

Full ASCII Keyboard for Apple 1/Apple II

I have completed a project to design a full ASCII parallel output keyboard for use with the Apple 1 and Apple II, but one that can be used for other systems requiring a keyboard with a parallel interface. Figure 1 shows the keyboard, note that the power switch is replaced by a Caps Lock key. Figure 2 is the keyboard without the key caps, the keyswitches are Cherry MX switches which is common switch. Figure 3 Shows an Apple 1 Keyboard and Figure 4 is the back side of that Keyboard showing the Daughter Board in place. Since the Keyboard is directly mounted to the faceplate no stiffeners are needed, if the board is mounted only on the ends then stiffeners are needed to prevent board flex as shown in Figure 5 where hardwood strips 1/4" by 3/8" are used as stiffeners.

Figure 6 shows the bottom view of an Apple II keyboard where 1/4" square aluminum bars are used as stiffeners. Figure 7 shows the top view of the Apple II Keyboard. You will notice that the Keyboard pattern is not exactly the same as the standard Apple II. The keyboard was designed primarily as an Apple 1 keyboard so exact compatibility was not a priority. The Repeat key has been removed since all keys are autorepeat and the return key was relocated and increased in size to be more like most standard keyboards. The overall keyboard outline was not changed and Figure 8 shows the keyboard in an Apple II enclosure.



Figure 1 Apple 1 Keyboard



Figure 2 Keyboard No Keycaps



Figure 3 Apple 1 Keyboard Mounted

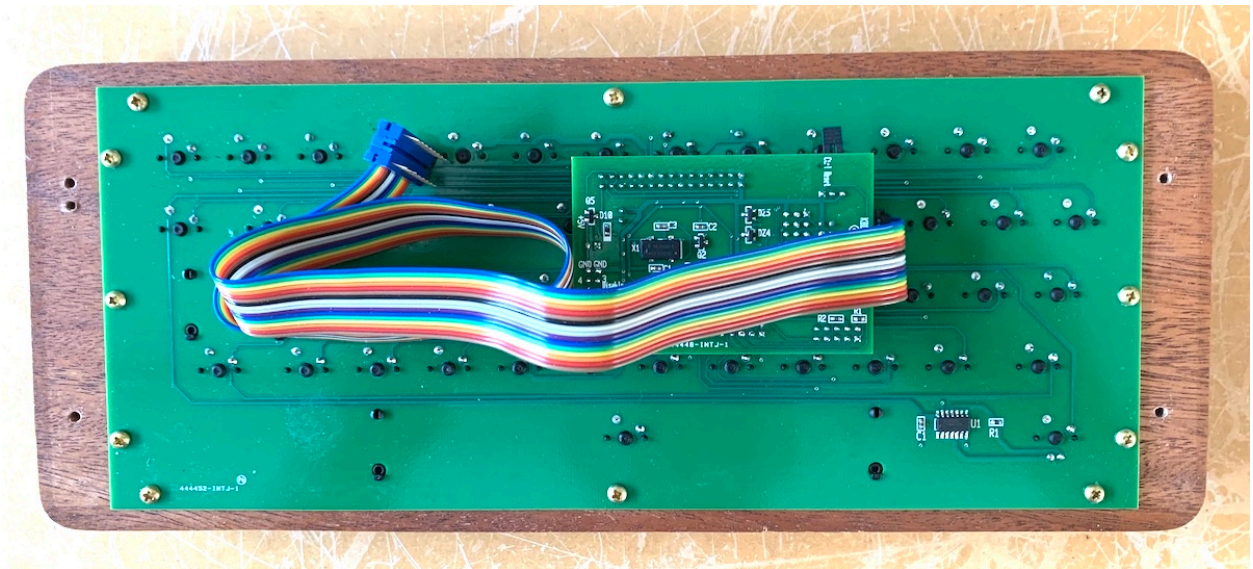


Figure 4 Apple 1 Keyboard Backside

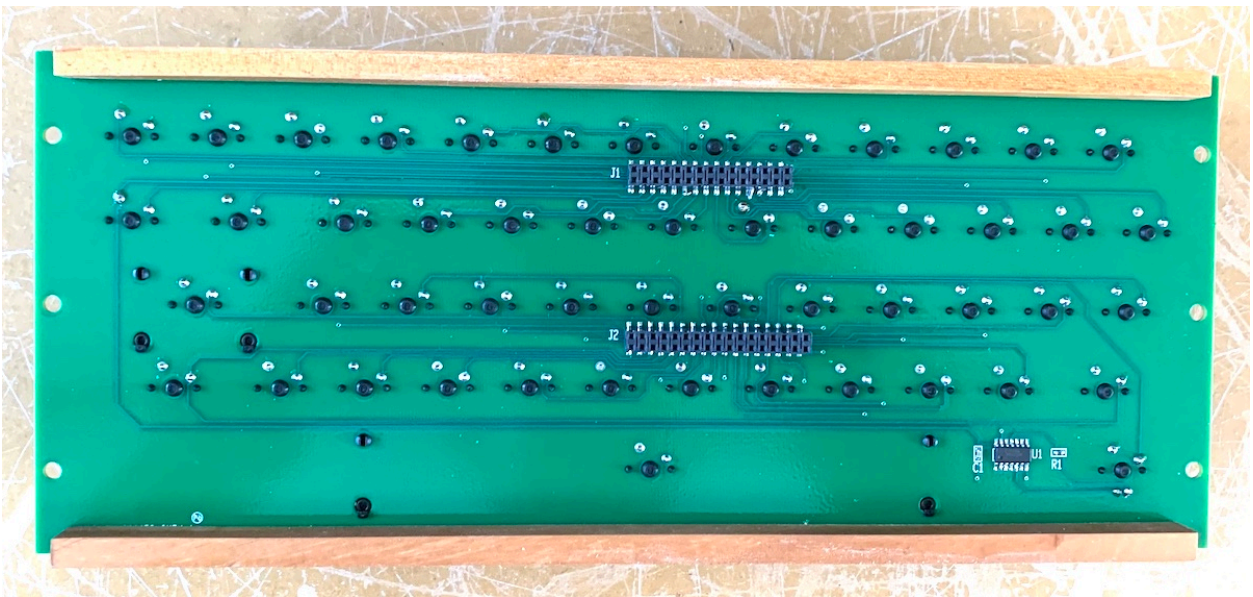


Figure 5 Apple 1 Keyboard Hardwood Rails

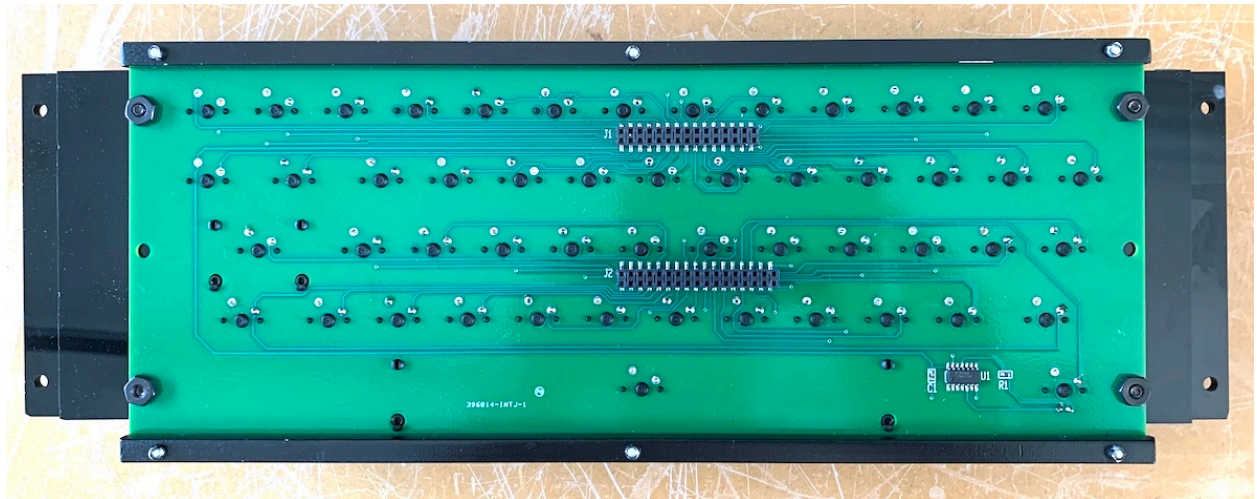


Figure 6 Apple II Bottom View

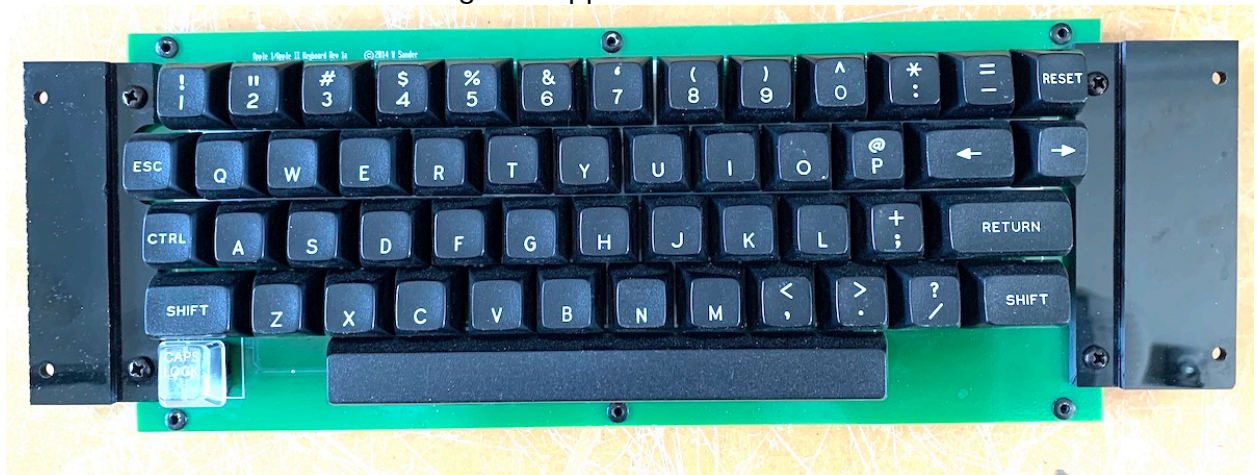


Figure 7 Apple II Top View



Figure 8 Apple II Mounted

Figure 9 shows the top and bottom of the daughter board. The figure on the left shows the top of the board with the connector that accepts a ribbon cable to a 16 pin dip header that goes to the computer. The plug shorting block next to that connector can be put into one of two positions that will map the connector for either an Apple 1 or an Apple II or II+. The large chip on the board is an Altera V CPLD that is used for the keyboard encoder.

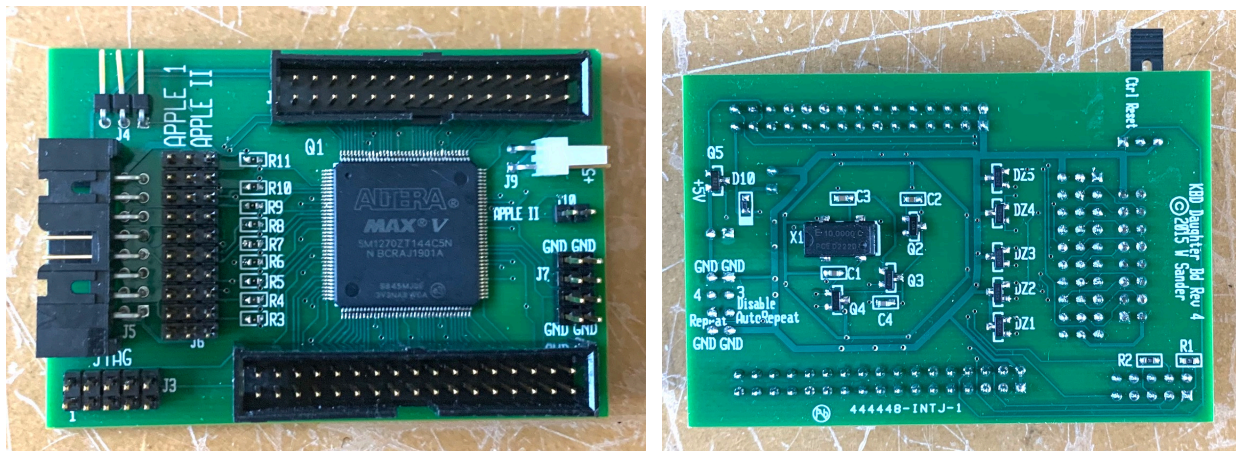


Figure 9 Daughter Board Front and Back

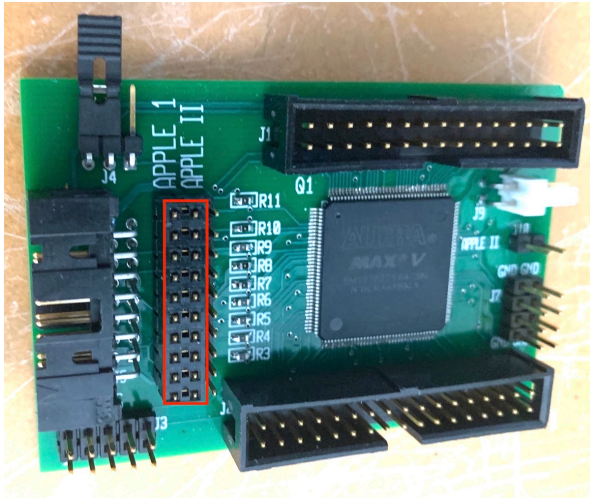


Figure 10 Apple 1 Configuration

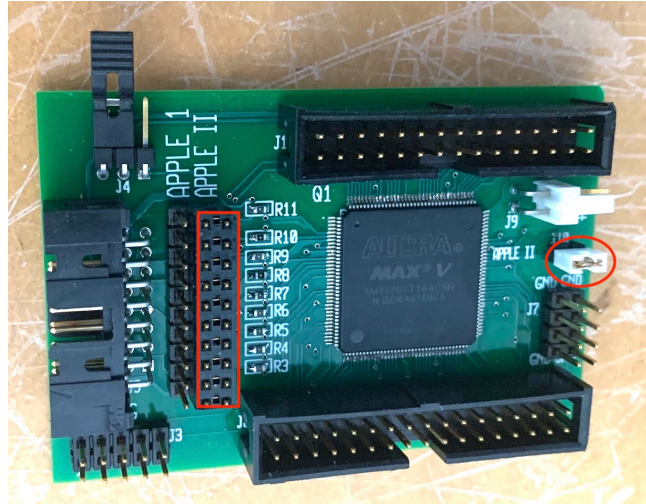


Figure 11 Apple II Configuration

Figure 10 shows the Daughter Board in an Apple 1 configuration and Figure 11 shows the Daughter Board in an Apple II Configuration. For the Apple 1 the 10 element shorting block highlighted is on the left pins and for the Apple II the shorting block is located on the right pins. For the Apple II an additional shorting block is added on the right side as highlighted.

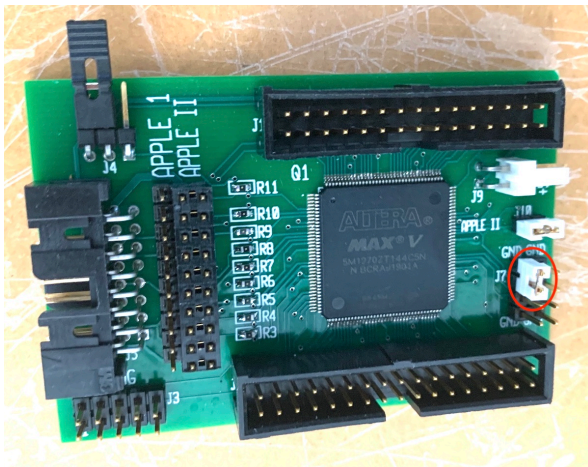


Figure 12 Capslock off at Power Up

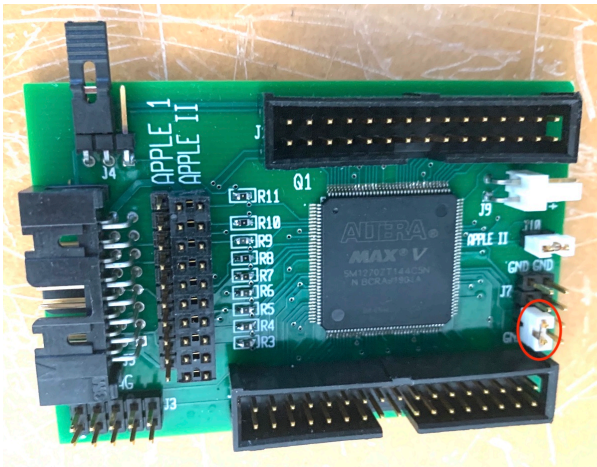


Figure 13 Disable Autorepeat

There are a few other optional functions that can be activated. For the Apple 1 and Apple II it is more appropriate for the Caps Lock function to be active so that is the appropriate default power on condition. For other applications it is better to have the Caps Lock inactive on power up so by adding the shorting block shown in Figure 12 the Keyboard will power up with Caps Lock off. The Caps Lock key is green when Caps Lock is on and Yellow when Caps Lock is off. The Autorepeat function can be disabled with a shorting block placed as shown in Figure 13.

The significant features of the keyboard are:

All 128 ASCII characters can be generated including Upper and Lower case.

The keyboard has true N-Key rollover with no diodes since each key goes directly to the FPGA

Every key is auto-repeat, after any key is held for 1 sec the repeat starts. This can be disabled on the daughter board.

The keyboard outline is compatible with the Apple II and Apple II+

The key switches are Cherry MX switches which are widely used, all parts are new and modern parts, no old stock parts.

Series resistors and zener diodes are used to protect the circuits if there is incorrect insertion of the 16 cable in the DIP header.

A Caps Lock toggle key is lighted Green for Caps Lock and Yellow for no Caps Lock

The Keyboard encoder is an Altera MAX V FPGA logic implementation, there is no microprocessor.

Table 1 shows the key combination needed to create any of the 128 ASCII codes

ASCII			KEYSTROKE		ASCII			KEYSTROKE		ASCII			KEYSTROKE		ASCII			KEYSTROKE	
			CAPSLOCK					CAPSLOCK					CAPSLOCK					CAPSLOCK	
Char	Hex	Dec	OFF	ON	Char	Hex	Dec	N/A	Char	Hex	Dec	OFF	ON	Char	Hex	Dec	OFF	ON	
NUL	00	0	Ctrl 0		SP	20	32	SPACE	@	40	64	Ctrl Shift P	Shift P	`	60	96	Ctrl Shift 7		
SOH	01	1	Ctrl A		!	21	33	Shft 1	A	41	65	Shift A	A	a	61	97	A		
STX	02	2	Ctrl B		"	22	34	Shift 2	B	42	66	Shift B	B	b	62	98	B		
ETX	03	3	Ctrl C		#	23	35	Shft 3	C	43	67	Shift C	C	c	63	99	C		
EOT	04	4	Ctrl D		\$	24	36	Shft 4	D	44	68	Shift D	D	d	64	100	D		
ENQ	05	5	Ctrl E		%	25	37	Shft 5	E	45	69	Shift E	E	e	65	101	E		
ACK	06	6	Ctrl F		&	26	38	Shft 6	F	46	70	Shift F	F	f	66	102	F		
BEL	07	7	Ctrl G		'	27	39	Shft 7	G	47	71	Shift G	G	g	67	103	G		
BS	08	8	Ctrl H		(	28	40	Shft 8	H	48	72	Shift H	H	h	68	104	H	
			A2←,A1 Ctrl←																
HT	09	9	Ctrl I		)	29	41	Shft 9	I	49	73	Shift I	I	i	69	105	I	
LF	0A	10	Ctrl J		*	2A	42	Shft :	J	4A	74	Shift J	J	j	6A	106	J		
VT	0B	11	Ctrl K		+	2B	43	Shft ;	K	4B	75	Shift K	K	k	6B	107	K		
FF	0C	12	Ctrl L		,	2C	44	,	L	4C	76	Shift L	L	l	6C	108	L		
CR	0D	13	Ctrl M		-	2D	45	-	M	4D	77	Shift M	M		6D	109	M		
			RETURN											m					
SO	0E	14	Ctrl N		.	2E	46	.	N	4E	78	Shift N	N	n	6E	110	N		
SI	0F	15	Ctrl O		/	2F	47	/	O	4F	79	Shift O	O	o	6F	111	O		
DLE	10	16	Ctrl P		0	30	48	0	P	50	80	Shift P	P	p	70	112	P		
DC1	11	17	Ctrl Q		1	31	49	1	Q	51	81	Shift Q	Q	q	71	113	Q		
DC2	12	18	Ctrl R		2	32	50	2	R	52	82	Shift R	R	r	72	114	R		
DC3	13	19	Ctrl S		3	33	51	3	S	53	83	Shift S	S	s	73	115	S		
DC4	14	20	Ctrl T		4	34	52	4	T	54	84	Shift T	T	t	74	116	T		
NAK	15	21	Ctrl U		5	35	53	5	U	55	85	Shift U	U	u	75	117	U		
			A2→																
SYN	16	22	Ctrl V		6	36	54	6	V	56	86	Shift V	V	v	76	118	V		
ETB	17	23	Ctrl W		7	37	55	7	W	57	87	Shift W	W	w	77	119	W		
CAN	18	24	Ctrl X		8	38	56	8	X	58	88	Shift X	X	x	78	120	X		
EM	19	25	Ctrl Y		9	39	57	9	Y	59	89	Shift Y	Y	y	79	121	Y		
SUB	1A	26	Ctrl Z		:	3A	58	:	Z	5A	90	Shift Z	Z	z	7A	122	Z		
			Ctrl :																
ESC	1B	27	Ctrl ;		;	3B	59	;	[	5B	91	Ctrl 8		{	7B	123	Ctrl Shift 8	
			ESC																
FS	1C	28	Ctrl ,		<	3C	60	Shift ,	\	5C	92	Ctrl /		|	7C	124	Ctrl Shift /		
GS	1D	29	Ctrl -		=	3D	61	Shift -	]	5D	93	Ctrl 9		}	7D	125	Ctrl Shift 9	
RS	1E	30	Ctrl .		>	3E	62	Shift .	^	5E	94	Shift 0		~	7E	126	Ctrl Shift -		
												Ctrl Shift N	Shift N						
US	1F	31		Ctrl /	?	3F	63	Shift /	_	5F	95	A1 ←; A2 Ctrl←		DEL	7F	127	Ctrl Shift ←		

Table 1 ASCII Key Codes