

USB 2.0 Flash Disk Controller

Description

The TS510 is a high-performance and low-cost USB 2.0 single-channel flash drive controller which offers high compatibility for 2D/3D NAND, high-speed Toggle and ONFI DDR NAND.

The TS510 delivers high data transfer rate, and ensures data accuracy and reliability with the powerful ECC engine and solve the read/write disturbances issue on new generation NAND.

Feature

- Complies with USB2.0 Specification.
- NAND Flash Support.
 - Support 8bit Flash.
 - Support 8KB/16KB page size.
 - Support 2D/3D MLC/TLC/QLC NAND Flash form Toshiba, SanDisk, Micron, Intel, Samsung and Hynix.
 - Support 3.3V/1.8V/1.2V NAND Flash.
 - Single channel interface support 4 NAND Flash devices.

- Support inter-leave
- Configurable BCH ECC engine with correction up to 91Bit/1KB.
- Supports data randomization and bad column management.
- Supports high-speed toggle DDR NAND and ONFI DDR NAND Flash.
- Integrated build-in Regulator & Crystal.
- Support boot from external EEPROM with I2C interface.
- Supports VID, PID, serial number, and vender information update.
- Integrated built-in Crystal.
- Support wear-leveling to extend device life.

Package

- SSOP24, Die Form.

Operation System

- Windows 10/8/7/XP.
- Mac OS 9.x or above.
- Linux kernel 2.4 or above.

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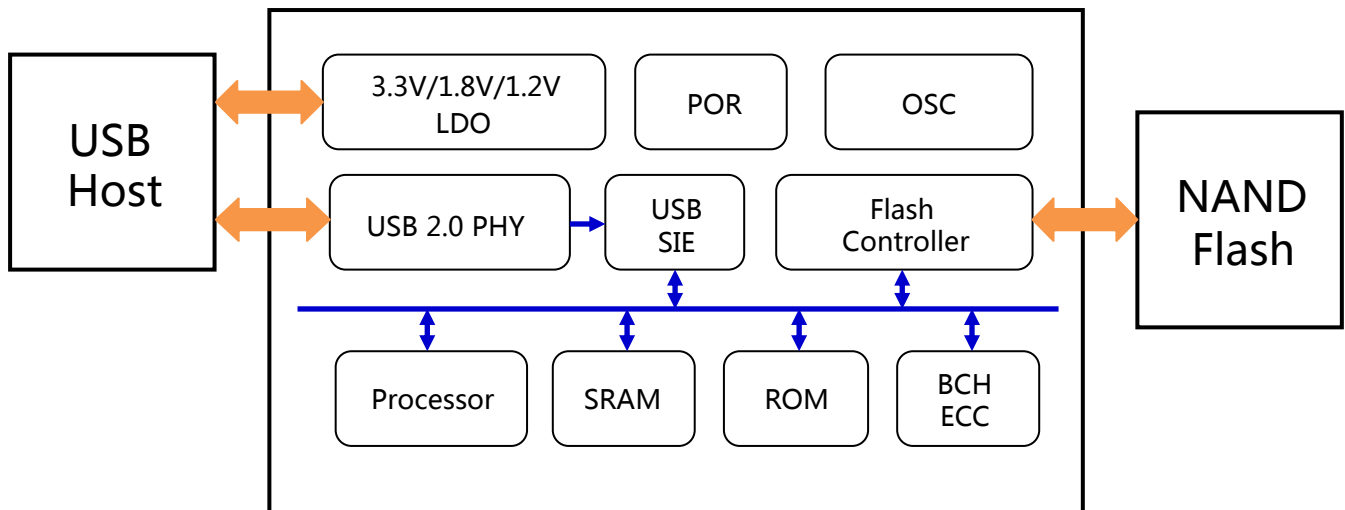
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更改纪录

版本	日期	更新信息
Rev 1.0	2022/1	初版

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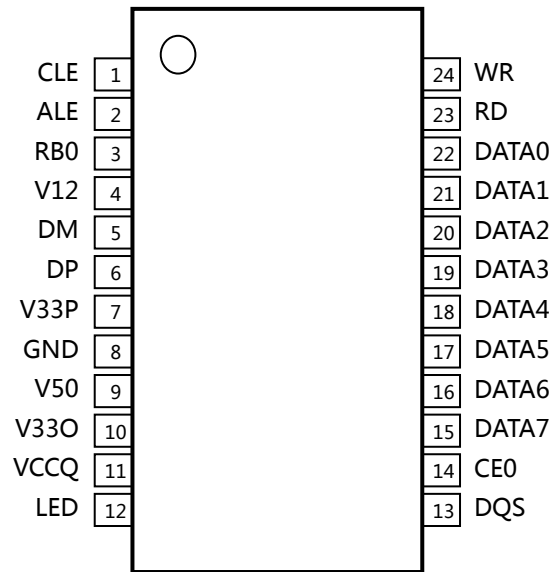
Function Block



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Pinout Diagram

SSOP24



Pin	Name	Type	Description
1	CLE	Output	Flash command latch enable.
2	ALE	Output	Flash Address latch enable.
3	RB0	Input	Flash ready/busy.
4	V12	PWR	1.2V input power.
5	DM	Input	USB DM.
6	DP	Input	USB DP.
7	V33P	PWR	3.3V power.
8	GND	GND	Ground.
9	V50	PWR	5V input power.
10	V33O	Output	3.3V output power.
11	VCCQ	Output	Flash IO power.
12	LED	Output	LED Indication.
13	DQS	I/O	Flash data strobe.
14	CE0	Output	Flash 0 select pin.

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15	DATA7	I/O	Flash data bus – bit 7.
16	DATA6	I/O	Flash data bus – bit 6.
17	DATA5	I/O	Flash data bus – bit 5.

Pin	Name	Type	Description
18	DATA4	I/O	Flash data bus – bit 4.
19	DATA3	I/O	Flash data bus – bit 3.
20	DATA2	I/O	Flash data bus – bit 2.
21	DATA1	I/O	Flash data bus – bit 1.
22	DATA0	I/O	Flash data bus – bit 0.
23	RD	Output	Flash read enable.
24	WR	Output	Flash write enable.

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Electrical Characteristics

Parameter	Symbols	Min.	Nom.	Max.	UNIT
Recommended Operating Conditions					
5.0V input voltage	V50	4.5	5.0	5.5	V
3.3V input voltage	V33P	3.0	3.3	3.6	V
1.2V input voltage	V12	1.08	1.2	1.32	V
Operating temperature range	T _{OP}	0		70	°C
I _{DD} @ Operating	I _{OP}		40		mA
I _{DD} @ Suspend-Mode	I _{SUSP}		1.5		mA

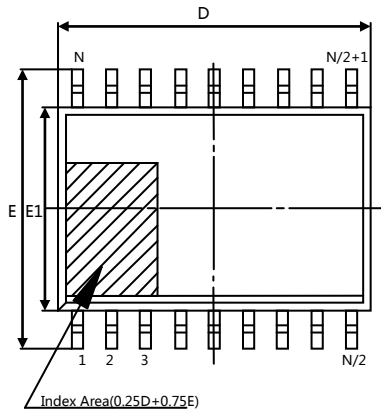
Absolute Maximum Ratings

Parameter	Range
Power supply	-0.5V to 5.5V
DC input voltage for digital I/O	-0.5V to 3.6V
DC input voltage for USB DP/Dm	-0.5V to 3.6V
Storage Temperature	-40°C to 150°C
Operation Temperature	0°C to 85°C

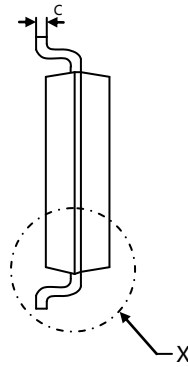
Note: Stress above conditions may cause permanent damage to the device. Functional operation of this device should be restricted to the conditions described.

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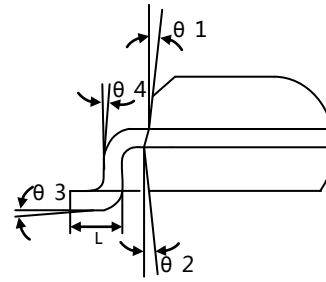
Package (SSOP24)



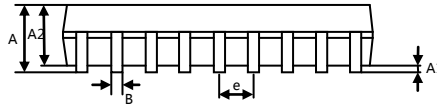
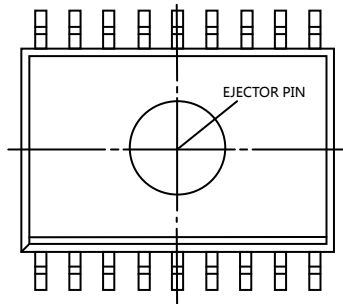
TOP View



Side View



Detail "X"



Symbol	MIN	MAX
A	1.50	1.80
A1	0.102	0.249
A2	1.40	1.55
E	5.842	6.198
E1	3.861	3.998
D	8.585	8.738
L	0.406	0.889
E	0.635 TYP	
B	0.20	0.30
C	0.2 TYP	
$\theta 1$	8° TYP	
$\theta 2$	8° TYP	
$\theta 3$	0°	8°
$\theta 4$	4° TYP	

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PCB Layout Guideline

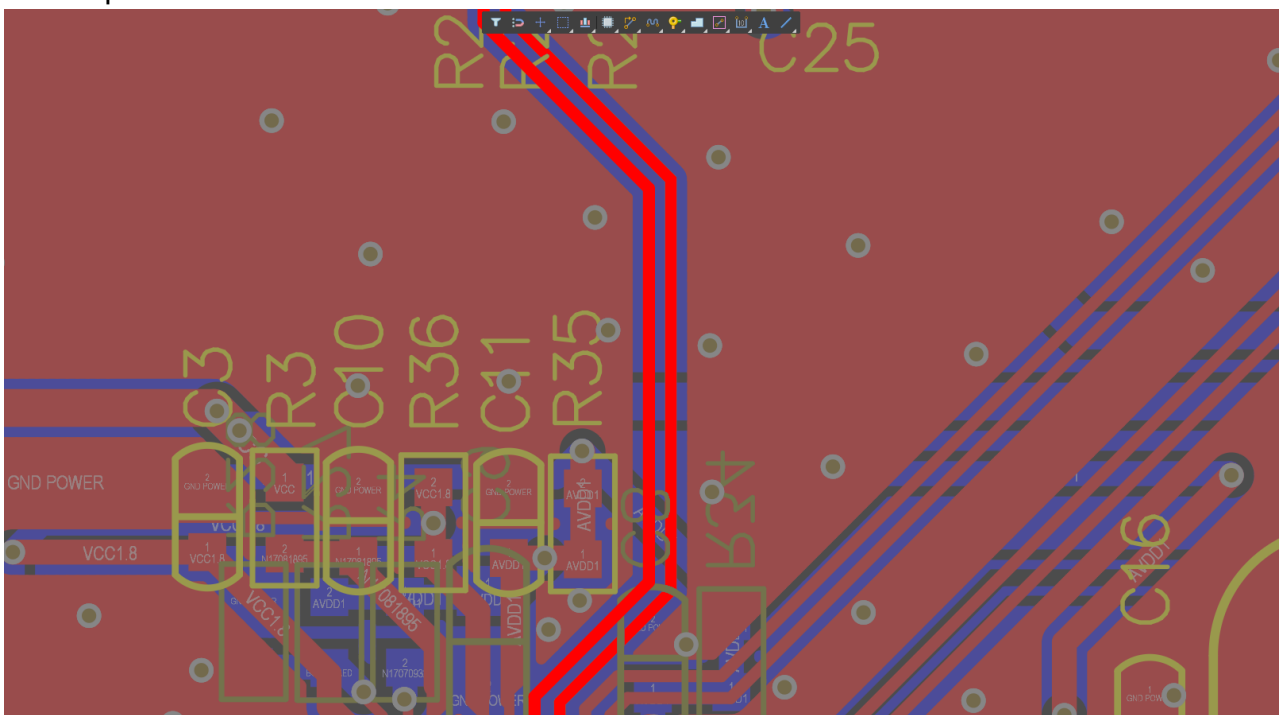
A. Principle of Impedance control

The length of intra-pair should be equal and the pair of trace should be routed closely. Components or Via on differential channel must be placed symmetrically. The distance between two traces of the differential pair must remain constant from beginning to the end. Calculations of differential impedance are necessary for differential signals and traces.

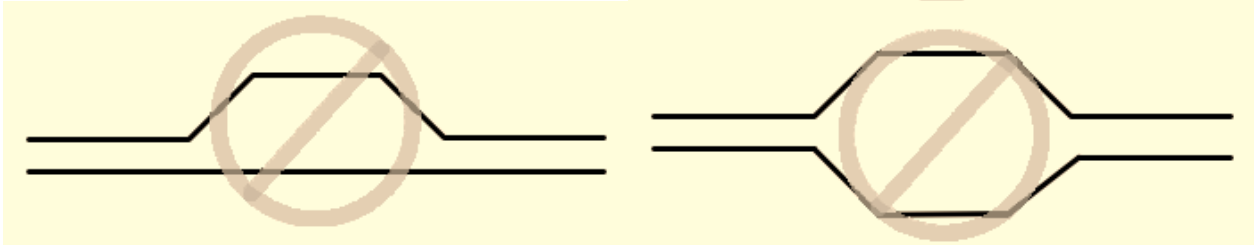
- ◆ HDMI the differential trace impedance: 100 ohm +/- 15%
- ◆ Display Port the differential trace impedance: 100 ohm +/- 15%
- ◆ USB 2.0 the differential trace impedance: 90 ohm +/- 15%
- ◆ USB Type-C the differential trace impedance: 90 ohm +/- 15%

B. Symmetry in the Differential Pairs

Route all high-speed differential pairs together symmetrically and parallel to each other. Deviating from this requirement occurs naturally during package escape and when routing to connector pins. These deviations must be as short.

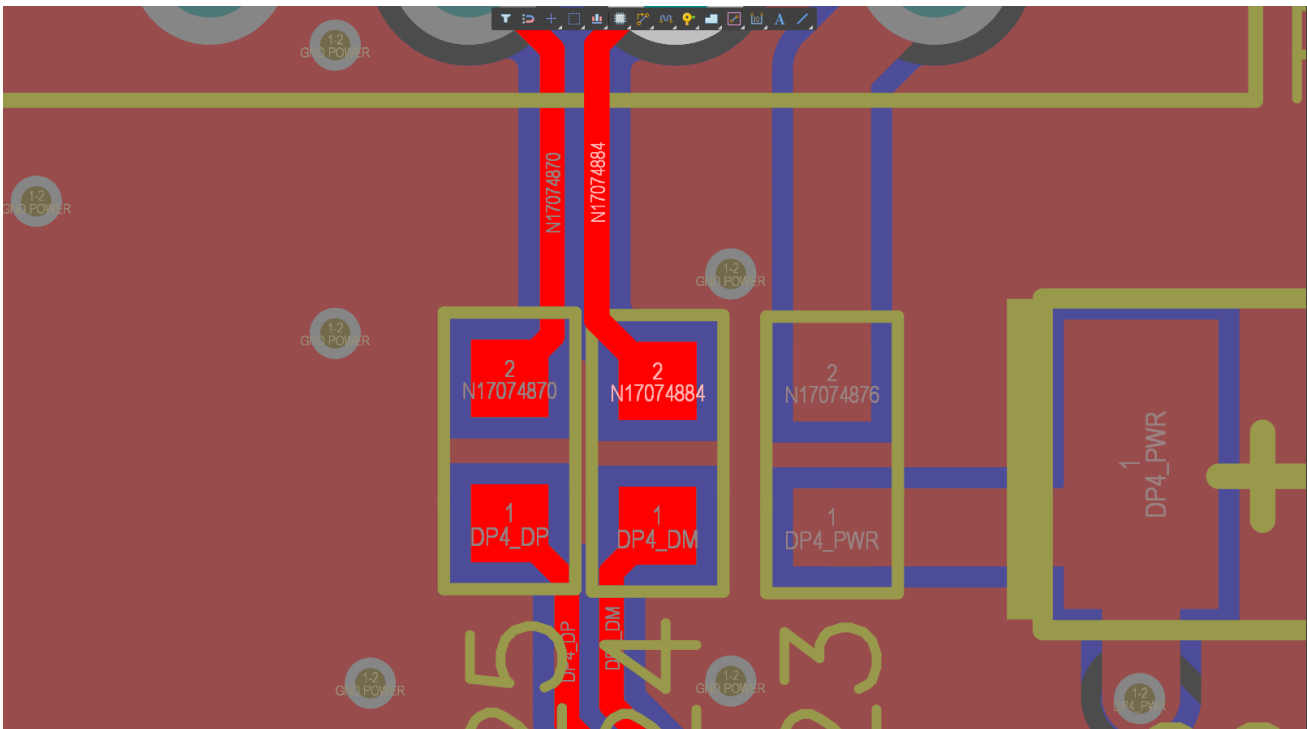


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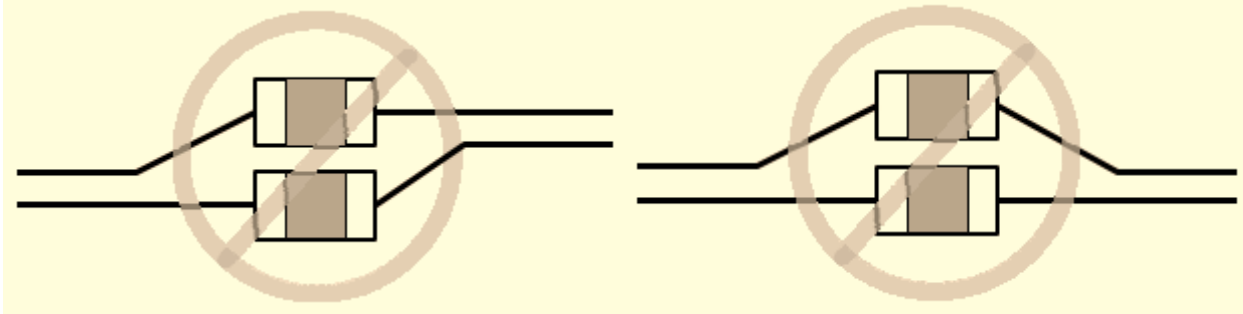


C. Surface-Mount Device Pad Discontinuity Mitigation

Avoid including surface-mount devices (SMDs) on high-speed signal traces because these devices introduce discontinuities that can negatively affect signal quality. When SMDs are required on the signal traces (for example, the USB SuperSpeed transmit AC coupling capacitors) the maximum permitted component size is 0603. It is strongly recommended use 0402 or smaller size. Place these components symmetrically during the layout process to ensure optimum signal quality and to minimize reflection. For examples of correct and incorrect AC coupling capacitor placement.



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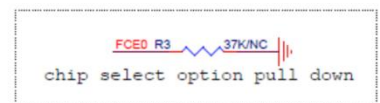
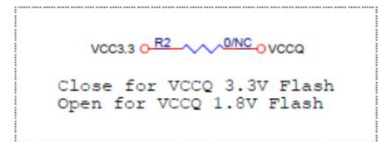
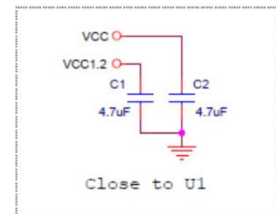
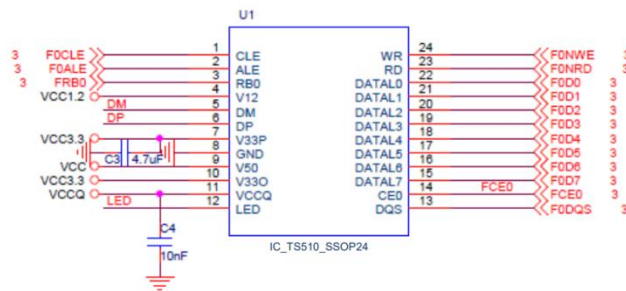
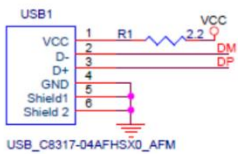


D. Exposed Pad (ePad)

ExposedPad (ePad) is used as electrical ground of the package for applications requiring optimum thermal performance. Soldering the ePad on to the ground plane of PCB is required to fulfill package power dissipation requirement. A clearance on the PCB between the edge of ePad and the inner edges of lead Pads should be designed at least 0.25 mm to avoid electrical short.

Application Circuit

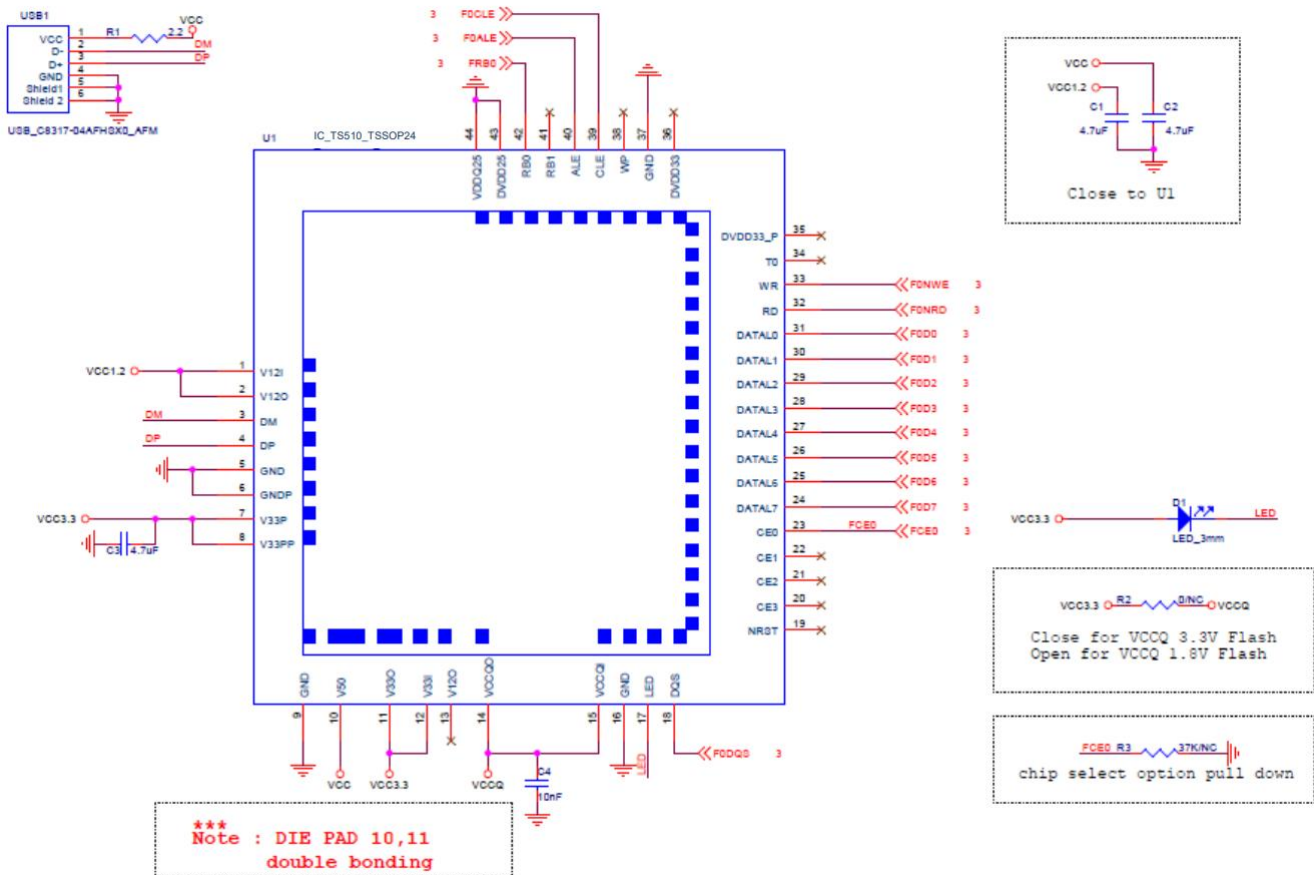
A. SSOP24 PCBA & BOM List



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No.	Category	Specification	UNIT	Quantity	Position No.	Remarks
1	PCB	TS510-SSOP24-1T1B-V1	PCS	1		
2	Capacity	4.7uF-0603-10V-10%	PCS	3	C1,C2,C3	
		0.1uF-0603-10V-10%	PCS	1	C4	
3	USB Plug	USB A Male U Plug	PCS	1	P1	
4	Resistance	2.2R-0603-1	PCS	1	R1	
		0R-0603-1	PCS	1	R2	Option for VCCQ=3.3V
		37KR-0603-1	PCS	1	R3	Option for chip selection
5	LED	LED-0603	PCS	1	D1	
6	MCU	TS510_SSOP_24P	PCS	1	U1	
7	Flash(Choose 1 from 2)	NAND-BGA152	PCS	1	U3	
		NAND-TSOP48	PCS	1	U2	

B. COB & BOM List



USB 2.0 Flash Disk Controller

No.	Category	Specification	UNIT	Quantity	Position No.	Remarks
1	PCB	TS510-COB44-TB-V1	PCS	1		
2	Capacity	4.7uF-0603-10V-10%	PCS	3	C1,C2,C3	
		0.1uF-0603-10V-10%	PCS	1	C4	
3	USB Plug	USB A Male U Plug	PCS	1	P1	
4	Resistance	2.2R-0603-1	PCS	1	R1	
		0R-0603-1	PCS	1	R2	Option for VCCQ=3.3V
		37KR-0603-1	PCS	1	R3	Option for chip selection
5	LED	LED-0603	PCS	1	D1	
6	MCU	TS510_Die	PCS	1	U1	
7	Flash(Choose 1 from 2)	NAND-BGA152	PCS	1	U3	
		NAND-TSOP48	PCS	1	U2	