

## 1. General Description

The eKM8050 is a Mouse Controller designed to control both USB & PS/2 Optical Mouse device. This Mouse Controller can auto detect USB or PS/2 mode, and supports X,Y,Z three axes , and L, R, M 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(eKM8050B) Z-axis input type.
- Support Agilent HDNS-2051 & 2610 & 2620 Optical Mouse Sensor.
- Applications
  - 3D, 3 Buttons USB and PS/2 Combo Mouse.

## 3. Pin assignment

CPIS	1 ●	18	Z1
L KEY	2	17	Z2
R KEY	3	16	IR_C
M KEY	4	15	PD
SCLK	5	14	SDIO
VSS	6	13	D+/CLK
VSS	7	12	D-/Data
V3.3	8	11	VDD
OSCI	9	10	OSCO

**eKM8050A (18-Pin)**

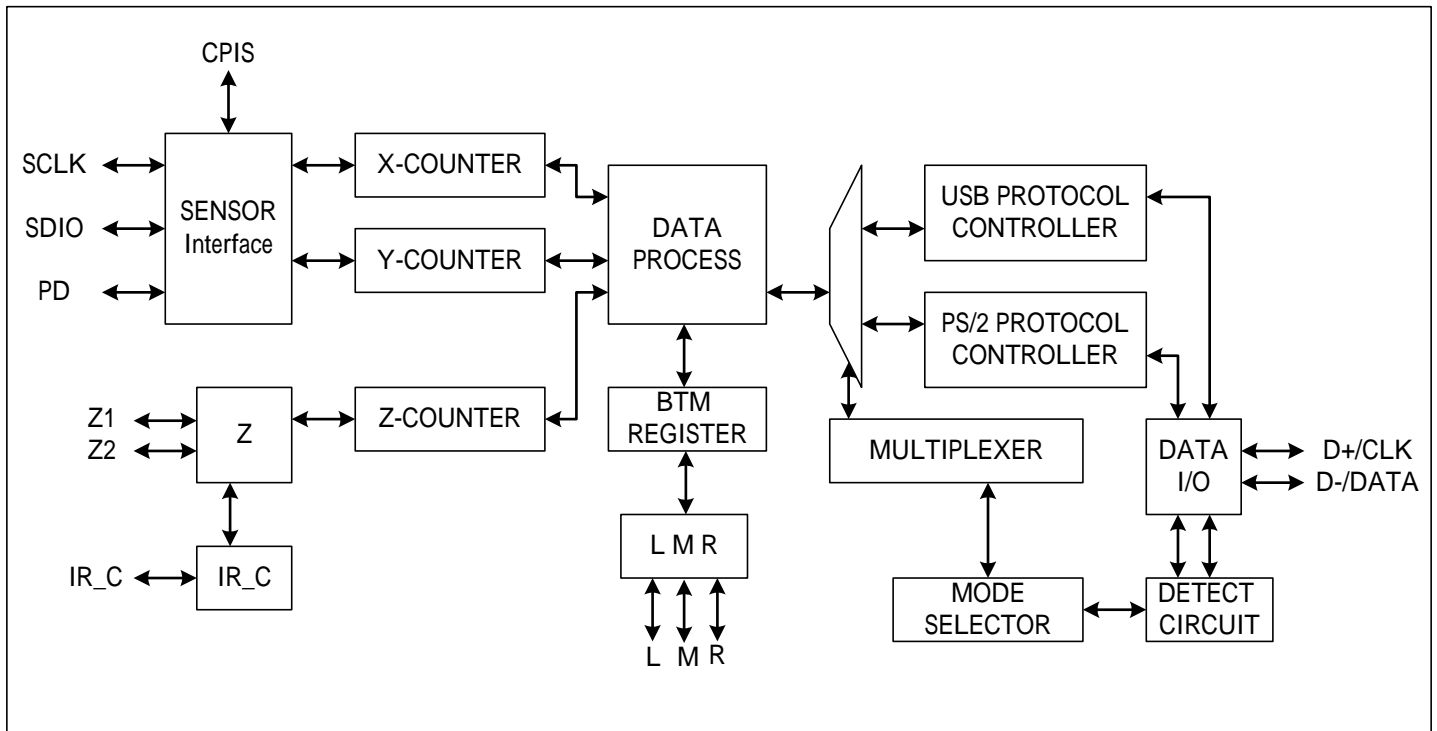


CPIS	1 ●	18	Z1
L KEY	2	17	Z2
R KEY	3	16	IR_C
M KEY	4	15	PD
SCLK	5	14	SDIO
Z_SEL	6	13	D+/CLK
VSS	7	12	D-/Data
V3.3	8	11	VDD
OSCI	9	10	OSCO

**eKM8050B (18-Pin)**

Symbol	I/O	PIN	Function
OSCI	I	9	6MHz ceramic resonator input.
OSCO	I/O	10	Return path for 6-MHz ceramic resonator.
V <sub>3.3V</sub>	O	8	3.3V DC voltage output from internal regulator. This pin has to be tied to a 4.7 μ F capacitor.
Z1	I	18	Z axis Input 1
Z2	I	17	Z axis Input 2
IR_C	I/O	16	IR Control Pin
PD	I	15	2051 Power Down Pin
CPIS	I	1	400/800 CPI Selection Pin ; 1 : 800 CPI ; 0 : 400 CPI
R	I	3	Right Key Input
M	I	4	Middle Key Input
L	I	2	Left Key Input
SCLK	I/O	5	Serial Clock to Agilent sensor IC SCLK
SDIO	I/O	14	Serial Data from Agilent sensor IC SDIO
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
V <sub>DD</sub>	-	11	5 V Power Input
V <sub>SS</sub>	-	6,7	GND
Z_SEL	I	6	Z/2 : Ground ; Z/4: Floating This function only support by eKM8050B

## 4. Function description


**Fig-1 : Function block**

### PS/2 function description

#### PS/2 Mouse Commands Description

Hex Code	Command	eKM8050 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 eKM8050 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 button 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
2	7	Y data overflow; 1 = overflow
	0-7	X data (D0-D7)
	0-7	Y data (D0-D7)
3	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  $\pm 7$

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.



**USB 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	02	01	00	00	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	03	15	00	25	01
	95	03	75	01	81	02	95	01
	75	05	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

## 5. Absolute Maximum Rating

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

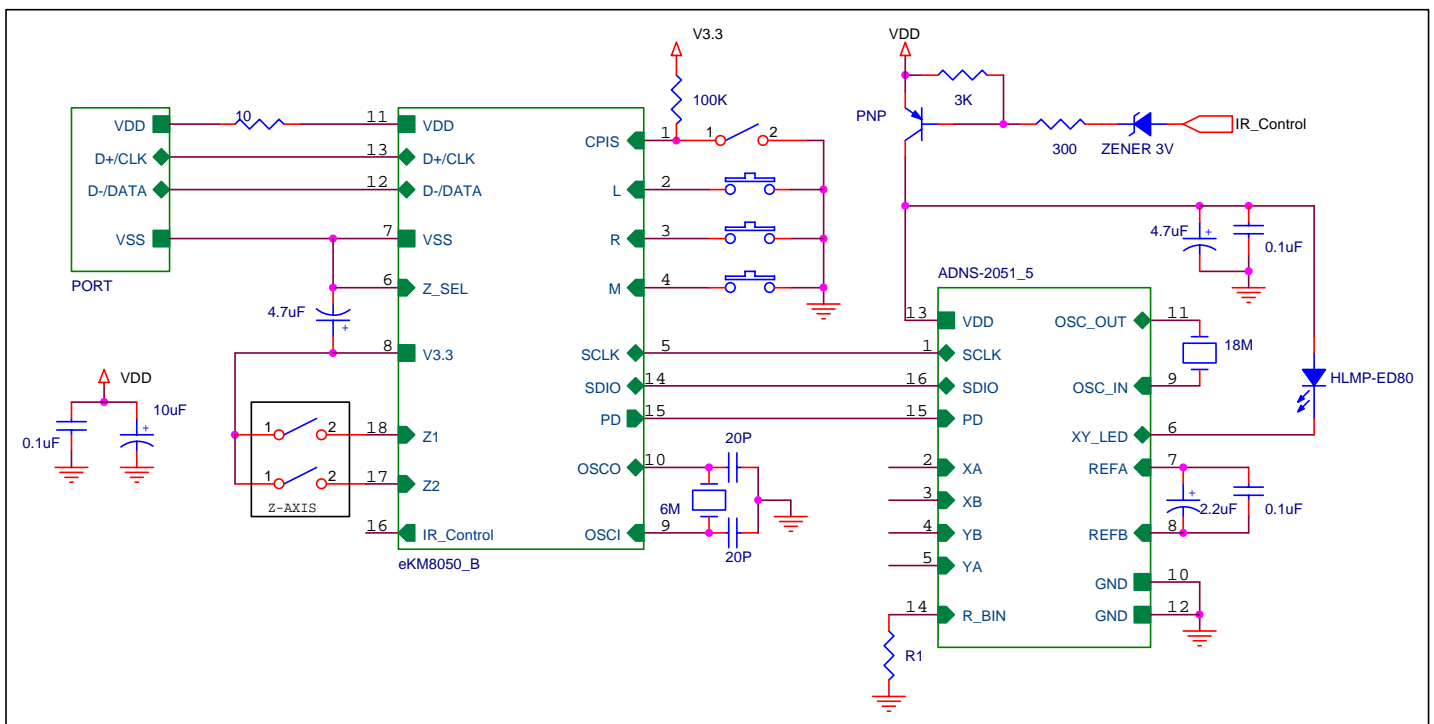
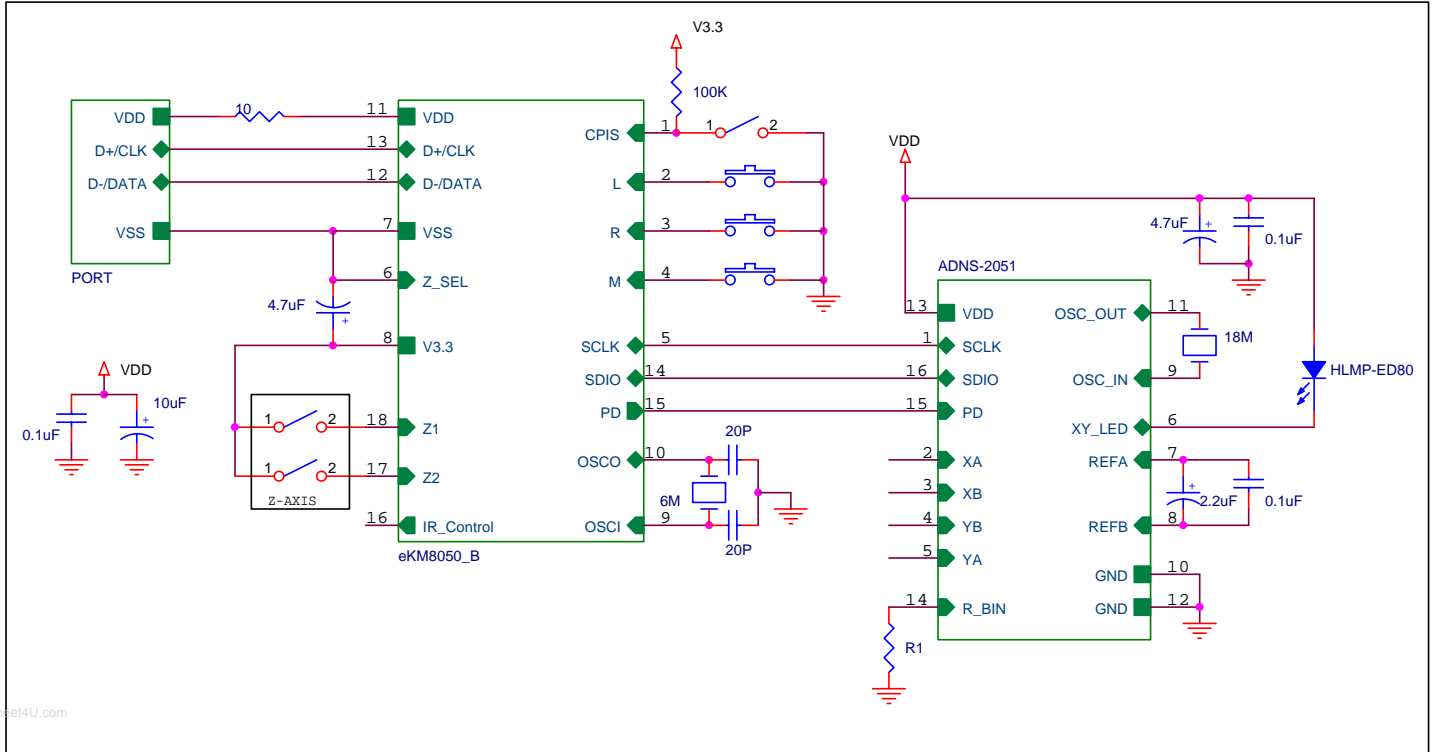
## 6. Electrical Characteristic

(T = 25°C, V<sub>DD</sub>=4.4~5.2V, V<sub>SS</sub>=0V)

Symbol	Parameter	Condition	Min	Type	Max	Unit
<b>3.3V Regulator</b>						
V <sub>Rag</sub>	Output voltage of 3.3v Regulator	V <sub>DD</sub> = 4.2V ~ 5.2V	3.0	3.3	3.6	V
V <sub>ResetL</sub>	Low Power Reset detecting low Voltage			-	2.3	V
V <sub>ResetH</sub>	Low Power Reset detecting high Voltage		2.4	-		V
<b>MCU operating</b>						
I <sub>IL</sub>	Input Leakage Current for input pins	V <sub>IN</sub> =V <sub>DD</sub> ,V <sub>SS</sub>	-	-	1	μA
V <sub>IHX</sub>	Clock Input High Voltage	OSCI	2.5	-	-	V
V <sub>ILX</sub>	Clock Input Low Voltage	OSCI	-	-	1.0	V
<b>GPIO Pins</b>						
V <sub>HL</sub>	High/Low level transfer point	Input		1.1	-	V
V <sub>OH</sub>	Output High Voltage	I <sub>Drive</sub> = 5.0mA	2.4	-	-	V
V <sub>OL</sub>	Output Low Voltage	I <sub>Sink</sub> = 5.0mA	-	-	0.4	V
I <sub>PH</sub>	Input current with pull-high resistor	The input pin with internal pull-high resistor of Port6 or port7 is connected to V <sub>SS</sub> .	-	25	-	μA
I <sub>PL</sub>	Input current with pull-low resistor	The input pin with internal pull-low resistor of Port6 is connected to V <sub>DD</sub> .	-	330	-	μA
<b>USB Interface</b>						
V <sub>OH</sub>	Static Output High	USB operation Mode	2.8	-	3.6	V
V <sub>OL</sub>	Static Output Low		-	-	0.3	V
V <sub>DI</sub>	Differential Input Sensitivity		0.2	-	-	V
V <sub>CM</sub>	Differential Input Command Mode Range		0.8	-	2.5	V
V <sub>SE</sub>	Single Ended Receiver Threshold	USB operation Mode	0.8	-	2.0	V
C <sub>IN</sub>	Transceiver Capacitance		-	-	20	pF
V <sub>RG</sub>	Output Voltage of Internal Regulator		3.0	-	3.6	V
R <sub>PH</sub>	Internal Pull-high Resistor (USB Spec 5%)		-20%	1.5	+20%	k

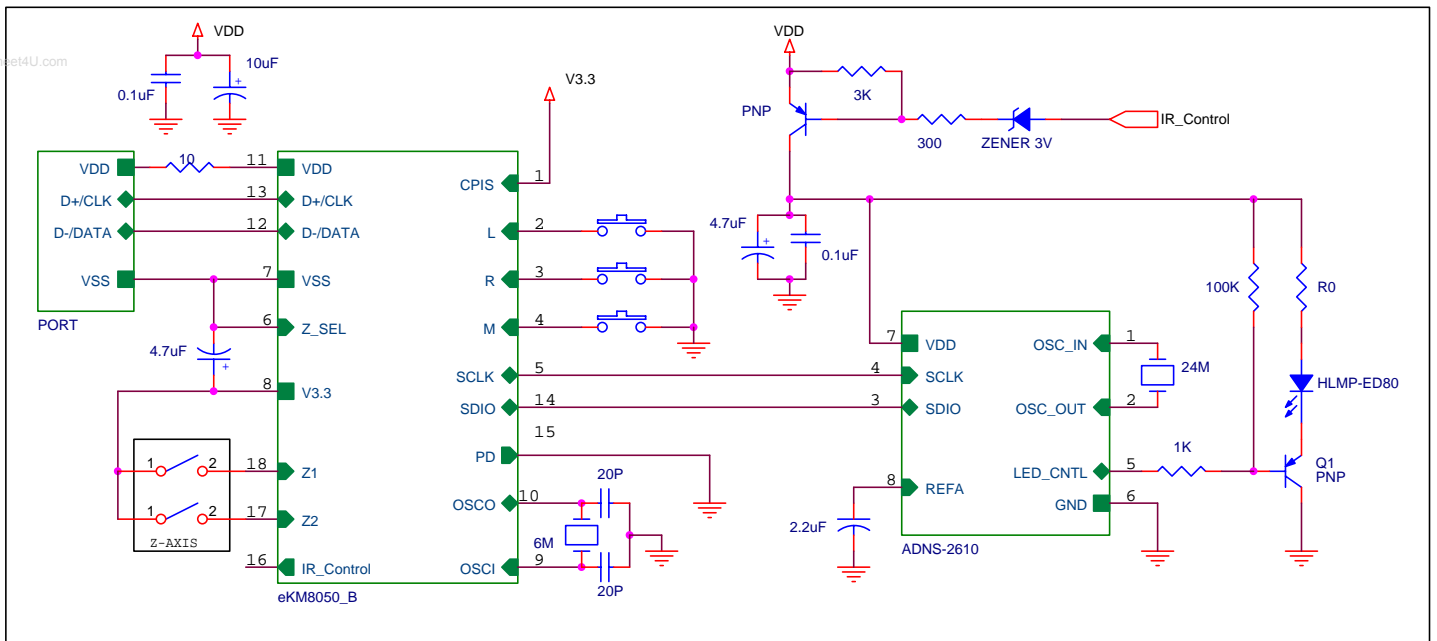
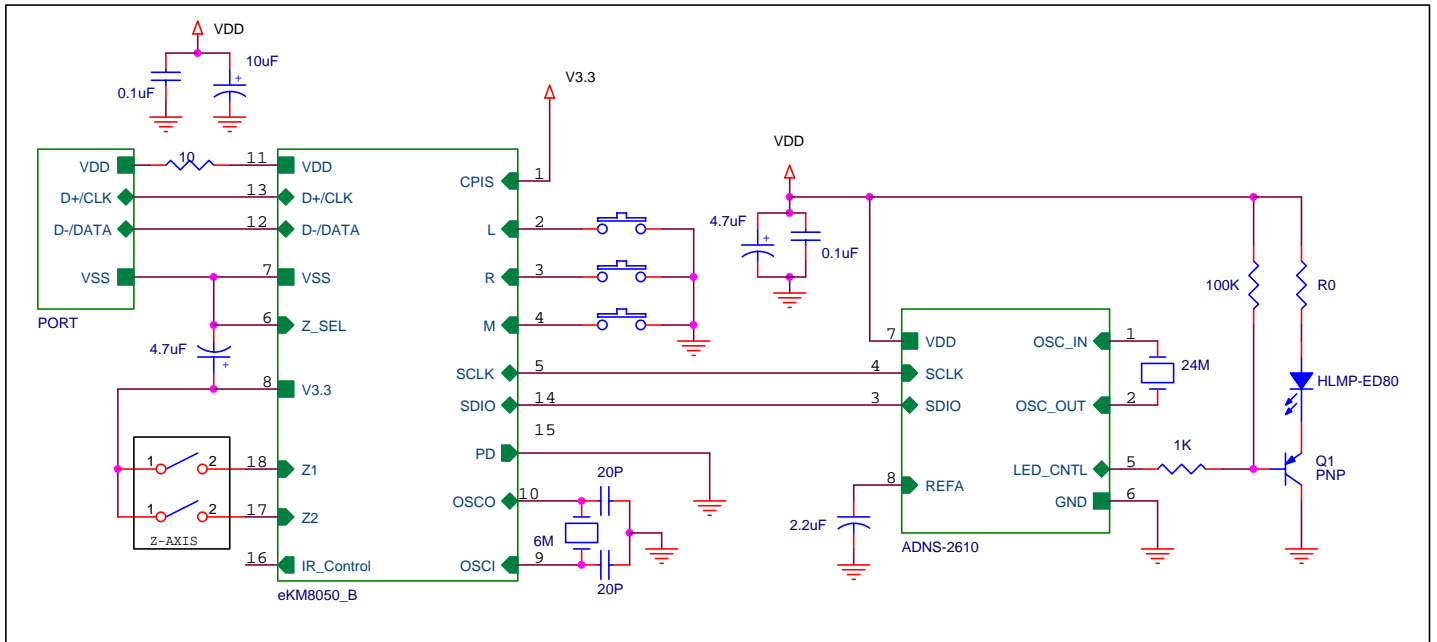
# 7. Application circuit

eKM8050 for ADNS-2051



Guarantee Suspend Current under 500 uA

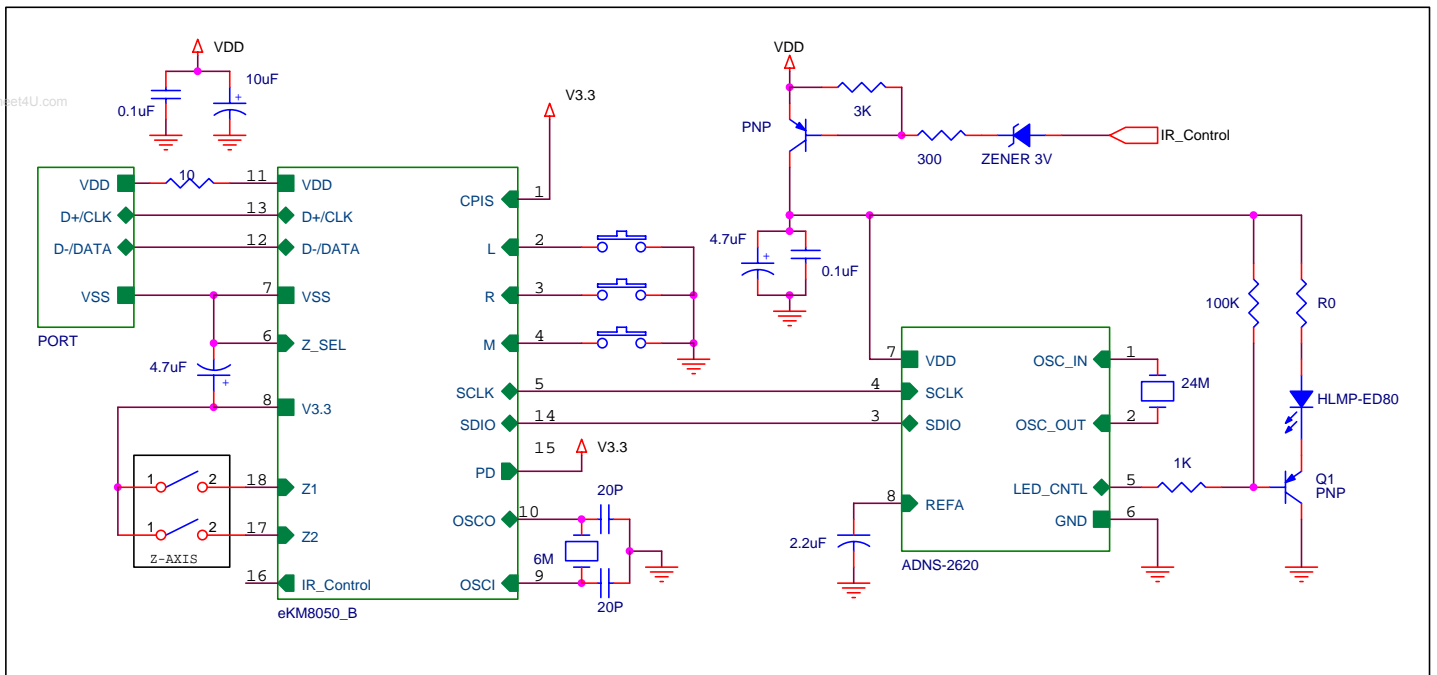
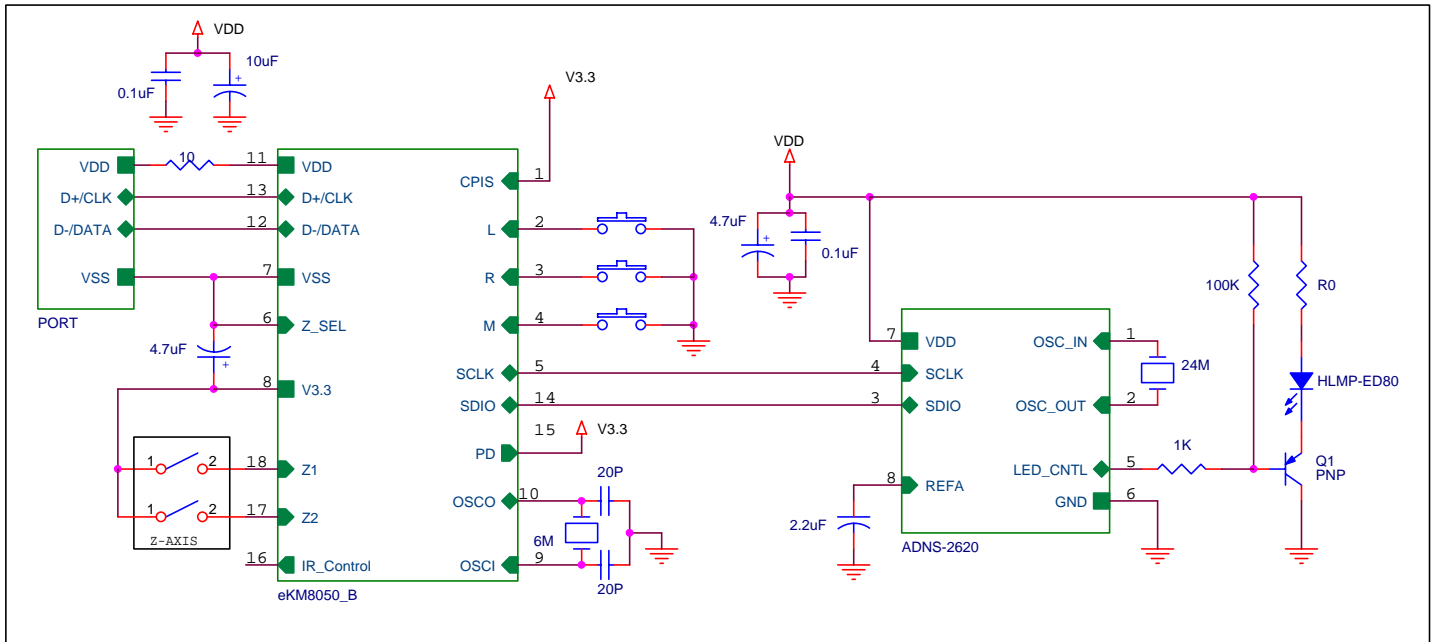
eKM8050 for ADNS-2610



Guarantee Suspend Current under 500 uA



eKM8050 for ADNS-2620



Guarantee Suspend Current under 500 uA