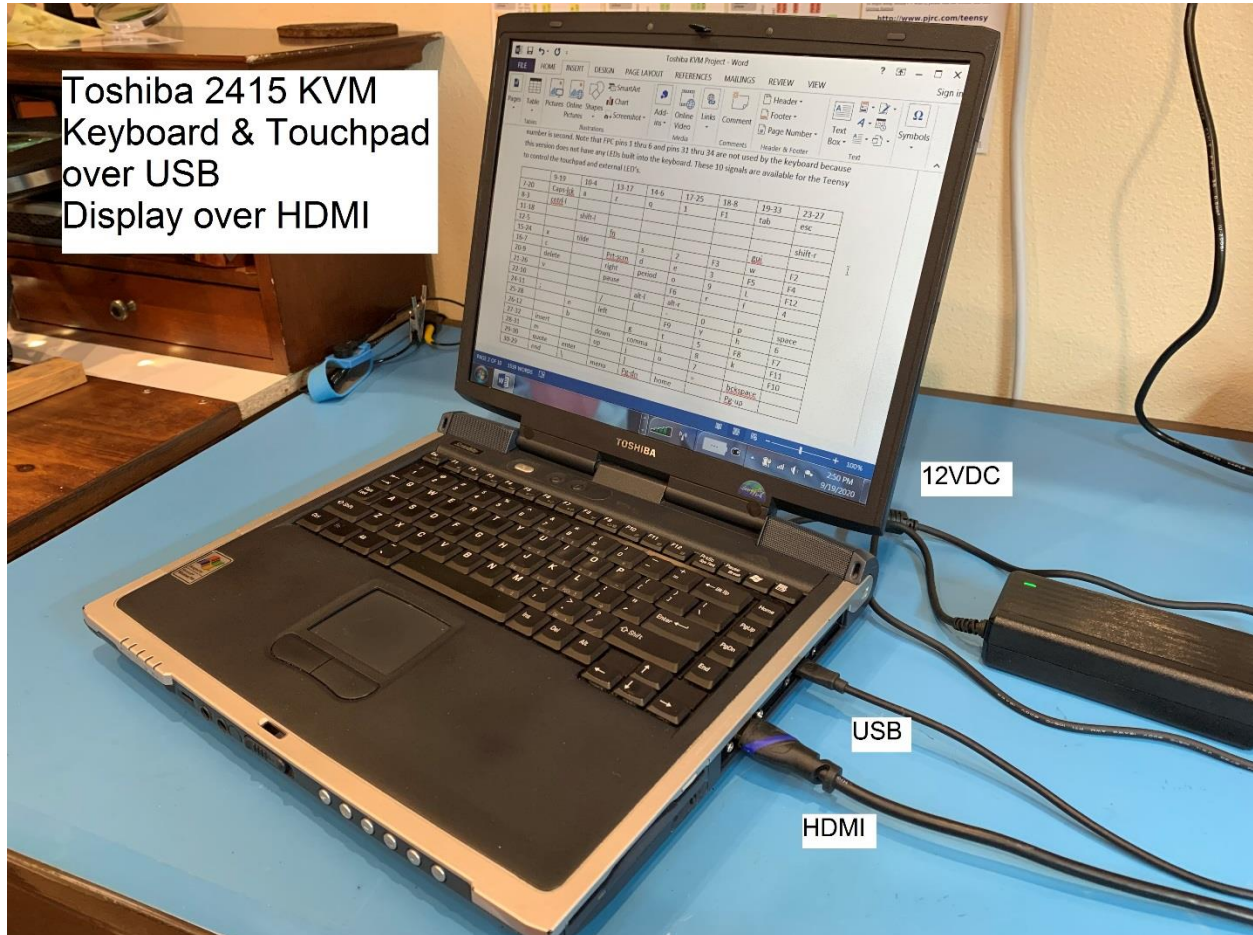


# Toshiba 2415 KVM

I converted a Toshiba 2415 laptop into a Keyboard Video Mouse (KVM). The original motherboard was removed and replaced with a Teensy 3.2, programmed as a USB keyboard and touchpad controller. An M.NT68676.2A video card is used to convert HDMI into LVDS for the display.

All documentation and the code "Toshiba\_2415\_KVM.ino" can be found at my [Github repo](#).

This is the finished KVM.



The keyboard matrix is given below. The FPC pin number is listed first, then the Teensy I/O number.

	9-19	10-4	13-17	14-6	17-25	18-8	19-33	23-27
7-20	Caps-lck	a	z	q	1	F1	tab	esc
8-3	cntrl-l							
11-18		shift-l						shift-r
12-5			fn				gui	
15-24	x	tilde		s	2	F3	w	F2
16-7	c		Prt-scrn	d	e	3	F5	F4
20-9	delete		right	period	o	9	L	F12
21-26	v		pause		F6	r	f	4
22-10				alt-l	alt-r			
24-11	;		/	[	-	0	p	space
25-28		n	left		F9	Y	h	6
26-12		b		g	t	5	F8	F7
27-32	insert		down	comma	i	8	k	F11
28-31	m		up	j	u	7		F10
29-30	quote	enter		]		=	bckspace	
30-29	end	\	menu	Pg-dn	home		Pg-up	

In addition to the standard “normal” key layer, the Teensy 3.2 code has cursor, number pad, and media layers. After scanning the keyboard matrix, the Teensy polls the touchpad over a PS/2 bus to see if there has been any cursor movement or button pushes. The overall scan rate is 30 milliseconds.

This keyboard came with built in LED’s on Caps Lock, Cursor Lock, and Number Lock.

#### Caps Lock LED

Anode = FPC 31

Cathode = FPC 32

#### Cursor Lock LED

Anode = FPC 6

Cathode = FPC 33

#### Number Lock LED

Anode = FPC 1

Cathode = FPC 34

I left off the header pins on the Teensy at I/O numbers 13, 14, and 15 in order to insert a current limit resistor for each LED. The circuit board pads under I/O 13, 14, and 15 go to FPC pins 34, 33, and 32 and are the cathodes for the 3 LEDs. 220Ω current limit resistors were soldered from the circuit board pads underneath I/O 13, 14, and 15 to ground. The software drives the anode to 3.3 volts to turn on the LED.

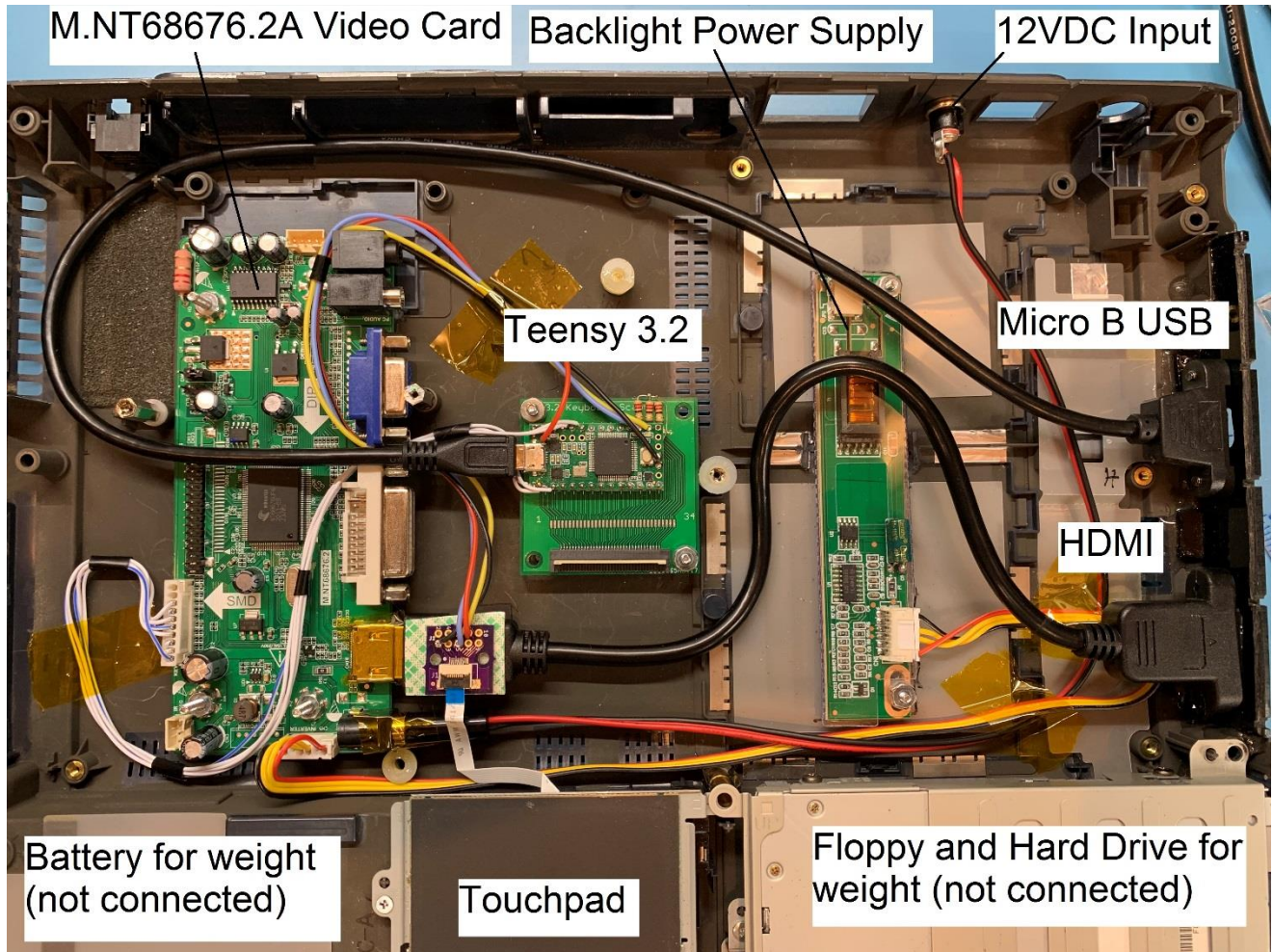
Teensy I/O's are used to drive the M.NT68676.2A video converter card's push button signals. This eliminates the need for the push button board. The Teensy code pulses the Menu, Up, Down, and Power signals to navigate thru the video card menus. The Teensy can adjust the contrast and brightness as well as toggle the video card on and off. All of the Fn function key combinations are given below:

Fn-Esc	Mute the volume
Fn-F1	Lower the volume
Fn-F2	Raise the volume
Fn-F3	Lower the display contrast
Fn-F4	Raise the display contrast
Fn-F5	Toggles the video card on/off
Fn-F6	Lower the display brightness
Fn-F7	Raise the display brightness
Fn-F8	Unused
Fn-F9	Toggle the touchpad on/off
Fn-F10	Toggle the cursor lock on/off (also controls the LED below the F10 key)
Fn-F11	Toggle the number pad on/off (also controls the LED below the F11 key)
Fn-F12	Toggle the scroll lock on/off (also controls the LED on the Teensy)

For brightness and contrast, press and hold the Fn - Function key until the desired level is reached, then release the keys and wait for the video menu to go away.

For volume control, press and hold the Fn key, then push and release the F1 or F2 key repeatedly until the desired volume is reached.

This shows the boards inside the laptop case.



A small board was designed for the touchpad FPC cable with a connector so that the signals can be jumpered to the Teensy per the table below. The FPC cable flips the signals so the pin numbers are the same on both ends of the cable.

Touchpad FPC	Signal Name	Teensy I/O
1	Ground	Gnd
2	Ground	Gnd
3	Ground	Gnd
4	NC	-
5	Clock	14
6	Data	15
7	5 Volt	Vin
8	5 Volt	Vin

The video push button board was replaced with the Teensy. The cable was cut at the button board and routed to the Teensy I/O's as shown below.

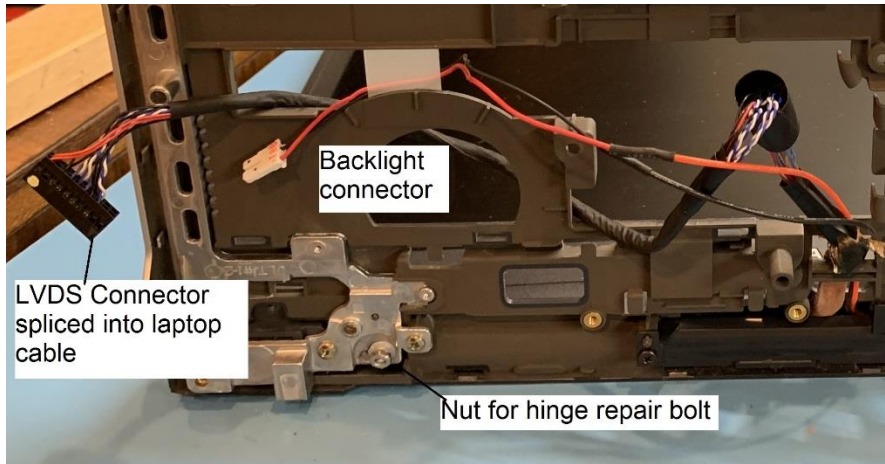
Signal Name	Button Board	Teensy I/O
Menu	K4	22
Down	K2	0
Up	K1	1
On/Off	K0	21
Ground	GND	GND

The 15 inch Samsung LCD part number is LT150X3-134 which has an LVDS 1 channel 6 bit 3.3 volt interface and a resolution of 1024 x 768. The video board was flashed for this display but it came with a 30 pin cable for the LCD instead of the 20 pin that the Samsung needs. I cut the original laptop connector off the end of the LVDS cable and spliced in the cable and connector that goes to the M.NT68676.2A board (see picture below). I made sure it had lots of extra length to make it easier to hook up. The modified LCD to video board cable has the following pinout.

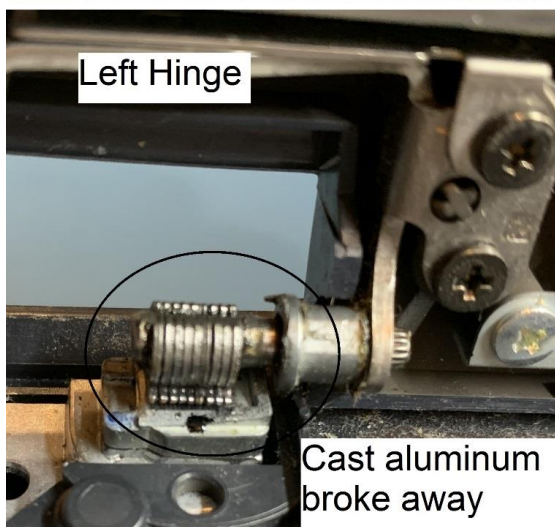
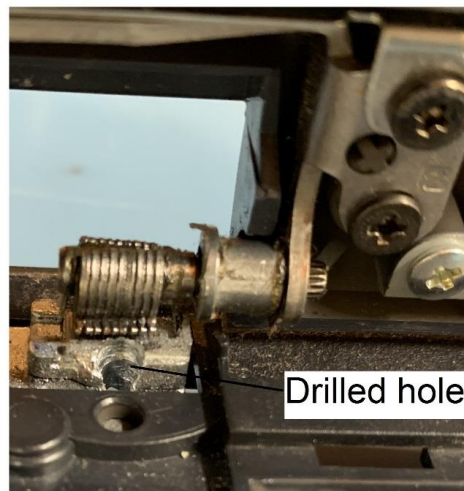
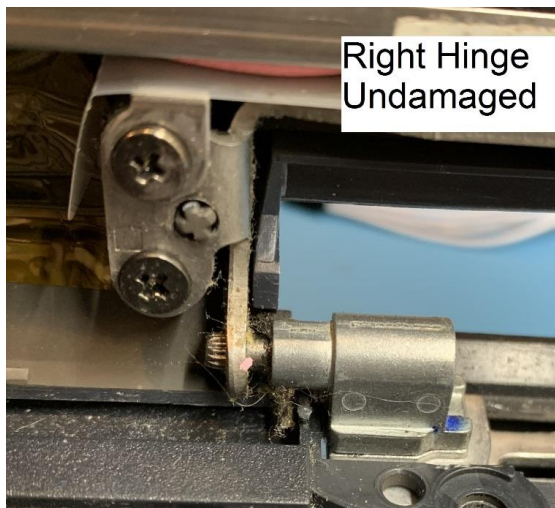
Signal Name	LCD Pin #	Video Card Pin #
VCC	1	1
VCC	2	2
GND	3	5
GND	4	6
RIN0-	5	7
RIN0+	6	8
GND	7	13
RIN1-	8	9
RIN1+	9	10
GND	10	14
RIN2-	11	11
RIN2+	12	12
GND	13	4
CLKIN-	14	15
CLKIN+	15	16



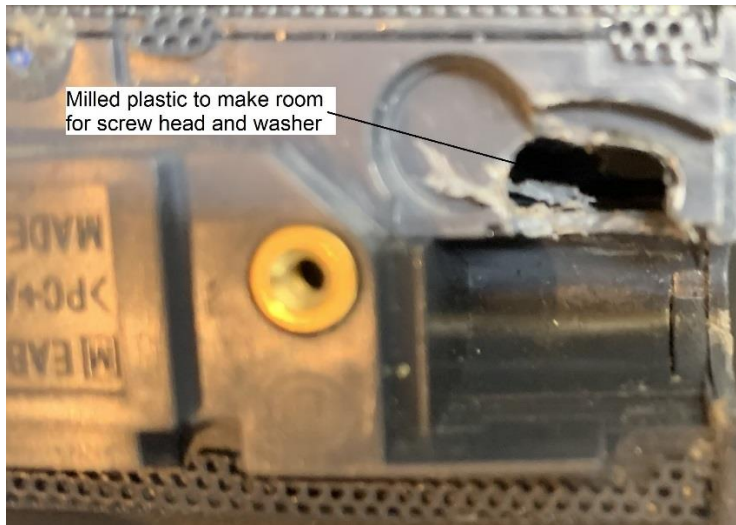
The backlight connector on the Samsung LCD did not fit the backlight connector that came with the M.NT68676.2A so I soldered a replacement connector from an old LCD with extra wire length.



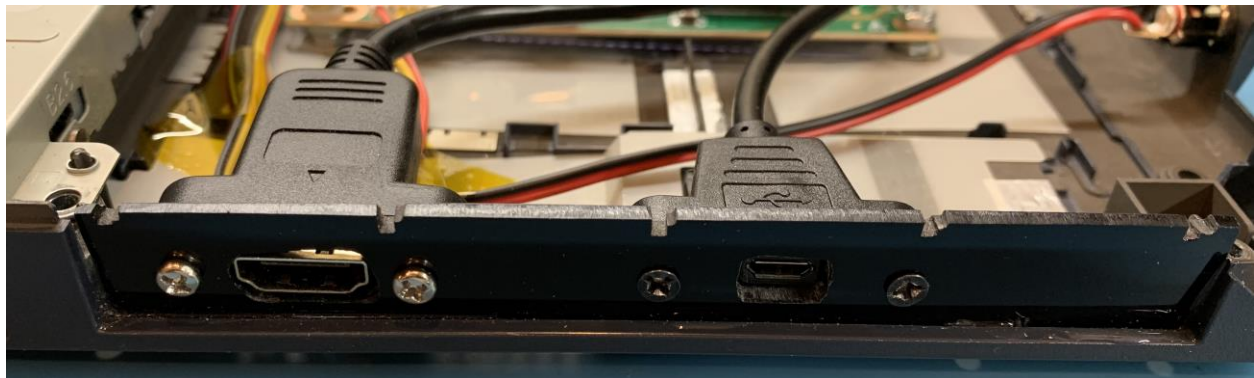
The Toshiba laptop hinge is prone to failure over time. The pictures below show the good right hinge and broken left hinge. A hole was drilled so that a bolt and washer could repair the hinge.



The left speaker had to be milled out with a Dremel to make space for the hinge repair screw.



Acrylic was cut to fit in the DVD opening and drilled for the HDMI and USB connector. JB Weld epoxy was used to glue it in place.



In addition to the donor laptop, HDMI cable, and USB cable, the parts to build the KVM are given below. The parts cost about \$104.

<b>Description</b>	<b>Part Number</b>	<b>Source</b>	<b>Price x Qty</b>
Teensy 3.2	<a href="#">PJRC TEENSY32 PINS</a>	PJRC	\$25.00
Header kit	<a href="#">1568-1422-ND</a>	Digikey	\$1.50
Keyboard Scanner Board	<a href="#">Keyboard Scanner LT2</a>	JLCPCB	\$3.00
34 pin 0.8MM FPC connectors for keyboard	<a href="#">34 pin 0.8mm pitch</a>	Aliexpress	\$5.00
8 pin 0.5mm FPC Connectors for touchpad	<a href="#">WM11195CT-ND</a>	Digikey	\$1.23
OSH Park PWB (lot of 3) for touchpad	<a href="#">FPC 10pin0p5mm</a>	OSH Park	\$2.25
HDMI 1ft extension cable/chassis mount	<a href="#">Bluwee store</a>	Amazon	\$5.69
Chassis mount power connector	<a href="#">EJ501A-ND</a>	Digikey	\$1.87
Power plugs for 12V into video card	<a href="#">CP3-1000-ND</a>	Digikey	\$1.29
Micro USB Male to Micro USB Female Extension Panel Mount 1 ft	<a href="#">UseBean store</a>	Amazon	\$4.99
Video Converter Board, 12 V Power Supply, Long LVDS Cable	M.NT68676.2A bundle	Ebay	\$42.32
Black acrylic sheet for mounting usb & hdmi in dvd location	<a href="#">Rock Hard Plastics Co</a>	Amazon	\$9.95