SPECIFICATION

1. General Description

The EKM8021 is an Mouse Controller designed to control both USB & PS/2 Mouse device. This Mouse Controller can auto detect USB or PS/2 mode, and supports X,Y,Z three axes , and three buttons under both USB and PS2 mode.

2. Features

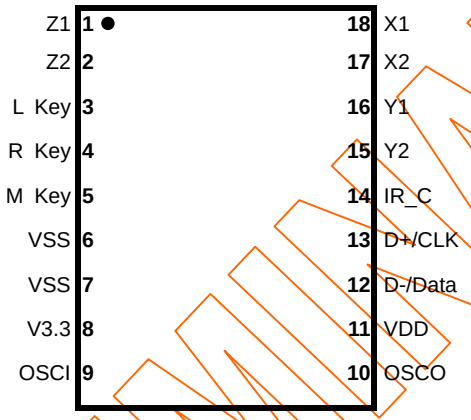
- Universal Serial Bus Specification, version 1.1
- USB HID Specification, version 1.1
- Auto-detecting PS/2 port or USB port.
- Compatible with Microsoft 3D PS/2 mouse.
- Support 3D (X,Y,Z) 3 Key (L,R,M) input.
- Support Z/2 mechanical, Z/2 Photo, and Z/4 Photo(eKM8021B) Z-axis input type.
- Support Agilent HDNS-2000 Optical Mouse Sensor.
- Applications

  3D, 3 Buttons USB and PS/2 Combo Mouse.

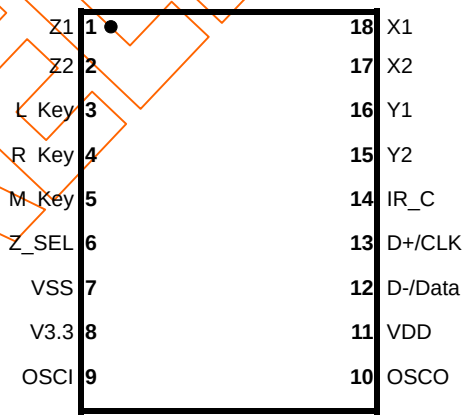
3. Applications

- USB & PS/2 3D 3Key Mouse
- USB & PS/2 3D 3Key Optical Mouse

4. Pin Configuration



eKM8021A (18-Pin)



eKM8021B (18-Pin)

5. Pin Description

Symbol	I/O	Pin	Function
OSCI	I	9	6MHz ceramic resonator input.
OSCO	I/O	10	Return path for 6-MHz ceramic resonator.
$V_{3.3V}$	O	8	3.3V DC voltage output from internal regulator. This pin has to be tied to a 4.7 µF capacitor.
X1	I	18	X axis Input 1
X2	I	17	X axis Input 2
Y1	I	16	Y axis Input 1
Y2	I	15	Y axis Input 2
Z1	I	1	Z axis Input 1
Z2	I	2	Z axis Input 2
R	I	4	Right Key Input
M	I	5	Middle Key Input
L	I	3	Left Key Input
IR_C	I/O	14	IR Control Pin.
D+ / CLK	I/O	13	USB D+ or PS/2 CLK I/O
D- / DATA	I/O	12	USB D- or PS/2 Data I/O
VDD	-	11	5 V Power Input
VSS	-	6,7	GND. EKM8021A Type both two pin should tired to GND
Z_SEL	I	6	Z/2 : Floating ; Z/4: Ground This function only support by eKM8021B

6. Function Description

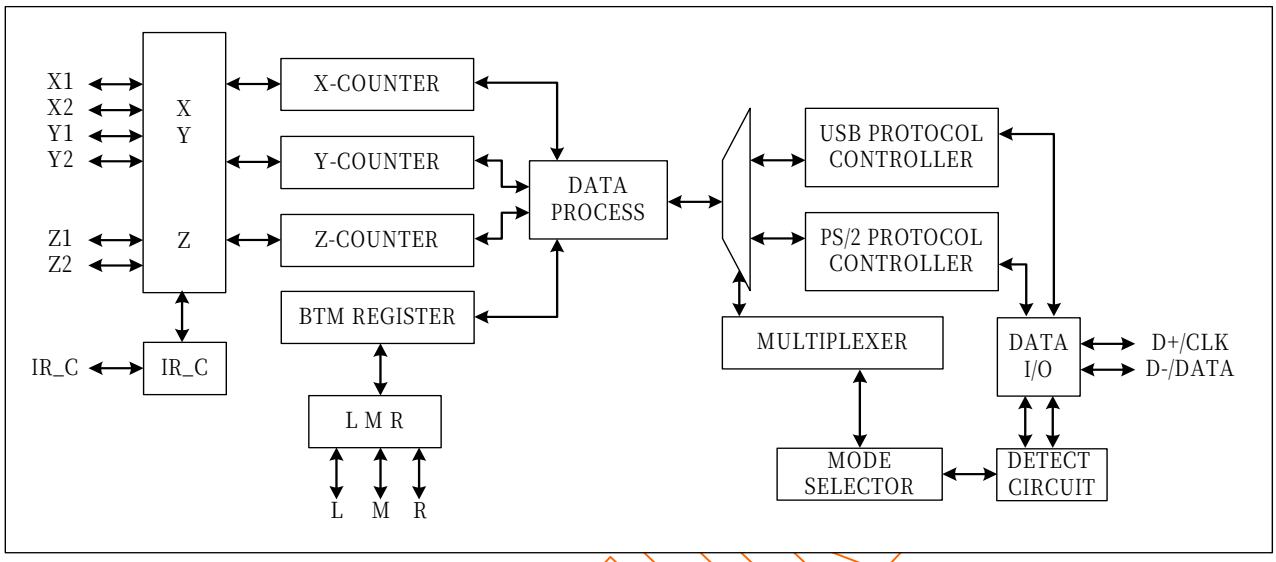


Fig-1 : Function block

6.1 PS/2 Mouse Function Description

PS/2 Mouse Commands Description

Hex Code	Command	EKM8021 echo code
FF	Reset	FA,AA,00
FE	Resend	XX,(XX,XX)
F6	Set Default	FA
F5	Disable	FA
F4	Enable	FA
F3,XX	Set Sampling Rate	FA,FA
F2	Read Device Type	FA,00
F0	Set Remote Mode	FA
EE	Set Wrap Mode	FA
EC	Reset Wrap Mode	FA
EB	Read Data	FA,XX,XX,XX
EA	Set Stream Mode	FA
E9	Status Request	FA,XX,XX,XX
E8	Set Resolution	FA,FA
E7	Set Autospeed	FA
E6	Reset Autospeed	FA

Microsoft PS/2 scrolling mouse

(A) Entering procedure: Except in WRAP mode, while eKM8021 received the following consecutive

command.

i. F3 C8 ---- set sampling rate 200/sec

ii. F3 64 ---- set sampling rate 100/sec

iii. F3 50 ---- set sampling rate 80/sec

(B) Operating:

a. All of the commands in legacy mode still be valid.

b. The ID code of read device type command (F2) will changed from "00" to be "03".

c. Data report will be four bytes format:

Byte	Bit	Description
1	0	Left button status; 1 = pressed
	1	Right buton status; 1 = pressed
	2	Middle button status; 1 = pressed
	3	Reserve
	4	X data sign; 1 = negative
	5	Y data sign; 1 = negative
	6	X data overflow; 1 = overflow
	7	Y data overflow; 1 = overflow
2	0-7	X data (D0-D7)
3	0-7	Y data (D0-D7)
4	0-7	Z data (D0-D7)

(C) Exiting Microsoft scrolling mode:

There are two ways to exit:

a. Power off.

b. Reset command (FF).

Z-axis Input Function : The Z0-Z7 limit value is ±7

Z-axis counter accumulates the Z1, Z2 phase changed by movement. This mode includes noise immunity.

Z/2 : 2 dot per count. The wheel should stay at Z1=0, Z2=0 or Z1=1, Z2=1 Phase

Z/4 : 4 dots per count. the wheel should stay at Z1=0, Z2=0 phase.

6.2 USB Mouse Function Description

Each Descriptor in USB Mode.

Descriptor Type	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8
Device Descriptor	12	01	10	01	00	00	00	08
	67	12	02	00	01	00	01	02
	00	01						
Configuration Descriptor	09	02	22	00	01	01	00	A0
	32							
Interface Descriptor	09	04	00	00	01	03	01	02
	00							
HID Descriptor	09	21	10	01	00	01	22	48
	00							
Endpoint	07	05	81	03	04	00	0A	
HID Report Descriptor	05	01	09	02	A1	01	05	09
	19	01	29	04	15	00	25	01
	95	04	75	01	81	02	95	01
	75	04	81	03	05	01	09	01
	A1	00	09	30	09	31	15	81
	25	7F	75	08	95	02	81	06
	C0	09	38	95	01	81	06	09
	3C	15	00	25	01	75	01	95
	01	B1	22	95	07	B1	01	C0

USB Mouse Report Data Type

Byte0	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
	0	0	0	0	0	M	R	L
Byte1	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
	X-AXIS							
Byte2	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
	Y-AXIS							
Byte3	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
	Z-AXIS							

7. ABSOLUTE MAXIMUM RATINGS

Symbol	min	Max	unit
Temperature under bias	**0**	**70**	**ºC**
Storage temperature	**-65**	**150**	**ºC**
Input voltage	**-0.5**	**6.0**	**V**
Output voltage	**-0.5**	**6.0**	**V**

8. DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Condition	Min	Type	Max	Unit
	3.3V Regulator					
V_{Rag}	Output voltage of 3.3v Regulator	V_{DD} = 4.2V ~ 5.2V	3.0	3.3	3.6	V
V_{ResetL}	Low Power Reset detecting low Voltage			-	2.3	V
V_{ResetH}	Low Power Reset detecting high Voltage		2.4	-		V
	MCU operating					
I_{IL}	Input Leakage Current for input pins	VIN=VDD,VSS	-	-	1	µA
V_{IHX}	Clock Input High Voltage	OSCI	2.5	-	-	V
V_{ILX}	Clock Input Low Voltage	OSCI	-	-	1.0	V
	GPIO Pins					
V_{HL}	High/Low level transfer point	Input		1.1	-	V
V_{OH}	Output High Voltage	I_{Drive} = 5.0mA	2.4	-	-	V
V_{OL}	Output Low Voltage	I_{Sink} = 5.0mA	-	-	0.4	V
I_{PH}	Input current with pull-high resister	The input pin with internal pull-high resistor is connected to VSS	-	25	-	µA
I_{PL}	Input current with pull-low resister	The input pin with internal pull-low resistor is connected to V3.3.	-	330	-	µA
	USB Interface					
V_{OH}	Static Output High	USB operation Mode	2.8	-	3.6	V
V_{OL}	Static Output Low		-	-	0.3	V
V_{DI}	Differential Input Sensitivity		0.2	-	-	V
V_{CM}	Differential Input Command Mode Range		0.8	-	2.5	V
V_{SE}	Single Ended Receiver Threshold		0.8	-	2.0	V
C_{IN}	Transceiver Capacitance	USB operation Mode	-	-	20	pF
V_{RG}	Output Voltage of Internal Regulator		3.0	-	3.6	V
R_{PH}	Internal Pull-high Resistor (USB Spec 5%)		-20%	1.5	+20%	kΩ

9. AC ELECTRICAL CHARACTERISTICS

Parameter	Sym.	Min.	Typ.	Max.	Unit
Time from DATA transition to falling edge of CLK	T1	5		25	µS
Time from rising edge of CLK to DATA transition	T2	5		T4 - 5	µS
Duration of CLK inactive	T3	30	40	50	µS
Duration of CLK active	T4	30	40	50	µS
Time to auxiliary device inhibit after clock 11 to ensure the auxiliary device does not start another transmission	T5			50	µS
Time from inactive to active CLK transition, used to time when auxiliary device samples DATA	T6	5		25	µS
System clock	FCLK		1.843		MHz
Watchdog (Ta=0℃to25℃, VDD=5V, VSS=0V)	Twdt		500Us ~ 16Ms		

10. PS/2 TIMING DIAGRAMS

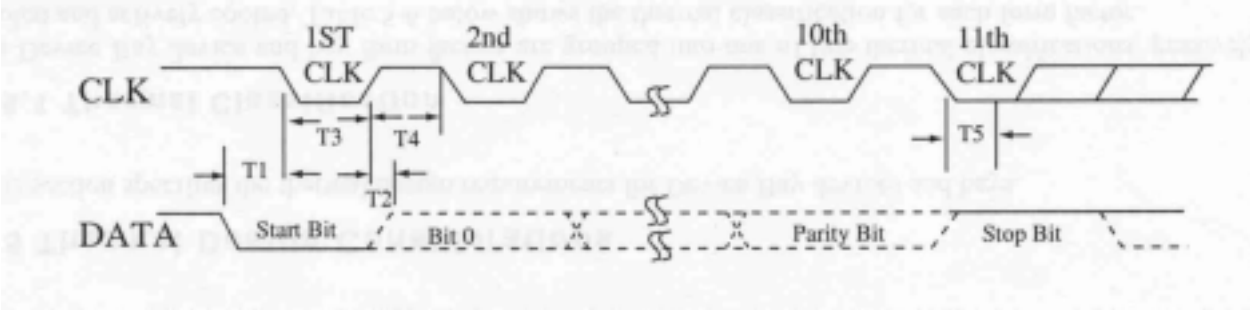


Fig 1. PS/2output data timings

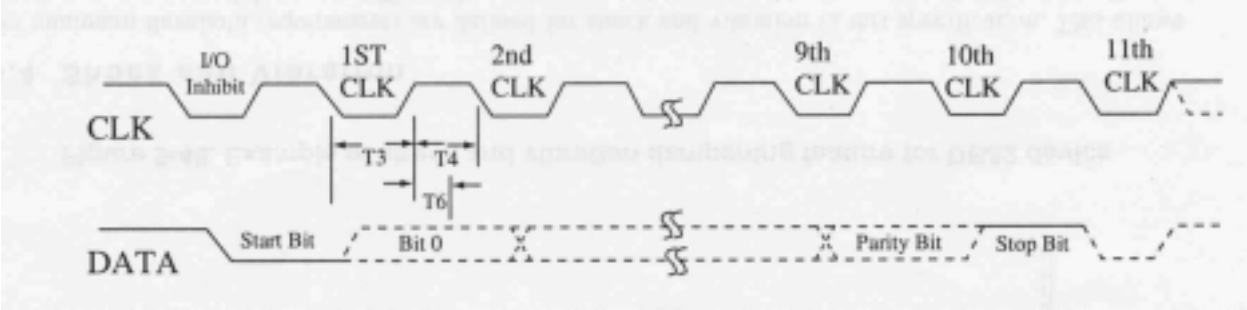
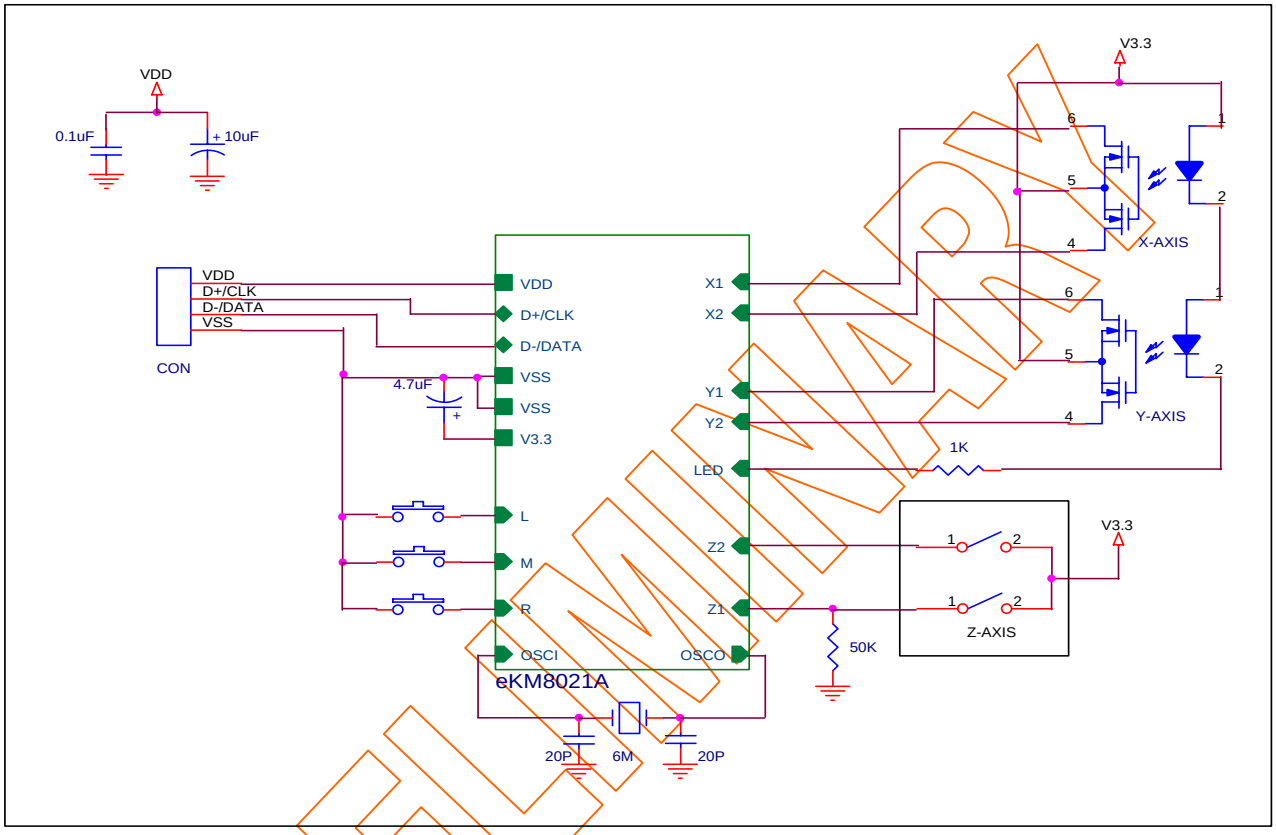
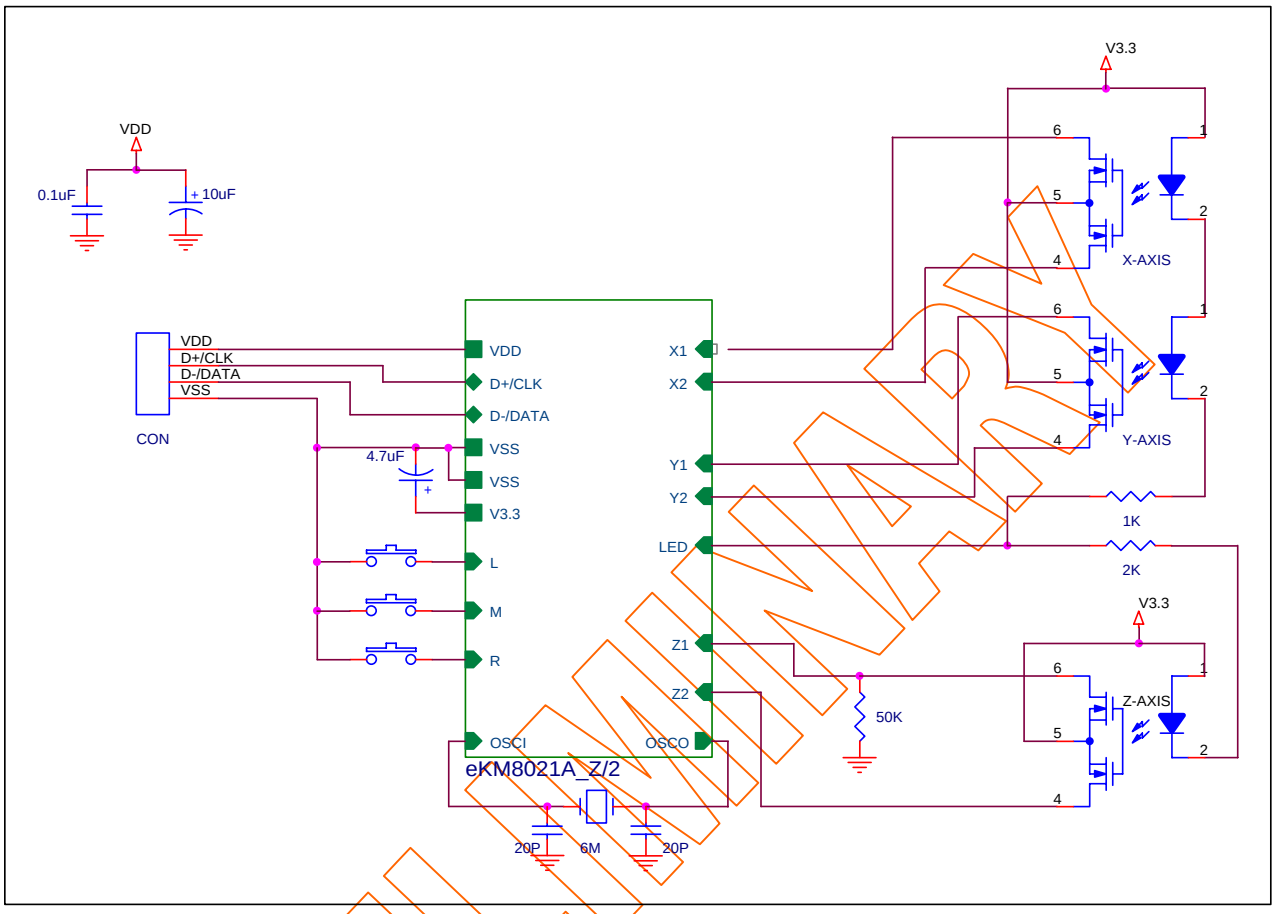


Fig 2. PS/2 input data timings

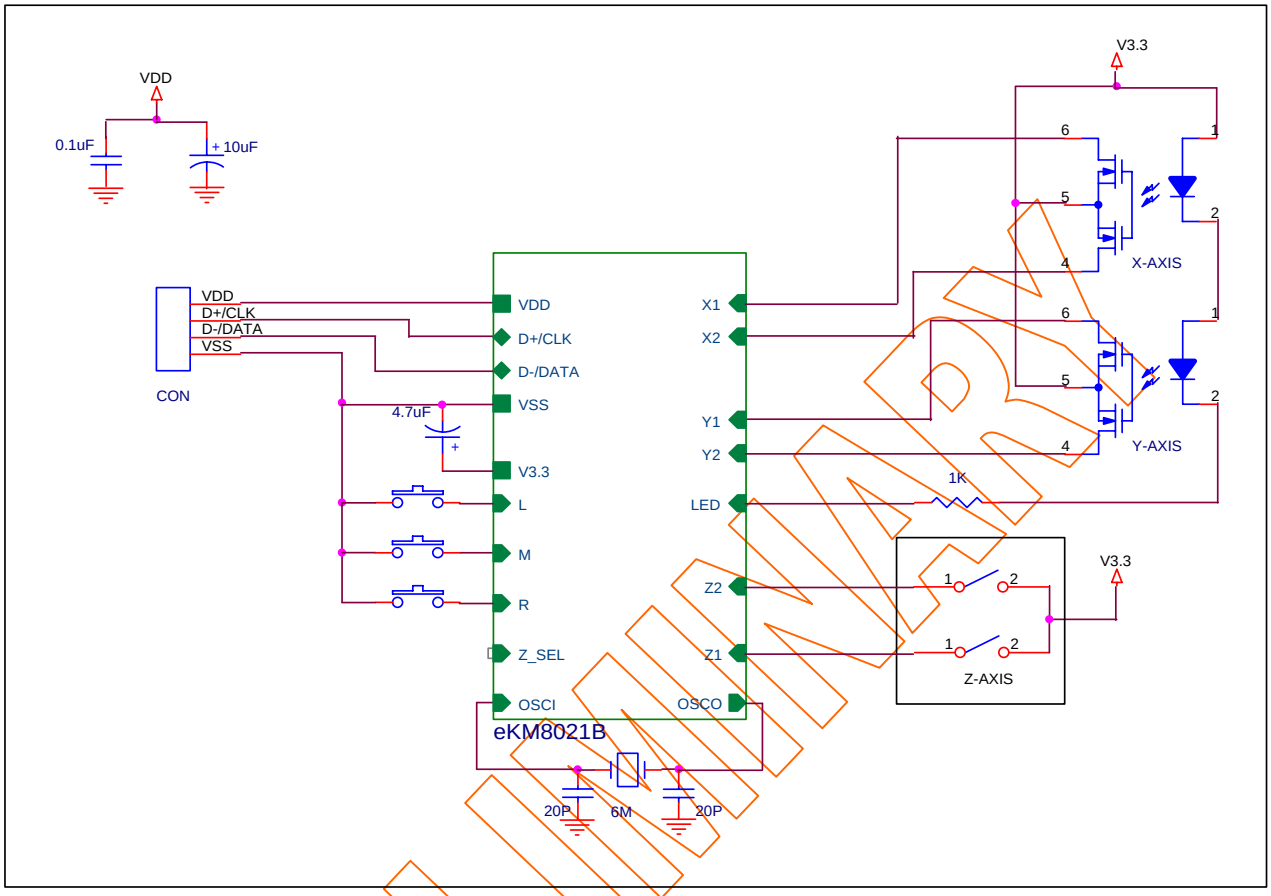
11. APPLICATION CIRCUIT



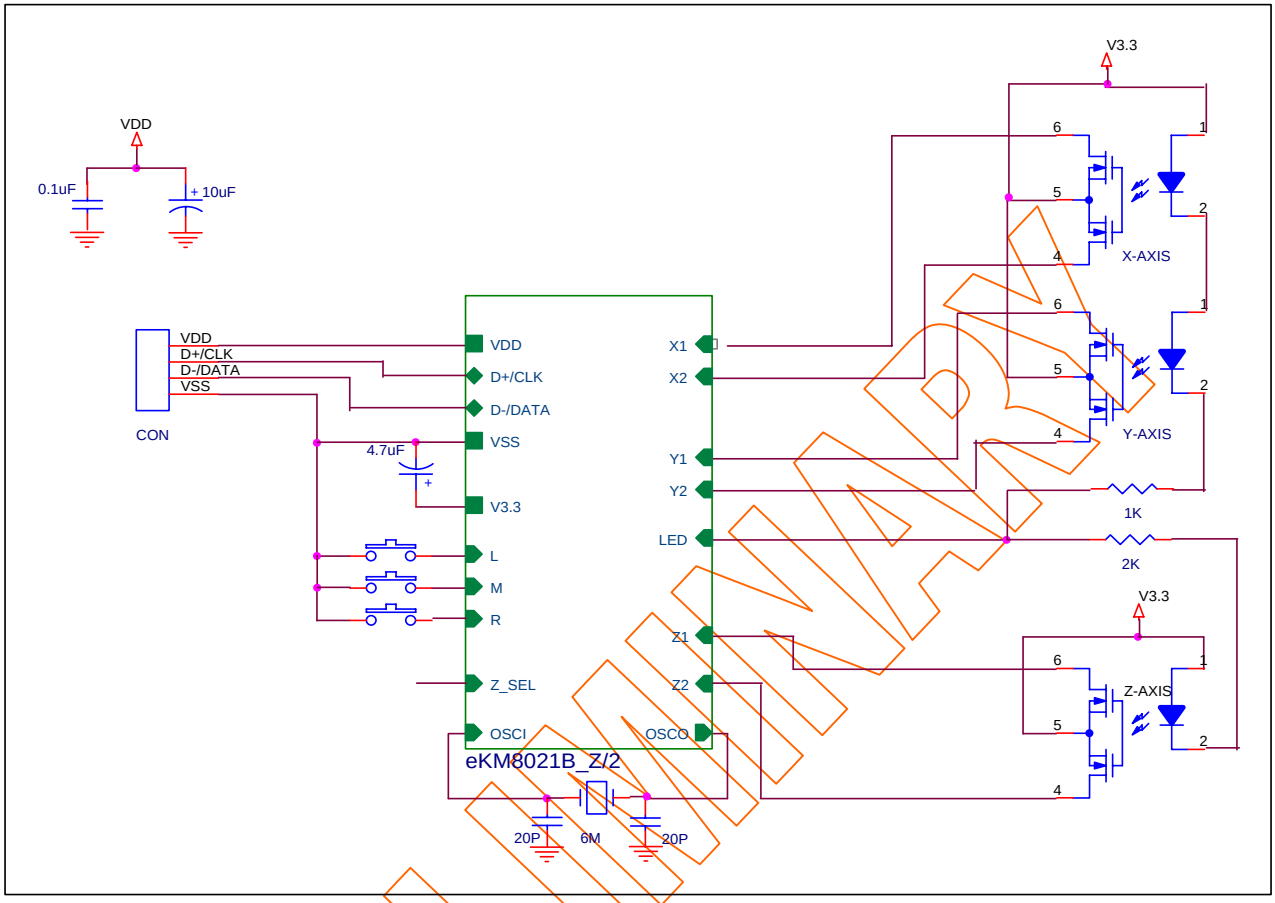
eKM8021A_Mechanical_Z/2 Application



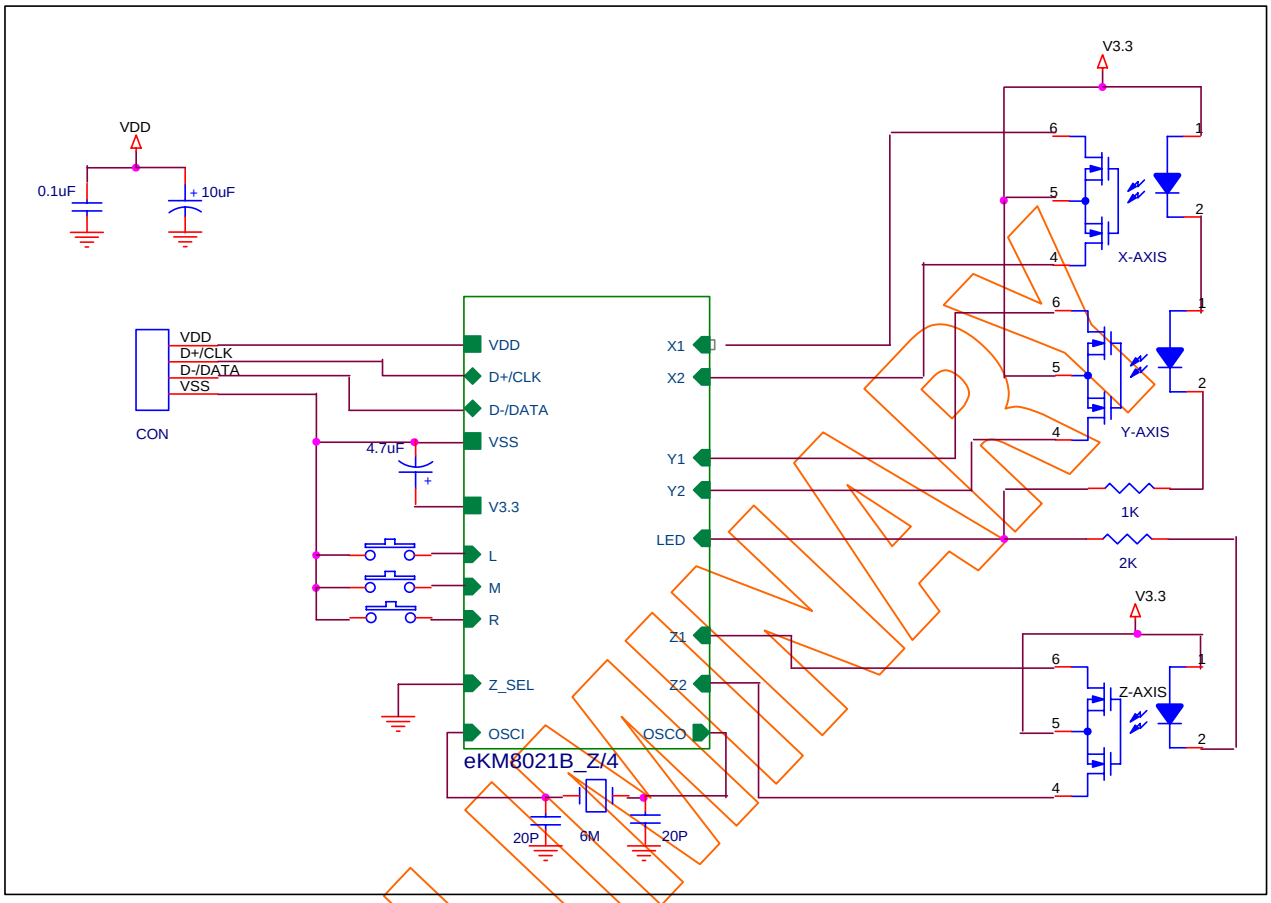
eKM8021A_Photo_Z/2 Application



eKM8021B_Mechanical_Z/2 Application



eKM8021B_Photo_Z/2 Application



eKM8021B_Photo_Z/4 Application

Printed in Taiwan, ROC, 09/2002

ELAN MICROELECTRONICS CORPORATION

Headquarters:
No. 12, Innovation Road 1,
Science-based Industrial Park,
Hsinchu, Taiwan, R.O.C.
Tel: +886 3 5639977
Fax:+886 3 5639966
http://www.emc.com.tw

Hong Kong Office:
Rm. 1005B, 10/F Empire Centre
68 Mody Road, Tsimshatsui
Kowloon , HONG KONG
Tel: +852 2838-8715
Fax: +852 2838-0497