LC24.2 SCREENKEY DATASHEET

Part numbers

P126-1b and T126-1b (tactile)

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Contents

1. Technical Description

The LC24.2 ScreenKey is a push-button keyswitch with built-in graphics display. A liquid crystal STN display is integrated within the key, with a resolution of 36*24 pixels. A single-chip graphical LCD display controller in integrated into the key. Every pixel can be turned on or off individually, allowing the display of text or graphics. To control the display only a clock and data line (synchronous data transfer) as well as V_{CC} and GND are required.

Background lighting is integrated in the switch through the use of multiple Red and Green LED's. This allows the use of color-coding to improve and simplify operator interfacing. Flashing between alternate colors can be used to request operator attention or to flag an alarm event. A variety of backlighting colors can be achieved based on the RG spectrum. Each LED color supports two selectable brightness levels (dark or bright). The available background colors are bright green, dark green, bright red, dark red, bright orange, dark orange, red-orange and green-orange (see note below).

LC ScreenKeys are physically compatible with RGB ScreenKeys. They have the same footprint, same pin-out, have an identical package size, and use the same command interface. The only difference is how the backlight colors are selected.

LC24.2 ScreenKeys are offered with the standard LC Trend non-tactile configuration (P126-1b) or with a tactile operation (T126-1b) that incorporates enhanced operational cycle lifetime.

The LC24.2 ScreenKey is designed for printed circuit board assembly.

1.1. Applications

The multi-function LC24.2 ScreenKey, with its LCD display and multi-colored backlighting, is suited for any application requiring a man-machine interface. ScreenKey technology is ideal for many different markets and applications where multi-functional input is required including:

- Media and Broadcasting
- Audio/Visual Studio and Production Equipment
- Industrial controls
- Point-of-Sale, Point-of-Information
- Medical Devices
- Automotive Industry
- Aerospace
- Financial Services / Stock Trading
- Air Traffic Control
- Telecommunications

  etc.

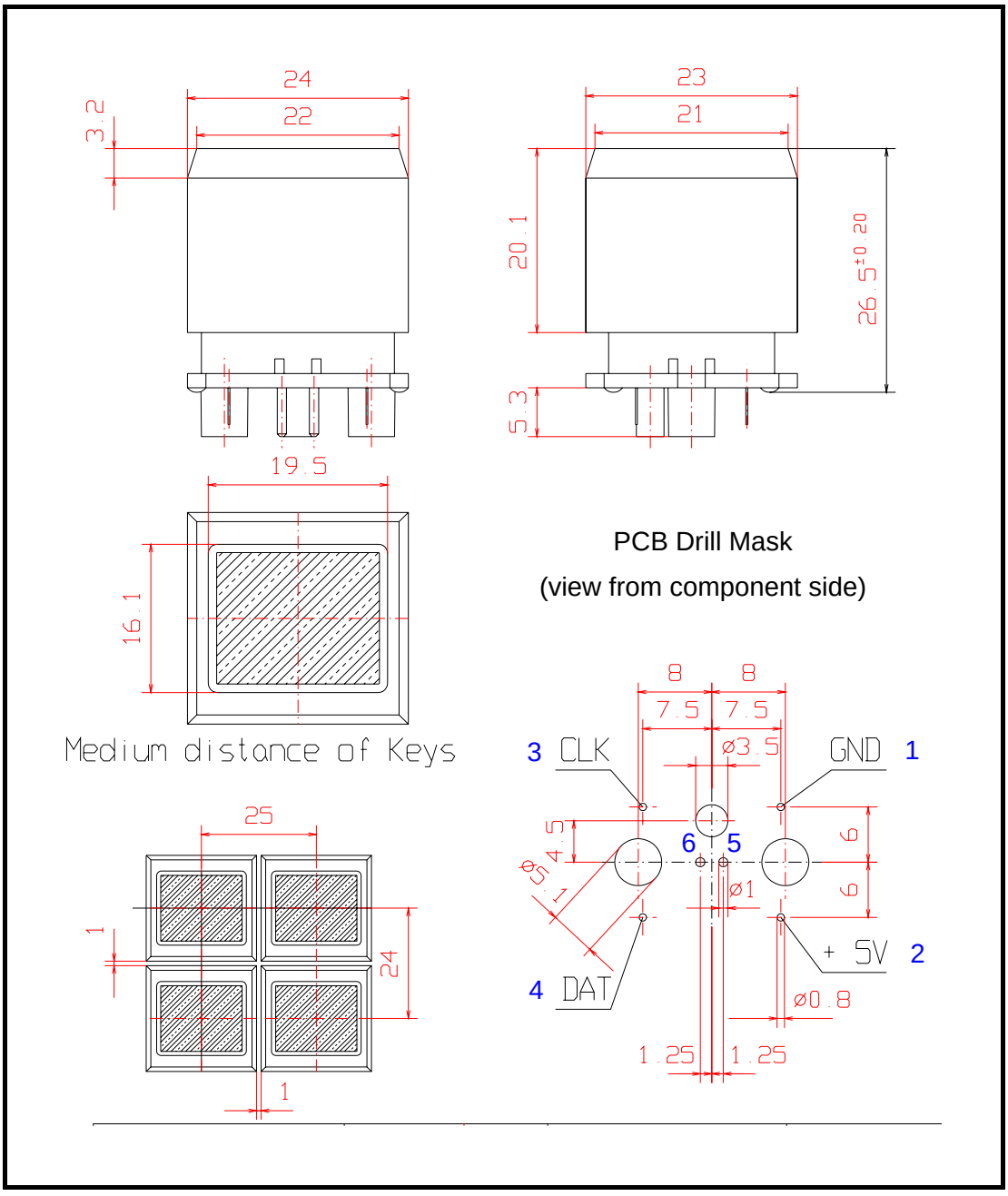
1.2. Advantages

The advantages of ScreenKeys are that they are simple to integrate into hardware, and software control of the LCD and LED backlighting is very straightforward. This allows for the easy integration of the switch into products without extensive development efforts.

- Only 6 contacts per ScreenKey (2 switch contact pins, 2 comms and 2 power)
- No external display controller required
- Greater signal effectiveness through multi-colored background lighting
- Display text, graphics or animation with 36*24 pixel resolution
- Fast data transmission due to high transmission rates (up to 4 MBaud)
- Display and background color refreshed internally
- Optimal illumination with 8 integrated LED's
- Positive feedback that function has been executed
- Tactile Feedback option
- Keyswitch lifetime of >3 million operations with tactile version (T126-1b)
- Intuitive user guidance through menu systems
- Multi-color backlighting based on RG spectrum
- LED's can operate at two different intensities (bright and dark)
- Identical technical and physical properties as the LC Trend Series
- Development Kits and Software Toolsets available

Note:
Due to variations in LED's and the bonding materials, color and brightness variations in the LC ScreenKeys cannot be eliminated. In order to provide consistent quality, it is preferable to use only the 2 basic LED colors (Red and Green) for standard backlighting. Composed colors should be used only on single displays as there may be visible differences between batches of ScreenKeys when displaying a composed color.

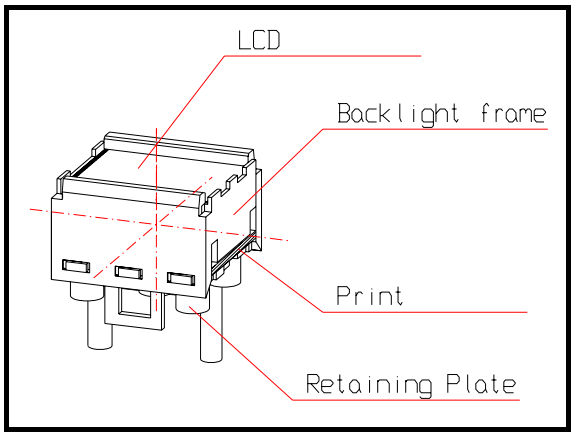
2. Dimensions



Drawing 2: Dimensions of LC24.2 ScreenKey in mm. Drill mask view from component side.

Note: For assembly in a keyswitch array, the distance between the displays should be at least 1 mm.

3. Display-Module

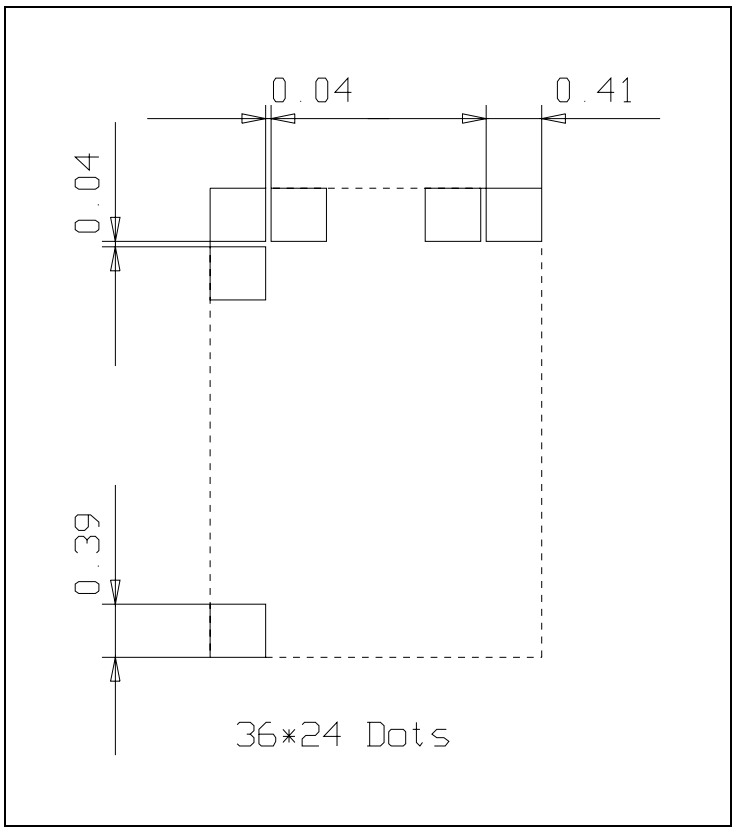


Drawing 3: LCD Module LC24.2.

3.1. Display Module Specifications

Description	Values
Connections	4 (V_{CC}, GND, CLK, Data)
Current consumption	max 87 mA
LCD Driver	integrated in ASIC
Pixel Area	14.74 mm x 10.52 mm
Viewing Angle	horizontal 100 degrees vertical 120 degrees

4. Liquid Crystal Display



Drawing 4: LCD - display area / pixel size in mm.

4.1. Liquid Crystal Display Specifications

Description	Values
Response Time	200 ms
Refresh Rate	64 Hz
Current Consumption	10 µA
Reflector	Transmissive
Contact	Elastomers (conductive rubber)
LCD Glass	STN, Yellow, Positive, Transflective
Pixel Matrix	36 columns x 24 rows
Pixel Size	0.41 mm x 0.39 mm
Orientation	6:00 o'clock
Operating Temperature	-10° ….. +70° Celsius
Storage Temperature	-20° ….. +80° Celsius
Humidity Storage/Operating	max. 80% relative at 40° Celsius
Life Cycle	5 – 7 years (life cycle from date of manufacture and may be reduced by exposure to excess humidity, temperature and ultra-violet light)

5. Key Switch

Description	Values
Circuit Voltage	5 Volts DC
Circuit Current	5 mA max.
Volume Resistance	< 200 Ohm
Insulating Resistance	> 100 MOhm
Contact bounce time	< 20 ms
Key Travel	2.4 mm
Operating Force	1.0 to 1.4 Newton
Durability	>1 Million operations (P126-1b) >3 Million operations (T126-1b)
Decoupling Diode	not present

6. Control

The LC24.2 ScreenKey is controlled by synchronous serial data transmission. This controls the multiplex frequency, the background lighting and the 36*24 pixel matrix in the display.

The clock is used for the internal control of the ASIC (data transfer, LCD refresh, etc.) and must be applied constantly.

Note: **Applying power to the LCD for extended periods when no clock is present may reduce the life of the LCD.**

The clock frequency can be between 50 kHz and 4 MHz. The minimum LCD repeat frequency is about 64Hz. In order to set this rate, the frequency register (internal address 0xEE) has to be loaded with a value from frequency value table (see 6.7).

Note: You may chose a value which is lower in order to increase the contrast ratio, but the given argument in the frequency value table **may not be exceeded at any time.** Optimum contrast and viewing angle is often achieved by over-clocking. To select the value for the OxEE register, choose the value which matches one-quarter of the actual clock frequency used.

To change the background colors, the corresponding value in the color register (internal address 0xED) must be changed. The values to set the colors are given in table 6.4.

Furthermore, the MUX register (internal addresses 0xEF - 0xF0) must be loaded with the values from table 6.6. The values in the MUX register are only valid if the value of the lowest 3 bits in register 0xEF are the inverse to the value of the lowest 3 bits in register 0xF0.

Starting at the internal addresses 0x80 are the pixel data values as per table 6.5.

The LC24.2 ScreenKey is addressed by transmitting a start-byte (always 0x00) on the serial line. After the start-byte, one of the following commands is expected:

Data	Description	Data Size
Command 0x80	to type pixel data into RAM.	max. 108 bytes
Command 0xED	to type color value into register.	1 byte
Command 0xEE	to type in frequency value into register	1 byte
Command 0xEF	to set MUX register	2 bytes
Command 0xAA	End byte	0 bytes

The data bytes follow the command, up to a maximum of 108 bytes for command 0x80, or otherwise one or two bytes per command. After the data bytes follows the end byte command 0xAA.

Note: The order Start Byte, Command Byte, Data Byte and End Byte must be adhered to. Since the data transfer to the LC24.2 ScreenKey is unidirectional, no values can be read from the display.

The Frequency and MUX registers should be written at least once after each Power On Reset (POR).

If the LC24.2 ScreenKey is loaded with values other than the ones given in the tables in this data sheet, the lifetime of the display may be reduced.

6.1. Parity Bit

A parity bit sent after every byte provides the differentiation between start byte, command and data bytes. The following assignments are valid:

Bytes	Parity
Start byte	Even
Command byte	Odd
Data bytes	Odd
End byte	Even

Even Parity:

The number of 1 bits in the byte should be supplied to ensure the total number of 1 bits is even.

Example: 00000000 Byte, Parity Bit = 0
00110111 Byte, Parity Bit = 1

Odd Parity:

The number of 1 bits in the byte should be supplied to ensure the total number of 1 bits is odd.

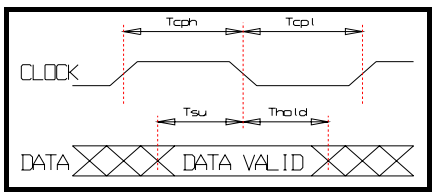
Example: 00000000 Byte, Parity Bit = 1
00110111 Byte, Parity Bit = 0

Note: The parity bit is not used to differentiate between Start/End Byte and the Command/Data Bytes and is not used for security purposes.

6.2. Timing Bit

For serial transmission of data to the display, the following conditions must be adhered to.

- Clock frequency max F_{max} 4 MHz
- Clock frequency min F_{min} 50 kHz
- Clock phase low max T_{cpl} 20 µs
- Clock phase low min T_{cpl} 125 ns
- Clock phase high max T_{cph} 20 µs
- Clock phase high min T_{cph} 125 ns
- Hold data min T_{hold} 10 ns
- Setup data min T_{su} 40 ns

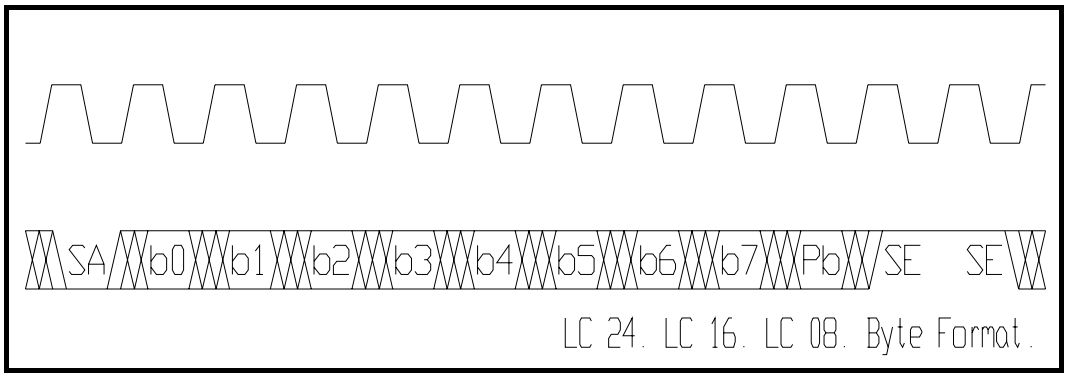


Drawing 6.2: Timing diagram

6.3. Data Byte Format

12 bits are required for the transmission of a byte.

- Start bit low SA
- Data bit low / high b0 - b7 (LSB first, MSB last)
- Parity bit low / high Pb
- 2 Stop bits high SE



Drawing 6.3: Byte format

6.4. Background Lighting

	B7	B6	B5	B4	B3	B2	B1	B0
Color	Red	red	green	green	red	red	green	green
Function (0/1)	dark / bright	dark / bright	dark / bright	dark / bright	off / on	off / on	off / on	off / on

Combinations of red and green are possible by setting the corresponding bits in the color register (0xED).

The following table shows some possible values for backlighting colors:

Color	HEX Value	Binary Value
Off	0x00	00000000
dark green	0x03	00000011
bright green	0x33	00110011
dark red	0x0C	00001100
bright red	0xCC	11001100
dark orange	0x0F	00001111
bright orange	0xFF	11111111
Greenish orange	0x3F	00111111
Reddish orange	0xCF	11001111

Table 6.4: Backlighting values for register 0xED

Note: Due to variations in LED's and the bonding materials, color and brightness variations in LC ScreenKeys cannot be eliminated. In order to provide consistent quality, it is preferable to use only the 2 basic LED colors (Red and Green) for standard backlighting.

Composed colors should be used only on single displays as there may be visible differences between batches of ScreenKeys when displaying a composed color.

*For further details, please refer to the **Color Selection Chart** available for download at www.screenkeys.com.*

Example – Changing background lighting to Bright Red:
Set decoder to address the display
`0x00 e, 0xED o, 0xCC o, 0xAA e`

6.5. Bit Mapping

Each bit in the data stream corresponds to a pixel in the display area. A 1-bit represents a black pixel, a 0-bit a light pixel. The allocation is shown in the following table. The upper line is the Byte number; the lower line shows the corresponding bits per pixel.

B4			B3				B2				B1				B0		
b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0
B8				B7				B6				B5				B4			
b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4
B13				B12				B11				B10				B9			
b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0
B17				B16				B15				B14				B13			
b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4
B22				B21				B20				B19				B18			
b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0
B26				B25				B24				B23				B22			
b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4
B31				B30				B29				B28				B27			
b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0
B35				B34				B33				B32				B31			
b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4
B40				B39				B38				B37				B36			
b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0
B44				B43				B42				B41				B40			
b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4
B49				B48				B47				B46				B45			
b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0
B53				B52				B51				B50				B49			
b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4
B58				B57				B56				B55				B54			
b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0
B62				B61				B60				B59				B58			
b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4
B67				B66				B65				B64				B63			
b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0
B71				B70				B69				B68				B67			
b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4
B76				B75				B74				B73				B72			
b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0
B80				B79				B78				B77				B76			
b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4
B85				B84				B83				B82				B81			
b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0
B89				B88				B87				B86				B85			
b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4
B94				B93				B92				B91				B90			
b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0
B98				B97				B96				B95				B94			
b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4
B103				B102				B101				B100				B99			
b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0
B107				B106				B105				B104				B103			
b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4	b3	b2	b1	b0	b7	b6	b5	b4

left half of display **right half of display**

Table 6.5: Bit Mapping

6.6. MUX Register

The MUX register controls the internal frequency divider for the control of the LCD and must be programmed with the values in table 6.6 to achieve optimum LCD contrast. Otherwise, loss of contrast or scrambled displays may result.

Description	Address	Value
MUX	0xEF	0x07
	0xF0	0x00

Table 6.6: MUX register

6.7. Frequency Value Table

The clock frequency can be set in a range from 50kHz to 4MHz. In the LC24.2 ScreenKey, the clock frequency will be divided down by a factor, which is set through the frequency register (0xEE). The aim is to set the LCD repeat frequency at a value of at least 64Hz. In the table below, the left column indicates the calculated clock frequency. In the right hand column the appropriate maximum data value to be entered in the frequency register is listed.

Note: The value given is the maximum value. It is possible to enter up to 75% lower frequency values. The best contrast will be found at values of less than 50% of the maximum allowed value for operating temperatures at about 21 degrees Celsius.

Example: The clock frequency is 500kHz; the corresponding value in the table is 0x68. Any value between the frequencies 125kHz (value 0x28) to 500kHz (value 0x68) may be entered.

Clock	Reg. 0xEE
49,92kHz	00
53,04kHz	02
56,16kHz	04
59,28kHz	06
62,40kHz	08
65,52kHz	0A
68,64kHz	0C
71,76kHz	0E
74,88kHz	10
78,00kHz	12
81,12kHz	14
84,24kHz	16
87,36kHz	18
90,48kHz	1A
93,60kHz	1C
96,72kHz	1E
99,84kHz	20
106,1kHz	22
112,3kHz	24
118,6kHz	26
124,8kHz	28
131,0kHz	2A
137,3kHz	2C
143,5kHz	2E
149,8kHz	30
156,0kHz	32
162,2kHz	34
168,5kHz	36
174,7kHz	38
181,0kHz	3A
187,2kHz	3C
193,4kHz	3E
199,7kHz	40
212,2kHz	42
224,6kHz	44

Clock	Reg. 0xEE
237,1kHz	46
249,6kHz	48
262,1kHz	4A
274,6kHz	4C
287,0kHz	4E
299,5kHz	50
312,0kHz	52
324,5kHz	54
337,0kHz	56
349,4kHz	58
361,9kHz	5A
374,4kHz	5C
386,9kHz	5E
399,4kHz	60
424,3kHz	62
449,3kHz	64
474,2kHz	66
499,2kHz	68
524,2kHz	6A
549,1kHz	6C
574,1kHz	6E
599,0kHz	70
624,0kHz	72
649,0kHz	74
673,9kHz	76
698,9kHz	78
723,8kHz	7A
748,8kHz	7C
773,8kHz	7E
798,7kHz	80
848,6kHz	82
898,6kHz	84
948,5kHz	86
998,4kHz	88
1,048MHz	8A

Clock	Reg. 0xEE
1,098MHz	8C
1,148MHz	8E
1,198MHz	90
1,248MHz	92
1,298MHz	94
1,348MHz	96
1,398MHz	98
1,448MHz	9A
1,498MHz	9C
1,548MHz	9E
1,597MHz	A0
1,697MHz	A2
1,797MHz	A4
1,897MHz	A6
1,997MHz	A8
2,097MHz	AA
2,196MHz	AC
2,296MHz	AE
2,396MHz	B0
2,496MHz	B2
2,596MHz	B4
2,696MHz	B6
2,796MHz	B8
2,895MHz	BA
2,995MHz	BC
3,095MHz	BE
3,195MHz	C0
3,395MHz	C2
3,594MHz	C4
3,794MHz	C6
4,000 MHz	C8

6.8. Programming Example

Given is a clock frequency of 500kHz, a switch pad with 4 LC24.2 ScreenKeys, each of which is supplied with the data stream by a decoder. The decoder chooses 4 switch addresses. These addresses are called ADR0, ADR1, ADR2 and ADR3. The displays will be first be cleared (reset). Afterwards, a frame with a thickness of 2 pixels will be displayed on the LC24.2 ScreenKey under ADR3. The LC24.2 ScreenKey with ADR1 receives Dark Blue background lighting.

First, the data for the frequency register (0xEE) is determined from table 6.7: the data value 0x68 is is specified for the value 499,2 kHz. For best contrast ratio, use the value equivalent to 25% of the actual clock. The value for 125KHz is 0x28. To initialize the MUX register, the command 0xEF from table 6.6. is used.

The pixel data to erase the display is 0x00 (all pixels off). The data value for Bright Red background lighting is taken from table 6.4. as 0xCC. The pixel data for the frame is taken from the bit-mapping table 6.5. Parity is shown as ‘o’ for odd parity, ‘e’ for even parity.

Program all ScreenKey displays with frequency value
Set decoder to all 4 addresses one after the other.
`0x00 e, 0xEE o, 0x28 o, 0xAA e`

Initialize MUX register for all ScreenKey displays
Set decoder to all 4 addresses one after the other.
`0x00 e, 0xEF o, 0x07 o, 0x00 o, 0xAA e`

Switch off background lighting to all ScreenKey displays
Set decoder to all 4 addresses one after the other.
`0x00 e, 0xED o, 0x00 o, 0xAA e`

Inscribe all ScreenKeys with blanks
Set decoder to all 4 addresses one after the other.

`0x00 e, 0x80 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o,`
`0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o,`
`0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o,`
`0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o,`
`0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o,`
`0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o,`
`0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o,`
`0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o,`
`0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o, 0x00 o,`
`0x00 o, 0x00 o, 0xAA e`

Inscribe the ScreenKey under ADR3 with a frame
Set decoder to address ADR3.

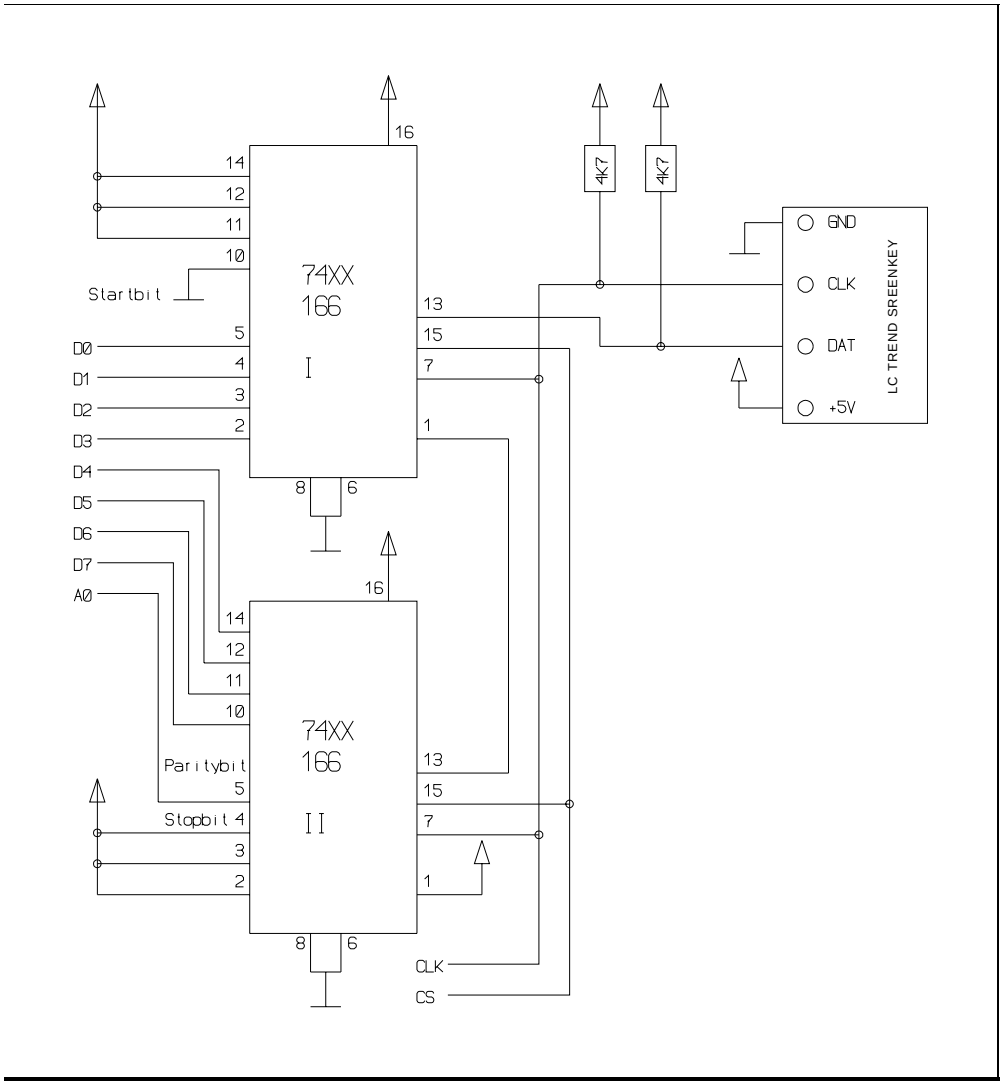
`0x00 e, 0x80 o, 0xFF o, 0xFF o, 0xFF o, 0xFF o, 0xFF o, 0xFF o, 0xFF o, 0xFF o, 0xFF o, 0x03 o,`
`0x00 o, 0x00 o, 0x00 o, 0x3C o, 0x00 o, 0x00 o, 0x00 o, 0xC0 o, 0x03 o, 0x00 o, 0x00 o, 0x00 o,`
`0x3C o, 0x00 o, 0x00 o, 0x00 o, 0xC0 o, 0x03 o, 0x00 o, 0x00 o, 0x00 o, 0x3C o, 0x00 o, 0x00 o,`
`0x00 o, 0xC0 o, 0x03 o, 0x00 o, 0x00 o, 0x00 o, 0x3C o, 0x00 o, 0x00 o, 0x00 o, 0xC0 o, 0x03 o,`
`0x00 o, 0x00 o, 0x00 o, 0x3C o, 0x00 o, 0x00 o, 0x00 o, 0xC0 o, 0x03 o, 0x00 o, 0x00 o, 0x00 o,`
`0x3C o, 0x00 o, 0x00 o, 0x00 o, 0xC0 o, 0x03 o, 0x00 o, 0x00 o, 0x00 o, 0x3C o, 0x00 o, 0x00 o,`
`0x00 o, 0xC0 o, 0x03 o, 0x00 o, 0x00 o, 0x00 o, 0x3C o, 0x00 o, 0x00 o, 0x00 o, 0xC0 o, 0x03 o,`
`0x00 o, 0x00 o, 0x00 o, 0x3C o, 0x00 o, 0x00 o, 0x00 o, 0xC0 o, 0x03 o, 0x00 o, 0x00 o, 0x00 o,`
`0x3C o, 0x00 o, 0x00 o, 0x00 o, 0xC0 o, 0xFF o, 0xFF o, 0xFF o, 0xFF o, 0xFF o, 0xFF o, 0xFF o,`
`0xFF o, 0xFF o, 0xAA e`

Give display under ADR0 Dark Blue backlighting color
Set decoder to ADR0.
`0x00 e, 0xED o, 0xCC o, 0xAA e`

7. Application

7.1. Application Control of ScreenKeys via Shift Register

A ScreenKey is connected to a microprocessor bus via 2 shift registers. The microprocessor provides the signals for D0 - D7, parity bit A0. CS and CLK are also required.



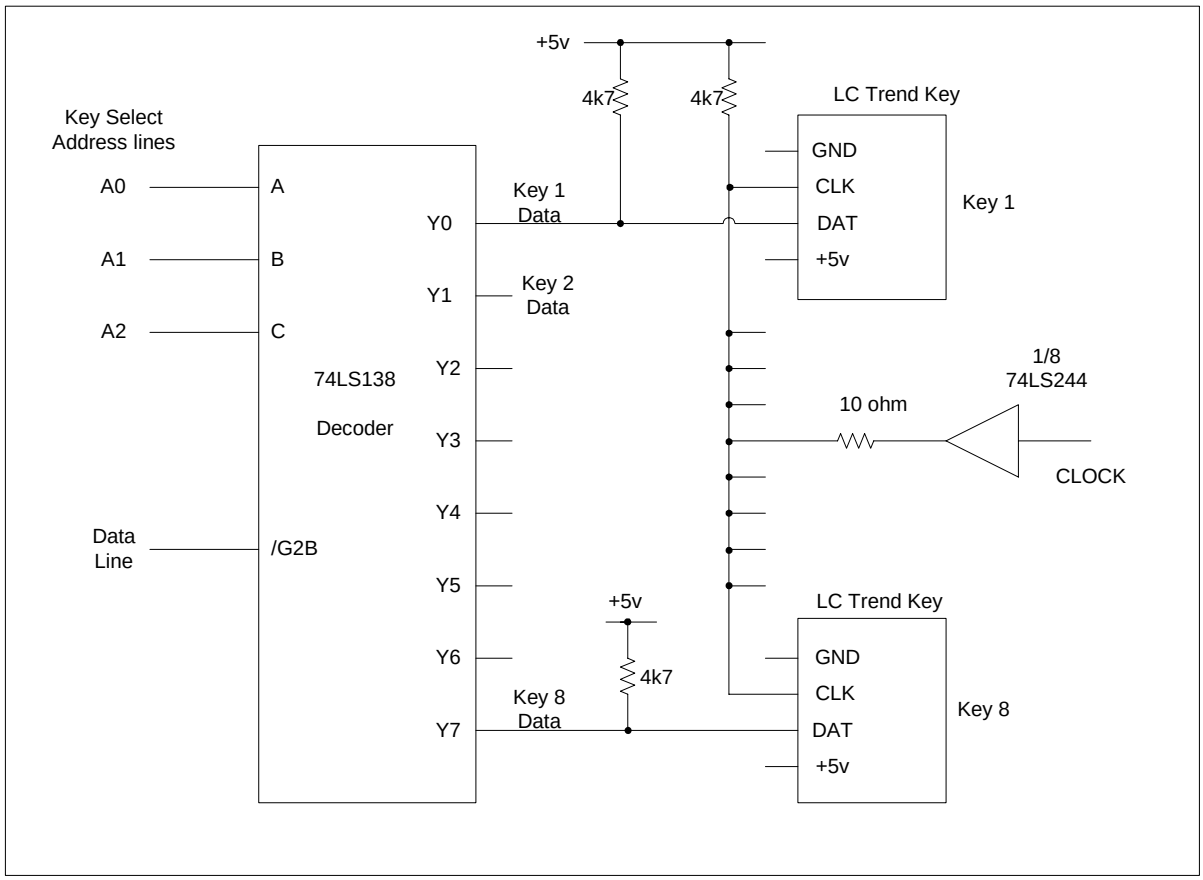
Drawing 7.1: Control parallel / serial.

Note: The data line must be set to high when inactive (no data transmission – stop bit) to avoid erroneous data transfers.

7.2. Control of Multiple ScreenKeys

To control several ScreenKeys, the data stream may be switched via a decoding circuit to each ScreenKey. The other keys receive a high signal, which produces stop bits.

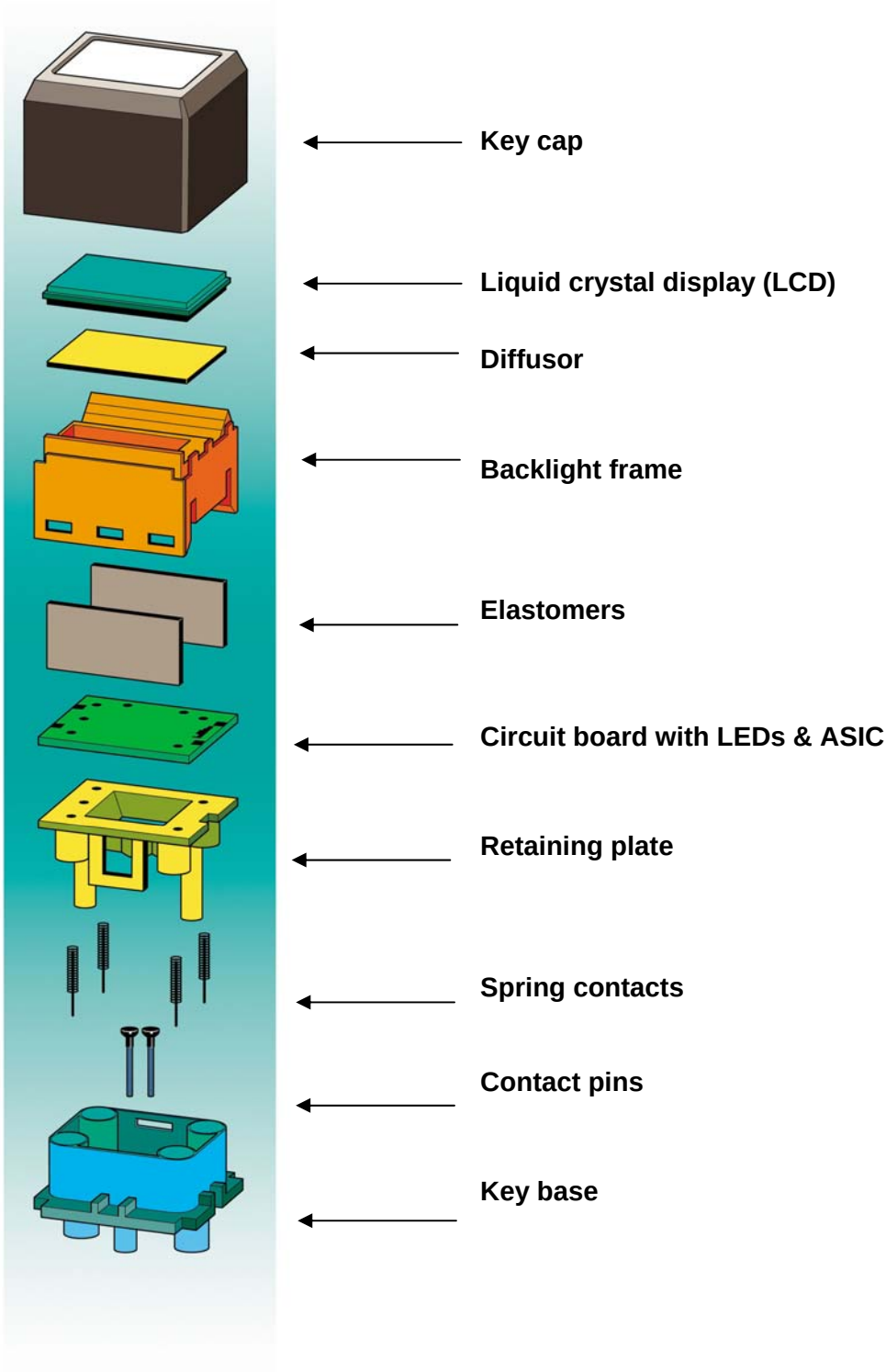
Due to the input capacitance of a ScreenKey, no more than 8 ScreenKeys should be directly driven from one TTL Clock Line. A line driver, as shown below, should be used to drive more than 8 ScreenKeys.



Drawing 7.2: Decoding circuit for multiple Screenkeys

Note: It is recommended to fit a 0.1uF decoupling capacitor across the power lines of each ScreenKey.

8. Parts Drawing



9. Technical Specifications

Description	Values
Dimensions (L x W x H)	24.0 x 23.0 x 26.5 mm + / - 0,2 mm
Screen Size (X x Y)	19.5 x 16.1 mm + / - 0.1 mm
Pixel Field Size (X x Y)	14.74 mm x 10.28mm
Pixel Size (X x Y)	0.41 x 0.39 mm
Pixel Matrix (X x Y)	36 x 24
Operating voltage	4.9 - 5.0 Volt (at operating temperature)
Current Consumption	max. 87 mA, typ. 43 mA
LED Backlighting	green, dark green, red, dark red, orange, dark orange, reddish-orange and greenish-orange
Operation Temperature	-10° to +70° Celsius
Humidity	max. 80 % relative at 40° Celsius
Storage Temperature	-20° to +80° Celsius
Manually solderable at	350° Celsius, 3.5 seconds
Wave solderable at	260° Celsius, 10 seconds

10. UL Material Listings

Description	Material	UL Listing	UL File
Display window	MAKROLON 2805 PC	UL 94 V2	A070
Key cap	Novodur P2H-AT ABS	UL 94 HB	CO10
Backlight frame	HOSTAFORM POM	UL 94 HB	E42337A
Retaining plate	HOSTAFORM POM	UL 94 HB	E42337A
Key body	MAKROLON 2805 PC	UL 94 V2	A070
Diffusor	Polycarbonate	UL 94 V2	E41613

11. Order Information

Order No.	Description
P126-1b	LC24.2 ScreenKey (Black)
T126-1b	LC24.2 ScreenKey (Black) with Tactile Feedback

12. Contact Information

For further information on LC ScreenKeys, RGB ScreenKeys and other information, including technical documentation, datasheets, user manuals and software downloads, development and prototyping tools, please visit our website at: www.screenkeys.com or email us at info@screenkeys.com.

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