LDR6321 PD+QC+AFC Sink Controller

REV1.5

Version history

REV1.0	Initial version	2018-08-02
REV1.1	Modify the performance parameter part	2018-09-10
REV1.2	1. Added pins for configuration, output 12v and 15v 2. The VBUS port adds a isolation MOSFET	2018-12-13
REV1.3	Revised the feature description part	2019-03-21
REV1.4	Revised the LDO of the typical application	2019-07-11
REV1.5	1. Add support for AFC protocol; 2. The LDR6321 pins for configuring voltage increase from 1 to 3; 3. The 10 ohm resistor connected to the power supply in typical application schemes are replaced by a schottky diode	2020-04-23

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Table of Contents

1. Overview

LDR6321 is a configurable sink controller compatible with USB PD, QC and AFC protocols, which is developed by Legendary Technology Co., Ltd. LDR6321 requests power from adapters that support USB PD, QC, or AFC protocols, and then supplies power to the device. For example, the adapter can be configured to output the required power to supply the wireless charger device. LDR6321 is compatible with legacy USB power adapters.

2. Features

◇ Compatible with USB PD 3.0 specification, support USB PD 2.0
◇ Compatible with QC 3.0 specification, support QC 2.0
◇ Support AFC protocol
◇ Configurable output 5V, 9V, 12V, 15V, 20V and other voltages
◇ The highest voltage within 9V, 12V, 15V and 20V can be automatically selected

3. Application

◇ All devices that require adapter (support USB PD, QC or AFC protocol) power supply

4.Function description

4.1 LDR6321 pins diagram

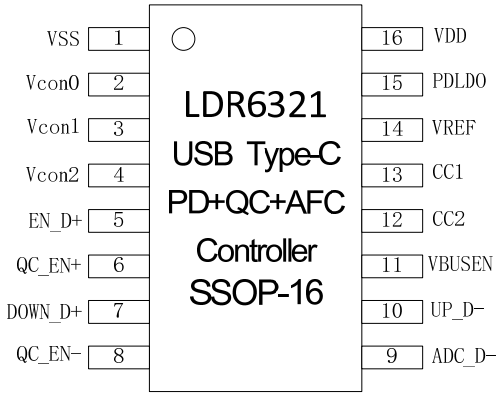


Figure1 LDR6321 pins diagram

4.2 LDR6321 pins function description

Pin Number	Pin Name	Type	Function description
1	VSS	--	Chip Ground pin
2	Vcon0	I	Pin floating to request the maximum voltage of 9V，Or connect a 10K resistor to ground to request the maximum voltage of 12V. For detailed configuration, refer to Table 2 in Section 4.3
3	Vcon1	I	Connect a 10K resistor to ground to request the maximum voltage of 15V. For detailed configuration, refer to Table 2 in Section 4.3
4	Vcon2	I	Connect a 10K resistor to ground to request the maximum voltage of 20V. For detailed configuration, refer to Table 2 in Section 4.3
5	EN_D+	I/O	EN_D +, QC_EN + and DOWN_D + are used to adjust the USB Type-C port voltage of D +. EN_D + and QC_EN + cooperate to set voltage of D+ to 3.3V, DOWN_D + and QC_EN + cooperate to set voltage of D+ to 0.6V
6	QC_EN+	0	Same as above
7	DOWN_D+	I/O	Same as above
8	QC_EN-	0	QC_EN-, ADC_D- and UP_D- are used to adjust the USB Type-c port voltage of D-. ADC_D- and QC_EN- cooperate to set voltage of D- to 0.6V, UP_D- set the voltage of D- to 3.3V in conjunction with QC_EN-.
9	ADC_D-	I/O	Same as above，where ADC_D- detects the voltage of D-, so as to judge whether the adapter supports the QC protocol.

10	UP_D-	I/O	Same as above
11	VBUSEN	O	Isolate the VBUS at the input port and output port to prevent the input port from being affected by the output, causing the adapter fails to handshake.
12	CC2	I/O	USB PD CC2
13	CC1	I/O	USB PD CC1
14	VREF	I	Detect the voltage of VBUS
15	PDLDO	O	USB PD communication LDO external capacitor interface
16	VDD	--	Chip Power Supply

Note: I = Input, O = Output, I/O = Input/Output

Table 1 LDR6321 pins function description

4.3 The voltage configuration of LDR6321

Pins Configuration			Output Voltage
Vcon2	Vcon1	Vcon0	USB PD + QC + AFC
NC	NC	NC	Maximum Voltage 9V
NC	NC	Pull Down	Maximum Voltage 12V
NC	Pull Down	NC	Maximum Voltage 15V
Pull Down	NC	NC	Maximum Voltage 20V

Table 2 The voltage configuration instructions of LDR6321

Note:
Vcon0: Pin 2 of LDR6321
Vcon1: Pin 3 of LDR6321
Vcon2: Pin 4 of LDR6321

NC: The pin is floating,
Pull Down: Pull down by a 10K resistor to ground.
The maximum voltage means to request the maximum voltage for priority, if the adapter does not support this voltage, find the next highest voltage until the supported voltage is requested.
For example, if the Vcon2 pin is connected to a 10K pull-down resistor and the Vcon1 and Vcon0 pins are left floating, the maximum output voltage is 20V.
If the attached power adapter supports 5V, 9V, 12V, 15V and 20V, it will output 20V.
If the attached power adapter supports 5V, 9V, 12V, 15V, it will output 15V.
If the attached power adapter supports 5V, 9V, 12V, it will output 12V.
If the attached power adapter supports 5V and 9V, it will output 9V.

4.4 Application Diagram of LDR6321

As shown in Figure 2, the input port of the LDR6321 is a USB Type-C receptacle, which is connected to an power adapter. CC1 for USB PD Protocol communication, D + and D- are used for QC and AFC communication.
The priority of the fast charge protocol is PD> QC> AFC, that is, the preferred PD. If PD is not supported, select QC, and then select AFC if there is no more.

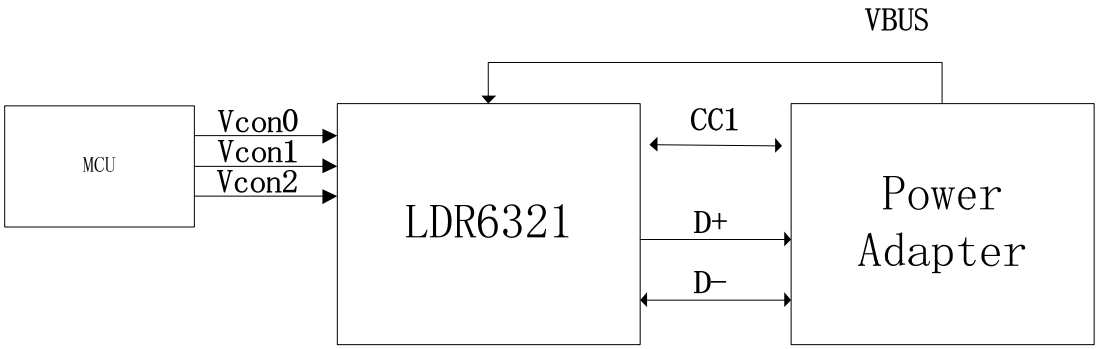


Figure 2 Application Diagram of LDR6321

5.Electrical Characteristics

5.1 Maximum rating

Parameter	Description	Min / Max	Unit
VDD	Power Supply	-0.3/6.0	V
V_I	Input Voltage	-0.3/VDD+0.3	V
V_O	Output Voltage	-0.3/VDD	V
T_{stg}	Storage Temperature	-55/+150	℃

5.2 Recommended Working Conditions

Parameter	Description	Min / Max	Unit

VDD	Power Supply	3.3/5	V
Ta	Ambient Temperature	-40/+85	℃

6.Typical Application

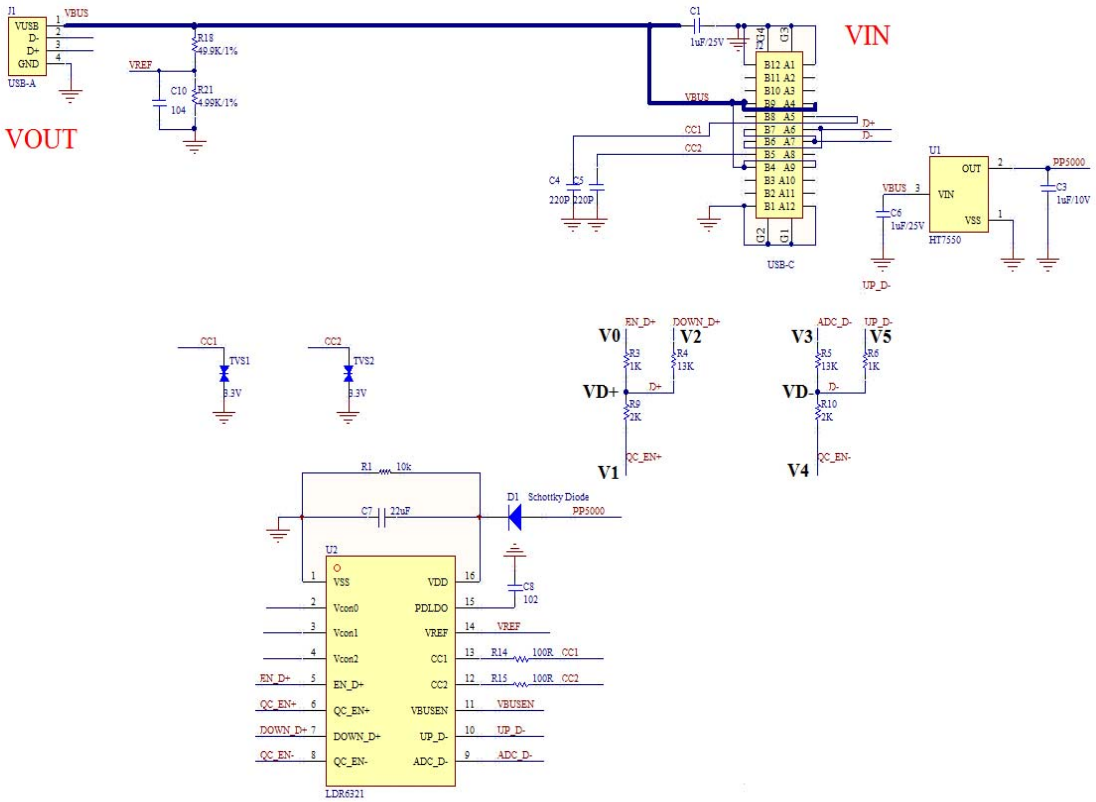


Figure 3 LDR6321 simplest application schematic

The output voltages VD + and VD- of D + and D- that control QC and AFC communication are 3.3V and 0.6V, which are realized by voltage divider resistance.
R3, R4, R5, R6, R9 should meet the following conditions:

D + voltage VD+

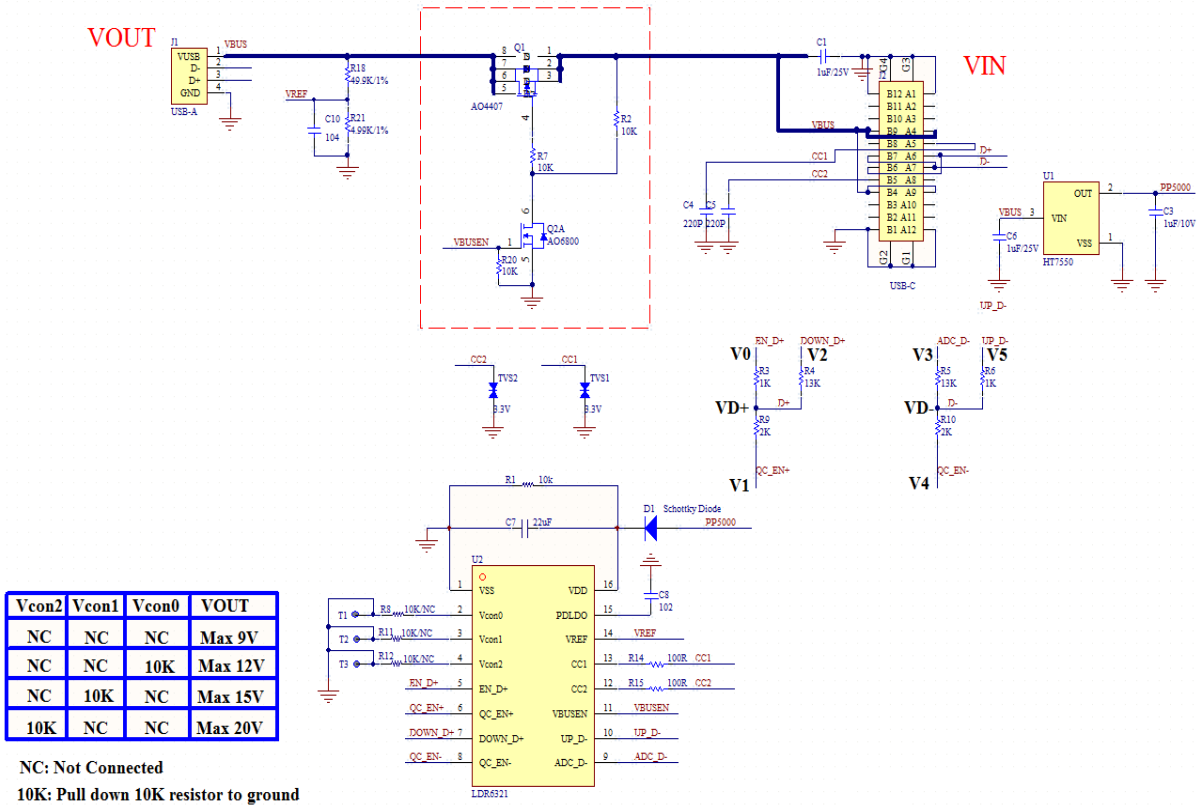
$$VD+ = [R9 \times (V0 - V1)]/(R3 + R9) = 3.3V$$

$$VD+ = [R9 \times (V2 - V1)]/(R4 + R9) = 0.6V$$

D-voltage VD-

$$VD- = [R10 \times (V3 - V4)]/(R5 + R10) = 0.6V$$

$$VD- = [R10 \times (V5 - V4)]/(R6 + R10) = 3.3V$$



Vcon2	Vcon1	Vcon0	VOUT
NC	NC	NC	Max 9V
NC	NC	10K	Max 12V
NC	10K	NC	Max 15V
10K	NC	NC	Max 20V

NC: Not Connected
10K: Pull down 10K resistor to ground

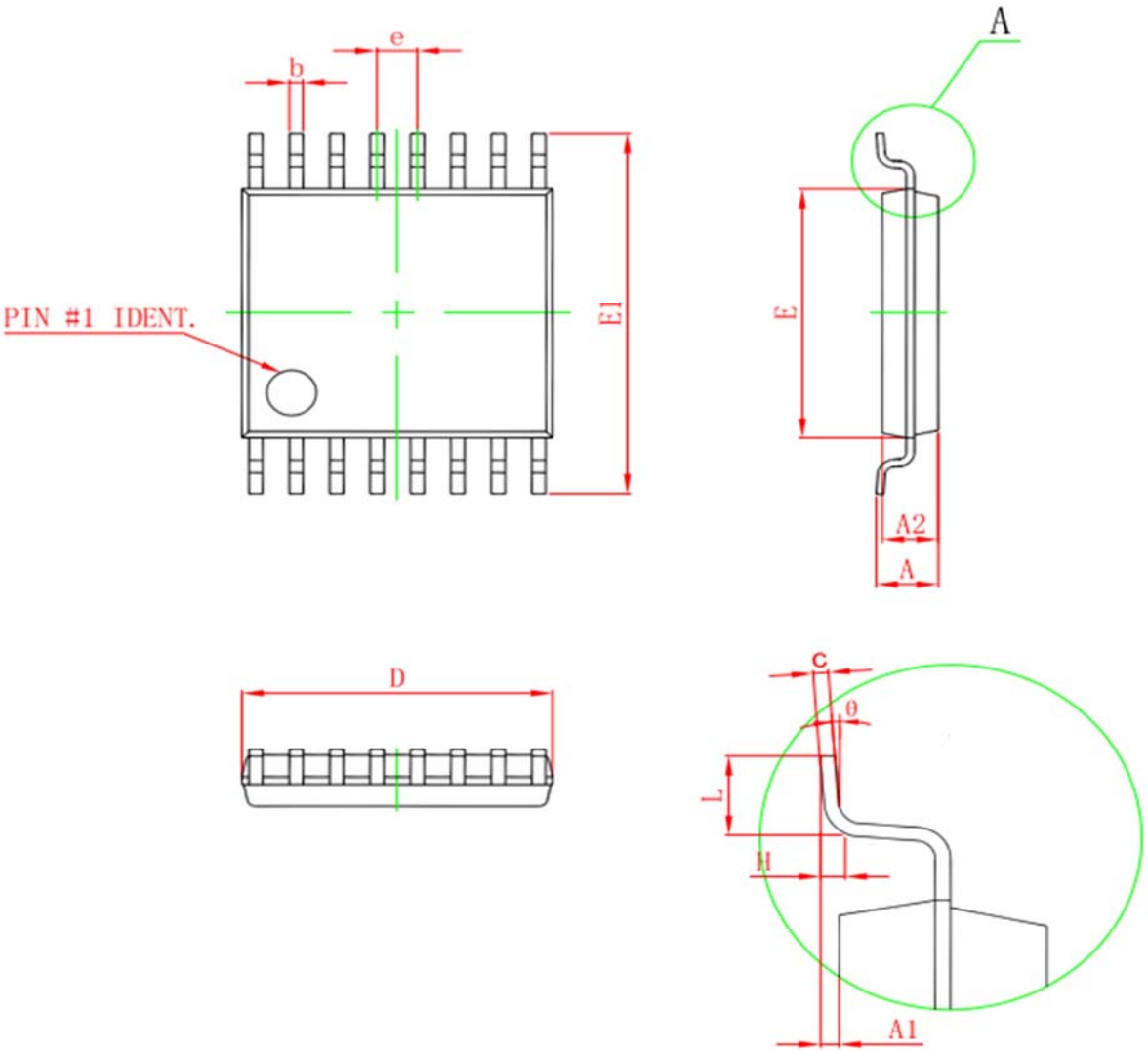
Figure 4 LDR6321 extended application schematic

The extended application schematic is fully backward compatible with the simplest application schematic, with two main additions:

1. Three configuration pins are added, and the maximum output voltage can be configured to be 9V, 12V, 15V and 20V respectively;
2. The isolation MOSFET is implemented between the input port and the output port to prevent the input port from being subjected to a large load such as a large-capacity capacitor connected to the output port, resulting in short circuit protection. If there is no large-capacity capacitor load, isolation MOSFET is not required, just connect the input port and the output port directly.

If your power strategy is different from above, you may communicate with us for the customize design.

7.Chip Package



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
D	4.900	5.100	0.193	0.201
E	4.300	4.500	0.169	0.177
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
E1	6.250	6.550	0.246	0.258
A		1.100		0.043
A2	0.800	1.000	0.031	0.039
A1	0.020	0.150	0.001	0.006
e	0.65 (BSC)		0.026 (BSC)	
L	0.500	0.700	0.020	0.028
H	0.25 (TYP)		0.01 (TYP)	
θ	1°	7°	1°	7°

Figure 5 LDR6321 Chip Package(SSOP-16)