FlexiCoder™ K25C81
Versatile PC/XC/AT/PS/2 Compatible Keyboard Encoder

HID & SYSTEM MANAGEMENT PRODUCTS, KEYCODER™ FAMILY

DESCRIPTION

The FlexiCoder™ is a versatile, low-power keyboard encoder. It offers two bi-directional channels for communicating with a PC/XT/AT/PS2 system, and/or any optional keyboard-compatible devices, such as an 83 or 101/102 standard desktop keyboard, OCR, barcode reader, etc. The K25C81 directly interfaces a PC keyboard port, making custom keyboard to system communications fully transparent.

On an 8 x 18 matrix, the FlexiCoder™ will scan, debounce and encode up to 144 keys. Scan codes corresponding to single keys of the IBM 101 keyboard, or a combination of these keys when depressed with Shift, Ctrl, and Alt keys, are generated with each key press. Custom keypad input is not effected by the Shift States of an external keyboard.

Users can conveniently define key assignments on the matrix as single or repeating actions. All keys must be released between key strokes or scanning is suspended. The encoder can buffer up to 122 keycodes, and control inputs and outputs are provided for interfacing with contact keyboards.

The FlexiCoder™ is ideal for use with either BIOS-compatible chip sets or single-board computers for PC systems requiring a custom keyboard / keypad as an alternate or additional input device. Boards and evaluation kits are immediately obtainable and ready to connect.

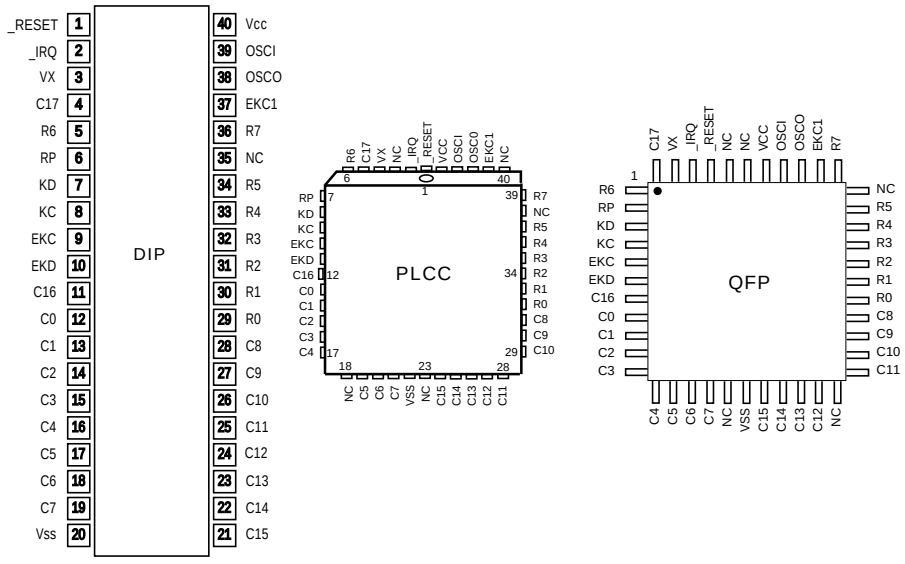
FEATURES

- Directly interfaces a PC keyboard port
- Encodes up to 144 custom keys on an 8 X 18 matrix
- Buffers up to 122 keycodes
- Interfaces to 83/101/102 standard keyboard or other 8042-compatible device
- Enables custom keypad scan codes to remain unaffected by the Shift States of an external keyboard
- Includes jumper-selectable auto-repeat for designated keys
- Offers two-key inhibit scanning mode

APPLICATIONS

- Custom keyboards/keypads
- Control panels
- Automatic teller machines
- Embedded control systems
- Public Information Kiosks
- Instrumentation
- Test and Measurement equipment
- Point of Sales terminals
- Industrial Controllers
- Medical Instruments

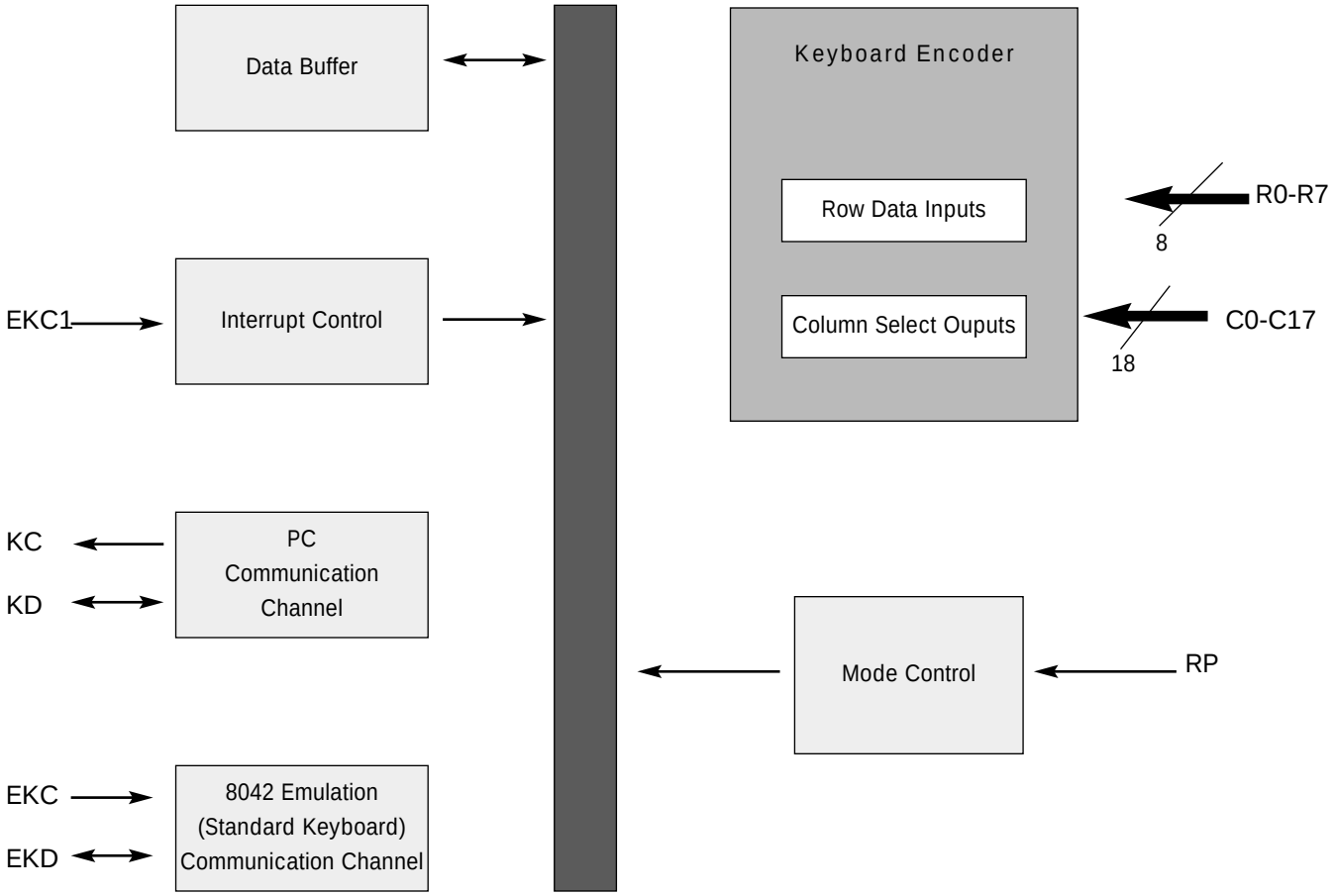
PIN ASSIGNMENTS



ORDERING CODE

Package options	Pitch In mm's	TA = -40°C to +85°C
40-pin, Plastic DIP	2.54 mm	K25C81-XX-P
44-pin, Plastic PLCC	1.27 mm	K25C81-XX-FN
44-pin, Plastic QFP	0.8 mm	K25C81-XX-FB

FUNCTIONAL DIAGRAM



FUNCTIONAL DESCRIPTION

The FlexiCoder™ consists of six major sections (see functional diagram, previous page). These are the Keyboard Encoder, the Mode Control Unit, the PC Communication Channel, the 8042 Emulation Channel, the Interrupt Control Unit and the Data Buffer. These sections communicate with each other and operate concurrently.

The controller continuously scans a keyboard organized as an 8 row by 18 column matrix, for a maximum of 144 keys. Smaller-size keyboards can be connected provided that all unused row pins are connected to Vcc. The microcontroller selects one of the 18 column lines (C0-C17) every 512 µS 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 9.2 mS. Each key press 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 PC Keyboard Communication Channel.

PIN DEFINITIONS

Mnemonic	DIP	PLCC	QFP	TYPE	Name and Function
Vcc	40	44	38	I	Power Supply: +5V
Vss	20	22	17	I	Ground
OSCI	39	43	37	I	Oscilator Input
OSCO	38	42	36	O	Oscilator Output
_RESET	1	1	41	I	Reset: apply 0 V to provide orderly start-up.
_IRQ	2	2	42	I	Must be tied to Vcc
VX	3	4	43	I	Tie to Vcc.
RP	6	7	2	I	Rollover Mode Selection: tie to Vcc to select N-Key Rollover. Tie to Ground to select Two-Key Inhibit Mode.
KC	8	9	4	I/O	Keyboard Clock: connects to PC's keyboard port Clock Line.
KD	7	8	3	I/O	Keyboard Data: connects to PC's keyboard port Data Line.
EKD	10	11	6	I/O	External Keyboard Data: connects to external keyboard Data Line.
EKC	9	10	5	I/O	External Keyboard Clock: connects to external keyboard Clock Line.
EKC1	37	41	35	I	External Keyboard Clock 2: connects to external keyboard Clock Line and is used to generate an interrupt for every Clock Line transition. This signal must be inverted for PC/XT keyboards.
C0-C7	12-19	3-17 18 19-21	8-15	O	Column Select Outputs: select one of columns.
C8-C15	28-21	31-24	26-18		
C16	11	12	7	O	
C17	4	5	44	I/O	Keyboard type selection: this pin is used both as outputs for column select and as input for standard keyboard-type selection.
R0-R5	29-34	32-37	27-32	I	Row data inputs
R6	5	6	1	I	
R7	36	39	34	I	
NC	35	38, 3 18, 23 40	16, 33 22, 39 40	- -	No Connects: these pins are unused.

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

REPEAT KEYS

In custom masks, each key can be defined individually to be either Typematic or Single-Touch Action. In the standard mask, all keys are defined to be Single-Touch Action, except the Arrow Keys. Pin RP controls the repeat action of keys that are defined to be Typematic.

Repeat Mode	RP
No repeat action	L
Repeat action	H

Table 1: Typematic Action Control

The Typematic rate can be controlled by issuing the appropriate commands from the system.

SPECIAL HANDLING

External Keyboard Connection

If an external keyboard was not connected during power-on and then connected at a later time, the controller will proceed with the normal reset routine in order to initialize the external keyboard properly. Thereafter, the FlexiCoder™ checks for the presence of an external keyboard every 2 seconds. After communication has been established, the controller continues checking for the external keyboard's presence. Should the external keyboard be removed at a later time, the K25C81 detects the disconnection and will reinitiate the reset sequence upon reconnection. This feature allows the user to connect and disconnect an external keyboard at any time without resetting the system.

FUNCTIONAL DESCRIPTION, (CON'T)

Switch Matrix Encoding

Each matrix location is programmed to represent either a single key or a combination of keys of the IBM-standard 101/102 keyboard.

Scan Code Table Sets

The FlexiCoder™ supports two scan code table sets. Scan Code Sets 1 and 2 are the default sets for PC/XT and AT/PS/2 systems respectively. For more information, refer to the IBM Technical Reference Manual. Custom scan code tables, including macros, are also available. Operating modes are defined by the logic level of the relevant mode pins in the Mode Control Unit.

SPECIAL HANDLING, (CON'T)

Scan Matrix Data Integrity

The FlexiCoder™ maintains the integrity of the codes corresponding to the scanned matrix locations, independently of the Shift Status of the external keyboard or the system. For example, if a key has been defined on the matrix to send code corresponding to lower case letter "a", it will still send the scan code for "a" even if the Shift Key has been pressed or the Caps Lock has been set by the external keyboard. This is accomplished by internally maintaining a set of flags to monitor the Shift Status of the external keyboard and the system. If, for instance, the lower case key "a" is found to be pressed and Caps Lock is set, the codes sent will be as follows:

1. Caps Lock Make Code
2. Caps Lock Break (this will reset the Caps Lock status of the system)
3. "a" Make Code
4. "a" Break Code
5. Lock Make Code
6. Caps Lock Break Code (this will restore the Caps Lock status of the system)

EXT. KBD COMMUNICATION

The external keyboard communication port of the FlexiCoder™ fully emulates a standard 8042, available to an 83/101/102 external keyboard or other compatible device. Communication with an external keyboard is accomplished via EKC and EKD, Clock and Data lines respectively. A third pin, EKC1 which connects to the Clock Line, interrupts the controller whenever an external keyboard initiates a communication.

When power is first applied, the controller proceeds with the standard reset sequence with the external keyboard. Data and commands coming from the external keyboard are buffered in the controller's FIFO, along with data from the scanned matrix, and then presented to the system as if originating from a single source. Commands and data from the system, after being acknowledged, are then transmitted to the external keyboard.

MODE CONTROL

The FlexiCoder™ implements all the standard functions of communication with a BIOS-compatible PC/XT or AT/PS/2 host system. Two lines, KC and KD, provide bi-directional clock and data signals according to the protocol (PC or AT) selected. In addition, the K25C81 supports commands from and to the system, as described in the IBM Technical Reference Manuals. The following table shows the commands that the system may send and their value in hex.

Command	Hex Value
Set/Reset Status Indicators	ED
Echo	EE
Invalid Command	EF
Select Alternate Scan Codes	F0
Invalid Command	F1
Read ID	F2
Set Typematic Rate/Delay	F3
Enable	F4
Default Disable	F5
Set Default	F6
Set All Keys	
■ Typematic	F7
■ Make/Break	F8
■ Make	F9
■ Typematic/Make/Break	FA
Set Key Type	
■ Typematic	FB
■ Make/Break	FC
■ Make	FD
Resend	FE
Reset	FF

Table 2: Keyboard Commands from the System (AT/PS/2 protocol)

These commands are supported in the AT/PS/2 protocol and can be sent to the keyboard at any time. Mode 1 accepts only the 'reset' command. Commands shown in italics do not affect the operation of the K25C81. Nevertheless, they are acknowledged and relayed to the external keyboard, if an external standard keyboard is present.

The following table shows the commands that the keyboard may send to the system.

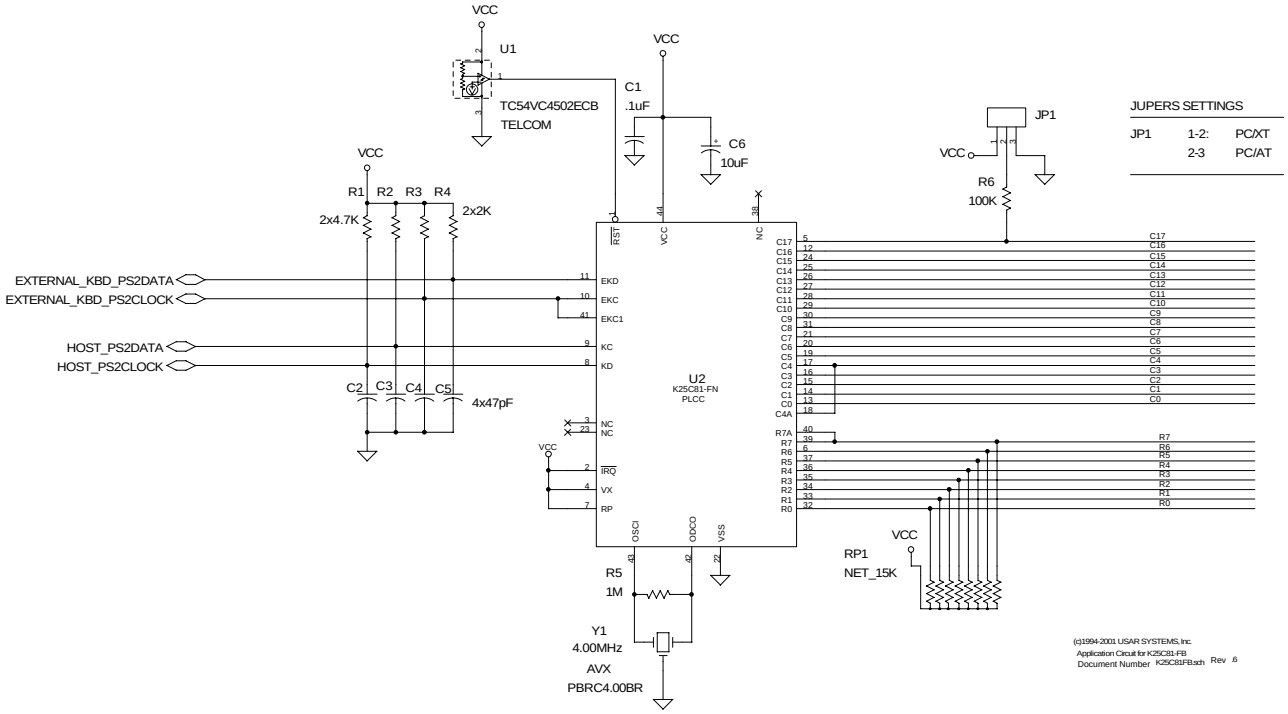
Command	Hex Value
Key Detection Error/Overrun	00*
Keyboard ID	83AB
BAT Completion Code	AA
BAT Failure Code	FC
Echo	EE
Acknowledge (Ack)	FA
Resend	FE
Key Detection Error/Overrun	FF*

*Scan Code Set 2

Table 3: Keyboard Commands to the System (AT/PS/2 protocol)

When an external keyboard is connected, commands from the system will also be directed to the external keyboard. Presence or absence of an external keyboard will not affect the normal operation of the FlexiCoder™.

SUGGESTED INTERFACING FOR K25C81-FN (44-PIN PLCC PACKAGE)



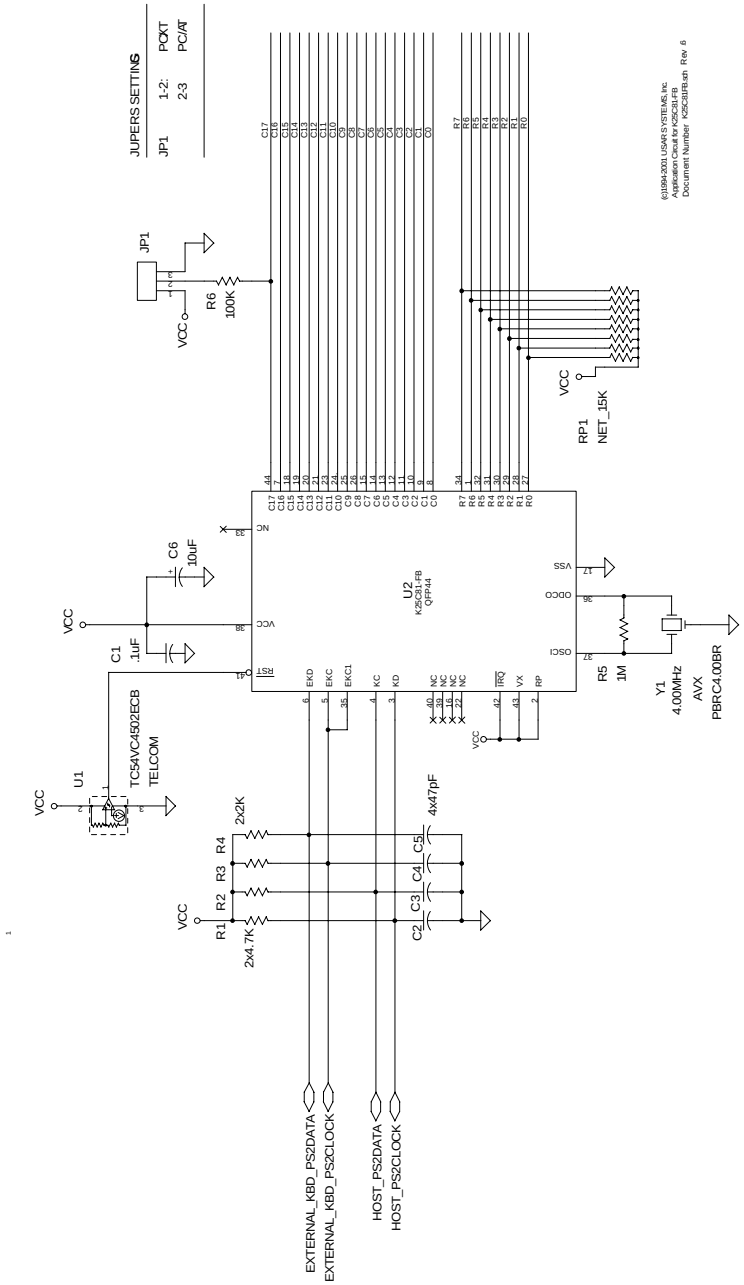
STANDARD KEYMAP FOR K25C81

Columns (C0–C17)	Rows (R0-R7)							
	0	1	2	3	4	5	6	7
0	F29	F28	End	F36	F34	F35	F33	F37
1	Pg Dn	Home	PgUp	:	F27	F30	F31	F32
2	]	(	)	*	^	F22	F21	F25
3	v	w	x	y	z	;	[	F20
4	o	p	q	r	s	t	u	F23
5	h	i	j	k	l	m	n	F18
6	a	b	c	d	e	f	g	i
7	.	, (comma)	- (dash)	/	%	&	#	0
8	S	T	U	V	W	X	Y	Z
9	J	K	L	M	N	O	P	Q
10	A	B	C	D	E	F	G	H
11	1	2	3	4	5	6	7	8
12	f3	f4	f6	f5	f7	f8	f9	f2
13	f14	f13	f12	f15	f11	f16	9	f10
14	f1	Backspace	Rt Arrow*	Dn Arrow*	F38	Space	F19	+
15	Ins	Esc	Up Arrow*	Lft Arrow*	R	Enter	$	=
16	Back-quote	!	@	-	{	}	\	|
17	'(Apostrophe)	"	<	>	?	~	Tab	Del

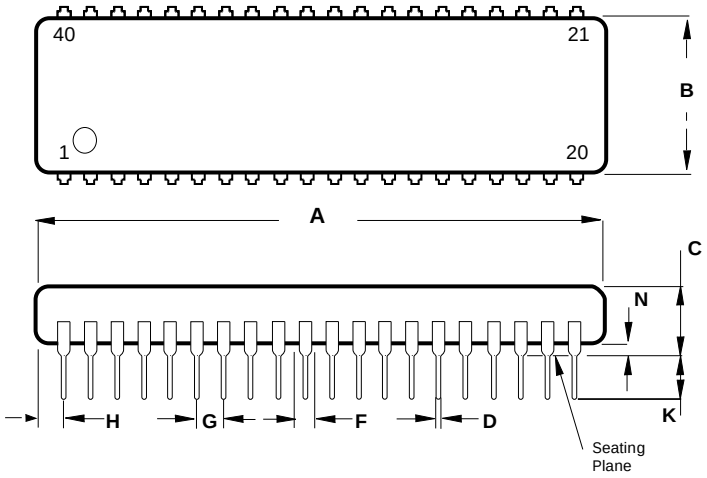
* Typematic Keys

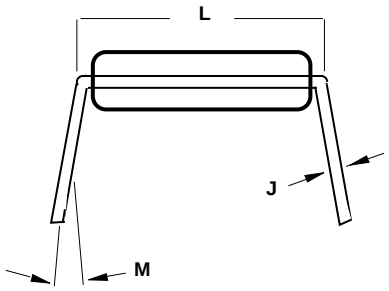
- Upper case A–Z correspond to Shift a–Shift z
- F21–F30 correspond to Ctrl F1–Ctrl F10
- F11–F20 correspond to Shift F1–Shift F10
- F31–... correspond to Alt F1–Alt F10

SUGGESTED INTERFACING FOR K25C81-FB (44-PIN QFP PACKAGE)



MECHANICALS FOR THE K25C81-P

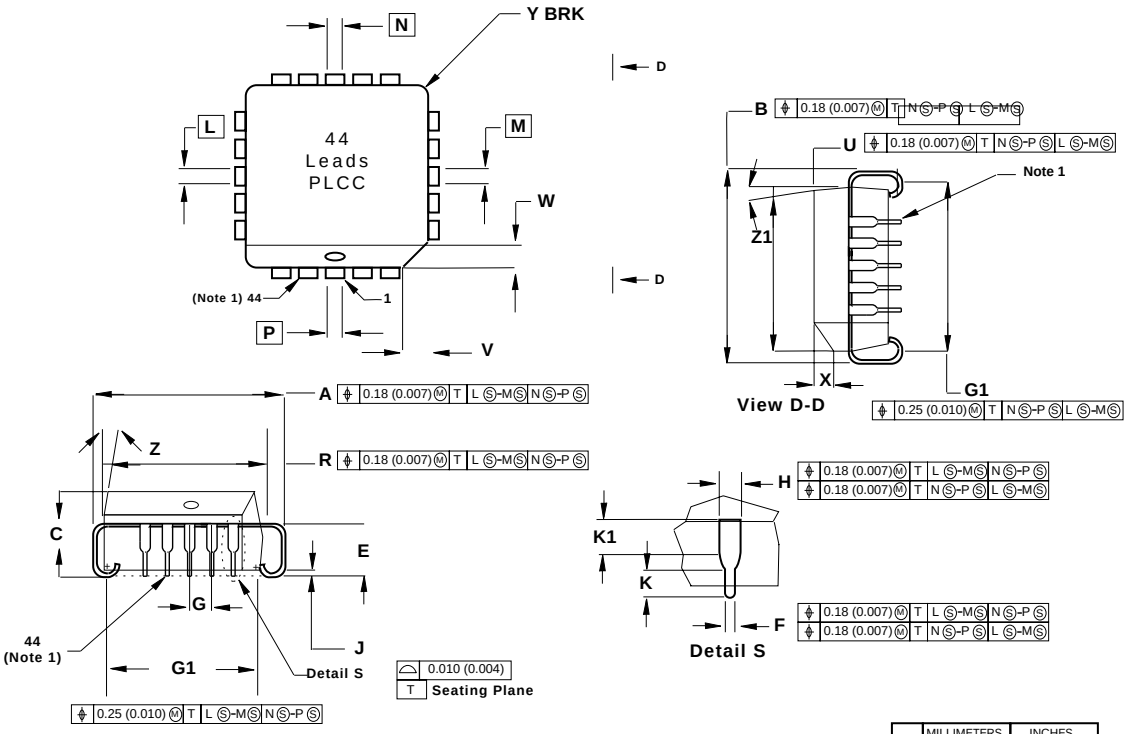




Notes:
1. Positional tolerance of leads (D) shall be within 0.25 mm (0.010) at maximum material condition, in relation to the seating plane and each other.
2. Diminsion L is to the center of the leads when the leads are formed parallel.
3. Dimension B does not include mold flash.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	51.69	52.45	2.035	2.065
B	13.72	14.22	0.540	0.560
C	3.94	5.08	0.155	0.200
D	0.36	0.56	0.014	0.022
F	1.02	1.52	0.040	0.060
G	2.54 BSC		0.100 BSC	
H	1.65	2.16	0.065	0.085
J	0.20	0.38	0.008	0.015
K	2.92	3.43	0.015	0.135
L	15.24 BSC		0.600 BSC	
M	0°	15°	0°	15°
N	0.51	1.02	0.020	0.040

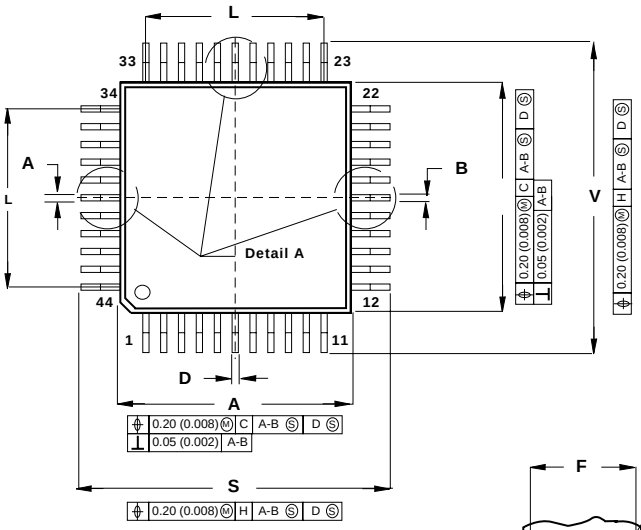
MECHANICALS FOR THE K25C81-FN

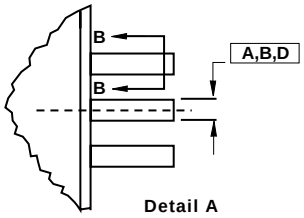


Notes:
1. Due to space limitation, the chip is represented by a general (smaller) case outline drawing rather than showing all 44 leads.
2. Datums L, M, N, and P determine where the top of the lead shoulder exits plastic body at mold parting line
3. DIM G1, true position to be measured at Datum T, Seating Plane
4. DIM R and U do not include mold protusion. Allowable mold protusion is 0.25 (0.010) per side.
5. Dimensioning and tolerancing per Ansi Y14.5M, 1982
6. Controlling dimension: Inch

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	17.40	17.65	0.685	0.695
B	17.40	17.65	0.685	0.695
C	4.20	4.57	0.165	0.180
E	2.29	2.79	0.090	0.110
F	0.33	0.48	0.013	0.019
G	1.27 BSC		0.050 BSC	
H	0.66	0.81	0.026	0.032
J	0.51	-	0.020	-
K	0.64	-	0.025	-
R	16.51	16.66	0.650	0.656
U	16.51	16.66	0.650	0.656
V	1.07	1.21	0.042	0.048
W	1.07	1.21	0.042	0.048
X	1.07	1.42	0.042	0.056
Y	-	0.50	-	0.020
Z	2 °	10 °	2 °	10 °
G1	15.50	16.00	0.610	0.630
K1	1.02	-	0.040	-
Z1	2 °	10 °	2	10 °

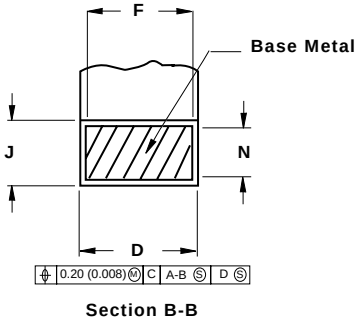
MECHANICALS FOR THE K25C81-FB



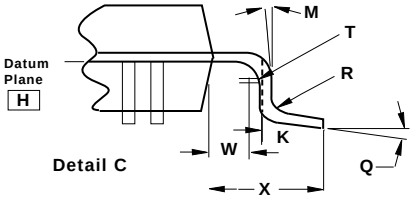


Notes

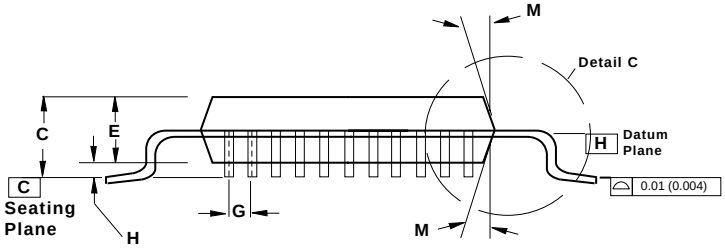
1. Dimensioning and tolerancing per Ansi Y14.5-M, 1982
2. Controlling dimension: Millimeter
3. Datum Plane "H" is located at the bottom of the lead and is coincident with the lead where the lead exits the plastic body at the bottom of the parting line.
4. Datums -A-, -B-, and -D- to be determined at Datum Plane -H-.
5. Dimensions S and V to be determined at seating plane -C-.
6. Dimensions A and B do not include Mold protusion. Allowable protusion is 0.25 (0.010) per side. Dimensions A and B do include mold mismatch and are determined at Datum Plane -H-.
7. Dimension D does not include Danbar protrusion. Allowable Danbar protrusion is 0.08 (0.003) total in excess of the D dimension at Maximum Material Condition. Danbar cannot be located on the lower radius or the foot.



Section B-B



Detail C



DIM	MILLIMETERS MIN	MAX	INCHES MIN	MAX
A	9.90	10.10	0.390	0.398
B	9.90	10.10	0.390	0.398
C	2.10	2.45	0.083	0.096
D	0.30	0.45	0.012	0.018
E	2.00	2.10	0.079	0.083
F	0.30	0.40	0.012	0.016
G	0.80 BSC		0.031 BSC	
H	-	0.25	-	0.010
J	0.13	0.23	0.005	0.009
K	0.65	0.95	0.026	0.037
L	8.00 REF		0.315 REF	
M	5 °	10 °	5 °	10 °
N	0.13	0.17	0.005	0.007
Q	0 °	7 °	0 °	7 °
R	0.13	.30	0.005	0.012
S	12.95	13.45	0.510	0.530
T	0.13	-	0.005	-
U	0 °	-	0 °	-
V	12.95	13.45	0.510	0.530
W	0.40	-	0.016	-
X	1.6 REF		0.063 REF	

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	25	mA
Operating Temperature K25C81	Ta	T low to T high 40 to +85	° C
Storage Temperature Range	Tstg	-65 to +150	° C

Thermal Characteristics

Characteristic	Symbol	Value	Unit
Thermal Resistence	Tja		° C per W
■ Plastic		60	
■ DIP		-60	
■ Plcc		70	

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

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage (I load<10µA)	Vol			0.1	V
	Voh	Vdd–0.1			
Output High Voltage (I load=0.8mA)	Voh	Vdd–0.8			V
Output Low Voltage (I load=1.6mA)	Vol:			0.4	V
Input High Voltage	Vih	0.7xVdd		Vdd	V
Input Low Voltage	Vil	Vss		0.2xVdd	V
Supply Current	Idd		4.7	7.0	mA
I/O Ports Hi-Z Leakage Current	Iil			+/-10	µA
Input Current	Iin			+/- 1	µA
I/O Port Capacitance	Cio		8	12	pF

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

Characteristic	Symbol	Min	Max	Unit
Frequency of Operation	fosc			MHz
■ Crystal Option			4.0	
■ External Clock Option		dc	4.0	

SEMTECH

For sales information and product literature, contact:

HID & System Mgmt Division
Semtech Corporation
568 Broadway
New York, NY 10012
hidinfo@semtech.com
http://www.semtech.com
212 226 2042 Telephone
212 226 3215 Telefax

Semtech Western Regional Sales
805-498-2111 Telephone
805-498-3804 Telefax

Semtech Central Regional Sales
972-437-0380 Telephone
972-437-0381 Telefax

Semtech Eastern Regional Sales
203-964-1766 Telephone
203-964-1755 Telefax

Semtech Asia-Pacific Sales Office
+886-2-2748-3380 Telephone
+886-2-2748-3390 Telefax

Semtech Japan Sales Office
+81-45-948-5925 Telephone
+81-45-948-5930 Telefax

Semtech Korea Sales Sales
+82-2-527-4377 Telephone
+82-2-527-4376 Telefax

Northern European Sales Office
+44 (0)2380-769008 Telephone
+44 (0)2380-768612 Telefax

Southern European Sales Office
+33 (0)1 69-28-22-00 Telephone
+33 (0)1 69-28-12-98 Telefax

Central European Sales Office
+49 (0)8161 140 123 Telephone
+49 (0)8161 140 124 Telefax