

1. Features

- Single-chip SuperSpeed USB 3.0 Single-LUN Mass Storage Card Reader Controller
- Compliant with both USB 3.0 and USB 2.0 specification
- Integrated SuperSpeed (5Gbps), Hi-Speed, and Full-speed USB transceiver
- High-performance embedded microcontroller
- Supports mainstream cost-efficient storage media: Secure Digital™ card (SDSC, SDHC, SDXC, up to v3.01 UHS-I SDR104 and compliant with SD5.0 UHS-II SD card) and MultiMediaCard™ (MMC) up to v4.2
- Built-in protocol engine to support USB mass storage class Bulk-Only Transport (BOT) specification. No device driver needed for major operation system.
- Firmware can be upgraded via USB interface using either external SPI flash or storage media (to reduce BOM cost).
- Built-in clock oscillator, no need of external crystal
- Built-in SD card power regulator
- Built-in SD interface power regulator
- Built-in 5V to 3.3V regulator
- QFN32 5mmx5mm package

2. General Description

The PL2731 is a SuperSpeed USB 3.0 Single-LUN card reader controller that integrates high performance protocol engine for USB BOT mass storage class. The PL2731 can support mainstream Secure Digital card up to the highest performance grade of SD3.0 UHS-I SDR104. With SuperSpeed USB 3.0 transfer rate of 5Gbps, the PL2731 can push the SD card up to UHS-I SDR104 performance.

To save BOM cost, many components have been integrated into the PL2731. The PL2731 integrates USB 3.0 SuperSpeed (5Gbps) transceiver and Hi-Speed / Full-speed transceiver. The PL2731 also integrates power management components including regulator to SD card power, regulator to SD UHS-I interface, and regulator for GPIO. Besides built-in regulators, the PL2731 integrates chip power stability monitors to make sure controller does not enter unknown state when system power is unstable. To maximize system compatibility and to integrate more value-added features, the PL2731 can be upgraded through commodity SPI flash.

3. Block Diagram

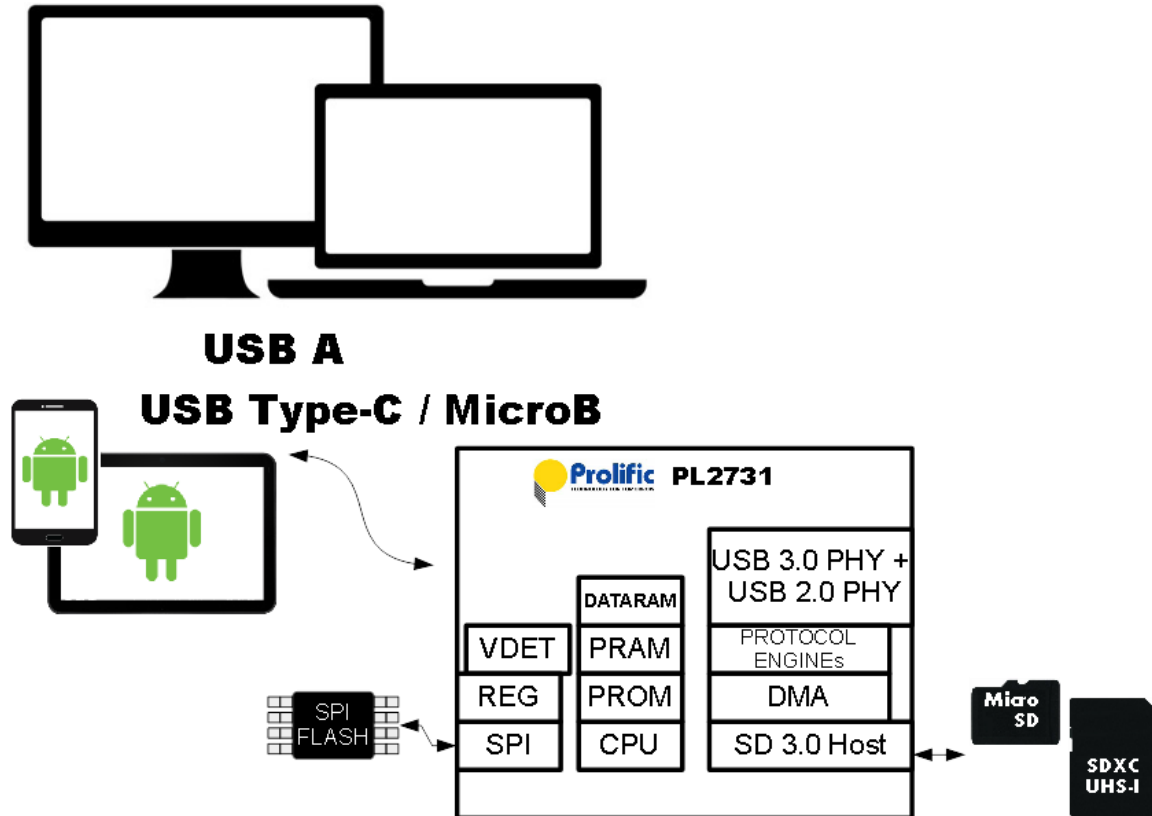


Figure 3-1: PL2731 Block Diagram & Application

4. Ordering Information

Table 4-1: Ordering Information

Product Name	Package Type	Ordering Number
PL2731	QFN32 (5 x 5 mm)	PL2731B4FRG8P3

5. USB Logo Certification

The PL2731 IC has been certified by the USB-IF organization with [TID 340970011](#) to be fully compliant with the USB 3.x(5Gbps) specification.



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6. Pin Assignment & Description

6.1 PL2731 Pin Assignment Diagram (QFN32)

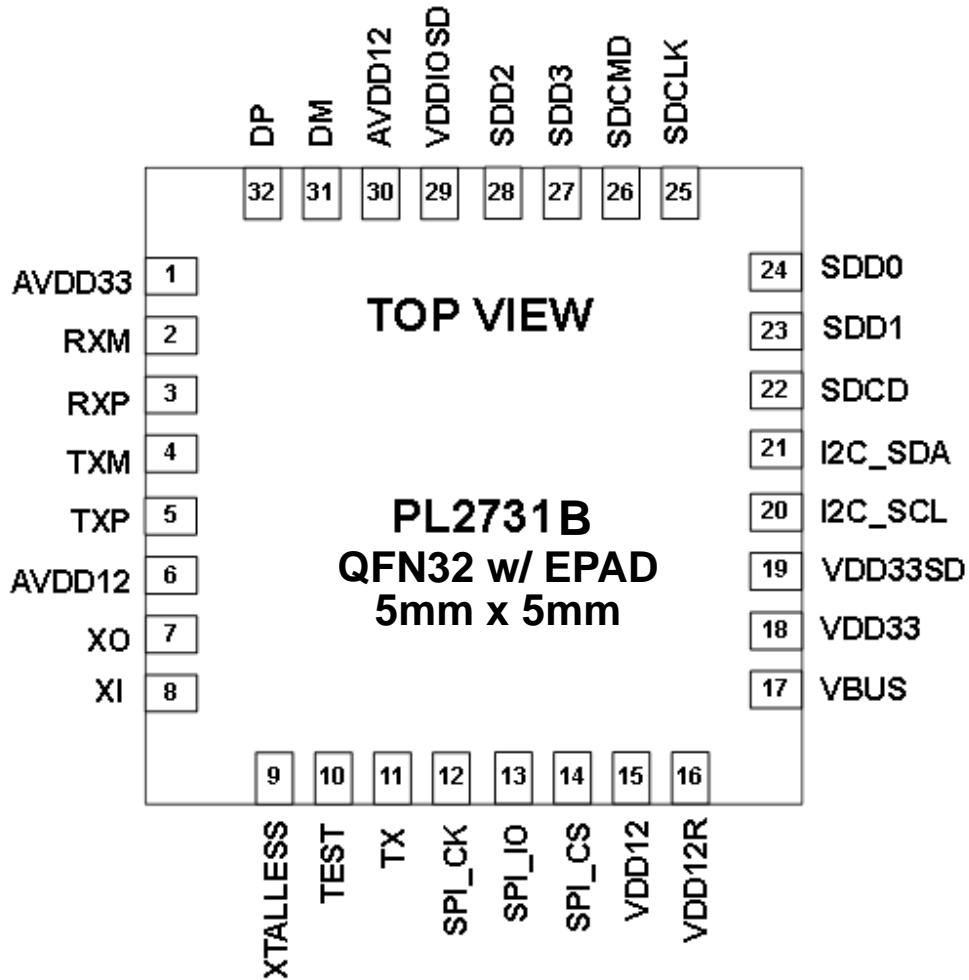


Figure 6-1: PL2731 Pin Assignment Diagram (QFN32 5x5)

6.2 PL2731 Pin Description Table

Table 6-1: PL2731 Pin Assignment

Pin #	Pin Name	Pin Type	Pin Description
1	AVDD33	P	3.3V analog power
2	RXM	AIO	USB Superspeed RXM
3	RXP	AIO	USB Superspeed RXP
4	TXM	AIO	USB Superspeed TXM
5	TXP	AIO	USB Superspeed TXP
6	AVDD12	P	1.2V analog power input
7	XO	DO	30MHz Crystal Oscillator Output
8	XI	DI	30MHz Crystal Oscillator Input
9	XTALLESS	DI	Selection of clock source High: clock from internal oscillator ; Low: clock from external crystal
10	TEST	DI	Active high test mode. Tie this pin to ground.
11	TX	DO	TEST POINT, For F/W debugging
12	SPI_CK	DO	SPI clock
13	SPI_IO	DIO	SPI data
14	SPI_CS	DO	SPI chip select
15	VDD12	P	1.2V power input
16	VDD12R	P	1.2V output power (NC is recommended)
17	VBUS	P	USB VBUS
18	VDD33	P	3.3V output power (internal regulator)
19	VDD33SD	P	3.3V output power for SD card
20	I2C_SCL	DIO	I2C SCL. Do not pull this pin to ground.
21	I2C_SDA	DIO	I2C SDA. Do not pull this pin to ground.
22	SDCD	DI	Card detect of SD card
23	SDD1	DIO	Data bit 1 of SD card 0
24	SDD0	DIO	Data bit 0 of SD card 0
25	SDCLK	DO	Clock pin of SD card 0
26	SDCMD	DIO	CMD pin of SD card 0
27	SDD3	DIO	Data bit 3 of SD card 0
28	SDD2	DIO	Data bit 2 of SD card 0
29	VDDIOSD	P	Power for IO of SD interface
30	AVDD12	P	1.2V analog power input
31	DM	AIO	USB DM
32	DP	AIO	USB DP
33	EPAD	P	Ground. This pin has to be short to system ground.

Pin Type:

- AIO – Analog Bi-directional
- P – Power / Ground
- DI – Digital Input
- DO – Digital Output
- DIO – Digital Bi-directional

7. AC & DC Characteristics

7.1 Absolute Maximum Ratings

Table 7-1: Absolute Maximum Ratings

Symbol	Parameter	Rating	Units
V _{VBUS}	Power supply of VBUS	-0.3 to 5.5	V
V _{VDD12}	Power supply of 1.2V (VDD12, AVDD12)	-0.3 to 1.4	V
V _{VDD33}	Power supply of 3.3V (VDD33, AVDD33)	-0.3 to 3.6	V
V _{VIN33}	Input signal voltage of 3.3V IO	-0.3 to 3.6	V
T _{op(1)}	Operating temperature	-40 to 85	°C
T _J	Junction Operation Temperature	-40 to 125	°C
T _{STG}	Storage temperature	-40 to 150	°C

Note:(1) –Use external PWM converter IC (5V-->1.2V) and external crystal for testing

7.2 Operating Current

Table 7-2: Operating Current Parameters

Crystal	1.2V input	USB port	idle	Write	Read	suspend	Units
External crystal	EXT 1.2V	USB3.0	52.4	75.0	64.4	2.1	mA
		USB2.0	23.8	30.0	37.1	2.1	mA
Internal oscillator	EXT 1.2V	USB3.0	74.6	93.1	84.2	1.9	mA
		USB2.0	45.9	52.1	60.2	2.1	mA

7.3 Recommended Operating Conditions

Table 7-3: Recommended Operating Conditions

Symbol	Parameter	Min	Typ	Max	Units
V _{VBUS}	Power supply of VBUS	2.7		5.5	V
V _{VDD12}	Power supply of 1.2V (VDD12, AVDD12)	1.28		1.344(*1)	V
V _{VDD33}	Power supply of 3.3V (VDD33, AVDD33)	2.7	3.3	3.6	V

*1: The maximum value is 1.28V tolerance 5%.

7.4 Package Thermal Characteristics

Table 7-4: Package Thermal Characteristics

SYMBOL	PARAMETER	RATING	UNITS
θ _{ja}	Junction-to-ambient thermal resistance	34	°C/W
θ _{jc}	Junction-to-case thermal resistance	1.1	°C/W

7.5 Signal level of SD bus

Table 7-5 Signal level of SD bus at VDDIOSD=3.3V

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS
V _{IH}	Input High Voltage	2.063		3.6	V
V _{IL}	Input Low Voltage	-0.3		0.825	V
V _{OL}	Output Low Voltage			0.4125	V
V _{OH}	Output High Voltage	2.475			V

Table 7-6 Signal level of SD bus at VDDIOSD=1.8V

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS
V _{IH}	Input High Voltage	1.125		2.1	V
V _{IL}	Input Low Voltage	-0.3		0.45	V
V _{OL}	Output Low Voltage			0.225	V
V _{OH}	Output High Voltage	1.35			V

8. Package Outline Diagram

8.1 PL2731 Outline Diagram (QFN32)

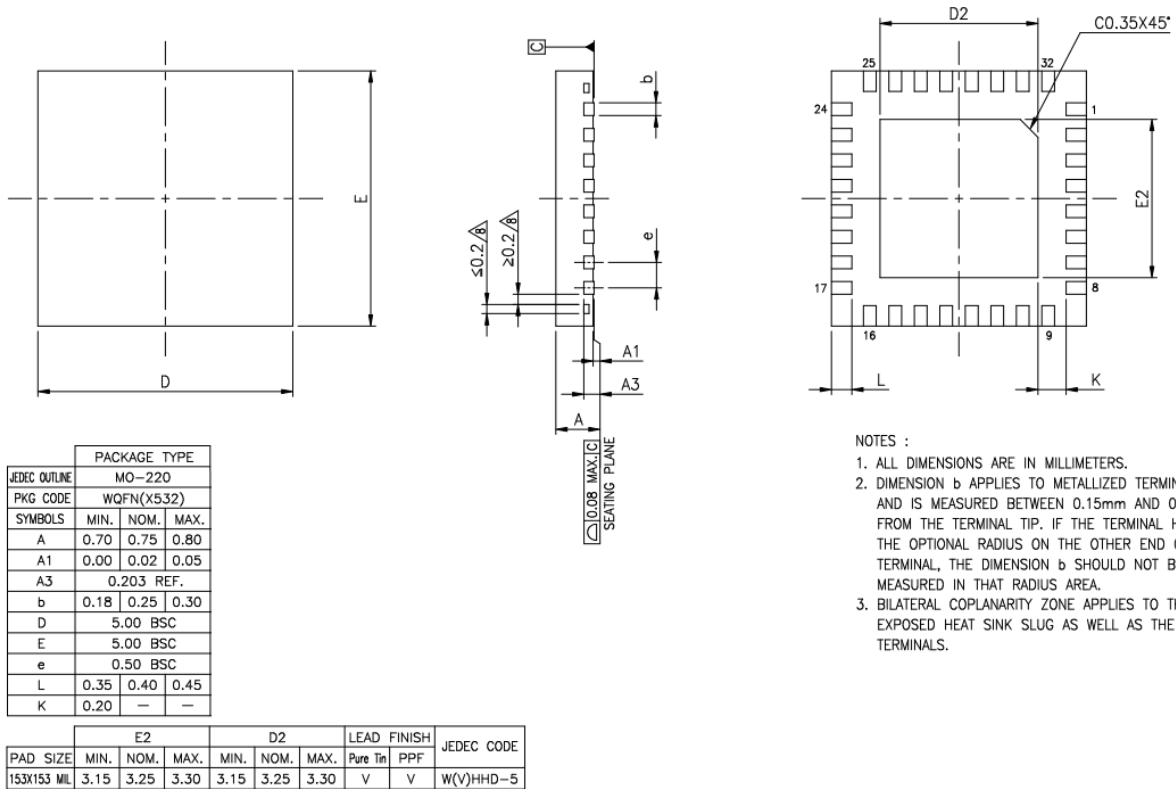


Figure 8-1: PL2731 Outline Diagram (QFN32 5x5mm)

9. Package Outline Diagram

9.1 Carrier Tape (QFN32)

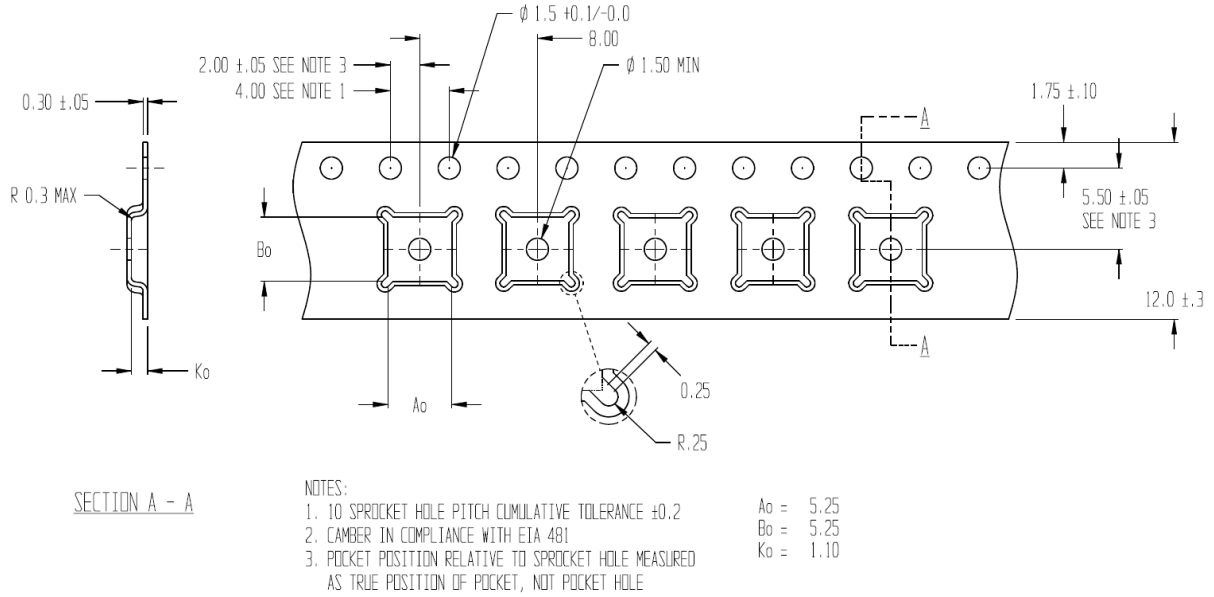


Figure 9-1: QFN32Carrier Tape

9.2 Reel Dimension

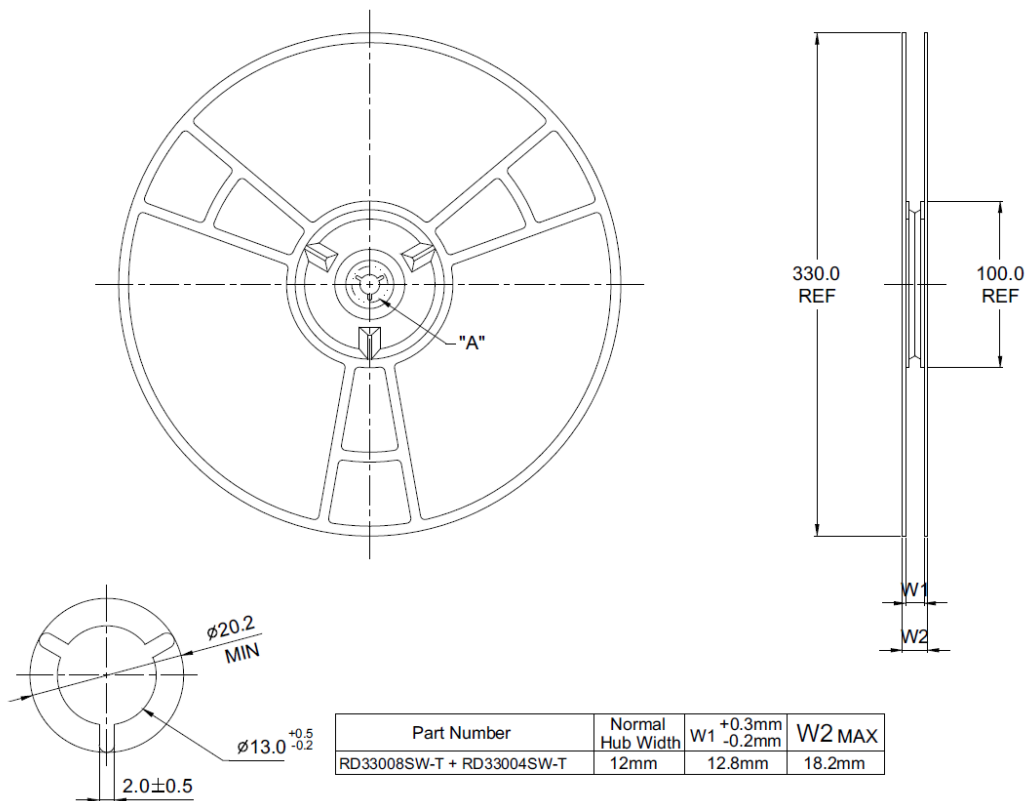


Figure 9-2: Reel Dimension

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Prolific Technology Inc.

7F, No. 48, Sec. 3, Nan Kang Rd.
Nan Kang, Taipei 115, Taiwan, R.O.C.
Telephone: +886-2-2654-6363
Fax: +886-2-2654-6161
E-mail: sales@prolific.com.tw
Website: <http://www.prolific.com.tw>