

HID & SYSTEM MANAGEMENT PRODUCTS, KEYCODER™ FAMILY
DESCRIPTION

The KeyCoder™ USB UR5HCGNK-UP60 is a single-chip, bootable USB keyboard encoder with a built-in PS/2 port available for an external PS/2 mouse or keyboard. The KeyCoder™ USB achieves in one easy-to-implement IC what would otherwise require cumbersome and expensive chip-sets.

The KeyCoder™ USB offers a hot-pluggable PS/2 port that can accept an external keyboard or pointing device. The user can easily connect legacy PS/2 keyboards or pointing devices to the current USB host system with no performance penalty. The KeyCoder™ USB auto-switches between an external keyboard or pointing device and transparently enables Mousewheel functionality in pointing devices that support it.

The KeyCoder™ USB manages the bi-directional translation from the PS/2 device to the system's USB support. Both internal keyboard and external PS/2 device reports are streamed and appear to the system as if coming from a single source.

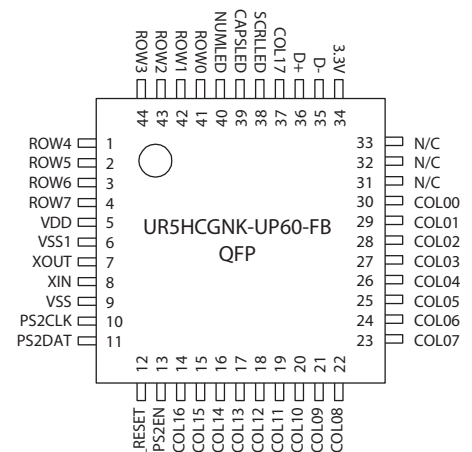
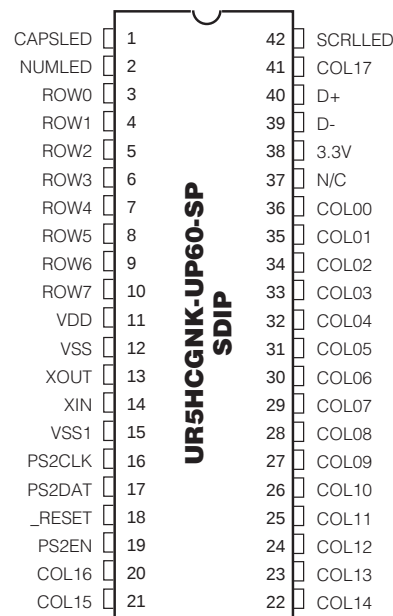
Customized versions of the KeyCoder™ USB are also available independently of production volumes, in order to facilitate the quick adoption of USB in platforms and input devices beyond the traditional desktop.

FEATURES

- Inexpensive, single-chip solution
- Supports boot mode of the USB 1.1 specification
- Single USB endpoint, compatible with the USB 1.1 specification
- Scans and encodes an 8 x 18 keyboard matrix
- External PS/2 interface to USB
- PS/2 port supports hot plug of PS/2 legacy devices
- Provides direct drive for three LEDs (caps lock, numeric lock, scroll lock)
- PS/2 port supports MouseWheel functionality

APPLICATIONS

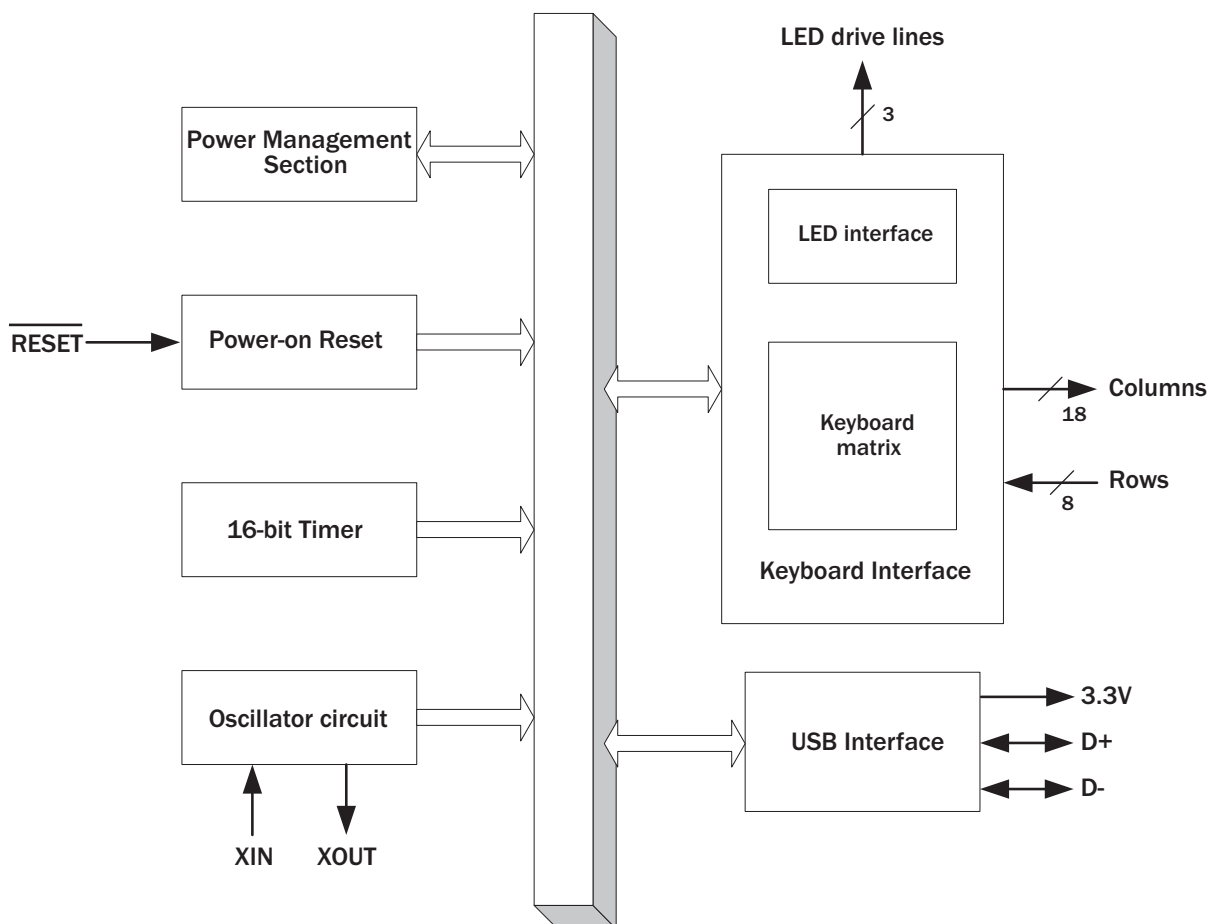
- System legacy support
- Industrial or custom keyboards
- Desktop computers
- Point-of-sale (POS) terminals
- Portable devices
- Hand-held PCs (H/PCs) and Pro H/PCs

PIN ASSIGNMENTS


ORDERING CODE

Package Options	Pitch	TA=-20° C to +85° C
42-pin SDIP	1.778 mm	UR5HCGNK-UP60-SP
44-pin QFP	0.8 mm	UR5HCGNK-UP60-FB
Other Materials	Type	Order number
KeyCoder™ USB Eval. Kit	Evaluation Kit	EVK5-GNK-UP60-XXX

BLOCK DIAGRAM FOR THE KEYCODER™ USB



FUNCTIONAL DESCRIPTION

The KeyCoder™ USB consists functionally of six major sections (see the Functional Diagram on Page 2). These are the Keyboard Interface, the Power Management Section, the 16-bit Timer, the Oscillator Circuit, Power-on Reset, and the USB Interface.

OSCILLATOR

The KeyCoder™ USB has a built-in oscillator circuit capable of operations with an external 6.00 MHz clock source, a ceramic resonator (preferably with built-in load capacitors), or a crystal with external load capacitors.

POWER MANAGEMENT

According to the USB specification, if there is no activity of the USB port for 3 ms, the system is considered to be in a suspended state. The KeyCoder™ USB, on detecting that the system is in suspend, will check the state of the touch screen and the right button. If there is no touch pressure detected or no button pressed, the KeyCoder™ USB enters the suspended state. In the suspended state, the IC fully complies with the USB specification for power consumption, dissipating current only in the USB-mandated pull-up for device identification.

Another technique the The KeyCoder™ USB uses to conserve power is called remote wake-up. If the system relies on the device to perform wake-up, the IC will send a resume message to the system when there is activity on the touch screen or button.

If the system does not allow remote wake-up, the KeyCoder™ USB does not send resume messages to the system when it is awakened by activity on the touch screen or button.

PIN DEFINITIONS

Mnemonic	SDIP	QFP	Type	Name and Function
Power:				
VDD	11	5	P	Power supply
VSS	12	9	P	Ground
VSS1	15	6	P	Ground
Reset:				
_RESET	18	12	I	Reset
Oscillators:				
XIN	14	8	I	Oscillator input
XOUT	13	7	O	Oscillator output
USB:				
D-	39	35	I/O	USB D- line
D+	40	36	I/O	USB D+line
3.3V	38	34	O	USB reference voltage output: output pin for pulling up a D- line with a 1.5K Ohm external resistor
Keyboard:				
COL00-COL16	36-20	30-14	O	Column lines for scan matrix
COL17	41	37	O	Column lines for scan matrix
ROW0-ROW3	3-6	41-44	I	Row lines for scan matrix
ROW4-ROW7	7-10	1-4	I	Row lines for scan matrix
LEDs:				
CAPSLED	1	39	O	Caps lock LED: direct drive port
NUMLED	2	40	O	Num lock LED: direct drive port
SCRLLLED	42	38	O	Scroll lock LED: direct drive port
PS/2:				
PS2DAT	17	11	I/O	External PS/2 port data line
PS2CLK	16	10	I/O	External PS/2 port clock line
PS2EN	19	13	I	External PS/2 port enable
N/C	37	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

USB FUNCTIONALITY

The KeyCoder™ USB is a low-speed USB device that includes two interfaces: internal keyboard and external PS/2.

The PS/2 interface supports legacy Human Input Devices (HID-class specification). The KeyCoder™ USB uses one interrupt endpoint, which is shared by the keyboard and the external PS/2 device.

Data from the different devices is distinguished by different report IDs, as described in the USB Descriptors section. Data can come from either the PS/2 port or from the keyboard. The KeyCoder™ USB manages the merging of the data and sends the merged data to the system

USB DESCRIPTORS

Offset	Name	Size	Value	Description
Device Descriptor				
0	bLength	1	0x12	Descriptor length in bytes: 0x12 = 18
1	bDescriptorType	1	0x01	Descriptor type: device
2	bcdUSB	2	0x10 01	USB HID spec release number: 01.10
4	bDeviceClass	1	0x00	Class code
5	bDeviceSubClass	1	0x00	Sub class code
6	bDeviceProtocol	1	0x00	Protocol code
7	bMaxPacketSize0	1	0x08	Maximum EP0 packet size
8	idVendor	2	0x7A 04	Semtech's vendor ID
10	idProduct	2	0x05 07	KeyCoder™ USB Product ID
12	bcdDevice	2	0x61 00	Device release number: 0.61
14	iManufacture	1	0x04	Index of manufacturer string descriptor
15	iProduct	1	0x0E	Index of product string descriptor
16	iSerialNumber	1	0x00	Index of serial number string descriptor: none
17	bNum	1	0x01	Number of possible configurations
Configuration Descriptor				
0	bLength	1	0x09	Descriptor length in bytes: 9
1	bDescriptorType	1	0x02	Descriptor type: configuration
2	wTotalLength	2	0x22 00	Total length of data returned
4	bNumInterface	1	0x02	Number of interfaces supported by this configuration
5	bConfigurationValue	1	0x01	Current configuration value
6	iConfiguration	1	0x00	Index of configuration string descriptor: none
7	bmAttribute	1	0xA0	Configuration characteristics - bus powered, with remote wakeup
8	MaxPower	1	0x32	Maximum power consumption of USB device: 100 mA
Interface Descriptor 0				
0	bLength	1	0x09	Descriptor length in bytes: 9
1	bDescriptorType	1	0x04	Descriptor type: interface
2	bInterfaceNumber	1	0x00	Interface number: 0
3	bAlternateSetting	1	0x00	Alternate setting number: 0
4	bNumEndpoints	1	0x01	Number of endpoints: 1
5	bInterfaceClass	1	0x03	Class code: HID
6	bInterfaceSubClass	1	0x01	Subclass code: boot interface
7	bInterfaceProtocol	1	0x01	Protocol code: keyboard
8	iInterface	1	0x00	Index of interface string descriptor: none
HID Descriptor 0				
0	bLength	1	0x09	Descriptor length in bytes: 9
1	bDescriptorType	1	0x21	Descriptor type: HID
2	bcdHID	2	0x00 01	HID Spec release number 01.00
4	bCountryCode	1	0x00	Hardware target country
5	bNumDescriptor	1	0x01	Number of class descriptors
6	bDescriptorType	1	0x22	Report descriptor type
7	wDescriptorLength	2	0x3F 00	Total length of report descriptor in bytes: 63
Endpoint Descriptor 0				
0	bLength	1	0x07	Descriptor length in bytes: 7
1	bDescriptorType	1	0x05	Descriptor type: endpoint
2		1	0x81	Endpoint address
3		1	0x03	Endpoint attributes
4		2	0x03 00	Packet size: 3
6		1	0x10	Polling rate

KEYBOARD & PS/2

Keyboard matrix scanning:

The encoder scans and debounces an 8 row by 18 column matrix keyboard. The KeyCoder™ USB provides internal pull-ups for the Row Input pins. When active, the encoder selects one of the column lines (C0-C18) and then reads the row data lines (R0-R7). A key closure is detected as a zero in the corresponding position of the matrix.

A complete scan cycle for the entire keyboard takes approximately 10 ms. Each key found pressed is debounced for a period of 20 ms. Once the key is verified, the corresponding key code(s) are loaded into the transmit buffer of the USB communication channel.

External PS/2 port:

The external PS/2 port allows the user to connect legacy PS/2 devices to the USB host system. Standard 104 keyboards and PS/2 mice, with support for MouseWheel, can be hot-plugged and immediately begin communicating with the host.

USB DESCRIPTORS (CONT'D)

Offset	Name	Size	Value	Description
Interface Descriptor 1				
0	bLength	1	0x09	Descriptor length in bytes: 9
1	bDescriptorType	1	0x04	Descriptor type: interface
2	bInterfaceNumber	1	0x00	Interface number: 0
3	bAlternateSetting	1	0x00	Alternate setting number: 0
4	bNumEndpoints	1	0x01	Number of endpoints: 1
5	bInterfaceClass	1	0x03	Class code: HID
6	bInterfaceSubClass	1	0x01	Subclass code: boot interface
7	bInterfaceProtocol	1	0x02	Protocol code: mouse
8	iInterface	1	0x00	Index of interface string descriptor: none
HID Descriptor 1				
0	bLength	1	0x09	Descriptor length in bytes: 9
1	bDescriptorType	1	0x21	Descriptor type: HID
2	bcdHID	2	0x00 01	HID Spec release number 01.00
4	bCountryCode	1	0x00	Hardware target country
5	bNumDescriptor	1	0x01	Number of class descriptors
6	bDescriptorType	1	0x22	Report descriptor type
7	wDescriptorLength	2	0x34 00	Total length of report descriptor in bytes: 52
Endpoint Descriptor 1				
0	bLength	1	0x07	Descriptor length in bytes: 7
1	bDescriptorType	1	0x05	Descriptor type: endpoint
2		1	0x82	Endpoint address
3		1	0x03	Endpoint attributes
4		2	0x08 00	Packet size: 8
6		1	0x10	Polling rate

USB DESCRIPTORS (CONT'D)

Offset	Data	Description	Value
Report Descriptor 0			
0	0x05 01	Usage Page	Generic Desktop
2	0x09 06	Usage	Keyboard
4	0xA1 01	Collection	Application
6	0x05 07	Usage page	Key codes
8	0x19 E0	Usage Minimum	224
10	0x29 E7	Usage Maximum	231
12	0x15 00	Logical Minimum	0
14	0x25 01	Logical Maximum	1
16	0x75 01	Report Size	1
18	0x95 08	Report Count	8
20	0x81 02	Input	Data, variable, absolute
22	0x75 08	Report Size	8
24	0x95 01	Report Count	1
26	0x81 01	Input	Constant
28	0x95 06	Report Count	6
30	0x75 01	Report Size	1
32	0x05 08	Usage Page	Page # for LEDs
34	0x19 01	Usage Minimum	1
36	0x29 06	Usage Maximum	6
38	0x91 02	Output	Data, variable, absolute
40	0x95 01	Report Count	1
42	0x75 01	Report Size	2
44	0x91 03	Output	Constant
46	0x95 06	Report Count	6
48	0x75 08	Report Size	8
50	0x15 00	Logical Minimum	0
52	0x25 65	Logical Maximum	101
54	0x05 07	Usage page	Key codes
56	0x19 00	Usage Minimum	0
58	0x29 65	Usage Maximum	101
60	0x81 00	Input	Data, array
62	0xC0	End Collection	

USB DESCRIPTORS (CONT'D)

Offset	Data	Mnemonic	Value
Report Descriptor 1			
0	0x05 01	Usage page	Generic Desktop
2	0x09 02	Usage	Mouse
4	0xA1 01	Collection	Application
6	0x09 01	Usage	Pointer
8	0xA1 00	Collection	Physical
10	0x05 09	Usage page	Buttons
12	0x19 01	Usage minimum	1
14	0x29 03	Usage maximum	3
16	0x15 00	Logical minimum	0
18	0x25 01	Logical maximum	1
20	0x95 03	Report count	3
22	0x75 01	Report size	1
24	0x81 02	Input	Data, variable, absolute
26	0x95 01	Report count	1
28	0x75 05	Report size	5
30	0x81 01	Input	Constant
32	0x05 01	Usage page	Generic Desktop
34	0x15 81	Logical minimum	-127
36	0x25 7F	Logical maximum	127
38	0x75 08	Report size	8
40	0x95 03	Report count	3
42	0x09 30	Usage	X
44	0x09 31	Usage	Y
46	0x09 38	Usage	Wheel
48	0x81 06	Input	Data, variable, relative
50	0xC0	End collection	
51	0xC0	End collection	

KEY MAP FOR THE FUJITSU FKB7401 KEYBOARD

Key map for the Fujitsu FKB7401 keyboard

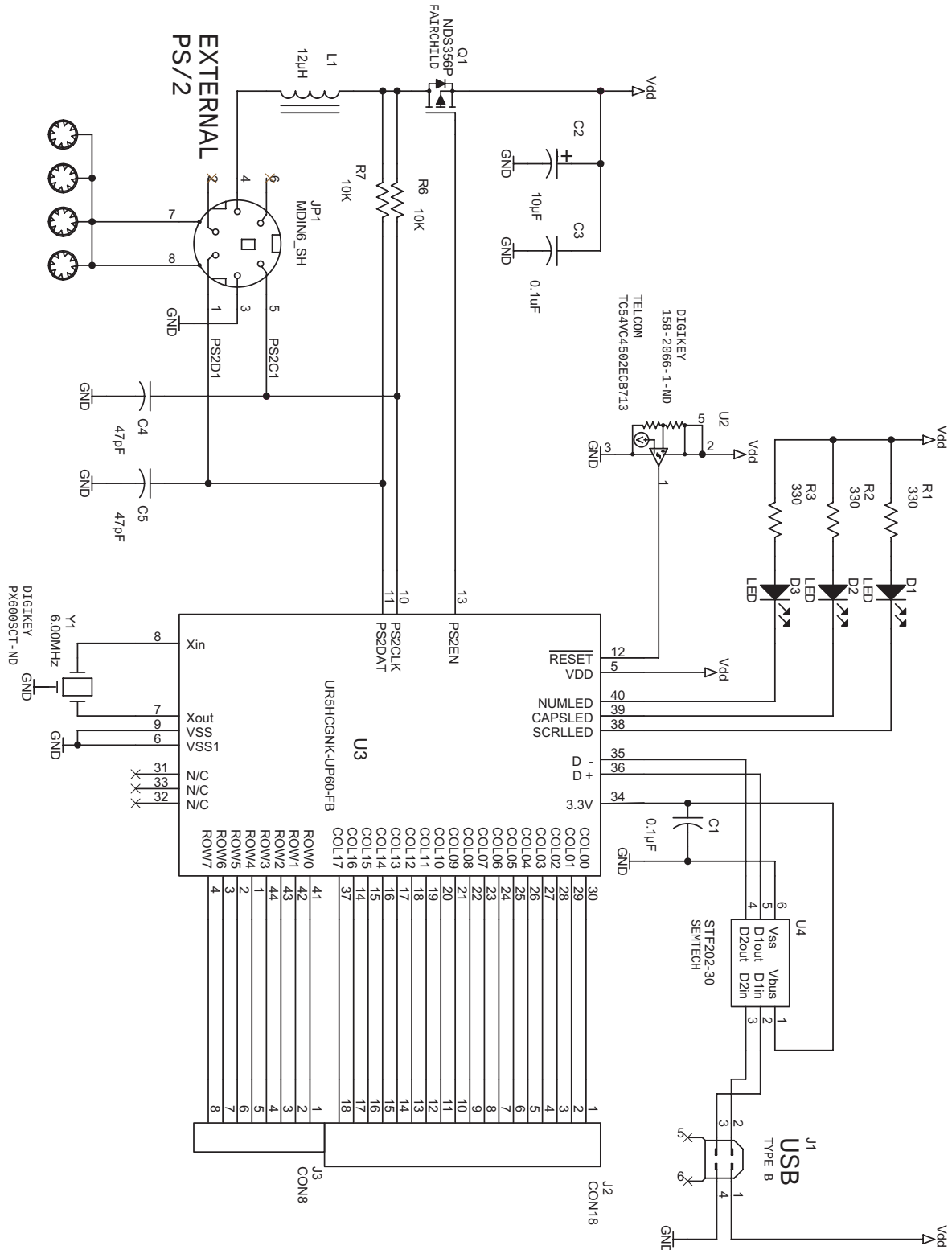
		Rows (R0-R7)							
		0	1	2	3	4	5	6	7
Columns (C0-C17)	0		`	F1	Tab	1		CapsLk	FN
	1	F5	F6	ESC		F7	Q	W	
	2	F2		F3	F4	2		F8	
	3	Fn							
	4				LShift	RShift			
	5	V	F	C	4	3	E	R	
	6	G	H	T	B	5	6	Y	N
	7	U	S	D	J	7	A	M	Space
	8		LWin						
	9	K	X	Z		8	,	!	F9
	10	RAlt	LAlt						
	11			LCtrl				RCtrl	
	12							RWin	
	13	O	LArr		L	9	]	=	
	14				;	[	/	0	-
	15					P	NumLk	Pause	F10
	16	DnArr	WinApp			.	F11	\	BkSp
	17	RArr	UpArr			F12	Insert	Del	Enter

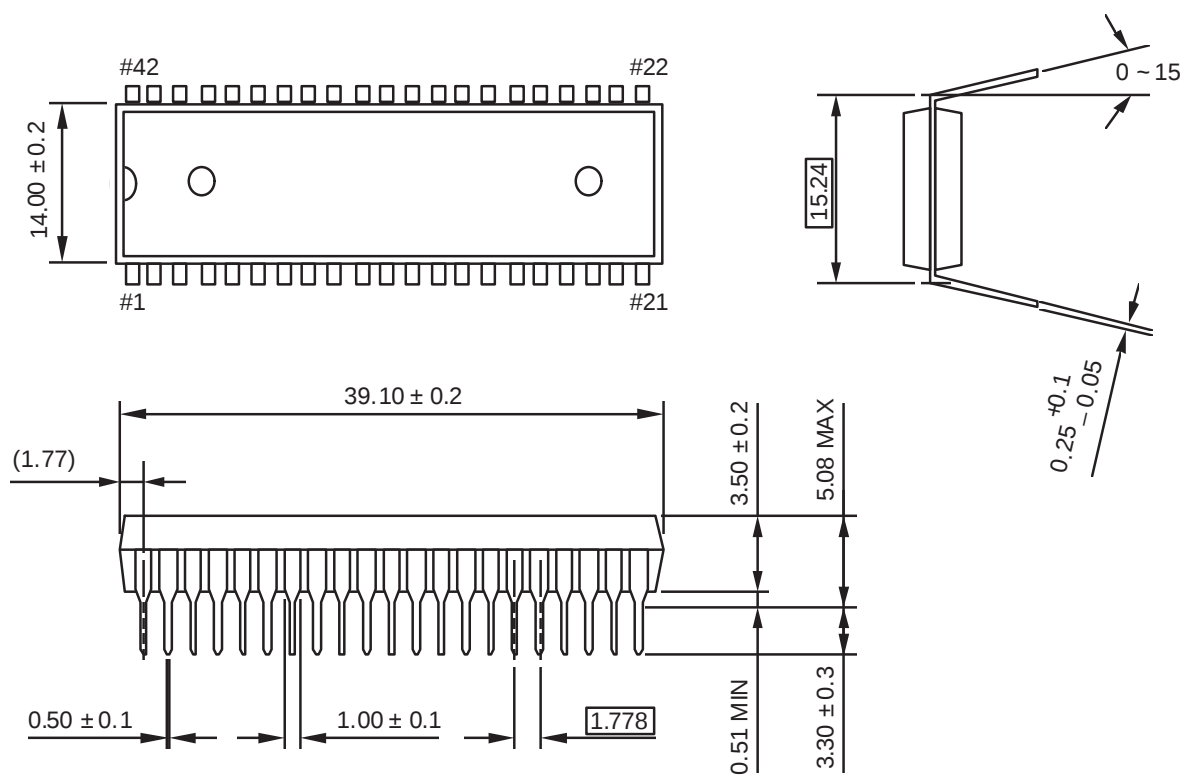
Keyboard layout for the Fujitsu FKB7401

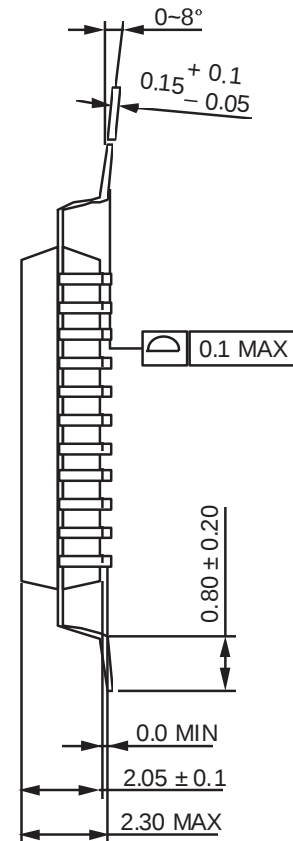
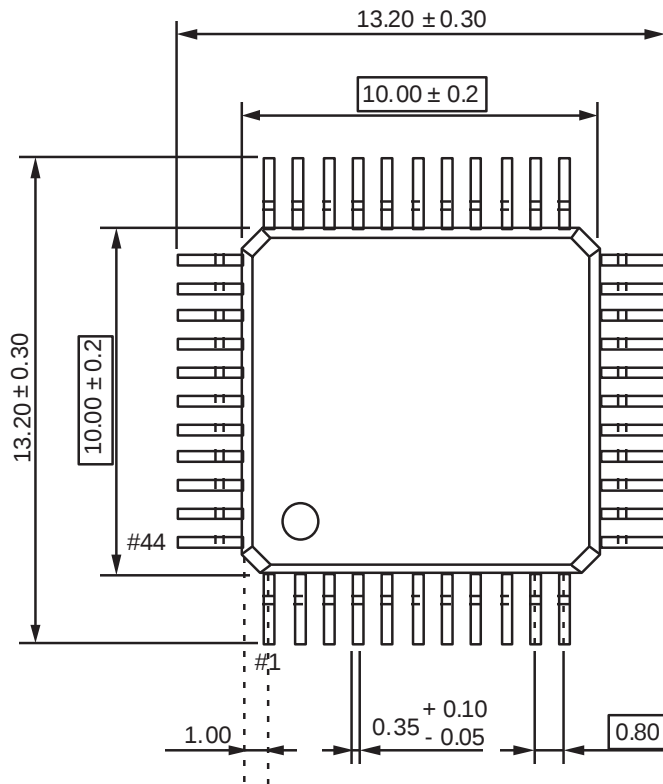




SUGGESTED INTERFACING FOR THE KEYCODER™ USB UR5HCGNK-UP60-FB







ELECTRICAL SPECIFICATIONS

Absolute Maximum Ratings

Ratings	Symbol	Value	Unit
Supply Voltage	Vdd	-0.3 to 7.0	V
Input Voltage	Vin	Vss -0.3 to Vdd +0.3	V
Current Drain per Pin (not including Vss or Vdd)	I	20	mA
Operating Temperature UR5HCGNK-UP60	Ta	T low to T high -20 to +85	°C
Storage Temperature Range	Tstg	-40 to +125	°C

DC Electrical Characteristics, Temperature range=T low to T high unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Supply Voltage		3.0	5.0	5.5	V
Output Voltage (10 μ A load)	Voh Vol	Vdd-0.1		0.1	V
Input High Voltage	Vih	0.8 x Vdd		Vdd	V
Input Low Voltage	Vil	Vss		0.2xVdd	V
Input Current	Iin			+/- 10	μ A
Supply Current (Vdd=5.0 Vdc +/-10%, Vss=0)	Idd		3.0	TBD	mA

Control Timing (Vdd=5.0 Vdc +/-10%, Vss=0 Vdc, Temperature range=T low to T high unless otherwise noted)

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

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