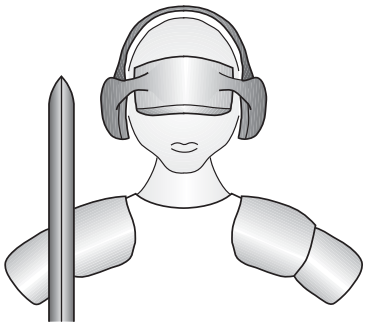
KeyWarrior24D

USB Keyboard Controller with direct data input



Code Mercenaries

1. Features

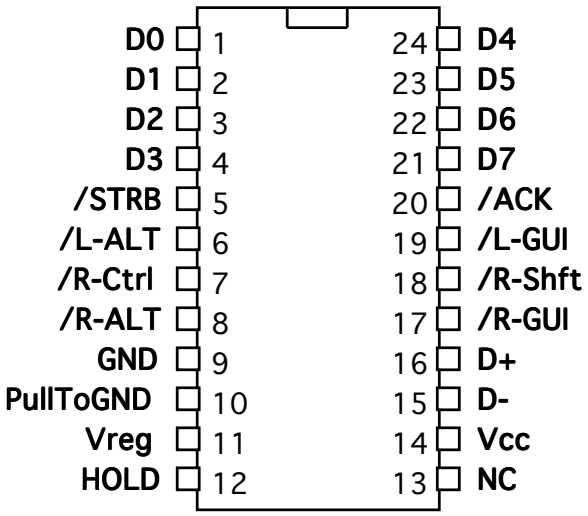
- USB low speed interface
- Full USB V1.1/2.0 compliance
- Full USB HID 1.1 compliance
- Direct data input for use with microcontrollers or simple circuits
- Supports all HID keyboard usage codes
- Modifier keys via direct control lines
- Single +5V power supply
- Low power consumption: 20mA max.
- Available as DIL24, SOIC24, and module

2. Functional Overview

KeyWarrior24D is intended for applications where computer keyboard input has to be generated from some kind of external data source.
Keystrokes are generated by applying the key code and modifier key status to the KeyWarrior24D input lines and then generating a strobe signal. KeyWarrior24D will send the data as keyboard input data to the host computer and issue an acknowledge signal to indicate its readyness for another code.

3. Pin Configuration

KeyWarrior24D-P DIL24
KeyWarrior24D-S SOIC24



TOP VIEW!

4. Pin Descriptions KeyWarrior24D

Name	I/O	Type	Pins	Description
D+, D-	I/O	special	16, 15	USB differential data lines
D0, D1, D2, D3, D4, D5, D6, D7	I	inputs with internal pull up resistor	1, 2, 3, 4, 24, 23, 22, 21	Data input lines for the key code (HID usage code)
/L-ALT, /L-GUI, /R-Ctrl, /R-Shft, /R-ALT, /R-GUI	I	inputs with internal pull up resistor	6, 19, 7, 18, 8, 17	Input lines for the modifier keys. Pull low to activate modifier
/STRB	I	input with internal pull up resistor	5	Pull low to signal that keycode data is valid and should be send
/ACK	O	open drain output with internal pull up resistor	20	Gets pulled low by KW24D to signal that data has been accepted
HOLD	I	Input with internal pull down	12	Pull high to hold modifier status
PullToGND	I		10	Used during manufacturing, connect to GND
GND		Power supply	9	Ground
Vcc		Power supply	14	Supply voltage
Vreg	O	Regulated 3V out	11	Power for D- pullup resistor
NC	-		13	do not connect

4.1 Pin Functions

D+, D-
Differential data lines of USB. Connect these signals direct to the USB cable or type B plug.

Vreg
Regulated 3V output, to be used only for the purpose of powering the USB D- pull up resistor.
Do not use this pin as a supply for any other circuit than the pull up resistor.

D0..D7
Data inputs, the HID usage code for the keystroke must be put on those lines prior to pulling /STRB low.
Inputs with internal pull up resistors.

/L-ALT, /L-GUI, /R-Ctrl, /R-Shft, /R-ALT, R-GUI
Inputs for modifier keys. For ALT and GUI left and right keys are available, for Ctrl and Shift only right keys.
Pull an input low to activate the corresponding modifier key for the next /STRB signal.
Inputs with internal pull up resistors.

/STRB
Strobe input to tell KeyWarrior24D to send a key code. Pulling this line low triggers KeyWarrior24D to send the usage code and modifiers as a keystroke.
Input with internal pull up resistor.

/ACK
Handshake output. This line gets pulled low by KeyWarrior24D when it has accepted the data on D0..7 and modifier inputs.
Open drain with internal pull up resistor.

HOLD
Pull this pin high to keep modifier key status active until next /STRB signal.
Input with internal pull down resistor.

Pull to GND
This pin is used during production of the KeyWarrior chips, connect to GND.

GND
Power supply ground.

Vcc
Supply voltage.

5. Device Operation

KeyWarrior24D registers as a standard HID keyboard and supports boot protocol. It does not need any special drivers to be installed, standard system drivers are sufficient.
The country code is 0 for not localized hardware, which allows to use a single version of the chip for all international keyboard layouts. Usage codes are defined for 0 to 223, which includes all keys and reserved codes below the modifiers, as well as the compose keys for Asian languages and several special keys that may or may not be supported by individual operating systems.

5.1 Power Up

Every time the supply voltage is applied KeyWarrior24D executes an internal reset sequence. All internal pull up resistors are disabled upon power up and will be activated during the internal reset sequence.

5.2 How to use KW24D

KeyWarrior24D turns an 8 bit code and six status lines for modifier keys into a USB keyboard data report.
To generate a keystroke the HID usage code (see the "KeyWarrior Scancode Tables" document for a complete list of the keyboard usage codes) for the required key is applied to D0..7. The status of any modifier keys to be combined with this key is indicated by pulling the corresponding pin low.
For example if a capital "A" should be produced put $04 on D0..7 and pull down /R-Shft.
After applying the data make sure /ACK is high, then pull down /STRB. /STRB may be pulled low only when /ACK is high.
Then wait for KeyWarrior24D to pull down /ACK. This signals that KeyWarrior24D has accepted the data. Release /STRB and do not pull it low again until /ACK has returned to high state.
All minimum setup and hold times are 0.
KeyWarrior24D will send the usage code as a short key press.

5.3 Modifier keys

Modifier keys are input to KeyWarrior24D by separate control lines. They can be transmitted in combination with a key code. If only a change of the status of the modifiers is intended apply a $00 to D0..7, which is the "idle" code for no key pressed.
If the HOLD input is pulled high the status of the modifier keys will stay valid until the next status is passed to KeyWarrior24D on the next falling edge of /STRB. When HOLD is low (default status due to internal pull down resistor) the modifier keys will return to idle after the keystroke.

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}	Max sink current on output pins		70	mA	Cummulative across all ports
I_{ol}	Sink current on output pins		2	mA	Vout = 0.4V
R_{up}	Pull-up Resistance	8	24	kΩ	
V_{ith}	Input threshold voltage	40%	60%	V_{cc}	All ports, low to high edge
V_H	Input hysteresis voltage	3%	10%	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 < Vin < 3.3V, Hi-Z State
R_{pu}	Bus Pull-up resistance	1.274	15.75	kΩ	1.3kΩ±2% to Vreg
R_{pd}	Bus Pull-down resístance	14.25	15.75	kΩ	15kΩ±5%

6.1 AC Characteristics

	Parameter	Min	Max	Units	Remarks
	clock accuracy	-1.5	+1.5	%	Derived from USB signal
	USB Driver Characteristics				
t_r	Transition rise time	75		ns	CLoad = 200pF
t_r	Transition rise time		300	ns	CLoad = 600pF
t_f	Transition fall time	75		ns	CLoad = 200pF
t_f	Transition fall time		300	ns	CLoad = 600pF
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_{eopr2}	EOP width at reeiver	670		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

6.2 Absolute Maximum Ratings

Storage Temperature	-65°C to +150°C
Ambient Operating Temperature	0°C to +70°C
Supply Voltage on Vcc relative to Vss	-0.5V to +7.0V
DC Input Voltage	-0.5V + Vcc + 0.5V
Max. Output Current into any Pin	70mA
Power Dissipation	300mW
Static Discharge Voltage	>2000V
Latch-up Current	>200mA

7. Ordering Information

Partname	Order Code	Description	Package
KeyWarrior24D	KW24D-P	Digital input keyboard controller	PDIP24
KeyWarrior24D	KW24D-S	Digital input keyboard controller	SOIC24
KeyWarrior24D	KW24D-MOD	Digital input keyboard controller, ready to use module	Module

7.1 Shipping info

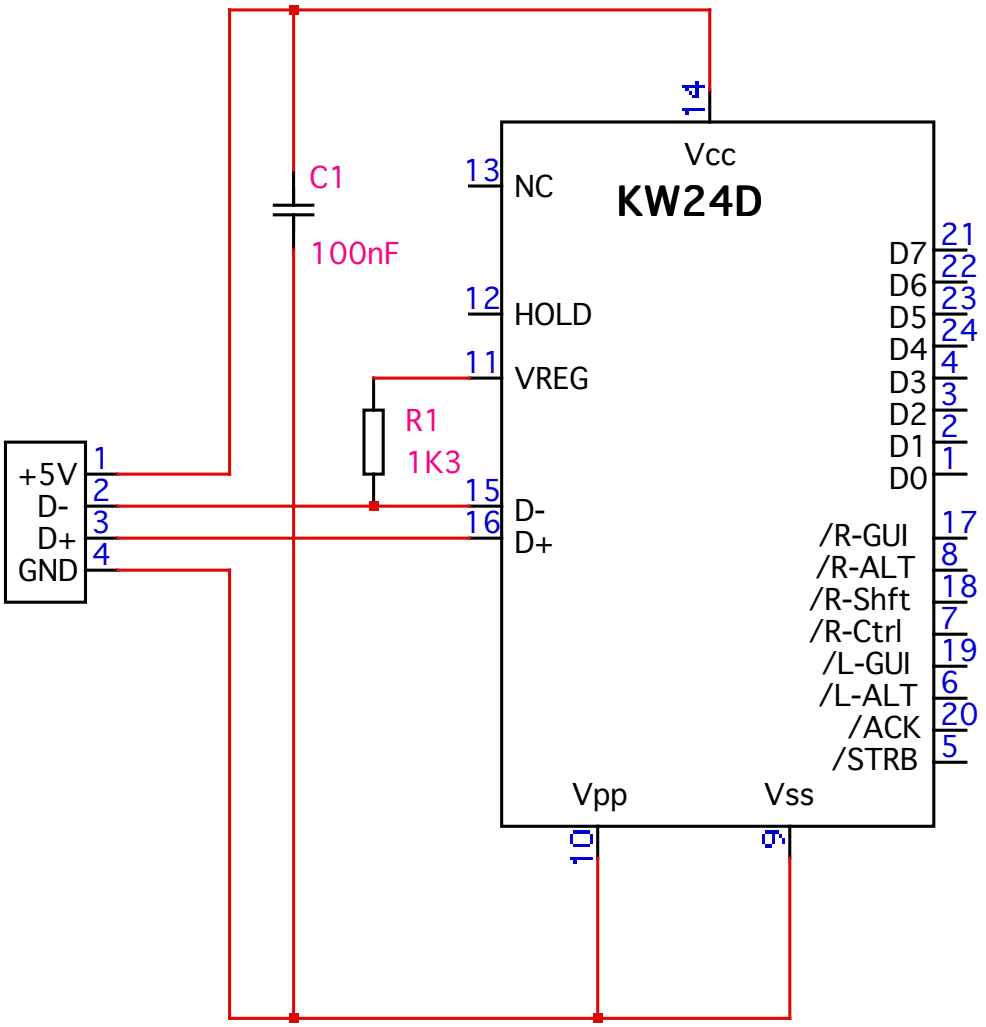
DIL24 chips come in tubes of 16 each. SOIC24 chips come in tubes of 31 each.
To assure the safest handling we recommed that you order in multiples of full tubes.
Custom chips can be ordered in full tubes only!
SOIC24 chips are shipped in a moisture barrier bag when ordered in a minimum quantity of one full tube.

7.2 USB VendorID and ProductID

By default all KeyWarrior chips are shipped with the USB VendorID of Code Mercenaries ($7C0 or decimal 1984).
The ProductID will be assigned by Code Mercenaries.
On request chips can be equipped with the customers VendorID and ProductID. VendorIDs can be obtained from the USB Implementers Forum <www.usb.org>
The ProductID for the standard KeyWarrior24D chips is:
KeyWarrior24D $0223

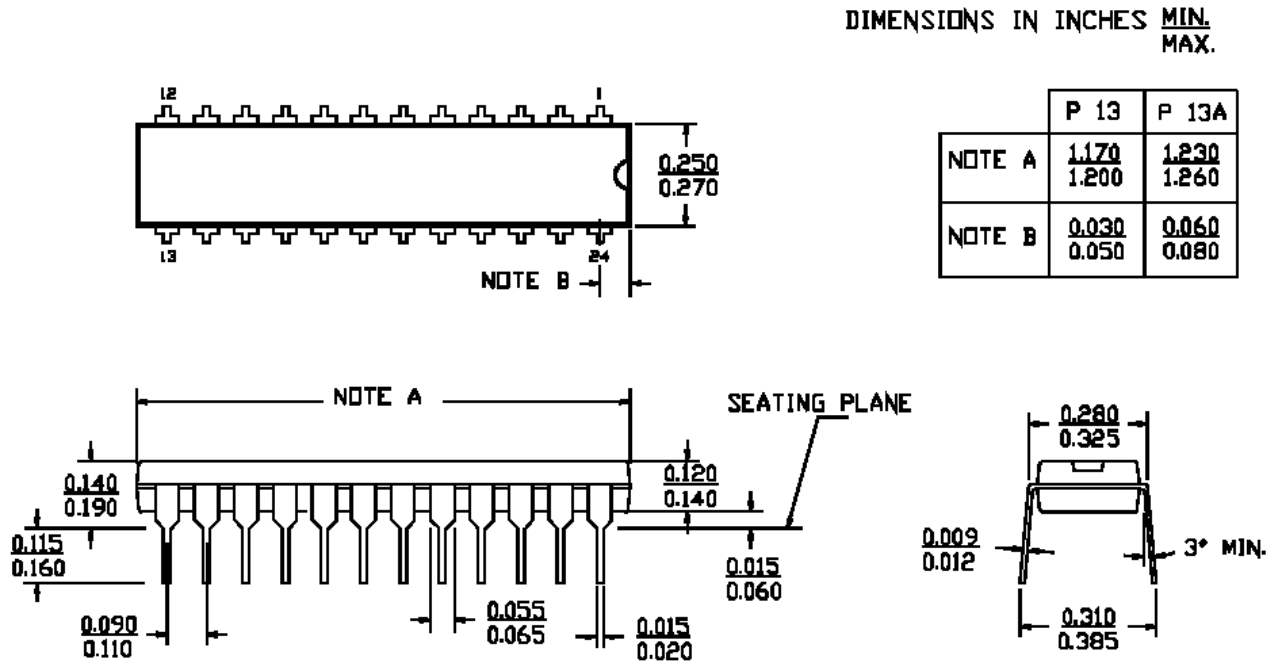
ProductIDs are independent of the package type.

8. External circuit for KeyWarrior24D

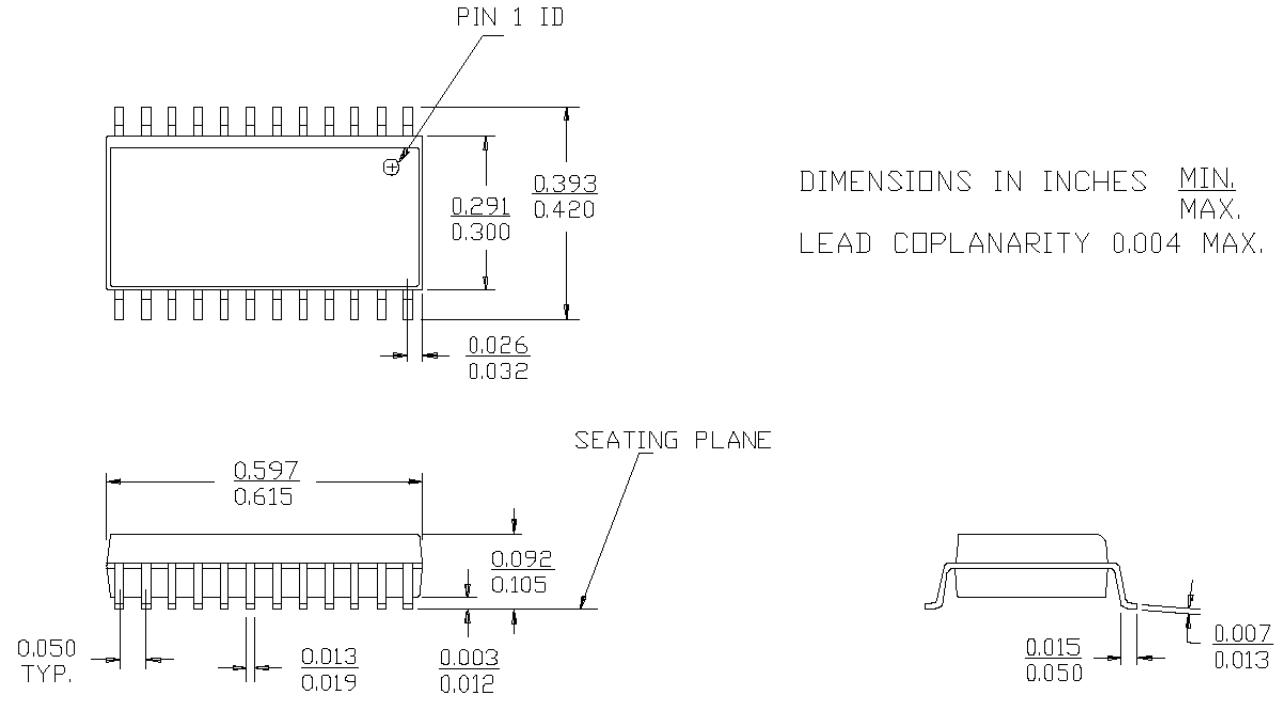


9. Package Dimensions

24 Pin DIL



24 Pin SOIC



10. ESD Considerations

KeyWarrior 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.

10.1 EMC Considerations

KeyWarrior uses relatively low power levels and so it causes few EMC problems.
To avoid any EMC problems the following rules should followed:

- Put a 100nF ceramic capacitor right next to the power supply pins 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.
- Make the signal lines only as long as absolutely necessary.

Adding a ferrite bead to the +5V and ground power supply lines is advisable.

11. Revision History

This is a supplemental data sheet to the KeyWarrior data sheet. Please refer to the main data sheet for the revision history.

V1.1.1.D is the inital release version of the KeyWarrior24D.

12. RoHS compatibility

RoHS compatible parts are indicated by a "R" being appended to the version number.
I.e. a KeyWarrior24D in DIL24 package will have a marking as follows if it is RoHS compatible:
KW24D-P
V1.1.1.DR

Legal Stuff

Code Mercenaries
Hard- und Software GmbH
Karl-Marx-Str. 147a
12529 Schönefeld
Germany
Tel: +49-3379-20509-20
Fax: +49-33790-20509-30
Mail: support@codemercs.com
Web: www.codemercs.com

HRB 9868 CB
Geschäftsführer: Guido Körber, Christian Lucht