-   DC.B  0x06, 0x02, 0x00, 0x00
0x06 0x00 0x02 0x00 0x00 0x00 0x0C 0x00 ;* -              ##    ##      #     :-   DC.B  0x06, 0x02, 0x00, 0x0C
0x06 0x00 0x0E 0x0F 0x08 0x0F 0x0F 0x07 ;* -    ############ ##      ####### :-   DC.B  0x06, 0xFE, 0xF8, 0x7F
0x06 0x00 0x0E 0x0F 0x08 0x0F 0x0F 0x07 ;* -    ############ ##      ####### :-   DC.B  0x06, 0xFE, 0xF8, 0x7F
0x06 0x00 0x00 0x00 0x08 0x01 0x0C 0x00 ;* -    ##     ##    ##            :-   DC.B  0x06, 0x00, 0x18, 0x0C
0x06 0x00 0x00 0x00 0x00 0x07 0x0C 0x00 ;* -     ###   ##    ##            :-   DC.B  0x06, 0x00, 0x70, 0x0C
0x06 0x00 0x0C 0x05 0x00 0x0C 0x0D 0x00 ;* -       ### ##    ##       ### #  :-   DC.B  0x06, 0x5C, 0xC0, 0x0D
0x06 0x00 0x0E 0x09 0x00 0x08 0x0F 0x00 ;* -         #####    ##      ####  # :-   DC.B  0x06, 0x9E, 0x80, 0x0F
0x06 0x00 0x02 0x09 0x00 0x00 0x0E 0x00 ;* -           ###    ##      #  #  # :-   DC.B  0x06, 0x92, 0x00, 0x0E
0x06 0x00 0x02 0x09 0x00 0x00 0x00 0x00 ;* -                  ##      #  #  # :-   DC.B  0x06, 0x92, 0x00, 0x00
0x06 0x00 0x0E 0x0F 0x00 0x00 0x00 0x00 ;* -                  ##      ####### :-   DC.B  0x06, 0xFE, 0x00, 0x00
0x06 0x00 0x0C 0x07 0x00 0x00 0x0E 0x01 ;* -            ####    ##       #####  :-   DC.B  0x06, 0x7C, 0x00, 0x1E
0x06 0x00 0x00 0x00 0x08 0x01 0x0F 0x03 ;* -    ##   ######   ##             :-   DC.B  0x06, 0x00, 0x18, 0x3F
0x06 0x00 0x06 0x00 0x08 0x09 0x03 0x07 ;* -    ##  ###  ###  ##      ##     :-   DC.B  0x06, 0x06, 0x98, 0x73
0x06 0x00 0x0E 0x03 0x08 0x09 0x01 0x06 ;* -    ##  ##    ##  ##      #####  :-   DC.B  0x06, 0x3E, 0x98, 0x61
0x06 0x00 0x08 0x0F 0x08 0x09 0x01 0x06 ;* -    ##  ##    ##  ##        ##### :-   DC.B  0x06, 0xF8, 0x98, 0x61
0x06 0x00 0x00 0x0C 0x00 0x03 0x03 0x07 ;* -     ##  ##  ###  ##           ## :-   DC.B  0x06, 0xC0, 0x30, 0x73
0x06 0x00 0x08 0x0F 0x00 0x0F 0x0F 0x03 ;* -     ##########   ##         ##### :-   DC.B  0x06, 0xF8, 0xF0, 0x3F
0x06 0x00 0x0E 0x03 0x00 0x0C 0x0F 0x01 ;* -       #######    ##      #####  :-   DC.B  0x06, 0x3E, 0xC0, 0x1F
0x06 0x00 0x06 0x00 0x00 0x00 0x00 0x00 ;* -                  ##      ##     :-   DC.B  0x06, 0x06, 0x00, 0x00
0x06 0x00 0x00 0x00 0x00 0x00 0x00 0x00 ;* -                  ##             :-   DC.B  0x06, 0x00, 0x00, 0x00
0x06 0x00 0x0C 0x0F 0x00 0x00 0x00 0x00 ;* -                  ##       ###### :-   DC.B  0x06, 0xFC, 0x00, 0x00
0x06 0x00 0x0E 0x0F 0x08 0x01 0x00 0x06 ;* -    ##        ##  ##      ####### :-   DC.B  0x06, 0xFE, 0x18, 0x60
0x06 0x00 0x02 0x00 0x08 0x01 0x03 0x06 ;* -    ##   ##   ## ##      #       :-   DC.B  0x06, 0x02, 0x18, 0x63
0x06 0x00 0x02 0x00 0x08 0x01 0x03 0x06 ;* -    ##   ##   ## ##      #       :-   DC.B  0x06, 0x02, 0x18, 0x63
0x06 0x00 0x0E 0x0F 0x08 0x01 0x03 0x06 ;* -    ##   ##   ## ##      ####### :-   DC.B  0x06, 0xFE, 0x18, 0x63
0x06 0x00 0x0E 0x0F 0x08 0x01 0x03 0x06 ;* -    ##   ##   ## ##      ####### :-   DC.B  0x06, 0xFE, 0x18, 0x63
0x06 0x00 0x00 0x00 0x08 0x0F 0x0F 0x07 ;* -    ############ ##             :-   DC.B  0x06, 0x00, 0xF8, 0x7F
0x06 0x00 0x00 0x00 0x08 0x0F 0x0F 0x07 ;* -    ############ ##             :-   DC.B  0x06, 0x00, 0xF8, 0x7F
0x06 0x0C 0x0E 0x0F 0x00 0x00 0x00 0x00 ;* -                 ##   ## ####### :-   DC.B  0xC6, 0xFE, 0x00, 0x00
0x06 0x0C 0x0E 0x0F 0x00 0x00 0x00 0x00 ;* -                 ##   ## ####### :-   DC.B  0xC6, 0xFE, 0x00, 0x00
0x06 0x00 0x00 0x00 0x08 0x01 0x00 0x00 ;* -    ##           ##             :-   DC.B  0x06, 0x00, 0x18, 0x00
0x06 0x00 0x00 0x00 0x08 0x01 0x00 0x00 ;* -    ##           ##             :-   DC.B  0x06, 0x00, 0x18, 0x00
0x06 0x00 0x00 0x00 0x08 0x01 0x00 0x00 ;* -    ##           ##             :-   DC.B  0x06, 0x00, 0x18, 0x00
0x06 0x00 0x00 0x00 0x08 0x0F 0x0F 0x07 ;* -    ############ ##             :-   DC.B  0x06, 0x00, 0xF8, 0x7F
0x06 0x00 0x00 0x00 0x08 0x0F 0x0F 0x07 ;* -    ############ ##             :-   DC.B  0x06, 0x00, 0xF8, 0x7F
0x06 0x00 0x00 0x00 0x08 0x01 0x00 0x00 ;* -    ##           ##             :-   DC.B  0x06, 0x00, 0x18, 0x00
0x06 0x00 0x00 0x00 0x08 0x01 0x00 0x00 ;* -    ##           ##             :-   DC.B  0x06, 0x00, 0x18, 0x00
0x06 0x00 0x00 0x00 0x08 0x01 0x00 0x00 ;* -    ##           ##             :-   DC.B  0x06, 0x00, 0x18, 0x00
0x06 0x00 0x00 0x00 0x00 0x00 0x00 0x00 ;* -                 ##             :-   DC.B  0x06, 0x00, 0x00, 0x00
0x06 0x00 0x00 0x00 0x00 0x00 0x00 0x00 ;* -                 ##             :-   DC.B  0x06, 0x00, 0x00, 0x00
0x06 0x00 0x00 0x00 0x00 0x00 0x00 0x00 ;* -                 ##             :-   DC.B  0x06, 0x00, 0x00, 0x00
* - End of Bitmap
```

Write Data to Display for **TE6432_inverse** bitmap

Command Data	Comments
`0x41`	Set color with 1 byte color command
`0x38`	**Red**: high intensity, **Green** medium intensity, **Blue** off 00**111**000 = **0x38**

Command Data	Comments
0x42	Set color with 3 byte color command
0x70 0x30 0x00	Set color with values **70 Red**, **30 Green**, **00 Blue**. 

Command Data	Comments
0x47 0x01	Sets key modes for display, backlite and group and terminate command (0x43)
0x47 0x01 0xE1 0x43	Set Group, Display ON, Backlite ON, Standard Mode, Group 1 = 11100001
0x47 0x01 0xC2 0x43	Set Group, Display OFF, Backlite ON, Standard Mode, Group 2 = 11000010
0x47 0x01 0x01 0x43	Select Group, Display OFF, Backlite OFF, Standard Mode, Group 1 = 00000001
0x47 0x01 0xE2 0x43	Set Group, Display ON, Backlite ON, Standard Mode, Group 2 = 11100010
0x47 0x01 0x72 0x43	Select Group, Display ON, Backlite ON, Positive Mode, Group 2 = 01110010
0x47 0x01 0x62 0x43	Select Group, Display ON, Backlite ON, Standard Mode, Group 2 = 01100010

Command Data	Comments
0x47 0x7F 0xFF	Write Display Data using 256 bytes
0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0xFF 0x7F 0xFE 0xFF 0xFF 0x7F 0xFE 0xFF 0xFF 0x7F 0xFE 0xFF 0xFF 0x7F 0xFE 0xFF 0xFF 0x7F 0xFE 0xFF 0xFF 0x7F 0xFE 0xFF 0x00 0x7E 0x7E 0x00 0x00 0x7E 0x7E 0x00 0x00 0x7E 0x7E 0x00 0x00 0x7E 0x7E 0x00 0x00 0x7E 0x7E 0x00 0x00 0x7E 0x7E 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x7E 0x00 0x77 0x00 0x08 0x80 0xFF 0x00 0x08 0x80 0xCD 0x00 0x7E 0x80 0xCD 0x00 0x00 0x80 0xC1 0x00 0x30 0x80 0xE3 0x00 0x48 0x00 0x63 0x00 0x7E 0x00 0x00 0x00 0x00 0x00 0x00	Data for **[E³ GmbH]** bitmap  Color command not shown.

Command Data	Comments
0x48 0x40 0x40 0x00 0x20 0x00 0x20 0x00 0x00 0x00	Set ***MSC*** colors for upper and lower segments Segment 1: sets color to pale yellow Segment 2: sets color to dark purple Segment 3: not supported in TE6432 switches (should be 0x00 0x00 0x00) 

Bit / Pixel Mapping

Please refer to the **Bit Mapping Table** below for the representative position of the bits in the data stream corresponding to the pixels of the LCD display. For java script and an example of the bitmapping routine, please visit http://www.e3-keys.com/technology.html#bitmapping .

Bit Mapping Table

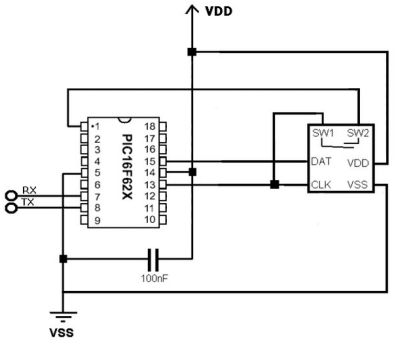
	Column 63	Column 62	Column 61	Column 60	...	Column 3	Column 2	Column 1	Column 0	
Address	1FCH	1F4H	1ECH	1E4H	...	1CH	14H	0CH	04H	
Row 16	D_0	D_0	D_0	D_0	...	D_0	D_0	D_0	D_0	
Row 17	D_1	D_1	D_1	D_1	...	D_1	D_1	D_1	D_1	
Row 18	D_2	D_2	D_2	D_2	...	D_2	D_2	D_2	D_2	
Row 19	D_3	D_3	D_3	D_3	...	D_3	D_3	D_3	D_3	
Address	1FDH	1F5H	1EDH	1E5H	...	1DH	15H	0DH	05H	
Row 20	D_0	D_0	D_0	D_0	...	D_0	D_0	D_0	D_0	
Row 21	D_1	D_1	D_1	D_1	...	D_1	D_1	D_1	D_1	
Row 22	D_2	D_2	D_2	D_2	...	D_2	D_2	D_2	D_2	
Row 23	D_3	D_3	D_3	D_3	...	D_3	D_3	D_3	D_3	
Address	1FEH	1F6H	1EEH	1E6H	...	1EH	16H	0EH	06H	
Row 24	D_0	D_0	D_0	D_0	...	D_0	D_0	D_0	D_0	
Row 25	D_1	D_1	D_1	D_1	...	D_1	D_1	D_1	D_1	
Row 26	D_2	D_2	D_2	D_2	...	D_2	D_2	D_2	D_2	
Row 27	D_3	D_3	D_3	D_3	...	D_3	D_3	D_3	D_3	
Address	1FFH	1F7H	1EFH	1E7H	...	1FH	17H	0FH	07H	
Row 28	D_0	D_0	D_0	D_0	...	D_0	D_0	D_0	D_0	
Row 29	D_1	D_1	D_1	D_1	...	D_1	D_1	D_1	D_1	
Row 30	D_2	D_2	D_2	D_2	...	D_2	D_2	D_2	D_2	
Row 31	D_3	D_3	D_3	D_3	...	D_3	D_3	D_3	D_3	
Address	1F8H	1F0H	1E8H	1E0H	...	18H	10H	08H	00H	Start
Row 0	D_0	D_0	D_0	D_0	...	D_0	D_0	D_0	D_0	
Row 1	D_1	D_1	D_1	D_1	...	D_1	D_1	D_1	D_1	
Row 2	D_2	D_2	D_2	D_2	...	D_2	D_2	D_2	D_2	
Row 3	D_3	D_3	D_3	D_3	...	D_3	D_3	D_3	D_3	
Address	1F9H	1F1H	1E9H	1E1H	...	19H	11H	09H	01H	
Row 4	D_0	D_0	D_0	D_0	...	D_0	D_0	D_0	D_0	
Row 5	D_1	D_1	D_1	D_1	...	D_1	D_1	D_1	D_1	
Row 6	D_2	D_2	D_2	D_2	...	D_2	D_2	D_2	D_2	
Row 7	D_3	D_3	D_3	D_3	...	D_3	D_3	D_3	D_3	
Address	1FAH	1F2H	1EAH	1E2H	...	1AH	12H	0AH	02H	
Row 8	D_0	D_0	D_0	D_0	...	D_0	D_0	D_0	D_0	
Row 9	D_1	D_1	D_1	D_1	...	D_1	D_1	D_1	D_1	
Row 10	D_2	D_2	D_2	D_2	...	D_2	D_2	D_2	D_2	
Row 11	D_3	D_3	D_3	D_3	...	D_3	D_3	D_3	D_3	
Address	1FBH	1F3H	1EBH	1E3H	...	1BH	13H	0BH	03H	
Row 12	D_0	D_0	D_0	D_0	...	D_0	D_0	D_0	D_0	
Row 13	D_1	D_1	D_1	D_1	...	D_1	D_1	D_1	D_1	
Row 14	D_2	D_2	D_2	D_2	...	D_2	D_2	D_2	D_2	
Row 15	D_3	D_3	D_3	D_3	...	D_3	D_3	D_3	D_3	

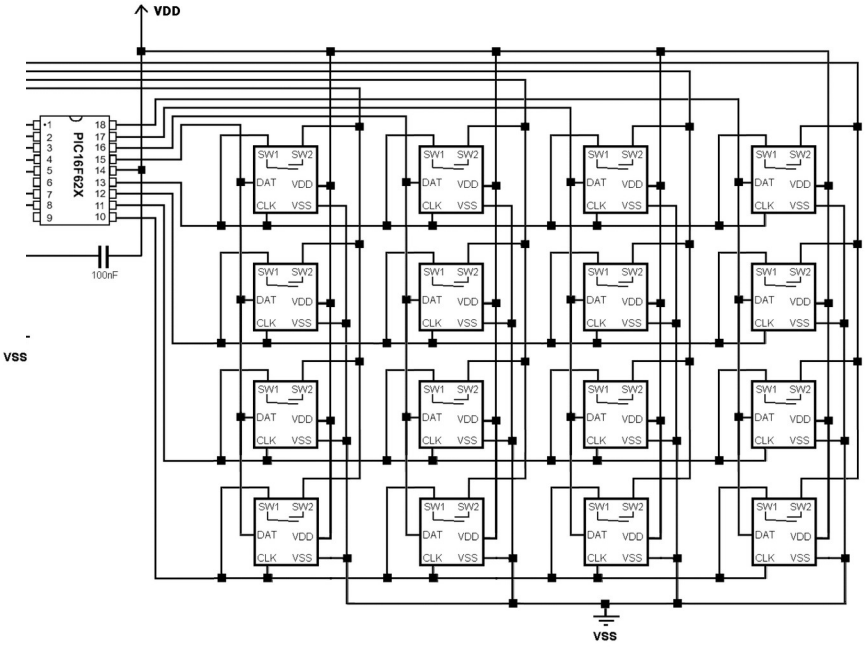
CONTROLLING TE6432 SWITCH ARRAYS

Below are sample schematics for controlling one or sixteen TE6432 keyswitches in an array using a PIC16F62X controller to illustrate the simplicity of the control circuitry.

For additional technical support with your own design implementation, please contact your local [E³] distributor or [E³] at techsupport@e3-keys.com.

In the above examples the clock and data signals are generated on the corresponding I/O pins of the PIC controller.





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Order Information

Part Number	Description
TE6432-B	TE pushbutton keyswitch with 64 x 32 pixel display inverse DFSTN display Backlit in > 1 million RGB and 2 segment MSC™ colors Black frame insert
TE6432-C	TE pushbutton keyswitch with 64 x 32 pixel display inverse DFSTN display Backlit in > 1 million RGB colors and 2 segment MSC™ colors Clear housing, no frame insert
SP0601	Socket pin connector for socket mounting of switches

Change History

Version	Date	Comments
0.1	03/12/19	Initial draft document
0.2	08/13/20	updated specifications and drawings
0.2x	08/13/20	Command and Mode Details (temporarily) deleted
0.3	01/13/23	TD6432/TE6432 specifications updated
0.4	04/14/23	Drawings, Mounting, Drill Mask, Contact Terminals updated
0.5	04/27/23	Updated images, mounting options clarified, keyswitch and electrical specifications confirmed
0.6	11/21/23	Updated footprint and drill mask drawing with contact hole diameter for direct and socket mount, contact terminal drawing; soldering specifications; key spacing; flammability ratings
0.7	02/27/24	Deleted SD/TD variants Positive Mode command and examples added Socket pin connector SP0601 specifications, article code added Socket Lock specifications, article code added
0.8	07/09/24	Socket pin connector information and drawings added. Socket lock SL0002 deleted. 3D images added.
0.9	10/09/24	New corporate address
0.10	02/20/25	Dimensions of active area corrected
1.0	07/11/25	Release Document

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