OK301

USB

鍵盤加密控制器

規 格 書

Version 1.1

November 8, 2012

奧樂科技股份有限公司
oTHE Technology Inc.

版 本 更 新 記 錄		
版 本	日 期	說 明
1.0	May 2, 2012	初版。
1.1	November 8, 2012	修改第 10 章應用電路。

章節 內 容 頁數

1. 簡介

OK301 是一個用在標準 USB 鍵盤的加密控制器。其內部包含 USB 鍵盤掃描控制器，及經美國 NIST FIPS 認證的 AES 加密引擎，透過 OK301 組合成的 USB 鍵盤與軟體端的加密整合技術，可以主動防治網路駭客或鍵盤側錄軟體等的惡意盜取個人資訊，解決使用者在上網時的疑慮，及被側錄的情況發生。

OK301 內含奧樂科技自行研發的 8-Bit RISC CPU、加密運算器及 8K Bytes Flash，它提供 USB V2.0 的介面與 V1.1 的通訊協定，同時整合了傳統的鍵盤掃描電路、自動偵測電路及鬼鍵消除電路，更可以接受同一時間按下 12 個鍵，解決傳統 USB 鍵盤無法同一時間按下超過 6 個鍵的限制。OK301 特殊的電源管理機制，讓 USB 鍵盤運作的功耗降到最低，不僅可用于傳統桌上型電腦鍵盤，也適用於筆記本電腦鍵盤。

OK301 採用標準的 LQFP-48Pin 封裝，針對駭客及鍵盤側錄軟體等惡意盜取個人資訊的情況，OK301 是一個同時可以做到低成本、高安全性與實用性的 USB 加密鍵盤保護方案。

2. 功能

- 單指令 RISC 架構 (TSIR) 的 8-Bit MCU
- 內建 256 Bytes SRAM 與 8KB Flash
- USB 2.0 介面 low speed 及 V1.1 協定
- 支援兩組 SPI 介面
- 支援 8 x 18 鍵盤掃描矩陣
- 內建自動鍵盤掃描偵測及鬼鍵消除電路
- 支持同一時間按下 12 個鍵
- 鍵盤掃描偵測無 Buffer 限制
- 內建 AES 加密引擎 (US NIST FIPS 認證#1576)
- 支援 Windows 98/ 2000/ NT/ XP/ Vista/ 7
- 支援多媒體及特殊編碼鍵盤
- 內建提升電阻
- 支援碳膜鍵盤
- 內建電源管理及看門狗電路
- 內建低功耗振盪器
- 內建 3.3V 電壓調整器
- 工作電壓: 4.5~5.5V
- 封裝: LQFP-48 pin

3. 內部方塊圖

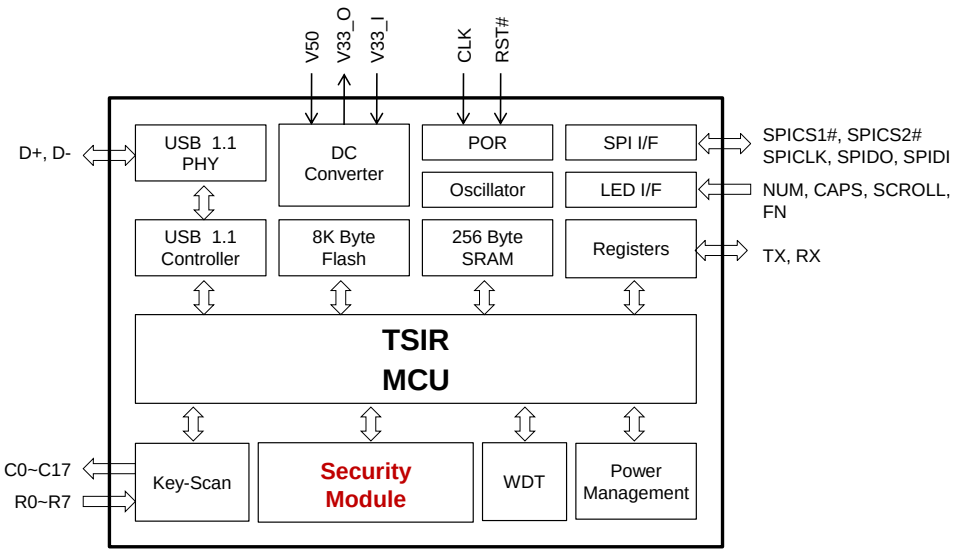

圖 3-1: OK301 內部方塊圖

4. 腳點陣圖

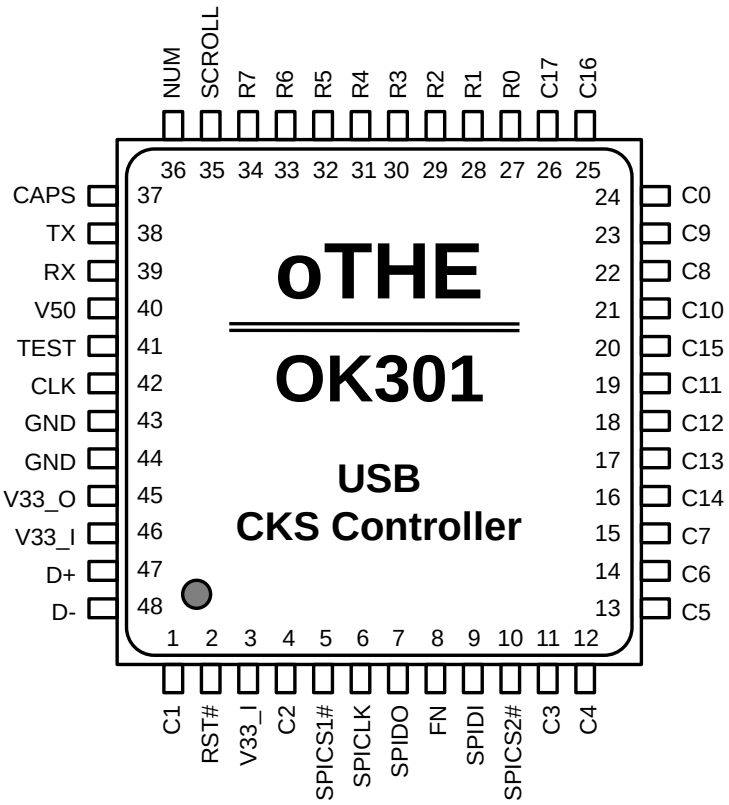

圖 4-1: OK301-LQ48 (LQFP-48pin)

5. 產品編號

表5-1: 產品編號

產品編號	封裝規格
OK301-LQ48	LQFP-48pin

6. 腳位定義

表6-1: 腳位定義

腳位名稱	I/O	說　明
R0~R7	I	Keyboard Scan Input
C0~C17	O	Keyboard Scan Output
SPICS1#	O	SPI Master Chip Select 1
SPICS2#	O	SPI Master Chip Select 2
SPICLK	O	SPI Master Clock Output
SPIDO	O	SPI Master Data Output
SPIDI	I	SPI Master Data Input
SCROLL	O	Scroll lock LED
NUM	O	Num Lock LED
CAPS	O	Caps Lock LED
FN	O	Fn Lock LED
TX	O	UART TX
RX	I	UART RX
D+	I/O	USB PHY I/F D+
D-	I/O	USB PHY I/F D-
CLK	I	External CLK (optional)
RST#	I	External Reset (optional)
TEST	I/O	Test Pin
V50	PWR	5V Power from USB Connector
V33_O	PWR	3.3V Regulator Output
V33_I	PWR	3.3V Regulator Input (2.0V~3.3V)
GND	PWR	Power Ground

7. 功能說明

7-1 鍵盤矩陣

表 7-1: 鍵盤矩陣對照表

	R0	R1	R2	R3	R4	R5	R6	R7
C0	Pause	Power	€	Sleep	Ctrl-R	Wake-up	Ctrl-L	F5
C1	Q	Tab	A	ESC	Z	N-CHG	` (~)	1 (!)
C2	W	CAP	S	K45	X	CHG	F1	2 (@)
C3	E	F3	D	F4	C	ROMA	F2	3 (#)
C4	R	T	F	G	V	B	5 (%)	4 ($)
C5	U	Y	J	H	M	N	6 (^)	7 (&)
C6	I	] (})	K	F6	, (<)	K56	= (+)	8 (*)
C7	O	F7	L	¥	. (>)	APP	F8	9 (‘(‘)
C8	P	[({)	; (:)	‘ (“)	K42	/ (?)	_ (-)	0 (‘)’)
C9	Scroll		Fn	Alt-L	M/Mode	Alt-R		Print Scr
C10	K14	Back	\ (|)	F11	Enter-L	F12	F9	F10
C11	7 (Home)	4 (←)	1 (End)	Space	Num	↓	Del	Power
C12	8 (↑)	5	2 (↓)	0 (Ins)	/	→	Ins	Sleep
C13	9 (PgUp)	6 (→)	3 (PgDn)	. (Del)	*	-	Page Up	Page Dn
C14	+	K107	Enter-R	↑	Paly/Pause	←	Home	End
C15	Wake Up	Shift-L	Shift-R	Volume -	Volume +	NextTrack	PrevTrack	Media
C16	Mail	Win-L	WWW Forward	WWW Stop	WWW Back	WWW Refresh	Mute	WWW Search
C17	KC-L	WWW Favorites	Win-R	My Computer	Stop	Caculator	Web/Home	KC-R

8. 電氣特性

8-1 最大極限

表8-1:最大極限值

說　明	符 號	數 值	單 位
Supply Voltage on V50 Relative to GND	V_{DD}	-0.5V~+6.5V	V
Supply Voltage on V33_I Relative to GND	V_{33_I}	-0.5V~+4.0V	V
Input Voltage Range	V_{IN}	-0.3 to V_{DD}+0.3	V
Power Dissipation	P_D	≦300	mW
Operation Temperature Range	T_{OPR}	-0 to +70	℃
Storage Temperature	T_{ST}	-45 to +150	℃
Soldering Temperature (10 seconds, Note 2)	T_{SOLDER}	260	℃

Notes:

1. These are stress ratings only. Stresses exceeding the range specified under ”Absolute Maximum Ratings” may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

2. The humidity resistance of the flat package may be reduced if the package is immersed in solder. Use a soldering technique that does not heat stress the package.

3. All supply voltages are referenced to GND = 0V.

8-2 DC 特性

表8-2: DC特性

符 號	說 明	條 件	Min.	Typ.	Max.	單 位
V_{50}	Supply Power	USB 5V	4.5	5	5.5	V
V_{IH1}	R0~R7 Input High	Voltage Schmitt-trigger is built-in	1.9		VDD+0.3	V
V_{IL1}	R0~R7 Input Low	Voltage Schmitt-trigger is built-in	-0.3		1.6	V
V_{IH2}	Input High	Voltage Schmitt-trigger is built-in	2.4		VDD+0.3	V
V_{IL2}	Input Low	Voltage Schmitt-trigger is built-in	-0.3		1.7	V
V_{OH}	Output High	Voltage I_{OH} = -2mA		V33_I - 0.3		V
V_{OL}	Output Low	Voltage I_{OL} = 2mA		0		V
I_{DS}	Drive/Sink Current for LED	V_{OL} = 0.2V (R=220 ohm)		8		mA
I_{IN}	Input Leakage Current	V33_I = 3.3V	-1		1	μA
R_{P1}	Pull up Resistance		60	80	100	KΩ
R_{P2}	Pull up Resistance	For Carbon wire	1.5	1.8	2.1	MΩ
I_{OP1}	Chip Operating Current	USB connected, continuous key pressed		2		mA
I_{OP2}	Chip Operating Current	USB connected,		2		mA
I_{SB1}	Chip Standby Current	USB Connected. Int OSC disable		2		mA
I_{SB2}	Chip Standby Current	non-WDT standby		270		μA
V_{33_O}	3.3V Regulator Output	VDD= 5V, 30mA (100Ω load)	3	3.3	3.6	V
F_{OSC}	System Clock	V33_I=3.3V, USB connected.	-1.5%	1.5	+1.5%	MHz
PWR_OK			2	2.05	2.1	V
USB Interface						
V_{ON}	Static Output High	15K ± 5% Ohm to GND	2.8		3.6	V
V_{OFF}	Static Output Low	RUP is enabled			0.3	V
V_{DI}	Differential Input Sensitivity		0.2			V
V_{CM}	Differential Input Common Mode Range		0.8		2.5	V
V_{SE}	Single Ended Receiver Threshold		0.8		2	V
C_{IN}	Transceiver Capacitance				20	pF
I_{IO}	Hi-Z State Data Line Leakage	0V < V_{IN} < 3.3V	-10		10	mA

8-3 AC 特性

表8-3: AC特性

符 號	說 明	條 件	Min.	Typ.	Max.	單 位
USB Driver						
T_{R1}	Transition Rise Time	CLOAD = 200 pF	75			ns
T_{R2}	Transition Rise Time	CLOAD = 600 pF			300	ns
T_{F1}	Transition Fall Time	CLOAD = 200 pF	75			ns
T_{F2}	Transition Fall Time	CLOAD = 600 pF			300	ns
T_R	Rise/Fall Time Matching		80		125	%
V_{CRS}	Output Signal Crossover Voltage		1.3		2.0	V
USB Data Timing						
T_{DRATE}	Low-speed Data Rate	Ave. Bit Rate (1.5 Mbps ± 1.5%)	1.4775		1.5225	Mbps
T_{DJR1}	Receiver Data Jitter Tolerance	To next transition	-75		75	ns
T_{DJR2}	Receiver Data Jitter Tolerance	To pair transition	-45		45	ns
T_{DEOP}	Differential to EOP Transition Skew		-40		100	ns
T_{EOPR1}	EOP Width at Receiver	Rejects as EOP			330	ns
T_{EOPR2}	EOP Width at Receiver	Accept as EOP	675			ns
T_{EOPT}	Source EOP Width		1.25		1.5	μs
T_{EOPT}	Source EOP Width		1.25		1.5	μs
T_{UDJ1}	Differential Driver Jitter	To next transition	-95		95	ns
T_{UDJ2}	Differential Driver Jitter	To pair transition	-95		95	ns
T_{LST}	Width of SE0 during Diff. Transition				210	ns

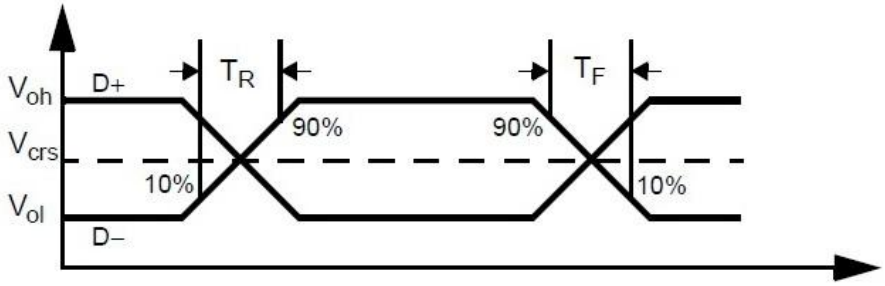

圖 8-1: USB Data Signal Timing

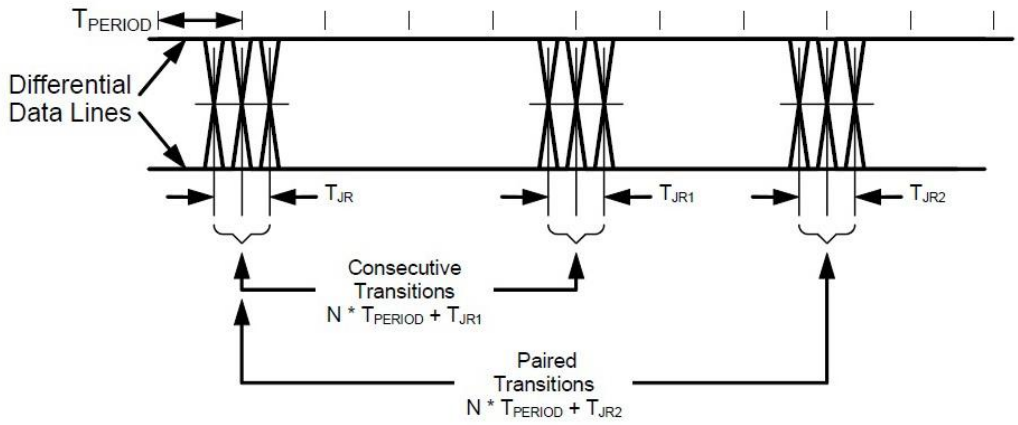

圖 8-2: Receiver Jitter Tolerance

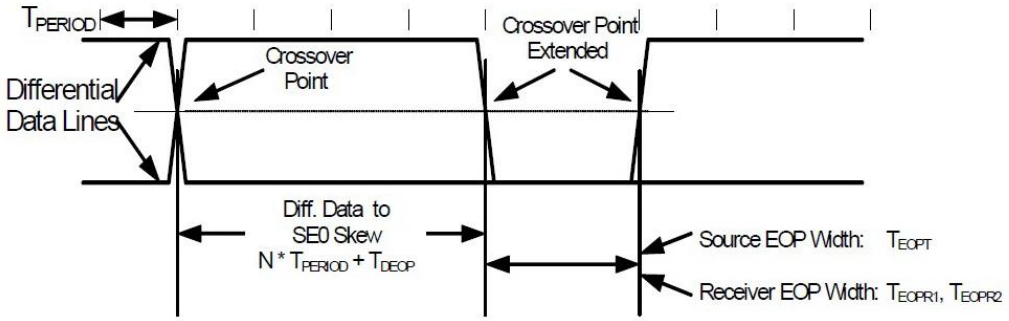

圖 8-3: Differential to EOP Transition Skew and EOP Width

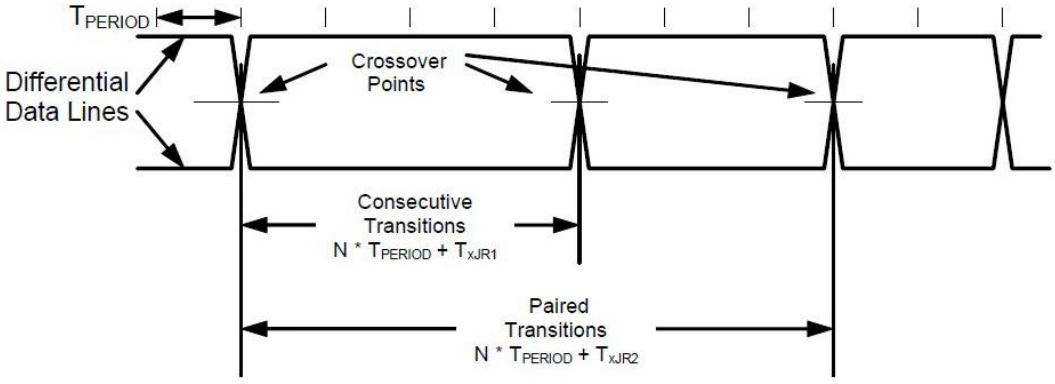

圖 8-4: Differential Data Jitter

9. 封裝

9-1 LQFP-48 Pin

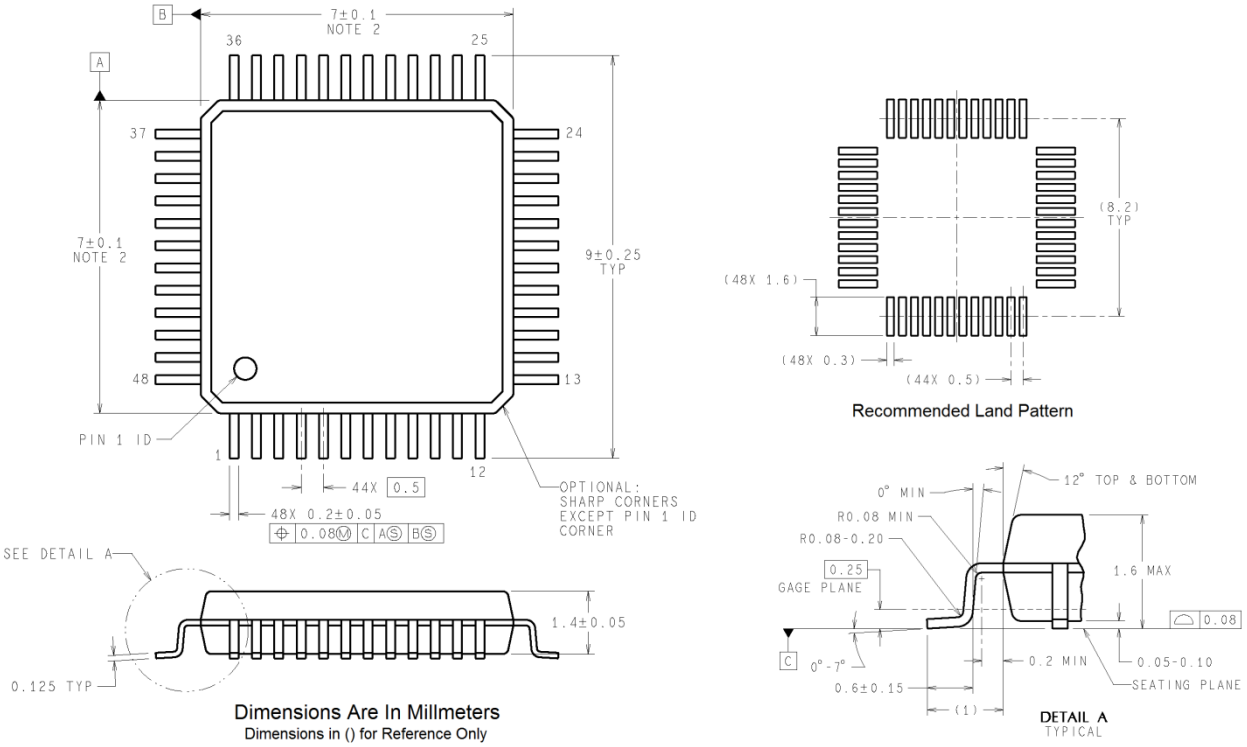

圖 9-1: LQFP-48 Pin 封裝尺寸

Notes:

1. Dimenision does not include mold protrusion. Maximum allowable mold protrusion is 0.25mm per-side.
2. Reference JEDEC registration MS-026, variation BBC.

10. 應用電路

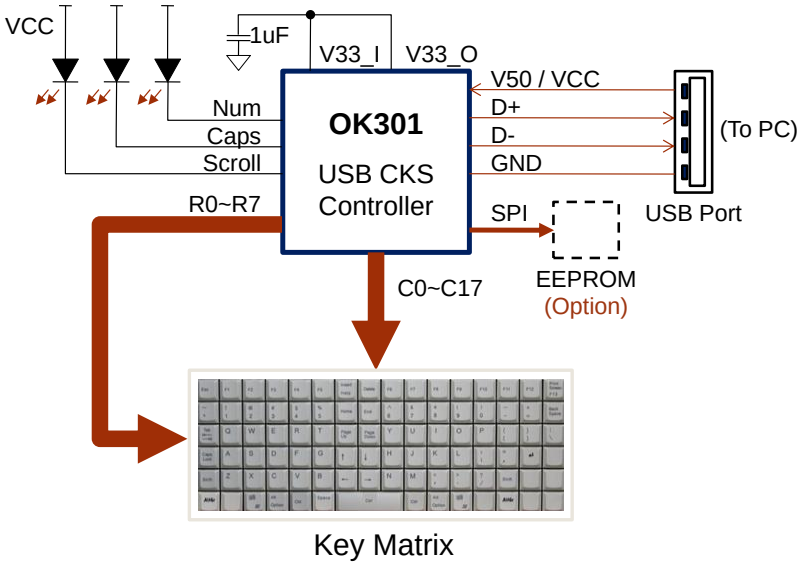

圖 10-1: 應用方塊圖

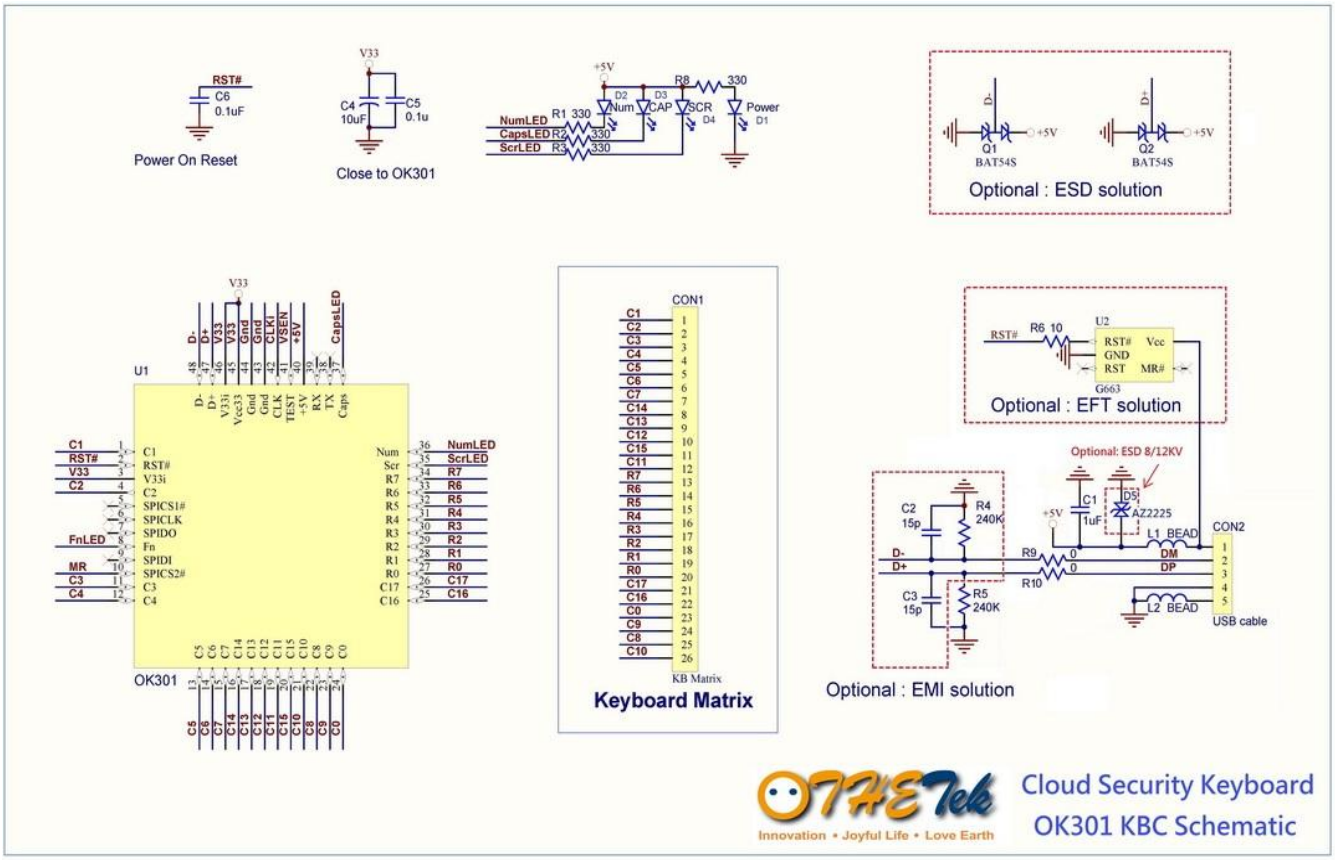

圖 10-2: USB 鍵盤應用電路

表 10-1: USB 鍵盤零件表

	Part Type	Footprint	Description	Q'ty	Designator				
1	0Ω	RES 0603	0Ω SMD Resistor 0603±5%	2	R9	R10			
2	330Ω	RES 0603	330Ω SMD Resistor 0603±5%	3	R1	R2	R3	R8	
3	240KΩ	RES 0603	240KΩ SMD Resistor 0603±5%	1	R5				
4	0.1uF	CAP NPO 0603	0.1uF Capacitor 0603 NPO 50V	2	C5	C6			
5	1uF	CAP NPO 0603	1uF Capacitor 0603 NPO 50V	1	C1				
6	10uF	CAP NPO 0805	10uF Capacitor 0805 NPO 50V	1	C4				
7	FB 300	FB 300 Ω	Ferrite Bead 300Ω @ 100MHz 0805	2	L1	L2			
8	LED		Power, Num, Cap, Scr	4	D1	D2	D3	D4	
9	OK301	LQFP 48L	OK301 CKS Chip LQFP48L	1	U1				
EMI Options									
10	15P	CAP NPO 0603	15pF Capacitor 0603 NPO 50V	2	C2	C3			
11	240K	RES 0603	240KΩ SMD Resistor 0603±5%	1	R4				
ESD Options									
12	BAT54S			2	Q1	Q2			
13	AZ2225		(for ESD 8/12KV)	1	D5				
EFT Options									
14	10Ω	RES 0603	10Ω SMD Resistor 0603±5%	1	R6				
15	G663	SOT-23-5	Reset chip	1	U2				

Note: C5, C6, R1 are for EFT options.

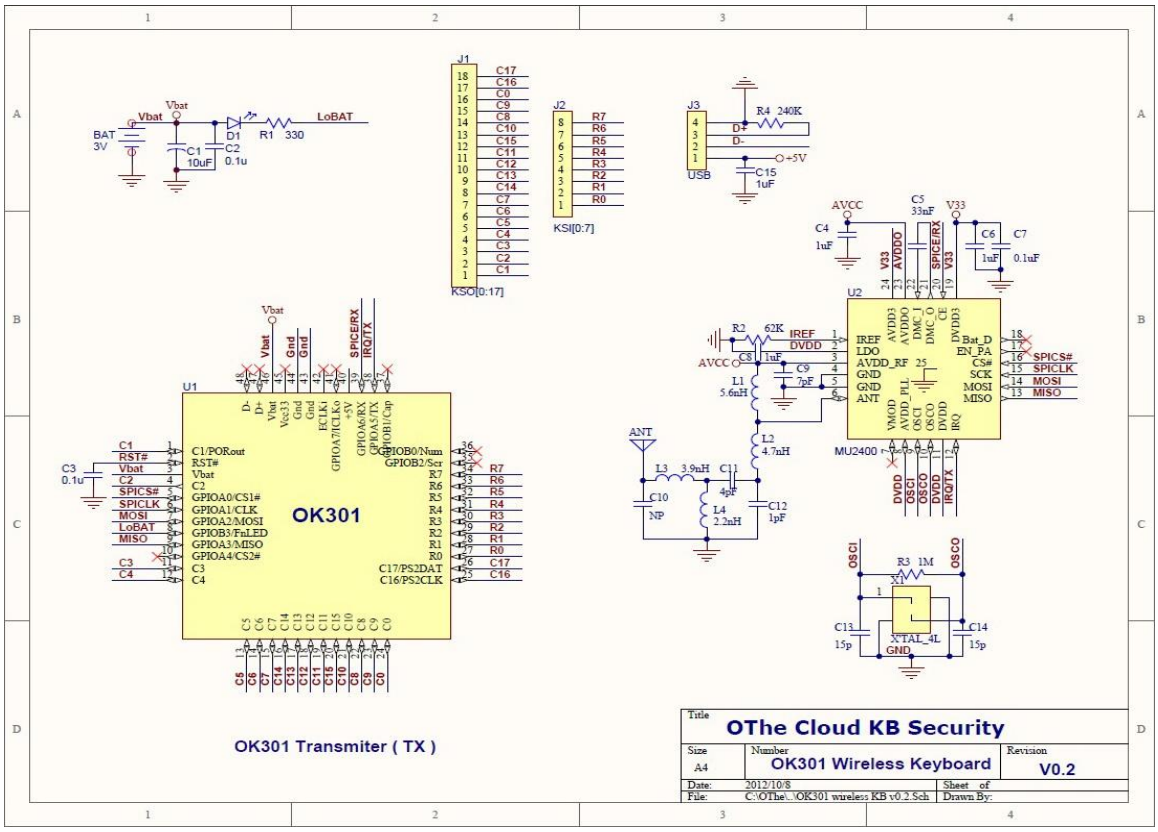

圖 10-3 : RF 鍵盤(發送端)應用電路

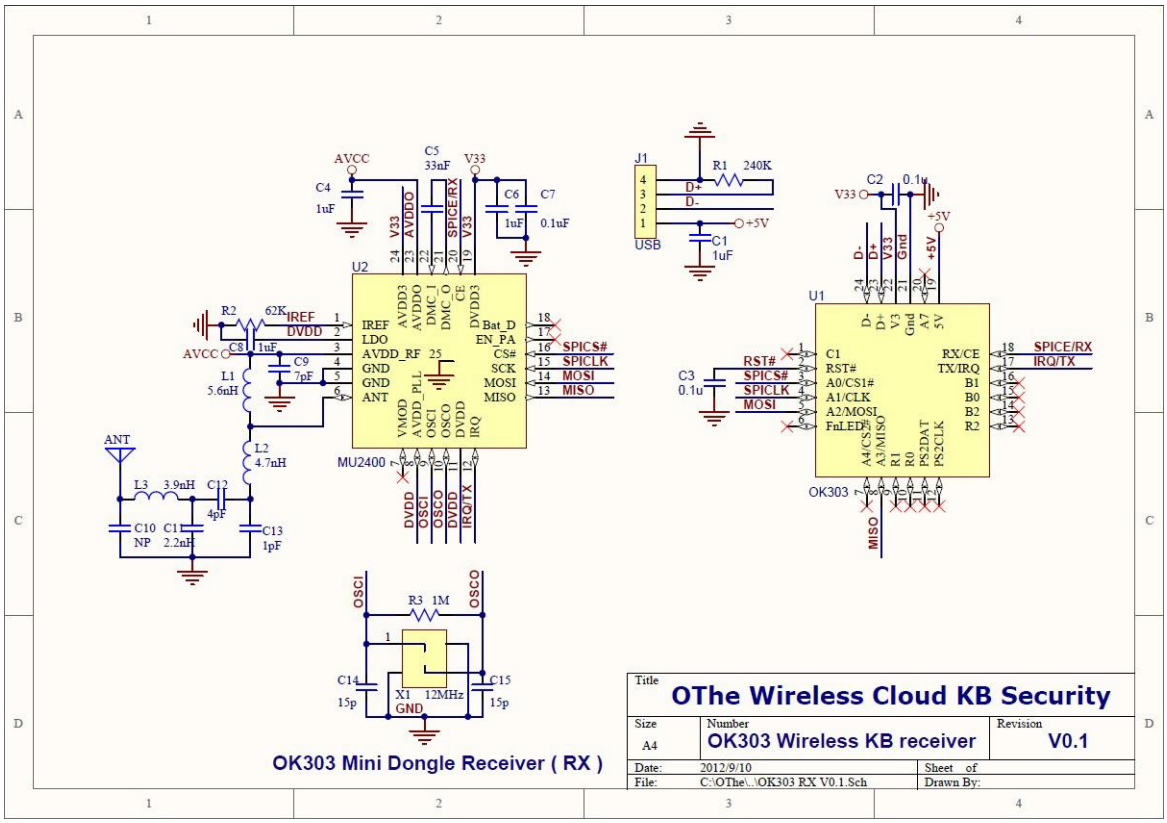

圖 10-4 : RF 鍵盤(接收端)應用電路

About oTHE

oTHE Technology Inc. was founded on August of 2008 located in Hsinchu City, Taiwan by over 15 years experienced RD and Marketing team from Hsinchu Science Park. oTHE team had successful experience and related background specialized in the field of PC related chips. oTHE is a leading and professional IC design company which decided to provide high quality, high performance and high value products and services. oTHE has extensive experience developing computer industry component, especially in PC keyboard controller, keyboard security, security information system and optics.

oTHE's symbol is the smile face, and the core meaning is joy employee provide well service to customer and then create profit to company, and next the profitable enterprise contribute source to society. Our Company slogan: Innovation, Joyful Life, Love Earth. For further information about oTHE, please contact us at http://www.othe.com.tw.

Innovation • Joyful Life • Love Earth

奧樂科技股份有限公司

OTHE TECHNOLOGY INC.

30076 新竹市科學園區新安路 5 號 4 樓
4F., No.5, Xin'an Rd., Science Park., Hsinchu City 30076, Taiwan
Tel: +886-666-8690
http://www.othe.com.tw