



# USAR GeniKey™ USB Keyboard Encoder with External PS/2 Port

*Preliminary  
USAR Geni™ USB IC family  
product specifications*

## Description

The USAR GeniKey™ is a single chip USB keyboard encoder with a built-in PS/2 port available for a PS/2 pointing or keyboard compatible input device. The USAR GeniKey™ achieves in one easy to implement IC what would otherwise require cumbersome and expensive chip-sets.

The USAR GeniKey™ 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 USAR GeniKey™ can auto-switch between an external keyboard or pointing device and will transparently enable the Mousewheel functionality in pointing devices that support it.

The USAR GeniKey™ 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 USAR GeniKey™ 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.

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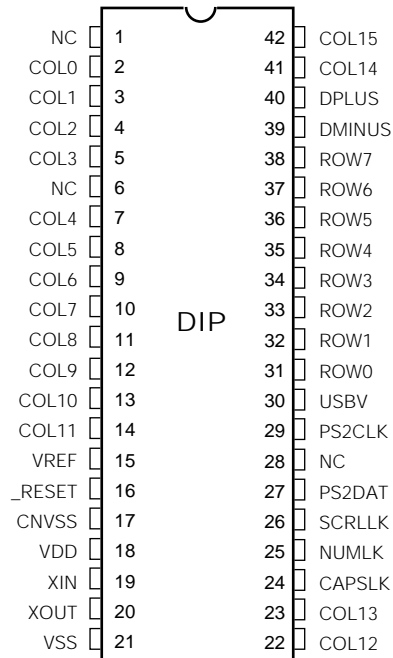
## Features

- Inexpensive, single-chip solution
- Supports boot mode of USB 1.1 specification
- Single USB endpoint, compatible with USB 1.1 specification
- Scans and encodes an 8 x 16 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
- Customized versions available

## Applications

- System Legacy Support
- Industrial or Custom Keyboards
- Desktop Computers
- P.O.S. Terminals
- Portable Devices
- H/PCs and Pro H/PCs

## Pin Assignments



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Ordering Code

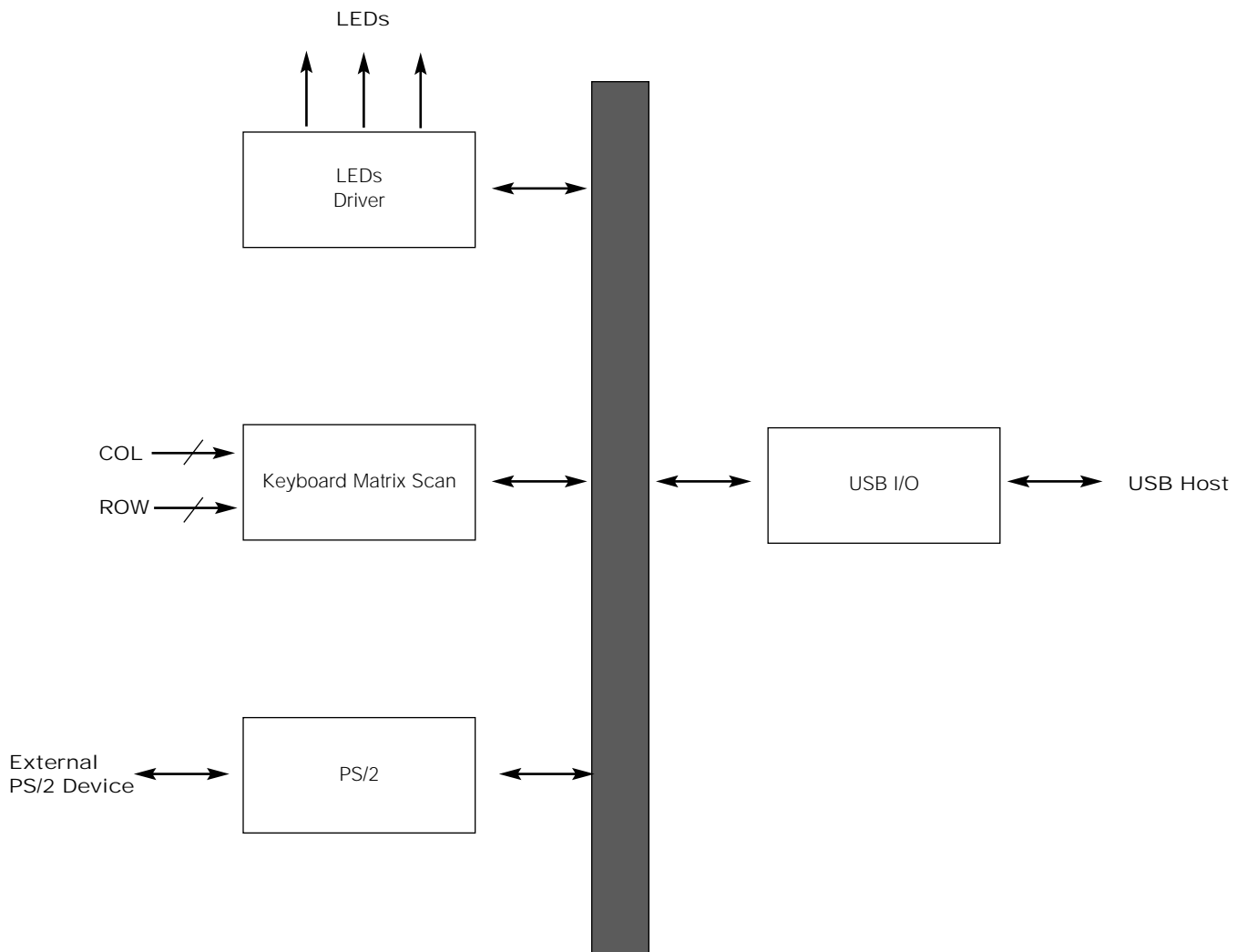
Package Options	Pitch in mm's	TA=-20° C to +85° C
42-pin, Plastic DIP	1.778mm	UR3HCGNK-UP60-PK
Other Materials	Type	Order number
USAR GeniKey™ Evaluation Kit	Evaluation Kit	EVK3-GNK-UP60-XXX

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Block Diagram



## Pin Definitions

### Pin Numbers

Mnemonic	DIP	Type	Name and Function
<b>Power Supply</b>			
VDD	18	PWR	Positive Supply Voltage
CNVSS	17	PWR	Ground
VSS	21	PWR	Ground
VREF	15	PWR	Positive Supply Voltage
USBV	30	PWR	USB Reference Voltage Out
<b>Reset</b>			
<u>RESET</u>	16	I	Reset
<b>Oscillator Pins</b>			
XIN	19	I	Oscillator IN
XOUT	20	O	Oscillator OUT
<b>USB</b>			
DMINUS	39	I/O	USB D- Line
DPLUS	40	I/O	USB D+ Line
<b>PS/2</b>			
PS2DAT	27	I/O	PS/2 Data Line
PS2CLK	29	I/O	PS/2 Clock Line
<b>LEDS</b>			
CAPSLK	24	O	CAPS LOCK LED: direct drive port
NUMLK	25	O	NUM LOCK LED: direct drive port
SCRLLK	26	O	SCRL LOCK LED: direct drive port
<b>Column Data Inputs</b>			
COL0-COL3	2-5	I	Column Line for Scan Matrix
COL4-COL11	7-14	I	Column Line for Scan Matrix
COL12,COL13	22,23	I	Column Line for Scan Matrix
COL14,COL15	41,42	I	Column Line for Scan Matrix
<b>Row Data Inputs</b>			
ROW0-ROW7	31-38	I	Row Line for Scan Matrix
<b>Reserved</b>			
NC	1, 6, 28		No connect: not used, reserved for future functions

Note: An underscore before a pin mnemonic indicates an active low signal.

## USB Functionality

The USAR GeniKey™ 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 USAR GeniKey™ uses one interrupt endpoint, which is shared by the keyboard and the 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 USAR GeniKey™ manages the merging of the data and then sends the data to the system.

## USB Descriptors

Offset	Part	Size	Value	Description
<b>Device Descriptor</b>				
0	bLength	1	0x12	Numeric expression specifying the size of device descriptor
1	bDescriptorType	1	0x01	Device descriptor type
2	bcdUSB	2	0x0110	USB HID specification release number
3	bDeviceClass	1	0x00	Class code
4	bDeviceSubClass	1	0x00	Sub class code
5	bDeviceProtocol	1	0x00	Protocol code
6	bMaxPacketSize0	1	0x08	Maximum packet size for EP0
8	idVendor	2	0x047A	USAR's vendor ID
10	idProduct	2	0x00FF	USAR GeniKey's Product ID
12	bcdDevice	2	0x0064	Device release number
14	iManufacture	1	0x04	Index of string descriptor describing manufacturer
15	iProduct	1	0x0E	Index of string descriptor describing product
16	iSerialNumber	1	0x00	Index of String descriptor describing serial number
17	bNum-Configuration	1	0x01	Number of possible configurations
<b>Configuration Descriptor</b>				
0	bLength	1	0x09	Size of configuration descriptor in bytes
1	bDescriptorType	1	0x02	Configuration (assigned by USB)
2	wTotalLength	2	0x0022	Total length of data returned for this configuration
4	bNumInterface	1	0x01	Number of interfaces supported by this configuration
5	bConfigurationValue	1	0x01	Current configuration value
6	iConfiguration	1	0x00	Configuration string descriptor index
7	bmAttribute	1	0xA0	Configuration characteristics - bus powered, remote wakeup
8	MaxPower	1	0x32	Maximum power consumption of USB device
<b>Interface Descriptor</b>				
0	bLength	1	0x09	Size of Interface descriptor in bytes
1	bDescriptorType	1	0x04	Interface descriptor type
2	bInterfaceNumber	1	0x00	Number of interface
3	bAlternateSetting	1	0x00	Number of alternate setting
4	bNumEndpoints	1	0x01	Number of endpoint
5	bInterfaceClass	1	0x03	Class code (HID)
6	bInterfaceSubClass	1	0x01	Subclass code (boot interface subclass)
7	bInterfaceProtocol	1	0x01	Protocol code = keyboard
8	iInterface	1	0x00	Index of string descriptor describing this interface
<b>HID Descriptor</b>				
0	bLength	1	0x09	Size of HID descriptor in byte
1	bDescriptorType	1	0x21	HID descriptor type
2	bcdHID	2	0x0100	HID Spec release number
4	bCountryCode	1	0x00	Hardware target country
5	bNumDescriptor	1	0x01	Number of HID class descriptor follow
6	bDescriptorType	1	0x22	Report descriptor type
7	wDescriptorLength	2	0x0095	Total length of report descriptor

## Keyboard Scanner

The encoder scans and debounces an 8 row by 16 column matrix keyboard. The USAR GeniKey™ provides internal pull-ups for the Row Input pins. When active, the encoder selects one of the column lines (C0-C15) 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.

## PS/2 Port

The 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.

Offset	Part	Size	Value	Description
<b>Endpoint Descriptor</b>				
0	bLength	1	0x07	Size of endpoint descriptor in bytes
1	bDescriptorType	1	0x05	Endpoint descriptor type
2	bEndpointAddress	1	0x81	Endpoint address (IN, Endpoint 1)
3	bmAttribute	1	0x03	Endpoint's attribute (interrupt)
4	WMaxPacketSize	2	0x0008	Maximum packet size
6	BInterval	1	0x0A	Interval for polling endpoint (poll every 10 milliseconds)

Offset	Part	Size	Value	Description
<b>String Descriptor</b>				
1	bLength	1	0x04	Length of string description in bytes
2	bDescriptorType	1	0x03	Descriptor type = String
3	bString	2	0x0904	LangID code = English
5	bLength	1	0x0A	Length of string descriptor
6	bDescriptorType	1	0x03	Descriptor Type = String
7	bString	8	'U','0','S', 0,'A',0, 'R',0	Manufacturer
15	bLength	1	0x16	Length of string descriptor
16	bDescriptorType	1	0x03	Descriptor type = String
17	bString	20	'G','0','e', 0,'n',0, 'i','0','K',0 , 'e',0,'y' 0,' ',0,'T' 0,'M',0	Product

Offset	Data	Mnemonic	Value
<b>Report Descriptor</b>			
0	05 01	Usage Page	Generic desktop
2	09 06	Usage	Keyboard
4	A1 01	Collection	Application
6	85 01	Report ID	01
8	05 07	Usage Page	Key codes
10	19 E0	Usage Minimum	224
12	29 E7	Usage Maximum	231
14	15 00	Logical Minimum	0
16	25 01	Logical Maximum	1
18	75 01	Report Size	1
20	95 08	Report Count	8
22	81 02	Input	Data, Variable, Absolute
24	95 01	Report Count	1
26	75 08	Report Size	8
28	81 01	Input	Constant
30	95 05	Report Count	5
32	75 01	Report Size	1
34	05 08	Usage Page	Page # for LEDs
36	19 01	Usage Minimum	1
38	29 05	Usage Maximum	5
40	91 02	Output	Data, Variable, Absolute
42	95 01	Report Count	1

USB Descriptors, Cont.

Offset	Data	Mnemonic	Value
Report Descriptor, Cont.			
44	75 03	Report size	3
46	91 01	Output	Constant
48	95 06	Report count	6
50	75 08	Report size	8
52	15 00	Logical minimum	0
54	26 DF 00	Logical maximum	223
55	05 07	Usage Page	Key Codes
56	19 00	Usage minimum	0
58	2A DF 00	Usage maximum	223
60	81 00	Input	Data, Array
62	C0	End	
63	05 01	Usage page	Generic Desktop
65	09 02	Usage	Mouse
67	A1 01	Collection	Application
69	85 02	Report ID	02
71	09 01	Usage	Pointer
73	A1 00	Collection	Physical
75	05 09	Usage page	Buttons
77	19 01	Usage minimum	1
79	29 03	Usage maximum	3
81	15 00	Logical minimum	0
83	25 01	Logical maximum	1
85	95 03	Report count	3
87	75 01	Report size	1
89	81 02	Input	Data, Variables, Absolute
91	95 01	Report count	1
93	75 05	Report size	5
95	81 01	Input	Constant
97	05 01	Usage page	Generic Desktop
99	16 00 FF	Logical minimum	-256
102	26 FF 00	Logical maximum	255
105	09 30	Usage	X
107	75 09	Report size	9
109	95 01	Report count	1
111	81 06	Input	Data, Variable, Relative
113	95 01	Report count	1
115	75 07	Report size	7
117	81 01	Input	Constant)
119	09 31	Usage	Y
121	75 09	Report size	9
123	95 01	Report count	1
125	81 06	Input	Data, Variable, Row
127	95 01	Report count	1
129	75 07	Report size	7
131	81 01	Input	Constant
133	15 80	Logical minimum	-128
135	25 7F	Logical maximum	127
137	09 38	Usage	Wheel
139	75 08	Report size	8
141	95 01	Report count	1
143	81 06	Input	Data, Variable, Row
145	C0	end	
146	C0	end	

Key Map for the Fujitsu FKB7654

		Rows (R0-R7)							
		0	1	2	3	4	5	6	7
Columns (C0-C15)	0								FN
	1						LWin		
	2	Tab	CapsLk	1	S	Z	A	Q	Esc
	3					RAIt			LAIt
	4	F1	F2	F3	E	D	W	2	X
	5	8/N8	9/N9	I/N5	,	Space	K/N2	U/N4	M/N0
	6	F6	3	4	F	C	R	5	F4
	7	F9	F5	6	V	B	G	T	F7
	8	F10	F11	F8	N	H	Y	7/N7	J/N1
	9	F12	O/N*	O/N6	.N.			L/N3	NumLk/ FScrLk
	10	Pause	=	]	\			[	`
	11	BkSp	DnArr/ FPgDn	UpArr/ FPgUp	'	WinApp	Enter		Ins/ FPrtScr
	12					RWin			
	13	RArr/ FEnd	LArr/ FHome	Del/ FSysReq	//N/		;N+	P/N-	-
	14		LCtrl					RCtrl	
	15	LShift		RShift					

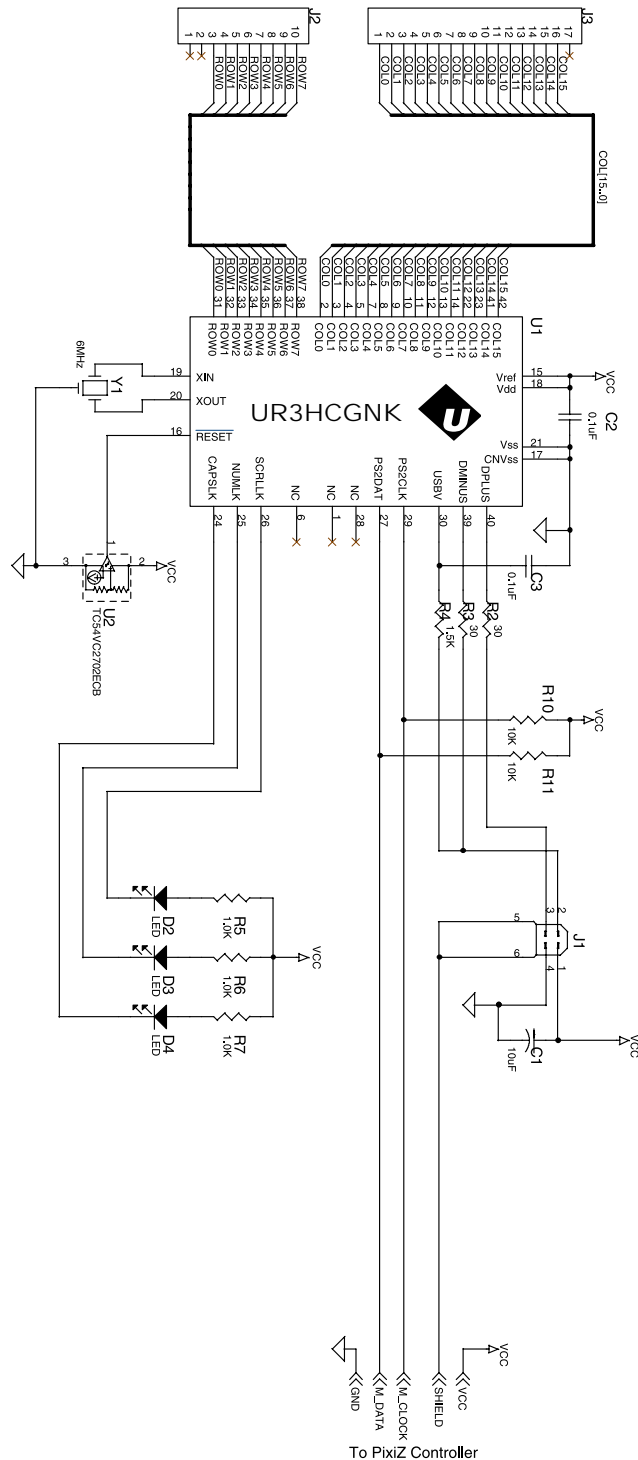
Note1: The letter N in italics, followed by a number or symbol, indicates that key in Num Case.  
Note2: The letter F in italics, followed by a key function, indicates that key in Function Case.

Keyboard Layout for the Fujitsu FKB7654

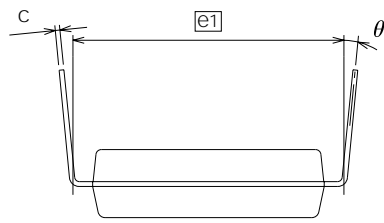




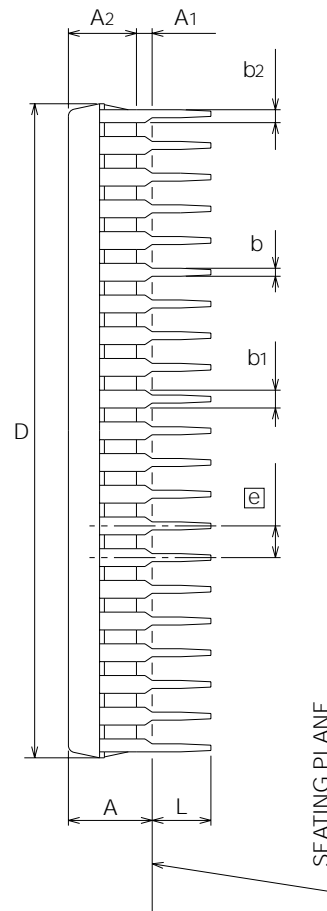
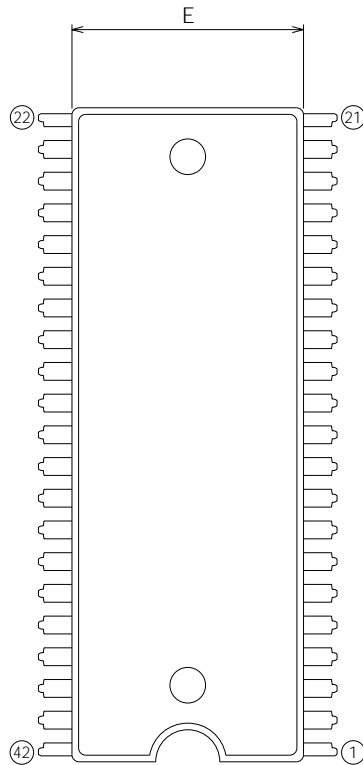
Suggested Interfacing for the UR3HCGNK



Mechanicals for the UR3HCGNK



Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	-	-	5.5
A1	0.51	-	-
A2	-	3.8	-
b	0.35	0.45	0.55
b1	0.9	1.0	1.3
b2	0.63	0.73	1.03
c	0.22	0.27	0.34
D	36.5	36.7	36.9
E	12.85	13.0	13.15
e	-	1.778	-
e1	-	15.24	-
L	3.0	-	-
theta	0°	-	15°



## Electrical Specifications

### Absolute Maximum Ratings

Ratings	Symbol	Pin	Value	Unit
Power Source Voltage	Vcc		-0.3 to 7.0	V
Input Voltage	Vi	2-5, 7-16, 19, 22-27, 29, 31-42	-0.3 to VCC + 0.3	V
Input Voltage	Vi	17*	-0.3 to 13	V
Output Voltage	Vo	4-5, 7-14, 20, 22-27, 29-42	-0.3 to VCC + 0.3	V
Power Dissipation	Pd		300	mW
Operating Temperature	Topr		T low to T high	
UR3HCKMC			-20 - 85	° C
Storage Temperature	Tstg		-40 - 125	° C

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

Characteristic	Symbol	Min	Typ	Max	Unit
Power Supply Voltage	Vdd	4.1	5.0	5.5	V
Input High Voltage	Vih	0.8 Vdd		0.8Vdd	V
Input Low Voltage	Vil	0		.3 Vdd	V
Peak Output Voltage	Ioh	-10		+10	mA
Average Output Current	Ioh(avg)	-5		5	mA
Output Voltage(Ioh=-5mA)	Voh	Vdd-1.5			V
(Ioh=5mA)	Vol			1.5	V
Input Current	Iih	-0.5	-0.2	5.0	mA
Supply Current, USB operating (Vdd=5.0 V)	Idd		6	10	mA
Supply Current, USB suspend (Vdd=5.0 V)	Idd		0.1	1.0	mA

### Control Timing(Vdd= 4.1 to 5.5 V)

Characteristic	Symbol	Min	Typ	Max	Unit
Internal/External Clock oscillation frequency	Xin			6	Mhz

\*Note 1: This is a rating only for the one-time PROM version. Connect to Vss for mask ROM version

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## Bill of Materials

Quantity	Reference	Part Number	Description
1	C1	10µF	10µF capacitor
2	C2, C3	0.1µF	0.1µF capacitor
3	D2, D3, D4	LED	LED
1	J1		USB connector
1	J2	AMP 487952-8	Keyboard rows connector for FKB7654
1	J3	AMP 1-487952-6	Keyboard columns connector for FKB7654
2	R2, R3	30	30 Ohm resistor
1	R4	1.5K	1.5K Ohm resistor
3	R5, R6, R7	1K	1K Ohm resistor
2	R10, R11	10K	10K Ohm resistor
1	U1	UR3HCGNK	USAR GeniKey™
1	U2	TC54VC2702ECB	Telcom (or Digikey)
1	Y1	EF0-S6004E5	Panasonic 6MHz ceramic resonator (or Digikey)

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