Ultimate KeyCoder® SH1101

User-Programmable Keyboard Encoder with Auto-Detecting USB or PS/2 Interface

HID & SYSTEM MANAGEMENT PRODUCTS, KEYCODER® FAMILY **PRELIMINARY**

DESCRIPTION

The Ultimate KeyCoder® SH1101 is a keyboard encoder with a user-programmable keyboard matrix, and an interface that automatically detects a USB or PS/2 port and communicates with either. The IC can be programmed to scan virtually any keyboard, so it combines the features of many encoders in one part. Custom keyboard solutions are enabled with an off-the-shelf IC with little additional development.

The SH1101 scans and encodes an 8-row by 16-column matrix. The encoder retrieves matrix information from a separate serial EEPROM IC. Semtech provides a Windows® application to create the matrix file, and another application to upload the matrix from the file to the EEPROM using the host PC's USB interface. In production, users have the option of gang programming the EEPROMs or loading them in-system via the USB port.

The SH1101 provides an external PS/2 port that supports hot plug and hot swap of certain PS/2 devices. If the SH1101 is connected to the host's PS/2 port, then the SH1101's external PS/2 port supports only keyboards. If the SH1101 is connected to the host's USB port, then the SH1101's external port supports keyboards or mice, including wheel mice.

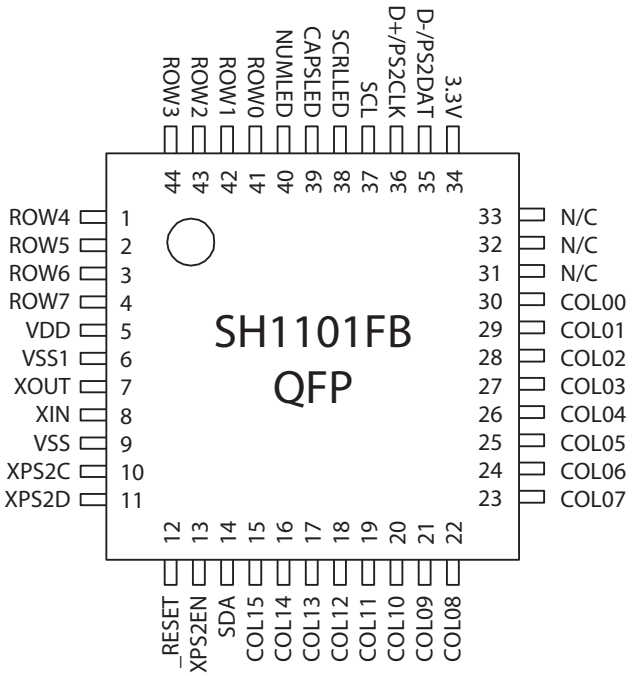
FEATURES

- User-programmable keyboard matrix
- Interfaces to host using USB or PS/2; automatically detects interface type
- Scans and encodes an 8 x 16 keyboard matrix
- Custom / macro keys
- Windows® application provided to design keyboard
- External PS/2 port supports hot plug and hot swapof PS/2 devices
- Provides direct drive for three LEDs (caps lock, numeric lock, scroll lock)
- Easy to set up and use

APPLICATIONS

- Industrial keyboards
- Point-of-sale (POS) terminals
- Web kiosks
- Notebook PCs
- Portable devices
- Accessories
- Embedded keyboards

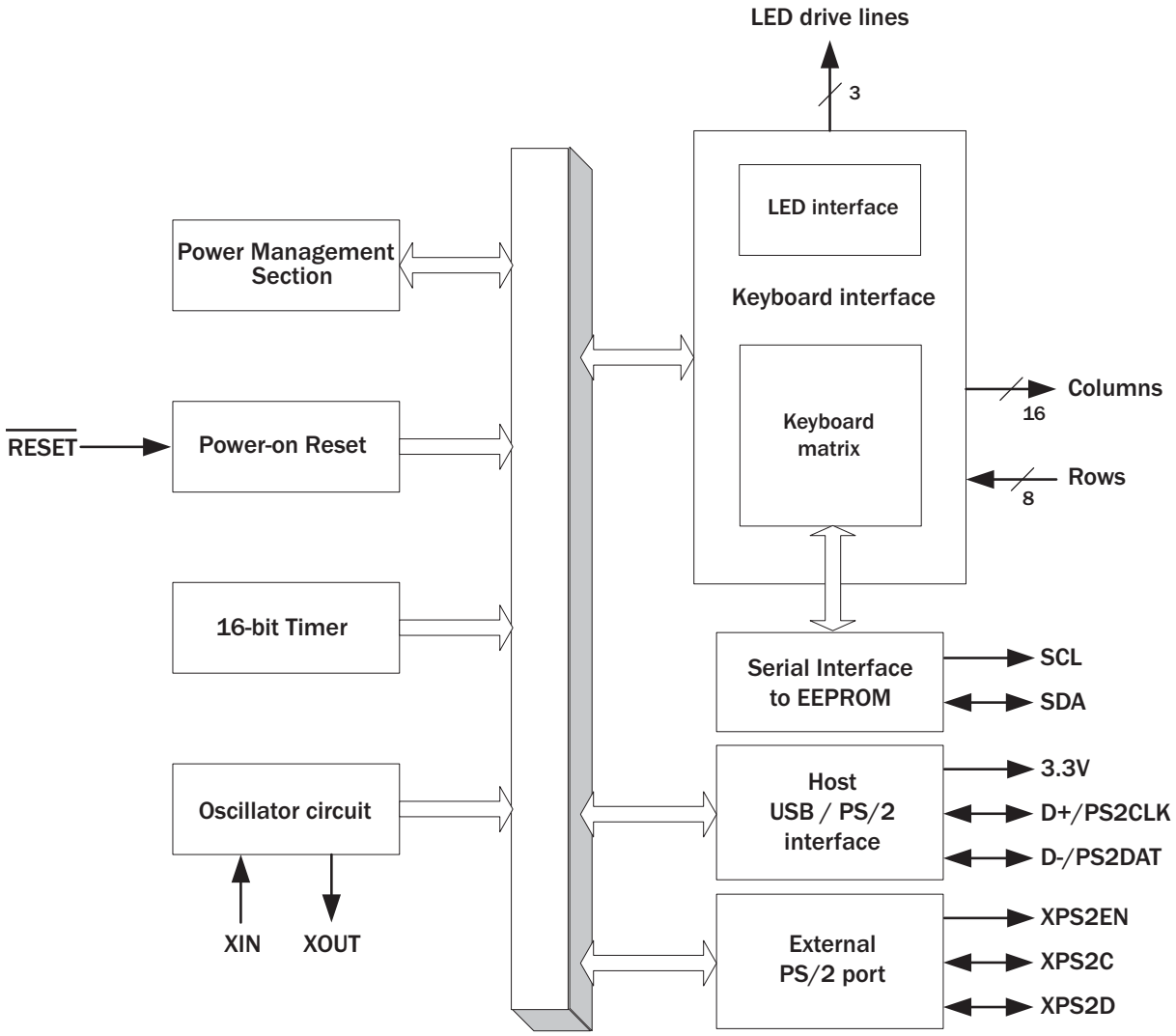
PIN ASSIGNMENTS



ORDERING CODE

Package Options	Pitch	T_A = -40° C to +85° C
44-pin QFP	0.8 mm	SH1101FB
Other Materials	**Type**	**Order number**
Ultimate KeyCoder® eval. kit	Evaluation kit	EVK-SH1101

BLOCK DIAGRAM FOR THE ULTIMATE KEYCODER®



SEMTECH

FUNCTIONAL DESCRIPTION

The Ultimate KeyCoder® consists of the following major functional sections (see the block diagram on the previous page). These are the Keyboard Interface, Power Management, the 16-bit Timer, the Oscillator Circuit, Power-on Reset, the USB / PS/2 Interface, the Serial Interface, and the External PS/2 Interface.

OSCILLATOR

The Ultimate KeyCoder® has a built-in oscillator circuit intended to work with an external 6.00 MHz ceramic resonator with built-in load capacitors.

USB POWER MANAGEMENT

If the SH1101 is connected to the host's USB port, it uses USB power management.

The USB host can put the Ultimate KeyCoder® in a suspended state. In this state, the IC fully complies with the USB specification for power consumption, dissipating current only in the USB-mandated pull-up for device identification.

EXTERNAL PS/2 PINS

If the external PS/2 port is not used, the external PS/2 clock and data pins (XPS2C and XPS2D) must each be connected to power (V_{DD}) through a 100KΩ resistor.

PIN DEFINITIONS

Mnemonic	Pin	Type	Name and Function
Power			
V_{DD}	5	P	**Power supply**
Vss	9	P	**Ground**
Vss1	6	P	**Ground**
Reset			
_RESET	12	I	**Reset**
Oscillators			
XIN	8	I	**Oscillator input**
XOUT	7	O	**Oscillator output**
USB / PS/2			
D-/PS2DAT	35	I/O	**USB D- line / PS2 data**
D+/PS2CLK	36	I/O	**USB D+line / PS2 clock**
3.3V	34	O	**USB reference voltage output**
Serial			
SDA	14	I/O	**Serial data** to and from matrix EEPROM
SCL	37	O	**Serial clock** for interface with EEPROM
Keyboard			
COL00-COL15	30-15	O	**Column lines for scan matrix**
ROW0-ROW3	41-44	I	**Row lines for scan matrix**
ROW4-ROW7	1-4	I	**Row lines for scan matrix**
LEDs			
CAPSLED	39	O	**Caps lock LED:** direct drive port
NUMLED	40	O	**Num lock LED:** direct drive port
SCRLLED	38	O	**Scroll lock LED:** direct drive port
Ext. PS/2			
XPS2D	11	I/O	**External PS/2 port data line**
XPS2C	10	I/O	**External PS/2 port clock line**
XPS2EN	13	O	**External PS/2 port enable**
Unused			
N/C	31-33		**Not connected**

Note: An underscore before a pin mnemonic denotes an active low signal.
Pin Types Legend: I=Input; O=Output; I/O=Input or Output; P=Power; AI= Analog Input

PS/2 POWER MANAGEMENT

If the SH1101 is connected to the host's PS/2 port, it uses PS/2 power management. After 200ms of inactivity, the SH1101 enters stop mode. The pressing of any key wakes up the SH1101 without losing the key data.

EEPROM SERIAL INTERFACE

The serial data and serial clock pins must be connected to an industry standard 32-Kbit EEPROM of generic type 24LC32.

USB FUNCTIONALITY

If the SH1101 is connected to the host's USB port, it acts as a low-speed USB device. The SH1101 has two USB endpoints; one endpoint is a keyboard device, the other endpoint is a composite device that includes three interfaces: a bootable mouse, a system power interface, and a consumer control interface.

PS/2 FUNCTIONALITY

If the SH1101 is connected to the host's PS/2 port, it acts as a multimedia PS/2 keyboard and fully implements the PS/2 specifications for scan code sets 1, 2, and 3.

EXTERNAL PS/2 PORT

The SH1101 provides an external port for PS/2 devices. A supported device can be hot-plugged into the port and can immediately start communicating with the host.

If the SH1101 is connected to the host's USB port, the SH1101's external PS/2 port supports keyboards and mice, including wheel mice.

If the SH1101 is connected to the host's PS/2 port, the SH1101's external PS/2 port supports only keyboards.

KEYBOARD SCANNER

The Ultimate KeyCoder® scans a keyboard organized as an 8 row by 16 column matrix for a maximum of 128 keys. Smaller size matrixes can be accommodated by leaving unused pins open. The IC provides internal pull-ups for the row input pins. When active, the encoder selects each column line (C0-C15); for each column selected, it reads the row data lines (R0-R7). A key closure is detected as a zero in the corresponding position of the matrix.

Each key found pressed is debounced for a period of 20ms. Once the key is verified, the corresponding key code(s) are loaded into the transmit buffer of the serial communication channel.

N-KEY ROLLOVER

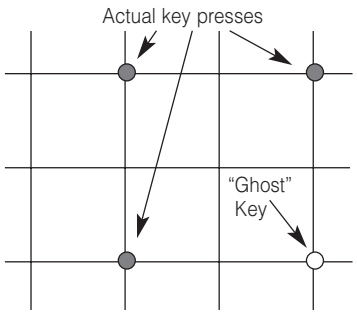
N-key rollover means the code(s) corresponding to each key press are transmitted to the host system as soon as that key is debounced, independent of the release of other keys.

When a key is released, the corresponding break code is transmitted to the host system. Several keys can be held pressed at the same time.

"GHOST" KEY ELIMINATION

In any scanned contact switch matrix, whenever three keys defining a rectangle on the switch matrix are pressed at the same time, a fourth key positioned on the fourth corner of the rectangle is sensed as being pressed. This is known as the "ghost" or "phantom" key problem.

Although the problem cannot be totally eliminated without using external hardware, there are methods to neutralize its negative effects for most practical applications. Keys that are intended to be used in combinations should be placed in the same row or column of the matrix, whenever possible. Shift keys (Shift, Alt, Ctrl, Window) should not reside in the same row (or column) as any other keys. The SH1101 has built-in mechanisms to detect and reject "ghost" keys.



KEYBOARD BACKLIGHT CONTROL

The SH1101 and its supporting software have the capability to control a keyboard backlight. This capability is not detailed in this data sheet. Users who require keyboard backlight control should contact Semtech for more information.

MATRIX DESIGN

Here are some factors that need to be considered when designing a keyboard matrix.

Because of the “ghost” key problem described in a previous section, shift-type keys should be treated carefully when designing a matrix. Shift-type keys are keys that are held down while other keys are pressed: Shift, Alt, Control, Win (or GUI), and Function.

(A) Some columns (or rows) should be set aside for shift-type keys only, and all shift-type keys should be assigned to those columns (or rows).

(B) Cases where shift-type keys share a row or a column should be kept to a minimum. As far as possible, two shift-type keys should not share a row or column with each other unless their function is the same, or they are very unlikely to be used together, or both.

For example, see this diagram of the standard matrix for the Fujitsu FKB7654 laptop-type keyboard.

(A) All shift-type keys are assigned to columns 0, 1, 3, 12, 14, and 15, and only shift-type keys are assigned to those columns.

(B) There are only four cases where shift-type keys share a row or a column, and only two keys in each case, seven keys total:

1. Function and Left Alt in row 7

2. Right Alt and Left Alt in column 3

3. Right Control and Left Control in column 14

4. Right Shift and Left Shift in column 15

EXAMPLE KEYBOARD MATRIX (FUJITSU FKB7654)

Columns → / Rows ↓	C00	C01	C02	C03	C04	C05	C06	C07	C08	C09	C10	C11	C12	C13	C14	C15
R0			TAB		F1	8 N8	F6	F9	F10	F12	PAUSE	BACKSPACE		ARWR END		LSHIFT
NL																
Fn																
R1			CAPS LOCK		F2	9 N9	3	F5	F11	0 N*	=/+	ARWDN PAGE DOWN		ARWL HOME	LCTRL	
NL																
Fn																
R2			1		F3	I N5	4	6	F8	O N6	]/}	ARWUP PAGE UP		DELETE SYSRQ		RSHIFT
NL																
Fn																
R3			S		E	,/ <	F	V	N	./> N.	\/|	'/"	RWIN	//? N/		
NL																
R4			Z	RALT	D	SPACE	C	B	H			APPLICATION				
R5		LWIN	A		W	K N2	R	G	Y			ENTER		;/: N+		
NL																
R6			Q		2	U N4	5	T	7 N7	L N3	[/{			P N-	RCTRL	
NL																
R7	FUNCTION		ESC	LALT	X	M N0	F4	F7	J N1	SCROL LOCK NUM LOCK	`/~	INSERT PRINT SCREEN		-/_		
NL																
Fn																

CREATING THE MATRIX

The Ultimate KeyCoder® Designer program enables the user to create keyboard matrix and macro key data, then save them in Intel hex and binary formats. This program was designed specifically for the Semtech Ultimate KeyCoder®, which keeps all its matrix information as well as scan codes and custom macro keys in an EEPROM.

The Designer program allows the user to assign a logical key to any position in the 8 x 16 matrix for each of four situations:

1. Num Lock off and Function key up

2. Num Lock on and Function key up

3. Num Lock off and Function key down

4. Num Lock on and Function key down

The Designer program also allows the user to create up to 22 macro keys, which can then be assigned to positions in the matrix

For detailed information and instructions for the Ultimate KeyCoder® Designer program, see the help file provided with the program.

UPLOADING THE MATRIX TO THE EEPROM

The Semtech Upgrader program loads a binary data file (which is created by the Ultimate KeyCoder® Designer program, and which contains keyboard matrix and custom key data) to an EEPROM, where it can be accessed by the Ultimate KeyCoder®.

For the most up-to-date and specific information on the Upgrader program, see the readme.txt file supplied with the program.

Using the Upgrader program

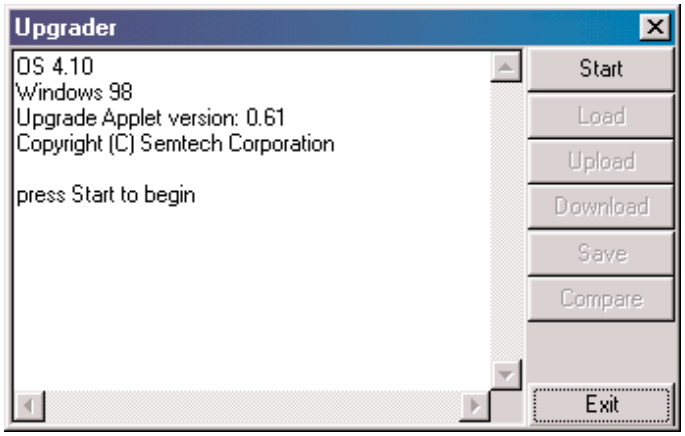
1. Connect the Ultimate KeyCoder® assembly, with the EEPROM, to the host PC with a USB cable. Windows® will automatically detect the assembly as a new USB HID (human interface device).

- Windows® may prompt the user to load the Windows® installation media to install the necessary USB HID files, including "hidclass.sys" and "hidusb.sys." Load the indicated media or find the files elsewhere. The assembly will not work until all necessary class and driver files are installed.

2. Start Upgrader by double-clicking on the executable file.

3. The Upgrader window appears. It consists of a message space and 7 buttons: Start, Load, Upload, Download, Save, Compare, and Exit.

- The message space shows which Windows® operating system is running. It also shows the version number of the Upgrader application that is running. This version must be 0.61 or higher to work with the released version of Ultimate KeyCoder®.



4. Click on the Start button. Upgrader looks for the Ultimate KeyCoder® assembly device. Upgrader indicates, in the message space, whether the device is found or not.

- If the device is not found, it might not have been installed correctly in step 1.

5. To upload a binary keyboard-matrix file to the EEPROM:

- Click on the Load button. An Open dialog box appears, looking for a file with the ".bin" extension.
- If the required file does not have the ".bin" extension, click the down arrow next to "Files of type" and pick "Any Files (*.*)."
- Select the required file. Upgrader loads the data from the file selected into memory.
- Click on the Upload button. Upgrader uploads the data from memory to the EEPROM.

6. To download the binary keyboard-matrix file from the EEPROM:

- Click on the Download button. Upgrader downloads the data from the EEPROM to memory.
- Click on the Save button. Upgrader saves the data from memory to a file, prompting the user for the file name and location.

UPLOADING THE MATRIX TO THE EEPROM (CONT'D)

7. To compare a binary keyboard-matrix loaded from a file to the data downloaded from the EEPROM:

   - Click on the Load button. An Open dialog box appears, looking for a file with the ".bin" extension.
   - If the required file does not have the ".bin" extension, click the down arrow next to "Files of type" and pick "Any Files (*.*)."
   - Select the required file. Upgrader loads the data from the file selected into memory.
   - Click on the Download button. Upgrader downloads the data from the EEPROM to memory.
   - Click on the Compare button. Upgrader compares the data loaded from the file to the data downloaded from the EEPROM. Upgrader indicates, in the message space, whether the data is identical or not.

   Note: What Upgrader actually compares are its load buffer and its download buffer. Data must be loaded from a disk file, and data must be downloaded from the EEPROM, for comparison to take place. If the message "Nothing to compare" appears, it means at least one of these steps was skipped and one of these buffers is empty.

8. Click on the Exit button to exit Upgrader.

9. Start using the the Ultimate KeyCoder® assembly, or disconnect it from the host PC.

Notes on the key codes table

SEUSB is the Semtech extended USB key number

Program code is the code entered by the user in the Designer program to identify the key

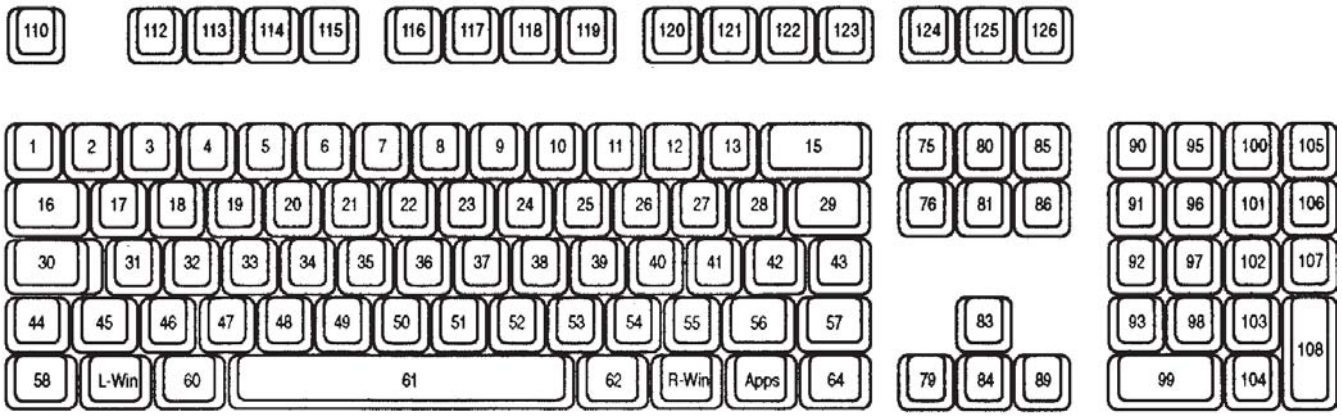
AT-101 is the key reference number on the standard AT-101 keyboard layout, shown in the diagram below

The **USB page** column contains the Universal Serial Bus (USB) Human Interface Device (HID) usage page for the key. Most kets are on the keyboard page, page 0x07. For information about USB codes, see the USB HID specifications, published by the USB-IF (http://www.usb.org/).

The **USB usage** column contains the USB HID usage ID for the key on the specified USB HID page.

PS/2 codes are the make (key press) and break (key release) codes for PS/2 scan sets 1, 2, and 3; U/A means unassigned. Note that some keys, by default, do not generate break codes, even if the break codes are shown in this table.

AT-101 key reference numbers



KEY CODES TABLE (CONT'D)

SEUSB	Program code	Description	Unshifted literal	Shifted literal	AT-101	USB page	USB usage	Scan 1 make	Scan 1 break	Scan 2 make	Scan 2 break	Scan 3 make	Scan 3 break
0	No Key	No Event	(none)	(none)	N/A	0x07	0x0000	None	None	None	None	None	None
1	ROLLOVER	Overrun Error	(none)	(none)	N/A	0x07	0x0001	0xFF	None	0x00	None	None	None
2	POSTFAIL	POST Fail	(none)	(none)	N/A	0x07	0x0002	0xFC	None	0xFC	None	None	None
3	UNDEFINED	ErrorUndefined	(none)	(none)	N/A	0x07	0x0003	U/A	U/A	U/A	U/A	U/A	U/A
4	A	literal	a	A	31	0x07	0x0004	0x1E	0x9E	0x1C	0xF0 1C	0x1C	0xF0 1C
5	B	literal	b	B	50	0x07	0x0005	0x30	0xB0	0x32	0xF0 32	0x32	0xF0 32
6	C	literal	c	C	48	0x07	0x0006	0x2E	0xAE	0x21	0xF0 21	0x21	0xF0 21
7	D	literal	d	D	33	0x07	0x0007	0x20	0xA0	0x23	0xF0 23	0x23	0xF0 23
8	E	literal	e	E	19	0x07	0x0008	0x12	0x92	0x24	0xF0 24	0x24	0xF0 24
9	F	literal	f	F	34	0x07	0x0009	0x21	0xA1	0x2B	0xF0 2B	0x2B	0xF0 2B
10	G	literal	g	G	35	0x07	0x000A	0x22	0xA2	0x34	0xF0 34	0x34	0xF0 34
11	H	literal	h	H	36	0x07	0x000B	0x23	0xA3	0x33	0xF0 33	0x33	0xF0 33
12	I	literal	i	I	24	0x07	0x000C	0x17	0x97	0x43	0xF0 43	0x43	0xF0 43
13	J	literal	j	J	37	0x07	0x000D	0x24	0xA4	0x3B	0xF0 3B	0x3B	0xF0 3B
14	K	literal	k	K	38	0x07	0x000E	0x25	0xA5	0x42	0xF0 42	0x42	0xF0 42
15	L	literal	l	L	39	0x07	0x000F	0x26	0xA6	0x4B	0xF0 4B	0x4B	0xF0 4B
16	M	literal	m	M	52	0x07	0x0010	0x32	0xB2	0x3A	0xF0 3A	0x3A	0xF0 3A
17	N	literal	n	N	51	0x07	0x0011	0x31	0xB1	0x31	0xF0 31	0x31	0xF0 31
18	O	literal	o	O	25	0x07	0x0012	0x18	0x98	0x44	0xF0 44	0x44	0xF0 44
19	P	literal	p	P	26	0x07	0x0013	0x19	0x99	0x4D	0xF0 4D	0x4D	0xF0 4D
20	Q	literal	q	Q	17	0x07	0x0014	0x10	0x90	0x15	0xF0 15	0x15	0xF0 15
21	R	literal	r	R	20	0x07	0x0015	0x13	0x93	0x2D	0xF0 2D	0x2D	0xF0 2D
22	S	literal	s	S	32	0x07	0x0016	0x1F	0x9F	0x1B	0xF0 1B	0x1B	0xF0 1B
23	T	literal	t	T	21	0x07	0x0017	0x14	0x94	0x2C	0xF0 2C	0x2C	0xF0 2C
24	U	literal	u	U	23	0x07	0x0018	0x16	0x96	0x3C	0xF0 3C	0x3C	0xF0 3C
25	V	literal	v	V	49	0x07	0x0019	0x2F	0xAF	0x2A	0xF0 2A	0x2A	0xF0 2A
26	W	literal	w	W	18	0x07	0x001A	0x11	0x91	0x1D	0xF0 1D	0x1D	0xF0 1D
27	X	literal	x	X	47	0x07	0x001B	0x2D	0xAD	0x22	0xF0 22	0x22	0xF0 22
28	Y	literal	y	Y	22	0x07	0x001C	0x15	0x95	0x35	0xF0 35	0x35	0xF0 35
29	Z	literal	z	Z	46	0x07	0x001D	0x2C	0xAC	0x1A	0xF0 1A	0x1A	0xF0 1A
30	1	literal	1	!	2	0x07	0x001E	0x02	0x82	0x16	0xF0 16	0x16	0xF0 16
31	2	literal	2	@	3	0x07	0x001F	0x03	0x83	0x1E	0xF0 1E	0x1E	0xF0 1E
32	3	literal	3	#	4	0x07	0x0020	0x04	0x84	0x26	0xF0 26	0x26	0xF0 26
33	4	literal	4	$	5	0x07	0x0021	0x05	0x85	0x25	0xF0 25	0x25	0xF0 25
34	5	literal	5	%	6	0x07	0x0022	0x06	0x86	0x2E	0xF0 2E	0x2E	0xF0 2E
35	6	literal	6	^	7	0x07	0x0023	0x07	0x87	0x36	0xF0 36	0x36	0xF0 36
36	7	literal	7	&	8	0x07	0x0024	0x08	0x88	0x3D	0xF0 3D	0x3D	0xF0 3D
37	8	literal	8	*	9	0x07	0x0025	0x09	0x89	0x3E	0xF0 3E	0x3E	0xF0 3E
38	9	literal	9	(	10	0x07	0x0026	0x0A	0x8A	0x46	0xF0 46	0x46	0xF0 46
39	0	literal	0	)	11	0x07	0x0027	0x0B	0x8B	0x45	0xF0 45	0x45	0xF0 45
40	ENTER	Return	(return)	(return)	43	0x07	0x0028	0x1C	0x9C	0x5A	0xF0 5A	0x5A	0xF0 5A
41	ESC	Escape	(none)	(none)	110	0x07	0x0029	0x01	0x81	0x76	0xF0 76	0x08	0xF0 08
42	BACKSPACE	Backspace	(none)	(none)	15	0x07	0x002A	0x0E	0x8E	0x66	0xF0 66	0x66	0xF0 66
43	TAB	Tab	(tab)	(tab)	16	0x07	0x002B	0x0F	0x8F	0x0D	0xF0 0D	0x0D	0xF0 0D
44	SPACE	Space	(space)	(space)	61	0x07	0x002C	0x39	0xB9	0x29	0xF0 29	0x29	0xF0 29
45	-/_	literal	-	_	12	0x07	0x002D	0x0C	0x8C	0x4E	0xF0 4E	0x4E	0xF0 4E
46	=/+	literal	=	+	13	0x07	0x002E	0x0D	0x8D	0x55	0xF0 55	0x55	0xF0 55
47	[/{	literal	[	{	27	0x07	0x002F	0x1A	0x9A	0x54	0xF0 54	0x54	0xF0 54
48	]/}	literal	]	}	28	0x07	0x0030	0x1B	0x9B	0x5B	0xF0 5B	0x5B	0xF0 5B

SEUSB	Program code	Description	Unshifted literal	Shifted literal	AT-101	USB page	USB usage	Scan 1 make	Scan 1 break	Scan 2 make	Scan 2 break	Scan 3 make	Scan 3 break
49	||	literal	\	|	29	0x07	0x0031	0x2B	0xAB	0x5D	0xF0 5D	0x5C	0xF0 5C
51	;/:	literal	;	:	40	0x07	0x0033	0x27	0xA7	0x4C	0xF0 4C	0x4C	0xF0 4C
52	'/"	literal	'	"	41	0x07	0x0034	0x28	0xA8	0x52	0xF0 52	0x52	0xF0 52
53	`/~	literal	`	~	1	0x07	0x0035	0x29	0xA9	0x0E	0xF0 0E	0x0E	0xF0 0E
54	,/<	literal	,	<	53	0x07	0x0036	0x33	0xB3	0x41	0xF0 41	0x41	0xF0 41
55	./>	literal	.	>	54	0x07	0x0037	0x34	0xB4	0x49	0xF0 49	0x49	0xF0 49
56	//?	literal	/	?	55	0x07	0x0038	0x35	0xB5	0x4A	0xF0 4A	0x4A	0xF0 4A
57	CAPS LOCK	Caps Lock	(none)	(none)	30	0x07	0x0039	0x3A	0xBA	0x58	0xF0 58	0x14	0xF0 14
58	F1	F1	(none)	(none)	112	0x07	0x003A	0x3B	0xBB	0x05	0xF0 05	0x07	0xF0 07
59	F2	F2	(none)	(none)	113	0x07	0x003B	0x3C	0xBC	0x06	0xF0 06	0x0F	0xF0 0F
60	F3	F3	(none)	(none)	114	0x07	0x003C	0x3D	0xBD	0x04	0xF0 04	0x17	0xF0 17
61	F4	F4	(none)	(none)	115	0x07	0x003D	0x3E	0xBE	0x0C	0xF0 0C	0x1F	0xF0 1F
62	F5	F5	(none)	(none)	116	0x07	0x003E	0x3F	0xBF	0x03	0xF0 03	0x27	0xF0 27
63	F6	F6	(none)	(none)	117	0x07	0x003F	0x40	0xC0	0x0B	0xF0 0B	0x2F	0xF0 2F
64	F7	F7	(none)	(none)	118	0x07	0x0040	0x41	0xC1	0x83	0xF0 83	0x37	0xF0 37
65	F8	F8	(none)	(none)	119	0x07	0x0041	0x42	0xC2	0x0A	0xF0 0A	0x3F	0xF0 3F
66	F9	F9	(none)	(none)	120	0x07	0x0042	0x43	0xC3	0x01	0xF0 01	0x47	0xF0 47
67	F10	F10	(none)	(none)	121	0x07	0x0043	0x44	0xC4	0x09	0xF0 09	0x4F	0xF0 4F
68	F11	F11	(none)	(none)	122	0x07	0x0044	0x57	0xD7	0x78	0xF0 78	0x56	0xF0 56
69	F12	F12	(none)	(none)	123	0x07	0x0045	0x58	0xD8	0x07	0xF0 07	0x5E	0xF0 5E
70	PRINT SCREEN	Print Screen	(none)	(none)	124	0x07	0x0046	0xE0 37	0xE0 B7	0xE0 7C	0xE0 F0 7C	0x57	0xF0 57
71	SCROL LOCK	Scroll Lock	(none)	(none)	125	0x07	0x0047	0x46	0xC6	0x7E	0xF0 7E	0x5F	0xF0 5F
72	PAUSE	Pause	(none)	(none)	126	0x07	0x0048	0xE1 1D 45 E1 9D C5	None	0xE1 14 77 E1 F0 14 F0 77	None	0x62	0xF0 62
72	PAUSE	Break (Ctl + Pause)	(none)	(none)	126	0x07	0x0048	0xE0 46 E0 C6	None	0xE0 7E E0 F0 7E	None	None	None
73	INSERT	Insert	(none)	(none)	75	0x07	0x0049	0xE0 52	0xE0 D2	0xE0 70	0xE0 F0 70	0x67	0xF0 67
74	HOME	Home	(none)	(none)	80	0x07	0x004A	0xE0 47	0xE0 C7	0xE0 6C	0xE0 F0 6C	0x6E	0xF0 6E
75	PAGE UP	Page Up	(none)	(none)	85	0x07	0x004B	0xE0 49	0xE0 C9	0xE0 7D	0xE0 F0 7D	0x6F	0xF0 6F
76	DELETE	Delete	(none)	(none)	76	0x07	0x004C	0xE0 53	0xE0 D3	0xE0 71	0xE0 F0 71	0x64	0xF0 64
77	END	End	(none)	(none)	81	0x07	0x004D	0xE0 4F	0xE0 CF	0xE0 69	0xE0 F0 69	0x65	0xF0 65
78	PAGE DOWN	Page Down	(none)	(none)	86	0x07	0x004E	0xE0 51	0xE0 D1	0xE0 7A	0xE0 F0 7A	0x6D	0xF0 6D
79	ARWR	Right Arrow	(none)	(none)	89	0x07	0x004F	0xE0 4D	0xE0 CD	0xE0 74	0xE0 F0 74	0x6A	0xF0 6A
80	ARWL	Left Arrow	(none)	(none)	79	0x07	0x0050	0xE0 4B	0xE0 CB	0xE0 6B	0xE0 F0 6B	0x61	0xF0 61
81	ARWDN	Down Arrow	(none)	(none)	84	0x07	0x0051	0xE0 50	0xE0 D0	0xE0 72	0xE0 F0 72	0x60	0xF0 60
82	ARWUP	Up Arrow	(none)	(none)	83	0x07	0x0052	0xE0 48	0xE0 C8	0xE0 75	0xE0 F0 75	0x63	0xF0 63
83	NUM LOCK	Num Lock	(none)	(none)	90	0x07	0x0053	0x45	0xC5	0x77	0xF0 77	0x76	0xF0 76
84	N/	Keypad literal /	/	/	95	0x07	0x0054	0xE0 35	0xE0 B5	0xE0 4A	0xE0 F0 4A	0x77	0xF0 77
85	N*	Keypad literal *	*	*	100	0x07	0x0055	0x37	0xB7	0x7C	0xF0 7C	0x7E	0xF0 7E
86	N-	Keypad literal -	-	-	105	0x07	0x0056	0x4A	0xCA	0x7B	0xF0 7B	0x84	0xF0 84
87	N+	Keypad literal +	+	+	106	0x07	0x0057	0x4E	0xCE	0x79	0xF0 79	0x7C	0xF0 7C
88	NENTER	Keypad Enter	(enter)	(enter)	108	0x07	0x0058	0xE0 1C	0xE0 9C	0xE0 5A	0xE0 F0 5A	0x79	0xF0 79
89	N1	Keypad 1 End	1	(none)	93	0x07	0x0059	0x4F	0xCF	0x69	0xF0 69	0x69	0xF0 69
90	N2	Keypad 2 Down	2	(none)	98	0x07	0x005A	0x50	0xD0	0x72	0xF0 72	0x72	0xF0 72
91	N3	Keypad 3 PageDn	3	(none)	103	0x07	0x005B	0x51	0xD1	0x7A	0xF0 7A	0x7A	0xF0 7A
92	N4	Keypad 4 Left	4	(none)	92	0x07	0x005C	0x4B	0xCB	0x6B	0xF0 6B	0x6B	0xF0 6B
93	N5	Keypad 5	5	(none)	97	0x07	0x005D	0x4C	0xCC	0x73	0xF0 73	0x73	0xF0 73
94	N6	Keypad 6 Right	6	(none)	102	0x07	0x005E	0x4D	0xCD	0x74	0xF0 74	0x74	0xF0 74

SEUSB	Program code	Description	Unshifted literal	Shifted literal	AT-101	USB page	USB usage	Scan 1 make	Scan 1 break	Scan 2 make	Scan 2 break	Scan 3 make	Scan 3 break
95	N7	Keypad 7 Home	7	(none)	91	0x07	0x005F	0x47	0xC7	0x6C	0xF0 6C	0x6C	0xF0 6C
96	N8	Keypad 8 Up	8	(none)	96	0x07	0x0060	0x48	0xC8	0x75	0xF0 75	0x75	0xF0 75
97	N9	Keypad 9 PageUp	9	(none)	101	0x07	0x0061	0x49	0xC9	0x7D	0xF0 7D	0x7D	0xF0 7D
98	N0	Keypad 0 Insert	0	(none)	99	0x07	0x0062	0x52	0xD2	0x70	0xF0 70	0x70	0xF0 70
99	N.	Keypad . Delete	.	(none)	104	0x07	0x0063	0x53	0xD3	0x71	0xF0 71	0x71	0xF0 71
100	KEY45	Europe 2	(none)	(none)	45	0x07	0x0064	0x56	0xD6	0x61	0xF0 61	0x13	0xF0 61
101	APPLICATION	App	(none)	(none)	129	0x07	0x0065	0xE0 5D	0xE0 DD	0xE0 2F	0xE0 F0 2F	0x8D	0xF0 8D
133	BRAZKEYP	Keypad literal , (Brazilian Keypad .)	,	,		0x07	0x0085	0x7E	0xFE	0x6D	0xF0 6D	0x6D	0xF0 6D
135	INTL1	Keyboard Int'l 1 (Ro)	(none)	(none)		0x07	0x0087	0x73	0xF3	0x51	0xF0 51	0x51	0xF0 51
136	INTL2	Keyboard Intl'2 (Katakana /Hiragana)	(none)	(none)		0x07	0x0088	0x70	0xF0	0x13	0xF0 13	0x87	0xF0 87
137	INTL3	Keyboard Int'l 3 ¥ (Yen)	(none)	(none)		0x07	0x0089	0x7D	0xFD	0x6A	0xF0 6A	0x5D	0xF0 5D
138	INTL4	Keyboard Int'l 4 (Henkan)	(none)	(none)		0x07	0x008A	0x79	0xF9	0x64	0xF0 64	0x86	0xF0 86
139	INTL5	Keyboard Int'l 5 (Muhenkan)	(none)	(none)		0x07	0x008B	0x7B	0xFB	0x67	0xF0 67	0x85	0xF0 85
140	INTL6	Keyboard Int'l 6 (PC9800 Keypad ,)	(none)	(none)		0x07	0x008C	0x5C	0xDC	0x27	0xF0 27	None	None
154	SYSRQ	Keyboard SysReq /Attention	(none)	(none)		0x07	0x009A	U/A	U/A	U/A	U/A	U/A	U/A
165	PWR	System power down	(none)	(none)	N/A	0x01	0x0081	0xE0 5E	0xE0 DE	0xE0 37	0xE0 F0 37	None	None
166	SLEEP	System sleep	(none)	(none)	N/A	0x01	0x0082	0xE0 5F	0xE0 DF	0xE0 38	0xE0 F0 38	None	None
167	WAKE	System wake up	(none)	(none)	N/A	0x01	0x0083	0xE0 63	0xE0 E3	0xE0 5E	0xE0 F0 5E	None	None
168	NXTRK	Scan next track	(none)	(none)	N/A	0x0C	0x00B5	0xE0 19	0xE0 99	0xE0 4D	0xE0 F0 4D	None	None
169	PVTRK	Scan previous track	(none)	(none)	N/A	0x0C	0x00B6	0xE0 10	0xE0 90	0xE0 15	0xE0 F0 15	None	None
170	STOP	Stop	(none)	(none)	N/A	0x0C	0x00B7	0xE0 24	0xE0 A4	0xE0 3B	0xE0 F0 3B	None	None
171	PLAY	Play/Pause	(none)	(none)	N/A	0x0C	0x00CD	0xE0 22	0xE0 A2	0xE0 34	0xE0 F0 34	None	None
172	MUTE	Mute	(none)	(none)	N/A	0x0C	0x00E2	0xE0 20	0xE0 A0	0xE0 23	0xE0 F0 23	None	None
173	BASSBOOST	Bass boost	(none)	(none)	N/A	0x0C	0x00E5	None	None	None	None	None	None
174	INCVOL	Volume increment	(none)	(none)	N/A	0x0C	0x00E9	0xE0 30	0xE0 B0	0xE0 32	0xE0 F0 32	None	None
175	DCRVOL	Volume decrement	(none)	(none)	N/A	0x0C	0x00EA	0xE0 2E	0xE0 AE	0xE0 21	0xE0 F0 21	None	None
176	INCBASS	Bass increment	(none)	(none)	N/A	0x0C	0x0152	None	None	None	None	None	None
177	DCRBASS	Bass decrement	(none)	(none)	N/A	0x0C	0x0153	None	None	None	None	None	None
178	INCTREB	Treble increment	(none)	(none)	N/A	0x0C	0x0154	None	None	None	None	None	None
179	DCRTREB	Treble decrement	(none)	(none)	N/A	0x0C	0x0155	None	None	None	None	None	None

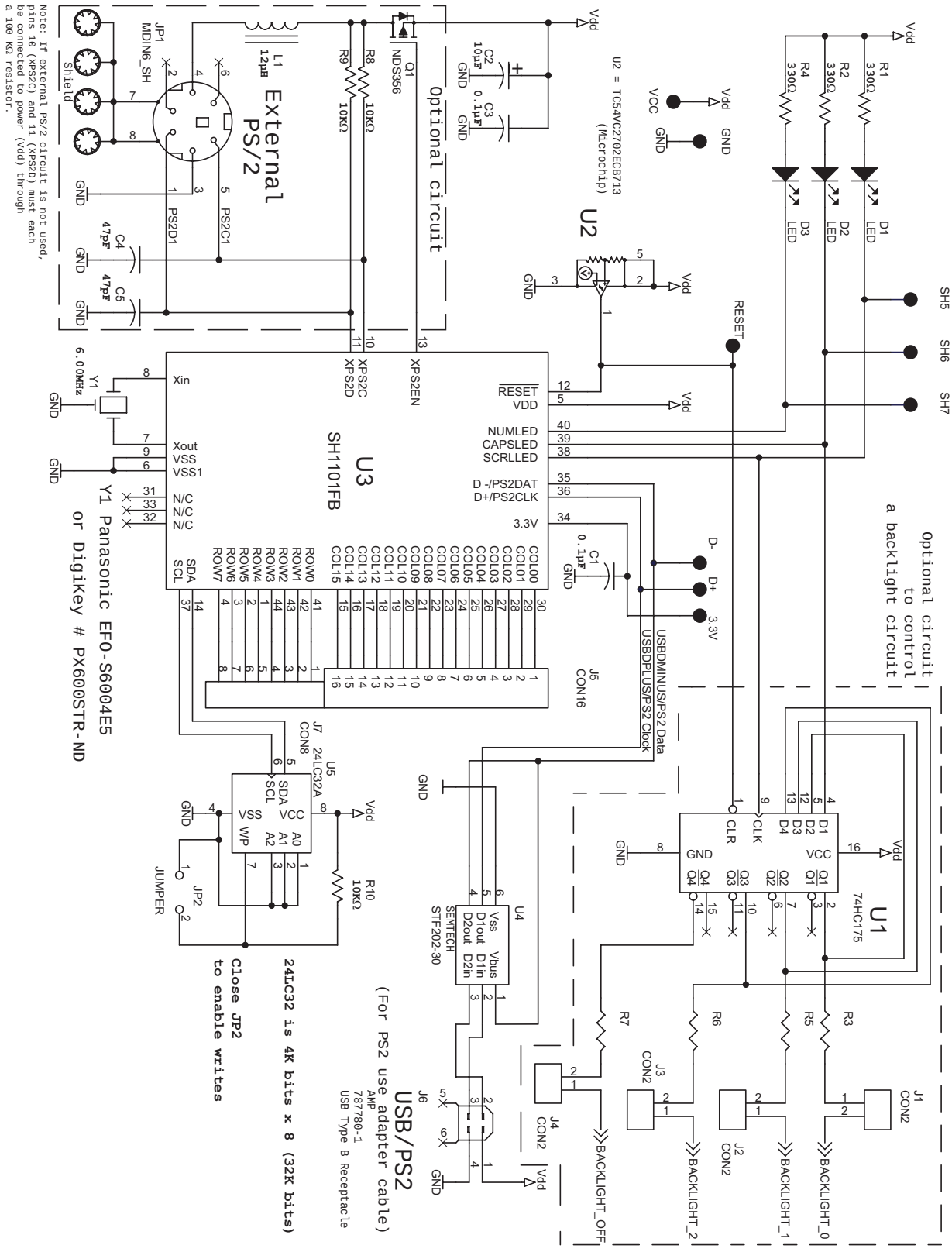
KEY CODES TABLE (CONT'D)

SEUSB	Program code	Description	Unshifted literal	Shifted literal	AT-101	USB page	USB usage	Scan 1 make	Scan 1 break	Scan 2 make	Scan 2 break	Scan 3 make	Scan 3 break
180	MAIL	AL (application launch) email reader	(none)	(none)	N/A	0x0C	0x018A	0xE0 6C	0xE0 EC	0xE0 48	0xE0 F0 48	None	None
181	WSEARCH	AC (application control) web search	(none)	(none)	N/A	0x0C	0x0221	0xE0 65	0xE0 E5	0xE0 48	0xE0 F0 48	None	None
182	WHOME	AC web home	(none)	(none)	N/A	0x0C	0x0223	0xE0 32	0xE0 B2	0xE0 3A	0xE0 F0 3A	None	None
183	WBACK	AC web back	(none)	(none)	N/A	0x0C	0x0224	0xE0 6A	0xE0 EA	0xE0 38	0xE0 F0 38	None	None
184	WFWD	AC web forward	(none)	(none)	N/A	0x0C	0x0225	0xE0 69	0xE0 E9	0xE0 30	0xE0 F0 30	None	None
185	WSTOP	AC web stop	(none)	(none)	N/A	0x0C	0x0226	0xE0 68	0xE0 E8	0xE0 28	0xE0 F0 28	None	None
186	WRFSH	AC web refresh	(none)	(none)	N/A	0x0C	0x0227	0xE0 67	0xE0 E7	0xE0 20	0xE0 F0 20	None	None
187	WBKMK	AC web bookmarks	(none)	(none)	N/A	0x0C	0x022A	0xE0 66	0xE0 E6	0xE0 18	0xE0 F0 18	None	None
188	CALC	AL calculator	(none)	(none)	N/A	0x0C	0x0192	0xE0 21	0xE0 A1	0xE0 2B	0xE0 F0 2B	None	None
189	LBRWS	AL local machine browser	(none)	(none)	N/A	0x0C	0x0194	0xE0 6B	0xE0 EB	0xE0 40	0xE0 F0 40	None	None
190	CCFG	AL consumer control configuration	(none)	(none)	N/A	0x0C	0x0183	0xE0 6D	0xE0 ED	0xE0 50	0xE0 F0 50	None	None
191	FBRWS	AL file browser	(none)	(none)	N/A	0x0C	0x01B4	None	None	None	None	None	None
192	REDO	AC redo/repeat	(none)	(none)	N/A	0x0C	0x0279	None	None	None	None	None	None
193	UNDO	AC undo	(none)	(none)	N/A	0x0C	0x021A	None	None	None	None	None	None
194	PVAPP	AL previous task /application	(none)	(none)	N/A	0x0C	0x01A4	None	None	None	None	None	None
195	PASTE	AC paste	(none)	(none)	N/A	0x0C	0x021D	None	None	None	None	None	None
196	WORD	AL word processor	(none)	(none)	N/A	0x0C	0x0184	None	None	None	None	None	None
197	SPRD	AL spreadsheet	(none)	(none)	N/A	0x0C	0x0186	None	None	None	None	None	None
198	CALND	AL calendar /schedule	(none)	(none)	N/A	0x0C	0x018E	None	None	None	None	None	None
199	LGOFF	AL logoff	(none)	(none)	N/A	0x0C	0x019C	None	None	None	None	None	None
200	CUT	AC cut	(none)	(none)	N/A	0x0C	0x021C	None	None	None	None	None	None
201	COPY	AC copy	(none)	(none)	N/A	0x0C	0x021B	None	None	None	None	None	None
202	NXAPP	AL next task /application	(none)	(none)	N/A	0x0C	0x01A3	None	None	None	None	None	None
203	SPELL	AL spell check	(none)	(none)	N/A	0x0C	0x01AB	None	None	None	None	None	None
204	HELP	Help	(none)	(none)	N/A	0x0C	0x0095	None	None	None	None	None	None
205	OFC	Office	(none)	(none)	N/A	0x0C	0x029D	None	None	None	None	None	None
206	TASK	Task panel	(none)	(none)	N/A	0x0C	0x029E	None	None	None	None	None	None
207	NEW	AC new	(none)	(none)	N/A	0x0C	0x0201	None	None	None	None	None	None
208	OPEN	AC open	(none)	(none)	N/A	0x0C	0x0202	None	None	None	None	None	None
209	CLOSE	AC close	(none)	(none)	N/A	0x0C	0x0203	None	None	None	None	None	None
210	REPLY	AC reply	(none)	(none)	N/A	0x0C	0x0289	None	None	None	None	None	None
211	MSFWD	AC forward message	(none)	(none)	N/A	0x0C	0x028B	None	None	None	None	None	None
212	SEND	AC send	(none)	(none)	N/A	0x0C	0x028C	None	None	None	None	None	None

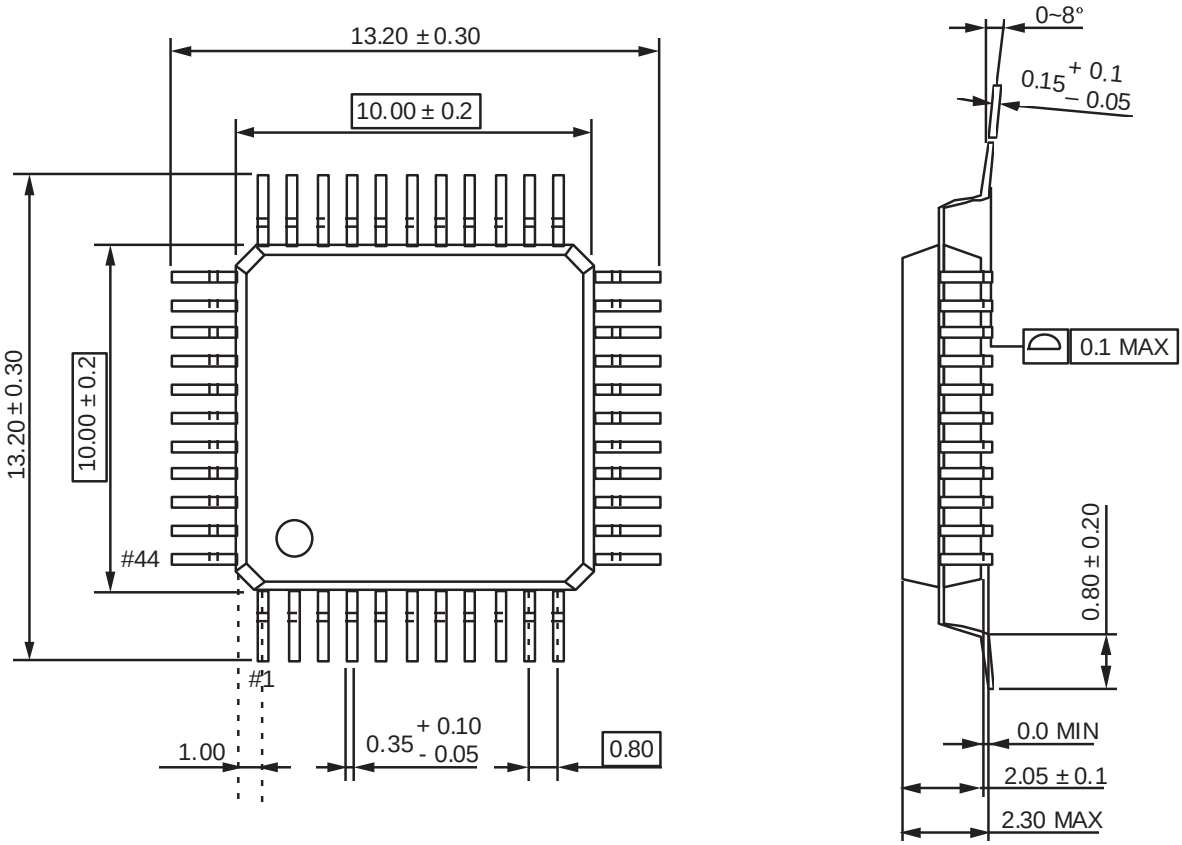
KEY CODES TABLE (CONT'D)

SEUSB	Program code	Description	Unshifted literal	Shifted literal	AT-101	USB page	USB usage	Scan 1 make	Scan 1 break	Scan 2 make	Scan 2 break	Scan 3 make	Scan 3 break
213	SAVE	AC save	(none)	(none)	N/A	0x0C	0x0207	None	None	None	None	None	None
214	APRNT	AC print	(none)	(none)	N/A	0x0C	0x0208	None	None	None	None	None	None
223	FUNCTION	(?)	(none)	(none)						(?)	(?)	(?)	(?)
224	LCTRL	Left Control	(none)	(none)	58	0x07	0x00E0	0x1D	0x9D	0x14	0xF0 14	0x11	0xF0 11
225	LSHIFT	Left Shift	(none)	(none)	44	0x07	0x00E1	0x2A	0xAA	0x12	0xF0 12	0x12	0xF0 12
226	LALT	Left Alt	(none)	(none)	60	0x07	0x00E2	0x38	0xB8	0x11	0xF0 11	0x39	0xF0 39
227	LWIN	Left GUI	(none)	(none)	127	0x07	0x00E3	0xE0 5B	0xE0 DB	0xE0 1F	0xE0 F0 1F	0x8B	0xF0 8B
228	RCTRL	Right Control	(none)	(none)	64	0x07	0x00E4	0xE0 1D	0xE0 9D	0xE0 14	0xE0 F0 14	0x58	0xF0 58
229	RSHIFT	Right Shift	(none)	(none)	57	0x07	0x00E5	0x36	0xB6	0x59	0xF0 59	0x59	0xF0 59
230	RALT	Right Alt	(none)	(none)	62	0x07	0x00E6	0xE0 38	0xE0 B8	0xE0 11	0xE0 F0 11	0x39	0xF0 39
231	RWIN	Right GUI	(none)	(none)	128	0x07	0x00E7	0xE0 5C	0xE0 DC	0xE0 27	0xE0 F0 27	0x8C	0xF0 8C
232	BLINC	Backlight increase (cycle)	(none)	(none)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
233	BLOFF	Backlight off	(none)	(none)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

EVALUATION BOARD SCHEMATIC FOR THE ULTIMATE KEYCODER® SH1101FB



MECHANICALS FOR THE QFP PACKAGE



ELECTRICAL SPECIFICATIONS

Absolute Maximum Ratings

Ratings	Symbol	Value	Unit
Supply voltage	V_{DD}	-0.3 to 6.5	V
Input and output voltage	V_{IN}, V_{OUT}	-0.3 to V_{DD} +0.3	V
Current Drain per Pin (not including V_{SS} or V_{DD})	I	20	mA
Operating Temperature SH1101	T_A	T low to T high -40 to +85	°C
Storage Temperature Range	T_{STG}	-65 to +150	°C
ESD rating (human body model)	V_{ESD}	2.0	KV

DC Electrical Characteristics (T_A = -40°C to +85°C, V_{DD} = 4.0 V to 5.25V)

Characteristic	Symbol	Min	Typ	Max	Unit
Supply voltage	V_{DD}	4.0	5.0	5.25	V
Input high voltage					
■ high	V_{IH}	0.8 x V_{DD}		V_{DD}	V
■ low	V_{IL}	V_{SS}		0.2 x V_{DD}	V
Output voltage (except D-, D+)					
■ high (I_{OH}=-200µa)	V_{OH}	V_{DD}–1.0			V
■ low (I_{OL}=1ma)	V_{OL}			0.4	
Output low current (V_{OL}=3V, only pins38, 39, 67)	I_{OL}	8	15	23	mA
Input leakage current					
■ high (all inputs except XIN, XOUT, RESET, D+, D-)	$I_{LIH}1$			3	µA
■ high (XIN, XOUT, RESET)	$I_{LIH}2$			20	µA
■ low (all inputs except XIN, XOUT, RESET, D+, D-)	$I_{LIL}1$			-3	µA
■ low (XIN, XOUT, RESET)	$I_{LIL}2$			-20	µA
Output leakage current (all I/O pins and output pins except D+, D-)					
■ high	$I_{LOH}1$			3	µA
■ low	I_{LOL}			-3	µA
Pull-up resistors (row pins, V_{IN}=0V)	R_L	25	50	100	KΩ
Supply current					
■ Normal operation mode	$I_{DD}1$		5.5	12	mA
■ Idle mode	$I_{DD}2$		2.2	5	mA
■ Stop mode	$I_{DD}3$		180	300	µA

Control Timing (T_A = -40°C to +85°C, V_{DD} = 4.0 V to 5.25V)

Characteristic	Symbol	Min	Typ	Max	Unit
Frequency of Operation					
■ Crystal Option	f_{OSC}		6.0		MHz
■ External Clock Option	fosc		6.0		MHz

SEMTECH

For sales information and product literature, contact:

Semtech Corporation
Human Interface Device (HID)
and System Management Division
200 Flynn Road
Camarillo, CA 93012-8790
sales@semtech.com
http://www.semtech.com/
(805)498-2111 Telephone
(805)498-3804 Fax