

MW24J8

Hybrid mouse and joystick controller
Supplement to the JoyWarrior data sheet



Code Mercenaries

1. Features

- Low Speed USB interface
- Full USB V1.1/2.0 compliance
- Full USB HID 1.1 compliance
- Uses 100K potentiometers for three axis joystick or mouse with scroll function
- Up to 6 buttons supported
- On-the-fly switching between joystick and mouse operation
- Minimal external component count: 2C, 1R
- Single +5V power supply
- Available in 24 pin DIL, or 24 pin SOIC

1.1 Variants

MouseWarrior24J8 is available in one variant only.

1.2 Custom variants

Custom adaptations are available on request.
Production of chips with different product names is available for volumes of 100 or more.

2. Functional overview

MouseWarrior24J8 does use a potentiometer joystick either for cursor control emulating a six button mouse with scroll wheel or as a three axis joystick. Switching between joystick and mouse mode can be done at any time by pulling a mode pin low or high.

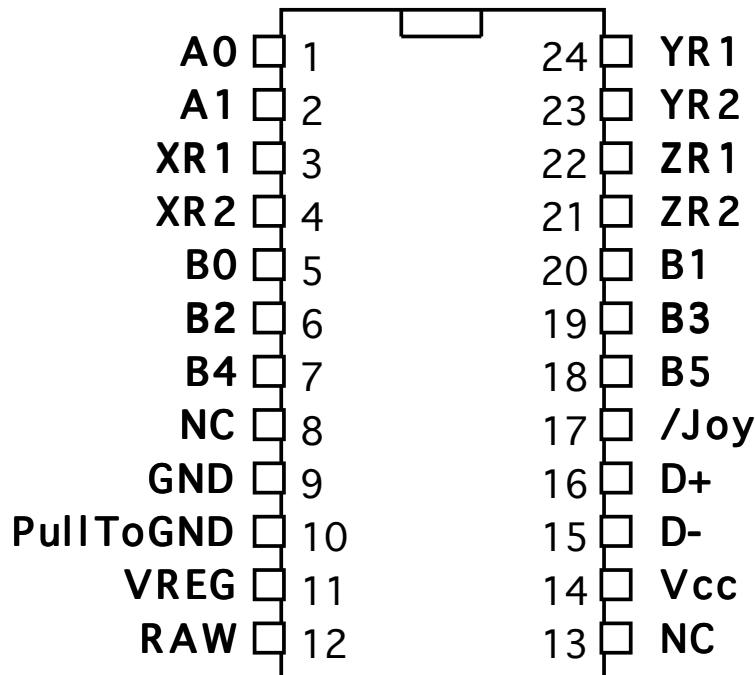
This allows to use one controller for the user interface as well as for input into specialised control software. By utilizing the USB standard joystick protocol MW24J8 can be easily used via the game controller input functions on any operating system. At the same time the mouse function can be used via the standard mouse driver of the system.

MW24J8 is based on the JoyWarrior24A8-8 chip.

MW24J8

3.0 Pin Configurations

MouseWarrior24J8-P/S 24 Pin PDIP or 24 Pin SOIC



Drawing: TOP VIEW!

4.0 Pin Descriptions MouseWarrior24J8

Name	I/O	Type	Pins	Description
D+, D-	I/O	special	16,15	USB differential data lines
B0, B1, B2, B3, B4, B5	I	input, internal Pull Up	5, 20, 6, 19, 7, 18	Button inputs, active low
/Joy	I	input, internal Pull Up	17	Mode pin, pull low to switch to joystick function
A0, A1	I/O	special *	1, 2	Connect center taps of pots here
XR1, XR2	O	special *	3, 4	Connections for X pot
YR1, YR2	O	special *	24, 23	Connections for Y pot
ZR1, ZR2	O	special *	22, 21	Connections for Z pot
VREG	O	special *	11	Power for USB D- pull up resistor
PullToGND	I		10	Used during manufacturing, connect to GND
GND		Power supply	9	Ground
Vcc		Power supply	14	Supply voltage
NC			8, 13	do not connect
RAW	I	input, internal pull down	12	Pull to Vcc to disable auto calibration and centering

*) See application circuit for details

MW24J8

4.4 Pin descriptions

D+, D-

Differential data lines of USB. Connect these signals direct to a USB cable. D- requires a pull up resistor, see application circuits for details.

B0..B5

Inputs for the buttons. Connect contacts closing to ground.

Internal pull up resistors.

VREG

Supplies 3.3V for the USB D- pull up resistor. Don't use this pin to supply power to external circuitry, it does only supply sufficient current for the pull up resistor.

A0, A1

The center taps of the pots and a capacitor are connected to these two pins. The pins are used to charge the capacitor and measure the time it takes to discharge the capacitor via the pots.

See application circuits for details.

XR1, XR2, YR1, YR2, ZR1, ZR2

These outputs connect to the outer taps of the pots. One of them is pulled low at a time to measure how long it takes to discharge the capacitor via the pot.

Axis values get smaller when the pot center tap gets closer to the tap connected to the nR1 pin, i.e. resistance between nR1 and A0, A1 gets smaller.

RAW

Pulling this pin to Vcc disables the autocalibration and auto-centering function. The chip will then report the raw axis data. This can be useful during design test or for applications that can't accept the autocalibration or auto-centering feature.

Internal weak pull down resistor.

/Joy

Pulling this pin low disables the mouse function and enables the joystick function. All axis data is then reported in joystick format. Letting the pin float high does enable the mouse mode in which the X/Y axis position is translated into cursor movements when the axis position is not center.

Internal pull up resistor.

GND

Power supply ground.

Vcc

Supply voltage.

MW24J8

5. Device Operation

By following the USB HID specifications MouseWarrior chips are able to work with most operating systems without the need to supply special drivers. Any operating system with support for USB HID mice and game controllers will have the necessary drivers already in place.

5.1 Operation with Windows

Any Windows versions 98 and newer and 2000 and newer will work with MouseWarrior. Older versions of Windows do not support USB.

Upon connecting a MouseWarrior based device for the first time you may be asked to perform the standard driver install. The same happens if you connect the device to a different USB port on the same computer.

After the driver installation has completed you should be able to see the device in the "Game Controllers" control panel and be able to access it via DirectInput. Also a mouse should show up in the device manager and when in mouse mode the JW24J8 should be able to control the mouse cursor.

5.2 Operation with MacOS

MacOS 9.0 and up and MacOS X do support MouseWarrior direct. Some versions of MacOS 8.x do support USB as well, though their use is not recommended.

With MacOS 9.x you will be able to use MouseWarrior based devices via InputSprocket or with 3rd party software like USB Overdrive.

On MacOS X access is available via the HIDManager.

There will be no warnings or dialogs when a properly functioning MouseWarrior based device is connected under MacOS, it will simply start to work.

5.3 Remote Wakeup

MouseWarrior24J8 does support Remote Wakeup of a sleeping host. The wake up can take place when a button is pressed while the host is sleeping. Remote wakeup has to be enabled by the operating system.

MW24J8

6. DC Characteristics

	Parameter	Min	Max	Units	Remarks
V _{cc}	Operating Voltage	4.35	5.25	V	
I _{cc}	Operating Supply Current		20	mA	
I _{sb}	Suspend mode current		25	μA	Oscillator off
I _{ol}	Sink current on output pins		70	mA	V _{out} = 0.4V
R _{up}	Pull-up Resistance	8	24	kΩ	
V _{ith}	Input Threshold Voltage	40%	60%	V _{cc}	
	USB Interface				
V _{oh}	Static output high	2.8	3.6	V	15kΩ±5% to GND
V _{ol}	Static output low		0.3	V	
V _{di}	Differential Input sensitivity	0.2		V	$(D+) - (D-)$
V _{cm}	Differential Input common Mode Range	0.8	2.5	V	
V _{se}	Single Ended Transceiver Threshold	0.8	2.0	V	
C _{in}	Transceiver capacitance		20	pF	
I _{io}	Hi-Z State Data Line Leakage	-10	10	μA	0V < V _{in} < 3.3V, Hi-Z State
R _{pu}	Bus Pull-up resistance	1.274	1.326	kΩ	1.3kΩ±2% to V _{reg}
R _{pd}	Bus Pull-down resistance	14.25	15.75	kΩ	15kΩ±5%

6.1 AC Characteristics

	Parameter	Min	Max	Units	Remarks
F _{iclck2}	Internal clock frequency	5.91	6.09	MHz	Clock synchronized to USB
	USB Driver Characteristics				
t _r	Transition rise time	75		ns	C _{Load} = 50pF
t _r	Transition rise time		300	ns	C _{Load} = 350pF
t _f	Transition fall time	75		ns	C _{Load} = 50pF
t _f	Transition fall time		300	ns	C _{Load} = 350pF
t _{rfm}	Rise/Fall Time matching	80	125	%	
V _{crs}	Output signal crossover voltage	1.3	2.0	V	
	USB Data Timing				
t _{drate}	Low Speed Data Rate	1.4775	1.5225	MBit/s	
t _{djr1}	Receiver data jitter tolerance	-75	75	ns	To next transition
t _{djr2}	Receiver data jitter tolerance	-45	45	ns	For paired transitions
t _{deop}	Differential to EOP transition skew	-40	100	ns	
t _{eopr1}	EOP width at receiver	165		ns	Rejects as EOP
t _{eopr2}	EOP width at receiver	675		ns	Accepts as EOP
t _{eopt}	Source EOP width	1.25	1.50	μs	
t _{udj1}	Differential driver jitter	-95	95	ns	To next transition
t _{udj2}	Differential driver jitter	-150	150	ns	To paired transition

MW24J8

7. Ordering information

Partname	Order Code	Description	Package
MouseWarrior24 J8	MW24J8-P	Joystick / Mouse hybrid controller	PDIP24
MouseWarrior24 J8	MW24J8-S	Joystick / Mouse hybrid controller	SOIC24

The chips listed here are standard products. Customized chips are available on request.

7.1 Packaging info

PDIP24 chips come in tubes with 16 chips each. SOIC24 chips come in tubes with 31 chips each. To assure best handling and shipping safety please order the chips in full tubes. Custom chips are produced in multiples of full tubes only.

7.2 USB VendorID and ProductID

By default all JoyWarrior chips are shipped with the USB VendorID of Code Mercenaries (\$7C0 or decimal 1984) and a fixed ProductID.

On request chips can be equipped with the customers VendorID and ProductID. VendorIDs can be obtained from the USB Implementers Forum <www.usb.org>

Customized chips are subject to minimum order quantities, contact <sales@codemercs.com> for details.

Following are the ProductIDs for the MouseWarrior controllers:

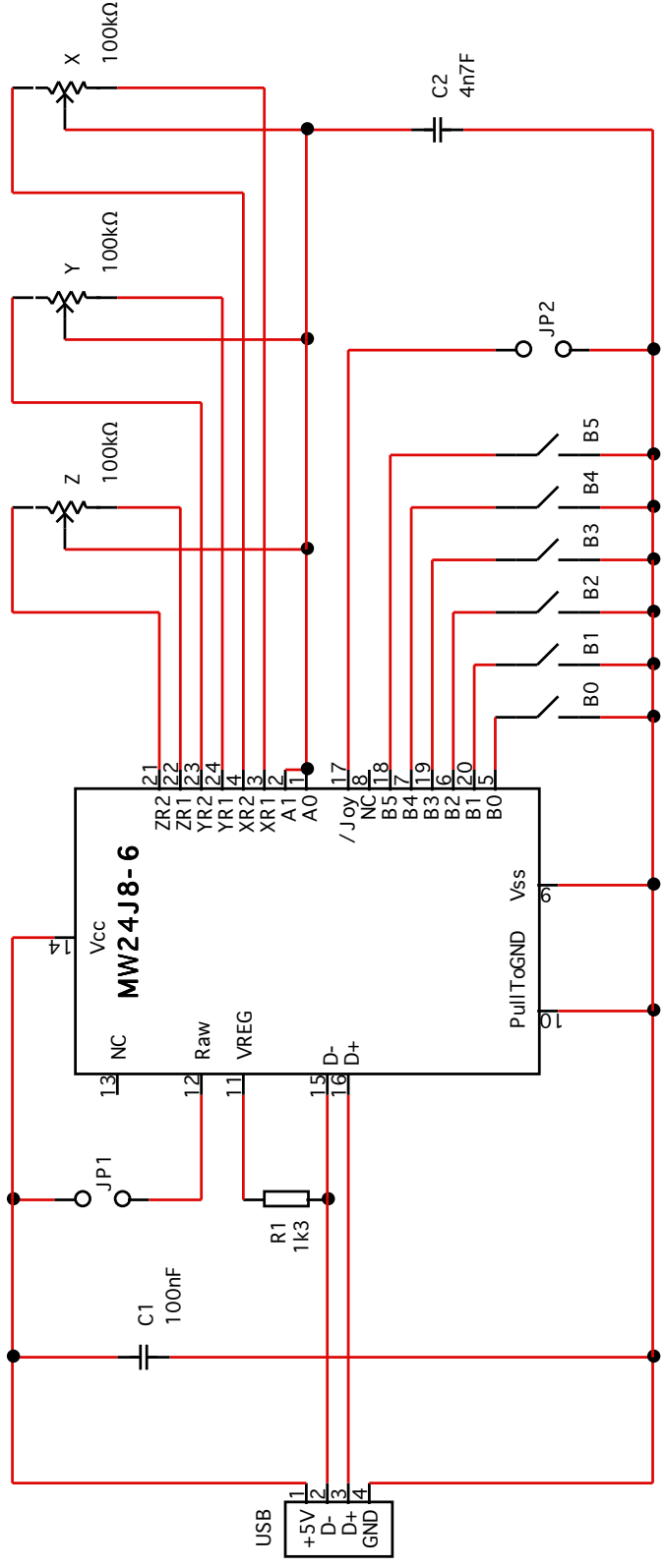
MouseWarrior24 J8 \$1112

ProductIDs are independent of the package type.

See the JoyWarrior data sheet for version information.

MW24J8

8. Typical application for MouseWarrior24 J8



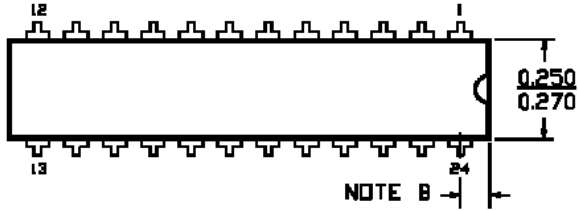
Close JP1 to disable auto centering and auto calibration
 Close JP2 to switch to joystick function

Circuit: MouseWarrior24J8-6		<p>Code Mercenaries</p>	
Version:	V1.0		
Date:	20.5.2005	Rev.	By
Drawn by:		Date	Change
Function:			Sign.
Page:			

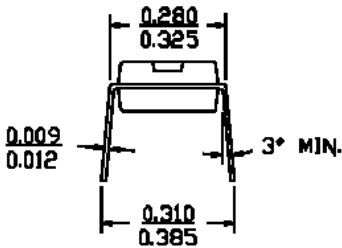
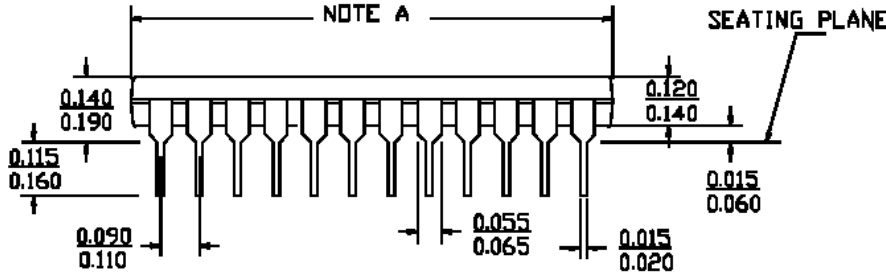
MW24J8

9. Package Dimensions 24 Pin PDIP

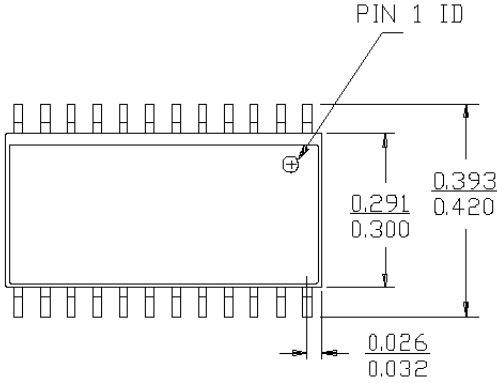
DIMENSIONS IN INCHES MIN.
MAX.



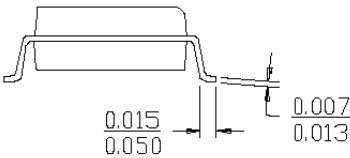
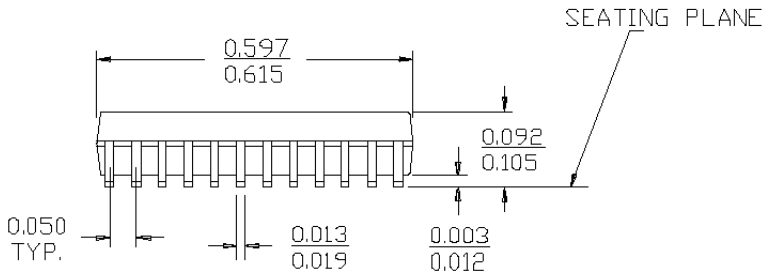
	P 13	P 13A
NOTE A	1.170 1.200	1.230 1.260
NOTE B	0.030 0.050	0.060 0.080



24 Pin SOIC



DIMENSIONS IN INCHES MIN.
MAX.
LEAD COPLANARITY 0.004 MAX.



MW24J8

10. ESD Considerations

JoyWarrior has an internal ESD protection to withstand discharges of more than 2000V without permanent damage. However ESD may disrupt normal operation of the chip and cause it to exhibit erratic behaviour.

For the typical office environment the 2000V protection is normally sufficient. Though for industrial use additional measures may be necessary.

When adding ESD protection to the signals special care must be taken on the USB signal lines. The USB has very low tolerance for additional resistance or capacitance introduced on the USB differential signals.

Series resistors of 27Ω may be used alone or in addition to some kind of suppressor device. In any case the USB 2.0 specification chapter 6 and 7 should be read for detailed specification of the electrical properties.

10.1 EMC Considerations

JoyWarrior uses relatively low power levels and so it causes few EMC problems.

To avoid any EMC problems the following rules should followed:

- Put the 100nF ceramic capacitor right next to the power supply pins of the chip and make sure the PCB traces between the chips power pins and the capacitor are as short as possible.
- Run the power supply lines first to the capacitor, then to the chip.
- Keep the two USB signal lines close to each other, route no other signal between them. USB uses differential signalling so the best signal quality with lowest RF emission is achieved by putting these lines very close to each other.
- Adding a ferrite bead to the +5V power supply line is advisable.

11. Revision History

Please refer to the JoyWarrior main data sheet for the revision history.

Legal Stuff

This document is ©1999-2005 by Code Mercenaries.

The information contained herein is subject to change without notice. Code Mercenaries makes no claims as to the completeness or correctness of the information contained in this document.

Code Mercenaries assumes no responsibility for the use of any circuitry other than circuitry embodied in a Code Mercenaries product. Nor does it convey or imply any license under patent or other rights.

Code Mercenaries products may not be used in any medical apparatus or other technical products that are critical for the functioning of lifesaving or supporting systems. We define these systems as such that in the case of failure may lead to the death or injury of a person. Incorporation in such a system requires the explicit written permission of the president of Code Mercenaries.

Trademarks used in this document are properties of their respective owners.

Code Mercenaries
 Hard- und Software GmbH
 Karl-Marx-Str. 147a
 12529 Schönefeld OT Grossziethen
 Germany
 Tel: x49-3379-20509-20
 Fax: x49-33790-20509-30
 Mail: support@codemerics.com
 Web: www.codemerics.com

HRB 9868 CB
 Geschäftsführer: Guido Körber, Christian Lucht