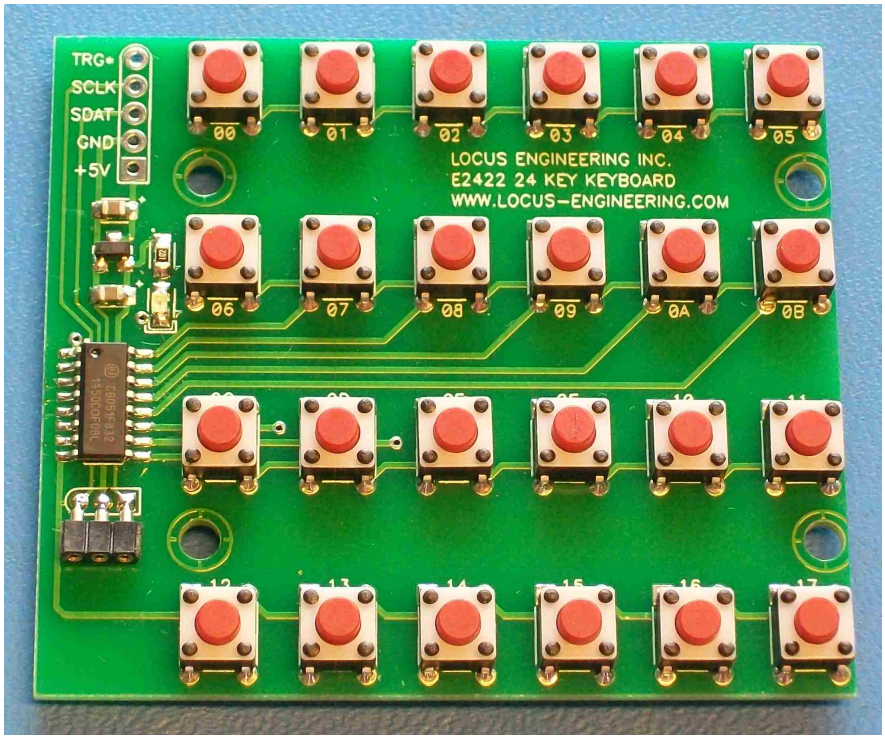
Locus Engineering Inc. E2422

24 Key Keyboard with Clocked Data Output



FEATURES

- 4x6 keyswitch array
- exclusive 8 bit code (00h to 17h) for each of 24 keys
- 20msec debounced keys
- output on make of key closure
- 2 key rollover
- typematic function, 5cps after 600ms key closure
- 100KHz clocked data output
- trigger pulse output
- TTL compatible outputs
- +3.3V to +6V operation
- 2.4mA supply current
- 2.6”W x 2.3”H size
- 0.375”H x 0.625”V keyswitch grid
- #4 mounting holes on 2.00”H by 1.25”V

DESCRIPTION

The E2422 Decoded 24 Key Keyboard provides a debounced 8 bit code with clocked data output on the make of each key closure. The 100KHz output is similar to a PS/2 interface and is framed by a trigger signal being active prior to the serial output and de-activated after it is sent. A depressed key must be released before other succeeding pressed keys are recognized. The keys are on a 0.375”H by 0.625”V grid which allows for labelling space and the keyboard is easily mounted with #4 hardware or standoffs. Power input is +3.3V to +6V and the outputs are TTL compatible.

APPLICATIONS

- custom keyboards
- industrial controls
- robotics

Table 1. Absolute Maximum Ratings

Parameter	Rating
Input Voltage to GND	-0.3 to +6.5V
Operating temperature range	-40 to +85°C
Storage temperature range	-65 to +150°C
Maximum output current through port pin	100mA
Maximum total current through Vdd or GND	300mA

Table 2. Electrical Characteristics

Test Conditions: Supply Voltage V_{dd} = +5.0V, $T_{ambient}$ = 25° C, unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{dd}	Supply voltage	3.3	5.0	6.00	V
I_{dd}	Supply current		5.4		mA
V_{OH}	Digital high output voltage	2.5V @Iout -10mA	2.6V @Iout -3mA	3.2V @Iout -10µA	V
V_{OL}	Digital low output voltage	0.1V @Iout 10µA	0.6V @Iout 10mA	1.0V @Iout 25mA	V
$T_{debounce}$	Debounce time		20		msec
T_{di}	Interrupt start to Data valid		50		µsec
$T_{interrupt}$	Interrupt pulse width		8		msec
F_{baud}	Clocked data rate		100		KHz
$T_{typematic}$	Typematic delay		600		msec
F_{repeat}	Typematic repeat		5		cps

General Precautions

Charged devices and circuit boards can discharge without warning. Proper ESD precautions should be followed to avoid failure.

This device is not authorized for use in any product where the failure or malfunction of the product can reasonably be expected to cause failure in a life support system or to significantly affect its operation.

Locus Engineering Inc. reserves the right to make changes at any time without notice to improve product features or reliability.

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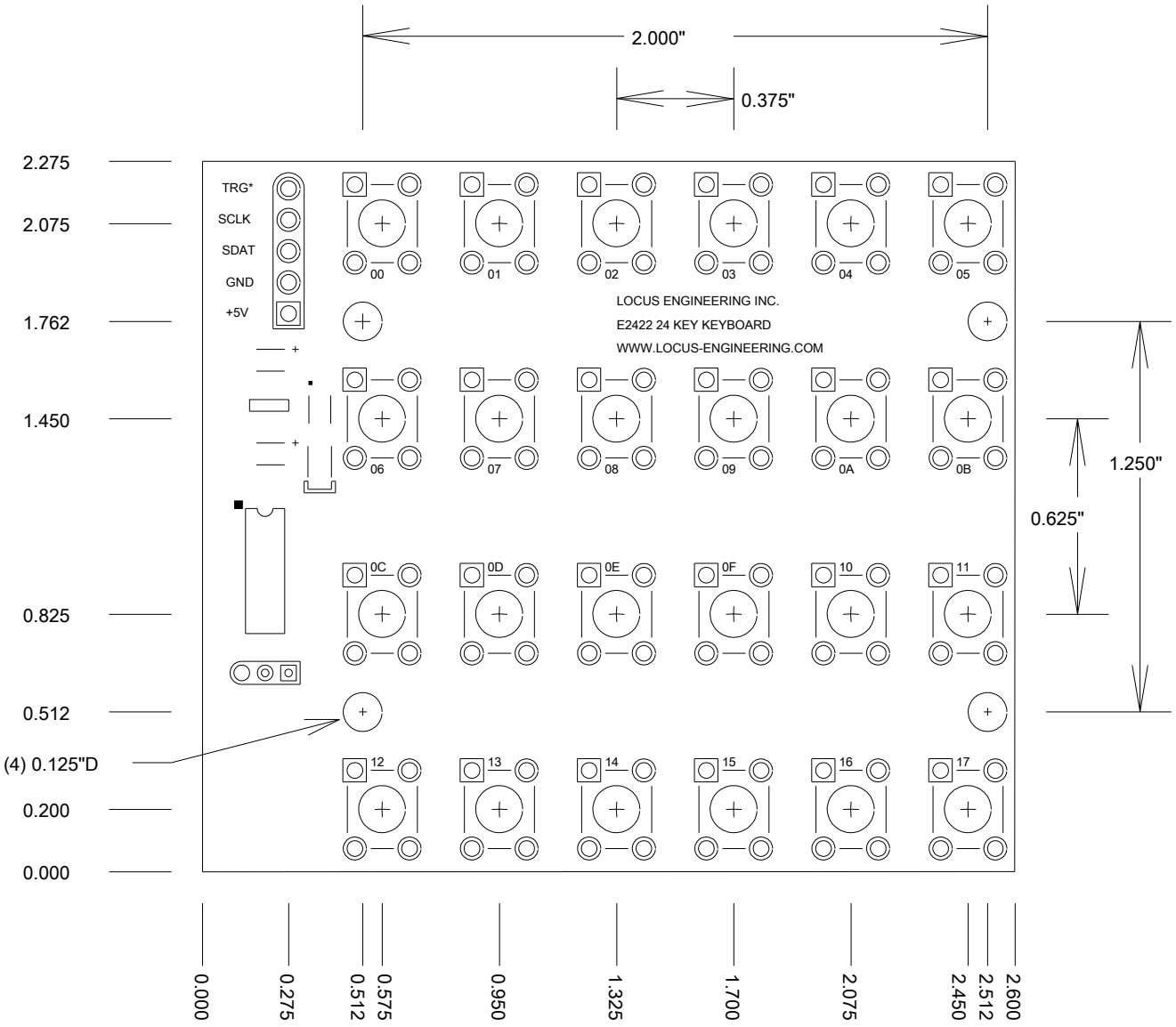

Figure 1. Keyboard Dimensions

Table 3. Pin Descriptions

Pin#	Name	Function
1	+5V	+3.3V to +6.0V
2	0V	Ground
3	SDAT	Clocked Data Port Data Output, ~100KHz, inverted
4	SCLK	Clocked Data Port Clock Output, ~100KHz
5	TRG*	Trigger output used as interrupt, 8msec active low

Power Supply

The E2422 keyboard will operate from voltages between +3.3V to +6.0V, and uses approximately 5mA of current. An onboard low dropout (~40mV @ 10mA) regulator supplies ~3.3V to the microcontroller.

Digital I/O

The digital input and output pins are TTL compatible. Outputs such as serial clocked data SDAT, serial clock SCLK, and trigger output TRG* are push-pull with 0 to +3.3V voltage swings and are compatible with TTL or LVC inputs.

Reset

The power-on reset circuitry is self-contained within the module. Ensure the power supply ramp is faster than 1msec.

Keyswitches

The keyboard is supplied with 24 keys soldered in place, however the board is also available without keys to allow the use of switches with different button heights. Not all keys need to be in place for the keyboard to work. Keyswitches should have bounce times of <10msec; most tactile switches have bounce times <2msec.

Switches are TE 1-1825910-0 or equivalent; these have standard 4.5mm x 6.5mm pin spacings. The switches supplied have a button height of 3.3mm or 0.130" however other switches in the same series have longer button heights to accommodate different packaging requirements.

For soldering the switches, ensure that the keyswitches in one row are fully seated, solder one pin of each switch, then verify they are all still fully seated before soldering the diagonal pin of the switches. This ensures the keyswitches will all line up with the panel. Repeat for the other rows.

Keyboard Operation

On power up or external reset, the E2422 scans and debounces the 24 keys. The first key debounced on the make of the key closure locks out the rest and a single output is sent to the clocked data port along with an active low interrupt pulse. The keyboard scan involves the rows being sequentially driven low by open drain drivers while the columns are sequentially sensed for a low due to a switch closure. Keys are debounced when they are solidly low for ~20msec. Some encoders encode a key on the first falling edge however EMI could also trigger a similar event which would be erroneous and other real pressed keys would be locked out and not properly validated.

The E2422 debounces each of the 24 switches to provide immunity from EMI and also a fast response to a valid switch closure. During a key closure, the contacts bounce between logic states for several milliseconds. A switch is considered debounced and stable once the switch contacts stop bouncing past a threshold of ~20msec. At this point it is encoded to a value 0x00 to 0x17 and sent as serial data at the selected baud rate followed by the clocked data. The trigger output is asserted low 50µsec prior to the data being sent to provide the host microcontroller time to service the interrupt and get ready for the serial clock and clocked data to be read. The trigger output is held low another 8msec to flash the LED. The remaining keys are inhibited in turn to prevent erroneous outputs in the case of multiple key closures.

If several keys are pressed, the first key decoded in the scanned array is sent out. As long as the first decoded key is pressed, all other keys are locked out, i.e. there are no further outputs until the first key is released. If there are several keys still pressed, the next decoded output will belong to the next scanned key in the array. The last switch pressed will produce a code.

The key code assignments are shown in Figure 1 Mechanical Dimensions drawing. As an example, the key code for a closed switch at row 3 and column 4 would be 0x0F hexadecimal.

The typematic function waits for a key to be continually closed for ~600msec; after this the encoded switch value is sent to the clocked data port, and the interrupt output is pulsed every ~200msec or ~5 characters per second rate (5cps) until the key is released.

Clocked Data Port

The clocked data port operates at approximately 100KHz and consists of a serial clock (SCLK), serial data (SDAT), and trigger (TRG*) outputs. The serial clock is pulsed low then high within the data bit so either edge can be used to sample the data. The TRG* signal is active low, and precedes the first clock by 50µsec and completes 8msec after the last bit is sent. The TRG* can be used as an interrupt to indicate to the host microcontroller that a clocked data transmission will commence. The TRG* output also drives the onboard LED. See Figure 2 Signal Output Timing. The serial data output is inverted and can easily be viewed using a 74LV164 or equivalent shift register connection as shown in Figure 3. To provide an audible key closure feedback, connect the TRG* output to a non-inverting open drain buffer such as a 74LVC1G07; connect a low power internally driver piezo sounder between the +5V and the buffer output.

Additional References

Locus Engineering application note AN102 describes how keyboard data can be parsed into commands and data.

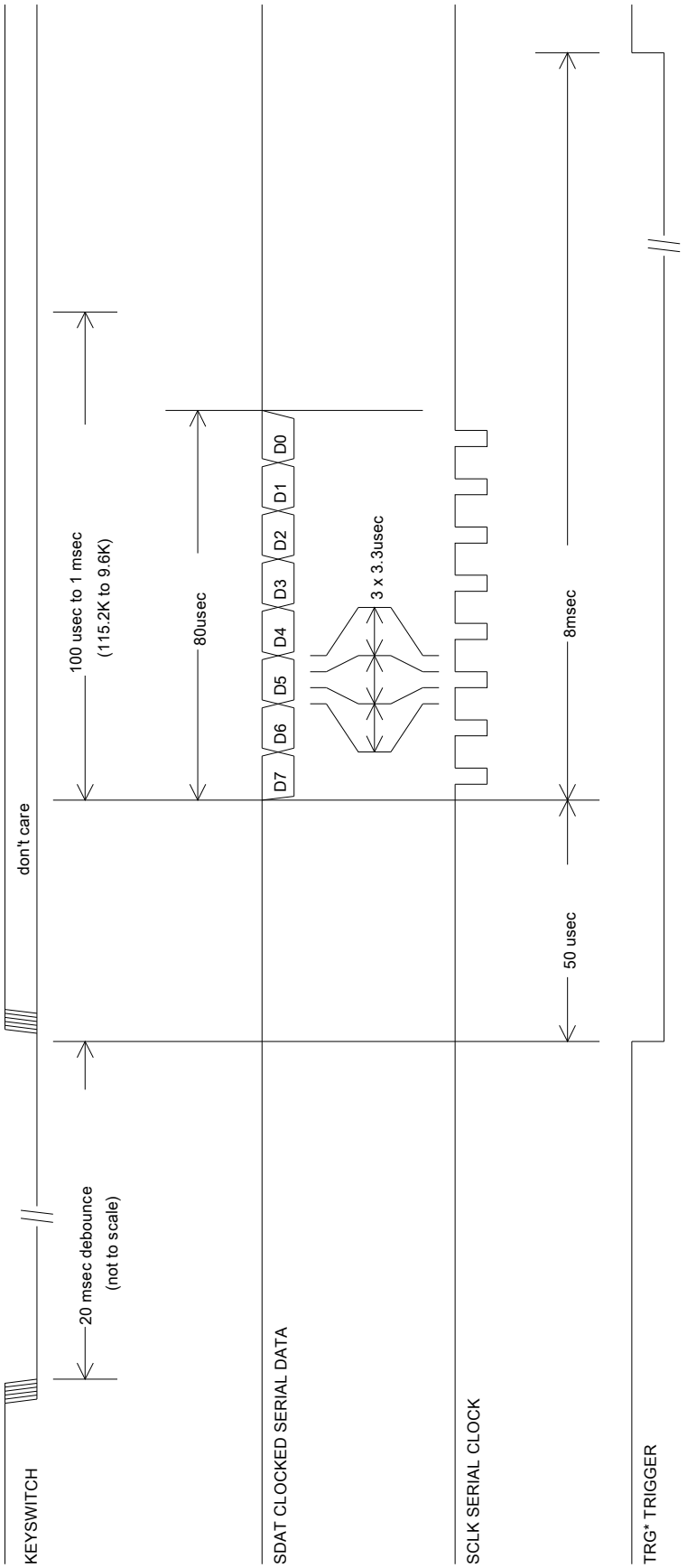

Figure 2. Signal Timing

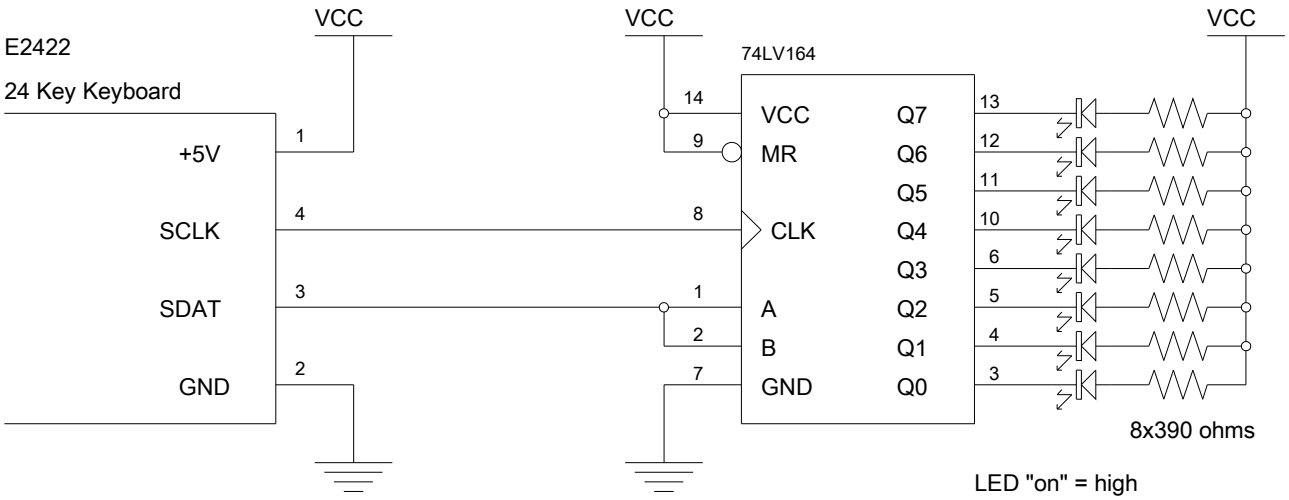

Figure 3. Clocked Data Test Circuit