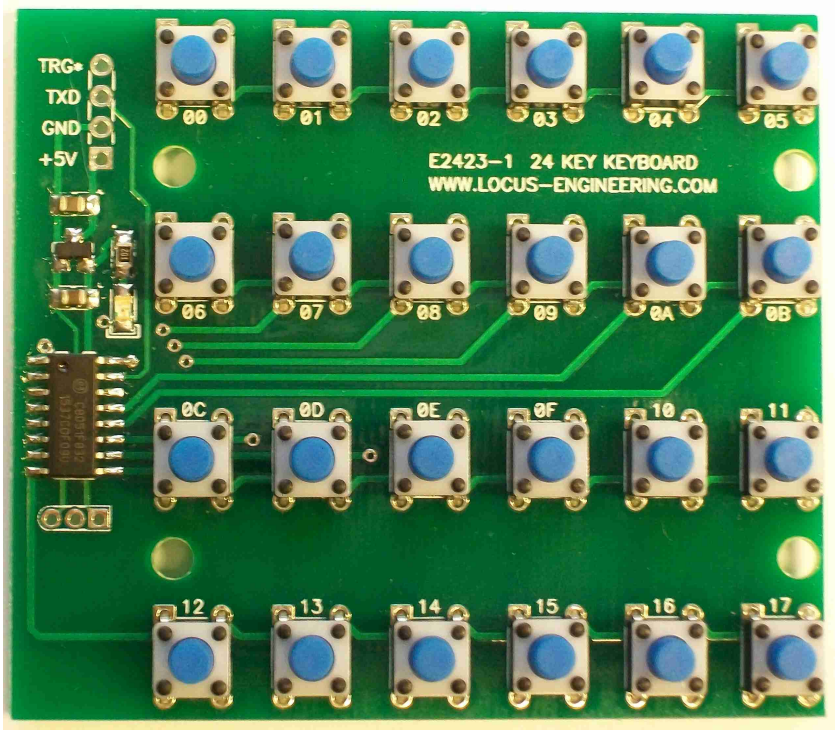
Locus Engineering Inc. E2423

24 Key Keyboard with Serial 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
- 57.6 Kbaud serial output
- trigger pulse output
- TTL compatible outputs
- +3.3V to +6V operation
- 2.4mA supply current
- 2.6” x 2.3” size
- 0.375”H x 0.625”V keyswitch grid
- #4 mounting holes on 2.00”H by 1.25”V

DESCRIPTION

The E2423 Decoded 24 Key Keyboard provides a debounced 8 bit code with a 57.6 Kbaud serial output on the make of each key closure. The serial output 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		2.4		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}	Output baud rate		57.6		KBaud
$T_{typematic}$	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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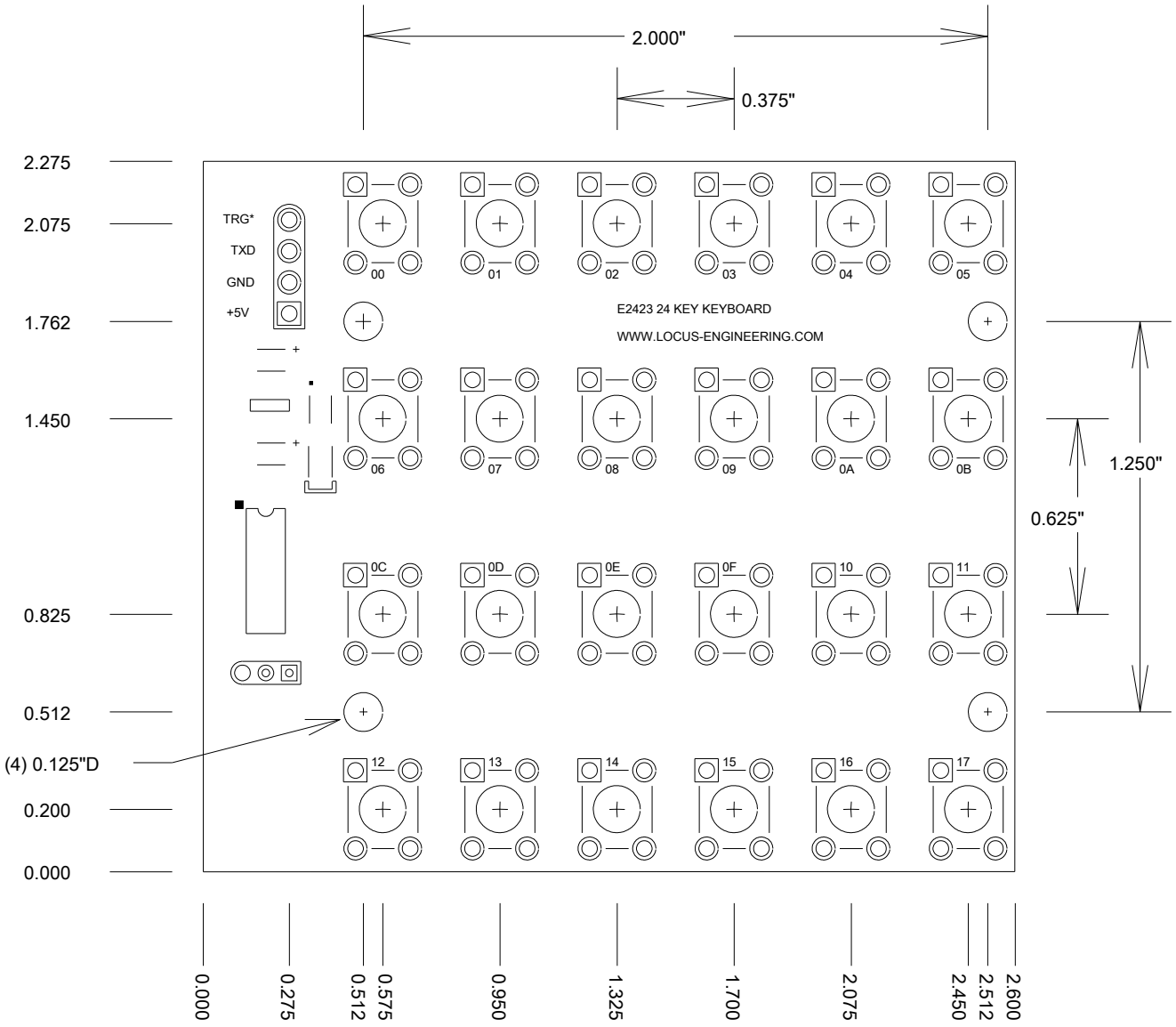

Figure 1. Keyboard Dimensions

Table 3. Pin Descriptions

Pin#	Name	Function
1	+5V	+3.3V to +6.0V
2	0V	Ground
3	TXD	Serial output 57.6 Kbaud
5	TRG*	Trigger output used as interrupt, 8msec active low

Power Supply

The E2423 keyboard will operate from voltages between +3.3V to +6.0V, and uses approximately 2.4mA 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 data TXD 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 E2423 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 serial 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 E2423 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 serial port and the clocked data port, and the interrupt output is pulsed every ~200msec or ~5 characters per second rate (5cps) until the key is released.

Serial Port

The serial port sends data at 57.6 Kbaud, 8 bits, no parity, one stop bit (8N1). The TX pin is a push-pull output with 0 to +3.3V signal swing with data sent least significant bit first. The TRG* signal is active low, and precedes the start of the serial transmission by 50µsec and completes 8msec after the end of the serial transmission. The TRG* can be used as an interrupt to indicate to the host microcontroller that a serial transmission will commence. The TRG* output also drives the onboard LED. Figure 2 shows the connection to a microcontroller and Figure 3 shows the signal timing. 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 driven piezo sounder between the V+ and buffer output.

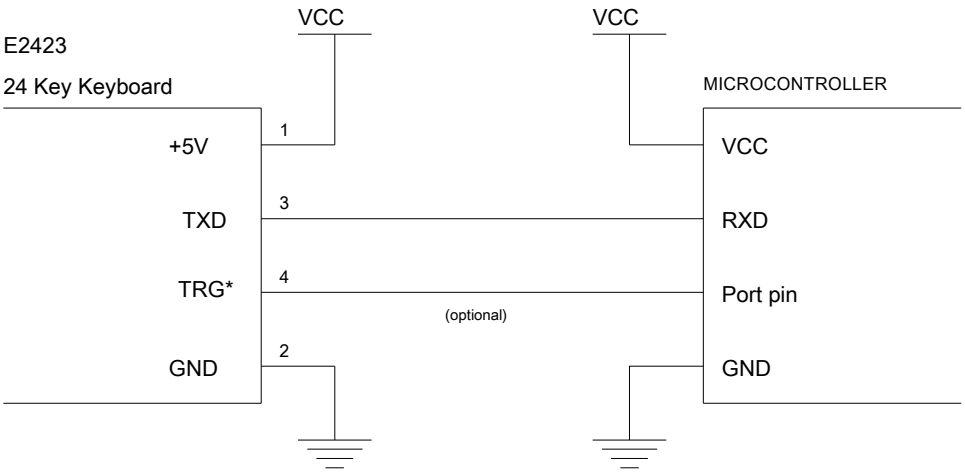

Figure 2. Typical Connection

Additional References

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

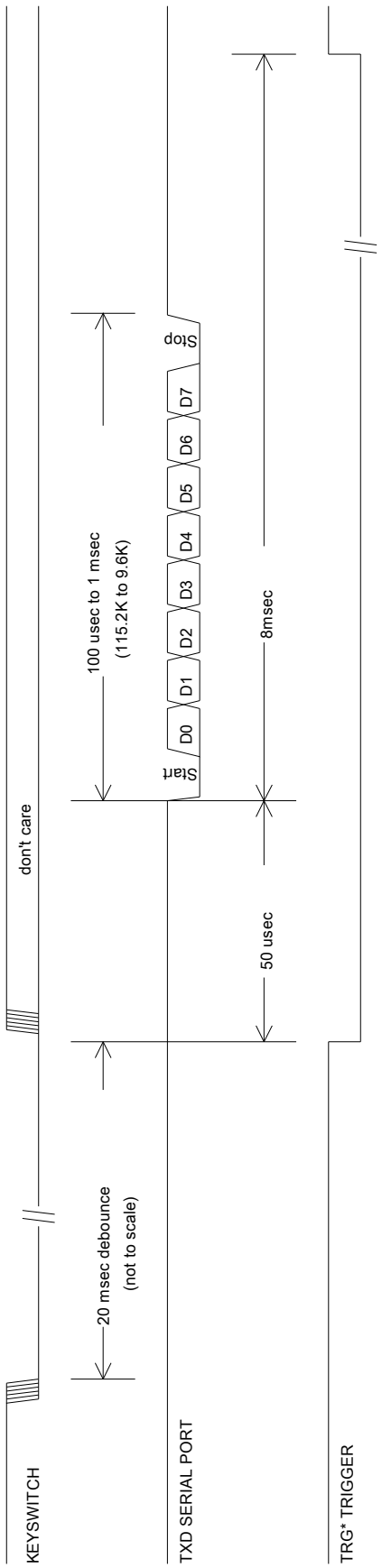

Figure 3. Signal Timing